32001 32nd Avenue South, Suite 300
Federal Way, Washington 98001
253-835-6400

Final Operations and Maintenance Manual Environmental Remediation System

Circle K 1461
Seattle, Washington

21 May 2025

Prepared for

Toxics Cleanup Program
3190 160th Avenue SE
Bellevue, Washington 98008-5452

KJ Project No. 2196008*00

Table of Contents

Table of Contents (cont'd)

Table of Contents (cont'd)

List of Tables

List of Figures

Table of Contents (cont'd)

List of Appendices

Change Log

Revision Date	Summary of Changes Made
13 October 2022	Original draft submission
30 March 2023	Updates based on RFQQ
8 August 2024	Updates based on constructed system
22 November 2024	Final draft based on constructed system and system start-up
21 May 2025	Final based on record drawings and initial system operation

Section 1: Introduction

Kennedy/Jenks Consultants, Inc. (Kennedy Jenks) has prepared this Operations and Maintenance Manual (O&M Manual) to document procedures for the operation, monitoring, and maintenance activities associated with the environmental remediation system installed at the Circle K Station #1461 (site) under the City of Seattle Construction permit 6996584-CN. The site is located at 2350 24th Avenue East in the City of Seattle (City), King County, Washington (see Figure 1). This site is listed on the Washington State Department of Ecology (Ecology) Site Information System and Hazardous Sites List as Circle K 1461, under cleanup site ID 5086 and facility/site ID 2322.

In April 1992, Ecology entered into Consent Decree No. 82-2-08095-8 (CD) with Mr. Kuk Jin Choung and Ms. Kathy-Kyung D. Choung, owners of the property, to conduct a remedial investigation and feasibility study (RI/FS) and develop a cleanup action plan (CAP) for the site. After completion of the RI/FS and CAP, the CD requires performance of the cleanup action to protect human health and the environment in accordance with Model Toxics Control Act (MTCA) regulations. The RI/FS and CAP were finalized in December 2017. Implementation of the CAP is continuing under the CD with Ecology oversight, under Ecology contract number C2100069.

1.1 System Objectives

The CAP is intended to address petroleum hydrocarbon-affected soil and groundwater at the site. Hydrocarbons detected in soil and groundwater have been attributed to an underground storage tank (UST) that was discovered to be leaking in August 1989. A groundwater recirculation system consisting of a Multi-Phase Extraction (MPE) system and surfactant / nutrient / oxygen injection system will be used to reduce concentrations of Total Petroleum Hydrocarbons (TPH) as Gasoline Range Organics (GRO) and benzene, toluene, ethylbenzene, and xylene (BTEX) in the soil and groundwater below the site. Groundwater, soil, and vapor samples will be collected periodically to monitor treatment progress.

The project goal with respect to GRO and BTEX is to remove contaminant mass to attain MTCA Method A groundwater and soil cleanup levels (CULs) for unrestricted land use. Reducing contaminant concentrations to the extent practicable will require:

- Systematic optimization of mass removal and remedial chemical injections through adjustments to operating wells and airflow based on monitoring results.
- Documentation of progress towards the removal of GRO and BTEX from the site.
- Compliance with the requirements of all applicable federal, state, and local permits for construction and industrial activities, underground injection, air discharge, and sewer discharge.

To support these goals, monitoring techniques will be used to demonstrate MPE system operational success.

1.2 MPE System Description

The MPE system is designed to incorporate three new vertical wells and three new slant wells along with seven existing wells into a single extraction/injection system for a total of 13 remediation wells. Each well within the network of remediation wells is individually connected to both the extraction and injection manifolds in the treatment system enclosure (Treatment Shed) located on site. The wells are organized into four banks of either three or four remediation wells (see Table 1). The vapor and water extracted from the wells is piped to the treatment system. The treatment train splits at a knock-out tank to a water treatment train and a vapor treatment train.

The water treatment train consists of a bag filter, two pairs of granular activated carbon (GAC) vessels plumbed in series, a mixing tank in which surfactants, bacteria, and/or nutrients can be added, and an oxygen generator. Water can be discharged to the City sanitary sewer system before the mixing tank or reinjected to the wells through the injection manifold.

The vapor treatment train consists of a temporary catalytic oxidizer to be used at system startup and a pair of vapor GAC vessels piped in series to be used once vapor contaminant concentrations are low enough for their use. Treated air is discharged through an exhaust pipe.

The system is designed to operate continuously, except for shutdowns for maintenance, replacement of media, or as-needed monitoring.

1.2.1 Air Permit Compliance Criteria

As a remediation project under a Consent Decree, the project is required to comply with the substantial requirements of the Puget Sound Clean Air Agency (PSCAA), however obtaining a PSCAA permit is not required. The MPE system will be operated to substantially meet the PSCAA operation and monitoring requirements (included in Appendix B) for remediation systems that use catalytic oxidizers and GAC for treatment of extracted soil vapors prior to discharge. Operation and monitoring requirements include moderating influent flow rate to the treatment system, and collection of field vapor measurements from treatment devices (i.e., the catalytic oxidizer and GAC vessels) to demonstrate compliance with control efficiency requirements for the treatment devices.

The control efficiency requirements are as follows:

- ≥ 97 percent (%) if inlet TPH ≥ 200 parts per million by volume (ppmv), measured as hexane or its equivalent
- ≥ 90% if inlet TPH < 200 ppmv, measured as hexane or its equivalent; or
- ≤ 10 ppmv at the outlet of the control device, measured as hexane or its equivalent.

The system shall be operated such that the effluent of the vapor treatment system meets the Washington Administrative Code (WAC) 173-460-150 Small Quantity Emission Rate (SQER) limits for the following constituents in pounds per day (lbs/day) or pounds per year (lbs/year) as applicable:

Constituent	SQER (lbs/day)	SQER (lbs/year)
Benzene	0.058	21
Toluene	370	135,050
Ethylbenzene	0.178	65
Total Xylenes	16	5,840

Compliance will be verified through vapor samples collected at the influent, midpoint, and effluent of the vapor treatment system (see Section 5.1 for details).

1.2.2 Discharge Permit Compliance Criteria

Due to the discharge of treated groundwater to the sanitary sewer as part of the system design, the project is required to comply with the requirements of a King County Industrial Waste Program Wastewater Discharge Authorization (KCIW WDA). Effluent limits for the constituents to be self-monitored as part of permit compliance are included in Section 4.2.8 of the Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP). Compliance will be verified through samples collected from the water treatment system (see Section 5.1 for details). Monitoring requirements are included in the KCIW WDA (Appendix A).

1.3 Site Contacts

Personnel associated with the treatment system include Ecology personnel, Kennedy Jenks personnel, the property owner, and contractors. The Ecology Site Manager is Dale Myers, the Kennedy Jenks' project manager is Shaelyn Thomas, and the property owners are Mr. Kuk Jin Choung and Kathy-Kyung D. Choung. The contact information for each is included below:

- Dale Myers, Ecology Site Manager
  - Phone: 425-649-4426
  - Email: damy461@ecy.wa.gov
- Shaelyn Thomas, Kennedy Jenks project manager
  - Phone: 503-423-4033
  - Email: ShaelynThomas@KennedyJenks.com
- The Choung Family:
  - Phone: 206-769-9853
  - Email: Ydc2415@hotmail.com

All field personnel must be Hazardous Waste Operations and Emergency Response (HAZWOPER) certified. A site-specific Health and Safety Plan (HASP) with Job Hazard Analyses for individual tasks has been developed for the site, and is incorporated into the O&M Manual as Appendix C.

The property is owned and managed by Mr. Kuk Jin Choung and Kathy-Kyung D. Choung who operate Jay's Dry Cleaning on the site and lease the space used for Mont's Market convenience store.

Ecology is the primary regulatory agency for the site and treatment system.

1.4 Contents

This O&M Manual provides a detailed description of each of the system components, the recommended maintenance schedule for the system, the proper operation of the remediation system, and the monitoring plan. This O&M Manual will be updated as needed based on changes to the system, including changes to installed equipment, information from vendors, permit requirement updates, and/or the O&M activities.

Section 2: System Components

This section provides detailed descriptions of each component of the MPE system, including the following:

- General Conveyance and Monitoring Infrastructure
  - Extraction/Injection Wells
  - Sub-slab Depressurization Wells
  - Vapor Pins
  - Extraction and Injection Manifold and Piping
- Water Treatment System
  - Vapor Liquid Separator
  - Transfer Pumps
  - 500 Gallon Storage Tank
  - Bag Filter
  - Liquid GAC Vessels
  - 300 Gallon Storage Tank
  - 300 Gallon Mixing Tank
  - Bacteria and Nutrients Feed
  - Surfactant Feed
  - Oxygen Generator and Injection System
- Vapor Treatment System
  - Liquid Ring Pump
  - Heat Exchanger
  - Temporary Catalytic Oxidizer
  - Coalescing Filter
  - Vapor-Phase GAC Vessels
- System Components and Control
  - Control Panel and Programmable Logic Controller (PLC)
  - Ancillary piping, controls, and gauges that connect, control, and monitor the primary components
  - Shutter Exhaust Fan System
  - Electric Base Board Heater
  - Explosion-Proof Convection Heater

The aboveground piping manifold and treatment system are housed in a fenced area on-site. Record drawings are included in Appendix D. Drawing G-05 includes the process flow diagram; Drawing C-01 shows the locations of the wells, manifolds, and treatment system; and Drawing C-03 shows the layout of the treatment system. Appendix E includes vendor-supplied documentation for the components of the treatment system including transfer pumps, tank mixer, liquid ring pump, and GAC vessels.

2.1 General Conveyance and Monitoring Infrastructure

2.1.1 Extraction/Injection Wells

The Extraction/Injection Wells (EIWs) consist of 13 remediation wells including one existing monitoring well (MW-4), six existing remediation wells (RW-2, RW-3, RW-4, RW-5, RW-6, RW-7), three new remediation wells (RW-8, RW-9, and RW-10) and three new slanted remediation wells (SW-1, SW-2, and SW-3)[1]. Use of monitoring well MW-4 for injection will be evaluated during system operation. Injection will be focused on the areas of highest petroleum hydrocarbon concentration and MW-4 is upgradient of these areas. Well locations are shown on Drawing C-01 in Appendix D. Well construction details are included in Table 1.

The EIWs are plumbed into four groups of three to four wells (see Section 2.1.4 and Table 1). The groups are identified as Well Bank 1 through Well Bank 4. A separate extraction-only well bank connects three sub slab depressurization (SSD) wells. Flow from and to all wells is controlled via three manifolds as discussed below. SSD wells are associated with Manifold A, extraction wells with Manifold B, and injection wells with Manifold C.

2.1.2 Sub-slab Depressurization Wells

Three 4-foot-long SSD horizontal wells constructed of 4-inch diameter Schedule 40 polyvinyl chloride (PVC) slotted pipes are installed below grade in gravel. The SSD wells are located on the north and west sides of the on-site building as shown on Drawing C-01 in Appendix D. The SSD wells are connected with 2-inch PVC to Manifold A to allow for a negative vacuum to be applied beneath the on-site building to mitigate potential vapor intrusion into the on-site building during system operations.

2.1.3 Vapor Pins

Four Vapor Pin monitoring points are installed through the floor slab inside of the on-site building. These devices are designed to be used for gas sampling to monitor sub-slab soil vapor and pressures.

2.1.4 Manifold and Piping

Extracted soil gas from three SSDs are manually controlled at Manifold A. Manifold A includes pressure gauge, isolation ball valve, flow control gate valve, ¼-inch sampling ball valve, and 3/8-inch threaded plug (for pitot tube) for each SSD well. There is no singular control or isolation valve for the SSD well bank.

Extracted air and water from each well group is controlled at Manifold B located within the northern portion of the Treatment Shed. The individual well pipes are grouped into three or four

[1] Wells RW-8, RW-9, RW-10, SW-1, SW-2, and SW-3 were installed during February 2024.

lines connected to a single extraction bank identified as Well Bank 1 through Well Bank 4. Each of the four well banks include a globe valve for overall bank flow control, a pneumatic solenoid-controlled isolation ball valve, and a manual isolation ball valve. The pneumatically operated ball valve is connected to the PLC via an electric solenoid and controls whether the well bank is used for extraction. The individual EIW pipes associated with each individual well include the following: isolation ball valve, flow control gate valve, ¼-inch sampling port valve, 3/8-inch threaded plug, and pressure indicator.

Treated water for recirculation back into the individual EIWs is controlled at Manifold C, located in the southern portion of the Treatment Shed. The individual well pipes are grouped into three or four lines connected to a single extraction bank identified as Well Bank 1 through Well Bank 4. The wells grouped together in the injection well banks are identical to the wells grouped together in the extraction well banks. Each of the four well banks include a globe valve for overall bank flow control, an electronic solenoid isolation ball valve, and a manual isolation ball valve. The electronically operated ball valve is connected to the PLC and controls whether the well bank is used for injection. The individual EIW pipes associated with each branch include the following: gate valve, ball valve, pressure gauge, ¼-inch sampling port valve, 3/8-inch threaded plug, and flow meter/totalizer.

The extraction and injection flow rate for each EIW is controlled individually by the hand-operated gate valves located at Manifold B and Manifold C within the Treatment Shed. These hand-operated gate valves are used to balance the groundwater flow to and from individual wells within each group. When attempting to adjust different extraction rates within a single well bank, the manual valves on the corresponding well bank of Manifold C need to be closed and vice versa when attempting different injection rates within a single well bank. The electric solenoid valves on Manifold B are interlocked with those on Manifold C via the PLC so that when one well bank is open on Manifold B to a group of wells, the corresponding electric solenoid valve on Manifold C to the same well bank is closed. This is done to avoid simultaneous extraction and injection to the same group of wells. Each piping manifold leg is labeled, and diagrams of the piping manifolds are provided in the vendor supplied documentation included in the Record Drawings (Appendix D, Drawing M-2).

2.2 Water Treatment System

2.2.1 Vapor Liquid Separator T-300

The 40-gallon, steel Vapor Liquid Separator tank (T-300 on Drawing I-02 and on Drawing M-1 in Appendix D) is located in the shed upstream of the liquid ring pump. Moisture is collected at the tank bottom and is pumped to the water treatment system. Vapor exits the top of the tank and continues to the blower inlet. When the high-level float switch (LSH 300) in T-300 is activated, the PLC switches on the transfer pump (P-300) and the water collected in T-300 is pumped into a 500-gallon storage tank (T-301). Once the low-level switch (LSL 300) in T-300 is activated, the PLC switches P-300 off, allowing T-300 to begin filling. T-300 holds approximately 1.92 gallons per inch and there are 13 inches between low and high level floats with an estimated 25 gallons discharged to T-301 per cycle.

If the high-high level switch in T-300 (LSHH-300) is activated, the PLC shall turn off the Liquid Ring Vacuum Pump (B-301) and the remote telemetry alarms the designated contact person that the system has been turned off for a high-high level in T-300. The Catalytic Oxidizer (TO-400) is interlocked to the blower operation and will not operate when the blower is shut down.

The web and local human-machine interface (HMI) will show the run status and alarm conditions for T-300.

2.2.2 Transfer Pump P-300

Transfer Pump P-300 is located downstream of T-300. When LSH 300 in T-300 is activated, P-300 pumps water out of T-300 to a 500-gallon storage tank (T-301). The average estimated discharge rate is between 15 and 20 gallons per minute (gpm) at 10 pounds per square inch gauge (psig). The maximum allowable discharge pressure is 50 psig or less.

The web and local HMI will show the run status for P-300.

2.2.3 Storage Tank T-301

A 500-Gallon Storage Tank (T-301) is located downstream of Transfer Pump P-300 in the Water Treatment System. Untreated groundwater accumulates here until LSH 301 is activated at which point the PLC switches on Transfer Pump P-400 to pump the water collected in T-301 to the bag filter (BF-400) and GAC Vessels (LG-400, LG-401, LG-402, and LG-403). Once the low-level switch (LSL 301) in T-301 is activated, the PLC switches P-400 off, allowing T-301 to begin filling.

If the high-high level switch (LSHH) in T-301 is activated, the PLC shall turn off transfer pump P-300 to stop filling T-301 and the remote telemetry alarms the designated contact person that there is a high-high level in T-301. The overall system is allowed to continue operating until the high-high level in T-300 is activated as discussed above. The continued operation may allow for P-400 to empty the tank; however, the system will still require an alarm reset. If water has been drawn down in the tank, the operator can select alarm reset to clear the alarm and allow P-300 to continue operation.

The web and local HMI will show the run status and alarm conditions for T-301.

2.2.4 Transfer Pump P-400

Transfer Pump P-400 is located downstream of T-301. When LSH-301 in T-301 is activated, P-400 pumps water out of T-301 to the bag filter (BF-400) and GAC Vessels (LG-400, LG-401, LG-402, and LG-403) at a minimum rate of three gpm and maximum rate of 15 gpm. Maximum discharge pressure is 50 psig or less.

The web and local HMI will show the run status for P-400.

2.2.5 Bag Filter BF-400

An in-line bag filter (filter) is located downstream of P-400 and T-301. Fouling of the filter is monitored via a pressure gauge and pressure transducer installed on each side of the bag filter (PI/PIT-400 and PI/PIT-401). The transducers are connected to the PLC and will register high pressure alarms at the PLC. PIT-400 and PIT-401 will be set to alarm at two pounds per square inch (psi) below the dead head of pump P-400 (30 psi). The remote telemetry will alarm the designated contact person. A flow meter is also located downstream of BF-400 to manually monitor flow rate through the GAC vessels.

The web and local HMI will show the pressure reading and alarm conditions for PIT-400 and PIT-401.

2.2.6 Liquid GAC Vessels LG-400/401/402/403

Four 55-gallon Liquid GAC Vessels are plumbed for operation in a lead-lag arrangement downstream of the filter. The Liquid GAC Vessels each contain approximately 200 pounds (lbs) of GAC. They are piped to be operated in two parallel trains of two vessels each. Each treatment train has a pressure gauge between the two GAC vessels that is not connected to the PLC. A pressure gauge is also located after the two trains prior to storage tank T-400. Flow meters are located on each train after the second GAC vessel. Each parallel system is capable of complete treatment, so the other system can be standby or be maintained without disrupting system operation. None of the valves controlling GAC vessel flow rates are connected to the PLC.

The lead liquid GAC vessel will be replaced if breakthrough is determined. Breakthrough occurs if the results from the sample collected at the midpoint of a train exceeds the screening levels for any compound listed in Special Condition C of the KCIW requirements (Appendix A). See Section 5.1 for sample collection details.

2.2.7 300-Gallon Storage Tank T-400

A 300-gallon Storage Tank (T-400) is connected downstream of the Liquid GAC Vessels to collect treated groundwater. Treated groundwater will initially be discharged by gravity to sanitary sewer from this tank. Once treated groundwater contaminant concentrations are amenable to bioremediation via reinjection, treated water from this tank is pumped to the 300-gallon mixing tank (T-500) where dry amendments are added by hand and mechanically mixed. Some of the water may be discharged to sanitary sewer during injection activities if injection rates are not sufficient to allow all the treated groundwater to be used for bioremediation.

GAC-treated groundwater accumulates here until LSH-400 is activated at which point the PLC switches on Transfer Pump P-401 to pump the water to T-500. LSH 400 is positioned below the outlet to the sanitary sewer and positioned to allow for switch engagement prior to discharge to the sanitary sewer. Once the low-level switch (LSL 400) in T-400 is activated, the PLC switches P-400 off, allowing T-400 to begin filling.

If the high-high level switch (LSHH) in T-400 is activated, the PLC shall turn off P-400 and the remote telemetry alarms the designated contact person that a high-high level condition exists in T-400. The system is allowed to continue operating in the event each tank transfer pump is able to ameliorate the condition. If not, tank T-301 will issue a high-high level condition and the system will switch off when Vapor Liquid Separator T-300 high-high level switch is triggered. Per discussion above, the system will issue appropriate alarms to designated personnel.

The web and local HMI will show the run status and alarm conditions for T-400.

2.2.8 Transfer Pump P-401

Transfer Pump P-401 is located downstream of Storage Tank T-400. When LSH-400 in T-400 is activated, P-401 pumps water out of T-400 to Mixing Tank T-500 at a rate of approximately 3 gpm.

The web and local HMI will show the run status for P-401.

2.2.9 300-Gallon Mixing Tank T-500

Water is transferred to the 300-Gallon Mixing Tank (T-500) from the 300-Gallon Storage Tank (T-400) by transfer pump P-401. A vented lid is located on top of T-500 for manual filling of dry amendments including surfactants, bacteria, and nutrients into the processed water in preparation for reinjection. T-500 is powered by an electric motor. T-500 is only operated during the addition of dry amendments. When the high-level switch for T-500 is activated, the PLC turns on the injection pump (P-500) delivering mixed flows from T-500 through the Oxygen Generator (OG-500) and into the injection well manifold. Once the low-level switch (LSL 500) in T-500 is activated, the PLC switches P-500 off, allowing T-500 to begin filling.

If the high-high level switch (LSHH) in T-500 is activated, the PLC shall turn off the transfer pump P-401 and the remote telemetry alarms the designated contact person of a high-high alarm condition. The extraction system is allowed to continued operation until a high-high level is triggered in Vapor Liquid Separator T-300 as discussed in sections above.

The web and local HMI will show the run status and alarm conditions for T-500.

2.2.10 Transfer Pump P-500

Transfer Pump P-500 is located downstream of Mixing Tank T-500. When the additives are fully mixed in T-500 and the high level switch is activated, the PLC turns on P-500. P-500 will then pump water out of T-500 to the Oxygen Generator (OG-500) and injection well manifold.

The web and local HMI will show the run status for P-500.

2.2.11 Oxygen Generator OG-500

The Oxygen Generator (OG-500) is connected to the injection piping downstream of Transfer Pump P-500. OG-500 is supplied by a self-contained air compressor. A pressure indicator and pressure gauge (PI/PT 502) are located on the oxygen feed line and are connected to the PLC (see Drawing P&ID-6 in Appendix D). PT-502 will alarm at high and low pressure setpoints (30 and -1 psi, respectively). If the high- or low-pressure alarm is triggered, the system will shut down. OG-500 will be used after surfactant injection has reduced the concentrations to those conducive to bioremediation, when the injection will transition to injection of bacteria and nutrients.

A high-efficiency, venturi-type, differential pressure injector equipped with flow control valves connects the oxygen generator to the rest of the system. Post-venturi pressure indicator and pressure gauge (PI/PT-503) will alarm at high and low pressure setpoints (100 and -1 psi, respectively). If the high-pressure alarm is triggered, P-500 will be shut off. If the low-pressure alarm is triggered, the system will remain on, but the remote telemetry system will notify the designated contact person. This injector is shown on P&ID-6 on the vendor-submitted documentation included in the Record Drawings (Appendix D).

The web and local HMI will show the run status for the oxygen generator via a hand/off/auto switch. The HMI will also relay defined alarm conditions.

2.3 Vapor Treatment System

2.3.1 Liquid Ring Pump B-301

The Liquid Ring Pump (B-301) installed downstream of the Vapor Liquid Separator (T-300) is connected to piping from the top of T-300 to pull vapor from the T-300 into the Vapor Treatment System. This pump operates at a maximum vacuum of 29 inches of mercury (in Hg) and is controlled at the PLC. B-301 exerts a vacuum on the wells to extract groundwater and soil vapor into T-300. The pumping capacity is approximately 300 actual cubic feet per minute (ACFM). The pump will be operated at an extraction flow rate based on meeting PSCAA treatment limits for TPH and BTEX constituents (see Appendix B).

B-301 is equipped with vacuum, pressure, level, and temperature gauge and transmitters. B-301 has a differential pressure transmitter for remote reading and a pitot tube and differential pressure gauge for local flow reading. A high and low level oil switch and a high temperature switch are also included.

A vacuum indicator and transmitter (PI/PT-300) is located upstream of B-301. Normal operating pressures for B-301 will be established during system startup, with a high and low vacuum alarm set at PT-300 to activate when pressure is +/- 2 in Hg above or below normal operating pressures. If PT-300 measures vacuum at 4 in Hg above normal operating pressures (or a maximum of 29 in Hg), the PLC shall turn off the Liquid Ring Vacuum Pump (B-301) and Catalytic Oxidizer (TO-400, if installed) and the remote telemetry alarms the designated contact person that the system has been turned off for a high vacuum level in VT-300.

A pressure indicator and transmitter (PI/PT-302) and a flow indicator and transmitter (FI/FT-302) are located downstream of B-301. If PT-302 measures pressure after the Liquid Ring Vacuum Pump (LRP) at 8 psi, the PLC shall turn off the LRP (B-301) and the remote telemetry alarms the designated contact person that the system has been turned off for a high pressure level in PT-302.

The web and local HMI will display the run status of B-301, the readings at PT-300, PT-302, FT-302, and any associated alarm conditions.

2.3.2 Heat Exchanger HEX-302

A heat exchanger reduces the exit temperature on the discharge side of the liquid ring pump. Vapor will be directed from the vacuum pump through the heat exchanger prior to entering TO-400 or the vapor GAC vessels.

The heat exchanger is equipped with a temperature transmitter (TT-302). An alarm will trigger if high temperature is measured at TT-302 and the LRP will be shut down. The web and local HMI will display the temperature at TT-302, along with any alarm conditions.

2.3.3 Temporary Catalytic Oxidizer TO-400

The Temporary Catalytic Oxidizer (TO-400) is installed downstream of the Vacuum Pump B-301. Vapor will be directed through TO-400 for the first several months of operation (approximately 6 months) until concentrations of the contaminants of concern have decreased to a level suitable for treatment via the Vapor GAC vessels (GAC-400/401). TO-400 will then be permanently removed, returned to the vendor, and vapor will be directed through the Vapor GAC vessels prior to discharge. TO-400 is controlled at the PLC. There is a 1/8" barbed sample port on the discharge stack of TO-400 for monitoring treated air.

The web and local HMI shall show the run status of TO-400. Any temperature or pressure alarm conditions from the vendor-defined controls at TO-400 will be relayed to the PLC and the web and local HMI.

2.3.4 Coalescing Filter

There is a coalescing filter prior to the vapor GAC units and/or TO-400 for capturing oils and water. Collected water is conveyed back to the inlet side of the Vapor Liquid Separator (T-300) via 5/16-inch tubing. There is a ¼-inch valve and sample port for collecting pre-treated air samples.

2.3.5 Vapor GAC Vessels GAC-400/401

Two Vapor GAC Vessels are connected downstream of Vacuum Pump B-301 parallel to Temporary Catalytic Oxidizer TO-400. Once vapor concentrations are reduced to a level suitable for treatment via the Vapor GAC vessels (below approximately 500 parts per million (ppm) as isobutylene), TO-400 will be removed from the treatment train and the vapor will be routed through GAC-400 and GAC-401. GAC-400 and GAC-401 contain 2,000-pounds of GAC each. The vessels are plumbed in series with only a primary and secondary vessel; when concentrations leaving the primary vessel indicate that the vessel capacity is exhausted, the GAC will be replaced in the primary vessel and the vessel order reversed. Valves controlling GAC vessel treatment flows are manually operated and are not connected to the PLC. After treatment through GAC-400 and GAC-401, vapor will be discharged via a vertical discharge stack along the southwest corner of the on-site building. Pressure indicators are located before, after, and between the two Vapor GAC Vessels.

The GAC in a vessel will be replaced upon "breakthrough", defined in the PSCAA requirements (Appendix B) as the higher of (a) an outlet concentration of 10 ppmv TPH (measured as hexane or its equivalent) or (b) an outlet concentration less than or equal to 10% of the inlet concentration of TPH to the same GAC vessel.

2.4 System Components and Control

2.4.1 Control Panel and Programmable Logic Control (PLC)

The PLC panel is located on the outside of the Treatment Shed and has manual controls and indicators for the following processes:

- Selecting the mode (injection / extraction) for each well bank (solenoid control).
- Hand/off/auto options for the Liquid Ring Pump B-301, Heat Exchanger HEX-302, Catalytic Oxidizer TO-400, and Oxygen Generator OG-500.
- Run time meter for B-301
- Status of level switches in tanks T-300, T-301, T-400, and T-500.
- Hand/off/auto options via the HMI for transfer pumps
- Hand/off/auto options for the electric mixer in mixing tank T-500 and the solenoid valve connecting the oxygen generator to the venturi injector
- Various pressure and temperature gauges and flow meters, as shown on the vendor-supplied Piping and Instrumentation Diagram (P&ID) drawings (Appendix D)
- Virtual E-stop button, labeled “System Stop”
- Manual reset button for each starter
- Four system shut-down alarms:
  - Oxygen feed low and high pressure (PT-502)
  - Post-venturi injector low and high pressure (PT-503)
  - Treatment shed low and high temperature (TT-100, TT-500)
  - Motor overload (OL1 through OL8)

Automatic equipment controls based on level switches are also controlled through the PLC.

2.4.2 Alarms

The treatment system has been configured with alarms and system shutdown triggers, which are detailed in Table 2. The P&ID showing the alarms and associated switches or triggers is included in Appendix D.

Alarm conditions include:

- T-300 Vapor Liquid Separator high-high level (LSHH-300)
- T-301 Storage Tank high-high level (LSHH-301)
- Pre-liquid GAC high pressure (PT-401)
- T-400 Storage Tank high level (LSHH-400)
- T-500 Mixing Tank high level (LSHH-500)
- B-301 Liquid Ring Pump high vacuum, low vacuum (PT-300)
- B-301 Liquid Ring Pump high discharge pressure (PT-302)
- B-301 Liquid Ring Pump high temperature switch; low and high oil switch (internal)
- Post-HEX-301 Heat Exchanger high temperature (TT-302)
- Oxygen-Feed high pressure and low pressure (PT-502)
- Post-Venturi Injector low pressure and high pressure (PT-503)
- P-500 Mixing Tank pump discharge high pressure (PT-501)
- Extraction Room high temperature and low temperature (TT-100)
- Bioremediation room high temperature and low temperature (TT-500)
- Motor overload (OL1 through OL8, located in control panel)
- Secondary Containment high level switches (LSH-600, LSH-601)

2.4.3 Alarm Notification System

The system is equipped with a web server device to provide the following functions:

- Accept hardwired digital and analog signals and output hardwired digital and analog signals to devices in the system.
- Priority list of people notified of alarm conditions via email. Phone numbers can be added to email system for text notifications.
- Provide status data as described above to authorized users via a web server.

2.4.4 Meters, Gauges, and Valves

The treatment system includes flow meters, pressure and temperature gauges, and a variety of valves. The meters, gauges, and valves are shown in the vendor supplied documentation drawings included in the Record Drawings (Appendix D).

2.4.5 Treatment Shed

The Treatment Shed houses components of the treatment system and the extraction/injection piping manifold. The PLC with HMI panel is located on the outside of the Treatment Shed. The Treatment Shed is cooled by a thermostat-controlled shutter exhaust fan system and heated by electric baseboard heaters.

Section 3: Component Inspection and Maintenance

This section lists each of the components in the system that require periodic maintenance and describes the type and frequency of that maintenance. These recommendations should be used in conjunction with manufacturer's operation and maintenance manuals.

Only qualified and experienced personnel with the appropriate credentials and health and safety training should perform maintenance on the system, and power should be disconnected prior to performing maintenance activities.

Table 2 includes a list of alarm causes and simple responses. If alarm conditions persist after following these measures, the applicable system component(s) may need to be checked and/or repaired by a qualified technician.

Table 3 summarizes the type and frequency of the required maintenance and Appendix E includes the vendor-supplied documentation for each item. Table 4 summarizes the expected number of visits based on the required maintenance activities.

3.1 General Conveyance and Monitoring Infrastructure

3.1.1 Extraction/Injection Wells

The construction contractor inspected each wellhead when the system is first operational to check for air leakage at the piping-well connection. Thereafter, wellheads will be inspected by the operator annually. Damage to the wellheads or conditions requiring correction will be noted on the monitoring form (Appendix F or electronic equivalent). There is no regular maintenance required for the wells. Regular maintenance of the well vaults consists of replacement of bolts and gaskets as needed to keep vault lids secure and in-place. If well plugging or fouling is noted during inspection, the well will be physically surged to remove any material from the well screen or sand pack to eliminate plugging or fouling.

3.1.2 Sub-slab Depressurization Wells

The construction contractor inspected each wellhead before covering them when the system is first constructed to check for air leakage at the piping-well connection. Thereafter, well extraction flow and vacuum will be monitored to detect changes to well performance. There is no regular maintenance required for the wells. If changes to well performance are noted for three consecutive months, the well will be evaluated and repaired, as needed. The functionality of the wells will be evaluated at least annually.

3.1.3 Vapor Pins

Vapor Pins will be inspected monthly to check that covers and valves are sound. Vapor pin condition and functionality will be evaluated during each inspection. Fasteners, valves, and gaskets are to be replaced as needed.

3.1.4 Manifold and Piping

Piping manifolds will be inspected monthly, at minimum, to check that piping connections are sound, valves are in the correct positions, and the moisture level in the sumps do not require draining. Damage will be noted on the monitoring form (Appendix F or electronic equivalent) and corrective action will be taken. If monitoring indicates possible airflow problems at individual wells, the individual manifold legs will be checked for condensate accumulation will be pumped out if needed through the wye fitting in each manifold leg.

Care will be taken during monitoring and maintenance to protect against debris entering the system. If manifold piping becomes plugged, the debris or plug will be removed. Caution will be exercised when plugs are removed from the manifold piping during flow measurement.

Piping between equipment will be inspected monthly, at minimum, for leaks or for accumulation of water at low spots in header lines. Gas lines and electric lines will be inspected for leaks and damage.

3.2 Water Treatment System

3.2.1 Vapor Liquid Separator T-300

The water level in T-300 will be checked monthly, and when the high-level alarm is activated. If the alarm is activated routinely, the schedule for inspection and water removal will be changed to weekly and transfer pump P-300 will be evaluated for functionality until alarm is no longer activated routinely.

The tank will be inspected for corrosion and leaks. If the differential pressure across the tank increases, inspect the internal Solberg filter, as well as the demister and replace as needed.

The Kunkle vacuum relief valve should be tested annually by closing the influent valve to increase vacuum above the relief valve setpoint and check that the valve opens. The level switch in the tank will be tested and the mist eliminator will be cleaned annually. T-300 will be drained and cleaned at least annually. Additional regular maintenance may also be required according to the manufacturer recommendations.

3.2.2 Transfer Pumps P-300/400/401/500

Transfer pumps will be inspected monthly for operating pressure, leaks, excessive noise or heat. Oil and hydraulic fluids will be maintained at necessary levels during system operation. If any of the tanks are regularly reaching high alarm level, the corresponding transfer pump will be inspected for proper function. The transfer pumps shall meet the following criteria:

- Minimum Flow rate: 5 gpm
- Power: Approximately 1 horsepower (hp)

The pump and piping should always be protected against freezing temperatures. If there is any danger of freezing, the unit should be drained. To drain the pump, remove the drain plug at the bottom of the volute, and remove the priming plug to vent the pump. Drain all piping. If the pump is not going to be used for a long period, the pump should be drained of water and flushed with clean water.

The following pump parts should be replaced if any of these conditions are found during inspection:

- Impeller – Replace the impeller if any vane is broken, excessive erosion shows, or if labyrinth surfaces are worn. Impeller nut should be replaced if damaged.
- Mechanical Seal – Seal face, O-ring and sealing members should be free of burrs and dirt. Complete seal assembly should be replaced if not in perfect condition.
- Shaft – Shaft surface under seal must be clean, smooth, and without any grooves. It should be replaced if necessary.
- Volute and Seal Plate Labyrinth Surfaces (Wear Rings) – if worn, replace necessary part. If furnished with pressed in wear rings, only the rings need to be replaced.

3.2.3 Storage Tank T-301

The water level in T-301 is checked monthly and when the high-level alarm is activated. If the high alarm is activated routinely, the schedule for inspection and water removal will be updated and transfer pump P-400 will be evaluated for functionality.

T-301 will be drained and cleaned at least annually. Additional regular maintenance may also be required according to the manufacturer recommendations.

3.2.4 Bag Filter BF-400

Bag filter BF-400 is inspected monthly for damage to the filter or housing components. If damage is noted, the filter or housing components will be replaced. The pressure difference across BF-400 is monitored using the upstream and downstream pressure gauges. If pressure upstream of the bag filter increases by 10 psi compared to system startup or since the last bag filter replacement, the bag filter will be replaced. The bag filter will be replaced at least semiannually, if no pressure buildup occurs. Filter and other replacement parts are purchased from the original manufacturer to match the original system unless otherwise determined.

3.2.5 Liquid GAC Vessels LG-400/401/402/403

Liquid GAC vessel maintenance includes inspecting the physical condition of the vessels for damage or corrosion, checking for accumulated sediment or increased differential pressure, checking for channeling, and monitoring for breakthrough of the media. If the vessels are damaged or corroded, repair damage and remove corrosion or replace vessels. If sediment has been accumulated, sediment will be removed; if channeling is noted, the carbon will be replaced. If leakage is noted or if the differential pressure across a vessel increases by 10 psi, the carbon or vessel will be replaced. The Liquid GAC media is monitored for breakthrough by analyzing water samples taken monthly for the first two quarters, then quarterly until one year into Phase 3, then semiannually. The system will be shut down and the lead GAC vessels' media changed out when the lead GAC vessel control efficiency drops to 90% or below.

3.2.6 300-Gallon Storage Tank T-400

The water level in T-400 is checked monthly and when the high-level alarm is activated. If the high alarm is activated routinely, the schedule for inspection will be updated and transfer pump P-401 will be evaluated for functionality.

T-400 shall be drained and cleaned at least annually. Additional regular maintenance may also be required according to the manufacturer recommendations.

3.2.7 300-Gallon Mixing Tank T-500

The water level in T-500 is checked monthly and when the high-level alarm is activated. If the high alarm is activated routinely, the schedule for inspection and water removal will be updated and transfer pump P-500 will be evaluated for functionality.

T-500 will be drained and cleaned at least annually to remove accumulation of non-soluble amendment components. T-500 will be inspected monthly to ensure there is no accumulation of amendments. T-500 will be drained and cleaned as needed if excessive accumulation of non-soluble amendment components is noted prior to scheduled draining and cleaning. The tank mixer in T-500 is serviced per manufacturer's recommended schedule.

3.2.8 Oxygen Generator OG-500

OG-500 and associated air compressor will be inspected monthly and maintained per the manufacturer's recommendations. OG-500 must be inspected periodically for proper cycling pressures per the manufacturer's recommendations. Hinges and other appurtenances will be lubricated as needed, at least annually to ensure that the proper functioning of the oxygen generator and air compressor are not inhibited.

