EAST BAY MUNICIPAL UTILITY DISTRICT

September 18, 2024

ADDENDUM # 2

TO PROSPECTIVE BIDDERS OF SD-428, MWWTP OXYGEN PLANT REHABILITATION

Notice is hereby given that Volumes I-A, I-B, II-A, II-B, and III of the SD-428 Contract Documents have been revised as follows:

VOLUME I-A – BIDDING DOCUMENTS AND SPECIFICATIONS (DIVISIONS 00-01)

1. On the Cover of Volume I-A: **REMOVE** the bid opening date of "Wednesday, October 9, 2024." and **REPLACE** with new bid opening date "Wednesday, October 23, 2024."

2. Document 00 11 13 Notice to Contractors: In the first paragraph, **REMOVE** the bid opening date of "Wednesday, October 9, 2024" and **REPLACE** with new bid opening date "Wednesday, October 23, 2024."

3. Document 00 41 02 Bid Form: **REMOVE** and **REPLACE** with REVISED Document 00 41 02 Bid Form.

4. Document 00 41 05 Description of Bid Items: **REMOVE** and **REPLACE** with REVISED Document 00 41 05 Description of Bid Items.

5. Document 01 21 00 Allowances: In Article 1.2 Section A.13, Allowance for Relocating or repairing mechanical, electrical, instrumentation, control wiring, and pneumatic controls, **REMOVE** monetary amount of $250,000 and **REPLACE** with monetary amount of $350,000.

6. Document 01 35 13 Special Project Procedures: **REMOVE** and **REPLACE** with REVISED Document 01 35 13 Special Project Procedures.

7. Document 01 35 53 Security Procedures: **REMOVE** and **REPLACE** with REVISED Document 01 35 53 Security Procedures. Only change is formatting update to remove unnecessary page break.

8. Document 01 75 17 Field Testing and Startup: **REMOVE** and **REPLACE** with REVISED Document 01 75 17 Field Testing and Startup.

9. Document 01 79 00 Demonstration and Training: **REMOVE** and **REPLACE** with REVISED Document 01 79 00 Demonstration and Training.

Note: Changes to Specifications 00 41 05 Description of Bid Items, 01 35 13 Special Project Procedures, 01 35 53 Security Procedures, 01 75 17 Field Testing and Startup, and 01 79 00 Demonstration and Training are shown as follows: additions are underlined and deletions are crossed out.

VOLUME I-B – APPENDICES

10. On the Cover of Volume I-B: **REMOVE** the bid opening date of "Wednesday, October 9, 2024" and **REPLACE** with new bid opening date "Wednesday, October 23, 2024."

11. Appendix C Listing of Sole-Sourced Products Specified in the Contract Documents: **REMOVE** and **REPLACE** with revised Appendix C Listing of Sole Source Products Specified in the Contract Documents.

12. Appendix D: **INSERT** the Instruction Manual Rotoflow Turboexpander with Dynamometer after the final page of Appendix D.

    Note: Changes to Appendix C Listing of Sole-Sourced Products Specified in the Contract Documents are shown as follows: additions are underlined and deletions are crossed out.

VOLUME II-A – TECHNICAL SPECIFICATIONS (DIVISIONS 02-26)

13. On the Cover of Volume II-A: **REMOVE** the bid opening date of "Wednesday, October 9, 2024" and **REPLACE** with new bid opening date "Wednesday, October 23, 2024."

14. Specification 05 05 14 Hot Dip Galvanizing: **REMOVE** and **REPLACE** with REVISED Specification 05 05 14 Hot Dip Galvanizing.

15. Specification 05 05 24 Shop and Field Welding and Brazing: **REMOVE** and **REPLACE** with REVISED Specification 05 05 24 Shop and Field Welding and Brazing.

16. Specification 22 11 19 Domestic Water Piping Specialties: **REMOVE** and **REPLACE** with REVISED Specification 22 11 19 Domestic Water Piping Specialties.

    Note: Changes to Specifications 05 05 14 Hot Dip Galvanizing, 05 05 24 Shop and Field Welding and Brazing, and 22 11 19 Domestic Water Piping Specialties are shown as follows: additions are underlined and deletions are crossed out.

VOLUME II-B – TECHNICAL SPECIFICATIONS (DIVISIONS 27-40)

17. On the Cover of Volume II-B: **REMOVE** the bid opening date of "Wednesday, October 9, 2024" and **REPLACE** with new bid opening date "Wednesday, October 23, 2024."

18. Specification 40 05 13 Process Pipe and Fittings: **REMOVE** and **REPLACE** with REVISED Specification 40 05 13 Process Pipe and Fittings.

19. Specification 40 05 23a Control Valve Purchase Specifications: **REMOVE** and **REPLACE** with REVISED Specification 40 05 23a Control Valve Purchase Specifications.

20. Specification 40 42 13.10 Process Piping Insulation: **INSERT** new Specification 40 42 13.10 Process Piping Insulation to Volume II-B following the last page of Specification 40 05 23b Purchase Specs Relief Valves (after Section 40 05 23 Process Valves).

21. Specification 40 70 70 Instrumentation for Process System – Data Sheets: **REMOVE** and **REPLACE** with REVISED Specification 40 70 70 Instrumentation for Process System – Data Sheets. Valve Tags for the Vibration Probes and Transmitters are included below:

MAC 1st Stage Vibration Probe	MAC 2nd Stage Vibration Probe	MAC 3rd Stage Vibration Probe
VE-501-1-1	VE-502-1-1	VE-503-1-1
VE-501-1-2	VE-502-1-2	VE-503-1-2
VE-501-2-1	VE-502-2-1	VE-503-2-1
VE-501-2-2	VE-502-2-2	VE-503-2-2

Model No: 330909 AXX BXX CXX DXX EXX

MAC 1st Stage Vibration Transmitter		MAC 2nd Stage Vibration Transmitter		MAC 3rd Stage Vibration Transmitter	
Current	Corrected	Current	Corrected	Current	Corrected
XIT-501-1	VT-501-1-1	XIT-502-1	VT-502-1-1	XIT-503-1	VIT-503-1-1
XIT-501-2	VT-501-1-2	XIT-502-2	VT-502-1-2	XIT-503-2	VIT-503-1-2
XIT-501-3	VT-501-2-1	XIT-502-3	VT-502-2-1	XIT-503-3	VIT-503-2-1
XIT-501-4	VT-501-2-2	XIT-502-4	VT-502-2-2	XIT-503-4	VIT-503-2-2

Model No: 990-05-50-03-00

22. Specification 43 01 10.17 Cryogenic Expansion Turbine Inlet Guide Vane Refurbishment: **INSERT** new Specification 43 01 10.17 Cryogenic Expansion Turbine Inlet Guide Vane Refurbishment to Volume II-B following the last page of Specification 40 95 13 Process Control Panels and Hardware.

23. Specification 46 31 58 Cleaning for Oxygen and Ozone Service: **INSERT** new Specification 46 31 58 Cleaning for Oxygen and Ozone Service to Volume II-B following the last page of Specification 43 01 10.17 Cryogenic Expansion Turbine Inlet Guide Vane Refurbishment.

    Note: Changes to Specifications 40 05 13 Process Pipe Fittings, 40 05 23a Control Valve Purchase Specifications, 40 42 13.10 Process Piping Insulation, and 40 70 70

Instrumentation for Process System – Data Sheets are shown as follows: additions are underlined and deletions are crossed out.

VOLUME III - DRAWINGS

The following listed Drawings have been revised under this Addendum. These REVISED Drawings shall **REPLACE** the respective Drawings provided with the original bid documents.

REVISED DRAWINGS		
Item No.	**Drawing Number**	**Rev No.**
	STRUCTURAL	
24	SD428-W4400-S001	1
MECHANICAL		
25	SD428-W4400-M102.3D	1
26	SD428-W4400-M102.3	1
27	SD428-W4400-M102.4D	1
28	SD428-W4400-M102.4	1
29	SD428-W4400-M102.5D	1
30	SD428-W4400-M102.5	1
31	SD428-W4400-M102.6D	1
32	SD428-W4400-M102.6	1
ELECTRICAL		
33	SD428-W4400-E102.3	2
34	SD428-W4400-E102.4	2
35	SS428-W4400-E121	1
36	SD428-W4400-E502	1
37	SD428-W4400-E503	2
38	SD428-W4400-E504	2
39	SD428-W4400-E505	2
40	SD428-W4400-E506	2
41	SD428-W4400-E507	1
42	SD428-W4400-E508	1
43	SD428-W4400-E902	1
INSTRUMENTATION		
44	SD428-W4400-I107	1
45	SD428-W4400-I108	1
46	SD428-W4400-I113	1
47	SD428-W4400-I114	1
48	SD428-W4400-I115	1
49	SD428-W4400-I157	1
50	SD428-W4400-I158	1

REVISED DRAWINGS		
Item No.	**Drawing Number**	**Rev No.**
51	SD428-W4400-I163	1
52	SD428-W4400-I164	1
53	SD428-W4400-I165	1
54	SD428-W4400-I169	1

Changes to the drawings are bubbled.

The following listed Drawings have been added under this Addendum. These NEW Drawings shall be **ADDED** to the Drawings in the original bid documents.

ADDED DRAWINGS		
Item No.	**Drawing Number**	**Rev No.**
MECHANICAL		
55	SD428-W4400-M102.7D	0
56	SD428-W4400-M102.8D	0
57	SD428-W4400-M103D	0
58	SD428-W4400-M103	0

BIDDERS MUST ACKNOWLEDGE RECEIPT OF THIS ADDENDUM ON THE BID FORM FOR CONSIDERATION OF THE BID BY THE DISTRICT.

Garin Warren

GARIN D. WARREN
Manager of Wastewater Engineering

DOCUMENT 00 41 02
Bid Form

SPECIFICATION SD-428

MAIN WASTEWATER TREATMENT PLANT OXYGEN PLANT REHABILITATION

NAME OF BIDDER _____

ITEM	DESCRIPTION	QUAN-TITY	UNIT MEAS-URE	UNIT PRICE (FIGURES)	LUMP SUM PRICE (IN FIGURES)
1	Mobilization and demobilization, and Construction to perform all work as shown on the drawings and as specified except for the following Bid Items.	1	Lump Sum	$_____	$_____
2	Oxygen Plant #1 Controls Upgrades	1	Lump Sum	$_____	$_____
3	Oxygen Plant #2 Controls Upgrades	1	Lump Sum	$_____	$_____
4	Cold Box Coatings Work (per plant)	2	Each	$_____	$_____
5	Main Air Compressor Motor Installation (per compressor)	4	Each	$_____	$_____
6	Per Specification Section 07 21 23: Remove and dispose of existing perlite from each cold box. Install new perlite in each cold box. (per plant) Remove and dispose of existing vermiculite and install new vermiculite in each turbine duct assembly. (per plant)	2	Each	$_____	$_____
7	Leak testing and oxygen pipe cleaning	1	Lump Sum	$_____	$_____
8	Allowance for partnership	1	Lump Sum	$20,000	$20,000
9	Allowance for unforeseen site conditions	1	Lump Sum	$200,000	$200,000

DOCUMENT 00 41 02
Bid Form

SPECIFICATION SD-428

MAIN WASTEWATER TREATMENT PLANT OXYGEN PLANT REHABILITATION

NAME OF BIDDER _____

ITEM	DESCRIPTION	QUAN -TITY	UNIT MEAS -URE	UNIT PRICE (FIGURES)	LUMP SUM PRICE (IN FIGURES)
10	Allowance for hazardous materials in addition to Bid Item 4	1	Lump Sum	$100,000	$100,000
11	Allowance for final record drawings	1	Lump Sum	$75,000	$75,000
12	Allowance for correcting electrical, instrumentation, and control wiring	1	Lump Sum	$200,000	$200,000
13	Allowance for relocating or repairing mechanical, electrical, instrumentation, control wiring, and pneumatic controls	1	Lump Sum	$350,000	$350,000
14	Refurbish Oxygen Plant #2 cryogenic turbine inlet guide vane	1	Lump Sum	$_____	$_____
SUBTOTAL BID in figures (sum of BID ITEMS 1 through 14)					$_____

THE BID FORM CONTINUES ON THE FOLLOWING PAGE.

DOCUMENT 00 41 02
Bid Form

SPECIFICATION SD-428

MAIN WASTEWATER TREATMENT PLANT OXYGEN PLANT REHABILITATION

NAME OF BIDDER _____

OPTIONAL BID ITEMS					
ITEM	DESCRIPTION	QUAN -TITY	UNIT MEAS -URE	UNIT PRICE (FIGURES)	LUMP SUM PRICE (IN FIGURES)
15	Refurbish Oxygen Plant #1 cryogenic turbine inlet guide vane	1	Lump Sum	$_____	$_____
TOTAL BID, INCLUDING OPTIONAL BID ITEMS (sum of BID ITEMS 1 through 15)					$_____

The Bidder shall bid on all items, including OPTIONAL BID ITEMS. Award of Contract will be based on the "TOTAL BID, INCLUDING OPTIONAL BID ITEMS" for Bid Items 1 through 15. See 00 41 05 DESCRIPTION OF BID ITEMS.

The price bid shall include all State, Federal, and other taxes applicable to the project, and shall be a firm offer for a period of one-hundred twenty (120) calendar days after the date of bid opening.

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In the event of any discrepancy, the award shall be based on Document 00 21 13 – Instructions to Bidders, Article 5.A

THE BID FORM CONTINUES ON THE FOLLOWING PAGE.

DOCUMENT 00 41 02
Bid Form

SPECIFICATION SD-428

MAIN WASTEWATER TREATMENT PLANT OXYGEN PLANT REHABILITATION

NAME OF BIDDER _____

BID DISCOUNT - To be eligible for the SB/DVB discount, bidders must check the Small Business and/or Disabled Veteran Business box below:

The Bidder is a:

❑ **Small Business and/or Disabled Veteran Business**, as described in the Contract Equity Program And Equal Employment Opportunity Guidelines (Document 00 43 39).

The District reserves the right to request support documentation, such as tax records, articles of incorporation and board minutes to verify composition of ownership and business size.

ADDENDA ACKNOWLEDGEMENT – Bidder shall check the project website for inclusion of addenda, if any, into this project and shall acknowledge the addenda, below.

ADDENDA - Receipt of the following addenda is hereby acknowledged:

Addendum Number	Date
_____	_____
_____	_____
_____	_____
_____	_____

DOCUMENT 00 41 05

DESCRIPTION OF BID ITEMS

Under each item listed on the Bid Form, perform the complete work indicated by that item. Payment for the various items will be made at the prices bid therefor, based on measurements and quantities (where applicable) as hereinafter described. Contract payment provisions, including adjustment of contract price on unit-price items, are covered by Section 01 29 00 Payment Procedures.

ITEM 1 All work as shown on the Drawings and as specified for improvements to the MWWTP's oxygen production facility and miscellaneous work, including but not limited to ~~replacement of four 1500-horsepower Main Air Compressor motors,~~ installation of a new fire protection and alarm system, and seismic retrofit of power distribution panels, except work included in the following items.

ITEM 2 Material and equipment, services, installation, construction and testing inherent to the Work for upgrades to Oxygen Plant #1. This work includes, but is not limited to, valve replacement, demolition of pneumatic tubing, work to furnish and install new valves, conduits, wires, and control panels. This bid item includes all work associated with Oxygen Plant #1 shown on the Drawings and specified except items specifically listed below.

ITEM 3 Material and equipment, services, installation, construction and testing inherent to the Work for upgrades to Oxygen Plant #2. This work includes, but is not limited to, valve replacement, demolition of pneumatic tubing, work to furnish and install new valves, conduits, wires, and control panels. This bid item includes all work associated with Oxygen Plant #2 shown on the Drawings and specified except items specifically listed below.

ITEM 4 All material, equipment, services, installation, construction and testing inherent to the Work associated with replacement of the coating replacement for the lower level of both cold boxes. This work includes but is not limited to: removal of existing coatings and surface preparation; containment and other lead paint abatement activities; re-coating of the cold boxes, testing, curing, and other appurtenant work, as shown on Drawing SD428-W4400-C102, as specified in Section 09 90 00, and as called out in the Contract Documents. Contractor shall include costs for handling and disposing of existing coatings high in lead that are generated as a result of the work.

ITEM 5 All equipment, services, installation, construction and testing inherent to the Work associated with replacement of four Main Air Compressor (MAC) Motors. This work includes but is not limited to removal of existing motors, rigging, protection of piping or conduits, temporary removal of piping,

installation, electrical and controls, testing, and all other work associated with the MAC motor replacement, as shown on the Contract Documents and in accordance with Section 22 05 00, Air Compressor Motor Replacement.

ITEM 6 Contractor shall include this item in the Total Bid. The Contractor shall remove and dispose of the existing perlite from each cold box. The Contractor shall washdown each cold box after the perlite is removed. The Contractor shall procure and install new perlite for each cold box. Work shall be completed in accordance with Section 07 21 23, Loose-Fill Insulation. Volume of perlite meeting the requirements of Section 07 21 23, Loose-fill Insulation shall be 7,400 cubic-feet for each cold box (this volume pertains to the media volume only, supersack volume may be greater). ~~Work shall be completed in accordance with Section 07 21 23, Loose-Fill Insulation.~~ This item shall also include removal and disposal of existing vermiculite from each turbine duct assembly and installation of new vermiculite. Contractor shall provide and install up to 200 cubic-feet (media volume) of vermiculite meeting the requirements of Section 07 21 23, Loose-fill Insulation for each turbine duct assembly.

ITEM 7 Leak testing in accordance with Section 01 75 17, Field Testing and Startup. Contractor shall be responsible for testing and retesting until leaks are repaired. Contractor shall clean all high purity and liquid oxygen piping, including stainless steel piping, in accordance with 01 35 13, Special Project Procedures. Contractor shall be responsible for consulting with its cryogenic oxygen expert to ensure proper safety and cleaning protocols are observed prior to returning high purity or liquid oxygen processes to service.

ITEM 8 Allowance for partnering, as described in Section 01 31 20. Contractor shall be reimbursed for actual expenses incurred with no mark-up. Any monies remaining shall be returned to the District.

ITEM 9 Allowance to pay for unforeseen additional work related to structural repair work, inaccurate electrical or mechanical as-built drawings (or needed field modifications), or additional start-up and commissioning support. This work may include additional demolition, concrete work, reinforcing, piping, coatings work, or conduit installation, to install all required improvements. Any monies remaining shall be returned to the District.

ITEM 10 Allowance for hazardous waste containment, treatment, and/or disposal with the exception hazardous materials generated in Bid Item 4. This allowance will pay for extra costs incurred due to the unexpected handling and disposal requirements if materials not specifically called out as hazardous in this contract are found to be hazardous. Any monies remaining shall be returned to the District.

ITEM 11 Allowance for the completion, delivery, of detailed final record drawings as required by Section 01 78 39 Record Drawings. Contractor shall submit monthly record drawings for new work done. Any monies remaining shall be returned to the District.

ITEM 12 Allowance will be made for the Contractor to~~an electrical subcontractor to~~ correct existing civil, mechanical, and electrical, instrumentation, communications, and control wiring issues in the construction area inconsistent with the drawings and/or as-builts. Any monies remaining shall be returned to the District.

ITEM 13 Allowance for relocating or repairing mechanical, electrical, instrumentation, control wiring, and pneumatic controls for improvements related to safety, operability, conflicts with existing piping or equipment, and/or access. Allowance includes touch-up of coatings or recoating of cryogenic oxygen equipment, piping, conduit, and supports. Repairs billed from this allowance shall be for existing leaky or damaged tubing, piping, cables, or conduits not damaged as a result of the Contractor's work activities. Any monies remaining shall be returned to the District.

ITEM 14 All equipment, services, installation, construction, sequencing, and testing inherent to the refurbishment of the Oxygen Plant #2 cryogenic expansion turbine inlet guide vane located in the turbine duct assembly. Work shall be completed in accordance with Section 43 01 10.17, Expansion Turbine Inlet Guide Vane Refurbishment.

ITEM 15 OPTIONAL BID ITEM: All equipment, services, installation, construction, sequencing, and testing inherent to the refurbishment of the Oxygen Plant #1 cryogenic expansion turbine inlet guide vane located in the turbine duct assembly. Work shall be completed in accordance with Section 43 01 10.17, Expansion Turbine Inlet Guide Vane Refurbishment. This work may be executed as an optional bid item by the District after it assesses the condition of the Plant #1 cryogenic expansion turbine. Work shall not be authorized without a separate Notice to Proceed (NTP) specific for this optional bid item.

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SECTION 01 35 13

SPECIAL PROJECT PROCEDURES

PART 1 - GENERAL

1.1 DEMOLITION OF EXISTING FACILITIES

A. The extent and sequence of demolition of existing facilities shall be as shown on the plans; and as described herein and in Section 02 41 13, Selective Site Demolition.

1.2 LIMIT OF CONSTRUCTION ACTIVITIES ON WORK SITE

A. All construction activities on the project site, including storage of equipment or materials, shall occur in the limits of work as shown on the plans. Access roads around the site must remain open at all times unless written approval has been given by the Engineer at least five (5) working days prior to temporary road closure.

1.3 WORK INVOLVED WITH EXISTING PLANT

A. General

Work shall include but not be limited to rehabilitation of the existing oxygen production facility. Work includes all work described herein the Plans and these Specifications and is summarized in 01 11 00, Summary of Work.

1. The work shall be executed while the oxygen production facility is in continuous operation. The operation of this facility shall not be jeopardized, nor shall the efficiency of the treatment process be reduced as a result of the execution of this work.

2. The oxygen production facility is in operation 24 hours per day, 7 days per week. The facility consists of two “cold boxes”, each of which is fed compressed air from two main air compressors (MACs). There are a total of four MACs. The work impacts both cold boxes and all four MACs. To maintain treatment capacity, no more than one cold box and one MAC may be out of service at any given time.

a. An additional (second) MAC may be taken out of service for brief (up to 4 hours) periods of time during dry weather flows and under normal plant operation with an approved System Outage Request (SOR) by the Engineer. Outages of more than one MAC at any given time shall be up to the jurisdiction of the District.

b. Coordinate MAC work with District's Contractor Cisco Air Systems, in accordance with 01 14 00, Work Restrictions.

3. The oxygen production facility also contains four liquid oxygen (LOX) tanks which can be used to supply oxygen in the event of an outage or unanticipated failure at the main production facility. The LOX tank system, vaporizers, and associated controls, must remain online at all times during the project, until work on both cold boxes is complete and both cold boxes have been successfully started up using the new control systems. The four LOX tanks at max capacity provide approximately 1-2 days of inventory in the event of an unanticipated failure.

4. The work involves replacement of the existing analog Control Panels (or Main Control Panels) with new DCS-based controls. All functionality of each cold box, its associated two MACs, and its associated additional standby MAC, must remain via its Main Control Panel until the DCS-based controls are in place, operational, and fully tested and accepted by the District for the other cold box and its associated MACs.

   a. If a temporary control system and/or workstation is needed to take an existing Main Control Panel out of service, the Contractor shall coordinate the design and functionality of the temporary control system with the Engineer no less than 30 business days prior to the requested start date of the outage. The Contractor shall provide a submittal for Engineer's approval of the temporary control system detailing how it will maintain the same functionality as the existing controls to be taken out of service. Submittal shall address how to test any temporary system. Failure to provide a functional temporary control system in a timely manner may result in delays for which the District shall not be responsible.

   b. Contractor shall note that there is only one hydrocarbon analyzer and it is mounted in the Main Control Panel for plant 2. This hydrocarbon analyzer shall remain operational at all times.

   c. Contractor shall note that there is only one single loop controller (PIC 635) for the LOX (or Driox) system and it is located in the main control panel for plant 1. This single loop controller for Driox shall remain operational throughout the upgrade to both cold boxes and all main air compressors at all times. Once the cold box and main air compressor upgrades are complete the Contractor shall fully install and wire the new electronic PID (proportional-integral-derivative) process controllers prior to replacing the associated control valve and instrumentation and transferring control from the existing single loop controller. The Contractor shall notify the District no less than four weeks ahead of the planned transfer of control.

d. Air supply tubing associated with existing analyzers located in the existing Main Control Panels (W-44-O2-AIT-355-1 & 2; W-44-O2-AIT-312-1 &2, W-44-O2-AIT-352-1 & 2) is scheduled for replacement as part of this work. New tubing shall be fully installed, tested and operational prior to demolition of the existing tubing serving this equipment.

e. Existing P/I panel in the Oxygen Plant Control Building shall not be demolished until successful startup of both oxygen plants after completion of the controls upgrade work. Verify power source for P/I (pressure to current) panel and provide temporary connection from LP1 (lighting panel 1) or LP2 (lighting panel 2) as needed to power P/I panel. Circuits 55/57/59 from LA-2 (breaker) feed LP1 and circuits 56/58/60 from LA-2 feed LP2.

5. The Contractor shall assume that certain work activities may temporarily disrupt the function of the plant and will require a planned outage. Article 1.5 of this Section details the requirements for outage, and the Contractor shall be required to meet the conditions of the outage restrictions and/or provide adequate temporary bypass facilities necessary for pumping, dewatering, chemical storage, temporary power, controls, instrumentation or alarms required to maintain control of the treatment plant process.

6. All planned outages and construction constraints described in this section shall be included in the project CPM schedule (see also Section 01 32 00 Construction Progress Documentation). All dates for outages and constraints shall be updated on the Contractor's three-week lookaheads.

7. When existing wire and/or conduit is reused for new installation, Contractor shall verify and confirm that all existing wires, cables, and conduits are functional, compatible, and in good condition when utilizing existing panels and junction boxes. If any discrepancies occur between the Drawings and field conditions, Contractor shall notify the Engineer.

8. Contractor shall trace all existing and new wires from the source of power (or MCC) to the field equipment. Contractor shall label all existing and new wire at the MCC and the field equipment.

9. Hearing protection is required when working near the main air compressors.

B. Outage of Treatment Process

1. Modifications to the existing facility, construction of new facility and connection of new to existing will necessitate temporary outage of the treatment process. The maximum duration of any outage shall be four hours unless specified otherwise in Article 1.6, Project Constraints or in

the Specifications. Treatment process outages shall not occur on consecutive days and shall be limited to two in any given seven (7) day period. The Contractor shall sequence its work activity to accommodate these outage restrictions. See also Article 1.6, Project Constraints.

2. The Contractor shall notify the Engineer in writing of any planned outage. See also Article 1.5, Outage Plan. The Engineer has the authority to modify any shutdown request if said work would adversely impact treatment processes.

3. The Contractor shall not begin an outage until the Engineer has granted specific permission for the outage.

4. The connections to existing facilities or other operations that interfere with the operations of the existing systems shall be thoroughly planned in advance, and all required equipment, materials and labor should be readily available on-site at the time of undertaking the connections.

5. Contractor shall notify the Engineer six weeks in advance of when it needs the oxygen plant shut down.

C. Operation of Equipment

1. Only District personnel shall perform operational functions or shutdown of existing facilities or systems required to facilitate the Contractor's work. The Contractor shall not adjust or operate any in-service equipment.

2. The District's plant operation and maintenance personnel will cooperate in a practical manner in order to facilitate Contractor's operation. However, certain shutdown and connections may only be permissible at times other than normal working hours, such as nights or weekends, at no additional cost to the District.

D. Protection of District Facilities

1. The Contractor shall take all necessary precautions to ensure that no damage occurs to the plant facility, including piping, utilities, roads, and structures that are to remain in operation and are not modified or replaced.

E. Cleaning for Oxygen and Liquid Oxygen Piping and Services

1. See Section 46 31 58, Cleaning for Oxygen and Ozone Service.

~~1. Cleaning Provider Qualifications~~

~~a. Experience minimum: 5 years in providing field cleaning services for equipment in high purity, liquid, or cryogenic-grade oxygen service in accordance with CGA publication No. G-4.1.~~

2. Contractor shall submit a SOR or specification for any oxygen piping cleaning work or oxygen assembly product cleaning work and indicate cleaning as a step on the SOR or submittal before handoff to the District. At a minimum, each cleaning submittal shall be approved by the Engineer and shall include:

a. Degree of cleaning in measurable terms.

b. Acceptable cleaning procedures per ASTM G93-03.

c. Inspection procedures required and method of inspection and testing assure the desired level of cleaning.

d. Acceptable cleaning materials.

e. Acceptable lubricants, sealants, and testing equipment.

f. Procedures and requirements to assure that the equipment supplier has complied with the cleaning specifications.

g. Packaging, protection, and storage of cleaned items.

h. The product information on all materials used, including, but not limited to:

1) Solvents.

2) Detergents.

3) Lubricants.

4) Drying agents.

5) Leak detection solutions.

6) Provider qualifications, experience description, and references.

3. Execution

a. Provider's personnel shall be thoroughly trained in the proper cleaning techniques, shall keep their clothing and hands free of oil and grease, and, when necessary, wear clean gloves.

b. Flammable solvents such as gasoline, kerosene, naphtha, mineral spirits, or acetone shall be used for cleaning.

~~e. The environment surrounding any high purity oxygen (>60%) and liquid oxygen equipment must be clean and dust free, with nearby grinding, welding, and sanding prohibited during cleaning procedures per ASTM-G93-03. For equipment requiring high degrees of cleanliness per ASTM-G93-03, classified clean rooms may be required for storing the equipment during final stages of cleaning until fully reassembled and installed.~~

~~d. All high purity oxygen (>60%) and liquid oxygen piping and manufactured products such as valves, regulators, and pumps that are removed from service shall be cleaned for the full length of pipe (not just the section being replaced) and manufactured products must be completely disassembled for cleaning in accordance with ASTM-G93-03 before being returned to service. Contractor shall verify that the entire length of pipe or any assembled product for any oxygen pipe worked on is free of debris and contaminants in accordance with ASTM-G93-03 prior to startup. When the components have been disassembled, parts shall be grouped according to cleaning method per ASTM-G93-03.~~

~~e. Purging any oxygen pipelines with nitrogen prior to removal of pipeline from service shall be done in coordination with the Engineer.~~

~~f. Factory or field cleaned piping shall be protected from contamination until they are placed back in service using the following methods:~~

~~1) Short-term protection for periods up to 1 week:~~

~~a) Pipe ends and other openings may be covered with metal or plastic caps or plugs, or with a double layer of 6-mil polyethylene film, sealed to the pipe or nozzle with waterproof tape.~~

~~2) Medium-term protection for periods between 1 week and 1 month:~~

~~a) Welding ends: Ends shall be closed with clean wedge projects or equivalent galvanized steel caps, sealed with 2 turns of Tuck No. 90 or equivalent 2-inch waterproof tape.~~

~~b) Flanged ends: Flanged ends shall be closed with 10-gage or heavier oxygen-cleaned steel flange covers over solid neoprene or "Durabla" gaskets, held in place with a least 4 hex-head bolts.~~

3) Long-term protection for periods longer than 1 month:

a) The cleaned line shall be filled with dry nitrogen pressurized to 2 psi.

b) Pressurized lines shall be identified at all significant flanges and valves.

4) Small parts:

a) Small parts such as valves, expansion joints, pressure gauges, etc., should be kept in heavy polyethylene bags or wrapped and sealed in polyethylene sheeting until installation.

5) Identification:

a) Any piping or equipment cleaned in the field as specified shall be identified as follows: CLEANED FOR OXYGEN SERVICE.

4. Safety and Liability

a. Contractor and Provider shall have full responsibility and liability for the safety aspects of the cleaning process.

b. Contractor shall be fully and solely responsible for any damage resulting from inadequate cleaning of oxygen piping and manufactured products, and for any hazards associated with the cleaning process.

c. Contractor shall have sole responsibility for ensuring that all high purity oxygen and liquid oxygen piping and manufactured products have been cleaned and recleaned, if necessary, and meet the requirements of this Section when placed into service.

d. Contractor shall comply with the requirements of Section 01 35 44 – Environmental Requirements for sampling and disposal of hazardous and non-hazardous wastes generated from the oxygen piping and manufactured products cleaning process.

1.4 SEQUENCE OF WORK

A. The following sequence of work for the oxygen production facility is provided for the Contractor's information as a potential sequence of work. Contractor may propose alternate sequencing as part of the baseline construction schedule submittal to the District.

1. Install new DCS control panel (Drop 23/73) associated with plant 2 along with associated network and power conduit and wire. Coordinate with the District to locate and install temporary workstation.

2. Contractor shall notify the Engineer six weeks in advance of when it needs the oxygen plant shut down. District will shut down oxygen (or cryogenic) plant, drain liquids and complete warm thaw.

3. Complete replacement of MAC motors associated with the cold box taken out of service, including installation of associated DCS control racks.

4. Allow District to shut off nitrogen purge to cold box.

5. Drain and dispose of vermiculite from turbine box (duct assembly) and wash down box interiors. Allow the Engineer to complete an internal inspection of the turbine box prior to subsequent work. Notify the Engineer when the turbine box is ready for inspection.

~~4.~~6. Remove cryogenic expansion turbine and inlet guide vanes from the turbine box. Move turbine to temporary storage and protect exposed piping and equipment. Ship inlet guide vanes to Engineer approved refurbishment shop for refurbishment.

7. Drain and dispose of perlite from cold box and wash down box interiors. ~~and vermiculite from turbine box.~~

~~5.~~8. Allow the Engineer to complete an internal inspection of the cold box prior to subsequent work. Notify the Engineer when the cold box is ready for inspection.

~~6.~~9. Demolish cold box valves, instruments, tubing, conduit, cable tray and wiring.

~~7.~~10. Demolish oxygen plant controls.

~~8.~~11. Cover/protect all open piping, fittings, and process equipment to prevent contamination and damage.

12. Complete recoating of lower portion of cold box per drawings and specifications.

13. Install new valves, instruments, tubing, fittings, cable, conduit, and other appurtenances, including cold end gel trap block valves (HV-X201A and HV-X203A) and rebuilt cold end check valves.

14. Complete internal cold box thermocouple installation, remaining internal cold box valve replacements, maintenance, and all leak testing. The District reserves the right to witness leak testing activities.

15. Allow the Engineer to complete an internal inspection of the cold box prior to filling the cold box with perlite insulation. Allow the Engineer to complete an internal inspection of the turbine box prior to filling the turbine box with vermiculite insulation. Notify the Engineer when the boxes are ready to be inspected.

~~9.~~

~~10.~~16. Install new DCS remote I/O panel associated with the turbine and cold box.

~~11.~~1. ~~Install new valves, instruments, tubing, fittings, and other appurtenances.~~

~~12.~~17. Install new conduit, cable trays, wiring, and other electrical and controls items.

~~13. Complete internal cold box thermocouple installation, internal cold box valve replacement, maintenance and all leak testing.~~

~~a. Allow District to inspect inside of cold box prior to starting work.~~

~~14.~~18. Install new perlite and vermiculite in cold box.

~~15.~~19. Complete installation of all remaining DCS field wiring terminations.

~~16.~~20. Commission and loop check all DCS controls and field instruments.

~~17.~~21. Notify the Engineer at minimum 60 days in advance of when the Contractor is ready to begin start-up and commissioning of an oxygen plant. Contractor's system integrator shall be on site during District start-up of the oxygen plant. Contractor shall begin performance testing once District has completed start-up of the oxygen plant.

~~18.~~22. Repeat steps for oxygen plant 1. Perform work on existing Drop 15/65.

B. Contractor shall follow the construction sequence as defined in this section and in consideration of other constraints in the specification.

1. Main Air Compressor 2-1 or Main Air Compressor 2-2. Only one of the four main air compressors shall be out of service at any given time.

2. Plant 2 Cold Box and Main Air Compressor 2-1 or Main Air Compressor 2-2, whichever main air compressor that was not replaced in step 1. Only one of the four main air compressors shall be out of service at any given time.

3. Main Air Compressor 1-1 or Main Air Compressor 1-2. Only one of the four main air compressors shall be out of service at any given time.

4. Plant 1 Cold Box and Main Air Compressor 1-1 or Main Air Compressor 1-2, whichever main air compressor that was not replaced in step 3. Only one of the four main air compressors shall be out of service at any given time.

5. LOX area work including valves, instrumentation, and controls associated with PIC-635 (LOX back-up control) shall begin only after both Cold Box 1, Cold Box 2, and all main air compressors have been fully commissioned and deemed fully operational.

6. Main Control Panel 1 and 2 selective equipment and tubing demolition and clean up. Demolish P/I panel (converter rack) and all associated tubing, conduit, and wire.

C. NOT USED.

D. Contractor shall sequence its operations such that one cold box and three Main Air Compressors (MAC) are in service at all times. Work shall proceed to upgrade one out-of-service cold box and its associated MAC(s) such that the complete assembly has been upgraded (including perlite replacement and painting work), tested, and is deemed ready for service by the District. Contractor shall note the time constraints for this work noted in Section 00 73 05.

1. Work shall not begin on a second oxygen plant until the first oxygen plant is upgraded and returned to service, and successfully undergoes a 90-day performance test.

2. Work shall not begin on a second oxygen plant until Drop 23/73 is installed, tested, and handed off to the District.

E. Work associated with the seismic retrofits of existing electrical equipment, except for MCCs P16 and MAC Motor Control Centers 2-1, and 2-2 (adjacent to switchgear S3), shall take place after the first oxygen plant has been upgraded and successfully undergone a 90-day performance test.

F. Work associated with the LOX tank area shall take place after the successful startup of both oxygen plants after the controls upgrades work is completed. LOX tanks shall remain in service at all times during the modifications to the cold boxes/oxygen plants.

G. Work associated with the cold box loose fill insulation (perlite and vermiculite), cold box painting, and cold box fall protection shall take place concurrent with the other upgrades at each cold box – only one shutdown of each cold box will be permitted during the project. Cold box loose fill insulation and cold box painting work shall be completed prior to start up of each cold box.

H. After removal of cold box loose fill insulation, hand over cold end check valves from cold box interior to District for refurbishment. Contractor shall hand over one set of cold end check valves for each cold box and replace any valves it damages or loses at no additional cost to the District.

1. For the first cold box worked on, District will provide one set of refurbished check valves to the Contractor. The refurbished check valves are stored at the District's MWWTP warehouse. Contractor shall coordinate handoff of the refurbished valves with the Engineer.

2. After Contractor hands off cold end check valves from the first cold box to the District, District will refurbish the check valves within 365 calendar days. After the check valves are refurbished, District will hand one set of refurbished cold end check valves to the Contractor for installation in the second cold box.

I. Work on motor control center (MCC) P15 necessitating an outage lasting over three hours to the MCC shall be completed while oxygen plant 1 is out of service. For outages over multiple consecutive days, Contractor shall reenergize MCC at the end of each work day or coordinate with the District to provide a temporary backup power supply for critical equipment on MCC P15. Contractor shall obtain approved SOR at least 4 weeks before planned outage.

J. Work on MCC P16 necessitating an outage lasting over three hours to the MCC shall be completed while oxygen plant 2 is out of service. Contractor shall reenergize MCC at the end of each work day or coordinate with the District to provide a temporary backup power supply for critical equipment on MCC P16. Contractor shall obtain approved SOR at least 4 weeks before planned outage.

K. Work on MCC P17, substation U10 and U11, and switchgear S3 shall take place after successful startup of both oxygen plants after the controls upgrade work has been completed. Contractor shall be limited to a 6-hour outage maximum each night between 11:00 P.M. and 5:00 A.M. Outages shall be limited to dry weather only. For the substations and switchgear, Contractor shall coordinate with the District to provide a temporary power supply for critical equipment during the outage. Contractor shall obtain approved SOR at least 4 weeks before planned outage.

1. Contractor may submit a plan for Engineer's approval to provide temporary power to equipment fed from MCC P17 to waive the night work and consecutive hours requirement. Loading is anticipated to be 600 kW. In its plan, the Contractor shall include a design to show how it will supply power to equipment on MCC P17 to allow the equipment to continue to operate while P17 is taken out of service. Contractor shall provide all equipment, conduit, materials, and labor necessary to install

the temporary system. Contractor shall remove the system once the outage is complete.

L. Isolation for the 2-inch 1W line in the oxygen control building is in the building's south end. The 1W line branches to the south to service Septage A and B. Contractor shall install flow isolation on the north branch of the 1W line servicing the oxygen plant and breakrooms to allow Septage A and B to remain in service during the 1W work. Outage to Septage A and B shall be coordinated with the Engineer and shall not last more than 2 hours. If a longer outage is needed, Contractor shall provide accessible temporary portable eyewashes and handwashing stations at Septage A and B, to be handed off to the District.

M. Isolation for the 5W main for fire protection work shall be limited to 2 hours. Contractor shall install new flow isolation at the stub-up to allow isolation of the 5W main from the new dry-action sprinkler system.

1.5 OUTAGE PLAN

A. Modifications to existing facilities, the construction of new facilities, and the connection of new to existing facilities may require the temporary outage of treatment processes or facilities. In addition to the construction schedule required under Section 01 32 00 Construction Progress Documentation, the Contractor shall submit a detailed outage plan and time schedule for all construction activities which will make it necessary to remove a cold box, Main Air Compressor, Liquid Oxygen Storage Tank or other facilities from service. The outage plans shall be submitted for the District's review and acceptance a minimum of four weeks in advance of the time that such outages are required. A System Outage Request (SOR) form as described in Document 00 73 05 Supplementary Requirements, shall accompany each outage plan. The outage plans shall be coordinated with the construction schedule specified in Section 01 32 00 Construction Progress Documentation and shall meet the restrictions and conditions specified in this section. The detailed plan shall describe the Contractor's method for preventing bypassing of other treatment units; the length of time required to complete said operation; any necessary pumping, dewatering, chemical storage, chemical feed, temporary power, controls, instrumentation or alarms required to maintain control, monitoring and alarms for the treatment plant processes; and the manpower, plant and equipment which the Contractor shall provide in order to ensure proper operation of associated treatment units. In addition, the outage plan shall describe the Contractor's contingency plan that shall be initiated in the event that its temporary facilities fail or it becomes apparent that the time constraints described in the approved SOR cannot be met. The contingency plan shall conform to all specified outage requirements. All costs for preparing and implementing both the outage and contingency plans shall be borne by the Contractor.

B. The District reserves the right to reject or modify any shutdown request as required for, but not limited to weather, process changes, staff limitations, etc. The Contractor shall then reschedule its operations so there shall be no conflict with necessary operations or maintenance of the plant. The Contractor shall, within two (2) working days, provide the District with a plan for rescheduling of the work in accordance with the requirements of Section 01 32 00 Construction Progress Documentation.

C. The District shall be notified in writing at least one week in advance of the required outage if the Contractor's schedule for performing the work has changed or if revisions to the outage plan are required.

D. The Contractor shall provide written confirmation of the shutdown date and time and schedule a shutdown coordination meeting two (2) working days prior to the actual shutdown.

1.6 PROJECT CONSTRAINTS

A. Critical events in the sequence of construction shall be utilized by the Contractor as a guideline. The construction constraints presented do not include all items affecting the completion of work, but are intended to describe critical events necessary to minimize disruption to the ongoing plant operation. It shall be understood and agreed by the Contractor that the critical events described are not all inclusive and that additional constraints not described may be required to minimize disruption and ensure compliance. Deviation from or modification of this suggested sequence may be permitted by the Engineer if techniques and methods known to the Contractor will result in reducing the disruption of the facility operation and efficiency, and is accepted in advance by the Engineer in writing.

1.7 SITE ACCESS

A. The project site is congested, and the Contractor shall conduct its operations to minimize interference with others. Access roads and circulation roads shall not be closed until dates are coordinated with the Engineer. An average of one hundred (100) trucks a day arrive and leave from the treatment plant site, consisting of sludge trucks, chemical deliveries, and other vehicles which will require daily access through the area. Continued road access shall be maintained by the Contractor for the activities indicated below.

1. All work at the oxygen plant, LOX fill station, and Septage A and B.

1.8 IMPACT ON DISTRICT OPERATIONS

A. If, in the opinion of the Engineer, any of the Contractor's proposed work will unduly impact the District's operations, such that the required wastewater treatment will be disrupted, then the Engineer may require the Contractor to

reschedule such work. If the rescheduling of the Contractor's work causes delay in the completion of the project, the Contractor shall follow General Conditions, Article 8 for request of time.

1.9 STORAGE OF TRENCH EXCAVATION

A. Excavated trench material, which is acceptable for use as backfill in the adjacent trench, shall not be stored in roads, public streets or highways. Excess excavated material shall be immediately removed from the site. After placing backfill, all excess material shall be removed immediately from the site.

1.10 RELOCATION OF UTILITIES

A. Work required in connection with utilities because of interference with contract work will be performed and paid for as specified in the following paragraph; however, when directed or approved by the Engineer, changes in line or grade of any structure being built may be made in order to avoid utilities. Any additional costs because of such changes in line or grade of any structure will be paid for as Extra Work.

1. By the District: When it is stated in the Contract Documents that a utility is to be relocated, altered or reconstructed by other than the Contractor, the District will perform such work, which will be done at no cost to the Contractor.

2. By the Contractor: When work on a utility is specified or indicated in the Contract Documents to be done by the Contractor, the Contractor shall make all arrangements and coordinate with the District as to when the work is to be done. If this work is not included as a separate bid item, all costs for such work shall be absorbed in the lump sum amount bid.

a. No attempt has been made to show service connections on the plans. However, the alteration or temporary relocation of all service connections (including but not limited to: sewer, natural or manufactured gas, underground and/or overhead telephone and electrical) to adjacent property shall be the responsibility of the Contractor. The Contractor shall make all arrangements with the utility owners regarding such work. All work necessary to relocate water mains and services shall be performed by the District. The costs for work on service connections shall be included in the lump sum amount bid.

3. By the Contractor or by others; unknown utilities (other than service connections) disclosed during contract work: In the event that a utility is disclosed or installed subsequent to the award of contract, such utility not being indicated on the drawings, the alteration, relocation or proper support and protection shall be done and paid for as extra work.

1.11 CONVENIENCE AND ACCESS

A. The Contractor shall conduct its operations so as to cause the minimum obstruction and inconvenience to the District's operations. No greater quantity of work shall be under construction at any one time than can be properly conducted with due regard for the District's operations. The Contractor shall notify the Engineer of the detailed sequence (daily activities) of its planned work at least ten working days in advance, to allow time for coordination of District's operations.

B. The Contractor shall provide access to all fire hydrants at all times.

C. Safe, adequate pedestrian access to all areas affected by the work shall be provided and maintained by the Contractor at all times.

D. All costs of complying with requirements of this Article shall be included in the lump sum bid.

1.12 OUTAGE OF SERVICE TO NON-DISTRICT UTILITY

A. Any utility (including electronic systems or traffic lane closures) outages shall be coordinated with the utility owner. At least two weeks' preliminary notice shall be given prior to any utility outage. Final notice shall be given a minimum of five (5) working days in advance of a utility outage. Any outage of utility service will be made by the utility owner upon such notice. Contractor shall not interrupt any utility service.

B. All materials and supplies for completing the connection and restoring utility service shall be on hand before utility service is interrupted. Service outages shall be limited to eight (8) hour durations. Contractor shall not leave the site until service is restored each day.

1.13 SITE ADMINISTRATION

A. Contractor shall be responsible for all areas of the site used by the Contractor and all subcontractors in the performance of the work. The Contractor shall exert full control over the actions of all employees and other persons with respect to the use and preservation of property and existing facilities, except such controls as may be specifically reserved to the District.

PARTS 2 AND 3 – NOT USED

END OF SECTION

SECTION 01 35 53

SECURITY PROCEDURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Requirements of this section apply to work at the Main Wastewater Treatment Plant (MWWTP), 2020 Wake Avenue, Oakland, CA.

2. Contractor shall comply with the District's protocol as described herein for personnel identification, site access control, and contractor deliveries. All Contractor personnel shall be badged or temporarily badged. Contractor may obtain a temporary badge at the guard shack. Contractor's staff without a badge shall check in with the guard shack at the front of the MWWTP.

3. Security of the site(s) and Contractor's equipment and tools shall be the Contractor's responsibility from commencement of work through contract completion.

4. Contractor's site security monitor shall be on-site and available at all times while work is being performed ensuring that requirements of this section are met. This individual may be the superintendent.

B. Related Sections:

1. Section 01 11 00 – Summary of Work

2. Section 01 14 00 – Work Restrictions

3. Section 01 35 24 – Project Safety Requirements

4. Section 01 50 00 – Temporary Facilities and Controls

1.2 SUBMITTALS

A. Provide daily sign-in log to the Engineer identifying all personnel on the job for that workday. Logs shall be provided to the Engineer at the end of each workday. Log shall include: individuals' full name, company and company phone number. Logs shall be scanned as a PDF and uploaded to the CMIS for each day of work; scanned logs shall be legible. Hard copies shall be maintained by the Contractor for District's review when requested.

B. Provide a legible photo copy of the personnel's current California Driver's License, California Identification Card (issued by the California Department of Motor Vehicles), or current driver's license or photo identification card from another State in the United States for all personnel working on site whether or not they have been issued a District photo identification badge. Provide these copies no later than the first day the personnel report to the work site. These copies shall be retained by the Engineer for the duration of the project and will be returned to the contractor or shredded, at Contractor's discretion, once the project is completed and all matters between District and Contractor are closed out.

C. Submit to the Engineer the Key Control Plan per Article 1.5 B.

D. Submit individual District photo identification badge application forms for all personnel who will work at the site and require badges per Article 1.3.B. Along with each application form, provide the Engineer with the following:

1. A copy of the individual's current California Driver License, California DMV Issued ID card, or the equivalent from another state. Contractor shall verify that each employee provides valid proof of his/her identity and that those employees who drive are properly licensed.

E. Submit name of individual(s) designated as the site security monitor(s), and that individual's cell phone contact number.

F. Submit to the Engineer acknowledgement of Contractor Deliveries requirements prior to allowing deliveries to the site.

G. Submit executed Photo Confidentiality Agreement prior to project mobilization.

1.3 PERSONNEL IDENTIFICATION AND BADGING

A. Contractor's personnel and all people associated with the work will be issued individual District photo identification badges that will be valid for the duration of the project.

B. Contractor shall make arrangements with the Engineer to schedule a day for employees to report to the MWWTP badging facility for preparation of photo identification badges. Proof of identification (e.g. driver's license) and a completed District Non-Employee Access Card Request Form (Form Number K-073A, see Appendix A) must be provided for each individual at the time they come to the District to have their photo taken upon issuance of a Photo ID Badge. The Contractor shall repeat this procedure on an as-needed basis when additional photographic identification badges are required. If a photographic identification badge cannot be immediately issued due to badging backlog, the Contractor's employee may perform work the same day using a temporary badge. The Contractor's employee is required to exchange the temporary badge for the photographic identification badge within five (5) days.

C. Record Keeping

1. Contractor shall keep a written record of the name, employer, work telephone number and a copy of the current driver's license or current State-issued identification card of each person issued a Photo ID Badge.

2. Lost or missing badges shall be reported immediately to the Engineer. Upon request, the District may issue a replacement card at the expense of Contractor.

3. A cumulative list of lost or missing Photo ID Badges shall be kept by the Contractor and submitted to the Engineer with monthly progress documentation, or upon the request of the Engineer.

4. All project specific Photo ID Badges shall be surrendered to the District no later than at the completion of the contract.

5. The Contractor shall immediately surrender to the District the badges of any Contractor's employee that is reassigned to other sites or terminated during the construction. The Contractor shall be responsible for collecting and returning the badges to the District when a contractor's staff leaves the company or is no longer assigned on that project; and all Photo ID Badges must be returned to the Engineer (who will return them to Security Administration) when the project is complete, with no exceptions.

D. The District will also issue badges at the MWWTP main gate badging station to delivery drivers and other temporary workers after reason for site visit is confirmed by the Contractor and the individual has signed in with the District's security officer. The badges shall be returned to the security officer upon leaving the site.

E. All personnel associated with the work shall be required to wear District-issued identification badge at all times while working at the site. Photo ID Badges shall be attached above the waist on outer garments or affixed to a hard hat and shall be visible at all times. Any Contractor employee or worker who does not display a photo identification badge while on site shall be required to leave the site or will be denied access until such time as they have an approved badge.

F. Upon request, badges shall be shown to District's staff or security officers. Persons without badges shall be required to immediately leave the site unless the Contractor's site security monitor can verify that the person is required on site.

G. Emergency (unplanned) occasional site access – For emergency access as determined by the Contractor and approved by the Engineer, the Contractor's site security monitor shall verify the identity of the visitor entering without a Photo ID Badge. That person will be deemed to be a visitor and must be escorted at all times while on the site, by a District employee or a Contractor employee that does

have a Photo ID Badge and is held responsible for that visitor. A legible photo copy of the visitor's current California Driver's License, California Identification Card (issued by the California Department of Motor Vehicles), or current driver's license or photo identification card from another State in the United States must be made on the site by the Contractor or the Engineer, and attached to the daily log of site personnel for that day.

H. The Contractor will be assessed $250 for each unreturned Photo ID Badge or each replacement badge, which shall be withheld from final payment.

I. Contractor and all other people associated with the work that enter the site are required to possess and carry a valid and current California Driver's License, California Identification Card (issued by the California Department of Motor Vehicles), or current driver's license or photo identification card from another State in the United States. This identification shall include a photograph and signature of the holder. Personnel without such identification shall be removed from the site by the Contractor.

1.4 BACKGROUND CHECKS

A. Upon request and at no additional cost to the District, the Contractor shall provide such information as necessary and as allowed by law to complete a background check on any person that enters the site.

B. The District reserves the right to deny access to the site to any person as allowed by law.

1.5 SITE ACCESS CONTROL

A. At the end of each workday, any gates, hatches, doors, windows, manways, and exterior ladders, etc. shall be secured, closed, and locked. Any alarmed system which is activated or disabled during the workday shall be tested through to the alarm monitoring station for proper actuation.

B. At the end of each workday, secure all equipment, hazardous materials, tools, materials, and flammable fluids. The Contractor shall maintain key control to assure only authorized personnel have access to equipment, hazardous materials, tools, materials, and flammable fluids. Prepare a Key Control Plan outlining the lock system to be used along with the list of personnel who will be issued keys and are authorized to use said keys. Upon loss of critical keys, the Contractor shall replace all corresponding locks and re-issue keys to prevent unauthorized access.

C. Unless otherwise indicated on the Drawings, existing fences and gates at the site shall remain intact and in use throughout construction. The existing perimeter security of the site shall be maintained at all times. Fences and gates that are breached due to construction (e.g., construction of a utility crossing under a

fence), shall be restored by the end of working hours each day. The District reserves the right to request additional fencing around any areas of the construction site. Additional fencing shall be paid as extra work.

D. Contractor-requested modifications to existing fences and gates are subject to Engineer's approval.

E. NOT USED.

F. At the Main Wastewater Treatment Plant, the District operates an existing security checkpoint officer at the Plant's main entry gate. The security checkpoint will be staffed by a District security officer during all regular working hours and other hours as may be determined by the District. As determined by the District, roving security officer(s) may also patrol the treatment plant property.

G. Facility perimeter gates are normally opened only for emergency or infrequent vehicle ingress/egress. Perimeter gates are to be kept closed at all other times.

H. The District reserves the right to establish a Security Check-in/Out location for any job site.

I. The District reserves the right to assign a District's security officer to provide security for any job site.

J. The Contractor is advised that all persons seeking entry to the site will be required to show proof of identification (e.g. driver's license). All Contractor's trucks and drivers are subject to the same identification and search requirements.

K. At all times, security measures at the site shall, at a minimum, be equal to the security measures prior to initiation of the project as determined by the Engineer.

1.6 DAILY SITE ACCESS PATH

A. General:

1. All personnel shall take the most direct path from their point of site entry to their work area and shall not loiter in non-work areas.

B. At the Main Wastewater Treatment Plant:

1. All personnel shall enter the site through the main gate on Wake Avenue and proceed directly to the work area of Contractor's on-site office.

2. Contractor's personnel shall use contractor-provided restroom facilities.

3. Contractor shall only park at designated areas. Contractor shall observe speed limit.

1.7 VEHICLE AND EQUIPMENT SEARCH

A. All vehicles and packages shall be subject to search by District designated security personnel or the Engineer.

B. Vehicles typically may be required to wait depending upon the amount of traffic. If the driver/owner of a vehicle will not allow the search, access to the site will be denied. All vehicles on District property may be searched for items that may pose a threat to the facility or to personnel. Informational signage will be posted in clear view at the entrance gate.

1.8 PHOTO CONTROL

A. Complete the Photo Confidentiality Agreement in Appendix A.

B. Restrict photos to work zone.

C. Photos, negatives, and other images of the project shall be destroyed at project completion when all claims are resolved.

D. The District reserves the right, at any time, to disallow photography at any site, of any District facilities, equipment, or processes which are deemed to be sensitive in nature, either due to current threat-level conditions or internal assessment of the business need and benefit to the District.

1.9 CONTRACTOR DELIVERIES – SECURE SITE

A. United States Postal Service, Federal Express, UPS, or similar mail and parcel deliveries may be addressed to the Contractor or any subcontractor or supplier to the Main Wastewater Treatment Plant, 2020 Wake Ave., Oakland, CA or other offsite point established by Contractor.

B. All deliveries shall be made during normal working hours as defined in Section 01 14 00 Work Restrictions.

C. Follow the guidelines in US Postal Inspection Service Publication 166, Mail Center Security Guidelines. A copy of these guidelines can be found at: http://about.usps.com/publications/pub166/welcome.htm.

D. Mail and Packages:

1. Contractor shall either:

a. Set up off-site package processing center with a separate address and then bring deliveries to the site with its own vehicles, or

b. Take delivery in a separate processing “shed” on site, but separated from main facility areas at a location approved by the Engineer.

This site can be the Contractor's separate temporary office facility outside of the main treatment plant gate.

2. All mail and packages whether delivered to the Contractor's onsite or offsite facility shall not be allowed into the Main Wastewater Treatment Plant until such time as they have been screened by Contractor's personnel in accordance with the US Postal Inspection Service Publication 166 mail and package screening guidelines, or with the Contractor's submitted mail screening procedures.

E. Freight and bulk deliveries:

1. All deliveries will be stopped at the security gate.

2. District's security officer will notify Contractor's site security monitor.

3. Truck drivers will be subject to the identification requirements as specified in Article 1.3 of this section.

4. Deliveries of freight and bulk (larger packages, crates, equipment, or materials) are permitted to enter the site only after:

a. The vehicle is met at the main gate by Contractor's site security monitor,

b. The source and contents of the packages, crates, equipment, or materials are verified by the Contractor's site security monitor,

c. The driver and others provide the security officer with sign-in information and badge(s) are issued to the driver (and others as required).

F. All freight and bulk deliveries made to the site may be subject to search and inspection regardless of the final delivery destination. The Contractor shall inform all delivery companies and drivers in advance that all freight entering the site is subject to search. Contractor shall submit acknowledgment from all freight and bulk delivery companies that the companies have been informed of and consent to such searches.

1.10 PRODUCTIVITY LOST AND COST INCURRED DUE TO SECURITY REQUIREMENTS

A. Time lost and/ or costs incurred due to compliance with District security measures (e.g., deliveries or personnel held at the gate without badges or identification, refusal of package deliveries, etc.) shall be deemed an inexcusable delay.

B. Failure to comply with these security measures may lead to the termination of the Contractor's right to proceed under the contract and may lead to termination of the contract, in accordance with 11.1 of Document 00 72 00 General Conditions.

1.11 PAYMENT

A. Full compensation for doing all work and furnishing all materials required to comply with site security requirements as specified in these Specifications shall be included in the price bid for the contract.

PART 2 - NOT USED

PART 3 - NOT USED

END OF SECTION

SECTION 01 75 17

FIELD TESTING AND STARTUP

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section covers general equipment and system testing and startup requirements, services of the manufacturer's representatives and special coordinating services required of the Contractor that shall apply during construction. Specific testing and tracking procedures and requirements found in the Technical Specifications shall also apply. Where testing and tracking procedures and requirements differ from requirements of this section, the more stringent shall apply.

B. The Contractor shall inform all subcontractors and manufacturers of the requirements herein and include the required services in the costs for the work specified in these Contract Documents. Where a minimum amount of time is stated in the Technical Specifications for manufacturers' services, any additional time required to perform the specified services shall be provided at no additional cost to the District.

C. Equipment testing and plant startup are requisite to satisfactory completion of the Contract and, therefore, shall be completed within the contract time. All equipment testing and plant startup activities shall be realistically allowed for and shown on the Contractor's Construction Progress Schedule, in accordance with Section 01 32 00 Construction Progress Documentation.

D. All equipment testing and plant startup activities shall be scheduled in conformance with the restrictions specified in Sections 01 14 00 Work Restrictions and 01 35 13 Special Project Procedures.

E. Equipment testing shall be satisfactorily completed prior to commencing plant startup associated with the particular equipment item or equipment package. The equipment shall not be considered ready for testing until the following conditions are satisfied:

1. Manufacturer's certification of equipment installation has been accepted by the Engineer.

2. Electrical and/or instrumentation subcontractor certification of motor control logic has been accepted by the Engineer.

3. Related Technical Submittals, O&M Manual and Final Shop Drawings have been accepted by the Engineer.

4. Operator training services have been furnished by the Contractor (must be completed prior to operational testing only), per Section 01 79 00 Demonstration and Training.

5. Testing procedures have been submitted in writing and accepted by the Engineer in accordance with Section 01 33 00, Submittal Procedures. All testing procedures and results shall be submitted in writing.

F. The requirements of plant startup specified herein shall also apply to the startup of individual treatment plant processes and facilities.

1.2 DEFINITIONS

A. Test Procedures: Test procedures shall include testing methods, acceptance criteria, procedures, and test data forms for functional, performance and startup tests.

B. Functional Test: The field testing required to determine if installed equipment or system will operate in a satisfactory manner and as specified. The Functional Test is a point-by-point test to confirm that all components associated with the equipment or system is operating properly. Functional testing is not intended to measure efficiency and performance.

C. Performance Test: The field testing required to demonstrate the individual equipment or system meets all of the specified performance requirements.

D. Startup Operational Test: A test of all systems operating together to demonstrate satisfactory performance of the facility as a whole for a continuous period.

E. Startup: The process of performing startup testing of the facility, which includes functional test, performance test, and startup/operational test.

1.3 FIELD TESTING INSTRUMENTS

A. Contractor shall provide all instruments and materials necessary to complete the field tests unless otherwise specified.

B. All instruments shall be calibrated. Certificates of calibration shall be current, and shall be at the job site during testing and provided upon request or when specified.

1.4 QUALITY ASSURANCE

A. All tests shall be subject to approval of the Engineer, and shall be witnessed by the District.

1.5 SUBMITTALS

A. Not less than ninety (90) calendar days prior to initial equipment or system startup, the Contractor shall submit to the Engineer for review, a detailed Facilities Startup Plan for the associated items of equipment and/or systems. The Plan shall be updated and/or revised as necessary prior to subsequent Construction Progress Meetings. Testing shall not be scheduled until the Plan is approved. Said Plan shall include:

1. A detailed sub-network of the Contractor's Construction Progress Schedule including the following activities: Manufacturer's Services; Installation Certifications; O&M Manual submittal; Functional Testing; Performance Testing; Operator Training; Startup Operational Testing; and all other activities necessary to effect a coordinated and successful Testing, Training and Startup.

2. Written test procedures with proposed checklists for each item of equipment to be tested and acceptance criteria indicating an acceptable test result. Separate procedures shall be provided for functional, performance, and operational testing.

3. A discussion of any coordination required with District staff and/or any system or equipment outage requirements.

B. Furnish names and telephone numbers of manufacturer's and vendor's current technical service representatives for use by the Engineer.

1. For preconstruction meetings, construction sequencing, outage of cryogenic equipment and process piping, functional testing, performance testing, and startup of the oxygen production system, including Main Air Compressors, ~~and~~ cold boxes, and liquid oxygen process systems, Contractor shall employ a Cryogenic Oxygen Plant specialist firm with a record of having successfully executed startups at least five Union Carbide "U" series cryogenic oxygen plants in the previous five years. Submit firm's qualifications, including reference contacts from at least five Union Carbide "U" series plants to the District for review.

2. The Contractor's Cryogenic Oxygen Plant specialist shall at a minimum be involved in the following activities:

a. Reviewing Contractor's submittals including work plans, baseline construction schedule/construction sequencing documents, project safety documents, and technical submittals.

b. Reviewing project test plans including start-up of major equipment, testing checklists, and system outage requests.

~~a.~~c. Attending training for cryogenic oxygen equipment provided in accordance with Section 01 79 00, Demonstration and Training.

C. At least sixty (60) calendar days prior to startup, provide a list of the manufacturer's recommended lubricants for use in the plant. All equipment lubrication shall be listed with the lubricant types and quantities recommended and approved by the equipment manufacturers. Provide the necessary lubricants for startup and the initial sixty (60) days of operation.

D. Upon completion of testing for each equipment item or system, the Contractor shall submit typewritten or word processed test reports and forms for review and acceptance. Submit test results with signed statement by manufacturer's representative that results meet specification requirements and manufacturer standards; when a manufacturer's representative is not required to be present during testing, this signed statement shall be provided by the Contractor. Upon acceptance, all test reports (including all factory and field testing) shall be inserted by the Contractor into their respective O&M manuals.

E. Final cold box leak check plan and P&ID markups of as-built conditions at least sixty (60) calendar days prior to startup of a cold box.

1.6 SYSTEM STARTUP AND TESTING

A. General:

1. The Contractor shall provide the effective coordination of all parties necessary for the successful project startup.

   The Engineer shall not be responsible to instruct the Contractor in the startup of the project, however, the Engineer will be available prior to and during startup to provide operational and technical support to the Contractor.

   The Engineer will be available to advise the contractor on any equipment or system startup that has, or could, have an effect on a plant operating process.

2. The Contractor shall furnish all labor, consumables (power, water, chemicals, air, etc.) tools, equipment, instruments, and services required and incidental to completing all functional, performance and operational testing of installed equipment.

3. The Contractor shall give the Engineer written notice confirming the date of testing at least five (5) working days before the time the equipment is scheduled to be tested.

4. All testing shall be witnessed by the Engineer to be considered valid.

5. Contractor shall submit written detailed results of all functional, performance and operational testing.

B. Functional Testing:

1. All items of mechanical and electrical equipment shall be functionally tested by the Contractor after installation for proper operation. A minimum of ten (10) days prior to the start of functional testing, the Contractor shall submit interconnection diagrams for the equipment and for the alarms, controls and instruments associated with the equipment. This requirement shall not relieve the Contractor of meeting any requirements in the technical specifications for earlier submittal of the interconnection diagrams.

2. The functional test of each piece of mechanical equipment shall continue for not less than eight (8) continuous hours without interruption.

3. The functional test, shall include checking for proper rotation, adjustment, alignment, mechanical and electrical connections, proper lubrication, speed, flows, pressure, vibration, sound level, etc. Initial equipment and system adjustment and calibrations shall be performed in the presence of and with the assistance of the manufacturer's representative.

4. The functional test shall include a demonstration of the proper performance of all alarms, local and remote controls (including DCS), instrumentation, equipment functions, and all other electrical, mechanical and piping systems.

5. All parts shall operate satisfactorily in all respects, under continuous full load, and in accordance with the specified requirements, for the full duration of the eight (8) hour test period.

6. If any part of a unit shows evidence of unsatisfactory or improper operation during the eight-hour test period, correction or repairs shall be made and the full eight (8) hour test operation, as specified herein, shall be repeated after all parts operate satisfactorily.

C. Performance Testing:

1. Where performance testing is required by the Technical Specifications, the testing shall be supervised by the manufacturer's representative. These services shall continue until such times as the applicable equipment or system has been successfully tested for performance and has been accepted by the Engineer for operational testing.

2. Performance testing shall take place after functional testing is successfully completed in accordance with Article 1.6 B.

3. Performance testing shall demonstrate that the equipment meets all performance requirements specified.

D. Startup/Operational Testing:

1. Upon successful completion of operator training and the functional, performance and leakage testing, the Contractor shall startup the plant facilities and test the equipment operation and performance by conducting a minimum seven (7) day, continuous operational test of the completed facilities as an operational process unit to demonstrate to the Engineer's satisfaction that all equipment and systems required by these specifications will operate in the manner in which they are intended to perform. Upon successful completion of operational testing, all equipment installation, testing, and maintenance records, shall be submitted to the Engineer. Said records shall be bound separately for each piece of equipment or system and shall be collected by type of record.

2. The District will provide Contractor-trained operating personnel for the duration of the operational test. Said operation shall be conducted and under the supervision and direction of the Contractor and/or manufacturer's representative.

3. All piping, conduit, equipment, and systems have been properly tagged and labeled.

4. All defects in materials or workmanship which appear during the operational test shall be immediately corrected by the Contractor. In the event of a malfunction or deficiency that results in shutdown or partial operation of a system or process unit or results in performance that is less than that specified, the startup duration shall be repeated for that corresponding system or process unit and any other affected equipment so its proper operation and performance as required by the Contract Documents is demonstrated for a minimum of seven (7) continuous and trouble free days.

5. If the operational test is interrupted through no fault of the Contractor, the test may resume at the earliest mutually agreeable time. The Contractor shall maintain a log of equipment or system deficiencies along with a description of required repairs to correct the problem.

6. No unit process or part thereof shall be placed in service until it has successfully completed operational testing.

7. During plant startup, the Contractor shall provide the appropriate construction trades and the services of authorized Manufacturer's representatives for operational testing and as necessary, to correct faulty equipment operation. All costs for corrective work and retesting shall be born by the Contractor.

8. After completion of all startup/operational testing, the Contractor shall repaint, hose, scrub, clean up and otherwise return the work to a "like new" condition, prior to District acceptance.

E. Factory testing:

1. The District reserves the right to witness manufacturer's factory testing. Costs associated with witnessing by two (2) District representatives shall be included in the Contractor's bid. These costs shall include travel costs, costs of transport to and from lodging, lodging, and a meal allowance per person per day. The lodging and meal allowance shall at minimum be the rates advertised by the U.S. General Services Administration for locations in the U.S and rates advertised by the U.S. Offices of Allowances for locations outside the U.S. The District reserves the right to witness factory testing of the following equipment:

a. New DCS Control Panels – Panels to be witnessed by District at panel fabricator shop after installation of DCS equipment (provided by Emerson). See 40 95 13, Process Control Panels and Hardware for more details.

2. If any of the witnessed tests cannot be accomplished in five 8-hour working days, or a test or portion of a test fails to the point where it needs to be rescheduled at a later date, additional tests shall be required at the Contractor's expense. Included shall be expenses for the Engineer's travel, accommodations, and sustenance of the same quality used for the original test.

3. Written factory test results shall be submitted to the Engineer at least ten (10) days prior to shipment. Equipment requiring factory tests shall not be delivered to the job site until the Contractor submits acceptable certified test results to the Engineer.

PART 2 - NOT USED

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall perform all functional and performance testing of installed equipment unless other specified.

B. The Contractor, at a minimum, shall maintain and provide to the District, the following records:

1. Daily logs indicating all equipment testing and startup activities and activities of all manufacturer’s representatives.

2. Records of all tests, calibrations, inspections, adjustments, services and corrective actions taken

C. In addition to the tests specified in the individual technical specifications, the Contractor shall perform additional tests as required by the Engineer to demonstrate to the Engineer's satisfaction that all equipment and systems required by the specifications will operate as intended.

D. If the testing of any equipment may affect the operation of existing District facilities, the testing shall be done under direct supervision of the Engineer. The Contractor shall comply with directions given by the Engineer.

E. Table 1 and 2 are a summary of equipment/systems that require functional, and performance tests. Additional testing may be required when specified elsewhere.

Table 1: Testing Summary

(Additional tests may be required in other specification sections)

Specification Section & Paragraph	System/Equipment Name	Functional Test Required	Performance Test Required
26 08 00, Part 3	Commissioning of Electrical Systems	Refer to Section	Refer to Section
40 80 00, 3.2	Commissioning of Process Systems	Refer to Section	Refer to Section
All equipment/systems required by these specifications shall be included in the Startup Test.			

