PUBLIC WORKS DEPARTMENT

BID SPECIFICATIONS

AND

CONTRACT DOCUMENTS

FOR

MAIN PUMP STATION IMPROVEMENTS

CITY PROJECT NUMBER:
SWR24003B

September 2025

CITY OF CAMAS, WASHINGTON

PUBLIC WORKS DEPARTMENT

Specifications and Contract Documents

MAIN PUMP STATION IMPROVEMENTS

in and for the

City of Camas
a Municipal Corporation

Consisting of

CALL FOR BIDS
BIDDING DOCUMENTS
CONTRACT DOCUMENTS

AFFIDAVIT OF E-VERIFY COMPLIANCE
AMENDMENTS TO THE STANDARD SPECIFICATIONS
SPECIAL PROVISIONS
STATE MINIMUM HOURLY PREVAILING WAGE RATES

CONSTRUCTION PLANS

By Order of the Mayor and City Council

City of Camas

City Project No. SWR24003B

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CALL FOR BIDS
CITY OF CAMAS PUBLIC WORKS DEPARTMENT
CITY PROJECT NO. SWR24003B
MAIN PUMP STATION IMPROVEMENTS

Sealed bids will be received by the City of Camas, Administrative Services, 616 NE 4th Avenue, Camas, Washington, until 10:00 A.M. on October 9, 2025, and will then and there be publicly read.

All Bid Proposals shall be accompanied by a Bid Proposal deposit in cash, certified check, cashier's check, or surety bond in an amount equal to five percent (5%) of the amount of such Bid Proposal. Should the successful Bidder fail to enter into such contract and furnish satisfactory contract bond within the time stated in the current updated version of the Washington State Department of Transportation (WSDOT) Standard Specifications for Road, Bridge, and Municipal Construction (standard specifications), the Bid Proposal deposit shall be forfeited to the City of Camas.

Free-of-charge access to project bid documents (plans, specifications, addenda, and Bidders List) is provided to Prime Bidders, Subcontractors, and Vendors by going to Builders Exchange of Washington (BXWA) at www.bxwa.com and clicking on "Posted Projects", "Public Works", and "City of Camas". This online plan room provides Bidders with fully usable online documents with the ability to: download, view, print, order full/partial plan sets from numerous reprographic sources, and a free online digitizer/take-off tool. It is recommended that Bidders "Register" in order to receive automatic email notification of future addenda and to place themselves on the "Self-Registered Bidders List". Bidders who do not register will not be automatically notified of addenda and will need to periodically check the on-line plan room for addenda issued on this project. Bids from Bidders who are not listed on the self-registered bidders list may be returned to bidders unopened. Contact Builders Exchange of Washington at (425) 258-1303 should you require assistance with access or registration. Hard copies of the bid documents can be purchased using the BXWA Online Print Ordering System.

The improvement for which bids will be received follows:

Sealed bids in envelopes marked with the Bidder's name, Project Title and Project number will be received at the time and address noted above.

Statement of Work:
This Work consists of the construction of all components of Main Pump Station Improvements, including demolition of existing pump station components, pipelines and building HVAC systems, construction of new pump station components, modification of existing components, conduit and equipment for electrical services and controls, construction of building HVAC, restoration, erosion control, bypass pumping, traffic control, and other work, all in accordance with the Plans and these Specifications.

For questions, please contact Rob Charles, PE, 360-817-7003 or RCharles@cityofcamas.us at the City of Camas.

Pre-Bid Conference:
A mandatory pre-bid conference for the Project will be held on September 30, 2025, at 9:00 A.M. at **231 Everett Street, Camas, Washington 98607.** Bids will not be accepted from Bidders that do not attend the mandatory pre-bid conference.

The Contractor is obligated to pay Washington State Department of Labor and Industries Prevailing Wages, Rates for Clark County, effective October 9, 2025.

American Made:
In an effort to maximize the creation of American jobs and restoring economic growth, the City of Camas encourages the use of products and services that are made in the United States of America whenever and wherever possible.

Disadvantaged Businesses:
The City of Camas encourages the solicitation and recruitment, to the extent possible, of certified minority-owned (MBE), women-owned (WBE), emerging small (ESB) businesses, and other disadvantaged companies in the construction of this project.

Americans with Disabilities Act (ADA) Information:
The City of Camas in accordance with Section 504 of the Rehabilitation Act (Section 504) and the Americans with Disabilities Act (ADA), commits to nondiscrimination on the basis of disability, in all of its programs and activities. This material can be made available in an alternate format by emailing Alena Morgan at procurement@cityofcamas.us or by calling collect 360-817-1560.

Civil Rights Act:
The City of Camas is an Equal Employment Opportunity employer. This Information is available in an alternate form by request by contacting 360-834-6864.

Spanish La información está disponible en un idioma alternativo a pedido,
Chinese Simplified kě gēn jù yāo qiú tí gòng tì dài yǔ yán de xìn xī,
Japanese Rikuesuto ni ōjite,-betsu no gengo de jōhō o nyūshu dekimasu,
Korean jeongboneun yocheong si daeche eon-eolo jegongdoebnida,
Vietnamese Thông tin có sẵn bằng ngôn ngữ thay thế theo yêu cầu,
Romanian Informațiile sunt disponibile într-o limbă alternativă la cerere,
Russian Informatsiya dostupna na drugom yazyke po zaprosu, and
Ukranian Informatsiya dostupna inshoyu movoyu za zapytom.

Title VI Statement:
The City of Camas, in accordance with the provisions of Title VI of the Civil Rights Act of 1964 (78 Stat. 252, 42 U.S.C. 2000d to 2000d-4) and the Regulations, hereby notifies all bidders that it will affirmatively ensure that in any contract entered into pursuant to this advertisement, disadvantaged business enterprises will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of race, color, or national origin in consideration for an award.

E-Verify Requirements:
Per City of Camas Ordinance No. 2626, as a condition for the award or renewal of any contract after January 1, 2012, the Contractor shall enroll in the E-Verify program through the United States Department of Homeland Security and thereafter shall provide the City with a copy of the Memorandum of Understanding (issued by Homeland Security), UPON REQUEST, affirming their enrollment and participation in the program. The Contractor shall be required to continue their participation in the program throughout the course of their contract with the City. Prime contractors shall require and verify that each of their subcontractors and lower tiered subcontractors are also enrolled and participants in the E-Verify program. This is intended to be used exclusively for employees hired after award and for the duration of the contract with the City of Camas.

E-Verify, is an Internet based system operated by the Department of Homeland Security in partnership with the Social Security Administration at no charge. E-Verify has been determined to be a suitable means for determining employment eligibility of new hires and the validity of their Social Security

numbers. Please visit the Department of Homeland Security's web site at http://www.dhs.gov/index.shtm and select E-Verify to learn more or to enroll in this program.

This document and all associated public records will be released where required by the Public Records Act, Chapter 42.56 RCW (the "Act"). To the extent that public records then in the custody of the Contractor are needed for the City to respond to a request under the Act, as determined by the City, the Contractor agrees to make them promptly available to the City. If the Contractor considers any portion of any record provided to the City under this Agreement, whether in electronic or hard copy form, to be protected from disclosure under law, the Contractor shall clearly identify any specific information that it claims to be confidential or proprietary. If the City receives a request under the Act to inspect or copy the information so identified by the Contractor and the City determines that release of the information is required by the Act or otherwise appropriate, the City's sole obligation shall be to notify the Contractor (a) of the request and (b) of the date that such information will be released to the requester unless the Contractor obtains a court order to enjoin that disclosure pursuant to RCW 42.56.540. If the Contractor fails to timely obtain a court order enjoining disclosure, the City will release the requested information on the date specified.

Cooperative Purchasing:

The City participates in cooperative purchasing and that other public agencies may desire to place orders against the awarded contract. Bidders/proposers may be asked to indicate if they agree to allow orders from public agencies that have an interlocal cooperative purchasing agreement with the City.
The City of Camas expressly reserves the right to reject any or all Proposals and to waive minor irregularities or informalities and to Award the Project to the lowest responsible bidder as it best serves the interests of the City. The City of Camas also reserves the right to delete any or all portions of individual bid items.

DocuSigned by:
Sydney Baker
69FB889B76B3492...

Sydney Baker
City Clerk

PART ONE
BIDDING DOCUMENTS

BIDDER'S INFORMATION PAGE

CITY PROJECT NO. SWR24003B

MAIN PUMP STATION IMPROVEMENTS

Proposal Submitted By:

_____

CONTRACTOR

_____

CONTRACTOR MAILING ADDRESS EMAIL

_____

CITY STATE ZIP CODE PHONE NO.

_____

WASHINGTON STATE CONTRACTORS LICENSE # EXPIRATION

BID OPENING: OCTOBER 9, 2025, AT 10:00 A.M.

City of Camas City Hall

616 NE 4th Avenue

Camas, Washington 98607

Contacts: **City of Camas**
Rob Charles, PE
Phone: 360-817-7003
E-mail: RCharles@cityofcamas.us

PROPOSAL

To the Office of the City Clerk
Camas, Washington

The undersigned hereby certifies that he has examined the location of

MAIN PUMP STATION IMPROVEMENTS
Project No. SWR24003B

and that the Plans, Specifications and contract governing the work embraced in this improvement, and the method by which payment will be made for said work is understood. The undersigned hereby proposes to undertake and complete the work embraced in this improvement, or as much thereof as can be completed with the money available in accordance with the said Plans, Specifications and contract, and the following schedule of rates and prices:

(Note: Unit prices for all items, all extensions, and total amount of bid should be shown. All entries must be typed or entered in ink.)

Item No.	Qty.	Unit	Description	Unit Price	Total
1.	1	LS	Mobilization	$	$
2.	1	LS	Erosion Control and Water Pollution Control	$	$
3.	1	LS	Trench Safety	$	$
4.	1	LS	Temporary Bypass Pumping System	$	$
5.	1	LS	Hatches and Safety Grates	$	$
6.	1,000	SF	Wetwell Epoxy Coating	$	$
7.	1	LS	HVAC Improvements, Complete	$	$
8.	1	LS	Piping Modifications, Complete	$	$
9.	1	LS	Electrical and Controls Improvements, Complete	$	$
10.	1	LS	Construction Documentation (minimum bid $2,000.00)	$	$

* "S" Denotes Special Specification

Subtotal	$
Sales Tax (8.6%)	$
Contract Total (Basis of Award)	**$**

Signature of Owner or Authorized Corporate Officer
(This is required for a valid bid)

By signing the Bid Proposal, the bidder hereby declares, under penalty of perjury under the laws of the United States that the Non-Collusion Declaration and Notice to All Bidders statements, as provided in these Bid Specifications and Contract Documents, are true and correct.

The City of Camas reserves the right to reject any or all proposals if found to be higher than the estimated cost and to waive any formality or technicality in any proposal in the interest of the City. The City of Camas also reserves the right to delete any or all portions of individual bid items.

MANDATORY BIDDER RESPONSIBILITY CRITERIA INFORMATION:

Per RCW 39.04.350 before award of a public works contract, a bidder must meet the following responsibility criteria to be considered a responsible bidder and qualified to be awarded a public works project. The bidder must provide the following:

CONTRACTOR **NAME OF OWNER OR CORPORATE OFFICER**

SIGNATURE OF OWNER OR CORPORATE OFFICER **DATE AND PLACE**

DEPARTMENT OF LICENSING CONTRACTOR LICENSE REGISTRATION NUMBER

UNIFIED BUSINESS IDENTIFIER (UBI)/WA STATE TAX REGISTRATION NUMBER

LABOR AND INDUSTRIES WORKERS' COMPENSATION NUMBER

EMPLOYMENT SECURITY DEPARTMENT NUMBER (UNEMPLOYMENT NUMBER)

EXCISE TAX REGISTRATION NUMBER (FEDERAL ID NUMBER)

ELECTRICAL CONTRACTOR'S LICENSE NUMBER (if applicable)

PLUMBING CONTRACTOR'S LICENSE NUMBER (if applicable)

BIDDER IS IN COMPLIANCE WITH L&I PREVAILING WAGE TRAINING REQUIREMENT:

☐ YES ☐ NO

By signing this page, the bidder hereby certifies that, within the three-year period immediately preceding the bid solicitation date, 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.

NOTE TO BIDDER: Complete and sign this page and submit it with your bid. Incomplete bid packages will be considered non-responsive and may be rejected. Mandatory Bidder Criteria information will be verified immediately for compliance to ensure that all accounts are current. Non-compliance with any of the above agency requirements may be considered grounds for a non-responsive bid.

Verification of Subcontractor Responsibility Criteria

This form provided for the Prime Contractor's use for all Subcontractors.

Per RCW 39.06.020, the Prime Contractor must verify bidder criteria for each first tier subcontractor. Lower-tiered subcontractors must also verify bidder criteria for their subcontractors. Licensing information to verify is the same as listed above under Mandatory Bidder's Criteria. As a courtesy, a blank Subcontractor Mandatory Bidder Responsibility form has been included in these specifications.

SUBCONTRACTOR
MANDATORY BIDDER RESPONSIBILITY CRITERIA

PROJECT NAME **PROJECT NUMBER**

GENERAL CONTRACTOR

Prior to subcontracting any work, the Contractor shall verify that every Subcontractor, first tier and lower, meets the responsibility criteria stated below at the time of subcontract execution. Contractor is to verify that there are not any of the proposed Subcontractors on the 'Debarred Contractors' List.

SUBCONTRACTOR NAME & SIGNATURE OF OWNER OR CORPORATE OFFICER **DATE**

SUBCONTRACTOR MAILING ADDRESS PHONE NUMBER

WA DEPARTMENT OF LICENSING CONTRACTOR LICENSE REGISTRATION NUMBER

UNIFIED BUSINESS IDENTIFIER NUMBER (UBI) / WA STATE TAX REGISTRATION NUMBER

WA STATE LABOR AND INDUSTRIES WORKER COMPENSATION NUMBER

WA STATE EMPLOYMENT SECURITY DEPT. NUMBER (UNEMPLOYMENT NUMBER)

EXCISE TAX REGISTRATION NUMBER (FEDERAL ID NUMBER)

ELECTRICAL OR PLUMBING CONTRACTOR LICENSE NUMBER (if applicable)

BIDDER'S CHECK LIST

The bidder's attention is especially called to the following forms, which must be executed in full as required and submitted at the bid opening:

A. PROPOSAL

Unit prices for all items, all extensions, and total amount of bid must be shown, except those items designated in the estimate of quantities to be paid for as lump sum. Any item shown on the Plans that does not have a bid item shall be considered incidental to the project and the costs thereof shall be included in other bid items of the project. Pay special attention to the Non-Collusion Declaration before signing the proposal. An unsigned bid may be considered a non-responsive bid.

B. BID BOND

Proposals must be accompanied by cash, a certified check, a cashier's check drawn on a bank of good standing, or a bid bond issued by a surety company authorized to issue such bonds in the State of Washington, in an amount of not less than five percent (5%) of the total amount of the bid submitted. The full amount will be returned within five (5) days after the contract has been executed.

C. DID YOU COMPLETE AND SUBMIT THE BIDDER'S INFORMATION PAGE?

D. DID YOU SIGN AND SUBMIT YOUR BID PROPOSAL?

E. DID YOU COMPLETE AND SUBMIT THE MANDATORY BIDDER RESPONSIBILITY CRITERIA INFORMATION FORM?

F. IF APPLICABLE, DID YOU ACKNOWLEDGE RECEIPT OF ADDENDUMS?

G. DID YOU READ THE 'NON-COLLUSION DECLARATION' AND 'NOTICE TO ALL BIDDERS' STATEMENTS?

As a condition of award, the bidder's attention is especially called to the following forms, which must be provided UPON REQUEST:

A. ACKNOWLEDGEMENT OF CONTRACTOR LAWFUL HIRING COMPLIANCE ENROLLMENT FORM (E-VERIFY).

B. A FULL AND COMPLETED COPY OF THE E-VERIFY MEMORANDUM OF UNDERSTANDING (MOU) ISSUED BY HOMELAND SECURITY.

The following forms are to be executed and submitted to the contracting agency by the successful bidder after the contract is awarded:

A. CONTRACT
This agreement is to be executed by the successful bidder.

B. CONTRACT BOND
This form is to be executed by the successful bidder and his surety company.

C. DECLARATION OF OPTION FOR INVESTMENT OF RETAINED PERCENTAGE
This agreement is to be executed by the successful bidder.

D. WAGE LAW INTENT AND AFFIDAVIT
This shall be completed in accordance with State Law.

E. PUBLIC LIABILITY AND PROPERTY DAMAGE INSURANCE
This is to be executed by the successful bidder.

F. SUBMITTAL OF WEEKLY CERTIFIED PAYROLL REPORTS FOR ALL WORKERS ON THE PROJECT
Failure to submit correct and timely certified payrolls will delay payment.

G. AFFIDAVIT OF E-VERIFY COMPLIANCE
To be completed prior to final payment

ACKNOWLEDGEMENT OF CONTRACTOR LAWFUL HIRING COMPLIANCE ENROLLMENT

Re: **City of Camas Public Work Contractor Lawful Hiring Compliance**
(Also referred to as E-Verify)

When specified as a condition of contract award, the Contractor shall enroll in the E-Verify program through the United States Department of Homeland Security and thereafter shall provide the City with a copy of the Memorandum of Understanding (issued by Homeland Security), UPON REQUEST, and this acknowledgement affirming their enrollment and participation in the program. The Contractor shall be required to continue their participation in the program throughout the course of their contract with the City. Prime contractors shall require and verify that each of their subcontractors and lower tiered subcontractors are also enrolled and participants in the E-Verify program. This is intended to be used exclusively for employees hired after award and for the duration of the contract with the City of Camas.

Your signature below indicates acceptance of these terms:

_____ _____

Signature of Owner or Authorized Corporate Officer **Date**

_____

Company Owner/Officer's name printed

_____

Company

NON-COLLUSION DECLARATION

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

1. **That the undersigned person(s), firm, association or corporation has (have) not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in connection with the project for which this proposal is submitted.**

2. **That by signing the signature page of this Proposal, I am deemed to have signed and have agreed to the provisions of this declaration.**

NOTICE TO ALL BIDDERS

To report bid rigging activities call:

1-800-424-9071

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

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

DOT 272-036I EF

BID BOND
ACKNOWLEDGEMENT

The bidder is hereby advised that by signature of this proposal they are deemed to have acknowledged all requirements and signed all certificates contained herein.

A proposal guaranty in an amount of five percent (5%) of the total bid, based upon the approximate estimate of quantities at the above prices, must be provided as required by law. The following forms as indicated below are acceptable and shall be attached hereto:

_____ CASH	**IN THE AMOUNT OF_____**
_____ CASHIER'S CHECK	**_____ DOLLARS**
_____ CERTIFIED CHECK	**($_____) PAYABLE TO THE CITY**
_____ PROPOSAL BOND	**TREASURER OF CAMAS, WASHINGTON, IN THE AMOUNT OF 5% OF THE BID.**

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

SIGNATURE OF OWNER OR AUTHORIZED CORPORATE OFFICER

_____

_____

FIRM NAME _____

ADDRESS _____

_____

City of Camas

616 NE 4th Avenue
Camas, WA 98607

Local Agency Subcontractor List

Prepared in compliance with RCW 39.30.060 as amended

To Be Submitted with the Bid Proposal

Project Name

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

Subcontractor(s) with whom the bidder will directly subcontract that are proposed to perform the work of structural steel installation, rebar installation, heating, ventilation and air conditioning, plumbing, as described in Chapter 18.106 RCW, and electrical as described in Chapter 19.28 RCW must be listed below. The work to be performed is to be listed below the subcontractor(s) name.

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

Subcontractor Name
(and License Number if required) _____

Work to be performed _____

_____

_____

Subcontractor Name
(and License Number if required) _____

Work to be performed _____

_____

_____

Subcontractor Name
(and License Number if required) _____

Work to be performed _____

_____

_____

Subcontractor Name
(and License Number if required)

Work to be performed

Subcontractor Name
(and License Number if required)

Work to be performed

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

DOT Form 271-015A Revised 06/2020

PART TWO
CONTRACT DOCUMENTS

CONTRACT

THIS AGREEMENT, made and entered into this _____ day of _____, 20___, between the City of Camas under and by virtue of Title 35A RCW (cities and towns), as amended

And, _____, hereinafter called the Contractor.

WITNESSETH:

That in consideration of the terms and conditions contained herein and attached and made a part of this agreement, the parties hereto covenant and agree as follows:

I. The Contractor shall do all work and furnish all tools, materials and equipment for **MAIN PUMP STATION IMPROVEMENTS, City of Camas Project No. SWR24003B**, in accordance with and as described in the attached plans and specifications, and the standard specifications of the Washington State Department of Transportation which are by the reference incorporated herein and made part hereof and, shall perform any changes in the work in accord with the Contract Documents.

The Contractor shall provide and bear the expense of all equipment, work and labor, of any sort whatsoever that may be required for the transfer of materials and for constructing and completing the work provided for in these Contract Documents except those items mentioned therein to be furnished by the City of Camas. In all respects, the Contractor is an independent Contractor, and not an employee of the City of Camas.

II. The City of Camas hereby promises and agrees with the Contractor to employ, and does employ the Contractor to provide the materials and to do and cause to be done the above described work and to complete and finish the same in accord with the attached plans and specifications and the terms and conditions herein contained and hereby contracts to pay for the same according to the attached specifications and the schedule of unit or itemized prices at the time and in manner and upon the conditions provided for in this contract.

III. The Contractor for himself/herself, and for his/her heirs, executors, administrators, successors, assigns, does hereby agree to the full performance of all the covenants herein contained upon the part of the Contractor.

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

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

the indemnification provided herein constitutes the Contractor's waiver of immunity under Industrial Insurance, Title 51 RCW, solely for the purposes of this indemnification. This waiver has been mutually negotiated by the parties. The provisions of this section shall survive the expiration or termination of this Agreement.

V. The Contractor shall provide a material, labor, and equipment guarantee for the work performed under this contract for a period of one year from the Date of Acceptance as shown on the Notice of Completion for Public Works Projects. All work shall be free of defect in workmanship or materials. Upon notice, the Contractor shall make all repairs promptly at no cost to the City. Failure to repair or replace defects in a manner satisfactory to the Engineer will constitute a breach of this contract.

VI. The Contractor is obligated to affirm its enrollment and participation in the E-Verify program as written in these specifications and per Camas Ordinance 2626.

VII. As provided by Title VI of the Civil Rights Act of 1964, and the Civil Rights Restoration Act of 1987, the contractor, with regard to the work performed by it during the contract, shall not discriminate on the grounds of race, color, sex or national origin in the selection and retention of sub-contractors, including procurement of materials and leases of equipment.

City of Camas, Washington in accordance with the provisions of Title VI of the Civil Rights Act of 1964 {78 Stat. 42 U.S.C. §§ 2000d to 2000d-4) and the Regulations, hereby notified all bidders that it will affirmatively ensure that any contract entered into pursuant to this advertisement, all contractors will be afforded full and fair opportunity to submit bids in response to this invitation and will not be discriminated against on the grounds of the owner's race, color, national origin, sex, age, disability, income-level, or LEP in consideration for an award.

VIII. The Contractor is obligated to pay Washington State Department of Labor and Industries Prevailing Wage Rates for Clark County effective October 9, 2025.

IX. The Contractor further acknowledges the following provisions and agrees to comply with the conditions as set forth therein:

THIS PROJECT REQUIRES A CONTRACT BOND FOR 100% OF THE CONTRACT AMOUNT.

X. The Contractor shall certify that they are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from participating in covered transactions by any State or Federal department or agency.

XI. The Contractor shall not propose or contract with any person or entity that is currently debarred, suspended, and ineligible contractors and grantees.

XII. It is further provided that no liability shall attach to the City of Camas by reason of entering into this contract, except as provided herein.

XIII. The Contractor shall maintain its records and accounts so as to facilitate audit requirements as established by the Office of the State Auditor and shall require subcontractors to do the same.

IN WITNESS WHEREOF, the Contractor has executed this instrument, on the day and year first below written and the Mayor of the City of Camas has caused this instrument to be executed by and in the name of the said City of Camas the day and year first above written.

Executed by the Contractor _____, 20___.

_____

_____

_____
Contractor

Executed by the Local Agency _____, 20___.

_____
Mayor of the City of Camas

Approved as to Form

_____
City of Camas Attorney

DECLARATION OF OPTION FOR INVESTMENT OF RETAINED PERCENTAGE

I hereby elect to have the retained percentage of this contract held in a fund by the City of Camas until forty-five (45) days following final acceptance of the work per RCW 60.28.011.

Signed _____

Date _____

****

I hereby elect to have the City of Camas invest the retained percentage of this contract from time to time as such retained percentage accrues and in accordance with RCW 60.28.021. The City will select the repository.

I hereby further agree to be fully responsible for payment of all costs or fees incurred as a result of placing said retained percentage in escrow and investing it as authorized by statute. The City of Camas shall not be liable in any way for any costs or fees in connection herewith.

Signed _____

Date _____

CONTRACT BOND

KNOW ALL PERSONS BY THESE PRESENTS, That _____

of _____, as Principal, and _____

as Surety, are jointly and severally held and bound unto the City of Camas, Washington,

in the penal sum of Dollars ($_____), for the payment of which we jointly and severely bind ourselves, our heirs, executors, administrators, and assigns, and successors and assigns, firmly by these presents.

THE CONDITION of this bond is such that whereas, on the _____

day of _____ A.D., 20___, the said _____,

Principal, herein, executed a certain contract with the City of Camas, Washington,

by the terms, conditions and provisions of which contract the said _____,

Principal, herein, agree to furnish all material and do certain work, to wit: That

_____ will undertake and

complete the construction of these **MAIN PUMP STATION IMPROVEMENTS, City of Camas Project No. SWR24003B**, according to the maps, plans and specifications made a part of said contract, which contract as so executed, is hereunto attached, is now referred to and by reference is incorporated herein and made a part hereof as fully for all purposes as if here set forth at length. The bond shall cover all approved change orders as if they were in the original contract.

NOW, THEREFORE, if the Principal herein shall faithfully and truly observe and comply with the terms, conditions and provisions of said contract in all respects and shall well and truly and fully do and perform all matters and things by **August 31, 2026,** undertaken to be performed under said contract, upon the terms proposed therein, and within the time prescribed therein, and until the same is accepted, and shall pay all laborers, mechanics, subcontractors and material men, and all persons who shall supply such contractor or subcontractor with provisions and supplies for the carrying on of such work, and shall in all respects faithfully perform said contract according to law, then this obligation to be void, otherwise to remain in full force and effect.

WITNESS our hands this _____ day of _____, 20___

_____

_____

_____
PRINCIPAL

_____

_____

_____
ATTORNEY-IN-FACT, SURETY

_____
NAME AND ADDRESS, LOCAL OFFICE OF AGENT

APPROVED:

CITY OF CAMAS, WASHINGTON

BY: _____
MAYOR, CITY OF CAMAS

DATE: _____, 20___

SURETY BOND NUMBER _____

The United States Department of Transportation
Appendix A of the
Standard Title VI/ Non-Discrimination Assurances

DOT Order No. 1050.2A

During the performance of this contract, the contractor, for itself, its assignees, and successors in interest (hereinafter referred to as the "contractor") agrees as follows:

1. Compliance with Regulations: The contractor (hereinafter includes consultants) will comply with the Acts and the Regulations relative to Non-discrimination in Federally-assisted programs of the U.S. Department of Transportation, Federal Highway Administration (FHWA), as they may be amended from time to time, which are herein incorporated by reference and made a part of this contract.
2. Non-discrimination: The contractor, with regard to the work performed by it during the contract, will not discriminate on the grounds of race, color, national origin, sex, age, disability, income-level, or Limited English Proficiency (LEP) in the selection and retention of subcontractors, including procurements of materials and leases of equipment. The contractor will not participate directly or indirectly in the discrimination prohibited by the Acts and the Regulations as set forth in Appendix E, including employment practices when the contract covers any activity, project, or program set forth in Appendix B of 49 C.F.R. Part 21.
3. Solicitations for Subcontracts, Including Procurements of Materials and Equipment: In all solicitations, either by competitive bidding, or negotiation made by the contractor for work to be performed under a subcontract, including procurements of materials, or leases of equipment, each potential subcontractor or supplier will be notified by the contractor of the contractor's obligations under this contract and the Acts and the Regulations relative to Non-discrimination on the grounds of race, color, national origin, sex. Age, disability, income-level or LEP.
4. Information and Reports: The contractor will provide all information and reports required by the Acts, the Regulations and directives issued pursuant thereto and will permit access to its books, records, accounts, other sources of information, and its facilities as may be determined by the Recipient or the FHWA to be pertinent to ascertain compliance with such Acts, Regulations and instructions. Where any information required of a contractor is in the exclusive possession of another who fails or refuses to furnish the information, the contractor will so certify to the Recipient or the FHWA, as appropriate, and will set forth what efforts it has made to obtain the information.
5. Sanctions for Noncompliance: In the event of a contractor's noncompliance with the Non-discrimination provisions of this contract, the Recipient will impose such contract sanctions as it or the FHWA may determine to be appropriate, including, but not limited to:
    a. withholding payments to the contractor under the contract until the contractor complies; and/or
    b. cancelling, terminating, or suspending a contract, in whole or in part.

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

The United States Department of Transportation
Appendix E of the
Standard Title VI/ Non-Discrimination Assurances
DOT Order No. 1050.2A

During the performance of this contract, the contractor, for itself, its assignees, and succors in interest (hereinafter referred to as the "contractor") agrees to comply with the following non-discrimination statutes and authorities, including, but not limited to:

Pertinent Non-Discrimination Authorities:

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

populations;

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

PART THREE
AFFIDAVIT OF E-VERIFY COMPLIANCE

AFFIDAVIT OF COMPLIANCE WITH PUBLIC WORK CONTRACTOR LAWFUL HIRING COMPLIANCE (E-VERIFY)

COMPLETE AND RETURN THIS FORM
AT COMPLETION OF THIS PROJECT

_____ being first duly sworn, on her/his oath says that Contractor, Subcontractors, and all Lower Tiered Subcontractors have complied with the terms and conditions for the E-Verify program as written in the contract and project specifications for**:**

MAIN PUMP STATION IMPROVEMENTS
City of Camas, Project No. SWR24003B

_____

_____
Contractor

Subscribed and sworn to before me this _____ day of _____, 20_____.

_____
Notary Public in and for
State of Washington, residing in

_____

My commission expires:

_____

Prior to issuance of final payment, this form must be signed, Notarized, and submitted to the City of Camas.

PART FOUR
AMENDMENTS TO THE STANDARD SPECIFICATIONS

INTRODUCTION

The following Amendments and Special Provisions shall be used in conjunction with the current updated 2021 version of the Standard Specifications for Road, Bridge, and Municipal Construction, as of the Call for Bids date.

AMENDMENTS TO THE STANDARD SPECIFICATIONS

WSDOT manuals and publications are updated continuously and revisions are issued periodically. It is the responsibility of bidders to make sure they have the current versions, regardless of the manual format or means of transmission. Publications on the WSDOT web page are the most recent versions and can be downloaded and printed without charge. Please check Standard Specifications Manual at https://wsdot.wa.gov/Publications/Manuals/M41-10.htm for the most current specifications.
https://wsdot.wa.gov/Publications/Manuals/M41-10.htm

PART FIVE
SPECIAL PROVISIONS

Main Pump Station Improvements

PROFESSIONAL OF RECORD CERTIFICATION(s):

SPECIAL PROVISIONS
INTRODUCTION TO THE SPECIAL PROVISIONS

(January 4, 2024 APWA GSP, Option A)
The work on this project shall be accomplished in accordance with the Standard Specifications for Road, Bridge and Municipal Construction, 2021 edition, as issued by the Washington State Department of Transportation (WSDOT) and the American Public Works Association (APWA), Washington State Chapter (hereafter "Standard Specifications"). The Standard Specifications, as modified or supplemented by these Special Provisions, all of which are made a part of the Contract Documents, shall govern all of the Work.

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

The GSPs are labeled under the headers of each GSP, with the effective date of the GSP and its source. For example:

(March 8, 2013 APWA GSP)

(April 1, 2013 WSDOTGSP)

(******) April 9, 2020 COC) Agency Special Provision

Project specific special provisions are labeled without a date as such:

(*****)

Also incorporated into the Contract Documents by reference are:

Manual on Uniform Traffic Control Devices for Streets and Highways, currently adopted edition, with Washington State modifications, if any

- Standard Plans for Road, Bridge and Municipal Construction, WSDOT Manual M21-01, current edition
- *City of Camas Design Standards Manual*, current edition
- Contractor shall obtain copies of these publications, at Contractor's own expense.

DIVISION 1
GENERAL REQUIREMENTS

1-00 GENERAL

(******)
These Special Provisions add to and are in addition to the current edition of the Washington State Department of Transportation Standard Specifications for Road, Bridge, and Municipal Construction. They are to be used in conjunction with the Standard Specifications. These Special Provisions, where in conflict with the Standard Specifications, shall take precedence.

The City of Camas Design Standards Manual shall add to and are in addition to the Washington State Department of Transportation Standard Specifications for Road, Bridge, and Municipal Construction and the Standard Plans.

APWA Special Provisions have been inserted into these Project Special Provisions and are denoted as such.

(date, APWA GSP)	Notes an APWA Special Provision
(******)	Notes a Project Specific Special Provision.

The Contractor shall meet the requirements of the Standard Specifications along with these Special Provisions.

1-01 DESCRIPTION OF WORK

(******) April 9, 2020 COC
This contract covers work to be performed on ***The City of Camas Main Street Pump Station located at 480 SE 3rd Ave***. *** This Work consists of the construction of all components of Main Street Pump Station Improvements, including demolition of existing pump station components, pipelines and building HVAC systems, construction of new pump station components, modification of existing components, conduit and equipment for electrical services and controls, construction of building HVAC, restoration, erosion control, bypass pumping, traffic control, and other work, all in accordance with the Plans and these Specifications.***

1-01.3 Definitions

(September 12, 2008 APWA GSP)

This Section is supplemented with the following:

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

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

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

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

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

Contract Documents
See definition for "Contract".

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

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

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

Contract Execution Date
The date the Contracting Agency officially binds the agency to the contract, and the final work day before Liquidated Damages

Notice to Proceed Date
The date stated in the Notice to Proceed on which the contract time begins.

Substantial Completion Date
The day the Engineer determines the Contracting Agency has full and unrestricted use and benefit of the facilities, both from the operational and safety standpoint, and only minor incidental work, replacement of temporary substitute facilities, or correction or repair remains for the physical completion of the total contract.

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

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

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

Notice of Award
The written notice from the Contracting Agency to the successful bidder signifying the Contracting Agency's acceptance of the bid.

Notice to Proceed
The written notice from the Contracting Agency or Engineer to the Contractor authorizing and directing the Contractor to proceed with the work and establishing the date on which the contract time begins.

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

(******) August 1, 2018 COC

The following new definitions are added to this section:

City
The City of Camas as determined by the jurisdiction in which the facilities are being constructed.

Standard Details
The City of Camas Design Standards Manual, incorporated into the Contract Documents by reference above, is also referred to as Standard Details

The definition for **Engineer** is replaced with the following:

Engineer or Project Engineer
For improvements constructed by private contract, shall mean the Project Engineer or Project Manager, for purposes of approval of changes to, and final acceptance of, the facilities that are or will become public facilities.

1-02 BID PROCEDURES AND CONDITIONS

1-02.1 Prequalification of Bidders

Delete this Section and replace it with the following:

1-02.1 Qualifications of Bidder

(******) COC - April 9, 2020

Bidders must meet the minimum qualifications of RCW 39.04.350(1), as amended:

"Before award of a public works contract, a bidder must meet the following responsibility criteria to be considered a responsible bidder and qualified to be awarded a public works project. The bidder must:

(a) At the time of bid submittal, have a certificate of registration in compliance with chapter 18.27 RCW;
(b) Have a current state unified business identifier number;

(c) If applicable, have industrial insurance coverage for the bidder's employees working in Washington as required in Title 51 RCW; an employment security department number as required in Title 50 RCW; and a state excise tax registration number as required in Title 82 RCW; and

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

1-02.6 Preparation of Proposal

Section 1-02.6 is supplemented with the following:

(August 2, 2004)
The fifth and sixth paragraphs of Section 1-02.6 are deleted.

1-02.9 Delivery of Proposal

(October 1, 2005 APWA GSP)

Revise the first paragraph to read:

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

(******) April 9, 2020

1-02.12 Opening of Proposal

Section 1-02.12 is supplemented with the following:

Date of Opening Bids
Sealed bids will be received at the following location before the specified time:

At Administrative Services, 616 NE 4th Avenue, Camas, Washington, 98607 until 10:00 A.M. Pacific Standard Time of the bid opening date. Administrative Services is located on the first floor of Camas City Hall.

The bid opening date for this project shall be:
Thursday, October 9, 2025, at 10:00 A.M. Pacific Standard Time at Camas City Hall located at 616 NE 4th Avenue, Camas, WA 98607.

1-02.13Irregular Proposals

(March 25, 2009 APWA GSP)

Revise item 1 to read:

1. A proposal will be considered irregular and will be rejected if:
   a. The Bidder is not prequalified when so required;
   b. The authorized proposal form furnished by the Contracting Agency is not used or is altered;
   c. The completed proposal form contains any unauthorized additions, deletions, alternate Bids, or conditions;

d. The Bidder adds provisions reserving the right to reject or accept the award, or enter into the Contract;
e. A price per unit cannot be determined from the Bid Proposal;
f. The Proposal form is not properly executed;
g. The Bidder fails to submit or properly complete a Subcontractor list, if applicable, as required in Section 1-02.6;
h. The Bidder fails to submit or properly complete a Disadvantaged, Minority or Women's Business Enterprise Certification, if applicable, as required in Section 1-02.6;
i. The Bid Proposal does not constitute a definite and unqualified offer to meet the material terms of the Bid invitation; or
j. More than one proposal is submitted for the same project from a Bidder under the same or different names.

1-02.14Disqualification of Bidders

(March 25, 2009 APWA GSP, Option B)

Delete this Section and replace it with the following:

A Bidder will be deemed not responsible if:

1. the Bidder does not meet the mandatory bidder responsibility criteria in RCW 39.04.350(1), as amended; or
2. evidence of collusion exists with any other Bidder or potential Bidder. Participants in collusion will be restricted from submitting further bids; or
3. the Bidder, in the opinion of the Contracting Agency, is not qualified for the work or to the full extent of the bid, or to the extent that the bid exceeds the authorized prequalification amount as may have been determined by a prequalification of the Bidder; or
4. an unsatisfactory performance record exists based on past or current Contracting Agency work or for work done for others, as judged from the standpoint of conduct of the work; workmanship; or progress; affirmative action; equal employment opportunity practices; termination for cause; or Disadvantaged Business Enterprise, Minority Business Enterprise, or Women's Business Enterprise utilization; or
5. there is uncompleted work (Contracting Agency or otherwise), which in the opinion of the Contracting Agency might hinder or prevent the prompt completion of the work bid upon; or
6. the Bidder failed to settle bills for labor or materials on past or current contracts, unless there are extenuating circumstances acceptable to the Contracting Agency; or
7. the Bidder has failed to complete a written public contract or has been convicted of a crime arising from a previous public contract, unless there are extenuating circumstances acceptable to the Contracting Agency; or
8. the Bidder is unable, financially or otherwise, to perform the work, in the opinion of the Contracting Agency; or
9. there are any other reasons deemed proper by the Contracting Agency.

As evidence that the Bidder meets the bidder responsibility criteria above, the apparent two lowest Bidders must submit to the Contracting Agency within 24 hours of the bid submittal deadline, documentation (sufficient in the sole judgment of the Contracting Agency)

demonstrating compliance with all applicable responsibility criteria, including all documentation specifically listed in the supplemental criteria. The Contracting Agency reserves the right to request such documentation from other Bidders as well, and to request further documentation as needed to assess bidder responsibility.

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

If the Contracting Agency determines the Bidder does not meet the bidder responsibility criteria above and is therefore not a responsible Bidder, the Contracting Agency shall notify the Bidder in writing, with the reasons for its determination. If the Bidder disagrees with this determination, it may appeal the determination within 24 hours of receipt of the Contracting Agency's determination by presenting its appeal to the Contracting Agency. The Contracting Agency will consider the appeal before issuing its final determination. If the final determination affirms that the Bidder is not responsible, the Contracting Agency will not execute a contract with any other Bidder until at least two business days after the Bidder determined to be not responsible has received the final determination.

1-02.15 Pre Award Information

(October 1, 2005 APWA GSP)

Revise this section to read:

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

1. A sworn affidavit that all materials to be used on this project are American made,
2. A complete statement of the origin, composition, and manufacture of any or all materials to be used,
3. Samples of these materials for quality and fitness tests,
4. A progress schedule (in a form the Contracting Agency requires) showing the order of and time required for the various phases of the work,
5. A breakdown of costs assigned to any bid item,
6. Attendance at a conference with the Engineer or representatives of the Engineer,
7. Obtain, and furnish a copy of, a business license to do business in the city or county where the work is located,
8. A copy of State of Washington Contractor's Registration,
9. Or any other information or action taken that is deemed necessary to ensure that the bidder is the lowest responsible bidder.

1-03 AWARD AND EXECUTION OF CONTRACT

1-03.1 Consideration of Bids

(January 23, 2006 APWA GSP)

Revise the first paragraph to read:

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

1-03.3 Execution of Contract

(******)COC – April 9, 2020

Revise this section to read:

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

Within 10 calendar days after the award date, the successful bidder shall return the signed Contracting Agency-prepared contract, an insurance certification as required by Section 1-07.18, and a satisfactory bond as required by law and Section 1-03.4. Before execution of the contract by the Contracting Agency, the successful bidder shall provide any pre-award information the Contracting Agency may require under Section 1-02.15.

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

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

1-03.4 Contract Bond

(October 1, 2005 APWA GSP)

Revise the first paragraph to read:

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

1. Be on a Contracting Agency-furnished form;

2. Be signed by an approved surety (or sureties) that:
   a. Is registered with the Washington State Insurance Commissioner, and
   b. Appears on the current Authorized Insurance List in the State of Washington published by the Office of the Insurance Commissioner,
3. Be conditioned upon the faithful performance of the contract by the Contractor within the prescribed time;
4. Guarantee that the surety shall indemnify, defend, and protect the Contracting Agency against any claim of direct or indirect loss resulting from the failure:
   a. Of the Contractor (or any of the employees, subcontractors, or lower tier subcontractors of the Contractor) to faithfully perform the contract, or
   b. Of the Contractor (or the subcontractors or lower tier subcontractors of the Contractor) to pay all laborers, mechanics, subcontractors, lower tier subcontractors, material person, or any other person who provides supplies or provisions for carrying out the work;
5. Be accompanied by a power of attorney for the Surety's officer empowered to sign the bond; and
6. Be signed by an officer of the Contractor empowered to sign official statements (sole proprietor or partner). If the Contractor is a corporation, the bond must be signed by the president or vice-president, unless accompanied by written proof of the authority of the individual signing the bond to bind the corporation (i.e., corporate resolution, power of attorney or a letter to such effect by the president or vice-president).

1-05 CONTROL OF WORK

1-05.7 Removal of Defective and Unauthorized Work

(October 1, 2005 APWA GSP)

Supplement this section with the following:

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

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

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

replacement of work of others destroyed or damaged by correction, removal, or replacement of the Contractor's unauthorized work.

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

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

1-05.12 Final Acceptance

Section 1-05.12 is supplemented with the following:

(******) October 29, 2020 COC
By signing the Contract the Contractor agrees to provide a material, labor, and equipment warranty for the work performed for a period of one (1) year from the acceptance date, for all work to be free of defect in materials or workmanship. All warranty related repairs will be made promptly upon notification to the Contractor at no cost to the City. The Contract Bond shall cover 100% of the work proposed in this contract, and as modified by change order, for a period no shorter than one calendar year (365 Days) from the date of Final Acceptance as established by the contracting agency.

1-05.12(1) Construction Documentation

(******) COC August 1, 2018

Description

This work shall include all labor, equipment, and materials to provide satisfactory and complete project documentation as may be required by the City of Camas, various Washington State Agencies, and the Federal Government that is specific to this project. Documentation shall include, but may not be strictly limited to, satisfactory completion of the following: Weekly Certified Payrolls for the Prime Contractor, and ALL Subcontractors; INTENTS and AFFIDAVITS of Wages Paid as required by the Department of Labor and Industries, MBE Documentation, Affidavit of Industrial Insurance Premiums for all contractors, submittal of tickets for all materials used on the project, and any other documentation as may be required by the Project Engineer, as is necessary to properly document the activities of the project.

Requirements

All documentation and other paperwork as may be required by the Contracting Agency, shall be completed correctly and submitted to the appropriate State or Local Agency at regular intervals as the work progresses. The Contracting Agency will review and monitor the documentation requirements as the project progresses and may direct the Contractor to complete various documentation items as may be required from the City of Camas, various State and Federal Funding and Regulatory Agencies, prior to any additional contract payments.

1-07 LEGAL RELATIONS AND RESPONSIBILITIES TO THE PUBLIC

1-07.1 Laws to be Observed

Section 1-07.1 is supplemented with the following:

(******) COC – April 9, 2020
In cases of conflict between different safety regulations, the more stringent regulation shall apply.

The Washington State Department of Labor and Industries shall be the sole and paramount administrative agency responsible for the administration of the provisions of the Washington Industrial Safety and Health Act of 1973 (WISHA).

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

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

The contractor shall prepare and submit a company-wide COVID-19 Plan for review with their bid. A job specific plan shall be submitted prior to commencing any work.

1-07.2 State Sales Tax

Delete this section, including its sub-sections, in its entirety and replace it with the following:

1-07.2 State Sales Tax
(October 1, 2005 APWA GSP)

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

The Contractor shall include all Contractor-paid taxes in the unit bid prices or other contract amounts. In some cases, however, state retail sales tax will not be included. Section 1-07.2(3) describes this exception.

The Contracting Agency will pay the retained percentage only if the Contractor has obtained from the Washington State Department of Revenue a certificate showing that all contract-related taxes have been paid (RCW 60.28.050). The Contracting Agency may deduct from its payments to the Contractor any amount the Contractor may owe the Washington State Department of Revenue,

whether the amount owed relates to this contract or not. Any amount so deducted will be paid into the proper State fund.

1-07.2(2) State Sales Tax — Rule 171
WAC 458-20-171, and its related rules, apply to building, repairing, or improving streets, roads, etc., which are owned by a municipal corporation, or political subdivision of the state, or by the United States, and which are used primarily for foot or vehicular traffic. This includes storm or combined sewer systems within and included as a part of the street or road drainage system and power lines when such are part of the roadway lighting system. For work performed in such cases, the Contractor shall include Washington State Retail Sales Taxes in the various unit bid item prices, or other contract amounts, including those that the Contractor pays on the purchase of the materials, equipment, or supplies used or consumed in doing the work.

1-07.2(3) State Sales Tax — Rule 170
WAC 458-20-170, and its related rules, apply to the constructing and repairing of new or existing buildings, or other structures, upon real property. This includes, but is not limited to, the construction of streets, roads, highways, etc., owned by the state of Washington; water mains and their appurtenances; sanitary sewers and sewage disposal systems unless such sewers and disposal systems are within, and a part of, a street or road drainage system; telephone, telegraph, electrical power distribution lines, or other conduits or lines in or above streets or roads, unless such power lines become a part of a street or road lighting system; and installing or attaching of any article of tangible personal property in or to real property, whether or not such personal property becomes a part of the realty by virtue of installation.

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

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

1-07.2(4) Services
The Contractor shall not collect retail sales tax from the Contracting Agency on any contract wholly for professional or other services (as defined in Washington State Department of Revenue Rules 138 and 244).

1-07.5(3) State Department of Ecology
(******) March 24, 2020 COC

Item No. 2. in the first paragraph is revised to read:

2. Perform Work in such a manner that all materials and substances not specifically identified in the Contract documents to be placed in the water do not enter waters of the State, including wetlands. These include, but are not limited to, petroleum products, hydraulic fluid, fresh concrete, concrete wastewater, process wastewater, slurry materials and waste

from shaft drilling, sediments, sediment-laden water, chemicals, paint, solvents, or other toxic or deleterious materials. **Also included are slurries generated due to saw cutting of cement concrete and asphalt concrete surfaces and structures.**

1-07.6 Permits and Licenses

(******) April 15, 2020 COC

Section 1-07.6 is supplement with the following:

NPDES Construction Stormwater General Permit

The Contracting Agency has obtained a NPDES Construction Stormwater General Permit for this project and developed an initial Stormwater Pollution Prevention Plan (SWPPP).

Ownership of this permit will be transferred to the Contractor as detailed in Section 8-01 of these Special Provisions. The Contractor, as the site operator, shall become the permittee, responsible for complying with all requirements under this permit, including amending and implementing the SWPPP, and bearing financial responsibility for any fees, violations or fines incurred.

The Contractor shall furnish one copy of all permits obtained by the Contractor to the Engineer and shall have a copy of all required permits on the project site at all times and available for inspection upon request of the Engineer.

1-07.17 Utilities and Similar Facilities

(******) April 21, 2020 COC

Section 1-07.17 is supplemented by the following:

Locations and dimensions shown in the Plans for existing facilities are in accordance with available information obtained without uncovering, measuring, or other verification.

The Contractor shall call the Utility Location Request Center (One Call Center), for field location, not less than two nor more than ten business days before the scheduled date for commencement of excavation which may affect underground utility facilities, unless otherwise agreed upon by the parties involved. A business day is defined as any day other than Saturday, Sunday, or a legal local, State, or Federal holiday. The telephone number for the One Call Center for this project may be obtained from the Engineer. If no one-number locator service is available, notice shall be provided individually to those owners known to or suspected of having underground facilities within the area of proposed excavation.

The Contractor is alerted to the existence of Chapter 19.122 RCW, a law relating to underground utilities. Any cost to the Contractor incurred as a result of this law shall be at the Contractor's expense.

No excavation shall begin until all known facilities, in the vicinity of the excavation area, have been located and marked.

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

Clark Public Utilities
Construction Services
Wade Hammerstrom
360.992.8721

City of Camas
Water & Sewer Department
Tobin Reed
360.817.7289 / cell:360.931.0327
treed@cityofcamas.us

Frontier Communications
Mike Bright
503.667.9781 / cell: 360.930.9031
mike.w.bright@ftr.com

City of Camas
Street Department
Denis Ryan
360.817.7213 / cell:360.772.6521
dryan@cityofcamas.us

Northwest Natural Gas
Ryan Winfree
503.226.4211 x 2045 / cell: 773.612.9237
ryan.winfree@nwnatural.com

1-07.18 Public Liability and Property Damage Insurance

Incorporate Facility Construction (Builders Risk) which includes new construction of buildings, facilities, and structures, including but not limited to, wastewater treatment plants, lift stations, water treatment plants, dams, piers, bridges, towers, reservoirs, and major sewer projects. Also use for additions, remodels or renovations to existing scheduled locations if the project exceeds $500,000 or when significant materials and equipment will be used in existing buildings:

Builders Risk insurance covering interests of the Public Entity, the Contractor, Subcontractors, and Sub-subcontractors in the work. Builders Risk insurance shall be on a special perils policy form and shall insure against the perils of fire and extended coverage and physical loss or damage including flood, earthquake, theft, vandalism, malicious mischief, and collapse. The Builders Risk insurance shall include coverage for temporary buildings, debris removal, and damage to materials in transit or stored off-site. This Builders Risk insurance covering the work will have a deductible of $5,000 for each occurrence, which will be the responsibility of the Contractor. Higher deductibles for flood and earthquake perils may be accepted by the Public Entity upon written request by the Contractor and written acceptance by the Public Entity. Any increased deductibles accepted by the Public Entity will remain the responsibility of the Contractor. The Builders Risk insurance shall be maintained until the Public Entity has granted substantial completion of the project. An installation floater may be acceptable in lieu of Builders Risk for renovation projects only if approved in writing by the Public Entity.

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

Contractor's Insurance for Other Losses. The Contractor shall assume full responsibility for all loss or damage from any cause whatsoever to any tools, Contractor's employee owned tools,

machinery, equipment, or motor vehicles owned or rented by the Contractor, or the Contractor's agents, suppliers, contractors or subcontractors as well as to any temporary structures, scaffolding and protective fences.

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

Verification of Coverage. The Contractor shall furnish the Public Entity with original certificates and a copy of the amendatory endorsements, including but not necessarily limited to the additional insured endorsements, evidencing the Automobile Liability and Commercial General Liability insurance of the Contractor before commencement of the work. Before any exposure to loss may occur, the Contractor shall file with the Public Entity a copy of the Builders Risk insurance policy that includes all applicable conditions, exclusions, definitions, terms and endorsements related to this project. Upon request by the Public Entity, the Contractor shall furnish certified copies of all required insurance policies, including endorsements, required in this Contract and evidence of all subcontractors' coverage.

Delete this section in its entirety, and replace it with the following:

1-07.18 Insurance

(May 10, 2006 APWA GSP)

1-07.18(1) General Requirements

A. The Contractor shall obtain the insurance described in this section from insurers approved by the State Insurance Commissioner pursuant to RCW Title 48. The insurance must be provided by an insurer with a rating of A-: VII or higher in the A.M. Best's Key Rating Guide, which is licensed to do business in the state of Washington (or issued as a surplus line by a Washington Surplus lines broker). The Contracting Agency reserves the right to approve or reject the insurance provided, based on the insurer (including financial condition), terms and coverage, the Certificate of Insurance, and/or endorsements.

   Extended Coverage for Completed Operations. The Contractor shall maintain Commercial General Liability completed operations coverage for a period of three years following substantial completion of the work for the benefit of the City by naming the City of Camas an additional insured using Insurance Services Office (ISO) Additional Insurance-Completed Operations endorsement CG 20 37 10 01 or an endorsement at least as broad coverage.

B. The Contractor shall keep this insurance in force during the term of the contract and for thirty (30) days after the Physical Completion date, unless otherwise indicated (see C. below).

C. If any insurance policy is written on a claims made form, its retroactive date, and that of all subsequent renewals, shall be no later than the effective date of this Contract. The policy shall

state that coverage is claims made, and state the retroactive date. Claims-made form coverage shall be maintained by the Contractor for a minimum of 36 months following the Final Completion or earlier termination of this contract, and the Contractor shall annually provide the Contracting Agency with proof of renewal. If renewal of the claims made form of coverage becomes unavailable, or economically prohibitive, the Contractor shall purchase an extended reporting period ("tail") or execute another form of guarantee acceptable to the Contracting Agency to assure financial responsibility for liability for services performed.

D. The insurance policies shall contain a "cross liability" provision.

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

F. All insurance policies and Certificates of Insurance shall include a requirement providing for a minimum of 30 days prior written notice to the Contracting Agency of any cancellation in any insurance policy.

The Contractor shall provide the City and all Additional Insured for this work with written notice of any policy cancellation within two business days of their receipt of such notice.

G. Upon request, the Contractor shall forward to the Contracting Agency a full and certified copy of the insurance policy(s), including endorsements, required in this Contract and evidence of all subcontractors coverage.

H. The Contractor shall not begin work under the contract until the required insurance has been obtained and approved by the Contracting Agency.

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

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

1-07.18(2) Additional Insured

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

- The City of Camas and its officers, elected officials, employees, agents, and volunteers

The above-listed entities shall be additional insured(s). If the Contractor maintains higher insurance limits than the minimums shown above, the Public Entity shall be insured for the full

available limits of Commercial General and Excess or Umbrella liability maintained by the Contractor, irrespective of whether such limits maintained by the Contractor are greater than those required by this Contract or whether any certificate of insurance furnished to the Public Entity evidences limits of liability lower than those maintained by the Contractor.

1-07.18(3) Subcontractors

The Contractor shall cause each and every Subcontractor to provide insurance coverage that complies with all applicable requirements of the Contractor-provided insurance as set forth herein, except the Contractor shall have sole responsibility for determining the limits of coverage required to be obtained by Subcontractors. The Contractor shall ensure that the City is an additional insured on each and every Subcontractor's Commercial General liability insurance policy using an endorsement at least as broad as ISO CG 20 10 10 01 for ongoing operations and CG 20 37 10 01 for completed operations.

1-07.18(4) Evidence of Insurance

The Contractor shall furnish the Contracting Agency with original Certificate(s) of Insurance and copies of endorsements for each policy of insurance meeting the requirements set forth herein when the Contractor delivers the signed Contract for the work. The certificate and endorsements must conform to the following requirements:

1. An ACORD certificate or a form determined by the Contracting Agency to be equivalent.
2. Copies of all endorsements naming Contracting Agency and all other entities listed in 1-07.18(2) as Additional Insured(s), showing the policy number. The Contractor may submit a copy of any blanket additional insured clause from its policies instead of a separate endorsement. A statement of additional insured status on an ACORD Certificate of Insurance shall <u>not</u> satisfy this requirement.
3. Any other amendatory endorsements to show the coverage required herein.

1-07.18(5) Coverages and Limits

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

<u>Excess or Umbrella Liability</u> insurance shall be excess over and at least as broad in coverage as the Contractor's Commercial General Liability and Automobile Liability insurance. The Public Entity shall be named as an additional insured on the Contractor's Excess or Umbrella Liability insurance policy. The Excess or Umbrella insurance coverage will drop down when underlying policy aggregate limits are exhausted.

<u>Excess or Umbrella Liability</u> insurance shall be written with limits of not less than $ (fill in the amount) per occurrence and annual aggregate. The Excess or Umbrella Liability requirement and limits may be satisfied instead through the Contractor's Commercial General Liability and Automobile Liability insurance, or any combination thereof that achieves the overall required limits.

1-07.18(5)A Commercial General Liability

Commercial General Liability insurance shall be at least as broad as ISO occurrence form CG 00 01 and shall cover liability arising from premises, operations, independent contractors, products-completed operations, stop gap liability, personal injury and advertising injury, and liability assumed under an insured contract. The Commercial General Liability insurance shall be endorsed to provide a per project general aggregate limit using ISO form CG 25 03 05 09 or an endorsement providing at least as broad coverage. There shall be no exclusion for liability arising from explosion, collapse or underground property damage. The Public Entity shall be named as an additional insured under the Contractor's Commercial General Liability insurance policy with respect to the work performed for the Public Entity using ISO Additional Insured endorsement CG 20 10 10 01 and Additional Insured-Completed Operations endorsement CG 20 37 10 01 or substitute endorsements providing at least as broad coverage.

Per project aggregate
Premises/Operations Liability
Products/Completed Operations – for a period of one year following final acceptance of the work.
Personal/Advertising Injury
Contractual Liability
Independent Contractors Liability
Stop Gap / Employers' Liability
Explosion, Collapse, or Underground Property Damage (XCU)
Blasting (only required when the Contractor's work under this Contract includes exposures to which this specified coverage responds)

Such policy must provide the following minimum limits:

$2,000,000	Each Occurrence
$2,000,000	General Aggregate
$2,000,000	Products & Completed Operations Aggregate
$1,000,000	Personal & Advertising Injury, each offence

Stop Gap / Employers' Liability

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

1-07.18(5)B Automobile Liability

Automobile Liability insurance covering all owned, non-owned, hired, and leased vehicles. Coverage shall be at least as broad as ISO form CA 00 01. For Construction and Services Contracts add: Pollution Liability coverage at least as broad as that provided under ISO Pollution Liability Broadened Coverage for Covered Autos Endorsement CA 99 48 shall be provided, and the Motor Carrier Act Endorsement (MCS 90) shall be attached.

$1,000,000	Minimum combined single limit for bodily injury and property damage per incident

1-07.18(5)C Workers' Compensation
The Contractor shall comply with Workers' Compensation coverage as required by the Industrial Insurance laws of the state of Washington.

Environmental Risks. Require for projects involving potential pollution risk from asbestos, hazardous chemicals or waste and nuclear hazards. Projects may include demolition, oil based paving projects, sanitary sewer projects, e.g. pipes, lift stations, and sewer outfall. Also, projects working on or near water drinking sources, rivers, streams and other bodies of water:

Contractors Pollution Liability insurance covering losses caused by pollution conditions that arise from the operations of the Contractor. Contractors Pollution Liability insurance shall be written in an amount of at least $2,000,000 per loss, with an annual aggregate of at least $2,000,000. Contractors Pollution Liability shall cover bodily injury, property damage, cleanup costs and defense, including costs and expenses incurred in the investigation, defense, or settlement of claims.

If the Contractors Pollution Liability insurance is written on a claims-made basis, the Contractor warrants that any retroactive date applicable to coverage under the policy precedes the effective date of this Contract; and that continuous coverage will be maintained or an extended discovery period will be exercised for a period of three (3) years beginning from the time that work under the Contract is completed.

The Public Entity shall be named by endorsement as an additional insured on the Contractors Pollution Liability insurance policy.

If the scope of services as defined in this Contract includes the disposal of any hazardous materials from the job site, the Contractor must furnish to the Public Entity evidence of Pollution Liability insurance maintained by the disposal site operator for losses arising from the insured facility accepting waste under this Contract. Coverage certified to the Public Entity under this paragraph must be maintained in minimum amounts of $2,000,000 per loss, with an annual aggregate of at least $2,000,000.

Please Note: For projects involving potential pollution risk from asbestos, hazardous chemicals or waste and nuclear hazards the amount of insurance required should be increased to reflect the amount of increased risk.

Contractors Using Unmanned Aerial Systems (UAS)
Aviation Liability or Aircraft Liability insurance with limits not less than $1,000,000 each occurrence and $2,000,000 in the aggregate. This coverage may also be provided by endorsement to the Contractor's Commercial General Liability Insurance policy.

Reduced Insurance Requirement
Section 1-07.18 is revised as follows:

Item number 1 in the first paragraph is deleted.

Item number 2 is revised to read:

2. Commercial General Liability Insurance written under ISO Form CG0001 or its equivalent with minimum limits of $2,000,000 per occurrence and in the aggregate for each policy year. Products and completed operations coverage shall be provided for a period of one year following final acceptance of the work. The Contracting Agency shall be named as an additional insured on the policy.

1-07.23(1) Construction Under Traffic

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

(******) August 1, 2018 COC
Allowable Lane and Road Closure Requirements.
The Contractor shall obtain the City's approval prior to closing any lanes, shall employ sufficient certified flaggers and adequate signage for such conditions, and shall perform all traffic control in accordance with the latest version of the MUTCD and the approved traffic control plan.

(******) August 1, 2018 COC
Material Delivery Subcontractors
According to prevailing wage laws in the State of Washington (Chapter 39.12 RCW and as defined by WAC 296-127-018), any person that delivers materials such as cement concrete or asphalt to a work site, regardless of the method of material placement, **is considered a subcontractor, and is subject to receiving prevailing wages, and all other conditions as required by law.**

(******) August 1, 2018 COC
Offsite Fabrication
According to prevailing wage laws in the State of Washington (Chapter 39.04.010 RCW and as defined by WAC 296-127-010(5)(b)) The offsite fabrication of nonstandard items specifically produced for a public works project is considered public work for which prevailing wages are required. Examples include, but not limited to, fabrication of ducts for HVAC systems, certain concrete tunnel liners, and certain steel or other metal prefabrication. If the item is not fabricated on the public works jobsite, contact L&I for a determination as to whether the work is subject to the payment of prevailing wages, and the appropriate classification of work, if applicable. This determination will be based upon all relevant information, including, but not limited to: (1) whether the item is fabricated in an assembly/fabrication plant set up for, and dedicated primarily to the public works project; (2) whether the item requires assembly, cutting, modification or other fabrication by the supplier; (3) whether the item is typically an inventory item which could reasonably be sold on the general market; and (4) whether the item, although generally defined as "standard," has unusual characteristics such as shape, type of material, strength requirements, or finish, etc., specifically for the public works project.

(******) August 1, 2018 COC
Cement Concrete and Asphalt
A material supplier delivery driver is to be paid prevailing wages for their covered travel time as outlined in WAC 296-127-018 subsection 1-3. Said material supplier *IS* considered a subcontractor and must comply with the requirements of 39.12 RCW.

(******) August 1, 2018 COC

Crushed Rock, Gravel, Sand, or other similar materials

A material supplier delivering materials to a designated stockpile (i.e. crushed rock or other similar material) are not subject to prevailing wage as outlined in 39.12 RCW. A "stockpile" is defined as materials delivered to a pile located away from the site of incorporation such that the stockpiled materials must be physically moved from the stockpile and transported to another location on the project site in order to be incorporated into the project (WAC 296-127-018 subsection 4).

1-08 PROSECUTION AND PROGRESS

1-08.0(2) Hours of Work

(******) August 1, 2018 COC

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

The Contractor shall not be allowed to perform any work on City recognized holidays, Saturdays, Sundays, or before 7:00 a.m. or after 6:00 p.m. on any week day. Camas may require that no work be performed during Camas Days in Late July.

Any work to be performed on Saturdays shall be approved in advance by the Contracting Agency. If approved, work hours shall be limited to 8:00 a.m. to 5:00 p.m. only.

1-08.5 Time for Completion

(******)

Section 1-08.5 is supplemented with the following:

This project shall be physically completed by September 30, 2026 following the date of the Notice to Proceed, unless amended by change order.

The Engineer will give the Contractor written notice of the physical completion date for all work the Contract requires. This date shall constitute the substantial completion date of the Contract, but shall not imply the City's acceptance of the work or the contract.

DIVISION 2
EARTHWORK

2-01 CLEARING, GRUBBING, AND ROADSIDE CLEANUP

2-01.1 Description

(******) August 1, 2018 COC

Section 2-01.1 is supplemented with the following:

Clearing and grubbing shall be done to within the limits per the plans. Items will be removed outside these limits only if specifically noted on the plans and staked in the field. Additionally, items within the limits of slope stakes are to remain, if they are shown in the plans or are designated by the Engineer to be saved, and shall be protected by the contractor.

2-01.3(4) Roadside Cleanup

(******) August 1, 2018 COC

Section 2-01.3(4) is supplemented with the following work:

Minor grading of slopes and restoration of all property, landscaping, and approaches to original condition that are adjacent to, impacted by, or on which work has occurred. Restoration shall be to the satisfaction of the Engineer. Final Cleanup shall be per Section 1-04.11

2-02 REMOVAL OF STRUCTURES AND OBSTRUCTIONS

2-02.1 Description

(******) August 1, 2018 COC

Section 2-02.1 is supplemented with the following:

Work shall include, but is not limited to, saw cutting, removal and disposal of existing cement concrete sidewalk, curb, driveway approach, as well as base rock, subgrade soil, and other material, to facilitate the construction of ADA compliant sidewalk ramps, side sewers, or other related items where indicated in the plans.

DIVISION 7
DRAINAGE STRUCTURES, STORM SEWERS, SANITARY SEWERS, WATER MAINS, AND CONDUITS

7-08 GENERAL PIPE INSTALLATION REQUIREMENTS

7-08.2 Materials
(******) August 1, 2018 COC

Section 7-08.2 is supplemented with the following:

Foundation material, if required to be installed by Engineer due to unsuitable native materials being encountered at the bottom of the trench, shall be Crushed Surfacing Top Course as defined in Section 9-03.9(3).

Pipe zone material shall be crushed surfacing top course as defined by Section 9-03.9(3). Backfill shall be as indicated on the details in the Plans.

7-08.3(1)B Shoring
(******) August 1, 2018 COC

Supplement with the following:

Construction Requirements
The Contractor shall supply and install a certified trench box for all excavations exceeding 4 feet in depth for the duration of this project. It is the Contractor's responsibility to determine the size and type of box required and to perform construction activities in a safe and responsible manner in accordance with the requirements of the Washington State Department of Labor and Industries. The City of Camas acknowledges no expertise or qualifications for determining the safety of construction activities for this project. However, the Contractor shall not allow any worker in a trench or excavation without proper safety equipment and shoring.

7-08.3(1)C Bedding the Pipe
(******) August 1, 2018 COC

Section 7-08.3(1)C is supplemented with the following:

Crushed surfacing top course meeting the requirements of Section 9-03.9(3) shall be used for pipe zone bedding and backfill. Pipe zone bedding shall be placed to the depths shown in the Plans. Pipe zone bedding shall be tamped around the pipe to 95-percent of maximum density by approved hand-held tools, so as to provide firm and uniform support for the full length of the pipe. Care shall be taken to prevent any damage to the pipe or its protective coating.

7-08.3(3) Backfilling
(******) August 1, 2018 COC

Delete the second paragraph of section 7-08.3(3) and replace with the following:

Pipe Zone backfill shall be crushed surfacing top course as defined by Section 9-03.9(3).

7-08.3 Construction Requirements

(******) August 1, 2018 COC

Section 7-08.3 is supplemented with the following:

7-08.3(5) Solid Rock Excavation

This work shall include the removal of solid rock from excavations and trenches for sidewalk, water and sanitary sewer pipe. For purposes of this contract, solid rock is defined as any naturally occurring formation of rock that cannot be removed, excavated, or ripped by a CAT 320 Excavator, or equivalent machine, fitted with "Tiger" or similar rock removing teeth, and, is further classified as material that requires the use of a track-mounted hydraulic hammer or portable jack hammer to be removed. Fractured rock, sandstone, or other resistive material shall not be classified as solid rock excavation for this contract. Solid Rock Excavation shall refer to a method of removal and not a geologic formation.

In these areas the Contractor shall remove solid rock as required to allow for the proper placement of bedding material under the new pipe or sidewalk.

Solid Rock Excavation shall be performed as required, or otherwise directed by the Engineer, to install water and sewer mains, water and sewer services, manholes, and sidewalk in accordance with the plans. Areas of solid rock excavation shall be agreed to in advance by the Engineer.

The maximum limits for the measurement of solid rock excavation are as follows:

Sidewalk:			
Depth:	2" below the bottom of cement concrete sidewalk	Width:	4" beyond the width of the cement concrete sidewalk
Water Pipe:			
Depth:	6" below the pipe invert	Width:	36"
Sewer Pipe:			
Depth:	6" below the pipe invert	Width:	36"
Sewer Manhole:			
Depth:	14" below the manhole base	Width:	12" beyond the diameter of the manhole base

Measurement and payment of Solid Rock Excavation shall only occur if the Engineer is notified in advance and is permitted to evaluate and field measure the pre-existing conditions.

PART SIX
CSI TECHNICAL SPECIFICATIONS

SECTION 00 01 05
CERTIFICATE OF ENGINEER

The technical material and specifications listed below were prepared by or prepared under the direct supervision of the undersigned, whose seal, as a professional engineer licensed to practice as such, is affixed below.

01 10 00 SUMMARY OF WORK
01 20 00 MEASUREMENT AND PAYMENT
01 31 00 PROJECT MANAGEMENT AND COORDINATION
01 32 19 SUBMITTALS
01 40 00 QUALITY REQUIREMENTS
01 43 33 MANUFACTURER'S FIELD SERVICES
01 51 00 TEMPORARY UTILITIES AND FACILITIES
01 51 39 TEMPORARY WASTEWATER PUMPING FACILITIES
01 55 25 TEMPORARY TRAFFIC CONTROL
01 60 00 PRODUCT REQUIREMENTS
01 76 00 PROTECTION AND MAINTENANCE OF WORK AND PROPERTY
01 78 23 OPERATIONS AND MAINTENANCE MANUALS
01 91 10 EQUIPMENT TESTING AND FACILITY STARTUP
02 41 00 DEMOLITION
03 11 00 CONCRETE FORMING
03 30 00 CAST-IN-PLACE CONCRETE
05 05 19 POST-INSTALLED CONCRETE ANCHORS
05 50 00 MISCELLANEOUS METALS
08 31 13 ACCESS DOORS AND FRAMES
09 90 00 PROTECTIVE COATINGS
09 90 10 GALVANIZING
31 11 00 SITE CLEARING
31 23 00 EXCAVATION AND FILL
31 23 33 TRENCHING BACKFILLING AND COMPACTION
33 05 06 HYDROSTATIC PRESSURE TESTING
40 27 00 PROCESS PIPING SYSTEMS
40 29 00 PROCESS VALVES

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Wes.Wegner@wallsieng.net

SECTION 00 01 05
CERTIFICATE OF ENGINEER

The technical material and specifications listed below were prepared by or prepared under the direct supervision of the undersigned, whose seal, as a professional engineer licensed to practice as such, is affixed below.

Specification Sections:

26 05 00 General Requirements for Electrical Work
26 05 05 Selective Demolition for Electrical
26 05 19 Low-Voltage Conductors, Wires and Cables
26 05 26 Grounding System
26 05 29 Hangers and Supports for Electrical Systems
26 05 33 Raceways Boxes and Fittings
26 05 53 Identification for Electrical Systems
26 08 00 Commissioning of Electrical Systems
26 27 26 Wiring Devices
26 28 13 Fuses
26 29 24 Active Front End Low-Voltage AFD
26 36 23 Automatic Transfer Switches
40 06 70 Schedules of Instrumentation for Process Systems
40 61 13 Process Control System General Provisions
40 61 21 Process Control System Testing
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40 62 63 Operator Interface Terminals (OIT)
40 63 43 Programmable Logic Controllers
40 67 16 Control Panels
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40 71 13 Magnetic Flow Meters
40 71 79 Flow Switches (air)
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40 78 56 Isolators Intrinsically-Safe Barriers and Surge Suppressors
40 78 59 Power Supplies
40 80 00 Commissioning of Process Systems

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SECTION 00 01 05
CERTIFICATE OF ENGINEER

The technical material and specifications listed below were prepared by or prepared under the direct supervision of the undersigned, whose seal, as a professional engineer licensed to practice as such, is affixed below.

SPECIFICATION SECTIONS:

00 01 05 CERTIFICATE OF ENGINEER

23 05 53 IDENTIFICATION FOR HVAC EQUIPMENT

23 05 93 TESTING, ADJUSTING, AND BALANCING OF HVA
HVAC

23 34 23 HVAC POWER VENTILATORS

23 84 10 ELECTRIC HEATING EQUIPMENT

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SECTION 01 10 00
SUMMARY OF WORK

PART 1 GENERAL

1.01 DESCRIPTION

A. The work to be performed under these Specifications and accompanying Drawings consists of furnishing all permits, labor, materials, and equipment necessary for the construction of improvements at the Main Pump Station, including all electrical work, piping and mechanical work, heating and ventilation work, and all work incidental to or necessary for satisfactory completion of the work shown on the Drawings and described in the Specifications. The major components of the work are:

1. Demolition of existing electrical and control equipment, and replacement with new electrical and control equipment.

2. Demolition of existing heating and ventilation equipment, and replacement with new heating and ventilation equipment.

3. Demolition of select piping, and installation of new flow meter, valves, and piping.

4. Surface preparation and epoxy coating the existing pump station wetwell.

1.02 SUBCONTRACTORS

A. No attempt has been made in these specifications or drawings to segregate work covered by any trade or subcontract. Such segregation and establishment of subcontract limits will be solely a matter of specific agreement between the contractor and his subcontractors and shall not be based upon any inclusion, segregation, or arrangement in or of these specifications. The contractor and subcontractor in each case is warned that work included in any subcontract may be divided between several general specifications and that each general specification or subhead of the technical specifications may include work covered by two or more subcontracts in excess of any one subcontract.

1.03 RESPONSIBILITY

A. The above general outline of principal features of the work does not in any way limit the responsibility of the Contractor to perform all work and furnish all equipment, labor, and materials required by the Specifications and the Drawings referred to therein.

PART 2 PRODUCTS - Not applicable to this Section.

PART 3 EXECUTION – Not applicable to this Section.

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

SECTION 01 20 00
MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SUMMARY

Work under this Contract will be paid on a unit price or lump sum basis as outlined on the Bid Proposal Form, for the quantity of Work as installed.

The contract price and payment thereof shall constitute full compensation for all work incidental to the completion of the project in accordance with the Contract Drawings and Specifications.

Measurement and payment will be in accordance with the Bid Proposal Form, the requirements of the Public Improvement Contract between the City and the Contractor, and of subsection 1.02 of this Section.

The application for payment will be for a specific item based on the percentage completed or the quantity installed. The percentage complete will be based on the value of the partially completed work relative to the value of the item when entirely completed and ready for service. The owner has sole discretion to make progress payments for bid items measured on a lump sum basis.

The Bids for the Work are intended to establish a total cost for the Work in its entirety. Should the Contractor feel that the cost for the Work has not been established by specific items in the Bid Proposal Form, include the cost for that Work in some related Bid Items so that the Proposal for the Project reflects the total cost for completing the Work in its entirety. This includes all indirect costs, such as supervision and overheads, profit, as specified in the Public Improvement Contract General Conditions. These items shall be allocated to each bid item as applicable. No separate payment will be made to the Contractor for these items.

Extra Work, if any, shall be performed in accordance with the Public Improvement Contract between the City and the Contractor, and will be paid for in accordance with this contract.

All workers on this project shall be paid the applicable prevailing wage rate in accordance with the Public Improvement Contract between the City and the Contractor, and will be paid for in accordance with this contract.

1.02 MEASUREMENT AND PAYMENT

The contract price and payment thereof shall constitute full compensation for all work incidental to the completion of the project in accordance with the plans and specifications. Measurement and payment will be in accordance with the Bid Proposal items, the requirements of the General Conditions of the Standard Specifications, and as follows:

Bid Schedule

ITEM 1. MOBILIZATION

A. Payment. Payment includes the costs associated with mobilization to perform the work and includes project coordination and meetings, temporary facilities, safety training, photo documentation, equipment, move-in, bonds, utility hookup and miscellaneous start-up costs.

B. Measurement. The quantity of payment shall be per the lump sum bid price, scheduled as follows:

1) When 5 percent of the awarded contract price is earned excluding mobilization and amounts paid for materials on hand, 50 percent of the amount bid for mobilization or 5 percent of the awarded contract price, whichever is less, will be paid.

2) When 10 percent of the awarded contract price is earned excluding mobilization and amounts paid for materials on hand, 100 percent of the amount bid for mobilization or 10 percent of the awarded contract price, whichever is less, will be paid.

3) Upon completion of all work, payment of any amount bid for mobilization in excess of 10 percent of the awarded contract price will be paid.

ITEM 2. EROSION CONTROL AND WATER POLLUTION CONTROL

A. Payment. Payment will be payment in full for furnishing all labor, equipment, and materials necessary to install and maintain the temporary water pollution and erosion control measures throughout the life of the project, complete work in accordance with the approved permits, and to remove the temporary erosion control devices upon project completion. Payment also includes the preparation and enforcement of a Pollution Control Plan, including a Spill Prevention Control and Countermeasures Plan.

B. Measurement. No measurement will be made for the lump sum (LS) bid item.

ITEM 3. TRENCH PROTECTION SYSTEM

A. Payment. Payment will be payment in full for furnishing all labor, equipment, materials, and coordination necessary to ensure protection of all excavations at all project sites with people and equipment within them through shoring, crib walls, and other trench protection system methods. Trench protection is also required to protect existing structures adjacent to excavations. This bid item shall also include all work necessary to complete plans designed and stamped by a professional engineer.

B. Measurement. No measurement will be made for the lump sum (LS) bid item.

ITEM 4. TEMPORARY BYPASS PUMPING SYSTEM

A. Payment for this bid item will be payment in full for furnishing all coordination, labor, equipment, and materials necessary to bypass sanitary sewer flows during construction.

B. Measurement. Measurement for this item shall be on a lump sum (LS) basis.

ITEM 5. HATCHES AND SAFETY GRATES

A. Payment. Payment includes all labor, materials, and equipment for procurement and installation of new hatches and safety grates. Payment includes removal and disposal of existing hatches and all miscellaneous fasteners and appurtenances necessary for installation of new hatches and safety grates..

B. Measurement. No measurement will be made for the lump sum (LS) bid item.

ITEM 6. WETWELL EPOXY COATING

A. Payment. Payment includes all labor, materials, and equipment for coating the existing wetwell, including surface preparation, epoxy coating, and testing.

B. Measurement. Measurement for this bid item will be per square foot (SF) of coating.

ITEM 7. HVAC IMPROVEMENTS, COMPLETE

A. Payment. Payment includes all labor, materials, and equipment for the pump station HVAC improvements. This includes all work necessary for a complete and operational HVAC system. Payment includes, but is not limited to, the following work: demolition and disposal of existing HVAC equipment; procurement and installation of new HVAC equipment.

B. Measurement. No measurement will be made for the lump sum (LS) bid item.

ITEM 8. PIPING MODIFICATIONS, COMPLETE

A. Payment. Payment includes all labor, materials, and equipment for installation of new piping, flow meter, and valves. This includes all work necessary for a complete and operational piping system. Payment includes, but is not limited to, the following work: demolition and clearing, including removal of existing piping components; trenching, excavation, and backfill; mechanical piping, fittings, valves, and other appurtenances; construction of a concrete anchor pad; hot tapping; line stopping; connections to existing pipes; pressure testing; and all other work necessary for a complete and operational system.

B. Measurement. No measurement will be made for the lump sum (LS) bid item.

ITEM 9. ELECTRICAL AND CONTROL IMPROVEMENTS, COMPLETE

A. Payment. Payment includes all labor, materials, and equipment for installation of new piping, flow meter, and valves. This includes all work necessary for a complete and operational electrical and control. Payment includes, but is not limited to, the following work: removal and disposal of existing electrical and control components; installation of new electrical and control components, including VFD's, control panels; and all other electrical work shown on the Drawings and Specified herein. This bid item also includes all electrical work for HVAC equipment and flow meters and, and all other work necessary for a complete and operational system.

B. Measurement. No measurement will be made for the lump sum (LS) bid item.

ITEM 10. CONSTRUCTION DOCUMENTATION

A. Payment. Payment shall include 100% of all Construction Documentation assigned to the Contractor and as required by various state agencies; Local, County, State, and Federal regulatory and funding agencies as required to perform this work in accordance with the Plans and Specifications, and as modified by Change Order or Verbal or written Field Directive as issued by the Contracting Agency. Payment for this item shall be made as determined by the Engineer once all Construction Documentation has been correctly completed and satisfactorily submitted and approved by the Contracting Agency, or otherwise reviewed and Approved by an outside Agency as may be required by State RCW or WAC rule. Partial or monthly payments WILL NOT be made for Project Documentation; rather Full Payment of this item will only occur after the conclusion of the project once the Engineer Determines that the Contractor has submitted all required paperwork and necessary Documentation as required to satisfactorily document and record the activities of the project. The minimum Bid for **"Construction Documentation",** per **Lump Sum , for this item shall be $2,000.00**.

B. Measurement. No measurement will be made for the lump sum (LS) bid item.

PART 2 PRODUCTS - Not applicable to this Section.

PART 3 EXECUTION – Not applicable to this Section.

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

SECTION 01 31 00
PROJECT MANAGEMENT AND COORDINATION

PART 1 GENERAL

1.01 SCHEDULING

A. The Contractor shall schedule and complete the work in accordance with approved schedules as outlined in this section. The work shall be scheduled to interfere as little as possible with traffic, residential access, operation of adjacent businesses, and the public in general. This pertains to both work on public and private property. Additionally, Work on private property shall be performed in such a manner as to limit to the greatest extent possible impacts on vehicular and pedestrian traffic, parking, and access to buildings during normal business hours. In the event that the Contractor must work outside normal working hours, the Contractor shall do this work at no additional cost to the Owner and shall obtain approval from the jurisdictional authority.

B. The Contractor shall coordinate the Work with other projects being completed in the area. The Contractor shall coordinate with the Owner's field representative and other contractors for expeditious execution of the Work.

C. The Contractor's allowable onsite working hours shall be between the hours of 7:00 am and 5:00 pm, Monday through Friday, unless otherwise authorized in writing by the City.

D. Construction progress schedule

1. Within ten days of the effective date of the Agreement, the Contractor shall submit a construction progress schedule as required in the **General Conditions**. In addition to those requirements, the schedule shall indicate the various subdivisions of the work, and the date of commencing and finishing each. The schedule shall adequately define the Contractor's work sequence. The schedule shall also show the time allowed for testing and other required procedures prior to the work being put into operation. The schedule shall be updated weekly and given to the Owner a minimum of two (2) business days prior to work taking place. The Contractor shall submit a copy of the construction schedule with notes indicating the percentage completion of each division of the work during the period of which the partial payment estimate is submitted. The schedule submittal is required prior to processing payment estimates.

2. The Contractor shall immediately advise the Owner of any proposed changes in the submitted construction progress schedule and/or work sequence. If it is the Owner's opinion that the submitted construction schedule is inadequate to ensure the completion of the work within the time limited therefore, or is otherwise not in accordance with the specifications, or if the work is not being adequately or properly prosecuted in any respect, the Owner - without deviating from the Owner's rights under the contract - shall have right to require the Contractor to submit a new construction schedule providing for proper and timely completion of the work.

3. Approval of any schedule submitted by the Contractor shall not be construed to assign responsibility of performance or contingencies to the Owner, nor relieve the Contractor of its responsibility to adjust its forces, equipment and work schedules as may be necessary to ensure completion of the work within prescribed contract time.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 51 39 - Temporary Wastewater Pumping Facilities

B. Section 01 78 23 - Operations and Maintenance Manuals

C. Section 01 91 10 - Equipment Testing and Facility Startup

1.03 WORK SEQUENCE CONSTRAINTS

A. The wastewater conveyance system must remain in continuous operation throughout the work. Temporary wastewater pumping facilities shall be installed per the Drawings and Section 01 51 39.

B. Prior to the commencement of the facility startup period, the Contractor shall complete and obtain final acceptance of the pump station improvements and meet the other requirements of Section 01 91 10.

C. Pump station piping improvements shall be completed prior to taking the pump station offline for the electrical and control improvements, to allow the upsized bypass pumping port to be used.

1.04 WEEKLY PROJECT MEETINGS

A. The Contractor shall attend and actively participate in a weekly project meeting to discuss the proposed schedule of work for that week, as well as any scheduled water shutdowns, and any special inspection needs. The meeting shall include the Owner or the Owner's representative.

1.05 PERMITS AND REGULATORY REQUIREMENTS

A. The Contractor shall comply with requirements of all ordinances and permits of City of Camas and laws of the State of Washington which are applicable to work of the nature herein contemplated and shall observe these in all respects and to the same extent as if such municipal ordinances and laws were repeated herein.

B. The Contractor shall be responsible for management of previously obtained permits for the project, including scheduling inspections and applying for permit extensions when required.

C. The Contractor shall obtain all other permits required for the work, including but not limited to:

1. Trade permits (electrical, HVAC)

2. Any permits required for the Contractor's excavation dewatering work.

1.06 PROJECT RECORD DOCUMENTATION REQUIREMENTS

A. “Record drawings” refer to those documents maintained and annotated by the Contractor during construction and shall include the following:

1. A neatly and legibly marked set of contract drawings showing the final location of piping, fittings, valves, services and meter boxes, manholes, and all other changes from the original Drawings.

2. Additional documents such as schedules, lists, drawings, and electrical and instrumentation diagrams included in the specifications.

3. Contractor layout and installation drawings.

B. Unless otherwise specified, record drawings shall be full size and maintained in a clean, dry, and legible condition. Record documents shall not be used for construction purposes and shall be available for review by the Owner at the Contractor's field office during normal working hours. At the completion of the work, prior to final payment, all record drawings shall be submitted to the Owner.

C. Record drawings must be maintained as a precondition to Contractor’s monthly pay request submittal.

D. Marking of the drawings shall be kept current and shall be done at the time the material and equipment are installed. Legibly mark to record actual depths, horizontal and vertical location of underground pipes, valves, and appurtenances referenced to permanent surface improvements. Annotations to the record documents shall be made with an erasable colored pencil conforming to the following color code:

1. Additions - Red

2. Deletions - Green

3. Comments - Blue

4. Dimensions – Graphite

PART 2 PRODUCTS - Not applicable to this Section.

PART 3 EXECUTION - Not applicable to this Section.

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

SECTION 01 32 19
SUBMITTALS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes definitions, descriptions, transmittal, and review of "Compliance" and "Miscellaneous" Submittals.

1.02 GENERAL INFORMATION

A. Definitions

1. Compliance Submittals include shop drawings, product data, and samples which are prepared by the Contractor, Subcontractor, Manufacturer, or Supplier and submitted by the Contractor to the Engineer as a basis for approval of the use of EQUIPMENT AND MATERIALS proposed for incorporation in the Work or as needed to describe installation, operation, maintenance, or technical properties.

a. Shop drawings include custom-prepared data of all types including drawings, diagrams, performance curves, material schedules, templates, instructions, and similar information that is not in standard printed form applicable to other projects.

b. Product data includes standard printed information on materials, products and systems that are not custom-prepared for this Project, other than the designation of selections from available choices.

c. Samples include both fabricated and unfabricated physical examples of materials, products, and Work; both as complete units and as smaller portions of units of Work; either for limited visual inspection or (where indicated) for more detailed testing and analysis. Mock-ups are a special form of samples which are too large to be handled in the specified manner for transmittal of sample Submittals.

B. Quality Requirements

1. City-provided submittal template or approved equal will be used. All submittals will go to and through the Construction Project Coordinator.

2. Ineligible submittals will be returned to Contractor without review.

3. Submittals such as shop drawings and product data shall be of the quality for legibility and reproduction purposes. All lines, characters, and letters shall be clearly legible. Drawings such as reproducibles shall be useable for further reproduction to yield legible hard copy.

4. Documents submitted to the Engineer that do not conform to these requirements shall be subject to rejection by the Engineer, and upon request by the Engineer, Contractor shall resubmit conforming documents. If conforming Submittals cannot be obtained, such documents shall be retraced, redrawn, or photographically restored as may be necessary to meet such requirements. Contractor's (or his Subcontractor's) failure to initially satisfy the legibility quality requirements will not relieve Contractor (or his Subcontractors) from meeting the required schedule for Submittal of shop drawings and product data.

C. Language and Dimensions

1. All words and dimensional units shall be in the English language.

2. Metric dimensional unit equivalents may be stated in addition to the English units.

D. Submittal Completeness

1. Submittals deemed to be incomplete will be returned without review.

2. Submittals shall be complete with respect to dimensions, design criteria, materials of construction, and other information specified to enable Engineer to review the information effectively.

3. Where standard drawings are furnished which cover multiple variations of the general class of equipment, each such drawing shall be individually annotated to describe exactly which parts of the drawing apply to the equipment being furnished. Use hatch marks to indicate variations that do not apply to the Submittal. The use of "highlighting markers" is not an acceptable means of annotating Submittals. Such annotation shall also include proper identification of the Submittal permanently attached to the drawing.

4. Reproduction or copies of Contract Drawings or portions thereof will not be accepted as complete fabrication or erection drawings. The Contractor may use a reproduction of the Engineer-prepared Contract Drawings for erection drawings such as to indicate information on erection or to identify detail drawing references. Where the drawings are revised

to show this additional Contractor information, the Engineer's title block is to be replaced with a Contractor's title block and the Engineer's professional seal will be removed from the drawing. The Contractor shall revise these erection drawings for subsequent Engineer revisions to the Contract Drawings.

1.03 COMPLIANCE SUBMITTALS

A. Items shall include, but not be limited to, the following:

1. Manufacturer's specifications.

2. Catalogs, or parts thereof, of manufactured equipment.

3. Shop fabrication and erection drawings.

4. General outline drawings of equipment showing overall dimensions, location of major components, weights, and location of required building openings and floor plates.

5. Detailed equipment installation drawings, showing foundation details, anchor bolt sizes and locations, baseplate sizes, location of Owner's connections; and all clearances required for erection, operation, and disassembly for maintenance.

6. Schematic diagrams for electrical items, showing external connections, terminal block numbers, internal wiring diagrams and one-line diagrams.

7. Bills of material and spare parts list.

8. Instruction books and operating manuals.

9. Material lists or schedules.

10. Surfacing and mix data from concrete and asphalt manufacturers.

11. Performance tests on equipment by manufacturers.

12. All drawings, catalogs or parts thereof, manufacturer's specifications and data, samples, instructions, and other information specified or necessary

    a. For Engineer to determine that the Equipment and Materials conform with the design concept and comply with the intent of the Contract Documents.

b. For the proper erection, installation, operation and maintenance of the Equipment and Materials which Engineer will review for general content but not for substance.

c. For Engineer to determine what supports, anchorages, structural details, connections, and services are required for the Equipment and Materials, and the effects on contiguous or related structures and Equipment and Materials.

B. Schedule of Compliance Submittals

1. Schedule all Compliance Submittals required prior to fabrication or manufacture for submission within thirty (30) days of the Notice to Proceed. Schedule Compliance Submittals pertaining to storage, installation and operation at the site for Engineer's acceptance prior to delivery of the Equipment and Materials.

2. Resubmit Compliance Submittals the number of times required for Engineer's "Submittal Accepted." However, any need for resubmittals in excess of the number set forth in the accepted schedule, or any other delay in obtaining acceptance of Submittals, will not be grounds for extension of the Contract Time, provided Engineer completes his reviews within the times stated above and within the specified requirements.

C. Transmittal of Compliance Submittals

1. All Compliance Submittals of Equipment and Materials furnished by Subcontractors, manufacturers, and Suppliers shall be submitted to Construction Project Coordinator by Contractor.

2. After checking and verifying all field measurements, transmit all Compliance Submittals to the Construction Project Coordinator for acceptance using the City’s standard Contractor Submittal Form, copies of which will be supplied to the Contractor.

3. Use Contractor Submittal Form for all compliance submittals whether prepared by Contractor, Subcontractor, or Supplier.

4. Each submittal package shall have a separate Contractor Submittal Form.

5. Each Contractor Submittal Form shall be identified with a sequential number. Resubmittals shall have the same number.

6. Each Contractor Submittal Form shall include the following information:

a. Description of item submitted.

b. Date of submission.

c. Project title and contract number.

d. Names of Contractor, Subcontractor, or Supplier.

e. The Section and Paragraph of the Contract Documents where specified.

f. The Drawing Number of the Contract Drawings where shown.

g. Type of submittal.

h. Description of variation or deviation from the Contract Documents.

7. Unidentifiable Submittals will be returned for proper identification.

8. Contractor shall check and stamp Compliance Submittals of Subcontractors, Suppliers, and manufacturers with his approval prior to transmitting them to Engineer. Contractor's stamp of approval shall constitute a representation to Owner and Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data, or he assumes full responsibility for doing so, and that he has coordinated each Compliance Submittal with the requirements of the Work and the Contract Documents.

9. At the time of each submission, call to the attention of Engineer in the letter of transmittal any deviations from the requirements of the Contract Documents.

10. Make all modifications noted or indicated by Engineer and return revised prints, copies, or samples until accepted. Direct specific attention in writing, or on revised Submittals, to changes other than the modifications called for by Engineer on previous Submittals. After Submittals have been accepted, submit copies thereof for final distribution. Prints of accepted drawings transmitted for final distribution will not be further reviewed and are not to be revised. If errors are discovered during manufacture or fabrication, correct the Submittal and resubmit for review.

11. Work requiring a Compliance Submittal shall not be commenced or shipped until the Submittal has been stamped "Submittal Accepted" or "Submittal Acceptable as Noted" by Engineer.