3.3 Vapor Treatment System

3.3.1 Liquid Ring Pump B-301

B-301 will be inspected monthly for oil level, operating pressure, leaks, and excessive heat, noise, and vibration. Inspection will include checking for oil in the scavenger tubing. If oil is present in the scavenger tubing, seals will be inspected and replaced as needed.

If the pump is to be shut down for more than a week, oil (such as Fluid Film, or equivalent) should be sprayed into the pump while it is rotating prior to shut down to coat all moving parts to prevent scaling and rusting. This should also be performed if moisture is expected or has been found to collect inside the pump.

The back pressure on the separator element will also be checked. The separator element shall be replaced if the back pressure exceeds 4 psig. The discharge pipe shall be checked for blockage. The inlet filter shall be cleaned or replaced. Any noted debris will be removed from the pump housing and motor fan guard. Any greased bearings shall be re-greased as needed.

After 500 hours of operation, the inlet filter will be checked, the strainers will be cleaned, and the temporary inlet screen removed. The inlet filter will be cleaned or replaced if needed.

Annually, the seal fluid will be replaced and couplings will be checked for wear and replaced as needed. Gear-end oil will be drained and replaced if the gear-end oil level is low.

Between 20,000 and 25,000 hours of operation, the motor bearings should be replaced. The motor must be taken to a UL-listed motor shop to change the bearings and keep the XP rating.

3.3.2 Heat Exchanger HEX-302

The heat exchanger will be inspected monthly for damage. Coils should be checked for buildup of debris. Compressed air or canned air conditioner coil leaner can be used to clean the coils.

3.3.3 Temporary Catalytic Oxidizer TO-400

The Catalytic Oxidizer is inspected weekly until treatment is transitioned to GAC treatment based on sampling results. TO-400 will be inspected weekly for damage to any parts.

The catalytic oxidizer will be operated pursuant to the vendor operating instructions (included in Appendix E) and consistent with the substantial requirements of the PSCAA permit including meeting control efficiency and operating requirements. Appendix B includes PSCAA operation and monitoring requirements for the catalytic oxidizer. The catalytic oxidizer shall be operated at a minimum temperature of 580ºF. The temperature will be measured weekly to check that proper temperature increase is maintained. If a temperature drop is noted, the catalytic oxidizer shall be inspected for accumulated carbon and organic matter. Any accumulated matter shall be removed through burn-out or air lancing.

3.3.4 Vapor GAC Vessels GAC-400/401

Vapor GAC vessel maintenance includes monthly inspection of the physical condition of the vessels for damage or corrosion and removal of accumulated water. Any corrosion or damage will be repaired as needed.

The Vapor GAC vessels will also be monitored for breakthrough of the media in accordance with PSCAA requirements (Appendix B). The Vapor GAC media is monitored for breakthrough by analyzing vapor samples collected using a handheld instrument [e.g., photoionization detector (PID)] at the inlet to the lead vapor GAC vessel, at the inlet of the second vapor GAC vessel (mid-point of the treatment system), and at the outlet of the second GAC vessel, as discussed in Section 5. The system will be shut down and the lead GAC vessels' media changed out with unspent carbon when the volatile organic carbon (VOC) concentration at the mid-point of the treatment system reaches any limits established in substantial requirements of the PSCAA permit. As shown in Appendix B, breakthrough is defined as the detection at the outlet from the lead GAC vessel of the higher of the following:

- 10% of the inlet stream concentration to the lead vessel (90% or less control efficiency)
- 10 ppmv, measured as hexane or its equivalent

Monitoring for breakthrough of the media will occur monthly during the first two quarters of operation, and then, depending on actual changeout frequency during operation, transition to quarterly during Phase 2 and through the first year of Phase 3, and then semiannually.

3.4 System Control

After system installation, the construction contractor completed the electrical inspections at start-up and one week after operation begins. These inspections were recorded on the mandatory electrical inspection form, included in Appendix F, and are included in the constructor contractor’s Construction Completion Report. An electrical inspection will also be completed two months and one year after operation begins. The results of these inspections will be recorded using the mandatory electrical inspection form and the completed form will be sent to warrantyfulfillment@prmfiltration.com.

3.4.1 Control Panel and Programmable Logic Controller (PLC)

The control panel is checked monthly for proper operation and system status. Individual light bulbs and fuses are replaced as needed. These parts will be accessed by opening the front door of the control panel. Electrical power must be disconnected before any repairs are made inside the control panel. Lock out/tag out procedures, as outlined in the standard operating guidelines (SOGs) in Appendix G, will be followed as appropriate. Any other repairs will be completed by a qualified electrical contractor.

3.4.2 Alarms

Alarms shall be tested semiannually to confirm proper functionality. If alarms are not functioning properly, they shall be replaced.

3.4.3 Meters, Gauges, and Valves

Flow meters shall be inspected monthly for damage, corrosion, or water accumulation. Flow meters shall be inspected annually while the system is not operational to verify zero calibration.

Temperature and pressure gauges shall be inspected monthly for damage, corrosion, or improper functioning. Malfunctioning gauges shall be replaced, as necessary.

Inspect valves monthly for corrosion, silt buildup, and damage. Exercise the valves monthly through the full range of motion to verify proper functioning.

Meters, gauges, and valves shall also be inspected monthly and maintained in accordance with manufacturer recommendations.

3.4.4 Treatment Shed

The Treatment Shed will be checked during each site visit or at least monthly for evidence of external or internal damage, leaks, loss of weatherproofing or insulation, loss of soundproofing (see details in Section 5), and any other change in condition detrimental to system operation. Changes to the condition will be noted and appropriate corrective actions will be performed. Electric baseboard heaters should be cleaned regularly per manufacturer's instructions using compressed air if dust build up is noted on the heating fins. Inspect black anodized heat sink for wear on the paint and repaint/replace as needed.

3.5 Spare Parts

Extra plugs, sample ports, bolts, and gauges will be kept on-site in the Treatment Shed in case of damage or loss of existing parts to the system components. The spare parts that should be kept in stock at all times, as space allows, include:

- Bag filters
- Fittings, such as PVC elbows, tees, and unions
- Manual valves
- Flow meters

3.6 Troubleshooting

Troubleshooting procedures will vary depending on the circumstances and are summarized in Table 5 and will be updated as needed during system operation.

3.7 Waste Management

Waste generated by the operation of the MPE system includes condensate and spent carbon.

Condensate from the Vapor Liquid Separator T-300 is pumped into drums for characterization and disposal at an approved facility. Condensate is expected to be characterized as non-hazardous waste.

Spent granular activated carbon generated during operation of the MPE system will be removed using a vacuum extraction device and placed in Department of Transportation (DOT)-approved 55-gallon drums or supersacks, characterized, sealed and hauled from the site under a waste manifest. The carbon will be analyzed using the Toxicity Characteristic Leaching Procedure (TCLP) and disposed of at an approved facility. The carbon will be analyzed annually to update the disposal profile.

Upon waste profile determination, the condensate and carbon will be transported to a treatment, storage and disposal (TSD) facility approved as a Hazardous Waste Management Vendor or Non-Hazardous Waste Management Vendor. A maximum of one drum or supersack is allowed to be kept on site at a time if space allows for storage of the drum or supersack in a safe location. Containers for both media will be identified with an appropriate waste classification label placed on each container indicating the generators name, site address, contact number, general waste description, and generation date.

Section 4: System Operation

The MPE and groundwater recirculation system operation includes both startup and long-term operation. The startup phase includes operation and well performance testing.

4.1 Well Performance Testing

Performance testing of the EIWs was conducted upon startup of continuous MPE system operation. Performance testing was completed by the construction contractor. The objective of the performance testing is to determine the vacuum/flow relationship for each well screen. The well performance testing may use the GAC treatment in lieu of the catalytic oxidizer if necessary. Performce testing consists of the following activities:

1. Install a DS-300 pitot tube and differential pressure gauge at the 3/8-inch threaded plug after the SSD well connection, as shown on P&ID-2 for startup testing (Appendix D).
2. Add water to the Vapor Liquid Separator (T-300) until the level is visible in the level glass. Measure the liquid level and record the result.
3. Open the dilution air inlet to 100%.
4. Close all screens at the piping manifolds, except the first screen to be tested.
5. Start the blower.
6. Monitor the vacuum and vapor flow rate at the manifold leg for the active well screen and allow it to operate for a minimum of 10 minutes.
7. Measure the liquid level every five minutes in T-300, recording the elapsed test time for each measurement.
8. After each 10-minute interval, increase the extraction rate by closing the dilution valve up to a maximum vacuum of 22 in Hg measured at the inlet to the blower.
9. Continue to record time, flow, vacuum, and T-300 liquid levels through a minimum of three flow increments until the maximum vacuum of 22 in Hg is reached.
10. Open the dilution air back to 100% and repeat for each well to be tested.
11. At the conclusion of the startup testing, remove the DS-300 pitot tube and differential pressure gauge.

4.2 Continuous Operation

After completion of the startup testing, continuous operation will begin. It is planned that the system will operate in three phases over the life of the system:

1. **Phase 1 – Multiphase extraction**. The EIWs will be operated to extract groundwater and soil vapor from the subsurface for treatment. Extraction will occur from all wells and all sub-slab depressurization locations. Vapors will be treated with the catalytic oxidizer until extraction vapor concentrations are reduced to 500 ppm; when this concentration is reached, the catalytic oxidizer will be removed and GAC will be employed. The use of the catalytic oxidizer is estimated to last from one to three months. GAC will be employed until groundwater concentrations stabilize and approach asymptotic levels, approximately six to 12 months, after which Phase 2 will commence.

2. **Phase 2 – Surfactant reinjection**. When groundwater concentrations stabilize and approach asymptotic levels, the system will begin reinjection with surfactant addition. Surfactants in the reinjected water will act to liberate hydrocarbons adsorbed to soils. Reinjection will occur until the liquid phase concentrations have dropped to a level indicative of asymptotic performance of the surfactant reinjection. Phase 2 duration is estimated to be six months.

3. **Phase 3 – Enhanced bioremediation.** Once Phase 2 is complete the surfactant reinjection will be replaced with oxygen/nutrient addition to the reinjected water. Operation will be rotated between the four sets of wells monthly to quarterly based on the monitoring results. Enhanced bioremediation will be conducted until the site constituents of concern have been reduced significantly in the wells or site cleanup levels have been reached. Phase 3 duration is estimated to last for 24 to 48 months.

Flow rates for active EIWs will be adjusted as needed throughout MPE system operation. The estimated operational durations described above are anticipated to change and will be modified as necessary to accommodate reinjection of treated groundwater and the use of GAC vessels for treatment.

At the conclusion of active remediation system operation, the site will transition to a period of monitored natural attenuation and confirmation monitoring. Compliance monitoring activities, including performance monitoring during system operation and confirmation monitoring to demonstrate attainment of site cleanup levels, are described in the Compliance Monitoring Plan (CMP) and in the SAP/QAPP included in Appendix H.

4.2.1 Phase 1 – Multiphase Extraction

The MPE system will commence operation, removing one to three pore volumes of impacted groundwater from the site until asymptotic concentrations are reached in the extracted groundwater. Pore volume information will be provided by Kennedy Jenks. The total volume extracted is measured at the flow totalizer at the discharge to the sanitary sewer after T-400. Extracted groundwater will be treated with GAC and discharged to the City sanitary sewer system that drains to the Publicly Owner Treatment Works (POTW) operated by King County. Soil from the surface to the depth of the exposed saturated zone will be remedied by the extraction of vapor from the unsaturated soils. The vapor will be treated with a catalytic oxidizer until extraction vapor concentrations are reduced to 500 ppm; when this concentration is reached, the catalytic oxidizer will be removed, and GAC will be employed for air treatment. Treated air will be discharged through an exhaust pipe. The use of the catalytic oxidizer is estimated to last from one to three months. GAC will be employed until groundwater concentrations stabilize and approach asymptotic levels, approximately six to 12 months, after which Phase 2 will commence.

Preliminary startup operations indicated that vapor concentrations were below 500 ppm (measured as isobutylene using a PID) when operating the system with all wells open 100%, including the SSDs. Closing SSDs completely resulted in inlet concentrations above 950 ppm, which caused the vapor control valve (VCV) of the Catalytic Oxidizers (CatOx) to close and VCV air dilution to open, thus dropping the vacuum to the extraction wells. A relatively steady state operation is preferred, therefore an inlet vapor concentration of 700 to 800 ppm should be targeted. The following provides example system startup and adjustments:

1. Select Extraction Well Banks 1 – 4 to green on HMI screen.
2. Open valves to all wells to 100% open on Manifold B.
3. Confirm manual air dilution valve at Vapor Liquid Separator is closed.
4. Start the blower. The VCV will close and VCV air dilution will open 100%. The VCV will begin to slowly open as TO-400 heats up to setpoint temperatures and VCV air dilution will begin to close. This process takes approximately 15 minutes.
5. Adjust SSD gate valves closed until vacuum is approximately 20-inches water column (WC) or less at Manifold A. The vacuum on each individual well at Manifold B is expected to be between 5 and 10 in Hg.
6. Allow system to operate until TO-400 temperatures stabilize. Temperatures around 700-750ºF indicate diluted soil vapor and temperatures of 950-1000ºF indicate excessive concentrations that may continue to climb and cause VCV to close and loss of vacuum at wells. Measure VOC concentrations at the coalescing filter for target concentration.
7. Adjust extraction rates from SSD wells by opening the valves to reduce inlet concentrations or closing the valves to increase concentrations. Certain wells have less measured VOC concentrations and may be closed completely to increase vacuum and flow rates from other wells and, potentially, VOC concentrations.
8. Balance the extraction rates for each well screen in each Well Bank by closing the dilution valve (if open), and adjusting the individual valves at the piping manifolds.
9. Extraction will be applied to all wells with the limitation that the number of wells and applied vacuum will be limited to maintain groundwater extraction rates within the limits of the groundwater treatment system from one to three gpm.
10. Operation will continue until one to three pore volumes are removed from the area of impacted groundwater or groundwater concentrations stabilize.

11. Recovered groundwater will be treated and discharged to the City sanitary sewer with no reinjection during initial MPE operation.

4.2.2 Phase 2 – Surfactant Reinjection

Extraction will be performed from one of the four sets of EIWs while reinjection of treated water amended with surfactant will occur in two sets of wells. A fourth set of wells will be allowed to rest. Operation will be cycled between the four sets of wells monthly until liquid phase concentrations have dropped to a level indicative of asymptotic performance of the surfactant reinjection. At that point surfactant injection will be discontinued and Phase 3 will begin.

Surfactant reinjection will employ injection in two out of four well banks while extracting from one well bank. The fourth well bank will be allowed to rest idle. See Section 4.3 for details on the injection and extraction schedule and well bank cycling.

A surfactant (ETEC, Inc.'s PetroSolv™, or equal) will be added to the 300-gallon mixing tank biweekly (every two weeks) by the operator. It is anticipated that approximately 100 gallons of surfactant will be added each month (50 gallons every two weeks). Surfactants are added to the 300-gallon mixing tank, dissolved by the extracted/treated groundwater, and reinjected. Extracted/treated groundwater is added to the 300-gallon mixing tank and reinjected with no amendments until the next round of amendments is added.

Surfactant Reinjection operation consists of the following tasks:

1. Open the dilution air inlet to 100 percent.

2. At start of reinjection, set Well Bank 1 to extraction and Well Banks 2 and 4 to injection mode at the PLC. Well Bank 3 will be idle initially; close the manual isolation valve and flow control valve for Well Bank 3 so extraction/injection does not occur.

3. Start the blower.

4. Balance the injection rates for each well screen in Well Banks 2 and 4 by adjusting the individual valves at the piping manifolds. Balance the extraction rates for each well screen in Well Bank 1 by closing the dilution valve and adjusting the individual valves at the piping manifolds.

5. Injection will be applied to the two active Well Banks (Banks 2 and 4 to start) with the limitation that the number of wells and applied pressure will be limited to maintain groundwater injections rates of one to three gpm.

6. Extraction will be applied to the active Well Bank (Bank 1 to start) wells with the limitation that the number of wells and applied vacuum will be limited to maintain groundwater extraction rates within the limits of the groundwater treatment system from one to three gpm.

7. Extracted water will be treated via the liquid GAC system and transferred to storage tank T-400. From Tank T-400, liquids will be transferred to mixing tank T-500 to prepare the next batch of surfactant for injection.

8. If injection rates are not fast enough to keep up with extraction rates, some of the treated extracted water may be discharged directly to the City sanitary sewer based on a timer controlled on the PLC.

9. Allow mixing tank (T-400) to complete one cycle of injections with recovered groundwater only before adding liquid surfactants. Manually start the tank mixer and add surfactants into the top of the tank. Continue mixing until all dry amendments are dissolved (typically 30 minutes) before turning off the mixer.

4.2.3 Phase 3 – Enhanced Bioremediation

Once liquid phase concentrations have dropped to a level indicative of asymptotic performance of the surfactant reinjection, the surfactant injection will be discontinued and replaced with oxygen/nutrient addition to the reinjected water. Operation will be rotated between the four well banks monthly to quarterly based on the monitoring results. Operating methods are otherwise the same as for Phase 2, with the replacement of surfactant with the amendments. The amendments will be ETEC Inc.'s PetroBac™, comprised of a TPH Bacterial Consortium (EZT-A2TM) and an Enzyme Accelerator, or other equal product, and ETEC Inc.'s CBN™ nutrients, or other equal product. These amendments will be added to the 300-gallon mixing tank approximately biweekly (every two weeks) by the operator. It is anticipated that approximately 10 gallons of PetroBac™ and 400 lbs of CBN™ will be added each month (10 gallons and 200 lbs, every two weeks).

4.3 Injection and Extraction Schedule

The 13 EIWs have been plumbed into four groups of wells: Well Bank 1, Well Bank 2, Well Bank 3, and Well Bank 4 (see Table 1). During surfactant reinjection and enhanced bioremediation, two well banks shall be operated in injection mode while one well bank is simultaneously operated in extraction mode and the fourth group is idle. Well banks modes are selectable on the PLC panel. If injection rates are not fast enough to keep up with extraction rates, some of the treated extracted water may be discharged directly to the City sanitary sewer.

The well banks set to extraction and injection modes will be changed periodically during system operation. Initially, Well Bank 1 shall be set to extraction mode and Well Banks 2 and 4 will be set to injection mode at the PLC. Well Bank 3 will be idle during the first month. To reduce the amount of electron acceptors and nutrients extracted from the groundwater and discharged to the City sanitary sewer, the Extraction Group will always be scheduled to follow the previous month's idle group. The operating schedule is as follows:

Month 1: Bank 1 Extraction, Bank 2 Injection, Bank 3 Idle, and Bank 4 Injection

Month 2: Bank 1 Injection, Bank 2 Idle, Bank 3 Extraction, Bank 4 Injection

Month 3: Bank 1 Injection, Bank 2 Extraction, Bank 3 Injection, Bank 4 Idle

Month 4: Bank 1 Idle, Bank 2 Injection, Bank 3 Injection, Bank 4 Extraction

The well banks used for injection and extraction are changed every month for the first six months of Phase 2 or Phase 3. After six months in the current phase, the total volumes injected into each area will be reviewed and the injection times increased for critical areas. Likewise, if monitoring the discharge to the City sanitary sewer reveals excessive nitrate (greater than 10 milligrams per liter (mg/L)) or orthophosphate (greater than 5 mg/L), the Idle Bank timing should be increased. This increase in Idle Bank time will give microbes more time to consume the amendments before the wells begin extraction again. This will reduce wasting treatment amendments that would otherwise be discharged to the City sanitary sewer.

4.4 Well Performance Refinement

Flow adjustments can be made to individual wells within each bank if the pressures exceed those of the other wells within the group by more than 20%. This is necessary to reduce the potential for injected groundwater and amendments to short circuit to the surface or follow preferential flow paths to other areas of the site. Likewise, a well that is less than 50% below the average pressure should be investigated for an injection line break or the material being injected into utility backfill material.

If an individual well has pressures exceeding those of the other wells in the group by more than 20%, the flow into this well should be decreased. If an individual well has pressures less than those of the other wells in the group by more than 20%, the flow into this well can be increased to reduce the amount of water discharged to the sanitary sewer.

If concentrations of VOCs or GRO/BTEX are consistently noted to be higher in specific wells or during extraction from a specific well group, amended groundwater injection should be increased for these wells (or well group) to further enhance the biodegradation and removal of petroleum hydrocarbons.

4.5 Shutdown and Startup Procedures

Mid-operation shutdown and startup procedures, such as shutdown for media replacement, emergency stops and restarts, are shown on the HMI screens included in Appendix I. Some equipment must be shut down according to manufacturer's instructions before maintenance is performed. If the system is shutdown, the operator shall restart the system following the original start up procedures, then proceed with the current phase of operation prior to shutdown. The system will be shut down as part of maintenance activities outlined in Table 3, including oil changes for the liquid ring pump, bag filter replacement, tank cleanouts, and other activities where the manufacturer’s instructions call for system shutdown prior to maintenance.

Section 5: Monitoring and Reporting

System performance data will be collected from the three points of compliance (soil, water and air) where cleanup levels established for the site must be achieved. Sample data sheets for these monitoring points of compliance are included in Appendix F or an electronic equivalent. These sample data sheets are living documents that are updated as needed.

A monitoring schedule was generated describing the process for data collection and monitoring of the MPE and groundwater recirculation system and is included as Table 6.

The operator is responsible for performing operation, maintenance and monitoring of the remediation system as described in the engineering design report (EDR), CMP, and SAP/QAPP. The operator is anticipated to conduct the following compliance monitoring sampling activities during remediation system operation and following shutdown:

- Collection of treatment train water samples from the treatment system for laboratory analysis.
- Collection of influent, mid-point, and/or effluent vapor samples from the treatment system and from individual extraction wells for field and laboratory analysis.
- Collection of vapor samples from SSD wells and vapor monitoring pins for field analysis.
- Collection of groundwater samples from monitoring wells for performance monitoring (at startup, and then at varying frequencies including monthly, quarterly, and/or semiannually, depending on system operating phase, well location, and required laboratory analyses) and confirmation monitoring (quarterly until results from four consecutive quarters are below site CULs).
- Collection of confirmation soil samples to demonstrate site CULs have been achieved in soil.
- Collection of soil and/or water samples for waste disposal characterization as required by the disposal facility.

Additional details on operator's responsibilities for monitoring are included in the CMP and SAP/QAPP included in Appendix H.

Monitoring locations, methods, frequency, data management, and reporting are described in the following subsections.

5.1 Measurement Parameters

Parameters monitored during operation of the MPE system and following shutdown include the following:

- Vacuum/Pressure

- Airflow
- Groundwater flow
- Noise level
- Temperature
- VOC Concentrations
- Oxygen, carbon dioxide and combustible gas
- GRO/BTEX/Selected Chlorinated VOCs (Selected CVOCs)/Fats, Oils, and Grease (FOG) Concentrations
- Nitrate and Orthophosphate Concentrations
- pH and Turbidity

Table 6 is a summary of the monitoring schedule and includes the frequency of collection of each measurement parameter.

5.1.1 Vacuum/Pressure

When vacuum measurements at wells or the treatment system are measured, the local barometric pressure is also recorded.

Individual Wells

Vacuum is measured for individual wells, including the SSD wells, in operation at the vacuum gauge located on each extraction line (VI-100 through VI-114).

Vacuum is also measured at each of the vapor pins. Vacuum can be measured with any of the following handheld instruments (or similar):

- Dwyer 477AV-3 Digital Manometer:
  - Pressure differential sensor with ± 0.5% accuracy
  - Display of negative, positive, and differential pressure
- Dwyer Magnehelic vacuum gauges (various ranges and models):
  - Accuracy of ± 2%

Groundwater injection pressure is measured for each well at Manifold C via pressure indicators installed for each well. Injection flow and injection pressures will be monitored during system operation to detect well plugging or fouling. Groundwater injection pressure is only measured during Phases 2 and 3.

Treatment System

Vacuum or pressure gauges are located at the following points along the treatment train:

- Before Vapor Liquid Separator (PI-210)
- After Vapor Liquid Separator, before liquid ring pump (PIT-300)
- Before heat exchanger (PIT-302)
- Before storage tank T-301 (PI-310)
- Before bag filter (PIT-400)
- After bag filter (PIT-401)
- Between and after liquid GAC vessels (PI-403, PI-406, PI-404)
- Before, between, and after vapor GAC vessels (PI-410, PI-411, PI-412)
- Before mixing tank T-500 (PI-408)
- After transfer pump P-500 (PIT-501)
- On the oxygen generator feed line (PIT-502)
- After the venturi injector (PIT-503)

5.1.2 Airflow

Individual Wells

Airflow can be measured for individual wells, including the SSD wells, in operation at the corresponding manifold legs. Due to the multi-phase nature of the extraction system, a small vapor-liquid separator system will need to be employed at each well leg to separator the liquid from the air. Airflow can then be measured using any of the following instruments (or similar):

- Dwyer 471B Thermo-Anemometer:
  - ± 1.6 feet per minute (ft/min) accuracy
  - Air velocity range of 45-6,000 ft/min
- TSI TA430 Airflow Velocity Meter:
  - ± 3 ft/min accuracy
  - Air velocity range of 0 to 6,000 ft/min

Treatment System

A flow indicator and transmitter (FI/FIT 302) is located before the heat exchanger. Airflow can be measured at the sampling ports before, after, and between the vapor GAC vessels, but this flow should be equivalent to the flow at FI/FIT 302 since there is no significant airflow losses along the treatment train.

The maximum influent flow rate to the catalytic oxidizer/Vapor GAC vessels shall not exceed 300 cubic feet per minute (cfm), in accordance with the PSCAA requirements (Appendix B).

5.1.3 Fluid Flow

Individual Wells

Groundwater injection flow rate is measured for each well at Manifold C via flow indicators installed for each well. Injection flow and injection pressures will be monitored during system operation to detect well plugging or fouling. Groundwater injection flow rate is only measured during Phases 2 and 3.

Treatment System

A flow indicator is installed at the following locations to measure water flow through the treatment system:

- After the bag filter (FI-400)
- After the liquid GAC vessels (FI-404, FI-407)
- Before transfer to mixing tank T-500 (FI-401)

A flow indicator and transmitter (FI/FIT-500) is located before the discharge to the sanitary sewer and totalizes the fluid volume discharged to the sanitary sewer. This total volume discharged to the sanitary sewer is reported on the PLC.

5.1.4 Noise Level

The noise emitted by the system will be measured quarterly to confirm compliance with the City's noise ordinance (limit of 60 dBA Leq). Noise level shall be measured outside of the treatment shed using a hand-held dBA noise level meter. If the noise level of the system is noted to be above the limit, Kennedy Jenks personnel will be notified, the source of the excessive noise will be determined, and noise reducing measures will be implemented until the noise level of the system is within the limit.

5.1.5 Temperature

A temperature indicator is located at the heat exchanger (TT-302). The temperature of the heat exchanger will be recorded during monitoring events. The ambient temperature will be measured and recorded during each monitoring event.

The temperature at the catalytic oxidizer shall be continuously measured and recorded. The minimum operating temperature for the catalytic oxidizer is 650˚ Fahrenheit (Appendix B).

5.1.6 TPH/BTEX Concentrations

TPH/BTEX concentrations are measured for individual wells and the treatment system using both field methods and laboratory analysis. TPH/BTEX concentrations are measured in the field using a PID.

5.1.6.1 TPH/BTEX Concentrations - Field

Individual Wells:

TPH/BTEX concentrations are measured for individual wells in operation using a PID at the corresponding manifold legs. Sample collection will be performed as indicated in the SAP/QAPP. TPH/BTEX concentrations can be measured using any of the following instruments (or similar):

- MiniRAE 2000 or 3000, PID
- RAE Model 8000, PID

TPH/BTEX concentrations will also be measured at each of the vapor pins and the SSD wells. TPH/BTEX concentrations will be measured with low-detection PIDs (ppbRAE 3000 or equal) and Four Gas Analyzers (RKI Eagle 2 or equal). If TPH concentrations measured at the SSD or vapor pins exceed 425 parts per billion (ppb) and/or if combustible gas is measured above 20% lower explosive limit (LEL), then vapor samples will be collected for laboratory analysis using standard soil gas sample collection procedures in Summa canisters analyzed for appropriate Environmental Protection Agency (EPA) methods for fixed gases (ASTM D1945) and hydrocarbon species.

Treatment System

TPH/BTEX concentrations are measured at several sampling ports located throughout the treatment train using a PID or an engineer-approved substitute. Sampling ports are located as follows:

- Prior to and after the catalytic oxidizer (when installed)
- Prior to, at the midpoint of, and after vapor GAC vessels

In accordance with PSCAA requirements, TPH/BTEX concentrations shall be measured monthly when the catalytic oxidizer is being used for treatment and twice per week when the vapor GAC vessels are being used (see Appendix B).

5.1.6.2 TPH/BTEX Concentrations - Laboratory

Samples of vapor for laboratory analysis are collected using Summa canisters and submitted for analysis by EPA Method TO-15.

Individual Wells

Samples are collected at the manifold legs corresponding to individual wells in operation for analysis of TPH/BTEX concentrations at each well.

Treatment System

Samples are collected at the combined inflow sample port after the Vapor Liquid Separator, and at the combined effluent sample port prior to air discharge. The sample ports are shown on the vendor drawings (Appendix E).

5.1.7 GRO/BTEX/Selected CVOCs/FOG Concentrations - Laboratory

Treatment System

Samples are collected at the following locations:

- Influent to the liquid GAC vessel trains
- Midpoint of each train
- Effluent of the liquid GAC vessel trains

Samples will be analyzed for GRO, BTEX, Selected CVOCs (tetrachloroethylene, trichloroethylene, cis-1,2-dichloroethylene, trans-1,2-dichloroethylene, vinyl chloride), and fats, oils and grease (FOG). Frequency will be in accordance with Table 6.

5.1.8 Nitrate and Orthophosphate – Laboratory

Treatment System

Samples are collected at the following location:

- Effluent of the liquid GAC vessel trains (Phase 3 only)

The samples will be analyzed for nitrate as nitrogen and total orthophosphate. As noted in Section 4, if the sample results reveal excessive nitrate (greater than 10 mg/L as Nitrogen) or excessive orthophosphate (greater than 5 mg/L), the well bank timing shall be adjusted.

5.1.9 pH and Turbidity

pH and turbidity will be measured during any water sampling event (both treatment train and point of discharge to sanitary sewer samples) using a calibrated field meter.

5.2 Additional Monitoring

Individual Wells

Samples will be collected at the wellhead of individual wells (as identified in the SAP/QAPP, Appendix H) for analysis of GRO, BTEX, and monitored natural attenuation parameters. See details in the SAP/QAPP regarding sampling frequency, monitoring well locations, and sampling methodology.

Soil Borings

Confirmation soil samples will be collected after remedial system operation has ended. Up to eight soil boring will be advanced to approximately 20 feet below ground surface. See details in the SAP/QAPP regarding soil boring locations and sampling methodology.

Treatment System

In accordance with the KCIW requirements, if operating criteria are exceeded during discharge to the sanitary sewer, additional samples will be collected and analyzed for settleable solids, hydrogen sulfide, and explosivity (see Appendix A).

Secondary Containment

Secondary containment is installed in two locations: (1) surrounding the liquid GAC vessels and water storage tanks (T-301 and T-400) and (2) surrounding the southern half of the Treatment Shed, where the mixing tank (T-500) is located. A high-level float switch (LSH-600, LSH-601) is installed in each secondary containment and connected back to the PLC. An alarm will be triggered if the switch is activated, indicating a possible overflow from one of the tanks.

5.3 Data Handling, Evaluation, and Reporting

Data is collected on paper field forms, or equivalent electronic field forms, and transcribed into spreadsheets for analysis. Laboratory data and associated field parameter data is obtained in electronic format and stored in a database. Draft monitoring form templates are included in Appendix F.

To meet the objectives of the performance monitoring program the data will be used as described in the following sections to:

- Comply with applicable permits.
- Optimize mass removal.
- Document progress toward asymptotic removal.

The operator will communicate with Kennedy Jenks and Ecology prior to site visits and coordinate if specific equipment should be inspected or if specific maintenance activities have been identified that need to be performed.

5.3.1 Inspection and Maintenance Documentation

Field forms will be completed and submitted for the system component inspection and maintenance activities identified in Section 3 and Table 3. The operator will submit electronic copies of these field forms to Ecology by the following Monday during system monitoring and inspection activities. Field forms will also be submitted by the following Monday for site visits for the Phase 2 surfactant addition and mixing and Phase 2 nutrients/bacteria amendment addition activities. The operator will submit to Ecology documentation of minor repairs conducted as part of the inspection and maintenance activities (if any).

The operator will provide documentation demonstrating removal of the catalytic oxidizer and connection of the vapor GAC vessels on the air treatment train, once completed. Documentation for this event includes:

- Documentation indicating that requirements are suitable for removal of the catalytic oxidizer. This documentation will be provided to Ecology a minimum of two weeks prior to operator performing the removal.

- Documentation of removal of catalytic oxidizer and connection of vapor GAC vessels will be provided to Ecology a maximum of four weeks after completion.

Any other major repairs will be documented via a written progress report and photographs, provided to Ecology within two weeks of completion.

Further details on reporting requirements are included in the SAP/QAPP.

5.3.2 Reporting

The operator will provide Ecology with monthly updates on the project schedule, budget, scope of work, and deliverables. This will include preparation of a brief monthly progress update and attendance of routine progress update calls (approximately 30-minutes in duration).

The operator will also provide Ecology with Remedial Progress Evaluation reports, on a monthly, quarterly, and/or annual basis, as identified in the SAP/QAPP. Additional details on the update and report requirements are included in Section 8 of the SAP/QAPP.

5.3.3 Permit Compliance

The efficacy of the vapor treatment system will be confirmed via sampling and analysis of the influent and effluent vapor streams, in accordance with requirements from the PSCAA (see Section 1.2 and Appendix B). The catalytic oxidizer influent and effluent will be monitored monthly during operation via handheld PID vapor samples. The vapor GAC vessels will be monitored for breakthrough of the media by analyzing with a handheld PID vapor samples collected at the inlet to the lead vapor GAC vessel, mid-point of the two vapor GAC vessels, and at the outlet of the second GAC vessel. This monitoring will be completed twice per week, in accordance with the PSCAA requirements (Appendix B).

The efficacy of the liquid treatment system will be confirmed via sampling and analysis of the influent and effluent liquid streams, in accordance with the requirements of the discharge permit for the City sanitary sewer (Section 1.2 and Appendix A). Weekly samples will be collected between the lead and lag liquid GAC vessels for breakthrough of BTEX compounds. The operator may request a reduced frequency of sample collection from KCIW based on analytical results.

If parameters exceed one of the limits listed in Section 1.2.1 or Section 1.2.2, the system is adjusted, or the GAC is replaced to return the system to compliant operation.

5.3.4 Document Asymptotic Removal

System operation will be documented through reports provided to Ecology and Kennedy Jenks by the operator. The responsibilities, content, and frequency for data reporting and remedial progress reporting to Ecology during operation and maintenance of the MPE system and compliance monitoring will be as provided in Section 8.4 of the SAP/QAPP.

During system operation, progress towards the objective of asymptotic removal of VOCs from the site will be visualized using time-series graphs prepared by Kennedy Jenks of the calculated mass removal rate and cumulative mass removed. The mass removal rate will generally decline over time, with fluctuations, as changes are made to the MPE system operation. As the mass removal rate decreases, the cumulative mass removed graph will gradually approach a horizontal line, which is indicative of asymptotic removal when additional operation yields little change in the mass removed.

References

Kennedy Jenks. 2017a. Remedial Investigation/Feasibility Study Report, Former Circle K Site. 14 December 2017.

Kennedy Jenks. 2017b. Cleanup Action Plan, Former Circle K Site. 18 December 2017.

Kennedy Jenks. 2017c. Pilot Study Work Plan, Former Circle K Site. 1 February 2017.

Kennedy Jenks. 2021. Technical Memorandum Re: Existing Project Data Review and Design Data Gap Analysis, Contract C2100069. 16 June 2021.

Kennedy Jenks. 2021. Engineering Design Report: Former Circle K Site 1461, Seattle, Washington. Prepared for Department of Ecology, State of Washington. 10 December 2021.

Tables

Table 1: Multi-Phase Extraction System Well Details

	Well Bank #	Screened Interval (ft bgs)	Sand Interval (ft bgs)	Applied Vacuum (in.w.c.)	Casing Diameter (in)	Pipe Diameter (in)	Pipe Run[(a)] (ft)
Existing Monitoring/Remediation Wells							
MW-4	4	4-18.8	5-22	28	2	1	160
RW-2	4	5-20	5-22	28	4	1	110
RW-3	1	5-20	5-22	28	4	1	100
RW-4	2	5-20	5-22	28	4	1	90
RW-5	3	5-20	5-22	28	4	1	70
RW-6	4	5-20	5-22	28	4	1	130
RW-7	1	5-20	5-22	28	4	1	70
New Remediation Wells							
SW-1	2	6-21[(b)]	4-21[(b)]	28	4	1	110
SW-2	3	6-21[(b)]	4-21[(b)]	28	4	1	80
SW-3	1	6-21[(b)]	4-21[(b)]	28	4	1	80
RW-8	2	5-20	5-22	28	4	1	100
RW-9	1	5-20	5-22	28	4	1	50
RW-10	3	25-30	5-22	28	4	1	80

Note and Abbreviations:

(a) Pipe run approximated from Construction Drawings. Pipe run lengths will be updated after system installation is complete.
(b) Depth expressed as measured depth within well casing. Well drilled at 30 degree angle.
ft bgs = feet below ground surface.
in.w.c. = vacuum or pressure in inches water column.
in = inches

Table 2: Alarms and Responses

Alarm or Indicator	Cause	System Response	Alarm Type	Operator Response
High-high water level (LSHH-300, LSHH-301, LSHH-400, LSHH-500)	High water level in moisture separator/storage/mixing tank	Shutdown LRP or transfer pump filling tank (LRP, P-300/301/400)	PLC Indicator	Inspect transfer pump after tank or LRP to determine issue and conduct necessary repairs. Restart pump or LRP.
Liquid Ring Pump Inlet Low or High Vacuum Alarm (VT-300)	Vacuum 2 in Hg above or below normal operating pressures on blower inlet piping	For low vacuum, generate alarm and notify operators. For high vacuum, shut down LRP.	System alerts designated contact person via remote telemetry	Inspect LRP and Moisture Separator to determine issue and conduct necessary repairs. Restart system.
Liquid Ring Pump Discharge High Pressure Alarm (PT-302)	High pressure after Liquid Ring Pump	Generate alarm and notify operators. Shut down LRP.	System alerts designated contact person via remote telemetry	Inspect LRP and Heat Exchanger to determine issue and conduct necessary repairs. Restart system.
Liquid Ring Pump High Temperature Switch	Internal high temperature switch at LRP	Generate alarm and notify operators. Shut down LRP.	System alerts designated contact person via remote telemetry	Inspect LRP and Heat Exchanger to determine issue and conduct necessary repairs. Restart system.
Liquid Ring Pump Low or High Oil Switch	Internal high or low oil level switch at LRP	Generate alarm and notify operators. Shut down LRP.	System alerts designated contact person via remote telemetry	Inspect LRP and Heat Exchanger to determine issue and conduct necessary repairs. Restart system.
Heat Exchanger Outlet High Temperature Alarm (TT-302)	Excessive temperature at heat exchanger outlet piping due to issues within heat exchanger or LRP	Generate alarm and notify operators. Shut down LRP.	System alerts designated contact person via remote telemetry	Inspect liquid ring vacuum pump and heat exchanger to determine issue and conduct necessary repairs. Reduce blower vacuum loading as needed. Restart system.
P-400 Transfer Pump Discharge High Pressure (PT-400)	High pressure after transfer pump, before bag filter	Generate alarm and notify operators. Shut down P-400.	System alerts designated contact person via remote telemetry	Inspect bag filter and pump and conduct necessary repairs. Restart system.
Pre-Liquid GAC High Pressure Alarm (PT-401)	High pressure after bag filter and before liquid GAC	Generate alarm and notify operators. Shut down LRP.	System alerts designated contact person via remote telemetry	Inspect bag filter and replace as needed. Inspect liquid GAC units and conduct necessary repairs or replace media. Restart system.

