

LONDON WATER COOPERATIVE

**BID PROPOSAL, CONTRACT DOCUMENTS,
AND TECHNICAL PROVISIONS FOR:**

Water Treatment Plant Replacement

RH2 Project No. LWC 23-0124

Volume I – Contract and Specifications

Volume 2 – Construction Plans

Spring 2025

<p>London Water Cooperation</p> <p>72762 Shoestring Road Cottage Grove, OR 97424</p> <p>Phone: 541/ 450-9536</p> <p>Contact: Eric Vortriede, President</p>	<p>RH2 Engineering, Inc.</p> <p>3553 Arrowhead Drive, Suite 200 Medford, OR 97504</p> <p>Phone: 541/ 665-5233</p> <p>Contact: Tyler Duncan, PE</p>
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Water Treatment Plant Replacement

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Volume I

Spring 2025

THE CONTENT OF THIS DOCUMENT, AS A MEANS OF PROFESSIONAL SERVICE, IS PROTECTED BY 17 U.S.C. § 101, ET SEQ. AS SUCH, IT SHALL NOT BE USED, IN WHOLE OR IN PART, FOR ANY OTHER PROJECT OR PURPOSE WITHOUT WRITTEN AUTHORIZATION FROM RH2 ENGINEERING. © 2025 RH2 ENGINEERING, INC.



EXPIRES: 12/31/2025

London Water Cooperative
Water Treatment Plant Replacement
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INSTRUCTION TO BIDDERS

LONDON WATER COOPERATIVE
72743 Shoestring Road
Cottage Grove, OR 97424

ADVERTISEMENT FOR BIDS

Notice is hereby given that sealed bids will be received by the London Water Cooperative for the construction of the Water Treatment Plant Replacement.

Work to be performed includes:

Installation of a new package water treatment plant, two new 10,000 gallon water tanks, associated yard piping, valves, sensors, and other components, new electrical service. Work includes grading and site development improvements, plumbing, mechanical, electrical, start up and testing, and other work as necessary.

The bid proposal shall be submitted under sealed cover and marked with the Contractor's name with the project name clearly on the envelope. Bid proposals shall be hand delivered to the London Grange, 72746 London Road, Cottage Grove, Oregon, between 1:30 PM and 2:00PM local time on June 12, 2025. Bid proposals will be opened at 2:00 PM local time on June 12, 2025, at which time they will be read aloud, and tabulated publicly. Proposals received after the time fixed for opening will not be considered. The London Water Cooperative reserves the right to cancel this procurement or reject any or all bids in accordance with ORS279B.100. Completed First Tier Subcontractor Form can be included with the bid package or hand delivered to Mr. Vortriede's residence, located at 72743 Shoestring Rd, Cottage Grove, OR.

The complete digital contract documents may be downloaded for a \$22.00 non-refundable fee by inputting the QuestCDN project #9692840 on the website at www.questCDN.com. Please contact QuestCDN at 952/233-1632 or info@questcdn.com for assistance in free membership registration, downloading, and working with this digital project information. All prospective bidders must provide a valid e-mail address and be added to the Plan Holders List by downloading the documents from www.questcdn.com. Notification of Addenda issuance will be issued via e-mail to the addresses listed on the Plan Holders List.

Technical questions regarding the project should be directed to:

Tyler Duncan, PE, at 425/471-8625, tduncan@rh2.com.

Bidder questions will be received through June 5, 2025. No questions will be responded to after that date.

A voluntary pre-bid site visit is scheduled for May 27th at 10:00 AM, meeting at the London Grange (address above).

Schedule Summary

Bid Advertisement:	May 16 th , 2025
Voluntary Pre-Bid Meeting:	May 27 th , 2025 at 10:00 AM @ London Grange
Bid Opening:	June 12 th , 2025 at 2:00 PM @ London Grange
First Tier Forms Due:	June 12 th , 2025 at 4:00 PM @ Mr. Vortriede's Residence
Bid Award:	June 24 th , 2025
Construction Start:	July 7 th , 2025
Substantial Completion:	November 30 th , 2025
Final Completion:	December 31 st , 2025

The London Water Cooperative hereby notifies all bidders that it will affirmatively ensure that in any contract entered into, pursuant to this advertisement, minority and women's business enterprises will be afforded full opportunity to submit bids in response to the invitation and will not be discriminated against on the grounds of race, color, national origin, or sex in consideration for an award.

Each bid proposal shall be accompanied by a bid proposal deposit in cash, certified check, cashier's check, postal money order, or surety bond in an amount equal to at least 5 percent of the amount of such bid proposal. Checks shall be made payable to the London Water Cooperative. Should the successful bidder fail to enter into such contract and furnish satisfactory performance and payment bond within the time stated in the Specifications, the bid proposal deposit shall be forfeited to the London Water Cooperative.

This is for public work and therefore subject to prevailing wage requirements of the Bureau of Labor and Industries (BOLI) Prevailing Wage rates pursuant to ORS 279C.800 thru 279C.870.

Bidders are required to disclose information about certain first-tier subcontractors when the contract price exceeds \$100,000 (ORS 279C.370). The subcontractor list **is required and can be** submitted with the bid. If the subcontractor listing is not submitted with the bid, it must be received within two (2) hours after the bid closing time and date to the London Water Cooperative, 72743 Shoestring Road, Cottage Grove OR 97424 to the attention of Eric Vortriede. Failure to supply a correct subcontractor listing will result in bid rejection.

This project is funded by the Small and Disadvantaged Communities (SUDC) Drinking Water Grant Program under the Water Infrastructure Improvement for the Nation (WIIN) Act Grant and is thereby subject to SUDC/WIIN Act requirements.

This project is funded by federal monies and therefore all iron and steel, manufactured products, and construction materials used in this project are subject to Build America, Buy America (BABA) requirements. Contractor will comply with BABA requirements accordingly.

The Cooperative reserves the right to waive any minor informalities or irregularities in bids. The London Water Cooperative may reject any bid not in compliance with all prescribed public bidding procedures and requirements, and may, for good cause, reject all bids upon a finding by the London Water Cooperative if it is in the public interest to do so in accordance with **ORS 279C.395**.

No bidder may withdraw their proposal after the hours set for the opening thereof, or before award of contract, unless said award is delayed for a period exceeding 60 calendar days.

PUBLISHED:
Daily Journal of Commerce
Publish Date
May 16, 2025

INSTRUCTIONS TO BIDDERS

01. General

The complete digital contract documents may be downloaded for a \$22.00 non-refundable fee by inputting the QuestCDN project #9692840 on the website at www.questcdn.com. Please contact QuestCDN.com at 952/233-1632 or info@questcdn.com for assistance in free membership registration, downloading, and working with this digital project information. All prospective bidders must provide a valid e-mail address and be added to the Plan Holders List by downloading the documents from www.questcdn.com. Notification of Addenda issuance will be issued via e-mail to the addresses listed on the Plan Holders List.

02. Location

Project is located at:

72764 Shoestring Road, Cottage Grove, Oregon.

03. Examination of Plans, Specifications and Site

Bidders shall satisfy themselves as to construction conditions by personal examination of Plans, Specifications and site of proposed work, and by any other examination and investigation which they may desire to make as to the nature of difficulties to be encountered.

04. Proposals

The bid proposal shall be submitted under sealed cover and marked with the Contractor's name with the project name clearly on the envelope. Bid proposals shall be hand delivered to the London Grange, 72746 London Road, Cottage Grove, Oregon, between 1:30 PM and 2:00PM local time on June 12, 2025. Bid proposals will be opened at 2:00 PM local time on June 12, 2025, at which time they will be read aloud, and tabulated publicly. Proposals received after the time fixed for opening will not be considered. The London Water Cooperative reserves the right to cancel this procurement or reject any or all bids in accordance with ORS279B.100. Completed First Tier Subcontractor Form can be included with the bid package or hand delivered to Mr. Vortriede's residence, located at 72743 Shoestring Rd, Cottage Grove, OR.

No proposal may be withdrawn after the time set for the bid opening or before award of contract unless said award is delayed for a period exceeding 60 calendar days.

05. Bid Proposal Deposit

As a guarantee of good faith and as required by law, each bid shall be accompanied by a bid proposal deposit in the form of a certified check, cashier's check, or surety bond, payable to the order of the London Water Cooperative, for an amount not less than 5 percent of the total amount of bid. Deposits of the three low bidders will be retained until a contract has been entered into between the successful bidder and the London Water Cooperative and until a performance and payment bond in

an amount of 100 percent of the contract price has been filed as required under these contract documents.

Deposits of other bidders will be returned as soon as it is determined that they are not one of the three low bidders.

06. Award of Contract

Contract will not be awarded until the London Water Cooperative is satisfied that successful bidder is reasonably familiar with the class of work contemplated and has the necessary capital, tools and experience to satisfactorily perform the work within the time stated. Completion of the work within the time stated is essential and prior commitments of the bidder, failure to complete other work on time, or reasonable doubt as to whether the bidder would complete the work on time would be cause for the rejection of any bid. In addition, the Owner may determine any bidder not to be responsible in accordance with ORS 279B.110 and/or any other legal authority. The right is reserved by Owner to waive any informalities in the bidding, to reject any or all proposals, to accept any proposal, to re-advertise for new proposals, or to otherwise carry out the work.

07. Failure to Execute Contract

In the event the successful bidder fails to furnish an approved bond and to sign the contract within ten (10) days after notification of award, an amount equal to five (5) percent of the amount of the bid shall be forfeited to Owner as liquidated damages. Said liquidated damages shall be paid from the check or bid bond filed by the bidder. Other proposals will then be reconsidered for award by Owner.

08. Corrections, Interpretations and Addenda

Any omissions, discrepancies, or need for interpretation should be brought in writing to the attention of Engineer. Written addenda to clarify questions which arise will then be issued.

All interpretation or explanations of the contract documents shall be in the form of an addendum and no oral statements by Owner, Engineer, or other representative of Owner shall, in any way, modify the contract documents, whether made before or after awarding the contract.

09. Project Engineer

Notices as required in the General Conditions shall be mailed to RH2 Engineering, Inc., 3355 Arrowhead Drive, Ste. 200, Medford, Oregon 97504 or by email to:

Tyler Duncan, PE, at 425/471-8625, tduncan@rh2.com.

10. Chemical Hazard Communication

Before starting work under this contract, Contractor is required to supply information to the London Water Cooperative on all chemical hazards that Contractor is bringing into the work place and thereby creating exposure to the London Water Cooperative employees.

11. Completion Time

Contractor is required to have substantial completion by November 30, 2025, and contract completion by December 31, 2025.

Working hours and days are defined in Division 1.

12. Insurance Requirements

The following insurance coverages and dollar amounts are required for this project:

Insurance Coverage	Combined Single Limit per Occurrence	Annual Aggregate Limit
Commercial General Liability	\$2,000,000	\$4,000,000
Commercial Automobile Liability	\$1,000,000	\$2,000,000

Insurance certificate shall be provided, and must include the following entities as additional insureds:

1. London Water Cooperative
2. RH2 Engineering, Inc.

13. Bidder's Responsibility Statement

It is the responsibility of each bidder to ascertain if all the documents listed on the attached index are included in their copy of the bid specifications.

If documents are missing, it is the sole responsibility of the bidder to contact the London Water Cooperative to obtain the missing documents prior to bid opening time.

14. SUDC/WIIN Act Grant Requirements

Work under this contract is funded by the federal Water Infrastructure Improvement for the Nation Act through Business Oregon and a partnership of Local and/or Private Funds. The following requirements are consistent with the federal Uniform Guidance as applicable to the WIIN Act Grant funded projects. Contractors and subcontractors are responsible for meeting the included requirements.

Whistleblower

Contractor receiving WIIN Act funds shall under or through this contract to, post notice of the rights and remedies provided to whistleblowers under No Fear Act Pub. L. 107-174.29CFR §1614.703(d).

Inspections; Information

Contractor shall permit, and cause its subcontractors to allow the State of Oregon, the federal government and any party designated by them to:

- Examine, visit and inspect, at any and all reasonable times, the property, if any, constituting the Project.
- Inspect and make copies of any accounts, books and records, including, without limitation, its records regarding receipts, disbursement, contracts, and any other matters

relating to the Project, and to its financial standing, and shall supply such reports and information as reasonably requested.

- Interview any officer or employee of the Contractor, or its subcontractors, regarding the Project.

Equal Opportunity

Contractor shall comply with Executive Order 11246 of September 24, 1965, entitled “Equal Employment Opportunity,” as amended by Executive Order 11375 of October 13, 1967, and as supplemented in Department of Labor regulations (41 CFR chapter 60).

Copeland “Anti-Kickback” Act

Contractor shall comply with the Copeland “Anti-Kickback” Act (40 U.S.C. 3145), as supplemented by Department of Labor regulations (29 CFR Part 3, “Contractors and Subcontractors on Public Building or Public Work Financed in Whole or in Part by Loans or Grants from the United States”). The Act provides that each contractor or subrecipient must be prohibited from inducing, by any means, any person employed in the construction, completion, or repair of public work, to give up any part of the compensation to which he or she is otherwise entitled. The non-Federal entity must report all suspected or reported violations to the Federal awarding agency.

Debarment and Suspension (Executive Orders 12549 and 12689)

A contract award (see 2 CFR 180.220) shall not be made to parties listed on the governmentwide exclusions in the System for Award Management (SAM), in accordance with the OMB guidelines at 2 CFR 180 that implement Executive Orders 12549 (3 CFR part 1986 Comp., p. 189) and 12689 (3 CFR part 1989 Comp., p. 235), “Debarment and Suspension.” SAM Exclusions contains the names of parties debarred, suspended, or otherwise excluded by agencies, as well as parties declared ineligible under statutory or regulatory authority other than Executive Order 12549. A list of excluded parties is available in the System for Award Management (SAM) at [Sam.gov](https://sam.gov) under “search records”.

Prohibition on Purchasing Telecommunications or Surveillance Equipment, Services, or Systems

As required by 2 CFR 200.216, federal grant or loan recipients and subrecipients are prohibited from obligating or expending loan or grant funds to procure or obtain; extend or renew a contract to procure or obtain; or enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that use covered telecommunications equipment, video surveillance services or services as a substantial or essential component of any system, or as critical technology as part of any system. As described in Public Law 115-232, section 889, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities). Prohibitions extend to the use of Federal funds by recipients and subrecipients to enter into a contract with an entity that “uses any equipment, system, or service that uses covered telecommunications equipment or services” as a substantial or essential component of any system, or as critical technology as part of any system. Certain equipment, systems, or services, including equipment, systems, or services produced or provided by entities subject to the prohibition are recorded in the System for Award Management exclusion list.

Preference to United States made goods

As appropriate and to the extent consistent with law, the contractor should, to the greatest extent practicable under a Federal award, provide a preference for the purchase, acquisition, or use of goods, products, or materials produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products). The requirements of this section must be included in all subawards including all contracts and purchase orders for work or products under this award. For purposes of this section:

- (1) “Produced in the United States” means, for iron and steel products, that all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States.
- (2) “Manufactured products” means items and construction materials composed in whole or in part of non-ferrous metals such as aluminum; plastics and polymer-based products such as polyvinyl chloride pipe; aggregates such as concrete; glass, including optical fiber; and lumber.

Disadvantaged Business Enterprises

The recipient agrees to make good faith efforts whenever procuring construction, equipment, services and supplies under an EPA financial assistance agreement, and to require that sub-recipients, loan recipients, and prime contractors also comply. Records documenting compliance with the six good faith efforts shall be retained. The specific six good faith efforts can be found at: [40 CFR Section 33.301 \(a\)-\(f\)](#). Recipient will ensure that each procurement contract (prime plus all subcontractor contracts) includes the following term and condition:

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

Procurement of recovered materials over \$10,000

The Contractor must comply with section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act. The requirements of Section 6002 include procuring only items designated in guidelines of the Environmental Protection Agency (EPA) at 40 CFR part 247 that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition, where the purchase price of the item exceeds \$10,000 or the value of the quantity acquired during the preceding fiscal year exceeded \$10,000; procuring solid waste management services in a manner that maximizes energy and resource recovery; and establishing an affirmative procurement program for procurement of recovered materials identified in the EPA guidelines.

Termination for Cause and for Convenience

Contractor shall address termination for cause and for convenience, including the manner by which it will be affected and the basis for settlement.

The Contract Owner shall have the option, in its sole discretion, to terminate this Agreement, at any time during the term hereof, for convenience and without cause. The Contract Owner shall exercise this option by giving Contractor written notice of termination. The notice shall specify the date on which termination shall become effective.

Certification Form Located in Appendix A. Byrd Anti-Lobbying Amendment (31 U.S.C. 1352)

Contractors that apply or bid for an award exceeding \$100,000 must file the required certification. Each tier certifies to the tier above that it will not and has not used Federal appropriated funds to pay any person or organization for influencing or attempting to influence an officer or employee of any agency, a member of Congress, officer or employee of Congress, or an employee of a member of Congress in connection with obtaining any Federal contract, grant or any other award covered by 31 U.S.C. 1352. Each tier must also disclose any lobbying with non-Federal funds that takes place in connection with obtaining any Federal award. Such disclosures are forwarded from tier to tier up to the non-Federal award.

Contract Work Hours and Safety Standards Act

The Contract Work Hours and Safety Standards Act requires all contractors—prime and sub—to pay laborers and mechanics performing on a federal service contract and federal and federally assisted construction contract over \$100,000, 1.5 times their basic rate of pay for all hours worked over 40 in a workweek. Employers are liable to employees for these unpaid wages. The failure of a contractor to comply with this Act may also result in liability under the False Claims Act. Employees who are due unpaid wages under the Contract Work Hours and Safety Standards Act may file a complaint with the Wage and Hour Division within the U.S. Department of Labor. The DOL may then enforce the provisions of the Act against violators.

Clean Air Act

Contractor shall comply with all applicable standards, orders, or requirements issued under section 306 of the Clean Air Act (42 U.S.C. 1857(h)), section 508 of the Clean Water Act (33 U.S.C. 1368), Executive Order 11738, and Environmental Protection Agency regulations (40 CFR part 15).

Acquisition Threshold

Contracts for more than the simplified acquisition threshold, which is the inflation adjusted amount determined by the Civilian Agency Acquisition Council and the Defense Acquisition Regulations Council (Councils) as authorized by 41 U.S.C. 1908, must address administrative, contractual, or legal remedies in instances where contractors violate or breach contract terms, and provide for such sanctions and penalties as appropriate.

Upon any breach of this Agreement by Contractor, the Contract Owner shall have all remedies available to it both in equity and/or at law.

Build America Buy America (BABA)

The Build America Buy America Act, enacted as part of the Infrastructure Investment and Jobs Act on November 15, 2021, established a domestic content procurement preference for all Federal financial assistance obligated for infrastructure projects after May 14, 2022. The domestic content procurement preference requires that all iron, steel, manufactured products, and construction materials used in covered infrastructure projects are produced in the United States. Additional language is to be included in the agreement and in all subcontracts.

The Contractor acknowledges to and for the benefit of the London Water Cooperative (“Owner”) and the State of Oregon (the “State”) that it understands the goods and services under this Agreement are being funded with federal monies and have statutory requirements commonly known as “Build America, Buy America,” that requires all of the iron and steel, manufactured products, and construction materials used in the project to be produced in the United States (“Build America, Buy America Requirements”) including iron and steel, manufactured products, and construction materials provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Owner and the State (a) the Contractor has reviewed and understands the Build America, Buy America Requirements, (b) all of the iron and steel, manufactured products, and construction materials used in the project will be and/or have been produced in the United States in a manner that complies with the Build America, Buy America Requirements, unless a waiver of the requirements is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the Build America, Buy America Requirements, as may be requested by the Owner or the State. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Owner or the State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney’s fees) incurred by the Owner or the State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, any damages owed to the State by the Owner). If the Contractor has no direct contractual privity with the State, as a lender or awardee to the Owner for the funding of its project, the Owner and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

15. Bid Package Checklist

The Following are required as a minimum for a complete bid:

- ☒ Non-Collusion Certificate
- ☒ Subcontractor List
- ☒ Bidder’s Qualification Certificate
- ☒ Bid Bond Form
- ☒ Bid Bond
- ☒ Signed Proposal Form
- ☒ Schedule of Prices
- ☒ Acknowledgement of Receipt of Addenda

BID FORMS

NON-COLLUSION CERTIFICATE

State of Oregon)
) ss.
County of _____)

The undersigned, being duly sworn, deposes and says that the person, firm, association, co-partnership or corporation herein named, has not, either directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken any action in restraint of free competitive bidding in the preparation and submission of a proposal to the London Water Cooperative for consideration in the award of a contract on the improvement described as follows:

WATER TREATMENT PLANT REPLACEMENT

(Name of Firm)

By: _____
(Authorized Signature)

Title:

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

Notary Public

Corporate Seal:

FIRST-TIER SUBCONTRACTOR DISCLOSURE FORM

(OAR 137-040-0017)

PROJECT NAME: WATER TREATMENT PLANT REPLACEMENT

PROJECT #: _____

PROPOSAL CLOSING: DATE: June 12, 2025 TIME: 2:00 PM

DISCLOSURE DEADLINE DATE: 06/12/2025 TIME: 4:00 PM

This form must be submitted within two (2) hours of the advertised proposal closing date and time and no later than the DISCLOSURE DEADLINE stated above.

List below the Name, Address, Dollar Value, Construction Contractor Board (CCB) number if required, Contact Name and Telephone Number of each subcontractor that will be furnishing labor or materials that are required to be disclosed. Enter "NONE" if there are no subcontracts that need to be disclosed.

(IF NEEDED ATTACH ADDITIONAL SHEETS.)

NAME / ADDRESS	DOLLAR VALUE / CCB#	CATEGORY OF WORK	CONTACT NAME/PHONE #
1)	\$ CCB#		
2)	\$ CCB#		
3)	\$ CCB#		
4)	\$ CCB#		
5)	\$ CCB#		
6)	\$ CCB#		

The above listed first-tier subcontractor(s) are providing labor and/or materials with a Dollar Value equal to or greater than:

5% of the total Contract Price, but at least \$15,000 (including all alternates). (If the Dollar Value is less than \$15,000 do not list the subcontractor above); or

\$350,000 regardless of the percentage of the total Contract Price.

FAILURE TO SUBMIT THIS FORM BY THE DISCLOSURE DEADLINE WILL RESULT IN A PROPOSAL SUBMITTED BECOMING NON-RESPONSIBLE AND SUCH PROPOSALS SHALL NOT BE CONSIDERED FOR AWARD!

Proposals that are submitted by proposal Closing, but for which the separate disclosure submittal has not been made by the specified deadline, are not Responsive and shall not be considered for Contract award.

Form Submitted by (Proposer Name): _____

Contact Name: _____

Phone: _____

BIDDER'S QUALIFICATION CERTIFICATE

The undersigned hereby certifies and submits the following qualifications:

1. Name and Address

2. State of Oregon CCB License Number and expiration _____

3. Number of years in contracting business under present firm name _____

4. Particular types of construction work performed by your company:

5. List several recent construction projects performed:

Amount	Type	Owner	Name	Phone

6. Gross amount of contracts now in hand:

7. Bank reference(s):

By (Authorized Signature): _____

Title _____

BID BOND FORM

Herewith find deposit in the form of a certified check, cashier's check, or cash in the amount of \$_____ which is not less than five percent (5%) of the total bid.

Sign Here: _____

BID BOND

Know all men by these presents, that we _____ as Principal and _____ as Surety, are held and firmly bound unto the London Water Cooperative Oregon, as obligee in the penal sum of _____ dollars, for the payment of which the principal and the surety binds themselves, their heirs, executors, administrators, successors and assigns, jointly and severally, by these presents.

The condition of the obligation is such that if the obligee shall make any award to the principal for _____, according to the terms of the proposal or bid made by the principal therefore, and the principal shall duly make and enter into a contract with the obligee in accordance with the terms of said proposal or bid award and shall give bond for faithful performance thereof, with surety or sureties approved by the obligee; or if the principal shall, in case of failure to do so, pay and forfeit to the obligee the penal amount of the deposit specified in the call for bids, then this obligation shall be null and void; otherwise it shall be and remain in full force and effect and the surety shall forthwith pay and forfeit to the obligee, as penalty and liquidated damages the amount of this bond.

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

Principal _____

Surety _____

Return of deposit in the amount of \$ _____

Date _____

By _____

PROPOSAL

Contractor: _____

City: _____, Oregon

Date: _____, 20____

The Board of Commissioners

London Water Cooperative
72762 Shoestring Road
Cottage Grove, OR 97424

Pursuant to and in compliance with your invitation for bids and all other documents relating thereto, the undersigned bidder, having familiarized themselves with the terms of the contract, the local conditions affecting the performance of the contract, the cost of the work at the place where the work is to be done, proposes and agrees to perform, within the time stipulated, the contract, if this project is accepted, including all its component parts and everything required to be performed, and to provide and furnish any and all labor, materials, tools, expendable equipment, and all utility and transportation services necessary to perform the contract, complete, in a workmanlike manner, of all the work covered by the contract in connection with London Water Cooperative's project, designated as Water Treatment Plant Replacement all as required by and in strict conformance with the Specifications, contract Plans and the Standard Plans for the following unit prices.

Note: Unit prices of all items, all extensions and total amount of bid must be shown. Show unit prices in both words and figures and, where conflict occurs, the written or typed words prevail.

SCHEDULE OF PRICES

WATER TREATMENT PLANT REPLACEMENT					
ITEM NUMBER	ITEM DESCRIPTION	UNIT	QTY.	UNIT COST	TOTAL
10	MOBILIZATION, DEMOBILIZATION, SITE PREPARATION, AND CLEAN UP	LS	1		
20	SITE WORK	LS	1		
30	PACKAGE WATER TREATMENT PLANT	LS	1		
40	WATER STORAGE TANKS	LS	1		
50	WATER PIPING	LS	1		
60	DRAINAGE PIPING	LS	1		
70	ELECTRICAL WORK	LS	1		
80	RECORD DRAWINGS AND O&M MANUAL	LS	1		
TOTAL					

TOTAL BID AMOUNT:

Total Bid amount in words:

All bidders shall sign the proposal in the space provided.

The successful bidder shall execute and furnish the attached (no substitution allowed) performance bond within ten (10) calendar days after the date of award of contract unless a written extension is granted by the London Water Cooperative.

The Contractor agrees to perform the complete contract work as specified, including corrections, finish and cleanup by December 31, 2025, beginning the date given in the notice to proceed by the London Water Cooperative. Failure to complete within the specified completion time may result in liquidated damages in the amount of \$750 for each calendar day beyond the completion date.

The proposal, together with the Agreement, a Work Schedule Chart, Contract Documents, Standard Specifications, Special Provisions, Addenda and Plans, when endorsed by the London Water Cooperative shall become a contract binding on both parties thereto, whereby the Contractor agrees to perform the complete contract work, as specified, and the London Water Cooperative agrees to make payment to the Contractor, as specified, for said completed and accepted work.

Dated this _____ day of _____, 20_____.

Contractor_____

Address_____

Telephone_____ License No._____

By: _____

Title: _____

Attest: (If Corporation)

Witness: (If Individual or Partnership)

Acknowledgement of Receipt of Addenda:

No._____ Date_____ Initials_____

No._____ Date_____ Initials_____

CONTRACT FORMS

AGREEMENT

State of Oregon)
) SS
County of Jackson)

THIS AGREEMENT AND CONTRACT, made and entered into at **_____** Oregon, this ____ day of _____, 20____, by and between the London Water Cooperative, Oregon, a municipal corporation, hereinafter designated as the "Owner," and _____ hereinafter designated as the "Contractor,"

WITNESSETH:

That WHEREAS the Owner has heretofore caused to be prepared certain Plans and Specifications described as the Water Treatment Plant Replacement and the Contractor did on _____ day of _____, 20____, file with the Owner a proposal to construct said work and agreed to accept as payment therefore the sum fully stated and set forth in the proposal, and

WHEREAS, the said Contract Documents fully and accurately described the terms and conditions upon which the Contractor proposes to furnish said equipment, labor, materials, and appurtenances and perform said work, together with the manner and time of furnishing same;

WHEREAS, The Contractor acknowledges to and for the benefit of the London Water Cooperative ("Owner") and the State of Oregon (the "State") that it understands the goods and services under this Agreement are being funded with federal monies and have statutory requirements commonly known as "Build America, Buy America;" that requires all of the iron and steel, manufactured products, and construction materials used in the project to be produced in the United States ("Build America, Buy America Requirements") including iron and steel, manufactured products, and construction materials provided by the Contractor pursuant to this Agreement. The Contractor hereby represents and warrants to and for the benefit of the Owner and the State (a) the Contractor has reviewed and understands the Build America, Buy America Requirements, (b) all of the iron and steel, manufactured products, and construction materials used in the project will be and/or have been produced in the United States in a manner that complies with the Build America, Buy America Requirements, unless a waiver of the requirements is approved, and (c) the Contractor will provide any further verified information, certification or assurance of compliance with this paragraph, or information necessary to support a waiver of the Build America, Buy America Requirements, as may be requested by the Owner or the State. Notwithstanding any other provision of this Agreement, any failure to comply with this paragraph by the Contractor shall permit the Owner or the State to recover as damages against the Contractor any loss, expense, or cost (including without limitation attorney's fees) incurred by the Owner or the State resulting from any such failure (including without limitation any impairment or loss of funding, whether in whole or in part, any damages owed to the State by the Owner). If the Contractor has no direct contractual privity with the State, as a lender or awardee to the Owner for the funding of its project, the Owner and the Contractor agree that the State is a third-party beneficiary and neither this paragraph (nor any other provision of this Agreement necessary to give this paragraph force or effect) shall be amended or waived without the prior written consent of the State.

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

IT IS THEREFORE AGREED, first, that a copy of said General Conditions and other Contract Documents filed with the Owner, as aforesaid, do, in all particulars, become a part of the Agreement and Contract by and between the parties hereto in all matters and things therein set forth and described; and further, that the Owner and the Contractor hereby accept and agree to the terms and conditions of said Contract Documents as filed as completely as if said terms and conditions and plans were herein set out in full.

IN FAITH WHEREOF, witness the hands and seals of both parties hereto on the day and year in this Agreement first above written.

Contractor _____
By _____
Title _____

Attest (If Corporation)	Witness (If Individual or Partnership)
_____	_____
_____	_____

By _____
Title _____
(Owner Signature and Title) _____

PROTECTIVE, COMMERCIAL GENERAL LIABILITY, COMMERCIAL AUTOMOTIVE LIABILITY

ACORDTM CERTIFICATE OF LIABILITY INSURANCE						<div style="border: 1px solid black; padding: 2px 5px;">Clear</div> <div style="border: 1px solid black; padding: 2px 5px;">Save</div>	DATE (MM/DD/YYYY)
PRODUCER				THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW.			
INSURED				INSURERS AFFORDING COVERAGE		NAIC #	
INSURER A:				INSURER B:		INSURER C:	
INSURER D:				INSURER E:		INSURER F:	
COVERAGES							
THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. AGGREGATE LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.							
INSR ADD'L LTR INSRD	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE (MM/DD/YYYY)	POLICY EXPIRATION DATE (MM/DD/YYYY)	LIMITS		
GENERAL LIABILITY <input type="checkbox"/> COMMERCIAL GENERAL LIABILITY <input type="checkbox"/> CLAIMS MADE <input type="checkbox"/> OCCUR <input type="checkbox"/> _____ <input type="checkbox"/> _____ GEN'L AGGREGATE LIMIT APPLIES PER: <input type="checkbox"/> POLICY <input type="checkbox"/> PRO-JECT <input type="checkbox"/> LOC		POLICY NUMBER		POLICY EFFECTIVE DATE (MM/DD/YYYY)		POLICY EXPIRATION DATE (MM/DD/YYYY)	
AUTOMOBILE LIABILITY <input type="checkbox"/> ANY AUTO <input type="checkbox"/> ALL OWNED AUTOS <input type="checkbox"/> SCHEDULED AUTOS <input type="checkbox"/> HIRED AUTOS <input type="checkbox"/> NON-OWNED AUTOS <input type="checkbox"/> _____		POLICY NUMBER		POLICY EFFECTIVE DATE (MM/DD/YYYY)		POLICY EXPIRATION DATE (MM/DD/YYYY)	
GARAGE LIABILITY <input type="checkbox"/> ANY AUTO <input type="checkbox"/> _____		POLICY NUMBER		POLICY EFFECTIVE DATE (MM/DD/YYYY)		POLICY EXPIRATION DATE (MM/DD/YYYY)	
EXCESS/UMBRELLA LIABILITY <input type="checkbox"/> OCCUR <input type="checkbox"/> CLAIMS MADE <input type="checkbox"/> _____ <input type="checkbox"/> DEDUCTIBLE <input type="checkbox"/> RETENTION \$		POLICY NUMBER		POLICY EFFECTIVE DATE (MM/DD/YYYY)		POLICY EXPIRATION DATE (MM/DD/YYYY)	
WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? If yes, describe under SPECIAL PROVISIONS below		POLICY NUMBER		POLICY EFFECTIVE DATE (MM/DD/YYYY)		POLICY EXPIRATION DATE (MM/DD/YYYY)	
OTHER		POLICY NUMBER		POLICY EFFECTIVE DATE (MM/DD/YYYY)		POLICY EXPIRATION DATE (MM/DD/YYYY)	
DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES / EXCLUSIONS ADDED BY ENDORSEMENT / SPECIAL PROVISIONS							
CERTIFICATE HOLDER				CANCELLATION			
				SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING INSURER WILL ENDEAVOR TO MAIL _____ DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER NAMED TO THE LEFT, BUT FAILURE TO DO SO SHALL IMPOSE NO OBLIGATION OR LIABILITY OF ANY KIND UPON THE INSURER, ITS AGENTS OR REPRESENTATIVES.			
				AUTHORIZED REPRESENTATIVE			

PERFORMANCE AND PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: THAT whereas the London Water Cooperative, Cottage Grove, Oregon a municipal corporation has awarded to:

(Contractor)

hereinafter designated as the "Principal" a contract for work items, which contract consists of the Proposal/Agreement, together with the Contract Documents, Specifications, Addenda and Plans, all as hereto attached and made a part hereof, and more particularly described as:

WATER TREATMENT PLANT REPLACEMENT

and whereas said principal is required under the terms of said contract to furnish a bond for the faithful performance of said contract:

NOW, THEREFORE, we the Principal and the London Water Cooperative, a corporation, organized and existing under and by virtue of the laws of the State of Oregon, and duly authorized to do business in the State of Oregon as surety, are firmly bound unto the London Water Cooperative in the sum of _____ dollars (\$_____) lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that if the above bonded principal, his or its heirs, executors, administrators, successors or assigns, shall in all things stand to and abide by, and well and truly keep and perform the covenants, conditions and agreements in said contract, and shall faithfully perform all the provisions of such contract, and shall also well and truly perform and fulfill all the undertakings, covenants, terms, conditions and agreements of any and all duly authorized modifications of said contract that may hereafter be made, at the time and in the manner therein specified; and shall pay all laborers, mechanics, subcontractors and materialmen, and all persons who shall supply such person or persons, or subcontractors, with provisions and supplies for the carrying on of such work on his or their parts; and shall indemnify and save harmless the Owner's Engineer, its officers and agents, from any loss or damage occasioned to any person or property by reason of any carelessness or negligence on the part of said principal, or any subcontractor, in the performance of said contract or any modifications thereof; and shall further indemnify and save harmless the London Water Cooperative, its officers and agents, from any damage or expense by reason of failure of performance as required by said contract, or any modifications thereof, or from defects appearing or developing in the material or workmanship provided or performed under said contract within a period of one year after acceptance thereof by the London Water Cooperative, then this obligation shall become null and void, otherwise it shall be and remain in full force and effect.

And the said surety, for value received, hereby further stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the work to be performed thereunder or the Specifications accompanying the same shall in any way affect its obligation on this bond, and it does hereby waive notice of any change, extension of time, alternations or additions to the terms of the Contract or the work or to the Specifications. This Bond is provided pursuant to and shall be construed in accordance with Ch. 39.08 RCW.

IN WITNESS THEREOF, the said Principal and the said surety caused this bond and three (3) counterparts thereof to be signed and sealed by their duly authorized officers, this _____ day of _____, 20__.

Principal
By _____
Title _____

ATTEST (If Corporation)

WITNESSES (If Individual or Partnership)

CORPORATE SEAL

By _____
Title _____

APPROVED AS TO FORM

Surety _____
By _____ By _____
(Attorney for _____)

Address of local office and agent of Surety Company is:

CONTRACTOR'S DECLARATION OF OPTION FOR MANAGEMENT OF STATUTORY RETAINED PERCENTAGE

Prior to beginning the project, complete and submit the “**Statement of Intent to Pay Prevailing Wages**” (Sample of the form is provided under the Prevailing Wages section, actual form shall be obtained from the State)

Retainage is held by the Owner following Substantial Completion. Contractor shall be responsible for paying the necessary insurance to the State of Oregon. Retainage will not be released until after the Owner receives the Contractor completed **Certification of Industrial Insurance Paid and Request for Release** form and all other contract requirements are met. If Contractor wishes to have retainage invested, fill out form below and submit to the Owner prior to first progress payment.

- A.** I hereby elect to have the retained percentage of this contract held in a fund by the Owner.

Signature _____ Date _____

- B.** I hereby elect to have the Owner deposit the retained percentage of this contract in an interest-bearing account, not subject to withdrawal until after final acceptance of the work.

Signature _____ Date _____

- D.** I hereby elect to have the Owner invest the retained percentage of this contract from time to time as such retained percentage accrues.

I hereby designate _____
as the repository for the escrow of said funds.

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 Owner shall not be liable in any way for any costs or fees in connection therewith.

Prior to the Owner investing any fund in an escrow account, the Contractor shall obtain a letter from the repositor on their letterhead stating their acceptance of the account, the account number and a statement that they will not release any funds until authorized in writing by the Owner.

Signature _____ Date _____

Certification of Industrial Insurance Paid and Request for Release

Prior to beginning the project the following shall be completed and copied to the Owner:

- “**Statement of Intent to Pay Prevailing Wages**” (Sample of the form is provided under the Prevailing Wages section, actual form shall be obtained from the State)
- If Contractor is self-insured, provide proof via letter correspondence from *Labor and Industries Self-Insured Certification Services* stating self-insurance is in good standing and will be for duration of the project.

Prior to project closeout and release of retainage the Contractor shall provide the Owner with the following information for all work on the project *including* subcontractors work:

- Complete and submit the State form “**Affidavit of Wages Paid**” (sample of this form is provided under the Prevailing Wages section. Actual form shall be obtained from the State)
- Provide a copy of the **Worker’s Compensation Rate Notice** from the Washington State Department of Labor and Industries
- Complete and submit the statement provided below certifying that all industrial insurance has been paid for all work performed on this project

Certification of Industrial Insurance Paid

I _____ (Contractor) hereby certify that all industrial insurance has been paid to the State of Oregon as required by law for all work on this project including the work of subcontractors and that the Owner shall be indemnified and held harmless from any and all claims arising from disputes over payment of industrial insurance with the State or any other person or entity.

Signature _____

Date _____

Business Name _____

L & I Account ID _____

Unified Business ID (UBI) _____

PREVAILING WAGES

PREVAILING WAGES

Prevailing wage rates for this project area and size can be found at the Oregon Bureau of Labor Industries (BOLI) or on the Web at: [HTTP://WWW.OREGON.GOV/BOLI](http://www.oregon.gov/boli)

TECHNICAL SPECIFICATIONS



EXPIRES: 12/31/2025

London Water Cooperative Water Treatment Plant Replacement

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Division 1

General

1.10 GENERAL

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

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

1.10.16 Definitions

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

Calculation(s): When the contract documents require the Contractor to provide calculations, those calculations must be prepared and stamped by a Professional Engineer licensed to practice in the State where the project is constructed or where components requiring calculations are fabricated.

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

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

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

Provide: When used in context of the Owner “providing” items such as materials, water, equipment, etc., “provide” means that the items are available, but it is the Contractor’s responsibility to pick up, haul, off-load, secure, manage, install, test, make provisions for, and provide all work necessary that is not specifically noted as being performed by the Owner.

1.11.00 Summary of Work/Project Narrative

The London Water Cooperative (LWC) is replacing the existing treatment plant with a new, packaged water treatment plant system, and adding two new water storage tanks. Work includes retrofitting the existing concrete water intake vault with a new lockable steel access hatch, installation of two new 10,000 gallon polypropylene water tanks, installation of a new package water treatment plant, yard piping improvements including new pipes, valves, and modifications to the existing yard piping, and electrical improvements including a new power service drop to a new meter.

The treatment train consists of cartridge pre-filtration, cartridge long term 2 enhanced water treatment (lt2) filtration, ultraviolet light disinfection, and chlorination. LWC intends to repurpose the two existing 10,000-gallon steel water storage tanks to store raw water to buffer the raw water supply to improve the batch water treatment process. LWC also plans to use the existing treatment plant to pre-filter raw water prior to storage in the repurposed storage tanks (raw water storage tanks). Raw water from the raw water storage tanks will be treated in the new packaged water treatment plant, and then stored in the two new 10,000-gallon polypropylene water storage tanks. Treated water from the storage tanks will be pumped via pumps integral to the new treatment plant into the distribution system. Project design includes piping modifications to allow for a wide range of operational flexibility under several operational scenarios that are described in 1.75.16.52 System Operations Testing.

1.11.02 Reuse of Documents

Contractor and any Subcontractor or Supplier shall not:

1. Have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions; or
2. Reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer.
3. The prohibitions of this Paragraph will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

1.11.03 Electronic Data

1. Unless otherwise stated in the Supplementary Conditions, the data furnished by Owner to Contractor, or by Contractor to Owner, that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.
2. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 30 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 30-day acceptance period will be corrected by the transferring party.
3. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

4. Computer Aided Design (CAD) files may be made available to the Contractor upon request, but only at the discretion of the Engineer. This includes AutoCAD™, Civil3D™, or other similar file types. If CAD files are provided, no level of accuracy is implied or should be assumed unless the Engineer expressly states a level of accuracy. CAD files by nature include extraneous information used to develop the drawings but are not part of the final design. Any use of CAD files is solely at the Contractor's risk and neither the Engineer nor the Owner take responsibility for interpretations by the Contractor, missing information, or inaccurate information.

1.13 Permits and Licenses

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

- Electrical Permit from Lane County
- Mechanical/Plumbing Permit from Lane County
- Aboveground Tank Installation Permit from Lane County

Copies of permits the Contractor has acquired shall be made available to the Owner upon request.

1.14 Work Restrictions

1.14.19 Use of Site

The Contractor shall not perform work activities, store materials or equipment, move equipment through, or disturb in any way the areas outside the Construction Limits shown on the Plans unless approved by the Owner in writing. Existing LWC Water Treatment Site may be utilized for staging and storage purpose, and all such use shall be coordinated with the Owner.

The Contractor shall provide, maintain, and adjust erosion control fencing, surface covering, and sediment traps for storm-water runoff prior to beginning any work activities within this area.

The project site is located within 200 feet of existing residential dwellings. The Contractor shall make a reasonable effort to minimize construction noise and disturbances to neighbors which shall include the following restrictions:

- On-site work shall be limited to the hours **7:00 AM – 6:00 PM Monday through Saturday**. No construction work shall be permitted on Sunday, unless permission is granted by the Owner.
- The site is accessed via a private gravel road used by multiple residents. The Contractor shall not park construction vehicles on this road at any time.
- Construction vehicles using the private access gravel road shall drive at a **10 MPH** or slower to minimize the amount of dust generated.

1.20 PRICE AND PAYMENT PROCEDURES

1.21.29 Quantity Allowances

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

1.21.55 Cost Increases for Materials

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

1.25.00 Substitution Procedures

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

Requests shall include an explanation of why the request is being made along with drawings, details, specifications, and samples sufficient to allow the Owner to evaluate the proposed substitute. Requests shall include any change necessary in construction methods with a detailed description and related drawings of the proposed methods. Provide an itemized comparison of each proposed substitution with the specified product or method. If the Contractor believes there are no variations from the bid documents, include a statement to that fact in the request for substitution.

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

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

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

1.25.13.10 Substitutions Prior to Bid Opening

Before opening bids, the Owner may consider written requests from product suppliers or prime bidders for substitutions. All requests for substitution must be received by Owner a minimum of 7 working days prior to bid opening. Requests shall be accompanied by drawings and specifications in sufficient detail to allow the Owner to determine whether or not the substitute proposed is equal to that specified. All requests shall include a listing of any significant variations in material or methods from those specified. If there are no variations, a statement to that fact shall be included in the request for approval. The determination as to whether or not a proposed substitute is acceptable shall rest solely with the Owner. Approval of substitutions will be only by addendum. The bidder shall include in their proposal all costs for any modifications required to adopt the substitute.

1.25.13.15 Substitutions After Contract Execution

Within 30 calendar days after the date of the contract, the Owner shall consider formal requests from the Contractor for a substitution of products in place of those specified. Submit two hardcopies or one electronic version of each request for a substitution. Data shall include the necessary change in construction methods, including a detailed description of the proposed method and related drawings illustrating the methods. An itemized comparison of each proposed substitution with product or method specified shall be provided.

In making a request for a substitution, the Contractor represents that they have investigated the proposed product or method and has determined that it is equal or superior to the product specified. The Contractor shall coordinate the installation of accepted substitutions into the work, making changes that may be required for the work to be completed. The Contractor waives all claims for additional costs related to substitutions.

1.30 ADMINISTRATIVE

1.31 Project Management and Coordination

1.31.01 Contractor's Responsibility

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

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

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

The Contractor and each of the Subcontractors are responsible for coordinating the required inspections. There are specific requirements for inspection responsibilities and the advance notice that must be given to minimize construction delays. It is the Contractor's responsibility

to be familiar with these requirements, include the coordination necessary in this estimate of project costs and schedule, and to comply with the requirements during construction. Failure to follow proper inspection and notification procedures may result in on-site work stoppages and removal or demolition of unapproved structures or systems, all at the Contractor's expense. See Starting and Adjusting section for details.

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

Contractor shall not operate valves or any part of the Owner's system. Where system shut downs are required or service to customers will be interrupted, provide 48-hours minimum notice to the Owner. Owner will notify its customers of planned shut downs.

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

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

1.31.19 Progress Meetings

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

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

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

13. Effect of proposed changes on progress schedule and coordination.
14. Safety issues relating to work.
15. Other business relating to work.

1.32.13 Scheduling of Work

Refer also to the Completion Time section under the Instructions (or Information) to Bidders.

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

Should the Contractor want to perform work activities on a non-working day or at a non-working time, the Contractor shall submit a request to the Owner. The Contractor shall not perform work activities on a non-working day or time without prior approval from the Owner. A non-working day is defined as any day on which normal work activities are not conducted, such as a Holiday or weekend. Non-working time is defined as any time during which normal work activities are not conducted, such as at night. Owner may delay monthly progress payments if Contractor fails to submit non-working day requests.

1.32.16 Construction Progress Schedule

Contractor is responsible for providing an up-to-date construction schedule with each monthly pay estimate and at other times as requested by the Owner or as required by progress of the work. If the current schedule is still in-line with the previous schedule, the Contractor shall inform the Owner with each pay estimate. Non-working day requests shall also be submitted by the Contractor with each monthly pay estimate. Owner may delay monthly progress payments if Contractor fails to submit updated schedule and non-working day requests.

1.32.29 Periodic Work Observation

The Owner may elect to request a third-party observer on site to monitor, observe and record construction progress. The Contractor maintains complete responsibility to verify construction is meeting the design intent and is being constructed in accordance with the Plans and specifications. The Contractor is solely responsible for maintaining safe working conditions in accordance with all local, state, and federal laws and regulations. Owner's observer shall, in accordance with the standard of care, immediately recommend stopping work if unsafe conditions are observed; however, the observer shall at no time be responsible for the site safety of others, nor directly control or manage the Contractor's work.

1.33 Submittals

1.33.23 Shop Drawings, Product Data, and Samples

Submittals are required for all items installed in this contract.

Email submittals to:

Tyler Duncan at tduncan@rh2.com

Submittals shall be provided in electronic format via email. The Owner assumes no responsibility for emails that do not make it to the recipient. Submittal responses will be provided electronically to the Contractor via email. If submittals and/or submittal responses are too large to email, they can be uploaded via RH2's Microsoft OneDrive account, or a different electronic file sharing platform.

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

Items that are installed in the work that have not been approved through the submittal process shall be removed and an approved product shall be furnished, all at the Contractor's expense. Shop drawing review will be limited to general design requirements only and shall not relieve the Contractor from responsibility for errors or omissions, or responsibility for consequences due to deviations from the contract documents. No changes may be made in any submittal after it has been reviewed except with written notice and approval from the Owner.

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

- Project Name as it appears on the Document Cover.
- Prime Contractor and Applicable Subcontractor.
- RH2 Engineering.
- Owner's Name (London Water Cooperative).
- Applicable Specification and Drawings Reference.
- A stamp or statement that the Contractor has checked the equipment for conformance with the contract requirements, coordination with other work on the job, and dimensional suitability.
- A place for the Engineer to respond. (Engineer may elect to respond using the Engineer's standard forms.)

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

Shop drawings and submittals shall contain the following information:

1. Drawings, dimensions, and weights.
2. Catalog information.
3. Model number, including descriptions for option and accessory codes.
4. Manufacturer's specifications.

5. Special handling instructions.
6. Maintenance requirements.
7. Wiring and control diagrams.
8. List of contract exceptions.

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

By approving and submitting shop drawing and samples, the Contractor warrants that they have determined and verified all field measurements, field construction criteria, materials, catalog numbers, and similar data, and have checked and coordinated each shop drawing with the requirements of the work and of the contract documents.

The Owner will pay the costs and provide review services for a first and second review of each submittal item. Additional reviews shall be paid by the Contractor by withholding the appropriate amounts from each payment estimate.

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

1.40 QUALITY REQUIREMENTS

1.42.19 Reference Standards

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

- Lane County Municipal Code
- IBC International Building Code
- UPC Uniform Plumbing Code
- IMC International Mechanical Code
- IFC International Fire Code
- NEC National Electrical Code
- AWWA American Water Works Association
- ANSI American National Standards Institute
- ASA American Standards Association
- ASTM American Society for Testing and Materials
- ODOT Oregon Department of Transportation
- OESC Oregon Electrical Specialty Code

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|----------------------------------|--|
| • OMSC | Oregon Mechanical Specialty Code |
| • OPSC | Oregon Plumbing Specialty Code |
| • OSSC | Oregon Structural Specialty Code |
| • Oregon Standard Specifications | Oregon Standard Specifications for Construction published by the Oregon Department of Transportation and the American Public Works Association |

1.43.20 Warranty

The Contractor shall warrant all work and products for a period of one (1) year following project acceptance except for additional warranties for specific items as described in these specifications. The date of project acceptance is defined as the date the final payment is sent to the Contractor from the Owner

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

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

- Division 7.20.02 Electrical Heat Tracing Systems
- Division 8.31.20 Vault Hatches
- Division 11.97 Water Storage Tanks

1.45.16 Field Quality Control Procedures

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

The Contractor shall schedule and arrange for the following inspections and tests with the appropriate reviewing agency and testing company.

- Special Inspections as required per IBC Division 17 and as noted on the drawings
- Any additional inspections required by approval agencies
- Soils and crushed rock compaction
- Pressure testing
- Water quality testing

1.50 TEMPORARY FACILITIES AND CONTROLS

1.51 Temporary Utilities

The Contractor is responsible for providing all necessary water for construction-related fire protection and utilities required by this contract, or by laws and regulations.

The Contractor is responsible for providing all sanitary facilities adequate for all workers. Sanitary facilities shall comply with all codes and regulations.

Temporary 120V AC electrical power is available at the site. The Contractor may use existing power facilities upon consultation with the Owner.

Temporary water is available at the site. Temporary water is assessable via a ¾-inch hose bib treated water connect in the existing pump station. The Contractor may use existing water upon consultation with the Owner.

1.52.00 Construction Facilities

The Contractor is responsible for construction and location of all field offices, all necessary gates and barricades, fences, handrails, guard rails, and securities required by this contract, or by laws and regulations. There shall be shelters and dry facilities for the workers as required. The contractor shall provide all guards, marks, shields, protective clothing, rain gear, and other equipment required by law, ordinance, labor contracts, Occupational Safety and Health Administration (OSHA) regulations, and other regulations for the maintenance of health and safety. First aid kits and equipment as required by law shall also be supplied.

1.52.20 Locks and Keys

All devices requiring locks, including but not limited to access hatches, electrical enclosures, etc. shall be configured to match Owner standard lock and keys. The Contractor shall provide and install the mortise cylinders and cores.

Owner will provide one or more keys to the Contractor for existing Owner locks. The Contractor is responsible for all Owner provided keys until returning them to the Owner. If the Contractor loses the key, the Contractor will pay for re-coring of all Owner locks that use that key.

1.54 Construction Aids

The Contractor or product manufacturer may include work, materials, or components to aid in shipping, storage, installation, or other work for their convenience. Such items shall be removed prior to final project acceptance if they may interfere with the operation or maintenance of permanent work. Some examples include, but are not limited to:

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

1.55.26 Traffic Control

Any traffic control activities required during construction shall be consistent with the Uniform Traffic Control Manual, latest edition and applicable local codes. The Contractor shall limit delay of traffic to 5 minutes.

If flaggers are used, orientation meetings per Section 00225 of the Oregon Standard Specifications, shall be held each time a new flagger is introduced to the site or if site conditions change significantly. The Contractor is responsible for scheduling such meetings.

1.56 Responsibility for Damage to Work, Property, and Facilities

As used in this Subsection, the term "Contractor" shall include the Contractor's agents, Subcontractors, and all workers performing Work under the Contract.

The Contractor shall be solely responsible for damages caused to the Work, the Property, Facilities, and Equipment arising from:

- The Contractor's operations
- The Contractor's negligence, gross negligence, or intentional wrongful acts
- The Contractor's failure to comply with any Contract provision
- Any damages, including theft, vandalism, arson, criminal mischief, or other criminal or illegal behaviors, that are the result of Contractor negligence in site security.

If the damage meets the conditions above, the Contractor shall repair all damages to Work performed, Materials supplied, and Equipment incorporated into the Work at the Contractor's expense.

1.61.31 Integrated (or Package) Products

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

- Pump stations
- Treatment systems
- HVAC systems
- Motor Control Centers
- Control systems

1.70 EXECUTION AND CLOSEOUT REQUIREMENTS

1.71 Examination and Preparation

1.71.23.16 Construction Surveying

The Contractor is responsible for locating all components necessary for construction and installation as shown on the Plans, and survey work may be required. All survey work shall be administered and approved by a registered professional land surveyor licensed in the State of Oregon. Provide a redlined set of Plans to the Owner for as-built purposes.

Replace all damaged survey monuments in accordance with ORS 209.150.

1.74 Cleaning and Waste Management

1.74.13 Progress Cleaning

Site and facility must be kept clean and orderly such that Owner staff may have access to the facility at any time. The Contractor shall promptly clean facility if requested by the Owner.

1.74.23 Final Cleaning

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

Clean up debris and unused material and remove from the site and any buildings. If construction vehicle traffic causes ruts or other damage to the private access gravel road leading to the site, the Contractor shall repair the road which may include, but is not limited to the following actions:

- Regrading of road
- Resurfacing of road

All costs associated with clean up and repair are incidental to the project and shall be borne by the Contractor.

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

Equipment shall be washed clean using appropriate methods.

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

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

1.75 Starting and Adjusting

1.75.16 Startup Procedures

1.75.16.10 Startup

See the Automatic Control section for control system startup.

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

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

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

1.75.16.12 Startup and Testing Coordination

The Contractor shall conduct testing and startup of all parts of the project except the Packaged Water Treatment Plant (WTP), which will be tested and started up by a representative from Precision Pumping Systems (PPS). However, the Contractor shall coordinate with the Owner and be available to assist the representative from PPS during the startup and testing of the Packaged WTP. Refer to Division 11.60 for more information regarding the Packaged Water Treatment Plant. Testing and startup shall not be a cause for claims for delay by the Contractor and all expenses for testing and startup shall be incidental to this contract.

The placing of all improvements in service shall consist of three parts: “testing”, “startup”, and “operation”. Not less than 14 calendar days before the anticipated time for beginning testing, the Contractor shall notify and submit to the Owner for approval, a complete plan for the following:

1. Schedules for tests:
 - A. Hydrostatic Pressure Testing
 - B. Water Storage Tank Leak Test
 - C. System Operations Testing
2. Detailed schedule of procedures for startup.
3. Complete schedule of events to be accomplished during testing.
4. An outline of work remaining under the contract that will be carried out concurrently with the operation phases.

Failure to provide proper notification to the Owner may lead to liquidated damages if schedule cannot be maintained. If rescheduling is required because components are not

ready for testing, the notification requirements are reset as needed to provide 14 calendar days advance notice to reserve the Engineer's and/or the Owner Representatives' time.

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

1.75.16.20 Testing

Work requiring testing shall be made accessible during the normal sequence of work. Timely notice to the Owner for such testing shall be provided. Should any work be covered up without notice, approval, or consent, it must, if required by the Owner, be uncovered for examination at the Contractor's expense. All necessary equipment shall be set up and the work given a preliminary test so that defects may be discovered and repaired prior to calling out the Owner to witness the test.

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

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

1.75.16.22 Scheduling of Owner Review for Testing

See Division 1.75.16.12 for scheduling and notification requirements.

The Contractor shall provide notification two (2) working days and four (4) working hours (to confirm readiness) of the scheduled test(s) to the Owner confirming that the Contractor has successfully completed all preliminary testing and that all equipment, tools, materials, labor, subcontractors, manufacturer's representatives, and all other items required for witnessed testing are available and fully functional. Failure to provide advance notification and confirmation or meet any of the testing requirements will constitute a failed test in accordance with the section Inspection and Tests of the General Conditions.

A detailed testing schedule shall be provided by the Contractor and updated as needed to be at least 48 hours ahead of actual testing. If testing requires downtime in order to perform repairs due to failed test, the Contractor shall pay the Owner in the amount of \$200 per hour per Owner Representative on site (minimum of \$400 per scheduled visit) for downtime lasting longer than 1 hour required to complete repairs to verify the complete construction is ready for startup and operation. This amount will be deducted from the appropriate bid item that relates to the finished construction and documented by the Owner at their discretion. The Contractor must have all systems pre-tested prior to calling the Owner for formal testing.

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

1.75.16.32 Pump Testing

Pumps located in the Packaged WTP shall be tested by a representative of PPS. During onsite pump testing, the Contractor shall coordinate with Owner and be available to assist with the testing.

1.75.16.35 Treatment System Testing

The treatment system located in the Packaged WTP shall be tested by a representative of PPS. During onsite treatment system testing, the Contractor shall coordinate with Owner and be available to assist with the testing.

1.75.16.40 Electrical and Control Systems Testing

The electrical and controls system located in the Packaged WTP shall be tested by a representative of PPS. During onsite electrical and controls testing, the Contractor shall coordinate with Owner and be available to assist with the testing.

1.75.16.50 Reservoir Testing and Disinfection

Part 3 – Execution

Preparation

The Owner will provide water for the initial testing of the reservoir at no cost to the Contractor. Should the initial test not pass, or the water sits in the reservoir and becomes unusable, the costs for additional water and tests shall be the responsibility of the Contractor. Do not damage surrounding properties when draining the reservoir.

Prior to disinfection, clean all surfaces and permanent equipment to the satisfaction of the Owner with pressurized potable water and/or scrubbing as appropriate for the reservoir size and type of equipment. After cleaning the surface shall be free of visible dust, dirt, oil, grease, blast media, and similar substances.

Sweep up debris, do not wash into the drainpipe. Suspended sediment may be washed through the drainpipe if allowed by the Owner, but the drainpipe must be cleared of sediment and sediment may not leave the site by storm water transport.

Cleaning

Follow the procedures of AWWA C652 Section 4, at a minimum, before placing the facility in service. Any of the three chlorination methods are allowed. The method descriptions below are a synopsis of C652 but are not comprehensive and may include modifications to C652. Follow all relevant procedures in C652 and as modified herein.

Water with a chlorine residual shall be stored and aerated or otherwise neutralized until it can be safely disposed of in accordance with all applicable regulations. All disposal is the

responsibility of the Contractor. Water containing a chlorine residual shall not be conveyed into the water system, stormwater system, or any surface watercourse.

1. Chlorination Method 1.

- a. Disinfect all surfaces above the overflow by spraying or brushing with 200 mg/L chlorine solution.
- b. Fill to the overflow level with potable water while adding enough chlorine to provide, when full, a free chlorine residual between 10 mg/L and 15 mg/L at the end of the retention period. The retention period is no less than 6-hours if chlorine is injected into the water as it enters the reservoir, or 12-hours if chlorine is added by pouring into the reservoir during filling.
- c. Following the retention period, record the free chlorine residual then reduce the free chlorine residual to 2.0 to 3.0 mg/L by partially draining and blending with system water. Alternately, completely drain the reservoir and refill with system water, but only if the system water has a chlorine residual no less than 0.5 mg/L or chlorine is added while filling to achieve 0.5 to 1.5 mg/L. Record the residual chlorine immediately following filling.

2. Chlorination Method 2.

- a. Disinfect all interior surfaces including walls, floor, piping, ceiling, columns, ladders, stairs, and appurtenances. Apply a chlorine solution containing not less than 200 PPM of chlorine using spray equipment or brushes. Chlorine solution may be re-circulated during disinfection unless it becomes contaminated or drops below 100 PPM. Open and close all valves several times during the chlorination. Liquid chlorine, sodium hypochlorite, or calcium hypochlorite may be used for disinfection purposes. Disinfected surfaces shall remain in contact with the strong chlorine solution for at least 30 minutes. Fill drainpipe with 10 ppm solution.
- b. If it will be more than 24 continuous hours between initial disinfection and filling, wash chlorine solution off any stainless steel using potable water no less than 30 minutes nor more than 12 hours after disinfection.
- c. Following initial disinfection, fill to overflow with potable water. Filling must occur as soon as practical after disinfection and the 30-minute waiting period. If filling is delayed for more than one week, the disinfection shall be repeated. Purge the water in the drainpipe prior to complete filling of the reservoir (dechlorinated if necessary). Record the free chlorine residual immediately after filling.

3. Chlorination Method 3.

- a. Disinfect all surfaces above the overflow by spraying or brushing with 200 mg/L chlorine solution.
- b. Fill 5-percent of the total storage volume with water and chlorine to achieve between 50 mg/L and 80 mg/L free chlorine residual. Hold for 6 to 12 hours.

- c. Following the hold period, record the free chlorine residual, then immediately begin filling with potable system water to the overflow level. Measure the free chlorine residual amount once full. Hold for 24 to 48 hours. Purge water from the drain pipe following the hold period.

Upon completion of disinfection, thoroughly flush the entire potable water system allowing two complete exchanges of contents. The Constructor may choose not to completely flush the two 10,000 gal tanks (i.e. fill to overflow and drain). Instead, the Constructor may choose to thoroughly rinse the inside walls of the tanks using treated water. Do not discharge chlorinated material to storm or surface water systems without thoroughly neutralizing the chlorine residual remaining in the water in accordance with AWWA C655 for field dechlorination.

Upon completion of flushing, refill the tanks with potable water and coordinate with the Owner to take a sample from each tank for microbiological analysis.

Field Tests

The following applies to all three chlorination methods.

Following the procedures and hold periods discussed in the preceding sections, let the water sit for 24 hours. A water sample will then be taken by the Owner from the reservoir and from the existing water supply for reference. A laboratory certified by the Oregon Department of Environmental Quality will be retained by the Owner to perform a bacteriological test of the samples. Test for the following parameters, minimum.

- Chlorine residual.
 - After 24 hours, the water must have a chlorine residual no less than 2.0 ppm or 50-percent of the chlorine residual when the tank was filled, whichever is less. If the value is less, the reservoir shall either be re-dosed with chlorine, or drained and re-sterilized, at the Owner's discretion.
- Coliform (absence required)
- pH (6.5 to 8.5)
- Alkalinity
- Turbidity
- Conductance (700 Ohms/cm max)
- See Reservoir Soak Test section for additional test parameters.

Alkalinity and turbidity do not have fixed values to meet but should be near those of the water used for filling. The Owner will determine if the values are acceptable.

The reservoir shall not be placed in service until passing test results have been received and approved by the Owner and the necessary documents have been submitted to the Oregon Health Authority. If all tests are satisfactory and the chlorine residual is above 1.5 mg/L, reduce the chlorine residual by partially draining and blending with system water to achieve a residual of 0.5 to 1.5 mg/L before placing the reservoir in service.

1.75.16.51 Reservoir Leakage Warranty

The Contractor shall repair any leaks, running water, wet spots, etc., appearing within the warranty period stated in division 1.43.20. Any such repairs are subject to an additional 3-year warranty starting the date the Owner accepts the repair.

1.75.16.52 System Operations Testing

Upon completion of all other testing and startup, the Contractor shall coordinate with the Owner to perform three (3) Operational Scenario tests to ensure the system performs correctly under the three different operating scenarios described below:

Operational Scenario 1: Upon completion of this project, this is how the system will operate.

1. Pretreat raw water via the existing treatment plant
2. Store pre-treated water in the existing tanks
3. Treat pre-treated water via the new treatment plant
4. Store treated water in the new water tanks
5. Pump treated water into the distribution system

Operational Scenario 2: Eventually, the existing treatment plant will be taken offline.

1. Store raw (untreated) water in the existing tanks
2. Treat raw water via the new treatment plant
3. Store treated water in the new water tanks
4. Pump treated water into the distribution system

Operational Scenario 3: Eventually, the existing water storage tanks will also be taken offline.

1. Treat raw water received directly from the source via the new treatment plant
2. Store treated water in the new water tanks
3. Pump treated water into the distribution system

Controls Narrative:

The following is a Control System Narrative intended to provide the Contractor with a general overview as to the system control strategy that will be implemented by the Owner upon project completion. This narrative pertains only to controls outside of the existing and new water treatment plants. Controls within the existing treatment plant will be modified by the Owner, as necessary, and PPS will provide SCADA integration for the new treatment plant. The Contractor shall not perform control integration work but should be aware of the operation intent of the improvements and will support the Owner and PPS throughout the SCADA integration process.

Under all three operational scenarios, if the water level in the two (2) treated water storage tanks drops below a level of 2 feet above the centerline of the water discharge pipe, the Package Water Treatment Plant shall turn on, and begin supplying treated water to the tanks until the water level is raised back up to 6 inches below the overflow pipe as measured by the

level transducers. However, if the water in the existing tanks (which are supplying the packaged WTP) drops below 2 feet from the center line of the discharge pipe, the new Packaged WTP shall shut off and remain shut off regardless of the level of water in the new tanks. The new Packaged WTP shall remain shut off until the water level in the existing tanks rises above the 2 feet mark as described above.

Under Operational Scenario 2, the new electrically actuated control valve shall be used to control water levels within the existing tanks repurposed to store raw water. When the water level in the two (2) raw water storage tanks drops below a level of 2 feet above the centerline of the water discharge pipe, the Package Water Treatment Plant shall turn on, and begin supplying treated water to the tanks until the water level is raised back up to 6 inches below the overflow pipe as measured by the existing level transducer.

1.78 Closeout Submittals

1.78.23 Operation and Maintenance Data

See also the Division 17 Automatic Controls section for additional requirements for automatic control systems manuals. Detailed requirements for specific equipment and systems may also be included in their respective specification sections.

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

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

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

Products

- A. Identification including brand name, model number, and serial numbers.
- B. Date of manufacture and date of installation on job site.
- C. Complete as-built elementary wiring and one-line diagrams.
- D. Complete parts list, by generic title and identification number, complete with exploded views of each assembly.

Maintenance

- A. Recommended spare parts.
- B. Lubrication schedule including the applicable lubricant designation available from the Standard Oil Company of California.

- C. Recommended preventive maintenance procedures and schedules. Schedule shall be provided for daily, weekly, monthly, quarterly, semi-annually and annually maintenance.
- D. Disassembly and re-assembly instructions including parts identification and a complete parts breakdown for all equipment.
- E. Weights of individual components of each item of equipment weighing over 50 pounds.
- F. Name, location, and telephone number of the nearest suppliers and spare parts warehouses.
- G. All manufacturers' warranties. Include name, address, and telephone number of the manufacturer's representative to be contacted for warranty, parts, or service information.
- H. Cleaning, repair, and maintenance instructions for each coating system.
- I. Provide USB flash drive or DVDs utilized in the manufacturer's instruction program.

Operation

- A. Recommended troubleshooting and startup procedures.
- B. Recommended step-by-step operating procedures.
- C. Emergency operation modes, if applicable.
- D. Normal shutdown procedures.
- E. Long term shutdown (mothballing) procedures.
- F. Equipment specifications and guaranteed performance data.
- G. General manuals which describe several items not in the contract will not be accepted unless all references to irrelevant equipment are neatly eradicated or blocked out.

Compile all operation and maintenance information described above into a single PDF file. The information shall be assembled and indexed so that information on each coating and piece of equipment can be readily found. Submit all operations and maintenance manuals in the single PDF file format to the Engineer.

The PDF file shall be based upon the following types of sources: original PDF files from the manufacturers and / or PDF files created directly from other electronic file formats such as .doc, .docx, .xls, .xlsx, or .dwg but not image formats such as .jpg or .TIF. The use of image formats may be approved, but on a case by case basis. In general, scanning hardcopies into PDF files is not acceptable. Doing so may be approved, but on a case by case basis.

Use standard page sizes which are:

- 8½ inches by 11 inches
- 11 inches by 17 inches
- 22 inches by 34 inches

In addition to the compiled PDF, items such as spreadsheets, images, and other digital information that may be useful or needed by operations staff shall be included in the appropriate editable file formats, such as Excel spreadsheet files and image file formats, for example.

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

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

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

1.78.39 Project Record Documents

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

The Contractor shall provide one (1) set of hard copy records made on clean unmarked ANSI D-size hard-copy prints and provide a set of records in PDF format.

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

See also electrical plan requirements in Division 16.05.

1.79 Demonstration and Training

1.79.10 Training

See the Automatic Control section for automatic control systems training.

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

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

1.80 PERFORMANCE REQUIREMENTS

1.81 Facility Performance Requirements

1.81.30 Seismic Restraint and Anchorage

Contractor shall furnish seismic restraint for the new water tanks, and any equipment, tanks, machinery, piping, valves, conduit, and other mechanical and electrical components for which

anchorage is not shown in the plans. Note that all anchorage for the new water treatment plant will be provided by PPS.

Seismic restraint shall be designed to meet IBC (ASCE 7 Chapter 13 – “Seismic Design Requirements for Nonstructural Components”) code requirements. The following design values shall be used in calculating seismic forces:

$I_p = 1.5$	$S_{ds} = 0.8$	Seismic Design Category = D
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A complete seismic restraint system shall be provided including struts, straps, bolts, nuts, washers, etc. as required for secure attachment to foundations, pads, ceilings, floors, and/or walls.

Contractor shall submit either of the following in accordance with ASCE 7, 13.2.1 for all components:

1. Project-specific design and documentation prepared and submitted by a registered design professional.
2. Submittal of the manufacturer’s certification that the component is seismically qualified by
 - a. Analysis
 - b. Testing in accordance with the alternative set forth in ASCE 7, Section 13.2.5.
 - c. Experience data in accordance with the alternative set forth in ASCE 7, Section 13.2.6.

Special Certifications are required for the following systems for Seismic Design Categories C, D, E, and F. Systems shall be certified in accordance with ASCE 7, 13.2.2.

1. Mechanical and electrical equipment that must remain operable following the design earthquake. All mechanical and electrical equipment installed under this project falls under this category.
2. Components with hazardous contents.

All materials and fabrication shall be as required in these specifications. Contractor shall submit this information to the Owner for review prior to fabrication and installation.

Install seismic restraints when called for in the contract or recommended by the product manufacturer. Install in accordance with the manufacturer’s requirements as applicable.

Seismic restraint systems shall be installed so as not to interfere with normal operations and maintenance of the equipment and other components as shown on the plans. Interference with normal operations and maintenance shall be as determined by the Owner. Drilled-in anchors for non-rotating equipment shall be Concrete Anchors unless otherwise specified.

1.81.40 Pressure Ratings

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

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

Equipment Type or Function	Test Pressure
Raw Water Piping	150 psi
Treated Water Piping	150 psi
Drain Piping	10 ft

Test Pressure: Maximum pressure during project specific testing.

Raw Water Piping: Piping that delivers raw/prereated water from the intake structure on Beaver Creek to the existing water treatment plant (WTP), from the existing WTR to the existing water storage tanks, and from the existing water storage tanks to the new packaged WTP. Denoted in the plans by a cyan color.

Treated Water Piping: Piping that delivers treated water from the packaged WTP to the water storage tanks, from the storage tanks back to the WTP, and from the WTP into the system. Denoted in the plans by a blue color.

Drain Piping: Piping that conveys drainage water from the packaged WTP, the two (2) proposed Water Storage Tanks, the two (2) existing Water Storage Tanks, and the existing WTP into the existing drainage system. Denoted in the plans by a green color.

1.81.45 Location Designations

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

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

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

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

Corrosive Locations: Areas where chlorine gas under pressure, sulfuric acid, or liquid polymer are stored or processed, sewer wetwells and sewer manholes.

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

1.81.50 Materials in Contact with Domestic Water

All devices, components, and materials in contact with potable water shall be certified by NSF International to comply with NSF/ANSI 61 (leachable materials) and NSF/ANSI 372 (lead

content). Certification of compliance shall be supplied in writing at the time of the submittal process. See OAR 333-061-0050 and 333-061-0087.

Division 2

Sitework

2.00 GENERAL

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

2.05 Common Work for Exterior Improvements

This division covers the work for providing materials and performing all sitework as described in these specifications and as shown on the Plans.

Part 1 - General

Submittals

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

- Traffic Control Plan
- Erosion and Sedimentation Control Plan
- Pipe Bedding
- Trench Backfill
- Aggregate Base Course
- Crushed Surfacing
- Fertilizers
- Topsoil
- Geo Textile Fabric
- Grass Seed Mix

Other items listed in this section or required by the Owner.

2.08 Special Inspections for Earth Work

Part 3 – Execution

Field Quality Control

Special inspections including visual, probing of subgrade, and compaction effort (nuclear densometer or probe) are required for the following locations:

- Packaged water treatment plant and treated water storage tank pads, including native subgrade and crushed base:
 - Subgrade:
 - Visual inspection by Engineer
 - Proof rolling may be required by Engineer

- Nuclear densometer testing may be required by the Engineer if visual and proof rolling results are inconclusive.
- Crushed base rock:
 - Nuclear densometer testing shall be conducted at a rate of two tests within the pad footprint for each compacted layer of aggregate base placed and compacted.
- Gravel roadway subgrade, fill material, and aggregate base rock:
 - Visual inspection by Engineer
 - Proof rolling may be required by Engineer
 - Nuclear densometer testing may be required by the Engineer if visual and proof rolling results are inconclusive.

Areas where fill (either native or non-native) is being placed shall be tested for compaction compliance by a special inspector. The Contractor shall coordinate and pay for all testing. If tests indicate failure of compaction requirements, the Contractor shall pay for subsequent tests until tests indicate compliance with the specifications. Areas of native undisturbed subgrade shall be visually inspected by the Contractor prior to placement of any material overtop.

The Contractor shall fully cooperate with the special inspector, including providing safe access to the testing areas. No extra compensation will be provided for cooperation with and facilitation of inspections.

2.10 SITE PREPARATION

2.10.2 Clearing and Grubbing

Part 3 - Execution

Construction

Clearing and grubbing shall be performed by the Contractor to remove and dispose of unwanted debris, vegetative matter, and other items noted on the Plans within the construction limits and shall conform to Section 00320 of the Oregon Standard Specifications.

Protect trees and tree roots, structures and foundations, utilities, fences, and all other existing site features, whether or not these items are indicated on the Plans to be protected.

Remove and relocate permanent improvements that are within the construction limits, such as mailboxes and traffic signs. Locate mailboxes to preserve mail service during construction. Return facilities to original location, or plan location, at completion of local work.

Do not remove organic material including plants, grasses, trees, and native topsoil unless directed on the Plans. Where the Contractor is allowed to clear areas to facilitate construction but is not required to, restore any areas disturbed by construction to existing or better condition including matching surface restoration with seed, sod, or plantings as shown in adjacent areas required to be modified by the Plans. Restoration shall be completed at no additional cost to the Owner.

2.10.3 Well Protection

Part 1 – General

The project is located within the Owner's Sanitary Control Area for a well, refer to Plans for existing well location.

The Contractor is responsible for preventing accidental release of contaminants due to construction activities. The Contractor is responsible for aquifer water quality during the entire construction phase and shall take appropriate means to protect the water quality. This may include but is not limited to, providing tarps under inactive equipment, the use of non-toxic oil in construction hydraulic equipment, immediate spill containment and cleanup, installation and maintenance of temporary erosion and sedimentation control devices, and all other work necessary to protect the water quality of the well.

Submittals

At a minimum, the Contractor shall provide the following as part of a spill control and response plan. A draft of this plan is due at the pre-construction conference. The approved version of the plan is due prior to commencing construction activities.

1. Provide a designated person in charge of spill control and site maintenance. This person shall be on-site during operating hours and be responsible for supervising the use and storage of hazardous materials and shall take appropriate actions in the event of a release. This person shall also be available 24 hours per day in the event of a release during non-working hours.
2. Provide secondary containment of hazardous materials and refueling areas (containment equal to the size of the primary container or the largest container for multiple containers in one containment device). Sanitary, refueling and hazardous material storage are not allowed within the 100-foot sanitary radius on the well site, and the Contractor shall designate other areas for this in their plan. Prevent public access to hazardous materials left on site during non-working hours.
3. Construction vehicles and stationary equipment that are leaking fuel, hydraulic fluid, and/or other hazardous materials shall be removed from the well protection area or repaired in place as soon as possible and may remain on the site in the interim only if leakage is completely contained. Keep spill containment and treatment materials on-site at all times. Depending on the frequency of occurrences, the Contractor may be required to provide spill containment devices on equipment at all times (i.e. diapers).
4. Store equipment and supplies adequate for the immediate clean-up of the worst-case hazardous materials spill on-site and close to hazardous materials.
5. All spills or leaks shall be immediately contained, reported, and cleaned up as required by state and local regulations, Oregon Department of Environmental Quality guidelines and as noted below. Upon detection of a leak, Contractor shall immediately stop work and correct the leak, contain the spill, and remove the contaminated material from the site for proper disposal. Over-excavate the contaminated site at least 2 feet in all directions to confirm that the spilled material has not penetrated further.

2.10.5 Temporary Access Roads

Part 1 - General

Summary

Provide temporary site access and maintain vehicular site access at all times. Access shall be of a quality to permit Contractor's forces and outside inspector's safe and convenient ingress/egress. Unless specifically provided for in other bid items, the cost of building and maintaining construction access shall be incidental with no separate payment. Any bid items for aggregate materials (e.g. crushed rock, ballast, etc.) shall not relate to construction access unless the description of that bid item specifically states inclusion of the construction access.

Part 3 - Execution

Repair/Restoration

Maintain all construction accesses during construction. The cost of such maintenance is incidental to the bid price. Maintenance includes repairing settled and damaged areas and providing dust control. Cost for maintenance due to rain, snow, wind, or other weather conditions is incidental to the bid price.

Cleaning

Wherever construction vehicle access routes intersect paved roads, make provisions to minimize the transport of sediment onto the paved road. Remove all dirt, mud, rocks, vegetation, or other deleterious material from all construction equipment prior to leaving the site. This may include spray washing, sweeping, or other physical methods needed to remove materials.

If sediment or other debris is transported onto a paved road surface, clean the road thoroughly by the end of the workday. Remove debris from roads by shoveling or sweeping. Street washing will be allowed only after debris has been removed in this manner.

2.11 Earthwork Materials

2.11.1 Common Work for Earthwork Materials

Part 1 - General

Acceptance at Site

Owner will review the site near the end of each pay period to determine the equivalent percentage of earthwork completed compared to the total earthwork lump sum price. Contractor will be paid based on the Owners judgement of percentage completed.

Part 2 - Products

Source Quality Control

All imported fill material shall be free of hydrocarbons (e.g. gasoline, diesel, oil, etc.), pesticides, herbicides, hazardous volatile organic compounds (VOCs) and synthetic organic chemicals (SOCs). Provide certification to the Owner that the fill is free of these chemicals.

Provide test data from an independent testing laboratory, ensuring the imported fill to be within the regulatory limits set by the Department of Environmental Quality (refer to OAR 340-093-0030(18)). This will include VOC and SOC tests on imported fill at random intervals averaging every 75 cubic yards. Imported fills found not to be compliant with regulatory standards shall be hauled off site and disposed of properly, at the sole expense of the Contractor.

2.11.2 General Fill

Part 1 – General

Summary

All fill not specifically defined as another type shall be “General Fill”.

References

Section 00405.14 of the Oregon Standard Specifications, Class A Backfill (native material).

Part 2 – Products

Components

General fill shall be soil free of organics, debris, and other deleterious materials, with no individual particles having a maximum dimension larger than 5 inches. The moisture content of the material and weather conditions at the time of placement will be used to determine the suitability of native materials for backfill as general fill.

Quality Control

All native material used as fill must be approved by the Owner. Native soils onsite are high in clay content and generally must be placed in dry conditions. Contractor shall notify the Owner a minimum of 2 working days prior to using any native material as fill so that Owner can be onsite to approve use of native material as fill. Native material is high in clay content and must be relatively dry to be placed. Contractor shall plan accordingly.

Part 3 – Execution

Installation/Construction

Compact general fill in uniform layers not exceeding 12 inches in loose thickness and to at least 95 percent maximum dry density based on the ASTM D-698 (standard) test procedure.

2.11.3 Structural Fill

Part 1 – General

Summary

All fill placed below and against building components, building structures, vaults, catch basins, handholes, slabs, and other structures shall be “Structural Fill”. The structural fill material has been selected to support the weight of the structure in combination with the existing native material and to prevent adverse movement during an earthquake. Take particular care to maintain the integrity of the design by using structural fill where shown.

Native material onsite is not anticipated to be suitable for use as structural fill material, and the contractor therefore shall plan to use structural fill materials as specified below.

Part 2 – Products

Components

Structural fill material used under structures shall be aggregate base course per Section 2.11.7 Aggregate Base Course.

When structural fill will be used around pipes, 100-percent of the material shall pass a 1-inch sieve.

Part 3 – Execution

Installation/Construction

Structural fill shall bear on firm base and be placed in uniform layers not exceeding 8 inches in loose thickness. The backfill area must be free of standing water and the subgrade soils must be stable. Each layer of structural fill shall be compacted to at least 92 percent of its maximum dry density based on the ASTM D-1557 (modified) test procedure or 95 percent of its maximum dry density based on the ASTM D-698 (standard) test procedure.

2.11.4 Pipe Bedding

Part 1 – General

Summary

Fill placed below and around buried utilities. The bedding material has been selected to support the weight of the utility by distributing the load so that the completed utility and backfill system does not weigh more than the native material. The grain size has been selected so that the bedding will not migrate into the bottom of the trench. Maintain the integrity of the utility design by using the appropriate pipe bedding material.

Submittals

Recent aggregate gradations must be provided.

Part 2 – Products

Materials

For PVC sewer, storm, and water piping regardless of diameter and all other piping and conduit 4-inch in diameter or less conform with the following specifications.

If groundwater is present in the bedding zone, use $\frac{3}{4}$ " – clean below the bedding material.

Bedding material shall be:

- Sand per Subsection 2.11.10 Sand.

Part 3 – Execution

Installation/Construction

Bedding material shall bear on firm subgrade, surround the pipe and conduits to the limits shown on the Plans, and provide uniform support along the entire length. Excavate holes for pipe bells to prevent concentrated loading at joints or bridging of the pipe.

2.11.5 Trench Backfill

Part 1 – General

Summary

All fill placed above the pipe bedding in a trench shall be “Trench Backfill”.

References

Where not installed under structures, trench backfill shall be General Backfill per Section 2.11.2 General Backfill.

Where pipes are installed under structures, Structural Fill shall be used. Per Section 2.11.3 Structural Fill.

Part 3 – Execution

Installation/Construction

Trench backfill shall follow the requirements of Section 00405.40 of the Oregon Standard Specifications.

2.11.7 Aggregate Base Course

Part 1 – General

Summary

All fill placed directly under and against paving, foundations, and structures shall be “Aggregate Base” unless otherwise called out on the Plans.

References

Aggregate for gravel base course under structures, and foundations shall conform Section 02630.10, Dense –Graded 1½-inch - 0 or ¾-inch – 0 of the Oregon Standard Specifications.

2.11.10 Sand

Part 1 – General

Summary

Sand used for bending and pipe zone fill around all PVC pipes.

References

Section 02690.30 Fine Aggregates of the Standard Specifications.

Part 2 – Products

Materials

Sand shall be clean, free-draining, durable crushed or uncrushed rock, meeting the grading requirements of Section 00360.10 Sand Drainage Blanket of the Standard Specifications.

2.11.20 Geotextile Fabric

Part 1 – General

Delivery, Storage, and Handling

Ship, store, place, overlap, and secure fabric based on manufacturer requirements.

Part 2 – Products

Materials

Chose geotextile fabric to meet the requirements based on place and purpose of use.

Geotextile fabric called out on the Plans to separate drain rock or French drains from surrounding soils shall be equal to Tencate Mirafi 140N.

Geotextile fabric called out for separation of soils shall be equal to Tencate Mirafi 140N.

Geotextile fabric placed between quarry spalls and fill to separate soil fines shall be equal to Tencate Mirafi 160N.

Geotextile fabric called out to drain behind a wall without the use of drain rock shall be equal to Tencate Mirafi G100W.

Geotextile fabric for embankment stabilization shall be equal to Mirafi Miramat TM8.

Geotextile fabric placed below crushed rock in road subgrade shall be equal to Tencate Mirafi 500X.

2.20 EARTH MOVING

2.23 Excavation

Part 1 – General

Summary

Excavate as necessary to construct the improvements shown.

Part 2 – Products

Materials

All excavated material below the organic layer can be re-used as backfill if it is properly protected from water saturation, meets the specification for the backfill purpose, and is approved by the Owner. Approval of material as backfill will be made the moment before placement of the material as backfill. Weather conditions may make previously approved material unsuitable for backfill requiring the material to be removed from the project site.

Excavated material that is not used as backfill shall be disposed off-site. All permits for the disposal of excavated material shall be obtained by the Contractor. A copy of all permits and the locations of each disposal site shall be submitted to the Owner.

Alternatively, at the approval of the Owner, excavated material may be disposed of on-site.

Part 3 – Execution

Installation/Construction

Excavation includes the digging, scraping, and removing existing native material, abandoned or interfering utilities, abandoned or interfering structures, and any other obstacles necessary for the construction of the improvements. Excavation includes utility excavation, structural excavation, and grading excavation.

Perform utility excavation to the depths necessary to complete the utility work shown.

Excavated material may be stockpiled onsite. Temporary stockpiling of excavated material will not be permitted outside the construction limits at any time.

Examination

The Owner will evaluate the base of the excavation to determine if it is suitable for backfilling. The Owner will evaluate the stability of the base of excavation by determining if all significant organic soils or other unsuitable materials have been removed.

2.25 Temporary Erosion and Sedimentation Control

2.25.3 Temporary Erosion and Sedimentation Control

Part 1 – General

Quality Assurance

The Contractor shall provide TESC facilities or processes as necessary to ensure that erosion and sedimentation problems do not occur. The Contractor shall inspect the TESC facilities daily and maintain the systems as necessary to prevent off-site damage.

Part 2 – Products

Materials

Straw or mulch shall be applied to exposed surfaces to minimize erosion and filter surface water runoff. Where straw or mulch is required for erosion control, apply to a minimum thickness of 2-inches. Straw shall be rice straw or other straw that is weed free.

Part 3 – Execution

Installation/Construction

All TESC systems including; fencing, earth berms, grasses, straw, mulch, culverts, drain pipe, outfalls, and other items required by for this project, must be installed prior to any clearing, grubbing, excavation, grading work, or other work that could result in off-site stormwater or material flows. TESC systems must remain in place throughout the duration of the construction activities. The systems may be relocated to complete construction activities if

their location impedes the associated work. If the systems are relocated to complete any work, they must be reinstalled to protect the construction and surrounding areas prior to commencing work on other portions of the project.

The Contractor shall take care and diligence to minimize erosion exposure and provide TESC measures as shown on the Plans and required by construction practice.

Stabilized construction entrances and wash pads at the beginning of construction activities and maintain for the duration of the project. Keep wash pads clean to prevent the transport of sediment onto adjoining roads.

Install earth berms as necessary to prevent surface water migration into excavations or off the project site. Route surface water intercepted by earth berms to an approved stormwater conveyance system. Ensure that the concentration of surface water at the earth berm does not erode the adjoining or downstream properties. Remove sediment deposited against the earth berm so surface water can flow freely. Do not remove the earth berm before the stabilization of the surface downhill from the berm.

2.25.4 Temporary Storm Water Pollution Control

Part 3 – Execution

Field Quality Control

The Contractor shall be responsible for meeting all construction stormwater discharge water quality requirements including State of Oregon, Construction Stormwater Permit requirements and local requirements regardless of weather conditions.

If the project is fined by the permitting authority, that fine shall be paid by the Contractor at no additional cost to the Owner.

2.25.5 Filter Fabric Fence

Part 2 – Products

Materials

Filter fabric per section 00280.16(c) of the ODOT Standard Specifications.

Part 3 – Execution

Installation/Construction

Install a filter fabric fence to allow the collection and passage of surface water through the fabric before discharge off site. When joints are necessary, splice filter fabric together at a support post with a minimum overlap of six inches. Secure both ends of the fabric to the post. Install the filter fabric fence following the contours of the existing grade where feasible. Drive the fence posts securely into the ground a minimum of 30-inches and spaced apart at a maximum of six feet. Fasten a wire mesh support fence securely to the uphill side of the posts using heavy-duty wire staples at least one inch long, tie wires, or wire rings. Extend the wire into the trench a minimum of four inches and not more than 36 inches above the existing surface. Excavate an 8-inch by 12-inch trench on the uphill side of the fence for securely burying the lower edge of the fabric fence. Extend at least 20 inches of the filter fabric fence

continuously into the trench. Extend the filter fabric fence 36-inches above the existing grade. Secure the filter fabric placed in the trench with backfill material of three-quarter inch washed rock. Place the backfill material in the trench and on either side of the fence as shown on the construction Plans.

Field Quality Control

Inspect the filter fabric fence immediately after each rainfall and at least once daily during periods of prolonged rainfall. Repair or replace sections of the filter fabric fence that are not filtering surface water. The filter fabric fence may be removed after the threat of off-site contamination has passed.

2.30 SITE IMPROVEMENTS

[CSI 32 30 00]

2.31 Fencing and Gates

[CSI 32 31 00]

2.31.1 Common Work for Fencing

[CSI 32 31 05]

Part 1 – General

Related Sections

- Division 1.52.20 Locks and Keys
- Division 3 Concrete

Part 3 – Execution

Preparation

Clear the area along the fence path, remove surface irregularities and grade earth smooth and continuous prior to fence installation.

2.31.3 Chainlink Fence

[CSI 32 31 13]

Part 1- General

Summary

This section describes the requirements for the chainlink fence located as shown and detailed on the Plans and these specifications.

Related Sections

- Division 2.31.1 Common Work for Fences
- Division 3.31.3 Post Footings

References

Chainlink Fence Manufacturers Institute Product Manual Specifications

Oregon Standard Specifications for Construction Section 01050

ASTM F626, A392, A817, F668, F1043, F1083, A121, F567

Submittals

Galvanizing information, steel quality standards, hardware quality standards.

Dimensional drawings including details, finishes, accessories and foundations.

Part 2 - Products

Materials

Obtain chain link fences and gates, including accessories, fittings, and fastenings, from a single source.

Chain-Link (woven wire fabric) fencing shall be commercial grade, as detailed on the Plans and in accordance with Section 03010.30 of the Oregon Standard Specifications for Construction except as modified herein.

Components

Fence Fabric: Galvanized wire: ASTM A392 - 1.2 oz./sf. Wire Spec-A817, Type and class per use and location of the project.

Size: Helically wound and woven to height of as indicated on drawings with 2-inch diamond mesh and core wire gauge of 9.

Selvage of fabric: Twisted and barbed at top and twisted at bottom unless noted otherwise on the Plans. Knuckled when using polymer coating.

Steel Fence Framework: Steel pipe - Type I: ASTM F1043 Group IC; minimum yield strength of 50,000 psi. Outside diameter (OD) sizes as shown on the Plans. Type B external coating, hot dip galvanized zinc 0.9 oz/ ft² with a clear polymeric overcoat, Type D interior 90% zinc-rich coating having a minimum thickness of 0.30 mils.

Accessories

Chain link fence accessories per ASTM F626 Provide items required to complete fence system. Galvanize each ferrous metal item and finish to match framing.

Post caps: Formed steel weather tight closure cap for pipe posts. Provide one cap for each post. Cap to have provision for barbed wire when necessary.

Wire ties: 9-gauge galvanized steel wire for attachment of fabric to line posts. Thirteen gauge for rails and braces.

Brace and tension (stretcher bar) bands: Pressed steel, minimum 300-degree profile curvature for secure fence post attachment.

Tension (stretcher) bars: One piece lengths equal to 2 inches less than full height of fabric with a minimum cross-section of $\frac{3}{16}$ inch by $\frac{3}{4}$ -inch. Provide tension (stretcher) bars where chain link fabric meets terminal posts.

Tension wire (used when top rails are not required): Polymer Steel Tension Wire ASTM F1664 class 2B, fused and adhered, 6 gauge, with tensile strength of 75,000 psi. Hog ties are permissible.

Tie rod, truss rods, and tightener: Steel rods with minimum diameter of $\frac{3}{8}$ -inch. Capable of withstanding a tension of minimum 2,000 lbs.

Nuts and bolts to be galvanized.

Fabrication

Fence frames that require welding shall be hot dipped galvanized in the shop unless approved otherwise by the Owner.

Part 3 - Execution

Installers

Installers shall have a minimum of two years of experience. References from three previous projects shall be submitted for review during shop drawing submittal.

Examination

Verify areas to receive fencing are completed to final grades and elevations.

Perform complete utility locates within the areas of fencing to verify conflicting utilities. Fence posts may require adjustment to avoid utilities by a minimum of 1-foot.

Installation/Construction

Chainlink Fence Framing Installation:

- A. Install chain link fence in accordance with ASTM F567 and manufacturer's instructions.
- B. Locate terminal post at each fence termination and change in horizontal or vertical direction of 30 degrees or more.
- C. Space line posts uniformly at 10-feet on center maximum and to avoid utilities by 1-foot minimum.
- D. Concrete set terminal and gate posts: Drill holes in firm, undisturbed or compacted soil. Trowel finish around post. Slope to direct water away from posts. Footings shall be sized per schedule on the Plans.
- E. Check each post for vertical and top alignment and maintain in position during placement and finishing operations.
- F. Bracing: Install horizontal pipe brace at mid-height for fences 8-feet tall and over, on each side of terminal posts. Firmly attach with fittings. Install diagonal truss rods at these points. Adjust truss rod, ensuring posts remain plumb.

- G. Tension wire: If shown on the Plans, install tension wire before stretching fabric and attach to each post with ties. Secure tension wire to fabric with 12½ gauge hog rings 24 inches O.C.

Chain Link Fabric Installation

- A. Fabric: Install fabric on side facing outward from site and attach so that fabric remains in tension after pulling force is released. Leave no more than 3-inches between finish grade and bottom selvage. Attach fabric with wire ties to line posts and tension wire at 15-inches on center and to rails and horizontal braces at 24-inches on center.
- B. Tension (stretcher) bars: Pull fabric taut; thread tension bar through fabric and attach to terminal posts with bands or clips spaced maximum of 15-inches on center. Hog ties are allowed.

Accessories

- A. Tie wires: Bend ends of wire to minimize hazard to persons and clothing.
- B. Fasteners: Install nuts on side of fence opposite fabric side for added security.

2.50 EXCAVATION SUPPORT AND PROTECTION

2.51 Contractor Designed Shoring

Part 1 - General

Summary

Where shoring, sheet piling, sheeting, bracing, lagging, or other supports are necessary to prevent cave-ins or damage to existing structures, it is the responsibility of the Contractor to design, furnish, place, maintain, and remove supports in accordance with applicable laws, codes, and safety requirements.

References

OAR, Chapter 437, OSHA Division 3, (29 CFR 1926) Construction, "Construction Subdivision P, Excavation".

OSHA

Quality Assurance

Where the Contractor is required to provide the shoring design, it shall be prepared by a competent person as defined by OAR 437 (29CFR 1926). Before beginning any excavation that is governed by the shoring requirements, the Contractor shall submit their stamped shoring plan and calculations to the Owner for approval. The stamp must be present on all Plans and calculations, and all submittals must be approved by the Owner prior to starting work.

Part 3 - Execution

Installation/Construction

Design, planning, installation, and removal of sheeting, shoring, sheet piling, lagging, and bracing shall maintain the undisturbed state of soil below and adjacent to excavation.

2.60 CONTAMINATED & WASTE MATERIALS HANDLING

2.60.2 Waste Material Control

Part 1 – General

Quality Assurance

Adhere to all requirements of federal, state, and local statutes and regulations dealing with pollution. Permit no public nuisances.

Use only dump sites that are approved by the regulatory agency having jurisdiction, and present proof of approval upon request.

Part 3 – Execution

Installation/Construction

The Contractor shall take precautions to warn, protect, and prevent the public from all hazards that exist on site due to demolition or construction operations. Surround stockpiled debris with yellow warning tape attached to lath, stakes, poles, or fencing to warn the public of any potential hazard.

Use water sprinkling, temporary enclosures, or other methods to limit dust and dirt from rising and scattering in the air. Collect and clean surface water runoff that is contaminated with site debris, silt, or other material that adversely affects water quality prior to discharge. On-site collection ponds may not be used to keep silt laden water from entering the storm water collection system.

Do not use water to control dust when its use may create hazardous or objectionable conditions such as ice formation, flooding, or pollution.

Minimize the amount of dust and other airborne particles caused by any demolition, excavation, stockpiling, or removal activities. Implement dust control measures prior to the beginning of work activities. Exposed soil may be wetted with water or covered to minimize dust creation. Water runoff from the wetting procedure shall be accumulated and cleaned prior to disposal. Remove water runoff accumulation from the site prior to project completion.

Cleaning

At all times, keep the construction area clean and orderly, and upon completion of the work, leave buildings broom clean and all parts of the work clean and free of rubbish and excess material of any kind. Leave fixtures, equipment, walls, and floors clean and free of stains, paint, roofing splashes, or other marks or defects. Upon completion, restore site and all work or equipment and material storage areas to their original conditions. Remove all miscellaneous unused material resulting from work and dispose of it in a manner satisfactory to the Owner.

The site, through the progress of construction, shall be kept as clean as possible and in a neat condition.

2.61 Contaminated Materials

2.61.2 Toxic Spill or Release Contact Requirements

Part 3 - Execution

Field Quality Control

During construction, if there is any toxic substance spill or release discharged into the environment, report the location, quantity, date and time of the spill or release to Oregon Office of Emergency Management at 1 (800) 452-0311 and the Owner's representative. Spills shall be monitored, contained, and cleaned up to applicable codes at the Contractor's expense.

During construction, spills shall be reported if spill includes:

- Any amount of oil to waters of the state
- Oil spills on land in excess of 42 gallons
- Hazardous materials that are equal to, or greater than, the quantity listed in the Code of Federal Regulations, 40 CFR Part 302 (List of Hazardous Substances and Reportable Quantities), and amendments adopted before July 1, 2002.

Report spills to:

- The Oregon Emergency Response System: 1-800-452-0311
- The National Response Center: 1-800-424-8802

2.61.3 Hazardous Lead Materials

Part 1 - General

Site Conditions

The Owner is not aware of any hazardous lead containing materials on or in the project site. If hazardous lead materials are discovered by the Contractor, the Owner will mitigate the removal of the hazardous material.

2.61.26 Hazardous Asbestos Materials

Part 1 - General

Site Conditions

The Owner is not aware of any hazardous asbestos containing materials on or in the project site. If hazardous asbestos materials are discovered by the Contractor, the Owner shall mitigate the removal of the hazardous material.

2.90 LANDSCAPING

2.90.1 Common Work for Landscaping

Part 1 – General

Submittals

Grass Seed Mix

Part 2 – Products

Materials

The Contractor shall select a grass seed mix that is similar to adjacent grass species, or as acceptable to the Owner, and shall submit seed mix for Owner approval prior to use.

The Contractor shall use straw mulch that conforms to section 01030.15(b) of the Oregon Standard Specifications for Construction.

Part 3 – Execution

Installation

The Contractor shall hand broadcast the seed mix over all disturbed bare earth area with approved seed mix at a rate recommended by the manufacturer.

Following seed broadcasting, the Contractor shall apply 2 inches of straw mulch over the broadcasted areas.

Upon Substantial Completion, the Owner will assume plant maintenance.

Cleaning

During landscape work, keep adjacent areas clean and work area in an orderly condition.

Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, soil, debris, straw mulch and equipment as instructed by Owner.

Division 3

Concrete

3.00 GENERAL

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

3.05 Common Work for Concrete

Part 1 - General

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

References

Materials shall conform to the following standards:

- Cement - ASTM C150
- Coarse aggregate - ASTM C33
- Fine aggregate - ASTM C33
- Admixtures - ASTM C494
- Air-entraining admixtures – ASTM C260
- Fly Ash – ASTM C618
- Admixture and products in contact with potable water – NSF 61

Submittals

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

- Concrete mix design including aggregate gradation and substantiating strength data.
- Admixture Data
- Special placement procedures for hot or cold weather
- Concrete anchors
- Concrete anchor installer certification per ACI/CRSI Adhesive Anchor Installer Certification Program.
- Rebar mill certifications
- Grouts
- Form Liners and associated products
- Form Release agent

Concrete mix designs shall be submitted to the engineer for approval a minimum of 14 calendar days prior to placing any concrete. The mix design shall include the amounts of cement, fine and coarse aggregate, water and admixtures, as well as the water cement ratio, slump, concrete yield, aggregate gradation, and substantiating strength data in accordance with ACI 318, Chapter 5. A batch plant inspection may be required, the cost of which shall be paid by the Contractor. Review of mix submittals by the engineer of record indicates only

that information presented conforms generally with contract documents. Contractor or supplier maintains full responsibility for specified performance.

Part 2 - Products

Components

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

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

Water used in concrete shall be potable.

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

Mixes

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

The concrete mix shall include the amount of cement, fine and coarse aggregate, including aggregate gradations, water, and admixtures as well as water cement ratio, slump, concrete yield, and sustaining strength data in accordance with these specifications, the requirements of the International Building Code Section 1905, and the requirements of ACI 318.

Finishes

Coat all aluminum in contact with concrete as specified in Division 9.

Part 3 - Execution

Inspection

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

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

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

Testing

Concrete strength tests shall be performed per section 1905.6 of the IBC and per the requirements noted herein. The Contractor shall be responsible for providing and paying for all costs of concrete testing. The Engineer shall be furnished with copies of all inspection reports and test results.

Cylinders used for concrete strength tests shall be 6 by 12. Four by 8 cylinders may be used for mixes with maximum aggregates less than 1-inch, however the testing lab must apply a 0.94 multiplier to the compressive strength test results unless data acceptable to the Engineer

is presented that would justify a higher multiplier. All mixes utilizing aggregates over 1 inch shall be tested using 6 by 12 cylinders.

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

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

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

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

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

The testing agency shall take a minimum of four samples for every 50 yards of concrete placed (and a minimum of four per pour); one for a 7-day test, two for 28-day tests, and one for backup testing in case the other two samples do not meet design strength. Additional samples may be taken to verify strength prior to form removal at the Contractor's expense.

3.10 FORMING AND ACCESSORIES

3.11 Formwork

3.11.13 Structural Cast in Place Forming

Part 1 – General

The Contractor shall submit a construction joint plan to the Engineer for review prior to formwork and rebar installation if altered from that shown on the Plans. Modifications to the construction joints shall be submitted to the Engineer no less than 7 working days prior to placing the forms and rebar.

Part 2 – Products

Materials

Unless otherwise directed, coat contact surface of forms with colorless, non-staining, mineral oil that is free from kerosene, or other approved suitable material, to permit satisfactory removal of forms without concrete damage. Form-release agent for interior of potable water storage structures shall be National Sanitation Foundation Standard (NSF) No. 61 approved for use in direct contact with potable water.

Form construction for surfaces covered with backfill shall be made of steel, plywood, or dressed, matched lumber. Form construction for exposed surfaces shall be made of new plywood or steel without surface markings.

Form ties for use in liquid containment structures shall be standard plastic cone snap-ties with $\frac{3}{4}$ -inch diameter neoprene waterstop washer or removable taper ties. Use Greenstreak X-plugs with removable taper ties or equal. Contractor shall submit to the Engineer form ties to be used for review prior to installation.

Part 3 - Execution

Installation/Construction

Concrete forms shall be sufficiently tight to prevent leakage of concrete or mortar and shall be properly braced or tied together to maintain desired position and shape until removed.

Conduits, pipes and sleeves of any material not harmful to concrete and within the limitations of ACI 318, Section 6.3 are permitted to be embedded in concrete with approval of the Engineer. Provide a $\frac{3}{4}$ -inch chamfer or radius at all exposed corners and edges, unless specifically stated otherwise on the Plans.

Forms shall remain in place until the concrete has developed sufficient strength to withstand imposed loads without damage or deflection. Wall and slab forms shall remain in place for a minimum of 24 hours after completion of the pour. Forms for beams and suspended slabs shall remain in place for a minimum of 14 days AND until concrete has developed 28-day design strength, unless approved by the Engineer. The Contractor shall coordinate with the testing lab to verify concrete strength prior to form removal.

Do not allow water to flow through areas where forms are to be placed. During form construction and prior to placement of concrete, keep footings and floor slab areas free of standing water.

Field Quality Control

Variations from plumb, specified grade, conspicuous lines, and walls shall not exceed plus or minus $\frac{1}{4}$ -inch in any 10-foot length, and shall not exceed one inch over the entire length. Variations from dimensions shall not exceed plus or minus $\frac{1}{2}$ -inch. Closer tolerances shall be achieved by the Contractor as necessary to accommodate equipment and other permanent materials.

3.15 Concrete Accessories

3.15.05 Pipe Penetrations through Concrete

Part 1 - General

Summary

Water holding structures and structures buried and subject to groundwater contact: As shown on the Plans.

Structures not holding water or unburied structures: Unless identified on the Plans, all pipes larger than two inches passing through poured-in-place concrete floors and walls shall be isolated from the concrete.

Part 2 - Products

Materials

Wrap the pipe in a flexible, non-biodegradable material such as high-density foam or asphalt board.

Part 3 - Execution

Examination

Wrapping must be inspected and approved by Engineer prior to concrete pour. Gaps, tears, or looseness in wrapping will be cause for rejection.

Installation

Wrapping shall be watertight and provide a minimum of 1/2-inch separation between the pipe and concrete. Extend wrapping a minimum of one inch above and below concrete pour and cut flush on accessible side(s) after curing.

3.15.19 Concrete Anchors

Part 2 - Products

Materials

Concrete anchors shall be stainless steel, and maybe threaded steel rods set with epoxy, or concrete anchor products selected to be suitable for the installation application, as approved by the Owner.

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

Part 3 - Execution

Installation

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

Use threaded rod or reinforcing bar as shown on the drawing, and meeting Manufacturer's recommendations. Provide minimum embedment as shown. Holes shall be drilled with carbide-tipped drill bit. Holes shall be cleaned of dust and debris. Adhesive shall be inserted with a mixing nozzle.

3.20 REINFORCING

3.21 Reinforcement Bars

3.21.11 Plain Steel Reinforcement Bars

Part 1 - General

References

ACI – American Concrete Institute- latest edition

CRSI Manual of Standard Practice – latest edition

Part 2 - Products

Materials

Grade – ASTM A706, Grade 60

ASTM A615, Grade 60 shall be permitted if:

- (a) The actual yield strength based on mill tests does not exceed f_y by more than 18,000 psi; and,
- (b) The ratio of actual tensile strength to the actual yield strength is not less than 1.25.

Detailing - ACI 318 and ACI 315

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

Tie wire - 16 gauge minimum

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

Bar supports for the bottom rebar mat of suspended slabs or beams in water holding structures must be point supports (chairs or dobbies), not continuous.

Part 3 - Execution

Installation

Reinforcing steel shall be detailed in accordance with ACI 315 and 318 and as shown on the Plans. Lap all reinforcements in accordance with “the reinforcing splice and development length schedule”. Provide corner bars at all wall and footing intersections. Bend wire bar ties away from formwork to provide the same concrete clearance as shown on the Plans to the bars.

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

Field Quality Control

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

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

3.30 CAST-IN-PLACE CONCRETE

3.30.05 Common Work for Cast in Place Concrete

Part 1 - General

Scheduling

Contractor shall schedule and attend a Concrete Placement meeting at least one week prior to placing concrete. The following shall attend:

- Owner
- Contractor

The following shall be discussed at the meeting:

- Safety (Contractor's sole responsibility)
- Batching and Delivery, Adjustments to Mix; Site Dosing
- Site Layout –Holding Area; Pump Truck Location; Truck Wash-out Area; Parking area
- Equipment – Pumps and Appurtenances; Vibrators; Spare Equipment
- Concrete Testing Procedures
- Curing

Delivery

Concrete shall be transported in a truck mixer to the jobsite and discharged within 1.5 hours after cement has been added to water or aggregates. Rejected concrete will be at Contractor's expense.

Part 2 - Products

Components

If allowed, curing materials shall conform to ASTM C171 and liquid membrane-forming compounds shall conform to ASTM C309. When concrete is to be coated or stained, use UV-dissipating form release and curing compounds.

Part 3 - Execution

Preparation

Do not place concrete during rain, sleet, or snow until water and freezing protection is provided.

Position embedded items accurately, and support against displacement or movement during placement.

Fill voids in sleeves, insets, anchor slots, etc., temporarily with readily removable materials to prevent entry of concrete into voids.

Before beginning placement of concrete, remove hardened concrete and foreign materials from inner surface of mixing and conveying equipment. Before depositing concrete, remove debris from space to be occupied by the concrete. Secure reinforcement in position to prevent movement during concrete placement.

At the beginning of the concrete pour for walls taller than 8 feet, place a 1½ to 2½-inch thick grout pad prior to placing the concrete for the wall. Grout mix shall consist of fine aggregates, concrete and water in the same ratios as used in the wall concrete. The placement of the concrete shall proceed immediately after the grout placement so as to prevent any cold joints.

At construction joints, thoroughly clean surface of existing concrete to remove laitance. Roughen existing concrete surface to expose aggregate uniformly and apply approved bonding agent to existing concrete in accordance with manufacturer's recommendations. Prior to placing fresh concrete, dampen joint and coat with grout mixture in accordance with ACI 301, Section 8.5.

Installation

Placement shall be in accordance with IBC, Section 1905.

Place no concrete when air temperature is below or expected to be below 40 degrees during the 28-day curing period unless a low temperature concrete mix has been approved by the Owner. Provide adequate equipment for heating materials and protecting concrete during freezing or near freezing weather. Keep materials, reinforcement, forms, and ground in contact with concrete free from frost at time of placement. Heat mixing water as required. Use no materials containing ice.

Place no concrete when air temperature exceeds or is expected to exceed 85 degrees during the 28-day curing period unless a high temperature placement plan has been approved, and unless adequate precautions are taken to protect work. Cool ingredients prior to mixing. Flake ice or crushed ice of a size that will melt completely during mixing may be substituted for all or part of water. Cool forms and reinforcing prior to placing concrete.

Handle concrete from mixer, ready-mixed truck, or from transporting vehicle to place of final deposit by methods which prevent separation or loss of ingredients. Under no circumstances shall concrete that has partially hardened be deposited.

Place concrete in maximum lifts of 3 feet. Deposit concrete continuously so that no concrete will be deposited on concrete which has hardened sufficiently to cause formation of seams and planes of weakness within the section. If a section cannot be placed continuously, locate and reinforce construction joints at points as provided for in the Plans or as approved by the Owner. Maximum concrete drop shall be 5 feet.

Consolidate concrete by vibration, supplemented by hand spading, rodding, forking, or tamping. Thoroughly work concrete around reinforcement, around embedded items, and

into corners of forms to eliminate air or rock pockets which may cause honeycombing, pitting, or planes of weakness. Insert and withdraw internal vibrators at points approximately 18 inches in each direction and extend into the lower concrete lifts. At each insertion, the duration shall be sufficient to consolidate the concrete; but not sufficient to cause segregation. Do not use vibrators to transport concrete within forms. Consolidate slabs by utilizing vibrating screeds, roller pipe screeds, internal vibrators, or other approved methods. Have a spare vibrator available at jobsite during concrete placing operations.

After removal of forms, cut out and patch defects in concrete surfaces. Remove form tie cones. Cut or snap off form ties to a depth of ¾-inch. Chip out rock pockets, holes from form tie removal, and other defects to solid concrete. Repair defects in accordance with 3.06.30.71.

Curing

See section 3.39.

3.31 Structural Concrete

Part 1 - General

Summary

All concrete shown in the contract documents.

Performance Requirements

28-day compressive strength – 4,500 psi minimum

Slump - Without plasticizers; 4 inches. With plasticizers, maximum 9 inches or as desired for placement. Use water reducers as required to achieve slump.

Part 2 - Products

Mixes

Water/cement ratio - 0.40 maximum (water cement ration may be increased to 0.45 maximum where used for non-structural items such as thrust blocks)

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

Entrained air ratio – 3.5 percent minimum to 6.5 percent maximum

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

[CSI 03 31 13.10]

Part 1 - General

Summary

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

Performance Requirements

28-day compressive strength – 3,000 psi minimum

Part 2 - Products

Mixes

Water/cement ratio - 0.45 maximum

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

Entrained air ratio – 3.5 percent minimum to 6.5 percent maximum

3.35 Concrete Finishing

3.35.05 Common Work for Surface Finishing

Part 2 - Products

Finishes

Each concrete area that requires finishing shall conform to one of the following requirements:

- Equipment Pads – Floated

Coatings

Coat concrete as specified in Division 9.

Part 3 - Execution

Preparation

Do not place concrete which requires finishing until the materials, tools, and labor necessary for finishing the wet concrete are on the job and acceptable to the Owner. If rainfall is possible, tent the work area prior to the pour and maintain protection until the concrete is cured sufficiently to resist damage.

3.35.54 Floated Finish

Part 3 - Execution

Construction

Consolidate, strike off, and level concrete; but do not work further until ready for floating. Begin floating when water sheen has disappeared and surface has stiffened sufficiently to permit floating operations. Consolidate surface with power-driven floats. Hand floating may be used if area is small or inaccessible to power units.

Field Quality Control

Check surface planeness during or after first floating. Cut down high spots and fill low spots to produce surface with tolerance of ¼-inch in 10 feet in any direction. Refloat to a uniform, smooth, sandy texture immediately after leveling.

3.39 Concrete Curing

Part 2 - Products

Materials

Curing compounds are not permitted on surfaces that will receive coatings.

Part 3 - Execution

Installation

All concrete shall be water-cured in accordance with ACI 308.1 unless approved in advance by the Owner. If allowed, curing compound shall be applied immediately after finishing or form removal. When plastic or burlap covers are used to augment or protect curing, extend sheeting beyond the edges of the concrete and secure against wind lift. Inspect and adjust curing systems daily, including over weekends and holidays.

3.40 PRE-CAST CONCRETE

3.48 Pre-Cast Concrete Specialties

3.48.50 Utility Structures

Part 1 - General

Summary

This subsection pertains to precast utility structures such as catch basins and vaults.

Design Requirements

All concrete structures identified on the Plans as being pre-cast, prefabricated, or not specifically detailed with reinforcing steel shall be pre-cast concrete.

Pre-cast vaults shall conform to ACI 318 and be constructed to the equivalent dimensions and functional characteristics of the specific product identified on the Plans.

Pre-cast catch basins shall be constructed to the equivalent dimensions and functional characteristics of the specific product identified on the plans.

Performance Requirements

Pre-cast structures shall be constructed to withstand anticipated construction loads that occur during transport, handling, and placement as well as the anticipated design loads. Design loads shall include the anticipated soil pressures and hydrostatic loads.