12. Except as otherwise specified, transmit all submittals in electronic pdf format.

13. Copies of the equipment contractor's erection drawings and other Compliance Submittals required for the installation of equipment furnished by others under separate contract for installation under this Contract will be transmitted to Contractor by Engineer in the final distribution of such Submittals.

D. Engineer's Review

1. Engineer will review and return Compliance Submittals to Contractor with appropriate notations. Instruction books and similar Submittals will be reviewed by Engineer for general content and format but not for substance.

2. Engineer's acceptance of Compliance Submittals will not relieve Contractor from his responsibility as stated in the General Conditions.

E. Compliance Submittal Action Stamp

1. Engineer's review action stamp, appropriately completed, will appear on all Compliance Submittals of Contractor when returned by Engineer. Review status designations listed on Engineer's action stamp are defined as follows:

a. NO EXCEPTION TAKEN: Signifies Equipment or Material represented by the Submittal conforms with the design concept and complies with the intent of the Contract Documents and is approved for incorporation in the Work. Contractor is to proceed with fabrication or procurement of the items and with related Work. Copies of the Submittal are to be transmitted to Engineer for final distribution.

b. MAKE CORRECTIONS NOTED: Signifies Equipment and Material represented by the Submittal conforms with the design concept and complies with the intent of the Contract Documents and is approved for incorporation in the Work in accordance with Engineer's notations. Contractor is to proceed with fabrication or procurement of the items and with related Work in accordance with Engineer's notations and is to submit a revised Submittal responsive to notations marked on the returned Submittal or written in the letter of transmittal.

c. REVISE AND RESUBMIT: Signifies Equipment and Material represented by the Submittal appears to conform with the design concept and comply with the intent of the Contract Documents but information is either insufficient in detail or contains discrepancies

which prevent Engineer from completing review. Contractor is to resubmit revised information responsive to Engineer's annotations on the returned Submittal or written in the letter of transmittal. Fabrication or procurement of items represented by the Submittal and related Work is not to proceed until the Submittal is acceptable.

d. REJECTED: Signifies Equipment and Material represented by the Submittal does not conform with the design concept or comply with the intent of the Contract Documents and is disapproved for use in the work. Contractor is to submit Compliance Submittals responsive to the Contract Documents.

e. PRELIMINARY SUBMITTAL: Signifies Submittals of such preliminary nature that a determination of conformance with the design concept or compliance with the intent of the Contract Documents must be deferred until additional information is furnished. Contractor is to submit such additional information to permit layout and related activities to proceed.

f. FOR REFERENCE, NO ACCEPTANCE REQUIRED: Signifies Submittals which are for supplementary information only; pamphlets, general information sheets, catalog cuts, standard sheets, bulletins and similar data, all of which are useful to Engineer or Owner in design, operation, or maintenance, but which by their nature do not constitute a basis for determining that items represented thereby conform with the design concept or comply with the intent of the Contract Documents. Engineer reviews such Submittals for general content but not for substance.

g. DISTRIBUTION COPY (PREVIOUSLY ACCEPTED): Signifies Submittals which have been previously accepted and are being distributed to Contractor, Owner, Resident Project Representative, and others for coordination and construction purposes.

h. SUBMIT SPECIFIED ITEM: Signifies that additional information is needed and that the Contractor is to make additional submittals as requested by the Engineer.

F. Instruction Books

1. Equipment instruction books shall be prepared by the manufacturer and shall include the following:

a. Index and tabs.

b. Instructions for installation, start-up, operation, inspection, maintenance, parts lists and recommended spare parts, and data sheets showing model numbers.

c. Applicable drawings.

d. Warranties and guarantees.

e. Name, address, and phone number of nearest manufacturers authorized service facility.

f. All additional data specified.

2. Information listed above shall be bound into one hard-back binder of three-ring or post type. Sheet size shall be 8-1/2 x 11. Capacity shall be sufficient to contain and utilize sheets with ease.

a. Provide with following accessories:

1) Label holder.

2) Business card holder.

3) Sheetlifters.

4) Horizontal pockets.

b. The following information shall be imprinted, inserted or affixed by label on the binder front cover:

1) Equipment name.

2) Manufacturer's name.

3) Project name: Main Pump Station Improvements.

4) Engineer's name.

c. The following information shall be imprinted, inserted, or affixed by label on the binder spine:

1) Equipment name.

2) Manufacturer's name.

3) Volume number (if applicable).

1.04 EFFECT OF REVIEW OF CONTRACTOR'S SUBMITTALS

A. Review by the Engineer of project data, methods of work, or information regarding materials or equipment is only for conformance with the general design concept of the project, and does not extend to consideration of specific dimensions, structural integrity, safety, detailed installation and construction requirements, or any other obligation of the Contractor. Any action shown is subject to the requirements of the Contract Documents. The review of project data by the Engineer shall not relieve the Contractor from his/her obligation to perform fully all contract requirements, nor shall review give rise to any right of action or suit in favor of the Contractor or third persons against the Engineer or the Owner.

PART 2 PRODUCTS - Not applicable to this Section.

PART 3 EXECUTION – Not applicable to this Section.

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

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing and inspection services.

1.02 REFERENCES

A. ASTM C 1077 – Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.

B. ASTM D 3740 – Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

1.03 TESTING AND INSPECTION AGENCIES

A. All quality control testing required in Contract Documents will be the responsibility of the Contractor.

B. Employment of an agency in no way relieves Contractor of the obligation to perform Work in accordance with requirements of Contract Documents.

C. All Work is subject to Owner's quality assurance inspection and testing at all locations and at all reasonable times before acceptance. Owner's quality assurance inspection and tests do not relieve the Contractor of performing quality control testing.

1.04 Submittals

A. Laboratory Test or Inspection reports. Each report shall be signed and certified by the supervising engineer of the testing laboratory. Unless otherwise specified, submit THREE (3) copies of each report to the Engineer.

PART 2 PRODUCTS - Not applicable to this Section.

PART 3 EXECUTION

3.01 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturer's tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Project Engineer before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.02 TESTING AND INSPECTION

A. The Contractor shall coordinate field testing in accordance with the following schedule. Additional source material testing shall be completed as necessary to establish the basis of field tests and satisfy all other requirements of the Technical Specifications. The frequency of testing listed in this schedule lists the minimum number of tests per quantity of work completed by the Contractor; the Owner may require more tests. Although the frequency of tests is listed, the Contractor shall obtain the Engineer's approval of all testing locations.

Equipment or Material	**Payment Responsibility**	**Frequency (a minimum of)**
Trench Backfill	Contractor	1 density test per 200 LF of trenching at surface and every 1.5' depth of fill.

B. Testing Agency Duties:

1. Test samples of mixes submitted by Contractor.
2. Provide qualified personnel at site. Cooperate with Project Engineer and Contractor in performance of services.
3. Perform specified sampling and testing of products in accordance with specified standards.
4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
5. Promptly notify Project Engineer and Contractor of observed irregularities or non-conformance of Work or products.
6. Perform additional tests and inspections required by Project Engineer.
7. Submit reports of all test/inspections specified.

C. Limits on Testing/Inspection Agency Authority:

1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency may not approve or accept any portion of the Work.
3. Agency may not assume any duties of the Contractor.
4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:

1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.

2. Cooperate with laboratory personnel and provide access to the Work.

3. Provide incidental labor and facilities.

E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Project Engineer.

F. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

3.03 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.

3.04 DEFECT ASSESSMENT

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

B. If, in the opinion of Project Engineer, it is not practical to remove and replace the Work, Project Engineer will direct an appropriate remedy or adjust payment.

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

SECTION 01 43 33
MANUFACTURER'S FIELD SERVICES

PART 1 GENERAL

1.01 SUBMITTALS

A. Manufacturer's Manuals. Provide manufacturer's manuals as required in other sections of these specifications, at least 60 days before actual equipment start-up. The manufacturer's manuals shall include, but not be limited to, installation instructions, operation and maintenance manuals with preventative maintenance and troubleshooting requirements, spare parts list, and shop drawings.

B. Training Schedule. Submit training schedule not less than thirty (30) days prior to start of equipment installation and revise as necessary for acceptance.

C. Training Materials

1. Submit written outlines of proposed training sessions for Engineer’s review. This submittal shall include credentials of manufacturer’s representative and be submitted not less than thirty (30) days prior to scheduled training.

2. Provide five (5) sets of all training materials which shall include operation and maintenance data.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 91 10 – Equipment Testing and Facility Startup

1.03 QUALIFICATION OF MANUFACTURER'S REPRESENTATIVE.

A. Authorized representative of the manufacturer shall be factory trained and experienced in the technical applications, installation, operation, and maintenance of respective equipment, sub-system, or system. Representative will be subject to acceptance by the Engineer. No substitute representatives will be allowed unless prior written approval by the Engineer has been given.

1.04 ITEMS REQUIRING MANUFACTURER’S FIELD SUERVICES

A. The items for which the Contractor is required to provide the services of the Manufacturer include, but are not necessarily limited to, the following:

1. Submersible pumps and motors.

PART 2 PRODUCTS - Not applicable to this Section.

PART 3 EXECUTION

3.01 FULFILLMENT OF SPECIFIED MINIMUM SERVICES

A. Where manufacturer's services are specified, furnish manufacturer's representative qualified to provide these services.

B. Only those days of service approved by Engineer will be credited to the fulfillment of the specified minimum services.

C. If specified, manufacturer's services shall include as a minimum:

1. Assistance during installation to include observation, guidance, instruction of Contractor's assembly, erection, installation and application procedures.

2. Inspection, checking, and adjustment as required for equipment to function as warranted by manufacturer and necessary to provide written approval of installation.

3. Revisiting the site as required to correct problems and until installation and operation are acceptable to Engineer.

4. Resolution of assembly or installation problems attributable to, or associated with, respective manufacturer's products and systems.

5. Assistance during functional and performance testing and start-up demonstration, and until product acceptance by the Owner.

6. Providing copies of manufacturer’s representatives field notes and data to Engineer.

7. Training of Owner's personnel in the operation and maintenance of the respective product as required herein.

3.02 TRAINING SCHEDULE

A. List specified equipment and systems with respective manufacturers that require training services of manufacturer's representatives and show:

1. Estimated dates for installation completion.

2. Estimated training dates.

B. Schedule manufacturer's field services to avoid conflicting with other field testing or other manufacturer's field services.

C. Adjust training schedule to ensure training of appropriate personnel as deemed necessary by Owner, and to allow full participation by manufacturer's representatives. Adjust schedule for interruption in operability of equipment.

D. Coordinate training sessions with Owner’s operating personnel and manufacturer’s representatives and with submission of operation and maintenance manuals.

E. Coordinate with and show on project schedule.

3.03 TRAINING OWNER’S PERSONNEL

A. Furnish trained, articulate manufacturer's representatives to provide detailed training to Owner's personnel on operation and maintenance of specified product (system, subsystem, component) and as many as may be required in applicable specifications.

B. Provide training session contents as outlined in the following subsection.

3.04 TRAINING SESSION CONTENTS

A. Equipment Operation:

1. Describe equipment's operating (process) function.

2. Describe equipment's fundamental operating principals and dynamics.

3. Identify equipment's mechanical, electrical, and electronic components and features.

4. Identify all support equipment associated with the operation of subject equipment (i.e., air intake filters, valve actuators, motors).

B. Detailed Component Description:

1. Identify and describe in detail each component's function.

2. Where applicable, group related components into subsystems. Describe subsystem functions and their interaction with other subsystems.

3. Identify and describe in detail equipment safeties and control interlocks.

C. Equipment Preventive Maintenance (PM):

1. Describe PM inspection procedures required to:

a. Perform an inspection of the equipment in operation.

b. Spot potential trouble symptoms (anticipate breakdowns).

c. Forecast maintenance requirements (predictive maintenance).

2. Define the recommended PM intervals for each component.

3. Provide lubricant and replacement part recommendations and limitations.

4. Describe appropriate cleaning practices and recommended intervals.

5. Describe special post start-up maintenance requirements, including special lubrication requirements, special equipment monitoring, and other special maintenance requirements.

D. Equipment Troubleshooting:

1. Define recommended systematic troubleshooting procedures.

2. Provide component-specific troubleshooting checklists.

3. Describe applicable equipment testing diagnostic procedures to facilitate troubleshooting.

E. Equipment Corrective Maintenance:

1. Describe recommended equipment preparation requirements.

2. Identify and describe the use of any special tools required for maintenance of the equipment.

3. Describe component removal/installation and disassembly/assembly procedures.

4. Perform at least two "hands-on" demonstrations of common corrective maintenance repairs.

5. Describe recommended measuring instruments and procedures and provide instruction on interpreting alignment measurements, as appropriate.

6. Define recommended torqueing, mounting, calibration, and/or alignment procedures and settings, as appropriate.

7. Describe recommended procedures to check/test equipment following a corrective repair.

F. Testing. See Section 01 91 10 – Equipment Testing and Facility Startup, and individual Specification sections, for equipment testing requirements.

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

SECTION 01 51 00
TEMPORARY UTILITIES AND FACILITIES

PART 1 GENERAL

1.01 DESCRIPTION

A. This Section includes requirements of a temporary nature not normally incorporated into final Work, including any temporary utilities and facilities required by the Contractor to complete the Work.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. WSDOT Standard Specifications for Road, Bridge, and Municipal Construction.

1.03 QUALITY ASSURANCE

A. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to:

1. Building Code requirements.

2. Health and safety regulations.

3. Utility company regulations.

4. Police, Fire Department, and rescue squad rules.

5. Environmental protection regulations.

B. Standards

1. Comply with NFPA 10 and 241, and ANSI A10 Series standards "Temporary Electrical Facilities."

2. Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70.

1.04 SUBMITTALS

A. Contractor shall submit the following below and provide the Engineer a minimum of 14 days for review and approval prior to beginning work:

1. Pollution Control Plan

2. Spill Prevention Control and Countermeasures Plan

PART 2 PRODUCTS - Not applicable to this Section.

PART 3 EXECUTION

3.01 TEMPORARY UTILITIES

A. Engage the appropriate local utility company to install temporary service or connect to existing service. Where the utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations. Provide adequate utility capacity at each stage of construction. Prior to availability of temporary utilities at the site, provide trucked-in services as required for start-up of construction operations. Materials used for temporary service shall not be used in the permanent system unless so specified by or acceptable to Engineer.

3.02 TEMPORARY ELECTRICITY AND LIGHTING

A. Use of Existing System: Existing pump station electrical service can be utilized for construction activity but shall not be used for sewer bypass pumping. Protect system to prevent interference with Owner's normal usage.

B. Costs of Installation and Operation. Pay all fees and charges for permits and applications; costs of installation, maintenance, removal of temporary services, and restoration of any permanent facilities used. Pay costs of electrical power used.

3.03 TEMPORARY WATER

A. Use of Permanent System. Prior to use of permanent system for construction purposes, obtain written permission of Owner.

3.04 TEMPORARY SANITARY FACILITIES

A. Contractor-Furnished Facilities. The following shall be provided for all construction workers under this Contract, and representatives at the site:

1. Sanitary Facilities. Furnish, install and maintain temporary sanitary facilities for use through construction period. Remove on completion of work. Toilet facilities shall be of the chemical-aerated recirculation or combustion type, properly vented and fully enclosed with a fiberglass-reinforced polyester shell or similar nonabsorbent material.

2. Supplies. Supply and maintain toilet tissue, paper towels, paper cups and similar disposable materials as appropriate for each facility. Provide appropriate covered waste containers for used material.

B. Use of Existing Facilities. Existing restroom facilities near the pump station site shall not be used.

3.05 TEMPORARY CONSTRUCTION AIDS

A. Provide construction aids and equipment required by personnel and to facilitate the execution of the Work: scaffolds, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes, and other such facilities and equipment. Materials may be new or used and must be suitable for the intended purpose and meet the requirements of applicable codes, regulations and standards. When permanent stair framing is in place, provide temporary treads, platforms, and railings for use by construction personnel.

3.06 TEMPORARY SAFETY AND HEALTH

A. Contractor shall be responsible for development of safety and health programs for personnel at Project site.

3.07 TEMPORARY FIRE PROTECTION

A. The Contractor shall be responsible for the development of a fire prevention and protection program for all Work under this Contract. The program shall comply with the applicable provisions for safety and protection as set forth in applicable parts of the NFPA 10 and 241. Locate fire extinguishers where convenient and effective for their intended purpose, but not less than one extinguisher on each floor at or near such usable stairwell. Store combustible materials in containers in fire-safe locations. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire protection facilities, stairways, and other access routes for fighting fires. Prohibit smoking in hazardous fire exposure areas. Provide supervision of welding operations and similar sources of fire ignition.

3.08 TEMPORARY EROSION AND WATER POLLUTION CONTROLS

A. The Contractor shall take whatever measures are necessary to prevent erosion and protect water quality. Prevent surface runoff of excavated sites by placing erosion control measures at locations shown on the Plans, and as required. Place inlet protection at existing catch basin grates located within the vicinity of construction activities. Clean the filter fabric as necessary to provide drainage through the fabric. Keep dirt, soil, aggregate, and extraneous material from entering the creek or storm drain system. Install hay bales, silt fence and/or straw mulch as required to prevent sediments from entering creek or the storm system.

B. Contractor shall prepare a Pollution Control Plan (PCP), including a Spill Prevention Control and Countermeasures plan (SPCC). These items shall be submitted and copies shall be maintained on-site at all times. The PCP, and SPCC shall meet all requirements of WSDOT Standard Specifications Section 1-07.15(1).

C. All materials spilled, dropped, washed, or tracked from vehicles onto roadways or into storm drains must be removed immediately.

D. Maintain and remove all erosion controls as specified on the standard erosion control details. The Contractor shall remove all accumulated sediment from catch basins, drywells, storm pipes, and culverts prior to acceptance by the Owner.

3.09 SECURITY

A. Protect Work, existing facilities, and Owner's operations from theft, vandalism, and unauthorized entry. Use temporary fences and barricades as required.

3.10 INSTALLATION AND REMOVAL

A. Relocation. Relocate construction aids as required by progress of construction, by storage, or Work requirements and to accommodate requirements of Owner and other Contractors at the site.

B. Removal. Remove temporary materials, equipment and services when construction needs can be met and allowed by use of permanent construction, or at completion of the Project.

C. Repair. Clean and repair damage caused by installation or by use of temporary facilities.

1. Remove foundations and underground installations for construction aids.

2. Grade the areas of the site affected by temporary installations to required elevations and clean the area.

3.11 RESTORATIONS, CLEANING, AND DUST CONTROL

A. General. Upon the termination of the work, and as a condition precedent to final acceptance, the Contractor shall remove all equipment and temporary structures and all rubbish, waste and surplus materials, and shall grade and relevel ground surface, repair pavement, walks and traveled surfaces to their original condition, re-establish plantings, and generally clean up the right of way and premises to fully conform to conditions as they existed before the improvement was made.

B. It is expressly understood that the Contractor shall, in particular, restore all such easements and rights-of-way to a condition equal to its original condition and in a condition satisfactory to the property owners and the Owner. It is also understood that any private improvements made in public rights-of-way are included in the above category.

C. Cleanup. The Contractor shall clean all soil deposited by construction activities from all pavements and sidewalks at the conclusion of each day's operation. The Contractor shall curtail construction activities in the event that spilled soil on traveled roadways creates a hazardous condition. The Contractor shall prevent dust by using water or an approved dust-preventative treatment.

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

SECTION 01 51 39
TEMPORARY WASTEWATER PUMPING FACILITIES

PART 1 GENERAL

1.01 EXTENT OF WORK

A. The work includes all labor, equipment, materials, to design, furnish, install, and operate a temporary wastewater pumping system for the purposes of diverting wastewater flows around the work area to prevent service interruptions. The bypassing system shall meet all Washington State Department of Ecology requirements in addition to these herein.

B. The bypass pumping requirements shown on the Plans and described herein are minimum requirements only. Contractor is responsible for providing a complete and operable bypass pumping facility as required. Contractor shall prepare a bypass pumping plan, including details, equipment, and contingency plans to address rainfall events and infiltration.

C. The bypass pumping requirements described herein describe a single bypass pumping system.

D. The Contractor's bypass pumping system shall provide pumping capacity equal to or greater than the existing pump station.

Existing Pump Station Parameter	Hydraulic Parameters Value
Flow (gpm)	7,700
Total Dynamic Head (ft)	85
Static Head (ft)	17

E. Mobilization and traffic control are covered by other specifications.

1.02 STANDARDS

A. The following standards form a part of these Specifications:

1. ISO 3864-2 Graphic Symbols, Safety Colors and Safety Signs, Part II: Design principles for product safety labels

1.03 SUBMITTALS

A. The Contractor shall submit a Bypass Pumping Plan for approval. No construction activities may start prior to the Contractor receiving the Engineer's written approval of the bypass pumping plan. A bypass pumping plan is required for each set-up and shall include, at a minimum, the following information:

1. A plan view of the diversion facilities on a site map, including location of pumps, suction and discharge manholes, vehicle crossings, details, and layout of discharge piping (may be included as part of the Staging Area Plan).

2. Bypass phasing plan.

3. Method of damming the flow.

4. Method of testing the bypass system prior to startup.

5. Assistance required of the Owner to execute the bypass pumping, and other relevant information.

6. Product information including manufacturer's literature and installation recommendations for proposed pumping equipment, piping, valves, fittings, and other appurtenances incorporated into the work.

7. Emergency response plan and spill prevention and response plan.

8. Contractor qualifications.

1.04 QUALITY ASSURANCE

A. Qualifications: Contractor shall have a minimum of five years' experience in performing substantially similar temporary bypass operations and shall submit evidence of satisfactory operation of temporary bypass facilities similar to those specified for at least five projects.

1.05 CONTRACTOR RESPONSIBILITY

A. Bypassing of untreated or partially treated wastewater to surface waters or drainage courses is prohibited. In the event of accidental bypassing caused by the Contractor, the Owner shall immediately be entitled to employ others to stop the bypassing.

B. Penalties imposed on the Owner as a result of any bypass or other discharge of wastewater caused by the actions of the Contractor, its employees, or subcontractors, shall be borne in full by the Contractor, including legal fees and other expenses to the Owner resulting directly or indirectly from the bypass.

C. Contractor shall take the following minimum precautions and protective measures:

1. Review existing sewer system plans with the Engineer and Owner.

2. Verify the size and location of existing sewer facilities.

3. Provide pumps with sufficient capacity and head.

4. Provide pumping equipment redundancy and standby equipment that can be readily employed.

5. Investigate upstream manholes.

6. Check and test pumping equipment and bypass system.

7. Provide suitably experienced persons and training personnel for the operation and maintenance of the system, including dealing with emergencies and spill response.

8. Check upstream manhole surcharging after bypassing operations have commenced.

9. Properly monitor and maintain system during operation.

PART 2 PRODUCTS

2.01 EQUIPMENT

A. General

1. A bypass pumping system shall be installed for wastewater bypass pumping.

2. Bypass pumping equipment shall not exceed noise levels in excess of 75 db at 30-feet from the source.

B. Pumps

1. All pumps used shall be electric submersible pumps, suitable for raw sewage application, or diesel powered dry prime pumps.

2. Bypass pumps shall be sized to match the capacity and total dynamic head of the existing pump station.

3. Contractor shall include one stand-by pump of each size to be maintained on site.

4. Pumps shall have soft starters to slowly ramp up flow when starting and ramp down flow when stopping.

C. Control System

1. A control system shall be provided to control the pumps and send alarms.

2. The control system shall include a monitoring and alarm system to immediately notify the Contractor and Owner of system failure 24-hours a day.

D. Standby Power System

1. If electric pumps are used, a standby power supply system shall be provided. At a minimum, the standby power supply system shall comprise of a backup

generator with sufficient capacity to operate both pumps, an automatic transfer switch, and all necessary appurtenances.

E. Discharge Piping

1. Discharge piping shall be temporarily constructed of watertight pipe that is manufactured for this intended use and approved by the Engineer.

2. Discharge piping joints shall be either fused HDPE or flanged; quick disconnect joints will not be allowed.

3. Discharge hose of material acceptable to the Engineer may be allowed for a single bypass pumping operation that is monitored by the Contractor and will be used less than one working day.

F. Traffic Ramps

1. Supply H20 rated discharge ramps were construction or public traffic is required to cross a temporary discharge line. The ramps shall be pressure rated, have mechanical connections at each end to connect to pipe, and be manufactured and marketed for this specific use.

PART 3 EXECUTION

3.01 INSTALLATION AND MAINTENANCE

A. The Contractor shall install and maintain the bypassing systems in accordance with the manufacturers recommendations and approved bypassing plan.

B. The Contractor shall operate, protect, maintain, and service the bypass pumping system for the duration of operations. Contractor shall be responsible for all equipment, electrical service, fuel, and all other appurtenances and consumables required for the operation of the bypass pumping system.

C. The bypass pumping system shall be in operation for a minimum of three days with no interruptions in service prior to taking the existing pump station offline.

D. The Contractor shall provide a dedicated operator to operate the bypassing system to prevent unintended release of sewage at all times while the bypassing system is operating. Contractor is responsible for coordinating sanitary sewer bypass pumping with the Owner.

E. In the event of system failure, the Contractor shall respond immediately and fix the cause of the problem. Contractor shall always be on-call 24 hours a day and be able to respond within 30 minutes during system operations. The Contractor shall demonstrate, to the satisfaction of the Owner, that this requirement can be met, and that responsible and appropriately trained personnel will be able to deal with emergencies that could arise.

F. Depth of surcharge upstream shall be kept to the minimum necessary. The Contractor shall be responsible for repairing any damage to upstream property due to flooding and/or spills.

G. The Contractor shall provide on-site sufficient equipment, parts and materials, and fuel to ensure continues and uninterrupted operation of the bypass system. A minimum of 24-hours of fuel shall be maintained on site for the backup generator.

3.02 CLEANUP

A. Following the removal of sewer bypassing system, all sewer pipes and manholes that were surcharged shall be properly flushed to remove accumulated sewage material.

B. If damaged, restore bypass areas to pre-existing conditions.

3.03 SPILLS

A. For a spill event, Contractor shall immediately report the spill to the Owner and the Washington State Department of Ecology.

B. Contractor shall provide a spill response kit and shall train staff on spill response.

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

SECTION 01 55 25
TEMPORARY TRAFFIC CONTROL

PART 1 GENERAL

1.01 DESCRIPTION

A. This work consists of providing temporary traffic control measures and furnishing, installing, moving, operating, maintaining, inspecting, and removing traffic control devices throughout the Project area according to the Drawings, the approved traffic control plan (TCP), and this Section.

B. No work shall commence onsite until traffic control measures are in place in accordance with an approved Traffic Control Plan. Work may be suspended if the Contractor fails to correct unsafe traffic conditions.

C. The Contractor shall obtain the appropriate traffic control permit(s) from the City and shall comply with all applicable rules and regulations. No road shall be closed to the public, except by express permission of the affected regulating authority.

D. The Contractor shall be responsible for the procurement, erection, and maintenance of all traffic control signs and devices, including PCMS boards.

1.02 REFERENCES

A. Washington State Department of Transportation Standard Specifications for Road, Bridge, and Municipal Construction (WSDOT Standard Specifications).

B. Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD).

1.03 SUBMITTALS

A. Temporary Traffic Control Plans

1. At least two weeks prior to beginning Work, submit an approved TCP for proposed work on both public and private property, incorporating all proposed work with applicable pedestrian and vehicular traffic control measures. This project will require an approved TCP from City of Stevenson, as described on the Contract Drawings. The TCP shall include the locations and quantities of all traffic control measures and devices and the proposed order and duration of each traffic

control measure, not to exclude protection and detouring of pedestrian traffic and detouring of vehicular traffic to private parking areas.

2. Traffic control plan shall meet the standards of the 2009 edition of the *Manual of Uniform Traffic Control Devices for Streets and Highways*, and Washington Modifications.

3. As the work progresses, the Contractor may be required to provide an updated traffic control plan. If required, this plan would need to be submitted seven (7) business days prior to the associated work taking place.

4. Provide material and manufacturer data for temporary traffic control devices when requested by the Owner.

5. A copy of the approved traffic control plans shall be available at the work area at all times. The Contractor shall comply with all permit conditions and have a copy of permits on site at all times.

PART 2 PRODUCTS

2.01 STANDARDS

A. All traffic control devices shall conform to the most recent version of the Federal Highway Administration's *Manual on Uniform Traffic Control Devices for Streets and Highways* (MUTCD), Chapter 6 – Temporary Traffic Control. In addition, all work zone traffic control devices shall comply with the crashworthy requirements of the National Cooperative Highway Research Program's *NCHRP Report 350: Recommended Procedures for the Safety Performance Evaluation of Highway Features*.

B. The acceptability of traffic control devices will be made by the criteria included in the most current version of the American Traffic Safety Services Association's *Quality Guidelines for Work Zone Traffic Control Devices*. Use new or acceptable traffic control devices for all installations unless otherwise specified.

C. All traffic control devices shall meet the requirements of the most recent version of WSDOT Standard Specifications Section 1-10

2.02 CERTIFICATIONS

A. Only training with WSDOT TCS card and WSDOT training curriculum is recognized in the State of Washington. The Traffic Control Supervisor shall be certified by one of the following:

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

2. Evergreen Safety Council
12545 135th Ave. NE
Kirkland, WA 98034-8709
1-800-521-0778

3. The American Traffic Safety Services Association
15 Riverside Parkway, Suite 100
Fredericksburg, Virginia 22406-1022
Training Dept. Toll Free (877) 642-4637
Phone: (540) 368-1701.

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Temporary traffic control measures and devices shall be implemented and installed in accordance with the approved TCP, the product manufacturer's recommendations, and the standards listed in subsection 2.01.

B. Temporary Signage. Once temporary signs have been installed, do not remove them from the project site until directed by the Owner. Install all temporary signing according to the Drawings, the MUTCD, and the Federal Highway Administration's *Standard Highway Signs*.

C. Pavement Edge Delineation. Place tubular or conical markers to delineate the edge of pavement when paving creates an abrupt or sloped edge drop-off 1-inch or more in height along the shoulder. Locate and maintain temporary traffic markers at intervals no more than 10 feet.

D. The Contractor shall notify emergency services, public transportation, and all affected utilities and local agencies about the operations so as to properly coordinate and expedite the work in such a manner as to cause the least amount of conflict and interference between the work and operations of other agencies. The Contractor shall notify school authorities at least 2 weeks in advance of any construction that will interfere with access to schools or affect school bus routes and schedules.

3.02 ACCESS REQUIREMENTS

A. All street must remain open at all times.

B. Driveway Access. It is incumbent upon the Contractor to provide timely notification to individual property owners regarding impending, temporary interruptions to residence and/or driveway access by private vehicles.

C. Access for school vehicles, mail services, emergency vehicles, and police and fire vehicles shall be continuously maintained. Failure of the Contractor to abide by access requirements shall be cause for work stoppage until effective access is reestablished.

D. The Contractor shall keep fire hydrants on or adjacent to work accessible to firefighting equipment.

E. The Contractor shall be responsible for providing adequate safeguards, safety devices, protective equipment, and any other needed actions to protect pedestrian traffic in connection with the performance of the work covered by the Contract. The Contractor shall perform any measures or actions that the Engineer may deem necessary to protect pedestrian traffic and shall be responsible for the provision and expense of this protection.

3.03 PEDESTRIAN ACCESS AND ROUTES

A. Prior to construction, barricades and signage along the existing sidewalk or pathway shall be used to direct pedestrian traffic to temporary pathways or alternative routes around the construction area. Signs shall be placed along the sidewalk to direct pedestrian traffic as necessary. Contractor is responsible for maintaining the fence, signs, and detour route during the Project and shall make every attempt to keep public out of the Project area.

B. Where shown on an approved TCP and where pedestrians are detoured onto the roadway pavement, the Contractor shall provide an approved method of pedestrian channelization. This channelization shall meet all of the following minimum performance criteria: channelization shall consist of a continuous alignment of connected segments with no gaps between each segment, with a minimum height of three feet. Traffic cones connected by tape will not suffice as a pedestrian channelization method.

3.04 FLAGGERS

A. Flaggers shall be located far enough in advance of the work area to permit adequate time for drivers to respond to the flagger's instructions. All flaggers shall use a “STOP” / ”SLOW” paddle. Where defined as part of the site specific safety plan, flaggers shall perform all flagging operations behind an approved protective barrier at all times.

B. Flagging personnel shall possess current flagger certifications meeting WSDOT requirements and must carry cards at all times.

C. The Contractor shall provide all flagging personnel with lighting stations as required when performing work outside of daylight hours.

3.05 MAINTENANCE

A. After traffic control devices have been installed and accepted, the Contractor shall be responsible for the inspection and maintenance of the devices. Devices shall be in a proper position, clean and visible/legible at all times. Lights, reflectors and flashers shall be clean, visible and operating property during both day and night hours. Temporary traffic control devices shall be maintained during suspensions of Work if necessary.

B. Maintain existing signage in the same manner as temporary signs and devices, in particular warning and directional signs.

3.06 REMOVAL OF TEMPORARY TRAFFIC CONTROL MEASURES AND DEVICES

A. When it is determined only minor work remains on the Project and the Work area does not encroach on the roadway or shoulder, provide signs for minor work on portable sign supports and remove all temporary signs, supports, and ballast including the advance construction signs and sign flag boards.

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

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. This section includes general product requirements for items incorporated in the Work. Products refers to material, equipment, machinery, components, subsystem, system, hardware, software, and terms of similar intent. This includes new items, whether purchased by Contractor or Owner for the Project, or taken from previously purchased stock, and existing materials or components required for reuse.

1.02 SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

1. Submit within 30 days after date of Agreement.

2. For products specified only by reference standards, list applicable reference standards.

B. Product Data: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

C. Shop Drawings: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances

D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

E. Manufacturer's Certificate of Compliance: When specified, a Manufacturer's Certificate of Compliance shall be submitted certifying that the product, material, or service complies with the requirements of the Specifications and Drawings. Certificate shall be signed by the entity supplying the product.

1.03 SUBSTITUTION PROCEDURES

A. Project Engineer will consider requests for substitutions only within 15 days after date of Agreement.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

C. A request for substitution constitutes a representation that the submitter:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.

2. Will provide the same warranty for the substitution as for the specified product.

3. Will coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.

4. Waives claims for additional costs or time extension that may subsequently become apparent.

5. Will reimburse Owner and Engineer for review or redesign services associated with re-approval by authorities.

D. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

E. Substitution Submittal Procedure:

1. Submit three copies of request for substitution for consideration. Limit each request to one proposed substitution.

2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on the proposer.

3. The Project Engineer will notify Contractor in writing of decision to accept or reject request.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Delivery Requirements:

1. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

2. Transport and handle product in accordance with manufacturer’s instructions.

3. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

4. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

5. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

B. Handling, Storage, and Protection Requirements:

1. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

2. Store and protect products in accordance with manufacturers' instructions.

3. Store with seals and labels intact and legible.

4. Store sensitive products in weather tight, climate-controlled enclosures in an environment favorable to product.

5. For exterior storage of fabricated products, place on supports above ground.

6. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

7. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

8. Prevent contact with material that may cause corrosion, discoloration, or staining.

9. Provide equipment and personnel to handle and store products by methods to prevent soiling, disfigurement, or damage.

10. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

11. The Contractor shall store all hazardous materials in suitable containers to prevent and/or contain spills in accordance with all current laws and regulations.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide interchangeable components of the same manufacturer for similar components, unless otherwise specified.

B. Mechanical and electrical equipment shall not create sound levels that are in excess of that permitted by OSHA for eight hours per day per worker exposure unless otherwise noted.

C. Products shall be manufactured to U.S.A standard sizes and gauges.

2.02 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

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

2.03 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Provide spare parts, maintenance, and extra products of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Engineer.

B. Install equipment level and plumb, as well as parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.

C. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

D. Install equipment giving right-of-way to piping systems installed at a required slope.

E. Repaint painted surfaces that are damaged.

F. Fill lubricant reservoirs and replace consumption during testing, startup, and operation prior to acceptance of equipment by Owner.

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

SECTION 01 76 00
PROTECTION AND MAINTENANCE OF WORK AND PROPERTY

PART 1 GENERAL

1.01 DESCRIPTION

A. This section sets forth Contractor responsibilities to protect public and private property including utilities, landscaping, and structures. The cost of all work in this section shall be considered incidental to other items of work and shall be included in the appropriate bid items.

1.02 COORDINATION OF WORK

A. The Contractor shall coordinate its work with other projects being completed in the area. The Contractor shall coordinate with the Owner's field representative, and other contractors, for coordination and expeditious execution of its work in relation to total project work required. The numbers given below are for the Contractor's convenience in coordinating its work and are not included for the intended purpose of emergency situations.

Camas Utility Operations ..... (360) 817-1563
Project Engineer ..... (360) 695-7041

1.03 PRESERVATION OF PUBLIC AND PRIVATE PROPERTY

A. Existing Pump Stations

1. The existing wastewater pump stations shall remain in complete operation until such time as bypassing equipment has been installed and approved.

B. Utilities

1. Utility Locate. The Contractor shall call the Northwest Utility Notification Center (NUNC) at (800) 424-5555 for field location, not less than two nor more than ten working days before the scheduled date for commencement of excavation which may affect underground utility facilities. Under no circumstances expose any utility without first obtaining permission from the appropriate utility agency.

2. Underground and Overground Utilities. The Contractor shall be solely and directly responsible to the Owner and Owners of Utilities for any and all damage, disruption of service, or claims which may result from the construction operations. The Contractor shall make all necessary arrangements for protection of existing power and telephone lines in the vicinity of this Contract that interfere with construction.

3. All costs of providing any required temporary or permanent protection to underground cables, in accordance with the power or telephone company's requirements, shall be paid by the Contractor.

4. Contractor's Responsibility. Neither the Owner nor its officers or agents shall be responsible to the Contractor for damages as a result of the Contractor's failure to protect utilities encountered in the work.

5. Restoration of Utilities. Restoration of utilities damaged by the Contractor, its agents or employees, shall be accomplished by the utility involved at the Contractor's expense.

1.04 RESTORATIONS, CLEANING, AND DUST CONTROL

A. General. Upon the termination of the work, and as a condition precedent to final acceptance, the Contractor shall remove all equipment and temporary structures and all rubbish, waste and surplus materials, and shall grade and relevel ground surface, repair pavement, walks and traveled surfaces to their original condition, re-establish plantings, and generally clean up the right-of-way and premises to fully conform to conditions as they existed before the improvement was made.

It is expressly understood that the Contractor shall, in particular, restore all such easements and rights-of-way to a condition equal to its original condition and in a condition satisfactory to the property owners and the Owner. It is also understood that any private improvements made in public rights-of-way are included in the above category. This restoration work will be performed at no additional cost to the Owner.

B. Cleanup. The Contractor shall clean all soil deposited by construction activities from all pavements and sidewalks at the conclusion of each day's operation. The Contractor shall curtail construction activities in the event that spilled soil on traveled roadways creates a hazardous condition. The Contractor shall prevent dust by using water or an approved dust-preventative treatment.

1.05 SAFETY

A. Emergencies. Whenever the Contractor's work endangers the safety of life or property including adjoining property or property in the immediate proximity of the project, the Contractor shall take all reasonable precautions to prevent threatened loss or injury therefrom and shall be solely responsible for any damages or injury occurring.

PART 2 PRODUCTS - Not applicable to this Section.

PART 3 EXECUTION - Not applicable to this Section.

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

SECTION 01 78 23
OPERATIONS AND MAINTENANCE MANUALS

PART 1 GENERAL

1.01 SUMMARY

A. This section includes detailed information for the preparation, submission, and Engineer's review of Operations and Maintenance (O&M) Manuals, as required by individual Specification sections.

B. The Contractor shall provide Operation and Maintenance (O&M) manuals for the complete project as applicable under this contract, including all Contractor furnished and installed equipment, systems and materials. Included herein are requirements for compiling and submitting the O&M data. Additional O&M data requirements are specified in the individual sections of the technical specifications. O&M Manual requirements shall be coordinated with the requirements as stated in the other technical specification sections and shall include listings for spare parts, framed instructions, etc.

C. Manual preparation for equipment and systems shall be completed by the equipment manufacturer or system supplier.

1.02 SUBMITTALS

A. Two copies of a complete DRAFT set of manuals shall be submitted.

B. Three copies of the final complete set of manuals shall be submitted. The requirement for three copies of the O&M manual shall supersede and replace any requirements for a lesser amount of manuals which may be indicated in some specification sections.

C. One copy of the complete O&M manual in electronic pdf format shall be provided.

1.03 PRELIMINARY O&M MANUAL AND DATA SUBMITTAL

A. To establish and assure that correct O&M manual information is provided, the Contractor shall submit and receive Engineer approval on all O&M manuals. Initial O&M Manual data submittal shall be a minimum of 30 days prior to 90 percent project completion.

B. Data submitted for the manual are to be for the specific equipment furnished, and are in addition to that furnished as shop drawings.

C. The Engineer will require thirty days for review of submitted O&M manual(s) or data. The Engineer will retain one copy of unacceptable O&M manual submittal and return remainder of copies to the Contractor marked "Returned for Correction." If "Returned for Correction" the Contractor shall resubmit the required number of copies of the manual(s) incorporating all comments, prior to substantial completion and/or use and possession. The Contractor may, at his option, update the copy retained by the Owner in lieu of providing the added copy.

D. For equipment or systems requiring personnel training and/or acceptance testing, the final O&M data shall be approved by the Engineer prior to the scheduling of the training and/or testing. O&M data on equipment or systems not requiring training or testing shall be submitted so all data will be approved and bound in the O&M manuals in the required quantity by the time the project reaches 90 percent completion. Failure to furnish approved, bound manuals in the required quantity by the time the project is 90 percent complete, will be cause for the Owner to hold or adjust the retained percentage in accordance with General Conditions.

E. Three of the six completed copies of the final O&M manuals shall contain original manufacturer's data. Data in the remaining manuals may be duplicated copies of original data. All data furnished must be of such quality to reproduce clear, legible copies.

1.04 BINDERS

A. Construction and Assembly. Manuals shall be contained in 3-ring binders. The manuals shall be hardback plastic-covered, cleanable, not over three inches thick and designed for 8.5 x 11 inch paper. The hard cover shall be of minimum stiffness equal to 0.080 inch display board or double weight illustration board. Page size of the hard copies and the electronic copy shall be standard 8.5 x 11 inch. Larger sizes of paper for drawings may be included as a folded 11 x 17 inch paper size, or larger sizes provided in a sleeve.

B. Cover and Spine. Identify manual with typed or printed title “OPERATION AND MAINTENANCE MANUAL” and list the following information:

1. OPERATION AND MAINTENANCE MANUAL

2. Project title.

3. System or equipment included in volume.

4. List of major items of equipment in volume.

C. Color. Color of binder and printing shall be the option of the Contractor except that printing color shall contrast with binder color, and colors shall be the same for all manuals.

D. Content. The O&M manuals shall be structured to address each of the following topics.

1. Warning Page: A warning page shall be provided to warn of potential dangers (if they exist), such as high voltage, toxic chemicals, flammable liquids, explosive materials, carcinogens, or high pressures. The warning page shall be placed inside the front cover, in front of the title page.

2. Title Page. Contractor name, address and telephone number. Subcontractor supplier, installer, or maintenance contractor’s name, address, telephone number, and area of responsibility.

3. Index: Each manual shall have a master index at the front identifying all manuals and volumes and subject matter by system name for each. Following the master index, each manual shall have an index of its contents listing each volume, tab numbers, etc., as necessary to readily refer to a particular operating or maintenance instruction. Rigid tabbed fly leaf sheets shall be provided for each separate product and/or piece of equipment under each system in the manual. All pages shall be numbered with the referenced number included in the index.

4. Description: Narrative and technical descriptions of the system and of the interrelations with other systems.

5. Product Data:

    a. Function, normal operating characteristics, and limiting conditions.

    b. Performance curves, engineering data, nameplate data, and tests.

    c. Complete nomenclature and commercial number of replaceable parts.

    d. Original manufacturer's parts list, illustrations, detailed assembly drawings showing each part with part numbers and sequentially numbered parts list, and diagrams required for maintenance.

    e. Spare parts ordering instructions.

6. Check List Prior to Start Up: Precautions and prechecks prior to start up of equipment and/or system, including safety devices, monitoring devices and control sequence shall be provided.

7. Start Up and Operation: Step-by-step sequential procedures for start and normal operation checks for satisfactory operation shall be provided. Safety precautions and instructions that should be followed during these procedures shall be incorporated into the operating instructions and flagged for the attention of the operator. Procedures shall include test, manual or normal, and automatic modes.

8. Shutdown: Procedures for normal and emergency shutdown of equipment and/or systems shall be provided. The instructions shall include any procedures necessary for placing the equipment and/or system on standby or preparing the equipment and/or system for start-up at a later time. Procedures shall include test, manual or normal, and automatic modes.

9. Operator Preventive Maintenance, Major Maintenance, and Adjustments: The instructions shall include recommended operator preventive maintenance which would normally be performed by operating personnel and adjustment procedures necessary for normal operation. Schedules shall be provided indicating time frames or operating hours for initiating operator maintenance and adjustments, and including manufacturer's recommended major maintenance requirements. Emergency adjustments shall be included and flagged for

operator's attention; the instructions shall also include procedures for emergency repairs that could be performed by operating personnel. These emergency repairs or "trouble-shooting guides" shall be outlined in three columns with the following headings:

a. Column 1 - Trouble

b. Column 2 - Probable Cause(s)

c. Column 3 - Correction

10. Operator Data: The instructions shall include equipment and/or system layouts showing all piping, wiring, breakers, valves, dampers, controls, etc., complete with diagrams, schematics, isometrics, and data to explain the detailed operation and control of each individual piece of equipment and/or system, including system components. Layouts shall show the location within the facility of controls, valves, switches, dampers, etc., by reference to site location, wing designation, floor, room number, or other clear and concise directions for locating the item. Operator data may be identical to posted data and framed instructions but shall be prepared as part of the O&M manuals. All control systems operations data shall include the following:

    a. A fully labeled control schematic which details all set points, throttling ranges, actions, spans, proportional bands, and any other adjustment.

    b. A fully labeled elementary diagram (ladder diagram).

    c. A sequence of control on the diagrams cross-referenced to the control schematic and elementary diagram.

    d. A generic, functional description of each control component shown on the drawings.

    e. Catalog data of every control device.

11. Electrical Layout Drawings: The Electrical O&M's shall include complete layout drawings and one-line diagrams of exterior and interior electrical with reference to the buildings and site layout. Drawings shall include layout of interior lighting, interior power, intrusion detection systems, communication systems and fire protection systems. Exterior layout drawings shall show location fed from, pad-mount transformer, metering, main distribution panel and communication lines. Layout drawings shall show the location within the facility or reference to the building and the site plan. Layout drawings shall be half size contract as-built drawings and shall be inserted into plastic pockets and installed at the back of the O&M's that pertain to that particular drawing.

12. Maintenance Procedures: Recommended procedures shall indicate preventive maintenance, lubrication, and good housekeeping practices which should be performed by operating personnel as well as more complex maintenance

procedures which would normally be performed by trained maintenance personnel only. The procedures shall be presented with a schedule indicating time frames or operating hours for specific maintenance to be accomplished. Safety precautions and instructions that should be followed during these procedures shall be incorporated into the maintenance procedures and flagged for the attention of personnel. The procedures shall include necessary operating instructions for taking equipment off-line, putting equipment on-line, or putting equipment on standby. The instructions shall include all necessary material, equipment, and system data to perform maintenance work and shall include, but not be limited to, manufacturers/bulletins, catalogs, and descriptive data; certified performance curves, copies of approved test plane including logs and records of performance acceptance test results, and actual adjustments made during final acceptance and inspection; system layouts, including block diagrams, wiring, control, and isometric diagrams; schematic items within the facility; and interrelationships with other items of the system.

13. A separate lubrication schedule shall be provided for each item of equipment that requires lubrication. The schedule shall show the recommended frequency of preventive maintenance and shall include a lubrication schedule, and the type of lubricant required. Lubricant information shall include SAE grade, type, and temperature ranges.

14. Repairs: Repair procedures shall be presented with a step-by-step procedure for locating and correcting the trouble. A "shop manual" may be used for this purpose. Repair procedures shall be keyed to a troubleshooting guide outlined in three columns with the following headings:

    a. Column 1 - Trouble

    b. Column 2 - Probable Cause(s)

    c. Column 3 - Correction

    The procedures shall clearly indicate a major repair activity which should only be performed in a shop or factory versus normal repair work that may be performed onsite or with equipment online. The procedures shall also clearly indicate the limit of repair work that may be performed by the Owner’s personnel during the warranty period without voiding warranty provisions. Safety precautions and instructions that should be followed during these procedures shall be incorporated into the repair procedures and flagged for the attention of personnel.

15. Tools: The Contractor shall provide one of each nonstandard tool, test instrument, and gauge necessary for performing maintenance and repair work. Nonstandard tool, test instrument, or gauge is defined as an item normally supplied by the manufacturer for the equipment operation or maintenance. The Contractor shall prepare a master list of such items for all equipment and systems and shall key maintenance and repair procedures to this list. The above

referenced items for performing maintenance and repair work shall be provided for each individual facility of multifacility projects.

16. Parts and Supplies: A complete list of parts and supplies shall be provided with the maintenance instructions. The list shall include all parts and components of individual pieces of equipment, and all parts and component of each system and shall identify such items as description of part, model number, circuit or component identification, etc. Parts and supplies lists shall be included within each volume of maintenance instructions. Further, a master list of spare parts and supplies recommended from each manufacturer for one year of operation, including source of supply, shall be sublisted with each instruction.

    a. Availability: The Contractor shall list the sources of supply for all parts and supplies, including name of supplier/manufacturer, address, and telephone number. If the parts and supplies are not normally stocked locally (within 6 hours travel time, round trip by surface transportation), necessary procurement time shall also be a part of the listing.

    b. Spare Parts: The Contractor shall provide those spare parts and supplies that are specified in the TECHNICAL SPECIFICATIONS and those which are normally provided with the equipment or material item. A separate master list shall be provided for these items upon turnover to the Owner of the parts and supplies.

17. Maintenance Schedule: A separate schedule of all required periodic maintenance shall be included. This schedule shall list by frequency of occurrence all lubricants and special adjustments required. The types and amounts of lubrication must be specified. The Contractor shall verify that the furnished maintenance schedule agrees with the published manufacturer's data.

E. Architectural/General O&M:

1. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

2. Moisture-protection and Weather-exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

3. Additional Requirements: As specified in individual specifications sections.

F. Warranties:

1. In addition to the general warranty required by the contract, the O&M manuals shall include any specific warranties required by other sections of the Specifications and other warranties normally provided with the particular piece of equipment or system. Extended warranties normally provided by

manufacturers that are beyond the warranty of construction shall be specifically noted. The O&M manuals shall also include a specific warranty section itemizing all standard and extended warranty items. The warranty list shall be as indicated below. Warranties will not begin until the facility is accepted by the Owner. Copy of warranty shall be included in the manual.

2. The warranty list shall include the following information::

   a. Project title

   b. Contract number

   c. General Contractors name and phone number

   d. For each item under warranty:

      1) Item description

      2) Warranty start and end date

      3) Manufacturers/warrantors name, address & phone Number

G. Data Layout:

1. Data Identification: Catalog data shall be marked to clearly identify pertinent data by highlighting the data with pointers or crossing out all non-pertinent data.

2. Drawings: All drawings bound in the manuals shall be of such size that will require only one fold made right to left. All larger size drawings shall be inserted into a separate pocket in the required location in the manual. All drawings shall be of microfilm quality.

3. Posted Data: The Contractor shall provide posted data for equipment systems, in addition to O&M manuals, and as required by other Technical Specifications sections. The data shall consist of as-built schematics of wiring, controls, piping, etc., as necessary for the operation of the equipment or system, and a condensed typewritten description of the system. The posted data may include approved shop drawings, layout drawings, riser, and block diagrams and shall indicate all necessary interrelation with other equipment and systems. The data may be presented in one or several frames, under glass or sheet acrylic glazing, for clarity and convenience of location. The framed data presentation and outline shall be acceptable to and posted locations designated by the Engineer. The data shall be posted before personnel training or performance testing acceptance for the related items of equipment or system.

4. Framed Instructions: Typewritten instructions, framed under glass or sheet acrylic glazing, explaining equipment or system prestart checkout, startup, operations and shutdown procedures, safety precautions, preventive maintenance procedures, and normal operation checks for satisfactory

performance of the equipment of systems shall be posted in conjunction with the posted data. The framed instructions may be presented in one or several frames for clarity and convenience of location. The instruction presentation and outline shall be acceptable to the Engineer prior to posting, and shall be posted at locations designated by the Engineer. All framed instructions shall be posted before personnel training or performance testing acceptance commences for the related item of equipment or system.

H. Checklist: Contractor shall complete and initial a copy of the O&M Manual Check List which is provided at the end of this section, and forwarded as part of the O&M Manual submittal to the Engineer for approval. The Check List is included at the end of this section.

PART 2 PRODUCTS - Not applicable to this Section.

PART 3 EXECUTION – Not applicable to this Section.

O&M MANUAL - REVIEW CHECKLIST

- ~ Does the manual cover all equipment furnished under the contract? (Review against equipment schedules on the drawings and/or equipment submittals.)
- ~ Does the manual clearly highlight all relevant portions or cross out all irrelevant portions of catalog data?
- ~ Does the manual contain operations data for the equipment? (Step-by-step operating instructions, start up procedures, sequences of operation, precautions.)
- ~ Does the manual contain maintenance and repair data for the equipment? (Lubrication, dismantling, assembly, adjustment, troubleshooting.)
- ~ Does the manual contain a separate maintenance schedule listed by frequency of occurrence?
- ~ Does the manual contain parts lists or parts catalogs for the equipment parts catalog or list containing identification, part numbers, recommended parts to be stocked, and local source of parts?
- ~ Does the manual contain electrical connection diagrams?
- ~ Does the manual contain control and interlock system diagrams where applicable?
- ~ Is every page in the manual numbered and an index provided for ready reference to the data?
- ~ Is the cover hard (nonflexible) with the facility name, identification number, location, and system embossed on both the spine and cover? Is the Contractor's name and address, and the contract title and contract number embossed on the inside of the Manual cover?
- ~ Is the binding 3-ring?
- ~ Is any of the data in the manual under the binding where it cannot be seen?
- ~ Do three sets of manuals contain all original data sheets and are the other three sets clearly legible?
- ~ Are system layout drawings provided? (Simplified diagrams for the system as installed.)
- ~ Are all drawings in the manual of such a size that requires one fold right to left, or if a larger size drawing, then inserted into a pocket in the manual?

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

SECTION 01 91 10
EQUIPMENT TESTING AND FACILITY STARTUP

PART 1 GENERAL

1.01 DESCRIPTION

A. Provide personnel, equipment, supplies and tools for equipment testing startup operation of the proposed pump station facilities.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 01 78 23 - Operation and Maintenance Manuals

1.03 SUBMITTALS

A. Notification of Intent. Submit a minimum of 10 days prior to beginning equipment testing and startup operations.

B. Schedule. Submit written schedule for equipment testing and facility startup a minimum of 10 days prior to beginning activities. Approval of this schedule by the Engineer is required prior to commencement of the startup period.

C. Inventory Lists. Submit inventory list at beginning and end of startup period.

1.04 EQUIPMENT INVENTORY

A. Prior to, and immediately upon completion of the Startup period, Contractor shall provide a list of all Owner owned equipment, tools, spare parts, fixtures, and supplies which are incorporated in the Work, or which will be in possession of or under the control of the Contractor. These lists shall include (for each item): description, manufacturer, model or catalog number, serial number, electrical characteristics, size or capacity, and net inventory cost, along with any other necessary data to fully identify the item.

B. Inventory lists shall be checked and signed by the Contractor and by a representative authorized by the Engineer, and shall then serve as the basis for adjustments for discrepancies as described in PART 3 of this Section.

1.05 SAFETY

A. Contractor shall provide, and make available to all on-site personnel, material safety data sheets for all hazardous materials purchased under this section.

B. Contractor shall be responsible for complying with safety standards.

PART 2 PRODUCTS

2.01 GENERAL

A. Contractor shall provide all supplies required equipment testing and facility startup.

B. Contractor is required to provide a one (1) year's supply of all lubricants, oils, and greases which are needed for all equipment furnished under this contract.

C. All products purchased by the Contractor under this Section shall become the property of the owner upon delivery to the site. Contractor shall use due care in the use of these products to avoid waste and to provide for the safe handling of same to protect life and property.

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor shall coordinate and obtain electricity and potable water necessary for the equipment testing and start up and operation of the new pump station. The Contractor shall pay any related service charges.

B. Owner personnel other than the Engineer may periodically observe Contractor operations during equipment testing and facility startup. However, only the Engineer may obligate the Owner or direct Contractor operations.

C. Contractor shall designate and furnish one or more personnel to coordinate and expedite equipment testing and facility startup. Representative shall be present during all startup meetings and shall be available at all times during testing and startup.

D. Subcontractor and equipment manufacturer's staff shall be adequately available to prevent delays.

3.02 EQUIPMENT TESTING

A. Complete installation prior to equipment testing.

B. Furnish qualified manufacturer's representative when required by individual Specification sections.

C. Provide a written test report for each item of equipment to be tested, to include the following:

1. Owner and project name.

2. Equipment or item tested.

3. Date and time of test.

4. Type of test performed.

5. Test method.

6. Test conditions.

7. Test results.

D. Prior to beginning equipment testing:

1. Calibrate testing equipment in accordance with manufacturer's instructions.

2. Inspect and clean equipment, devices, connected piping, and structures to ensure they are free of foreign material.

3. Lubricate equipment in accordance with manufacturer's instructions.

4. Turn rotating equipment by hand when possible to confirm that equipment is not bound.

5. Open and close valves by hand and operate other devices to check for binding, interference, or improper functioning.

6. Check power supply to electric-powered equipment for correct voltage.

7. Adjust clearances and torque.

8. Test piping for leaks.

E. Conduct equipment testing as specified in individual Specification sections. Contractor shall provide all labor, materials, and supplies necessary to complete the test.

F. Retesting. If the equipment of components fail to meet specified design, loading, operating, or performance criteria, the contractor (assisted by subcontractors and/or manufacturer's representative as needed) shall make all necessary revisions or modifications, and shall retest the unit again to demonstrate compliance.

G. Final Inspection and Acceptance. All material and completed work are subject to final inspection by the Engineer before acceptance by the Owner. The Engineer may require and shall have the right to subject all machinery and equipment and work to such test, as in his opinion, will assist in determining whether the Contract has been performed in accordance with the Contract Documents. All such tests shall be at the expense of the Contractor.

H. All testing shall be conducted in the presence of the Owner and the Engineer.

I. All testing shall first be completed with clean water, unless otherwise directed by the Engineer.

3.03 FACILITY STARTUP

A. Prior to the commencement of the startup period, the Contractor shall:

1. Complete and obtain final acceptance of all pump station pipe, structures, and equipment.

2. Submit and obtain approval of the Operation and Maintenance Manuals for all equipment in accordance with Section 01 78 23 and have these manuals available on-site for reference by the Contractor, and the Engineer or his representative.

3. Demonstrate that all major pump station control, operation, maintenance and monitoring equipment is fully functional.

4. Complete all training required by other Sections of these Specifications.

B. Contractor shall provide all supplies and tools required during the startup period.

C. Interruptions in Startup. The startup period shall be considered that period of time when the pump station facility is operational and no Interruptions in Startup occur. Interruptions in Startup shall be any event that significantly hinders startup operations, as determined by the Engineer, and shall include interruptions due to failure of any equipment furnished under the Contract.

D. For a period of seven (7) days without Interruptions in Startup, following successful testing of all piping, structures, and equipment, Contractor shall operate, maintain, monitor and adjust all equipment and systems to demonstrate that the facility is functioning as designed, and is integrated to provide a fully functional system.

E. Temporary sewer bypassing system shall remain in place for the duration of the startup period such that flow is not interrupted in the event of an operational issue with the permanent pump station.

F. Upon commencement of the startup period, Contractor shall provide all labor, tools, and supplies to maintain the pump station equipment in like-new condition for the duration of the period, perform all tasks to ensure that equipment warranties remain valid, and enforce any and all warranties for equipment which malfunctions during the period.

G. Contractor shall check fluid levels, and add or replace lubricants for all equipment in accordance with the operation and maintenance instructions for each piece of equipment in the facility for the duration of the period. Specific attention is directed to requirements for lubricant draining and replacement of lubricants after initial run-in periods for most equipment.

H. Contractor shall perform all preventive maintenance checks in accordance with the operation and maintenance manual, and shall make all adjustments and repairs to equipment as becomes necessary for the duration of the period. Contractor shall not

make any repairs to equipment that will render any equipment guarantee or warranty invalid.

I. Contractor shall be responsible for general housekeeping chores, and shall maintain the facilities in a neat and clean condition for the duration of the period.

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

SECTION 02 41 00
DEMOLITION

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This work shall consist of the removal and disposal of all structures, surfacing, equipment, piping, and any other obstructions within the construction limits that are not designated to remain.

1.02 DISPOSAL OF PRODUCTS OF DEMOLITION

A. All materials associated with the demolition that are not noted to be salvaged shall be disposed of by the Contractor at an off-site and legal location of their choosing. The Contractor shall be responsible for obtaining any and all necessary permits and shall comply with applicable codes, laws, and standards.

PART 2 PRODUCTS – Not applicable to this Section.

PART 3 EXECUTION

3.01 PRELIMINARY ACTIVITIES

A. The Contractor shall notify the Engineer 14 days in advance of actual demolition activities, and coordinate with Contract Operations staff to ensure no interruption or inconvenience to pump station operations.

3.02 GENERAL DEMOLITION

A. The Contractor shall conduct all demolition operations to avoid damage to adjacent property, surfacing, equipment, and structures. When portions of an existing structure are slated to be retained, diamond saw cutting, or other similar methods, shall be used along the lines shown on the drawings to separate the portion to be retained from the portion to be demolished prior to demolition. All debris from demolition activities shall be disposed of at appropriate locations.

B. Existing building or mechanical items for reuse on drawings shall be removed without damage. All materials that will be reused shall be stored to prevent damage at a location of the Contractor's choosing such that materials do not obstruct Plant operations and construction activities.

C. All equipment shall be removed in such a manner to assure that associated piping, wiring, and other assemblages are not damaged.

D. Provide temporary support of existing structures to prevent unintentional collapse.

3.03 CONCRETE AND MASONRY DEMOLITION AND PREPARATION

A. Existing concrete and masonry scheduled to remain shall be accurately cut, utilizing diamond saw or other similar methods, to the lines and dimensions established on the drawings. Where cutting of metal pieces embedded in concrete is required, the amount of head shall be minimized to that required to cut the metal piece to prevent damage to existing concrete.

B. Contractor shall inspect all concrete surfaces scheduled to remain and clean to produce a sound surface. Generally, this can be achieved with a low pressure water cleaning using equipment capable of 5,000 psi at 4 gpm. Grind concrete surfaces free from fins and sack all surfaces to fill voids.

C. All waste material generated during the cleaning procedure shall be collected, removed from site and disposed of in a manner approved by the City.

D. All surfaces must be inspected by the Engineer or his representative during and after preparation and before repair material is applied.

E. Methods of demolition shall avoid vibratory loading to the underlying soils that would cause damage to adjacent facilities.

3.04 METAL AND WOOD DEMOLITION

A. Existing metal and wood scheduled to remain shall be accurately cut from the portion to be demolished along the lines and grades shown on the drawings.

B. Exercise extreme care to ensure that small items (such as bolts or pieces of demolished material) do not fall and affect surrounding equipment.

3.05 SURFACING DEMOLITION

A. Coordinate with the Engineer for demolition limits prior to sawcutting cement concrete and asphalt concrete surfaces.

B. Make a vertical full depth sawcut between the existing asphalt pavement, cement concrete sidewalk, or cement concrete driveway that is to remain and the portion that is to be removed. For asphalt pavement removal, the Contractor may use asphalt planing equipment provided that a clean vertical edge remains.

3.06 BURIED PIPE ABANDONMENT

A. Where pipes are located below the surface, they shall be removed in full, and the void shall be filled with compacted pipe backfill material. If removal is not possible due to location of other existing utilities to remain, pipe to be abandoned may be filled with CDF (controlled density fill).

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

SECTION 03 11 00
CONCRETE FORMWORK

PART 1 GENERAL

1.01 DESCRIPTION

A. The section addresses the concrete formwork associated with the pump station work.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 03 30 00 – Cast in Place Concrete

1.03 REFERENCES

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

1. American Concrete Institute (ACI) 347R, Guide to Formwork for Concrete.

2. American National Standard Institute (ANSI) A135.4, Basic Hardboard.

3. National Bureau of Standards (NBS) PS 1 Structural Plywood.

4. American Society for Testing and Materials (ASTM), C31 Making and Curing Concrete Test Specimens in the Field.

1.04 SUBMITTALS

A. The following shall be submitted:

1. Design analysis and calculations for form design and methodology used in the design shall be submitted.

2. Manufacturer's data shall include literature describing form materials, accessories, and form releasing agents.

3. Drawings showing details of formwork including joints, supports, studding and shoring, and sequence of form and shoring removal.

4. Manufacturer's recommendation on method and rate of application for form releasing agents.

1.05 DESIGN CRITERIA

A. Formwork shall be designed in accordance with methodology of ACI 347R for anticipated loads, lateral pressures, and stresses.

B. Forms shall be capable of withstanding the pressures resulting from placement and vibration of concrete.

C. Limit panel deflection to 1/360 of each component span to achieve tolerances specified.

PART 2 PRODUCTS

2.01 FORM MATERIALS

A. Forms for use where concrete will be not be exposed to view after construction:

1. Any material specified for use where concrete will be exposed to view after construction.

2. Shiplap lumber.

3. Tempered concrete form hardboard conforming to ANSI A135.4.

B. Form Ties:

1. Prefabricated steel rod of the cone-type snap-tie configuration, or approved threaded internal disconnecting type, to resist all imposed loads of freshly placed concrete, and permit tightening and spreading of forms.

2. Diameter on ends shall be 3/4 inch minimum to 1 inch maximum. Embedded portion of ties shall be not less than 1 1/2 inch from face of concrete after ends have been removed. Ties with built-in waterstops shall be provided in all walls that will be in contact with process liquid during plant operation and/or high ground water.

3. Wire ties not permitted.

C. Form Coating: Form releasing agents shall be commercial formulations that will not bond with, stain or adversely affect concrete surfaces. Agents shall not impair subsequent treatment of concrete surfaces depending upon bond or adhesion nor impede the wetting of surfaces to be cured with water or curing compounds. Coatings containing mineral oils or other nondrying ingredients will not be permitted.

PART 3 EXECUTION

3.01 INSTALLATION

A. Forms shall be mortar tight, properly aligned and adequately supported to produce concrete surfaces meeting the surface requirements specified in Section 03 30 00 and conforming to construction tolerances given in TABLE I, included at the end of this section.

B. Where forms for continuous surfaces are placed in successive units, care shall be taken to fit the forms over the completed surface so as to obtain accurate alignment of the surface and to prevent leakage of mortar.

C. Forms shall not be reused if there is any evidence of surface wear and tear or defects which would impair the quality of the surface. Surfaces of forms to be reused shall be cleaned of mortar from previous concreting and of all other foreign material before reuse.

D. Construct so ties remain embedded in the member with no metal within 1 inch of concrete surface when forms, inserts, and tie ends are removed. Form ties that are to be completely withdrawn shall be coated with a nonstaining bond breaker.

E. Except as otherwise shown, form 3/4 inch bevels at external corners that will be exposed.

3.02 COATING

A. Forms for use where concrete will not be exposed to view after construction may be wet with water in lieu of coating immediately before placing concrete, except that in cold weather with probable freezing temperatures coating shall be mandatory.

B. Prevent coating from getting on reinforcing steel, embedded items, construction joints or other surfaces requiring bond with concrete.

C. Remove surplus coating on form surfaces before placing concrete.

3.03 REMOVAL OF FORMS

A. Do not remove forms until concrete has attained sufficient strength to support anticipated loads and is sufficiently hard so as not to sustain damage during form removal.

B. Non-supporting forms may be removed after cumulatively curing at not less than 50 degrees F for 24 hours from time of concrete placemen, provide curing and protection operations are maintained.

C. Where no reshoring is planned, forms and shoring used to support weight of concrete shall be left in place until concrete has attained its specified 28-day strength.

D. Use methods of form removal that will not cause damage or overstressing of the concrete. Remove supports to permit the concrete to uniformly and gradually take the stress due to its own weight. Do not use high impact methods to remove supports.

E. Break back ties after concrete has cured sufficiently to maintain unbroken bond with steel rod.

3.04 FORM TIES

A. Where Cone-snap Rod and Bar Ties are used, forms shall be tied together at not more than 2-foot centers vertically and horizontally.

B. After forms are removed from wall, fill tie holes by removing form ties from surface, roughening cone shaped tie holes with heavy sandblasting prior to repair and drypacking as listed in this specification.

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

SECTION 03 30 00
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 DESCRIPTION

A. This section describes the materials and methods to be used in construction of cement concrete anchor pads.

1.02 REFERENCES.

A. The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only. Publications shall be the most current edition.

1. American Concrete Institute (ACI)

    a. ACI 117 Standard Tolerances for Concrete Construction and Materials

    b. ACI 305R Hot Weather Concreting

2. American Society for Testing and Materials (ASTM)

    a. ASTM C 31- Making and Curing Concrete Test Specimens in the Field

    b. ASTM C 39- Compressive Strength of Cylindrical Concrete Specimens

    c. ASTM C 42- Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

    d. ASTM C 78- Flexural Strength of Concrete (Using Simple Beam With Third-Point Loading)

    e. ASTM C 94- Ready-Mixed Concrete

    f. ASTM C 109- Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens)

    g. ASTM C 143- Slump of Hydraulic Cement Concrete

    h. ASTM C 150- Portland Cement

    i. ASTM C 171- Sheet Materials for Curing Concrete

j. ASTM C 172- Sampling Freshly Mixed Concrete

k. ASTM C 173- Air Content of Freshly Mixed Concrete by the Volumetric Method

l. ASTM C 192- Making and Curing Concrete Test Specimens in the Laboratory

m. ASTM C 231- Air Content of Freshly Mixed Concrete by the Pressure Method

n. ASTM C 260- Air-Entraining Admixtures for Concrete

o. ASTM C 309- Liquid Membrane-Forming Compounds for Curing Concrete

p. ASTM C 494- Chemical Admixtures for Concrete

q. ASTM C 595- Blended Hydraulic Cements

r. ASTM C 597- Pulse Velocity Through Concrete

s. ASTM C 618- Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete

t. ASTM C 803- Penetration Resistance of Hardened Concrete

u. ASTM C 805- Rebound Number of Hardened Concrete

v. ASTM C 989- Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars

w. ASTM C 1017- Chemical Admixtures for Use in Producing Flowing Concrete

x. ASTM C 1107- Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

y. ASTM D 98 - Calcium Chloride

z. ASTM E 96 - Water Vapor Transmission of Materials

3. National Ready-mixed Concrete Association (NRMCA)

a. NRMCA CPMB 100- Concrete Plant Standards

b. NRMCA QC 3- Quality Control Manual: Section 3, Plant Certifications Checklist: Certification of Ready-Mixed Concrete Production Facilities

c. NRMCA TMMB 1- Truck Mixer and Agitator Standards

1.03 SUBMITTALS

A. The following shall be submitted in accordance with Section 01 32 19:

1. Proportions of Mix. The results of trial mix along with a statement giving the maximum nominal coarse aggregate size and the proportions of all ingredients that will be used in the manufacture of each strength of concrete, at least 14 days prior to commencing concrete placing operations. Aggregate weights shall be based on the saturated surface dry condition. The statement shall be accompanied by test results from an independent commercial testing laboratory, attesting that the proportions selected will produce concrete of the qualities indicated. No substitutions shall be made in the materials used in the work without additional tests to show that the quality of the concrete is satisfactory.

2. Sampling and Testing Reports. Certified copies of laboratory test reports, including all test data, for aggregate, admixtures, and curing compound. These tests shall be made by an approved commercial laboratory or by a laboratory maintained by the manufacturers of the materials.

3. Certificates of Cementitious Materials. Manufacturer's certification of compliance, accompanied by mill test reports attesting that the materials meet the requirements of the Specification under which it is furnished, for cement, pozzolan, and ground iron blast-furnace slag. No cement, pozzolan, or slag shall be used until notice of acceptance has been given. Cement, pozzolan, and slag may be subjected to check testing by the Owner from samples obtained at the mill, at transfer points, or at the project site.

1.04 GENERAL REQUIREMENTS

A. Tolerances. Tolerances for concrete construction and materials shall be in accordance with ACI 117.

B. Air Entrainment. Concrete may be air entrained to produce concrete with 3 to 5 percent total air entrainment.

C. Special Properties. Concrete may contain other admixtures, such as water reducers, superplasticizers, or set retarding agents to provide special properties to the concrete, if approved. Dosage and application requirements shall be in accordance with the manufacturer's instruction. Approved admixtures used in order to provide flowing characteristics shall be at no cost to the Owner.

1.05 PROPORTIONS OF MIX

A. Mixture Proportioning, Normal Weight Concrete. Trial batches shall contain materials proposed to be used in the project. Trial mixtures having proportions, consistencies and air content suitable for the work shall be made based on methodology described in ACI 211.1, using at least three different water-cement ratios. Maximum water-cement ratio shall be 0.45. Trial mixes shall be proportioned to produce concrete strengths specified. In the case where ground iron blast furnace slag is used, the weight of the slag will be substituted in the equations for the term P which is used to denote the weight of pozzolan. Trial mixtures shall be designed for maximum permitted slump and air content. The temperature of concrete in each trial batch shall be reported. For each water-cement ratio at least three test cylinders for each test age shall be made and cured in accordance with ASTM C 192. They shall be tested at 7 and 28 days in accordance with ASTM C 39. From these test results a curve shall be plotted showing the relationship between water-cement ratio and strength. For each strength of concrete the maximum allowable water-cement ratio shall be that shown by these curves to produce an average strength as specified in the next paragraph.

B. Average Strength. In meeting the strength requirements specified, the selected mixture proportion shall produce an average compressive strength exceeding the specified strength by the amount indicated below. Where a concrete production facility has test records, a standard deviation shall be established. Test records from which a standard deviation is calculated shall represent materials, quality control procedures, and conditions similar to those expected; shall represent concrete produced to meet a specified strength or strengths within 1,000 psi of that specified for proposed work; and shall consist of at least 30 consecutive tests. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days or at other test age designated for determination of the specified strength.

   1. Test Records Exceeding 29. Required average compressive strength used as the basis for selection of concrete proportions shall be the larger of the specified strength plus the standard deviation multiplied by 1.34 or the specified strength plus the standard deviation multiplied by 2.33 minus 500.

   2. Test Records Less Than 29. Where a concrete production facility does not have test records meeting the above requirements but does have a record based on 15 to 29 consecutive tests, a standard deviation may be established as the product of the calculated standard deviation and a modification factor from the following table:

No. of tests (1)	Modification factor for standard deviation
less than 15	See Note
15	1.16
20	1.08
2	1.03
30 or more	1.00

When a concrete production facility does not have field strength test records for calculation of standard deviation or the number of tests is less than 15, the required average strength shall be:

1) *The specified strength plus 1000 specified strength of less than 3,000 psi.*
2) *The specified strength plus 1200 for specified strengths of 3,000 to 5,000 psi.*
3) *The specified strength plus 1400 for specified strengths greater than 5,000 psi.*

1.06 STORAGE OF MATERIALS.

A. Cement and pozzolan shall be stored in weathertight buildings, bins, or silos which will exclude moisture and contaminants. Aggregate stockpiles shall be arranged and used in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of aggregates. Reinforcing bars and accessories shall be stored above the ground on platforms, skids or other supports. Other materials shall be stored in such a manner as to avoid contamination and deterioration. Admixtures which have been in storage at the project site for longer than 6 months or which have been subjected to freezing shall not be used unless retested and proven to meet the specified requirements.

PART 2 PRODUCTS

2.01 ADMIXTURES. Admixtures shall conform to the following:

A. Accelerating Admixture: ASTM C 494, Type C or E; or calcium chloride conforming to ASTM D 98

B. Air-Entraining Admixture: ASTM C 260

C. Flowing Concrete Admixture: ASTM C 1017, Type 1 or 2

D. Water-Reducing or Retarding Admixture: ASTM C 494, Type A, B, D, F, or G

2.02 CEMENTITIOUS MATERIALS.

A. Cementitious materials shall each be of one type and from one source when used in concrete which will have surfaces exposed in the finished structure. Cementitious materials shall conform to one of the following:

1. Cement: ASTM C 150, Type II for all waterbearing structures and Type I for all other structures

2. Portland Blast-Furnace-Slag Cement: ASTM C 595, Type IS (MS)

3. Portland-Pozzolan Cement: ASTM C 595, Type IP (MS)

4. Pozzolan: ASTM C 618, Class F or C

5. Ground Iron Blast-Furnace Slag: ASTM C 989, Grade 120

2.03 AGGREGATES

A. Aggregates shall conform to the following:

1. Normal Weight Aggregate: ASTM C 33. Grading requirement for coarse aggregate shall conform to size number 57.

2.04 CURING MATERIALS

1. Burlap: FS CCC-C-467

2. Impervious Sheets: ASTM C 171, type optional, except that polyethylene film, if used, shall be white opaque.

3. Membrane-Forming Compounds: ASTM C 309, Type l-D, Class A or B

2.05 NONSHRINK GROUT.

A. Nonshrink grout shall conform to ASTM C 1107 Grade C and shall be a formulation suitable for the application.

2.06 WATER.

A. Water shall be potable, except that nonpotable water may be used if it produces mortar cubes having 7- and 28-day strengths at least 90 percent of the strength of similar specimens made with water from a municipal supply. The strength comparison shall be made on mortars, identical except for mixing water, prepared and tested in accordance with ASTM C 109. Water for curing shall not contain any substance injurious to concrete, or which causes staining.

PART 3 EXECUTION

3.01 PREPARATION OF SURFACES.

A. Surfaces to receive concrete shall be clean and free from frost, ice, mud, and water. Conduit and other similar items shall be in place and clean of any deleterious substance.

1. Preparation of bases for anchor pads shall be as specified in Section 31 23 33 – Trenching, Backfilling and Compaction.

3.02 BATCHING, MIXING AND TRANSPORTING CONCRETE.

A. Ready-mixed concrete shall be batched, mixed and transported in accordance with ASTM C 94, except as otherwise specified. Truck mixers, agitators, and nonagitating units shall comply with NRMCA TMMB 1. Ready-mix plant equipment and facilities shall be certified in accordance with NRMCA QC 3. Site-mixed concrete shall be mixed in accordance with ACI 301. On-site plant shall conform to the NRMCA CPMB 100.

1. Admixtures. Admixtures shall be batched within an accuracy of 3 percent. Where two or more admixtures are used in the same batch, they shall be batched separately and must be compatible. Retarding admixture shall be added within one minute after addition of water is complete or in the first quarter of the required mixing time, whichever is first. Superplasticizing admixtures shall be added as recommended by manufacturer. Concrete that shows evidence of total collapse or segregation caused by the use of admixture shall be removed from the site.

2. Control of Mixing Water. No water from the truck system or elsewhere shall be added after the initial introduction of mixing water for the batch except when on arrival at the jobsite, the slump of the concrete is less than that specified. Water added to bring the slump within the specified range shall not change the total water in the concrete to a point that the approved water-cement ratio is exceeded. The drum shall be turned an additional 30 revolutions, or more, if necessary, until the added water is uniformly mixed into the concrete. Water shall not be added to the batch at any later time.

3.03 CONVEYING CONCRETE.

A. Concrete shall be conveyed from mixer to forms as rapidly as possible and within the time interval specified in paragraph CONCRETE PLACEMENT by methods which will prevent segregation or loss of ingredients.

1. Chutes. When concrete can be placed directly from a truck mixer or other transporting equipment, chutes attached to this equipment may be used. Separate chutes will not be permitted except when specifically approved.

2. Buckets. Bucket design shall be such that concrete of the required slump can be readily discharged. Bucket gates shall be essentially grout tight when closed. The bucket shall provide

means for positive regulations of the amount and rate of deposit of concrete in each dumping position.

3. Belt Conveyors. Belt conveyors may be used when approved. Belt conveyors shall be designed for conveying concrete and shall be operated to assure a uniform flow of concrete to the final place of deposit without segregation or loss of mortar. Conveyors shall be provided with positive means for preventing segregation of the concrete at transfer points and point of placement.

4. Pumps. Concrete may be conveyed by positive displacement pumps when approved. Pump shall be the piston or squeeze pressure type. Pipeline shall be steel pipe or heavy duty flexible hose. Inside diameter of the pipe shall be at least three times the maximum size of the coarse aggregate. Distance to be pumped shall not exceed the limits recommended by the pump manufacturer. Concrete shall be supplied to the pump continuously. When pumping is completed, the concrete remaining in the pipeline shall be ejected without contaminating the concrete in place. After each use, the equipment shall be thoroughly cleaned. Flushing water shall be wasted outside the forms.

3.04 CONCRETE PLACEMENT

A. Mixed concrete which is transported in truck mixers or agitators or concrete which is truck mixed, shall be discharged within 1-1/2 hours or before the drum has revolved 300 revolutions, whichever comes first after the introduction of the mixing water to the cement and aggregates or the introduction of the cement to the aggregates. These limitations may be waived by the Owner if the concrete is of such slump after the 1-1/2 hour time or 300 revolution limit has been reached that it can be placed, without the addition of water to the batch. When the concrete temperature exceeds 85 degrees F, the time shall be reduced to 45 minutes. Concrete shall be placed within 15 minutes after it has been discharged from the truck.

B. Placing Operation. Concrete shall be handled from mixer to forms in a continuous manner until the approved unit of operation is completed. Adequate scaffolding, ramps and walkways shall be provided so that personnel and equipment are not supported by in-place reinforcement. Placing will not be permitted when the sun, heat, wind, or limitations of facilities furnished by the Contractor prevent proper consolidation, finishing and curing. Concrete shall be deposited as close as possible to its final position in the forms, and there shall be no vertical drop greater than 5 feet except where suitable equipment is provided to prevent segregation and where specifically authorized. Depositing of the concrete shall be so regulated that it will be effectively consolidated in horizontal layers not more than 12 inches thick, except that all slabs shall be placed in a single layer. Concrete to receive other construction shall be screeded to the proper level to avoid excessive shimming or grouting.

C. Cold Weather Requirements. Special protection measures, approved by the Owner, shall be used if freezing temperatures are anticipated before the expiration of the specified curing period. The

ambient temperature of the air where concrete is to be placed and the temperature of surfaces to receive concrete shall be not less than 40 degrees F. The temperature of the concrete when placed shall be not less than 50 degrees F nor more than 75 degrees F. Heating of the mixing water or aggregates will be required to regulate the concrete placing temperature. Materials entering the mixer shall be free from ice, snow, or frozen lumps. Salt, chemicals or other materials shall not be incorporated in the concrete to prevent freezing. Upon written approval, calcium chloride or chemical admixture conforming to ASTM C 494 Type C or E may be used. The amount of calcium chloride shall not exceed 2 percent by weight of the cement, and it shall be batched in solution form.

D. Warm Weather Requirements. The temperature of the concrete placed during warm weather shall not exceed 85 degrees F except where an approved retarder is used. The mixing water and/or aggregates shall be cooled, if necessary, to maintain a satisfactory placing temperature. In no case shall the placing temperature exceed 95 degrees F.

3.05 CURING AND PROTECTION

A. General.

1. All concrete shall be cured by an approved method for the period of time given below:

Concrete with Type I, II, IP or IS cement	7 days
Concrete with Type I or Type II cement blended with pozzolan	7 days

2. Immediately after placement, concrete shall be protected from premature drying extremes in temperatures, rapid temperature change, mechanical injury and injury from rain and flowing water. Air and forms in contact with concrete shall be maintained at a temperature above 50 degrees F for the first 3 days and at a temperature above 32 degrees F for the remainder of the specified curing period. All materials and equipment needed for adequate curing and protection shall be available and at the site prior to placing concrete. No fire or excessive heat shall be permitted near or in direct contact with the concrete at any time.

B. Moist Curing. Concrete to be moist-cured shall be maintained continuously wet for the entire curing period. If water or curing materials used stains or discolors concrete surfaces which are to be permanently exposed, the concrete surfaces shall be cleaned. When wooden forms are left in place during curing, they shall be kept wet at all times. Horizontal surfaces shall be cured by ponding, by covering with a 2-inch minimum thickness of continuously saturated sand, or by covering with waterproof paper, polyethylene sheet, polyethylene-coated burlap or saturated burlap.

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

SECTION 05 05 19
POST INSTALLED CONCRETE ANCHORS

PART 1 GENERAL

1.01 DESCRIPTION

A. This section covers concrete post-installed concrete anchors, including adhesive anchors and expansion (wedge) anchors.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 05 50 00 - Miscellaneous Metals

1.03 REFERENCES.

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. Publications shall be the most current edition.

B. American Concrete Institute (ACI)

1. ACI 355.2, Qualification of Post-Installed Mechanical Anchors in Concrete

2. ACI 355.4, Qualification of Post-Installed Adhesive Anchors in Concrete

C. American Society for Testing and Materials (ASTM)

1. ASTM A193/A193M, Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service

2. ASTM F593, Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs

3. ASTM F594, Specification for Stainless Steel Nuts

D. International Code Council Evaluation Service (ICC-ES)

1. AC193, Acceptance Criteria for Mechanical Anchors in Concrete Elements

2. AC308, Acceptance Criteria for Post Installed Adhesive Anchors in Concrete Elements

1.04 SUBMITTALS

A. Submit the following:

1. Shop drawings showing details of installation.

2. Product data including descriptive literature, load capacity charts/calculations, and installation instructions.

3. Current ICC Evaluation Service Reports for each type of post-installed anchor to be used.

4. Installer certification for horizontal or upwardly inclined adhesive anchors.

B. Anchor bolts shall be submitted and approved by the Engineer for each specific application and from supplier of equipment to be anchored, if applicable.

1.05 QUALITY ASSURANCE

A. Installers of adhesive anchors or adhesive dowels horizontally or upwardly inclined to support sustained tension loads shall be certified by an applicable certification program. Certification shall include written and performance tests in accordance with the ACI/CRSI Adhesive Installer Certification Program, or equivalent.

PART 2 PRODUCTS

2.01 GENERAL:

A. All materials for post-installed concrete anchors shall be type 316 stainless steel.

B. Post-installed anchor systems used in concrete shall be approved by ICC Evaluation Services Report (ESR) or equivalent for use in cracked concrete and for short and long-term loads including wind and earthquake.

C. Mechanical anchors shall comply with the requirements of ICC-ES AC193 or ACI 355.2.

D. Adhesive anchors shall comply with the requirements of ICC-ES AC308 or ACI 355.4.

E. Concrete anchors shall have the minimum embedment lengths as recommended by the manufacturer, or as shown on the Drawings, whichever is greater.

2.02 ADHESIVE ANCHORS:

A. Threaded rod shall be ASTM F593, Type 316 stainless steel. Nuts shall be F594 Heavy Hex Nuts, Type 316 stainless steel.

B. Threaded rod shall be of the diameter shown on the drawings, length as required to provide minimum embedment depth indicated. Threaded rod shall be clean and free of grease, oil, or other deleterious material.

C. Adhesive shall be two-component, insensitive to moisture, designed to be used in adverse freeze/thaw environments, and compatible for intended use and anticipated environmental conditions.

D. Products:

1. Hilti, Inc.; HIT Doweling Anchor System, or HIT-HY 200.

2. Simpson Strong-Tie Co.; SET-XP Epoxy Adhesive Anchors Adhesive Anchors.

2.03 EXPANSION ANCHORS (WEDGE ANCHORS):

A. Products:

1. Hilti, Inc; Kwik-Bolt TZ Anchors SS 316.

2. Simpson Strong Tie Co.; Strong-Bolt 2, Type 316 stainless steel.

3. Other manufacturers upon approval of Engineer.

PART 3 EXECUTION

3.01 GENERAL

A. Anchor bolts to be used with new concrete shall be cast-in-place anchors concrete, unless post-installed anchors are specified or shown on the Drawings.

B. Anchor bolts to be used with existing concrete shall be adhesive anchors, unless expansion anchors are shown on the Drawings.

C. Anchor bolts shall be installed per the Manufacturer's written instructions.

D. Anchor bolts shall be clean and free of dirt and oil prior to placement. They shall be properly located and secured in place prior to pouring concrete. Wedge anchors or drop in anchors shall only be set in concrete which has reached its design strength. Ensure that anchors are set no closer than six times the anchor diameter to another anchor or the edge of the concrete structure.

E. Provide minimum embedment, edge distance, and spacing as indicated on the Drawings and recommended by the Manufacturer.'

F. Use only drill type and bit type and diameter recommended by anchor manufacturer.

G. Clean hole of debris and dust per manufacturer's requirements.

H. Use anti-seizing lubricant on all stainless-steel bolt threads.

3.02 REINFORCING STEEL CONFLICTS WITH POST-INSTALLED ANCHORS

A. Locate existing concrete reinforcing with ground penetrating radar or other non-destructive method approved by Engineer prior to drilling. Coordinate with Engineer to adjust anchor location where installation would result in hitting reinforcing.

B. When unidentified reinforcing steel is encountered in the drill path, slant drill to clear obstruction. Slant shall not exceed 10 degrees or per the manufacturer's installation instructions, whichever is less. If slanting the drill does not resolve the conflict, coordinate with Engineer for direction on how to proceed.

3.03 ADHESIVE ANCHORS

A. Anchor diameter and material shall be per Contract Documents or equipment manufacturer's specifications. Anchor shall be threaded or deformed the full length of embedment and shall be free of rust, scale, grease, and oils.

B. Embedment depth shall be as specified or as required by the equipment manufacturer.

C. Follow the anchor system manufacturer's installation instructions.

D. Holes shall be blown clean with oil-free compressed air and be free of dust or standing water prior to installation. Follow additional requirements of the adhesive manufacturer.

E. Concrete and air temperature shall be compatible with curing requirements of adhesives per adhesive manufacturer's instructions.

F. Anchors shall be left undisturbed and unloaded for full adhesive curing period, which is based on temperature of the concrete.

G. Do not install prior to concrete attaining an age of 21 days.

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

SECTION 05 50 00
MISCELLANEOUS METALS

PART 1 GENERAL

1.01 DESCRIPTION

A. This section covers the structural steel and miscellaneous metals for the project.

B. Furnish, install and erect all items of miscellaneous metals as required to satisfy the entire job as specified herein and as shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 09 90 00 – Protective Coatings

B. Section 09 90 10 - Galvanizing

1.03 SUBMITTALS

A. Submit shop drawings showing details of installation, methods of fabrication, metal type, sizes, and finish.

1.04 QUALITY ASSURANCE

A. Perform welding for steel in accordance with the specifications of the American Welding Society "Code for Arc and Gas Welding in Building Construction", by accomplished welders certified in accordance with "AWS Specifications for Standard Qualification Procedure". All welding operators are subject to examination for prequalification at any time during the progress of the work.

PART 2 PRODUCTS

2.01 METAL FASTENING

A. Bolts. Use ASTM A 307 steel bolts, galvanized. Where specified or as called for on the Drawings use stainless steel ASTM A320, Type 316.

B. Bolt and Nut Dimensions. Per ANSI Standard B18.2.2.

C. Washer Dimensions. ANSI Standard B27.2.

D. Fully threaded galvanized rod. ASTM F1554, GR. 36.

E. Blind Bolts for Hollow Structural Section connections shall be Lindapter “Hollo-Bolt” or approved equivalent.

F. Expansion Bolts. Expansion bolts shall be of the standard hex head type, constructed entirely of stainless steel, and shall utilize a 3-part assembly.

G. Steel Pipe. Steel pipe shall be ASTM A 53.

H. Thimbles. Stainless steel, eye and eye, extra heavy wire rope thimble.

2.02 STRUCTURAL METAL

A. Structural Steel Shape and Plates. ASTM A36 Structural Grade.

B. Aluminum Structural Shapes and Plates. Alloy 6061 - T6.

C. Stainless Steel Bars and Shape. ASTM A276, Type 316.

D. Hollow Structural Sections (HSS). ASTM A500, Grade C.

2.03 CABLE TRENCH FRAME AND COVER

A. Electrical cable trench frames and covers for power and control cables from the disconnect to the wet well shall be a pre-engineered, manufactured system that conforms to the design loading requirements of AASHTO H-20 and HS-20. The system shall include a method of forming a round bottom channel pre-sloped to a minimum of 0.5%. The frame shall be factory powder coated and have anchors at 45 degrees into surrounding concrete, with intersection kits available for 45 degree and 90 degree angles. A solid cast iron cover shall be supplied with a locking device which directly connects the cover to the frame.

B. Trench frame and cover system shall be EconoDrain as manufactured by MultiDrain System or approved equivalent.

PART 3 EXECUTION

3.01 GENERAL

A. Fabricate all items neatly and rigidly in accordance with details in first-class finished, workmanlike manner. Form curved work neatly to radii indicated. Provide members of sizes indicated and weld, bolt, or rivet securely together. Furnish bolts, nuts, washers and other fastening devices required for anchoring and securing work. Where bolted connections are shown on the plans, provide bolts of adequate length to make the connection with a nut and washer where required.

3.02 WORKMANSHIP

A. Fabrication and workmanship shall be in accordance with AISC Specifications for Fabrication and Erection. Form work true to detail, with clean, straight, sharply defined profiles. Unless otherwise shown or specified, finish exposed welds flush and smooth.

B. Weld all joints, unless other fastening methods are shown, specified or specifically approved. Close fit exposed joints; make joints where least conspicuous.

C. Perform cutting, drilling, punching required for accurate fitting and assembly of work. In addition, perform similar operations as required for attachment of work of other trades, provided that directions for such work are supplied prior to shop drawings approval.

D. Furnish miscellaneous metal items complete with framing, supports, hangers, bracing, anchors and other devices shown, specified or necessary for reinforcement and proper, secure setting or attachment to building construction.

3.03 INSTALLATION

A. Metalwork shall be installed as shown or as directed. Metalwork which is bent, broken or otherwise damaged shall be repaired or replaced by the Contractor to the satisfaction of the Engineer.

B. Metalwork to be embedded in concrete shall be placed accurately and held in correct position while the concrete is placed or, if shown or accepted, recesses or blockouts shall be formed in the concrete and the metalwork shall be grouted in place. The surfaces of metalwork in contact with or embedded in concrete shall be thoroughly cleaned of all rust, dirt, grease, loose scale, grout, mortar and other foreign matter. If accepted, recesses may be neatly cored in the concrete after it has attained its design strength and the metalwork grouted in place. Aluminum materials embedded in concrete or attached directly to concrete shall be coated with 20 m of bitumastic paint

C. Assemble and install work with adequate provisions to prevent objectionable distortion and overstressing from expansion-contraction. Where necessary, provide properly designed expansion joints; construct to be weather-tight if to be exposed to the weather.