Table 2: Power Equipment Testing Summary

(Additional tests may be required in other specification sections)

System/Equipment Name	Associated Circuit Breaker or Component	Circuit Breaker Test Required	Thermographic Survey Required
Switchgear S-3	Main breaker for Bus A and Bus B and Tie Breaker	N/A	Yes
U10, U11, U10-U11 Tie	Breakers	NETA	No
Main Air Compressor Motor (Qty 4)	Motor Protection Termination Box	N/A	Yes
MCC-P15	Main breaker and all feeder breakers	NETA	Yes
MCC-P16	Main breaker and all feeder breakers	NETA	Yes

MCC-P17	Main breaker and all feeder breakers	NETA	Yes
Main Air Compressor Motor Starter (Qty 4)	New MV Cable lug connection	N/A	Yes

3.2 SERVICES DURING CONSTRUCTION

A. General:

1. The Contractor shall provide the services of competent and experienced technical representatives of the manufacturers of all equipment and systems furnished under the contract, for as many days as may be necessary for assembly, installation and testing assistance. In each case, the Contractor shall arrange to have the manufacturer's representative revisit the job site as often as necessary until testing and startup problems have been resolved to the satisfaction of the Engineer. This requirement applies to manufacturers of all equipment furnished (excluding manually operated valves smaller than twenty-four (24) inches in size, and any other items of equipment specifically exempted by the Engineer in writing), whether or not specifically set forth in the Technical Specifications. The Contractor shall maintain a service record on each item of equipment and shall deliver these service records to the Engineer prior to acceptance of operational testing.

B. Fulfillment of Specified Minimum Services:

1. The Contractor shall obtain prior written approval from the Engineer for providing manufacturers' services. All requests to the Engineer for prior approval shall 1) be in writing, 2) be submitted not less than ten (10) calendar days prior to providing of the subject services, 3) state the service to be provided, and 4) state the reason(s) why the timing of the service is appropriate. Request made to the Engineer less than ten (10) calendar days prior to the manufacturers' services may not receive consideration and response prior to the times the services are provided. Visits of manufacturers and their representatives to the jobsite or training classroom without prior approval as provided herein may not act to fulfill the specified minimum man-day requirements.

C. Certificate of Proper Installation:

1. Equipment shall not be considered ready for functional testing until after the following certifications have been submitted and accepted by the Engineer.

a. The Contractor shall require that each manufacturer's representative furnish to the Engineer a written and signed report addressed to the District certifying that the equipment has been properly installed, adjusted, lubricated, is in accurate alignment, is free from any undue stress imposed by connecting piping or anchor bolts, has been operated satisfactorily under full-load conditions and is ready for full-time operation. For pumps, compressors, blowers, engines, motors, and other rotating or reciprocating equipment, the report shall certify that the equipment operates within the manufacturer's allowable limits for vibration. The report shall also certify that all controls, protective devices, instrumentation, and control panels furnished as part of the manufacturer's equipment package are properly installed and calibrated; and that the control logic for equipment startup, shutdown, sequencing, interlocks, and emergency shutdown has been tested and is properly operating. The Contractor shall also sign said certification. The Contractor shall submit "Manufacturer's Certification of Proper Installation" on the District form, provided at the end of this Section.

b. The Contractor shall require that the electrical and/or instrumentation subcontractor furnish a written and signed report to the Engineer certifying that the motor control logic for the equipment item that resides in motor control centers, control panels, control boards, microprocessors, distributed processing units, computers, and the like furnished by the electrical and/or instrumentation subcontractor has been properly tested and calibrated. The report shall certify that the control logic for equipment startup, shutdown, sequencing, interlocks, and emergency shutdown has been tested and is properly operating. The Contractor shall also sign said certification.

3.3 RECORD KEEPING

A. The Contractor shall maintain as a minimum, the following records:

1. Equipment manufacturer's shop drawings

2. Daily logs indicating all equipment testing and startup activities.

3. Log and time sheets of all manufacturers' representatives performing services on the jobsite

4. Updated equipment testing and startup schedules

5. Records of system cleaning

6. Hydrostatic and pressure test records

7. Equipment alignment and vibration measurements and corrective actions

8. Equipment lubrication records

9. Insulation resistance measurements

10. Electrical phase, voltage and amperage measurements

11. Electrical breaker inspection, test, and adjustment records

12. Logs of abnormal circuits and lifted wires

13. Testing and validation of all central and alarm functions

14. Data sheets of all testing and calibration of instrumentation devices and control loops including documentation of set points

15. Equipment and system release logs (from construction to startup)

16. Daily work reports

17. Adequate manufacturer's instruction file so that the information will be readily available during equipment testing and startup.

18. A record of flushing and chemical/mechanical cleaning

19. Prior to startup, provide the Engineer with a record of all test data and the work completed.

3.4 CONSTRUCTION

A. Removal of temporary bracing:

1. Prior to equipment testing, remove all temporary supports, bracing, or other foreign objects that were installed in vessels, transformers, rotating machinery, or other equipment to prevent damage during shipping, storage, and erection, and repair any damage sustained.

3.5 FIELD QUALITY CONTROL

The general work procedures listed below outline the work to be performed by the Contractor. Additional procedures applicable to specific equipment items are specified elsewhere.

A. General

1. Operate the equipment and check for excessive vibration, abnormal operating noises, overheating and lubricant leakage, etc., and test any safety shutdown/alarm devices for proper operation, and make any

operating tests required by the Engineer. The adjustments required for proper operation shall be made prior to operational testing.

2. Prior to startup, all sidewalks, gratings, handrails, safety chains, safety shields, etc., shall be installed.

3. Prior to startup, demonstrate to the Engineer's satisfaction that all chemical solution pipelines are connected to the intended tank(s), feeder(s), pump(s), and application points, and that the pipes, appurtenances contained therein and diffusers will operate at the intended flow rates.

4. Prior to startup, the applicable safety equipment, emergency shower and eyewash units, fire extinguishers, fire suppression equipment, self-contained breathing apparatus, toxic and/or combustible gas detectors (including the respective personnel warning system), protective clothing, emergency repair kits, etc., shall be installed in an acceptable manner-subject to the Engineer's approval, and be fully ready for operation.

5. All safety hazards, e.g., exposed drive shafts or rotating equipment members, exposed electrical circuitry, open electrical junction boxes and panels, improperly supported piping and conduits, missing safety devices, etc., shall be corrected prior to supplier training of the District's personnel.

6. The Contractor shall perform a comprehensive safety inspection and correct any safety deficiencies found before implementing plant startup.

7. Roadways that are required for ambulance service, fire fighting access, delivery of treatment chemicals and supplies, and disposal of the treatment byproducts shall be completed prior to startup.

8. Prior to startup, install all warning and safety signs, labels, and devices.

9. Test all tanks and internals, as required to demonstrate conformance to the Contract Documents. Dispose of test media in a manner that is acceptable to and approved by the District and the applicable regulatory agencies.

B. Electrical power and lighting systems:

1. Provide the Engineer with 3-day advance notification in writing of the test schedule. The Contractor is advised that the tests shall be witnessed by the Engineer.

2. Perform insulation resistance tests on all wiring 120 volt and larger. Do not meggar instruments or solid-state devices.

3. Perform insulation resistance tests on all motor and transformer windings from phase to phase and phase to ground.

4. Perform grounding system tests to determine the continuity of connections and the value of resistance to ground.

5. Fill electrical gear with oil and/or other media as recommended by the equipment manufacturer.

6. Prior to substantial completion and startup, test and set switchgear and circuit breaker relays for proper coordination and operation.

7. The Contractor shall obtain the services of a qualified "independent testing service", member of the National Electric Testing Association, to perform a thermographic survey on all switchgear buses, insulators and power connections when energized and under at least 20 percent load. Significant hot spots shall be further checked by infrared pyrometer for exact temperature rise. The Contractor shall troubleshoot and correct the thermographic hot spots. Correction shall be verified by repeating the thermographic survey at no additional cost to the Owner.

8. The Contractor shall obtain the services of a qualified "independent testing service", member of the National Electric Testing Association, to inspect and test the protective relays and the 800-ampere and larger drawout breakers for proper installation, adjustment, and operation in accordance with the manufacturer recommendations.

9. The Contractor shall obtain the services of a qualified "independent testing service", member of the National Electrical Testing Association, to perform DC high potential tests on all cables that will operate at more than 2,000 volts to ground.

10. Obtain local electrical inspector's approval where required.

11. Energize all substations, with approval of the Utility Company and the Engineer after completion of all electrical testing.

12. Prior to startup, perform tests and adjustments on all switchgear and motor control equipment to demonstrate proper operation and conformance to the Contract Documents and manufacturer's recommended settings.

13. Prior to startup, test installation of emergency power and lighting systems for proper operation, including light intensity.

14. Vacuum clean all electrical equipment prior to startup and acceptance.

C. Cryogenic Oxygen Production Piping Systems and Valves Leak Testing:

1. Provide the Engineer with three (3) day advance notification in writing of the schedule for nonoperating field leak tests or field pressure tests on

piping and field fabricated equipment, unless otherwise directed by the Engineer.

2. Contractor shall submit their plan for leak testing at least 60 days prior to startup of a cold box. Contractor shall identify any existing leaks prior to start of Work that will not be repaired as part of the Work. Contractor shall repair any leaks found as a result of its Work.

3. Contractor shall submit sample test forms that will be used for all tests.

4. Pressure Zones in Cryogenic Oxygen Plant:

   a. There are two pressure zones in the cryogenic oxygen plant. They can be described as high pressure and low pressure.

   b. The high pressure passages and vessels of the plant operate at between 60-70 PSIG. The high pressure passages and vessels include, but are not limited to, the lower column, the cold end gel trap, the reversing heat exchanger, the switch valves, the cold end check valves, and the high pressure side of all the miscellaneous piping.

   c. The low pressure passages and vessels operate at between 4-6 PSIG. The low pressure passages and vessels include, but are not limited to, the upper column, the recirculating gel trap, the low pressure side of the cold end check valves and switch valves, and the low pressure side of all the miscellaneous piping and heat exchangers

5. Leak testing shall be performed before an isolated system of the plant is put online. Leak testing shall be performed around any breakage in process piping, flanges, or fittings throughout the project. All fittings, fasteners, and process piping and vessels that contain pressure shall be leak tested before access is lost to those areas of the plant. This applies both inside and outside the cold box. Leak testing shall occur for each individual valve, flange, and fitting included in the Work.

6. One final leak check of the cold box as a system is required prior to filling the cold box with insulation and proceeding with the start-up of the cold box.

7. Leak testing shall be performed by pressurizing the line associated with the flange, fitting, or valve which had undergone work. The line shall be pressurized to operating pressure using air from the main air compressor. Once the line is pressurized the entire area shall be sprayed with an approved leak check solution. The area shall then be monitored for a period of ten minutes for bubbles. Any bubbles are an indication of a leak. Areas with leaks shall be re-fastened and re-checked until no bubbles

appear. No leaks are acceptable. Testing pressures for low pressure areas of the plant shall not exceed 7 PSIG and higher pressure areas of the plant shall not exceed 70 PSIG.

8. Valve testing occurs when the valve is fully open and when the valve is fully closed. Both flanges shall be fully sprayed with a leak check solution. The valve packing shall be sprayed as well to ensure that there are no packing leaks. The valve shall be actuated twice during this process, fully open and fully closed, to ensure the valve is not being jarred into a leaking position.

9. All pressure vessels and process piping internal to the cold box shall be sprayed with leak check solution and check for full system integrity. This includes but is not limited to heat exchanger seams, thermowells, threaded fittings, compression fittings, flanges, valves, and welded caps to ensure absolutely no leaks are present inside the cold box.

10. Compression fittings shall be sprayed with a leak check solution on both sides of the fitting. It is important that the fittings are not applied incorrectly and not overtightened. If this occurs the Contractor shall replace the fitting.

11. Blind flanges inside the cold box shall be leak tested by spraying a leak check solution around the entire flange when the associated pressure vessel is at operating pressure or slightly below relief valve settings. Relief valve settings are 7-8 PSIG for low pressure passages and vessels, and 60-70 PSIG for high pressure passages and vessels. -The area shall be monitored for a period of 10 minutes if any bubbles or leaks are formed or detected the blind flange should be re-fastened and re-tested.

12. A leak down test shall occur after all valves are installed to ensure that no valves are leaking across their seat. This test would show that pressure is not migrating across valve seats and into other areas of the plant. Measure pressure upstream and downstream of the valve.

13. Insulate or paint piping, flanges, threaded joints, or field welds after the specified testing of each item has been completed unless instructed otherwise by the Engineer.

14. Prior to substantial completion and startup, check pipehangers, supports, guides, and pipe specialties for the removal of all shipping and erection stops and for the correctness of the cold and hot settings for the design service. Make adjustments as necessary to obtain proper installation. Provide the Engineer with instructions for the hot settings.

15. Prior to startup, install all of the valve and piping system identification labels.

16. Prior to startup, check and record the position of all process system valves.

17. Prior to startup, correct support, vibration, and thermal expansion problems detected during the preliminary equipment testing.

18. Prior to the startup, retorque all hot and cold service bolting as required to ensure a permanent and proper installation.

19. Prior to startup, demonstrate to the Engineer's satisfaction that each piping system (e.g., chemical, sample, utility, irrigation process, etc.) functions as designed and required by the contract documents.

D. Final Cryogenic Leak Check Procedure:

1. A final leak check shall take place after all valve and fitting work has been completed. This final leak check shall be fully documented and marked up on a copy of updated P&IDs to ensure that each valve, fitting, and fill port has been thoroughly checked and monitored for a ten minute period for any bubbling and leaking. In order to properly leak check valves in and around the cold box, the cold box must be set up properly in order to maintain proper pressure without setting off relief valves or putting low pressure components at risk. The Contractor shall work with the District during the leak check to assist in starting the compressor and operating various manual valves to complete the check. A sample procedure is provided below, Contractor may propose modifications to this procedure except where leak checks are called out.

    a. Align valves and remove any blind flanges blocking air flow from the chosen main air compressor to the cold box to be tested.

    b. Ensure that the interconnection valve between the two plants is closed so the running plant is not impacted by the leak test.

    c. Close all manual process valves including the cold end gel trap isolation valves.

    d. Ensure that all work in and around the cold box is completed and that valves are operational and in their fail-safe positions. All calibration of transmitters, valves, and flow meters should be completed to verify pressures throughout the plant.

    e. Start the intended main air compressor with the assistance from District and allow the compressor to come online. The compressor should be allowed to idle for ten minutes before loading to operating pressure.

f. After approximately ten minutes load the compressor to 60-65 PSIG. Once pressure has stabilized set the pressure in auto to maintain 60-65 PSIG throughout the leak check procedure.

g. Air should be flowing and pressurized at the inlet switch valves. Using a listening device check that no air is moving past the switch valves. If air is moving past the switch valves then the closed stop on the actuator will need adjusted to close the valve completely.

h. After checking that the inlet switch valves are leak free, introduce air through the switch valve bypasses and allow pressure in the reversing heat exchanger up to HV-X201A which should be closed, to balance with the MAC pressure. Air flow into the plant should stop when equalized.

i. Check that there is no air flowing out of the waste nitrogen switch valves with a listening device. If any air is flowing from these valves their closed stop will need to be adjusted prior to continuing with the test.

j. Spray both pairs of switch valves with leak check solution and ensure they are not leaking.

k. Spray the inlet check valves (HV-Y113A and HV-Y112A) on both flanges to ensure there are no leaks.

l. After waiting for the check to be completed the inlet air switch valves should be actuated and rechecked. The packings on all switch valves shall also be checked at this time.

m. Once the inlet check valve leak check is complete the cold end gel trap should be pressurized by cracking open HV-X201A to allow flow into the gel trap. Once pressurized close HV-X201A and keep track of how long it takes for pressure to drop in the cold end gel trap. Leak check HV-X201A while waiting for a pressure drop.

n. Once the leak check of HV-X201A is complete slowly open HV-B201A to allow air to flow into the lower column. Allow the lower column to pressurize to 60-65 PSIG. Once the lower column is pressurized check that no pressure or flow is going into the upper column which is the low-pressure column.

o. If pressure is flowing into the upper column, adjust FV-213A, LV-330A, and FV-340N until no flow is present.

p. Perform a flow test on FV-213A, LV-330A, and FV-340N.

q. To perform a flow test with the above valves, the upper column will need to be at or close to 0 PSIG. Slowly open the valve to be tested and wait for the upper column pressure to rise. Once the pressure has risen to 2-3 PSIG close the valve and vent out the FV-601X product oxygen vent valve. Repeat test for the above valves.

r. Once the flow test has been completed the entire system needs to be pressurized. Open FV-213A, LV-330A, and FV-340N about 15-20% and open FV-601X until the pressure in the upper column reaches at least operating pressure (5 PSIG) but no greater than 7 PSIG. At this time all valves all sides of the valves will be pressurized. Leak check all valves, fittings, fill ports, and valve packings including instrument tubing external to the cold box.

s. All found leaks shall be noted on approved test forms and corrected. After correcting the leaking point shall be rechecked to ensure proper seating.

t. After testing, close the switch valve bypasses and open the waste nitrogen switch valves (FCV-113N & FCV-114N) to depressurize the plant through the upper column. Check the packings on these valves to ensure they are not leaking.

u. Once the plant has depressurized close all valves and return them to their fail-safe position.

3.6 ADJUSTING AND CLEANING

A. Mechanical equipment:

1. Level baseplates and soleplates and grout under all load bearing surfaces.

2. Install suitable supports and flexible connections to alleviate any piping stresses that may be imposed on pumps, compressors, and drivers.

3. In accordance with the manufacturer's recommendations, chemically clean lube oil, seal oil, and cooling systems. Dispose of waste and cleaning media in a manner that is acceptable to and approved by the District and applicable regulatory agencies.

4. In accordance with the manufacturer's recommendations, charge the lube oil, seal oil, and cooling systems with flushing media and circulate for cleaning purposes. Dispose of any flushing media in a manner that is acceptable to and approved by the District and applicable regulatory agencies.

5. Charge the lube oil systems, seal oil systems, and cooling systems with the amount and type of operating oil or coolant recommended by the manufacturer.

B. Tanks:

1. Prior to startup, conduct chemical cleaning or flushing operations as specified. Dispose of wastes and cleaning media in a manner that is acceptable to and approved by the District and the applicable regulatory agencies.

2. Prior to startup, install all chemical identification, warning, and safety signs and labels.

C. Removal of rust preventives:

1. Prior to equipment testing, remove all rust preventives and oils used to protect the equipment during the construction period whenever these protective materials will be detrimental to operation or equipment maintenance.

D. Lubricants:

1. Flush systems and install the initial charge of all lubricants. Dispose of flushing oil in accordance with applicable regulations.

2. The Contractor shall lubricate the equipment in accordance with the manufacturer's recommendations until the equipment is accepted by the District.

3. Maintain a lubrication record for each item of equipment. The Contractor shall submit the lubrication records to the Engineer prior to equipment testing.

E. Packing and seals:

1. Install, adjust, and replace packing, mechanical seals, and accessories, as necessary, during the equipment testing and startup period.

2. Adjust seal water and flushing water flow rates in accordance with the equipment manufacturer's recommendations.

F. Rotation, alignment, and vibration:

1. Prior to equipment testing, check rotating machinery for correct direction of rotation and for freedom of moving parts before connecting the driver.

2. Prior to equipment testing, perform the cold alignment and hot alignment to the manufacturer's tolerances.

3. Prior to equipment testing, test equipment vibration and correct any vibration in excess of the manufacturer's recommendation.

G. Tie-ins at the contract limits:

1. Obtain approval and make the necessary tie-ins at the unit limits as required by the Contract Documents and as approved by the Engineer.

2. Prior to startup, remove the temporary blind flanges, plugs, bulkheads, seals, etc.

H. Pressure/vacuum safety relief devices:

1. Prior to equipment testing, test and adjust all safety devices as recommended by the equipment manufacturer.

2. Prior to plant startup, provide the Engineer with a list of all field or factory equipment settings.

I. Flushing and chemical/mechanical cleaning:

1. Prior to equipment operation, conduct all flushing, blowing, and chemical/mechanical cleaning operations without using the permanently installed equipment.

2. Provide any special media needed for flushing and/or cleaning purposes.

3. Dispose of all media in a manner that is acceptable to and approved by the District and the applicable regulatory agencies.

4. All systems shall be free of trash and construction debris before initiating startup.

J. Screens and strainers:

1. Provide and install temporary strainers and screens necessary to protect the equipment and to test the equipment and pipelines.

2. Prior to startup, remove all of the temporary blinds and temporary appurtenances.

3. Clean the screens and strainers as required during startup.

4. At the end of startup, clean all of the permanently installed screens and strainers.

K. Purging/inerting:

1. Prior to startup, purge and/or passivate the facilities as specified.

2. Install purge/inerting connections in accordance with the manufacturer's recommendations.

3. Provide purge or inerting materials and conduct the necessary operations as recommended by the equipment manufacturer.

L. Drying out:

1. Prior to startup, dry out the facilities as specified or recommended by the equipment manufacturer to prevent contamination of catalysts, operating materials, and/or product

2. Dry out systems, protective coatings, refractories, and linings as specified or recommended by the equipment manufacturers.

M. Cryogenic equipment and piping:

1. Prior to returning oxygen piping to service, clean all oxygen valves and piping in accordance with ASTM-G93-03.

END OF SECTION

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MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

This is to certify that the equipment supplied by (MANUFACTURER'S NAME) and described as (NAME OF EQUIPMENT) has been installed in accordance with manufacturer's recommendations. The equipment was inspected by an authorized manufacturer's representative on (DATE) and has been serviced with the proper initial lubricants and is free from any undue stress imposed by piping or supports. Applicable safety equipment has been properly installed and proper electrical and mechanical connections have been made. Proper adjustments have been made and the equipment and or system is ready for operation. All reports have been submitted to the District and the equipment and or system is certified for field testing and startup in accordance with Specification SD-[number] [project title], Section 01 75 17 Field Testing and Startup.

Authorized Manufacturer's Representative		Contractor's Representative	
Title	Date	Title	Date

MANUFACTURER'S CERTIFICATE OF FUNCTIONAL TESTING ASSISTANCE

Functional testing, including checks for proper rotation, alignment, speed, excessive vibration, and noisy operation has been performed The equipment has been operated under full-load conditions and is ready for full-time operation. Controls, protective devices, instrumentation, and control panels are properly installed and calibrated. The control logic for startup, shutdown, sequencing, interlocks, etc. has been tested and is properly operating. This testing, including initial equipment and system adjustment and calibrations, was performed in the presence of the manufacturer's representative on (DATE).

Authorized Manufacturer's Representative	
Title	Date

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SECTION 01 79 00

DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included: Perform training of District personnel for furnished or installed equipment, systems and facilities operation. Develop training program including scheduling, and coordination of training activities and training materials. Specific training procedures and requirements found in the technical sections shall also apply. Coordinate training program with District's Consultant who is the designer of record for this project.

B. Related Sections:

1. Section 01 32 00 – Construction Progress Documentation

2. Section 01 75 17 – Field Testing and Startup

3. Section 40 80 00 – Commissioning of Process Systems

C. All training activities shall be shown on the Contractor's construction schedule in accordance with Section 01 32 00 Construction Progress Documentation.

D. Contractor and Contractor's Ceryogenic Oexygen Pplant specialist shall meet with the Engineer to review training requirements including, training schedules, lesson plans, learning objectives, content outline, instructional delivery methods, and other details as determined by the Contractor and/or the District. This meeting shall occur prior to submitting training documentation, and will be held at the Main Wastewater Treatment Plant, 2020 Wake Avenue, Oakland, CA, or other location as determined by the Engineer. Subsequent meetings may be required if all issues cannot be adequately addressed. All manufacturers' training representatives should be present at this meeting. The Contractor shall bring O&M manuals (hardcopy and electronic format), for all systems requiring training, to the meeting.

0.1. The District's DCS supplier will provide one 8-hour training session on DCS Equipment and hardware. The Contractor shall coordinate with the District's DCS supplier to provide supplementary training and training materials during this training session on Contractor installed DCS equipment related to installation, preventative maintenance, photo documentation, and as-builts. The Contractor shall work with the DCS supplier to update training materials to match as-built conditions. The Contractor shall coordinate scheduling of the DCS supplier's training to occur prior to the 90-day operational test for the first Oxygen Plant.

1.2 SUBMITTALS

A. Submit a minimum of ninety (90) calendar days prior to training and include within the Facilities Startup Plan as specified in Section 01 75 17 Field Testing and Startup:

1. Comprehensive training schedule identifying all training by specification section and paragraph number

2. The Contractor's Training Coordinator name

3. Training lesson plans for each specification section requiring training. Each lesson plan shall include learning objectives and a content outline with approximate time scheduled for each topic.

4. Manufacturer's training representative's resume demonstrating their qualifications and ability to perform the specified training services.

5. Contractor shall advise the Engineer in writing of any special coordination required for any system or equipment outages.

B. Submit a minimum of one (1) working day after final training session the attendance list(s).

1.3 TRAINING OF DISTRICT PERSONNEL

A. General

1. Operation and maintenance training of District personnel shall be provided as specified under this section (see Table 1 at end of section) or as required under other sections. These training services shall be provided by the manufacturer's representative and shall include classroom and hands-on instruction.

2. The Contractor shall provide all equipment and materials required for training.

3. Training shall be conducted by competent representatives who are certified by the manufacturer to be thoroughly familiar with the subject matter as well as instructional methods.

4. Training materials shall be submitted to the District (see Paragraph C below) for review. Acceptance of training materials is required prior to start of training.

5. All training shall be completed prior to beginning operational testing.

6. The District shall have the right to videotape any or all training sessions, or may designate separate sessions or portions thereof for the sole purpose of videotaping.

7. Training Locations: All classroom training shall be at District facilities or other locations within the San Francisco Bay Area as determined by the District unless otherwise specified. Coordinate the exact locations for training sessions with the District.

8. Training shall ensure measurable and observable means that District personnel are qualified to perform equipment task requirements, including essential knowledge, skills, and abilities. If the Contractor or the manufacturer's representative fails to provide training which qualifies the District personnel to perform equipment task requirements, the Contractor hereby agrees to provide remedial training to ensure District personnel proficiency at no additional cost to the District.

9. The Contractor shall require that all training instructors prepare and utilize an attendance list. The Contractor shall submit the completed list to the District within one (1) working day following completion of each training session.

B. Training Schedule

1. The Contractor's coordinator shall coordinate the training periods with District personnel and manufacturer's representatives, and shall submit a training schedule and the training materials for each piece of equipment or system for which training is to be provided. Said training schedule shall be submitted not less than 21 calendar days prior to the time that the associated training is to be provided and shall be based on the then current Plan of Operation.

2. Equipment and/or systems shall be deemed suitable for use in training upon satisfactory completion of functional testing.

3. All training with regards to a unit process or part thereof shall be completed prior to the start of operational testing.

4. The Contractor shall provide distinct and separate training sessions for both operations and maintenance personnel, meeting the following criteria:

   a. Maintenance training shall be provided for each piece of equipment listed in Table 1. The Contractor shall provide two (2) separate training sessions at a time agreed to by the Engineer. One training session shall focus on mechanical equipment and the other shall concentrate on electrical, instrumentation, and control. Training shall emphasize theory of operations, troubleshooting, and preventative maintenance and repair procedures.

b. Operations training shall be provided for each piece of equipment listed in Table 1. The Contractor shall provide two (2) separate training sessions for each of three (3) operating shifts (total of 6 training sessions). Sessions are to be provided for each shift, on Tuesday through Thursdays only, within the following time periods.

1) Day Shift 8:00 a.m. - 2:00 p.m.

2) Swing Shift 4:00 p.m. - 10:00 p.m.

3) Grave Shift 12:00 a.m. - 6:00 a.m.

Training session schedules shall be approved by the Engineer. Training shall emphasize theory of operations, startup instructions, emergency and normal shutdown instructions, lockout procedures, troubleshooting, preventative maintenance, and alarm and control logic.

5. The Contractor shall confirm each training period a minimum of three (3) working days prior to the schedule time.

6. If a manufacturer's representative fails to conduct a scheduled training class, the Contractor hereby agrees to compensate the District for labor costs, including overhead, for all District personnel in attendance for the entire scheduled training period.

C. Training Content:

1. O&M Manual Review: Provide a thorough discussion of the contents of the final approved O&M Manuals, including the following:

a. Procedures for contacting the manufacturer's representative for equipment field service.

b. Procedures for ordering parts

c. Discussion of equipment warranty

2. Maintenance Training:

a. Training objectives

b. Routine and preventive maintenance

c. Adjustment procedures

d. Overhaul procedures

e. Identify lubrication and adjustment locations

f. Maintenance access locations

g. Maintenance safety precautions

h. Trouble shooting guide

i. Field test procedures

3. Operations Training:

a. Training objectives

b. Principles of operation

c. Discussion of all design features

d. Startup, shutdown, and emergency operating procedures

e. Operational safety precautions

D. Training Acceptance: Training that does not meet the following training criteria may not be accepted, and the training shall be repeated at the Contractor's expense including all costs for District trainee time.

1. Training shall present all information necessary to properly operate and maintain the system or equipment.

2. Training shall present all material as submitted in the approved training lesson plan.

3. The trainer's expertise shall be sufficient to accurately respond to questions posed by the trainees related to the system or equipment operation, maintenance, or principles of operation.

4. Training shall be efficient and without unrelated or irrelevant discussion. Breaks during training sessions shall be limited to 30-minutes total for each four-hour session.

5. Training Evaluation: Training will be evaluated at the end of each training session by the trainees. The evaluations will be one means used by the District to determine if the training adequately instructed District personnel on the proper operation and maintenance of the systems and equipment provided. A typical training evaluation form is included in Appendix A.

1.4 TRAINING COORDINATOR

A. The Contractor shall designate one member of the Contractor's staff to be the Training Coordinator. To maintain training continuity, the Training Coordinator shall not be replaced throughout the duration of the Contract unless the Training

Coordinator is unable to continue the work (termination of employment, long-term illness, etc.), or unless specifically agreed to by the District.

B. The Training Coordinator's responsibilities shall include, but not be limited to:

1. Develop a training schedule that is coordinated with all project schedules, and is acceptable to the District.

2. Work with the District Training Administrator to identify and schedule training locations at District facilities or other locations as needed.

3. Coordinate and supervise all facets of each training session. Provide any necessary training materials including computers, overhead projectors, screens, white boards, flip charts, etc.

4. Coordinate scheduling of manufacturer visits for training.

5. Coordinate professional video taping of all training sessions, and participate in editing of the final training videotapes before submittal to the District.

6. Provide refreshments for each training session (coffee, tea, juice, cold soft drinks, a selection of bakery items and fresh fruit, etc.).

PART 2 - NOT USED

PART 3 - EXECUTION

3.1 GENERAL

A. Table 1 is a summary of equipment/systems that require training. Additional training may be required when specified elsewhere.

Table 1: Training Summary (Additional Training May be Required in Other Sections)	
Specification Section & Paragraph or Drawing	System / Equipment Name
22 05 00	1500 horsepower main air compressor motors – Contractor shall provide training from the motor manufacturer's representative or firm with expertise on motors of similar size, type, and application – as approved by the Engineer – on an overview of the motor components, preventative maintenance activities and frequency, autotransformer tap settings, and alarms.
26 09 16	Schweitzer Engineering Laboratories (SEL) 710-5, motor protection relay for main air compressors. SEL 2600, motor stator RTD.
40 70 70	Bently Nevada main air compressor vibration probes and transmitters W-44-LOS-VE/W-44-LOS-VT
40 80 00	DCS drops, all equipment and instrumentation being integrated into DCS, remote I/O cabinets, and new DCS workstations.
SD428-W4400-S011	Fall protection system. Refer to note 2.4 on Sheet SD428-W4400-S011

B. DCS Training: Contractor shall coordinate with District provided cryogenic specialist and District provided DCS provider to lead training sessions on overall oxygen plant operations. Training sessions shall provide integrated approach to operating the renovated oxygen plant.

END OF SECTION

TRAINING MATERIAL REVIEW CHECKLIST

Lesson Title: _____

Project: _____

Contractor: _____

Date: _____ Reviewed by: _____

YES	NO		
_____	_____	1.	Are learning objectives identified for the lesson material?
_____	_____	2.	Are the objectives/lesson plan contents sequenced properly?
_____	_____	3.	Do the learning objectives describe skills and knowledge appropriate for the position?
_____	_____	4.	Do the lesson plan contents support the learning objectives?
_____	_____	5.	Do the lesson plans include adequate teaching and evaluation methods?
_____	_____	6.	Do the lesson contents include industry events, facility events, or other experience-related items?
_____	_____	7.	Are learning activities included which involve the trainees and enable learning?
_____	_____	8.	Do the references and texts sufficiently support the lesson material?
_____	_____	9.	Do the lesson plans incorporate the use of audio-visual materials?
_____	_____	10.	Is the use of handouts and other trainee materials consistent with the objectives, usable and complete?
_____	_____	11.	Are the lesson materials current?

Lesson Materials Approved _____

Revise Lesson Materials and Resubmit _____

Comments: _____

_____

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INSTRUCTOR QUALIFICATION CHECKLIST

Date: _____

Project: _____

Contractor: _____

Instructor: _____

Documents Provided for Assessing Instructor Qualification: (Resume, Certificates, Letters of Reference, etc.)

_____

_____

_____

_____

YES	NO		
_____	_____	1.	Instructor has necessary educational, experiential and technical qualifications to present subject matter.
_____	_____	2.	Instructor has necessary knowledge of instructional methods, strategies and objectives as well as skills to conduct training.

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A P P E N D I X C

LISTING OF SOLE-SOURCED PRODUCTS SPECIFIED
IN THE CONTRACT DOCUMENTS

Specification Section	Product	Reason for Selection
26 09 16	Schweitzer Engineering Laboratories for motor management relays and fiber optic cable	Sole-source selection of the specified product is needed to reduce spare parts inventory and keep the equipment usage and training consistent.
40 70 00	Rosemount for air and oxygen level and pressure sensors/transmitter	Sole-source selection of the specified product is needed because the District has standardized on this manufacturer for most applications, in order to avoid the increased costs associated with maintaining a larger amount of spare parts and training Maintenance staff on multiple equipment manufacturers
40 70 00	Phoenix Contact for current transducers	Same as above.
40 70 00	United Electric for digital temperature switches	Same as above.
40 70 00	Bentley Nevada for vibration transmitters	Same as above.
40 70 00	Wilcoxon vibration transmitter iT301	Same as above.
40 05 13	Stainless steel tubing Swagelok compression fittings	Sole-source selection of the specified product is needed because the District has standardized on this manufacturer for most applications, in order to avoid the increased costs associated with maintaining a larger amount of spare parts.

END OF SECTION

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INSTRUCTION MANUAL

ROTOFLOW

TURBOEXPANDER

with

DYNAMOMETER

Designed & Manufactured

for

UNION CARBIDE CORPORATION

LINDE DIVISION

Tonawanda, NY

P.O. 825-29704-X

Project 6586

EAST BAY MUNICIPAL UTILITIES DISTRICT

Oakland, CA

ROTOFLOW Job 1158

September 1975

ROTOFLOW CORPORATION
2235 Carmelina Avenue
Los Angeles, CA 90064
Telephone: (213) 477-3083
Telex: 67-3687

TABLE OF CONTENTS

		PAGE
SECTION ONE - DESCRIPTION & TECHNICAL DATA		
1-1	INTRODUCTION	1-1
	UNIT IDENTIFICATION	1-1
1-2	DESIGN SPECIFICATIONS	1-2
1-3	SEAL GAS REQUIREMENTS	1-2
1-4	LUBRICATION SYSTEM DATA	1-3
1-5	RECOMMENDED CONTROL SETTINGS	1-4
1-6	DETAILED DESCRIPTION	1-6
	A. Turboexpander	1-6
	B. Seal Gas System	1-6
	C. Dynamometer	1-7
	D. Lubrication System	1-8
	E. Alarm & Shutdown Control System	1-8
SECTION TWO - INSTALLATION		
2-1	EQUIPMENT FOUNDATIONS	2-1
2-2	COLDBOX CONNECTIONS	2-1
2-3	PLANT PROCESS CONNECTIONS	2-1
2-4	PIPE CONNECTIONS	2-2
2-5	SEAL GAS SYSTEM	2-2
2-6	LUBE OIL COOLER	2-3
2-7	VARIABLE NOZZLE	2-3
2-8	SAFETY SHUTDOWN VALVE	2-3
2-9	ELECTRICAL CONNECTIONS	2-3

PAGE

SECTION THREE - OPERATING INSTRUCTIONS

3-1 PRECAUTIONARY INSTRUCTIONS 3-1

3-2 PRE-START INSTRUCTIONS 3-1

3-3 INITIAL STARTING PROCEDURE 3-3

A. General Instructions 3-3

B. Detailed Instructions 3-3

C. Seal Gas Flow Adjustment 3-6

3-4 NORMAL OPERATIONS & PERIODIC SERVICE 3-6

3-5 NORMAL SHUTDOWN 3-7

3-6 EMERGENCY SHUTDOWN 3-8

3-7 THAWING INSTRUCTIONS 3-8

3-8 PRESSURE TAPS 3-9

3-9 TROUBLE SHOOTING 3-9

A. Oil Pressure - Failure to Come Up to Normal 3-9

B. Variable Nozzles Failing to Return to Closed Position 3-9

C. Oil Dripping Out of the Bearing Oil Seal 3-10

D. Excessive Seal Gas Requirement 3-11

E. Low Efficiency 3-11

F. Too Cold to Start 3-12

G. Expander Housing Gasket Leaking 3-13

SECTION FOUR - MAINTENANCE

4-1 DISASSEMBLY 4-1

A. Rotating Assembly - Field Removal 4-1

B. Rotating Assembly - Disassembly 4-2

		PAGE
	C. Nozzle Assembly	4-4
	D. Nozzle Actuator Assembly	4-5a
4-2	CLEANING & REASSEMBLY	4-6
4-3	INSPECTION & ALLOWABLE WEAR DATA	4-6
4-4	RECOMMENDED SPARE PARTS	4-9
4-5	FIELD SERVICE	4-10

SECTION FIVE - DRAWINGS

SECTION SIX - COMPONENT MANUFACTURERS' DATA

SECTION SEVEN - REVISIONS

K&E 10 X 10 TO THE INCH • 7 X 10 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

ROTOFLOW CORPORATION
LOS ANGELES CALIF 90045

PERFORMANCE OF DYNO LOADED EXPANDER

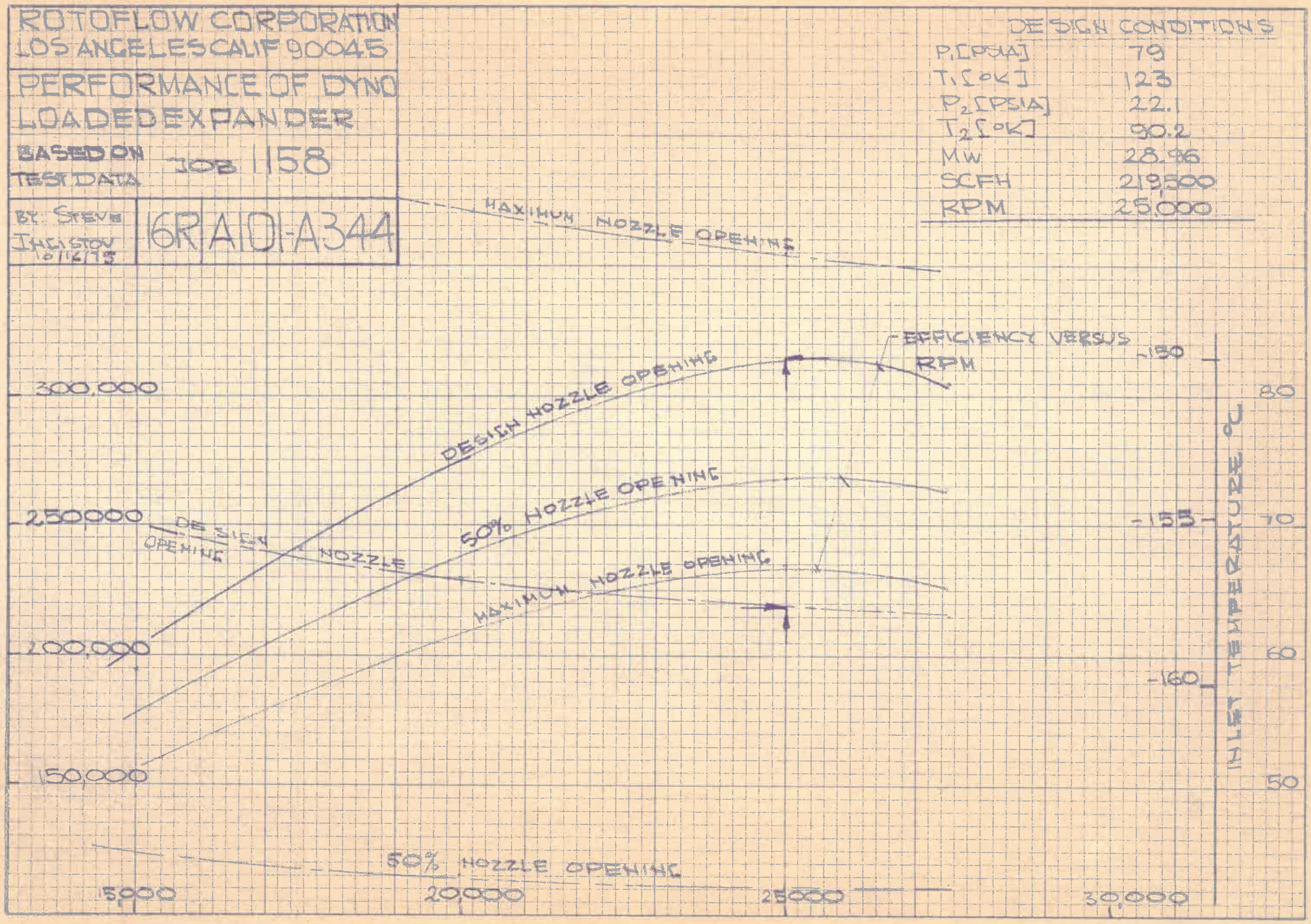
BASED ON TEST DATA JOB 158

By Steve Ingliston 10/16/75

16RADI-A344

DESIGN CONDITIONS

P_1 [PSIA]	79
T_1 [°K]	123
P_2 [PSIA]	22.
T_2 [°K]	90.2
MW	28.96
SCFH	219,500
RPM	25,000



SECTION ONE

DESCRIPTION & TECHNICAL DATA

1-1 INTRODUCTION

The units described in this manual are two identical 79.5 hp, 79 psia, turboexpanders, to be used for the expansion and refrigeration of air.

The power developed by the turboexpander shaft is absorbed and rejected in the form of heat by an integral oil-filled dynamometer, located on the opposite end of the shaft.

Each unit is supported vertically in Purchaser's piping and is serviced by its own separately skid-mounted lubrication system with attached control panel.

UNIT IDENTIFICATION

	Model Number	Serial Number
Turboexpander Unit I	20R-5E2D	18904
Turboexpander Unit II	20R-5E2D	18906
Lube Console Unit I	20R1158D8	18905
Lube Console Unit II	20R1158D8	18907
Spare Rotating Assembies		
Unit I	20R-5E2D	18908
Unit II	20R-5E2D	18934

1-2 DESIGN SPECIFICATIONS

Condition	Design	Off-Design Minimum	Off-Design Maximum
Molecular Weight	28.96	28.96	28.96
P_1, psia	79	79	79
T_1, °K.	123	153	119
P_2, psia	22.1	20.8	23.8
T_2, °K.	90.2	118	90.5
Flow, SCFH	219,500	91,300	306,600
Flow, Lbs/hr	16,440	6,840	22,965
Horsepower	79.5	36	94.5
Speed, rpm	25,000	19,500	26,500
Efficiency %	83	68	78

Critical Rotor Resonance Speeds: None

1-3 SEAL GAS REQUIREMENTS

	Process Seal	Bearing Oil Seal
Unit	Expander	
Gas	Dry air	Dry air
Rate	15 SCFM Normal (Approx.) 29 SCFM Maximum	2 SCFM
Supply Pressure	60-100 psig	3 psig
Temperature	70°F.	

1-4 LUBRICATION SYSTEM DATA

Reservoir Capacity		
Maximum Level	96 gal. (9" from bottom)	
Minimum Level	53 gal. (5" from bottom)	
Oil Specifications		
Type	Light non-foaming turbine oil	
Viscosity @ 100°F.	100-150 SSU	
Viscosity Index	75 or higher	
Pour Point	-25°F. or lower	
Additives	None required	
System Requirements	**Bearings**	**Dynamometer**
	C-2	C-1
Lube Oil Supply Pressure	130 psig	100 psig
Lube Oil Reservoir Pressure	Atmospheric	
Bearing Oil Temperature In	115°F.	120°F.
Normal Temperature Rise	38°F.	14°F.
Cooling Water Requirements		
Flow, Water	11.5 gpm	43 gpm
Oil	7 gpm	70 gpm
Design Pressure, Oil	200 psig	150 psig
Water	150 psig	150 psig
Design Temperature	300°F.	300°F.
Water Temperature In	75°F.	75°F.
Out	85°F.	85°F.
Heat Exchanged	57,000 Btu/hr	215,000 Btu/hr

1-5 RECOMMENDED CONTROL SETTINGS

Refer to System Schematic and Wiring Diagram Drawings.

Condition	Component	Function	Setting
Accumulator Charge Pressure	AC-1	Emergency Oil Supply	45 psig
Instrument Air Supply to Nozzle Positioner	FV220A	Positioner Supply Pressure	35 psig
Nozzle Actuator Signal Pressure	FV220A	Flow Control	3-15 psig
Nozzle Actuator Stroke	FV220A	Stroke Travel	.745 in. Unit I .749 in Unit II
Seal Gas Pressure	PCV-580	Control	45 psig
Seal Gas Pressure	PCV-584A	Control	3 psig
Seal Gas Pressrue	PSV-580A	Pressure Relief	48 psig
Seal Gas Pressure	PSL-580	Alarm	32 psig dec.
Shaft Overspeed	SE-219	Alarm/Shutdown	26,300/ 27,500 rpm inc.
Oil Reservoir Heater	TSL-20	Control	80°F. inc.
Oil Pump Discharge	PSV-20L	Safety Relief	160 psig
Bearing Oil Supply	PCV-21L	Pressure Control	130 psig
Bearing Oil Supply	PSL-23-2	Alarm	110 psi dec.
Bearing Oil Supply	PSL-23-1	Shutdown	90 psi dec.
High Oil Drain Temperature	TSH-24-2	Alarm	175°F. inc.
High Oil Drain Temperature	TSH-24-1	Shutdown	185°F. inc.

Condition	Component	Function	Setting
Dynamometer Oil Supply	PSV-22L	Safety Relief	100 psig
Dynamometer Oil Supply	FY220	Oil Pressure Relief	To actuate below 10,000 rpm

1-6 DETAILED DESCRIPTION

Refer to the Service Assembly and System Schematic Drawings.

A. Turboexpander

The expander nozzle assembly surrounds the periphery of the expander rotor. The nozzles may be used to control the flow and may act as a back pressure regulator. The rate of the process gas flow into the expander is controlled by the variable clearance between the nozzle vanes. This clearance is adjusted by an external air nozzle actuator in response to Purchaser's air signal. Regardless of the degree of change made to the vanes, the resulting velocity streams are guided into the rotor at the correct angle; and this, in combination with ROTOFLOW's nozzle and rotor, gives high efficiency over a wide range of flow.

B. Seal Gas System

The expander has ROTOFLOW's "oil-free" seal wherein the process gas pressure is sealed around the shaft by a labyrinth seal between the expander and atmosphere. The bearing case has its own oil seal. The shaft is exposed between these two seals for protection against possible entry of oil and is further protected by outward leakage of gas permitted out of the labyrinth seal. However, to prevent loss of process gas, there is a provision at an intermediate point of the labyrinth seal to inject a stream of compatible, warm, less valuable pressurized

gas (referred to as "seal gas") at a rate slightly higher than that leaking out through the seal.

The seal gas is supplied by Purchaser. The control system consists of a regulator, filter, graduated needle valve(s), or flow meter(s), relief valve(s), and gauges, which are mounted on the control panel. The flow is controlled by the flow meter(s).

C. Dynamometer

The dynamometer consists of a rotor and dynamometer end cap. The dynamometer end cap encloses the dynamometer cavity, which is filled with pressurized oil from the lubrication system. The power developed in the turbo-expander shaft is absorbed by the dynamometer rotor and transformed into heat by the turbulent action of the rotor as it agitates the pressurized oil. The heated oil is then self-circulated through its water-cooled heat exchanger, where the heat is dissipated.

D. Lubrication System

The lubrication system circulates cooled, filtered and pressurized lube oil as shown in the System Schematic Drawing. Operating pressures and flow figures are given in Sub-section 1-4. Component Manufacturers' Data is given on the System Schematic Drawing in in Section Six. The Service Assembly Drawing shows in cross-section the

lubricant supply and discharge passages within the unit.

E. Alarm & Shutdown Control System

Please refer to the Wiring Diagram Drawing. See Sub-section 1-5 for control settings and Section Six for Component Manufacturers' Data.

The tachometer should have a relay to energize and open the discharge solenoid valve and reduce the dynamometer lube oil pressure for starting. The tachometer should open this relay on rising speed above a few thousand rpm to de-energize solenoid valve and permit it to close. This increases the pressure in the dynamometer loop for the higher speeds. The emergency shutdown is accomplished by the closure of the expander inlet trip valve, installed by Purchaser. The closure is signalled by the interruption of a 110 VAC electrical circuit. The valve system should be sized to close within 1/2 second.

Either the alarm or shutdown, or both the alarm and then the shutdown systems, go into effect as a result of signals from instruments described herein, when any of the conditions listed inder Sub-section 1-5 occur.

SECTION TWO

INSTALLATION

(Please refer to Section Five for referenced drawings.)

2-1 EQUIPMENT FOUNDATIONS

Dimensions for mounting the system are given on the Machinery Arrangement Drawing.

A suitable hoist or crane should be provided for installation purposes. Most models have provisions for the attachment of lifting yokes on the sides of the skid.

2-2 COLDBOX CONNECTIONS

Coldbox connections are supplied. Please refer to Coldbox Junction Assembly Drawing. A coldbox closure for sealing between the coldbox and the expander consists of a split aluminum annular ring.

2-3 PLANT PROCESS CONNECTIONS

Connection sizes and locations for the plant process inlet and discharge piping are shown on the Machinery Arrangement Drawing.

A fine 80-mesh cone-type screen should be installed in the expander inlet of the unit. The screen should

be installed in Purchaser's pipe with the screen side upstream. Refer to Sub-section 3-1 as to cleanliness, keeping it in mind during installation.

NOTE

The inlet screen(s) are to be designed to withstand a maximum differential pressure of 75 psi. It is therefore recommended that it be instrumented and protected as necessary. The screen should be in such location as to be conveniently removable for cleaning and should not interfere with the operation of the safety shutdown valve.

2-4 PIPE CONNECTIONS

If the Purchaser provides the fabricated piping between the lube console and the expander, the relative elevation of the two must be carefully selected. Drain piping should have an uninterrupted slope of at least $\frac{1}{2}$ inch per foot.

2-5 SEAL GAS SYSTEM

A suitable seal gas supply should be connected to the seal gas controls mounted on the control panel, if applicable.

2-6 LUBE OIL COOLER

If a water-type lube cooler is furnished, cooling water supply and return lines must be connected. Refer to the Machinery Arrangement drawing or the Lube Console drawing (if lube system is mounted separately) and to Section Six for the locations and cooler data. Flow requirements are given in Sub-section 1-4.

2-7 VARIABLE NOZZLE

After installing the nozzle actuator, if supplied, connect Purchaser's instrument air supply and air signal line to the variable nozzle positioner. Refer to System Schematic and Sub-section 1-5 for pressures.

2-8 SAFETY SHUTDOWN VALVE

An expander shutdown valve (with solenoid valve control) is to be placed in the process piping at the expander inlet. An adequate air supply must be connected to the solenoid valve which should be sized to close the shutdown valve within $\frac{1}{2}$ second.

2-9 ELECTRICAL CONNECTIONS

Refer to the System Schematic and/or Electrical Schematic drawing for wiring and to Section Six for component manufacturer's data.

SECTION THREE

OPERATING INSTRUCTIONS

3-1 PRECAUTIONARY INSTRUCTIONS

If after installation it is believed there is significant possibility of injurious foreign matter having entered the unit, it must be disassembled and all parts cleaned and reassembled before initial start-up. Verify that the cold section of the expander is free of oil or grease. Assembly and disassembly instructions are given in Section Four.

NOTE

This may be a good time to have a serviceman instruct Purchaser's operating personnel in the assembly and disassembly of the unit.

3-2 PRE-START INSTRUCTIONS

The following steps must be taken before putting the system into operation.

A. Verify correct installation of the screen (screen-side upstream) in the process line upstream of the expander inlet.

B. Fill the lube oil reservoir with oil in accordance with the specifications given in Sub-section 1-4, and check the reservoir oil level to insure that it is filled to a point between maximum and minimum levels.

CAUTION

IF THE RESERVOIR NEEDS FLUSHING, DO NOT USE A DETERGENT-CONTAINING OIL. INSURE THAT THE OIL DOES NOT HAVE WATER AT THE BOTTOM.

C. Check shaft alignment of oil pump(s) and driver(s).

D. If an accumulator is used, verify that its bladder is charged to the correct pressure level specified in Sub-section 1-5.

E. Verify proper connection of all electrical circuits.

F. Verify that all valves are in their correct open or closed positions.

G. Verify that a suitable seal gas supply is connected to the expander and to the seal gas components on the control panel.

H. Verify that all gauges, controls and safety devices are properly connected and working correctly.

I. Verify that the stroke of the nozzle actuator rod corresponds to the figures given in Sub-section 1-5.

Verify that the safety inlet trip system is functional. The valve should be capable of closing within $\frac{1}{2}$ second.

3-3 INITIAL STARTING PROCEDURE

A. General Instructions

Briefly, the intial starting procedure consists of:

1. Admitting and regulating Purchaser's seal gas supply.
2. Starting the lube oil supply system.
3. Admitting the process gas stream flow.
4. Adjusting the oil pressures after the speed and flow are set and stabilized.

B. Detailed Instructions

Refer to Sub-section 1-3 for correct seal gas requirements; to Sub-section 1-4 for correct lube oil operating temperatures and pressures, and to Sub-section 1-5 for correct control settings.

NOTE

INSURE THAT PLANT PROCESS GAS IS COMPLETELY SHUT OFF FROM THE EXPANDER BEFORE PROCEEDING WITH THE FOLLOWING STEPS.

1. Admit the seal gas supply to the system at the control

panel. Adjust the flow valve to the specified flow. (Sometimes new seals will not leak the specified rate, but they soon break in.) Verify the existence of an escape route for the seal gas leaving each side of each seal.

2. Make sure the purge valves in the lubrication console are open. Start the lube pump(s). Then close the purge valves after all air in the oil lines is purged. This may be indicated by stabilized readings on the pressure gauges. A combination of pressure and gas pockets will sometimes collapse the filter cartridge unless purge valves are closed slowly. Circulate oil until required temperature and pressures are reached.

NOTE

During this oil circulation period, the dynamometer loop is pressurized; but it may contain entrapped air or gas. The dynamometer case is vented into the oil reservoir by way of the dynamometer rotor seal. The maximum possible amount of gas would be vented in less than five minutes, so this oil circulation (pressurization of dyno loop) should be maintained for at least this minimum period before starting.

3. Open expander discharge valve (supplied by Purchaser).

4. See that Purchaser's expander inlet valve is closed and open safety trip valve in expander inlet line (in some installations it is permissible to use the trip valve for starting).

5. Regulate actuator to set variable nozzle at a low position.

6. Slightly crack Purchaser's expander inlet valve and admit process gas to expander so that it starts to rotate at about 1/3 of operating speed but at a speed above that at which the Solenoid valve closes. Monitor all gauges and insure that speed stabilizes, which may require five minutes or more. Regulate seal gas supply, if required. See Section 3-3C for seal gas flow adjustment. This should provide time to break in seals and to verify that lube oil is at the correct pressure.

7. Increase flow through expander inlet valve in steps until full pressure is reached.

8. Over a second period of 10 to 30 minutes, gradually increase power to desired capacity by adjusting nozzles.

9. Check seal gas system pressure gauges. Observe that the supply pressure is as specified in Section 1-3, and seal gas flow as in 3-3C. Monitor oil discharge line thermometer(s).

10. The expander inlet screen should be checked at the earliest opportunity after initial start-up, preferably within a few hours after start-up.

C. Seal Gas Flow Adjustment

The seal gas flow should be adjusted to the minimum required to prevent fog from emerging from the expander labyrinth seal when unit is operating on cold gas.

3-4 NORMAL OPERATIONS AND PERIODIC SERVICE

Normal operation requires only a routine monitoring of system controls and gauges. The normal operating temperatures and pressures are given in Section One.

A. The following should be checked often, daily or more frequently:

1. Reservoir lube oil level.
2. Seal gas flow.
3. Lube oil pressure.
4. Lube oil temperature.

B. The lube oil should be changed every three to six months or as often as found necessary as indicated by lube oil contamination. Frequent checks should be made immediately after startup, however, to ascertain the necessary checking frequency.

C. The filters will probably not require changing except to remove contaminated oil.

D. Annual inspection of the expander is not essential, unless there is suspicion of damage.

E. If an accumulator is used, periodically check its bladder pressure.

3-5 NORMAL SHUTDOWN

A. Close inlet trip or other expander inlet valve.

B. Observe the expander to determine that rotation has stopped.

NOTE

It is perferable not to close the nozzles on shutdown because slight leakage from the shutdown valve has less tendency to cause the expander to continue to rotate if the nozzles are open.

C. Close block valves.

D. Shut down the lube oil system.

E. Shut off the seal gas supply.

3-6 EMERGENCY SHUTDOWN

In the event of emergency conditions (see Sub-section 1-6E) the safety devices will automatically cause the inlet valve to close and shut off the process stream to the expander. The lube oil and seal gas will continue to flow unless the system is out of order.

3-7 THAWING INSTRUCTIONS

Accumulation of ice or other frozen material in the expander passages will cause a reduction in flow and/or disturbance of normal pressure distribution. Frozen matter can be thawed out by passing clean, dry, warm gas forward through the expander at a temperature not exceeding 150° F, and at a rate not exceeding 25 percent of rated flow. Due to the selected rate of warm gas flow the expander may rotate. Because of this it is necessary to maintain the lubrication oil and seal gas supply during the thawing process. The thaw cycle should be continued until the expander discharge has reached a sufficiently high temperature to melt the material being purged;

otherwise, frozen material may be left in the expander rotor causing unbalance. Note that there may be a temperature drop through the system during the thaw cycle.

3-8 PRESSURE TAPS

Pressure taps are often provided for connection to Purchaser's control circuitry for alarm and/or shut-down to detect deposit build-up on the expander rotor. If so, it will be marked and usually located on the expander side of the journal bearing support.

3-9 TROUBLE SHOOTING

A. Oil Pressure - Failure to Come up to Normal

This would appear to be due to the pump not putting out sufficient oil; however, oil pumps do not usually do this until they are in an advanced state of deterioration and noisy. We provide a substantial factor of safety on the oil flow. The trouble would probably be due to a bypass valve not being completely closed or leaking or due to the pressure regulator seat being eroded (cut out) and leaking excessively.

B. Variable Nozzles Failing to Return to Closed Position

This is almost invariably due to the spring in the actuator not being tight enough. The positioner adjusts the stroke but it relies on spring force for

the return. Tightening the spring will provide additional returning force. The air pressure to open then would be somewhat higher, but this is controlled by the positioner.

C. Oil Dripping Out of the Bearing Oil Seal

1. The oil seal nearest the expander leaking may be due to incorrectly positioning the oil slinger. If it has not been pressed far enough onto the shaft and extends out beyond the level of the oil seal, then the flowing seal gas will sometimes draw a vacuum and draw oil out.

   The solution is to either relocate the oil slinger or apply a small low pressure stream of seal air to the oil seal.

2. If the unit is a high speed unit there is occasionally some difficulty with oil not draining out of the bearing chamber because of the high shaft velocity and extreme gas turbulence, and the oil tends to be churned by this. There is a threaded hole on the bearing housing, normally plugged, into which seal air or seal gas can be injected to vent the housing better and exhaust the oil. The removal of the plug and putting in a short

nipple and elbow to protect from dust should vent the housing sufficiently.

D. Excessive Seal Gas Requirement

This indicates that the labyrinth seal has worn for some reason (such as by the unit having been operated under unbalanced conditions due to freezing or the like, or possibly to erosive dust blowing out through the seal), so replacing the labyrinth seal or labyrinth seal insert will surely correct the problem. Be sure to adjust its axial position upon installation.

The seal is on a conical section of the shaft and adjustment of the axial position of the old labyrinth seal would tighten the seal. In most models there are gaskets which can be respectively adjusted (so as not to change the overall stackup dimension) to move the labyrinth seal farther onto the shaft cone. If the labyrinth seal has no removable gasket or shim, some material can usually be machined off to correct it pending procurement of a new labyrinth seal.

E. Low Efficiency

If the efficiency has fallen, the tendency is to believe that some damage has occured in the

expander. This, of course, is possible but usually it doesn't have very much effect on efficiency. Erosion of the nozzles or even serious erosion of the rotor seems not to affect the efficiency extensively. A drop in efficiency will occur - sometimes as much as 20 percent - if the expander is badly frozen or obstructed with CO_2 or ice or gas hydrate, and deriming should correct it. If the pressure is measured upstream of the inlet screen, it, of course, could be fouled with particles of ice or the like and could cause an apparent low efficiency.

F. Too Cold to Start

The danger here is that the journal bearing nearest the expander may be so cold that oil would not be circulating through it and it is not safe to start the unit and count on friction warming the bearings. It is necessary to warm the bearing by some artificial means. The bearing is well bonded thermally to the bearing housing, and if the bearing housing is not cold then the bearings should not be too cold. However, in cold weather it is possible for the small heat leak into the expander to cool the bearing somewhat further and reduce its temperature to near or below the pour point of the oil.

It is not safe to assume that deriming with warm gas will warm the bearing because there is excellent insulation between the expander and the bearing and this is a very slow process. Instead the bearing housing should be warmed with steam or hot water or the like. Obviously, if the bearing is cold and the oil is not circulating, there is no way to warm it with oil circulation.

G. Expander Housing Gasket Leaking

The start-up of an expander gives the machine a temperature shock which could aggravate gasket problems. To minimize this problem ROTOFLOW expanders are designed with the bearing housing axially offset from the important components of the expander so that the temperature changes will deflect the gasket flanges a minimum amount and usually this is not a problem. However, if leakage should be persistent, putting in a somewhat thicker gasket or backing up the existing gasket with a layer of paper and coating the gasket with a suitable sealant should correct the problem.

SECTION FOUR

MAINTENANCE

In these procedures every question obviously cannot be answered, nor every problem anticipated. The maintenance man must use judgment in handling the parts, being careful also in following the drawing. IN CASE OF INCONSISTENCY IN ANY NUMBER, THE DRAWING IS TO PREVAIL.

4-1 DISASSEMBLY

Disconnect all lube oil and seal gas piping and the tachometer pickup. Plug all lines to prevent the entry of any foreign matter.

The referenced drawing clearly indicates the attachment of all assembled parts; therefore, detailed hardware descriptions are omitted from the following procedures.

A. Rotating Assembly - Field Removal

Refer to the Service Assembly Drawing and Parts List. Some of the components are heavy and a hoist should be made available for support during field removal. During field removal of rotating assembly, extreme caution should be exercised in the handling of internal parts. They have been precision machined and dynamically balanced, and careless injury to parts may result in irreparable damage. Avoid marring any flange or gasket face.

It is suggested that the dynamometer end cap (202) be removed in a clean working area, so as not to expose the delicate parts. Only if it is necessary to lessen the weight should the part be removed in the field.

1. Separate piping from dynamometer end cap (202) and remove coldbox junction assembly (33).

2. Separate bearing housing (147) from expander case (61) by removing nuts (443) and washers (444). Remove heat barrier wall gasket (99).

3. The complete rotating assembly may now be carefully withdrawn. Care should be exercised to avoid bumping expander rotor (107). The temporary use of two long screws on opposite sides of journal bearing support can aid in this step. The rotating assembly should be taken to a clean work area for further disassembly.

B. Rotating Assembly - Disassembly

1. Remove dynamometer end cap (202) by releasing screws (423). Remove shims (212) and O-ring (430). Remove dynamometer impeller (201) by releasing end cap screw (179) with lockwasher (417).

2. Position assembly vertically on a workbench with expander end up.

3. Remove expander rotor (107) by releasing end cap screw (118), lockwasher (461) & retaining washer (119). Remove expander rotor utilizing 7/16-4 UNC threaded hole provided for pulling purposes. Remove keys (464) & backup ring (117). Release screws (466) & remove heat barrier wall front plate (96).

4. Remove heat barrier wall (102) by removing screws (471) & washers (101). Remove gasket (100). Remove oil retainer (129) by releasing screws (500). Remove oil retainer seal (132), O-ring (491) & gasket (133).

5. Invert unit taking care not to damage front bearing (137). Position assembly with shaft protruding through a hole in workbench. Remove dynamometer impeller seal (206) with O-ring (521) by releasing screws (515). Remove back bearing (138) utilizing two 1/4-20 UNC threaded holes provided for pulling purposes. Remove O-rings (533 & 535).

6. Carefully slide shaft (126) from bearing housing (147) with attached thrust washers & pins (127). Maintain center alignment to avoid bumping or damaging journal bearing or shaft. Do not drop either thrust washer.

7. Invert unit, break lockwires & remove screws (545)

& washers (546). Remove front bearing (137) by using two 1/4-20 UNC threaded holes provided for pulling purposes. Remove O-rings (548 & 550).

C. Nozzle Assembly

To remove this component, it is not necessary to remove nozzle actuator or bonnet assembly.

1. Align the two 7/32 holes in nozzle cover (88) with two 10-32 UNF threaded holes in nozzle adjusting ring (90). Insert screws (561) & tighten to hold nozzle assembly together during removal.

2. Release nuts (443) with washers (444), & carefully withdraw nozzle assembly from expander case (61). The actuator rod (224) should be adjusted sufficiently to relieve force on the pin in adjusting ring, to facilitate removal. The nozzle assembly should be taken to a clean work area for further disassembly. Remove gasket (67).

3. Remove screws (561) & separate nozzle cover (88) from nozzle adjusting ring (90) exposing nozzle segments (89).

4. To remove nozzle fixed ring (91), shims (92) & piston ring (93) from expander case, release screws (575).

NOTE

TO REINSTALL THE NOZZLE ASSEMBLY, THE FOLLOWING PROCEDURES ARE CARRIED OUT IN A CLEAN WORK AREA:

1. Place nozzle segments (89) on pins of nozzle cover (88) in closed position. Place adjusting ring (90) over nozzle segments and engage segment pins on slots of adjusting ring. Insure that actuator rod pin in adjusting ring is on the correct side for engagement with actuator rod (224).

2. Holding assembly together, turn it over and align two 7/32 holes in nozzle cover with two 10-32 UNF holes in adjusting ring. Insert two screws (561) and tighten.

3. The nozzle assembly may now be installed in the expander case by carefully engaging adjusting ring pin in actuator rod (224). This may require some manipulation of adjusting rod and care must be taken to avoid bending the pin.

4. When the pin is fully engaged, screws (561) may be removed and the nozzle cover (88) attached to the expander case with nuts (443) and washers (444).

D. Variable Nozzle Actuator Assembly

Refer to the Nozzle Actuator Assembly Drawing.

1. Disconnect instrument air lines from nozzle actuator regulator and positioner.

2. To remove actuator motor, remove Sel-lok pin (S2) in stem, then remove locking nut (S7) for actuator.

3. To remove bonnet assembly, loosen gland follower and remove socket head cap screws (S3) at base of assembly. Lift assembly off actuator rod.

4-2 CLEANING AND REASSEMBLY

After disassembly, the parts should be cleaned thoroughly. Parts other than those of the expander housing should be coated with a thin film of lubricating oil to protect them against rusting.

Reassembly of the unit is in the reverse order of disassembly. Insure that the expander end of the unit is not tilted below a horizontal position, which could allow coating oil to leak into labyrinth seal.

If prevention of gas seepage is imperative, all gaskets should be coated with a viscous sealant. A published rule* for torque to be applied to screws is Torque (lb-inch)= $2000D^3$, where D is nominal screw diameter in inches. Lock or stake all screws.

* Ref: ASME Publication 69-DE-48

4-3 INSPECTION AND ALLOWABLE WEAR DATA

Check the journal and thrust bearings and the shaft as follows:

The maximum allowable clearances are given in this section.

Carefully examine the bearings and thrust washer faces for score marks. If scoring is excessive, replace them with

new parts. It is recommended that all seals and seal inserts be replaced.

The dynamic balance of shaft, expander rotor and dynamometer impeller should also be checked in accordance with tabulated figures following. The rotating assembly components have been accurately machined and dynamically balanced; to check balance of assembly or to follow alignment marks between its components is unnecessary unless suspicion of unbalance exists.

The following table specifies allowable wear and dynamic balance figures on expander rotating assembly components. Should it be found upon inspection that clearance or balance figures exceed those specified, parts should be replaced or, if possible, the condition corrected.

Component	Allowable Clearance
Expander Side (front) Journal Bearing & Shaft	.0024-.0029 in.(dia.)
Dynamometer Side (back) Journal Bearing & Shaft	.0024-.0029 in.(dia.)
Shaft End Play	.008-.014 in.
Heat Barrier Labyrinth (with shaft thrust clearance in direction of seal)	.003-.015 in.

Component	Dynamic Balance Required
Expander Rotor	.002 in.-oz.
Shaft	.002 in.-oz.
Dynamometer Impeller	.0015 in.-oz.

Labyrinth Seal Clearance

Should it become necessary to ascertain if the heat barrier labyrinth bore is worn, proceed as follows:

A. Remove heat barrier wall and loosen front bearing screws. Pull bearing forward to oil retainer, then reinstall heat barrier wall. Loosen dynamometer impeller. Measure and record shaft end play.

B. Remove heat barrier wall, tighten front bearing, being careful to fit O-rings, tighten dynamometer impeller. Measure and record shaft end play.

C. If the reading from Step "A" exceeds the reading from Step "B" by more than that mentioned in the previous table, replace heat barrier wall or adjust its position by gasket thickness adjustments to the correct fit, but total stackup dimension must be maintained.

Clearance Adjustment on Face of Dynamometer Impeller

This clearance should be .001 to .004 inches with shaft pulled toward minimum clearance. It should be checked with clay on the face of the blades, then corrected if necessary, by adjustment of shims (212).

4-4 RECOMMENDED SPARE PARTS

Qty.	Description	Part Number
2	Expander rotor	1158C26
2	Dynamometer impeller	1158C24
2	Shaft	216104C04
2	Front bearing*	221100C05
2	Back bearing*	221103C08
2	Heat barrier wall	225010D04-10
2	Heat barrier wall front plate*	1158B18
2	Nozzle fixed ring	1158C13
4	Thrust washer & pins	256100A04
2	Oil retainer	280000C04
2	Oil retainer seal	281100B04
2	Dynamometer impeller seal	247000C04-7
2	Sets shims (dyno end cap)	1035B17
2	Sets shims (nozzle fixed ring)	1158B17
2	H.B.W. gasket, front*	1158A30
2	H.B.W. gasket, back*	228000B04
2	Gasket - expander case	B16712-222
2	Gasket - oil retainer	279000B04

Purchaser is advised to stock a sufficient supply of O-rings for replacement at proper maintenance periods. Refer to Service Assembly Drawing for sizes.

*Refer to the Service Assembly Drawing for locations of items referenced "front" and "back".

4-5 FIELD SERVICE

In cases where either field service or spare parts are required, please contact our nearest representative or ROTOFLOW's home office. Telephone numbers are as follows:

Los Angeles, California	ROTOFLOW CORPORATION	(213) 477-3083
Houston, Texas	ROTOFLOW SALES CORPORATION Mr. Roy A. Ford	(713) 447-4896
Mexico City, Mexico	Industrias Especializadas de Mexico, S.A.	905-528-7769
Tokyo, Japan	C. Itoh & Company (Chemical Machinery Section)	662-5111
Gachnang, Switzerland	ROTOFLOW SERVICES AG	054-947-84

In case of emergency after office hours, please contact Mr. D. John Hill at (213) 256-8045, in Los Angeles, California, U.S.A.