Submittals

Provide documentation showing the utility structure is equivalent in dimensions and functional characteristics of the specific product identified on the Plans.

Part 2 - Products

Materials

Additional reinforcement shall be provided within the pre-cast concrete structure at all penetrations, openings, joints, and connections. The additional reinforcement shall be provided to prevent damage during shipping, handling and installation. All damaged units shall be rejected.

All precast structures that consist of sections (base, riser, lid, etc.) shall have the joints sealed with rubber gaskets or mastic, of a material appropriate for the installation.

Components

Refer to the plans for sizes of Utility Structures.

Part 3 - Execution

Cleaning

Fill picking holes with grout flush to the structure surface, including those in vault lids. Cut, remove, and grind smooth shipping lifting hooks on the vault interior, unless directed otherwise by the Engineer.

Division 4
Masonry – This Division Not Used

Division 5

Metals

5.00 GENERAL

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

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

5.05 Common Work for Metals

Part 1 - General

Related Sections

- Division 1.81.45 Location Designations
- Division 9.90.00 Common Work for Painting and Coating
- Division 9.90.01 Color Schedule
- Division 9.91.13.12 Metals in contact with Concrete
- Division 9.91.13.01 Exterior metals
- Division 9.91.23.04 Galvanized iron and nonferrous
- Division 9.91.33 Submerged metals
- Division 1.81.30 Seismic Restraint

Submittals

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

- Shop Drawings showing details of Fabricated Metalwork including connections and welding.
- Calculations and plans stamped by a professional engineer licensed in the State of Oregon for all Contractor- or Manufacturer-designed components or assemblies.
- Welder certifications if applicable. For ASME Section IX certifications, and if requested by the Owner, provide a continuity log if the last certification was 6 months prior to the work being performed.

Inspections

Unless otherwise noted on the Plans, specifications, or building department requirements, special inspections related to metal fabrications, placement and welding shall be subject to 48-hour notice to the Engineer prior to the inspection time. A 48-hour notice is defined in Division 1, Contractor Responsibility.

Any Field welding shown on the Plans will require special inspections in accordance with section 1704.3 of the IBC and AISC 360.

Quality Assurance

Only prequalified welds (as defined by AWS) shall be used.

Fabricator shall be registered and approved by American Institute of Steel Construction (AISC) to perform shop fabrication without special inspection. Submit certificate of compliance to the Owner at the completion of fabrication. Owner will forward this to the Building Official.

If fabricator is not registered and approved, or the certificate of compliance is not received, the Contractor shall reimburse the Owner for all Special Inspections required by the IBC on shop fabricated items. The Contractor shall also reimburse the Owner for all Special Inspections required by the IBC for field welding not specifically shown on the Plans. Contractor shall alert Owner at least 30 calendar days in advance if such Special Inspections will be required in order to procure the services of a testing lab.

Special Inspection by the Owner does not relieve the Contractor of responsibility of performing their own inspections and testing to ensure that all items are properly constructed.

Part 2 - Products

Materials

Structural Steel

Structural steel shall conform to the following requirements:

Plates, shapes, angles, rods - ASTM A36 and A992, $F_y \geq 36$ ksi

Special shapes, plates - ASTM A572, $F_y \geq 50$ ksi

Pipe Columns - ASTM A53, Grade B Type E or S, $F_y \geq 35$ ksi (see Division 15.22 for steel pipe carrying fluids).

Structural Tubing - ASTM A500, Grade B, $F_y \geq 46$ ksi

Stainless Steel

Stainless steel shall be type 304 (non-welded) or type 304L (welded) or as called out.

Plates - ASTM A240

Fasteners - ASTM F593

Extruded Structural Shapes - ASTM A276

Pipe - ASTM A240 or higher grade or as called out.

See Section 15.22.4 for information on pipe used for mechanical applications.

All stainless steel shall have a standard mill finish where concealed or No. 4 finish where exposed and shall be cleaned of all foreign matter before delivery to the job site.

Aluminum

Plates - ASTM B209, Type 6061-T6

Extruded Shapes - ASTM B308, Type 6061-T6

Pipe - ASTM B210 Type 6061

Architectural Applications - ASTM B210, Type 6063

Aluminum materials in contact with concrete or other metals or other masonry materials shall have surfaces coated per Division 9.

Galvanized Steel

Base metal shall be as specified for Mild Steel.

Hot-dip galvanized after fabrication in accordance with ASTM A 924/A 924M.

Finishes: For pieces that will NOT be painted, galvanize with zinc coating in accordance with ASTM A 653/A 653M. For pieces that WILL be painted, galvalume with zinc/10 percent iron coating in accordance with ASTM A 653/A 653M.

Manufactured Units

Design of Contractor- or Manufacturer-designed components or assemblies shall meet the specific component requirements as provided here-in, as well as all applicable state and federal codes. Design shall include gravity loads and seismic loads in accordance with ASCE 7-10 Chapter 13 "Seismic Design Requirements for Nonstructural Components". Design criteria shall be as provided herein for components, and as provided on the Plans.

Contractor-designed components and assemblies shall be shop welded and field bolted if possible. Field welding will NOT be allowed unless specifically shown, or there is no reasonable alternative.

Finishes

All steel fabrications shall be surface prepped, shop primed and field coated in accordance with Division 9. Shop priming shall be protected as required to prevent damage to the coating during shipping. Hold back shop priming from areas to be field welded.

Isolate and coat dissimilar metals to prevent galvanic corrosion.

Non-exposed structural steel: Mill finish or as shown on Plans

Exposed structural steel (damp or wet locations): Division 9

Aluminum: Division 9

Galvanized steel: Division 9

Stainless steel: Uncoated

Part 3 - Execution

Fabrication

All welding shall be in accordance with AISC and American Welding Society (AWS) standards and shall be performed by AISC and/or AWS certified welders using electrodes to match base material. Only prequalified welds (as defined by AWS) shall be used. Welding inspection shall be performed in accordance with the applicable AWS provisions and Chapter 17 of the IBC. Shop welding requiring inspection or testing per IBC Chapter 17 must be tested by an independent testing laboratory certified by AWS and approved by the owner at the

Contractor's expense. Field welding, where required or allowed, will be inspected by a representative of the owner at the owner's expense. This does not relieve the Contractor of responsibility of performing his own inspections and testing to ensure that all items are properly constructed.

All shop welds shall be ground smooth.

Any shop paint on metal surfaces adjacent to joints to be field welded shall be wire brushed to remove the paint film prior to welding.

Where steel items to be welded are galvanized, galvanizing must first be removed by grinding with a silicon carbide wheel, by grit blasting or by sand blasting.

Any cutting or grinding equipment used on stainless steel must be new or only previously used on other stainless-steel material.

All stainless-steel shop welds shall be pickled after welding to remove heat damage and contaminants. Field welds must be passivated using an Engineer approved product (Citrisurf 2210 or equal). If the metal will be in contact with potable water, pickling and passivation products must be citric acid based and thoroughly removed, or use a product approved by USDA or NSF.

Installation

Fabrications shall be installed as shown on the approved shop drawings. All members shall be accurately located and erected plumb and level.

Metal fabrications shall be installed or erected as based on the American Institute of Steel Construction (AISC) "Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings", latest edition, plus all referenced code requirements.

Temporary bracing, such as temporary guys, braces, false-work, cribbing, or other elements, shall be provided by the Contractor in accordance with the requirements of the "Code of Standard Practice", wherever necessary to accommodate all loads to which the structure may be subjected, including construction loads. Such bracing shall be left in place as long as may be required for safety. As erection progresses, the work shall be securely bolted or welded to compensate for all loads during construction.

No permanent bolting or welding shall be performed until the structure has been properly aligned.

5.05.23 Bolts and Other Connectors for Structural Elements

Part 2 - Products

Materials

Bolts and other connectors not specifically called out otherwise shall be in accordance with the following.

Under no circumstances shall the fasteners be of lesser strength or higher corrosion potential than the materials being connected.

Connection bolts, nuts and washers for all materials in wet, damp or corrosive locations shall be Stainless Steel, alloy 304 in raw domestic or treated domestic water, alloy 316 in treatment

process and sewage applications, and alloy 317 for acidic transport. Bolts and nuts shall meet ASTM F593B (bolts 1/4-inch to 1 1/2-inch in diameter with 30 ksi yield) and F594B (nuts). Use Nitronic 60 bolts and nuts for strong chlorine environments.

Steel and cast-iron fabrications: Connection bolts for dry locations shall be ASTM A307 galvanized or zinc plated bolts.

Structural Plastic Fabrications: Connection bolts shall be ASTM A307 galvanized in dry applications and Stainless Steel in wet, damp or corrosive locations.

Aluminum Fabrications: Connection bolts shall be ASTM A307 galvanized. Aluminum fasteners may be allowed where high strength is not needed (e.g. mounting expanded metal screens, or louver fins), confirm with Engineer prior to use. Steel screws must be galvanized, or zinc plated. 300 Series stainless steel fasteners allowed only with the use of isolating washers.

Stainless steel fabrications: Fasteners to match same stainless series as structure (e.g. 300 series fasteners with 300 series structure)

Bolts installed into hardened concrete and CMU shall be Concrete Anchors per section 3.15.19.

Bolts and studs shall be long enough that at least two threads extend beyond the face of the tightened nut.

For pump anchor bolts, see Division 11.

For mechanical pipe (non-structural) connections, see Division 15.21, "Common Work for Pipe and Fittings".

Part 3 - Execution

Installation

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

Dissimilar metals:

In damp locations, isolate dissimilar metals using nylon isolation sleeves and washers, Cooper B-Line Nylon Headed Sleeve Kit or equal.

For wet locations: avoid dissimilar metals unless specifically approved or shown. Use similar metals with welded connections. If approved or shown, use galvanized mild steel bolts installed into prepped and coated holes with additional field coating over the top of bolt.

Division 6
**Wood, Plastics, and Composites –
This Division Not Used**

Division 7

Thermal and Moisture Protection

7.00 GENERAL

This division covers furnishing all labor, materials, and equipment for providing a structure that is completely weather-tight.

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

7.05 Common Work for Thermal and Moisture Protection

Part 1 - General

Summary

Provide the necessary pipe insulation, insulation jackets, and heat tracing systems to sufficiently insulate and heat all above ground, exterior piping systems, and as specified elsewhere herein and as shown on the Plans. Some items required to properly install pipe insulation, insulation jackets, and heat tracing systems are not shown on the Plans. The Contractor shall provide all necessary items as required by accepted design criteria and manufacturer recommendations to install all thermal protection systems.

Related Sections

- Division 15 Mechanical

References

- ASTM C 547, "Standard Specification for Mineral Fiber Pipe Insulation"
- ASTM C 585, "Standard Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System)"
- ASTM C 1136, "Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation"

Submittals

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

- Fiberglass pipe insulation
- Aluminum insulation jackets
- Heat tracing

7.20 THERMAL PROTECTION

7.20.01 Fiberglass Pipe Insulation

Part 1 – General

Design Requirements

All above ground exterior piping shall be insulated with pre-formed fiberglass pipe insulation unless otherwise specified in the Plans or approved by the Engineer.

All pipe insulation shall be 2-inches thick minimum, unless otherwise noted or approved by the Engineer.

Insulation materials furnished and installed hereunder shall meet the fire hazard requirements of applicable building codes when tested in composite form per one of the following nominally equivalent test methods:

- American Society for Testing of Materials ASTM E 84
- Underwriters' Laboratories, Inc. UL 723, CAN/ULC-S102-M88
- National Fire Protection Association NFPA 255

Submittals

The Contractor shall submit product cut sheets which shall include compliance with design requirements.

Part 2 – Products

Materials

Molded pipe insulation shall be manufactured to meet ASTM C 585.

Fittings and valves shall be insulated with pre-formed fiberglass fittings, fabricated sections of pipe insulation, or other products approved by the Engineer. Thickness shall be equal to adjacent pipe insulation.

Flanges, couplings and valve bonnets shall be covered with an oversized pipe insulation section sized to provide the same insulation thickness as on the main pipe section. An oversized insulation section shall be used to form a collar between the two insulation sections with low-density blanket insulation being used to fill gaps. Jacketing shall match that used on straight pipe sections. Rough cut ends shall be coated with suitable weather or vapor resistant mastic as dictated by the system location and service.

Piping and fittings located outdoors and exposed to the weather shall be insulated as indicated above and shall include aluminum metal jacketing 0.016-inch (0.4 mm) with moisture barrier, secured in accordance with the jacket manufacturer's recommendations. Joints shall be applied so they will shed water and shall be sealed completely.

Part 3 – Execution

Field Quality Control

All of the insulation materials and accessories covered by this specification shall be delivered to the job site and stored in a safe, dry place with appropriate labels and/or other product identification.

The contractor shall use whatever means are necessary to protect the insulation materials and accessories before, during, and after installation. No insulation material shall be installed that has become damaged in any way. The contractor shall also use all means necessary to protect work and materials installed by other trades.

If any insulation material has become wet because of transit or job site exposure to moisture or water, the contractor shall not install such material, and shall remove it from the job site. An exception may be allowed in cases where the contractor is able to demonstrate that wet insulation when fully dried out (either before installation or afterward following exposure to system operating temperatures) will provide installed performance that is equivalent in all respects to new, completely dry insulation. In such cases, consult the insulation manufacturer for technical assistance.

Installation

Install fiberglass pipe insulation, aluminum jackets and all associated components in accordance with industry standards and the manufacturers' installation instructions and/or recommendations.

7.20.02 Electrical Heat Tracing Systems

Part 1 – General

Design Requirements

All above ground piping exterior to building shall be electrically heated to ensure that the contents are maintained above 32 degrees Fahrenheit to prevent freezing

Submittals

The Contractor shall submit product cut sheets which shall include compliance with design requirements.

Part 2 – Products

General

The electrical heat tracing system shall consist of self-regulating heat cable, heat cable powered tee connection and end seal kit, heat trace label, glass tape and thermostat. The heat trace cable shall be rated for a nominal heat output of 5 watts per foot and suitable for operation on a 120 VAC single phase power system.

Self-Regulating Heating Cables

All heat-tracing applications with continuous exposure (maintain) temperatures from 150 degrees Fahrenheit (65 degrees Celsius) to 250 degrees Fahrenheit (121 degrees Celsius)

or intermittent exposure temperatures from 185 degrees Fahrenheit (85 degrees Celsius) to 420 degrees Fahrenheit (215 degrees Celsius) shall use self-regulating cables.

1. Self-regulating heating cable shall vary its power output relative to the temperature of the surface of the pipe or the vessel. The cable shall be designed such that it can be crossed over itself and cut to length in the field.
2. Self-regulating heating cable shall be designed for a useful life of 20 years or more with “power on” continuously, based on the following useful life criteria:
 - a. Retention of at least 75 percent of nominal rated power after 20 years of operation at the maximum published continuous exposure (maintain) temperature.
 - b. Retention of at least 90 percent of nominal rated power after 1,000 hours of operation at the maximum published intermittent exposure temperature. The testing shall conform to UL 746B, IEC 216-1 Part 1.
3. A warranty against manufacturing defects for a period of 10 years shall be available.
4. All cables shall be capable of passing a 2.5 kV dielectric test for one minute (ASTM 2633) after undergoing a 0.5 kg-m impact (BS 6351, Part 1, 8.1.10).

Freeze Protection Cables

1. The heating cable shall consist of two 16 AWG or larger nickel-plated copper bus wires, embedded in a self-regulating polymeric core that controls power output so that the cable can be used directly on plastic or metallic pipes. Cables shall have a temperature identification number (T-rating) of T6 (185 degrees Fahrenheit or 85 degrees Celsius) without use of thermostats.
2. A ground-fault protection device set at 30 mA, with a nominal 100-ms response time, shall be used to protect each circuit.
3. The heating cable shall have a tinned copper braid with a resistance less than the heating cable bus wire resistance as determined in type test (ASTM, B193, Sec. 5). The braid shall be protected from chemical attack and mechanical abuse by a modified polyolefin or fluoropolymer outer jacket.
4. In order to provide rapid heat-up, to conserve energy, and to prevent overheating of fluids and plastic pipe, the heating cable shall have the following minimum self-regulating indices:

Heating Cable	S.R. Index (W/°F)	S.R. Index (W/°C)
3 W/ft.	0.038	0.068
5 W/ft.	0.060	0.108
8 W/ft.	0.074	0.133
10 W/ft.	0.100	0.180

- a. The self-regulating index is the rate of change of power output in watts per degree Fahrenheit or watts per degree Celsius, as measured between the temperatures of 50 degrees Fahrenheit (10 degrees Celsius) and 100 degrees Fahrenheit (38 degrees Celsius) and confirmed by the type test and published data sheets.

5. In order to ensure that the self-regulating heating cable does not increase power output when accidentally exposed to high temperatures, resulting in thermal runaway and self-ignition, the cable shall produce less than 0.5 watts per foot (1.64 watts per meter) when energized and heated to 350 degrees Fahrenheit (177 degrees Celsius) for 30 minutes. After this test, if the cable is re-energized, it must not have an increasing power output leading to thermal runaway.
6. In order to confirm 3.1B, the self-regulating heating cable shall retain at least 90 percent of its original power output after having been cycled 300 times between 50 degrees Fahrenheit (10 degrees Celsius) and 210 degrees Fahrenheit (99 degrees Celsius), allowing at least six minutes of dwell time at each temperature.
7. The heating cable shall be Raychem® BTV-CT or BTV-CR self-regulating heater, with continuous exposure (maintain) capability up to 150 degrees Fahrenheit (65 degrees Celsius) and intermittent exposure capability up to 185 degrees Fahrenheit (85 degrees Celsius), as manufactured by Tyco Thermal Controls, or equal.

Terminations

1. All connection components used to terminate heating cables, including power connectors, splices, tees, and connectors shall be approved for the respective area classification and approved as a system with the particular type of heating cable in use. Under no circumstances shall terminations be used which are manufactured by a vendor other than the cable manufacturer.
2. In order to keep connections dry and corrosion resistant, components shall be constructed of nonmetallic, electrostatic, charge-resistant, glass-filled, engineered polymer enclosure rated NEMA 4X. The component stand shall allow for up to four inches.
3. Terminations shall include thermal insulation to (100 mm) thick minimum.
4. Terminals shall be spring clamp wire connection type to provide reliable connection, maintenance-free operation, and ease of reentry.
5. Heating cable terminations shall use cold-applied materials and shall not require the use of a heat gun, torch, or hot work permit for installation.
6. Components shall be rated to a minimum installation temperature of -40 degrees Fahrenheit (-40 degrees Celsius), minimum usage temperature of -75 degrees Fahrenheit (-60 degrees Celsius), and maximum pipe temperature of 500 degrees Fahrenheit (260 degrees Celsius).
7. The component system shall be Raychem JBM-100-L-A connection kit complete with integral LED power indicating light to serve as complete power, splice, or tee connection for up to three Raychem BTV, QTVR, or XTV industrial parallel heating cables as manufactured by Tyco Thermal Controls, or equal.

Thermostats and Contactors

Freeze protection systems shall be controlled by an ambient sensing thermostat set at 40 degrees Fahrenheit either directly or through an appropriate contactor. The thermostat shall be selected by the heat tracing system manufacturer as appropriate for the location and

classification. For short pipe runs (10 feet or less) the self-regulating properties of the cables may be allowed to provide freeze protection without necessitating thermostat control. The Manufacturer shall denote the short pipe lengths for which thermostats are not required.

Part 3 – Execution

Installation/Construction

Heat tracing systems shall be installed only after successful completion of leak testing for the pipeline on which the heat tracing system is to be installed. Installation shall be in accordance with the manufacturer's recommendations.

Field Quality Control

Factory inspections and tests for self-regulating, power limiting, series constant wattage and constant wattage (MI) heater cables shall include but are not limited to the following:

1. Testing shall be done per the latest IEEE Std. 515 test section and applicable manufacturer's standards.
2. In the field, all heater cables shall be meggered. The following separate field megger readings shall be taken on each self-regulating and each M.I. heater cable:
 - a. Heater cable shall be meggered when received at jobsite before installation.
 - b. Heater cable shall be meggered after installation, but before insulation is applied.
 - c. Heater cable shall be meggered after insulation has been installed.
3. All three of the above field megger readings shall be greater than 20 megaohms. Otherwise, the heater cable is not acceptable and shall be replaced.
4. Field megger tests shall be recorded for each heater cable, and certified reports shall be submitted to the user.

Division 8

Openings

8.00 GENERAL

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

8.05 Common Work for Openings

Part 1 - General

Summary

This division covers furnishing all labor, materials, and equipment necessary for providing all interior and exterior doors, frames, and windows.

Related Sections

- Division 5.05.23 Bolts and Other Connectors

Submittals

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

- Hatches

8.30 SPECIALTY DOORS

8.31 Access Doors and Panels

8.31.20 Vault Hatches

Part 1 - General

Summary

The Contractor shall visit the existing intake vault and verify all dimensions prior to providing any submittals.

Related Sections

- 1.52.20 Locks and Keys

Performance Requirements

Access hatches shall be rated for H-20 (AASHTO) loading.

Access hatches shall not have any obstructions such as intermediate hatch support beams.

Submittals

Provide manufacturer's statement of load rating.

For aluminum frames to be cast in concrete, provide submittal for frame coating.

Locate gutter drain outlet location and routing of drain line to its intended location.

Finishes

Aluminum hatch frames shall be protectively coated prior to casting in concrete to prevent the accelerated corrosion that occurs when aluminum is in contact with concrete.

Warranty

Manufacturer shall guarantee against defects in material or workmanship for a period of five years.

Part 2 - Products

Manufacturers

Hatches shall be equal to USF Fabrications, Bilco, Halliday or LW Products.

Components

Access hatches shall have aluminum diamond plate door leaf (or leaves), stainless steel spring lift, neoprene weather seal, stainless steel hardware, self-latching stainless-steel slam lock, and recessed padlock hasp with cover. An unkeyed internal lever shall open the latch to prevent accidental entrapment. Any drainage provision provided by the hatch or frame shall be routed to the vault or building sump or drain system using Sch 40 PVC anchored to the walls and ceiling unless shown otherwise on the plans.

Part 3 - Execution

Installation

Installation shall be in accordance with manufacturer's instructions.

Hatch gutter drain shall be connected to 2.5-inch or larger Schedule 40 PVC pipe and routed to daylight or storm drain unless shown otherwise on the plans.

Field Quality Control

Frame shall be installed square and true without binding of door throughout the full arc of travel. Mis-operation of door shall be corrected by the Contractor.

Division 9

Finishes

9.00 GENERAL

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

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

9.90 PAINTING AND COATING

9.90.05 Common Work for Painting and Coating

Part 1 – General

Scope

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

Definitions

Applicator: When used to describe work, the applicator is the party who is qualified for and performs the coating work. When used to describe contract requirements, the Contractor has responsibility as the applicator unless specifically stated otherwise. Contract requirements include but are not limited to submittals, warranties, insurance, etc.

Submittals

- **Products:** Before beginning any painting or coating, submit a list of coatings and manufacturers for review by the Owner. Do not provide an indiscriminate collection of data sheets. Include the application each coating is intended for, any surface preparation, number of coats, method of application, and coating thickness. If submitted products are manufactured by a company other than the specified reference standard, provide complete comparison to specified projects including application procedures, coverage rates, and verification that product is appropriate for intended use. Provide information that demonstrates the submitted products are equal to the performance standards of products manufactured by Tnemec Corporation, which is the reference standard.
- **Colors:** Provide color choices to Owner for color selection color samples prepared by the coating manufacturer. Electronic (PDF, jpg, etc.) charts, are acceptable.
- **Safety Data Sheets (SDS):** Provide an SDS for every material including solvents.

- Potable Water: Provide NSF certification for finishes in potential contact with potable water. Submit this information according to the requirements regarding shop drawings included herein.
- Schedule: Provide a schedule of coating operations and inspection timing.

Performance Requirements

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

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

Quality Assurance

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

Paint used in the first field coat over shop painted or previously painted surfaces shall cause no wrinkling, lifting, or other damage to the underlying paint.

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

Storage and Handling

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

Waste Products

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

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

Part 2 – Products

Manufacturers

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

1. Tnemec Company
2. Sherwin Williams
3. Or Equal

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

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

Part 3 – Execution

Preparation

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

Installers

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

Preparation

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

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

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

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

Installation/Construction

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

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

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

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

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

Field Quality Control

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

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

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

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

Inspection

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

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

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

Repair/Restoration

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

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

Cleaning

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

9.90.06 Product and Color Schedule

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

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

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

9.90.13 Unpainted Items

Part 1 – General

Summary

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

- Aluminum, galvanized, or stainless-steel items.
- Brass and copper pipe, valves, and fittings for plumbing fixtures.
- Sensors, switches, transmitters.

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

- Control valve pilot systems
- Sensor piping systems
- Ductile Iron Gate Valves

9.91.13.01 - System 1: Metals – Exterior and Wet Conditions

Part 2 - Products

1. Tnemec
 - a. Prime Coat: Series 27 Fast Cure Epoxy (3 to 5 Mil DFT)
 - b. Finish Coat: Series 1095 EnduraShield (3 to 5 Mil DFT)

2. Sherwin Williams

For products that are supplied in bare (unprimed) metal:

- a. Primer: Corothane 1 Galvapac Zinc Primer B65G11 (2.5 to 3.5 Mil DFT)
- b. Intermediate: Acrolon 218HS B65-650 Series (3 to 5 Mil DFT)
- c. Finish Coat: Acrolon 218HS B65-650 Series (3 to 5 Mil DFT)

For products that are supplied with a shop prime coat:

- a. Primer: Shop
- b. Intermediate: Macropoxy 646FC B58-600 Series (5 to 8 Mil DFT)
- c. Finish Coat: Acrolon 218HS B65-650 Series (3 to 5 Mil DFT)

Part 3 - Execution

Surface Preparation

1. Clean, dry, and free of all dirt, oil, grease, and other contaminants.
2. For new work: SSPC-SP1 solvent cleaned.
3. For coating over existing painted surfaces: Remove all loose and damaged coatings. Prepare with SSPC-SP2 hand tool or SP3 power tool cleaning.
4. All hollow metal doors, windows, and frames shall be bonderized, pickled, or phosphatized, which will serve as a primer for and shall be compatible with the finish coat to be applied in the field

9.91.13.10.01 - System 2: PVC and Elastomers – Exterior, Painted for UV Protection

Part 1 - General

Exterior PVC pipe, fittings and elastomers exposed to UV light.

Part 2 - Products

1. Tnemec
 - a. Primer: Series 73 Endura-Shield (3-4 Mil DFT)
 - b. Finish Coat: Series 73 Endura-Shield (3-4 Mil DFT)
2. Sherwin Williams
 - a. Primer: Acrolon Ultra (3-4 Mil DFT)
 - b. Finish Coat: Acrolon Ultra (3-4 Mil DFT)

Part 3 - Execution

Surface Preparation

Abrade surface by sanding; substrate should be dull and rough prior to finish coating. SSPC-SP1 Solvent Clean the substrate just prior to coating operations.

9.97.23.14 – System 3: Concrete Sealer

Part 2 – Products

Materials

1. Tnemec
 - a. 662 Prime-a-Pell Plus (100 sq. /ft. per gallon coverage based on smooth precast concrete. See product data sheet for coverage on other concrete surfaces.)
2. Sherwin Williams
 - a. Loxon 40 percent Silane Water Repellant (125 -175 sq./ft. per gallon coverage based on smooth precast concrete. See product data sheet for coverage on other concrete surfaces.)

Part 3 – Execution

Preparation

Surface Preparation

Prepare surface to clean, bare concrete free of contaminants including dust, oil and water. Apply sealer to concrete until it has moist appearance using a garden sprayer. Clean the surface to remove purged matter and allow it to dry a minimum of 24 hours. Repeat process to apply two coats.

Construction

Apply concrete sealer to the following locations:

- All exposed surfaces of equipment pads for water tank and water treatment plant.

Division 10
Specialties – This Division Not Used

Division 11

Equipment

11.00 GENERAL

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

11.05 Common Work for Equipment

Part 1 - General

Related Sections

- Division 1.81.30 Seismic Restraint Requirements

Submittals

Provide submittal information to the Owner for the following items:

- Water Storage Tanks

11.60 TREATMENT EQUIPMENT

11.60.01 Packaged Water Treatment Plant

Part 1 - General

Summary

The Owner has pre-purchased a Packaged Water Treatment Plant (WTP) from Precision Pumping Systems (PPS).

The Contractor shall be responsible for the following activities regarding the Packaged WTP.

- Receiving shipment of the WTP from PPS.
- Storage and maintenance of the WTP after receiving delivery from PPS.
- Installation of the WTP on the project site, which shall include but is not limited to:
 - Setting of WTP on the concrete pad and installation of anchors.
 - All plumbing connections to the WTP, included but not limited to raw water suction, treated water suction, treated water discharges, and floor drains.
 - Routing and connecting electrical power to the WTP.
 - Routing and connection of applicable sensors and instrumentation to the WTP.
- Assisting the PPS representative during the startup and testing of the WTP.

Related Sections

- Division 1.75 Startup and Adjusting
- Division 1.81.30 Seismic Anchorage
- Division 3

- Division 11.97 Water Storage Tanks
- Division 16
- Division 17

11.90 OTHER EQUIPMENT

11.97 Water Storage Tanks

Part 1 – General

Summary

1. These specifications cover upright, cylindrical, flat tanks molded in one-piece seamless construction by rotational molding. The tanks are designed for outdoor, above-ground, vertical installation. Included are requirements for materials, properties, design, construction, dimensions, tolerances, workmanship, and appearance. Tank capacities are from 10,000 gallons up to 10,500 gallons.
2. These specifications do not cover the design of vessels intended for use at pressures above or below atmospheric conditions.

Work of this Section

1. The work of this section includes providing high density linear polyethylene tanks with piping connections, seismic/wind restraint, and accessories. Tank resin and applicable accessories to be NSF 61 and FDA 177.1520 compliant.
2. The work also requires that one manufacturer accept responsibility for furnishing the work as indicated.
3. The work additionally requires that the manufacturer who accepts the indicated responsibilities shall manufacture the tank.
4. The installing contractor will coordinate the installation of all items specified herein and required to ensure the complete, and proper interfacing of all the components and systems.

Related Sections

- Division 1.75 Starting and Adjusting
- Division 1.81 Seismic Restraint and Anchorage

References

Except as otherwise indicated, the current editions of the following apply to the work of this section.

1. American Society for Testing and Materials (ASTM) Standards
 - a. ASTM D618 Conditioning Plastics and Electrical Insulating Materials for Testing
 - b. ASTM D638 Tensile Properties of Plastics
 - c. ASTM D746 Brittleness Temperature of Plastics and Elastomers by Impact

- d. ASTM D790 Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
 - e. ASTM D883 Definitions of Terms Relating to Plastics
 - f. ASTM D1505 Density of Plastics by the Density-Gradient Technique
 - g. ASTM D1525 Vicat Softening Temperature Plastics
 - h. ASTM D1693 Environmental Stress-Cracking of Ethylene Plastics
 - i. ASTM D1998 Standard Specification for Polyethylene Upright Storage Tanks
 - j. ASTM D2837 Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials
 - k. ASTM D3892 Practice for Packaging/Packing of Plastics
 - l. ASTM F412 Definitions of Terms Relating the Plastic Piping Systems
- 2. Association of Rotational Molders (ARM) Standards
 - a. Low Temperature Impact Resistance (Falling Dart Test Procedure)
 - 3. National Sanitation Foundation (NSF)/ American National Standards Institute (ANSI)
 - a. ANSI 61 American Waterworks Association – Drinking Water System Components
 - 4. Food and Drug Administration (FDA) Standards
 - a. 21 CFR 177.1520 Indirect Food Additives: Polymers
 - 5. Building Code
 - a. 2022 Oregon Structural Specialty Code

Design and Performance Standards

- 1. The minimum required wall thickness for the cylinder straight shell must be sufficient to support its own weight in an upright position without any external support. The standard design specific gravity of the tank shall be a minimum of 1.5. Flat areas shall be provided to allow locating large fittings on the cylinder straight shell.
- 2. The top head must be integrally molded with the cylinder shell. The minimum thickness of the top head shall be equal to the top of the straight wall.
- 3. Tanks shall have a minimum of three lifting lugs. The lifting lugs shall be designed to allow erection of an empty tank.
- 4. The tank shall be designed to provide a minimum of four tie-down lugs integrally molded into the top head. The tie-down lugs shall be designed to allow tank retention in wind and seismic loading situations without tank damage.

Submittals

- 1. Factory shop drawing that includes overall tank dimensions; manufacturer part number; fitting and accessory orientation; fitting, gasket and bolt style and size; tank material and specific gravity; and tank color. Provide details on inlet and outlet fittings, manways, flexible connections and vents.

2. Seismic support structure and anchoring system details, seismic and engineering calculations stamped by a licensed engineer in the state of the installation.
 - a. Tank restraint system. Show seismic and wind criteria.
3. Tank and Fitting Material Data Sheets and statement by the manufacturer indicating compliance with the materials requirements.
 - a. Resin manufacturer data sheet
 - b. Fitting material
 - c. Gasket style and material
 - d. Bolt material
4. Manufacturer's guidelines for use and installation.
5. Manufacturer's tank unloading and storage procedures.
6. Factory warranty.
7. Supporting documentation for Manufacturer's certification to NSF/ANSI Standard 61 – Drinking Water System Components for water treatment chemicals.

Quality Assurance

1. All tanks shall be certified by the manufacture as complying with ASTM D1998
2. All tanks shall undergo a hydrostatic water test which shall consist of filling the tank to brim full capacity for a minimum of four hours and conducting a visual inspection for leaks.
3. The finished tank wall shall be visually inspected and certified to be free, as commercially practicable, of visual defects such as foreign inclusions, air bubbles, pinholes, pimples, crazing, cracking, and delaminations that will impair the serviceability of the vessel. All cut edges where openings are cut into the tanks shall be trimmed smooth.
4. Tanks shall be manufactured from materials compatible to contain the intended chemical at the storage temperature.

Delivery, Storage, and Handling

Project Conditions

Warranty

The tank shall be warranted for three (3) years to be free of defects in material and workmanship from the date of project acceptance as determined by the Owner in writing.

Part 2 - Products

Manufacturers

Chemical storage tanks shall be as constructed by Snyder Industries, Inc. (www.snydernet.com), or approved equal.

Components

Tanks

The following tanks shall be provided under this section. The manufacturer shall refer to the Plans for additional details regarding installation and operations conditions.

Description: Treated Water Storage Tank

Quantity	2
Capacity	10,000 gallon minimum
Nominal diameter, in.	142
Storage Conditions and Color	Outdoor, UV Exposure, Opaque Color
Access Requirements:	Vented manhole access lid
Connection Requirements:	See Plans (summarized below)
	3-inch Treated Water Inlet (near bottom of tank)
	3-inch Treated Water Outlet (near bottom of tank)
	3-inch Drain Outlet (near bottom of tank)
	3-inch Overflow Outlet (near top of tank)
	Ultrasonic Level Transmitter

Tank Fittings

1. Threaded bulkhead fittings shall be provided for fittings located above the maximum liquid level or where specified on the Plans. Self-aligning threaded bulkhead fittings shall be provided where fittings are located on tank dome or other curved surface, or as specified on the Plans. Fittings must be placed away from tank knuckle radius' and flange lines. The bulkhead fittings shall be constructed of PVC. Gaskets shall be a minimum of 1/4-inch thickness material suitable for water storage. For NSF/ANSI 61 certification, EPDM or Viton GF gaskets shall be supplied.
2. Bolted double flange fittings or SUMO fittings (for Snyder Industry tanks) are required for fittings located below the maximum liquid level or where specified on the Plans. Fittings must be placed away from tank knuckle radius' and flange lines.
 - a. The bolted flange fitting shall be constructed with one 150-pound flange, one 150 pound flange gasket, and the correct number and size of all-thread bolts for the flange specified by the flange manufacturer. The flanges shall be constructed of PVC Type I, Grade I. Standard orientation of bolted double flange fittings shall have bolt holes straddling the principal centerline of the tank in accordance with ANSI/ASME B-16.5, unless otherwise specified.

Gaskets shall be a minimum of 1/4-inch thickness material suitable for the chemical stored. There shall be a minimum of four full thread bolts. The bolts will have bolt heads encapsulated in elastomer material. The encapsulated bolt shall be designed to prevent metal exposure to the liquid in the tank and prevent bolt rotation during installation. The elastomeric encapsulation shall fully cover the bolt head and a minimum of 1/4-inch of the threads closest to the bolt head. The polyethylene shall be color coded to distinguish bolt material. Each encapsulated bolt shall have a gasket to provide a sealing surface against the inner flange. The bolt material shall be titanium for sodium hypochlorite applications; 316 stainless steel for sodium hydroxide (caustic) and all other chemical applications.

3. Tank fitting attachments shall be equipped with flexible couplers or other movement provisions recommended by the tank manufacturer and specified on the Plans. The tank will deflect based upon tank loading, chemical temperature, and storage time duration. Tank piping flexible couplers shall be designed to allow 4 percent design movement. Movement shall be considered to occur both outward in tank radius and downward in fitting elevation from the neutral tank fitting placement.

Tank Attachments and Accessories

- Level Sensors: All tanks shall be equipped by the supplier with ultrasonic level sensors. The level transmitter shall be Siemens Sitrans Probe LU or equal. The sensor mount location shall be per the Plans and supplier shall provide tank mounting system for sensor.
- Float Indicator: All tanks shall be equipped by the supplier with a reverse float level indicator. The level indicator shall be assembled to the tank and shall consist of a PVC float, indicator, polypropylene rope, perforated interior pipe, PVC roller guides, clear UV resistant PVC sight tube, and necessary pipe supports. The level indicator shall act inversely to the tank contents and shall not allow entrance of tank contents into the sight tube at any time. Indicator shall be neon orange color for visual ease for onsite operators.
- Seismic Restraint System: All tanks shall be equipped with seismic restraints. The restraint system must meet the requirements of the IBC's most current edition. The complete system shall be constructed of 316 stainless steel materials. Stamped engineering calculations by a registered structural engineer in the State of Oregon shall be submitted as part of the submittal review process. The Contractor shall install per the manufacturer's recommendations. Tank manufacturer must provide finite analysis proving that the tank can withstand the structural loads implied.
- Vents: Each tank must be properly vented for the type of material and flow rates expected. Vents shall be screened and be located above the highest water level to permit circulation of air above the water. Vents integrated into the manhole access lid are acceptable.
- Lockable Access Plate: Each tank's access hatch shall be fitted with a waterproof lockable access plate to prevent unauthorized access.
- Overflow switch: An overflow switch shall be installed on the overflow line at the exterior of the tank to provide alarming if the tank level overflows.

Part 3 - Execution

Installation/Construction

Installation shall be in accordance with the manufacturer's recommendations.

Field Quality Control

1. Field testing shall be in accordance with the manufacturer's recommendations.
2. After installation of tank and all fittings, the tank shall be water tested by filling the entire tank with water and monitoring the tank, as well as all fitting connections, for at least 24 hours. Any leaks shall be corrected prior to acceptance.
3. The tanks shall be disinfected according to Division 1.75.

Division 12

Furnishings – This Division Not Used

Division 13
Special Construction – This Division Not Used

Division 14

Conveying Systems – This Division Not Used

Division 15

Mechanical

15.00 GENERAL

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

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

15.05 Common Work for Mechanical

Part 1 - General

Summary

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

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

Related Sections

- Division 1.81.30 Seismic Restraint and Anchorage
- Division 1.81.40 Pressure Ratings
- Division 1.81.50 Materials in Contact with Drinking Water
- Division 10.14.23 Panel Signage

References

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

Submittals

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

- PVC pipe and fittings
- Isolation valves
- Control valves
- Floor drains and cleanouts
- Level sensors
- Pressure gauges

- Packaged Water Treatment Plant
- Water Storage Tank

Part 2 – Products

Materials

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

Part 3 - Execution

Field Quality Control

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

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

Cleaning

Potable Water Systems

After preliminary purging of the system, chlorinate entire potable water system in accordance with AWWA C651 for flushing and disinfecting water mains, AWWA C652 for disinfecting water storage facilities, and in accordance with all other pertinent rules and regulations. Operate each valve during chlorination period to provide contact. Retention time shall be 24 hours minimum, or 48 hours if the water temperature is less than 41-degrees Fahrenheit. Total retention time shall not exceed 3 days after which the chlorinated water shall be immediately flushed out.

Upon completion of disinfection, thoroughly flush the entire potable water system allowing two complete exchanges of contents. The Constructor may choose not to completely flush the two 10,000 gal tanks (i.e. fill to overflow and drain). Instead, the Constructor may choose to thoroughly rinse the inside walls of the tanks using treated water. Do not discharge chlorinated material to storm or surface water systems without thoroughly neutralizing the chlorine residual remaining in the water in accordance with AWWA C655 for field dechlorination.

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

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

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

15.10 BURIED PIPE INSTALLATION

Part 1 – General

Site Conditions

Existing soils are unclassified except where specifically identified on the Plans or specifications.

Part 3 - Execution

Installation

Install pipes to the depth shown on the details. Regardless of vertical tolerance, do not create new high points in pressure pipe not otherwise shown on the Plans. Regardless of vertical tolerance, do not lay gravity pipe with reverse slope.

All non-metallic pipe, including service and air valve lines, shall include a tracer wire taped every 5 feet to the top of the pipe. Loop tracer wire to the surface in accessible locations such as valve boxes, meter vaults, or other surface access. If no access is available for more than 1,500 feet, provide a valve box specifically for the tracer wire. Wire shall be solid UF, 12AWG minimum for 2,000-foot runs and less, or 10AWG for runs longer than 2,000 feet.

Keep openings in pipe closed during the progress of work. Install plugs to prevent water and debris from entering pipe. No payment will be made to clean pipes.

15.11 Open Trench Pipe Installation

15.11.11 Pressure Pipe Installation

Part 1 - General

References

Use materials and installation methods in accordance with the latest edition of the Uniform Plumbing Code and local codes and regulations that are applicable.

Scheduling

Connections to live mains shall be made only after contacting the Owner 48 hours prior (not including weekends or holidays).

The Contractor shall make every effort to minimize interrupted service to customers when making connections to live mains. Once connection work has started, the Constructor shall progress continuously until installation is complete and service to customers has been restored.

The Owner will notify customers in advance of service interruption. If, in the opinion of the Owner, the Contractor has not adequately scheduled the work to occur within these timeframes, the Owner may cancel the service interruption. No time or monetary compensation will be provided for such cancellation.

If a service interruption extends beyond these timeframes and, in the opinion of the Owner, the extended service interruption was caused by the Contractor's failure to properly schedule or perform the work, the Owner has the right to charge liquidated damages in the amount of \$500 per calendar day for each occurrence.

Part 3 - Execution

Installation

Install pipes in accordance with the manufacturer's recommendations. Use types and sizes of pipes as specified herein and/or as shown on the Plans. Where small pipe sizes are omitted from the Plans and not mentioned in the specifications, use sizes corresponding to code requirements and as required by equipment and plumbing fixtures and appurtenances. Properly size any undesignated pipe sizes for the functions to be performed.

Lay pipe and supports at proper lines and grades. Follow the piping runs shown on the Plans as closely as possible, except for minor adjustments to avoid architectural and structural features as well as existing pipes. Make major relocations, if required, in a manner acceptable to the Owner and as approved by the Engineer.

Keep openings in pipes closed during progress of work.

Form thrust blocking so that bolts, joints, gaskets, and flanges of adjacent joints are clear of concrete allowing access to the joints without removing concrete. All concrete blocking shall have a minimum compressive strength of 4,000 psi unless identified otherwise in Division 3 or on the Plans.

Pipe passing through concrete walls or slabs shall be made watertight.

Trenches shall be excavated to a sufficient width to allow for pipe installation, compaction equipment, and shoring when necessary. Maximum trench width shall not exceed 36-inch plus OD for 4-inch and larger pipe, or 24-inch plus OD for 3-inch and smaller pipe for pay items or related materials including but limited to crushed surfacing, patching, import bedding, import backfill, and rock excavation.

Bedding shall be mechanically compacted in lifts no greater than 8-inches from base to springline and from springline to top of pipe using a jumping jack or sheepsfoot. Hoe-packs, sheepsfoots, and vibratory rollers shall not be used within 12-inches directly above the pipe. Compact trench backfill in lifts not exceeding 18-inches loose-thickness.

Flanged Joint Assembly

1. Bolt holes of flanges shall straddle the horizontal and vertical centerlines of the pipe. Clean flanges by wire brushing before assembling. Clean flange bolts and nuts by wire brushing; lubricate bolts with graphite or oil.

2. Insert the nuts and bolts (or studs), finger tighten, and progressively tighten diametrically opposite bolts uniformly around the flange to the proper tension. Bolts shall have minimum of two threads showing beyond the nut.
3. Tighten joints carefully to prevent strain upon valves, pumps, and other equipment.
4. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reset or replace the gasket, reinstall or re-tighten the bolts and nuts, and retest the joints. Replace the gasket if damaged.

Field Quality Control

Make no permanent connections to the existing water system until the new water main has been tested and approved by the Owner. No temporary connections of the untested, unapproved new water main to the existing water system shall be made without the installation of a double check valve assembly between the new water main and the existing water system. The Contractor shall verify the size, material, and location of the existing main at the connection point prior to installing the new water main.

15.13 Above Grade Mechanical Installation

15.18 Buried Piping Inspection and Testing

15.18.02 Buried Pressure Pipe Inspection and Testing

Part 3 - Execution

Preparation

Provide all required personnel and equipment and complete all tests required to demonstrate the integrity of the finished installation for the approval of the Owner and all agencies having jurisdiction.

Backfill the pipeline trench sufficiently to prevent movement of the pipe under pressure. All thrust blocks shall be in place and sufficiently cured to reach design strength before testing. Furnish, install, and remove temporary blocking where permanent blocking is not required and remove it after testing.

Furnish and operate all pumps, gauges, plugs, saddles, valves, miscellaneous hose and piping, and other equipment necessary for performing the test. Pressure gauges shall be legible, accurate (+/- 3-percent of scale), and scaled appropriately for the test. Scale range shall not exceed 200-percent of the test pressure. For example, for a 250-psi test, the gauge scale shall not exceed $2 \times 250 = 500$ psi. Gauge face must be no smaller than 2.5-inch diameter. Gauges used in the test may be required to be certified for accuracy at a laboratory by the Owner and the Owner has the right to reject any gauges that are suspect in their accuracy.

Tests/Inspection

Water Main Flushing

Flushing shall allow two complete exchanges of water and remove any debris. Refer to Section 15.05 for flushing requirements of the two (2) water storage tanks.

Hydrostatic Pressure Testing

Cover any exposed pressurized PVC or HDPE pipe to protect from direct sunlight if the air temperature is above 70-degree Fahrenheit.

Test all pipelines and appurtenances under a hydrostatic test pressure equal to that specified under Division 1.81.40 of these Specifications. The Owner has the right to require more stringent test criteria than stated in this Specification or in the pressure rating section if it is determined that field conditions warrant such measures.

An acceptable test of pipe and fittings buried under or adjacent to concrete slabs or other structures must be performed prior to construction of the structure.

The Owner will furnish the water necessary to fill the pipelines and for testing at a time of day when sufficient quantities of water are available for normal system operation.

Fill the pipelines with water and allow to stand under pressure for a minimum of 24 hours to allow air to escape and allow the lining of the pipe to absorb water. The Contractor is responsible for the proper disposal of any waste, including water.

Fittings and sections of pipe that cannot be pressure tested, such as connections to the existing system, shall be left exposed for a visual inspection under system pressure. Any visible leakage shall be corrected by the Contractor to the satisfaction of the Owner regardless of the allowable leakage specified herein. Should the test section fail to meet the specified pressure test successfully, the Contractor shall locate and repair the defects and then retest the pipeline at their expense.

Prior to calling out the Owner to witness the pressure test, the Contractor shall have all equipment completely set up, ready for operation, and have successfully performed the test to assure that the pipe is in a satisfactory condition. The Owner shall witness the test; if the test does not pass inspection for any reason, additional trips required to witness another test shall be done at the Contractor's expense.

Before applying the specified test pressure, air shall be expelled completely from the pipe, valves, and appurtenances.

The test shall be accomplished by pumping the main up to the required pressure. During the test, the section being tested shall be observed for visible leakage. A clean container shall be used for holding water for pumping pressure on the main being tested. This makeup water shall be sterilized by the addition of chlorine to a concentration of 50 mg/l (ppm).

Sections to be tested shall be isolated and pumped to test pressure. Test pressure shall be sustained for a minimum of 60 minutes with less than 2-percent (5 psi) loss in pressure throughout the test duration with Owner present and on site throughout test duration. If test results do not comply, Contractor shall repair leaks and retest until testing is passed in presence of Owner.

15.18.03 Valve Testing

Part 3 - Execution

Testing

All valves shall be pressure tested. Do not exceed the rated working pressure of the valve when operating the valve. Bleed off test pressure prior to operating. Check all valve bonnet fasteners for tightness.

Post-Installation

Test all valves for water tightness under differential working pressure. To perform this test, pressurize pipe section with valve in place, close valve and relieve pressure on seat side of the valve. The valve shall not pass water during a 5-minute test period.

Operate all valves at least once from closed-to-open-to-closed positions while valve is under working (not test) pressure.

15.18.05 Gravity Pressure Test Method

Part 3 - Execution

Testing

All gravity pipelines, including all connected side sewers, shall be tested for water tightness in accordance with the provisions of 00445.72 of the Oregon Standard Specifications. No other test procedures will be allowed except by written approval of the Engineer. Whenever groundwater is encountered in the sewer construction, an approved water level monitoring device shall be installed at each manhole. Refer to Division 1.81.40 for hydrostatic testing head.

15.20 PIPE AND FITTINGS

15.21 Common Work for Pipe and Fittings

Part 2 - Products

Components

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

Fasteners for pipe and fittings: Per AWWA standards unless otherwise specified. All relevant subsections of AWWA C100, C200, and C500. All bolts and studs shall be long enough so that no less than two threads extend beyond the face of the nut. Non-submerged flange bolts to be ASTM A307 Grade A, zinc plated.

Finishes

For conditions other than submerged, all nuts and bolts shall be zinc plated, and suitable for above and below grade locations as required. Where above grade/exposed piping is specially

coated, the connecting nuts and bolts shall be coated using the same system unless directed otherwise by the Owner.

Part 3 - Execution

Construction

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

15.22 Metal Pipe and Fittings

15.22.07 Corrugated Metal Pipe

Part 1 - General

Submittals

Provide documentation showing the pipe and appurtenances meets the AASHTO and / or ASTM ratings called for in the ODOT Standard Specifications.

Part 2 - Products

Materials

Pipe and appurtenances for culverts shall comply with ODOT Section 00445. Materials may be aluminum coated steel or aluminum ODOT Section 02420. Metal pipe thickness as shown on the Culvert Pipe Schedule in ODOT Section 02420.

Part 3 - Execution

Installation

Installation shall comply with ODOT Section 02420 for storm sewers unless shown otherwise on the Plans.

15.23 Non-Metal Pipe and Fittings

15.23.05 PVC Pipe and Fittings – Solvent Weld

Part 2 - Products

Materials

Polyvinyl chloride (PVC) material for pipe fittings and couplings shall conform to ASTM D-1784, Type 1, Grade 1, with 2,000 psi design stress. Pipe shall be Schedule 80 in accordance with ASTM D-1785, as shown on the Plans. All PVC pipe that shall be in contact with raw or treated water shall be NSF 61 compliant.

- Sewer pipe color shall be green.
- Water pipe color shall be white.

Part 3 - Execution

Installation

For exposed locations that will not be painted, primer and glue must be applied carefully and not allowed to run. Areas where primer/glue has run more than 1/4-inch past the joint will be cleaned, painted, or replaced by the Contractor at the discretion of the Owner.

15.30 VALVES

15.31 Common Work for Valves

Part 1 – General

Design and Performance Requirements

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

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

Pressure rating shall be per Division 1.81.40 unless shown otherwise.

Part 2 – Products

Components

Exposed gate valves shall be equipped with an AWWA 2-inch wrench nut with a minimum of 10 turns required to close the valve, unless otherwise noted on Plans.

Buried ball valves, when the valve handle is located more than 6 inches below the valve box lid, shall be equipped with a stem extension. Refer to Section 15.75.12 for additional information regarding PVC ball valves.

Part 3 - Execution

Installation

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

15.32 Isolation Valves

15.32.02 Resilient Wedge (Seat) Gate Valves

Part 1 – General

Design Requirements

All gate valves for water lines 3-inches to 48-inches shall be of the resilient, wedge-type, and shall meet or exceed the performance requirements of AWWA C509 or AWWA C515-Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service, unless shown otherwise. Valves shall be suitable for installation with the type and class of pipe being installed. Valve opening direction shall be counter-clockwise. Valves shall be rated per Division 1.81.40.

Part 2 – Products

Components

The wedge shall be fully encapsulated with vulcanized SBR rubber or EPDM. Ends as shown on the plans. All exterior valve body bolting (bonnet, stuffing box, gear box) shall use Cor-Ten, 304 (18-8) SS, or 316 SS bolts and nuts.

Gate valves shall be factory coated with a protective epoxy coating meeting the requirements of AWWA C550.

Part 3 - Execution

Installation

Install valves in strict accordance with manufacturer's instructions and as shown on the Plans. Verify alignment and adjustments after installation.

15.33 Check Valves

15.33.09 Duckbill Elastomeric Check Valves

[CSI 40 05 71.13]

Part 1 – General

Summary

Duckbill Elastomeric Check Valves shall be provided on the reservoir inlet system or discharge outfall.

Submittals

Submit product literature including information on performance and operation valve, materials of construction, dimensions/weight, elastomer, flow data, headloss data, and pressure ratings.

Upon request, provide shop drawings that clearly identify the valve dimensions.

Part 2 – Products

Manufactured Unit

Check Valves are to be all rubber and of the flow operated check type with a connection end as shown on the plans. The port area shall contour down to a duckbill, which shall allow passage of flow in one direction while preventing reverse flow. The valve shall be one-piece rubber construction. Valves must be self-supporting with no sag in both empty and filled conditions. The bill portion shall be thinner and more flexible than the valve body. The bill-slit-height of the duckbill valve must be larger than the nominal pipe diameter to allow for least restrictive full pipe flow area. Backup rings and any metal components shall be 316 stainless steel. Company name, plant location, valve size and serial number shall be bonded to the check valve.

Part 3 – Execution

Installation

Valve shall be installed as shown on the plans.

15.40 PIPING SPECIALTIES

15.40.08 Valve Box – Cast Iron

Part 2 - Products

Components

Cast iron valve boxes shall be a complete unit composed of the following:

- Valve box
- Lid

Valve box assembly shall be adjustable to accommodate variable trench depths. Valve box assembly shall be rated for continuous traffic loading.

Part 3 - Execution

Installation

Valve boxes shall be provided and installed for all buried valves. Install box plumb with surface and straight so that keys and operators do not bind.

15.70 PLUMBING

15.70.05 Common Work for Plumbing

Part 2 – Products

Components

Joists and Connections

- Solvent Cement: Use solvent cement approved by pipe and fitting manufacturer and apply in accordance with the manufacturer's installation procedures.

Part 3 - Execution

Examination

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

Installation

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

Inspection

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

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

15.73 Sewer Fixtures

15.73.03 Cleanouts

Part 2 – Products

Manufacturers

Cleanouts shall be equal to Wade Model 8130 floor cleanouts.

Manufactured Units

Provide floor cleanouts fabricated from cast iron with spigot type outlet, threaded adjustable housing, and round, heavy duty, cover with satin bronze finish.

Wall cleanouts shall be threaded male cleanouts plumb connected to threaded female wye fittings.

15.75 Plumbing Fixtures

15.75.12 PVC True Union Ball Valves

Part 2 – Products

Manufacturers

Valves shall be equal to Hayward TBH Series, Chemtrol Tu Series Tru-bloc, or Engineer approved equal.

Manufactured Unit

Provide true union ball valves fabricated from PVC Type 1, Grade 1 with PTFE seats and FKM or FPM “O” ring seals. PVC valves shall be listed by the NSF for use in potable water

systems. Valves shall be pressure-rated per the pressure rating section in this division. Valves designated for panel mounting shall have handle extensions designed for panel mounting.

In buried applications, when the valve handle is located more than 6 inches below the valve box lid, the valve shall be equipped with a stem extension.

15.75.13 PVC True Union Ball Valves Electronic Actuator

Part 2 – Products

Manufactured Unit

Provide an electronic actuator that is compatible with the PVC true union ball valve as specified in Division 15.75.12.

The electronic actuator shall have the following criteria:

- Universal voltage: 24 to 240 VAC/DC
- Internal thermostat controlled anti-condensation heater
- Isolated end of travel limit switches
- Manual override
- Visual valve position indicator
- LED Status lights to indicate operational status
- External wiring connections with DIN plugs
- Over-torque protection
- Minimum temperature service rating of 0° F to 120° F
- IP67 rated weatherproof enclosure
- Self-lubrication shaft bearings

15.75.21 Unions

Part 2 – Products

Manufactured Units

As shown on the Plans, unions shall be water tight, capable of pressure forces of the pipe it is connected to, and allow a minimum of 1/4-inch of play for installation and maintenance flexibility. Unions shall be threaded to match the pipe it connects and match the pipe material (copper, brass or PVC).

15.75.30 PVC Backwater Valve

Part 2 – Products

Manufactured Unit

Provide backwater valve fabricated from PVC. Valve should contain a quick action flapper with an elastomeric seal that provides a watertight seal. Valve should also contain a threaded access cap which incorporates a neoprene seal for positive sealing and can be tightened or removed by hand. Valve should be intended for buried applications.

Accessories

Provide an access sleeve and lid that fits over the top of the backwater valve so that the valve cover can be accessed and removed by hand.

Division 16

Electrical

16.00 GENERAL

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

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

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

16.05 Common Work for Electrical

Part 1 - General

Summary

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

Regulatory Requirements

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

Codes and Standards

Provide all electrical work in accordance with latest edition of National Electrical Code, National Electrical Safety Code, Oregon Electrical Specialty Code, and local ordinances. If any conflict occurs between government adopted code rules and these specifications, the codes are to govern. All electrical products shall bear a label from a certified testing laboratory recognized by the State of Oregon. Recognized labels in the State of Oregon are UL, ETL, and CSA-US.

Definitions

Dry Locations: All those indoor areas which do not fall within the definitions below for wet, damp, or corrosive locations and which are not otherwise designated on the Plans.

Wet Locations: All locations exposed to the weather, whether under a roof or not, unless otherwise designated on the Plans.

Damp Locations: All spaces wholly or partially underground, or having a wall or ceiling forming part of a channel or tank unless otherwise designated on the Plans.

The words “plans” and “drawings” are used interchangeably in this specification and in all cases shall be interpreted to mean “Plans”.

The word “provide” shall be interpreted to mean furnish and install.

Design Requirements

Unless otherwise noted, provide enclosures as follows:

1. Indoors Unclassified Locations: NEMA Type 12
2. Outdoors and/or Wet Locations: NEMA Type 3R

Submittals

Provide submittals of each item specified in this division to engineer for approval in accordance with Division 1 of these specifications. Submittals for motor control centers, motor control panels, control panels, instrumentation panels, and pump control panels shall include at a minimum: a wiring diagram or connection schematic, and an interconnection diagram.

Provide submittal information for the following items:

1. Utility Meter Enclosure
2. Service Disconnect
3. Conduit and Fittings
4. Wire and Cables
5. Other Electrical Components listed in this Division and/or required by the Engineer.

Project Conditions

Contractor shall keep all power shutdown periods to a minimum. Carry out shutdowns only after a shutdown schedule has been submitted and approved by both the Owner and the Engineer.

Construction Power

See Division 1.51

Part 2 - Products

Source Quality Control

Provide adequate space and fit for the electrical installation, including, but not limited to, determination of access-ways and doorways, shipping sections, wall and floor space, and space occupied by mechanical equipment. Provide electrical equipment that fits in the areas shown on the Plans. All equipment shall be readily accessible for maintenance, shall have electrical clearances in accordance with National Electric Code (NEC) and shall be installed in locations which will provide adequate cooling.

Do not use equipment exceeding dimensions indicated or equipment or arrangements that reduce required clearances or exceed specified maximum dimensions unless approved by the Owner.

Identification of Listed Products

Electrical equipment and materials shall be listed for the purpose for which they are to be used, by an independent testing laboratory. When a product is not available with a testing

laboratory listing for the purpose for which it is to serve, the inspection authority may require the product to undergo a special inspection at the manufacturer's place of assembly. All costs and expenses incurred for such inspections shall be included in the original contract price.

Materials

Use equipment, materials and wiring methods suitable for the types of locations in which they will be located, as defined in Definitions above.

All materials and equipment specified herein shall, within the scope of UL Examination Services, be approved by the Underwriter's Laboratories for the purpose for which they are used and shall bear the UL label.

Components

Fasteners for securing equipment to walls, floors, and the like shall be either hot-dip galvanized after fabrication or stainless steel. Provide stainless steel fasteners in corrosive locations. When fastening to existing walls, floors, and the like, provide capsule anchors, not expansion shields. Size capsule anchors to meet load requirements. Minimum size capsule anchor bolt is $\frac{3}{8}$ -inch.

Accessories

Wire Identification

1. Identify each wire or cable at each termination and in each pull-box using numbered and lettered wire markers. All electrically common conductors shall have the same number. Each electrically different conductor shall be uniquely numbered. Identify panelboard circuits using the panelboard identification and circuit number. Identify motor control circuits using the equipment identification number assigned to the control unit by the motor control center manufacturer and the motor control unit terminal number. Identify other circuits as approved by the Engineer. Identify each wire or cable in each pull-box with plastic sleeves having permanent markings. Conductors between terminals of different numbers shall have both terminal numbers shown at each conductor end. The terminal number closest to the end of the wire shall be the same as the terminal number.

Finishes

Refer to each electrical equipment section of these specifications for painting requirements of equipment enclosures.

Part 3 - Execution

Installation

General

1. Complete the wiring, connection, adjustment, calibration, testing and operation of mechanical equipment having electrical motors and/or built-in or furnished electrical components in accordance with electrical code, UL listing requirements and manufacturer's instructions. Install electrical components that are furnished with mechanical equipment.
2. Provide the size, type and rating of motor control devices, equipment and wiring necessary to match the ratings of motors furnished with mechanical equipment.

3. Complete the procurement, installation, wiring, connection, calibration, adjustment, testing and operation of all electrical devices, components accessories and equipment which is not shown or specified but which is nonetheless required to make the systems shown and specified properly functional.

Workmanship

1. Assign a qualified representative who shall supervise the electrical construction work from beginning to completion and final acceptance.
2. Provide all labor using qualified craftsmen, who have had experience on similar projects.
3. Ensure that all equipment and materials fit properly in their installations.

Field Services

1. Provide field services of qualified technicians to supervise and check out the installation of the equipment, to supervise and check out interconnecting wiring, to conduct start-up and operation of the equipment, and to correct any problems which occur during testing and start-up.

Installing Equipment

1. Provide the required inserts, bolts and anchors, and securely attach all equipment and materials to their supports.
2. Install all floor-mounted equipment on 3½-inch high reinforced concrete pads.
3. Install all equipment and junction boxes to permit easy access for normal maintenance.

Cutting, Drilling, and Welding

1. Provide any cutting, drilling, and welding that is required for the electrical construction work.
2. Structural members shall not be cut or drilled, except when approved by the Engineer. Use a core drill wherever it is necessary to drill through concrete or masonry. Perform patch work with the same materials as the surrounding area and finish to match.

Metal Panels

1. Mount all metal panels, which are mounted on, or abutting concrete walls in damp locations or any outside walls ¼-inch from the wall and paint the back side of the panels with a high build epoxy primer with the exception of stainless-steel panels. Film thickness shall be 10 Mils minimum.

Seismic Requirements

1. See Division 1.81.30

Load Balance

1. Balance electrical load between phases as nearly as possible on panelboards, motor control centers, and other equipment where balancing is required.

2. When loads must be reconnected to different circuits to balance phase loads, maintain accurate record of changes made, and provide circuit directory that lists final circuit arrangement.

Field Quality Control

Minor Deviations

1. The electrical plans are diagrammatic in nature and the location of devices, fixtures, and equipment is approximate unless dimensioned. Based on this, the right is reserved by the owner to provide for minor adjustments and deviations from the locations shown on the Plans without any extra cost. Deviations from the Plans and/or specifications required by code shall also be done, subsequent to Owner's approval, without extra cost.
2. Plans indicate the general location and number of the electrical equipment items. When raceway, boxes, and ground connections are shown, they are shown diagrammatically only and indicate the general character and approximate location. Layout does not necessarily show the total number of raceways or boxes for the circuits required. Furnish, install, and place in satisfactory condition all raceways, boxes, conductors, and connections, and all of the materials required for the electrical systems shown or noted in the contract documents complete, fully operational, and fully tested upon the completion of the project.

Project Record Plans

1. A set of Plans shall be maintained at the job site showing any deviations in the electrical systems from the original design. A set of electrical Plans, marked in red to indicate the routing of concealed conduit runs and any deviations from the original design, shall be submitted to the Owner for review prior to final acceptance.
2. After testing and acceptance of the project the Contractor shall furnish in the O&M manuals an accurate connection schematic and interconnection diagram for every service entrance panel, pump control panel, motor control center, and instrumentation panel provided this project.

Cleanup and Equipment Protection

Equipment Protection

1. Always exercise care after installation of equipment, motor control centers, control panels, etc., to keep out foreign matter, dust debris, and moisture. Use protective sheet metal covers, canvas, heat lamps, etc., as needed to ensure equipment protection.

Cleaning Equipment

1. Thoroughly clean all soiled surfaces of installed equipment and materials upon completion of the project. Clean out and vacuum all construction debris from the bottom of all equipment enclosures.

Painting

1. Repaint any electrical equipment or materials scratched or marred in shipment or installation, using paint furnished by the equipment manufacturer.

Final Cleanup

1. Upon completion of the electrical work, remove all surplus materials, rubbish, and debris that accumulated during the construction work. Leave the entire area neat, clean and acceptable to the Owner.
2. Lamps and fluorescent tubes shall be cleaned, and defective units replaced at the time of final acceptance.

16.10 ELECTRICAL SITE WORK

16.10.1 Common Work for Electrical Site Work

Part 1 – General

Summary

The work included in this section consists of furnishing and installing conduit, fittings, handholes, pull vaults, warning tape, cables, wires, and related items, complete as specified herein and as indicated on the Plans for a complete and functional underground electrical system. Special vaults, grounding, trench backfill requirements may be specified with the particular equipment or electrical system involved.

Related Sections

- Wire and cable per Section 16.60.
- Raceways and conduit per Section 16.70.

Design Requirements

Materials and equipment shall conform to the respective specifications and standards; and to be the specifications herein. Electrical rating shall be as indicated on Plans.

Part 3 – Execution

Construction

Provide all excavation, trenching, backfill, and surface restoration required for the electrical work.

Excavate to depths as required by Code, particular installation, or as shown on the Plans. Trench width and length as required by the installation or as shown. Trench bottom shall be free of debris and graded smooth. Where trench bottom is rock or rocky or contains debris larger than 1 inch or material with sharp edges, over excavate 3 inches and fill with 3 inches of sand. Separation between new electrical utilities and other utilities shall be 12 inches horizontal and 6 inches vertical minimum, except gas line separation shall be 12 inches both vertical and horizontal. Cross concrete or asphalt only after surface material has been saw cut to required width and removed.

Backfill around raceways shall be 3-inches of pea gravel or sand for systems of 600 volt or less. Provide red marker tape over raceways below grade. Place backfill material to obtain a minimum degree of compaction of 95 percent of maximum density at optimum moisture

content. Moisten backfill material as required to obtain proper compaction. Do not use broken pavement, concrete, sod, roots or debris for backfill.

16.10.2 Underground Marking Tape (Detectable Type)

Part 2 – Products

Manufacturers

Tape shall be Brady “Detectable Identoline – Buried Underground Tape”, or equal.

Materials

Underground marking tape shall be for location and early warning protection of buried power and communication lines. Tape shall be detectable by a pipe/cable locator or metal detector from above the undisturbed ground. Tape shall be nominally 2 inches wide with a type B721 aluminum foil core laminated between two layers of 5 Mil thickness polyester plastic. The plastic color shall be red for electrical lines and orange for telephone lines.

Part 3 – Execution

Installation

Unless noted otherwise on Plans, install approved underground marking tape 12 inches above and directly over the conduit or raceway in all trenches.

16.15 Grounding and Bonding for Electrical Systems

Part 1 - General

References

Service and equipment grounding shall be per Article 250 of the NEC.

Performance Requirements

Verify that a low-resistance ground path is provided for all circuits so an accidental contact to ground of any live conductor will instantly trip the circuit.

Part 2 - Products

Components

The grounding systems shall consist of the ground rods, grounding conductors, ground bus, ground fittings and clamps, and bonding conductors to water piping and structural steel as shown on the Plans.

System components shall be as allowed in the NEC unless specified otherwise below:

1. Ground Rods: Ground rods shall be cone pointed copper clad Grade 40 HS steel rods conforming to ASTM B228. The welded copper encased steel rod shall have a conductivity of not less than 27 percent of pure copper.
2. Ground Conductors: Buried conductors shall be medium-hard drawn bare copper; other conductors shall be soft drawn copper. Sizes over No. 6 AWG shall be stranded.

Coat all ground connections except the exothermic welds with electrical joint compound, non-petroleum type, UL listed for copper and aluminum applications.

3. Ground Rod Boxes: Boxes shall be a 9-inch diameter precast concrete unit with hot-dip galvanized traffic cover. Boxes shall be 12-inches deep minimum. Covers shall be embossed with the wording "Ground Rod".

Part 3 - Execution

General Grounding Installation

When available a UFER ground per latest edition of NEC shall be provided as the primary means to ground the electrical system.

Ground electrical service neutral at service entrance equipment to supplementary grounding electrodes.

Ground each separately derived system neutral to nearest effectively grounded building structural steel member or separate grounding electrode.

Provide a ground rod box for each ground rod to permit ready access to facilitate testing.

Provide a ground wire in every conduit carrying a circuit of over 110 volts to ground.

Make embedded or buried ground connections, taps and splices with exothermic welds. Coat ground connections.

Bond metallic water piping at its entrance into each building.

Ground Connections

Above grade ground connections shall be exothermic weld, mechanical, or compression-type connectors; or brazing.

Below grade ground connections shall be exothermic weld, mechanical, or compression-type connectors.

Install all ground connections in strict accordance with connector manufacturer's recommendations and methods.

Testing

Following completion of the grounding electrode system, if installed, measure ground resistance at each ground rod using the three-rod method. Submit results to engineer prior to final acceptance by the Owner.

Perform testing per NETA Standard ATS paragraph 7.13. Testing methods shall conform to NETA Standard ATS using the three-electrode method for large systems. Conduct tests only after a period of not less than 48 hours of dry weather.

Furnish to the Engineer a test report with recorded data of each ground rod location. See Division 16.95.4.

16.20 UTILITY SERVICE

16.21 Electrical Service

Part 1 – General

Description of Work

Work consists of installation of new 200-amp, 120/240-volt, single phase overhead service, pole-mounted transformers.

Scheduling Work with the Utility Company

The Contractor shall be fully and completely responsible for all scheduling and coordination with the utility company. The Contractor shall coordinate and schedule power outages, power service for operation and construction, and power service as may be required prior to Certification of Occupancy.

The Contractor shall make all necessary applications for service with the utility and shall notify the Owner in writing of any obligations that the Owner must fulfill for service to be started, installed, or modified.

Contractor/Utility Interface Responsibilities

The electrical utility providing service to these facilities is Emerald PUD.

During design, contact was made with Customer Service Representative, Tyler Lindley, who can be contacted by telephoning 541-744-7477. The division of responsibilities stated below has been determined by coordination with the serving utility. The Contractor shall comply with all utility company standards and requirements.

All utility charges for and related to the final permanent service to the facility will be paid by the Owner, directly to the utility company and not be included in the Contractor's bid price.

Contractor shall notify the Owner of any changes to the responsibilities between the electrical utility and the Contractor as outlined in these specifications prior to submitting a bid. Any change(s) in responsibilities not brought to the attention of the Owner prior to bidding will not be cause for additional payment.

The Contractor shall notify the Owner (in writing) of any obligations or forms that the Owner is responsible to provide for service.

The Contractor shall:

Install new raceway for secondary service from the proposed utility pole location to the proposed service entrance panel including trenching, backfill, and restoration.

Install utility meter enclosure, raceway, and conductors for utility revenue metering as shown on the Plans.

The Utility Company shall:

Replace existing pole-mounted transformer bank.

Provide and install secondary power conductor.

Install a utility revenue meter in the proposed main revenue metering enclosure installed by the Contractor.

Project Conditions

Before submitting a bid, the Contractor shall become familiar with all the electrical service requirements that may affect the execution of their work.

Standards and Codes

Work involving service installation shall be done in accordance with the service utilities standards and the NEC.

Service equipment shall be listed and labeled by UL as “suitable for use as service equipment”.

16.21.2 Electrical Utility Meter Enclosure

Manufacturers

Meter enclosure shall be a Circle AW or equal and as required to meet the requirement of the serving utility. Installation shall be in vandal proof NEMA 3R enclosure with a lockable hinged door. Meter shall include a metal vandal screen that can be purchased from serving utility.

Materials

Contractor shall coordinate with Emerald PUD on the type of metering required and shall provide all labor and material necessary to meet their requirements.

16.21.4 Circuit Breaker Service Disconnect Switch

Design

The switch shall be heavy duty type, shall be quick-make, quick-break, and shall be horsepower rated. The switch shall have blades as required to open all ungrounded conductors. The disconnect shall have a minimum available fault current withstand rating of 22,000 amperes unless noted otherwise on the Plans.

Service equipment shall meet the requirements of the serving utility and shall be suitable for use as service equipment. Service entrance disconnect shall be furnished with a UL service entrance label.

Manufacturers

Materials, equipment, and accessories specified in this section for the service disconnect switch shall be products of:

- Eaton (Cutler Hammer)
- General Electric
- Schneider Electric (Square D)
- Siemens
- Or approved equal

Materials

The switch shall be pad-lockable in both the OFF or ON position.

The enclosure shall be NEMA 3R rated unless noted otherwise on the Plans. The enclosure shall have interlocking cover to prevent opening door when switch is closed. The interlock shall include a defeating scheme. The enclosure shall be pad-lockable.

Circuit breakers shall be molded case thermal-magnetic type and meet molded case circuit breaker specifications covered in Division 16.55.16.

16.55 Switches and Protective Devices

16.55.1 Common Work for Switches and Protective Devices

Part 1 - General

Design Requirements

Overcurrent devices shall be NEMA rated.

Extra Materials

Provide one fuse for each ungrounded conductor and a minimum of one spare fuse per phase of each ampacity and voltage used on the project. Deliver fuses to Owner at the completion of the project.

Part 3 – Execution

Installation

Overcurrent protection devices and safety switches shall be centered 60 inches above the finished floor unless noted otherwise on the Plans.

16.55.16 Molded Case Circuit Breakers

Part 1 - General

Design Requirements

Breakers shall have the interrupting rating and trip rating indicated on the Plans. All breakers shall be calibrated for operation in an ambient temperature of 40 degrees Celsius.

Part 2 - Products

Manufactured Units

Molded case circuit breakers shall be quick-make and quick-break type with wiping type contacts. Each breaker shall be provided with arc chutes and individual trip mechanisms on each pole consisting of both thermal and magnetic trip elements. Two and three pole breakers shall be common trip. Molded case circuit breakers shall be trip-free. Each breaker shall have trip indication independent of the “ON” or “OFF” positions.

16.60 CONDUCTORS

16.61 Low Voltage Wire and Cable

Part 1 - General

Design Requirements

This section is for power and control conductors for 600 volts or less.

All conductors shall be copper. Wire or cable not shown on the Plans or specified, but required, shall be of the type and size required for the application and in conformance with the applicable code.

Part 2 - Products

Materials

Conductors

1. Solid and stranded copper wire shall be 600-volt Type THW, THWN, or THHW, Class B stranding, sizes #14 AWG, #12 AWG, and #10 AWG only. Use of THHN insulation shall not be allowed. Aluminum conductors shall not be allowed.
2. Stranded copper wire shall be 600-volt Type XHHW, Class B stranding, sizes #8 AWG and larger. Aluminum conductors shall not be allowed.

Splices

1. For Lighting Systems and Power Outlets: Wire nuts shall be twist-on type insulated connectors utilizing an outer insulating cover and a means for connecting and holding the conductors firmly.
2. All Equipment: Crimp type connectors shall be insulated type, suitable for the size and material of the wires and the number of wires to be spliced and for use with either solid or stranded conductors.
3. Division 16 Equipment and Power Conductors: Bolted pressure connectors shall be suitable for the size and material of the conductors to be spliced.
4. All Equipment: Epoxy splice kits shall include epoxy resin, hardener, mold, and shall be suitable for use in wet and hazardous locations.

Terminations

1. Crimp type terminals shall be self-insulating sleeve type, with ring or rectangular type tongue, suitable for the size and material of the wire to be terminated, and for use with either solid or stranded conductors.
2. Terminal lugs shall be split bolt or bolted split sleeve type in which the bolt or set screw does not bear directly on the conductor.
3. Wire Markers shall be plastic sleeve type. Wire numbers shall be permanently imprinted on the markers.

Finishes

Color Coding: Provide color coding for all circuit conductors. Insulation color shall be white for neutrals and green for grounding conductors. An isolated ground conductor shall be identified with an orange tracer in the green body. Ungrounded conductor colors shall be as follows:

1. 120/240 Volt, 1 Phase: Red and black.

Part 3 – Execution

Location (Installment) Schedule

Provide the following conductors for the following applications:

1. Use stranded copper conductors for all power and control circuits unless noted otherwise on plans or below. Size as noted on the Plans.
2. Contractor may use solid copper conductors for lighting and receptacle circuits using screw-type terminals. Size as noted on the Plans.
3. Size #14 AWG wire or smaller shall not be allowed on power circuits.

Installation

Conductor Identification

1. Except for interior lighting and receptacle circuits, identify each wire or cable at each termination and in each pullbox, junction box, handhole, and manhole using numbered and lettered wire markers. All electrically common conductors shall have the same number. Each electrically different conductor shall be uniquely numbered. Identify panelboard circuits using the panelboard identification and circuit number. Identify motor control circuits using the equipment identification number assigned to the control unit by the motor control center manufacturer and the motor control unit terminal number. Identify other circuits as shown in the circuit schedule as favorably by the Engineer.
2. Conductors between terminals of different numbers shall have both terminal numbers shown at each conductor end. The terminal number closest to the end of the wire shall be the same as the terminal number.

Testing

Insulation Resistance Tests: For all circuits 150 volts to ground or more and for all motor circuits over ½ horsepower, test cables per NETA Paragraph 7.3.1. The insulation resistance shall be 20 megohms or more. Submit results to Engineer for review.

16.70 RACEWAYS, BOXES, AND FITTINGS

16.71 Raceways

Part 1 – General

Design Requirements

Conduit sizes not noted on Plans shall be in accordance with NEC requirements for the quantities and sizes of wire installed therein.

Grounding of the raceway, junction boxes, fittings and any other boxes is the responsibility of the Contractor. Ground conductors, bushings, connections, clamps and other materials as needed to ground the raceway system is the responsibility of the Contractor. All raceways shall be grounded in accordance with the NEC.

Part 2 – Products

Components

Conduit and Fittings

1. Nonmetallic Conduit: Nonmetallic Conduit shall be rigid PVC, Schedule 40 (PVC-40) or 80 (PVC-80). PVC conduit installed above grade shall be Schedule 80 extra heavy wall 90 degree Celsius. UL listed for aboveground use and UV resistant. Conduit shall be gray in color. Fittings shall be of the same material as the raceway and installed with solvent per the Manufacturer's instructions. Conduit, fittings, and solvent shall all be manufactured by the same Manufacturer.

Conduit and Cable Supports

1. Conduit Supports: Conduit support for PVC or PVC coated rigid steel shall be one-hole PVC or epoxy coated clamps or PVC conduit wall hangers.

Conduit Sealants

1. Moisture Barrier Types: Sealant shall be a non-toxic, non-shrink, non-hardening, putty type hand applied material providing an effective barrier under submerged conditions.
2. Fire Retardant Types: Fire stop material shall be a reusable, non-toxic, asbestos-free, expanding, putty type material with a 3-hour rating in accordance with UL 1479. Provide products indicated by the manufacturer to be suitable for the type and size of penetration.

Part 3 - Installation

Installation

All conduits shall be concealed in the floor, walls, ceiling slab, or beneath the floor slab. Surface mounted conduit will not be accepted unless noted otherwise on the construction Plans.

Size of Raceways:

1. Raceway sizes as shown on the Plans, if not shown on the Plans, then size in accordance with NFPA 70.
2. Unless specifically indicated otherwise, the minimum raceway size shall be:

- a) Conduit: $\frac{3}{4}$ -inch

All raceways shall contain a separate grounding conductor.

Spare conduits shall contain one $\frac{3}{16}$ -inch diameter nylon pull rope.

Conduit routing is shown diagrammatic on the Plans. Contractor is responsible for routing the conduits in a neat manner, parallel and perpendicular to walls and ceilings.

Location of conduit ends are shown approximately. Contractor is responsible for ending conduits in location that will not conflict with electrical equipment. Route conduit ends to facilitate ease of equipment maintenance. Conduits extending from the floor to a device shall be located as close as possible to avoid creating a hazard.

Conduit shall not be routed on exterior of structures except as specifically indicated on the Plans.

Where water cannot drain to openings, provide drain fittings in the low spots of the conduit run.

Securely fasten raceways at intervals and locations required by NEC, or the type of raceway employed.

Provide all required openings in walls, floors and ceilings for conduit penetration.

1. Do not install one (1) inch and larger raceways in or through structural members (beams, slabs, etc.) unless approved by Engineer.
2. New Construction: Avoid cutting openings, where possible, by setting sleeves or frames in masonry and concrete, and by requesting openings in advance.
3. Existing Construction: Core drill openings in masonry and concrete. Avoid structural members and rebar.

Plastic raceway joints shall be solvent cemented in accordance with recommendations of raceway manufacturer.

All conduit openings not encased in a panel shall be sealed with duct seal.

16.95 Testing

16.95.1 Common Work for Testing

Part 1 - General

Submittals

Test reports shall be submitted to the Engineer prior to final acceptance in accordance with Division 1.33 of these specifications.

Scheduling and Coordination

The Contractor shall inform the Engineer in advance of testing in accordance with the requirements listed in Division 1 of these specifications.

Prior to scheduling the testing, the Contractor shall have satisfied themselves that the project area is properly cleaned up; all patching and painting deemed necessary properly completed; and all systems, equipment and controls are functioning as intended.

Part 2 - Products

Source Quality Control

Submit reports of factory tests and adjustments performed by equipment manufacturers to the Engineer prior to field testing and adjustment of equipment. These reports shall identify the equipment and show dates, results of test, measured values and final adjustment settings. Provide factory tests and adjustments for equipment where factory tests are specified in the equipment specifications. The Engineer may inspect the fabricated equipment at the factory before shipment to job site. Provide the Engineer with sufficient prior notice so that an inspection can be arranged at the factory.

Part 3 – Execution

Site Testing

Test all circuits for continuity, freedom from ground, and proper operation during progress of the work.

Insulation Resistance, Continuity, and Rotation: Perform routine insulation resistance, continuity and rotation tests for all distribution and utilization equipment prior and in addition to tests performed by the testing laboratory specified herein.

Field Quality Control

General

1. Conduct final test in the presence of Owner and/or their authorized representative. Contractor shall provide all testing instrumentation and labor required to demonstrate satisfactory operation of systems, equipment and controls.

Operational Tests

1. Operational test all circuits to demonstrate that the circuits and equipment have been properly installed, adjusted and are ready for full-time service. Demonstrate the proper functioning of circuits in all modes of operation, and including alarm conditions, and demonstrate satisfactory interfacing with the data acquisition and alarm systems.

16.95.3 Conductor Test Report

Conductor Test Report Page 1 of 1														
PROJECT:					OWNER:									
Contractor Co. Name:					Phone Number:									
Tested by:					Test Date:									
Race-way	V	C	Operating Load Voltage					Insulation Resistance - OHMS						
Label	(1)	(2)	(3)	VAB	VCB	VCA	VAN	VCN	A-B	B-C	C-A	A-G	B-G	C-G
A														
B														
C														
D														
E														
F														
G														

1. Refer to raceway and wire schedule and one-line diagram for description of feeder identified by label shown on this report
2. Visual Inspection – Check when completed
3. Continuity Test – Check when completed

Ground Electrode Resistance Test Report	
PROJECT:	OWNER:
Contractor Co. Name:	Phone Number:
Tested by:	Test Date:
Test Meter Type:	
Test Distance-D:	
Soil Conditions:	
Measured Resistance:	
DESCRIPTION OF TEST PROCEDURE, CONDITIONS, RESULTS:	

Division 17

Automatic Control - This Division Not Used

Division 18

Measurement and Payment

18.0 GENERAL

It is the intention of these specifications that performance of work under bid items shall result in complete construction, in proper operating condition, of improvements identified in these written specifications and accompanying Plans. Work and material not specifically listed herein but required according to the Plans and specifications and general practice shall be included in Contractor's bid price in the most closely applicable bid item.

If a minimum bid amount has been established for any item and the bidder's entry is less than the minimum specified amount, the Owner will unilaterally revise the price to the minimum specified amount and recalculate the total. The recalculated total will be used by the Owner for award purposes and to fix the contract price amount and the amount of the contract bond.

If a maximum or fixed bid amount has been established for any item and the bidder's entry exceeds the maximum or fixed specified amount, the Owner will reduce the bid item price to the maximum or fixed specified amount and relocate the offsetting amounts to bid items of the Owner's choosing.

Payment for the work included under each bid item shall be lump sum, and includes all labor, equipment, materials, and all other effort and costs associated with the bid item.

Bid Item 1 – Mobilization, Demobilization, Site Preparation, and Cleanup

Lump sum price covers complete cost of furnishing, installing and testing, complete and in-place, all work and materials necessary to: move and organize equipment and personnel onto the job site; secure job site; construction surveying and staking; traffic control; provide and maintain necessary support facilities; obtain all necessary permits and licenses; prepare site for construction operations; maintain site and surrounding areas during construction; provide system testing, move all personnel and equipment off site after contract completion, and provide as-built data; cleanup site prior to final acceptance; and accomplish all other items of work not specifically listed in other divisions.

No more than 80 percent of bid amount for this item will be paid before final payment request, and this bid amount may not be more than 10-percent of the total contract value.

Bid Item 2– Site Work

Lump sum price shown shall cover the complete cost of providing all site work relating to construction of improvements as shown on the Plans and specified herein. Work includes, but not limited to: temporary construction fencing; temporary erosion and sediment control, all demolition work including removal of structures and obstructions, including hauling, and proper disposal, clearing and grubbing; earthwork including excavation and grading (excluding trenching associated with utilities), fill placement, backfilling, compaction, compaction testing, disposal of excess materials; access road; concrete pads; drainage culverts; seeding bare earth areas and establishing grass cover; and all other work necessary for a complete installation of all site work.

Site Work lump sum price shall include all labor, materials, and equipment for the required work.

Bid Item 3 – Package Water Treatment Plant

Lump sum price shown shall cover the complete cost of installing the Owner furnished Package Water Treatment Plant. Work includes but is not limited to; coordination with the supplier, receipt of shipment, storing and maintaining equipment, installation of package water treatment plant on concrete pad, completing plumbing and electrical connections, facilitating start-up and testing, training of LWC staff, and all other work associated with package treatment plant installation. Note that packaged water treatment plant is Owner furnished.

Bid Item 4–Water Storage Tanks

Lump sum price shown shall cover the complete cost of installing two polypropylene water storage tanks. Work includes, but is not limited to, procurement, installation, disinfection and testing, and all associated accessories such as the seismic restrain system, and level sensor. Water Storage Tank lump sum price shall include all labor, materials, and equipment for the required work.

Payment for Water Storage Tanks will be paid no more than 90 percent of the lump sum price if it has not yet passed both pressure and bacteriological testing.

Bid Item 5 – Water Piping

Lump sum price shown shall cover the complete cost of providing all work relating to construction of water piping improvements. Work includes, but not limited to, trenching, pipe bedding, pipe installation, backfilling, fittings, valves, and appurtenances, insulation, connections to existing system, connections to new equipment including the storage tanks and water treatment plant, concrete vaults and boxes (including addition of lockable access hatch to existing intake vault), disinfecting testing, and all other work necessary for a complete installation of all water piping work.

Payment for Water Piping will be paid no more than 90 percent of the Lump sum price if it has not yet passed both pressure and bacteriological testing.

Bid Item 6 – Drainage Piping

Lump sum price shown shall cover the complete cost of providing all work relating to construction of drainage piping improvements. Work includes, but not limited to, trenching, bedding, pipe, backfilling, fittings, valves, connections to existing system, connections to new equipment including the Packaged Water Treatment Plant and Water Storage Tanks, connection to the existing upwell vault, catch basins, backwater valve, testing, and all other work necessary for a complete installation of all drainage piping work.

Payment for Drainage Piping will be paid no more than 90 percent of the Lump sum price if it has not yet passed testing.

Bid Item 7 – Electrical Work

Lump sum price shown shall cover the complete cost of providing all work relating to construction of electrical improvements. Work includes, but not limited to, coordination with the power company; construction of electrical equipment pedestal, main disconnect, and utility meter; trenching, pipe bedding, backfill, communication and electrical conduit and wire installation, and electrical connections; level transducer and overflow switch installation within water storage tanks, and all other work necessary for a complete installation to power the improvements associated with this project.

Bid Item 8 – Record Drawings and O&M Information

Minimum bid price for this bid item is \$5,000. Lump sum price shown shall cover the complete cost of providing contractor redline mark-ups for preparation of the record drawings, and operation and maintenance information for preparation of operation and maintenance manual. Work includes but is not limited to post-construction survey; and providing complete redline mark-ups to the Plans for all changes that occurred during construction; and acquiring, compiling, and preparing all operation and maintenance information.

APPENDICES

APPENDIX A

Certificate Regarding Lobbying

Appendix A
Certification Regarding Lobbying
(Awards to Contractors and Subcontractors in Excess of \$100,000)

The undersigned certifies, to the best of his or her knowledge and belief, that:

- (1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan or cooperative agreement.
- (2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.
- (3) The undersigned shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than \$10,000 and not more than \$100,000 for each such failure.

Signed: _____

Title: _____

Date: _____

APPENDIX B




Package Treatment Plant Submittal

RESPONSE TO SUBMITTAL REVIEW

DATE: FEBRUARY 27, 2025
SUBJECT: LONDON WATER CO-OP
FROM: Precision Pumping Systems

#	Reviewer Comment	PPS Response
1	<p>TREATMENT SYSTEM: Q: Chemical Analyzer (Item #2 on the Design Specifications list on page 11) – Need additional information. Please provide additional information similar to what you have provided for the ProMinent turbidimeter. Identify sample line material and size to help us identify connection points on existing infrastructure. Verify that chlorine analyzers are connected to the correct locations. One needs to monitor treated water going to the storage tanks, and one needs to monitor distribution water coming from the storage tanks. At various locations chlorine analyzers are labeled as monitoring “raw” water, which will not have any chlorine in it since this water is directly from Beaver Creek.</p>	<p>A: Each treated water has ports and proper sensors; Turbidity and Chlorine are checked at station discharge of treated water line and at station suction of distribution line.</p> <p>Please refer to drawing.</p> <p>Please refer to 7.2 of submittal.</p> <p>I see the ports for NTU and chlorine, but no information on the specific chlorine analyzer probe proposed for this application. Please confirm.</p>
2	<p>Q: Cartridge Filter – The BOM lists an HC 90-LT2 cartridge filter, but the submittal documentation highlights a PP-HC-90-1 filter, which does not appear to be appropriate for surface water treatment. Identify an appropriate surface water treatment filter cartridge.</p>	<p>A: Please refer to section 6.0 with revised data.</p> <p>I don't see any LT2 rated cartridge identified in section 6.0. Please confirm the installed filter cartridge will meet surface water treatment standards.</p>
3	<p>Q: Turbidity Meters – Turbidity meters are needed to monitor turbidity of raw and treated water, as well as distribution water.</p>	<p>A: Please refer to 7.2 of submittal.</p> <p>Looks good, thank you.</p>

Turning water into communities ... one pump station at a time.

1	<p>STRUCTURAL SYSTEM:</p> <p>Q: Anchor Bolts – Provide anchor bolt sizes and calculations stamped and signed by a registered Professional Engineer holding a valid engineering license in the State of Oregon for all anchor bolts connecting major pieces of equipment, structure, and other components.</p>	<p>A:</p> <p>Please see Station Drawing Section – 1.1.</p> <p>  <div>The structural calculations are stamped by an Idaho PE, Oregon PE license is required</div> </p>
2	<p>Q: Structure/Enclosure – Provide information on materials used, means of attachment, and provide a structural calculations package for the structure/enclosure stamped and signed by a registered Professional Engineer holding a valid engineering license in the State of Oregon.</p>	<p>A:</p> <p>Please see Enclosure Drawing Section – 1.1.1.</p> <p>  <div>The structural calculations are stamped by an Idaho PE, Oregon PE license is required</div> </p>
1	<p>MECHANICAL SYSTEM:</p> <p>Q: General – Verify that all components in contact with potable water are NSF-61 certified and suitable for potable water applications. In re-submittal, provide manufacturer certifications for each component specified stating that components are compliant with drinking water requirements.</p>	<p>A: Please refer to the submittal.</p> <p>  <div>Looks good, thank you.</div> </p>

2	<p>Q: Air Relief Valve – Air relief valve specified is rejected as it is not for use in potable water applications.</p>	<p>A: Please refer to section 5.2 of the submittal.</p> <p>Looks good, thank you.</p>
3	<p>Q: Heating/Cooling – Item #26 on the Design Specifications list on page 11 indicates that a radiant heater will be provided. Per previous correspondence, LWC has requested that a mini-split heat pump be provided for heating and cooling.</p>	<p>A: Mini-Split added, and the radiant heaters are now removed.</p> <p>Please refer to the updated drawing and submittal.</p> <p>Looks good, thank you.</p>
4	<p>Q: Pipe – Submit cut sheets indicating pipe to be used.</p>	<p>A: Please refer to the submittal.</p> <p>I cannot find pipe material cutsheet information. The layout drawing lists PVC, is this schedule 40?</p>
5	<p>Q: Pressure Tank – Drawing on page 11 of the submittal does not appear to show that the pressure tank is connected to the system.</p>	<p>A: The drawing is updated, and a pressure tank hose has been added. Please refer to the submittal.</p> <p>What material is the hose?</p>

1	<p>CONTROLS SYSTEM:</p> <p>Q: Cellular Modem – No cell service is available onsite.</p>	<p>A: We ship our control panels with a cell phone modem regardless of on-site service. This is critical infrastructure for our remote technical support team. PPS recommends adding the cost of a directional amplifying Yagi antenna OR an omnidirectional amplifying Peplink antenna. PPS has had success with getting good reception in difficult locations using these devices. These antennas work differently than a cell phone does, and the power transmission is multiple times higher than a standard cell phone.</p> <p>Note to Tyler: discuss adding the cost of an antenna with the client</p>
2	<p>Q: PLC - Verify that PLC code can be modified by the owner, and that the code is not 'locked'.</p>	<p>A: The PLC code is not locked. PPS does not provide licensing to program IDEC products. The customer would be responsible for acquiring the correct programming software from IDEC.</p> <p>Thanks for clarifying</p>
1	<p>ELECTRICAL SYSYEM:</p> <p>Q: Wiring Diagram - There's a chlorine analyzer identified in the wiring diagram for "Raw." Suggest this get updated to "Distribution" since raw water should have zero chlorine. Update wiring diagram to include the breaker panel (ABB Load Center).</p>	<p>A: The wiring diagram has been updated to change the nomenclature from "Raw" to "Distribution". The Load Center schematic has been added to the panel schematic.</p> <p>"Raw chlorine" still shown, see snip below</p>

54	Raw chlorinne meter (+24VDC COM)
55	Raw chlorine meter (4-20mA reference)
56	Raw chlorine meter alarm input (N.O.)
57	Raw chlorine meter (0vDC rtn)(4-20 rtn)
58	Raw chlorine meter shield/ground

Turning water into communities ... one pump station at a time.

MODEL: V##V2V002X00010-080HSCB2410AS-2

POTABLE

FLOODED SUCTION

PERFORMANCE INITIAL:

DESIGN POINT:	1	2
DESIGN FLOW RATE (GPM):	10	35
INTAKE PRESSURE (PSI):	n/a	n/a
STATION PRESSURE (PSI):	80	80
DISCHARGE PRESSURE (PSI):	80	80

ELECTRICAL INPUT INITIAL:

VOLTAGE:	240		
PHASE:	1	DISCONNECT AMP RATING	NEC FLA
Hz:	60	100	65

PUMP AND MOTOR INITIAL:

FUNCTION	QTY	HP	PERFORMANCE	PUMP TYPE / MOTOR ENCLOSURE RATING	
MAIN/DUTY	2	1.5	10 GPM @ 185' TDH	VMS (VERTICAL MULTI-STAGE)	ODP
MAIN/DUTY 2	2	3	35 GPM @ 185' TDH	VMS (VERTICAL MULTI-STAGE)	ODP

MATERIAL/COATINGS

MATERIALS	COATINGS
PIPING: PVC	PIPE INTERIOR: PVC
	PIPE EXTERIOR: PVC
SKID: GALVANIZED	SKID BASE: GALVANIZED
	ENCLOSURE: PPS BEIGE

MATERIAL SUBSTITUTION DISCLAIMER

- YES** I authorize PPS to make material changes to equal or better quality components, as market availability allows, in order to minimize my project lead time
- NO** I understand that material lead times are currently unreliable and accept that. I only want the material that was approved per submittal

Vertical Multistage pumps (where utilized) require that intake water be free of suspended solids. Failure to adequately pre-screen can result in severe pump damage.

<div>LONDON WATER CO-OP</div> <div>RE-SUBMITTAL</div> <div>95% FINAL</div> <div>QT#22432 REV-A</div> <div>02/27/2025</div>	<p>You must initial ALL sections above and provide signature & date below to complete submittal approval process.</p> <p>APPROVED BY: _____</p> <p>DATE: _____</p>
--	--

ABOUT PPS



PRECISION PUMPING SYSTEMS' COMPANY & FACILITY FEATURES



State of the Art
Manufacturing
Facility



Extensive Pump
Station Testing
Facilities



VFD/ Automation
Testing Facility



Large Inventory of
replacement
equipment & parts

Family Owned & Operated Since 1972



For over 100 years, the Purdy Family has been involved in agricultural irrigation and irrigation/municipal water system sales.

The core staff of PPS has been here from the very beginning. We have decades of accumulated knowledge in our field.

We take great pride in the products, support, and services we offer.

Leaders in Variable Speed Pumping Technology



PPS has been integrating VFD's with Pumps for 40 years.

We use the latest technology to create simpler, safer, and more efficient systems. PPS was one of the first pump station manufacturers to effectively implement programmable logic controllers to achieve this goal.

Easy to understand, Easy to operate touch-screens on every system.

Unparalled Service & Support



Personal Service Available 24/7

Free Remote Technical Support for the Life of the System

3 Year Standard Warranty

Professional Start-up & Training Services

Collaborative Design



PPS uses the latest software to design perfectly accurate, top quality pump station designs to ensure premium performance and quality. Precise dimensions and site layout for guaranteed ease of installation. PPS will work directly with site contractors before delivery to ensure an easy and successful installation.

Precision Pumping Systems

6515 S Business Way
Boise, ID 83716
(208) 323 - 5300
www.gopps.us





Certifications

Quality Management System – ISO 9001:2015

PPS Boise Facility Complies with the requirements of ISO 9001:2015 for the manufacturing of pumping systems, pump control panels, and remote monitoring control systems.

Certificate No: CERT-0138890

File No: 1694007

Issue Date: March 28, 2024

Certificate Expiry Date: March 27, 2027

Safety Management System – (UL 508A / UL QCZJ)

UL 508A - Standard for Industrial Control Panels:

This certifies that the control panel complies with nationally recognized safety standards.

PPS manufactures Control Panels in accordance with the National Electrical code, NFPA 70.

File #: E210861

UL QCZJ - Packaged Pumping Systems:

This certifies that the complete pumping system, including the control panel, complies with nationally recognized safety standards.

PPS manufactures Packaged Pumping Systems in accordance with Article 680 or 682 of ANSI/NFPA 70, "National Electrical Code" (NEC).

File #: E327721



In addition to these safety and quality certifications, each pump station undergoes a complete factory dynamic test to ANSI/HI 14.6 and ANSI/HI 9.6.4 standards and specifications.



NITW.E210861

Industrial Control Panels

[Page Bottom](#)

Industrial Control Panels

[See General Information for Industrial Control Panels](#)

PRECISION PUMPING SYSTEMS

E210861

6515 BUSINESS WAY
BOISE, ID 83716 USA

Industrial control panels.

[Last Updated](#) on 2009-05-01

[Questions?](#)

[Notice of Disclaimer](#)

[Page Top](#)

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Certificate of Compliance

Certificate Number:

UL-US-L327721-11-
92409002-2

Report Reference:

E327721-20090429

Issue Date:

2024-12-06

Issued to:

Precision Pumping Systems
6515 S Business Way Boise, ID 83716-5551
United States

This certificate confirms that representative samples of:
QCZJ - Packed Pumping Systems

See Addendum Page for Product Designation(s).

Have been evaluated by UL in accordance with the Standard(s) indicated on this Certificate.

Additional Information:

See UL Product iQ® at <https://iq.ulprospector.com> for additional information.

This Certificate of Compliance indicates that representative samples of the product described in the certification report have met the requirements for UL certification. It does not provide authorization to apply the UL Mark. Only the Authorization Page that references the Follow-Up Services Procedure for ongoing surveillance provides authorization to apply the UL Mark.

Only those products bearing the UL Mark should be considered as being UL Certified and covered under UL's Follow-Up Services.

Look for the UL Certification Mark on the product.



A handwritten signature in black ink, appearing to read 'David Piecuch'.

David Piecuch
UL Mark Certification Program Owner

CERTIFICATE OF COMPLIANCE

Certificate number UL-US-L327721-11-92409002-2
Report reference E327721-20090429
Date 2024-12-06

This is to certify that representative samples of the product as specified on this certificate were tested according to the current UL requirements.

Model	Product Description
CB Series*	Packaged pumping systems
S-Submersible Series*	Packaged pumping systems
T-Turbine Series*	Packaged pumping systems
V Series*	Packaged pumping systems
VMS Series*	Packaged pumping systems



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CERTIFICATE

Section A3
ISO 9001:2015
Certification

Certificate Number: 112749.00

The Quality Management System and implementation of:

Purdy Enterprises Inc, dba Precision Pumping Systems

With Central Functions At:

6515 South Business Way
Boise, ID 83716
United States

meets the requirements of the standard:

ISO 9001:2015

Scope:

Design and manufacture of pumping systems, pump control panels, and remote monitoring and control systems.

Site Activities:

6515 South Business Way, Boise, ID 83716 – Design and manufacture of pumping systems, pump control panels, and remote monitoring and control systems.

743 McGregor Court, Suite 120, Boise, ID 83716 – Panel Assembly.

Certification Structure: Campus

Certificate Expires: March 27, 2027
Certificate Issued: March 28, 2024
Certified Since: March 28, 2018



Dr. Cem O. Onus
Managing Director

DEKRA Certification, Inc.
1945 The Exchange SE #300
Atlanta, GA 30339 USA
(215) 997-4519
<https://www.dekra.us/en/audits/>



Precision Pumping Systems Standard Warranty

The equipment furnished as part of this agreement is subject to the original manufacturer's warranty only. In addition, Precision Pumping Systems (PPS) provides the following LIMITED WARRANTY.

Telephone Technical Support

Free-of-charge for the life of your product. After hours fees may apply.

Limited 1-Year Warranty

PPS warrants to the original buyer that its products and systems will be free from defects in material and workmanship for a period of twelve (12) months from the date of placing the Equipment in operation or fifteen (15) months from the date of completion of manufacture of the Equipment, whichever shall occur first.

When notified by Purchaser of a defect which conforms to this Warranty PPS shall, at its sole discretion, correct the defect by performing a suitable repair to the Equipment or by providing a replacement part. This warranty does not apply to equipment that has been damaged, misapplied or modified in any way.

Terms and Conditions:

1. Warranty claims must be submitted directly to Precision Pumping System within the valid warranty period. No claims for warranty will be paid without prior approval by PPS.
2. The determination regarding defective status of components or products is at the sole discretion of PPS.
3. If a component or product is determined to be defective by Precision Pumping System, then PPS shall, at its sole discretion, correct the defect by performing a suitable repair to the equipment or by providing a replacement part.
4. Proper start-up and operational procedures must be followed, and the required annual preventative maintenance must be performed by authorized PPS personnel or this warranty shall be void.
5. Within the first year after start-up, PPS will cover labor and materials costs. In any subsequent years of the warranty period (if an extended warranty is purchased) only materials costs are covered by this warranty – no labor costs will be paid.

Disclaimers

1. PPS shall not be liable for repairs, replacements or adjustments to the Equipment or costs of labor performed by the Purchaser without prior written consent of PPS.

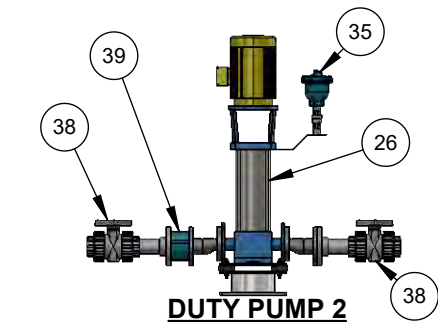
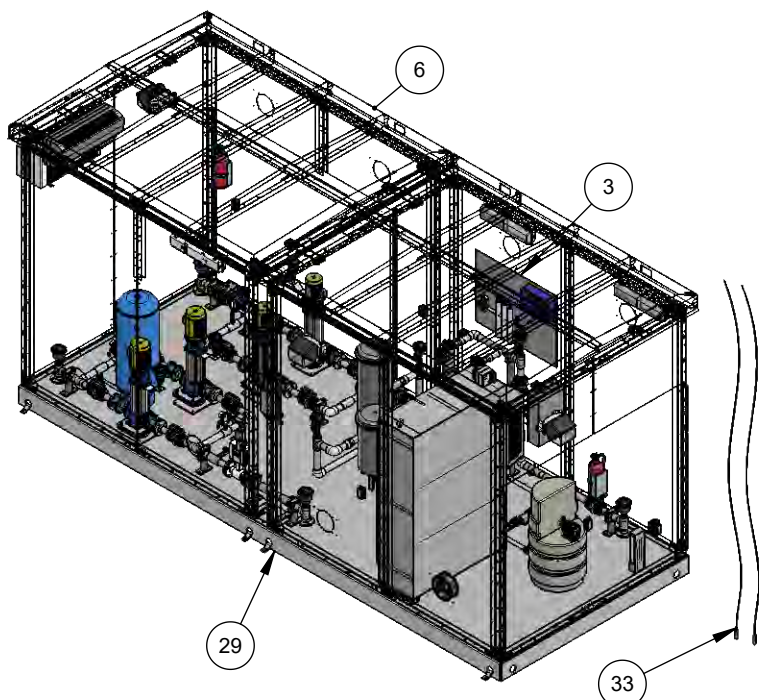
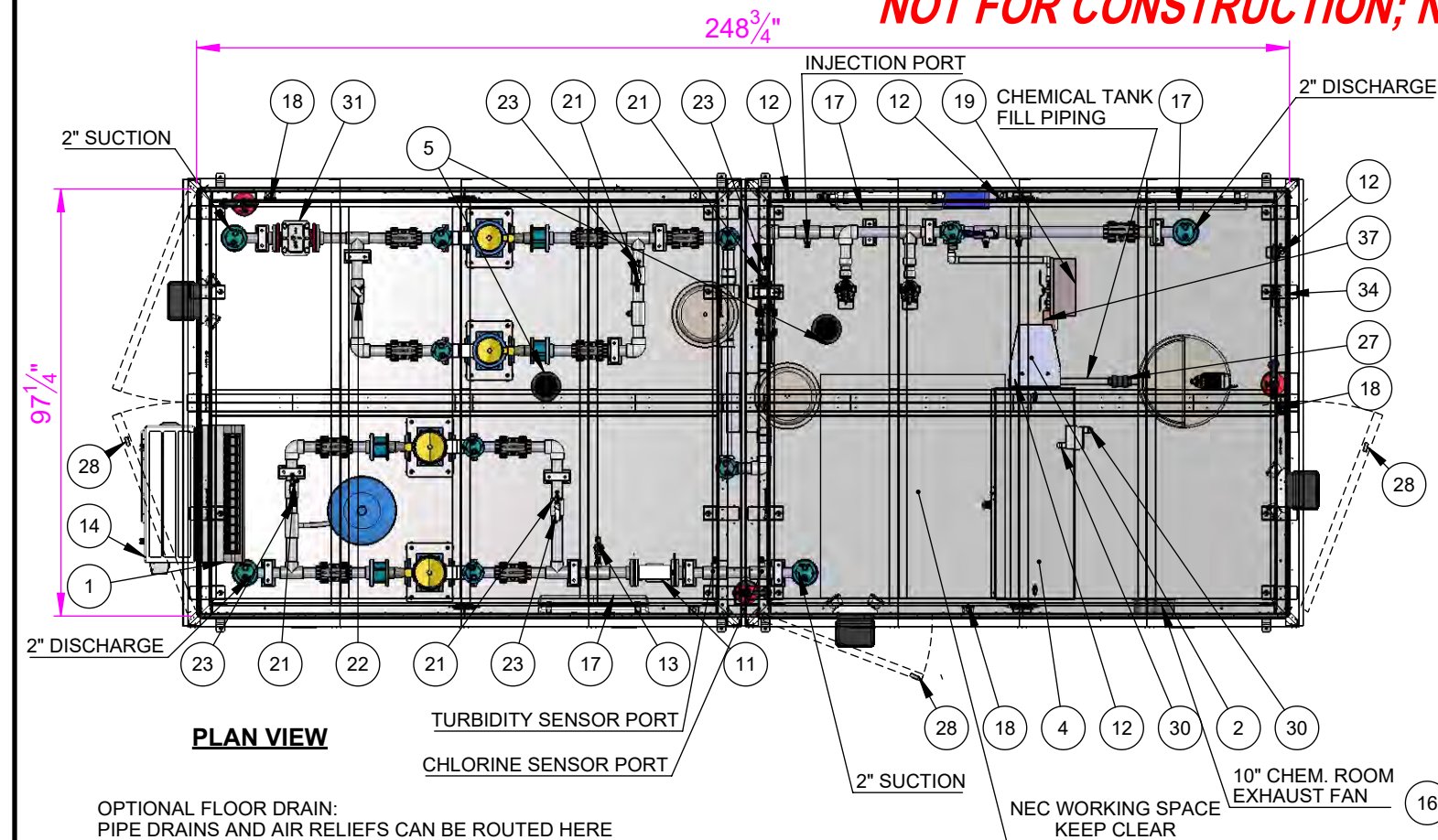
2. All PPS warranty provisions require the Purchaser to operate and maintain the Equipment according to good industry practices and to comply with all recommendations by PPS regarding operation and maintenance.
3. PPS systems are equipped with safety features which protect key components from damage. Many of these safety features are overridden when operating the system in "Hand". Operation of the system in "Hand" voids this warranty unless directly authorized by a PPS technician.
4. There is no warranty coverage for mechanical pump seals or packing glands unless the failure occurs during the initial start-up of the system.
5. Any modifications to the pumping system without written approval by PPS shall void this warranty. Such modifications include, but are not limited to, changes to PLC/HMI programming, removing or disabling sensors, or adding or removing valves or piping.
6. PPS makes no performance warranty unless specifically stated in its proposal.
7. The effects of corrosion, erosion and normal wear and tear are specifically excluded from the PPS warranty.
8. PPS provides no warranty for used or existing customer owned equipment of any character expressed or implied.
9. Blown fuses regardless of cause are excluded. Damages or problems created by or caused by lightning or power surges, low voltage, or other incoming power related problems are excluded from these warranties.
10. Damages created by or resulting from excessively dirty water, mud, silt, sand, grass, weeds, or any other organic or inorganic materials, clogged pump intake impellers or suction screens, and/or build-up of sediment in the sump are excluded.
11. Natural disasters, misuse, abuse, or misapplication, or other causes beyond PPS' control, and acts of God are excluded from these warranties.
12. PPS will not accept any responsibility for the costs associated with systems installed in difficult to access areas including, but not limited to, those requiring cranes in excess of 5 tons, divers, helicopters, excavators, dredges, etc. Determination of difficult to access locations is at the sole discretion of PPS.
13. PPS MAKES NO OTHER WARRANTY OR REPRESENTATION OF ANY KIND WHATSOEVER, EXPRESSED OR IMPLIED, EXCEPT THAT OF TITLE, AND ALL IMPLIED WARRANTIES, INCLUDING ANY WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE SPECIFICALLY EXCLUDED.
14. PPS will assume no liability for any incidental or consequential damages with respect to this contract or the Equipment and services furnished hereunder, in connection with the performance or breach thereof, or from the manufacture, sale, delivery, installation, repair or technical direction covered by or furnished under this contract. This is a commercial transaction.
15. It is also agreed that the owner's or purchaser's sole remedy, whether for breach of contract, warranty or in tort, shall be limited to the return of any goods and repayment of the contract price or the costs of repair and replacement of defective goods, at the option of PPS. No claim by the buyer of any kind shall be greater in amount than the net purchase price of the equipment.

Choice of law and arbitration:

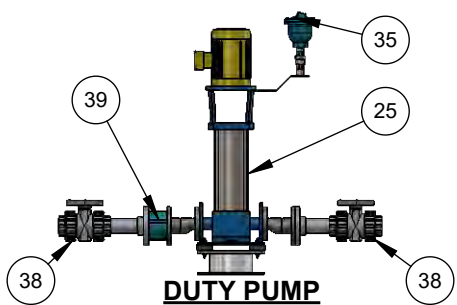
Any claim or controversy arising under or relating to this warranty shall be submitted for arbitration and shall be governed by the laws of the state of Idaho.