D. After installation of miscellaneous metal items, touch up field bolts, field welds, uncoated connections and abrasions to shop protective coatings. In case of galvanized items, touch up with Galvo-Weld or accepted equal. Clean items of mud, dirt and other objectionable foreign matter.

E. Expansion bolts shall be installed per the manufacturer’s written instructions.

3.04 WELDING

A. Use electric shielded arc process in accordance with Weld Specifications of American Welding Society. Use only welding operators properly trained and highly skilled in arc welding. Grind smooth surface welds exposed to view.

3.05 GALVANIZING

A. Galvanizing shall be as specified in Section 09 90 10.

3.06 PROTECTIVE COATINGS

A. Coatings shall be as specified in Section 09 90 00.

3.07 FIELD TOUCH UP

A. After installation of miscellaneous metal items, touch up field bolts, field welds, uncoated connections and abrasions shop protective coatings. In case of galvanized items, touch up with zinc enriched galvanizing repair paint according to ASTM A 780. Clean items of mud, dirt and other objectionable foreign matter.

3.08 CONCRETE ANCHORS

A. Anchor bolts shall be clean and free of dirt and oil prior to placement. They shall be properly located and secured in place prior to pouring concrete. Wedge anchors or drop-in anchors shall only be set in concrete which has reached its design strength. Ensure that anchors are set no closer than six times the anchor diameter to another anchor or the edge of the concrete structure.

3.09 WIRE ROPE THIMBLES

A. Provide machined collars to attach thimbles to wire rope.

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

SECTION 08 31 13
ACCESS DOORS AND FRAMES

PART 1 GENERAL

1.01 DESCRIPTION

A. Furnish and install the metal hatches as shown on the Drawings.

PART 2 MATERIALS

2.01 ACCESS DOORS AND FRAMES

A. Access Doors

1. Door leaf configuration shall be as shown on the Drawings. Compression springs shall be included to make opening the access door easy, smooth and controlled through both opening and closing. Door leaf shall be designed to automatically lock into place when opened in the vertical position.

2. Doors for exterior hatches shall be designed to support an H-20 wheel load with a maximum deflection of 1/150th of the span.

3. Doors for interior hatches shall be designed to support 300 pounds per square foot pedestrian loads.

4. Access Door Leaf(s): 1/4-inch aluminum diamond pattern plate. Provide stainless steel safety chain and attachments for end of double-leaf door assembly when open.

5. Door Hardware:

a. Hinges: Heavy-duty stainless steel with stainless steel pins through-bolted to cover plate with tamper-proof stainless steel bolts flush with top of cover and to outside leg of channel frame with stainless steel bolts and locknuts.

b. Lifting Mechanism: Stainless steel compression lift springs enclosed in telescoping vertical housing or stainless steel torsion lift springs.

c. Hold-Open Arm: Stainless steel, locks automatically when in open position and disengages with slight pull on vinyl grip with a single hand. Door can be easily closed with one hand by pulling forward and down on vinyl grip.

6. Slam Lock: Stainless steel slam lock mounted on bottom of door leaf with removable topside key wrench and inside fixed lever handle. Threaded plug for flush outside surface with key wrench removed.

B. Safety Grating:

1. Provide OSHA compliant fall protection safety grating unless otherwise noted on the Drawings.

2. The safety grate openings shall allow for visual inspection and limited instrumentation adjustments while the safety grate fall protection is in place. Design must ensure that the fall through protection is in place before the doors can be closed.

3. The grate shall be able to operate independently of the access door and hinge in a direction noted on the plans. If a direction is not shown, the safety grates shall hinge on the short sides of the hatch opening.

4. Epoxy or powder coated aluminum grating, OSHA type safety yellow or orange color.

5. Stainless steel hold-open device to securely lock the grate in the open position.

C. Frame

1. Vault hatches shall be provided with drainable channel frames that drain downwards into the vault, and shall have an integrated fitting for drain piping.

2. Wetwell hatches shall be provided with angle frames.

D. Manufacturers: Nystrom Products Co., Halliday Products, LW Products, USF Fabrications, or approved equal.

PART 3 EXECUTION

3.01 GENERAL

A. Hatches shall be installed in strict accordance with the manufacturer's recommendations and according to the details on the Drawings.

B. Plumb channel frame hatches as shown on the Drawings.

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

SECTION 09 90 00
PROTECTIVE COATINGS

PART 1 GENERAL

1.01 SUMMARY

A. This section covers the protective paint coatings for exterior steel, mechanical, electrical, and concrete items. Paint all ferrous metal surfaces that are not galvanized including piping, valves, operators, electrical controls structure, miscellaneous structural metals, yard hydrants, hangers and supports. Coat concrete walls and base/invert for each wetwell with Raven 405 epoxy lining, or equal.

1.02 REFERENCES

A. Applicable Standards:

1. American Society for Testing and Materials (ASTM):

a. D522: Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings

b. D638: Standard Test Method for Tensile Properties of Plastics

c. D695: Standard Test Method for Compressive Properties of Rigid Plastics

d. D792: Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement

e. D2240: Standard Test Method for Rubber Property – Durometer Hardness

f. D3359: Standard Test Methods for Rating Adhesion by Tape Test

g. D 3363: Standard Test Method for Film Hardness by Pencil Test

h. D4414: Standard Practice for Measurement of Wet Film Thickness by Notch Gages

i. D4541: Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers

1.03 QUALITY ASSURANCE

A. All materials delivered to the job site shall be in original sealed and labeled containers of the paint manufacturer.

B. Do not paint when ambient temperature is below 55 degrees F or during periods of high humidity.

C. Provide adequate ventilation and heating.

D. Apply not less than the number of coats or minimum dry film thickness (DFT) specified.

E. All paint shall be applied according to manufacturer's instructions and surface preparation recommendations.

F. The manufacturer of the specified product shall be ISO 9001 certified and have in existence a recognized ongoing quality assurance program independently audited on a regular basis.

G. Contractor shall be qualified in the field of concrete and metal coatings and protection with a successful track record of applications of similar products on similar projects. Contractor shall provide a list of a minimum of three (3) different projects completed in the last five (5) years with similar scope of work. Include name and address of project, size of project, and contact person.

H. Contractor shall maintain qualified personnel who have received product training by a manufacturer's representative.

1.04 SUBMITTALS

A. Submit paint material catalog cuts for each system for favorable review.

B. Obtain colors from Owner and submit color samples for favorable review.

C. Certification of applicator by materials manufacturer.

D. Certification of Warranty.

1.05 HEALTH AND SAFETY

A. Be advised that harmful or fatal materials are specified if contact or ingestion occurs.

B. Take appropriate action to comply with local, state, and federal regulatory and other applicable agencies with regard to environment, health, and safety.

1.06 WARRANTY

A. Manufacturer shall warranty its products as free from material defects for a minimum period of three (3) years, beginning with date of substantial completion of project. Provide associated Warranty Certificate.

B. Applicator shall warranty the installed protective coatings as free from workmanship defects for a minimum period of three (3) years, beginning with date of substantial completion of project. Provide associated Warranty Certificate.

PART 2 PRODUCTS

2.01 GENERAL

A. Coatings shall meet the Government V.O.C. Levels as mandated in the 1992 enforcement of the Clean Air Act by the U.S. Government.

2.02 MANUFACTURER

A. Tnemec, Sherwin Williams, and Raven Lining Systems have been used as the basis of design. The words "or equal" apply wherever listed.

B. Alternate Products:

1. Coating of same generic type by other manufacturer's such as Sherwin Williams, Carboline, or engineer approved equal. Coating thickness and number of coats comparable to guide product.

2. Manufacturer shall have a minimum of ten (10) years' experience in manufacturing of, and providing technical service for, chemical resistant systems equivalent to those specified.

3. Document application, serviceability, performance, physical properties, and composition equivalent to guide product.

4. Provide materials for each system that are compatible with one another and substrates indicated, under conditions of service and application of and application as demonstrated by manufacturer, based on testing and field experience

C. Single Source Responsibility:

1. Materials shall be products of a single manufacturer.

2. Provide secondary materials which are produced or are specifically recommended by coating system manufacturer to ensure compatibility of system.

2.03 COLOR REQUIREMENTS

A. All equipment shall be painted with the color as approved by the Owner. All non-submerged portions of equipment shall be painted the same color as the process piping it serves, except as follows: dangerous parts of equipment and machinery shall be OSHA Orange, fire protection equipment and apparatus shall be OSHA Red, and physical hazards in normal operating areas shall be OSHA Yellow.

B. Each coat of paint shall be darker than the preceding coat such that the finish coat is the darkest coat.

C. Colors shall be selected from “deep” pigments.

D. Colors shall be formulated with colorants free of lead and lead compounds.

PART 3 EXECUTION

3.01 SURFACE PREPARATION

A. General:

1. Surfaces shall be clean and free of oil, grease, loose material, dirt, waxes, form release, curing compounds, efflorescence, sealers, salts, or other contaminants.

2. Surfaces shall be prepared in strict conformance with the coating manufacturer’s printed instructions.

B. Metal Surface Preparation:

1. Ductile iron and non-galvanized steel: Power tool or hand tool per SSPC-SP-3 or SSPC-SP-2. Remove sharp edges and weld spatter. Ductile Iron pipe shall be surface prepared using NAPF 500-03 producing an anchor profile of between 2-3 mils.

2. Galvanized steel: Clean and prepare galvanized surfaces prior to powder coating according to ASTM 6386. Galvanized steel shall be smoothed and cleaned per ASTM 6386 Section 5 and prepared according to ASTM 6386 Section 5.4.1.

C. Concrete Surface Preparation:

1. The applicator shall inspect all surfaces specified to receive a protective coating prior to surface preparation. All concrete or mortar that is not sound or has been damaged by chemical exposure shall be removed to a sound concrete surface or replaced. Applicator shall notify Owner of any noticeable disparity in the surfaces which may interfere with the proper preparation or application of the repair mortar and protective coating.

2. Surface preparation method(s) shall be based upon the conditions of the substrate, service environment and the manufacturer’s recommendations and requirements of the epoxy protective coating to be applied. At a minimum, surfaces to receive protective coating shall be cleaned and abraded to produce a sound surface with adequate profile and porosity to provide a strong bond between the protective coating and substrate. Surface preparations may include:

a. Low pressure water cleaning using equipment capable of 5,000 psi at 4 gpm.

b. Other methods such as high pressure water jetting (refer to NACE Standard No. 5/SSPS SP12), abrasive blasting, shotblasting, grinding, or scarifying may also be used.

c. Detergent water cleaning and hot water blasting may be necessary to remove oils, grease, or other hydrocarbon residues from the concrete.

3. Where required by these specifications, additional structural grout shall be applied to the concrete surfaces to rebuild the wall thickness to original condition. Grout shall be as recommended by the epoxy lining manufacturer and installed according to the manufacturer's recommendations. The area between the manhole/access port and the manhole/access port ring and the areas between the riser and grade rings, and any other area that might exhibit movement or cracking due to expansion and contraction, shall be grouted with a flexible or elastomeric grout or gel.

4. Test prepared surfaces after cleaning but prior to application of the epoxy coating to determine if a specific pH or moisture content of the concrete is in accordance to the manufacturer's recommendations.

5. All surfaces must be inspected by the Engineer or their representative during and after preparation and before the repair material is applied.

3.02 APPLICATION

A. General:

1. Coatings shall be applied per coating manufacturer's printed instructions.

2. Conditions:

a. No coating or paint shall be applied when the surrounding air temperature or the temperature of the surface to be coated or painted is below 40 degrees F (4.4 degrees C) or less than 5 degrees F (2.78 degrees C) above the dewpoint within eight hours after application of coating or paint. Dewpoint shall be measured by use of an instrument such as a Sling Psychrometer in conjunction with U.S. Department of Commerce Weather Bureau Psychrometric Tables. Maximum substrate temperature shall not exceed 110°F.

b. No coating shall be applied when the ambient temperature is below 55 degrees F.

B. Concrete Coatings:

1. To prevent pinhole formation, concrete coatings shall be placed only during the period of day when ambient temperatures are decreasing.

3.03 CORRECTIONS AND CLEANUP

A. Patching. Perform required patching, repair and cleaning to the satisfaction of the Engineer.

B. Site Clean-up. Upon completion and prior to final acceptance, all equipment and unused materials accumulated in the painting process shall be removed from the site and any spillage, splatter, spots or other misplaced paint material shall be removed in a manner which will not damage surfaces.

C. Rust stains penetrating the paint on painted metal shall be removed by wire brushing and sanding followed by priming the bare metal and painting as specified. The Contractor shall not request final inspection of the project if rust stains are showing on any painted metal.

D. Owner-furnished paint. Not less than one quart, in unopened containers, of touch up paint shall be provided to the Owner.

3.04 COATING SYSTEM SCHEDULE

A. Items shall be coated according to the following coating schedule:

Coating System S2	
Environmental Conditions	Interior, moderately corrosive service, exposed
Material	Ductile iron piping, steel piping, steel fabrications, miscellaneous steel components, including galvanized steel
Location	Interior of drywell
Primer Coat	Epoxy Polyamidoamine Primer, Tnemec N69 Epoxoline Primer applied at 3-6 mils DFT.
Finish Coat	Epoxy Polyamidoamine Primer, Tnemec N69 Epoxoline Primer applied at 3-6 mils DFT.

Coating System C1	
Environmental Conditions	Interior, highly corrosive service, exposed and submerged
Material	Concrete and grout
Location	Interior of wetwells
Finish Coat	Raven 405 epoxy coating, ultra high solids, 80 mil minimum thickness, 100 mil average thickness.

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

SECTION 09 90 10
GALVANIZING

PART 1 GENERAL

1.01 SUMMARY

This section addresses the galvanizing of existing gravity thickener metal decking and walkway access bridge and platform structure.

1.02 REFERENCES

A. Codes and standards referred to in this Section are:

1. ASTM A 123 - Specification for Zinc-Coated (Hot-Dip Galvanized) Coatings on Iron and Steel Products

2. ASTM A 153 - Specification for Zinc Coating (Hot-Dip) On Iron and Steel Hardware

3. ASTM A 924 - Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process

4. ASTM A 385 - Practice for Providing High-Quality Zinc-Coatings (Hot-Dip)

5. ASTM A 392 - Specification for Zinc-Coated Steel Chain-Link Fence Fabric

6. ASTM A 53 - Specification for Pipe, Steel, Black and Hot-Dipped, Zinc- Coated Welded and Seamless

7. ASTM A 121 - Specification for Zinc-Coated (Galvanized) Steel Barbed Wire

8. ASTM A 143 - Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement

9. ASTM A 384 - Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanization of Steel Assemblies

10. ASTM B 6 - Specification for Zinc (Slab Zinc)

11. MIL-P-21035B - Paint High Zinc Dust Content, Galvanizing Repair

12. MIL-P-26915C - Primer Coating Zinc Dust Pigmented for Steel Surfaces

PART 2 PRODUCTS

2.01 MATERIALS

A. Standard: Meet the requirements of ASTM B 6 and "Prime Western" grade, or equal, for zinc for galvanizing, zinc coating or plating.

PART 3 EXECUTION

3.01 PREPARATION

A. Base Metal Cleaning: Thoroughly clean base metal. Remove surface contaminants and coatings which would not be removable by the normal chemical cleaning process in the galvanizing operation, by blast cleaning, by immersion in a caustic bath, acid pickle and flux or other approved method.

3.02 APPLICATION

A. Hot Dip: Use the hot-dip process for galvanizing as required by the appropriate ASTM and American Hot-Dip Galvanizers Association, Inc. specifications.

1. Do not allow the dipping to come in contact with or rest upon the dross during the operation.

2. Do not use procedures tending to agitate the dross.

3. Plug existing fastener openings as required to enable in-kind fastener replacements with new fasteners.

B. Required Facilities: Perform the galvanizing and coating in a plant having the required facilities to produce the quality of coatings specified and with ample capacity for the volume of work required. Handle and ship galvanized material in a manner which will avoid damage to the zinc coating.

C. Requirements: Perform galvanizing in accordance with ASTM A 123.

3.03 REMOVAL AND RE-INSTALLATION

A. Structural members and decking to be removed and recoated shall be protected from damage.

B. Field Coating for Touch-Up: Coat all field welds, abraded areas where damage is more than 3/16-inch wide or uncoated cut edges in material more than 1/10-inch thick with an organic zinc-rich paint complying with MIL-P-21035B or MIL-P-26915C in multiple coats to dry film thickness of 8 mils.

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

SECTION 23 05 53
IDENTIFICATION FOR HVAC EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

1.02 SUBMITTALS

A. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.01 NAMEPLATES

A. Manufacturers:

1. Advanced Graphic Engraving, LLC.
2. Brimar Industries, Inc.
3. Craftmark Pipe Markers.
4. Kolbi Pipe Marker Co.
5. Seton Identification Products, a Tricor Direct Company.

B. Letter Color: White.

C. Letter Height: 1/4 inch.

D. Background Color: Black.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

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

SECTION 23 84 10
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Measurement of final operating condition of HVAC systems.

1.02 RELATED WORK

A. Section 01 33 00 – Submittals Procedure

B. Division 26 - Electrical

1.03 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.

B. ASHRAE Std 110 - Methods of Testing Performance of Laboratory Fume Hoods; 2016, with Errata.

C. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008, with Errata (2019).

D. NEBB (TAB) - Procedural Standard for Testing, Adjusting and Balancing of Environmental Systems; 2019, with Errata (2022).

E. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2002.

1.04 SUBMITTALS

A. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.

B. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:

B. AABC (NSTSB), AABC National Standards for Total System Balance.

C. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.

D. SMACNA (TAB).

E. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

F. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

G. TAB Agency Qualifications:

1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.

2. Having minimum of three years documented experience.

3. Certified by one of the following:

4. AABC, Associated Air Balance Council: www.aabc.com; upon completion submit AABC National Performance Guaranty.

5. NEBB, National Environmental Balancing Bureau: www.nebb.org

6. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute

H. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:

1. Systems are started and operating in a safe and normal condition.

2. Temperature control systems are installed complete and operable.

3. Proper thermal overload protection is in place for electrical equipment.

4. Fans are rotating correctly.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations.

3.04 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

A. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

B. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

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

SECTION 23 34 23
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Upblast roof exhausters.

1.02 RELATED REQUIREMENTS

A. Section 01 33 00 – Submittals Procedure

B. Division 26 - Electrical

1.03 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.

B. AMCA 99 - Standards Handbook; 2016.

C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2020.

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016.

E. AMCA 211 - Certified Ratings Program Product Rating Manual for Fan Air Performance; 2022.

F. AMCA 260 - Laboratory Methods of Testing Induced Flow Fans for Rating; 2020.

G. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.

H. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2014.

I. AMCA 311 - Certified Ratings Program Product Rating Manual for Fan Sound Performance; 2016.

J. NEMA MG 1 - Motors and Generators; 2017.

K. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.

L. UL 705 - Power Ventilators; Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

B. Manufacturer's Instructions: Indicate installation instructions.

C. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 ROOF EXHAUSTERS

A. Manufacturers:

1. Loren Cook Company
2. Greenheck Fan Corporation
3. Twin City Fan & Blower

B. Direct Drive Fan:

1. Fan Wheel:
   a. Type: Non-overloading, backward inclined centrifugal.
2. Statically and dynamically balanced.
3. Housing:
   a. Rigid internal support structure.
   b. One-piece fabricated or fully welded curb-cap base to windband for leak proof construction.
   c. Provide breather tube for fresh air motor cooling and wiring.

4. Shafts and Bearings:

5. Fan Shaft:

   a. Ground and polished steel with anti-corrosive coating.

   b. First critical speed at least 25 percent over maximum cataloged operating speed.

6. Bearings:

   a. Permanently sealed or pillow block type.

   b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.

   c. 100 percent factory tested.

7. Drive Assembly:

   a. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower.

   b. Belts: Static free and oil resistant.

   c. Fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.

   d. Motor pulley adjustable for final system balancing.

   e. Readily accessible for maintenance.

8. Disconnect Switches:

   a. Factory mounted and wired.

   b. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

   c. Finish for Painted Steel Enclosures: Provide manufacturer's standard, factory applied gray.

   d. Positive electrical shutoff.

   e. Wired from fan motor to junction box installed within motor compartment.

9. Drain Trough: Allows for single-point drainage of water, grease, and other residues.

PART 3EXECUTION

3.01 Installation

1. Install in accordance with manufacturer's instructions.

2. Extend ducts to roof exhausters into roof curb.

3. Counter flash duct to roof opening.

4. Secure roof exhausters with cadmium-plated steel lag screws to the roofing curb.

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

SECTION 23 05 53
IDENTIFICATION FOR HVAC EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates

1.02 SUBMITTALS

A. Product Data: Provide manufacturers catalog literature for each product required.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

PART 2 PRODUCTS

2.01 NAMEPLATES

A. Manufacturers:

1. Advanced Graphic Engraving, LLC: www.advancedgraphicengraving.com.

2. Brimar Industries, Inc: www.pipemarker.com.

3. Craftmark Pipe Markers: www.craftmarkid.com.

4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com.

B. Letter Color: White.

C. Letter Height: 1/4 inch.

D. Background Color: Black.

E. Plastic: Comply with ASTM D709.

PART 3EXECUTION

3.01 PREPARATION

1. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

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

SECTION 26 05 00
GENERAL REQUIREMENTS FOR ELECTRICAL WORK

PART 1 GENERAL

1.1 SUMMARY

A. This Section specifies general requirements applicable to all electrical work to be completed at the facility. This may include such things as underground conduit, surface conduit, motors, control components and similar.

B. Section includes:

1. Scope.
2. Definitions.
3. Reference Standards.
4. Quality Assurance.
5. Submittals.
6. Drawings.
7. Project Site Conditions.
8. Equipment Coordination.
9. Basis of Design.
10. Products.
11. Execution – General.
12. Testing.

1.2 SCOPE

A. This section specifies general requirements for electrical work. Detailed requirements for specific electrical items are specified in other sections but are subject to the general requirements of this section.

B. Related Sections:

1. The Contract Documents are complementary; what is called for by one is as binding as if called for by all.

2. It is the Contractor's responsibility for scheduling and coordinating the Work of subcontractors, suppliers, and other individuals or entities performing or furnishing any of Contractor's Work.

C. Interfaces to Equipment, Instruments, and Other Components:

1. The Drawings, Specifications, and overall design are based on preliminary information furnished by various equipment manufacturers, which identify a minimum scope of supply from the manufacturers. This

information pertains to, but is not limited to, instruments, control devices, electrical equipment, packaged mechanical systems, and control equipment provided with mechanical systems.

2. Provide all material and labor needed to install the actual equipment furnished. Include additional conduit, wiring, terminals, or other electrical hardware to the work, which may be necessary to make a complete functional installation, based on the actual equipment furnished:

    a. Make all changes necessary to meet the manufacturer's wiring requirements.

3. Submit all such changes and additions to the Engineer for acceptance in accordance with the General Conditions.

4. Review the complete set of Drawings and Specifications in order to ensure that all items related to the electrical power and control systems are completely accounted for. Include items that appear on Drawings or in Specifications from another discipline in the scope of Work:

    a. If a conflict between Drawings and Specifications is discovered, refer conflict to the Engineer as soon as possible for resolution.

D. All electrical equipment and systems for the entire project shall comply with the requirements of Division 26, whether referenced in the individual equipment specifications or not:

1. The requirements of Division 26 apply to all electrical work specified in other Divisions and Sections, including HVAC controls, packaged mechanical systems, Local Control Panels (LCPs), Vendor Control Panels (VCPs), Instruments Junction Boxes (IJBs), Power Junction Boxes (PJBs) and enclosures.

2. The Owner is not responsible for any additional costs due to the failure of the Contractor to notify all Subcontractors and suppliers of the Division 26 requirements.

E. Contract Documents:

1. General:

    a. The Drawings and Specifications are complementary and are to be used together to fully describe the Work.

2. Contract Drawings:

a. The electrical Drawings show in a diagrammatic manner, the desired locations, and arrangements of the components of the electrical work. Follow the Drawings as closely as possible. Use professional judgment and coordinate with the other trades to secure the best possible installation. Use the entire Drawing set for construction purposes.

b. Locations of equipment, control devices, instruments, boxes, and panels are approximate only, exercise professional judgment in executing the Work to ensure the best possible installation:

1) The equipment locations and dimensions shown on plans and elevations are approximate. Use the Shop Drawings to determine the proper layout, foundation, and pad requirements for final installation. Coordinate with all Subcontractors to ensure that all electrical equipment is compatible with other equipment and space requirements. Make changes required to accommodate differences in equipment dimensions.

2) The Contractor has the freedom to select any of the named manufacturers, as identified in the individual specification sections. The Engineer has designed the spatial equipment layout based upon a single manufacturer and has not confirmed that every named manufacturer's equipment fits in the allotted space. It is the Contractor's responsibility to ensure that the equipment being furnished fits within the defined space.

c. Installation Details:

1) The Contract Drawings include typical installation details, which show the means and methods the Contractor is to use to install electrical equipment. For cases where a typical detail does not apply, develop installation details that may be necessary for completing the Work, and submit these details for review by the Engineer.

F. Permits, Fees and Service Charges:

1. Coordinate and obtain inspections and final installation approval from serving authorities having jurisdiction.

2. Contractor shall be responsible for obtaining all electrical permits and fees associated with the electrical system as required, unless specifically excluded or listed as paid by the Owner.

1.3 DEFINITIONS

A. WIRING, ELEMENTARY OR SCHEMATIC DIAGRAM: A schematic (elementary) diagram shows, by means of graphic symbols, the electrical connections and functions of a specific circuit arrangement. The schematic diagram facilitates tracing the circuit and its functions without regard to the actual physical size, shape, or location of the component devices or parts.

B. ONE-LINE DIAGRAM: A one-line diagram shows by means of single lines and graphical symbols the course of an electrical circuit or system of circuits and the components, devices or parts used therein. Physical relationships are usually disregarded.

C. BLOCK DIAGRAM: A block diagram is a diagram of a system, instrument, computer, or program in which selected portions are represented by annotated boxes and interconnecting lines.

D. CONNECTION DIAGRAM: A connection diagram includes all of the devices in a system and shows their physical relationship to each other including terminals and interconnecting wiring in an assembly. This diagram shall be (a) in a form showing interconnecting wiring only by terminal designation (wireless diagram), or (b) a panel layout diagram showing the physical location of devices plus the elementary diagram.

E. INTERCONNECTION DIAGRAM:

1. Interconnection diagrams shall show all external connections between terminals of equipment and outside points, such as motors and auxiliary devices. References shall be shown to all connection diagrams which interface to the interconnection diagrams. Interconnection diagrams shall be of the continuous line type. Bundled wires shall be shown as a single line with the direction of entry/exit of the individual wires clearly shown. Wireless diagrams and wire lists are not acceptable.

2. Each wire identification as actually installed shall be shown. The wire identification for each end of the same wire shall be identical. All devices and equipment shall be identified. Terminal blocks shall be shown as actually installed and identified in the equipment complete with individual terminal identification.

3. All jumpers, shielding and grounding termination details not shown on the equipment connection diagrams shall be shown on the interconnection diagrams. Wires or jumpers shown on the equipment connection diagrams shall not be shown again on the interconnection diagram. Signal and DC circuit polarities and wire pairs shall be shown. Spare wires and cables shall be shown.

F. ARRANGEMENT, LAYOUT, and/or OUTLINE DRAWINGS: An arrangement, layout, and or outline drawing is one which shows the physical space and mounting requirements of a piece of equipment. It may also indicate ventilation requirements and space provided for connections or the location to which connections are to be made.

1.4 REFERENCE STANDARDS

A. This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or other- wise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
NECA-1	National Electrical Contractors Association – Standard Practices for Good Workmanship in Electrical Contracting
NFPA-70 NFPA-70E	National Electrical Code (NEC) Electrical Safety in the Workplace
NEMA	National Electrical Manufacturers Association
IEEE	Institute of Electrical and Electronic Engineers
IES	Illuminating Engineering Society
IBC	International Building Code
WAC	Washington Administrative Code

1.5 QUALITY ASSURANCE

A. IDENTIFICATION OF LISTED PRODUCTS:

1. Electrical equipment and materials shall be listed for the purpose for which they are to be used, by an independent testing laboratory. Three such organizations are Underwriters Laboratories (UL), Factory Mutual (FM), and Electrical Testing Laboratories (ETL). Independent testing laboratory shall be acceptable to the inspection authority having jurisdiction.

2. When a product is not available with a testing laboratory listing for the purpose for which it is to serve, the product may be required by the inspection authority, to undergo inspection at the manufacturer's place of assembly. All costs and expenses incurred for such inspections shall be included in the original contract price. Contractor shall comply with Washington Administrative Code regulations concerning Listing requirements for electrical equipment.

B. SUPERVISION: The Contractor shall maintain adequate supervision of the work and shall have a responsible person in charge during all times the work in under contract and in progress, and or as necessary for coordination with other work.

C. FACTORY TESTS: Where specified in the individual product specification section, factory tests shall be performed at the place of fabrication and performed on completion of manufacture or assembly. The costs of factory tests shall be included in the contract price.

1.6 DELIVERY AND STORAGE:

A. Equipment shall be handled and stored in accordance with manufacturer’s instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

B. Store indoors in clean dry space with uniform temperature to prevent condensation and per manufacturer’s recommendations. Protect from exposure to dirt, fumes, water, corrosive substances, and physical damage.

C. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.

D. Provide equipment and personnel to handle products; use methods to prevent soiling, disfigurement, or damage

1.7 SUBMITTALS

A. PROCEDURES: Section 01 32 19

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

    a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

    b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

    a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

    b. Catalog cuts shall be edited to show only the items, model numbers, and information which apply.

    c. Submittals are to made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable. Submittals that are not submitted in the format outlined may be rejected outright and the Contractor is required to resubmit in the correct format.

4. Provide Seismic calculations for anchoring and support of equipment as required in Section 40 05 07

5. Interconnection diagram: The Contractor shall prepare interconnection diagrams depicting all cable requirements together with their actual terminations as specified.

6. Conduit layout drawings indicating size, location, and support, for all conduits other than single runs of 1-inch diameter or less cast in concrete construction.

    a. Conduit layout drawings shall illustrate a system which conforms to the requirements of the project.

    b. For changes to the layouts shown on the contract documents, provide engineering design and calculations signed and sealed by a Professional Engineer registered in State of Washington. Engineering design and calculations shall demonstrate that the proposed layout does not impair or significantly reduce the design structural strength.

7. Maintenance Data: For all equipment and for components to include in maintenance manuals specified in Division 1 General Requirements. In addition to requirements specified in Section 01 31 00 and 01 78 23, include the following:

    a. Routine maintenance requirements for equipment and components.

8. Manufacturer's written instructions for testing and adjusting.

1.8 WARRANTY

A. Provide a written warranty covering the work done under this Division as required by the General Conditions. Incandescent lamps will be excluded from this warranty.

B. Apparatus:

1. Free of defects of material and workmanship and in accord with the Contract Documents.

2. Built and installed to deliver its full rated capacity at the efficiency for which it was designed.

3. Operate at full capacity without objectionable noise or vibration.

C. Systems: Any system damage caused by failures of any system component shall be included.

1.9 PROJECT/SITE CONDITIONS

A. GENERAL: Unless otherwise specified, equipment and materials shall be sized and derated for the ambient condition of 40 degrees C at an elevation ranging from sea level to 1000 feet without exceeding the manufacturer's stated tolerances.

B. OPERATING FACIILITY: When working in an operating facility, such as a pump station or treatment plant, portions of this facility must remain fully functional throughout the entire construction period. In consideration of this requirement, comply with the following guidelines:

1. All outages must be of minimal duration and fully coordinated and agreed to by the Owner. Adjust the construction schedule to meet the requirements of the Owner. All changes in schedule and any needs to reschedule are included in the Work.

2. As weather and operational conditions dictate, re-adjust the construction schedule to meet the demands placed upon Owner by its users.

3. Coordinate the construction and power renovation, bear all costs, so that all existing facilities can continue operation throughout construction.

C. HAZARDOUS (CLASSIFIED) AREAS: All areas are designated as ‘Unclassified’ in accordance with the NEC, NFPA 820.

D. SEISMIC: Electrical equipment supports, and anchorage shall be designed and installed in accordance to local governing codes, and as specified in Section 40 05 07.

1.10 ELECTRICAL NUMBERING SYSTEMS

A. TAGGING: All circuit raceways and armored cables shall be tagged at all terminations, panels, MCCs, pull boxes, junction boxes, etc. in accordance with the assigned numbers on the circuit/raceway schedule and schematic/plan drawings. The tags shall be installed in a clean and high workmanship manner. In addition to tags at the terminations, exposed raceways and armored cables shall be tagged at each side of concealment.

1. The standards of documentation, instrument tagging, cable and conductor ferruling, terminal identification and labeling that apply to the new installation apply equally to the existing installation which forms part of the modified system.

B. PREFIX MODIFIERS: The following prefix modifiers shall be used when scheduling/tagging cables and raceway:

Raceway Prefix	Type of Function
H	Power above 600V
P	Power 120V to 600V
C	Control or power - 120V or less
S	Low level signal (less than 90-volt communication or less than 30-volt instrumentation)
D	Data
PC	Composite of power 120 to 600V and control
F	Optical Fiber
PSP, CSP	Spare power, spare control

C. RACEWAY NUMBERS: Where circuit/raceway numbers have not been assigned, Contractor shall assign raceway numbers in accordance with the system outlined in the drawings.

1.11 CONDUCTOR NUMBERS:

A. WIRE MARKERS: All control and signal conductors in panels, pull boxes, power, instrument, and relay compartments of motor control centers, control cabinets, instrument cabinets, field cabinets and control stations, as well as connections to mechanical equipment, shall be tagged at each end with legible, coded tight-fitting wire-marking sleeve showing the complete wire designation. The letters and numbers that identify each wire shall be machine printed on sleeves with permanent black ink. The figures shall be 1/8 inch high. Sleeves shall be yellow or white tubing, sized to fit the conductor insulation. The sleeves shall be shrunk to fit the conductor with hot air after installation. They shall be T&B, SHRINK-KON HVM or equal. Adhesive strips are not acceptable. Conductors size No. 10 AWG or smaller shall have identification sleeves. Conductors No. 8 AWG and larger shall use cable markers of the locking tab type. Tabs shall be white plastic with conductor identification number permanently embossed.

B. INTERNAL WIRING:

1. Wiring within a single enclosure shall be marked with the basic wire and terminal number at each end. The wire number shall designate the terminal or equipment number at each end of the wire separated by a slash.

2. Wiring within MCC buckets shall have a simple numbering scheme, and shall use the same number at each end. (1,2,3,4,5, etc.) Wiring which lands on field terminals shall utilize the terminal number for the internal wire number.

C. FIELD WIRING: All field wiring shall have wire labels at each end. The labels shall be marked with the output terminal number at the original equipment (local control panel or MCC) and the remote device terminal # (if applicable) and tag name separated by a slash. Conductors shall be identified with numbers at both ends. Conductor tag numbers shall be the conductor number specified on the control diagram or if not shown, shall follow the convention below.

1. Wires from MCC buckets shall be labeled with [MCC number (086) - bucket number(A4) - terminal number (6)] (MCC3-A4-6)

2. Wires from Local Control Panels shall be labeled with panel number (PNL2000)- terminal number (12)] (PNL2000-12)

3. Wires from PLC panels or remote I/O panels shall have Rack or Bus (1) – Card or Block (7) -Terminal number(A3) only (1-7-A3)

4. Wires from devices, instruments etc. shall have the instrument or device name and terminal number if applicable. Equipment name is typically DEVICE TYPE - NUMBER. (HS2510) (TSH2510) (FIT2562)

D. EXAMPLE for a control cable from the Area Control Panel PNL2000 bus 1, block 1, terminal A4 to the level transmitter (LIT2501) - the wire tag number at both ends shall be LIT2501 / 1-1-A4. (Do not include the panel name, just the bus, block, terminal number.)

E. EXAMPLE for a control cable from the Area Control Panel PNL2000 rack 4, card 5, terminal A4 to the MCC3, bucket D5 terminal 6 the tag number at both ends shall be MCC3-D5-6/4-5-A4

F. EXAMPLE for a control cable from the MCC3 bucket A4 terminal 12 to device HS4030, the wire tag number at both ends shall be MCC3-A4-12 / HS4030. (Do not include the system abbreviation on devices connected to an MCC bucket.)

1.12 INDICATING LAMP COLORS

A. All indicating lamps shall have an integrated lamp-test function for all lamps on a single line-up of equipment (i.e. Motor Control Center, Switchgear).

B. Unless otherwise specified, indicating lights shall be equipped with colored lenses in accordance with the following schedule:

Color	Function	Example
Green	Run, open valve	Equipment operating, motor running
Red	Stopped, Closed valve	Alarm, end of cycle, motor stopped
White or clear	Normal condition, Ready	Control power on, status OK
Amber (yellow)	Abnormal condition	Failure of equipment or status abnormal, fault condition
Green	Breaker Open	Switchgear breaker illuminated pushbutton
Red	Breaker Closed	Switchgear breaker illuminated pushbutton
Amber (yellow)	Breaker Tripped	Switchgear breaker illuminated pushbutton

1.13 EQUIPMENT COORDINATION

A. The Contractor is responsible to coordinate the equipment supplied from various manufacturers and vendors. This includes but is not limited to:

1. Obtaining specific information on equipment ratings and sizes and verifying the electrical components supplied meet, or match the requirements such as voltage, phase, frequency, starter types, etc.

2. Shall provide equipment that will fit within the space allocated and meet OSHA and NEC clearances.

3. Shall provide coordinated electrical installations with the supplied equipment's electrical power and control requirements.

4. Shall provide power and control equipment, wiring, and raceways to meet the requirements of the mechanical equipment supplied.

5. Shall provide all necessary control wiring and components for any special requirements from an equipment manufacturer.

B. The Contractor shall verify as a minimum:

1. Correct voltage, phase and frequency
2. Size and space requirements
3. Mounting requirements
4. Correct motor starter type and NEMA size
5. Proper coordination with the controls and control System Integrator

C. Any discrepancies between the electrical equipment and other equipment shall be brought to the immediate attention of the Owner.

D. The Contractor shall assure that no instrumentation or control interferences are created by the variable frequency drives (VFDs) or load wiring. The Contractor shall coordinate with the VFD manufacturer to provide necessary separation of conductors or shielding and/or filtering equipment as required by the VFD manufacturer. If interferences do occur, the Contractor shall be responsible to take corrective action at no additional cost to the Owner.

E. WIRING FOR VENDOR PACKAGES:

1. Equipment specifications indicate when the Vendor is responsible for providing interconnection wiring between components of a Vendor package that are installed on separate skids or assemblies. In this circumstance, interconnection wiring between skids or assemblies in a Vendor package is scheduled as “Vendor Wiring” in the conduit/cable schedules.

2. Where equipment specifications do not specify Vendor furnished wiring be- tween skids or assemblies in a Vendor package, the Contractor shall provide and install interconnection wiring between skids or assemblies per the Vendor’s interconnection wiring requirements. Interconnection wiring between skids or assemblies in a Vendor package that is furnished and installed by the Contractor is not scheduled in the conduit/cable schedules.

3. Determination of cable requirements.

    a. Coordinate cable/conductor requirements with the selected Vendors to determine the correct wiring required to interconnect the package system components/skids.

    b. Wiring between Vendor furnished components shipped on separate skids or assemblies shall conform to requirements specified in Division 25 and Division 26.

    c. Wiring between the plant control system and Packages system components/skids are specified in the conduit/cable schedules.

    d. Wiring between external power supplies and the packaged system components/skids are specified in the conduit/cable schedules.

4. Assign numbers and tagging for unscheduled raceway, and cable between Vendor furnished components on separate skids or assemblies as specified

in Section 26 05 00. Coordinate this information in submittals, record drawings, and O&M manuals provided under this contract.

5. Contract documents shall be updated in the record drawing set to include the work provided for wiring the vendor packages.

1.14 BASIS OF DESIGN

A. The basis of the mechanical and electrical design is the installation of equipment and motors as shown in the electrical one-line drawing(s) and load/panel schedules. In the event that different equipment motors are provided in order for the vendor's equipment to meet mechanical performance requirements, the contractor shall coordinate various suppliers, vendors, and subcontractors to change the required electrical conduit, cables, breakers, motor control center sections, starters units and accessories, etc. as necessary to meet the vendor's equipment installation requirements of the National Electrical Code. The traits and characteristics of all provided materials, equipment, and devices shall meet the specifications. These changes to materials, equipment, and devices shall be at no cost to the Owner. Electrical submittal information shall be coordinated with the equipment and motors provided.

1.15 ARC FLASH MITIGATION METHODS

A. The following mitigation method requirements shall apply to all power distribution and utilization equipment supplied for any products supplied on the project and applies to all equipment divisions in the Contract Documents. Refer to the NFPA-70 (NEC) and NFPA-70E (Electrical Safety in the Workplace) for equipment labeling requirements.

1. EQUIPMENT LABELS: Equipment labels shall be installed on the outside of the electrical equipment enclosure, cabinet, and panels to avoid opening the equipment to access the manufacture's data or the equipment ratings.

2. HINGED DOORS: Power distribution equipment shall have hinged rear doors where back access is shown.

3. POWER AND CONTROL EQUIPMENT SEPARATION:

a. Provide separation between power equipment within an enclosure, cabinet, or panel by the use of barriers, separate access doors, or by other means.

b. Provide separation barriers between main breaker feeders coming in- to equipment and other termination points or bussing on the load side of the main breaker.

PART 2 PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. GENERAL: Equipment and materials shall be new and free from defects. All material and equipment of the same or a similar type shall be of the same manufacturer throughout the work. Standard production materials shall be used wherever possible.

B. EQUIPMENT FINISH: Unless otherwise specified, electrical equipment shall be painted by the manufacturer as specified in Section 09 90 00.

C. GALVANIZING: Where specified, galvanizing shall be in accordance with Section 05 50 00 and Section 09 90 10.

2.2 WIRE MARKERS

A. Each power and control conductor shall be identified at each terminal to which it is connected. Conductors size No. 1 AWG or smaller shall have identification sleeves. Conductors No. 2 AWG and larger shall use cable markers of the locking tab type. Tabs shall be white plastic with conductor identification number permanently embossed.

B. Conductors shall be identified in accordance with Section 26 05 00. Adhesive strips are not acceptable.

C. The letters and numbers that identify each wire shall be machine printed on sleeves with permanent black ink with figures 1/8 inch high. Sleeves shall be yellow or white tubing and sized to fit the conductor insulation. Shrink the sleeves with hot air after installation to fit the conductor.

D. Conductor and Wire Marker Manufacture:

1. TMS Thermofit Marker System by Raychem Co

2. Sleeve style wire marking system by W. H. Brady Co.

3. Or approved equal

2.3 MC-HL CABLE AND RACEWAY TAGS

A. Tags shall be:

1. Manufactured of permanent metal or heavy mill plastic.

2. Fastened to the raceways at both ends of the tag with permanent fasteners.

a. Fastened to the raceways at both ends of the tag with permanent fasteners.

3. Tag numbers shall be 1-inch tall and machine printed. Hand labeled tags are unacceptable.

2.4 NAMEPLATES

A. Nameplates shall be provided on all electrical devices, including but not limited to motor control equipment, junction boxes, panels, instruments, disconnect switches, indicating lights, and all electrical equipment enclosures.

B. Nameplates shall also be provided on all electrical panel interior equipment, including but not limited to relays, circuit breakers, power supplies, terminals, contactors, and other devices.

C. Equipment nameplates shall have both the equipment name and number.

D. Nameplates shall be made of 1/16-inch-thick machine engraved laminated phenolic having black letters not less than 3/16" high on white background or as shown on the drawings or other sections of the specifications. Nameplates on the interior of panels shall be White Polyester with printed thermal transfer lettering and permanent pressure sensitive acrylic; TYTON 822 or approved equal. All nameplates shall include the equipment name and number (and function, if applicable).

E. Provide warning nameplates on all panels and equipment which contain multiple power sources. Lettering shall be white on red background.

F. Nameplates shall be secured to equipment with stainless steel screws/fasteners.

G. Nameplates for disconnect switches shall contain name and number as well as voltage, phases and colors of conductors.

2.5 TERMINAL BLOCKS

A. GENERAL:

1. Terminal Blocks for all contractor supplied equipment and devices shall be manufactured by Allen Bradley, Bussmann, Phoenix Contact, or approved equal.

2. Unless otherwise specified, terminal blocks shall be panhead strap screw type. Terminals shall be provided with integral marking strips which shall be permanently identified with the connecting wire numbers as shown on the drawings. Terminal blocks for P-circuits (power 120-600 volts) shall be

rated not less than the conductor current rating and shall not be rated less than 600 volts AC. Terminal blocks for C-circuits (control and/or control power 120 volts or less) and S-circuits (signal) shall be rated not less than 20 amperes and shall not be rated less than 600 volts AC. Terminals shall be tin-plated. Insulating material shall be nylon. Terminal blocks shall be in accordance with section 26 27 16 for all electrical equipment.

3. Provide terminals for all wire connections to field wiring and internal power distribution. Analog loops that are 24 VDC powered shall have a knife switch to disable the loop if necessary.

4. Connections shall have compression terminals capable of terminating 2 #14 AWG stranded wires. Terminals shall be DIN rail strip mounted as manufactured by Phoenix Contact, or approved equal. Provide number strips for terminal blocks that are referenced by the wire marker. Provide bridge bars for jumpers between terminal blocks. Provide end clamps to separate and terminate terminal block groups. Provide end covers for groups of terminal blocks in sets to match the number points associated with individual I/O cards in the PLC block.

5. Provide Separation Plates on each side of terminals that are at a different potential or polarity than surrounding terminals.

6. Provide clear plastic DIN rail mounted nametag stanchions for each block of terminations. Each nametag shall hold a preprinted label designating the PLC bus and PLC block that terminates to that set of terminals.

7. Terminals shall be mounted such that there is a minimum of 1.5 inches of clear space on both sides of the terminal; for ease of wiring.

8. Mount all terminals strips on 2-inch standoffs.

9. Provide 10 spare terminals or 5% whichever is the greater amount, spare (non-installed) replacement terminals for each type used.

10. Provide wired terminals to match the number of points supplied on each installed I/O card or spare slot in a PLC cabinet.

B. DIGITAL TERMINALS:

1. Terminal Blocks for use in general purpose and digital input terminations shall be Phoenix Contact UK 5, or approved equal. Provide double high terminals for general purpose.

2. Where space is limited for the required number of digital input points double high terminals are permitted if first approved by the Owner.

C. ANALOG TERMINALS:

1. Terminal Blocks for use in analog input terminations shall be knife disconnect, with socket for analog isolator Phoenix Contact URELG-PMTK, or approved equal.

2. Terminal blocks for analog outputs shall be fused, double high with a separate ground terminal.

3. The wire used for analog inputs and outputs shall be multi-conductor #18 twisted pairs with an overall shield. Provide 4 & 8 pairs to match the input or output cards. Wire pairs shall be numbered and colored red for + and black for -. Use BELDEN-M 9520 CMG or approved.

D. FUSED TERMINALS:

1. Fuse terminal blocks shall be hinged disconnect level type with "blown fuse" indicators. PHOENIX CONTACT UK 5 HESI series, or approved equal.

PART 3 EXECUTION

3.1 GENERAL

A. CONSTRUCTION

1. The work under Division 26 shall be performed in accordance with these specifications.

2. Unless otherwise detailed or dimensioned, electrical layout drawings are diagrammatic. The Contractor shall coordinate the field location of electrical material or equipment with the work of other disciplines and subcontractors. Minor changes in location of electrical material or equipment made prior to installation shall be made at no cost to the Owner.

3. The Contractor shall perform core drilling required for installation of raceways through concrete walls and floors. Locations of floor penetration, as may be required, shall be based on field conditions. Verify all exact core-drilling locations based on equipment actually furnished as well as exact field placement.

4. The Contractor shall seal all roof penetrations in accordance with approved sealing means.

B. HOUSEKEEPING:

1. Electrical equipment shall be protected from dust, water and damage. Motor control centers, switchgear, and buses shall be wiped free of dust and dirt, kept dry, and shall be vacuumed on the inside within 30 days of acceptance of the work.

2. Before final acceptance, the Contractor shall touch up any scratches on equipment as specified in Section 09 90 00.

3. Electrical equipment temporarily exposed to weather, debris, liquids, or damage during construction shall be adequately protected.

C. ELECTRICAL EQUIPMENT LABELING:

1. Electrical equipment shall have field marked signs and labeling to warn qualified persons of the potential electric arc flash hazards per NEC Article 110.16 Flash Protection.

2. Electrical equipment shall have NFPA 70E labels installed stating the results of the Arc Flash analysis specified in Section 26 05 73.

3. Electrical distribution equipment and utilization equipment shall be provided with field labels to identify the power source and the load as specified. Refer to NEC Article 110.22 for Identification of Disconnecting Means installation criteria. Specific information is required such as the equipment tag number and equipment description of both the power source and the load equipment.

D. MOTOR CONNECTIONS: Verify that the motors are purchased with the correct size motor termination boxes for the circuit content specified in the conduit and cable schedules or submit custom fabrication drawing indicating proposed motor termination box material, size, gasket, termination kit, grounding terminal, boot type insulated motor lead connection (T&B type MSC, or approved equal), and motor terminal box connection/support system. Verify the motor termination box location prior to raceway rough-in.

E. CONDUCTOR INSTALLATION: An enclosure containing disconnecting means, overcurrent devices, or electrical equipment shall not be used as a wireway or raceway for conductors not terminating within the enclosure. Provide wireways, raceways, termination boxes, or junction boxes external to the enclosure for the other conductors.

3.2 TESTING

A. GENERAL: Prior to energizing the electrical circuits, insulation resistance measurements tests shall be performed using a 1000-volt megohmmeter to verify the conductor is acceptable for use on the project. The test measurements shall

be recorded on the specified forms and provided in accordance with Section 26 08 00 and 26 05 00.

B. INSULATION RESISTANCE MEASUREMENTS:

1. GENERAL:

a. Insulation resistance measurements shall be made on conductors and energized parts of electrical equipment (600V or less). Minimum acceptable values of insulation resistance shall be in accordance with the applicable ICEA, NEMA or ANSI standards for the equipment or material being tested, unless otherwise specified. The ambient temperature at which insulation resistance is measured shall be recorded on the test form.

b. Insulation resistance measurements shall be recorded. Insulation with resistance of less than 10 megohms is not acceptable.

2. CONDUCTOR AND CABLE TESTS: The phase-to-ground insulation resistance shall be measured for all circuits rated 120 volts and above except lighting circuits. Measurements may be made with motors and other equipment connected. Solid state equipment shall be disconnected, unless the equipment is normally tested by the manufacturer at voltages in excess of 1000 volts DC.

3. MOTOR TESTS: Installed motors shall be tested per Section 26 08 00 shall be completed for each motor after installation. Motors shall have their insulation resistance measured before they are connected. Motors 50 HP and larger shall have their insulation resistance measured at the time of delivery as well as when they are connected. Insulation resistance values less than 10 megohms are not acceptable.

C. PRE-FUNCTIONAL TEST CHECKOUT: Functional testing shall be performed in accordance with the requirements of Section 26 08 00. Prior to functional testing, all protective devices shall be adjusted and made operative.

1. Submit a description of the proposed functional test procedures prior to the performance of functional checkout.

2. Prior to energization of equipment, perform a functional checkout of the control circuit. Checkout:

a. Energizing each control circuit.

b. Operating each control device, alarm device, or monitoring device.

c. Operate each interlock to verify that the specified action occurs.

D. Verify motors are connected to rotate in the correct direction. Verification may be accomplished by momentarily energizing the motor, provided the Contractor confirms that neither the motor nor the driven equipment will be damaged by reverse operation or momentary energization.

3.3 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable switches and circuit-breaker trip ranges.

3.4 CLEANING

A. On completion of installation, inspect interior and exterior of enclosures. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

3.5 OPERATION AND MAINTENANCE MANUALS

A. Comply with Section 01 31 00, Section 01 78 23 and Part 1 of this specification.

END OF SECTION

SECTION 26 05 05
SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.1 SUMMARY

A. This Section specifies requirements for selective demolition of portions of the electrical system at the facility. This may include such things as underground conduit, surface conduit, motors, control components and similar.

B. Section includes:

1. Scope
2. Reference Standards
3. Quality Assurance
4. Demolition
5. Relocation

1.2 SCOPE

A. Verify with the owner all items to be salvaged. All items that are not directed in the field (or by other means) to be salvaged or turned over to the owner shall be considered scrap. Carefully inspect the entire site and verify all items to be removed, to remain, or to be relocated.

B. Demolition work shall be the responsibility of each trade's contractor. Notify the project manager at least two days prior to commencing work in a particular area.

C. Coordinate and schedule all work in a careful manner with all necessary consideration for the owner, other contractors and the public, avoiding interference with the use of, and passage to and from, adjacent areas and facilities designated to remain in use during demolition.

D. Maintain all existing circuits to items that remain in use. Reroute and rework all conduits, wiring, etc. as required.

1.3 REFERENCE STANDARDS

A. NFPA 70 National Electrical Code

B. NFPA 70E National Electrical Safety Code

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work

1.5 DEMOLITION

A. Demolish and remove equipment foundation and supports, conduits, wire, and all other existing items designated for removal as indicated on the drawings and in these specifications. Do not use equipment or methods that will cause damage to adjacent construction designated to remain.

B. Remove existing influent pump station control panel, PLC panel and VFD panels. Salvage equipment as requested by the owner.

C. Pull conductors from abandoned concealed raceway systems. Any section of raceway system exposed due to remodeling shall be cut flush at exposing surface. Concealed raceways need not be removed except where they interfere with remodeling.

D. Disconnect all electrical connections to equipment designated to be removed by other trades.

E. The drawings indicate the general concept of the demolition to be performed, and are not intended to be totally inclusive. The contractor is responsible to visit the site and fully inform himself of all demolition requirements.

1.6 RELOCATION

A. No relocation of electrical equipment is anticipated for this project. Contractor to take special care of existing fiber conduit when removing and installing new conduits on south side of the construction area.

END OF SECTION

SECTION 26 05 19
LOW-VOLTAGE CONDUCTORS, WIRES AND CABLES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

Scope.
Reference Standards.
Quality Assurance.
Definitions.
Submittals.
Products.
Execution.

1.2 SCOPE

A. This section specifies cables, conductors and fibers including:

1. Stranded copper cables, conductors, and wire rated 600 volts insulation used for power; lighting, analog, digital, or pulse signals and control circuits.

2. Copper cables and coax cable rated 300-volt insulation used for data, communication, and signaling.

1.3 REFERENCE STANDARDS

A. This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

B. This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

1. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or

otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
ASTM B3	Soft or Annealed Copper Wire
ASTM B8	Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B33	Tinned Soft or Annealed Copper Wire for Electrical Purposes
ICEA S-95-658/ NEMA WC70	Non-shielded 0-2kV Cables
NFPA 70	National Electric Code (NEC)
IEEE 383	Type Test of Class IE Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations
UL 44	Rubber-Insulated Wires and Cables
UL 83	Thermoplastic-Insulated Wires and Cables
ANSI X3.166	Information Systems--Fiber Data Distributed Interface (FDDI)--Token Ring Physical Layer Medium Dependent (PMD)
EIA RS232D	Interface Between Data Terminal Equipment and Data Circuit Terminating Equipment Employing Serial Binary Data Interchange
EIA RS422	Electrical Characteristics of Balanced Voltage Digital Interface Circuits
EIA RS485	Electrical Characteristics of Generators and Receivers for Use in Balanced Digital Multipoint Systems
IEEE 802	IEEE Standards for Local and Metropolitan Area Networks: Overview and Architecture
IEEE 802.3	Information Processing Systems--Local and Metropolitan Area Networks--Part 3: Carrier Sense Multiple Access with Collision
IEEE 802.3k	Supplement to ISO/IEC 8802-3, Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical
IEEE 802.4	Information Processing Systems--Local Area Networks--Part 4: Token-Passing Bus Access Method and Physical Layer
ANSI/NFPA 72	Installation, Maintenance, and Use of Protective Signaling Systems
ANSI/NFPA 72H	Testing Procedures for Signaling Systems

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment start-up or eighteen months from the date of shipment, whichever occurs first, to be free from defects in design, workmanship or materials.

1.5 DEFINITIONS

A. LOW LEVEL ANALOG: A signal that has a full output level of 100 millivolts or less. This group includes thermocouples and resistance temperature detectors.

B. DATA OR DIGITAL CODE: Coded information such as that derived from the output of an analog to digital converter or the coded output from a digital computer or other digital transmission terminal. This type includes those cases where direct line driving is utilized, such as EIA RS422.

C. PULSE FREQUENCY: Counting pulses such as those emitted from speed transmitters.

D. HIGH LEVEL ANALOG: Signals with full output level greater than 100 millivolts but less than 30 volts, including 4-20 mA transmission.

E. MODULATED SIGNALS: Signals emanating from modems or low-level audio signals. Normal signal level is plus 4 dBm to minus 22 dBm. Frequency range is 300 to 10,000 hertz.

F. DISCRETE EVENTS: Dry contact closures monitored by solid state equipment. If the conductors connecting to dry contacts enter enclosures containing power or control circuits and cannot be isolated from such circuits in accordance with NEC Article 725, this signal shall be treated as low voltage control.

G. LOW VOLTAGE CONTROL: Contact closures monitored by relays, or control circuits operating at less than 30 volts and 250 milliamperes.

H. HIGH LEVEL AUDIO SIGNALS: Audio signals exceeding plus 4 dBm, including loudspeaker circuits.

I. RADIO FREQUENCY SIGNALS: Continuous wave alternating current signals with fundamental frequency greater than 10 kilohertz.

1.6 SUBMITTALS

A. PROCEDURES: Section 01 32 19

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

    a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

    b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

    a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

    b. Catalog cuts shall be edited to show only the items, model numbers, and information which apply.

    c. Submittals are to made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable. Submittals that are not submitted in the format outlined may be rejected outright and the Contractor is required to resubmit in the correct format.

4. Catalog cuts showing information of the conductors and cables to be supplied under this section.

5. Field test reports showing conductor and cable insulation resistance test results.

6. Provide engineering pull calculations for all 600V main feeders run underground outside building footprints.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Approved manufacturers are listed in the Cable Specification Sheets located at the end of this specification section.

2.2 GENERAL

A. UNSCHEDULED CONDUCTORS AND CABLES:

1. With the exception of lighting and receptacle circuits, the type, size and number of conductors shall be as specified on the drawings or schedules. 120V panel circuit conductors mentioned above that are unscheduled and shall be sized by the Contractor in accordance with the breakers specified and the NEC to limit voltage drop to 3 percent. Minimum size of power, lighting, and receptacle circuits shall be 12 AWG. Number and types of communication, paging, and security cables shall be as required for the particular equipment provided. Power, lighting, and receptacle circuit conductors shall be provided in accordance with CABLESPEC “THHN” or “XHHW,” unless otherwise specified.

2. Where not specified on the Drawings, conductors and cables shall be sized in accordance with the National Electrical Code for the particular equipment served with the minimum size as specified herein. Unscheduled conductors shall be sized by the Contractor in accordance with NEC tables and to limit voltage drop to 3 percent.

3. Unscheduled conductors with insulation shall be provided in accordance with the CABLE SPECIFICATIONS in TABLE 2 according to the purpose.

B. CABLE SPECIFICATION SHEETS (CABLESPEC): General requirements for conductors and cables specified in this Section are listed on CABLESPEC sheets.

2.3 COLOR CODING

A. POWER AND CONTROL CABLES:

1. Wire coloring shall conform to the color code shown in the table below.

2. Insulation on phase conductors run in conduits sizes #10 AWG and smaller shall be colored, #8 AWG and larger may have black insulation with plastic tape of the appropriate color from the table below.

3. Insulation on the grounded conductor (neutral) sizes #8 AWG and smaller shall be colored, #6 AWG and larger may have black insulation with plastic tape of white or gray in accordance with the table below.

Description	120/208V	277/480V	Control
Phase A (Left)	Black	Brown	--
Phase B (Center)	Red	Orange	--
Phase C (Right)	Blue	Yellow	--
Neutral	White	Gray	White
Ground	Green	Green	Green
120 VAC Control	--	--	Red
120 VAC Control Neutral	--	--	White
DC Control (+)	--	--	Blue
DC Control (-)	--	--	Gray
Signal (+)	--	--	Red
External Source	--	--	Yellow
Computer/Signal Ground			Green/yellow stripe

4. All control wiring in control panels or other enclosures that is powered from an external source and is not disconnected by the control panel disconnect shall be terminated at a disconnecting terminal block upon entering the enclosure. The color of the wire shall then be changed to yellow to identify it as being powered from an external source. Provide identification nameplate on exterior of enclosure to indicate sources of external power.

5. All wiring in industrial machines and equipment shall be in accordance with NFPA 79. Notify owner of any deficiencies noted during installation.

6. Multi-conductor power cable colors shall be manufacturer's standard.

7. Cables sized No. 6 AWG and larger may be black with colored 3/4-inch vinyl plastic tape applied in 3-inch lengths around the cable at each end. The cables shall be tagged at terminations and in pull boxes, hand holes and manholes.

B. SIGNAL AND DATA CABLES: Unless otherwise specified, cables shall be color coded black and white for pairs or black, red, and white for triads.

2.4 POWER AND CONTROL CONDUCTORS AND CABLE, 600 VOLT

A. SINGLE CONDUCTOR: Single conductor cable shall be stranded copper and shall be used in conduits for power and control circuits. Single conductor cable shall be provided in accordance with CABLESPEC “THHN” or “XHHW” type of conductors unless otherwise specified.

B. MULTI-CONDUCTOR CABLE: Provide multi-conductor power cable and multi-conductor control cable where identified on the drawings. Multi-conductor cables shall be in accordance with CABLESPEC “TC” type cables.

2.5 SIGNAL, DATA AND INSTRUMENTATION CABLES

A. GENERAL:

1. Signal cable shall be provided for instrument signal transmission, alarm, communication, and other circuits as specified. Circuit shielding shall be provided in addition to cable shielding.

2. Single circuit signal cable shall be provided in accordance with CABLESPEC “INS,” unless otherwise specified for hazardous locations type “SP-OS” (ITC/PLTC). Multi-circuit signal cable shall be provided in accordance with CABLESPEC “INS/M,” unless otherwise specified for hazardous locations type “SP-OS” (ITC/PLTC).

3. Terminal blocks shall be provided at cable junction for running signal leads and shield drain wires. Each conductor shall be identified at such junctions.

a. Shields shall not be used as a ground path.

b. Shields shall be grounded at one end only. Refer to I drawings for grounding location.

c. Signal, data, and communication cables shall be terminated and spliced on terminal strips properly mounted and labeled in accordance with this Section and Section 26 05 00. No exceptions.

4. CABLE SPECIFICATION SHEETS (CABLESPEC): General requirements for conductors and cables specified in this Section are listed on CABLESPEC sheets in Section 26 05 19-3.7.

2.6 WIRE MARKERS

A. 600 VOLT AND 300 VOLT RATED CONDUCTORS:

1. Per 26 05 00 Paragraph 2.2.

2.7 SPLICING AND TERMINATING MATERIALS

A. 600-VOLT AND 300-VOLT RATED CONDUCTORS:

1. Connectors shall be tool applied compression type of correct size and UL listed for the specific application. Connectors shall be tin-plated high conductivity copper. Connectors for wire sizes No. 10 AWG and smaller shall be nylon self-insulated, ring tongue or locking-spade terminals. Connectors for wire sizes No. 8 AWG and larger shall be one-hole lugs up to size No. 3/0 AWG, and two-hole or four-hole lugs for size No. 4/0 and larger. Mechanical clamp, dimple, screw-type connectors are not acceptable.

2. In-line splices and taps shall not be used. All circuits shall be continuous though all junction boxes, wireways, pull boxes, etc. until the circuit conductors are terminated at suitable terminal strips within motor control centers, PLC cabinets and panels, distribution panels, local control stations, etc.

3. Motor terminations at 460-volt motors shall be made by bolt-connecting the lugged connectors. Connections shall be insulated with Thomas and Betts (T&B), MSC series Motor Stub Splice Insulators and sealed with the appropriate tape for the motor voltage. (Example 480V = Scotch 33)

2.8 CORD GRIPS

A. Cord grips shall be provided where specified on the Drawings to attach flexible cord to equipment enclosures. Cord grips shall consist of a threaded aluminum body and compression nut with a neoprene bushing and stainless-steel wire mesh for strain relief. Cord grip shall provide a watertight seal at enclosure interface and sized to accommodate the flexible cord.

PART 3 EXECUTION

3.1 GENERAL

A. Conductors shall be identified at each connection terminal and at splice points. The identification marking system shall comply with Section 26 05 00.

B. Pulling wire and cable into conduit or trays shall be completed without damaging or putting undue stress on the insulation or jacket. Manufacture recommended and UL Listed pulling compounds are acceptable lubricants for pulling wire and cable. Grease is not acceptable.

C. Raceway construction shall be complete, cleaned, and protected from the weather before cable is installed. Where wire or cable exits a raceway, a wire or cable support shall be provided.

D. Provide tin-plated bus bar. Scratch-brush the contact areas and tin plate the connection where flat bus bar connections are made with un-plated bar. Bolts shall be torqued to the bus manufacturer's recommendations.

3.2 600-VOLT CONDUCTOR AND CABLE

A. Conductors in panels and electrical equipment shall be bundled and laced at intervals not greater than 6 inches, spread into trees and connected to their respective terminals. Lacing is not necessary in plastic panel wiring duct or wall mounted steel raceway used above countertops. Lacing shall be made up with plastic cable ties. Cable ties shall be tensioned and cut off by using a tool specifically designed for the purpose such as a Panduit GS2B. Other methods of cutting cable ties are unacceptable.

B. Conductors crossing hinges shall be bundled into groups not exceeding 10 to 15 conductors and protected using nylon spiral flexible covers to protect conductors. Provide oversized plastic panel wiring duct within panels and panelboards.

C. Slack shall be provided in junction and pull boxes, hand holes and manholes. Slack shall be sufficient to allow cables or conductors to be routed along the walls. Amount of slack shall be equal to largest dimension of the enclosure. Provide dedicated electrical wireways and insulated cable holders mounted on unistrut in manholes and hand holes.

D. Raceway fill limitations shall be as defined by NEC and the following:

1. Lighting and receptacle circuits may be in the same conduit in accordance with de-rating requirements of the NEC. Lighting and receptacle circuits shall not be in conduits with power or control conductors. Signal conductors shall be in separate conduits from power and control

conductors. Motor feeder circuits shall be in separate conduits including small fan circuit unless combination fan-light fixture.

2. Power conductors derived from uninterruptible power supply systems shall not be installed in raceways with conductors of other systems. Install in separate raceways.

3. Splices and terminations are subject to inspection by the Owner prior to and after insulating.

4. Motor terminations at 460-volt motors shall be made by bolt-connecting the lugged connectors.

5. In-line splices and tees, where approved by the Owner, shall be made with tubular compression connectors and insulated as specified for motor terminations. Splices and tees in underground hand holes or pull boxes shall be insulated using Scotch-cast epoxy resin or Raychem splicing kits.

6. Solid wire shall not be used.

7. Sharing neutrals for power circuits is unacceptable.

8. Conductor and cable markers shall be provided at splice points.

3.3 SIGNAL CABLE

A. Circuits shall be run as individually shielded twisted pairs or triads. In no case shall a circuit be made up using conductors from different pairs or triads. Triads shall be used wherever 3-wire circuits are required. Terminal blocks shall be provided at instrument cable junctions, and circuits shall be identified at such junctions unless otherwise specified. Signal circuits shall be run without splices between instruments, terminal boxes, or panels.

B. Shields shall not be used as a signal conductor.

C. Common ground return conductors for two or more circuits are not acceptable.

D. Unless otherwise specified, shields shall be bonded to the signal ground bus at the control panel and isolated from ground and other shields at other locations. Terminals shall be provided for running signal leads and shield drain wires through junction boxes.

E. Cable for communication systems shall be installed and terminated in compliance with the equipment manufacturer's recommendations and applicable NEC requirements.

F. Cable for data circuits and operating at greater than 10 kHz, shall be run continuously from node to node without splices or intermediate terminal blocks unless otherwise specifically specified or shown.

G. Cable for low-level instrumentation circuits shall be run continuously between final terminations without splices or intermediate terminal blocks unless otherwise specifically shown or specified.

H. Spare circuits and the shield drain wire shall be terminated on terminal blocks at both ends of the cable run and be electrically continuous through terminal boxes. Shield drain wires for spare circuits shall not be grounded at either end of the cable run.

I. Terminal boxes shall be provided at instrument cable splices. If cable is buried or in raceway below grade at splice, an instrument stand shall be provided as specified with terminal box mounted approximately 3 feet above grade.

3.4 INSTALLATION

A. Raceway fill shall be as scheduled, and shall not exceed NEC limitations.

B. Feeder, branch, control and instrumentation circuits shall not be combined in a raceway, cable tray, junction or pull box, except as permitted in the following:

1. Where specifically indicated on the drawings.

2. Where field conditions dictate and written permission is obtained from the Owner.

3. Control circuits shall be isolated from the feeder and branch power and instrumentation circuits but combining of control circuits with power is permitted as noted below.

a. The combinations shall comply with the following:

1) 12 VDC, 24 VDC and 48 VDC may be combined.

2) 125 VDC shall be isolated from all other AC and DC circuits.

3) All AC circuits shall be isolated from all DC circuits.

4. Instrumentation circuits shall be isolated from feeder and branch power and control circuits but combining of instrumentation circuits is permitted.

a. The combinations shall comply to the following:

1) Analog signal circuits may be combined.

2) Digital circuits may be combined but isolated from analog signal circuits.

5. Multiple branch circuits for lighting, receptacle and other 120 VAC circuits are allowed to be combined into a common raceway.

a. Contractor is responsible for making the required adjustments in conductor and raceway size, in accordance with all requirements of the NEC, including but not limited to:

1) Up sizing conductor size for required Ampacity de-ratings for the number of current-carrying conductors in the raceway.

2) The neutral conductors may not be shared.

3) Up sizing raceway size for the size and quantity of conductors.

C. Pulling wire and cable into conduit or cable trays shall be completed without damaging or putting undue stress on the cable insulation. Only UL listed pulling compounds are acceptable lubricants for pulling wire and cable. Grease is not acceptable. Raceway construction shall be complete, cleaned, and protected from the weather before cable is placed.

D. Whenever a cable leaves a raceway, a cable support shall be provided. Conductors in panels and electrical equipment shall be bundled and laced at intervals not greater than 6 inches, spread into trees and connected to their respective terminals. Lacing shall be made up with plastic cable ties. Lacing is not necessary in plastic panel wiring duct. Conductors crossing hinges shall be bundled into groups not exceeding 12 and shall be so arranged that they will be protected from chafing when the hinged member is moved.

E. Slack shall be provided in junction and pull boxes, hand holes and manholes. Slack shall be sufficient to allow cables or conductors to be routed along the walls of the box. Amount of slack shall be equal to largest dimension of the box. Where plastic panel wiring duct is provided for wire runs, lacing is not required. Plastic panel wiring duct shall not be used in manholes and hand holes.

F. Do not exceed cable manufacturer's maximum recommended pulling tension. Use dynamometer or break-away swivel on pulls exceeding 150 feet.

G. Observe manufacturer's minimum recommended pulling and training radii.

H. Where data cables are installed in cable trays, provide barriers in the tray to separate data cables from power and/or control cables.

I. At each end of the run leave sufficient cable for termination. Coil sufficient cable in each manhole, handhold, or pull box to permit future splice.

J. In-line splices and tees are not allowed.

K. Splices shall not be permitted in any coaxial, twin-axial, or data cable runs.

L. Ground cable shields at one end only. Unless otherwise specified, ground the shields at the panel end.

M. Protect all cables against moisture during and after installation.

N. Install and ground Ethernet cable in accordance with IEEE 802.3. Attach trunk cable to walls and ceilings with PVC clamps with clamp backs at 4-foot intervals.

O. Signal and control cable suspended into the wet well shall be provided with heavy duty wire mesh cord grip of flexible stainless-steel wire to take the tension from the cable termination. Strain relief system shall be suitably anchored.

P. Circuits provided under this Section shall not be direct buried.

3.5 TERMINATIONS

A. Terminations shall be on terminators as identified in Section 26 05 00.

B. Each conductor shall be identified with a wire marker at each terminal to which it is connected. The marking system shall comply with Section 26 05 00.

C. Stranded conductors shall be terminated as described in Section 26 05 19, except where terminals will not accept such terminations. Compression lugs and connectors shall be installed using manufacturer's recommended tools. Where terminal blocks will not accept lugged conductors, the conductors shall be tinned using 60 percent tin, 40 percent lead alloy non-corrosive resin core solder before insertion into pressure terminals.

D. Electrical spring connectors (wire nuts) shall not be used for any purpose on any cable specified under this Section except for receptacle and lighting circuits. Lugs and connectors shall be installed with a compression tool.

E. All splices and terminations are subject to inspection by the Owner prior to and after insulating.

F. Terminations at solenoid valves, 120-volt motors, and other devices furnished with pigtail leads shall be made using self-insulating forked compression connectors and terminal strips within a termination/junction box.

G. Provide tool-crimp N connectors at coaxial cable terminations except trunk runs.

H. Provide tool-crimp TRN connectors at twin-axial cable terminations.

I. Conductor and cable markers shall be provided at splice points.

3.6 TESTING

A. GENERAL:

1. The Contractor shall test conductors and cable in accordance with Section 26 08 00. Instrument and Data Cables shall be subjected to additional tests as specified in this section.

B. INSTRUMENT CABLE:

1. Each signal pair or triad shall be tested for electrical continuity. Any pair or triad exhibiting a loop resistance of less than or equal to 50 ohms shall be deemed satisfactory without further test. For pairs with greater than 50-ohm loop resistance, the Contractor shall calculate the expected loop resistance considering loop length and intrinsic safety barriers if present. Loop resistance shall not exceed the calculated value by more than 5 percent.

2. Each shield drain conductor shall be tested for continuity. Shield drain conductor resistance shall not exceed the loop resistance of the pair or triad.

3. Each conductor (signal and shield drain) shall be tested for insulation resistance with all other conductors in the cable grounded.

4. Instruments used for continuity measurements shall have a resolution of 0.1 ohms and an accuracy of better than 0.1 percent of reading plus 0.3 ohms. A 500-volt megohmmeter shall be used for insulation resistance measurements.

3.7 CABLE SPECIFICATIONS SHEETS (CABLESPEC)

A. GENERAL: Conductor, wire, and cable types for different locations, service conditions and raceway systems are specified on individual cable specification sheets. Scheduled and unscheduled conductors, wires, and cables shall be installed in accordance with the CABLESPEC SHEETS.

B. CABLESPEC SHEETS: The following CABLESPEC sheets are included in this section:

CABLESPEC	Volts	Product	Purpose
XHHW	600	Single conductor cross- linked polyethylene power and control cable	Power and control conductors for use in conduit raceways.
THHN/THWN-2	600	Single conductor PVC, nylon	Power and control conductors for use

		jacket power and control cable	in conduit raceways.
CORD	600	Rubber Jacketed multi-conductor cable.	Temporary power cable.
INS	600	Single Pair/Triad #18 ST plus overall shield,	Instrumentation
INS/M	600	Multiple Pair/Triad #18STP plus overall shield,	Instrumentation
NC2	300	Category 6 Ethernet cable, 4 pairs, non-armored	Gigabit Ethernet cable
NC3	300	Category 6 Ethernet cable, 4 pairs, Shielded	Gigabit Ethernet cable

C. CABLE TYPE: XHHW

1. Description: Single conductor Cross-linked polyethylene power and control cable for sizes No. 14 AWG and larger.

2. Voltage: 600 volts

3. Conductor Material: Bare annealed copper; stranded in accordance with ASTM B8

4. Insulation: XHHW-2, 90 degree C dry, 75 degree C wet, cross-linked polyethylene in accordance with ICEA S-95-658/NEMA WC70.

5. Jacket: None.

6. Manufacturer(s): Okonite, X-Olene; Durasheath XLP; or approved equal

7. Uses Permitted: Power, control, lighting, receptacle and appliance circuits

8. Execution:

   a. Installation: Install in accordance with Section 26 05 19.

   b. Testing: Test in accordance with this Section and Sections 26 05 00.

D. CABLE TYPE: THHN/THWN-2

1. Description: Single conductor polyvinyl chloride (PVC), nylon jacket power and control cable for sizes No. 14 AWG and larger.

2. Voltage: 600 volts

3. Conductor Material: Bare annealed copper; stranded in accordance with ASTM B3 & B8

4. Insulation: Heat and moisture resistant colored polyvinyl chloride, 90 degree C dry, 90 degree C wet, in accordance with ICEA S-95-658/NEMA WC70.

5. Jacket: Nylon or UL-listed jacket.

6. Manufacturer(s): Southwire, Cerrowire, Encore Wire

7. Uses Permitted: Power, control, lighting, receptacle and appliance circuits

8. Execution:

   a. Installation: Install in accordance with Section 26 05 19.

   b. Testing: Test in accordance with this Section and Sections 26 05 00 and 26 08 00.

E. CABLE TYPE: CORD

1. Description: Portable Cord, 3-conductor with ground, extra hard usage, oil, weather, and water resistant. 10 AWG and smaller, UL listed, type SOOW; larger than 10 AWG, UL listed type G.

2. Voltage: 600 volts

3. Conductor Material: Type G - Flexible rope lay stranded per ASTM B189 and B33. Type SOOW – Soft bare annealed copper per ASTM B-3, flexible bunch strand per ASTM B-174.

4. Insulation: Insulation shall be ethylene propylene (EPR) as per ICEA S-68-516 and rated for continuous operation at 90 degrees C.

5. Jacket: Black chlorinated polyethylene (CPE) rubber ICEA S-98-658.

6. Manufacturer(s): Type SOOW - Houston Wire HW250, Southwire Viper, or approved equal. Type G – Houston Wire HW258, Southwire Type G, or approved equal.

7. Execution:

   a. Installation: Install in accordance with Section 26 05 19.

   b. Testing: Test in accordance with Sections 26 05 00.

   c. Sizing Cables: Cables shall be sized for loads to be served.

F. CABLE TYPE: INS

1. Description: Single twisted, shielded pair or triad, 18 AWG, instrumentation cable, rated for wet and dry locations.

2. Voltage: 600 volts

3. Conductor Material: Bare annealed copper; stranded in accordance with ASTM B8

4. Insulation: PVC/Nylon

5. Shield: 100 percent, 1.35 mil aluminum-Polyester tape with 20 AWG 7-strand tinned copper drain wire

6. Jacket: 48 mil flame-resistance polyvinylchloride

7. Flame Resistance: UL 1685, ICEA T-29-520, and IEEE 1202.

8. Manufacturer(s): Single Pair: BELDEN 1120A, or approved equal. Single Triad: BELDEN 1121A, or approved equal.

9. Execution:

   a. Installation: Install in accordance with Section 26 05 19.

   b. Testing: Test in accordance with this Section and Sections 26 05 00.

G. CABLE TYPE: INS/M

1. Description: Multiple twisted, shielded pairs or triads, instrumentation cable, rated for wet and dry locations.

2. Voltage: 600 volts

3. Conductor Material: Bare annealed copper; stranded in accordance with ASTM B8

4. Lay: Length 2.5 inches

5. Insulation: PVC/Nylon

6. Shield: 100 percent, 1.35 mil aluminum-Polyester tape with 18 AWG 7-strand tinned copper drain wire

7. Jacket: 48 mil or 68 mil or 84 mil flame-resistance polyvinylchloride

8. Flame Resistance: UL 1685 and IEEE 1202.

9. Manufacturer(s): 2 pair: BELDEN 1048A, or approved equal. 4 pair: BELDEN 1049A, or approved equal. 12 pair: BELDEN 1051A, or approved equal 4 triad: BELDEN 1093A, or approved equal. 12 triad: BELDEN 1095A, or approved equal.

10. Execution:

    a. Installation: Install in accordance with Section 26 05 19.

    b. Testing: Test in accordance with this Section and Sections 26 05 00.

H. CABLE TYPE: NC2

1. Description: Paired – MediaTwist Enhanced Category 6, gigabit Ethernet, 100BaseTX, 4 pair cable, non-armored

2. Voltage: 300V rms

3. Conductor Material: Tinned copper 24 AWG

4. Insulation Material: Polyolefin (PO)

5. Shield: Unshielded

6. Jacket: Polyvinyl chloride (PVC), 0.365x0.165-inch diameter

7. Flame Resistance: UL 1666 riser

8. Electrical Characteristics: 350 MHz, 51.1 dB/100 meters

9. Manufacturer(s): Belden 1875GB, Okonite, or approved equal.

10. Uses Permitted: Conduit.

11. Execution:

    a. Application: Data Network Communications – Ethernet.

    b. Installation: Install in accordance with this Section and associated equipment manufacturer's instruction.

    c. Testing: Test in accordance with this Section.

I. CABLE TYPE: NC3

1. Description: Category 6, gigabit Ethernet, 4 pair cable, shielded

2. Voltage: 300V rms

3. Conductor Material: Solid bare copper 23 AWG

4. Insulation Material: Polyolefin (PO) + Fluorinated Ethylene Propylene (FEP)

5. Shield: Shielded, Polyester + Bi-Laminate (Alum+Poly) 100 percent coverage with solid drain wire

6. Jacket: Polyvinyl chloride (PVC), 0.290-inch diameter

7. Flame Resistance: UL 1666 riser

8. Electrical Characteristics: 250 MHz, 22.0 dB/100 meters

9. Manufacturer(s): Belden 1351A, Okonite, or approved equal

10. Uses Permitted: Conduit.

11. Execution:

    a. Application: Data Network Communications – Shielded Ethernet.

    b. Installation: Install in accordance with this Section and associated equipment manufacturer's instruction.

    c. Testing: Test in accordance with this Section.

J. CABLE TYPE: NC4

1. Description: Category 6, gigabit Ethernet, 4 pair cable, shielded

2. Voltage: 600V rms

3. Conductor Material: Solid bare copper 23 AWG

4. Insulation Material: Polyolefin (PO) + Fluorinated Ethylene Propylene (FEP)

5. Shield: Shielded, Polyester + Bi-Laminate (Alum+Poly) 100 percent coverage with solid drain wire

6. Jacket: Polyvinyl chloride (PVC), 0.290-inch diameter

7. Flame Resistance: UL 1666 riser

8. Electrical Characteristics: 250 MHz, 22.0 dB/100 meters

9. Manufacturer(s): Belden 1351A, Okonite, or approved equal

10. Uses Permitted: Conduit.

11. Execution:

    a. Application: Data Network Communications – Shielded Ethernet.

    b. Installation: Install in accordance with this Section and associated equipment manufacturer's instruction.

    c. Testing: Test in accordance with this Section.

END OF SECTION

SECTION 26 05 26
GROUNDING SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope.
2. Reference Standards.
3. Quality Assurance.
4. System Requirements.
5. Sizing.
6. Submittals.
7. Products.
8. Execution.

1.2 SCOPE

A. This section specifies the system for grounding electrical distribution and utilization equipment, including but not limited to cabinets, motor frames, manholes, instrumentation, metal surfaces of process/mechanical equipment that contain energized electrical components, metal structures and buildings, outdoor metal enclosures, fences and gates.

1.3 REFERENCE STANDARDS

A. This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
IEEE 81	Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System
IEEE Std 81.2-1991	Guide to Measurement of Impedance and Safety Characteristics of Large, Extended or Interconnected Grounding Systems
NETA - ATS	Inter-National Electrical Testing Association Inc. - Acceptance Testing Specifications
NFPA 70	National Electric Code (NEC) Article 250

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design workmanship or materials.

1.5 SYSTEM REQUIREMENTS

A. Provide equipment grounding conductors in all electrical raceways. The conductors shall be sized in accordance with the National Electrical Code.

B. Underground, rebar, and building steel ground connections shall be via exothermic weld or hydraulically die crimped cold weld.

C. Bond building's rebar and building steel attributes to form a ground mat. Bond all site ground mats via exothermic weld or hydraulically die crimped cold weld.

D. Provide cable tray grounding and bonding in accordance with these project specifications and the drawings.

1.6 SIZING

A. SIZING: The minimum size of the Equipment Grounding Conductors installed with the circuit conductors shall be per the National Electrical Code Table 250.122. The circuit grounding conductor size routed with a feeder or branch circuit conductors is as shown on the drawings.

1.7 SUBMITTALS

A. PROCEDURES: Section 01 32 19.

B. ACTION SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

    a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

    b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Marked product literature for ground rods, test wells, and equipment ground plate.

4. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

    a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

    b. Catalog cuts shall be edited to show only the items, model numbers, and information which apply.

    c. Submittals are to made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable. Submittals that are not submitted in the

format outlined may be rejected outright and the Contractor is required to resubmit in the correct format.

5. Grounding system test data.

6. Maintenance Data: For all equipment and for components to include in maintenance manuals specified in Division 1 General Requirements. In addition to requirements specified in Section 01 31 00 and 01 78 23, include the following:

   a. Routine maintenance requirements for equipment and components.

PART 2 PRODUCTS

2.1 PROCESS EQUIPMENT GROUNDS

A. The contractor shall coordinate with the equipment supplier to provide an equipment ground lug and contractor provided ground cable and terminations to bond the equipment to the grounding electrode system. Ground cable shall be sized in accordance with this specification. Provide cables, exothermic welds, hydraulic die crimp connections and equipment bolted connections as necessary.

2.2 GROUND CONDUCTORS

A. The System Ground Conductor shall be soft-drawn, bare annealed copper, concentric stranded, as specified. The minimum sizes shall be as follows, where American Wire Gage (AWG) conductor sizes are not shown or specified:

15 kV-5 kV transformers	4/0 AWG
480V switchboards	4/0 AWG
480V MCC	4/0 AWG
ATS and MTS	2/0 AWG
Cable tray	2/0 AWG
Lighting & Power panels	2 AWG
Exposed metal cabinets	2 AWG
Electrical & Process equipment	2 AWG
Buildings and enclosure	2 AWG
Fences and gates	2 AWG
Motors 25 HP to 250 HP	2 AWG
Motors 1 HP to 25 HP	6 AWG

2.3 GROUND RODS

A. Ground rods shall be copper covered steel, 3/4-inch diameter and 10-feet long. Rods shall have threaded type removable caps so that extension rods of same diameter and length may be added where necessary.

2.4 CONNECTORS

A. COMPRESSION CONNECTORS: Compression connections shall be irreversible, cast copper as manufactured by Thomas and Betts, or approved equal.

B. BOLTED CONNECTORS: Bolted connectors shall be Burndy, O. Z. Gedney, Thomas and Betts, or approved equal.

C. EXOTHERMIC WELDED CONNECTORS: Exothermic welding products shall be Erico's Cadweld Plus system with a remotely operated battery powered electronic ignition device and moisture resistant weld metal cup for the required mold, or approved equal.

D. COLD WELDED CONNECTORS: Hydraulically die crimped cold weld connectors shall be cast copper compression cross grid type as manufactured by Burndy, or approved equal.

2.5 EQUIPMENT GROUND BARS and lugs

A. Ground bars required in power distribution equipment shall be tin plated copper and sized in accordance with manufacturer's standard.

B. Copper equipment ground bars shall be Erico Eritech EGB Series or approved equal, sized as required for the installation.

C. Ground lugs shall be as shown on the drawings.

PART 3 EXECUTION

3.1 INSTALLATION

A. Grounding conductors, which are extended beyond concrete surfaces for equipment connection, shall be extended a sufficient length to reach the final connection point without splicing. Minimum extension shall be 3 feet. Grounding conductors, which project from a concrete surface, shall be located as close as possible to a corner of the equipment pad, protected by non-metallic conduit, or terminated in a flush grounding plate. Exposed grounding conductors shall be supported by noncorrosive metallic hardware at 4-foot intervals or less.

Grounding conductors for future equipment shall be terminated using a two-hole copper flush mounted grounding plate.

B. Ground conductors, except signal conductor shields, entering enclosures shall be bonded together to the enclosure if it is metallic and to metallic raceways within or terminating at the enclosure. Prior to making ground connections or bonds, the metal surface at the point of connection shall be cleaned.

C. Compression-type lugs shall be used in accordance with manufacturer's recommendations.

D. Grounding conductor shall not be used as a system neutral.

E. Surge arresters shall be directly connected to the ground system using copper conductors, sized as specified.

F. Metallic sheaths or shields of shielded power cable shall be terminated by a copper grounding strip provided with cable connection for connection to the grounding system. Grounding strip shall be sized to withstand available fault current for specimen to be terminated.

G. Furnish an equipment grounding conductor in all conduit runs sized in accordance with the NEC.

H. Grounding system shall be provided in compliance with the NEC.

I. Metallic sheaths or shields of shielded power cable shall be terminated by a copper grounding strip provided with cable connection for connection to the grounding system.

3.2 RACEWAY GROUND

A. All service, feeder and branch circuit raceways shall contain a green insulated ground conductor sized per applicable NFPA 70 National Electrical Code (NEC) tables:

1. T250.66 - Grounding Electrode Conductor for Alternating-Current Systems or

2. T250.122 - Minimum Size Equipment Grounding Conductors for Grounding Raceways and Equipment.

B. Metallic conduits terminating at concentric knock-outs or reducing washers shall be bonded using insulated grounding bushings. Grounding bushings shall be connected to the grounding system using conductors sized in compliance with NEC.

C. Provide equipment grounding conductors in all power and control circuit raceways.

3.3 EQUPMENT AND ENCLOSURE BONDING

A. Electrical distribution and utilization equipment enclosure ground bus, motor frames, manholes, metal structures and buildings, outdoor metal enclosures, fences and gates shall be bonded to the grounding system with conductor sizes as specified.

B. Connect the conductor to the metal enclosure using a UL listed connector, where the enclosure does not contain an internal ground bus.

C. Non-electrical equipment with metallic enclosures that are located outdoor, and without a cover or a shade, shall be connected to the grounding system.

3.4 ISOLATED GROUNDING

A. An isolated ground system shall be installed where required by an equipment manufacturer. The isolated ground conductor shall have green insulation with a yellow stripe and shall be run in the same raceway as the power and neutral conductors. The isolated ground bus shall be kept isolated from neutral and grounding buses.

B. Where specifically directed by the Owner and required by an equipment manufacturer, the Contractor shall provide an additional isolated ground conductor from the service or separately derived system to an isolated ground bus bar at each associated distribution point.

C. The neutral conductor from the ultra-isolation transformers shall be grounded only at the single point ground bus in the automatic transfer switch.

3.5 GROUNDING SYSTEM TESTS

A. The Contractor shall test the facility grounding system and the building grounding system to determine the ground resistance. The grounding test shall be IEEE Standard 81 using the NETA Fall-of-Potential procedure. A plot of ground resistance readings for each isolated ground rod, ground mat, or ground bus shall be submitted on 8-1/2 x 11-inch size graph paper. Point-to-point resistance measurements are not acceptable.

1. The current reference rod shall be driven at least 100 feet from the ground rod or grid under test or as recommended by IEEE Standard 81. The measurements shall be made at 10-foot intervals beginning 25 feet from the test electrode and ending 75 feet from it, in direct line between the ground rod or center of grid and the current reference electrode.

2. A grounding system that shows greater than 2-ohm resistance for the flat portion of the plotted data shall be considered inadequately grounded.

3. The Contractor shall add additional parallel connected ground rods and/or deeper driven rods until the ground resistance measurements meet the 2-ohm requirement. Additional ground rods will be paid for as extra work where the required numbers exceed that specified when authorized and approved by the Construction Manager.

4. Use of salts, water, or compounds to attain the specified ground resistance is not acceptable.

END OF SECTION

SECTION 26 05 29
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope.
2. Reference Standards.
3. Quality Assurance.
4. Submittals.
5. Products.
6. Execution.

1.2 SCOPE

A. This Section specifies requirements for design, furnishing and installation of support systems for electrical raceways, cables and enclosures.

1.3 REFERENCE STANDARDS

A. This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
ANSI C80.1	Rigid Steel Conduit-Zinc Coated
ASTM A48 REV A	Gray Iron Castings
ASTM F512	Smooth-Wall Polyvinylchloride Conduit and Fittings for Underground Installation
FEDSPEC WW-C-581E	Conduit, Metal, Rigid and Intermediate; and Coupling, Elbow, and Nipple, Electrical Conduit; Zinc Coated
FEDSPEC W-C-1094A	Conduit and Conduit Fittings, Plastic, Rigid

Reference	Title
NEMA ICS 6	Industrial Control and Systems Enclosures
NEMA TC2	Electrical Plastic Tubing (EPT) and Conduit (EPC 40 and EPC 80)
NEMA TC6	PVC and ABS Plastic Utilities Duct for Underground Installation
NEMA 250	Enclosures for Electrical Equipment (1000 volts maximum)
NFPA 70	National Electrical Code (NEC)
NFPA 79	Electrical Standards for Industrial Machinery
UL 1	Flexible Metal Electrical Conduit
UL 6	Rigid Metal Electrical Conduit
UL 360	Liquid Tight Flexible Electrical Conduit
UL 651	Rigid Nonmetal Electrical Conduit

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design, workmanship or materials.

1.5 SUBMITTALS

A. PROCEDURES: Section 01 32 19.

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the

requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

    a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

    b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

    a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

    b. Catalog cuts shall be edited to show only the items, model numbers, and information which apply.

    c. Submittals are to made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable. Submittals that are not submitted in the format outlined may be rejected outright and the Contractor is required to resubmit in the correct format.

4. Supports, seismic bracing, and other electrical system mounting elements are generally not shown on the plan drawings. Hangers, supports, seismic restraints, and other electrical system mounting elements shall be submitted in accordance 40 05 07.

PART 2 PRODUCTS

2.1 RACEWAY SUPPORTS

A. CONDUIT SUPPORTS

1. Framing channel with end caps and straps shall be provided to support groups of conduit. Individual conduit supports shall be one-hole pipe straps used with clamp backs and nesting backs where required. Material as specified herein.

2. Conduit supports for PVC coated rigid steel and PVC conduit systems shall be one-hole PVC coated rigid steel clamps or oversized stainless-steel clamps.

B. SUSPENDED RACEWAY SUPPORTS AND RACKS:

1. Suspended raceway supports shall consist of concrete inserts, steel rod hangers, and jam nuts supporting framing channel or lay-in pipe hangers as required. Framing channel shall be a minimum of 12-gauge. Material as specified herein.