Table 2: Alarms and Responses

Alarm or Indicator	Cause	System Response	Alarm Type	Operator Response
P-500 Mixing Tank Pump High Pressure Alarm (PT-501)	High pressure after mixing tank pump P-500	Generate alarm and notify operators. Shut down P-500.	System alerts designated contact person via remote telemetry	Inspect pump P-500 and conduct necessary repairs. Inspect oxygen generator and venturi injector to determine issue and conduct necessary repairs. Restart system.
Oxygen Feed Low or High Pressure Alarm (PT-502)	High or low pressure on feed line to oxygen generator	Generate alarm and notify operators. Shut down system.	System alerts designated contact person via remote telemetry	Inspect oxygen generator to determine issue and conduct necessary repairs. Restart system.
Post-Venturi Injector Low or High Pressure Alarm (PT-503)	High or low pressure after venturi injector	Generate alarm and notify operators. Shut down system.	System alerts designated contact person via remote telemetry	Inspect oxygen generator and venturi injector to determine issue and conduct necessary repairs. Restart system.
Treatment Shed (Extraction Room) Low or High Temperature Alarm (TT-100)	High or low temperature in treatment shed	Generate alarm and notify operators. Shut down system.	System alerts designated contact person via remote telemetry	Inspect system and treatment shed to determine issue and conduct necessary repairs. If due to weather, wait for extreme weather conditions to abide. Restart system.
Treatment Shed (Bioremediation Room) Low or High Temperature Alarm (TT-500)	High or low temperature in treatment shed	Generate alarm and notify operators. Shut down system.	System alerts designated contact person via remote telemetry	Inspect system and treatment shed to determine issue and conduct necessary repairs. If due to weather, wait for extreme weather conditions to abide. Restart system.
Secondary Containment high level (LSH-600, LSH-601)	High fluid level in secondary containment in treatment shed or at storage tanks	Generate alarm and notify operators.	System alerts designated contact person via remote telemetry	Inspect storage tanks or mixing tank and determine if there is an overflow issue. Conduct necessary repairs or replacements.

Table 2: Alarms and Responses

Alarm or Indicator	Cause	System Response	Alarm Type	Operator Response
Motor Overload Alarm	OL1 through OL8, located in panel	Generate alarm and notify operators. Shut down system.	System alerts designated contact person via remote telemetry	Inspect system motors to determine issue and conduct necessary repairs. Restart system.
Catalytic Oxidizer vendor-defined alarm conditions	Vendor-defined alarm conditions	Generate alarm and notify operators. Shut down system.	System alerts designated contact person via remote telemetry	Inspect oxidizer to determine issue. Check oxidizer temperature. Restart system.
Emergency Stop (E-STOP) button manually engaged	Manual engagement of emergency stop button.	Shut down system.	System alerts designated contact person via remote telemetry	Determine why E-STOP activated and correct problem. Reset (pull out) E-STOP button. Restart system. Notify Ecology and Kennedy Jenks.

Table 3: Maintenance Schedule

Component	ID	Maintenance Task	Trigger/ Threshold	Frequency[a]	Maintenance Activities	Expected Results	Type of Work
General Conveyance and Monitoring Infrastructure							
EIWs and Well Vaults	MW-4; RW-2, 3, 4, 5, 6, 7, 8, 9, 10; SW-1, 2, 3	Inspect	See Frequency	Once per well when first actively used, and annually thereafter	Check for air leakage when system first operational. Inspect well vault for damage. Check wellhead cap is airtight.	Well vault is in good condition. Wellhead cap is airtight.	General Inspection
		Inspect	If other monitoring indicates abnormal system performance	As needed, at least annually	Inspect well vault for damage. Check wellhead cap is airtight. Inspect well for plugging/fouling.	Well vault is in good condition. Wellhead cap is airtight. Well does not indicate plugging/fouling.	Response to abnormal system performance
		Replacement of bolts and gaskets	If inspection indicates damage to well	As needed	Repair or replace well vault, well cap, or other components.	Well vault lids are secure and in-place.	Parts replacement
		Well surging	If well plugging/fouling is noted	As needed	Remove trash/debris. Physically surge well to eliminate plugging/fouling.	Well does not indicate plugging/fouling	System repair
Sub-Slab Depressurization Wells	SSD-1, 2, 3	Inspect	See Frequency	Once per well, prior to backfill	Check for air leakage before covering. If air leakage noted, repair or replace well prior to backfill.	Well does not indicate air leakage.	Prior to system completion
		Evaluate Functionality	If well is not operating properly for 3 consecutive months	As needed, at least annually	Evaluate repair or replacement options.	Decide the approach for the malfunctioning well.	System repair
Vapor Pins	VP-1, 2, 3, 4	Inspect	See Frequency	Monthly	Check that covers and valves are sound; that vapor pins are functional. Replace components as needed.	Vapor pins are in good working condition.	General Inspection
		Replacement of fasteners, valves, gaskets	If inspection indicates replacement is needed	As needed	Replace fasteners, valves, or gaskets.	Vapor pins are in good working condition.	Parts replacement
		Replace vapor pin	If vapor pin is not operating properly	As needed	Evaluate repair or replacement options.	Replace vapor pin.	System repair

Table 3: Maintenance Schedule

Component	ID	Maintenance Task	Trigger/ Threshold	Frequency[(a)]	Maintenance Activities	Expected Results	Type of Work
Extraction and Injection Manifold	Manifold A, B, and C	Inspect	See Frequency	Monthly	Check that piping connections are sound; valves in correct position. Check moisture levels in sumps. Inspect manifold for damage.	Manifold is in good working condition and allows for extraction and injection.	General Inspection
		Remove Trash and Debris	Manifold is damaged or plugged based on inspection.	As needed, at least annually	Remove trash/debris. Repair or replace any damaged portion of the manifold.	Trash/debris has been removed. Manifold has been repaired or replaced.	Trash and Debris
Piping	–	Inspect	See Frequency	Monthly	Inspect manifold piping for damage or plugging/fouling.	Piping is in good working condition and allows for extraction and injection.	General Inspection
		Inspect	See Frequency	Monthly	Inspect piping between equipment for leaks or accumulation of water at low spots in header lines. Inspect gas and electric lines for leaks and damage. Drain any accumulated water. Repair or replace piping/lines as needed.	Piping is in good working condition with no leaks or accumulated water.	General Inspection
		Check condensate accumulation in individual manifold legs	If other monitoring indicates abnormal system performance	As needed, at least quarterly	If condensate accumulation is present, pump out condensate through wye fitting.	Condensate has been removed from piping.	System repair
Gas and Electric Lines	–	Inspect	See Frequency	Monthly	Inspect gas and electric lines for leaks or damage.	Gas and electric lines are in good working condition with no leaks or damage.	General Inspection

Table 3: Maintenance Schedule

Component	ID	Maintenance Task	Trigger/ Threshold	Frequency[a]	Maintenance Activities	Expected Results	Type of Work
Water Treatment System							
Vapor Liquid Separator	T-300	Inspect	See Frequency	Monthly	Check for level and potential need for pumpout. If pumpout is needed, turn on pump P-300. Record differential pressure.	Vapor liquid separator is in good condition, no pumpout required.	General Inspection
		Inspect	When high-high level alarm is activated	When triggered	Check for level and potential need for pumpout. If pumpout is needed, turn on pump P-300. Record differential pressure. Inspect pump P-300 and tank level switches to determine why automatic pumpout did not occur.	Pump P-300 is turned on to lower water level in T-300 or extraction is stopped. Pump or level switch issue is fixed.	Alarm response
		Update inspection frequency	If high-high level alarm is activated routinely	When triggered	Update inspection frequency to weekly.	More frequent inspection. Identification and repair of any system issues.	Alarm response
		Clean mist eliminator	See Frequency	Semiannually	Clean mist eliminator.	Mist eliminator in good condition.	General Maintenance
		Test level switch	See Frequency	Annually	Open and inspect interior of vessel. Test level controls.	Vapor liquid separator and alarms are in good condition.	General Maintenance
Transfer Pumps	P-300/ 400/ 401/ 500	Inspect	See Frequency	Monthly	Inspect for damage.	Pump is in good working condition.	General Inspection
		Evaluate Functionality	When high-high level alarm for associated tank is activated	When triggered, at least annually	Evaluate functionality of pump and level switch to determine why pumpout did not occur. Repair or replace as needed.	Pump is operating properly in response to high-level indicator.	Alarm response
		Evaluate Functionality	If high-high level alarm for associated tank is activated routinely	When triggered, at least annually	Evaluate functionality of pump. Repair or replace as needed.	Three grab samples for FOG. Discharge permit compliance, see O&M manual	Alarm response
		Oil and Fluids	See Frequency	Monthly	Maintain oil and hydraulic fluids at necessary levels during operation.	Pumps function properly and have sufficient oil and hydraulic fluids.	General Maintenance

Table 3: Maintenance Schedule

Component	ID	Maintenance Task	Trigger/ Threshold	Frequency(a)	Maintenance Activities	Expected Results	Type of Work
Storage Tanks	T-301/ 400/ 500	Inspect	See Frequency	Monthly	Check for level and potential need for pumpout. If pumpout is needed, turn on transfer pump.	Tank is in good condition, no pumpout required.	General Inspection
		Inspect	See Frequency	Monthly	Check mixing tank for accumulated amendments. If amendments have accumulated, drain and clean tank.	Tank is in good condition, no pumpout required.	General Inspection
		Inspect	When high-high level alarm is activated	When triggered	Check for level and potential need for pumpout. If pumpout is needed, turn on transfer pump. Inspect pump and tank level switches to determine why automatic pumpout did not occur.	Pump is turned on to lower water level in tank. Pump or level switch issue is fixed.	Alarm response
		Update inspection frequency	If high-high level alarm is activated routinely	When triggered	Update inspection frequency to weekly.	More frequent inspection. Identification and repair of any system issues.	Alarm response
		Drain and Clean	See Frequency	Annually	Drain and clean tanks.	Tanks are in good working condition.	General Maintenance
Bag Filter	BF-400	Inspect	See Frequency	Monthly	Inspect filter and housing components. Record pressure differential across the filter.	Filter is in good working condition with minimal pressure drop across the filter.	General Inspection
		Replace bag filter	If pressure upstream of the bag filter increases by 10 psi compared to system startup or since last bag filter replacement.	As needed, at least semiannually	Replace bag filter. Record new upstream pressure	Filter is in good working condition. Pressure upstream of bag filter has been reduced.	System repair

Table 3: Maintenance Schedule

Component	ID	Maintenance Task	Trigger/ Threshold	Frequency[a]	Maintenance Activities	Expected Results	Type of Work
Liquid GAC Vessels	LG-400/ 401/ 402/ 403	Inspect	See Frequency	Monthly	Inspect for corrosion, damage, leakage indicating sediment accumulation. Check differential pressure across vessels. Inspect for evidence of channelling.	GAC vessels are in good working condition.	General Inspection
		Repair damage, remove corrosion	If inspection indicates corrosion or damage	As needed	Replace GAC vessel housing if corrosion and damage is extensive. Repair damage and remove corrosion if not extensive.	GAC vessels are in good working condition.	System repair
		Replace GAC vessel	If inspection indicates leakage, or differential pressure across the vessel increases 10 psi.	As needed	Replace GAC vessel.	GAC vessel has been replaced.	System repair
		Check for breakthrough of media	See Frequency	Monthly during first two quarters of operation, then quarterly until one year into Phase 3, then semiannually	Analyze influent and effluent of water treatment system for GRO/BTEX. Check for concentrations above permit limit or treatment efficiency drops to 90%.	If breakthrough of media is noted, switch GAC	Parts replacement
		Replace media	When breakthrough of media or channeling is noted.	As needed	Replace carbon in GAC vessel.	GAC vessel carbon is replaced.	Parts replacement
Oxygen Generator and Air Compressor	OG-500 and C-500	Inspect	See Frequency	Monthly	Inspect for proper cycling pressures. Check for damage	Oxygen generator in good working condition with proper cycling pressures.	General Inspection
		Clean out filter	See Frequency	Monthly	Clean out filter. Replace if needed.	Filter is in good working condition.	General Maintenance
		Lubricate hinges or other appurtenances	See Frequency	As needed, at least annually	Lubricate door hinges or other appurtenances periodically.	No rust or other damage is present on components that may inhibit proper functioning of oxygenator.	General Maintenance

Table 3: Maintenance Schedule

Component	ID	Maintenance Task	Trigger/ Threshold	Frequency[(a)]	Maintenance Activities	Expected Results	Type of Work
Vapor Treatment System							
Liquid Ring Vacuum Pump	B-301	Inspect	See Frequency	Monthly	Check oil level and for presence of oil in scavenger tubing. Check for potential leakage. Check back pressure on separator element. Check discharge pipe for blockage.	Oil level is sufficient. No oil in scavenger tubing. No leaks are identified. Back pressure is less than 4 psig. No blockages in discharge pipe.	General Inspection
		Maintenance	See Frequency	Monthly	Clean or replace inlet filter. Remove debris from pump housing and motor fan guard. Re-grease bearings using manufacturer approved grease.	Inlet filter clean. Debris removed. Bearings re-greased.	General Maintenance
		Check Inlet Filter	See Frequency	After 500 hours of operation	Clean or replace inlet filter if needed. Remove temporary inlet screen.	Inlet filter is clean.	General Maintenance
		Clean Strainers	See Frequency	After 500 hours of operation	Clean or replace strainers.	Strainers are clean.	General Maintenance
		Replace Seal Fluid	See Frequency	Annually	Replace seal fluid.	Seal fluid replaced.	General Maintenance
		Check couplings wearing surfaces	See Frequency	Annually	Check couplings and wearing surfaces for wear. Replace as needed.	Couplings and wearing surfaces in good condition.	General Maintenance
		Oil	If oil level is low	As needed, at least per manufacturer's recommendations	Replace gear-end oil if level is low.	Gear-end oil level sufficient.	Parts replacement
		Inspect Seals	If oil is present in scavenger tubing	As needed, at least per manufacturer's recommendations	Check seals. Replace seals if needed.	Seals inspected and replaced.	Parts replacement
		Replace Separator Element	If back pressure exceeds 4 psig	As needed, at least per manufacturer's recommendations	Replace separator element.	Back pressure is less than 4 psig.	System repair
Heat Exchanger	HEX-302	Inspect	See Frequency	Monthly	Inspect for damage. Remove any debris present.	Heat exchanger in good working condition.	General Inspection

Table 3: Maintenance Schedule

Component	ID	Maintenance Task	Trigger/ Threshold	Frequency[a]	Maintenance Activities	Expected Results	Type of Work
Temporary Catalytic Oxidizer	TO-400	Inspect	See Frequency	Weekly	Inspect for damage. Check temperature.	Oxidizer in good working condition with sufficiently high temperature.	General Inspection
		Remove accumulated matter	If temperature drops below setpoint	As needed, at least per manufacturer's recommendations	Remove accumulated carbon and organic matter through burn-out or air lancing.	Temperature increases to sufficiently high value	System repair
Vapor GAC Vessels	GAC-400/ 401	Inspect	See Frequency	Monthly	Inspect for corrosion, damage, water accumulation.	GAC vessels are in good working condition. No corrosion, damage, or water accumulation noted.	General Inspection
		Repair damage, remove corrosion	If inspection indicates corrosion or damage	As needed	Replace GAC vessel housing if corrosion and damage is extensive. Repair damage and remove corrosion if not extensive.	GAC vessels are in good working condition. No corrosion, damage, or water accumulation noted.	System repair
		Remove accumulated water	See Frequency	Monthly	Drain any moisture from vessel. Investigation issues with vapor liquid separator system.	Vapor liquid separator system has been repaired.	System repair
		Check for breakthrough of media	See Frequency	Monthly during first two quarters of operation, then quarterly for two years, then semiannually	Analyze influent and effluent of water treatment system for VOCs. Check for concentrations above permit limit or treatment efficiency drops to 90%.	If breakthrough of media is noted, switch GAC	Parts replacement
		Replace media	When breakthrough of media is noted.	As needed	Replace carbon in GAC vessel	GAC vessel carbon is replaced.	Parts replacement
System Components and Control							
Control Panel and PLC	–	Inspect	See Frequency	Monthly	Check for proper operation and system status. Replace light bulbs and fuses as needed.	System is operating properly and in good working condition.	General Inspection
Alarms	–	Inspect	See Frequency	Semiannually	Test alarms for proper operation. Replace alarms as needed.	Alarms are operating properly.	General Inspection
Flow Meters	–	Inspect	See Frequency	Monthly	Inspect for damage, corrosion, and water accumulation. Repair or replace as needed.	No damage, corrosion, or water accumulation noted.	General Inspection
			See Frequency	Annually	Verify zero calibration.	Flow meters have been verified for zero calibration.	General Inspection
Temperature and Pressure Gauges	–	Inspect	See Frequency	Monthly	Inspect for damage, corrosion, or improper functioning. Repair or replace as needed.	Temperature and pressure gauges are in good working condition.	General Inspection

Table 3: Maintenance Schedule

Component	ID	Maintenance Task	Trigger/ Threshold	Frequency[(a)]	Maintenance Activities	Expected Results	Type of Work
Exercising Valves	–	Inspect	See Frequency	Monthly	Inspect valves for corrosion, silt buildup, and damage. Operate through full range of motion to verify proper functioning.	Valves are in good working condition.	General Inspection
Treatment Shed	–	Inspect	See Frequency	Monthly	Check general condition. Check for external or internal damage, leaks, loss of weatherproofing or insulation, loss of soundproofing, or other detrimental changes. Take corrective actions as needed. Remove trash and debris from inside and outside of compound enclosure.	Treatment shed is in good, clean condition.	General Inspection

Note:
(a) Frequency may be adjusted over the life of the system.

Table 4: Summary of MPE System Routine Operations and Maintenance Visits

General Operations by Phase				Number of Visits[a]						
Phase	**Duration (Months)**	**Elapsed Time At Completion (Years)**	**Event**	**One Time**	**Weekly**	**Bi-Weekly[b]**	**Monthly**	**Semi-Annually**	**Annually**	**Total**
Phase 1	-	0.5	Removal of Catalytic Oxidizer, Switch to vapor GAC vessels	1	-	-	-	-	-	**1**
Phase 1	6	0.5	Catalytic Oxidizer - Inspection, Temperature Check, Removal of Accumulated Debris	-	24	-	-	-	-	**24**
Phase 2	6	1.5	Surfactant Addition and Mixing	-	-	12	-	-	-	**12**
Phase 3	48	5.5	Amendment/Nutrient Addition and Mixing	-	-	96	-	-	-	**96**
All	66	5.5	Liquid and Vapor GAC Vessel & Media Changeout	-	-	-	34	-	-	**34**
All	66	5.5	Bag Filter Replacement	-	-	-	-	11	-	**11**
All	66	5.5	Liquid Ring Pump - Inspect Inlet Filter, Clean Strainers, Every 500 hours	-	-	-	-	-	-	**100**
			TOTAL	**1**	**24**	**108**	**34**	**11**	**0**	**278**

Regular Inspections and Maintenance by Phase				One Time	Weekly	Bi-Weekly[b]	Monthly	Semi-Annually	Annually	Total
Phase 1	12	1	Regular Inspections and Minor Repairs	-	-	-	12	2	1	**15**
Phase 2	6	1.5	Regular Inspections and Minor Repairs	-	-	-	6	1	-	**7**
Phase 3	48	5.5	Regular Inspections and Minor Repairs	-	-	-	48	8	4	**60**
			TOTAL	**0**	**0**	**0**	**66**	**11**	**5**	**82**

Notes:

(a) Some events may be combined into one visit. These combinations are not reflected here for clarity.

(b) Bi-weekly indicates one visit every two weeks.

Table 5: Troubleshooting Procedures

Problem	Procedures
Liquid ring pump will not start.	Check that E-STOP button is reset (pulled out). Check the water level in the moisture separator tank and pump out accumulated water. Check that all alarms have been cleared at the PLC. Open dilution air to 100% and attempt to restart.
Liquid ring pump shuts down.	Check operating temperature. Check overload setting on starter and fuses. Check for loose electrical connections. Check oil level. Drain or add oil as needed. Clean oil strainer. Check back pressure. If higher than 4 psig, replace oil separator element.
Low pressure alarm shuts down air compressor.	Re-prime discharge pump.
Motor will not start - no noise.	Check fuses and power distribution to motor. Reset overload. Check main power. Check PLC operating sequence to determine if a start requirement has not been met.
Motor will not start - humming noise.	Change fuse. Check for loose wire or poor connection. Disassemble driven component, check clearances, clean internal components, and replace any damaged parts.
Overload trip immediately after start-up.	Replace bearings and/or replace motor. Change fuse. Search for wiring short and replace wire, if necessary. Check operating capabilities of driven component.
Motor amps above allowable value listed on nameplate.	Determine if motor is designed to operate at upper amperage limit. Open component and clean scale buildup in driven component, if necessary. Check direction of rotation of driven component and correct, if necessary. Adjust overloads for higher amps if the difference is small; otherwise change voltage to motor.
Transmitter sending inaccurate signal.	Check for water in air lines; drain lines, if needed. Verify that transmitter and PLC ranges match. Calibrate transmitter.
Transmitter sending 0-2 mA signal to PLC input.	Check wiring against device specifications and wiring schematic. Check for loose connections. Confirm if transmitter is damaged by swapping in a different transmitter.

Table 5: Troubleshooting Procedures

Problem	Procedures
Transmitter sending signal over 20 mA.	Replace transmitter.
Pump producing insufficient pressure.	Prime pump. Check pump rotation direction and change direction, if needed. Replace pressure gauge, if faulty. Check motor and impeller size and replace, if needed. Check for flow restrictions in strainers and piping between pump and gauge. Check power supply to pump if pump has no power.
Pump is leaking.	Check gaskets and replace if damaged. Check housing for cracks and replace if needed. Check if mechanical seal has been overheated and replace if needed. Check if fittings are leaking; tighten or apply thread sealant.
Pump flow rate too low.	Reduce back-pressure. Check pump size and replace pump, if necessary. Check if pump impeller is worn and replace, if necessary. Check if ball valve on discharge is restricted; adjust. Check for flow restrictions in strainers and piping.
Pump making excessive noise.	Manually rotate pump impeller and listen for clearance issues. Disassemble pump and repair clearance problem. Check impeller for lodged trash and replace, if necessary. Check if motor shaft is bent or if motor bearing is failing. Replace motor.
Level float staying open or closed and not activating switch.	Check float orientation. If float is in normally closed position, disassemble float stem and reinstall in correct position. Check float for dirt or film causing it to stick. Clean float and stem, then reinstall. Check wiring for cuts or loose connections that may be causing float wiring to sh ort. Check if intrinsically safe barrier is shorted out internally. Check for loose input wiring in terminal strip. Tighten, if necessary. Check level switch wiring against schematic drawing. Check if site tube is clogged. Clean, if needed. Replace float, if determined to be damaged or faulty.
Flow meter not rotating.	Check for debris; disassemble and clean meter, if needed. Check for pipe restrictions, clogging, or clogged strainers. Clean, if needed.

Table 5: Troubleshooting Procedures

Problem	Procedures
Flow meter rotating but pulse input is not working.	Test for faulty meter switch by removing wiring and testing contacts on the meter to ensure they are opening and closing. If they are not, replace meter head. Check if input wiring is grounding out. Test input wiring by isolating input wires and checking if input is on. Check if input to PLC is not working by simulating rotating meter by contacting input wires together and check for a detected flow rate and change in totalized flow.
Other equipment issues.	See troubleshooting documentation provided by relevant equipment vendor.

Notes and Abbreviations:

psig = pounds per square inch, gauge
PLC = programmable logic controller
mA = milli-amperes

Table 6: Monitoring Schedule

Parameter	Type	Media	Location	Frequency[a]	Equipment	Notes
Vacuum	Field	Air	Individual Wells (13)	Quarterly	Dwyer 477AV-3 Digital, Dwyer Magnehelic vacuum gauge, or equal.	See O&M Manual.
			SSD Wells (3)			
			Vapor Pins (4)			
			Treatment System	Monthly	None, use system gauges	See O&M Manual Section 5.1.1 for exact pressure gauges.
Barometric Pressure	Field	Air	Ambient	Monthly	Dwyer 477AV-3 Digital, Dwyer Magnehelic vacuum gauge, or equal.	With measurement of vacuum at individual wells and treatment system locations. See O&M Manual.
Pressure	Field	Water	Individual Wells (13)	Monthly	None, use system gauges	Injection flowrate during Phase 2: Surfactant Reinjection and Phase 3: Enhanced Bioremediation.
Airflow	Field	Air	Individual Wells (13)	Quarterly for first year of operation, then as needed	Dwyer 471B Thermo-Anemometer, TSI TA430 Airflow Velocity meter, or equal.	See O&M Manual.
			SSD Wells (3)			
			Treatment System	Monthly	None, use system flowmeter	Air permit compliance, see O&M Manual. System flowmeter: FE/FIT 302.
Groundwater Flow	Field	Water	Individual Wells (13)	Monthly	None, use system flowmeters	Injection flowrate during Phase 2: Surfactant Reinjection and Phase 3: Enhanced Bioremediation.
			Treatment System	Monthly	None, use system flowmeters	See O&M Manual Section 5.1.3 for exact flow meters.
Noise	Field	Air	Outside Treatment Shed	Quarterly	Hand-held dBA noise level meter	Limit of 60 dBA Leq, City of Seattle noise ordinance[b]
Temperature	Field	Air	Treatment System	Monthly	None, use system gauges	See O&M Manual Section 5.1.5. System guages: TIT-302, TIT-400
			Ambient	Monthly	Dwyer 471B Thermo-Anemometer, TSI TA430 Airflow Velocity meter, or equal.	See O&M Manual.

Table 6: Monitoring Schedule

Parameter	Type	Media	Location	Frequency[a]	Equipment	Notes
TPH, BTEX	Field	Air	Individual Wells (13)	Quarterly for first year of operation, then as needed	PID (MiniRAE 2000 or 3000 series, or equal)[c]	See O&M Manual.
			Vapor Pins (4)	Quarterly	Low-Detection PID (ppbRAE 3000 or equal) and Four-Gas Meter (RKI Eagle 2 or equal)[c]	Protection Monitoring - see SAP/QAPP
			SSD Wells (3)	Semiannually	Low-Detection PID (ppbRAE 3000 or equal) and Four-Gas Meter (RKI Eagle 2 or equal)[c]	Protection Monitoring - see SAP/QAPP
			Before, between, and after vapor GAC vessels	Twice per week, as needed during system operation	PID (MiniRAE 2000 or 3000 series, or equal)[c]	Air permit compliance, see Section 3.3.4 and 5.1.6 of the O&M manual
TPH, BTEX	Lab	Air	Individual Wells (13)	At startup, then as needed	Summa Canister	As needed samples collected if field TPH measurements are elevated compared to startup concentrations
			SSD Wells (3)	As needed	Summa Canister	If field measurement of total TPH or combustible gas is elevated[d]
			Vapor Pins	As needed	Summa Canister	If field measurement of total TPH or combustible gas is elevated[d]
			Before, between, and after vapor GAC vessels	First month of each phase, as needed during system operation	Summa Canister	System operation.
BTEX, Selected CVOCs[f]	Lab	Water	Between lead and lag liquid GAC vessels	Weekly	Glass sample jars	Discharge permit compliance, see O&M manual
BTEX, Selected CVOCs[f], FOG	Lab	Water	Discharge to Sanitary Sewer (after liquid GAC vessels)	Monthly	Glass sample jars	Three grab samples for FOG. Discharge permit compliance, see O&M manual
Settleable solids, hydrogen sulfide, explosivity	Grab, Meter	Water	Discharge to Sanitary Sewer (after liquid GAC vessels)	Only if operating criteria are exceeded	Imhoff cone; Portable field meter	Discharge permit compliance, see O&M manual
GRO, BTEX	Lab	Water	Before, between, and after liquid GAC vessels	Varies[e], As needed	Glass sample jars	System operation.

Kennedy Jenks

Table 6: Monitoring Schedule

Parameter	Type	Media	Location	Frequency[a]	Equipment	Notes
pH, Turbidity	Field	Water	Treatment System	Varies[e], As needed	Portable field meter	Discharge permit compliance. As needed samples collected if effluent limits are exceeded.
			Discharge to Sanitary Sewer (after liquid GAC	Quarterly for first year of Phase 3, then semiannually; As needed	Portable field meter	

Kennedy Jenks

Table 6: Monitoring Schedule

Parameter	Type	Media	Location	Frequency[a]	Equipment	Notes
Nitrate/Ortho-phosphate	Lab	Water	Discharge to Sanitary Sewer (after liquid GAC	Quarterly for first year of Phase 3, then semiannually	Glass sample jars	Injection/extraction schedule[g]
Field Parameters and Laboratory Analyses[h]	Field & Lab	Water	Off-Property Monitoring Wells (4)	At startup	Pump, tubing, and glass sample jars	Off-property monitoring wells, see SAP/QAPP
			Individual Wells at Wellhead (5)	At startup, then varies[i]	Pump, tubing, and glass sample jars	Performance monitoring wells, see SAP/QAPP
			Individual Wells at Wellhead (8)	See SAP/QAPP for frequency	Glass sample jars	Subset of Performance monitoring wells, see SAP/QAPP
			Individual Wells at Wellhead (13)	Quarterly after system operation has ended	Pump, tubing, and glass sample jars	Confirmation monitoring at select wells, see SAP/QAPP
Field Screening Parameters[j]	Field	Soil	Soil Borings (8)	After system operation has ended	PID (MiniRAE 2000 or 3000 series, or equal)[c]	Confirmation soil sampling, see SAP/QAPP
GRO, BTEX, and percent moisture	Lab	Soil	Soil Borings (8)	After system operation has ended	Soil boring and sample collection equipment	Confirmation soil sampling, see SAP/QAPP
Time of Operation	Field	System	System Controls	Monthly during operation	None needed	Maintain records for two years. See PSCAA permit compliance requirements (Appendix B)

Notes:

(a) Frequency may be adjusted over the life of the system.

(b) If the result is greater than 60 dBA, notify Kennedy Jenks personnel, determine the source of excessive noise, and implement sound reducing measures.

(c) A portable four-gas meter will be used to measure concentrations of total VOCs, oxygen, carbon dioxide, and combustible gas [(reported as percent lower explosive limit (%LEL)]. TPH will also be measured using a portable photoionization detector (PID) (e.g., MiniRAE 2000 or 3000 series, or equal) and/or a low-detection PID (e.g. ppbRAE 3000, or equal).

(d) If field measurement of TPH concentration is above 425 ppb and/or if combustible gas is measured above 20% LEL, a soil gas sample for laboratory analysis will be collected.

(e) Monthly for 6 months, then quarterly for two years, then semiannual for the remainder of remedial system operation.

(f) GRO (gasoline range organics), BTEX (benzene, toluene, ethylbenzene, and total xylenes), Selected chlorinated VOCs (Selected VOCs: tetrachloroethylene, trichloroethylene, cis-1,2-dichloroethylene, trans-1,2-dichloroethylene, vinyl chloride), and FOG (nonpolar fat, oil, and grease).

(g) If nitrate result is greater than 5 milligrams per liter (mg/L) or orthophosphate result is greater than 10 mg/L, the Idle Well Group timing should be increased.

(h) Samples will be submitted for analysis of one or more of the following: GRO, BTEX, nitrate and total orthophosphate, monitored natural attenuation parameters. See SAP/QAPP. Field parameters will be collected during groundwater purging prior to sample collection. Field parameters include: depth to groundwater, temperature, pH, specific conductivit, oxidation-reduction potential, dissolved oxygen, and turbidity.

(i) At startup, then monthly for 6 months, then quarterly until one year into Phase 3, then semiannual.

(j) Field screening parameters include physical observation, sheen tests, and measurement of headspace vapor using a PID.

Figures

\\kjc.local\KJC-Root\KJ-Office\FWY\Data\Projects\2016\1696010.00 WA DOE Circle K Site Assessment\GIS\Events\20210517_DataGapsTM\Figure1_VicinityMapv2.mxd

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors,

Legend

Site Location

N

0 200 400

Scale: Feet

Note:
1. All locations are approximate.

Kennedy Jenks

Former Circle K Site
Seattle, Washington

Site Location and Vicinity Map

K/J 2196008*00

Figure 1

Appendix A

King County Wastewater Discharge Authorization No. 4614-01

King County
Wastewater Treatment Division
Industrial Waste Program
Department of Natural Resources and Parks
201 South Jackson Street, Mailstop KSC-NR-5513
Seattle, WA 98104-3855
206-477-5300
TTY Relay: 711

March 31, 2023

SENT VIA EMAIL ONLY
ELECTRONIC READ RECEIPT REQUESTED

Kuk-Jin Choung
Jay's Cleaners
2350 24th Ave E
Seattle, WA 98112
Jchoung860@msn.com

Issuance of new Wastewater Discharge Authorization No. 4614-01 to Jay's Cleaners - Circle K 1461 Treatment System

Dear Kuk-Jin Choung:

The King County Industrial Waste (KCIW) Program is responsible for regulating industrial wastewater in the region so that it is treated properly before being discharged to the sanitary sewer system. KCIW partners with industries to ensure appropriate discharge limits are followed, which, in turn, protects the County's wastewater conveyance and treatment systems, workers, and water quality.

To this end, KCIW has reviewed the application to discharge industrial wastewater to the sewer system from the Jay's Cleaners - Circle K 1461 Treatment System facility located at 2350 24th Avenue E., Seattle, Washington, and has issued the enclosed Major Discharge Authorization.

This discharge authorization permits your facility to discharge limited amounts of industrial wastewater into King County's sewer system in accordance with the effluent limitations and other requirements and conditions set forth in the document and the regulations outlined in King County Code 28.84.060 (enclosed). As long as Jay's Cleaners maintains compliance with regulations and does not change the nature and volume of its discharge, KCIW will not require application for an industrial wastewater discharge permit, a type of approval that would result in additional requirements, oversight, and increased fees.

To increase the volume of discharge or change the type or quantities of substances discharged, Jay's Cleaners must contact KCIW at least 60 days before making these changes.

King County Code 28.84 authorizes a fee for each Major Discharge Authorization issued by the King County Department of Natural Resources and Parks. The current fee for issuance of a new Major Discharge Authorization is $3000. King County will send you an invoice for this amount.

For questions about this discharge authorization or wastewater discharge from the Jay's Cleaners - Circle K 1461 Treatment System facility, please call 206-477-5476 or email Ryan.Salem@kingcounty.gov. Additional information is available on KCIW's website at www.kingcounty.gov/industrialwaste.

Thank you in advance for your efforts to maintain the integrity of King County's wastewater conveyance and treatment infrastructure, ensure worker safety, and protect water quality in the central Puget Sound region.

Sincerely,

DocuSigned by:

Ryan Salem

4DE9136CC5F142A...

Ryan Salem
Compliance Investigator

Enclosures

cc: Angelique Hockett, Seattle Public Utilities, angelique.hockett@seattle.gov
Dale Myers, WA Department of Ecology, damy461@ecy.wa.gov
Ryan Hultgren, Kennedy Jenks, ryanhultgren@kennedyjenks.com

King County

MAJOR DISCHARGE AUTHORIZATION
King County Industrial Waste Program
201 S. Jackson Street, Mailstop KSC-NR-5513
Seattle, WA 98104-3855

NUMBER 4614-01

for

Jay's Cleaners - Circle K 1461 Treatment System

Facility address: 2350 24th Avenue E.
Seattle, Washington

Mailing address: 2350 24th Ave E
Seattle,WA 98112

Phone: 206-683-5917

Emergency (24-hour) phone: Not Found

Industry type: Groundwater Remediation - Petroleum

SIC code: 9511 **EPA Id. No.:** NA

Discharge to: West Point

*Note: This authorization is valid only for the specific discharges shown below:

Discharge process: Wastewater generated by Groundwater Remediation - Petroleum operation

Pretreatment process: Filtration and Carbon Adsorption

Effective date: April 7, 2023
Expiration date: April 6, 2028

DESCRIPTION OF SAMPLE SITES AND DISCHARGE VOLUMES

Sample Site No.	Description	Maximum Volume (gallons per day)	
		Industrial	Total
IW1594A	Effluent from treatment system	4,500	4,500

Permission is hereby granted to discharge industrial wastewater from the above-identified facility into the King County sewer system in accordance with the effluent limitations and monitoring requirements set forth in this authorization.

If the industrial user wishes to continue to discharge after the expiration date, an application must be filed for re-issuance of this discharge authorization at least 90 days prior to the expiration date. For information concerning this King County Discharge Authorization, please call Industrial Waste Compliance Investigator Ryan Salem at 206-477-5476.

24-HOUR EMERGENCY NOTIFICATION
West Point Treatment Plant: 206-263-3801
Washington State Department of Ecology: 206-594-0000

I. SPECIAL CONDITIONS

A. Discharge to the sanitary sewer shall not be until KCIW has conducted a preoperative inspection of the pretreatment facilities and has sent written notification (email is sufficient) to the permittee that discharges may begin.