SECTION 05 05 14

HOT-DIP GALVANIZING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included: Hot-dip galvanize iron and steel items as shown on the drawings and as specified in this Section.

B. Related Sections:

1. Section 01 45 27 – Shop Inspections.

2. Section 05 50 00 – Metal Fabrications.

1.2 REFERENCE STANDARDS

A. ASTM International (ASTM):

1. A123 Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

2. A143 Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement

3. A153 Zinc Coating (Hot-Dip) on Iron and Steel Hardware

4. A384 Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies

5. A385 Providing High-Quality Zinc Coatings (Hot-Dip)

6. A-780 Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

1.3 QUALITY ASSURANCE

A. Qualifications:

1. Applicator: Regularly engaged in application of hot-dip galvanized coatings for at least two years immediately prior to this work. Provide samples of coating operation for approval.

2. Workers: Experienced and knowledgeable in preparation for and application of hot-dip galvanized coatings.

1.4 PRODUCT HANDLING, STORAGE AND DELIVERY

A. Handle all products to be galvanized in such a manner as to avoid any mechanical damage and to minimize distortion.

B. Load and store galvanized products to prevent formation of wet storage film.

1. Stack or bundle galvanized products to allow air between the galvanized surfaces.

2. Do not store galvanized products directly on the ground.

PART 2 - PRODUCTS

2.1 HOT DIP GALVANIZING REPAIR

A. Zinc based solder. All solders shall be lead free

1. Product

a. REGALV Galvanizing Repair Stick-Lead Free

b. Or Equal

~~Cold Galvanizing Sprays~~

~~Product~~

~~Rust-Oleum Cold Galvanizing~~

~~Or Equal~~

B. NOT USED

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Pre-clean steel work utilizing an alkaline cleaner, acid pickle, and flux. Alternatively, the steel shall be blast cleaned and fluxed.

3.2 APPLICATION OF COATING

A. Galvanize steel members, fabrications, and assemblies by the hot-dip process in accordance with ASTM A123.

B. Galvanize bolts, nuts, and washers, and iron and steel hardware components in accordance with ASTM A153.

C. Safeguard products against steel embrittlement in conformance with ASTM A143.

D. Clean damaged surfaces of galvanized metals and touch up with zinc-rich paint conforming to ASTM A780. Extent of repair area to be approved by the Engineer.

3.3 INSPECTION

A. All materials and workmanship shall be inspected to ensure that both fully meet these specifications. Any work found deficient shall be replaced and brought up to full compliance with these specifications.

B. Provide notification for Engineer prior to coating application. See Section 01 45 27 for inspection advance notification requirements and District travel expenses.

3.4 FIELD REPAIRS

A. The Engineer will determine whether items with defects or damage to coatings are to be returned to shop for recoating or whether touch-up in field is acceptable.

B. For indoor locations with low humidity: Field touch-up of defects or damage to coatings shall be with a minimum of two coats of a compatible cold galvanizing product, as approved by the Engineer.

C. For all outdoor locations or indoor locations with high humidity: Field touch-up of defects or damage to coatings shall be with zinc based soldering rods per ASTM A780. Repair shall be followed by one coat of compatible cold galvanizing product as approved by the Engineer.

D. Defect areas shall be slightly hand roughed up (not significantly removing galvanized coating) using 100 grit aluminum oxide sand paper including surrounding area within one inch of defect. Entire sanded area including defect shall be coated.

END OF SECTION

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SECTION 05 05 24

SHOP AND FIELD WELDING AND BRAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Use this section for welding requirements of the related sections as described in 1.1.B and as listed in 1.1.C.

B. Section includes:

1. Shop and field welding of structural steel and other metals

~~1.~~2. Shop and field brazing of copper pipe and fittings.

~~2.~~3. Third-party independent inspection and examination of welds and brazed joints.

C. Related Sections:

1. Section 05 50 00 – Metal Fabrications

1.2 APPLICABLE CODES AND STANDARDS

A. AWS D1.1 – Structural Welding Code – Steel, 2020 edition

B. AWS D1.6 – Structural Welding Code – Stainless Steel, latest edition

C. AWS 3.0 – Standard Welding Terms and Definitions, latest edition

D. AWS A2.4 – Standard Symbols for Welding, Brazing and Nondestructive Examination, latest edition.

~~D.~~E. ASME Boiler & Pressure Vessel Code, Section IX, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators, Latest Edition including addenda, supplements, and interpretations.

1.3 TERMS AND DEFINITIONS

A. Certified Welding Inspector (CWI) – A person certified as a welding inspector as given in AWS QC1- Latest Edition, Standard for AWS Certification of Welding Inspectors.

B. Nondestructive Examination (NDE) – The act of determining the suitability of some material or component for its intended purpose using techniques that do not affect its serviceability.

C. NDE Level II Technician/Operator (NDE Level II): An individual certified at Level II as defined in American Society for Nondestructive Testing (ASNT) Recommended Practice SNT-TC-1A specific to the NDE method used.

D. Procedure Qualification Record (PQR) – A record of welding variables used to produce an acceptable test weldment and the results of tests conducted on the weldment to qualify a welding procedure specification.

E. Welding Procedure Specification (WPS) – A document providing the required welding variables for a specific application to assure repeatability by qualified welders and welding operators. WPSs that are not prequalified by Code shall be supported with a PQR.

F. Standard Welding Terms and Definitions: See AWS 3.0, Standard Welding Terms and Definitions.

G. Brazing Procedure Specifications (BPS) – A document providing the required brazing variables for a specific application.

~~F.~~H. AWS B2.2:2010, Specification for Brazing Procedure and Performance Qualification.

1.4 SUBMITTALS

A. Contractor's Field Welding Plan:

1. Submit a Field Welding Plan listing each WPS to be used on the project and indexing that WPS to the drawing and weld. All joints requiring radiographic testing per this section shall be clearly identified in the Field Welding Plan, and radiographic testing activities shall be shown on the Contractor's three week look ahead schedule as required in Project Meetings.

2. Following the scheduling of radiographic testing by the Contractor, a pre-testing meeting shall be scheduled by the Contractor. Attendees shall at a minimum include the third-party CWI, representatives from the company performing the radiographic testing including the actual technicians that will perform the testing, the Contractor's representative, and representatives from the District including the Plant Inspection Section. The meeting shall be scheduled via a Plant Inspection Request.

B. Qualification of Welders and Welding Procedures:

1. For field welding for Section 05 50 00 – Metal Fabrications, submit records consistent with Paragraph 1.6, shop and field welding requirements.

2. For pipe welding submit records consistent with: Paragraph 1.5.A for procedure qualifications; Paragraph 1.5.B for shop welder qualifications; and, Paragraph 1.5.C for field welder qualifications.

C. Brazing

1. Contractor's Brazing Plan: The Contractor shall submit a Brazing Plan listing each BSP to be used on the project and indexing that BSP to the drawing and braze joint.

2. Qualification of Brazers and Brazing Procedures

a. For pipe brazing submit records consistent with: Paragraph 1.5.A for procedure qualifications; Paragraph 1.5.B for shop brazer qualifications; and, Paragraph 1.5.C for field brazer qualifications:

~~C.~~D. Qualification of Inspectors and NDE Examiners:

1. Submit verifiable evidence of the current CWI certification of all third party CWIs.

2. Submit verifiable evidence of the certification of all personnel performing NDE or interpreting the test results to ASNT-TC-1A Level II as a minimum.

~~D.~~E. Submit complete fabrication and erection drawings for the Engineer's approval prior to cutting or fabrication. Shop drawings shall show the details of fabrication with weld symbols in accordance with AWS A2.4 for all joints to be welded.

~~E.~~F. Provide all submittals to the Engineer with sufficient review time for approval prior to start of welding. Welding shall not proceed until the related submittals are approved by the Engineer.

1.5 QUALIFICATIONS AND INSPECTIONS

A. Pipe-Welding and Brazing Procedure Specifications:

1. All welds shall be completed in accordance with a qualified WPS.

a. The Contractor may use a prequalified WPS conforming to the provisions of AWS D1.6 – Clause 5, Prequalification of WPSs.

2. All WPSs that are not prequalified as given above shall be qualified in accordance with one of the following:

a. AWS D1.6 – Clause 6

3. A CWI shall review and stamp all WPSs and PQRs.

B. Pipe Welding and Brazing, Shop:

1. Welders and brazers shall be qualified under AWS D1.6 – Clause 6, for the welding processes, positions, and procedures, and ASME Boiler & Pressure

Vessel Code, Section IX, Part QW/QB, for the brazing, to be used for this project~~.~~.

2. Welders shall have verifiable evidence they have maintained their qualifications in accordance with AWS D1.6 – Clause 6

3. Welder and Brazer Qualification(s) shall be witnessed and stamped indicating acceptance by a CWI.

C. Pipe Welding and Brazing, Field:

1. Prior to the start of welding or brazing on this project, each welder/brazer shall perform welder/brazer qualification testing specific to the welding on this project. Only welders and brazers that pass welder/brazer qualification testing for this project will be allowed to weld on this project. Prior welder qualification records will not be accepted. All welder/brazer qualification tests will be at the expense of the Contractor. Qualifications shall be in accordance with AWS D1.6-Clause 6 and ASME Boiler & Pressure Vessel Code, Section IX, Part QW/QB, for each process, position and procedure to be used on the project.

2. Welder and brazer qualification testing shall be witnessed by a third party AWS CWI provided by and at the Contractor's expense. Upon successful completion of testing, the AWS CWI shall stamp, sign and date the welder /brazer qualification form.

3. The Engineer reserves the right to witness all welder qualification tests and be present for all weld coupon testing.

D. Metal Fabrication Welding as specified in Section 05 50 00 – Metal Fabrications

1. Stainless Steel welding shall conform to ANSI/AWS D1.6 latest edition – Structural Welding Code – Stainless Steel.

2. Certification of Welders:

a. Submit verifiable evidence of initial qualification for each welder.

b. Submit verifiable evidence each welder has maintained current qualification(s).

3. Submit WPSs with supporting PQRs for approval per **Error! Reference source not found.**~~1.5.D~~ above.

E. Testing and Inspection:

1. The ~~Contractor~~ District wi~~sha~~ll provide independent inspection of all structural steel framing welds and nondestructive examination (NDE) as indicated on applicable Contract Drawings. The District will perform direct visual

verification of these inspections and tests. Notify the District ~~'s Plant Inspection Section~~ at (510) 287-~~1132~~ 0779 for all field testing and shop inspections and tests.

2. ~~Welding inspection personnel shall be certified in accordance with AWS QC1 at the level of Certified Welding Inspector.~~ NOT USED.

3. ~~NDE personnel shall be certified in accordance with ASNT-TC-1A Level II as a minimum.~~NOT USED.

4. Inspections and test results wi~~sha~~ll comply with AWS D1.6 Clause 8 for the related inspection and test method.

5. The costs of all reinspection and ~~inspections and tests, including~~ retests after repair, shall be borne by the Contractor.

F. Tolerances:

1. Dimensional tolerances and allowances for fit shall be in accordance with applicable AWS Standards unless shown otherwise. Tolerances and allowances shall be shown on the Contractor's erection or working drawings.

1.6 RETESTING OF WELDERS/BRAZERS BASED ON QUALITY OF WORK:

A. When the quality of a welder's/brazer's work appears to be below the requirements of this specification or referenced Codes, the Engineer may require that the welder/brazer demonstrate an ability to produce sound welds by requiring complete requalification in accordance with the latest edition of AWS D1.6, Clause 6 and ASME. All re-qualifications will be at the Contractor's expense.

1.7 NONDESTRUCTIVE EXAMINATION-GENERAL

A. Types of NDE and Acceptance Criteria:

1. Radiographic Examination (RT) per Paragraph UW-51, Section VIII, ASME Boiler & Pressure Vessel Code

2. NOT USED.

3. Magnetic Particle (MT) per Section V, ASME Boiler & Pressure Vessel Code. Acceptance criteria shall be as given by AWS D1.1 – Clause 8, Part C

B. Nondestructive Examination of Production Welds:

1. In addition to any NDE required by the Contract Documents, the Engineer may elect to perform additional NDE of in-process or completed shop or field welds to verify weld quality. Any additional NDE may be performed by District personnel or the Engineer may request the Contractor perform or subcontract these examinations.

2. Cost of Examinations:

a. The cost of NDE identified in the Contract Documents for specific welded connections shall be borne by the Contractor.

b. The cost of additional NDE requested by the District will be borne by the District in the event that all examined welds are found to be acceptable. In the event of a rejected weld, the Contractor shall bear the costs of all NDE, including NDE of weld seams found to be acceptable, as well as the costs of repairs, re-inspection and re-examination of the rejected weld.

c. The cost of NDE performed by District personnel will be borne by the District. The costs of repairs, re-inspection and re-examination resulting from a rejected weld shall be borne by the Contractor.

1.8 CLEANING ~~AND PASSIVATING~~ OF STAINLESS STEEL WELDMENTS

A. Larger than 2-inch pipe joints and structural steel, including the entire heat-affected zone (HAZ), shall be:

1. Cleaned in accordance with ASTM A380. The joints shall be visually inspected to be free of paint, oil, grease, welding flux, slag, heat-treating and hot-forming scale, dirt, trash, metal and abrasive particles and chips, and other gross contamination. Dust may be present on the exterior surfaces, but should not be on the interior surfaces.

~~1.~~2. De-scaled (pickled) with citric acid per in accordance with ASTM A380 Table 2.1, Part III. Perform intermittent scrubbing as required to assure a completely cleaned surface. Do not use a steel wire brush.

~~1.~~3. Passivated per ASTM A380 with final cleaning per ASTM A380 Table 2.1, Part II, and in accordance with ASTM A967. The finish shall be inspected to be free of contaminating iron particles, heat-tint oxides per AWWA C220, weld scale, and other impurities.

~~1.~~4. Follow immediately with a thorough rinse and water-jet spray to remove excess acid to prevent attack of the base metal.

~~1.~~5. Both the exterior and interior of the joint and HAZ shall be treated. Inaccessible interior joints, as approved by the Engineer, shall be omitted from this process.

~~A.~~B. The weld and HAZ shall be tested per ASTM A967 to be free of contaminating iron particles and other impurities. The ASTM A967 test method used shall be approved by the Engineer.

~~A.~~C. ~~2-inch and smaller pipe joints: Shop welded stainless steel pipe joints shall be treated as described above when called out on the drawings.~~NOT USED.

~~A.~~D. ~~At branch locations, if any of the joined pipes are larger than 2-inches, joints shall be treated as described above.~~NOT USED.

1.9 VERIFICATION

A. General Requirements:

1. All welds and brazing shall be visually inspected and accepted by the Contractor's Third-Party CWI and the Engineer prior to performance of all NDE, including hydrostatic and air tests. Final visual inspection shall be performed after the weld has cooled to ambient temperature.

2. In-process and final inspections shall be documented on the attached "Field Welding/Brazing Inspection Form" by the Contractor's Third-Party CWI, and available for review by the Engineer. At a minimum, all applicable elements listed on the form are required.

3. All visual inspections and nondestructive examinations shall be completed and confirmed as acceptable by the Engineer prior to further processing that could compromise the integrity of the Work.

B. Radiograph Records:

1. All radiographs, including information only examinations, will become the property of the District.

a. The Fabricator shall provide to the District all hardware and software necessary to review the radiographs. The Fabricator shall provide one set of hardware and software to the District prior to the start of radiography for retention by the District.

b. The Contractor shall provide the District with one new film viewer as follows: LC NDT FV-2010-T-PLUS High Intensity Portable LCD Film Viewer with Built-in Densitometer and Electronic Masking, or equal as approved by the Engineer.

C. Field Inspection:

1. Responsibilities

a. The Contractor shall provide third party CWIs and NDE Examiners. Third party inspectors and examiners shall be independent from work production and schedule responsibilities. Third party CWIs and NDE Examiners shall provide daily reports, documented on the attached "Field Welding/Brazing Inspection Form" to the Engineer for all work performed. The reports shall be signed and stamped and provide a clear summary of the inspection or NDE activities performed, direct traceability to the work, and a determination of acceptability.

b. The District will verify that the third party independent inspections and NDE comply with these requirements, including referenced Codes and Standards, and will review and accept (or reject) the reports of the CWIs and Examiners. The Engineer may at any time verify by direct inspection or surveillance the acceptability of all phases of welding/brazing and third party independent inspection and NDE activities.

1.10 OXYGEN ENRICHED ENVIRONMENT

A. Contractor shall submit a job hazard analysis (JHA) and hot work permit and perform the work in accordance with the requirements of Section 01 35 24, Project Safety Requirements.

1. Contractor's workers performing field welding and brazing near an operating cold box and/or liquid oxygen storage tank or liquid oxygen piping shall monitor the atmosphere for oxygen content at all times during the work.

2. No welding or brazing operations shall be undertaken on in service cryogenic equipment or piping. No welding or brazing operations shall be undertaken on idle equipment or piping that still has gaseous or liquid oxygen in it.

3. Depending on wind direction, the operating oxygen plant may need to be shut down prior to cutting and welding. The Contractor shall not allow cutting or welding fumes to enter any Main Air Compressor intake filters. The Contractor shall not allow acetylene from cutting torches to enter any Main Air Compressor intake filters. The Contractor shall submit a System Outage Request (SOR) and take steps to demonstrate that welding and cutting activities will not introduce contaminants into the Main Air Compressors.

4. Contractor shall inspect the grounding system for each cold box prior to hot work activities.

5. The Contractor shall use welding blankets to protect adjacent process tubing, process piping, valves, instrumentation, conduits, cables, or other equipment from sparks and hot slag.

6. The Contractor shall have fire extinguishing equipment in close proximity when performing hot work activities. The Contractor shall conduct a safety tailgate for hot work in the cold box area prior to start of hot work.

~~1.~~7. The Contractor shall identify relief valves on in service process piping and monitor for any sudden discharges of oxygen.

PART 2 - NOT USED

PART 3 - EXECUTION

3.1 GENERAL PROCEDURES

A. Use Shielded Metal Arc Welding (SMAW), Flux Cored Arc Welding (FCAW), Gas Tungsten Arc Welding (GTAW), or Gas Metal Arc Welding (GMAW-Spray or Globular modes only), unless the Engineer approves another process prior to use.

1. Gas Metal Arc Welding (Short-Circuit) is not allowed.

B. All welds shall be made according to an approved WPS.

C. Each step of the welding process will be inspected and approved before proceeding to the next step.

D. Welding shall be performed in at least two layers. Passes shall not exceed 1/4 inch in throat dimension.

E. Welds shall be thoroughly cleaned after each pass.

F. Welds shall be fully fused with base metal, uniform in appearance, free from cracks and reasonably free from irregularities. Weld shall blend smoothly and gradually into the base material

G. Restart in weld zone on clean and sound metal.

H. Remove defective welds by chipping, grinding, flame gouging, or air-arc gouging and repair by re-welding.

I. No undercut is allowed.

J. Use procedures or welding sequences that will minimize eccentric stresses, shear or distortion in the weld.

K. Butt welds, where authorized, shall have complete penetration and fusion.

L. Finished weld bead shall be central to the seam.

M. Artificial or forced cooling of welded joints is not permitted.

N. Low hydrogen electrode storage shall be in accordance with AWS D1.1 – 5.3.2.1.

O. See District Standard Drawings 323-EA, 324-EA, and 325-EA for welding of flanges.

P. Joining Dissimilar Metals

1. When joining carbon steel to various stainless steels, the following filler material shall be used unless otherwise called out on the drawings.

a. Carbon steel to stainless steel: 309L filler material.

b. Carbon steel to type 316 or 316L stainless steel: 309L or 316L filler material.

~~P.~~Q. Brazing

1. All braze joints shall be made according to an approved BPS and in accordance with the specifications herein.~~When joining carbon steel to various stainless steels, the following filler material shall be used unless otherwise called out on the drawings:~~

~~a. Carbon steel to stainless steel: 309L filler material~~

~~b. Carbon steel to type 316 or 316L stainless steel: 309L or 316L filler material~~

3.2 SUPPLEMENTS

A. The following supplements follow END OF SECTION and are a part of this section:

1. Field Welding Inspection Form

2. Field Welding Submittal Checklist

END OF SECTION

Spec. Number		**Date**	
General Contractor		**Welding Subcontractor**	
Inspection Co		**CWI NAME & #**	

WELDING INSPECTION RECORD

LOCATION DESCRIPTION	*STATION*	*PC MKS*	*DWG DETAIL REF.*	*WELDER ID*	*WPS*	*JOINT FIT-UP AND FIELD TOP*	*ROOT PASS (GROOVE) *FIRST PASS (FILLET)*	*BACK GOUGE VISUAL/NDT*	*FINAL VISUAL*

DESCRIBE ALL IN-PROCESS REWORK: _____

_____

_____

_____

ALL WORK AS LISTED IS IN CONFORMANCE WITH THE CONTRACT DOCUMENTS

FINAL ACCEPTANCE : STAMP / DATE /SIGNATURE	

Sketches:

Field Welding Submittal Checklist

SUBMITTALS TO BE APPROVED PRIOR TO START OF WELDING

Field Pipe Welding (1.5.C) and Structural Welding (1.5.D)	
Description	**Paragraph Reference**
Field Welding Plan	1.4.A
Welding Procedure Specifications for all processes and positions on plan	1.5.A
Procedure Qualification Records (as applicable for above WPS)	1.4.B
Request to witness welder qualification and weld coupon testing (Separate Submittal)	1.5.E~~1.5.F~~
CWI certifications (Separate submittal)	1.4D.1~~1.4C.1~~
NDE certifications (Separate submittal)	1.4D.2~~1.4C.2~~
Resulting welder/procedure qualification record	1.4.B

Miscellaneous Metals per (1.5.E)	
Description	**Paragraph Reference**
Field Welding Plan	1.4.A
Welder qualification records for all processes and positions on plan including qualification maintenance records for each welding process	1.5D.2~~1.5E.4~~
Welding Procedure Specifications for all processes and positions on plan	1.5D.3~~1.5E.5~~
Procedure Qualification Records (as applicable)	1.5D.3~~1.5E.5~~
CWI certifications (Separate submittal)	1.4D.1~~1.4C.1~~
NDE certifications (Separate submittal)	1.4D.2~~1.4C.2~~

Notes:
1. Check List is being provided for informational purposes only.

SECTION 22 11 19

DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Temperature-actuated, water mixing valves.

2. Strainers for domestic water piping.

3. Flexible connectors.

4. Drain valves.

5. Pressure control valves.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

1.4 INFORMATIONAL SUBMITTALS

A. Test and inspection reports.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Domestic water piping specialties intended to convey or dispense water for human consumption are to comply with the SDWA, requirements of authorities having jurisdiction, and NSF 61 and NSF 372, or to be certified in compliance with NSF 61 and NSF 372 by an American National Standards Institute (ANSI)-accredited third-party certification body that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water Tempering Valves:

1. Standard: ASSE 1070, thermostatically controlled, water tempering valve.

2. Pressure Rating: 125 psig minimum unless otherwise indicated.

3. Body: Bronze body with corrosion-resistant interior components.

4. Temperature Control: Adjustable.

5. Inlets and Outlet: Threaded.

6. Finish: Rough or chrome-plated bronze.

B. Primary, Thermostatic, Water Mixing Valves:

1. Standard: ASSE 1017.

2. Pressure Rating: 125 psig minimum unless otherwise indicated.

3. Type: Exposed-mounted, thermostatically controlled, water mixing valve.

4. Material: Bronze body with corrosion-resistant interior components.

5. Connections: Threaded inlets and outlet.

6. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.

7. Pressure Drop: 5 psi maximum at valve flow rate unless otherwise indicated.

2.4 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.

2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.

3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.

4. Screen: Stainless steel with round perforations unless otherwise indicated.

5. Perforation Size:

   a. Strainers NPS 2 and Smaller: 0.033 inch.

   b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.

6. Drain: Pipe plug.

7. Pressure Drop: 3 psi maximum at valve flow rate unless otherwise indicated.

2.5 FLEXIBLE CONNECTORS

A. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.

2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.

3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

2.6 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for full-port, two-piece ball valves.

2. Pressure Rating: 400-psig minimum CWP.

3. Size: NPS 1.

4. Body: Copper alloy.

5. Ball: Chrome-plated brass.

6. Seats and Seals: Replaceable.

7. Handle: Vinyl-covered steel.

8. Inlet: Threaded or solder joint.

9. Outlet (where applicable): Threaded, short nipple with ¾ inch garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.7 PRESSURE CONTROL VALVES

A. Water Hammer Arresters:

1. Standard: ANSI/ASSE 1010 Performance Requirements For Water Hammer Arresters

2. Pressure Rating: Minimum 150-psig.

3. Size: NPS 1.

4. Body: Copper.

5. End connection: Threaded.

2.8 EMERGENCY EYEWASH

A. Self-contained Eyewash Station:

1. Provide in accordance with OSHA, 29 CFR 1910.151(c) and ANSI Z358.1.

2. Mount eyewash station on wall or provide floor mounted eyewash stand. Water flow pattern shall be between 33" and 53" from the floor and at least 6" from the wall or nearest obstruction.

3. Eyewash shall be fully self-contained and not require plumbing or drainage. Discharge and rinse water from eyewash shall be collected by the eyewash. Spills from using the eyewash shall be minimal.

4. Install emergency sign, hanging bracket, and inspection tag adjacent to eyewash.

5. Flow: 0.4-gpm

6. Capacity: Minimum 15 minutes at the rated flow

7. Cartridges:

a. Quantity: Minimum 4 saline cartridges.

b. Life: Minimum 24-month.

~~5.~~8. Products: Honeywell Pure Flow 1000 Eyewash Station or Equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

B. Y-Pattern Strainers: For water, install per drawings.

3.2 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping specialties adjacent to equipment and machines, allow space for service and maintenance.

C. Comply with requirements for ground equipment in Section 26 05 26 - Grounding and Bonding for Electrical Systems.

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:

1. Temperature-actuated, water mixing valves.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 22 05 53.05 - Identification for Plumbing Piping and Equipment.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative.

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

2. Operational Test: After electrical circuitry has been energized, start units to confirm unit operation.

3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports. Note any defects or failures.

3.5 ADJUSTING

A. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION

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SECTION 40 05 13

PROCESS PIPE AND FITTINGS

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes

1. Provide all labor, materials, equipment, incidentals, and appurtenances required for process pipe and fittings in accordance with this Section and applicable reference standards listed in Article 1.3.

2. Furnish, install, test and make ready for operation all process pipe and fittings of the type(s) and size(s) required as shown on the Drawings and as specified. Provide all related appurtenances, including but not limited to attachments, foundations, anchors, supports, couplings, restraints and all related accessories to provide complete operational piping systems as shown on the Drawings and as specified.

3. Unless otherwise indicated, all fittings and appurtenances shall be of the same type and grade of materials as the connecting pipe. All products provided under this section shall conform to current AWWA and ANSI specifications as appropriate to the type of pipe specified.

4. Furnish one set of all special tools required to completely assemble, disassemble, or maintain the process piping and appurtenances. Special tools shall refer to oversized or specially dimensioned tools, special attachments or fixtures, or any similar items.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and payment requirements: per Division 01 General Requirements.

1.3 REFERENCES

A. Reference Standards

1. ASME International (ASME)

a. ASME B1.1 Unified Inch Screw Threads (UN and UNR Thread Form)
b. ASME B1.20.1 Pipe Threads, General Purpose (Inch)
c. ASME B16.1 Cast Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250
d. ASME B16.3 Malleable Iron Threaded Fittings Classes 150 and 300
e. ASME B16.9 Factory-Made Wrought Buttwelding Fittings
f. ASME B16.15 Cast Bronze Threaded Fittings Classes 125 and 250

g. ASME B16.18 Cast Copper Alloy Solder Joint Pressure Fittings
h. ASME B16.21 Nonmetallic Flat Gaskets for Pipe Flanges
i. ASME B16.22 Wrought Copper and Copper Alloy Solder Joint Pressure Fittings
j. ASME B16.26 Standard for Cast Copper Alloy Fittings for Flared Copper Tubes
k. ASME B31.1 Power Piping
l. ASME B31.9 Building Services Piping

2. ASTM International (ASTM)

a. ASTM A193 Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service
b. ASTM A269 Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
c. ASTM A307 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
d. ASTM A479 Standard Specification for Stainless Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels
e. ASTM A536 Standard Specification for Ductile Iron Castings
f. ASTM A632 Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing (Small-Diameter) for General Service
g. ASTM B32 Standard Specification for Solder Metal
h. ASTM B61 Standard Specification for Steam or Valve Bronze Castings
i. ASTM B62 Standard Specification for Composition Bronze or Ounce Metal Castings
j. ASTM B88 Standard Specification for Seamless Copper Water Tube
k. ASTM B124 Standard Specification for Copper and Copper Alloy Forging Rod, Bar, and Shapes
l. ASTM B813 Standard Specification for Lequid and Paste Fluxes for Soldering of Copper

3. American Water Works Association (AWWA)

a. AWWA C104/A21.4 Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
b. ANSI/AWWA C110/A21.10 Ductile-Iron and Gray-Iron Fittings, 3 in through 48 in (76 mm through 1219 mm), for Water
c. ANSI/AWWA C111/A21.11 Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
d. AWWA C115/A21.15 Flanged Ductile-Iron Pipe With Ductile-Iron or Gray-Iron Threaded Flanges
e. AWWA C150/A21.50 Thickness Design of Ductile-Iron Pipe
f. AWWA C606 Grooved and Shouldered Joints

4. International Organization For Standardization (ISO)

a. ISO 228-1 Pipe Threads Where Pressure-Tight Joints Are Not Made on the Threads - Part 1: Dimensions, Tolerances and Designation

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination, Sequencing, and Scheduling: per Division 01 General Requirements.

1.5 RELATED SECTION

A. Section 01 33 00 – Sumbittal Procedures

B. Section 01 75 17 – Field Testing and Startup

C. Section 05 05 24 – Shop and Field Welding and Brazing

D. Section 05 50 00 – Metal Fabrications

E. Section 09 90 00 – Paintings and Coating

F. Section 22 05 53.05 – Pipe Identification

~~B.~~ Section 22 11 15 – Domestic Water Piping

G.

H. Section 22 11 19 – Domestic Water Piping Specialties

I. Section 46 31 58 – Cleaning for Oxygen and Ozone Service

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery: All materials that will not be installed the same day as delivered to the site shall be stored in the original manufacturer's packaging. Loose items with no original packaging shall be boxed to protect the products from scratches, abrasion, or breakage.

B. Protection Prior to Installation

1. All products shall be transported, handled and stored in accordance with the manufacturer's recommendations.

2. All products shall be protected from excessive heat, moisture, and other adverse environmental conditions during storage and handling.

3. All plastic materials shall be stored out of direct sunlight.

~~1.5~~1.7 SUBMITTALS

A. Submit the following in accordance with Division 01 General Requirements.

B. Shop Drawings

1. Shop Drawings for each type of process pipe shall be identified with the applicable style or series designation. Shop drawings shall show layout and dimensions of equipment, major components, key alignment locations and locations of bolt holes. Drawings shall show critical field dimensions identified by the Manufacturer.

2. Shop Drawings shall show layouts and dimensions of the piping, including actual pipe lengths, diameters, fittings and appurtenances.

C. Product Data

1. Submit sufficient product data to verify compliance with the specifications and to illustrate the construction and assembly of the products. Include compliance of materials and components with applicable standards. Product data shall include manufacturer's descriptive data, technical literature, performance charts, catalog cuts, and installation instructions.

2. Prior to shipment of pipe, submit a certified affidavit of compliance from the pipe manufacturer stating that the pipe, fittings, gaskets, linings and exterior coatings for this Project have been manufactured and tested in accordance with applicable AWWA, ASTM and other standards as well as the requirements specified.

D. Reports

1. Submit field test reports for each section of piping tested for pressure and leakage.

E. Calculations

1. Thermal expansion calculations: For cryogenic services 1" in diameter or greater, provide calculations to demonstrate that pipe supports used can accommodate thermal contraction and expansion of the piping (or tubing) system without damage to the pipe supports or piping. Temperatures may range from negative 300 degrees to plus 100 degrees Fahrenheit.

~~1.6~~1.8 QUALITY ASSURANCE

A. Provide in accordance with Division 01 General Requirements.

B. All welding and brazing shall be conducted under qualified welding procedures. All welders, brazers, and operators shall be certified in accordance with the latest applicable AWS and ANSI codes for shop and Project Site welding of piping work. Furnish written proof of certifications upon request from the Engineer.

~~1.7~~1.9 DELIVERY, STORAGE AND HANDLING

A. Provide in accordance with Division 01 General Requirements.

B. All equipment delivered and placed in storage shall be provided with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants in accordance with the Manufacturer's written instructions.

C. Finished surfaces of all exposed openings shall be protected by caps, wooden blanks or other suitable cover to prevent foreign material and debris from entering the equipment.

D. Off-load equipment at the installation site using equipment of sufficient size and design to prevent damage to the equipment. Immediately after off-loading, inspect all equipment for shipping damage or missing parts. Any damage or discrepancy shall be noted in a written claim with the shipper prior to accepting delivery. Validate all serial numbers and parts lists with the shipping documentation. Notify the Manufacturer of any unacceptable conditions with the shipper. Pipe which has been rejected after delivery shall be specifically marked for non-use and shall be removed from the Project Site at no additional cost to ~~Owner~~District. The acceptance of manufacturer's pipe samples prior to shipment shall not guarantee acceptance of all subsequent piping delivered to the job Site.

E. Where necessary to store outside, enclose with durable, waterproof wrapping. Store rubber products under cover out of direct sunlight. Do not store materials directly on the ground.

F. Stacking & Unloading

1. Unload all piping in strict accordance with the manufacturer's recommendations. Take care not to damage the pipe during unloading. Utilize padding on all hooks, slings, and pipe tongs used for unloading to prevent damage to the piping including exterior coating and interior lining. Damage to the interior lining of piping shall render it unfit for use. Dropping of pipe during unloading is not acceptable. Care shall be taken to not skid piping against stationary piping during unloading or stacking.

2. All piping shall be stacked in accordance within the limits recommended by its manufacturer. The piping shall be supported off the ground through the use on timbers, rails, or concrete as recommended by the piping manufacturer.

3. Avoid contact between stainless steel piping and ferrous surfaces or materials, which may lead to rusting of particles embedded in the walls of stainless steel piping. All stainless steel piping shall be stored on supports constructed of non-ferrous metal materials. All tools for stainless steel piping installation shall be specifically designated for use on stainless steel piping to ensure no contamination from ferrous metals occurs. All piping

storage and fabrication supports shall be constructed from non-ferrous metal, stainless steel, or provided with a rubber lining.

~~1.8~~1.10 WARRANTY

A. Provide in accordance with Division 01 General Requirements.

~~1.9~~1.11 SITE CONDITIONS

A. Existing Conditions: per Division 01 General Requirements.

PART 2 – PRODUCTS

2.1 COPPER PIPE, TUBING & FITTINGS FOR DOMESTIC WATER PIPING

A. See 22 11 16, Domestic Water Piping. Pipe sizes and end connections shall be as shown on the Drawings or as specified. Provide all necessary end connections and appurtenances as required to connect to the end uses.

B. Press Fittings

1. Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117. Sealing elements for press fittings shall be FKM (Viton). Sealing elements shall be factory installed or an alternative supplied by fitting manufacturer.

2. Press fittings shall be designed to assure leakage of liquids and/or gases from inside the system past the sealing element of an un-pressed connection. The function of this feature is to provide easy identification of connections which have not been pressed prior to putting the system into operation.

3. Press fittings shall be of the same Type and Temper of copper as the connecting pipe.

C. Flanged Joints

1. Where copper piping is connected to equipment the end connection shall be flanged. Flanges and flanged fittings shall be faced and drilled Class 125/150 in accordance with ASME B16.26. For tie-in to existing flanges, field check existing flanges for non-standard bolt-hole configurations. Provide adaptors and fittings to assure new pipes and flanges mate properly. All flanged joints shall be in alignment with the holes mating with the centerline of the piping.

2. All bolts for flanged connections shall be lubricated with a graphite and oil mixture prior to tightening. All bolts shall be tightened with proper tools to avoid overstressing the piping, bolts, and sealing gaskets beyond the proper designed limits.

3. Alloy bolts ASTM A193, Grade B7 shall be tightened to obtain a stress of 45,000 psi. Carbon steel bolts ASTM A307, Grade B shall be tightened to obtain a stress of 15,000 psi based on the root thread area. All flange bolts shall be of sufficient length so as to allow a minimum of 2 full threads to extend beyond the fastening nut. Provide dielectric isolation between dissimilar metals.

D. Threaded Joints

1. Threaded joints shall be made with an Engineer approved joint compound applied to the male thread only. The use of caulking on the threaded joint shall not be acceptable. All threaded connections shall be in accordance with ASME B1.20.1. The threaded connections shall be full thread, true taper type, machined accurately to gauge. Size reductions shall be through the use of reducing fittings. All plugs shall be steel or brass with a square head design. Bushings and close nipples shall not be acceptable.

E. Solder & Flux

1. Solder and flux shall conform to ASTM B32. The solder alloy shall be 95 percent tin and 5 percent antimony on all pressure piping and potable water piping. No lead-bearing solder shall be permitted under any circumstances. All soldering shall conform to ASTM B813. Silver solder with 45 percent brazing silver alloy shall be utilized.

2. All tubing shall be square cut with reamed ends to prevent improperly sized ends or burrs prior to soldering. Prior to soldering all surfaces shall be cleaned to a bright metal finish and be free of dirt, grease, or other foreign materials prior to fluxing and soldering. All cleaning shall be conducted using an emery cloth, sandpaper, or steel wool.

3. Both the outside and inside ends of the pipe to be soldered shall be cleaned to a length of at least 3/4 inches greater than the depth of the fitting. All joints shall be assembled using non-corrosive flux. Acid solder or flux shall not be permitted under any circumstances. Any cracks, holes, areas of incomplete penetration, or other related defective connections shall not be acceptable. Peening of defects is not permitted under any circumstances.

4. All soldered joints shall be heated uniformly to the solder melting point to allow a complete draw of the solder into the connecting joint. All excess solder shall be completely removed with a cloth brush. A fillet shall be left around the end of the fitting. All connections shall be required to have full penetration of solder throughout the entire connection joint. The cooling of soldered joints via quenching is not permitted.

F. Brazing

1. All flux shall be applied in strict accordance with the recommendations of the brazing manufacturer. Flux is required when joining copper tubing to

cast bronze fittings. Flux is not required when joining copper tubing to wrought copper fittings. Parts to be joined shall be heated 1 inch from the edge of the fitting. Once the flux has become transparent, the heating of the fitting at the base of the cup shall commence. The torch flame shall move continuously throughout the process.

2. Brazing materials shall be applied where the tubing enters the socket or fitting. Direct flames shall not be applied to the brazing material. Capillary action from the heated joint shall draw the brazing material into the joint. A properly made joint shall show a visible fillet completely around the pipe joint. No additional filler shall be added once a fillet has been formed.

3. All flux material shall be removed once the brazing material has solidified. All fittings shall be allowed to cool naturally without the aid of separate quenching. Any cracks, holes, areas of incomplete penetration, or other related defective connections is not acceptable. Peening of defects is not permitted under any circumstances.

G. Grooved Joint Couplings and Fittings

1. Grooved end copper fittings shall be ASME B16.22 wrought copper or ASME B16.18 cast bronze, manufactured to copper tube dimensions. Flaring of tube or fitting ends to accommodate alternate sized couplings shall not be permitted.

a. Provide grooved end fittings for copper pipe of the same type, style, and duty. Acceptable level of quality: equivalent to Victaulic – Copper Connection.

2. Grooved joint couplings and associated fittings shall be ASTM A536, Grade 65-45-12 ductile iron, manufactured to copper tube dimensions. Couplings shall have two housing segments. Coupling gaskets shall be pressure responsive elastomer, center-leg type with pipe stop to ensure proper groove engagement, alignment, and pipe insertion depth. Fitting gaskets shall be Nitrile. The coupling system shall be rated to 300 psi (2065 kPa) with Type K or L Copper Tubing.

a. Provide grooved joint couplings for copper pipe of the same type, style, and duty. Acceptable level of quality: equivalent to Victaulic - Style 607.

H. Copper Tubing

1. All seamless copper alloy tubing shall conform to ASTM B88, alloy C12200, Type L, with an O60 annealed temper. Copper tubing shall only be used where specified or specifically indicated on the Drawings.

I. Copper Joints

1. If the joint type is not specified elsewhere, use soldered joints or joining as directed by the Engineer. Dielectric fittings or isolation joints and materials shall be provided between all dissimilar metals.

2. Unions shall be installed to allow for ease of disassembly for any future piping alterations or repairs. All unions shall be installed as shown on the Drawings and as directed by the Engineer. Unions shall also be installed in in long piping runs, equipment bypasses, connections to equipment, pumps, tanks and between shutoff valves.

3. Unions or flanges for servicing and disconnect are not required in installations using grooved joint couplings.

J. Copper Fittings - General

1. All component castings of flanges and fittings shall be copper alloy and shall conform to ASTM B61 or ASTM B62. Solder joint fittings shall conform to ASME B16.22 and ASME B16.18. Fittings for flared copper tube shall conform to ASME B16.26. Cast bronze threaded fittings shall conform to ASME B16.15 and be threaded in accordance with ASME B1.20.1. Tubing compression fittings shall be forged brass alloy C37700, conforming to ASTM B124.

2. Flared fittings shall not be used without prior written approval from the Engineer.

3. Fittings shall match the type and grade of the connecting piping.

K. Bolting for Copper Piping

1. All bolting materials shall meet the requirements of ASME B31.1. Bolts shall be provided with washers of the same material as the bolts. Provide flange bolt isolators for all dissimilar metals.

L. Pipe Bending

1. All bending of copper piping shall be in accordance with the recommendations of the pipe manufacturer. All bends shall be free from damage including, but not limited to, holes, cracks, or buckles.

2.2 STAINLESS STEEL TUBING

A. All stainless steel tubing shall meet the requirements of ASTM A269 and ASTM A632. All tubing shall be seamless or welded, Type 316 with nominal size and wall thickness. Provide tubing sizes indicated on Drawings.

B. Fittings shall be compression style, constructed of ASTM A479 stainless steel, Type 316. All nuts, ferrules, and bodies shall be rated to a minimum 150 psi pressure. Threads shall be straight conforming to ISO 228-1 and ASME B1.1.

C. All tubing of the same type, style, and duty shall be supplied by a single manufacturer. Stainless steel tubing to be a product of one of the following manufacturers.

~~1. Eagle Stainless Tube & Fabrication, Inc.~~

~~2.~~1. Swagelok Company, no substitutions allowed.

~~3. Plymouth Tube Company~~

D. ~~Or equal~~All tubing and fittings for cryogenic service shall be cleaned and suitable for use with the process fluid it is applied to. Provide stainless steel tubing for instrumentation and sample lines in accordance with the manufacturer's recommendations and these Specifications.

~~4.~~

2.3 GASKETS

A. Gaskets shall conform to ANSI/AWWA C111/A21.11. Gaskets shall be provided by the pipe manufacturer unless otherwise noted. Unless otherwise noted, all gaskets 12 inches in diameter or less shall be a minimum of 1/8 inches thick. All gaskets larger than 12 inches in diameter shall be a minimum of 3/32 inches thick.

B. Gaskets to have a smooth finish, be designed for use in plastic, metal or plastic-lined metal piping systems as applicable and be compatible with the associated process fluid. Gaskets for use in potable water service shall have an NSF 61 listing. Gaskets for low pressure air piping shall be suitable for use at temperatures to 250 degrees F.

C. Gaskets for use on flanged piping shall be low torque, flat ring type, full face to ANSI B16.5 dimensions for 125/150-pound flanges and rated for a minimum pressure of 150 psi. Gaskets shall have two concentric, convex, molded rings between the center hole and bolt hole circle. For flanged CPVC piping, when the mating flange has a raised face an additional filler gasket shall be provided between the outer diameter of the raised face and outer diameter of the flange to protect the flange from bolting moments.

D. Gaskets for use on mechanical joint and push-on joint piping shall meet or exceed the minimum requirements of AWWA C111/A21.11 for styrene-butadiene rubber (SBR) gaskets. Gaskets for use on bell and spigot joint FRP piping shall be EPDM.

E. Gaskets for use with grooved end joints shall be pressure responsive elastomer. Gaskets for carbon steel grooved end piping shall be EHP and suitable for water service to 250 deg F. Gaskets for HDPE grooved end piping to be pre-lubricated.

F. If for a specific application a pipe or valve manufacturer recommends a different type of gasket than that specified, submit gasket information to the Engineer ~~the~~ for review and approval.

G. Gaskets of the same type and material to be provided by a single manufacturer. Gaskets to be a product of one of the following manufacturers.

1. Asahi America, Inc.

2. Allstate Gasket & Packing, Inc.

3. Metro Industries, Inc.

4. Or equal

2.4 UNIONS

A. When joining pipe segments, provide unions where called for on the Drawings and as specified. Provide additional unions to allow for disassembly of piping segments. Provide unions at pumps, equipment and valves to allow for removal without disassembly of the piping systems.

B. Unions or flanges for servicing and disconnect are not required in installations using grooved joint couplings.

2.5 ATTACHMENT HARDWARE

A. Unless otherwise indicated, all attachment hardware, including but not limited to nuts, bolts, washers and all related fastening devices shall be 316 stainless steel. Threads shall be coated with mineral oil or another anti-seize compound prior to installation. Hardware for submerged applications shall be 316 stainless steel.

2.6 STAINLESS STEEL PIPE FOR LIQUID OXYGEN PROCESS PIPING

A. General:

1. Pipe sizes specified in the Specifications are nominal.

B. Wall thickness:

1. Schedule 40S.

C. Piping material and manufacturing:

1. Comply with the requirements outlined in the following table:

Service	Stainless Steel Grade	Pipe Manufacturing Process
Oxygen Service		
Piping 2 1/2 inches in nominal diameter and larger	Type 316L or LDX 2101 stainless steel in accordance with ASTM A 240	Type 316L in accordance with ASTM A 778
		Type LDX 2101 in accordance with ASTM A 790
Piping less than 2 1/2 inches in nominal diameter	Type 316L or LDX 2101 stainless steel in accordance with ASTM A 240	Type 316L in accordance with ASTM A 312
		Type LDX 2101 in accordance with ASTM A 790

D. Fittings for piping 2 1/2 inches in nominal diameter and greater:

1. Material: In accordance with ASTM A 240 stainless steel, grade to match the pipe.

2. Manufacturing standard: In accordance with ASTM A 774.

3. Wall thickness of fitting: In accordance with ASME B36.19 for the schedule of pipe specified.

4. End configuration: As needed to comply with specified type of joint.

5. Dimensional standards:

   a. Fittings with weld ends: In accordance with ASME B16.11.

   b. Fittings with flanged ends: In accordance with ASME B16.5, Class 150.

   c. Fittings for piping less than 2 1/2 inches in diameter D

6. Material: In accordance with ASTM A 240 stainless steel, grade to match the pipe.

7. Manufacturing standard: In accordance with ASTM A 403, Class WP.

8. Wall thickness and dimensions of fitting: In accordance with ASME B16.11 and as required for the schedule of pipe specified.

9. End configuration: As needed to comply with specified type of joint.

10. Forgings in accordance with ASTM A 182, or barstock in accordance with ASTM A 276. Match forging or barstock material to the piping materials.

E. Piping joints:

1. Joints in piping 2 inches in diameter and smaller: Flanged socket welded ~~or screwed with Teflon tape thread lubricant~~ except threaded joints for relief valve installations 1 inches in diameter and smaller.

~~, as specified in Section 40 05 00.01.~~

2. Welded joints:

a. Piping less than 4 inches in diameter: Single butt-welded joints.

b. Mark each weld with a symbol that identifies the welder.

3. Flanged joints: Conforming to the requirements in accordance with ASME B16.5, Class 150.

4. Flanges for Schedule 40S and Schedule 80S pipe:

a. Provide forged stainless steel (type matching piping system) slip-on flanges in accordance with ASME B16.5 Class 150.

b. Material: In accordance with ASTM A 182D.

F. Gaskets:

1. PTFE sheet with a minimum thickness of 1/8". Acceptable Manufacturers: Garlock Gylon Style 3502 or equal.

G. Bolts for flanges:

1. Bolts and nuts: Type 316 stainless steel in accordance with ASTM A 193 heavy hex head.

H. Bolt length such that after installation, end of bolt projects 1/8-inch to 3/8 inch beyond outer face of nut.

I. Nuts: In accordance with ASTM A 194 heavy hex pattern.

J. Fabrication of pipe sections:

1. Welding: Weld in accordance with ASME B31.3 and Section 05 05 24.

a. Notify the Engineer when shop welding will be performed and facilitate Engineer inspection as specified in Section 05 05 24.

b. Follow general welding procedures as specified in Section 05 05 24.

2. Weld seams:

a. Full penetration welds, free of oxidation, crevices, pits and cracks, and without undercuts.

b. Provide weld crowns of 1/16 inch with tolerance of plus 1/16 inch and minus 1/32 inch.

c. Where internal weld seams are not accessible, use gas tungsten-arc procedures with internal gas purge.

d. Where internal weld seams are accessible, weld seams inside and outside using manual shielded metal-arc procedures.

3. Inspect and perform non-destructive examination on shop welds as specified in Section 05 05 24. Pay for non-destructive examination as specified in Section 05 05 24.

~~A.~~K. Cleaning:

1. Following shop fabrication of pipe sections, straight spools, fittings, and other piping components, clean fabricated pieces.

2. NOT USED.

3. NOT USED.

4. Oxygen clean and seal piping sections in accordance with Section 46 31 58.

2.7 COPPER TUBING FOR LIQUID OXYGEN SERVICE

COPPER TUBING, [CU] Suitable for cryogenic liquid oxygen service and cleaned per ASTM B819 and Section 46 31 58.		
TUBING~~PIPE~~	Materials and Construction / Dimensions:	Exposed service: Seamless Copper Tube per ASTM B88, Type K, hard temper (no coils).
FITTINGS & UNIONS	Materials:	Cast copper or bronze: ASTM B584, Alloy C84400 (Lead-free) Wrought copper or bronze: ASTM B75, Alloy C12200 (Lead-free)
	Construction / Dimensions:	Fittings: Cast: ASME B16.18 Wrought: ASME B16.22 Wrought Radius Elbows: MSS-SP-104 Unions: MSS-SP-123 Contractor shall not use unions or flared fittings for copper tubing 1” and larger.

FLANGES	Materials and Construction/ Dimensions:	Flanges shall be bronze raised face and meet ANSI Class 150 and ASTM A 182, F-316 suitable for either slip-fit brazed to copper tubing Type K or threaded to threaded-by-slip fit copper fitting and specified as compatible with liquid oxygen service. Acceptable manufactures: NIBCO Style 771-LF (slip fit–) and Style 775-LF (threaded) or equal, Valves shall be flanged except pressure relief valves which shall be threaded. Gaskets shall be~~r~~ PTFE sheet with a minimum thickness of 1/8". Acceptable Manufacturers: Garlock Gylon Style 3502 or equal.
JOINTS	Construction:	Soldered: per ASTM A5.3 and B828
SOLDER	Materials:	45% silver solder in accordance with AWS A5.8 BAg-5.
FLUX	Materials:	Appropriate for brazing filler material.
END OF [CU]		

PART 3 – EXECUTION

3.1 INSTALLATION - GENERAL

A. Piping systems shall be fabricated and installed in accordance with ASME B31.1. Install each run of piping with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance or replacement of valves and equipment. Reduce sizes, where indicated on the Drawings, by use of reducing fittings. Align piping accurately at connections, within 1/16-inch misalignment tolerances.

B. Locate piping runs, except as indicated, vertically and horizontally (pitched to drain) and avoid diagonal runs wherever possible. Orient horizontal runs parallel with walls and column lines. Locate runs as shown, or, if not otherwise indicated, run piping in the shortest route which does not obstruct usable space or block access for servicing the building and its equipment. Hold piping close to walls, overhead construction, columns, and other structural and permanent-enclosure elements of buildings.

C. Provide unions in piping as shown on the Drawings and as specified. Unions shall be provided in locations, including but not limited to the following: equipment, pumps, tanks, valves, long piping runs, piping bypasses around equipment, or any other location as directed by the Engineer or District. Unions shall be located to allow for piping disassembly, alterations, and repairs.

D. Provide all field routing and coordination of process piping routing as required to accommodate all necessary coordination with other Work of the Contract,

including, but not limited to heating, ventilating, and air-conditioning (HVAC), electrical, structural, architectural, plumbing, and civil work.

3.2 LIQUID OXYGEN PIPING

A. General:

1. Follow procedures in industry standards for cryogenic liquid oxygen systems including, but not limited to, ASME, ASTM, CGA, and Section 46 31 58 - Cleaning for Oxygen and Ozone Service, when modifying existing, and installing new, liquid oxygen piping and equipment.

2. Install piping in such a manner as not to impart strain to connected equipment.

3. Nitrogen purge connections to existing piping prior to hot work activities.

B. Stainless Steel Piping

1. Field Assembly of Shop-Fabricated Stainless Steel Piping Sections:

a. Join shop-fabricated piping sections together using flanges.

b. If field welding is required, pickle and passivate the field welds by using a cleaning process as specified in Section 46 31 58 where the Provider uses a cleaning process that also pickles and passivates the interior welds. Exterior field welds shall be pickled and passivated by using K-2 Pickling Paste and K-2 Passivation, or equal as approved by the Engineer, in accordance with the manufacturer's instructions. Use only a stainless steel brush to clean the field welds.

2. Field Quality Control:

a. Test stainless steel piping to 225 psi pressure and by method as specified in ASME B31.3.

b. Visually inspect pipe for welding defects such as crevices, pits, cracks, protrusions, and oxidation deposits.

c. Welds in liquid oxygen service piping: Examined and inspected in accordance with ASME B31.3.

3. Protection:

a. Preserve appearance and finish of stainless steel piping by providing suitable protection during handling and installation and until final acceptance of the Work:

1) Use handling methods and equipment to prevent damage to the coating, include the use of wide canvas slings and wide padded skids.

2) Do not use bare cables, chains, hooks, metal bars, or narrow skids.

3) Store stainless steel piping and fittings away from any other piping or metals. Storage in contact with ground or outside without projection from bad weather is prohibited.

4) Protect stainless steel piping and fittings from carbon steel projections (when grinding carbon steel assemblies in proximity) and carbon steel contamination (do not contact stainless steel with carbon steel wire brush or other carbon steel tool).

C. Copper Piping and Tubing

1. Install in accordance with ASME B31.3, ASME B31.5, and ASTM B828.

2. See Section 05 05 24 Shop and Field Welding and Brazing for silver soldering certification requirements.

~~1.~~3. Contractor shall test piping and tubing for leaks by soap testing in attendance of the Engineer. District reserves the right to require ~~Examine via~~ 100% radiography testing in accordance with ASME B31.3 for failed soap tests.

4. Test copper tubing to 150 psi with nitrogen and by method as specified in ASME B31.3. Contractor shall provide all equipment and materials needed for the test.

a. Submit a test plan including layout of test apparatus and test method to the Engineer.

~~3.2~~3.3 COPPER PIPE & TUBING INSTALLATION FOR DOMESTIC WATER PIPING

A. All threaded connections shall conform to ANSI B2 and ASME B1.20.1. All threaded connections shall be true, accurate, and of full thread. All threaded plugs shall be brass with a square head. All threaded joints shall be made with a joint compound approved by the piping manufacturer. The joint compound shall be applied to the male thread only. Caulking of threaded joints is not acceptable. All reductions and expansions in piping diameters shall be through the use of reducers and expansion fittings. Bushings or close nipples are not acceptable.

B. Soldering

1. Unless otherwise indicated all joints for copper pipe 2 inches and smaller shall be soldered. Prior to soldering, all surfaces shall be thoroughly cleaned and polished, and free from dirt, grease, grime or other foreign materials before fluxing and soldering. The cleaning shall be performed by using an emery cloth, sandpaper, or steel wool. Clean the outside end of the copper

tubing for a length of a least 1/2 inch greater than the depth of the fitting. The inside of the fittings shall be cleaned in a similar manner. Apply non-corrosive flux and assemble the joint. Insert ends of tubes into fittings to the full depth of the sockets. Acid solder and acid flux are not acceptable.

2. The copper piping and tubing surfaces to be joined shall be heated up slowly and uniformly. The surface being soldered shall be heated to the melting point of the solder. Apply heating to draw the solder completely into the joint. Form continuous solder beads around the entire circumferences of the joints. Once solder is plasticized, remove all excess with a brush or other suitable cleaning device. Excess solder shall be removed from the interior and exterior of the piping. Provide a fillet around the end of all fittings and joints. Allow soldered joints to cool slowly in the air. The use of water for quenching is not acceptable. Provide full penetration of solder within all joints.

C. All cutting of copper tubing shall be square. The ends of all-cut piping shall be reamed or filed to remove burrs. The use of piping with out-of-round ends is not acceptable. Any type of defects, including but not limited to, cracks, holes, and incomplete solder penetration is not acceptable. Peening for the closing of defects is not acceptable under any circumstances.

D. Utilize heating torches of sufficient size based on the size of the piping to be joined. Utilize combination torches with ring burners or multiple tips for heating of copper fittings 1-3/4 inches and larger.

E. Brazing

1. All joints for interior copper pipe larger than 2 inches shall be brazed. Apply all flux in strict accordance with the recommendations of the manufacturer of brazing filler material. Apply flux to the outside of fittings and avoid allowing the flux to enter the inside of the tubing. Apply heat to the brazed sections of piping beginning 1 inch from the edge of each fitting.

2. Once the flux becomes transparent, heat the fitting at the base of the cup. All heating shall be conducted while continuously moving the torch flame. Continuously maintain heating along the joint between the fitting and tubing connection axis.

3. Apply the brazing material at the joint where the tubing enters the socket of a fitting. Heat the joint to melt the brazing material. Do not apply the torch flame directly on the brazing material. A properly assembled joint shall consist of a fillet of filler being visible around the complete circumference of the joint. Once a complete fillet is visible, stop adding filler metal. Remove any excess flux residue.

4. Allow all joints to cool slowly via the surrounding air. The use of water for quenching is not acceptable. Any type of defects, including but not limited to, cracks, holes, and incomplete filler material penetration is not

acceptable. Peening for the closing of defects is not acceptable under any circumstances.

F. Flanges

1. Install flanged connections as required as shown on the Drawings and as approved by the Engineer. Install all flange faces in perfect alignment. The flange holes shall straddle the vertical center line of the piping.

2. Flange bolts shall be alloy steel, ASTM A193 Grade B7, or commercial grade carbon steel, ASTM A307, Grade B. Alloy steel bolts shall be tightened to obtain a stress of 45,000 psi and carbon steel bolts shall be tightened to obtain approximately 15,000 psi of stress. The stress shall be based on the root area of the bolt thread. Provide flange bolt isolators for dissimilar metals.

3. Lubricate all bolts over the entire thread length with a heavy graphite and oil mixture prior to tightening. Tighten bolts with proper wrenches. Secure flanges with uniform pressure on the bolts and gaskets. Flanged joints with flange dishing and over-compression of the gaskets due to overstressing of the bolts is not acceptable. Utilize bolts of adequate length to allow for a minimum of 2 full thread lengths to extend beyond the fastening nut.

~~3.3~~3.4 STAINLESS STEEL TUBING~~-~~ INSTALLATION

A. Install all tubing~~pipe~~ and fittings in strict accordance with the recommendations of the pipe manufacturer. All ~~piping~~tubing shall be pitched to low points and shall be provided with condensate drains. All pipe supports and restraints shall be provided as recommended by the pipe Manufacturer.

B. If pipe cutting is required for installation, a machine shall be used. All cuts shall be neat, true, and smooth at 90-degree angles to the pipe longitudinal axis or center line.

C. Prior to assembly in the field, clean all flanges, gaskets or threads with a soap and warm water solution. All flanged bolts shall be tightened alternately and evenly to the manufacturer's required torque. Take care not to over-tighten any flange bolts. Do not utilize extension or pipe ratchet wrenches, which may cause over-torque of flange bolts. All flange joints shall be assembled with gaskets, bolts and nuts, bolt studs with a nut on each end, or studs and nuts when the pipe is tapped. Ensure all flange holes are provided with connectors.

D. Cut threads full and clean using sharp dies. Ream all threaded ends to remove burrs and restore the full inside pipe diameter. Apply pipe joint compound or Teflon pipe joint tape as recommended by the pipe and fitting manufacturer on male threads at each joint, and tighten the joint to leave not more than 3 threads exposed.

E. All pipe and fittings shall be cleaned of all dust, oil, grease, water, dirt or any other foreign matter prior to installation. Ensure no foreign matter, tools, or other

construction materials are left in the ~~piping~~tubing. All stainless steel ~~piping~~tubing shall be washed clean with steam or warm water to remove any other remaining foreign matter or debris.

F. Stainless steel ~~piping~~tubing used in low pressure air or other associated hot applications to be designed to account for thermal expansion and contraction over a temperature range of 0 degrees F to 200 degrees F.

G. Welding in the field shall only be conducted with prior written approved by the Engineer. All welds shall be made by welders certified under ASME Section IX and be equal or exceed shop welds in all respects. Field welding shall only be conducted after a demonstration weld is successfully completed by each welder, at no additional cost to the ~~Owner~~District or Engineer. All field-welded joints shall be thoroughly cleaned and buffed using deburring and finishing wheels.

H. Provide certifications that on-Site welders are qualified in accordance with ANSI B31.1, Paragraph 127.5 for shop and Project Site welding of pipe work. Provide certified copies of current welding certificates for welders on Site to Engineer and ~~Owner~~District.

I. If rusting of stainless steel ~~piping~~tubing occurs after installation, remove at no additional cost to ~~Owner~~District or Engineer. Pickle the affected surface area of the ~~piping~~tubing with a deoxidizer as recommended by the pipe manufacturer and approved by Engineer. Scrub affected areas of the ~~piping~~tubing with stainless steel brushes and then thoroughly rinse the affected area.

~~3.4~~3.5 INSTALLATION OF SLEEVES AND SEALS

A. Install pipe sleeves of types as indicated on the Drawings where piping passes through walls, floors, ceilings, and roofs. Do not install sleeves through structural members of Work, except as detailed on the Drawings, or as approved by the Engineer. Install sleeves accurately centered on pipe runs. Size sleeves so that piping and insulation will have free movement in the sleeve, including allowance for thermal expansion; but not less than 2 pipe sizes larger than the piping run. Install length of sleeve equal to thickness of construction penetrated, and finish flush to surface, except floor sleeves. Extend floor sleeves 4 inches above the level floor finish, and 4 inches above floor finishes sloped to drain. Provide temporary support of sleeves and provide temporary closure to prevent concrete and other materials from entering sleeves.

B. Sleeve Seals shall be installed in accordance with the following:

1. Mechanical Seals: Loosely assemble rubber links around the pipe with bolts and pressure plates located under each bolt head and nut. Push into sleeve and center. Tighten bolts until links have expanded to form a watertight seal.

2. Wall Pipe: Install wall pipe where indicated on Drawings. Joints shall be as indicated for connection to adjacent piping.

~~3.5~~3.6 CLEANING

A. Thoroughly clean the interior and exterior of all piping prior to testing. Provide removal of all dirt, dust, oil, grease and other foreign materials from the piping. Exercise care while cleaning piping to avoid damage to linings and coatings. Clean all piping in strict accordance with the recommendation of the piping manufacturer.

B. Flush out piping systems, except odor control piping, with clean water prior to proceeding with the required tests. Inspect each run of piping for completion of joints, supports, accessory items, and appurtenances prior to testing.

~~B.~~C. For piping and tubing to be used for cryogenic service, see Section 46 31 58, Cleaning for Oxygen and Ozone Service.

3.7 PIPE SUPPORT SYSTEMS

A. No attempt has been made to show all required pipe supports in all locations on the drawings. The absence of pipe supports and details on any drawing shall not relieve the Contractor of the responsibility for providing them in accordance with the pipe manufacturer's written recommendations and these specifications.

B. Provide special pipe supports where shown.

C. General support spacing shall be at maximum distances as listed below (unless otherwise shown):

TYPE OF PIPE	1" SIZE AND SMALLER	1-1/4" SIZE AND LARGER
Stainless Steel	6'-0"	10'-0" *
Copper Tubing	5'-0"	8'-0"

* Except for the Make lines (insulated 2" LOX-STL between cold box and LOX tanks). M~~m~~atch existing support spacing for the Make lines.

D. Provide at least one pipe support at each change of direction of the pipe.

E. Provide additional pipe supports directly adjacent to valves and other operating devices so that piping does not move when the valve or device is operated.

F. Decrease spacing as necessary to prevent sagging and vibration.

G. Provide a minimum of two anchor bolts on each channel support attached to concrete.

H. Install supports to allow up to 0.25-inches of thermal expansion for liquid oxygen piping.

~~3.6~~3.8 PIPE TESTING - GENERAL

A. Test all piping in the presence of the Engineer and the plumbing or building inspector if required by the State of the Project location or by the ~~Owner~~District. All testing shall be in accordance with the requirements of the local and state plumbing codes and the appropriate sections of these Specifications. All testing shall be conducted at no additional cost to the ~~Owner~~District or Engineer. Provide all labor, equipment, materials, taps, water, gauges, pumps, and appurtenances to conduct all piping tests.

B. When requested by the Engineer or local plumbing inspector, building gravity drains shall be tested prior to backfilling or concealing. All other piping may be tested after backfilling. Any deficiencies found during testing shall be repaired and retested at no additional cost to the Engineer or ~~Owner~~District. Provide lawful disposal of all waste after the testing.

C. Test all piping systems before insulation is installed. Remove all control devices before testing. Test each natural section of each piping system independently but do not use piping system valves to isolate sections where the test pressure exceeds the valve pressure rating. Test each section with water or other fluids as directed by the Engineer and ~~Owner~~District. Pressurize the pipe to the specified level for the required time period.

~~3.7~~3.9 HYDROSTATIC PRESSURE TESTING

A. All liquid service pipe and fittings shall be pressure tested using water to the test pressures specified or as directed by the Engineer. All pipe and fittings shall be pressure tested with water at the maximum service temperature specified or as directed by the Engineer. Test pressures for designations and systems not listed shall be as directed by the Engineer prior to testing. All testing shall be in accordance with the procedures of ASME B31.1.

B. Provide water or other test fluid as directed by the Engineer, of sufficient capacity to deliver the required test pressure specified. Provide all valves on the suction and discharge side of the pump as well as a strainer on the inlet side of the pump to prevent foreign matter from entering the system. Provide pressure gauges capable of reading 50 percent higher than the specified test pressure. The pressure gauges shall be located at the pump discharge and any other place as directed by the Engineer. Provide a pressure relief valve set at a pressure 20 to 25 percent above the specified test pressure. Provide heaters, if required, to heat the test water to the specified test temperature.

C. Preparation For Testing

1. Coordinate the testing fluid to be used with Engineer and ~~Owner~~District. When the fluid test temperature is not ambient, consult with Engineer for the appropriate test temperature. All testing equipment shall be compatible with the piping and test fluid. Provide vents at all high points of the system

if not already installed. Provide drains in locations where venting or draining devices do not exist.

2. Remove all discs, pistons, and balls from check valves if they prohibit testing of the piping system. Ensure all valves and appurtenances are fully open within the section of piping to be tested. Remove all control instruments and alarms prior to testing. Block off or remove all pressure relief valves prior to testing and temporarily close all external openings of the piping section to be tested. All closures shall be specifically designed for the test pressure. All joints in the piping section to be tested shall be left exposed for examination and inspection during the test period. Pipe insulation shall not be installed prior to conducting pipe testing.

3. Provide temporary supports for vapor or gas piping to support the weight of the test fluid if the vapor or gas piping is directed to be hydrostatically tested.

4. Provide temporary support, restraint or isolation for all expansion joints.

D. Hydrostatic Test

1. Slowly fill the piping system, expelling entrapped air from all high points. The fill rate shall be controlled so that the fluid velocity within the pipe system is less than 2 feet per second. Once the filling process has been completed the piping system shall be brought up to the specified test temperature, if required or directed by the Engineer. The pressure shall be held at 20 percent less than the test pressure until the temperature has been stabilized. Once the temperature has stabilized, raise the pressure to the test level as specified or as directed by the Engineer.

2. The pipe system shall be slowly brought up to the test pressure. Take care not to create shock, surge, or water hammer in the pipe system.

3. For pressure piping, test each piping system at 150 percent of the design operating pressure, but not less than 25 psig test pressure, whichever is greater. Pressure piping shall be defined as piping systems in which the process fluid does not flow via gravity. The minimum test pressure for all gravity piping shall be 10 psig. Provide the Engineer and ~~Owner~~District with a minimum 24-hour notice prior to the testing. Tests which are not witnessed by Engineer are not acceptable. In the absence of specified test pressures, consult the Engineer for determining the test pressure for each system. The required test period shall be a minimum of 2 hours.

4. The test duration time limit shall not begin until the full pressure specified or indicated by the Engineer has been reached and the system has been stabilized to within plus or minus 5 percent of the test temperature. The system temperature shall be maintained to within plus or minus 5 percent of the specified or Engineer indicated value for the entire duration of the test.

The test pressure shall be maintained at plus or minus 5 psi of the specified or Engineer indicated test pressure for the entire duration of the test.

5. The pressure test to be monitored by a recording type pressure gauge. When temperature and pressure control is required, use a combination temperature and pressure recording gauge. Record the entire test process. The records shall include, but are not limited to, the date of testing, piping section tested, test pressure, testing equipment, testing results, test fluid, test temperature, and signatures of Engineer, Contractor, and ~~Owner~~District.

E. Inspection of Testing

1. Observe each test section for leakage during the test period. The hydrostatic test shall be deemed acceptable if no visible leaks are detected and the pipe system pressure can be maintained within plus or minus 1 percent but no more than 5 psi of the specified value.

2. Upon completion of the test, the pressure shall be slowly removed by opening a valve or other pressure-relieving device at a location remote to the location of the pressure and temperature monitoring equipment. The pressure shall be reduced to approximately 20 percent of the specified or Engineer indicated test pressure. Stabilize the system pressure at that point while the entire system is inspected for leaks, cracks, or other piping system defects. If any defects are found, alleviate pressure in the piping system, drain the test fluid, correct all defects, and retest the piping system.

3. Repair all piping system sections which fail the hydrostatic pressure piping test, by disassembly and re-installation using new materials to the extent required to overcome leakage or pressure drop. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods. Repair and retest all defective piping sections at no additional cost to the ~~Owner~~District or Engineer. Drain and dispose of all fluids from the piping systems after testing and repair Work has been completed.

~~3.8~~3.10PNEUMATIC PRESSURE TESTING

A. All low-pressure air service pipe and fittings shall be pneumatically pressure tested using air to the test pressures specified or as directed by the Engineer. All pipe and fittings shall be pressure tested with air at the maximum service temperature specified or as directed by the Engineer. Test pressures for designations and systems not listed shall be as approved by the Engineer prior to testing. All testing shall be in accordance with the procedures of ASME B31.1.

B. Preparation For Testing

1. Coordinate testing pressure with Engineer. When the air test temperature is not ambient, consult the Engineer for the appropriate test temperature. All testing equipment shall be compatible with the piping. Provide vents at all high points of the system if not already installed.

2. Remove all discs, pistons and balls from check valves if they prohibit testing of the piping system. Ensure all valves and appurtenances are fully open within the section of piping to be tested. Remove all control instruments and alarms prior to testing. Block off or remove all pressure relief valves prior to testing and temporarily close all external openings of the piping section to be tested. All closures shall be specifically designed for the test pressure. All joints in the piping section to be tested shall be left exposed for examination and inspection during the test period. Insulation shall not be installed prior to conducting tests. Provide a soapy water solution and test all fittings, joints, couplings and valves for air leakage.