1 Station Overview

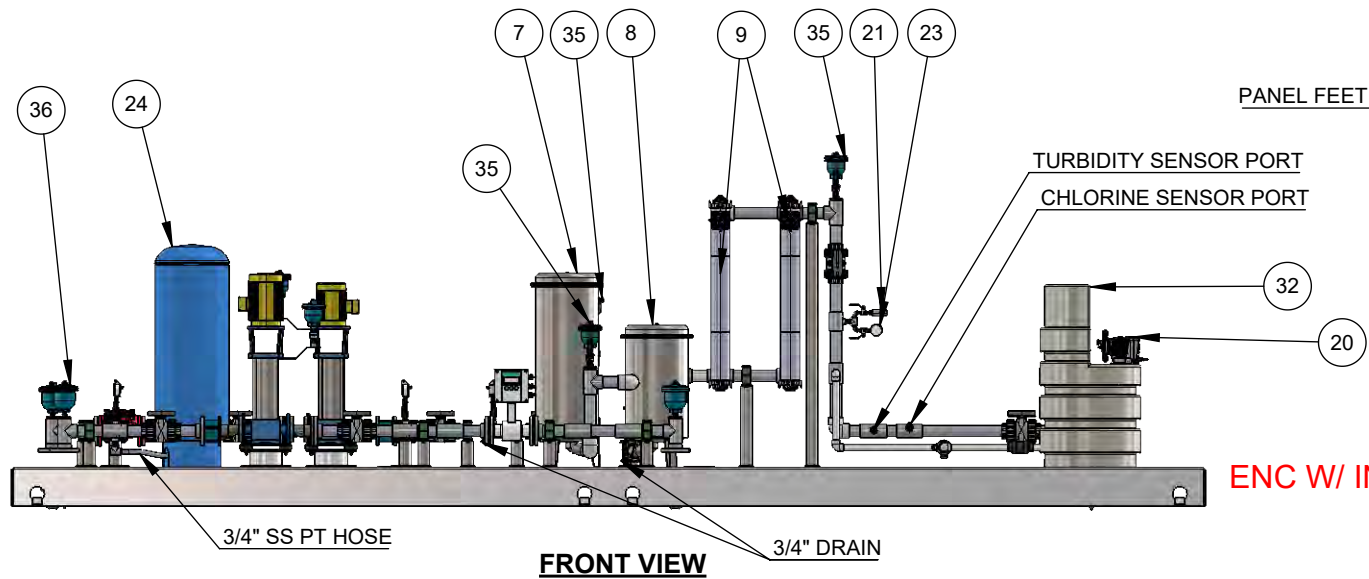
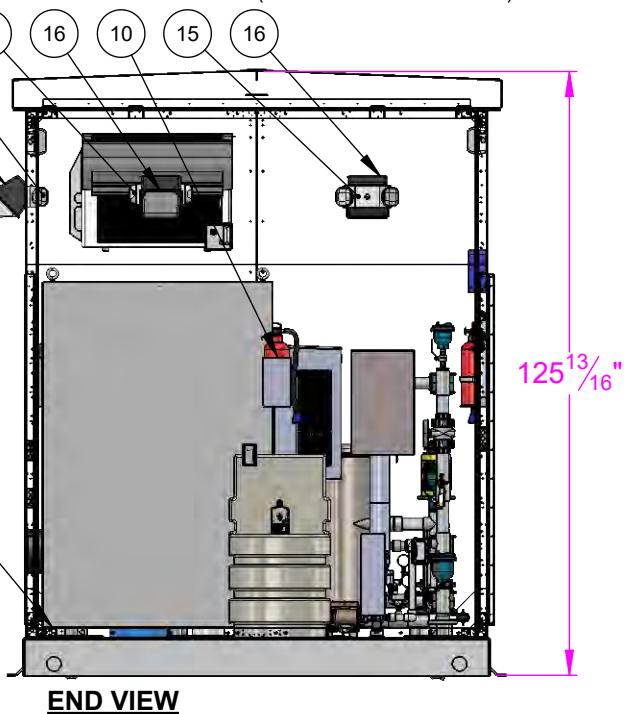
NOT FOR CONSTRUCTION; NOT FOR FABRICATION



NOTE
ALL HOLES TO BE 100% WATER TIGHT
CUSTOMER TO RUN NEUTRAL AND GROUND



PANEL FEET (2X3X3/16 ALUM REC TUBE)

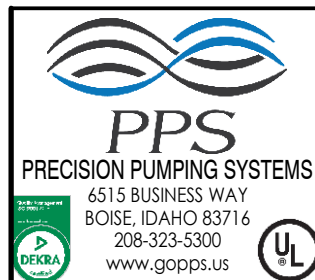


ENC W/ INSULATION & HEATER
COLOR - PPS BEIGE
POTABLE

DESIGN SPECIFICATIONS

Design Point 1:	10	GPM @ 80 PSI
Design Point 2:	35	GPM @ 80 PSI
Pump #1 Details:	1.5HP/Pump	10 GPM @ 185 TDH
Pump #2 Details:	3 HP/Pump	35 GPM @ 185 TDH
Minimum Power:	240 Volt / 1 Phase	
Model #	V##V2V002X00010-080HSCB241OAS-2	

ITEM NO.	DESCRIPTION	Size	QTY.
1	AC, MINI-SPLIT AIR HANDLER		1
2	AC UNIT		1
3	CHEMICAL ANALYZER		1
4	CONTROL PANEL	72"x48"x18"	1
5	DRAIN, FLOOR		2
6	ENCLOSURE, MARINE GRADE ALUMINUM	96"x248"x110"	1
7	FILTER, HC 170-5 MICRON CARTRIDGE	2"	1
8	FILTER, HC 90-LT2 CARTRIDGE	2"	1
9	FILTER, UV		2
10	FIRE EXTINGUISHER (48" AFF)	20LB	3
11	FLOW METER, BADGER	2"	1
12	GFCI OUTLET	15A	6
13	HOSE BIB	3/4"	1
14	HVAC, MINI-SPLIT CONDENSER		1
15	LIGHT, EMERGENCY MOTION		3
16	LIGHT FIXTURE, EXTERNAL		3
17	LIGHT FIXTURE, LED	24"	3
18	LIGHT SWITCH		3
19	LOAD CENTER (P-1)	200 A	1
20	METERING PUMP, BETA B4	.37GPH	1
21	PRESSURE SENSOR, -14.5..145PSI, LED DISPLAY, 4-20MA, IFM	1/4"	5
22	PRESSURE GAUGE, 30PSI	2-1/2"	1
23	PRESSURE GAUGE, 160PSI, NSF	2-1/2"	5
24	PRESSURE TANK, AMTROL WX-203	32 Gal	1
25	PUMP, VMS	1.5 HP	2
26	PUMP, VMS	3 HP	2
27	PVC BALL CHECK, 1" SCH80	1"	1
28	SENSOR, INTRUSION		3
29	SKID, BENT	96"x248"	1
30	SMOKE ALARM, GENTEX		2
31	STRAINER, H-STYLE	2"	1
32	TANK	15 GAL	1
33	TRANSMITTER, LEVEL, LEVELGAGE, DEEP WELL		2
34	UTILITY HEATER	500W	1
35	VALVE, AIR RELIEF	3/4"	7
36	VALVE, AIR RELIEF	1"	4
37	VALVE, BACKFLOW PREVENTER	1"	1
38	VALVE, BALL, PVC	2"	12
39	VALVE, CHECK	2"	4



MATERIAL
Piping: PVC,
Skid: STEEL A36, GALVANIZED

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL: ±1/8"
ONE PLACE DECIMAL: ±.10
TWO PLACE DECIMAL: ±.05
DO NOT SCALE DRAWING

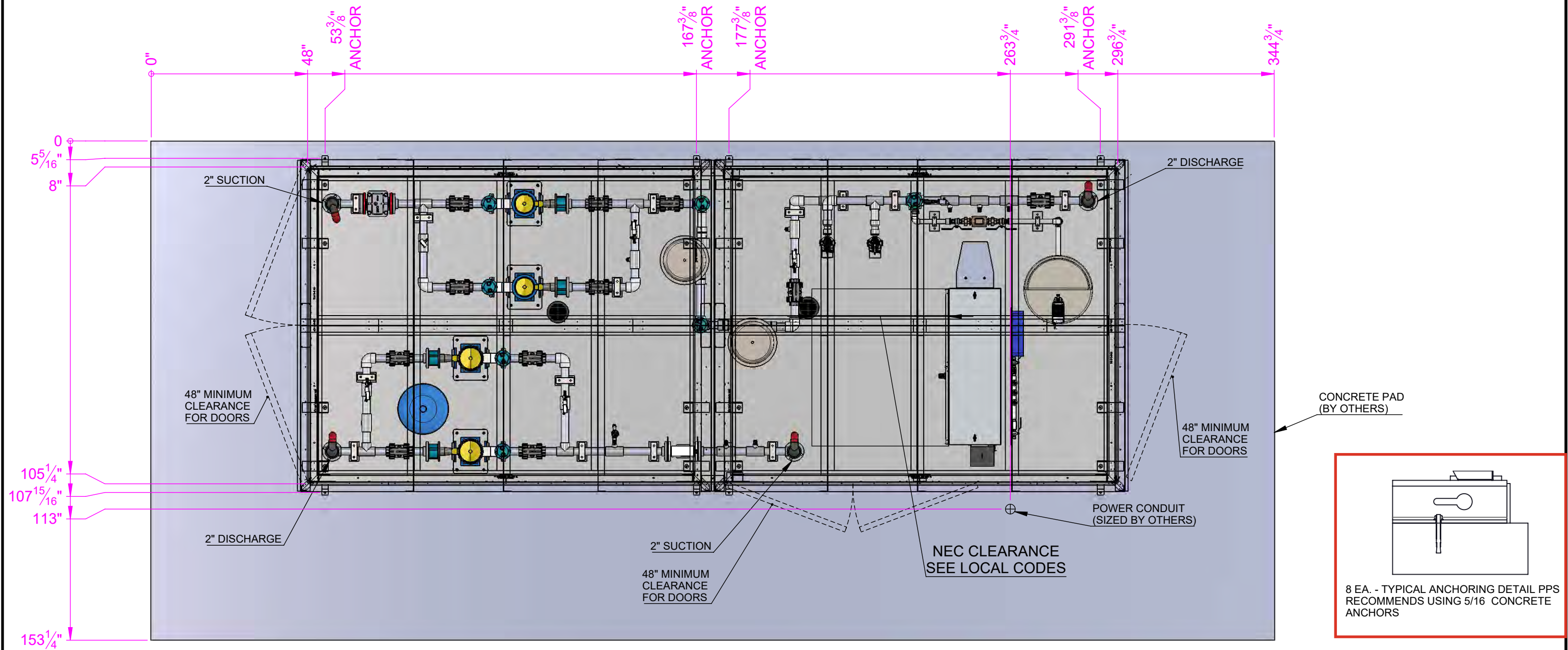
DRAWN: ACL

DATE: 2/17/2025

SALESMAN:
Matt Purdy

TITLE:	FLODED SUCTION PUMP STATION			
PROJECT:	LONDON WATER COOP			
LEVEL:	90% Final			
PART NO:	2V-2-NJ-2OT-2VF-2UV-FM-AL-PT			
JOB:	SIZE: B	SCALE: NTS	SHEET: 1 OF 1	REV: DEFAULT

NOT FOR CONSTRUCTION; NOT FOR FABRICATION




RECOMMENDED PAD LAYOUT

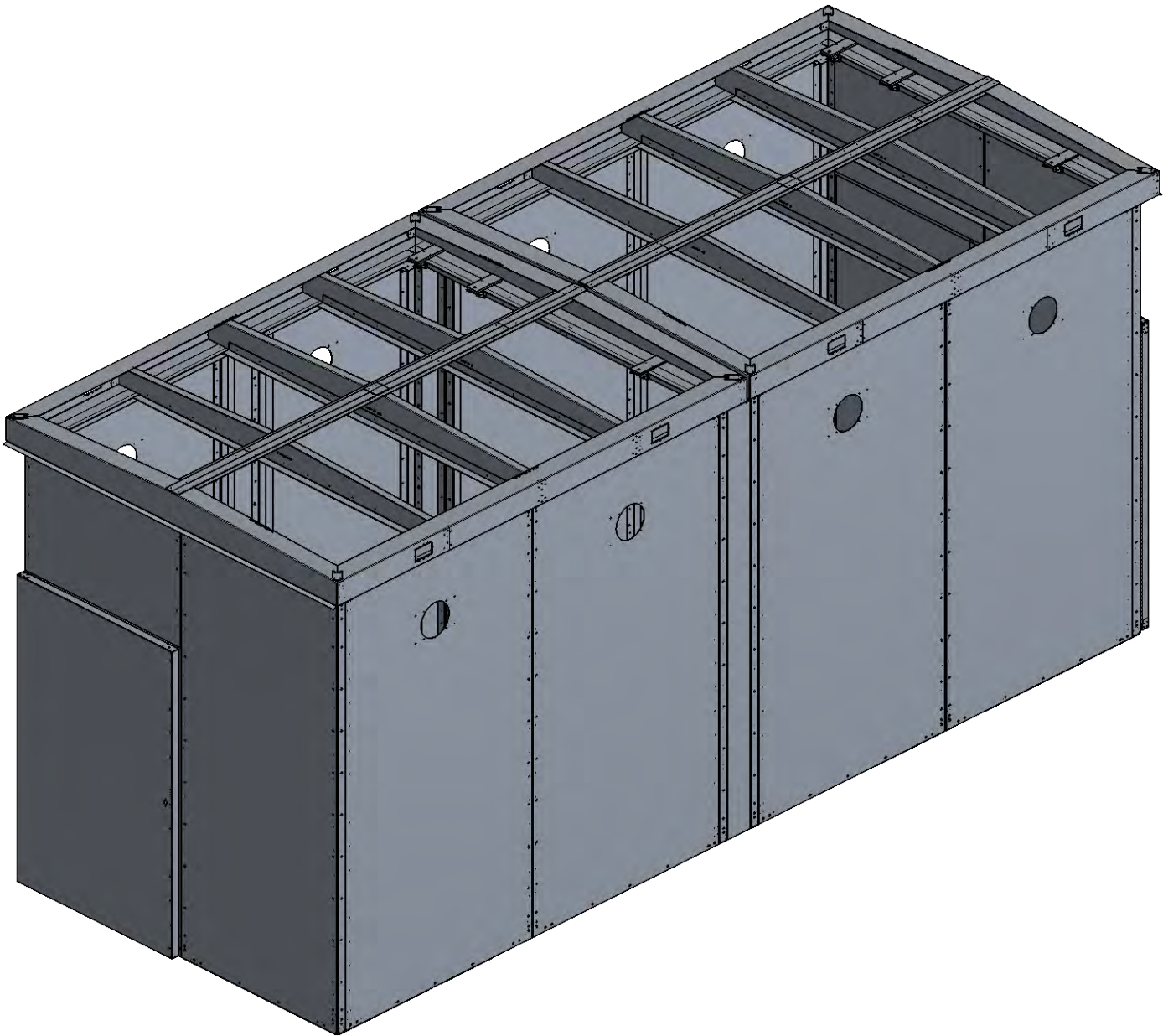
NOTE



- THIS DRAWING IS FOR A STANDARD PAD LAYOUT ONLY. EQUIPMENT SHOWN MAY NOT REFLECT ACTUAL EQUIPMENT ORDERED. SEE QUOTE AND/OR SUBMITTAL FOR PURCHASED EQUIPMENT.
- CONTRACTOR TO VERIFY PUMP LAYOUT WITH SUBMITTAL DRAWING

APPROX LOCATIONS

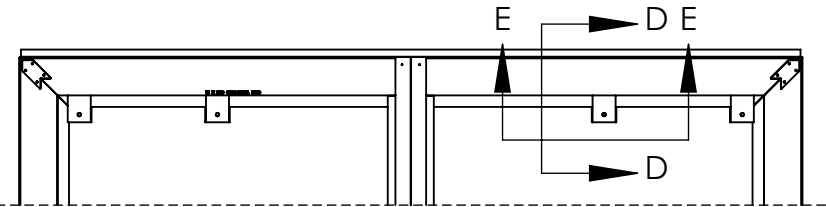
 PPS PRECISION PUMPING SYSTEMS 6515 BUSINESS WAY BOISE, IDAHO 83716 208-323-5300 www.gopps.us	MATERIAL		TITLE: PAD LAYOUT	
	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL: ±1/8" ONE PLACE DECIMAL: ±.10 TWO PLACE DECIMAL: ±.05 DO NOT SCALE DRAWING		PROJECT: LONDON WATER COOP	
	SALESMAN: Matt Purdy	PART NO: 2V-2-NJ-2OT-2VF-2UV-FM-AL-PT	LEVEL: 90% Final	
	DRAWN: ACL	DATE: 12/10/2024	JOB:	SIZE: B SCALE: NTS SHEET: 1 OF 1 REV

	INITIAL	DATE
CUT		
FAB		
LEAK TEST		

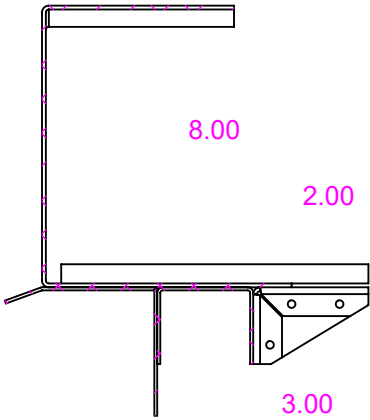


<div>  <p>PPS PRECISION PUMPING SYSTEMS</p> <p>6515 BUSINESS WAY BOISE, IDAHO 83716 208-323-5300 www.gopps.us</p>  </div>	MATERIAL		PART NO: PK-TOPS-XD ENCLOSURE 4DR	
	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL: $\pm 1/8"$ ONE PLACE DECIMAL: $\pm .10$ TWO PLACE DECIMAL: $\pm .05$ DO NOT SCALE DRAWING		DESCRIPTION: ASSEMBLY	
			SERIES: TOPS - STRUCTURAL	
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	DRAWN: SEM	DATE: 1/28/2025	JOB:	SIZE: B SCALE: NTS SHEET: 1 OF 17 REV: DEFAULT

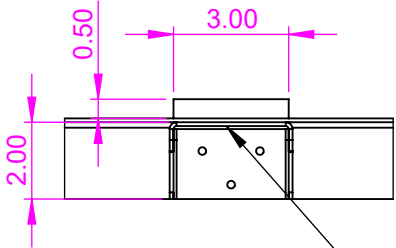
NOTE: ALL RIVETS ARE $\phi 3/16"$ X .575"
LONG, 304 STAINLESS STEEL, 950 LB.
SHEAR STRENGTH, 1200 LB. TENSILE



TOP VIEW

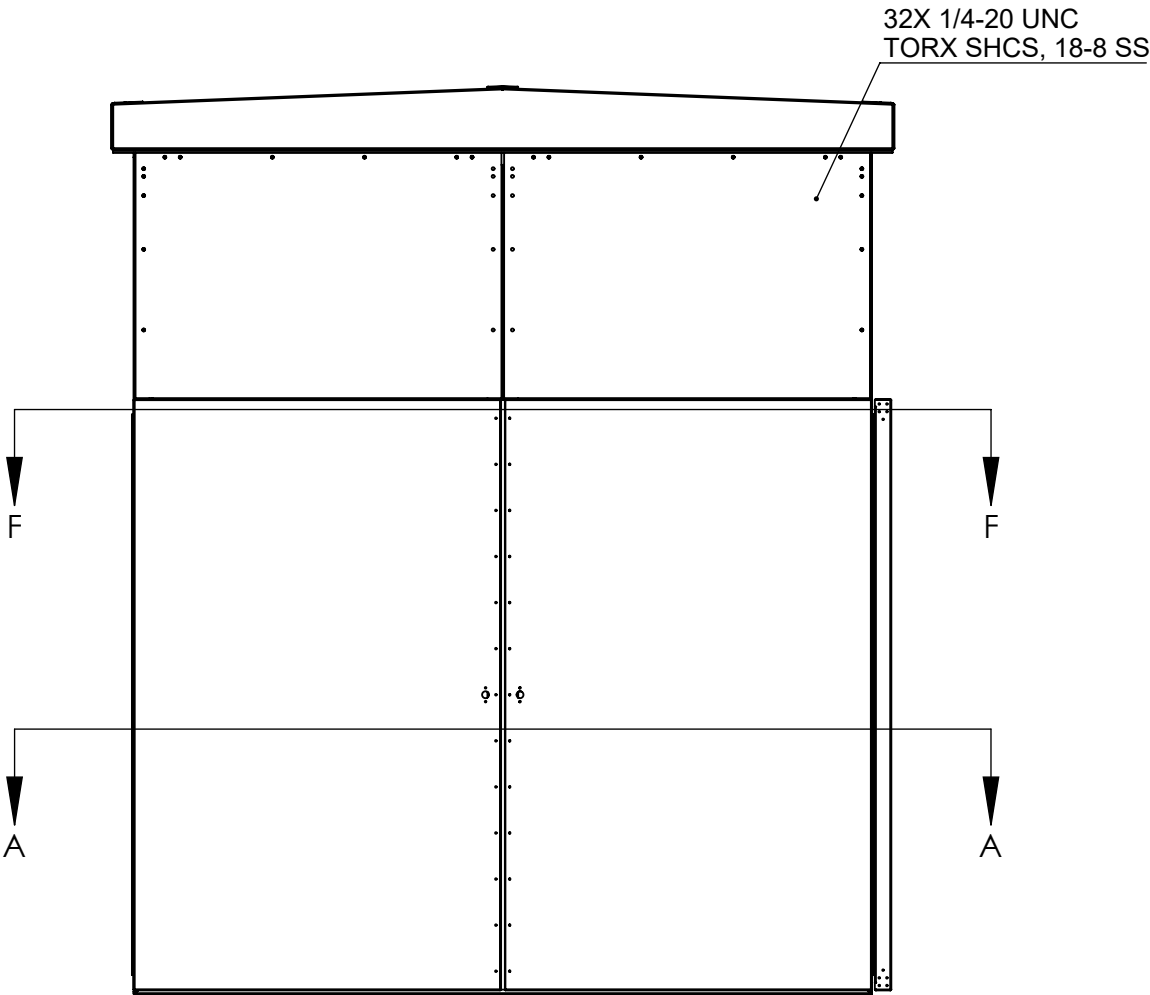


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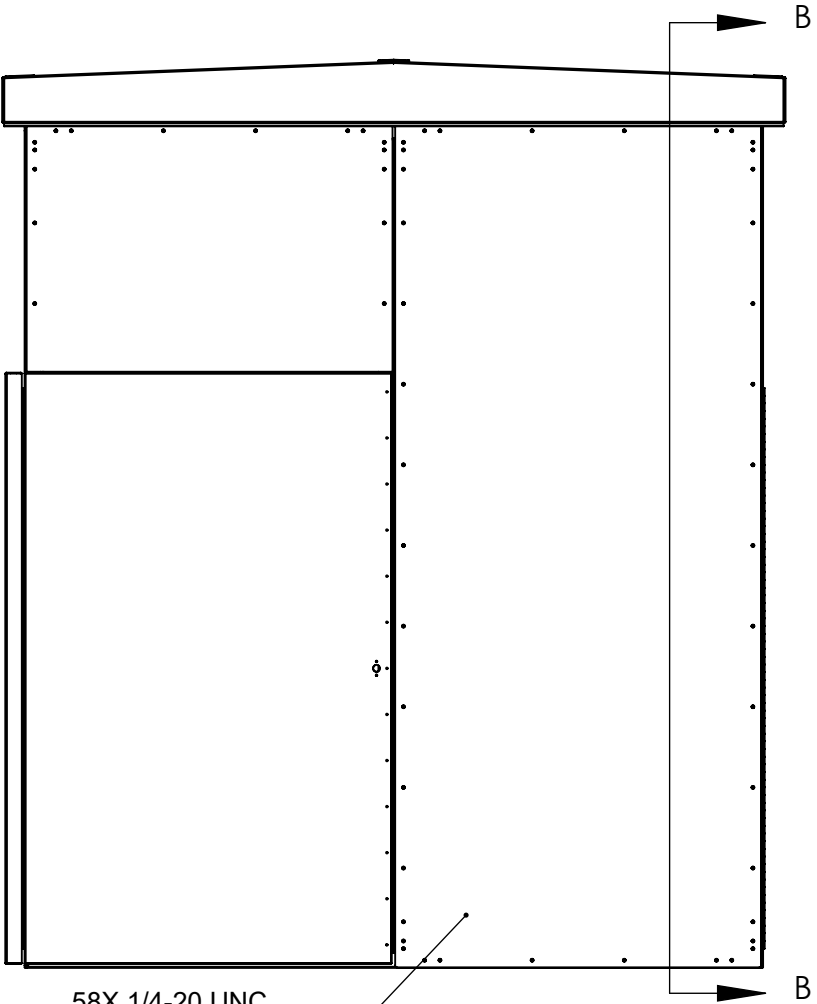


SECTION E-E
SCALE 1 : 5

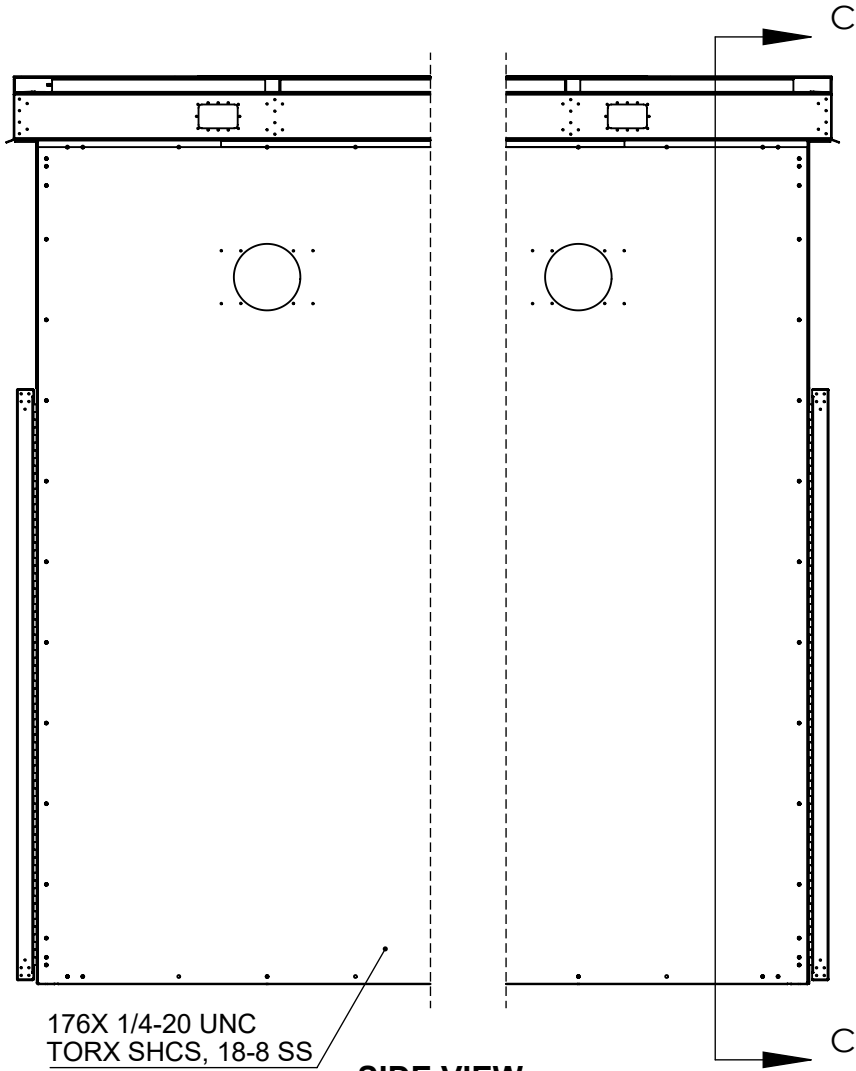
1/2-20 UNF HEX BOLT,
ZINC PLATED GR. 5




FRONT VIEW



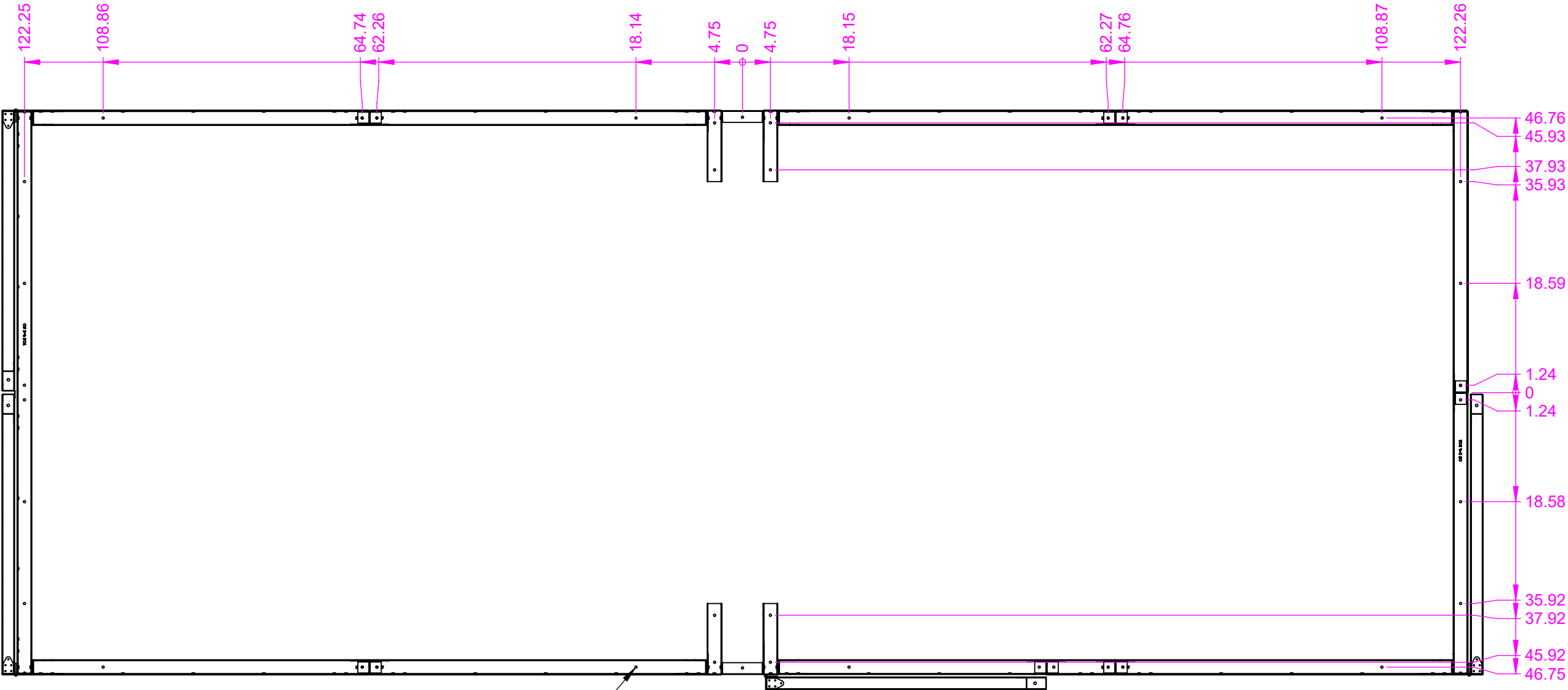
BACK VIEW



SIDE VIEW




 PRECISION PUMPING SYSTEMS 6515 BUSINESS WAY BOISE, IDAHO 83716 208-323-5300 www.gopps.us		MATERIAL		PART NO: PK-TOPS-XD ENCLOSURE 4DR	
		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL: $\pm 1/8"$ ONE PLACE DECIMAL: $\pm .10$ TWO PLACE DECIMAL: $\pm .05$ DO NOT SCALE DRAWING		DESCRIPTION: ASSEMBLY	
		DRAWN: SEM		SERIES: TOPS - STRUCTURAL	
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		JOB:		SIZE: B	SCALE: NTS
				SHEET: 2 OF 17	REV: DEFAULT

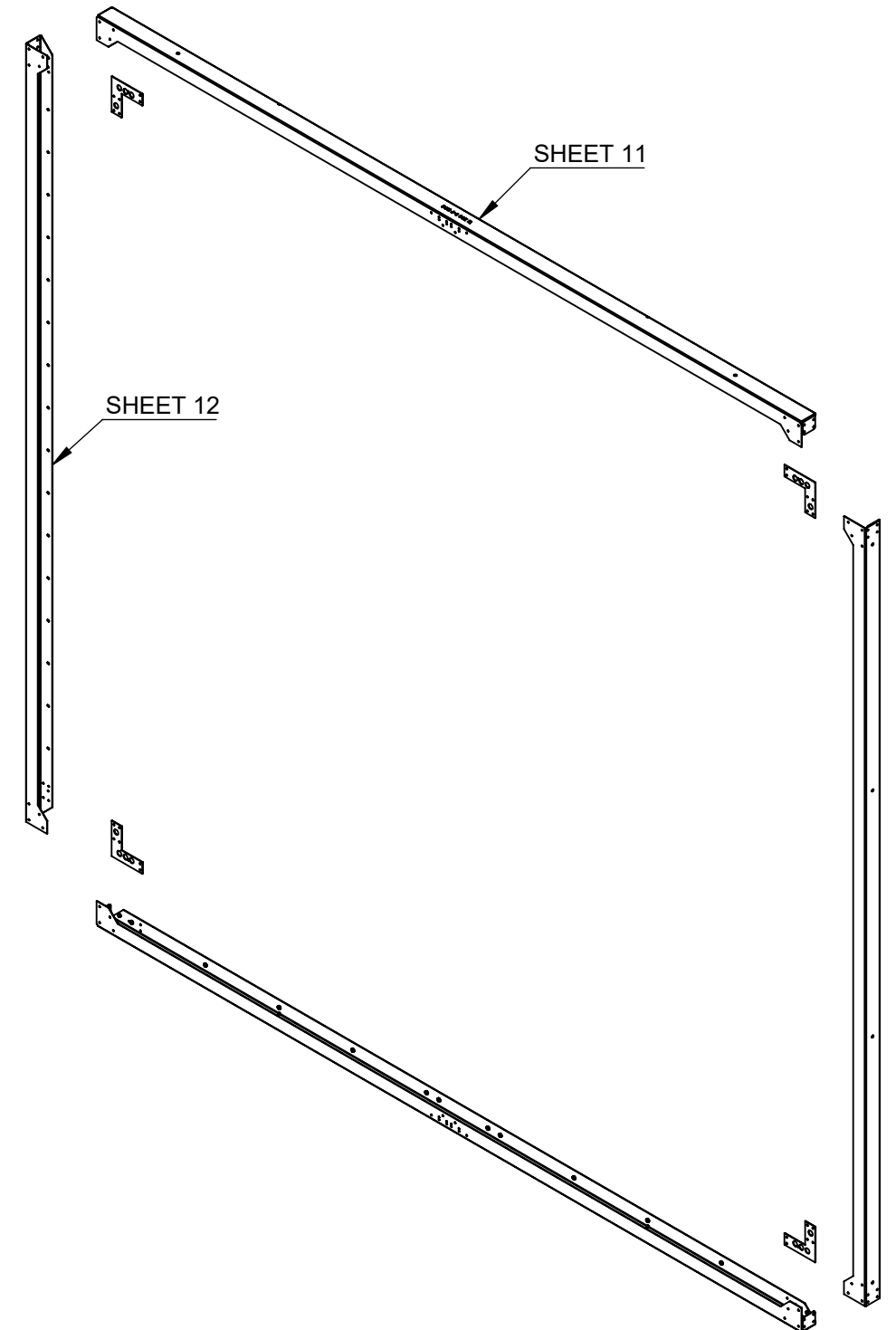
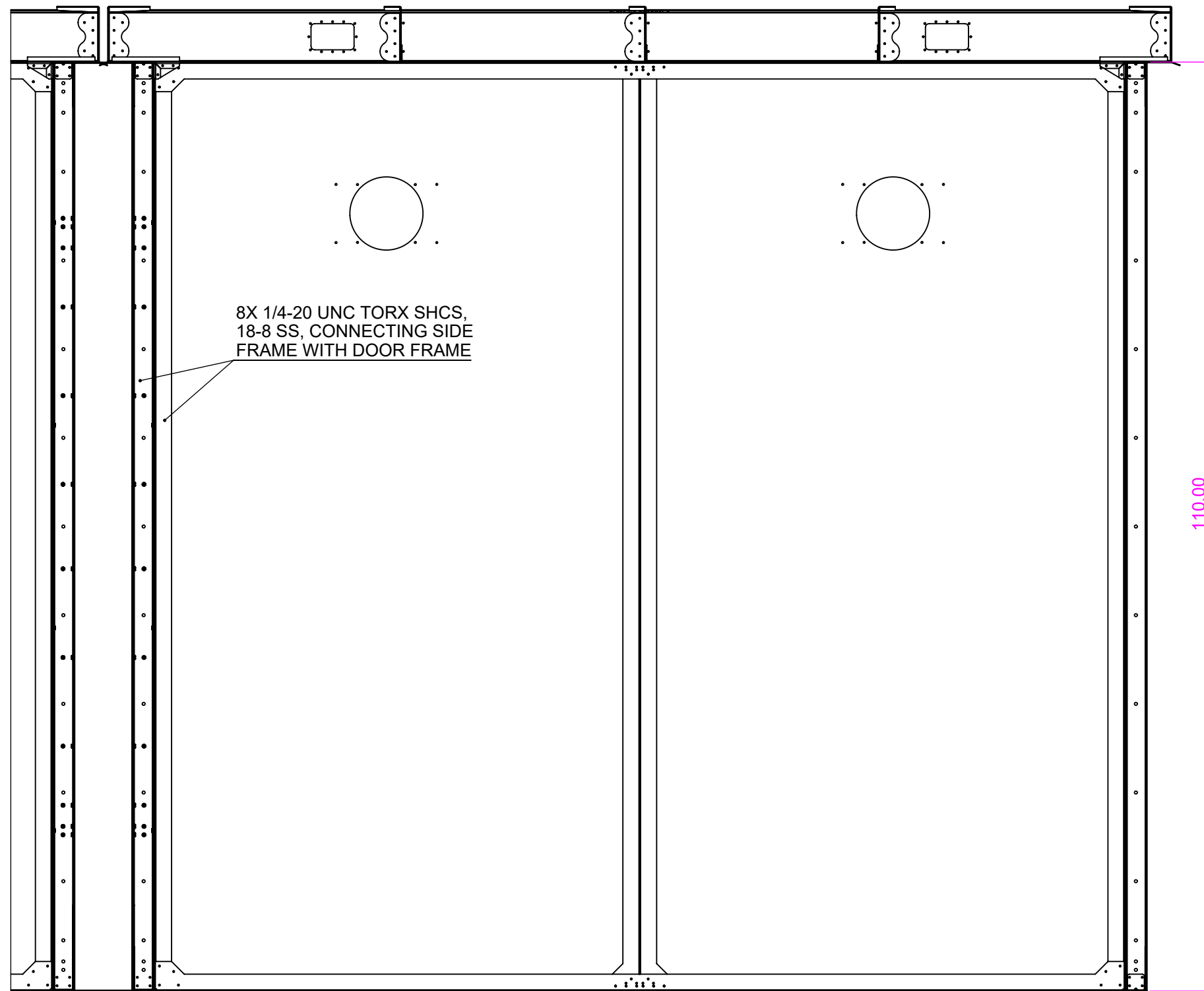
	INITIAL	DATE
CUT		
FAB		
LEAK TEST		




39X 5/16-18 HEX BOLT,
ZINC PLATED, GR. 5,
THREADED INTO 3/8"
THICK A36 STEEL SKID

SECTION A-A

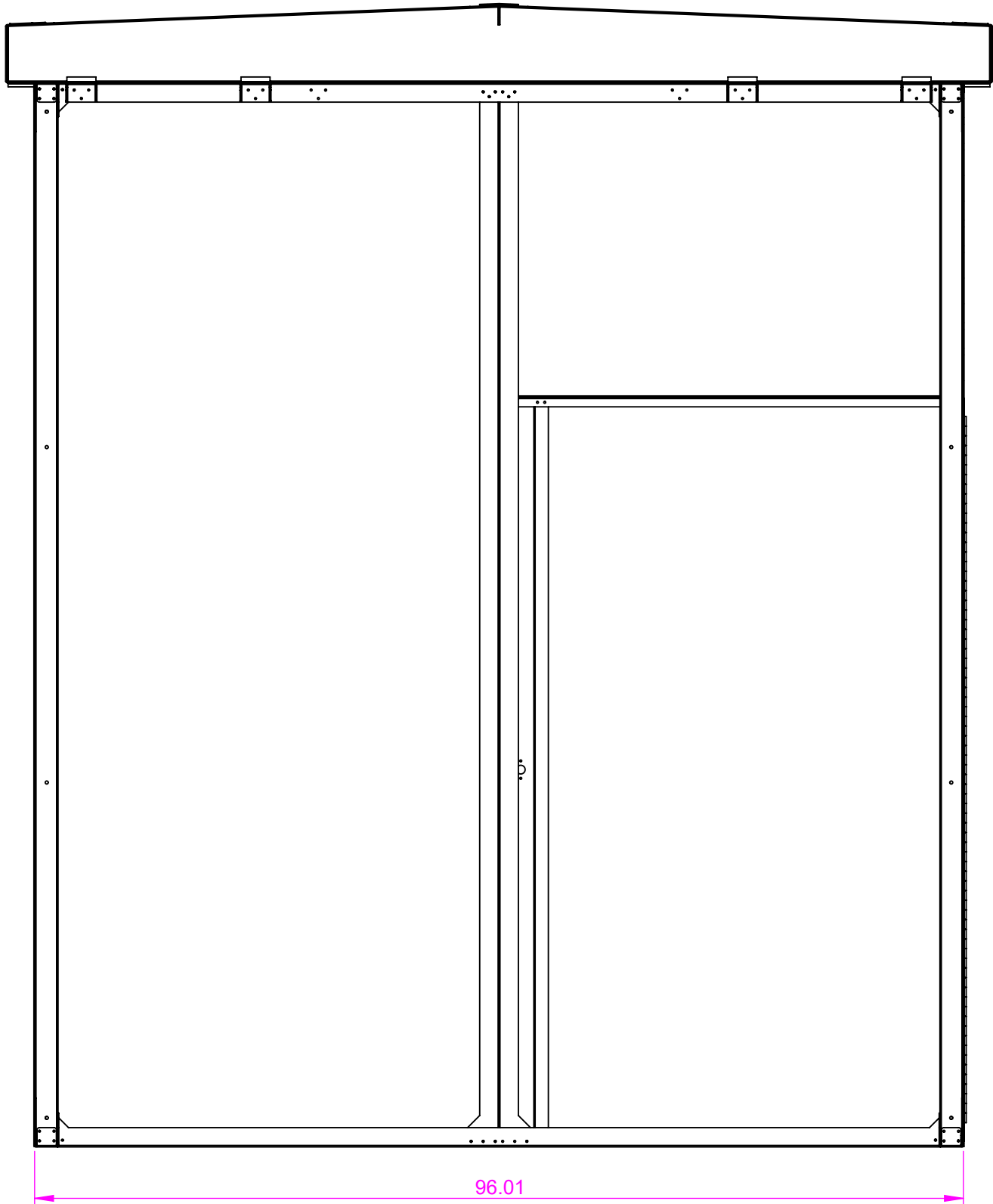
<div> PPS PRECISION PUMPING SYSTEMS 6515 BUSINESS WAY BOISE, IDAHO 83716 208-323-5300 www.gopps.us</div> <div></div>	MATERIAL		PART NO: PK-TOPS-XD ENCLOSURE 4DR					
	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL: ±1/8" ONE PLACE DECIMAL: ±.10 TWO PLACE DECIMAL: ±.05 DO NOT SCALE DRAWING		DESCRIPTION: ASSEMBLY					
			SERIES: TOPS - STRUCTURAL					
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			DRAWN: SEM		DATE: 1/28/2025		JOB:	SIZE: B



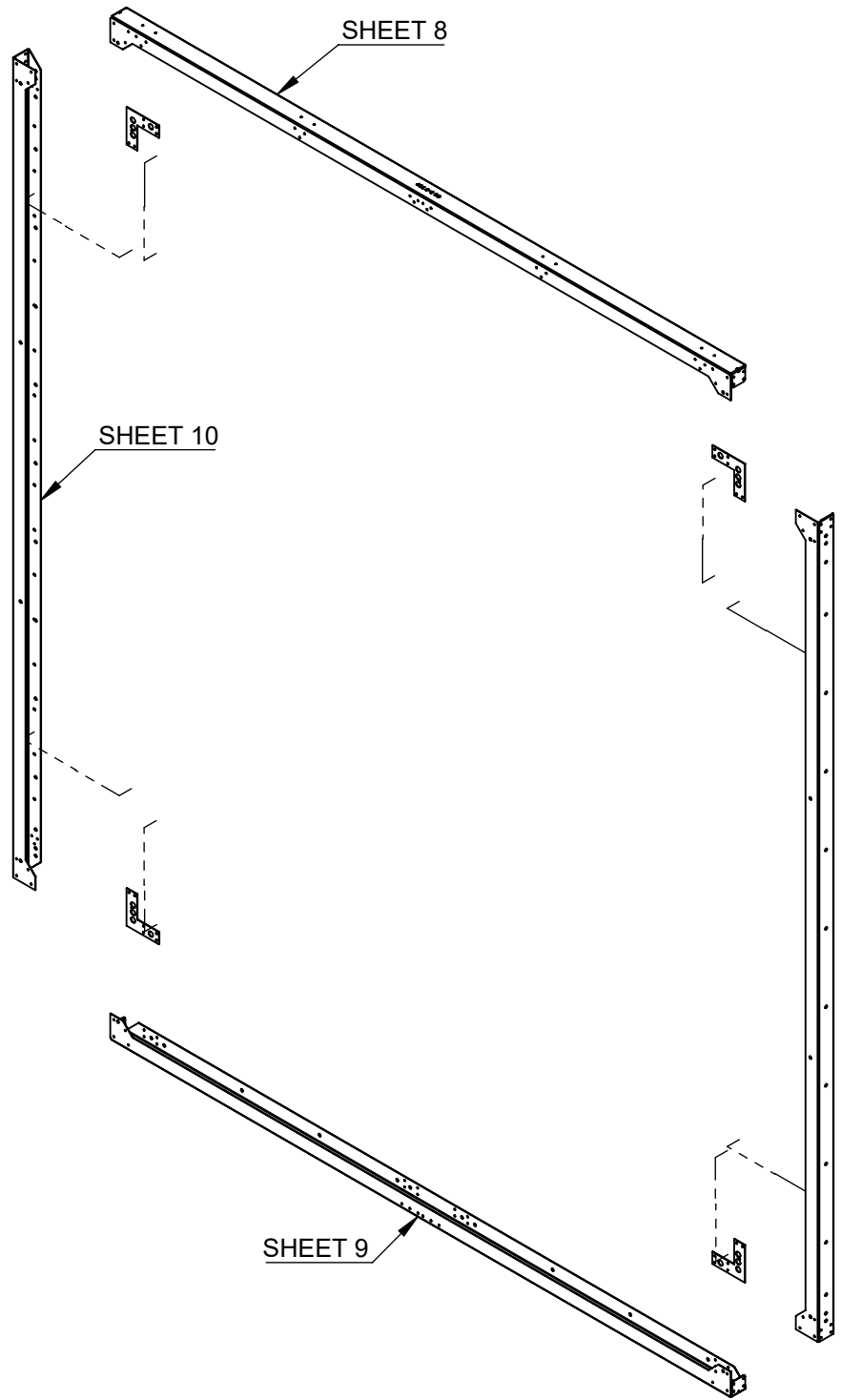
SECTION B-B
SCALE 1 : 15



 PRECISION PUMPING SYSTEMS 6515 BUSINESS WAY BOISE, IDAHO 83716 208-323-5300 www.gopps.us		MATERIAL		PART NO: PK-TOPS-XD ENCLOSURE 4DR	
		UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL: $\pm 1/8"$ ONE PLACE DECIMAL: $\pm .10$ TWO PLACE DECIMAL: $\pm .05$ DO NOT SCALE DRAWING		DESCRIPTION: ASSEMBLY	
				SERIES: TOPS - STRUCTURAL	
				LEVEL: 90% Final	
		DRAWN: SEM	DATE: 1/28/2025	JOB:	SIZE: B SCALE: NTS SHEET: 4 OF 17 REV: DEFAULT

	INITIAL	DATE
CUT		
FAB		
LEAK TEST		



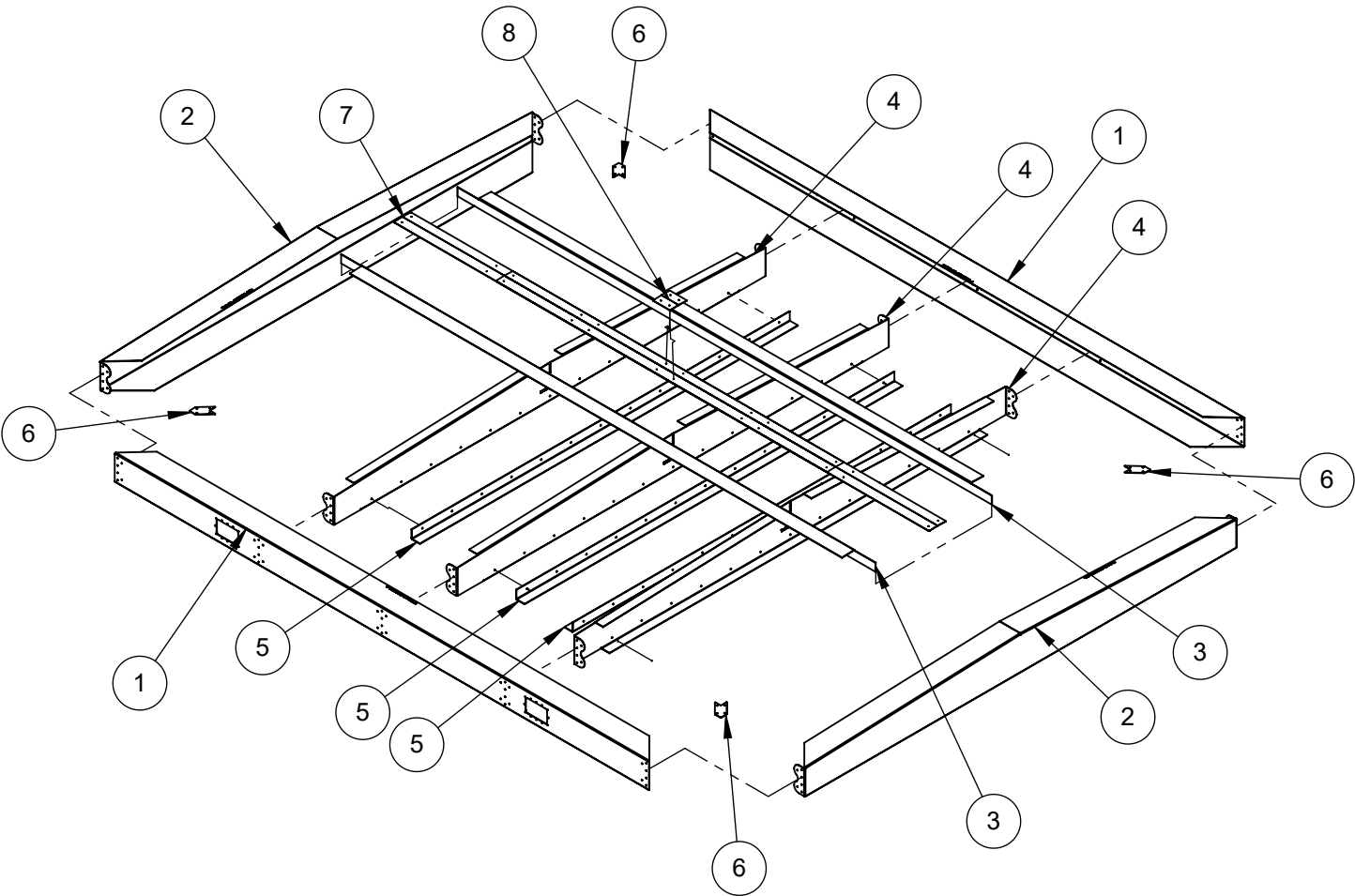
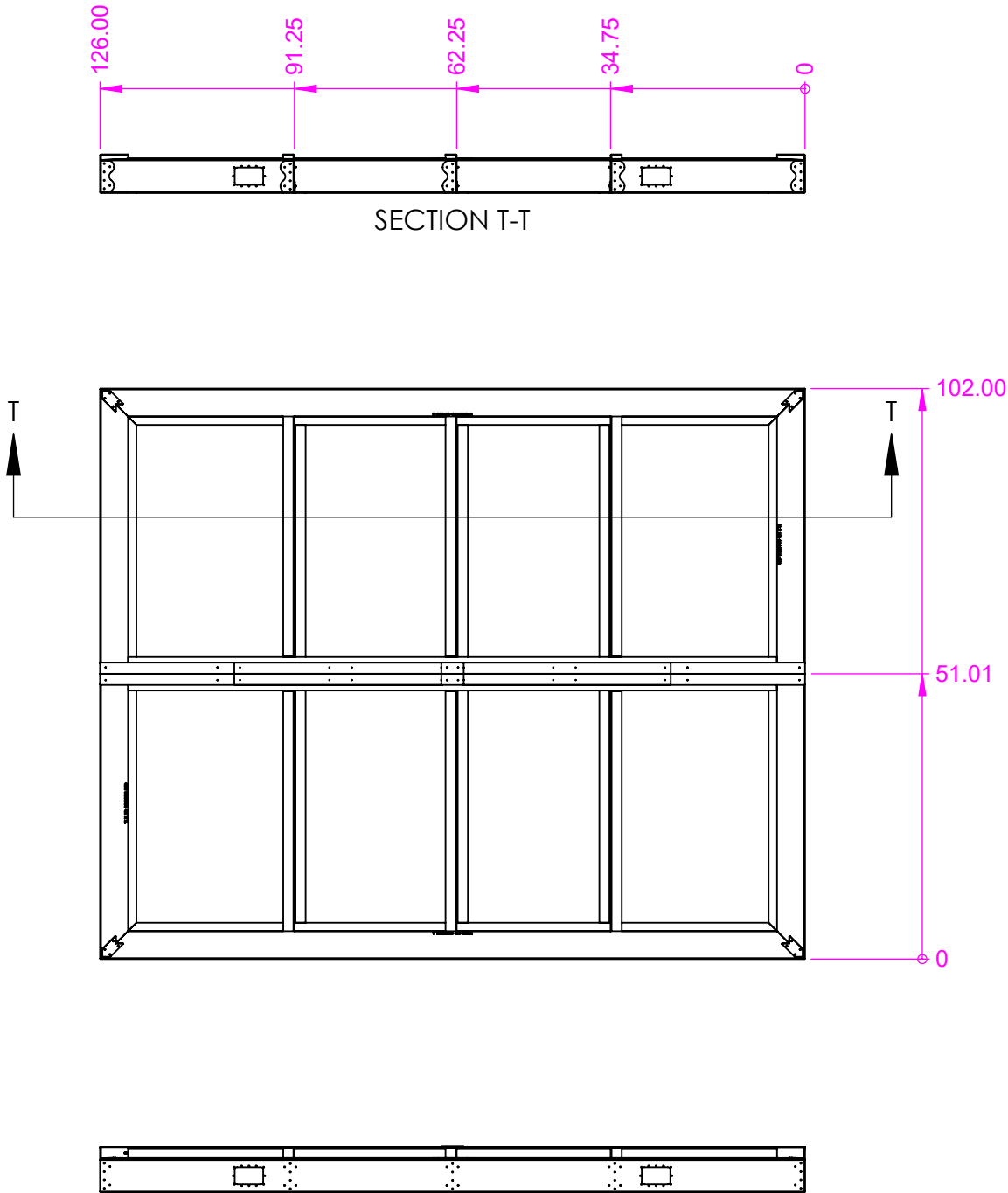
SECTION C-C
SCALE 1 : 15






 PRECISION PUMPING SYSTEMS 6515 BUSINESS WAY BOISE, IDAHO 83716 208-323-5300 www.gopps.us 	MATERIAL		PART NO: PK-TOPS-XD ENCLOSURE 4DR	
	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL: $\pm 1/8"$ ONE PLACE DECIMAL: $\pm .10$ TWO PLACE DECIMAL: $\pm .05$ DO NOT SCALE DRAWING		DESCRIPTION: ASSEMBLY	
			SERIES: TOPS - STRUCTURAL	
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	DRAWN: SEM	DATE: 1/28/2025	JOB:	SIZE: B SCALE: NTS SHEET: 5 OF 17 REV: DEFAULT

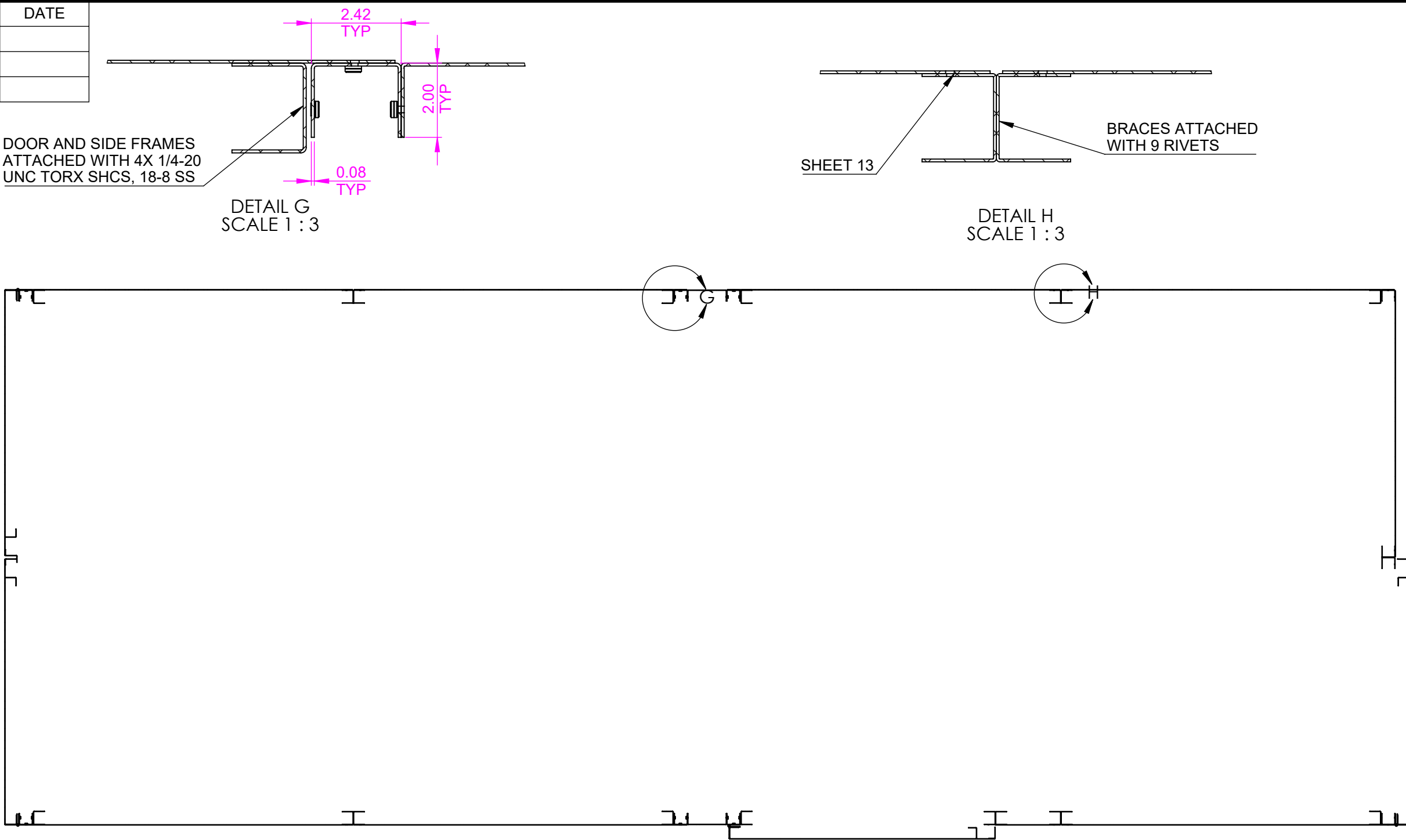
	INITIAL	DATE
CUT		
FAB		
LEAK TEST		




ITEM NO.	PART NUMBER	QTY.
1	PFE-TITAN-X10 LID CHANNEL A	2
2	PFE-TITAN-X LID CHANNEL END	2
3	PFE-TITAN-X10 LID RIDGE SUP	2
4	PFE-TITAN-X LID TRUSS	3
5	PFE-TITAN-X LID TRUSS ANGLE	3
6	PFE-MISC LID CORNER COVER	4
7	PFE-MISC RIDGE CAP	2
8	PFE-MISC RIDGE CAP SPLICE	1

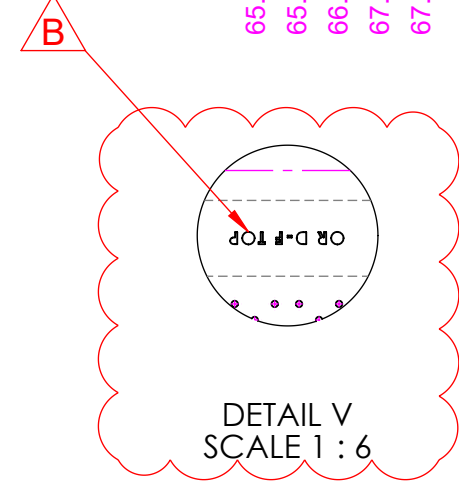
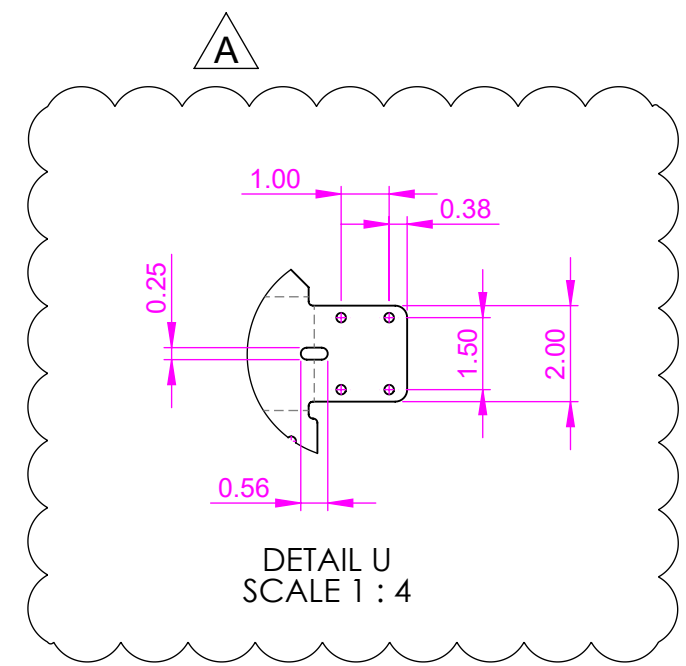
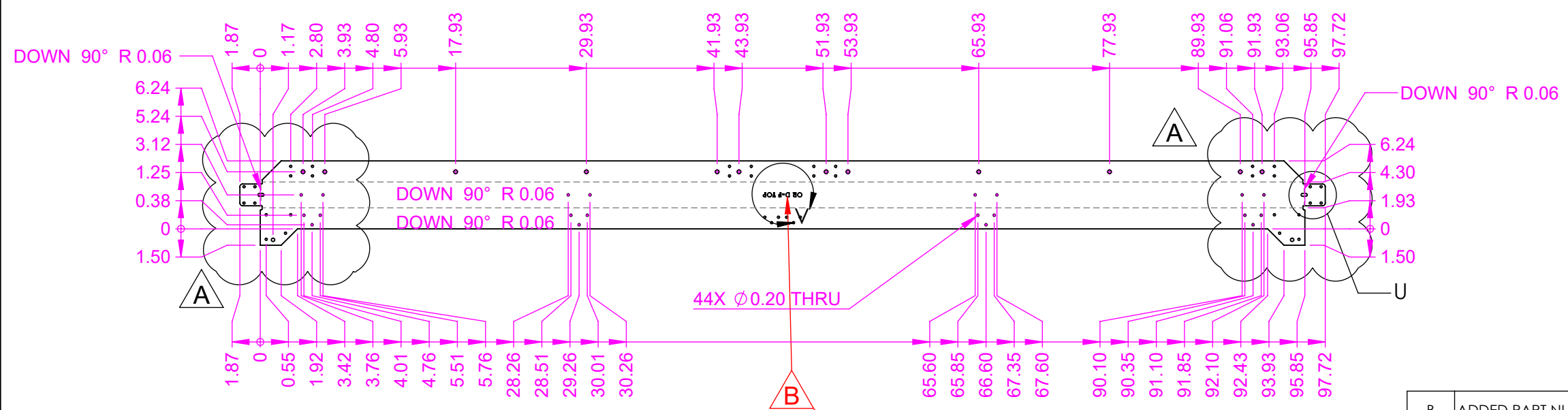
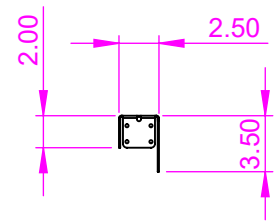
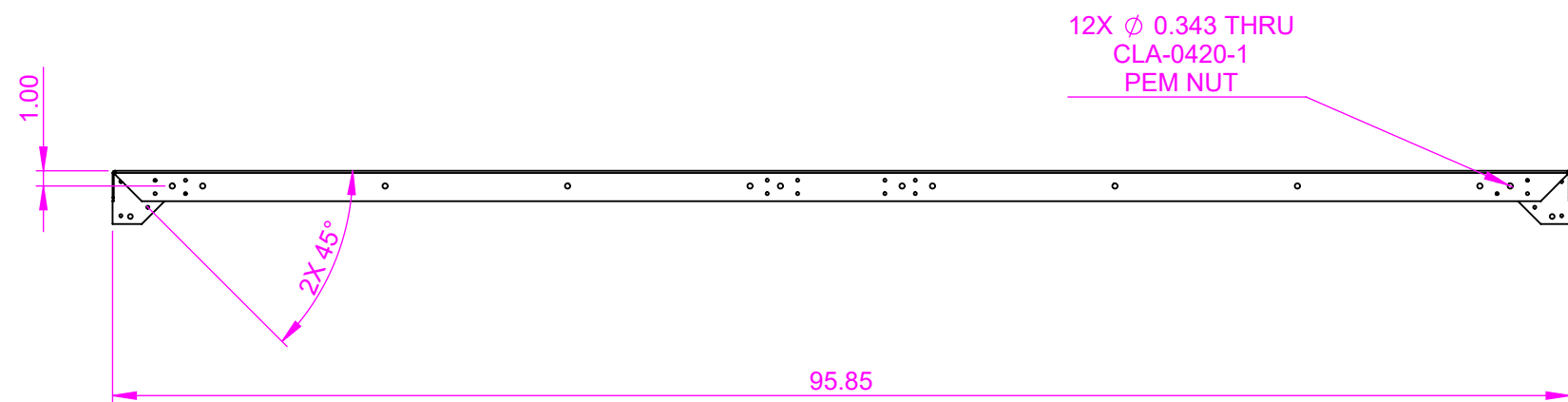


 PPS PRECISION PUMPING SYSTEMS 6515 BUSINESS WAY BOISE, IDAHO 83716 208-323-5300 www.gopps.us	MATERIAL		PART NO: PK-TOPS-XD ENCLOSURE 4DR	
	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL: $\pm 1/8"$ ONE PLACE DECIMAL: $\pm .10$ TWO PLACE DECIMAL: $\pm .05$ DO NOT SCALE DRAWING		DESCRIPTION: ASSEMBLY	
			SERIES: TOPS - STRUCTURAL	
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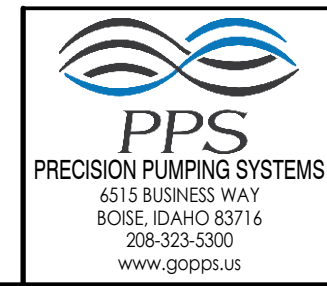
	INITIAL	DATE
CUT		
FAB		
LEAK TEST		



 PPS PRECISION PUMPING SYSTEMS 6515 BUSINESS WAY BOISE, IDAHO 83716 208-323-5300 www.gopps.us	MATERIAL		PART NO: PK-TOPS-XD ENCLOSURE 4DR	
	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL: ±1/8" ONE PLACE DECIMAL: ±.10 TWO PLACE DECIMAL: ±.05 DO NOT SCALE DRAWING		DESCRIPTION: ASSEMBLY	
			SERIES: TOPS - STRUCTURAL	
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	REV DEFAULT			

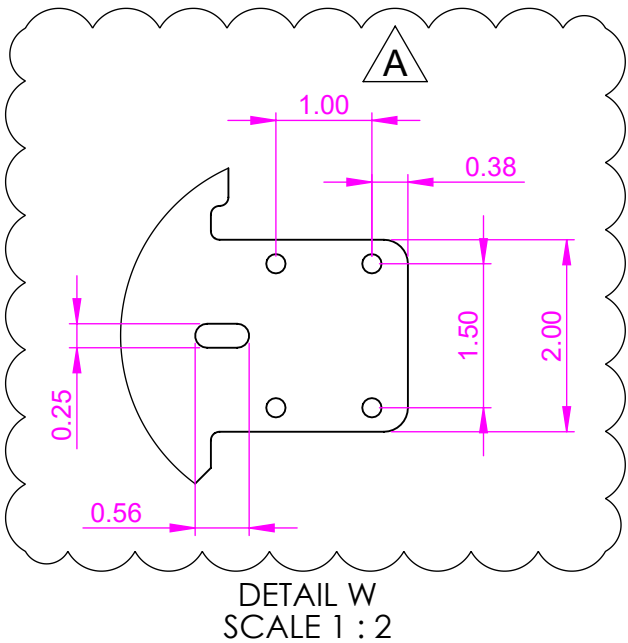
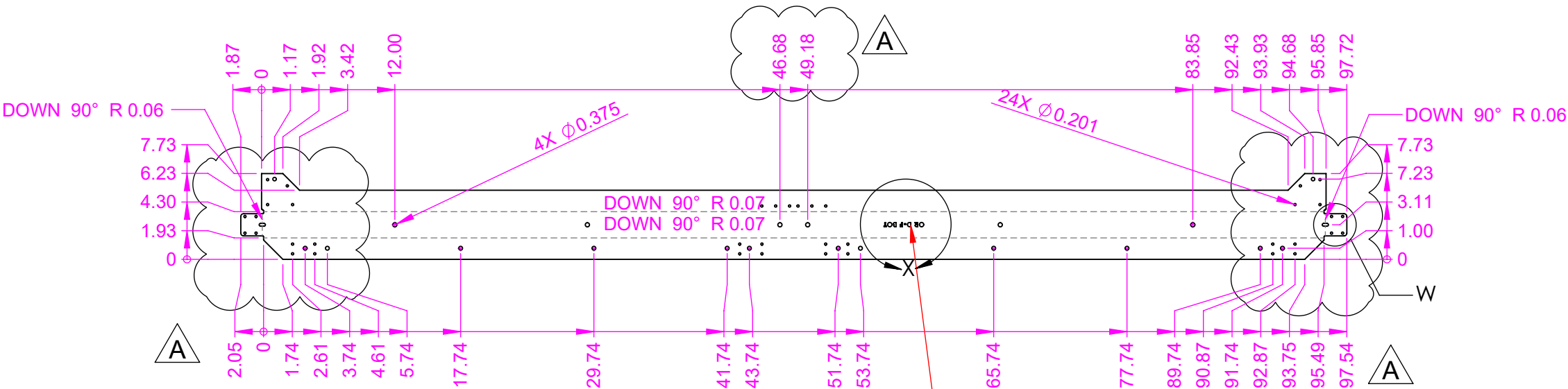
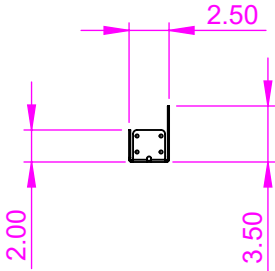
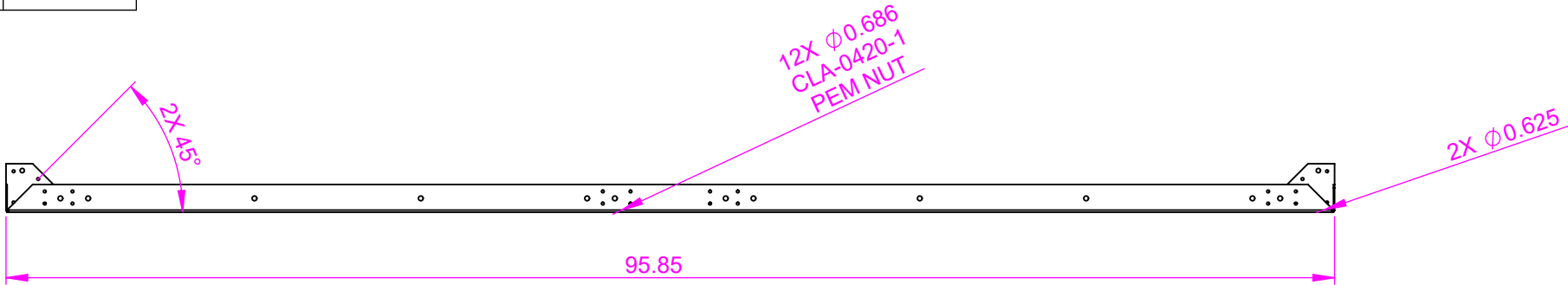


NOTE: ALL PEM NUTS ON INSIDE OF CHANNEL

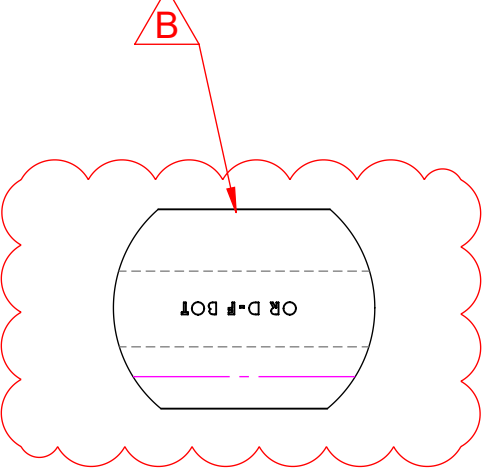


B	ADDED PART NUMBER FOR LASERCUTTING	11/4/2022	ACL
A	-ADDED TABS ON ENDS -PART NUMBER WAS PFE-ORION DOOR TOP BRACE	12/8/2019	
REV.	DESCRIPTION	DATE	APVD
REVISIONS			
MATERIAL .080" 5052-H32 ALUMINUM		PART NO: PFE-ORION DOOR FRAME TOP	
		DESCRIPTION: DETAIL	
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL: ±1/8" ONE PLACE DECIMAL: ±.10 TWO PLACE DECIMAL: ±.05 DO NOT SCALE DRAWING		SERIES: TOPS - STRUCTURAL	
		LEVEL: 90% Final	
DRAWN: SEM	DATE: 1/28/2025	JOB:	SIZE: B SCALE: NTS SHEET: 8 OF 17 REV B

	INITIAL	DATE
CUT		
FAB		
LEAK TEST		

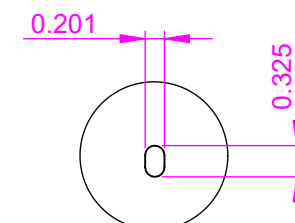
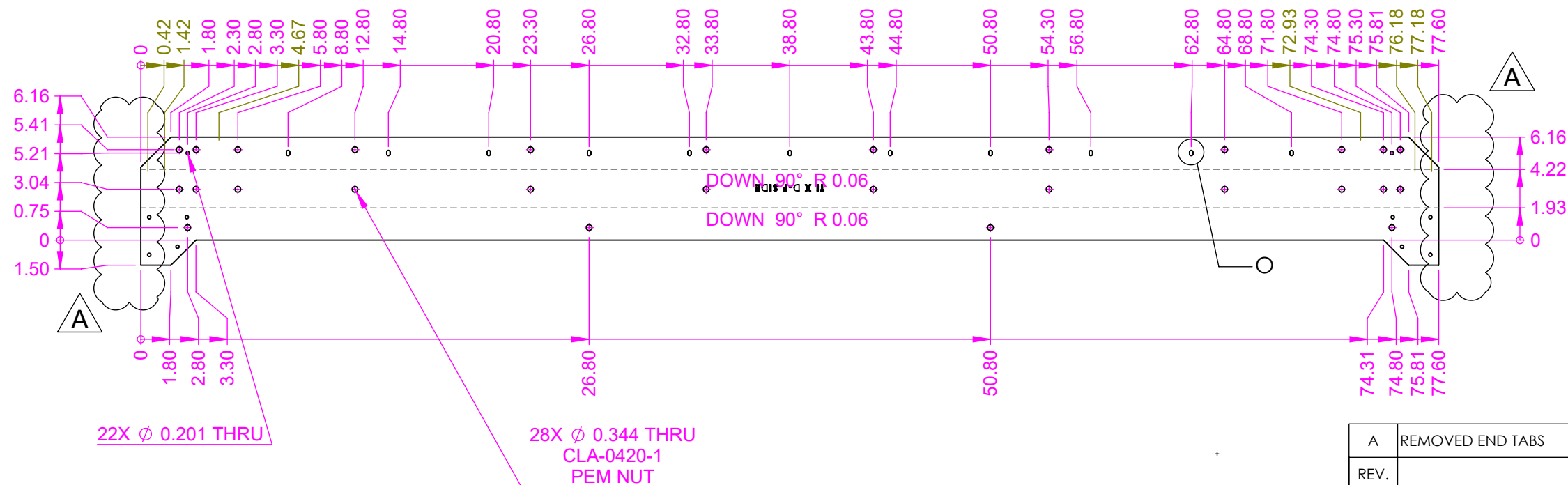
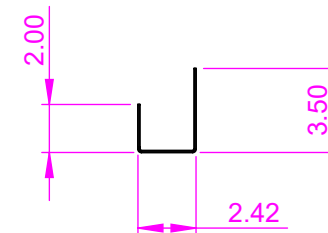
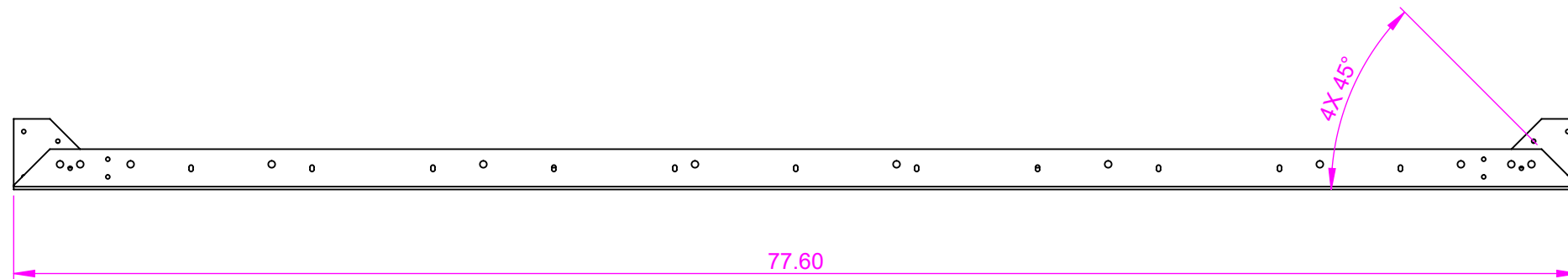


NOTE: ALL PEM NUTS ON INSIDE OF CHANNEL



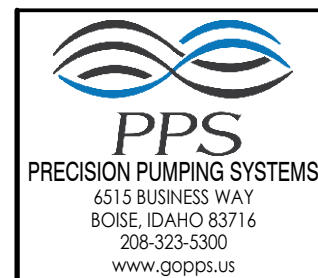
PPS
PRECISION PUMPING SYSTEMS
6515 BUSINESS WAY
BOISE, IDAHO 83716
208-323-5300
www.gopps.us

B	ADDED PARTNUMBER FOR LASERCUTTING	11/4/2022	ACL
A	-ADDED TABS ON BOTH ENDS -CHANGED POSITION OF TWO HOLES -PART NUMBER WAS PFE-ORION DOOR BOTTOM BRACE	12/8/2019	
REV.	DESCRIPTION	DATE	APVD
REVISIONS			
MATERIAL .080" 5052-H32 ALUMINUM			
PART NO: PFE-ORION DOOR FRAME BOTTOM			
DESCRIPTION: DETAIL			
SERIES: TOPS - STRUCTURAL			
LEVEL: 90% Final			
DRAWN: SEM	DATE: 1/28/2025	JOB:	SIZE: B SCALE: NTS SHEET: 9 OF 17 REV B

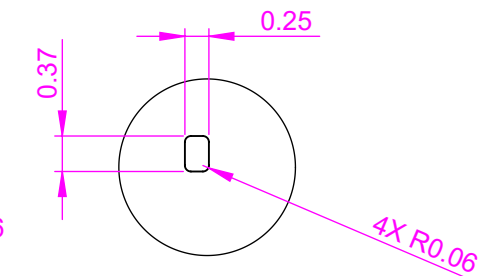
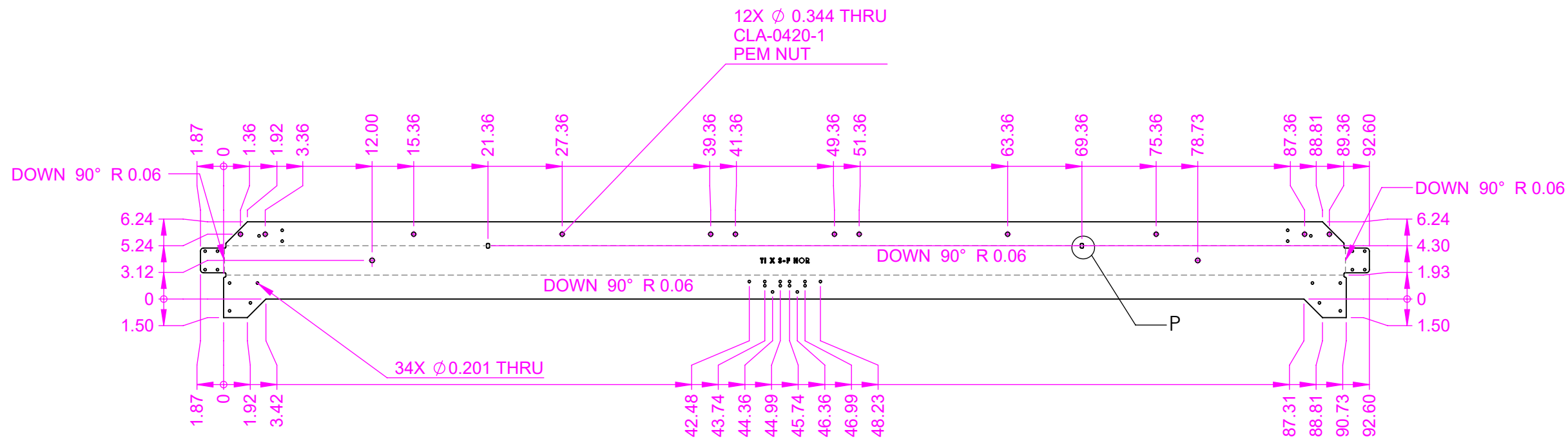
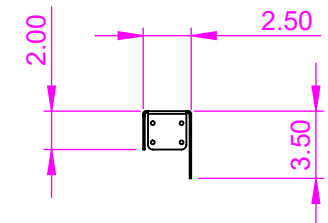
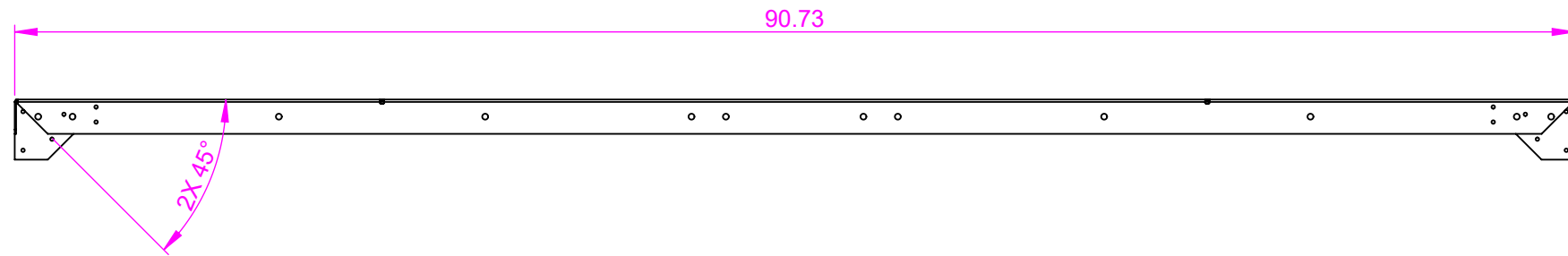


DETAIL O
SCALE 1 : 2

NOTE: ALL PEM NUTS ON INSIDE OF CHANNEL



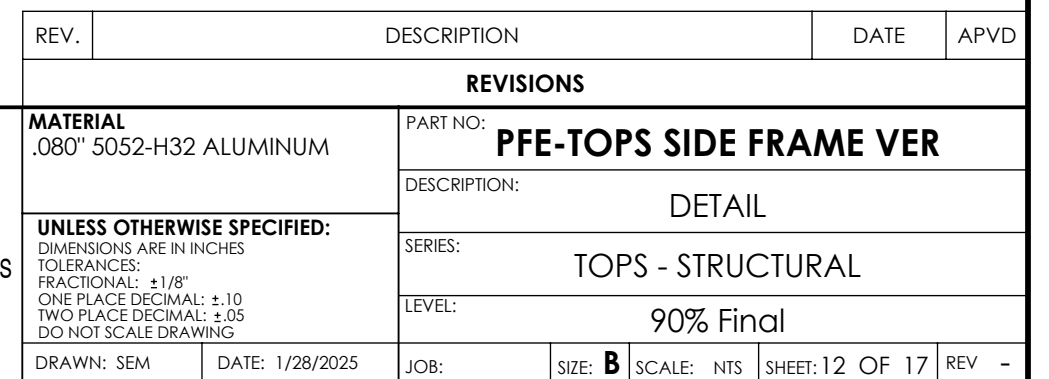
A REMOVED END TABS		12/8/2019	
REV.	DESCRIPTION	DATE	APVD
REVISIONS			
MATERIAL .080" 5052-H32 ALUMINUM		PART NO: PFE-TITAN-X DOOR FRAME SIDE	
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL: ±1/8" ONE PLACE DECIMAL: ±.10 TWO PLACE DECIMAL: ±.05 DO NOT SCALE DRAWING		DESCRIPTION: DETAIL	
		SERIES: TOPS - STRUCTURAL	
		LEVEL: 90% Final	
DRAWN: SEM	DATE: 1/28/2025	JOB:	SIZE: B SCALE: NTS SHEET: 10 OF 17 REV A

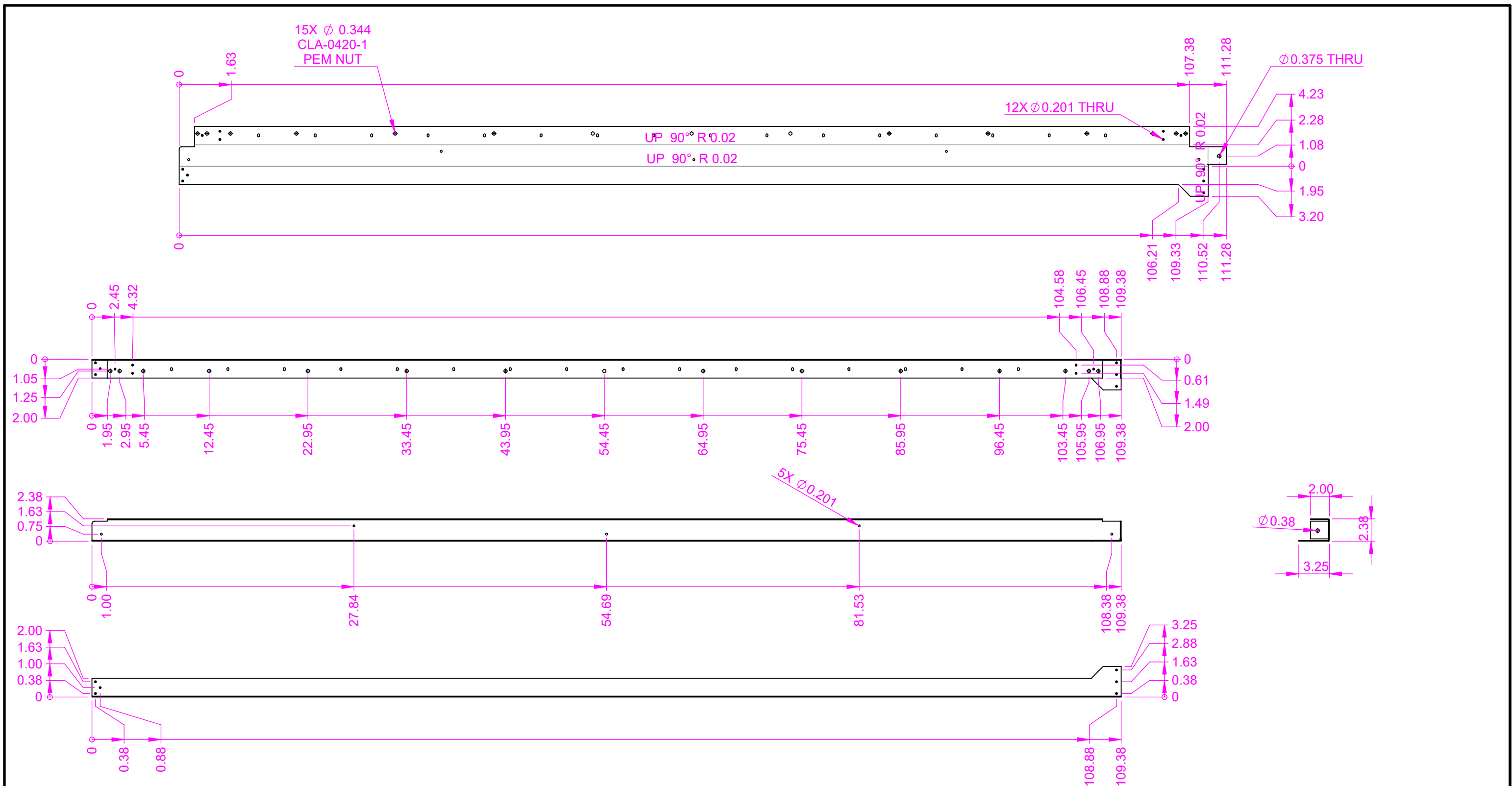


NOTE: ALL PEM NUTS ON INSIDE OF CHANNEL



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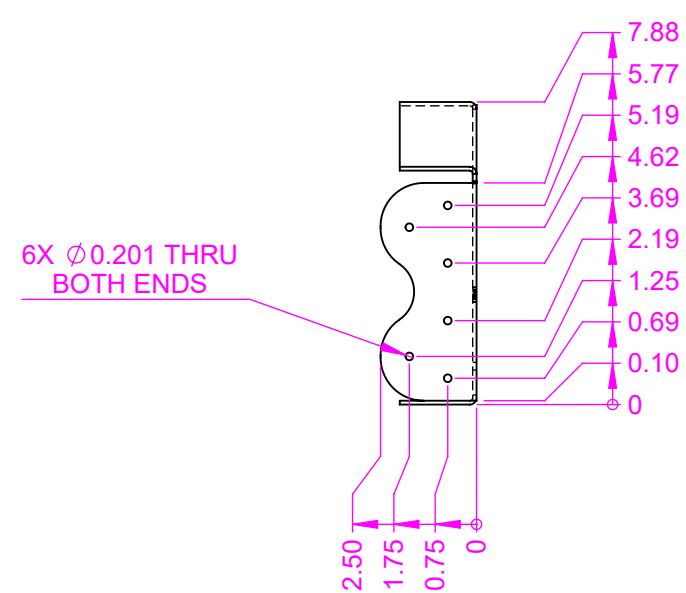
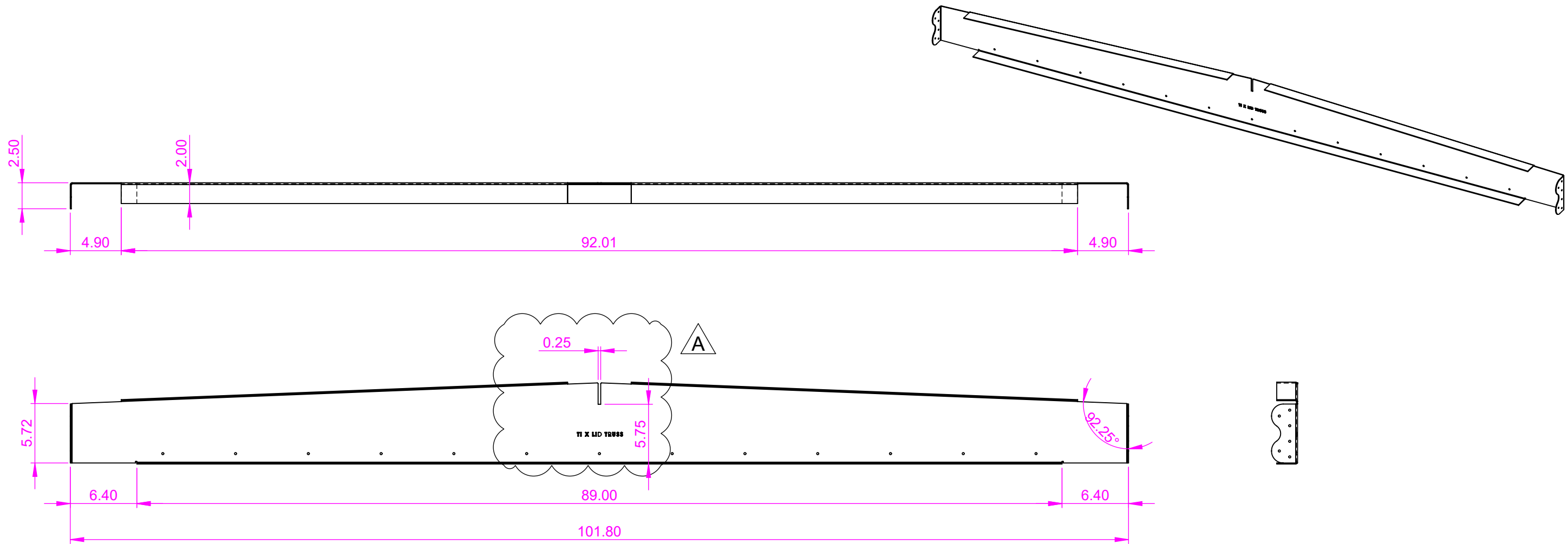
A	MOVED HOLE LOCATIONS	12/8/2020	
REV.	DESCRIPTION	DATE	APVD
REVISIONS			
MATERIAL .080" 5052-H32 ALUMINUM		PART NO: PFE-TITAN-X SIDE FRAME HOR	
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL: ±1/8" ONE PLACE DECIMAL: ±.10 TWO PLACE DECIMAL: ±.05 DO NOT SCALE DRAWING		DESCRIPTION: DETAIL	
DRAWN: SEM		SERIES: TOPS - STRUCTURAL	
DATE: 1/28/2025		LEVEL: 90% Final	
JOB:	SIZE: B	SCALE: NTS	SHEET: 11 OF 17
REV	A		



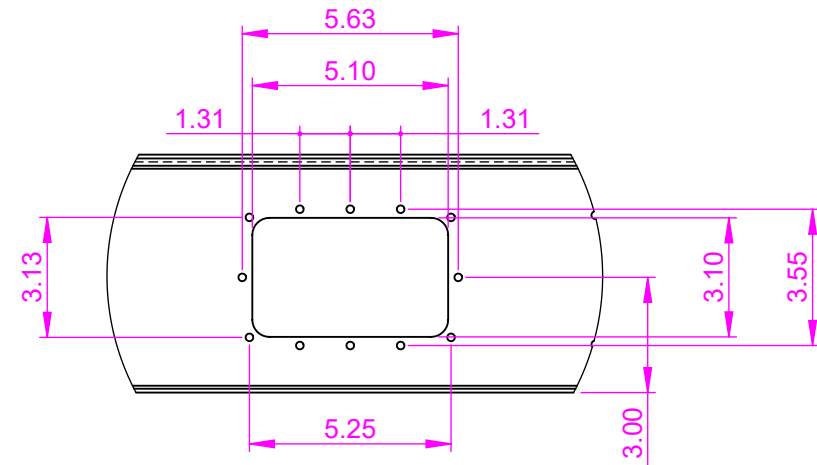


NOTE: ALL PEM NUTS ON INSIDE OF CHANNEL

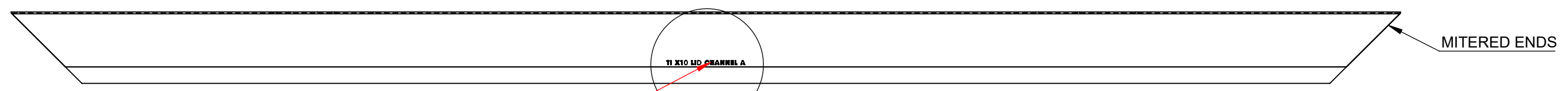
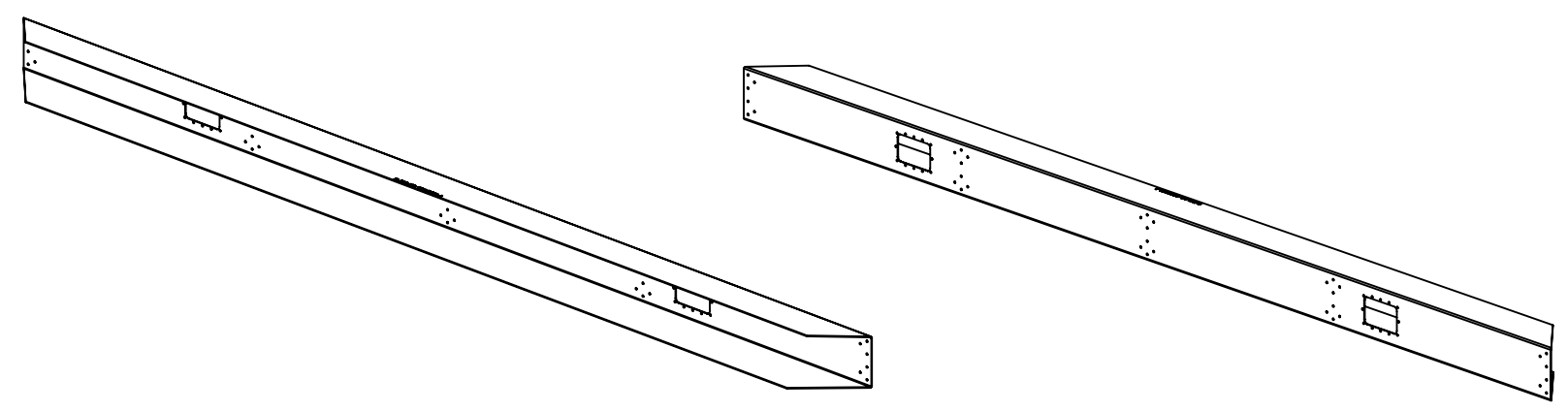
 PPS PRECISION PUMPING SYSTEMS 6515 BUSINESS WAY BOISE, IDAHO 83716 208-323-5300 www.gopps.us	MATERIAL		PART NO:	
	.080" 5052-H32 ALUMINUM		PFE-TOPS FRAME BRACE L	
	UNLESS OTHERWISE SPECIFIED:		DESCRIPTION:	
	DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL: ±1/8" ONE PLACE DECIMAL: ±.10 TWO PLACE DECIMAL: ±.05 DO NOT SCALE DRAWING		DETAIL	
DRAWN: SEM		DATE: 1/28/2025		PROJECT:
				LEVEL:
				90% Final
		JOB:		SIZE: B
				SCALE: NTS
				SHEET: 13 OF 17
				REV -



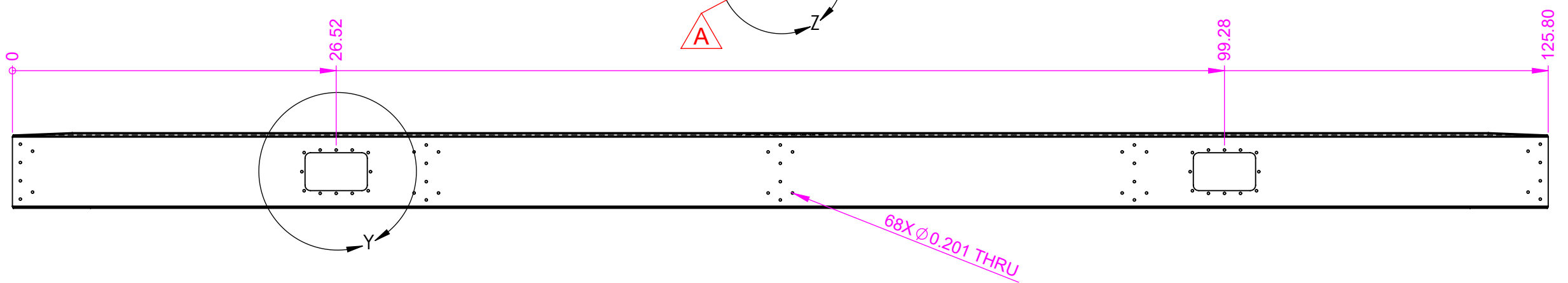
A	INCREASED TOP NOTCH FOR CLEARANCE	2/29/2020	
REV.	DESCRIPTION	DATE	APVD
REVISIONS			
MATERIAL		PART NO: PFE-TITAN-X LID TRUSS	
.100" 5052-H32 ALUMINUM		DESCRIPTION: DETAIL	
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL: ±1/8" ONE PLACE DECIMAL: ±.10 TWO PLACE DECIMAL: ±.05 DO NOT SCALE DRAWING		SERIES: TOPS - STRUCTURAL	
DRAWN: SEM		LEVEL: 90% Final	
DATE: 1/28/2025		WEIGHT: 10.19	SIZE: B
		SCALE: NTS	SHEET: 15 OF 17
		REV	A



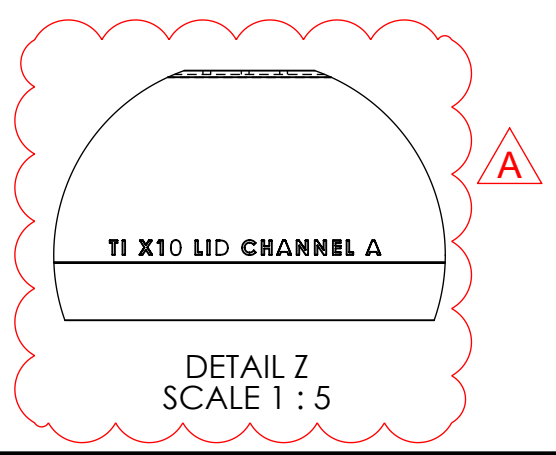
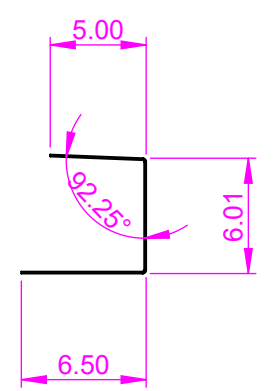
DETAIL Y
SCALE 1 : 5



MITERED ENDS



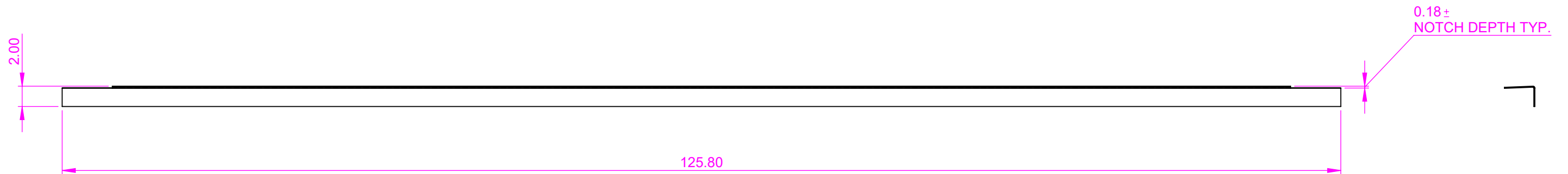
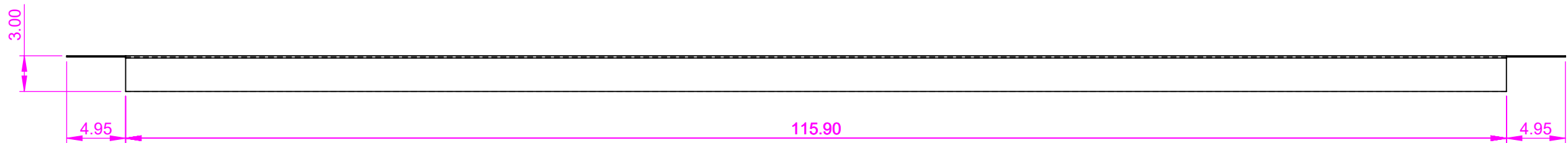
68X Ø0.201 THRU




DETAIL Z
SCALE 1 : 5


PPS
PRECISION PUMPING SYSTEMS
6515 BUSINESS WAY
BOISE, IDAHO 83716
208-323-5300
www.gopps.us

B	INCREASED LENGTH AND WIDTH OF SQUARE CUTOUT	10/27/2023	ACL
A	ADDED PART NUMBER FOR LASERCUTTING	11/17/2022	ACL
REV.	DESCRIPTION	DATE	APVD
REVISIONS			
MATERIAL .100" 5052-H32 ALUMINUM		PART NO: PFE-TITAN-X10 LID CHANNEL A	
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL: ±1/8" ONE PLACE DECIMAL: ±.10 TWO PLACE DECIMAL: ±.05 DO NOT SCALE DRAWING		DESCRIPTION: DETAIL	
DRAWN: SEM		DATE: 1/28/2025	
DATE: 1/28/2025		SERIES: TOPS - STRUCTURAL	
JOB:		LEVEL: 90% Final	
SIZE: B	SCALE: NTS	SHEET: 16 OF 17	REV B



 PPS PRECISION PUMPING SYSTEMS 6515 BUSINESS WAY BOISE, IDAHO 83716 208-323-5300 www.gopps.us	MATERIAL .100" 5052-H32 ALUMINUM		PART NO: PFE-TITAN-X10 LID RIDGE SUP				
	UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES TOLERANCES: FRACTIONAL: ±1/8" ONE PLACE DECIMAL: ±.10 TWO PLACE DECIMAL: ±.05 DO NOT SCALE DRAWING		DESCRIPTION: DETAIL				
			SERIES: TOPS - STRUCTURAL				
			LEVEL: 90% Final				
			JOB: SIZE: B SCALE: NTS SHEET: 17 OF 17 REV -				
DRAWN: SEM		DATE: 1/28/2025					

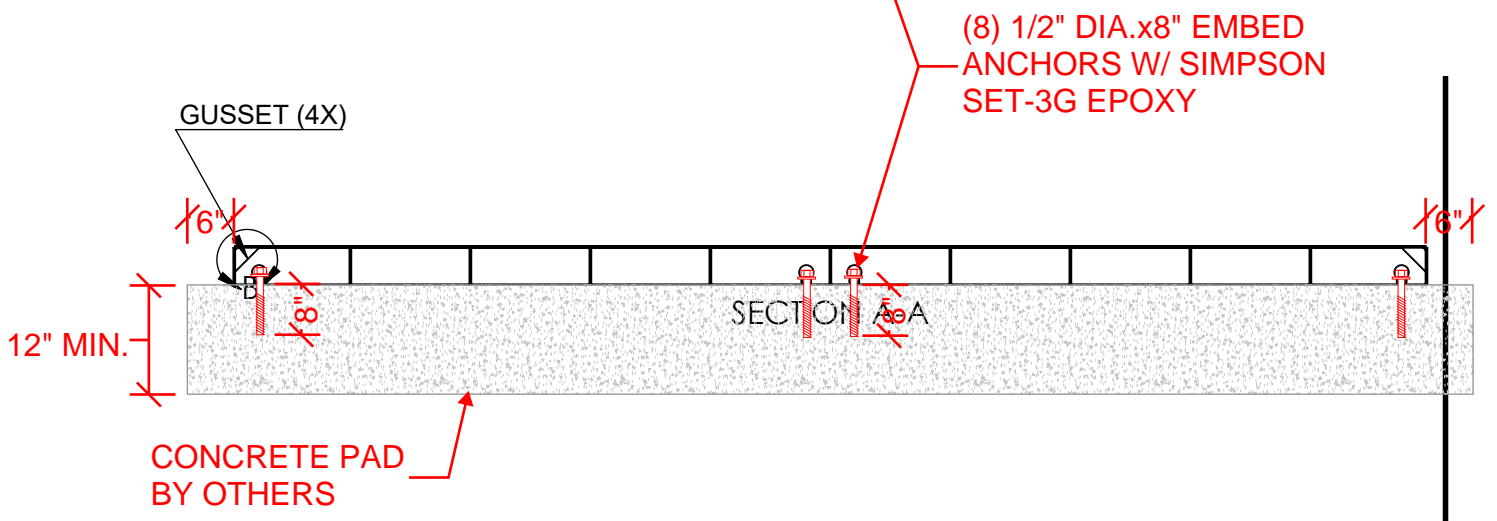
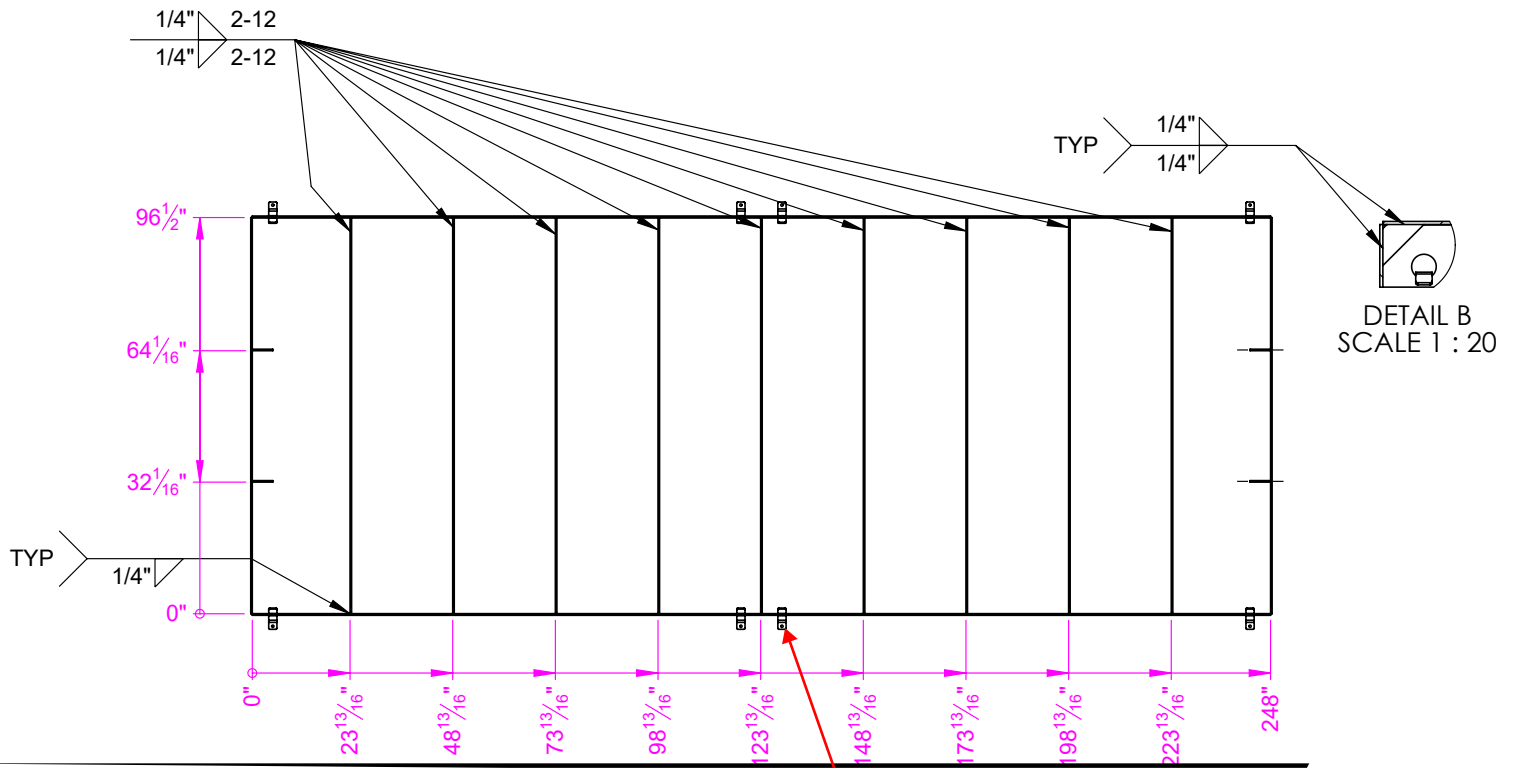
STRUCTURAL EDGE ENGINEERING, PLLC

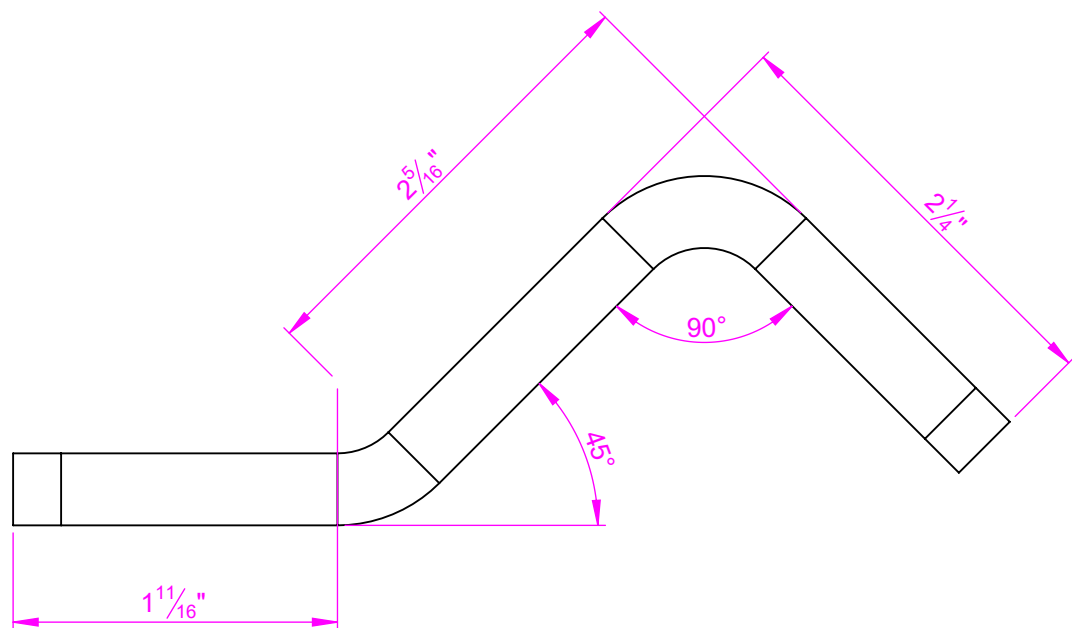
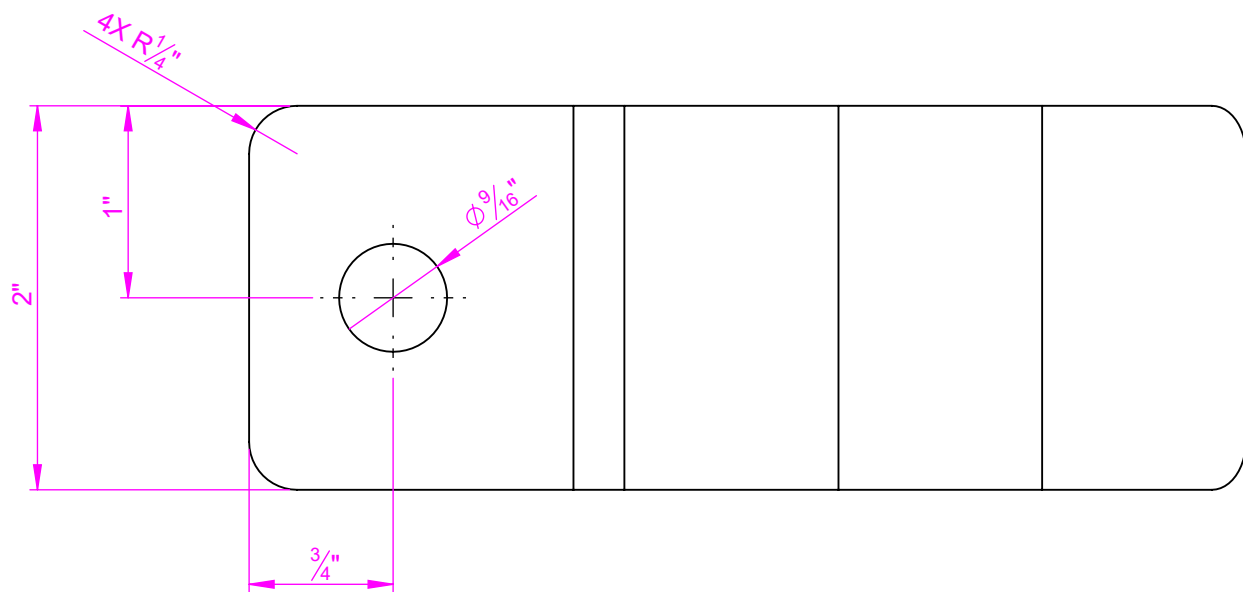
TOPS-XD ENCLOSURE SUPPORT SKID

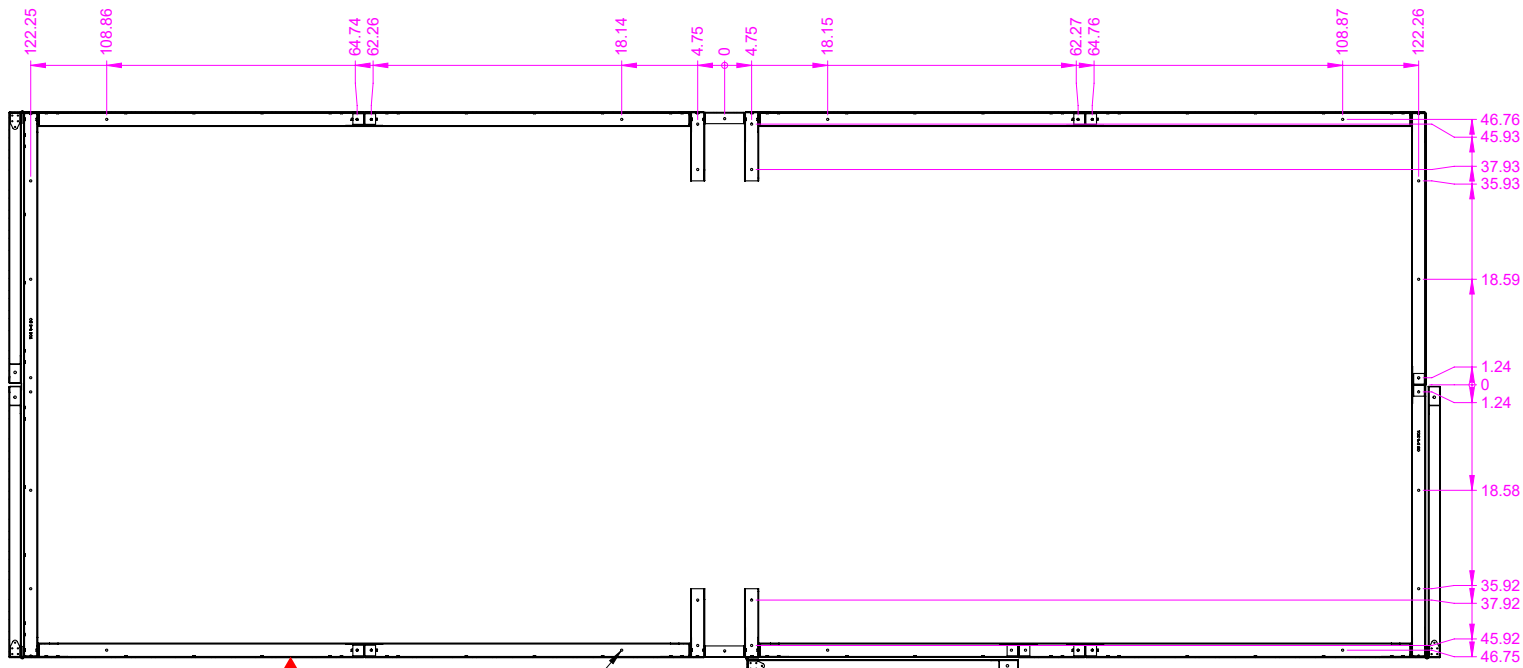
SE PROJECT NO: SE25-043



PREPARED FOR:	PRECISION PUMPING SYSTEMS
PREPARED BY:	KYLE STAAB
CODE:	2018 IBC
DATE:	FEBRUARY 26, 2025



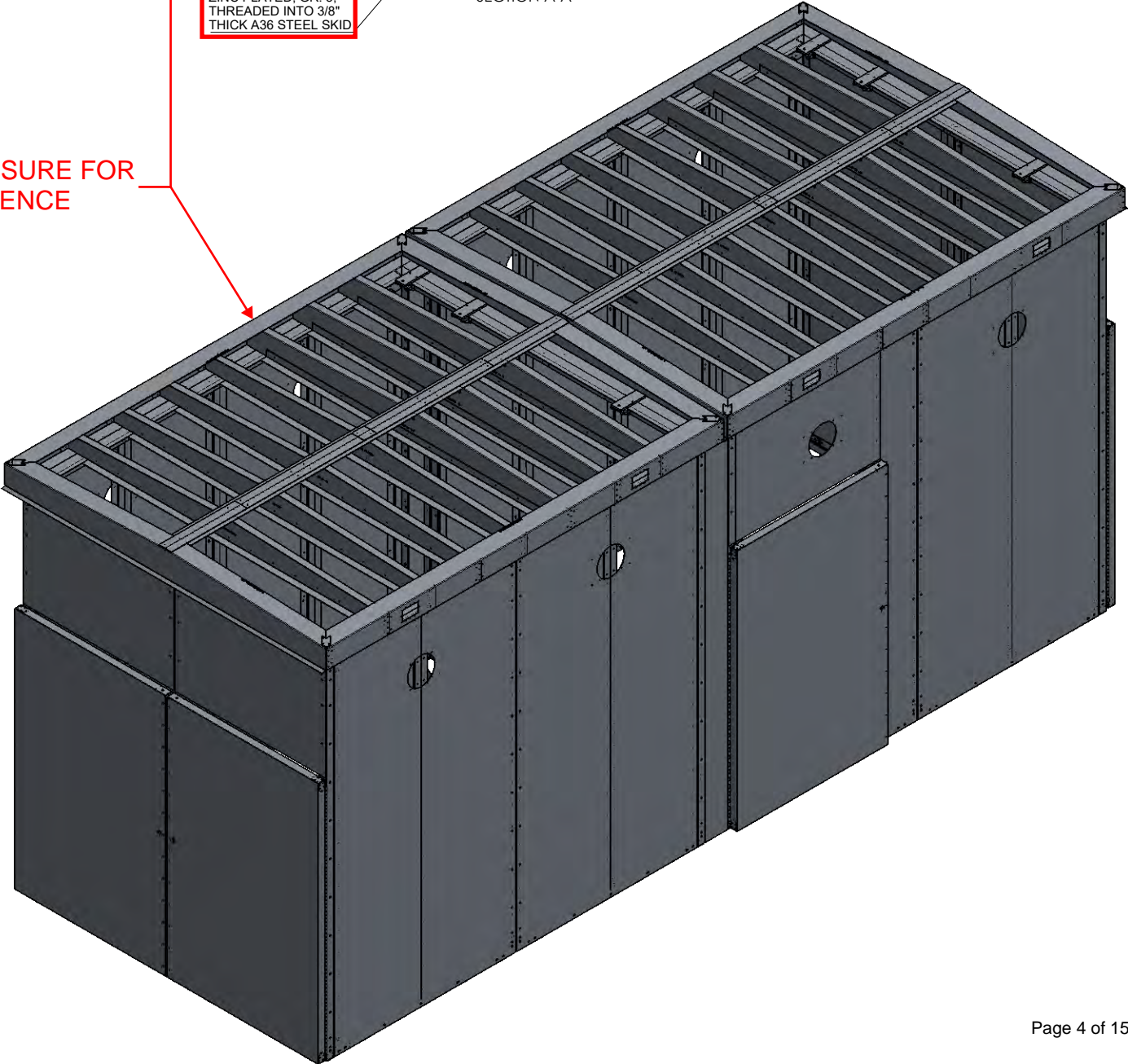




39X 5/16-18 HEX BOLT,
ZINC PLATED, GR. 5,
THREADED INTO 3/8"
THICK A36 STEEL SKID

SECTION A-A

ENCLOSURE FOR
REFERENCE



ASCE 7-16 Wind Forces Chpt 28, Pt2 & Chpt 30, Pt2

Project File: Kennedy Enclosure.ec6

LIC# : KW-06015978, Build:20.25.02.04

Structural Edge Engineering, PLLC

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: Wind Pressures**General Design Values**

Calculations per ASCE 7-16

V : Basic Wind Speed per Sect 26.5-1 or 2 **120.0** mph
 User specified minimum design pressu 10.0 psf
 Occupancy per Table 1.5-1 IV Buildings and other structures designated as essential
 Exposure Category per 26.7 Exposure B
 Topographic Factor Kzt per 26.8 1.00

*"Lambda" is interpolated between height tabular values.***Main Force Resisting System Value****Component & Cladding Values**

MRH : Mean Roof Height 10.0 ft Effective Wind Area of Component & Clad 22.0 ft²
 Roof Slope Angle 0 to 5 degrees Roof pitch for cladding pressure Flat/Hip/Gable Roof
 LHD : Least Horizontal Dimension 8.0 ft
 a = max (0.04 * LHD, 3, min(0.10 * LHD, 0.4*MRH)) 3.00 ft

Lambda MWFRS: per Figure 26.