2. Hanger rods shall be a minimum of 1/2-inch diameter all-thread rod and shall meet ASTM A193. Suspended raceway supports and racks shall be braced for seismic forces as specified in Section 40 05 07.

C. MATERIALS: Table A specifies the type of raceway supports required for each location and application.

Table A

Location	Framing Channel and Accessories	Threaded Rod, Hardware, & Fittings
Indoor Dry	Zinc Plated Steel	Zinc Plated Steel
Indoor, Wet	316 Stainless Steel	316 Stainless Steel
Outdoor	316 Stainless Steel	316 Stainless Steel
Submerged	316 Stainless Steel	316 Stainless Steel
Headspace	316 Stainless Steel	316 Stainless Steel
Chemical Corrosive	316 Stainless Steel	316 Stainless Steel
Process Corrosive	316 Stainless Steel	316 Stainless Steel

2.2 EQUIPMENT SUPPORTS

A. Equipment supports shall be installed where shown on the drawings and as required to support the panels and enclosures being installed.

B. Equipment support materials shall adhere to Table A above unless specified otherwise on the drawings.

C. Equipment supports shall be installed per details in the Construction Documents.

2.3 ANCHOR BOLTS

A. Anchor bolts shall be as specified in Section 05 50 00.

PART 3 EXECUTION

3.1 INSTALLATION

A. Hangers and supports shall be installed with spacing between support points in compliance with all applicable codes.

B. The cut ends of support channels shall be smoothed and without burrs left from cutting.

END OF SECTION

SECTION 26 05 33
RACEWAYS, BOXES, AND FITTINGS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope.
2. Reference Standards.
3. Quality Assurance.
4. Definitions.
5. Submittals.
6. Products.
7. Installation.
8. Raceway Specification Sheets.

1.2 SCOPE

A. This section covers the furnishing and installation of electrical conduits, wireways, pull boxes, electrical vaults, hand holes, and fittings. Raceways shall be provided for lighting, receptacles, power, control, instrumentation, signaling and grounding systems.

1.3 REFERENCE STANDARDS

A. This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
ANSI C80.1	Rigid Steel Conduit-Zinc Coated
ANSI C80.3	Electrical Metallic Tubing-Zinc Coated
ASTM F512	Smooth-Wall Polyvinylchloride Conduit and Fittings for Underground Installation
FEDSPEC WW-C-581E	Conduit, Metal, Rigid and Intermediate; and Coupling, Elbow, and Nipple, Electrical Conduit; Zinc Coated
FEDSPEC W-C-1094A	Conduit and Conduit Fittings, Plastic, Rigid
NEMA ICS 6	Industrial Control and Systems Enclosures
NEMA TC2	Electrical Plastic Tubing (EPT) and Conduit (EPC 40 and EPC 80)
NEMA TC6	PVC and ABS Plastic Utilities Duct for Underground Installation
NECA-1	National Electrical Contractors Association – Standard Practices for Workmanship
WAC	Washington Administration Code
IBC	International Building Code

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work

B. Listing and Labeling: Provide raceway and boxes that are Listed and Labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the Authority Having Jurisdiction, and marked for intended use for the location and environment in which they are installed.

C. Comply with NECA's "National Electrical Installation Standards."

D. Comply with NFPA 70, as adopted and administered by the Authority Having Jurisdiction.

1.5 DEFINITIONS

A. Conduit: Exposed or concealed conduit and other raceway, either metallic or nonmetallic, used above grade.

B. Duct: Electrical conduit and other raceways, either metallic or nonmetallic, used underground, embedded in earth or concrete.

C. Ductbank: 2 or more conduits or other raceway installed underground in the same trench or concrete envelope.

D. Handhole/Pull Box: An underground structure provided with an open or closed bottom, and sized to allow personnel to reach into, but not enter, for the purpose of installing, operating or maintaining equipment or wiring or both.

E. Manhole: An underground utility structure, large enough for a person to enter, with facilities for installing, operating and maintaining submersible equipment and cables.

F. Vault: An underground structurally solid utility structure including all sides, top and bottom, where entry is limited to personal qualified to install, maintain, operate or inspect the equipment or cable enclosed. The enclosure may have openings for ventilation, personnel access, cable entrance, and other openings required for operation of equipment in the vault.

1.6 DELIVERY AND STORAGE:

A. Equipment shall be handled and stored in accordance with manufacturer's instructions.

B. Store indoors in clean dry space with uniform temperature to prevent condensation and per manufacturer's recommendations. Protect from exposure to dirt, fumes, water, corrosive substances, and physical damage.

C. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.

D. Provide equipment and personnel to handle products; use methods to prevent soiling, disfigurement, or damage

1.7 SUBMITTALS

A. PROCEDURES: Section 01 32 19 Submittal Procedures

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

    a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

    b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

    a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

    b. Catalog cuts shall be edited to show only the items, model numbers, and information which apply.

    c. Submittals are to made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable. Submittals that are not submitted in the format outlined may be rejected outright and the Contractor is required to resubmit in the correct format.

C. Submittals shall include the following:

1. Product Data:

    a. Conduit and accessories including elbows, thread sealant, end bells, anti-corrosion wrap, fittings and solvent cement.

1.8 DELIVERY, STORAGE AND HANDLING

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

B. Store indoors in clean dry space with uniform temperature to prevent condensation and per manufacturer's recommendations. Protect from exposure to dirt, fumes, water, corrosive substances, and physical damage.

C. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.

D. Provide equipment and personnel to handle products; use methods to prevent soiling, disfigurement, or damage

PART 2 PRODUCTS

2.1 RACEWAY

A. General requirements for raceway materials specified in this section are listed in the RACESPECS sheets at the end of this section. The type of raceway to be used for any given area and application shall conform to the requirements of Table A in this section.

2.2 RACEWAY SUPPORTS

A. All support systems for electrical systems shall be as specified in Section 26 05 29 Hangers and Supports for Electrical Systems.

2.3 BOXES AND FITTINGS

A. PULL BOXES AND WIRING GUTTERS: Indoor boxes above grade and in unclassified indoor areas shall be NEMA 12 with hinged doors. Similar enclosures for below grade and outdoors shall be rated NEMA 4X (Type 316 stainless steel) with hinged doors. Boxes in hazardous classified areas shall be rated for the classification, NEMA 7. Box covers shall be provided with hinged doors with quick release latches and oil resistant gaskets. Box and gutter sizes, metal thickness, and grounding shall comply with the National Electrical Code. Bolt-on junction and pull box covers are not allowed.

B. TERMINAL CABINETS: Terminal cabinets located indoors and in unclassified indoor areas shall be NEMA 12. Cabinets located below grade, outdoors, and in corrosive or damp areas shall be NEMA 4X (Type 316 stainless steel). Cabinets in hazardous classified areas shall be rated for the classification, NEMA 7. Cabinets shall be provided with hinged doors with quick release latches. Adjustable terminal strip mounting accessories shall be provided. Cabinets shall be provided with channel mounted terminal blocks rated 30 amperes, 600-volt AC. Terminals shall be No. 8 minimum strap-screw type, suitable for ring tongue or locking spade terminals. Hoffman type CHQR, or approved equal.

C. PULL/JUNCTION BOXES:

1. Indoor boxes above grade and in unclassified indoor areas shall be NEMA 12 with hinged doors. Similar enclosures for below grade and outdoors shall be rated NEMA 4X (Type 316 stainless steel) with hinged doors. Boxes in hazardous classified areas shall be rated for the classification, NEMA 7. Pull and junction boxes for use in raceway systems with conduits 1-1/4" or larger shall be hinged boxes with 2 screw driver operable or quick release latches. Minimum depth of box shall be 5.3", the minimum size shall be as shown on the drawings or as required for the application or NEC. Hoffman type CH or approved equal. For damp, below grade, outdoor, or corrosive applications provide Hoffman type CHFNFSS or approved equal.

2. For Hazardous areas provide Cast copper free aluminum box with neoprene gasketed screw on cover. Crouse-Hinds GUE, GUB, or approved equal.

2.4 EXPOSED NON-HAZARDOUS ENVIRONMENT

A. Conduit that leaves in the underground duct bank into a nonhazardous environment shall use GRS type conduit.

B. Sealing: Provide temporary closure at all duct terminations in manholes and vaults installed in this Project. Use sealing compound and plugs to withstand a minimum of 15 psi hydrostatic pressure.

C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's instructions. Stagger couplings so those of adjacent ducts do not lie in the same plane.

D. Unused conduits shall be provided with conduit seal caps.

2.5 EXPOSED HAZARDOUS ENVIRONMENT

A. Conduit that leaves in the underground duct bank into a hazardous environment shall use PGRS type conduit along with all proper.

B. Sealing: Provide temporary closure at all duct terminations in manholes and vaults installed in this Project. Use sealing compound and plugs to withstand a minimum of 15 psi hydrostatic pressure.

C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's instructions. Stagger couplings so those of adjacent ducts do not lie in the same plane.

D. Unused conduits shall be provided with conduit seal caps.

2.6 NAMEPLATES

A. Nameplates shall be provided for all pull and junction boxes in accordance with the requirements of Section 26 05 00. Nameplate numbering shall be as indicated on the drawings. Where no wording is specified, the Contractor shall provide the functional description of the device on the nameplate or as required by the Engineer and Owner. Any nameplates provided where the wording is not specified shall first be approved by the Engineer and Owner.

PART 3 EXECUTION

3.1 INSTALLATION:

A. Table A specifies the type of raceway required for each location and application. Unscheduled conduit, (i.e. lighting, convenience outlets, etc.), not shown on the drawings shall be in accordance with Table A below.

Table A

Location	Application/Condition	RACESPEC
Indoor Dry	Exposed	GRS
Indoor Wet	Exposed	PGRS
Outdoor	Exposed	PGRS
Concealed	Power circuits embedded in concrete structure or beneath slab-on-grade	PVC4
Concealed	Instrumentation, communications and data signals encased in concrete, duct bank	PGRS
Underground	Power circuits encased in concrete, duct bank	PVC4
Underground	Power circuits directly buried	PVC4
Underground	Instrumentation, communications and data signals directly buried	PVC4
Nonhazardous	Final connection to equipment and light fixtures	LFS
Corrosive	Exposed	PGRS
Hazardous corrosive	Exposed	PGRS
Architecturally finished areas	Final connection to light fixtures	FLEX

3.2 CONDUIT

A. GENERAL:

1. The number of directional changes of a conduit shall be limited to 270 degrees in any run between pull boxes.

2. Conduit runs shall be limited to a maximum of 400 feet, less 100 feet or fraction thereof, for every 90 degrees of change in direction.

3. Provide pull and junction boxes per code. When shown on drawings, box or manhole sizes shall be considered to be minimum sizes and shall be upsized by the Contractor for ease of pulling wire or if required by NEC.

B. INDOOR AND OUTDOOR CONDUIT SYSTEMS:

1. In general, Contractor shall be responsible for determining conduit routing that conforms to the specified installation requirements:

   a. Conduits for lighting and outlets: exposed

   b. Conduits for lighting and outlets: concealed

   c. Conduits for process equipment: exposed

   d. Conduit inside structures: exposed

   e. Conduit concealed inside water chambers slabs and walls: not permitted.

2. Existing conduit installations may be utilized provided the installation meets the following requirements:

   a. The installation meets the project specifications.

   b. The raceway meets the minimum National Electrical Code (NEC) requirements.

   c. The raceway is re-labeled per the project raceway schedules.

3. Conduit installation shall conform to the requirements of the RACESPEC sheets and the following specified installation requirements:

   a. Exposed conduit: Install parallel or perpendicular to structural members and surfaces. Install conduit horizontally and allow minimum headroom of 7 feet.

   b. Route two or more exposed conduits in the same general routing parallel with symmetrical bends.

c. Maintain minimum spacing between exposed parallel conduit and piping runs in accordance with the following when the runs are greater than 30 feet:

1) Between instrumentation and telecommunication: 1 inch

2) Between instrumentation and 125 VDC, 48 VDC, and 24 VDC: 2 inches

3) Between instrumentation and 600 VAC and less power: 6 inches

4) Between instrumentation and 600 VAC and greater power: 12 inches

5) Between telecommunication and 125 VDC, 48 VDC, and 24 VDC: 2 inches

6) Between telecommunication and 600 VAC and less power: 6 inches

7) Between telecommunication and 600 VAC and greater power: 12 inches

8) Between 125 VDC, 48 VDC, and 24 VDC and 600 VAC and less power: 2 inches

9) Between 125 VDC, 48 VDC, and 24 VDC and 600 VAC and greater power: 2 inches

10) Between 600 VAC and less power and 600 VAC and greater power: 2 inches

11) Between process, gas, air and water pipes: 6 inches

d. Space exposed conduit installed on supports not more than 10 feet apart. Space multiple conduits in parallel and use framing channel.

e. Comply with the requirements of Section 26 05 00 and herein, where conduits are suspended from the ceiling.

f. Secure conduit rack supports to concrete walls and ceilings with cast-in-place anchors or framing channel concrete inserts.

g. Install conduits at least 6 inches from high temperature piping, ducts, and flues with temperatures higher than 90-degree C.

h. Install conduits so as not to interfere with access to valves, pumps, fans and other process equipment. Provide at least 6 inches between conduit all such equipment.

i. Install conduits between the reinforcing steel in walls or slabs that have reinforcing in both faces.

j. Place conduits under the reinforcement in slabs with only a single layer of reinforcing steel. Separation between conduits, conduits and reinforcement, and conduits and surfaces of concrete shall be maintained in accordance with IBC.

k. Route conduit clear of structural openings and indicated future openings.

l. Provide conduits with flashed and watertight seals routed through roofs or metal walls.

m. Grout conduits into openings cut into concrete and masonry structures.

n. Cap conduits or plug flush conduits during construction to prevent entrance of dirt, trash, and water. Cap or plug empty conduits designated as “future”, “spare”, or “empty” and include a pulling line accessible at both ends. Use anti-seize compound on cap and plug threads prior to installation.

o. Determine concealed conduit stubup locations from the manufacturer’s shop drawings. Terminate concealed conduit for future use in specified equipment.

p. Install conduit flush with structural surfaces with galvanized couplings and plugs. Caps and plugs shall match the conduit system.

q. Provide concealed portions of conduits for future equipment where the drawings indicate future equipment. Match the existing installation for duplicate equipment.

r. Terminate conduits that enter enclosures with fittings that match the NEMA rating of the enclosure.

s. Underground metallic or nonmetallic conduit that turn out of concrete, masonry or earth: Install a 90-degree elbow of PVC-coated rigid steel conduit before emergence above ground.

t. Provide O-Z Gedney “Type DX” or Crouse-Hinds “Type XD” bonded, weather-tight expansion and deflection fitting for the conduit size where conduit across structural joints that allows structural movement.

C. UNDERGROUND CONDUIT SYSTEM: Excavation, backfilling, and concrete work shall conform to respective sections of these specifications. Underground conduit shall conform to the following requirements:

1. Underground conduit bend radius shall be not less than 2 feet minimum at vertical risers and shall be not less than 3 feet elsewhere.

2. Where conduit and concrete encasement are terminated underground, the conduit and reinforcing shall both extend at least 2 feet past the concrete. Conduits shall be capped and threads protected. Steel surfaces shall be given two coats of epoxy paint.

3. Underground conduits and conduit banks shall have 2 feet minimum earth cover unless otherwise shown.

4. Thoroughly swab conduits and raceways on the inside, immediately upon completion of pouring concrete.

5. After the concrete has set and before backfilling, pull a mandrel through each conduit. The mandrel shall have a diameter equal to the nominal conduit inside diameter minus 1/2 inch and shall not be less than 4 inches long.

6. If the mandrel showed signs of protrusions on the inside of the conduit, the conduit shall be repaired or replaced.

7. Provide manufactured plastic conduit spacers anchored to prevent movement during the concrete pour. Manufacture: Carlon, PW Pipe, Underground Devices, or equal.

8. Backfill duct banks with clean fill compacted to 90-percent in 6-inch lifts after concrete has cured. Refer to Section 03 30 00 for concrete requirements including minimum 7 days of cure time prior to backfill over duct banks.

9. Provide PVC threaded adapter with female threads where PVC conduit is joined to steel conduit. Procedure:

a. Before assembly: Double coat steel conduit with Red-Robroy, Green-Permacote, Blue-Ocal or approved equal product.

b. After assembly: Seal with 65-mil thick, 2-inch-wide mastic sealing tape to 1/2-inch beyond threads. Products: 3M Scotch 2228; Plymouth 02625; or approved equal.

c. Cover with 20-mil corrosion protection tape applied in 1/2-lap layers to 2-inch beyond threads. Products: 3M Scotchwrap 51; Plymouth Plywrap 12; or approved equal.

10. Provide PVC conduit with bell ends where duct banks terminate at walls, electrical vaults, or hand holes. Install bell ends flush with finished concrete.

11. Provide PVC conduit with bell ends where conduit rise below grade into a floor mounted electrical panel, electrical cabinet, MCC, or switchboard.

12. Separate power conduits from signal conduit within the same duct bank by 12” or greater separation where possible.

13. Separate high voltage duct banks from low voltage duct banks, where shown.

14. Provide wireways for transition from underslab conduits rising into wall-mounted panels where the number of conduits exceed the NEC allowable panel space in the bottom of the panel. Provide conduit sleeves or fitting for panel transition. Continuous thread or all-thread is prohibited.

D. CONDUIT SEAL-OFF FITTINGS:

1. Conduits passing:

a. Between Class I, Division 1 area and Class I, Division 2 area; provide sealing fittings located at the boundary in accordance with NEC Article- 500.

b. From hazardous or corrosive area into a non-hazardous or non-corrosive area.

c. Install the seal-off material in the conduit seal-off fittings after inspection.

E. CONDUIT SEALING MATERIAL: Provide HYDRA-SEAL® Handi-Polyurethane-Foam or approved equal product to seal conduits and inner ducts.

1. Sealing product required features

a. Compatible with common cable jacket materials.

b. ASTM E-84 flame spread requirements and UL Classified.

c. Pre-pressurized, portable, one-component closed-cell foam sealing system.

d. Dries tack-free within 15 minutes and cures within 24 hours.

e. Reacts with applied moisture or with ambient humidity.

f. Remove over-spray with acetone and remove cured foam mechanically

2. Application Criteria:

a. Apply in ambient temperatures between 60° to 100° F.

b. Apply bead onto clean surface.

3.3 RACEWAY NUMBERING

A. Each conduit shall be provided with a number tag at each end and in each manhole, hand hole, or pull box.

B. Within electrical vaults, glue raceway tag to manhole wall next to raceway penetration.

3.4 RACEWAY SCHEDULE

A. GENERAL: Raceways are scheduled on the drawings.

B. UNSCHEDULED RACEWAY:

1. With the exception of lighting and receptacle circuits, the type and size of raceway shall be as specified on the drawings or schedules.

2. Unscheduled lighting and receptacle raceways shall be sized by the Contractor in accordance with the NEC. Minimum size shall be 3/4 inch for exposed and 1 inch for embedded raceway.

3.5 RACESPEC SHEETS

A. The following RACESPECS are included in Paragraph 3.7.

1. FLEX
2. GRS
3. LFS
4. PGRS

5. PVC4

3.6 RACEWAY SPECIFICATION SHEETS (RACESPEC)

A. RACEWAY SPECIFICATION SHEETS (RACESPEC) – FLEX

1. Description: Flexible Steel Conduit

2. Application: Final connection to equipment subject to vibration or adjustment.

3. Compliance: UL 1

4. Construction: Spirally wound galvanized steel strip with successive convolutions securely interlocked

5. Minimum size: ½ inch

6. Fittings: Compression type

7. Other: FLEX shall be provided with an internal ground wire.

B. RACEWAY SPECIFICATION SHEETS (RACESPEC) – GRS

1. Description: Galvanized Rigid Steel Conduit (GRS).

2. Application: Final connection to equipment subject to vibration or adjustment.

3. Compliance: ANSI and UL

4. Finish: Hot-dip galvanized after fabrication, inside and outside. Smooth finished surfaces.

5. Minimum size: Unless otherwise specified, ¾ inch for exposed, 1 inch for embedded, encased, or otherwise inaccessible.

6. Fittings:

a. Locknuts, Rings, Hubs: Hot-dip galvanized insulated throat with bonding locknut or ring. The hubs shall utilize a neoprene “O” ring and provide a watertight connection. O-Z Gedney, CHM-XXT, or approved equal.

b. Unions: Electro-galvanized ferrous alloy type Appleton UNF or UNY, Crouse-Hinds UNF or UNY, or approved equal. Threadless fittings are not acceptable.

7. Conduit Bodies: 40% Oversized conduit bodies (Similar to T&B Form 8): Ferrous alloy type with screw taps for fastening covers to match the conduit system. Gaskets shall be made of neoprene.

8. Boxes:

    a. Indoor: Type FD cast ferrous for all device boxes and for junction boxes less than 6 inches square.

    b. Outdoor: Type FD cast ferrous for all device boxes and for junction boxes less than 6 inches square.

    c. Corrosive: NEMA 4X stainless steel or nonmetallic, as specified.

    d. Hazardous: NEMA Class 7 cast ferrous.

9. Elbows:

    a. ¾ '' thru 1 ½'': Factory fabricated or field bent

    b. 2'' thru 6'': Factory fabricated only

10. Conduit Bodies (Oversized):

    a. ¾ '' thru 4'': Malleable iron, hot-dip galvanized, unless otherwise noted. Neoprene gaskets for all access plates. Tapered threads for conduit entrances

    b. 5'' and 6'': Electro-galvanized iron or cast-iron box

11. Expansion Fittings: Expansion fittings in embedded runs shall be watertight with an internal bonding jumper. The expansion material shall be neoprene allowing for 3/4-inch movement in any direction

12. Manufacturers: Appleton, Crouse-Hinds, Hubbell, O. Z. Gedney, or approved equal

13. Installation:

    a. Rigid steel conduit shall be made up tight and with conductive thread compound. Joints shall be made with standard couplings or threaded unions. Steel conduit shall be supported away from the structures using hot-dip galvanized malleable iron straps with nesting backs or framing channel.

    b. Conduit entering boxes shall be terminated with a threaded hub with a grounding bushing.

c. Exposed male threads on rigid steel conduit shall be coated with zinc-rich paint.

C. RACEWAY SPECIFICATION SHEETS (RACESPEC) - LFS

1. Description: Liquidtight Flexible Steel Conduit.

2. Application: Final connection to equipment subject to vibration or adjustment.

3. Compliance: UL 360.

4. Construction: Spirally wound galvanized steel strip with successive convolutions securely interlocked and jacketed with liquidtight plastic cover.

5. Minimum size: ¾ inch, except for instruments where ½ inch is acceptable.

6. Fittings:

a. Cadmium-plated malleable iron body and gland nut with cast-in lug, brass grounding ferrule threaded to engage conduit spiral

b. O-ring seals around the conduit and box connection and insulated throat

c. Provide forty-five and ninety-degree fittings where applicable

d. Provide PVC coated flexible conduit and fittings where the conduit system is PVC coated

7. Installation: Length of flexible liquidtight conduit shall not exceed 36 inches in length. Use conductive thread compound.

D. RACEWAY SPECIFICATION SHEETS (RACESPEC) – PGRS

1. Description:

a. Rigid Steel Conduit, Corrosion-Resistant, Polyvinyl Chloride (PVC) Coated.

b. Provide factory made and coated elbows.

2. Compliance: ANSI and UL. The PVC coated rigid galvanized steel conduit shall meet NEMA RN1-2005 and UL-6 PVC adhesion performance requirements.

3. Finish:

    a. PGRS shall be hot-dip galvanized rigid steel conduit as specified in 26 05 33-3.7 GRS, with a PVC Coating. The PVC coating shall be gray, minimum 40 mils thick, bonded to the outside and continuous over the entire length of the conduit except at the threads, and be free of blisters, bubbles, or pinholes. Thread protectors shall be used on the exposed threads of the PVC coated conduit

    b. A 2-mil coat of urethane enamel coating shall be bonded to the inside. Coating shall be free of pinholes. Bond strength shall exceed the tensile strength of the PVC coat.

4. Minimum size: ¾ inch

5. Fittings: Similarly coated to the same thickness as the conduit and provided with Type 316 stainless steel hardware. Conduit and fittings shall be manufactured by the same company Conduit and fittings shall be coated by the same company. Male threads on elbows and nipples, and female threads on fittings or conduit couplings shall be protected by application of urethane coating.

6. Covers: PVC coated covers shall have a NEMA 4X rating and stainless-steel hardware.

7. Conduit Bodies: 40% Oversized conduit bodies with covers as specified above.

8. Hubs:

    a. Hubs for connection of conduit to junction, device, or terminal boxes shall be threaded cast ferrous alloy.

    b. Hubs shall have the same PVC coating as the conduit and insulating grounding bushings. Hubs shall utilize a neoprene “O” ring and shall provide a watertight connection.

9. Boxes:

    a. Nonhazardous: Type FD cast ferrous with PVC coating for all device boxes and for junction boxes less than 6 inches square.

    b. Hazardous: NEMA Class 4X stainless steel or nonmetallic for junction boxes 6 inches square and larger.

c. Manufacturers: Ocal Blue, Robroy Industries, Plasti-Bond, Perma-Cote, KorKap or approved equal.

10. Installation:

a. Plastic coated conduit shall be made up tight, threaded, and installed using tools approved by the PVC-coated conduit manufacturer.

b. Exposed conduit threads shall be covered by a plastic overlap coated and sealed per manufacturer's recommendations.

c. Pipe wrenches and channel locks shall not be used for tightening plastic-coated conduits. Damaged areas shall be patched, using manufacturer's recommended material. The area to be patched shall be built up to the full thickness of the coating. Painted fittings are not acceptable.

d. PVC coated conduit shall be supported away from the structure using PVC coated conduit wall hangers or PVC coated conduit mounting hardware.

e. Damaged work shall be replaced.

11. Training: Installers shall be trained and certified in the proper installation techniques provided by the PVC-coated conduit system manufacture.

E. RACEWAY SPECIFICATION SHEETS (RACESPEC) – PVC4

1. Description: Rigid Nonmetallic Conduit.

2. Application: Heavy wall thickness for direct bury, concrete encasement or surface mounting where not subject to physical damage.

3. Compliance: NEMA TC2, UL 651

4. Construction: Schedule 40, high-impact, polyvinylchloride (PVC).

5. Minimum size: ¾ inch exposed; 1 inch embedded or encased

6. Fittings: PVC solvent weld type.

7. Boxes:

a. Indoor: NEMA Class 4, nonmetallic

b. Outdoor and corrosive:

1) NEMA Class 4X stainless steel or nonmetallic for junction boxes 6 inches square and larger.

2) NEMA Class 4X, nonmetallic

8. Manufacturers: Cantex, Allied, Prime or approved equal

9. Installation:

a. PVC conduit entering fiberglass boxes or cabinets shall be secured by threaded bushings on the interior of the box and shall be terminated with a threaded male terminal adapter having a neoprene O ring.

b. Joints shall be made with standard PVC couplings.

c. PVC conduit shall have bell ends where terminated at walls and boxes.

END OF SECTION

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope.
2. Reference Standards.
3. Quality Assurance.
4. Submittals.
5. Coordination.
6. Products.
7. Execution.

1.2 SCOPE

A. This section includes identification of electrical materials, equipment, and installations. The extent and location of “Electrical Identification” Work is shown in the Contract Documents.

1.3 REFERENCE STANDARDS

A. NFPA 70E National Electrical Safety Code

B. NFPA 70 National Electrical Code

C. ANSI A13.1.,

D. ANSI Z535.4

E. 29 CFR 1910.144

F. 29 CFR 1910.145.

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work.

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design, workmanship or materials.

1.5 SUBMITTALS

A. PROCEDURES: Section 01 32 19

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

b. Catalog cuts shall be edited to show only the items, model numbers, and information which apply.

c. Submittals are to made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The

PDF shall be searchable. Submittals that are not submitted in the format outlined may be rejected outright and the Contractor is required to resubmit in the correct format.

C. Submittals shall include the following.

1. Product Data for each type of product specified.

2. Schedule of identification nomenclature to be used for identification signs and labels.

1.6 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 PRODUCTS

2.1 LABEL TYPES

A. Manufacturer’s standard products with colors prescribed by ANSI A13.1, NFPA 70, and these Specifications. Only temporary markings that are removable without damaging finish are permitted on equipment.

1. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Install labels and nameplates parallel to equipment lines. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.

2. Provide engraved laminated phenolic plastic or melamine label for equipment as noted below. Securely attach engraved labels with blunt end, self-tapping stainless-steel screws with blunt ends. Sheet metal screws are not allowed. Provide white letters on black background for normal power, white letters on red background for emergency power.

    a. Provide 5/8-inch minimum height letters on the following equipment:

        1) Panelboards, provide labels and warning signs. Secure nameplates to inside surface of door where panel is recessed in finished locations.

        2) Switchboards/distribution centers, motor control centers and power centers, pad mounted transformers

        3) Secondary feeder breakers in distribution equipment

        4) Automatic and manual transfer switches. Labels shall include both normal and emergency source and load.

        5) Special equipment housed in cabinets, on outside door.

        6) Terminal junction boxes and data gathering panels

        7) Cable trays.

        8) UPS equipment

    b. Provide 1/4-inch minimum height letters on the following equipment:

        1) Disconnects and starters for motors on fixed appliances and starters in MCCs or fabricated Motor control panels.

        2) Motor controllers and VFDs.

        3) Enclosed switches and circuit breakers

        4) Low voltage transformers

        5) Feeder circuit breakers in switchboards, switchgear, and distribution panelboards. Circuit breakers shall be labeled with destination panel name or load.

        6) Duplex receptacles (self-adhesive labels indicating panel and circuit number)

7) Local control panels

8) Raceways and junction boxes

9) Instrumentation Labels

c. Refer to table and descriptions in subparagraphs below for acceptable labeling procedure:

Section	Title	Label Types														
		B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
26 05 26	Grounding			⅝		X										
26 05 23	Control/Signal Transmission Media	X	X												X	
26 05 19	600-Volt or Less Wire and Cable	X	X			X									X	
26 05 13	Medium-Voltage Cables						X								X	
26 05 33	Raceways and Boxes															X
26 05 43	Underground Ducts and Manholes						X		X	X	X	X			X	
26 27 16	Cabinets and Enclosures			⅜												
26 27 26	Wiring Devices				¼											
no section	Electrical Power Monitoring and Control			⅜												
26 19 13 16	Reduced Voltage Motor Controllers			⅝							X					
26 28 16	Enclosed Switches and Circuit Breakers			⅝												
26 09 26	Panelboards			½												
26 29 13	Motor Controllers			⅜												
26 25 00	Low-Voltage Busway			⅜								X	X			
26 22 00	Dry-Type Transformers (600-Volt and Less)			½												
26 28 13	Fuses				X											
26 43 13	Transient Voltage Suppression			⅜												
26 51 00	Interior Lighting				X											
26 08 00	Acceptance Testing													X		

B. Heat-shrink preprinted tubes, flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around cable it identifies. Full shrink recovery at a maximum of 200-degree F. Comply with UL 224.

C. Preprinted, flexible, self-adhesive vinyl label laminated with a clear weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.

D. Engraved melamine plastic laminate flat stock, 1/16-inch minimum thickness for sizes up to 15 square inches. Use 1/8-inch minimum for sizes larger than 15 square inches. Black with white letters for normal power systems and red with white letters for emergency power systems, with height as shown in table above unless specified otherwise. UV-inhibited when used outdoors. Secure with stainless steel drive screws, stainless steel self-tapping screws or stainless-steel oval-head 6-32 screws tapped into enclosure, or with stainless steel bolts with elastic stopnut.

E. Adhesive-backed plastic machine-printed labels, white with black letters. Indicate panel name and circuit number(s).

1. For Raceway at more than 600V, provide black letters on an orange field label with the legend, “HIGH VOLTAGE”. Indicate feeder number.

F. Plain-colored vinyl adhesive tape, 3-mil minimum by 1-inch-wide minimum. Apply 1/2-inch minimum over-wrap through 2-inch minimum length. Refer to Section 26 05 19 – Low-Voltage Conductors, Wires and Cables for color.

G. Engraved plastic melamine laminate flat stock. 1/16-inch minimum thickness for sizes up to and including 15 square inches, 1/8” thick for larger than 15 square inches. White background with black letters for normal power, red background with white letters for emergency power. Holes at each end for attachment with nylon ty-wraps.

H. Underground line warning tape with pre-printed warning message identifying type of system. Material shall be pigmented polyolefin, continuous-printed on one side, and compounded for unlimited life when direct buried. 6-inch minimum width by 4-mils thick. Tensile strength of 1750 psi.

1. Inscriptions for Red-Colored Tapes: ELECTRICAL LINE, HIGH VOLTAGE.

2. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATION CABLE, OPTICAL FIBER CABLE.

I. Underground metallic line-warning tape with pre-printed warning message identifying type of system. Material shall be detectable three-layer laminate consisting of printed pigmented polyolefin, a solid aluminum-foil core with a clear protective film that allows inspection of the continuity of the conductive core, and compounded for unlimited life when direct buried. Use when metal-detection of line is required on Medium Voltage Systems. 6-inch minimum width by 4-mils thick.

1. Inscriptions for Red-Colored Tapes: “CAUTION: MEDIUM VOLTAGE ELECTRICAL LINE BELOW”.

J. Warning signs: Baked Enamel on aluminum plate, punched or drilled for fasteners, with colors, legend, and size required for applications. ¼-inch grommets in corners for mounting. Minimum nominal size of 7 by 10 inches with 0.040-inch minimum thickness. OSHA standard wording where approved. Custom wording if required. Secure with non-corrosive fasteners.

1. Where applicable, provide labels for multiple power source warning: “DANGER – ELECTRICAL SHOCK HAZARD – EQUIPMENT HAS MULTIPLE POWER SOURCES”

K. Warning labels: Self-adhesive, multicolor, flexible pressure-sensitive vinyl conforming to OSHA “Danger” and “Caution” standards. 2½ x1¾” minimum with black letters on yellow background. Label shall read: “WARNING! DO NOT USE AS WALKWAY, LADDER, OR SUPPORT FOR LADDERS OR PERSONNEL - CABLES ADDED AFTER INITIAL INSTALLATION REQUIRE POS/F & I APPROVAL.”

1. Where applicable, provide labels for multiple power source warning: “DANGER – ELECTRICAL SHOCK HAZARD – EQUIPMENT HAS MULTIPLE POWER SOURCES”

L. Stencils: Machine-punched patterns, nonfading waterproof paint with color and formulation appropriate for material and location. Minimum letter height shall be 1 inch.

M. Adhesive-backed metal labels manufactured with testing agency logo. Punched or engraved with actual settings and date. Label shall be 1/16-inch minimum thickness for sizes up to 15 square inches. Use 1/8-inch minimum for sizes larger than 20 square inches. Black with white letters for normal power systems and red with white letters for emergency power systems, with height as shown in table above unless specified otherwise.

N. Stainless-steel machine or hand-stamped wire marker plates with one hole at each end for attachment with non-corrosive fasteners that do 0.010-inch minimum thickness (for outdoor application).

O. Adhesive machine-printed plastic tape, cut to length, black with white letters unless specified otherwise. 3/8-inch minimum width of tape in unfinished areas only. Provide white lettering on red background when served by an emergency source.

2.2 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Floor Marking: Coordinate with the Port Electric Shop for painting working clearances on the floor in front of the equipment.

B. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior and interior).

PART 3 EXECUTION

3.1 INSTALLATION

A. Fasteners for labels and signs: Self tapping, blunt-ended stainless-steel screws, or stainless-steel machine screws with nuts and flat and lock washers. Sheet metal screws are not acceptable. Self-drilling screws are not allowed.

B. Install identification labels according to manufacturer's written instructions.

C. Install labels where indicated and as required by the Authority Having Jurisdiction and the Department of Labor and Industries. Locate for optimum viewing and without interference with the operation and maintenance of equipment.

D. Verify identity of each item before installing identification products.

E. Labeling abbreviations not permitted without F&I approval.

F. Temporary markings allowed only if removable without damage to equipment or enclosure finish.

G. System Identification Color-Coding Bands for Raceways: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.

1. 208/120V Blue

2. 480/277V Yellow

3. Controls Black

H. Cable Ties: For attaching tags. Use general-purpose type, fungus inert, self-extinguishing, one-piece, self-locking Type 6/6 nylon, except as listed below:

1. Outdoors: UV-stabilized nylon.

2. In spaces handling environmental air: Plenum rated.

I. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

J. Coordinate names, abbreviations, colors, graphics and other designations used for electrical identification with corresponding designations used in the Contract Documents or as required by codes and standards. Use consistent designations throughout the Project. Labeling abbreviations are not allowed.

K. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish Work.

1. Coordinate installing electrical identifying labels prior to installing acoustical ceilings and similar finishes that conceal such items.

L. Clean surfaces of dust, loose material, and oily films before applying painted or self-adhesive identification products.

M. Painted Identification Products:

1. Prime surfaces according to manufacturer's instructions prior to applying painted labels:

a. For galvanized metal, use single-component, acrylic vehicle coating formulated for galvanized surfaces.

b. For concrete masonry units, use heavy-duty, acrylic-resin block filler.

c. For concrete surfaces, use clear, alkali-resistant, alkyd binder-type sealer.

2. Apply one intermediate and one finish coat of paint.

3.2 IDENTIFICATION SCHEDULE

A. Instrumentation Labels: Affix permanent type nameplate or tag on all field-mounted instruments, transmitters, pressure gauges, and control valves with proper identification number and service description.

1. Provide 3"x1" aluminum or stainless-steel tag stamped with the instrument loop number designation and the calibrated range.

B. Accessible Raceways, More Than 600 V: Self-adhesive vinyl labels. Install labels at all conduit penetrations and along length of exposed conduit run at 25-foot maximum intervals.

C. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.

1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for feeder and branch-circuit conductors.

a. Provide colored insulation when available, typically for wire sized #8 AWG and smaller.

b. Provide minimum 2-inch-wide band of colored plastic tape at all terminations and splices (where allowed). 3M Scotch No. 35, [ ], Or Approved Equal Electrical Color Coding Tape.

c. Colors for 480/277V 3Ø, 4-wire systems:

1) Phase A (left or top): Brown.

2) Phase B (center): Orange.

3) Phase C (right or bottom): Yellow.

4) Neutral: Gray.

5) Ground: Green.

d. Colors for 208/120V, 3Ø, 4-wire systems:

1) Phase A (left or top): Black.

2) Phase B (center): Red.

3) Phase C (right or bottom): Blue.

4) Neutral: White.

5) Ground: Green.

6) Isolated Ground: Green with yellow or orange stripe.

e. 575V, 3Ø, 4-wire systems:

1) Phase A (left or top): Brown with purple stripe.

2) Phase B (center): Orange with purple stripe.

3) Phase C (right or bottom): Yellow with purple stripe.

4) Neutral: Gray with purple stripe.

5) Ground: Green.

f. Colors for 120/240V, 1Ø, 3-wire systems: (non-standard)

1) Phase A: Black.

2) Phase B: Red.

3) Neutral: White.

4) Ground: Green.

g. For 240-delta systems (obsolete) the color of the high leg (approximately 200 volts to ground) shall be red. Label interior of all equipment "CAUTION: HIGH LEG IS OVER 120V TO GROUND. DO NOT USE FOR 120V CIRCUITS".

h. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

2. Provide wire markers on each conductor in panelboards, gutters, pull boxes, outlet and junction boxes and at the load connection. Identify with branch circuit or feeder number for power and lighting circuits.

a. Install conductor labeling in panelboards and enclosures to ensure labels are visible.

D. Install instructional sign including the color code for grounded and ungrounded conductors using adhesive-film-type labels.

E. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.

1. Provide wire markers on each conductor in wire gutters, pull boxes, outlet and junction boxes and at the equipment connection. Identify with control wire number as indicated on schematics and interconnection diagrams or equipment manufacturer's shop drawings for control wiring.

F. Control-Circuit Conductor Termination Identification: For identification at terminations provide heat-shrink preprinted tubes with the conductor designation.

G. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.

3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.

H. Conductor Identification:

1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.

2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color coding for voltage and phase indication of secondary circuit.

3. Multiple Control and Communications Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color coding, or cable marking tape.

I. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.

1. Install underground-line warning tape for both direct-buried cables and cables in raceway.

J. Workspace Indication: Install floor marking tape or paint to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.

K. Warning, Caution, and Instruction Signs:

1. Install warning, caution, and instruction signs, where indicated or required to ensure safe operation and maintenance of electrical systems and of items to which they connect. Provide OSHA standard text where approved. Provide text of sufficient clarity and lettering of sufficient size to convey adequate information at each location. Mount permanently in an appropriate location. Comply with ANSI A13.1 standard color and design.

2. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.

3. Emergency-Operating Signs: Install engraved laminate signs with white legend on red background with minimum 3/8-inch-high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

L. Apply equipment identification labels of engraved plastic laminate on each major unit of equipment, including central or master unit of each system. This includes communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Except as otherwise indicated, provide a single line of text with 1/4-inch-high lettering on 1-inch-high label. Use white lettering on black field. Apply labels parallel to equipment lines.

M. Outdoor Equipment: Engraved, laminated acrylic or melamine label, to comply with requirements listed above. Provide panel schedule printed on 8.5x11 paper in Port standard format in each panelboard. Insert folded schedule in schedule holder on inside of panel door. Posted panel schedule shall be updated to reflect all new work in panel. Include project completion date on schedule.

N. Provide self-adhesive tape labels on all receptacle cover plates. Labels shall be machine printed with black lettering on white or clear background.

1. Indicate source panel name and circuit number.

2. Provide red lettering on white or clear background for devices on emergency circuits.

3. Where receptacle faceplate is dark color, provide white letters on clear background.

END OF SECTION

SECTION 26 08 00
COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope.
2. Reference Standards.
3. Quality Assurance.
4. Submittals.
5. Products.
6. Testing.
7. Functional Checkout.

1.2 SCOPE

A. This section specifies the acceptance testing of electrical materials, equipment, and systems. Provide all labor, tools, material, power, and other services necessary to provide the specified tests. All testing described in this section shall be coordinated with the requirements of Section 01 40 00.

B. All testing required herein and the test results shall also be submitted and documented as required under Sections 01 40 00, 26 05 00, and where identified within the specific sections.

C. Test results for a specific piece of equipment shall also be included in the operation and maintenance manual(s).

1.3 REFERENCE STANDARDS

A. This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or other- wise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
ANSI/NETA ATS- 2021	Standard for Acceptance Testing Specifications for Electrical Power Distribution Equipment Systems

C. APPLICATION: Where testing in accordance with this section and other Division 26 Sections is required or recommended by the above standards are to be completed prior to energization, the required tests, including the retesting after the correction of found defects must be complete, and the submittal of final test reports to the Owner for review shall be completed prior to the energizing of material, equipment, or systems.

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work.

B. Comply with section 5, General, of the ANSI/NETA ATS – 2021 standard for safety, test equipment requirements.

1.5 SUBMITTALS

A. PROCEDURES: Section 01 32 19

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Proposed testing procedures including proposed test report forms.

2. Test reports including documentation for all tests performed. Test reports shall be submitted for review prior to the equipment being energized.

3. Execution plan including schedule.

PART 2 PRODUCTS

2.1 TESTING EQUIPMENT AND INSTRUMENTS

A. The test equipment, instruments and devices used for testing shall be calibrated to test equipment standards with references traceable to the National Institute of Standards and Technology. The test equipment, instruments and devices shall have current calibration stickers indicating date of calibration, deviation from standard, name of calibration laboratory and technician, and date of next recalibration.

2.2 PRODUCT DATA

A. The following information shall be provided in accordance with Section 01 32 19 and Section 01 40 00:

1. Test reports: Provide the report required in NETA ATS-2021 paragraph 5.4. Results shall be placed on the forms specified in this Section. Test reports shall also be part of the operation and maintenance manuals.

a. The test report shall include the following:

1) Summary of project.

2) Description of equipment tested.

3) Description of tests.

4) Device settings.

5) Test data.

b. Test data records shall include the following

1) Equipment Identification.

2) Nameplate data.

3) Date of testing.

4) Expected test value/result.

5) Actual test result.

6) Testing results outside of acceptable limits.

2. Short circuit analysis and protective device curves.

3. Defects: Notify the Owner of any material or workmanship found defective within 24 hours of discovery.

PART 3 EXECUTION

3.1 TESTING

A. GENERAL

1. Ensure that all testing performed is in strict conformance with the electrical acceptance tests specified herein. Contact the Owner 10 days prior to the testing to allow witnessing of all tests.

2. The test measurements shall be recorded on specific forms for the subject test.

3. Testing shall be per ANSI/NETA ATS 2021. Provide testing data sheet for the following:

    a. Cables – Low voltage (600 VAC maximum)

    b. Circuit breakers – Low voltage (Insulated Case/Molded Case)

    c. Protective Relays

    d. Instrument Transformers

    e. Grounding Systems

    f. Rotating Machinery

    g. Motor Control

B. FUNCTIONAL CHECKOUT:

1. Comply with all requirements of 26 05 00 and 01 31 00.

2. Functional testing shall be performed in accordance with the requirements of this Section. Prior to functional testing, all protective devices shall be adjusted and made operative. Prior to energizing the equipment, perform a functional checkout of the control circuits. Checkout shall consist of energizing each control circuit and operating each control, alarm or malfunction device and each interlock in turn to verify that the specified action occurs. Submit a description of proposed functional test procedures prior to the performance of functional checkout.

3. Verify that motors are connected to rotate in the correct direction. Verification may be accomplished by momentarily energizing the motor after confirming that neither the motor nor the driven equipment will be damaged by reverse operation.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 **GENERAL**

1.1 SUMMARY

A. Section includes:

1. Scope.
2. Reference Standards.
3. Quality Assurance.
4. Submittals.
5. Products.
6. Execution.

1.2 SCOPE

A. This Section specifies general use wiring devices consisting of receptacles, plugs, switches and appurtenances. Also covered in this section are plugs and receptacles used for motor disconnecting or isolation means. See also 26 28 16.16 for enclosed disconnect switches.

1.3 REFERENCE STANDARDS

A. This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

1. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
NEMA 250	Enclosures for Electrical Equipment (1000 volts maximum)
NEMA WD-1	General Requirements for Wiring Devices
NEMA WD-6	Wiring Devices - Dimensional
NFPA 70	National Electrical Code (NEC)
UL 20	General-Use Snap Switches
UL 498	Attachment Plugs and Receptacles
UL 514A	Metallic Outlet Boxes

Reference	Title
UL 894	Switches for Use In Hazardous (Classified) Locations
UL 943	Ground-Fault Circuit Interrupters
UL 1010	Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design, workmanship or materials.

1.5 DELIVERY AND STORAGE:

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

B. Store indoors in clean dry space with uniform temperature to prevent condensation and per manufacturer's recommendations. Protect from exposure to dirt, fumes, water, corrosive substances, and physical damage.

C. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.

D. Provide equipment and personnel to handle products; use methods to prevent soiling, disfigurement, or damage

1.6 SUBMITTALS

A. PROCEDURES: Section 01 32 19

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

    a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

    b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

    a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

    b. Catalog cuts shall be edited to show only the items, model numbers, and information which apply.

    c. Submittals are to made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable. Submittals that are not submitted in the format outlined may be rejected outright and the Contractor is required to resubmit in the correct format.

PART 2 **PRODUCTS**

2.1 GENERAL

A. Wiring devices shall be UL approved for the current and voltage specified and shall comply with NEMA WD-1. Devices shall contain provisions for back wiring and side wiring with captive binding screws.

B. Provide devices colored to conform to manufacturer's or industry standard for special use such as orange for isolated ground receptacles, blue for surge suppression receptacles, and red for emergency power receptacles. Unless shown

otherwise on the Drawings or Schedules, normal use devices shall be brown, except those located in finished areas shall be ivory.

2.2 RECEPTACLES AND PLUGS

A. GENERAL: Receptacles shall be grounding type.

B. 120V RECEPTACLES:

1. INDOOR, CLEAN AREAS: Unless shown otherwise on the Drawings or Schedules, receptacles shall be duplex 20 amp, NEMA 5-20R, and shall accept NEMA 5-15P and 5-20P plugs. Where the manufacturer of cord connected equipment requires an isolated ground, a receptacle with isolated ground shall be provided.

a. Manufacturers: Hubbell 5362, 5362-AI or approved equal.

b. Isolated ground receptacle manufacturers: Hubbell IG-5362, Arrow- Hart IG5362, or approved equal.

c. Receptacles shall be white in occupied areas with white faceplate.

d. Receptacles shall be grey in un-occupied areas with chrome faceplate.

e. Receptacles shall be mounted at 18 inches above floor unless otherwise indicated on plan drawings.

2. OUTDOOR, PROCESS OR CORROSIVE AREAS: Receptacle shall be duplex, 20 ampere, NEMA 5-20R, IP65/66/67, and shall accept NEMA 5- 15P and 5-20P plugs. Receptacle and plug shall be corrosion resistant, watertight, marine duty with yellow polycarbonate weatherproof lift covers.

a. Manufacturers: Hubbell 60W33H/15W33H, or approved equal.

3. INDOOR/OUTDOOR, GROUND FAULT CURRENT INTERRUPTING: receptacle shall be duplex, 20 ampere, NEMA 5-20R and shall accept NEMA 5-15P and 5-20P plugs. Receptacle shall have LED indication of device fault and tripped condition. Receptacles shall meet the 2006 UL 943 standard for surge testing (3kA, 6kV) and requirement for “no power to face when miswired.”

a. Manufacturers: Hubbel GF20Xx.

C. PLUG CAPS: Male plug caps for 120 volt and 250-volt receptacles shall be of the cord grip armored type with heavy phenolic housing, of the same manufacture as

the receptacle. Plug caps shall be rated 15 amps. One plug cap shall be provided for every four receptacles furnished, with a minimum of two plug caps being provided. Plug caps shall be delivered to the Owner.

2.3 SWITCHES

A. GENERAL PURPOSE (INDOOR, OCCUPIED AREAS): General purpose switches shall be rocker type, quiet AC type, specification grade, back and side wired, and shall be provided in accordance with rated capacities as required or as indicated on Drawings or Schedules. Switches shall match receptacles in color. Voltage and current ratings shall be 120VAC, 20-ampere.

1. Manufacturers: General Electric, Hubbell, or Owner accepted substitute.

B. GENERAL PURPOSE (INDOOR, UNOCCUPIED AREAS): General purpose switches shall be toggle type, quiet AC type, specification grade, back and side wired, and shall be provided in accordance with rated capacities as required or as indicated on Drawings or Schedules. Switches shall match receptacles in color. Voltage and current ratings shall be 120VAC, 20-ampere.

1. Manufacturers: General Electric, Hubbell, or Owner accepted substitute.

C. SWITCHES FOR OUTDOOR AND CORROSIVE AREAS: Switches shall be 20- ampere with weatherproof/ corrosion resistant neoprene plate. Switches shall be mounted in “FD” type cast ferrous or cast ferrous PVC-coated boxes as specified.

1. Manufacturers: Hubbell or Arrow-Hart as follows:

Type	Hubbell with 17CM50 plate	Arrow-Hart with 2881 plate
Single-pole	1281	2991
Double-pole	1282	2992
3-way	1283	2993
4-way	1284	2994

2.4 DEVICE PLATES

A. RECEPTACLES AND SWITCHES (Occupied areas):

1. Indoor device plates shall be made of sheet steel, zinc electroplated with chrome finish as manufactured by Hubbell, Crouse-Hinds, Appleton, or approved equal.

2. In areas susceptible to splashing water; receptacle covers shall provide while-in-use protection, rated NEMA 3R with cover closed. Covers shall be expandable polycarbonate as manufactured by Hubbell/Taymac ML500G or approved equal.

B. RECEPTACLES AND SWITCHES (Un-Occupied areas):

1. In non-corrosive un-occupied indoor areas, device plates shall be made of sheet steel, zinc electroplated with chrome finish as manufactured by Crouse-Hinds, Appleton, or approved equal.

2. In corrosive indoor areas device plates shall be corrosion-resistant/marine-duty type. Plates shall be of the same manufacturer as the receptacle or switch.

3. In outdoor or wet areas receptacle covers shall provide while-in-use protection, rated NEMA 3R with cover closed. Covers shall be powder-coated cast zinc, with self-closing lid and stainless-steel hinges as manufactured by Leviton M5979 or approved equal.

4. Device plates for explosion-proof equipment shall be factory provided with the equipment.

C. Device plates shall be provided with engraved laminated phenolic nameplates with 1/8-inch white characters on black background.

1. Nameplates for switches shall identify panel and circuit number and area served (if remotely switched).

2. Nameplates for receptacles shall identify circuit and voltage if other than 120 volts, single phase.

PART 3 **EXECUTION**

3.1 GENERAL

A. Boxes shall be independently supported by galvanized brackets, expansion bolts, toggle bolts, or machine or wood screws as appropriate. Wooden plugs inserted in masonry or concrete shall not be used as a base to secure boxes, nor shall welding or brazing be used for attachment.

B. Receptacles and switches installed in sheet steel boxes shall be flush mounted. Flush mounted receptacles shall be located 18 inches above the floor unless otherwise indicated. Switch boxes shall be mounted 48 inches above the floor. Receptacles installed in cast device boxes shall be located 48 inches above the floor.

C. Wiring devices shall be tested for correct connections.

END OF SECTION

SECTION 26 28 13
FUSES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope.
2. Reference Standards.
3. Quality Assurance.
4. Definitions
5. Submittals.
6. Coordination.
7. Products.
8. Execution.

1.2 SCOPE

A. This section includes cartridge fuses, rated 600V and less, for use in switches, panelboards, switchboards, controllers, and motor-control centers; and spare fuse cabinets.

1.3 REFERENCE STANDARDS

A. NEMA FU1 (National Electrical Manufacturers Association) - Low Voltage Cartridge Fuses.

B. NETA ATS (National Electrical Testing Association) - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems (International Electrical Testing Association).

C. NFPA 70 (National Fire Protection Association) - National Electrical Code.

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work.

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment first start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design workmanship or materials.

1.5 DEFINITIONS

A. RMS: Root mean square.

B. SPDT: Single pole, double throw.

1.6 SUBMITTALS

A. PROCEDURES: Section 01 33 00

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the CONTRACTOR of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the CONTRACTOR permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

a. The OWNER shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Product Data: For each fuse type indicated:

a. Ambient Temperature Adjustment Information: If rating of fuses has been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.

1) For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature and adjusted fuse rating.

2) Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.

b. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.

c. Let-through current curves for fuses with current-limiting characteristics.

d. Time-current coordination curves and current-limitation curves for each type and rating of fuse. Coordination charts and tables, and related data.

4. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

b. Catalog cuts shall be edited to show only the items, model numbers, and information which apply.

c. Submittals are to made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable. Submittals that are not submitted in the format outlined may be rejected outright and the Contractor is required to resubmit in the correct format.

1.7 COORDINATION

A. Coordinate fuse ratings with all equipment nameplate limitations of maximum fuse size.

B. Select fuses to provide appropriate levels of short circuit and overcurrent protection for components such as wire and cable, bus structures, and other overcurrent equipment.

C. Select fuses to coordinate with time-current characteristics of other overcurrent protective elements, such as other fuses, circuit breakers, and protective relays. Design system to ensure that device closest to fault operates first.

D. The Engineer shall verify that the let-through current of the selected fuse does not exceed the rating of downstream devices or conductors. The Engineer shall calculate the short-circuit capability of downstream cable to verify that it is protected by the fuse time-current characteristic curve.

E. The Engineer shall selectively coordinate all protective devices so faults are isolated to the most localized level.

1. On low voltage systems this may occasionally indicate the use of a fuse in series with a circuit breaker.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bussmann; Division of Cooper Industries.
2. Ferraz Shawmut.
3. Littelfuse.
4. Or Approved Equal.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, non-renewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

2.3 LOW-VOLTAGE FUSES

A. Fuses for circuits under 600V shall be UL listed, Class J, Class L, Class R or RK.

B. Fuses for safety switches shall be class R, intended for use with rejection clips.

1. Use Class L and Class T fuses to protect loads over 600 Amps such as transformer secondaries, switchboard mains or large feeders

2. Use Class J, Class K and Class R fuses to protect most feeder and branch-circuit applications.

C. Fuse Applications:

1. Main Services and Main Feeders

a. 601 to 6000A circuits: Provide Class L with 4-second minimum time delay at 500% rated current, with an interrupting rating of 200,000 amperes RMS symmetrical.

b. 600 amperes and less circuits: Provide Class RK1 dual-element, time-delay, non-interchangeable fuses with an interrupting rating of 200,000 amperes, for 600 volt and 250-volt applications, respectively.

c. 600-volt RK1 fuses shall have an indicating feature, which clearly indicates when fuse is opened (blown).

2. Motor Circuit Fuses: Provide Class RK1 and Class J dual-element time-delay fuses with 10-second minimum time delay at 500% rated current, sized at 125% of full-load current of motor.

3. Current limiting fuses Protecting Molded-Case Circuit Breaker Panelboards

a. Molded case circuit breaker panelboards, having short-circuit ratings less than the available short-circuit current at the point where the panelboard is applied, shall be protected by Class and maximum fuse ratings listed by the panelboard manufacturer.

b. Class G (300V) and Class CC (600V) current limiting, noninterchangeable, time delay or non-time delay fuses are used in branch-circuit panelboards.

4. Lighting Fixture Protection

a. Lighting fixture ballasts shall be individually protected on their line.

b. In each instance, fuse size and type shall be as recommended by the fixture or ballast manufacturer.

2.4 MEDIUM-VOLTAGE FUSES

A. Fuses for medium-voltage motors shall be R-rated for use with an overload relay and contactor as part of a medium-voltage motor starter package. Typically, the starter manufacturer will select the fuse.

B. Fuses for other medium-voltage loads including transformers, feeders, and capacitors shall be E-rated general-purpose current limiting fuses.

2.5 POTENTIAL TRANSFORMER FUSES

A. Medium-voltage fuses shall be E-Rated, intended for the purpose. Low-voltage fuses shall be as selected by the original equipment manufacturer.

2.6 SPARE FUSE CABINET

A. Cabinet: Wall-mounted, 0.05-inch- thick steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.

2. Finish: Gray, baked enamel.

3. Identification: “SPARE FUSES” in 1-1/2-inch high letters on exterior of door.

4. Fuse Pullers: For each size fuse.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.

B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.

C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Main Services and Main Feeders:

1. 601A to 6000A circuits: Class L, minimum 4 second time delay at 500% rated current, with an interrupting rating of 200,000 amperes RMS symmetrical.

2. 600A and less circuits: Class RK1 dual-element, time delay, non-interchangeable fuses with an interrupting rating of 200,000 amperes, for 600V and 250V applications.

a. 600V RK1 fuses shall have an indicating feature which clearly indicates when fuse is opened (blown).

B. Motor Branch Circuits: Class RK1 and Class J dual element time-delay fuses with 10-second minimum time delay at 500% rated current, sized at 125% of full load current of motor.

C. Current Limiting Fuses Protecting Molded Case Circuit Breaker Panelboards:

1. Molded case circuit breaker panelboards having short circuit ratings less than the available short circuit current at the point where the panelboard is applied shall be protected by Class and maximum fuse ratings listed by the panelboard manufacturer.

2. Class G (300V) and Class CC (600V) current limiting, non-interchangeable time delay or non-time delay fuses are used in branch circuit panelboards.

D. Light Fixture Protection:

1. Luminaire ballasts shall be individually protected on their line.

2. In each instance, fuse size and type shall be as recommended by the fixture or ballast manufacturer.

3.3 FUSE INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so that manufacturer, type and rating information is readable without removing fuse. Do not mix brands of types of fuses in device.

B. The Electrical CONTRACTOR at the job site shall install all fuses only when equipment is to be energized. Fuses shall not be installed prior to shipment.

C. Install spare fuse cabinet[s]. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

END OF SECTION

SECTION 26 29 24
ACTIVE FRONT END LOW VOLTAGE ADJUSTABLE FREQUENCY DRIVES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope.
2. Reference Standards.
3. Quality Assurance.
4. Submittals.
5. Products Requirements.
6. Coordination.
7. Products.
8. Execution.

1.2 SCOPE

A. This specification specifies low voltage, adjustable frequency drives (AFDs), and variable frequency drives (VFDs). For the purpose of this specification the terms AFD and VFD are interchangeable and equivalent.

B. The Variable-frequency Drive (VFD) system for motors rated 30Hp and larger shall use an Active Front End (AFE) Low Harmonic design and shall contain all components required to meet the performance, protection, safety and certification criteria of this specification.

C. Units shall utilize an insulated gate bipolar transistor (IGBT) technology as the input rectifier unit. This system shall be designed and configured such that IEEE 519 harmonic emission limits are inherently met without the need for external mitigation devices such as line reactors or filters.

D. Refer to the drawings for control and monitoring requirements including special interlocking requirements.

1.3 REFERENCE STANDARDS

A. This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
ANSI/IEEE C37.30A(1984)	Definitions and Requirements for High- Voltage Air Switches, Insulators, and Bus Supports, Supplement to C37.30-1971
ANSI C37.32	Schedules of Preferred Ratings, Manufacturing Specifications and Application Guide for High-Voltage Air Switches, Bus Supports, and Switch Accessories
NEMA ICS 1	General Standards for Industrial Controls and Systems
NEMA ICS 2	Standards for Industrial Control Devices, Controllers and Assemblies
NEMA ICS 3	Industrial Systems
NEMA ICS 3.1	Safety Standards for Construction and Guide for Selection, Installation and Operation of Variable-speed Drive Systems
NEMA ICS 4	Terminal Blocks for Industrial Control Equipment and Systems
NEMA ICS 6	Enclosures for Industrial Controls and Systems
ANSI C37.90	Relays and Relay Systems Associated with Electric Power Apparatus
IEEE 519	Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems
NFPA 70	National Fire Protection Association – US National Electrical Code

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 26 05 00 General Requirements for Electrical Work

B. The manufacturer shall warranty the above specified equipment for a period of twelve months from equipment start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design, workmanship or materials.

1.5 SUBMITTALS

A. PROCEDURES: Section 01 33 00

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

    a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

    b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Where submitted items deviate from interconnection diagrams provided in the contract drawings, provide a marked-up copy on the contract drawing denoting required changes.

4. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

    a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

    b. Catalog cuts shall be edited to show only the items, model numbers, and information which are applicable and crossing out all inapplicable information.

5. Submittals are to made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable. Submittals that are not submitted in the format outlined may be rejected outright and the Contractor is required to resubmit in the correct format.

6. Provide Seismic calculations for anchoring and support of equipment as required in Section 01 41 20.

7. Installation instructions, outline dimensions and weights including filters and/or phase shifting autotransformers, front view drawing identifying control and monitoring devices, nameplate engravings, shipping section dimensions, weight, and foundation requirements or wall mounting requirements for all assemblies.

8. External connection diagram showing function and identification of all terminals requiring field connections.

9. O&M manuals per Section 01 33 00 and Section 26 05 00.

10. Product Data Sheets

    a. VFD and Operator Interface publications.

    b. Data sheets and publications on all major components including, but not limited to, the following:

        1) Contactors
        2) Circuit breaker and fuse (power and control)
        3) Control power transformers
        4) Pilot devices
        5) Relays/Timers

11. Schematics and wiring diagrams.

12. Plan drawings showing conduit entry locations.

13. Current and voltage distortion calculations.

    a. Point of Common Coupling (PCC)

    b. Include first 36 odd current and voltage harmonics. Voltage shall be calculated on line-to-line basis.

    c. Provide distortion figures for each harmonic and the total demand distortion.

14. Efficiency and power factor calculations:

    a. Calculate efficiencies of the VFD controller including the auto-transformer (where applicable), ventilation fans, control power and all VFD losses.

    b. Calculate displacement and total power factor including filter.

    c. Perform calculations at 100, 75, and 50 percent speed.

    d. Include first 36 harmonics.

15. Harmonic Analysis Report that is project specific and includes the manufacturers statement of compliance with IEEE 519

16. Calculations of cooling and ventilation requirements.

17. Certified final factory test procedure and results for each drive.

18. Location and description of service center and spare parts stock.

19. Recommended spare parts list.

20. Factory and field test documentation.

21. Training schedule and materials.

22. Written descriptions explaining ladder diagram operation, system operation, and analog signal processing.

23. Comprehensive interconnection diagrams for VFD and motor.

24. In accordance with seismic anchoring requirements:

    a. Certification of compliance with local code and seismic designation.

    b. A sketch or description of the anchorage and restraint system.

25. Certification that VFD, motor, and driven load are compatible throughout the specified speed range.

26. Certified statement from the manufacturer accepting responsibility for providing a fully functioning installation as specified herein.

1.6 PRODUCT REQUIREMENTS

A. The VFD system shall convert 460 volt, 60-Hertz nominal input to a suitable voltage and frequency to cause a premium efficient, inverter duty, squirrel-cage induction motor to run at a speed proportional to an external input analog 4 to 20 ma dc or digital input command as specified for the required VFD speed range. Where submitted items deviate from interconnection diagrams provided in the contract drawings, provide a marked-up copy on the contract drawing denoting required changes.

B. The VFD system shall include converter units, inverter units, control circuitry, protective equipment, load side DV/dt and sine wave filters, LCL filters and other filters and accessories as necessary to provide the specified functions to meet voltage and current harmonics at the specified point of common connection and to mitigate the motor reflected voltage wave. Unless otherwise specified, the point of common connection for VFDs shall be the 480V-distribution bus (motor control center, distribution panel, etc.) immediately upstream of the VFD.

C. A HIM (Human Interface Module) shall be supplied with all VFDs regardless if one is shown on the plans or not.

1. Unit shall be of the latest offering by the manufacturer and shall be capable of remote mounting on the enclosure door if required.

D. Active Front End Low Voltage Adjustable Frequency Drives.

1. Listed and labeled by Underwriter's Laboratories, Inc. (UL), ETL, or Factory Mutual (FM).

    a. All upgrades to specified requirements per UL or ETL.

2. QUALITY ASSURANCE: The Owner reserves the right to observe factory tests on the VFD controller at the Owner's option and expense.

    a. All inspection and testing procedures shall be developed and controlled under the guidelines of the supplier's quality control system and must be registered to ISO 9001 and audited by a third party registrar.

3. COMPATIBILITY: VFD controller's performance shall be compatible and tolerant of disturbances produced by other VFD controllers and not interfere with each other.

4. PROGRAMMING: Provide VFD controller configuration and MACRO or sub-routine programming to meet specified driven equipment requirements.

5. MAINTAINABILITY: VFD controller's parts shall be interchangeable and modular for all controllers.

E. FACTORY TEST: Subject complete VFD system to a complete simulated operational test. Drive a calibrated load at various speeds over the specified speed range to determine VFD efficiency.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. See 26 05 00 – Section 1.6

B. Contractor shall coordinate shipping of the equipment to the site with the manufacturer/supplier.

1.8 COORDINATION

A. Obtain and review the appropriate data for the driven motor and load over the required speed range, for a complete system analysis. Verify that equipment is mutually compatible and free of resonance over the complete operating range. Coordinate the assignment of any critical frequencies with the equipment suppliers.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Variable frequency drives shall be as manufactured by the vendor listed below. To conform with specified requirements, a manufacturer's standard product may require modification.

1. ABB ACQ580 or ACS880 product family

2. Allen Bradley Powerflex 755 TL

3. Or approved equal

2.2 SYSTEM

A. The System shall use a transistor-based Active Front End as the input rectifier that uses a Selective Harmonic Elimination algorithm, mitigating the harmonics enough to meet IEEE-519-2014 without the need for phase shifting transformers and multi-pulse diode rectifiers. Total current harmonic distortion shall not exceed 5% at the VFD input terminals at full load conditions. AFE rectifier shall be phase rotation insensitive, tolerant of line voltage imbalance up to 10% without affecting

the harmonic mitigation or VFD output, and capable of operating the motor at full output with a 10% drop on input voltage.

B. The unit shall use an LCL filter assembly to filter up to and including the 50th harmonic to reduce EMI/RFI emissions. The LCL filter assembly shall include Passive Dampening. The drive will provide Active Resonance Detection and Protection to minimize any damage to the drive from supply side resonance: Provide integrated, all solid-state variable frequency drives (VFD) complete with incoming line reactors. Provide all components, with terminal numbers as shown on the Drawings.

C. Operation: Accomplish speed control by adjusting the output frequency according to the desired reference speed. Adjust ac voltage and frequency simultaneously to provide the constant Volts/Hertz necessary to operate the motor at the desired speed. The VFD must use pulse width modulation (PWM) technology.

D. The drive shall have a built-in circuit breaker as part of the drive's pre-charge circuit (250 hp and up) or provide built-in electrical connections for one to be field connected (10hp-250hp).

E. The drive will have two sets of tuning settings for the configuration of the line side converter such that appropriate values can be selected for two input sources (example: main utility power or back-up generator) and can be selected from the Human Interface Module or communications network

F. The VFD shall meet the voltage sag ride-through requirements of SEMI-F47.

G. Incorporate phase-to-phase and phase-to-ground MOV protection on the AC input line.

H. Microprocessor-based inverter and converter logic shall be isolated from power circuits.

I. Use latest generation IGBT inverter and converter sections that shall not require commutation capacitors.

J. Motor side inverters, line side converters and LCL filter modules (for drives greater than 250 Hp) shall be on roll-out chassis with front accessible connections for ease of repair or replacement and to provide access to load cables. Motor side inverter modules shall be removable without disturbing the load cables after installation.

K. Line converter modules and load inverter modules sections (for drives greater than 250 Hp) shall be interchangeable so as to reduce necessary spare parts.

L. Rating:

1. Line Voltage: 480 volts, -5 percent continuous, -10 percent momentary, +10 percent, 3- phase.

2. Line Frequency: 60 Hz, ±2 Hz

3. Ambient Temperature: 5°C to 40°C

4. Altitude: Up to 3,300 feet above sea level.

5. Power Factor: Above 0.95 at full speed and rated load.

M. Performance:

1. Efficiency: Above 95 percent at 100 percent full speed, above 93 percent at 70 percent full speed.

2. VFD Inrush Current: Limited to less than 100 percent of motor full load

3. Duty Cycle: 6 starts per hour.

4. Flying Start: 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 sped.

N. Features:

1. Provisions to accept the following control signals for automatic and manual operation:

   a. Ethernet communications port support Ethernet/IP protocol. All operating parameters and control functions shall be accessible via Ethernet communications.

   b. FWD & REV Run signal from a single remote contact closure when specified

   c. A 4-20 mA dc signal for speed control. The VFD shall provide linear speed control of the motor from zero to full speed as the variable speed input signal varies from its minimum to maximum. Input impedance shall be 250 ohms resistive.

2. Have a lineside converter input frequency range from 47 to 63 Hz

3. The carrier frequency of the lineside converter shall be fixed at 4 kHz.

4. The motor side inverter frequency output will be sine coded PWM with a carrier frequency that can be selected at 1.33 kHz, 2 kHz, or 4 kHz.

5. The VFD motor side inverter shall be capable of the following maximum frequency outputs:

    a. 325 Hz when operating with an output carrier frequency of 1.33kHz or 2 kHz.

    b. 590 Hz when operating with an output carrier frequency of 4kHz

6. Use gold plated plug-in connections on printed circuit boards.

7. Motor speed indicator calibrated in percent of full speed.

8. A 4-20 mA dc signal for remote speed indication to a local PLC. The VFD shall provide linear speed indication of the motor speed from zero to full speed. Input impedance shall be 250 ohms resistive.

9. A 4-20 mA dc signal for remote motor current indication to a local PLC. The VFD shall provide linear current indication of the motor from zero to full current. Input impedance shall be 250 ohms resistive.

10. Incoming line fused lockable disconnect or lockable main circuit breaker.

11. 24 VDC control circuitry and 480V-120V step down transformer.

12. Variable time delay for delaying motor drive restart after power failure; timer range shall be 0 to 120 seconds, with initial settings differing by 10 seconds for each drive; provide module which causes multiple attempts to restart.

13. Provision for automatic emergency shutdown in any mode, activated by the following:

    a. Any additional abnormal conditions as shown on the Drawings. Provide for manual restart.

14. Auxiliary contacts for remote indication of “Run” and “VFD Fault.”

15. VFD operable with motor disconnected, in order to test VFD.

16. Linearity and repeatability accuracy of 3 phase output of 1 percent of analog input control signal regardless of input power voltage fluctuations between 437 and 505 volts.

17. Independent acceleration and deceleration controls, adjustable from 2 to 30 Hz per second.

18. Label with fault current rating per NEC article 409.110 and arc flash warning label per NEC Article 110.16.

19. Auxiliary Power module for secondary power feed to control boards.

O. Motor Control

1. Selectable Sensorless Vector, Flux Vector, V/Hz, economizer mode selectable through programming.

2. The drive shall be supplied with an 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.

5. Capable of operating induction and permanent magnet motors

P. Protection: Protect VFD against the following conditions:

1. Reverse phase sequence and single phasing of input power.

2. Input power failure.

3. Input transient voltages, including peak suppression and snubbers, in accordance with ANSI C37.90.

4. Transmission signal interference.

5. Output overcurrent.

6. Input overcurrent.

7. Motor over temperature.

8. Cabinet over temperature.

9. Under voltage: VFD shall automatically shut down if input voltage falls below preset limit with automatic restart upon return to a stable supply.

Q. Enclosure Door Mounted Human Interface Module (HIM)

1. VFD shall provide a HIM with integral LCD display, operating keys and programming keys.

2. An enclosure door-mounted HIM, rated UL Type 12, shall be provided

3. The HIM shall have the following features:

4. A four (4) to seven (7) line backlit LCD display with graphics capability.

5. Shall indicate drive operating conditions, adjustments and fault indications.

6. Shall be configured to display in the following:

7. One zone shall display the status of direction, drive condition, fault / alarm conditions and Auto / Manual mode.

8. Another zone shall display drive output frequency, voltage or current.

9. Another Zone shall display one of 6 to 12 user selected values such as power, torque, DC bus voltage, Analog values, discrete I/O status and etc.

10. The keypad shall include programming keys, drive operating keys (Start, Stop, Direction, Jog and Speed Control), and numeric keys for direct entry.

R. Construction:

1. VFDs shall be mounted in floor mounted control enclosure, minimum Nema 1 rating.

   a. Door-mount the following devices:

      1) HMI with the following indications:

         a) Power On
         b) Speed indication
         c) Motor Run
         d) VFD Fault Indication
         e) External operating handle for the incoming line fused disconnect.

   b. Control components shall be in accordance Section26 27 16. Configuration of the enclosure and the components shall be as shown on the drawings.

   c. Components: Mount components on circuit cards or modules, which can be adjusted or replaced in the field without the use of special tools.

   d. Finish: Paint finish shall be ANSI Grey.

S. Spare Parts: Furnish two sets of spare power fuses for each size and type of fuse used; furnish a minimum of five fuses of each size and type of control circuit fuse.

PART 3 EXECUTION

3.1 INSTALLATION

A. REQUIREMENTS: Section 26 05 00 and install in accordance with manufacturer's instructions for the specified functional requirements.

B. Properly level and plumb VFDs so that doors will open and close freely.

C. Clean and repair scratched or damaged surfaces to "new" condition.

D. Provide the services of a factory trained service technician to inspect and check out each system before energizing.

E. Per manufacturer's instructions, lace power conductors to resist short circuit forces.

3.2 COMPONENT TEST PHASE

A. PROCEDURES: Section 01 75 16

B. Operate each drive from no load to full load and perform a spectrum analysis to verify that the waveform on the line side of the VFD is in compliance with IEEE 519 for general systems.

3.3 MANUFACTURER'S SERVICES

A. ON-SITE INSPECTIONS AND TRAINING: Provide a factory-trained manufacturer's representative at the Site for the following activities. Specified durations do not include travel time to or from the Site.

1. INSTALLATION INSPECTIONS: Assist, supervise, and inspect the Contractor's activities during installation. Provide 8 hours of installation inspection.

2. TRAINING SESSIONS: Procedures: Section 01 75 16. Coordinate training with operations and maintenance staff schedules to ensure all required staff can attend.

END OF SECTION

SECTION 26 36 23
AUTOMATIC TRANSFER SWITCHES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope.
2. System Requirements
3. Quality Assurance.
4. Submittals.
5. Products
6. Installation
7. Testing

1.2 SCOPE

A. The Contractor shall furnish and install Automatic Transfer Switch (ATS) with number of poles, amperage, voltage, and withstand current ratings as shown on the drawings. Each automation transfer shall consist of a contactor style switch mechanism and a microprocessor controller, interconnected to provide complete automatic operation.

B. The ATS shall be installed in the existing switchgear, replacing the existing 800A unit. It shall provide all of the proper disconnecting, protection, grounding and bonding as required.

1.3 SYSTEM REQUIREMENTS

A. The ATS shall be Rated for use at 480 VAC, 800 amps with a withstand rating of 22,000 AIC unless otherwise shown on the drawings. Unit shall be 3-pole with a solid neutral unless shown or specified differently on the drawing. Unit shall be Delayed Transition style.

1.4 QUALITY ASSURANCE

A. REFERENCE STANDARDS

1. This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

   a. UL 1008 - Standard for Automatic Transfer Switches

   b. CSA 22.2 No 178

   c. IEC 60947-6-1

   d. NFPA 70 - National Electrical Code

   e. NEMA Standard ICS10-1993 (formerly ICS2-447) - AC Automatic Transfer Switches

   f. NEC Articles 700, 701, 702

   g. NFPA 110 - Emergency and Standby Power Systems

   h. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications

   i. International Standards Organization ISO 9001: 2008

   j. UL 508 Industrial Control Equipment

1.5 SUBMITTALS

A. REQUIREMENTS: Section 01 33 00.

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

    a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

    b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

    a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

    b. Catalog cuts shall be edited to show only the items, model numbers, and information which are applicable and crossing out all inapplicable information.

    c. Submittals are to made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable. Submittals that are not submitted in the format outlined may be rejected outright and the Contractor is required to resubmit in the correct format.

4. Installation instructions, outline dimensions and weights, front view drawing identifying control and monitoring devices, nameplate engravings, shipping dimensions, weight, and wall mounting requirements.

5. Component list

6. Conduit entry/exit locations where applicable

7. Assembly ratings including:

a. Short-circuit rating

b. Voltage

c. Continuous current

8. Cable terminal sizes

9. Product data sheets, external connection diagram showing function and identification of all terminals requiring field connections.

10. O&M manuals per Section 01 33 00 and Section 26 05 00.

11. Schematics and wiring diagrams.

12. Recommended spare parts list.

13. Factory test documentation.

14. In accordance with seismic anchoring requirements:

a. Certification of compliance with local code and seismic designation.

b. A sketch or description of the anchorage and restraint system.

PART 2 PRODUCTS

2.1 MANUFACTURES

A. Candidate manufacturers and models are listed below. To conform to specified requirements, the manufacturer's standard product may require modifications.

1. Asco 300 and 7000 Series

2. Cummins OTEC series C

3. Or approved equal

2.2 AUTOMATIC TRANSFER SWITCH

A. Furnish and install where indicated a "programmed (delayed) transition" style, 3-pole (with solid neutral) automatic transfer switch with ratings, features, accessories, enclosures, etc. indicated on the drawings or noted herein.

B. The transfer switch equipment as specified herein shall be rated for continuous duty at the ratings shown on the plans and shall conform to the applicable

requirements for UL 1008 for emergency total system load. All transfer switch equipment supplied shall bear the UL label.

C. All main power contacts shall be rated for multiple fault interruptions per UL 489, and/or UL 1087. Main contacts shall have independent “break-before-make” transfer action which shall positively prevent dangerous “source-to-source” connections.

D. Automatic transfer switches specified herein shall consist of completely enclosed contact assemblies and a separately mounted control logic panel. Control power for all automatic transfer operations shall be derived from the line side of the source to which the load is being transferred.

E. Upon loss of phase-to-phase voltage of the normal power source on any phase to 70% of nominal, and after a time delay of 0-5 seconds (adjustable to meet conditions present) to override momentary dips and/or outages, starting of the emergency/standby power source shall be initiated. Transfer to the emergency standby power source shall take place 2-60 seconds (adjustable) after attainment of 90% of rated voltage and frequency of that source.

F. When the normal power source has been restored to 90% of rated voltage and after a time delay adjustable from 0-30 minutes (to ensure the integrity of the normal power source), the load shall be retransferred to the normal source.

G. A time delay, adjustable 0-10 minutes, shall delay shutdown of the emergency/standby power source after retransfer to allow the generator to run unloaded for cool-down, after which the generator shall be automatically shut down.

H. If the emergency/standby power source should fail while carrying the load, transfer to the normal power source shall be made instantaneously upon restoration of the normal source to satisfactory conditions.

I. The following features/accessories shall be provided:

1. Auto/test switch to provide test operation of the automatic transfer switch by simulating a loss of the normal power source.

2. Pilot lights to indicate to which source the load is connected.

3. Plant exerciser timer providing automatic test operation of the emergency/standby power source at pre-selected intervals at least once per week, including a selector switch to select exercise with or without load or a bypass of the exercise period. The clock timer shall be provided with a digital readout and include a lithium battery backup to assure

continuity of power to the clock timer for a minimum of 72 hours during an outage.

4. Provide an input connection to be able to remotely exercise the generator through a remote mounted “dry” contact.

5. Provide “dry”, form C contacts for the following conditions, as a minimum. Contacts shall be rated 10 Amps at 120 VAC:

   a. ATS in “Emergency” position

   b. “Utility Available”

   c. “Generator Power Available”

6. Provide operator interface display allowing adjustment to all settings and viewing of all values.

PART 3 PART 3 EXECUTION

3.1 INSTALLATION

A. Install interior to existing switchgear as shown on the drawings and coordinate interconnection with the existing generator.

3.2 DAMP AND WET LOCATIONS

A. Unless otherwise specified, all electrical enclosures in damp and wet locations shall be NEMA 4, stainless steel.

B. All conduit entries into equipment located in damp or wet locations shall be through the bottom or lower sides of enclosures. Top entry of conduits will not be allowed.

3.3 TESTING

A. Service Equipment shall be tested for proper operation and function in accordance with Section 26 08 00.

B. Provide an integrated test to demonstrate ATS senses loss of utility power, starts the generator, verifies the electrical output from the generator is valid and transfer the load to the standby power source.

C. Verify also that restoring Utility power is sensed appropriately by the ATS and that after the selected time delay, restores utility power to the generator. Verify

proper generator cool down run time is provided for either in the generator or in ATS settings.

D. The complete ATS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.

E. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.

END OF SECTION

SECTION 31 11 00
SITE CLEARING

PART 1 GENERAL

1.01 DESCRIPTION.

A. This section includes provisions for clearing, grubbing, and related work necessary to prepare the site for construction operations.

PART 2 PRODUCTS – not applicable to this Section.

PART 3 EXECUTION

3.01 GENERAL

A. Unless otherwise noted on the Contract Drawings, the limits of clearing shall be determined by the Contractor and approved by the Owner prior to beginning the work.

B. Clearing shall be confined to the immediate vicinity of the construction, insofar as practicable, and shall not extend beyond the right-of-way, tax lot boundary, property boundary, wetland boundary or easement lines shown on the Contract Drawings without the express written approval of the Owner.

3.02 CLEARING

A. Clear site of snags, brush, shrubs and other vegetation, rubbish, debris, and other materials that may interfere with the proper execution of the work.

B. Within the excavation footprint, all vegetation standing higher than 4" above the existing ground shall be mowed as close to the ground as possible. Mowed material shall be hauled off and disposed of offsite.

3.03 GRUBBING

A. Remove all trees where shown on the Contract Drawings, including root systems as described in this Section.

B. Remove all stumps and roots larger than 1-1/2" in diameter which occur within the following:

1. Areas to be occupied by buildings, structures, walks, asphalt or gravel surfaces, and areas which occur within ten (10) feet of structure areas.

2. Areas where stumps and roots are less than 12" below finished grade.

3.04 STRIPPING TOPSOIL

A. The upper six (6) inches of topsoil shall be carefully removed from all areas to be excavated or filled and shall be stockpiled in a topsoil stockpile where indicated by Owner.

B. In building and structure foundation areas, strip the topsoil to a minimum depth of 6-inches and subgrade prepared/compacted to 85% maximum density.

3.05 DISPOSAL OF CLEARED, DEMOLISHED AND STRIPPED MATERIAL

A. Cleared material shall be disposed of by the Contractor in an approved waste disposal site in accordance with all federal, state, and local regulations.

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

SECTION 31 23 00
EXCAVATION AND FILL

PART 1 GENERAL

1.01 DESCRIPTION

A. This section describes materials and methods to be used to perform all excavation, fill, shoring, foundation preparation, and compaction Work.

1.02 Related Work Specified Elsewhere

1. Section 01 32 19 - Submittals

2. Section 01 40 00 - Quality Requirements

3. Section 31 23 19 - Dewatering

4. Section 31 23 33 - Trenching, Backfilling and Compaction

1.03 QUALITY ASSURANCE

A. Compaction testing will be completed by a qualified testing firm hired by the Owner. Additional source material testing may be completed to establish the basis of field tests and satisfy all other requirements of the contract documents.

B. Where testing results indicate that material has been placed below compaction limits specified, the Contractor shall take whatever measures are necessary to bring the materials up to the requirements of the specifications at no additional cost to the Owner. Such measures may include removal of placed materials and replacement and compaction to specified limits.

1.04 REGULATORY REQUIREMENTS

A. Conform to the following:

1. Revised Code of Washington (RCW) 39.04.180

2. Washington Administrative Code (WAC) Chapter 296-155, Part N: Excavation, Trenching and Shoring

B. It shall be the responsibility of the Contractor to comply with all state and federal laws regarding environmental protection, and archaeological and historical preservation.

1.05 SUBMITTALS

A. For each item specified in Part 2, submit the following in accordance with Section 01 32 19:

1. Gradation test reports per ASTM C136.

2. Moisture density test reports per ASTM D698.

B. Submit compaction testing results per the test frequency described in Section 01 40 00.

C. Submit certification that all excavation support system design work has been performed under the direction of a professional engineer licensed by the State of Washington.

D. For positive pressure shoring systems, submit the following:

1. Shop Drawings and calculations signed by a professional engineer licensed by the State of Washington.

2. Shoring installation and construction sequence and procedures.

3. Methods and materials to be used to fill voids behind shoring system, if applicable.

1.06 DEFINITIONS

A. Subgrade. The existing soil after completion of required excavation, prior to placement of fill, or construction of structures or pavement.

B. Degree of Compaction. Degree of compaction shall be expressed as a percentage of the maximum density at optimal moisture content, as obtained by the test procedure presented in AASHTO T-99.

C. Embankment. The fill material required to raise the existing grade.

D. Rocks and Boulders. Rock shall consist of material, which by actual demonstration, cannot be reasonably excavated with suitable power excavation equipment. The Engineer may waive the required demonstration if the material is well defined rock. Rock is defined by method of removal and not geological formation. Boulders shall consist of floater rock fragments. Fragmented rock materials excavated directly below rock excavation shall not be considered boulders.

E. Rock Excavation. Rock excavation is defined as sound and solid masses, layer or ledges of mineral matter in place and of such hardness and texture that, when encountered, cannot be loosened by three passes of a track-mounted hydraulic excavator from a 42,000-pound class equipped with a single shank ripper for excavating trenches. Removal of rock shall be by specialized rock excavating equipment. Hardpan, hard clay, glacial till, sandstone, siltstone, shale, or other sedimentary rock will not be classified as rock excavation. Blasting will not be permitted.

F. Boulder Excavation. Boulder excavation is defined as the removal of rock fragments, in whole, or in part of the trench limits, with any dimension after removal greater than 3 feet measured in a straight line. Materials with a maximum dimension of less than 3 feet are considered normal excavation.

G. Unsuitable Material. Unsuitable material shall consist of materials unable to properly support the utility pipe, conduit, or appurtenance structure.

H. Over-Excavation and Backfill. Over-excavation and backfill shall be defined as the removal of unstable material or material to a depth greater than shown as directed by the Engineer, and placement and compaction of backfill to fill the void.

PART 2 PRODUCTS

2.01 BEDDING, PIPE ZONE, AND TRENCH BACKFILL MATERIAL

A. Provide approved 3/4”-0 crushed surfacing top course that meets WSDOT Standard Specification Section 9-03.9(3).

2.02 BASE COURSE MATERIAL

A. Provide approved 3/4”-0 crushed surfacing base course that meets WSDOT Standard Specification Section 9-03.9(3).

2.03 FOUNDATION MATERIAL

A. Provide clean aggregate material, free from dirt, roots, topsoil and debris. Foundation material shall conform to WSDOT Standard Specification Section 9-03.9(1).

2.04 STRUCTURAL FILL

A. Provide approved aggregate material free of wood waste or other organic material. Structural fill shall be crushed surfacing top course or base course conforming to WSDOT Standard Specification Section 9-03.9(3).

PART 3 EXECUTION

3.01 SAFETY

A. The Contractor shall provide such safeguards and protection around and in the vicinity of excavations as may be necessary to prevent and avoid the occurrence of damage, loss, injury, and death because of such excavations. Liability for such damage, loss, injury, and death shall rest with the Contractor and shall cease when all work to be done under the Contract is completed and accepted by the Owner.

B. The Contractor shall be solely and completely responsible for conditions of the jobsite, including safety of all persons and property during the performance of the work. This requirement will apply continuously and not be limited to normal working hours.

C. The duty of the Owner to conduct construction review of the Contractor's performance is not intended to include review of the adequacy of the Contractor's safety measures in, on, or near the construction site.

3.02 SHORING AND MOVABLE SHIELDS

A. The Contractor shall install and maintain an excavation safety system where excavations exceed a depth of four (4) feet, or where conditions warrant these measures. The system shall meet the requirements of the Washington Administrative Code, WAC 296-155 as well as other applicable local, State, and Federal laws and regulations.

B. The Contractor shall provide all materials, labor, and equipment necessary to shore trenches and excavations to protect the Work, existing property, utilities, pavement, etc., and to provide safe working conditions in the trench. The Contractor may elect to use any combination of shoring and overbreak, tunneling, boring, sliding trench shield, or other method of accomplishing the Work consistent with applicable local, State, or Federal safety codes and the requirements of the project specifications.

C. Positive Pressure Shoring

1. Positive pressure shoring shall be installed for excavations where shown on the Drawings, and where excavation is within a 1:1 influence zone of adjacent building foundations.

2. Positive pressure shoring systems shall be designed for site specific conditions and shall be designed for slope stability above and below the shoring system. Design shall consider nearby structures, construction equipment, and all other factors that may impact soil stability and settlement.

D. Movable Shields

1. For shield widths less than 48 inches, the inside shield width shall not be less than the OD of the pipe plus 12 inches. When removing movable shield from trench, shore excavations to protect adjacent utilities and structures.

3.03 CONTROL OF SURFACE WATER AND GROUNDWATER

A. Provide and maintain ample means and devices with which to promptly remove and dispose of all water entering the excavation.

B. Dewater excavations in accordance with Section 31 23 19.

3.04 EXCAVATION

A. All excavation shall be within the "limits of excavation" as indicated on the Drawings or specified herein.

B. Remove all boulders and rock as necessary to construct utility improvements. Backfill voids left by removed and excavated rock with compacted trench backfill material.

C. Excavation work necessary for construction of pipe trenches shall be performed according to Section 31 23 33.

3.05 SUBGRADE PREPARATION

A. After clearing and grubbing operations, the Contractor shall prepare the site for excavation and embankment fill operations with particular attention to surface drainage.

B. The Engineer shall be notified within 48 hours and at least 24 hours prior to final excavation.

C. If the subgrade is unsuitable for foundation, remove such materials to the depth and limits as directed in writing by the Engineer. Provide a stable foundation by placing and compacting foundation material in lifts with 6-inch loose thickness and compacted to 95% of its maximum relative density at optimum moisture content.

3.06 GENERAL FILL AND BACKFILL REQUIREMENTS

A. Place fill and backfill material in horizontal lifts of uniform thickness and compact each lift to specified densities prior to proceeding with additional lifts. Place and spread material to avoid segregation.

B. Fill and backfill material shall be kept level around structures.

C. Where fill and backfill material of any specified class is being placed adjacent to other classes of material, control the placement of the various lifts to prevent more than 1 foot of vertical grade separation between lifts.

D. Use foundation material under structures, vaults and similar facilities unless shown otherwise on the Contract Drawings. Minimum compacted depth of foundation material under all structures shall be 12 inches to subgrade.

E. Insofar as practicable, maintain optimum moisture content required for compaction throughout each lift of the fill. Add any required moisture to material which is not predominantly granular by nature, preferably at the site of excavation. Add moisture to granular backfill by sprinkling during compaction operation. Do not compact nongranular material if it is significantly above optimum moisture content. Aerate by such processes as scarifying, blading, or discing prior to compaction.

3.07 GENERAL COMPACTION REQUIREMENTS

A. Select proper size and type of compaction equipment and method of utilization to attain the required compaction density. Contractor must demonstrate that his compaction equipment and method can achieve the specified compaction densities.

B. Remove and recompact material that does not meet specified requirements.

C. The Contractor shall tailor his operations to allow for unrestricted access for purposes of testing for compaction by the Owner. All costs in connection with excavating test pits, shoring, backfilling, and from standby time during field density test shall be considered as incidental to backfill, and shall be included in unit prices bid for the various items involved.

D. The Contractor shall schedule his operations so that compaction to the specified densities can be achieved with the materials specified. In those areas where native backfill materials are specified, this may require scheduling trenching around inclement weather.

3.08 FOUNDATION MATERIAL CONSTRUCTION

A. Place foundation material from undisturbed ground to the bottom of the structure.

B. Deposit foundation material in lifts not exceeding 8 inches of compacted thickness. Depth of loose fill will depend on the ability of the Contractor's compaction equipment to meet the specified percent of compaction.

C. The area covered by each lift shall not be less than the area of the structure or vault in plan view plus 1 foot on either side.

D. Compact structural fill to 95 percent of its maximum relative density.

E. Jetting or puddling will not be permitted. Make adequate provision for thorough drainage of all backfill.

3.09 GEOSYNTHETIC MATERIAL

A. All geotextile, geogrid, and other geosynthetic materials shall be stored, handled, and installed in accordance with the manufacturer’s recommendations. Install application-specific geosynthetics where shown on the Contract Drawings, and as directed by the Owner.

3.10 STRUCTURAL BACKFILL AND EMBANKMENT FILL

A. Embankment fill and structural backfill under pipe, conduits, and structures shall be as specified herein or on the Contract Drawings. Each layer of embankment fill shall be placed in lifts not exceeding 12 inches loose thickness, and compacted to 95 percent of maximum relative density.

B. Unless otherwise shown on the Drawings, backfill around underground structures with a crushed aggregate material. Crushed aggregate material shall be structural fill, trench backfill material, crushed surfacing top course, crushed surfacing base course, or other material approved by the Engineer. Each layer of backfill shall be placed in lifts not exceeding 12 inch loose thickness, and compacted to 95 percent of maximum density.