3. Personnel not directly involved in pneumatic pressure testing of piping shall be evacuated from the area. The maximum length of piping to be tested at 1 time shall be 400 feet. Examine all connections prior to testing to ensure proper fit and tightness. Determine the pressure rating for all connected devices and appurtenances to ensure they are rated for the required test pressure. Isolate all equipment and appurtenances, which may be damaged by testing. Plug all test, drain, and vent ports, which are not required for the test. If the section of pipe being tested is isolated from other sections by in-line valves, ensure that the portion not being tested is open to the atmosphere. Protect expansion joints against system pressures by suitable movement-limiting devices.

C. Pneumatic Pressure Test

1. Slowly fill the piping system. Each piping system shall be brought up to the specified test temperature. The pressure shall be held at 20 percent less than the required test pressure until the temperature has been stabilized. Once the temperature has stabilized, raise the pressure to the test level as specified or as directed by the Engineer.

2. Test each piping system at 150 percent of the design operating pressure, but not less than 25 psi test pressure, whichever is greater. Provide the Engineer and ~~Owner~~District with a minimum of 24-hour notice prior to the testing. Tests which are not witnessed by Engineer are not acceptable. In the absence of specified test pressures, consult Engineer for determining the test pressure for each system. The required test period shall be 2 hours.

3. The test duration time limit shall not begin until the full pressure specified or indicated by the Engineer has been reached and the system has been stabilized to within plus or minus 5 percent of the test temperature. The system temperature shall be maintained to within plus or minus 5 percent of the specified or Engineer indicated value for the entire duration of the test. The test pressure shall be maintained at plus or minus 0.5 psi of the specified or Engineer indicated test pressure for the entire duration of the test.

4. The pressure test shall be monitored by a recording type pressure gauge. When temperature and pressure control is required, use a combination temperature and pressure recording gauge. Record the entire test process.

The records shall include, but are not limited to, the date of testing, piping section tested, test pressure, testing equipment, testing results, test temperature, and signatures of the Engineer, Contractor, and ~~Owner~~District.

D. Inspection

1. Observe each test section for leakage during the test period. Once the test segment has been pressurized to the specified levels, the source of pressurization shall be isolated and all piping, connections shall be tested for leaks by swabbing with standard high film soap solution while also observing for the formation of air bubbles. Each pneumatic pressure test shall be deemed acceptable if no visible leaks (air bubbles) are detected and the pipe system pressure can be maintained to within plus or minus 1/2 percent but no more than 0.5 psi of the specified value.

2. Upon completion of the test, the pressure shall be slowly removed by opening a valve or other pressure-relieving device at a location remote to the location of the pressure/temperature monitoring equipment. If any defects are found, alleviate all pressure in the piping system, correct all defects, and retest the piping system.

3. Repair all piping system sections which fail the pneumatic pressure-piping test, by disassembly and re-installation, using new materials to the extent required to overcome leakage or pressure drop. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods. Repair and retest defective piping sections at no additional cost to ~~Owner~~District or Engineer.

END OF SECTION

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PURCHASE SPECIFICATIONS
CONTROL VALVES

74 Sail Away Lane
Moneta, VA 24121
Tel. (513)939-9380

Revision	No.	Date	By
30% Design		12/2/21	D. Boggs
90% Design		1/25/23	D.Boggs
100% Design		11/29/23	D.Boggs
100% Design	1	3/26/24	D. Boggs
100% Design	2	4/12/2024	D. Boggs
Addendum 2	1	9/3/2024	D. Boggs

	Tag No.	FV-111A & FV-112A	**Service**	Air (reversing heat exchanger switch valves)
PIPE	Size Upstream	In.	14"	
	Schedule		10	
	Size Downstream	In.	14"	
	Schedule		10	

VALVE BODY	High Performance Butterfly Valve (Switching)	**POSITIONER**	
Manufacturer	Jamesbury Neles or equal	Manufacturer	N/A
Model No.	14 815WO-11-3600XZ-MM	Model No.	N/A
Type	High Performance and Cycle Butterfly	Type	N/A
Nominal Size	14 Inches	Action	N/A
Rated Temp./Press.	200 F/ 235 PSIG	Signal Range	N/A
Body Material	316 SST	Filter/ Reg.	N/A
Bonnet Material	N/A	Gauge Set	N/A
Disc and Shaft	Double Eccentric 316 SST Disc and Shaft		
End Connections	Wafer Style		

ACTUATOR		**POSITION MONITOR**	
Manufacturer	Metso or equal	Manufacturer	Westlock or equal
Model No.	B1CU13-55L	Model No.	2007NBY2B2M0200
Type	Pneumatic Cylinder, Double Acting	Type	Position Limit Switch
Action	Open Close	Signal Range	120 VAC
Air Pressure	60 PSIG		
Failure Mode	Closed		
Solenoid Valve	Four Way Solenoid		
Solenoid Mfg.	ASCO		
Solenoid Model No.	8344G074		
Tubing	1/2" SS		

NOTES:

The body thickness of these butterfly valves is consdierably less than the existing DeZurik plug style valves. Carbon steel flanged spool pieces must be field fabricated and provided to close the remaining gap in the piping. Replace valve, actuators, position monitor and solenoid. Inlcude filter regulator set at 60 PSIG on supply line. Oxygen Cleaning Required

PURCHASE SPECIFICATIONS
CONTROL VALVES

74 Sail Away Lane
Moneta, VA 24121
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Revision	No.	Date	By
30% Design		12/2/21	D. Boggs
90% Design		1/25/23	D.Boggs
100% Design		11/29/23	D.Boggs
100% Design		3/26/24	D. Boggs
Addendum 2	1	9/3/2024	D. Boggs

	Tag No.	FV-113N & FV-114N	**Service**	Nitrogen (reversing heat exchanger switch valves)
PIPE	Size Upstream	In.	20"	
	Schedule		10	
	Size Downstream	In.	20"	
	Schedule		10	

VALVE BODY	High Performance Butterfly Valve (Switching)	**POSITIONER**	
Manufacturer	Jamesbury Neles or equal	Manufacturer	N/A
Model No.	20 815WO-11-3600XZ-MM	Model No.	N/A
Type	High Performance and Cycle Butterfly	Type	N/A
Nominal Size	20 Inches	Action	N/A
Rated Temp./Press.	200 F/ 235 PSIG	Signal Range	N/A
Body Material	316 SST	Filter/ Reg.	N/A
Bonnet Material	N/A	Gauge Set	N/A
Disc and Shaft	Double Eccentric 316 SST Disc and Shaft		
End Connections	Wafer Style		

ACTUATOR		**POSITION MONITOR**	
Manufacturer	Metso or equal	Manufacturer	Westlock or equal
Model No.	B1CU13-55L	Model No.	2007NBY2B2M0200
Type	Pneumatic Cylinder, Double Acting	Type	Position Limit Switch
Action	Modulate	Signal Range	120 VAC
Air Pressure	60 PSIG		
Failure Mode	N/A		
Solenoid Valve	Included		
Solenoid Mfg.	ASCO		
Solenoid Model No.	8344G074		
Tubing	1/2" SS		

NOTES:

The body thickness of these butterfly valves is consdierably less than the existing DeZurik plug style valves. Carbon steel flanged spool pieces must be field fabricated and provided to close the remaining gap in the piping. Replace valve, actuators, position monitor and solenoid. Inlcude filter regulator set at 60 PSIG on supply line. Oxygen Cleaning Required

PURCHASE SPECIFICATIONS
CONTROL VALVES

74 Sail Away Lane
Moneta, VA 24121
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30% Design		12/2/21	D. Boggs
90% Design		1/12/23	D. Derr
100% Design		11/29/23	D.Boggs
100% Design	1	3/26/24	D. Boggs
100% Design	2	4/12/2024	D. Boggs
Addendum 2	1	9/3/2024	D. Boggs

	Tag No.	FV-213A	**Service** Air (turbine bypass)
PIPE	Size Upstream	In.	2"
	Schedule		40
	Size Downstream	In.	2"
	Schedule		40

VALVE BODY	Cryogenic Proportional Trim Globe Valve	**POSITIONER**	
Manufacturer	Valtek/Flowserve, Fisher, or equal	Manufacturer	Valtek/Flowserve, Fisher, or equal
Model No.	TBD	Model No.	TBD
Type	Globe, Proportional Trim	Type	Electronic
Nominal Size	2"	Action	Reverse Acting
Rated Temp./Press.	-320 F/100 PSIG	Signal Range	4 to 12 ma (split)
Body Material	316 SS	Filter/ Reg.	Included
Bonnet Material	316SS	Gauge Set	Supply/Output
Stem Style	30" Extended Stem, Extractable		
End Connections	150#, RF ANSI Flanges		

ACTUATOR		**TRIM**	
Manufacturer	Valtek/Flowserve, Fisher, or equal	Type	Globe
Model No.	TBD	Port Size	2"
Type	Pneumatic Diaphragm	Characteristics	Equal Percent
Action	Modulate	Rated Cv	Full Flow
Air Pressure	60 PSIG	Plug/Disc Material	316SS
Failure Mode	Closed	Seat Material	316SS
Solenoid Valve	Included	Cage/Guide Matl.	Bronze C93200
Solenoid Mfg.	ASCO	Stem Material	316SS
Solenoid Model No.	V0432	Bushing Material	N/A
Tubing	1/4" SS	Packing Matl./Type	PTFE
		Shut Off Class	150

NOTES:

Replacing Valve, Solenoid, Actuator and Positioner. Vermiculite from the turbine box will need to be removed to replace valve. New valve boot will be needed to install valve. Inlcude filter regulator set at 60 PSIG on supply line. Oxygen Cleaning Required

PURCHASE SPECIFICATIONS
CONTROL VALVES

74 Sail Away Lane
Moneta, VA 24121
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30% Design		12/2/21	D. Boggs
90% Design		1/12/23	D. Boggs
100% Design		11/29/23	D.Boggs
100% Design	1	3/26/24	D. Boggs
100% Design	2	4/12/2024	D. Boggs
Addendum 2	1	9/3/2024	D. Boggs

	Tag No.		FV-214A	**Service**	Air (turbine trip)
PIPE	Size Upstream	In.	6"		
	Schedule		40		
	Size Downstream	In.	6"		
	Schedule		40		

VALVE BODY	Cryogenic Butterfly Valve	**POSITIONER**	
Manufacturer	Jamesbury, Fisher, or equal	Manufacturer	N/A
Model No.	6 K815WO-30-36-HB-AS	Model No.	N/A
Type	Wafer	Type	N/A
Nominal Size	6 Inches	Action	N/A
Rated Temp./Press.	-320 F/100 PSIG	Signal Range	N/A
Body Material	316 SST	Filter/ Reg.	N/A
Bonnet Material	N/A	Gauge Set	N/A
Stem Style	30" Extended Stem		
End Connections	150#, RF ANSI Flanges		

ACTUATOR		**POSITION MONITOR**	
Manufacturer	Jamesbury, Fisher, or equal	Manufacturer	Jamesbury, Fisher, or equal
Model No.	VPVL550SR4B-D	Model No.	QG4WP025DM
Type	Rack and pinion, pneumatic cylinder	Type	Quartz QG
Action	Open/Close	Signal Range	On/OFF
Air Pressure	60 PSIG		
Failure Mode	Closed		
Solenoid Valve	Required		
Solenoid Mfg.	ASCO		
Solenoid Model No.	8316G14		
Tubing	1/4" SS		

NOTES:

Replacing Valve, Solenoid, Actuator and Position Monitor. Vermiculite from the turbine box will need ro be removed to replace valve. New valve boot will be needed to install valve (Hypalon or equal). Inlcude filter regulator set at 60 PSIG on supply line. Oxygen Cleaning Required

PURCHASE SPECIFICATIONS
CONTROL VALVES

74 Sail Away Lane
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30% Design		12/2/21	D. Boggs
90% Design		1/12/23	D. Derr
100% Design		11/29/23	D.Boggs
100% Design	1	3/26/24	D. Boggs
100% Design	2	4/12/2024	D. Boggs
Addendum 2	1	9/3/2024	D. Boggs

	Tag No.	FV-215A	**Service**	Air (heat exchanger bypass)
PIPE	Size Upstream	In.	4"	
	Schedule			
	Size Downstream	In.	4"	
	Schedule			

VALVE BODY	Cryogenic Butterfly Valve	**POSITIONER**	
Manufacturer	Jamesbury, Fisher, or equal	Manufacturer	Jamesbury, Fisher, or equal
Model No.	4 K815WO-30-36-HB-AS	Model No.	ND 9102HNUG
Type	Wafer	Type	ND 9000
Nominal Size	4 Inches	Action	Direct Acting
Rated Temp./Press.	-320 F/100 PSIG	Signal Range	12 to 20 ma (split)
Body Material	316 SST	Filter/ Reg.	Included
Bonnet Material	N/A	Gauge Set	Supply/Output
Stem Style	30" Extended Stem		
End Connections	150#, RF ANSI Flanges		

ACTUATOR		**POSITION MONITOR**	
Manufacturer	Jamesbury, Fisher, or equal	Manufacturer	N/A
Model No.	QPX4C/MASC	Model No.	N/A
Type	Pneumatic Diaphragm	Type	N/A
Action	Modulate	Signal Range	N/A
Air Pressure	60 PSIG		
Failure Mode	Closed		
Solenoid Valve	Required		
Solenoid Mfg.	ASCO		
Solenoid Model No.	8316G14		
Tubing	1/4" SS		

NOTES:

Replacing Valve, Solenoid, Actuator and Positioner. Vermiculite from the turbine box will need ro be removed to replace valve. New valve boot will be needed to install valve (Hypalon or equal). Inlcude filter regulator set at 60 PSIG on supply line. Oxygen Cleaning Required

PURCHASE SPECIFICATIONS
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100% Design	1	3/26/24	D. Boggs
100% Design	2	4/12/2024	D. Boggs
Addendum 2	1	9/3/2024	D. Boggs

	Tag No.	FV-220A	**Service**	Air (turbine inlet guide vanes)
PIPE	Size Upstream	In.	N/A	
	Schedule			
	Size Downstream	In.	N/A	
	Schedule			

VALVE BODY	Turbine Inlet Guide Vane	**POSITIONER**	
Manufacturer	N/A	Manufacturer	Fisher or equal
Model No.	N/A	Model No.	TBD
Type	N/A	Type	TBD
Nominal Size	N/A	Action	Direct Acting
Rated Temp./Press.	N/A	Signal Range	4-20 mA
Body Material	N/A	Filter/ Reg.	Included
Bonnet Material	N/A	Gauge Set	Supply/Output
Stem Style	N/A		
End Connections	N/A		

ACTUATOR		**POSITION MONITOR**	
Manufacturer	Fisher or equal	Manufacturer	
Model No.	657-38-3481970	Model No.	
Type	Pneumatic Diaphragm	Type	
Action	Modulate	Signal Range	
Air Pressure	60 PSIG		
Failure Mode	Closed		
Solenoid Valve	Not Required		
Solenoid Mfg.			
Solenoid Model No.			
Tubing			

NOTES:

Replacing Actuator and Positioner
Inlcude filter regulator set at 60 PSIG on supply line. Oxygen Cleaning Required

PURCHASE SPECIFICATIONS
CONTROL VALVES

74 Sail Away Lane
Moneta, VA 24121
Tel. (513)939-9380

Revision	No.	Date	By
30% Design		12/2/21	D. Boggs
90% Design		1/12/23	D. Derr
100% Design		11/29/23	D.Boggs
100% Design	1	3/26/24	D. Boggs
100% Design	2	4/12/2024	D. Boggs
Addendum 2	1	9/3/2024	D. Boggs

	Tag No.		LV-330A	**Service** Crude Liquid Oxygen (lower column level control)
PIPE	Size Upstream	In.	2"	
	Schedule		40	
	Size Downstream	In.	2"	
	Schedule		40	

VALVE BODY	Cryogenic Proportional Trim Globe Valve	**POSITIONER**	
Manufacturer	Valtek/Flowserve, Fisher, or equal	Manufacturer	Valtek/Flowserve, Fisher, or equal
Model No.	TBD	Model No.	TBD
Type	Globe, Proportional Trim	Type	Electronic
Nominal Size	2"	Action	Direct Acting
Rated Temp./Press.	-320 F/100 PSIG	Signal Range	4 to 20 ma
Body Material	316 SS	Filter/ Reg.	Included
Bonnet Material	316SS	Gauge Set	Supply/Output
Stem Style	30" Extended Stem, Extractable (minimum 24")		
End Connections	150#, RF ANSI Flanges		

ACTUATOR		**POSITION MONITOR**	
Manufacturer	Valtek/Flowserve, Fisher, or equal	Manufacturer	
Model No.	TBD	Model No.	
Type	Pneumatic Diaphragm	Type	
Action	Modulate	Signal Range	
Air Pressure	60 PSIG		
Failure Mode	Closed		
Solenoid Valve	Included		
Solenoid Mfg.	ASCO		
Solenoid Model No.	V0432		
Tubing	1/4" SS		

NOTES:

Replacing Valve, Actuator, Solenoid and Positioner. Perllite from the cold box will need to be removed to replace valve. New valve boot will be needed to install valve (Hypalon or equal). Inlcude filter regulator set at 60 PSIG on supply line. Oxygen Cleaning Required

PURCHASE SPECIFICATIONS
CONTROL VALVES

74 Sail Away Lane
Moneta, VA 24121
Tel. (513)939-9380

Revision	No.	Date	By
30% Design		12/2/21	D. Boggs
90% Design		1/12/23	D. Derr
100% Design		11/29/23	D.Boggs
100% Design	1	3/26/24	D. Boggs
100% Design	2	4/12/2024	D. Boggs
Addendum 2	1	9/3/2024	D. Boggs

	Tag No.		FV-340N	**Service**	Liquid Nitrogen (shelf)
PIPE	Size Upstream	In.	2"		
	Schedule		40		
	Size Downstream	In.	2"		
	Schedule		40		

VALVE BODY	Cryogenic Proportional Trim Globe Valve	**POSITIONER**	
Manufacturer	Valtek/Flowserve, Fisher, or equal	Manufacturer	Valtek/Flowserve, Fisher, or equal
Model No.	TBD	Model No.	TBD
Type	Globe, Proportional Trim	Type	Electronic
Nominal Size	2"	Action	Direct Acting
Rated Temp./Press.	-320 F/100 PSIG	Signal Range	4 to 20 ma
Body Material	316 SS	Filter/ Reg.	Included
Bonnet Material	316SS	Gauge Set	Supply/Output
Stem Style	30" Extended Stem, Extractable (24" minimum)		
End Connections	150#, RF ANSI Flanges		

ACTUATOR		**POSITION MONITOR**	
Manufacturer	Valtek/Flowserve, Fisher, or equal	Manufacturer	
Model No.	TBD	Model No.	
Type	Pneumatic Diaphragm	Type	
Action	Modulate	Signal Range	
Air Pressure	60 PSIG		
Failure Mode	Closed		
Solenoid Valve	Included		
Solenoid Mfg.	ASCO		
Solenoid Model No.	V0432		
Tubing	1/4" SS		

NOTES:

Replacing Valve, Actuator, Solenoid and Positioner. Perllite from the cold box will need to be removed to replace valve. New valve boot will be needed to install valve (Hypalon or equal). Inlcude filter regulator set at 60 PSIG on supply line. Oxygen Cleaning Required

PURCHASE SPECIFICATIONS
CONTROL VALVES

74 Sail Away Lane
Moneta, VA 24121
Tel. (513)939-9380

Revision	No.	Date	By
30% Design		12/2/21	D. Boggs
90% Design		1/12/23	D. Boggs
100% Design		11/29/23	D.Boggs
100% Design	1	3/26/24	D. Boggs
100% Design	2	4/12/2024	D. Boggs
Addendum 2	1	9/3/2024	D. Boggs

	Tag No.	LV-350 & LV-351	**Service**	Liquid Oxygen (make & add)
PIPE	Size Upstream	In.	1"	
	Schedule		Type K (copper)	
	Size Downstream	In.	1"	
	Schedule		Type K (copper)	

VALVE BODY	Cryogenic Proportional Trim Globe Valve	**POSITIONER**	
Manufacturer	Valtek/Flowserve, Hammel Dahl, or equal	Manufacturer	
Model No.	Mark One	Model No.	
Type	Globe, Proportional Trim	Type	
Nominal Size	2"	Action	
Rated Temp./Press.	-320 F/100 PSIG	Signal Range	
Body Material	316SS	Filter/ Reg.	
Bonnet Material	316SS	Gauge Set	
Stem Style	12" Extended Stem		
End Connections	150#, RF ANSI Flanges		

ACTUATOR		**TRIM**	
Manufacturer	Valtek/Flowserve, Hammel Dahl, or equal	Type	Globe
Model No.	TBD	Port Size	1"
Type	Pneumatic Diaphragm	Characteristics	Equal Percent
Action	Modulate	Rated Cv	Full Flow
Air Pressure	60 PSIG	Plug/Disc Material	Monel 400
Failure Mode	Closed	Seat Material	Monel 400
Solenoid Valve	Required	Cage/Guide Matl.	Bronze C93200
Solenoid Mfg.	ASCO	Stem Material	Monel 400
Solenoid Model No.	8316G14	Bushing Material	N/A
Tubing	1/4" SS	Packing Matl./Type	PTFE
		Shut Off Class	150

NOTES:

Replacing Valve, Actuator, and Solenoid. Include filter regulator set at 60 PSIG on supply line. Oxygen Cleaning Required

PURCHASE SPECIFICATIONS
CONTROL VALVES

SOLUTIONWERKS
EQUIPMENT AND SERVICES FOR THE INDUSTRIAL GASES INDUSTRY
74 Sail Away Lane
Moneta, VA 24121
Tel. (513)939-9380

Revision	No.	Date	By
30% Design		12/2/21	D. Boggs
90% Design		1/26/23	D. Boggs
100% Design		11/29/23	D.Boggs
100% Design	1	3/26/24	D. Boggs
100% Design	2	4/12/2024	D. Boggs
Addendum 2	1	9/3/2024	D. Boggs

	Tag No.		FV-600X	**Service** Oxygen (product)
PIPE	Size Upstream	In.	6"	
	Schedule		40	
	Size Downstream	In.	6"	
	Schedule		40	

VALVE BODY	High Performance Butterfly Valve	**POSITIONER**	
Manufacturer	Jamesbury, Fisher, or equal	Manufacturer	Jamesbury, Fisher, or equal
Model No.	6 815WO-11-3600XZ-MM	Model No.	ND 9102HNUG
Type	Wafer	Type	ND 9000
Nominal Size	6 Inches	Action	Direct Acting
Rated Temp./Press.	200 F/ 235 PSIG	Signal Range	4 to 20 ma
Body Material	316 SST	Filter/ Reg.	Included
Bonnet Material	N/A	Gauge Set	Supply/Output
Stem Style	N/A		
End Connections	Wafer Style		

ACTUATOR		**POSITION MONITOR**	
Manufacturer	Jamesbury, Fisher, or equal	Manufacturer	N/A
Model No.	QPX4C/MASC	Model No.	N/A
Type	Pneumatic Diaphragm	Type	N/A
Action	Modulate	Signal Range	N/A
Air Pressure	60 PSIG	Filter/ Reg.	N/A
Failure Mode	Closed	Gauge Set	N/A
Solenoid Valve	Required		
Solenoid Mfg.	ASCO		
Solenoid Model No.	8316G14		
Tubing	1/4" SS		

NOTES:

Replacing Valve, Actuator, Solenoid, and Positioner. Inlcude filter regulator set at 60 PSIG on supply line. Oxygen Cleaning Required

PURCHASE SPECIFICATIONS
CONTROL VALVES

74 Sail Away Lane
Moneta, VA 24121
Tel. (513)939-9380

Revision	No.	Date	By
30% Design		12/2/21	D. Boggs
90% Design		1/26/23	D. Boggs
100% Design		11/29/23	D.Boggs
100% Design	1	3/26/24	D. Boggs
100% Design	2	4/12/2024	D. Boggs
Addendum 2	1	9/3/2024	D. Boggs

	Tag No.	FV-601X	**Service**	Oxygen (vent)
PIPE	Size Upstream	In.	4"	
	Schedule		40	
	Size Downstream	In.	4"	
	Schedule		40	

VALVE BODY	High Performance Butterfly Valve	**POSITIONER**	
Manufacturer	Jamesbury, Fisher, or equal	Manufacturer	Jamesbury, Fisher, or equal
Model No.	4 815WO-11-3600XZ-MM	Model No.	ND 9102HNUG
Type	Wafer	Type	ND 9000
Nominal Size	4 Inches	Action	Direct Acting
Rated Temp./Press.	200 F/ 235 PSIG	Signal Range	4 to 20 ma
Body Material	316 SST	Filter/ Reg.	Included
Bonnet Material	N/A	Gauge Set	Supply/Output
Stem Style	N/A		
End Connections	Wafer Style		

ACTUATOR		**POSITION MONITOR**	
Manufacturer	Jamesbury, Fisher, or equal	Manufacturer	N/A
Model No.	QPX3C/MASC	Model No.	N/A
Type	Pneumatic Diaphragm	Type	N/A
Action	Modulate	Signal Range	N/A
Air Pressure	60 PSIG	Filter/ Reg.	N/A
Failure Mode	Closed	Gauge Set	N/A
Solenoid Valve	Required		
Solenoid Mfg.	ASCO		
Solenoid Model No.	8316G14		
Tubing	1/4" SS		

NOTES:

Replacing Valve, Actuator, Solenoid, and Positioner. Oxygen Cleaning Required
Inlcude filter regulator set at 60 PSIG on supply line.

PURCHASE SPECIFICATIONS
CONTROL VALVES

SOLUTIONWERKS
EQUIPMENT AND SERVICES FOR THE INDUSTRIAL GASES INDUSTRY
74 Sail Away Lane
Moneta, VA 24121
Tel. (513)939-9380

Revision	No.	Date	By
30% Design		12/2/21	D. Boggs
90% Design		1/26/23	D. Boggs
100% Design		11/29/23	D.Boggs
100% Design	1	3/26/24	D. Boggs
100% Design	2	4/12/2024	D. Boggs
Addendum 2	1	9/3/2024	D. Boggs

	Tag No.	FV X600X-1 & X600X-2	**Service**	Oxygen (midpoint temperature control)
PIPE	Size Upstream	In.	6"	
	Schedule		40	
	Size Downstream	In.	6"	
	Schedule		40	

VALVE BODY	High Performance Butterfly Valve	**POSITIONER**	
Manufacturer	Jamesbury, Fisher, or equal	Manufacturer	Jamesbury, Fisher, or equal
Model No.	6 815WO-11-3600XZ-MM	Model No.	ND 9102HNUG
Type	Wafer	Type	ND 9000
Nominal Size	6 Inches	Action	Direct Acting
Rated Temp./Press.	200 F/ 235 PSIG	Signal Range	4 to 20 ma
Body Material	316 SST	Filter/ Reg.	Included
Bonnet Material	N/A	Gauge Set	Supply/Output
Stem Style	N/A		
End Connections	Wafer Style		

ACTUATOR		**POSITION MONITOR**	
Manufacturer	Jamesbury, Fisher, or equal	Manufacturer	N/A
Model No.	QPX3C/MASC	Model No.	N/A
Type	Pneumatic Diaphragm	Type	N/A
Action	Modulate	Signal Range	N/A
Air Pressure	60 PSIG	Filter/ Reg.	N/A
Failure Mode	Closed	Gauge Set	N/A
Solenoid Valve	Not required		
Solenoid Mfg.			
Solenoid Model No.			
Tubing	1/4" SS		

NOTES:
Converting manual valves to automatic with positioner and actuator. Inlcude filter regulator set at 60 PSIG on supply line. Oxygen Cleaning Required

PURCHASE SPECIFICATIONS
CONTROL VALVES

74 Sail Away Lane
Moneta, VA 24121
Tel. (513)939-9380

Revision	No.	Date	By
30% Design		12/2/21	D. Boggs
90% Design		1/12/23	D. Boggs
100% Design		11/29/23	D.Boggs
100% Design	1	3/26/24	D. Boggs
100% Design	2	4/12/2024	D. Boggs
Addendum 2	1	9/3/2024	D. Boggs

	Tag No.	PV-615 & PV-625 (2 sets)	**Service**	Oxygen (economizer)
PIPE	Size Upstream	In.	1.5"	
	Schedule		Type K (copper)	
	Size Downstream	In.	1.5"	
	Schedule		Type K (copper)	

VALVE BODY	Cryogenic Proportional Trim Globe Valve	**POSITIONER**	
Manufacturer	Valtek/Flowserve, Fisher, or equal	Manufacturer	Valtek/Flowserve, Fisher, or equal
Model No.	Mark One	Model No.	TBD
Type	Globe, Proportional Trim	Type	Electronic
Nominal Size	1.5"	Action	Reverse Acting
Rated Temp./Press.	-320 F/100 PSIG	Signal Range	4 to 12 ma (split)
Body Material	Monel	Filter/ Reg.	Included
Bonnet Material	316SS	Gauge Set	Supply/Output
Stem Style	12" Extended Stem		
End Connections	150#, RF ANSI Flanges		

ACTUATOR		**TRIM**	
Manufacturer	Valtek/Flowserve, Fisher, or equal	Type	Globe
Model No.	TBD	Port Size	1.5"
Type	Pneumatic Diaphragm	Characteristics	Equal Percent
Action	Modulate	Rated Cv	32
Air Pressure	60 PSIG	Plug/Disc Material	Monel 400
Failure Mode	Closed	Seat Material	Monel 400
Solenoid Valve	Not required	Cage/Guide Matl.	Bronze C93200
Solenoid Mfg.	N/A	Stem Material	Monel 400
Solenoid Model No.	N/A	Bushing Material	N/A
Tubing	1/4" SS	Packing Matl./Type	PTFE
		Shut Off Class	150

NOTES:

Replacing Valve, Actuator and Positioner. Inlcude filter regulator set at 60 PSIG on supply line. Oxygen Cleaning Required

PURCHASE SPECIFICATIONS
CONTROL VALVES

74 Sail Away Lane
Moneta, VA 24121
Tel. (513)939-9380

Revision	No.	Date	By
30% Design		12/2/21	D. Boggs
90% Design		1/12/23	D. Boggs
100% Design		11/29/23	D.Boggs
100% Design	1	3/26/24	D. Boggs
100% Design	2	4/12/2024	D. Boggs
Addendum 2	1	9/3/2024	D. Boggs

	Tag No.	PV-616 & PV-626 (2 sets)	**Service**	Liquid Oxygen (pressure build)
PIPE	Size Upstream	In.	1.5"	
	Schedule		Type K (copper)	
	Size Downstream	In.	1.5"	
	Schedule		Type K (copper)	

VALVE BODY	Cryogenic Proportional Trim Globe Valve	**POSITIONER**	
Manufacturer	Valtek/Flowserve, Hammel Dahl, or equal	Manufacturer	Valtek/Flowserve, Hammel Dahl, or equal
Model No.	Mark One	Model No.	L1W1L11B100-PP02BW00
Type	Globe, Proportional Trim	Type	Electronic
Nominal Size	1.5"	Action	Direct Acting
Rated Temp./Press.	-320 F/100 PSIG	Signal Range	12 to 20 ma (split)
Body Material	Monel	Filter/ Reg.	Included
Bonnet Material	316SS	Gauge Set	Supply/Output
Stem Style	12" Extended Stem		
End Connections	150#, RF ANSI Flanges		

ACTUATOR		**TRIM**	
Manufacturer	Valtek/Flowserve, Hammel Dahl, or equal	Type	Globe
Model No.	TBD	Port Size	1.5"
Type	Pneumatic Diaphragm	Characteristics	Equal Percent
Action	Modulate	Rated Cv	32
Air Pressure	60 PSIG	Plug/Disc Material	Monel 400
Failure Mode	Closed	Seat Material	Monel 400
Solenoid Valve	Required	Cage/Guide Matl.	Bronze C93200
Solenoid Mfg.	ASCO	Stem Material	Monel 400
Solenoid Model No.	8316G14	Bushing Material	N/A
Tubing	1/4" SS	Packing Matl./Type	PTFE
		Shut Off Class	150

NOTES:

Replacing Valve, Solenoid, Actuator and Positioner. Oxygen cleaning required.
Inlcude filter regulator set at 60 PSIG on supply line.

PURCHASE SPECIFICATIONS
CONTROL VALVES

SOLUTIONWERKS
EQUIPMENT AND SERVICES FOR THE INDUSTRIAL GASES INDUSTRY
74 Sail Away Lane
Moneta, VA 24121
Tel. (513)939-9380

Revision	No.	Date	By
30% Design		12/2/21	D. Boggs
90% Design		1/26/23	D. Boggs
100% Design		11/29/23	D.Boggs
100% Design	1	3/26/24	D. Boggs
100% Design	2	4/12/2024	D. Boggs

	Tag No.		PV-635X	**Service** Oxygen (product back-up)
PIPE	Size Upstream	In.	6"	
	Schedule		40	
	Size Downstream	In.	6"	
	Schedule		40	

VALVE BODY	High Performance Butterfly Valve	**POSITIONER**	
Manufacturer	Jamesbury, Fisher, or equal	Manufacturer	Jamesbury, Fisher, or equal
Model No.	6 815WO-11-3600XZ-MM	Model No.	ND 9102HNUG
Type	Wafer	Type	ND 9000
Nominal Size	6 Inches	Action	Direct Acting
Rated Temp./Press.	200 F/ 235 PSIG	Signal Range	4 to 20 ma
Body Material	316 SST	Filter/ Reg.	Included
Bonnet Material	N/A	Gauge Set	Supply/Output
Stem Style	N/A		
End Connections	Wafer Style		

ACTUATOR		**POSITION MONITOR**	
Manufacturer	Jamesbury, Fisher, or equal	Manufacturer	N/A
Model No.	QPX3C/MASC	Model No.	N/A
Type	Pneumatic Diaphragm	Type	N/A
Action	Modulate	Signal Range	N/A
Air Pressure	60 PSIG	Filter/ Reg.	N/A
Failure Mode	Closed	Gauge Set	N/A
Solenoid Valve	Required		
Solenoid Mfg.	ASCO		
Solenoid Model No.	8316G14		
Tubing	1/4" SS		

NOTES:

Replacing Valve, Solenoid, Actuator and Positioner.
Inlcude filter regulator set at 60 PSIG on supply line. Oxygen Cleaning Required

PURCHASE SPECIFICATIONS
CONTROL VALVES

74 Sail Away Lane
Moneta, VA 24121
Tel. (513)939-9380

Revision	No.	Date	By
30% Design		12/2/21	D. Boggs
90% Design		1/26/23	D. Boggs
100% Design		11/29/23	D.Boggs
100% Design	1	3/26/24	D. Boggs
100% Design	2	4/12/2024	D. Boggs

Tag No.	FV-500A-1-1 & FV-500A-1-2 & FV-500A-2-1 & FV-500A-2-2		**Service**	**Main Air Compressor Inlet Guide Vane**
PIPE	Size Upstream	In.	6"	
	Schedule		40	
	Size Downstream	In.	6"	
	Schedule		40	

VALVE BODY	Main Air Compressor Inlet Guide Vane	**POSITIONER**	
Manufacturer	N/A	Manufacturer	Fisher or equal
Model No.	N/A	Model No.	DVC-3793-4346221
Type	N/A	Type	Electro Pneumatic
Nominal Size	N/A	Action	Direct Acting
Rated Temp./Press.	N/A	Signal Range	4-20 Ma
Body Material	N/A	Filter/ Reg.	50 PSIG
Bonnet Material	N/A	Gauge Set	N/A
Stem Style	N/A	Field Mounting P#	MTG-225-1669010
End Connections	N/A		

ACTUATOR		**POSITION MONITOR**	
Manufacturer	Fisher or equal	Manufacturer	
Model No.	656	Model No.	
Size	60	Type	
Action	Direct Acting	Signal Range	
Air Pressure	50 PSIG	Filter/ Reg.	
Failure Mode	Closed	Gauge Set	
Solenoid Valve	Required		
Solenoid Mfg.	ASCO or equal		
Solenoid Model No.	8316G14		
Tubing	1/4" SS		

NOTES:

Replacing Actuator, Solenoid, and Positioner
Inlcude filter regulator set at 60 PSIG on supply line. Oxygen Cleaning Required

PURCHASE SPECIFICATIONS
CONTROL VALVES

74 Sail Away Lane
Moneta, VA 24121
Tel. (513)939-9380

Revision	No.	Date	By
30% Design		12/2/21	D. Boggs
90% Design		1/26/23	D. Boggs
100% Design		11/29/23	D.Boggs
100% Design	1	3/26/24	D. Boggs
100% Design	2	4/12/2024	D. Boggs

	Tag No.	PV-506A-1-1 & PV-506A-1-2 & PV-506A-2-1 & PV-506A-2-2	**Service**	Main Air Compressor Vent Valve
PIPE	Size Upstream	In.	4"	
	Schedule		40	
	Size Downstream	In.	4"	
	Schedule		40	

VALVE BODY	Rotary control valve	**POSITIONER**	
Manufacturer	Masoneilan or equal	Manufacturer	Masoneilan or equal
Model No.	4" 35-3512 Camflex 2	Model No.	4700E
Type	Rotary Control	Type	ElectroPneumatic Positioner
Nominal Size	4 Inches	Action	Reverse Acting
Rated Temp./Press.	200 F/ 235 PSIG	Signal Range	4 to 20 ma
Body Material	316 SST	Filter/ Reg.	Included
Bonnet Material	N/A	Gauge Set	Supply/Output
Stem Style	N/A		
End Connections	Wafer Style		

ACTUATOR		**POSITION MONITOR**	
Manufacturer	Masoneilan or equal	Manufacturer	N/A
Model No.	35	Model No.	N/A
Type	Spring opposed rolling diaphragm	Type	N/A
Action	Modulate	Signal Range	N/A
Air Pressure	60 PSIG	Filter/ Reg.	N/A
Failure Mode	Open	Gauge Set	N/A
Solenoid Valve	Required		
Solenoid Mfg.	ASCO or equal		
Solenoid Model No.	8316G14		
Tubing	1/4" SS		

NOTES:

Replacing Valve, Solenoid, Actuator and Positioner.
Inlcude filter regulator set at 60 PSIG on supply line. Oxygen Cleaning Required

PURCHASE SPECIFICATIONS
CONTROL VALVES

74 Sail Away Lane
Moneta, VA 24121
Tel. (513)939-9380

Revision	No.	Date	By
30% Design		12/2/21	D. Boggs
90% Design		1/26/23	D. Boggs
100% Design		11/29/23	D.Boggs
100% Design	1	3/26/24	D. Boggs
100% Design	2	4/12/2024	D. Boggs

	Tag No.	Sample taps and instrument valves		**Service**	Instrument Sample Lines
PIPE	Size Upstream	In.	1/2'		
	Schedule		40		
	Size Downstream	In.	1/2"		
	Schedule		40		

VALVE BODY	Ball Valves	**POSITIONER**	
Manufacturer	Jamesbury or equal	Manufacturer	N/A
Model No.	1/2"33-3600TL	Model No.	N/A
Type	Ball Valves	Type	N/A
Nominal Size	1/2 Inch	Action	N/A
Rated Temp.	Negative 60 to 250 F	Signal Range	N/A
Body Material	316 SST	Filter/ Reg.	N/A
Seat material	PTFE Seat with Graphite Seal	Gauge Set	N/A
Stem Style	N/A		
End Connections	Female NPT		

ACTUATOR		**POSITION MONITOR**	
Manufacturer	N/A	Manufacturer	N/A
Model No.	N/A	Model No.	N/A
Type	N/A	Type	N/A
Action	N/A	Signal Range	N/A
Air Pressure	N/A	Filter/ Reg.	N/A
Failure Mode	N/A	Gauge Set	N/A
Solenoid Valve	N/A		
Solenoid Mfg.	N/A		
Solenoid Model No.	N/A		
Tubing	N/A		

NOTES:

Replacing Valve Only. Oxygen Cleaning Required

PURCHASE SPECIFICATION
MANUAL VALVES

SOLUTIONWERKS
EQUIPMENT AND SERVICES FOR THE INDUSTRIAL GASES INDUSTRY

74 Sail Away Lane
Moneta, VA 24121
Tel. (513-939-9380)

Revision No.	Date	By
0	8/20/24	D. Derr
Checked	Approved	

Tag No(s). X201A; X203A **Service** Cold End Gel Trap Block Valves **Fluid** Gaseous Cryogenic Air/Oxygen

VALVE BODY		**STEM**	
Manufacturer	Jamesbury or equal	Type	Extended
Model No.	12 K815WO-56-36HBASC/LKEXXXX	Stem Length	56"
Type	High performance butterfly	Material	17-4PH SST
Nominal Size	12 Inches	Seal Material	PTFE
Max. Svc. Temp.	350 deg. F		
Min. Svc. Temp.	-300 deg. F.		
Max. Svc. Press.	100 psig		
Throttle / ON-OFF	Open-Closed		
Body Material	316 SST		
Disc Material	316 SST		
End Connections	Wafer style, non-lugged		
Seat Material	PTFE/316 SST		

ACTUATOR		
Manufacturer	Jamesbury or equal	
Model No.	M12/Q	
Type	Manual handwheel/gear operator	
Case Material	Cast Iron	
Shaft Material	316 SST	
Coupling Material	Cast Iron	
Coupling Bolts	SST	

PIPE	
Size Upstream	12"
Material	Sch. 10 aluminum
Size Downstream	12"
Material	Sch. 10 aluminum

NOTES
Clean for oxygen service
Requires ring style gaskets, 1/16" thick, 150 lb. ANSI, rigid Teflon

PURCHASE SPECIFICATION
MANUAL VALVES

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EQUIPMENT AND SERVICES FOR THE INDUSTRIAL GASES INDUSTRY

74 Sail Away Lane
Moneta, VA 24121
Tel. (513-939-9380)

Revision No.	Date	By
0	8/20/24	D. Derr
Checked	Approved	

Tag No(s). X609X-1; X609X-2 **Service** LOX Withdrawal Selector Valves **Fluid** Liquid Oxygen

VALVE BODY		**STEM**	
Manufacturer	William Powell or equal	Type	Extended
Model No.	MSS SP-80, Fig. 2714	Stem Length	12"
Type	Rising Stem Cryogenic Gate Valve	Material	B371 Bronze
Nominal Size	2 Inches	Seal Material	PTFE
Class	150 lb.		
Max. Svc. Temp.	150 deg. F		
Min. Svc. Temp.	-300 deg. F.		
Max. Svc. Press.	150 psig		
Throttle / ON-OFF	Manual Throttle		
Body Material	B62 Bronze		
Bonnet Material	B62 Bronze		
Bonnet Ring Mat'l.	B62 Bronze		
Wedge Mat'l.	B62 Bronze		
Gland Material	B62 Bronze		
Hand Wheel Mat'l.	Malleable Iron		
End Connections	FNPT		

ACTUATOR		
Type	Manual handwheel	
Hand Wheel Mat'l.	Malleable Iron	

PIPE	
Size Upstream	2"
Material	Type K Copper
Size Downstream	2"
Material	Type K Copper

NOTES
Clean for oxygen service
Back-solder threaded ends after installation

END OF SECTION

SECTION 40 42 13.10

PROCESS PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Insulation for piping and related systems.

B. Related sections:

1. Section 01 75 17 – Field Testing and Startup

2. Section 09 90 00 – Paints and Coatings

3. Section 22 05 53.05 – Pipe Identification

4. NOT USED

5. NOT USED

6. NOT USED

7. Section 40 05 13 – Process Pipe and Fittings

8. Section 40 05 15 – Process Pipe Supports

1.2 REFERENCES

A. ASTM International (ASTM):

1. A53 – Specification for Pipe, Steel, Black and Hot-dipped, Zinc-Coated, Welded and Seamless

2. C168 – Terminology Relating to Thermal Insulating Materials

3. C177 – Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus

4. C272 – Test Method for Water Absorption of Core Materials for Sandwich Constructions

5. C335 – Test Method for Steady-state Heat Transfer Properties of Horizontal Pipe Insulation

6. C518 – Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus

7. C533 – Specification for Calcium Silicate Block and Pipe Thermal Insulation

8. C534 – Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

9. C547 – Specification for Mineral Fiber Pipe Insulation

10. C552 – Specification for Cellular Glass Thermal Insulation

11. C585 – Practice for Inner and Outer Diameters of Rigid Thermal Insulation for Nominal Sizes of Pipe and Tubing (NPS System)

12. C591 – Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation

13. C795 – Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel

14. C929 – Practice for Handling, Transporting, Shipping, Storage, Receiving and Application of Thermal Insulation Materials for Use in Contact with Austenitic Stainless Steel

15. C1136 – Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation

16. D2310 – Classification of Machine-Made "Fiberglass" (Glass-Fiber-Reinforced-Thermosetting-Resin) Pipe

17. E84 – Test Method for Surface Burning Characteristics of Building Materials

18. E96 – Test Methods for Water Vapor Transmission of Materials

1.3 DEFINITIONS

A. Concealed: Piping above suspended ceilings and within walls, partitions, shafts, or service spaces and spaces not normally exposed to view but not buried

B. Buried: Piping that is installed below buildings, foundations or finish grade, either in soil or encased in concrete in soil

C. Exposed: Piping that is not concealed or buried

D. K Factor: Thermal conductivity determined in accordance with ASTM C177 or C518 and expressed in units of [Btu-inch]/[hour-feet2- degrees Fahrenheit]

1.4 SUBMITTALS

A. Product Data:

1. Insulation Properties: Include K factor, thickness, density, operating temperature limits, tensile strength, compressive strength, moisture absorption, flame spread and smoke developed in accordance with ASTM E84 and corrosivity to stainless steel piping in accordance with ASTM C795.

2. Jacket Properties: Include covering material, cover thickness, tensile strength, tear strength, permeability per ASTM E96, flame spread and smoke developed in accordance with ASTM E84, closure type or devices, and accessories.

3. Vapor Barrier product literature.

4. Safety data sheets for all products.

B. Manufacturer's Application Instructions: Include assembly and application drawings and detailed instructions.

C. Laboratory Report: Provide certified laboratory report that insulation is not manufactured using chlorinated polymers and does not contain chloride, bromides, sulfates, or fire-retardant materials.

D. Thermal expansion calculations: Provide calculations to demonstrate that the insulation can accommodate thermal contraction and expansion of the piping (or tubing) system without any damage to the insulation materials. Temperatures may range from negative 300 degrees to plus 100 degrees Fahrenheit.

E. Manufacturer’s written confirmation that vapor barrier, jacket, and adhesive are compatible with pipe insulation to form a complete insulation system meeting the requirements of this Section.

1.5 QUALITY ASSURANCE

A. Provide in accordance with 01 45 00, Quality Control.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store insulation materials under cover and protected from moisture.

B. Handle and store insulation for use on stainless steel in accordance with ASTM C929.

1.7 PROJECT CONDITIONS

A. Cryogenic process piping operating ranges are included in the Division 40, Process Integration and Section 01 75 17, Field Testing and Start-up specifications.

1.8 SEQUENCING AND SCHEDULING

A. Test piping and obtain acceptance of piping by Engineer prior to applying insulation.

1. Testing includes but is not limited to leak and pressure testing.

1.9 WARRANTY

A. Provide minimum 1 year warranty for insulation from the time of acceptance from the District. Warranty shall cover performance defects and workmanship.

PART 2 - PRODUCTS

2.1 PIPE INSULATION, GENERAL REQUIREMENTS

A. NOT USED.

B. Insulation Types: Provide in accordance with the drawings and with the Piping Insulation Schedule below.

C. NOT USED.

D. All materials of construction in areas subject to liquid oxygen leakage shall be non-flammable and non-hazardous when in contact with liquid or high purity gaseous oxygen.

E. Insulation in exposed areas shall be suitable for outdoor use and weatherproof. Insulation shall not deform from normal wear and tear. Insulation shall be resistant to penetration by moisture and be non-hydroscopic.

F. Vapor barriers shall prevent moisture penetration and be completely sealed to prevent penetration by free water and humidity. The vapor barriers shall withstand thermal contraction and expansion without degradation or loss of performance. Vapor barrier shall be compatible with the pipe insulation.

G. Jacketing for insulation shall be capable of withstanding environmental conditions and be rated for outdoor use. The material shall be resistant to UV radiation and withstand thermal stresses from external and internal temperature differences without cracking, softening, or loss of integrity.

H. Adhesives used for insulation shall be weatherproof and rated for the same temperature ranges as the external layer of the insulation.

2.2 PIPE INSULATION

A. NOT USED.

B. NOT USED.

C. NOT USED.

D. NOT USED.

E. NOT USED.

F. NOT USED.

G. NOT USED.

H. NOT USED.

I. NOT USED.

J. Insulation, Type 10, Cryogenic Steel Piping:

1. Insulation Material: Cellular glass insulation in accordance with ASTM C552

2. Temperature Range: Minus 297 degrees to plus 250 degrees Fahrenheit

3. K Factor at 75 degrees Fahrenheit: maximum 0.19

4. Water Adsorption: less than 1.0% by volume in accordance with ASTM C272

5. Water Vapor Permeability (Transmission): less than 3.5 Perm-in in accordance with ASTM E96

6. Acceptable Products: FOAMGLAS by Owens Corning, or equal.

2.3 VAPOR BARRIERS

A. Vapor Barrier, Type 1:

1. Material: per pipe insulation’s manufacturer’s recommendation.

2. Permeability: 0.02 perm or lower

3. Maximum Flame Spread Rating: 25

4. Edge Seal: Pressure sensitive tape lap seal

5. Circumferential Joints: 4-inch wide tape or similar properties or 4-inch wide overlap with adhesive seal

6. Acceptable Products: per pipe insulation’s manufacturer’s recommendation. Vapor barrier shall be compatible with pipe insulation and suitable for use for liquid oxygen piping.

2.4 INSULATION JACKETS

1. NOT USED.

2. NOT USED.

3. NOT USED.

4. NOT USED.

5. NOT USED.

B. Jacket, Type 6:

1. Material: Bituminous resin reinforced with woven glass fabric and with integral aluminum foil layer and protective plastic film coating; total thickness 0.125 inches minimum.

2. Temperature range: Minus 20 degrees to plus 110 degrees Fahrenheit.

3. Fire Rating: 25 maximum flame spread, smoke developed 30 or less

4. Color: Black

5. Overlap: 2 inch minimum at joints and fittings

6. Joint Seal: Heat Sealed at the overlaps

7. Fittings: Factory made with full thickness insulation

8. Acceptable Products: Pittsburgh Corning Corp. PITTWRAP, or Equal

2.5 RELATED MATERIALS

A. Cover Adhesive: Premium adhesive as recommended by the insulation cover supplier for heavy duty service in corrosive, wet environments. Standard duty adhesives are not permitted.

B. Vapor Seal Mastic and Weatherproof Coating:

1. Acceptable Products: Benjamin Foster, No. 30-76, Insul-Coustic, No. I.C.-580, or Equal.

C. NOT USED.

D. NOT USED.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to installing insulation, verify that tests of piping systems have been performed at the pressures specified in the Mechanical Piping Schedule in Section 40 20 20.

B. Verify that piping surfaces are dry and free of loose scale, rust, dirt, oil, or water prior to applying insulation.

C. Field-finish pipe surfaces as specified prior to installation of insulation.

3.2 APPLICATION

A. Apply insulation and cover materials in accordance with manufacturer's written instructions.

B. Apply insulation in smooth, clean manner with tight and finished smooth joints. Do not use torn, cracked, or chipped sections. Fit insulation tightly against surfaces.

C. Apply and test heat tracing where specified or indicated on the drawings before installing insulation.

D. Apply sealant or cement when previous applications or adhesives and cement have thoroughly dried.

E. Apply insulation to permit expansion or contraction of pipelines without damage to insulation or jacketing.

F. Terminate preformed pipe jackets or covering at sufficient distance from flanges to permit removal of bolts.

G. Overlap flange and flanged fitting insulation on adjacent pipe covering by at least 2 inches.

H. Insulate valves up to packing gland only.

I. Provide continuous insulation through and over pipe supports and provide protection saddles at supports.

J. Extend insulation against insulation end protection shields or covers so that insulation voids do not exist and provide water-tight end seals and covers where insulation terminates.

K. Insulate pipeline strainers to permit removal of strainer basket without disturbing insulation on strainer body.

L. Provide continuous pipe insulation and covering through sleeves or openings in walls and floors.

M. Apply premolded pipe insulation with extended legs when used on pipe traced with either tubing or electric cable type.

N. Apply piping identification on jackets as specified in Section 22 05 53.05.

3.3 REPAIR

A. Restore existing insulation and surfaces disturbed or damaged by application of new pipe insulation.

3.4 PIPING INSULATION SCHEDULE

PIPING INSULATION SCHEDULE						
System Code and Service	Location[(1)]	Insulation Type	Vapor Barrier Type	Jacket Type	Service Temp. °F	Notes
LOX – Liquid oxygen	E	10	1	6	-320	

Notes:
1. E or C means exposed or concealed piping, respectively.
2. NOT USED.
3. NOT USED.

END OF SECTION

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TRANSMITTER PURCHASE SPECIFCATION			PROJECT:	EBMUD	SHEET #:	1 OF 14
CURRENT TRANSDUCERS						
#	BY	DATE	REVISION		PROJECT #	SD428
0	RH	01/17/22	INITIAL		SPEC. #	
1	DB	02/01/23	90% Design		P.O. #	
2	DB	January 2024	100% Design		PREPARED BY	RH
3	DB	April 2024	100% Design		CHECKED BY	
4						

TAG NUMBER	W-44-AHP-IT-500
SERVICE	Main Air Comp Motor Current
MANUFCTURER	PHOENIX CONTACT. NO SUBSTITUTIONS ALLOWED.
QTY	4

SERVICE CONDITIONS	
FLUID	N/A
OPER. TEMP.	-20 TO 60 DEGC
OPER. PRESS.	N/A
STATE	N/A
AMBIENT TEMP.	120 DEGF

DESIGN DETAILS	
TYPE (ELEC/PNEUM)	ELECTRICAL/ELECTRONIC
OUTPUT SIGNAL	4-20 mA
POWER SUPPLY	LOOP 24 VDC
ADJUSTABLE RANGE	N/A
CALIBRATED RANGE	0-200A / 4-20 mADC
ACCURACY	+/- 1% OF END VALUE
SENSOR	CT
PROCESS CONN. SIZE	N/A
ELECTRICAL CLASS	CLASS 1 DIV 2
DISPLAY	N/A
MOUNTING BRACKET	DIN RAIL

MATERIALS	
ELECTR. HOUSING	POLYAMIDE PA
WETTED PARTS	N/A
HARDWARE	STD
FILL FLUID	N/A
MODEL NO.	MCR-SL-S-200-I-LP

ACCESSORIES	
	TAGS: IT-500-1-1 IT-500-1-2 IT-500-2-1 IT-500-2-2
MANUFACTURER	
MODEL NO.	
MANUFACTURER	
MODEL NO.	

GENERAL NOTES: Vendor to supply asset identification tags in accordance with Section 01 91 13.10 Asset Identification Tags.

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PROCESS ANALYZERS

#	BY	DATE	REVISION	PROJECT #	SD-428
0	RH	11/11/21	INITIAL	SPEC. #	
1	RH	01/17/22	REVISED AIT-312, ADDED TAGS	P.O. #	
2	DB	1/31/23	90% Design	PREPARED BY	RLH
3	DB	January 2024	100% Design	CHECKED BY	
4	DB	April 2024	100% Design		

TAG NUMBER	W-44-O2-AIT-312	W-44-O2-AIT-352	W-44-O2-AIT-355
SERVICE	Nitrogen Purity Analyzer (Waste or Shelf)	Hydrocarbon Analyzer	Product Oxygen Purity Analyzer
MANUFACTURER	Servomex, Siemens, or equal	Servomex, Siemens or equal	Servomex, Siemens or equal
MODEL	MultiExact 4100 or 7MB2011-1AA00AA1	Servopro FID or 7MB2421-1BA100A2	MultiExact 4100 or 7MB2011-1AA00AA1
QTY	2	2	2
SERVICE CONDITIONS			
FLUID	GAN	GOX from MC	GOX product
STATE	VAPOR	VAPOR	VAPOR
OPER. TEMP/PRESS.	5 psig	5 psig	5 psig
SP.GR. @ OP. T&P			
AMBIENT TEMP.	60-105 DEGF	60-105 DEGF	60-105 DEGF
SENSOR			
TYPE	PARAMAGNETIC	FID	PARAMAGNETIC
REQ. FLOW RATE	1-2 SCFH	1 SLPM	1-2 SCFH
RESPONSE	90% FS IN <10 SEC	90% FS IN <15 SEC	90% FS IN <10 SEC
ACCURACY	+-1% FS	+- 2% FS	+-1% FS
ZERO DRIFT	1% O2/1 MONTH	2% FS / 1 WEEK	1% O2/1 MONTH
REPEATABILITY	0.1%/FS	1% FS	0.1%/FS
ZERO GAS	ZERO GRADE AIR	UHP O2 <.1 PPM HC	ZERO GRADE AIR
SPAN GAS	UHP O2	90% FS PPM / BAL O2	UHP O2
TRANSMITTER			
OUTPUT SIGNAL	4-20 mAdc	4-20 mAdc	4-20 mAdc
ELECT CLASS	GP	GP	GP
POWER SUPPLY	120 VAC	120 VAC	120 VAC
MOUNTING	FLUSH- 19"	FLUSH- 19"	FLUSH-19"
CALIBRATED RANGE	0-100%	0-100 PPM	0-100 %
INTEGRAL DISPLAY	5 DIGIT RED LED	LED	5 DIGIT RED LED
AMB TEMP RANGE	32 TO 113 DEGF	40 TO 110 DEGF	32 TO 113 DEGF
XMTR HOUSING	GP	GP	GP
OPTIONS			
4-20 MADC OUT			
SENSOR	Paramagnetic	FID	Paramagnetic
OUTPUT ADAPTER			
OEM			
	TAGS: AIT-312-1 AIT-312-2	COMB AIR HC FREE AIR FUEL GAS 40/60 H2/N2 TAGS: AIT-352-1, AIT-352-2	TAGS: AIT-355-1 AIT-355-2

GENERAL NOTES: Vendor to supply asset identification tags in accordance with Section 01 91 13.10 Asset Identification Tags.

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FLOW TRANSMITTERS

#	BY	DATE	REVISION	PROJECT #	SD428
0	RH	11/11/21	INITIAL	SPEC. #	
1	DB	02/01/23	90% Design	P.O. #	
2	DB	January 2024	100% Design	PREPARED BY	RLH
3	DB	April 2024	100% Design	CHECKED BY	
4					

TAG NUMBER	W-44-AHP-FIT-115	W-44-AHP-FIT-120	W-44-N2-FIT-340	W-44-O2-FIT-600
SERVICE	Unbalanced Air Flow Transmitter	Cold End Air Flow Transmitter	Shelf Flow Transmitter	Oxygen Flow Transmitter
MANUFACTURER	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.
MODEL NO.	0305-R-C-3-2B-11-B4-P2	0305-R-C-3-2B-11-B4-P2	0305-R-C-3-2B-11-B4-P2	0305-R-C-3-2B-11-B4-P2
QTY	2	2	2	2

SERVICE CONDITIONS.				
FLUID	VAPOR	VAPOR	VAPOR	VAPOR
OPER. TEMP.	AMBIENT	AMBIENT	AMBIENT	AMBIENT
OPER. PRESS.	65 PSIG	65 PSIG	65 PSIG	10 PSIG
SP.GR. @ OP. T&P				
AMBIENT TEMP.	45 TO 105 DEGF	45 TO 105 DEGF	45 TO 105 DEGF	45 TO 105 DEGF
DESIGN DETAILS				
TYPE (ELEC/PNEUM)	ELECTRONIC	ELECTRONIC	ELECTRONIC	ELECTRONIC
OUTPUT SIGNAL	4-20 mADC	4-20 mADC	4-20 mADC	4-20 mADC
POWER SUPPLY	LOOP 24 VDC	LOOP 24 VDC	LOOP 24 VDC	LOOP 24 VDC
ADJUSTABLE RANGE				
CALIBRATED RANGE				
ACCURACY	+- 0.1% SPAN	+- 0.1% SPAN	+- 0.1% SPAN	+- 0.1% SPAN
MAX. ALLOW. PRESS.	2000 PSIG	2000 PSIG	2000 PSIG	2000 PSIG
PROCESS CONN. SIZE	½" NPT	½" NPT	½" NPT	½" NPT
ELECTRICAL CLASS	4X	4X	4X	4X
DISPLAY	LCD	LCD	LCD	LCD
MOUNTING BRACKET	COPLANAR 2" PIPE	COPLANAR 2" PIPE	COPLANAR 2" PIPE	COPLANAR 2" PIPE

MATERIALS				
ELECTR. HOUSING	ALUMINUM	ALUMINUM	ALUMINUM	ALUMINUM
WETTED PARTS	SST	SST	SST	SST
HARDWARE	SST	SST	SST	SST
FILL FLUID	INERT	INERT	INERT	INERT
MANUFACTURER	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.
MODEL NO.	3051CDXA22A2AS5B4M5Q4P2	3051CDXA22A2AS5B4M5Q4P2	3051CDXA22A2AS5B4M5Q4P2	3051CDXA22A2AS5B4M5Q4P2
ACCESSORIES				
MANIFOLD	3-VALVE	3-VALVE	3-VALVE	3-VALVE
MANUFACTURER	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.
MODEL NO.	0305-R-C-3-2B-11-B4-P2	0305-R-C-3-2B-11-B4-P2	0305-R-C-3-2B-11-B4-P2	0305-R-C-3-2B-11-B4-P2

GENERAL NOTES: Vendor to supply asset identification tags in accordance with Section 01 91 13.10 Asset Identification Tags.

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TRANSMITTER PURCHASE SPECIFCATION			PROJECT:	EBMUD	SHEET #:	4 of 14
FLOW TRANSMITTERS						
#	BY	DATE	REVISION		PROJECT #	SD428
0	RH	11/11/21	INITIAL		SPEC. #	
1	RH	01/14/22	ADDITIONS		P.O. #	
2	DB	02/01/23	90% Design		PREPARED BY	RLH
3	DB	January 2024	100% Design		CHECKED BY	
4	DB	April 2024	100% Design			

TAG NUMBER	W-44-AHP-FIT-502
SERVICE	Main Air Comp, 3rd Stage DP For Anti-Surge Control
MANUFACTURER	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.
QTY	4

SERVICE CONDITIONS	
FLUID	AIR
OPER. TEMP.	AMBIENT
OPER. PRESS.	65 PSIG
SP.GR. @ OP. T&P	
AMBIENT TEMP.	45 TO 105 DEGF

DESIGN DETAILS	
TYPE (ELEC/PNEUM)	ELECTRONIC
OUTPUT SIGNAL	4-20 mADC
POWER SUPPLY	LOOP 24 VDC
ADJUSTABLE RANGE	-250 TO 250 INWC
CALIBRATED RANGE	0-100 INWC
ACCURACY	+- 0.1% SPAN
MAX. ALLOW. PRESS.	2000 PSIG
PROCESS CONN. SIZE	½" NPT
ELECTRICAL CLASS	4X
DISPLAY	LCD
MOUNTING BRACKET	COPLANAR 2" PIPE

MATERIALS	
ELECTR. HOUSING	ALUMINUM
WETTED PARTS	SST
HARDWARE	SST
FILL FLUID	INERT
MANUFACTURER	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.
MODEL NO.	3051CD2A22A2AS5B4M5Q4P2

ACCESSORIES	
MANIFOLD	3-VALVE
MANUFACTURER	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.
MODEL NO.	0305-R-C-3-2B-11-B4-P2
MANUFACTURER	

GENERAL NOTES: Vendor to supply a permanently attached stainless steel nameplate, engraved with the instrument tag.

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TRANSMITTER PURCHASE SPECIFCATION			PROJECT:	EBMUD	SHEET #:	5 of 14
LEVEL TRANSMITTERS						
#	BY	DATE	REVISION		PROJECT #	SD428
0	RH	11/11/21	INITIAL		SPEC. #	
1	DB	02/01/23	90% Design		P.O. #	
2	DB	January 2024	100% Design		PREPARED BY	RLH
3	DB	April 2024	100% Design		CHECKED BY	
4						

TAG NUMBER	W-44-O2-LIT-330	W-44-O2-LIT-352
MANUFACTURER	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.
SERVICE	Kettle Level Transmitter	Upper Column Level Transmitter
QTY	2	2

SERVICE CONDITIONS		
FLUID	VAPOR	VAPOR
OPER. TEMP.	AMBIENT	AMBIENT
OPER. PRESS.	65 PSIG	65 PSIG
SP.GR. @ OP. T&P		
AMBIENT TEMP.	45 TO 105 DEGF	45 TO 105 DEGF
DESIGN DETAILS		
TYPE (ELEC/PNEUM)	ELECTRONIC	ELECTRONIC
OUTPUT SIGNAL	4-20 mADC	4-20 mADC
POWER SUPPLY	LOOP 24 VDC	LOOP 24 VDC
ADJUSTABLE RANGE	-250 TO +250 INWC	-250 TO +250 INWC
CALIBRATED RANGE	0-100 INWC	0-88 INWC
ACCURACY	+- 0.1% SPAN	+- 0.1% SPAN
MAX. ALLOW. PRESS.	2000 PSIG	2000 PSIG
PROCESS CONN. SIZE	½" NPT	½" NPT
ELECTRICAL CLASS	4X	4X
DISPLAY	LCD	LCD
MOUNTING BRACKET	COPLANAR 2" PIPE	COPLANAR 2" PIPE
MATERIALS		
ELECTR. HOUSING	ALUMINUM	ALUMINUM
WETTED PARTS	SST	SST
HARDWARE	SST	SST
FILL FLUID	INERT	INERT
MANUFACTURER	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.
MODEL NO.	3051CD2A22A2AS5B4M5Q4P2	3051CD2A22A2AS5B4M5Q4P2
ACCESSORIES		
MANIFOLD	3-VALVE	3-VALVE
MANUFACTURER	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.
MODEL NO.	0305-R-C-3-2B-11-B4-P2	0305-R-C-3-2B-11-B4-P2

GENERAL NOTES: Vendor to supply asset identification tags in accordance with Section 01 91 13.10 Asset Identification Tags.

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EQUIPMENT AND SERVICES FOR THE INDUSTRIAL GASES INDUSTRY

Industrial Gases & Services
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TRANSMITTER PURCHASE SPECIFCATION			PROJECT:	EBMUD	SHEET #:	6 of 14

PRESSURE TRANSMITTER

#	BY	DATE	REVISION	PROJECT #	SD428
0	RH	10/13/21	INITIAL	SPEC. #	
1	RH	01/18/22	UPDATED TAGS; MODEL CODES	P.O. #	
2	DB	02/01/23	90% Design	PREPARED BY	RH
3	DB	January 2024	100% Design	CHECKED BY	
4	DB	April 2024	100% Design		

TAG NUMBER	W-44-AHP-PIT-214	W-44-ALP-PIT-216	W-44-N2-PIT-300	W-44-O2-PIT-352
SERVICE	TURBINE INLET PRESSURE	TURBINE OUTLET PRESSURE	LOWER COLUMN PRESSURE	MAIN CONDENSER PRESS.
MANUFACTURER	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.
QTY	2	2	2	2
SERVICE CONDITIONS				
FLUID	AIR	AIR	AIR	AIR
OPER. TEMP.	70 °F	70 °F	70 °F	70 °F
OPER. PRESS.	60 PSIG	15 PSIG	60 PSIG	15 PSIG
STATE	VAPOR	VAPOR	VAPOR	VAPOR
AMBIENT TEMP.	20-110 DEGF	20-110 DEGF	20-110 DEGF	20-110 DEGF
DESIGN DETAILS				
TYPE (ELEC/PNEUM)	ELECTRONIC (SMART - HART)	ELECTRONIC (SMART - HART)	ELECTRONIC (SMART - HART)	ELECTRONIC (SMART - HART)
OUTPUT SIGNAL	4-20 mA	4-20 mA	4-20 mA	4-20 mA
POWER SUPPLY	24 VDC	24 VDC	24 VDC	24 VDC
ADJUSTABLE RANGE	-14.2 TO +300 PSIG	-14.2 TO +36 PSIG	-14.2 TO +300 PSIG	-14.2 TO +36 PSIG
CALIBRATED RANGE	0 to 100 PSIG	0 TO 15 PSIG	0 to 100 PSIG	0 TO 15 PSIG
ACCURACY	0.075 % SPAN	0.075 % SPAN	0.075 % SPAN	0.075 % SPAN
MAX. ALLOW. PRESS.	3626 PSIG	3626 PSIG	3626 PSIG	3626 PSIG
PROCESS CONN. SIZE	1/2" NPT	1/2" NPT	1/2" NPT	1/2" NPT
ELECTRICAL CLASS	NEMA 4X	NEMA 4X	NEMA 4X	NEMA 4X
DISPLAY	LCD LOCAL INDICATOR	LCD LOCAL INDICATOR	LCD LOCAL INDICATOR	LCD LOCAL INDICATOR
MOUNTING BRACKET	2" PIPE	2" PIPE	2" PIPE	2" PIPE
MATERIALS				
ELECTR. HOUSING	ALUMINUM w/ POLY FINISH	ALUMINUM w/ POLY FINISH	ALUMINUM w/ POLY FINISH	ALUMINUM w/ POLY FINISH
WETTED PARTS	316 SS	316 SS	316 SS	316 SS
HARDWARE	316 SS	316 SS	316 SS	316 SS
FILL FLUID	INERT	INERT	INERT	INERT
MANUFACTURER	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.
MODEL NO.	3051CG-4-A22-A2A-S5-B4-M5-Q4-P2	3051CG-3-A22-A2A-S5-B4-M5-Q4-P2	3051CG-4-A22-A2A-S5-B4-M5-Q4-P2	3051CG-3-A22-A2A-S5-B4-M5-Q4-P2
ACCESSORIES				
	2-VALVE MANIFOLD	2-VALVE	2-VALVE	2-VALVE
MANUFACTURER	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.
MODEL NO.	0305RC22B11B4P2	0305RC22B11B4P2	0305RC22B11B4P2	0305RC22B11B4P2
MANUFACTURER				
MODEL NO.				

GENERAL NOTES: Vendor to supply asset identification tags in accordance with Section 01 91 13.10 Asset Identification Tags.

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TRANSMITTER PURCHASE SPECIFCATION			PROJECT:	EBMUD	SHEET #:	7 OF 14
PRESSURE TRANSMITTER						

#	BY	DATE	REVISION	PROJECT #	SD428
0	RH	11/11/21	INITIAL	SPEC. #	
1	RH	01/14/22	REVISIONS, ADDITIONS	P.O. #	
2	RH	01/18/22	REVISIONS, ADDITIONS	PREPARED BY	RH
3	DB	02/01/23	90% Design	CHECKED BY	
4	DB	April 2024	100% Design		

TAG NUMBER	W-44-AHP-PIT-506	W-44-LOS-PIT-53	W-44-IA-PIT-590
SERVICE	Discharge Pressure	Main Air Comp, Lube Oil Supply Press	Instrument Air Press
MANUFACTURER	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.
P&ID	4	4	2

SERVICE CONDITIONS			
FLUID	AIR	LUBE OIL	AIR
OPER. TEMP.	70 °F	120 °F	AMBIENT
OPER. PRESS.	60 PSIG	40 PSIG	60 PSIG
STATE	VAPOR	LIQUID	VAPOR
AMBIENT TEMP.	40-105 DEGF	40-105 DEGF	40-105 DEGF
DESIGN DETAILS			
TYPE (ELEC/PNEUM)	ELECTRONIC (SMART - HART)	ELECTRONIC (SMART - HART)	ELECTRONIC (SMART - HART)
OUTPUT SIGNAL	4-20 mA	4-20 mA	4-20 mA
POWER SUPPLY	24 VDC	24 VDC	24 VDC
ADJUSTABLE RANGE	-300 TO +300 PSIG	-300 TO +300 PSIG	-300 TO +300 PSIG
CALIBRATED RANGE	0 to 100 PSIG	0-50 PSIG	0-100 PSIG
ACCURACY	0.075 % SPAN	0.075 % SPAN	0.075 % SPAN
MAX. ALLOW. PRESS.	3626 PSIG	3626 PSIG	3626 PSIG
PROCESS CONN. SIZE	1/2" NPT	1/2" NPT	1/2" NPT
ELECTRICAL CLASS	NEMA 4X	NEMA 4X	NEMA 4X
DISPLAY	LCD LOCAL INDICATOR	LCD LOCAL INDICATOR	LCD LOCAL INDICATOR
MOUNTING BRACKET	2" PIPE	2" PIPE	2" PIPE
MATERIALS			
ELECTR. HOUSING	ALUMINUM w/ POLY FINISH	ALUMINUM w/ POLY FINISH	ALUMINUM w/ POLY FINISH
WETTED PARTS	316 SS	316 SS	316 SS
HARDWARE	316 SS	316 SS	316 SS
FILL FLUID	INERT	INERT	INERT
MANUFACTURER	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.
MODEL NO.	3051CG-4-A22-A2A-S5-B4-M5-Q4-P2	3051CG-4-A22-A2A-S5-B4-M5-Q4-P2	3051CG-4-A22-A2A-S5-B4-M5-Q4-P2
ACCESSORIES			
MANIFOLD	2-VALVE	2-VALVE	2-VALVE
MANUFACTURER	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.
MODEL NO.	0305RC22B11B4P2	0305RC22B11B4P2	0305RC22B11B4P2
MANUFACTURER			
MODEL NO.			