B. Jay's Cleaners shall collect weekly samples between the lead and lag granulated activated carbon (GAC) vessels to check for breakthrough of BTEX compounds. If any BTEX compounds in the breakthrough sampling exceed the wastewater screening levels listed below in Special Condition C, the permittee shall cease discharge and change out the media in the lead GAC vessel. Records of breakthrough sampling shall be maintained onsite for a minimum of three years.

C. Organic Compound Screening Levels and Reporting Requirements

1. Discharges that exceed the following screening levels have the potential to cause health hazards in the sewage collection system or indicate that treatment has not been sufficient enough to remove hazardous waste characteristics.

Compound	CAS Number	Wastewater Screening Level (mg/L)
Benzene	71-43-2	0.070
Ethylbenzene	100-41-4	1.7
Toluene	108-88-3	1.4
Total Xylenes	1330-20-7	2.2
Trichloroethylene	79-01-6	0.5
Cis-1,2-Dichloroethylene	156-59-2	1.0
Tetrachloroethylene	127-18-4	0.24
Trans-1,2-Dichloroethylene	156-60-5	1.0
Vinyl Chloride	75-01-4	0.012

2. For each exceedance of the screening levels, the permittee shall:

   a. Notify KCIW within 24 hours of learning of the exceedance

   b. Collect a sample and submit new data to KCIW within 14 days of becoming aware of the exceedance (or the next time discharge occurs if greater than 14 days)

   c. Submit a written report within 14 days of learning of the exceedance (*14-Day Report*)

   d. The report should explain the cause of the exceedance and corrective actions taken to respond to the exceedance and ensure ongoing compliance

3. Whenever KCIW's monitoring or the permittee's self-monitoring results exceed the screening level for three out of four consecutive sampling events, the permittee shall submit a plan indicating the steps that will be taken to ensure that organic compound discharges do not exceed screening levels. The report:

    a. Shall be submitted within 30 days of the third self-monitoring result that shows organic compound discharges that exceed screening levels

    b. Shall indicate the steps that will be taken to reduce organic chemical concentrations so that they remain consistently below screening levels within 60 days

    c. May be used by the permittee or KCIW to evaluate the adequacy of your pretreatment system and other best management practices in order to identify whether additional waste characterization needs to be performed; or additional operational and structural upgrades are needed that will enable you to consistently meet King County organic compound screening levels

II. SELF-MONITORING REQUIREMENTS

A. The following self-monitoring requirements shall be met for this discharge authorization:

Sample Site No.	Parameter	Sample Type	Frequency
IW1594A	Daily Discharge Volume	Meter Reading	Daily
	Nonpolar FOG	3 grabs	monthly
	Benzene	grab	monthly
	Ethylbenzene	grab	monthly
	Toluene	grab	monthly
	Total Xylenes	grab	monthly
	Total Monthly Flow	continuous	monthly
	Trichloroethylene[1]	grab	monthly
	Cis-1,2-Dichloroethylene	grab	monthly
	Tetrachloroethylene	grab	monthly
	Trans-1,2-Dichloroethylene	grab	monthly
	Vinyl Chloride	grab	monthly
IW1594A	Settleable solids	Grab (by Imhoff cone)	Only if operating criteria are exceeded
	Hydrogen sulfide	Meter reading	Only if operating criteria are exceeded
	Explosivity	Meter reading	Only if operating criteria are exceeded

B. The settleable solids field test by Imhoff cone must be performed as follows:

1. Fill Imhoff cone to one-liter mark with well-mixed sample
2. Allow 45 minutes to settle
3. Gently stir sides of cone with a rod or by spinning; settle 15 minutes longer
4. Record volume of settleable matter in the cone as mL/L

C. The three nonpolar fats, oils, and grease (FOG) grab samples shall be of equal volume, collected at least five minutes apart, and analyzed separately. When using U.S. Environmental Protection Agency approved protocols specified in 40 CFR Part 136, the individual grab samples may be composited (at the laboratory) prior to analysis. The result of the composite sample or the average of the concentrations of the three grab samples may be reported as total FOG unless the value is 100 mg/L or greater, in which case the concentration of nonpolar FOG must be reported.

[1] Parameters in bold font should be sampled a minimum of three months. If a parameter is non-detectable in the initial three samples the permittee may discontinue sampling unless otherwise directed by KCIW.

D. If a violation of any discharge limits or operating criteria is detected in monitoring, you shall notify KCIW immediately upon receipt of analytical data.

E. A self-monitoring report shall be filed with KCIW no later than the 15th day of the time period following the sample collection (i.e., the 15th day of the following month for monthly, weekly, daily samples; the 15th day of the following quarter for quarterly samples). If no discharge takes place during any monitoring period, it shall be noted on the report.

F. All self-monitoring data submitted to KCIW, which required a laboratory analysis, must have been performed by a laboratory accredited by the Washington State Department of Ecology for each parameter tested, using procedures approved by 40 CFR 136. This does not apply to field measurements performed by the industrial user such as pH, temperature, flow, atmospheric hydrogen sulfide, total dissolved sulfides, total settleable solids by Imhoff cone, or process control information.

G. All sampling data collected by the permittee and analyzed using procedures approved by 40 CFR 136 or approved alternatives shall be submitted to KCIW whether required as part of this authorization or done voluntarily by the permittee.

H. Self-monitoring reports shall be signed by an authorized representative of the industrial user. The authorized representative of the industrial user is defined as:

1. The president, secretary, treasurer, or a vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation

2. The manager of one or more manufacturing, production, or operating facilities, but only if the manager:

    a. Is authorized to make management decisions that govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiate and direct other comprehensive measures to assure long-term environmental compliance with environmental laws and regulations

    b. Can ensure that the necessary systems are established, or actions taken to gather complete and accurate information for control mechanism requirements and knowledgeable of King County reporting requirements

    c. Has been assigned or delegated the authority to sign documents, in accordance with corporate procedures

3. A general partner or proprietor if the industrial user is a partnership or proprietorship, respectively

4. A director or highest official appointed or designated to oversee the operation and performance of the industry if the industrial user is a government agency

5. The individuals described in one through four above may designate an authorized representative if:

   a. The authorization is submitted to King County in writing.

   b. The authorization specifies the individual or position responsible for the overall operation of the facility from which the discharge originates or having overall responsibility for environmental matters for the company or agency.

III. GENERAL DISCHARGE LIMITATIONS

A. Operating Criteria

There shall be no odor of solvent, gasoline, or hydrogen sulfide (rotten egg odor), oil sheen, unusual color, or visible turbidity. The discharge must remain translucent. If any discharge limits are exceeded, you must stop discharging and notify KCIW at 206-477-5300.

B. Corrosive Substances

Limits

Instantaneous minimum:	pH 5.0 (standard units [s.u.])
Daily minimum:	pH 5.5 (s.u.)
Maximum:	pH 12.0 (s.u.)

The instantaneous minimum pH limit is violated whenever any single grab sample or any instantaneous recording is less than pH 5.0.

The daily minimum pH limit is violated whenever any continuous recording of 15 minutes or longer remains below pH 5.5 or when each pH value of four consecutive grab samples collected at 15-minute intervals or longer within a 24-hour period remains below pH 5.5.

Discharges of caustic solutions greater than pH 12.0 are prohibited unless King County provides prior written authorization. For these situations, the authorized caustic solution discharges above pH 12.0 must be less than pH 12.5 and must not contain an equivalent weight of sodium hydroxide (NaOH) that exceeds a daily loading rate of 21 pounds/day. The authorized discharge of caustic solutions greater than pH 12.0 shall be subject to special conditions to protect worker safety and the POTW.

C. Fats, Oils, and Grease (FOG)

FOG Accumulations and Obstructions
Discharges of FOG shall not result in significant accumulations which, either alone or in combination with other wastes, are capable of obstructing flow or interfering with the operations or performance of the POTW.

Nonpolar FOG (mineral/petroleum origin)
Nonpolar FOG limit: 100 mg/L

The limit for nonpolar FOG is violated when either:

- The arithmetic mean of the concentration from the individual analyses of three grab samples, taken no more frequently than five-minute intervals, exceeds the limitation, or
- The concentration of a single composite sample of three grab samples, taken no more frequently than five-minute intervals, exceeds the limitation.

Industrial users that violate the nonpolar FOG limit may be required to complete, for King County review and approval, a FOG control plan.

Polar FOG (Animal and Vegetable Origin)
Industrial users that have the potential to discharge polar FOG shall minimize free-floating polar FOG. Industrial users must minimize the use of emulsifying agents, such as cleaners or detergents, to only the quantity needed to maintain industrial activities at their facility and to not impact the POTW.

Industrial users may not add emulsifying agents prior to or within FOG-removal devices, exclusively for the purposes of emulsifying free-floating FOG.

Industrial users that discharge free-floating polar FOG will be required to complete, for King County review and approval, a FOG control plan.

King County has the authority to include aqueous concentration-based discharge limits for polar FOG or total FOG (i.e., the sum of polar and nonpolar FOG) in permits and discharge authorizations issued to industrial users that primarily discharge FOG of animal or vegetable origin. The concentration-based limits shall be based on what can be achieved through implementation of a treatment technology that the Wastewater Treatment Division Director determines represents all known, available, and reasonable methods of prevention, control, and treatment.

D. Flammable or Explosive Materials

No person shall discharge any pollutant, as defined in 40 CFR 403.5, that creates a fire or explosion hazard in any sewer or treatment works, including, but not limited to, waste streams with a closed cup flashpoint of less than 140° Fahrenheit or 60° Centigrade using the test methods specified in 40 CFR 261.21.

At no time shall two successive readings on an explosion hazard meter, at the point of discharge into the system (or at any point in the system), be more than 5 percent nor any single reading be more than 10 percent of the lower explosive limit (LEL) of the meter.

Pollutants subject to this prohibition include, but are not limited to, gasoline, kerosene, naphtha, benzene, toluene, xylene, ethers, alcohols, ketones, aldehydes, peroxides, chlorates, perchlorates, bromates, carbides, hydrides, and sulfides, and any other substances that King County, the fire department, Washington state, or the U.S. Environmental Protection Agency has notified the user are a fire hazard or a hazard to the system.

E. Heavy Metals/Cyanide

The industrial user shall not discharge wastes, which exceed the following limitations:

Heavy Metals & Cyanide	Daily Maximum ppm (mg/L)[1]
Arsenic	4.0
Cadmium	0.6
Chromium	5.0
Copper	8.0
Lead	4.0
Mercury	0.2
Nickel	5.0
Silver	3.0
Zinc	10.0
Cyanide	3.0

[1] The daily maximum is violated whenever any sample exceeds the limitation.

F. High Temperature

The industrial user shall not discharge material with a temperature in excess of 65° C or 150° F.

G. Hydrogen Sulfide

The following are atmospheric hydrogen sulfide limits as measured at a monitoring location designated by King County:

- Short-Term Limit: 15.0 parts per million volume (ppmv) as a 15-minute average
- 8-Hour Limit: 10.0 ppmv as an 8-hour average
- Weekly Limit: 3.0 ppmv as a 7-day average

More stringent weekly atmospheric hydrogen sulfide limits may be developed and imposed on a case-by-case basis depending on nuisance conditions or risks to workers and sewer infrastructure.

Aqueous soluble sulfide limits may be established on a case-by-case basis depending on the volume of discharge and conditions in the receiving sewer, including oxygen content, pH, and existing sulfide concentrations.

H. Organic Compounds

No person shall discharge any organic pollutants that result in the presence of toxic gases, vapors, or fumes within a public or private sewer or treatment works in a quantity that may cause acute worker health and safety problems. Organic pollutants subject to this restriction include, but are not limited to, the following:

- Any organic compound listed in the “Total Toxic Organics (TTO)” definition provided in 40 CFR Section 433.11(e) and 40 CFR Section 413.02(i)

- Acetone, 2-butanone (MEK), 4-methyl-2-pentanone (MIBK), xylenes

Industrial users are required to implement source control strategies and best management practices to minimize the concentration of any of the aforementioned organic pollutants.

I. Settleable Solids

Settleable solids concentrations: 7.0 ml/L

IV. GENERAL CONDITIONS

A. All requirements of King County Code pertaining to the discharge of wastes into the municipal sewer system are hereby made a condition of this discharge authorization.

B. All pretreatment systems used to bring the permittee’s discharge into compliance with King County’s discharge limitations and all compliance monitoring equipment shall be maintained continuously in satisfactory and effective operations by the permittee at the permittee’s expense and shall be subject to periodic inspections by authorized KCIW personnel. These systems shall be attended at all times during discharge to the King County sewerage system. In the event that such equipment fails, the permittee must notify KCIW immediately and take spill prevention precautions.

C. The industrial discharger shall implement measures to prevent accidental spills or discharges of prohibited substances to the municipal sewer system. Such measures include, but are not limited to, secondary containment of chemicals and wastes, elimination of connections to the municipal sewer system, and spill response equipment.

D. Any facility changes, which will result in a change in the character or volume of the pollutants discharged to the municipal sewer system, must be reported to your KCIW representative. Any facility changes that will cause the violation of the effluent limitations specified herein will not be allowed.

E. In the event the permittee is unable to comply with any of the conditions of this discharge authorization because of breakdown of equipment or facilities, an accident caused by human error, negligence, or any other cause, such as an act of nature the company shall:

1. Take immediate action to stop, contain, and clean up the unauthorized discharges and correct the problem.

2. Immediately notify KCIW and, if after 5 p.m. weekdays and on weekends, call the emergency King County treatment plant phone number on Page 1 so steps can be taken to prevent damage to the sewer system.

3. For discharge violations, collect a sample and submit new data to KCIW within 14 days of becoming aware of the violation.

4. Submit a written report within 14 days of the event (*14-Day Report*) describing the breakdown, the actual quantity and quality of resulting waste discharged, corrective action taken, and the steps taken to prevent recurrence.

F. Compliance with these requirements does not relieve the permittee from responsibility to maintain continuous compliance with the conditions of this discharge authorization or the resulting liability for failure to comply.

G. The permittee shall, at all reasonable times, allow authorized representatives of KCIW to enter that portion of the premises where an effluent source or disposal system is located or in which any records are required to be kept under the terms and conditions of this authorization.

H. Nothing in this discharge authorization shall be construed as excusing the permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations including discharge into waters of the state. Any such discharge is subject to regulation and enforcement action by the Washington State Department of Ecology.

I. This discharge authorization does not authorize discharge after its expiration date. If the permittee wishes to continue to discharge after the expiration date, an application must be filed for reissuance of this discharge authorization at least 90 days prior to the expiration date. If the permittee submits its reapplication in the time specified herein, the permittee shall be deemed to have an effective wastewater discharge authorization until KCIW issues or denies the new wastewater discharge authorization. If the permittee fails to file its reapplication in the time period specified herein, the permittee will be deemed to be discharging without authorization.

DocuSigned by:

Compliance Investigator: Ryan Salem Date: 3/31/2023

4DE9136CC5F142A...

Ryan Salem

Appendix B

PSCAA Operation and Monitoring Requirements

Puget Sound Clean Air Agency – Soil Remediation Operation and Monitoring Requirements – Catalytic Oxidizers

1. The operator shall vent all vapors from the multi-phase extraction (MPE) system to a catalytic oxidizer prior to discharge to the atmosphere. The MPE system shall not be used to process halogenated compounds or Resources Conservation Recovery Act (RCRA) hazardous waste.

2. The control efficiency of the MPE system abatement device shall meet the following requirements, as applicable:
    a. ≥97% if inlet TPH ≥ 200 ppmv, measured as hexane or its equivalent; or
    b. ≥90% if inlet TPH < 200 ppmv, measured as hexane or its equivalent; or
    c. ≤10 ppmv at the outlet of the control device, measured as hexane or its equivalent.

3. The operator shall meet the following operating requirements:
    a. The maximum influent flow rate to the abatement system shall not exceed 300 cubic feet per minute (cfm). The influent flow rate shall be based on meeting the effluent limits for TPH/BTEX.
    b. The operator shall only use electric power to operate the catalytic oxidizer.
    c. The MPE system shall be operated with a minimum catalytic oxidizer temperature of at least 580 degrees Fahrenheit.
    d. The MPE system shall be equipped with an alarm that shuts the system off when the actual temperature readings fall below the minimum operating temperature in Condition No. 3.c.

4. The catalytic oxidizer shall be equipped with continuous temperature measuring and recording instrumentation to demonstrate compliance with the minimum inlet temperature requirements of Condition No. 3.c.

5. To demonstrate compliance with Condition No. 2 of this order, the owner or operator shall measure the inlet and exhaust gas streams by use of a hand held instrument capable of detecting concentrations at the levels expected, EPA Reference Method 8260B, EPA Method 8021, EPA Method TO-15, EPA Method 8015, or other equivalent method approved by the agency at least once per month after initial start-up as follows:
    a. Analyze inlet gas stream to determine the flow rate and the concentration of TPH/BTEX present.
    b. Analyze exhaust gas to determine the flow rate, and the concentration of TPH/BTEX present.
    c. Calculate the control efficiency based on the inlet and exhaust concentrations.

    The MPE system shall not contain a valve or any other device which will either dilute or restrict the flow of the soil gases unless the position of the device can be measured and controlled. If a device is installed, its position must be measured and recorded any time a test sample is taken which will be used to calculate either the mass flow rate of VOCs into the atmosphere or the destruction efficiency of the control device.

    If using a PID or FID, TPH shall be measured as hexane or its equivalent using the applicable response factors.

6. The owner or operator may operate the soil vapor extraction system without any controls when inlet sampling data from two or more consecutive months shows all of the following:
    a. Pre-control TPH emission rate is equal to or less than 2.74 lbs/day.
    b. Pre-control Benzene emission rate is equal to or less than 0.018 lbs/day.

7. The owner or operator shall maintain records of the following information:
    a. Hours and time of operation of the extraction system and control devices.

   b. The results of analysis or monitoring performed as required by condition 5.
   c. The control efficiency calculation results.
   d. A summary of the temperature readings data on a monthly basis.

8. The owner or operator shall report any non-compliance with any condition of this order to the Agency no later than 30 days in which it is first discovered. The owner or operator shall detail the corrective action taken and include the data showing the exceedance as well as the time of occurrence in the submittal.

9. Records required to be maintained by this Order of Approval shall be kept for at least two years from the date of generation and made available to Puget Sound Clean Air Agency personnel upon request.

<u>Puget Sound Clean Air Agency – Soil Remediation Operation and Monitoring Requirements – Activated Carbon System</u>

1. The operator shall vent all vapors from the multi-phase vapor extraction (MPE) system to a minimum of two (2) granular activated carbon (GAC) canisters arranged in series prior to discharge to the atmosphere. The MPE system shall not be used to process halogenated compounds or Resources Conservation Recovery Act (RCRA) hazardous waste.

2. The control efficiency of the MPE system abatement device shall meet the following requirements, as applicable:
   a. ≥97% if inlet TPH ≥ 200 ppmv, measured as hexane or its equivalent; or
   b. ≥90% if inlet TPH < 200 ppmv, measured as hexane or its equivalent; or
   c. ≤10 ppmv at the outlet of the control device, measured as hexane or its equivalent.

3. The operator shall ensure the maximum influent flow rate to the abatement system shall not exceed 300 cubic feet per minute (cfm). The influent flow rate shall be based on meeting the effluent limits for TPH/BTEX.

4. To demonstrate compliance with Condition No. 2 of this order, the owner or operator shall measure the inlet and exhaust gas streams by use of a hand held instrument capable of detecting concentrations at the levels expected, EPA Reference Method 8260B, EPA Method 8021, EPA Method TO-15, EPA Method 8015, or other equivalent method approved by the agency at least once per month after initial start-up as follows:
   a. Analyze inlet gas stream to determine the flow rate and the concentration of TPH/BTEX present.
   b. Analyze exhaust gas to determine the flow rate, and the concentration of TPH/BTEX present.
   c. Calculate the control efficiency based on the inlet and exhaust gas analysis.

   The MPE shall not contain a valve or any other device which will either dilute or restrict the flow of the soil gases unless the position of the device can be measured and controlled. If a device is installed, its position must be measured and recorded any time a test sample is taken which will be used to calculate either the mass flow rate of VOCs into the atmosphere or the destruction efficiency of the control device.

   If using a PID or FID, TPH shall be measured as hexane or its equivalent using the applicable response factors.

5. <u>Breakthrough:</u> During operation of the activated carbon vessels, the owner or operator shall contemporaneously monitor the gas stream by use of a hand held instrument capable of detecting concentrations at the levels expected to prevent breakthrough at least twice per week at the following locations:
   a. At the lead carbon vessel inlet;
   b. At the inlet to the last carbon vessel in series (outlet of lead carbon vessel);
   c. Outlet of the last carbon vessel prior to venting to the atmosphere.

   The owner/operator of this source may propose for Agency approval, based on actual measurements taken at the site during operation of the source, that the monitoring schedule be changed based on the decline in organic emissions and/or the demonstrated breakthrough rate of the carbon vessels.

   TPH shall be measured as hexane or its equivalent using the applicable response factors.

6. The operator shall immediately change out the first carbon bed with unspent carbon upon breakthrough defined as the detection at its outlet of the higher of the following:
   a. 10 % of the inlet stream concentration to the carbon vessel.
   b. 10 ppmv (measured as hexane or its equivalent).

7. Spent carbon removed from the MPE system shall be stored in closed containers prior to removal from the site.

8. The owner or operator may operate the MPE system without any controls when all the sampling data from two or more consecutive months shows the following:
    a. Pre-control TPH emission rate is equal to or less than 2.74 lbs/day.
    b. Pre-control Benzene emission rate is equal to or less than 0.018 lbs/day.

9. The owner or operator shall maintain records of the following information:
    a. Hours and time of operation.
    b. The results of analysis or monitoring performed as required by condition 5.
    c. The control efficiency calculation results.
    d. When operating the activated carbon vessels, the date change out occurred and the number of carbon vessel(s) changed.

10. The owner or operator shall report any non-compliance with any condition of this order to the Agency no later than 30 days in which it is first discovered. The owner or operator shall detail the corrective action taken and include the data showing the exceedance as well as the time of occurrence in the submittal.

11. Records required to be maintained by this Order of Approval shall be kept for at least two years from the date of generation and made available to Puget Sound Clean Air Agency personnel upon request.

Appendix C

Health and Safety Plan

Kennedy Jenks

32001 32nd Avenue South
Federal Way, Washington 98001
253-835-6400
FAX: 253-952-3435

Site-Specific
Health and Safety Plan (HASP)

Former Circle K Site
2350 24th Avenue East
Seattle, Washington

[*6 February 2024*]

Prepared for

Washington State Department of Ecology

3190 160th Avenue SE
Bellevue, Washington 98008

Project No. 2196008*00

Table of Contents

Table of Contents (cont'd)

List of Tables

List of Attachments

List of Appendices

Health and Safety Plan (HASP) Summary

Project Name	Circle K 1461 Environmental Design & Cleanup	**Project No.**	2196008*00
Prepared by	Ella Gyerko	**Date**	6 February 2024
Project Manager	Ryan Hultgren	**Office**	Federal Way

Field Services Description

Field Services Date(s) 2024

Site Name Former Circle K

Location 2350 24th Avenue East, Seattle, WA

Client Site Contact Dale Myers

Client Site Telephone 425-649-4426

Type of Investigation:

Sampling Investigation:

- ☐ Hand Auger
- ☒ Drilling
- ☒ Trenching
- ☐ Well Installation
- ☐ Soil Sampling
- ☐ Groundwater Sampling
- ☐ Other:

Site Remediation:

- ☒ Excavation
- ☒ Treatment System Installation/O&M
- ☐ Underground Storage Tank (UST) Removal

- ☒ Site Walk-through
- ☐ Other: ___________________

Section 1: Introduction

This Site-Specific Health and Safety Plan (SSHSP), also referred to as a Health and Safety Plan (HASP), developed in accordance with Occupational Safety and Health Administration (OSHA) standards for hazardous waste operations (29 CFR 1910.120) and Washington Department of Safety and Health (DOSH) Standards [Washington Administrative Code (WAC)] Chapter 296-843 establishes general health and safety protocols for Kennedy Jenks personnel at the Washington State Department of Ecology's Former Circle K site located at 2350 24th Avenue East in Seattle, Washington. As needed, addenda containing activity-specific health and safety protocols will be prepared and attached to this HASP prior to the initiation of each additional field activity. The HASP and activity-specific addenda, as a minimum, contain the following information:

- Names of key personnel and alternates responsible for site health and safety and appointment of a Site Safety Officer (SSO).
- A job hazard analysis (JHA) for each site task and operation (see Appendix A).
- Personal protective equipment (PPE) to be used by employees for each site task and operations being conducted.
- Medical surveillance requirements.
- Frequency and types of air monitoring, personal monitoring, and environmental sampling techniques and instrumentation to be used. Methods of maintenance and calibration of monitoring and sampling equipment to be used.
- Site control measures.
- Decontamination procedures.
- An Emergency Response Plan and Procedures that addresses effective site response to emergencies.
- Procedures to report injuries or illness, incident/property damage, or near miss incidents.

For informational purposes only, this plan may be provided to subcontractors of Kennedy Jenks involved in activities at the site, interested regulatory agencies, or others. However, entities and personnel other than Kennedy Jenks shall be solely responsible for their own health and safety and shall independently assess onsite conditions and develop their own health and safety protocols to meet the minimum health and safety requirements.

Kennedy Jenks has developed a Health & Safety Operations Manual (Kennedy Jenks, Corporate Health and Safety Program, July 2023). Kennedy Jenks' Health & Safety Program, upon which the manual is based, complies with current health and safety regulations, including OSHA 29 CFR 1910.120 and Hazardous Waste Operations and Emergency Response. Many of the protocols of the corporate program are conducted on a routine basis (general training, respirator fit testing, general medical record keeping, etc.) and are not repeated herein. The Health and Safety Operations Manual is available to Kennedy Jenks employees upon request during normal business hours. Questions regarding the program should be referred to the Kennedy Jenks Health & Safety Manager (H&S Manager) John Jindra.

A copy of this HASP, along with any addenda containing activity-specific health and safety information, will be kept in a conspicuous location at all times while work is being conducted at the site.

Section 2: Key Health and Safety Personnel

Kennedy Jenks' SSO will be designated by the Project Manager, as appropriate. The current SSO for the project is Ella Gyerko. In the absence of the SSO during field activities, a member of the field investigation team will be designated as Kennedy Jenks SSO. The SSO is responsible for the following.

- Conducting daily tailgate safety briefings (TSBs) for Kennedy Jenks personnel at the beginning of each workday and documenting that subcontractors are also conducting TSBs. Kennedy Jenks staff may combine TSBs with the subcontractor in lieu of conducting separate safety meetings. Combined TSBs meetings will be led by the subcontractor and must include emphasis provided by the subcontractor relative to the subcontractor's work. Other participants, including Kennedy Jenks and any regulatory personnel in attendance, should also discuss their respective health and safety issues and oversight specific to their activities. The TSB Record is attached to this HASP as Appendix B, and a copy of each day's executed form for Kennedy Jenks' TSB must be obtained for the project files, signed by all Kennedy Jenks employees attending the TSB meeting. Any subcontractors must provide the SSO with a daily copy of the subcontractor's own safety briefing form for the project file.
- Observing field activities for compliance with this HASP, applicable addenda, and Kennedy Jenks Health and Safety Operations Manual.
- Maintaining onsite medical surveillance, if required, and emergency medical treatment programs, and assisting in onsite emergencies.
- Modifying health and safety protocols or terminating field work when unsafe work conditions exist.
- Assuring all project team members participating in field activities have read and signed this HASP and have had the opportunity to ask safety-related questions regarding this project.
- Familiarizing personnel with health and safety protocols.
- Observing field personnel wear appropriate PPE.
- Recording data from direct reading instruments on field logs (as appropriate) and evaluating potential hazards.
- Monitoring decontamination procedures.
- Recording occurrence of any site injury, illness, incident, property damage or near miss incident.

If unsafe conditions are encountered, if illness or injury occurs, or if the level of protection needs to be changed, the SSO will consult, in a timely manner, with the Project Manager, Ryan Hultgren, or the H&S Manager, John Jindra.

Section 3: Site Description and History

The Site is associated with a former gasoline service station property located at 2350 24th Avenue East in Seattle, Washington. In 1989, approximately 4,000 to 6,000 gallons of gasoline from a leaking underground storage tank (UST) was released to the subsurface at the Site. Based on available information, the related contaminant plume has extended off-property beneath adjacent streets and residential properties.

The property is approximately 0.26 acre in size and is located in the Montlake neighborhood southeast of the intersection between 24th Avenue East and East McGraw Street, approximately 1,800 feet south of Lake Washington. The area surrounding this Site consists mainly of residential houses and buildings, with some small commercial business located west of the Site along the 24th Avenue East. The property consists of a one-story building and a newer addition to it, which are presently being utilized as a retail dry cleaning store and a convenience store, known as Jay's Cleaners and Mont Market.

The property was operated as a gasoline station and convenience store from 1968 to 1981, owned by Mr. George Renale. Prior to 1968, it is believed the property was residential. From 1981 to July 1990, the property was leased by Mr. Renale to Circle K Corporation, who also operated the facility as a gasoline station and convenience store. In November 1990, Mr. Kuk Jin Choung, the current owner, purchased the property from Mr. Renale and has operated it as a retail dry cleaning retail store since then. In February 1992, Mr. Choung entered into a Consent Decree with Ecology to begin investigation and remediation of contamination at the Site.

Section 4: Planned Site Activities

Type of Investigation:

Sampling Investigation:
- ☐ Hand Auger
- ☒ Drilling
- ☒ Trenching
- ☐ Well Installation
- ☐ Soil Sampling
- ☐ Groundwater Sampling
- ☐ Other:

Site Remediation:
- ☒ Excavation
- ☒ Treatment System Installation/O&M
- ☐ UST Removal

☒ Site Walk-through ☐ Other: ________________

☒ Onsite Inspection or Construction-Related Services

☐ Entry into a Confined Space or Excavation[1]

☐ Work Along a Leading-Edge Requiring Fall Protection

☐ Entry into an Excavation or Trench with a Depth of 5 feet or Greater (4 feet in Oregon and Washington)

☐ Field Investigation Requiring
- ☐ a. Entry into (potentially) hazardous area
- ☐ b. Interruption of vehicular traffic
- ☐ c. Interruption of plant processes
- ☐ d. Operation of pilot plant

☐ Chemical Use[2]

☐ Other - *specify*

[1] Completion of Kennedy Jenks Confined Space Pre-Entry Checklist and Entry Authorization is required or review of Client's Confined Space Procedures.

[2] A Field Chemical Use Plan must be completed.

Potential Hazards:

☒ Organics		☒ Solvents	☐ Bases
☐ Inorganics		☐ Pesticides	☐ Fire/Explosion
☒ Metals	☐ Acids	☒ Other: ________________	

Personal Protective Equipment:
- ☐ Level C
- ☒ Level D

The Site is currently operated as a retail mini-mart and dry cleaners with limited parking onsite. Field investigation activities will include utility locate, oversight of subcontractors (e.g. surveying) and resident engineering for a contractor hired by Ecology to install a remediation system. Work will require coordination with the current property owner/operator to consider appropriate means to protect facility operations and workers/customers. In addition, traffic control services are needed for work in City of Seattle right-of-way areas.

Section 5: Hazard Assessment

5.1 Potential Physical & Environmental Hazards

Every job must be scrutinized for potential hazards, which may cause an injury, illness, incident, property damage, or a near miss incident. The preferred method of assessing a job for hazards is to break down each job into smaller tasks. Each task may then be scrutinized by performing a JHA.

Kennedy Jenks JHA form provides examples to assist employees in performing their own JHA. The JHA process is intended to provide a brief, consistent means of identifying and addressing hazards which may injure employees.

Potential hazards may include, but are not limited to, the following:

- Heavy equipment
- Excavations and Trench work
- Tripping and falling hazards
- Heat stress
- Cold exposure
- Underground/overhead utilities
- Motor vehicle hazards
- Biological exposure
- Equipment hazards
- Working over or near open water
- Chemical exposure
- Fire/explosion hazard.

5.1.1 Heavy Equipment

Field personnel should be cognizant of potential physical hazards associated with use of heavy equipment and electrical equipment during field operations. Appropriate precautions include the following:

- American National Standards Institute (ANSI)-approved hardhats, Class II reflective safety vests (when outside), safety glasses or goggles, and safety-toe boots will be worn.

- Loose clothing that may catch in moving parts will not be worn.
- Hearing protection will be worn if a preliminary noise survey or past experience indicates maximum noise levels will exceed 85 decibels at any time during site operations or if sound levels become uncomfortable or prevent conversation at normal levels.
- Maintain visual contact with the equipment operator at all times within or near the equipment operating radius.

Prior to conducting drilling, a survey shall be conducted and discussed in the TSB to identify overhead electrical hazards and potential ground hazards, such as hazardous agents in the soil or underground utilities. Kennedy Jenks' staff will stay at least 25 feet from active drilling rig when possible. Coordinate collection of samples with equipment operator. Wear hearing protection when equipment is operating.

5.1.2 Excavation and Trench Work

Field personnel should enter an excavation or trench only as a last resort. Any excavation or trench exceeding 5 feet (4 feet in Washington and Oregon) in depth must be properly shored, braced, or sloped, and a safety ladder must be provided for ready access or egress.

5.1.3 Tripping and Falling Hazards

Other potential physical hazards include falling and tripping on slippery, uneven, or unpaved surfaces.

Extra care should be taken in the event of freezing ground, sleet, or snow. Modify walking activities accordingly, paying close attention to exposed bare surfaces, such as stairs, platforms, concrete walkways, truck beds, etc.

5.1.4 Heat Stress

Adverse climate conditions, primarily heat, are important considerations in planning and conducting site operations. Maximum daytime temperature may exceed 75 degrees Fahrenheit (°F) at the site, and heat stress is an associated concern. Provisions of Kennedy Jenks Heat Illness Prevention Fact Sheet, Appendix C, will be applied to all projects when Kennedy Jenks employees are subjected to sustained temperatures of 85 °F or greater.

Preventive measures include the following:

- Water and/or commercial electrolyte solutions will be available, and drinking these fluids will be encouraged. When temperatures exceed 85 °F, sufficient water will be provided to accommodate each employee with 1 quart of water per hour. Water will be kept cool by means of a portable cooler with ice or similar means.
- Suitable acclimation periods will be provided for workers to gradually establish their resistance to heat stress.

Personnel exhibiting symptoms of heat stress (nausea, cramps, dizziness, clammy skin) will be removed from the work area, cooled, and provided with water, and the personnel will be observed (see Appendix C, Heat Stress Fact Sheet). Personnel exhibiting symptoms of heat stroke (hot dry skin, mental confusion, unconsciousness) will be immediately cooled and taken to the hospital. A map and written directions to the local medical facility are included as Attachment 1.

5.1.5 Cold Exposure

Cold injury (e.g., frostbite and hypothermia) and impaired ability to work are dangers encountered at low temperatures and high wind-chill factors. To guard against these conditions, if cold weather is an important consideration at this site, field personnel should wear appropriate clothing, have access to readily available warm shelter, take carefully scheduled work and rest periods, and monitor physical conditions of other workers. See Appendix D, Cold Stress Fact Sheet.

5.1.6 Underground/Overhead Utilities

The site may contain underground and aboveground utilities, including buried electrical, natural gas, water, sewer and fuel lines, and aboveground utilities, such as high-voltage transmission lines. These utilities present a potential hazard if they are struck or can arc if equipment is located too close to them. Kennedy Jenks will use the following notification, documentation and clearance procedures to clear all boring or excavation locations of utilities prior to subsurface invasive activities. Subsurface invasive work includes excavations, borings, surface grading, and hand augering soil samples when depths penetrate more than 6 inches below ground surface (bgs). Work is not to proceed where there is doubt regarding the location of underground utilities or obstructions. Invasive Activities – Utility Location Standard Operating Procedures are included as Appendix E.

Notification Procedures: Notification is made through the One-Call Center (411) for all subsurface invasive work located on public property. Kennedy Jenks or its designated subcontractor will call for a universal underground notice at least 2 business days (48-Hours) before drilling or subsurface invasive activities are to begin.

As applicable, document any conversations with local facility personnel who may know of mapped or unmapped utilities on client property.

Document time of the notifications/calls, names of utilities to be contacted, and obtain a ticket number for the call on Kennedy Jenks Utility Location and Acknowledgement Form included as Appendix E. On private property not covered by the Utilities Underground Location Center, Kennedy Jenks may be required to contact and receive utility clearance approval from a combination of other public and private entities, as well as private landowners, City officials, and State of Washington entities to obtain clearance approval who may have underground utilities in the work area that includes the use of geophysical methods to verify marked utilities and potentially identify unmarked or unmapped utilities. These methods include electromagnetic conductive surveys, electromagnetic passive surveys, and electromagnetic inductive surveys. Further discussions of each of these methods can be found at the following federal highway administration weblink: https://www.fhwa.dot.gov/utilities/utilityrelo/4.cfm

Documentation: All proposed subsurface excavations, boring, and well locations are to be marked on the ground surface using **white** paint in accordance with American Public Works as shown on the American Public Works Association (APWA) Uniform Color Code. A Kennedy

Jenks Utility Location and Acknowledgement Form must be filled out for each proposed well, boring, or excavation location. Obtain signatures on the Acknowledgement Form from each private or public utility owner to document clearance on each form, as required. All correspondence (emails or voice) with the public or private locator and client representative should be documented on the Communication Log.

At all locations where drilling, probing, or well installation will be performed, an air knife or similar form of suction potholing will be performed to assess possible underground utilities in the upper 6 to 8 feet of soils (depending on local conditions and expected depth of utilities). Potholing is required at **all drilling locations**, except in remote areas where the likelihood of encountering underground utilities is very low and only as approved by a Risk Manager, Operations Manager or Officer of the company familiar with underground utilities. (Note: Use of an air knife will be appropriate for most invasive drilling and probing work but may not be appropriate for certain activities like very shallow borings (less than 1-foot deep), certain hand-auger borings, remedial injections using probe equipment, and test pitting.) Case--by--case exceptions for activities may be provided.

Should an underground line or pipe or other obstruction be encountered unexpectedly or disturbed (broken, damaged, or undermined) immediately discontinue invasive activities and contact the Project Manager. If the Project Manager cannot be reached, contact an officer of Kennedy Jenks. Secure the area to prevent further disturbance/damage.