1.00

Lambda Component & Cladding : per Figure 26.

0.82

Design Wind Pressures**Horizontal Pressures . . .**

Zone: A = 22.80 psf Zone: C = 15.10 psf
 Zone: B = -11.90 psf Zone: D = -10.00 psf

Vertical Pressures . . .

Zone: E = -27.40 psf Zone: G = -19.10 psf
 Zone: F = -15.60 psf Zone: H = -12.10 psf

Overhangs . . .

Zone: Eoh = -38.40 psf Zone: Goh = -30.10 psf

ASCE 7-16 Section 28.5.4 Minimum Design Wind Loads requires that the load effects of the design wind pressures from Section 28.5.3 shall not be less than a minimum load defined by assuming the pressures, ps, for zones A and C equal to +16 psf, Zones B and D equal to +8 psf, while assuming ps for Zones E, F, G, and H are equal to 0 psf.

Component & Cladding Design Wind Pressures*Design Wind Pressure = Lambda * Kzt * Ps30 per Table 6-1*

Roof Pressures		Positive	Negative	Overhang Pressures		Negative
Zone 1	10.000		-31.373 psf	Zone 1		-30.045 psf
Zone 1'	10.000		-19.434 psf	Zone 1'		-30.045 psf
Zone 2	10.000		-41.487 psf	Zone 2		-37.223 psf
Zone 2e	***		*** psf	Zone 2e		*** psf
Zone 2n	***		*** psf	Zone 2n		*** psf
Zone 2r	***		*** psf	Zone 2r		*** psf
Zone 3	10.000		-54.596 psf	Zone 3		-50.332 psf
Zone 3e	***		*** psf	Zone 3e		*** psf
Zone 3r	***		*** psf	Zone 3r		*** psf

Wall Pressures

Wall Zone 4 : 20.172 -21.976 psf
 Wall Zone 5 : 20.172 -26.399 psf

*** : There is no value in Figure 30.4-1 Tabular Values

ENCLOSURE SKID

L = 20.50 FT *skid length*
 W = 8.00 FT *skid width*
 P = 3500 LB *skid steel weight*
 P = 18500 LB *skid steel + enclosure + equip total wt*
 Pick Pts = 10.25 FT *span btwn pick points*

From Enercalc use:	113 PSF	PL3/8"x7"	Ext. Beam/Rim
From Enercalc use:	113 PSF	PL3/8"x7"	Int Beams

R_bm = 4320 LB *max beam reaction*
 Weld = 1/4 *min weld size*
 T_weld = 3710 LB/IN

Min Weld Length =	1.16 in	of 1/4" Fillet
-------------------	---------	----------------

(use for framing & pick points)

Seismic Load:

Sds = 33.00% *Seismic Design Category 'C' for risk category IV*

$$v = \frac{S_{ds} * W}{(R_p / I_p)} = 4579 \text{ LB}$$

S_{ds} = 0.330
 P = 18500 LB
 R_p = 2.0
 I_p = 1.5
 (ASCE 7-16 CH. 15 LOADING GOVERNS OVER CH. 13, CONSERVATIVE AND OK)

Wind Load: p = 24.5 PSF
 Area = 103 ft²
 v = 2511 LB

M_{ot} = 25113 FT*LB *overturning moment*
 M_{res} = 12600 FT*LB *resisting moment*
 Uplift = 1564 LB *uplift force per side*
 CG = 5.00 FT *center of gravity elevation*
 Anchors = 4 *Per side*
 V_{anchor} = 572 LB *=v/anchors*
 Ω = 2.5 *brittle failure*
 V_{anchorΩ} = 1431 LB *=V_{anchor}*Ω seismic shear/anchor*
 T_{anchorΩ} = 3910 LB *=Uplift*Ω seismic tension/anchor*

USE: (8) 1/2" SIMPSON SET 3G W/ 8" EMBED INTO CONCRETE, MIN

0.1" Aluminum Footplate to Steel Skid: A_y = 0.10 in X 0.38 in
 F_y = 17.0 ksi Plate Capacity at anchor = 478 LB LRFD

Anchors = 4
 V_{anchor} = 1145 LB *=v/anchors*

USE: (4) Min 3/8" Dia. Bolts each corner to attach Building to Steel Skid

Steel Beam

Project File: Kennedy Enclosure.ec6

LIC# : KW-06015978, Build:20.25.02.04

Structural Edge Engineering, PLLC

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: Skid Support Equivalent T-Shape

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019

Load Combination Set : IBC 2018

Material Properties

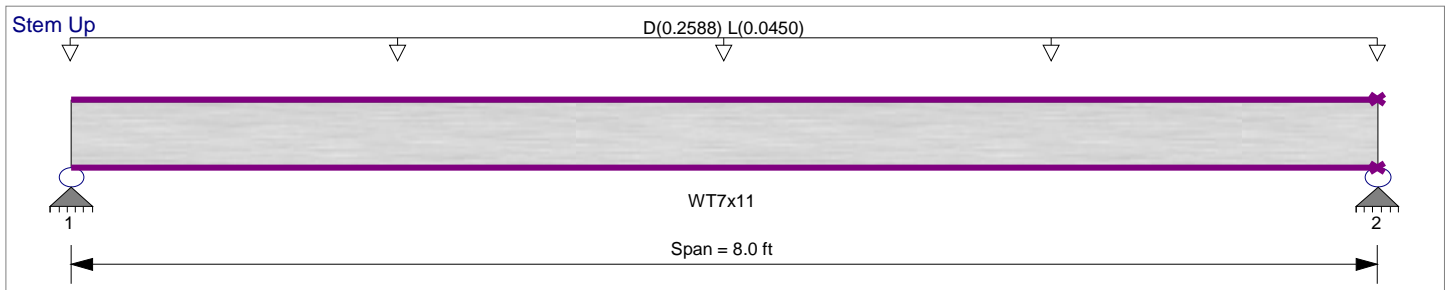
Analysis Method : Allowable Strength Design

Fy : Steel Yield : 36.0 ksi

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

E : Modulus : 29,000.0 ksi

Bending Axis : Major Axis Bending



Applied Loads

Service loads entered. Load Factors will be applied for calculations

Beam self weight NOT internally calculated and added

Uniform Load : D = 0.1150, L = 0.020 ksf, Tributary Width = 2.250 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =		0.523 : 1	Maximum Shear Stress Ratio =		0.059 : 1
Section used for this span		WT7x11	Section used for this span		WT7x11
Ma : Applied		2.430 k-ft	Va : Applied		1.215 k
Mn / Omega : Allowable		4.642 k-ft	Vn/Omega : Allowable		20.437 k
Load Combination			Load Combination		
			+D+L		+D+L
Span # where maximum occurs		Span # 1	Location of maximum on span		0.000 ft
Span # where maximum occurs		Span # 1	Span # where maximum occurs		Span # 1
Maximum Deflection					
Max Downward Transient Deflection		0.010 in	Ratio =	9,889	>=360
Max Upward Transient Deflection		0 in	Ratio =	0	<360
Max Downward Total Deflection		0.066 in	Ratio =	1465	>=180
Max Upward Total Deflection		0 in	Ratio =	0	<180
			Span: 1 : L Only		
			n/a		
			Span: 1 : +D+L		
			n/a		

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
			M	V	Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx	Vnx/Omega
D Only														
Dsgn. L = 8.00 ft		1	0.446	0.051	2.07		2.07	7.75	4.64	1.00	1.00	1.04	34.13	20.44
+D+L														
Dsgn. L = 8.00 ft		1	0.523	0.059	2.43		2.43	7.75	4.64	1.00	1.00	1.22	34.13	20.44
+D+0.750L														
Dsgn. L = 8.00 ft		1	0.504	0.057	2.34		2.34	7.75	4.64	1.00	1.00	1.17	34.13	20.44
+0.60D														
Dsgn. L = 8.00 ft		1	0.268	0.030	1.24		1.24	7.75	4.64	1.00	1.00	0.62	34.13	20.44

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+L	0.0655	4.023		0.0000	0.000

Vertical Reactions

Support notation : Far left is #

Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	1.215	1.215
Max Upward from Load Combinations	1.215	1.215
Max Upward from Load Cases	1.035	1.035
D Only	1.035	1.035
+D+L	1.215	1.215
+D+0.750L	1.170	1.170
+0.60D	0.621	0.621

Steel Beam

Project File: Kennedy Enclosure.ec6

LIC# : KW-06015978, Build:20.25.02.04

Structural Edge Engineering, PLLC

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: Skid Support Equivalent T-Shape

Vertical Reactions

Support notation : Far left is #

Values in KIPS

Load Combination	Support 1	Support 2
L Only	0.180	0.180

Steel Beam

Project File: Kennedy Enclosure.ec6

LIC# : KW-06015978, Build:20.25.02.04

Structural Edge Engineering, PLLC

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: Skid Support Equivalent L-Shape

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019

Load Combination Set : IBC 2018

Material Properties

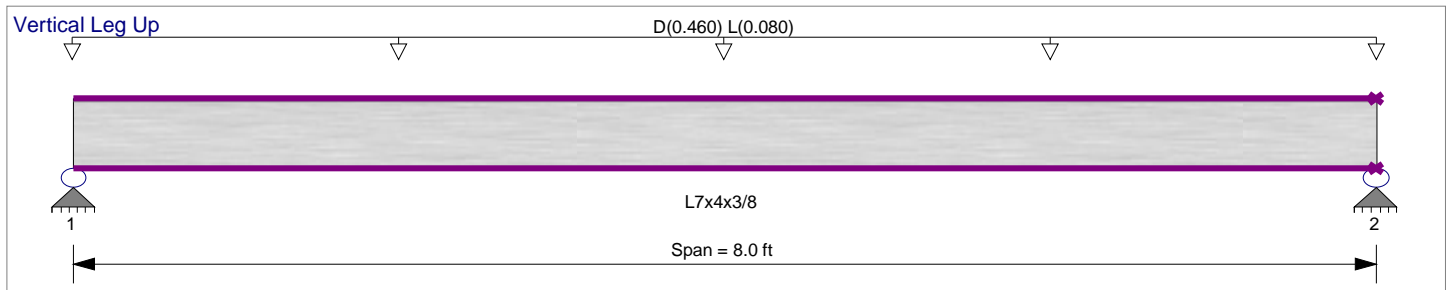
Analysis Method : Allowable Strength Design

Fy : Steel Yield : 36.0 ksi

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

E: Modulus : 29,000.0 ksi

Bending Axis : Major Axis Bending



Applied Loads

Service loads entered. Load Factors will be applied for calculations

Beam self weight NOT internally calculated and added

Uniform Load : D = 0.1150, L = 0.020 ksf, Tributary Width = 4.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio = 0.420 : 1

Maximum Shear Stress Ratio = 0.064 : 1

Section used for this span

L7x4x3/8

Section used for this span

L7x4x3/8

Ma : Applied 4.320 k-ft

Va : Applied 2.160 k

Mn / Omega : Allowable 10.286 k-ft

Vn/Omega : Allowable 33.952 k

Load Combination

Load Combination

+D+L

+D+L

Span # where maximum occurs

Span # 1

Location of maximum on span
Span # where maximum occurs0.000 ft
Span # 1

Maximum Deflection

Max Downward Transient Deflection 0.012 in Ratio = 7,705 >=360 Span: 1 : L Only

Max Upward Transient Deflection 0 in Ratio = 0 <360 n/a

Max Downward Total Deflection 0.084 in Ratio = 1142 >=180 Span: 1 : +D+L

Max Upward Total Deflection 0 in Ratio = 0 <180 n/a

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios		Summary of Moment Values							Summary of Shear Values		
			M	V	Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Va Max	Vnx	Vnx/Omega
D Only														
Dsgn. L = 8.00 ft		1	0.358	0.054	3.68		3.68	17.18	10.29	1.00	1.00	1.84	56.70	33.95
+D+L														
Dsgn. L = 8.00 ft		1	0.420	0.064	4.32		4.32	17.18	10.29	1.00	1.00	2.16	56.70	33.95
+D+0.750L														
Dsgn. L = 8.00 ft		1	0.404	0.061	4.16		4.16	17.18	10.29	1.00	1.00	2.08	56.70	33.95
+0.60D														
Dsgn. L = 8.00 ft		1	0.215	0.033	2.21		2.21	17.18	10.29	1.00	1.00	1.10	56.70	33.95

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+L	0.0841	4.023		0.0000	0.000

Vertical Reactions

Support notation : Far left is #

Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	2.160	2.160
Max Upward from Load Combinations	2.160	2.160
Max Upward from Load Cases	1.840	1.840
D Only	1.840	1.840
+D+L	2.160	2.160
+D+0.750L	2.080	2.080
+0.60D	1.104	1.104

Steel Beam

Project File: Kennedy Enclosure.ec6

LIC# : KW-06015978, Build:20.25.02.04

Structural Edge Engineering, PLLC

(c) ENERCALC, LLC 1982-2025

DESCRIPTION: Skid Support Equivalent L-Shape

Vertical Reactions

Support notation : Far left is #

Values in KIPS

Load Combination	Support 1	Support 2
L Only	0.320	0.320



Anchor Designer™ for
Concrete Software
Version 3.3.2404.1

Company:		Date:	2/17/2023
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Project:			
Address:			
Phone:			
E-mail:			

1. Project information

Project description:

Location:

Fastening description:

Comment:

2. Input Data & Anchor Parameters

General

Design method: ACI 318-14

Units: Imperial units

Anchor Information:

Anchor type: Bonded anchor

Material: F1554 Grade 36

Diameter (inch): 0.500

Effective Embedment depth, h_{ef} (inch): 6.000

Code report: ICC-ES ESR-4057

Anchor category: -

Anchor ductility: Yes

h_{min} (inch): 7.25

c_{ac} (inch): 12.35

c_{min} (inch): 1.75

s_{min} (inch): 2.50

Base Material

Concrete: Normal-weight

Concrete thickness, h (inch): 12.00

State: Cracked

Compressive strength, f'_c (psi): 2500

$\Psi_{c,v}$: 1.0

Reinforcement condition: B tension, B shear

Supplemental edge reinforcement: Not applicable

Reinforcement provided at corners: No

Ignore concrete breakout in tension: No

Ignore concrete breakout in shear: No

Hole condition: Dry concrete

Inspection: Continuous

Temperature range, Short/Long: 150/110°F

Reduced installation torque (for AT-3G): Not applicable

Ignore 6do requirement: Not applicable

Build-up grout pad: No

Recommended Anchor

Anchor Name: SET-3G™ - SET-3G w/ 1/2"Ø F1554 Gr. 36

Code Report: ICC-ES ESR-4057





Company:		Date:	2/17/2023
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Project:			
Address:			
Phone:			
E-mail:			

Load and Geometry

Load factor source: ACI 318 Section 5.3

Load combination: not set

Seismic design: No

Anchors subjected to sustained tension: No

Apply entire shear load at front row: Yes

Anchors only resisting wind and/or seismic loads: No

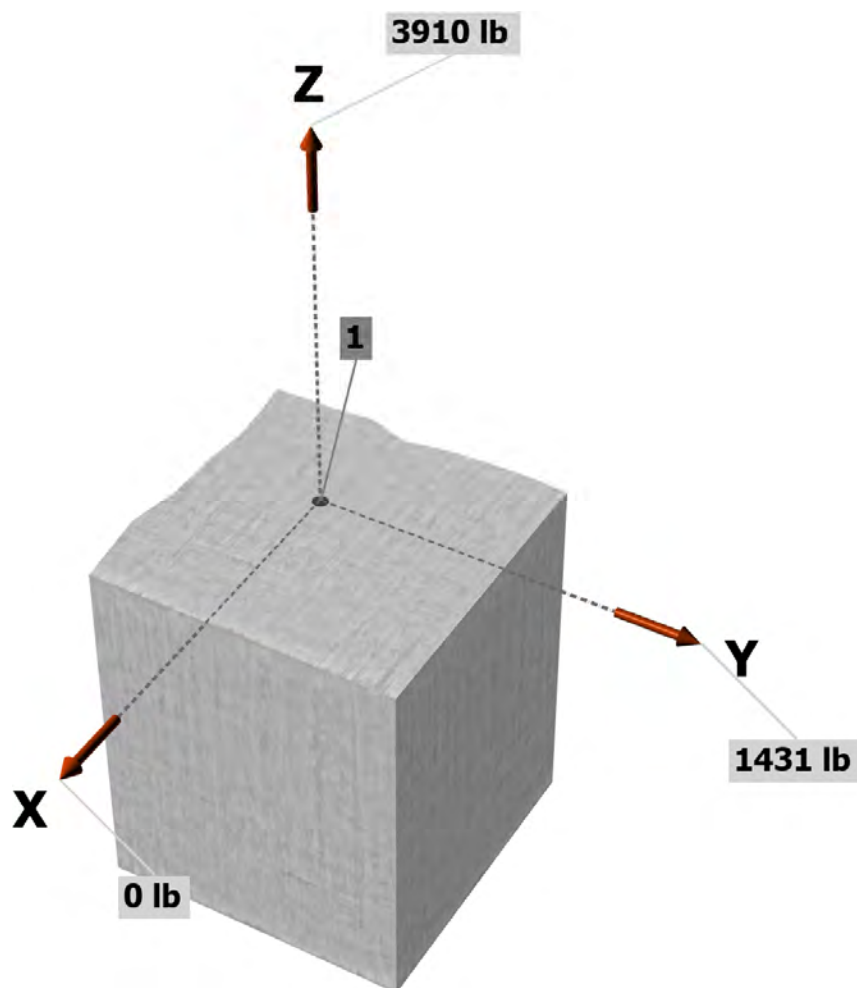
Strength level loads:

N_{ua} [lb]: 3910

V_{uax} [lb]: 0

V_{uay} [lb]: 1431

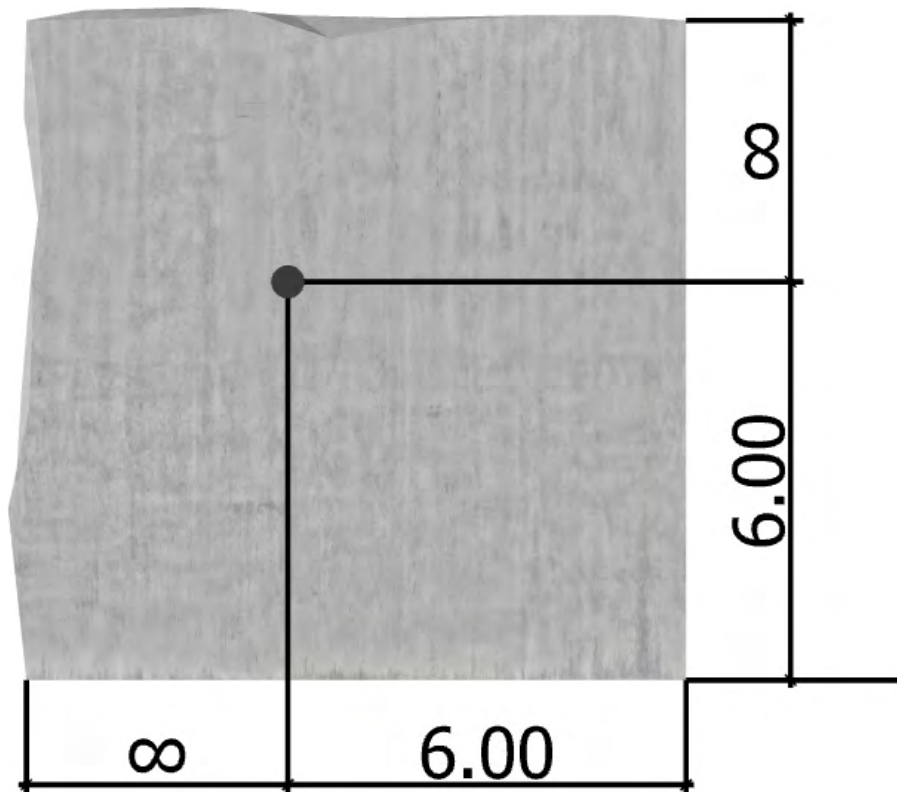
<Figure 1>





Company:		Date:	2/17/2023
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<Figure 2>



3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2 + (V_{uay})^2}$ (lb)
1	3910.0	0.0	1431.0	1431.0
Sum	3910.0	0.0	1431.0	1431.0

Maximum concrete compression strain (‰): 0.00

Maximum concrete compression stress (psi): 0

Resultant tension force (lb): 3910

Resultant compression force (lb): 0

Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00

Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00

Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00

Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00



**Anchor Designer™ for
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E-mail:			

4. Steel Strength of Anchor in Tension (Sec. 17.4.1)

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
8235	0.75	6176

5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.4.2)

$$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5} \text{ (Eq. 17.4.2.2a)}$$

k_c	λ_a	f'_c (psi)	h_{ef} (in)	N_b (lb)
17.0	1.00	2500	6.000	12492

$$\phi N_{cb} = \phi (A_{Nc} / A_{Nco}) \psi_{ed,N} \psi_{c,N} \psi_{cp,N} N_b \text{ (Sec. 17.3.1 & Eq. 17.4.2.1a)}$$

A_{Nc} (in ²)	A_{Nco} (in ²)	$c_{a,min}$ (in)	$\psi_{ed,N}$	$\psi_{c,N}$	$\psi_{cp,N}$	N_b (lb)	ϕ	ϕN_{cb} (lb)
225.00	324.00	6.00	0.900	1.00	1.000	12492	0.65	5075

6. Adhesive Strength of Anchor in Tension (Sec. 17.4.5)

$$\tau_{k,cr} = \tau_{k,cr} f_{short-term} K_{sat} (f'_c / 2,500)^n$$

$\tau_{k,cr}$ (psi)	$f_{short-term}$	K_{sat}	f'_c (psi)	n	$\tau_{k,cr}$ (psi)
1402	1.00	1.00	2500	0.24	1402

$$N_{ba} = \lambda_a \tau_{cr} \pi d_a h_{ef} \text{ (Eq. 17.4.5.2)}$$

λ_a	τ_{cr} (psi)	d_a (in)	h_{ef} (in)	N_{ba} (lb)
1.00	1402	0.50	6.000	13214

$$\phi N_a = \phi (A_{Na} / A_{Na0}) \psi_{ed,Na} \psi_{cp,Na} N_{ba} \text{ (Sec. 17.3.1 & Eq. 17.4.5.1a)}$$

A_{Na} (in ²)	A_{Na0} (in ²)	c_{Na} (in)	$c_{a,min}$ (in)	$\psi_{ed,Na}$	$\psi_{cp,Na}$	N_{ba} (lb)	ϕ	ϕN_a (lb)
173.37	205.45	7.17	6.00	0.951	1.000	13214	0.65	6893

8. Steel Strength of Anchor in Shear (Sec. 17.5.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout} \phi V_{sa}$ (lb)
4940	1.0	0.65	3211

9. Concrete Breakout Strength of Anchor in Shear (Sec. 17.5.2)

Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines must be checked for plausibility.

Simpson Strong-Tie Company Inc. 5956 W. Las Positas Boulevard Pleasanton, CA 94588 Phone: 925.560.9000 Fax: 925.847.3871 www.strongtie.com



Anchor Designer™ for Concrete Software

Version 3.3.2404.1

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Phone:			
E-mail:			

Shear perpendicular to edge in y-direction:

$$V_{by} = \min[7(l_e / d_a)^{0.2} \sqrt{d_a} \lambda_a \sqrt{f_c} c_{a1}^{1.5}; 9 \lambda_a \sqrt{f_c} c_{a1}^{1.5}] \text{ (Eq. 17.5.2.2a \& Eq. 17.5.2.2b)}$$

l_e (in)	d_a (in)	λ_a	f_c (psi)	c_{a1} (in)	V_{by} (lb)
4.00	0.500	1.00	2500	6.00	5513

$$\phi V_{cbx} = \phi (A_{vc} / A_{vco}) \psi_{ed,v} \psi_{c,v} \psi_{h,v} V_{by} \text{ (Sec. 17.3.1 \& Eq. 17.5.2.1a)}$$

A_{vc} (in ²)	A_{vco} (in ²)	$\psi_{ed,v}$	$\psi_{c,v}$	$\psi_{h,v}$	V_{by} (lb)	ϕ	ϕV_{cbx} (lb)
135.00	162.00	0.900	1.000	1.000	5513	0.70	2894

Shear parallel to edge in x-direction:

$$V_{by} = \min[7(l_e / d_a)^{0.2} \sqrt{d_a} \lambda_a \sqrt{f_c} c_{a1}^{1.5}; 9 \lambda_a \sqrt{f_c} c_{a1}^{1.5}] \text{ (Eq. 17.5.2.2a \& Eq. 17.5.2.2b)}$$

l_e (in)	d_a (in)	λ_a	f_c (psi)	c_{a1} (in)	V_{by} (lb)
4.00	0.500	1.00	2500	6.00	5513

$$\phi V_{cbx} = \phi (2)(A_{vc} / A_{vco}) \psi_{ed,v} \psi_{c,v} \psi_{h,v} V_{by} \text{ (Sec. 17.3.1, 17.5.2.1(c) \& Eq. 17.5.2.1a)}$$

A_{vc} (in ²)	A_{vco} (in ²)	$\psi_{ed,v}$	$\psi_{c,v}$	$\psi_{h,v}$	V_{by} (lb)	ϕ	ϕV_{cbx} (lb)
135.00	162.00	1.000	1.000	1.000	5513	0.70	6432

10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.5.3)

$$\phi V_{cp} = \phi \min[k_{cp} N_a; k_{cp} N_{cb}] = \phi \min[k_{cp} (A_{Na} / A_{Na0}) \psi_{ed,Na} \psi_{cp,Na} N_{ba}; k_{cp} (A_{Nc} / A_{Nco}) \psi_{ed,N} \psi_{c,N} \psi_{cp,N} N_b] \text{ (Sec. 17.3.1 \& Eq. 17.5.3.1a)}$$

k_{cp}	A_{Na} (in ²)	A_{Na0} (in ²)	$\psi_{ed,Na}$	$\psi_{cp,Na}$	N_{ba} (lb)	N_a (lb)
2.0	173.37	205.45	0.951	1.000	13214	10605

A_{Nc} (in ²)	A_{Nco} (in ²)	$\psi_{ed,N}$	$\psi_{c,N}$	$\psi_{cp,N}$	N_b (lb)	N_{cb} (lb)	ϕ	ϕV_{cp} (lb)
225.00	324.00	0.900	1.000	1.000	12492	7808	0.70	10931

11. Results

Interaction of Tensile and Shear Forces (Sec. R17.6)

Tension	Factored Load, N_{ua} (lb)	Design Strength, ϕN_n (lb)	Ratio	Status
Steel	3910	6176	0.63	Pass
Concrete breakout	3910	5075	0.77	Pass (Governs)
Adhesive	3910	6893	0.57	Pass

Shear	Factored Load, V_{ua} (lb)	Design Strength, ϕV_n (lb)	Ratio	Status
Steel	1431	3211	0.45	Pass
T Concrete breakout y+	1431	2894	0.49	Pass (Governs)
 Concrete breakout x+	1431	6432	0.22	Pass (Governs)
Pryout	1431	10931	0.13	Pass

Interaction check	$(N_{ua} / \phi N_n)^{5/3}$	$(V_{ua} / \phi V_n)^{5/3}$	Combined Ratio	Permissible	Status
Sec. R17.6	0.65	0.31	95.7%	1.0	Pass

SET-3G w/ 1/2"Ø F1554 Gr. 36 with hef = 6.000 inch meets the selected design criteria.

12. Warnings

- Designer must exercise own judgement to determine if this design is suitable.
- Refer to manufacturer's product literature for hole cleaning and installation instructions.

Input data and results must be checked for agreement with the existing circumstances, the standards and guidelines must be checked for plausibility.

Simpson Strong-Tie Company Inc. 5956 W. Las Positas Boulevard Pleasanton, CA 94588 Phone: 925.560.9000 Fax: 925.847.3871 www.strongtie.com

BUILDERS	
PRECISION PUMPING SYSTEMS	
CUSTOMER	
LONDON WATER CO-OP	
DATE	DWG NO.
12.25.24	MM1C2X003-241-LA-2XA1.5V-2XUV-CW-U3A-TE-PLC6E-HG8C-UPS24-VZW-CUSTOM

CAUTION

The diagram illustrates the 240V wiring for a 5A AC unit (N2040K100) connected to four Mitsubishi 3HP VFD units. The AC unit is connected to a 240VAC 5A supply. The wiring is organized into four columns, each representing a VFD unit. The AC unit's output is connected to a terminal block (P1-P4) which then connects to the input of the first VFD unit. The other three VFD units are connected to the same AC supply via a common terminal block (P7-P10). The output of each VFD unit is connected to a motor. The first two motors are bare, and the last two are treated. The diagram includes a red dashed box highlighting the motor connections and a blue dashed box highlighting the terminal block connections.

AC UNIT
N2040K100
4kBTU
240VAC
1-PHASE
5A

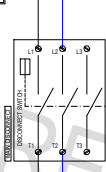
Terminal Blocks:
P1, P2, P3, P4
P7, P8, P9, P10
P11, P12

VFD Units:
MITSUBISHI FR-FR2-0115-2ZWE 3HP VFD UNIT
MITSUBISHI FR-FR2-0202B-2ZWE 3HP VFD UNIT
MITSUBISHI FR-FR2-0202B-2ZWE 3HP VFD UNIT
MITSUBISHI FR-FR2-0202B-2ZWE 3HP VFD UNIT

Motors:
BARE MOTOR #0
BARE MOTOR #1
TREATED MOTOR #2
TREATED MOTOR #3

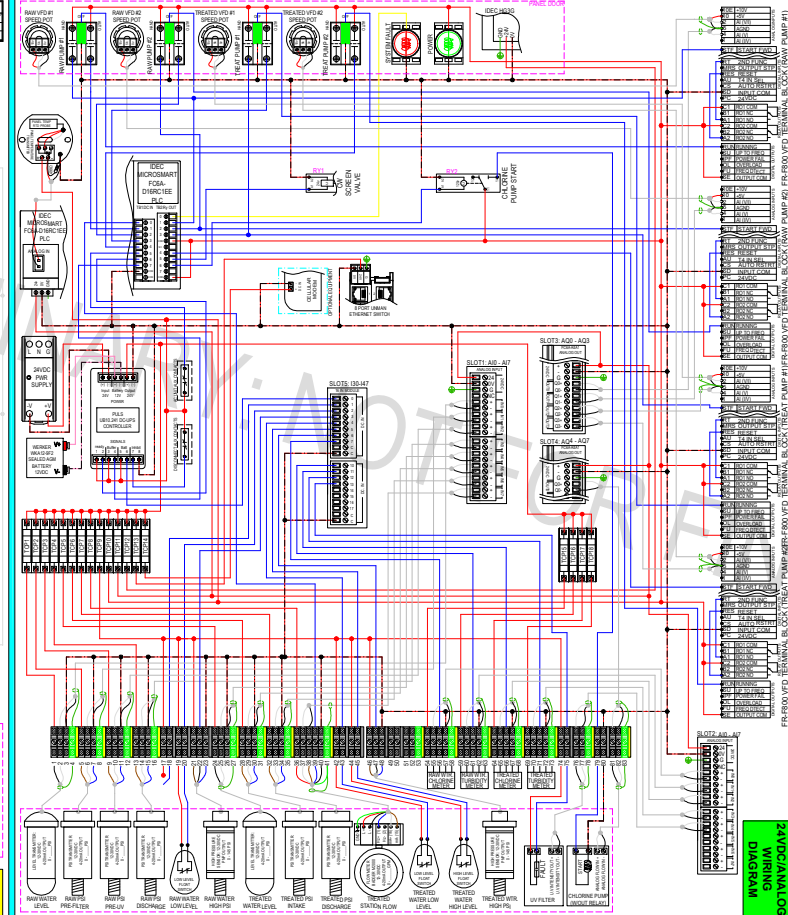
Wiring:
Blue lines represent the main power supply.
Red lines represent the VFD output to the motors.
Green lines represent ground connections.

240V WIRING DIAGRAM

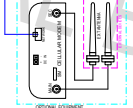
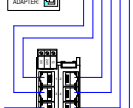
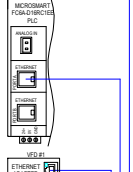


RV1
CW SCREEN
VALVE RELAY

120VAC WIRING DIAGRAM



The diagram shows a terminal labeled 'DEC' connected to the 'TO B' port of the 'HG3G MICROII USER INTERFACE UNIT'. The unit also features a 'SERIAL 1' port, a 'USB' port, and a power switch.



**COMMUNICATION
WIRING DIAGRAM**

TOPS	AMP	24V CIRCUIT	
1	0.25A	RAW SOURCE LEVEL	raw source level (amps) - (2600C VOLT)
2	0.25A	RAW PSIG PWR FILTER	raw source level (amps) - (20.5mA wt)
3	0.25A	RAW PSIG PWR FILTER	raw source level (amps) - (24V return)
4	0.25A	RAW PSIG DISCHARGE	raw source level transmitter shunt
5	0.25A	TREATED SRC LVL	raw PSIG PWR filter (amps) - (2400C PWR)
6	0.25A	TREATED ATAKE PSI	raw PSIG PWR filter (amps) - (4.20MA wt)
7	0.25A	TREATED DISCH PSI	raw PSIG PWR filter (amps) - (24V return)
8	2A	STATION FLOW MTR	raw PSIG PWR filter (amps) - (2400C PWR)
9	1A	INLET DIGITAL INPUTS	raw PSIG PWR filter (amps) - (24V return)
10	1.5A	INLET DIGITAL INPUTS	raw PSIG PWR filter (amps) - (24V return)
11	1A	PLC POWER	raw PSIG PWR filter (amps) - (24V return)
12	2A	TOUCHSCREEN PWR	raw PSIG PWR filter (amps) - (24V return)
13	2A	COMMUNICATION	raw PSIG PWR filter (amps) - (24V return)
14	0.25A	CELLAR AIR TURBIDITY	raw PSIG PWR filter (amps) - (24V return)
15	0.25A	RAW WTR CHLORINE	raw PSIG PWR filter (amps) - (24V return)
16	0.25A	RAW WTR TURBIDITY	raw PSIG PWR filter (amps) - (24V return)
17	0.25A	TREATED WTR CHLOR	raw PSIG PWR filter (amps) - (24V return)
18	0.25A	TREATED WTR TURB	raw PSIG PWR filter (amps) - (24V return)

BASE PLC INPUT CONFIG	14	Normally start input (N.O.)
10 FLOW METER (PULSE)	15	Raw source LLFS (+24VDC COM)
11 PUMP #1 AUTO	16	Raw source input (N.C.)
12 PUMP #2 AUTO	17	Raw high PSI switch (+24VDC COM)
3 PUMP #3 AUTO	18	Raw high PSI switch input (N.O.)
4 PUMP #4 AUTO	19	Raw high PSI switch (N/C return)
5 AC UNIT FAULT		
6 UPS BATTERY READY	20	Isolated sv. level trn. (+240VDC Power)
7 CONTROL VOLTAGE	21	Isolated source level trn. (4-20mA rel)

BASE PLC OUTPUT CONFIG	
Q0	FAULT LAMP
Q1	VFD #1 START (STF)
Q2	VFD #2 START (STF)
Q3	VFD #3 START (STF)
Q4	VFD #4 START (STF)
Q5	CW SCREEN
Q6	CHLORINE PUMP STR.

SLOT 1 8 ANALOG IN CONFIG	
AI0	Pressure sensor transducer
AI1	Pressure sensor transducer
AI2	Pressure sensor transducer
AI3	Pressure sensor transducer
AI4	Pressure sensor transducer
AI5	Pressure sensor transducer
AI6	Pressure sensor transducer
AI7	Pressure sensor transducer

A10	RAW SOURCE LEVEL	36	Treated discharge PSI transmitter shield
A11	RAW PRE-FILTER PSI	37	Treated flow meter (+24VDC Power)
A12	RAW PRE-U.V. PSI	37	Treated flow meter (4-20mA reference)
A13	RAW DISCHARGE PSI	38	Treated flow meter (4-20mA return)
A14	TREATED SOURCE LEVEL	39	Treated flow meter (pulse input reference)
A15	TREATED INTAKE PSI	40	Treated flow meter (24V return)
A16	TREATED DISCHARGE PS	41	Treated flow meter shield/ground
A17	STATION FLOW METER		
SLOT 2 : ANALOG IN CONFIG			
A10	RAW ANALOG CHLORINE	36	Treated source LLFS (+24VDC COM)
		37	Treated source LLFS input (R.C.)

A11	RAW WATER TURBIDITY
A12	TREATED WTR CHLORINE
A13	TREATED WTR TURBIDITY
A14	UV FILTER INTENSITY

SLOT 3 4 ANALOG OUT COMP	
AQ0	YED #1 SPEED REF
AQ1	YED #2 SPEED REF
AQ2	YED #3 SPEED REF
AQ3	YED #4 SPEED REF

SLOT 4: 4 ANALOG OUT CONFIG	
A00	CHLORINE FLOW REF.

SLOT 5: 16 DIG. INPUT CONFIG.	
I30	UPS REPLACE BATTERY
I31	REMOTE START
I32	RAW L.L. FLOAT SWITCH
I33	RAW HIGH PSI SWITCH
I34	TREATED L.L. FLOAT SW.
I35	TREATED H.L. FLOAT SW.

36	TREATED HIGH PSI SW.
37	RAW CHLORINE FAULT
40	RAW TURBIDITY FAULT
41	TREATED CHLORINE FLT.
42	TREATED TURBIDITY FLT.
43	U.V. FILTER FAULT

IO REFERENCE

	Control source HLEFS = 2400C.COM
	Control source HFS input (H.C.)
1	Control input PDI in = 2400C.COM
2	Control input PDI switch input (N.O.)
3	Control input PDI switch (N.O.C. returns)
4	30 screen output output (2400C)
5	30 screen output output (2400C)
6	Control input power output (2400C)
7	Control input power output (2400C)
8	Control input ground
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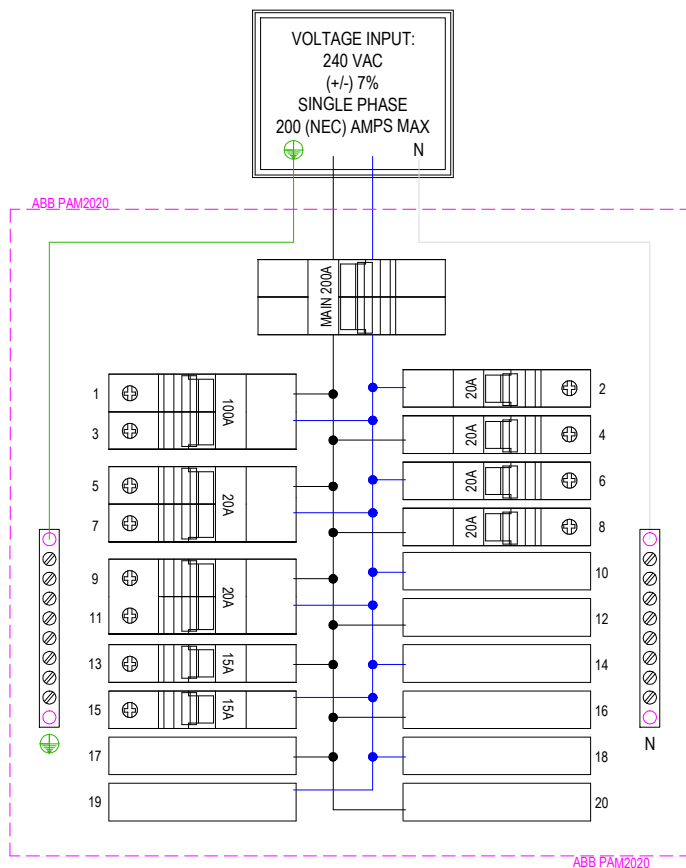
PRECISION PUMPING SYSTEMS

LONDON WATER CO-OP

DWG NO.

01.22.24

LOAD CENTER



Main - 200A	
Pump Station Control Panel - 1	2 - GFCI Outlet Circuit #1
Pump Station Control Panel - 1	4 - GFCI Outlet Circuit #2
Mini Split AC Unit - 5	6 - GFCI Outlet Circuit #3
Mini Split AC Unit - 7	8 - GFCI Outlet Circuit #4
Utility Heater - 9	10 - spare
Utility Heater - 11	12 - spare
Lighting Circuit (interior) - 13	14 - spare
Lighting Circuit (exterior) - 15	16 - spare
spare - 17	18 - spare
spare - 19	20 - spare

LOAD CENTER WIRING DIAGRAM

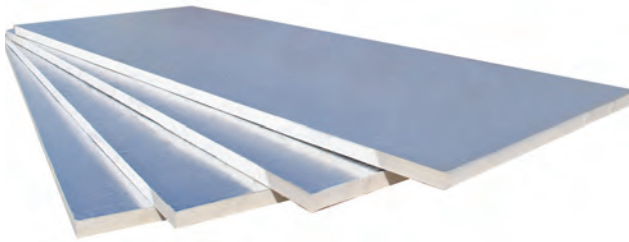


TSX-8500

Insulation for Exposed Use

PRODUCT DESCRIPTION

Rmax TSX-8500 is an energy-efficient thermal insulation board composed of a closed-cell polyisocyanurate (Polyiso) foam core bonded to embossed, glass fiber reinforced aluminum foil facers on both sides. The exposed side of the board has a heavy 12mil facer with an aluminum reflective surface. The other side is marked in production to ensure proper installation. TSX-8500 utilizes a CFC-, HCFC- and HFC-free blowing agent that has zero Ozone Depletion Potential (ODP) and negligible Global Warming Potential (GWP). This pressure washable insulation is suitable for use in walls or ceilings and some limited roofing applications in commercial, agricultural and industrial buildings – new construction or thermal retrofit. Specifically, TSX-8500 is ideal for masonry or stud construction; farm or storage buildings; pre-engineered metal buildings; laminate panels and other similar applications. TSX-8500 is designed to be left exposed without a thermal barrier to provide an attractive interior finish.



PRODUCT BENEFITS

- Part of the overall design solution
- Installed continuously to reduce thermal bridging
- Meets R-value requirements with a thinner profile
- Blocks air and moisture
- Mold resistant per ASTM D3273 (no defacement)
- Reduces energy costs
- Reflective facer acts as a radiant barrier
- Pressure Washable
- Lightweight and easy to install
- Reduces material and labor costs
- Tested per NFPA 285 without requiring exterior gypsum board or fire-stops around header openings
- Contributes toward LEED credits in the following categories:
 - Energy & Atmosphere
 - Materials & Resources
- Offers tax credit, where applicable

COMPLIANCES

- ASTM C1289 Type I, Class 1
- ASHRAE 90.1
- International Energy Conservation Code (IECC)
- International Building Code (IBC) Section 2603, *Foam Plastic*
- DrJ TER 1309-03
- ESR-1864, ICC Evaluation Service
- Miami-Dade County Product Control Approved
- RR 25322, City of Los Angeles Research Report
- California Code of Regulations, Title 24
- Class A Flame Spread and Smoke Developed Indices per IBC Chapter 8, *Interior Finishes*
- Tested per UL1715 to comply with IBC Section 2603, *Special Approval* paragraph
 - Up to 4.5 inches on walls
 - Up to 12 inches on ceilings
- Tested per NFPA 285 to comply with IBC Section 2603.5.5
- Water-Resistive Barrier (WRB) per AC71 (ASTM E331, AATCC Test Method 127)
- Air Barrier Material per ASTM E2178
- 1, 2, 3 or 4 hour Fire Rated Assemblies as shown in the UL Fire Resistance Directory
 - Design No.: U026, U326, U330, U354, U424, U460, U902, U904, U905, U906, U907, V454, V499

THERMAL PROPERTIES / PRODUCT DATA

"R" means resistance to heat flow. The higher the R-value, the greater the insulating power.

Nominal Thickness	Thermal R-Value ¹	System R-Value ²	Pcs/Bdl
Inches	°F·ft ² ·hr/Btu	°F·ft ² ·hr/Btu	
0.50	3.2	5.97	96
0.75	5.0	7.77	60
1.00	6.0	8.77	48
1.50	9.6	12.37	32
1.55	10.0	12.77	30
2.00	13.1	15.87	24
2.30	15.3	18.07	20
2.50	16.7	19.47	19
3.00	20.3	23.07	16
3.50	23.9	26.67	13
4.00	27.4	30.17	12
4.50	31.0	33.77	10

¹Thermal values are determined by using ASTM C518 test method at 75°F mean temperature on material conditioned according to PIMA Technical Bulletin No. 101.

²Includes the ASHRAE assigned 2.77 R-value of a ¾ inch air tight space against a reflective foil in a typical wall assembly.

Additional thermal R-values can be found on the insert to this document. TSX-8500 is shipped in bundles that are approximately 48 inches high and wrapped in plastic for easy handling. Visit www.rmax.com for a complete list of thicknesses and packaging information.

TYPICAL PHYSICAL PROPERTIES

Physical properties shown are based on data obtained under controlled conditions and are subject to normal manufacturing tolerances.

Property	Test Method	Results
Density, Overall, Nominal	ASTM D1622	2.0 pcf
Compressive Strength ¹	ASTM D1621	20 psi Standard Also Available in 25 psi Upon Request
Flame Spread, Faced ²	ASTM E84	25 or Less
Smoke Developed, Faced ²	ASTM E84	< 450
Water Vapor Transmission	ASTM E96	< 0.03 Perm
Water Absorption	ASTM C209	< 0.2% Vol.
Dimensional Stability	ASTM D2126, 7 days, 158°F, 98% RH	< 2% Linear Change
Reflectance Emittance	ASTM E408	0.96 0.04
Air Permeance	ASTM E2178	< 0.02 L/(s.m ²)
Service Temperatures		-40°F to +250°F

¹Less than 1" is only available at 16psi.

²Flame spread and smoke numbers are shown for comparison purposes only and are not intended to represent the performance of TSX-8500 and related components under actual fire conditions.

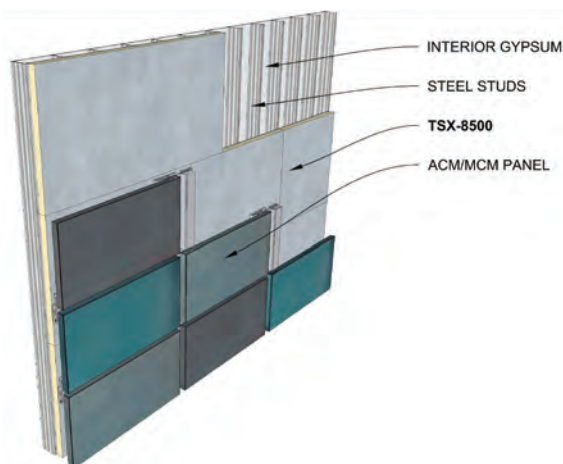
APPLICATION / INSTALLATION

General - TSX-8500 passes UL1715 (walls only or ceilings only) in single or multiple layers without joint treatment of any kind. Therefore, the boards only need to be tightly butted. However, taping the seams is acceptable using R-SEAL 3000, or equivalent. For a more professional, finished look, use Rmax's PVC insulation clip. Refer to Rmax publication, *Joint Closure Recommendations and Installation Instructions for Interior Exposed Applications*, for additional information and guidelines on installation, joint treatment and sealing techniques. TSX-8500 may be covered with an interior finish product provided it is compliant with the requirements of IBC Chapter 8, including interior paint. A quality grade acrylic latex paint is recommended for coating the surface. While primer is not generally required, consult the paint manufacturer and/or industrial paint supply for recommendations and best practice.

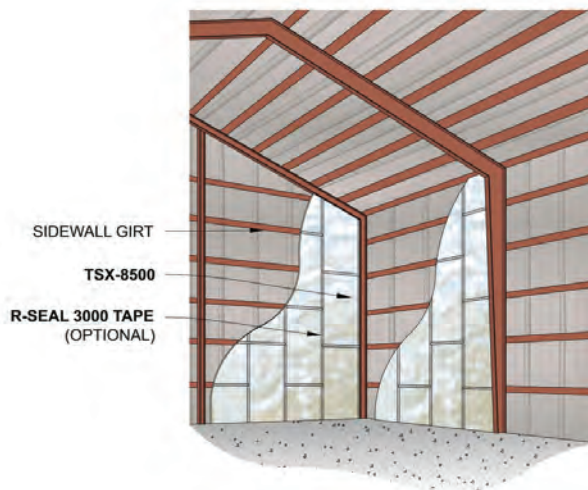
Securement - TSX-8500 may be fastened to wood framing using roofing nails, bugle head screws or minimum 3/4 inch cap nails. The fasteners shall be long enough to penetrate wood framing a minimum of 1 inch. TSX-8500 may be fastened to metal framing using self-taping screws and plastic washers. The fasteners shall be long enough to penetrate metal framing a minimum of four threads. Wherever possible, the insulation boards shall be installed vertically with all edges tightly butted and backing by framing. When the insulation boards are installed horizontally, i.e., perpendicular to framing, the maximum span shall be 5 feet. TSX-8500 may be secured to concrete surfaces using plastic masonry fasteners with washer or a quality grade construction adhesive.

Water-Resistive Barrier - When TSX-8500 is installed over wood or steel studs with the joints sealed, it serves as a Water-Resistive Barrier. TSX-8500 has been tested per the guidelines set forth in the ICC-ES *Acceptance Criteria for Foam Plastic Sheathing Panels Used as Water-Resistive Barriers* (AC71). For use as a WRB, TSX-8500 shall be installed with board joints placed directly over wood or steel framing spaced a maximum of 24 inches o.c. All insulation board joints shall be covered by R-SEAL 3000 tape. All transitions and throughwall penetrations must be flashed to comply with applicable code.

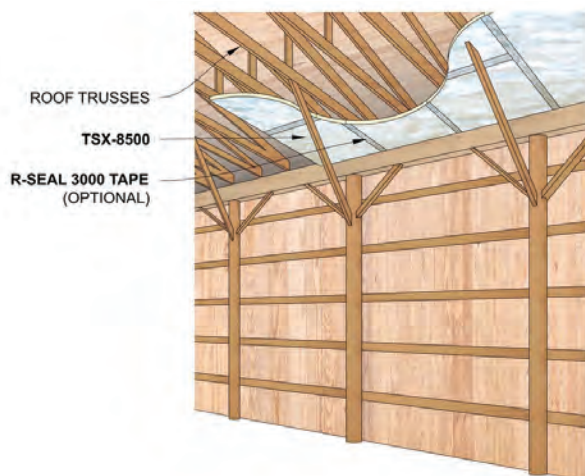
Exterior Walls - TSX-8500 can be specified in exterior walls of buildings of any height utilizing brick veneer, stucco, limestone or natural stone veneer, cast artificial stone veneer, MCM, ACM, terracotta cladding, metal skin, cement board siding, stone/aluminum honeycomb composite panels, AAC panels or thin brick. TSX-8500 has been tested per NFPA 285 and successfully passes with the exposed side facing the exterior. The NFPA 285 listing/approval is dependent on all components of the assembly. For a full explanation of approved assemblies and acceptable components, refer to Rmax *Architectural Solutions: NFPA 285 and Exterior Walls with Rmax TSX-8500*. Third party evaluations and listings should also be consulted for specific instructions.



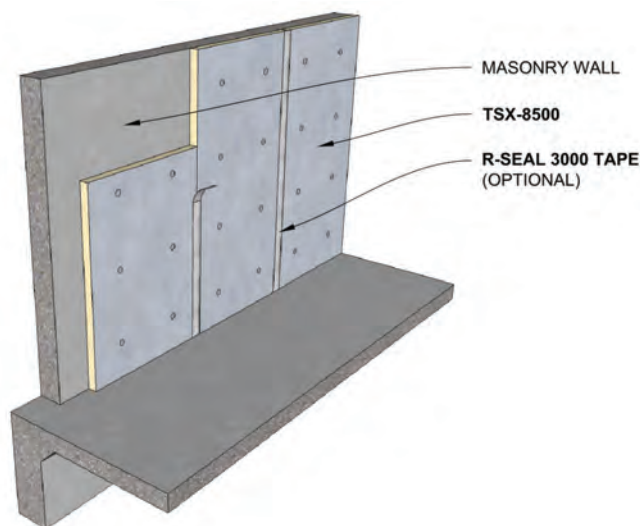
Pre-Engineered Metal Buildings - TSX-8500 provides a layer of continuous insulation (ci) for walls or ceilings of pre-engineered metal buildings in one easy step. The TSX-8500 is simply fastened to the face of the girts or between the girts and the metal exterior skin of the building. Use Rmax PVC clips for an easy yet clean, professional installation.



Agricultural, Farm, Storage Buildings and Other Light Commercial Structures - TSX-8500 may be used as an exposed, finished, continuous insulation (ci) system in agricultural, farm, storage buildings and other light commercial structures. It may be secured directly to the wood or metal framing members, or use Rmax PVC insulation clips for an easy yet clean, professional installation.



Masonry - TSX-8500 is applied to the interior face of concrete or concrete masonry to provide a layer of continuous insulation (ci) over the entire surface. It may be adhered or anchored directly to the concrete surface or attached to furring. Use Rmax PVC clips for an easy yet clean, professional installation. For example, TSX-8500 is an excellent product for use in insulating block walls, standard cavity walls and the underside of slabs such as ceilings of parking structures. It can also be used in conjunction with tilt-up wall panels.



Pressure Washable - TSX-8500 is pressure washable, up to 1000 psi using a cleaning spray rig. The wand nozzle must have a fan spray tip with an angle of at least 15 degrees. The washing wand should not be used at a distance of less than 3 feet from the surface of the insulation board. Pressures greater than 1000 psi may result in damage to the insulation facer.

Limitations

TSX-8500 is not recommended, nor warranted, for use as a commercial roof insulation directly under membrane systems. Consult Rmax Sales for suitable commercial roof insulation products.

TSX-8500 is not a structural panel. It must not be used as a nailing base for any other building products. Furthermore, walls insulated with TSX-8500 must be properly braced for lateral loads according to the requirements of local Building Codes.

Warning

Polyiso foam is an organic material which will burn when exposed to an ignition source of sufficient heat and intensity and may contribute to flames spreading.

Consult local Building Codes and insurance authorities regarding special applications or details required when using TSX-8500 as an exposed product.

Per the IBC and IRC, a WRB is required behind the exterior wall veneer.

The code also has provisions regarding vapor retarders, type and location, based on the assembly, climate zone and the amount of continuous insulation. It is up to the design professional to specify an assembly that will perform adequately and meet these requirements.

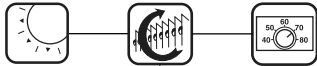
Warranty

See Rmax "Sales Policy" and applicable warranties for terms and conditions. Rmax does not assume any responsibility or liability for the performance of any products other than those manufactured by Rmax. **NOTE: All Rmax products must be tarped, placed on skids and kept dry before and throughout construction.**

UTILITY HEATER

U
SERIES

RADIANT/PUMP HOUSE HEATER
FREEZE PROTECTION



FEATURES:

- Radiant Heat
- Convection Heat
- Built-In Thermostat
- Steel Element
- Mounting Feet
- Steel Case with an Expanded Metal Element Shield
- Baked Enamel Protective Coating
- Available in Stainless Steel

MODEL CODE:

U1250
U Series
120 Volts
500 Watts

SELECTION:

WATTAGE	120V		240V		WEIGHT (lbs)
	MODEL	UPC #093319 PART NO.	MODEL	UPC #093319 PART NO.	
62	U1206	12601			5
125	U1212	12602			
187	U1218	12604			
250	U1225	12600	U2425	12612	
500	U1250	12605	U2450	12615	
750	U1275	12606	U2475	12618	
1000	U12100	12609	U24100	12621	

The U Series heater is designed to keep mechanical equipment from freezing such as pumps, valves, and farm machinery. The radiant heat is absorbed by the metal equipment thus making it more effective than convection heaters. This heater is simple and reliable with no moving parts to wear out or maintain. An inexpensive choice when freeze protection is required.

It has a built-in thermostat so it will turn off when the ambient temperature is safely above freezing. The guard keeps foreign objects away from the element.

ENGINEERING SPECIFICATIONS:

Contractor shall supply and install, U Pump House series radiant heaters, manufactured by King Electrical Mfg. Company. Heaters shall be of the wattage and voltage as indicated on the plans.

Element: 304 or 840 Stainless

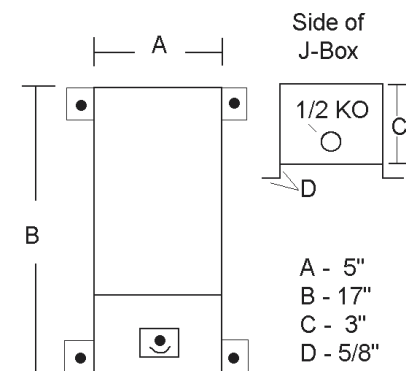
Thermostat: Built-in snap action with a range of 40° to 90° F

Safety Limit: Capillary tube running the full length of the element provides over-temperature protection, automatically resets when temperature drops

Enclosure: Steel case with an expanded metal element shield

Finish: Baked enamel protective coating

DIMENSIONS



Section 1.5 Fire Extinguisher



FIRST ALERT
by **resideo**



UL Listed	Yes
Defective Code	A
Agency Approval	US Coast Guard
Metal pull pin with safety seal deters accidental	Metal pull pin with safety seal deters accidental discharge
Application	For Commercial Applications
Container Size	20 lb
Discharge Type	Metal Valve and Trigger
Product Type	Fire Extinguisher
Each Weight	35.000 LB
Velocity	X
Hazardous Material	Yes
Alternative UPC	047871662067
Warranty	2 year limited
Color	Red
Operating Pressure	200 psi
Valve material	Metal
Hazardous Marine	Hazardous transport required
Nomenclature	FE20A120B FIRE EXTINGUISHER
Hazardous Inland	Hazardous transport required
Extinguish Agent Type	Monoammonium Phosphate
Capacity	20 Lb
Dimensions	7-1/2 in Dia x 21-1/2 in H

First Alert FE20A120B Rechargeable Fire Extinguisher, 20 lb Capacity, Monoammonium Phosphate, 20-A:120-B:C Class



DAIKIN 17 SERIES SINGLE-ZONE INVERTER WALL-MOUNT SYSTEMS

Up to 17 SEER
Up to 9.0 HSPF / Up to 11.5 EER
HEAT PUMP AND COOLING ONLY

Today, the air is perfect. Perfect temperature. Perfect humidity. Perfectly clean and fresh, like just after a rainstorm. And the only thing more perfect than this outdoor scenario is that it's all happening inside. Because that's where we work. That's where we play, where we sleep, where we truly live.

And that's why at Daikin, we aim to make the air inside as refreshing as the outside. Better comfort. Better control and efficiency. Better quality. So you can create your own unique ecosystem. And everyday is perfect.

Inside and out.

17 series Single-Zone Inverter Wall-Mount Systems

HEAT PUMP AND COOLING ONLY



AIR INTELLIGENCE™ built inside

A better understanding of how people inhabit their living spaces has led to products designed to create indoor environments that help use energy resources more effectively. Heat pumps extract or reject heat from the outside air, even in cold weather. They use an electrically powered compressor and are extremely effective at heating and cooling an

apartment or a house. Daikin heat pumps are quiet and discreet, and use state-of-the-art technology to keep your energy bills low. With a Daikin heat pump, a large portion of the energy used to heat or cool your home comes from the outside air, a free and infinitely renewable resource.



Comfort

We offer a wide range of products, and always provide you with the ideal solution, whether for an apartment, condo or a house. Our units are whisper quiet and, with their specially designed airflow pattern, they create your ideal indoor climate.

Daikin units are designed to include features that let you create your own unique ecosystem. From the wide angle louver design to the auto-swing and comfortable mode controller settings, effective heating and cooling is ensured throughout the space.

Smart inverter technology

Integrated with an inverter variable-speed compressor, Daikin systems deliver the capacity required to maintain desired room conditions, typically reducing energy consumption by up to 30% or more (compared to traditional fixed-speed ducted systems). This technology minimizes temperature fluctuations and provides continuous cooling and heating comfort.

Energy efficiency

Our products are designed to be highly efficient all year round, and their low energy consumption is reflected in low energy bills for you.

Control

Our expertise makes life easier for you, allowing you to control your system via a user-friendly remote control.

Reliability

Daikin products are renowned for their reliability. And you can rely on outstanding limited warranties* to match.



* Complete warranty details available from your local dealer or at www.daikincomfort.com.

Elegant and stylish wall-mounted unit providing high efficiency and comfort

17 series single-zone inverter wall-mounted systems provide energy efficiency and comfort control with an affordable, cost-saving solution. Available in both heat pump and cooling only models, these systems feature streamlined, wall mounted indoor units paired with quietly compact outdoor units.

Premium comfort features:

- » **Energy Efficient** – Up to 17 SEER / Up to 9.0 HSPF / Up to 11.5 EER for efficient cooling and heating operation and reduced operating costs compared to conventional lower-efficiency systems.
- » Heating Range 5° - 65° F*
Cooling Range 50° - 115° F

*Heat pump models only.

Ideal solution for:

- » Renovations, remodeling and new construction
- » A perfect alternative to noisy and inefficient window or through-the-wall air conditioner units
- » Sun rooms, basements, attics, garages, hot or cold rooms, and more
- » Rooms where floor space comes at a premium or is not available for other application
- » Ceiling void or attic does not allow for a viable duct run option
- » Cooling Only models are an excellent value for space not requiring heating

Outdoor unit features:



**Anti-Corrosion Treatment
on Heat Exchanger**



17 SERIES SINGLE-ZONE INVERTER WALL-MOUNTED SYSTEM

Up to 17 SEER / Up to 9.0 HSPF / Up to 11 EER
HEAT PUMP AND COOLING ONLY

Wall-mounted units provide high efficiency and comfort.

17 series single-zone inverter wall-mounted units are simple to install. The curved contour design blends to match with any home décor and is ideal for single room enhancements, spaces requiring additional heating or cooling, and additions. The air direction and flow rate are adjustable so that the air will not blow directly at people in the room.

Indoor unit features:



Powerful Operation – Pushing the POWERFUL button on the remote control gives you a boost in cooling or heating power for a 20-minute period, even if the unit is already operating at high capacity.



ECO+ – An intelligent feature that ensures optimum energy consumption while fulfilling basic human comfort needs. Once activated, set temperature will be adjusted automatically to an optimum energy consumption level.



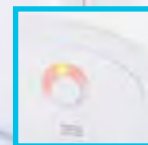
Blue Fin Protection – The hydrophilic coated fin ensures the condensate water moves easily to the drain pan — thus enhancing the cleanliness and lifespan of the cooling coil.



Titanium Apatite Photocatalytic Air Purifying Filter – This filter combines the air-purifying filter and titanium apatite photocatalytic deodorizing filter in a single highly effective unit.

Multi-monitor lamp

The lamp color changes according to the mode of operation.



Knowledge is power.

In general, system performance is measured by a higher Seasonal Energy Efficiency Ratio (SEER) and Energy Efficiency Ratio (EER). Higher ratings mean lower operating costs. Similarly, a higher rated Heating Seasonal Performance Factor (HSPF) and Coefficient of Performance (COP) means a more efficient air-source heat pump.

Why is it important?

The COP of a heat pump is the ratio of: $COP = \frac{\text{energy out}}{\text{energy in}}$

When the COP is >1, the result is a system providing more heating energy than energy consumed. As the COP increases, the higher the efficiency — resulting in lower utility costs.

Up to 17 SEER	Up to 11.5 EER
Up to 9.0 HSPF	Up to 3.68 COP
(Coefficient of Performance)	

Single-Zone Heat Pump
Efficiency ratings

COP



17 series
Up to 3.68
(Wall Mount Unit)

Cooling Only Specifications

Unit Size	Indoor Unit Model # / Dimensions (HxWxD)	Outdoor Unit Model # / Dimensions (HxWxD)	Efficiency Rating	Lowest Sound Level (dB(A))		Weight (lbs)		AHRI #
				Indoor	Outdoor	Indoor	Outdoor	
9,000	FTKB09AXVJU	RKB09AXVJU	17 SEER / 11 EER	23	45	20	53	10578900
	11 ¹¹ / ₁₆ x 35 ¹ / ₁₆ x 8 ¹ / ₄	21 ⁵ / ₈ x 25 ¹⁵ / ₁₆ x 10 ³ / ₄						
12,000	FTKB12AXVJU	RKB12AXVJU	17 SEER / 8.5 EER	22	46	20	57	10571502
	11 ¹¹ / ₁₆ x 35 ¹ / ₁₆ x 8 ¹ / ₄	21 ⁵ / ₈ x 25 ¹⁵ / ₁₆ x 10 ³ / ₄						
18,000	FTKB18AXVJU	RKB18AXVJU	17 SEER / 10.5 EER	32	51	31	82	10571503
	12 ⁵ / ₈ x 46 ¹ / ₈ x 9 ¹ / ₂	25 ¹¹ / ₁₆ x 33 ¹¹ / ₁₆ x 12 ¹⁵ / ₁₆						
24,000	FTKB24AXVJU	RKB24AXVJU	17 SEER / 11 EER	37	51	31	97	10571504
	12 ⁵ / ₈ x 46 ¹ / ₈ x 9 ¹ / ₂	25 ¹¹ / ₁₆ x 33 ¹¹ / ₁₆ x 12 ¹⁵ / ₁₆						

Heat Pump Specifications

Unit Size	Indoor Unit Model # / Dimensions (HxWxD)	Outdoor Unit Model # / Dimensions (HxWxD)	Efficiency Rating	Lowest Sound Level (dB(A))		Weight (lbs)		AHRI #
				Indoor	Outdoor	Indoor	Outdoor	
9,000	FTXB09AXVJU	RXB09AXVJU	17 SEER / 11 EER / 9 HSPF / 3.56 COP	23	45	20	53	10578901
	11 ¹¹ / ₁₆ x 35 ¹ / ₁₆ x 8 ¹ / ₄	21 ⁵ / ₈ x 25 ¹⁵ / ₁₆ x 10 ³ / ₄						
12,000	FTXB12AXVJU	RXB12AXVJU	17 SEER / 8.5 EER / 9 HSPF / 3.30 COP	22	46	20	57	10574119
	11 ¹¹ / ₁₆ x 35 ¹ / ₁₆ x 8 ¹ / ₄	21 ⁵ / ₈ x 25 ¹⁵ / ₁₆ x 10 ³ / ₄						
18,000	FTXB18AXVJU	RXB18AXVJU	17 SEER / 10.5 EER / 9 HSPF / 3.30 COP	32	51	31	82	10574896
	12 ⁵ / ₈ x 46 ¹ / ₈ x 9 ¹ / ₂	25 ¹¹ / ₁₆ x 33 ¹¹ / ₁₆ x 12 ¹⁵ / ₁₆						
24,000	FTXB24AXVJU	RXB24AXVJU	17 SEER / 11 EER / 9 HSPF / 3.68 COP	37	51	31	97	10575515
	12 ⁵ / ₈ x 46 ¹ / ₈ x 9 ¹ / ₂	25 ¹¹ / ₁₆ x 33 ¹¹ / ₁₆ x 12 ¹⁵ / ₁₆						

Why choose Daikin?

Daikin is the world leader when it comes to heating and cooling. Thanks to our constant innovation in comfort, energy efficiency, control and reliability, we define the benchmarks for quality within the industry.

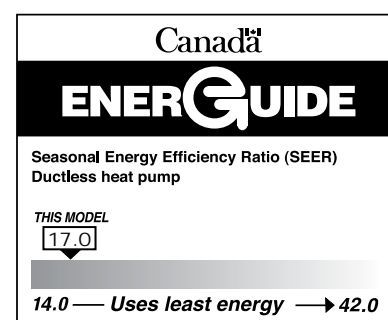
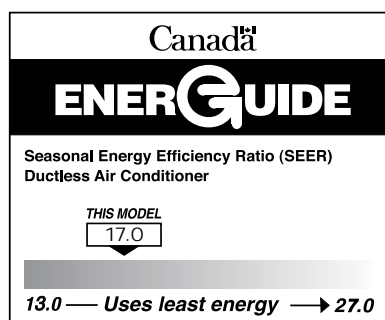
Expert reviews from our most important critics.

Daikin offers a wide selection of choices for energy-efficient indoor comfort. As a worldwide leader in heating and cooling technology, Daikin is also a highly-rated brand. See for yourself at www.daikincomfort.com/reviews.

ADDITIONAL INFORMATION

Before purchasing this appliance, read important information about its estimated annual energy consumption, yearly operating cost, or energy efficiency rating that is available from your retailer.

Daikin and its design are trademarks owned by Daikin.



Our continuing commitment to quality products may mean a change in specifications without notice.
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CB-17Series_5-18

Section 1.7 Intrusion Alarm

**N200AU**

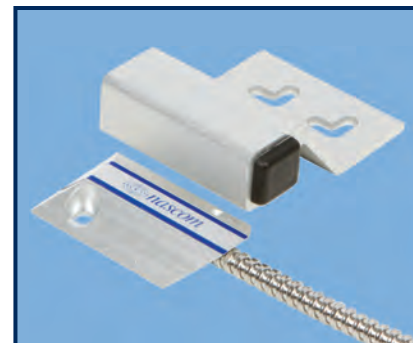
MIGHTY MITE OVERHEAD DOOR SWITCH WITH UNIVERSAL MAGNET

DESCRIPTION

Nascom's N200AU MIGHTY MITE is a mini overhead door switch with universal magnet for commercial and industrial overhead door applications.

The MIGHTY MITE combines the installers' choice of contact configuration with an N35 NdFeB magnet for maximum gap performance.

The closed loop versions of the N200AU prevent false alarms caused by the side to side shifting of overhead doors with our unique **NO DEAD SPOT™** technology.



FEATURES

- **NO DEAD SPOT™** TECHNOLOGY
- EXTRA WIDE GAP - N35 NdFeB RARE EARTH MAGNET
- 24" ARMORED CABLE LEAD PROTECTION
- LISTED TO UL634 STANDARD
- UNIVERSAL MOUNT
- 36" 22AWG WIRE LEADS
- EXTRUDED ANODIZED (TYPE II) ALUMINUM

ORDERING INFORMATION

PART NUMBER	COLOR	OPERATE GAP (in INCHES)	CONTACT RATING (Max DC/Peak AC Resistive)				STATIC CONTACT RESISTANCE (50mV, 100mA)
			SWITCHING		CARRY		
			V	I	V	I	

CLOSED LOOP, NORMALLY OPEN, 1FA, SWITCH/MAGNET SET:

N200AU/ST	SILVER	1.75 to 2.75	200 VDC	0.5 Amps	10vA	1.5 Amps	150 mOhms
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DUAL CLOSED LOOP, NORMALLY OPEN, 1FA, SWITCH/MAGNET SET:

N200AU/ST2CR	SILVER	1.75 to 2.75	200 VDC	0.5 Amps	10vA	0.5 Amps	150 mOhms
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OPEN LOOP, NORMALLY CLOSED, 1FB, SWITCH/MAGNET SET:

N200AU/STFB	SILVER	1.50 to 2.50	30 VDC	0.2 Amps	3vA	0.5 Amps	100 mOhms
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SINGLE POLE DOUBLE THROW, SWITCH/MAGNET SET:

N200AU/STSD	SILVER	1.50 to 2.50	30 VDC	0.2 Amps	3vA	0.5 Amps	100 mOhms
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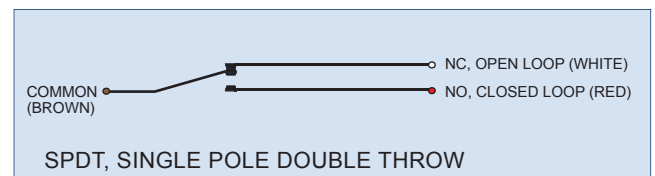
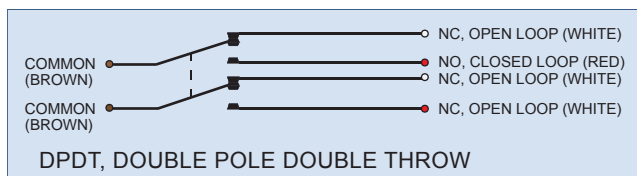
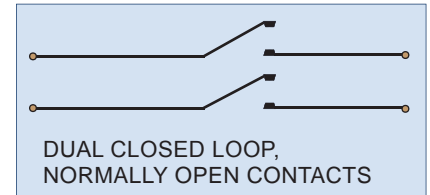
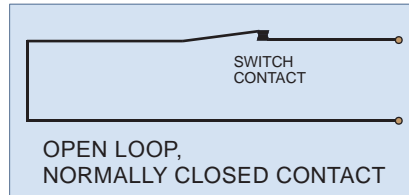
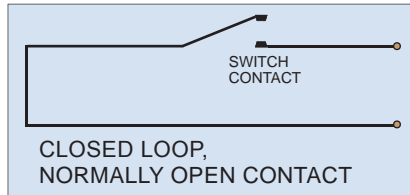
DOUBLE POLE DOUBLE THROW, SWITCH/MAGNET SET:

N200AU/STDD	SILVER	1.50 to 2.50	30 VDC	0.2 Amps	3vA	0.5 Amps	100 mOhms
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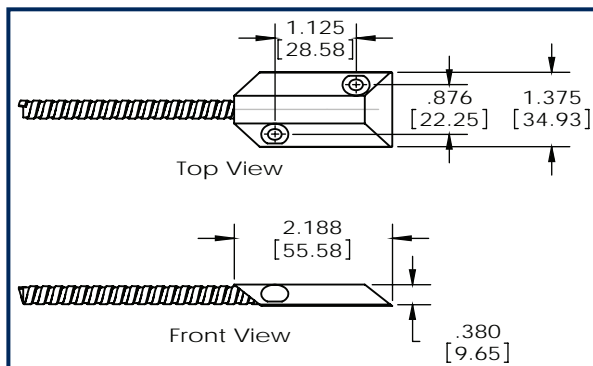
HIGH SECURITY, NORMALLY OPEN, 1FA, SWITCH/MAGNET SET:

N200AU/STHS	SILVER	0.1875 to 0.50	300 VDC	0.25 Amps	10vA	0.25 Amps	150 mOhms initial
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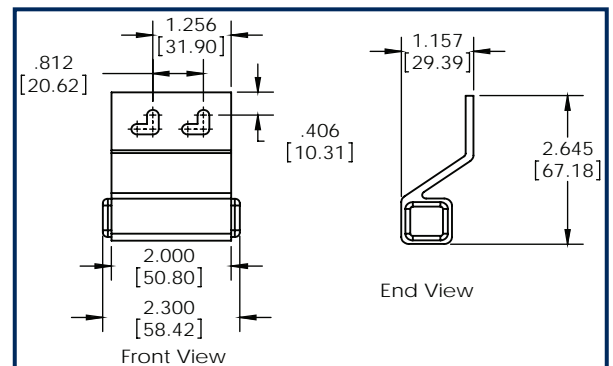
WIRING SCHEMATIC



DIMENSIONS - IN [mm]



SWITCH



MAGNET

INSTALLATION INSTRUCTIONS

The switch can be mounted on the floor at the base of the door or on the wall at the top of the door. For best performance, align the switch and magnet housings and keep the gap distance between the switch and magnet as close as possible.

FLOOR MOUNT:

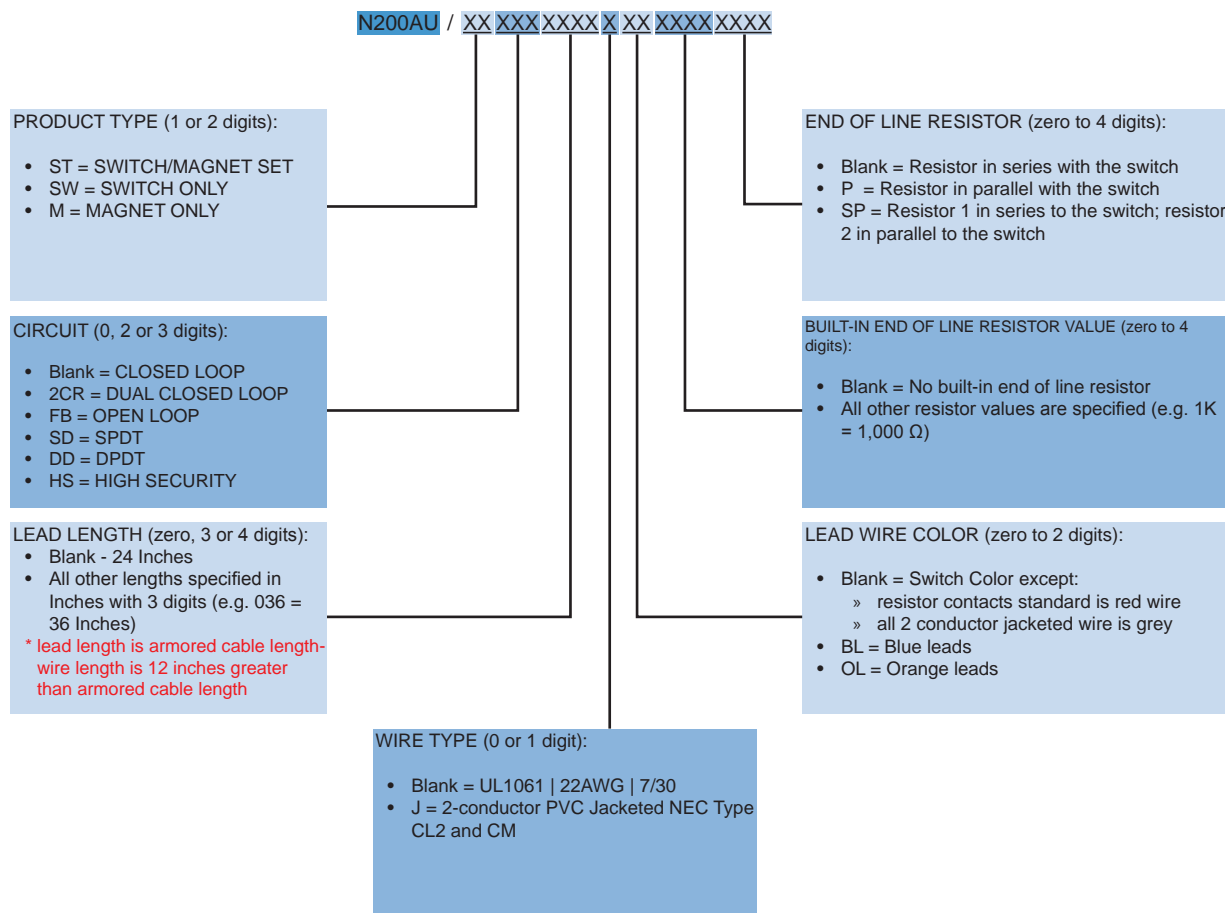
- With the overhead door closed, position the magnet on the lower right or left side of the door, then align the switch under the magnet. Adjust the position of the switch and magnet to ensure there is adequate clearance between the housings (1/4" minimum).
- Make sure the stainless steel armored cable will not interfere with the door operation.
- Mark the mounting hole locations for the switch and magnet.
- Drill the marked locations on the door using a high speed drill adequately sized for self-tapping screws or machine screws.
- Mount the magnet on the door.
- Raise the door and drill the switch mounting hole locations using a masonry bit for concrete floors, sized to fit expansion anchors for #6 self-tapping screws.
- Secure the switch to the floor.
- Test the switch by attaching an ohm meter to the switch leads and operate the door.
- Connect the leads to the alarm system conductors.

INSTALLATION INSTRUCTIONS, continued

TOP MOUNT:

- With the overhead door closed, position the magnet at the top of the door in the desired location, then align the switch under the magnet. Adjust the position of the switch and magnet to ensure there is adequate clearance between the housings (1/4" minimum).
- Make sure the stainless steel armored cable will not interfere with the door operation.
- Mark the mounting hole locations for the switch and magnet.
- Drill the marked locations on the door using a high speed drill adequately sized for self-tapping screws or machine screws.
- Drill the switch mounting hole locations using a masonry bit for concrete or cement block walls sized to fit expansion anchors for #6 self-tapping screws or use dry wall anchors for sheet rock walls.
- Attach the switch to the wall first using #6 self-tapping screws and then attach the magnet to the door using #8 self-tapping screws.
- Test the switch by attaching an ohm meter to the switch leads and operate the door.
- Connect the leads to the alarm system conductors.

PART NUMBER SYSTEM



2 Control Panel

Components

2.1

Programmable Logic Controller (PLC) & Components

MicroSmart FC6A Plus PLC

CPU Module Specifications



FC6A PLUS CPU MODULES

Part No.	High-speed Counter & Pulse Output	Power	Input	Output	Interface	I/O Points
FC6A-D16R1CEE	<ul style="list-style-type: none"> High-speed counter Maximum input frequency: 100kHz Pulse output (*1) Maximum output frequency: 100kHz 	24V DC	24V DC (Sink/Source)	Relay Output 2A (240V AC-2A, 30V DC-2A)	Port 1 (USB) Port 2 (Ethernet) Port 3 (Ethernet)	16 points (8/8)
FC6A-D16P1CEE				Transistor Source Output 0.5A		
FC6A-D16K1CEE				Transistor Sink Output 0.5A		
FC6A-D32P3CEE				Transistor Source Output 0.1A	Port 3 (Ethernet)	32 points (16/16)
FC6A-D32K3CEE				Transistor Sink Output 0.1A		

SPECIFICATIONS

Part No.	FC6A-D16R1CEE FC6A-D16P1CEE FC6A-D16K1CEE	FC6A-D32P3CEE FC6A-D32K3CEE
Rated Power Voltage	24V DC	
Allowable Voltage Range	20.4 to 28.8V DC (including ripple)	
Maximum Power Consumption (CPU module)	FC6A-D16R1CEE: 2.88W (24V DC) FC6A-D16P1CEE: 2.88W (24V DC) FC6A-D16K1CEE: 2.88W (24V DC) FC6A-D32P3CEE: 3.36W (24V DC) FC6A-D32K3CEE: 3.36W (24V DC)	
Inrush Current	35A maximum	
Allowable Momentary Power Interruption	10ms (at rated voltage)	
Operating Temperature	-10 to +55°C (no freezing)	
Storage Temperature	-25 to +70°C (no freezing)	
Relative Humidity	Level RH1 (IEC 61131-2) 10 to 95% (no condensation)	
Altitude	Operation: 0 to 2,000m, 795 to 1,013hPa, Transport: 0 to 3,000m, 701 to 1,013hPa	
Pollution Degree	2 (IEC 60664-1)	
Corrosion Immunity	Free from corrosive gases	
Dielectric Strength	Between power and FE terminals: 500V AC, 1 minute Between transistor output and FE terminals: 500V AC, 1 minute Between power and input terminals: 500V AC, 1 minute Between power and relay output terminals: 2,300V AC, 1 minute Between input and relay output terminals: 2,300V AC, 1 minute Between input and FE terminals: 500V AC, 1 minute Between relay output and FE terminals: 2,300V AC, 1 minute Between power and transistor output terminals: 500V AC, 1 minute Between input and transistor output terminals: 500V AC, 1 minute	

PRODUCT DESCRIPTION

This next-generation IDEC MicroSmart FC6A Plus PLC performs beyond micro PLC limits. With its 2,060 I/O capacity, it can control large machines or entire small-scale manufacturing facilities, providing more capabilities for the most demanding applications.

KEY FEATURES

- Dual Ethernet ports
- iOS and Android WindEDIT app
- Maximum 2,060 digital I/O
- Maximum 511 analog I/O
- Bluetooth communication
- BACnet/IP and Modbus TCP



SPECIFICATIONS CONT.

Insulation Resistance	Between power and FE terminals: 100MΩ or higher (500V DC megger) Between transistor output and FE terminals: 100MΩ or higher (500V DC megger) Between power and input terminals: 100MΩ or higher (500V DC megger) Between power and relay output terminals: 100 MΩ or higher (500V DC megger) Between input and relay output terminals: 100MΩ or higher (500V DC megger)	Between input and FE terminals: 100MΩ or higher (500V DC megger) Between relay output and FE terminals: 100MΩ or higher (500V DC megger) Between power and transistor output terminals: 100 MΩ or higher (500V DC megger) Between input and transistor output terminals: 100 MΩ or higher (500V DC megger)
Noise Resistance	AC/DC power terminals: 1kV, 50ns to 1μs I/O terminals (coupling clamp): 1.5kV, 50ns to 1μs coupling adapter	
Vibration Resistance	5 to 8.4Hz amplitude 3.5mm 8.4 to 150Hz acceleration 9.8m/s ² (1G), 2 hours per axis on each of three mutually perpendicular axes (IEC 61131-2)	
Shock Resistance	147m/s ² (15G), 11ms duration, 3 shocks per axis on three mutually perpendicular axes	
Degree of Protection	IP20 (IEC 60529)	
Power Supply Wire	UL1007 AWG24-16, UL2464 AWG24-16, UL1015 AWG20-16	
Grounding Wire	UL1007 AWG16	
Ground	D-type ground (Class 3 ground)	
Mounting	DIN rail or panel mounting	
Weight (approx.)	FC6A-D16R1CEE: 290g FC6A-D16P1CEE: 275g FC6A-D16K1CEE: 275g	FC6A-D32P3CEE: 255g FC6A-D32K3CEE: 255g

FUNCTION SPECIFICATIONS

Part No.		FC6A-D16R1CEE FC6A-D16P1CEE (*4) FC6A-D16K1CEE (*4)	FC6A-D32P3CEE (*4) FC6A-D32K3CEE (*4)
Control System		Stored program system	
Instruction Words	Basic	42	
	Advanced	130	
Program Capacity (*1)		800KB (100,000 steps)	
User Program Storage		Serial Flash Memory (100,000 times rewritable)	
Processing Time	Basic Instruction	21μs/1,000 steps	
	END Processing (*2)	1ms maximum	
I/O Points	Input	8 points	16 points
	Output	8 points	16 points
Expandable Modules		7 modules (*3)	
Expandable I/O Points with Expansion Modules		224 points	
Expandable Modules with Unibody Type Expansion Modules		8 modules	
Expandable I/O Points with Unibody Type Expansion Modules		256 points	
Expandable Modules with Separate Type Expansion Modules (*5)		63 modules (separate type master: 1 module maximum, separate type slave: 10 modules maximum)	
Expandable I/O Points with Separate Type Expansion Modules (*5)		2,016 points	
Internal Relay		15,400 points	
Special Internal Relay		1,600 points	
Shift Register		256 points	
Data Register		60,000 points	
Non-Retentive Data Register		200,000 points	
Special Data Register		900 points	
Counter		512 points	
Timer (1ms, 10ms, 100ms, 1s)		2,000 points	
Clock		Clock accuracy: ±30 sec/month (typical) at 25°C	
RAM Backup	Backup Data	Internal relay, shift register, counter, data register, timer, special data register, special internal relay, clock data	
	Battery	Lithium primary battery (BR2032)	
	Battery Life	Approx. 4 years	
	Replaceability	Possible	
Self-diagnostic Function		Keep data, user program sum check (serial flash memory), user program sum check (RAM), timer/counter preset value sum check, user program syntax check, user program execution check, WDT check, user program write check, power failure, clock error, data link connection check, I/O bus initialization check	
Input Filter		0 ms (without filter), 3 to 15ms (selectable in increments of 1ms) I14, I15, I16, I17: 3ms	
Catch Input/Interrupt Input		Six inputs I0, I1, I3, I4, I6, I7 (Minimum turn on pulse width: 5μs max./Minimum turn off pulse width: 5μs max.)	

USB PORT SPECIFICATIONS

USB Type	USB mini-B
USB Standard	USB 2.0
Isolation	Not isolated from the internal circuit
Communication Function	Maintenance communication to PC

ETHERNET PORT 1 SPECIFICATIONS

Communication Type	IEEE802.3 compliant
Communication Speed	10BASE-T, 100BASE-TX
Connector	RJ45
Cable	CAT.5STP
Maximum Cable Length	100m
Isolation	Pulse transformer isolation
Communication Function	Maintenance communication (server), user communication (server/client), user communication UDP, Modbus TCP (server/client), Email, Web Server, PING, SNMP, FTP server/client, BACnet/IP server

ETHERNET PORT 2 SPECIFICATIONS

Communication Type	IEEE802.3 compliant
Communication Speed	10BASE-T, 100BASE-TX
Connector	RJ45
Cable	CAT.5STP
Maximum Cable Length	100m
Isolation	Pulse transformer isolation
Communication Function	Maintenance communication (server), user communication (server/client), user communication UDP, Modbus TCP (server/client), PING

FUNCTION SPECIFICATIONS CONT.

High-speed Counter	Maximum Counting Frequency and High-speed Counter Points	Total 6 points Single/two-phase selectable: 100kHz (single-phase: 6 points, two-phase: 3 points)
	Counting Range	0 to 4,294,967,295 (32 bits)
	Operation Mode	Rotary encoder mode, adding counter mode, frequency measurement mode
Analog Potentiometer	Quantity	1 point
	Data Range	0 to 1,000
Analog Voltage Input	Quantity	1 point
	Input Voltage Range	0 to 10V
	Input Impedance	Approx. 100KΩ
	Digital Resolution	Approx. 4,000 steps (12 bits)
Pulse Output (transistor output model only)	Quantity	4 points
	Maximum Output Pulse Frequency	Q0, Q2, Q4, Q6: 100kHz
	Reversible Control	Single-pulse output mode: 4 axis (Q0-Q7), Dual-pulse output mode: 4 axis (Q0-Q7)
	PWM Output	Duty cycle 0.1 to 100.0% (increments of 0.1%), Output pulse frequency 15 to 5,000 Hz (increments of 1 Hz): 4 points (Q0, Q2, Q4, Q6) (Adjust 5μs minimum as ON time and 15μs minimum as OFF time.)
USB Port		USB mini-B (maintenance communication)
Ethernet Port 1		Maintenance communication (server), user communication TCP (server/client), user communication UDP, Modbus TCP (server/client), Email, Web Server, PING, SNTP, FTP server/client
Ethernet Port 2		Maintenance communication (server), user communication TCP (server/client), user communication UDP, Modbus TCP (server/client), PING
Cartridge (option)		Two cartridges can be added (when using FC6A-HPH1)/One cartridge can be added (when using FC6A-PH1)
SD Card Slot		Embedded
HMI Module (option)		Yes

*1: 1 step equals 8 bytes.
*2: Not including expansion I/O service time, counter timer processing time, data link processing time, and interrupt processing time.
*3: A maximum of 5 modules can be connected when using the expansion interface module separate type master.
*4: Transistor output model
*5: Communication module cannot be connected.

INPUT SPECIFICATIONS

Part No.		FC6A-D16R1CEE FC6A-D16P1CEE FC6A-D16K1CEE	FC6A-D32P3CEE FC6A-D32K3CEE
Input Points		8 (8/1 common)	16 (16/1 common)
Rated Input Voltage		24V DC: 24V DC sink/source input signal	
Input Voltage Range		0 to 28.8V DC	
Rated Input Current		High speed input port 5mA/pt, middle/normal speed input port 7mA/pt	
Input Impedance		High speed input port 4.9kΩ, middle/normal speed input port: 3.4kΩ	
Input Delay	Turn ON Time	High speed input port: 5μs + filter value Middle speed input port: 35μs + filter value Normal speed input port: 35μs + filter value	
	Turn OFF Time	High speed input port: 5μs + filter value Middle speed input port: 35μs + filter value Normal speed input port: 100μs + filter value	
Isolation		Between input terminals: Not isolated Internal circuit: Optocoupler-isolated	
Input Type		Type1 (IEC 61131-2)	
External Load for I/O Interconnection		Not needed	
Signal Determination Method		Static	
Effect of Improper Input Connection		Both sinking and sourcing input signals can be connected, therefore reverse connection does not cause damage. If any input exceeding the rated value is applied, permanent damage may be caused.	
Cable Length		3m in compliance with electromagnetic immunity	
Connector	Insertion Durability	100 times minimum	
	Applicable Ferrule	1-wire: AI 0.5-8 WH (Phoenix Contact) 2-wire: AI-TWIN 2x0.5-8 WH (Phoenix Contact)	

RELAY OUTPUT SPECIFICATIONS

Part No.		FC6A-D16R1CEE
Relay Output Points		8
Output Points per Common Line	COM1	4
	COM2	4
Output Type		1NO
Maximum Load Current	Per Point	2A
	Per Common	COM1: 7A COM2: 7A
Minimum Switching Load		1mA/5V DC (reference value)
Initial Contact Resistance		30mΩ maximum

RELAY OUTPUT SPECIFICATIONS CONT.

Electrical Life		100,000 operations minimum (rated resistive load 1,800 operations/hour)
Mechanical Life		20,000,000 operations minimum (no load 18,000 operations/hour)
Rated Load		Resistive load: 240V AC 2A, 30V DC 2A Inductive load: 240V AC 2A (cos ϕ = 0.4), 30V DC 2A (L/R = 7 ms)
Connector	Insertion/Removal Durability	100 times minimum
	Applicable Ferrule	1-wire: AI 0.5-8 WH (Phoenix Contact) 2-wire: AI-TWIN 2x0.5-8 WH (Phoenix Contact)

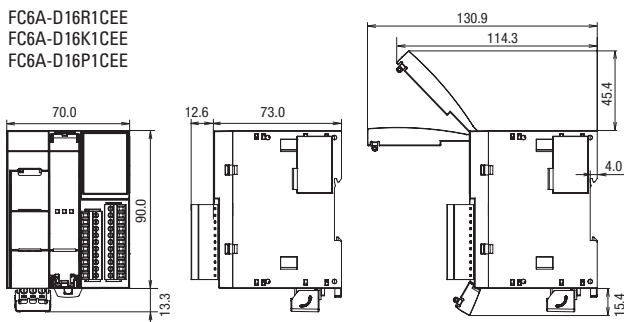
TRANSISTOR OUTPUT SPECIFICATIONS

Part No.		FC6A-C16P1CEE FC6A-C16K1CEE	FC6A-D32P3CEE FC6A-D32K3CEE
Transistor Output Points		8 (8/1 common)	16 (16/1 common)
Output Type	Transistor Sink	FC6A-D16K1CEE/FC6A-D32K3CEE	
	Transistor Source	FC6A-D16P1CEE/FC6A-D32P3CEE	
Rated Load Voltage		24V DC	
Voltage Tolerance		19.2 to 28.8V DC	
Rated Load Current	Per Point	0.5A	0.1A
	Per Common	4.0A	1.6A
Output Delay	Turn ON Time	High speed input port: 5 μ s Normal speed input port: 300 μ s	
	Turn OFF Time	High speed input port: 5 μ s Normal speed input port: 300 μ s	
Isolation		Between output terminal and Internal circuit: Optocoupler-isolated Between output terminals: Not isolated	
Voltage Drop (ON Voltage)		1V max (voltage between COM and output terminal when output is on.)	
Inrush Current		1A	0.2A
Leakage Current		0.1mA maximum	
Clamping Voltage		39V \pm 1V	
Maximum Lamp Load		12W	2.4W
Inductive Load		L/R=10ms (28.8V DC, 1Hz)	
Overcurrent Protection		Transistor Sink Output: No Transistor Source Output: Overcurrent is detected by current limit resistance. (*1)	
External Current Draw		100mA maximum, 24V DC (power voltage at the +V terminal, -V terminal at source)	
Connector	Insertion Durability	100 times minimum	
	Applicable Ferrule	1-wire: AI 0.5-8 WH (Phoenix Contact) 2-wire: AI-TWIN 2x0.5-8 WH (Phoenix Contact)	—

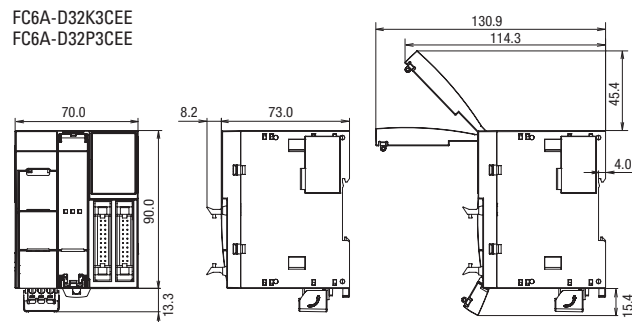
*1: This overcurrent signals consist of one signal per 4 point outputs. When microprocessor gets this overcurrent signal by interrupt input, microprocessor turns off 4pt outputs of this category at fixed time (approx. 1sec).

DIMENSIONS (mm)

FC6A-D16R1CEE
FC6A-D16K1CEE
FC6A-D16P1CEE



FC6A-D32K3CEE
FC6A-D32P3CEE



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High Performance Touchscreens



TOUCHSCREEN PART NUMBERS

Display Screen	Part Number	Description
15"	HG5G-VFXT22MF-B	15 inch Color TFT LCD display Black Bezel with multimedia function
12.1"	HG4G-VCXT22MF-B	12.1 inch Color TFT LCD display Black Bezel with multimedia function
10.4"	HG3G-VAXT22MF-W	10.4 inch Color TFT LCD display Light Gray Bezel with multimedia function
	HG3G-VAXT22MF-B	10.4 inch Color TFT LCD display Black Bezel with multimedia function
8.4"	HG3G-V8XT22MF-W	8.4 inch Color TFT LCD display Light Gray Bezel with multimedia function
	HG3G-V8XT22MF-B	8.4 inch Color TFT LCD display Black Bezel with multimedia function
5.7"	HG2G-V5FT22TF-W	5.7 inch Color TFT LCD display Light Gray Bezel
	HG2G-V5FT22TF-B	5.7 inch Color TFT LCD display Black Bezel

PRODUCT DESCRIPTION

New Enhanced High Performance Series: 5.7" to 15" displays

IDEC touchscreens are redefining Human Machine Interaction. Our new High Performance 5.7", 8.4", 10.4" and 12.1" HMI's offer upgraded features and with the addition of a new 15" model, users have options for applications on any size equipment.

Featuring up to 800 cd/m² brightness, 1024 x 768 pixels high resolution displays, and over 100,000 hours of backlight life, they are the brightest, longest-lasting displays on the market.

An exceptionally wide operating temperature range of -20°C to +60°C as well as IP66F, IP67F, Type 4X, 12, 13, and Class I Div 2 approval ratings, assures reliable operation in the toughest environments. These touchscreens are built for endurance and are backed by an industry leading three-year warranty.

KEY FEATURES

- High Resolution Display: 1024 x 768 pixels (8.4", 10.4", 12.1", 15"), 640 x 480 pixels (5.7")
- Backlight light of 100,000 hours with up to 800 cd/m² brightness
- Wide range of Operating Temperature: -20°C to +60°C
- Multiple Protocols - up to 4 protocols simultaneously
- Remote Access, Monitor and Control Function
- FTP, Email, Mobile App and Custom Web Page
- Audio and Video Interface (8.4", 10.4", 12.1", 15")
- Supports Analog and Discrete I/O Expansion Modules
- IP66F/67F, Type 4X, 12 and 13, Class I Div 2
- 3 Year Warranty



GENERAL SPECIFICATIONS

	5.7"	8.4"	10.4"	12.1"	15"
Model	HG2G-V5FT22TF	HG3G-V8XT22MF	HG3G-VAXT22MF	HG4G-VCXT22MF	HG5G-VFXT22MF
Rated Power Voltage	24V DC				
Power Voltage Range	20.4 to 28.8V DC				
Power Consumption	18W maximum 8W maximum when not using USB2 or EXT 4W maximum when Backlight OFF	25W maximum 15W maximum when not using USB2 or EXT 7W maximum when Backlight OFF			25W maximum 20W maximum when not using USB2 or EXT 7W maximum when Backlight OFF
Allowable Momentary Power Interruption	10 ms maximum				
Inrush Current	30A maximum				
Dielectric Strength	1,000V AC, 10 mA, 1 minute between power and FG terminals				
Operating Temperature	-20 to +60°C (no freezing)				
Operating Humidity	10 to 90% RH (no condensation)				
Storage Temperature	-20 to +70°C (no freezing)				
Storage Humidity	10 to 90% RH (no condensation)				
Pollution Degree	2				
Vibration Resistance	5 to 8.4 Hz amplitude 3.5 mm, 8.4 to 150 Hz acceleration 9.8 m/s ² 10 cycles (100 minutes) on each of three mutually perpendicular axes				
Shock Resistance	147 m/s ² , 11 ms 5 shocks on each of three mutually perpendicular axes				
Noise Immunity	Fast transient/burst test, Power terminals: ±2 kV, Communication line: ±1 kV (IEC/EN61131-2)				
Electrostatic Discharge	Contact ±6 kV, air ±8 kV (IEC/EN61131-2)				
Corrosion Immunity	Free from corrosive gases				
Degree of Protection *1	IP66F/IP67F (IEC 60529) (front part when mounted) Type 4X, 12, and 13				
Switching Element	Analog resistive membrane				
Operating Force	3N maximum				
Mechanical Life	1,000,000 operations				
Sound Acknowledgement	Electronic buzzer	Electronic buzzer or speaker output			
Dimensions	167.2W x 134.7H x 54.4D mm	231W x 176H x 54.4D mm	270W x 212H x 52.7D mm	314W x 240H x 54.1D mm	364.5W x 291.5H x 54.8D mm
Weight (approx.)	0.65 kg	1.25 kg	1.65 kg	2.1 kg	3.2 kg
Approvals	Safety Standards: UL61010-1, UL61010-2-201, UL12.12.01 CSA C22.2 No.61010-1-12 CSA C22.2 No.61010-2-201 CSA C22.2 No.213 Class I Div 2 Ship Classification Standards (pending): ABS, LR, NK, DNV GL				

Do not use the touchscreen in an environment subject to strong ultraviolet rays, otherwise the LCD quality will deteriorate.

*1 Protection degree of the front surface after mounting. Operation not guaranteed in certain environments.

DISPLAY
SPECIFICATIONS

	5.7"	8.4"	10.4"	12.1"	15"
Model	HG2G-V5FT22TF-B or W	HG3G-V8XT22MF-B or W	HG3G-VAXT22MF-B or W	HG4G-VCXT22MF-B	HG5G-VFXT22MF-B
Display Type	Color TFT LCD				
Color Depth	65,536				
User Memory	56 MB				
Display Resolution	640W x 480H pixels	1024W x 768H pixels			
Backlight	White LED				
Backlight Life *1	100,000 hours min.				
Brightness *2	800 cd/m ²		700 cd/m ²	600 cd/m ²	650 cd/m ²
Brightness Adjustment	48 scales				
SD Card Slot	✓				
FC6A Analog & Digital I/O Cards Supported	2	4			
Ethernet Port	1 RJ-45				
USB Ports	1 Type A & 1 MiniB				
Serial Ports	2 (RS-232, RS-485, RS-422 configurable)				
Video In	—	2 Composite Video RCA connector (NTSC or PAL)			
Audio Out	—	3.5 mm audio mini-jack (stereo)			

*1 The backlight life refers to the time until the surface brightness reduces by half after continuous use at 25°C. *2 Brightness of the LCD only.

ACCESSORIES

	Part Number	Quantity	Description	5.7"	8.4"/10.4"	12.1"	15"
Programming Software	SW1A-W1C	1	Automation Organizer	✓	✓	✓	✓
USB Maintenance Cable	HG9Z-XCM2A	1	USB Programming Cable USB-MiniB (2 m)	✓	✓	✓	✓
Mounting Clip	SLD-K02	1	Replacement clip (4pcs are supplied with HMI)	✓	—	—	—
	HG9Z-4K2PN04	4	Replacement clips (4pcs are supplied with HMI)	—	✓	✓	—
	HG9Z-4K2PN06	6	Replacement clips (6pcs are supplied with HMI)				✓
Host Communication Plug	HG9Z-XT09V	1	Replacement terminal block plug (1 is supplied with HMI)	✓	—	—	—
	HG9Z-XT09	1	Replacement terminal block plug (1 is supplied with HMI)	—	✓	✓	✓
Replacement Battery	HG9Z-XR2	1	Lithium battery CR2032 (one battery is supplied with HMI)	✓	✓	✓	✓
USB Cable Lock Pin	HG9Z-XU1PN05	5	Used to lock USB cable (for USB2)	✓	✓	✓	✓
USB Panel-Mount Extension Cable	HG9Z-XCE11	1	For USB-A port (1 m)	✓	✓	✓	✓
	HG9Z-XCE21	1	For USB-mini B port (1 m)	✓	✓	✓	✓
Memory Card	HG9Z-XMS2	1	SD Memory Card (2 GB)	✓	✓	✓	✓
Protective Cover	HG9Z-2E2	1	Use with 5.7" HMI (Covers entire front of HMI)	✓	—	—	—
Protective Sheet *1	HG9Z-2D5	1	Use with 5.7" HMI (Sheet lays over LCD area)	✓	—	—	—
	HG9Z-3D8	1	Use with 8.4" HMI (Sheet lays over LCD area)	—	✓	—	—
	HG9Z-3DA2	1	Use with 10.4" HMI (Sheet lays over LCD area)	—	✓	—	—
	HG9Z-4DC	1	Use with 12.1" HMI (Sheet lays over LCD area)	—	—	✓	—
	HG9Z-5DFPN01	1	Use with 15" HMI (Sheet lays over LCD area)	—	—	—	✓
Expansion Module Clamp *2	HG9Z-XJ3	1	Short type for installing expansion I/O modules (Total width 17.6 to 41.1 mm)	✓	✓	✓	✓
	HG9Z-XJ4	1	Long type for installing expansion I/O modules (Total width 47 to 68.8 mm)	✓	✓	✓	✓
	HG9Z-XJ5	1	Extra-Long type for installing expansion I/O modules (Total width 70.1 to 93.9 mm)	✓	✓	✓	✓

*1 The protective sheet is UV resistant, however, resistance against direct sunlight in outdoor usage is not guaranteed.

*2 Use the expansion module clamp when using expansion modules.

Order the module clamp by referring to the width of the module shown in the dimensions of each module.