GENERAL NOTES: Vendor to supply asset identification tags in accordance with Section 01 91 13.10 Asset Identification Tags.

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TRANSMITTER PURCHASE SPECIFCATION			PROJECT:	EBMUD	SHEET #:	8 OF 14
PRESSURE TRANSMITTER						
#	BY	DATE	REVISION		PROJECT #	SD428
0	RH	01/14/22	INITIAL		SPEC. #	
1	RH	01/18/22	REVISED MODEL CODES		P.O. #	
2	DB	02/01/23	90% Design		PREPARED BY	RH
3	DB	January 2024	100% Design		CHECKED BY	
4	DB	April 2024	100% Design			

TAG NUMBER	W-44-AHP-PIT-200	W-44-N2-PIT-349	W-44-O2-PIT-600	W-44-LOR-PIT-20
SERVICE	RHX Pass "A" Air / Waste Press	Upper Column Pressure	Product O2 From Cold Box Press	Expansion Turbine Lube Oil To Filters Press
MANUFACTURER	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.
MODEL NO.	3051CG-4-A22-A2A-S5-B4-M5-Q4-P2	3051CG-3-A22-A2A-S5-B4-M5-Q4-P2	3051CG-3-A22-A2A-S5-B4-M5-Q4-P2	3051CG-4-A22-A2A-S5-B4-M5-Q4-P2
QTY	2	2	1	2
SERVICE CONDITIONS				
FLUID	AIR	OXYGEN	OXYGEN	LUBE OIL
OPER. TEMP.	150 °F	70 °F	AMBIENT	120 °F
OPER. PRESS.	60 PSIG	5 PSIG	5 PSIG	140 PSIG
STATE	VAPOR	VAPOR	VAPOR	VAPOR
AMBIENT TEMP.	40-105 DEGF	40-105 DEGF	40-105 DEGF	40-105 DEGF
DESIGN DETAILS				
TYPE (ELEC/PNEUM)	ELECTRONIC (SMART - HART)	ELECTRONIC (SMART - HART)	ELECTRONIC (SMART - HART)	ELECTRONIC (SMART - HART)
OUTPUT SIGNAL	4-20 mA	4-20 mA	4-20 mA	4-20 mA
POWER SUPPLY	24 VDC	24 VDC	24 VDC	24 VDC
ADJUSTABLE RANGE	-300 TO +300 PSIG	-36 TO +36 PSIG	-36 TO +36 PSIG	-300 TO +300 PSIG
CALIBRATED RANGE	0 to 100 PSIG	0-15 PSIG	-2.5 TO 10 PSIG	0-200 PSIG
ACCURACY	0.075 % SPAN	0.075 % SPAN	0.075 % SPAN	0.075 % SPAN
MAX. ALLOW. PRESS.	3626 PSIG	3626 PSIG	3626 PSIG	3626 PSIG
PROCESS CONN. SIZE	1/2" NPT	1/2" NPT	1/2" NPT	1/2" NPT
ELECTRICAL CLASS	NEMA 4X	NEMA 4X	NEMA 4X	NEMA 4X
DISPLAY	LCD LOCAL INDICATOR	LCD LOCAL INDICATOR	LCD LOCAL INDICATOR	LCD LOCAL INDICATOR
MOUNTING BRACKET	2" PIPE	2" PIPE	2" PIPE	2" PIPE
MATERIALS				
ELECTR. HOUSING	ALUMINUM w/ POLY FINISH	ALUMINUM w/ POLY FINISH	ALUMINUM w/ POLY FINISH	ALUMINUM w/ POLY FINISH
WETTED PARTS	316 SS	316 SS	316 SS	316 SS
HARDWARE	316 SS	316 SS	316 SS	316 SS
FILL FLUID	INERT	INERT	INERT	INERT
ACCESSORIES				
MANIFOLD	2-VALVE	2-VALVE	2-VALVE	2-VALVE
MANUFACTURER	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.
MODEL NO.	0305RC22B11B4P2	0305RC22B11B4P2	0305RC22B11B4P2	0305RC22B11B4P2
MANUFACTURER				
MODEL NO.				

GENERAL NOTES: Vendor to supply asset identification tags in accordance with Section 01 91 13.10 Asset Identification Tags.

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TRANSMITTER PURCHASE SPECIFCATION			PROJECT:	EBMUD	SHEET #:	9 OF 14
PRESSURE TRANSMITTER						
#	BY	DATE	REVISION		PROJECT #	SD428
0	RH	01/14/22	INITIAL		SPEC. #	
1	RH	01/18/22	REVISED MODEL CODES		P.O. #	
2	DB	3/2/22	Additions		PREPARED BY	RH
3	DB	02/01/23	90% Design		CHECKED BY	
4	DB	April 2024	100% Design			

TAG NUMBER	W-44-O2-PIT-630	W-44-O2-PIT-635		
SERVICE	O2 Product from Vaporizer Pressure	Back-up product pressure		
MANUFACTURER	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.		
QTY	1	1		
SERVICE CONDITIONS				
FLUID	Oxygen	OXYGEN		
OPER. TEMP.	70 °F	70 °F		
OPER. PRESS.	5 PSIG	5 PSIG		
STATE	VAPOR	VAPOR		
AMBIENT TEMP.	40-105 DEGF	40-105 DEGF		
DESIGN DETAILS				
TYPE (ELEC/PNEUM)	ELECTRONIC (SMART - HART)	ELECTRONIC (SMART - HART)		
OUTPUT SIGNAL	4-20 mA	4-20 mA		
POWER SUPPLY	24 VDC	24 VDC		
ADJUSTABLE RANGE	-36 TO +36 PSIG	-36 TO +36 PSIG		
CALIBRATED RANGE	0-15 PSIG	0-15 PSIG		
ACCURACY	0.075 % SPAN	0.075 % SPAN		
MAX. ALLOW. PRESS.	3626 PSIG	3626 PSIG		
PROCESS CONN. SIZE	1/2" NPT	1/2" NPT		
ELECTRICAL CLASS	NEMA 4X	NEMA 4X		
DISPLAY	LCD LOCAL INDICATOR	LCD LOCAL INDICATOR		
MOUNTING BRACKET	2" PIPE	2" PIPE		
MATERIALS				
ELECTR. HOUSING	ALUMINUM w/ POLY FINISH	ALUMINUM w/ POLY FINISH		
WETTED PARTS	316 SS	316 SS		
HARDWARE	316 SS	316 SS		
FILL FLUID	INERT	INERT		
MANUFACTURER	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.		
MODEL NO.	3051CG-4-A22-AA-S5-B4-M5-Q4-P2	3051CG-3-A22-A2A-S5-B4-M5-Q4-P2		
ACCESSORIES				
MANIFOLD	2-VALVE	2-VALVE		
MANUFACTURER	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.		
MODEL NO.	0305RC22B11B4P2	0305RC22B11B4P2		

GENERAL NOTES: Vendor to supply asset identification tags in accordance with Section 01 91 13.10 Asset Identification Tags.

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SWITCH PURCHASE SPECIFCATION			PROJECT:	EBMUD	SHEET #:	10 OF 14

TEMPERATURE SWITCHES

#	BY	DATE	REVISION	PROJECT #	SD428
0	RH	12/17/21	INITIAL	SPEC. #	
1	RH	01/18/22	ADDED TAGS	P.O. #	
2	DB	02/01/23	90% Design	PREPARED BY	RLH
3	DB	January 2024	100% Design	CHECKED BY	
4	DB	April 2024	100% Design		

TAG NUMBER	W-44-AHP-TSHH-506			
SERVICE	MAC#1 DISCHARGE TEMPERATURE			
MANUFACTURER	UNITED ELECTRIC. NO SUBSTITUTIONS ALLOWED.			
MODEL NO.	F400 7BS M201 M446			
QTY	4			

SERVICE CONDITIONS				
FLUID	AIR			
OPER. TEMP.	AMBIENT			
OPER. PRESS.	THERMOWELL			
RANGE	0-400 DEGF			
SETPOINT	160 DEGF INC			

DESIGN DETAILS				
TYPE (ELEC/PNEUM)	ELECTRIC			
OUTPUT SIGNAL	CONTACT			
POWER SUPPLY	N/A			
CONTACTS QTY	1			
CONTACT RATING	15A 125 VAC			
CONTACT CONFIG	SPDT			
VISUAL INDICATOR	NONE			
PROCESS CONN. SIZE	BULB 3/8" X 3" + 20' CAPILLARY			
ELECTRICAL CLASS	NEMA 4X			
ELECTRICAL CONN	7/8" ELEC. OPENING			
MOUNTING BRACKET	PROCESS/WALL MOUNT			

MATERIALS				
HOUSING	DIE-CAST ALUMINUM			
DIAPHRAGM/FILL	NON-TOXIC OIL FILLED			
PROCESS CONN,	BULB 3/8" X 3" + 20' CAPILLARY			
PROOF PRESS	N/A			
ADDL. MODEL INFO	SW: 160 DEGF INC			
ADDL. MODEL INFO	20 FOOT CAPILLARY LENGTH			

ACCESSORIES				
	TAGS: TSHH-506-1-1 TSHH-506-1-2 TSHH-506-2-1 TSHH-506-2-2			
MANUFACTURER				
MODEL NO.				

GENERAL NOTES: Vendor to supply asset identification tags in accordance with Section 01 91 13.10 Asset Identification Tags.

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THERMOCOUPLES / RTDs

#	BY	DATE	REVISION	PROJECT #	SD428
0	RH	12/28/21	INITIAL	SPEC. #	
1	RH	01/17/22	30% Design	P.O. #	
2	DB	02/01/23	90% Design	PREPARED BY	RLH
3	DB	January 2024	100% Design	CHECKED BY	
4	DB	April 2024	100% Design		

TAG NUMBER	VARIOUS - SEE LIST	VARIOUS - SEE LIST	VARIOUS - SEE LIST
SERVICE	VARIOUS FOR 2"-6" PIPE	VARIOUS FOR 8" - 12" PIPE	VARIOUS FOR 18" - 20" PIPE
MANUFACTURER	OMEGA OR EQUAL	OMEGA OR EQUAL	OMEGA OR EQUAL
MODEL NO.	NB4-CPSS-14U-4-CAL-3	NB4-CPSS-14U-4-CAL-3	NB4-CPSS-14U-4-CAL-3
QTY	2	2	2
SERVICE CONDITIONS			
FLUID	VARIES	VARIES	VARIES
OPER. TEMP.	CRYOGENIC	CRYOGENIC	CRYOGENIC
OPER. PRESS.	<70 PSIG	<70 PSIG	<70 PSIG
SP.GR. @ OP. T&P	N/A	N/A	N/A
AMBIENT TEMP.	N/A	N/A	N/A
DESIGN DETAILS			
TYPE (ELEC/PNEUM)	ELECTRIC	ELECTRIC	ELECTRIC
OUTPUT SIGNAL	THERMOCOUPLE VOLTAGE	THERMOCOUPLE VOLTAGE	THERMOCOUPLE VOLTAGE
SENSOR DIAMETER	3/8" OD	3/8" OD	3/8" OD
SENSOR LENGTH	3.5"	5.5"	8.5"
CABLE LENGTH	150 FT.	150 FT.	150 FT.
SENSOR TYPE	Dual, UNGROUNDED	Dual, UNGROUNDED	Dual, UNGROUNDED
THERMOCOUPLE TYPE	"T" COPPER/CONSTANTAN	"T" COPPER/CONSTANTAN	"T" COPPER/CONSTANTAN
PROCESS CONN. SIZE	3/8" SWAGELOK	3/8" SWAGELOK	3/8" SWAGELOK
PIPE CONN	3/8" SWAGELOK MALE ADAPTER	3/8" SWAGELOK MALE ADAPTER	3/8" SWAGELOK MALE ADAPTER
THERMOWELL			
MATERIALS			
SENSOR	304 SS	304 SS	304 SS
CABLE	PFA INSULATED	PFA INSULATED	PFA INSULATED
HARDWARE	316L SS	316L SS	316L SS
HEAD			
TAGS			
	TE-154-1, -2	TE-149-1, -2	TE-184-1, -2
	TE-155-1, -2	TE-186-1, -2	TE-185-1, -2
	TE-190-1, -2	TE-201-1, -2	TE-187-1, -2
	TE-191-1, -2	TE-216-1, -2	TE-188-1, -2
	TE-215-1, -2		
	TE-150-1, -2		
	TE-24-1, -2		

GENERAL NOTES: Vendor to supply asset identification tags in accordance with Section 01 91 13.10 Asset Identification Tags.

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THERMOCOUPLES / RTDs

#	BY	DATE	REVISION	PROJECT #	SD428
0	RH	01/17/22	INITIAL	SPEC. #	
1	DB	02/01/23	90% Design	P.O. #	
2	DB	January 2024	100% Design	PREPARED BY	RLH
3	DB	April 2024	100% Design	CHECKED BY	
4					

TAG NUMBER	W-44-AHP-TE-552
SERVICE	Thaw Heater Outlet Temp
MANUFACTURER	BURNS OR EQUAL
MODEL NO.	100GKD035/LY240M02C40A240/FC0324
QTY	2

SERVICE CONDITIONS	
FLUID	AIR
OPER. TEMP.	350 DEGF
OPER. PRESS.	70 PSIG
SP.GR. @ OP. T&P	N/A
AMBIENT TEMP.	N/A

DESIGN DETAILS	
TYPE (ELEC/PNEUM)	ELECTRIC
OUTPUT SIGNAL	THERMOCOUPLE VOLTAGE
SENSOR DIAMETER	3/8" OD
SENSOR LENGTH	3.5"
CABLE LENGTH	20 FT.
SENSOR TYPE	Dual, UNGROUNDED
THERMOCOUPLE TYPE	TYPE K
PROCESS CONN. SIZE	3/8" MNPT
PIPE CONN	3/8" SWAGELOK MALE ADAPTER
THERMOWELL	YES

MATERIALS	
SENSOR	316L SS
CABLE	CHROMEL/INCONEL
HARDWARE	316L SS
HEAD	N/A

TAGS
TE-552-1
TE-552-2

GENERAL NOTES: Vendor to supply asset identification tags in accordance with Section 01 91 13.10 Asset Identification Tags.

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TRANSMITTER PURCHASE SPECIFCATION			PROJECT:	EBMUD	SHEET #:	13 OF 14
TEMPERATURE TRANSMITTERS						
#	BY	DATE	REVISION		PROJECT #	SD428
0	RH	01/17/22	INITIAL		SPEC. #	
1	DB	02/01/23	90% Design		P.O. #	
2	DB	January 2024	100% Design		PREPARED BY	RH
3	DB	April 2024	100% Design		CHECKED BY	
4						

TAG NUMBER	W-44-LOS-TIT-53	W-44-AHP-TIT-505	W-44-O2-TIT-635
SERVICE	Main Air Comp, Lube Oil Supply Temp	Air From Main Air Comp, Aftercooler Temp	Air From Main Air Comp, Aftercooler Temp
MANUFACTURER	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.
MODEL NO.	644-F-A-NA-R2-M5-Q4-XA	644-FA-R2-B5-M5-Q4-XA	644-FA-R2-B5-M5-Q4-XA
QTY	4	4	4

SERVICE CONDITIONS			
FLUID	LUBE OIL	AIR	Oxygen
OPER. TEMP.	120 °F	100 DEGF	100 DEGF
OPER. PRESS.	60 PSIG	65 PSIG	10 PSIG
STATE	LIQUID	VAPOR	VAPOR
AMBIENT TEMP.	45 TO 105 DEGF	45 TO 105 DEGF	45 TO 105 DEGF
DESIGN DETAILS			
TYPE (ELEC/PNEUM)	ELECTRONIC (SMART - HART)	ELECTRONIC	ELECTRONIC
OUTPUT SIGNAL	4-20 mA	4-20 mADC	4-20 mADC
POWER SUPPLY	LOOP 24 VDC	LOOP 24 VDC	LOOP 24 VDC
ADJUSTABLE RANGE	-328 TO 1562 DEGF	-328 TO 1562 DEGF	-328 TO 1562 DEGF
CALIBRATED RANGE	0 to 150 DEGF	0-120 DEGF	-20-120 DEGF
ACCURACY	+/- 0.18 DEGC	+/- 0.18 DEGC	+/- 0.18 DEGC
SENSOR	100 OHM PLAT RTD	100 OHM PLAT RTD	100 OHM PLAT RTD
PROCESS CONN. SIZE	½" NPT	½" NPT	½" NPT
ELECTRICAL CLASS	NEMA 4X	NEMA 4X	NEMA 4X
DISPLAY	LCD LOCAL INDICATOR	LCD LOCAL INDICATOR	LCD LOCAL INDICATOR
MOUNTING BRACKET	L-BRACKET FOR 2" PIPE	L-BRACKET FOR 2" PIPE	L-BRACKET FOR 2" PIPE
MATERIALS			
ELECTR. HOUSING	ALUMINUM w/ POLY FINISH	ALUMINUM w/ POLY FINISH	ALUMINUM w/ POLY FINISH
WETTED PARTS	316 SS	316 SS	316 SS
HARDWARE	316 SS	316 SS	316 SS
FILL FLUID	INERT	N/A	N/A
ACCESSORIES			
	SENSOR/THERMOWELL	SENSOR	SENSOR/Thermowell
MANUFACTURER	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.	ROSEMOUNT. NO SUBSTITUTIONS ALLOWED.
MODEL NO.	0068-N21-C30-A-030-T26-XA	0068-N21-C30-A-060-T26-XA	0068-N21-C30-A-060-T26-XA
MANUFACTURER MODEL NO.	TAGS: TIT-53-1-1 TIT-53-1-2 TIT-53-2-1 TIT-53-2-1	TAGS: TIT-505-1-1 TIT-505-1-2 TIT-505-2-1 TIT-505-2-1	TAGS: TIT-635

GENERAL NOTES: Vendor to supply asset identification tags in accordance with Section 01 91 13.10 Asset Identification Tags.

SOLUTIONWERKS
EQUIPMENT AND SERVICES FOR THE INDUSTRIAL GASES INDUSTRY

Industrial Gases & Services
74 Sail Away Lane,
Moneta, Va 24121
1 513-939-9380
info@solutionwerks.com

VIBRATION TRANSMITTERS AND PROBES

#	BY	DATE	REVISION	PROJECT #	SD428
0	RH	01/14/22	INITIAL	SPEC. #	
1	RH	01/18/22	ADDED TAGS	P.O. #	
2	DB	02/01/23	90% Design	PREPARED BY	RLH
3	DB	January 2024	100% Design	CHECKED BY	
4	DB	April 2024	100% Design		
5	DB	9/05/24	Addendum 2		

TAG NUMBER	W-44-LOS-VE-501 (PROBE)	W-44-LOS-VE-502 (PROBE)	W-44-LOS-VE-503 (PROBE)
SERVICE	Main Air Comp, 1st Stage Vibration	Main Air Comp, 2nd Stage Vibration	Main Air Comp, 3rd Stage Vibration
MANUFACTURER	BENTLY NEVADA. NO SUBSTITUTIONS ALLOWED.	BENTLY NEVADA. NO SUBSTITUTIONS ALLOWED.	BENTLY NEVADA. NO SUBSTITUTIONS ALLOWED.
MODEL NO.	330909 AXX BXX CXX DXX EXX	330909 AXX BXX CXX DXX EXX~~990-05-50-03-00~~	330909 AXX BXX CXX DXX EXX~~990-05-50-03-00~~
QTY	4	4	4

SERVICE CONDITIONS			
FLUID	N/A	N/A	N/A
OPER. TEMP.	150 DEGF	150 DEGF	150 DEGF
OPER. PRESS.	65 PSIG	65 PSIG	65 PSIG
SP.GR. @ OP. T&P	N/A	N/A	N/A
AMBIENT TEMP.	45 TO 105 DEGF	45 TO 105 DEGF	45 TO 105 DEGF
DESIGN DETAILS			
TYPE (ELEC/PNEUM)	ELECTRONIC	ELECTRONIC	ELECTRONIC
OUTPUT SIGNAL	4-20 mADC	4-20 mADC	4-20 mADC
POWER SUPPLY	LOOP 24 VDC	LOOP 24 VDC	LOOP 24 VDC
ADJUSTABLE RANGE	200mV/MIL	200mV/MIL	200mV/MIL
CALIBRATED RANGE	0-1.5 MILS	0-1.5 MILS	0-1.5 MILS
ACCURACY	+/-1.5% SCALE	+/-1.5% SCALE	+/-1.5% SCALE
TEMP RANGE	-31 TO 350 DEGF	-31 TO 350 DEGF	-31 TO 350 DEGF
PROCESS CONN. SIZE	N/A	N/A	N/A
ELECTRICAL CLASS	GENERAL PURPOSE	GENERAL PURPOSE	GENERAL PURPOSE
DISPLAY	N/A	N/A	N/A
MOUNTING BRACKET	DIN RAIL MTD.	DIN RAIL MTD.	DIN RAIL MTD.
MATERIALS			
ELECTR. HOUSING	SST	SST	SST
WETTED PARTS	N/A	N/A	N/A
HARDWARE			
FILL FLUID	N/A	N/A	N/A
ACCESSORIES			
	~~PROBE~~TRANSMITTER	TRANSMITTER~~PROBE~~	TRANSMITTER~~PROBE~~
MANUFACTURER	BENTLY NEVADA. NO SUBSTITUTIONS ALLOWED.	BENTLY NEVADA. NO SUBSTITUTIONS ALLOWED.	BENTLY NEVADA. NO SUBSTITUTIONS ALLOWED.
MODEL NO.	990-05-50-03-00	990-05-50-03-00	990-05-50-03-00
	TAGS:	TAGS:	TAGS:
MANUFACTURER	VIT-501-1-1 VIT-501-1-2 VIT-501-2-1	VIT-502-1-1 VIT-502-1--2 VIT-502-2-1	VIT-503-1-1 VIT-503-1--2 VIT-503-2-1
MODEL NO.	VIT-501-2-2	VIT-502-2-2	VIT-503-2-2

GENERAL NOTES: Vendor to supply asset identification tags in accordance with Section 01 91 13.10 Asset Identification Tags.

SECTION 43 01 10.17

CRYOGENIC EXPANSION TURBINE INLET GUIDE VANE REFURBISHMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Work included:

1. Provide all labor, materials, equipment, incidentals, and appurtenances required for removal, refurbishment, and reinstallation of the turbine inlet guide vane (IGV) assemblies, FV220A, for one or, at District's option, both cryogenic oxygen plants.

2. The IGV's are an accessory to cryogenic expansion turbines, model no. 20R-5E2D, manufactured by Rotoflow Corporation, now a subsidiary of Air Products.

3. The IGV assembly is located in the turbine box above and attached to the turbine. The IGV modulates the flow of cold air through the turbine to regulate the amount of refrigeration generated by the turbine.

4. The IGV for plant no. 2 is currently unable to be closed below approximately 20% of its intended range of travel. Consequently, the turbine speed cannot be adjusted slow enough to complement operation of the cryo plant when operating at turndown.

5. The IGV is modulated by a pneumatic sliding stem actuator mounted on the outside of the cold box and connected to the IGV via an extended stem that penetrates the turbine box.

6. All turbine and IGV removal and re-installation work is to be completed in compliance with the instructions found in the "Instruction Manual, Rotoflow Turboexpander with Dynamometer, Project 6586, dated September 1975" attached as Appendix D hereto.

7. In summary, to remove the IGV, Contractor must:

a. Lock out and tag out the associated lube oil skid and all its appurtenances.

b. Disconnect all instrumentation, oil and seal gas piping from the turbine

c. Remove the turbine from the turbine box

d. Remove the IGV assembly

e. All removed components placed in storage shall be provided with protection from the weather, humidity and temperature variations, dirt and dust, or other contaminants.

f. The turbine cavity must be suitably covered to prevent moisture, foreign material and debris from entering the cavity.

8. The IGV must be securely packaged and crated to ensure that no damage occurs during shipment either from handling or from outside elements.

9. Ship the packaged IGV to a qualified refurbishment shop.

10. The refurbishment shop must:

    a. Disassemble the IGV

    b. Thoroughly inspect, measure and prepare a photographic as well as written record of the as-found condition of the IGV.

    c. Either restore or replace all components of the IGV that do not meet the original Rotoflow dimensional and quality specifications.

    d. If the inlet guide vane guide plates are found to be worn and have uneven surfaces, these plates must either be resurfaced and machined flat, if the required dimensional tolerances can be maintained, or replaced with new. The guide plates must be hard coated with either a plasma or thermal spray process to increase wear resistance.

    e. Measure and prepare a photographic as well as written record of the as-completed refurbishment.

11. Following refurbishment but prior to reassembly, all IGV components must be cleaned for oxygen service per the requirements of ASTM G93-03-2011 Standard Practice for Cleaning Methods and Cleanliness Levels for material and Equipment Used in Oxygen-Enriched Environments.

12. Following oxygen cleaning, the IGV components must be reassembled per the original Rotoflow design. Oxygen cleanliness must be maintained throughout the reassembly process.

13. Following refurbishment, the IGV must be securely packaged and crated to ensure that no damage occurs during shipment either from handling or from outside elements.

14. Upon return to the job site, re-installation of the IGV and turbine must be completed in strict accordance with the previously referenced Rotoflow instruction manual.

15. Upon completion of re-installation of all IGV and turbine components and accessories, and at the earliest availability of the balance of the cryogenic plant, the lube oil system must be energized and the turbine subjected to a defrost procedure with sufficient air flow to cause the turbine to rotate at up to 5000 RPM in order to demonstrate the operability of the IGV as well as the mechanical integrity of the turbine.

16. The IGV must be capable of operation through a full range of motion, from 0% to 100% open, when complete.

1.2 QUALIFICATIONS OF REFURBISHMENT SHOP

A. Prequalified refurbishment shops acceptable to District include:

1. Rotoflow, subsidiary of Air Products

2. Bo-Ge Assembly, subsidiary of Matheson Tri-Gas

B. “Or equal” shops:

1. Must have been in the business of refurbishing comparable IGV assemblies for cryogenic air separation expansion turbines for a minimum of five years.

2. Must have successfully refurbished a minimum of five cryogenic IGV assemblies and provide a list of the customers, including their contact names, phone numbers and email addresses, for same as a pre-qualification submittal.

3. At least two of the previously refurbished IGV assemblies must have been manufactured by Rotoflow for 20R-5E2D or closely comparable model cryogenic turbines.

4. Must have the requisite machine and metrology tools in house to complete the necessary machine operations and verify the dimensional and surface quality metrics upon completion.

5. Must be familiar with and suitably equipped to clean the IGV for oxygen service per the requirements of ASTM G93-03-2011 Standard Practice for Cleaning Methods and Cleanliness Levels for material and Equipment Used in Oxygen-Enriched Environments.

6. Must have time available in its shop schedule to complete the required work within the constraints of the SD-428 project schedule.

1.3 SUBMITTALS

A. Qualification letter for selected refurbishment shop.

B. Workplan for refurbishment including proposed schedule.

1.4 WARRANTY

A. Provide in accordance with Division 01 General Requirements.

END OF SECTION

SECTION 46 31 58

CLEANING FOR OXYGEN AND OZONE SERVICE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Included:

1. Materials, methods, and inspection procedure to be used in factory or field cleaning of the equipment and piping used with liquid oxygen, gaseous oxygen, ozone gas, and ozone off-gas.

a. Field passivation of stainless steel components is not anticipated for this project.

2. This section also includes requirements for post-cleaning protection, identification, and other functions related to cleaning.

3. After cleaning, the Contractor shall protect system components from recontamination until installed and successfully tested.

4. The Contractor shall provide cleaning in accordance with this section for any Contractor-provided or Contractor-modified piping and equipment used with liquid oxygen, gaseous oxygen, ozone gas, and ozone off-gas.

B. The Work in this Section shall be performed by a qualified provider of cleaning services. The term ‘Provider’ in this section shall refer to the cleaning services provider that performs field cleaning. This fieldwork can be performed on new equipment or piping delivered to site uncleaned or on existing equipment or piping involved with the project.

C. Related Sections:

1. Section 01 33 00 – Submittal Procedures.

1.2 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM):

1. A967, Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts

2. G93-03, Standard Practice for Cleaning Methods and Cleanliness Levels for Materials and Equipment Used in Oxygen-Enriched Environments

B. Compressed Gas Association (CGA):

1. G-4.1, Cleaning Equipment for Oxygen Service

1.3 SUBMITTALS

A. Provide in accordance with Section 01 33 00 Submittal Procedures.

B. Factory-cleaned equipment:

1. Inspection records:

a. The Ozone or Oxygen System Supplier (OSS) will submit to the Contractor a manufacturer's inspection record for each equipment cleaned for oxygen or ozone service.

b. The Contractor shall submit to the Engineer a copy of the manufacturer's inspection record for each Contractor-supplied equipment cleaned for oxygen or ozone service. The Contractor shall submit manufacturer's inspection records for all equipment cleaned for oxygen or ozone service.

c. The manufacturer's inspection record for each item shall include the following information:

1) A designation of the item covered

2) Serial number

3) Invoice number or other means of identification

4) Cleaning specification and method employed

5) Dates of inspection

6) Methods of inspection

7) Results of inspection

8) Inspector's signature and date signed.

C. Cleaning procedures:

1. Prior to cleaning, the Contractor shall submit cleaning specifications and standards for all equipment, piping, valves, fittings, and accessories to be cleaned for oxygen or ozone service. At a minimum, each cleaning specification shall include the following:

a. Degree of cleaning in measurable terms.

b. Acceptable cleaning procedures.

c. Inspection procedures required and method of inspection and testing to assure the desired level of cleaning.

d. Acceptable cleaning materials

e. Acceptable lubricants, sealants, and testing equipment

f. Procedures and requirements to assure that the equipment supplier has complied with the cleaning specifications

g. Packaging, protection, and storage of cleaned items

h. Whether item will be factory cleaned or field cleaned.

D. Field cleaning plan:

1. The name of the Provider.

2. The product information on all materials used, including, but not limited to:

a. Solvents

b. Detergents

c. Lubricants

d. Drying agents

e. Leak detection solutions

3. Field cleaning procedure including step-by-step actions.

4. Schedule of the Work including durations of required shutdowns.

a. Contractor shall provide an updated schedule if additional field cleaning is identified. All field cleaning activities shall require an approved System Outage Request (SOR) and hot work permit.

5. Lay down drawing of testing equipment with rough dimensions.

E. Provider qualifications:

1. Provider experience description

2. Provider references.

1.4 QUALITY CONTROL

A. Cleaning requirements:

1. All cleaning performed shall be in accordance with the requirements of the latest edition of CGA Publication No. G-4.1 and G-4.4 in addition to the specific requirements herein.

2. Stainless steel components shall be passivated in accordance with ASTM A967.

B. Provider qualifications:

1. Experience minimum: 5 years in providing field cleaning services for equipment in oxygen and ozone service in accordance with CGA Publication No. G-4.1.

C. The cleaning and passivation procedures shall be supervised and monitored by a person skilled and experienced in cleaning oxygen and ozone equipment cleaning:

1. This person shall be responsible for monitoring the cleaning and for determining whether a component is cleaned properly.

2. Any components for oxygen or ozone service that were delivered to the jobsite uncleaned shall either be returned to the manufacturer for cleaning or shall be cleaned in the field by the Provider at the option of Contractor at no additional cost to the District.

3. Cleaning in the field shall be done in accordance with the approved Provider's printed instructions.

4. A recalibration of the equipment components shall be done only by the manufacturer's representative.

D. Any equipment and in-line components that have been cleaned by the manufacturer before delivery to the jobsite shall be inspected by Contractor or the Provider for adequate cleaning and packaging:

1. Components which require recleaning shall be cleaned in the field by the Provider. Any cleaned components that are stored improperly shall be re-cleaned at no additional cost to the District.

E. The pressure of the nitrogen purge on skid-mounted equipment shall be checked in the field before removing the blind flanges and connections to the piping system:

1. If pressure has been reduced to less than 2 pounds per square inch or to a value unacceptable to the equipment supplier, the skid shall be recleaned in the field by the Provider.

PART 2 - PRODUCTS

2.1 FACTORY-CLEANED EQUIPMENT

A. The equipment furnished by the OSS, including but not limited to control valves, instrumentation, and stainless-steel piping, shall be factory cleaned before it is delivered to the site. The stainless-steel components shall be passivated prior to delivery.

B. NOT USED.

1. NOT USED.

C. Skid mounted equipment shall be bypassed until the connecting piping has been oxygen cleaned in the manner specified.

D. Each piece of factory cleaned equipment shall be labeled "CLEANED FOR OXYGEN SERVICE." and sealed by the manufacturer in clear polyethylene protective wrapping to prevent recontamination during shipping, storage, and handling.

2.2 FIELD CLEANING

A. Cleaning Services Provider:

1. Astro Pak

2. Clean Sciences, Inc.

3. Delta Tech Service Inc.

4. Or equal

B. Obtain approval of field cleaning plan from the Engineer before commencing work.

C. Field cleaning and passivation shall be performed by the Provider.

2.3 MATERIALS

A. The following materials shall be used for field cleaning, testing, and assembly of piping and equipment components:

1. No other materials may be used without the specific approval of the Engineer.

2. Contractor shall be responsible for proper disposal of all solvents, detergents, leak detection solutions, drying agents, and other fluids used in cleaning and testing.

3. Detergents:

    a. Any commercial alkaline or neutral water-soluble cleaner recommended by the cleaning company may be used provided that it is effective and is thoroughly flushed from the equipment item or pipe after cleaning.

    b. The cleaning shall be done according to the manufacturer's directions.

    c. Detergent shall be contained so that there is no discharge to the plant drainage systems.

4. Utilities:

    a. Contractor or Provider shall provide the compressed air or nitrogen for purging, drying, and testing the equipment after final cleaning.

    b. The air or nitrogen shall be dry, with a dewpoint of -30 degrees Fahrenheit or lower, and oil-free, or shall meet the Provider’s requirements, whichever are more stringent:

        1) The Contractor and the Provider shall closely monitor the operation of the gas filtering equipment.

    c. Water for preparing the solutions or for flushing, rinsing, or testing the system after final cleaning shall be deionized or shall be of equivalent or superior purity.

5. Tools and equipment used in cleaning the piping and system components:

    a. Store separately from other tools or thoroughly clean before each use.

    b. Wire brushes shall be of austenitic stainless steel or bronze to avoid introducing iron particles in the equipment being cleaned:

        1) Brushes made with natural bristles are preferred.

    c. Any tanks, pumps, instruments, shunts across valves or equipment, or temporary pipe supports used during cleaning shall be furnished by the Provider.

6. Lubricants:

    a. Lubricants shall be used sparingly and only to facilitate assembly or to lubricate packing.

    b. General lubricant:

        1) Manufacturers:

a) Montedison USA, Fomblin

b) Hooker Fluorolube, Halocarbon

c) DuPont, Krytox

d) 3M, Kel-F Fluorocarbon oils and greases

e) Oxweld, No. 64 Anti-Friction Compound

f) Or equal

c. Oxygen service lubricant:

1) Manufacturers:

a) Montedison USA, Fomblin

b) DuPont, Krytox

c) Or equal

7. Leak detection solutions:

a. General leak detection:

1) Manufacturers:

a) Glyco Chemicals, Sulfatate B-l (4 fluid ounces per pint of water)

b) American Gas & Chemical Company, Leak-Tec

c) Swagelok, Snoop

d) Ivory soap solution

e) Or equal

b. Leak detection chemical additives for uses at below freezing temperatures:

1) Manufacturers:

a) Swagelok, Real Cool Snoop

b) Commercial grade ethylene glycol

c) Methyl alcohol

d) Or equal

8. Drying agents: Isopropyl alcohol, if required

PART 3 - EXECUTION

3.1 SAFETY

A. Provider's personnel shall be thoroughly trained in the proper cleaning techniques, shall keep their clothing and hands free of oil and grease and, if necessary, wear clean gloves.

B. Flammable solvents such as gasoline, kerosene, naphtha, mineral spirits, or acetone shall not be used for cleaning.

C. Fire extinguisher fluids shall not be used for cleaning.

D. Contractor and Provider shall have full responsibility and liability for the safety aspects of the cleaning process.

3.2 COORDINATION

A. Contractor shall be fully and solely responsible for any damage resulting from inadequate cleaning of equipment or piping for ozone or oxygen service, and for any hazards associated with the cleaning process.

B. Contractor shall have sole responsibility for ensuring that all equipment, piping, tubing, instrumentation, vessels, and any combined systems thereof that will be used with liquid oxygen, gaseous oxygen, ozone gas, and ozone off-gas, have been cleaned and recleaned, if necessary, and meet the requirements of this Section when placed into service.

1. All high purity oxygen (>60%) and liquid oxygen piping and manufactured products such as valves, regulators, and turbines that are removed from service with the intent of returning them to service must be maintained in an oxygen clean state. Any sections of piping, valves, or other equipment that are modified and/or otherwise exposed to potential contaminants shall be cleaned in accordance with ASTM-G93-03 before being returned to service. Contractor shall verify that the entire length of pipe or any assembled product for any oxygen pipe worked on is free of debris and contaminants in accordance with ASTM-G93-03 prior to startup. When the components have been disassembled, parts shall be grouped according to cleaning method per ASTM-G93-03.

3.3 PROTECTION OF PIPING SYSTEM, VESSELS, AND EQUIPMENT

A. The factory or field cleaned piping, vessels, and equipment shall be protected from contamination until they are placed in service using the methods described below.

B. Short-term protection for periods up to 1 week:

1. Pipe ends and other openings may be covered with metal or plastic caps or plugs, or with a double layer of 6-mil polyethylene film, sealed to the pipe or nozzle with waterproof tape.

C. Medium-term protection for periods between 1 week and 1 month:

1. Welding ends: Ends shall be closed with clean Wedge Projects or equivalent galvanized steel caps, sealed with 2 turns of Tuck No. 90 or equivalent 2-inch waterproof tape.

2. Flanged ends: Flanged ends shall be closed with 10-gage or heavier oxygen-cleaned steel flange covers over solid neoprene or “Durabla” gaskets, held in place with at least 4 hex-head bolts.

D. Long-term protection for periods 1 month and longer:

1. The cleaned line shall be filled with dry nitrogen pressurized to 2 pounds per square inch.

2. Pressurized lines shall be identified at all significant flanges and valves.

E. Protection of small parts:

1. Small parts such as valves, expansion joints, pressure gauges, etc., should be kept in heavy polyethylene bags or wrapped and sealed in polyethylene sheeting until installation.

F. Equipment protection:

1. After cleaning, manholes, inspection ports, nozzles, and other openings shall be covered using blind flanges, plastic protectors, hardboard covers, or polyethylene sheets securely taped in place:

a. Larger pieces of equipment shall be completely covered with polyethylene sheeting.

G. Identification:

1. Any piping, equipment, or vessels cleaned in the field as specified in this Section shall be identified as follows: CLEANED FOR OXYGEN SERVICE. Contractor shall remove any temporary labeling and packaging after cleaned components are installed.

3.4 INSPECTION AND TESTS

A. The factory or field cleaned components of the oxygen, ozone, off-gas, or supplemental nitrogen system shall be inspected using black light where possible or by any of the methods specified below as applicable:

1. If the inspection reveals contaminants, the component shall be recleaned.

B. Direct visual inspection:

1. The cleaned components shall be free of observable residual oil, grease, lubricants, water, paint, coating, varnish, or other films; extensive adherent rust or mill scale; and loose rust, scale, abrasives, filings, loose weld spatter, chips, fluxes, dirt and any other particulate matter.

2. Marking materials, labels, and any other extraneous materials must be removed.

3. Sandblasted surfaces shall meet SSPC-The Society for Protective Coatings' Pictorial Standard CSa2.

C. Inspection by Ultraviolet or "Black Light":

1. The cleaned surfaces shall be examined in darkness or subdued light using a 3200-3800 AU wavelength black light to reveal common hydrocarbon oils or greases that fluoresce.

2. To detect nonfluorescent such as fish oil based rust preventives, or vegetable oil-based cutting emulsion the system supplier shall review the applicable manufacturing procedures to make sure that no such products have been used.

3. If fluorescence appears as a blotch, smear, smudge, or film, the affected component shall be recleaned.

D. Wipe test:

1. The component to be tested by wiping at least 1 square foot of its surface with clean white paper or an unbleached cloth, which shall then be examined under both normal ambient light and black light for signs of contamination.

2. If excessive discoloration or any fluorescence appears, the surface shall be recleaned.

3.5 CLEANING PROCEDURES FOR EQUIPMENT

A. All equipment requiring oxygen cleaning shall be furnished already cleaned and passivated by the equipment supplier:

1. If, for any reason, recleaning or repassivation in the field is required, it shall be done in accordance with the equipment manufacturer's printed instructions.

2. Any equipment recalibration required shall be done by the equipment manufacturer's representative.

3. After cleaning, the equipment shall be inspected and shall be installed immediately or shall be packaged and tagged.

3.6 CLEANING METHODS

A. The following methods shall be used either singly or in combination to clean the oxygen, ozone, ozone off-gas, and supplemental nitrogen supply equipment:

1. The actual choice will depend on the type and size of the component to be cleaned, the type and extent of contamination, and the facilities available.

B. The Provider shall provide temporary shunts for connecting sections of piping that are to be connected in the final installation by a factory cleaned valve or other connecting device.

C. The Provider shall also provide temporary supports for gas piping, where required, to help bear the additional weight of the water and other fluids used in cleaning the piping.

D. Mechanical cleaning:

1. Mechanical cleaning consists of physically removing contaminants from equipment by brushing, sweeping, blowing, scraping, chaining, sandblasting, agitating, or similar methods.

2. It is generally used for a preliminary cleaning or in combination with other methods.

E. Flushing:

1. Clean the equipment or piping section with detergent solution and followed by purging with dry, oil-free air or nitrogen.

2. The initial rinse with deionized water shall be followed by flushing with detergent solution.

3. If detergent solution is used in a closed piping system, it shall be circulated for at least 2 hours, followed by the final rinse which shall be continued until measurements by the Provider confirm that the system is clean:

a. Measurements shall include but shall not be limited to, the pH value and comparison between influent and effluent conductivity.

4. The system shall be dried using oil-less, dry air of the quality specified, or nitrogen or isopropyl alcohol, if required.

5. Any reference to detergent cleaning elsewhere in this Section implies both rinsing and drying.

6. NOT USED.

7. If the Provider prefers to use a different procedure than specified, the Contractor shall submit details of such a procedure to the Engineer for review.

8. All effluent used in the cleaning process shall be contained, removed, and disposed of off-site.

F. Immersion:

1. Cleaning by immersion involves submerging, and if possible scrubbing, the equipment to be cleaned in a bath selected detergent solution.

2. If many components are being cleaned, 2 baths shall be used:

a. First bath: Remove most of the contaminants.

b. Second bath: Remove the remainder of the contaminants.

3. When the first bath becomes heavily soiled, it shall be emptied and replaced with the second bath, and a new, clean second bath shall be provided.

4. Nonmetallic components shall be immersed briefly or wiped with a cloth as described below.

G. Wiping or mopping:

1. Large, readily accessible surfaces such as compressor parts or vessels that can be entered, may be cleaned by wiping with a detergent solution.

3.7 CLEANING PROCEDURE FOR PIPING SYSTEMS

A. The general concept of oxygen cleaning of piping systems is to clean each pipe section, fitting, valve, or other in-line component before it is installed except where such components can be pre-assembled into spools of a size and configuration suitable for cleaning, inspecting, and handling. Inspection for cleanliness shall be the final step before installation.

B. Items that have been cleaned in the shop by their equipment supplier shall be checked for cleanliness immediately before installation, and recleaned if necessary.

C. In-place cleaning of a preassembled piping or equipment system shall be done in accordance with the procedures used by the Provider for field cleaning and as recommended by Contractor:

1. The Provider shall access and prepare any line to be cleaned in accordance with the District's procedures.

2. All valves (other than full-port ball valves) and instruments shall be removed and replaced with temporary shunts while the cleaning fluid is circulated.

3. Valves shall be cleaned separately and the system reassembled using proper techniques, acceptable to the Contractor and the Provider.

4. Cleaning of skid-mounted, factory-assembled piping systems shall be in accordance with the equipment supplier's printed instructions, and only under the direct supervision of a representative of the equipment supplier.

D. Skid-mounted equipment which has been factory cleaned, such as ozone generators, destruction units, LOX tanks, vaporizers, oxygen filters, and skid-mounted pressure reducing stations shall be bypassed during pressure testing or startup until all piping has been cleaned.

E. Stainless steel and copper piping:

1. Small lines and fittings shall be flushed with detergent solution following cutting to size, preparing ends for welding, and fabrication, where possible.

2. The interior surface of larger lines and fittings shall be swabbed with a rag moistened with detergent solution.

3. After rinsing as described in this Section, the pipe shall be purged until dry and odor-free with dry oil-free air or nitrogen.

4. After cleaning, the pipe shall be inspected and, unless it is installed immediately, shall be protected as specified in this Section.

F. Valves:

1. All valves shall be cleaned at the factory before delivery to the project site.

2. However, if the valves require re-cleaning in the field, the cleaning shall proceed as follows.

3. Butterfly and ball valves:

a. The valve shall be disassembled and each part cleaned by immersion or by swabbing with detergent, rinsed, as specified, and dried with dry oil-free air or nitrogen.

b. They shall be inspected and reassembled using virgin Teflon packing, new gaskets, and approved lubricant.

c. The recleaned valve shall be installed immediately or shall be packaged and tagged.

4. All other valves:

a. Recleaning in the field shall be in accordance with the valve manufacturer's printed instructions.

b. If recalibration is required, it shall be done by the valve manufacturer's representative.

c. After cleaning, the valve shall be inspected and shall be installed immediately, or shall be packaged and tagged.

G. Miscellaneous in-line components:

1. In-line components such as strainers, orifice plates, etc., shall be cleaned, if required, by swabbing with detergent solution.

2. Expansion joints shall be cleaned by scrubbing and flushing and shall be inspected before installation.

H. Instrumentation tubing:

1. Stainless steel tubing shall be flushed with detergent solution, rinsed as specified in this Section, and blown dry with clean oil-free air or nitrogen.

2. Ends of tubing shall be capped until used.

3. Before use, tubing shall be tested for cleanliness.

END OF SECTION

SD-428 Addendum No. 2

VOLUME III - DRAWINGS - REVISED

STRUCTURAL ABBRIVIATIONS

&	AND
@	AT
ACI	AMERICAN CONCRETE INSTITUTE
AFF	ABOVE FINISH FLOOR
ASCE	AMERICAN SOCIETY OF CIVIL ENGINEERS
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
ALUM	ALUMINUM
BOC	BOTTOM OF CONCRETE
BOT	BOTTOM
℄	CENTER LINE
c:	CONTINUOUS INSULATION
CJ	CONSTRUCTION JOINT
CLR	CLEAR
CONC	CONCRETE
CONT	CONTINUOUS
COORD	COORDINATE
DIA	DIAMETER
DIAG	DIAGONAL
DWGS	DRAWINGS
EA	EACH
EL	ELEVATION
EQ	EQUAL
EQUIP	EQUIPMENT
EXG	EXISTING
EXT	EXTERIOR
FF	FINISHED FLOOR
FIN	FINISHED
FT	FOOT, FEET
GALV	GALVANIZED
GC	GENERAL CONTRACTOR
GRTG	GRATING
GWB	GYPSUM WALL BOARD
HOR	HORIZONTAL
HP	HIGH POINT
IJ	ISOLATION JOINT
IN	INCH(ES)
INT	INTERIOR
LB	POUNDS
LF	LINEAR FEET
LLV	LONG LEG VERTICAL
LP	LOW POINT
MECH	MECHANICAL
MIN	MINIMUM
N/A	NOT APPLICABLE
NIC	NOT IN CONTRACT
NO	NUMBER
NTS	NOT TO SCALE
OC	ON CENTER
OCEW	ON CENTER EACH WAY
OPNG(S)	OPENING
PCI	POUNDS PER CUBIC INCH
PM	PAINTED METAL
PSF	POUNDS PER SQUARE FEET
PSI	POUNDS PER SQUARE INCH
PT	PRESERVATIVE TREATED
PTD	PAINTED
PVC	POLYVINYL CHLORIDE PLASTIC
REINF	REINFORCE,REINFORCING
REQ'D	REQUIRED
RO	ROUGH OPENING
SF	SQUARE FEET
SP	SPACE
SPEC	SPECIFICATION
SQ	SQUARE
SS	STAINLESS STEEL
STD	STANDARD
TOC	TOP OF CONCRETE
TYP	TYPICAL
UNO	UNLESS NOTED OTHERWISE
VERT	VERTICAL
W/	WITH
W/O	WITHOUT

NOTES:

1. THIS IS A GENERAL LIST OF SYMBOLS AND ABBREVIATIONS. NOT ALL ITEMS SHOWN HERE APPEAR ON CONTRACT DOCUMENTS.

SYMBOLS

1 / S001 — DETAIL NO / DWG NO — PLAN OR SECTION DETAIL

STRUCTURAL GENERAL NOTES

A. GENERAL DESIGN NOTES:

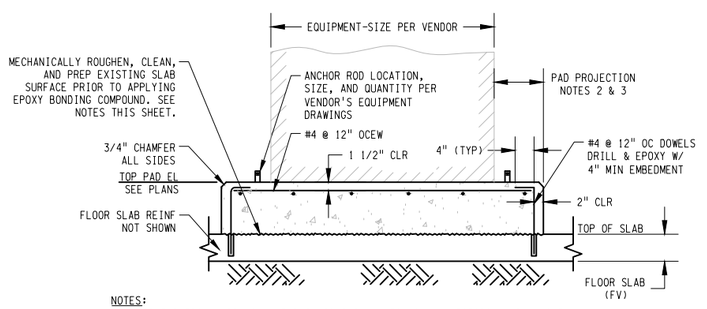
1. DESIGN IS IN ACCORDANCE WITH CALIFORNIA BUILDING CODE, 2022
2. THESE NOTES SHALL APPLY TO ALL STRUCTURAL WORK SHOWN ON THESE DRAWINGS, UNO.
3. STRUCTURAL DRAWINGS SHALL BE USED IN CONJUNCTION WITH THE DRAWINGS AND SPECIFICATIONS OF ALL DISCIPLINES WHICH SHALL BE REFERRED TO FOR SIZES AND LOCATIONS OF ALL PADS, CONDUIT, AND EQUIPMENT ETC.
4. WHERE DIFFERENCES BETWEEN STRUCTURAL DRAWINGS, NOTES OR SPECIFICATIONS OCCUR, THE MOST STRINGENT REQUIREMENT SHALL GOVERN AND THE CONTRACTOR SHALL REQUEST IMMEDIATE CLARIFICATION BEFORE PROCEEDING WITH THE WORK.

B. EXISTING CONDITIONS AND CONSTRUCTION:

1. CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS AND LAYOUT BEFORE BIDDING AND CONSTRUCTION. WHERE ELEVATIONS OF EXISTING STRUCTURES ARE GIVEN, CONTRACTOR SHALL FIELD VERIFY THOSE RECORD DRAWING ELEVATIONS BEFORE CONSTRUCTION. IF EXISTING CONDITIONS DIFFER FROM THAT SHOWN ON THE ATTACHED DRAWINGS, NOTIFY ENGINEER BEFORE PROCEEDING WITH THE WORK.
2. FIELD VERIFY LOCATION OF ALL UTILITIES. UTILITY RELOCATION AND/OR REROUTING MAY BE REQUIRED. LOCATIONS OF ALL UTILITIES ARE NOT SHOWN ON THE DRAWINGS.
3. CONTRACTOR SHALL COORDINATE ALL WORK WITH OWNER WITH RESPECT TO WORK HOURS, AVAILABLE WORK AREAS, DEMOLITION DISTURBANCE, ETC.
4. DURING DEMOLITION AND SURFACE PREPARATION, CONTRACTOR SHALL MINIMIZE DISTURBANCE TO OWNER'S DAILY OPERATIONS DUE TO DUST, DEBRIS, EXCESSIVE NOISE, ETC. PROVIDE TEMPORARY BARRICADES AND OTHER FORMS OF PROTECTION AS NECESSARY TO PROTECT THE OWNER'S PERSONNEL, PROPERTY AND THE GENERAL PUBLIC FROM INJURY.
5. ALL MATERIAL SHALL BE FURNISHED BY THE CONTRACTOR AND ALL DEMOLITION, SURFACE PREPARATION, AND OTHER WASTE DEBRIS SHALL BE REMOVED AND DISPOSED OF AT AN APPROVED FACILITY BY THE CONTRACTOR, UNLESS NOTED OTHERWISE. COSTS ASSOCIATED WITH TESTING AND/OR CHARACTERIZATION OF WASTE DEBRIS, AS MAY BE REQUIRED TO PERMIT DISPOSAL AT THE APPROPRIATE WASTE FACILITY, SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
6. CARE SHALL BE TAKEN WHEN WORKING WITH OR AROUND ALL EXISTING MATERIALS. DAMAGE TO EXISTING MATERIALS SHALL BE REPAIRED BY THE CONTRACTOR AT NO ADDITIONAL EXPENSE TO THE OWNER. RESTORE ALL AREAS DISTURBED BY THE WORK TO MATCH EXISTING CONSTRUCTION/FINISH.
7. THE CONTRACTOR SHALL OBTAIN ALL STATE, LOCAL, UTILITY, AND OTHER MISCELLANEOUS PERMITS REQUIRED FOR COMPLETION OF WORK. ANY AND ALL FEES ASSOCIATED WITH THIS WORK ARE THE RESPONSIBILITY OF THE CONTRACTOR.
8. ANY WORK DETERMINED TO BE DEFECTIVE/INCOMPLETE BY THE ENGINEER SHALL BE REPAIRED, REWORKED AND/OR COMPLETED PER THE APPROVAL OF THE ENGINEER.

B. EQUIPMENT PADS:

1. CONTRACTOR TO VERIFY THE SIZE (PLAN DIMENSIONS) WITH THE ACTUAL EQUIPMENT. LOCATIONS OF THE EQUIPMENT PADS SHALL BE PER THE ELECTRICAL DRAWINGS.



NOTES:

1. SEE ELECTRICAL DRAWINGS FOR EQUIPMENT LOCATIONS, QUANTITIES, AND LAYOUT.
2. EQUIPMENT PAD PROJECTIONS PAST FACE OF MECHANICAL EQUIPMENT:
   FOR ANCHOR RODS GREATER THAN 5/8" DIAMETER: MINIMUM 9-INCH PROJECTION
   FOR ANCHOR RODS 5/8" DIAMETER OR LESS: MINIMUM 6-INCH PROJECTION
3. EQUIPMENT PAD PROJECTIONS PAST FACE OF ELECTRICAL MOTOR CONTROLS, SWITCHBOARDS, TRANSFORMERS, AND CONTROL PANELS: 4-INCH MINIMUM
4. ELECTRICAL EQUIPMENT PADS SHALL BE 4" THICK (MINIMUM); MATCH EXISTING ELECTRICAL PADS.
5. IN THE CASE OF SLOPED FLOORS, PADS SHALL BE 4" THICK AT THE HIGHEST TOP OF SLAB ELEVATION AND MAINTAIN A CONSTANT TOP OF PAD ELEVATION. ADJUST DOWEL LENGTH TO MAINTAIN SPECIFIED EMBEDMENT AND CLEAR COVER.
6. PROVIDE SAWED JOINT (SJ) IN EQUIPMENT PADS, IF SHOWN AND NOTED ON PLANS.
7. ANCHOR RODS SHALL BE 316 AISI STAINLESS STEEL, UNLESS NOTED OTHERWISE.

EQUIPMENT PAD

DETAIL 1 — SD428-W4400-E102.3, SD428-W4400-E102.4

C. STRUCTURAL FILL SUBGRADE COMPACTION

1. SUBGRADE SOILS AND STRUCTURAL FILL SHALL BE COMPACTED TO A MINIMUM OF 97% OF ITS MAXIMUM DENSITY PER STANDARD PROCTOR (ASTM D698)
2. LIFTS SHALL NOT EXCEED 10"

D. REINFORCED CONCRETE:

1. PROVIDE 4,000 PSI COMPRESSIVE STRENGTH AT 28 DAYS, ALONG WITH ALL SPECIFIED SUBMITTALS AND TESTING, PER SECTION 03 30 00.
2. ALL DESIGN IN ACCORDANCE WITH ACI 318-19 CONCRETE BUILDING CODE. ALL CONCRETE SHALL BE PROVIDED, PLACED, AND MOIST CURED (MIN 7 DAYS) AS PER ALL APPLICABLE SECTIONS OF ACI, AS APPROVED BY THE ENGINEER.
3. REINFORCEMENT: ASTM A615 GRADE 60 – ALL SPLICES CLASS B (UNO). REINFORCEMENT PROVIDED PER SECTION 03 20 00.
4. ALL CONCRETE SHALL BE FIELD TESTED BY AN INDEPENDENT TESTING LABORATORY AS PER ASTM SPECIFICATIONS AND SECTION 03 30 00.
5. GROUT: PROVIDE MINIMUM 1/2" THICK NON-SHRINK NON-METALLIC CONFORMING SECTION 03 30 00 BELOW SUPPORT/EQUIPMENT BASE PLATES, SKID, ETC. GROUT PAD SHALL BE PLACED BELOW ENTIRE PLATE/SKID FOR ALL EQUIPMENT. MINIMUM WIDTH OF GROUT PADS SHALL BE THE WIDTH OF THE PLATE/SKID CHANNELS THAT WILL BARE ON THE GROUT PADS. SLOPE THE GROUT PADS DOWN TO THE CONCRETE PAD AT A 1H:1V SLOPE.
6. CONCRETE CURING/SEALING COMPOUND: PROVIDE PER SECTION 03 30 00 FOR HORIZONTAL AND VERTICAL EXPOSED TO VIEW CONCRETE SURFACES OF THE SLAB. APPLY IN STRICT ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. PRIOR TO APPLICATION, SUBMIT PRODUCT TO BE USED TO THE ENGINEER FOR APPROVAL.
7. CONCRETE ANCHORS
   ANCHORS AND ADHESIVE SHALL BE PROVIDED AND INSTALLED PER SECTION 05 05 19.

   ADHESIVE ANCHORS:

ANCHOR	HILTI HIT HAS-316SS
ADHESIVE	HILTI HIT-RE 500VS OR SIMPSON STRONG-TIE SET-XP

8. PROVIDE 3/4" CHAMFER ON EXPOSED EDGES OF CONCRETE, UNO.
9. CONCRETE FINISH: ALL EQUIPMENT PADS SHALL BE LEVEL WITHIN 1/8". SLAB TOP SHALL RECEIVE A TROWEL FINISH TO MATCH ADJACENT CONCRETE. SLAB SIDES EXPOSED TO VIEW SHALL RECEIVE A SACK RUBBED FINISH.

D. EPOXY BONDING COMPOUND

1. BONDING COMPOUND SHALL BE PROVIDED PER SECTION 03 30 00.
2. PRIOR TO APPLYING THE EPOXY BONDING COMPOUND, THE SUBSTRATE SHALL BE ROUGHENED TO A SURFACE PROFILE CSP VALUE BETWEEN 5-7. IF THE SUBSTRATE HAS AN EXISTING COATING, THE COATING SHALL BE FULLY REMOVED IN THE AREA OF THE PAD EXTENSION PRIOR TO PLACING THE EPOXY BONDING COMPOUND.
3. SUBMIT EPOXY BONDING COMPOUND FOR ENGINEERS APPROVAL.

E. EMBEDDED CONDUITS AND PIPES:

1. ALL ELECTRICAL/INSTRUMENTATION CONDUIT EMBEDDED IN CONCRETE SHALL BE INSTALLED, ARRANGED, AND SPACED AS PER THE REQUIREMENTS OF ACI 318-19, SECTION 20.6, AND AS FOLLOWS.
2. OUTSIDE DIAMETER OF CONDUIT SHALL NOT EXCEED 1/3 OF CONCRETE THICKNESS.
3. SPACING SHALL NOT BE LESS THAN 3 OUTSIDE DIAMETERS ON CENTER. ROUTE CONDUIT AS REQUIRED TO MINIMIZE CROSSING OF DIFFERENT CONDUIT RUNS.
4. CONDUITS SHALL NOT BE EMBEDDED IN CONCRETE SLABS LESS THAN 4 INCHES THICK.
5. ONLY 2 CONDUITS MAY CROSS AT ANY POINT AND THE SUM OF THE OUTSIDE DIAMETER OF THE CROSSING CONDUITS SHALL NOT EXCEED 1/3 OF THE CONCRETE THICKNESS.
6. PROVIDE A MINIMUM 1-1/2 INCH CONCRETE COVER OVER CONDUITS.
7. CONDUITS SHALL NOT BE LOCATED BETWEEN BOTTOM OF REINFORCING STEEL AND BOTTOM OF SLAB.
8. ALUMINUM CONDUIT SHALL NOT BE EMBEDDED IN CONCRETE.
9. PROVIDE ADDITIONAL REINFORCEMENT AROUND ALL GROUPS OF CONDUITS WHICH STUB UP THROUGH SLABS.

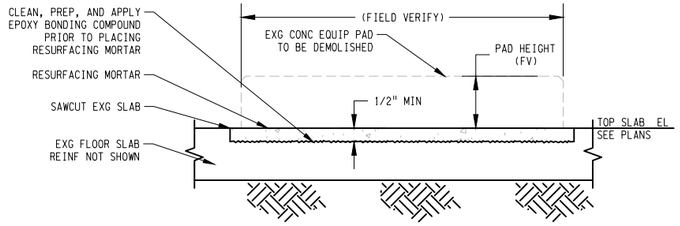
F. DESIGN LOADS: (CALIFORNIA BUILDING CODE, 2022)

1. PROJECT SCOPE IS CONSTRAINED TO EXTERIOR & INTERIOR EQUIPMENT PADS AND TRANSMITTER RACK FOOTING.
2. RISK CATEGORY III - WATER TREATMENT FACILITY
3. WIND FORCES

DESIGN WIND SPEED	V ult = 99mph
EXPOSURE CATEGORY	C

4. SEISMIC LOADS:

REFER TO SPECIFICATION 01 33 12 FOR DETAILS	
SITE CLASS	D (ASSUMED)
DESIGN SPECTRAL ACCEL - 0.2s	SDS= 1.111g
DESIGN SPECTRAL ACCEL - 0.2s	SD1= 1.056g
IMPORTANCE FACTOR	Ie = 1.5
SEISMIC DESIGN CATEGORY	D



NOTES:

1. CONCRETE RESURFACING SHALL BE PROVIDED PER SECTION 03 01 30.61
2. SEE DEMOLITION DRAWINGS FOR LOCATION, QUANTITY, AND APPROXIMATE SIZE OF EXISTING CONCRETE EQUIPMENT PADS TO BE DEMOLISHED.
3. EXISTING CONCRETE SLAB REINFORCEMENT SHALL NOT BE CUT OR DAMAGED DURING DEMOLITION. IF SLAB REINFORCEMENT IS ENCOUNTERED PRIOR TO REACHING THE REQUIRED 1/2-INCH DEPTH OF SLAB DEMOLITION, IMMEDIATELY TERMINATE SLAB DEMOLITION AT ENCOUNTERED REINFORCEMENT LAYER.
4. EXISTING SLAB SHALL BE SAWCUT AROUND FULL PERIMETER OF EXISTING CONCRETE PAD WITHOUT OVER-CUTTING CORNERS.
5. APPLY AND FINISH RESURFACING MORTAR TO MATCH ELEVATION AND TEXTURE OF ADJACENT SLAB SURFACES.
6. IF EXISTING FLOOR SLAB IS PAINTED, CLEAN AREA AND APPLY COLOR MATCHING PAINT SYSTEM OVERLAPPING EXISTING COATING A MINIMUM OF 1-FOOT. REFER TO SPECIFICATION 09 90 00 FOR PAINTS AND COATINGS.

SLAB REPAIR AT PAD DEMO

DETAIL 2 — SD428-W4400-E102.3, SD428-W4400-E102.4

SPECIAL INSPECTIONS

A. SPECIAL INSPECTION WILL BE PROVIDED BY THE DISTRICT AND CONDUCTED IN ACCORDANCE WITH THE REQUIREMENTS SETFORTH IN CHAPTER 17 OF THE CALIFORNIA BUILDING CODE (CBC). CONTRACTOR SHALL ACCOMMODATE SPECIAL INSPECTION BY THE DISTRICT FOR THE FOLLOWING ITEMS AT A MINIMUM:

1. REINFORCING STEEL - REINFORCING STEEL SHALL BE INSPECTED PRIOR TO CLOSING THE FORMS OR DELIVERY OF CONCRETE TO JOBSITE.
2. CONCRETE - THE INSPECTOR SHALL BE PRESENT DURING PLACEMNT OF REINFORCED CONCRETE AND SHALL OBSERVE THE PREPARATION OF THE COMPRESSION TEST SPECIMENS. THE INSPECTOR SHALL VERIFY THE USE OF THE REQUIRED DESIGN MIX, PERFORM SLUMP AND AIR CONTENT TESTS, AND DETERMINE THE TEMPERATURE OF THE CONCRETE.
3. POST INSTALLED ANCHORS - THE INSPECTOR SHALL VERIFY HOLE DEPTH AND CLEANLINESS AND ANCHOR INSTALLATION IN ACCORDANCE WITH THE MANUFACTURERS PUBLISHED INSTALLATION INSTRUCTIONS AND ICC-ES EVALUATION REPORT.

Thomas J Scalese
Digitally signed by Thomas J Scalese
DN: C=US, E=tjscalese@woodardcurran.com, O=Woodard & Curran, CN=Thomas J Scalese
Reason: Signed
Date: 2024.09.12 15:58:03-06'00'

REGISTERED PROFESSIONAL ENGINEER — Thomas J Scalese — 89977 — exp: 06/30/2025 — CIVIL — STATE OF CALIFORNIA

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SOLUTIONWERKS™ INCORPORATED

NO.	DATE	REVISION	BY	REC.	APP.
01	12SEP2024	REVISED PER ADDENDUM NO. 2	LM	JC	DCR

SD428 - MWWTP OXYGEN PLANT REHABILITATION

CONSULTANT

DESIGN BY:	T. SCALESE
DRAWN BY:	T. SCALESE
DESIGN CHECKED BY R.P.E. NO. 89977	T. SCALESE
PROJECT MANAGER R.P.E. NO.	J. JANCAITIS
APPROVED: PRINCIPAL IN CHARGE R.P.E. NO. 37097	D. RICHARDSON

EBMUD

PROJECT MANAGER R.P.E. NO. 95846	J. LAW
RECOMMENDED: SR. ENGINEER R.P.E. NO. 69681	D. RUSSELL

EAST BAY MUNICIPAL UTILITY DISTRICT
SPECIAL DISTRICT NO.1
OAKLAND, CALIFORNIA

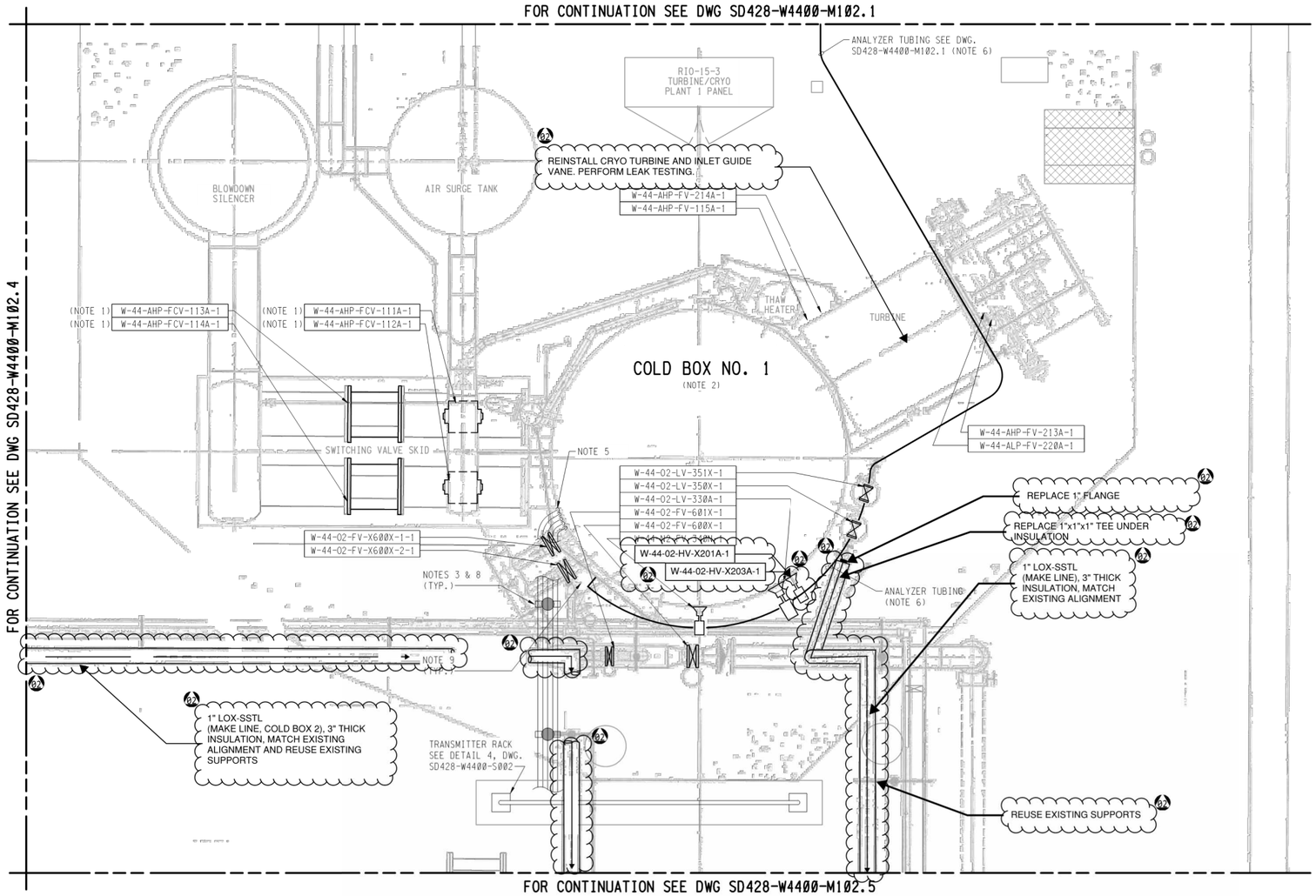
MAIN WASTEWATER TREATMENT PLANT
OXYGEN PRODUCTION PLANT
STRUCTURAL
ABBREVIATIONS, GENERAL NOTES AND DETAILS

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DATE 28JUN24
SD428-W4400-S001
DRAWING NUMBER
01
REV.