When clearing the site for utilities, **ALWAYS REMEMBER TO LOOK UP for overhead utilities**. Kennedy Jenks will direct its subcontractors to limit the proximity of equipment to overhead power transmission lines according to the following schedule:

Power Line	Distance from Power Line
50 kilovolts (kV) or below	10 feet
50 KV – 200 kV	15 feet
200 KV – 350 kV	20 feet
350 KV – 500 kV	25 feet
500 kV – 750 kV	35 feet
750 kV – 1,000 kV	45 feet

If the voltage of a power line is unknown, assume it is 1,000 kV

5.1.7 General Motor Vehicle Hazards

When working at the site, personnel should be aware of the following situations or activities:

- Vehicle, truck, and equipment traffic on residential streets and nearby service roads. Use barricades, signage, and/or a traffic control plan, where appropriate. Kennedy Jenks personnel are NOT trained in and are NOT authorized to set up traffic control or work as a highway flagger.

- When driving personnel should be aware of the potential of falling asleep at the wheel and take rest stops and breaks, at regular intervals or as needed. Do not drive to and from the site if weather conditions make road travel unsafe.

- When driving or walking, personnel should be aware of backing up hazards. Recognize that not all vehicles have warning beeping sounds or review cameras to see people and objects as they are moving in reverse. As the driver, visually confirm the area behind the vehicle is clear of any obstacles before backing up.

5.1.7.1 Work Zone Hazards

A work zone is an area of roadway with construction, maintenance, or utility work activities. A work zone is typically marked by signs, channelizing devices, barriers, pavement markings, and/or work vehicles. It extends from the first warning sign or rotating/strobe lights on a vehicle to the "End of Road Work" sign or the last temporary traffic control device.

- Do not speed in work zones; obey the posted speed limits.
- Stay alert! Expect the unexpected.
- Watch for workers; drive with caution.
- Don't change lanes unnecessarily.
- Avoid using mobile phones while driving in work zones.
- Turn on headlights so that workers and other drivers can see you.
- Be especially alert at night while driving in work zones.
- Expect delays, especially during peak travel times.
- Allow ample space between you and the car in front of you.
- Anticipate lane shifts, and merge when directed to do so.
- Be patient!

5.1.7.2 Seasonal Change Hazards

- Winter driving will bring slippery roads, visibility issues and cold.
- Spring provides rain which can cause slippery roads.
- Summer with high temps can cause vehicle problems and more traffic on roads.
- Fall brings wet leaves on the road which can make it slippery and require longer stopping distances, similar to driving on light snow.
- During Daylight Savings Time, the position of the sun in the sky changes. Related hazards to consider are shadows, darkness and glare.

5.1.7.3 Winter Driving

- Drive slowly and carefully, especially on curves.
- Steer and brake with a light touch. Do not over-steer.
- When slowing or stopping, be careful not to lock the wheels while braking. This could cause skidding.
- Apply even pressure on the brake pedal (ABS or non-ABS).

5.1.7.4 Distracted Driving

Distracted driving is any activity that could divert a person's attention away from the primary task of driving. All distractions endanger driver, passenger, and bystander safety.

- There are three main types of distracted driving:
  - Visual - taking your eyes off the road
  - Manual - taking your hands off the wheel
  - Cognitive - taking your mind off of driving.
- Using a cell phone while driving, whether it is hand-held or hands-free, delays a driver's reactions as much as having a blood alcohol concentration at the legal limit of .08 percent.
- Driving while using a cell phone reduces the amount of brain activity associated with driving by 37 percent.
- Always stay focused and alert when driving.
- Avoid touching and using cell phones.
  - Alternatives:
    - Turn off cell phone while driving.
    - Pull off to the side of the road to make important calls.
    - NOTE: Hands – free devices are safer than holding a phone, however, that does not diminish the dialing distraction and inability to focus completely on driving during a conversation.
    - Bluetooth.
    - Voice-activated and speed dialing.
    - Push-to-Talk devices (radio).
    - Use voicemail until getting to safe destination.

- Exceptions:
  - Emergencies – calling law enforcement for assistance.
  - Reporting road hazards to the authorities.
  - Notifying the authorities of an erratic driver.
- Avoid eating and drinking while driving.
- Do your multi-tasking outside the car (text messaging, eating, making calls, etc.).
- Pull over if you need something from the floor, dashboard, glove compartment, or another part of the car.
- Don't engage in sightseeing while you drive. Stop your car in a safe place if you want to look around.
- If you are drowsy, pull off the road.
- Adjust climate controls, radio, and other infotainment systems before you start driving, or pull over to make adjustments, or ask a front-seat passenger to assist you.
  - When renting vehicles, adjust mirrors, seat and become familiar with controls (lights, blinkers, windshield wipers) before you start driving
- Speak out if the driver in your car is distracted.
- Require passengers to keep their seat belts on at all times and ask for their cooperation in helping you keep your attention on driving.
- Keep your eyes and mind on the task – driving. Do not drive when you are upset, excited, or having other strong emotions or physical symptoms which could interfere with your concentration.

5.1.8 Biological Hazards

Personnel should be aware of the potential presence of insects such as spiders and wasp/hornets, or snakes in wellheads or other enclosures.

The site may have some vegetative areas that may contain poisonous plants or tress such as sumac and/or poison ivy. Contact with such plants should be avoided. If contact is suspected, wash the area immediately with soap and water.

Ticks may be prevalent at the site. To prevent exposure, staff should wear long sleeves, light colors, and consider tucking pant legs into boot cuffs and/or duct taping pant legs to boots. Regular "tick checks" should be conducted throughout the day. Field clothes should be removed immediately after work is complete and washed.

Insect repellent with DEET could also be used to prevent exposure to biting insects such as ticks and mosquitoes.

Mosquitoes may pose a hazard because they are potentially infected with Eastern Equine Encephalitis (EEE) which may be transmitted through their bite. Personnel should have awareness of the severity of EEE warnings currently in the area. Field work should not be conducted during times of day when mosquitoes are known to be most active (i.e., dawn and dusk). Long-sleeve shirts, pants, gloves, and mosquito netting (over head and neck) should be worn to prevent exposure.

5.1.9 Equipment Hazards

Working with hand and small power tools, personnel should be aware of the following:

- Utilize tools only for the purpose for which they were designed.
- Inspect all tools and equipment before they are used.
- Immediately remove from service any tool or piece of equipment that is damaged.
- Be aware of potential of a burning hazard should equipment get hot during use.
- Do not wear any jewelry (including finger rings) or loose-fitting clothes that may get caught in equipment while conducting field activities.
- Use caution when lifting and carrying backpack containing bladder pump. The backpack weighs approximately 25 pounds. If walking long distances between monitoring wells, take intermittent rest breaks as needed to prevent fatigue.

5.1.10 Working Over Near Water

Employees working over or near water shall consider the following recommended safety procedures:

- Employees must evaluate water conditions such as temperature or water current to select proper PPE. Example: dry suit and/or fall protection equipment. In addition, employees working within 4 feet of the water edge must wear properly sized U.S. Coast Guard personal floatation device (PFD).
- Perform visual inspections of area noting potential overhead and other hazards that are not in the normal field of vision.
- For work to be performed near water and more than 4 feet from the water’s edge, erect sufficient barricades 4 feet away from the water’s edge using traffic cones, plastic fencing, or caution tape to serve as a warning system when a worker unintentionally approaches the water’s edge.
- For work to be performed above water and/or within 4 feet of the water’s edge, another worker who can immediately summon emergency rescue must stand guard.
- Employees must know how to use rescue equipment such as “pole & life hook or ring buoy.” (Ring buoys with at least 90 feet of line shall be provided and readily available for emergency rescue operations.)

- Proper footwear with adequate traction must be utilized when working or walking on wet surfaces.

5.1.11 Winter Weather Hazard

There is a potential for snow and/or ice in the area of the proposed investigation. Personnel should layer clothing to lessen impact of the cold stress on the body (see Cold Stress Fact Sheet in Appendix D). Snow and ice can also cause roads and ground to be slick; therefore, extra precaution should be taken while driving, and moving around the work site. If personnel become too cold, they should take a break to warm up or add extra layers that do not impact PPE. If personnel experience symptoms of cold stress, they should stop work, and seek medical attention. See the Cold Stress Fact Sheet in Appendix D.

5.1.12 Other Safety Considerations

When working at the site, personnel should be aware of the following situations or activities:

- Vehicle, truck, and equipment traffic on residential streets and nearby service roads. Use barricades, signage, and/or a traffic control plan, where appropriate. Kennedy Jenks personnel are NOT trained in and are NOT authorized to set up traffic control or work as a highway flagger.

- Working with hand and small power tools. Utilize tools only for the purpose for which they were designed. Inspect all tools and equipment before they are used. Immediately remove from service any tool or piece of equipment that is damaged. Be aware of the potential of a burning hazard should equipment get hot during use.

- Do not wear any jewelry (including finger rings) or loose fitting clothes that may get caught in equipment while conducting field activities.

- Personnel should be aware of the potential presence of black widow spiders, wasp/hornets, or snakes in wellhead or other enclosures.

- When driving, personnel should be aware of the potential for wildlife to be on the road, or run into the road. Driving after dark should be limited as much as possible.

- When driving, personnel should be aware of the potential of falling asleep at the wheel and take rest stops and breaks, at regular intervals or as needed. Do not drive to and from the site if weather conditions make road travel unsafe.

5.2 Potential Chemical Hazards

Gasoline-range organics (GRO), and benzene, toluene, ethylbenzene, and xylenes (BTEX) have been detected in groundwater and soil samples collected at the site. Field personnel could potentially be exposed to GRO and BTEX at the site by direct contact with soil or groundwater, through inhalation of dusts containing organic chemicals or through inhalation of organic chemical vapors. Field personnel will minimize potential chemical hazards by 1) avoiding direct contact with groundwater and soil, 2) performing air monitoring to determine necessary level of personal protective equipment, and 3) avoiding generation of dust. Ingestion of particulate matter containing chemicals is another general exposure route. However, for site personnel, the potential for this type of exposure is minimal. Safe work practices, including restriction of eating, drinking, or smoking to certain times and places, will be enforced at the work site.

5.2.1 Groundwater Samples

Chemicals detected in groundwater from the site and the highest detected concentrations are listed in Table 1.

5.2.2 Soil Samples

COCs have been detected in subsurface soil samples collected at the site. The highest reported concentrations are listed in Table 2.

Available Threshold Limit Values (TLV) or Permissible Exposure Limits (PEL) published for potential chemicals that may be detected in soil and groundwater are listed in Table 3.

5.2.3 Chemical Use Plan and Safety Data Sheets (SDS)/Hazard Communication

In addition to site-related chemicals, Kennedy Jenks field personnel may work with compressed gasses, decontamination materials, and other materials that present potential health and safety issues. Typical chemicals that may be brought to the site are listed below.

- Aerosol marking paint for utility locating
- Simple Green for equipment decontamination

Kennedy Jenks has a "cradle to grave" policy regarding the purchase, storage, use, transportation, and disposal of chemicals used in the field. The Chemical Use Policy and Procedures are attached as Appendix F to provide guidance on the proper protocols for chemical use in the field. The Chemical Use Plan (see Appendix F) must be completed by Kennedy Jenks field staff using the chemicals and approved by the H&S Manager.

Kennedy Jenks has a Hazard Communication Written Program located on SafetyZone. Personnel conducting field activities must complete a review of the Hazard Communication Written Program and site-related chemical hazards prior to starting field activities.

The Hazard Communication Written Program is part of Kennedy Jenks Health and Safety Operations Manual.

Copies of the SDS for chemicals listed in Table 1 or listed in this section are provided in Appendix G.

Section 6: Community Hazard Analysis

Generally, insignificant particulate and vapor emissions are generated during routine soil and groundwater sampling activities. During construction-related activities, particulate and vapor emissions may increase above concentrations generated during routine soil and groundwater sampling activities. Therefore, activity-specific health and safety addenda will be developed for activities where elevated particulate and vapor emissions may develop. Onsite worker exposure to chemicals at concentrations of concern is not expected. Potential exposures to the surrounding community will likely be much less than potential onsite worker exposure and is, therefore, also not expected to be of concern.

However, a potential for onsite worker exposure to chemicals exists during drilling and sampling activities. If, based on the action levels provided in Section 7, it becomes necessary for site personnel to don Level C PPE, Kennedy Jenks along with its subcontractors will establish three work zones: Exclusion Zone, Contaminant Reduction Zone, and Support Zone as described in Section 7.2. Exclusion and Contaminant Reduction Zones will control entrance and exit from potential exposure areas. Continuous air monitoring will be performed during activities performed within the Exclusion Zone to ensure that the appropriate level of PPE is selected and within the Support Zone to ensure that support workers are not exposed to chemicals. Potential exposures to the surrounding community are unlikely based on the size of the property. If air monitoring indicates that there is the potential for the surrounding community to be exposed, Kennedy Jenks will stop work and evaluate the need for alternative controls.

Use of barricades, caution tape, or signage to keep the general public away from working areas should be used where and when appropriate. At a minimum, keep public and non-essential personnel at least 50 feet away from an active drilling area. This can be accomplished using barricades, cones, vehicles, and caution tape.

Section 7: Protective Actions

7.1 PPE

Field personnel will wear equipment to protect against potential physical and chemical hazards, which have been identified herein and those that become apparent in the field. Guidelines for Contaminants Commonly Encountered at Kennedy Jenks Sites provide guidance in assessing potential hazards and selecting the appropriate protection. Level D protection will be required at a minimum for field activities at the site. Level D personal protective equipment to be used may include all items on the following list that are denoted by an asterisk (*).

The level of protection employed may be upgraded, as deemed necessary by the SSO. If non-routine field activities are initiated, the level of protection will be specified in the activity-specific health and safety addenda.

PPE and Monitoring Equipment

☒ Safety Glasses

☐ Face Shield

Boots: ☒ Safety-Toe ☐ Work ☐ Rubber ☐ Other
☒ Class II High-Visibility Reflective Safety Vest
☒ Hard Hat
☒ Earmuffs/Plugs (as needed)
☒ Work Gloves ☐ *Neoprene* ☐ *Rubber* ☒ *Nitrile*
☐ Suits: ☐ *Cotton* ☐ *Tyvek* ☐ *Nylon* ☐ *Other*

☐ Respirator: (Type/Cartridge: *specify)*
☒ Emergency Eyewash bottle ☐ Emergency Shower
☐ Spill Kit
☒ Fire Extinguisher
☒ First Aid Kit
☐ Life Jackets ☐ Rescue Life Ring
☐ Safety Belt/Harness/Tripod
☐ Lights *(type:_________)*

☒ Cell Phone

☐ Lockout Tags and Locks

☐ Four Gas Monitor for Confined Space Entry (calibration date: specify)
☐ Ventilator/Fan
☐ Volt/Ampere Meter
☒ PID *(calibration date: daily)*
☐ OVA *(calibration date: specify)*
☐ OVM *(calibration date: specify)*
☐ Hydrogen Sulfide Meter *(calibration date: specify)*
☐ Draeger Detection Tubes
☐ Soil Sampling Kit

☐ pH Meter/Paper
☐ Conductivity/Temperature Meter
☐ Metal Detector
☐ Air Sampling Equipment
☐ Peristaltic Pump

☐ Other: specify

7.2 Work Zones

Work zones, including designation of an Exclusion Zone, a Contamination Reduction Zone, and a Support Zone, will be established for any field activity that requires Level C protection or greater. Work zones will be clearly marked in the field. Work zones may vary depending on the proposed field activity and will be established in the activity-specific health and safety addenda.

7.3 Monitoring

7.3.1 Hazardous Substances

As appropriate, field personnel will perform air monitoring at least twice daily with a direct reading organic vapor analyzer (OVA, OVM, or HNU) in the breathing zone at each work location. All readings shall be recorded in field logs. All direct reading instruments shall be calibrated according to the manufacturer's specifications. The following action levels will be used.

- If OVA readings for a particular work area consistently exceed 5 parts per million (ppm) above background, then sampling will cease and personnel will withdraw from the work area.
- If concentrations persist above 5 ppm, then Level C protection will be required if work is to continue.
- If OVA readings exceed 10 ppm in the breathing zone while workers are in Level C protection, then work will cease, and the source of the emission will be determined and eliminated before work continues.
- Periodic measurements of the area will be taken before re-entry to ensure lower exposure limit (LEL) has been reduced to safe working levels.

7.3.2 Explosive Limits

If conditions encountered during drilling or sampling suggest potentially explosive conditions may exist, the SSO will direct explosimeter monitoring be conducted. The following explosimeter monitoring action levels will be used:

- If gas or vapor concentration is less than 10 percent of its LEL, continue investigation.
- If concentrations are between 10 and 25 percent of its LEL, continuously monitor site and continue investigation with extreme caution.
- If concentrations are greater than 25 percent of LEL, withdraw from area immediately.

7.3.3 Noise

Field personnel will initially monitor noise levels associated with equipment and machinery with a direct reading portable noise level monitor unless based on experience, it is known that hearing protection is not necessary. Readings will be taken within the normal worker hearing zone. If maximum noise levels exceed 85 decibels at any time during site operations, hearing protection will be worn.

The OSHA permissible noise exposure limit is 90 decibels as an average exposure over an 8-hour work period. If an employee's 8-hour time-weighted average noise exposure for any day is in excess of 85 decibels, the employee must participate in a hearing conservation program. For most field activities, it is unlikely the employee exposure in excess of 85 decibels for 8 hours will occur. Although a written hearing conservation program is not required, Kennedy Jenks will provide field personnel with appropriate hearing protection (i.e., earmuffs or plugs) whenever noise levels have the potential to exceed 85 decibels.

All contractors are responsible to ensure whether a hearing conservation program is warranted per site conditions and are to ensure compliance with applicable OSHA regulations.

7.4 Site Control

Work zones will not be established for Level D activities. Individuals not directly involved in ongoing work will be requested to stay at least 50 feet away from Level D activities. For work inside a building, access will be controlled using building access control.

7.5 Decontamination

For activities requiring Level D protection and modified Level C protection without established work zones, it is unlikely major decontamination will be necessary. At the conclusion of each day or work period, disposable gloves and coveralls will be removed and disposed of in onsite containers.

If full Level C protection is required, minimum decontamination procedures associated with Level C protection will be followed and established within the Contamination Reduction Zone. These procedures are presented in Table 4.

7.6 Training

Kennedy Jenks personnel participating in field activities will have completed the Hazardous Waste Operations and Emergency Response 40-hour health and safety training course (29 CFR 1910.120), or have equivalent training, and have undergone annual 8-hour refresher training. Training requirements are discussed in Kennedy Jenks Health and Safety Operation Manual. Prior to each work day, a TSB meeting will be held at the site to familiarize personnel with health and safety issues, protective equipment, emergency information, and supplies and to discuss special topics.

7.7 Medical Monitoring

Kennedy Jenks personnel participating in field activities will be included in a medical monitoring program. The program includes a baseline physical examination, pulmonary function test, and blood and urine tests. Periodic (annual) examinations will be provided to employees who are exposed to hazardous substances or health hazards at or above the established PEL, above the published exposure levels for these substances, without regard to the use of respirators, for 30 days or more a year. Annual examinations will also be provided to Kennedy Jenks employees who wear a respirator for 30 days or more a year or as required by 1910.134. Details of the medical program are included in the Kennedy Jenks Health and Safety Operations Manual.

7.8 Sanitation and Illumination

The site may have drinking water, washing water, and restroom facilities available. If drinking water is not available at the site, a sufficient amount of water will be provided to accommodate each employee with 1 quart of water per hour. The water will be kept cool by means of a portable cooler with ice or similar means.

No eating, drinking, smoking, or gum or tobacco chewing is allowed in restricted areas.

Activities will take place during daylight hours. Because natural illumination (approximately 50- to 200-foot candles) will be sufficient to meet the 5-foot candle requirement for general site areas, no additional illumination will be required.

7.9 COVID-19 Procedures and Processes

The following information summarizes hazards, risks, and mitigation/minimization strategies for COVID-19 exposure and transmission in anticipation of field activities. The procedures established herein provide a framework, with the expectation that site personnel will work together to optimize and refine these procedures to most effectively achieve the objective of minimizing COVID-19 exposure and transmission risks and safely completing their field assignments.

7.9.1 COVID-19 Background

Coronaviruses are a large family of viruses that may cause illness in humans or animals. In humans, several coronaviruses are known to cause respiratory infections ranging from the common cold to more severe diseases, such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS). The most recently discovered coronavirus causes coronavirus disease COVID-19.

COVID-19 is thought to spread mainly from person-to-person between people who are in close contact with one another, or through respiratory droplets produced when an infected person coughs or sneezes. These droplets can land in the mouths or noses of people who are nearby or possibly be inhaled into the lungs. It may be possible that a person can get COVID-19 by touching a surface or object that has the virus on it and then touching their own mouth, nose, or possibly their eyes, but this is not thought to be the main way the virus spreads.

7.9.2 Prevention

The best way to prevent illness is to avoid being exposed to this virus. COVID-19 vaccines are available and have been distributed to communities throughout the U.S. Centers for Disease Control and Prevention (CDC) recommends everyday preventive actions to help prevent the spread of respiratory diseases.

7.9.3 Site-Specific Procedures and Guidelines

The following presents guidelines to be followed by all personnel onsite in conjunction with those already set in place. Other contractors/consultants working onsite should be provided this document and commit to abiding by these procedures (or more stringent firm-specific procedures). These procedures supplement those established in each firm's site-specific health and safety plan.

7.9.3.1 Daily Activities

Kennedy Jenks activities at the site are considered a low exposure risk as per OSHA's COVID-19 Regulations.

OSHA recommends the following for low exposure risk:

- Engineering Controls: No additional engineering controls recommended.
- Administrative Controls: Monitor COVID-19 public health communications.
- PPE: No additional PPE required.
- COVID-19 testing as necessary.
- Communication.
- Sanitation.

7.9.3.2 Daily Safety Tailgate Briefings

Field teams conduct daily job safety briefings at the beginning of every workday. These meetings will be conducted onsite each morning or as conditions change. The meetings include daily scope of work and hazards that are present onsite. Recognizing the everchanging stream of information and decisions related to COVID-19, safety briefings will include an overview of pertinent updates. At the end of each meeting (and anytime during the day), all personnel present will have a chance to voice concerns. All personnel onsite have stop work authority, and COVID-19 comfort concerns are a valid reason to stop work and revisit the procedures outlined herein and/or make a go/no-go decision regarding additional field activities. Field teams will record the meeting attendees in a field book in lieu of passing the tailgate sheet for signatures.

7.9.4 Communication and Updates

While onsite, all personnel should practice safe prevention techniques as outlined in the Introduction and follow the guidelines hereinto. COVID-19 will continue to be a concern across the U.S. Kennedy Jenks will continue to provide pertinent communication with personnel onsite.

IF YOU FEEL ILL, CONTACT YOUR H&S REPRESENTATIVE - <u>DO NOT COME TO THE SITE</u>.

Section 8: Emergency Response Plan and Procedures

Workplace emergencies can happen on any jobsite and may have the potential for severe injury to workers and even extreme property damages. Emergency Response Plans and Procedures provide a basic understanding so workers will know what is expected and what to do in the event of an emergency.

In most cases, the first reaction in any emergency is to call 911, but before any project starts, it is critical to verify that the emergency 911 system is in effect in the area and to understand the emergency resources and facilities that are available for the specific jobsite.

All employees must be aware of their role during any emergency situation. Pre-rescue planning, communication, and effective coordination of rescue activities are critical in the event that a life-threatening incident should occur. Does the employee have the appropriate equipment for response and rescue? Every employee needs to know details of the emergency action plan, including specialized safety training and required PPE.

Pre-planning for potential emergencies and potential emergency responses need to be discussed in the Project Kickoff Meeting, each job safety briefing held before work begins and in the development of specific job hazard analysis (JHA).

In the event of an emergency, field personnel must know what to do or be aware of:

- Basic first aid
- How to report any emergency
- The procedure for emergency evacuation, including the type of evacuation and exit route assignments
- What does the alarm system look or sound like to alert workers of emergencies?
- How to account for all employees after evacuation
- Procedures for employees performing rescue or medical duties
- Name or job title of employees to contact.

Hazard recognition is an essential part of the Emergency Response Plan. Initiation of the contingency plan relies on the employee's ability to recognize an emergency or potential for an emergency. The following is a list of events that will immediately initiate emergency procedures:

- Fire and Explosion
- Tornadoes and Earthquakes
- Heavy Equipment Failures
- Hazardous Material Incidents

- Struck-by/Caught-in Incidents
- Release of organic vapors or particulate above the action levels
- Personal injury
- Medical Emergencies
- Failure or expected failure of runon/runoff control measures
- Natural occurrences (i.e., lightning, tornado, high winds, etc.)
- Spills.

8.1 Emergency Communications

Emergency communications will consist of two methods.

8.1.1 Verbal Communication

Verbal communication will be the primary method of emergency communication between onsite personnel, distance permitting.

8.1.2 Telephones

Telephones are used for routine communication and to notify offsite agencies of incidents and request assistance. Emergency telephone numbers are given in Section 9.

8.2 Emergency Protocol

When an event recognized as an emergency occurs, the alarm system will be used to notify personnel. As soon as the alarm system is activated, the SSO will be notified.

The SSO will take into account the following information:

- Nature of emergency
- Wind direction
- Location of personnel
- Monitoring results
- Emergency equipment available
- Offsite population.

Based on this information, the SSO will direct appropriate emergency action and agency notification. After the emergency has been controlled and the site is considered safe to re-enter, the SSO, in coordination with the Project Manager, will direct remedial action to restore the site to full operating condition.

The SSO will investigate the nature and cause of the incident so work procedures can be modified to minimize the likelihood of the incident's recurrence.

All incidents must be reported in a timely and appropriate manner to the Chief Risk Officer and the H&S Manager. An incident is any unplanned event resulting in injury, damage, loss of assets, adverse publicity, or which requires notification of a regulatory agency, regardless of severity. All Kennedy Jenks personnel should report an incident to the SSO. The SSO will report to the Project Manager, who is responsible for notifying the Chief Risk Officer and H&S Manager.

Each incident will be investigated and a Root Cause Analysis Report will be generated and forwarded to the Project Manager and the H&S Manager.

If work zones are established, the Exclusion Zone will have several emergency exits, which will allow safe egress in multiple directions from any point onsite. The exit selection will be based on the emergency location, type of emergency, and wind direction. Upon hearing the evacuation signal or otherwise being notified of an evacuation, employees will immediately travel to the assembly area located at the decontamination station.

Employees will follow a route that avoids locations downwind from the emergency. If emergency exits are used, employees will proceed to the assembly area by the quickest route possible. When the assembly area is reached, employees will immediately check in with the SSO. The site will remain evacuated until the all clear signal has been given.

8.3 Emergency Supplies

The following is a list of emergency equipment available to take to the site:

- Portable emergency eye wash bottles.
- First aid supplies.
- Cooler for water and ice (when temperatures are predicted to be above 85°F).
- Shade cover to protect from sun exposure.

All personnel will have a thorough understanding of the HASP before starting work. It will be reviewed periodically to keep it current with new or changing site conditions or information.

8.4 Injury Response

In the event of an employee injury in a contaminated area, consideration must be given before moving the injured and contaminated employee to outside the restricted contamination area. The nature of the injury, hazards posing an immediate danger, and other factors must all be weighed before moving an injured employee who is wearing contaminated PPE. Initial responders should follow directions from 9-1-1 personnel or the H&S Manager.

Section 9: Reporting (Injury/Illness, Incident/Property Damage, or Near Miss)

9.1 Injury/Illness Care and Notification Procedures

9.1.1 Emergency Services (9-1-1)

Call 9-1-1 for critical injuries or illnesses (i.e., head injuries, uncontrolled bleeding, difficulty breathing, chest pain, or altered level of consciousness) or if an employee or his/her supervisor has immediate concerns about an injury or illness.

9.1.2 Injury/Illness Intervention

Kennedy Jenks has retained WorkCare, a team of occupational physicians, to provide our employees with effective treatment of non-critical work-related injuries and illnesses. WorkCare provides on the spot, 24/7 employee consultations at the time an on-the-job incident occurs, as well as post-accident follow-up and consultation.

9.1.3 When to Call WorkCare

In the instance of a non-critical workplace injury or illness, an employee should call WorkCare at (888) 449-7787 to receive instruction on how to contact one of its clinicians and contact their immediate supervisor as soon as possible. Common non-critical workplace injuries/illnesses include:

- Back sprains
- Slips, trips, falls
- Shoulder strains
- Contact with a harmful substance.

9.1.4 Employee Role

The injured employee, if able, must do the following:

- Report any non-critical injuries/illness to WorkCare at (888) 449-7787 and, as soon as possible, to their immediate supervisor. WorkCare will notify the Chief Risk Officer and the H&S Manager of the injury or illness. The Chief Risk Officer, or designate, will notify the Director of Operations of the injury or illness.

- If WorkCare determines medical attention is required, transportation must be provided for the injured employee. An injured employee must not transport himself/herself to a facility for medical treatment. If a co-worker is not available to transport the injured employee, an ambulance, a taxi, or other means of transportation must be provided, unless the employee is working in a remote area and no other form of transportation is available. WorkCare will send the employee to an approved local facility and inform the treating physician the injury is work related.

9.1.5 Project Manager Role

The Project Manager must do the following:

- Make sure the injured employee contacts WorkCare and is provided transportation to immediately obtain any required medical care from an approved doctor or hospital, if required.

- Provide emergency ambulance service if needed for critical injuries or illnesses, if required.

- Notify the Chief Risk Officer and H&S Manager of the injury or illness.

9.1.6 Injured Subcontractor or Other Non-Kennedy Jenks Employee

In the case of injuries or illness to non-employees, the appropriate staff member should ensure they receive proper medical attention, and their supervisor and the Chief Risk Officer are notified immediately. The Chief Risk Officer will notify appropriate Senior Leadership Team members.

9.2 Injury/Illness, Incident/Property Damage, Near Miss, and Motor Vehicle Incident Investigation

All work-related injury/illness, incident/property damage, near miss, and motor vehicle incidents will be investigated by Kennedy Jenks in a timely manner. Minor incidents and "near misses" will also be investigated so the risk of serious occurrences can be reduced in the future. All serious incidents and serious "near misses" will be investigated by the Chief Risk Officer or the H&S Manager.

- Near Miss. Incidents where no property was damaged and no personal injury sustained, but where, given a slight shift in time or position, damage and/or injury easily could have occurred.

- Rule of Thumb. If you need to ask yourself if the incident was a near miss or not, you have answered the question, and it is a near miss.

Forms

The Injury/Illness, Incident/Property Damage, Near Miss, and Motor Vehicle Incident Reporting Forms are included as Appendix H.

Section 10: Emergency/Team Contacts & Approvals

Emergency Telephone Numbers

	Name	Phone
Site Contact	Dale Myers (DOE)	425-649-4426
WorkCare (Non-Critical Injuries)	WorkCare	888-449-7787
Fire Department[1]		9-1-1
Hospital: UW Medical Center 1959 NE Pacific Street, Suite 207 Seattle, WA		206-598-3300
Directions to hospital[2]: See attached map		
Ambulance		9-1-1
Police		9-1-1
Kennedy Jenks:		
Project Manager	Ryan Hultgren	253-835-6432 (Office) 253-549-9725 (Cell)
Site Safety Officer (SSO)	Ryan Hultgren	253-835-6432 (Office) 253-549-9725 (cell)
Health and Safety Manager	John Jindra	253-835-6466 (Office) 253-254-1079 (Cell)

[1] The local fire department prefers the public use 911 to assure the proper assistance in case of accident or injury.
[2] Attach written directions and map showing route to hospital.

Project Team Members Participating in Field Activities

Name	Affiliation	Responsibility	Signature/Date	
Cayla Whiteside	KJ	Field Engineer/SSO	Cayla Whiteside	6/14/2024
Ella Gyerko	KJ	Field Engineer/SSO	Ella Gyerko	2/6/2024
Mike McIntosh	KJ	Field Geologist/SSO	Michael McIntosh	2/6/2024
Ryan Hultgren	KJ	Project Manager		2/6/2024
Robert Ardissono	KJ	Field Engineer/SSO	Robert Ardissono	6/14/2024

Approvals

	Name	Signature/Date
Project Manager	Ryan Hultgren	2/6/2024
Health and Safety Manager	John Jindra	John Jindra 2/6/24

CC: Project File
PM Portal

Tables

Table 1: Chemicals Detected in Groundwater Monitoring Samples

Chemical	Maximum Concentrations (µg/L)	Sample Location
TPH[a] (GRO)[b]	historical: 464 recent: 109	MW-8[c] (2001) MW-13[c] (2006)
Benzene	historical: 54 recent: 7.26	MW-13 (1990) MW-13 (2006)
Toluene	historical: 28 recent: 14.7	MW-4[c] (2001) MW-13 (2006)
Ethylbenzene	historical: 50 recent: 27.7	MW-13 (1990) MW-8 (2006)
Total Xylenes	historical: 17.1 recent: 15.5	MW-4 (2001) MW-13 (2006)
MTBE	15.5 ug/L	MW-15 (2003)

Note:

(a) Total petroleum hydrocarbon
(b) Gasoline-range organics
(c) Non-aqueous phase liquid (NAPL) has been present historically in wells MW-4, -8, -9, and -13.
mg/L = milligrams per liter
ug/L = micrograms per liter

Table 2: Chemicals Detected in Soil Samples

Chemical	Maximum Concentrations (mg/kg)	Sample Location
TPH[a] (GRO)[b]	1700	NW-1 (north side of former UST excavation area) at 13 feet bgs[c] (1990)
Benzene	31	NW-1 (north side of former UST excavation area) at 13 feet bgs (1990)
Toluene	55	NW-1 (north side of former UST excavation area) at 13 feet bgs (1990)
Ethylbenzene	140	NW-1 (north side of former UST excavation area) at 13 feet bgs (1990)
Total Xylenes	300	NW-1 (north side of former UST excavation area) at 13 feet bgs (1990)

Note:

(a) Total petroleum hydrocarbon
(b) Gasoline-range organics
(c) Below ground surface
mg/kg = milligrams per kilogram

Table 3: Chemical Allowable Exposure Values and Exposure Symptoms

Chemical	TLV TWA[(a)]	STEL[(b)]	PEL[(b)]	Acute Exposure Symptoms[(c)]	Target Organs[(c)]
Benzene	0.5 ppm[(e)]	5 ppm	1 ppm	Irritant to eyes, nose respiratory system nausea	Skin[(d)], liver, kidneys, respiratory system, cardiovascular system, central nervous system (CNS)
Ethylbenzene	100 ppm	125 ppm	100 ppm	Irritant to eyes, mucous membranes, dermatitis, narcosis coma	Skin, liver, kidneys, respiratory system, cardiovascular system, CNS
Toluene	50 ppm	300 ppm ceiling	100 ppm	Fatigue, weakness, confusion, euphoria, dizziness, headache, dilated pupils	CNS, liver, kidneys, skin
Xylene	100 ppm	150 ppm	100 ppm	Dizziness, excitement, vomiting	CNS, eyes, GI tract, blood, liver, kidneys, skin
Methanol (preservative)	100 ppm	250 ppm	200 ppm IDLH[(f)] 6,000 ppm	Eye, skin, and mucus irritant, dizziness, nausea	Optic nerve, liver, and other organ damage
Lead	0.05 mg/m^{3}[(a)]	----	0.05 mg/m^3 IDLH 100 mg/m^3	Weakness, lassitude, insomnia, facial pallor, abdominal pain, anemia, tremor, eye irritation, liver and kidney disease	Eyes, GI tract, CNS, kidneys, blood, gingival tissue
Gasoline	None Developed	----	None Developed	Irritant to eyes, skin, mucous membranes, dermatitis, lassitude, blurred vision, dizziness, slurred speech, confusion, convulsions	Eyes, skin, respiratory system, CNS, liver kidneys
Ethylene dichloride (1,2-DCE; EDC)	1 ppm (Ca TWA[(c)])	2 ppm (ST REL[(c)])	50 ppm TWA	Irritant to eyes, corneal opacity, CNS depression, nausea, vomiting, dermatitis.	Eyes, skin kidneys, liver, CNS, cardiovascular system.
Ethylene dibromide (1,2-DBE; EDB)	0.045 ppm (Ca TWA[(c)])	----	20 ppm TWA	Irritant to eyes, skin, respiratory system, dermatitis with vesiculation..	Eyes, skin, respiratory system, liver, kidneys, reproductive system.

Notes:

(a) TLV TWA = threshold limit value – 8-hour time-weighted average.
American Conference of Governmental Industrial Hygienists (ACGIH). TLV and Biological Exposure Indices for 1997.
TLV TWA reported in ppm represents parts of vapor per million parts of air by volume at 25 degrees Celsius (°C) and 760 torr.
TLV - TWA reported in milligrams per cubic meter (mg/m^3) represents milligrams of substance per cubic meter of air.

(b) STEL = short-term exposure limit.
PEL = Federal Occupational Safety and Health Administration (OSHA) (29 CFR 1910 Subpart Z) Permissible Exposure Level based on 8-hour time weighted average.

(c) Source: U.S. Department of Health and Human Services. National Institute for Occupational Safety and Health (NIOSH) Pocket Guide to Chemical Hazards. June 1994. Sittig, Marshall. 1985. Handbook of Toxic and Hazardous Chemicals and Carcinogens. Park Ridge, New Jersey. Noyes Publications.

(d) Skin notation indicates route of exposure through cutaneous absorption.

(e) ppm = parts per million.

(f) IDLH = immediately dangerous to life and health.

Table 4: Action Measures for Level C Decontamination

Station	Description
1	**Equipment Drop** Deposit equipment used onsite (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, a cool down station may be set up within this area.
2	**Outer Garment, Boots, and Gloves Wash and Rinse** Scrub outer boots, outer gloves, and splash suit with decon solution or detergent water. Rinse off using copious amounts of water.
3	**Outer Boot and Glove Removal** Remove outer boots and gloves. Deposit in container with plastic liner.
4	**Canister or Mask Change** If worker leaves Exclusion Zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and boot covers donned, joints taped, and worker returns to duty.
5	**Boot, Gloves and Outer Garment Removal** Boots, chemical resistant splash suit, inner gloves removed and deposited in separate containers lined with plastic.
6	**Face Piece Removal** Face piece is removed. Avoid touching face with fingers. Face piece is deposited on plastic sheet.
7	**Field Wash** Hands and face are thoroughly washed. Shower as soon as possible.