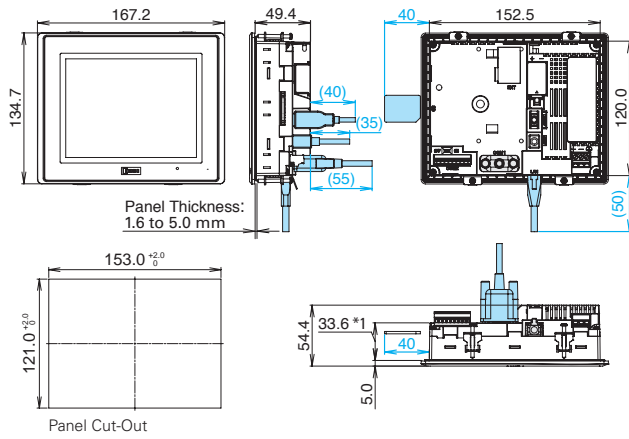
Note: When connecting expansion modules to the HMI's, note the limits shown below:

-Output Current flow rate at 5V: 130 mA max. (HG2G/3G/4G/5G)

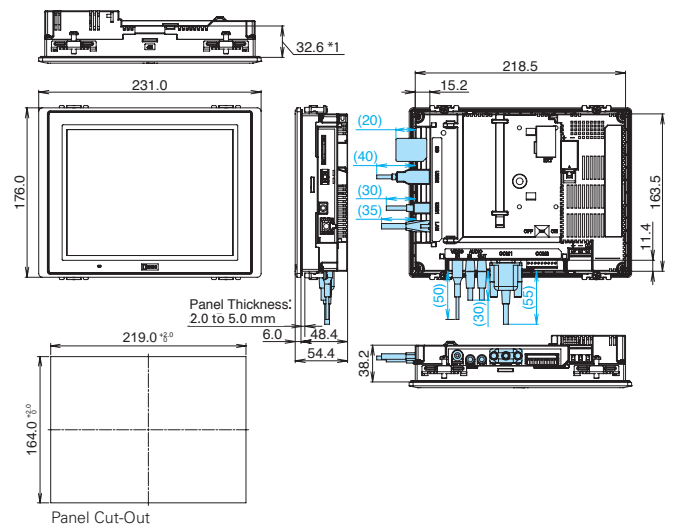
-Output Current flow rate at 24V: 50 mA max. (HG5G);24V: 150 mA max. (HG2G/3G/4G)

DIMENSIONS (All dimensions in mm)

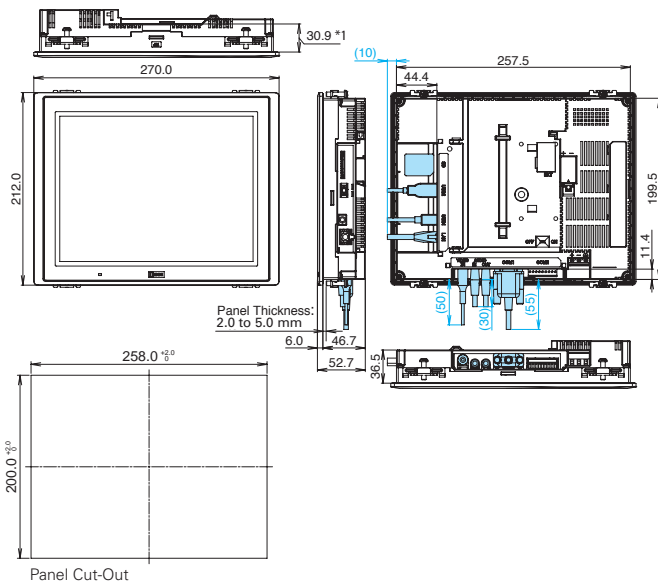
HG2G-V5 5.7"



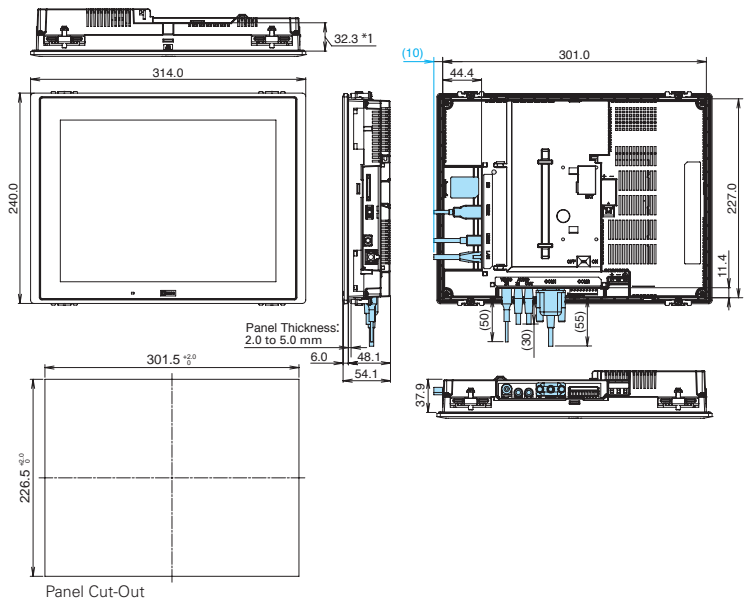
HG3G-V8 8.4"



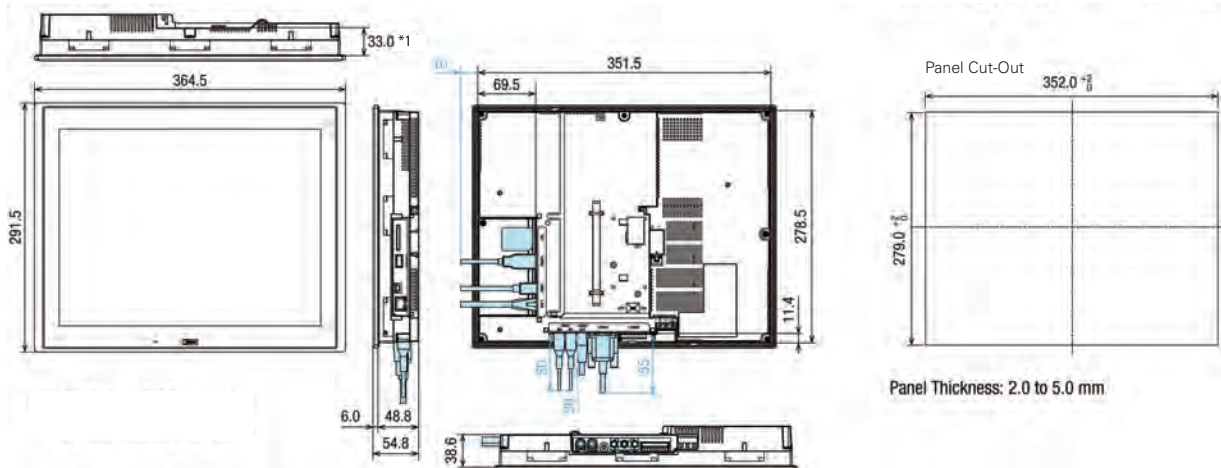
HG3G-VA 10.4"



HG4G-VC 12.1"



HG5G-VF 15"



*1) Depth from the expansion module mounting surface.

Note 1: Dimensions in blue show the mounting dimensions of the cable. Note 2: The tightening torque of HG2G-V5 is 0.2 to 0.3Nm and HG3G/4G/5G-V is 0.5 to 0.6Nm.

Note 3: Do not tighten with excessive force, otherwise the HG*G-V and screen may become distorted and waterproof characteristics may be lost.



Power supply CP-E 24/5.0

Primary switch mode power supply

The CP-E range offers enhanced functionality while the number of different types has been considerably reduced. Now all power supply units can be operated at an ambient temperature of up to +70 °C.



2CDC 271 024 F0008

Characteristics

- Rated output voltage 24 V DC
- Output voltage adjustable via front-face rotary potentiometer “OUTPUT Adjust”
- Rated output current 5 A
- Rated output power 120 W
- Supply range 115/230 V AC (90-132 V AC, 180-264 V AC, 210-375 V DC), auto select
- Typical efficiency of 86 %
- Low power dissipation and low heating
- Free convection cooling (no forced cooling with ventilators)
- Ambient temperature range during operation -35...+70 °C
- Open-circuit, overload and short-circuit stable
- Integrated input fuse
- Redundancy unit CP-A RU offering true redundancy, available as accessory
- Signalling contact “13-14” (solid-state) for output voltage OK
- LEDs for status indication

Approvals

- UL 508, CAN/CSA C22.2 No.107.1 ¹⁾
- ANSI/ISA-12.12, CAN/CSA C22.2 No. 213 (Class I, Div. 2, hazardous locations)
- UL 60950, CAN/CSA C22.2 No.60950 ¹⁾
- EAC
- CCC ¹⁾

¹⁾ Approval refers to rated input voltage U_n

Marks

- CE
- RCM

Order data

Type	Input voltage range	Rated output voltage / current	Order code
CP-E 24/5.0	90-132 V AC / 180-264 V AC 210-375 V DC	24 V DC / 5 A	1SVR 427 034 R0000

Order data – accessories

Type	Description	Order code
CP-A RU	Redundancy unit The CP-A RU provides decoupling of two CP-E power supply units ≤ 40 V and ≥ 5 A.	1SVR 427 071 R0000

Functions



- 1** OUTPUT L+, L-, L+, L-:
terminals – output
- 2** INPUT L, N, PE:
terminals – input
- 3** 13-14:
terminals – signalling contact
- 4** OUTPUT LOW:
red LED – output voltage too low
- 5** OUTPUT OK:
green LED – output voltage OK
- 6** OUTPUT Adjust:
potentiometer – adjustment of the output voltage
- 7** single/parallel:
sliding switch – adjustment of single or parallel operation
- 8** Circuit diagram

Application

The primary switch mode power supply offers two voltage input ranges. This enables the supply with AC or DC. Furthermore it is equipped with two generous capacitors, which ensure mains buffering of at least 30 ms (at 230 V AC). That is why the devices can be used worldwide also in high fluctuating networks and battery-powered plants.

Operating mode

By means of the potentiometer “OUTPUT Adjust” the output voltage can be adjusted within a range of 22.5 to 28.5 V DC. Thus, the power supply can be optimally adapted to the application, e.g. compensating the voltage drop caused by a long line length.

The green LED “OUTPUT OK” is lightening during proper operation.

The red LED “OUTPUT LOW” is lightening when the output voltage is too low.

Switch “single/parallel” for selection of single or parallel operation.

Signalling contact 13-14 (max. 60 V DC / 0.3 A) is ON when the output voltage is more than 75 %.



Technical data

Data at $T_a = 25\text{ °C}$, $U_{in} = 230\text{ V AC}$ and rated values, unless otherwise indicated

Input circuits

Supply circuits		
Rated input voltage U_{in}	L,N	115 / 230 V AC auto select
Input voltage range	AC	90-132 V, 180-264 V
	DC	210-375 V
Frequency range	AC	47-63 Hz
Typical input current	at 115 V AC	2.2 A
	at 230 V AC	0.83 A
Typical power consumption		140 W
Inrush current limiting	at 115 V AC	24 A (max. 5 ms)
	at 230 V AC	48 A (max. 5 ms)
Discharge current	input / output	0.25 mA
	input / PE	3.5 mA
Power failure buffering time	at 115 V AC	min. 25 ms
	at 230 V AC	min. 30 ms
Internal input fuse		3.15 A slow-acting / 250 V AC
Power factor correction (PFC)		yes, passive, 0.7

User interface

Indication of operational states		
Output voltage	OUTPUT OK: green LED	 : output voltage OK
	OUTPUT LOW: red LED	 : output voltage too low

Output circuit

Rated output voltage	L+, L+, L-, L-	24 V DC
Tolerance of the output voltage		0...+1 %
Adjustment range of the output voltage		22.5-28.5 V DC
Rated output power		120 W
Rated output current I_r	$T_a \leq 60\text{ °C}$	5 A
Derating of the output current	$60\text{ °C} < T_a \leq 70\text{ °C}$	2.5 %/°C
Signalling contact for output voltage OK	13-14	solid-state (max. 60 V DC, 0.3 A)
Minimum fuse rating to achieve short-circuit protection	13-14	$\geq 60\text{ V DC}$, $\leq 0.3\text{ A}$ fast-acting
Maximum deviation with	load change statical	$\pm 1\%$ (single mode)
		$\pm 5\%$ (parallel mode)
	change of output voltage within the input voltage range	$\pm 0.5\%$
Control time		< 2 ms
Starting time after applying the supply voltage	at I_r	max. 1 s
	with 3500 μF	max. 1.5 s
Rise time	at I_r	max. 150 ms
	with 3500 μF	max. 500 ms
Fall time		max. 150 ms
Residual ripple and switching peaks	BW = 20 MHz	50 mV
Parallel connection		configurable, to increase power, up to 3 devices, min. 0.1 I_r – max. 0.9 I_r
Series connection		yes, to increase voltage, max. 2 devices
Resistance to reverse feed		max. 35 V DC

Output circuit – no-load, overload and short-circuit behaviour

Characteristic curve of output	U/I characteristic curve
Short-circuit protection	continuous short-circuit proof
Short-circuit behaviour	continuation with output power limiting
Overload protection	output power limiting
No-load protection	continuous no-load stability
Starting of capacitive loads	3500 µF

General data

Power dissipation	typ. 20 W
Efficiency	typ. 86 %
Duty time	100 %
Dimensions (W x H x D)	63.2 x 123.6 x 123.6 mm (2.49 x 4.87 x 4.87 in)
Weight	1 kg (2.20 lb)
Material of housing	Plastic
Mounting	DIN rail (IEC/EN 60715), snap-on mounting without any tool
Mounting position	horizontal
Minimum distance to other units	horizontal / vertical 25 mm / 25 mm (0.98 in / 0.98 in)
Degree of protection	housing / terminals IP20 / IP20
Protection class	I

Electrical connection – input circuit / output circuit

Connecting capacity	fine-strand with wire end ferrule	0.2-4 mm² (24-11 AWG)
	fine-strand without wire end ferrule	0.2-6 mm² (24-10 AWG)
	rigid	
Stripping length		8 mm (0.31 in)
Tightening torque		1.0 Nm (9 lb.in) / 0.62 Nm (5.5 lb.in)

Environmental data

Ambient temperature range	operation	-35...+70 °C (-31...+158 °F)
	rated load	-35...+60 °C (-31...+140 °F)
	storage	-40...+85 °C (-40...+185 °F)
Damp heat		95 % RH, without condensation
Vibration (sinusoidal) (IEC/EN 60068-2-6)		10-500 Hz, 2 G, along X, Y, Z each axis, 60 min. for each axis
Shock (half-sine) (IEC/EN 60068-2-27)		15 G, 11 ms, 3 axis, 6 faces, 3 times for each face

Isolation data

Rated insulation voltage U_i	input / output	3 kV AC
	input / PE	1.5 kV AC
	output / PE	0.5 kV AC; 0.71 kV DC
	signalling contact / PE	0.5 kV DC
Pollution degree		2
Overvoltage category		II

Standards / Directives

Standards	IEC/EN 60950-1
Low Voltage Directive	2014/35/EU
Protective low voltage	SELV (IEC/EN 60950-1)
EMC Directive	2014/30/EU
RoHS Directive	2011/65/EU

Electromagnetic compatibility

Interference immunity to		IEC/EN 61000-6-2
electrostatic discharge	IEC/EN 61000-4-2	Level 4 (air discharge 15 kV / contact discharge 8 kV)
radiated, radio-frequency, electromagnetic field	IEC/EN 61000-4-3	Level 3 (10 V/m)
electrical fast transient / burst	IEC/EN 61000-4-4	Level 4 (4 kV / 5 kHz)
surge	IEC/EN 61000-4-5	L-L Level 3 (2 kV) / L-PE Level 4 (4 kV)
conducted disturbances, induced by radio-frequency fields	IEC/EN 61000-4-6	Level 3 (10 V)
power frequency magnetic fields	IEC/EN 61000-4-8	Level 4 (30 A/m)
voltage dips, short interruptions and voltage variations	IEC/EN 61000-4-11	dip: >95 % 10 ms / >30 % 500 ms interruptions: >95 % 5000 ms
Interference emission		IEC/EN 61000-6-3
high-frequency radiated	IEC/CISPR 22, EN 55022	Class B
high-frequency conducted	IEC/CISPR 22, EN 55022	Class B
limits for harmonic current emissions	IEC/EN 61000-3-2	Class D

8-Port Ethernet Switch

Unmanaged Industrial Ethernet Switch

Section 2.1.4 Ethernet Switch



EtherNet/IP®

PRODUCT DESCRIPTION

The 8-port unmanaged Ethernet switch is now equipped with the features of managed Ethernet switch.

Designed to meet all communication requirements! The SX5E series of 8-port unmanaged switch supports the IGMP snooping function and QoS function, which automatically prioritizes EtherNet/IP packets. With an industrial-grade design, rugged metal housing and extreme operating temperature, this switch is suitable for industrial applications in harsh environmental conditions.

SPECIFICATIONS

Rated Input Voltage	24V DC, 24V AC
Voltage Tolerance	12-48V DC, 18-30V AC
Power Consumption	4.1W
Ethernet Standard	IEEE802.3u (10BASE-TX)/IEEE802.3i (10BASE-T) compliant
Data Transfer Speed	10Mbps/100Mbps (Auto-negotiation function)
Communication Method	All ports full/half duplex (Auto-negotiation function)
Number of Ports	8
Frame Transfer Method	Store and forward
Throughput	1.2Mpps
Address Table	2,048 entries
Buffer Size	4Mbits
EMI/EMS	<ul style="list-style-type: none">• FCC CFR47 Part 15, EN55022, CISPR22, Class A• Electrostatic discharge: ±6kV (contact), ±8kV (air) (IEC61000-4-2)• Radiation electromagnetic field: 10V/m (80MHz-2GHz), 3V/m (2GHz-2.7GHz) (IEC61000-4-3)• FTB: ±2kV (Power Port), ±1kV (Data Port) (IEC61000-4-4)• Lighting surge: ±1kV/DM, ±2kV/CM (Power Port), ±1kV (Data Port) (IEC61000-4-5)• RF conducted immunity: 10V (150kHz-80MHz) (IEC61000-4-6)
Vibration Resistance	5Hz to 9Hz: 3.5mm, 9Hz to 150Hz: 2.0G (IEC60068-2-6)
Shock Resistance	150m/s ² 11ms (IEC60068-2-27)
Operating Temperature	-40 to +75°C (no freezing)
Operating Humidity	5 to 95% RH (no condensation)
Storage Temperature	-40 to +85°C (no freezing)
Mounting	DIN rail/panel mounting (*1)
Degree of Protection	IP30
Weight (approx.)	250g

*1: Optional accessory is necessary for panel mounting.

KEY FEATURES

- 8-Port 10/100Mbps Fast Ethernet
- Supports QoS Function
- Supports IGMP Snooping Function
- Extreme Operating Temperature Range: -40 to +75 °C
- Redundant Power Input Design
- Broadcast Storm Protection
- Rugged Metal Housing
- IP30 Protection
- UL Class I Div 2 Certified (July 2021)



SX5E Ethernet Switch

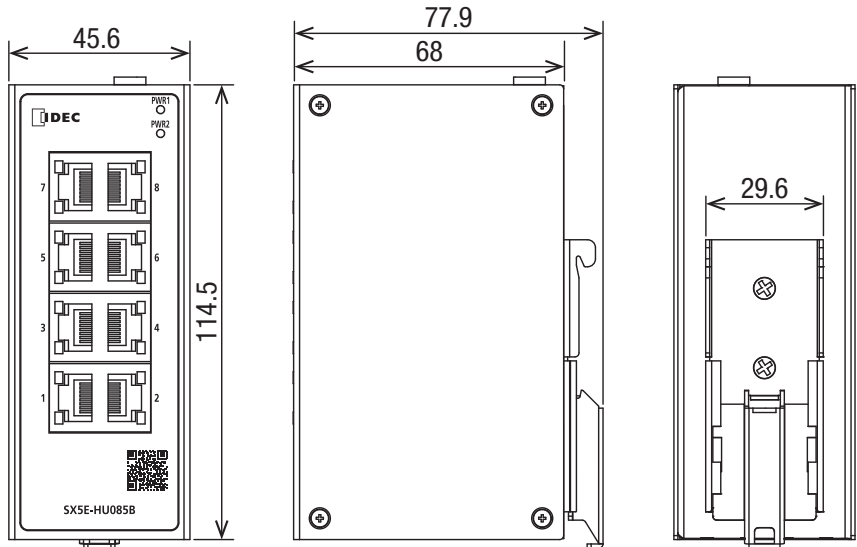
PART NUMBERS

Model	Part Number
8 port Ethernet Switch	<div>SX5E-HU085B</div>

ACCESSORIES

Model	Part Number	Package Quantity
RJ45 connector cover (IP30) 	SX9Z-CAP2PN02	2
Direct mounting bracket 	SX9Z-1A01	1
Power Supply Terminal Block 	SX9Z-PMTD04PN02	2

DIMENSIONS (mm)



ALSO AVAILABLE IN 5-PORT STANDARD MODEL



SX5E 5-PORT UNMANAGED INDUSTRIAL ETHERNET SWITCH

Fast with compact industrial-grade design and rugged metal housing.



IDEC Corporation • 1175 Elko Drive • Sunnyvale, CA 94089 • 800-262-IDEC (4332) • Fax: 408-745-5258 • www.IDEC.com/usa

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MAX BR1 Mini Industrial-Grade 4G LTE Router



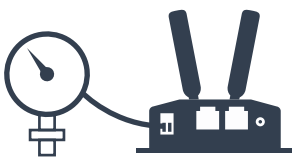
Rugged 4G LTE Router with Add-On Automatic Failover

The BR1 Mini offers redundant SIM slots with automatic switching, DC or terminal block power capability, advanced GPS fleet tracking, and remote management, all packed into a durable metal enclosure.

Compatible With:



*Selected models



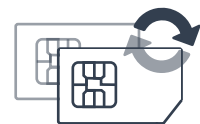
Out of Band Management, IOT, and M2M Telemetry

Manage and configure your networking devices securely even if the primary line is not available. Gather data from meters, sensors and other remote equipment via RS-232 serial port adapter.



Add-On WAN Capabilities

The MAX BR1 Mini has an optional license that enables Ethernet and Wi-Fi WAN for failover between different WAN connections.



Redundant SIM Slots for Multiple Carriers

Redundant SIM slots with automatic switching for reliable networking. You can set the BR1 Mini to automatically switch SIM cards when you're about to exceed a data cap. It also allows you travel across borders without changing SIM cards manually.



Support for T-Mobile (Band 12) and Sprint* (Band 26)

The BR1 Mini LTE-A supports Band 12 (700 Mhz) for T-Mobile and Band 26 (850 Mhz) for Sprint*. These bands penetrate buildings extremely well and also cover longer distances.



Fleet Tracking and Management

With built-in GPS fleet tracking and InControl cloud-based management, you can keep tabs on location and manage your mobile network from any Internet-connected device.



Terminal Block for Secure Power Supply

The MAX BR1 Mini is equipped with a terminal block for secure power installation in vehicles and other locations.

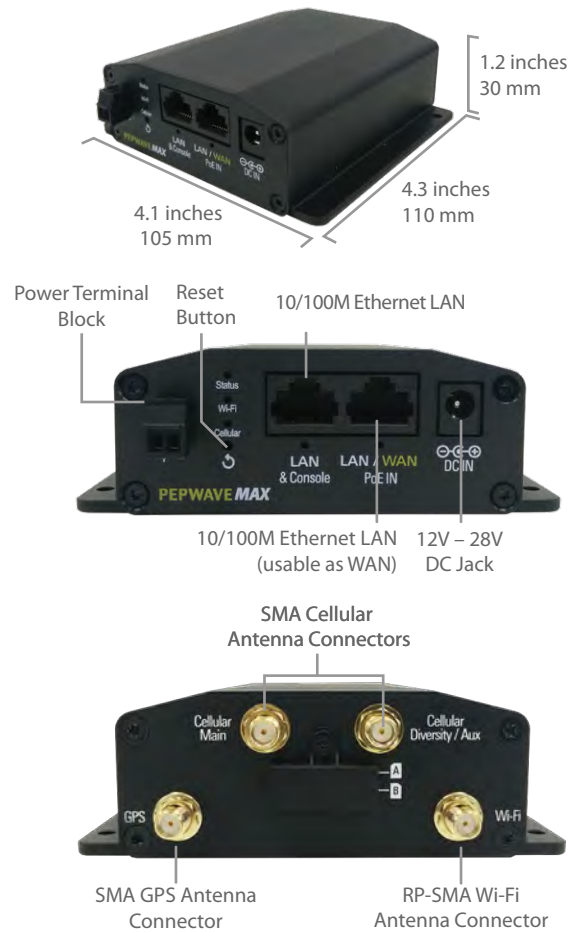
* Sprint Certification Pending

MAX BR1 Mini

Industrial-Grade 4G LTE Router

Specifications

	MAX BR1 Mini
WAN Interface	1x 10/100M Ethernet Port 1x Embedded LTE Modem with Redundant SIM Slot
LAN Interface	1x 10/100M Ethernet Port
Wi-Fi Interface	802.11b/g/n Wi-Fi WAN or AP
Router Throughput	100 Mbps
Recommended Users	60
LTE Modem	Downlink/Uplink Datarate: 150Mbps/50Mbps
LTE-A Modem	Downlink/Uplink Datarate: 300Mbps/50Mbps
Cellular and GPS Antenna Connector	2x SMA Antenna Connectors 1x SMA GPS Antenna Connector 1x Wi-Fi Connector
Power Input	DC Jack/Terminal Block: 12V – 28V DC Passive PoE Input (WAN Port, 12V – 28V DC)
Power Consumption	12W (max.)
Dimensions	4.1 x 4.3 x 1.2 inches 105 x 110 x 30 mm
Weight	0.54 pound 244 grams
Operating Temperature	-40° – 149°F -40° – 65°C
Humidity	15% – 95% (non-condensing)
Certifications	FCC, CE, RoHS, E-Mark, IC, EN 61373: Shock and Vibration Resistance, EN 50155: Railway Applications - Electronic Equipment used on Rolling Stock, EN 61000: Electromagnetic Compatibility
Warranty	1-Year Limited Warranty



Ordering Information

	Product Code	Carrier/Region	Embedded Modem	Standard	4G Bands	3G Bands
LTE	MAX-BR1-MINI-LTE-US-T	United States	1	LTE Cat. 4	B2, B4, B5, B12, B13	HSPA+: B2, B5
	MAX-BR1-MINI-LTE-E-T	Europe/International	1	LTE Cat. 4	4G LTE: B1, B3, B5, B7, B8, B20, B38 (TDD), B40(TDD), B41 (TDD)	WCDMA/HSPA+/DC-HSPA+: B1, B5, B8
LTEA	MAX-BR1-MINI-LTEA-W-T	Americas/EMEA	1	LTE Cat. 6	4G LTE-A: B1, B2, B3, B4, B5, B7, B8, B12, B13, B20, B25, B26, B29, B30, B41	2500WCDMA/HSPA+/DC-HSPA+: B1, B2, B3, B4, B5, B8
	MAX-BR1-MINI-LTEA-P-T	Asia Pacific	1	LTE Cat. 6	B1, B3, B5, B7, B8, B18, B19, B21, B28, B38, B39, B40, B41	WCDMA/HSPA+/DC-HSPA+: B1, B5, B6, B8, B9, B19 TD-SCDMA: B39

Product Code	Description
MAX-BR1-MINI-LC-FS	Failover software license and related feature set for BR1-MINI, enables Ethernet and Wi-Fi WAN.
ACW-102	PoE injector for delivering passive PoE power to the BR1 Mini

Section 2.1.6 Battery

WERKER **WKA12-26NB** 12V 26AH BATTERY SPS BRAND

SPECS

- AJC® Replacement Batteries
- Part # AJC-D26S
- Voltage: 12V (12 Volts)
- Capacity: 26Ah
- Terminals: NB
- Chemistry: Sealed Lead Acid (AGM)
- Length 6.5 in
- Width 6.89 in
- Height 5 in
- Weight: 18.7 lbs



2.2

Motor Controls

FR-F800 Product Details

FR-F800-E Series

The FR-F800-E is a pump and fan control VFD that combines performance, accuracy and reliability with embedded Ethernet based communications to enhance overall system flexibility. With 100Mbps Ethernet TCP/IP and BACnet/IP connectivity as the standard, the FR-F800-E provides an increased ability for remote system monitoring, parameter adjustments and easy integration into an existing network environments.

- **NEMA 1 / UL-1 Rated:** FR-F800 is Plenum-Rated and can be mounted as a stand-alone unit when required – no need to provide a separate enclosure*
- **Ethernet Communications as Standard:** Communicate with Modbus TCP/IP or CC-Link IE Field Basic communications networks at a speed of 100Mbps without the need for an extra option card.
- **Built-in Filter:** Limits the effects of radio noise on sensitive equipment
- **Drive to Drive Communications:** Utilize the internal PLC to communicate without a master PLC controller allowing the drives to work together as a team.
- **Optimum Excitation Control:** FR-F800 uses vector drive technology to calculate motor load and ensures maximum energy savings, even if motor loading changes
- **3 Programmable Skip Frequencies:** Avoid points of mechanical resonance in ducting and pipework.
- **Drive Settings can be Uploaded or Downloaded:** Using a standard USB memory stick
- **Real-time Clock:** Drive trip messages are 'time stamped' for diagnostic purposes**
- **Bi-Directional Coasting Motor Restart:** FR-F800 can safely 'catch' and control a motor which is already spinning (in either direction) on start-up.
- **Advanced PID Control Features:**
 - 2 Independent PID loops
 - Pre-Charge Mode
 - Sleep Mode
 - Multiple Motor control (up to 4)
 - Selectable response to 'loss of signal'
- **Control of high efficiency IPM motors**
- **Advanced Power Monitoring Capability:** Including pulse train output
- **UL-Approved Rating:** For single phase operation (coming soon)
- **Out-of-Range Warning System:** Detects broken drive belts and other potential mechanical problems
- **Automatic IP Address Detection:** Automatically detect the IP address of all connected drives, quickly enabling connection and programming using FR-Configurator software.
- **Remote Operation:** Communicate with a drive remotely for commissioning, monitoring or troubleshooting anytime from anywhere.



Notes

* Drive Sizes up to 40HP

** Requires the use of the FR-LU08 keypad

FR-F800 Ratings, 240V Class

Model Number	AMPS for Duty		HP For Duty (NEC)		Frame Size	Weight (lbs)	Cooling Method	Protective Rating	Stocked Item
	SLD	LD	SLD	LD					
FR-F820-00046-E3N6	4.6	4.2	1	1	A	6	Self-Cooling	UL Type 1- Plenum Rated	S
FR-F820-00077-E3N6	7.7	7	2	2	B	6			S
FR-F820-00105-E3N6	10.5	9.6	3	3	C	9	S		
FR-F820-00167-E3N6	16.7	15.2	5	5	C	9	S		
FR-F820-00250-E3N6	25	23	7.5	7.5	C	9	S		
FR-F820-00340-E3N6	34	31	10	10	D	17	S		
FR-F820-00490-E3N6	49	45	20	15	D	17	S		
FR-F820-00630-E3N6	63	58	20	20	E	20	S		
FR-F820-00770-E3N6	77	70.5	25	25	F	37	S		
FR-F820-00930-E3N6	93	85	30	30	F	37	S		
FR-F820-01250-E3N6	125	114	40	40	F	37	S		
FR-F820-01540-E360	154	140	60	50	G	48	Forced Air Cooling	IP00	S
FR-F820-01870-E360	187	170	60	60	H	92			S
FR-F820-02330-E360	233	212	75	75	H	92			S
FR-F820-03160-E360	316	288	125	100	K	119			S
FR-F820-03800-E3U6	380	346	150	125	L	163			S
FR-F820-04750-E3U6	475	432	150	150	L	163			-

Note: Drives in Shaded Area MUST be used together with FR-HEL DC Link Choke (sold separately).

SLD - 100% 60s, 120% 3s (inverse-time characteristics) at ambient temperature of 40°C.

LD - 120% 60s, 150% 3s (inverse-time characteristics) at ambient temperature of 50°C.

FR-HEL DC Link Chokes (sold separately)

Model Number	LD	SLD
FR-F820-03160-E360	FR-HEL-75K	FR-HEL-90K
FR-F820-03800-E3U6	FR-HEL-90K	FR-HEL-110K
FR-F820-04750-E3U6	FR-HEL-110K	FR-HEL-110K

FR-F800-E Ratings, 480V Class

Model Number	AMPS for Duty		HP For Duty (NEC)		Frame Size	Weight (lbs) (*1)	Cooling Method	Protective Rating	Stocked Item
	SLD	LD	SLD	LD					
FR-F840-00023-E3N6	2.3	2.1	1	1	C	8	Self - Cooling	UL Type 1 – Plenum Rated	S
FR-F840-00038-E3N6	3.8	3	2	2	C	8			S
FR-F840-00052-E3N6	5.2	4.8	3	3	C	8			S
FR-F840-00083-E3N6	8.3	7.6	5	5	C	9			S
FR-F840-00126-E3N6	12.6	11.5	7.5	7.5	C	9			S
FR-F840-00170-E3N6	17	16	10	10	D	17	Forced Air Cooling		S
FR-F840-00250-E3N6	25	23	15	15	D	17			S
FR-F840-00310-E3N6	31	29	20	20	E	20			S
FR-F840-00380-E3N6	38	35	25	25	E	20			S
FR-F840-00470-E3N6	47	43	30	30	F	37			S
FR-F840-00620-E3N6	62	57	40	40	F	37		S	
FR-F840-00770-E360	77	70	60	50	G	51		IP00	S
FR-F840-00930-E360	93	85	60	60	H	90			S
FR-F840-01160-E360	116	106	75	75	H	90			S
FR-F840-01800-E360	180	144	150	100	H	95			S
FR-F840-02160-E3U6	216	180	150	150	J	114			S
FR-F840-02600-E3U6	260	216	200	150	J	121			S
FR-F840-03250-E3U6	325	260	250	200	L	156			S
FR-F840-03610-E3U6	361	325	300	250	L	172			S
FR-F840-04320-E3U6	432	361	350	300	M	257			S
FR-F840-04810-E3U6	481	432	400	350	M	257			S
FR-F840-05470-E3U6	547	481	450	400	N	365			S
FR-F840-06100-E3U6	610	547	500	450	N	365	S		
FR-F840-06830-E3U6	683	610	550	500	N	365	S		

Note 1: Weights of the drive and the CC2 modules are COMBINED. Drives in Shaded Area MUST be used together with FR-HEL-H DC Link Choke (sold separately)

Model Number	AMPS for Duty		HP For Duty (NEC)		Frame Size	Weight (lbs) (*1)	Cooling Method	Protective Rating	Stocked Item
	SLD	LD	SLD	LD					
FR-F842-07700-E3U6 + FR-CC2-H355K-60	-	683	-	550	P+R	827	Forced Air Cooling	IP00	S
FR-F842-07700-E3U6 + FR-CC2-H400K-60	770	-	650	-	P+S	979			S
FR-F842-08660-E3U6 + FR-CC2-H400K-60	-	770	-	650	P+S	979			S
FR-F842-08660-E3U6 + FR-CC2-H450K-60	866	-	700	-	P+S	986			S
FR-F842-09620-E3U6 + FR-CC2-H450K-60	-	866	-	700	Q+S	1162			S
FR-F842-09620-E3U6 + FR-CC2-H500K-60	962	-	800	-	Q+S	1168			S
FR-F842-10940-E3U6 + FR-CC2-H500K-60	-	962	-	800	Q+S	1168			S
FR-F842-10940-E3U6 + FR-CC2-H560K-60	1094	-	900	-	Q+S	1168			S
FR-F842-12120-E3U6 + FR-CC2-H560K-60	-	1094	-	900	Q+S	1168			S
FR-F842-12120-E3U6 + FR-CC2-H630K-60	1212	-	1000	-	Q+S	1168			S

Note: Weights of the drive and the CC2 modules are COMBINED. Drives in Shaded Area MUST be used together with FR-HEL-H DC Link Choke (sold separately).

SLD- 100% 60s, 120% 3s (inverse-time characteristics) at ambient temperature of 40°C

LD- 120% 60s, 150% 3s (inverse-time characteristics) at ambient temperature of 50°C

Always install the FR-CC2-H converter unit (not required when the FR-HC2 high power factor converter is used)

FR-F800-E Ratings, 600V Class

Model Number (*3)	AMPS for Duty		Horsepower for Duty (NEC)		Frame Size	Weight (lbs)	Cooling Method	Protective Rating	Stocked Item
	SLD	LD	SLD	LD					
FR-F860-00027-E3N6	2.7	2.5	2	1.5	C	11.7	Self Cooling	Enclosed Type (UL-1 plenum rated)	S
FR-F860-00061-E3N6	6.1	5.6	5	3	C	12.8			S
FR-F860-00090-E3N6	9	8.2	7.5	5	C	12.8			S
FR-F860-00170-E3N6	17	16	15	10	D	15.4			S
FR-F860-00320-E3N6	32	27	30	25	E	19.8			S
FR-F860-00450-E3N6	45	41	40	40	F	37.4	Forced Air Cooling	Open Type (IP00)	S
FR-F860-00680-E360	68	62	60	60	H	79.2			S
FR-F860-01080-E360 (*1)	108	99	100	100	H	90.2			S
FR-F860-01440-E360 (*1)	144	131	150	125	J	114			S
FR-F860-01670-E360 (*1)	167	152	150	150	J	114			S
FR-F860-02430-E360 (*1)	243	221	250	200	J	121			S
FR-F860-02890-E360 (*1)	289	255	300	250	M	246			S
FR-F860-03360-E360 (*1)	336	304	350	300	M	253			S
FR-F860-04420-E360 (*1)	442	402	450	400	N	337			S
FR-F862-05450-E360 + FR-CC2-C355K-60 (*2)	545	496	550	500	P+R	810			S
FR-F862-06470-E360 + FR-CC2-C400K-60 (*2)	647	589	650	600	Q+S	920			S
FR-F862-08500-E360 + FR-CC2-C560K-60 (*2)	850	773	850	750	Q+S	1126	S		

480V FR-HEL-H DC Link Chokes (sold separately)

Model Number	LD	SLD
FR-F840-01800-E360	FR-HEL-H75K	FR-HEL-H90K
FR-F840-02160-E3U6	FR-HEL-H90K	FR-HEL-H110K
FR-F840-02600-E3U6	FR-HEL-H110K	FR-HEL-H132K
FR-F840-03250-E3U6	FR-HEL-H132K	FR-HEL-H160K
FR-F840-03610-E3U6	FR-HEL-H160K	FR-HEL-H185K
FR-F840-04320-E3U6	FR-HEL-H185K	FR-HEL-H220K
FR-F840-04810-E3U6	FR-HEL-H220K	FR-HEL-H250K
FR-F840-05470-E3U6	FR-HEL-H250K	FR-HEL-H280K
FR-F840-06100-E3U6	FR-HEL-H280K	FR-HEL-H315K
FR-F840-06830-E3U6	FR-HEL-H315K	FR-HEL-H355K

600V FR-HEL-C DC Link Chokes (sold separately)

Model Number	SLD	LD
FR-F860-01080-E360	FR-HEL-C75K	FR-HEL-C75K
FR-F860-01440-E360	FR-HEL-C90K	FR-HEL-C90K
FR-F860-01670-E360	FR-HEL-C110K	FR-HEL-C110K
FR-F860-02430-E360	FR-HEL-C185K	FR-HEL-C132K
FR-F860-02890-E360	FR-HEL-C220K	FR-HEL-C185K
FR-F860-03360-E360	FR-HEL-C280K	FR-HEL-C220K
FR-F860-04420-E360	FR-HEL-C280K	FR-HEL-C280K

Notes:

1. These drives MUST be used with a DC Link Choke (sold separately).
2. FR-F862 Drives are inverter stage only; use together with FR-CC2-C rectifier stage. Maximum Input and Output Current of FR-CC2 modules is the value shown. COMBINED weight shown.
3. The FR-F860 does not include a built-in parameter unit. The FR-DU08 or FR-LU08 is sold separately.

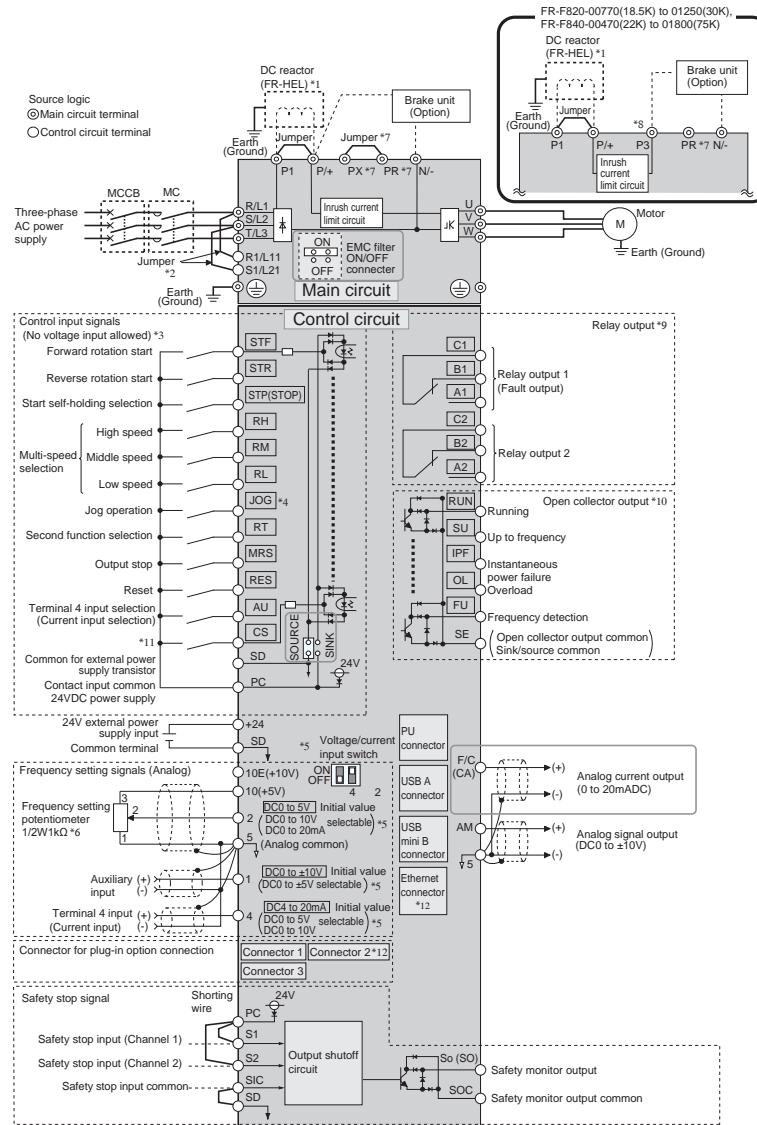
FR-F800-E General Specifications

Operation Specifications	Control Method		Soft-PWM control, high carrier frequency PWM control (selectable among V/F control (Optimum excitation control), Advanced magnetic flux vector control (Advanced optimum excitation control) and PM motor control)
	Output Frequency Range		0.2 to 590 Hz (The upper-limit frequency is 400 Hz under Advanced magnetic flux vector control, and PM motor control.)
	Frequency Setting Resolution	Analog Input	0.015 Hz/60 Hz (terminal 2, 4: 0 to 10 V/12 bits) 0.03 Hz/60 Hz (0 to 5 V/11 bits or 0 to 20 mA/approx. 11 bits for terminals 2 and 4, 0 to ±10 V/12 bits for terminal 1) 0.06 Hz/60 Hz (0 to ±5 V/11 bits for terminal 1)
		Digital Input	0.01Hz
	Frequency Accuracy	Analog Input	Within ±0.2% of the max. output frequency (25°C ±10°C)
		Digital Input	Within 0.01% of the set output frequency
	Voltage / Frequency Characteristics		Base frequency can be set from 0 to 590 Hz. Constant-torque/variable-torque pattern or adjustable 5 points V/F can be selected.
	Starting Torque	Induction Motor	120% 0.5 Hz (Advanced magnetic flux vector control)
		IPM Motor	50%
	Torque Boost		Manual torque boost
	Acceleration / Deceleration Time Setting		0 to 3600 s (acceleration and deceleration can be set individually), linear or S-pattern acceleration/deceleration mode, backlash countermeasures acceleration/deceleration can be selected.
	DC Injection Brake (Induction Motor)		Operation frequency (0 to 120 Hz), operation time (0 to 10 s), operation voltage (0 to 30%) variable
	Stall Prevention Operation Level		Activation range of stall prevention operation (SLD rating: 0 to 120%, LD rating: 0 to 150%). Whether to use the stall prevention or not can be selected. (V/F control, Advanced magnetic flux vector control)
	Frequency Setting Signal	Analog Input	Terminals 2 and 4: 0 to 10 V, 0 to 5 V, 4 to 20 mA (0 to 20 mA) are available. Terminal 1: -10 to +10 V, -5 to 5 V are available.
		Digital Input	Input using the setting dial of the operation panel or the parameter unit. Four-digit BCD or 16-bit binary (when used with option FR-A8AX)
Start Signal		Forward and reverse rotation or start signal automatic self-holding input (3-wire input) can be selected.	
Input Signal		Low-speed operation command, Middle-speed operation command, High-speed operation command, Second function selection, Terminal 4 input selection, Jog operation selection, Output stop, Start self-holding selection, Forward rotation command, Reverse rotation command, Inverter reset The input signal can be changed using Pr.178 to Pr.189 (Input terminal function selection).	
Pulse Train Input		100kpps	
Operational Functions		Maximum and minimum frequency settings, multi-speed operation, acceleration/deceleration pattern, thermal protection, DC injection brake, starting frequency, JOG operation, output stop (MRS), stall prevention, regeneration avoidance, increased magnetic excitation deceleration, DC feeding (*1), frequency jump, rotation display, automatic restart after instantaneous power failure, electronic bypass sequence, remote setting, retry function, carrier frequency selection, fast response current limit, forward/reverse rotation prevention, operation mode selection, slip compensation, speed smoothing control, traverse, auto tuning, applied motor selection, RS-485 communication, Ethernet communication, PID control, PID pre-charge function, cooling fan operation selection, stop selection (deceleration stop/coasting), power-failure deceleration stop function, PLC function, life diagnosis, maintenance timer, current average monitor, multiple rating, test run, 24 V power supply input for control circuit, safety stop function, self power management, BACnet communication, PID gain tuning, cleaning, load characteristics storage, emergency drive (*1)	
Output Signals	Open Collector Output (Five Terminals) Relay Output (Two Terminals)	Inverter running, Up to frequency, Instantaneous power failure/undervoltage (*1), Overload warning, Output frequency detection, Fault. The output signal can be changed using Pr.190 to Pr.196 (Output terminal function selection). Fault codes of the inverter can be output (4 bits) from the open collector.	
	Pulse Train Output (FM Type)	50 kpps	
Indication	For Meter	Pulse Train Output (FM Type)	Max. 2.4 kHz: one terminal (output frequency) The monitored item can be changed using Pr.54 FM/CA terminal function selection.
		Current Output (CA Type)	Max. 20 mADC: one terminal (output frequency) The monitored item can be changed using Pr.54 FM/CA terminal function selection.
		Voltage Output	Max. 10 VDC: one terminal (output frequency) The monitored item can be changed using Pr.158 AM terminal function selection.
	Operation Panel (FR-DU08)	Operating Status	Output frequency, output current, output voltage, frequency setting value The monitored item can be changed using Pr.52 Operation panel main monitor selection.
		Fault Record	Fault record is displayed when a fault occurs. Past 8 fault records and the conditions immediately before the fault (output voltage/current/frequency/cumulative energization time/year/month/date/time) are saved.
Protective / Warning Function		Overcurrent trip during acceleration, Overcurrent trip during constant speed, Overcurrent trip during deceleration or stop, Regenerative overvoltage trip during acceleration, Regenerative overvoltage trip during constant speed, Regenerative overvoltage trip during deceleration or stop, Inverter overload trip (electronic thermal relay function), Motor overload trip (electronic thermal relay function), Heatsink overheat, Instantaneous power failure (*1) Undervoltage (*1), Input phase loss (*1, *2), Stall prevention stop, Loss of synchronism detection (*2), Upper limit fault detection, Lower limit fault detection, Brake transistor alarm detection(*1), Output side earth (ground) fault overcurrent, Output short circuit, Output phase loss, External thermal relay operation (*2), PTC thermistor operation (*2), Option fault, Communication option fault, Parameter storage device fault, PU disconnection, Retry count excess (*2), CPU fault, Operation panel power supply short circuit, 24 VDC power fault, Abnormal output current detection (*2), Inrush current limit circuit fault (*1) Ethernet communication fault (*2), Analog input fault, USB communication fault, Safety circuit fault, Overspeed occurrence (*2), 4 mA input fault (*2), Pre-charge fault (*2), PID signal fault (*2), Internal circuit fault, User definition error in the PLC function. Fan alarm, Stall prevention (overcurrent), Stall prevention (overvoltage), Regenerative brake pre-alarm (*1, *2), Electronic thermal relay function pre-alarm, PU stop, Parameter copy, Safety stop, Maintenance timer 1 to 3 (*2), USB host error, Operation panel lock (*2), Password locked (*2), Parameter write error, Copy operation error, 24 V external power supply operation, Load fault warning, Emergency drive in operation (*1), Continuous operation during communication fault, Ethernet communication fault	
Environment	Ambient Temperature		-10°C to +50°C (non-freezing) (LD rating) -10°C to +40°C (non-freezing) (SLD rating)
	Ambient Humidity		With circuit board coating (conforming to IEC60721-3-3 3C2/3S2): 95% RH or less (non-condensing) Without circuit board coating: 90% RH or less (non-condensing)
	Storage Temperature (*3)		-20°C to +65°C
	Atmosphere		Indoors (without corrosive gas, flammable gas, oil mist, dust and dirt, etc.)
	Altitude / Vibration		Maximum 1000 m above sea level (*4), 5.9 m/s² or less (*5) at 10 to 55 Hz (directions of X, Y, Z axes)

Notes:

1. Available only for the standard model.
2. This protective function is not available in the initial status.
3. Temperature applicable for a short time, e.g. in transit.
4. For the installation at an altitude above 1,000 m (up to 2,500 m), derate the rated current 3% per 500 m.
5. 2.9 m/s² or less for the FR-F840-04320(185K) or higher.

FR-F800 Series Terminal Connection Diagram (Version with 0-20mA Analog Output Signal) CA Type



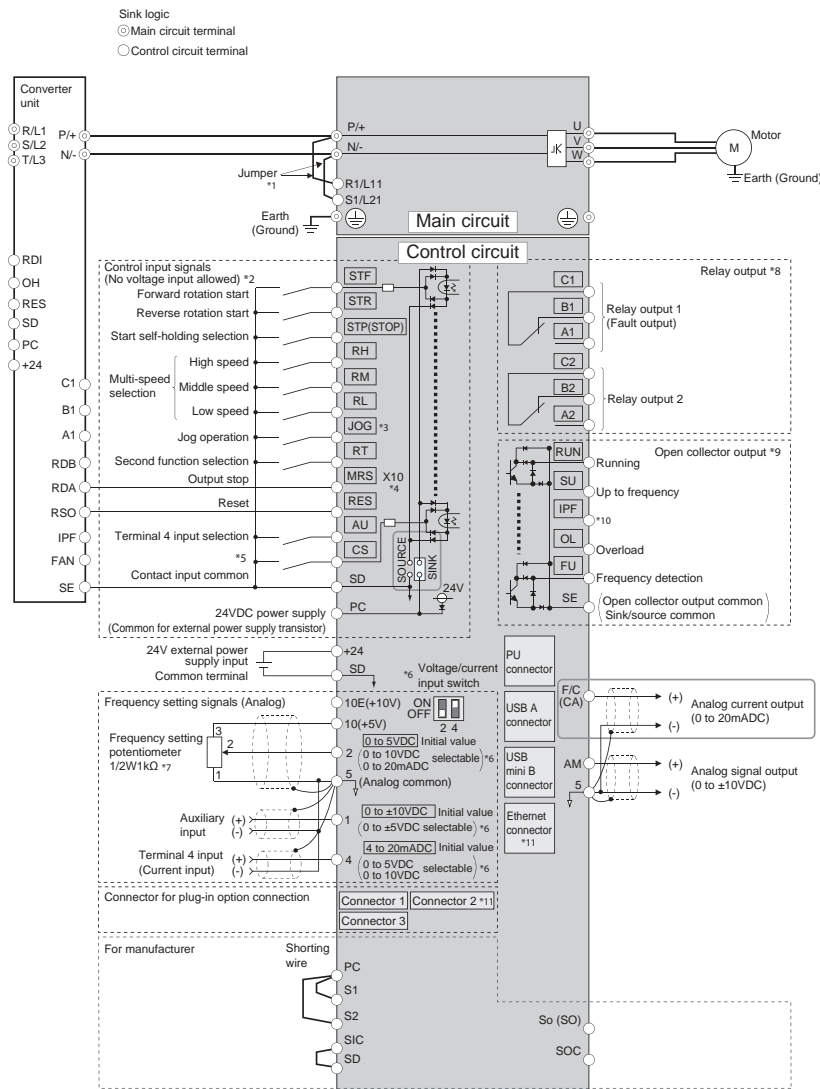
Notes:

- For the FR-F820-03160(75K) or higher, the FR-F840-01800(75K) or higher, always connect a DC reactor (FR-HEL), which is available as an option. (To select a DC reactor, refer to the User Guide, and select one according to the applicable motor capacity.) When a DC reactor is connected to the FR-F820-02330(55K) or lower or the FR-F840-01160(55K) or lower, if a jumper is installed across terminals P1 and P/+, remove the jumper before installing the DC reactor.
- When using separate power supply for the control circuit, remove the jumper between R1/L11 and S1/L21.
- The function of these terminals can be changed with the input terminal assignment (Pr.178 to Pr.189).
- Terminal JOG is also used as the pulse train input terminal. Use Pr.291 to choose JOG or pulse.
- Terminal input specifications can be changed by analog input specification switchover (Pr.73, Pr.267). To input a voltage, set the voltage/current input switch OFF. To input a current, set the voltage/current input switch ON. Terminals 10 and 2 are also used as a PTC input terminal. (Pr.561) (Refer to the FR-F800 Instruction Manual (Detailed).)
- It is recommended to use 2 W 1 kΩ when the frequency setting signal is changed frequently.
- Do not use terminals PR and PX. The jumper may or may not be attached depending on the inverter.
- Do not connect the DC power supply (under DC feeding mode) to terminal P3.
- The function of these terminals can be changed with the output terminal assignment (Pr.195, Pr.196).
- The function of these terminals can be changed with the output terminal assignment (Pr.190 to Pr.194).
- No function is assigned in the initial status. Assign the function using Pr.186 CS terminal function selection.
- The option connector 2 cannot be used because the Ethernet board is installed in the initial status. The Ethernet board must be removed to install a plug-in option to the option connector 2. (However, Ethernet communication is disabled in that case.)

ADDITIONAL NOTES:

- To prevent a malfunction due to noise, keep the signal cables 10 cm or more away from the power cables. Also, separate the main circuit cables at the input side from the main circuit cables at the output side.
- After wiring, wire offcuts must not be left in the inverter. Wire offcuts can cause an alarm, failure or malfunction. Always keep the inverter clean. When drilling mounting holes in an enclosure etc., take caution not to allow chips and other foreign matter to enter the inverter.
- Set the voltage/current input switch correctly. Incorrect setting may cause a fault, failure or malfunction.

FR-F802 Series Terminal Connection Diagram (Version with 0-20mA Analog Output Signal)



Notes:

- Terminals R1/L11 and S1/L21 are connected to terminals P/+ and N/- with a jumper respectively. When using separate power supply for the control circuit, remove the jumpers from R1/L11 and S1/L21.
- The function of these terminals can be changed with the input terminal assignment (Pr.178 to Pr.189).
- Terminal JOG is also used as the pulse train input terminal. Use Pr.291 to choose JOG or pulse.
- The X10 signal (NC contact input specification) is assigned to the terminal MRS in the initial setting. Set Pr.599 = "0" to change the input specification of the X10 signal to NO contact.
- No function is assigned in the initial setting. Use Pr.186 for function assignment.
- Terminal input specifications can be changed by analog input specification switchover (Pr.73, Pr.267). To input a voltage (0 to 5 V/0 to 10 V), set the voltage/current input switch OFF. To input a current (4 to 20 mA), set the voltage/current input switch ON. Terminals 10 and 2 are also used as a PTC input terminal. (Pr.561)
- It is recommended to use 2 W 1 kΩ when the frequency setting signal is changed frequently.
- The function of these terminals can be changed with the output terminal assignment (Pr.195, Pr.196).
- The function of these terminals can be changed with the output terminal assignment (Pr.190 to Pr.194).
- No function is assigned in the initial setting. Use Pr.192 for function assignment.
- The option connector 2 cannot be used because the Ethernet board is installed in the initial status. The Ethernet board must be removed to install a plug-in option to the option connector 2. (However, Ethernet communication is disabled in that case.)

ADDITIONAL NOTES

- To prevent a malfunction due to noise, keep the signal cables 10 cm or more away from the power cables. Also, separate the main circuit cables at the input side from the main circuit cables at the output side.
- After wiring, wire offcuts must not be left in the inverter. Wire offcuts can cause an alarm, failure or malfunction. Always keep the inverter clean. When drilling mounting holes in an enclosure etc., take caution not to allow chips and other foreign matter to enter the inverter.
- Set the voltage/current input switch correctly. Incorrect setting may cause a fault, failure or malfunction.
- Terminals S1, S2, SIC, So (SO), and SOC are for manufacturer setting. Do not remove the shorting wires across terminals S1 and PC, terminals S2 and PC, and terminals SIC and SD. When the shorting wires are removed, the inverter does not operate.

FR-F800-E Dimensions – Frame Size Key Dimensions, 230V and 480V Drives

Series		Height in (mm)	Width in (mm)	Depth in (mm)
FR-F800	A	12.2 (310)	4.33 (110)	4.39 (112)
	B	12.2 (310)	4.33 (110)	4.98 (127)
	C	12.52 (318)	5.91 (150)	5.57 (141.6)
	D	12.76 (324)	8.66 (220)	6.69 (170)
	E	14.29 (363)	8.66 (220)	7.48 (190)
	F	20.37 (517)	9.84 (250)	7.48 (190)
	G	21.67 (550)	12.80 (325)	7.68 (195)
	H	21.67 (550)	17.13 (435)	9.84 (250)
	J	24.41 (620)	18.31 (465)	11.81 (300)
	K	27.56 (700)	18.31 (465)	9.84 (250)
	L	29.13 (740)	18.31 (465)	14.17 (360)
	M	39.76 (1010)	19.61 (498)	14.96 (380)
	N	39.76 (1010)	26.77 (680)	14.96 (380)

Series		Height in (mm)	Width in (mm)	Depth in (mm)
FR-F842	P	52.4 (1330)	21.3 (540)	17.3 (440)
	Q	62.2 (1580)	26.8 (680)	17.3 (440)
FR-CC2-H	R	52.4 (1330)	23.6 (600)	17.3 (440)
	S	62.2 (1580)	23.6 (600)	17.3 (440)

FR-F800-E Series Options and Accessories

Model Number	Description	Comments	Stocked Item
FR-A8AX	16 Bit Digital Input Card	BCD or Binary input	S
FR-A8AY	Digital Output / Extended Analog Output Card	2 extra 0-20 mA or 0-10V output signals	S
FR-A8AR	Relay Output Card	3 extra independent type 'C' relays	S
FR-A8ERS-60	A/F800 Series RS485 Option Card		S
FR-A8AC	A/F800 120V Control Option		S
FR-A8AN	A/F800 4-20mA I/O Card		S
FR-A8NL	A/F800 Series LONWorks Communication Card		S
FR-A8NC	CC-Link® Communications Card		S
A8NC-CON	CC-Link® Communications Card and Connectors		S
FR-A8ND	DeviceNet™ Communications Card		S
FR-A8NP	Profibus DPV0 Communications Card		S
A8NDPV1	Profibus DPV1 Communications Card		S
FR-A8NF	FL-Net Communications Card		S
A8N-XLT	Multi-protocol RS-485 Communications Card	(BACnet MS/TP), Siemens FLN (P1), Metasys N2	S
A8NEIP-2P	EtherNET™ IP Communications Card		S
A8NPRT-2P	Profinet® Communications Card		S
FR-A8NCE	CC-Link® IE Communications Card		S
A8NECT-2P	EtherCAT® Communications Card		S
A8NETH-2P	Multi-protocol EtherNET Communications Card	EtherNET IP, Modbus TCP/IP, Profinet, BACnet IP	S
FR-LU08	Liquid Crystal Operation Panel	Mount on VFD or panel	S
FR-LU08-01	LCD Operational Panel (Hand/Auto Key) HVAC		S
FR-PU07, FR-PU07-01	Parameter Unit	Mount on panel only. FR-PU07-1 is for HVAC	S
FR-PU07BB-L	Parameter Unit with Battery Back-up	Hand held. Can program unpowered drives	S
FR-CB20 _ (= 1, 3 or 5)	Parameter Unit Connection Cable	1, 3 or 5 meter lengths	S
FR-ADP	Keypad Adaptor Unit	Connect FR-DU08 or FR-LU08 to FR-CB2	S
FR-A8TAT	Control Terminal Block Adaptor	Use FR-A500 or FR-A700 terminal block with FR-A800	S
FR-A8TR	Screw Terminal Block Option	Screw Terminal Block Option	S
FR-HC2	Zero Harmonic Controller	Available for all sizes	S
FR-HEL, FR-HEL-H, FR-HEL-C	DC Link Chokes	Use in accordance with selection guide	S
FR-CONFIGURATOR2	Software Setup Utility for 800 Series		S

Dimensions of REQUIRED DC Link Chokes (sold separately)

Model Number	Height in (mm)	Width in (mm)	Depth in (mm)	Weight (lbs)
FR-HEL-75K	13.39 (340)	5.91 (150)	7.87 (200)	37.4
FR-HEL-90K	13.39 (340)	5.91 (150)	7.87 (200)	41.8
FR-HEL-110K	15.75 (400)	6.89 (175)	7.87 (200)	44
FR-HEL-H75K	12.60 (320)	5.51 (140)	7.28 (185)	35.2
FR-HEL-H90K	13.39 (340)	5.91 (150)	7.48 (190)	44
FR-HEL-H110K	13.39 (340)	5.91 (150)	7.68 (195)	48.4
FR-HEL-H132K	15.94 (405)	6.89 (175)	7.87 (200)	57.2
FR-HEL-H160K	15.94 (405)	6.89 (175)	8.07 (205)	61.6
FR-HEL-H185K	15.94 (405)	6.89 (175)	9.45 (240)	63.8
FR-HEL-H220K	15.94 (405)	6.89 (175)	9.45 (240)	66
FR-HEL-H250K	17.32 (440)	7.48 (190)	9.84 (250)	77
FR-HEL-H280K	17.32 (440)	7.48 (190)	10.04 (255)	83.6
FR-HEL-H315K	19.49 (495)	8.27 (210)	9.84 (250)	92
FR-HEL-H355K	19.49 (495)	8.27 (210)	9.84 (250)	101
FR-HEL-C75K	12.6 (320)	5.5 (140)	7.3 (185)	35
FR-HEL-C90K	13.3 (340)	5.9 (150)	9.4 (240)	44
FR-HEL-C110K	13.3 (340)	5.9 (150)	9.4 (240)	51
FR-HEL-C132K	15.9 (405)	6.9 (175)	7.7 (195)	53
FR-HEL-C185K	15.9 (405)	6.9 (175)	9.4 (240)	70
FR-HEL-C220K	15.9 (405)	6.9 (175)	9.4 (240)	73
FR-HEL-C280K	17.3 (440)	7.5 (190)	9.8 (250)	88

2.3

Over-current & Short-circuit Protection

MINIATURE CIRCUIT BREAKERS

ST200M Datasheet

Supplementary protection acc. to CSA C22.2 No. 235 / UL 1077



—
01 ST201M / ST203M
miniature circuit breakers

Features

- High performance MCB with interrupt rating up to 10 kA
- Certified for AC and DC use acc. to UL 1077 and CSA 22.2 No. 235
- Suitable for many applications due to a wide range of product types and available accessories
- High calibration temperature of 40 °C for reduced derating in ICP applications
- Short-circuit current rating (SC) U2 enables continuous high level short circuit protection
- Laser printing provides clear product information on device
- Clear contact position indication in red/green (“real CPI”)
- Unique, patented twin terminal for wiring up to 35 mm² with captive screws
- Field wiring available for most types
- Robust thermoplastic housing material for better protection against external influences

The ST200M miniature circuit breaker provides supplementary protection acc. to UL 1077 up to 480 Y/277 V AC and 125 V DC.

With a broad range of options and approvals acc. to the international standards UL, CSA and IEC, the ST 200 M is ideal for multiple applications and markets.

It is also fully compatible with System pro M compact® accessories.

Standards and approvals

Standards


UL 1077
CSA 22.2 No. 235
IEC/EN 60947-2


Approvals


UL 1077	US
CSA 22.2 No. 235	CA
VDE	DE
CCC	CN
EAC	RU


Miniature Circuit Breaker ST200M

Ordering data characteristic C

1 pole	Box Qty	Weight each (kg)	Rated Current	Part number
	10	0.115	0.5 A	ST201M-C0.5
			1.0 A	ST201M-C1
			1.6 A	ST201M-C1.6
			2.0 A	ST201M-C2
			3.0 A	ST201M-C3
			4.0 A	ST201M-C4
			5.0 A	ST201M-C5
			6.0 A	ST201M-C6
			7.0 A	ST201M-C7
			8.0 A	ST201M-C8
			10.0 A	ST201M-C10
			13.0 A	ST201M-C13
			15.0 A	ST201M-C15
			16.0 A	ST201M-C16
			20.0 A	ST201M-C20
			25.0 A	ST201M-C25
			30.0 A	ST201M-C30
			32.0 A	ST201M-C32
			35.0 A	ST201M-C35
			40.0 A	ST201M-C40
			50.0 A	ST201M-C50
			60.0 A	ST201M-C60
			63.0 A	ST201M-C63

1 pole + Neutral	Box Qty	Weight each (kg)	Rated Current	Part number
	5	0.230	0.5 A	ST201M-C0.5NA
			1.0 A	ST201M-C1NA
			1.6 A	ST201M-C1.6NA
			2.0 A	ST201M-C2NA
			3.0 A	ST201M-C3NA
			4.0 A	ST201M-C4NA
			5.0 A	ST201M-C5NA
			6.0 A	ST201M-C6NA
			7.0 A	ST201M-C7NA
			8.0 A	ST201M-C8NA
			10.0 A	ST201M-C10NA
			13.0 A	ST201M-C13NA
			15.0 A	ST201M-C15NA
			16.0 A	ST201M-C16NA
			20.0 A	ST201M-C20NA
			25.0 A	ST201M-C25NA
			30.0 A	ST201M-C30NA
			32.0 A	ST201M-C32NA
			35.0 A	ST201M-C35NA
			40.0 A	ST201M-C40NA
			50.0 A	ST201M-C50NA
			60.0 A	ST201M-C60NA
			63.0 A	ST201M-C63NA

2 poles	Box Qty	Weight each (kg)	Rated Current	Part number
	5	0.230	0.5 A	ST202M-C0.5
			1.0 A	ST202M-C1
			1.6 A	ST202M-C1.6
			2.0 A	ST202M-C2
			3.0 A	ST202M-C3
			4.0 A	ST202M-C4
			5.0 A	ST202M-C5
			6.0 A	ST202M-C6
			7.0 A	ST202M-C7
			8.0 A	ST202M-C8
			10.0 A	ST202M-C10
			13.0 A	ST202M-C13
			15.0 A	ST202M-C15
			16.0 A	ST202M-C16
			20.0 A	ST202M-C20
			25.0 A	ST202M-C25
			30.0 A	ST202M-C30
			32.0 A	ST202M-C32
			35.0 A	ST202M-C35
			40.0 A	ST202M-C40
			50.0 A	ST202M-C50
			60.0 A	ST202M-C60
			63.0 A	ST202M-C63

3 poles	Box Qty	Weight each (kg)	Rated Current	Part number
	1	0.345	0.5 A	ST203M-C0.5
			1.0 A	ST203M-C1
			1.6 A	ST203M-C1.6
			2.0 A	ST203M-C2
			3.0 A	ST203M-C3
			4.0 A	ST203M-C4
			5.0 A	ST203M-C5
			6.0 A	ST203M-C6
			7.0 A	ST203M-C7
			8.0 A	ST203M-C8
			10.0 A	ST203M-C10
			13.0 A	ST203M-C13
			15.0 A	ST203M-C15
			16.0 A	ST203M-C16
			20.0 A	ST203M-C20
			25.0 A	ST203M-C25
			30.0 A	ST203M-C30
			32.0 A	ST203M-C32
			35.0 A	ST203M-C35
			40.0 A	ST203M-C40
			50.0 A	ST203M-C50
			60.0 A	ST203M-C60
			63.0 A	ST203M-C63

Section 2.3.2

Disconnect Switch



PRODUCT-DETAILS

OT100F3

OT100F3 SWITCH-DISCONNECTOR



General Information

Extended Product Type	OT100F3
Product ID	1SCA105004R1001
EAN	6417019391359
Catalog Description	OT100F3 SWITCH-DISCONNECTOR
Long Description	3-pole, front operated, base mounted, DIN-rail mountable switch-diconnector / non-fusible diconnect switch with front protected clamp terminals, handle and shaft are not included

Ordering

Minimum Order Quantity	10 piece
Customs Tariff Number	85365080
Country of Origin	Finland (FI)

Popular Downloads

Data Sheet, Technical Information	1SCC301020C0201
Instructions and Manuals	1SCC301058M0008
Mechanical Drawings	1SCC301466F0001 1SCC301465F0001 OT100-125F3.igs

Dimensions

Product Net Width	100 mm
Product Net Height	70 mm
Product Net Depth / Length	74 mm
Product Net Weight	0.36 kg

Technical

Rated Operational Current AC-21A (I_e)	(380 ... 415 V) 100 A (500 V) 100 A (690 V) 100 A
Rated Operational Current AC-22A (I_e)	(380 ... 415 V) 100 A (500 V) 100 A (690 V) 100 A
Rated Operational Current AC-23A (I_e)	(380 ... 415 V) 80 A (500 V) 60 A (690 V) 40 A
Rated Operational Power AC-23A (P_e)	(220 ... 240 V) 22 kW (400 ... 415 V) 37 kW (500 V) 37 kW (690 V) 37 kW
Conventional Free-air Thermal Current (I_{th})	q = 40 °C 115 A
Conventional Thermal Current (I_{the})	Fully Enclosed 115 A
Rated Impulse Withstand Voltage (U_{imp})	8 kV
Rated Insulation Voltage (U_i)	acc. to IEC/EN 60664-1 750 V
Rated Operational Voltage	Main Circuit 750 V
Rated Short-Circuit Making Capacity (I_{cm})	(690 V) 3.6 kA
Rated Short-time Withstand Current Low Voltage (I_{cw})	for 1 s 2.5 kA
Power Loss	at Rated Operating Conditions per Pole 4.0 W
Pollution Degree	3
Handle Color	Black
Handle Type	Knob Handle and shaft not included Mechanism on Top of the Switch
Distance Between Phases	Standard
Position of Line Terminals	Top In - Bottom Out Bottom In - Top Out
Operating Mode	Front operated
Standards	IEC 60947-3 / UL 98 / CSA C22.2 NO.4
Special Functions	No
Mounting Type	Base mounting
Number of Poles	3
Cable Cross-Section	Cu 10...70 mm ²
Degree of Protection	Front IP20
Terminal Type	Screw Terminals
Tightening Torque	acc. IEC 60947-1 6 N·m
Mechanical Durability	20000
Lock Type	No

Technical UL/CSA

Maximum Operating Voltage UL/CSA	600 V
Horsepower Rating UL/CSA	(110 ... 120 V AC) Single Phase 5 Hp (240 V AC) Single Phase 15 Hp (440 ... 480 V AC) Single Phase 25 Hp (550 ... 600 V AC) Single Phase 20 Hp (220 ... 240 V AC) Three Phase 30 Hp (440 ... 480 V AC) Three Phase 50 Hp (550 ... 600 V AC) Three Phase 50 Hp
Ampere Rating UL/CSA	100 A
Tightening Torque UL/CSA	55 in-lb

Environmental

RoHS Status	Following EU Directive 2011/65/EU
Environmental Information	1SCC301264D0201

Certificates and Declarations (Document Number)

Declaration of Conformity - CE	1SCC301168D2702
Environmental Information	1SCC301264D0201
Instructions and Manuals	1SCC301058M0008
RoHS Information	1SCC301168D2702
UL Certificate	cULus certificate OT30-125

Container Information

Package Level 1 Units	box 1 piece
Package Level 1 Width	81 mm
Package Level 1 Depth / Length	112 mm
Package Level 1 Height	86 mm
Package Level 1 Gross Weight	0.39 kg
Package Level 1 EAN	6417019391359

Classifications

Object Classification Code	Q
ETIM 5	EC000216 - Switch disconnecter
ETIM 6	EC000216 - Switch disconnecter
ETIM 7	EC000216 - Switch disconnecter
ETIM 8	EC000216 - Switch disconnecter
UNSPSC	39122233
WEEE Category	5. Small Equipment (No External Dimension More Than 50 cm)
E-Number (Finland)	3601400
E-Number (Sweden)	3170942

Categories

Low Voltage Products and Systems → Switches → Switch Disconnectors



Section 2.3.3

Disconnect Switch



PRODUCT-DETAILS

OHB80L6

OHB80L6 HANDLE



General Information

Extended Product Type	OHB80L6
Product ID	1SCA022577R7010
EAN	6417019186955
Catalog Description	OHB80L6 HANDLE
Long Description	OHB80L6 PISTOL HANDLE

Circular Value

Conflict Minerals Reporting Template (CMRT)	9AKK108467A5658
REACH Declaration	1SCC011021D0201
RoHS Information	1SCC011020D0201

Ordering

Minimum Order Quantity	1 piece
Customs Tariff Number	85389099
Country of Origin	Estonia (EE)

Popular Downloads

Data Sheet, Technical	1SCC301020C0201
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Information

Instructions and Manuals	1SCC390022M0020
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Dimensions

Product Net Width	113 mm
Product Net Height	45 mm
Product Net Depth / Length	66 mm
Product Net Weight	0.155 kg

Technical

Handle Color	Black
Handle Length	80 mm
Handle Type	Pistol
Special Functions	L6
Color	Black
Degree of Protection	IP66
Lock Type	Yes

Environmental

RoHS Status	Following EU Directive 2011/65/EU and Amendment 2015/863 July 22, 2019
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Certificates and Declarations (Document Number)

Declaration of Conformity - CE	1SCC390030D2704
Instructions and Manuals	1SCC390022M0020
REACH Declaration	1SCC011021D0201
RoHS Information	1SCC011020D0201

Container Information

Package Level 1 Units	bag 1 piece
Package Level 1 Width	80 mm
Package Level 1 Depth / Length	80 mm
Package Level 1 Height	66 mm
Package Level 1 Gross Weight	0.16 kg
Package Level 1 EAN	6417019186955

Classifications

Object Classification Code	N/A
ETIM 5	EC000229 - Handle for power circuit breaker
ETIM 6	EC000229 - Handle for power circuit breaker
ETIM 7	EC000229 - Handle for power circuit breaker
ETIM 8	EC000229 - Handle for power circuit breaker
ETIM 9	EC000229 - Handle for power circuit breaker

UNSPSC	31162801
IDEA Granular Category Code (IGCC)	3038 >> Handles or knobs
eClass	V11.1 : 27370414
WEEE Category	Product Not in WEEE Scope

Categories

- Low Voltage Products and Systems → Switches → DC Switch-Disconnectors Accessories
- Low Voltage Products and Systems → Switches → Switch Disconnectors Accessories
- Low Voltage Products and Systems → Switches → Switch Fuses Accessories → Accessories for Switch Fuses



2.4

Voltage Management

Section 2.4.1 Transformer

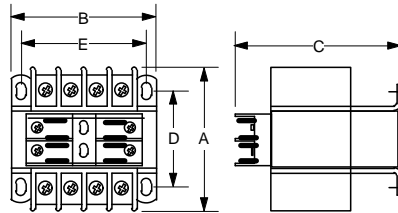
Transformers

Transformers



X4045SF1

Primary voltage — 460/230/208V, 480/240V, 440/220/200V
Secondary voltage — 115/24V ②, 120/25V, 110/23V
Use Class CC fuse



Top View

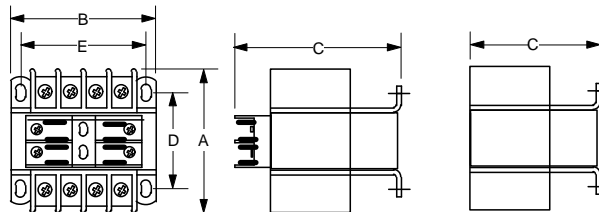
Side View

		Dimensions													
VA Rating	Catalog number	Output Amps 24/115	A		B		C		D		E		Mounting slots		
			in	mm	in	mm	in	mm	in	mm	in	mm	in	mm	
45	X4045SF1	1.90 / 0.39	4½	115	3	76	3⅞	80	2⅞	72	2½	64	¾	x 7/16	5 x 12
50	X4050PSF1	2.08 / 0.44	4½	115	3	76	4	102	2⅞	72	2½	64	¾	x 7/16	5 x 12
75	X4075PSF1	3.13 / 0.65	4½	114	3⅞	86	4 ⅜	110	2¾	71	2¾	71	¾	x 7/16	5 x 12
100	X4100PSF1	4.17 / 0.87	4½	115	3¾	95	4⅝	118	3	76	3⅞	80	¾	x 7/16	5 x 12
150	X4150PSF1	6.25 / 1.30	5	128	3¾	95	4⅝	118	3⅞	81	3⅞	80	¾	x 7/16	5 x 12
200	X4200PSF1	8.33 / 1.74	4⅝	111	4½	114	5¼	134	3¾	76	3¾	95	¾	x 7/16	5 x 12
250	X4250PSF1	10.42 / 2.17	4¾	120	4½	114	5¼	134	3¾	76	3¾	95	¾	x 7/16	5 x 12
300	X4300PSF1	12.50 / 2.61	6⅞	155	5¼	133	6	151	3⅞	98	4⅜	111	⅝	x 1⅞	8 x 27
350	X4350PSF1	14.58 / 3.04	6⅞	155	5¼	133	6	151	3⅞	98	4⅜	111	⅝	x 1⅞	8 x 27
500	X4500PSF1	20.84 / 4.35	7⅞	181	5¼	133	5⅞	131	5.37	136	4⅜	111	⅝	x 1⅞	8 x 27



X4750PSF1

Primary voltage — 460/230/208V, 480/240V, 440/220/200V
Secondary voltage — 115V, 120V, 110V
Use Class CC fuse



Top View

Side View

Side View

VA Rating			Catalog Number	Output Amps	Dimensions										Mounting slots	
					A		B		C		D		E			
					in	mm	in	mm	in	mm	in	mm	in	mm	in	mm
750	X4750PS1	6.52	7 ⁵ / ₈	193	5 ¹ / ₄	133	6	151	5 ³ / ₄	146	4 ³ / ₈	111	5/16 x 1 ¹ / ₁₆	8 x 27		
1000	X41K1	8.70	7 ¹ / ₈	181	6 ⁵ / ₈	162	5 ⁵ / ₈	137	4 ¹ / ₂	114	5 ⁵ / ₁₆	135	5/16 x 1 ¹ / ₁₆	8 x 17		
1500	X41.5K1	13.04	7 ¹ / ₂	191	6 ³ / ₄	171	5 ¹¹ / ₁₆	144	4 ⁷ / ₁₆	113	6 ¹ / ₁₆	154	9/32 x 9/16	7 x 14		
2000	X42K1	17.39	8 ³ / ₄	210	6 ³ / ₄	171	5 ¹¹ / ₁₆	144	5 ¹ / ₄	133	6 ¹ / ₁₆	154	9/32 x 9/16	7 x 14		
3000	X43K1	26.09	8 ⁹ / ₁₆	217	9	229	7 ¹ / ₂	191	5 ³ / ₄	147	7 ¹ / ₂	191	7/16 x 3/4	11 x 19		
5000	X45K1	43.48	10 ¹ / ₂	267	9	229	10 ³ / ₈	259	6 ¹ / ₂	165	6 ¹ / ₂	165	7/16 x 3/4	11 x 19		



T41K1

Covers

Description	Catalog number
Terminal covers	TPTC-1001
Primary fuse covers	TPTC-2006

① Primary & secondary fuse block provided as standard (750VA unit, only).

② Whenever both secondary voltages are to be used at the same time, remove the secondary fuse clip and use a separate mounted 2 pole fuse block.

Technical data

UL Overcurrent protection

Primary & secondary

Overcurrent protection on both the primary and secondary sides of transformers are specified in UL508 and the National Electrical Code. The maximum acceptable ratings are shown below. Due to the high inrush currents present when a transformer is initially energized, it is recommended that the primary fuse be time delay, to prevent nuisance trips during startup.

Maximum acceptable rating of primary overcurrent protection

Primary voltage	25	50	75	100	150	200	250	300	350	500	750
115	6/10 (1)	1-1/4 (2)	1-8/10 (3-2/10)	2-1/2 (4)	3-1/2 (6-1/4)	5 (8)	5	6-1/4	7-1/2	10	15
120	6/10 (1)	1-1/4 (2)	1-8/10 (3)	2-1/4 (4)	3-1/2 (6-1/4)	5 (8)	5	6-1/4	7	10	15
200	3/10 (6/10)	3/4 (1-1/4)	1-1/8 (1-8/10)	1-1/2 (2-1/2)	2-1/4 (3-1/2)	3 (5)	3-1/2 (6-1/4)	4-1/2 (7-1/2)	5 (8)	6-1/4	9
208	3/10 (6/10)	6/10 (1-1/8)	1 (1-8/10)	1-4/10 (2-1/4)	2 (3-1/2)	2-8/10 (4-1/2)	3-1/2 (6)	4 (7)	5 (8)	6	9
220	3/10 (1/2)	6/10 (1-1/8)	1 (1-6/10)	1-1/4 (2-1/4)	2 (3-2/10)	2-1/2 (4-1/2)	3-2/10 (5-6/10)	4 (6-1/4)	4-1/2 (7-1/2)	5-6/10	8
230	3/10 (1/2)	6/10 (1)	8/10 (1-6/10)	1-1/4 (2)	1-8/10 (3-2/10)	2-1/2 (4)	3-2/10 (5)	3-1/2 (6-1/4)	4-1/2 (7-1/2)	5	8
240	3/10 (1/2)	6/10 (1)	8/10 (1-1/2)	1-1/4 (2)	1-8/10 (3)	2-1/4 (4)	3 (5)	3-1/2 (6-1/4)	4 (7)	5	7-1/2
277	1/4 (4/10)	1/2 (8/10)	8/10 (1-1/4)	1 (1-8/10)	1-6/10 (2-1/2)	2 (3-1/2)	2-1/2 (4-1/2)	3-2/10 (5)	3-1/2 (6-1/4)	5 (9)	6-1/4
380	3/16 (3/10)	3/10 (6/10)	1/2 (8/10)	3/4 (1-1/4)	1-1/8 (1-8/10)	1-1/2 (2-1/2)	1-8/10 (3-2/10)	2-1/4 (3-1/2)	2-1/2 (4-1/2)	3-1/2 (6-1/4)	5-6/10 (9)
400	3/16 (3/10)	3/10 (6/10)	1/2 (8/10)	3/4 (1-1/4)	1-1/8 (1-8/10)	1-1/2 (2-1/2)	1-8/10 (3)	2-1/4 (3-1/2)	2-1/2 (4)	3-1/2 (6-1/4)	5-6/10 (9)
415	15/100 (3/10)	3/10 (6/10)	1/2 (8/10)	6/10 (1-1/8)	1 (1-8/10)	1-4/10 (2-1/4)	1-8/10 (3)	2 (3-1/2)	2-1/2 (4)	3-1/2 (6)	5 (9)
440	15/100 (1/4)	3/10 (1/2)	1/2 (8/10)	6/10 (1-1/8)	1 (1-6/10)	1-1/4 (2-1/4)	1-6/10 (2-8/10)	2 (3-2/10)	2-1/4 (3-1/2)	3-2/10 (5-6/10)	5 (8)
460	15/100 (1/4)	3/10 (1/2)	4/10 (8/10)	6/10 (1)	8/10 (1-6/10)	1-1/4 (2)	1-6/10 (2-1/2)	1-8/10 (3-2/10)	2-1/4 (3-1/2)	3-2/10 (5)	4-1/2 (8)
480	15/100 (1/4)	3/10 (1/2)	4/10 (3/4)	6/10 (1)	8/10 (1-1/2)	1-1/4 (2)	1-1/2 (2-1/2)	1-8/10 (3)	2 (3-1/2)	3 (5)	4-1/2 (7-1/2)
550	1/8 (2/10)	1/4 (4/10)	4/10 (6/10)	1/2 (8/10)	8/10 (1-1/4)	1 (1-8/10)	1-1/4 (2-1/4)	1-6/10 (2-1/2)	1-8/10 (3)	2-1/2 (4-1/2)	4 (6-1/4)
575	1/8 (2/10)	1/4 (4/10)	3/10 (6/10)	1/2 (8/10)	3/4 (1-1/4)	1 (1-6/10)	1-1/4 (2)	1-1/2 (2-1/2)	1-8/10 (3)	2-1/2 (4)	3-1/2 (6-1/4)
600	1/8 (2/10)	2/10 (4/10)	3/10 (6/10)	1/2 (8/10)	3/4 (1-1/4)	8/10 (1-6/10)	1-1/4 (2)	1-1/2 (2-1/2)	1-6/10 (2-8/10)	2-1/4 (4)	3-1/2 (6-1/4)

If the rated primary current is less than 2 amps, the maximum rating of the overcurrent device is 300% for power circuits, shown above, or 500% for control circuits, shown above in (brackets). If the rated primary current is 2 amps or more, the maximum rating of the overcurrent device is 250%.

All figures assume secondary overcurrent protection per UL/NEC.

Reference: NEC 430 - 72(c) exception #2, 450-3(b) 1 & 2, UL508 32.7, UL845 11.16 & 11.17.

Maximum acceptable rating of secondary overcurrent protection

Secondary voltage	25	50	75	100	150	200	250	300	350	500	750
23	1-8/10	3-1/2	5	7	10	12	15	20	20	30	45
24	1-6/10	3-2/10	5	6-1/4	10	12	15	20	20	30	40
25	1-6/10	3-2/10	5	6-1/4	10	12	15	15	20	25	40
90	4/10	8/10	1-1/4	1-8/10	2-1/2	3-1/2	4-1/2	5	6-1/4	9	12
95	4/10	8/10	1-1/4	1-6/10	2-1/2	3-1/2	4	5	6	8	12
100	4/10	8/10	1-1/4	1-6/10	2-1/2	3-2/10	4	5	5-6/10	8	12
110	3/10	3/4	1-1/8	1-1/2	2-1/4	3	3-1/2	4-1/2	5	7-1/2	10
115	3/10	6/10	1	1-4/10	2	2-8/10	3-1/2	4	5	7	10
120	3/10	6/10	1	1-1/4	2	2-1/2	3-2/10	4	4-1/2	6-1/4	10
220	15/100	3/10	1/2	3/4	1-1/8	1-1/2	1-8/10	2-1/4	2-1/2	3-1/2	5-6/10
230	15/100	3/10	1/2	6/10	1	1-4/10	1-8/10	2	2-1/2	3-1/2	5
240	15/100	3/10	1/2	6/10	1	1-1/4	1-6/10	2	2-1/4	3-2/10	5

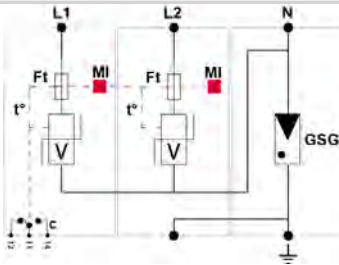
If the rated secondary current is less than 9 amps, the maximum rating of the overcurrent device is 167%; 9 amps or more, the maximum rating of the overcurrent device is 125%. If 125% does not correspond to a standard fuse rating, the next highest standard rating may be used.

Reference: NEC 430 - 72(c) exception #2, 450-3(b) 1 & 2, UL508 32.7, UL845 11.16 & 11.17.

DS73US-120T/G



- Multi-MOV Technology
- UL1449 Type 1 LISTED
- 75kA Surge Current Rating per module
- Visual fault indicator and remote contacts
- 10-Year warranty



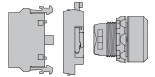
V: High-energy varistor
Ft: Thermal fuse
C: Remote signal contact
t*: Thermal disconnection system
MI: Disconnection indicator

Electrical Characteristics		
POWER SPD TYPE		UL1449 TYPE 1 LISTED
VOLTS	(V)	240/120
AC/DC/DC PV/RF		AC
PHASE	(PH)	1S
AMPS	(A)	n/a
AMBIENT MIN	(C)	-35
AMBIENT MAX	(C)	+85
MODES		L-L, L-N, L-G, N-G
VPR	(V)	1200/800/1500/1200
MCOV	(V)	420/210/255/255
IN(15 impulses 8/20μs)	(kA)	20
SCCR	(kA)	200
IMAX(8/20μs)	(kA)	75
Mechanical Characteristics		
TECHNOLOGY		Multi-MOV+GSG
NETWORK CONFIGURATION		1PH, 3W+G, Split Phase
CONNECTION METHOD		Screw Terminal (8-12AWG)
MOUNTING		DIN RAIL
MATERIAL		Thermoplastic UL94-V0
NEMA RATING (IP RATING)		NEMA 2 (IP20)
FAIL-SAFE BEHAVIOR		Disconnection via fuse-link
REAL-TIME DIAGNOSTICS		Visual indicator and remote contacts
DIMENSIONS		See diagram (mm)
Standards		
UL STANDARD		UL1449 4th Edition
UL CATEGORY		VZCA, VZCA7
UL FILE NUMBER		E326289
STANDARDS		NOM-003-SCFI-2014, NOM-001-SCFI-1993
ENVIRONMENTAL STANDARDS		ROHS
Part number		
32273355		

2.5

Pilot Devices

Modular Range

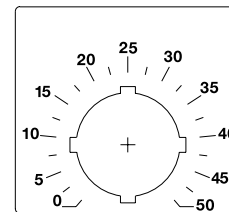
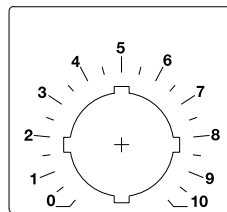
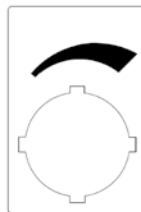


Potentiometer

Operator: Potentiometer

Description	Type	Order Code	Package Quantity	Weight Kg
Complete Potentiometers				
Black knob with integrated position indication and marking in white				
With Resistor 5 kohm				
Black Plastic Bezel	MT-105B	1SFA 611 410 R1056	1	0.040
Chrome Metal Bezel	MT-305B	1SFA 611 410 R3056	1	0.048
With Resistor 10 kohm				
Black Plastic Bezel	MT-110B	1SFA 611 410 R1106	1	0.040
Chrome Metal Bezel	MT-310B	1SFA 611 410 R3106	1	0.048
With Resistor 50 kohm				
Black Plastic Bezel	MT-150B	1SFA 611 410 R1506	1	0.040
Chrome Metal Bezel	MT-350B	1SFA 611 410 R3506	1	0.048
Knob without Resistor				
Black knob with integrated position indication and marking in white. For shaft diameter 6 -6.35 mm. Min. shaft length 20 mm.				
Black Plastic Bezel	KT-100B	1SFA 616 410 R1006	10	0.034
Chrome Metal Bezel	KT-300B	1SFA 616 410 R3006	10	0.042
Legend Plates Aluminum				
Symbol: see fig. (29.6 x 44.5 mm)	-	SK 615 562-87	10	0.002
Scale: 0-10 (48.5 x 44.5 mm)	-	SK 615 562-88	10	0.002
Scale: 0-50 (48.5 x 44.5 mm)	-	1SFA 611 930 R1252	10	0.002

Legend Plates



Buzzers



Buzzer

Operator: Buzzer

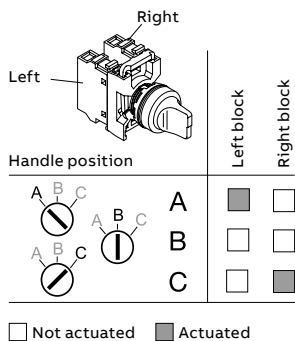
Description	Type	Order Code	Package Quantity	Weight Kg	
Buzzers					
Black. Frequency: Approx. 2400 Hz. Loudness: Min 80 dB (A)/10 cm Rated Current: < 8 mA. Service Life:>5000 h Suitable for both 50 and 60 Hz networks					
Supply Voltage	Tone Type				
24 V AC/DC	Continuous	KB1-4010	1SFA 616 401 R4010	1x10	0.020
115 V AC/DC	Continuous	KB1-4030	1SFA 616 401 R4030	1x10	0.020
230 V AC	Continuous	KB1-4040	1SFA 616 401 R4040	1x10	0.020
24 V AC/DC	Pulsating	KB1-4110	1SFA 616 401 R4110	1x10	0.020
115 V AC/DC	Pulsating	KB1-4130	1SFA 616 401 R4130	1x10	0.020
230 V AC	Pulsating	KB1-4140	1SFA 616 401 R4140	1x10	0.020

Modular plastic range

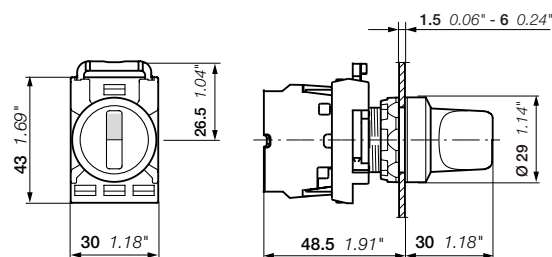
Illuminated selector switches - 3-position - Short handle



Contacts actuated

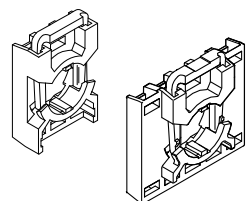
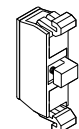
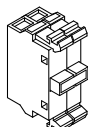
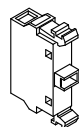
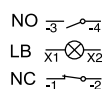
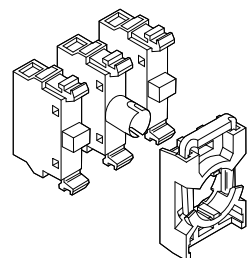
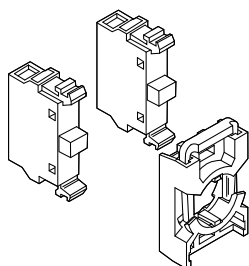


Operating principle	Color	Bezel	Type	Order code	Pkg qty	Weight (1 pce) kg
	Red	Black plastic	M3SS1-11R	1SFA611210R1101	1	0.015
		Chrome plastic	M3SS1-21R	1SFA611210R2101	1	0.015
		Chrome metal	M3SS1-31R	1SFA611210R3101	1	0.024
	Green	Black plastic	M3SS1-11G	1SFA611210R1102	1	0.015
		Chrome plastic	M3SS1-21G	1SFA611210R2102	1	0.015
		Chrome metal	M3SS1-31G	1SFA611210R3102	1	0.024
	Yellow	Black plastic	M3SS1-11Y	1SFA611210R1103	1	0.015
		Chrome plastic	M3SS1-21Y	1SFA611210R2103	1	0.015
		Chrome metal	M3SS1-31Y	1SFA611210R3103	1	0.024
	Blue	Black plastic	M3SS1-11L	1SFA611210R1104	1	0.015
		Chrome plastic	M3SS1-21L	1SFA611210R2104	1	0.015
		Chrome metal	M3SS1-31L	1SFA611210R3104	1	0.024
	Clear	Black plastic	M3SS1-11C	1SFA611210R1108	1	0.015
	Red	Black plastic	M3SS2-11R	1SFA611211R1101	1	0.015
		Chrome plastic	M3SS2-21R	1SFA611211R2101	1	0.015
		Chrome metal	M3SS2-31R	1SFA611211R3101	1	0.024
	Green	Black plastic	M3SS2-11G	1SFA611211R1102	1	0.015
		Chrome plastic	M3SS2-21G	1SFA611211R2102	1	0.015
		Chrome metal	M3SS2-31G	1SFA611211R3102	1	0.024
	Yellow	Black plastic	M3SS2-11Y	1SFA611211R1103	1	0.015
		Chrome plastic	M3SS2-21Y	1SFA611211R2103	1	0.015
		Chrome metal	M3SS2-31Y	1SFA611211R3103	1	0.024
	Blue	Black plastic	M3SS2-11L	1SFA611211R1104	1	0.015
		Chrome plastic	M3SS2-21L	1SFA611211R2104	1	0.015
		Chrome metal	M3SS2-31L	1SFA611211R3104	1	0.024
	Clear	Black plastic	M3SS2-11C	1SFA611211R1108	1	0.015
	Red	Black plastic	M3SS3-11R	1SFA611212R1101	1	0.015
		Chrome plastic	M3SS3-21R	1SFA611212R2101	1	0.015
		Chrome metal	M3SS3-31R	1SFA611212R3101	1	0.024
	Green	Black plastic	M3SS3-11G	1SFA611212R1102	1	0.015
		Chrome plastic	M3SS3-21G	1SFA611212R2102	1	0.015
		Chrome metal	M3SS3-31G	1SFA611212R3102	1	0.024
	Yellow	Black plastic	M3SS3-11Y	1SFA611212R1103	1	0.015
		Chrome plastic	M3SS3-21Y	1SFA611212R2103	1	0.015
		Chrome metal	M3SS3-31Y	1SFA611212R3103	1	0.024
	Blue	Black plastic	M3SS3-11L	1SFA611212R1104	1	0.015
		Chrome plastic	M3SS3-21L	1SFA611212R2104	1	0.015
		Chrome metal	M3SS3-31L	1SFA611212R3104	1	0.024
	Clear	Black plastic	M3SS3-11C	1SFA611212R1108	1	0.015
	Red	Black plastic	M3SS7-11R	1SFA611216R1101	1	0.015
		Chrome plastic	M3SS7-21G	1SFA611216R2102	1	0.015
		Chrome metal	M3SS7-31G	1SFA611216R3102	1	0.024
	Green	Black plastic	M3SS7-11G	1SFA611216R1102	1	0.015
		Chrome plastic	M3SS7-21G	1SFA611216R2102	1	0.015
		Chrome metal	M3SS7-31G	1SFA611216R3102	1	0.024
	Yellow	Black plastic	M3SS7-11Y	1SFA611216R1103	1	0.015
		Chrome plastic	M3SS7-21Y	1SFA611216R2103	1	0.015
		Chrome metal	M3SS7-31Y	1SFA611216R3103	1	0.024
	Blue	Black plastic	M3SS7-11L	1SFA611216R1104	1	0.015
		Chrome plastic	M3SS7-21L	1SFA611216R2104	1	0.015
		Chrome metal	M3SS7-31L	1SFA611216R3104	1	0.024
	Clear	Black plastic	M3SS7-11C	1SFA611216R1108	1	0.015
		Chrome plastic	M3SS7-21C	1SFA611216R2108	1	0.015
		Chrome metal	M3SS7-31C	1SFA611216R3108	1	0.024



M3SS

Dimensions (mm, inches)



Contact block holders

Contact blocks and lamp blocks with holder for front mounting

Max. number of blocks in holder	Included blocks	Catalog No.	Ref. Code
For non-illuminated operators			
3	1 NC	MCBH-01	1SFA 611 605 R1110
3	1 NO	MCBH-10	1SFA 611 605 R1101
3	2 NC	MCBH-02	1SFA 611 605 R1120
3	2 NO	MCBH-20	1SFA 611 605 R1102
3	3 NC	MCBH-03	1SFA 611 605 R1130
3	3 NO	MCBH-30	1SFA 611 605 R1103
3	1 NO + 1 NC	MCBH-11	1SFA 611 605 R1111
3	1 NO + 2 NC	MCBH-12	1SFA 611 605 R1121
3	2 NO + 1 NC	MCBH-21	1SFA 611 605 R1112

For illuminated operators

3	1 LB	MCBH-001	—
3	1 NC + 1 LB	MCBH-011	1SFA 611 605 R1210
3	1 NO + 1 LB	MCBH-101	1SFA 611 605 R1201
3	1 NO + 1 NC + 1 LB	MCBH-111	1SFA 611 605 R1211
3	2 NC + 1 LB	MCBH-021	1SFA 611 605 R1220
3	2 NO + 1 LB	MCBH-201	1SFA 611 605 R1202

Single contact blocks for front mounting

Contacts	Catalog No.	Ref. Code
1 NO	MCB-10	1SFA 611 610 R1001
1 NC	MCB-01	1SFA 611 610 R1010
1 NO with gold plated contacts	MCB-10G	1SFA 611 610 R1101
1 NC with gold plated contacts	MCB-01G	1SFA 611 610 R1110

Double contact block for front mounting

To be used together with MCBH5-00 when contact blocks in position 4- and 5- are needed.
Also when using MCBH-00 together with selector switch and contact block in position 3- is needed

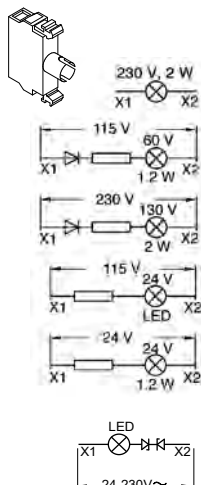
Included blocks	Catalog No.	Ref. Code
2 NO	MCB-20	1SFA 611 610 R1002
2 NC	MCB-02	1SFA 611 610 R1020
1 NO + 1 NC	MCB-11	1SFA 611 610 R1011

Micro contact blocks for front mounting

Contacts	Catalog No.	Ref. Code
1 NO	MCBL-10	1SFA611612R1010
1 NC	MCBL-01	1SFA611612R1001

Holders

Description	Catalog No.	Ref. Code
Holders for front mounting		
For three blocks	MCBH-00	1SFA 611 605 R1100
For five blocks	MCBH5-00	1SFA 611 601 R1100



Single lamp blocks for front mounting, Ba 9s base

Description	Catalog No.	Ref. Code
For max. 2 W, 230 V AC and DC filament bulb or LED	MLB-1	1SFA 611 620 R1001
115 V AC supply voltage for 60 V filament bulb max. 1.2 W.	MLB-2	1SFA 611 620 R1002
230 V AC supply voltage for 130 V filament bulb max. 2 W	MLB-3	1SFA 611 620 R1003
115 V AC and DC supply voltage For 24 V LED	MLB-4	1SFA 611 620 R1004
24 V AC and DC supply voltage with resistor. Intended for electronic circuits. The resistor limits the making current and protects against disturbances in the electronic circuit. For 24 V filament bulb	MLB-5	1SFA 611 620 R1005
With Zener diode, max 230V AC/DC, LEDs. Used in applications where voltage interference is a problem (i.e., the LED is visibly lit although control voltage is off.	MLB-8	1SFA 611 620 R1008

Transformer blocks

For 6 or 24 V filament bulb and 24 V LED. Rated power 1.5 W.

Primary voltage	Secondary voltage	Bulb Suffix LED Filament	Catalog No.	Ref. Code
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With lamp holder for pilot lights, front mounting, Ba 9s base

Intended to supply a 1.2 W filament bulb.

110 - 127 V AC	6 V AC	-	T1	KTR1-1001	1SFA 616 950 R1001
220 - 250 V AC	6 V AC	-	T2	KTR1-1002	1SFA 616 950 R1002
380 - 420 V AC	6 V AC	-	T3	KTR1-1003	1SFA 616 950 R1003
440 - 480 V AC	6 V AC	-	T4	KTR1-1004	1SFA 616 950 R1004
500 - 600 V AC	6 V AC	-	T5	KTR1-1005	1SFA 616 950 R1005
110 - 127 V AC	24 V AC ①	TL1	T6	KTR1-1011	1SFA 616 950 R1011
220 - 250 V AC	24 V AC ①	TL2	T7	KTR1-1012	1SFA 616 950 R1012
380 - 420 V AC	24 V AC ①	TL3	T8	KTR1-1013	1SFA 616 950 R1013
440 - 480 V AC	24 V AC ①	TL4	T9	KTR1-1014	1SFA 616 950 R1014

For illuminated operators ②

Intended to supply a 1.2 W filament bulb mounted in lamp block MLB-1 (1SFA 611 620 R1001) only.

110 - 127V AC	6 V AC	-	T1	KTR1-2001	1SFA 616 950 R2001
220 - 250 V AC	6 V AC	-	T2	KTR1-2002	1SFA 616 950 R2002
380 - 420 V AC	6 V AC	-	T3	KTR1-2003	1SFA 616 950 R2003
440 - 480 V AC	6 V AC	-	T4	KTR1-2004	1SFA 616 950 R2004
500 - 600 V AC	6 V AC	-	T5	KTR1-2005	1SFA 616 950 R2005
110 - 127 V AC	24 V AC ①	TL1	T6	KTR1-2011	1SFA 616 950 R2011
220 - 250 V AC	24 V AC ①	TL2	T7	KTR1-2012	1SFA 616 950 R2012
380 - 420 V AC	24 V AC ①	TL3	T8	KTR1-2013	1SFA 616 950 R2013
440 - 480 V AC	24 V AC ①	TL4	T9	KTR1-2014	1SFA 616 950 R2014

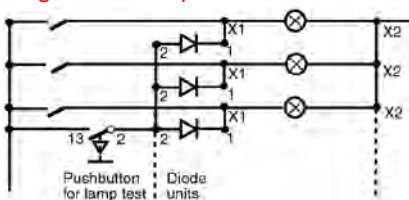
Diode blocks

To be used if several lamps are to be connected to a common lamp-test pushbutton.

A diode must be connected in series with each lamp. The diode block snaps onto the lamp block or is placed at the side.

Description	Catalog No.	Ref. Code
Diode block	MDB-1001	1SFA 611 630 R1001

Diagram for lamp test with three diode block



- ① Can be used with LED bulb
- ② To be used with directly supplied lamp blocks only.

Accessories



LEDs

With one diode chip mounted on a Ba 9s base. Choose the same color for the LED and the lamp cap or else use a clear lamp cap.

For white light use white LED with clear lamp cap. At DC the lamp base have to be connected to cathode (-) and the bottom contact to anode (+).

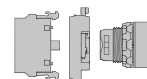
Description				Catalog No.	Ref. Code
Color	Rated current mA	Wave-length nm	Luminance mcd		
Rated voltage 12 V, DC Service life >50 000 h					
Red	15	630	250	KA2-2011	1SFA 616 921 R2011
Green	15	525	1000	KA2-2012	1SFA 616 921 R2012
Yellow	15	592	250	KA2-2013	1SFA 616 921 R2013
Blue	15	470	450	KA2-2014	1SFA 616 921 R2014
White	15	x=0.31 y=0.32	600	KA2-2015	1SFA 616 921 R2015
Rated voltage 24 V, (AC)/DC ① Service life >50 000 h					
Red	15	630	250	KA2-2021	1SFA 616 921 R2021
Green	15	525	800	KA2-2022	1SFA 616 921 R2022
Yellow	15	592	250	KA2-2023	1SFA 616 921 R2023
Blue	15	470	400	KA2-2024	1SFA 616 921 R2024
White	15	x=0.31 y=0.32	500	KA2-2025	1SFA 616 921 R2025
Rated voltage 36 V, (AC)/DC ① Service life >50 000 h					
Red	12	630	250	KA2-2031	1SFA 616 921 R2031
Green	12	525	800	KA2-2032	1SFA 616 921 R2032
Yellow	12	592	250	KA2-2033	1SFA 616 921 R2033
Blue	12	470	400	KA2-2034	1SFA 616 921 R2034
White	12	x=0.31 y=0.32	500	KA2-2035	1SFA 616 921 R2035
Rated voltage 48 V, (AC)/DC ① Service life >50 000 h					
Red	12	630	200	KA2-2041	1SFA 616 921 R2041
Green	12	525	1700	KA2-2042	1SFA 616 921 R2042
Yellow	12	592	240	KA2-2043	1SFA 616 921 R2043
Blue	12	470	720	KA2-2044	1SFA 616 921 R2044
White	12	x=0.31 y=0.32	1200	KA2-2045	1SFA 616 921 R2045
Rated voltage 60 V, (AC)/DC ① Service life >50 000 h					
Red	10	630	160	KA2-2051	1SFA 616 921 R2051
Green	10	525	1400	KA2-2052	1SFA 616 921 R2052
Yellow	10	592	200	KA2-2053	1SFA 616 921 R2053
Blue	10	470	600	KA2-2054	1SFA 616 921 R2054
White	10	x=0.31 y=0.32	1000	KA2-2055	1SFA 616 921 R2055
Rated voltage 110-130 V, AC ① Service life 25 000 h					
Red	4-6	630	60-100	KA2-2131	1SFA 616 921 R2131
Green	4-6	525	500-850	KA2-2132	1SFA 616 921 R2132
Yellow	4-6	592	70-120	KA2-2133	1SFA 616 921 R2133
Blue	4-6	470	220-350	KA2-2134	1SFA 616 921 R2134
White	4-6	x=0.31 y=0.32	350-600	KA2-2135	1SFA 616 921 R2135
Rated voltage 110-130 V, AC/DC ① Service life 25 000 h					
Red	4-6	630	60-100	KA2-2141	1SFA 616 921 R2141
Green	4-6	525	500-850	KA2-2142	1SFA 616 921 R2142
Yellow	4-6	592	70-120	KA2-2143	1SFA 616 921 R2143
Blue	4-6	470	220-350	KA2-2144	1SFA 616 921 R2144
White	4-6	x=0.31 y=0.32	350-600	KA2-2145	1SFA 616 921 R2145
Rated voltage 230 V, AC ① Service life 25 000 h					
Red	4	630	60	KA2-2221	1SFA 616 921 R2221
Green	4	525	500	KA2-2222	1SFA 616 921 R2222
Yellow	4	592	70	KA2-2223	1SFA 616 921 R2223
Blue	4	470	220	KA2-2224	1SFA 616 921 R2224
White	4	x=0.31 y=0.32	350	KA2-2225	1SFA 616 921 R2225
Rated voltage 230 V, AC/DC ① Service life 25 000 h					
Red	4	630	60	KA2-2231	1SFA 616 921 R2221
Green	4	525	500	KA2-2232	1SFA 616 921 R2222
Yellow	4	592	70	KA2-2233	1SFA 616 921 R2223
Blue	4	470	220	KA2-2234	1SFA 616 921 R2224
White	4	x=0.31 y=0.32	350	KA2-2235	1SFA 616 921 R2225

① At AC the luminance is decreased with 30 % and there is also a slight flickering.

Accessories for Modular Range LED Blocks, front mounting

Section 2.5.4 LED Blocks

Modular Range



LED Block with built in
leakage current protection

Description	Rated Current mA	Wavelength nm	Luminance mcd	Catalogue No.	List Price	Weight Kg
LED-blocks						
Rated Voltage 12 V, DC						
● Red	12.0	620	320	MLBL-00R		0.012
● Green	9.3	520	1500	MLBL-00G		0.012
● Yellow	12.0	588	380	MLBL-00Y		0.012
● Blue	9.5	468	450	MLBL-00L		0.012
○ White	9.3	¹⁾ 600	600	MLBL-00W		0.012
Rated Voltage 24 V, AC/DC						
● Red	9.9	620	250	MLBL-01R		0.012
● Green	9.2	520	1500	MLBL-01G		0.012
● Yellow	9.9	588	250	MLBL-01Y		0.012
● Blue	9.3	468	450	MLBL-01L		0.012
○ White	9.2	²⁾ 600	600	MLBL-01W		0.012
Rated Voltage 48 V, AC/DC						
● Red	10.0	620	260	MLBL-02R		0.012
● Green	9.7	520	1500	MLBL-02G		0.012
● Yellow	10.0	588	300	MLBL-02Y		0.012
● Blue	9.7	468	450	MLBL-02L		0.012
○ White	9.7	¹⁾ 600	600	MLBL-02W		0.012
Rated Voltage 60 V, AC/DC						
● Red	13.0	620	350	MLBL-03R		0.012
● Green	12.7	520	2000	MLBL-03G		0.012
● Yellow	13.0	588	400	MLBL-03Y		0.012
● Blue	12.7	468	550	MLBL-03L		0.012
○ White	12.7	¹⁾ 750	750	MLBL-03W		0.012
Rated Voltage 110-130 V, AC						
● Red	8.6	620	200	MLBL-04R		0.012
● Green	8.5	520	1200	MLBL-04G		0.012
● Yellow	8.6	588	250	MLBL-04Y		0.012
● Blue	7.0	468	400	MLBL-04L		0.012
○ White	7.0	¹⁾ 500	500	MLBL-04W		0.012
Rated Voltage 110-130 V, DC						
● Red	9.9	620	250	MLBL-05R		0.012
● Green	9.8	520	1500	MLBL-05G		0.012
● Yellow	9.9	588	300	MLBL-05Y		0.012
● Blue	9.8	468	450	MLBL-05L		0.012
○ White	9.8	¹⁾ 600	600	MLBL-05W		0.012
Rated Voltage 220 V, DC						
● Red	8.0	620	180	MLBL-06R		0.012
● Green	8.0	520	110	MLBL-06G		0.012
● Yellow	8.0	588	200	MLBL-06Y		0.012
● Blue	8.0	468	450	MLBL-06L		0.012
○ White	8.0	¹⁾ 600	600	MLBL-06W		0.012
Rated Voltage 230 V, AC						
● Red	9.5	620	250	MLBL-07R		0.012
● Green	9.4	520	1500	MLBL-07G		0.012
● Yellow	9.5	588	300	MLBL-07Y		0.012
● Blue	8.2	468	450	MLBL-07L		0.012
○ White	8.2	¹⁾ 600	600	MLBL-07W		0.012

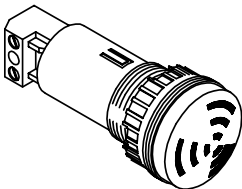
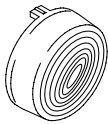
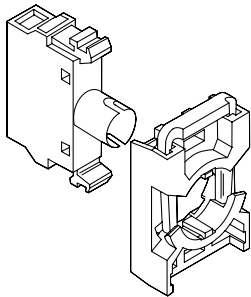
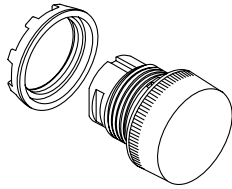
Note: Care should be taken for DC supply where + and - must be correctly connected. This is marked X1 (+) and X2 (-) on the product.

¹⁾ X=0.31, Y=0.32 according to the ICI Chromaticity Diagram.

Pilot lights and Buzzers

Pilot Devices
Modular Range
22mm

8



Pilot light head ①②

Lens color	Catalog No.	Ref. Code
Red	ML1-100R	1SFA 611 400 R1001
Green	ML1-100G	1SFA 611 400 R1002
Yellow	ML1-100Y	1SFA 611 400 R1003
Blue	ML1-100L	1SFA 611 400 R1004
White	ML1-100W	1SFA 611 400 R1005
Clear	ML1-100C	1SFA 611 400 R1008

Lamp blocks with holder ①

Supply voltage	Catalog No.	Ref. Code
For max. 2 W, 230 V AC and DC filament bulb or LED $\begin{array}{c} 230 \text{ V, 2 W} \\ \text{X1} \text{---} \text{X2} \end{array}$	MCBH-001	1SFA 611 605 R1200
115 V AC supply voltage. For 60 V filament bulb max. 1.2 W $\begin{array}{c} 115 \text{ V} \sim \\ \text{X1} \text{---} \text{X2} \end{array}$	MCBH-002	1SFA 611 605 R1300
230 V AC supply voltage. For 130 V filament bulb max. 2 W $\begin{array}{c} 230 \text{ V} \sim \\ \text{X1} \text{---} \text{X2} \end{array}$	MCBH-003	1SFA 611 605 R1400

Light diffusing lens

To improve illumination. *Note: Cannot be used with text cap.*

Description	Catalog No.	Ref. Code
The lens is used instead of text cap	KA1-8005	1SFA 616 920 R8005

Buzzers

Black. Frequency: Approx. 2400 Hz. Loudness: Min 80 dB (A)/10 cm
Rated current: ≤ 8 mA. Service life: >5000 h

Supply voltage	Tone	Catalog No.	Catalog No.	Ref. Code
24 V AC/DC	Continuous	KB1-4010		1SFA 616 401 R4010
115 V AC/DC	Continuous	KB1-4030		1SFA 616 401 R4030
230 V AC	Continuous	KB1-4040		1SFA 616 401 R4040
24 V AC/DC	Pulsating	KB1-4110		1SFA 616 401 R4110
115 V AC/DC	Pulsating	KB1-4130		1SFA 616 401 R4130
230 V AC	Pulsating	KB1-4140		1SFA 616 401 R4140

① Bulb not included. See page 8.23

② For compact style, see page 8.33.

2.6

Electrical Enclosure/Control Panel

Section 2.6.1

Electrical Enclosure



FREE-STAND ENCLOSURES TYPE 12 FREE-STAND ENCLOSURES

FREE-STAND, SINGLE OR DUAL ACCESS, TYPE 12



72" x 48" x 18"

INDUSTRY STANDARDS

UL 508A Listed; Type 12; File No. E61997
cUL Listed per CSA C22.2 No. 94; Type 12; File No. E61997

NEMA/EEMAC Type 12
E.I.A. RS310D
CSA, File No. 42186, Type 12
IEC 60529, IP55

APPLICATION

Available with front or front and rear access, these Type 12 enclosures have sturdy unibody construction and flexible internal mounting options.

SPECIFICATIONS

- 12 gauge steel
- Seams continuously welded and ground smooth; no holes or knockouts
- Stiffeners on back of two-door enclosures maintain flatness and increase rigidity
- Lifting eyes for easy handling
- 3-point latches operated by oil-tight key-locking handle
- Latch rod rollers for easy door closing
- Concealed, easy-to-remove hinges
- Data pockets are high-impact thermoplastic
- Internal mounting channels welded horizontally to sides at top, bottom and center
- Optional panels and rack mount angles can be mounted anywhere along channels
- Oil-resistant door gasket
- Bonding provision on door
- Provision for mounting fluorescent light

FINISH

Two finishes available: ANSI 61 gray, polyester powder paint outside and inside; or ANSI 61 gray outside and white, polyester powder paint inside. Optional panels available with a white or conductive finish.

ACCESSORIES

See also Accessories.

Plate Casters

Electric Heater

Door Stop Kit

Compact Cooling Fans

PANELITE™ Enclosure Lights Overview

See also the Popular Cooling Products and Accessories tables following the Standard Products tables.