C. Embankment and Structural Backfill Within Five Horizontal Feet of Sides of Structures or Vaults

1. Place backfill or embankment around concrete structures only after the concrete has attained a minimum of two-thirds of its specified compressive strength. Remove all form materials and trash from the excavation before placing backfill.

2. Earth moving equipment shall not be operated within 5 feet of walls of concrete structures unless approved otherwise in writing by the Owner. Compact adjacent to concrete walls with pneumatic tampers or other approved equipment that will not damage the structure.

3.11 CONSTRUCTION OF BASE AND TOP COURSES

A. Construct base and top courses under proposed concrete and asphalt surfaces to the dimensions and depths shown on the Contract Drawings. Compact crushed surfacing to 95 percent of maximum relative density.

3.12 FINISHED EXCAVATION, FILLS, AND EMBANKMENTS

A. All areas covered by the project shall be uniformly smooth-graded, including excavated and filled sections and adjacent transition areas. The finished surface shall be reasonably smooth, compacted, and free from irregular surface changes. The degree of finish shall be that ordinarily obtainable from blade-grader operations, except as otherwise specified. Ditches and gutters shall be finished to permit adequate drainage.

3.13 PROTECTION

A. During construction, fills, embankments, and excavations shall be kept shaped and drained. Newly graded areas shall be protected from traffic and erosion, and any settlement or washing away that may occur from any cause, prior to acceptance, shall be repaired and grades reestablished to required elevations and slopes. All work shall be conducted in accordance with local, state, and federal environmental protection requirements.

3.14 CLEANUP

A. Contractor shall clean up and remove all excess materials, construction materials, and debris from construction. Contractor shall replace or repair any fences, signs, landscaping, or other facilities removed or damaged during construction at the Contractor's own expense and without additional compensation from the Owner.

B. Contractor shall be responsible for leaving the work site in a condition equal to original condition before construction.

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

SECTION 31 23 33
TRENCHING, BACKFILLING AND COMPACTION

PART 1 GENERAL

1.01 DESCRIPTION

A. This section describes construction requirements for all trenching, bedding, backfilling, and compaction.

B. Related Work Specified Elsewhere:

1. Section 31 23 00 - Excavation and Fill

PART 2 PRODUCTS

2.01 EXCAVATION AND FILL MATERIAL

A. Bedding, pipe zone, trench backfill, and trench foundation material shall be as specified in Section 31 23 00 – Excavation and Fill.

PART 3 EXECUTION

3.01 GENERAL

A. All surfacing, structure, and utilities shall be left in a condition equal to or better than their original condition. Where damage occurs and cannot be repaired or replaced, the Contractor shall purchase and install new material that is satisfactory to the Owner.

B. The Contractor's operations shall be confined to rights-of-way and easements provided. Contractor shall not encroach on or damage any private property or existing utilities unless prior arrangements have been made and a copy of these arrangements submitted to the Owner.

3.02 TRENCH SAFETY AND PROTECTION

A. The Contractor shall use shoring in accordance with federal, state, and local safety requirements. The Contractor shall install and maintain an adequate trench safety system where the trench excavation exceeds a depth of four (4) feet.

B. Specific excavation safety and protection requirements are described in Section 31 23 00.

3.03 EXISTING UTILITIES AND EXPLORATORY EXCAVATIONS

A. Existing utilities of record are shown on the Contract Drawings. These are shown for convenience only, and the Owner assumes no responsibility for improper locations or failure to show utilities.

B. The Contractor shall protect existing utilities and work around them during excavation and pipe laying operations. Any damages to utilities resulting from the Contractor's operation shall be reported to the Owner immediately, and repaired in a manner meeting the Owner's approval.

C. The Contractor shall perform exploratory excavations at all locations where the proposed pipelines or conduit cross existing underground utilities to determine the location of utility crossings.

D. The Contractor shall be responsible for meeting the construction requirements of each utility company, including coordination and crossing permit requirements.

E. If the proposed pipe or conduit is shown on the Plans to pass over the underground utility, the exploratory excavation depth shall be to the top of the underground utility. If the sewer pipeline is shown on the Plans to pass under the underground utility, the exploratory excavation depth shall be to the bottom of the underground utility.

F. The Contractor shall provide the Engineer with potholing notes in table format including the following information: station, thickness of pavement (if present) at location of utility, type of existing utility, material and condition of the existing utility, and vertical distance from top of existing utility and bottom of existing utility to roadway or ground surface directly above the centerline of the existing utility at the proposed pipeline or appurtenance crossing location. The Contractor shall supply the Engineer with potholing notes from each exploratory excavation at least seven days prior to ordering manholes adjacent to that location.

G. The Contractor shall limit the excavation footprint for exploratory excavations. At no point should the excavation extend beyond the horizontal trench limits for the proposed pipe or conduit. Any repairs required for excavation beyond the identified limits shall be borne by the Contractor.

H. Immediately following the exploratory excavation, the Contractor shall backfill the excavation with crushed surfacing top course placed in maximum six (6) inch lifts compacted to 95% maximum density as determined by ASTM D698.

I. The surface disturbed by exploratory excavation shall be restored immediately following backfill according to existing surfacing as follows: with crushed surfacing top course on existing gravel surfaces, with a minimum two (2) inches of compacted cold-mix asphalt patch in paved surfaces outside of roadway travel lanes, or with a minimum of two inches of compacted hot mix asphalt pavement where existing surface is paved and within a travel lane.

3.04 OBSTRUCTIONS

A. Obstructions are defined as items which may be encountered and do not require replacement. Obstructions to construction of the trench such as tree roots, stumps, abandoned subsurface utilities, abandoned structures, logs, rubbish, and debris of all types shall be removed and disposed of in accordance with local, state, and federal

requirements. Tree roots within the excavated trench shall be cleanly cut with a sharp pruning tool or an appropriate saw.

B. The Owner may, if requested, make changes in the trench alignment to avoid major obstructions, if such alignment changes can be made without adversely affecting the intended function of the utility or at increased cost to the Owner.

C. If the Contractor encounters existing structures that will prevent construction and are not adequately shown on the Contract Drawings, the Contractor shall immediately notify the Owner before continuing with the work, in order that the Owner may make such field revisions as necessary to avoid conflicts.

3.05 TRENCH EXCAVATION

A. Prior to trench excavation in asphalt or concrete pavements, pavement shall be sawcut full depth to a neat clean edge.

B. Cut open trenches to the lines and grades shown on the Drawings and as specified herein.

C. Remove excavation spoils offsite immediately after excavation, unless the Owner provides an area for spoils which does not obstruct other construction materials and Wastewater Treatment Plant operations. Provide free access to all equipment onsite. Leave clearance to enable the free flow of stormwater in all gutters, conduits and natural water-courses.

D. Excavated material not required for backfilling shall become the property of the Contractor and shall be promptly removed from the site.

E. Bell holes shall be excavated to the extent necessary to permit accurate work in making and inspecting the joints.

F. Unless otherwise permitted by the Owner, trenching operations shall not be completed beyond the distance which will be backfilled and compacted in the same day. All excavations shall be closed or plated at the end of every working day unless otherwise permitted in writing by the Owner.

G. The Contractor shall exercise sound professional judgement and follow standard construction practices in excavating the trench and maintaining it so that no damage will occur to any foundation, structure, pole line, adjacent pipe line, or other facility because of slough or slopes, boulder excavation, or from any other cause. If, as a result of the excavation, there is disturbance of the ground which may endanger other property, the Contractor shall immediately take remedial action at no expense to the Owner. No act, representation, or instruction of the Owner shall in any way relieve the Contractor from liability for damages or costs that result from trench excavation.

H. Trench widths shall be as noted in the Contract Drawings. Trench walls below and above the top of the pipe shall be sloped, or made vertical, as recommended in the pipe manufacturer's installation manual. Where required to control trench width or to protect

adjacent structures, the trench shall be sheeted and braced. The trench width below the top of the pipe shall not exceed that recommended in the manufacturer's installation manual.

3.06 CONSTRUCTION OF TRENCH FOUNDATION

A. If the trench bottom is unsuitable below the depth required for bedding, the Owner may require additional excavation. This extra excavation shall be backfilled with compacted trench foundation material. Trench foundation shall be placed in lifts not to exceed eight (8) inches as measured after compaction, and compacted to form a uniformly dense and unyielding foundation.

3.07 PIPE BEDDING

A. Bedding material shall be placed under the pipe and to a depth as shown on the Contract Drawings. Care shall be taken to prevent any damage to the pipe or its protective coating.

B. The bedding material shall be rammed and tamped around the pipe by the use of hand-operated compaction tools, so as to provide firm and uniform support over the full length of all pipe, valves, and fittings and to compact the bedding to 95% of its maximum density at optimum moisture content, as determined by AASHTO T-99.

3.08 TRENCH BACKFILLING

A. Prior to backfill, all form lumber and debris shall be removed from the trench. Sheeting used by the Contractor shall be removed just ahead of the backfilling.

B. Where materials excavated from the trench shall be used for backfill, organic material, frozen lumps, or rocks or pavement chunks more than six inches in maximum dimensions shall not be used; and material determined by the Owner to be unsuitable for backfill at the time of excavation shall be removed and replaced with approved backfill material as described in Section 31 23 00.

C. Take all necessary precautions to protect the pipe from any damage, movement or shifting. Backfill up to 12 inches over the top of the pipe shall be evenly and carefully placed. Remove from the backfill any materials capable of damaging the pipe, pipe coating, or tracer wire.

D. When backfill is placed mechanically, push the backfill material into the trench so as to permit free fall of the material into the open trench until at least two feet of cover is provided over the pipe. Place pipe zone backfill material in maximum 8-inch lifts compacted thickness above this cover, placing and compacting lifts to equal elevation on each side of the pipe or conduit.

E. Compaction

1. Compact pipe zone and backfill material to a minimum of 95% maximum density at optimum moisture content, as determined by AASHTO T-99. Compact material

below pipe haunches with handheld tamping bars. Use a shovel to slice material under haunches to ensure voids are completely filled before placing additional lifts.

2. Select proper size and type of compaction equipment and method of utilization to attain the required compaction density. Contractor must demonstrate that his compaction equipment and method can achieve the specified compaction densities.

3. Remove and recompact material that does not meet specified requirements.

4. The Contractor shall tailor his operations to allow for unrestricted access for purposes of compaction testing. All costs in connection with excavating test pits, shoring, backfilling, and from standby time during field density test shall be considered as incidental to backfill, and shall be included in unit prices bid for the various items involved.

5. The Contractor shall schedule his operations so that compaction to the specified densities can be achieved with the materials specified. In those areas where native backfill materials are specified, this may require scheduling trenching around inclement weather.

3.09 SURFACE RESTORATION AND CLEANUP

A. At the end of each work day, all open trenches within vehicular access areas and roadways shall be backfilled and resurfaced with temporary pavement restoration. Paved areas shall be temporarily resurfaced with asphalt pavement. The Contractor shall be responsible for maintaining and replacing temporary surfaces as needed to maintain a travelable surface in the Owner's opinion, until final surface restoration is complete.

B. At the end of each work day, all open trenches within the site outside of vehicle access areas shall be backfilled and resurfaced. Alternatively, if approved by the Owner, open trenches may be securely covered with a plate or other approved method.

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

SECTION 33 05 06
HYDROSTATIC PRESSURE TESTING

PART 1 GENERAL

1.01 DESCRIPTION

A. This section describes hydrostatic pressure testing for new and existing piping systems.

B. Related Work Specified Elsewhere

1. Section 40 27 00 – Process Piping Systems

1.02 SUBMITTALS

A. Submit a testing plan, including schedule and details, on proposed methods for pressure testing.

1.03 SCHEDULING

A. Pressure testing shall be performed in accordance with a schedule prepared by the Contractor and approved by the Owner. This schedule shall be submitted in writing for approval a minimum of two weeks before testing is to start.

B. Contractor shall provide 72-hour notification to the Owner prior to conducting hydrostatic testing.

C. Contractor shall provide coordination and scheduling required for the Owner to witness and provide necessary labor for operating Owner's existing system during hydrostatic testing and disinfecting procedures.

PART 2 PRODUCTS – Not applicable to this Section.

PART 3 EXECUTION

3.01 HYDROSTATIC PRESSURE TESTING FOR PRESSURE PIPING

A. All of the pipe, fittings, services, and valves, except the last connection with the existing main, after being placed, must be pressure tested, conforming to AWWA C600 Section 4 specifications and ASTM F2164. If the Contractor elects to test the line in sections, the lengths of the sections and provisions for testing shall be subject to approval by the Engineer.

B. Before testing the pipeline for leakage, the pipeline shall be thrust blocked. The interior of the pipeline shall be thoroughly cleaned to remove all foreign matter.

C. The Contractor shall furnish necessary thrust blocks, pumps, medium range pressure gauges, means of measuring water loss, and all other equipment, materials and labor required for making the tests.

D. All air vents shall be open during the filling of the pipeline with water. After a test section is completely filled, it shall be allowed to stand under slight pressure for at least 24 hours to allow the lining to absorb what water it will and to allow the escape of air from any small air pockets. During this period, the bulkheads, valves and exposed connections shall be examined for leaks. If any are found, they shall be stopped. The pressure shall then be raised slowly to the minimum hydrostatic pressure as listed below, measured at the point of highest elevation and shall be maintained for a period of at least 2 hours, beginning at a time of day to be mutually agreed upon between the Contractor and the Engineer.

Piping System	Test Pressure	Test Duration
Sanitary Sewer Force Main Piping System	100 psi	2 hr

E. Test pressure shall not exceed 150% of pipe pressure rating.

F. No leakage is acceptable. While the pipe is under pressure and stabilized, an inspection for leaks along the pipeline shall be made by the Contractor. The gauges should be graduated at 2 PSI increments. Any leaks found shall be recorded and shall be repaired by the Contractor. All such repairs shall be made subject to the approval of the Engineer.

G. The Contractor, at their own expense, shall perform any excavation required to locate and repair leaks or other defects on piping installed by the Contractor which may develop under the test. He shall remove backfill and paving already placed, shall replace such removed material, and shall make all repairs necessary to secure the required water tightness. Pipe shall be retested following any repairs. All repairs and retests shall be made at the Contractor's sole expense.

H. All leakage tests shall be made in the presence of the Engineer.

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

SECTION 40 06 70
SCHEDULES OF INSTRUMENTATION FOR PROCESS SYSTEMS

TAG	DESCRIPTION	SPEC	SCALE
LT-01	Wet Well Radar Level Transducer	40 72 23	TBD FT
LSHH-01	Wet Well High High Level Float	EXISTING	
LSH-02	Wet Well High (Lag) Level Float	EXISTING	
LSH-01	Wet Well Low (Lead) Level Float	EXISTING	
LSL-01	Wet Well Low Level Float	EXISTING	
FE-01	Flow Meter	40 71 13	
FIT-01	Flow Transmitter	40 71 13	0 – 15000GPM
FSL-SF01	Supply Fan 01 Air Flow Switch	40 71 79	
FSL-SF02	Supply Fan 02 Air Flow Switch	40 71 79	
FSL-EF01	Exhaust Fan 01 Air Flow Switch	40 71 79	
FSL-EF02	Exhaust Fan 02 Air Flow Switch	40 71 79	

END OF SECTION

SECTION 40 27 00
PROCESS PIPING SYSTEMS

PART 1 GENERAL

1.01 DESCRIPTION

A. This Section includes pipe, fittings, and appurtenances for the proposed pump station improvements.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 09 90 00 - Protective Coatings

B. Section 40 29 00 - Process Valves

C. Section 33 05 06 - Hydrostatic Pressure Testing

1.03 REFERENCES

A. Applicable Standards

1. American Water Works Association (AWWA):

a. C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water

b. C110 - Ductile-Iron and Gray-Iron Fittings, 3 Inches Through 48 Inches, for Water and Other Liquids

c. C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

d. C115 - Flanged Ductile-Iron Pipe with Threaded Flanges

e. C150 - Thickness Design of Ductile-Iron Pipe

f. C151 - Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids

g. C153 - Ductile-Iron Compact Fittings, 3 In. Through 24 In. and 54 In. Through 64 In., for Water

h. C602 - Cement-Mortar Lining of Water Pipelines 4 Inches (100 mm) and Larger - in Place

i. C606 - Grooved and Shouldered Joints

j. M23 - PVC Pipe Design and Installation

2. American National Standards Institute (ANSI):

a. B16.1 - Cast-Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250 and 800

b. B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges

3. American Society for Testing and Materials (ASTM):

a. A307 - Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength

b. D1248 - Polyethylene Plastics Molding and Extrusion Materials

c. F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipe

4. Steel Structures Painting Council (SSPC):

a. SPl - Solvent Cleaning

b. SP3 - Power Tool Cleaning

c. SP5 - White Metal Blast Cleaning

d. SP7 - Brush-Off Blast Cleaning

1.04 SUBMITTALS

A. Submit the following for acceptance prior to fabrication:

1. Pipe and joint details

2. Special fitting and coupling details

3. Specifications, data sheets and affidavits of compliance for protective shop coatings and linings

B. Submit the following Certificates and Affidavits prior to shipment:

1. Affidavit of compliance with applicable standards.

2. Certificate of origin for all steel flanges.

3. Test certificates.

1.05 QUALITY ASSURANCE

A. Manufacturers shall be experienced in the design and manufacture of pipe, fittings, specials or appurtenances for a minimum period of 5 years.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture. Protect flanges, fittings, and piping specialties from moisture and dirt. Handle in a manner to ensure installation in sound and undamaged condition. Do not drop or bump. Use slings, lifting lugs, hooks, and other devices designed to protect pipe, joint elements, linings and coatings.

B. Ship, move, and store with provisions to prevent movement or shock contact with adjacent units.

C. Handle with equipment capable of work with adequate factor of safety against overturning or other unsafe procedures.

D. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.07 REGULATORY REQUIREMENTS:

A. Comply with Plumbing and Drainage Institute, PDI WH-201.

B. Pipe and fittings shall be approved by National Sanitation Foundation.

PART 2 PRODUCTS

2.01 GENERAL PIPE REQUIREMENTS

A. Furnish pipe of materials, joint types and sizes as indicated on the Drawings.

B. Pipe Marking: All pipe and fittings shall be marked conforming to the applicable standard specification under which the pipe is manufactured and as otherwise specified.

2.02 DUCTILE IRON PIPE AND FITTINGS

A. Ductile iron pipe shall conform to AWWA C150 and C151, with a minimum Class 52 wall thickness, except for pipe 30-inches and larger which shall be thickness Class 50 minimum.

B. Minimum thickness for ductile iron pipe threaded for screw-on flanges shall be Class 53 in accordance with AWWA C115.

C. Joints:

1. All joints shall be restrained unless specifically noted otherwise on the Drawings.

2. Joints shall conform to AWWA C111.

3. Mechanical Joints:

a. Joint restraint shall be restrained mechanical joint or restrained retainer gland.

b. Restrained mechanical joint: American Cast Iron Pipe Co., MJ Coupled Joint; U.S. Pipe Harness-Lok; or equal.

c. Restrained retainer glands: EBAA Iron, Inc., Megalug, or approved equal.

4. Flanged Joints:

a. Flanges for pipe shall be ductile iron and conform to the applicable provisions of AWWA C110 and C115 and shall be drilled ANSI B16.1 Class 125 flat face.

5. Sleeved or Coupled

a. Provide sleeves or couplings where indicated.

b. Furnish pipe ends suitable for receiving style of sleeve or coupling indicated or specified.

c. Provide anchored couplings where restraint is required to withstand specified operating or hydrostatic test pressure and where indicated.

D. Fittings

1. Fittings shall be ductile iron and shall conform to AWWA C110 or AWWA C153, minimum 250 psi working pressure.

2. Fittings shall have a pressure rating of not less than that specified for pipe and shall have joints matching that specified for the pipe.

3. Provide openings for air valve, drain, sampling, sensing, testing, etc., connections with threaded bosses or flange outlets sized and located where indicated.

4. Pipe end space shall not exceed one-third of sleeve laying length.

E. Lining

1. All ductile iron pipe and fittings shall be lined with epoxy lining.

F. Coating

1. All buried iron pipe and fittings shall be coated with manufacturer's standard coating.

2. Exposed interior and exterior iron pipe shall be coated as specified in Division 9.

3. Flange faces shall be coated in accordance with AWWA C115.

2.03 PVC PIPE AND FITTINGS

A. Pipe: Schedule 80, Type I, Grade I or Class 12454-B conforming to ASTM D1784 and ASTM D1785. Pipe shall be manufactured with titanium dioxide for ultraviolet protection.

B. Fittings: Schedule to match pipe, ASTM D2466 and ASTM D2467 for socket weld type and Schedule 80 ASTM D2464 for threaded type. Fittings shall be manufactured with titanium dioxide for ultraviolet protection.

C. Joints: Solvent socket weld, except where connected to threaded valves and equipment or where otherwise specified.

D. Flanges: one-piece, molded hub type PVC flat face flange in accordance with fittings above. ASME 16.1, Class 125 drilling.

E. Solvent cement: Socket type joints shall be made employing solvent cement that meets or exceeds the requirements of ASTM D2564 and primer that meets or exceeds requirements of ASTM F656, chemically resistant to the fluid service, and as recommended by pipe and fitting manufacturer. Solvent cement and primer shall be listed by NSF 61 for contact with potable water.

F. Thread lubricant: Teflon tape.

2.04 STAINLESS STEEL PIPE AND FITTINGS

A. Stainless Steel Pipe:

1. 2-1/2” and smaller: Schedule 40S, meeting the requirements of ASTM A312/A312M, Type 316 seamless, pickled and passivated.

B. Joints:

1. 1-1/2” and smaller: Threaded or flanged at equipment as required or shown.

2. 2” and larger: Butt-welded or flanged at valves and equipment.

C. Fittings:

1. 1-1/2” and smaller: Threaded, forged 1,1000 CWP minimum, ASTM A182/A182M, Grade F316 or cast Class 150, ASTM A351/A351M, Grade CF8M/316.

2. 2” thru 2-1/2”: Butt welded, ASTM A403/A403M, Grade WP316L conforming to ASME B16.9 and MSS SP 43, annealed, pickled and passivated. Fitting wall thickness to match adjoining pipe. Long radius elbows unless shown otherwise.

3. Unions, 2” and smaller: 2,000-pound or 3,000 pound WOG, integral ground seats, AAR design meeting the requirements of ASME B16.11, bore to match pipe.

D. Thread lubricant shall be 100% virgin PTFE Teflon tape.

2.05 COUPLINGS AND ADAPTORS

A. Restrained Flange Adapters

1. Adapters for joining direct buried, exposed exterior, vault or pit installations of ductile iron pipe shall be ductile iron.

2. Adapters for joining exposed interior ductile iron pipe may be steel or ductile iron.

3. Flanged end bolt circle, bolt size and spacing shall conform to the applicable provisions of ANSI B16.1 and shall be drilled Class 125 for iron adapters. Flanges on steel adapters shall be AWWA C207, Class D, drilled ANSI B16.1 Class 125.

4. Bolts and nuts shall be ductile iron for iron adapters and high-strength, low-alloy steel for steel adapters.

5. Lining and Exterior Coating for Steel Adapters shall be two-part epoxy or nylon fuse-coated to a minimum 10 mils thickness. Completely coat adapter sleeve and end follower gland plus line interior for adapters intended for exposed-exterior, vault or pit installations. Line interior of all adapters intended for exposed interior installations. Coat exterior with normal shop coating.

6. Flange coupling adapters shall be Ebaa Iron Megaflange or equal.

2.06 GASKETS AND BOLTS

A. Provide all gaskets, bolts, lubricant, and other accessories required to install pipe, fittings and specials complete and ready for service.

B. Gasket lubricant shall be provided by pipe manufacturer and no substitute will be allowed.

C. Gasket pressure rating shall be equal to or exceed the pipe pressure rating.

D. Gaskets for flanged joints:

1. Gaskets shall conform to ANSI B16.21, 3 mm (1/8-inch) thick, full-face, homogeneous black rubber (EPDM), hardness 60 (Shore A), rated to 212 degrees F. Blind flange gaskets shall cover the entire inside face with gasket cemented to blind flange.

2. Gaskets for ductile iron flanged pipe and fittings 300 mm (12 inch) and smaller shall have "nominal" inside diameters, not the larger inside diameters per ANSI B16.21.

3. American Cast Iron Pipe Company Toruseal 3 mm (1/8-inch) thick full-face gasket or U.S. Pipe Full Face Flange-Tyte 3 mm (1/8-inch) thick gasket.

E. Gaskets for grooved end joints: Halogenated butyl conforming to ASTM D2000 and AWWA C606.

F. Bolting:

1. Flange, exposed service: ASTM A307, Grade A carbon steel hex head bolts. ASTM A563, Grade A carbon steel hex head nuts and ASTM F436/F436M hardened steel washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.

2. Flange, submerged or wetwell service, or stainless steel pipe: Type 316 stainless steel, ASTM A320/A320M, Grade B8M hex head bolts; ASTM A194/A194M, Grade 8M hex nuts and ASTM F436/F436M Type 3 alloy washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.

G. Gaskets and bolts for other than flanged and grooved joints shall be as otherwise specified for pipe and pipe joints.

PART 3 EXECUTION

3.01 INSTALLATION

A. Utilize equipment, methods, and materials ensuring installation to lines and grades indicated.

1. Maintain within tolerances specified or acceptable laying schedule.

a. Alignment: +1 inch per 100 feet in open cut or tunnel. Correct alignment to original alignment if total cumulative misalignment reaches 3 inches.

b. Grade: +1 inch per 100 feet. Correct grade to original grade if total cumulative deviation in grade reaches 3 inches.

2. Do not lay on blocks unless pipe is to receive total concrete encasement.

3. Accomplish horizontal and vertical curve alignments with bends, bevels, and joint deflections. Limit joint deflection with ductile-iron pipe to conform to AWWA C600. Deflection may, with approval, exceed standard deflections by utilizing machined bells. Where restrained joint pipe is used, limit deflection to ½ of the maximum recommended deflection.

4. Obtain acceptance of method proposed for transfer of line and grade from control to the work.

B. Install pipe of size, materials, strength class, and joint type with embedment indicated for plan location.

C. Insofar as possible, install pipe with bell ends in direction of laying. Obtain approval for deviations therefrom.

D. Clean interior of all pipe, fittings, and joints prior to installation. Exclude entrance of foreign matter during installation and at discontinuance of installation. Close open ends of pipe with snug-fitting closures. Do not let water fill trench. Include provisions to prevent flotation should water control measures prove inadequate. Remove water, sand, mud and other undesirable materials from trench before removal of end cap.

E. Brace or anchor as required to prevent displacement after establishing final position.

F. Perform only when weather and trench conditions are suitable. Do not lay in water.

G. Observe extra precaution when hazardous atmospheres might be encountered.

3.02 JOINTING

A. Follow manufacturer's printed installation instructions for the various types of pipes specified.

B. General Requirements

1. Locate joint to provide for differential movement at changes in type of pipe embedment, impervious trench checks, encasement, and structures. Joint location shall not be located more than 9 inches from structure wall or end of encasement.

2. Clean and lubricate all joint and gasket surfaces with lubricant recommended.

3. Utilize methods and equipment capable of fully homing or making up joints without damage.

4. Check joint opening and deflection for specification limits.

C. Special Provisions for Jointing Ductile-Iron Pipe

1. Conform to AWWA C600.

2. Visually examine while suspended and before lowering into trench.

3. Paint bell, spigot, or other suspected portions with turpentine and dust with cement to check for cracks invisible to the eye. Remove turpentine and cement by washing when test is satisfactorily completed.

3.03 CUTTING

A. Cut in neat manner without damage to pipe.

B. Observe Specifications regarding joint locations.

C. Cut ductile-iron pipe with carborundum saw or other acceptable method per manufacturer's instructions. Smooth cut by power grinding to remove burrs and sharp edges. Repair lining as required and approved.

3.04 CLOSURE PIECES

A. Connect two segments of pipeline or a pipeline segment and existing structure with short sections of pipe fabricated for the purpose.

B. Observe Specifications regarding location of joints, type of joints, and pipe materials and strength classifications.

C. Field-fabricated closures, where required, shall be concrete encased between adjacent flexible joints.

D. May be accomplished with sleeve coupling of length such that gaskets are not less than 3 inches from pipe ends. Include spacer ring identical to pipe end such that clear space in closure does not exceed 1/4-inch.

3.05 TEMPORARY PLUGS

A. Furnish and install temporary plugs at each end of work for removal by others when completed ahead of adjacent contract.

B. Remove from pipe laid under adjacent contract in order to complete pipe connection when work by other contractor is finished prior to work at connection point under this Contract.

C. Test plugs shall be as manufactured by pipe supplier, or fabricated by Contractor of substantial construction. Plugs shall be watertight against heads up to 20 feet of water and shall be secured in place in a manner to facilitate removal when required to connect pipe.

D. Temporary plugs shall not be used as test plugs.

3.06 PIPING SLEEVES

A. General. Install piping as described below, except where system sections specify otherwise.

B. Install sleeves for pipes passing through concrete and masonry walls, concrete floor and roof slabs, and where indicated.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches (50 mm) above finished floor level.

Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring where specified.

2. Build sleeves into new walls and slabs as work progresses.

3. Install large enough sleeves to provide 1/4-inch (6 mm) annular clear space between sleeves and pipe or pipe insulation. Use the following sleeve materials:

   a. Steel Pipe Sleeves: For pipes smaller than 6 inches (150 mm).

   b. Cast-Iron Sleeve Fittings: For floors having membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level.

4. Seal space outside of sleeve fittings with non-shrink, non-metallic grout.

5. Except for below-grade wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants specified.

3.07 ROUGHING IN

A. Verify final equipment locations for roughing in.

B. Refer to equipment specifications in other Sections for roughing-in requirements.

3.08 COMPLETION

A. Complete hydrostatic pressure testing per Section 33 05 06. Hydrostatic pressure testing shall be conducted in the presence of the Engineer.

B. Pipe Repairs:

1. Repair damaged pipe and fittings.

2. Remove and replace cracked or defective pipe, gaskets, joints, fittings, and valves.

3.09 FIELD PAINTING

A. Specified in Section 09 90 00.

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

SECTION 40 29 00
PROCESS VALVES

PART 1 GENERAL

1.01 DESCRIPTION

A. This Section includes general duty valves common for process piping systems.

1.02 RELATED WORK SPECIFIED ELSEWHERE

1. Section 09 90 00 - Protective Coatings
2. Section 40 27 00 – Process Piping Systems
3. Section 01 78 23 - Operation and Maintenance Manuals

1.03 REFERENCES

A. Applicable Standards

1. American Society for Testing and Materials (ASTM):
    a. Al26 - Gray Iron Castings for Valves, Flanges, and Pipe Fittings
    b. B62 - Composition Bronze or Ounce Metal Castings. c. B584-90 - Copper Alloy Sand Castings for General Applications
2. American Society of Mechanical Engineers (ASME):
    a. B1.20.1 - Pipe Threads, General Purpose
    b. B16.1 - Cast Iron Pipe Flanges and Flange Fittings
    c. Bl6.5 - Pipe Flanges and Flanged Fittings
    d. B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings
    e. Bl6.24 - Bronze Pipe Flanges and Flanged Fittings
    f. B31.1 - Power Piping. g. B31.9 - Building Services Piping
3. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS):
    a. SP-45 - Bypass and Drain Connections
    b. SP-70 - Cast Iron Gate Valves, Flanged and Threaded Ends
    c. SP-71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends

d. SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends

e. SP-80 - Bronze Gate, Globe, Angle and Check Valves

f. SP-85 - Cast Iron Globe and Angle Valves, Flanged and Threaded Ends

g. SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved, and Flared Ends

1.04 SUBMITTALS

A. General

1. Product Data for each valve type. Include body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and manufacturer's printed installation instructions. Include list indicating valve type and its application.

2. Maintenance data for valves to include in the operation and maintenance manual specified in Section 01 78 23. Include detailed manufacturer's instructions on adjusting, servicing, disassembling, and repairing.

1.05 QUALITY ASSURANCE

A. Single-Source Responsibility: To the maximum extent possible provide products of the same kind from a single source.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping by protecting internal parts against rust and corrosion, protecting threads, flange faces, grooves, and weld ends, setting globe and gate valves closed to prevent rattling, setting ball and plug valves open to minimize exposure of functional surfaces, and blocking check valves in either closed or open position.

B. During storage maintain valve end protection. Store indoors and maintain valve temperature higher than ambient dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use a sling to handle large valves. Rig to avoid damage to exposed parts. Do not use handwheels and stems as lifting or rigging points.

PART 2 PRODUCTS

2.01 VALVE AND GATE OPERATORS

A. General Requirements

1. Use rising stem or rising outside screw and yoke stems, except where headroom prevents full extension of rising stems.

2. All manually operated valves shall open by turning counterclockwise.

3. Worm and Gear operators shall be one-piece design, of gear bronze material. Worm shall be hardened alloy-steel with thread ground and polished. Operators of the geared traveling nut type shall have threaded steel reach rods with an internally threaded bronze or ductile iron nut.

B. Exposed Valves. Use specified operators as follows:

1. Handwheels: For valves other than quarter turn.

2. Lever Handles: For quarter-turn valves 6 inches and smaller, except for plug valves, which shall have totally enclosed worm gear operators with handwheel or chainwheel as required.

3. Gear-Drive Operators: For quarter-turn valves 8 inches and larger.

2.02 VALVE JOINTS

A. Threads: ASME Bl.20.1.

B. Flanges: ASME B16.1 for cast iron, ASME B16.5 for steel, and ASME B16.24 for bronze valves.

C. Solder Joint: Not allowed.

2.03 COATINGS

A. Buried valves. Coat with coal tar epoxy.

B. Exposed valves. Coat as specified in Division 9.

2.04 BALL VALVES

A. Stainless Steel Ball Valves:

1. MSS-SP-110; three piece, full port, 1000 psi CWP; Type CF8M or Type 316 stainless steel body, bonnet, and ball; blowout proof stainless steel stem; reinforced PTFE seats, seals and packing; adjustable packing gland; stainless steel lever operator with vinyl grip; and NPT threaded ends.

2. Manufacturers: Apollo, Nibco, or approved equal.

B. PVC Ball Valves

1. Rated 150 psi at 73 degrees F, with ASTM D1784, Type I, Grade 1 polyvinyl chloride body, ball, and stem, end entry, double union design, solvent-weld socket ends, elastomer seat, Viton or Teflon O-ring stem seals, to block flow in both directions.

2. Manufacturers: Nibco, ASAHI/America, Sears, or equal.

2.05 PLUG VALVES

A. Plug valves shall be eccentric plug valves of the non-lubricated type with round or rectangular port having no less than 80 percent of connected pipe area; rated 175 psig CWP minimum, drip-tight shutoff with pressure from either direction; ASTM A536 ductile-iron body and bonnet; ductile-iron plug coated with Buna N; Buna N, Viton, or PTFE packing; nickel or stainless steel seat; flanged or grooved end connections for exposed service and mechanical joint ends for buried service.

B. Interior of valve shall be lined with a minimum 12 mils corrosion resistant fusion bonded epoxy.

C. Manufacturers: DeZurick PEC, Pratt Ballcentric, Milliken Millcentric, or approved equal.

2.06 KNIFE GATE VALVES

A. Knife gate valves shall be Wafer type suitable for long term use with raw sewage, minimum pressure rating 150 psi, bi-directional. DeZurik Figure KGC-BD or approved equal.

1. Materials:

a. Wetted Parts: AISI Type 316 stainless steel.

b. Valve Stem: AISI Type 316 stainless steel.

2. Wafer Flanges: ANSI B16.1 Class 150 drilled. Flange holes may either be tapped or be drilled through the valve body. Bolts and nuts to be ASTM A276 stainless steel.

3. Protective Coating: All non-stainless steel surfaces shall be coated with a minimum thickness of 16 mils epoxy.

4. Resilient Seat/Seal: Shall be capable of bubble-tight bi-directional shutoff to the full pressure rating of the valve. Seat material shall be chloroprene, sewage and grease resistant.

5. Packing: PTFE impregnated synthetic fiber.

6. Operator: Each valve to be factory equipped with a chain wheel operator.

7. Testing: Each valve shall be factory tested.

2.07 AIR RELEASE VALVES

A. Sewage Air Release Valves:

1. Air/vacuum valves, where shown on the Contract Drawings, shall be model D-026 as manufactured by A.R.I, or approved equal.

2. The inlet end connection shall be threaded or flanged. The valve body shall be type 316 stainless steel.

3. All metal components shall be stainless steel. Valves shall be rated for 145 psi working pressure.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine piping system for compliance with requirements for installation tolerances and other conditions affecting performance of valves. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

C. Operate valves from fully open to fully closed positions. Examine guides and seats made accessible by such operation.

D. Examine threads on valve and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.

F. Do not attempt to repair defective valves; replace with new valves.

3.02 INSTALLATION

A. Install valves in accordance with the manufacturer's recommendations and details shown on the Drawings.

B. Piping installation requirements are specified in other DIVISION 40 Sections. Drawings indicate the general arrangement of piping, fittings, and specialties.

C. Valves shall be rigidly held in place using supports and hangers as shown on the Drawings and as specified.

D. Install valves with unions or flanges at each piece of equipment arranged to allow servicing, maintenance, and equipment removal without system shutdown.

E. Locate valves for easy access and provide separate support where necessary.

F. Generally, unless otherwise indicated on the Drawings, all valves installed in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above the finish floor shall be installed with their operating stems vertical. Valves installed in horizontal runs of pipe having centerline elevations between 4 feet 6 inches and 6 feet 9 inches above the finish floor shall be installed with their operating stems horizontal. If adjacent piping prohibits this, the stems and operating handwheel shall be installed above the valve horizontal centerline as close to horizontal as possible. Valves installed in vertical runs of pipe shall have their operating stems orientated to facilitate the most practicable operation.

G. Installation of Check Valves: Install for proper direction of flow and in a horizontal position with hinge pin level.

H. Installation of Plug Valves: Install to orient the valve such that the plug is stored in the top of the valve while in the open position. While in the closed position, the plug shall seat facing away from the direction of higher pressure.

3.03 THREADED CONNECTIONS

A. Note the internal length of threads in valve ends and proximity of valve internal seat or wall to determine how far pipe should be threaded into valve.

B. Align threads at point of assembly.

C. Apply appropriate tape or thread compound to the external pipe threads, except where dry seal threading is specified.

D. Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

3.04 FLANGED CONNECTIONS

A. Align flange surfaces parallel.

B. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.

3.05 VALVE END SELECTION

A. Select valves with the following ends or types of pipe/tube connections:

1. Steel Pipe Sizes, 3 Inches and Smaller: Threaded or grooved end.

2. Ductile Iron Pipe Sizes, 4 Inches and Larger: Grooved end or flanged for exposed service; mechanical joint with restraint for buried service.

3.06 ADJUSTING

A. Adjust or replace packing after piping systems have been tested and put into service, but before final adjusting and balancing. Replace valves if leak persists.

3.07 TESTS

A. Test all valves and appurtenances for proper operating adjustments and settings and for freedom from vibration, binding scraping, and other defects. The adequacy of all pipe hangers and supports and valve supports to meet specified requirements shall be verified. All defects found shall be corrected. Valves found to leak during tests shall be repaired and retested.

3.08 CLEANING

A. All valves and appurtenances shall be flushed clean of all foreign matter together with the piping as specified in other sections.

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

SECTION 40 61 13
PROCESS CONTROL SYSTEM GENERAL PROVISIONS

PART 1 GENERAL

1.1 SUMMARY

A. This section specifies general requirements which are applicable to providing instrumentation and controls for the process system

B. The requirements of this section are applicable to all work to be completed by the System Integrator and as specified in all sections of 40 61 XX, 40 63 XX, 40 67 XX, 40 71 XX, 40 72 XX, 40 73 XX, 40 78 XX and 40 80 XX. Where XX refers to any specification section beginning with the preceding section numbers.

C. Electrical requirements applicable to this work are specified in Division 26.

D. Section includes:

1. Scope
2. Definitions
3. Quality Assurance.
4. Submittals.
5. Products.
6. Installation.
7. Testing.
8. Manufacturers Services.

1.2 SCOPE

A. The work consists of a qualified System Integrator to provide the requirements on this specification section as well as those listed or referenced herein.

1. New primary process measurement devices, instrumentation and new process auxiliary devices.

2. New SCADA system hardware including digital process controllers (PLC based), IO modules, power modules, communication modules, UPS, and network switches.

3. New custom control panels, control stations, junction boxes, and control power distribution panels.

4. Process control system networking.

5. Submittal documentation for process systems instrumentation and control including schedules, drawings, product manuals.

6. Maintaining construction RECORD/AS BUILT of submittal documentation and incorporating interconnection detail from other sections submittals to show accurately process systems instrumentation and control wiring as complete from circuits start and end connections.

7. Configuration set up, calibration, testing process systems instrumentation and controls.

8. Training.

9. Collaboration with System Programmer to provide a fully integrated PLC based SCADA system.

10. Assemble process control hardware into customized fabricated process control panel(s).

11. Factory test process control panel customized fabrication(s).

12. Deliver and install process control panel customized fabrication(s) on site.

B. PROGRAMMING: The Owner's Programmer provides process control system PLC, SCADA and OIT application programming.

1.3 DEFINITIONS

A. GENERAL: Definitions of terminology related to Instrumentation and Industrial Electronic Systems used in the specifications as defined in IEEE 100, ISA S51.1, and NEMA ICS 1.

B. VENDOR PACKAGE PROCESS CONTROL SYSTEM: A system of equipment and hardware provided by a vendor used for control, monitoring process conditions, control feedback and process performance for an associated vendor package equipment system which interfaces to the control system.

C. TWO-WIRE TRANSMITTER: An instrument which derives operating power supply from the signal transmission circuit and requires no separate power supply connections. A two-wire transmitter produces a 4 to 20 milliampere current regulated signal in a series circuit from a 24-volt direct current driving potential and a maximum circuit resistance of 600 ohms. A two-wire transmitter is also referred to as looped power.

D. FOUR-WIRE TRANSMITTER: An instrument which derives operating power from separate power supply connections. A four-wire transmitter produces a 4 to 20

milliampere current regulated signal in a series circuit with a maximum circuit resistance of 600 ohms. Four-wire transmitters typically require 120Vac or 24Vdc input power supply.

E. GALVANIC ISOLATION: Electrical node having no direct current path to another electrical node. Galvanic isolation refers to a device with electrical inputs and/or outputs which are isolated from ground, the device case, the process fluid, and separate power supply terminals. Inputs and/or outputs may be externally grounded without affecting the characteristics of the devices or providing path for circulation of ground currents.

F. PANEL: An instrument support system which may be a flat surface, a partial enclosure, or a complete enclosure for instruments and other devices used in process control systems including consoles, cabinets and racks. Panels provide mechanical protection, electrical isolation, and protection from dust, dirt, moisture, and chemical contaminants which may be pre- sent in the atmosphere.

G. DATA SHEETS: Data sheets shall refer to ISA S20 or ISA TR20.00.01 latest version.

H. SIGNAL TYPES:

1. LOW-LEVEL ANALOG: Signal with full output level of 100 millivolts or less including thermocouples and resistance temperature detectors.

2. HIGH-LEVEL ANALOG: Signals with full output level greater than 100 millivolts but less than 30 volts, including 4 to 20 mA transmission.

3. PULSE FREQUENCY: Counting pulses emitted from speed or flow transmitters.

4. DISCRETE CONTROL OR EVENTS: Dry contact closures and signals monitored by solid state equipment, relays, or control circuits typically rated for 120 volts AC or 24 volts DC.

I. SYSTEMS INTEGRATOR: A firm engaged in the business of detailed control system design and engineering, custom panel fabrication, instrumentation component purchase, instrumentation tuning, system and panel assembly, and testing the specified process control and industrial automation systems.

J. SYSTEMS PROGRAMMER: The Owner's Programmer providing the PLC and SCADA application programming including startup and training service related to programming. The Programmer shall be provided by the Owner. No substitutions will be allowed.

1. OCD Automation – PO Box 2275, Estacada, OR 97023 – ocdautomation.com – (503) 807-2085.

K. OIT: Acronym for Operator Interface Terminal

L. SCADA: Acronym for Supervisory Control And Data Acquisition

M. PLC: Acronym for Programmable Logic Controller – synonymous with Programmable Automation Controller (PAC) for purposes of this project

1.4 QUALITY ASSURANCE

A. This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or other- wise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
IEEE 100	Standard Dictionary of Electrical and Electronics Terms
ISA S5.4	Instrument Loop Diagrams
ISA S20	Specification Forms For Process Measurement and Control Instrumentation, Primary Elements, and Control Valves
ISA S51.1	Process Instrumentation Terminology
ISA TR20.00.01	Specification Forms for Process Measurement and Control Instruments Part 1: General Considerations
NEMA ICS 1	General Standards for Industrial Control and Systems

1.5 SYSTEMS INTEGRATOR

A. The Owner's current System Integrator of record is:

1. OCD Automation – PO Box 2275, Estacada, OR 97023 – ocdautomation.com – (503) 807-2085.

1.6 SYSTEMS INTEGRATOR RESPONSIBILITY

A. GENERAL

1. The specified control system and instrumentation integration including new control panels, instrument calibration, testing, startup, operational testing, and training shall be performed by a Systems Integrator.

2. The control system components shall, as far as practical, be of one manufacturer.

3. The components, modules, devices, and control system equipment shall be recognized industrial quality products. Recognized commercial or office grade products are prohibited.

4. Systems Integrator shall lead the effort to coordinate with the PROGRAMMER, the Contractor and the Owner and Engineer to ensure the control system meets the requirements to interconnect all controlled and monitored equipment correctly and that the PROGRAMMER is kept informed of actual PLC and network arrangements and addressing.

5. Systems Integrator shall host a one day work shop in their manufacturing facility during which the PROGRAMMER will pre load PLC and OIT programs and participate in verification of the control panel readiness for shipment to the site for installation.

    a. Work shall be scheduled at least 2 weeks in advance with all interested parties. City must approve proposed dates and times for all testing and commissioning.

6. Systems Integrator shall coordinate with the PROGRAMMER at least 2 weeks before needing PROGRAMMER to be in attendance for any testing or commissioning/

7. Coordinate testing and configuration of all VFDs installed on the project. This work is expected to be completed in conjunction with the electrical contractor and VFD suppliers.

8. The specified system performance shall be demonstrated to and accepted by the Owner, the Systems Programmer and the Engineer.

B. PRE-SUBMITTAL CONFERENCE:

1. Schedule a pre-submittal conference with the Owner and Engineer within 30-calendar days after Contract award to discuss the work equipment, submittal format, and establish the framework for project coordination and communication.

    a. Provide materials 10-days prior to the conference:

b. Instrument Schedule specified in Section 40 06 70 with manufacturer and model number added.

c. Product descriptive literature with a statement that the item is as specified.

d. Proposed equal products with comparative listing of the published specifications for the specified item and the pro- posed item.

e. A copy of this specification section, with addendum up- dates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements.

2. The pre-submittal conference will not replace the Product and Shop Drawing Submittal review process.

C. PROCESS EQUIPMENT COORDINATION

1. Systems Integrator shall provide wiring interconnect diagrams for the process control system to interface with submitted vendor equipment panels and devices. The wiring diagrams shall be a complete representation of the process control requirements for specific equipment. Systems Integrator coordinates to collect equipment wiring information from other Sections to show a totally wired integrated control system.

2. Integrate, furnish, and install equipment in conformance with the drawings, specifications, and the recommendations of the equipment manufacturer and the related processes equipment manufacturers.

3. Systems Integrator shall obtain manufacturer's technical information for items of equipment not provided with, but directly connected to, the control system. Provide the necessary coordination and components for correct signal interfaces between specified equipment and the control system.

4. Systems Integrator shall coordinate with project subcontractors and equipment suppliers.

5. Systems Integrator shall provide installation supervision for the duration of the project.

6. Conflicts between the plans, specifications, manufacturer/vendor drawings and installation instructions, etc., shall be presented to the Owner for resolution before proceeding.

1.7 SUBMITTALS

A. PROCEDURES: Section 01 32 19

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration

C. Product Data: For each type of device and system:

1. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

b. Catalog cuts shall be edited to show only the items, model numbers, and information which apply.

c. Submittals are to made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable. Submittals that are not submitted in the format outlined may be rejected outright and the Contractor is required to resubmit in the correct format.

2. Provide Seismic calculations for anchoring and support of equipment as required in Section 40 05 07.

3. Manufacturer's installation instruction excerpts that apply to this project:

a. Mounting requirements

b. Electrical connection diagrams

c. Calibration procedures

d. Operation and maintenance information

e. Warranty information

D. SUBMITTAL DRAWINGS

1. GENERAL

a. Prepare drawings in AutoCAD version 2018 or later with borders and title blocks identifying the project and system.

b. Diagrams shall carry a uniform and coordinated set of wire numbers and terminal block numbers

c. The drawing numbers and file names are to be based on equipment tag numbers

d. Provide the following submittal drawings

1) Arrangement and layout drawings

a) Contract document’s drawings are typical illustrations of panel hardware/component arrangement and layouts representing one or more than one panel with similar interconnection requirements. Provide the unique panel arrangement, layout and outline drawings. Show arrangement and layout to scale. Add components and

wiring to the unique panel drawings as required to complete a fully integrated operation. Include on the drawings a Bill of Material that identifies all components in the arrangement and layout.

2) Schematic diagrams

a) Show components of a control panel in an arrangement similar to the actual layout of the panel including internal wiring between devices include IO module layout connections. Show terminal blocks used for internal wiring or field wiring, identified as such

3) Loop diagrams

a) Provide the unique loop diagram for each piece of equipment.

4) Network block diagram

a) A network block diagram is a diagram of the control system, with annotated boxes to show the primary network components (controllers, hubs, switches, computers, displays), and annotated interconnecting lines that show the system communication media and communication protocols].

PART 2 PRODUCTS

2.1 GENERAL

A. MATERIALS AND QUALITY:

1. Provide process control hardware new, free from defects, and industrial-grade, as specified. Each type of instrument, instrument accessory, and device used throughout the work shall be manufactured by one firm, where possible.

2. Electronic process control hardware shall be of solid-state construction with printed or etched circuit boards of glass epoxy of sufficient thickness to prevent warping.

B. ENCLOSURES: NEMA rating for the location and application shown herein and as specified in Section 40 67 16, Division 26, and as shown on the drawings.

Location	Enclosure Material and NEMA Rating
Indoor Dry	NEMA 12: mild steel
Indoor Wet	NEMA 12: mild steel when specified with mounting pad or legs for minor splash resistance) or NEMA 4X: 316 Stainless Steel
Outdoor	NEMA 4X: 316 Stainless Steel
Process Corrosive	NEMA 4X: 316 Stainless Steel
Chemical Corrosive	NEMA 4X: 316 Stainless Steel
Hazardous Area:	NEMA 7: Galvanized Malleable Iron or Aluminum or NEMA 4X and UL listed or FM Approved for the Hazardous Area.

2.2 NAMEPLATES

A. Provide nameplates for all field mounted instrument, analyzer, or equipment. Include the equipment title, the equipment tag number, and power source(s) in the nameplate inscription. Provide machine engraved laminated black phenolic nameplates with white lettering for equipment identification with 1/8-inch high lettering.

2.3 ISOLATION AND SURGE PROTECTION

A. Surge protect power and output signals for transmitters located outdoors:

1. Signal: Provide internal surge protector as a product option. If transmitter does not include an internal surge protector, then provide an external surge protector: Emerson/Rosemount Model 470 D, Emerson/EDCO SS64-036-2, CCI SPN-42 FS28 Series, or approved equal.

2. AC Power: Provide internal surge protector as a product option. If transmitter does not include an internal surge protector then provide an external surge protector. External surge protector UL 1449, LED indicator, screw terminal connections, NEMA 4X, EDCO HSP121A or approved equal.

3. Provide a terminal junction box for housing external surge protector. Box to match NEMA rating of the transmitter.

B. Provide intrinsic safety barrier with two-wire transmitter located in a facility area classified as hazardous per the NEC when instrument is not available as explosion proof (Class I, Division 1) or an alternative protection method recognized by NEC (Class I, Division 2). Require the two-wire transmitter product manufacturer to list

intrinsic safety barriers as an acceptable method for installation in a hazardous classified area.

1. Intrinsic safety barriers for two-wire transmitters to be of the active, isolating, loop powered type. Barrier shall be as recommended by the two-wire transmitter product manufacturer, or accepted equal.

2.4 TRANSMITTER

A. Comply with the following for primary process measurement transmitters unless specified elsewhere for specific instruments:

1. Any transmitter that does not include an integral indicator, provide output indicators. Configure indicator display readout, whether integral or separate, in process measuring units over the calibrated range of the transmitter. Display process measurement as a digital LED or LCD readout with process measuring units on the face of the indicator. Provide indicator with accuracy within two percent of span. Provide loop powered unless otherwise specified. Provide output indicator housing with the same NEMA rating as the transmitter, unless otherwise specified.

2. Operating power derived from the signal transmission circuit for two-wire type transmitters.

3. Provide load variations within the range of 0 to 600 ohms with the power supply at a nominal 24 volts DC with the default range of 0 to 100% corresponding to 4 to 20 mA dc for the transmitter.

4. Configure transmitter output to increase with increasing measurement unless otherwise noted.

5. Galvanically isolate via electro-mechanical or optical technology the transmitter output. If transmitter is not galvanically isolated then provide transmitter output with a loop-powered signal current isolator.

    a. Provide galvanic isolation of milliampere transmission signals from transmitters. Locate isolator inside panel and DIN rail mount. Derive operating power from the signal input circuit or as specified on the drawings.

    b. Input and output signals 4 to 20 milliamperes with error not exceeding 0.1 percent of span. Input resistance not to exceed 550 ohms with an output load of 250 ohms.

6. Provide transmitter enclosures as rated NEMA 250, Type 4X, unless otherwise specified.

2.5 SPARES:

A. Provide 10% spare for most components or at least one spare for each panel component unless a larger specific requirement is listed herein.

1. Power Supplies – 1 of each type used

2. Terminal Blocks – 5 of each type used

3. Fuse – 5 of each type used

4. Circuit Breakers – 2 of each type and size used

5. Surge Protection Devices – 1 of each type used

6. Relays – 2 of each type used

7. Relays Bases – 1 of each type used

8. PLC Modules – 1 of each type used

PART 3 EXECUTION

3.1 INSTALLATION

A. GENERAL:

1. Install process control hardware in locations that are accessible for operation and maintenance services. Process control hardware not accessible shall be reinstalled at no cost to the Owner.

2. Install process control hardware in accordance with product manufacturer's requirements.

3. Ensure process control hardware is grounded per NEC and manufacturer's requirements.

4. Provide proper clearance for process control hardware for heat dissipation and access.

5. Ensure UL/FM or equal listings/markings/labels are viewable after installation.

6. Provide secure mounting of all process control hardware (such as DIN rail mount).

7. Provide electrical circuit protection for process control hardware if not integral.

B. FIELD EQUIPMENT:

1. Provide equipment with ports and adjustable items accessible for in-place testing and calibration. Install equipment between 50 inches and 60 inches above the floor or permanent work platform. Mount equipment to avoid shock or vibration that may impair operation. Mount equipment for unobstructed access and walkways. Equipment support systems not to be attached to hand- rails, process piping or mechanical equipment.

2. Space instruments and cabinets supported by concrete walls by 5/8 inch using framing channel between instrument or cabinet and wall. Block wall shall have additional installation supports, as required, to avoid damage to the wall. Equipment supports shall be hot-dip galvanized after fabrication or shall be 316L stainless steel, as shown or specified.

3. Design support systems for panels to prevent deformation greater than 1/8 inch in any direction under the attached equipment load and under an external load of 200 pounds.

4. In wet or outdoor areas, conduit penetrations into instrument housing shall be made through the bottom (preferred) or side of enclosures to minimize water entry from around or from inside of conduits. Provide conduit hubs for connections and waterproof mastic for moisture sealant.

5. Provide nameplates for all primary process measurement devices. Attach nameplates to support hardware with a minimum of two self-tapping Type 316 stainless steel screws in a readily visible location, but such that if the field device is changed out, the nameplate will remain to identify the service.

6. The transmitter’s output indicator or the switch’s status lights must be viewable from floor or permanent work platform without obstruction.

7. Provide configuration equipment including cables and software to communicate with and configure instruments.

C. ELECTRICAL POWER CONNECTIONS:

1. Equipment electric power wiring shall comply with Division 26. Power disconnect switches shall be provided within sight of equipment and labeled to indicate the specific equipment served and the power source location (including circuit breaker number). "Within sight of" is defined as

having an unobstructed view from the equipment served and within 50 feet of the equipment served.

2. Equipment power disconnect switches shall be mounted between 36 inches and 72 inches above the floor or permanent work platform. Where equipment location requirements cannot be met by a single disconnect switch, provide two disconnect switches: one at the equipment and one at the work platform.

3. Provide a surge arrestor on each 120-volt AC disconnect switch serving primary process measurement device located outdoors.

D. CONTROL AND SIGNAL CONNECTIONS:

1. Equipment electric signal connections shall be made on terminal blocks or by locking plug and receptacle assemblies. Flexible cable, receptacle and plug assemblies shall be used where shown or specified.

2. Jacketed flexible conduit shall be used between equipment and rigid race-way systems (Section 26 05 33). 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 3 feet except where sufficient length is required to allow withdrawal of instruments for maintenance or calibration without disconnection of conduit or cord assemblies.

3.2 TESTING

A. DELIVERY INSPECTION: Notify the Owner upon arrival of any material or equipment to be incorporated into the work. Remove protective covers or otherwise provide access in order that the Owner may inspect such items.

B. REQUIREMENTS: Section 40 61 21.

3.3 MANUFACTURER'S SERVICES

A. TRAINING: Provide a factory-trained manufacturer's representative or System Integrator skilled in equipment use at the Site for the following activities. Specified durations do not include travel time to or from the Site.

B. Procedures specified in section 01 43 33.

C. Provide the services of the manufacturer's representative for a minimum of 2 hours per instruments to evaluate the installation of the instruments, testing and calibration, certification of proper installation, and training.

D. Training sessions to be of adequate duration to cover the scope of the project. Do not repeat a device training if covered in multiple process areas; provide reference to the training session where the device was covered.

E. Coordinate training with operations and maintenance staff schedules to ensure all required staff can attend.

F. Training to include configuration, operation, trouble shooting, wiring, calibration, testing, installation, safety, and warranty coverage for each process control hardware type.

G. Certify completion of training.

END OF SECTION

SECTION 40 61 21
PROCESS CONTROL SYSTEM TESTING

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope
2. Quality Assurance
3. Submittals
4. Product
5. Execution – General
6. Preoperational Test Phase
7. Component Test Phase
8. Operation Test Phase

1.2 SCOPE

A. This section specifies Contractor and Systems Integrator requirements for testing and documenting the process instrumentation and control system for automation integration with SCADA in conjunction with the Owner's Systems Programmer.

B. The term instrumentation covers field and panel instruments, analyzers, primary sensing elements, transmitters, power supplies, and monitoring devices.

C. Provide the labor, tools, material, power, and services necessary to provide the process instrumentation and control system inspection and testing specified herein. Coordinate all test procedures with the requirements of Section 01 40 00.

1. Include the following action items

a. Develop test plan.

b. Develop record keeping system.

c. Coordinate testing with the Owner's Systems Programmer.

D. Testing to include:

1. Pre-Operational - Factory Acceptance Testing (FAT)

2. Component Testing Sequence:

a. Wiring Testing

b. Network and Bus Cable System Inspection and Testing

c. Piping Testing

d. Installation Inspection

e. Instrumentation Calibration

f. Loop Testing

g. Network Testing

3. System (Functional) Testing Sequence:

a. Process Control Strategy/Sequence Testing

b. Control System Closed Loop

c. Functional Checkout

4. Operational Testing:

a. System Acceptance Testing (SAT)

E. Definitions: Section 40 61 13 and for definition of System Integrator and Owner's Programmer.

1.3 QUALITY ASSURANCE

A. REQUIREMENTS: Section 40 61 13 Process Control System General Provisions

B. TESTING MANAGER:

1. The Contractor or Systems Integrator shall appoint a qualified specialist as process control system testing manager to manage, coordinate, and supervise the testing work.

2. The Testing Manager requires at least 5 years of total experience, or experience on at least five separate projects, in managing the testing and startup of electrical and instrumentation control systems of equal or greater scope and complexity. Testing Manager to provide a quality assurance program which includes:

a. Definition of process areas and systems, with testing executed on an area-by-area basis.

b. Sequential list of the test phases required for each process area and system.

c. Completion status tracking form by process area, system, and test phase.

1.4 SUBMITTALS

A. PROCEDURES: Section 01 32 19 Submittal Procedures

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration

C. Package 1:

Organize the submittal items in the following manner for review.

1. QUALIFICATION SUBMITTAL

a. Testing Manager Qualifications and resume

b. Network testing entity qualifications and staff performing inspections and testing

D. Package 2:

1. DEFINITION SUBMITTAL

a. Control descriptions in accordance with the requirements of paragraph 40 61 21 - 2.2 C.

b. I/O Interface Summary in accordance with the requirements of paragraph 40 61 21 - 2.2 D.

c. Testing status spreadsheet in accordance with the requirements of paragraph 40 61 21 - 2.2 A. 3.

d. Test procedures in accordance with the requirements of paragraph 40 61 21-3.1 D.

e. Proposed test forms per PART 3 of this Section 40 61 21, detailed for each test for this project.

f. Certified Factory Calibration Reports.

g. Provide up to date, as constructed control system drawings in accordance with paragraph 40 61 13 - 1.6 D.

h. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

E. Package 3:

1. FAT Schedule and Location

F. Package 4:

1. Completed Test Forms:

a. Completed test forms per PART 3. Separate submittals may be provided for each process area.

b. List of factory calibrated items and calibration certificates.

c. Documentation of network data communication nodes for networked controllers, remote I/O and related devices.

d. Final Test Report assembled in a three-ring binder and submitted at the completion of the inspection and testing activities for a facility.

1) Label the binder cover and spine to identify the project name and facility. Test report includes the applicable test procedures for the facility and the completed inspection and test report forms associated with the equipment and systems of that area.

2) Organize test results by equipment item or system with individual, labeled tab dividers to identify each. System deficiencies and non-compliant test results identified in the final test report and acknowledged by the responsible party as having been corrected.

PART 2 PRODUCTS

2.1 GENERAL

A. The Testing Manager shall provide test forms, documentation, and records as specified in the following paragraphs.

2.2 TESTING DOCUMENTATION

A. DOCUMENTATION RECORDS: The Testing Manager shall develop a record keeping system to document progress and completion for each task in each process area or system. Keep the following current and available for inspection on-site at all times in a location designated by the Owner:

1. Testing Manager's qualifications, project startup and testing history, including resume as specified in this Section.

2. List of names of Contractor’s and System Integrator’s personnel associated with final construction and testing, and normal and emergency contact telephone numbers.

3. Testing Status spreadsheet with breakdown for each process area and process system, with percentage complete on each testing sequence task.

4. Test Report Volumes.

B. TEST REPORT VOLUMES: The Contractor develops and maintains testing documentation for each area of the facility in separate volumes. Keep each volume current and available for inspection on-site at all times in a location designated by the Owner. Each volume includes the following as a minimum:

1. Three-ring binder with front cover and spine labeled: "Testing Documentation For Process Area / Process System" including Owner's name, facility name, project name, and project number.

2. Table of Contents with same labeling as the volume cover with tabs for each section:

a. Section 1 – Control Description

b. Section 2 – I/O Interface Summary

c. Section 3 – Schedules for Integrated Automation Instrumentation and Terminal Devices

d. Section 4 – Test Forms

e. Section 5 – Certified Factory Calibration Reports

f. Section 6 – Final Test Report

C. I/O INTERFACE SUMMARY: Provide I/O spreadsheets for each area of the facility based on the contract drawings, and IO lists. Spreadsheets to include the following for each I/O point:

1. Signal number/tag

2. Annotation description that may be logically abbreviated and that is subject to approval.

3. Complete physical I/O channel designation and addressing or communication I/O register designation.

4. True/False status designations for digital I/O.

5. Process range; engineering units and any multipliers; and raw signal range count for analog I/O.

6. Signals: Fixed point and scaled at the Controller with minimum four significant implied digits of scaling. E.g.: 0 to 1400 at Controller for a pH range of 0 to 14 at Operator Interface.

7. Provide Operator Interface scaling to display decimal digits required.

8. Test result- pass or fail and date of test.

9. Maintain in Excel with electronic updates to Owner issued within 2 days after each test after any updates or changes by Contractor.

PART 3 EXECUTION

3.1 GENERAL

A. GENERAL REQUIREMENTS:

1. Prior to testing, provide notice to the Owner. Provide notice between 60 and 70 days before starting any testing activity, and include a detailed step-by-step test procedure complete with forms for the recording of test results, testing equipment used, and a place for identification of the individual performing or, if applicable, witnessing the test.

2. System integrator to provide detail assistance to the Contractor in generating test forms, customized for this project.

B. TECHNICIAN QUALIFICATIONS:

1. Calibrate and set up field instruments and analyzers using a certified instrument technician qualified to calibrate the instrumentation.

2. Technicians are to be qualified by completion and certification from training courses offered by the Instrumentation, Systems, and Automation Society (ISA), the instrumentation and analyzer manufacturer's training courses, or technician training courses at a recognized trade school that specializes in instrumentation calibration.

C. TEST EQUIPMENT AND MATERIALS:

1. Provide test equipment to conduct the specified tests that simulate inputs and read outputs with a rated accuracy at the point of measurement at least three times greater than the component under test.

2. Ensure test instruments have a current calibration sticker showing date of calibration, deviation from standard, name of calibration laboratory and technician, and date recalibration is required. Include certified calibration reports traceable to the National Institute of Standards and Technology with the final test report.

3. Provide a documenting calibration system to conduct process instrumentation calibration activities that consist of a documenting process calibrator and an instrumentation data management software system that captures the calibration results and electronically documents instrument data, date of calibration, calibration procedures, and as-found and as-left instrument calibration data.

4. Provide an instrument calibration system such as Fluke 743B with Fluke DPC/Track Instrumentation Management software or similar system. Submit calibration files with the final test report in hard copy and electronic formats that do not require specialized equipment or software to read and print the files.

5. Vendor software tools may document the systems where a licensed copy of the identical software including connectors, cables, keys, interface cards and devices required for operation is submitted with the final documentation files.

D. FIELD TEST PROCEDURE DOCUMENTATION:

1. Organize and assemble in separate volumes for each process area test procedures for each analog and discrete loop in the process control system. Submit final test records in electronic form by scanning and converting the records and files to Adobe PDF format, to preserve actual signatures and signoffs.

2. Include test procedure documentation with detailed step-by-step description of the required test procedure, panel and terminal block numbers for points of measurement, input test values, expected resultant values, test equipment required, process setup requirements, and safety precautions.

3. Include test report forms for each loop covering wiring, piping, and individual component tests. Record the actual test results on these forms and assemble a final test report as specified in this Section.

4. Preprint and complete test report forms to the extent possible prior to commencing testing. Include for test report forms that document the field test procedures the following information:

   a. Project name

   b. Process area associated with the equipment under test.

   c. Instrument loop description.

d. Instrument loop identification number.

e. Instrument nameplate data.

f. Instrument setup and configuration parameters.

g. Time and date of test.

h. Inspection checklist and results.

i. Reference to applicable test procedure.

j. Expected and actual test results for each test point in the loop including programmable controller data table or register values.

k. Test equipment used.

l. Space for remarks regarding test procedure or results, unusual or noteworthy observations, etc.

m. Name, date, and signature of testing personnel.

n. Test witness' name and signature.

E. INSTALLED TESTS

1. Provide test forms in conformance with the referenced forms. Develop additional or detailed forms as necessary to suit complex instrumentation. Usage of terms used on test forms shall comply with ISA S51.1.

F. WITNESSING

1. The Owner reserves the right to observe factory and field instrumentation testing and calibration procedures. Notify Owner and Owner's System Programmer prior to testing, as specified herein.

3.2 PREOPERATIONAL TEST PHASE

A. FACTORY ACCEPTANCE TEST (FAT):

1. GENERAL: Factory Acceptance Test control system equipment witnessed by the Owner. The Owner's System Programmer loads control system panel programmable logic controllers (PLCs) with testing software to allow the PLCs to view the process control hardware integrated in specified panels at the System Integrator factory prior to the FAT. System Integrator sets up a temporary network with power to the equipment and collaborates the testing with the Owner's System Programmer to be able

to check out the process control hardware. Provide written notice to the Owner and the Owner's System Programmer thirty working days before the commencement of the FAT activity which includes:

a. Schedule for the FAT.

b. Location of the FAT.

c. Testing equipment used.

d. Detailed test procedure with forms for the recording of test results.

e. Sign-off spaces for the individuals performing and witnessing the tests.

2. FACTORY ACCEPTANCE TEST PROCEDURES: Interlock or network panels as applicable, operated, and checked-out by the equipment supplier prior to the FAT. Submit certification indicating that the panels are ready for the FAT. Include in the FAT the following:

a. Visual inspection of equipment, instruments, control panels, and graphic displays.

b. Validate each input loop and output loop by simulated signals for analog inputs and by shorting discrete inputs with the Owner's System Programmer.

c. Validate with the Owner's System Programmer the following:

1) Monitoring state changes on operator interface screens based on the inputs state change.

2) Observation of online PLC programming application software with the associated PLC outputs state change.

3) Outputs triggered by operator interface software devices (pushbuttons, sliders, manually-entered values, etc.)

4) Calibration and operation of instruments on or in the control panels.

d. Repair of loops which do not pass validation.

e. Retest of the FAT at no additional cost.

f. Panels that pass the FAT may be shipped to the site upon shipping schedule and storage accommodation approval by the Owner.

3.3 COMPONENT TEST PHASE

A. GENERAL REQUIREMENTS: In general, perform tests in the following order

1. WIRING TESTING: Provide electrical power and signal cable ring-out and resistance testing. Conduct test in accordance with Sections 26 05 00 and 26 08 00. Do not conduct wiring tests until cables have been tagged and inspected.

a. Power and Control: In accordance with the requirements of Section 26 08 00.

b. Test shield to ground in panels and cabinets to verify terminal connections.

c. Sample test forms are included at the end of this section.

2. NETWORK AND BUS CABLE INSPECTION AND TESTING

a. Inspect and test by independent industrial network testing firms.

b. Test proprietary bus systems by the manufacturers' qualified field services technician. Manufacturer's sales personnel are not considered to be qualified technicians unless qualifications are documented and certified by the manufacturer.

c. Test standardized networks and buses by a qualified independent network testing service. Test the following types of cabling and networks, and certify by the independent industrial network testing firm:

1) Ethernet system cabling

2) Other networks provided as a part of a vendor packaged monitoring or interfacing to the process control system.

d. Test and verify control and instrumentation bus cabling using the standards that apply to the specific cable and bus type as follows:

1) Ethernet Category 5E and Category 6: in accordance with the requirements of TIA/EIA-568B standards

2) PRE-ACTIVE TESTING: Prior to energizing, inspect and test cabling to verify the following:

a) Media type and specifications.

b) Physical routing and project specific cable identification tagging.

c) Correct termination installation and connection of conductors to pins at terminations.

d) Record cable run length and compare to the manufacturer or industry standards to verify lengths are within specifications.

e) Locations and values of network termination resistance.

f) Integrity and grounding of cable shields.

g) Values of transient protection (surge) elements.

h) Firmware revision level of network devices available prior to energization.

i) Settings of dip switches and configuration parameters.

3) ACTIVE SYSTEM TESTING: After the cable or network system has been activated for testing, provide diagnostic monitoring and signal analysis for the bus network system to evaluate network and bus integrity and data transfer quality. Measure, verify and record the following parameters:

a) Node addressing.

b) Signal attenuation before and after any repeater device and at the farthest point in the network.

c) Total network trunk voltage and current loading as applicable.

d) Baud rate, message traffic rate, percent bandwidth used, error rate, lost packet count.

e) Firmware revision level of the network devices.

f) Pre-active and active testing shall fall within the specified range of values established by the referenced standards.

g) Correct the functionality of networks and devices connected to the network.

3. INSTRUMENT AND COMPONENT INSPECTION: Inspect process, instrumentation and controls components, include the following:

   a. Compare and validate instrument type and nameplate data with the drawings, specifications, and data sheet.

   b. Validate instrument identification tag.

   c. Confirm instrument installation conforms to drawings, specifications, and manufacturer's instructions.

   d. Verify proper conductor termination and tagging.

   e. Visual check for physical damage, dirt accumulation, and corrosion.

   f. Verify all components and instruments including isolation amplifiers, surge protection, and safety barriers are properly installed.

   g. Report deficiencies identified within 24 hours of discovery. No instrument or system component shall be tested until all deficiencies are addressed.

4. INSTRUMENTATION CALIBRATION:

   a. Field calibrate instruments and final elements in accordance with the manufacturer's recommended procedures and test in accordance with the Contractor's submitted test procedure.

   b. Do not commence individual component calibration and testing until Instruments and Component Inspections are completed and documented to the satisfaction of the Owner and the Engineer.

   c. Calibrate analog instruments at 0, 10, 50, 90, and 100 percent of the specified full-scale range in both ascending and descending order. Adjust each signal sensing trip and process sensing switch to the required setting. Record calibration data on test forms as specified herein.

   d. Test and adjust final element alignment to verify that each final element operates smoothly over the full range in response to the specified process control signals.

e. Enter test data on the applicable test forms at the time of testing: Set alarm trips, control trips, and switch dead bands to initial values specified by Owner's System Programmer. Check final elements for range, dead- band, and speed of response.

f. Repair or replace by the manufacturer any component that fails to meet the required tolerances. Repeat the specified tests until the component is within tolerance.

g. Install a calibration sticker on each instrument following successful calibration that indicates the date of calibration, the name of the testing company, and personnel who calibrated the instrument.

h. Use test form at the end of this section

5. CERTIFIED TEST REPORTS: Field test and inspection activities include verification of instrument parameter setup, verification of instrument zero, and performance at five operating points within the instrument range. Return for re-calibration or replace as agreed depending on the impact to the project as determined by the Owner and Engineer, any instrument which fails to demonstrate proper performance.

6. LOOP TESTING: System Integrator to collaborate the loop testing with the Owner's System Programmer. The System Integrator is to be in the field with the Owner's System Programmer to assist in the testing by verifying wiring and equipment is functioning properly and recording testing results. The Owner's System Programmer verifies the application programming.

   a. Do not commence Loop Testing until the Individual Component Calibration and Testing has been completed and documented to the satisfaction of the Owner and Engineer.

   b. Test each instrument loop as an integrated system. Check operation from field instruments to transmitter to receiving components to the vendor panel or the Plant Control System Operator Interface Station. Inject test signals at the process impulse line connection where the measuring technique permits, and otherwise at the most primary signal access point.

   c. Testing of loops with an interface to a programmable logic controller and SCADA graphical user interface are to include verification of the programmable logic controller input/output assignment and verification of operation of the input/output system, processor and SCADA. Test loop from field through

programmable logic controller and SCADA with the Owner's System Programmer.

d. Correct the loop circuitry or device if the output control or monitoring device fails to indicate properly. Repeat the test until devices and instruments operate as required.

e. See test form at the end of this section.

3.4 SYSTEM TEST PHASE

A. GENERAL: System Integrator to collaborate the system test phase with the Owner's System Programmer. The System Integrator to be in the field with the Owner's System Programmer to assist in the testing by verifying wiring and equipment is functioning properly, tuned as required, and recording testing results. The Owner's System Programmer verifies the application programming.

B. PROCESS CONTROL STRATEGY/FUNCTIONAL TESTING:

1. Do not commence Control Strategy Testing until the Loop Testing has been completed and documented to the satisfaction of the Owner and Engineer.

2. Control Strategy Testing consists of installing and debugging the PLC control logic program, verifying the interface points between the PLCs and field devices and equipment, and exercising the control strategies. Perform Control Strategy Testing on one PLC at a time.

3. Provide qualified personnel to immediately correct any deficiencies in the Work that may be encountered during Control Strategy Testing. Failure of the Contractor to provide such personnel in a timely manner may prolong the time allotted to complete Control Strategy Testing.

C. CONTROL SYSTEM CLOSED LOOP TESTING:

1. Do not commence Closed-Loop tests until the Control Strategy Testing has been successfully completed and documented to the satisfaction of the Owner and Engineer.

2. Demonstrate closed-loop tests, performed as part of the system tests, provide stable operation of each loop under operating conditions. Adjust loop tuning parameters as required during the testing.

3. Tuning parameters for PID control: Tune the gain (or proportional band), integral time constant, and derivative time constant for each control loop. Adjust to provide 1/4-amplitude damping, unless otherwise specified.

4. Adjust control loops with "batch" features to provide optimum response following start-up from an integral action saturation condition.

5. Provide graph recordings to show the PID response (include set point, control output, measured feedback) at initial start-up, during sequencing, during a step disturbance additional and show 1/4 amplitude damping. Label to show loop number and title, and settings of parameters and set point.

6. Where a loop is controlled under the direction of a programmable logic controller, the Owner's System Programmer will perform the necessary adjustment of loop tuning parameters and set points; Contractor records the loop response, adjusts final elements, and assures total integrated loop performance as specified.

D. FUNCTIONAL CHECKOUT:

1. Conduct to verify the operation of discrete and hardwired control devices.

2. Exercise the operable devices and energizing the control circuit.

3. Operate control element, alarm device, and interlocks to verify the specified action occurs.

3.5 OPERATIONAL TEST PHASE

A. Perform System Acceptance Test (SAT) after component and subsystem tests have been completed. Perform the test of the completed system in full operation and demonstrate that all functional requirements of this specification have been met. System Integrator to collaborate SAT with the Owner's System Programmer. The System Integrator to be in the field with the Owner's System Programmer to assist in the testing by verifying wiring and equipment is functioning properly, tuned as required, and recording testing results. The Owner's System Programmer verifies the application programming. Demonstrate during SAT the following:

1. Each component of the system operates correctly with all other components of the system.

2. Analog control loops operate in a stable manner.

SAMPLE INSTRUMENT CALIBRATION SHEET

COMPONENT	MANUFACTURER	PROJECT
Code:	Name:	Number:
Name:	Model: Serial #:	Name:

FUNCTIONS

	RANGE	VALUE	UNITS	COMPUTING FUNCTIONS? Y / N	CONTROL? Y / N Action? direct / reverse Modes? P / I / D
Indicate? Y / N	Chart:			Describe:	
Record? Y / N	Scale:				SWITCH? Y / N Unit Range:
Transmit/ Convert? Y / N	Input:				Differential: fixed/adjustable
	Output:				Reset? automatic / manual

ANALOG CALIBRATIONS							DISCRETE CALIBRATIONS					Note No.
REQUIRED			AS CALIBRATED				REQUIRED			AS CALIBRATED		
Input	Indicated	Output	Increasing Input		Decreasing Input		Number	Trip Point	Reset Pt.	Trip Point	Reset Pt.	
			Indicated	Output	Indicated	Output		(note rising or falling)		(note rising or falling)		
							1.					
							2.					
							3.					
							4.					
							5.					
							6.					
CONTROL MODE SETTINGS:			P:	I:	D:		7.					

#	NOTES:	Component Calibrated and Ready for Startup
		CONTRACTOR'S REPRESENTATIVE:
		Date:
		Tag No.:

SAMPLE MOTOR DATA FORM:

Equipment Name____Equipment No(s) ____

Project Site Location _____

Nameplate Markings

Mfr:		Mfr Model:		Frame:		Horsepower:	
Volts:		Phase:		RPM:		Service Factor:	
FLA:		LRA:		Frequency:		Amb Temp Rating:	ºC
Time rating:				Design Letter:			
	(NEMA MG1-10.35)				(NEMA MG-1.16)		
KVA Code Letter:				Insulation Class:			

The following information is required for explosion-proof motors only:

A. Approved by UL for installation in Class___, Div___, Group _____

B. UL frame temperature code_____ (NEC Tables 500-8B)

The following information is required for all motors 1/2 horsepower and larger:

A. Guaranteed minimum efficiency __

B. Nameplate or nominal efficiency _

Data Not Necessarily Marked on Nameplate

Type of Enclosure:			Enclosure Material:		
Temp Rise:	ºC (NEMA MG1-12.41,42)				
Space Heater included?	☐ Yes	☐ No	If Yes:	Watts	Volts
Type of motor winding over-temperature protection, if					

Provide information on other motor features specified:

SAMPLE TRANSMITTER CALIBRATION TEST DATA FORM

Tag No. and Description:

Make & Model No.: Serial No.:

Input:

Output:

Range: Scale:

Simulate process variable (flow, pressure, temperature, etc.) and measure output with appropriate meter.

% of Range	Input	Expected Reading	Actual Reading	% Deviation
0				
50				
100				
			% Deviation Allowed:	

CERTIFIED Date

Contractor's Representative

WITNESSED Date

Owner's Representative

SAMPLE CONTROL LOOP CALIBRATION TEST DATA FORM

Tag No. and Description:

Make & Model No.: Serial No.:

Input: Process Variable (PV) Scale:

Output: Output Scale:

PV Scale Calibration

% of Range	Input	Expected Reading	Actual Reading	% Deviation
0				
50				
100				
			% Deviation Allowed:	

Connect output to PV for following tests:

Set Point (SP) Indicator			Output Meter Accuracy			Controller Accuracy		
SP	PV Reading	Expected % Dev.	Actual Readin	Expecte d	Actual % Dev.	Output	Output	% Dev.
(0%)								
(50%)								
(100%)								
% Deviation			% Deviation			% Deviation		

CERTIFIED Date

Contractor's Representative

WITNESSED Date

Owner's Representative

END OF SECTION

SECTION 40 61 26
PROCESS CONTROL SYSTEM TRAINING

PART 1 **GENERAL**

1.1 SUMMARY

A. CONTRACTOR shall provide operator training on the operation and maintenance of the control system and all components.

B. The process instrumentation and control Work for which training is to be provided includes, but is not limited to, the following:

1. Field-mounted instruments and devices.

2. Programmable logic controllers (PLC)

3. Local area network hardware and software.

4. Field instruments network communication hardware and software required for interfacing various systems to provide a fully-integrated system.

C. Coordination

1. Some panels and equipment are furnished under other Specification Sections. Under this Contract the Contractor shall coordinate the training for the use and maintenance of equipment they provide with control equipment provided with packaged equipment and with the PLC and SCADA system programming that will be provided by the OWNER's Programmer. CONTRACTOR shall coordinate with Suppliers of panels and equipment to provide fully functional system complying with the Contract Documents and that interfaces with the process control network.

1.2 SCOPE

A. Process Instrumentation and Control System Work for which training is to be provided is specified under the control panel and instrumentation Division 40 specifications.

1.3 REFERENCES

A. Underwriters Laboratory (UL).

B. National Electrical Manufacturers Association (NEMA).

C. Instrument Society of America (ISA).

D. ISA 5.4, Instrument Loop Diagrams.

E. ISA 20, Specification Forms for Process Measurement & Control Instruments, Primary Elements & Control Valves.

F. ANSI/ASQ Z1.4, Sampling Procedures and Tables For Inspection By Attributes.

G. NFPA 79, Electrical Standard for Industrial Machinery.

1.4 SUBMITTALS

A. Operator Training plan and schedule

B. Maintenance Training and schedule

1.5 TRAINING

A. General:

1. Provide an integrated training program for Owner's personnel.

2. Perform training to meet specific needs of Owner's personnel.

3. Include training sessions for managers, engineers, operators, and maintenance personnel.

4. Provide instruction on two working shift(s) as needed to accommodate the Owner's personnel schedule.

5. Owner reserves the right to reuse videotapes of training sessions.

B. Operations and Maintenance Training:

1. General:

a. Refer to specific requirements specified in Div 40 Subsections.

b. Include review of O&M data and survey of spares, expendables, and test equipment.

c. Use equipment similar to that provided.

d. Unless otherwise specified in Process Control System subsections, provide training suitable for instrument technicians with at least a 2-year associate engineering or technical degree, or equivalent

education and experience in electronics, instrumentation, or digital systems.

2. Operations Training: For Owner's operations personnel on operation of I&C components.

    a. Training Session Duration: 1/2 instructor days.

    b. Number of Training Sessions: Two.

    c. Location: Project Site.

    d. Course Objective: Develop skills needed to use I&C components and functions to monitor and control the plant on a day-to-day basis.

    e. Content: Conduct training on loop-by-loop basis.

        1) Loop Functions: Understanding of loop functions, including interlocks for each loop.

        2) Loop Operation: For example, adjusting process variable setpoints, AUTO/MANUAL control transfer, AUTO and MANUAL control, annunciator acknowledgement and resetting.

        3) Interfaces with Process Control System subsystems.

3. Maintenance Training:

    a. Training Session Duration: 1/2 instructor days.

    b. Number of Training Sessions: Two.

    c. Location: Project Site

    d. Course Objective: Develop skills needed for routine maintenance of Process Control System.

    e. Content: Provide training for each type of component and function provided.

        1) Loop Functions: Understanding details of each loop and how they function.
        2) Component calibration.
        3) Adjustments: For example, controller tuning constants, current switch trip points, and similar items.

4) Troubleshooting and diagnosis for equipment and software.
5) Replacing lamps, and fuses.
6) I&C components removal and replacement.
7) Periodic preventive maintenance.

PART 2 **PRODUCTS**

2.1 NOT USED

PART 3 **EXECUTION**

3.1 FIELD TRAINING

A. Training sessions to be 1-hour duration and do not repeat a device training if covered in multiple Facility areas; provide reference to the training session where the device was covered. Conduct one training session for each device type per week on two consecutive weeks to accommodate the shift schedules of operation and maintenance staff.

B. Training to include a demonstration of configuration, operation, trouble shooting, wiring, calibration, testing, installation, safety, and warranty coverage for each device type.

3.2 MANUFACTURER'S SERVICES

A. TRAINING: Provide a factory-trained manufacturer's representative or System Integrator skilled in equipment use at the Site for the following activities. Specified durations do not include travel time to or from the Site.

B. Coordinate training with operations and maintenance staff schedules to ensure all required staff can attend.

C. Training to include configuration, operation, trouble shooting, wiring, calibration, testing, installation, safety, and warranty coverage for each process control hardware type.

D. Certify completion of training on form provided herein.

END OF SECTION

SECTION 40 62 63
OPERATOR INTERFACE TERMINALS (OIT)

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope
2. Reference Standards
3. Quality Assurance
4. Submittals
5. Products
6. Installation
7. Testing

1.2 SCOPE

A. This Section specifies requirements for supply and installation of an Operator Interface Terminal (OIT).

B. The Systems Integrator shall provide all hardware and all software licenses for a fully functional OIT.

1.3 REFERENCE STANDARDS

A. ASTM – American Society for Testing and Materials

B. NEMA – National Electrical Manufacturer's Association

C. NEC – National Electrical Code

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 40 61 13 Process Control System General Provisions and Section 40 67 00 Control System Panels.

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design workmanship or materials.

1.5 DELIVERY AND STORAGE:

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

B. Store indoors in clean dry space with uniform temperature to prevent condensation and per manufacturer's recommendations. Protect from exposure to dirt, fumes, water, corrosive substances, and physical damage.

C. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.

D. Provide equipment and personnel to handle products; use methods to prevent soiling, disfigurement, or damage.

1.6 SUBMITTALS

A. PROCEDURES: Section 01 32 19

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the

specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

   a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

   b. Catalog cuts shall be edited to show only the items, model numbers, and information which are applicable and crossing out all inapplicable information.

   c. Submittals are to made electronically in PDF format, the PDF shall be organized by specification section and linked to an index. The PDF shall be searchable. Submittals that are not submitted in the format outlined may be rejected outright and the Contractor is required to resubmit in the correct format.

C. Manufacturer's installation instructions.

D. Operation and Maintenance Manual if applicable.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. The OIT shall be:

1. DC powered, 17” industrial panel mount color monitor and resistive touch screen with stainless steel bezel.

2. To match standardized units currently used by the Owner, the unit shall be an Automation Direct EA9-T10CL.

2.2 ENVIRONMENTAL REQUIREMENTS

A. Operating Temperature of 32 to 122 degrees F.

B. Vibration tolerance of 57 to 500 hertz at 2 G peak acceleration or testing per IEC60068-2-6 (Test Fc).

C. Shock withstand during operation of 11 G at 11 milliseconds or testing per IEC60068-2-27 (Test Ea).

D. NEMA/UL Type 4/4X (indoor use) and IEC IP65 (indoor use)

2.3 FEATURES

A. Thin Film Transistor (TFT) Color graphic display

1. Four-wire analog resistive, single touch

2. Brightness: 280 nits minimum

B. Battery or capacitor backed real time clock (30-day minimum)

C. SD card memory slot

2.4 ELECTRICAL REQUIREMENTS

A. Supply Voltage 120 VAC, single phase or 18 – 32 VDC as shown on the drawings.

2.5 COMMUNICATION REQUIREMENTS

A. Communication protocol compatible with the PLC as listed on the drawings.

B. Ethernet TCP/IP 100 MB and/or serial port as listed on the drawings.

C. Two USB ports for peripherals

PART 3 EXECUTION

3.1 INSTALLATION

A. REQUIREMENTS: Section 40 61 13 and install in accordance with manufacturer's instructions for the specified functional requirements.

B. Install per manufacturer’s instructions and as shown on the drawings.

C. The screens for the operator interface terminal shall be consistent with the layout of the existing operator interface screens within the system. Consult with Owner to provide access to those stations for preview whom may provide a copy of the current programming of one of the stations upon request.

3.2 TESTING

A. REQUIREMENTS: Section 40 61 21.

B. Ensure proper installation per manufacturers recommendations

3.3 MANUFACTURER'S SERVICES

A. REQUIREMENTS: Section 40 61 13 and 40 61 26

END OF SECTION

SECTION 40 63 43
PROGRAMMABLE LOGIC CONTROLLERS

PART 1 GENERAL

1.1 SUMMARY

A. Programmable logic process controllers are also known as programmable logic controllers (PLCs) and central processing unit (CPU). This section specifies general requirements for programmable logic process controllers and I/O Modules.

B. Section includes:

1. Scope
2. Quality Assurance
3. Submittals
4. Performance Requirements
5. Products
6. Installation
7. Testing
8. Manufacturer's Services

1.2 SCOPE

A. Provide and test programmable logic process controllers with other process control hardware specified to form a functional process control system.

B. Provide remote Point I/O for the input/output requirements as specified on the drawings for executing the control sequences PLC and SCADA logic.

1.3 QUALITY ASSURANCE

A. REQUIREMENTS: Section 40 61 13 Process Control System General Provisions

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design workmanship or materials

1.4 SUBMITTALS

A. PROCEDURES: Section 01 32 19 and 40 61 13

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein,

or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

    a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

    b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration

C. Product Data: For each type of device and system:

    1. Include product data sheets and equipment brochures showing standard products and specified accessories.

        a. Mark data sheets to clearly show exact product and options being provided

D. Manufacturer's installation instructions.

E. Operation and Maintenance Manual if applicable.

PART 2 PRODUCTS

2.1 CANDIDATE MANUFACTURERS

A. To ensure compatibility with the Owners existing PLC System, the PLC System shall be Rockwell Automation, (Allen-Bradley PLC), CompactLogix System with 1769-L33ER CPU.

2.2 MATERIALS

A. Provide new, free from defects, and industrial-grade processor and I/O modules as shown on the drawings.

B. Provide additional components, including power supplies and cables, as required by the manufacturer.

C. Provide appropriate screw type terminal connector for each type of I/O module required or listed herein.

2.3 INPUT/OUTPUT MODULES

A. Provide input/output modules as shown on the drawings or as required for a complete and functional system.

B. Unless shown differently on the plans, module types shall be:

1. PLC Power Supply, 120VAC 1769-PA2

2. Discrete Input Module, 120VAC, 16 Pt. 1769-IA16

3. Discrete Output Module, 120VAC, 16 Pt. 1769-OA16

4. 4 Channel Analog Input Module, 1769-IF4I

5. Termination End Cap, 1769-ECR

C. Provide 1 spare PLC module for each type of module, no spare CPU required.

PART 3 EXECUTION

3.1 INSTALLATION

A. Installation requirements: I/O to be din-rail mounted inside control panel as specified in Section 40 67 16 Control Panels and as shown on the drawings

3.2 TESTING

A. Testing requirements specified in: Section 40 61 21.

3.3 MANUFACTURER'S SERVICES

A. REQUIREMENTS: Section 40 61 13 and 40 61 26

END OF SECTION

SECTION 40 67 16
CONTROL PANELS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope
2. Panel Information
3. Panel Design
4. Quality Assurance
5. Submittals
6. Performance Requirements
7. Products
8. General

1.2 SCOPE

A. This section specifies requirements for process control panels and hardware required for custom fabrication.

B. Provide the instrument, control, and monitoring features indicated on the electrical drawings. Panels shall be arranged to separate control and instrument devices from power wiring. Panel shall be arranged for dedicated field wiring terminations rated for 600 Vac or less for power, control, and instrument signal wiring shall be fabricated by a UL-508A recognized facility and shall bear the appropriate UL 508A Industrial Control Panel label. Panels for Hazardous (Classified) Locations shall bear the appropriate UL 698A label.

C. Panels that contain programmable logic controllers (PLC) are as shown on the drawings.

D. Comply with the specified products in Sections 40 61 13. Panels that do not comply with the specified products and specified logic method, hardwired or PLC logic, shall not be accepted. Cost to retrofit the panel as specified shall be borne by the panel supplier. Corrections or modifications to UL 508A Industrial Control Panels shall be transported to the panel supplier's facility for corrections, testing, relabeling and inspection.

E. Field modifications require a UL inspector site inspection for approval of panel corrections and to re-label the panel after the field modifications are completed.

F. Refer to Section 26 27 16 that specifies requirements for manufacturer, vendor, and Contractor provided panels that include motor controllers, combination motor starters, control devices, and logic devices as shown on the electrical drawings. These requirements apply to this section as well.

G. Submittal drawing requirements specified in Section 01 32 19 and 40 61 13.

H. Label panels with fault current rating per NEC article 409.110.

1.3 REFERENCE STANDARDS

A. This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

1. American National Standards Institute (ANSI).

2. ASTM International (ASTM):

a. B75, Standard Specification for Seamless Copper Tube.

3. National Electrical Manufacturers Association (NEMA):

a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

b. ICS 4, Industrial Control and Systems: Terminal Blocks.

4. National Fire Protection Association (NFPA):

a. 70, National Electrical Code (NEC).