Attachment 1

Map and Written Directions to Local Hospital

Google Maps

2350 24th Ave E, Seattle, WA 98112 to UW Medical Center - Montlake | Seattle Hospital

Drive 0.9 mile, 5–9 min

Map data ©2024 Google 500 ft

2350 24th Ave E
Seattle, WA 98112

1. Head north on 24th Ave E toward E McGraw St
   0.2 mi
2. Continue onto E Montlake Pl E
   0.5 mi
3. Use the left lane to turn left onto NE Pacific St
   0.1 mi
4. Continue straight to stay on NE Pacific St
   236 ft
5. Turn left onto Frontage Rd
   390 ft
6. Turn right
   105 ft

UW Medical Center - Montlake | Seattle Hospital
Main Hospital, 1959 NE Pacific St, Seattle, WA 98195

Attachment 2

Site Map

\\kjc.local\KJC-Root\KJ-Office\FWY\Data\Projects\2016\1696010.00 WA DOE Circle K Site Assessment\GIS\Events\20210517_DataGapsTM\Figure1_VicinityMapv2.mxd

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors,

Legend

Site Location

N

0 200 400

Scale: Feet

Note:
1. All locations are approximate.

Kennedy Jenks

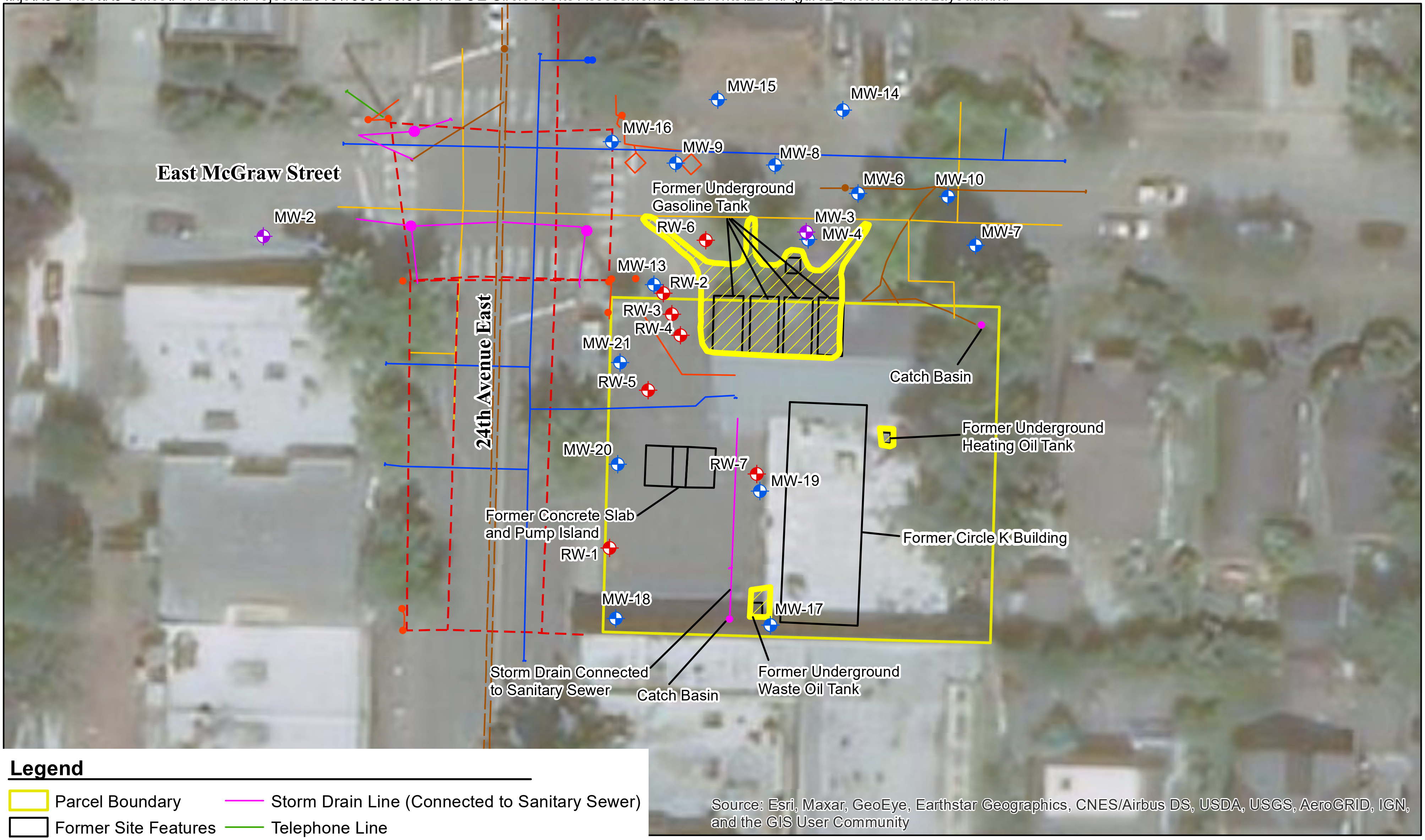
Former Circle K Site
Seattle, Washington

Site Location and Vicinity Map

K/J 2196008*00

Figure 1

\\kjc\KJC-Root\KJ-Office\FWY\Data\Projects\2016\1696010.00 WA DOE Circle K Site Assessment\GIS\Events\EDR\Figure2_HistoricalSiteLayout.mxd



Legend

- Parcel Boundary
- Former Site Features
- Previous Excavations
- Monitoring Well
- Landau Well
- Multipurpose Wells
- Storm Drain Line (Connected to Sanitary Sewer)
- Telephone Line
- Power Line
- Gas Line
- Overhead Power Line
- Sanitary Sewer Line
- Water Line
- 90" RCP Sanitary Sewer Line

Notes:
1. All locations are approximate.
2. Sewer and water line locations are based on available site information and not appropriate for construction purposes.
3. Former feature locations georeferenced from *Report of Geotechnical Services Subsurface Contamination Study and Remedial Action Monitoring Circle K Facility 1461 Seattle, Washington*, dated 6 March 1990 by GeoEngineers.

N

0 20 40

Scale: Feet

Kennedy Jenks

Former Circle K Site
Seattle, Washington

Historical Site Features, Monitoring Wells and Soil Boring Locations

K/J 2196008*00

Figure 2

Appendix A

Job Hazard Analysis

JOB HAZARD ANALYSIS	**Project No.:** 2196008*00
Job/Operation Title: Construction Management / Resident Engineering	**Date:** February 2024
Business Unit: Environmental/Industrial	**JHA Reviewed By:** John Jindra
Project Location: Seattle, WA	**JHA Revised By:** Ella Gyerko
Person(s) Performing This Job/Task: Insert Name(s)	**Project Manager:** Ryan Hultgren
Job/Task Start Date: February 2024	**Job/Task Duration:** 1 year

As a Construction Manager or Resident Engineer, Kennedy Jenks personnel may be exposed to construction hazards created by the Host Employer, Controlling Contractor, or their sub-Controlling Contractors. It is the Controlling Contractor's responsibility to provide Kennedy Jenks personnel with safe access to all areas of the work zone. Kennedy Jenks personnel will not enter areas deemed to be unsafe (i.e., unprotected excavations and trenches, unprotected walkways and platforms and lifts greater than 6 feet high, and confined spaces). Prior to entry, Kennedy Jenks staff will independently assess the work zone to identify hazards to which they may be exposed to and request that the hazard be corrected prior to entry.

To the extent possible, Kennedy Jenks personnel will attend the Controlling Contractor's Tailgate Safety Briefings. At a minimum, Kennedy Jenks staff will conduct an independent safety briefing at least every 10 days when two or more employees are assigned to a project site.

Controlling Contractor Designated Authorized or Named Competent Person (as applicable):

Excavation ____________________________
Confined Space ____________________________
Scaffolding ____________________________
Fall Protection ____________________________
NFPA 70E ____________________________

Task/Step	Potential Hazards	Recommended Safe Job Procedures
Change in Scope of Work	Failure to identify new hazards due to change in scope of work.	• Change Orders may introduce new hazards to the work site. Any changes or modifications to the the scope of work must be addressed in a Tailgate Safety Briefing prior to initiating work.
Use of hand tools	Broken or Unauthorized Tools.	• All tools and equipment used by Kennedy/Jenks Consultants personnel must be inspected prior to use. This includes any tools and equipment brought onsite after the project has started. Any tool or piece of equipment deemed unsatisfactory will be tagged and removed. Any tool or piece of equipment that leaves the work site must be re-inspected upon its return. GFCIs must be used on all portable electrical equipment, 125v or less. Extension cords must be at least 14ga.

Task/Step	Potential Hazards	Recommended Safe Job Procedures
Using Portable Ladders (e.g., A-frame, straight, or extension)	Falls	• Before use, check the load rating of the ladder, to make sure the ladder can support the combined weight of the user, the weight of tools, and the weight of any material that will be placed on the ladder. This includes the weight of anything that may be supported by the user.
Use of Fixed Ladders (including job made ladders)	Falls	• Before use, ladders shall be inspected by a competent person (CP) for visible defects on a periodic basis and after any occurrence that could affect their safe use. • A CP must visually inspect job-made ladders for defects on a periodic basis and after any occurrence that could affect their safe use. • Defects to look for include: structural damage, broken/split side rails (front and back), missing cleats/steps, and parts/labels painted over. • Ladders should be free of oil, grease, and other slipping hazards. • Maintain three points of contact at all times when climbing a fixed ladder. • Keep hands free of additional material when climbing. Use a rope to lift material and tools. • Do not overextend when working by reaching out too far on the side of a ladder. Keep your belt buckle between the two side rails.
Hazardous Energy Sources	Stored energy, Employee Exposure, Electrical Shock, Chemical Exposure	• Follow approved Kennedy/Jenks Consultants, Host Employer or Controlling Contractor procedures for any Lockout/Tagout (LOTO) system. Host Employer or Controlling Contractor will initiate LOTO first; Kennedy/Jenks Consultants personnel will apply locks over Controlling Contractor's once LOTO has been verified. All personnel must provide their own locks for each LOTO point. Kennedy/Jenks Consultants personnel must review Host Employer's or Controlling Contractor's LOTO procedures and training before participating in the LOTO system. • Zero energy state verification of all electrical wiring or components that are being worked on or otherwise exposed must be complete prior to work being performed under LOTO. • Zero energy state verification for electrical wiring and components must be performed by a person trained in NFPA 70E, using the

Task/Step	Potential Hazards	Recommended Safe Job Procedures
		properly rated test equipment, and wearing the proper PPE.
Handling of Chemical/Products	Chemical exposure	• Controlling Contractor must supply all safety data sheets (SDS) for chemicals that will be used on site. SDS(s) must be reviewed by Kennedy/Jenks Consultants personal prior to potential exposure. • Review and adhere to SDS before handling chemicals/products. • SDS(s) will be required to be maintained at the job site. • If additional PPE is prescribed within SDS(s), Kennedy/Jenks Consultants must acquire and utilize addition PPE.
Welding, Cutting, Brazing, Soldering, Grinding	Fire or spark generation Burns (skin or eyes)	• A Hot Work Permit is required before any open flame work may be done. • All Kennedy/Jenks Consultant's personnel engaged in observation of welding or cutting job tasks shall wear all industry recognized PPE to protect from burns either to the skin or the eyes. All Kennedy/Jenks Consultants personnel exposed to hot work activities will review the Hot Work Permit. • A 20 pound ABC fire extinguisher shall be readily accessible and immediately available when any open flame work is performed. Combustibles and flammables must be kept clear of the open flame work area. • A Fire Watch assigned by Controlling Contractor as required by the Hot Work Permit • Fire watches must be trained and competent in the use of fire suppression equipment. Fire extinguishers must be inspected monthly. Inspections must be documented on the inspection tag attached to the fire extinguisher. • Fire watches must have the means and know to call the emergency services in case of an emergency. Fire watches are to remain 30 minutes after completion of open flame work is stopped. • Smoking is only allowed in designated smoking areas.

Task/Step	Potential Hazards	Recommended Safe Job Procedures
Lifts (use of cranes, hoists, forklifts, or chain falls to move, place, or lift items)	Dropped load Calculations not computed properly Equipment not inspected Striking overhead electric lines	• Follow the Controlling Contractor's Manual of Construction. • Onsite crane inspections by Controlling Contractor. • Operation training license/certification. • Operator medical evaluation. • Third party inspection for cranes. • Approved lift plan if needed. • Maintain 20-foot distance from overhead electrical lines and equipment.
Elevated work at heights at above 6 feet	Fall Hazards	• Use of full body safety harnesses with shock absorbing lanyards, guardrail systems, or safety net systems are required for all work over 6 feet high. (100% tie off). • Standard guardrails are required for scaffolding over 6 feet. • Toeboards are required if workers work or pass below. • Top rails are to be placed 42-45 inches high with a mid-rail and supporting posts every 8 feet. Examples of guardrail applications: stairs, stairwells, stairway landings, pits, porches, balconies, ramps, runways, floor openings, floor periphery (skeleton steel buildings), wall openings, landing platforms and elevator shafts, open sides of scaffolds, platforms, surfaces, catwalks, excavations and crossovers, false work, roofs, demolition, skylights. • Guardrails must be capable of supporting 200 pounds of lateral force. Top rails, handrails, and posts must be made of 2 x 4 wood or equivalent. • Floor edges of steel buildings may be guarded with 3/8-inch wire rope in lieu of railings. • Scaffolds must be properly assembled and maintained during use. • Scaffolds that are incomplete or unsafe will be tagged "UNSAFE- DO NOT USE" or "INCOMPLETE- DO NOT USE." • Holes (including skylights) shall be protected by covers or guardrails. Floor hole covers shall be marked with the word "HOLE" or "COVER." Covers shall be strong enough to support the intended load and shall be

Task/Step	Potential Hazards	Recommended Safe Job Procedures
		secured to prevent accidental displacement. • Safety lines, lifelines and anchorage points shall be capable of supporting 5,400 lb. dead weight. • Drop lines subject to excessive fraying or damage shall be protected and shall have a wire center. • Fall protection equipment shall be inspected before each use. Fall protection equipment that shows excessive wear, has been deployed, or is in unsafe condition shall be removed from service and destroyed. • Anchorage points shall be secured at a level not lower than the worker's waist, limiting the fall distance to a maximum of 4 feet. • No employees will be allowed to use fall protection equipment without first receiving training in the proper and safe use of the equipment. • This training will be documented, such as during tailgate safety meetings or other training classes. • All safety belts, harnesses, and lanyards shall be labeled as meeting the requirements contained in ANSI.
Excavation and trenching	Contacting underground utilities Falls Cave-ins	• A Traffic/Pedestrian Control Plan is required when blocking or partially blocking any walkway, roadway, or driveway. • Work area should be delineated off from unauthorized personnel and signs posted. • Proper PPE shall be worn by adjacent personnel, as required by their proximity to the work task. • An Excavation CP shall be assigned. • Soil type shall be classified by the CP. If no soil testing is performed, the soil shall be classified as type "C." • Trenches, spoil piles, and surrounding work areas are inspected daily or as needed. • Shoring or benching is required as determined by the CP. • Cave in protection is required for all excavation 5 feet (Washington and Oregon, 4 feet) or deeper

Task/Step	Potential Hazards	Recommended Safe Job Procedures
		• A means of egress is required so that workers are never more than 25 feet from a means of egress in all excavations 4 feet or deeper. • Excavated soil spoils are properly managed. • Any trench greater that 5 feet deep, located next to underground piping or tanks containing hazardous materials, or having soil discoloration or odors, shall be evaluated for permit-required confined space controls. • Follow all underground utility locate requirements. • Ensure all areas to be disturbed have been scanned prior to the start of work. • All areas within 30 inches of known utilities shall be hand dug unless an exemption id obtained.
Spotter duties	Contact with overhead lines (raised dump beds/trailers, excavators, cranes). Operating in congested areas (traffic, near other equipment, near buildings).	• Spotters are to always maintain visual contact with the operator while the vehicle is backing up or moving forward while traversing under an overhead line.. • Spotters are not to have additional duties while they are acting as spotters. • Spotters are not to use personal mobile phones, personal headphones, or other items that could pose a distraction during spotting activities.
Dumping of material from dump bed/trailer	Contact with overhead lines (raised dump beds/trailers, excavators, cranes). Operating in congested areas (traffic, near other equipment, near buildings).	• If contact is made with overhead wires operator should not exit the vehicle. Remain in the vehicle till directed to exit by emergency personnel. • No dumping of any kind from a dump truck shall be performed onsite without the use of a spotter when working near overhead wires. • After dumping their loads, all trucks must lower their beds before driving away. • Operators must maintain visual contact with spotters while the vehicle is backing up, operating near overhead wires, or operating in a congested area. • Operators are to stop their equipment immediately upon losing sight of the spotter or the signals are unclear. • Spotters must be present during all movement of equipment.

Task/Step	Potential Hazards	Recommended Safe Job Procedures
Working in Confined Spaces	Asphyxiation, Engulfment, or Entrapment	• See Construction Confined Space Entry Written Program, Confined Space Entry Permit requirements, and Confined Space Entry JHA.
Scaffolds	Falls Damaged/Broken Equipment Improper Assembly Improper Use	• All scaffolds must be erected and used in accordance with 29CFR1926 Subpart L – Scaffolds. • Scaffolds must be designed by a qualified person. Qualified means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated his/her ability to solve or resolve problems related to the subject matter, the work, or the project. • Scaffolds must be used and inspected in accordance with the manufacturer's instruction for each specific model and type of scaffold being used. • All wheels equipped with locking devices must be locked prior to climbing, all bolts and nuts must be tight, and all cotter pins must be in place and secured before use. • All Controlling Contractor erected scaffolds must be erected under the supervision of a scaffold competent person. • When working off scaffolds that are 4 feet or more above a walking/working surface, fall protection or OSHA compliant handrails are required. • The scaffold competent person and the qualified person may be the same individual. • Newly erected or modified scaffolds must be inspected by the Controlling Contractors scaffold competent person and by an Argonne Independent Competent person prior to use. • Daily pre-use inspections must be conducted by the Controlling Contractors' competent person, and the scaffold tag must be signed by the scaffold competent person. Inspection tags may be obtained from the Argonne project specialist.

Task/Step	Potential Hazards	Recommended Safe Job Procedures
Elevated Work Platforms (e.g., scissor lifts, boom lifts, JLG's, etc.)	Falls Damaged/Broken Equipment Improper Use	• All elevated work platforms must be used in accordance with 29CFR1926 Subpart L scaffolds. • Elevated work platforms must be used and inspected in accordance with the manufacturer's instruction for each specific model and type of elevated work platform being used. • All elevated work platforms (e.g., scissors lifts, aerial platforms, etc.) and boom lifts must be inspected by the Controlling Contractor prior to use. • Elevated work platforms and boom lifts must be inspected by a trained and qualified operator prior to each use. Inspection of the equipment must be documented. • If the elevated work platform or boom lift does not pass inspection, the equipment must be flagged with a red "Do Not Use" tag. Elevated work platforms that are taken out of service are to be reported to the Controlling Contractor's site foreman immediately. • Fall protection must be used in accordance with the manufacturers' recommendations on all elevated platforms and boom lifts.

JOB HAZARD ANALYSIS	**Project No.:** 2196008*00
Job/Operation Title: Excavation or Trenching	**Date:** February 2024
Business Unit: Environmental/Industrial	**JHA Reviewed By:** John Jindra
Project Location: Seattle, WA	**JHA Revised By:** Ella Gyerko
Person(s) Performing This Job/Task: Insert Name(s)	**Project Manager:** Ryan Hultgren
Job/Task Start Date: February 2024	**Job/Task Duration:** 1 year

Task/Step	Potential Hazards	Recommended Safe Job Procedures
Mobilize equipment	Risk of injury to automotive or pedestrian traffic.	A Traffic / Pedestrian Control Plan is required when blocking or partially blocking any walkway, roadway, or driveway. Work area should be delineated off from Unauthorized personnel and signs posted. Proper PPE shall be worn by adjacent personnel, as required by their proximity to the work task.
Locate utilities	Risk of damaging underground utilities.	Follow Utility Locate Stand Operating Procedures (SOPs). Ensure all areas to be disturbed have been scanned prior to the start of work.

Task/Step	Potential Hazards	Recommended Safe Job Procedures
Excavate or trench	Risks of injury from cave-in's collapse of unstable or poorly supported soil.	Soil type shall be classified by an Excavation Competent Person (CP). The contractor or subcontractor will provided an Excavation CP. Trenches, spoil piles, and surrounding work areas must be inspected daily or as needed. Kennedy Jenks personnel will not enter any trench greater than 5 feet deep (4 feet in Washington and Oregon) that is not shored or benched. Appropriate shoring or benching is determined by the CP. Excavated soil spoils are properly managed. Any trench greater than 5 feet deep (4 feet in Washington and Oregon), located next to underground piping or tanks containing hazardous materials or having soil discoloration or odors shall be evaluated for permit-required confined space controls.
Containment	Risk of accidental release into the storm water drains	Follow Stormwater Pollution Prevention Program as required. If storm drains are below work areas, ensure drain covers are surrounded by waddles, lined with mesh covers (silt screens).

JOB HAZARD ANALYSIS	**Project No.:** 2196008*00
Job/Operation Title: Geo Probe	**Date:** February 2024
Business Unit: Environmental/Industrial	**JHA Reviewed By:** John Jindra
Project Location: Seattle, WA	**JHA Revised By:** Ella Gyerko
Person(s) Performing This Job/Task: Insert Name(s)	**Project Manager:** Ryan Hultgren
Job/Task Start Date: February 2024	**Job/Task Duration:** 1 year

Task/Step	Potential Hazards	Recommended Safe Job Procedures
Site/GeoProbe Set-up	Struck by/caught between	• Only qualified operator to unload the GeoProbe. • Use spotter. • Unload on level ground surface. • Secure transport vehicle or trailer (emergency break for vehicle, wheel chokes if trailer is disconnected or if the transport trailer is on a sloped surface). • Ensure all tools and rig equipment is secure prior to moving. • Establish site control or hazard warning devices around the unloading area if near the general public or other site workers. • Do not stand directly in front of the GeoProbe as it descends from the transport vehicle/trailer.
Utility Locate	Underground Equipment Utilities	• Investigate to ensure public and private underground utilities have been located by physical inspecting markings. • Ensure boring locations are at least 3 feet from marked underground utility lines
Utility Locate	Overhead Utilities	• Inspect routes to drilling locations for overhead utility lines. • Maintain 10 feet distance for overhead utility lines or minimum clearance distances described in the Utility Locate Acknowledge Form and SOP. • GeoProbe mast must be in the down position while mobilizing GeoProbe to boring

Task/Step	Potential Hazards	Recommended Safe Job Procedures
		locations.
Fueling for drill Rig	Fire Spills	• No smoking during refueling. • Fire extinguisher readily available. • Do not lock nozzle in the open position. • Remain with equipment at all times during refueling.
Mobilizing drill rig and equipment to boring locations	Overturning of drill rig. Struck by objects/Overhead hazard. Falling/Crushing injuries. Rotating / moving parts of drill rig. Struck by drill auger.	• Ensure stable ground and adequate footing for machinery. Adequate ground preparation to support loads. • Establish drill pad if necessary. • Ensure drill rig is level and stabilized. • Tools and equipment secured prior to rig movement. • Do not ride on the GeoProbe. • Do not utilize the GeoProbe to move objects it is not designed to haul. • Complete daily inspection of GeoProbe and equipment. • Ensure appropriate guards are installed or suitable barriers to protect personnel from moving parts.
Equipment Operation	Struck by vehicles and/or equipment. Dermal or inhalation exposure to contaminants. Slips, trips, and falls. Sprains and strains. Failure of drill rig components. Weather. Exposure to dust. Excessive noise.	• Ensure spill kit is readily available. • Properly clean up spills, if safe to do so. • Notify site supervisor if spills occurs. • Kill switch installed, clearly identified, and operational. • Test kill switch at the beginning of each shift. • Ensure all personnel know the location of and how to engage the kill switch. • Properly dispose of used materials. • Always make eye contact and get permission from the vehicle or equipment operator before approaching or crossing the path of any vehicle or piece of equipment. • Follow traffic control plans if developed. • Wear Class II safety vest. • Be aware of site traffic and pedestrians. • Establish a work zone large enough to

Task/Step	Potential Hazards	Recommended Safe Job Procedures
		protect those outside the work area from the hazards inside the work area. • Loose clothing, long hair, and jewelry to be safely secured. • Do not approach an operating GeoProbe without making eye contact and getting permission from the operator. • Wear safety toe boots, Class II safety vest, hardhat, safety glasses. • Conduct air monitoring for potential hazardous atmospheres as described in the project's HASP. • Don PPE as prescribed in the project's written HASP. • Ensure good footing. Remove mud from work boots when possible. • Maintain good housekeeping in work area (i.e., remove excess materials, tools, and trash that create a slip or trip hazard. • Use proper lifting techniques and get help with heavy or awkward loads. • Use two people to lift object greater than 50 pounds. • Defective components repaired prior to return to service. • Lockout/tag out procedures used prior to maintenance • GeoProbe not to be operated in severe inclement weather, such as lightning storms, high winds, or severe rain. Mast to be lowered in these conditions. • Fugitive dust suppressed with water or by other approved means. • Fugitive dust suppressed with water or by other approved means. • Wear hearing protection while the GeoProbe is running.
Handling Probes and Augers	Cuts/abrasions. Struck by. Stains/sprains. Contact with contamination.	• Inspect equipment for sharp protrusions or debris. • Wear cut resistant gloves. • Make sure the path is clear before moving tools.

Task/Step	Potential Hazards	Recommended Safe Job Procedures
		• Maintain good housekeeping. • Wear protective safety toe boots. • Use proper lifting techniques. • Utilize the GeoProbe move tools. • Use two people to lift objects greater than 50 pounds. • Wear PPE as described in the Site-Specific HASP.
Hoisting operations	Overhead hazards	• Ensure all personnel stand clear during hoisting. • Ensure rigging is not damaged and is rated for what is being lifted.
Waste Disposal	Contact with contaminated debris and water	• Wear PPE as described in the site HASP.
Drum Moving	Strains and Sprains	• Fill drum a maximum of 85% full. • Use a drum dolly or similar mechanical device to move the drum.
Decontamination	Contact with contaminated debris and water	• Perform decontamination according to the site HASP. • Wear poly-coated tyvek with hood and booties, face shield, and nitrile gloves if pressure washing.

JOB HAZARD ANALYSIS	**Project No.:** 2196008*00
Job/Operation Title: Soil Sampling, Logging and Screening	**Date:** February 2024
Business Unit: Environmental/Industrial	**JHA Reviewed By:** John Jindra
Project Location: Seattle, WA	**JHA Revised By:** Ella Gyerko
Person(s) Performing This Job/Task: Insert Name(s)	**Project Manager:** Ryan Hultgren
Job/Task Start Date: February 2024	**Job/Task Duration:** 1 year

Task/Step	Potential Hazards	Recommended Safe Job Procedures
Prepare Work Area	Slips Trips and Falls Cuts / Abrasions Struck By Strains / Sprains	• Maintain good housekeeping practices. • Setup work area away from active operations and high traffic areas. • Remove trip hazards in workspace. • Setup work area on a level surface. • Use caution when climbing in and out of truck bed, avoid jumping out of truck bed. • Wear cut resistant gloves while using cutting devices. • Wear cut resistant gloves while unloading work supplies that may have pinch point or sharp edges, such as a sample table or work canopy. • Inspect work area for sharp edges prior to setup. • Wear safety toe boots. • Wear a hardhat. • Use proper lifting techniques. • Use two people to lift objects greater than 50 pounds.
Obtain Sample (Either from loose soil or sample tube)	Contamination with Hazardous Substances Cuts / Abrasions	• Conduct breathing space monitoring with a photoionization detector (PID) and follow site-specific Health and Safety Plan (HASP) requirements. • Wear chemical resistant gloves as defined in the site specific HASP. • Use caution when collecting sample from sample tube, as there may be rough or

Task/Step	Potential Hazards	Recommended Safe Job Procedures
		sharp edges
Clean work area in preparation for the next sample	Contamination w/ hazardous substances Cuts/abrasions	• Conduct breathing space monitoring with a PID and follow site-specific HASP requirements. • Wear chemical resistant gloves as defined in the site-specific HASP. • Pick up samples and place in appropriate disposal container. • Avoid brushing off work area with your hand, use a brush or broom.
Changing out PPE (Gloves)	Contamination w/ hazardous substances	• Remove gloves by removing one glove and turning the glove inside out as it is being removed. Use the inside out glove to remove the second glove also turning the second glove inside out as it is being removed. • Place the contaminated gloves in appropriate waste container.
Log sample description	Contamination w/ hazardous substances	• Remove contaminated PPE prior to handling the logbook. • Locate logbook away from contaminated areas.
Collect headspace analysis from soil sample	Contamination w/ hazardous substances	• Wear chemical resistant gloves as defined in the site-specific HASP. • Wear safety glasses. • Hold sample bag away from your body when puncturing bag.
Place soil sample in sample jar	Contamination w/ hazardous substances (including sample jar preservative)	• Wear chemical resistant gloves as defined in the site-specific HASP.
Cleanup/Decontaminate work area	Contamination w/ hazardous substances	• Wear chemical resistant gloves as defined in the site-specific HASP. • Wear safety glasses. • Place all waste in appropriate waste containers. • Decontaminate all surfaces and equipment that has contacted the contaminated soil according to the site-specific HASP.
Demobilize work area	Slips, trips, and falls Cuts/abrasions	• Maintain good housekeeping. • Use caution when climbing in and out of

Task/Step	Potential Hazards	Recommended Safe Job Procedures
	Struck by Strains/sprains	truck bed, avoid jumping out of truck bed. • Wear cut resistant gloves while loading work supplies that may have pinch point or sharp edges, such as a sample table or work canopy. • Wear steel toe boots. • Wear a hardhat. • Use proper lifting techniques. • Use two people to lift objects greater than 50 pounds.

JOB HAZARD ANALYSIS	**Project No.:** 2196008*00
Job/Operation Title: Utility Locating Clearing	**Date:** February 2024
Business Unit: Environmental/Industrial	**JHA Reviewed By:** John Jindra
Project Location: Seattle, WA	**JHA Revised By:** Ella Gyerko
Person(s) Performing This Job/Task: Insert Name(s)	**Project Manager:** Ryan Hultgren
Job/Task Start Date: February 2024	**Job/Task Duration:** 1 year

Task/Step	Potential Hazards	Recommended Safe Job Procedures
Inspect site for evidence of utilities	Slips, Trips, and Falls	• Inspect walking surfaces for terrain hazards or potholes that could cause a slip, trip, or fall. • Identify and/or communicate fall hazards to project team. • Do not walk through tall grass or vegetation where the walking surface cannot be viewed. The area should be cut down prior to walking through it. • Wear appropriate work shoes or boots. • Avoid working at times when it is dark, or you should use additional lighting when necessary.
	Biological Hazards Animals Insects Poisonous Plants	• Avoid all animals, including domestic animals. • Be aware of insect nests and wear long pants, long sleeve shirts. • Apply insect repellant. • Use insect pesticide to eradicate insects that interfere with work activities. • Review site HASP for understanding of biological hazards, including poisonous plants. • If contacted by a poisonous plant, immediately decontaminate skin with soap and water. • If contact with poisonous plants is necessary, you must don chemical resistant suits and gloves. • Report all incidents involving biological hazards to the site safety officer.

Task/Step	Potential Hazards	Recommended Safe Job Procedures
	Heat/Cold Stress	• Monitor for heat/cold stress. • Dress appropriate for the weather. • Provide fluids to prevent worker dehydration. • Establish work/rest.
	Traffic	• Don a hi-visibility vest. • Do not enter the right-of-way or roads unless free of traffic or a traffic control plan has been developed and implemented.
Perform utility locating using GPR and/or Electromagnetic Induction	Slips, Trips, and Falls	• Inspect walking surfaces for terrain hazards or potholes that could cause a slip, trip, or fall. • Identify and/or communicate fall hazards to project team. • Do not walk through tall grass or vegetation where the walking surface cannot be viewed. The area should be cut down prior to walking through it. • Wear appropriate work shoes or boots. • Avoid working at times when it is dark, or you should use additional lighting when necessary.
	Biological Hazards	• Avoid all animals, including domestic animals. • Be aware of insect nests and wear long pants, long sleeve shirts. • Apply insect repellant. • Use insect pesticide to eradicate insects that interfere with work activities. • Review site HASP for understanding of biological hazards, including poisonous plants. • If contacted by a poisonous plant, immediately decontaminate skin with soap and water. • If contact with poisonous plants is necessary, you must don chemical resistant suits and gloves. • Report all incidents involving biological hazards to the site safety officer.

Task/Step	Potential Hazards	Recommended Safe Job Procedures
	Heat/Cold Stress	• Monitor for heat/cold stress. • Dress appropriate for the weather. • Provide fluids to prevent worker dehydration. • Establish work/rest.
	Traffic	• Don a hi-visibility vest. • Do not enter the right-of-way or roads unless free of traffic.
	Lifting – Strains/Sprains	• Utilize proper lifting techniques when loading and unloading equipment. • Use a team lift if the weight of object is greater than 40 pounds or if the object is an awkward size or shape.
	Electrical	• Avoid opening electrical panels or outlets. • Don insulated gloves and tools if required to be exposed to live electrical wires. • Do not attempt to repair damaged electrical lines. • Maintain a minimum of 10 feet from unprotected electrical lines.
	Gas leaks	• If leaks in gas or fuel lines are identified, immediately contact the public utility company responsible for the utility. • Evacuate area and do not let anyone into area until the leak is resolved. • Remove all sources of ignition from the area if it is safe to do so.
	Hazardous Chemicals	• All chemicals, including spray paints, must have an MSDS onsite. • Portions of the site may be contaminated with hazardous substances. Don nitrile gloves (or similar type of glove if handling soils). • Decontaminate shoes/boots, if necessary.
Soft digging to clear/daylight utilities (air knife, hand dig w/shovel, hydro excavation)	Slips, Trips, and Falls	• Inspect walking surfaces for terrain hazards or potholes that could cause a slip, trip, or fall. • Identify and/or communicate fall hazards to project team. • Do not walk through tall grass or vegetation where the walking surface cannot be

Task/Step	Potential Hazards	Recommended Safe Job Procedures
		viewed. The area should be cut down prior to walking through it. • Wear appropriate work shoes or boots. • Avoid working at times when it is dark, or you should use additional lighting when necessary.
	Biological Hazards	• Avoid all animals, including domestic animals. • Be aware of insect nests and wear long pants, long sleeve shirts. • Apply insect repellant. • Use insect pesticide to eradicate insects that interfere with work activities. • Review site HASP for understanding of biological hazards, including poisonous plants. • If contacted by a poisonous plant, immediately decontaminate skin with soap and water. • If contact with poisonous plants is necessary, you must don chemical resistant suits and gloves. • Report all incidents involving biological hazards to the site safety officer.
	Heat/Cold Stress	• Monitor for heat/cold stress. • Dress appropriate for the weather. • Provide fluids to prevent worker dehydration. • Establish work/rest.
	Traffic	• Don a hi-visibility vest. • Do not enter the right-of-way or roads unless free of traffic.
	Lifting – Strains/Sprains	• Utilize proper lifting techniques when loading and unloading equipment. • Use a team lift if the weight of object is greater than 40 pounds or if the object is an awkward size or shape.
	Noise	• Utilize hearing protection during air knife and hydro excavation.
	Flying Debris	• Wear safety glasses with side shield at a minimum. Upgrade to add a face shield

Task/Step	Potential Hazards	Recommended Safe Job Procedures
		during air knife or at any time debris is flying up towards the operators face.
	Abrasions/Cuts/Contusions	• Wear work gloves to prevent blisters or scratches • Wear steal toe boots or shoes. • Avoid contact with pressure lines/wands for air knife and hydro excavation.

JOB HAZARD ANALYSIS	**Project No.:** 2196008*00
Job/Operation Title: Working in the Vicinity of Heavy Equipment	**Date:** February 2024
Business Unit: Environmental/Industrial	**JHA Reviewed By:** John Jindra
Project Location: Seattle, WA	**JHA Revised By:** Ella Gyerko
Person(s) Performing This Job/Task: Insert Name(s)	**Project Manager:** Ryan Hultgren
Job/Task Start Date: February 2024	**Job/Task Duration:** 1 year

Task/Step	Potential Hazards	Recommended Safe Job Procedures
Preparing Job Site	Trips and Falls. Bodily injury to others.	• Clear area within work zone; remove trip hazards and/or mark clearly hazards with cones, etc. • Identify work zone with cones, barricades, and other means necessary to keep pedestrian and other traffic out of work zone.
Operational Tasks	Bodily Injury to workers.	• Wear reflective safety vest, hardhat, and safety glasses. • A pre-job discussion should occur to ensure both the equipment operator and assisting workers understand the scope of the project. • Operator should keep watch for ground workers near equipment and ensure they are aware of operator’s intended direction of movement. Use spotter, as needed, to warn/watch for ground workers. • Ground workers should watch operator and equipment, staying clear of equipment’s path. • All workers need to be aware of changing conditions at work site.
After Operations or during periods when area is not occupied by workers	Bodily Injury to workers and others.	• Operator should always leave equipment with bucket/attachments down. • Operator should ensure equipment is secured/locked out so it cannot be used by unauthorized personnel. • Workers should secure job site with barricades, cones, and signs to warn others to keep out of work site. • Supervisor may place employee to watch job site if extreme hazards exist.

Appendix B

Tailgate Safety Briefing Form

Kennedy Jenks
TAILGATE SAFETY BRIEFING

Project Name:____ Date:_________________________

Project No.:_______________ Conducted By:______________________ Contractor(s):____________

Check the Topics/Information Reviewed:

O emergency procedures & evacuation route
O site-specific safety plan, review, and location
O fire prevention/safety/fire extinguishers
O training/certification
O COVID-19
O sharp objects, rebar, and scrap metals
O slips, trips, and falls
O vehicle safety and driving/road conditions
O overhead utility locations and clearances
O open pits and excavations
O drinking water and restroom locations
O smoking in designated areas only
O eye wash station locations
O Hazard Communication//SDS locations
O site control/security
O heat and cold stress
O confined spaces
O fall protection
O equipment and machinery familiarization
O insects/snakes/biological hazards
O daily scope of work
O directions to hospital
O stop work authority
O pinch points
O lifting techniques
O site housekeeping
O parking and lay down areas
O backing-up hazards
O location of utilities
O noise hazards
O equipment movement
O decontamination procedures
O first aid
O no horseplay
O visitors / media / passers-by
O lockout/tagout
O ladders safety
O scaffolding
O cell phone usage / prohibitions
O personal protective equipment
O PPE
O strains and sprains
O buddy system
O tool safety
O public safety
O traffic safety
O hearing & eyewear protection
O flying debris hazards
O fire extinguisher locations
O heavy equipment hazards
O dust and/or vapor control
O drug and alcohol policy
O weather hazards
O electrical hazards
O other

Discussion/Comments/Questions/Near Misses/Follow-up Actions:

List Any Special Site Conditions / H&S Precautions Reviewed

By signing below, I acknowledge that I have participated in this safety briefing. I am aware that a site-specific safety plan exists for this project and that it is available to me upon request.