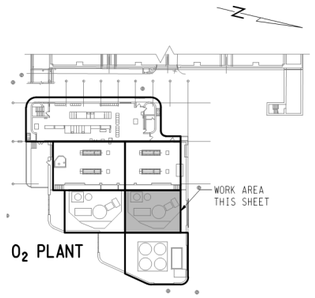
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PLAN



KEY PLAN

3" ON ORIGINAL DOCUMENT
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NOTES:

1. FIELD FABRICATE SPOOL PIECES FOR PROPER VALVE INSTALLATION.
2. REPLACEMENT COLD END CHECK VALVES HV-Y112A-1, HV-113A-1, HV-140N-1, HV-141N-1, HV-Y142N-1 AND HV-Y143N-1 (TOTAL OF 6 VALVES, NOT SHOWN ON PLAN) SHALL BE PROVIDED BY THE DISTRICT AND INSTALLED BY THE CONTRACTOR.
3. PROVIDE RACK SUPPORT FOR PNEUMATIC TUBING ROUTED TO TRANSMITTER RACK. SEE DWG. SD428-W4400-E102.3 FOR TRANSMITTER LOCATIONS.
4. FIELD ROUTE PNEUMATIC TUBING AS INDICATED ON PNEUMATIC AIR TUBING SCHEDULE SHOWN ON DWG. SD428-W4400-M302.
5. APPROXIMATE LOCATION OF COMBINED PNEUMATIC TUBING FROM VALVES TO RISE ALONG SIDE OF COLD BOX AND ROUTED TO RACK SUPPORT. TUBING IS SHOWN DIAGRAMMATICALLY AND DOES NOT INDICATE EXACT AMOUNT.
6. ROUTE ANALYZER TUBING TO MAIN CONTROL PANEL PLANT 1 UTILIZING EXISTING CABLE TRAY SUPPORTS FOLLOWING THE SAME ROUTING AS ELECTRICAL CONDUIT. SEE DWG. SD428-W44-E102.3 FOR GENERAL PATH LOCATION.
7. PRIOR TO RETURNING OXYGEN PIPING TO SERVICE, CLEAN ALL OXYGEN VALVES AND PIPING IN ACCORDANCE WITH ASTM-G93-03.
8. COORDINATE TUBING TO BE FIELD ROUTED WITH ENGINEER PRIOR TO INSTALLATION.
9. REPLACE SAMPLE VALVES (NOT SHOWN ON PLAN) ACCORDING TO SCHEDULE.

SAMPLE VALVE REPLACEMENT SCHEDULE
(NOTE 9)

VALVE NO.
CRYO PLANT NO. 1
H115A-1
H120A-1
H330A-1
H340N-1
H352X-1
H600X-1
L115A-1
L120A-1
L330A-1
L340N-1
L352X-1
L600X-1
P200A-1
P300N-1
P349N-1
P352X-1
P590A-1
P600A-1
S350N-1
S355X-1
S600X-1
TURBINE NO. 1
H215A-1
L215A-1
P216A-1

10. FOR REPLACEMENT OF CRYOGENIC PIPING, CONTRACTOR SHALL VERIFY FLEXIBILITY OF PIPING AND PIPE SUPPORTS TO ACCOMMODATE THERMAL CYCLING. CONTRACTOR SHALL SUBMIT CALCULATIONS TO DEMONSTRATE THAT PIPE SUPPORTS CAN ACCOMMODATE THERMAL EXPANSION AND CONTRACTION IN NEW PIPING.

David L. Richardson
Digitally signed by David L. Richardson
Reason: I agree to the terms defined by the placement of my signature on this document.
Date: 2024.09.16 12:23:52-04'00'

REGISTERED PROFESSIONAL ENGINEER
DAVID LLOYD RICHARDSON
No. 37097
CIVIL
STATE OF CALIFORNIA

Woodard & Curran

SOLUTIONWERKS™ INCORPORATED

NO.	DATE	REVISION	BY	REC.	APP.
02	10SEP2024	REVISED PER ADDENDUM NO. 02	JL	JL	DCR

SD428 - MWWTP OXYGEN PLANT REHABILITATION

CONSULTANT

DESIGN BY:	D. BOGGS
DRAWN BY:	L. MAXWELL
DESIGN CHECKED BY R.P.E. NO. 37097	D. RICHARDSON
PROJECT MANAGER R.P.E. NO.	J. JANCAITIS
APPROVED: PRINCIPAL IN CHARGE R.P.E. NO. 37097	D. RICHARDSON

EBMUD

PROJECT MANAGER R.P.E. NO. 95046	J. LAW
RECOMMENDED: SR. ENGINEER R.P.E. NO. 69681	D. RUSSELL

EAST BAY MUNICIPAL UTILITY DISTRICT
SPECIAL DISTRICT NO.1
OAKLAND, CALIFORNIA

MAIN WASTEWATER TREATMENT PLANT
OXYGEN PRODUCTION PLANT
MECHANICAL
PARTIAL PLAN 3

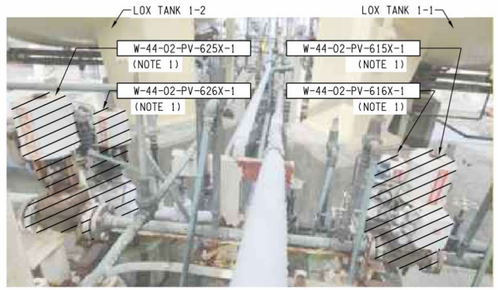
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DATE 28JUN24

SD428-W4400-M102.3
DRAWING NUMBER

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(NOTE 2)

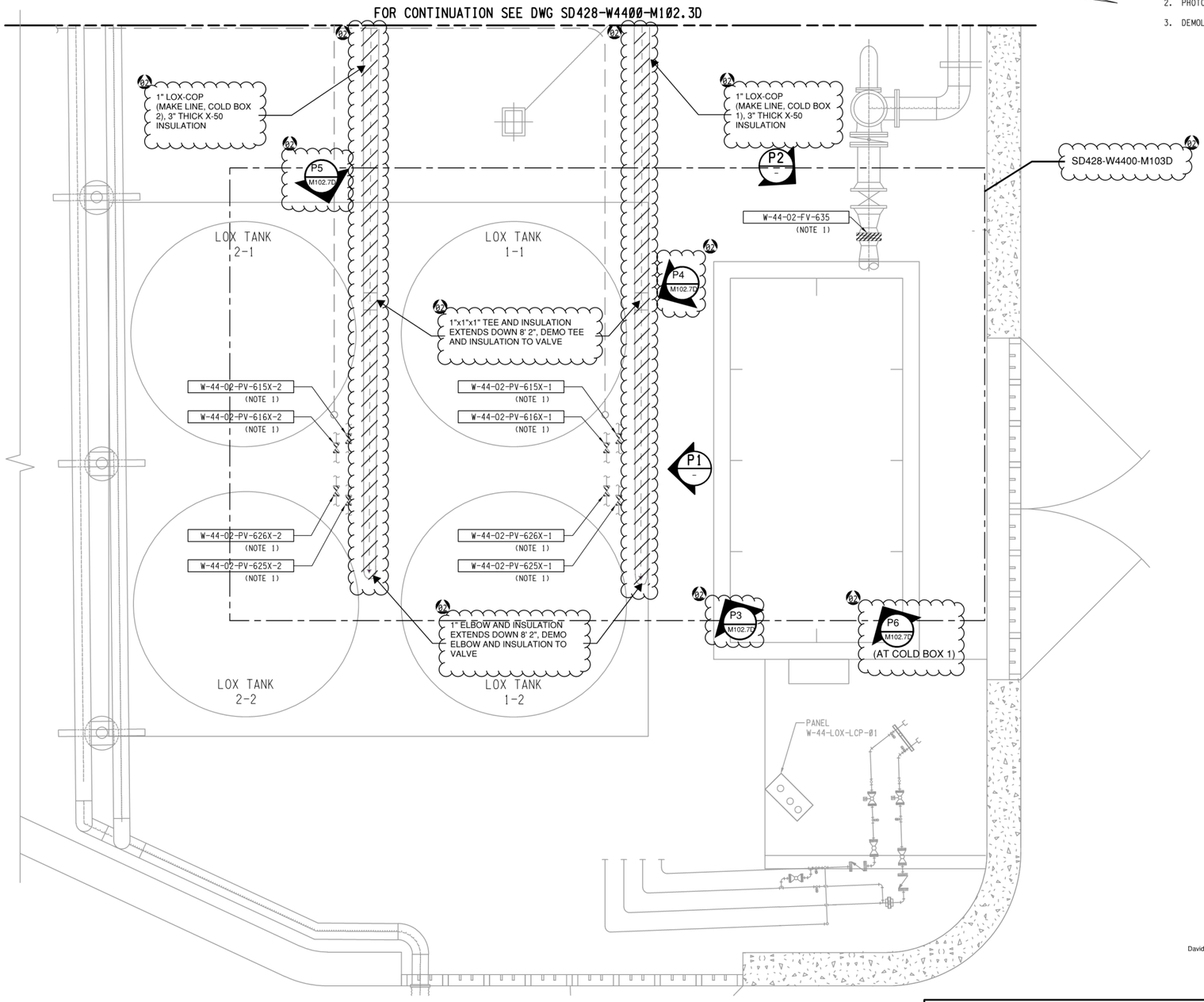
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PHOTO DETAIL P2

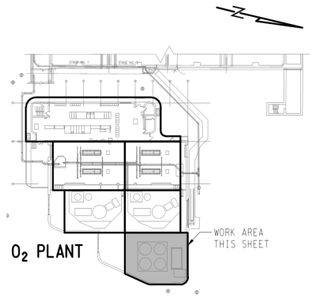
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PLAN

NOTES:

1. DEMOLISH AND REPLACE VALVE ASSEMBLY.
2. PHOTO TYPICAL FOR LOX TANKS 2-1 & 2-2
3. DEMOLISH AND REPLACE PNEUMATIC TUBING



KEY PLAN

3" ON ORIGINAL DOCUMENT

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Digitally signed by David L. Richardson
Reason: I agree to the terms defined by the placement of my signature on this document.
Date: 2024.09.16 12:23:58-04'00'

REGISTERED PROFESSIONAL ENGINEER
DAVID LLOYD RICHARDSON
No. 37097
CIVIL
STATE OF CALIFORNIA

Woodard & Curran

SOLUTIONWERKS™ INCORPORATED

NO.	DATE	REVISION	BY	REC.	APP.
02	10SEP2024	REVISED PER ADDENDUM NO. 02	JL	JL	DCR

SD428 - MWWTP OXYGEN PLANT REHABILITATION

CONSULTANT

DESIGN BY:	D. BOGGS
DRAWN BY:	L. MAXWELL
DESIGN CHECKED BY R.P.E. NO. 37097	D. RICHARDSON
PROJECT MANAGER R.P.E. NO.	J. JANCAITIS
APPROVED: PRINCIPAL IN CHARGE R.P.E. NO. 37097	D. RICHARDSON

EBMUD

PROJECT MANAGER R.P.E. NO. 95046	J. LAW
RECOMMENDED: SR. ENGINEER R.P.E. NO. 69681	D. RUSSELL

EAST BAY MUNICIPAL UTILITY DISTRICT
SPECIAL DISTRICT NO.1
OAKLAND, CALIFORNIA

MAIN WASTEWATER TREATMENT PLANT
OXYGEN PRODUCTION PLANT

MECHANICAL

PARTIAL DEMOLITION PLAN 5

SCALE	DRAWING NUMBER	REV.
3/8"=1'-0"	SD428-W4400-M102.5D	01
DATE 28JUN24		

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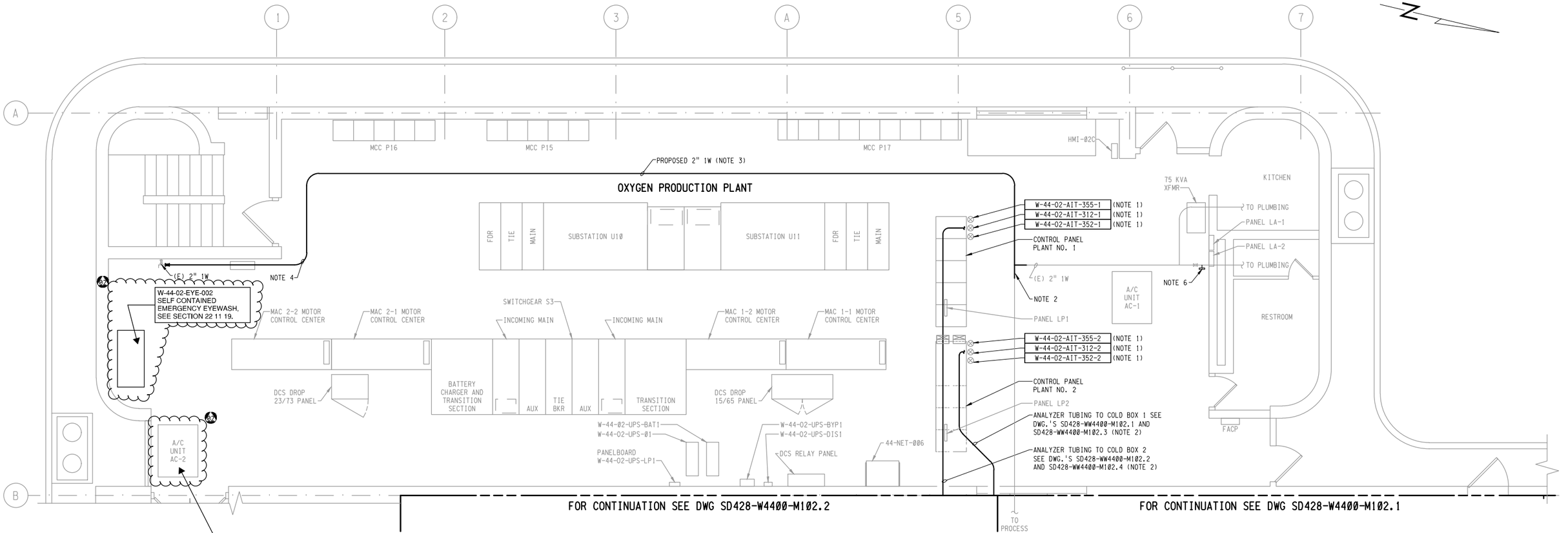
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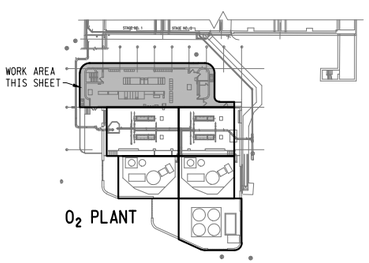
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NOTES:

1. THE ANALYZERS ARE LOCATED WITHIN THE EXISTING CONTROL PANELS.
2. PROVIDE TEE AND CONNECT TO EXISTING BRANCHES SERVING PLUMBING AND PROCESS.
3. PROVIDE 2" 1W LINE. CENTERLINE SHALL BE HALFWAY BETWEEN SUBSTATIONS AND MCC'S.
4. PROVIDE AND CONNECT 90° ELBOW TO EXISTING LINE
5. FIELD ROUTE PNEUMATIC TUBING AS INDICATED ON PNEUMATIC TUBING SCHEDULE SHOWN ON DWG.'S SD428-W4400-M301 THRU SD428-W4400-M303.
6. INSTALL WATER HAMMER ARRESTOR DOWNSTREAM OF RESTROOM ISOLATION VALVE TO PREVENT SHAKING OF 1W LINE WHEN TOILET IS FLUSHED.



PLAN



KEY PLAN

3" ON ORIGINAL DOCUMENT
0 1 2 3

David L. Richardson
Digitally signed by David L. Richardson
Reason: I agree to the terms defined by the placement of my signature on this document.
Date: 2024.09.16 12:24:01-04'00'

REGISTERED PROFESSIONAL ENGINEER
DAVID LLOYD RICHARDSON
No. 37097
CIVIL
STATE OF CALIFORNIA

Woodard & Curran

SOLUTIONWERKS™ INCORPORATED

NO.	DATE	REVISION	BY	REC.	APP.
02	10SEP2024	REVISED PER ADDENDUM NO. 02	JL	JL	DCR

SD428 - MWWTP OXYGEN PLANT REHABILITATION

CONSULTANT

DESIGN BY:	D. BOGGS
DRAWN BY:	L. MAXWELL
DESIGN CHECKED BY R.P.E. NO. 37097	D. RICHARDSON
PROJECT MANAGER R.P.E. NO.	J. JANCAITIS
APPROVED: PRINCIPAL IN CHARGE R.P.E. NO. 37097	D. RICHARDSON

EBMUD

PROJECT MANAGER R.P.E. NO. 95046	J. LAW
RECOMMENDED: SR. ENGINEER R.P.E. NO. 69681	D. RUSSELL

EAST BAY MUNICIPAL UTILITY DISTRICT
SPECIAL DISTRICT NO.1
OAKLAND, CALIFORNIA

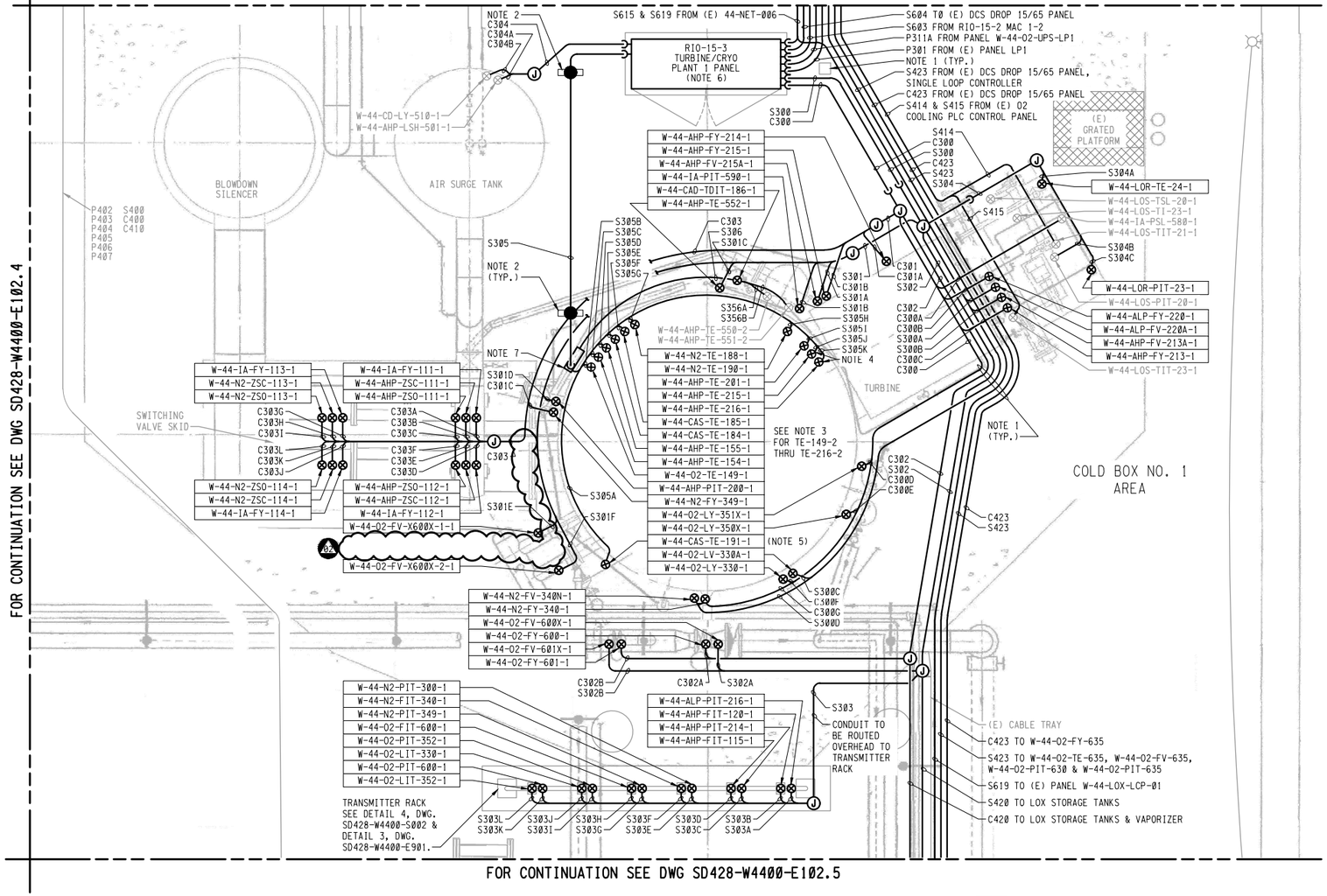
MAIN WASTEWATER TREATMENT PLANT
OXYGEN PRODUCTION PLANT
MECHANICAL
PARTIAL PLAN 6

SCALE 1/4"=1'-0"
DATE 28JUN24

SD428-W4400-M102.6
DRAWING NUMBER

01
REV.

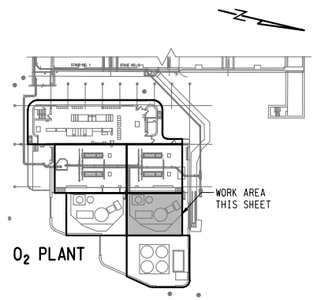
FOR CONTINUATION SEE DWG SD428-W4400-E102.4



PLAN

NOTES:

1. UTILIZE EXISTING CONDUIT AND CABLE TRAY SUPPORTS FOR CONDUIT WHEN POSSIBLE.
2. PROVIDE CONDUIT RACK SUPPORTS FOR SIGNAL AND CONTROL CONDUITS
3. FIELD VERIFY LOCATIONS OF TE-149-1 THRU TE-190-1 AND TE-201-1 THRU TE-216-1 LOCATED WITHIN THE COLD BOX.
4. TE-215-1 AND TE-216-1 LOCATED INSIDE TURBINE BOX
5. TE-191-1 SERVES COOL DOWN HEADER
6. ALL CONDUITS CONNECTING TO PANELS LOCATED OUTDOORS SHALL BE SIDE ENTRY.
7. PROVIDE THERMOCOUPLE TERMINATION BOX (CB T/C T-BOX). ENCLOSURE SHALL BE NEMA 4X, 316 SS. MOUNT TO SIDE OF COLD BOX.



KEY PLAN

Andrew J. Fitzpatrick
Digitally signed by Andrew J. Fitzpatrick
DN: C=US, E=afitzpatrick@woodardcurran.com, O=Woodard & Curran, OU=Technical Delivery Group, CN=Andrew J. Fitzpatrick
Location: Bangor, ME
Reason: I agree to the terms defined by the placement of my signature on this document.
Contact Info: 800.426.4262
Date: 2024.09.13 08:36:00-04'00'

LICENSED PROFESSIONAL ENGINEER
ANDREW J. FITZPATRICK
No. 20004
ELECTRICAL
STATE OF CALIFORNIA

09/12/2024

3" ON ORIGINAL DOCUMENT
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Woodard & Curran

SOLUTIONWERKS™ INCORPORATED

NO.	DATE	REVISION	BY	REC.	APP.
02	12SEP2024	REVISED PER ADDENDUM NO. 2	LM	JC	DCR
01	26AUG2024	REVISED PER ADDENDUM NO. 1	LM	JC	DCR

SD428 - MWWTP OXYGEN PLANT REHABILITATION

CONSULTANT

DESIGN BY:	L. MAXWELL	
DRAWN BY:	L. MAXWELL	
DESIGN CHECKED BY R.P.E. NO. 16928	D. RAMMELL	
PROJECT MANAGER R.P.E. NO.	J. JANCAITIS	
APPROVED: PRINCIPAL IN CHARGE R.P.E. NO. 37097	D. RICHARDSON	

EBMUD

PROJECT MANAGER R.P.E. NO. 95846	J. LAW	
RECOMMENDED: SR. ENGINEER R.P.E. NO. E16072	R. MAC	

EAST BAY MUNICIPAL UTILITY DISTRICT
SPECIAL DISTRICT NO.1
OAKLAND, CALIFORNIA

MAIN WASTEWATER TREATMENT PLANT
OXYGEN PRODUCTION PLANT

ELECTRICAL

PARTIAL POWER AND SIGNAL PLAN 3

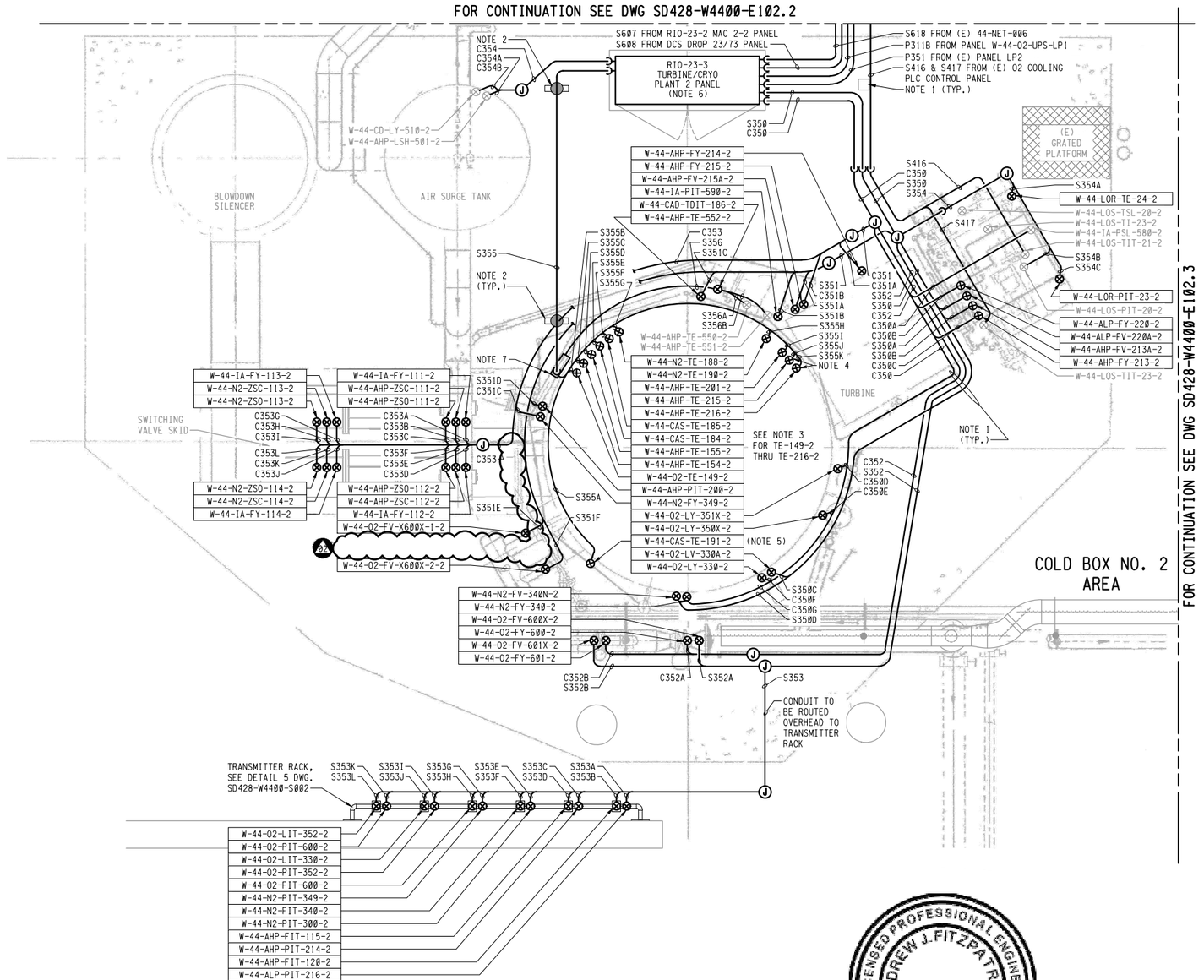
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DATE 28JUN24

SD428-W4400-E102.3
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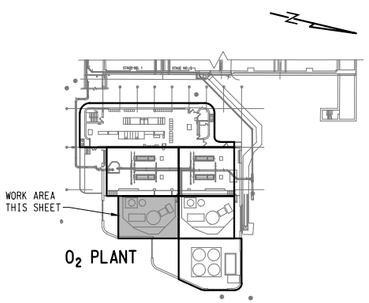
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FILE: #FILENAME#



PLAN



KEY PLAN

NOTES:

1. UTILIZE EXISTING CONDUIT AND CABLE TRAY SUPPORTS FOR CONDUIT WHEN POSSIBLE.
2. PROVIDE CONDUIT RACK SUPPORTS FOR SIGNAL AND CONTROL CONDUITS
3. FIELD VERIFY LOCATIONS OF TE-149-2 THRU TE-190-2 AND TE-201-2 THRU TE-216-2 LOCATED WITHIN THE COLD BOX.
4. TE-215-2 AND TE-216-2 LOCATED INSIDE TURBINE BOX
5. TE-191-2 SERVES COOL DOWN HEADER
6. ALL CONDUITS CONNECTING TO PANELS LOCATED OUTDOORS SHALL BE SIDE ENTRY.
7. PROVIDE THERMOCOUPLE TERMINATION BOX (CB T/C T-BOX). ENCLOSURE SHALL BE NEMA 4X, 316 SS. MOUNT TO SIDE OF COLD BOX.

LICENSED PROFESSIONAL ENGINEER
ANDREW J. FITZPATRICK
No. 20004
ELECTRICAL
STATE OF CALIFORNIA

Andrew J. Fitzpatrick
Digitally signed by Andrew J. Fitzpatrick
DN: C=US, E=afitzpatrick@woodardcurran.com, O=Woodard & Curran, OU=Technical Delivery Group, CN=Andrew J. Fitzpatrick
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Contact Info: 800.426.4262
Date: 2024.09.19 08:36:01-04'00'

09/12/2024

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Woodard & Curran

SOLUTIONWERKS™ INCORPORATED

NO.	DATE	REVISION	BY	REC.	APP.
01	12SEP2024	REVISED PER ADDENDUM NO. 2	LM	JC	DCR
02	26AUG2024	REVISED PER ADDENDUM NO. 1	LM	JC	DCR

SD428 - MWWTP OXYGEN PLANT REHABILITATION

CONSULTANT

DESIGN BY:	L. MAXWELL
DRAWN BY:	L. MAXWELL
DESIGN CHECKED BY R.P.E. NO. 12SEPT	D. RAMMELL
PROJECT MANAGER R.P.E. NO.	J. JANCAITIS
APPROVED: PRINCIPAL IN CHARGE R.P.E. NO. 37097	D. RICHARDSON
PROJECT MANAGER R.P.E. NO. 95046	J. LAW
RECOMMENDED: SR. ENGINEER R.P.E. NO. E16072	R. MAC

EBMUD

EAST BAY MUNICIPAL UTILITY DISTRICT
SPECIAL DISTRICT NO.1
OAKLAND, CALIFORNIA

MAIN WASTEWATER TREATMENT PLANT
OXYGEN PRODUCTION PLANT

ELECTRICAL

PARTIAL POWER AND SIGNAL PLAN 4

SCALE 3/8"=1'0"
DATE 28JUN24

SD428-W4400-E102.4
DRAWING NUMBER

02
REV.

CONDUIT SCHEDULE - CONTROLS

CONDUIT NUMBER	CONDUIT SIZE	CONDUCTOR QTY AND SIZE	FROM	TO	COMMENTS
C100	3/4"	6#14, 3#14GND	RIO-15-1 MAC 1-1 PANEL	J-BOX	MAIN AIR COMPRESSOR 1-1
C100A	3/4"	2#14, 1#14GND	J-BOX	W-44-LOS-TSH-503-1-1	MAIN AIR COMPRESSOR 1-1
C100B	3/4"	2#14, 1#14GND	J-BOX	W-44-IA-FY-500-1-1	MAIN AIR COMPRESSOR 1-1, INLET VALVE'S I/P
C100C	3/4"	2#14, 1#14GND	J-BOX	W-44-EXH-FY-506-1-1	MAIN AIR COMPRESSOR 1-1, F.O. DISCHARGE (ANTI-SURGE) VENT VALVE'S IP
C150	3/4"	6#14, 3#14GND	RIO-15-2 MAC 1-2 PANEL	J-BOX	MAIN AIR COMPRESSOR 1-2
C150A	3/4"	2#14, 1#14GND	J-BOX	W-44-LOS-TSH-503-1-2	MAIN AIR COMPRESSOR 1-2
C150B	3/4"	2#14, 1#14GND	J-BOX	W-44-IA-FY-500-1-2	MAIN AIR COMPRESSOR 1-2, INLET VALVE'S I/P
C150C	3/4"	2#14, 1#14GND	J-BOX	W-44-EXH-FY-506-1-2	MAIN AIR COMPRESSOR 1-2, DISCHARGE PRESSURE FOR ANTI-SURGE CONTROL
C200	3/4"	6#14, 3#14GND	RIO-23-1 MAC 2-1 PANEL	J-BOX	MAIN AIR COMPRESSOR 2-1
C200A	3/4"	2#14, 1#14GND	J-BOX	W-44-LOS-TSH-503-2-1	MAIN AIR COMPRESSOR 2-1
C200B	3/4"	2#14, 1#14GND	J-BOX	W-44-IA-FY-500-2-1	MAIN AIR COMPRESSOR 2-1, INLET VALVE'S I/P
C200C	3/4"	2#14, 1#14GND	J-BOX	W-44-EXH-FY-506-2-1	MAIN AIR COMPRESSOR 2-1, DISCHARGE PRESSURE FOR ANTI-SURGE CONTROL
C250	3/4"	6#14, 3#14GND	RIO-23-2 MAC 2-2 PANEL	J-BOX	MAIN AIR COMPRESSOR 2-2
C250A	3/4"	2#14, 1#14GND	J-BOX	W-44-LOS-TSH-503-2-2	MAIN AIR COMPRESSOR 2-2
C250B	3/4"	2#14, 1#14GND	J-BOX	W-44-IA-FY-500-2-2	MAIN AIR COMPRESSOR 2-2, INLET VALVE'S I/P
C250C	3/4"	2#14, 1#14GND	J-BOX	W-44-EXH-FY-506-2-2	MAIN AIR COMPRESSOR 2-2, DISCHARGE PRESSURE FOR ANTI-SURGE CONTROL
C300	2"	54#14, 27#14GND	RIO-15-3 TURBINE/CRYO PLANT 1 PANEL	J-BOX	COLD BOX NO. 1
C300A	3/4"	2#14, 1#14GND	J-BOX	W-44-IA-PSL-580-1	COLD BOX NO. 1
C300B	3/4"	2#14, 1#14GND	J-BOX	W-44-ALP-FY-220-1	COLD BOX NO. 1
C300C	3/4"	2#14, 1#14GND	J-BOX	W-44-AHP-FY-213-1	COLD BOX NO. 1
C300D	3/4"	2#14, 1#14GND	J-BOX	W-44-O2-LY-351X-1	COLD BOX NO. 1
C300E	3/4"	2#14, 1#14GND	J-BOX	W-44-O2-LY-350X-1	COLD BOX NO. 1
C300F	3/4"	2#14, 1#14GND	J-BOX	W-44-O2-FY-340-1	COLD BOX NO. 1
C300G	3/4"	2#14, 1#14GND	J-BOX	W-44-O2-LY-330-1	COLD BOX NO. 1
C301	2"	34#14, 17#14GND	J-BOX	J-BOX	COLD BOX NO. 1
C301A	3/4"	2#14, 1#14GND	J-BOX	W-44-AHP-FY-214-1	COLD BOX NO. 1
C301B	3/4"	2#14, 1#14GND	J-BOX	W-44-AHP-FY-215-1	COLD BOX NO. 1
C301C	3/4"	2#14, 1#14GND	J-BOX	W-44-N2-FY-349-1	COLD BOX NO. 1
C301D	DELETED				COLD BOX NO. 1
C301E	DELETED				COLD BOX NO. 1
C302	3/4"	4#14, 2#14 GND	J-BOX	J-BOX	COLD BOX NO. 1
C302A	3/4"	2#14, 1#14GND	J-BOX	W-44-O2-FY-600-1	COLD BOX NO. 1
C302B	3/4"	2#14, 1#14GND	J-BOX	W-44-O2-FY-601-1	COLD BOX NO. 1
C303	1 1/2"	24#14, 12#14GND	J-BOX	J-BOX	COLD BOX NO. 1
C303A	3/4"	2#14, 1#14GND	J-BOX	W-44-IA-FY-111-1	COLD BOX NO. 1
C303B	3/4"	2#14, 1#14GND	J-BOX	W-44-AHP-ZSC-111-1	COLD BOX NO. 1
C303C	3/4"	2#14, 1#14GND	J-BOX	W-44-AHP-ZSO-111-1	COLD BOX NO. 1
C303D	3/4"	2#14, 1#14GND	J-BOX	W-44-IA-FY-112-1	COLD BOX NO. 1
C303E	3/4"	2#14, 1#14GND	J-BOX	W-44-AHP-ZSC-112-1	COLD BOX NO. 1
C303F	3/4"	2#14, 1#14GND	J-BOX	W-44-AHP-ZSO-112-1	COLD BOX NO. 1
C303G	3/4"	2#14, 1#14GND	J-BOX	W-44-IA-FY-113-1	COLD BOX NO. 1
C303H	3/4"	2#14, 1#14GND	J-BOX	W-44-N2-ZSC-113-1	COLD BOX NO. 1
C303I	3/4"	2#14, 1#14GND	J-BOX	W-44-N2-ZSO-113-1	COLD BOX NO. 1
C303J	3/4"	2#14, 1#14GND	J-BOX	W-44-IA-FY-114-1	COLD BOX NO. 1
C303K	3/4"	2#14, 1#14GND	J-BOX	W-44-N2-ZSC-114-1	COLD BOX NO. 1
C303L	3/4"	2#14, 1#14GND	J-BOX	W-44-N2-ZSO-114-1	COLD BOX NO. 1
C304	3/4"	4#14, 2#14GND	RIO-15-3 TURBINE/CRYO PLANT 1 PANEL	J-BOX	COLD BOX NO. 1
C304A	3/4"	2#14, 1#14GND	J-BOX	W-44-AHP-LSH-501-1	COLD BOX NO. 1
C304B	3/4"	2#14, 1#14GND	J-BOX	W-44-CD-LY-510-1	COLD BOX NO. 1
C350	2"	54#14, 27#14GND	RIO-23-3 TURBINE/CRYO PLANT 2 PANEL	J-BOX	COLD BOX NO. 2
C350A	3/4"	2#14, 1#14GND	J-BOX	W-44-IA-PSL-580-2	COLD BOX NO. 2
C350B	3/4"	2#14, 1#14GND	J-BOX	W-44-ALP-FY-220-2	COLD BOX NO. 2
C350C	3/4"	2#14, 1#14GND	J-BOX	W-44-AHP-FY-213-2	COLD BOX NO. 2
C350D	3/4"	2#14, 1#14GND	J-BOX	W-44-O2-LY-351X-2	COLD BOX NO. 2
C350E	3/4"	2#14, 1#14GND	J-BOX	W-44-O2-LY-350X-2	COLD BOX NO. 2
C350F	3/4"	2#14, 1#14GND	J-BOX	W-44-O2-FY-340-2	COLD BOX NO. 2
C350G	3/4"	2#14, 1#14GND	J-BOX	W-44-O2-LY-330-2	COLD BOX NO. 2
C351	2"	34#14, 17#14GND	J-BOX	J-BOX	COLD BOX NO. 2
C351A	3/4"	2#14, 1#14GND	J-BOX	W-44-AHP-FY-214-2	COLD BOX NO. 2
C351B	3/4"	2#14, 1#14GND	J-BOX	W-44-AHP-FY-215-2	COLD BOX NO. 2
C351C	3/4"	2#14, 1#14GND	J-BOX	W-44-N2-FY-349-2	COLD BOX NO. 2
C351D	DELETED				COLD BOX NO. 2
C351E	DELETED				COLD BOX NO. 2
C352	3/4"	4#14, 2#14 GND	J-BOX	J-BOX	COLD BOX NO. 2
C352A	3/4"	2#14, 1#14GND	J-BOX	W-44-O2-FY-600-2	COLD BOX NO. 2
C352B	3/4"	2#14, 1#14GND	J-BOX	W-44-O2-FY-601-2	COLD BOX NO. 2

CONDUIT SCHEDULE - CONTROLS CON'T

CONDUIT NUMBER	CONDUIT SIZE	CONDUCTOR QTY AND SIZE	FROM	TO	COMMENTS
C353	1 1/2"	24#14, 12#14GND	J-BOX	J-BOX	COLD BOX NO. 2
C353A	3/4"	2#14, 1#14GND	J-BOX	W-44-IA-FY-111-2	COLD BOX NO. 2
C353B	3/4"	2#14, 1#14GND	J-BOX	W-44-AHP-ZSC-111-2	COLD BOX NO. 2
C353C	3/4"	2#14, 1#14GND	J-BOX	W-44-AHP-ZSO-111-2	COLD BOX NO. 2
C353D	3/4"	2#14, 1#14GND	J-BOX	W-44-IA-FY-112-2	COLD BOX NO. 2
C353E	3/4"	2#14, 1#14GND	J-BOX	W-44-AHP-ZSC-112-2	COLD BOX NO. 2
C353F	3/4"	2#14, 1#14GND	J-BOX	W-44-AHP-ZSO-112-2	COLD BOX NO. 2
C353G	3/4"	2#14, 1#14GND	J-BOX	W-44-IA-FY-113-2	COLD BOX NO. 2
C353H	3/4"	2#14, 1#14GND	J-BOX	W-44-N2-ZSC-113-2	COLD BOX NO. 2
C353I	3/4"	2#14, 1#14GND	J-BOX	W-44-N2-ZSO-113-2	COLD BOX NO. 2
C353J	3/4"	2#14, 1#14GND	J-BOX	W-44-IA-FY-114-2	COLD BOX NO. 2
C353K	3/4"	2#14, 1#14GND	J-BOX	W-44-N2-ZSC-114-2	COLD BOX NO. 2
C353L	3/4"	2#14, 1#14GND	J-BOX	W-44-N2-ZSO-114-2	COLD BOX NO. 2
C354	3/4"	4#14, 2#14GND	RIO-23-3 TURBINE/CRYO PLANT 2 PANEL	J-BOX	COLD BOX NO. 2
C354A	3/4"	2#14, 1#14GND	J-BOX	W-44-AHP-LSH-501-2	COLD BOX NO. 2
C354B	3/4"	2#14, 1#14GND	J-BOX	W-44-CD-LY-510-2	COLD BOX NO. 2
C360	3/4"	2#14, 1#14GND	(E) DCS DROP 15/65 PANEL	(E) MAC 1-1 MOTOR CONTROL CENTER	RUN STATUS
C362	3/4"	16#14, 2#14GND	J-BOX	J-BOX	RIO-15-1 AND RIO-15-2 MAC PANELS
C362A	3/4"	8#14, 1#14GND	J-BOX	(E) MAC 1-1 MOTOR CONTROL CENTER	RIO-15-1 AND RIO-15-2 MAC PANELS
C362B	3/4"	8#14, 1#14GND	J-BOX	(E) MAC 1-2 MOTOR CONTROL CENTER	RIO-15-1 AND RIO-15-2 MAC PANELS
C362C	3/4"	8#14, 1#14GND	J-BOX	(E) CONTROL PANEL PLANT NO. 1	CONTROL ROOM
C362D	3/4"	8#14, 1#14GND	J-BOX	RIO-15-1 MAC 1-1 PANEL	RIO-15-1 MAC 1-1 PANEL
C362E	3/4"	4#14, 1#14GND	J-BOX	RIO-15-2 MAC 1-2 PANEL	RIO-15-2 MAC 1-2 PANEL
C363	3/4"	2#14, 1#14GND	(E) DCS DROP 15/65 PANEL	(E) MAC 1-2 MOTOR CONTROL CENTER	RUN STATUS
C364	3/4"	3#10, 1#10GND	MAC 1-1 MOTOR TERMINATION BOX	(E) MAC 1-1 MOTOR CONTROL CENTER	DIFFERENTIAL CT
C365	3/4"	3#10, 1#10GND	MAC 1-2 MOTOR TERMINATION BOX	(E) MAC 1-2 MOTOR CONTROL CENTER	DIFFERENTIAL CT
C370	3/4"	2#14, 1#14GND	DCS DROP 23/73 PANEL	(E) MAC 2-1 MOTOR CONTROL CENTER	RUN STATUS
C372	3/4"	16#14, 2#14GND	J-BOX	J-BOX	RIO-23-1 AND RIO-23-2 MAC PANELS
C372A	3/4"	8#14, 1#14GND	J-BOX	(E) MAC 2-1 MOTOR CONTROL CENTER	RIO-23-1 AND RIO-23-2 MAC PANELS
C372B	3/4"	8#14, 1#14GND	J-BOX	(E) MAC 2-2 MOTOR CONTROL CENTER	RIO-23-1 AND RIO-23-2 MAC PANELS
C372C	3/4"	4#14, 1#14GND	J-BOX	(E) CONTROL PANEL PLANT NO. 2	CONTROL ROOM
C372D	3/4"	8#14, 1#14GND	J-BOX	RIO-23-1 MAC 2-1 PANEL	RIO-23-1 MAC 2-1 PANEL
C372E	3/4"	8#14, 1#14GND	J-BOX	RIO-23-2 MAC 2-2 PANEL	RIO-23-2 MAC 2-2 PANEL
C373	3/4"	2#14, 1#14GND	DCS DROP 23/73 PANEL	(E) MAC 2-2 MOTOR CONTROL CENTER	RUN STATUS
C374	3/4"	3#10, 1#10GND	MAC 2-1 MOTOR TERMINATION BOX	(E) MAC 2-1 MOTOR CONTROL CENTER	DIFFERENTIAL CT
C375	3/4"	3#10, 1#10GND	MAC 2-2 MOTOR TERMINATION BOX	(E) MAC 2-2 MOTOR CONTROL CENTER	DIFFERENTIAL CT
C420	1-1/2"	20#14, 20#14GND	J-BOX	J-BOX	LOX (SPARE 6#14, 6#16 GND)
C420A	3/4"	2#14, 1#14GND	J-BOX	W-44-O2-PY-616-1	LOX TANK 1-1
C420B	3/4"	2#14, 1#14GND	J-BOX	W-44-O2-PY-626-1	LOX TANK 1-2
C421	3/4"	4#14, 4#14GND	J-BOX	J-BOX	LOX
C421A	3/4"	2#14, 1#14GND	J-BOX	W-44-O2-PY-616-2	LOX TANK 2-1
C421B	3/4"	2#14, 1#14GND	J-BOX	W-44-O2-PY-626-2	LOX TANK 2-2
C422	3/4"	10#14, 5#14GND	J-BOX	J-BOX	LOX VAPORIZER
C422A	3/4"	2#14, 1#14GND	J-BOX	W-44-O2-TSL-640	LOX VAPORIZER
C422B	3/4"	2#14, 1#14GND	J-BOX	W-44-O2-TSL-690	LOX VAPORIZER
C422C	3/4"	2#14, 1#14GND	J-BOX	W-44-O2-TSL-631	LOX VAPORIZER
C422D	3/4"	2#14, 1#14GND	J-BOX	W-44-O2-TSH-631	LOX VAPORIZER
C422E	3/4"	2#14, 1#14GND	J-BOX	W-44-O2-FY-690	LOX VAPORIZER
C423	3/4"	2#14, 1#14GND	(E) DCS DROP 15/65 PANEL	W-44-O2-FY-635	LOX VAPORIZER

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REF 8: REF#TLDWWE
REF 9: REF#TLDWWE

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USER: ##USER##
DATE: ##DATE##
FILE: ##FILENAME##
PLOT SCALE: PLOTSCALE

Andrew J. Fitzpatrick

Digitally signed by Andrew J. Fitzpatrick
DN: C=US, E=afitzpatrick@woodardcurran.com, O=Woodard & Curran, OU=Technical Delivery Group, CN=Andrew J. Fitzpatrick
Location: Bangor, ME
Reason: I agree to the terms defined by the placement of my signature on this document
Contact Info: 800.426.4262
Date: 2024.09.16 16:16:15-04'00'

LICENSED PROFESSIONAL ENGINEER
ANDREW J. FITZPATRICK
No. 20004
ELECTRICAL
STATE OF CALIFORNIA

09/16/2024

Woodard & Curran

SOLUTIONWERKS™ INCORPORATED

NO.	DATE	REVISION	BY	REC.	APP.
01	12SEP2024	REVISED PER ADDENDUM NO. 2	LM	JC	DCR

SD428 - MWWTP OXYGEN PLANT REHABILITATION

CONSULTANT

DESIGN BY:	D. RAMMELL
DRAWN BY:	L. MAXWELL
DESIGN CHECKED BY R.P.E. NO. 16928	D. RAMMELL
PROJECT MANAGER R.P.E. NO.	J. JANCAITIS
APPROVED: PRINCIPAL IN CHARGE R.P.E. NO. 37097	D. RICHARDSON

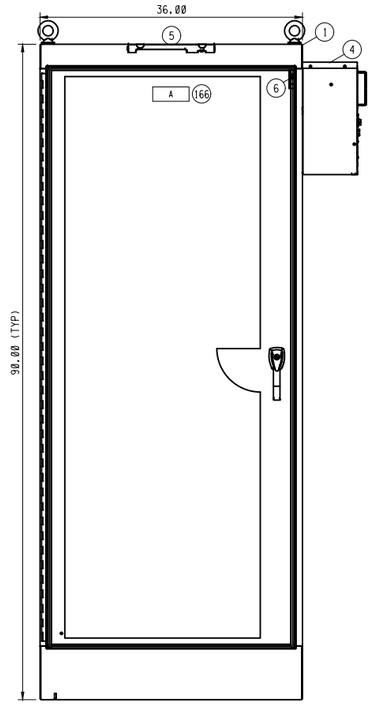
EBMUD

PROJECT MANAGER R.P.E. NO. 95046	J. LAW
RECOMMENDED: SR. ENGINEER R.P.E. NO. E16072	R. MAC

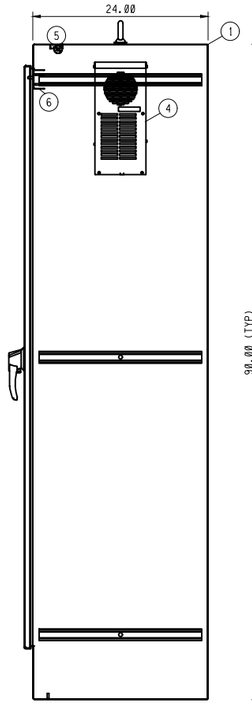
EAST BAY MUNICIPAL UTILITY DISTRICT
SPECIAL DISTRICT NO.1
OAKLAND, CALIFORNIA

MAIN WASTEWATER TREATMENT PLANT
OXYGEN PRODUCTION PLANT
ELECTRICAL
CONDUIT SCHEDULE 1
CONTROLS

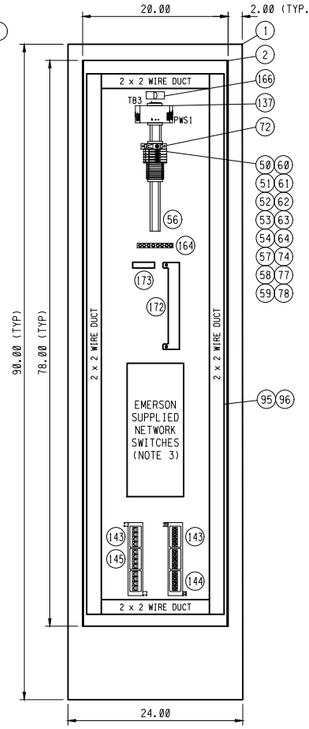
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DATE 28JUN24
SD428-W4400-E121
DRAWING NUMBER
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REV.



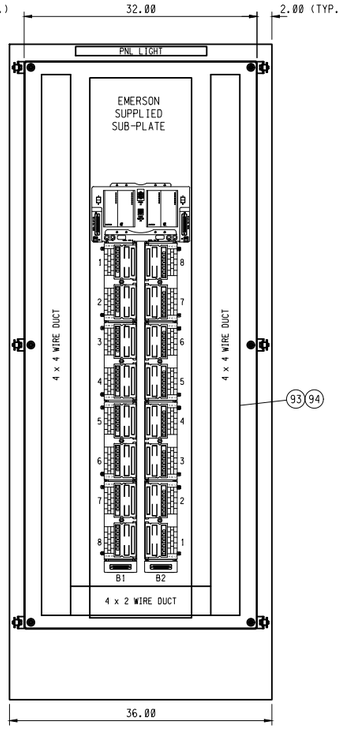
ENCLOSURE EXTERIOR FRONT VIEW
(NOTES 1 & 2)



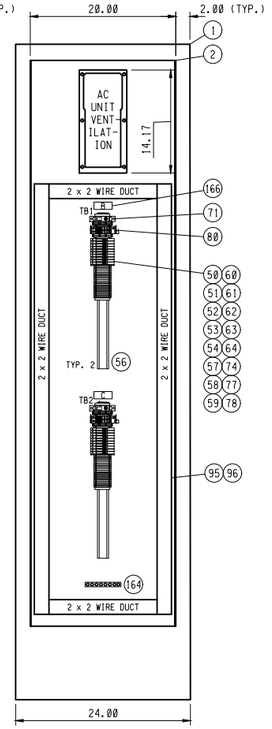
ENCLOSURE EXTERIOR SIDE VIEW
(NOTES 1 & 2)



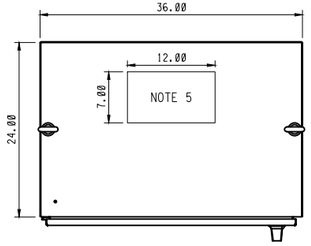
LEFT PANEL
(NOTE 3)



BACK PLATE
(NOTE 3)

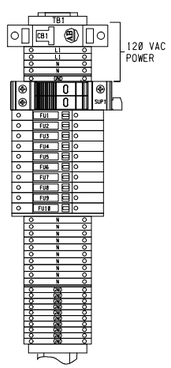


RIGHT PANEL

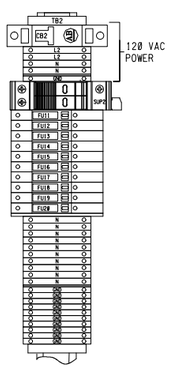


ENCLOSURE EXTERIOR TOP VIEW

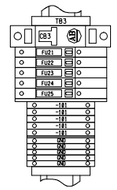
TERMINAL BLOCK LAYOUTS



(1) 20 AMP CIRCUIT BREAKER
(1) 120 VAC SURGE PROTECTOR
(14) 1-TIER TERMINALS
(2) 1-TIER END BARRIERS
(11) GROUNDING TERMINALS
(10) FUSE BLOCKS
(1) FUSE BLOCK END BARRIERS
(1) 120VAC RELAY
(2) END ANCHORS



(1) 20 AMP CIRCUIT BREAKER
(1) 120 VAC SURGE PROTECTOR
(14) 1-TIER TERMINALS
(2) 1-TIER END BARRIERS
(11) GROUNDING TERMINALS
(10) FUSE BLOCKS
(1) FUSE BLOCK END BARRIERS
(1) 120VAC RELAY
(2) END ANCHORS



(1) 10 AMP CIRCUIT BREAKER
(5) 1-TIER TERMINALS
(1) 1-TIER END BARRIERS
(5) GROUNDING TERMINALS
(5) FUSE BLOCKS
(1) FUSE BLOCK END BARRIERS
(2) END ANCHORS

NOTES:

1. ENCLOSURE SHALL SIT ON A 4" HEIGHT HOUSEKEEPING PAD.
2. ENCLOSURE SHALL BE PAINTED STEEL, TYPE NEMA 12, AND HAVE PROVISION FOR PADLOCK.
3. SUBPLATE AND NETWORK SWITCHES SHALL BE SUPPLIED BY EMERSON AND INSTALLED BY THE CONTRACTOR AFTER COMPLETION OF PANEL. CONTRACTOR SHALL COORDINATE WITH EMERSON FOR RECEIVING THE EQUIPMENT AND INSTALLATION SEQUENCE AND SCHEDULE. EMERSON SHALL SUPPLY ETHERNET AND FIBER PATCH CORDS. CONTRACTOR SHALL PROVIDE AND INSTALL POWER CONNECTIONS TO EMERSON EQUIPMENT AS DIRECTED BY EMERSON.
4. NAMEPLATE SHALL BE BLACK WITH WHITE LETTERS WITH ADHESIVE BACK. TEXT SIZE TO BE .375
5. AREA RESERVED FOR CONDUIT ENTRY.
6. ENCLOSURE LIGHT AND INTRUSION SWITCH SHALL BE MOUNTED WITH STAINLESS STEEL SCREWS, NUTS AND NEOPRENE BONDED SEALING WASHERS TO MAINTAIN THE NEMA 4X RATING OF ENCLOSURE. (SEALING WASHER MANUFACTURER & ITEM NUMBER: THE HILLMAN GROUP #290250 OR EQUAL)

NAMEPLATE SCHEDULE (NOTE 4)			
ITEM	DIMENSION	DESCRIPTION	FABRICATION COMMENTS
A	5" x 2"	DROP 23/73 PANEL	NOTE 4
B	2.5" x 1"	TB1	NOTE 4
C	2.5" x 1"	TB2	NOTE 4
D	2.5" x 1"	TB3	NOTE 4

BILL OF MATERIALS

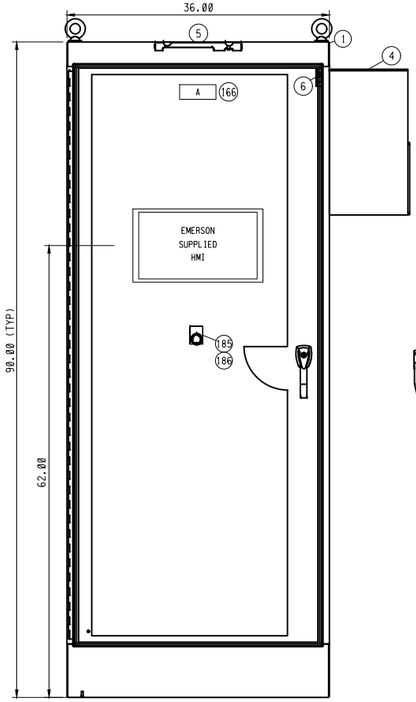
ITEM	QTY.	MANUFACTURER	PART NUMBER	DESCRIPTION	DESIGNATION
				****ENCLOSURE & RELATED EQUIPMENT****	
1	1	HAMMOND MANUFACTURING	1418YY24	ENCLOSURE, NEMA 12, 90.00" x 36.00" x 24.00", PAINTED STEEL	ENCLOSURE
2	1	HAMMOND MANUFACTURING	90YFW	INTERNAL PANEL, 78" X 32"	BACK PANEL
3	2	SAGINAW CONTROL	SCE-90SMP20	SIDE PANEL, 78" X 20"	SIDE PANELS
4	1	HAMMOND MANUFACTURING	DTS3021A115LG	AC UNIT 900-1300 BTU/HR - 115V - NEMA 12	AC UNIT
5	1	HOFFMAN	LEDA1S35	ENCLOSURE LIGHT	LT-01
6	1	HOFFMAN	ALFSWD	ENCLOSURE DOOR SWITCH	SW-01
				****TERMINAL BLOCKS & RELATED EQUIPMENT****	
50	33	ALLEN BRADLEY	1492-J4	TERMINAL BLOCK 1 TIER	TB1, TB2, TB3
51	5	ALLEN BRADLEY	1492-EBJ3	TERMINAL BLOCK END BARRIER, 1 TIER	TB1, TB2, TB3
52	8	ALLEN BRADLEY	1492-EAJ35	TERMINAL BLOCK END ANCHOR	TB1, TB2, TB3
53	2	ALLEN BRADLEY	1492-CJJ5-10	TERMINAL BLOCK JUMPER, 10 POLE	TB1, TB2
54	27	ALLEN BRADLEY	1492-JG3	TERMINAL BLOCK, GROUNDING	TB1, TB2
56	3	ALLEN BRADLEY	1492-DR6	DIN RAIL, RAISED	TB1, TB2, TB3, TB4
57	20	ALLEN BRADLEY	1492-H4	FUSED TERMINAL BLOCK, NEON INDICATOR	FU1-FU20
58	5	ALLEN BRADLEY	1492-H6	FUSED TERMINAL BLOCK, LED INDICATOR	FU21-25
59	3	ALLEN BRADLEY	1492-N37	FUSED TERMINAL BLOCK END BARRIER	FU10, FU20, FU25
60	3	ALLEN BRADLEY	1492-N49	FUSE BLOCK SIDE JUMPERS 10 POLE	FU1-FU10, FU11-20, FU21-FU25
61	3	ALLEN BRADLEY	1492-SJS	FUSE BLOCK SIDE JUMPER INSULATING SLEEVE	FU1-FU10, FU11-20, FU21-FU25
62	1	ALLEN BRADLEY	1492-M5X12	GROUNDING TERMINAL BLOCK BLANK MARKING TAGS, 144 CT.	TB1, TB2, TB3
63	2	ALLEN BRADLEY	1492-M5X8	TERMINAL BLOCK BLANK MARKING TAGS, 2 TIER, 144 CT.	TB1, TB2, TB3
64	1	ALLEN BRADLEY	1492-MS8X12	FUSE BLOCK BLANK MARKING TAGS, 100 CT.	FU1-FU25
71	3	ALLEN BRADLEY	1489-M1D200	CIRCUIT BREAKER, 20AMP, SINGLE POLE	CB1, CB2, CB6
72	1	ALLEN BRADLEY	1489-M1D100	CIRCUIT BREAKER, 10AMP, SINGLE POLE	CB3
74	30	BUSSMANN	AGC-1	FUSE, 1A, 250V, FAST ACTING	FU2-FU9, FU12-FU20, FU22-25 PLUS SPARES
77	2	BUSSMANN	AGC-10	FUSE, 10A, 250V FAST ACTING	FU10 PLUS SPARE
78	5	BUSSMANN	AGC-2	FUSE, 2A, 250V, FAST ACTING	FU1, FU11, FU21, PLUS SPARES
80	3	PHOENIX CONTACT	2905348	VAL-SEC-T2-1S-175-FM, 120VAC SURGE PROTECTOR	SUP1, SUP2, PLUS 1 SPARE
				****WIREDUCT****	
93	18FT	PANDUIT	F4X4LG6	WIRING DUCT, 4"W x 4"H	
94	18FT	PANDUIT	C4LG6	WIRING DUCT COVER, 4"W	
95	36FT	PANDUIT	F2X2LG6	WIRING DUCT, 2"W x 2"H	
96	36FT	PANDUIT	C2LG6	WIRING DUCT COVER, 2"W	
				POWER SUPPLIES*	
137	1	PHOENIX CONTACT	2866763	POWER SUPPLY, 240/120VAC IN, 24VDC, 10 AMP	PWS1
				****COMMUNICATIONS****	
143	1	EMERSON	5X00133G05	MINI-COM PATCH PANEL - 12 PORTS	
144	1	EMERSON	1X00118H01	MINI-COM MODULE FOR FO-ST	
145	1	PANDUIT	CJ6C88TGIW	MINI-COM MODULE FOR TX6 10/GIG UTP JACK	
				****MISCELLANEOUS PANEL EQUIPMENT****	
164	3	PANDUIT	UGB2/0-414-6	GROUND BAR	
166	4	PANEL FABRICATOR		NAMEPLATE, PHENOLIC, ENGRAVED	SEE SCHEDULE ON EQUIPMENT LAYOUT
172	1	EMERSON	2379C68G01	RTD ASSEMBLY	
173	1	PHOENIX CONTACT	2864587	TEMP XMIT MCR-FL-TS-LP-I-EX	

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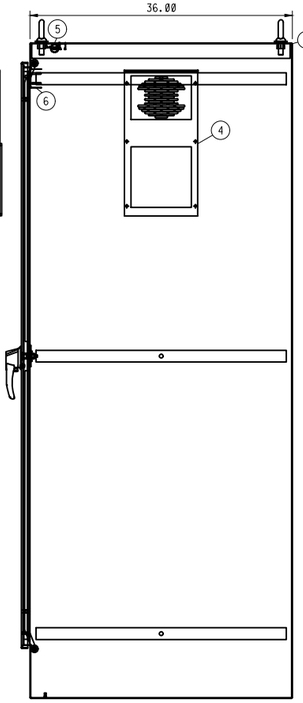
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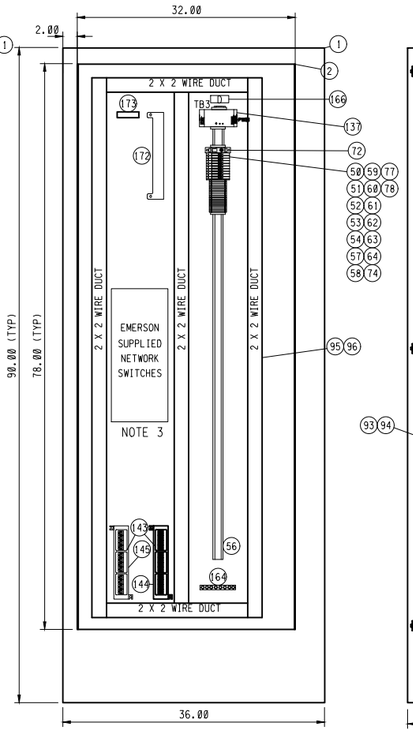
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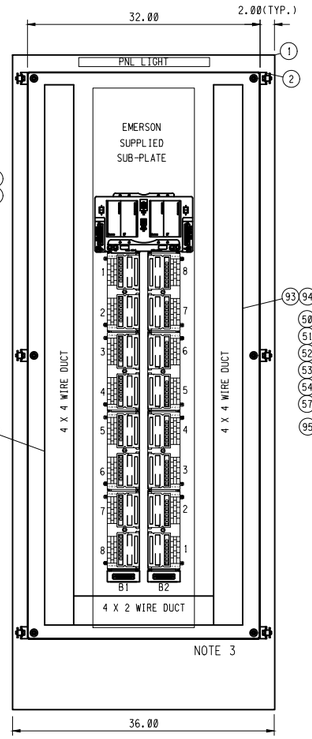
ENCLOSURE EXTERIOR FRONT VIEW
(NOTES 1 & 2)



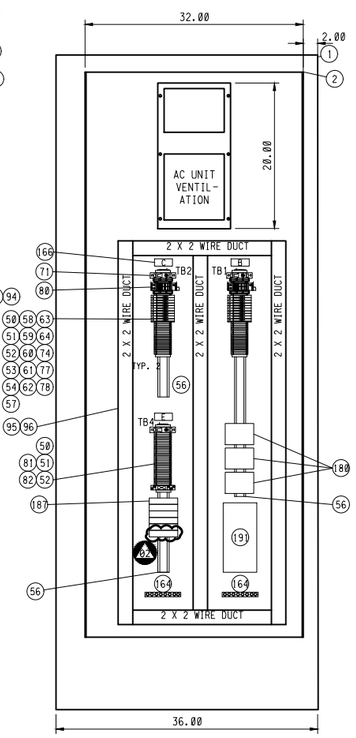
ENCLOSURE EXTERIOR SIDE VIEW
(NOTES 1 & 2)



LEFT PANEL



BACK PLATE



RIGHT PANEL

NOTES:

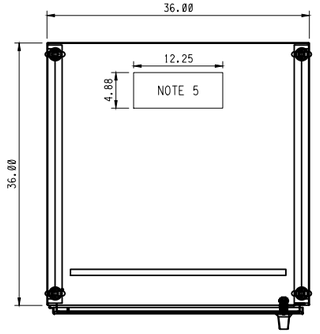
1. ENCLOSURE SHALL SIT ON A 4" HEIGHT HOUSEKEEPING PAD.
2. ENCLOSURE SHALL BE SS316, TYPE NEMA 4X, AND HAVE PROVISION FOR PADLOCK.
3. SUBPLATE, HMI, AND NETWORK SWITCHES SHALL BE SUPPLIED BY EMERSON AND INSTALLED BY THE CONTRACTOR AFTER COMPLETION OF PANEL. CONTRACTOR SHALL COORDINATE WITH EMERSON FOR RECEIVING THE EQUIPMENT AND INSTALLATION SEQUENCE AND SCHEDULE. EMERSON SHALL SUPPLY ETHERNET AND FIBER PATCH CORDS. CONTRACTOR SHALL PROVIDE AND INSTALL POWER CONNECTIONS TO EMERSON EQUIPMENT AS DIRECTED BY EMERSON.
4. NAMEPLATE SHALL BE BLACK WITH WHITE LETTERS WITH ADHESIVE BACK. TEXT SIZE TO BE .375
5. AREA RESERVED FOR CONDUIT ENTRY.
6. ENCLOSURE LIGHT AND INTRUSION SWITCH SHALL BE MOUNTED WITH STAINLESS STEEL SCREWS, NUTS AND NEOPRENE BONDED SEALING WASHERS TO MAINTAIN THE NEMA 4X RATING OF ENCLOSURE. (SEALING WASHER MANUFACTURER & ITEM NUMBER: THE HILLMAN GROUP #290250 OR EQUAL)

NAMEPLATE SCHEDULE (NOTE 4)

ITEM	DIMENSION	DESCRIPTION	FABRICATION COMMENTS
A	5" x 2"	RIO-15-1 MAC 1-1 PANEL	NOTE 4
B	2.5" x 1"	TB1	NOTE 4
C	2.5" x 1"	TB2	NOTE 4
D	2.5" x 1"	TB3	NOTE 4
E	2.5" x 1"	TB4	NOTE 4

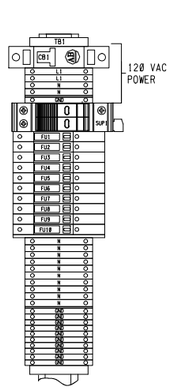
BILL OF MATERIALS

ITEM	QTY.	MANUFACTURER	PART NUMBER	DESCRIPTION	DESIGNATION
				****ENCLOSURE & RELATED EQUIPMENT****	
1	1	HAMMOND MANUFACTURING	HNAFS903636S16	ENCLOSURE, NEMA 4X, 90.00" x 36.00" x 36.00", 316SS	ENCLOSURE
2	1	HAMMOND MANUFACTURING	90YFW	INTERNAL PANEL, 78" X 32"	BACK PANEL
3	2	SAGINAW CONTROL	SCE-90SMP30	SIDE PANEL, 78" X 30"	SIDE PANELS
4	1	HAMMOND MANUFACTURING	DTS3081A115N4SS	AC UNIT 2500 BTU/HR - 115V - NEMA 4X	AC UNIT
5	1	HOFFMAN	LEDA1S35	ENCLOSURE LIGHT	LT-01
6	1	HOFFMAN	ALFSWD	ENCLOSURE DOOR SWITCH	SW-01
				****TERMINAL BLOCKS & RELATED EQUIPMENT****	
50	68	ALLEN BRADLEY	1492-J4	TERMINAL BLOCK 1 TIER	TB1, TB2, TB3, TB4
51	6	ALLEN BRADLEY	1492-EBJ3	TERMINAL BLOCK END BARRIER, 1 TIER	TB1, TB2, TB3, TB4
52	10	ALLEN BRADLEY	1492-EAJ35	TERMINAL BLOCK END ANCHOR	TB1, TB2, TB3, TB4
53	2	ALLEN BRADLEY	1492-CJJ5-10	TERMINAL BLOCK JUMPER, 10 POLE	TB1, TB2
54	32	ALLEN BRADLEY	1492-JG3	TERMINAL BLOCK, GROUNDING	TB1, TB2, TB3
56	3	ALLEN BRADLEY	1492-DR6	DIN RAIL, RAISED	TB1, TB2, TB3
57	20	ALLEN BRADLEY	1492-H4	FUSED TERMINAL BLOCK, NEON INDICATOR	FU1-FU20
58	5	ALLEN BRADLEY	1492-H5	FUSED TERMINAL BLOCK, LED INDICATOR	FU21-30
59	3	ALLEN BRADLEY	1492-N37	FUSED TERMINAL BLOCK END BARRIER	FU10, FU20, FU30
60	3	ALLEN BRADLEY	1492-N49	FUSE BLOCK SIDE JUMPERS 10 POLE	FU1-FU10, FU11-20, FU21-FU30
61	3	ALLEN BRADLEY	1492-SJS	FUSE BLOCK SIDE JUMPER INSULATING SLEEVE	FU1-FU10, FU11-20, FU21-FU30
62	1	ALLEN BRADLEY	1492-M5X12	GROUNDING TERMINAL BLOCK BLANK MARKING TAGS, 144 CT.	TB1, TB2, TB3
63	2	ALLEN BRADLEY	1492-M5X8	TERMINAL BLOCK BLANK MARKING TAGS, 2 TIER, 144 CT.	TB1, TB2, TB3
64	1	ALLEN BRADLEY	1492-MS8X12	FUSE BLOCK BLANK MARKING TAGS, 100 CT.	FU1-FU25
71	3	ALLEN BRADLEY	1489-M1D200	CIRCUIT BREAKER, 20AMP, SINGLE POLE	CB1, CB2, CB6
72	2	ALLEN BRADLEY	1489-M1D100	CIRCUIT BREAKER, 10AMP, SINGLE POLE	CB3, CB7
74	33	BUSSMANN	AGC-1	FUSE, 1A, 250V, FAST ACTING	FU3-FU9, FU12-FU20, FU25-FU30 PLUS SPARES
77	2	BUSSMANN	AGC-10	FUSE, 10A, 250V FAST ACTING	FU10 PLUS SPARE
78	11	BUSSMANN	AGC-2	FUSE, 2A, 250V, FAST ACTING	FU1, FU2, FU11, FU21-24, PLUS SPARES
80	3	PHOENIX CONTACT	2905348	VAL-SEC-T2-1S-175-FM, 120VAC SURGE PROTECTOR	SUP1, SUP2, PLUS 1 SPARE
81	1	ALLEN BRADLEY	700-HK32A1	GENERAL PURPOSE SLIM LINE RELAY, 120VAC	RL500
82	1	ALLEN BRADLEY	700-HN121	RELAY SOCKET	RL500
				****WIREDUCT****	
93	18FT	PANDUIT	F4X4LG6	WIRING DUCT, 4"W x 4"H	
94	18FT	PANDUIT	C4LG6	WIRING DUCT COVER, 4"W	
95	48FT	PANDUIT	F2X2LG6	WIRING DUCT, 2"W x 2"H	
96	48FT	PANDUIT	C2LG6	WIRING DUCT COVER, 2"W	
				****POWER SUPPLIES****	
137	1	PHOENIX CONTACT	2866763	POWER SUPPLY, 240/120VAC IN, 24VDC, 10 AMP	PWS1
				****COMMUNICATIONS****	
143	1	EMERSON	5X00133G05	MINI-COM PATCH PANEL - 12 PORTS	
144	1	EMERSON	1X00118H01	MINI-COM MODULE FOR FO-ST	
145	1	PANDUIT	CJ6C88YGW	MINI-COM MODULE FOR TX6 10GIG UTP JACK	
				****MISCELLANEOUS PANEL EQUIPMENT****	
164	3	PANDUIT	UGB2/0-414-6	GROUND BAR	
166	4	PANEL FABRICATOR		NAMEPLATE, PHENOLIC, ENGRAVED	SEE SCHEDULE ON EQUIPMENT LAYOUT
172	1	EMERSON	2379C68G01	RTD ASSEMBLY	
173	1	PHOENIX CONTACT	2864587	TEMP XMIT MCR-FL-TS-LP-I-EX	
180	3	BENTLY NEVADA	990-05-70-03-00	VIBRATION TRANSMITTER	
185	1	ALLEN BRADLEY	800H-FRXT6A1	30MM PUSH-PULL/TWIST PUSHBUTTON, MUSHROOM HEAD, RED	
186	1	ALLEN BRADLEY	800H-W300JE	30MM PUSHBUTTON LEGEND PLATE, JUMBO, CUSTOM TEXT, "SYSTEM STOP"	
187	6	WILCOXON	IT301	USER-CONFIGURABLE INTELLIGENT VIBRATION TRANSMITTER	
191	1	SEL	SEL-2600A	RTD MODULE	PROVIDED BY ELECTRICAL CONTRACTOR

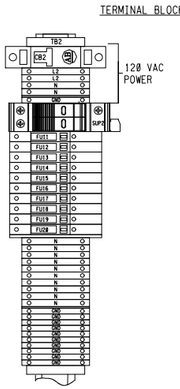


ENCLOSURE EXTERIOR TOP VIEW

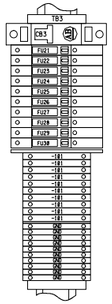
TERMINAL BLOCK LAYOUTS



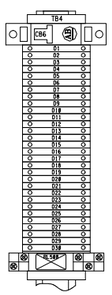
(1) 20 AMP CIRCUIT BREAKER
(1) 120 VAC SURGE PROTECTOR
(14) 1-TIER TERMINALS
(2) 1-TIER END BARRIERS
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(10) FUSE BLOCKS
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(1) 10 AMP CIRCUIT BREAKER
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(1) 10 AMP CIRCUIT BREAKER
(30) 1-TIER TERMINALS
(1) 1-TIER END BARRIERS
(1) 120V RELAY
(2) END ANCHORS

LICENSED PROFESSIONAL ENGINEER
ANDREW J. FITZPATRICK
No. 20004
ELECTRICAL
STATE OF CALIFORNIA

Andrew J. Fitzpatrick

Digitally signed by Andrew J. Fitzpatrick
DN: C=US, E=afitzpatrick@woodardcurran.com, O=Woodard & Curran, OU=Technical Delivery Group, CN=Andrew J. Fitzpatrick
Location: Harpor, ME
Reason: I agree to the terms defined in Adobe Approved Trust List in my signature on this document.
Contact Info: 800.426.4262
Date: 2024.09.13 08:38:02-04'00'

09/12/2024

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Woodard & Curran

SOLUTIONWERKS™ INCORPORATED

NO.	DATE	REVISION	BY	REC.	APP.
02	12SEP2024	REVISED PER ADDENDUM NO. 2	RSS	JC	DCR
01	26AUG2024	REVISED PER ADDENDUM NO. 1	RSS	JC	DCR

CONSULTANT
EBMUD

DESIGN BY:	R. SPEYRER
DRAWN BY:	R. SPEYRER
DESIGN CHECKED BY R.P.E. NO. 7556	K. TRACY
PROJECT MANAGER R.P.E. NO.	J. JANCAITIS
APPROVED: PRINCIPAL IN CHARGE R.P.E. NO. 37097	D. RICHARDSON
PROJECT MANAGER R.P.E. NO. 95046	J. LAW
RECOMMENDED: SR. ENGINEER R.P.E. NO. CS7604	R. MAC

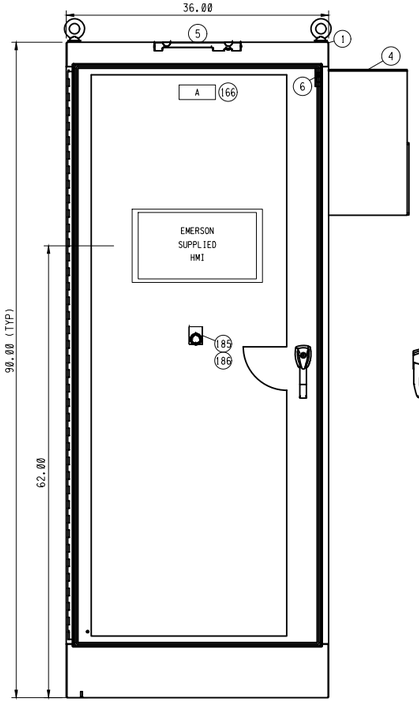
SD428 - MWWTP OXYGEN PLANT REHABILITATION

EAST BAY MUNICIPAL UTILITY DISTRICT
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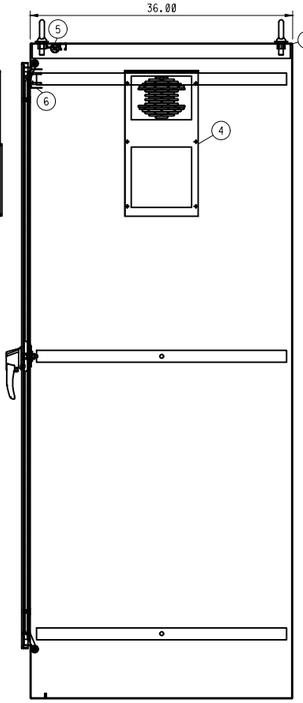
MAIN WASTEWATER TREATMENT PLANT
OXYGEN PRODUCTION PLANT
ELECTRICAL
RIO-15-1 MAC 1-1 PANEL
EQUIPMENT ELEVATION

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DATE 28JUN24
SD428-W4400-E503
DRAWING NUMBER
02
REV.