5. Underwriters Laboratories, Inc. (UL):

a. 508A, Standard for Safety Industrial Control Panels.

b. 913, Standard for Safety, Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations.

c. 698A, Industrial Control Panels Relating to Hazardous (Classified) Locations.

1.4 DEFINITIONS

A. The term "panel" refers to control panels or enclosures listed in the schedule included in this Section.

B. Foreign Voltages: Voltages that may be present in circuits when the panel main power is disconnected.

1. Intrinsically Safe Circuit: A circuit in which any spark or thermal effect is incapable of causing ignition of a mixture of flammable or combustible material in air under test conditions as prescribed in UL 913.

C. Cable: Multi-conductor, insulated, with outer sheath containing either building wire or instrumentation wire.

D. Instrumentation Cable:

1. Multiple conductor, insulated, twisted or untwisted, with outer sheath.

2. Instrumentation cable is typically either TSP (twisted-shielded pair) or TST (twisted-shielded triad) and is used for the transmission of low current or low voltage signals.

E. Ground Fault Circuit Interrupter (GFCI): A type of device (e.g., circuit breaker or receptacle) which detects an abnormal current flow to ground and opens the circuit preventing a hazardous situation.

F. Programmable Logic Controller (PLC): A specialized industrial computer using programmed, custom instructions to provide automated monitoring and control functions by interfacing software control strategies to input/output devices. Synonymous with Programmable Automation Controller (PAC) for purposes of this project

G. Remote Terminal Unit (RTU): An industrial data collection device designed for location at a remote site, that communicates data to a host system by using telemetry such as radio, dial-up telephone, or leased lines.

H. Input/Output (I/O): Hardware for the moving of control signals into and/or out of a PLC or RTU.

I. Supervisory Control and Data Acquisition (SCADA): Used in process control applications, where programmable logic controllers (PLCs) perform control functions but are monitored and supervised by computer workstations.

J. Digital Signal Cable: Used for the transmission of digital communication signals between computers, PLCs, RTUs, etc.

K. Uninterruptible Power Supply (DC UPS):

1. A backup power unit that provides continuous power when the normal power supply is interrupted.

2. Provided in each cabinet and panel as indicated by an asterisk (*) in the Panel Schedule in Paragraph 3.05.

3. Sized to provide a minimum of 8 hours of continuous operation of all connected components.

L. Provide monitoring and alarm points as shown on the Drawings.

M. Loop Calibrator: Portable testing and measurement tool capable of accurately generating and measuring 4-20ma DC analog signals.

1.5 QUALITY ASSURANCE

A. REQUIREMENTS: Section 40 61 13 Process Control System General Provisions

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design workmanship or materials

C. Entire assembly shall be affixed with a UL 508A or 698A label "Listed Enclosed Industrial Control Panel" prior to shipment to the jobsite.

D. Each panel shall have an affixed fuse identification list.

E. Each panel shall have an affixed power and short circuit rating label.

1.6 SUBMITTALS

A. PROCEDURES: Section 01 32 19

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way

submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration

C. Submittal items required include:

1. Submit items specified in Section 40 61 13

2. Arrangement and Layout Drawings

3. Exterior panel layout

4. Interior panel layout

5. Bill of Materials

6. PLC I/O list

7. Door-in-door construction devices, where required

8. Sections showing clearances between face and rear mounted equipment.

9. Connection Diagrams.

10. Nameplate engraving schedule:

a. Indicate engraving by line

b. Character size

c. Nameplate size

d. Panel and equipment tag number and description

11. Heat load calculations for each cabinet based on the highest ambient temperature for the area in which the subject panel will be located.

12. Power supply calculations.

13. Manufacturer's operation and maintenance information as specified in Section 01 78 23. Manual shall include final reviewed submittal redlined to show AS BUILT conditions; and separate record of all final configuration, jumper, and switch settings.

14. Climate control calculations for each panel

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Enclosures

1. Pentair/Hoffman Enclosures, Inc
2. Saginaw
3. Rittal
4. Hammond Manufacturing
5. Milbank Mfg. Co.

B. Panel Heaters

1. Pentair/Hoffman Enclosures, Inc.
2. Saginaw
3. Rittal
4. Hammond Manufacturing.

C. Ventilation Fans

1. Pentair/Hoffman Enclosures, Inc.
2. Saginaw
3. Rittal
4. Hammond Manufacturing

D. Internal corrosion inhibitors:

1. Hoffman Enclosures, Inc.: Model A-HCI.
2. Northern Technologies International Corporation (NTIC):
3. Model Zerust VC.
4. Cortec Corporation: Model VpCl Emitting Systems.

E. Thermostat

1. Pfannenberg

2. Stego
3. Or approved equal.

2.2 FABRICATION

A. General:

1. Fabricate panels with instrument arrangements and dimensions identified in the Contract Documents.

2. Provide panel(s) with the required enclosure rating per NEMA 250 to meet classifications identified in the Contract Documents. Only NEMA Type 4X will be accepted for installation in the field. NEMA 12 will be acceptable in air- conditioned electrical rooms.

3. Devices installed in panel openings shall have a NEMA enclosure rating at least equal to the panel enclosure rating.

4. Short circuit current rating of panel:

   a. 5,000A, minimum.

5. Panels and pedestals to be located outdoors shall be fabricated from 316 stainless steel and shall utilize appropriate hinge and locking components. Panel(s) shall be completely assembled at the Contractor's factory:

   a. No fabrication other than correction of minor defects or minor transit damage shall be performed on panels at the jobsite.

6. Painting:

   a. Panels fabricated from steel shall have their internal and external surfaces prepared, cleaned, primed, and painted:

      1) Mechanically abrade all surfaces to remove rust, scale, and surface imperfections.

      2) Provide final surface treatment with 120 grit abrasives or finer, followed by spot putty to fill all voids.

      3) Utilize solvent or chemical methods to clean panel surfaces.

      4) Apply surface conversion of zinc phosphate prior to painting to improve paint adhesion and to increase corrosion resistance.

5) Electrostatically apply polyester urethane powder coating to all inside and outside surfaces.

6) Bake powder coating at high temperatures to bond coating to enclosure surface.

a) Panel interior shall be white with semi-gloss finish.

b) Panel exterior shall be ANSI #61 gray with flat finish.

7) Application of alkyd liquid enamel coating shall be allowed in lieu of polyester urethane powder for wall mounted NEMA 12 rated panels

b. Panels fabricated from stainless steel, aluminum, or fiberglass shall not be painted.

7. Finish opening edges of panel cutouts to smooth and true surface conditions:

a. Panels fabricated from steel shall have the opening edges finished with the panel exterior paint.

8. Panel shall meet all requirements of UL 508A

a. If more than one (1) disconnect switch is required to disconnect all power within a panel or enclosure, unless otherwise required by UL 508A, provide a cautionary marking with the words "CAUTION" and the following or equivalent, "Risk of Electric Shock-More than one (1) disconnect switch required to de-energize the equipment before servicing."

9. Provide control panel in accordance with NEC Article 409 - Industrial Control Panels:

a. In the event of any conflict between NEC Article 409 and UL 508A, the more stringent requirement shall apply.

10. Panel shall meet all requirements of UL 698A

a. Provide intrinsically safe circuit extensions from panels in unclassified locations into hazardous classified locations in accordance with the NEC as required by UL 698A.

11. Panel door handles shall be lockable with a paddle lock. Verify acceptable shank diameter and lock sizes with SPU.

B. Wall Mount, Free-Standing or Pedestal-Mounted Panels:

1. Welded construction.

2. Completely enclosed, self-supporting and gasketed dust-tight.

3. Rolled lip around all sides of enclosure door opening.

4. Seams and corners welded and ground smooth to touch and smooth in visual appearance.

5. Full height, fully gasketed flush pan doors.

6. Full length piano hinges rated for 1.5 times door plus instrument weight.

7. Doors with 3-point latch and L-shaped, quarter-turn padlockable handles.

8. Appropriate conduit, wiring, and instrument openings shall be provided.

9. Lifting eyebolts:

   a. To allow simple, safe rigging and lifting of panel during installation.

   b. Removed, holes plugged, and eyebolts stored inside respective enclosure.

10. Enclosures shall be constructed of a minimum of 12-gauge stainless steel.

11. Where double doors are provided, provide removable center post.

C. Internal Panel Lighting:

1. One (1) 12-inch 12 VDC or 30 VDC LED strip light fixture with door-activated switch (es) per FT of panel face. Model: Saginaw SCE-SLMS with mounting accessories and connectors; or approved equal.

D. Component Mounting and Placement:

1. Components shall be installed per manufacturer instructions. Double-faced tape will not be permitted.

2. Control relays and other control auxiliaries shall be mounted on DIN rail mounting channels where practical.

3. Terminal blocks shall be mounted vertically in the enclosure with ample clearance to allow visual guidance for installing wires.

4. Front panel devices shall be mounted within a range of 40 to 70 IN above the finished floor or grade, unless otherwise shown in the Contract Documents.

5. I/O rack or module installation:

   a. Located such that the LED indicators and switches are readily visible with the panel door open.

   b. Located such that calibration, repair and/or replacement of component can be accomplished without the need to remove wire terminations or other installed components.

   c. Where components such as relays, and other electromagnetic devices are installed within the same enclosure as the PLC system components, provide a barrier of at least 6-inch of separation between the “power area containing the electromagnetic devices” and the “control area”.

6. Components mounted in the panel interior shall be fastened to an interior sub- panel using machine screws:

   a. Fastening devices shall not project through the outer surface of the panel enclosure.

7. Locate and install all devices and components so that connections can be easily made and ample room is provided for servicing each item

E. Follow UL recommendations.

2.3 INTERNAL WIRING

A. See Section 40 67 33

2.4 SPARE PARTS

A. Spare parts are to be provided in accordance with 40 61 13

B. Tag and store spare parts in accordance with Section 40 61 13.

C. Provide 20 percent spare contiguous sub-panel area for future expansion.

PART 3 EXECUTION

3.1 TEST PLANS AND REPORT

A. The Contractor shall be required to prepare and submit for review and approval the following:

1. Factory Acceptance Test Plan and procedures.

2. Site Acceptance Test Plan and procedures.

3. Test Schedules.

4. Test Reports.

5. Instrument and (applicable) component calibration sheets.

3.2 FACTORY TESTING

A. Factory Acceptance Test (FAT) and verification for all deliverable equipment, programs, and associated documentation shall be performed prior to shipment of the system. The tests shall verify that the equipment is manufactured and assembled correctly, is operating as designed, and is in compliance with the contractual requirements. The tests shall verify that the software and hardware meet the functional and performance requirements of the project. The FAT shall be performed at the Contractor's factory and shall be witnessed by Owner personnel.

B. Testing requirements shall be part of every PLC installation. The Contractor shall demonstrate the system was fully tested during development and installation.

3.3 INSTALLLATION

A. Mount and shim to precise alignment floor mounted control panels so doors operate without binding. Provide sealant for conduit entering the panels.

1. Anchor panels in a manner to prevent the enclosure from racking, which may cause the access doors to become misaligned.

2. Provide sunshields where shown on the Drawings.

B. Floor-mounted panels except in dry control rooms or electrical equipment rooms shall be mounted on 3-1/2-inch minimum height concrete pads or grouted bases as specified. Coating shall be provided for outdoor panels in contact on concrete. Field panels and cabinets shall be mounted in compliance with 26 27 16

C. Spray terminals and terminal blocks after all terminations have been completed with a silicone resin similar to Dow Corning R-4-3117 conformal coating. Spray coating only required for control panels in corrosive or classified installation environments.

D. Provide panels with the Record As-built schematic, connection, and interconnection diagrams mounted behind Plexiglas holder on the inside of the door. Place documentation in a water proof clear bag in the panel document holder.

E. Vacuum clean control panels and cabinets.

3.4 SITE ACCEPTANCE TESTING

A. PROCEDURES: Section 40 61 21

B. The following testing is in addition to Section 40 61 21 requirements for the preoperational test phase and component test phase.

C. A System Acceptance Test (SAT) and a System Operational Acceptance Test (OAT) shall be performed at the site. The final documentation will then be reviewed for completeness. Site Acceptance Testing shall be witnessed by SPU personnel.

D. The SAT shall include the requirements as follows:

1. The acceptance test shall verify that the equipment and all cables have been properly installed, have not been damaged, and have not failed in shipment or storage

2. The acceptance test shall demonstrate stable operation of all PLC I/O modules, wiring, and data transmission to the OIU under actual operating or simulated conditions. The test shall also demonstrate proper operation of all digital or sequential control. All start/stop, open/close, raise/lower and similar commands and all discrete status inputs shall be tested for proper operation. In addition, all alarms, both analog and discrete, shall be tested.

3. After one week of operation without notable events or failures, finalize the wiring between the new PLC and the I/O. Organize unused wiring to provide a neat and clean appearance.

E. The System OAT shall require the testing of system functions, software, and performance in hand-only mode after completion of all site installation tests. These tests shall verify complete operation of the system or site, including additional tests required to verify field-installed equipment, which was not available at the factory. The Contractor shall be required to perform the following:

1. Verify the facility installation.

2. Verify the SAT.

3. Verify operation of any local operator interface device.

END OF SECTION

SECTION 40 67 33
PANEL WIRING

PART 1 **GENERAL**

1.1 SUMMARY

A. Section includes:

1. Scope
2. Reference Standards
3. Quality Assurance
4. Submittals
5. Installation
6. Testing

1.2 SCOPE

A. This section specifies wiring requirements for wiring of process control panels.

B. Comply with the specified products in Sections 40 61 13 and 40 67 16. Panels that do not comply with the specified products and specified logic method, hardwired or PLC logic, shall not be accepted. Cost to retrofit the panel as specified shall be borne by the panel supplier. Corrections or modifications to UL 508A Industrial Control Panels shall be transported to the panel supplier's facility for corrections, testing, relabeling and inspection.

C. All panel wiring is to be completed within a UL 508A certified fabrication facility. Field modifications require a UL inspector site inspection for approval of panel corrections and to re-label the panel after the field modifications are completed.

D. Refer to Section 26 27 16 that specifies requirements for manufacturer, vendor, and Contractor provided panels that may include motor controllers, combination motor starters, control devices, and logic devices as shown on the electrical drawings. These requirements apply to this section as well.

E. Submittals as specified in Section 01 32 19 and Section 40 61 13.

1.3 REFERENCE STANDARDS

A. This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

1. American National Standards Institute (ANSI).

2. ASTM International (ASTM):

a. B75, Standard Specification for Seamless Copper Tube.

3. National Electrical Manufacturers Association (NEMA):

a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

b. ICS 4, Industrial Control and Systems: Terminal Blocks.

4. National Fire Protection Association (NFPA):

a. 70, National Electrical Code (NEC).

5. Underwriters Laboratories, Inc. (UL):

a. 508A, Standard for Safety Industrial Control Panels.

b. 913, Standard for Safety, Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations.

c. 698A, Industrial Control Panels Relating to Hazardous (Classified) Locations.

1.4 DEFINITIONS

A. The term "panel" refers to control panels or enclosures listed in the schedule included in this Section.

B. Foreign Voltages: Voltages that may be present in circuits when the panel main power is disconnected.

1. Intrinsically Safe Circuit: A circuit in which any spark or thermal effect is incapable of causing ignition of a mixture of flammable or combustible material in air under test conditions as prescribed in UL 913.

C. Cable: Multi-conductor, insulated, with outer sheath containing either building wire or instrumentation wire.

1.5 QUALITY ASSURANCE

A. REQUIREMENTS: Section 40 61 13 Process Control System General Provisions

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design workmanship or materials

C. Entire assembly shall be affixed with a UL 508A or 698A label "Listed Enclosed Industrial Control Panel" prior to shipment to the jobsite.

D. Each panel shall have an affixed fuse identification list.

E. Each panel shall have an affixed power and short circuit rating label.

1.6 SUBMITTALS

A. PROCEDURES: Section 01 32 19 and 40 61 13

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration

C. Submittal items required include:

1. Wire Types

2. Labeling materials and methods

3. Wiring lugs

4. Wireways

5. Hinge wiring method description

6. Wire colors

PART 2 **PRODUCTS – Not Used**

PART 3 **EXECUTION**

3.1 INTERNAL PANEL WIRING

A. Arrange wiring neatly, cut to proper length, with surplus wire removed:

1. Arrange wiring with sufficient clearance.

2. Provide abrasion protection for wire bundles that pass-through openings or across edges of sheet metal.

3. Conductors for AC and DC circuits shall be type MTW stranded copper listed for operation with 600 V at 90 DegC:

4. Conductor size shall be as required for load and 16 AWG minimum. Conductors for power wiring shall be sized for load and 14 AWG minimum.

5. Internal panel wiring color code:

a. 120 VAC circuits:

1) Power wiring: Black

2) Control circuits: Red

3) Neutral: White

4) Ground: Green

6. Low voltage DC circuits (typically 24 V):

a. DC Control (+): Blue

b. DC Control, Common (-): White-Blue Stripe

7. Unless otherwise required by UL.

B. Splicing and tapping of wires permitted only at terminal blocks

C. Wire bundles shall be secured using plastic tie wraps except within wiring ducts. The bundles shall be securely fastened to the steel structure at intervals not exceeding 12-IN using appropriately sized stainless-steel machine screws.

D. Wires shall be supported by means other than the connectors or terminal strips. Wires shall be contiguous from connector to connector without wire splices between them.

E. Wiring shall be installed such that if wires, including neutral/common wires, are removed from one (1) device, source of power will not be disrupted to other devices.

1. AC circuits:

a. Routed separate from analog signal cables and DC signal wires or cables.

b. Separate by at least 6-IN, except at unavoidable crossover points and at device terminations.

2. Analog signal cables carrying low level signals of 100 millivolts or less shall not be run in the same bundle, duct, or wire duct as digital input or control output wiring.

F. Wiring to pilot devices or rotary switches shall be individually bundled and installed with a "flexible loop" of sufficient length to permit the component to be removed from panel for maintenance without removing terminations.

G. Equipment requiring AC power shall be provided with an NFPA 70 Type SJ cord with a molded-on grounding type plug for the AC power connection.

H. Analog signal cables shall be of 600 V, 90 deg C rated insulation, with stranded copper wire in twisted-shielded pairs:

1. The cable’s outer diameter shall be 0.25 IN maximum with 100 percent coverage aluminum foil mylar-lined shield and 22 AWG minimum stranded tinned copper drain. The cable shall be UL listed.

2. Conductor size: 18 AWG minimum.

3. Terminate shield drain conductors to ground only at one (1) end of the cable. The drain wire shall not be used as a control signal conductor. It shall be terminated at a terminal strip or trimmed back to the jacket of the shielded cable, as required by its application.

4. Shields that are connected to ground shall either be tinned by solder or have heat shrink insulation installed over the wires to prevent stray strands from reaching ground or shorting to other terminals.

I. Panel wire duct shall be installed between each row of components, and adjacent to each terminal strip:

1. Route wiring within the panel in wire-duct as possible

2. Follow wire-duct manufacturers recommended fill limits. In addition, raceways must meet fill requirements per UL 508A and NEC.

3. Wire-duct shall have removable snap-on covers and perforated walls for easy wire entrance.

4. Wire-duct shall be Panduit Type E or NE, constructed of nonmetallic materials, and rated in excess of the maximum voltage carried therein.

J. Wire-duct shall be supported by appropriately sized plastic rivets or screws which have been tapped into the subpanel.

K. Wire bunches to doors shall be secured at each end so that bending or twisting will be around longitudinal axis of wire:

1. Protect bend area with sleeve.

L. Provide surge protection for analog inputs from field (remote) devices

M. No more than two connections made to one terminal.

N. Wire and cable identification:

1. Wire and cables numbered and tagged at each termination.

2. Wire tags:

a. Slip-on shrink fitted plastic wire sleeves with legible, machine-printed markings.

b. Adhesive, snap-on, or adhesive type labels are not acceptable.

c. Provide at both ends, except for pre-terminated cables with connectors.

d. Markings as identified in the shop drawings

O. Grounding Requirements:

1. Each panel shall be provided with two copper ground bars:

2. One bar (standard panel system ground bus) shall be bonded to the panel frame or sheet metal and to the station ground system.

3. The second bar (signal ground bus) shall be mounted on insulated stand-offs and shall be bonded to the frame ground bar at one point only.

3.2 TESTING

A. FACTORY TESTING:

1. Prior to shipment, the manufacturer tests the functional operation of the control panels as described in Section 40 61 21.

2. Complete point to point testing and verification of each wire.

3. The Owner requires the factory test to be a witnessed test. The Contractor shall include in the bid price the expense for travel and accommodations for one (1) representative from the Owner to witness the factory test at the manufacturer's facility. If test results require the testing to be redone, the additional costs for additional testing shall be borne by the Contractor.

B. SHIPMENT, PROTECTION AND STORAGE:

1. Equipment shipment, protection and storage shall conform to the requirements specified in Section 01 60 00.

END OF SECTION

SECTION 40 71 13
MAGNETIC FLOW METERS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope
2. Reference Standards
3. Quality Assurance
4. Submittals
5. Performance Requirements
6. Product Requirements
7. Installation
8. Testing
9. Manufacturer's Services

1.2 SCOPE

A. This Section specifies requirements for supply and installation of the Magnetic Flow Meters measuring system(s). This includes testing, documenting, and start up.

B. CONTRACTOR shall provide all components, piping, wiring, accessories and labor required for a complete, workable and integrated system.

C. Instruments shall be mounted as shown on the plans. All metal mounting hardware shall be stainless steel.

1.3 REFERENCE STANDARDS

A. UL – Underwriters Laboratory approved

B. ASTM – American Society for Testing and Materials

C. NEMA – National Electrical Manufacturer's Association

D. NEC – National Electrical Code

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 40 61 13 Process Control System General Provisions

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design workmanship or materials.

1.5 SUBMITTALS

A. PROCEDURES: Section 01 32 19

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration

C. Product Data: For each type of device and system:

1. Include product data sheets and equipment brochures showing standard products and specified accessories.

a. Mark data sheets to clearly show exact product and options being provided.

1) Must include:

a) Dimensional Drawings

b) Materials of Construction

(1) Sensor
(2) Liner
(3) Electrodes
(4) Process Connection

2) Accuracy

3) Range

4) Enclosure Rating

5) Classification Rating

6) Power Requirements

7) Output Options

D. Manufacturer's installation instructions, including mounting requirements.

E. Operation and maintenance information.

F. Warranty information.

1.6 PERFORMANCE REQUIREMENTS

A. REQUIREMENTS: Section 40 61 13

B. OPERATING CONDITIONS: Section 40 06 70 instrument schedules.

C. This section specifies requirements for supply and installation of Magnetic Flow Meters listed in Section 40 06 70 Schedules of Instrumentation for Process Systems.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Flow Meter candidate manufacturers and models:

1. Endress+Hauser Promag 400 W

2. KROHNE, Inc. ENVIROMAG

3. Siemens SITRANS F M 5100W, and MAG 6000 transmitter.

4. KROHNE, Inc. IFC 100

5. Approved equal by Project Engineer

6. To conform to specified requirements, the manufacturer's standard product may require modification.

2.2 GENERAL

A. Magnetic flow meter provided as a system consisting of a flow tube with locally or remotely mounted converter / indicating transmitter as listed in the instrument schedule or as shown on the drawings. Meters to be provided with all required interconnecting cables between flow tube and transmitter.

B. Transmitter specified is to comply with Section 40 61 13 transmitter requirements.

2.3 FLOW METERS

A. Flow Tube:

1. The flow meter shall be microprocessor based and possess a method in which to store the sensor calibration and transmitter setup information in non-volatile memory. The electronics shall be interchangeable for meters sizes 1" – 120"

2. The sensor shall consist of a stainless-steel flow tube with ANSI B16.5 or AWWA C207 carbon steel or stainless-steel flanges. The flanges shall carry Class 150 or 300 for 24" and smaller, and AWWA Class D for 28" and larger as specified.

3. The sensor tube shall be lined with polyurethane.

4. The sensor shall house two measuring electrodes, a grounding electrode, and one for physical empty pipe detection. The electrodes shall be made of 316L SS.

5. The full-bore magnetic flowmeter in sizes 1"-120" shall maintain zero pressure loss while achieving 0.5% of rate accuracy even when mounted directly before or after a piping elbow, T-fitting or insertion device. This flow tube shall have four measuring electrodes (sizes 1-2.5") and six measuring electrodes (sizes 3"-120") plus a grounding electrode and an empty pipe electrode.

6. The external sensor housing shall enclose the coil assemblies and internal wiring. The materials shall be designed and constructed to prevent moisture ingress and promote corrosion resistance.

7. Process Connection: Flange, ANSI B16.5, Class 150, raised face.

8. Flow tubes shall be pressure rated from full vacuum to 300 psig, unless otherwise noted.

9. Flow tube sizes below 2 inches may be wafer-style ductile-iron or full-body flanged construction.

10. Grounding Ring required and must be provided with flow meter.

11. The sensor shall be rated for NEMA 6P/IP68 service and shall allow for permanent immersion in water depths up to 10 feet.

12. Materials:

    a. Flow Tube: Stainless steel.

    b. Flange: Stainless steel or epoxy coated steel

    c. Electrodes: 316 L stainless steel

    d. Grounding Rings: Same metal as for the electrodes

    e. Liner: Polyurethane

B. Indicating Transmitter:

1. The transmitter shall be a three-stage microprocessor controller mounted remotely as specified in the instrument schedule. The transmitter shall operate on AC (100 to 240V) or DC (24 V) via a dedicated or universal power supply as specified. The transmitter housing will carry a NEMA 4X rating and shall be constructed to prevent moisture ingress, promote corrosion resistance, and be impervious to saline environments.

2. The measurement signals from the sensor shall be conducted up to 1,000 feet to the transmitter.

3. The transmitter display shall indicate simultaneous flow rate and total flow with three Totalizers (eg. forward, reverse and net total) and user-selectable engineering units, readout of diagnostic remedy messages.

4. 4-20 MA output proportioned to flow range.

5. The transmitter shall internally retain all setup parameters, calibration parameters and accumulated measurements in non-volatile memory in the event of power failure.

6. Pules output selectable settable for flows from 1 to 500 gallons per pulse.

7. Internal circuitry to drive flow signal to zero upon flow meter determined empty pipe condition.

PART 3 EXECUTION

3.1 INSTALLATION

A. REQUIREMENTS: Section 40 61 13

B. Install all components of Magnetic Flow Meters system in accordance with manufacturer's specifications and instructions for the specified functional requirements.

C. Ensure proper installation of the Magnetic Flow Meters system so as to not result in false reading due to ambient conditions or equipment at the installation site.

D. Comply with mounting details provided on the drawings.

3.2 TESTING

A. REQUIREMENTS: Section 40 61 21.

B. Instruments shall be calibrated and tested on site in accordance with the requirements of Section 40 61 21 and in accordance with the manufacturer's recommendations. Field calibration shall be conducted by a technical representative, factory trained and certified by the manufacturer.

C. In addition, the instruments shall be operationally tested in conjunction with the functional acceptance test of the complete system of Instrumentation and Controls for the completed system.

3.3 MANUFACTURER'S SERVICES

A. REQUIREMENTS: Section 40 61 13 and 40 61 26

B. CONTRACTOR shall provide the services of the manufacturer's representative for a minimum of one day to evaluate the installation of the instruments, testing and calibration, certification of proper installation, and training.

END OF SECTION

SECTION 40 71 79
FLOW SWITCHES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope
2. Reference Standards
3. Quality Assurance
4. Submittals
5. Products Requirements
6. Installation
7. Testing

1.2 SCOPE

A. This Section specifies requirements for supply and installation of process flow sensing devices listed in section 40 06 70 Schedules of Instrumentation for Process Systems.

1.3 REFERENCE STANDARDS

Reference	Title
ASTM	American Society for Testing and Materials
NEMA	National Electrical Manufacturer's Association
NEC	National Electrical Code

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 40 61 13 Process Control System General Provisions

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design workmanship or materials.

1.5 DELIVERY AND STORAGE:

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

B. Store indoors in clean dry space with uniform temperature to prevent condensation and per manufacturer's recommendations. Protect from exposure to dirt, fumes, water, corrosive substances, and physical damage.

C. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.

D. Provide equipment and personnel to handle products; use methods to prevent soiling, disfigurement, or damage.

1.6 SUBMITTALS

A. REQUIREMENTS: Section 01 33 00.

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration

C. Product Data: For each type of device and system:

D. Include product data sheets and equipment brochures showing standard products and specified accessories.

1. Mark data sheets to clearly show exact product and options being provided

E. Manufacturer's installation instructions.

F. Operation and Maintenance Manual

1.7 PERFORMANCE REQUIREMENTS

A. REQUIREMENTS: Section 40 61 13

B. OPERATING CONDITIONS: Units shall be suited for environment into which unit is to be installed.

C. See Section 40 06 70 Schedule of Instrumentation for Process Systems.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Flow Switch candidate manufacturers and models:

1. Dwyer Instruments, Inc. : Series AVFS Air Flow Switch

2. Approved equal by Project Engineer.

3. To conform to specified requirements, the manufacturer’s standard product may require modification.

2.2 GENERAL

A. Flow switch shall be provided where indicated, specified, or required to meet the functional requirements of the System, as specified.

B. Include accessories: Connector, cable, Mounting bracket and Mounting Gasket.

2.3 FEATURES

A. Air Velocity Range: 197 – 1969 FPM (1 – 10 m/s)

B. Temperature Limits: 5 to 122 degrees Fahrenheit (-10 to 50 degrees Celsius)

C. Humidity Limits: 0 – 90% Relative Humidity

D. Wetted Materials: PBT body, Titanium Sensor

E. Housing: PBT

F. Maximum Pressure: 14.7 psig (1 bar)

G. Repeatability: 5%

H. Contact Rating: 3 A (25 VDC/250 VAC)

I. Response Time: 3 – 60 seconds. Varies with flow and set point.

J. Certifications and Standards

1. NEMA 4X/IP65 Rated

2. CE

K. Weight: 7.2 oz (203 g)

2.4 ELECTRICAL REQUIREMENTS

A. Switch Type: N.O. SPST.

B. Power Requirements:

1. AFVS-01: 80 – 250 V AC/DC (47 – 63 Hz AC)

C. Power Consumption: 3 VA

D. Electrical Connection: 6.5 ft. Cable

2.5 MOUNTING

A. The airflow monitor should be mounted by means of the provided mounting bracket under normal conditions.

B. If the mounting needs to be airtight, use the provided gasket.

PART 3 EXECUTION

3.1 INSTALLATION

A. REQUIREMENTS: Section 40 61 13 and install in accordance with manufacturer's instructions for the specified functional requirements.

B. Install all components of flow switch in accordance with manufactures specifications and instructions.

C. CONTRACTOR shall provide the services of the manufacturer's representative for a minimum of one day for the calibration and testing of the instruments after certification of proper installation.

3.2 TESTING

A. REQUIREMENTS: Section 40 61 21.

B. Ensure proper installation of the Flow Switch so as to not be result in false reading due to ambient conditions or equipment at the installation site.

C. The instruments shall be operationally tested in conjunction with the functional acceptance test of the complete system of Instrumentation and Controls for the completed well system

3.3 MANUFACTURER'S SERVICES

A. REQUIREMENTS: Section 40 61 13 and 40 61 26

B. The contractor shall provide for a manufacturer's representative to be onsite for 1 day.

END OF SECTION

SECTION 40 72 23
RADAR LEVEL METERS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope
2. Reference Standards
3. Quality Assurance
4. Submittals
5. Performance Requirements
6. Product Requirements
7. Installation
8. Testing
9. Manufacturer's Services

1.2 SCOPE

A. This Section specifies requirements for supply and installation of the Radar Level Monitoring system. This includes testing, documenting, and start up.

B. CONTRACTOR shall provide all components, piping, wiring, accessories and labor requires for a complete, workable and integrated system.

C. Instruments shall be mounted as shown on the plans. All metal mounting hardware shall be stainless steel.

1.3 REFERENCE STANDARDS

Reference	Title
UL	Underwriters Laboratory approved
ASTM	American Society for Testing and Materials
NEMA	National Electrical Manufacturer's Association
NEC	National Electrical Code
NFPA No. 70, NEC	National Electrical Code
NFPA No. 79	Electrical Standard for Industrial Machinery
ISA	Instrumentation, Systems, and Automation Society
ICS-2, ICS-3	Standards for Industrial Control Devices, Controllers and Industrial Systems

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 40 61 13 Process Control System General Provisions.

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design workmanship or materials.

1.5 DELIVERY AND STORAGE:

A. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

B. Store indoors in clean dry space with uniform temperature to prevent condensation and per manufacturer's recommendations. Protect from exposure to dirt, fumes, water, corrosive substances, and physical damage.

C. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.

D. Provide equipment and personnel to handle products; use methods to prevent soiling, disfigurement, or damage.

1.6 SUBMITTALS

A. PROCEDURES: Section 01 33 00

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written

explanation of the reasons for requesting the deviation must also be included.

a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration

C. Product Data: For each type of device and system:

1. Include product data sheets and equipment brochures showing standard products and specified accessories.

a. Mark data sheets to clearly show exact product and options being provided

D. Manufacturer's installation instructions, including mounting requirements.

E. Operation and maintenance information.

F. Warranty information.

1.7 PERFORMANCE REQUIREMENTS

A. REQUIREMENTS: Section 40 61 13

B. OPERATING CONDITIONS: Units shall be suited for environment into which unit is to be installed.

C. See Section 40 06 70 Schedule of Instrumentation for Process Systems if provided.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Radar Level Meter candidate manufactures and models:

1. Endress+Hauser Micropilot FMR20B

2. Vega Vegapuls C21

3. Approved equal by Project Engineer.

2.2 GENERAL

A. Radar Level Measurement provided as a system consisting of a radar level sensor and a remotely mounted display unless otherwise noted.

B. Radar Level Sensor is to comply with Section 40 61 13 transmitter requirements.

C. Radar Level Measurement system shall be a pulse time of flight-based system intended primarily for solids applications. The unit shall operate at ~80 GHz.

D. The Radar Level Meter shall not be affected by changing media, changing temperatures, gas blankets or vapors. The transmitter shall measure almost completely independent from product properties.

2.3 FEATURES

A. Radar Level Sensor and Electronics:

1. Process Connection: Flange, UNI DN80….DN150 (3"…6") B

2. Commissioning, operation and maintenance via free iOS / Android app using Bluetooth.

3. Hermetically sealed wiring and fully potted electronics

4. Unit shall employ multi echo tracking algorithms for reliable level measurement.

5. Specifications:

a. Ingress protection: IP66/68 / NEMA 4X/6P

b. Measuring range: up to 15 m (49.21 ft)

c. Process temperature: –40 to 80 °C (–40 to 176 °F)

d. Process pressure: –1 to 3 bar (–14 to 43 psi)

e. Accuracy: up to ± 2 mm (0.08 in)

f. International explosion protection certificates

6. Materials: Full PVDF body

2.4 ELECTRICAL REQUIREMENTS

A. Signal Output: 4 – 20 mA Analog (Loop Powered)

B. Contain electronics associated with the radar level meter system. Enclosure rating NEMA-4X/6P.

C. Cable: Signal cable provided by the system manufacturer with sufficient length of cable for continuous installation between the sensor control panel or pump disconnect panel as shown on the drawings.

PART 3 EXECUTION

3.1 INSTALLATION

A. REQUIREMENTS: Section 40 61 13 and install in accordance with manufacturer's instructions for the specified functional requirements.

B. Install all components of Radar Level Meter system in accordance with manufacturer’s specifications and instructions for the specified functional requirements.

C. Instruments shall be installed, calibrated and tested on site in accordance with the requirements of Section 40 61 21 and 40 61 26 and in accordance with the manufacturer’s recommendations. Field calibration shall be conducted by a technical representative, factory trained and certified by the manufacturer. CONTRACTOR shall provide the services of the manufacturer’s representative for a minimum of one day got the installation of the instruments and for certification of proper installation.

D. CONTRACTOR shall provide the services of the manufacturer’s representative for a minimum of one day for the calibration and testing of the instruments after certification of proper installation.

E. In addition, the instruments shall be operationally tested in conjunction with the functional acceptance test of the complete system of Instrumentation and Controls for the completed well system.

3.2 TESTING

A. REQUIREMENTS: Section 40 61 21.

B. Instruments shall be calibrated and tested on site in accordance with the requirements of Section 40 61 21 and in accordance with the manufacturer’s

recommendations. Field calibration shall be conducted by a technical representative, factory trained and certified by the manufacturer.

3.3 MANUFACTURER'S SERVICES

A. REQUIREMENTS: Section 40 61 13 and 40 61 26

B. CONTRACTOR shall provide the services of the manufacturer's representative for a minimum of one day to evaluate the installation of the instruments, testing and calibration, certification of proper installation, and training.

END OF SECTION

SECTION 40 78 16
INDICATING LIGHTS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope
2. Reference Standards
3. Quality Assurance
4. Submittals
5. Product Requirements
6. Installation
7. Testing

1.2 SCOPE

A. This Section specifies requirements for supply and installation of indicating lights

1.3 REFERENCE STANDARDS

A. ASTM – American Society for Testing and Materials

B. NEMA – National Electrical Manufacturer's Association

C. NEC – National Electrical Code

D. NFPA No. 70, NEC - National Electrical Code

E. NFPA No. 79, Electrical Standard for Industrial Machinery.

F. ISA – Instrumentation, Systems, and Automation Society.

G. ICS-1 – General Standards for Industrial Control and System

H. ICS-2 – Standards for Industrial Control Devices, Controllers and

I. ICS-3 – Industrial Systems.

J. UL – Underwriter's Laboratory UL (Note: Other Nationally Recognized Testing Laboratories [NRTL], such as ETL, may be used in lieu of UL.)

1. Standard 508 (Industrial Control Panels for General Use).

2. Standard 698 (Industrial Control Panels Relating to Hazardous (Classified) Locations)

3. Standard 913 (Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations)

K. NETA – National Electrical Testing Association.

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 40 67 16 and 40 61 13 Process Control System General Provisions

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design workmanship or materials

1.5 SUBMITTALS

A. Submittal requirements specified in: Section 01 32 19.

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration

C. Product Data: For each type of device and system:

1. Include product data sheets and equipment brochures showing standard products and specified accessories.

a. Mark data sheets to clearly show exact product and options being provided

D. Manufacturer's installation instructions.

E. Operation and Maintenance Manual if applicable.

PART 2 PRODUCTS

2.1 GENERAL

A. Pilot Devices shall be provided as a Panel Assembly component where indicated, specified, or required to perform the functional requirements of the System, as specified. All Pilot Devices shall meet the following minimum specifications, unless otherwise noted.

1. All pilot devices shall be of heavy-duty, non-metallic, type 4/13, watertight/oiltight construction. Units shall mount through a 30.5 mm round hole.

2. All pilot devices shall have custom legends as shown. Legends shall be black with white letters, and letter height shall be minimum 3/16-inch-high characters.

3. All button and lens colors shall be as shown. Color code is as follows:

4. A = Amber, B = Blue, G = Green, R = Red, Y = Yellow, W = White

5. All pilot devices shall be equipped with a sufficient number of contact blocks to accomplish the switching functions specified.

B. Indicating lights shall meet the following minimum specifications, unless otherwise noted.

1. All indicating lights shall be full voltage type with LED lamps. Units shall be rated for the voltage shown.

2. All indicating lights shall be "push-to-test" type.

3. All indicating light lenses shall be plastic.

C. Candidate manufacturers and models include the following

1. Allen-Bradley, Bulletin 800H.

2. Square D. Co., Type T.A

3. Approved Equal

PART 3 EXECUTION

3.1 INSTALLATION

A. REQUIREMENTS: Section 40 61 13 and install in accordance with manufacturer's instructions for the specified functional requirements.

B. Install per manufacturer’s instructions.

3.2 TESTING

A. REQUIREMENTS: Section 40 61 21.

B. Ensure proper installation per manufacturers recommendations

3.3 MANUFACTURER’S SERVICES

A. REQUIREMENTS: Section 40 61 13 and 40 61 26

END OF SECTION

SECTION 40 78 19
SWITCHES AND PUSH BUTTONS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope
2. Reference Standards
3. Quality Assurance
4. Submittals
5. Product Requirements
6. Installation
7. Testing

1.2 SCOPE

A. This Section specifies requirements for supply and installation of push buttons and indicating lights

1.3 REFERENCE STANDARDS

A. ASTM – American Society for Testing and Materials

B. NEMA – National Electrical Manufacturer's Association

C. NEC – National Electrical Code

D. NFPA No. 70, NEC - National Electrical Code

E. NFPA No. 79, Electrical Standard for Industrial Machinery.

F. ISA – Instrumentation, Systems, and Automation Society.

G. ICS-1 – General Standards for Industrial Control and System

H. ICS-2 – Standards for Industrial Control Devices, Controllers and

I. ICS-3 – Industrial Systems.

J. UL – Underwriter's Laboratory UL (Note: Other Nationally Recognized Testing Laboratories [NRTL], such as ETL, may be used in lieu of UL.)

1. Standard 508 (Industrial Control Panels for General Use).

2. Standard 698 (Industrial Control Panels Relating to Hazardous (Classified) Locations)

3. Standard 913 (Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations)

K. NETA – National Electrical Testing Association.

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 40 61 13 Process Control System General Provisions

B. The manufacturer shall warranty the above specified equipment for twelve months from equipment start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design workmanship or materials

1.5 SUBMITTALS

A. PROCEDURES: Section 01 32 19

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

C. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements,

with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Candidate manufacturers and models include the following

1. Allen-Bradley, Bulletin 800H.

2. Square D. Co., Type T.A

3. Approved Equal

2.2 GENERAL

A. Pilot Devices shall be provided as a Panel Assembly component where indicated, specified, or required to perform the functional requirements of the System, as specified. All Pilot Devices shall meet the following minimum specifications, unless otherwise noted.

1. All pilot devices shall be of heavy-duty, non-metallic, type 4/13, watertight/oiltight construction. Units shall mount through a 30.5 mm round hole.

2. All pilot devices shall have custom legends as shown. Legends shall be black with white letters, and letter height shall be minimum 3/16-inch-high characters.

3. All button and lens colors shall be as shown. Color code is as follows:

4. A = Amber, B = Blue, G = Green, R = Red, Y = Yellow, W = White

5. All pilot devices shall be equipped with a sufficient number of contact blocks to accomplish the switching functions specified.

6. All selector switches shall be knob type.

7. Illuminated selector switches shall be 120-volt AC, full voltage type with LED lamps where specified.

B. Pushbuttons shall meet the following minimum specifications, unless otherwise noted.

1. All pushbuttons shall be flush type.

2. All emergency stop pushbuttons shall be red colored, jumbo mushroom head, push operate / twist release type, with one form C contact, minimum. Emergency stop pushbutton legends shall be red with white letters, and letter height shall be minimum 3/16-inch-high characters.

3. Unless otherwise shown, all other pushbuttons shall be black in color.

4. Illuminated push buttons shall be 120-volt AC, full voltage type with LED lamps where specified.

PART 3 EXECUTION

3.1 INSTALLATION

A. REQUIREMENTS: Section 40 61 13 and install in accordance with manufacturer's instructions for the specified functional requirements.

B. Install all components in accordance with manufactures specifications and instructions.

C. Components shall be installed and tested on site in accordance with the requirements of Section 40 61 13 and in accordance with the manufacturer’s recommendations.

3.2 TESTING

A. REQUIREMENTS: Section 40 61 21.

B. Ensure proper installation per manufacturers recommendations

END OF SECTION

SECTION 40 78 53
RELAYS/TERMINAL BLOCKS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope
2. Quality Assurance
3. Reference Standards
4. Submittals
5. Performance Requirements
6. Products
7. Installation
8. Testing

1.2 SCOPE

A. This section specifies requirements for Auxiliary Relays used for control signal isolation and Terminal Blocks used for control conductor termination installed in control panels. And junction boxes.

1.3 REFERENCE STANDARDS

A. ASTM – American Society for Testing and Materials

B. NEMA – National Electrical Manufacturer's Association

C. NEC – National Electrical Code

D. NFPA No. 70, NEC - National Electrical Code

E. NFPA No. 79, Electrical Standard for Industrial Machinery.

F. ICS-1 – General Standards for Industrial Control and System

G. ICS-2 – Standards for Industrial Control Devices, Controllers and

H. ICS-3 – Industrial Systems.

I. UL – Underwriter's Laboratory UL (Note: Other Nationally Recognized Testing Laboratories [NRTL], such as ETL, may be used in lieu of UL.)

1. Standard 508 (Industrial Control Panels for General Use).

2. Standard 698 (Industrial Control Panels Relating to Hazardous (Classified) Locations)

3. Standard 913 (Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations)

J. NETA – National Electrical Testing Association.

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 40 61 13 Process Control System General Provisions

B. The manufacturer shall warranty the specified equipment for twelve months from equipment start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design workmanship or materials.

1.5 SUBMITTALS

A. PROCEDURES: Section 01 32 19

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the

specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration

C. Product Data: For each type of device and system:

1. Include product data sheets and equipment brochures showing standard products and specified accessories.

a. Mark data sheets to clearly show exact product and options being provided

D. Manufacturer's installation instructions.

E. Operation and Maintenance Manual if applicable.

F. Warranty information.

1.6 PERFORMANCE REQUIREMENTS

A. RELAYS:

1. OPERATING CONDITIONS: Environmental and Hazardous Location ratings shall be determined by the ratings of the control apparatus for the installation where used. Where Relay does not meet these requirements, a suitable enclosure shall be provided to meet the requirements.

B. TERMINAL BLOCKS:

1. OPERATING CONDITIONS: Environmental and Hazardous Location ratings shall be determined by the ratings of the control apparatus for the installation where used. Where Terminal block does not meet these requirements, a suitable enclosure must be provided that meets the requirements.

2. Terminal block shall be rated for the Voltage, Amperage, and Conductor size for the application requirements.

PART 2 PRODUCTS

2.1 RELAY CANDIDATE MANUFACTURERS

A. Power and Master Control Relays

1. Allen Bradley 700P/PK

2. Square D 8501X/XM

3. Approved Equal

B. Plug-in Interposing/Auxiliary Relays

1. Idec RR/RJ Series

2. Allen Bradley, Bulletin 700-HA/700-HB/700-HK

3. Phoenix PLC-RIF/RSC

4. Approved Equal

C. Terminal Block Style Interposing/Auxiliary Relays

1. Idec RV8H series

2. Allen Bradley, Bulletin 700-HLT

3. Phoenix DEK

4. Approved Equal

a. Units used with PLC outputs to be provided with leakage current suppression circuiting.

D. Timing Relays for Auxiliary Control

1. Allen Bradley 700-FS/HR

2. Approved Equal

E. Terminal Blocks

1. Allen-Bradley – 1492 J series

2. Phoenix Contact – UK 5 series

3. Entrelec

4. Approved Equal

2.2 RELAYS GENERAL

A. Relay contact ratings shall be evaluated for rated Voltage and Amperage per application needs to obtain minimum operational cycles:

1. Power and Master Control Relays

    a. 10,000,000 mechanical operations and 1,000,000 electrical operations at rated load.

2. Plug-in Interposing/Auxiliary Relays

    a. 10,000,000 mechanical operations and 1,000,000 electrical operations at rated load.

3. Terminal Block Style Interposing/Auxiliary Relays

    a. 10,000,000 mechanical operations and 1,000,000 electrical operations at rated load.

4. Timing Relays for Auxiliary Control

    a. 10,000,000 mechanical operations and 1,000,000 electrical operations at rated load.

5. Submersible Pump Thermal/Leakage Relay

    a. 10,000,000 mechanical operations and 1,000,000 electrical operations at rated load.

B. Plug-in and Terminal Block Style Interposing/Auxiliary relays shall Equipped with a push-to-test button and indicator light.

C. Coil voltage shall match the control circuit voltage.

2.3 TERMINAL BLOCKS

A. GENERAL:

1. Terminal blocks shall be one-piece, molded, plastic blocks with screw-type terminals and barriers rated for 600 volts.

2. Unless otherwise specified, terminal blocks shall be cage clamp screw type. Terminals shall be provided with integral marking strips which shall be permanently identified with the connecting wire numbers as shown on the drawings.

3. Units must be rated for ampacity of wiring connected.

    a. Minimum 20 amps unless otherwise noted.

4. Terminals shall be tin-plated. Insulating material shall be nylon.

5. Provide jumper bars for jumpering between terminal blocks.

6. Provide end clamps to separate and terminate terminal block groups. Provide end covers for groups of terminal blocks in sets to match the number points associated with individual I/O cards in the PLC block.

7. Provide Separation Plates on each side of terminals that are at a different potential or polarity than surrounding terminals.

8. Provide clear plastic DIN rail mounted nametag stanchions for each block of terminations. Each nametag shall hold a preprinted label designating the PLC bus and PLC block that terminates to that set of terminals.

9. Terminals shall be mounted such that there is a minimum of 1.5 inches of clear space on both sides of the terminal; for ease of wiring.

10. Provide wired terminals to match the number of points supplied on each installed I/O card or spare slot in a PLC cabinet.

11. Fuse terminal blocks shall be hinged disconnect level type with “blown fuse” indicators.

PART 3 EXECUTION

3.1 INSTALLATION

A. REQUIREMENTS: Section 40 61 13 and install in accordance with manufacturer's instructions for the specified functional requirements.

B. Components shall be installed and tested on site in accordance with the requirements of Section 40 61 13 and in accordance with the manufacturer’s recommendations.

C. Terminals shall be torqued to manufacturer specifications.

1. Provide terminals for all wire connections to field wiring and internal power distribution.

2. Terminals shall be DIN rail strip mounted. Provide number strips for terminal blocks that are referenced by the wire marker.

3.2 TESTING

A. REQUIREMENTS: Section 40 61 21.

B. Relays shall be tested in accordance with the requirements of Section 40 61 21 and in accordance with the manufacturer's recommendations. Field calibration shall be conducted by a technical representative, factory trained and certified by the manufacturer.

C. In addition, the units shall be operationally tested in conjunction with the functional acceptance test of the complete system of Instrumentation and Controls for the completed system.

END OF SECTION

SECTION 40 78 56
ISOLATORS, INTRINSICALLY-SAFE BARRIERS, AND SURGE SUPPRESSORS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope
2. Reference Standards
3. Quality Assurance
4. Submittals
5. Performance Requirements
6. Products Requirements
7. Installation
8. Testing
9. Manufacturer's Services

1.2 SCOPE

A. This Section covers the requirements for signal isolators, intrinsically safe barriers, intrinsically safe relays and surge suppressors.

1.3 REFERENCE STANDARDS

A. ASTM – American Society for Testing and Materials

B. NEMA – National Electrical Manufacturer's Association

C. NEC – National Electrical Code

D. NFPA No. 70, NEC - National Electrical Code

E. NFPA No. 79, Electrical Standard for Industrial Machinery.

F. ICS-1 – General Standards for Industrial Control and System

G. ICS-2 – Standards for Industrial Control Devices, Controllers and

H. ICS-3 – Industrial Systems.

I. UL – Underwriter's Laboratory UL (Note: Other Nationally Recognized Testing Laboratories [NRTL], such as ETL, may be used in lieu of UL.)

1. Standard 508 (Industrial Control Panels for General Use).

2. Standard 698 (Industrial Control Panels Relating to Hazardous (Classified) Locations)

3. Standard 913 (Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, and III, Division 1, Hazardous (Classified) Locations)

J. NETA – National Electrical Testing Association.

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 40 61 13 Process Control System General Provisions

B. The manufacturer shall warranty the specified equipment for twelve months from equipment start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design workmanship or materials.

1.5 SUBMITTALS

A. Comply with applicable Submittal requirements specified in: Section 01 32 19.

B. Product Data: For each type of device and system:

1. Include product data sheets and equipment brochures showing standard products and specified accessories.

a. Mark data sheets to clearly show exact product and options being provided

C. Manufacturer's installation instructions.

D. Operation and Maintenance Manual

1.6 PERFORMANCE REQUIREMENTS

A. REQUIREMENTS: Section 40 61 13

B. OPERATING CONDITIONS: Section 40 06 70 instrument schedules.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. PR Electronics

B. Turck

C. Approved equal

2.2 GENERAL

A. Intrinsically Safe Barrier specified is to comply with Section 40 61 13 requirements as well as those specified herein.

B. Intrinsically safe devices (barriers/relays) shall be provided as a Panel Assembly component where indicated, specified, or required to perform the functional requirements of the System, as specified.

C. General: All intrinsically safe devices shall be installed in accordance with applicable section of the NEC. Intrinsically safe wiring shall be separated from non-intrinsically safe wiring by at least 2-inches or by other means acceptable per the NEC. Intrinsically safe wiring must be identified, either by color coding, with light blue jacketed cable, or by tagging, at regular intervals, up to 25 feet. Non-intrinsically safe wiring shall not be connected to intrinsically safe terminations of intrinsically safe devices.

2.3 INTRINSICALLY SAFE BARRIERS:

A. Transformer isolated barrier

1. Containing a transformer to provide:

a. Complete isolation between safe and hazardous areas for loop powered devices.

b. 3 way isolation between safe area, hazardous area and power supply powered devices.

c. Resistor for current limitation.

d. Fuses for short circuit protection.

e. Provide barriers with pluggable connectors that are coded for easy replacement.

f. Transmission error shall be less than or equal to 0.1 percent of full scale.

g. DIN rail mounted on 35 millimeters DIN rail

h. Approvals:

1) FM.

2) UL 913.

B. Intrinsically safe barriers shall conform to UL-913 or FM-3610 standards as approved by ETL, FM, MSHA, or UL features

1. Provide and install intrinsically safe barriers/relays acceptable for use in Class I, Division 2, Group D, as required or indicated.

2. Intrinsically safe barriers shall meet the following minimum specifications, unless otherwise noted.

    a. Barrier designed to be used with 4-20 ma DC signals.

    b. Solid State construction

    c. DIN rail mounted.

    d. FM approved

3. Transmitter and converters for use with 4 to 20 milliamperes signals without Hart® communications capability:

    a. Designed and approved for use with 4 to 20 milliamperes analog signals.

    b. Designed for powering 2 and/or 3 wire transmitters in hazardous locations and repeating and/or generating the current to the safe area.

    c. Supply voltage: 20 to 30 VDC.

4. Transmitter and converters for use with 4 to 20 milliamperes signals with Hart® communications capability:

    a. Designed and approved for use with 4 to 20 milliamperes analog signals.

    b. Designed for powering 2 and/or 3 wire transmitters in hazardous locations and repeating and/or generating the current to the safe area.

    c. Transfer digital signals from the hazardous area to the safe area.

    d. Complete bi-directional communication between a smart transmitter located in the field and the suitable equipment located in the safe area.

    e. Supply voltage: 20 to 30 VDC.

2.4 INTRINSICALLY SAFE RELAYS

A. Intrinsically safe relays shall be fixed sensitivity type U/L approved for use with a remote pilot device (dry contact) located in Hazardous (Classified) areas.

1. Provide and install intrinsically safe barriers/relays acceptable for use in Class I, Division 1, Group C or D, as required or indicated.

a. Designed and approved for use with discrete inputs.

b. Supply power: 20 to 30 VDC.

c. Output to track input.

d. LED in the cover to indicate the status of the input.

e. Selector switch to change the logic of the input.

f. Input: Dry contact.

g. Output: SPDT relay.

h. Single or Dual channel as shown on the drawings

2.5 SURGE PROTECTION DEVICES

1. Control panel power:

a. 120-volt control power source: Non-UPS powered:

1) Provide surge protection device (SPD) for panel power entrances:

a) Nominal 120 VAC with a nominal clamping voltage of 200 volts.

b) Non-faulting and non-interrupting design.

c) A response time of not more than 5 nanoseconds.

2) Control panel power system level protection, non-UPS powered:

a) Design to withstand a maximum 10 kA test current of a 8/20 µs waveform according to IEEE C62.41.1Category C Area.

b) For panels receiving power at 120 VAC, provide surge protection at secondary of main circuit breaker.

c) Provide both normal mode noise protection (line to neutral) and common mode (neutral to ground) surge protection.

d) DIN rail mounting.

e) Attach wiring to the SPD by means of a screw type cable-clamping terminal block:

(1) Gas-tight connections.

(2) The terminal block: Fabricated of non-ferrous, non-corrosive materials.

f) Visual status indication of MOV status on the input and output circuits.

g) Dry contact rated for at least 250 VAC, 1 Amp for remote status indication.

h) Meeting the following requirements:

(1) Response time: Less than or equal to 100 ns.

(2) Attenuation: Greater than or equal to -40 dB at 100 kilovolt-hertz as determined by a standard 50 ohms insertion test.

(3) Safety approvals:

(a) UL 1283 (EMI/RFI Filter).

(b) UL 1449 2nd Edition.

i) Manufacturer: One of the following or equal:

(1) Phoenix Contact type SFP TVSS/Filter.

(2) Liebert Accuvar series.

(3) Islatrol.

(4) Allen-Bradley

b. 120-volt control power source: UPS powered.

1) Provide surge protection on the control power source at each panel containing power supplies, or electronic components including PLCs, I/O, HMI, and digital meters.

2) Location:

a) For panels with a UPS, install surge protection ahead of UPS and maintenance bypass switch.

(1) Surge protection is not required for 120 VAC circuits that are only used for panel lights and receptacles.

b) For panels receiving power at 480 VAC, provide surge protection on the 120 VAC control power transformer secondary.

3) MCOV: 150 VAC.

4) Surge capability (8/20 microsecond wave): 10 kA.

5) Peak let-through: 620V L-N, 850V L-G.

6) Manufacturer: One of the following or equal:

a) Phoenix Contact Plugtrab PT series

b) MTL Surge Technologies MA15 series

2. Instrument, data and signal line protectors (traditional I/O) – panel mounted:

a. Surge protection minimum requirements: Withstand a 10-kA test current of a 8/20 µs waveform in accordance with IEEE C62.41.1 Category C Area.

b. DIN rail mounting on 35 millimeters rail (except field mounted SPDs).

c. SPDs consisting of 2 parts:

1) A base terminal block.

2) A plug protection module:

a) Replacing a plug shall not require the removal of any wires nor interrupt the signal.

b) Base and plug coded to accept only the correct voltage plug.

d. SPD Manufacturer: One of the following or equal:

1) Phoenix Contact Plugtrab Series.

2) Bournes Series 1800.

3. Instrument, data and signal line protectors (traditional I/O)– field mounted:

a. Surge protection minimum requirements: Withstand a minimum 10 kA test current of a 8/20 µs waveform in accordance with IEEE C62.41.1 Category C Area.

b. Manufacturer: One of the following or equal:

1) Plugtrab PT Series

2) MTL TP48 Series.

2.6 SIGNAL ISOLATORS AND CONVERTERS

A. Furnish signal isolators that provide complete isolation of input, output, and power input:

1. Minimum isolation level: 1.5 kilovolts AC/50 hertz for at least 1 minute.

2. Independently adjustable span and zero.

3. Accuracy including linearity and hysteresis within 0.1 percent max at 25 degrees Celsius.

4. Operating temperature: 0 degrees Celsius to 55 degrees Celsius.

5. Supply power: 9 to 30 VDC.

6. Output capable of driving loads up to 500 ohms

7. Field selectable for current or voltage input and current or voltage output

a. 4-20 mA input – 1 to 5 VDC out

b. 1 to 5 VDC input - 4-20 mA out

c. 0 – 10 VDC input – 0-20 mA out

d. 0-20 mA input – 0-10 VDC out

8. Ambient temperature range: -20 degrees Celsius to +65 degrees Celsius.

B. Manufacturer: One of the following or equal:

1. Phoenix Contact MCR Series.

2. Acromag 1500, 600T, 800T, Flat Pack or ACR Series.

3. Action Instruments Q500 Series or Ultra SlimPakII.

4. AGM electronics Model TA-4000.

PART 3 EXECUTION

3.1 INSTALLATION

A. REQUIREMENTS: Section 40 61 13 and install in accordance with manufacturer's instructions for the specified functional requirements.

B. Barriers shall be installed, calibrated and tested on site in accordance with the requirements of Section 40 61 21 and 40 61 26 and in accordance with the manufacturer’s recommendations.

C. Install Barriers, Isolators and surge suppressors per manufacturer’s instructions.

3.2 TESTING

A. REQUIREMENTS: Section 40 61 21

B. Ensure proper installation per manufacturers recommendations

C. In addition, the devices shall be operationally tested in conjunction with the functional acceptance test of the complete system of Instrumentation and Controls for the completed well system.

END OF SECTION

SECTION 40 78 59
POWER SUPPLIES

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope
2. Reference Standards
3. Quality Assurance
4. Submittals
5. Performance Requirements
6. Products Requirements
7. Installation
8. Testing

1.2 SCOPE

A. This section specifies requirements for Panel mounted 120 Vac input, 120 Vac and 24 Vdc outputs are specified herein or shown on the drawings.

B. Comply with the specified products in Sections 40 67 16, 40 67 63, and those shown on the drawings. Panels that do not comply with the specified products and specified logic method, hardwired or PLC logic, shall not be accepted. Cost to retrofit the panel as specified shall be borne by the panel supplier. Corrections or modifications to UL 508A Industrial Control Panels shall be transported to the panel supplier's facility for corrections, testing, relabeling and inspection.

C. Field modifications require a UL inspector site inspection for approval of panel corrections and to re-label the panel after the field modifications are completed.

D. Refer to Section 40 67 16 Control Panels for additional requirements.

E. Submittal drawing requirements specified in Section 40 61 13.

F. The manufacturer shall warranty the above specified equipment for twelve months from equipment start-up or eighteen months from date of shipment, whichever occurs first, to be free from defects in design workmanship or materials

1.3 REFERENCE STANDARDS:

A. This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein.

In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

B. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
NEMA 250	Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
UL 94	Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
UL 508A	Industrial Control Panels
UL 698A	Industrial Control Panels Relating to Hazardous (Classified) Locations

1.4 QUALITY ASSURANCE

A. REQUIREMENTS: Section 40 61 13 Process Control System General Provisions

1.5 SUBMITTALS

A. PROCEDURES: Section 01 32 19

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written

explanation of the reasons for requesting the deviation must also be included.

a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Include product data sheets of equipment, devices, and materials requested by the individual specification sections.

a. Catalog information shall include technical specifications and application information, including ratings, range, weight, accuracy, etc.

4. Catalog cuts shall be edited to show only the items, model numbers, and information which apply

5. Installation instructions, outline dimensions and weights including filters and/or phase shifting autotransformers, front view drawing identifying control and monitoring devices, nameplate engravings, shipping section dimensions, weight, and foundation requirements or wall mounting requirements for all assemblies.

6. External connection diagram showing function and identification of all terminals requiring field connections.

7. O&M manuals per Section 01 32 19 and Section 26 05 00

C. Submittal items required include:

1. Connection Diagrams.

2. Power supply calculations.

3. Product Data: For each type of device and system:

4. Include product data sheets and equipment brochures showing standard products and specified accessories.

1.6 PERFORMANCE REQUIREMENTS

A. REQUIREMENTS: Section 40 67 63.

B. OPERATING CONDITIONS: Section 40 67 63.

PART 2 PRODUCTS

2.1 DIRECT-CURRENT POWER SUPPLIES

A. Convert 120 VAC to 24 volt DC or other DC voltages required or as required for the application.

B. Sized to provide 40 percent excess rated capacity.

C. Sized as shown on the drawings as a minimum. Provide calculations to show anticipated load does not exceed 70% of power supply rating.

D. UL 508C listed to allow full rated output without de-rating.

E. FEATURES:

1. Convection-cooled linear type or switching type.

2. Line regulation: 0.4 percent for line variations from 105 to 132 volts.

3. Load regulation: 0.4 percent for load variations from 0 to full load.

4. Output regulation: Within 0.05 percent for a 10 percent line change or a 50 percent load change:

5. Ripple and noise: Not exceed 100 mV peak-to-peak.

6. Hold-up time at maximum load: Not less than 16 milliseconds.

7. Continuous duty from 0 to 50 degrees C at rated load.

8. Provide a minimum of 1 set of dry contacts configured to change state on failure for monitoring and signaling purposes.

9. Output electronically current limited.

10. Over-voltage crowbar shutdown.

11. Output voltage:

a. Rated 24 - 28 Vdc.

b. Adjustable plus or minus 5 percent.

c. Set to provide 24.0 volts.

F. MANUFACTURERS:

1. Sola

2. Allen Bradley

3. PULS

4. Phoenix Contact

5. Approved equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. REQUIREMENTS: Section 40 61 13 and install in accordance with manufacturer's instructions for the specified functional requirements.

3.2 OPERATION AND MAINTENANCE MANUALS

A. Comply with Section 01 31 00 and 01 78 23 - Operations and Maintenance Data and Part 1 of this specification.

3.3 TESTING

A. Power Supplies shall be tested in accordance with the requirements of Section 40 61 21 and in accordance with the manufacturer’s recommendations.

B. In addition, the units shall be operationally tested in conjunction with the functional acceptance test of the complete system of Instrumentation and Controls for the completed system.

END OF SECTION

SECTION 40 80 00
COMMISSIONING OF PROCESS SYSTEMS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes:

1. Scope
2. Quality Assurance
3. Submittals
4. Products
5. Testing
6. Functional Checkout

1.2 SCOPE

A. This section specifies the acceptance testing of the process control materials, equipment, and systems. Provide all labor, tools, material, power, and other services necessary to provide the specified tests. All testing described in this section shall be coordinated with the requirements of Section 01 40 00 Quality Requirements, 26 08 00 Commissioning of Electrical Systems and 40 61 21 Process Control System Testing.

B. Provide the labor, tools, material, power, and services necessary to provide the process instrumentation and control system inspection and testing specified herein. Coordinate all test procedures with the requirements of Section 01 40 00. Include the following action items:

1. Develop test plan.

2. Develop record keeping system.

3. Coordinate testing with Vendor package equipment.

4. Coordinate testing with the Owner's Systems Programmer.

C. Testing to include:

1. Pre-Operational - Factory Acceptance Testing (FAT)

2. Component Testing Sequence:

a. Wiring Testing

b. Network and Bus Cable System Inspection and Testing

c. Piping Testing

d. Installation Inspection

e. Instrumentation Calibration

f. Loop Testing

g. Network Testing

3. System (Functional) Testing Sequence:

a. Process Control Strategy/Sequence Testing

b. Control System Closed Loop

c. Functional Checkout

4. Operational Testing:

a. System Acceptance Testing (SAT)

1.3 QUALITY ASSURANCE

A. TESTING MANAGER:

1. The Contractor or Systems Integrator shall appoint a qualified specialist as Testing Manager to manage, coordinate, and supervise the testing work.

2. The Testing Manager requires at least 5 years of total experience, or experience on at least five separate projects, in managing the testing and startup of electrical and instrumentation control systems of equal or greater scope and complexity. The Testing Manager shall provide a quality assurance program which includes:

a. Definition of process areas and systems, with testing executed on an area-by-area basis, based on the P&ID or drawings if available.

b. Sequential list of the test phases required for each process area and system.

c. Completion status tracking form by process area, system, and test phase.

B. REFERENCE STANDARDS:

1. This Section incorporates by reference the latest revisions of the following documents. They are part of this Section insofar as specified and modified herein. In the event of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.

2. Unless otherwise specified, references to documents shall mean the documents in effect on the effective date of the Agreement. If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued.

Reference	Title
ANSI/NETA ATS-2009	Standard for Acceptance Testing Specifications for Electrical Power Distribution Equipment Systems

C. APPLICATION:

1. Where testing in accordance with this section and other Division 26 and 40 Sections is required, the required tests, including the retesting after the correction of found defects must be complete, and the submittal of final test reports to the Owner for review shall be completed prior to the energizing of material, equipment, or systems.

1.4 SUBMITTALS

A. PROCEDURES: Section 01 32 19

B. SUBMITTAL ITEMS FOR THIS SECTION:

1. Review of Shop Drawings and Brochures shall not relieve the Contractor of responsibility for dimensions and/or errors that may be contained therein, or deviations from Contract Document requirements. It shall be clearly understood that the noting of some errors, but the overlooking of others does not grant the Contractor permission to proceed in error. Regardless of any information contained in the Shop Drawings and Brochures, the requirements of the Contract Documents shall govern and are not waived or superseded in any way by the review of the Shop Drawings and Brochures.

2. Where submitted items deviate from specification requirements, a list of any specification sections that are not being met by the submitted item must be provided. The list is to be organized by specification section and

paragraph and shall list the product requirement and in what way submitted item does not comply with the requirement. A detailed written explanation of the reasons for requesting the deviation must also be included.

a. The Owner shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance with the specifications.

b. Failure to include a list of the specification section deviations along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

3. Proposed testing procedures including proposed test report forms in accordance with 40 61 21 Process Control System Testing.

a. Test reports including documentation for all tests performed. Test reports shall be submitted for review prior to the equipment being energized.

b. Execution plan including schedule.

c. Test results for a specific piece of equipment as required by the equipment specification shall also be included in the operation and maintenance manual(s).

4. All testing required herein and the test results shall also be submitted and documented as required under Sections 01 40 00, 26 05 00, 40 61 21 and where identified within specific sections.

PART 2 PRODUCTS

2.1 TESTING EQUIPMENT AND INSTRUMENTS

A. The test equipment, instruments and devices used for testing shall be calibrated to test equipment standards with references traceable to the National Institute of Standards and Technology. The test equipment, instruments and devices shall have current calibration stickers indicating date of calibration, deviation from standard, name of calibration laboratory and technician, and date of next recalibration.

2.2 PRODUCT DATA

A. The following information shall be provided in accordance with Section 01 32 19 and Section 01 40 00:

1. Defects: Notify the Owner of any material or workmanship found defective within 24 hours of discovery.

2. Short circuit analysis and protective device curves.

3. Test reports: Provide the report required in NETA ATS-2009 paragraph 5.4. Results shall be placed on the forms specified in this Section. Test reports shall also be part of the operation and maintenance manuals.

PART 3 EXECUTION

3.1 TESTING

A. GENERAL

1. Ensure that all electrical system testing performed is in strict conformance with the electrical acceptance tests specified in Section 26 08 00. Contact the Owner 10 days prior to the testing to allow witnessing of all tests.

2. The test measurements shall be recorded on specific forms for the subject test.

3. Testing shall be per ANSI/NETA ATS 2009. Provide testing data sheet for the following:

a. Cables – Low voltage (600 VAC maximum)

b. Circuit breakers – Low voltage (Insulated Case/Molded Case)

c. Protective Relays

d. Instrument Transformers

e. Grounding Systems

f. Rotating Machinery

g. Motor Control

h. PLC I/O checkout

END OF SECTION

PART SEVEN
WASHINGTON STATE
HOURLY PREVAILING WAGE RATES

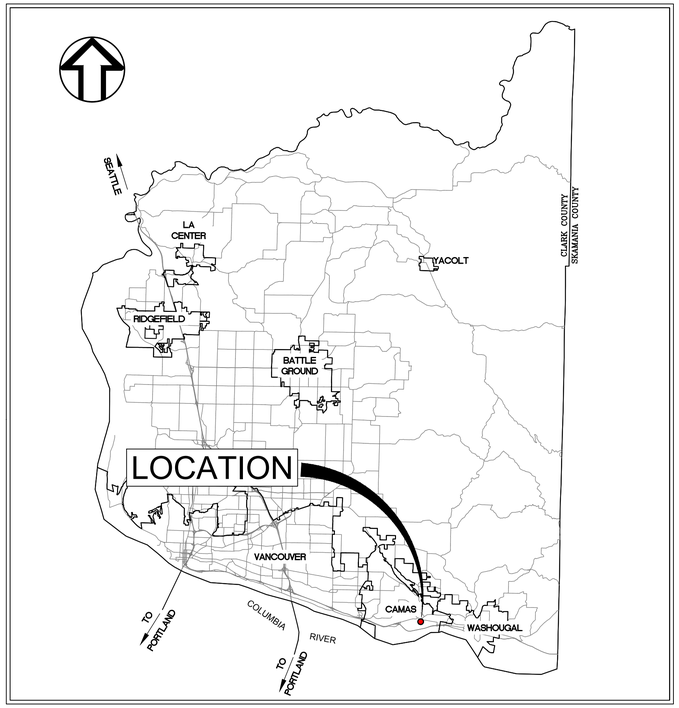
- **Journey level wage rates are not included in this packet for your reference.** Journey and apprentice rates applicable to this project can be looked up at the Washington State Department of Labor and Industries web site at **www.lni.wa.gov/TradesLicensing/PrevWage/WageRates/**
- Washington State LNI wage rates for Clark County effective date October 9, 2025.
- A printed copy of the wages rates are available for viewing in the Public Works Department at Camas City Hall.
- The City of Camas will mail a hard copy of the applicable prevailing wage rates upon request.

PART EIGHT
REDUCED SIZE CONSTRUCTION PLANS

CITY OF CAMAS

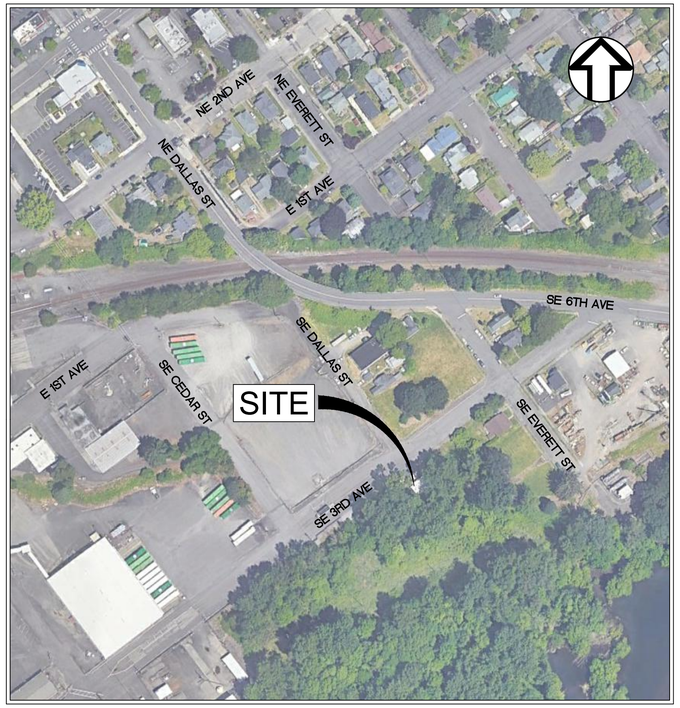
MAIN PUMP STATION IMPROVEMENTS

JULY 2025



LOCATION MAP

NOT TO SCALE



PROJECT SITE MAP

NOT TO SCALE

wallis engineering

Civil Engineer: Wallis Engineering
215 W. 4th Ave., Suite 200
Vancouver, Washington 98660
Contact: Wes Wegner, P.E.
(360) 695-7041

City of Camas WASHINGTON

Owner: City of Camas
616 NE 4th Ave
Camas, WA 98607
Contact: Rob Charles, Utility Manager
(360) 817-7003

SHEET INDEX

WESLEY MARTIN WEGNER — STATE OF WASHINGTON — 49136 — REGISTERED PROFESSIONAL ENGINEER — 7-30-2025

NO.	REVISION	BY	DATE

DESIGNED BY: JW
DRAWN BY: AH/CK
REV: WMW

ONE INCH AT FULL SCALE
IF NOT ONE INCH ADJUST SCALE ACCORDINGLY
0 1"

COVER

wallis engineering

PROJECT NO: WW02
DATE: 07/2025

City of Camas WASHINGTON

MAIN PUMP STATION IMPROVEMENTS

DRAWING NO:

G1

1 OF 29

P:\City of Camas\Camas22WW02 Camas Main P.S. Imp\500 DWG\501 Plan Sheets\COVER.dwg, 7/30/2025 12:27:18 PM, Chad Keys

GENERAL NOTES

1. THE CONTRACTOR SHALL MAINTAIN A CURRENT, APPROVED SET OF PLANS AND PERMITS ON THE PROJECT SITE AT ALL TIMES. THE CONTRACTOR SHALL COMPLY WITH ALL PERMIT REQUIREMENTS.
2. OPEN TRENCHES AND EXCAVATIONS SHALL BE COVERED AT THE END OF EACH WORK DAY.
3. THE EXISTING STRUCTURES AND EQUIPMENT SHOWN ON THE PLANS WERE COMPILED FROM AS-BUILT DRAWINGS. THE ENGINEER DOES NOT GUARANTEE THE ACCURACY OF THE DRAWINGS WITH REGARD TO EXACT LOCATIONS OF PIPING AND EQUIPMENT. CONTRACTOR SHALL TAKE FIELD MEASUREMENTS OF ALL EXISTING EQUIPMENT, PIPING, AND STRUCTURES WHERE NECESSARY PRIOR TO ORDERING MATERIALS TO ENSURE THAT ALL MATERIALS WILL FIT.

EROSION AND SEDIMENT CONTROL NOTES

1. ESC MEASURES SHALL BE IMPLEMENTED ACCORDING TO CITY OF CAMAS STANDARD DETAILS NO. EC2, EC3, AND EC12; OTHER APPLICABLE STANDARD DETAILS AND BEST MANAGEMENT PRACTICES REQUIRED BY THE PLANS AND SPECIFICATIONS; THE CONTRACTOR-SUBMITTED, APPROVED STORMWATER POLLUTION PREVENTION PLAN; AND PROJECT PERMITS.

PIPE FITTINGS

DOUBLE LINE	SINGLE LINE	ABBREV	DESCRIPTION
		FL	FLANGED JOINT
		MJ	MECHANICAL JOINT
		WYE	LATERAL/45° WYE
		WYE	LATERAL/45° WYE
		WYE	LATERAL/45° WYE
		ECC RDCR	ECCENTRIC REDUCER
		BEND	BEND, ANGLE AS NOTED
		BEND 90	90° BEND
		BEND DN	TURNED DOWN
		BEND UP	TURNED UP
		TEE	STRAIGHT
		TEE UP	OUTLET UP
		TEE DN	OUTLET DOWN

VALVES

DOUBLE LINE	SINGLE LINE	ABBREV	DESCRIPTION
		SCV	SWING CHECK VALVE
		GV	GATE VALVE
		EPV	ECCENTRIC PLUG VALVE

NOTE:
PIPES 3" AND SMALLER DIAMETER ARE SHOWN AS A SINGLE LINE. 4" AND LARGER DIAMETER ARE SHOWN AS A DOUBLE LINE.

WESLEY MARTIN WIEGNER
STATE OF WASHINGTON
49136
REGISTERED
PROFESSIONAL ENGINEER
11-25-2025

NO.	REVISION	BY	DATE

DESIGNED BY: JW
DRAWN BY: AH/CK
REV: WMW

ONE INCH
0 1"
ONE INCH AT FULL SCALE. IF NOT ONE INCH ADJUST SCALE ACCORDINGLY

GENERAL NOTES & LEGEND

wallis engineering

PROJECT NO: WW02
DATE: 07/2025

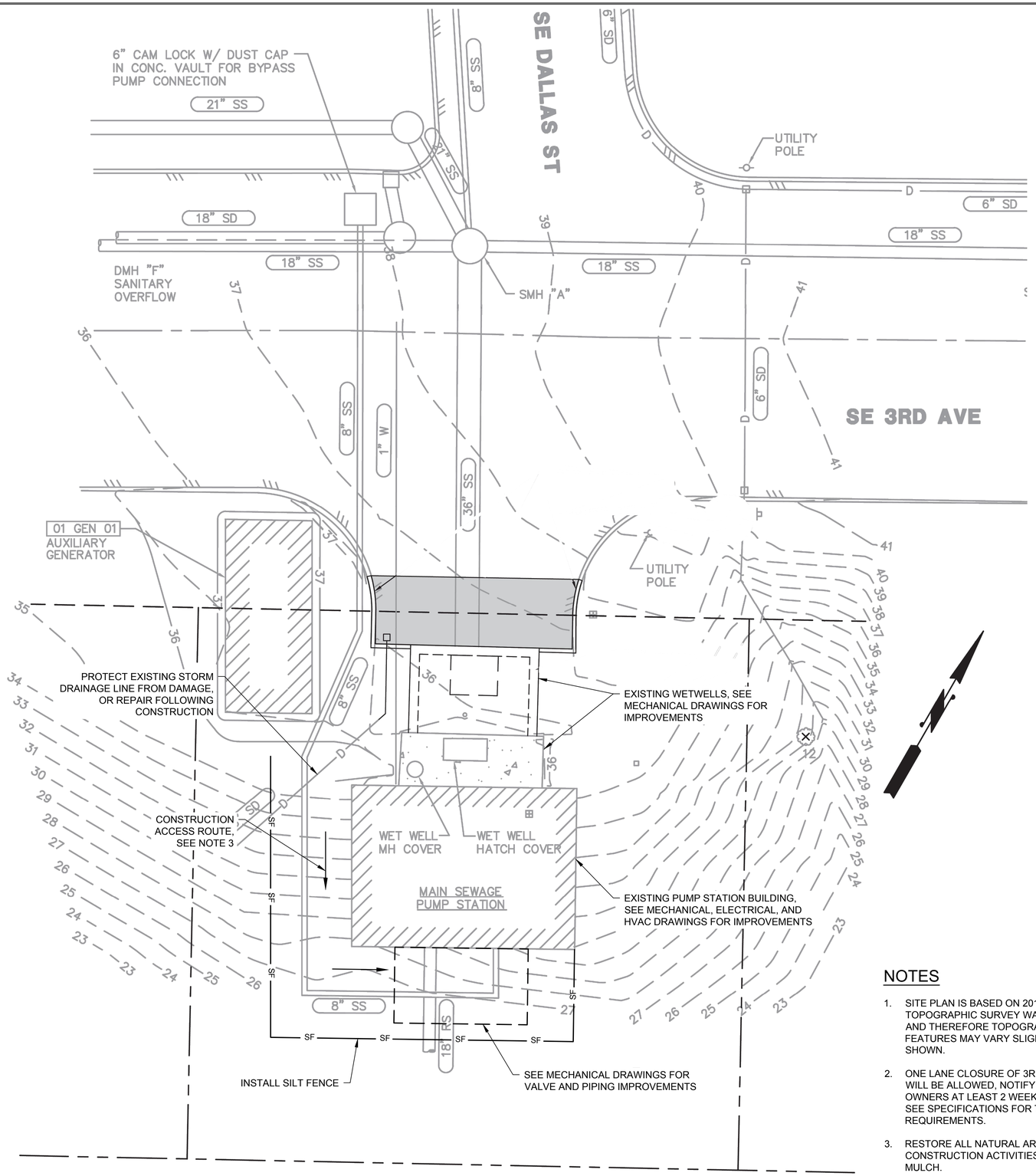
City of Camas WASHINGTON

MAIN PUMP STATION IMPROVEMENTS

DRAWING NO:
G2

EXISTING SYMBOL LEGEND

- ASPHALT PAVEMENT (CONSTRUCTED 2012)
- ASPHALT PAVEMENT
- GRAVEL SURFACING
- CONCRETE SURFACING
- FENCE
- CONCRETE FENCE
- GATE VALVE
- BUTTERFLY VALVE
- CHECK VALVE
- PLUG VALVE
- THRUST BLOCK
- UTILITY POLE WITH GUY WIRE
- UTILITY POLE
- LUMINARY
- JUNCTION BOX (AS NOTED)
- MANHOLE
- FIRE HYDRANT
- TYPE 1 CATCH BASIN OR CURB INLET
- TYPE 2 CATCH BASIN
- PROPERTY LINE
- RIGHT-OF-WAY LINE
- SECTION CORNER
- 1/4 CORNER
- WATER METER
- MONUMENT
- TREES
- SHRUBS
- BORING AND TEST PIT LOCATIONS
- BUILDINGS
- 20 CONTOUR
- YH YARD HYDRANT
- C.O. CLEANOUT
- ELECTRICAL PULL BOX



PLAN
NTS

NOTES

1. SITE PLAN IS BASED ON 2012 RECORD DRAWING. NO TOPOGRAPHIC SURVEY WAS COMPLETED SINCE THEN, AND THEREFORE TOPOGRAPHY AND SURFACE FEATURES MAY VARY SLIGHTLY FROM WHAT IS SHOWN.
2. ONE LANE CLOSURE OF 3RD AVENUE, WITH FLAGGING, WILL BE ALLOWED, NOTIFY ALL ADJACENT PROPERTY OWNERS AT LEAST 2 WEEKS IN ADVANCE OF WORK. SEE SPECIFICATIONS FOR TRAFFIC CONTROL REQUIREMENTS.
3. RESTORE ALL NATURAL AREAS DISTURBED BY CONSTRUCTION ACTIVITIES WITH 6" DEPTH BARK MULCH.

WESLEY MARTIN WIEGNER — STATE OF WASHINGTON — 49136 — REGISTERED PROFESSIONAL ENGINEER — 7-29-2025

NO.	REVISION	BY	DATE

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ONE INCH
0 1"
ONE INCH AT FULL SCALE. IF NOT ONE INCH ADJUST SCALE ACCORDINGLY

SITE PLAN

wallis engineering

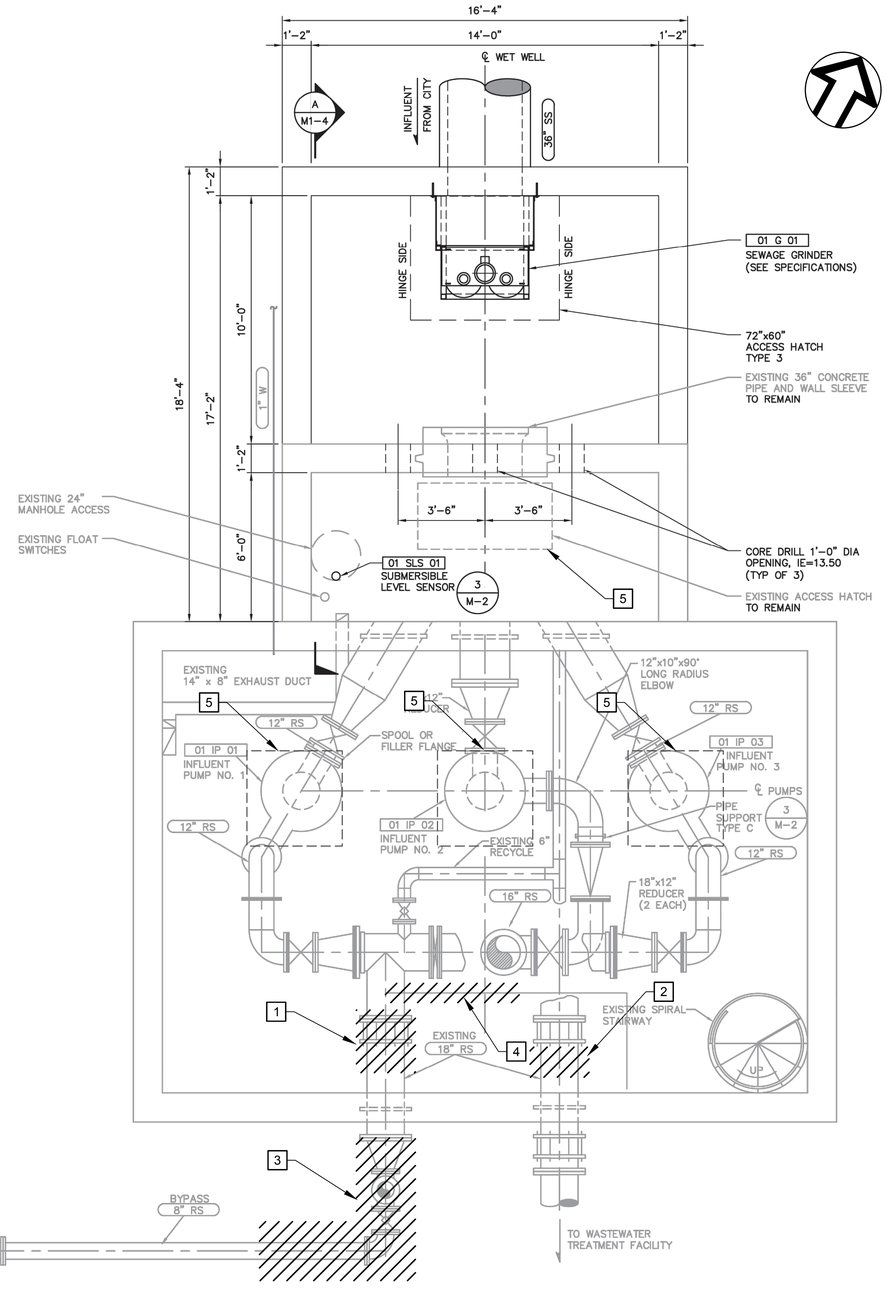
PROJECT NO: WW02
DATE: 07/2025

City of Camas WASHINGTON

MAIN PUMP STATION IMPROVEMENTS

DRAWING NO:
G3
3 OF 29

P:\City of Camas\Camas22WW\02 Camas Main P.S. Imp\500 DWG\501 Plan Sheets\SITE PLAN.dwg, 7/30/2025 12:27:31 PM, Chad Kaya



DEMOLITION PLAN

NTS

DEMOLITION KEY NOTES

1. REMOVE 18-INCH SEWAGE FORCE MAIN PIPING AND FLANGE ADAPTER AS REQUIRED FOR INSTALLATION OF FLOW METER AND FLANGE ADAPTERS.
2. REMOVE 18-INCH SEWAGE FORCE MAIN PIPING AS REQUIRED FOR INSTALLATION OF KNIFE GATE VALVE AND FLANGE ADAPTER.
3. REMOVE EXISTING 18"X8" REDUCER, 8" TEE, 8" GATE VALVE AND VALVE BOX, AND 8" PIPING AS REQUIRED FOR INSTALLATION OF NEW PIPE, VALVES AND FITTINGS.
4. REMOVE 2-INCH AIR RELEASE PIPING UP TO EXISTING UNION FITTING.
5. REMOVE EXISTING ACCESS HATCH COVER.

GENERAL NOTES

1. PROTECT ALL PIPING AND EQUIPMENT NOT SHOWN TO BE REMOVED.
2. SEE ELECTRICAL DEMOLITION PLAN FOR ADDITIONAL DEMOLITION REQUIREMENTS.
3. SEE PHASING PLAN FOR DEMOLITION PHASING REQUIREMENTS.
4. THIS DRAWING IS BASED ON THE 2012 AS-BUILT DRAWINGS. ALL NOTES EXCEPT THE DEMOLITION KEY NOTES ARE FROM THE 2012 IMPROVEMENTS, AND ARE EXISTING FEATURES NOT PROPOSED IMPROVEMENTS.

WESLEY MARTIN WIEGNER
STATE OF WASHINGTON
49136
REGISTERED
PROFESSIONAL ENGINEER
7-29-2025

NO.	REVISION	BY	DATE

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DRAWN BY: AH/CK
REV: WMW

ONE INCH
0 1"
ONE INCH AT FULL SCALE.
IF NOT ONE INCH ADJUST
SCALE ACCORDINGLY

DEMOLITION PLAN

wallis engineering

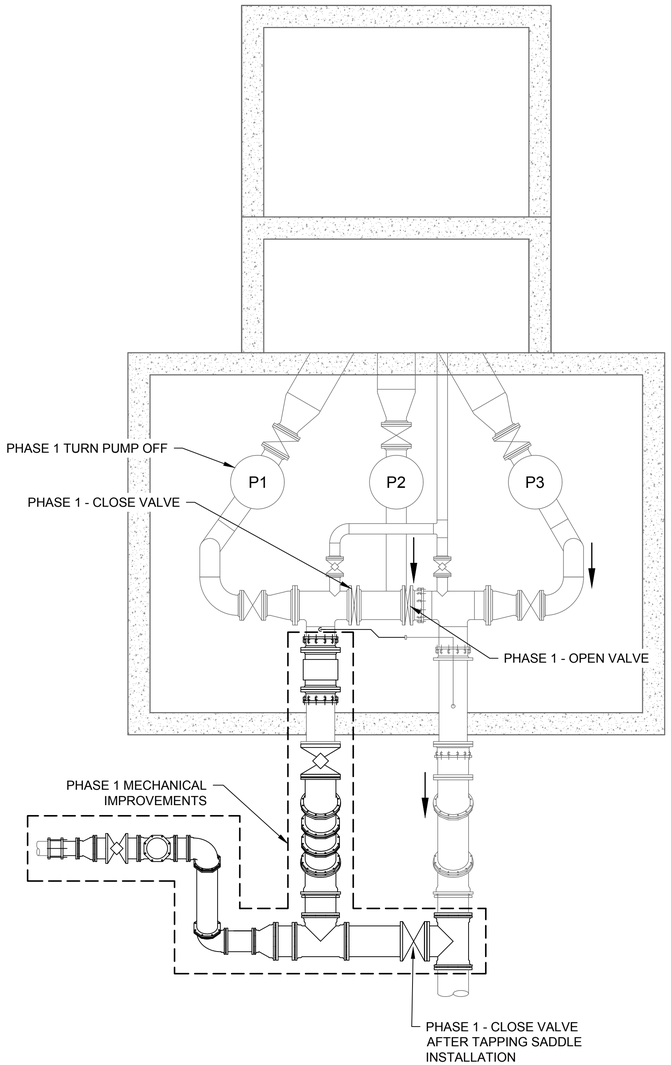
PROJECT NO: WW02
DATE: 07/2025

City of Camas WASHINGTON

MAIN PUMP STATION IMPROVEMENTS

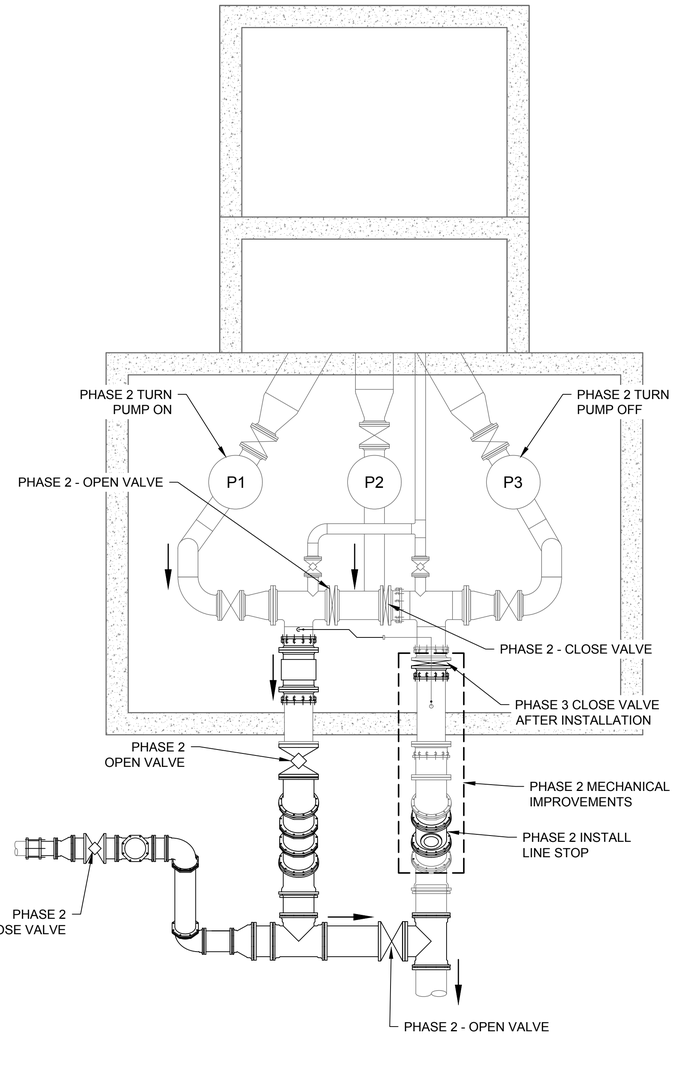
DRAWING NO:

G4



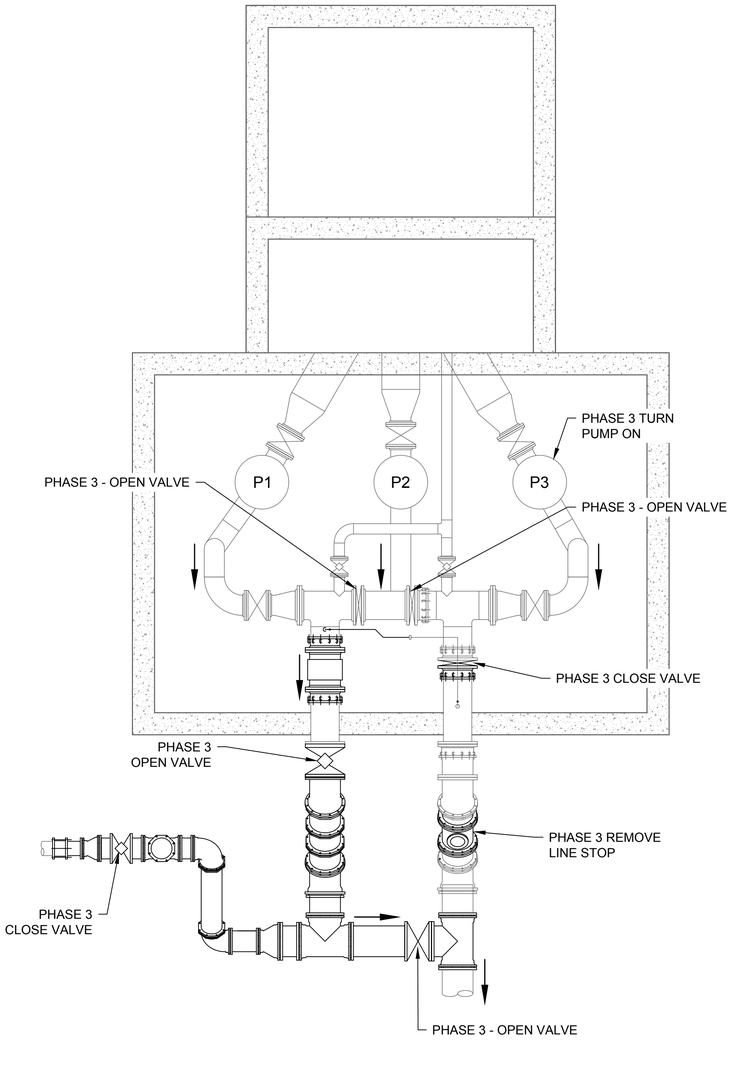
MECHANICAL IMPROVEMENTS PHASE 1

SCALE: 1/4" = 1'-0"



MECHANICAL IMPROVEMENTS PHASE 2

SCALE: 1/4" = 1'-0"



MECHANICAL IMPROVEMENTS PHASE 3

SCALE: 1/4" = 1'-0"

GENERAL SEQUENCING NOTES

1. THE EXISTING PUMP STATION IS CONTINUOUSLY PUMPING SEWAGE. THIS FUNCTION MUST NOT BE INTERRUPTED. SEQUENCE THE WORK TO MINIMIZE DISRUPTION TO PUMP STATION OPERATIONS.