NAME	SIGNATURE	COMPANY

Appendix C

Heat Stress Fact Sheet

Heat Stress Prevention

HEAT EXHAUSTION

What happens to the body:

Headaches, dizziness, or light-headedness, weakness, mood changes, irritability, or confusion, feeling sick to your stomach, vomiting, fainting, decreased, and dark-colored urine, and pale, clammy skin.

What should be done:

- Move the person to a cool, shaded area. Don't leave the person alone. If the person is dizzy or light-headed, lay him on his back and raise his legs about 6-8 inches. If the person is sick to his stomach, lay him on his side.
- Loosen and remove heavy clothing.
- Have the person drink some cool water (a small cup every15 minutes) if he is not feeling sick to his stomach.
- Try to cool the person by fanning him. Cool the skin with a cool spray mist of water or wet cloth.
- If the person does not feel better in a few minutes call for emergency help (ambulance or 911).

If heat exhaustion is not treated, the illness may advance to heat stroke.

HEAT STROKE
A Medical Emergency

What happens to the body:

Dry, pale skin, sweating may still be present; hot, red skin (looks like a sunburn); mood changes; irritability, confusion, and not making any sense; seizures or fits, and collapse (will not respond).

What should be done:

- Call for emergency help (ambulance or 911.)
- Move the person to a cool, shaded area. Don't leave the person alone. Lay him on his back and if the person is having seizures; remove objects close to him so he won't hit them. If the person is sick to his stomach, lay him on his side.
- Remove heavy and outer clothing.
- Have the person drink small amounts of cool water if he is alert enough to drink anything and not feeling sick to his stomach.
- Try to cool the person by fanning him or her. Cool the skin with a cool spray mist of water, wet cloth, or wet sheet.
- If ice is available, place ice packs in armpits and groin area.

PREVENTING HEAT RELATED ILLNESS

- Drink a lot of water, about 1 cup every 15 minutes.
- Know the signs/symptoms of heat-related illness; monitor yourself and co-workers.
- Block out direct sun or other heat sources.
- Use cooling fans/air-conditioning; rest regularly.
- Wear lightweight, light colored, loose-fitting clothes.
- Avoid alcohol, caffeinated drinks, or heavy meals.

Washington State Department of
Labor & Industries
Division of Occupational Safety and Health

PUBLICATION F417-218-909 [05-2008]

Appendix D

Cold Stress Fact Sheet

COLD STRESS PREVENTION

Protecting Workers from Cold Stress

Cold temperatures and increased wind speed (wind chill) cause heat to leave the body more quickly, putting workers at risk of cold stress. Anyone working in the cold may be at risk, e.g., workers in freezers, outdoor agriculture and construction.

Common Types of Cold Stress

Hypothermia

- Normal body temperature (98.6°F) drops to 95°F or less.
- **Mild Symptoms**: alert but shivering.
- **Moderate to Severe Symptoms**: shivering stops; confusion; slurred speech; heart rate/breathing slow; loss of consciousness; death.

Frostbite

- Body tissues freeze, e.g., hands and feet. Can occur at temperatures above freezing, due to wind chill. May result in amputation.
- **Symptoms**: numbness, reddened skin develops gray/white patches, feels firm/hard, and may blister.

Trench Foot (also known as Immersion Foot)

- Non-freezing injury to the foot, caused by lengthy exposure to wet and cold environment. Can occur at air temperature as high as 60°F, if feet are constantly wet.
- **Symptoms**: redness, swelling, numbness, and blisters.

Risk Factors

- Dressing improperly, wet clothing/skin, and exhaustion.

For Prevention, Your Employer Should:

- Train you on cold stress hazards and prevention.
- Provide engineering controls, e.g., radiant heaters.
- Gradually introduce workers to the cold; monitor workers; schedule breaks in warm areas.

How to Protect Yourself and Others

- Know the symptoms; monitor yourself and co-workers.
- Drink warm, sweetened fluids (no alcohol).
- Dress properly:
  - Layers of loose-fitting, insulating clothes
  - Insulated jacket, gloves, and a hat (waterproof, if necessary)
  - Insulated and waterproof boots

What to Do When a Worker Suffers from Cold Stress

For Hypothermia:

- Call 911 immediately in an emergency.
- To prevent further heat loss:
  - Move the worker to a warm place.
  - Change to dry clothes.
  - Cover the body (including the head and neck) with blankets, and with something to block the cold (e.g., tarp, garbage bag). Do **not** cover the face.
- If medical help is more than 30 minutes away:
  - Give warm, sweetened drinks if alert (no alcohol).
  - Apply heat packs to the armpits, sides of chest, neck, and groin. Call 911 for additional rewarming instructions.

For Frostbite:

- Follow the recommendations "**For Hypothermia**".
- Do not rub the frostbitten area.
- Avoid walking on frostbitten feet.
- Do not apply snow/water. Do not break blisters.
- Loosely cover and protect the area from contact.
- Do not try to rewarm the area unless directed by medical personnel.

For Trench (Immersion) Foot:

- Remove wet shoes/socks; air dry (in warm area); keep affected feet elevated and avoid walking. Get medical attention.

Appendix E

Utility Location Standard Operations Procedures

Utility Location and Acknowledgement Form

Communication Log

KENNEDY/JENKS CONSULTANTS

STANDARD OPERATING PROCEDURES

INVASIVE ACTIVITIES - UTILITY LOCATION PROCEDURES

Below is a summary of the minimum requirements for location of potential underground utilities where invasive activities are planned. Invasive activities include, but are not limited to, drilling soil borings, installing wells, hand-auger borings, excavating test pits, remedial injections, and other similar activities which penetrate the ground surface.

Minimum Procedures

1. Contact the client or property owner where invasive activities will be performed to inquire about possible underground utilities and request maps or drawings documenting the location of the utilities. Document your request for information (e.g., written email request for information).

2. Contact the local/regional underground utility location center to document planned activities and request all underground utilities be located. In most (if not all) US states, this can be initiated by dialing “811”. Contacting the local underground utility center is also required by state law. Contacting the local utility location center is required for each episode (event) of invasive work. It is preferred to arrange a field meeting with utility representatives to confirm the absence of utilities at each drilling location. Maintain a written record for each boring/invasive location and get signatures from the locators documenting the locations are clear of utilities. This can be performed on a site map or KJ’s *Utility Locate Form & Acknowledgment Form* (provided in the KJ Safety Zone). The goal is to have written acknowledgement that all final drilling locations are free of underground utilities.

3. At all locations where drilling, probing or well installation will be performed, an air-knife or similar form of suction pot-holing will be performed to assess possible underground utilities in the upper 6 to 8 feet of soils (depending on local conditions and expected depth of utilities). Potholing is required at **all drilling locations**, except in remote areas where the likelihood of encountering underground utilities is very low and only as approved by a Risk Manager, Resource Manager or Officer of the company familiar with underground utilities. (Note: Use of an air knife will be appropriate for most invasive drilling and probing work, but may not be appropriate for certain activities like very shallow borings (less than 1-foot deep), certain hand-auger borings, remedial injections using probe equipment and test pitting.) Case by case exceptions for activities may be provided.

Optional Step – While it is recommended under most conditions, an optional additional step includes coordinating (including establishing a written contract) with a private utility locator to perform an independent utility evaluation to locate “all underground utilities” at the proposed locations of invasive work. Maintain written record for each boring/invasive location and get signatures from the locators. *[Note: This step is typically not too expensive and can save costs incurred during suction pot-holing by focusing the areas of the borings (i.e., provides prior knowledge of possible utilities)*

KENNEDY/JENKS CONSULTANTS
UTILITY LOCATION & ACKNOWLEDGEMENT FORM
Call 811 for Utility Locate at Least 48 Hours Prior to Work

Project Location: ____________________

Project Number: ____________________

Project Name: ____________________

Planned Start Date of Field Activities: ____________________

Kennedy Jenks Personnel: ____________________

Private Utility Locator Name: ____________________

811 Contact Date and Time (48 hours before work begins): ____________________

KJ One-Call Contractor ID# (varies by state) ____________________

Ticket Number: ____________________

Utility Clearance Information

How Were Boring/Excavation Locations Cleared:

Utilities Contacted by 811	Utility Contact Number	Utility Contacted by Telephone	Marked in Field	Other (Describe)

Contact information verified by (KJ Staff):____________________

Scheduled On-Site Meeting Location (if applicable):

Public Utility____________________

Private Utility Locator____________________

Use back of sheet to sketch of identified utilities and proposed boring/excavation locations **OR** attach figure. Include north arrow and structures if applicable.

Notes:

Mark all proposed borings and excavations with WHITE paint per APWA Utility Color Codes.

Request locator to mark utilities as required by their standard operating procedures or at least within 25 feet of boring/excavation, whichever is greater, with paint/flags.

Utility marks are valid for 14 calendar days and must be remarked if work continues beyond 14 days.

Make a sketch or include a figure of identified utilities and proposed boring/excavation locations. Include north arrow and structures if applicable.

Communication Log

Public Utilities: ____

____

____

____

____

____

____

Private Locator: ____

____

____

____

____

____

____

Client Representative: ____

____

____

____

____

Appendix F

Field Chemical Use Policy and Procedures

Field Chemical Use Form

Field Chemical Use Policy & Procedures

Policy: Kennedy Jenks will follow appropriate chemical handling protocol, implement proper health and safety measures, and follow appropriate waste regulations when using chemicals in the field. Examples of field chemical use include, but are not limited to:

- Test kits with chemical reagents
- Chemical preservatives for samples
- Chemicals for field investigations, bench tests, and pilot studies
- Special chemicals for cleaning equipment.

Procedures: The Health & Safety Manager or Representative must review and approve field chemical use before chemicals can be purchased or taken into the field. A site-specific project Health and Safety Plan (HASP) that addresses field chemical use must be prepared by the Project Manager or Designee, then reviewed and approved by the Health & Safety Manager or Representative. The portion of a project HASP that addresses field use of chemicals should include the following information:

- Chemical use justification. Include evaluation of alternatives, such as, less hazardous chemicals, alternative means of measuring (direct measurements without chemical reagents), and testing by a commercial laboratory or mobile laboratory.
- List of chemicals to be used, including quantities on hand.
- Safety Data Sheets (SDS) for the chemicals.
- Names of staff members that will be using the chemicals.
- Personal protective equipment (PPE) required.
- Description of how the materials will be transported, where the materials will be received and how the materials will be stored (note that our office leases prohibit handling or storage of hazardous materials or non-hazardous materials in quantities considered hazardous).
- Description of how the waste residuals will be disposed. Hazardous wastes generated from field testing, pilot studies, or equipment decontamination must be disposed in accordance with state and federal hazardous waste regulations. The Project Manager should include provisions and budget for assisting clients with residual waste disposal. As the generator, the client should sign the hazardous waste manifest. Consider:
  - Coordinating with a local analytical laboratory to accept the waste. Some laboratories will accept small quantities of reagent waste along with samples for disposal for a small fee. This typically involves collecting the wastes in an appropriate container, placing wastes into a sealed container inside of a cooler, and including safety data sheets for the materials with the shipment.

- Using client's existing hazardous waste generator process to dispose of waste. Provide client with information on the type of waste generated to assure compatibility with existing waste streams.

- Returning excess chemicals to the vendor for recycling or reuse. Wherever possible, purchase reagents from a vendor that will accept return of unused product. Have the vendor provide appropriate packaging materials for the return shipment.

- Disposing of non-hazardous residuals as solid waste or in a sanitary sewer. Some wastes, with review and approval by the Health & Safety Manager or Representative, can be disposed of in the local municipal solid waste or wastewater systems.

This information on the field use of chemicals can be provided by incorporating the example form provided at the end of this document into the HASP. An SDS for each chemical or product must be attached to the HASP. The Health & Safety Manager or Representative will review the HASP and conduct appropriate Hazard Communication update training for the staff that will be using the chemicals.

Project Task: ______________________________

Name of Preparer: ______________________________

Describe Evaluation of Alternatives to Chemical Use:

Chemicals to be Used for Project:

Chemical Name	Quantity (indicate units)

Names of Staff Using Chemicals During Project:

Describe Personal Protection to be Used When Using or Handling Chemicals:

- ☐ Safety Goggles
- ☐ Nitrile Gloves
- ☐ Respirator with _____ cartridges
- ☐ Other: _____
- ☐ Portable Eye Wash
- ☐ Splash Apron/Coveralls
- ☐ Face Shield

Describe how Chemicals will be Transported and Stored at Project Site:

Describe How Used or Leftover Chemicals will be Disposed:

Health and Safety Manager Approval Signature **Date Approved**

Appendix G

Safety Data Sheets (SDSs)

Search the NIOSH Pocket Guide

SEARCH

Enter search terms separated by spaces.

Benzene

Synonyms & Trade Names Benzol, Phenyl hydride

CAS No. 71-43-2	**RTECS No.** CY1400000 (/niosh-rtecs/CY155CC0.html)	**DOT ID & Guide** 1114 130 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx/guide130/) (http://www.cdc.gov/Other/disclaimer.html)
Formula C_6H_6	**Conversion** 1 ppm = 3.19 mg/m^3	**IDLH** Ca [500 ppm] See: 71432 (/niosh/idlh/71432.html)

Exposure Limits **NIOSH REL** : Ca TWA 0.1 ppm ST 1 ppm See Appendix A (nengapdxa.html) **OSHA PEL** : [1910.1028] TWA 1 ppm ST 5 ppm See Appendix F (nengapdxf.html)	**Measurement Methods** **NIOSH** 1500 (/niosh/docs/2003-154/pdfs/1500.pdf) , 1501 (/niosh/docs/2003-154/pdfs/1501.pdf) , 3700 (/niosh/docs/2003-154/pdfs/3700.pdf) , 3800 (/niosh/docs/2003-154/pdfs/3800.pdf) ; **OSHA** 12 (http://www.osha.gov/dts/sltc/methods/organic/org012/org012.html) (http://www.cdc.gov/Other/disclaimer.html) , 1005 (http://www.osha.gov/dts/sltc/methods/validated/1005/1005.html) (http://www.cdc.gov/Other/disclaimer.html) See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description Colorless to light-yellow liquid with an aromatic odor. [Note: A solid below 42°F.]

MW: 78.1	**BP:** 176°F	**FRZ:** 42°F	**Sol:** 0.07%	**VP:** 75 mmHg	**IP:** 9.24 eV
Sp.Gr: 0.88	**Fl.P:** 12°F	**UEL:** 7.8%	**LEL:** 1.2%		

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities Strong oxidizers, many fluorides & perchlorates, nitric acid

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression; [potential occupational carcinogen]

Target Organs Eyes, skin, respiratory system, blood, central nervous system, bone marrow

Cancer Site [leukemia]

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation
Provide: Eyewash, Quick drench

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately
Skin: Soap wash immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations
(See Appendix E) (nengapdxe.html)

NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0015 (/niosh/ipcsneng/neng0015.html) See MEDICAL TESTS: 0022 (/niosh/docs/2005-110/nmed0022.html)

Page last reviewed: April 4, 2011
Page last updated: February 13, 2015
Content source: National Institute for Occupational Safety and Health (NIOSH) Education and Information Division

Centers for Disease Control and Prevention 1600 Clifton Road Atlanta, GA 30329-4027, USA
800-CDC-INFO (800-232-4636) TTY: (888) 232-6348 - Contact CDC–INFO

Centers for Disease Control and Prevention
CDC 24/7: Saving Lives. Protecting People.™

Search the NIOSH Pocket Guide

SEARCH

Enter search terms separated by spaces.

Ethyl benzene

Synonyms & Trade Names Ethylbenzol, Phenylethane

CAS No. 100-41-4	**RTECS No.** DA0700000 (/niosh-rtecs/DAAAE60.html)	**DOT ID & Guide** 1175 130 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx/guide130/) (http://www.cdc.gov/Other/disclaimer.html)
Formula $CH_3CH_2C_6H_5$	**Conversion** 1 ppm = 4.34 mg/m^3	**IDLH** 800 ppm [10%LEL] See: 100414 (/niosh/idlh/100414.html)

Exposure Limits **NIOSH REL** : TWA 100 ppm (435 mg/m^3) ST 125 ppm (545 mg/m^3) **OSHA PEL** † (nengapdxg.html) : TWA 100 ppm (435 mg/m^3)	**Measurement Methods** **NIOSH** 1501 (/niosh/docs/2003-154/pdfs/1501.pdf) ; **OSHA** 7 (http://www.osha.gov/dts/sltc/methods/organic/org007/org007.html) (http://www.cdc.gov/Other/disclaimer.html) , 1002 (http://www.osha.gov/dts/sltc/methods/mdt/mdt1002/1002.html) (http://www.cdc.gov/Other/disclaimer.html) See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description Colorless liquid with an aromatic odor.

MW: 106.2	**BP:** 277°F	**FRZ:** -139°F	**Sol:** 0.01%	**VP:** 7 mmHg	**IP:** 8.76 eV
Sp.Gr: 0.87	**Fl.P:** 55°F	**UEL:** 6.7%	**LEL:** 0.8%		

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities Strong oxidizers

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma

Target Organs Eyes, skin, respiratory system, central nervous system	
Personal Protection/Sanitation (See protection codes (protect.html)) **Skin:** Prevent skin contact **Eyes:** Prevent eye contact **Wash skin:** When contaminated **Remove:** When wet (flammable) **Change:** No recommendation	**First Aid** (See procedures (firstaid.html)) **Eye:** Irrigate immediately **Skin:** Water flush promptly **Breathing:** Respiratory support **Swallow:** Medical attention immediately

Respirator Recommendations

NIOSH/OSHA

Up to 800 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
(APF = 10) Any supplied-air respirator*
(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0268 (/niosh/ipcsneng/neng0268.html) See MEDICAL TESTS: 0098 (/niosh/docs/2005-110/nmed0098.html)

Page last reviewed: April 4, 2011
Page last updated: February 13, 2015
Content source: National Institute for Occupational Safety and Health (NIOSH) Education and Information Division

Centers for Disease Control and Prevention
CDC 24/7: Saving Lives. Protecting People.™

Search the NIOSH Pocket Guide

SEARCH

Enter search terms separated by spaces.

Ethylene dibromide

Synonyms & Trade Names 1,2-Dibromoethane; Ethylene bromide; Glycol dibromide

CAS No. 106-93-4	**RTECS No.** KH9275000 (/niosh-rtecs/KH8D8678.html)	**DOT ID & Guide** 1605 154 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx/guide154/) (http://www.cdc.gov/Other/disclaimer.html)
Formula $BrCH_2CH_2Br$	**Conversion** 1 ppm = 7.69 mg/m^3	**IDLH** Ca [100 ppm] See: 106934 (/niosh/idlh/106934.html)

Exposure Limits **NIOSH REL** : Ca TWA 0.045 ppm C 0.13 ppm [15-minute] See Appendix A (nengapdxa.html)
OSHA PEL : TWA 20 ppm C 30 ppm 50 ppm [5-minute maximum peak]

Measurement Methods
NIOSH 1008 (/niosh/docs/2003-154/pdfs/1008.pdf) ;
OSHA 2 (http://www.osha.gov/dts/sltc/methods/organic/org002/org002.html) (http://www.cdc.gov/Other/disclaimer.html)
See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description Colorless liquid or solid (below 50°F) with a sweet odor. [fumigant]

MW: 187.9	**BP:** 268°F	**FRZ:** 50°F	**Sol:** 0.4%	**VP:** 12 mmHg	**IP:** 9.45 eV
Sp.Gr: 2.17	**Fl.P:** NA	**UEL:** NA	**LEL:** NA		

Noncombustible Liquid

Incompatibilities & Reactivities Chemically-active metals such as sodium, potassium, calcium, hot aluminum & magnesium; liquid ammonia; strong oxidizers

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes, skin, respiratory system; dermatitis with vesiculation; liver, heart, spleen, kidney damage; reproductive effects; [potential occupational carcinogen]

Target Organs Eyes, skin, respiratory system, liver, kidneys, reproductive system

Cancer Site [in animals: skin & lung tumors]

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation
Provide: Eyewash, Quick drench

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately
Skin: Soap wash immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations

NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0045 (/niosh/ipcsneng/neng0045.html) See MEDICAL TESTS: 0103 (/niosh/docs/2005-110/nmed0103.html)

Page last reviewed: April 4, 2011
Page last updated: February 13, 2015
Content source: National Institute for Occupational Safety and Health (NIOSH) Education and Information Division

Centers for Disease Control and Prevention 1600 Clifton Road Atlanta, GA 30329-4027, USA
800-CDC-INFO (800-232-4636) TTY: (888) 232-6348 - Contact CDC–INFO

Search the NIOSH Pocket Guide

SEARCH

Enter search terms separated by spaces.

Ethylene dichloride

Synonyms & Trade Names 1,2-Dichloroethane; Ethylene chloride; Glycol dichloride

CAS No. 107-06-2	**RTECS No.** KI0525000 (/niosh-rtecs/KI802C8.html)	**DOT ID & Guide** 1184 131 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx/guide131/) (http://www.cdc.gov/Other/disclaimer.html)
Formula $ClCH_2CH_2Cl$	**Conversion** 1 ppm = 4.05 mg/m^3	**IDLH** Ca [50 ppm] See: 107062 (/niosh/idlh/107062.html)

Exposure Limits **NIOSH REL** : Ca TWA 1 ppm (4 mg/m^3) ST 2 ppm (8 mg/m^3) See Appendix A (nengapdxa.html) See Appendix C (nengapdxc.html) (Chloroethanes)
OSHA PEL † (nengapdxg.html) : TWA 50 ppm C 100 ppm 200 ppm [5-minute maximum peak in any 3 hours]

Measurement Methods
NIOSH 1003 (/niosh/docs/2003-154/pdfs/1003.pdf) ;
OSHA 3 (http://www.osha.gov/dts/sltc/methods/organic/org003/org003.html) (http://www.cdc.gov/Other/disclaimer.html)
See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description Colorless liquid with a pleasant, chloroform-like odor. [Note: Decomposes slowly, becomes acidic & darkens in color.]

MW: 99.0	**BP:** 182°F	**FRZ:** -32°F	**Sol:** 0.9%	**VP:** 64 mmHg	**IP:** 11.05 eV
Sp.Gr: 1.24	**Fl.P:** 56°F	**UEL:** 16%	**LEL:** 6.2%		

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities Strong oxidizers & caustics; chemically-active metals such as magnesium or aluminum powder, sodium & potassium; liquid ammonia [Note: Decomposes to vinyl chloride & HCl above 1112°F.]

Exposure Routes inhalation, ingestion, skin absorption, skin and/or eye contact

Symptoms irritation eyes, corneal opacity; central nervous system depression; nausea, vomiting; dermatitis; liver, kidney, cardiovascular system damage; [potential occupational carcinogen]

Target Organs Eyes, skin, kidneys, liver, central nervous system, cardiovascular system

Cancer Site [in animals: forestomach, mammary gland & circulatory sys cancer]

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation
Provide: Eyewash, Quick drench

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations

NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0250 (/niosh/ipcsneng/neng0250.html) See MEDICAL TESTS: 0104 (/niosh/docs/2005-110/nmed0104.html)

Page last reviewed: April 4, 2011
Page last updated: February 13, 2015
Content source: National Institute for Occupational Safety and Health (NIOSH) Education and Information Division

Centers for Disease Control and Prevention 1600 Clifton Road Atlanta, GA 30329-4027, USA
800-CDC-INFO (800-232-4636) TTY: (888) 232-6348 - Contact CDC–INFO

Search the NIOSH Pocket Guide

SEARCH

Enter search terms separated by spaces.

Gasoline

Synonyms & Trade Names Motor fuel, Motor spirits, Natural gasoline, Petrol [Note: A complex mixture of volatile hydrocarbons (paraffins, cycloparaffins, and aromatics).]

CAS No. 8006-61-9	**RTECS No.** LX3300000 (/niosh-rtecs/LX325AA0.html)	**DOT ID & Guide** 1203 128 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx/guide128/) (http://www.cdc.gov/Other/disclaimer.html)
	Conversion 1 ppm = 4.5 mg/m^3 (approx)	**IDLH** Ca [N.D.] See: IDLH INDEX (/niosh/idlh/intridl4.html)

Exposure Limits **NIOSH REL** : Ca See Appendix A (nengapdxa.html) **OSHA PEL** † (nengapdxg.html) : none	**Measurement Methods** **OSHA** PV2028 (http://www.osha.gov/dts/sltc/methods/partial/pv2028/2028.html) (http://www.cdc.gov/Other/disclaimer.html) See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description Clear liquid with a characteristic odor.

MW: 110 (approx)	**BP:** 102°F	**FRZ:** ?	**Sol:** Insoluble	**VP:** 38-300 mmHg	**IP:** ?
Sp.Gr(60°F): 0.72-0.76	**Fl.P:** -45°F	**UEL:** 7.6%	**LEL:** 1.4%		

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities Strong oxidizers such as peroxides, nitric acid & perchlorates

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes, skin, mucous membrane; dermatitis; headache, lassitude (weakness, exhaustion), blurred vision, dizziness, slurred speech, confusion, convulsions; chemical pneumonitis (aspiration liquid); possible liver, kidney damage; [potential occupational carcinogen]

Target Organs Eyes, skin, respiratory system, central nervous system, liver, kidneys

Cancer Site [in animals: liver & kidney cancer]

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation
Provide: Eyewash, Quick drench

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately
Skin: Soap flush immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations

NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html)

Page last reviewed: April 4, 2011
Page last updated: February 13, 2015
Content source: National Institute for Occupational Safety and Health (NIOSH) Education and Information Division

Centers for Disease Control and Prevention
CDC 24/7: Saving Lives. Protecting People.™

Search the NIOSH Pocket Guide

SEARCH

Enter search terms separated by spaces.

Lead

Synonyms & Trade Names Lead metal, Plumbum

CAS No.	RTECS No.	DOT ID & Guide
7439-92-1	OF7525000 (/niosh-rtecs/OF72D288.html)	
Formula Pb	**Conversion**	**IDLH** 100 mg/m^3 (as Pb) See: 7439921 (/niosh/idlh/7439921.html)

Exposure Limits **NIOSH REL** *: TWA (8-hour) 0.050 mg/m^3 See Appendix C (nengapdxc.html) [*Note: The REL also applies to other lead compounds (as Pb) -- see Appendix C.]
OSHA PEL *: [1910.1025] TWA 0.050 mg/m^3 See Appendix C (nengapdxc.html) [*Note: The PEL also applies to other lead compounds (as Pb) -- see Appendix C.]

Measurement Methods
NIOSH 7082 (/niosh/docs/2003-154/pdfs/7082.pdf) , 7105 (/niosh/docs/2003-154/pdfs/7105.pdf) , 7300 (/niosh/docs/2003-154/pdfs/7300.pdf) , 7301 (/niosh/docs/2003-154/pdfs/7301.pdf) , 7303 (/niosh/docs/2003-154/pdfs/7303.pdf) , 7700 (/niosh/docs/2003-154/pdfs/7700.pdf) , 7701 (/niosh/docs/2003-154/pdfs/7701.pdf) , 7702 (/niosh/docs/2003-154/pdfs/7702.pdf) , 9100 (/niosh/docs/2003-154/pdfs/9100.pdf) , 9102 (/niosh/docs/2003-154/pdfs/9102.pdf) , 9105 (/niosh/docs/2003-154/pdfs/9105.pdf) ;
OSHA ID121 (http://www.osha.gov/dts/sltc/methods/inorganic/id121/id121.html) (http://www.cdc.gov/Other/disclaimer.html) , ID125G (http://www.osha.gov/dts/sltc/methods/inorganic/id125g/id125g.html) (http://www.cdc.gov/Other/disclaimer.html) , ID206 (http://www.osha.gov/dts/sltc/methods/inorganic/id206/id206.html) (http://www.cdc.gov/Other/disclaimer.html)
See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description A heavy, ductile, soft, gray solid.

MW:	BP:	MLT:	Sol:	VP:	IP:
207.2	3164°F	621°F	Insoluble	0 mmHg (approx)	NA

Sp.Gr: 11.34	Fl.P: NA	UEL: NA	LEL: NA		

Noncombustible Solid in bulk form.

Incompatibilities & Reactivities Strong oxidizers, hydrogen peroxide, acids

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypertension

Target Organs Eyes, gastrointestinal tract, central nervous system, kidneys, blood, gingival tissue

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: Daily
Remove: When wet or contaminated
Change: Daily

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately
Skin: Soap flush promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations
(See Appendix E) (nengapdxe.html)
NIOSH/OSHA

Up to 0.5 mg/m^3:
(APF = 10) Any air-purifying respirator with an N100, R100, or P100 filter (including N100, R100, and P100 filtering facepieces) except quarter-mask respirators.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
(APF = 10) Any supplied-air respirator

Up to 1.25 mg/m^3:
(APF = 25) Any supplied-air respirator operated in a continuous-flow mode
(APF = 25) Any powered, air-purifying respirator with a high-efficiency particulate filter.

Up to 2.5 mg/m^3:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode
(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter
(APF = 50) Any self-contained breathing apparatus with a full facepiece
(APF = 50) Any supplied-air respirator with a full facepiece

Up to 50 mg/m^3:
(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Up to 100 mg/m^3:

(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.
Click here (pgintrod.html#nrp) for information on selection of N, R, or P filters.
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0052 (/niosh/ipcsneng/neng0052.html) See MEDICAL TESTS: 0127 (/niosh/docs/2005-110/nmed0127.html)

Page last reviewed: April 4, 2011
Page last updated: February 13, 2015
Content source: National Institute for Occupational Safety and Health (NIOSH) Education and Information Division

Centers for Disease Control and Prevention 1600 Clifton Road Atlanta, GA 30329-4027, USA
800-CDC-INFO (800-232-4636) TTY: (888) 232-6348 - Contact CDC–INFO

Centers for Disease Control and Prevention
CDC 24/7: Saving Lives. Protecting People.™

Search the NIOSH Pocket Guide

SEARCH

Enter search terms separated by spaces.

m-Xylene-alpha,alpha'-diamine

Synonyms & Trade Names 1,3-bis(Aminomethyl)benzene; 1,3-Benzenedimethanamine; MXDA; m-Phenylenebis(methylamine); m-Xylylenediamine

CAS No. 1477-55-0	**RTECS No.** PF8970000 (/niosh-rtecs/PF88DF10.html)	**DOT ID & Guide**
Formula $C_6H_4(CH_2NH_2)_2$	**Conversion**	**IDLH** N.D. See: IDLH INDEX (/niosh/idlh/intridl4.html)

Exposure Limits **NIOSH REL** : C 0.1 mg/m^3 [skin]
OSHA PEL † (nengapdxg.html) : none

Measurement Methods
OSHA 105 (http://www.osha.gov/dts/sltc/methods/organic/org105/org105.html) (http://www.cdc.gov/Other/disclaimer.html)
See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description Colorless liquid.

MW: 136.2	**BP:** 477°F	**FRZ:** 58°F	**Sol:** Miscible	VP(77°F): 0.03 mmHg	**IP:** ?
Sp.Gr: 1.032	**Fl.P:** 243°F	**UEL:** ?	**LEL:** ?		

Class IIIB Combustible Liquid: Fl.P. at or above 200°F.

Incompatibilities & Reactivities None reported

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms In animals: irritation eyes, skin; liver, kidney, lung damage

Target Organs Eyes, skin, respiratory system, liver, kidneys

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: Prevent skin contact
Eyes: Prevent eye contact

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately
Skin: Water flush immediately
Breathing: Respiratory support

Wash skin: When contaminated **Remove:** When wet or contaminated **Change:** No recommendation **Provide:** Eyewash, Quick drench	**Swallow:** Medical attention immediately

Respirator Recommendations

Not available.

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 1462 (/niosh/ipcsneng/neng1462.html)

Page last reviewed: April 4, 2011
Page last updated: February 13, 2015
Content source: National Institute for Occupational Safety and Health (NIOSH) Education and Information Division

Centers for Disease Control and Prevention
CDC 24/7: Saving Lives. Protecting People.™

Search the NIOSH Pocket Guide

SEARCH

Enter search terms separated by spaces.

o-Xylene

Synonyms & Trade Names 1,2-Dimethylbenzene; ortho-Xylene; o-Xylol

CAS No. 95-47-6	**RTECS No.** ZE2450000 (/niosh-rtecs/ZE256250.html)	**DOT ID & Guide** 1307 130 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx/guide130/) (http://www.cdc.gov/Other/disclaimer.html)
Formula $C_6H_4(CH_3)_2$	**Conversion** 1 ppm = 4.34 mg/m^3	**IDLH** 900 ppm See: 95476 (/niosh/idlh/95476.html)

Exposure Limits **NIOSH REL** : TWA 100 ppm (435 mg/m^3) ST 150 ppm (655 mg/m^3) **OSHA PEL** † (nengapdxg.html) : TWA 100 ppm (435 mg/m^3)	**Measurement Methods** **NIOSH** 1501 (/niosh/docs/2003-154/pdfs/1501.pdf) , 3800 (/niosh/docs/2003-154/pdfs/3800.pdf) ; **OSHA** 1002 (http://www.osha.gov/dts/sltc/methods/mdt/mdt1002/1002.html) (http://www.cdc.gov/Other/disclaimer.html) See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description Colorless liquid with an aromatic odor.

MW: 106.2	**BP:** 292°F	**FRZ:** -13°F	**Sol:** 0.02%	**VP:** 7 mmHg	**IP:** 8.56 eV
Sp.Gr: 0.88	**Fl.P:** 90°F	**UEL:** 6.7%	**LEL:** 0.9%		

Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

Incompatibilities & Reactivities Strong oxidizers, strong acids

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis

Target Organs Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations

NIOSH/OSHA

Up to 900 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
(APF = 10) Any supplied-air respirator*
(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0084 (/niosh/ipcsneng/neng0084.html)

Page last reviewed: April 4, 2011
Page last updated: February 13, 2015
Content source: National Institute for Occupational Safety and Health (NIOSH) Education and Information Division

Centers for Disease Control and Prevention 1600 Clifton Road Atlanta, GA 30329-4027, USA
800-CDC-INFO (800-232-4636) TTY: (888) 232-6348 - Contact CDC–INFO

Search the NIOSH Pocket Guide

SEARCH

Enter search terms separated by spaces.

Tetrachloroethylene

Synonyms & Trade Names Perchlorethylene, Perchloroethylene, Perk, Tetrachlorethylene

CAS No. 127-18-4	**RTECS No.** KX3850000 (/niosh-rtecs/KX3ABF10.html)	**DOT ID & Guide** 1897 160 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx/guide160/) (http://www.cdc.gov/Other/disclaimer.html)
Formula $Cl_2C=CCl_2$	**Conversion** 1 ppm = 6.78 mg/m^3	**IDLH** Ca [150 ppm] See: 127184 (/niosh/idlh/127184.html)
Exposure Limits **NIOSH REL** : Ca Minimize workplace exposure concentrations. See Appendix A (nengapdxa.html) **OSHA PEL** † (nengapdxg.html) : TWA 100 ppm C 200 ppm (for 5 minutes in any 3-hour period), with a maximum peak of 300 ppm		**Measurement Methods** **NIOSH** 1003 (/niosh/docs/2003-154/pdfs/1003.pdf) ; **OSHA** 1001 (http://www.osha.gov/dts/sltc/methods/mdt/mdt1001/1001.html) (http://www.cdc.gov/Other/disclaimer.html) See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description Colorless liquid with a mild, chloroform-like odor.

MW: 165.8	**BP:** 250°F	**FRZ:** -2°F	**Sol:** 0.02%	**VP:** 14 mmHg	**IP:** 9.32 eV
Sp.Gr: 1.62	**Fl.P:** NA	**UEL:** NA	**LEL:** NA		

Noncombustible Liquid, but decomposes in a fire to hydrogen chloride and phosgene.

Incompatibilities & Reactivities Strong oxidizers; chemically-active metals such as lithium, beryllium & barium; caustic soda; sodium hydroxide; potash

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; [potential occupational carcinogen]

Target Organs Eyes, skin, respiratory system, liver, kidneys, central nervous system

Cancer Site [in animals: liver tumors]

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation
Provide: Eyewash, Quick drench

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations

NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0076 (/niosh/ipcsneng/neng0076.html) See MEDICAL TESTS: 0179 (/niosh/docs/2005-110/nmed0179.html)

Page last reviewed: April 4, 2011
Page last updated: February 13, 2015
Content source: National Institute for Occupational Safety and Health (NIOSH) Education and Information Division

Centers for Disease Control and Prevention 1600 Clifton Road Atlanta, GA 30329-4027, USA
800-CDC-INFO (800-232-4636) TTY: (888) 232-6348 - Contact CDC–INFO

Search the NIOSH Pocket Guide

SEARCH

Enter search terms separated by spaces.

Toluene

Synonyms & Trade Names Methyl benzene, Methyl benzol, Phenyl methane, Toluol

CAS No. 108-88-3	**RTECS No.** XS5250000 (/niosh-rtecs/XS501BD0.html)	**DOT ID & Guide** 1294 130 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx/guide130/) (http://www.cdc.gov/Other/disclaimer.html)
Formula $C_6H_5CH_3$	**Conversion** 1 ppm = 3.77 mg/m^3	**IDLH** 500 ppm See: 108883 (/niosh/idlh/108883.html)

Exposure Limits **NIOSH REL** : TWA 100 ppm (375 mg/m^3) ST 150 ppm (560 mg/m^3) **OSHA PEL** † (nengapdxg.html) : TWA 200 ppm C 300 ppm 500 ppm (10-minute maximum peak)	**Measurement Methods** **NIOSH** 1500 (/niosh/docs/2003-154/pdfs/1500.pdf) , 1501 (/niosh/docs/2003-154/pdfs/1501.pdf) , 3800 (/niosh/docs/2003-154/pdfs/3800.pdf) , 4000 (/niosh/docs/2003-154/pdfs/4000.pdf) ; **OSHA** 111 (http://www.osha.gov/dts/sltc/methods/organic/org111/org111.html) (http://www.cdc.gov/Other/disclaimer.html) See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description Colorless liquid with a sweet, pungent, benzene-like odor.