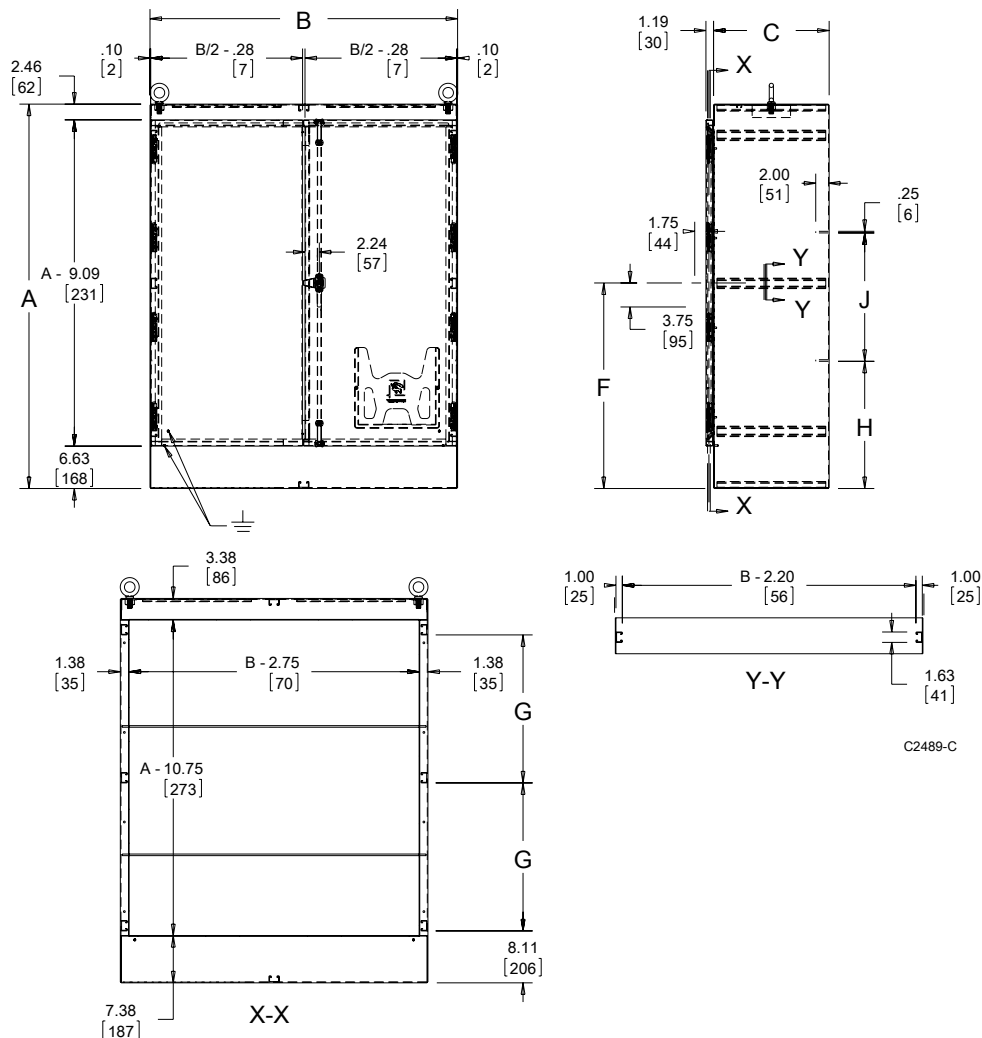
MODIFICATION AND CUSTOMIZATION

Hoffman excels at modifying and customizing products to your specifications. Contact your local Hoffman sales office or distributor for complete information.

BULLETIN: A30

Catalog Number	AxBxC in.	AxBxC mm	Interior Finish	F (in.)	F (mm)	G (in.)	G (mm)	H (in.)	H (mm)	J (in.)	J (mm)	Number of Lifting Eyes	Number of Rack Units
A604818FSDG	60.06 x 48.06 x 18.06	1526 x 1221 x 459	Gray	32.03	814	23.12	587	19.88	505	20.03	509	2	28
A604818FSD	60.06 x 48.06 x 18.06	1526 x 1221 x 459	White	32.03	814	23.12	587	19.88	505	20.03	509	2	28
A724818FSDG	72.06 x 48.06 x 18.06	1830 x 1221 x 459	Gray	38.03	966	29.12	740	23.88	607	24.03	610	2	35
A724818FSD	72.06 x 48.06 x 18.06	1830 x 1221 x 459	White	38.03	966	29.12	740	23.88	607	24.03	610	2	35
A726018FSDG	72.06 x 60.06 x 18.06	1830 x 1526 x 459	Gray	38.03	966	29.12	740	23.88	607	24.03	610	2	35
A726018FSD	72.06 x 60.06 x 18.06	1830 x 1526 x 459	White	38.03	966	29.12	740	23.88	607	24.03	610	2	35
A727218FSDG	72.06 x 72.06 x 18.06	1830 x 1830 x 459	Gray	38.03	966	29.12	740	23.88	607	24.03	610	2	35
A727218FSD	72.06 x 72.06 x 18.06	1830 x 1830 x 459	White	38.03	966	29.12	740	23.88	607	24.03	610	2	35
A904820FSDG	90.06 x 48.06 x 20.06	2288 x 1221 x 510	Gray	47.03	1195	38.12	968	29.88	759	30.03	763	2	45
A904820FSD	90.06 x 48.06 x 20.06	2288 x 1221 x 510	White	47.03	1195	38.12	968	29.88	759	30.03	763	2	45
A907220FSDG	90.06 x 72.06 x 20.06	2288 x 1830 x 510	Gray	47.03	1195	38.12	968	29.88	759	30.03	763	2	45
A907220FSD	90.06 x 72.06 x 20.06	2288 x 1830 x 510	White	47.03	1195	38.12	968	29.88	759	30.03	763	2	45
A724824FSDG	72.06 x 48.06 x 24.06	1830 x 1221 x 611	Gray	38.03	966	29.12	740	23.88	607	24.03	610	2	35
A724824FSD	72.06 x 48.06 x 24.06	1830 x 1221 x 611	White	38.03	966	29.12	740	23.88	607	24.03	610	2	35
A726024FSDG	72.06 x 60.06 x 24.06	1830 x 1526 x 611	Gray	38.03	966	29.12	740	23.88	607	24.03	610	2	35
A726024FSD	72.06 x 60.06 x 24.06	1830 x 1526 x 611	White	38.03	966	29.12	740	23.88	607	24.03	610	2	35
A727224FSDG	72.06 x 72.06 x 24.06	1830 x 1830 x 611	Gray	38.03	966	29.12	740	23.88	607	24.03	610	2	35
A727224FSD	72.06 x 72.06 x 24.06	1830 x 1830 x 611	White	38.03	966	29.12	740	23.88	607	24.03	610	2	35
A907224FSDG	90.06 x 72.06 x 24.06	2288 x 1830 x 611	Gray	47.03	1195	38.12	968	29.88	759	30.03	763	2	45
A907224FSD	90.06 x 72.06 x 24.06	2288 x 1830 x 611	White	47.03	1195	38.12	968	29.88	759	30.03	763	2	45
A726036FSDG	72.06 x 60.06 x 36.06	1830 x 1526 x 916	Gray	38.03	966	29.12	740	23.88	607	24.03	610	4	35
A726036FSD	72.06 x 60.06 x 36.06	1830 x 1526 x 916	White	38.03	966	29.12	740	23.88	607	24.03	610	4	35
A907236FSDG	90.06 x 72.06 x 36.06	2288 x 1830 x 916	Gray	47.03	1195	38.12	968	29.88	759	30.03	763	4	45
A907236FSD	90.06 x 72.06 x 36.06	2288 x 1830 x 916	White	47.03	1195	38.12	968	29.88	759	30.03	763	4	45

Removable 12.00 x 12.00 (305mm x 305mm) data pocket.



Section 2.1 Load Center



Catalog No. PAM2020R

Description: LD CTR MCB 200A 20/40 AL N3R GR PON UL

UPC No 783164701241

[Home](#) > [Load Centers](#) > [Load Centers](#)

ABB ReliaHome makes homes reliable, with ease. We designed our ReliaHome load centers to be installed as fast as possible - and reliable so your customers can leave a job with confidence. They work seamlessly with all our residential circuit breakers, optimizing your stock.

Descriptors

Category	Load Centers
GO Schedule	RT
Grouping	Single Phase - USA

Specifications

# Branch Circuit 250A	20
1" Space	20
1/2" Space	0
Amperage	200 A
Circuit Breaker Style	Plug-On Neutral
Door	Yes
Enclosure	Outdoor
Enclosure Type	Outdoor, Surface Mount
Factory Installed Ground Kit	No
Feed	Top
Input/Output Voltage	120/240V ac
Interrupt Rating	22kAIC
Interrupting Capacity Rating	22kAIC
Load Center Type	P-Series (PON)
Meter Socket Options: 200 Amp Main Breaker Installed	No
Meter Socket Options: High Amp Mode	None
NEMA Rating	NEMA 3R
No of Circuits	40
Phase	1 Phase
Service & Voltage	1 Phase, 3 Wire, 120/240V ac
Wires	3 Wire

Classifications

UL/CUL Listing	UL
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KT-VTLED19-2A-8XX-VDIM-P

VAPOR TIGHT FIXTURE

DESCRIPTION

2' 19W LED Vapor Tight Fixture | 120–277V Input | 0–10V Dimming | Premium Series

APPLICATION

Used for commercial and industrial rugged or outdoor applications



5 YEAR
WARRANTY



PRODUCT FEATURES

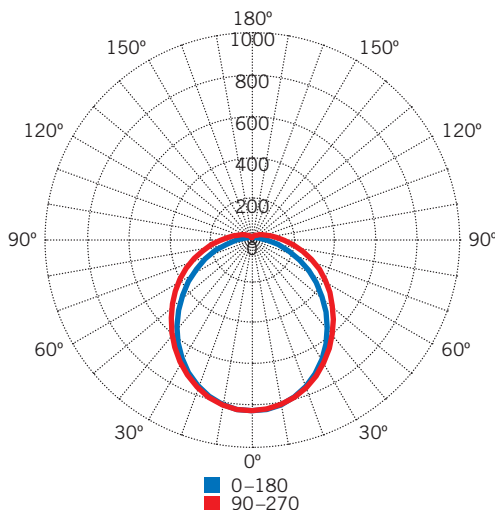
- Traditional design, narrow body, Vapor Tight fixture, suitable for rugged, demanding applications
- Powered by Keystone 0–10V dimming LED drivers
- IP66, suitable for wet location
- Smooth, diffused lens for even appearance
- Stainless steel lens clips
- 0–10V dimming, 10% minimum
- Impact Resistance Rating: IK10
- Ambient operating temperature: –20°C/–4°F to 50°C/122°F
- UL Listed 1598
- THD: <20%
- PF: >0.95
- LED chip lifetime: L70>100,000 hours @ 25°C/77°F ambient fixture temperature
- Includes mounting hardware
- High quality, impact resistant Poly Carbonate lens

PRODUCT SPECIFICATIONS

Catalog Number	Color Temperature	Nominal Length	Input Voltage	Wattage	CRI	Lumen Output	Efficacy
KT-VTLED19-2A-840-VDIM-P	4000K	2 ft.	120–277V	19W	>82.0	2,430 lm	128 lm/W
KT-VTLED19-2A-850-VDIM-P	5000K	2 ft.	120–277V	19W	>82.0	2,465 lm	130 lm/W

PHOTOMETRIC SPECIFICATIONS

LUMINOUS INTENSITY DISTRIBUTION



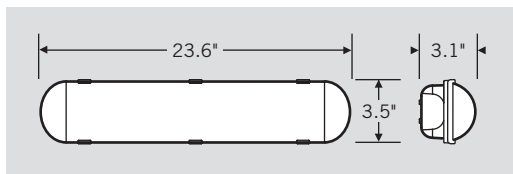
ZONAL LUMEN SUMMARY

Degree	Flux (Lumens)	% Luminaire
0~10°	78.3 lm	3.10%
0~20°	300.8 lm	11.92%
0~30°	633.1 lm	25.09%
0~40°	1,026.4 lm	40.68%
0~50°	1,429.2 lm	56.64%
0~60°	1,796.7 lm	71.21%
0~70°	2,094.0 lm	82.99%
0~80°	2,298.9 lm	91.11%
0~90°	2,413.3 lm	95.65%
0~100°	2,471.5 lm	97.95%
0~110°	2,500.7 lm	99.11%
0~120°	2,514.1 lm	99.64%
0~130°	2,519.0 lm	99.83%
0~140°	2,520.4 lm	99.89%
0~150°	2,521.5 lm	99.93%
0~160°	2,522.4 lm	99.97%
0~170°	2,523.0 lm	99.99%
0~180°	2,523.2 lm	100.00%

KT-VTLED19-2A-8XX-VDIM-P

VAPOR TIGHT FIXTURE

PHYSICAL SPECIFICATIONS



ORDERING INFORMATION

CATALOG NUMBER	PACKAGING STYLE	PACK QUANTITY	ITEM STATUS
KT-VTLED19-2A-840-VDIM-P-CP	Carton Pack	4	Active
KT-VTLED19-2A-850-VDIM-P-CP	Carton Pack	4	Active

CATALOG NUMBER BREAKDOWN

KT-VTLED19-2A-850-VDIM-P-CP

1 2 3 4 5 6 7 8 9 10

- 1 Keystone Technologies
- 2 Vapor Tight LED Fixture
- 3 Wattage
- 4 2' Nominal Length
- 5 Lamp Type
- 6 800 Series
- 7 Color Temperature
- 8 0-10V Dimming
- 9 Premium Series
- 10 Packaging Style

SPECTRACOOL NARROW INDOOR/OUTDOOR



N43
11000 BTU/Hr.
3223 Watt

N36
6000/8000 BTU/Hr.
1758/2344 Watt

N28
4000 BTU/Hr.
1172 Watt

INDUSTRY STANDARDS

UL/cUL Listed; Type 12, 3R, 4; 4X optional; File No. SA6453

CE
IP 56 Internal Loop
IP 34 on External Loop
Telcordia GR-487 capable (Outdoor)

APPLICATION

- Industrial automation
- Waste water treatment systems
- Package handling equipment
- Security and defense systems

FEATURES

- Narrow design accommodates 12-in. (300-mm) deep cabinets
- Energy efficient reciprocating compressor on N28 models
- Energy efficient rotary compressor on N36 and N43 models
- R407c and R134a earth-friendly refrigerants
- Models for 115, 230 and 400/460 3-phase VAC power input
- UL Listed to save customers time and money with agency approvals
- Outdoor model operating temperature range from -40 F/-40 C to 131 F/55 C (125 F/52 C on N28 Series)
- Attractive industrial design with minimal use of visible fasteners
- Reliable mechanical thermostat on enclosure side of the unit; indoor Air Conditioner models include digital display on ambient side
- Galvanized sheet-metal cover for rugged factory and outdoor environments
- Easy-mount flanges for simple installation
- Cut-out adapter options for enclosures with GENESIS® air conditioners enable users to easily transition to the new unit
- Dust-resistant condenser coil allows the unit to be run filterless in most applications
- Cleanable, reusable aluminum mesh filter protects coils for maximum cooling performance
- Mounting hardware, gaskets and user manual furnished with the unit
- Every unit functionally tested before shipping
- Standard Indoor Air Conditioner models also include:
 - Active condensate management with heater strip
 - Power-off relay for door switch and other system requirements
 - Malfunction switch
- Standard Outdoor Air Conditioner models also include:
 - Telcordia GR-487 capable
 - Corrosion-resistant components
 - Malfunction switch
 - Compressor heater
 - Head pressure control
 - 1300 W enclosure heater

SPECIFICATIONS

- Nominal cooling capacity:
 - N28 4000 BTU/Hr. (1172 W)
 - N36 6000 & 8000 BTU/Hr. (1758 and 2344 W)
 - N43 11000 BTU/Hr. (3223 W)
- Outdoor model operating temperature range from -40 F/-40 C to 131 F/55 C (125 F/52 C on N28 Series)

FINISH

- RAL 7035 light-gray, semi-textured powder-coat paint
- Other colors and textures available

NOTES

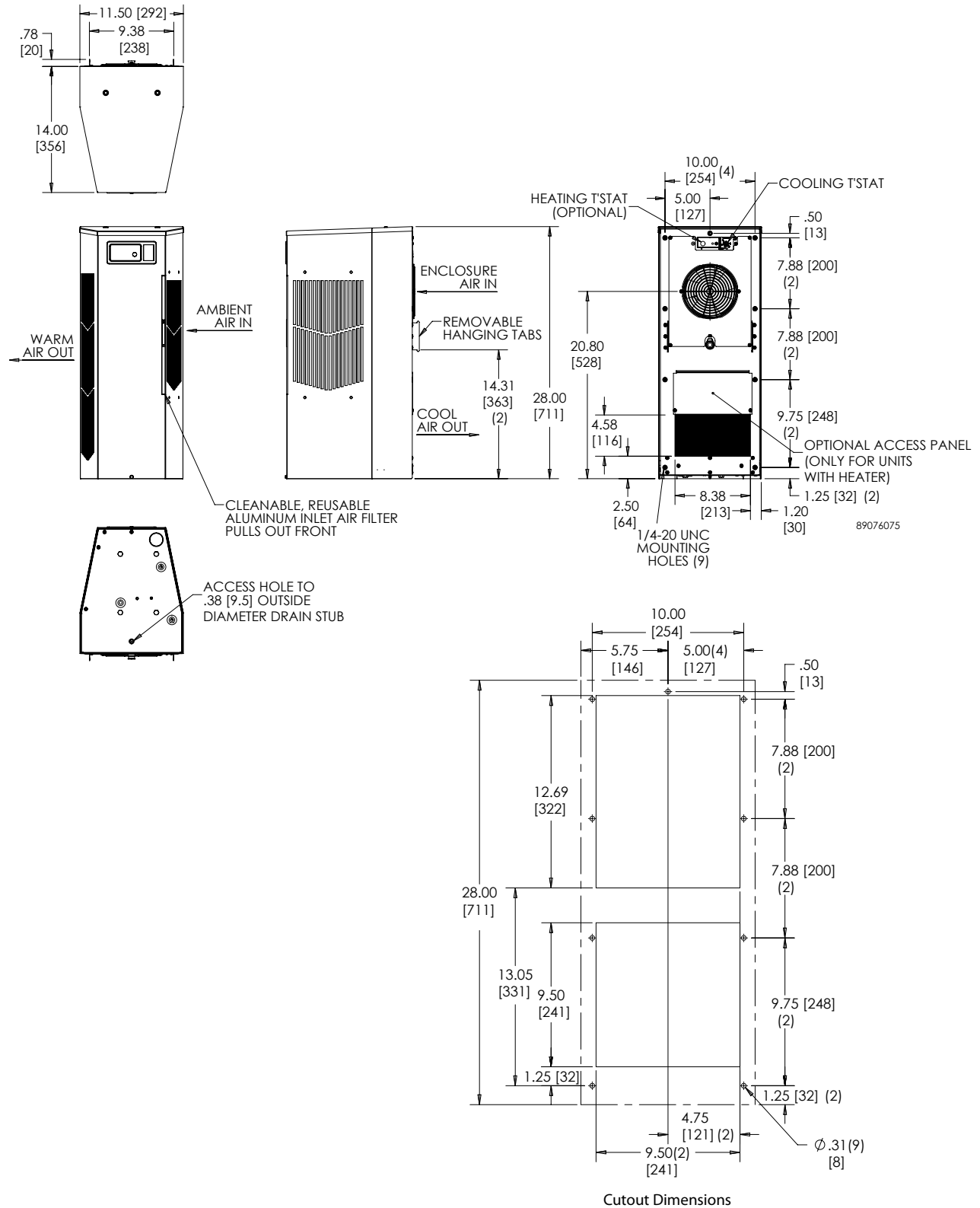
Visit www.PentairProtect.com to download 2D and 3D CAD drawings into the overall design of your electrical system.

Performance Data **N28 4000 BTU/Hr. (1172 Watt)**

CATALOG NUMBER			
Indoor Model	N280416G050	N280426G050	N280446G050
Indoor Model Stainless Steel Type 4X	N280416G051	N280426G051	N280446G051
Indoor Model with Remote Access Control*	N280416G060	N280426G060	N280446G060
Outdoor Model without Heat Pkg.	N280416G100	N280426G100	N280446G100
Outdoor Model without Heat Pkg. Stainless Steel Type 4X	N280416G102	N280426G102	N280446G102
Outdoor Model with Heat Pkg.	N280416G150	N280426G150	—
Outdoor Model with Heat Pkg. Stainless Steel Type 4X	N280416G151	N280426G151	—
COOLING PERFORMANCE			
Nominal:			
BTUs/Hr.	3800 / 4000	3800 / 4000	4000
Watts	1114 / 1172	1114 / 1172	1172
At 125 F / 125 F (50 C / 50 C):			
BTU/Hr. (50 / 60 Hz)	3940 / 4104	4269 / 4703	4703
Watts (50 / 60 Hz)	1150 / 1000	1250 / 1378	1378
At 95 F / 95 F (35 C / 35 C):			
BTU/Hr. (50 / 60 Hz)	3754 / 4011	3700 / 4291	4291
Watts (50 / 60 Hz)	1100 / 1175	1086 / 1257	1257
Refrigerant	R134a	R134a	R134a
Refrigerant Charge (ounces/grams)	10 / 283	11 / 312	11 / 312
Operating Temperature Range:			
Maximum [°F / °C]	125/52	125/52	125/52
Minimum [°F / °C]	-40/-40	-40/-40	-40/-40
Air Flow at 0 Static Pressure:			
Internal loop 50 Hz (CFM / M ³ /Hr)	138 / 234	N/A	N/A
External loop 50 Hz (CFM / M ³ /Hr)	268 / 455	N/A	N/A
Internal loop 60 Hz (CFM / M ³ /Hr)	143 / 362	143 / 243	143 / 243
External loop 60 Hz (CFM / M ³ /Hr)	288 / 728	288 / 489	288 / 489
Max. Heater W (Outdoor Models)	1300	1300	1300
ELECTRICAL DATA			
Rated Voltage	110 / 115	230	460
Frequency (Hz)	50 / 60	50 / 60	60
Operating Range	+/-10%	+/-10%	+/-10%
Max. Power Consumption (Watts at 50 / 60 Hz)	971 / 1116	975 / 1104	1104
Max. Nominal Current (Amps at 50 / 60 Hz)	10.6 / 10.0	4.9 / 5.0	2.5
Starting Current (Amps)	40	24.5	12.5
Agency Approvals		cUL Listed CE	
Power Input Description		Others available upon request	
		Terminal Block	
ENCLOSURE PROTECTION			
UL Type		Type 12, 3R, 4 Standard Type 4X Stainless Steel Optional	
CONTROLLER			
Description		Basic Mechanical Thermostat	
Thermostat Location		Enclosure Side	
Factory Thermostat Setting [°F / °C]		80 / 27	
SOUND LEVEL			
At 1.5 Meters	64.4 dBA	65.5 dBA	65.5 dBA
UNIT CONSTRUCTION			
Material		Galvanized sheet metal standard Stainless steel optional	
Finish		RAL 7035 light-gray, semi-textured powder-coat paint standard Other colors available	
ACCESSORIES			
EASYSWAP Adaptor Plenum (GENESIS M33)		Enables SPECTRACOOL to be mounted to a GENESIS M33 air conditioner cutout Catalog Number PLM33N28	
UNIT DIMENSIONS			
Height (in / mm)		28 / 711.2	
Width (in / mm)		11.50 / 292.1	
Depth (in / mm)		14.00 / 355.6	
Weight (lb / kg)	84/38	84/38	92/41.7

*Units with Remote Access Control utilize a digital controller and communicate via EtherNet/IP, Profinet, Modbus TCP/IP and SNMP over ethernet or modbus RTU over USB.

N28 Models 4000 BTU/Hr. (1172 Watt)



Visit www.PentairProtect.com to download 2D and 3D CAD drawings into the overall design of your electrical system.

UF15PC series

Section 2.6.4 Enclosure Fan



(172 x 150 x 51 mm)

6.77 x 5.91 x 2.0 inches

Operating voltage: 115 or 230 VAC

Construction: aluminum die cast frame;
UL94V-0 PBT impeller

Bearing option: ball bearing

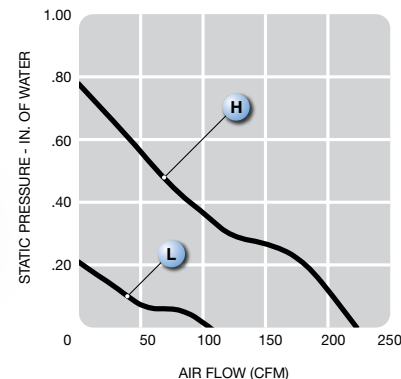
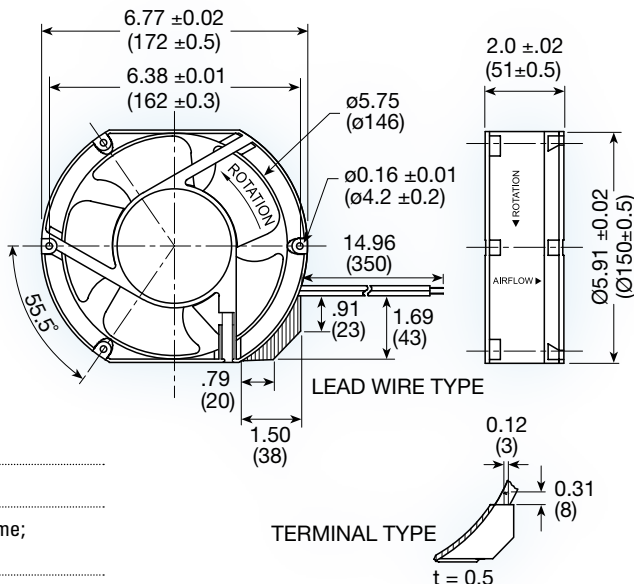
Motor: permanent split capacitor

Air Flow: exhaust over struts

Connection: terminal or 22 AWG lead wire

Protection: thermal

Option: dual voltage 115/130VAC; IP55;
IP55 + salt fog, tachometer output



Model No.	Rated Voltage V	Freq. HZ	Input Power W	Rated Cur. A	Locked Cur. A	Speed RPM	Air Volume		Max. Static Pressure (H ₂ O)		Sound Noise dBa	Weight kg
							M ³ /Min.	CFM	MM	INCH		
UF15PC12-__H	115	60	31	0.25	0.43	3,400	6.4	226	20.0	0.79	58	0.80
UF15PC23-__H	230	60	29	0.12	0.19	3,400	6.4	226	20.0	0.79	58	0.80
UF15PC12-__L	115	60	31	0.15	0.20	1,700	3.0	106	5.5	0.22	37	0.80
UF15PC23-__L	230	60	29	0.07	0.09	1,700	3.0	106	5.5	0.22	37	0.80

UF25GC series

**Size: (254 dia. x 89 mm)
10.0 dia. x 3.5 inches**

Operating voltage (VAC): 115 or 230

Construction: aluminum die cast frame;
UL94V-0 PBT impeller

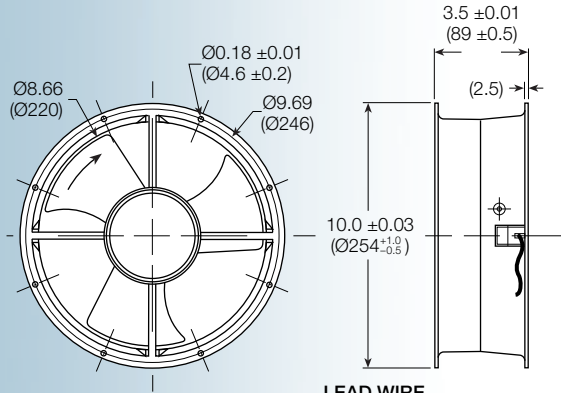
Bearing option: motor quality ball bearings

Motor: capacitor start

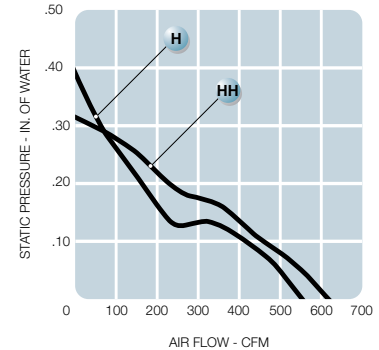
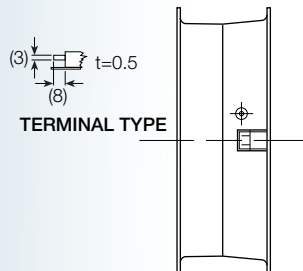
Air flow: exhaust over struts

Connection: terminal or 22 AWG lead wire

Protection: thermal



LEAD WIRE



Model No.	Rated Voltage V	Freq. HZ	Input Power W	Rated Cur. A	Locked Cur. A	Speed RPM	Air Volume		Max Static Pressure (H ₂ O)		Sound Noise		Wt LBS
							M ³ /Min	CFM	MM	INCH	dB		
UF25GC12-__H	115	60	33	0.29	0.51	1,650	15.5	550	10	0.40	56	4.2	
UF25GC23-__H	230	60	33	0.14	0.25	1,650	15.5	550	10	0.40	56	4.2	
UF25GC12-__HH	115	60	72	0.61	0.62	2,000	17.6	620	8.25	0.33	58	4.2	

OCH / OCH2 Sizing Chart

MOUNTING HEIGHT	HEATER MFG MODEL	WATTS	HEAT PATTERN COVERAGE (AT FLOOR LEVEL)			TOTAL WATTS / SQ. FT.
			LENGTH	WIDTH	SQ. FT.	
7'	OCH-46	1500	11	9	99	15.2
		2000	11	9	99	20.2
8'	OCH-46	1500	12	10	120	12.5
		2000	12	10	120	16.7
	OCH-57	3000	13	10	130	23.1
		2250	13	10	130	17.3
	OCH2-55	4000	16	10	160	25.0
		6000	17	10	170	35.3
9'	OCH-46	1500	13	11	143	10.5
		2000	13	11	143	14.0
	OCH-57	3000	14	11	154	19.5
		2250	14	11	154	14.6
10'	OCH-57	3000	15	12	180	16.7
		2250	15	12	180	12.5
	OCH2-55	4000	19	13	247	16.2
		6000	20	13	260	23.0
12'	OCH-57	3000	17	14	238	12.6
		2250	17	14	238	9.5
	OCH2-55	4000	22	15	330	12.1
		6000	23	15	345	17.4
14'	OCH2-55	4000	25	17	425	9.4
	OCH2-66	6000	26	17	442	13.6

Product Specifications

Series: OCH-46
OCH-57
Dimensions: Length: 48"; Width: 5.375"; Height: 6.5"
Length: 59"; Width: 5.375"; Height: 6.5"

Housing: 24 gauge Aluminized Steel with a baked on brown powder coat finish. Housing is cETLus Listed for indoor or outdoor applications. Horizontal mounting only.

Reflectors and End Caps: .040 Gold anodized Aluminum reflectors and end caps for superior reflectiveness. 60 degree medium (symmetric) pattern only.

Elements: Quartz Tubes. Frosted quartz envelope with a Nickel-Chromium coiled filament, porcelain end caps, and threaded-screw (stud) terminations. Fast heat-up and cool-down performance. Available Wattages from 1500 to 3000 Watts per element. Available voltages from 120 to 480 Volts.

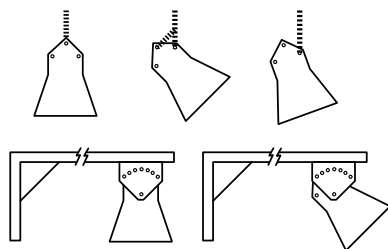
Controls: OCH Series heaters are not manufactured with any control device on the unit. All controls are accessories and should be specified as such. Please consult the technical sales department of factory for help in determining applicable controls. Please follow installation instructions that accompany each heater.

Accessories: Adjustable mounting brackets (stainless steel only), vertical mounting brackets (stainless steel only), wire guards, thermostats, SCR controllers, and power contactor panels.

Mounting Configurations & Reflector Pattern

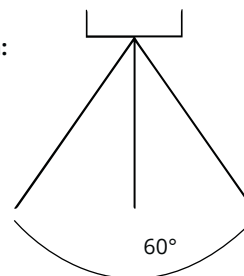
- Mounting**
- Chain, surface mount or use our vertical mounting bracket as shown below. Note: All units must be mounted horizontally.
 - In-Built surface mounting bracket allows for fixture adjustment up to a 45° horizontal tilt.
 - As shown, the heater may be suspended at any horizontal angle desired.

Chain Mount:
(Chain supplied)



Optional Vertical Mounting Bracket:
Model # VMB-41-SS

Reflector Pattern:



Mounting Clearances & Recommended Mounting Height

MOUNTING CLEARANCES	RECOMMENDED MOUNTING HEIGHT	
3" from ceiling; 12" from vertical surface 72" from face of heater to combustible surface 36" from another heater	OCH-46	7'-9'
	OCH-57	8'-10'

OCH2 Series Outdoor / Indoor Rated Quartz Electric Infrared Heater

86



Heats solid objects, not the air!



WARNING: This product can expose you to chemicals including nickel which is known to the State of California to cause cancer, and chromium, which is known to the State of California to cause birth defects and/or reproductive harm. For more information go to www.P65Warnings.ca.gov.



Features

- 2 Frosted Quartz Tube heating elements (included)
- Listed for suspended, totally exposed (outdoor) and indoor** spot heating applications
- Finish: High-temp brown powder coated finish or corrosion resistant stainless steel 20 gauge housing
- 60° Symmetric Heat Pattern
- Gold anodized Aluminum reflector and end caps
- 6" long lead wires for direct field connection
- Two 2' ft. long mounting chains and four S-Hooks included
- The OCH2-Series can be wall or ceiling mounted using the supplied mounting brackets which allow up to a 45° horizontal tilt adjustment
- Made in U.S.A.

Series:
OCH2-55
OCH2-66

Dimensions:
Length: 55"; Width: 7.5"; Height: 7"; Weight: 21 lbs.
Length: 66"; Width: 7.5"; Height: 7"; Weight: 25 lbs.

Product Models

MFG CATALOG NUMBER	PAINTED BROWN MFG MODEL NUMBER		MFG CATALOG NUMBER	STAINLESS STEEL MFG MODEL NUMBER		WATTS	BTUs	VOLTS	AMPS	Qtz. Tube Repl. Element
04915502	OCH2-55-208V		04915902	OCH2-55-208V-SS		4000	13652	208	19.23	671-5062
04915602	OCH2-55-240V		04916002	OCH2-55-240V-SS				240	16.67	671-5063
04915702	OCH2-55-277V		04916102	OCH2-55-277V-SS				277	14.44	671-5064
04915802	*OCH2-55-480V		04916202	*OCH2-55-480V-SS				480	8.33	*671-5063
04916302	OCH2-66-208V		04916702	OCH2-66-208V-SS		6000	20478	208	28.85	671-5065
04916402	OCH2-66-240V		04916802	OCH2-66-240V-SS				240	25	671-5066
04916502	OCH2-66-277V		04916902	OCH2-66-277V-SS				277	21.66	671-5067
04916602	*OCH2-66-480V		04917002	*OCH2-66-480V-SS				480	12.5	*671-5066

*480V models use (2) 240V elements wired in series.

**Not for residential use

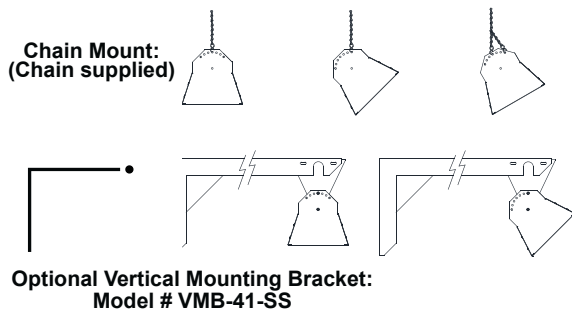
Product Accessories

MFG CATALOG NUMBER	MFG MODEL NUMBER	DESCRIPTION	FOR USE WITH	LIST
04917102	OCH2WG-55	Wire Guards	OCH2-55 Series Models	90
04917202	OCH2WG-66		OCH2-66 Series Models	109

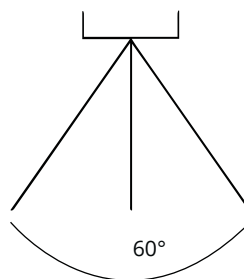
Mounting Configurations & Reflector Pattern

Mounting

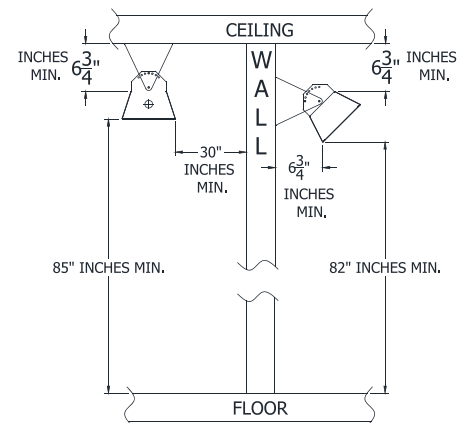
- Chain, surface mount or use our vertical mounting bracket as shown below.
- In-Built surface mounting bracket allows for fixture adjustment up to a 45° horizontal tilt.
- As shown, the heater may be suspended at any horizontal angle desired.



Reflector Pattern:



Note: All units must be mounted horizontally.



Mounting Clearances & Recommended Mounting Height

MOUNTING CLEARANCES	RECOMMENDED MOUNTING HEIGHT	
6-3/4" from ceiling; 30" from vertical surface 85" from face of heater to combustible surface 36" from another heater	OCH2-55	9'-11'
	OCH2-66	10'-12'



Reinventing Safety All Around

1597, 2097, 1597TR, 2097TR, 1597TRWR, 2097TRWR

The radiant® Self-Test GFCI receptacle with SafeLock® Protection conducts an automatic test every three seconds, ensuring it's always ready to protect. If the device fails the test, the indicator light flashes to signal that the GFCI should be replaced. It also has our proven SafeLock Protection feature: if critical components are damaged and protection is lost, power to the receptacle is disconnected.

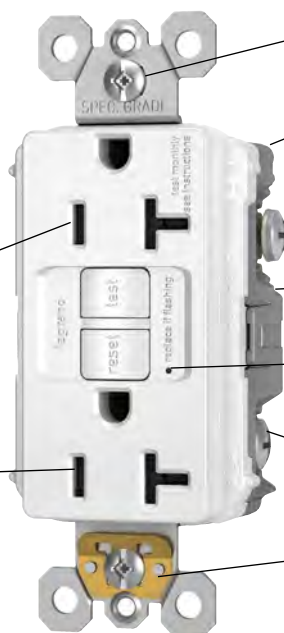
Features & Benefits

New external back wire pressure plates with posted terminal screws for faster installation.

Patented SafeLock® Protection: if critical components are damaged and ground fault protection is lost, power to the receptacle is disconnected.

Enhanced tamper-resistant automatic shutter system allows for easier plug insertion while preventing young children from inserting common household objects.

Now with black "invisi-shutters" for an invisible effect preferred by end users



Captive screws make for easier installation.

Ground terminal clamp allows for fast installation.

Prevents line-load reversal miswire: No power to the face or downstream receptacles if wired incorrectly.

High-impact-resistant, thermoplastic construction for superior strength and durability.

The indicator light flashes if the device fails the self-test, signalling that the GFCI should be replaced.

Redesigned side wire cavity improves speed of side wire installation.

Auto-ground clip assures a positive ground to metal box.

2097TRW

Meets latest UL Requirements



3rd Party Compliance



cULus Listed File Number E42190, Standard UL498 Attachment Plugs and Receptacles, UL943 GFCIs. Federal Specification WC596, Hospital Grade. Standard CSA C22.2 No. 42 General Use Receptacles, CSA C22.2 No. 144 GFCIs. Conforms to NEMA WD-1 and WD-6. RoHS compliant.

Technical Information

Performance

Electrical

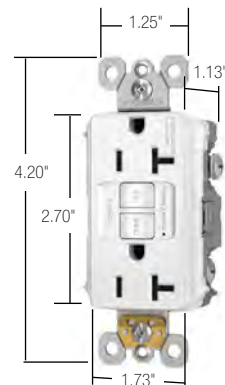
Dielectric Withstand Voltage	Withstands 1500V minimum
Trip Level	4 to 6 mA
Trip Time	.025 Second Nominal
Frequency	60 Hz
Maximum Working Voltage	125VAC
Voltage Range	102-132VAC

Mechanical

Terminal Identification	Terminals identified in accordance with UL498 (Hot, White, Green)
Terminal Accommodation	#14 AWG – #10 AWG solid or stranded copper conductor only
Product Identification	Ratings are a permanent part of device

Environmental

Operating Temperature	-35°C to +66°C
Maximum Humidity	95%
Flammability	UL94 V2
Certification	RoHS Compliant



**Dimensions for
15 & 20 Amp**

Material Specs

Face	Nylon
Body	Nylon
Contacts	.03" Brass (.8)
Mounting Strap	Galvanized Steel
Terminal Screws	Nickel-Plated Steel #8 - 32
Hex Head Grounding Screw	Steel (Green)
Flat Head Mounting Screws	Zinc-Plated Steel
Test/Reset Buttons	Nylon
Auto-Ground Clip	Brass Alloy
Tamper-Resistant Shutter*	Thermoplastic

*For 1597TR, 1597TRWR, 2097TR and 2097TRWR

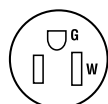
Warranty

1 year

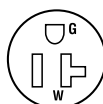
Ordering Information

Catalog Number	Description	Ratings	Colors	NEMA Config
1597TR*	radiant®/Spec Grade Tamper-Resistant 15 Amp Duplex GFCI	15A 125V	I, W, –, BK, LA, NI, DB, G	5-15R
1597*	radiant®/Spec Grade 15 Amp Duplex GFCI	15A 125V	I, W, –, GRY, BK, RED, LA	5-15R
1597TRWR*	radiant®/Spec Grade Weather-Resistant 15 Amp Duplex GFCI	15A 125V	I, W, –, GRY, BK, LA	5-15R
2097TR*	Spec Grade Tamper-Resistant 20 Amp Duplex GFCI	20A 125V	I, W, –, GRY, BK, RED, LA	5-20R
2097*	Spec Grade 20 Amp Duplex GFCI	20A 125V	I, W, –, GRY, BK, RED, LA	5-20R
2097TRWR*	radiant®/Spec Grade Weather-Resistant 20 Amp Duplex GFCI	20A 125V	I, W, –, GRY, BK, LA	5-20R

*For 1597TR, 1597TRWR, 2097TR and 2097TRWR



**NEMA
5-15R**



**NEMA
5-20R**

*Color Designation

I	Ivory	–	Brown	BK	Black	LA	Light Almond
W	White	GRY	Gray	RED	Red	NI	Nickel
DB	Dark Bronze	G	Graphite				

For more information on these and other Legrand products refer to our web site.

Vertical Markets

- Industrial
- Healthcare
- Education
- Institutional
- Retail
- Office
- Hospitality/Lodging
- Multiple Dwelling

Also available...

- USB Charging Devices
- PlugTail® Devices
- Surge Protective & Isolated Ground Devices
- Ground Continuity Monitoring (GCM)
- Straight Blade Plugs & Connectors
- Turnlok® Locking Devices
- Weatherproof Boxes & Covers
- IEC 309 Industrial Products
- Flexcor® Wire Mesh Grips
- Night Lights



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West Hartford, CT 06110
1.877.BY.LEGRAND (295.3472)
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FOLLOW US



FEATURES

- LED life-cycle exceeding 10 years
- Red or Green field selectable exits in AC only or emergency
- AC or Emergency models
- Dual-voltage 120 or 277V AC input
- Remote capacity or extended runtime option
- Damp Location Listed 20°C to 30°C (68°F to 86°F)
- Provided with test switch and AC-On indicator
- Remote Capacity (RC) models have a minimum runtime of 120 minutes when no remotes are installed



RELATED PRODUCTS

[CIR Remote](#)

[COR Remote](#)

SPECIFICATIONS

CONSTRUCTION

- The white or black housing is made of high impact UL flame rated thermoplastic with UV protection
- Universal single or double face

INSTALLATION

- Snap together canopy, housing and covers with removable chevrons for quick and easy installation

ELECTRICAL

- The remote capacity option will run 2 CIR/COR single remote lamp-heads or 1 double CIR/COR remote
- Also available with self-test/self-diagnostics to monitor battery/charger failure, battery disconnect and lamp failure

CERTIFICATIONS

- UL924 Listed for Damp Location
- NFPA 101 and NFPA 70
- OSHA
- CEC T20 Compliant

SELF-DIAGNOSTIC FEATURES

- Fault identification for battery, charger, LED integral lamps and remotes
- Self-Testing monthly and annual for 90 minutes
- Manual Testing for 30 second, 15 minutes and 90 minutes

WARRANTY

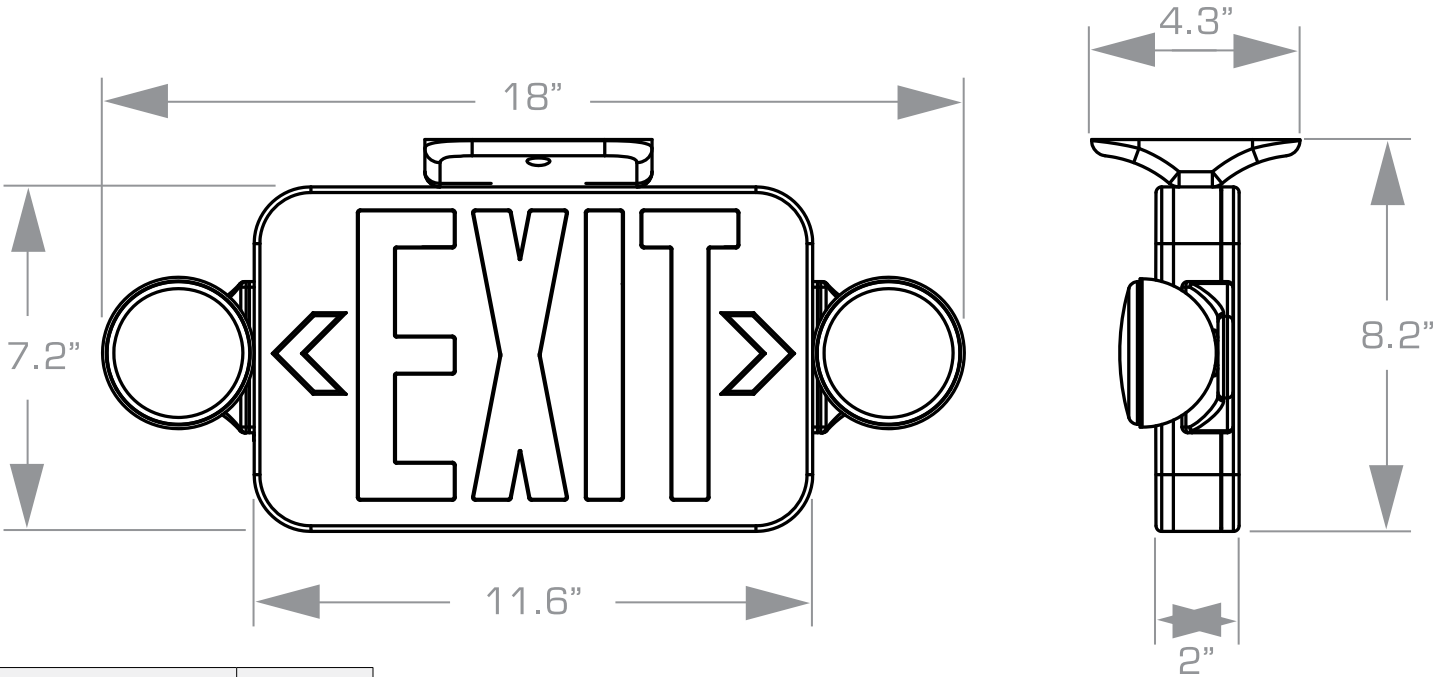
- 2 year full unit warranty
- See [HLI Standard Warranty](#) for additional information

ORDERING GUIDE

Catalog Number	Description	Accessories (Order Separately)
CCRG	White Finish, Combination Exit/Emergency Light, Univ. Face, Selectable Red or Green LED, NiCad Battery, CEC T20 Compliant	WGEL Wireguard 8"H x 20"W x 8" D
CCRGB	Black Finish, Combination Exit/Emergency Light, Univ. Face, Selectable Red or Green LED, NiCad Battery, CEC T20 Compliant	
CCRGRC	White Finish, Combination Exit/Emergency Light, Univ. Face, Selectable Red or Green LED, Remote Capacity, NiMh Batt., CEC T20 Compliant	CIR Series Matching LED Indoor Remote Heads
CCGRGB	Black Finish, Combination Exit/Emergency Light, Univ. Face, Selectable Red or Green LED, Remote Capacity, NiMh Batt., CEC T20 Compliant	
CCR	White Finish, Combination Exit/Emergency Light, Universal Face, Red Letters, NiCad Battery, CEC T20 Compliant	COR Series Matching LED Outdoor Remote Heads
CCRB	Black Finish, Combination Exit/Emergency Light, Universal Face, Red Letters, NiCad Battery, CEC T20 Compliant	
CCG	White Finish, Combination Exit/Emergency Light, Universal Face, Green Letters, NiCad Battery, CEC T20 Compliant	
CCGB	Black Finish, Combination Exit/Emergency Light, Universal Face, Green Letters, NiCad Battery, CEC T20 Compliant	
CCRRC	White Finish, Combination Exit/Emergency Light, Universal Face, Red Letters, Remote Capacity, NiMh Batt., CEC T20 Compliant	
CCRRCB	Black Finish, Combination Exit/Emergency Light, Universal Face, Red Letters, Remote Capacity, NiMh Batt., CEC T20 Compliant	
CCGRC	White Finish, Combination Exit/Emergency Light, Universal Face, Green Letters, Remote Capacity, NiMh Batt., CEC T20 Compliant	
CCRSD	White Finish, Combination Exit/Emergency Light, Universal Face, Red Letters, Self-Test/Self-Diagnostics, NiCad Battery, CEC T20 Compliant	
CCGSD	White Finish, Combination Exit/Emergency Light, Universal Face, Green Letters, Self-Test/Self-Diagnostics, NiCad Battery, CEC T20 Compliant	
CCRRCSD	White Finish, Combination Exit/Emergency Light, Universal Face, Red Letters, Self-Test/Self-Diagnostics, NiMh Batt., Remote Capacity, CEC T20	
CCGRCS	White Finish, Combination Exit/Emergency Light, Universal Face, Green Letters, Self-Test/Self-Diagnostics, NiMh Batt., Remote Capacity, CEC T20	

Note: Remote Capacity Exit will only power Compass Indoor and Outdoor Remote (CIR and COR Series)

DIMENSIONS



Single Carton Weight	2.5lbs.
Master Carton Quantity	6 each

ENERGY CONSUMPTION

	120VAC	277VAC
CCRG	3.9W	4.2W
CCRGRC	4.4W	4.8W
CCR	4.12W	3.20W
CCG	3.22W	3.18W
CCRRC	4.00W	4.06W
CCGRC	4.10W	4.28W

ACCESSORIES



SELF DIAGNOSTIC FEATURES

SELF-DIAGNOSTIC FEATURES

- Fault identification for battery, charger, LED integral lamps and remotes
- Self-Testing monthly and annual for 90 minutes
- Manual Testing for 30 second, 15 minutes and 90 minutes



Classic Series Small Wall Light

Section 2.6.8 Exterior Light



PROJECT INFORMATION

JOB NAME	
FIXTURE TYPE	Small Wall Light
CATALOG NUMBER	
APPROVED BY	

SPECIFICATIONS

Construction:

Rugged Traditional aluminum die cast housing provides proven environmental protection for LED modules. Traditional fixture designs provide a familiar look and standard installation requirements. Retaining this look allows the ability to upgrade fixtures gradually, while retaining the same overall fixture appearance throughout a facility. The smooth housing prevents debris build up and maximizes airflow over housing.

Glare Free:

Positioning of the LED modules within the housing result in light directed to desired locations and eliminates offensive light.

Lens:

Lens assembly is designed to provide high efficiency and to target the light where needed to satisfy outdoor lighting requirements.

Positioning of the LEDs (along with Patent Pending thermal management system) results in the light being directed to desired locations eliminating glare and offensive light.

Thermal Management:

Atlas' Patent Pending exclusive Thermal Management System™ features a unique internal design that allows for lower operating temperatures which results in a brighter, whiter light, more stable color and longer LED (200,000+ hrs¹) and driver life.

Listings:

Luminaire is certified to UL/cUL Standards for Wet Locations

AC Input: 120/208/240/277V

Driver:

Constant current, Class 2, 120-277 VAC, 50-60 Hz

High Efficiency – min. 84%

Off-State Power: 0 Watts

Dimming: 0-10V

LEDs:

Available in 3000K, 4000K, 4500K and 5000K CCT
Epoxy Guard™ protective conformal coated boards
Atlas LEDs provide higher lumen output, greater energy efficiency and more reliable fixture performance.

Reduced Glare:

Positioning of the LED modules within the housing result in light directed to desired locations and reduces offensive light.

Testing:

Atlas LED luminaires have been tested by an independent laboratory in accordance with IESNA LM-79 & LM-80.

Warranty: Five-year limited warranty

Installation:

Fixture retains the same knock-out sizes and positions as previous models, reducing wiring costs.

Photo Control: For factory installed 120V button photo control add suffix PC to part number.



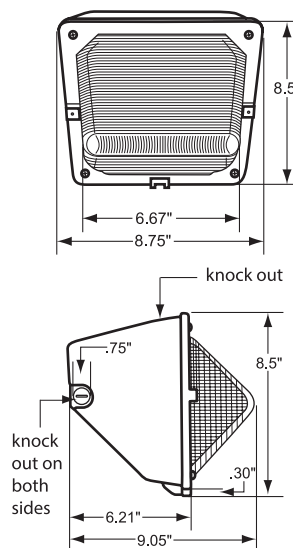
BUY AMERICAN



COMPLIANT*

DIMENSIONS

Weight: 6.6 lbs.



¹LED Life Span Based Upon LM-70 Test Results

Atlas Lighting Products, Inc.

PO Box 2348 | Burlington, NC 27216

800-849-8485 | fax: 1-855-847-2794 | www.atlasled.com

Rebates and Incentives are available in many areas.
Contact an Atlas Representative for more information.

*The majority of Atlas Lighting Products are assembled in USA facilities by an American Workforce utilizing both Domestic and Foreign components. Meets Buy American requirements within the ARRA.



Classic Series Small Wall Light



ORDERING INFORMATION

WLSG	27LED				
PRODUCT SERIES	WATTAGE	COLOR TEMP.	CONTROLS	VOLTAGE	FIXTURE COLOR
WLSG = Small Wall Light	27LED = 27 Watts	Blank = 4500K 3K = 3000K 4K = 4000K 5K = 5000K	Blank = Dimming (0-10V) PC = 120V Photocontrol PM = 120-277V Photocontrol	Blank = 120-277	Blank = Bronze WT = White* BK = Black* <i>*optional with adder</i>

PERFORMANCE DATA

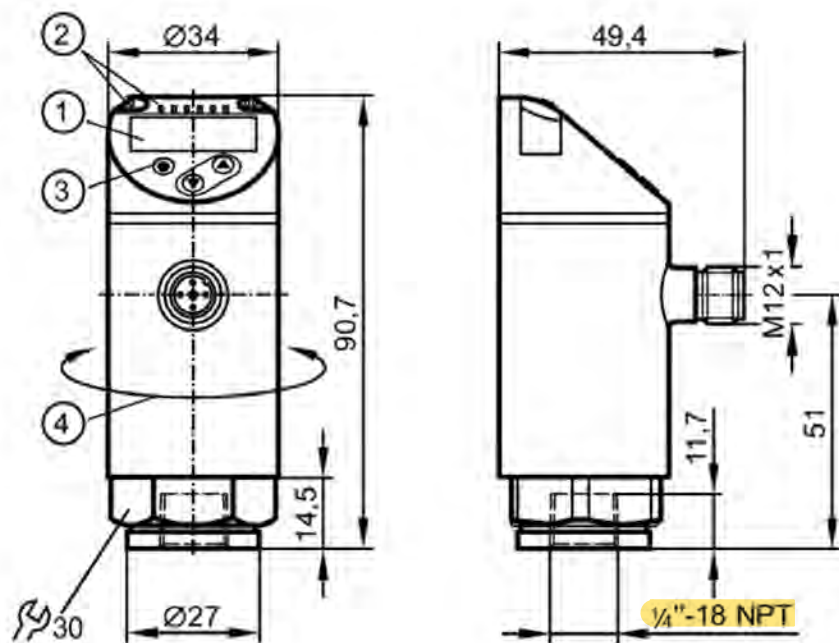
UNIT	CRI	3000K CCT		4000K CCT		4500K CCT		5000K CCT		WATTAGE	REPLACES UP TO
		DELIVERED LUMENS	EFFICACY (LPW)	DELIVERED LUMENS	EFFICACY (LPW)	DELIVERED LUMENS	EFFICACY (LPW)	DELIVERED LUMENS	EFFICACY (LPW)		
27LED	83	2,749	105	2,749	105	3,017	113	3,017	113	27	100W MH

3 Instrumentation



Pressure sensor with display

PN-010-REN14-MFRKG/US/ IV



- 1 alphanumeric display 4-digit red/green
- 2 LEDs Display unit / switching status
- 3 programming button
- 4 upper part of the housing can be rotated 345°



Made in Germany

Application

Measuring element	ceramic-capacitive pressure measuring cell		
Application	for industrial applications		
Media	liquids and gases		
Medium temperature [°C]	-25...80		
Pressure rating	1087 psi	75 bar	7.5 MPa
Min. bursting pressure	2175 psi	150 bar	15 MPa
Vacuum resistance [mbar]	-1000		
Type of pressure	relative pressure		
MAWP (for applications according to CRN)	725 psi	50 bar	5 MPa

Electrical data

Operating voltage [V]	18...30 DC; (according to EN 50178 SELV/PELV)		
Current consumption [mA]	< 35		
Min. insulation resistance [MΩ]	100; (500 V DC)		
Protection class	III		
Reverse polarity protection	yes		
Power-on delay time [s]	0.3		
Integrated watchdog	yes		



Pressure sensor with display

PN-010-REN14-MFRKG/US/ /V

Outputs			
Total number of outputs	2		
Output signal	switching signal; analogue signal; IO-Link; (configurable)		
Number of digital outputs	2		
Output function	normally open / normally closed; (parameterisable)		
Max. voltage drop switching output DC [V]	2		
Permanent current rating of switching output DC [mA]	250		
Switching frequency DC [Hz]	< 500		
Number of analogue outputs	1		
Analogue current output [mA]	4...20; (scalable 1:5)		
Max. load [Ω]	500		
Analogue voltage output [V]	0...10; (scalable 1:5)		
Min. load resistance [Ω]	2000		
Electrical design	PNP/NPN		
Short-circuit protection	yes		
Type of short-circuit protection	pulsed		
Overload protection	yes		
Measuring/setting range			
Measuring range	-14.6...145 psi	-1...10 bar	-0.1...1 MPa
Set point SP	-13.6...145 psi	-0.94...10 bar	-0.094...1 MPa
Reset point rP	-14.2...144.4 psi	-0.98...9.96 bar	-0.098...0.996 MPa
Analogue start point	-14.6...116 psi	-1...8 bar	-0.1...0.8 MPa
Analogue end point	14.6...145 psi	1...10 bar	0.1...1 MPa
In steps of	0.2 psi	0.02 bar	0.002 MPa
Accuracy / deviations			
Switch point accuracy [% of the span]	< ± 0,4; (Turn down 1:1)		
Repeatability [% of the span]	< ± 0,1; (with temperature fluctuations < 10 K; Turn down 1:1)		
Characteristics deviation [% of the span]	< ± 0,25 (BFSL) / < ± 0,5 (LS); (Turn down 1:1; BFSL = Best Fit Straight Line; LS = limit value setting)		
Hysteresis deviation [% of the span]	< ± 0,1; (Turn down 1:1)		
Long-term stability [% of the span]	< ± 0,05; (Turn down 1:1; per 6 months)		
Temperature coefficient zero point [% of the span / 10 K]	0,2; (-25...80 °C)		
Temperature coefficient span [% of the span / 10 K]	0,2; (-25...80 °C)		
Response times			
Response time [ms]	< 1.5		
Delay time programmable dS, dr [s]	0...50		
Damping for the switching output dAP [s]	0...4		
Damping for the analogue output dAA [s]	0...4		
Max. response time analogue output [ms]	3		



Pressure sensor with display

PN-010-REN14-MFRKG/US/ /V

Software / programming		
Parameter setting options		hysteresis / window; normally open / normally closed; switch-on/switch-off delay; Damping; Display unit; current/voltage output
Interfaces		
Communication interface		IO-Link
Transmission type		COM2
IO-Link revision		1.1
SDCI standard		IEC 61131-9
IO-Link device ID		473 d / 00 01 d9 h
Profiles		Smart Sensor: Process Data Variable; Device Identification, Device Diagnosis
SIO mode		yes
Required master port type		A
Process data analogue		1
Process data binary		2
Min. process cycle time [ms]		2.3
Operating conditions		
Ambient temperature [°C]		-25...80
Storage temperature [°C]		-40...100
Protection		IP 65; IP 67
Tests / approvals		
EMC		DIN EN 61000-6-2
		DIN EN 61000-6-3
Shock resistance		50 g (11 ms)
Vibration resistance		20 g (10...2000 Hz)
MTTF [years]		138
UL approval		UL Approval no. J012
Pressure Equipment Directive		Sound Engineering Practice; can be used for group 2 fluids; group 1 fluids on request
Mechanical data		
Weight [g]		221.5
Materials		stainless steel (1.4404 / 316L); PBT+PC-GF30; PBT-GF20; PC
Materials (wetted parts)		stainless steel (1.4404 / 316L); Al2O3 (96 %; ceramics); FKM
Min. pressure cycles		100 million
Tightening torque [Nm]		> 50; (depends on lubrication, seal and pressure rating)
Process connection		threaded connection 1/4 NPT internal thread
Restrictor element integrated		no (can be retrofitted)
Displays / operating elements		
Display		Display unit
		switching status
		measured values
		3 x LED, green (bar, psi, MPa) 2 x LED, yellow alphanumeric display, red/green 4-digit
Remarks		
Pack quantity		1 pcs.
Electrical connection		
Connector: 1 x M12; Contacts: gold-plated		

PN2294

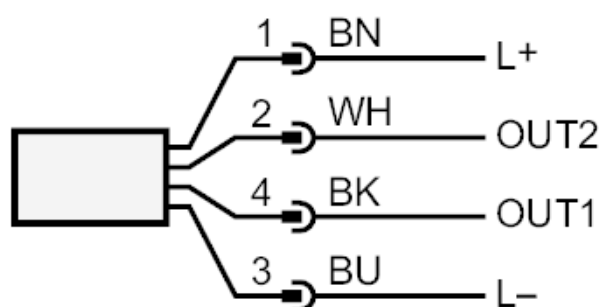


Pressure sensor with display

PN-010-REN14-MFRKG/US/ /V



Connection



OUT1 switching output

OUT2 switching output

analogue output

Core colours :

BK = black

BN = brown

BU = blue

WH = white

PRESSURE & LEVEL MEASUREMENT SOLUTIONS



Cage-Protected Level Transmitters

Designed for severe high solids environments such as sewage, lift stations, storm canals, wet wells and slurry tanks where sludge, slurry or turbulence may be present.

3-YEAR WARRANTY

- Features large 3" non-fouling sensing area
- Welded at cap and base to provide a leak-proof seal
- Highly accurate, shock-resistant and extremely stable over long periods of time
- Electrical surge, noise and reverse polarity protected



Pressure Gauges

Vacuum and pressure from 10 inH₂O through 145,000 psig, as well as differential pressure.

3-YEAR WARRANTY

- Dial indicating, process, digital and differential gauges
- Multiple case materials, filling and connection options
- Vibration, shock, pulsation and chemical-resistant
- High quality construction including heavy Bourdon tubes for longer life
- Liquid-filled and dry configurations available



Pressure Transmitters and Transducers

NOSHOK pressure transmitters and transducers are available in vacuum, absolute and gauge pressure ranges up to 145,000 psig.

3-YEAR WARRANTY

- Vibration and chemical resistant with a full array of commonly used outputs (4 mA - 20 mA, 0 Vdc - 10 Vdc, .5 Vdc - 4.5 Vdc, etc.)
- Extremely stable zero and span
- Front flush diaphragm option for sludge, slurry or high viscosity media
- High RFI, EMI & ESD protection



Dial Indicating Pressure Gauges

ABS & Stainless Steel Liquid Filled



900 SERIES

- Extremely high quality pressure gauges, liquid filled for extended service life and shock resistance
- Ranges available from vacuum to 15,000 psi
- 1-1/2, 2, 2-1/2, 4 inch sizes – bottom or back connected
- Lightweight shatter-resistant ABS case with Plexiglass™ lens for extra strength, or 304 stainless steel case with polycarbonate lens
- Unique o-ring case and connection seals guard against leakage and protect against shock and vibration
- Relief disc on top or back provides positive case relief
- Brass and copper alloy movement
- High grade Glycerine fill dampens the effects of pulsation, vibration and shock loads, and provides lubrication of the movement
- Volume oriented
- Stock availability

OPERATING SPECIFICATIONS

1. Working Pressure Limitations

a. Dynamic Pressure

The working pressure should be limited to 60% of the dial range

b. Static Pressure

The working pressure, when no sharp fluctuations occur, should be limited to 90% of the dial range.

2. Ambient Temperature

-4°F to 140°F (-20°C to 60°C) Glycerine Fill

-40°F to 140°F (-40°C to 60°C) Special Fill

3. Media Temperature

-4°F to 140°F (-20°C to 60°C) Glycerine Fill

-40°F to 140°F (-40°C to 60°C) Special Fill

APPLICATIONS

- Industrial applications where pulsation, vibration and shock are present

ACCURACY

- 1-1/2 and 2 inch 900 Series Gauges: $\pm 2.5\%$
- 2-1/2 inch 900 Series Gauges: $\pm 1.5\%$
- 4 inch 900 Series Gauges: $\pm 1.0\%$

For details on accuracy/standard dial configuration and dial layouts, see pages 74-78

	MODELS	SPECIFICATIONS
Case	15-910, 25-900, 25-910	ABS (Acryl Nitril Butadien Styrol)
	25-901, 25-911, 40-901, 40-911	304 Stainless steel
Bezel	25-901, 25-911, 40-901, 40-911	304 Stainless steel
Lens	15-910, 25-900, 25-910	Plexiglass™; ultrasonically welded to the case
	25-901, 25-911	Polycarbonate
	40-901, 40-911	Instrument glass
Bourdon Tube	15-910, 25-900, 25-910, 25-901, 25-911, 40-901, 40-911 (up to 600 psi)	Phosphor bronze "C" tube
	15-910, 25-900, 25-910, 25-901, 25-911, 40-901, 40-911 (greater than 600 psi)	Coiled safety tube
Connection	15-910	1/8" NPT brass
	25-900, 25-910, 25-901, 25-911, 40-901, 40-911	1/4" NPT brass
	40-901, 40-911	1/4" NPT brass or 1/2" NPT brass
Movement	15-910, 25-900, 25-910, 25-901, 25-911, 40-901, 40-911	Brass and nylon with highly polished bearing surfaces
Safety Protection	15-910, 25-900, 25-910	Safety relief disc on the back of the case
	25-901, 25-911, 40-901, 40-911	Safety relief disc on the top of the case
Accuracy	15-910, 20-901, 20-911	$\pm 2.5\%$ Full Scale ASME grade B
	25-900, 25-910, 25-901, 25-911	$\pm 1.5\%$ Full Scale ASME grade A
	40-901, 40-911	$\pm 1\%$ Full Scale ASME grade 1A
Pointer	15-910, 25-900, 25-910, 25-901, 25-911	Molded plastic
	40-901, 40-911	Balanced aluminum, black finish
Dial	15-910, 25-900, 25-910, 25-901, 25-911	Molded plastic, white background with black psi scale and red kPa scale. UV resistant
	40-901, 40-911	Aluminum, white background, dual scale psi – kPa. black psi scale and Red kPa scale. UV resistant
Fill Liquid	15-910, 25-900, 25-910, 25-901, 25-911, 40-901, 40-911	Glycerine and water

ORDERING INFORMATION								
SERIES	900							
SIZE	15	1-1/2"	20	2"	25	2-1/2"	40	4"
CASE TYPE	900	ABS Case, Liquid Filled, Bottom Connection			910	ABS Case, Liquid Filled, Back Connection		
	901	SS Case, Liquid Filled, Bottom Connection			911	SS Case, Liquid Filled, Back Connection		
PRESSURE RANGES	30 ~ Vac	-30 inHg to 0	100	0 psi to 100 psi	5000	0 psi to 5,000 psi	10	0 bar to 10 bar
	30/15	-30 inHg to 0 to 15 psi	160	0 psi to 160 psi	6000	0 psi to 6,000 psi	16	0 bar to 16 bar
	30/30	-30 inHg to 0 to 30 psi	200	0 psi to 200 psi	7500	0 psi to 7,500 psi	25	0 bar to 25 bar
	30/60	-30 inHg to 0 to 60 psi	300	0 psi to 300 psi	10000	0 psi to 10,000 psi	40	0 bar to 40 bar
	30/100	-30 inHg to 0 to 100 psi	400	0 psi to 400 psi	15000	0 psi to 15,000 psi	60	0 bar to 60 bar
	30/160	-30 inHg to 0 to 160 psi	600	0 psi to 600 psi	-1	-1 bar to 0 bar	100	0 bar to 100 bar
	30/200	-30 inHg to 0 to 200 psi	800	0 psi to 800 psi	1	0 bar to 1 bar	160	0 bar to 160 bar
	30/300	-30 inHg to 0 to 300 psi	1000	0 psi to 1,000 psi	1.6	0 bar to 1.6 bar	250	0 bar to 250 bar
	15	0 psi to 15 psi	1500	0 psi to 1,500 psi	2.5	0 bar to 2.5 bar	400	0 bar to 400 bar
	30	0 psi to 30 psi	2000	0 psi to 2,000 psi	4	0 bar to 4 bar	600	0 bar to 600 bar
	60	0 psi to 60 psi	3000	0 psi to 3,000 psi	6	0 bar to 6 bar	1000	0 bar to 1,000 bar
SCALE OPTION	psi	psi single scale	psi/kg/cm ²	psi/kg/cm ² dual scale	bar/psi	bar/psi dual scale	psi/kPa	psi/kPa dual scale
	psi/bar	psi/bar dual scale						
CONNECTION SIZE	1/8	1/8" NPT	1/4	1/4" NPT	1/2	1/2" NPT	1/4 BSPP	1/4" BSPP
OPTIONS	PMC	Steel Panel Mount Clamp	SSCR	304SS Cover Ring	SSFF	304SS Front Flange	BP3	Brass Press Fit Orifice 0.3 mm
	SPMC	304SS Panel Mount Clamp	MIP	Maximum Indicating Pointer	SSRF	304SS Rear Flange	BT5	Brass Threaded Orifice 0.5 mm
	SSB-U	Stainless Steel Bezel & U-Clamp	AP	Adjustable Pointer	LM	Laser Marking	BT8	Brass Threaded Orifice 0.8 mm
	SSB	Stainless Steel Bezel	SGL	Safety Glass Lens	ST	Stainless Steel Tagging	7/16" -20	Straight Thread Available*

Please consult your local NOSHOK Distributor or NOSHOK, Inc. for availability and delivery information.

NOTE: Refer to 900 Series Options & Accessories chart on page 67 for availability by model number.

* Includes Viton® O-Ring

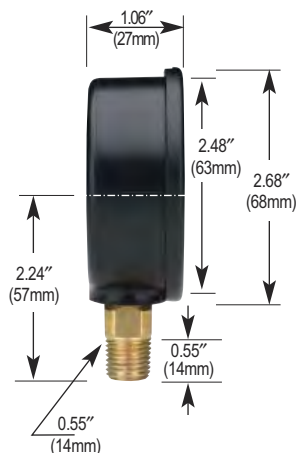
EXAMPLE

1. Select model number (size & case type)
2. Select pressure range & scale option
3. Select connection size (if more than one is offered)
4. Select any required accessory or option

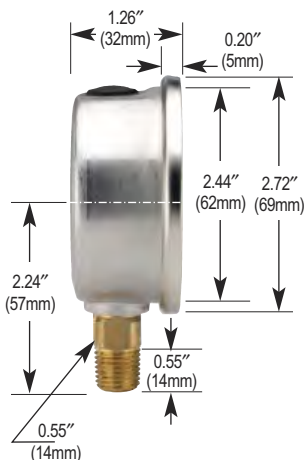
25-910 - 1000 psi/kPa - 1/4 - PMC

OUTLINE DIMENSIONS

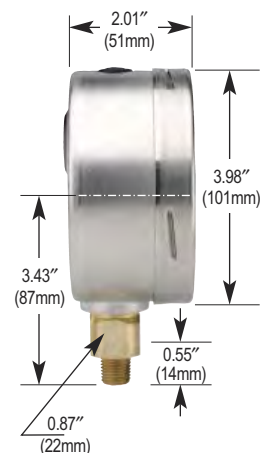
25-900



25-901



40-901





M-Series® M2000

Electromagnetic Flow Meter Detector

DESCRIPTION

The Badger Meter M-Series® model M2000 detector is the result of years of research and field use of electromagnetic flow meter technology. Based on Faraday's law of induction, these meters can measure almost any liquid, slurry, or paste that has minimum electrical conductivity.

Designed, developed, and manufactured under strict quality standards, the M-Series meter features sophisticated, processor-based signal conversion with accuracies of ± 0.25 percent. The wide selection of liner and electrode materials helps ensure maximum compatibility and minimum maintenance over a long operating period.

OPERATION

The flow meter is a stainless steel tube lined with a non-conductive material. Outside the tube, two DC powered electromagnetic coils are positioned opposing each other. Perpendicular to these coils, two electrodes are inserted into the flow tube. Energized coils create a magnetic field across the whole diameter of the pipe.

As a conductive fluid flows through the magnetic field, a voltage is induced across the electrodes. This voltage is proportional to the average flow velocity of the fluid and is measured by the two electrodes. This induced voltage is then amplified and processed digitally by the converter to produce an accurate analog or digital signal. The signal can then be used to indicate flow rate and totalization or to communicate to remote sensors and controllers.

With no moving parts in the flow stream, there is no pressure lost. Also, accuracy is not affected by temperature, pressure, viscosity, density or flow profile. There is practically no maintenance required.

APPLICATION

The M2000 has many advantages over other conventional technologies. It can be used in a majority of industrial flow applications. The M2000 meter can accurately measure fluid flow—whether the fluid is water or a highly corrosive liquid, very viscous, contains a moderate amount of solids, or requires special handling. Today, magnetic meters are successfully used in industries including food and beverage, pharmaceutical, water and wastewater, and chemical.

ELECTRODES

When looking from the end of the meter into the inside bore, the two measuring electrodes are positioned at three o'clock and nine o'clock. M2000 mag meters have an "empty pipe detection" feature. This is accomplished with a third electrode positioned in the meter between twelve o'clock and one o'clock.

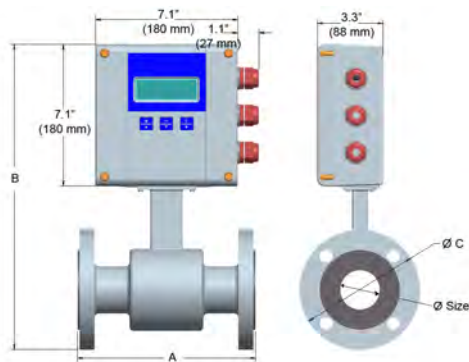


If this electrode is not covered by fluid for a minimum five-second duration, the meter will display an "empty pipe detection" condition, send out an error message if desired, and stop measuring to maintain accuracy. When the electrode again becomes covered with fluid, the error message will disappear and the meter will continue measuring.

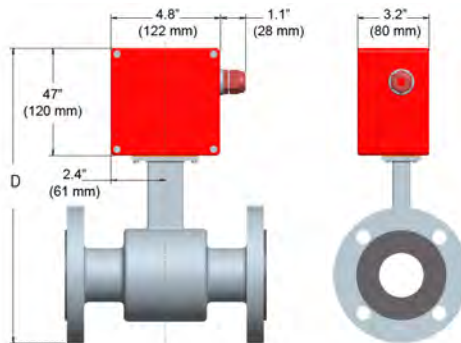
As an option to using grounding rings, a grounding electrode (fourth electrode) can be built into the meter during manufacturing to assure proper grounding. The position of this electrode is at five o'clock.

FEATURES

- Pulsed DC magnetic field for zero point stability
- Corrosion resistant liners for long life
- Calibrated in state-of-the art facilities
- Optional grounding rings or grounding electrode
- Measurement largely independent of flow profile
- NSF listed
- Integral and remote signal converter availability
- Available in sizes 0.25...54" (6...1400 mm)



Meter with M2000 amplifier



Meter with junction box for remote M2000 amplifier

Size		A		B		C		D		Est. Weight with M-2000		Flow Range			
inch	mm	inch	mm	inch	mm	inch	mm	inch	mm	lb	kg	LPM		GPM	
												min	max	min	max
1/4	6	6.7	170	14.0	356	3.5	89	11.4	288	10	4.5	0.063	20	0.02	5
5/16	8	6.7	170	14.0	356	3.5	89	11.4	288	10	4.5	0.114	34	0.03	9
3/8	10	6.7	170	14.0	356	3.5	89	11.4	288	10	4.5	0.177	53	0.05	14
1/2	15	6.7	170	14.0	356	3.5	89	11.4	288	10	4.5	0.416	125	0.11	33
3/4	20	6.7	170	14.2	361	3.9	99	11.5	293	13	5.5	0.75	225	0.2	59
1	25	8.9	225	14.4	366	4.3	108	11.7	298	18	8.0	1.20	350	0.3	93
1-1/4	32	8.9	225	15.2	386	4.6	117	12.5	318	20	9.0	2.00	575	0.5	152
1-1/2	40	8.9	225	15.4	390	5.0	127	12.7	322	21	9.5	2.00	900	0.8	229
2	50	8.9	225	15.9	403	6.0	152	13.2	335	26	11.5	4.70	1400	1	373
2-1/2	65	11.0	280	17.1	434	7.0	178	14.4	366	32	25.5	8	2400	2	631
3	80	11.0	280	17.3	440	7.5	191	14.7	372	54	24.5	12	3600	3	956
4	100	11.0	280	18.4	466	9.0	229	15.7	398	56	25.5	19	5600	5	1493
5	125	15.8	400	19.6	498	10.0	254	16.9	430	58	26.0	30	8800	8	2334
6	150	15.8	400	20.6	524	11.0	279	17.9	456	60	27.0	40	12700	11	3361
8	200	15.8	400	22.5	572	13.5	343	20.4	518	86	39.0	75	22600	20	5975
10	250	19.7	500	26.8	681	16.0	406	24.1	613	178	81.0	120	35300	30	9336
12	300	19.7	500	28.9	734	19.0	483	26.2	666	207	94.0	170	50800	45	13444
14	350	19.7	500	30.8	782	21.0	533	28.2	716	258	117	230	69200	60	18299
16	400	23.6	590	33.7	856	23.5	597	31.0	788	306	139	300	90400	80	23901
18	450	23.6	590	35.0	890	25.0	635	32.4	822	400	181	380	114000	100	30250
20	500	23.6	590	38.2	969	27.5	699	35.5	901	493	224	470	140000	125	37346
22	550	23.6	590	39.6	1005	29.5	749	36.9	937	523	237	570	170000	150	45188
24	600	23.6	590	42.2	1071	32.0	813	39.5	1003	552	251	680	200000	180	53778
28	700	23.6	590	46.2	1173	36.5	927	44.0	1118	648	294	920	275000	240	73100
30	750	31.5	800	48.3	1228	39.0	984	45.7	1161	702	319	1060	315000	280	84000
32	800	31.5	800	52.2	1325	41.4	1015	49.5	1257	768	349	1200	361000	320	95600
36	900	31.5	800	55.3	1405	46.0	1168	54.1	1374	848	385	1500	457000	400	121000
40	1000	31.5	800	60.0	1525	50.2	1230	57.4	1457	922	419	1900	565000	500	149300
42	1050	36.0	914	66.0	1675	53.0	1346	63.4	1610	1198	499	2100	620000	550	164600
48	1200	39.4	1000	69.9	1775	59.4	1455	67.2	1707	1208	549	2700	814000	720	215100
54	1400	39.4	1000	78.5	1995	68.4	1675	75.9	1927	1362	619	3700	1100000	980	292700

SPECIFICATIONS

Flow Range	0.1...39.4 fps (0.03...12 m/s)	Pipe Spool Material	316 stainless steel
Min. Conductivity	≥ 5 micromhos/cm	Meter Housing Material	Carbon steel welded
Accuracy	± 0.25 percent of rate for velocities greater than 1.64 ft/s (0.50 m/s), ± 0.004 ft/s (± 0.001 m/s) for velocities less than 1.64 ft/s (0.50 m/s)	Flanges	Standard (ANSI B16.5 Class 150 RF): Carbon steel Optional: 316 stainless steel
Electrode Materials	Standard: Alloy C Optional: 316 stainless steel, gold/platinum plated, tantalum, platinum/rhodium	Meter Enclosure Classification	NEMA 4X (IP66) Optional: Submersible NEMA 6P (remote amplifier required)
Liner Material	PFA up to 3/8", PTFE 1/2"...24", soft and hard rubber from 1"...54" Halar® from 14"...40"	Junction Box Enclosure Protection	For remote amplifier option: Powder coated die-cast aluminum, NEMA 4 (IP65)
NSF Listed	Models with hard rubber liner 4" size and up; PTFE liner, all sizes.	Cable Entries	1/2" NPT Cord Grip
Fluid Temperature	With Remote Amplifier: PFA, PTFE & Halar 311° F (155° C) With Meter Mounted Amplifier: Rubber 178° F, (80° C), PFA, PTFE & Halar 212° F (100° C), Rubber 178° F, (80° C)	Optional Stainless Steel Grounding Rings	Meter Size Thickness (of one ring) Up through 10 inches 0.135" 12"...2" 0.187"

M-Series is a registered trademark of Badger Meter, Inc. Other trademarks appearing in this document are the property of their respective entities.

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www.badgermeter.com

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Section 3.4 Level Transmitter

Levelgage

GENERAL PURPOSE SUBMERSIBLE LEVEL TRANSMITTER

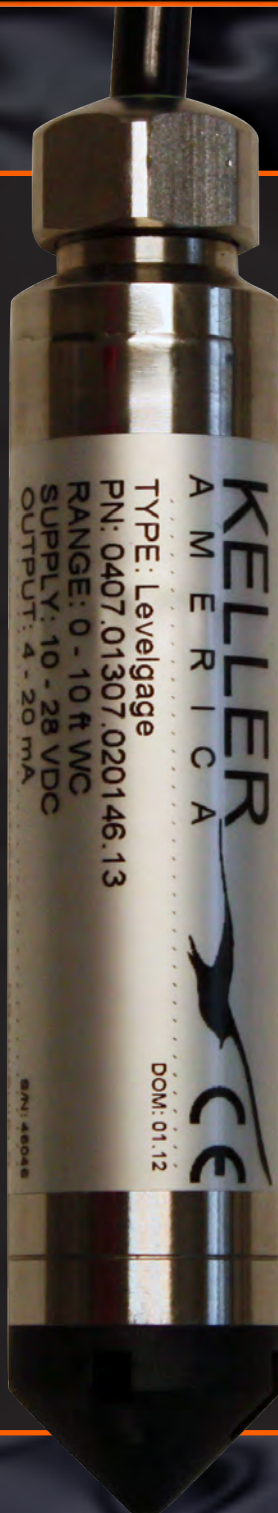
DESCRIPTION

The Levelgage by Keller America is designed for indefinite submersion in a wide variety of liquid media. Intended for general purpose monitoring and control applications, the Levelgage is a smart choice for OEMs, system integrators and end-users alike.

The Levelgage combines proven piezo-resistive silicon sensor technology with Keller's state-of-the-art signal conditioning circuitry to provide an accurate, reliable, and temperature compensated analog output.

Plus, Keller America's guaranteed lightning protection makes this transmitter ideal for installation in areas prone to chronic damage due to transients caused by lightning.

For more information on the Levelgage, or any other Keller product, please contact Keller America, or view the entire Keller catalog at www.kelleramerica.com/pdf-library/.



FEATURES

4...20mA models include guaranteed lightning protection at no additional cost.

16-bit internal digital error correction for cost-effective low Total Error Band (TEB)

316L SS construction

2-year warranty covers defects in materials and workmanship.

Standard outputs simplify interface to controls, data collection, and telemetry systems.

Built in the U.S.A. ARRA Section 1605 Compliant.

Standard 3 day lead time at no additional charge.

APPLICATIONS

Groundwater	Wastewater
Reservoirs	Lift Stations
Potable Water	Landfills
Monitoring Wells	Leachate
Tanks	Chemicals
Wet Wells	Hydrocarbons

KELLER AMERICA INC

351 BELL KING ROAD · NEWPORT NEWS, VA 23606 · TOLL FREE 877-253-5537 · PHONE (757) 596-6680 · FAX (757) 596-6659

EMAIL SALES@KELLERAMERICA.COM · WEBSITE WWW.KELLERAMERICA.COM



Levelgage

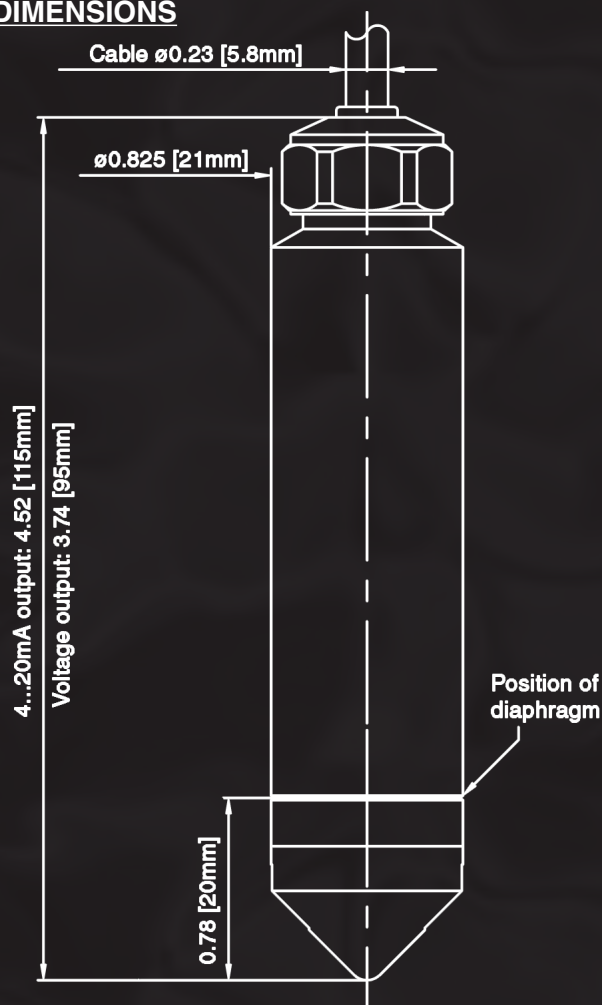
GENERAL PURPOSE SUBMERSIBLE LEVEL TRANSMITTER

SPECIFICATIONS

Available ranges _{1,2}	
Relative	Infinite from 0.3 to 0...900ft W.C.
Absolute	Infinite from 0...2Bar to 0...11 Bar
Accuracy, TEB ₃	Standard 1% FS TEB Optional 0.5% FS TEB
Compensated Temp. Range	-10...60°C
Output	4...20mA, 0...5VDC, 0...10VDC
Resolution	0.002% FS
Supply	
4...20 mA Output	8...28 VDC _{4,5}
0...5 VDC Output	8...28 VDC ₅
0...10 VDC Output	13...28 VDC ₅
Load Resistance	
Current	<(Supply-8V)/0.02A
Voltage	>4k ohm
Wetted Materials	Standard 316L S.S. Polyamide Fluorocarbon
Environmental Protection	IP68
Cable	Polyethylene for general purpose Hytel for hydrocarbons Tefzel for chemical interaction
Optional Accessories	Drying Tube Aneroid Bellows 1/2"NPT Conduit Fitting Stabilizing Weight Termination Enclosure Cable Hanger Digital Display / Process Controller Open-face nose cap

Specifications and dimensions are subject to change without notice.

DIMENSIONS



WIRING DIAGRAM

Output	White	Black	Red
2-wire (mA)	OUT / GND	+Vcc	N/A
3-wire (VDC)	GND	+VCC	+OUT

Braided shield wire connected to transmitter housing₆

NOTES

- The Levelgage can be provided with custom calibration at no extra cost for fluids other than water, provided the specific gravity is given at the time the order is placed.
- Level range may be specified in units of lb/in²(psi), inches WC or feet WC. Keller America uses the International Standard conversion of 2.3067 feet WC/psi.
- TEB: Total Error Band; Includes the combined effects of non-linearity, hysteresis and non-repeatability as well as thermal dependencies, over the compensated temperature range.
- Internal lightning protection increases the minimum-required supply voltage, due to internal resistance of the surge protectors. In addition, cable resistance (~70Ω / 1000ft) adds to the supply requirement. In order to insure proper system operation, calculate the minimum required supply voltage (at the source) as follows:
For two-part (internal+external) system (recommended): MINIMUM SUPPLY VOLTAGE = 10.75 + 0.025 (CABLE LENGTH x 0.07) VDC
For internal only protector (standard with 4-20mA output): MINIMUM SUPPLY VOLTAGE = 9.65 + 0.025 (CABLE LENGTH x 0.07) VDC
- Nominal values may be higher depending upon cable length. Cable resistance = ~70Ω / 1000ft.
- The drain / shield is connected to the transmitter housing. For lightning protection to function properly (4-20mA only) the shield wire must be connected to a good earth ground!



Optional

A C C E S S O R I E S

Keller America offers a variety of optional accessories designed to enhance versatility, simplify the installation, and increase the longevity of your Keller pressure or level transmitter. If you have any questions, or would like to discuss your particular application in more detail, contact Keller America today!



Drying Tube Assembly - Clear tube filled with indicating desiccant, attaches directly to cable vent tube, intercepts water vapor. Highly recommended when operating in high humidity conditions. Must be periodically renewed as desiccant becomes saturated, turning color from blue (dry) to pink (saturated).



Bellows Assembly - Alternative to the drying tube, this aneroid bellows attaches to cable vent tube and requires no periodic maintenance. Recommended where a slight sacrifice in accuracy can be tolerated.



1/2" NPT Pipe Conduit Fitting - 1/2" NPT male fitting, allows rigid mounting to 1/2" conduit for Levelgage, Acculevel, Digilevel, or LevelRat submersible transmitters. It can also be added to our Preciseline and Valueline pressure transmitters.



Stabilizing Weight - Zinc prop shaft anode adapted to fit Ø21 mm O.D. of Levelgage, Acculevel, and LevelRat submersible level transmitters. Aids in corrosion resistance as well as helps ensure that the cable remains taut in turbulent conditions.



Cable Hanger - Single eye mesh cord grip style cable hanger for use with Keller's 0.230 inch O.D. cables



Termination Enclosure - Convenient option complementing gauge-type pressure/level transmitters, where it is desired to terminate the transmitter cable close to the measurement point. It includes a NEMA 4X clear front enclosure (7.9 X 4.7 X 3.5 inches) with two, liquid-tight cable fittings (one in, one out), a terminal strip, and provisions for mounting both a drying tube or bellows assembly, each sold separately.

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4 Pump & Motor

Data



Project
2023-12-13

QUOTATION

Company

Contact

Phone No.

Email

1SV10GD4F50 | Configuration Summary

PUMP

Installation	Complete Pump	Pump Size	1-22SV
		Speed	3500

MOTOR

Sizing Method	Max. shaft power	Frequency (Hz)	60
Service Factor	1.15	Poles	2
Upsize	No	Enclosure	ODPE
Overloading	No	Frame Size	56C
		Power	1.1 kW
		Phase (~)	3
		Voltage	208-230/460 V

MATERIALS

Pump Body Material	Cast Iron (ASTM Class 35/40B)	Impeller Material	Stainless Steel (AISI 304)
--------------------	-------------------------------	-------------------	----------------------------

SEAL

Type of Seal	Mechanical Seals	Rotating Face	Carbon
		Stationary Face	Silicon Carbide Graphite Filled
		Elastomers	Viton
		Spring	316 SS
		Metal Components	316 SS

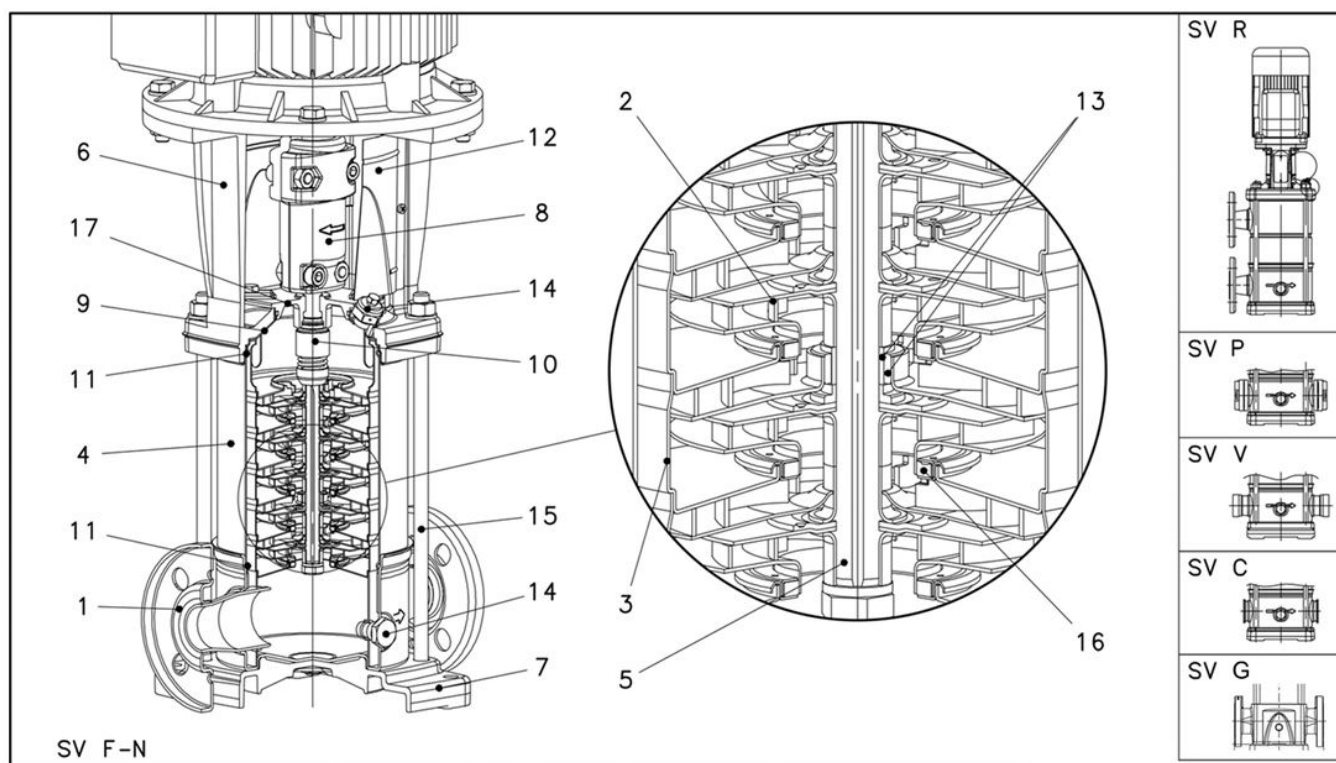
FLANGE

Flange	[G] = Round Flanges (AISI 304/Cast Iron)	Class Type	Class 250 / 300
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STANDARD OPTIONS

Special Configuration	Please Select	Additional Configuration	Please Select
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1SV10GD4F50 | Product Details



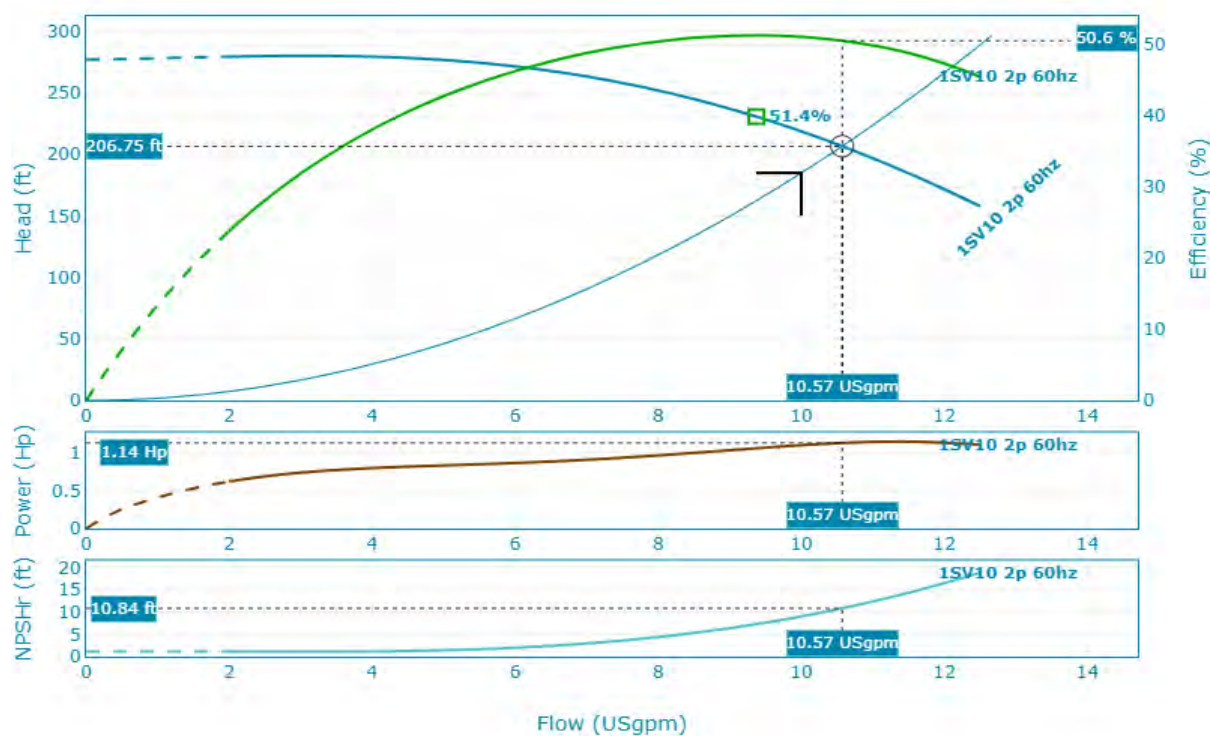
Material Details

Elastomers (11)	Viton (opt. EPDM)	Shaft (5)	Stainless Steel / AISI 316
Casing (4)	Stainless Steel / AISI 316L	Tie Rods (15)	Carbon Steel / Zinc Plated / A29 Gr.1045
Seal Gland (17)	Stainless Steel / AISI 316	Coupling (8)	Aluminum / A384.0-F
Diffuser (3)	Stainless Steel / AISI 304	Mechanical Seal (10)	See Mechanical Section
Shaft Sleeve and Bushing (13)	Tungsten Carbide	Coupling Guard (12)	Stainless Steel / AISI 304
Pump Body (1)	Cast Iron (G) / ASTM Class 35/40B	Wear Ring (16)	PPS
Seal Plate (9)	Stainless Steel / AISI 316L	Impeller (2)	Stainless Steel / AISI 304
Fill/Drain Plugs (14)	Stainless Steel / AISI 316	Adapter (6)	Cast Iron / ASTM Class 35/40B

Motor Data

Enclosure	ODPE	Phase	3
Speed	3,450 rpm	FLA	4.5-4.2/2.1
Rated Power	1.1 kW	SLA	4.9-4.6/2.3
Rated Voltage	208-230/460 V		
Frame Size	56C		

1SV10GD4F50 | Hydraulic Data & Performance Curve



Selection Criteria

Series	e-SV
Model	1SV10 3500rpm
Stages	10
Frequency	60 Hz
Total Flow	10.00 USgpm
Total Head	185.00 ft
Pump Flow	10.00 USgpm
Pump Head	185.00 ft
System Type	Single Pump
Operating Pumps	1
Rated Power	1.5 Hp
Max Operating Pressure	121.3 psi
Max P2	1.16 Hp

Design Curve Data

Rated Motor Speed	3,500 RPM
Min Flow	2 USgpm
Max Flow	12.5 USgpm
H@QMax	157.83 ft
H@QMin	279.53 ft
BEP	51.4 %
BEP Flow	9.37 USgpm
BEP Head	230.76 ft

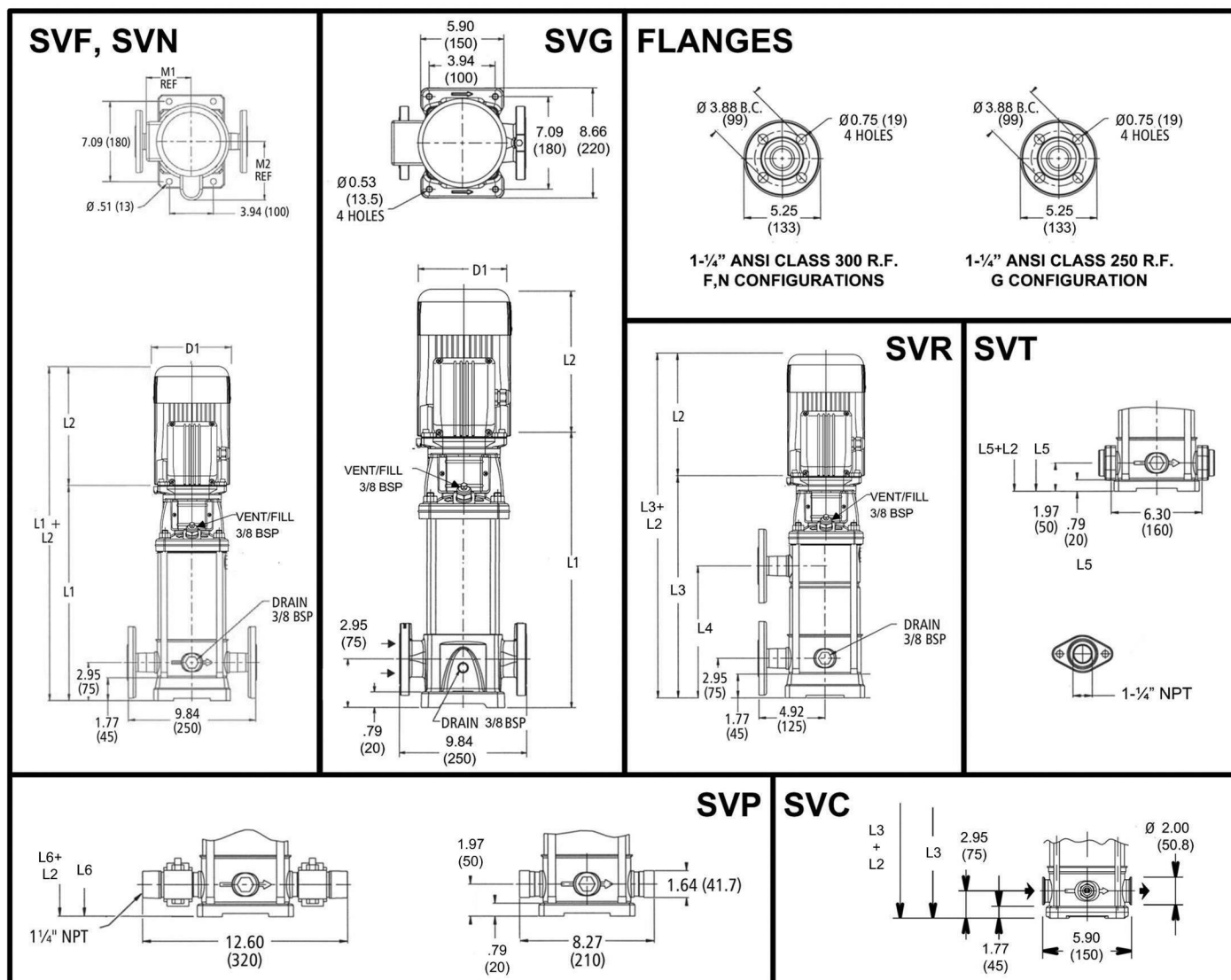
Design Point

Flow	10.57 USgpm
Head	206.75 ft
Efficiency	50.62 %
Shaft power (P2)	1.14 Hp
NPSHr	10.84 ft

Fluid Data

Fluid Type	Water
Fluid Temperature	68 °F
Specific Gravity	1
Density	62.31322 lb/ft³
Dynamic Viscosity	1.00165 cP
Fluid Vapor Pressure	0.33929 psi

1SV10GD4F50 | Dimensional Data & Drawing



Dimensions

Total Weight	66 lbs
NEMA Frame	56C
L1	18.78 inch
L2	10.17 inch
D1 (MAX.)	7.19 inch
L3	18.78 inch
L4	10.51 inch
L5	17.8 inch
L6	17.8 inch
D2	6.51 inch
M (Ref.)	6.92 inch



Company

Contact

Phone No.

Email

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xylem.

Project

2024-07-12

QUOTATION

Company

Contact

Phone No.

Email

5SV9GF4F50 | Configuration Summary

PUMP

Installation	Complete Pump	Pump Size	1-22SV
		Speed	3500

MOTOR

Frequency (Hz)	60	Power	3 hp
Poles	2	Phase (~)	3
Enclosure	ODPE	Voltage	208-230/460 V
Frame Size	56C	Sizing Method	Max Shaft Power Across Curve
		Service Factor	1.15
		Allow Service Factor Usage	Yes
		Upsize	No

MATERIALS

Pump Body Material	Cast Iron (ASTM Class 35/40B)	Impeller Material	Stainless Steel (AISI 304)
--------------------	-------------------------------	-------------------	----------------------------

SEAL

Type of Seal	Mechanical Seals	Rotating Face	Carbon
		Stationary Face	Silicon Carbide Graphite Filled
		Elastomers	Viton
		Spring	316 SS
		Metal Components	316 SS

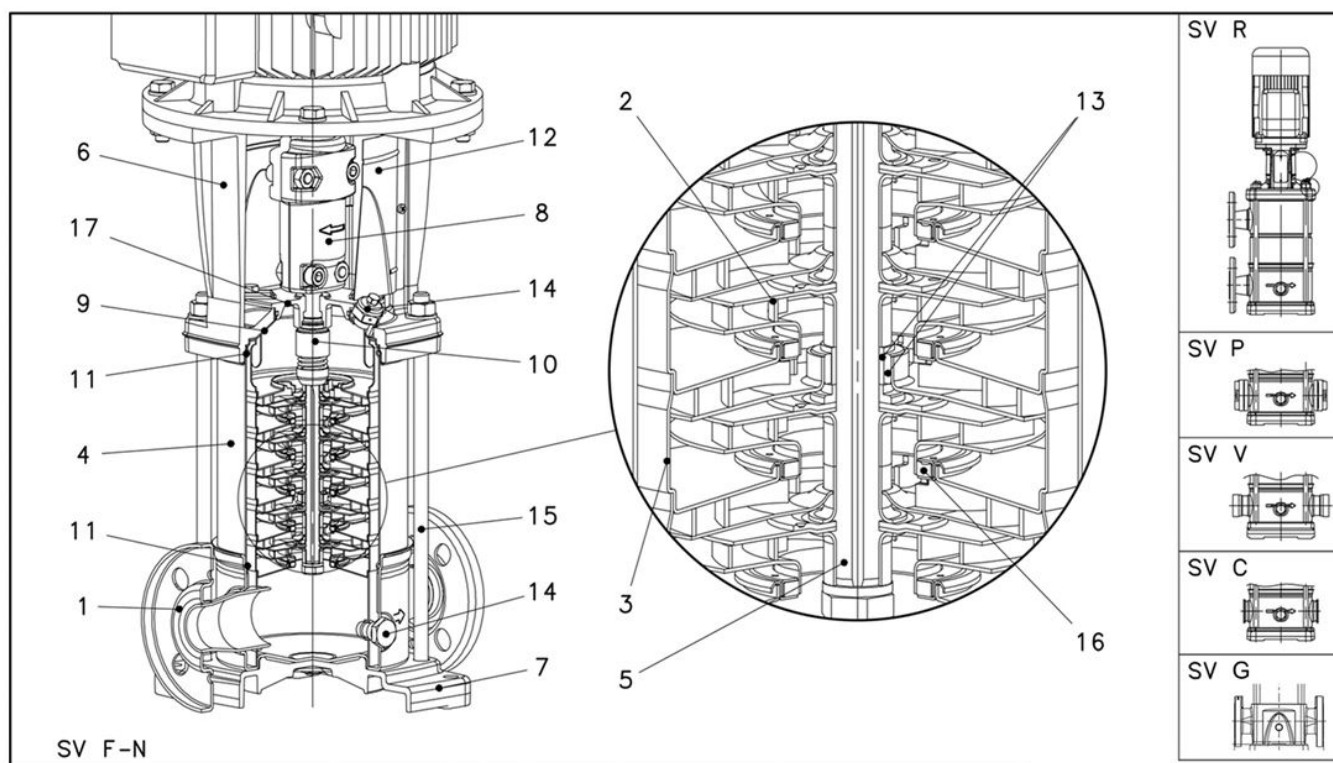
FLANGE

Flange	[G] = Round Flanges (AISI 304/Cast Iron)	Class Type	Class 250 / 300
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STANDARD OPTIONS

Special Configuration	Please Select	Additional Configuration	Please Select
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5SV9GF4F50 | Product Details



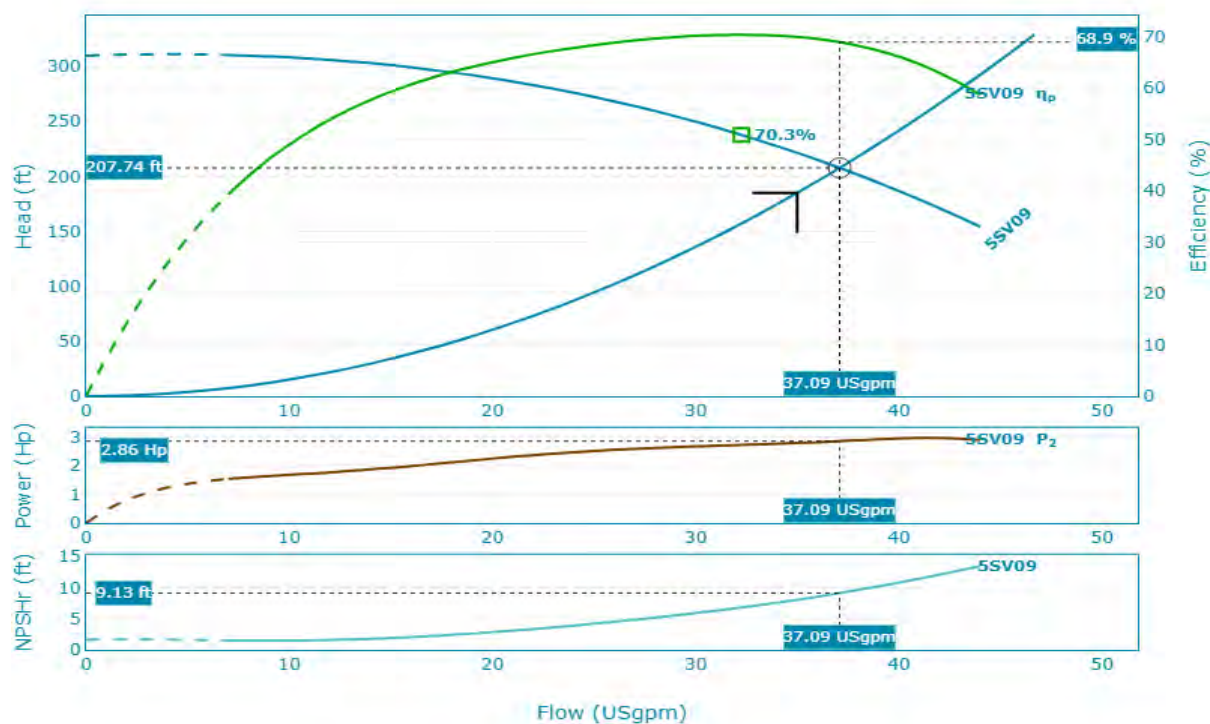
Construction Materials

Elastomers (11)	Viton (opt. EPDM)	Shaft (5)	Stainless Steel / AISI 316
Casing (4)	Stainless Steel / AISI 316L	Tie Rods (15)	Carbon Steel / Zinc Plated / A29 Gr.1045
Seal Gland (17)	Stainless Steel / AISI 316	Coupling (8)	Aluminum / A384.0-F
Diffuser (3)	Stainless Steel / AISI 304	Mechanical Seal (10)	See Mechanical Section
Shaft Sleeve and Bushing (13)	Tungsten Carbide	Coupling Guard (12)	Stainless Steel / AISI 304
Pump Body (1)	Cast Iron (G) / ASTM Class 35/40B	Wear Ring (16)	PPS
Seal Plate (9)	Stainless Steel / AISI 316L	Impeller (2)	Stainless Steel / AISI 304
Fill/Drain Plugs (14)	Stainless Steel / AISI 316	Adapter (6)	Cast Iron / ASTM Class 35/40B

Motor

There is no information available for the given configuration.

5SV9GF4F50 | Hydraulic Data & Performance Curve



Selection

Series	e-SV
Name	5SV09 3500rpm
Stages	9
Frequency	60 Hz
Total Flow	35.00 USgpm
Total Head	185.00 ft
Pump Flow	35.00 USgpm
Pump Head	185.00 ft
Acceptance Grade	Manufacturer's Standard
System Type	Single Pump
Operating Pumps	1
Standby Pumps	No Standby Pump

Design Point

Flow	37.09 USgpm
Head	207.74 ft
Pump Efficiency (η_p)	68.90 %
Shaft power (P2)	2.86 Hp
NPSHR	9.13 ft
Flow To BEP Ratio	115 %

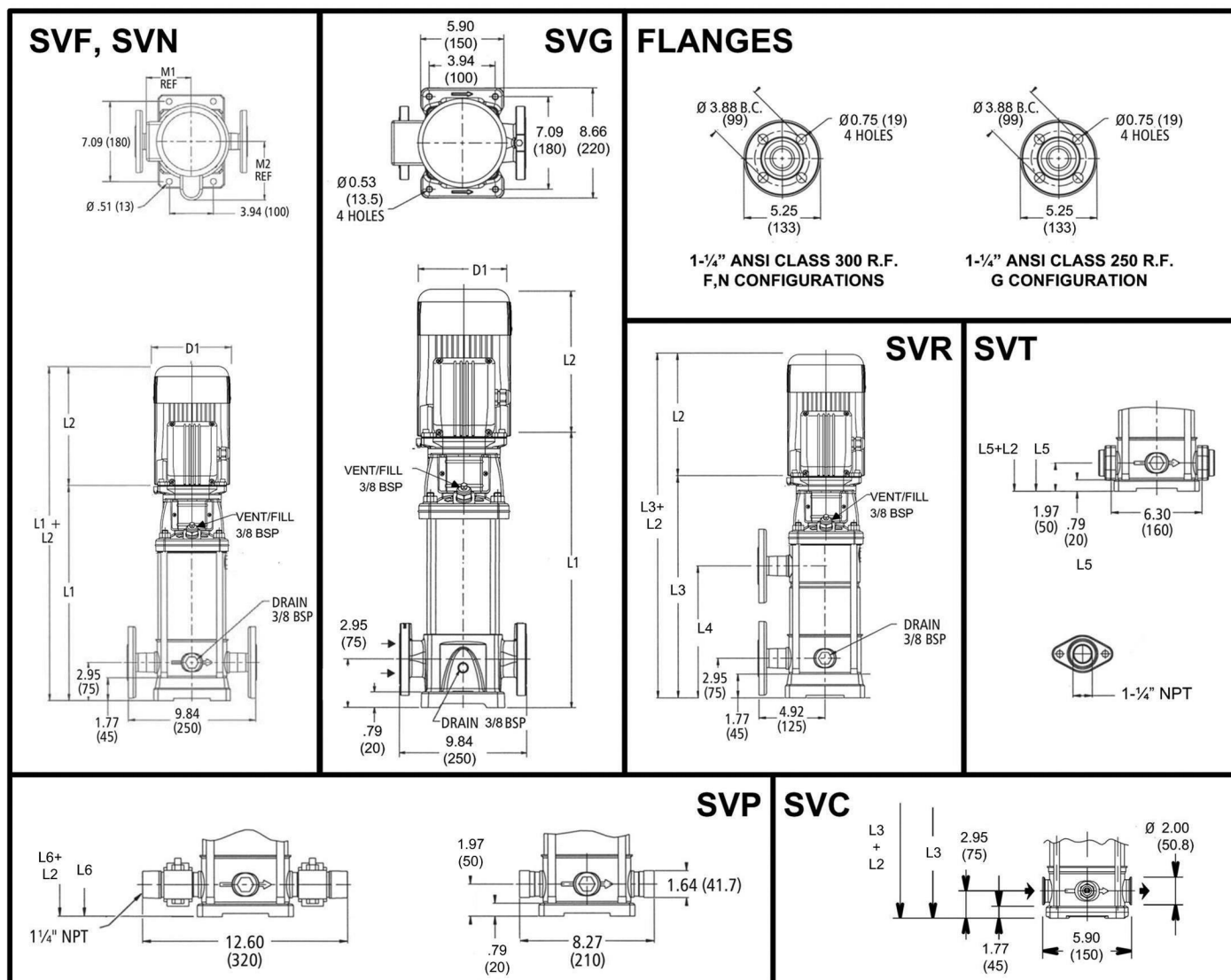
Fluid

Fluid Type	Water
Fluid Temperature	68 °F
Specific Gravity	1
Density	62.31322 lb/ft ³
Dynamic Viscosity	1.00165 cP
Fluid Vapor Pressure	0.33929 psi

Design Curve

Rated Speed	3,500 RPM
Min Flow	7 USgpm
Max Flow	44 USgpm
H@QMin	310.48 ft
H@QMax	154.27 ft
BEP	70.3 %
BEP Flow	32.26 USgpm
BEP Head	237.75 ft
Max Operating Pressure	134.7 psi
Max P2	2.97 Hp

5SV9GF4F50 | Dimensional Data & Drawing



Dimensions

Total Weight	83 lbs
NEMA Frame	56C
L1	19.77 inch
L2	11.18 inch
D1 (MAX.)	7.19 inch
L3	19.77 inch
L4	11.5 inch
L5	18.78 inch
L6	18.78 inch
D2	8.89 inch
M (Ref.)	6.92 inch

Company

Contact

Phone No.