ELECTRICAL SEQUENCING REQUIREMENTS

1. PRIOR TO TAKING ELECTRICAL AND CONTROL EQUIPMENT OFFLINE, CONTRACTOR SHALL EITHER PROVIDE BACKUP PUMPING SYSTEM, OR A BACKUP POWER AND CONTROL SYSTEM FOR THE EXISTING PUMPS. SEE SPECIFICATIONS FOR BYPASS PUMPING REQUIREMENTS.

MECHANICAL SEQUENCING REQUIREMENTS

1. PERFORM THE WORK PER THE SEQUENCING PLAN DESCRIBED BELOW AND SHOWN THIS SHEET, OR PER AN ALTERNATE PLAN APPROVED BY THE CITY.

2. PRIOR TO ORDERING PIPE, FITTINGS, AND VALVES, PERFORM EXPLORATORY EXCAVATION IN THE PRESENCE OF THE ENGINEER AND CONFIRM PIPE FITTING TYPES, PIPE ELEVATIONS, AND SPACING.

PHASE 1:

- TURN OFF PUMP 1, CLOSE VALVE ISOLATING DISCHARGE PIPING AS SHOWN.
- CONTINUE OPERATING PUMP STATION WITH PUMP 2 AND 3,
- INSTALL TAPPING SADDLE, FLOW METER, VALVES AND FITTINGS IN AREA SHOWN.

PHASE 2:

- OPEN VALVE ON TAPPING SADDLE
- TURN ON PUMP 1, TURN OFF PUMP 3, AND CLOSE VALVE ISOLATING DISCHARGE PIPING AS SHOWN.
- CONTINUE OPERATING PUMP STATION WITH PUMP 1 AND 2.
- INSTALL LINE STOP TO ISOLATE PORTION OF PIPE FOR KNIFE GATE VALVE, AND INSTALL KNIFE GATE VALVE.

PHASE 3:

- REMOVE LINE STOP
- OPEN VALVES TO ALLOW ALL PUMPS TO OPERATE AND ROUTE FLOW THROUGH THE FLOW METER AS SHOWN.

LEGEND

FLOW PATH

4 0 4 8

SCALE IN FEET

WESLEY MARTIN WIEGNER
STATE OF WASHINGTON
49136
REGISTERED
PROFESSIONAL ENGINEER
7-29-2025

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ONE INCH 0 1"
ONE INCH AT FULL SCALE.
IF NOT ONE INCH ADJUST SCALE ACCORDINGLY

PHASING PLAN

wallis engineering

PROJECT NO: WW02
DATE: 07/2025

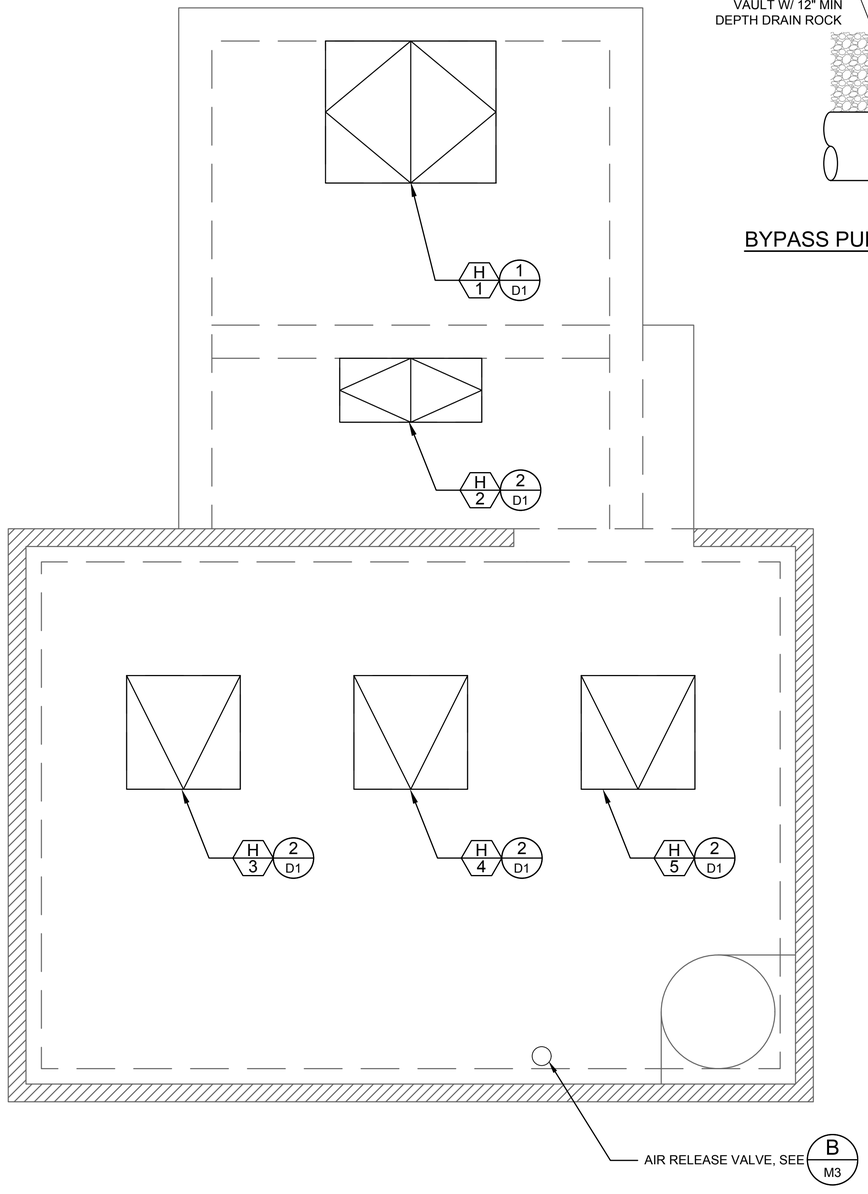
City of Camas WASHINGTON

MAIN PUMP STATION IMPROVEMENTS

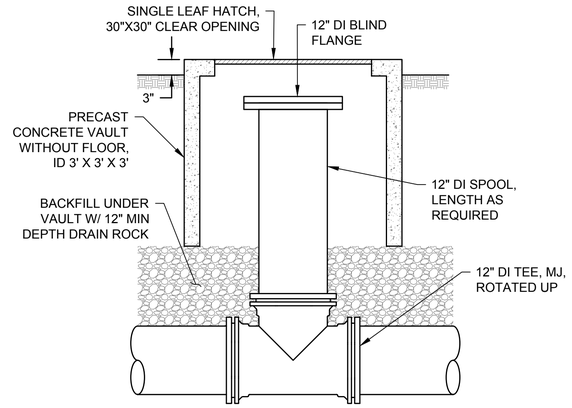
DRAWING NO:

G5

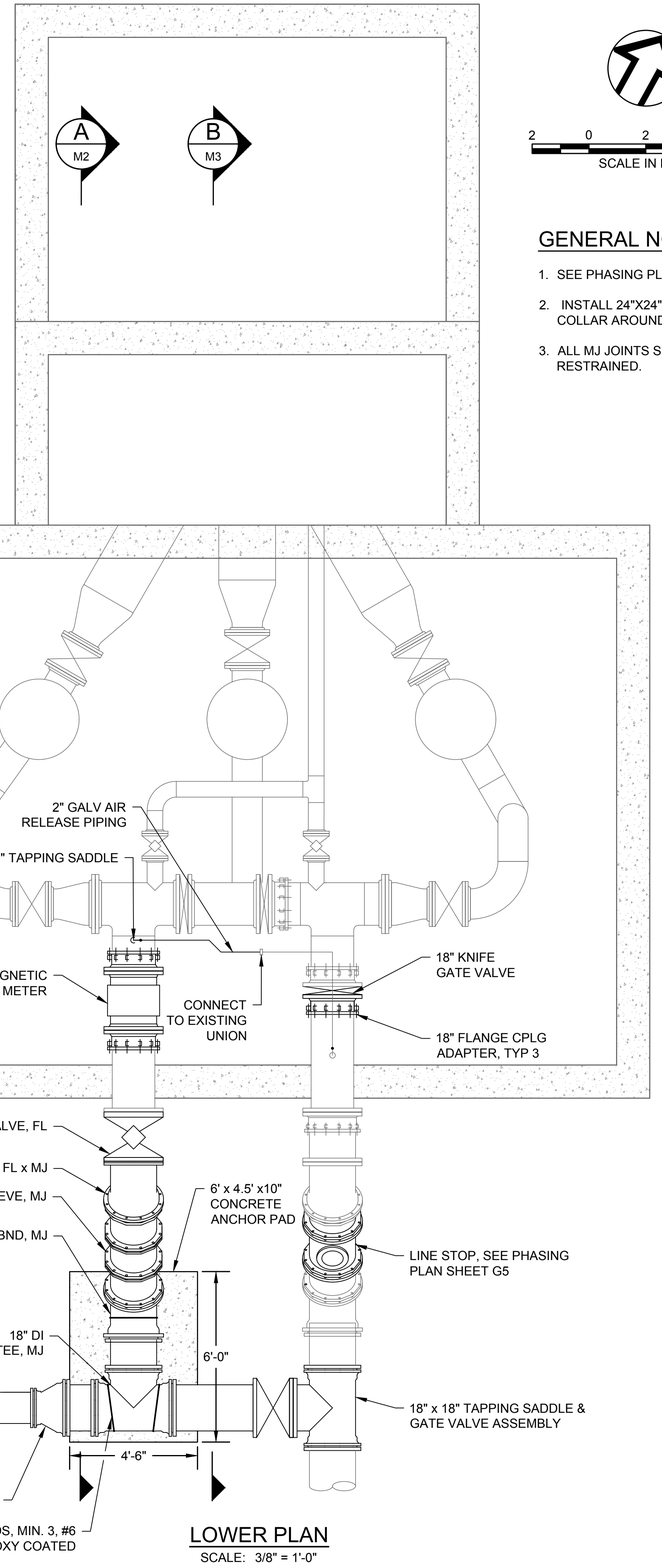
5 OF 29



UPPER PLAN
SCALE: 3/8" = 1'-0"



BYPASS PUMPING CONNECTION PORT DETAIL
NTS



LOWER PLAN
SCALE: 3/8" = 1'-0"

2 0 2 4 6
SCALE IN FEET

GENERAL NOTES

1. SEE PHASING PLAN, SHEET G5.
2. INSTALL 24"X24"X6" CONCRETE COLLAR AROUND ALL VALVE BOXES.
3. ALL MJ JOINTS SHALL BE RESTRAINED.

WESLEY MARTIN WIEGNER
STATE OF WASHINGTON
49136
REGISTERED
PROFESSIONAL ENGINEER
11-25-2025

NO.	REVISION	BY	DATE

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REV: WMW

ONE INCH
0 1"
ONE INCH AT FULL SCALE. IF NOT ONE INCH ADJUST SCALE ACCORDINGLY

MECHANICAL PLAN

wallis engineering

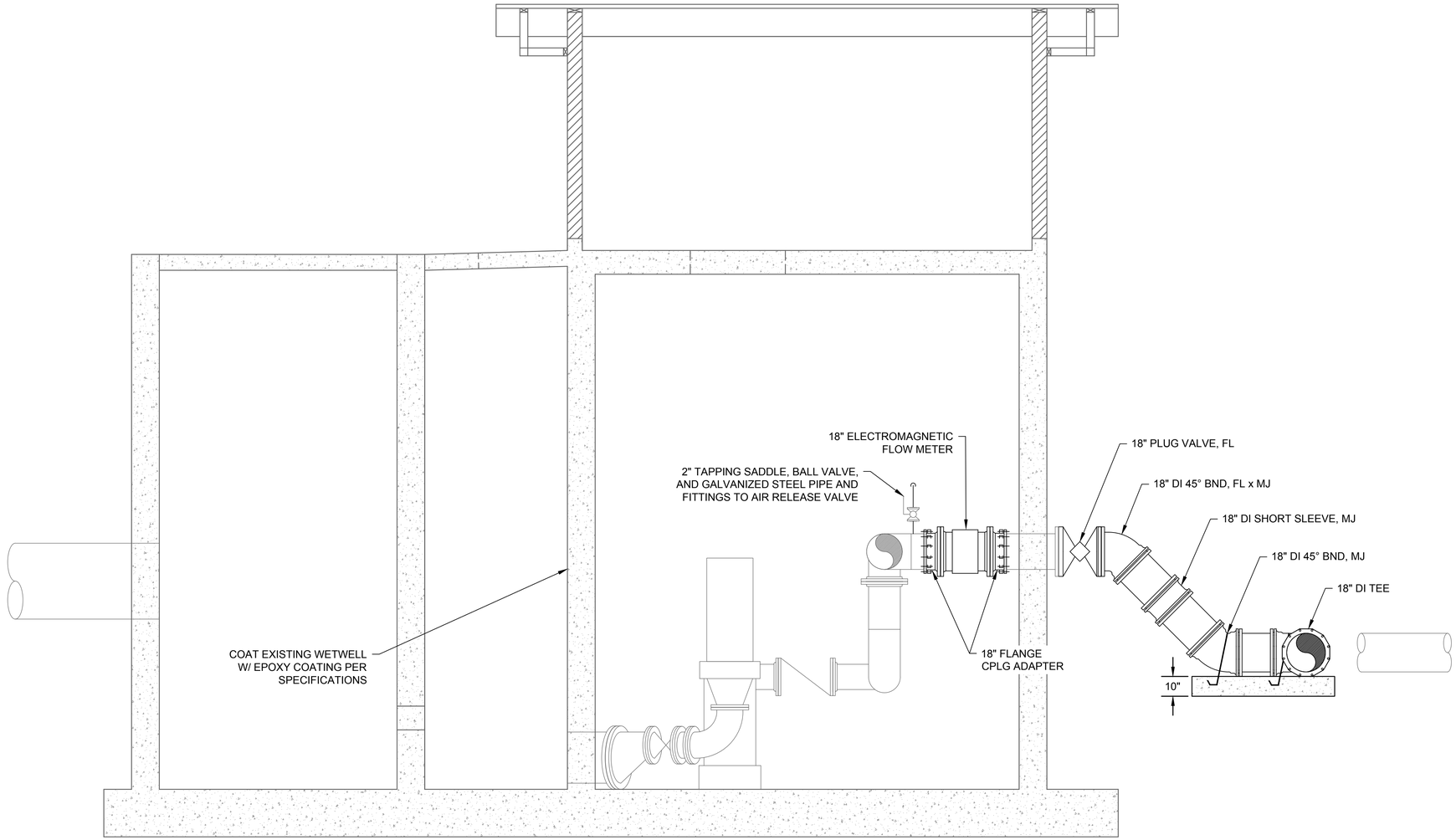
PROJECT NO: WW02
DATE: 07/2025

City of Camas WASHINGTON

MAIN PUMP STATION IMPROVEMENTS

DRAWING NO:
M1

2 0 2 4 6
SCALE IN FEET



A / M1 SECTION
SCALE: 3/8" = 1'-0"

WESLEY MARTIN WEGNER
STATE OF WASHINGTON
49136
REGISTERED
PROFESSIONAL ENGINEER
7-29-2025

NO.	REVISION	BY	DATE

DESIGNED BY: JW
DRAWN BY: AH/CK
REV: WMW

ONE INCH
0 1"
ONE INCH AT FULL SCALE.
IF NOT ONE INCH ADJUST
SCALE ACCORDINGLY

MECHANICAL
SECTIONS I

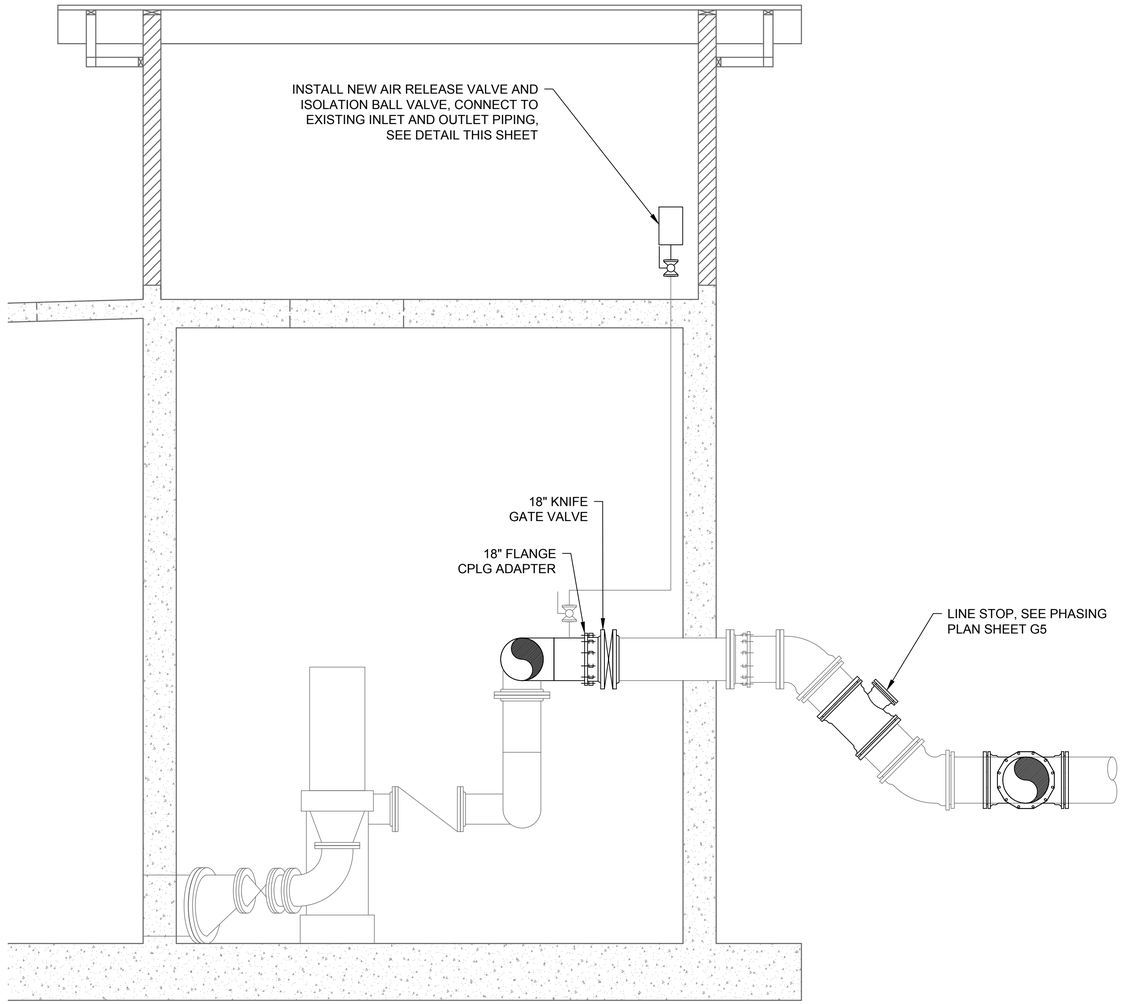
wallis engineering

PROJECT NO: WW02
DATE: 07/2025

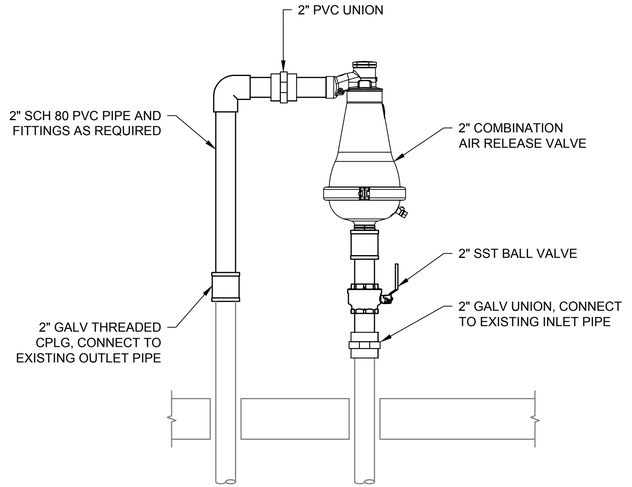
City of Camas WASHINGTON

MAIN PUMP STATION
IMPROVEMENTS

DRAWING NO:
M2



B / M1 SECTION
SCALE: 3/8" = 1'-0"



1 / - AIR RELEASE VALVE DETAIL
NTS

2 0 2 4 6
SCALE IN FEET

WESLEY MARTIN WEGNER
STATE OF WASHINGTON
49136
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PROFESSIONAL ENGINEER
7-29-2025

NO.	REVISION	BY	DATE

DESIGNED BY: JW
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ONE INCH
0 1"
ONE INCH AT FULL SCALE. IF NOT ONE INCH ADJUST SCALE ACCORDINGLY

MECHANICAL SECTIONS II

wallis engineering

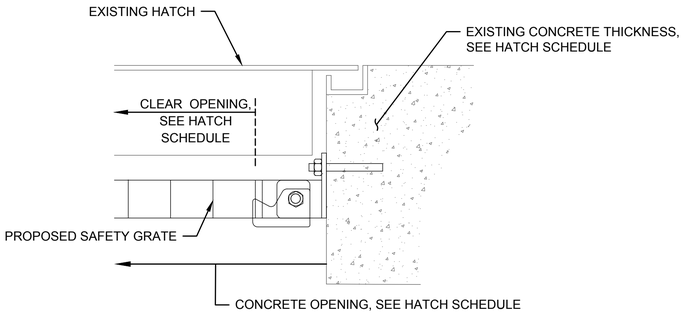
PROJECT NO: WW02
DATE: 07/2025

City of Camas WASHINGTON

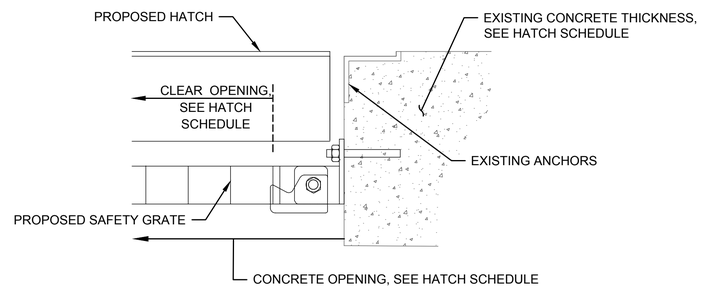
MAIN PUMP STATION IMPROVEMENTS

DRAWING NO:
M3

8 OF 29



1 - RETROFIT SAFETY GRATING ONLY
NTS



2 - RETROFIT HATCH AND SAFETY GRATING - FLUSH WITH SURFACE
NTS

HATCH SCHEDULE

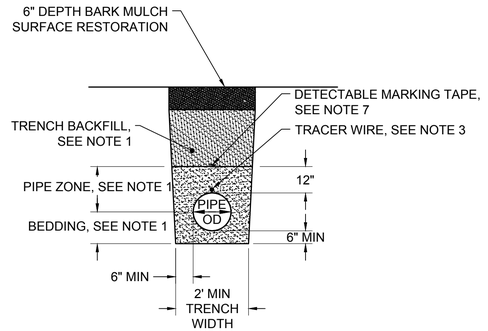
HATCH	TYPE	CONCRETE OPENING	CLEAR OPENING	SLAB THICKNESS
H 1	SAFETY GRATE	60" X 72"	54" X 64"	10"
H 2	HATCH AND SAFETY GRATE	60" X 27"	52" X 23"	6"
H 3	HATCH AND SAFETY GRATE	48" X 48"	42" X 40"	10"
H 4	HATCH AND SAFETY GRATE	48" X 48"	42" X 40"	10"
H 5	HATCH AND SAFETY GRATE	48" X 48"	42" X 40"	10"

NOTES:

1. INSTALL DUAL LEAF HATCHES AND SAFETY GRATING HINGES ON SAME WALL WHERE POSSIBLE.

TRENCH NOTES:

1. BEDDING AND PIPE ZONE SHALL BE CSTC PER WSDOT STD SPEC 9-03.9(3), COMPACTED TO 95% OF MAXIMUM DENSITY. BACKFILL MATERIAL ABOVE THE PIPE ZONE MAY BE NATIVE BACKFILL COMPACTED IN 12" LIFTS.
2. BEDDING MATERIAL SHALL BE TAMPED AROUND PIPE HAUNCHES.
3. THE TONING WIRE SHALL BE RWU90 #10 AWG COPPER COATED STEEL WIRE, W/ 40 MIL MIN THICKNESS OF BLACK CROSS-LINKED POLYETHYLENE INSULATION MANUFACTURED FOR DIRECT BURIAL APPLICATIONS. SECURE TRACER WIRE TO TOP OF PIPE WITH TAPE AT MAXIMUM INTERVALS OF 10 FEET. SEAL SPLICE CONNECTIONS WITH 3M DBY, KING GEL CAPS, OR EQUAL. THE TRACER WIRE SHALL BE CERTIFIED BY A LICENSED ELECTRICAL CONTRACTOR FOR CONTINUITY. FINAL ACCEPTANCE WILL NOT BE GRANTED UNTIL CERTIFICATION IS RECEIVED.
4. THE TONING WIRE SHALL BEGIN AT THE VALVE VAULT TEST STATION W/ A MINIMUM OF ONE (1) FOOT COIL OF WIRE AND END AT THE TEST STATION AT THE DISCHARGE MANHOLE
5. THE TONING WIRE SHALL BE LAID FLAT AND SECURELY AFFIXED TO THE TOP OF THE FORCE MAIN AT 6FT INTERVALS.
6. THE PIPE SHALL BE MARKED WITH CONTINUOUS GREEN THREE (3) INCH WIDE BY FOUR (4) MIL MINIMUM THICKNESS WARNING TAPE WITH ONE (1) INCH HIGH BLACK LETTERING EVERY THREE (3) FEET READING: "CAUTION BURIED PRESSURE SEWER"
7. MARKING TAPE TO BE LOCATED EIGHTEEN (18) INCHES ABOVE A FORCE MAIN.



3 - TRENCH DETAIL
NTS

WESLEY MARTIN WIESNER
STATE OF WASHINGTON
49136
REGISTERED
PROFESSIONAL ENGINEER
11-25-2025

NO.	REVISION	BY	DATE

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DRAWN BY: AH/CK
REV: WMW

ONE INCH
0 1"
ONE INCH AT FULL SCALE. IF NOT ONE INCH ADJUST SCALE ACCORDINGLY

DETAILS I

wallis engineering

PROJECT NO: WW02
DATE: 07/2025

City of Camas WASHINGTON

MAIN PUMP STATION IMPROVEMENTS

DRAWING NO:
D1
9 OF 29

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EROSION/SEDIEMENT CONTROL NOTES:

1. THE EROSION/SEDIMENT CONTROL (ESC) PLAN AND STORMWATER POLLUTION PREVENTION PLAN (SWPPP) IS TO BE UTILIZED AS A GUIDE TO CONTROL THE TRANSPORT OF LOOSE SOILS TO THE PROPERTY OUTSIDE OF THE CONSTRUCTION AREA AND AROUND THE CONSTRUCTION SITE. THE ESC MEASURES SHALL BE UPGRADED AS NEEDED FOR UNEXPECTED STORM EVENTS AND TO ENSURE THAT SEDIMENT AND SEDIMENT LADEN WATER DOES NOT LEAVE THE SITE.

2. THE IMPLEMENTATION OF THE ESC PLANS AND THE CONSTRUCTION, MAINTENANCE, REPLACEMENT AND UPGRADING OF THE ESC MEASURES IS THE RESPONSIBILITY OF THE CONTRACTOR UNTIL ALL CONSTRUCTION IS COMPLETED AND APPROVED AND PERMANENT VEGETATION/LANDSCAPING IS ESTABLISHED.

3. IF THE CITY INSPECTOR OR ENGINEER(S) HAS EVIDENCE OF POOR CONSTRUCTION PRACTICES OR EROSION CONTROL TECHNIQUES, A "STOP WORK" ORDER SHALL BE ISSUED UNTIL PROPER MEASURES HAVE BEEN TAKEN AND APPROVED BY THE CITY ENGINEERING STAFF.

4. THE CONTRACTORS SHALL BE RESPONSIBLE TO FAMILIARIZE THEMSELVES WITH THE MOST RECENTLY ADOPTED EDITION OF THE STORMWATER MANAGEMENT MANUAL FOR WESTERN WASHINGTON, VOL. II AND THE CITY OF CAMAS MUNICIPAL CODE 14.06 (2011).

5. ALL EROSION/SEDIMENT CONTROL MEASURES SHALL BE IN PLACE AND IN WORKING CONDITION PRIOR TO DISTURBING AND EXPOSING ANY SOIL SURFACES (I.E. CONSTRUCTION ENTRANCES, FILTER FABRIC SEDIMENT BARRIERS, AND SEDIMENTATION TRAPS) AND MAINTAINED FOR THE DURATION OF THE PROJECT. TRAPPED SEDIMENT IN EXCESS OF 1 FOOT SHALL BE REMOVED OR STABILIZED ON-SITE. DISTURBED SOIL AREAS RESULTING FROM VEGETATION REMOVAL SHALL BE PERMANENTLY STABILIZED. ADDITIONAL MEASURES MAY BE REQUIRED TO ENSURE THAT ALL PAVED AREAS ARE KEPT CLEAN FOR THE DURATION OF THE PROJECT.

6. TO MINIMIZE EROSION AND SEDIMENTATION TRANSPORTATION, EARTHWORK SHALL NOT BE PERFORMED WHILE SOILS ARE IN AN UNSTABLE STATE DUE TO PRECIPITATION.

7. THE CONTRACTOR SHALL BE RESPONSIBLE TO HAVE CLEARING LIMITS AND/OR ANY EASEMENTS, SENSITIVE OR CRITICAL AREAS, AND THEIR BUFFERS, TREES, AND DRAINAGE COURSES FLAGGED PRIOR TO CONSTRUCTION. DURING THE CONSTRUCTION PERIOD, NO DISTURBANCE BEYOND THE FLAGGED CLEARING LIMITS SHALL BE PERMITTED. FLAGGING LIMITS ARE TO BE MAINTAINED BY THE CONTRACTOR FOR THE DURATION OF CONSTRUCTION.

8. REMOVE ONLY THOSE TREES AND SHRUBS THAT NEED TO BE REMOVED FOR THE CONSTRUCTION OF ROADS, SIDEWALKS, UTILITIES, AND STORMWATER FACILITIES.

9. ALL EXISTING AND NEWLY CONSTRUCTED ROAD CATCH BASINS AND CURB INLETS AFFECTED BY CONSTRUCTION SHALL BE PROTECTED AGAINST SEDIMENT DEPOSITS. AT NO TIME SHALL MORE THAN ONE FOOT OF SEDIMENT BE ALLOWED TO ACCUMULATE WITHIN A TRAPPED CATCH BASIN. ALL CATCH BASINS AND CONVEYANCE LINES SHALL BE CLEANED PRIOR TO PAVING. THE CLEANING OPERATION SHALL NOT FLUSH SEDIMENT LADEN WATER INTO THE DOWNSTREAM SYSTEM.

10. ALL POLLUTANTS THAT OCCUR ON-SITE DURING CONSTRUCTION SHALL BE HANDLED AND DISPOSED OF IN A MANNER THAT DOES NOT CAUSE CONTAMINATION OF STORMWATER SYSTEM.

11. ALL DISTURBED SOIL SURFACES ARE TO BE STABILIZED BY A SUITABLE APPLICATION OF "BEST MANAGEMENT PRACTICES" (BMP'S). DURING THE PERIOD OF OCTOBER 1 THROUGH JULY 5 DISTURBED SOILS MAY REMAIN UNSTABILIZED FOR UP TO TWO DAYS WHEN NOT BEING WORKED. FROM JULY 5 THROUGH OCTOBER 1, DISTURBED SOILS MAY REMAIN UNSTABILIZED FOR UP TO 7 DAYS WHEN NOT BEING WORKED. STABILIZATION OF DISTURBED SOIL AREAS MAY CONSIST OF HYDROSEEDING, HAND-SEEDING AND MULCHING, PLACEMENT OF EROSION CONTROL BLANKETS OR PLASTIC. ALL SEEDED AREAS ARE TO BE FERTILIZED, WATERED, AND MAINTAINED TO ENSURE THAT THE GROWTH OF VEGETATION OCCURS AS SOON AS POSSIBLE.

12. ALL TEMPORARY SEDIMENT AND EROSION CONTROL BMP'S SHALL BE REMOVED WITHIN 30 DAYS AFTER FINAL SITE STABILIZATION IS ACHIEVED OR AFTER THE TEMPORARY BMP'S ARE NO LONGER NEEDED.

REV. NO.	DATE	BY	APPR.
1	9/18/07	SD	JC
2	1/1/11	SCD	JC

CITY OF CAMAS ~ EROSION CONTROL DETAIL
EROSION/SEDIMENT CONTROL NOTES
DETAIL APPROVED BY _____ DATE 1-4-11
NOT TO SCALE
DETAIL NO. EC2
EC-NOTES.DWG

EROSION/SEDIMENT CONTROL NOTES (CONTINUED):

13. THE CONTRACTOR SHALL BE RESPONSIBLE FOR POLICING THE JOB SITE DAILY AND MAINTAINING THE EROSION/SEDIMENT CONTROL MEASURES THROUGHOUT ALL PHASES OF CONSTRUCTION. AN INSPECTION LOG SHALL BE KEPT AND MADE AVAILABLE TO THE CITY OF CAMAS. THE POLICING AND MAINTENANCE SHALL INCLUDE, BUT NOT BE LIMITED TO:
   - VERIFYING THAT ALL AREAS ARE GRADED SUCH THAT ALL RUNOFF IS DIRECTED TO A SEDIMENTATION DEVICE BEFORE DISCHARGE TO SURFACE.
   - REMOVAL OF TRAPPED SILT AT SILT BARRIERS, SILT TRAPS, OR POINTS OF ACCUMULATION.
   - ADDITIONAL PROTECTIVE MEASURES DUE TO JOB SITE OR WEATHER CONDITIONS AS REQUIRED BY THE CITY OF CAMAS.
   - MONITORING OF VEHICLES LEAVING THE SITE TO MINIMIZE TRANSMISSION OF LOOSE SOILS TO THE PUBLIC ROADWAYS.
   - VERIFY THAT ALL PROPERTIES ADJACENT TO THE PROJECT SITE ARE PROTECTED FROM SEDIMENTATION DEPOSITION. THIS MAY BE ACCOMPLISHED BY INSTALLING PERIMETER CONTROLS SUCH AS SEDIMENTATION BARRIERS, FILTERS OR DIKES, SEDIMENTATION BASINS/TRAPS, OR BY A COMBINATION OF SUCH MEASURES.

14. CUT AND FILL SLOPES SHALL BE DESIGNED AND CONSTRUCTED IN A MANNER THAT WILL MINIMIZE EROSION. SLOPES SHALL BE STABILIZED IN ACCORDANCE WITH EROSION/SEDIMENT CONTROL NOTE 11. SLOPES FOUND TO BE ERODING EXCESSIVELY WITHIN TWO YEARS OF CONSTRUCTION MUST BE PROVIDED WITH ADDITIONAL SLOPE STABILIZING MEASURES. THESE MEASURES MAY CONSIST OF ROUGHENED SOIL SURFACES, INTERCEPTORS, DIVERSIONS OR TERRACES, TEMPORARY OR PERMANENT CHANNELS, ADDITIONAL VEGETATION, OR PIPE SLOPE DRAINS AS REQUIRED BY THE CITY OF CAMAS UNTIL THE PROBLEM IS CORRECTED.

15. THE ESC MEASURES ON INACTIVE SITES SHALL BE INSPECTED AND MAINTAINED A MINIMUM OF ONCE A MONTH OR WITHIN 24 HOURS FOLLOWING ANY STORM EVENT.

16. THE CONTRACTOR SHALL BE RESPONSIBLE FOR INSTALLING UNDERGROUND UTILITIES AS SPECIFIED BELOW:
   - WHERE FEASIBLE, NO MORE THAN 500 FEET OF TRENCH SHALL BE OPEN AT ONE TIME.
   - WHERE CONSISTENT WITH SAFETY AND SPACE CONSIDERATIONS, EXCAVATED MATERIAL SHALL BE PLACED ON THE UPHILL SIDE OF TRENCHES.
   - TRENCH DE-WATER DEVICES SHALL DISCHARGE INTO A SEDIMENT TRAP OR SEDIMENT POND.

17. PRIOR TO CONSTRUCTION, THE CITY OF CAMAS REQUIRES AN APPROVED FORM OF SECURITY IN THE AMOUNT OF 200% OF THE ENGINEER'S ESTIMATED COST OF THE ESC MEASURES, INCLUDING ASSOCIATED LABOR, AS SHOWN IN THE APPROVED ESC PLAN AND SWPPP.

18. SUGGESTED STANDARD SEED MIXTURE FOR THOSE AREAS WHERE A TEMPORARY VEGETATIVE COVER IS REQUIRED:
TEMPORARY EROSION CONTROL MIX*

SEED VARIETY	% WEIGHT	% PURITY	% GERMINATION
CHEWINGS OR ANNUAL BLUE GRASS (*FESTUCA RUBRA VAR. COMMUTATA OR POA ANNA*)	40	98	90
PERENNIAL RYE (*LOLIUM PERENNE*)	50	98	90
REDTOP OR COLONIAL BENTGRASS (*AGROSTIS ALBA OR AGROSTIS TENUIS*)	5	92	85
WHITE DUTCH CLOVER (*TRIFOLIUM REPENS*)	5	98	90

*APPLICATION RATE OF 120 LBS/ACRE AND COVERED WITH STRAW OR MULCH

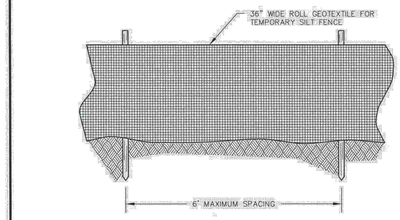
19. SUGGESTED TURF SEED MIXTURE FOR DRY SITUATIONS WHERE THERE IS NO NEED FOR MUCH WATER:
LOW-GROWING TURF SEED MIX*

SEED VARIETY	% WEIGHT	% PURITY	% GERMINATION
DWARF TALL FESCUE (SEVERAL VARIETIES) (*FESTUCA ARUNDINACEA VAR.*)	45	98	90
DWARF PERENNIAL RYE (*LOLIUM PERENNE VAR. BARCLAY*)	30	98	90
RED FESCUE (*FESTUCA RUBRA*)	20	98	90
COLONIAL BENTGRASS (*AGROSTIS TENUIS*)	5	98	90

*APPLICATION RATE OF 120 LBS/ACRE AND COVERED WITH STRAW OR MULCH

REV. NO.	DATE	BY	APPR.
1	9/18/07	SD	JC
2	1/1/11	SCD	JC

CITY OF CAMAS ~ EROSION CONTROL DETAIL
EROSION/SEDIMENT CONTROL NOTES
DETAIL APPROVED BY _____ DATE 1-4-11
NOT TO SCALE
DETAIL NO. EC3
EC-NOTES.DWG



NOTES:
1. MAXIMIZE DETENTION OF STORMWATER BY PLACING FENCE AS FAR AWAY FROM THE TOE OF SLOPE AS POSSIBLE WITHOUT ENCROACHING ON SENSITIVE AREAS OR OUTSIDE OF THE CLEARING BOUNDARIES.
2. BURY BOTTOM OF FILTER FABRIC 6" VERTICALLY BELOW FINISHED GRADE.
3. COMPACT ALL AREAS OF FABRIC TRENCH.
4. POSTS SHALL BE WOOD, DIMENSIONAL FIR OR PINE, 2"x2" NOMINAL.
5. STITCHED LOOPS SHALL BE INSTALLED ON UPHILL SIDE OF FENCE.
6. INSTALL SEDIMENT FENCING ALONG CONTOURS WHENEVER POSSIBLE.
7. INSTALL THE ENDS OF THE SEDIMENT FENCE TO POINT SLIGHTLY UP-SLOPE TO PREVENT SEDIMENT FROM FLOWING AROUND THE ENDS OF THE FENCE.
8. SEDIMENT BUILDUP IN EXCESS OF 8-INCHES SHALL BE REMOVED.

REV. NO.	DATE	BY	APPR.
1	9/18/07	SCD	JC
2	1/1/11	SCD	JC
3	3/1/12	SCD	JC

CITY OF CAMAS ~ EROSION CONTROL DETAIL
SILT FENCE
DETAIL APPROVED BY _____ DATE 3-1-12
NOT TO SCALE
DETAIL NO. EC12
EC-SEDFENCE.DWG

GENERAL CONSTRUCTION NOTES:

1. ALL CONSTRUCTION MATERIALS AND WORKMANSHIP SHALL CONFORM TO THE MOST RECENTLY ADOPTED EDITION OF THE WSDOT/APWA "STANDARD SPECIFICATIONS FOR ROAD, BRIDGE, AND MUNICIPAL CONSTRUCTION" AND STANDARD DETAIL SHEETS ATTACHED HEREWITH.

2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR DETERMINING THE LOCATION OF ALL EXISTING UNDERGROUND UTILITIES, INCLUDING THE INVERT AND TOP ELEVATIONS AT CROSSING LOCATIONS, PRIOR TO THE START OF CONSTRUCTION AND TO NOTIFY THE CITY ENGINEER OF ANY POTENTIAL CONFLICTS.

3. CONTRACTOR SHALL CONTACT CLARK COUNTY'S 24-HOUR UTILITY NOTIFICATION CENTER AT CALLBEFOREYOUDIG.ORG OR CALL (800) 424-5555 (OR 811) TO SUBMIT A REQUEST FOR UTILITY LOCATES, A MINIMUM OF 48 HOURS PRIOR TO THE START OF CONSTRUCTION.

4. ALL EXISTING MONUMENTS, PROPERTY CORNERS AND SURVEY MARKERS SHALL BE PROTECTED. REPLACEMENT OF LOST, DESTROYED OR DAMAGED MARKERS SHALL BE DONE BY A LICENSED LAND SURVEYOR IN ACCORDANCE WITH RCW 58.09 AT THE CONTRACTORS EXPENSE.

5. THE CONTRACTOR SHALL NOT EXCAVATE OVER FOUR FEET IN DEPTH WITHOUT USING ADEQUATE SAFETY MEASURES. THE CONTRACTOR IS REFERRED TO TITLE 296 WAC, PART N FOR EXCAVATION, TRENCHING AND SHORING REQUIREMENTS.

6. ALL UTILITY TRENCHES SHALL HAVE BEDDING, PRE-COVER AND BACKFILL MATERIAL AS REQUIRED IN GENERAL DETAILS G2 WITHIN PAVED AREAS & G3 WITHIN UNPAVED AREAS.
   - WATER SETTLEMENT OF UTILITY TRENCHES IS NOT ALLOWED.
   - TRENCH LINES LOCATED WITHIN AN EXISTING ROADWAY SHALL BE PLATED OR TOPPED WITH COLD MIX.
   - CRUSHED ROCK BACKFILL OVERNIGHT IS NOT ALLOWED.
   - PLATES SHALL HAVE COLD MIX AROUND ALL EDGES.

7. ALL EROSION/SEDIMENT CONTROL MEASURES SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE EROSION/SEDIMENT CONTROL PLAN AND CITY OF CAMAS EROSION/SEDIMENT CONTROL DETAILS PRIOR TO ANY CLEARING OR THE START OF ANY CONSTRUCTION.

8. IF THE CITY INSPECTOR OR ENGINEER(S) HAS EVIDENCE OF POOR CONSTRUCTION PRACTICES OR EROSION CONTROL TECHNIQUES, A "STOP WORK" ORDER SHALL BE ISSUED UNTIL PROPER MEASURES HAVE BEEN TAKEN AND APPROVED BY THE CITY ENGINEERING STAFF.

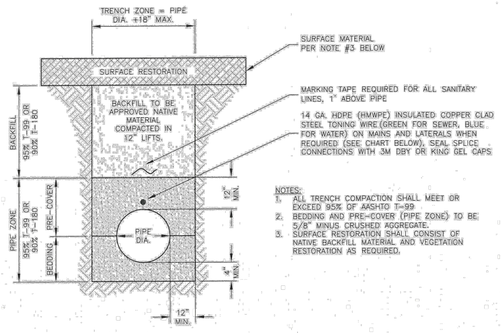
9. THE CONTRACTOR SHALL SUBMIT A TRAFFIC CONTROL PLAN TO THE CAMAS ENGINEERING DEPARTMENT. APPROVAL SHALL BE OBTAINED PRIOR TO THE START OF CONSTRUCTION.

10. THE DEVELOPER/CONTRACTOR SHALL REQUEST A PRE-CONSTRUCTION MEETING WITH THE CITY OF CAMAS ENGINEERING DEPARTMENT PRIOR TO COMMENCING ANY WORK.

11. ANY SIGNIFICANT DEVIATIONS FROM THE PLANS WILL REQUIRE A SUBMITTAL FROM THE APPLICANT'S ENGINEER AND APPROVAL FROM THE CITY OF CAMAS ENGINEERING DEPARTMENT.

12. AN EROSION/SEDIMENT CONTROL BOND MAY BE REQUIRED BY THE CITY OF CAMAS PRIOR TO WORK COMMENCING.

City of Camas WASHINGTON
GENERAL DETAIL
CONSTRUCTION NOTES
DETAIL APPROVED BY _____ DATE 8-12-22
NOT TO SCALE
REVISION: 6 DATE: 8/12/2022
DETAIL NO. G1
G2&4-NOTES.DWG



NOTES:
1. ALL TRENCH COMPACTION SHALL MEET OR EXCEED 95% OF AASHTO T-99.
2. BEDDING AND PRE-COVER (PIPE ZONE) TO BE 5/8" MINUS CRUSHED AGGREGATE.
3. SURFACE RESTORATION SHALL CONSIST OF NATIVE BACKFILL MATERIAL AND VEGETATION RESTORATION AS REQUIRED.

UTILITY TRENCH SECTION FOR UNPAVED AREAS

MINIMUM PIPE COVER TABLE

UTILITY TYPE	MAIN TYPE	MIN. PIPE (MAIN) COVER	MIN. LATERAL OR SERVICE COVER
WATER:	DISTRIBUTION (C)	2.5'	2' (C)
	TRANSMISSION (A)	3'	2' (B)
STORM	MAIN	5'	PER PLAN (MIN. 2')
SEWER:	STEP (C)	5'	1.5' (C)
	STEF (C)	6'	4.5' (C)
	GRAVITY	6'	4.5' (C)

(NOTES)
A. TONING WIRE REQUIRED FOR MAINS 12" DIA. AND LARGER
B. SERVICES ONLY ALLOWED WHERE APPROVED
C. TONING WIRE REQUIRED

City of Camas WASHINGTON
GENERAL DETAIL
UTILITY TRENCH FOR UNPAVED AREAS
DETAIL APPROVED BY _____ DATE 9-26-23
NOT TO SCALE
REVISION: 7 DATE: 09/26/2023
DETAIL NO. G3
G2&4-TRENCH.DWG

WESLEY MARTIN WISSNER
STATE OF WASHINGTON
49136
REGISTERED
PROFESSIONAL ENGINEER
7-29-2025

NO.	REVISION	BY	DATE

DESIGNED BY: JW
DRAWN BY: AH/CK
REV: WMW

ONE INCH 0 1"
ONE INCH AT FULL SCALE. IF NOT ONE INCH ADJUST SCALE ACCORDINGLY

DETAILS II

wallis engineering

PROJECT NO: WW02
DATE: 07/2025

City of Camas WASHINGTON

MAIN PUMP STATION IMPROVEMENTS

DRAWING NO: D2

10 OF 29

P:\City of Camas\Camas22\WW02 Camas Main P.S. Imp\500 DWG\501 Plan Sheets\EC DETAILS.dwg 7/30/2025 12:28:35 PM, Chad Keys

GENERAL SYMBOLS

1	KEYNOTE
A	REVISION TAG
	REVISION CLOUD
X / XXX	DETAIL/PLAN CALLOUT
N	NORTH ARROW
	MATCHLINE
	POINT OF CONNECTION
	POINT OF DEMOLITION
	CONTINUATION SYMBOL
	AREA TO BE DEMOLISHED
	AREA NOT IN CONTRACT

HVAC SYMBOLS & TAGS

T	THERMOSTAT
H	HUMIDISTAT
TH	TEMPERATURE & HUMIDITY SENSOR
HS	HUMIDITY SENSOR
MS	MANUAL SWITCH
S	SENSOR
CO	CARBON MONOXIDE (CO) SENSOR
CO2	CARBON DIOXIDE (CO_2) SENSOR
NO2	NITROGEN DIOXIDE (NO_2) SENSOR
U	DOOR UNDERCUT
AHU-101	EQUIPMENT TAG
TYPE / SIZE CFM	DIFFUSER TAG

SEQUENCE OF OPERATIONS

VENTILATION FANS (EF-01, EF-02, SF-01, SF-02):
- FANS SHALL OPERATE CONTINUOUSLY.

ELECTRIC WALL HEATERS (EUH-01, EUH-02):
- HEATERS (EWH) SHALL OPERATE TO MAINTAIN A SPACE TEMPERATURE OF 45°F FOR FREEZE PROTECTION.

ABBREVIATIONS

Ø	ROUND
AC	AIR CONDITIONING
ADD	ADDENDUM
AFF	ABOVE FINISHED FLOOR
AFUE	ANNUAL FUEL UTILIZATION EFFICIENCY
ALT	ALTERNATE
AP	ACCESS PANEL
ARCH	ARCHITECT/ARCHITECTURAL
BFF	BELOW FINISHED FLOOR
BTU	BRITISH THERMAL UNITS
BTUH	BRITISH THERMAL UNITS PER HOUR
CAP	CAPACITY
CFM	CUBIC FEET PER MINUTE
CO	CLEAN OUT
D	DEGREE
DB	DRY BULB
DIA	DIAMETER
DN	DOWN
EAT	ENTERING AIR TEMPERATURE
ELEC	ELECTRICAL
EQUIP	EQUIPMENT
EWC	ELECTRIC WATER COOLER
EWT	ENTERING WATER TEMPERATURE
E/A	EXHAUST AIR
(E)	EXISTING
°F	DEGREES FAHRENHEIT
FD	FIRE DAMPER
FL	FLOOR
FO	FUEL OIL
FOV	FUEL OIL VENT
FOR	FUEL OIL RETURN
FOS	FUEL OIL SUPPLY
FPM	FEET PER MINUTE
FS	FLOOR SINK
FT	FOOT/FEET
GAL	GALLON
GC	GENERAL CONTRACTOR
GPM	GALLONS PER MINUTE
HP	HORSE POWER
ID	INDIRECT
IN	INCH
INV	INVERT
LB	POUND
LB/HR	POUNDS PER HOUR
LAT	LEAVING AIR TEMPERATURE
LP	LOW PRESSURE
LPG	LIQUEFIED PETROLEUM GAS
LVR	LOUVER
LWT	LEAVING WATER TEMPERATURE
M/A	MIXED AIR
MAX	MAXIMUM
MBH	ONE THOUSAND BTU PER HOUR
MCF	ONE THOUSAND CUBIC FEET
MD	MOTORIZED DAMPER
MECH	MECHANICAL
MFR	MANUFACTURER
MIN	MINIMUM
MISC	MISCELLANEOUS
MUA	MAKE-UP/AIR
NC	NOISE CRITERIA
NC	NORMALLY CLOSED
NIC	NOT IN CONTRACT
NO	NUMBER
NO	NORMALLY OPEN
NTS	NOT TO SCALE
O	OXYGEN
O/A	OUTSIDE AIR
PD	PRESSURE DROP
PRESS	PRESSURE
PRV	PRESSURE REDUCING VALVE
PSI	POUNDS PER SQUARE INCH
PSIG	POUNDS PER SQUARE INCH GAUGE
PWR	POWER
(R)	RELOCATE
R/A	RETURN AIR
RCP	RADIANT CEILING PANEL
REC	RECESSED
RED	REDUCER
RH	RELATIVE HUMIDITY
RL/A	RELIEF AIR
RM	ROOM
RPM	REVOLUTIONS PER MINUTE
SF	SQUARE FOOT
S/A	SUPPLY AIR
SF	SQUARE FOOT
SD	SMOKE DAMPER
SM	SURFACE MOUNT
SP	STANDPIPE
SP	STATIC PRESSURE
STM	STEAM
T	THERMOSTAT
TD	TEMPERATURE DROP
TEMP	TEMPERATURE
TYP	TYPICAL
UG	UNDERGROUND
VAC	VACUUM
V	VENT
VAV	VARIABLE AIR VOLUME
VENT	VENTILATION
WB	WET BULB
(X)	DEMOLISH

MECHANICAL BASIS OF DESIGN

BUILDING DESCRIPTION
RENOVATION OF THE HEATING AND VENTILATION SYSTEMS SERVING AN EXISTING TWO LEVEL WET WELL / DRY WELL PUMP STATION BUIDING IN CAMAS, WA.

CODES AND STANDARDS
BUILDING MECHANICAL SYSTEMS ARE DESIGN IN ACCORDANCE WITH THE FOLLOWING CODES AND STANDARDS:
- 2021 INTERNATIONAL BUILDING CODE WITH WASHINGTON AMENDMENTS
- 2021 INTERNATIONAL MECHANICAL CODE WITH WASHINGTON AMENDMENTS
- 2021 WASHINGTON STATE ENERGY CODE
- 2024 NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

HVAC DESIGN CRITERIA
PEARSON AIRFIELD

ASHRAE FUNDAMENTALS 2021

ELEVATION: 30'
LAT: 45.621N
LONG: 122.657W

OUTDOOR DESIGN CONDITIONS

WINTER: 24.4°F DB (99.6%)
SUMMER: 91.4°F DB (0.4%)
66.7°F WB (0.4%)

INDOOR DESIGN CONDITIONS

HEATING: 55°F (FREEZE PROTECTION)
COOLING: NA

VENTILATION CRITERIA
CONTINUOUS VENTILATION AT SIX AIR CHANGES PER HOUR PER NFPA 820 TABLE 4.2.2 "COLLECTION SYSTEMS", STORM WATER PUMP STATION WET WELLS, NEC HAZARDOUS LOCATION CLASSIFICATION: UNCLASSIFIED.

GENERAL NOTES

1. REMOVE ALL UNUSED PIPING, DUCTWORK AND ACCESSORIES.
2. THE MECHANICAL CONTRACTOR SHALL BE RESPONSIBLE FOR FIELD VERIFYING, PRIOR TO FINAL BID, ALL EXISTING CONDITIONS FOR MECHANICAL SYSTEMS WITHIN THE BUILDING.
3. THESE DRAWINGS ARE DIAGRAMMATIC IN NATURE AND INDICATE THE GENERAL ARRANGEMENT OF SYSTEMS AND EQUIPMENT. FINAL LOCATIONS OF EQUIPMENT SHALL BE FIELD DETERMINED. ALL DISCREPANCIES IN THE DRAWINGS SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER IN WRITING PRIOR TO SUBMISSION.
4. COORDINATE INSTALLATION OF PIPING, DUCTWORK, CONDUIT, LIGHTS, CABLE TRAY, STRUCTURE, AND EQUIPMENT TO PREVENT CONFLICTS.
5. THE CONTRACTOR SHALL BE FAMILIAR WITH ALL THE CONDITIONS BOTH EXISTING AND THOSE ILLUSTRATED BY THESE DOCUMENTS AS WELL AS THOSE WHICH CAN BE REASONABLY ANTICIPATED.
6. FINAL PRODUCT SHALL BE A COMPLETE AND FUNCTIONING SYSTEM, AND SHALL CONFORM TO ALL REQUIREMENTS OF APPLICABLE FEDERAL, STATE AND LOCAL CODES, INCLUDING BUT NOT LIMITED TO THE INTERNATIONAL BUILDING CODE AND INTERNATIONAL MECHANICAL CODE.
7. EQUIPMENT FOR OTHER DISCIPLINES MAY BE SHOWN FOR REFERENCE ONLY. REFER TO OTHER DISCIPLINES' DRAWINGS FOR MORE DETAIL REGARDING EQUIPMENT SPECIFICATIONS AND INFORMATION.
8. PLANS SHALL GOVERN IN MATTERS OF QUANTITY, SPECIFICATIONS SHALL GOVERN IN MATTERS OF QUALITY. IN CASE OF DISCREPANCY BETWEEN DRAWINGS AND SPECIFICATIONS, THE SPECIFICATIONS SHALL GOVERN. PLANS ARE TO BE TIED TO SPECIFICATIONS FOR A COMPLETE DESIGN PACKAGE. NOTIFY ENGINEER OF ANY DISCREPANCY BETWEEN DRAWINGS AND SPECIFICATIONS.
9. ANYTHING MENTIONED IN THE SPECIFICATIONS AND NOT SHOWN ON THE DRAWINGS, OR SHOWN ON THE DRAWINGS AND NOT MENTIONED IN THE SPECIFICATIONS, SHALL BE OF LIKE EFFECT AS IF SHOWN OR MENTIONED IN BOTH.
10. PROVIDE FIRE PROOFING FOR ALL PENETRATIONS OF FIRE RATED ASSEMBLIES. FIRE PROOFING MUST BE EQUIVALENT OR HIGHER TO THAT OF THE PENETRATED ASSEMBLY. REFER TO ARCHITECTURAL PLANS.
11. PROVIDE SLEEVES AND/OR OPENINGS TO RUN PIPES AND DUCTS THROUGH FOUNDATIONS, FLOORS, WALLS, AND ROOF. CONSULT STRUCTURALLY ENGINEER OF RECORD FOR ALL STRUCTURAL PENETRATIONS. PROVIDE WATER-PROOFING AS NEEDED FOR ALL EXTERIOR PENETRATIONS.
12. ADJUST PIPING AND DUCTWORK SIZES TO PROPERLY CONNECT TO MECHANICAL EQUIPMENT.
13. PIPE AND DUCTWORK SIZES SHOWN SHALL BE CONTINUED IN THE DIRECTION OF FLOW UNTIL ANOTHER SIZE IS SHOWN.
14. FOR DETAILS, EQUIPMENT CONNECTIONS, DUCT AND PIPE SIZES NOT SHOWN ON THE SEGMENTS, REFER TO DETAILS, SCHEDULES, AND SPECIFICATIONS.
15. INSTALL ALL EQUIPMENT IN ACCORDANCE WITH THE RESPECTIVE MANUFACTURER'S WRITTEN INSTALLATION INSTRUCTIONS, AT A LEVEL OF QUALITY AND WORKMANSHIP CONSISTENT WITH THE SPECIFICATIONS.
16. LOCATIONS OF PIPING, DUCTWORK AND EQUIPMENT AS INDICATED ON THE DRAWINGS, ARE APPROXIMATE AND SUBJECT TO MINOR ADJUSTMENTS IN THE FIELD. WORK SHALL BE COORDINATED WITH ALL OTHER TRADES TO AVOID INTERFERENCE IN THE FIELD.
17. THE MECHANICAL CONTRACTOR SHALL PROVIDE AND INSTALL ALL NECESSARY CONDUIT, WIRING, CONTROLS, AND APPURTENANCES FOR A COMPLETE AND OPERABLE HVAC SYSTEM.
18. SEISMIC ANCHORAGE AND RESTRAINTS MUST BE COORDINATED WITH STRUCTURAL ENGINEER AND AUTHORITY HAVING JURISDICTION.
19. LOCATE THERMOSTATS AND TEMPERATURE SENSORS A MINIMUM OF 8" AWAY FROM LIGHT SWITCHES.
20. CONTRACTOR SHALL PROVIDE AND INSTALL ALL CONTROL WIRING.
21. ALL SUPPLY, RETURN, AND EXHAUST DUCTWORK SHALL BE RATED FOR PRESSURE CLASS OF 2" W.G. UNLESS NOTED OTHERWISE.
22. CONTRACTOR TO PROVIDE OPERATION & MAINTENANCE MANUALS AND AS-BUILT DRAWINGS FOR NEW SYSTEMS AND EQUIPMENT WITHIN 90 DAYS OF COMPLETION

* NOTE *
ALL OF GENERAL NOTES ON THIS SHEET ARE TO BE APPLIED TO ALL OTHER DRAWINGS IN THIS SET. THE SYMBOLS AND ABBREVIATIONS SHOWN ON THIS SHEET MAY OR MAY NOT BE USED IN THIS SET OF DRAWINGS.

NFPA 820 VENTILATION CALCULATION

ROOM NAME	SQFT	HEIGHT	ACH	MIN. CFM
DRY WELL	468	25	6	1170
CONTROL ROOM	532	10	6	532

FANS

TAG	LOCATION	SERVES	TYPE	AIRFLOW	ESP	ELECTRICAL			WEIGHT	BASIS OF DESIGN		NOTES
						HP	VOLT	PH		MANUFACTURER	MODEL	
EF-01	ROOF	DRYWELL	DOWNBLAST CENTRIFUGAL	1200 CFM	.75" W.C.	1/2 HP	115 V	1 Ø	80 LBS	LOREN COOK	101 ACE-D VF	1,2,3 & 4
EF-02	ROOF	CONTROL ROOM	DOWNBLAST CENTRIFUGAL	600 CFM	.25" W.C.	1/6 HP	115 V	1 Ø	30 LBS	LOREN COOK	101 ACE-D VF	1,2,3 & 4
SF-01	UPPER LEVEL	CONTROL ROOM	WALL MOUNT	600 CFM	.25" W.C.	1/3 HP	115 V	1 Ø	70 LBS	LOREN COOK	120 SQN-D	1,2,3, 4,5 & 6
SF-02	UPPER LEVEL	DRYWELL	WALL MOUNT	1200 CFM	.25" W.C.	1/2 HP	115 V	1 Ø	130 LBS	LOREN COOK	165 SQN-D	1,2,3, 4,5 & 6

NOTES:
1. PROVIDE CURB ADAPTOR, COORDINATE DIMENSIONS WITH EXISTING CONDITIONS.
2. PROVIDE MOTORIZED DAMPER, POWER AND CONTROL FROM FAN.
3. PROVIDE BIRDSCREEN AND INTAKE/OUTLET GUARD.
4. PROVIDE SERVICE SWITCH.
5. PROVIDE EXTERIOR INTAKE HOOD EQUIPPED WITH INSECT SCREEN.
6. PROVIDE DUCT EXTENSION TO ACCOMODATE AIRFLOW SENSOR. COORDINATE WITH DIV. 40.

ELECTRIC UNIT HEATER

TAG	LOCATION	BASIS OF DESIGN		STYLE	FINISH	ELECTRICAL			NOTES
		MANUFACTURER	MODEL			KW	VOLT	PH	
EUH-01	UPPER LEVEL	CHROMOLOX	LUH	CEILING MOUNTED	WHITE	5	480	3 Ø	ALL
EUH-02	UPPER LEVEL	CHROMOLOX	LUH	CEILING MOUNTED	WHITE	5	480	3 Ø	ALL

NOTES:
1. PROVIDE INTERNAL THERMOSTAT.
2. PROVIDE CEILING MOUNTED SWIVEL BRACKET.
3. PROVIDE DISCONNECT SWITCH.

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REV: CH

ONE INCH 0 1"
ONE INCH AT FULL SCALE.
IF NOT ONE INCH ADJUST SCALE ACCORDINGLY

HVAC NOTES AND LEGENDS

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DATE: 07-16-2025
PROJECT NO: 24100

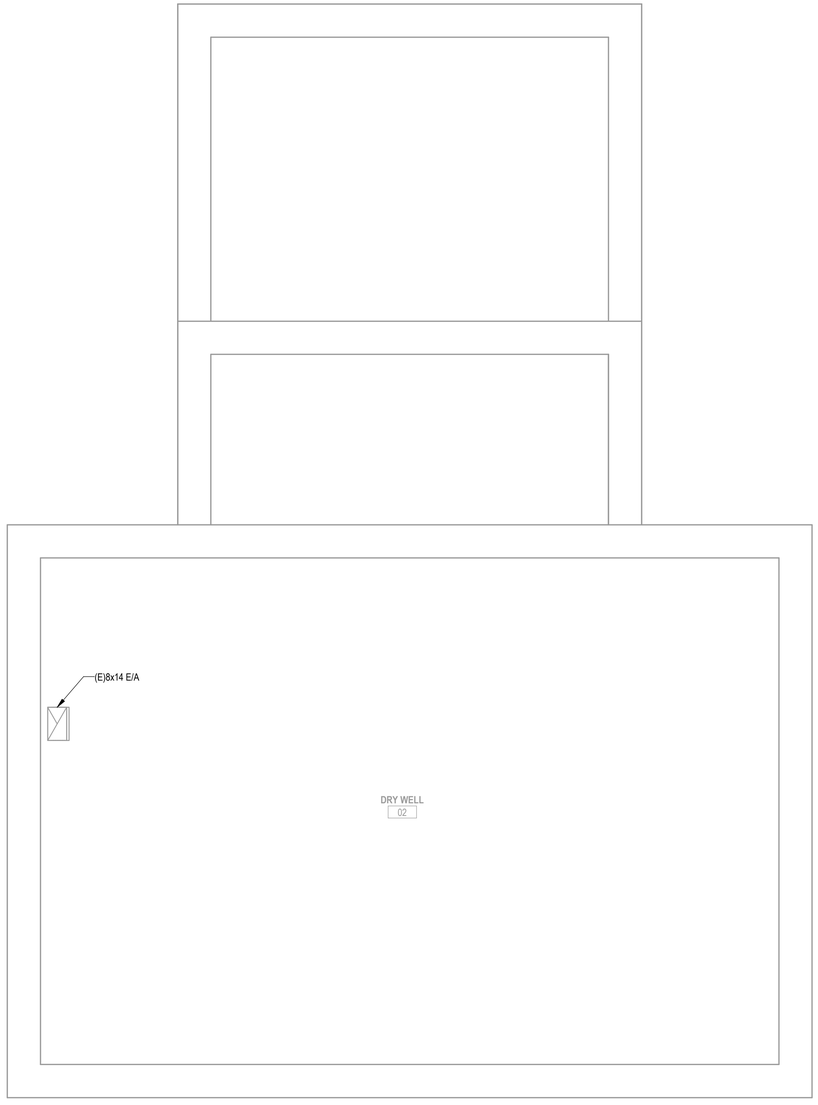
City of Camas WASHINGTON

MAIN PUMP STATION IMPROVEMENTS

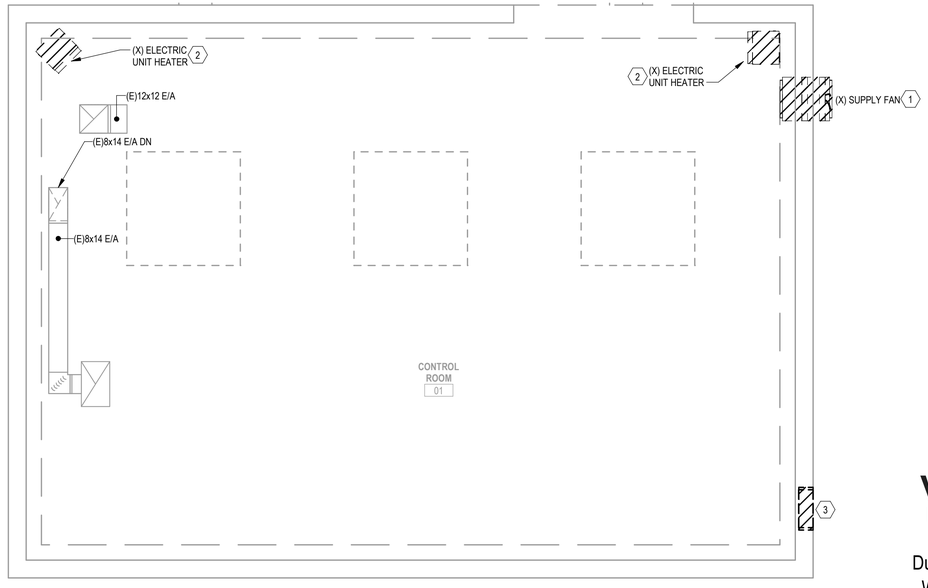
DRAWING NO:
H1
11 OF 29

KEYNOTES:

1 DEMOLISH EXISTING SUPPLY FAN AND PREPARE FOR INSTALLATION OF NEW FAN.
2 DEMOLISH EXISTING HEATER AND PREPARE FOR INSTALLATION OF NEW HEATER.
3 DEMOLISH EXISTING LOUVER AND PREPARE OPENING FOR INSTALLATION OF SUPPLY FAN.



1 LEVEL 1 PLAN - HVAC - DEMO
SCALE: 3/8" = 1'-0"



2 LEVEL 2 PLAN - HVAC - DEMO
SCALE: 3/8" = 1'-0"

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HVAC DEMO - FLOOR PLAN

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PROJECT NO: 24100
DATE: 07-16-2025

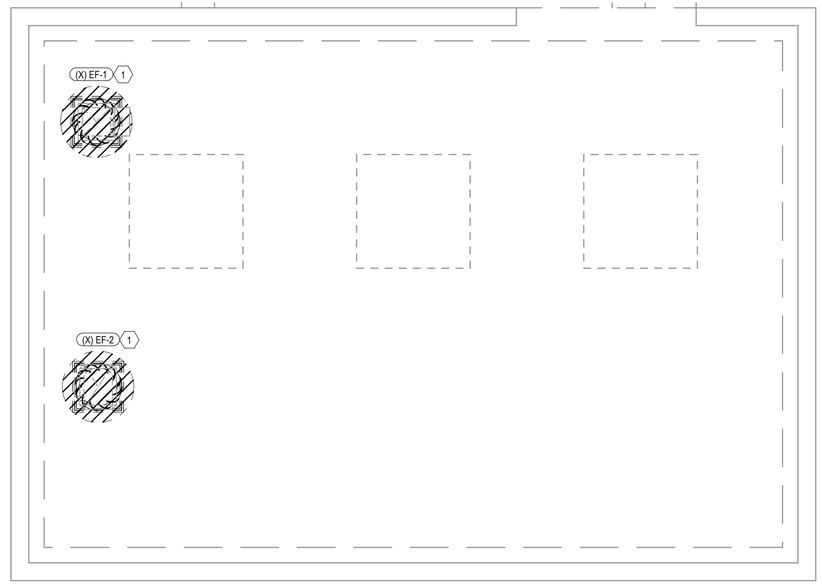
City of Camas WASHINGTON

MAIN PUMP STATION IMPROVEMENTS

DRAWING NO:
H2
12 OF 29

KEYNOTES:

1 DEMOLISH EXISTING EXHAUST FAN AND PREPARE OPENING FOR INSTALLATION OF NEW FAN.



1 ROOF PLAN - HVAC - DEMO
SCALE: 3/8" = 1'-0"

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ONE INCH AT FULL SCALE.
IF NOT ONE INCH ADJUST
SCALE ACCORDINGLY

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HVAC DEMO - ROOF PLAN

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DATE: 07-16-2025

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MAIN PUMP STATION IMPROVEMENTS

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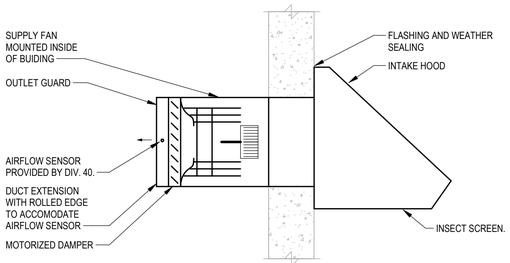
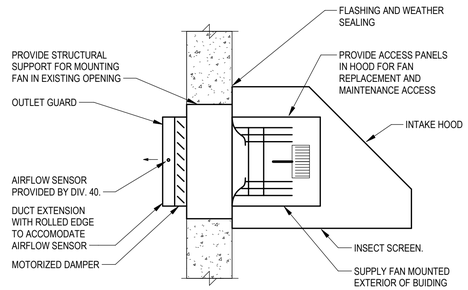
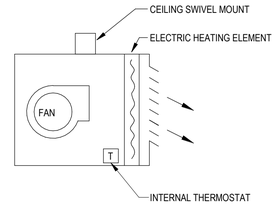


3 WALL MOUNTED INLINE SUPPLY FAN - INTERIOR
NOT TO SCALE



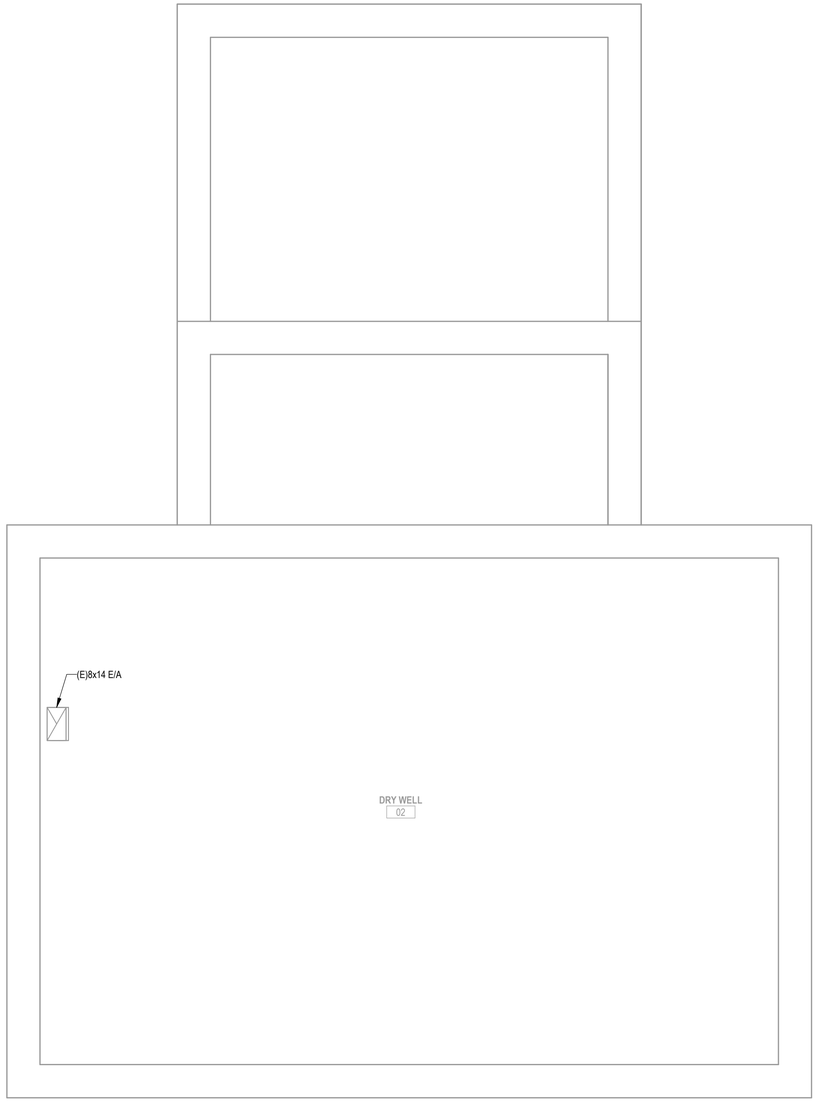
4 WALL MOUNTED INLINE SUPPLY FAN - EXTERIOR
SCALE: 1" = 10'-0"



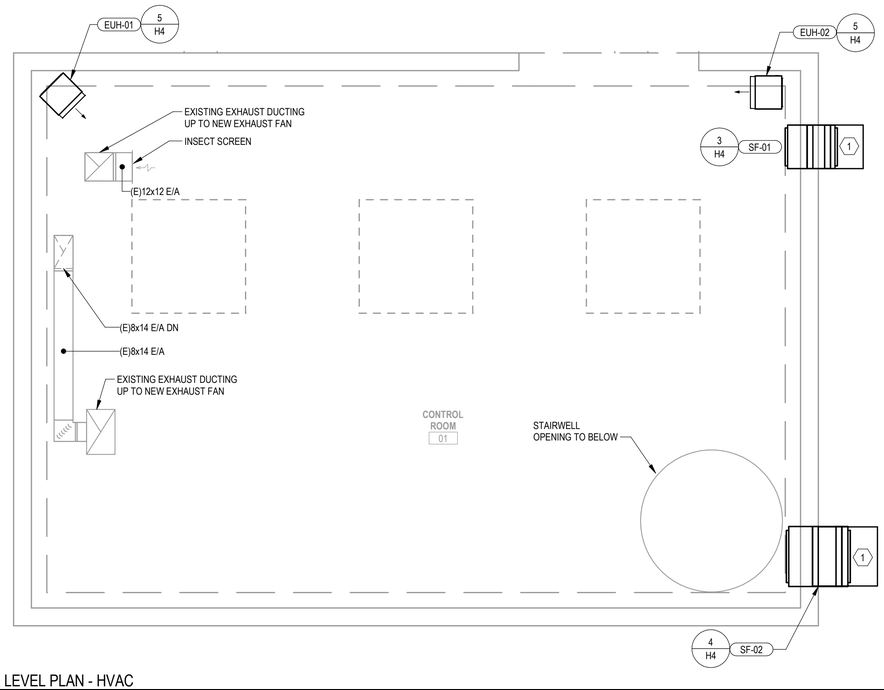
5 ELECTRIC UNIT HEATER
NOT TO SCALE

KEYNOTES:

1 PROVIDE EXTERIOR INTAKE HOOD WITH INSECT SCREEN.



1 LOWER LEVEL PLAN - HVAC
SCALE: 3/8" = 1'-0"



2 UPPER LEVEL PLAN - HVAC
SCALE: 3/8" = 1'-0"

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SCALE ACCORDINGLY

HVAC FLOOR PLANS

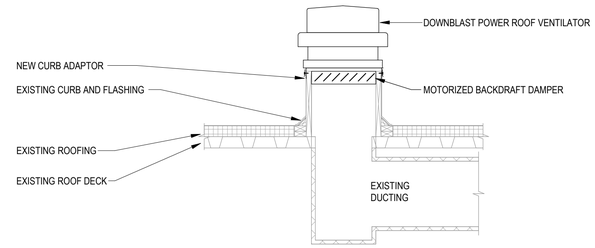
wallis engineering

PROJECT NO: 24100
DATE: 07-16-2025

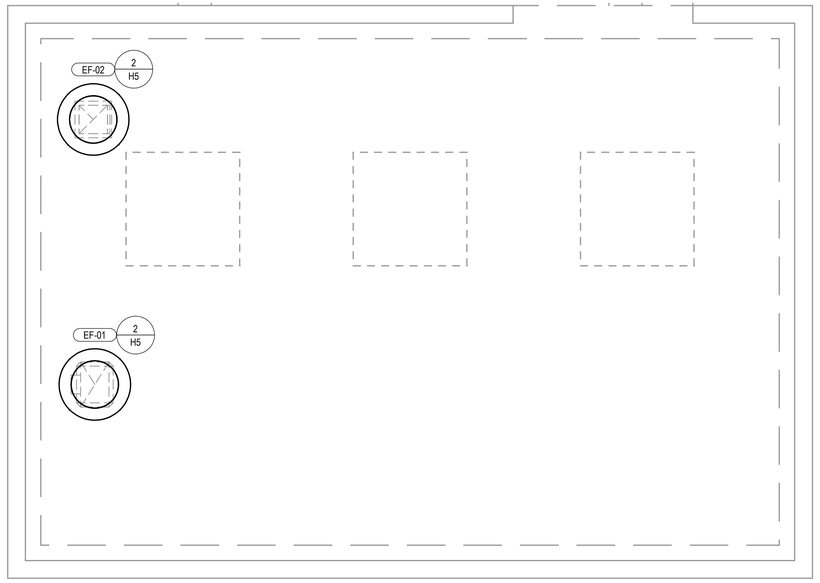
City of Camas WASHINGTON

MAIN PUMP STATION
IMPROVEMENTS

DRAWING NO:
H4
14 OF 29



2 UPBLAST POWER ROOF VENTILATOR DETAIL
SCALE: NO SCALE



1 ROOF PLAN - HVAC
SCALE: 3/8" = 1'-0"

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SCALE ACCORDINGLY

HVAC ROOF PLAN

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PROJECT NO: 24100
DATE: 07-16-2025

City of Camas WASHINGTON

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GENERAL NOTES:

1. ALL MATERIALS AND INSTALLATIONS SHALL BE IN ACCORDANCE WITH THE LATEST NATIONAL ELECTRICAL CODE. ALL MATERIALS SHALL BE NEW AND LISTED BY THE UNDERWRITERS' LABORATORY INC. (UL). ALL ELECTRICAL WORK SHALL BE INSTALLED IN A SAFE AND FUNCTIONAL MANNER.
2. REFER TO THE ELECTRICAL CIRCUIT SCHEDULE FOR CIRCUIT IDENTIFICATIONS, ROUTING, CONDUCTOR SIZES, ETC.
3. ELECTRICAL CONTRACTOR SHALL COORDINATE WITH OTHER DISCIPLINES AS REQUIRED TO MITIGATE INTERFERENCES.
4. CONDUIT MATERIAL SHOWN ON ELECTRICAL PLANS ARE SPECIFIC FOR THE LOCATION WHERE THE CONDUIT STARTS. CONTRACTOR IS RESPONSIBLE FOR TRANSITIONING TO APPROVED CONDUIT MATERIAL BASED ON LOCATION AND IN ACCORDANCE TO ELECTRICAL SPECIFICATIONS.

ABBREVIATIONS

a	CIRCUIT BREAKER AUX. CONTACT, CLOSED WHEN BREAKER IS CLOSED
A	AMMETER, AMPERES
AC	ALTERNATING CURRENT
A/D	ANALOG TO DIGITAL
AF	AMPERE FRAME
AIC	AMPERES INTERRUPTING CAPACITY
ALT	ALTERNATOR
A/M	AUTO/MANUAL CONTROLLER
ANN	ANNUNCIATOR
AS	AMMETER SWITCH
ASD	ADJUSTABLE SPEED DRIVE
AT	AMPERE TRIP
ATS	AUTOMATIC TRANSFER SWITCH
AUTO	AUTOMATIC
AWG	AMERICAN WIRE GAGE
b	CIRCUIT BREAKER AUX. CONTACT, CLOSED WHEN BREAKER IS OPEN
BCG	BARE COPPER GROUND
C	CONDUIT, CONTACTOR
CAP	CAPACITOR
CB	CIRCUIT BREAKER
CC	CONTROL CABLE, CLOSING COIL
CHH	COMMUNICATION HANDHOLE
CL	CHLORINE
CKT	CIRCUIT
CMH	COMMUNICATION MANHOLE
CO	CONDUIT ONLY
COMM	COMMUNICATION
CON	CONTACTOR
COND	CONDUCTOR
CONT	CONTINUED, CONTINUATION
CPT	CONTROL POWER TRANSFORMER
CP	CONTROL PANEL
CR	CONTROL RELAY
CS	CONTROL SWITCH
CT	CURRENT TRANSFORMER
CWP	COLD WATER PIPE
DC	DIRECT CURRENT
DIAG	DIAGRAM
DISC	DISCONNECT
DISTR	DISTRIBUTION
DP	DISTRIBUTION PANEL
DPDT	DOUBLE POLE, DOUBLE THROW
DPST	DOUBLE POLE, SINGLE THROW
EXST	EXISTING
EF	EXHAUST FAN
EHH	ELECTRICAL HANDHOLE
ELEM	ELEMENTARY
EMERG	EMERGENCY
EFFL	EFFLUENT
EQ	EQUAL
EQUIP	EQUIPMENT
ETM	ELAPSED TIME METER
FACP	FIRE ALARM CONTROL PANEL
FIN FL	FINISHED FLOOR
FLEX	FLEXIBLE
FLUOR	FLUORESCENT
FO	FIBER OPTIC
FREQ	FREQUENCY
FU	FUSE
FUT	FUTURE
FVNR	FULL VOLTAGE, NON REVERSING
FVR	FULL VOLTAGE, REVERSING
FWD	FORWARD
GA	GAUGE
GEN	GENERATOR
GFI	GROUND FAULT INTERRUPTER
GRS	GALVANIZED RIGID STEEL
H_2O_2	HYDROGEN PEROXIDE
HMI	HUMAN MACHINE INTERFACE
HOA	HAND-OFF-AUTOMATIC
HOR	HAND-OFF-REMOTE
HORZ	HORIZONTAL
HPS	HIGH PRESSURE SODIUM
HTR	HEATER
HV	HIGH VOLTAGE
HZ	HERTZ (CYCLES PER SECOND)
IND LT	INDICATING LIGHT
INCAND	INCANDESCENT
I/O	INPUT/OUTPUT
IGBT	INSULATED GATE BIPOLAR TRANSISTOR
JB	JUNCTION BOX
KA	KILOAMPERES
KCMIL	THOUSANDS OF CIRCULAR MILS
KV	KILOVOLTS
KVA	KILOVOLT AMPERES
KVAR	KILOVOLT AMPERES REACTIVE
KVARH	KILOVOLT AMPERES REACTIVE HOURS
KW	KILOWATTS
KWH	KILOWATT HOURS
LCP	LIGHTING CONTROL PANEL
LP	LIGHTING PANEL
LPS	LOW PRESSURE SODIUM
LTG	LIGHTING
LT(S)	LIGHT(S)
(M)	MODIFIED
Ma	MILLIAMPERES
MCC	MOTOR CONTROL CENTER
MCP	MOTOR CIRCUIT PROTECTOR
MOV	MOTOR OPERATED VALVE
MS	MOTOR STARTER
MTD	MOUNTED
MTG	MOUNTING
MTS	MANUAL TRANSFER SWITCH
(N)	NEW
NEC	NATIONAL ELECTRICAL CODE
NEMA	NATIONAL ELECTRICAL MANUFACTURER'S ASSOC.
NEUT	NEUTRAL
NO	NORMALLY OPEN, NUMBER
NTS	NOT TO SCALE
OVHD	OVERHEAD
OL	THERMAL OVERLOAD RELAY
OT	OVER TEMPERATURE
PB	PULLBOX, PUSHBUTTON
PD	POSITIVE DISPLACEMENT
PE	PHOTOELECTRIC
PEC	PHOTOELECTRIC CELL
PF	POWER FACTOR
pH	MEASURE OF ACIDITY OR ALKALINITY
PH	PHASE
PLC	PROGRAMMABLE LOGIC CONTROLLER
PM	POWER MONITOR
PNL	PANEL
PNLBD	PANELBOARD
PRI	PRIMARY
PS	PRESSURE SWITCH
PSI	POUNDS PER SQUARE INCH
PWR	POWER
(RL)	RELOCATE
(RLD)	RELOCATED
RCPT	RECEPTACLE
RCT	REPEAT CYCLE TIMER
RPM	REVOLUTIONS PER MINUTE
RT	RESET TIMER
SCR	SILICON CONTROLLED RECTIFIER
SD	SMOKE DETECTOR
SDBC	SOFT-DRAWN BARE COPPER
SEC	SECONDS, SECONDARY
SECT	SECTION
SF	SUPPLY FAN
SHH	SIGNAL HANDHOLE
SIG	SIGNAL
SN	SOLID NEUTRAL
SPEC	SPECIFICATIONS
SPD	SURGE PROTECTIVE DEVICE
SPDT	SINGLE POLE, DOUBLE THROW
SS	STAINLESS STEEL, SOLID
SW	STATE SWITCH
SWBD	SWITCHBOARD
SWGR	SWITCHGEAR
SYNC	SYNCHRONIZING TERMINAL
TB	BOX, TERMINAL BOARD
TC	TELEPHONE CABINET
TEMP	TEMPERATURE
TP	TWISTED PAIR UNSHIELDED
TSP	TWISTED SHIELDED PAIR
TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSOR
UH	UNIT HEATER
UV	ULTRA VIOLET
V	VOLTS
VA	VOLT-AMPERES
VFD	VARIABLE FREQUENCY DRIVE
VAR	VOLT AMPERES REACTIVE
VERT	VERTICAL
VH	VAR-HOUR
VS	VOLTMETER SWITCH
W	WIRE, WATTS
WHM	WATTHOUR METER
WHDM	WATTHOUR DEMAND METER
WP	WEATHERPROOF
WTRT	WATERTIGHT
WTP	WATER TREATMENT PLANT
XFMR	TRANSFORMER

ELECTRICAL PLAN SYMBOLS

- CONDUIT UP
- CONDUIT DOWN
- CONDUIT UP FROM UNDERGROUND RACEWAY
- CONDUIT STUB
- FLEXIBLE CONDUIT OR MFR CONDUIT
- SURFACE RACEWAY
- UNDERGROUND RACEWAY
- XXX — HOME RUN, ELECTRICAL PANEL DESTINATION SHOWN
- POWER POLE WITH GUY WIRE
- CONDUIT SEAL
- GFI — DUPLEX, QUADPLEX RECEPTACLE, W/DESIGNATOR GFI = GROUND FAULT INTERRUPTING WP = WEATHERPROOF +48 = HEIGHT AFF.
- SPECIAL EQUIPMENT CONNECTION AS SHOWN
- J — JUNCTION BOX
- HP — MOTOR CONNECTION, HORSEPOWER INDICATED
- 20A — DISCONNECT SWITCH, AMPERAGE RATING SHOWN
- F — FUSED DISCONNECT SWITCH
- $M — MOTOR RATED SWITCH
- METER BASE
- G — GENERATOR
- WIFI ACCESS POINT
- T — TRANSFORMER
- T — THERMOSTAT
- V — VAULT
- CONDUIT SEAL-OFF
- GROUND CONNECTION PER NEC ARTICLE 250

MISCELLANEOUS SYMBOLS

- HORN
- BATTERY
- DUPLEX RECEPTACLE
- SIMPLEX RECEPTACLE
- UPS — UPS CONNECTION
- DATAPORT WITH RECEPTACLE
- HEATER
- SCADA/YAGI ANTENNA
- IP CAMERA (PTZ OR OTHER)

ELECTRICAL SYMBOLS

- PANEL WIRING
- FIELD WIRING
- TWISTED SHIELDED PAIR
- SHIELD WIRING
- TWISTED SHIELDED TRIAD
- SHIELD WIRING
- CONNECTING LINES
- NON-CONNECTING LINES
- M — METERBASE W/UTILITY METER
- DISCONNECT RECEPTACLE AND PLUG
- HP — MOTOR CONNECTION, HORSEPOWER INDICATED
- 5A — FUSE, SIZE SHOWN
- THERMAL MAGNETIC CIRCUIT BREAKER
- 30AC 150AT — MAGNETIC ONLY CIRCUIT BREAKER (MOTOR CIRCUITS ONLY) CONTINUOUS CURRENT RATING AND TRIP SETTINGS SHOWN
- 2 123 1 2 — MOTOR STARTER, SIZE SHOWN
- XXA XXX — FUSED TERMINAL BLOCK FUSE SIZE SHOWN
- CONTROL PANEL TERMINAL BLOCK
- COMPONENT TERMINAL BLOCK
- VFD — VARIABLE FREQUENCY DRIVE (AFE DESIGNATES ACTIVE FRONT END)
- SSRV — SOFT START REDUCED VOLTAGE
- LINE OR LOAD REACTOR, IMPEDENCE SHOWN
- XFMR NAME KVA VOLTAGE(120V-240V-480V-4160V-12.247V) PHASE(1Ø/3Ø), 3W/4W Z%=XXX A FAULT= XXXA
- UNGROUNDED DELTA
- GROUNDED DELTA
- OPEN DELTA
- GROUNDED WYE
- PM — POWER MONITOR
- G — EMERGENCY STANDBY ENGINE GENERATOR, RATING AS INDICATED ON ONE-LINE DIAGRAM
- SPD — SURGE PROTECTIVE DEVICE
- PMR — PHASE MONITOR RELAY
- TDR — TIME DELAY RELAY
- PMR — PHASE MONITOR RELAY
- ALT — ALTERNATOR RELAY
- CR5 — 120V CONTROL RELAY, DPDT MINIMUM
- CR5 — 24VDC CONTROL RELAY, DPDT MINIMUM
- RELAY CONTACT - NO, NC
- PUSHBUTTON OR SWITCH CONTACT BLOCK - NO, NC
- OFF HAND AUTO — THREE POSITION SELECTOR SWITCH
- PUSH-TO-TEST LED PILOT LIGHT
- R — INDICATOR LIGHT W - WHITE A - AMBER R - RED G - GREEN
- FLOAT SWITCH - NO, NC
- TEMPERATURE SWITCH - NO, NC
- LIMIT SWITCH - NO, NC
- TIME DELAY CONTACTS, NORMALLY OPEN TIMED CLOSED NORMALLY CLOSED TIMED OPEN
- FLOW SWITCH - NO, NC
- PRESSURE SWITCH - NO, NC
- SPEED POTENTIOMETER
- ETM — ELAPSED TIME METER
- CNT — COUNTER
- TRANSFER SWITCH
- SOLENOID VALVE
- CURRENT TRANSFORMER
- 30A — DISCONNECT SWITCH, AMPERAGE RATING SHOWN
- FUSED DISCONNECT
- XXX — TEST POINT TERMINAL
- SINGLE POINT GROUND
- EOL - END OF LINE RESISTOR
- ISB — INTRINSICALLY SAFE BARRIER
- ISR — INTRINSICALLY SAFE RELAY
- ETM — ELAPSED TIME METER

NOTE: NOT ALL SYMBOLS OR ABBREVIATIONS USED.