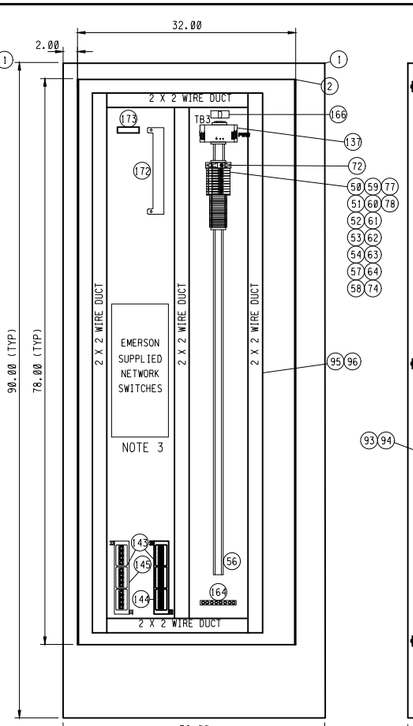
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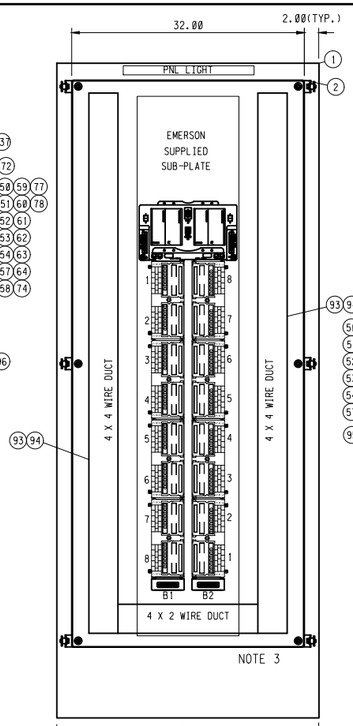
ENCLOSURE EXTERIOR FRONT VIEW
(NOTES 1 & 2)



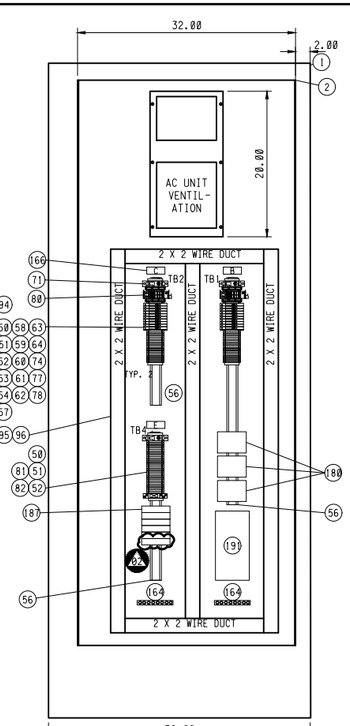
ENCLOSURE EXTERIOR SIDE VIEW
(NOTES 1 & 2)



LEFT PANEL



BACK PLATE



RIGHT PANEL

NOTES:

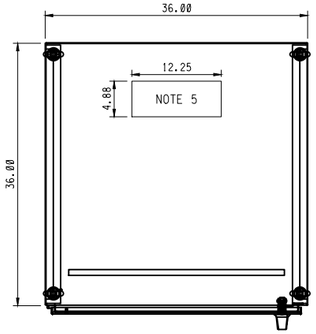
1. ENCLOSURE SHALL SIT ON A 4" HEIGHT HOUSEKEEPING PAD.
2. ENCLOSURE SHALL BE SS316, TYPE NEMA 4X, AND HAVE PROVISION FOR PADLOCK.
3. SUBPLATE, HMI, AND NETWORK SWITCHES SHALL BE SUPPLIED BY EMERSON AND INSTALLED BY THE CONTRACTOR AFTER COMPLETION OF PANEL. CONTRACTOR SHALL COORDINATE WITH EMERSON FOR RECEIVING THE EQUIPMENT AND INSTALLATION SEQUENCE AND SCHEDULE. EMERSON SHALL SUPPLY ETHERNET AND FIBER PATCH CORDS. CONTRACTOR SHALL PROVIDE AND INSTALL POWER CONNECTIONS TO EMERSON EQUIPMENT AS DIRECTED BY EMERSON.
4. NAMEPLATE SHALL BE BLACK WITH WHITE LETTERS WITH ADHESIVE BACK. TEXT SIZE TO BE .375
5. AREA RESERVED FOR CONDUIT ENTRY.
6. ENCLOSURE LIGHT AND INTRUSION SWITCH SHALL BE MOUNTED WITH STAINLESS STEEL SCREWS, NUTS AND NEOPRENE BONDED SEALING WASHERS TO MAINTAIN THE NEMA 4X RATING OF ENCLOSURE. (SEALING WASHER MANUFACTURER & ITEM NUMBER: THE HILLMAN GROUP #290250 OR EQUAL)

NAMEPLATE SCHEDULE (NOTE 4)

ITEM	DIMENSION	DESCRIPTION	FABRICATION COMMENTS
A	5" x 2"	RIO-23-1 MAC 2-1 PANEL	NOTE 4
B	2.5" x 1"	TB1	NOTE 4
C	2.5" x 1"	TB2	NOTE 4
D	2.5" x 1"	TB3	NOTE 4
E	2.5" x 1"	TB4	NOTE 4

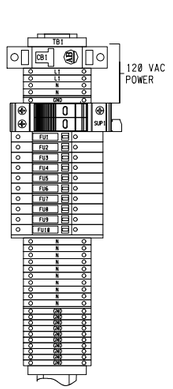
BILL OF MATERIALS

ITEM	QTY.	MANUFACTURER	PART NUMBER	DESCRIPTION	DESIGNATION
				****ENCLOSURE & RELATED EQUIPMENT****	
1	1	HAMMOND MANUFACTURING	HNAFS903636S16	ENCLOSURE, NEMA 4X, 90.00"x 36.00"x 36.00", 316SS	ENCLOSURE
2	1	HAMMOND MANUFACTURING	90YFW	INTERNAL PANEL, 78"X 32"	BACK PANEL
3	2	SAGINAW CONTROL	SCE-90SMP30	SIDE PANEL, 78" X 30"	SIDE PANELS
4	1	HAMMOND MANUFACTURING	DTS3081A115N4SS	AC UNIT 2500 BTU/HR - 115V - NEMA 4X	AC UNIT
5	1	HOFFMAN	LEDA1S35	ENCLOSURE LIGHT	LT-01
6	1	HOFFMAN	ALFSWD	ENCLOSURE DOOR SWITCH	SW-01
				****TERMINAL BLOCKS & RELATED EQUIPMENT****	
50	68	ALLEN BRADLEY	1492-J4	TERMINAL BLOCK 1 TIER	TB1, TB2, TB3, TB4
51	6	ALLEN BRADLEY	1492-EBJ3	TERMINAL BLOCK END BARRIER, 1 TIER	TB1, TB2, TB3, TB4
52	10	ALLEN BRADLEY	1492-EAJ35	TERMINAL BLOCK END ANCHOR	TB1, TB2, TB3, TB4
53	2	ALLEN BRADLEY	1492-CJJ5-10	TERMINAL BLOCK JUMPER, 10 POLE	TB1, TB2
54	32	ALLEN BRADLEY	1492-JG3	TERMINAL BLOCK, GROUNDING	TB1, TB2, TB3
56	3	ALLEN BRADLEY	1492-DR6	DIN RAIL, RAISED	TB1, TB2, TB3
57	20	ALLEN BRADLEY	1492-H4	FUSED TERMINAL BLOCK, NEON INDICATOR	FU1-FU20
58	5	ALLEN BRADLEY	1492-H5	FUSED TERMINAL BLOCK, LED INDICATOR	FU21-30
59	3	ALLEN BRADLEY	1492-N37	FUSED TERMINAL BLOCK END BARRIER	FU10, FU20, FU30
60	3	ALLEN BRADLEY	1492-N49	FUSE BLOCK SIDE JUMPERS 10 POLE	FU1-FU10, FU11-20, FU21-FU30
61	3	ALLEN BRADLEY	1492-SJ5	FUSE BLOCK SIDE JUMPER INSULATING SLEEVE	FU1-FU10, FU11-20, FU21-FU30
62	1	ALLEN BRADLEY	1492-M5X12	GROUNDING TERMINAL BLOCK BLANK MARKING TAGS, 144 CT.	TB1, TB2, TB3
63	2	ALLEN BRADLEY	1492-M5X8	TERMINAL BLOCK BLANK MARKING TAGS, 2 TIER, 144 CT.	TB1, TB2, TB3
64	1	ALLEN BRADLEY	1492-MS8X12	FUSE BLOCK BLANK MARKING TAGS, 100 CT.	FU1-FU25
71	3	ALLEN BRADLEY	1489-M1D200	CIRCUIT BREAKER, 20AMP, SINGLE POLE	CB1, CB2, CB6
72	2	ALLEN BRADLEY	1489-M1D100	CIRCUIT BREAKER, 10AMP, SINGLE POLE	CB3, CB7
74	33	BUSSMANN	AGC-1	FUSE, 1A, 250V, FAST ACTING	FU3-FU9, FU12-FU20, FU25-FU30 PLUS SPARES
77	2	BUSSMANN	AGC-10	FUSE, 10A, 250V FAST ACTING	FU10 PLUS SPARE
78	11	BUSSMANN	AGC-2	FUSE, 2A, 250V, FAST ACTING	FU1, FU2, FU11, FU21-24, PLUS SPARES
80	3	PHOENIX CONTACT	2905348	VAL-SEC-T2-1S-175-FM, 120VAC SURGE PROTECTOR	SUP1, SUP2, PLUS 1 SPARE
81	1	ALLEN BRADLEY	700-HK32A1	GENERAL PURPOSE SLIM LINE RELAY, 120VAC	RL500
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				****MISCELLANEOUS PANEL EQUIPMENT****	
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187	6	WILCOXON	IT301	USER-CONFIGURABLE INTELLIGENT VIBRATION TRANSMITTER	
191	1	SEL	SEL-2600A	RTD MODULE	PROVIDED BY ELECTRICAL CONTRACTOR

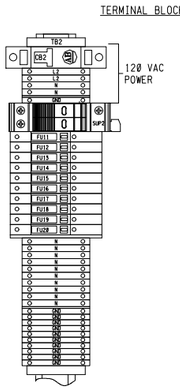


ENCLOSURE EXTERIOR TOP VIEW

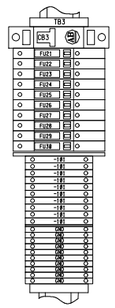
TERMINAL BLOCK LAYOUTS



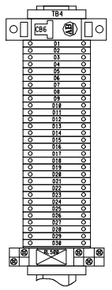
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(1) 120 VAC SURGE PROTECTOR
(14) 1-TIER TERMINALS
(2) 1-TIER END BARRIERS
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(1) FUSE BLOCK END BARRIERS
(1) 120VAC RELAY
(2) END ANCHORS



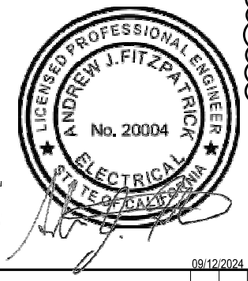
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Andrew J. Fitzpatrick
Digitally signed by Andrew J. Fitzpatrick
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CONSULTANT

DESIGN BY:	R. SPEYRER
DRAWN BY:	R. SPEYRER
DESIGN CHECKED BY R.P.E. NO. 7556	K. TRACY
PROJECT MANAGER R.P.E. NO.	J. JANCAITIS
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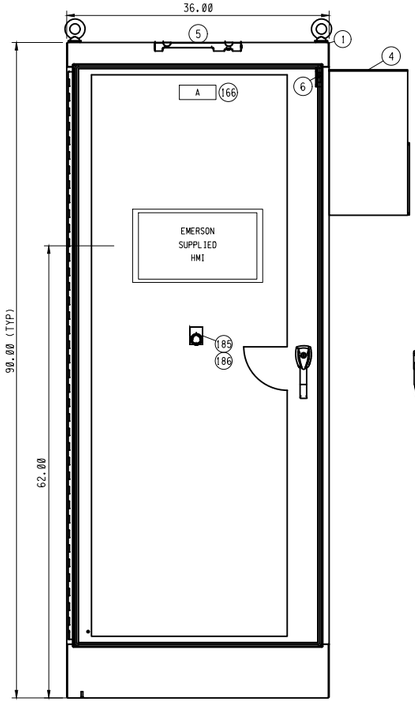
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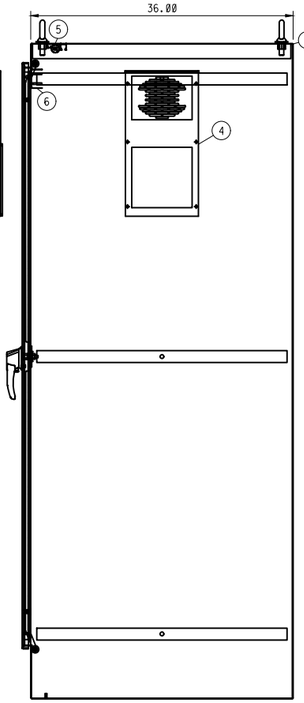
MAIN WASTEWATER TREATMENT PLANT
OXYGEN PRODUCTION PLANT
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RIO-23-1 MAC 2-1 PANEL
EQUIPMENT ELEVATION

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DATE 28JUN24
SD428-W4400-E504
DRAWING NUMBER
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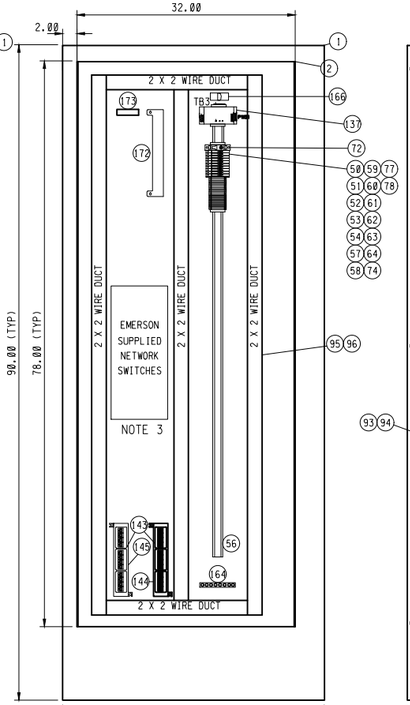
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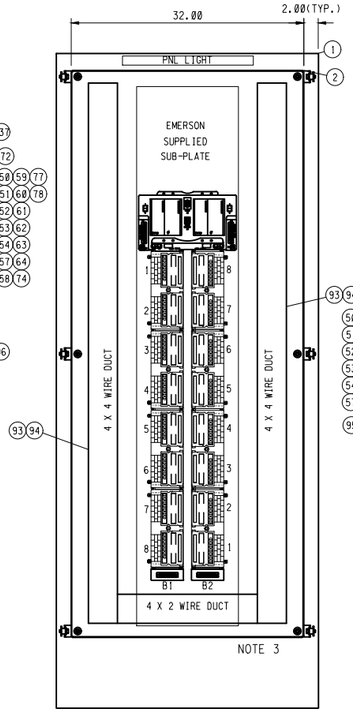
ENCLOSURE EXTERIOR FRONT VIEW
(NOTES 1 & 2)



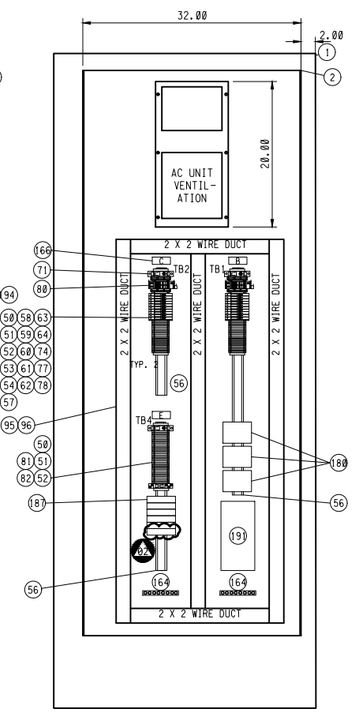
ENCLOSURE EXTERIOR SIDE VIEW
(NOTES 1 & 2)



LEFT PANEL



BACK PLATE



RIGHT PANEL

NOTES:

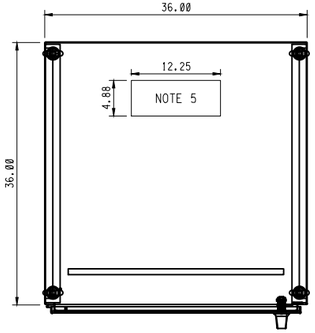
1. ENCLOSURE SHALL SIT ON A 4" HEIGHT HOUSEKEEPING PAD.
2. ENCLOSURE SHALL BE SS316, TYPE NEMA 4X, AND HAVE PROVISION FOR PADLOCK.
3. SUBPLATE, HMI, AND NETWORK SWITCHES SHALL BE SUPPLIED BY EMERSON AND INSTALLED BY THE CONTRACTOR AFTER COMPLETION OF PANEL. CONTRACTOR SHALL COORDINATE WITH EMERSON FOR RECEIVING THE EQUIPMENT AND INSTALLATION SEQUENCE AND SCHEDULE. EMERSON SHALL SUPPLY ETHERNET AND FIBER PATCH CORDS. CONTRACTOR SHALL PROVIDE AND INSTALL POWER CONNECTIONS TO EMERSON EQUIPMENT AS DIRECTED BY EMERSON.
4. NAMEPLATE SHALL BE BLACK WITH WHITE LETTERS WITH ADHESIVE BACK. TEXT SIZE TO BE .375
5. AREA RESERVED FOR CONDUIT ENTRY.
6. ENCLOSURE LIGHT AND INTRUSION SWITCH SHALL BE MOUNTED WITH STAINLESS STEEL SCREWS, NUTS AND NEOPRENE BONDED SEALING WASHERS TO MAINTAIN THE NEMA 4X RATING OF ENCLOSURE. (SEALING WASHER MANUFACTURER & ITEM NUMBER: THE HILLMAN GROUP #290250 OR EQUAL)

NAMEPLATE SCHEDULE (NOTE 4)

ITEM	DIMENSION	DESCRIPTION	FABRICATION COMMENTS
A	5" x 2"	RIO-23-1 MAC 2-1 PANEL	NOTE 4
B	2.5" x 1"	TB1	NOTE 4
C	2.5" x 1"	TB2	NOTE 4
D	2.5" x 1"	TB3	NOTE 4
E	2.5" x 1"	TB4	NOTE 4

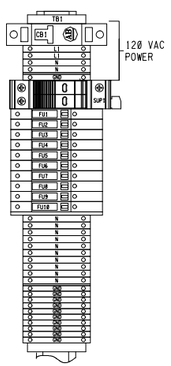
BILL OF MATERIALS

ITEM	QTY.	MANUFACTURER	PART NUMBER	DESCRIPTION	DESIGNATION
				****ENCLOSURE & RELATED EQUIPMENT****	
1	1	HAMMOND MANUFACTURING	HNAFS903636S16	ENCLOSURE, NEMA 4X, 90.00" x 36.00" x 36.00", 316SS	ENCLOSURE
2	1	HAMMOND MANUFACTURING	90YFW	INTERNAL PANEL, 78" X 32"	BACK PANEL
3	2	SAGINAW CONTROL	SCE-90SMP30	SIDE PANEL, 78" X 30"	SIDE PANELS
4	1	HAMMOND MANUFACTURING	DTS3081A115N4SS	AC UNIT 2500 BTU/HR - 115V - NEMA 4X	AC UNIT
5	1	HOFFMAN	LEDA1S35	ENCLOSURE LIGHT	LT-01
6	1	HOFFMAN	ALFSWD	ENCLOSURE DOOR SWITCH	SW-01
				****TERMINAL BLOCKS & RELATED EQUIPMENT****	
50	68	ALLEN BRADLEY	1492-J4	TERMINAL BLOCK 1 TIER	TB1, TB2, TB3, TB4
51	6	ALLEN BRADLEY	1492-EBJ3	TERMINAL BLOCK END BARRIER, 1 TIER	TB1, TB2, TB3, TB4
52	10	ALLEN BRADLEY	1492-EAJ35	TERMINAL BLOCK END ANCHOR	TB1, TB2, TB3, TB4
53	2	ALLEN BRADLEY	1492-CJJ5-10	TERMINAL BLOCK JUMPER, 10 POLE	TB1, TB2
54	32	ALLEN BRADLEY	1492-JG3	TERMINAL BLOCK, GROUNDING	TB1, TB2, TB3
56	3	ALLEN BRADLEY	1492-DR6	DIN RAIL, RAISED	TB1, TB2, TB3
57	20	ALLEN BRADLEY	1492-H4	FUSED TERMINAL BLOCK, NEON INDICATOR	FU1-FU20
58	5	ALLEN BRADLEY	1492-H5	FUSED TERMINAL BLOCK, LED INDICATOR	FU21-30
59	3	ALLEN BRADLEY	1492-N37	FUSED TERMINAL BLOCK END BARRIER	FU10, FU20, FU30
60	3	ALLEN BRADLEY	1492-N49	FUSE BLOCK SIDE JUMPERS 10 POLE	FU1-FU10, FU11-20, FU21-FU30
61	3	ALLEN BRADLEY	1492-SJS	FUSE BLOCK SIDE JUMPER INSULATING SLEEVE	FU1-FU10, FU11-20, FU21-FU30
62	1	ALLEN BRADLEY	1492-M5X12	GROUNDING TERMINAL BLOCK BLANK MARKING TAGS, 144 CT.	TB1, TB2, TB3
63	2	ALLEN BRADLEY	1492-M5X8	TERMINAL BLOCK BLANK MARKING TAGS, 2 TIER, 144 CT.	TB1, TB2, TB3
64	1	ALLEN BRADLEY	1492-MS8X12	FUSE BLOCK BLANK MARKING TAGS, 100 CT.	FU1-FU25
71	3	ALLEN BRADLEY	1489-M1D200	CIRCUIT BREAKER, 20AMP, SINGLE POLE	CB1, CB2, CB6
72	2	ALLEN BRADLEY	1489-M1D100	CIRCUIT BREAKER, 10AMP, SINGLE POLE	CB3, CB7
74	33	BUSSMANN	AGC-1	FUSE, 1A, 250V, FAST ACTING	FU3-FU9, FU12-FU20, FU25-FU30 PLUS SPARES
77	2	BUSSMANN	AGC-10	FUSE, 10A, 250V FAST ACTING	FU10 PLUS SPARE
78	11	BUSSMANN	AGC-2	FUSE, 2A, 250V, FAST ACTING	FU1, FU2, FU11, FU21-24, PLUS SPARES
80	3	PHOENIX CONTACT	2905348	VAL-SEC-T2-1S-175-FM, 120VAC SURGE PROTECTOR	SUP1, SUP2, PLUS 1 SPARE
81	1	ALLEN BRADLEY	700-HK32A1	GENERAL PURPOSE SLIM LINE RELAY, 120VAC	RL500
82	1	ALLEN BRADLEY	700-HN121	RELAY SOCKET	RL500
				****WIREDUCT****	
93	18FT	PANDUIT	F4X4LG6	WIRING DUCT, 4"W x 4"H	
94	18FT	PANDUIT	C4LG6	WIRING DUCT COVER, 4"W	
95	48FT	PANDUIT	F2X2LG6	WIRING DUCT, 2"W x 2"H	
96	48FT	PANDUIT	C2LG6	WIRING DUCT COVER, 2"W	
				****POWER SUPPLIES****	
137	1	PHOENIX CONTACT	2866763	POWER SUPPLY, 240/120VAC IN, 24VDC, 10 AMP	PWS1
				****COMMUNICATIONS****	
143	1	EMERSON	5X00133G05	MINI-COM PATCH PANEL - 12 PORTS	
144	1	EMERSON	1X00118H01	MINI-COM MODULE FOR FO-ST	
145	1	PANDUIT	CJ6C88YGW	MINI-COM MODULE FOR TX6 10GIG UTP JACK	
				****MISCELLANEOUS PANEL EQUIPMENT****	
164	3	PANDUIT	UGB2/0-414-6	GROUND BAR	
166	4	PANEL FABRICATOR		NAMEPLATE, PHENOLIC, ENGRAVED	SEE SCHEDULE ON EQUIPMENT LAYOUT
172	1	EMERSON	2379C68G01	RTD ASSEMBLY	
173	1	PHOENIX CONTACT	2864587	TEMP XMIT MCR-FL-TS-LP-I-EX	
180	3	BENTLY NEVADA	990-05-70-03-00	VIBRATION TRANSMITTER	
185	1	ALLEN BRADLEY	800H-FRXT6A1	30MM PUSH-PULL/TWIST PUSHBUTTON, MUSHROOM HEAD, RED	
186	1	ALLEN BRADLEY	800H-W300JE	30MM PUSHBUTTON LEGEND PLATE, JUMBO, CUSTOM TEXT, "SYSTEM STOP"	
187	6	WILCOXON	IT301	USER-CONFIGURABLE INTELLIGENT VIBRATION TRANSMITTER	
191	1	SEL	SEL-2600A	RTD MODULE	PROVIDED BY ELECTRICAL CONTRACTOR

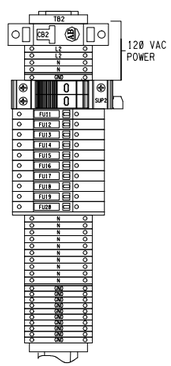


ENCLOSURE EXTERIOR TOP VIEW

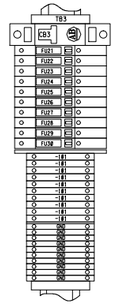
TERMINAL BLOCK LAYOUTS



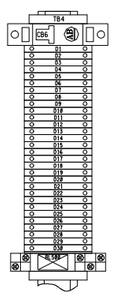
(1) 20 AMP CIRCUIT BREAKER
(1) 120 VAC SURGE PROTECTOR
(14) 1-TIER TERMINALS
(2) 1-TIER END BARRIERS
(11) GROUNDING TERMINALS
(10) FUSE BLOCKS
(1) FUSE BLOCK END BARRIERS
(1) 120VAC RELAY
(2) END ANCHORS



(1) 20 AMP CIRCUIT BREAKER
(1) 120 VAC SURGE PROTECTOR
(14) 1-TIER TERMINALS
(2) 1-TIER END BARRIERS
(11) GROUNDING TERMINALS
(10) FUSE BLOCKS
(1) FUSE BLOCK END BARRIERS
(1) 120VAC RELAY
(2) END ANCHORS



(1) 10 AMP CIRCUIT BREAKER
(10) 1-TIER TERMINALS
(1) 1-TIER END BARRIERS
(10) GROUNDING TERMINALS
(10) FUSE BLOCKS
(1) FUSE BLOCK END BARRIERS
(2) END ANCHORS



(1) 10 AMP CIRCUIT BREAKER
(30) 1-TIER TERMINALS
(1) 1-TIER END BARRIERS
(1) 120V RELAY
(2) END ANCHORS



Andrew J. Fitzpatrick
Digitally signed by Andrew J. Fitzpatrick
DN: C=US, E=afitzpatrick@woodardcurran.com, O=Woodard & Curran, OU=Technical Delivery Group, CN=Andrew J. Fitzpatrick
Location: Bangor, ME
Reason: I agree to the terms defined by the placement of my signature on this document.
Contact Info: 800.426.4262
Date: 2024.09.13 08:36:04-04'00'

09/12/2024

3" ON ORIGINAL DOCUMENT
0 1 2 3

Woodard & Curran

SOLUTIONWERKS™ INCORPORATED

NO.	DATE	REVISION	BY	REC.	APP.
2	12SEP2024	REVISED PER ADDENDUM NO. 2	RSS	JC	DCR
1	26AUG2024	REVISED PER ADDENDUM NO. 1	RSS	JC	DCR

CONSULTANT

DESIGN BY:	R. SPEYRER
DRAWN BY:	R. SPEYRER
DESIGN CHECKED BY R.P.E. NO. 7556	K. TRACY
PROJECT MANAGER R.P.E. NO.	J. JANCAITIS
APPROVED: PRINCIPAL IN CHARGE R.P.E. NO. 37097	D. RICHARDSON
EBMUD PROJECT MANAGER R.P.E. NO. 95046	J. LAW
RECOMMENDED: SR. ENGINEER R.P.E. NO. CS7604	R. MAC

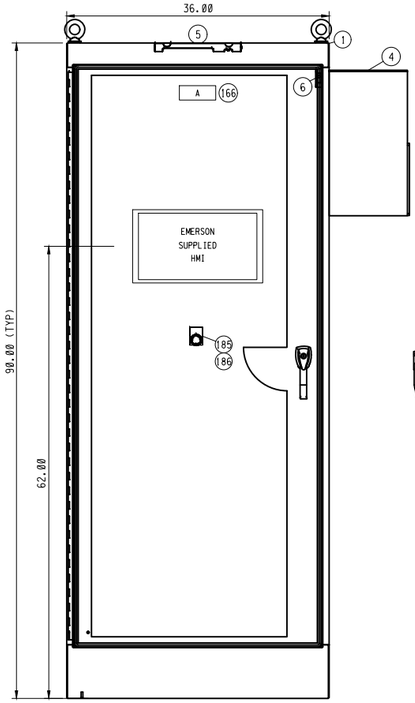
SD428 - MWWTP OXYGEN PLANT REHABILITATION

EAST BAY MUNICIPAL UTILITY DISTRICT
SPECIAL DISTRICT NO.1
OAKLAND, CALIFORNIA

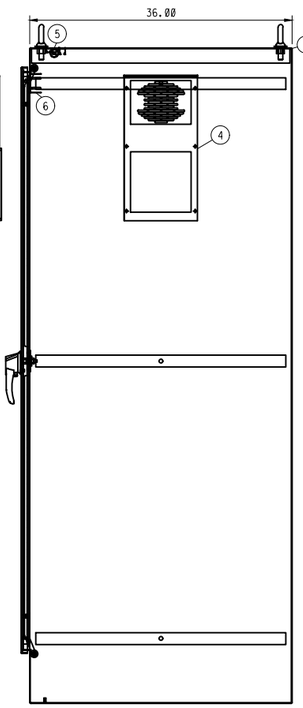
MAIN WASTEWATER TREATMENT PLANT
OXYGEN PRODUCTION PLANT
ELECTRICAL
RIO-15-2 MAC 1-2 PANEL
EQUIPMENT ELEVATION

SCALE NONE
DATE 28JUN24
SD428-W4400-E505
DRAWING NUMBER
02
REV.

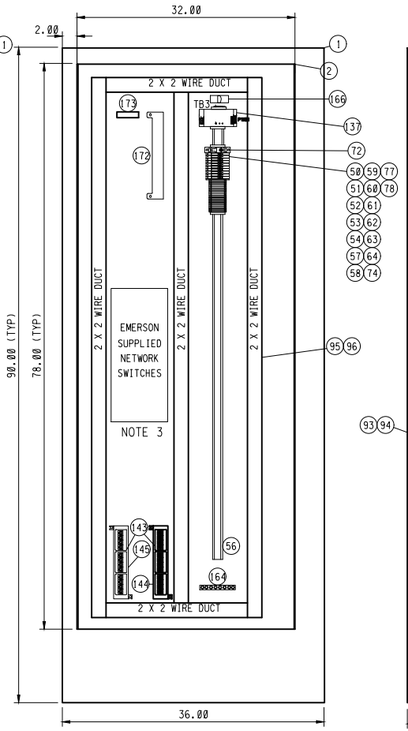
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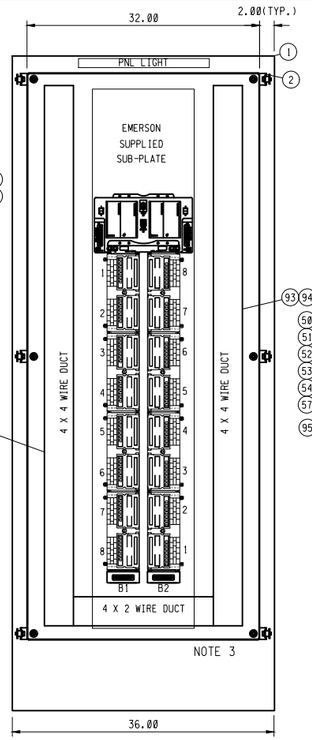
ENCLOSURE EXTERIOR FRONT VIEW
(NOTES 1 & 2)



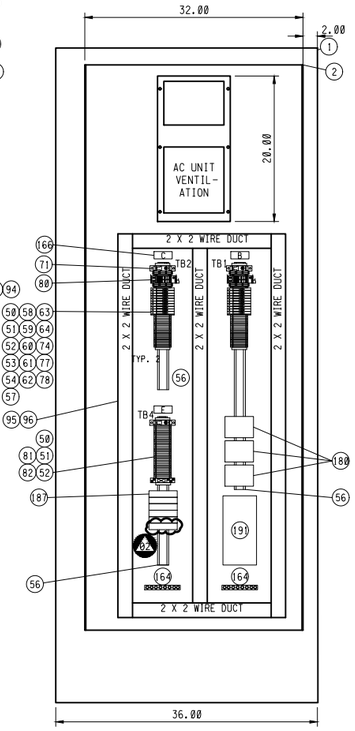
ENCLOSURE EXTERIOR SIDE VIEW
(NOTES 1 & 2)



LEFT PANEL



BACK PLATE



RIGHT PANEL

NOTES:

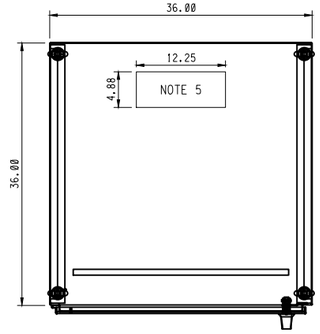
1. ENCLOSURE SHALL SIT ON A 4" HEIGHT HOUSEKEEPING PAD.
2. ENCLOSURE SHALL BE SS316, TYPE NEMA 4X, AND HAVE PROVISION FOR PADLOCK.
3. SUBPLATE, HMI, AND NETWORK SWITCHES SHALL BE SUPPLIED BY EMERSON AND INSTALLED BY THE CONTRACTOR AFTER COMPLETION OF PANEL. CONTRACTOR SHALL COORDINATE WITH EMERSON FOR RECEIVING THE EQUIPMENT AND INSTALLATION SEQUENCE AND SCHEDULE. EMERSON SHALL SUPPLY ETHERNET AND FIBER PATCH CORDS. CONTRACTOR SHALL PROVIDE AND INSTALL POWER CONNECTIONS TO EMERSON EQUIPMENT AS DIRECTED BY EMERSON.
4. NAMEPLATE SHALL BE BLACK WITH WHITE LETTERS WITH ADHESIVE BACK. TEXT SIZE TO BE .375
5. AREA RESERVED FOR CONDUIT ENTRY.
6. ENCLOSURE LIGHT AND INTRUSION SWITCH SHALL BE MOUNTED WITH STAINLESS STEEL SCREWS, NUTS AND NEOPRENE BONDED SEALING WASHERS TO MAINTAIN THE NEMA 4X RATING OF ENCLOSURE. (SEALING WASHER MANUFACTURER & ITEM NUMBER: THE HILLMAN GROUP #290250 OR EQUAL)

NAMEPLATE SCHEDULE (NOTE 4)

ITEM	DIMENSION	DESCRIPTION	FABRICATION COMMENTS
A	5" x 2"	RIO-23-2 MAC 2-2 PANEL	NOTE 4
B	2.5" x 1"	TB1	NOTE 4
C	2.5" x 1"	TB2	NOTE 4
D	2.5" x 1"	TB3	NOTE 4
E	2.5" x 1"	TB4	NOTE 4

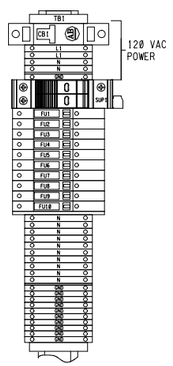
BILL OF MATERIALS

ITEM	QTY.	MANUFACTURER	PART NUMBER	DESCRIPTION	DESIGNATION
				****ENCLOSURE & RELATED EQUIPMENT****	
1	1	HAMMOND MANUFACTURING	HNAFS903636S16	ENCLOSURE, NEMA 4X, 90.00"x 36.00"x 36.00", 316SS	ENCLOSURE
2	1	HAMMOND MANUFACTURING	90YFW	INTERNAL PANEL, 78"X 32"	BACK PANEL
3	2	SAGINAW CONTROL	SCE-90SMP30	SIDE PANEL, 78" X 30"	SIDE PANELS
4	1	HAMMOND MANUFACTURING	DTS3081A115N4SS	AC UNIT 2500 BTU/HR - 115V - NEMA 4X	AC UNIT
5	1	HOFFMAN	LEDA1S35	ENCLOSURE LIGHT	LT-01
6	1	HOFFMAN	ALFSWD	ENCLOSURE DOOR SWITCH	SW-01
				****TERMINAL BLOCKS & RELATED EQUIPMENT****	
50	68	ALLEN BRADLEY	1492-J4	TERMINAL BLOCK 1 TIER	TB1, TB2, TB3, TB4
51	6	ALLEN BRADLEY	1492-EBJ3	TERMINAL BLOCK END BARRIER, 1 TIER	TB1, TB2, TB3, TB4
52	10	ALLEN BRADLEY	1492-EAJ35	TERMINAL BLOCK END ANCHOR	TB1, TB2, TB3, TB4
53	2	ALLEN BRADLEY	1492-CJJ5-10	TERMINAL BLOCK JUMPER, 10 POLE	TB1, TB2
54	32	ALLEN BRADLEY	1492-JG3	TERMINAL BLOCK, GROUNDING	TB1, TB2, TB3
56	3	ALLEN BRADLEY	1492-DR6	DIN RAIL, RAISED	TB1, TB2, TB3
57	20	ALLEN BRADLEY	1492-H4	FUSED TERMINAL BLOCK, NEON INDICATOR	FU1-FU20
58	5	ALLEN BRADLEY	1492-H5	FUSED TERMINAL BLOCK, LED INDICATOR	FU21-30
59	3	ALLEN BRADLEY	1492-N37	FUSED TERMINAL BLOCK END BARRIER	FU10, FU20, FU30
60	3	ALLEN BRADLEY	1492-N49	FUSE BLOCK SIDE JUMPERS 10 POLE	FU1-FU10, FU11-20, FU21-FU30
61	3	ALLEN BRADLEY	1492-SJS	FUSE BLOCK SIDE JUMPER INSULATING SLEEVE	FU1-FU10, FU11-20, FU21-FU30
62	1	ALLEN BRADLEY	1492-M5X12	GROUNDING TERMINAL BLOCK BLANK MARKING TAGS, 144 CT.	TB1, TB2, TB3
63	2	ALLEN BRADLEY	1492-M5X8	TERMINAL BLOCK BLANK MARKING TAGS, 2 TIER, 144 CT.	TB1, TB2, TB3
64	1	ALLEN BRADLEY	1492-MS8X12	FUSE BLOCK BLANK MARKING TAGS, 100 CT.	FU1-FU25
71	3	ALLEN BRADLEY	1489-M1D200	CIRCUIT BREAKER, 20AMP, SINGLE POLE	CB1, CB2, CB6
72	2	ALLEN BRADLEY	1489-M1D100	CIRCUIT BREAKER, 10AMP, SINGLE POLE	CB3, CB7
74	33	BUSSMANN	AGC-1	FUSE, 1A, 250V, FAST ACTING	FU3-FU9, FU12-FU20, FU25-FU30 PLUS SPARES
77	2	BUSSMANN	AGC-10	FUSE, 10A, 250V FAST ACTING	FU10 PLUS SPARE
78	11	BUSSMANN	AGC-2	FUSE, 2A, 250V, FAST ACTING	FU1, FU2, FU11, FU21-24, PLUS SPARES
80	3	PHOENIX CONTACT	2905348	VAL-SEC-T2-1S-175-FM, 120VAC SURGE PROTECTOR	SUP1, SUP2, PLUS 1 SPARE
81	1	ALLEN BRADLEY	700-HK32A1	GENERAL PURPOSE SLIM LINE RELAY, 120VAC	RL500
82	1	ALLEN BRADLEY	700-HN121	RELAY SOCKET	RL500
				****WIREDUCT****	
93	18FT	PANDUIT	F4X4LG6	WIRING DUCT, 4"W x 4"H	
94	18FT	PANDUIT	C4LG6	WIRING DUCT COVER, 4"W	
95	48FT	PANDUIT	F2X2LG6	WIRING DUCT, 2"W x 2"H	
96	48FT	PANDUIT	C2LG6	WIRING DUCT COVER, 2"W	
				****POWER SUPPLIES****	
137	1	PHOENIX CONTACT	2866763	POWER SUPPLY, 240/120VAC IN, 24VDC, 10 AMP	PWS1
				****COMMUNICATIONS****	
143	1	EMERSON	5X00133G05	MINI-COM PATCH PANEL - 12 PORTS	
144	1	EMERSON	1X00118H01	MINI-COM MODULE FOR FO-ST	
145	1	PANDUIT	CJ6C88YGW	MINI-COM MODULE FOR TX6 10GIG UTP JACK	
				****MISCELLANEOUS PANEL EQUIPMENT****	
164	3	PANDUIT	UGB2/0-414-6	GROUND BAR	
166	4	PANEL FABRICATOR		NAMEPLATE, PHENOLIC, ENGRAVED	SEE SCHEDULE ON EQUIPMENT LAYOUT
172	1	EMERSON	2379C68G01	RTD ASSEMBLY	
173	1	PHOENIX CONTACT	2864587	TEMP XMIT MCR-FL-TS-LP-I-EX	
180	3	BENTLY NEVADA	990-05-70-03-00	VIBRATION TRANSMITTER	
185	1	ALLEN BRADLEY	800H-FRXT6A1	30MM PUSH-PULL/TWIST PUSHBUTTON, MUSHROOM HEAD, RED	
186	1	ALLEN BRADLEY	800H-W300JE	30MM PUSHBUTTON LEGEND PLATE, JUMBO, CUSTOM TEXT, "SYSTEM STOP"	
187	6	WILCOXON	IT301	USER-CONFIGURABLE INTELLIGENT VIBRATION TRANSMITTER	
191	1	SEL	SEL-2600A	RTD MODULE	PROVIDED BY ELECTRICAL CONTRACTOR

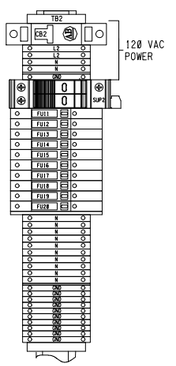


ENCLOSURE EXTERIOR TOP VIEW

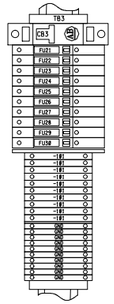
TERMINAL BLOCK LAYOUTS



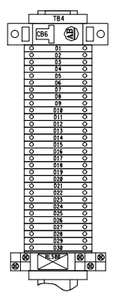
(1) 20 AMP CIRCUIT BREAKER
(1) 120 VAC SURGE PROTECTOR
(14) 1-TIER TERMINALS
(2) 1-TIER END BARRIERS
(11) GROUNDING TERMINALS
(10) FUSE BLOCKS
(1) FUSE BLOCK END BARRIERS
(1) 120VAC RELAY
(2) END ANCHORS



(1) 20 AMP CIRCUIT BREAKER
(1) 120 VAC SURGE PROTECTOR
(14) 1-TIER TERMINALS
(2) 1-TIER END BARRIERS
(11) GROUNDING TERMINALS
(10) FUSE BLOCKS
(1) FUSE BLOCK END BARRIERS
(1) 120VAC RELAY
(2) END ANCHORS



(1) 10 AMP CIRCUIT BREAKER
(10) 1-TIER TERMINALS
(1) 1-TIER END BARRIERS
(10) GROUNDING TERMINALS
(10) FUSE BLOCKS
(1) FUSE BLOCK END BARRIERS
(2) END ANCHORS



(1) 10 AMP CIRCUIT BREAKER
(30) 1-TIER TERMINALS
(1) 1-TIER END BARRIERS
(1) 120V RELAY
(2) END ANCHORS



Andrew J. Fitzpatrick

Digitally signed by Andrew J. Fitzpatrick
DN: C=US, E=AJFitzpatrick@woodardcurran.com, O=Woodard & Curran, OU=Technical Delivery Group, CN=Andrew J. Fitzpatrick
Location: Bangor, ME
Reason: I agree to the terms defined by the placement of my signature on this document.
Contact Info: 800.426.4262
Date: 2024.09.13 08:06:04-04'00'

09/12/2024

3" ON ORIGINAL DOCUMENT
0 1 2 3

Woodard & Curran

SOLUTIONWERKS™ INCORPORATED

NO.	DATE	REVISION	BY	REC.	APP.
02	12SEP2024	REVISED PER ADDENDUM NO. 2	RSS	JC	DCR
01	26AUG2024	REVISED PER ADDENDUM NO. 1	RSS	JC	DCR

CONSULTANT

EBMUD

DESIGN BY:	R. SPEYRER	
DRAWN BY:	R. SPEYRER	
DESIGN CHECKED BY R.P.E. NO. 7556	K. TRACY	
PROJECT MANAGER R.P.E. NO.	J. JANCAITIS	
APPROVED: PRINCIPAL IN CHARGE R.P.E. NO. 37097	D. RICHARDSON	
PROJECT MANAGER R.P.E. NO. 95046	J. LAW	
RECOMMENDED: SR. ENGINEER R.P.E. NO. CS7604	R. MAC	

SD428 - MWWTP OXYGEN PLANT REHABILITATION

EAST BAY MUNICIPAL UTILITY DISTRICT
SPECIAL DISTRICT NO.1
OAKLAND, CALIFORNIA

MAIN WASTEWATER TREATMENT PLANT
OXYGEN PRODUCTION PLANT
ELECTRICAL
RIO-23-2 MAC 2-2 PANEL
EQUIPMENT ELEVATION

SCALE NONE
DATE 28JUN24

SD428-W4400-E506
DRAWING NUMBER

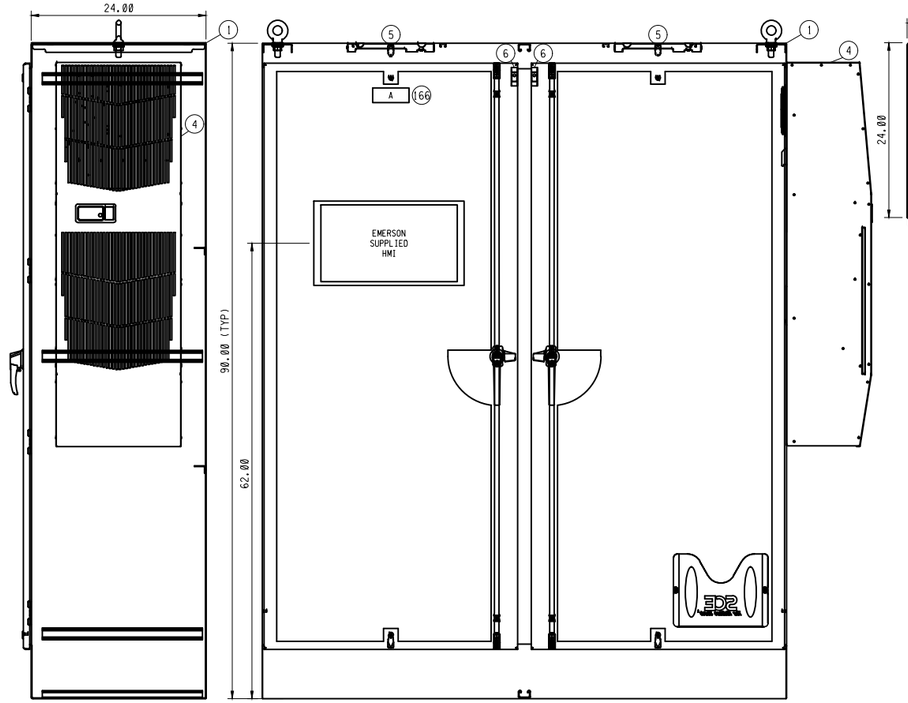
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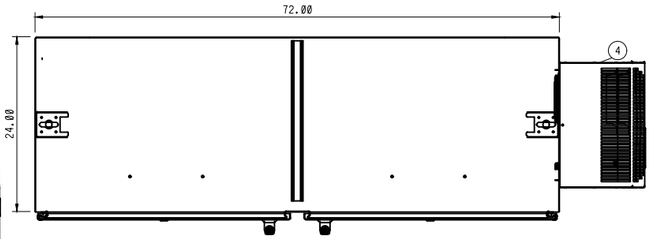
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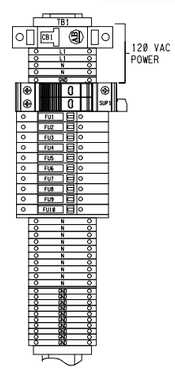


ENCLOSURE EXTERIOR SIDE VIEW
(NOTES 1 & 2)

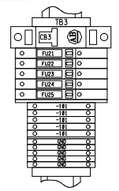


ENCLOSURE EXTERIOR TOP VIEW

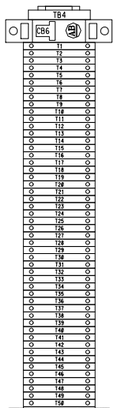
TERMINAL BLOCK LAYOUTS

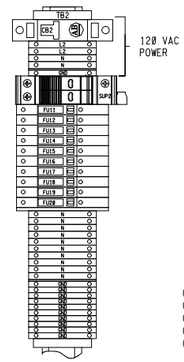


(1) 20 AMP CIRCUIT BREAKER
(1) 120 VAC SURGE PROTECTOR
(14) 1-TIER TERMINALS
(2) 1-TIER END BARRIERS
(11) GROUNDING TERMINALS
(10) FUSE BLOCKS
(1) FUSE BLOCK END BARRIERS
(1) 120VAC RELAY
(2) END ANCHORS

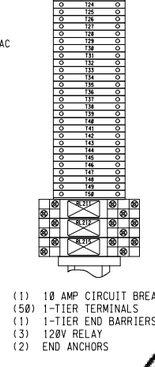


(1) 10 AMP CIRCUIT BREAKER
(5) 1-TIER TERMINALS
(1) 1-TIER END BARRIERS
(5) GROUNDING TERMINALS
(5) FUSE BLOCKS
(1) FUSE BLOCK END BARRIERS
(2) END ANCHORS



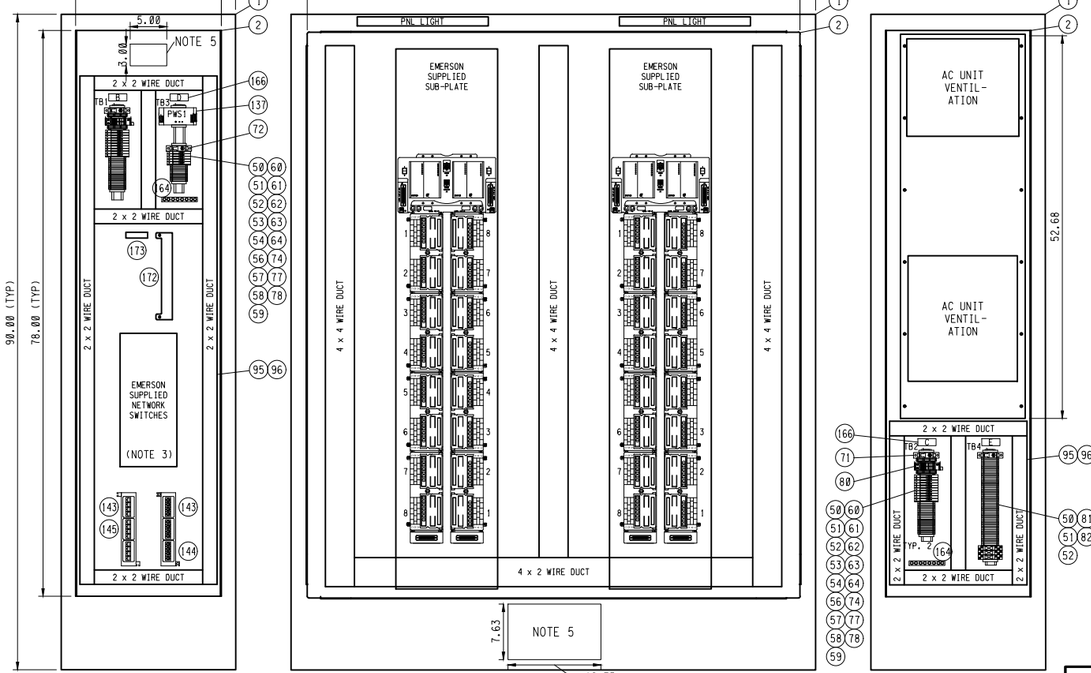


(1) 20 AMP CIRCUIT BREAKER
(1) 120 VAC SURGE PROTECTOR
(14) 1-TIER TERMINALS
(2) 1-TIER END BARRIERS
(11) GROUNDING TERMINALS
(10) FUSE BLOCKS
(1) FUSE BLOCK END BARRIERS
(1) 120VAC RELAY
(2) END ANCHORS



(1) 10 AMP CIRCUIT BREAKER
(50) 1-TIER TERMINALS
(1) 1-TIER END BARRIERS
(3) 120V RELAY
(2) END ANCHORS

ENCLOSURE EXTERIOR FRONT VIEW
(NOTES 1 & 2)



LEFT PANEL
(NOTE 3)

BACK PLATE
(NOTE 3)

RIGHT PANEL

3" ON ORIGINAL DOCUMENT
0 1 2 3

NOTES:

1. ENCLOSURE SHALL SIT ON A 4" HEIGHT HOUSEKEEPING PAD.
2. ENCLOSURE SHALL BE SS316, TYPE NEMA 4X, AND HAVE PROVISION FOR PADLOCK.
3. SUBPLATE AND NETWORK SWITCHES SHALL BE SUPPLIED BY EMERSON AND INSTALLED BY THE CONTRACTOR AFTER COMPLETION OF PANEL. CONTRACTOR SHALL COORDINATE WITH EMERSON FOR RECEIVING THE EQUIPMENT AND INSTALLATION SEQUENCE AND SCHEDULE. EMERSON SHALL SUPPLY ETHERNET AND FIBER PATCH CORDS. CONTRACTOR SHALL PROVIDE AND INSTALL POWER CONNECTIONS TO EMERSON EQUIPMENT AS DIRECTED BY EMERSON.
4. NAMEPLATE SHALL BE BLACK WITH WHITE LETTERS WITH ADHESIVE BACK. TEXT SIZE TO BE .375
5. AREA RESERVED FOR CONDUIT ENTRY.
6. ENCLOSURE LIGHT AND INTRUSION SWITCH SHALL BE MOUNTED WITH STAINLESS STEEL SCREWS, NUTS AND NEOPRENE BONDED SEALING WASHERS TO MAINTAIN THE NEMA 4X RATING OF ENCLOSURE. (SEALING WASHER MANUFACTURER & ITEM NUMBER: THE HILLMAN GROUP #290250 OR EQUAL)

NAMEPLATE SCHEDULE (NOTE 4)

ITEM	DIMENSION	DESCRIPTION	FABRICATION COMMENTS
A	5" x 2"	RIO-15-3 TURBINE/CRYO PLANT 1 PANEL	NOTE 4
B	2.5" x 1"	TB1	NOTE 4
C	2.5" x 1"	TB2	NOTE 4
D	2.5" x 1"	TB3	NOTE 4
E	2.5" x 1"	TB4	NOTE 4

BILL OF MATERIALS

ITEM	QTY.	MANUFACTURER	PART NUMBER	DESCRIPTION	DESIGNATION
				****ENCLOSURE & RELATED EQUIPMENT****	
1	1	SAGINAW CONTROL	SCE-90EL7224SS6FSD	ENCLOSURE, NEMA 4X, 90.00"x 72.00"x 24.00", 316SS	ENCLOSURE
2	1	SAGINAW CONTROL	SCE-90P72F1	INTERNAL PANEL, 78" X 68"	BACK PANEL
3	2	SAGINAW CONTROL	SCE-90SMP20	SIDE PANEL, 78" X 20"	SIDE PANELS
4	1	HOFFMAN	G521216G102	AC UNIT 12000 BTU - 115V - NEMA 4X	AC UNIT
5	2	HOFFMAN	LEDA1S35	ENCLOSURE LIGHT	LT-01, LT-02
6	2	HOFFMAN	ALFSWD	ENCLOSURE DOOR SWITCH	SW-01, SW-02
				****TERMINAL BLOCKS & RELATED EQUIPMENT****	
50	83	ALLEN BRADLEY	1492-J4	TERMINAL BLOCK 1 TIER	TB1, TB2, TB3, TB4
51	6	ALLEN BRADLEY	1492-EBJ3	TERMINAL BLOCK END BARRIER, 1 TIER	TB1, TB2, TB3, TB4
52	10	ALLEN BRADLEY	1492-EAJ35	TERMINAL BLOCK END ANCHOR	TB1, TB2, TB3, TB4
53	2	ALLEN BRADLEY	1492-CJJ5-10	TERMINAL BLOCK JUMPER, 10 POLE	TB1, TB2
54	27	ALLEN BRADLEY	1492-JG3	TERMINAL BLOCK, GROUNDING	TB1, TB2
56	2	ALLEN BRADLEY	1492-DR6	DIN RAIL, RAISED	TB1, TB2, TB3
57	20	ALLEN BRADLEY	1492-H4	FUSED TERMINAL BLOCK, NEON INDICATOR	FU1-FU20
58	5	ALLEN BRADLEY	1492-H5	FUSED TERMINAL BLOCK, LED INDICATOR	FU21-25
59	3	ALLEN BRADLEY	1492-N37	FUSED TERMINAL BLOCK END BARRIER	FU10, FU20, FU25
60	3	ALLEN BRADLEY	1492-N49	FUSE BLOCK SIDE JUMPERS 10 POLE	FU1-FU10, FU11-20, FU21-FU25
61	3	ALLEN BRADLEY	1492-SJS	FUSE BLOCK SIDE JUMPER INSULATING SLEEVE	FU1-FU10, FU11-20, FU21-FU25
62	1	ALLEN BRADLEY	1492-M5X12	GROUNDING TERMINAL BLOCK BLANK MARKING TAGS, 144 CT.	TB1, TB2, TB3
63	2	ALLEN BRADLEY	1492-M5X8	TERMINAL BLOCK BLANK MARKING TAGS, 2 TIER, 144 CT.	TB1, TB2, TB3
64	1	ALLEN BRADLEY	1492-MS8X12	FUSE BLOCK BLANK MARKING TAGS, 100 CT.	FU1-FU25
71	3	ALLEN BRADLEY	1489-M1D200	CIRCUIT BREAKER, 20AMP, SINGLE POLE	CB1, CB2, CB6
72	2	ALLEN BRADLEY	1489-M1D100	CIRCUIT BREAKER, 10AMP, SINGLE POLE	CB3, CB7
74	30	BUSSMANN	AGC-1	FUSE, 1A, 250V, FAST ACTING	FU2-FU9, FU12-FU20, FU22-25 PLUS SPARES
77	2	BUSSMANN	AGC-10	FUSE, 10A, 250V FAST ACTING	FU10 PLUS SPARE
78	5	BUSSMANN	AGC-2	FUSE, 2A, 250V, FAST ACTING	FU1, FU11, FU21, PLUS SPARES
80	3	PHOENIX CONTACT	2905348	VAL-SEC-T2-1S-175-FM, 120VAC SURGE PROTECTOR	SUP1, SUP2, PLUS 1 SPARE
81	3	ALLEN BRADLEY	700-HK32A1	GENERAL PURPOSE SLIM LINE RELAY, 120VAC	RL211, RL212, RL215
82	3	ALLEN BRADLEY	700-HN121	RELAY SOCKET	RL211, RL212, RL215
				****WIREDUCT****	
93	30FT	PANDUIT	F4X4LG6	WIRING DUCT, 4"W x 4"H	
94	30FT	PANDUIT	C4LG6	WIRING DUCT COVER, 4"W	
95	36FT	PANDUIT	F2X2LG6	WIRING DUCT, 2"W x 2"H	
96	36FT	PANDUIT	C2LG6	WIRING DUCT COVER, 2"W	
				****POWER SUPPLIES****	
137	1	PHOENIX CONTACT	2866763	POWER SUPPLY, 240/120VAC IN, 24VDC, 10 AMP	PWS1
				****COMMUNICATIONS****	
143	1	EMERSON	5X00133G05	MINI-COM PATCHPANEL - 12 PORTS	
144	1	EMERSON	1X00118H01	MINI-COM MODULE FOR FO-ST	
145	1	PANDUIT	CJ6C88YGIW	MINI-COM MODULE FOR TX6 10GIG UTP JACK	
				****MISCELLANEOUS PANEL EQUIPMENT****	
164	3	PANDUIT	UGB2/0-414-6	GROUND BAR	
166	4	PANEL FABRICATOR		NAMEPLATE, PHENOLIC, ENGRAVED	SEE SCHEDULE ON EQUIPMENT LAYOUT
172	1	EMERSON	2379C68G01	RTD ASSEMBLY	
173	1	PHOENIX CONTACT	2864587	TEMP XMIT MCR-FL-TS-LPI-EX	

Andrew J. Fitzpatrick

LICENSED PROFESSIONAL ENGINEER
ANDREW J. FITZPATRICK
No. 20004
ELECTRICAL
STATE OF CALIFORNIA

09/12/2024

Woodard & Curran

SOLUTIONWERKS™ INCORPORATED

NO.	DATE	REVISION	BY	REC.	APP.
01	12SEP2024	REVISED PER ADDENDUM NO. 2	RSS	JC	DCR

CONSULTANT

DESIGN BY:	R. SPEYRER	
DRAWN BY:	R. SPEYRER	
DESIGN CHECKED BY R.P.E. NO. 7556	K. TRACY	
PROJECT MANAGER R.P.E. NO.	J. JANCAITIS	
APPROVED: PRINCIPAL IN CHARGE R.P.E. NO. 37097	D. RICHARDSON	

EBMUD

PROJECT MANAGER R.P.E. NO. 95846	J. LAW	
RECOMMENDED: SR. ENGINEER R.P.E. NO. C57604	R. MAC	

SD428 - MWWTP OXYGEN PLANT REHABILITATION

EAST BAY MUNICIPAL UTILITY DISTRICT
SPECIAL DISTRICT NO.1
OAKLAND, CALIFORNIA

MAIN WASTEWATER TREATMENT PLANT
OXYGEN PRODUCTION PLANT

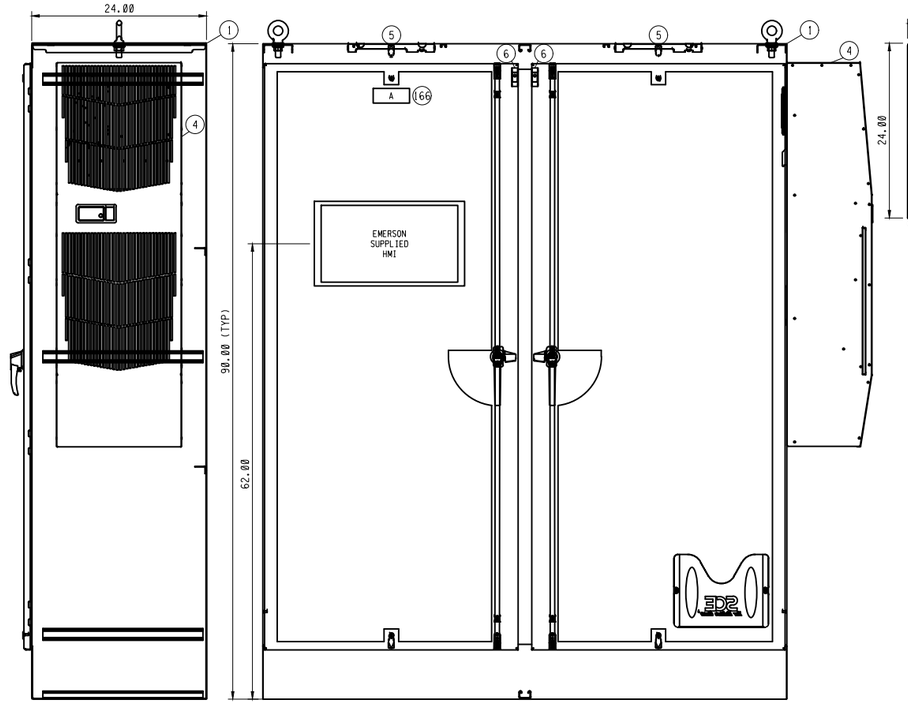
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RIO-15-3 TURBINE/CRYO PLANT 1 PANEL
EQUIPMENT ELEVATION