Email

kobe@gopps.us

xylem
Let's Solve Water

5 Valves

5.

Check Valves

VAL-MATIC®

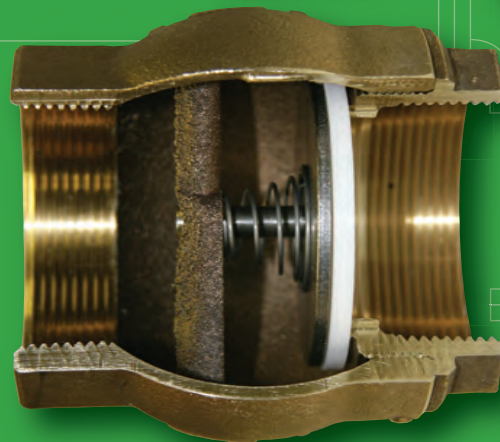
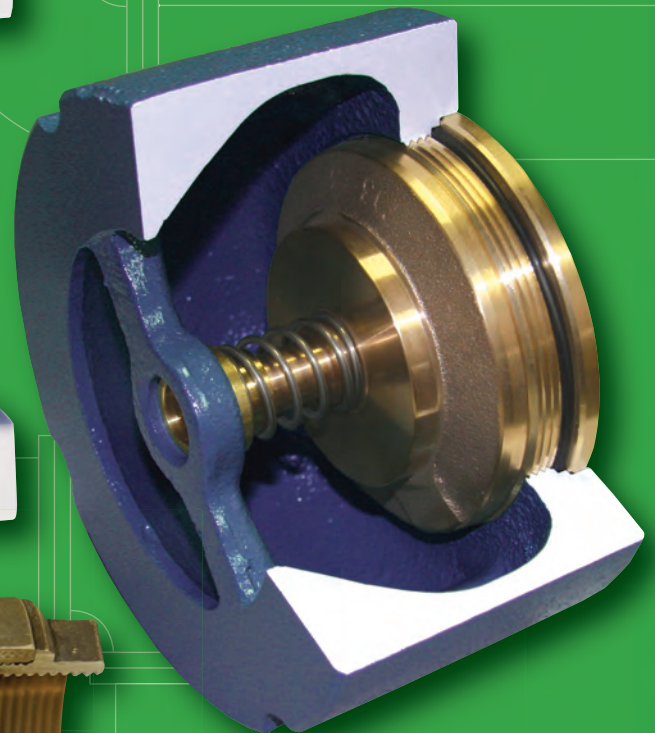
Silent Operation

Proven Performance

Cost Effective

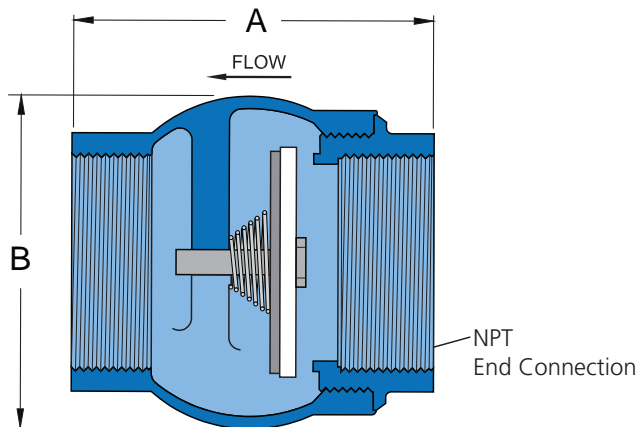


Silent Check
Valves



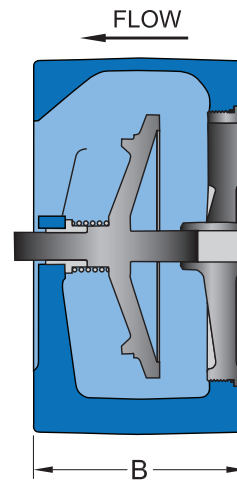
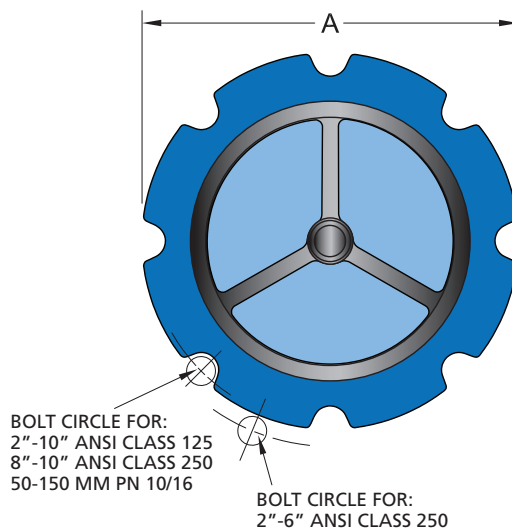
Installation Dimensions

Series 1400THR - Threaded



Dimensions				
Valve Size (NPT)	CWP psig (Bar)	A in (mm)	B in (mm)	Weight lb (kg)
1/2	250 (17.2)	2.06 (52.3)	1.38 (35.0)	.38 (.17)
3/4	250 (17.2)	2.25 (57.1)	1.63 (41.4)	.48 (.22)
1	250 (17.2)	2.63 (66.8)	2.00 (50.8)	.81 (.37)
1 1/4	250 (17.2)	2.94 (74.6)	2.38 (60.4)	1.22 (.55)
1 1/2	250 (17.2)	3.31 (84)	2.75 (69.8)	1.61 (.73)
2	250 (17.2)	3.68 (93.4)	3.38 (85.8)	5.13 (2.33)

Series 1400A - Wafer



Dimensions - Inch					
Valve Size	CWP (psig)	ANSI Class	A	B	Weight (lb)
2*	400	125/250	4.25	2.63	6
2 1/2*	400	125/250	5.00	2.88	7
3*	400	125/250	5.75	3.13	11
4*	400	125/250	7.00	4.00	19
5*	400	125/250	8.75	4.75	28
6*	400	125/250	9.75	5.50	41
8	200	125	13.38	6.50	81
	400	250	13.38	6.50	89
10	200	125	16.00	8.25	99
	400	250	16.00	8.25	137

Dimensions - Metric					
Valve Size	CWP (Bar)	PN Class	A	B	Weight (kg)
50	27.6	10/16	107.9	66.8	3
65	27.6	10/16	127	73.1	4
80	27.6	10/16	146	79.5	5
100	27.6	10/16	177.8	101.6	9
125	27.6	10/16	222.2	107.9	13
150	27.6	10/16	247.6	139.7	19

*Note: Sizes 2 - 6 in. are dual rated to fit between both ANSI Class 125 and 250 flanges.

Valve Construction

PRESSURE RATINGS

MAXIMUM PRESSURE RATINGS				
SERIES	DESCRIPTION	SIZE RANGE	END CONNECTION	CWP psig (Bar)
1400THR	Threaded	1/2" - 2" (15-50mm)	Threaded NPT	250 (17.2)
1400A	Wafer Style	2" - 6" (50-150mm)	Wafer Class 125/250	400 (27.6)
		8" - 10" (200-250mm)	Wafer Class 125	200 (13.8)
		8" - 10" (200-250mm)	Wafer Class 250	400 (27.6)
1800	Globe Style	2 1/2" - 12" (65-250mm)	Flanged Class 125	200 (13.8)
		14" - 42" (300-1050mm)	Flanged Class 125	150 (10.3)
		2 1/2" - 12" (65-250mm)	Flanged Class 250	400 (27.6)
		14" - 42" (300-1050mm)	Flanged Class 250	300 (20.7)

MATERIALS OF CONSTRUCTION

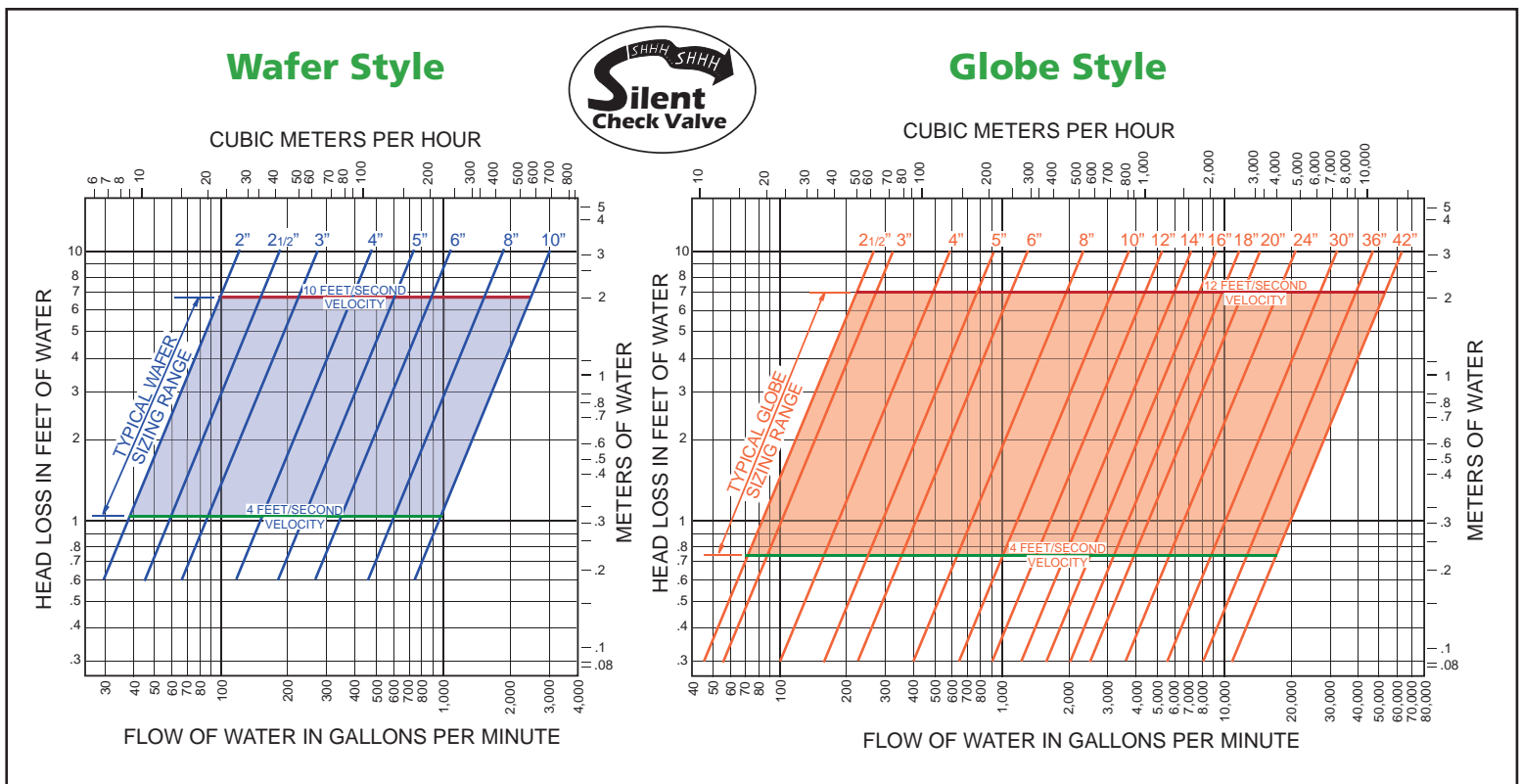
Threaded Style

COMPONENT	STANDARD
Body	Lead-Free Bronze
Disc	Lead-Free Bronze
Seat	Teflon
Spring	T316 Stainless Steel

Wafer & Globe Style

COMPONENT	STANDARD	OPTIONAL
Body	Cast Iron	Stainless Steel Ductile Iron
Disc	Lead-Free Bronze	Al-Bronze (Lead-Free) Stainless Steel
Seat	Lead-Free Bronze	Al-Bronze (Lead-Free) Stainless Steel
Resilient Seat	-	Buna-N EPDM
Spring	T316 Stainless Steel	Heavy Duty Spring

Headloss Chart



Size	2	2-1/2	3	4	5	6	8	10	12	14	16	18	20	24	30	36	42
Wafer Cv	43	88	130	228	350	520	900	1450	-	-	-	-	-	-	-	-	-
Globe Cv	-	127	155	278	435	625	1115	1770	2500	3400	4400	5600	6900	10,000	15,400	22,400	30,400

5.3

Backflow Preventer

VAT-MATIC®



Bulletin 1500

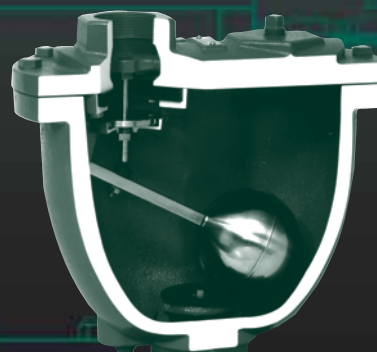
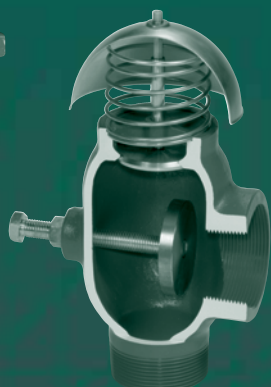
AIR VALVES

PROVIDING
SYSTEM
EFFICIENCY
AND
PROTECTION



WATER QUALITY

NSF/ANSI 61
Certified



Air Release Valves

Operational Highlights:

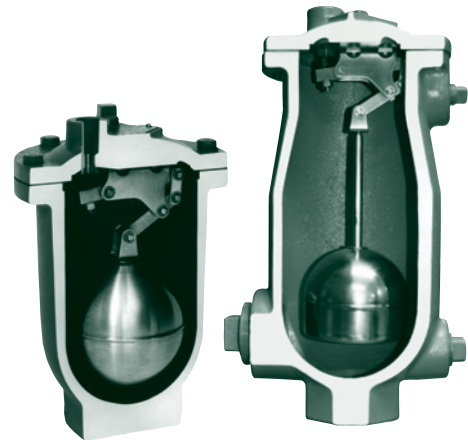
- Maintains system flow efficiency
- Releases unwanted air pockets during system operation
- Protects system against air related surges

Product Features:

- Unconditionally guaranteed stainless steel floats
- Stainless steel 316 internal trim
- Resilient seating for positive shutoff
- Performance proven for over 40 years
- Non-clog design eliminates backwashing

Optional Accessories:

- Vacuum check (prevents inflow of air)
- Outlet hood with screen (prevents debris from entering valves)
- Ball and plug isolation valves (allows valve maintenance)
- Inflow Preventer on outlet (stops flood water and resulting contamination from entering pipeline)
- Backwash kit (for severe wastewater applications)



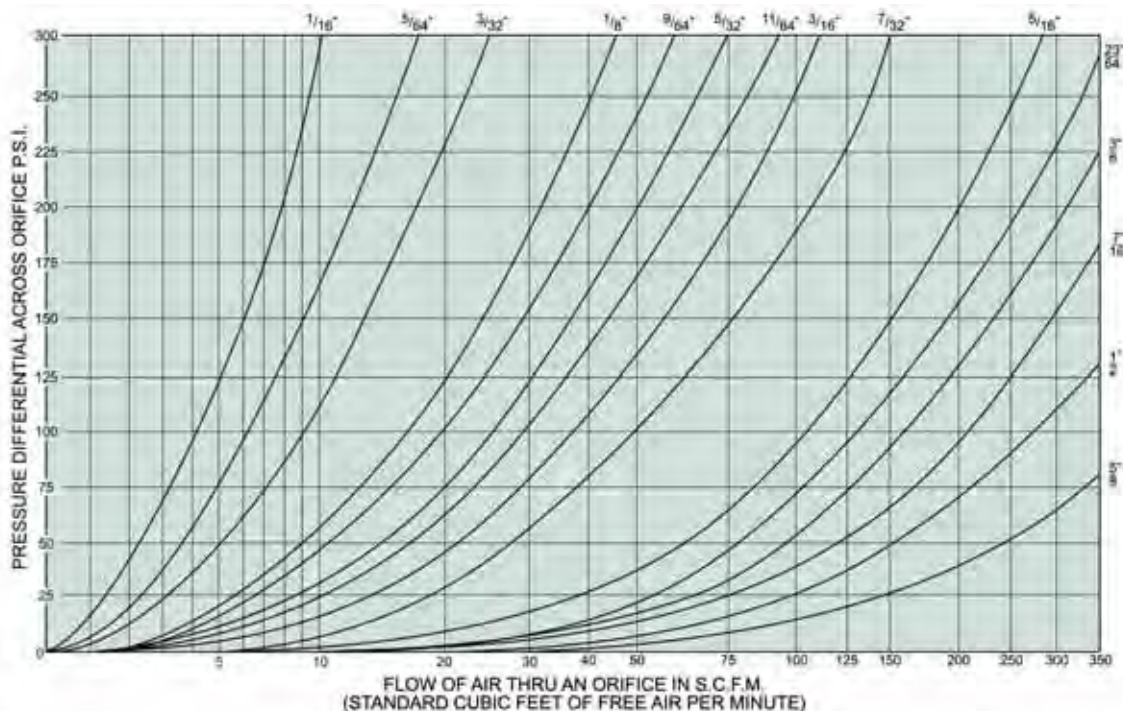
Clean Water*

Wastewater



MATERIALS OF CONSTRUCTION		
COMPONENT	STANDARD	OPTIONAL
Body and Cover	Cast Iron ASTM A126 Class B < 300 psig	Ductile Iron ASTM A536 Grade 65-45-12 Stainless Steel ASTM A351 Grade CF8M
Trim	Type 316 Stainless Steel	—
Coating	Universal Alkyd Primer (external)	Non-Stick Fusion Bonded Epoxy (internal & external)

Venting Capacity for Air Release Valve Orifice Sizes

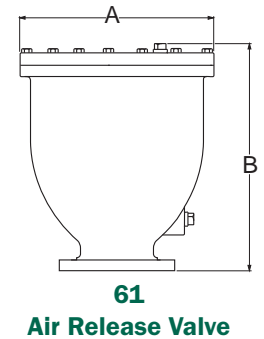
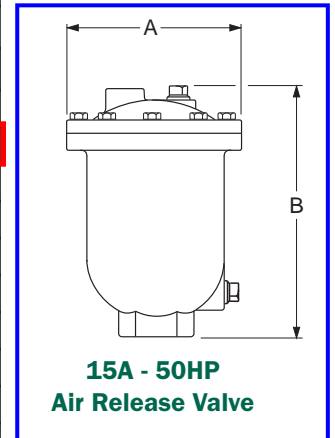


Air Release Valves

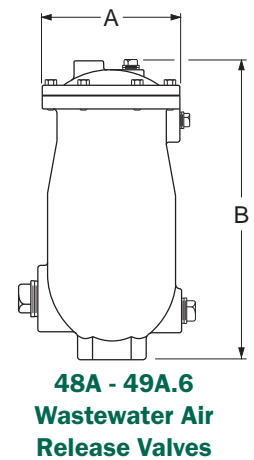
Installation Dimensions

WATER AIR RELEASE VALVES						
Inlet Size	Outlet Size	Model Number	CWP PSI	Orifice Size	Dimensions	
					A	B
1/2" NPT	1/2" NPT	15A* •	175	1/16"	4 3/4"	5 1/4"
3/4" NPT	1/2" NPT	15A.2* •	175	1/16"	4 3/4"	5 1/4"
1" NPT	1/2" NPT	15A.3* •	175	1/16"	4 3/4"	5 1/4"
1" NPT	1/2" NPT	22.3* •	175	3/32"	5 1/8"	6"
1/2" - 3/4" NPT	1/2" NPT	22.4* •	175	3/32"	5 1/8"	6"
1/2" NPT	1/2" NPT	22.7* •	300	1/16"	5 1/8"	6"
1/2" - 1" NPT	1/2" NPT	22.9*	300	1/16"	5 1/8"	6"
3/4" - 1" NPT	1/2" NPT	25.5*	150	1/8"	6 1/8"	7"
3/4" - 1" NPT	1/2" NPT	25.6*	300	3/32"	6 1/8"	7"
1" NPT	1/2" NPT	38*	150	3/16"	7"	10"
1" NPT	1/2" NPT	38HP*	500	1/8"	7"	10"
2" NPT	1/2" NPT	38.2*	150	3/16"	7"	10"
1" NPT	1/2" NPT	38.5*	300	5/32"	7"	10"
2" NPT	1/2" NPT	38.6*	300	5/32"	7"	10"
2" NPT	1" NPT	45*	150	23/64"	9 1/2"	12 1/4"
2" NPT	1" NPT	45HP*	400	3/16"	9 1/2"	12 1/4"
3" NPT	1" NPT	45.2*	150	23/64"	9 1/2"	12 1/4"
2" NPT	1" NPT	45.5*	300	7/32"	9 1/2"	12 1/4"
3" NPT	1" NPT	45.6*	300	7/32"	9 1/2"	12 1/4"
2" NPT	1" NPT	50*	500	7/32"	10 7/8"	13"
2" NPT	1" NPT	50HP*	1000	1/8"	10 7/8"	13"
6" 125lb Flg	1" NPT	61*	150	1"	18 3/4"	22"

*NSF/ANSI 61 Certified • UL Listed/FM Approved



WASTEWATER AIR RELEASE VALVES						
Inlet Size	Outlet Size	Model Number	CWP PSI	Orifice Size	Dimensions	
					A	B
2" NPT	1/2" NPT	48A	150	3/16"	7"	15 5/16"
3" NPT	1/2" NPT	48A.2	150	3/16"	7"	15 5/16"
2" NPT	1/2" NPT	48A.4	75	5/16"	7"	15 5/16"
3" NPT	1/2" NPT	48A.5	75	5/16"	7"	15 5/16"
2" NPT	1" NPT	49A	150	7/16"	9 1/2"	17 9/16"
3" NPT	1" NPT	49A.2	150	7/16"	9 1/2"	17 9/16"
2" NPT	1" NPT	49A.4	75	1/2"	9 1/2"	17 9/16"
3" NPT	1" NPT	49A.5	75	1/2"	9 1/2"	17 9/16"
4" NPT	1" NPT	49A.6	75	1/2"	9 1/2"	17 9/16"



D-021

PN 10



Combination Air Valve - Reclaimed and Non-Potable Water

Description

The D-021 Combination Air Valve combines an air & vacuum orifice and an air release orifice in a single body. The valve is specially designed to operate with liquids carrying solid particles such as reclaimed water and effluents. The combination air valve discharges air (gases) during the filling or charging of the system, admits air into the system while it is being emptied of liquid and releases accumulated air (gases) from the system while it is under pressure and operating. The valve's unique design enables the separation of the liquid from the sealing mechanism and assures optimum working conditions.

Applications

- Reclaimed water
- Raw water
- Effluent water
- Water with suspended solids
- Coolant water

Operation

The air & vacuum component discharges air at high flow rates during the filling of the system and admits air into the system at high flow rates during its drainage and at water column separation. High velocity air will not blow the float shut. Water will lift the float which seals the valve.

At any time during system operation, should internal pressure of the system fall below atmospheric pressure, air will enter the system. The smooth discharge of air reduces pressure surges and other destructive phenomena.

The intake of air in response to negative pressure protects the system from destructive vacuum conditions and prevents damage caused by water column separation. Air entry is essential to efficiently drain the system.

The automatic air release component releases entrapped air in pressurized systems.

Without air valves, pockets of accumulated air may cause the following hydraulic disturbances:

- Restriction of effective flow due to a throttling effect as would a partially closed valve. In extreme cases this will cause complete flow stoppage.
- Obstruction of efficient hydraulic transmission due to air flow disturbances.
- Accelerate cavitation damages.
- Pressure transients and surges.
- Corrosion in pipes, fittings and accessories.

- Danger of high-energy bursts of compressed air.
- Inaccuracies in flow metering.

As the system starts to fill, the combination wastewater valve functions according to the following stages:

1. Entrapped air/gas is discharged by the valve.
2. When the liquid level reaches the valve's lower portion, the lower float is lifted, pushing the sealing mechanism to its sealing position.
3. The entrapped air is confined in a pocket between the liquid and the sealing mechanism. The air pressure is equal to the system pressure.
4. Increases in system pressure compress the trapped air in the upper section of the conical chamber. The conical shape assures the height of the air gap. This enables separation of the liquid from the sealing mechanism.
5. Entrapped air (gas), accumulating at peaks and along the system, rises to the top of the valve, and displaces the liquid in the valve's body.
6. When the liquid level is lowered to a point where the float is no longer buoyant, the float drops, unsealing the rolling seal. The air release orifice opens and allows part of the air that accumulated in the upper portion of the valve to be released to the atmosphere.
7. Liquid enters the valve. The float rises, pushing the rolling seal to its sealing position. The remaining air gap prevents the wastewater from fouling the mechanism.

When internal pressure falls below atmospheric pressure (negative pressure):

1. The floats will immediately drop down, opening the air & vacuum and air release orifices.
2. Air enters into the system.

Main Features

- Working pressure range: 0.2 - 10 bar
- Testing pressure: 16 bar
- Maximum working temperature: 60° C.
- Maximum intermittent temperature: 90° C.
- The unique design of the valve prevents contact between the wastewater and the sealing mechanism by creating an air gap at the top of the valve. These features are achieved by:
 - **The conical body shape:** designed to maintain the maximum distance between the liquid and the sealing mechanism and still obtain minimum body length.
 - **Spring-loaded joint between the stem and the upper float:** vibrations of the lower float will not unseal the air release component. Release of air will occur only after enough air accumulates.

• **The Rolling Seal Mechanism:** less sensitive to pressure differentials than a direct float seal. It accomplishes this by having a comparably large orifice for a wide pressure range (up to 10 bar).

• **Funnel-shaped lower body:** designed to ensure that residue reclaimed water solid matter will fall back into the system and be carried away by the main pipe.

- Body made of composite materials, resistant to corrosion.
- Internal metal parts are made of corrosion-resistant stainless steel.
- Floats are made of composite materials.
- Flexible rolling seal provides smooth positive opening, closing, and leak-free sealing over a wide range of pressure differentials.
- Drainage tap with ball valve is provided.
- 3/8" threaded discharge outlet enables removal of excess fluids.
- Dynamic design allows for high velocity air discharge while

preventing premature closure.

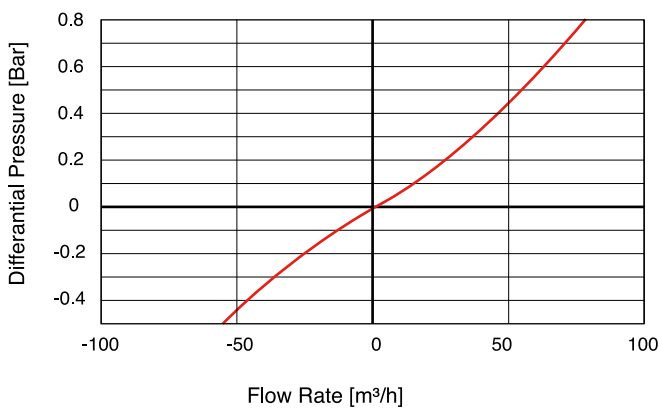
- 1/4" ball valve releases trapped pressure and drains the valve body prior to maintenance.

Valve Selection

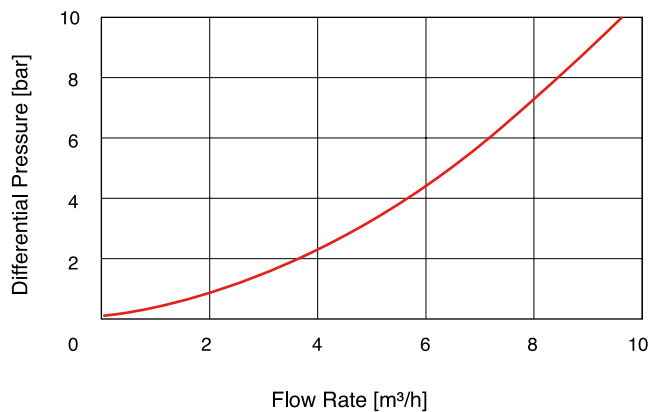
- Size Range: 1" & 2" with a BSP/NPT male threaded connection or with flanged ends to meet any requested standard.
- Additional one-way out check valve attachment allows air discharge, not allowing air intake.
- For best suitability, it is recommended to send the fluid chemical properties along with the valve request.

Upon ordering, please specify: model, size, working pressure, threads standard and type of liquid.

AIR & VACUUM FLOW RATE



AUTOMATIC AIR RELEASE FLOW RATE

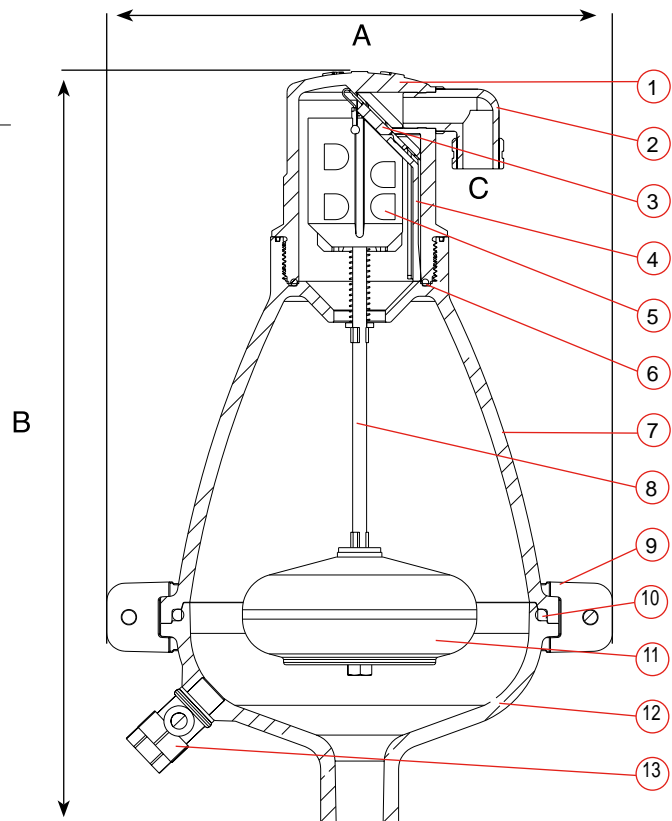


DIMENSIONS AND WEIGHTS

Dimensions mm		Connection	Weight	Orifice Area mm ²	
A	B			Auto.	A / V
216	324	3/8" BSP Female	1.78	7.8	100

PARTS LIST AND SPECIFICATION

No. Part	Material
1. Body	Reinforced Nylon
2. Discharge Outlet	Polypropylene
3. Rolling Seal	EPDM
4. Clamping Stem	Reinforced Nylon
5. Float	Foamed Polypropylene
6. O-Ring	BUNA-N
7. Body	Reinforced Nylon
8. Float Stem	Stainless Steel 316
9. Clamp	Reinforced Nylon + Stainless Steel 316
10. O-Ring	BUNA-N
11. Float	Foamed Polypropylene
12. Base	Reinforced Nylon
13. Ball Valve 1/4"	Brass, Nickel Plated



5.3

Air Relief Valves

Section 5.3.1

Backflow Preventer

Series 009

Reduced Pressure Zone Assemblies

Sizes: 1/4" – 2"

Series 009 Reduced Pressure Zone Assemblies are designed to protect potable water supplies in accordance with national plumbing codes and water authority requirements. This series is designed to protect drinking water supplies from dangerous cross-connections in accordance with national plumbing codes and water authority requirements for non-potable service applications such as irrigation, fireline, or industrial processing.

This series features two in-line, independent check valves, captured springs and replaceable check seats with an intermediate relief valve. Its compact modular design facilitates easy maintenance and assembly access. Sizes 1/4" – 1" shutoffs have tee handles.

Features

- Single access cover and modular check construction for ease of maintenance
- Top entry - all internals immediately accessible
- Captured springs for safe maintenance
- Internal relief valve for reduced installation clearances
- Replaceable seats for economical repair
- Bronze body construction for durability 1/4" – 2"
- Ball valve test cocks — screwdriver slotted 1/4" – 2"
- Large body passages provides low pressure drop
- Compact, space saving design
- No special tools required for servicing

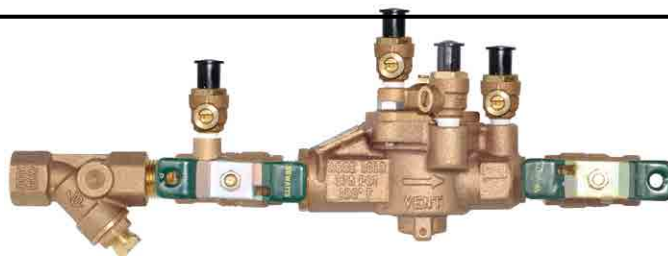
Specifications

A Reduced Pressure Zone Assembly shall be installed at each potential health hazard location to prevent backflow due to back-siphonage and/or backpressure. The assembly shall consist of an internal pressure differential relief valve located in a zone between two positive seating check modules with captured springs and silicone seat discs. Seats and seat discs shall be replaceable in both check modules and the relief valve. There shall be no threads or screws in the waterway exposed to line fluids. Service of all internal components shall be through a single access bronze cover secured with stainless steel bolts. The assembly shall also include two resilient seated isolation valves, four resilient seated test cocks and an air gap drain fitting. The assembly shall meet the requirements of: USC; ASSE Std. 1013; AWWA Std. C511-92; CSA B64.4. Shall be a Watts Series 009.

†Does not indicate approval status. Refer to Page 2 for approved sizes & models.

NOTICE

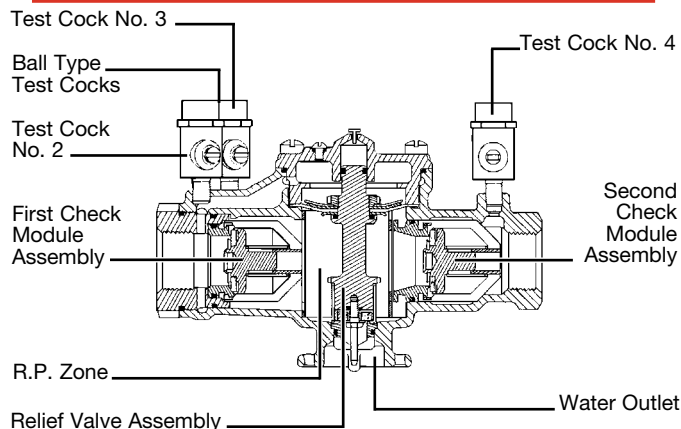
Inquire with governing authorities for local installation requirements



009QT-S



009M2QT



Now Available WattsBox Insulated Enclosures.

For more information, send for literature ES-WB.

NOTICE

The information contained herein is not intended to replace the full product installation and safety information available or the experience of a trained product installer. You are required to thoroughly read all installation instructions and product safety information before beginning the installation of this product.

WARNING

It is illegal to use this product in any plumbing system providing water for human consumption, such as drinking or dishwashing, in the United States. Before installing standard material product, consult your local water authority, building and plumbing codes.

Available Models: 1/4" – 2"

Suffix:

- QT – quarter-turn ball valves
- S – bronze strainer
- LF – without shutoff valves
- AQT – elbow fittings for 360° rotation
3/4" – 2" only
- PC – internal Polymer Coating
- SH – stainless steel ball valve handles
- HC – 2 1/2" inlet/outlet fire hydrant fitting (2" valve)

Prefix:

- C – clean and check strainer 3/4" – 1" only
- U – union connections (see ES-U009)

Materials: 1/4" – 2"

Bronze body construction, silicone rubber disc material in the first and second check plus the relief valve. Replaceable polymer check seats for first and second checks. Removable Relief valve seats. Stainless steel cover bolts.

Standardly furnished with NPT body connections. For optional bronze union inlet and outlet connections, specify prefix U (1/2" – 2"). Series 009QT furnished with quarter turn, full port, resilient seated, bronze ball valve shutoffs.

Pressure / Temperature

Series 009 1/4" – 2" Suitable for supply pressure up to 175psi (12.1 bar). Water temperature: 33°F – 180°F (0.5°C – 75°C).

Standards

USC

ASSE No. 1013

AWWA C511-92

CSA B64.4

IAPMO File No. 1563.

†Does not indicate approval status. See below for approved models.



Approvals

ASSE, AWWA, CSA, IAPMO

Approved by the Foundation for Cross-Connection Control and Hydraulic Research at the University of Southern California.

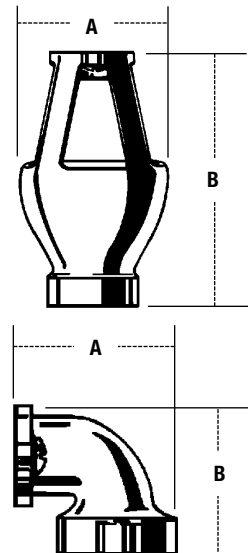
UL Classified 3/4" – 2"

(LF models only except 009M3LF)

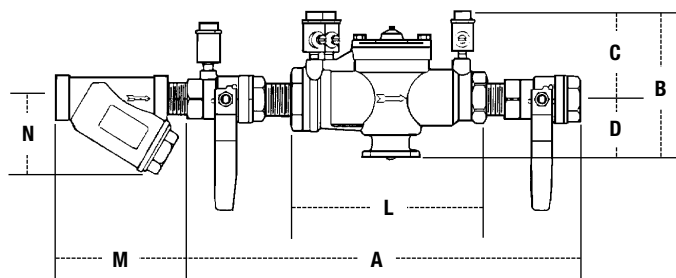
Air Gaps and Elbows

MODEL	for 909, 009 and 993 sizes	DRAIN OUTLET		DIMENSIONS				WEIGHT	
		in.	mm	in.	mm	in.	mm	lbs.	kgs.
909AGA	1/4"-1/2" 009, 3/4" 009M2/M3	1/2	13	2 3/8	60	3 1/8	79	0.625	0.28
909AGC	3/4"-1" 009/909, 1"-1 1/2" 009M2	1	25	3 1/4	83	4 7/8	124	1.5	0.68
909AGF	1 1/4"-2" 009M1, 1 1/4"-3" 009/909, 2" 009M2, 4"-6" 993	2	51	4 3/8	111	6 3/4	171	3.25	1.47
909AGK	4"-6" 909, 8"-10" 909M1	3	76	6 3/8	162	9 5/8	244	6.25	2.83
909AGM	8"-10" 909	4	102	7 3/8	187	11 1/4	286	15.5	7.03
909ELA	1/4"-1/2" 009, 3/4" 009M2/M3	–	–	–	–	–	–	–	–
909ELC	3/4"-1" 009/909	–	–	2 3/8	60	2 3/8	60	0.38	0.17
* 909ELF	1 1/4"-2" 009M1, 1 1/4"-2" 009/909, 2" 009M2, 4"-6" 993	–	–	3 3/8	92	3 3/8	92	2	0.91
* 909ELH Vertical	2 1/2"-3" 009/909	–	–	–	–	–	–	–	–

* Epoxy coated



Dimensions and Weight: 1/4" – 2" 009



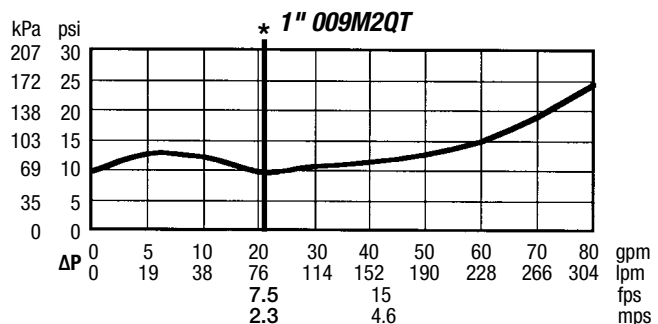
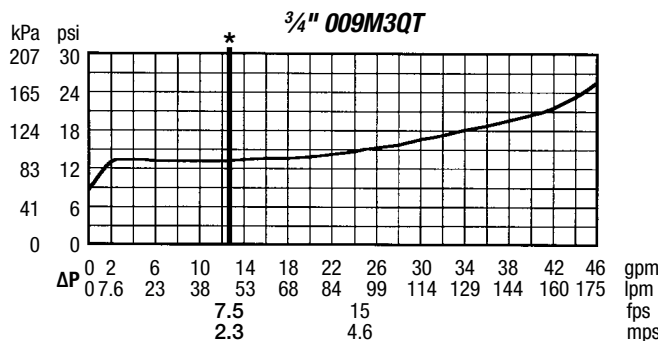
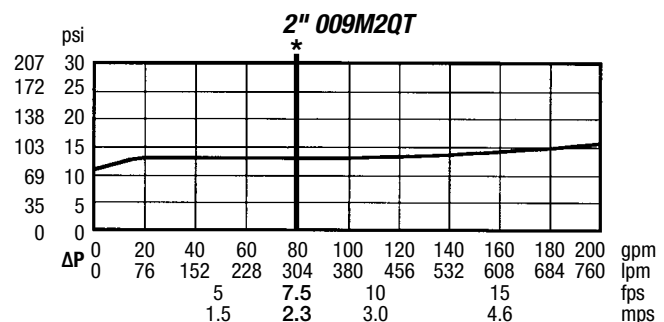
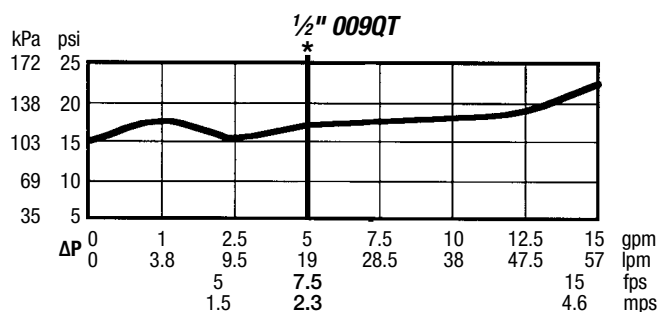
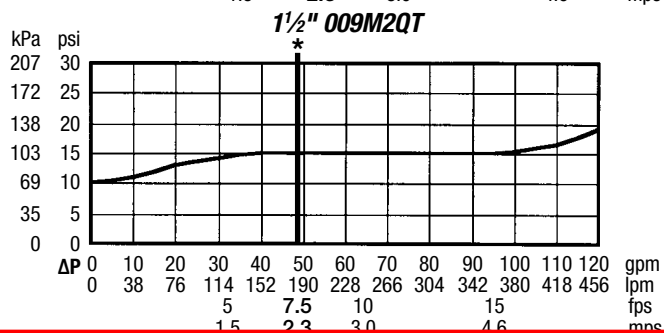
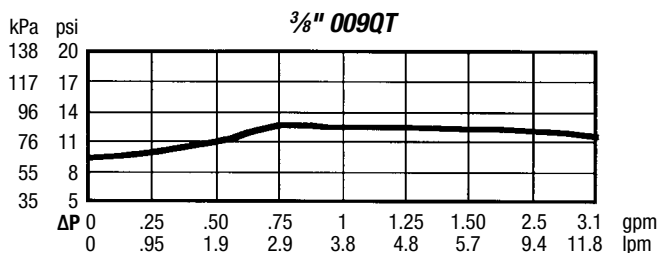
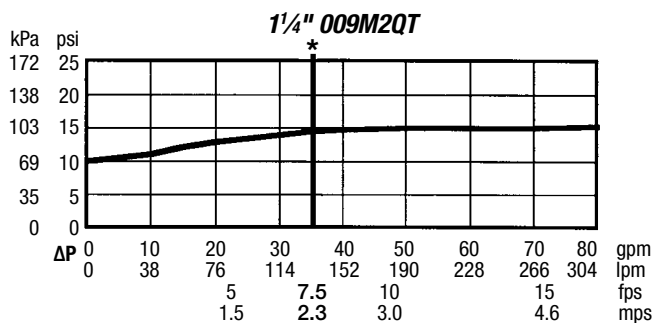
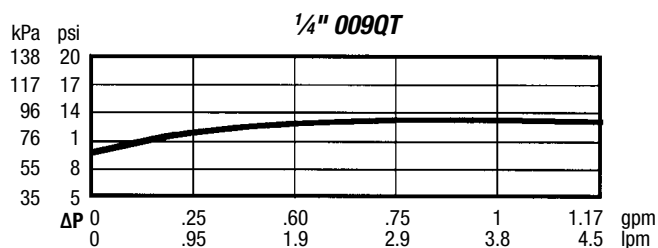
009 1/4" – 2"

SIZE			DIMENSIONS (APPROX.)								STRAINER DIMENSIONS				WEIGHT	
	A		B		C		D		L		M		N			
<i>in.</i>	<i>in.</i>	<i>mm</i>	<i>in.</i>	<i>mm</i>	<i>in.</i>	<i>mm</i>	<i>in.</i>	<i>mm</i>	<i>in.</i>	<i>mm</i>	<i>in.</i>	<i>mm</i>	<i>in.</i>	<i>mm</i>	<i>lbs.</i>	<i>kgs.</i>
¼	10	250	4⅝	117	3⅜	86	1¼	32	5½	140	2⅜	60	2½	64	5	2
⅜	10	250	4⅝	117	3⅜	86	1¼	32	5½	140	2⅜	60	2½	64	5	2
½	10	250	4⅝	117	3⅜	86	1¼	32	5½	140	2¾	70	2¼	57	5	2
¾	10¾	273	5	127	3½	89	1½	38	6¾	171	3⅜	81	2¾	70	6	3
1	14½	368	5½	140	3	76	2½	64	9½	241	3¾	95	3	76	12	5
1¼	17⅜	441	6	150	3½	89	2½	64	11⅜	289	4⅞	113	3½	89	15	6
1½	17⅞	454	6	150	3½	89	2½	64	11⅞	283	4⅞	124	4	102	16	7
2	21⅜	543	7¾	197	4½	114	3¾	83	13½	343	5⅝	151	5	127	30	13

Suffix HC – Fire Hydrant Fittings dimension 'A' = 25"

Capacity

Performance as established by an independent testing laboratory. *Typical maximum system flow rate (7.5 feet/sec., 2.3 meters/sec.)



USA: T: (978) 689-6066 • F: (978) 975-8350 • Watts.com

Canada: T: (905) 332-4090 • F: (905) 332-7068 • Watts.ca

Latin America: T: (52) 81-1001-8600 • Watts.com

6 Filtration

HARMSCO®

Hurricane® HP Filter Housings

Two Technologies in One

Lower Operation Cost

- Harmsco® Hurricane® filters provide unsurpassed performance. Our unique design separates dense solids prior to cartridge filtration for extended filter life, increased dirt holding capacity and reduced maintenance costs.

Features

- ▶ Combination cyclone separator and cartridge filter in a single compact design
- ▶ Patented Up-flow design with tangential entry - prevents air entrapment
- ▶ Rotational flow “flutters” media pleats - improving loading performance
- ▶ Electropolished 304 stainless steel housing
- ▶ Fail-Safe closure system
- ▶ Three sizes for greater media surface area
- ▶ CPVC standpipe (standard) - stainless steel optional
- ▶ Extensive choice of cartridge micron ratings and media, including carbon block
- ▶ NSF 61 listed



Certified to
ANSI-NSF 61
Excluding High Temp Cartridges



Applications

- ▶ Commercial/Residential Drinking Water
- ▶ Cooling Tower Filtration
- ▶ Desalination Pre-filtration (316 and coated options)
- ▶ Surface Water Treatment Rule (SWTR) I, II
- ▶ Process Water
- ▶ Whole House Filtration
- ▶ Industrial Waste Water Treatment
- ▶ Reverse Osmosis Pre-filtration
- ▶ Small Community Compliance (cysts)
- ▶ Well Water
- ▶ Ground Water Remediation
- ▶ Ground Water Under Direct Influence (GUDI)



HARMSCO® Filtration Products



Made in USA

HC/40-0.35	Hur 40 Cartridge - 0.35 Micron	●	●				●		●					●
HC/40-1	Hur 40 Cartridge - 1 Micron	●	●				●		●					●
HC/40-5	Hur 40 Cartridge - 5 Micron	●	●				●		●					● ●
HC/40-10	Hur 40 Cartridge - 10 Micron	●	●				●		●					● ● ●
HC/40-20	Hur 40 Cartridge - 20 Micron	●	●				●		●		●			● ● ●
HC/40-50	Hur 40 Cartridge - 50 Micron	●	●				●		●		●			● ● ●
HC/40-100	Hur 40 Cartridge - 100 Micron	●	●				●		●		●			● ● ●
HC/40-150	Hur 40 Cartridge - 150 Micron	●	●				●		●		●			● ● ●
HC/90-0.35	Hur 90 Cartridge - 0.35 Micron	●	●					●	●					●
HC/90-1	Hur 90 Cartridge - 1 Micron	●	●					●	●					●
HC/90-5	Hur 90 Cartridge - 5 Micron	●	●					●	●					● ●
HC/90-10	Hur 90 Cartridge - 10 Micron	●	●				●		●					● ● ●
HC/90-20	Hur 90 Cartridge - 20 Micron	●	●				●		●		●			● ● ●
HC/90-50	Hur 90 Cartridge - 50 Micron	●	●				●		●		●			● ● ●
HC/90-100	Hur 90 Cartridge - 100 Micron	●	●				●		●		●			● ● ●
HC/90-150	Hur 90 Cartridge - 150 Micron	●	●				●		●		●			● ● ●
HC/170-0.35	Hur 170 Cartridge - 0.35 Micron	●	●					●	●					●
HC/170-1	Hur 170 Cartridge - 1 Micron	●	●					●	●					●
HC/170-5	Hur 170 Cartridge - 5 Micron	●	●					●	●					● ●
HC/170-10	Hur 170 Cartridge - 10 Micron	●	●				●		●					● ● ●
HC/170-20	Hur 170 Cartridge - 20 Micron	●	●				●		●		●			● ● ●
HC/170-50	Hur 170 Cartridge - 50 Micron	●	●				●		●		●			● ● ●
HC/170-100	Hur 170 Cartridge - 100 Micron	●	●				●		●		●			● ● ●
HC/170-150	Hur 170 Cartridge - 150 Micron	●	●				●		●		●			● ● ●

[illegible]

100% Synthetic Composite media													
HC/40-1W-HF	Hur 40 Cartridge - 1 Micron	●	●				●		●	●			●
HC/40-5W-HF	Hur 40 Cartridge - 5 Micron	●	●				●		●	●			● ●
HC/40-20W-HF	Hur 40 Cartridge - 20 Micron	●	●			●			●	●	●		● ●
HC/90-1W-HF	Hur 90 Cartridge - 1 Micron	●	●				●		●	●			●
HC/90-5W-HF	Hur 90 Cartridge - 5 Micron	●	●				●		●	●			● ●
HC/90-20W-HF	Hur 90 Cartridge - 20 Micron	●	●			●			●	●	●		● ●
HC/170-1W-HF	Hur 170 Cartridge - 1 Micron	●	●				●		●	●			● ●
HC/170-5W-HF	Hur 170 Cartridge - 5 Micron	●	●				●		●	●			● ●
HC/170-20W-HF	Hur 170 Cartridge - 20 Micron	●	●			●			●	●	●		●

[illegible]

100% polypropylene media with polypropylene end caps and components															
HC-PP-40-0.2	Hur 40 High Purity Pleated PP - 0.2 Mic	●	●			●		●		●				●	
HC-PP-40-0.45	Hur 40 High Purity Pleated PP - 0.45 Mic	●	●			●		●		●				●	
HC-PP-40-1	Hur 40 High Purity Pleated PP - 1 Mic	●	●			●		●		●				●	
HC-PP-40-5	Hur 40 High Purity Pleated PP - 5 Mic	●	●					●		●				●	
HC-PP-90-0.2	Hur 90 High Purity Pleated PP - 0.2 Mic	●	●			●		●		●				●	
HC-PP-90-0.45	Hur 90 High Purity Pleated PP - 0.45 Mic	●	●			●		●		●				●	
HC-PP-90-1	Hur 90 High Purity Pleated PP - 1 Mic	●	●			●		●		●				●	
HC-PP-90-5	Hur 90 High Purity Pleated PP - 5 Mic	●	●					●		●				●	
HC-PP-170-0.2	Hur 170 High Purity Pleated PP - 0.2 Mic	●	●			●		●		●				●	
HC-PP-170-0.45	Hur 170 High Purity Pleated PP - 0.45 Mic	●	●			●		●		●				●	
HC-PP-170-1	Hur 170 High Purity Pleated PP - 1 Mic	●	●			●		●		●				●	
HC-PP-170-5	Hur 170 High Purity Pleated PP - 5 Mic	●	●					●		●				●	

40

90

170

Sediment Removal
Turbidity Reduction
Chlorine Removal
Taste & Odor Reduction
Cyst Removal
Pre-Filtration
Post-Filtration
Antimicrobial
Absolute Rated
Nominal Rated
100% Synthetic
Non Potable Use
Course Filtration
High Temperature
All Polypropylene
NSF Listed
Cleanable/ Reusable

SureSafe Antimicrobial - reduces growth of bacteria and mold on media

HC/40-20-AM	Hur 40 Cartridge - 20 Micron	•	•				•			•							•
HC/40-50-AM	Hur 40 Cartridge - 50 Micron	•	•				•			•							•
HC/90-20-AM	Hur 90 Cartridge - 20 Micron	•	•				•			•							•
HC/90-50-AM	Hur 90 Cartridge - 50 Micron	•	•				•			•							•
HC/170-20-AM	Hur 170 Cartridge - 20 Micron	•	•				•			•							•
HC/170-50-AM	Hur 170 Cartridge - 50 Micron	•	•				•			•							•

Carbon Block - includes pleated 5 micron nominal pre-filtration

HC/40-AC-5	Hur 40 Cart. Carbon + 5 Mic Pre-filt	•	•	•	•			•									•
HC/90-AC-5	Hur 90 Cart. Carbon + 5 Mic Pre-filt	•	•	•	•			•									•
HC/170-AC-5	Hur 170 Cart. Carbon + 5 Mic Pre-filt	•	•	•	•			•									•

EZ Clean - 100% synthetic composite 50 micron media

HC/40-EZ-CLEAN	Hur Cartridge - EZ CLEAN - 50 Micron	•	•							•	•						•
HC/90-EZ-CLEAN	Hur Cartridge - EZ CLEAN - 50 Micron	•	•							•	•						•
HC/170-EZ-CLEAN	Hur Cartridge - EZ CLEAN - 50 Micron	•	•							•	•						•

Poly-Mesh - 100% synthetic composite 250 micron media

HC/170-PM	Hur 170 Cartridge Poly Mesh - 250 Micron	•	•							•	•						•
-----------	--	---	---	--	--	--	--	--	--	---	---	--	--	--	--	--	---

Nano Fiber - 1 micron absolute, multi-layered media, low initial pressure drop, high flow rates

Nano-HC-40-1	Hur 40 Cartridge - 1 Micron	•	•							•							•
Nano-HC-90-1	Hur 90 Cartridge - 1 Micron	•	•							•							•
Nano-HC-170-1	Hur 170 Cartridge - 1 Micron	•	•							•							•

Cartridge Sizing Guide

Cleanable/ Reusable Hurricane® cartridges are cleanable and reusable in most applications and micron ratings (5 micron and up).

For Harmsco® Hurricane® and WaterBetter® Single-cartridge Filter Housings

Harmsco® recommends operation at 70% of maximum flow rate for optimum performance.

Polyester, High Temperature, Harmsco Free, SureSafe, EZ Clean, Poly-Mesh

Filter Model	Pleated Media Area (sq.ft.)	Length (in.)	O.D. (in.)	Max Flow Rate (GPM)	Recommended Flow Rate (GPM)	Max Flow Rate (LPM)	Max Flow Rate (M³/HR)	No./ Case	Carton Size
HUR 40 HP	40	9-5/8	7-3/4	Up to 50	35	Up to 189	Up to 12	1	9x9x11
HUR 90 HP	90	19-1/2	7-3/4	Up to 100	70	Up to 378	Up to 24	1	9x9x21
HUR 170 HP	170	30-3/4	7-3/4	Up to 150	105	Up to 568	Up to 36	1	9x9x32

Poly-Pleat

HUR 40 HP	25	9-5/8	7-3/4	—	15	—	—	1	9x9x11
HUR 90 HP	50	19-1/2	7-3/4	—	25	—	—	1	9x9x21
HUR 170 HP	100	30-3/4	7-3/4	—	50	—	—	1	9x9x32

Nano Fiber

HUR 40 HP	25	9-5/8	7-3/4	Up to 50	25	Up to 189	Up to 12	1	9x9x11
HUR 90 HP	50	19-1/2	7-3/4	Up to 100	50	Up to 378	Up to 24	1	9x9x21
HUR 170 HP	100	30-3/4	7-3/4	Up to 150	100	Up to 568	Up to 36	1	9x9x32

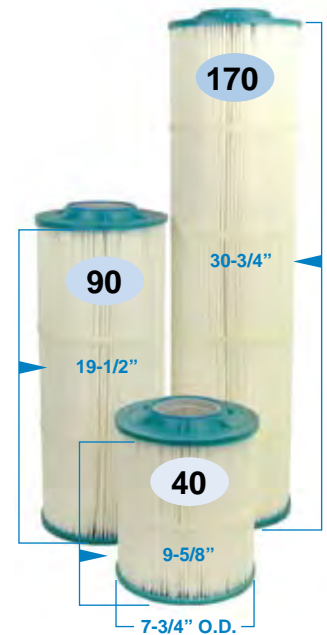
All-Poly

HUR 40 HP	25	9-5/8	7-3/4	25	17	19	Up to 12	1	9x9x11
HUR 90 HP	50	19-1/2	7-3/4	50	35	38	Up to 24	1	9x9x21
HUR 170 HP	75	30-3/4	7-3/4	100	60	76	Up to 36	1	9x9x32

Carbon Block

HUR 40 HP	25	9-5/8	7-3/4	—	5*	—	—	1	9x9x11
HUR 90 HP	55	19-1/2	7-3/4	—	10*	—	—	1	9x9x21
HUR 170 HP	90	30-3/4	7-3/4	—	15*	—	—	1	9x9x32

*recommended flow for maximum chlorine removal



Hurricane® Cartridges
Length and O.D.

Media Options



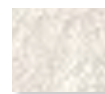
Polyester*



High Temperature



Harmsco Free*



Poly-Pleat* (multi-layer)



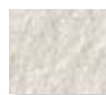
All-Poly (multi-layer)



SureSafe Antimicrobial



Carbon Block / 5 Micron Pleated Pre-filter



EZ Clean



Poly-Mesh

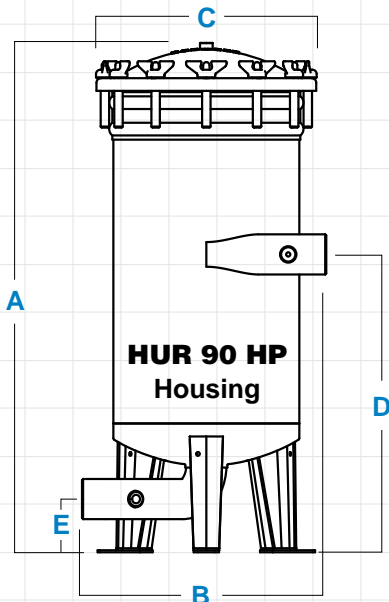


Nano Fiber (multi-layer)

*Polyester, Harmsco Free and Poly-Pleat cartridges are NSF-61 listed.

Cartridges in the industry for all your filtration needs.

Harmsco® Hurricane® HP Filter Housings



Certified to
ANSI-NSF 61

Excluding High Temp Cartridges



HUR 40 HP



HUR 90 HP



HUR 170 HP

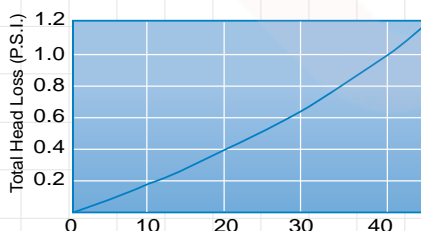
Filter Model	A Filter Height	B Width	C Diameter	D Inlet	E Outlet	Pipe Size NPT	Drain Size NPT	Floor Space In.	Service Ht.	Shipping Wt. Lbs.	Carton Size In.
HUR 40 HP	19-1/2"	14-5/8"	13"	12-3/4"	3-7/16"	2"	1"	15x15	35"	40	14x16x21
HUR 90 HP	29-7/8"	14-5/8"	13"	17-3/4"	3-7/16"	2"	1"	15x15	51"	52	14x16x38
HUR 170 HP	40-1/2"	14-5/8"	13"	23-5/8"	3-7/16"	2"	1"	15x15	72"	64	14x16x42

Filter Specifications

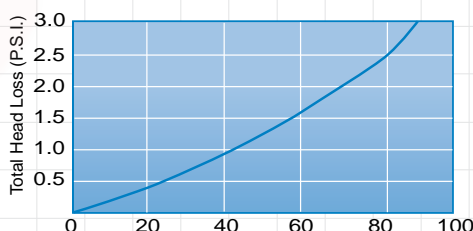
- ▶ Electropolished 304 stainless steel*
- ▶ Standpipe - CPVC*
- ▶ Temperature - 140°F (60°C)* max. *Up to 250°F (121°C) with optional stainless steel standpipe and high temperature cartridges installed
- ▶ Pressure - 150 psi (10 bar) max.
- ▶ Wing nuts - brass
- ▶ Rim gaskets - EPDM (Buna-N, Viton available)
- ▶ BSTP optional
- ▶ Gauge sample ports (1/4"), inlet and outlet
- ▶ 90° elbow and 45° sweep on outlet for staggered in-line vertical installation

*All stainless steel housings are 304; 316 available upon request. Stainless steel standpipe for high temperature also available.

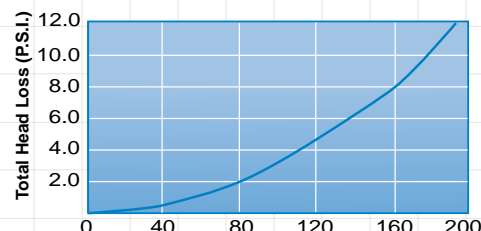
Pressure Drop



Pressure drop HUR 40 HP



Pressure drop HUR 90 HP



Pressure drop HUR 170 HP

The total head loss data shown above was developed by NSF International and indicates pressure drop with Hurricane® filter housings and one micron filter cartridges in clean water.

For additional information, please refer to the "Installation & Operation Manual" for Hurricane® Filters.



HARMSCO® Filtration Products

P.O. Box 14066, North Palm Beach, FL 33408

(561) 848-9628 • Toll-free: (800) 327-3248 • Fax: (561) 845-2474 • E-mail: sales@harmasco.com

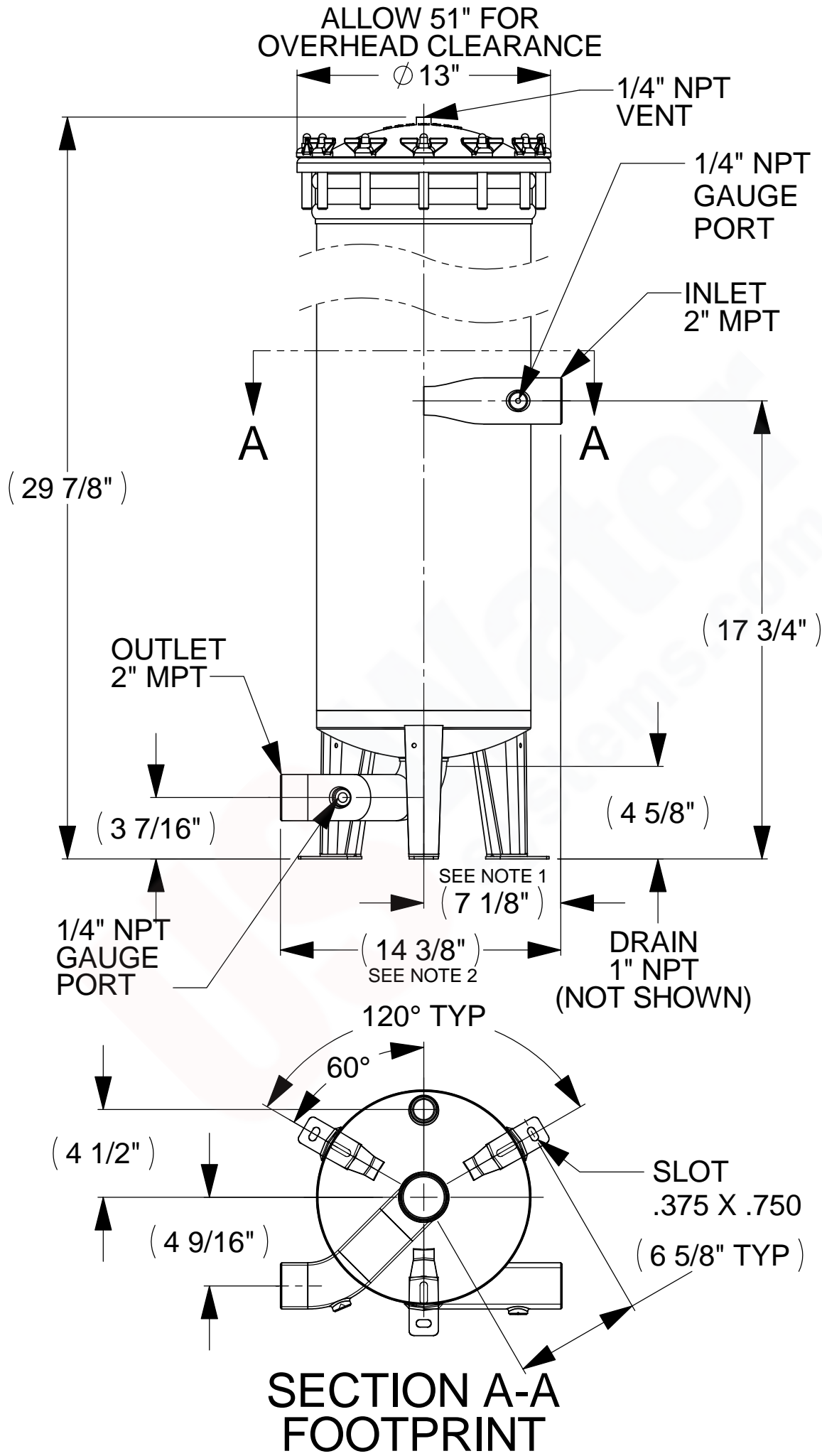
www.harmasco.com



Made in USA

07D 3/10

REVISIONS		DATE	APPROVED
REV.	DESCRIPTION		



APPROVALS		DATE	
DRAWN	CWN	5/3/00	
APPROVED	RPT	5/31/00	
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES +/- 1/8 +/- .010 +/- 30°			
DRAWN ON CAD DO NOT SCALE			
HARMSCO INC.		N. PALM BEACH, FL	
P.O. BOX 14066		PART NO.	
SCALE 1:7		HUR 90 HP	
PART NAME		INSTALLATION DIAGRAM	

2. ADD 1" TO THIS DIMENSION WHEN USING A THREADED FLANGE (150 PSI).

1. ADD 1/2" TO THIS DIMENSION WHEN USING A THREADED FLANGE (150 PSI).

NOTES:

Premium Hurricane® Polyester Cartridges

Maximum Surface Area

Designed for Hurricane® and WaterBetter® Filter Housings

High Flow Performance

Lower Operation Cost with Hurricane® Cartridges

- **High flow capability**
- Lower overall operating cost**
- Reduced waste disposal**
- Longer filter runs for fewer change-outs**
- Increased contaminant removal**
- Operator friendly**



Certified to
ANSI-NSF 61



**Premium Hurricane®
Polyester Cartridges**

Features

- ▶ Fewer cartridges for fewer change-outs and lower maintenance cost
- ▶ Pleated Polyester-Plus™ filter media provides higher flow rates and lower initial pressure drop
- ▶ Pleated surface area provides higher loading capacity for longer filter life and increased particle removal
- ▶ End cap, center tube and media are thermally bonded as one integral component for added strength
- ▶ Offered in three sizes (40, 90 and 170) and eight micron ratings (0.35, 1, 5, 10, 20, 50, 100 and 150) to meet all your high flow requirements

Applications

- ▶ Reverse Osmosis Pre-filtration
- ▶ Municipal Drinking Water Filtration
- ▶ Commercial/Residential Drinking Water Filtration
- ▶ Desalination Pre-filtration
- ▶ Industrial Water Filtration
- ▶ Cooling Tower Filtration
- ▶ Chill Water Loop Filtration
- ▶ Food & Beverage Filtration
- ▶ Marine/Aquatic Filtration
- ▶ Industrial Coolant Filtration



Premium Hurricane® Polyester Cartridges

Specifications

- **Micron Ratings:** Nominal micron ratings of 0.35, 1, 5, 10, 20, 50, 100, 150
- **Filter Media:** nominal pleated Polyester-Plus™
- **End Caps:** Pliable PVC with sealing surface built-in
- **Center Tubes:** ABS or PVC
- **Temperature:** 140°F (60°C) temperature limit*
* Temperature limits vary and depend on pressure and time under load.

Cleanable/Reusable in most filtration applications and micron ratings.

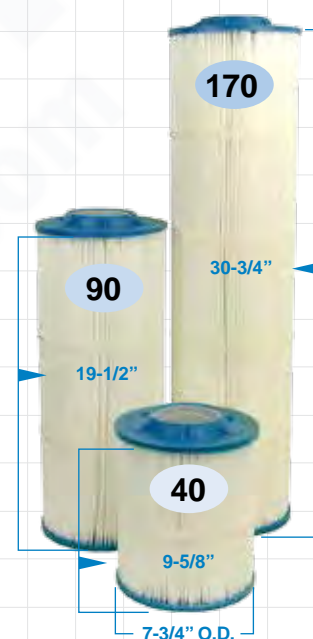


Certified to
ANSI-NSF 61

Cartridge Selection/Sizing Guide

7-3/4" O.D. For Harmsco® Hurricane® and WaterBetter® Single-cartridge Filter Housings

Cartridge Length	Product Code	Nominal Micron Rating	Media (sq ft)	Recommended Flow Rate* (GPM)	Max Flow Rate* (GPM)	Max Flow Rate* (LPM)	Max Flow Rate* (M³/HR)	No./ Carton	Carton Size
9-5/8"	Premium Hurricane® Polyester Cartridges - rated up to 140°F (60°C).								
	HC/40-0.35	0.35	40	35	50	189	12	1	9x9x11
	HC/40-1	1	40	35	50	189	12	1	9x9x11
	HC/40-5	5	40	35	50	189	12	1	9x9x11
	HC/40-10	10	40	35	50	189	12	1	9x9x11
	HC/40-20	20	40	35	50	189	12	1	9x9x11
	HC/40-50	50	40	35	50	189	12	1	9x9x11
	HC/40-100	100	40	35	50	189	12	1	9x9x11
	HC/40-150	150	40	35	50	189	12	1	9x9x11
	HC/90-0.35	0.35	90	70	100	378	24	1	9x9x21
19-1/2"	HC/90-1	1	90	70	100	378	24	1	9x9x21
	HC/90-5	5	90	70	100	378	24	1	9x9x21
	HC/90-10	10	90	70	100	378	24	1	9x9x21
	HC/90-20	20	90	70	100	378	24	1	9x9x21
	HC/90-50	50	90	70	100	378	24	1	9x9x21
	HC/90-100	100	90	70	100	378	24	1	9x9x21
	HC/90-150	150	90	70	100	378	24	1	9x9x21
	HC/170-0.35	0.35	170	105	150	568	36	1	9x9x32
	HC/170-1	1	170	105	150	568	36	1	9x9x32
	HC/170-5	5	170	105	150	568	36	1	9x9x32
30-3/4"	HC/170-10	10	170	105	150	568	36	1	9x9x32
	HC/170-20	20	170	105	150	568	36	1	9x9x32
	HC/170-50	50	170	105	150	568	36	1	9x9x32
	HC/170-100	100	170	105	150	568	36	1	9x9x32
	HC/170-150	150	170	105	150	568	36	1	9x9x32



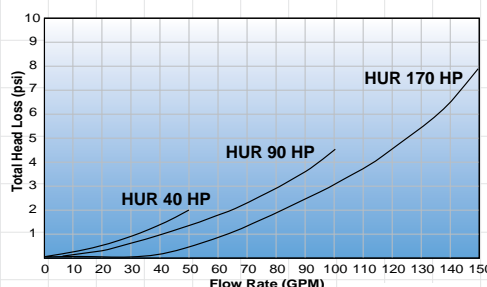
Premium Hurricane® Polyester Cartridges

Length and O.D.

*Harmsco® recommends operation at 70% of maximum flow rate for optimum performance.

Pressure Drop

Pressure drop shown at right is for filter housing and 20 micron filter cartridge in clean water.



Note: This publication is to be used as a guide. The data within has been obtained from many sources and is considered to be accurate. Harmsco does not assume liability for the accuracy and/or completeness of this data. Changes to the data can be made without notification. Temperature, Pressure, Flow Rates, Differential Pressures, Chemical Combinations and other unknown factors can affect performance in unknown ways. **Limited Warranty:** Harmsco warrants their products to be free of material and workmanship defects. Determination of suitability of Harmsco products for uses and applications contemplated by Buyer shall be the sole responsibility of Buyer. The end user/installer/buyer shall be liable for the product's performance and suitability regarding their specific intended applications. End users should perform their own tests to determine suitability for each application.



HARMSCO® Filtration Products

P.O. Box 14066, North Palm Beach, FL 33408

(561) 848-9628 • Toll-free: (800) 327-3248 • Fax: (561) 845-2474 • E-mail: sales@harmsco.com

www.harmsco.com



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Section 6.2 Strainer

— MODEL —

X43H

H Style Strainer

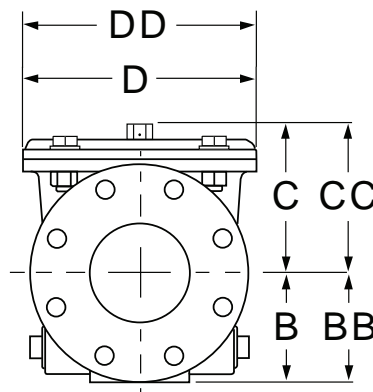
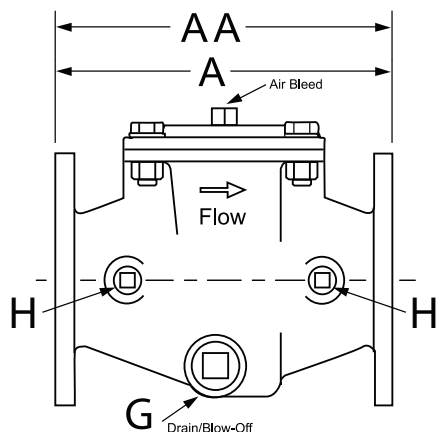


- Low Pressure Drop
- Ductile Iron with NSF/ANSI 61 Fusion Bonded Epoxy Coating Construction with a 316 Stainless Steel Strainer
- Large Flow Area H-Style Design
- Service Without Removal From Line

The Cla-Val Model X43H Strainer offers an effective means of removing unwanted solid particles in pipeline flow. These strainers are ideal for preventing fouling, debris and particle buildup in Cla-Val Automatic Control Valves. The large flow area design, with a flat stainless steel strainer mesh perpendicular to flow, is optimized for low pressure drop applications.

Optional accessories that can be added to the X43H Strainer include the Differential Pressure Switch and the X141DP Differential Pressure Gauge Assembly.

Maintenance is fast and easy with the compact H-pattern, requiring only top cover removal. Though the strainer may be installed in any position, installation with the cover up is recommended.



Dimensions

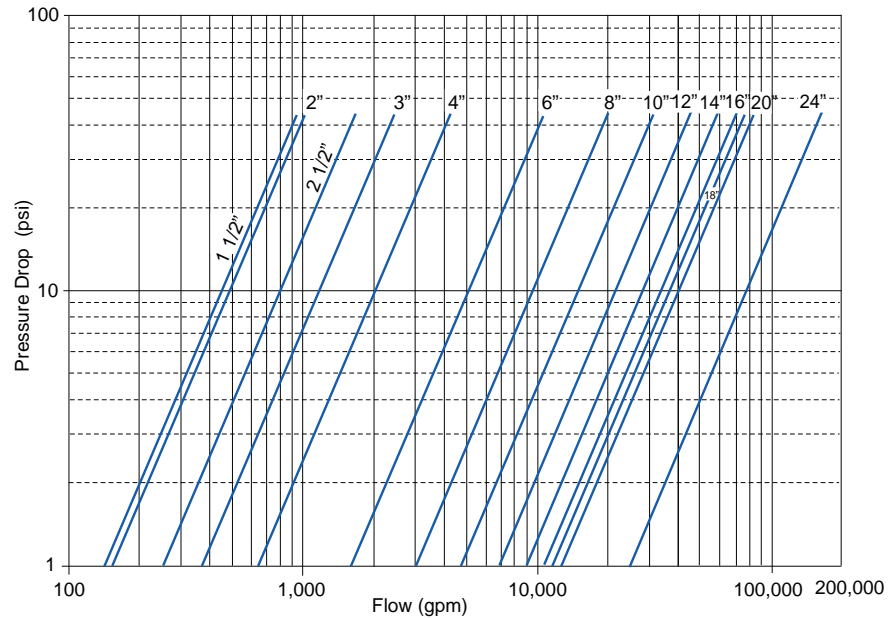
Strainer Size (inches)	1 ½	2	2 ½	3	4	6	8	10	12	14	16	18	20	24	30	36	48
A 150 ANSI	9.06	9.06	9.06	11.81	11.81	15.75	19.69	22.83	24.02	25.59	31.50	31.50	37.40	43.31	45.27	45.67	45.67
AA 300 ANSI	9.13	9.13	9.13	11.89	11.89	15.83	19.76	22.91	24.09	25.67	31.57	31.57	37.48	43.39	--	--	--
B 150 ANSI	2.50	3.26	3.66	4.06	4.33	5.63	6.69	8.40	9.40	10.24	12.20	13.18	19.09	19.09	22.49	26.00	34.00
BB 300 ANSI	3.26	3.26	3.66	4.06	5.02	5.63	7.50	8.86	10.20	10.94	12.70	15.00	19.09	19.09	--	--	--
C Max. 150 ANSI	3.78	3.78	3.78	5.91	5.91	7.52	8.82	11.61	15.16	14.96	19.69	19.69	23.98	23.98	25.10	36.20	34.11
CC Max. 300 ANSI	5.20	5.20	5.35	6.22	6.22	7.99	9.33	12.79	15.67	15.67	19.69	19.69	23.98	23.98	--	--	--
D Dia. 150 ANSI	7.87	7.87	7.87	9.25	9.25	15.74	18.11	22.05	26.77	26.77	35.43	35.43	46.85	46.85	46.85	61.65	61.65
DD Dia. 300 ANSI	7.99	7.99	7.99	9.37	9.37	15.86	18.23	22.17	26.85	26.85	35.43	35.43	46.85	46.85	--	--	--
H Inlet/Outlet Plugs NPT	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½
G Drain/Blow-off Plug NPT	1¼	1¼	1¼	1¼	1¼	1¼	1¼	1¼	2	2	2	2	2	2	2	2	2
Approx. Ship Wt. Lbs.	33	36	39	59	73	143	212	432	626	683	970	1073	1175	1962	2249	4123	4828

Strainer Size (mm)	40	50	65	80	100	150	200	250	300	350	400	450	500	600	750	900	1200
A 150 ANSI	230	230	230	300	300	400	500	580	610	650	800	800	950	1100	1150	1160	1160
AA 300 ANSI	232	232	232	302	302	402	502	582	612	652	802	802	952	1102	--	--	--
B 150 ANSI	64	83	93	103	110	143	170	213	240	260	310	335	485	485	571.5	660.5	862.5
BB 300 ANSI	83	83	93	103	128	143	191	225	259	278	321	380	485	486	--	--	--
C Max. 150 ANSI	96	96	96	150	150	191	224	295	385	380	500	500	609	609	637.5	919.5	866.5
CC Max. 300 ANSI	132	132	136	158	158	203	237	325	398	398	500	500	609	609	--	--	--
D Dia. 150 ANSI	200	200	200	235	235	400	460	560	680	680	900	900	1190	1190	1190	1566	1566
DD Dia. 300 ANSI	203	203	203	238	238	403	463	563	682	682	900	900	1190	1190	--	--	--
H Inlet/Outlet Plugs NPT	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½	½
G Drain/Blow-off Plug NPT	1¼	1¼	1¼	1¼	1¼	1¼	1¼	1¼	2	2	2	2	2	2	2	2	2
Approx. Ship Wt. (kg)	15	16	18	27	33	65	96	196	284	310	440	600	810	890	1020	1870	2190

Specifications

Sizes (Inches):	1½, 2, 2½, 3, 4, 6, 8, 10, 12, 14, 16, 18, 20, 24, 30, 36 and 48
Sizes (mm):	40, 50, 65, 80, 100, 150, 200, 250, 300, 350, 400, 450, 500, 600, 750, 900, 1200
Ends:	Flanged, ANSI Class 150 and 300 (Note: 300# Flanges are Raised Face)
Max Pressure Rating:	150# - 250 psi • 300# - 400 psi
Temperature:	Maximum 175°F
Materials:	
Body & Cover:	Ductile Iron ANSI B16.42; Fusion Bonded Epoxy Coating Standard
Cover Seal:	Buna-N® Synthetic Rubber
Strainer:	316 Stainless Steel; Ductile Iron, Epoxy Coated Frame
Strainer Mesh Sizes:	Standard 10 mesh / 2000 Micron / Openings 0.078 inch • Optional .039 and .059 inch openings available
Drain/Blow-Off:	Connection furnished with Standard Stainless Steel Plug
Cover Fasteners:	Stainless Steel

Model X43H Flow Chart



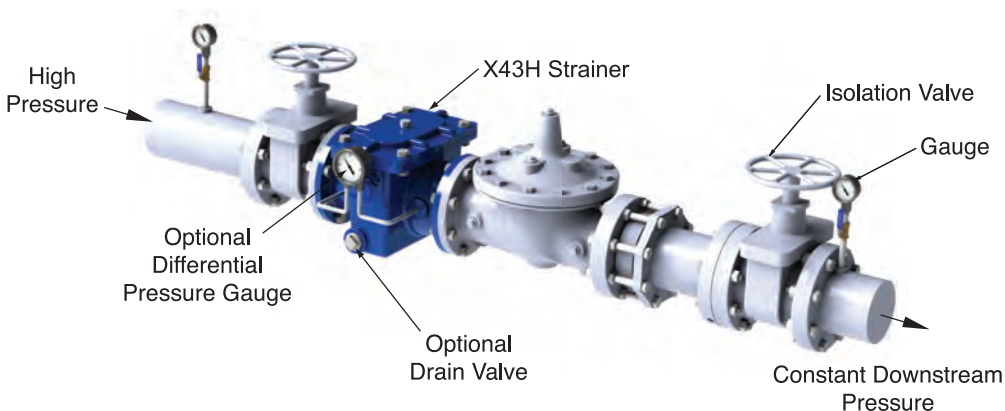
C_V Factor

Size (inches)	1 ½	2	2 ½	3	4	6	8	10	12	14	16	18	20	24	*30	*36	*48
Size (millimeters)	40	50	65	80	100	150	200	250	300	350	400	450	500	600	750	900	1200
C _V (Gal/Min. - gpm.)	96	150	254	367	654	1644	3922	4566	6800	8949	11692	12796	18264	26302	CF	CF	CF
C _V (Litres/Sec - l/s.)	23	36	61	88	157	395	942	1097	1634	2150	2809	3074	4388	6319	CF	CF	CF

C_V in gpm = gpm @ 1psid head loss • C_V in l/s = l/s @ 1bar head loss

*Consult factory to confirm flow data for 30-inch/750mm and larger strainers

Model X43H Strainer Typical Application



Strainer Options

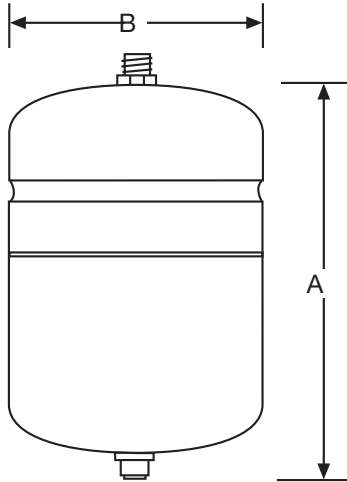


7 Miscellaneous

WELL-X-TROL®

Pre-pressurized diaphragm-type well tanks
WX-100, 200 and 300 SERIES

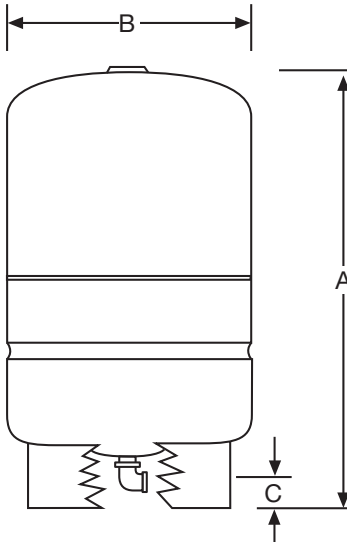
In-Line Models



Model No.	Tank Vol.		Max. Accept. Factor	A Height		B Diameter		Sys. Conn. ¹	Factory Pre-charge	Working Pressure	Ship Wt.	
	Lit	Gal		mm	in	mm	in				kg	lb
WX-101	8	2.0	0.45	321	12 ⁵ / ₈	203	8	3/4	18	150	2.3	5
WX-102	17	4.4	0.55	381	15	279	11	3/4	18	150	4.0	9
WX-103	33	7.6	0.42	629	22 ¹ / ₄	279	11	3/4	28	150	7.0	15
WX-104	39	10.3	1.00	451	17 ³ / ₄	390	15 ³ / ₈	1	38	150	9.0	20
WX-200	53	14.0	0.81	559	22	390	15 ³ / ₈	1	38	150	10.0	22

¹ System Connection: Stainless Steel Waterway. ² 150 PSIG is 1034 kPa.

Stand Models



Model No.	Tank Vol.		Max. Accept. Factor	A Height		B Diameter		C Conn. ³	Sys. Conn. ¹	Factory Pre-charge	Working Pressure	Ship Wt.	
	Lit	Gal		mm	ins.	mm	ins.	ins.				kg	lbs.
WX-104-S	39	10.3	1.00	489	19 ¹ / ₄	390	15 ³ / ₈	1 ¹³ / ₁₆	1	38	150	10.5	23
WX-201	53	14.0	0.81	606	23 ⁷ / ₈	390	15 ³ / ₈	1 ¹³ / ₁₆	1	38	150	11.4	25
WX-202	76	20.0	0.57	803	31 ³ / ₈	390	15 ³ / ₈	1 ¹³ / ₁₆	1	38	150	15.0	33
WX-202XL	98.4	26.0	0.44	971.5	38 ¹ / ₄	390.5	15 ³ / ₈	1 ¹³ / ₁₆	1	38	150	16.3	36
WX-203	121	32.0	0.35	1143	45	390	15 ³ / ₈	1 ¹³ / ₁₆	1	38	150	20.0	43
WX-205	129	34.0	1.00	752	29 ⁵ / ₈	559	22	2 ³ / ₁₆	1 ¹ / ₄	38	150	28.0	61
WX-250	167	44.0	0.77	914	36	559	22	2 ³ / ₁₆	1 ¹ / ₄	38	150	31.0	69
WX-251	235	62.0	0.55	1187	46 ³ / ₄	559	22	2 ³ / ₁₆	1 ¹ / ₄	38	150	41.0	92
WX-255	306.6	81.0	0.41	1432	56 ³ / ₈	558.8	22	2 ³ / ₁₆	1 ¹ / ₄	38	150	47.0	103
WX-302	326	86.0	0.54	1200	47 ¹ / ₄	660	26	2 ³ / ₁₆	1 ¹ / ₄	38	150	56.0	123
WX-350	450	119.0	0.39	1572	61 ⁷ / ₈	660	26	2 ³ / ₁₆	1 ¹ / ₄	38	150	75.0	166

² 150 PSIG is 1034 kPa.

³ System Connection: Stainless Steel.

Max. Operating Conditions

Operating Temperature	200° F (93° C)
-----------------------	----------------

Complies with Low Lead Plumbing Law

Specifications

Description	Standard Construction
Shell	Steel
Diaphragm	Heavy Duty Butyl
Liner	Polypropylene
Coating	Tuf-Kote™ Coating Technology

All dimensions are approximate.



Job Name _____
Location _____

Engineer _____
Contractor _____

Contractor P.O. No. _____
Sales Representative _____
Model No. Ordered _____
Pump Cut-In _____ PSI
Pump Cut-Out _____ PSI
Pump GPM _____ PSI

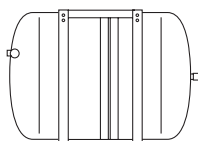
Underground Models



Model No.	Tank Vol.		Max. Accept. Factor	Height		Diameter		Sys. Conn. ¹ PSIG	Factory Precharge	Ship Wt.	
	Lit.	Gal		mm	ins.	mm	ins.			kg	lbs.
WX-200-UG	53	14.0	0.81	559	22	390	15 ³ / ₈	1	38	10.0	22
WX-202-UG	76	20.0	0.57	726	30	390	15 ³ / ₈	1	38	13.6	30
WX-250-UG	167	44.0	0.77	848	33 ³ / ₈	559	22	1 ¹ / ₄	38	27.0	60
WX-251-UG	235	62.0	0.55	1121	44 ¹ / ₈	559	22	1 ¹ / ₄	38	38.0	83

¹ **System Connection:** Stainless Steel Coupling. **Coating** on underground models is an epoxy-based paint.
Working Pressure: 150 PSIG (1034 kPa)

Pump Stand Models



Model No.	Height (ins)	Dimensions		Total Volume (gals)	Max. Accept. Factor	System Drawdown			Shipping Wt. (Vol.) lbs (cu ft)
		Width (ins)	Length (ins)			20/40 (gals)	30/50 (gals)	40/60 (gals)	
WX-102-PS	12 1/16	11	15 5/16	4.4	0.55	1.8	1.5	1.3	13 (1.4)
WX-105-PS	11	10 1/2	18 1/4	5.3	0.80	2.1	1.8	1.6	13 (1.5)
WX-110-PS	12 1/8	11	20 9/16	7.4	0.43	2.7	2.3	1.9	15 (2.0)
WX-200-PS	15 3/8	15 3/8	20 7/8	14.0	0.81	5.6	4.8	4.1	29 (4.0)
WX-202-PS	16	15 3/8	27 13/16	20.0	0.57	8.0	6.8	5.9	33.5 (4.9)

Precharge Pressure is 38 PSIG for all models.

Maximum Working Pressure is 150 PSIG and Maximum Working Temperature is 200° F.

Maximum Operating Conditions

Operating Temperature	200° F (93° C)
Working Pressure Pump Stand Models	150 PSIG (1034 kPa)
Working Pressure UG Models	150 PSIG (1034 kPa)

Complies with Low Lead Plumbing Law

Specifications

Description	Standard Construction
Shell	Steel
Diaphragm	Heavy Duty Butyl
Liner	Polypropylene
Coating	Pump Stand Models Tuf-Kote™ Coating Technology

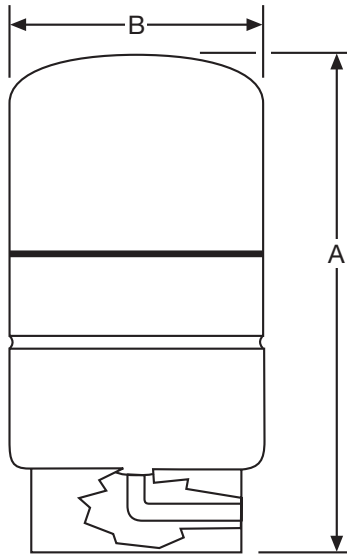
All dimensions are approximate.

Job Name _____
 Location _____

 Engineer _____
 Contractor _____

Contractor P.O. No. _____
 Sales Representative _____
 Model No. Ordered _____
 Pump Cut-In _____ PSI
 Pump Cut-Out _____ PSI
 Pump GPM _____ PSI

Pre-pressurized diaphragm-type well tanks
Stainless steel system connection piped to the stand



Stand Models

Model No.	Tank Vol.		Max. Accept. Factor	A Height		B Diameter		Sys. Conn. ¹	Factory Pre-charge	Working Pressure	Ship Wt.	
	Lit.	Gal		mm	ins.	mm	ins.				kg	lbs.
WX-202P	76	20.0	0.57	803	31 ⁵ / ₈	390	15 ³ / ₈	1	38	150	15.0	33
WX-202XLP	98.4	26.0	0.44	971.5	38 ¹ / ₄	390.5	15 ³ / ₈	1	38	150	16.3	36
WX-203P	121	32.0	0.35	1181	46 ¹ / ₂	390	15 ³ / ₈	1	38	150	20.0	43
WX-205P	129	34.0	1.00	752	29 ⁵ / ₈	559	22	1 ¹ / ₄	38	150	28.0	61
WX-250P	167	44.0	0.77	914	36	559	22	1 ¹ / ₄	38	150	31.0	69
WX-251P	235	62.0	0.55	1187	46 ³ / ₄	559	22	1 ¹ / ₄	38	150	41.0	92
WX-255P	306.6	81.0	0.41	1432	56 ³ / ₈	558.8	22	1 ¹ / ₄	38	150	38.4	103
WX-302P	326	86.0	0.54	1200	47 ¹ / ₄	660	26	1 ¹ / ₄	38	150	56.0	123
WX-350P	450	119.0	0.39	1572	61 ⁷ / ₈	660	26	1 ¹ / ₄	38	150	75.0	166

¹ 150 PSIG is 1034 kPa.

Max. Operating Conditions

Operating Temperature	200° F (93° C)
Working Pressure	150 PSIG (1034 kPa)

Complies with Low Lead Plumbing Law



NSF/ANSI 61

Specifications

Description	Standard Construction
Shell	Steel
Diaphragm	Butyl
Liner	Polypropylene
System Connection	Stainless Steel NPTF

All dimensions are approximate.

Job Name _____

Location _____

Engineer _____

Contractor _____

Contractor P.O. No. _____

Sales Representative _____

Model No. Ordered _____

Pump Cut-In _____ PSI

Pump Cut-Out _____ PSI

Pump GPM _____ PSI

Turbidity measuring point DULCOTEST DULCO turb C

Reliable on-line measurement of turbidity with DULCOTEST DULCO turb C measuring points



Turbidity measurements with DULCOTEST DULCO turb C: Compact measuring instrument that uses light scatter to measure turbidity, with a large measuring range and different designs to comply with ISO and EPA standards. Available with or without automatic cleaning.

Technical Details

- The measuring process in types TUC 1/TUC 5 (infrared light) corresponds to the global standard ISO 7027 and the European standard DIN EN 27027.
- The measuring process in types TUC 2/TUC 6 (white light) corresponds to the US standard USEPA 180.1.



Turbidity measuring point DULCOTEST DULCO turb C

Reliable on-line measurement of turbidity with DULCOTEST DULCO turb C measuring points

Technical Data

Measuring range	a) TUC1, TUC4; factory calibrated: 0...1000 NTU, other measuring ranges: 0...10 NTU and 0...100 NTU b) TUC5, TUC6; factory-calibrated 0...100 NTU, other measuring ranges: 0...10 NTU and 0...1000 NTU
Accuracy	± 2 % of the indicated value or ± 0.02 NTU below 40 NTU depending on which value is greater ± 5 % of the indicated value above 40 NTU
Resolution	0.0001 NTU below 10 NTU
Response time	Configurable
Display	Multiple row LCD display with background lighting
Alarm relay	Two programmable alarms, 120-240 VAC, 2 A Form C relay
Output signal	4...20 mA, 600 Ω, electric isolation: dual insulation, interference surge category II
Communication interface	Bi-directional RS-485, Modbus
Max. pressure	Integrated pressure regulator regulates TUC1, TUC2: 1380 kPa (200 psi) TUC 5, TUC6: 700 kPa (101,5 psi) based on the flow rate
Flow	6...60 l/h
Temperature	1...50 °C
Materials in Contact With the Medium	Polyamide (PA), silicone, polypropylene (PP), Viton®, stainless steel, borosilicate glass
Voltage supply	100 – 240 V AC, 47 – 63 Hz, 80 VA
Hydraulic connections	Black hose, inside 4.75 mm, outside 8 mm, installation in the bypass for the process main line
Ambient conditions	Not suitable for operation outdoors. Maximum operating altitude 2000 m above sea level. Maximum 95% relative air humidity (non-condensing).
Standard	Infrared light: ISO 7027, DIN EN 27027
Dimensions H x W x D	35 x 30 x 30 cm
Shipping weight	2.5 kg

	Standard	Ultrasonic cleaning	Order no.
TUC 1	Infrared light: ISO 7027, DIN EN 27027	No	1037696
TUC 2	White light: US EPA 180.1	No	1037695
TUC 5	Infrared light: ISO 7027, DIN EN 27027	Yes	1115440
TUC 6	White light: US EPA 180.1	Yes	1115441

DULCOMETER diaLog X

The Ultimate in Water Treatment Control Flexibility

Technical Data Sheet

ProMinent®



CONTINUOUS MULTI-PARAMETER MONITORING & CONTROL

The diaLog X is a programmable controller used in a variety of water treatment applications to control metering pumps, valves, motors and other components to provide full automation of your chemical feed system.

With user friendly flexible programming and an open platform, it is customizable to optimize your water treatment process. With up to 24 user inputs, the diaLog X can be setup to measure and monitor chemicals such as chlorine, chlorine dioxide, chlorite, ozone, hydrogen peroxide, bromine, peracetic acid, and more.

CONTROL & MONITORING APPLICATIONS

- Potable water treatment
- Wastewater treatment
- Fruit and vegetable washing
- Chemical fluid handling and metering
- Cooling tower and boiler water treatment

FEATURES

- Up to two satellite units can be added Easy on-site expandability with additional inputs and outputs
- Digital display screen All parameters and measured variables displayed on one screen
- Web based GUI (graphical user interface) Easy monitoring & control from remote location
- Built-in Modbus RTU connectivity (standard)
(BACnet, Modbus TCP, PROFINET available via gateway) Building management systems adaptability
- Various network protocol support, access and data management
(ie. FTP, MQTT, Wi-Fi & LAN) Flexible device access connectivity and system integration
- Built-in data logging Historical performance monitoring and analysis
- Advanced custom formulas and logic Site specific process calculations and reporting

BENEFITS

INPUTS AND OUTPUTS

Inputs:

- 4 plug-in module slots per unit for:
 - 2-channel serial sensor input module
 - 2-channel conductivity input module
 - 2-channel mV input module
 - 2-channel mA input module
 - 2-channel mV / mA input module
- Up to 24 flexible sensor inputs and mA outputs (8 per device)
- Up to 24 digital inputs (8 per device) to control level switches, water meters and remote switches

Outputs:

- 2-channel mA output module
- 6 output relays as changeover contacts (of which 3 are potential free and 3 are AC/DC)
- 4 pulse frequency outputs for controlling metering pumps
- Digital control inputs for contact water meter, flow switch and pause for locking
- Up to 30 output relays and pulse outputs (10 per device) to control pumps and other actuators
- Up to 12 pulse frequency outputs and up to 18 relays

MEASURED VARIABLES & CONNECTIONS

Conductivity:

- With digital sensor CTFS at input A and B, and via serial module D1: 0.1 - 10 mS/cm
- Via conductivity module L3 depending on sensor used (LMP, LFT): 50 µS/cm - 20 mS/cm
- Via mA module AA with the inductive conductivity sensor ICT: 8 to 2 mS/cm
- 20 mS/cm, 200 mS/cm

Temperature:

- Via Pt 100/Pt 1000, measuring range 32 - 302 °F (0 - 150 °C)

Type of connection mV:

- pH: 0.00 ... 14.00
- ORP potential: -1500 ... +1500 mV

Type of connection mA (amperometric 2 ppm / 10 ppm sensors):

- Chlorine • Chlorine Dioxide • Chlorite • Bromine • Ozone • Hydrogen Peroxide • Peracetic Acid

ADDITIONAL SPECIFICATIONS

- **Enclosure rating:** Wall-mounted: IP 67
- **Field bus connection:** Modbus RTU, additional field buses via gateway
- **Tests and approvals:** CE, MET registered, UK, CA
- **Accuracy:** 0.3% based on the full-scale reading
- **Temperature compensation:** Pt 100/Pt 1000 for pH
- **Control characteristic:** P/PI/PID control
- **Field bus connection:** Modbus RTU (additional protocols via gateway)
- **Electrical connection:** 100 – 230 V, 50/60 Hz
- **Ambient temperature:** 23 - 122 °F (-5 - 50 °C) at max. 95% relative air humidity (non-condensing)
- **Housing material:** PC with flame proofing equipment
- **Dimensions (H x W x D):** 10.9 x 16.7 x 5.4 in (276 x 424 x 137 mm)
- **Web interface:** Wi-Fi and Ethernet, FTP server, rest API, MQTT client interface

Technical Data Sheet

PROVEN SOLUTIONS THAT MEET YOUR NEEDS

ProMinent Fluid Controls offers the highest quality metering pumps, disinfection systems, polymer preparation systems, metering systems for solids, instrumentation, and custom designed systems. The Group is headquartered in Heidelberg, Germany with more than 2,800 employees throughout 50 sales and service locations and 11 production sites. With over 60 years of experience, our expertise and wide range of products positions us as your reliable solution partner for the treatment of water. To learn how we can help you, contact us at:

ABOUT PROMINENT NORTH AMERICA

Your partner for in-house system design, manufacturing, testing and certification, with complete aftermarket services, including field technicians for startup and repair, technical support, training, along with a large inventory of spare parts and components to keep your system operating at peak performance.

US HEAD OFFICE:
Pittsburgh, PA • (412) 787-2484
prominentcsd-us@prominent.com
www.prominent.us

CANADA OFFICE:
Guelph, ON • 1-888-709-9933
sales-can@prominent.com
www.prominent.ca

ProMinent[®]

Ultraviolet Water Systems from VIQUA

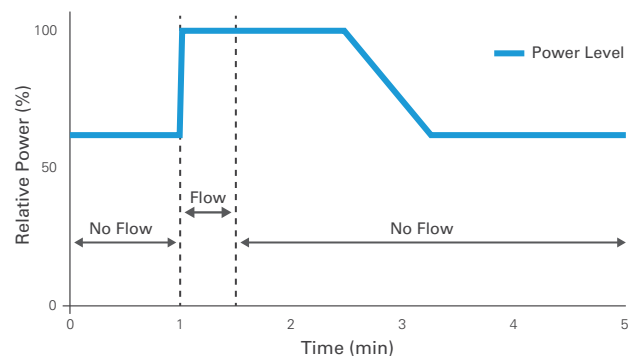
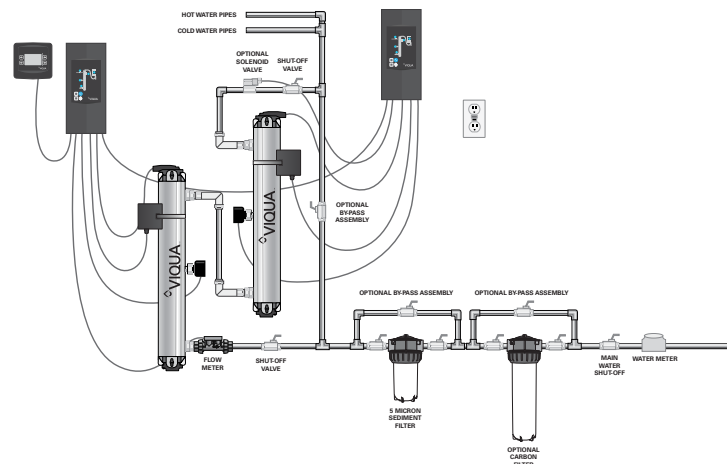
VIQUA's 4-Log Adenovirus UV water system makes complying with the Ground Water Rule and LT2 regulations a lot easier. These systems provide a 186 mJ/cm² UV dose for 4-log reduction of viruses, including Adenovirus.

The PRO24-186 systems are fully validated to UVDGM protocol for 4-log Adenovirus reduction. 4-log virus validated UV water treatment equipment provides significantly greater peace of mind for small public water systems.

The VIQUA PRO24-186 system provides treated drinking water for small public water systems (PWS), in accordance with state, provincial, and federal regulations. As PWS get smaller, the available capacity for testing, metering, and monitoring becomes a challenge. The PRO24-186 is designed to measure and log UV dose and flow, and with a four-point stepped validation, ensures compliance at all times.

Public Water Applications

- Churches
- Schools
- Rest Areas
- Bed & Breakfasts
- Community Centers
- Restaurants
- Camps
- Dairy Farms
- Swine Farms
- Poultry Farms

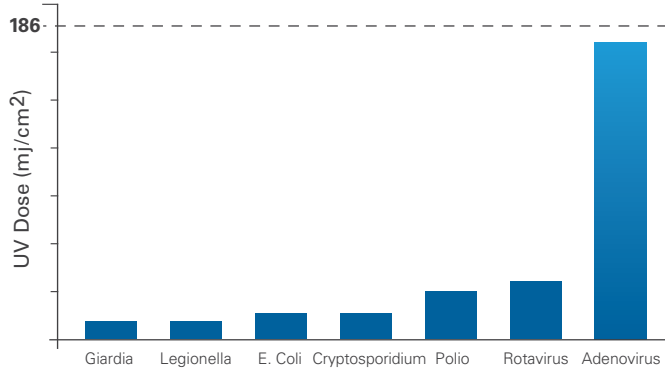


VIQUA's LightWise technology allows the system to reduce lamp power during periods of no flow.

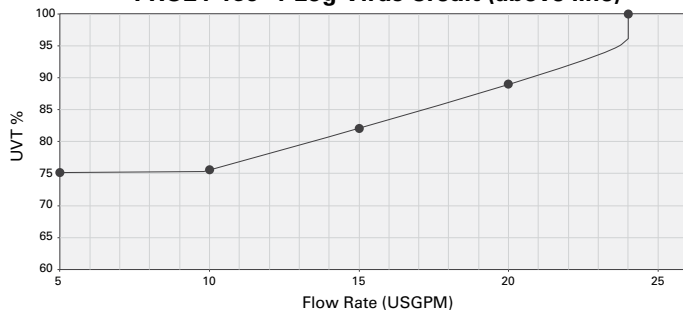
Features of VIQUA UV water systems

- Third party validated for Adenovirus (4-log virus) for 24 gpm (45 lpm) flow at an applied UV dose of 186 mJ/cm².
- Two-chamber, ultra-high output VIQUA amalgam UV lamps with Cool-Touch fan technology.
- The CoolTouch Fan significantly reduces water temperature and does not waste any water.
- For the sleeve bolts, a quarter-twist to the positive stop and you're done. No tools, no risk of over-tightening.
- Like a standard plug - no more grounding wires!
- The optional plug-and-play solenoid valve stops water flow in the event that water treatment is compromised.
- Flexibility to connect to either 1¼" MNPT or 1" FNPT
- Our revolutionary amalgam lamps reduce maintenance requirements by lasting up to 2 years.
- Intuitive Interface - a picture is worth a thousand words.
- With plug-and-play colour coded connections, it's as easy as "connect the dots."
- The COMMcenter displays UV dose!
- Flow sensor monitors flow to provide real time UV dose.
- The UVMAX systems use a revolutionary lamp with twice the output of current high-output lamps, giving you compact single-lamp systems that are half the size of their predecessors.
- LightWise Technology allows the controller to reduce lamp power during periods of no water flow. By adjusting the lamp power, water temperature is maintained below 40°C (104°F), the rate of sleeve fouling is consequently reduced by as much as 60%, resulting in estimated energy savings of 30%.