GROUNDING PLAN SYMBOLS

- GROUND ROD
- GROUND TEST WELL
- GROUND CONNECTION TO EQUIPMENT DETAIL CALLOUT SHOWN ON PLAN DWG.
- GROUND CONNECTION, DETAIL CALLOUT SHOWN ON PLAN DWG.
- GROUND CONNECTION TO REBAR, DETAIL CALLOUT SHOWN ON PLAN DWG.
- BELOW GRADE #4/0 AWG BARE COPPER FOR MAIN PLANT GROUND
- BELOW GRADE #2/0 AWG INSULATED COPPER FOR GROUND TAP.
- ABOVE GRADE #2/0 AWG INSULATED GROUND TAP

LIGHTING PLAN SYMBOLS

- FLOOD LIGHT
- $ $ 3 — WALL SWITCH STANDARD TOGGLE, DESIGNATOR
  2=DOUBLE POLE, 3 = 3-WAY, D = DIMMER, T = TIMER, LV=LOW VOLTAGE, 4=FOUR WAY, K=KEY OPERATED, WP=WEATHER PROOF, TH=THERMAL SWITCH
- SURFACE MOUNTED LED LUMINAIRE *
- RECESSED MOUNTED LED LUMINAIRE *
- WALL MOUNTED LED LUMINAIRE *
  * SHADED LUMINAIRE INDICATES BATTERY BACKED UNIT
- EXIT SIGN - WALL MOUNTED
- EXIT SIGN - 2 SIDED CEILING MOUNTED
- P — PHOTOCELL
- M — MOTION SENSOR
- FLOOD LIGHT
- STANCHION FIXTURE - POLE MOUNT
- STANCHION FIXTURE - WALL MOUNT

GENERAL SYMBOLS

- NEW ELECTRICAL EQUIPMENT
- EXISTING ELECTRICAL EQUIPMENT
- EQUIPMENT TO BE DEMO'D OR REMOVED
- 1 — DRAWING NOTE
- P1 — ELECTRICAL CIRCUIT IDENTIFICATION
- P1 P2 C1 C2 — MULTIPLE ELECTRICAL CIRCUITS, SEPARATE CONDUITS
- 1"C P1 P2 P3 P4 — MULTIPLE ELECTRICAL CIRCUITS, COMMON CONDUIT (SIZE SHOWN)
- X XX TITLE SCALE

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OR CCB #196597 WA #INDUSSI880K9
AK #1018436
PROJECT#: 23.65.02

MICHAEL EZRA NATIVIDAD — STATE OF WASHINGTON — 57964 — REGISTERED PROFESSIONAL ENGINEER — 7/29/25

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REV: MEW

ONE INCH AT FULL SCALE. IF NOT ONE INCH ADJUST SCALE ACCORDINGLY (0 — 1")

ELECTRICAL LEGEND, SYMBOLS AND ABBREVIATIONS

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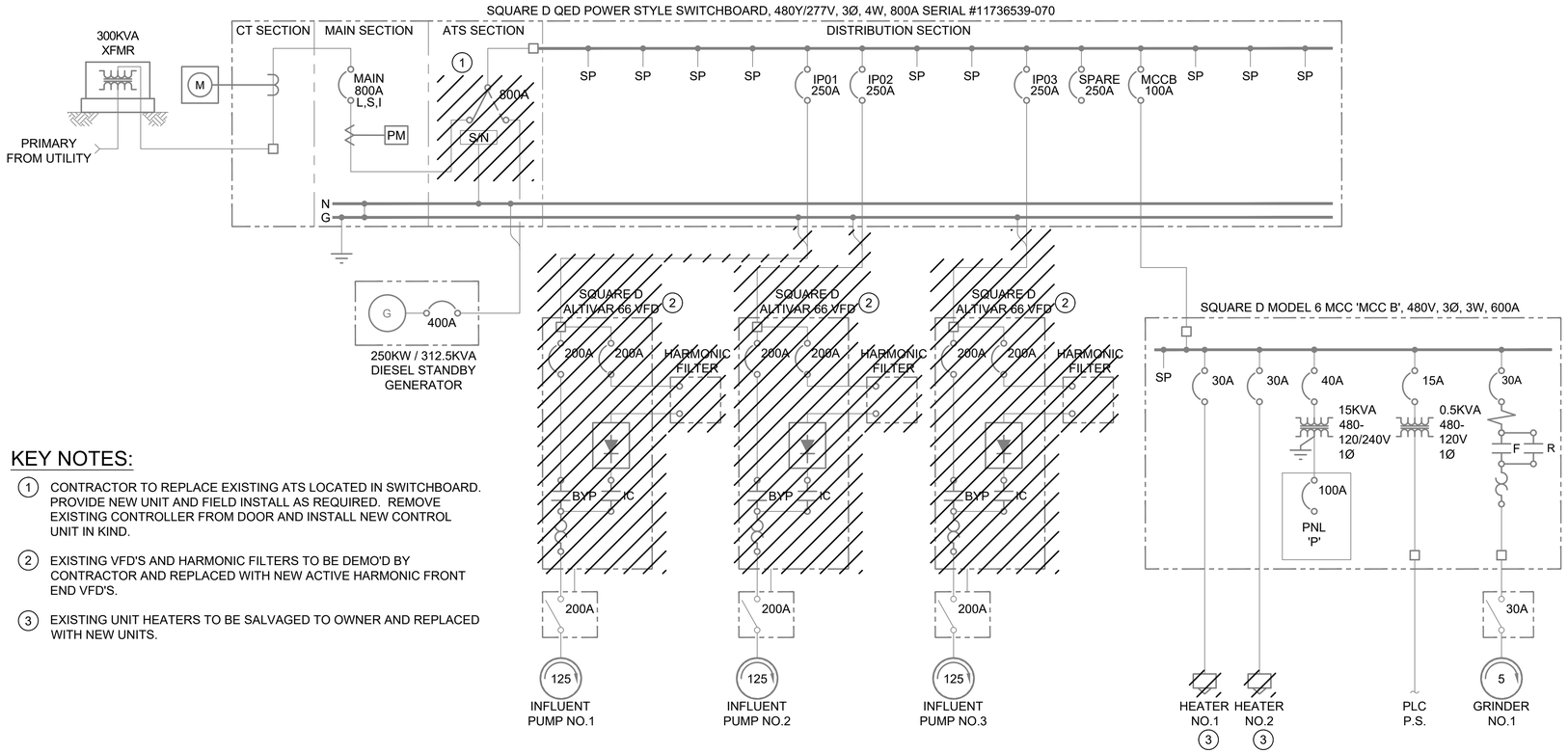
DATE: 07/2025
PROJECT NO: WW02

City of Camas WASHINGTON

MAIN PUMP STATION IMPROVEMENTS

DRAWING NO: E1

16 OF 29



1 EXISTING ONE-LINE DIAGRAM - DEMO
SCALE: NONE

KEY NOTES:

1. CONTRACTOR TO REPLACE EXISTING ATS LOCATED IN SWITCHBOARD. PROVIDE NEW UNIT AND FIELD INSTALL AS REQUIRED. REMOVE EXISTING CONTROLLER FROM DOOR AND INSTALL NEW CONTROL UNIT IN KIND.
2. EXISTING VFD'S AND HARMONIC FILTERS TO BE DEMO'D BY CONTRACTOR AND REPLACED WITH NEW ACTIVE HARMONIC FRONT END VFD'S.
3. EXISTING UNIT HEATERS TO BE SALVAGED TO OWNER AND REPLACED WITH NEW UNITS.

2 EXISTING SWITCHBOARD ELEVATION
SCALE: NONE

CONTROLLER (BACK OF DOOR)

SWITCH (INTERIOR)

3 EXISTING ATS TO BE REPLACED 1
SCALE: NONE

4 EXISTING HARMONIC FILTERS
SCALE: NONE

MICHAEL EZRA NATIVIDAD
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57964
REGISTERED PROFESSIONAL ENGINEER
7/29/25

NO.	REVISION	BY	DATE

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REV: MEW

ONE INCH
0 1"
ONE INCH AT FULL SCALE.
IF NOT ONE INCH ADJUST SCALE ACCORDINGLY

ELECTRICAL EXISTING ONE-LINE DIAGRAM - DEMO

wallis engineering

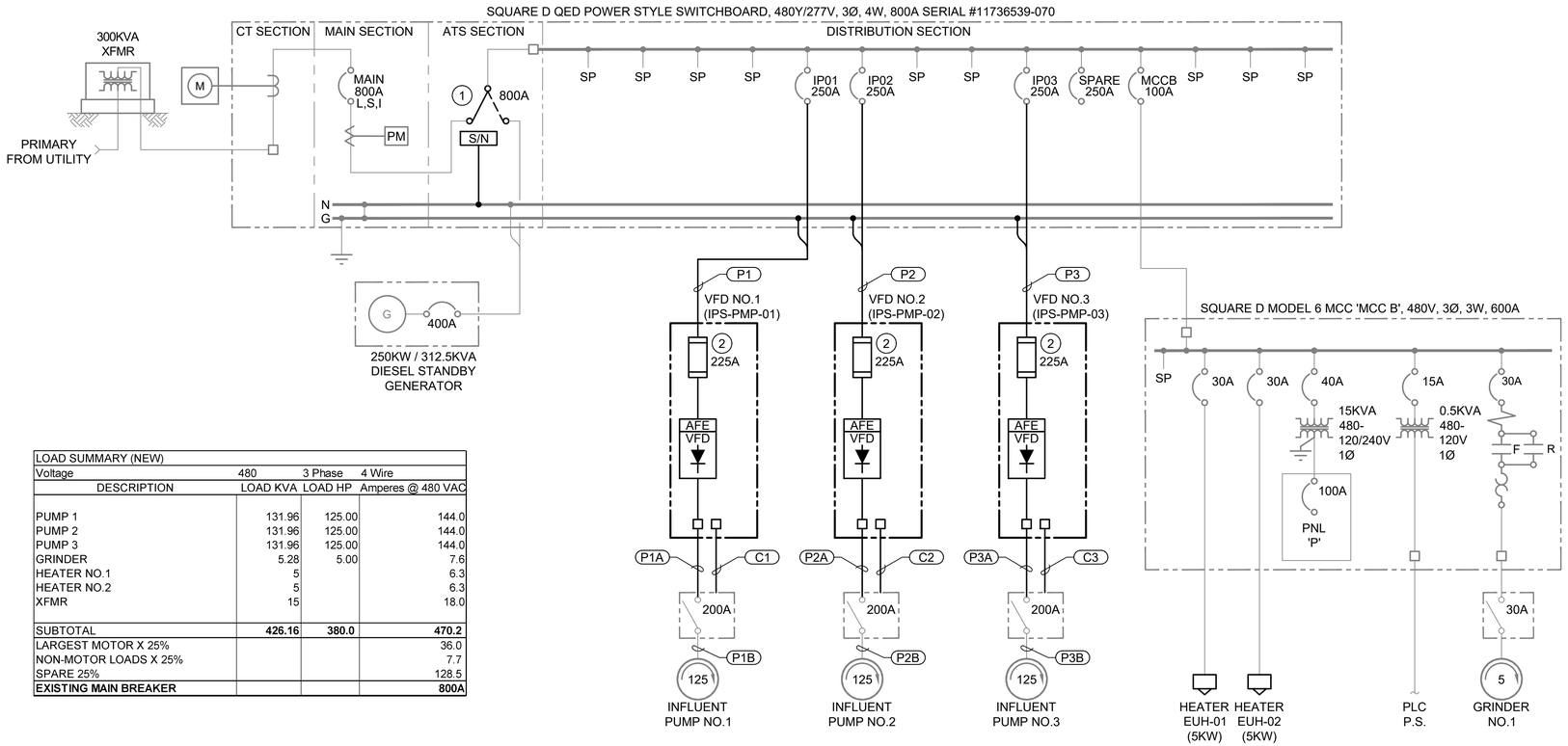
PROJECT NO: WW02
DATE: 07/2025

City of Camas WASHINGTON

MAIN PUMP STATION IMPROVEMENTS

Industrial Systems INC
12119 NE 99th Street
Suite #2090
Vancouver, Washington 98682
Phone: (360) 718-7267
Fax: (360) 952-8958
e-mail: is@is-inc.com
OR CCB #196597 WA #INDUSSI880K9
AK #1018436
PROJECT# 23.65.02

DRAWING NO:
E2



LOAD SUMMARY (NEW)			
Voltage	480	3 Phase	4 Wire
DESCRIPTION	LOAD KVA	LOAD HP	Amperes @ 480 VAC
PUMP 1	131.96	125.00	144.0
PUMP 2	131.96	125.00	144.0
PUMP 3	131.96	125.00	144.0
GRINDER	5.28	5.00	7.6
HEATER NO.1	5		6.3
HEATER NO.2	5		6.3
XFMR	15		18.0
SUBTOTAL	**426.16**	**380.0**	**470.2**
LARGEST MOTOR X 25%			36.0
NON-MOTOR LOADS X 25%			7.7
SPARE 25%			128.5
EXISTING MAIN BREAKER			**800A**

1 EXISTING ONE-LINE DIAGRAM - MODIFIED
SCALE: NONE

KEY NOTES:

1. NEW 800A, 3-POLE, SOLID NEUTRAL AUTOMATIC TRANSFER SWITCH WITH CONTROLLER MOUNTED IN EXISTING DOOR OF SWITCHGEAR.
2. FUSING FOR SCR PROTECTION, IF REQUIRED BY MANUFACTURER. SIZE PER MANUFACTURER'S RECOMMENDATIONS.

MICHAEL EZRA NATIVIDAD — STATE OF WASHINGTON — 57964 — REGISTERED PROFESSIONAL ENGINEER — 7/29/25

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ELECTRICAL EXISTING ONE-LINE DIAGRAM - MODIFIED

wallis engineering

PROJECT NO: WW02
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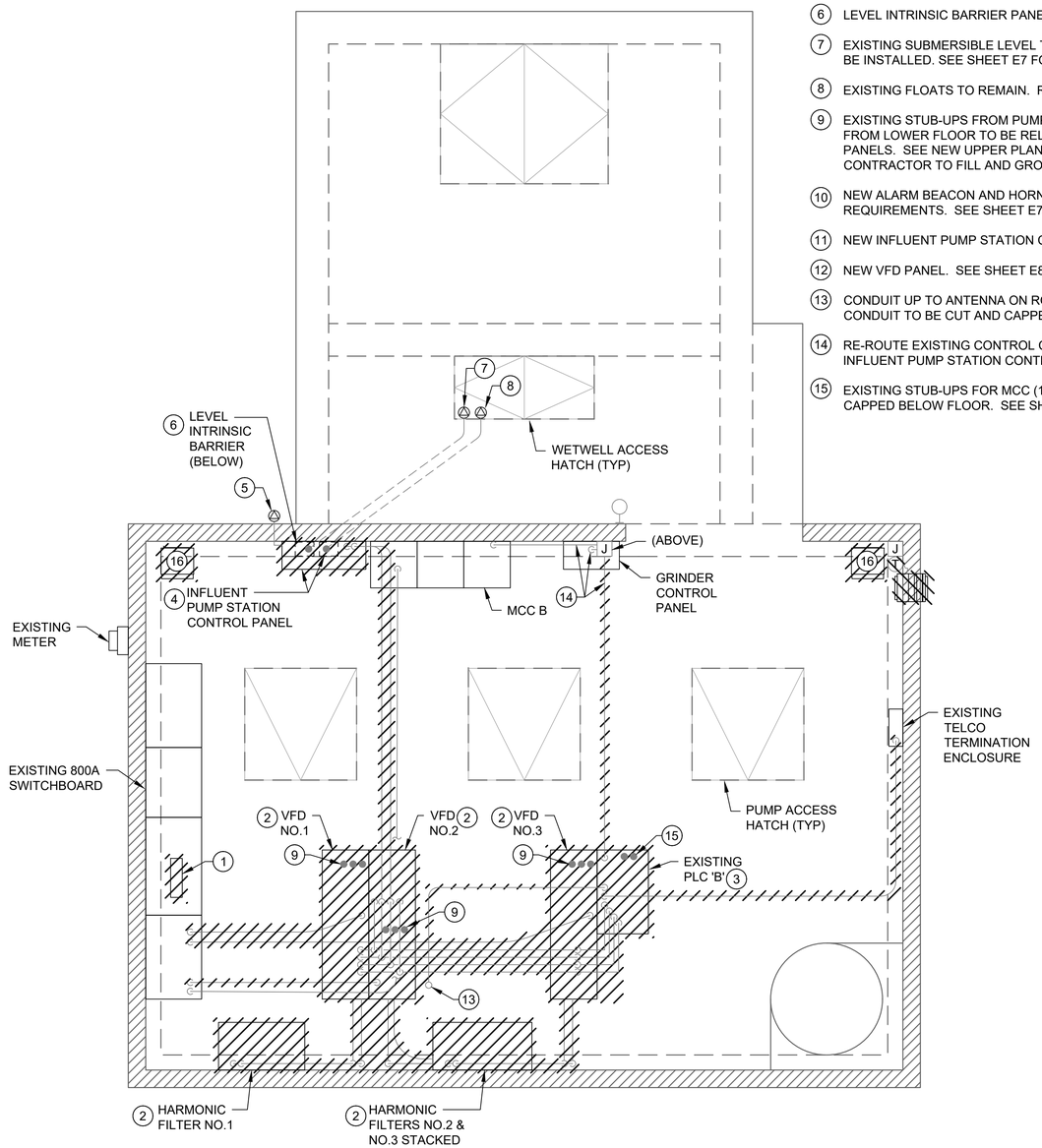
DRAWING NO: E3

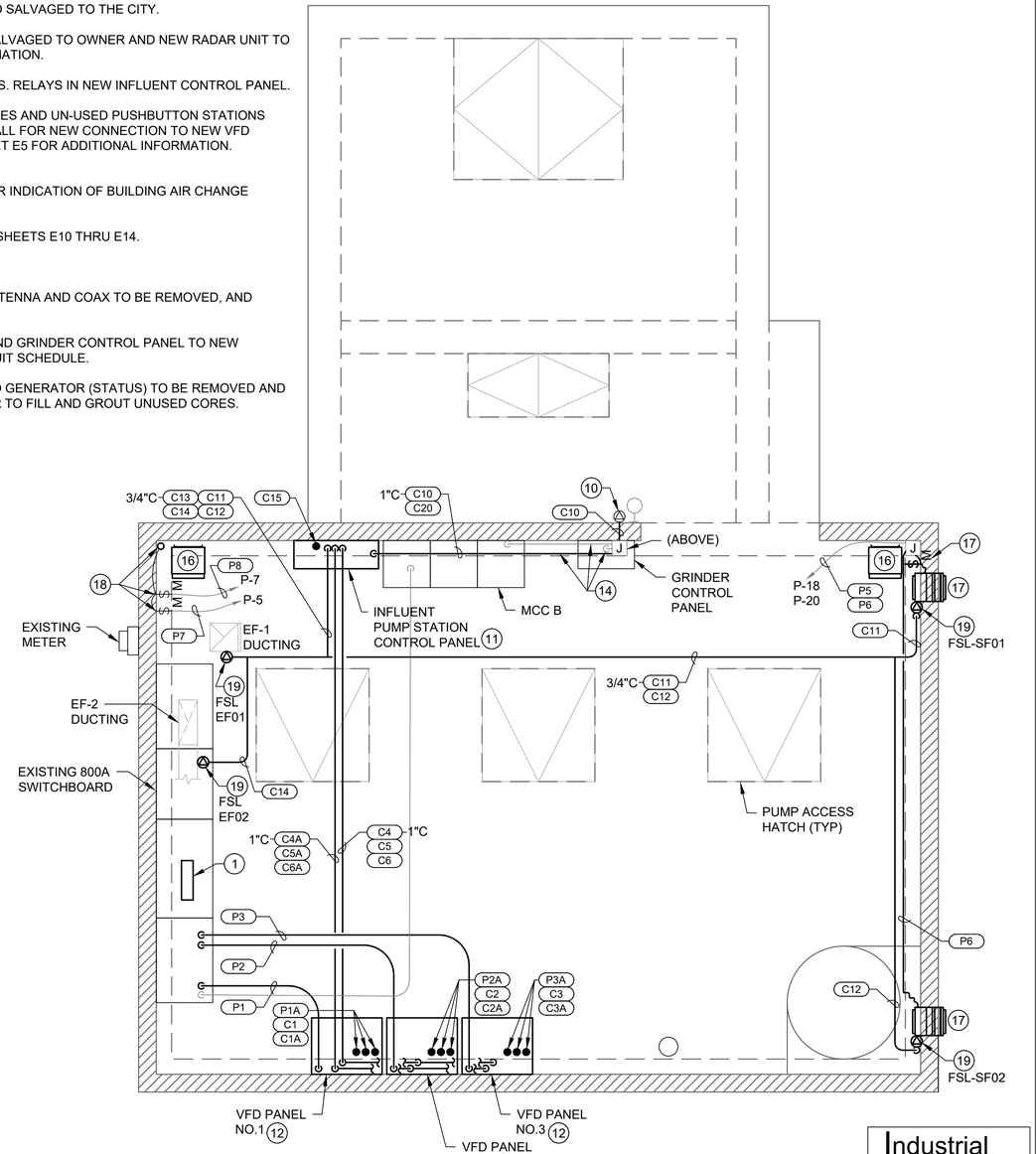
2 0 2 4 6
SCALE IN FEET

KEY NOTES:

1. CONTRACTOR TO REPLACE EXISTING ATS LOCATED IN SWITCHBOARD. SEE SHEET E1 FOR ADDITIONAL INFORMATION.
2. EXISTING VFD'S, HARMONIC FILTERS AND ASSOCIATED CONDUITS AND CONDUCTORS TO BE DEMO'D. SEE SHEET E1 FOR ADDITIONAL INFORMATION.
3. EXISTING PLC 'B' TO BE DEMO'D. COORDINATE SALVAGE OF INTERIOR EQUIPMENT WITH CITY PERSONNEL AND CONTRACTOR TO DISPOSE OF REMAINING EQUIPMENT.
4. EXISTING INFLUENT CONTROL PANEL AND LEVEL XDCR INTRISIC SAFE J-BOXT O BE SALVAGED TO OWNER. CONTRACTOR TO COORDINATE REMOVAL OF MISSION MYDRO CELLULAR TELEMETRY PANEL AND EQUIPMENT INTERIOR TO PANEL FOR RE-INSTALLATION IN NEW INFLUENT CONTROL PANEL. NOTE INTRINSICALLY SAFE CIRCUITS, FOR FLOATS, INTERIOR TO PANEL TO BE RE-CONNECTED TO NEW INFLUENT CONTROL PANEL.
5. EXISTING MISSION MYDRO CELL ANTENNA TO BE RE-CONNECTED TO NEW INFLUENT CONTROL PANEL.
6. LEVEL INTRINSIC BARRIER PANEL TO BE REMOVED AND SALVAGED TO THE CITY.
7. EXISTING SUBMERSIBLE LEVEL TRANSDUCER TO BE SALVAGED TO OWNER AND NEW RADAR UNIT TO BE INSTALLED. SEE SHEET E7 FOR ADDITIONAL INFORMATION.
8. EXISTING FLOATS TO REMAIN. RE-CONNECT TO NEW I.S. RELAYS IN NEW INFLUENT CONTROL PANEL.
9. EXISTING STUB-UPS FROM PUMP DISCONNECT SWITCHES AND UN-USED PUSHBUTTON STATIONS FROM LOWER FLOOR TO BE RELOCATED TO SOUTH WALL FOR NEW CONNECTION TO NEW VFD PANELS. SEE NEW UPPER PLAN THIS SHEET AND SHEET E5 FOR ADDITIONAL INFORMATION. CONTRACTOR TO FILL AND GROUT UNUSED CORES.
10. NEW ALARM BEACON AND HORN (GO/NO-GO) LIGHT FOR INDICATION OF BUILDING AIR CHANGE REQUIREMENTS. SEE SHEET E7.
11. NEW INFLUENT PUMP STATION CONTROL PANEL. SEE SHEETS E10 THRU E14.
12. NEW VFD PANEL. SEE SHEET E8 THRU E9.
13. CONDUIT UP TO ANTENNA ON ROOF (NOT SHOWN). ANTENNA AND COAX TO BE REMOVED, AND CONDUIT TO BE CUT AND CAPPED BELOW CEILING.
14. RE-ROUTE EXISTING CONTROL CIRCUITS FROM MCC AND GRINDER CONTROL PANEL TO NEW INFLUENT PUMP STATION CONTROL PANEL. SEE CIRCUIT SCHEDULE.
15. EXISTING STUB-UPS FOR MCC (120V POWER CKTS) AND GENERATOR (STATUS) TO BE REMOVED AND CAPPED BELOW FLOOR. SEE SHEET E5. CONTRACTOR TO FILL AND GROUT UNUSED CORES.
16. EXISTING HEATERS TO BE REPLACED WITH NEW. RECONNECT TO EXISTING CIRCUIT.
17. EXISTING SUPPLY FAN TO BE REPLACED WITH NEW. REMOVE EXISTING THERMOSTAT AND REPLACE WITH MOTOR RATED SWITCHES FOR SF-01 AND SF-02. SEE DETAIL SHEET E7.
18. EXISTING EF-01 AND EF-02 ON ROOF (NOT SHOWN) TO BE REPLACED. RE-USE EXISTING CONDUIT AND ADJUST AS REQUIRED FOR FINAL CONNECTION AT NEW EQUIPMENT. INSTALL NEW CONDUCTORS FROM EXISTING SWITCHES IF UNABLE TO REACH FINAL TERMINATION WITHOUT SPLICING. SEE HVAC DRAWINGS FOR ADDITIONAL INFORMATION.
19. AIR FLOW SWITCHES FOR CONFIRMATION OF SUPPLY AND EXHAUST AIR FLOW TO MEET NFPA 820 REQUIREMENTS FOR AREA DECLASSIFICATION.



UPPER PLAN - DEMO
SCALE: 3/8" = 1'-0"



UPPER PLAN - NEW
SCALE: 3/8" = 1'-0"

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MICHAEL EZRA NATIVIDAD STATE OF WASHINGTON 57964 REGISTERED PROFESSIONAL ENGINEER 7/29/25

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ELECTRICAL UPPER SITE PLANS

wallis engineering

PROJECT NO: WW02
DATE: 07/2025

City of Camas WASHINGTON

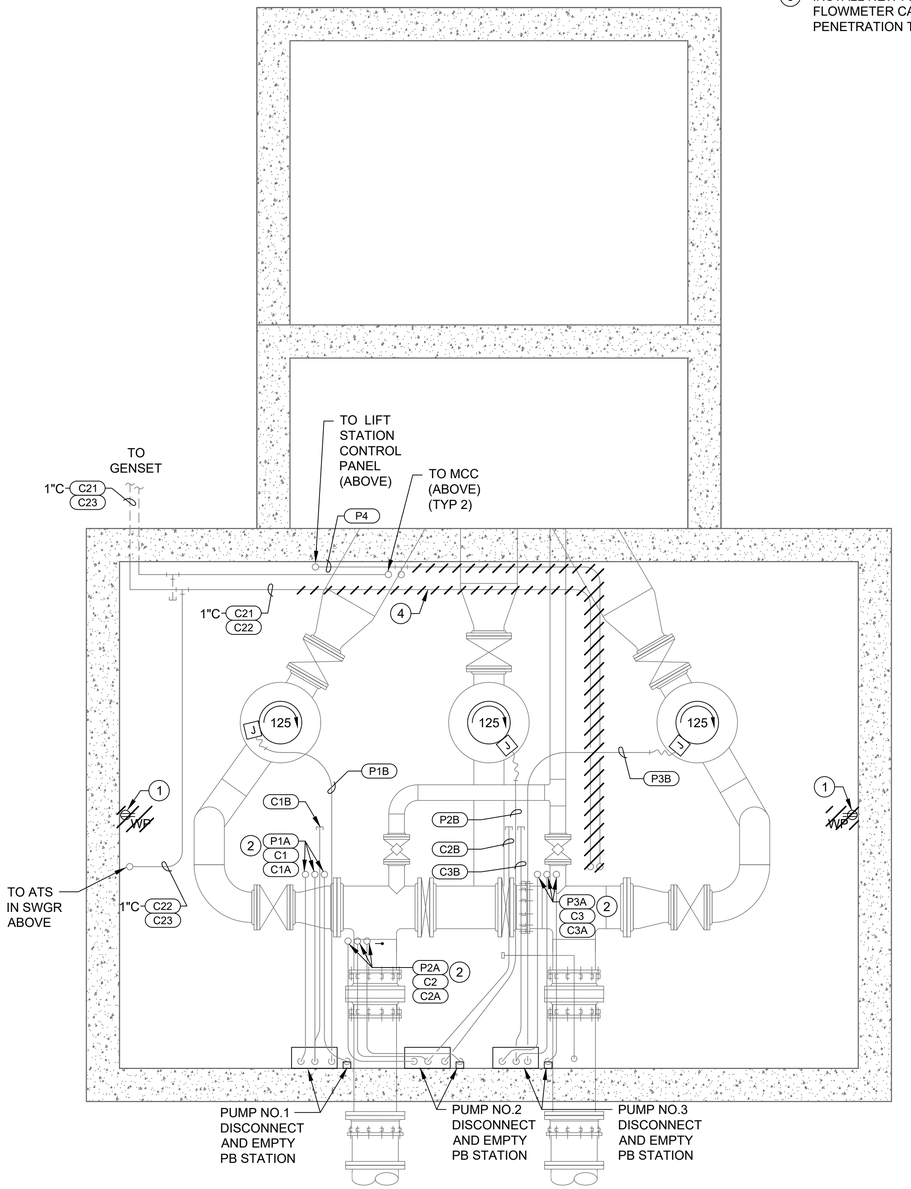
MAIN PUMP STATION IMPROVEMENTS

DRAWING NO:
E4

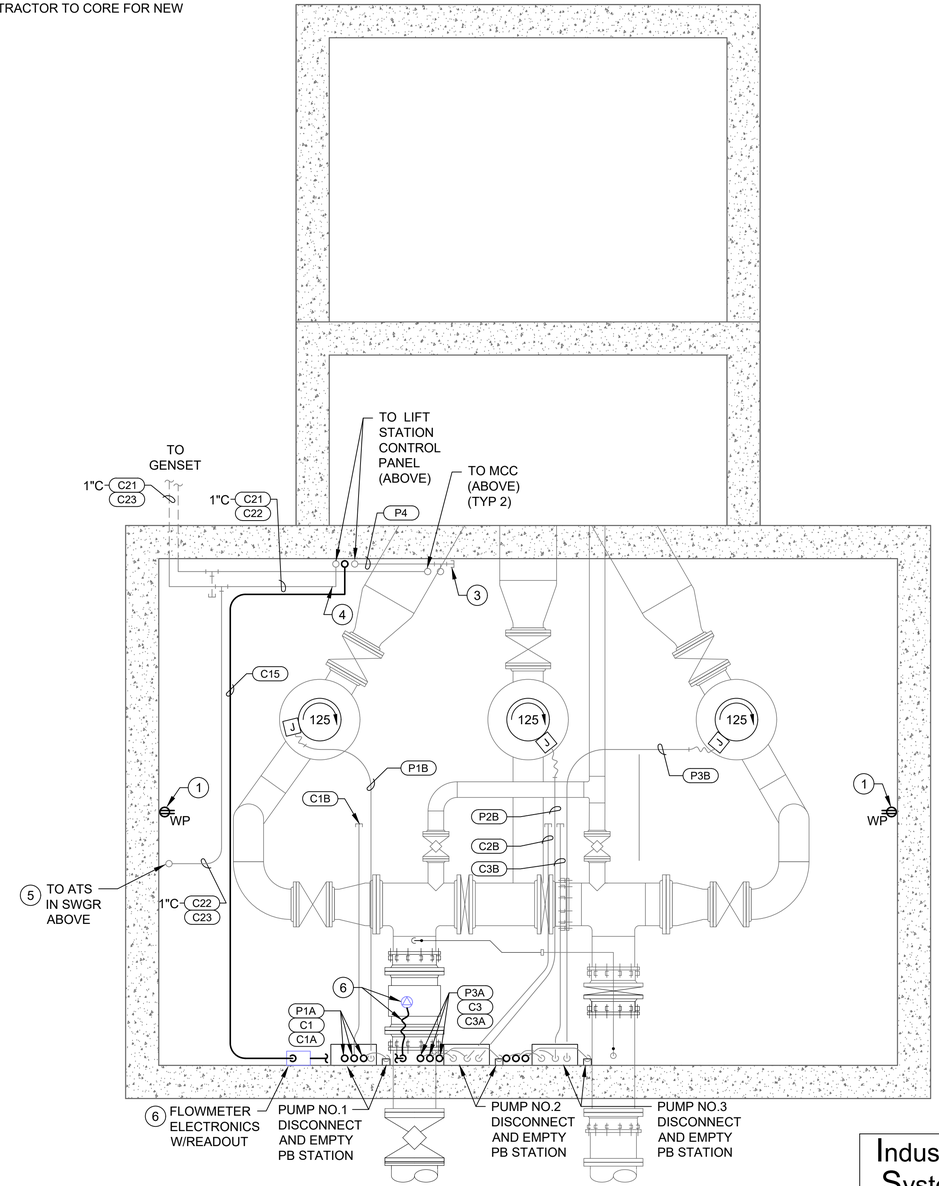
KEY NOTES:

1. EXISTING RECEPTACLES AND COVERS TO BE REPLACED. PROVIDE NEW GFCI RECEPTACLE WITH IN-USE RATED COVER.
2. EXISTING CONDUITS FROM PUMP DISCONNECT SWITCHES AND UN-USED PUSHBUTTON STATIONS TO UPPER FLOOR TO BE RELOCATED TO SOUTH WALL FOR NEW CONNECTION TO NEW VFD PANELS. SEE NEW LOWER PLAN THIS SHEET AND SHEET E4 FOR ADDITIONAL INFORMATION. CONTRACTOR TO CORE FOR NEW PENETRATIONS AS REQUIRED.
3. REMOVE EXISTING 120V CIRCUITS (4 TOTAL) FROM EXISTING 1" CONDUIT AND CAP BELOW CEILING.
4. INTERCEPT EXISTING 1" GENERATOR STATUS CIRCUIT CONDUIT AND RE-ROUTE TO NEW LIFT STATION CONTROL PANEL ABOVE ON UPPER FLOOR. CONTRACTOR TO CORE FOR NEW PENETRATION AS REQUIRED.
5. CONNECT GENERATOR START SIGNAL TO NEW ATS IN SWITCHGEAR ON UPPER FLOOR,
6. INSTALL NEW FLOWMETER ELECTRONICS APPROXIMATELY 5' ABOVE GRADE. ROUTE MFR FLOWMETER CABLES TO FLOWTUBE AS REQUIRED. CONTRACTOR TO CORE FOR NEW PENETRATION TO LIFT STATION CONTROL PANEL.

2 0 2 4 6
SCALE IN FEET



LOWER PLAN - DEMO
SCALE: 3/8" = 1'-0"



LOWER PLAN - NEW
SCALE: 3/8" = 1'-0"

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MICHAEL EZRA WALLIS
STATE OF WASHINGTON
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PROFESSIONAL ENGINEER
7/29/25

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ELECTRICAL
LOWER SITE PLANS

wallis engineering

PROJECT NO: WW02
DATE: 07/2025

City of Camas WASHINGTON

MAIN PUMP STATION
IMPROVEMENTS

DRAWING NO:
E5
20 OF 29

ALL CIRCUITS ARE IDENTIFIED ON THE PLANS WITH THE ELLIPSE SYMBOL. CONDUCTOR SIZES ARE BASED ON COPPER CONDUCTORS. CONDUIT SIZES ARE SHOWN FOR CASES WHEN CIRCUIT CONDUCTORS ARE RUN WITHOUT OTHER CIRCUITS. MULTIPLE CIRCUITS RUN IN COMMON CONDUITS ARE SHOWN ON PLANS AND SUPERSEDE THE BASIC CONDUIT SIZE SHOWN.

RACEWAY SIZES ARE IN INCHES WITH QUANTITIES IN EXCESS OF (1) SHOWN IN ADJACENT PARENTHESIS. CONDUCTOR CONFIGURATIONS ARE CODED AS FOLLOWS: P- FOR POWER CONDUCTORS, G - FOR GROUND CONDUCTORS, N - FOR NEUTRAL CONDUCTORS, C - FOR CONTROL CONDUCTORS, TSP - FOR TWISTED SHIELDED PAIR TST - TWISTED SHIELDED TRIAD AND SP - FOR SPARE CONDUCTORS.

CIRCUITS REVISED SINCE LAST ISSUE ARE INDICATED BY AN ASTERISK(*).

CIRCUIT NUMBER	FROM	TO	CONDUCTORS	RACEWAY	NOTES
P1	EXISTING SWITCHGEAR	VFD PANEL NO.1	(3) 250 KMCIL, P (1) 4 AWG, G	2	VFD NO.1 POWER
P1A	VFD PANEL NO.1	PUMP NO.1 DISCONNECT	(3) 3/0 AWG, P (1) 4 AWG, G	2	PUMP NO.1 POWER, INTERCEPT AND RE-ROUTE EXIST CONDUIT. NEW CONDUCTORS.
P1B	PUMP NO.1 DISCONNECT	PUMP NO.1	(3) 3/0 AWG, P (1) 4 AWG, G (2) 14 AWG, C	EXIST 2	PUMP NO.1 POWER, EXIST CONDUIT AND CONDUCTORS TO REMAIN. MOTOR THERMAL CIRCUIT
P2	EXISTING SWITCHGEAR	VFD PANEL NO.2	(3) 250KCMIL, P (1) 4 AWG, G	2	VFD NO.2 POWER
P2A	VFD PANEL NO.2	PUMP NO.2 DISCONNECT	(3) 3/0 AWG, P (1) 4 AWG, G	EXIST 2	PUMP NO.2 POWER, INTERCEPT AND RE-ROUTE EXIST CONDUIT. NEW CONDUCTORS.
P2B	PUMP NO.2 DISCONNECT	PUMP NO.2	(3) 3/0 AWG, P (1) 4 AWG, G (2) 14 AWG, C	EXIST 2	PUMP NO.2 POWER, EXIST CONDUIT AND CONDUCTORS TO REMAIN. MOTOR THERMAL CIRCUIT
P3	EXISTING SWITCHGEAR	VFD PANEL NO.3	(3) 250KCMIL, P (1) 4 AWG, G	2	VFD NO.3 POWER
P3A	VFD PANEL NO.3	PUMP NO.3 DISCONNECT	(3) 3/0 AWG, P (1) 4 AWG, G	EXIST 2	PUMP NO.3 POWER, INTERCEPT AND RE-ROUTE EXIST CONDUIT. NEW CONDUCTORS.
P3B	PUMP NO.3 DISCONNECT	PUMP NO.3	(3) 3/0 AWG, P (1) 4 AWG, G (2) 14 AWG, C	EXIST 2	PUMP NO.3 POWER, EXIST CONDUIT AND CONDUCTORS TO REMAIN. MOTOR THERMAL CIRCUIT
P4	EXISTING MCC PANEL "P"	LIFT STATION CONTROL PANEL	(1) 12 AWG, P (1) 12 AWG, N (1) 12 AWG, G	EXIST 1	RE-USE EXISTING CONDUIT AND PROVIDE NEW CONDUCTORS IF NEEDED.
P5	EXISTING MCC PANEL "P"	SUPPLY FAN SF-01	(1) 12 AWG, P (1) 12 AWG, N (1) 12 AWG, G	EXIST 1	RE-USE EXISTING CONDUIT AND CONDUCTORS VIA SWITCH.
P6	EXISTING MCC PANEL "P"	SUPPLY FAN SF-02	(1) 12 AWG, P (1) 12 AWG, N (1) 12 AWG, G	1	PARTIALLY ROUTE IN EXISTING CONDUIT FOR SF-01
P7	EXISTING MCC PANEL "P"	EXHAUST FAN EF-01	(1) 12 AWG, P (1) 12 AWG, N (1) 12 AWG, G	EXIST 1	RE-USE EXISTING CONDUIT AND CONDUCTORS.
P8	EXISTING MCC PANEL "P"	EXHAUST FAN EF-02	(1) 12 AWG, P (1) 12 AWG, N (1) 12 AWG, G	EXIST 1	RE-USE EXISTING CONDUIT AND CONDUCTORS.
C1	VFD PANEL NO.1	PUMP NO.1 DISCONNECT	(4) 14 AWG, C (1) 14 AWG, G	EXIST 3/4	DISC SWITCH AUX & PUMP OT CKT INTERCEPT AND RE-ROUTE EXIST CONDUIT AND CONDUCTORS.
C1A	VFD PANEL NO.1	PUMP NO.1 PUSHBUTTON STATION	PULL CORD	EXIST 1	INTERCEPT AND RE-ROUTE EXIST CONDUIT.
C1B	PUMP NO.1 DISCONNECT	PUMP NO.1 PUSHBUTTON STATION	PULL CORD	EXIST 3/4	CAPPED EMPTY CONDUIT
C2	VFD PANEL NO.2	PUMP NO.2 DISCONNECT	(4) 14 AWG, C (1) 14 AWG, G	EXIST 3/4	DISC SWITCH AUX & PUMP OT CKT INTERCEPT AND RE-ROUTE EXIST CONDUIT AND CONDUCTORS.
C2A	VFD PANEL NO.2	PUMP NO.2 PUSHBUTTON STATION	PULL CORD	EXIST 1	INTERCEPT AND RE-ROUTE EXIST CONDUIT.
C2B	PUMP NO.2 DISCONNECT	PUMP NO.2 PUSHBUTTON STATION	PULL CORD	EXIST 3/4	CAPPED EMPTY CONDUIT
C3	VFD PANEL NO.3	PUMP NO.3 DISCONNECT	(4) 14 AWG, C (1) 14 AWG, G	EXIST 3/4	DISC SWITCH AUX & PUMP OT CKT INTERCEPT AND RE-ROUTE EXIST CONDUIT AND CONDUCTORS.
C3A	VFD PANEL NO.3	PUMP NO.3 PUSHBUTTON STATION	PULL CORD	EXIST 1	INTERCEPT AND RE-ROUTE EXIST CONDUIT.
C3B	PUMP NO.3 DISCONNECT	PUMP NO.3 PUSHBUTTON STATION	PULL CORD	EXIST 3/4	CAPPED EMPTY CONDUIT
C4	VFD PANEL NO.1	LIFT STATION CONTROL PANEL	(9) 14 AWG, C (1) 14 AWG, G	3/4	CTRL & STATUS
C4A	VFD PANEL NO.1	LIFT STATION CONTROL PANEL	(1) CAT 6	3/4	COMMS FOR VFD CTRL/STATUS
C5	VFD PANEL NO.2	LIFT STATION CONTROL PANEL	(9) 14 AWG, C (1) 14 AWG, G	3/4	CTRL & STATUS
C5A	VFD PANEL NO.2	LIFT STATION CONTROL PANEL	(1) CAT 6	3/4	COMMS FOR VFD CTRL/STATUS
C6	VFD PANEL NO.3	LIFT STATION CONTROL PANEL	(9) 14 AWG, C (1) 14 AWG, G	3/4	CTRL & STATUS
C6A	VFD PANEL NO.3	LIFT STATION CONTROL PANEL	(1) CAT 6	3/4	COMMS FOR VFD CTRL/STATUS

1 - CIRCUIT SCHEDULE
SCALE: NONE

CIRCUIT NUMBER	FROM	TO	CONDUCTORS	RACEWAY	NOTES
C7-C9	NOT USED				
C10	GO/NO-GO BEACON	LIFT STATION CONTROL PANEL	(3) 14 AWG, C (1) 14 AWG, G	3/4	ROUTE VIA EXIST J-BOX
C11	SF-01 FLOW SWITCH FS-SF01	LIFT STATION CONTROL PANEL	(1) 14 AWG, P (1) 14 AWG, N (2) 14 AWG, C (1) 14 AWG, G	3/4	120V PWR STATUS CONTACT
C12	SF-02 FLOW SWITCH FS-SF02	LIFT STATION CONTROL PANEL	(1) 14 AWG, P (1) 14 AWG, N (2) 14 AWG, C (1) 14 AWG, G	3/4	120V PWR STATUS CONTACT
C13	EF-01 FLOW SWITCH FS-EF01	LIFT STATION CONTROL PANEL	(1) 14 AWG, P (1) 14 AWG, N (2) 14 AWG, C (1) 14 AWG, G	3/4	120V PWR STATUS CONTACT
C14	EF-02 FLOW SWITCH FS-EF02	LIFT STATION CONTROL PANEL	(1) 14 AWG, P (1) 14 AWG, N (2) 14 AWG, C (1) 14 AWG, G	3/4	120V PWR STATUS CONTACT
C15	FLOWMETER ELECTRONICS	LIFT STATION CONTROL PANEL	(2) 14 AWG, C (1) 18 AWG, TSP (2) 14 AWG, C (1) 14 AWG, G	3/4	24VDC PWR STATUS CONTACT PULSE SIGNAL
C20	EXISTING MCC GRINDER BUCKET	LIFT STATION CONTROL PANEL	(4) 14 AWG, C (1) 14 AWG, G	3/4	RUN FWD/RUN RVS/OVRLD STATUS INTERCEPT EXIST CKTS AT J-BOX AND RE-ROUTE
C21	EXISTING GENERATOR	LIFT STATION CONTROL PANEL	(4) 14 AWG, C (1) 14 AWG, G	EXIST 1	RUN/ALARM STATUS INTERCEPT AND RE-ROUTE EXIST CONDUIT AND CONDUCTORS.
C22	EXISTING ATS	LIFT STATION CONTROL PANEL	(6) 14 AWG, C (1) 14 AWG, G	EXIST 1	ATS POS/UTIL & GEN PWR STATUS INTERCEPT AND RE-ROUTE EXIST CONDUIT AND CONDUCTORS.
C23	EXISTING ATS	EXISTING GENERATOR	(2) 14 AWG, C (1) 14 AWG, G	EXIST 1	GEN START SIGNAL

6

PANEL: P (EXISTING) BUS: 100A VOLTAGE: 120/240V, 1PH, 3 WIRE

FEEDER: SEE POWER RISER MAIN BRKR: 100A MOUNTING: MCC BUCKET INTERIOR

CKT NO.	CIRCUIT DESCRIPTION	CKT BREAKER POLES/AMPS	Type	LOAD Volt-Amps	PHASE	LOAD Volt-Amps	Type	CKT BREAKER POLES/AMPS	CIRCUIT DESCRIPTION	CKT NO.
1	OUTSIDE LIGHTING (EXIST)	1-20		200	A	640		1-20	PUMP ROOM LIGHTING (EXIST)	2
3	MAIN FLOOR LIGHTING (EXIST)	1-20		672	B	300		1-20	WET WELL LIGHTING (EXIST)	4
5	EXHAUST FAN EF-01 (1/2 HP) **NEW**	1-20		1176	A	1176		1-20	SUMP PUMP (EXIST)	6
7	EXHAUST FAN EF-02 (1/6HP) **NEW**	1-20		528	B	360		1-20	PUMP ROOM RECEPTS (EXIST)	8
9	MAIN FLOOR RECEPTS (EXIST)	1-20		540	A	540		1-20	GENERATOR BATTERY CHGR (EXIST)	10
11	EMERGENCY LIGHT RECEPT (EXIST)	1-20		180	B	2500		1-30	BLOCK HEATER (EXIST)	12
13	INSTA-HOT (EXIST)	1-30		1500	B	0		1-20	SPARE IN PLC CABINET (EXIST)	14
15	CP01G01 GRINDER CTRL PNL (EXIST)	1-20		500	B	0		1-20	SPARE IN PLC CABINET (EXIST)	16
17	CONTROL PANEL **NEW**	1-20		500	B	1176		1-20	SUPPLY FAN SF-02 (1/2 HP) **NEW**	18
19	SONITROL RECEPTACLE (EXIST)	1-20		360	A	864		1-20	SUPPLY FAN SF-01 (1/3) **NEW**	20

	CONNECTED LOAD		TOTAL LOAD
LOAD PER PHASE (VA)	A= 5496	A=	5948
	B= 3536	B=	3988
LOAD PER PHASE (AMPS)	A= 45.80	A=	49.56
	B= 29.47	B=	33.23
TOTAL LOAD (KVA)	9.03		9.94
SPARE CAPACITY	10.00%	0.90 DATE	17-Jul-25

.....NOTES.....
1.
2.
3.
4.
5.

1 2 3 4 5

2 - PANEL SCHEDULE
SCALE: NONE

KEY NOTES:

1. EXISTING CIRCUIT FOR EXHAUST FANS TO BE RE-USED FOR CONNECTION TO NEW EXHAUST FANS.
2. EXISTING LEVEL SENSOR CONTROL PANEL CIRCUIT TO BE RE-USED FOR CONNECTION TO NEW CONTROL PANEL.
3. EXISTING SPARE IN PLC CABINET CIRCUITS TO BECOME EMPTY SPARE BREAKERS.
4. EXISTING SPARE IN PLC CABINET CIRCUIT TO BE RE-USED FOR CONNECTION TO NEW SUPPLY FAN SF-02.
5. EXISTING HVAC FAN CIRCUIT TO BE RE-USED FOR CONNECTION TO NEW SUPPLY FAN SF-01.
6. UPDATE AND INSTALL NEW PANEL SCHEDULE TO REFLECT PROJECT MODIFICATIONS.

MICHAEL EZRA NATIVIDAD STATE OF WASHINGTON 57964 REGISTERED PROFESSIONAL ENGINEER 7/29/25

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ELECTRICAL SCHEDULES

wallis engineering

PROJECT NO: WW02
DATE: 07/2025

City of Camas WASHINGTON

MAIN PUMP STATION IMPROVEMENTS

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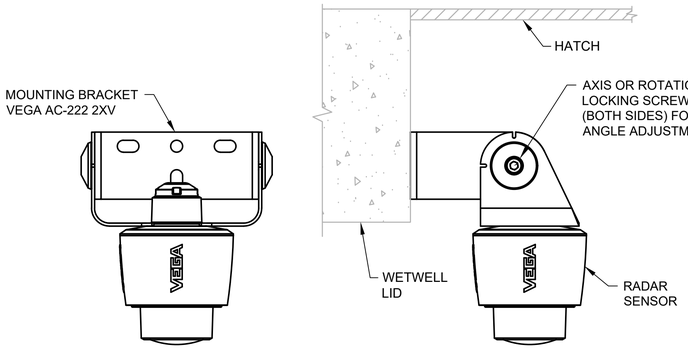
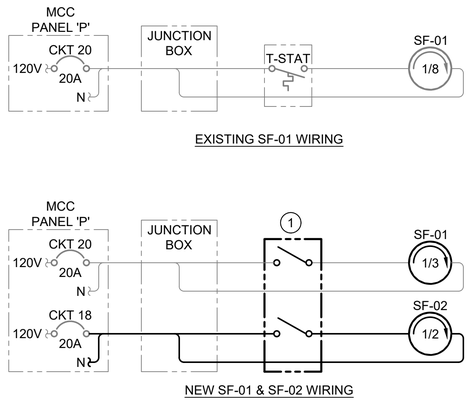
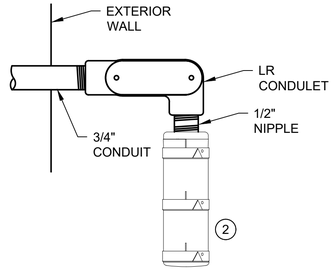
DRAWING NO:
E6
21 OF 29



1 - RADAR SENSOR MOUNT DETAIL
SCALE: NONE



2 - SUPPLY FAN WIRING DETAIL
SCALE: NONE



3 - GO/NO-GO LIGHT
SCALE: NONE

KEY NOTES:

1. LABEL SWITCHES FOR FANS "SF-01" AND "SF-02".
2. NEMA 4 TOWER STACK LIGHT WITH (1) GREEN LED LIGHT (1) RED LED LIGHT. ALLEN-BRADLEY 855EC-B10Y3Y4 OR AS APPROVED.

MICHAEL EZRA WALLIS
STATE OF WASHINGTON
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ONE INCH
0 1"
ONE INCH AT FULL SCALE. IF NOT ONE INCH ADJUST SCALE ACCORDINGLY

ELECTRICAL DETAILS

wallis engineering

PROJECT NO: WW02
DATE: 07/2025

City of Camas WASHINGTON

MAIN PUMP STATION IMPROVEMENTS

DRAWING NO:
E7

22 OF 29

Industrial Systems INC
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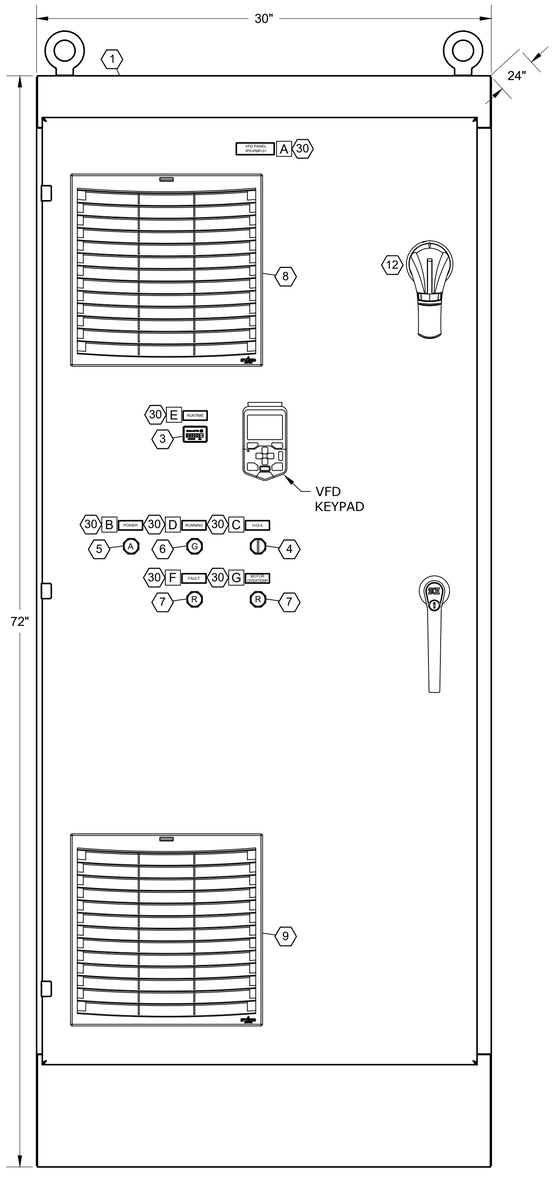
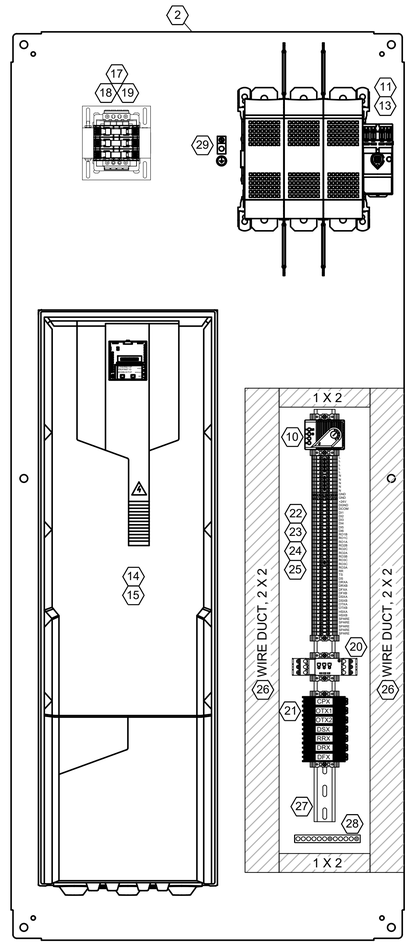
Phone: (360) 718-7267
Fax: (360) 952-8958
e-mail: is@is-inc.com
OR CCB #196597 WA #INDUSSI880K9
AK #1018436
PROJECT#: 23.65.02



EXTERIOR



BACK PANEL

1 VFD PANEL LAYOUT AND ELEVATION
SCALE: NONE

GENERAL NOTES:

1. PANEL LAYOUT IS CONCEPTUAL AND FINALIZED LAYOUT SHALL BE PROVIDED BY MANUFACTURER PER UL-508 REQUIREMENTS.
2. PROVIDE 2 SPARE COOLING FAN FILTERS PER EACH PANEL.
3. PANEL IS TYPICAL FOR 3 UNITS. VFD-1 (IPS-PMP-01), VFD-2 (IPS-PMP-02) AND VFD 3 (IPS-PMP-03)

[A]

ITEM	NAMEPLATE SCHEDULE
A	VFD PANEL IPS-PMP-0X (X=1,2 OR 3)
B	POWER
C	H/O/A
D	RUNNING
E	RUNTIME
F	FAULT
G	MOTOR OVERTEMP

[#]

ITEM	QTY	DESCRIPTION	MANUFACTURER	CATALOG NUMBER	EQUALS ALLOWED
1	1	ENCLOSURE, 72"x30"x28", FLOOR STANDING NEMA 12	SAGINAW	SCE-72EL3024FS	YES
2	1	BACK PANEL	SAGINAW	SCE-72P3F1	YES
3	1	6-DIGIT HOUR TIMEMETER INCUDING 10'THS OF HOUR	TRUMETER	722-0002	YES
4	1	3 POS. SELECTOR SWITCH W/NAMEPLATE	ALLEN BRADLEY	800T-J2A	YES
5	1	AMBER LED PILOT INDICATOR, PUSH TO TEST	ALLEN BRADLEY	800T-QTH2A	YES
6	1	GREEN LED PILOT INDICATOR, PUSH TO TEST	ALLEN BRADLEY	800T-QTH2G	YES
7	2	RED LED PILOT INDICATOR, PUSH TO TEST	ALLEN BRADLEY	800T-QTH2R	YES
8	1	FILTER FAN GRAY 115VAC 414 CFM	STEGO	018849-00	YES
9	1	EXHAUST GRILLE GRAY	STEGO	0118840-30	YES
10	1	THERMOSTAT CONTROLLER, 115VAC, FAHRENHEIT	STEGO	011709-00	YES
11	1	400A FUSED DISCONNECT SWITCH	SOCOMEC	38513038	YES
12	1	2-POS, LOCKABLE ROTARY HANDLE	SOCOMEC	142G2111	YES
13	3	FAST ACTING, CURRENT LIMITING FUSE, 225A	BUSSMAN	JJS-225	YES
14	1	125HP VFD WITH ACTIVE HARMONIC FRONT END	ABB	ACQ-580-31-156A-4	YES
15	1	ETHERNET I/P MODULE ADAPTER KIT	ABB	FEIP-21-KIT	YES
16		NOT USED			
17	1	CONTROL POWER TRANSFORMER, 250VA	ALLEN BRADLEY	1497-E-BASX-3-N	YES
18	2	CLASS CC FUSE PRIMARY - 2.5 AMP	EDISON	ATD2.5	YES
19	1	CLASS CC FUSE SECONDARY - 3 AMP	MERSEN	ATDR3	YES
20	1	TIMING RELAY, MULTI-FUNCTION, MULTIRANGE	ALLEN BRADLEY	700-FSM8UU23	YES
21	A/R	DPDT CONTROL RELAY, 24VDC OR 120VAC W/INDICATOR & BASE	IDEC	RJ2S SERIES	YES
22	A/R	FEED THROUGH TERMINAL BLOCK	PANEL FAB CHOICE		YES
23	A/R	TERMINAL BLOCK END STOP	PANEL FAB CHOICE		YES
24	A/R	TERMINAL BLOCK END PLATE	PANEL FAB CHOICE		YES
25	A/R	TERMINAL BLOCK (GROUND)	PANEL FAB CHOICE		YES
26	A/R	WIREWAY (SIZE AS NOTED ON DRAWING)	PANEL FAB CHOICE		YES
27	A/R	DIN-RAIL	PANEL FAB CHOICE		YES
28	1	GROUND BUS	EATON C-H	GBK10	YES
29	1	GROUNDING LUG #14 TO #2	BURNDY	KA2U	YES
30	AR	1"X2" BLACK LETTERS ON WHITE PHENOLIC NAMEPLATE	PANEL FAB CHOICE		YES

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MICHAEL EZRA NATHAN STATE OF WASHINGTON 57964 REGISTERED PROFESSIONAL ENGINEER 7/29/25

NO.	REVISION	BY	DATE

DESIGNED BY: RSC
DRAWN BY: RSC
REV: MEW

ONE INCH 0 1"
ONE INCH AT FULL SCALE.
IF NOT ONE INCH ADJUST SCALE ACCORDINGLY

VFD PANEL LAYOUT

wallis engineering

PROJECT NO: WW02
DATE: 07/2025

City of Camas WASHINGTON

MAIN PUMP STATION IMPROVEMENTS

DRAWING NO:
E8

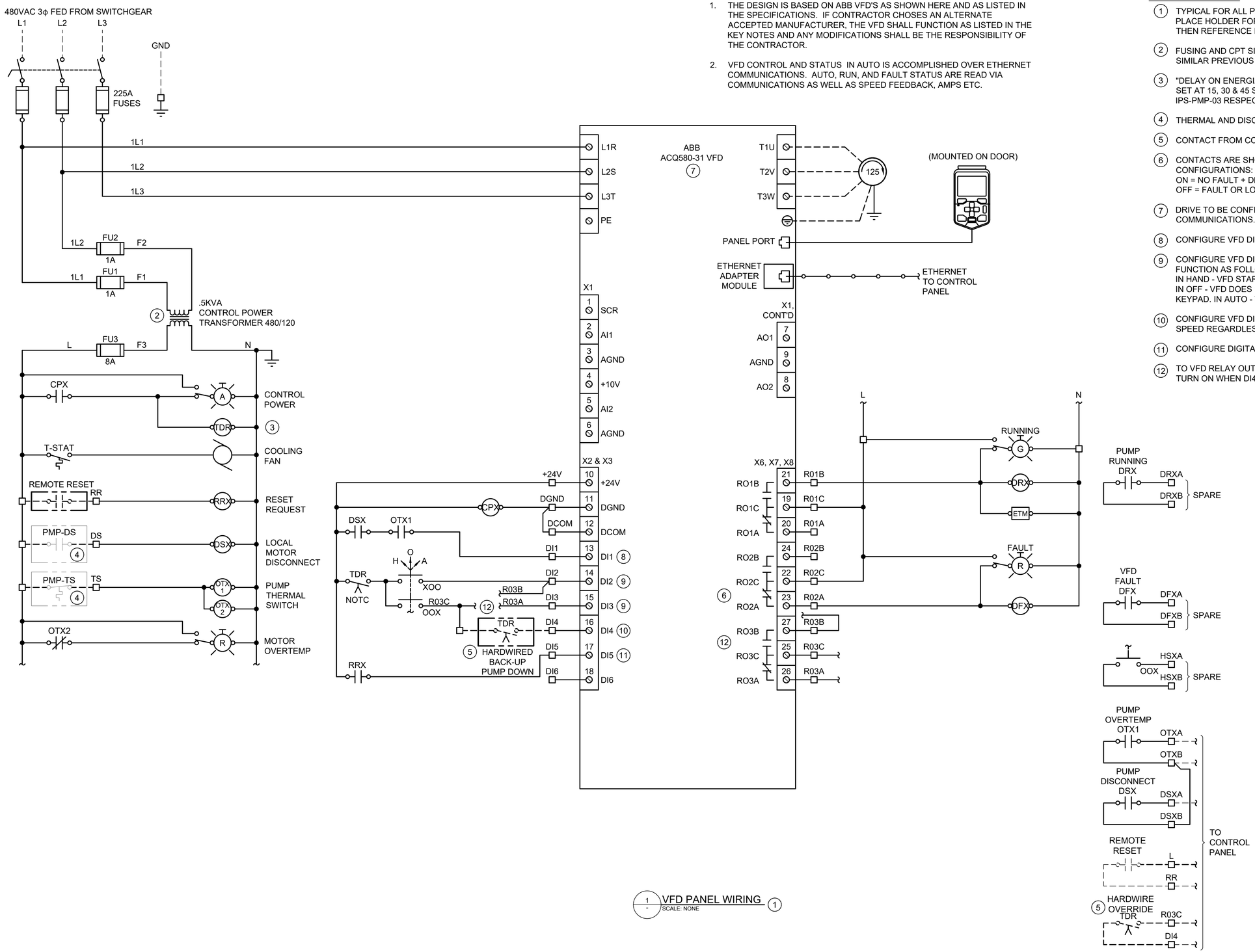
GENERAL NOTES:

1. THE DESIGN IS BASED ON ABB VFD'S AS SHOWN HERE AND AS LISTED IN THE SPECIFICATIONS. IF CONTRACTOR CHOSES AN ALTERNATE ACCEPTED MANUFACTURER, THE VFD SHALL FUNCTION AS LISTED IN THE KEY NOTES AND ANY MODIFICATIONS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

2. VFD CONTROL AND STATUS IN AUTO IS ACCOMPLISHED OVER ETHERNET COMMUNICATIONS. AUTO, RUN, AND FAULT STATUS ARE READ VIA COMMUNICATIONS AS WELL AS SPEED FEEDBACK, AMPS ETC.

KEY NOTES:

1. TYPICAL FOR ALL PUMPS. THEREFORE, "X" IN RELAY NAME IS PLACE HOLDER FOR WHICH SPECIFIC PUMP OF TWO. IF X = 1, THEN REFERENCE IPS-PMP-01.
2. FUSING AND CPT SIZED PER PANEL DESIGN PROVIDED ON SIMILAR PREVIOUS PROJECTS. VERIFY AND MODIFY IF REQUIRED.
3. "DELAY ON ENERGIZE" TIME DELAY RELAY, 0-60 SECOND TIMER SET AT 15, 30 & 45 SECONDS FOR IPS-PMP-01, IPS-PMP-02, AND IPS-PMP-03 RESPECTIVELY FOR DELAY ON POWER-UP.
4. THERMAL AND DISCONNECT CONTACTS ARE EXISTING.
5. CONTACT FROM CONTROL PANEL.
6. CONTACTS ARE SHOWN IN "OFF" STATE. FAULT OUTPUT CONFIGURATIONS:
   ON = NO FAULT + DRIVE POWERED
   OFF = FAULT OR LOSS OF DRIVE POWER
7. DRIVE TO BE CONFIGURED NOT TO FAULT ON LOSS OF COMMUNICATIONS.
8. CONFIGURE VFD DIGITAL INPUT 1 AS AN ENABLE INPUT.
9. CONFIGURE VFD DIGITAL INPUTS FOR HAND AND AUTO TO FUNCTION AS FOLLOWS:
   IN HAND - VFD STARTS AND SPEED IS CONTROLLED VIA KEYPAD.
   IN OFF - VFD DOES NOT START FROM AUTO (PROFINET) OR KEYPAD. IN AUTO - VFD IS CONTROLLED BY PROFINET (PLC).
10. CONFIGURE VFD DIGITAL INPUT TO START VFD AND RUN AT 100% SPEED REGARDLESS OF ETHERNET SETTINGS.
11. CONFIGURE DIGITAL INPUT FOR FAULT RESET.
12. TO VFD RELAY OUTPUT 3. OUTPUT TO BE PROGRAMMED TO TURN ON WHEN DI4 "HARDWIRED OVERRIDE" IS ON.



1 / - VFD PANEL WIRING (1)
SCALE: NONE

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MICHAEL EZRA NATIVIDAD — STATE OF WASHINGTON — 57964 — REGISTERED PROFESSIONAL ENGINEER — 7/29/25

NO.	REVISION	BY	DATE

DESIGNED BY: RSC
DRAWN BY: RSC
REV: MEW

ONE INCH AT FULL SCALE. IF NOT ONE INCH ADJUST SCALE ACCORDINGLY
0 — 1"

VFD PANEL WIRING

wallis engineering

PROJECT NO: WW02
DATE: 07/2025

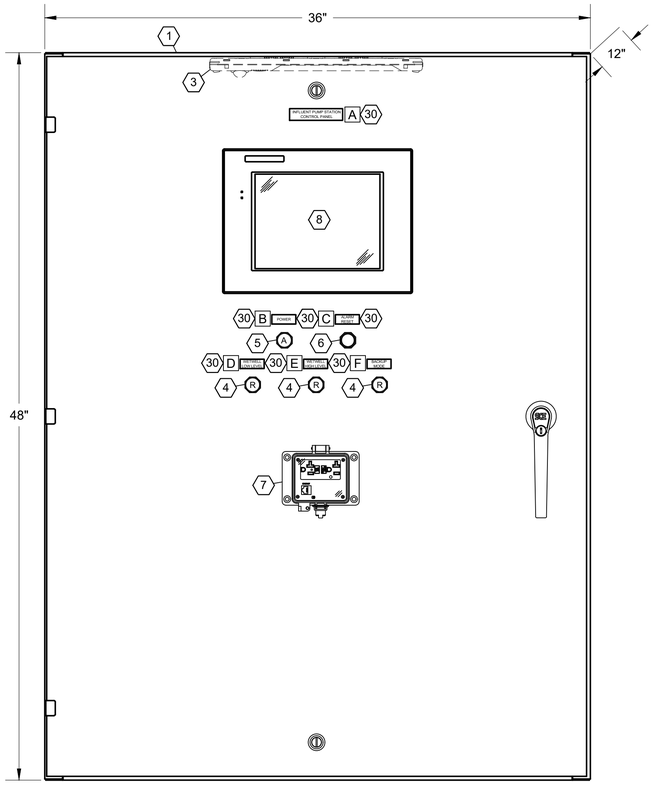
City of Camas WASHINGTON

MAIN PUMP STATION IMPROVEMENTS

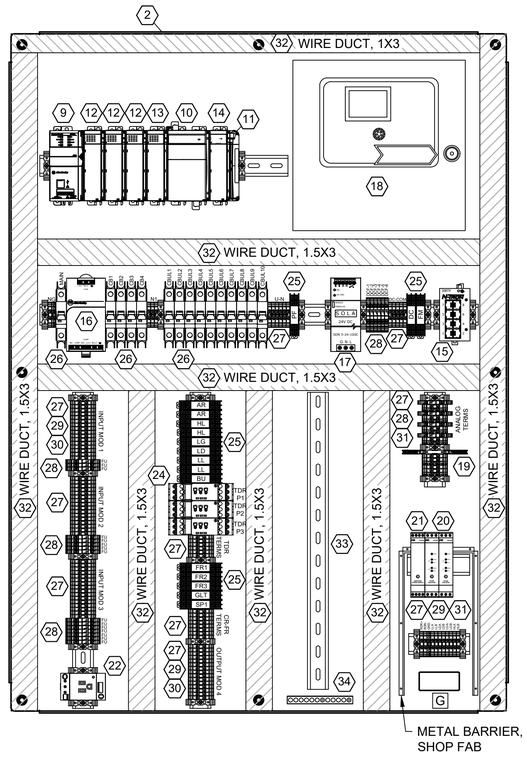
DRAWING NO:
E9

GENERAL NOTES:

1. PANEL LAYOUT IS CONCEPTUAL AND FINALIZED LAYOUT SHALL BE PROVIDED BY MANUFACTURER PER UL-508 REQUIREMENTS.



EXTERIOR



BACK PANEL

1 - CONTROL PANEL LAYOUT AND ELEVATION
SCALE: NONE

A	ITEM	NAMEPLATE SCHEDULE
	A	INFLUENT PUMP STATION CONTROL PANEL
	B	POWER
	C	ALARM RESET
	D	WETWELL LOW LEVEL
	E	WETWELL HIGH LEVEL
	F	BACKUP MODE
	G	INTRINSICALLY SAFE CIRCUITS
	H	-WARNING- SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY

#	ITEM	QTY	DESCRIPTION	MANUFACTURER	CATALOG NUMBER	EQUALS ALLOWED
	1	1	NEMA 4 ENCLOSURE, 48"x36"x12" W/3-POINT LATCH	SAGINAW	SCE-48EL3612LPPL	YES
	2	1	BACK PANEL	SAGINAW	SCE-48P36	YES
	3	1	CONTROL PANEL LED LIGHT W/MOTION SENSOR	SAGINAW	SCE-SLMS	YES
	4	1	RED LED PILOT INDICATOR, PUSH TO TEST W/NAMEPLATE	ALLEN BRADLEY	800T-QTH2R	YES
	5	1	AMBER LED PILOT INDICATOR, PUSH TO TEST W/NAMEPLATE	ALLEN BRADLEY	800T-QTH2A	YES
	6	1	PUSHBUTTON, FLUSH BLACK	ALLEN BRADLEY	800T-A2D1	YES
	7	1	DATAPORT WITH ETHERNET AND GFCI	HUBBELL	PR205E	YES
	8	1	OPERATOR INTERFACE TERMINAL, 10" WITH TOUCH SCREEN	AUTOMATION DIRECT	EA9-T10CL	NO
	9	1	PLC PROCESSOR W/ETHERNET PORT	ALLEN BRADLEY	1769-L33ER	NO
	10	1	PLC POWER SUPPLY	ALLEN BRADLEY	1769-PA2	NO
	11	1	PLC TERMATION END CAP, RIGHT	ALLEN BRADLEY	1769-ECR	NO
	12	2	120VAC DISCRETE INPUT MODULE, 16 POINT	ALLEN BRADLEY	1769-IA16	NO
	13	1	120VAC DISCRETE OUTPUT MODULE, 16 POINT	ALLEN BRADLEY	1769-OA16	NO
	14	1	ISOLATED ANALOG INPUT MODULE, 4 CHANNEL	ALLEN BRADLEY	1769-IF4I	NO
	15	1	UNMANAGED INDUSTRIAL ETHERNET SWITCH, 8TX PORT	NTRON	308TX	YES
	16	1	TVSS SURGE SUPRESSOR 120V/240V SINGLE PHASE	ALLEN BRADLEY	4983-DC120-20	YES
	17	1	DC POWER SUPPLY 120VAC-24VDC, 5.0A	SOLA	SDN 5-24-100C	YES
	18	1	CELLULAR TELEMETRY PANEL (EXISTING TO BE RE-USED)	MISSION	MYDRO	NO
	19	1	24VDC ANALOG LOOP ISOLATOR/DUPLICATOR - 2 CHANNEL	PHOENIX CONTACT	2905027	YES
	20	2	INTRINSICALLY SAFE RELAYS, 2 CHANNEL, DIP SWITCH SETTABLE	PR ELECTRONICS	5202B2	YES
	21	1	INTRINSICALLY SAFE BARRIER, 1 CHANNEL	PR ELECTRONICS	5104BB2A	YES
	22	1	SIMPLEX RECEPTACLE, DIN-RAIL MOUNT	PHOENIX CONTACT	0804155	YES
	23	1	600VA UPS	APC	BE600M1	YES
	24	3	TIMING RELAY, MULTI-FUNCTION, MULTIRANGE	ALLEN BRADLEY	700-FSM8UU23	YES
	25	A/R	DPDT CONTROL RELAY, 24VDC OR 120VAC W/INDICATOR & BASE	IDEC	RJ2S SERIES	YES
	26	AR	MINIATURE CIRCUIT BREAKER (SIZE AS INDICATED ON DWG)	ALLEN BRADLEY	1489 SERIES	YES
	27	A/R	FEED THROUGH TERMINAL BLOCK (NON FUSED)	PANEL FAB CHOICE		YES
	28	A/R	TERMINAL BLOCK (FUSED) W/BLOWN FUSE INDICATION	PANEL FAB CHOICE		YES
	29	A/R	TERMINAL BLOCK END STOP	PANEL FAB CHOICE		YES
	30	A/R	TERMINAL BLOCK END PLATE	PANEL FAB CHOICE		YES
	31	A/R	TERMINAL BLOCK (GROUND)	PANEL FAB CHOICE		YES
	32	A/R	WIREWAY (SIZE AS NOTED ON DRAWING)	PANEL FAB CHOICE		YES
	33	A/R	DIN-RAIL	PANEL FAB CHOICE		YES
	34	1	GROUND BUS	EATON C-H	GBK10	YES
	35	AR	CAT 6 ETHERNET PATCH CABLE (NOT SHOWN)	PANEL FAB CHOICE		YES
		AR	= AS REQUIRED			

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MICHAEL EZRA WALLIS
STATE OF WASHINGTON
57964
REGISTERED
PROFESSIONAL ENGINEER
7/29/25

NO.	REVISION	BY	DATE

DESIGNED BY: RSC
DRAWN BY: RSC
REV: MEW

ONE INCH 0 1"
ONE INCH AT FULL SCALE.
IF NOT ONE INCH ADJUST SCALE ACCORDINGLY

INFLUENT PUMP STATION CONTROL PANEL LAYOUT

wallis engineering

PROJECT NO: WW02
DATE: 07/2025

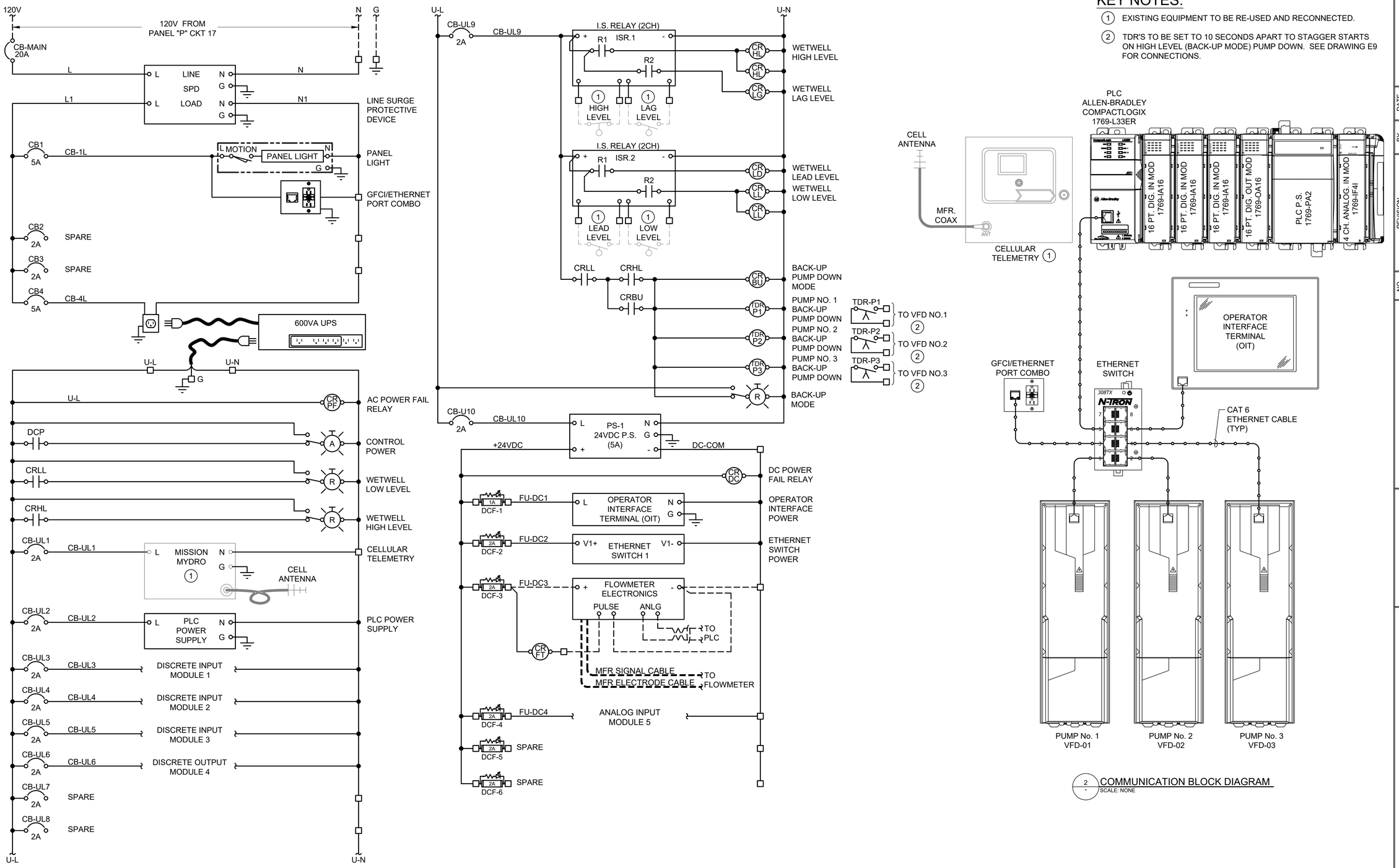
City of Camas WASHINGTON

MAIN PUMP STATION IMPROVEMENTS

DRAWING NO:
E10
25 OF 29

KEY NOTES:

1. EXISTING EQUIPMENT TO BE RE-USED AND RECONNECTED.
2. TDR'S TO BE SET TO 10 SECONDS APART TO STAGGER STARTS ON HIGH LEVEL (BACK-UP MODE) PUMP DOWN. SEE DRAWING E9 FOR CONNECTIONS.



1 CONTROL PANEL POWER WIRING
SCALE: NONE

2 COMMUNICATION BLOCK DIAGRAM
SCALE: NONE

MICHAEL EZRA NATLIN
STATE OF WASHINGTON
57964
REGISTERED PROFESSIONAL ENGINEER
7/29/25

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INFLUENT PUMP STATION CONTROL PANEL POWER WIRING

wallis engineering

PROJECT NO: WW02
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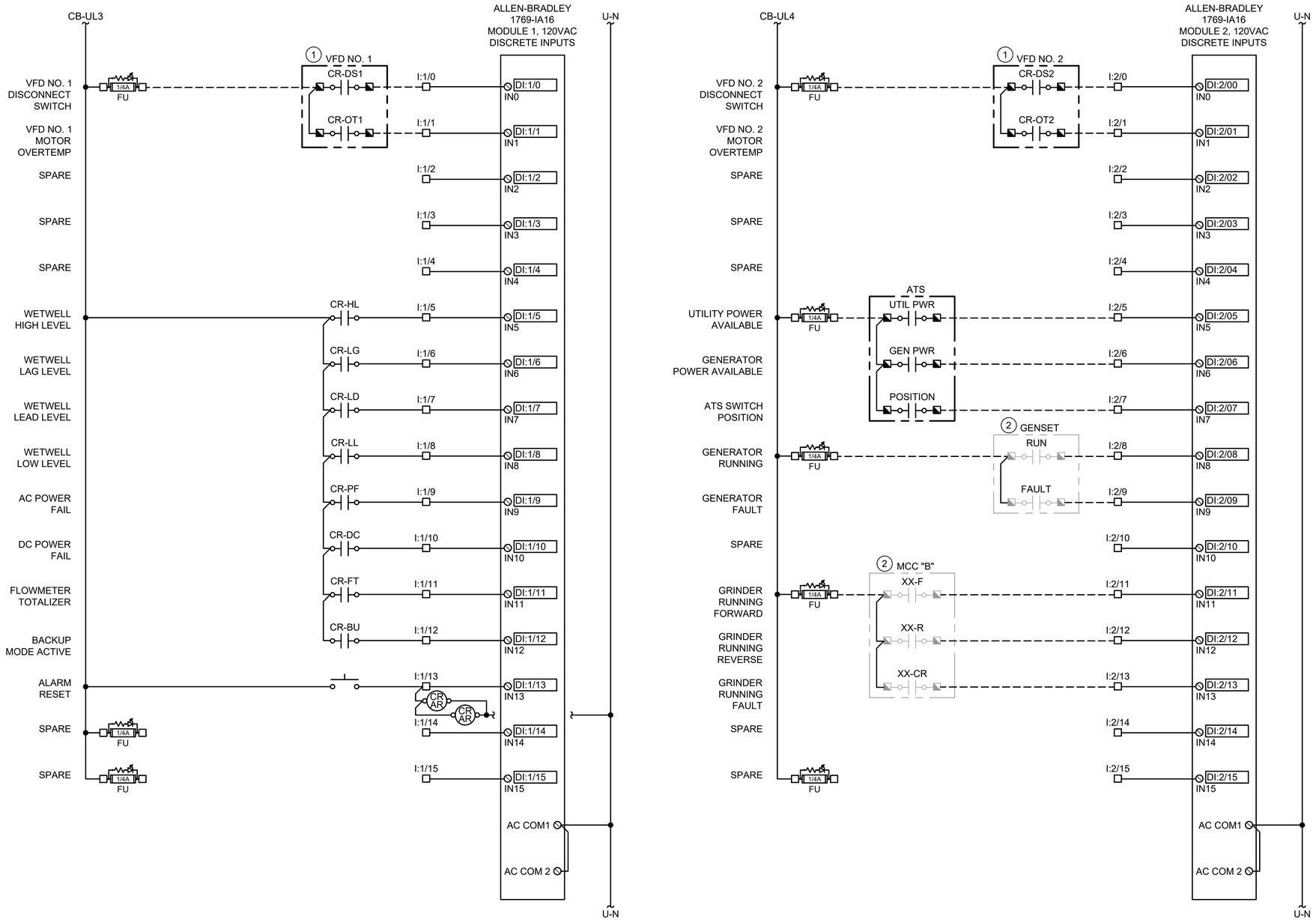
DRAWING NO:
E11



1 / - CONTROL PANEL DISCRETE I/O WIRING
SCALE: NONE

KEY NOTES:

1. SEE DRAWING E-9 FOR CONNECTIONS.
2. EXISTING CONNECTION TO BE RE-CONNECTED.

MICHAEL EZRA WALLIS — STATE OF WASHINGTON — 57964 — REGISTERED PROFESSIONAL ENGINEER — 7/29/25

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INFLUENT PUMP STATION CONTROL PANEL DISCRETE I-O WIRING 1

wallis engineering

PROJECT NO: WW02
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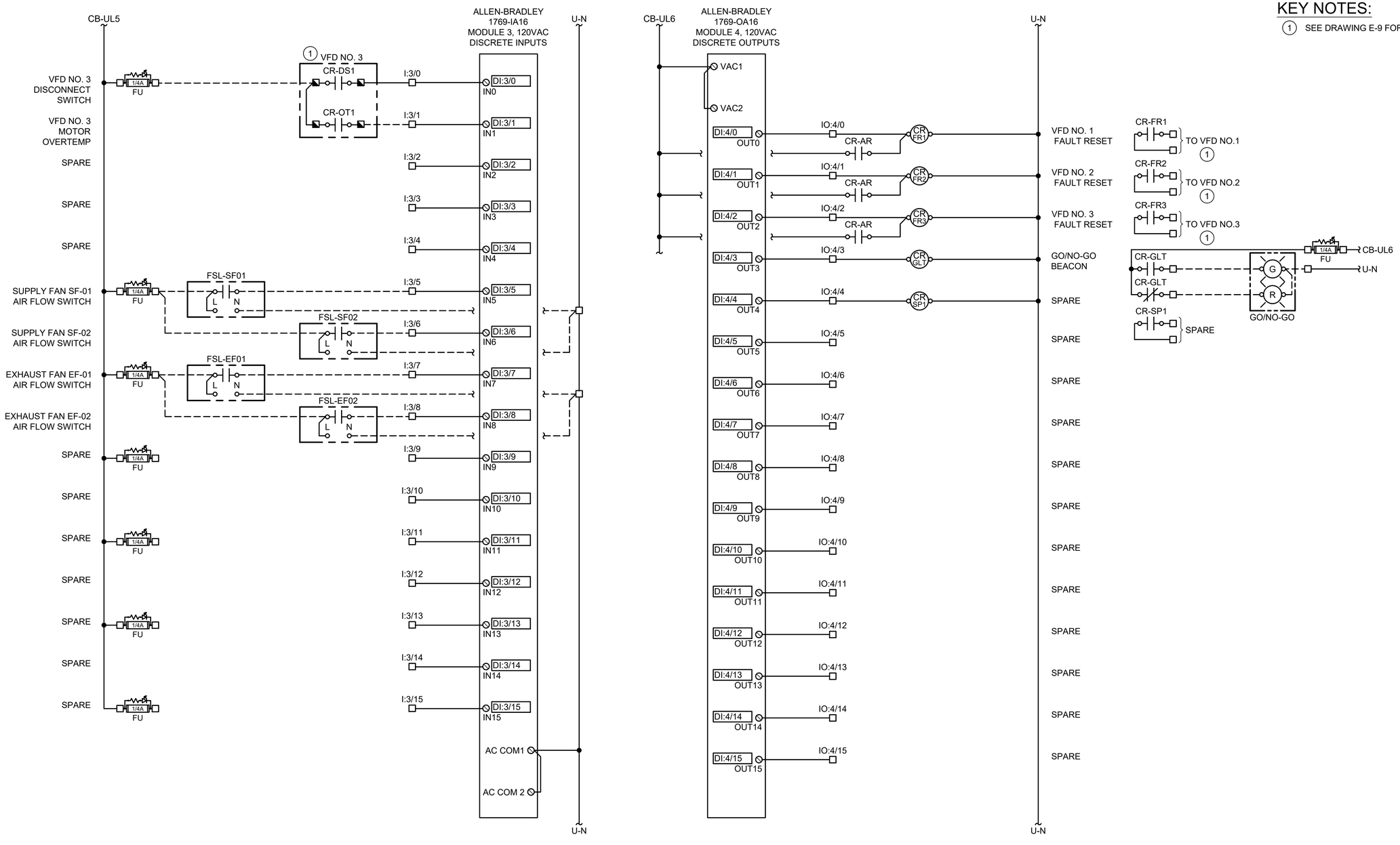
DRAWING NO:
E12



KEY NOTES:

1. SEE DRAWING E-9 FOR CONNECTIONS.

1 CONTROL PANEL DISCRETE I/O WIRING
SCALE: NONE

MICHAEL EZRA WALLIS
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INFLUENT PUMP STATION CONTROL PANEL DISCRETE I-O WIRING 2

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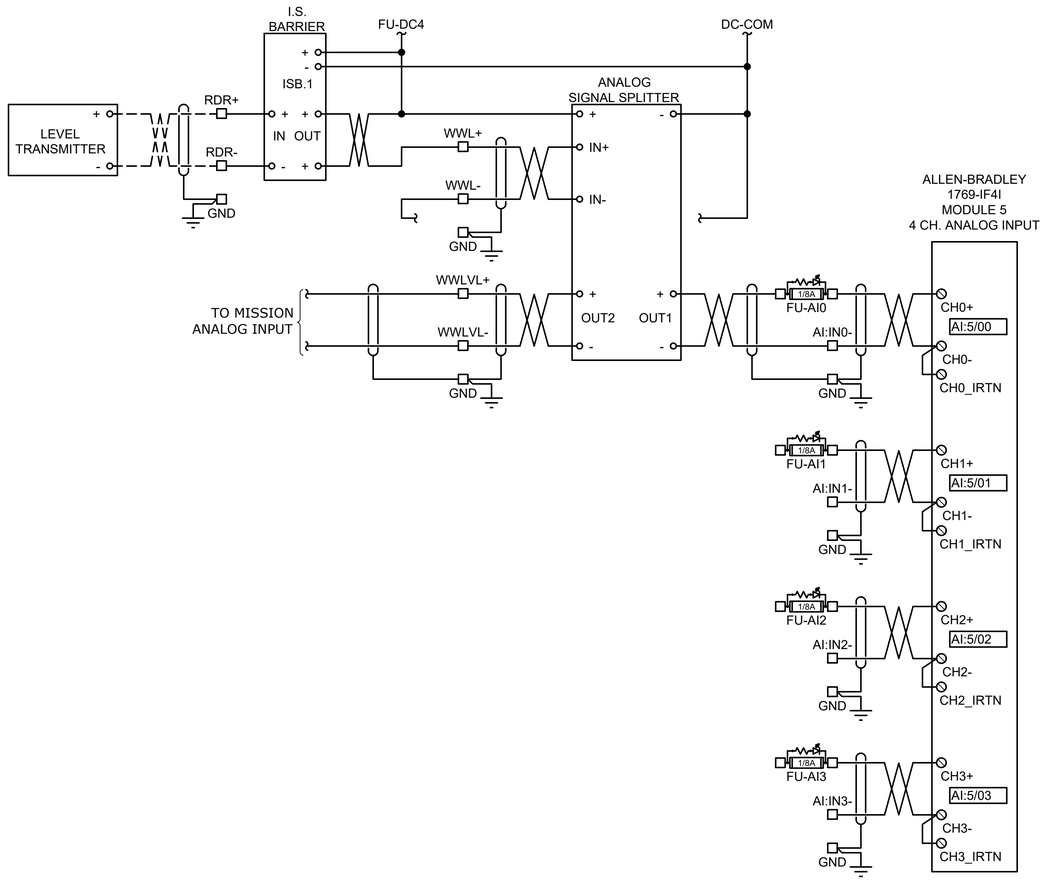
DRAWING NO:
E13



1 CONTROL PANEL ANALOG I/O WIRING
SCALE: NONE

MICHAEL EZRA WALLIS
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INFLUENT PUMP STATION CONTROL PANEL ANALOG I-O WIRING

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DRAWING NO:
E14
29 OF 29