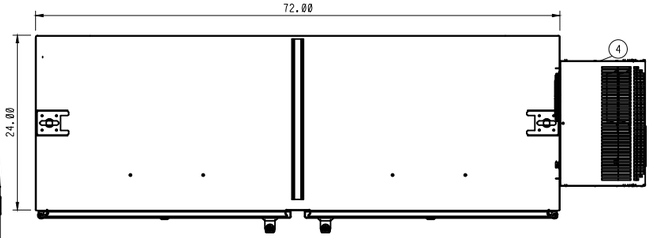
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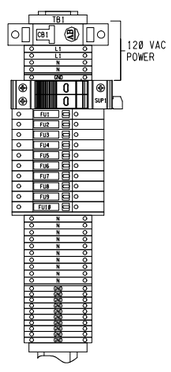


ENCLOSURE EXTERIOR SIDE VIEW
(NOTES 1 & 2)

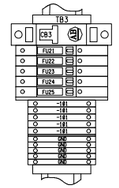


ENCLOSURE EXTERIOR TOP VIEW

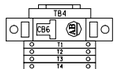
TERMINAL BLOCK LAYOUTS



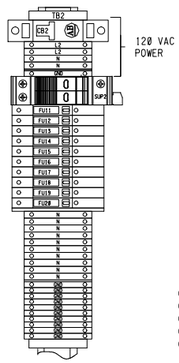
(1) 20 AMP CIRCUIT BREAKER
(1) 120 VAC SURGE PROTECTOR
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(2) 1-TIER END BARRIERS
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(10) FUSE BLOCKS
(1) FUSE BLOCK END BARRIERS
(1) 120VAC RELAY
(2) END ANCHORS



(1) 10 AMP CIRCUIT BREAKER
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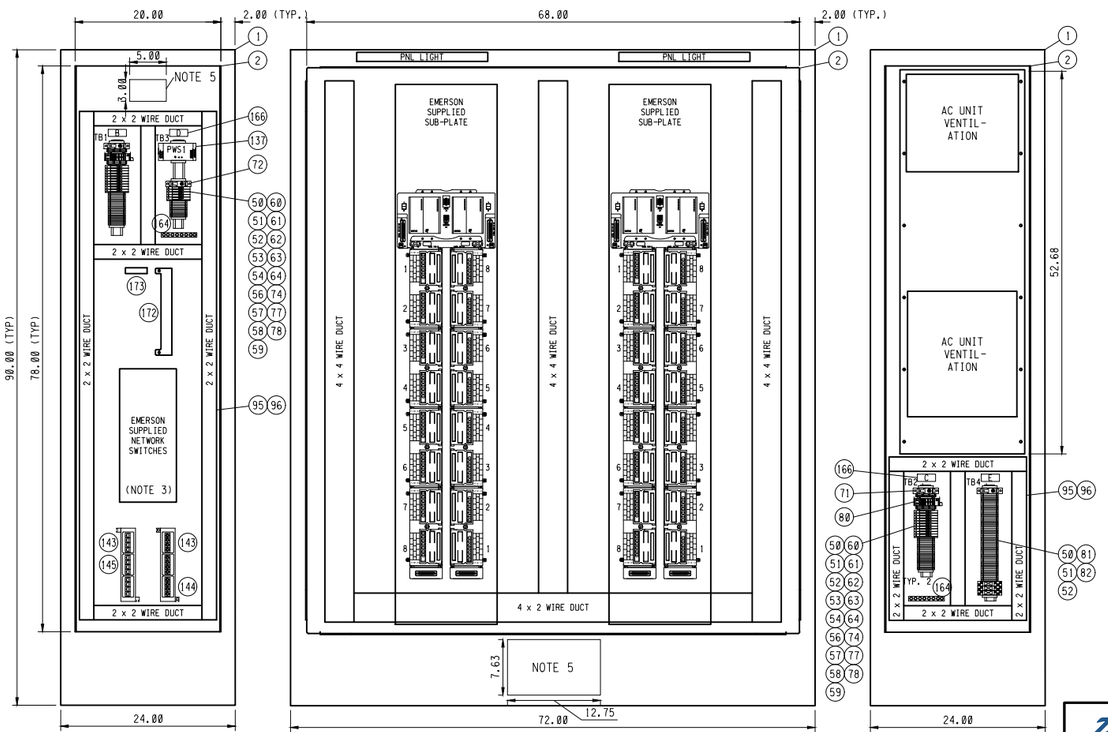


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(1) 120 VAC SURGE PROTECTOR
(14) 1-TIER TERMINALS
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(11) GROUNDING TERMINALS
(10) FUSE BLOCKS
(1) FUSE BLOCK END BARRIERS
(1) 120VAC RELAY
(2) END ANCHORS



(1) 10 AMP CIRCUIT BREAKER
(50) 1-TIER TERMINALS
(1) 1-TIER END BARRIERS
(3) 120V RELAY
(2) END ANCHORS

ENCLOSURE EXTERIOR FRONT VIEW
(NOTES 1 & 2)



LEFT PANEL (NOTE 3) | BACK PLATE (NOTE 3) | RIGHT PANEL

3" ON ORIGINAL DOCUMENT
0 1 2 3

NOTES:

1. ENCLOSURE SHALL SIT ON A 4" HEIGHT HOUSEKEEPING PAD.
2. ENCLOSURE SHALL BE SS316, TYPE NEMA 4X, AND HAVE PROVISION FOR PADLOCK.
3. SUBPLATE AND NETWORK SWITCHES SHALL BE SUPPLIED BY EMERSON AND INSTALLED BY THE CONTRACTOR AFTER COMPLETION OF PANEL. CONTRACTOR SHALL COORDINATE WITH EMERSON FOR RECEIVING THE EQUIPMENT AND INSTALLATION SEQUENCE AND SCHEDULE. EMERSON SHALL SUPPLY ETHERNET AND FIBER PATCH CORDS. CONTRACTOR SHALL PROVIDE AND INSTALL POWER CONNECTIONS TO EMERSON EQUIPMENT AS DIRECTED BY EMERSON.
4. NAMEPLATE SHALL BE BLACK WITH WHITE LETTERS WITH ADHESIVE BACK. TEXT SIZE TO BE .375
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NAMEPLATE SCHEDULE (NOTE 4)

ITEM	DIMENSION	DESCRIPTION	FABRICATION COMMENTS
A	5" x 2"	RIO-23-3 TURBINE/CRYO PLANT 2 PANEL	NOTE 4
B	2.5" x 1"	TB1	NOTE 4
C	2.5" x 1"	TB2	NOTE 4
D	2.5" x 1"	TB3	NOTE 4
E	2.5" x 1"	TB4	NOTE 4

BILL OF MATERIALS

ITEM	QTY.	MANUFACTURER	PART NUMBER	DESCRIPTION	DESIGNATION
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2	1	SAGINAW CONTROL	SCE-90P72F1	INTERNAL PANEL, 78" X 68"	BACK PANEL
3	2	SAGINAW CONTROL	SCE-90SMP20	SIDE PANEL, 78" X 20"	SIDE PANELS
4	1	HOFFMAN	G521216G102	AC UNIT 12000 BTU - 115V - NEMA 4X	AC UNIT
5	2	HOFFMAN	LEDA1S35	ENCLOSURE LIGHT	LT-01, LT-02
6	2	HOFFMAN	ALFSWD	ENCLOSURE DOOR SWITCH	SW-01, SW-02
				****TERMINAL BLOCKS & RELATED EQUIPMENT****	
50	83	ALLEN BRADLEY	1492-J4	TERMINAL BLOCK 1 TIER	TB1, TB2, TB3, TB4
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53	2	ALLEN BRADLEY	1492-CJJ5-10	TERMINAL BLOCK JUMPER, 10 POLE	TB1, TB2
54	27	ALLEN BRADLEY	1492-JG3	TERMINAL BLOCK, GROUNDING	TB1, TB2
56	2	ALLEN BRADLEY	1492-DR6	DIN RAIL, RAISED	TB1, TB2, TB3
57	20	ALLEN BRADLEY	1402-H4	FUSED TERMINAL BLOCK, NEON INDICATOR	FU1-FU20
58	5	ALLEN BRADLEY	1492-H5	FUSED TERMINAL BLOCK, LED INDICATOR	FU21-25
59	3	ALLEN BRADLEY	1492-N37	FUSED TERMINAL BLOCK END BARRIER	FU10, FU20, FU25
60	3	ALLEN BRADLEY	1492-N49	FUSE BLOCK SIDE JUMPERS 10 POLE	FU1-FU10, FU11-20, FU21-FU25
61	3	ALLEN BRADLEY	1492-SJS	FUSE BLOCK SIDE JUMPER INSULATING SLEEVE	FU1-FU10, FU11-20, FU21-FU25
62	1	ALLEN BRADLEY	1492-M5X12	GROUNDING TERMINAL BLOCK BLANK MARKING TAGS, 144 CT.	TB1, TB2, TB3
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64	1	ALLEN BRADLEY	1492-MS8X12	FUSE BLOCK BLANK MARKING TAGS, 100 CT.	FU1-FU25
71	3	ALLEN BRADLEY	1489-M1D200	CIRCUIT BREAKER, 20AMP, SINGLE POLE	CB1, CB2, CB6
72	2	ALLEN BRADLEY	1489-M1D100	CIRCUIT BREAKER, 10AMP, SINGLE POLE	CB3, CB7
74	30	BUSSMANN	AGC-1	FUSE, 1A, 250V, FAST ACTING	FU2-FU9, FU12-FU20, FU22-25 PLUS SPARES
77	2	BUSSMANN	AGC-10	FUSE, 10A, 250V FAST ACTING	FU10 PLUS SPARE
78	5	BUSSMANN	AGC-2	FUSE, 2A, 250V, FAST ACTING	FU1, FU11, FU21, PLUS SPARES
80	3	PHOENIX CONTACT	2905348	VAL-SEC-T2-1S-175-FM, 120VAC SURGE PROTECTOR	SUP1, SUP2, PLUS 1 SPARE
81	3	ALLEN BRADLEY	700-HK32A1	GENERAL PURPOSE SLIM LINE RELAY, 120VAC	RL211, RL212, RL215
82	3	ALLEN BRADLEY	700-HN121	RELAY SOCKET	RL211, RL212, RL215
				****WIREDUCT****	
93	30FT	PANDUIT	F4X4LG6	WIRING DUCT, 4"W x 4"H	
94	30FT	PANDUIT	C4LG6	WIRING DUCT COVER, 4"W	
95	36FT	PANDUIT	F2X2LG6	WIRING DUCT, 2"W x 2"H	
96	36FT	PANDUIT	C2LG6	WIRING DUCT COVER, 2"W	
				****POWER SUPPLIES****	
137	1	PHOENIX CONTACT	2866763	POWER SUPPLY, 240/120VAC IN, 24VDC, 10 AMP	PWS1
				****COMMUNICATIONS****	
143	1	EMERSON	5X00133G05	MINI-COM PATCHPANEL - 12 PORTS	
144	1	EMERSON	1X00118H01	MINI-COM MODULE FOR FO-ST	
145	1	PANDUIT	CJ6C88YGIW	MINI-COM MODULE FOR TX6 10GIG UTP JACK	
				****MISCELLANEOUS PANEL EQUIPMENT****	
164	3	PANDUIT	UGB20-414-6	GROUND BAR	
166	4	PANEL FABRICATOR		NAMEPLATE, PHENOLIC, ENGRAVED	SEE SCHEDULE ON EQUIPMENT LAYOUT
172	1	EMERSON	2379C68G01	RTD ASSEMBLY	
173	1	PHOENIX CONTACT	2864587	TEMP XMIT MCR-FL-TS-LP-I-EX	

Andrew J. Fitzpatrick
Digitally signed by Andrew J. Fitzpatrick
DN: C=US, E=afitzpatrick@woodardcurran.com, OU=Technical & Curran, CN=Andrew J. Fitzpatrick, L=Location: Bangor, ME
Reason: I agree to the terms defined by the placement of my signature on this document.
Contact Info: 207-451-6252
Date: 2024.09.13 08:36:09-04'00'

LICENSED PROFESSIONAL ENGINEER
ANDREW J. FITZPATRICK
No. 20004
ELECTRICAL
STATE OF CALIFORNIA

09/12/2024

NO.	DATE	REVISION	BY	REC.	APP.
4	12SEP2024	REVISED PER ADDENDUM NO. 2	RSS		DCR

Woodard & Curran

SOLUTIONWERKS™ INCORPORATED

CONSULTANT

EBMUD

DESIGN BY:	R. SPEYRER
DRAWN BY:	R. SPEYRER
DESIGN CHECKED BY R.P.E. NO. 7556	K. TRACY
PROJECT MANAGER R.P.E. NO.	J. JANCAITIS
APPROVED: PRINCIPAL IN CHARGE R.P.E. NO. 37097	D. RICHARDSON
PROJECT MANAGER R.P.E. NO. 95046	J. LAW
RECOMMENDED: SR. ENGINEER R.P.E. NO. CS7604	R. MAC

SD428 - MWWTP OXYGEN PLANT REHABILITATION

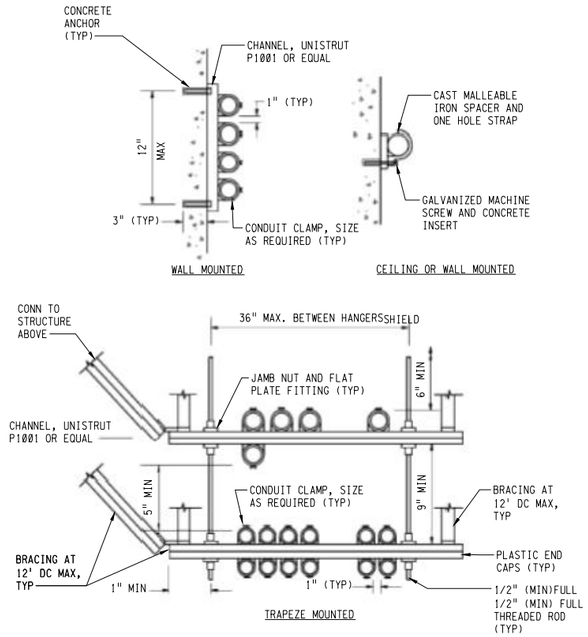
EAST BAY MUNICIPAL UTILITY DISTRICT
SPECIAL DISTRICT NO.1
OAKLAND, CALIFORNIA

MAIN WASTEWATER TREATMENT PLANT
OXYGEN PRODUCTION PLANT
ELECTRICAL
RIO-23-3 TURBINE/CRYO PLANT 2 PANEL
EQUIPMENT ELEVATION

SCALE NONE
DATE 28JUN24
SD428-W4400-E508
DRAWING NUMBER
01
REV.

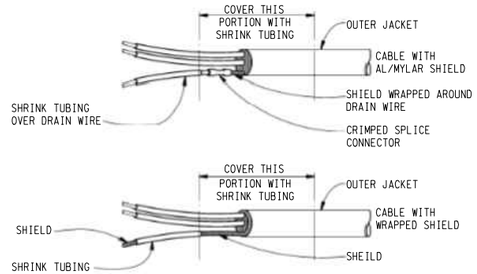
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REF 9, REF12#FILENAME

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DATE: #DATE#
FILE: #FILENAME#



CONDUIT MOUNTING DETAIL

DETAIL 7
SD428-W4400-E902

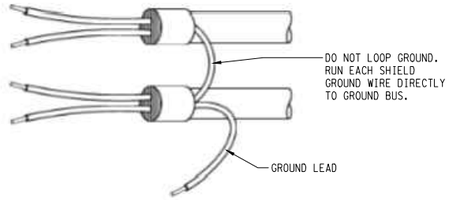


NOTES:

1. SHIELD GROUNDED AT TERMINATION CABLES MAY BE MULTIPLE PAIRS.
2. FOR USE WHENEVER SHIELDED CONTROL CABLES ARE USED. APPLIES AT TERMINATIONS WHERE SHIELD IS TO BE GROUNDED. SEE OTHER DETAILS FOR GROUNDING SHIELD. GROUND ONE END OF CABLE ONLY.

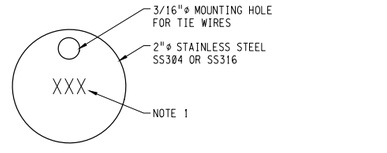
TERMINATION OF SHIELDED CONTROL CABLE (GROUNDED ENDS)

DETAIL 8
SD428-W4400-E902

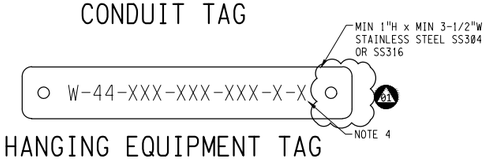


UNACCEPTABLE METHOD OF GROUNDING CONTROL CABLE SHIELD

DETAIL 10
SD428-W4400-E902



CONDUIT TAG



HANGING EQUIPMENT TAG

NOTES:

1. WHERE XXX IS THE CONDUIT TAG NAME OR TAG NUMBER IN COMPLIANCE WITH DISTRICT TAG NAME CONVENTIONS OR IN ACCORDANCE WITH THE CONDUIT SCHEDULE.
2. LETTER SIZE SHALL BE IN ACCORDANCE WITH Ø1 91 13.10.
3. ATTACH CONDUIT TAG WITH STAINLESS STEEL WIRE ROPE.
4. FOR EQUIPMENT LISTED IN THE SPECIFICATIONS AND DRAWINGS, EQUIPMENT TAG SHALL BE IN ACCORDANCE WITH THE FOLLOWING FORMAT:

   W-AREA CODE-SYSTEM CODE-EQUIPMENT CODE-ID NUMBER-MODIFIER

   SEE SPECIFICATIONS (INSTRUMENT SCHEDULE, VALVE SCHEDULE, CONTROL NARRATIVES) AND DRAWINGS FOR TAG NAMES. FOR CONFLICTING TAG NAMES, CONFIRM THE APPROPRIATE TAG NAME WITH THE ENGINEER.
5. PRINTING OF TAGS SHALL BE IN ACCORDANCE WITH Ø1 91 13.10

EQUIPMENT AND CONDUIT TAG

DETAIL 9
SD428-W4400-E902

Andrew J. Fitzpatrick
Digitally signed by Andrew J. Fitzpatrick
DN: C=US, E=ajfitzpatrick@woodardcurran.com, O=Woodard & Curran, OU=Technical Delivery Group, CN=Andrew J. Fitzpatrick
Location: Bangor, ME
Reason: I agree to the terms defined by the placement of my signature on this document.
Contact Info: 800.426.4262
Date: 2024.09.10 08:39:06-04'00'

LICENSED PROFESSIONAL ENGINEER
ANDREW J. FITZPATRICK
No. 20004
ELECTRICAL
STATE OF CALIFORNIA

09/12/2024

3" ON ORIGINAL DOCUMENT
0 1 2 3

Woodard & Curran

SOLUTIONWERKS™ INCORPORATED

NO.	DATE	REVISION	BY	REC.	APP.
01	12SEP2024	ISSUED PER ADDENDUM NO. 2	LM	JC	DCR

SD428 - MWWTP OXYGEN PLANT REHABILITATION

CONSULTANT

DESIGN BY:	D. RAMMELL
DRAWN BY:	L. MAXWELL
DESIGN CHECKED BY R.P.E. NO. 16928	D. RAMMELL
PROJECT MANAGER R.P.E. NO.	J. JANCAITIS
APPROVED: PRINCIPAL IN CHARGE R.P.E. NO. 37097	D. RICHARDSON

EBMUD

PROJECT MANAGER R.P.E. NO. 95046	J. LAW
RECOMMENDED: SR. ENGINEER R.P.E. NO. E16072	R. MAC

EAST BAY MUNICIPAL UTILITY DISTRICT
SPECIAL DISTRICT NO.1
OAKLAND, CALIFORNIA

MAIN WASTEWATER TREATMENT PLANT
OXYGEN PRODUCTION PLANT
ELECTRICAL
DETAILS 2

SCALE NONE
DATE 28JUN24

SD428-W4400-E902
DRAWING NUMBER

01
REV.

REF 7: REF#FILENAME
REF 8: REF#FILENAME
REF 9: REF#FILENAME
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PLOT SCALE: PLOTSCALE
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REF 6: REF6#$FILENAME

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REF 2: REF2#$FILENAME
REF 3: REF3#$FILENAME

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DATE: $$$$

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REF 8: REF8#FILENAME
REF 9: REF9#FILENAME

REF 4: REF4#FILENAME
REF 5: REF5#FILENAME
REF 6: REF6#FILENAME

REF 1: REF1#FILENAME
REF 2: REF2#FILENAME
REF 3: REF3#FILENAME

PLOT SCALE: PLOT$SCALE

USER: $$USER$$$$
DATE: $$$$$$DATE$$$$$$
FILE: $$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$FILE$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

DCS

R10-15-3 TURBINE/CRYO PANEL PLANT 1

PLT 1 GEL TRAP INLET TEMP TI 201-1

COLD BX 1 UNBAL AIR FLOW FI 115-1

COLD BX 1 COLD END AIR FLOW FI 120-1

COLD BX 1 PROD O2 VLV OPEN CMD ZOC 600-1

COLD BX 1 PROD O2 VLV POS CMD ZC 600X-1

COLD BX 1 PROD O2 VENT VLV POS CMD ZC 601X-1

COLD BX 1 PROD O2 VENT VLV OPEN CMD ZOC 601-1

PLT 1 INSTR AIR PAL 590-1 PRESS ALM L

PI 590-1 PRESS

COLD BX 1 PROD O2 PRESS PI 600-1

PCV 600-1 PI AS FY 600-1 FV 600X-1 4-12ma S FO FC 6" HV-Y600X

PIT 600-1 HV-P600X-1 LP01 L04 10" HV-X600X

10" PRODUCT 02 L04 TO PRODUCT 02 LINE SD428-W4400-I169 5

FROM RHX SD428-W4400-I107 2 10" PRODUCT O2 4" O2

4" O2 VENT TO ATMOSPHERE

PCV 601-1 PI AS FY 601-1 FV 601X-1 12-20ma S FO FC

BYPASS AHP 1 1/2"-100 PSV 201A-1 2" HV-V201A TE 201-1 HV-V202A 1/2" CEGT 6" HV-B201A 12" HV-X201A-1 02A 12" HV-X203A-1 02A

FROM RHX SD428-W4400-I107 3 12" AHP

PRESSURIZATION AND COOLDOWN

FIT 120-1 FE 120-1 1/2" HV-H120A HV-L120A 1/2"

TO RHX AND LOWER COLUMN SUPERHEATER 12" C.E. AIR SD428-W4400-I110 4

PI 201-1 2" N HV-T201A 1" HV-X202A

FIT 115-1 FE 115-1 HV-D303A HV-H115A 1/2" HV-L115A 1/2"

HV-X213A 4" 4" AHP TURBINE AIR TO TURBINE SD428-W4400-I110 1

FROM RHX SD428-W4400-I107 5 4" AHP

TO THAW HTR

TO COLD BOX NO. 2 INSTRUMENTATION AIR CROSS TIE

TO MAIN INSTRUMENT PANEL AND TURBINE PANEL IA SD428-W4400-I106 5

FROM RHX SD428-W4400-I107 6 1"

HV-X555A HV-Y590A 1" HV-V590A 1" HV-X590A 1" HV-FV600X HV-FV601X

TO 0591A DRAIN SD428-W4400-I106 1

C

1A3

B

HV-FV120A HV-LV330A HV-FV340N

F

HV-P590A PIT 590-1

PCV 590-1 PI HV-FT600 HV-FT115 HV-FI120 HV-LT352 HV-LT330 HV-FT340 HV-X593A

HV-P591A HV-X591A HV-Y591A 1"

RHX INSTR. AIR ACCUMULATOR

1" 1A1 TO CRYO SWITCH VALVE SOLENOIDS SD428-W4400-I106 3

Kyle E. Tracy

Digitally signed by Kyle E. Tracy
Reason: I agree to the terms defined by the placement of my signature on this document.
Date: 2024.09.16 12:28:39-04'00'

LICENSED PROFESSIONAL ENGINEER KYLE EVAN TRACY CS. 7556 CONTROL SYSTEM STATE OF CALIFORNIA

NOTES

1. ALL EQUIPMENT AND VALVE TAGS ARE PRECEDED "W-44-" UON.

3" ON ORIGINAL DOCUMENT
0 1 2 3

Woodard & Curran

SOLUTIONWERKS™ INCORPORATED

SUPERSEDES: OLD DRAWING NUMBER

A COPY OF ORIGINAL DOCUMENT CAN BE FOUND IN THE WASTEWATER DRAFTING UNIT

NO.	DATE	REVISION	BY	REC.	APP.
02	10SEP2024	REVISED PER ADDENDUM NO. 02	JL	JL	DCR

SD428 - MWWTP OXYGEN PLANT REHABILITATION

CONSULTANT

DESIGN BY:	R. SPEYRER
DRAWN BY:	L. MAXWELL
DESIGN CHECKED BY R.P.E. NO.	K. TRACY
PROJECT MANAGER R.P.E. NO.	J. JANCAITIS
APPROVED: PRINCIPAL IN CHARGE R.P.E. NO. 37097	D. RICHARDSON
PROJECT MANAGER R.P.E. NO. 95046	J. LAW
RECOMMENDED: SR. ENGINEER R.P.E. NO. CS7604	R. MAC

EBMUD

EAST BAY MUNICIPAL UTILITY DISTRICT
SPECIAL DISTRICT NO.1
OAKLAND, CALIFORNIA

MAIN WASTEWATER TREATMENT PLANT
OXYGEN PRODUCTION PLANT

INSTRUMENTATION

RHX AND TURBINE COLD BOX NO. 1

SCALE NONE

DATE 5APR24

SD428-W4400-I108
DRAWING NUMBER

01
REV.

REF 7: REF7#FILENAME
REF 8: REF8#FILENAME
REF 9: REF9#FILENAME

REF 4: REF4#FILENAME
REF 5: REF5#FILENAME
REF 6: REF6#FILENAME

REF 1: REF1#FILENAME
REF 2: REF2#FILENAME
REF 3: REF3#FILENAME

PLOT SCALE: PLOT#SCALE

USER: $$USER$$$$
DATE: $$$$$$DATE$$$$$$
FILE: $$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$FILE$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

DCS

COLD BX 1 LOWER COLM LIQUID LVL — LI 330-1
COLD BX 1 LOWER COLM PRESS — PI 300-1
PLT 1 PROD N2 PURITY — AI 312-1
PLT 1 COOL DOWN SYS TEMP — TI 191-1
PLT 1 LIQUID ADD VLV OPEN CMD — ZOC 351-1
PLT 1 LIQUID MAKE UP VLV OPEN CMD — ZOC 350-1

R10-15-3 TURBINE/CRYO PANEL PLANT 1
DCS DROP 15/65 PANEL
R10-15-3 TURBINE/CRYO PANEL PLANT 1
DCS DROP 15/65 PANEL
R10-15-3 TURBINE/CRYO PANEL PLANT 1

1 FROM UPPER COLUMN SUPERHEATER — SD428-W4400-I111 — 2" O2
2 FROM DRIOX TANK NO. 1-1 — SD428-W4400-I114 — 1" O2 L02-1
7 FROM DRIOX PRODUCT VAPORIZER — SD428-W4400-I169 — 2" CD01 COOL DOWN SYSTEM
3 FROM UPPER COLUMN SUPERHEATER — SD428-W4400-I112 — 2" N2 SHELF TRANSFER
4 FROM O2 SUPERHEATER — SD428-W4400-I112 — 1" AHP
6 FROM CEGT — SD428-W4400-I112 — 10" C.E. AIR

TO DRIOX TANKS NO. 1-1 AND 1-2 — SD428-W4400-I114 — 1" O2 L01-1 — 1
TO UPPER COLUMN SUPERHEATER — SD428-W4400-I111 — 10" N2 — 2
TO N2 SUPERHEATER KETTLE TRANSFER — SD428-W4400-I112 — 2" O2 KETTLE TRANSFER — 5
TO DRAIN VAPORIZER — SD428-W4400-I168 — 3" WGS LD1 — 5

PI 350X-1
LY 350X-1
IA
S
FO
LY 350X-1
HV-350X
FC
PSV 352X-1
HV-S356X
PSV 351X-1
PI
LY 351X-1
IA
S
FO
LV 351X-1
FC
HV-B351X
HV-X351X
L
PI 301-1
PIT 300-1
HV-P300N
1/4"
A P300
B P300
1/2"
HV-P301N
PSV 301-1 N
HV-T340N
2"
HV-S350N
1/2"
B S350
A S350
AS
PI
PCV 351-1
PI
PCV 312-1
HV-S351N
HV-S341A
HV-S313N
TO S312
FI 313-1
A VENT
FI 313-1
FI 312-1
HV-D350X
2"
HV-D350X
2"
A VENT
AIT 312-1
CONTROL PANEL PLANT NO.1
PSV 330-1 X
2"
HV-X330X
3"
A
HV-D332X
1"
LOWER COLUMN
HV-L330A
1/2"
PSE 330-1 L
LIT 330-1
0-100" H 0
25.5"
PSE 330-1 H
1/2"
HV-H330A
HV-S330A
1/2"
HV-V330A
2"
HV-D330A
3"
HV-D121A
DS
HV-D120A
HV-D341N
HV-S340N
HV-D331A
DRAIN MANIFOLD
3"
TE 191-1

NOTES

1. ALL EQUIPMENT AND VALVE TAGS ARE PRECEDED "W-44-" UON.

3" ON ORIGINAL DOCUMENT
0 1 2 3

Woodard & Curran

SOLUTIONWERKS™ INCORPORATED

NO.	DATE	REVISION	BY	REC.	APP.
1	10SEP2024	REVISED PER ADDENDUM NO. 02	JL	JL	DCR

Kyle E. Tracy
Digitally signed by Kyle E. Tracy
Reason: I agree to the terms defined by the placement of my signature on this document.
Date: 2024.09.16 12:26:40-04'00'

LICENSED PROFESSIONAL ENGINEER
KYLE EVAN TRACY
CS. 7556
CONTROL SYSTEM
STATE OF CALIFORNIA

SD428 - MWWTP OXYGEN PLANT REHABILITATION

CONSULTANT

DESIGN BY:	R, SPEYRER
DRAWN BY:	L. MAXWELL
DESIGN CHECKED BY R.P.E. NO.	K. TRACY
PROJECT MANAGER R.P.E. NO.	J. JANCAITIS
APPROVED: PRINCIPAL IN CHARGE R.P.E. NO. 37097	D. RICHARDSON
PROJECT MANAGER R.P.E. NO. 95046	J. LAW
RECOMMENDED: SR. ENGINEER R.P.E. NO. CS7604	R. MAC

EBMUD

EAST BAY MUNICIPAL UTILITY DISTRICT
SPECIAL DISTRICT NO.1
OAKLAND, CALIFORNIA

MAIN WASTEWATER TREATMENT PLANT
OXYGEN PRODUCTION PLANT
INSTRUMENTATION
LOWER COLUMN SUPERHEATER COLD BOX NO. 1

SCALE NONE
DATE SAPR24

SD428-W4400-I113
DRAWING NUMBER

01
REV.

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REF 8: REF8##FILENAME
REF 9: REF9##FILENAME

REF 4: REF4##FILENAME
REF 5: REF5##FILENAME
REF 6: REF6##FILENAME

REF 1: REF1#FILENAME
REF 2: REF2#FILENAME
REF 3: REF3#FILENAME

PLOT SCALE: PLOT$SCALE

USER: $$USER$$$
DATE: $$$$$$$$DATE$$$$$$$
FILE: $$FILE$$

DCS

RIO-15-3
TURBINE/CRYO
PANEL PLANT 1

LOX STORAGE TNK 1-1 PRESS CNTL VLV POS CMD
ZC 615X-1

LOX STORAGE TNK 1-1 ECONOMIZER CNTL VLV POS CMD
ZC 616X-1

LOX STORAGE TNK 1-1 ECONOMIZER CNTL VLV OPEN CMD
ZOC 616-1

PSE 610-1
PSE 618-1
PSV 615-1
HV-X618X
PCV 618-1
PSV 619-1
PY 616-1
S
PV 616X-1
1 1/2"
12-20ma
PI
PCV 619-1
1A
FC
PSV 617-1
HV-X619X
HV-X617X
1 1/2"
TO DRIOX VAPORIZER WARMING COIL
1 1/2" O2 LP03
SD428-W4400-I115 2

DRIOX TANK NO. 1-1
TL 11,000
MAKE AND STORAGE
F C B E A D L K H

I
PIT 616-1
TO LOX FILL PANEL PLC
SD428-W4400-I166 1
PI 616-1
PCV 616-1
IA
HV-X616X
PSE 618-1
TO LOX FILL PANEL PLC
SD428-W4400-I166 2
PI 616-1
TT 616-1
I
LIT 616-1
TO LOX FILL PANEL PLC
SD428-W4400-I166 3

HV-V619X
1 1/2"
PSV 614-1
PV 615X-1
1 1/2"
4-12ma
R/A
PI
PCV 615-1
IA
FC
PSV 615-1
HV-V613X
1 1/2"
HV-V614X
PSV 616-1
PCV 612-1
PSV 612-1
HV-X614X
PSV 610-1
1/4"
FULL TRICOCK
HV-S616X
HV-L616X
1/4"
HV-H616X
1/4"
HV-H616X
HV-X611X

02
TO UPPER COLUMN SUPERHEATER
2" O2 L02-1
SD428-W4400-I113 2

FROM DRIOX VAPORIZER PRESS. BLDG. UNIT NO. 1
2 SD428-W4400-I168
1 1/2" O2 PB1-1

FROM DRIOX TANK NO. 1-2
4 SD428-W4400-I115
2" O2 L02-1

02
FROM UPPER COLUMN SUPERHEATER
1 SD428-W4400-I113
1" O2 L01-1

HV-X610X
1"
HV-Y610X
1"
HV-X605
1"
HV-X615X
1 1/2"
HV-Y615X
HV-X608X
1"
1" O2 L03-1
TO DRIOX VAPORIZER PRESS. BLDG. UNIT NO. 1
SD428-W4400-I168 6
1" O2 L01-1
TO DRIOX TANK NO. 1-2
SD428-W4400-I115 1
1"
HV-X642X

TRUCK FILL STATION
2" O2 L01-1
2"
HV-X603X

Kyle E. Tracy
Digitally signed by Kyle E. Tracy
Reason: I agree to the terms defined by the placement of my signature on this document.
Date: 2024.09.16 12:26:45-04'00'

LICENSED PROFESSIONAL ENGINEER
KYLE EVAN TRACY
CS. 7556
CONTROL SYSTEM
STATE OF CALIFORNIA

3" ON ORIGINAL DOCUMENT
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Woodard & Curran

SOLUTIONWERKS™ INCORPORATED

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02	10SEP2024	REVISED PER ADDENDUM NO. 02	JL	JL	DCR

SD428 - MWWTP OXYGEN PLANT REHABILITATION

CONSULTANT

DESIGN BY:	R. SPEYRER
DRAWN BY:	L. MAXWELL
DESIGN CHECKED BY R.P.E. NO.	K. TRACY
PROJECT MANAGER R.P.E. NO.	J. JANCAITIS
APPROVED: PRINCIPAL IN CHARGE R.P.E. NO. 37097	D. RICHARDSON
PROJECT MANAGER R.P.E. NO. 95046	J. LAW
RECOMMENDED: SR. ENGINEER R.P.E. NO. CS7604	R. MAC

EBMUD

EAST BAY MUNICIPAL UTILITY DISTRICT
SPECIAL DISTRICT NO.1
OAKLAND, CALIFORNIA

MAIN WASTEWATER TREATMENT PLANT
OXYGEN PRODUCTION PLANT

INSTRUMENTATION

DRIOX TANK NO. 1-1

SCALE NONE
DATE 5APR24

SD428-W4400-I114
DRAWING NUMBER

01
REV.

REF 7: REF7#$FILENAME
REF 8: REF8#$FILENAME
REF 9: REF9#$FILENAME

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REF 5: REF5#$FILENAME
REF 6: REF6#$FILENAME

REF 1: REF1#$FILENAME
REF 2: REF2#$FILENAME
REF 3: REF3#$FILENAME

USER: $$USER$$$$
DATE: $$$$$$DATE$$$$$$
FILE: $$$$$$$

DCS

RIO-23-3 TURBINE/CRYO PANEL PLANT 2

COLD BX 2 RHX PASS "A" AIR/WASTE PRESS

PAHH 200-2 PRESS ALM HH 60 PSIG

PAH 200-2 PRESS ALM H 5 PSIG

PI 200-2 PRESS

COLD BX 1 PROD O2 MID-PT TEMP

VLV POS CMD ZC X600X-1-2

VLV 2 POS CMD ZC X600X-2-2

COLD BX 2 WARM AIR STREAM "A" TEMP TI 185-2

COLD BX 2 WARM AIR STREAM "B" TEMP TI 184-2

COLD BX 2 UNBAL AIR MID-PT TEMP 2 TI 155-2

COLD BX 2 UNBAL AIR MID-PT TEMP 2 TI 154-2

COLD BX 2 PROD O2 COLD END TEMP TI 149-2

COLD BX 2 O2 FLOW FI 600-2

COLD BX 2 WASTE N2 COLD END TEMP TI 188-2

COLD BX 2 COLD END DELTA TEMP TDI 186-2

REF 7: REF7#FILENAME
REF 8: REF8#FILENAME
REF 9: REF9#FILENAME

2 SD428-W4400-I162 18" N2 WASTE
FROM N2 SUPERHEATER WASTE

1 SD428-W4400-I162 8" PRODUCT O2
FROM O2 SUPERHEATER

N2 WASTE

PRODUCT O2

PRODUCT O2

18" PRODUCT O2 LP#1 TO PRODUCT O2 LINE SD428-W4400-I158 2

PCV 600-2-1 PI AS 4-20ma FV X600X-2-1 6" FC

HV-V600X 1" 6" FC

AS 4-20ma FV X600X-2-2

PCV 600-2-2 PI

60 PSIG 5 PSIG PIT 200-2

HV-P200A

1/2" HV-02110A

FROM CRYO SWITCH VALVE FCV-111A-2 1 SD428-W4400-I156 20" AHP

FROM CRYO SWITCH VALVE FCV-114A-2 2 SD428-W4400-I156 20" AHP

D 6" O2 6" Ø2

6" O2 6" Ø2

E HV-S600X B 5600

RHX (2 CORES)

20" 12"

PASS B 20" 12"

20" 12"

PASS A 20" 12"

1" 3"

1" 3"

1" TE 155-2 3" 3" TE 154-2

TE 184-2

TE 185-2

HV-Y211A

TE 149-2

FIT 600-2

FE 600X-2

8" HV-L600V HV-H600V

HV-Y140N 12"

HV-Y112A 12"

HV-Y142N 12"

HV-Y141N 12"

HV-Y113A 12"

HV-Y143N 12"

2"

2"

TE 188-2

TE187 (LOW)

TDIT 186-2

TE186 (HIGH)

12" AHP TO CEGT TANK SD428-W4400-I158 3

4" AHP TO TURBINE SD428-W4400-I158 5

1" IA TO THAW HEATER AND 1A1,1A2,1A3,1A4 SD428-W4400-I158 6

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DCS

RIO-15-3 TURBINE/CRYO PANEL PLANT 1

O2 PROD VAPOR. H2O BATH H TEMP — TAH 631
O2 PROD VAPOR. H2O BATH L TEMP — TAL 631
DRIOX VENT RECOV VAPORI. OUTLET L TEMP — TAL 640
RIO-15-3 TURBINE/CRYO PANEL PLANT 1 — DCS DROP 15/65 PANEL
O2 PROD COLD END TEMP — TI 635
O2 PROD VAPOR. PRESS — PI 630
O2 PROD. VAPOR. VLV OPEN CMD — ZOC 635
BKUP O2 PROD. VAPOR. VLV POS CMD — ZC 635
BKUP O2 PROD. VAPOR. PRESS — PI 635
DCS
BKUP O2 PROD. VAPOR. — PIC 635 / PIC 630 / TIC 635 — SLC — SLC (DCS BKUP CNTL)
HI SEL
LO SEL
SLC/DCS SEL
ZC 635-A — VLV POS CMD
MAIN CONTROL PANEL PLANT 1

SD

FROM O2 PRODUCT LINE PLANT NO. 1 — SD428-W4400-I108 — 10" O2 L04
FROM O2 PRODUCT LINE PLANT NO. 2 — SD428-W4400-I158 — 10" O2 L04
TO REACTOR DECK
FROM MW1 — 1" MW1 — HV-X810X — 1"
TSL 640
PSV 640 X
LP03 LP04 — 2" — HV-X640X
DRIOX BACK-UP FROM DRIOX TANKS NO. 1-1 & 1-2 — SD428-W4400-I115 — 2" O2 L02
DRIOX BACK-UP FROM DRIOX TANKS NO. 2-1 & 2-2 — SD428-W4400-I125 — 2" O2 L02
FROM DRIOX VENT RECOVERY PLANT NO.1 — SD428-W4400-I115 — 2" O2 LP03
FROM DRIOX VENT RECOVERY PLANT NO. 2 — SD428-W4400-I165 — 2" O2 LP03 — 2" O2 L03
FY 635 — S — FQ
PCV 635 — PI — IA — 4-20ma — FV 635
PSV 635 X — 3x4x4 SET @ 100 PSIG SERIES 73
PIT 635
PSV 600 X — 6x8 AGCO SERIES 93
HV-P600X
10" O2
8" FC
12" — HV-Y635X
12" — HV-X635X
PIT 630
HV-P630X
LP02 STN ST.
LP04 C.S.
PSV 641 X
PSV 641-1 X
HV-X641X
HV-Y641X
2" LP02 CD01
TIT 635
TO COLD BOX COOLDOWN LINE PLANT NO. 1 — 2" O2 CD01 — SD428-W4400-I113 — 7
TO COLD BOX COOLDOWN LINE PLANT NO. 2 — 2" O2 CD01 — SD428-W4400-I163 — 7

TSH 631 — HI — SET AT 200° F
TSL 631 — LO — SET AT 100° F

TSL 641 10#KW
TSL 642 10#KW
TSL 643 10#KW
TSL 644 10#KW
TSL 645 10#KW
TSL 646 10#KW
TSL 647 10#KW
TSL 648 10#KW

FOR CONTINUATION SEE DWG. SD428-W4400-I168

WARMING COIL
PRODUCT VAPORIZER

DRIOX VAPORIZOR BATH

ABBREVIATIONS

SD - SIGNAL DUPLICATOR
SLC - SINGLE LOOP CONTROLLER

3" ON ORIGINAL DOCUMENT
0 1 2 3

Kyle E. Tracy
Digitally signed by Kyle E. Tracy
I agree to the terms defined by the placement of my signature on this document.
Date: 2024.09.16 12:26:50-07'00'

LICENSED PROFESSIONAL ENGINEER — KYLE EVAN TRACY — CS. 7556 — CONTROL SYSTEMS — STATE OF CALIFORNIA

Woodard & Curran

SOLUTIONWERKS™ INCORPORATED

SUPERSEDES: OLD DRAWING NUMBER

A COPY OF ORIGINAL DOCUMENT CAN BE FOUND IN THE WASTEWATER DRAFTING UNIT

NO.	DATE	REVISION	BY	REC.	APP.
02	10SEP2024	REVISED PER ADDENDUM NO. 02	JL	JL	DCR

SD428 - MWWTP OXYGEN PLANT REHABILITATION

CONSULTANT

DESIGN BY:	R. SPEYRER
DRAWN BY:	L. MAXWELL
DESIGN CHECKED BY R.P.E. NO.	K. TRACY
PROJECT MANAGER R.P.E. NO.	J. JANCAITIS
APPROVED: PRINCIPAL IN CHARGE R.P.E. NO. 37097	D. RICHARDSON

EBMUD

PROJECT MANAGER R.P.E. NO. 95846	J. LAW
RECOMMENDED: SR. ENGINEER R.P.E. NO. CS7604	R. MAC

EAST BAY MUNICIPAL UTILITY DISTRICT
SPECIAL DISTRICT NO.1
OAKLAND, CALIFORNIA

MAIN WASTEWATER TREATMENT PLANT
OXYGEN PRODUCTION PLANT

INSTRUMENTATION

DRIOX VAPORIZER

SCALE NONE
DATE 5APR24

SD428-W4400-I169
DRAWING NUMBER

01
REV.

SD-428 Addendum No. 2

VOLUME III - DRAWINGS - NEW

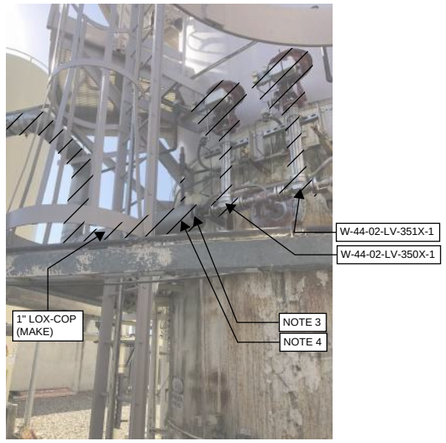


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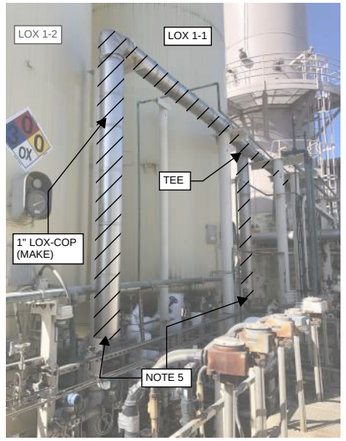


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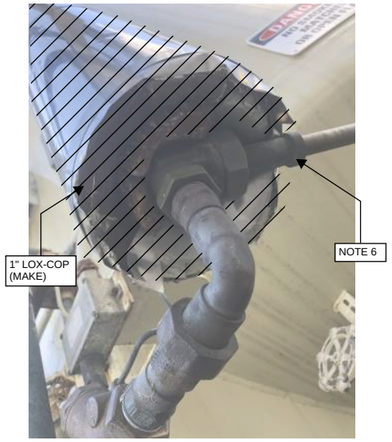


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NOTES:

1. DEMOLISH 1" LOX-COP AND 3" INSULATION FOR THE MAKE LINES BETWEEN EACH COLD BOX AND PAIR OF LOX STORAGE TANKS. ROUTE NEW 1" LOX-STL MAKE LINE ALONG EXISTING ALIGNMENT. REUSE PIPE SUPPORTS. IDENTIFY ANY PIPE SUPPORTS TOO CORRODED TO REUSE TO THE ENGINEER PRIOR TO START OF WORK. INSTALL NEW INSULATION ON MAKE LINES MATCHING EXISTING EXTENTS.

2. WORK ON THE MAKE LINE FOR COLD BOX 2 AND LOX STORAGE TANKS 2-1 AND 2-2 SHALL ONLY OCCUR WHEN COLD BOX 2 (OXYGEN PLANT 2) IS OUT OF SERVICE AND HANDED OFF TO THE CONTRACTOR. WORK ON THE MAKE LINE FOR COLD BOX 1 (OXYGEN PLANT 1) AND LOX STORAGE TANKS 1-1 AND 1-2 SHALL ONLY OCCUR WHEN COLD BOX 1 IS OUT OF SERVICE AND HANDED OFF TO THE CONTRACTOR. CONTRACTOR SHALL SUBMIT A SYSTEM OUTAGE REQUEST FOR THE MAKE LINE AT LEAST 30 DAYS PRIOR TO START OF WORK TO ALLOW ISOLATION OF THE LOX TANKS. CONTRACTOR SHALL BE RESPONSIBLE FOR ANY THAWING OR PURGING NEEDED TO SAFELY PERFORM ITS WORK.

3. DEMO AND REPLACE FLANGE.

4. TEE NOT SHOWN, DEMO UP TO RELIEF VALVE. REPLACE BRANCH FROM TEE TO RELIEF VALVE WITH STAINLES STEEL PIPE (INCLUDING TEE). INSTALL DIELECTRIC COUPING BETWEEN DISSIMILAR METALS.

5. DEMO 1" LOX-COP AND INSULATION TO VALVE (HV-X610X AND HV-X620X FOR EACH PAIR OF LOX STORAGE TANKS). REPLACE MAKE LINE WITH 1" LOX-STL AND NEW INSULATION TO VALVE FOR BOTH COLD BOXES.

6. PHOTO IS TYPICAL FOR LOX TANKS 1-2, 2-1, AND 2-2. THE VALVE STEM SHOWN IS FOR HV-X610X-1 AND TYPICAL FOR HV-X610X-2, HV-X620X-1, AND HV-X620X-2. REPLACE THE MAKE LINE WITH 1" LOX-STL TO THIS VALVE FOR EACH COLD BOX AND LOX STORAGE TANK.

7. REPLACE COLD END GEL TRAP INLET VALVES (W-44-02-HV-X201A-1 AND W-44-02-HV-X201A-2) AND OUTLET VALVES (W-44-02-HV-X203A-1 AND W-44-02-HV-X203A-2) FOR BOTH COLD BOXES. WORK ON VALVES SHALL BE COMPLETED WHEN PERLITE IS REMOVED FROM EACH CORRESPONDING COLD BOX. PHOTO SHOWS COLD BOX 1 ONLY BUT IS TYPICAL FOR COLD BOX 2.

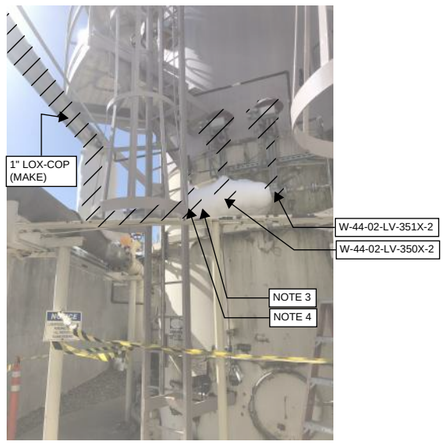


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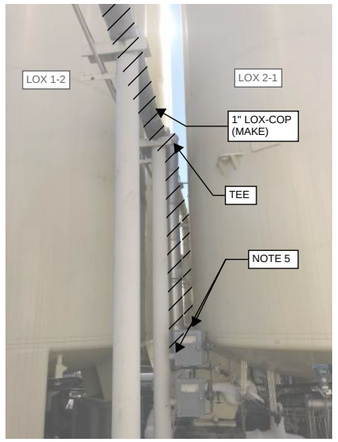


PHOTO DETAIL P5 (M102.5D)
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PHOTO DETAIL P6 (M102.5D)
NO SCALE

REGISTERED PROFESSIONAL ENGINEER
JOHN C. LAW
NO. C95046
CIVIL
STATE OF CALIFORNIA
09/10/2024

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NO.	DATE	REVISION	BY	REC.	APP.
02	10SEP2024	CREATED PER ADDENDUM NO. 02	JL	JL	DCR

SD428 - MWWTP OXYGEN PLANT REHABILITATION

DESIGN	DESIGN BY:	J. LAW
	DRAWN BY:	J. LAW
REVIEW	DESIGN CHECKED BY: R.P.E. NO. 95046	J. LAW
	CONSTRUCTABILITY CHECKED BY:	
	ELECTRICAL CHECKED BY: R.P.E. NO.	---
	PROJECT ENGINEER	
	PROJECT MANAGER	J. LAW
	RECOMMENDED: SR. ENGINEER R.P.E. No. 69681	D. RUSSELL

EAST BAY MUNICIPAL UTILITY DISTRICT
SPECIAL DISTRICT NO. 1
OAKLAND, CALIFORNIA

MAIN WASTEWATER TREATMENT PLANT
OXYGEN PRODUCTION PLANT
MECHANICAL
PHOTOS 1

SCALE NTS
DATE 23AUG2024
SD428-W4400-M102.7D
DRAWING NUMBER
0
REV.

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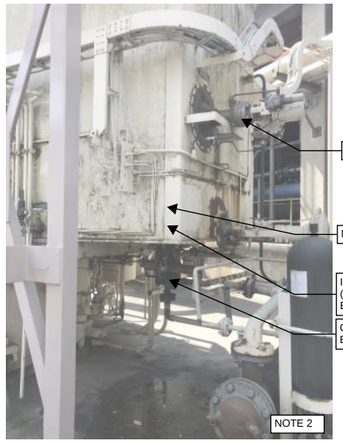


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NOTES:

1. DEMOLITION AND SCOPE FOR W-44-AHP-FV-213A NOT SHOWN ON THIS SHEET.

2. PHOTO OF THE TURBINE DUCT ASSEMBLY (BOX) FOR COLD BOX 2 IS TYPICAL FOR COLD BOX 1.

3. REMOVE AND REFURBISH INLET GUIDE VANES (IGV) OF CRYOGENIC EXPANSION (CRYO) TURBINE FOR BOTH OXYGEN PLANTS. STORE AND PROTECT TURBINE WHILE IGV ARE BEING REFURBISHED. PROTECT EXPOSED PIPING FROM DEBRIS.

4. REMOVAL OF THE CRYO TURBINE REQUIRES REMOVAL OF VERMICULITE FROM THE TURBINE BOXES. FOR EACH OXYGEN PLANT, CONTRACTOR SHALL SEQUENCE THE REMOVAL OF THE VERMICULITE AND SHIP THE IGV FOR REFURBISHMENT BEFORE THE START OF COATINGS OR OTHER WORK ON THE OXYGEN PLANT.

5. SEE SPECIFICATION SECTION 43 01 10.17, EXPANSION TURBINE INLET GUIDE VANE REFURBISHMENT FOR MORE DETAILS.

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NO.	DATE	REVISION	BY	REC.	APP.
02	10SEP2024	CREATED PER ADDENDUM NO. 02	JL	JL	DCR

REGISTERED PROFESSIONAL ENGINEER
JOHN C. LAW
NO. C95046
CIVIL
STATE OF CALIFORNIA
09/10/2024

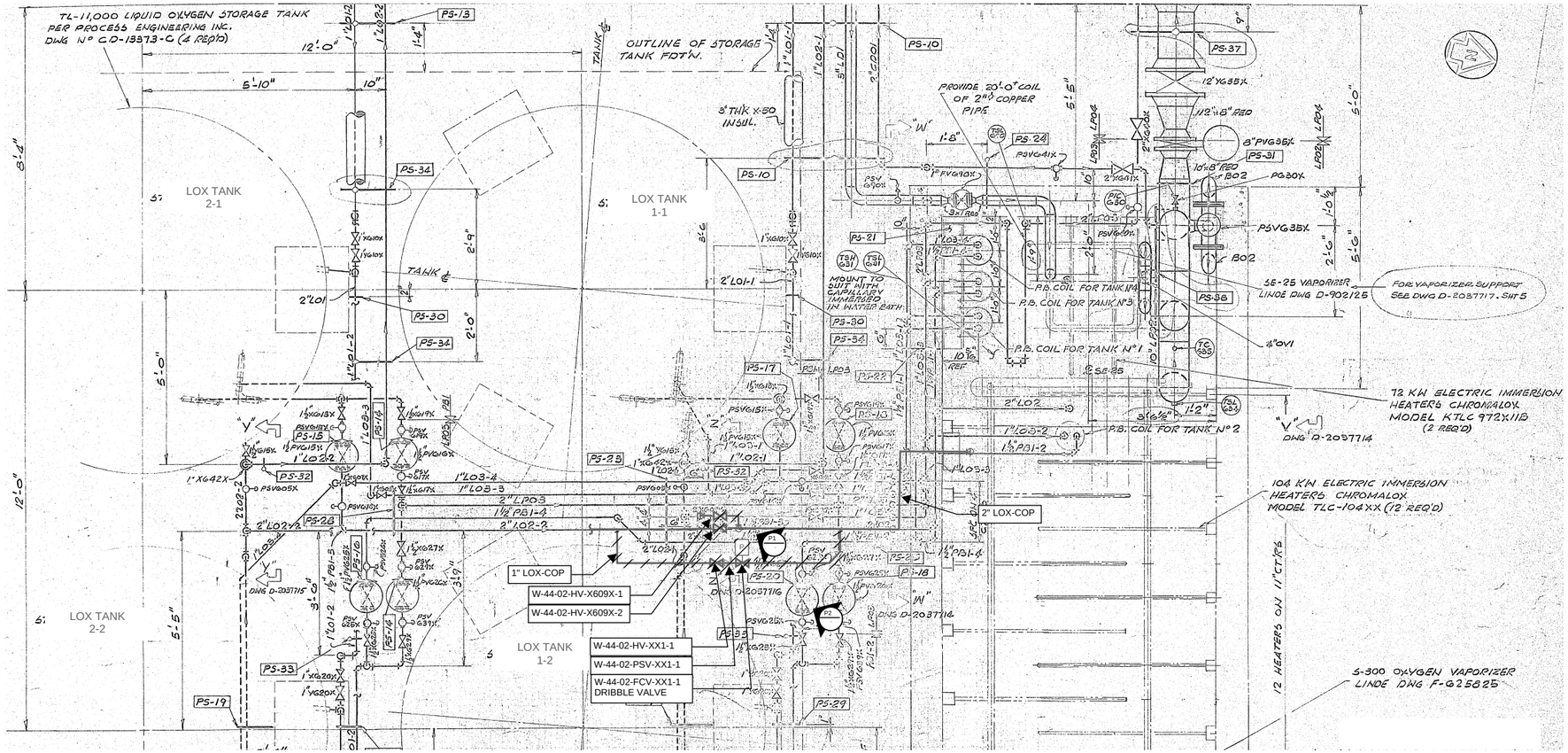
SD428 - MWWTP OXYGEN PLANT REHABILITATION

DESIGN	DESIGN BY:	J. LAW
	DRAWN BY:	J. LAW
REVIEW	DESIGN CHECKED BY: R.P.E. No. 95046	J. LAW
	CONSTRUCTABILITY CHECKED BY:	
	ELECTRICAL CHECKED BY: R.P.E. No. ---	
	PROJECT ENGINEER	
	PROJECT MANAGER	J. LAW
	RECOMMENDED: SR. ENGINEER R.P.E. No. 69681	D. RUSSELL

EAST BAY MUNICIPAL UTILITY DISTRICT
SPECIAL DISTRICT NO. 1
OAKLAND, CALIFORNIA

MAIN WASTEWATER TREATMENT PLANT
OXYGEN PRODUCTION PLANT
MECHANICAL
PHOTOS 2

SCALE NTS
DATE 23AUG2024
SD428-W4400-M102.8D
DRAWING NUMBER
0
REV.



PLAN
NTS

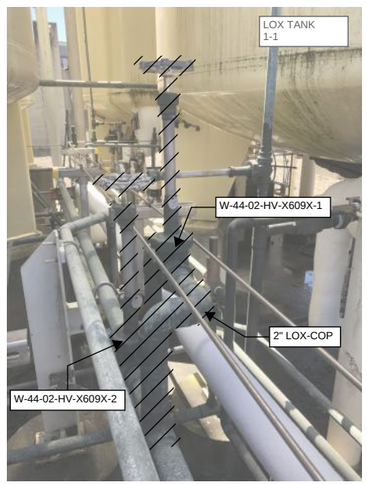


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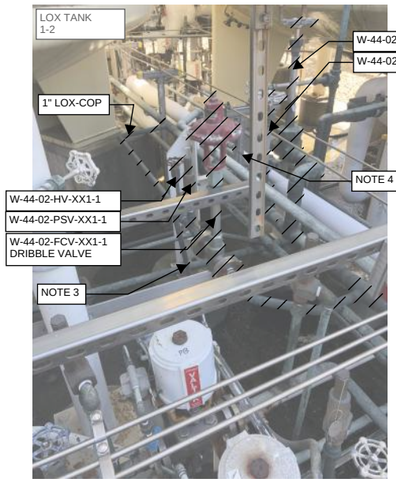


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NOTES:

1. CONTRACTOR SHALL VIF PIPING ALIGNMENT PRIOR TO STARTING WORK. AS-BUILT HAS NOT BEEN VERIFIED FOR ACCURACY. NOT ALL JOINTS AND SUPPORTS ARE SHOWN. ELEVATIONS NOT SHOWN. PROTECT IN PLACE PIPING NOT CALLED OUT FOR DEMOLITION OR NEEDING TO BE DEMOLISHED. WORK SHOWN ON OTHER PROJECT DRAWINGS FOR LOX STORAGE AREA NOT SHOWN ON THESE DRAWINGS. CONTRACTOR SHALL COORDINATE WORK ON THIS SHEET WITH OTHER WORK IN THE CONTRACT DOCUMENTS.

2. DEMO LOX WITHDRAWAL VALVES HV-X609X-1 AND HV-X609X-2. SOLDER 2" COPPER SPOOL PIECE IN PLACE OF EXISTING VALVE LOCATION.

3. DEMO DRAIN LINE OFF PRESSURE RELIEF IN ITS ENTIRETY.

4. DEMOLISH PNEUMATIC TUBING FOR FCV-XX!-1 DRIBBLE VALVE IN ITS ENTIRETY. CONTRACTOR SHALL TRACE AND DEMOLISH TUBING BACK TO P/I PANEL AND MAIN CONTROL PANEL IN O2 CONTROL BUILDING.

5. CONTRACTOR SHALL NOT BEGIN WORK ON THE X609X VALVES UNTIL WORK ON BOTH COLD BOXES IS COMPLETE.

REGISTERED PROFESSIONAL ENGINEER
JOHN C. LAW
NO. C95046
CIVIL
STATE OF CALIFORNIA
09/10/2024

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NO.	DATE	REVISION	BY	REC.	APP.
02	10SEP2024	CREATED PER ADDENDUM NO. 02	JL	JL	DCR

SD428 - MWWTP OXYGEN PLANT REHABILITATION

DESIGN	DESIGN BY:	J. LAW
	DRAWN BY:	J. LAW
REVIEW	DESIGN CHECKED BY: R.P.E. No. 95046	J. LAW
	CONSTRUCTABILITY CHECKED BY:	
	ELECTRICAL CHECKED BY: R.P.E. No. ---	
	PROJECT ENGINEER	
	PROJECT MANAGER	J. LAW
	RECOMMENDED: SR. ENGINEER R.P.E. No. 69681	D. RUSSELL

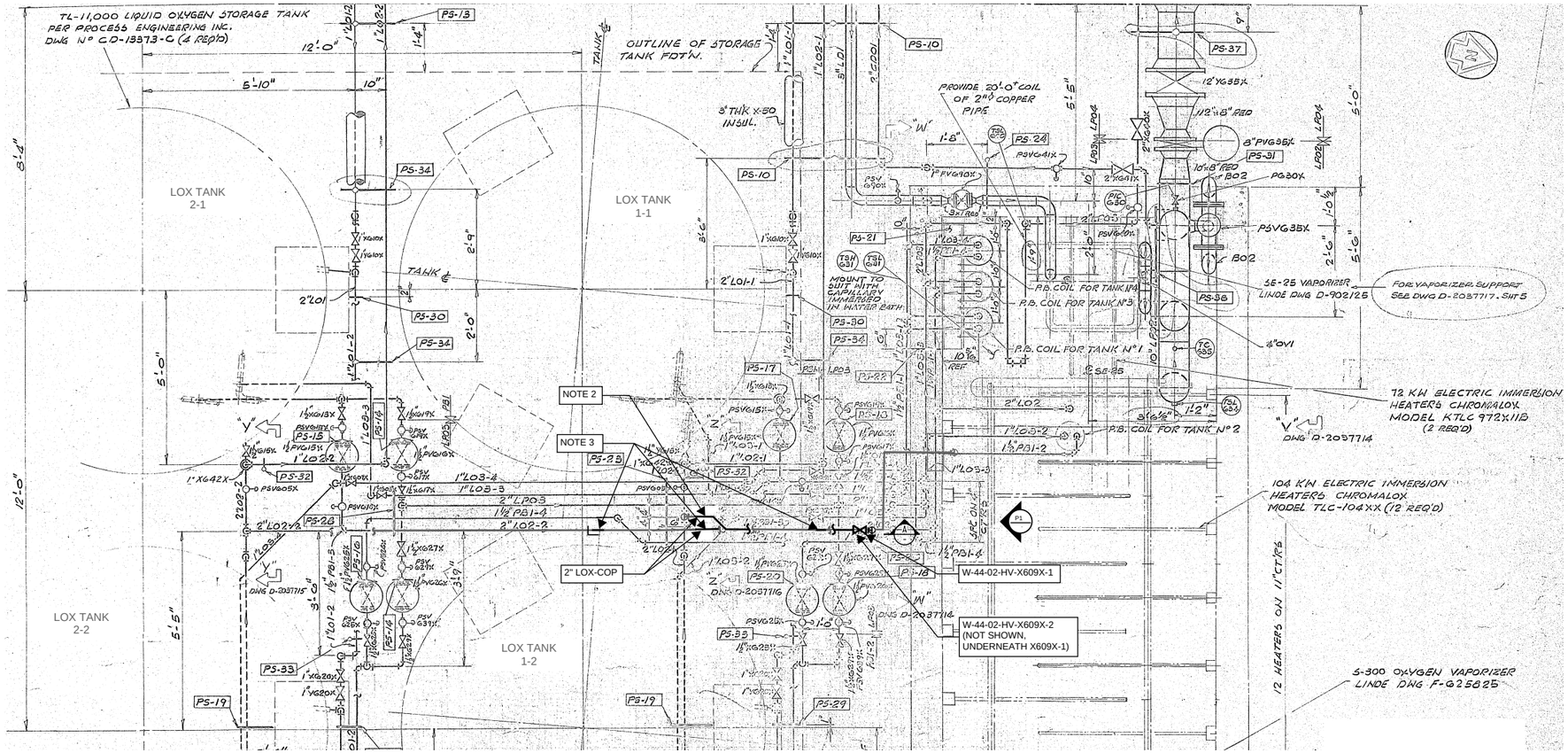
EAST BAY MUNICIPAL UTILITY DISTRICT
SPECIAL DISTRICT NO. 1
OAKLAND, CALIFORNIA

MAIN WASTEWATER TREATMENT PLANT
OXYGEN PRODUCTION PLANT
MECHANICAL

PIPING PLAN
LOX STORAGE AREA

SCALE NTS
DATE 23AUG2024
SD428-W4400-M103D
DRAWING NUMBER
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REV.

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DATE:
FILE:



PLAN
NTS
M102.5

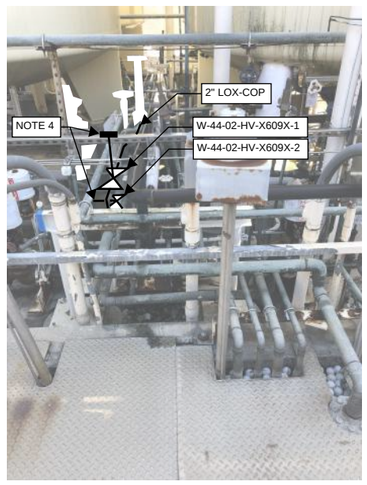
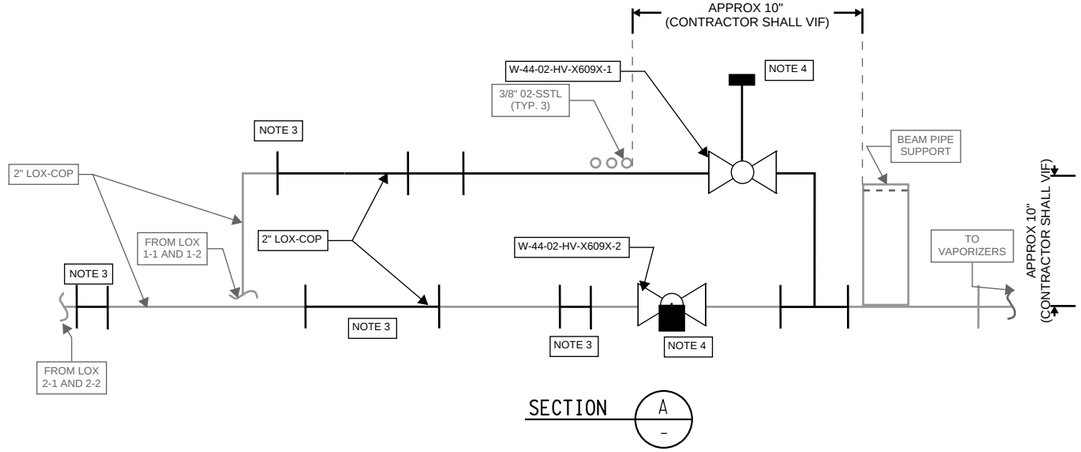


PHOTO DETAIL P1
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SECTION A
-

NOTES:

1. CONTRACTOR SHALL VIF PIPING ALIGNMENT PRIOR TO STARTING WORK. AS-BUILT HAS NOT BEEN VERIFIED FOR ACCURACY. NOT ALL JOINTS AND SUPPORTS ARE SHOWN. PROTECT IN PLACE PIPING NOT PART OF THE WORK. WORK SHOWN ON OTHER PROJECT DRAWINGS FOR LOX STORAGE AREA NOT SHOWN ON THESE DRAWINGS. CONTRACTOR SHALL COORDINATE WORK ON THIS SHEET WITH OTHER WORK IN THE CONTRACT DOCUMENTS.

2. 2" LOX-COP ON HV-X609X-1 BRANCH IS APPROXIMATELY 10" HIGHER THAN 2" LOX-COP OF HV-X609X-2 BRANCH.

3. SOLDER NEW SPOOL WHERE TEE IS CUT.

4. EXTEND VALVE STEM OF HV-X609X-1 APPROXIMATELY 24" FROM TOP OF PIPE. EXTEND VALVE STEM OF HV-X609X-2 TO EAST (APPROXIMATELY 12"). VALVE OPERATORS FOR HV-X609X VALVES SHALL BE READILY ACCESSIBLE FROM EXISTING WALKWAYS.

5. NEW WORK IS SHOWN DIGRAMMATICALLY ON PHOTO 1 FOR REFERENCE.

6. PROVIDE NEW VALVE TAGS FOR RELOCATED VALVES.

REGISTERED PROFESSIONAL ENGINEER
JOHN C. LAW
NO. C95046
CIVIL
STATE OF CALIFORNIA
09/10/2024

3" ON ORIGINAL DOCUMENT
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NO.	DATE	REVISION	BY	REC.	APP.
2	10SEP2024	CREATED PER ADDENDUM NO. 02	JL	JL	DCR

SD428 - MWWTP OXYGEN PLANT REHABILITATION

DESIGN	DESIGN BY:	J. LAW
	DRAWN BY:	J. LAW
REVIEW	DESIGN CHECKED BY: R.P.E. No. 95046	J. LAW
	CONSTRUCTABILITY CHECKED BY:	
	ELECTRICAL CHECKED BY: R.P.E. No. ---	
	PROJECT ENGINEER	
	PROJECT MANAGER	J. LAW
	RECOMMENDED: SR. ENGINEER R.P.E. No. 69681	D. RUSSELL

EAST BAY MUNICIPAL UTILITY DISTRICT
SPECIAL DISTRICT NO. 1
OAKLAND, CALIFORNIA

MAIN WASTEWATER TREATMENT PLANT
OXYGEN PRODUCTION PLANT
MECHANICAL

PIPING PLAN
LOX STORAGE AREA

SCALE NTS
DATE 23AUG2024
SD428-W4400-M103
DRAWING NUMBER
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REV.

REF 1; REF 2; REF 3
REF 4; REF 5; REF 6
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