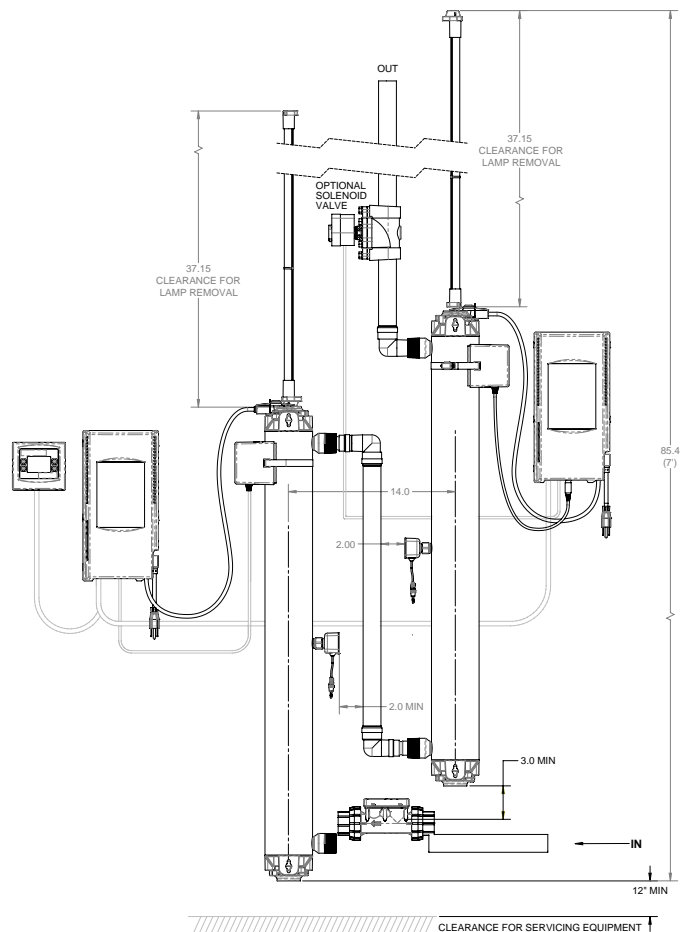
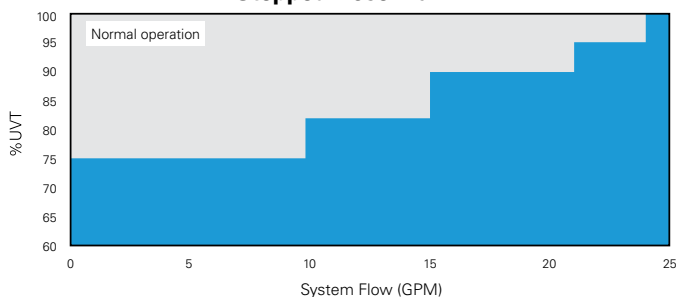
USEPA requirement for 4-log inactivation of viruses



PRO24-186 4-Log Virus Credit (above line)



Stepped Dose Alarm



Specifications



MODEL	PRO24-186
FLOW RATES	
UV Dose	186 mJ/cm²
Validated Flow	10/15/20/24 GPM (38/57/75/90 lpm) <i>UVT Dependant*</i> (2.3/3.4/4.5/5.4 m³/hr)
Validated UVT	75%/85%/90%/95%
DIMENSIONS	
Chamber	41" x 18" (103 cm x 45 cm)
Controller	13" X 6 1/2" x 4 1/2" (33 cm x 16.5 cm x 11.5 cm)
Inlet/Outlet Port Size	1 1/4" MNPT / 1" FNPT COMBO
Shipping Weight	63 lbs (29 kg)
ELECTRICAL	
Voltage	100-240V / 50/60 Hz
Power Consumption	460 W
Maximum Operating Pressure	125 psi (8.62 bar)
Influent Water Temperature	2-40°C (36-104°F)
FEATURES	
Visual "Power On"	YES
Chamber Material	316 SS
Visual Lamp Life Remaining	YES
Audible Lamp Failure	YES
Audible Lamp Replacement Reminder	YES
UV Sensor	YES
Sensor Reading Output (4-20mA)	Optional
Flow Meter	YES
Cool Touch Fan	YES

* Please refer to the Validation Charts for alternate UVT validated flow rates

Replacement Parts

602850-103 (QUANTITY 2) – lamp & quartz sleeve kit	
602856 (QUANTITY 2) – lamp	650709-013 – controller
602976 (QUANTITY 2) – quartz sleeve	410982R-30 – flow meter
650580 (QUANTITY 2) – UV sensor	270288-R – COMMcenter

Water Quality Parameters

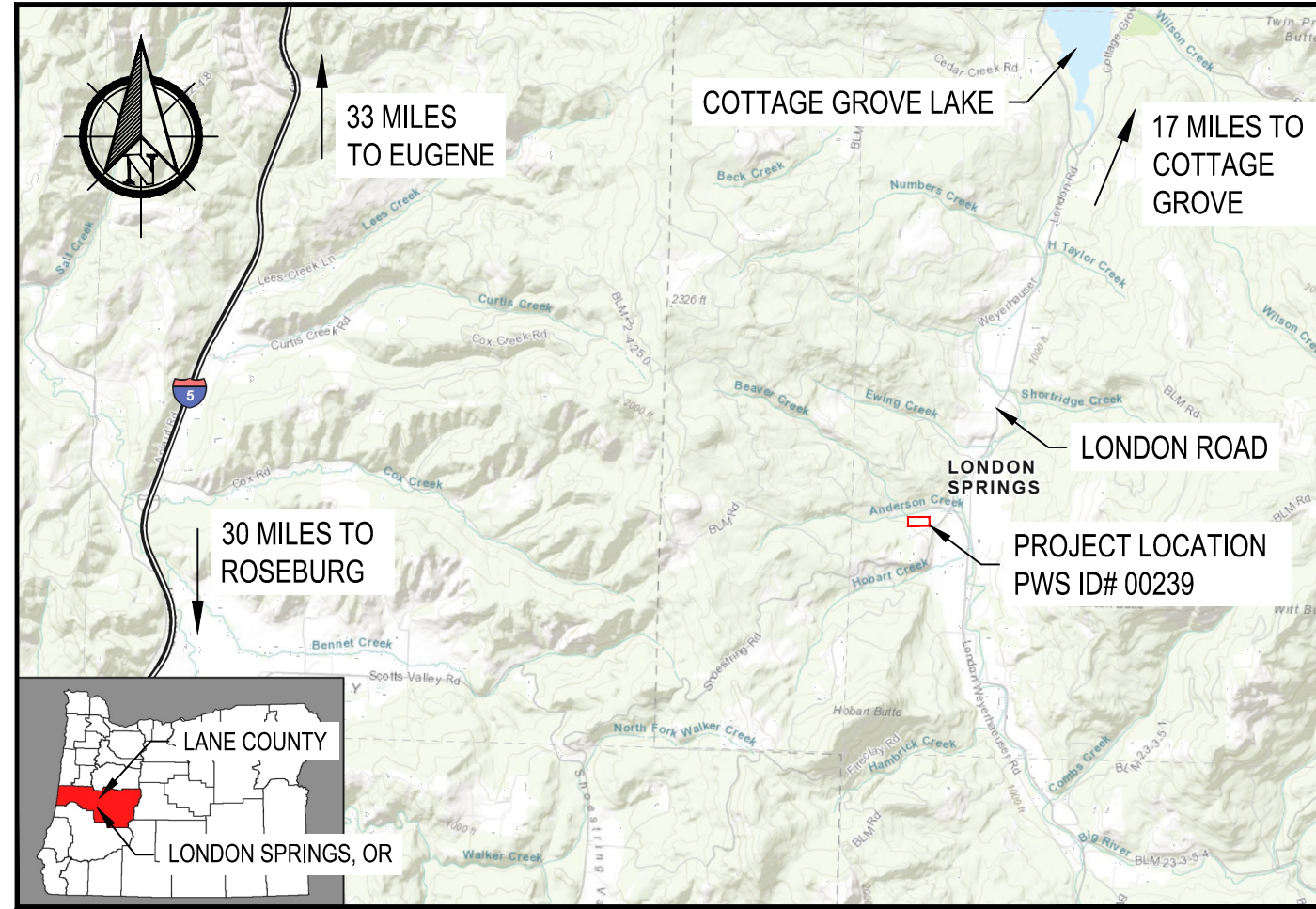
Hardness	Iron	Tannins
< 7 grains (120 mg/L)	< 0.3 mg/L	< 0.1 mg/L

VOLUME 2 - PLANS

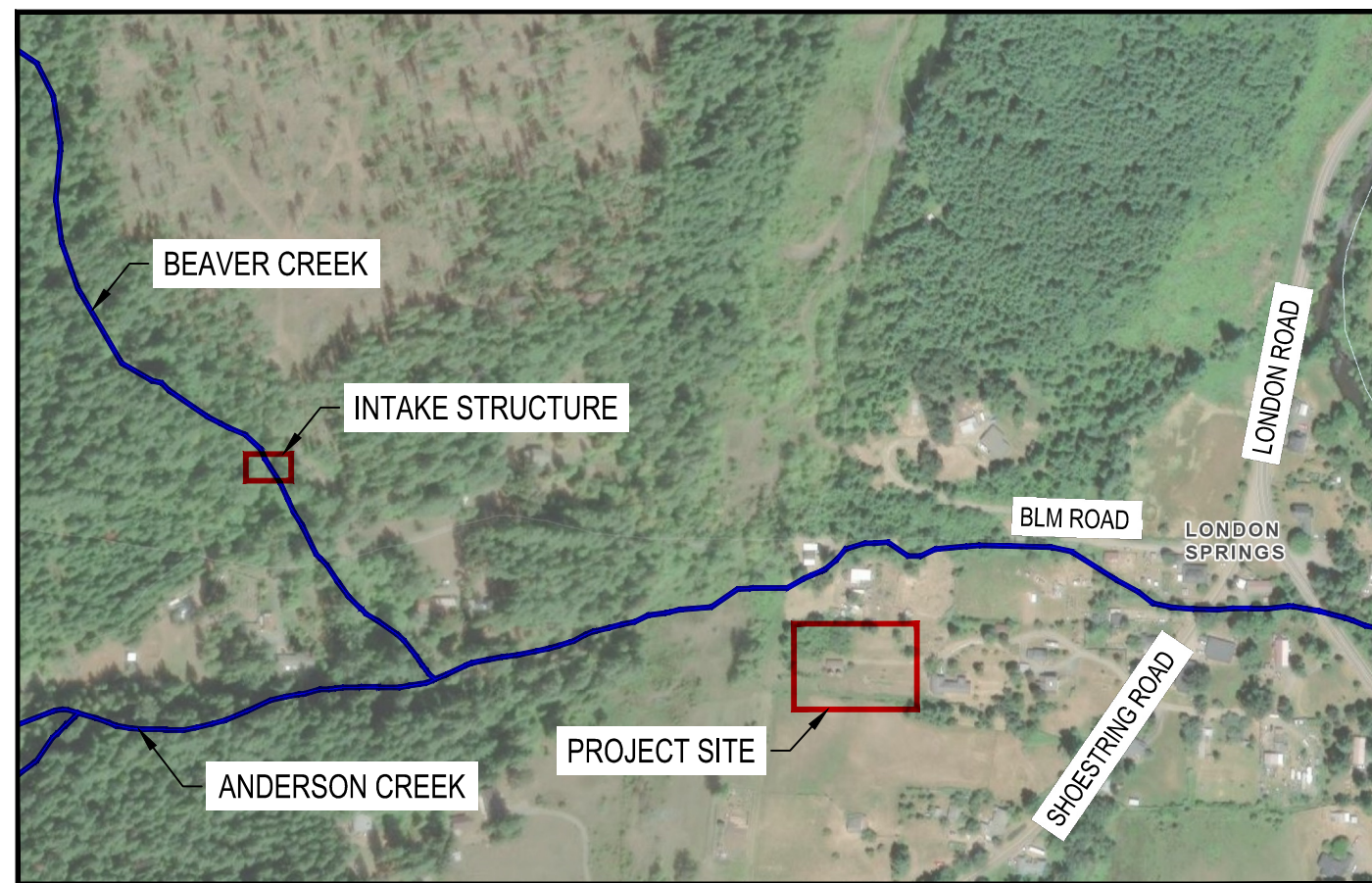
LONDON WATER COOPERATIVE WATER TREATMENT PLANT REPLACEMENT

SPRING 2025

PROJECT VICINITY MAP



PROJECT LOCATION MAP



**CALL 48 HOURS BEFORE YOU DIG
ONE CALL 811**

ATTENTION: OREGON LAW REQUIRES YOU TO FOLLOW RULES ADOPTED BY THE OREGON
UTILITY NOTIFICATION CENTER. THOSE RULES ARE SET FORTH IN OAR 952-001-0010 THROUGH
OAR 952-001-0090. YOU MAY OBTAIN COPIES OF THE RULES BY CALLING THE CENTER AT
503-232-1978

REPORT SPILLS

ATTENTION: OREGON LAW REQUIRES THAT SPILLS BE REPORTED TO THE FOLLOWING ENTITIES:

OREGON EMERGENCY RESPONSE SYSTEM: 1-800-452-0311
THE NATIONAL RESPONSE CENTER: 1-800-424-8802

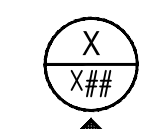
ABBREVIATIONS

APPROX	APPROXIMATELY	MAX	MAXIMUM
CLSM	CONTROLLED LOW STRENGTH	MIN	MINIMUM
	MATERIAL	MFG	MANUFACTURER
CONC	CONCRETE	NO	NUMBER
CMP	CORRUGATED METAL PIPE	NPT	NATIONAL PIPE THREAD
DOGAMI	OREGON DEPARTMENT OF GEOLOGY	OHP	OVERHEAD POWER
	AND MINERAL INDUSTRIES	PE	POLYETHYLENE
DI	DUCTILE IRON	PP	POLYPROPYLENE
DIA	DIAMETER	PVC	POLYVINYL CHLORIDE
DWG	DRAWING	R	RADIUS
EA	EACH	RJ	RESTRAINED JOINT
EX	EXISTING	RW	RAW WATER
EXT	EXTENSION	SCH	SCHEDULE
EG	EXISTING GRADE	SPEC	SPECIFICATIONS
FG	FINISHED GRADE	SSTL	STAINLESS STEEL
FL	FLANGED	TDH	TOTAL DYNAMIC HEAD
GAL	GALLONS	TOPO	TOPOGRAPHICAL
GPM	GALLONS PER MINUTE	TW	TREATED WATER
GSP	GALVANIZED STEEL PIPE	TYP	TYPICAL
GV	GATE VALVE	V	VALVE
IE	INVERT ELEVATION	W	WATER
LF	LINEAR FEET	WI	WITH
LTF	LENGTH TO FIT	WTP	WATER TREATMENT PLANT
LWC	LONDON WATER		
	COOPERATIVE		

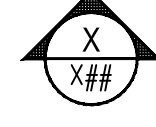
SECTION AND DETAIL REFERENCES

THE FOLLOWING CONVENTIONS HAVE BEEN USED WITHIN THESE DRAWINGS TO REFER THE READER BETWEEN THE SECTION/DETAIL AND THE PLAN FROM WHICH IT IS REFERENCED.

REFERENCE BUBBLES



DETAIL REFERENCE BUBBLE - REFERS READER BACK TO THE
PLAN FROM WHICH THE DETAIL OR SECTION ORIGINATED.



SECTION REFERENCE BUBBLE - REFERS READER TO THE
DRAWING ON WHICH THE SECTION IS LOCATED.

WHERE, X = SECTION/DETAIL REFERENCE ID*
X## = DRAWING NUMBER ON WHICH DETAIL ORIGINATED OR RESIDES.

***SECTION/DETAIL REFERENCE ID CONVENTIONS:**
SECTIONS OR ELEVATIONS SHOULD HAVE A LETTER REFERENCE ID
(A - ZZ) AND DETAILS SHOULD HAVE A NUMERICAL REFERENCE ID (0 - 999)

SURVEY NOTES

NO SURVEY WAS CONDUCTED FOR THIS PROJECT.

NO GUARANTEE IS MADE BY THE ENGINEER AS TO THE ACCURACY OF EXISTING OBJECTS SHOWN ON THESE DRAWINGS. THE LOCATIONS OF EXISTING STRUCTURES, PIPING, AND OTHER INFORMATION ARE BASED UPON THE "PIPING, RESERVOIR, AND FOUNDATION DETAILS" DRAWING DATED 10/26/1983 BY WAGNON & ASSOCIATES, INC. THE DRAWING WAS PROVIDED TO RH2 BY LWC AND THE LOCATIONS OF OBJECTS SHOWN ARE THOUGHT BY LWC STAFF TO BE ACCURATE BASED ON FIELD EXPERIENCE. TOPOGRAPHICAL DATA IS BASED ON PUBLICLY AVAILABLE DOGAMI LIDAR DATA WITH THE FOLLOWING SPECIFICATIONS:

1. PROJECTION: OREGON STATEWIDE LAMBERT CONFORMAL CONIC
2. HORIZONTAL DATUM: NAD 83 (2011), INTERNATIONAL FEET
3. VERTICAL DATUM: NAVD 88 (GEOID 12A), INTERNATIONAL FEET
4. RESOLUTION: 3 FOOT
5. DATES OF DATA ACQUISITION: SEPTEMBER 05, 2013 - JUNE 08, 2015

EXISTING LEGEND

	MAJOR CONTOUR
	MINOR CONTOUR
	FENCE
	PROPERTY LINE
	DITCH LINE
	RAW WATER LINE
	TREATED WATER LINE
	DRAIN LINE
	CULVERT PIPE
	OVERHEAD POWER
	STRUCTURE
	GRAVEL ROADWAY
	CONCRETE PAD
	VEGETATION
	THICK VEGETATION
	BRUSH PILE
	WATER VALVE
	FLOW METER
	WELLHEAD
	FLOW DIRECTION
	DRAIN VALVE
	DRAIN FEATURE
	POWER POLE
	TREE

PROPOSED LEGEND

	MAJOR CONTOUR
	MINOR CONTOUR
	STRUCTURE
	STRUCTURE DOORS
	CONCRETE PAD
	GRAVEL ROADWAY
	BARE EARTH
	SEEDED AREAS
	CULVERT PIPE
	TREATED WATER LINE
	RAW WATER LINE
	DRAIN LINE
	VALVE
	BEND FITTING
	CONNECTION TO EXISTING
	TEE
	CROSS
	REDUCER
	BULKHEAD FITTING
	WYE
	VERTICAL BEND
	CLEAN OUT
	CATCH BASIN

SHEET LIST INDEX

SHEET NO	SHEET TITLE	DWG NO
01	COVER SHEET	COV
02	GENERAL CONSTRUCTION NOTES	G01
03	EXISTING & DEMOLITION SITE PLAN	C01
04	PROPOSED GRADING PLAN	C02
05	PROPOSED SITE PLAN	C03
06	PROPOSED WATER PIPING PLAN	C04
07	PROPOSED DRAIN PIPING PLAN	C05
08	DETAILS I	D01
09	DETAILS II	D02
10	DETAILS III	D03
11	DETAILS IV	D04
12	DETAILS V	D05
13	ELECTRICAL LEGEND	E01
14	ELECTRICAL SITE PLAN	E02
15	ELECTRICAL DETAILS AND SCHEDULES	E03

CONTACT PERSONNEL

CONTACT	AGENCY	PHONE
ERIC VORTRIEDE	LWC	541-450-9536
TYLER DUNCAN, P.E.	RH2 ENGINEERING	425-471-8625
GENERAL	EMERALD PUD	541-746-1583



GENERAL CONSTRUCTION NOTES

PROJECT INFORMATION

PROJECT SITE:
43°38'01"N 123°05'41"W 280 m

OWNER:
LONDON WATER COOPERATIVE
72764 SHOESTRING ROAD
COTTAGE GROVE, OR 97424

ENGINEER:
RH2 ENGINEERING, INC.
2 CENTERPOINTE DRIVE, SUITE 325
LAKE OSWEGO, OR 97035

CRITERIA

1. ALL BUILDING MATERIALS, WORKMANSHIP, DESIGN AND CONSTRUCTION SHALL CONFORM TO THESE DRAWINGS, SPECIFICATIONS, AND OREGON SPECIALTY CODES, LATEST EDITION.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLYING WITH THE PROVISIONS OF ALL APPLICABLE PERMITS AND APPROVALS ISSUED BY LANE COUNTY, THE STATE OF OREGON, AND OTHER REGULATORY AUTHORITIES HAVING JURISDICTION.

GENERAL CONSTRUCTION

1. A COPY OF THE APPROVED PLANS AND SPECIFICATIONS MUST BE ON-SITE WHENEVER CONSTRUCTION IS IN PROGRESS.
2. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VISIT THE SITE AND VERIFY ALL EXISTING CONDITIONS BEFORE START OF WORK. THE CONTRACTOR SHALL TAKE ALL NECESSARY FIELD MEASUREMENTS AND OTHERWISE VERIFY ALL DIMENSIONS AND EXISTING CONSTRUCTION CONDITIONS INDICATED AND/OR SHOWN ON THE PLANS. SHOULD ANY ERROR OR INCONSISTENCY EXIST, THE CONTRACTOR SHALL NOT PROCEED WITH THE WORK AFFECTED UNTIL REPORTED TO THE PROJECT ENGINEER FOR CLARIFICATION OR CORRECTION.
3. CONTRACTOR IS RESPONSIBLE FOR OBTAINING ALL REQUIRED OR RELATED PERMITS PRIOR TO BEGINNING CONSTRUCTION.
4. IN THE EVENT THAT STANDARD CONSTRUCTION NOTES ARE FOUND TO BE IN CONFLICT WITH PROJECT SPECIFIC NOTES, THE CONTRACTOR SHALL NOTIFY THE ENGINEER IMMEDIATELY. WHERE CONFLICTS ARISE, THE CONTRACTOR SHALL ASSUME THAT THE THE MORE RESTRICTIVE CONDITION SHALL APPLY.
5. THE CONTRACTOR SHALL NOT PERFORM WORK WITHOUT AGENCY INSPECTIONS WHERE INSPECTIONS ARE REQUIRED.
6. REQUESTS BY THE CONTRACTOR FOR CHANGES TO THE PLANS MUST BE APPROVED BY RH2 ENGINEERING, INC. BEFORE CHANGES ARE IMPLEMENTED.

GENERAL NOTES

1. A PRE-CONSTRUCTION CONFERENCE SHALL BE HELD PRIOR TO THE START OF CONSTRUCTION. THE CONTRACTOR SHALL PROVIDE TWO WORKING DAYS MINIMUM ADVANCE NOTIFICATION TO THE OWNER, ENGINEER, AND ALL AFFECTED UTILITY COMPANIES PRIOR TO ACTUAL START OF WORK.
2. PROTECTION OF THE ENVIRONMENT: NO CONSTRUCTION RELATED ACTIVITY SHALL CONTRIBUTE TO THE DEGRADATION OF THE ENVIRONMENT, ALLOW MATERIAL TO ENTER SURFACE OR GROUND WATERS, OR ALLOW PARTICULATE EMISSIONS TO THE ATMOSPHERE, WHICH EXCEED LOCAL, STATE, OR FEDERAL STANDARDS. ANY ACTIONS THAT POTENTIALLY ALLOW DISCHARGE TO STATE WATERS MUST HAVE PRIOR APPROVAL.
3. INSPECTION BY THE OWNER, ENGINEER, AGENCIES, HAVING JURISDICTION, OR OTHER ENTITIES DO NOT IN ANY WAY RELIEVE THE CONTRACTOR FROM ANY OBLIGATION TO PERFORM THE WORK IN COMPLIANCE WITH APPLICABLE CODES, REGULATIONS, OR CONTRACT DOCUMENTS.
4. THE CONTRACTOR SHALL PROVIDE AT MINIMUM 48 HOUR ADVANCE NOTIFICATION TO THE OWNER'S REPRESENTATIVE AND ENGINEER PRIOR TO ANY REQUIRED SPECIAL INSPECTION, DESIGN CRITICAL OBSERVATION, OR ANY OTHER EVENTS WHICH MAY REQUIRE ADVANCE SCHEDULING OF THE OWNER'S REPRESENTATIVE, ENGINEER OR OTHER THIRD PARTIES.
5. UNLESS OTHERWISE NOTED, ALL TREES, STRUCTURES, UTILITIES, EQUIPMENT, AND ALL OTHER ITEMS NOT INDICATED TO BE DISCONNECTED AND/OR REMOVED SHALL REMAIN AND BE PROTECTED.
6. RED-LINED DRAWINGS SHOWING ANY MODIFICATIONS TO WHAT WAS CONSTRUCTED COMPARED TO THE CONFORMED SET OF PLANS AND SPECIFICATIONS SHALL BE SUBMITTED PRIOR TO FINAL INSPECTION.
7. CONCRETE AND OTHER SPECIAL TESTING SHALL BE CONDUCTED IN ACCORDANCE WITH THESE PLANS, SPECIFICATIONS AND APPLICABLE REGULATORY REQUIREMENTS.
8. CONTRACTOR INITIATED CHANGES SHALL BE SUBMITTED IN WRITING TO THE ENGINEER AND OWNER FOR APPROVAL PRIOR TO IMPLEMENTATION OR CONSTRUCTION. ANY SIGNIFICANT DEVIATIONS FROM THE PLANS WILL REQUIRE A WRITTEN REQUEST AND APPROVAL FROM THE OWNER, OWNER'S REPRESENTATIVE, AND ENGINEER.
9. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SETTING AND MAINTAINING ALL ALIGNMENT STAKES, SLOPE STAKES, AND GRADES NECESSARY FOR THE CONSTRUCTION OF MINOR CONCRETE WORK, SURFACE AND PAVING. EXCEPT FOR THE SURVEY CONTROL DATA FURNISHED BY THE OWNER; CALCULATIONS, SURVEYING, AND MEASURING REQUIRED FOR SETTING AND MAINTAINING THE NECESSARY LINES AND GRADES SHALL BE THE CONTRACTOR'S RESPONSIBILITY.

SITE

1. DO NOT DISTURB ANY AREAS OUTSIDE OF CONSTRUCTION LIMITS AS SHOWN ON THE PLANS. EXISTING LWC WATER TREATMENT SITE MAY BE UTILIZED FOR STAGING AND STORAGE PURPOSES, AND ALL SUCH USE SHALL BE COORDINATED WITH THE OWNER.
2. PROJECT SITE IS LOCATED WITHIN 200 FEET OF EXISTING RESIDENTIAL DWELLINGS. CONTRACTOR SHALL MAKE A REASONABLE EFFORT TO MINIMIZE CONSTRUCTION NOISE AND DISTURBANCE TO NEIGHBORS. REFER TO SPECIFICATIONS FOR ADDITIONAL INFORMATION REGARDING WORKING HOURS AND CONSTRUCTION NOISE LIMITATIONS.
3. AREAS, BUILDINGS, EQUIPMENT, AND ANY OTHER FEATURES OR PROPERTY THAT BECOME DISTURBED OR DAMAGED DURING CONSTRUCTION SHALL BE RESTORED TO EXISTING OR BETTER CONDITION UNLESS OTHERWISE STATED ON THE PLANS.
4. CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR MAINTAINING INTEGRITY AND SECURITY OF SITE TO DISCOURAGE ACCESS BY UNAUTHORIZED PERSONNEL. ANY DAMAGE OR LOSS THAT OCCURS DUE TO THEFT OR VANDALISM DURING CONSTRUCTION SHALL BE REMEDIED BY THE CONTRACTOR AT CONTRACTOR'S SOLE EXPENSE.
5. ALL VEHICLES ARE TO BE CLEANED OF ALL EXCESS CONCRETE AND DIRT PRIOR TO LEAVING THE SITE. PROTECT ALL ROADS FROM DAMAGE OR SEDIMENT TRANSPORT DURING CONSTRUCTION. ANY DAMAGE OR CLEANUP SHALL BE SOLELY AT THE CONTRACTOR'S EXPENSE AND BE COMPLETED TO THE SATISFACTION OF THE OWNER.
6. THE CONTRACTOR SHALL CLEAN UP ALL AREAS AFFECTED BY HIS ACTIVITIES TO THE SATISFACTION OF THE OWNER BY THE END OF EACH WORKING DAY OR MORE FREQUENTLY IF REQUIRED BY THE OWNER. THIS INCLUDES REMOVAL OF ALL DUST, MUD, ROCKS, ASPHALT DEBRIS, AND REFUSE FROM THE PROJECT SITE, STREETS, WALKS, DRIVEWAYS, AND ANY OTHER AREAS AFFECTED BY CONSTRUCTION ACTIVITIES.

FAILURE TO CLEANUP TO THE SATISFACTION OF THE OWNER WILL NECESSITATE A SHUTDOWN OF THE PROJECT UNTIL CLEANUP IS PROPERLY PERFORMED. DAILY CLEANUP IS AN INTEGRAL PART OF THIS WORK.

THE CONTRACTOR SHALL PRESERVE ALL EXISTING SURVEY MONUMENTS IN AND AROUND THE WORK AREA INCLUDING MARKERS FOR FRONT PROPERTY CORNERS. IF ANY SURVEY MONUMENT OR MARKERS WILL BE DISTURBED BY CONSTRUCTION, IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO HIRE A PROFESSIONAL LAND SURVEYOR LICENSED IN THE STATE OF OREGON TO CONDUCT A PRE-CONSTRUCTION SURVEY AND TO REPLACE THE AFFECTED MONUMENTS AND MARKERS IN ACCORDANCE WITH STATE LAWS.

CONTRACTOR IS SOLELY RESPONSIBLE FOR MEETING ALL DISPOSAL REQUIREMENTS INCLUDING OFF SITE DISPOSAL OF WASTE MATERIAL AT APPROVED SITES.

- TEMPORARY AND/OR PERMANENT ONSITE EROSION, SEDIMENTATION, AND POLLUTION CONTROL MEASURES SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR AND BE IN PLACE PRIOR TO CONSTRUCTION. ANY PROBLEMS OCCURRING BEFORE FINAL ACCEPTANCE BY THE OWNER SHALL BE CORRECTED BY THE CONTRACTOR. UPON FINAL ACCEPTANCE BY THE OWNER, OR AS OTHERWISE DIRECTED BY THEIR REPRESENTATIVE, THE CONTRACTOR SHALL REMOVE ALL TEMPORARY EROSION, SEDIMENTATION, AND POLLUTION CONTROL MEASURES.

UTILITIES

UTILITIES WERE NOT LOCATED AS PART OF THIS PROJECT, OTHER THAN SOME FEATURES WITHIN THE EXISTING LUK WATER TREATMENT PLANT BUILDING CONSIDERED TO BE CRITICAL TO THE WORK. NOT ALL CONDUIT, PIPING, EQUIPMENT AND OTHER FEATURES WERE LOCATED, AND IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY THE EXACT LOCATION OF SITE FEATURES WHICH MAY AFFECT THE CONTRACTOR'S WORK. OTHER UTILITIES OR DEVIATIONS FROM THESE PLANS MAY EXIST. NO SUB-SURFACE EXPLORATION WAS MADE TO VERIFY UTILITY ROUTINGS AND THE ROUTING OF ALL BURIED UTILITIES SHOULD BE CONFIRMED WITH THE UTILITY PURVEYOR AND EXPOSED IN AREAS CRITICAL TO CONSTRUCTION FOR VERIFICATION. THE CONTRACTOR SHALL VERIFY THE EXACT LOCATION, ELEVATION AND SIZE OF EXISTING UTILITIES PRIOR TO CONDUCTING ANY ACTIVITIES WHICH COULD POTENTIALLY DAMAGE EXISTING UTILITIES. CONTRACTOR SHALL NOTIFY OREGON UTILITY NOTIFICATION CENTER AT 811, AND THE OWNER AT LEAST 48 HOURS PRIOR TO BEGINNING WORK. THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE OWNER AND THE UTILITY COMPANY WHEN A CONFLICT OCCURS OR WHEN A CONFLICT IS ANTICIPATED.

- UTILITIES SHOULD BE CONFIRMED WITH THE UTILITY PURVEYOR AND EXPOSED IN AREAS CRITICAL TO CONSTRUCTION FOR VERIFICATION. THE CONTRACTOR SHALL VERIFY THE EXACT LOCATION, ELEVATION AND SIZE OF EXISTING UTILITIES PRIOR TO CONDUCTING ANY ACTIVITIES WHICH COULD POTENTIALLY DAMAGE EXISTING UTILITIES. CONTRACTOR SHALL NOTIFY OREGON UTILITY NOTIFICATION CENTER AT 811, AND THE OWNER AT LEAST 48 HOURS PRIOR TO BEGINNING WORK. THE CONTRACTOR SHALL IMMEDIATELY NOTIFY THE OWNER AND THE UTILITY COMPANY WHEN A CONFLICT OCCURS OR WHEN A CONFLICT IS ANTICIPATED.

TRAFFIC CONTROL

1. CONTRACTOR SHALL SAFEGUARD THE PERSONS AND PROPERTY OF THE TRAVELING PUBLIC. CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ERECTING AND MAINTAINING TRAFFIC CONTROL THROUGHOUT THE PROJECT DURATION IN ACCORDANCE WITH THE APPROVED TRAFFIC CONTROL PLAN. ALL TRAFFIC CONTROL DEVICES SHALL MEET MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES STANDARDS.
2. CONTRACTOR SHALL PROVIDE FOR EMERGENCY VEHICLE ACCESS TO THE PROJECT SITE AND ALL PROPERTIES ADJACENT TO THE PROJECT SITE AT ALL TIMES.

GENERAL TESC

1. CONTRACTOR WILL DEVELOP AND SUBMIT AN EROSION AND SEDIMENT CONTROL PLAN FOR REVIEW AND APPROVAL BY THE ENGINEER
2. THE CONTRACTOR SHALL ADHERE TO ALL APPLICABLE EROSION CONTROL STANDARDS AND IS SOLELY RESPONSIBLE FOR IMPLEMENTATION, MAINTENANCE, REPLACEMENT, AND UPGRADING OF TESC FACILITIES AS REQUIRED TO PREVENT EROSION UNTIL ALL CONSTRUCTION IS APPROVED.
3. IN THE EVENT OF ANY EROSION CONTROL MEASURE FAILURE, IMMEDIATE ACTION SHALL BE TAKEN TO REPAIR, REPLACE, OR IMPLEMENT ADDITIONAL MEASURES AS REQUIRED TO ENSURE ADEQUATE EROSION CONTROL PROTECTION.
4. ANY DISCHARGE OF SEDIMENT-LADEN RUN-OFF OR OTHER POLLUTANTS TO WATERS OF THE STATE IS SUBJECT TO ENFORCEMENT ACTION, THE COST FOR WHICH SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR.
5. DURING CONSTRUCTION, ALL RELEASES OF OILS, HYDRAULIC FLUIDS, FUELS, OTHER PETROLEUM PRODUCTS, PAINTS, SOLVENTS, AND OTHER DELETERIOUS MATERIALS MUST BE CONTAINED AND REMOVED IN A MANNER THAT WILL PREVENT THEIR DISCHARGE TO WATERS AND SOILS. THE CLEANUP OF SPILLS SHALL TAKE PRECEDENCE OVER OTHER WORK ON THE PROJECT. BARRELS, PETROPHILIC PADS, TARPS, AND OTHER EQUIPMENT NECESSARY FOR CAPTURING, CONTROLLING, AND DISPOSING OF HAZARDOUS FLUIDS SHALL BE AVAILABLE ON-SITE AT ALL TIMES.
6. PROPER EROSION AND SEDIMENT CONTROL PRACTICES MUST BE USED ON THE CONSTRUCTION SITE AND ADJACENT AREAS TO PREVENT SEDIMENTS FROM ENTERING THE NATURAL DRAINAGE SYSTEM. ALL SURFACE AREAS DISTURBED AND ANY EMBANKMENTS OR EXCAVATIONS CREATED BY CONSTRUCTION ACTIVITIES MUST BE REVEGETATED OR PROVIDED AN EQUIVALENT TYPE OF PROTECTION AGAINST EROSION.
7. OWNER REPRESENTATIVES MAY DIRECT MAINTENANCE AND REPAIR OF TESC MEASURES AND/OR FACILITIES AS THE HIGHEST PRIORITY WORK AT ANY TIME THE TESC MEASURES AND/OR FACILITIES DO NOT MEET THE PERMIT, CITY, OR PLAN REQUIREMENTS.
8. DUST CONTROL MUST BE PROVIDED BY THE CONTRACTOR. THE CONTRACTOR SHALL SWEEP TO REMOVE DUST AND DEBRIS FROM PAVEMENT AREAS AS DIRECTED BY THE OWNER'S REPRESENTATIVE. FLUSHING OF STREETS SHALL NOT BE PERMITTED WITHOUT PRIOR APPROVAL.
9. DURING THE CONSTRUCTION PERIOD, THE TESC FACILITIES SHALL BE UPGRADED AS NEEDED FOR UNEXPECTED STORM EVENTS AND MODIFIED TO ACCOUNT FOR CHANGING SITE CONDITIONS (E.G. ADDITIONAL COVER MEASURES, RELOCATION OF DITCHES AND SILT FENCES, PERIMETER PROTECTION ETC.) AS DIRECTED BY THE ENGINEER, OWNER, OR REGULATORY AGENCY. THE CONTRACTOR SHALL BE COGNIZANT OF FUTURE WEATHER PATTERNS AND PLAN ACCORDINGLY.
10. CLEARING AND GRUBBING WHERE REQUIRED SHALL BE PERFORMED WITHIN THE CONSTRUCTION AREAS SHOWN ON THE PLANS. DEBRIS RESULTING FROM THE CLEARING AND GRUBBING SHALL BE DISPOSED OF BY THE CONTRACTOR AND IN ACCORDANCE WITH THE TERMS OF ALL APPLICABLE PERMITS.
11. TESC MATERIALS ON HAND - THE CONTRACTOR SHALL KEEP A SUFFICIENT SUPPLY OF TESC MATERIALS

ON NAD TO REMEDY ANY FAILURE OF TESC BMPs THAT IS DETRIMENTAL TO DOWNSTREAM OR ADJACENT DRAINAGE DITCHES, CONVEYANCE SYSTEMS, OR OTHER PROPERTIES. THESE MATERIALS INCLUDE, BUT ARE NOT LIMITED TO: SANDBAGS, SILT FENCE, EROSION CONTROL BLANKET, ROCK, STRAW OR MULCH.

THE TESC FACILITIES SHALL BE INSPECTED AT LEAST WEEKLY BY THE CONTRACTOR'S TESC SUPERVISOR AND MAINTAINED TO ENSURE CONTINUED PROPER FUNCTIONING.

ANY AREAS OF EXPOSED SOILS, INCLUDING ROADWAY EMBANKMENTS, THAT WILL NOT BE DISTURBED FOR FOURTEEN CONSECUTIVE DAYS DURING THE WET SEASON OR THIRTY DAYS DURING THE DRY SEASON SHALL BE STABILIZED WITH THE APPROVED TESC METHODS (E.G., SEEDING, MULCHING, PLASTIC COVERING, ETC.).

- SEED ALL BARE EARTH AREAS WITH AN APPROVED SEED MIX SELECTED TO MATCH GRASSES IN ADJACENT AREAS.

PHASING PLAN

- CONSTRUCT ALL IMPROVEMENTS SUCH THAT THE SYSTEM IS READY FOR START-UP AND TESTING, WITH THE EXCEPTION OF MAKING NEW WATER PIPING CONNECTIONS TO THE EXISTING SYSTEM.
- DISINFECT AND TEST ALL WATER LINES
- MAKE CONNECTIONS BETWEEN THE NEW AND EXISTING WATER PIPING SYSTEMS. COORDINATE WITH THE OWNER TO OPERATE VALVES TO PROPERLY ISOLATE THE SYSTEM PRIOR TO COMMENCING CONNECTION WORK. CONNECTION WORK SHALL MINIMIZE DISRUPTION TO WATER SYSTEM OPERATION, REFER TO THE SPECIFICATIONS FOR SPECIFIC REQUIREMENTS.
- PERFORM START-UP AND TESTING OF THE NEW WATER TREATMENT PLANT, REFER TO SPECIFICATIONS.
- DISCONNECT THE EXISTING PIPING AS SHOWN ON THE PROPOSED WATER PIPING PLAN SHEET.



EXPIRES: 12/31/2025

LONDON WATER COOPERATIVE
WATER TREATMENT PLANT REPLACEMENT

GENERAL CONSTRUCTION NOTES

[illegible]

$$1^{29} = 10$$


GENERAL NOTES

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01 WEST SIDE OF WTP



02 SOUTH SIDE OF WTP



03 EXISTING TANKS



04 EXISTING TANKS



EXPIRES: 12/31/202

LONDON WATER COOPERATIVE
WATER TREATMENT PLANT REPLACEMENT



EXISTING & DEMOLITION SITE PLAN

[illegible]

 $1^n = 10$ 

WATERLINE KEYNOTES

TREATED WATER PIPING

- 17 APPROX 40 LF OF 2" SCH 80 PVC PIPE
- 18 APPROX 10 LF OF 2" SCH 80 PVC PIPE
- 19 APPROX 12 LF OF 2" SCH 80 PVC PIPE
- 20 (1) - 2" SCH 80 PVC TEE
- 21 (2) - 2" SCH 80 PVC PIPE, LTF
(1) - 2" SCH 80 PVC BALL VALVE W/ STEM EXT
(2) - 3"x2" SCH 80 PVC REDUCER 
(2) - 3" SCH 80 PVC PIPE, LTF 
(2) - 3" SCH 80 PVC 90° BEND
(1) - APPROX 5 LF OF 3" SCH 80 PVC PIPE
(1) - 3" FLEXIBLE TANK CONNECTION FITTING
(1) - 3" TANK ATTACHMENT FITTING
- 22 APPROX 20 LF OF SCH 80 PVC PIPE

GENERAL NOTES

1. NO GUARANTEE IS MADE BY THE ENGINEER AS TO THE ACCURACY OF EXISTING OBJECTS SHOWN ON THIS DRAWING. THE LOCATIONS OF EXISTING STRUCTURES, PIPING, AND OTHER INFORMATION ARE BASED UPON THE "PIPING, RESERVOIR, AND FOUNDATION DETAILS" DRAWING DATED 10/26/1983 BY WAGNON & ASSOCIATES, INC. THE DRAWING WAS PROVIDED TO RH2 BY LWC AND THE LOCATIONS OF OBJECTS SHOWN ARE THOUGHT BY LWC STAFF TO BE ACCURATE BASED ON FIELD EXPERIENCE. NO SURVEY WAS PERFORMED FOR THIS PROJECT. TOPOGRAPHICAL DATA IS BASED ON PUBLICLY AVAILABLE DOGAMI LIDAR DATA.
2. THRUST BLOCKING SHALL BE INSTALLED ON ALL PROPOSED WATER PIPING, REFER TO DETAIL. 13
004
3. PAINT AND INSTALL PIPE INSULATION ON ALL ABOVE GRADE PIPES, FITTINGS, AND VALVES. HEAT TRACE ALL INSULATED ITEMS THAT ARE REGULARLY FILLED WITH WATER.
4. THE PIPING DESIGN SHOWN IS DETAILED, HOWEVER, NO GUARANTEE IS MADE THAT EVERY COMPONENT NECESSARY IS SHOWN. CONTRACTOR IS RESPONSIBLE FOR PROVIDING ALL COMPONENTS NECESSARY, WHETHER SHOWN ON THESE PLANS OR NOT, TO CONSTRUCT A COMPLETE SYSTEM THAT FUNCTIONS AS INTENDED.
5. INSTALL TRACER WIRE OVER ALL ALL WATER LINES, REFER TO SPECIFICATIONS.

WATERLINE KEYNOTES

RAW WATER PIPING

- 1 (2) – CONNECTION TO EX 4" PVC WATER PIPE
(3) – 4" SCH 80 PVC PIPE, LTF
(1) – 4" SCH 80 PVC TEE
(1) – 4" SCH 80 PVC BALL VALVE W/ STEM EXT
- 2 APPROX 12 LF OF 4" SCH 80 PVC PIPE
- 3 (1) – 4" SCH 80 PVC TEE
(3) – 4" SCH 80 PVC PIPE, LTF
(3) – 4" SCH 80 PVC BALL VALVE W/ STEM EXT
- 4 APPROX 5 LF OF 4" SCH 80 PVC PIPE
- 5 (1) – 4" SCH 80 PVC TEE
(1) – 4" SCH 80 PVC BALL VALVE W/ STEM EXT
(1) – 4" SCH 80 PVC PIPE, LTF
- 6 APPROX 26 LF OF 4" SCH 80 PVC PIPE
- 7 (1) – 4" SCH 80 PVC 90° BEND
- 8 APPROX 8 LF OF 4" SCH 80 PVC PIPE
- 9 (1) – 4"x2" SCH 80 PVC REDUCER
(1) – 2" SCH 80 PVC 90° VERTICAL BEND
(2) – APPROX 4 LF 2" OF SCH 80 PVC PIPE
(1) – CONNECTION TO PACKAGED WTP 2" SUCTION INLET
- 10 APPROX 23 LF OF 4" SCH 80 PVC PIPE
- 11 (1) – 4"x2" SCH 80 PVC REDUCER
(1) – 2" SCH 80 PVC PIPE LTF
(1) – 2" PVC TEE SPLICED INTO EX 2" PVC PIPE
- 12 APPROX 5 LF OF 4" SCH 80 PVC PIPE
- 13 (1) – 4" SCH 80 PVC CROSS
(3) – 4" SCH 80 PVC PIPE, LTF
(3) – CONNECTION TO EX 4" PVC WATER PIPE

TREATED WATER PIPING

- 14 (1) - CONNECTION TO PACKAGED WTP 2" DISCHARGE OUTLET
(1) - SCH 80 PVC 90° VERTICAL BEND
(2) - APPROX 4 LF OF 2" SCH 80 PVC PIPE
- 15 (1) - 2" SCH 80 PVC 90° BEND
- 16 APPROX 13 LF OF 2" SCH 80 PVC PIPE

WATERLINE KEYNOTES

TREATED WATER PIPING

- 23 APPROX 28 LF OF 2" SCH 80 PVC PIPE
- 24 (1) - CONNECTION TO PACKAGED WTP 2" SUCTION INLET
(1) - SCH 80 PVC 90° VERTICAL BEND
(2) - APPROX 4 LF OF 2" SCH 80 PVC PIPE
- 25 APPROX 25 LF OF 2" SCH 80 PVC PIPE
- 26 APPROX 16 LF OF 2" SCH 80 PVC PIPE
- 27 (1) - 2" SCH 80 PVC BALL VALVE W/ STEM EXT
(1) - 2" SCH 80 PVC PIPE, LTF
(1) - 4"x2" SCH 80 PVC REDUCER
(3) - 4" SCH 80 PVC PIPE, LTF
(1) - 4" SCH 80 PVC TEE
(2) - CONNECTION TO EX 4" PVC TREATED WATER PIPE
- 28 (2) - CONNECTION TO EX 4" PVC TREATED WATER PIPE
(14) - 4" SCH 80 PVC PIPE, LTF
- (14)
D04
- (2) - 4" SCH 80 PVC TEE
(6) - 4" SCH 80 PVC 90° BEND
(3) - 4" SCH 80 PVC BALL VALVE W/ STEM EXT
(1) - 4" ELECTRONICALLY ACTUATED CONTROL VALVE (4" SCH 80 PVC BALL VALVE), REFER TO SPECIFICATIONS
(1) - CONCRETE VAULT, EQUAL TO CHRISTY N36

WATER PIPING DISCONNECTIONS

- 1 UPON SUCCESSFUL COMPLETION OF WATER TREATMENT PLANT START-UP AND TESTING, PHYSICALLY DISCONNECT EXISTING 4" PVC PIPE, AND INSTALL 4" PVC CAP ON END OF TEE. INSTALL 4" PVC CAPS ON ENDS OF EX PVC PIPES, AND ENCASE IN CLSM.

**EXPIRES: 12/31/2025**

LONDON WATER COOPERATIVE
WATER TREATMENT PLANT REPLACEMENT

PROPOSED WATER PIPING PLAN

24-0124

CLIENT: LWC

FILE NAME: IWC-B-WATERPD.DWG

ENGINEER: 33B	SAVE DATE: May 1, 2023
REVIEWED: TMD	PLT DATE: May 7 2023

1

VG NO 0

SCALE SHOWN

SCALE: SHOWN

1' 2'


DRAWING IS FULL SCALE WHEN
BAR MEASURES 2"

DRAWING NO.: C04
 SHEET NO.: 06

15 |

 $1'' = 10'$ 

GENERAL NOTES

1. NO GUARANTEE IS MADE BY THE ENGINEER AS TO THE ACCURACY OF EXISTING OBJECTS SHOWN ON THIS DRAWING. THE LOCATIONS OF EXISTING STRUCTURES, PIPING, AND OTHER INFORMATION ARE BASED UPON THE "PIPING, RESERVOIR, AND FOUNDATION DETAILS" DRAWING DATED 10/26/1983 BY WAGNON & ASSOCIATES, INC. THE DRAWING WAS PROVIDED TO RH2 BY LWC AND THE LOCATIONS OF OBJECTS SHOWN ARE THOUGHT BY LWC STAFF TO BE ACCURATE BASED ON FIELD EXPERIENCE. NO SURVEY WAS PERFORMED FOR THIS PROJECT. TOPOGRAPHICAL DATA IS BASED ON PUBLICLY AVAILABLE DOGAMI LIDAR DATA.
2. THRUST BLOCKING SHALL BE INSTALLED ON ALL PROPOSED WATER PIPING, REFER TO DETAIL. 
3. PAINT AND INSTALL PIPE INSULATION ON ALL ABOVE GRADE PIPES, FITTINGS, AND VALVES. HEAT TRACE ALL INSULATED ITEMS THAT ARE REGULARLY FILLED WITH WATER.
4. THE PIPING DESIGN SHOWN IS DETAILED, HOWEVER, NO GUARANTEE IS MADE THAT EVERY COMPONENT NECESSARY IS SHOWN. CONTRACTOR IS RESPONSIBLE FOR PROVIDING ALL COMPONENTS NECESSARY, WHETHER SHOWN ON THESE PLANS OR NOT, TO CONSTRUCT A COMPLETE SYSTEM THAT FUNCTIONS AS INTENDED.
5. INSTALL TRACER WIRE OVER ALL ALL WATER LINES, REFER TO SPECIFICATIONS.

DRAINAGE KEYNOTES

DRAIN PIPING

1. 3" BULKHEAD FITTING, FITTED TO BOTTOM OF TANK W/ INTERNAL SIPHON TUBE
 1. 3" BULKHEAD FITTING, FITTED TO TOP OF TANK
 - (3) - 3" SCH 80 PVC PIPE, LTF
 - (1) - 3" SCH 80 PVC BALL VALVE
 - (1) - 3" SCH 80 PVC 90° BEND
 - (1) - APPROX 10 LF OF 3" SCH 80 PVC PIPE
 - (1) - 3" SCH 80 PVC TEE
 - (1) - 3" DUCK BILLED CHECK VALVE
 - (1) - 12"x12" CATCH BASIN W/ 4" OUTLET, EQUAL TO OLDCASTLE CB-121218
 2. APPROX 11 LF OF 4" SCH 80 PVC PIPE
 3. (1) - 4" SCH 80 PVC 45° BEND
 4. APPROX 1 LF OF 4" SCH 80 PVC PIPE
 5. (1) - 4" DRAIN CLEAN OUT, REFER TO DETAIL
 6. (1) - 4" SCH 80 PVC WYE
 7. APPROX 19 LF OF 4" SCH 80 PVC PIPE
 8. APPROX 6 LF OF 4" SCH 80 PVC PIPE
 9. APPROX 18 LF OF 4" SCH 80 PVC PIPE
 10. (1) - CUT EXISTING EXPOSED DRAIN PIPE AT ELBOW
 - (1) - 12"x12" CATCH BASIN W/ 4" OUTLET, EQUAL TO OLDCASTLE CB-121218
 - (2) - 4" SCH 80 PVC PIPE, LTF
 - (4) - 4" SCH 80 PVC 45° BEND
 11. APPROX 20 LF OF 4" SCH 80 PVC PIPE
 12. (1) - 4" DI GATE VALVE (FLxFL)
 13. APPROX 13 LF OF 4" SCH 80 PVC PIPE
 14. (1) - 4" SCH 80 PVC WYE
 - (2) - CONNECTION TO EXISTING 4" PVC DRAIN PIPE
 15. (1) - 4" PVC BACKWATER VALVE
 - (2) - CONNECTION TO EXISTING 4" PVC DRAIN PIPE
 16. APPROX 21 LF OF 4" SCH 80 PVC PIPE
 17. (1) - 4" SCH 80 PVC WYE
 - (2) - 4" SCH 80 PVC PIPE, LTF
 - (1) - 4" SCH 80 PVC 45° BEND
 - (1) - CONNECTION TO PACKAGED WTP FLOOR DRAIN
 18. (1) - APPROX 6 LF OF 4" SCH 80 PVC PIPE
 - (1) - 4" SCH 80 PVC WYE
 - (1) - 4" SCH 80 PVC PIPE, LTF

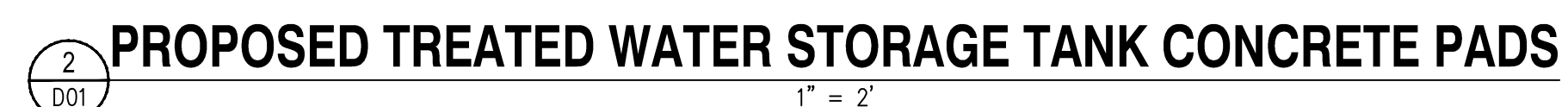
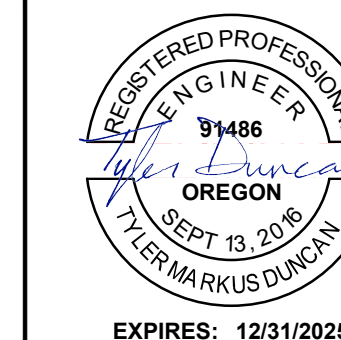


EXPIRES: 12/31/2025

LONDON WATER COOPERATIVE
WATER TREATMENT PLANT REPLACEMENT

PROPOSED DRAIN PIPING PLAN

[illegible]



DETAILS I

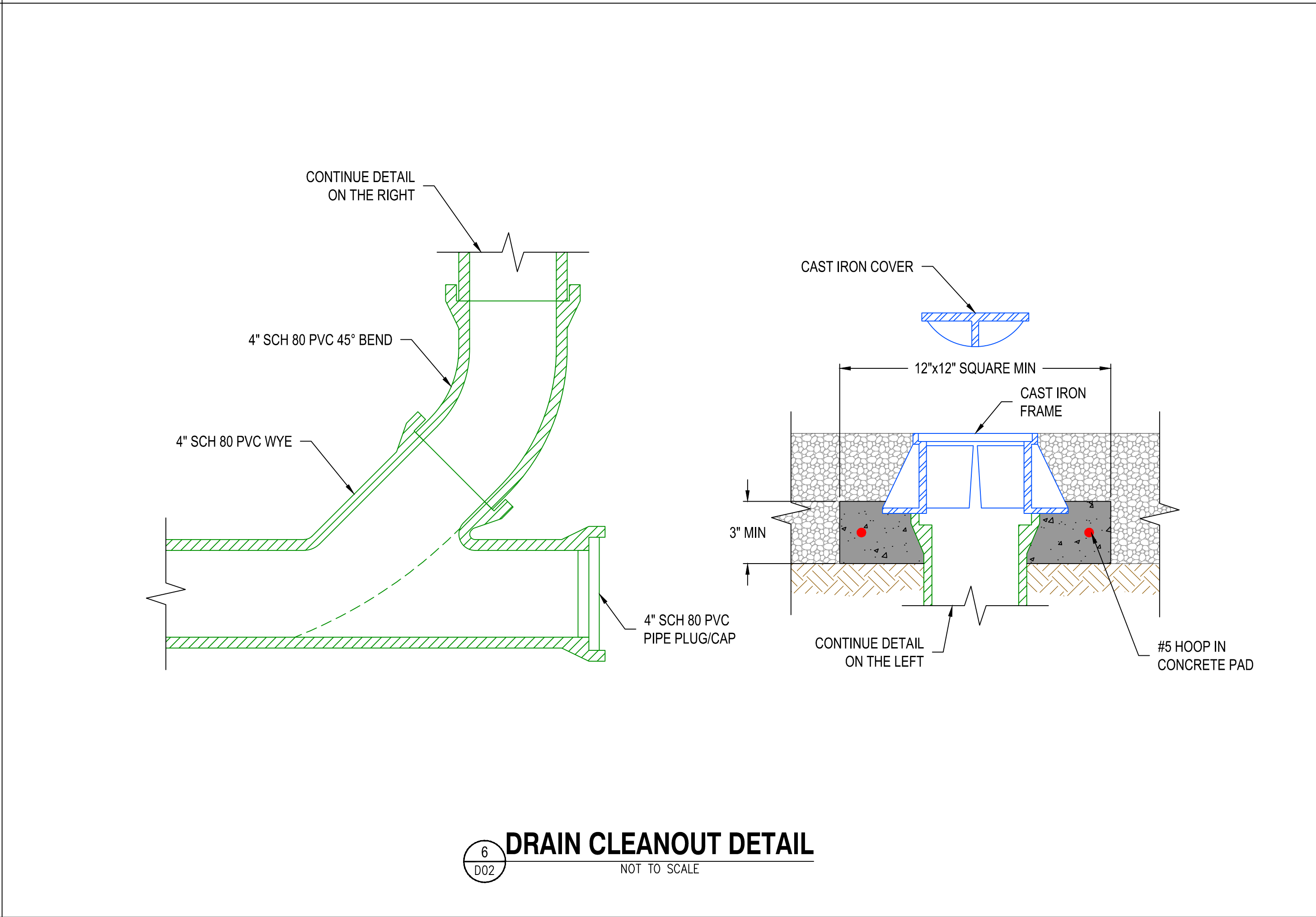
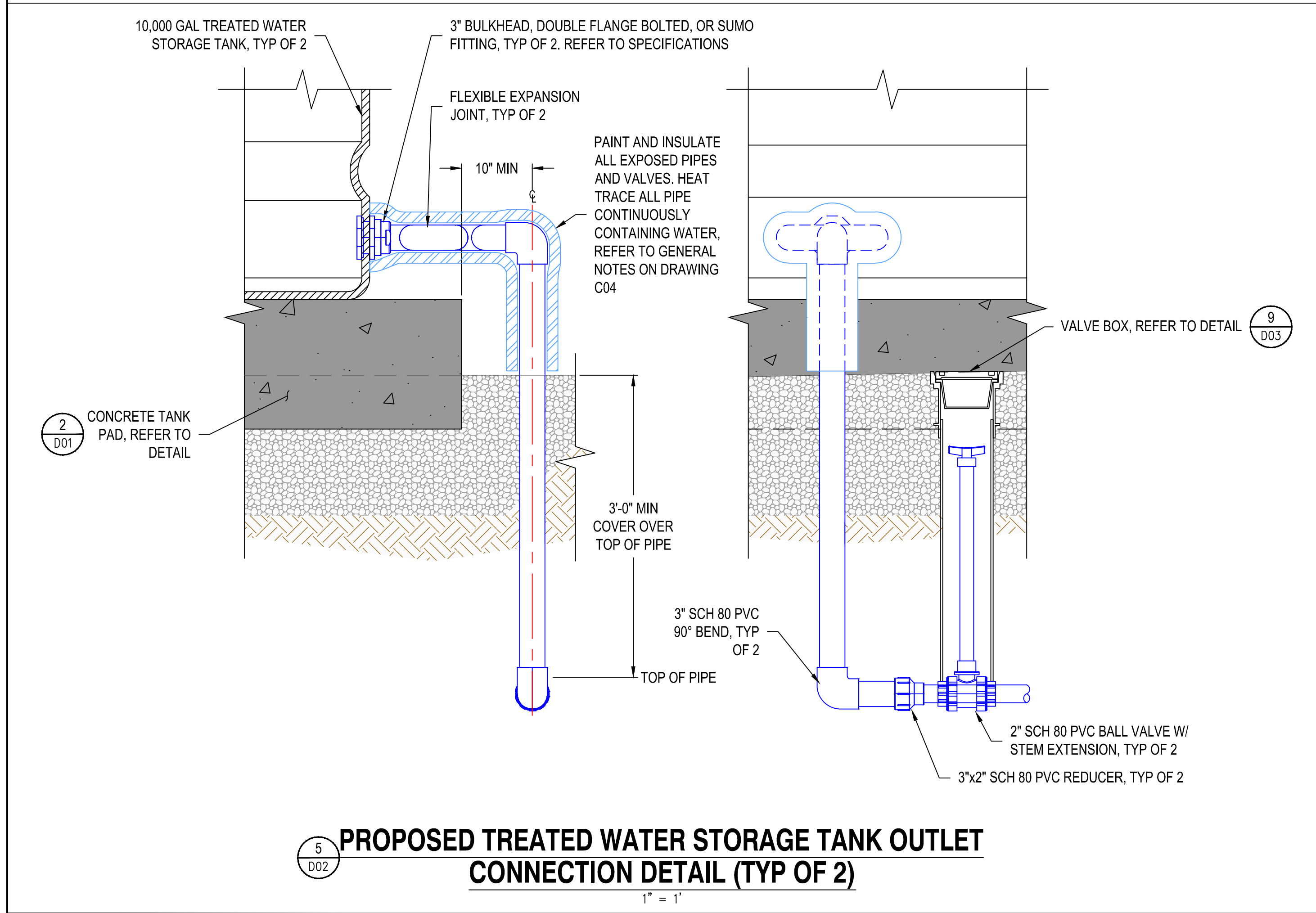
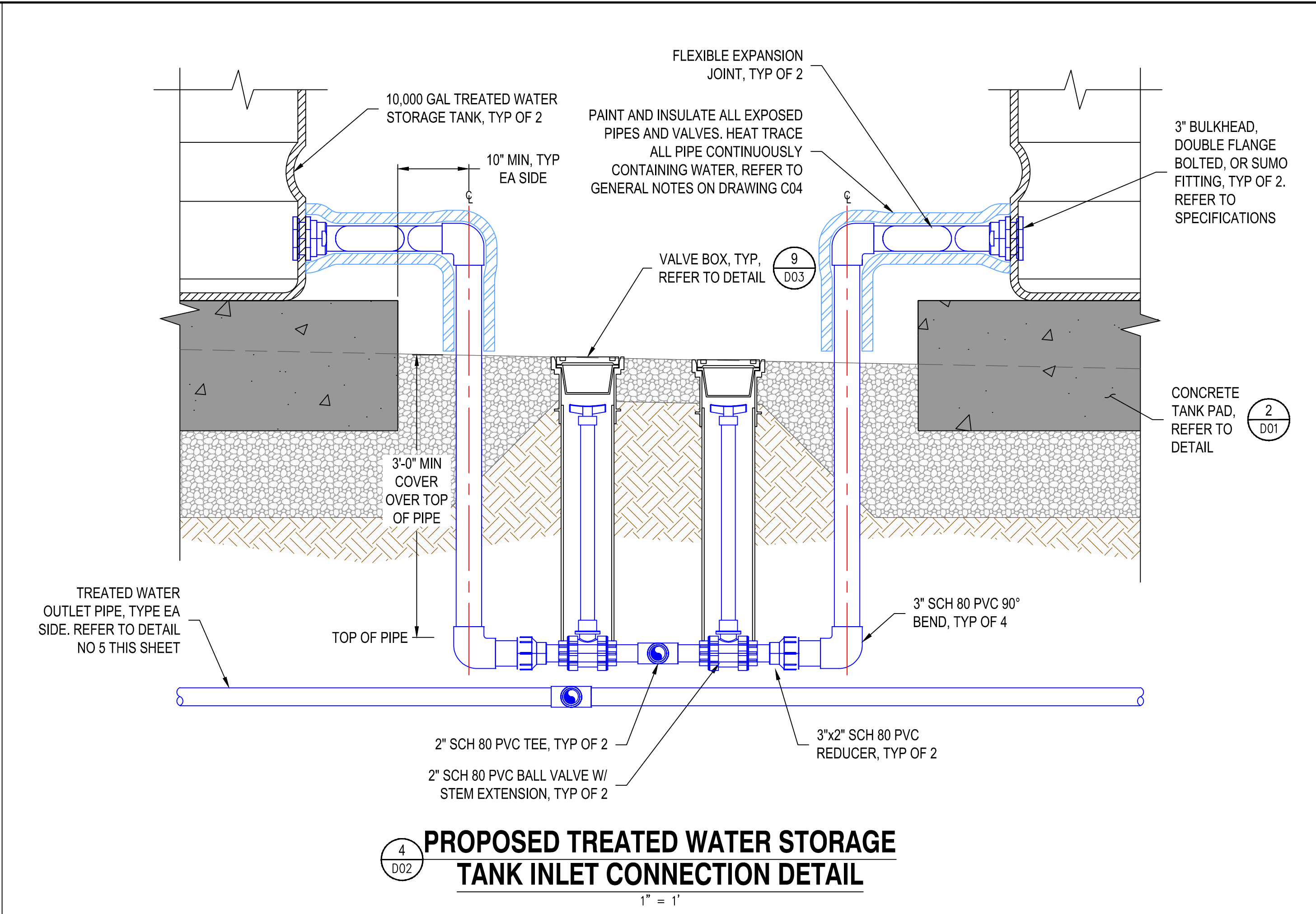
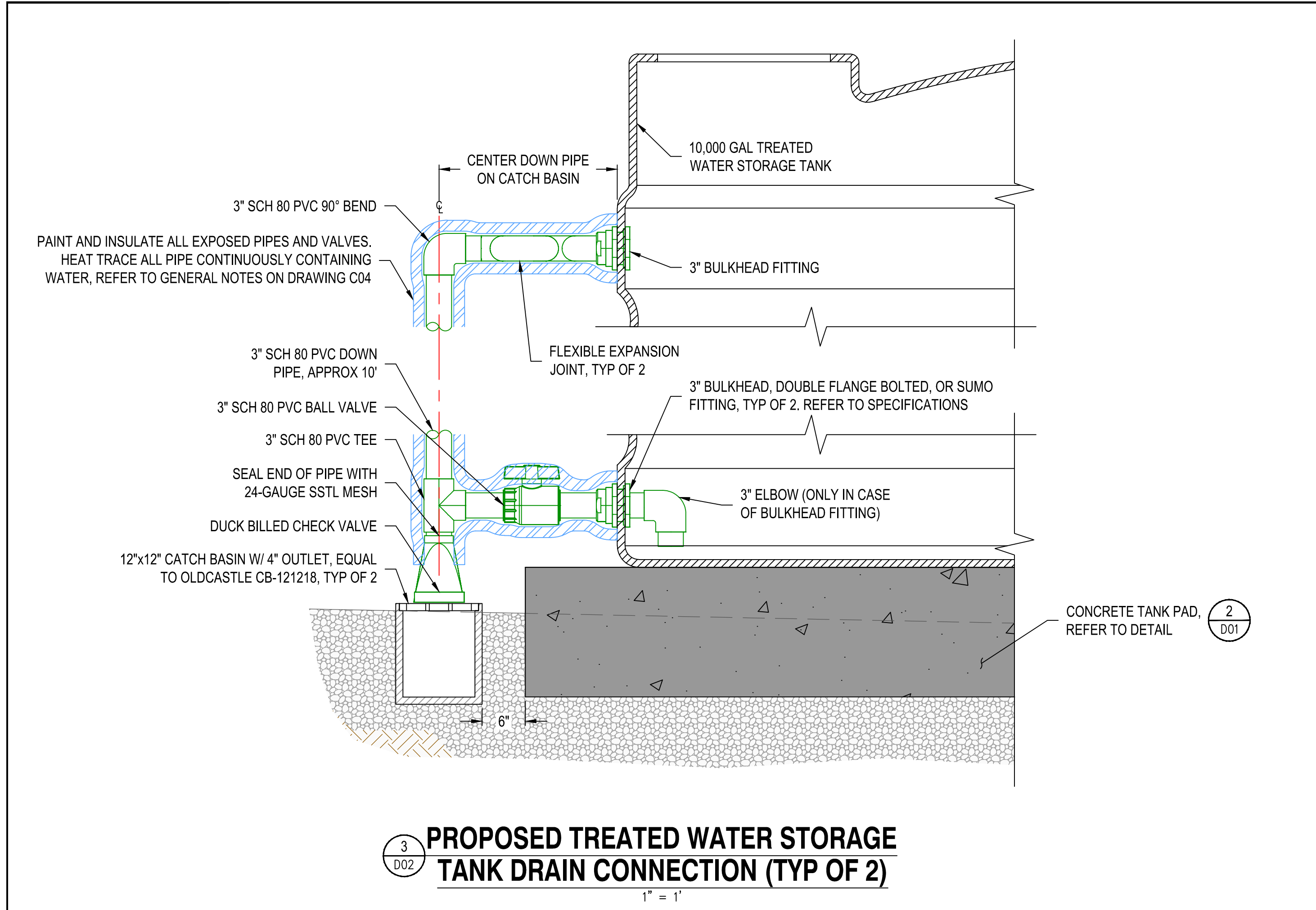
ENGINEER: SSB		SAVE DATE: May 7, 2025	CLIENT: LWC	JOB NO.: 24-0124
REVIEWED: TMD		PLOT DATE: May 7, 2025	FILENAME: LWC-D-DET.DWG	
REVISIONS				

0' 1'

SCALE: SHOWN

DRAWING IS FULL SCALE WHEN
BAR MEASURES 2"

DWG NO.:	D01	SHEET NO.:	08
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LONDON WATER COOPERATIVE
WATER TREATMENT PLANT REPLACEMENT

DETAILS II

ENGINEER	SAFE DATE	PLOT DATE	CLIENT	FILE NAME	JOB NO.	REVISIONS	DATE	BY	REVIEW
ENGINEER: SSB	May 7, 2025	May 7, 2025	CLIENT: LWC	FILE NAME: LWC-D-DET.DWG	24-0724				
REVIEWED: TMD									

SCALE: SHOWN

DRAWING IS FULL SCALE WHEN BAR MEASURES 2"

DWG NO.: **D02**

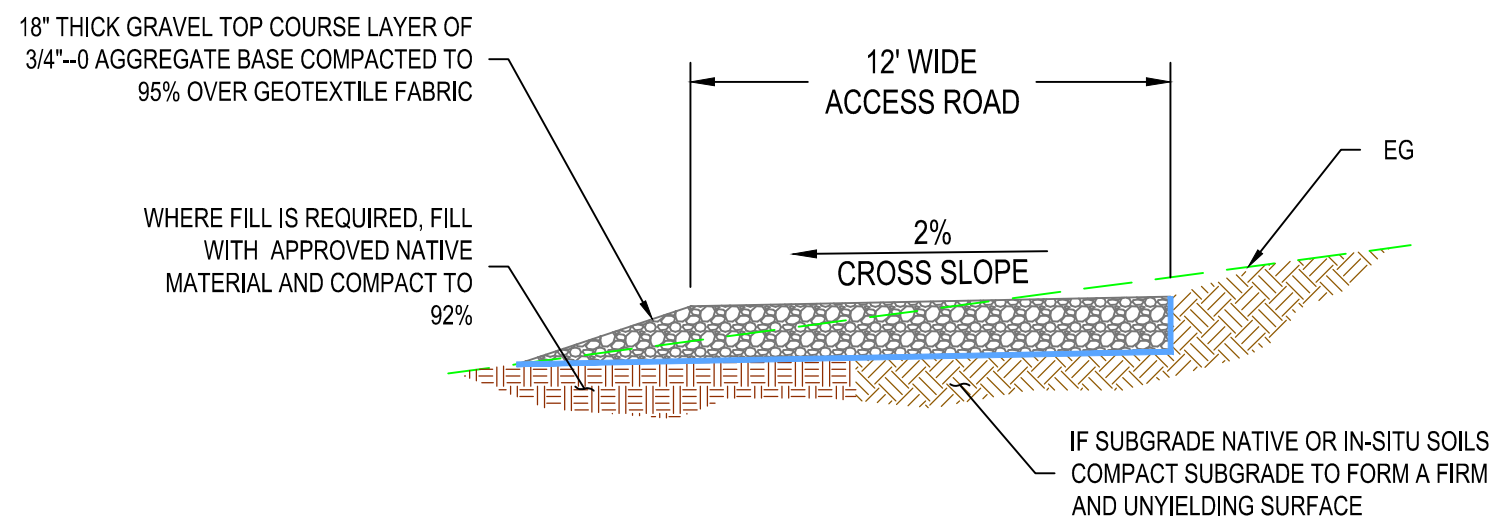
SHEET NO.: **09**

WEST TANK

EAST TANK

EXISTING WATER STORAGE TANK DRAINAGE MODIFICATIONS DETAIL

NOT TO SCALE



TYPICAL VEHICLE ACCESS ROAD

NOT TO SCALE

- NOTES:**
1. ALL FILL SHALL BE COMPACTED IN 8-INCH THICK MAX LOOSE LIFTS. COMPACTION IS BASED ON MAXIMUM DRY DENSITY PER ASTM D-698 (STANDARD PROCTOR).
 2. CUT AND FILL SLOPES SHALL BE 4:1 MAX.
 3. GEOTEXTILE FABRIC SHALL BE MIRAFI 500X, OR APPROVED EQUAL.



EXISTING BEAVER CREEK INTAKE VAULT ACCESS HATCH INSTALLATION

NOT TO SCALE



EXPIRES: 12/31/2025

LONDON WATER COOPERATIVE WATER TREATMENT PLANT REPLACEMENT

DETAILS III

[illegible]

1. FENCE HEIGHT IS MEASURED FROM TOP OF MESH TO FINISHED GROUND SURFACE
2. ALL POSTS AND RAILS SHALL BE SCHED. 40 STEEL PIPE UNLESS OTHERWISE NOTED, SIZE NOTED ON PLANS SHALL BE O.D.
3. ALL COMPONENTS SHALL BE HOT DIPPED GALVANIZED PER THE TECHNICAL SPECIFICATIONS BASED ON MATERIAL TYPE. POSTS AND RAILS TO GRADE 1, FABRIC TO CLASS 1. HARDWARE TO MATCH GALVANIZING REQUIREMENTS TO WHICH IT IS ATTACHED.
4. ALL FABRIC SHALL BE CORE WIRE GAUGE 9 AND 2-INCH MESH. EXCEPT FOR RAILING EQUIVALENT FENCE, TOP AND BOTTOM FABRIC SELVAGES SHALL BE TWISTED. TOP SELVAGE OF RAILING EQUIVALENT FENCE SHALL BE KNUCKLED. LEAVE NO MORE THAN 3-INCH GAP BETWEEN FINISHED GROUND SURFACE AND BOTTOM SELVAGE.
5. ALL GATE FRAMES SHALL BE SIZED AND CONSTRUCTED TO MEET CHAINLINK FENCE MANUFACTURERS INSTITUTE PRODUCT MANUAL SPECIFICATIONS, MINIMUM.
6. ADJUST FENCE POST LOCATIONS TO AVOID CONFLICT WITH UTILITIES OR OTHER STRUCTURES. MINIMUM 1' CLEARANCE.



CHAINLINK ACCESS GATE DETAIL



THRUST BLOCKING DETAIL

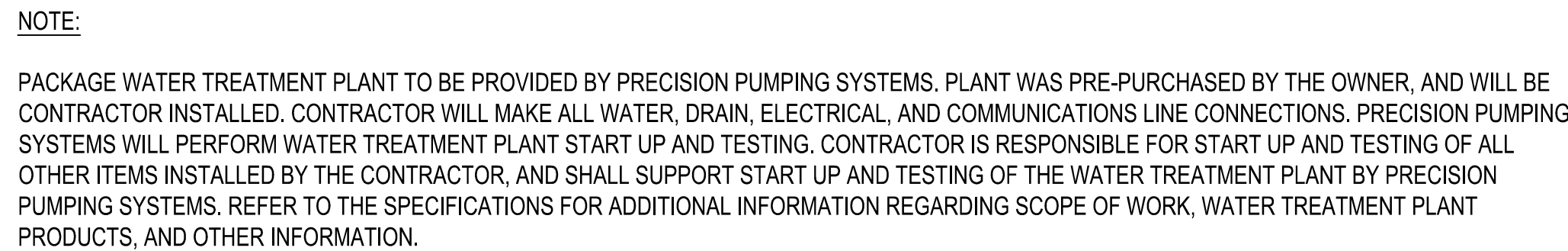
14 VALVE VAULT DETAIL
D04 NOT TO SCALE



		SCALE: SHOWN DRAWING IS FULL SCALE WHEN BAR MEASURES 2"	
DWG NO.:	D04	SHEET NO.:	11
DESIGNED BY:	DATE:	CHECKED BY:	DATE:
PROJECT:	NO.	DATE	DESCRIPTION
BY	REVIEW		



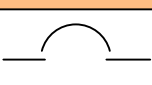
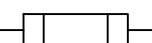
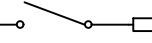
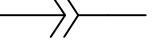

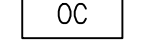
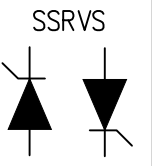
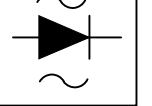
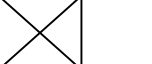
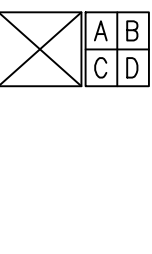
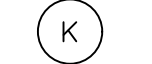

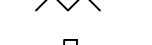
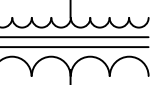

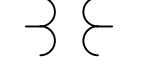
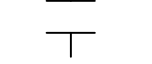





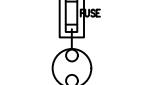
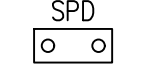


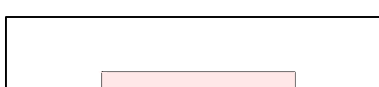


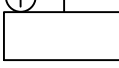








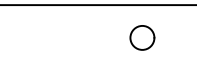

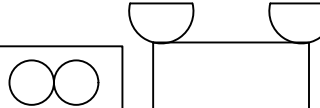




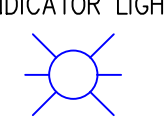
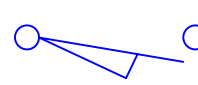
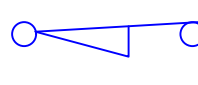
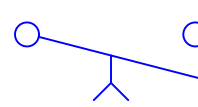
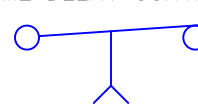



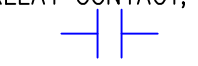
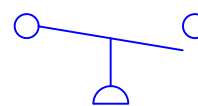
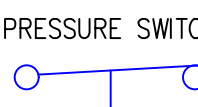
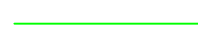



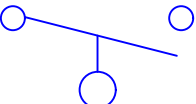
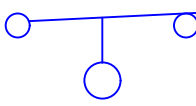
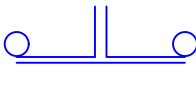
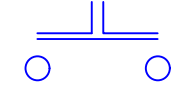



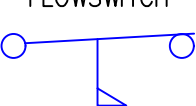
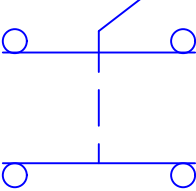
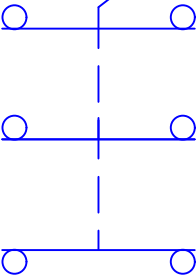





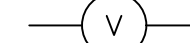









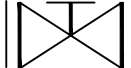
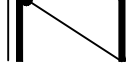









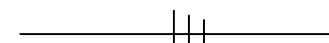
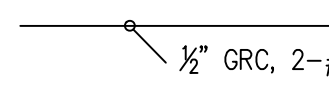
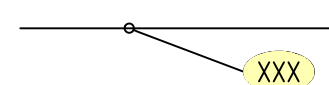
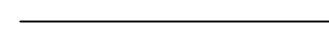
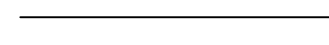
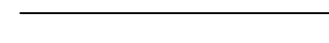
















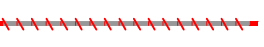


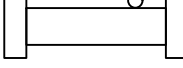




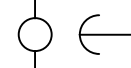








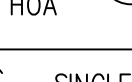










DETAILS V



PROPOSED PACKAGED WTP
NOT TO SCALE

DESIGN SPECIFICATIONS			
Design Point 1:		10 GPM @ 80 PSI	
Design Point 2:		35 GPM @ 80 PSI	
Pump #1 Details:		1.5HP/Pump	10 GPM @ 185 TDH
Pump #2 Details:		3 HP/Pump	35 GPM @ 185 TDH
Minimum Power: 240 Volt / 1 Phase			
Model # V##V2V002X00010-080HSCB241OAS-2			
ITEM NO.	DESCRIPTION	Size	QTY.
1	AC, MINI-SPLIT AIR HANDLER		1
2	AC UNIT		1
3	CHEMICAL ANALYZER		1
4	CONTROL PANEL	72"x48"x18"	1
5	DRAIN, FLOOR		2
6	ENCLOSURE, MARINE GRADE ALUMINUM	96"x248"x110"	1
7	FILTER, HC 170-5 MICRON CARTRDGE	2"	1
8	FILTER, HC 90-LT2 CARTRIDGE	2"	1
9	FILTER, UV		2
10	FIRE EXTINGUISHER (48" AFF)	20LB	3
11	FLOW METER, BADGER	2"	1
12	GFCI OUTLET	15A	6
13	HOSE BIB	3/4"	1
14	HVAC, MINI-SPLIT CONDENSER		1
15	LIGHT, EMERGENCY MOTION		3
16	LIGHT FIXTURE, EXTERNAL		3
17	LIGHT FIXTURE, LED	24"	3
18	LIGHT SWITCH		3
19	LOAD CENTER (P-1)	200 A	1
20	METERING PUMP, BETA B4	.37GPH	1
21	PRESSURE SENSOR, -14.5..145PSI, LED DISPLAY, 4-20MA, IFM	1/4"	5
22	PRESSURE GAUGE, 30PSI	2-1/2"	1
23	PRESSURE GAUGE, 160PSI, NSF	2-1/2"	5
24	PRESSURE TANK, AMTROL WX-203	32 Gal	1
25	PUMP, VMS	1.5 HP	2
26	PUMP, VMS	3 HP	2
27	PVC BALL CHECK, 1" SCH80	1"	1
28	SENSOR, INTRUSION		3
29	SKID, BENT	96"x248"	1
30	SMOKE ALARM, GENTEX		2
31	STRAINER, H-STYLE	2"	1
32	TANK	15 GAL	1
33	TRANSMITTER, LEVEL, LEVELGAGE, DEEP WELL		2
34	UTILITY HEATER	500W	1
35	VALVE, AIR RELIEF	3/4"	7
36	VALVE, AIR RELIEF	1"	4
37	VALVE, BACKFLOW PREVENTER	1"	1
38	VALVE, BALL, PVC	2"	12
39	VALVE, CHECK	2"	4

		TITLE: FLODED SUCTION PUMP STATION			
PROJECT:		LONDON WATER COOP			
LEVEL:		90% Final			
SALESMAN: Matt Purdy		PART NO: 2V-2-NJ-2OT-2VF-2UV-FM-AL-PT			
2/17/2025	JOB:	SIZE: B	SCALE: NTS	SHEET: 1 OF 1	REV DEFAULT

ONE-LINE DIAGRAM SYMBOLS	PANELBOARDS, SWITCHES, AND EQUIPMENT	LIGHTING FIXTURES/DEVICES	ABBREVIATIONS		LADDER LOGIC SYMBOL LEGEND		
<div>CIRCUIT BREAKER xxx/yy – CB SIZE & NO. OF POLES ET – ELECTRONIC TRIP TM – THERMAL MAGNETIC BREAKER MCP – MOTOR CIRCUIT PROTECTOR SE – SERVICE ENTRANCE GFI – GROUND FAULT INTERRUPTER</div> <div>FUSE</div> <div>FUSED DISCONNECT SWITCH</div> <div>PLUG-IN CONNECTION</div> <div>RTM RUN TIME METER</div> <div>OC MOTOR OPERATION COUNTER</div> <div>SSRVS SSRVS – SOLID STATE REDUCED VOLTAGE STARTER</div> <div>VARIABLE FREQUENCY DRIVE</div> <div>MOTOR STARTER</div> <div>MOTOR STARTER W/ OPERATOR DEVICES A – HAND-OFF-AUTO B – OPERATIONAL COUNTER C – RUN TIME METER D – RUN LIGHT E – FAIL LIGHT F – EMERGENCY STOP</div> <div>KIRK KEY INTERLOCK</div> <div>POWER TRANSFORMER</div> <div>CONTROL POWER TRANSFORMER</div> <div>TRANSFORMER</div> <div>CURRENT TRANSFORMER</div> <div>VOLTAGE TRANSFORMER</div> <div>CONTACTOR</div> <div>CAPACITOR</div> <div>ENGINE GENERATOR</div> <div>GENERATOR CONNECTION RECEPTACLE</div> <div>S/N SOLID NEUTRAL</div> <div>TB TERMINAL BLOCK</div> <div>SURGE PROTECTION DEVICE</div> <div>SPD SURGE PROTECTION DEVICE (ALTERNATIVE)</div>	<div>SERVICE ENTRANCE, SWITCHGEAR, MOTOR CONTROL CENTER, OR PANELBOARD</div> <div>SURFACE MOUNTED PANELBOARD</div> <div>FLUSHED MOUNTED PANELBOARD</div> <div>NX FIELD CONTROL STATION WITH NEMA REQUIREMENTS: N1 – NEMA 1 N3R – NEMA 3R N4 – NEMA 4 N4SS – NEMA 4 STAINLESS STEEL N4F – NEMA 4 FIBERGLASS N6 – NEMA 6 N12 – NEMA 12 GASKETED</div> <div>EQUIPMENT MOUNTING STAND</div> <div>HEATER, WATTAGE NOTED</div> <div>EQUIPMENT CONNECTION</div> <div>M SINGLE PHASE MOTOR. HORSEPOWER AS NOTED</div> <div>HP THREE PHASE MOTOR. HORSEPOWER AS NOTED</div> <div>HP SINGLE PHASE MOTOR. HORSEPOWER AS NOTED</div> <div>ELECTRICAL PLUG</div> <div>DISCONNECT SWITCH</div> <div>F FUSED DISCONNECT SWITCH</div> <div>COMBINATION MOTOR STARTER AND DISCONNECT SWITCH</div>	<div>FLUORESCENT FIXTURE</div> <div>WALL/CEILING MOUNTED FIXTURE</div> <div>EMERGENCY LIGHT WITH SELF CONTAINED BATTERY</div> <div>SURFACE OR PENDANT MOUNTED FIXTURE</div> <div>RECESSED FIXTURE</div> <div>MD MOTION DETECTOR</div> <div>PC PHOTO CONTROL CELL</div>	<div>SPDT – SINGLE POLE, DOUBLE THROW SPST – SINGLE POLE, SINGLE THROW DPST – DOUBLE POLE, SINGLE THROW WP – WEATHER-PROOF GFI – GROUND FAULT INTERRUPT P – POWER C – CONTROL J – INSTRUMENTATION PC – POWER & CONTROL CJ – CONTROL & INSTRUMENTATION CKT. – CIRCUIT C.O. – CONDUIT ONLY N.L. – NIGHT LIGHT AL. – ALUMINUM CU. – COPPER</div> <div>HOA – HAND-OFF-AUTO SWITCH RTM – RUN TIME METER OC – OPERATION COUNTER MRIL – MOTOR RUN INDICATION LIGHT SFIL – SEAL FAIL INDICATION LIGHT SFTR – SEAL FAIL TRIP RESET OTIL – OVER TEMPERATURE INDICATION LIGHT MOIL – MOTOR OVERLOAD INDICATION LIGHT</div>		<div>INDICATOR LIGHT INDICATOR LIGHT A – AMBER G – GREEN B – BLUE R – RED C – CLEAR W – WHITE</div> <div>LIMIT SWITCH LIMIT SWITCH, NORMALLY OPEN</div> <div>LIMIT SWITCH LIMIT SWITCH, NORMALLY CLOSED</div> <div>TIME DELAY CONTACT TIME DELAY CONTACT, NORMALLY OPEN, TIME TO CLOSE</div> <div>TIME DELAY CONTACT TIME DELAY CONTACT, NORMALLY CLOSED, TIME TO OPEN</div> <div>TIME DELAY CONTACT TIME DELAY CONTACT, NORMALLY OPEN, TIME TO OPEN</div> <div>TIME DELAY CONTACT TIME DELAY CONTACT, NORMALLY CLOSED, TIME TO CLOSE</div> <div>RELAY CONTACT, NC RELAY CONTACT, INSTANTANEOUS CHANGE</div> <div>RELAY CONTACT, NO</div> <div>PRESSURE SWITCH PRESSURE SWITCH, NORMALLY OPEN</div> <div>PRESSURE SWITCH PRESSURE SWITCH, NORMALLY CLOSED</div> <div><div>LADDER LOGIC LINETYPES</div><div>COMPONENT INSTALLED INSIDE ENCLOSURE</div><div>COMPONENT INSTALLED ON FRONT OF ENCLOSURE</div><div>FIELD CONNECTED COMPONENT</div></div>		<div>RELAY RELAY XYZ 123 RELAY TR – TIMED RELAY CR – CONTROL RELAY</div> <div>FLOAT SWITCH FLOAT SWITCH, NORMALLY OPEN</div> <div>FLOAT SWITCH FLOAT SWITCH, NORMALLY CLOSED</div> <div>PUSHBUTTON PUSHBUTTON, NORMALLY CLOSED</div> <div>PUSHBUTTON PUSHBUTTON, NORMALLY OPEN</div> <div>THERMOSTAT THERMO SWITCH, NORMALLY OPEN</div> <div>THERMOSTAT THERMO SWITCH, NORMALLY CLOSED</div> <div>FLOWSWITCH FLOWSWITCH, NORMALLY OPEN</div> <div>FLOWSWITCH FLOWSWITCH, NORMALLY CLOSED</div> <div>2 POLE SWITCH</div> <div>3 POLE SWITCH</div>
FIRE SYSTEM SYMBOLS			INDICATE TYPE BY LETTER	INSTRUMENT METER			
<div>HEAT DETECTOR</div> <div>SMOKE DETECTOR</div> <div>FIRE ALARM DISPATCH STROBE ALARM</div> <div>FIRE ALARM AUDIBLE/VISUAL ALARM</div> <div>FIRE ALARM MANUAL PULL STATION</div>			<div>V V – VOLTMETER</div> <div>AH – AMPHOUR</div>	<div>A – AMMETER AH – AMPERE-HOUR PF – POWER FACTOR V – VOLTMETER VA – VOLT AMPMETER</div> <div>VAR – VARMETER VARH – VARHOUR METER W – WATTMETER WH – WATTHOUR METER</div>			
ADDITIONAL SYMBOLS			RACEWAY LEGEND				
<div>SOUND SYSTEM SPEAKER</div> <div>SOUND SYSTEM VOLUME CONTROL</div> <div>DOORBELL</div>			<div>PROPOSED POWER</div> <div>TEL PROPOSED TELEPHONE</div> <div>TELM PROPOSED INSTRUMENTATION</div> <div>FO PROPOSED FIBER OPTICS</div>				
VALVE SYMBOLS			BUILDING OR FACILITY PLAN LEGEND				
<div>PILOT VALVE SOLENOID</div> <div>VALVE</div> <div>CHECK VALVE</div> <div>CONTROL VALVE</div>			<div>480 VOLT EXPOSED RACEWAY</div> <div>480 VOLT WIRING CONCEALED, UNDERGROUND, EMBEDDED, OR CONCRETE ENCASED RACEWAY</div> <div>120/208/240 VOLT EXPOSED RACEWAY</div> <div>120/208/240V WIRING CONCEALED, UNDERGROUND, EMBEDDED, OR CONCRETE ENCASED RACEWAY</div> <div>CONTROL OR INSTRUMENTATION EXPOSED RACEWAY</div> <div>CONTROL OR INSTRUMENTATION, UNDERGROUND, EMBEDDED, OR CONCRETE ENCASED RACEWAY</div> <div>HOME RUN TO PANELBOARD OR AS INDICATED</div> <div>CONDUIT RUN, BROKEN AND CONTINUED SAME SHEET OR AS NOTED</div> <div>FLEXIBLE CONDUIT</div> <div>CONDUIT RUN. HATCH MARKS INDICATE NUMBER OF CONDUCTORS CALLOUT INDICATING CONDUIT SIZE, NUMBER AND SIZE OF WIRE.</div> <div>CALLOUT INDICATING CONDUIT PER SCHEDULE</div> <div>CONDUIT BENT UP OR TOWARD</div> <div>CONDUIT BENT DOWN OR AWAY</div> <div>CAPPED CONDUIT</div>				
RECEPTACLES AND JUNCTION BOX SYMBOLS			ONE-LINE DIAGRAM INFORMATION				
<div>CEILING JUNCTION BOX</div> <div>WALL JUNCTION BOX</div> <div>FLOOR JUNCTION BOX</div> <div>DUPLIX WALL RECEPTACLE, 120V WP = WEATHERPROOF G = GROUNDED IG = ISOLATED GROUND GFI = GROUND FAULT INTERRUPTER</div> <div>DOUBLE DUPLIX</div> <div>SINGLE RECEPTACLE, 120V</div> <div>SINGLE RECEPTACLE, 208V</div> <div>DUPLIX FLOOR RECEPTACLE, 120V</div> <div>SPECIAL PURPOSE WALL RECEPTACLE, RATING AS NOTED</div> <div>CLOCK</div> <div>TELEVISION</div> <div>TELEPHONE</div> <div>TELEPHONE/DATA WITH CABLE</div> <div>TELEPHONE/DATA WITHOUT CABLE</div>			<div>EXISTING EQUIPMENT AND CONDUIT</div> <div>PROPOSED EQUIPMENT AND CONDUIT</div> <div>GROUNDING EQUIPMENT AND CONDUCTORS</div> <div>CONDUIT, WIRING OR EQUIPMENT TO BE REMOVED</div>				
GROUNDING SYSTEM SYMBOLS			GENERAL NOTES				
<div>GROUND</div> <div>METAL PIPE GROUND</div> <div>CONNECTION POINT, EXOTHERMIC WELD, CADWELD OR APPROVED EQUAL.</div> <div>GROUND ROD SIZED PER N.E.C. USE EXOTHERMIC WELD CONNECTION AT THE GROUND ROD.</div> <div>PIGTAIL, BARE COPPER, LENGTH AS REQUIRED, 8' MINIMUM.</div> <div>CONNECTION POINT, MECHANICAL, COMPRESSION TYPE.</div>			<div>1. THIS IS A STANDARD LEGEND. NOT ALL OF THE INFORMATION SHOWN ON THIS PAGE WILL APPEAR IN THIS SET OF PLANS.</div> <div>2. THESE DRAWINGS ARE DIAGRAMMATIC ONLY; EXACT LOCATIONS OF ELECTRICAL EQUIPMENT SHALL BE DETERMINED IN THE FIELD BY THE CONTRACTOR. THE INSTALLATION OF ALL EQUIPMENT SHOWN ON THESE DRAWINGS OR DESCRIBED IN THE SPECIFICATIONS SHALL CONFORM TO THE REQUIREMENTS SET FORTH IN THE LATEST EDITIONS OF ALL APPLICABLE CODES AND UTILITY COMPANY STANDARDS. CONTACT THE UTILITY COMPANY REPRESENTATIVES AND VERIFY THEIR REQUIREMENTS.</div> <div>3. NOTIFY THE ENGINEER IMMEDIATELY IF CONFLICTS IN EQUIPMENT LOCATIONS ARE DISCOVERED OR IF PROBLEMS ARISE DUE TO FIELD CONDITIONS, LACK OF INFORMATION OR ANY OTHER REASON. NO PAYMENT WILL BE MADE FOR CHANGES WHICH HAVE NOT BEEN REVIEWED BY THE ENGINEER.</div>				
ELECTRICAL SITE PLAN SYMBOLS			SWITCH OUTLETS				
<div>UTILITY POLE AND GUY WIRE</div> <div>HH MANHOLE OR HANDHOLE</div> <div>P BURIED POWER VAULT OR MANHOLE</div> <div>T TELEPHONE VAULT OR PEDESTAL</div> <div>F FIBER OPTICS VAULT OR PEDESTAL</div> <div>LUMINAIRE</div> <div>PAD-MOUNT TRANSFORMER</div>			<div>S STANDARD SWITCH, 120VAC, 20 AMP</div> <div>S 3-WAY SWITCH, 120VAC, 20 AMP</div> <div>S 3-POSITION SWITCH, 120VAC, 20 AMP, LABEL SWITCH POSITION HAND-OFF-MOTION OR PHOTO</div> <div><div>S SINGLE-POLE</div><div>S DOUBLE-POLE</div><div>S THREE WAY</div><div>S FOUR WAY</div><div>S DIMMER</div><div>S OCCUPANCY SENSOR</div></div> <div><div>S PILOT-LIGHTED</div><div>S KEY-OPERATED</div><div>S LOW VOLTAGE</div><div>S MASTER</div><div>S PUSHBUTTON</div></div>				

ENGINEER: APB

SAFETY DATE: May 7, 2025

REVIEWED: MWB

PLOT DATE: May 8, 2025

CLIENT: LVC

FILENAME: LVC-P-ELEC01.DWG

JOB NO.: 24-0724

REVISIONS

NO.	DATE	DESCRIPTION	BY	REVIEW

SCALE: SHOWN

0"1"2"

DRAWING IS FULL SCALE WHEN BAR MEASURES 2"


DWG NO.: E01

SHEET NO.: 13

RH2

REGISTERED PROFESSIONAL ENGINEER
104363PE
OREGON
JAN. 9, 2024
MARK WILLIAM BRAUNER

EXPIRES: 12/31/2025



REGISTERED PROFESSIONAL ENGINEER
104363PE
OREGON
WILLIAM BRAACON
EXPIRES: 12/31/2025

LONDON WATER COOPERATIVE
WATER TREATMENT PLANT REPLACEMENT

ELECTRICAL LEGEND

ENGINEER: APB	SAFETY DATE: May 7, 2025	CLIENT: LVC	FILENAME: LVC-P-ELEC01.DWG	JOB NO.: 24-0724	REVISIONS	NO.	DATE	DESCRIPTION	BY	REVIEW
REVIEWED: MWB	PLOT DATE: May 8, 2025									

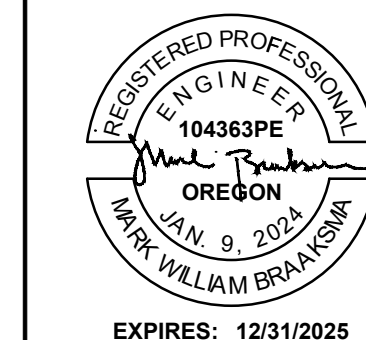
SCALE: SHOWN

0"1"2"

DRAWING IS FULL SCALE WHEN BAR MEASURES 2"

DWG NO.: E01

SHEET NO.: 13



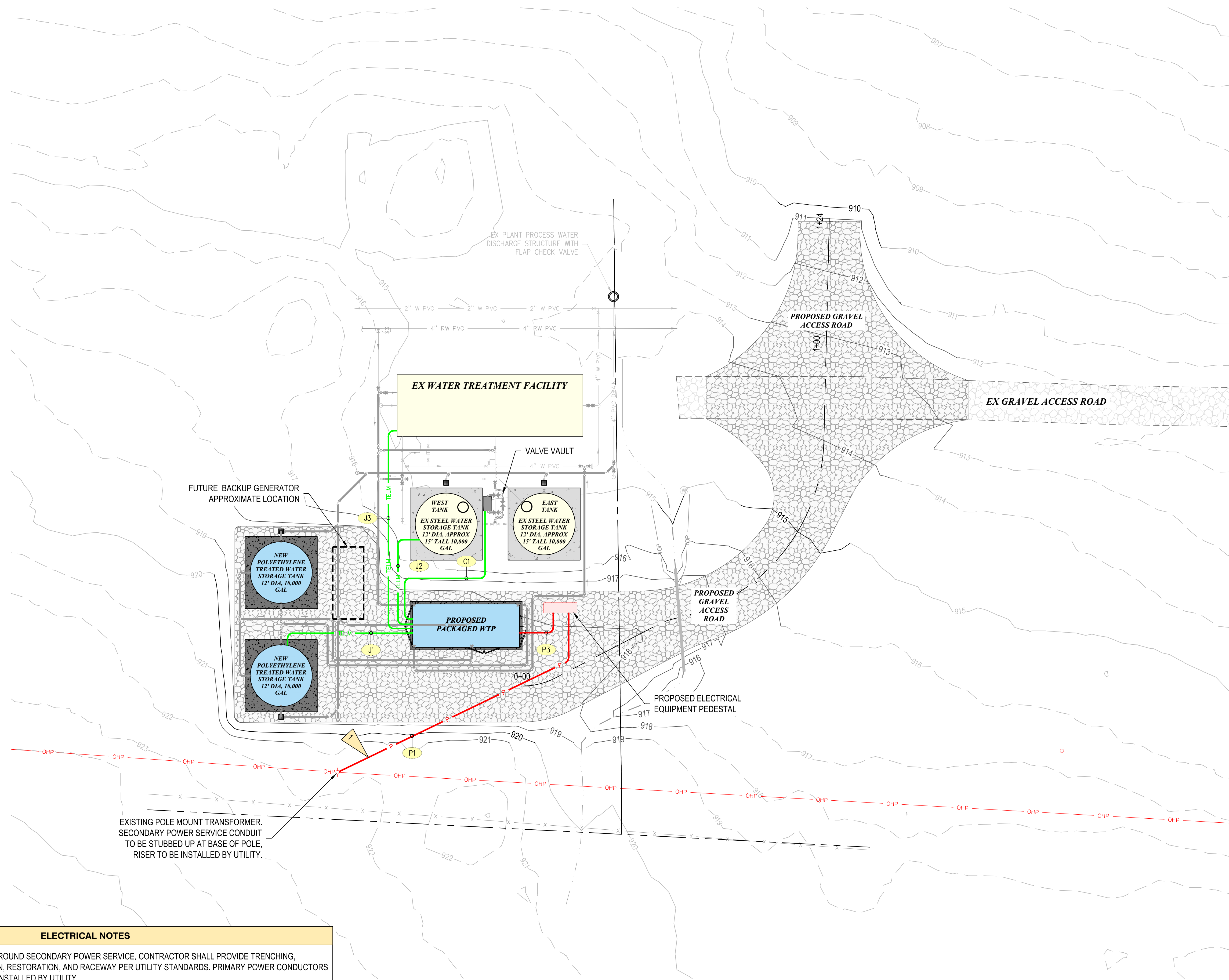
ELECTRICAL SITE PLAN

ENGINEER: APB		SAVE DATE: May 7, 2025	CLIENT: LWC	JOB NO.: 24-0124
REVIEWED: MMB		PLOT DATE: May 8, 2025	RELEASE: LWC-P-ELECT.DWG	
REVISIONS				
NO.	DATE	DESCRIPTION	BY	REVIEW

SCALE: SHOWN

DRAWING IS FULL SCALE WHEN BAR MEASURES 2"

DWG NO.: E02	SHEET NO.: 14 OF 15
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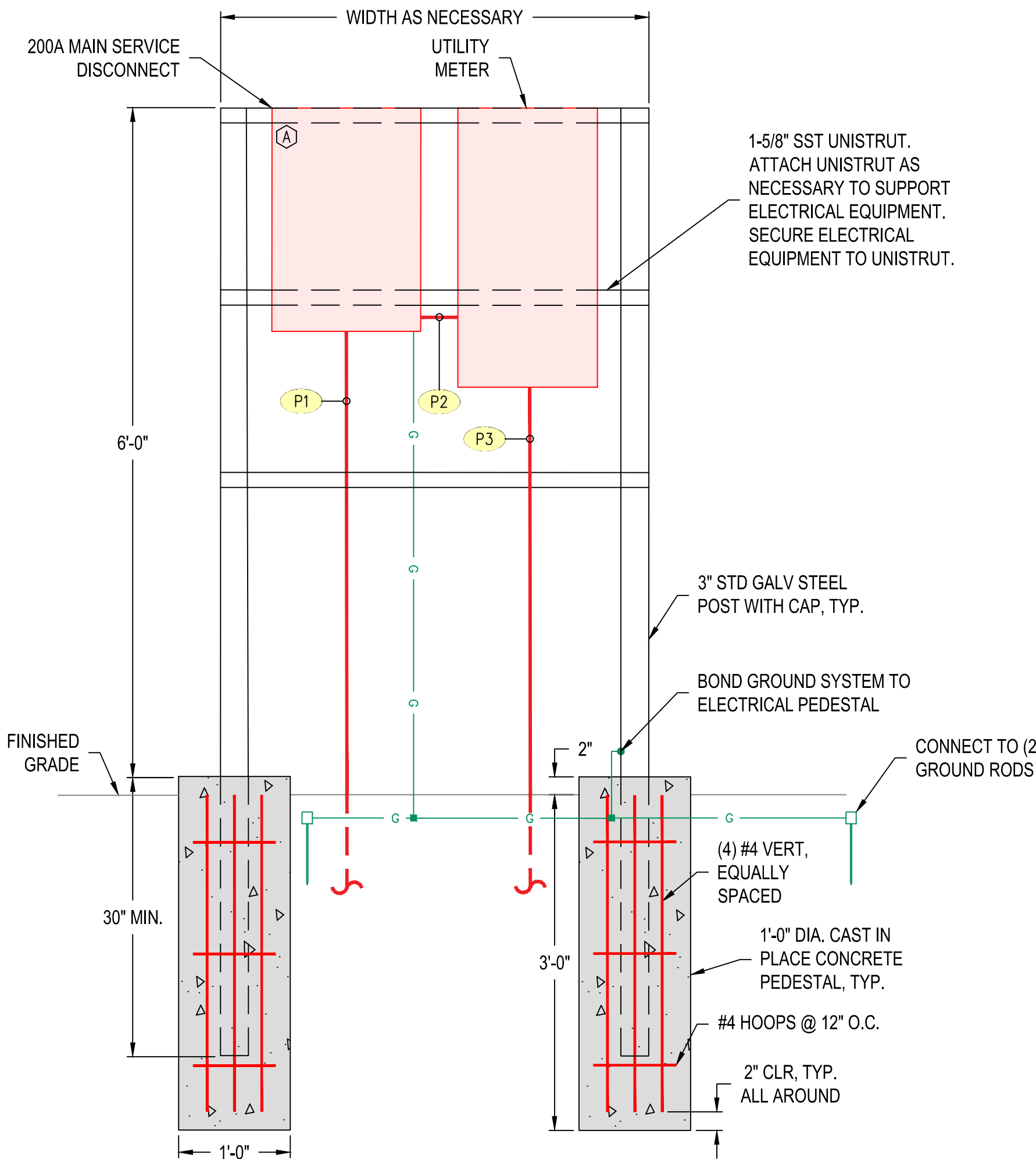


ELECTRICAL NOTES

- | | |
|----|--|
| 1 | 1. PROPOSED UNDERGROUND SECONDARY POWER SERVICE. CONTRACTOR SHALL PROVIDE TRENCHING, BACKFILL, COMPACTION, RESTORATION, AND RACEWAY PER UTILITY STANDARDS. PRIMARY POWER CONDUCTORS TO BE PROVIDED AND INSTALLED BY UTILITY. |
| XX | 2. SEE DWG NO. E03 FOR CONDUIT AND CONDUCTOR SCHEDULE. |

PROPOSED SITE PLAN

 $1'' = 10'$ 

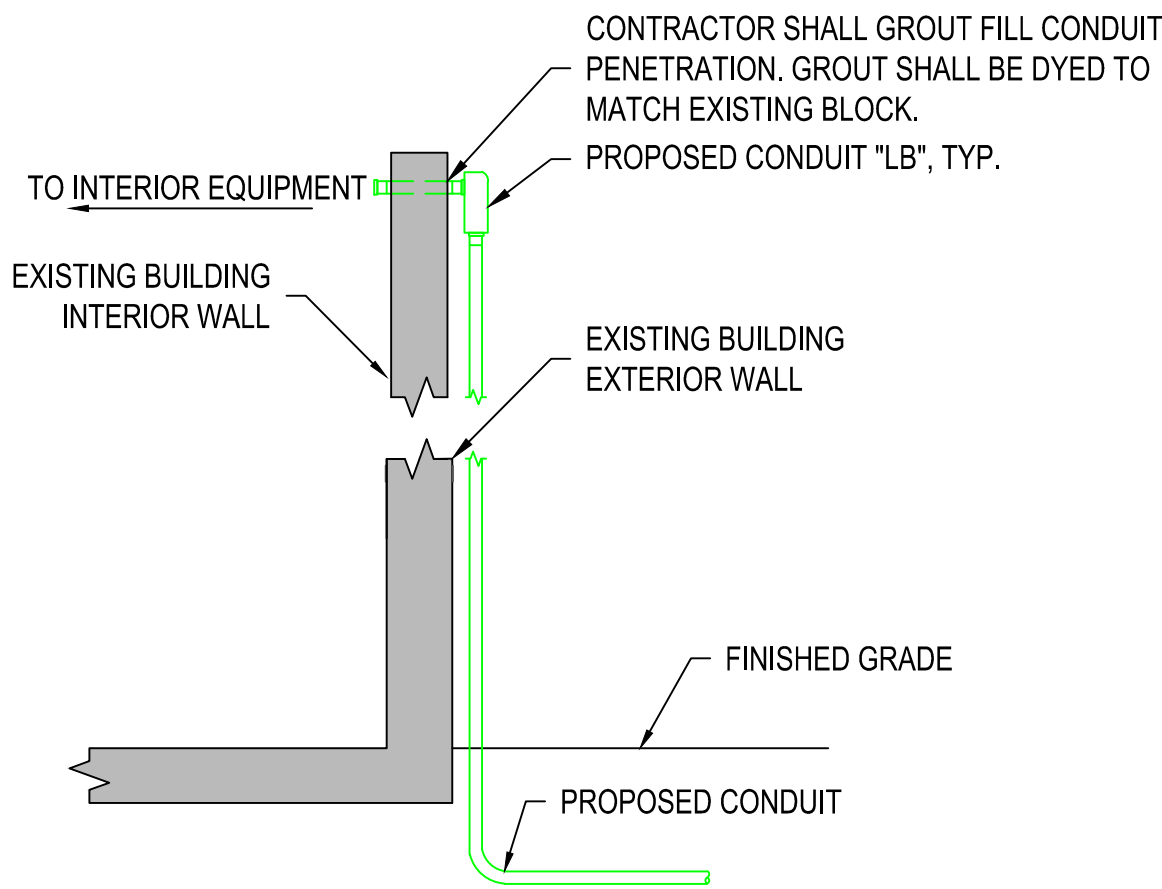


**ELECTRICAL EQUIPMENT
PEDESTAL DETAIL**
NOT TO SCALE

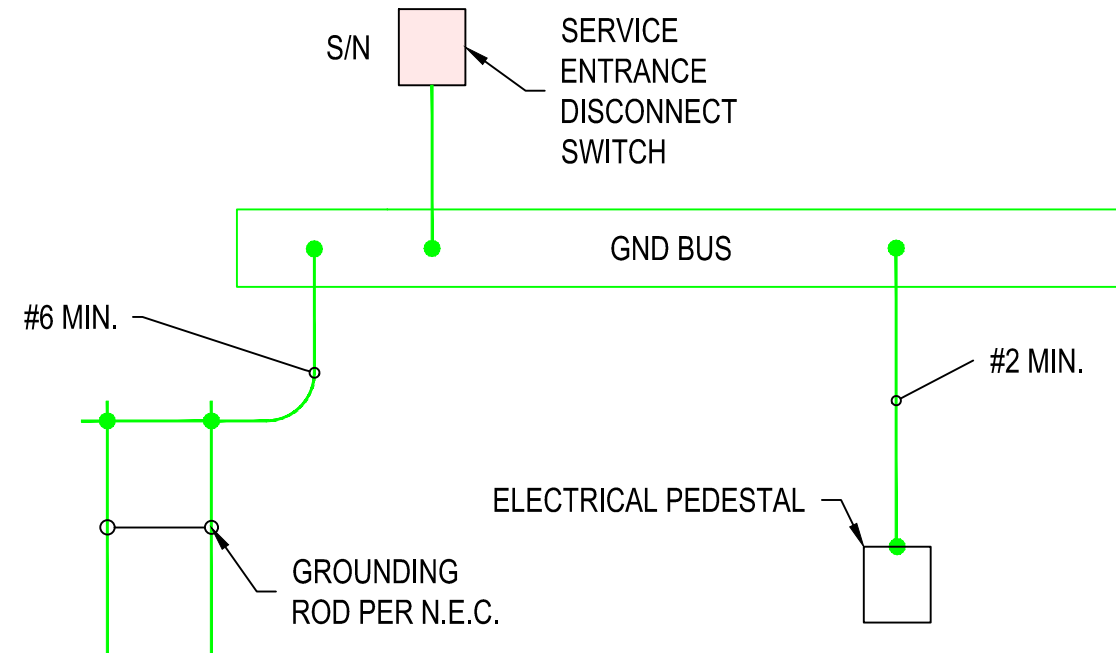
POWER CONDUIT AND CONDUCTOR SCHEDULE					
CIRCUIT	SOURCE	DESTINATION	TRADE SIZE	(QUANTITY) CONDUCTORS	NOTES
P1	UTILITY POLE MOUNT TRANSFORMER	MAIN SERVICE DISCONNECT	2"		CONDUCTOR TO BE INSTALLED BY ELECTRICAL UTILITY
P2	MAIN SERVICE DISCONNECT	UTILITY METER	2"	(2) - 3/0, (1) - 3/0 N	
P3	UTILITY METER	PACKAGED WATER TREATMENT PLANT, "WTP"	2"	(2) - 3/0, (1) - 3/0 N	

CONTROL CONDUIT AND CONDUCTOR SCHEDULE					
CIRCUIT	SOURCE	DESTINATION	TRADE SIZE	(QUANTITY) CONDUCTORS	NOTES
C1	WATER TREATMENT PLANT CONTROL PANEL	VALVE VAULT	1"	NYLON PULL-CORD	

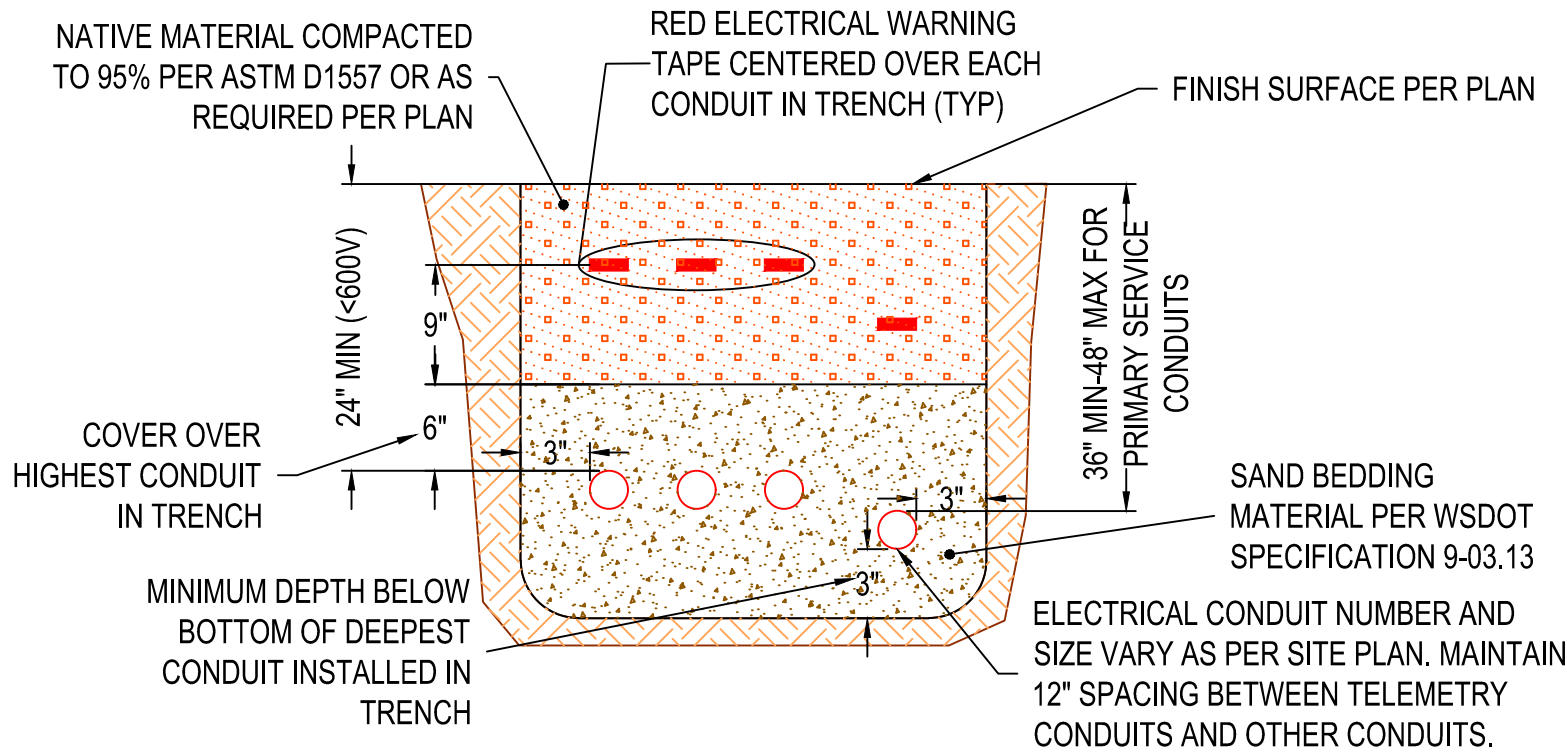
INSTRUMENTATION CONDUIT AND CONDUCTOR SCHEDULE					
CIRCUIT	SOURCE	DESTINATION	TRADE SIZE	(QUANTITY) CONDUCTORS	NOTES
J1	WATER TREATMENT PLANT CONTROL PANEL	TREATED WATER LEVEL SENSOR	1"	(1) 2-CONDUCTOR SHIELDED CABLE	
J2	WATER TREATMENT PLANT CONTROL PANEL	RAW WATER LEVEL SENSOR	1"	(1) 2-CONDUCTOR SHIELDED CABLE	
J3	WATER TREATMENT PLANT CONTROL PANEL	EXISTING WATER TREATMENT FACILITY	1"	NYLON PULL-CORD	



EXISTING BUILDING CONDUIT PENETRATION DETAIL
NOT TO SCALE

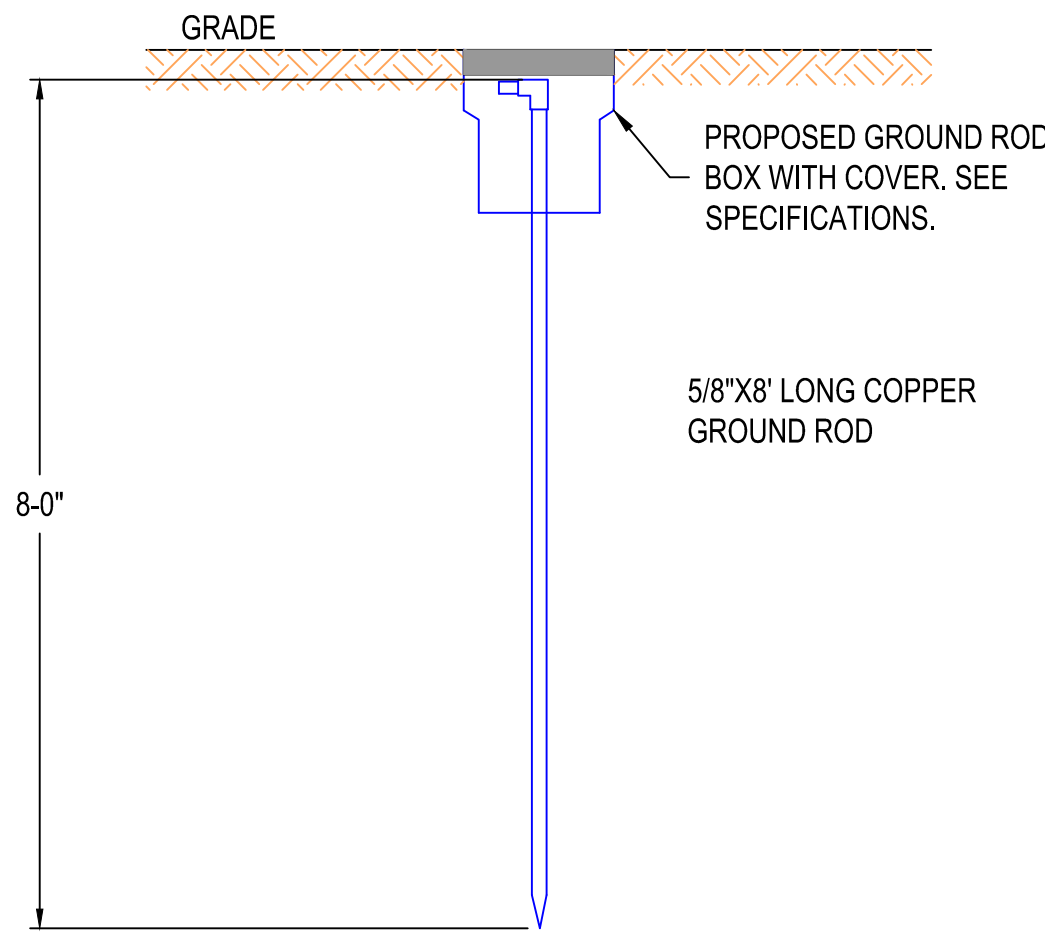


GROUNDING
NO SCALE



TYPICAL ELECTRICAL TRENCH DETAIL
NOT TO SCALE

NOTE: BURY DEPTH OF CONDUIT AND HORIZONTAL SPACING SHALL BE CONFIRMED WITH SERVING UTILITY BEFORE CONSTRUCTION.



GROUND ROD DETAIL
NOT TO SCALE



**LONDON WATER COOPERATIVE
WATER TREATMENT PLANT REPLACEMENT**

ELECTRICAL DETAILS AND SCHEDULES

NO.	DATE	DESCRIPTION	BY	REVIEW

ENGINEER: APB	SAFETY DATE: May 7, 2025	CLIENT: LWC	JOB NO.: 24-0724
REVIEWED: MWB	PLOT DATE: May 8, 2025	FILENAME: LWC-P-ELECT.DWG	

REVISIONS

SCALE: SHOWN

DRAWING IS FULL SCALE WHEN BAR MEASURES 2"

DWG NO.: E03 SHEET NO.: 15