MW: 92.1	**BP:** 232°F	**FRZ:** -139°F	Sol(74°F): 0.07%	**VP:** 21 mmHg	**IP:** 8.82 eV
Sp.Gr: 0.87	**Fl.P:** 40°F	**UEL:** 7.1%	**LEL:** 1.1%		

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities Strong oxidizers

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia;

paresthesia; dermatitis; liver, kidney damage

Target Organs Eyes, skin, respiratory system, central nervous system, liver, kidneys

Personal Protection/Sanitation (See protection codes (protect.html))
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation

First Aid (See procedures (firstaid.html))
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations

NIOSH

Up to 500 ppm:
(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*
(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
(APF = 10) Any supplied-air respirator*
(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:
(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode
(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister
Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0078 (/niosh/ipcsneng/neng0078.html) See MEDICAL TESTS: 0232 (/niosh/docs/2005-110/nmed0232.html)

Page last reviewed: April 4, 2011
Page last updated: February 13, 2015
Content source: National Institute for Occupational Safety and Health (NIOSH) Education and Information Division

Centers for Disease Control and Prevention 1600 Clifton Road Atlanta, GA 30329-4027, USA
800-CDC-INFO (800-232-4636) TTY: (888) 232-6348 - Contact CDC–INFO

Safety Data Sheet

RUST-OLEUM CORPORATION
* Trusted Quality Since 1921 *
www.rustoleum.com

1. Identification

Product Name:	ICWB LSPR 12PK WHITE MARKING	**Revision Date:**	4/8/2020
Product Identifier:	203039	**Supercedes Date:**	2/18/2019
Recommended Use:	Marking Paint / Aerosols		
Supplier:	Rust-Oleum Corporation 11 Hawthorn Parkway Vernon Hills, IL 60061 USA	**Manufacturer:**	Rust-Oleum Corporation 11 Hawthorn Parkway Vernon Hills, IL 60061 USA
Preparer:	Regulatory Department		
Emergency Telephone:	24 Hour Hotline: 847-367-7700		

2. Hazard Identification

Classification

Symbol(s) of Product

Signal Word
Danger

Possible Hazards
35% of the mixture consists of ingredient(s) of unknown acute toxicity.

GHS HAZARD STATEMENTS

Flammable Aerosol, category 1	H222	Extremely flammable aerosol.
Compressed Gas	H280	Contains gas under pressure; may explode if heated.
Carcinogenicity, category 2	H351	Suspected of causing cancer.
STOT, repeated exposure, category 2	H373	May cause damage to organs through prolonged or repeated exposure.

GHS LABEL PRECAUTIONARY STATEMENTS

P210	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. NO SMOKING.
P211	Do not spray on an open flame or other ignition source.
P251	Do not pierce or burn, even after use.
P410+P412	Protect from sunlight. Do not expose to temperatures exceeding 50°C / 122°F.
P410+P403	Protect from sunlight. Store in a well-ventilated place.
P201	Obtain special instructions before use.
P280	Wear protective gloves/protective clothing/eye protection/face protection.
P308+P313	IF exposed or concerned: Get medical advice/attention.
P405	Store locked up.
P501	Dispose of contents/container in accordance with local, regional and national regulations.

P260	Do not breathe dust/fume/gas/mist/vapors/spray.
P314	Get medical advice/attention if you feel unwell.

3. Composition / Information On Ingredients

HAZARDOUS SUBSTANCES

Chemical Name	CAS-No.	Wt.% Range	GHS Symbols	GHS Statements
Propane	74-98-6	10-25	GHS04	H280
Titanium Dioxide	13463-67-7	2.5-10	Not Available	Not Available
n-Butane	106-97-8	2.5-10	GHS04	H280
Naphtha, Petroleum, Hydrotreated Light	64742-49-0	2.5-10	GHS08	H304
Xylenes (o-, m-, p- Isomers)	1330-20-7	2.5-10	GHS02-GHS07	H226-315-319-332
Hydrous Magnesium Silicate	14807-96-6	1.0-2.5	Not Available	Not Available
n-Butyl Acetate	123-86-4	1.0-2.5	GHS02-GHS07	H226-336
Ethylbenzene	100-41-4	1.0-2.5	GHS02-GHS07-GHS08	H225-304-332-351-373
Octane	111-65-9	0.1-1.0	GHS02-GHS07-GHS08	H225-304-315-336

4. First-Aid Measures

FIRST AID - EYE CONTACT: Immediately flush eyes with plenty of water for at least 15 minutes holding eyelids open. Get medical attention. Do NOT allow rubbing of eyes or keeping eyes closed.

FIRST AID - SKIN CONTACT: Wash skin with soap and water. Remove contaminated clothing. Get medical attention if irritation develops or persists.

FIRST AID - INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get immediate medical attention. Do NOT use mouth-to-mouth resuscitation. If you experience difficulty in breathing, leave the area to obtain fresh air. If continued difficulty is experienced, get medical assistance immediately.

FIRST AID - INGESTION: Aspiration hazard: Do not induce vomiting or give anything by mouth because this material can enter the lungs and cause severe lung damage. Get immediate medical attention. If swallowed, get medical attention.

5. Fire-Fighting Measures

EXTINGUISHING MEDIA: Alcohol Film Forming Foam, Carbon Dioxide, Dry Chemical, Dry Sand, Water Fog

UNUSUAL FIRE AND EXPLOSION HAZARDS: FLASH POINT IS LESS THAN 20°F. EXTREMELY FLAMMABLE LIQUID AND VAPOR!Water spray may be ineffective. Closed containers may explode when exposed to extreme heat due to buildup of steam. Closed containers may explode when exposed to extreme heat. Vapors may form explosive mixtures with air. Vapors can travel to a source of ignition and flash back. Isolate from heat, electrical equipment, sparks and open flame. Perforation of the pressurized container may cause bursting of the can.

SPECIAL FIREFIGHTING PROCEDURES: Full protective equipment including self-contained breathing apparatus should be used. Evacuate area and fight fire from a safe distance. Water may be used to cool closed containers to prevent pressure buildup and possible autoignition or explosion. Use water spray to keep fire-exposed containers cool. Containers may explode when heated.

Special Fire and Explosion Hazard (Combustible Dust): No Information

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: Contain spilled liquid with sand or earth. DO NOT use combustible materials such as sawdust. Isolate the hazard area and deny entry to unnecessary and unprotected personnel. Remove all sources of ignition, ventilate area and remove with inert absorbent and non-sparking tools. Dispose of according to local, state (provincial) and federal regulations. Do not incinerate closed containers. Ventilate area, isolate spilled material, and remove with inert absorbent. Dispose of contaminated absorbent, container, and unused contents in accordance with local, state, and federal regulations.

7. Handling and Storage

HANDLING: Wash thoroughly after handling. Wash hands before eating. Remove contaminated clothing and launder before reuse. Use only with adequate ventilation. Follow all SDS and label precautions even after container is emptied because it may retain product residues. Avoid breathing fumes, vapors, or mist. Avoid contact with eyes, skin and clothing.

STORAGE: Keep containers tightly closed. Isolate from heat, electrical equipment, sparks and open flame. Contents under pressure. Do not store above 120 ° F. Store large quantities in buildings designed and protected for storage of flammable aerosols. Product should be stored in tightly sealed containers and protected from heat, moisture, and foreign materials. Keep away from heat, sparks, flame and sources of ignition. Avoid excess heat.

Advice on Safe Handling of Combustible Dust: No Information

8. Exposure Controls / Personal Protection

Chemical Name	CAS-No.	Weight % Less Than	ACGIH TLV-TWA	ACGIH TLV-STEL	OSHA PEL-TWA	OSHA PEL-CEILING
Propane	74-98-6	20.0	N.E.	N.E.	1000 ppm	N.E.
Titanium Dioxide	13463-67-7	10.0	10 mg/m3	N.E.	15 mg/m3	N.E.
n-Butane	106-97-8	10.0	N.E.	1000 ppm	N.E.	N.E.
Naphtha, Petroleum, Hydrotreated Light	64742-49-0	10.0	N.E.	N.E.	N.E.	N.E.
Xylenes (o-, m-, p- Isomers)	1330-20-7	10.0	100 ppm	150 ppm	100 ppm	N.E.
Hydrous Magnesium Silicate	14807-96-6	5.0	2 mg/m3	N.E.	N.E.	N.E.
n-Butyl Acetate	123-86-4	5.0	50 ppm	150 ppm	150 ppm	N.E.
Ethylbenzene	100-41-4	5.0	20 ppm	N.E.	100 ppm	N.E.
Octane	111-65-9	1.0	300 ppm	N.E.	500 ppm	N.E.

PERSONAL PROTECTION

ENGINEERING CONTROLS: Use explosion-proof ventilation equipment. Provide general dilution of local exhaust ventilation in volume and pattern to keep TLV of hazardous ingredients below acceptable limits. Prevent build-up of vapors by opening all doors and windows to achieve cross-ventilation. Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits.

RESPIRATORY PROTECTION: A respiratory protection program that meets OSHA 1910.134 and ANSI Z88.2 requirements must be followed whenever workplace conditions warrant a respirator's use. A NIOSH/MSHA approved air purifying respirator with organic vapor cartridge or canister may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits.

SKIN PROTECTION: Use gloves to prevent prolonged skin contact. Nitrile or Neoprene gloves may afford adequate skin protection.

EYE PROTECTION: Use safety eyewear designed to protect against splash of liquids.

OTHER PROTECTIVE EQUIPMENT: Refer to safety supervisor or industrial hygienist for further guidance regarding types of personal protective equipment and their applications.

HYGIENIC PRACTICES: Wash thoroughly with soap and water before eating, drinking or smoking. Remove contaminated clothing immediately and launder before reuse.

Engineering Measures for Combustible Dust: No Information

9. Physical and Chemical Properties

Appearance:	Aerosolized Mist	**Physical State:**	Liquid
Odor:	Solvent Like	**Odor Threshold:**	N.E.
Specific Gravity:	0.883	**pH:**	N.D.
Freeze Point, °C:	N.D.	**Viscosity:**	N.D.
Solubility in Water:	Miscible	**Partition Coefficient, n-octanol/ water:**	N.D.
Decompostion Temp., °C:	N.D.		
Boiling Range, °C:	-37 - 537	**Explosive Limits, vol%:**	0.9 - 12.6
Flammability:	Does not Support Combustion	**Flash Point, °C:**	-96
Evaporation Rate:	Faster than Ether	**Auto-ignition Temp., °C:**	N.D.
Vapor Density:	Heavier than Air	**Vapor Pressure:**	N.D.

(See "Other information" Section for abbreviation legend)

10. Stability and Reactivity

CONDITIONS TO AVOID: Avoid temperatures above 120°F (49°C). Avoid all possible sources of ignition.

INCOMPATIBILITY: Incompatible with strong oxidizing agents, strong acids and strong alkalies.

HAZARDOUS DECOMPOSITION: By open flame, carbon monoxide and carbon dioxide. When heated to decomposition, it emits acrid smoke and irritating fumes. Contains solvents which may form carbon monoxide, carbon dioxide, and formaldehyde.

HAZARDOUS POLYMERIZATION: Will not occur under normal conditions.

STABILITY: This product is stable under normal storage conditions.

11. Toxicological Information

EFFECTS OF OVEREXPOSURE - EYE CONTACT: Causes Serious Eye Irritation

EFFECTS OF OVEREXPOSURE - SKIN CONTACT: No Information

EFFECTS OF OVEREXPOSURE - INHALATION: High gas, vapor, mist or dust concentrations may be harmful if inhaled. High vapor concentrations are irritating to the eyes, nose, throat and lungs. Harmful if inhaled. Avoid breathing fumes, spray, vapors, or mist. Prolonged or excessive inhalation may cause respiratory tract irritation.

EFFECTS OF OVEREXPOSURE - INGESTION: Harmful if swallowed.

EFFECTS OF OVEREXPOSURE - CHRONIC HAZARDS: Overexposure to xylene in laboratory animals has been associated with liver abnormalities, kidney, lung, spleen, eye and blood damage as well as reproductive disorders. Effects in humans, due to chronic overexposure, have included liver, cardiac abnormalities and nervous system damage. IARC lists Ethylbenzene as a possible human carcinogen (group 2B). Contains Titanium Dioxide. Titanium Dioxide is listed as a Group 2B-"Possibly carcinogenic to humans" by IARC. No significant exposure to Titanium Dioxide is thought to occur during the use of products in which Titanium Dioxide is bound to other materials, such as in paints during brush application or drying. Risk of overexposure depends on duration and level of exposure to dust from repeated sanding of surfaces or spray mist and the actual concentration of Titanium Dioxide in the formula. (Ref: IARC Monograph, Vol. 93, 2010)May cause central nervous system disorder (e.g., narcosis involving a loss of coordination, weakness, fatigue, mental confusion, and blurred vision) and/or damage. Reports have associated repeated and prolonged occupational overexposure to solvents with permanent brain and nervous system damage. High concentrations may lead to central nervous system effects (drowsiness, dizziness, nausea, headaches, paralysis, and blurred vision) and/or damage.

PRIMARY ROUTE(S) OF ENTRY: Eye Contact, Ingestion, Inhalation, Skin Absorption, Skin Contact

ACUTE TOXICITY VALUES
The acute effects of this product have not been tested. Data on individual components are tabulated below:

CAS-No.	Chemical Name	Oral LD50	Dermal LD50	Vapor LC50
13463-67-7	Titanium Dioxide	>10000 mg/kg Rat	2500 mg/kg	N.E.
106-97-8	n-Butane	N.E.	N.E.	658 mg/L Rat
64742-49-0	Naphtha, Petroleum, Hydrotreated Light	>5000 mg/kg Rat	>3160 mg/kg Rabbit	>4951 mg/L Rat
1330-20-7	Xylenes (o-, m-, p- Isomers)	3500 mg/kg Rat	>4350 mg/kg Rabbit	29.08 mg/L Rat
14807-96-6	Hydrous Magnesium Silicate	6000	N.E.	30
123-86-4	n-Butyl Acetate	10768 mg/kg Rat	>17600 mg/kg Rabbit	> 21 mg/L Rat
100-41-4	Ethylbenzene	3500 mg/kg Rat	15400 mg/kg Rabbit	17.4 mg/L Rat
111-65-9	Octane	N.E.	N.E.	>23.36 mg/L Rat

N.E. - Not Established

12. Ecological Information

ECOLOGICAL INFORMATION: Product is a mixture of listed components.

13. Disposal Information

DISPOSAL INFORMATION: Do not incinerate closed containers. This product as supplied is a USEPA defined ignitable hazardous waste. Dispose of unusable product as a hazardous waste (D001) in accordance with local, state, and federal regulation.

14. Transport Information

	Domestic (USDOT)	International (IMDG)	Air (IATA)	TDG (Canada)
UN Number:	N.A.	1950	1950	N.A.
Proper Shipping Name:	Aerosols	Aerosols	Aerosols, flammable	Aerosols
Hazard Class:	N.A.	2	2.1	N.A.
Packing Group:	N.A.	N.A.	N.A.	N.A.
Limited Quantity:	Yes	Yes	Yes	Yes

15. Regulatory Information

U.S. Federal Regulations:

CERCLA - SARA Hazard Category

This product has been reviewed according to the EPA 'Hazard Categories' promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

Gas under pressure, Carcinogenicity, Specific target organ toxicity (single or repeated exposure)

Sara Section 313:

This product contains the following substances subject to the reporting requirements of Section 313 of Title III of the Superfund Amendment and Reauthorization Act of 1986 and 40 CFR part 372:

Chemical Name	CAS-No.
Xylenes (o-, m-, p- Isomers)	1330-20-7
Ethylbenzene	100-41-4

Toxic Substances Control Act:

This product contains the following chemical substances subject to the reporting requirements of TSCA 12(b) if exported from the United States:

Chemical Name	CAS-No.
Castor oil, sulfated, sodium salt	68187-76-8

U.S. State Regulations:

California Proposition 65:

WARNING: Cancer and Reproductive Harm - www.P65Warnings.ca.gov.

16. Other Information

HMIS RATINGS

Health:	2*	**Flammability:**	4	**Physical Hazard:**	0	**Personal Protection:**	X

NFPA RATINGS

Health:	2	**Flammability:**	4	**Instability**	0

Maximum Incremental Reactivity 0.83

SDS REVISION DATE: 4/8/2020

REASON FOR REVISION:
Substance Chemical Name Changed
Product Composition Changed
Substance and/or Product Properties Changed in Section(s):
09 - Physical & Chemical Properties
15 - Regulatory Information
16 - Other Information
Revision Statement(s) Changed

Legend: N.A. - Not Applicable, N.D. - Not Determined, N.E. - Not Established

Section 1: IDENTIFICATION

Product Name: Simple Green® All-Purpose Cleaner
Additional Names:

Manufacturer's Part Number: **Please refer to Section 16*

Recommended Use: Cleaner & Degreaser for water tolerant surfaces.
Restrictions on Use: Do not use on non-rinsable surfaces.

Company: Sunshine Makers, Inc.
15922 Pacific Coast Highway
Huntington Beach, CA 92649 USA

Telephone: 800-228-0709 ● 562-795-6000 *Mon – Fri, 8am – 5pm PST*
Fax: 562-592-3830
Email: info@simplegreen.com

Emergency Phone: Chem-Tel 24-Hour Emergency Service: 800-255-3924

Section 2: HAZARDS IDENTIFICATION

This product has been assessed in accordance to 2012 OSHA Hazard Communication Standards (29 CFR 1910.1200) and has been determined to not be classifiable as hazardous.

OSHA HCS 2012
Label Elements
Signal Word: None

Hazard Symbol(s)/Pictogram(s): None required

Hazard Statements: None
Precautionary Statements: None
Hazards Not Otherwise Classified (HNOC): None
Other Information: None Known

Section 3: COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient	CAS Number	Percent Range
Water	7732-18-5	> 84.8%*
C9-11 Alcohols Ethoxylated	68439-46-3	< 5%*
Sodium Citrate	68-04-2	< 5%*
Sodium Carbonate	497-19-8	< 1%*
Tetrasodium Glutamate Diacetate	51981-21-6	< 1%*
Citric Acid	77-92-9	< 1%*
Methylchloroisothiazolinone	26172-55-4	< 0.002%*
Methylisothiazolinone	2682-20-4	< 0.001%*
Fragrance	Proprietary Mixture	< 1%*
Liquitint Colorant	Proprietary Mixture	< 1%*

**specific percentages of composition are being withheld as a trade secret*

Section 4: FIRST-AID MEASURES

Inhalation: Not expected to cause respiratory irritation. If adverse effect occurs, move to fresh air.
Skin Contact: Not expected to cause skin irritation. If adverse effect occurs, rinse skin with water.
Eye Contact: Not expected to cause eye irritation. If adverse effect occurs, flush eyes with water.
Ingestion: May cause upset stomach. Drink plenty of water to dilute. See section 11.

Most Important Symptoms/Effects, Acute and Delayed: None known.

Indication of Immediate Medical Attention and Special Treatment Needed, if necessary: Treat symptomatically

Section 5: FIRE-FIGHTING MEASURES

Suitable & Unsuitable Extinguishing Media: Use Dry chemical, CO2, water spray or "alcohol" foam. Avoid high volume jet water.
Specific Hazards Arising from Chemical: In event of fire, fire created carbon oxides may be formed.
Special Protective Actions for Fire-Fighters: Wear positive pressure self-contained breathing apparatus; Wear full protective clothing.

This product is non-flammable. See Section 9 for Physical Properties.

Section 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures: *For non-emergency and emergency personnel:* See section 8 – personal protection. Avoid eye contact. Safety goggles suggested.

Environmental Precautions: Do not allow into open waterways and ground water systems.

Methods and Materials for Containment and Clean Up: Dike or soak up with inert absorbent material. See section 13 for disposal considerations.

Section 7: HANDLING AND STORAGE

Precautions for Safe Handling: Ensure adequate ventilation. Keep out of reach of children. Keep away from heat, sparks, open flame and direct sunlight. Do not pierce any part of the container. Do not mix or contaminate with any other chemical. Do not eat, drink or smoke while using this product.

Conditions for Safe Storage including Incompatibilities: Keep container tightly closed. Keep in cool dry area. Avoid prolonged exposure to sunlight. Do not store at temperatures above 109°F (42.7°C). If separation occurs, mix the product for reconstitution.

Section 8: EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Limit Values: No components listed with TWA or STEL values under OSHA or ACGIH.

Appropriate Engineering Controls: Showers, eyewash stations, ventilation systems

Individual Protection Measures / Personal Protective Equipment (PPE)
Eye Contact: Use protective glasses or safety goggles if splashing or spray-back is likely.
Respiratory: Use in well ventilated areas or local exhaust ventilations when cleaning small spaces.
Skin Contact: Use protective gloves (any material) when used for prolonged periods or dermally sensitive.
General Hygiene Considerations: Wash thoroughly after handling and before eating or drinking.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Green Liquid	**Partition Coefficient: n-octanol/water:**	Not determined		
Odor:	Added sassafras odor	**Autoignition Temperature:**	Non-flammable		
Odor Threshold:	Not determined	**Decomposition Temperature:**	42.7°C (109°F)		
pH ASTM D-1293:	8.5 – 9.2	**Viscosity:**	Like water		
Freezing Point ASTM D-1177:	0-3.33°C (32-38°F)	**Specific Gravity** ASTM D-891:	1.01 – 1.03		
Boiling Point & Range ASTM D-1120:	101°C (213.8°F)	**VOCs:** ***Water & fragrance exemption in calculation*			
Flash Point ASTM D-93:	> 212°F	SCAQMD 304-91 / EPA 24:	0 g/L	0 lb/gal	0%
Evaporation Rate ASTM D-1901:	½ Butyl Acetate @ 25°C	CARB Method 310**:	2.5 g/L	0.021 lb/gal	0.25%
Flammability (solid, gas):	Not applicable	SCAQMD Method 313:	Not tested		
Upper/Lower Flammability or Explosive Limits:	Not applicable	**VOC Composite Partial Pressure:**	Not determined		
Vapor Pressure ASTM D-323:	0.60 PSI @77°F, 2.05 PSI @100°F	**Relative Density** ASTM D-4017:	8.42 – 8.59 lb/gal		
Vapor Density:	Not determined	**Solubility:**	100% in water		

Section 10: STABILITY AND REACTIVITY

Reactivity:	Non-reactive.
Chemical Stability:	Stable under normal conditions 70°F (21°C) and 14.7 psig (760 mmHg).
Possibility of Hazardous Reactions:	None known.
Conditions to Avoid:	Excessive heat or cold.
Incompatible Materials:	Do not mix with oxidizers, acids, bathroom cleaners, or disinfecting agents.
Hazardous Decomposition Products:	Normal products of combustion - CO, CO2.

Section 11: TOXICOLOGICAL INFORMATION

Likely Routes of Exposure:	Inhalation -	Overexposure may cause headache.
	Skin Contact -	Not expected to cause irritation, repeated contact may cause dry skin.
	Eye Contact -	Not expected to cause irritation.
	Ingestion -	May cause upset stomach.

Symptoms related to the physical, chemical and toxicological characteristics: no symptoms expected under typical use conditions.
Delayed and immediate effects and or chronic effects from short term exposure: no symptoms expected under typical use conditions.
Delayed and immediate effects and or chronic effects from long term exposure: headache, dry skin, or skin irritation may occur.
Interactive effects: Not known.

Numerical Measures of Toxicity

Acute Toxicity:	Oral LD_{50} (rat)	> 5 g/kg body weight
	Dermal LD_{50} (rabbit)	> 5 g/kg body weight

Calculated via OSHA HCS 2012 / Globally Harmonized System of Classification and Labelling of Chemicals

Skin Corrosion/Irritation:	Non-irritant per Dermal Irritection® assay modeling. No animal testing performed.
Eye Damage/Irritation:	Non/Minimal irritant per Ocular Irritection® assay modeling. No animal testing performed.
Germ Cell Mutagenicity:	Mixture does not classify under this category.
Carcinogenicity:	Mixture does not classify under this category.
Reproductive Toxicity:	Mixture does not classify under this category.
STOT-Single Exposure:	Mixture does not classify under this category.
STOT-Repeated Exposure:	Mixture does not classify under this category.
Aspiration Hazard:	Mixture does not classify under this category.

Section 12: ECOLOGICAL INFORMATION

Ecotoxicity: Volume of ingredients used does not trigger toxicity classifications under the Globally Harmonized System of Classification and Labelling of Chemicals.

Aquatic: Aquatic Toxicity - Low, based on OECD 201, 202, 203 + Microtox: EC_{50} & IC_{50} ≥100 mg/L. Volume of ingredients used does not trigger toxicity classifications under the Globally Harmonized System of Classification and Labelling of Chemicals.

Terrestrial: Not tested on finished formulation.

Persistence and Degradability:	Readily Biodegradable per OCED 301D, Closed Bottle Test. Reaches 100% biodegradability within 1 year or less.
Bioaccumulative Potential:	No data available.
Mobility in Soil:	No data available.
Other Adverse Effects:	No data available.

Section 13: DISPOSAL CONSIDERATIONS

Unused or Used Liquid: May be considered hazardous in your area depending on usage and tonnage of disposal – check with local, regional, and or national regulations for appropriate methods of disposal.

Empty Containers: May be offered for recycling.

Never dispose of used degreasing rinsates into lakes, streams, and open bodies of water or storm drains.

Section 14: TRANSPORT INFORMATION

U.N. Number: Not applicable
U.N. Proper Shipping Name: Cleaning Compound, Liquid NOI
Transport Hazard Class(es): Not applicable
Packing Group: Not applicable
Environmental Hazards: Marine Pollutant - NO
Transport in Bulk (according to Annex II of MARPOL 73/78 and IBC Code): Unknown.
Special precautions which user needs to be aware of/comply with, in connection with transport or conveyance either within or outside their premises: None known.

U.S. (DOT) / Canadian TDG:	Not Regulated for shipping.	**ICAO/ IATA:**	Not classified as Hazardous
IMO / IDMG:	Not classified as Hazardous	**ADR/RID:**	Not classified as Hazardous

Section 15: REGULATORY INFORMATION

<u>**All components are listed on**</u>**:** TSCA and DSL Inventory.

<u>**SARA Title III:**</u> Sections 311/312 Hazard Categories – Not applicable.
Sections 313 Superfunds Amendments and Reauthorizations Act of 1986 – Not applicable.
Sections 302 – Not applicable.

<u>**Clean Air Act (CAA):**</u> Not applicable
<u>**Clean Water Act (CWA):**</u> Not applicable

<u>**State Right To Know Lists:**</u> No ingredients listed
<u>**California Proposition 65:**</u> No ingredients listed
<u>**Texas ESL:**</u>

Ethoxylated Alcohol	68439-46-3	60 µg/m³ long term	600 µg/m³ short term
Sodium Citrate	68-04-2	5 µg/m³ long term	50 µg/m³ short term
Sodium Carbonate	497-19-8	5 µg/m³ long term	50 µg/m³ short term
Citric Acid	77-92-9	10 µg/m³ long term	100 µg/m³ short term

This product has been classified as "not classifiable as hazardous" in accordance with Consumer Product Safety Commission (16 CFR Chapter 2), and labelled and packaged accordingly.

Section 16: OTHER INFORMATION

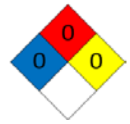
Size	UPC	Size	UPC
2 fl. oz.	043318131035	67.6 fl. oz.	043318130144
4 fl. oz.	043318130014	67.6 fl. oz.	043318000393
16 fl. oz.	043318130021	1 gallon	043318000799
22 fl. oz.	043318130229	1 gallon	043318130052
24 fl. oz.	043318130137	1 gallon	043318004957
32 fl. oz.	043318002557	1 gallon w/ dilution bottle	043318480492
32 fl. oz.	043318130335	140 fl. oz. w/ dilution bottle	043318001468
32 fl. oz.	043318000652	2.5 gallon	043318004889

USA items listed only. Not all items listed. USA items may not be valid for international sale.

Section 16: OTHER INFORMATION - continued

NFPA:

Health – None
Flammability – Non-flammable
Stability – Stable
Special - None



Acronyms

NTP	National Toxicology Program	IARC	International Agency for Research on Cancer
OSHA	Occupational Safety and Health Administration	CPSC	Consumer Product Safety Commission
TSCA	Toxic Substances Control Act	DSL	Domestic Substances List

Prepared / Revised By: Sunshine Makers, Inc., Regulatory Department.
This SDS has been revised in the following sections: Clarification on hazards in section 2, expanded transparency in section 3, revised layout in section 9, 14 & 16, added statement in section 15.

DISCLAIMER: The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Appendix H

Injury/Illness, Incident/Property Damage, Near Miss, and Motor Vehicle Incident Reporting Forms

Injury/Illness Report Form

This form should only be used for reporting an incident resulting in employee injury/illness. Prior to completing this form, verify that the appropriate notifications have been made as identified below. Use the Incident/Property Damage Report Form to document property damage or other incident. Use the Near Miss Report Form to document Near Misses.

Name and job title of injured/illness employee:

Employee's address and telephone number:

Time, Date, and Location where the injury/illness occurred:

Address of KJ site contact:

Check the appropriate nature of injury/illness(s):

___ Sprain ___ Laceration ___ Impact/Compression Injury ___ Nausea

___ Fracture ___ Puncture ___ Allergic Reaction ___ Chemical/Substance Exposure

___ Abrasion ___ Avulsion (amputation) ___ Eye Injury ___ Heat/Cold Exposure

___ Bruise ___ Burn ___ Hearing-Related Injury

___ Altered Level of Consciousness ___ Respiratory/Cardiac-Related Event

Identify the body part affected:

What was the employee doing when the injury/illness occurred?

What action, mechanism, or piece of equipment directly contributed to the injury/illness?

What other processes or items may have indirectly contributed to the employee injury/illness?

Description of accident, accident scene and if accident scene has been instrumentally altered by employees, bystanders and/or emergency personnel and equipment:

How might have this injury/illness been avoided?

Was the injury/illness immediate or did it gradually evolve over time?

If this event occurred at a job site, was a site-specific safety plan prepared and approved? If so, please attach to this form.

If this event occurred at a job site, was a job hazard analysis completed for the task which the employee was performing at the time of injury/illness? If so, please attach.

What were weather conditions at the time of the injury/illness?

Was the employee's supervisor notified? When?

Did the employee contact WorkCare for medical direction? When?

List emergency medical services, fire, or law enforcement agencies summoned for the injured employee:

Provide names and phone numbers of witnesses:

Injured employee was transported to:

I declare that the information provided within this report is true and correct, to the best of my knowledge and subject to review by representatives of Kennedy Jenks and its insurers.

Name of person preparing this report: ___________________________________

Title: _______________________________ Date: ________________________

Signature: ____

Incident/Property Damage Report Form

This form should be used only for an incident resulting in property damage without injury to employees involved. Use the Injury/Illness Report Form to document employee injuries. Use the Near Miss Report Form to document Near Misses.

Name(s) of employee(s) involved:

Time, Date, and Location where the incident/property damage occurred:

Description of the incident/property damage:

What was the employee doing when the incident/property damage occurred?

What action, mechanism, or piece of equipment may have directly contributed to the incident/property damage?

What other processes or items may have indirectly contributed to this incident/property damage?

If this incident/property damage occurred at a job site, was a site-specific safety plan prepared and approved? If so, please attach to this form.

Detail any corrective actions taken.

Provide names and phone numbers of witnesses:

I declare that the information provided within this report is true and correct, to the best of my knowledge and subject to review by representatives of Kennedy Jenks and its insurers.

Name of person preparing this report: ___________________________________

Title: _______________________________ Date: ________________________

Signature of H&S Manager: _________________________________ Date:____________________

Signature of Project Manager: _______________________________ Date:____________________

Near Miss Report Form

This form should only be used for Near Miss events which did NOT result in injury or incident/property damage. Use the Injury/Illness Report Form to record injuries or illness. Use the Incident/Property Damage Report Form to record property damage.

Date: ________________ Location: ____

Time:______________ ☐a.m. ☐p.m.

Weather Conditions: ____

Please check all that apply:

☐Unsafe Act ☐Unsafe Condition ☐Unsafe Equipment ☐Unsafe Use of Equipment

Description of Near Miss in detail:

Employee Name ____________________________________ Date: _________________

This section to be completed by Supervisor, Health & Safety Manager, or Representative.

Cause of Near Miss:

Corrective action(s) taken:

H&S Manager ____________________________ Date: _________________

Kennedy Jenks

Motor Vehicle Incident Report

Directions: Employee must gather the detailed information below and submit as soon as possible to the Chief Risk Officer (Jerry Cavaluzzi), Health & Safety Manager (John Jindra), copy their Supervisor and the Fleet Administrator (Melissa Hines). After review and approval by the Chief Risk Officer, the Fleet Administrator will submit Report to: https://www.zurichna.com/claims noting Zurich **Policy Number BAP9326879**.

Employee Information

Employee Name: ______________________________

Address:______________________________City:____________State:________Zip:__________

Home Phone (_____) _____-_____ Employee's preferred language: ______________________________

Driver's License:____________________ State Issued____________Injured? ☐ Yes ☐ No

Company Vehicle

Was the vehicle Company/Personal/Rental?________________Rental Agency: ____________________

Year:________Make:________Model:________License Plate Number:__________Odometer Reading: __________

VIN:________________Area of Damage to Vehicle:________________

Vehicle Drivable? Yes ☐ No ☐ Phone number of garage taken to:____________________

Incident Information

Date of Incident:_____/_____/_____ Time of Incident:_____:_____☐A.M. ☐ P.M

Location of Incident:____________________City:____________ State:________ Zip:__________

Were Police Called? ☐ Yes ☐☐ No☐ Department: __________

Officer Name/Badge #______________________________ Phone (_____)_____-_____

Police Report Number:______________ Was a citation/ticket issued to any driver? Yes ☐ No☐

Reason: ______________________________

How did incident occur? (please be specific) ______________________________

Other Vehicle (use additional sheet if necessary, for additional vehicles)

Was another person/vehicle involved in incident? ☐ Yes ☐ No Were they issued a citation? ☐Yes ☐No

Year:______Make:__________Model:__________ License Plate #:______________Driver's License #: ________

Owner's Name:______________Address:__________ City:______________ State:______ Zip:__________

Driver's Name:______________ Address:__________ City:______________ State: ______ Zip: __________

Home Phone (_____)_____-_____ Work Phone (_____))________-________ Damage to Vehicle: ________

Insurance Carrier:______________Policy #:__________ Agent's Name:______________Phone (____)_____-_____

Were there passengers in the other vehicle? ☐ Yes ☐No

Injured

Name: ______________________________ Phone (____)_____-_____ ☐ Yes ☐No

Name:______________________________ Phone (_____)_____-_____ ☐ Yes ☐No

Name: ______________________________ Phone (_____)_____-_____ ☐ Yes ☐

Witness Information

Were there any witnesses to this incident? Yes No

Name: ______________________________ Phone (_____)_____-_____

Name: ______________________________ Phone (_____)_____-_____

Kennedy Jenks

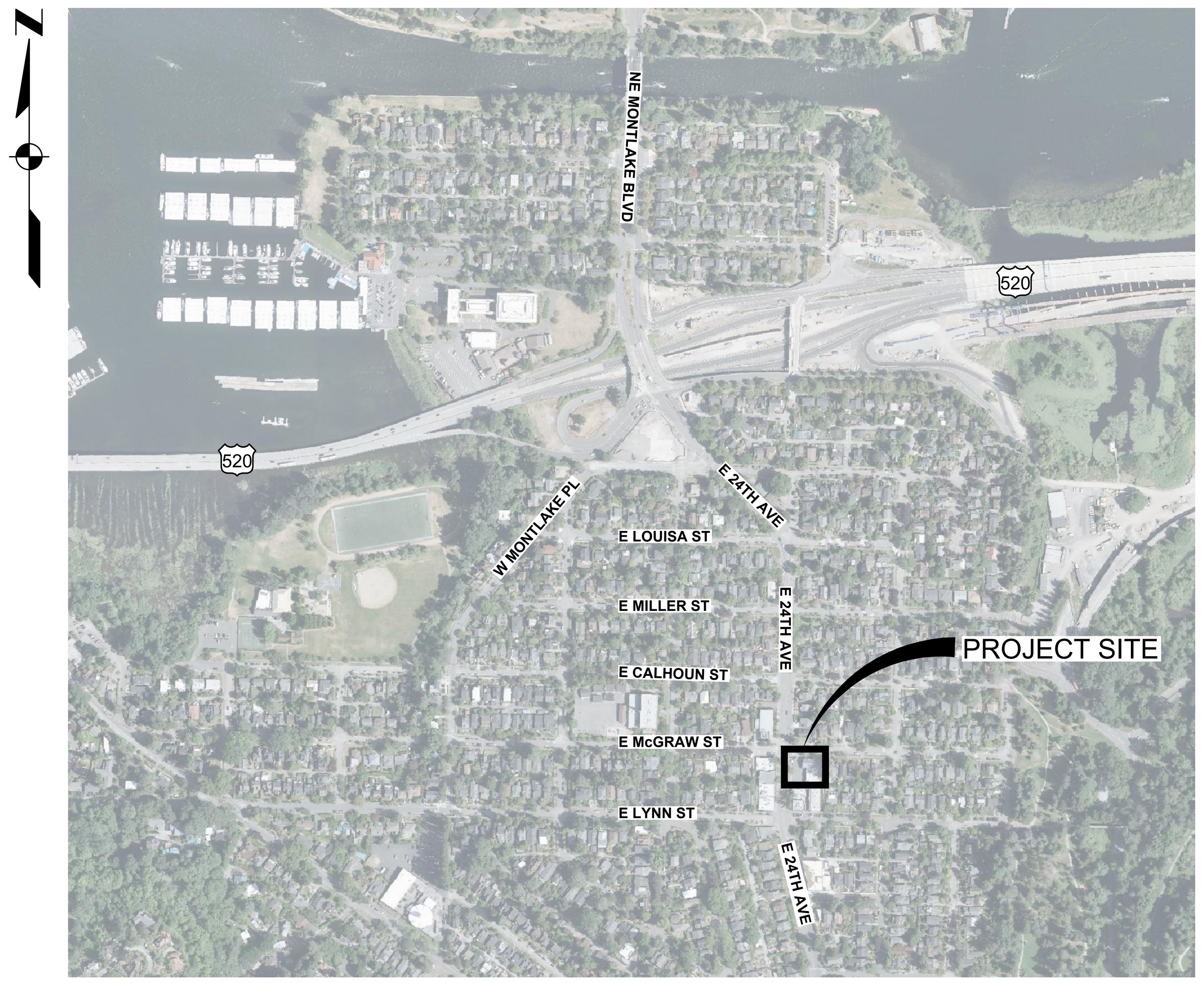
Please provide the following photos to avoid delays:

- 1 photo of odometer (showing full mileage)
- 1 photo of VIN# (combination of 17 digits and letters, located on the driver door or door frame, or on the left bottom corner of the windshield)
- 1 photo of license plate
- 1 photo standing 5-7 feet away from the vehicle showing wide shot of the damage
- At least 4 in total showing all components damaged on the vehicle

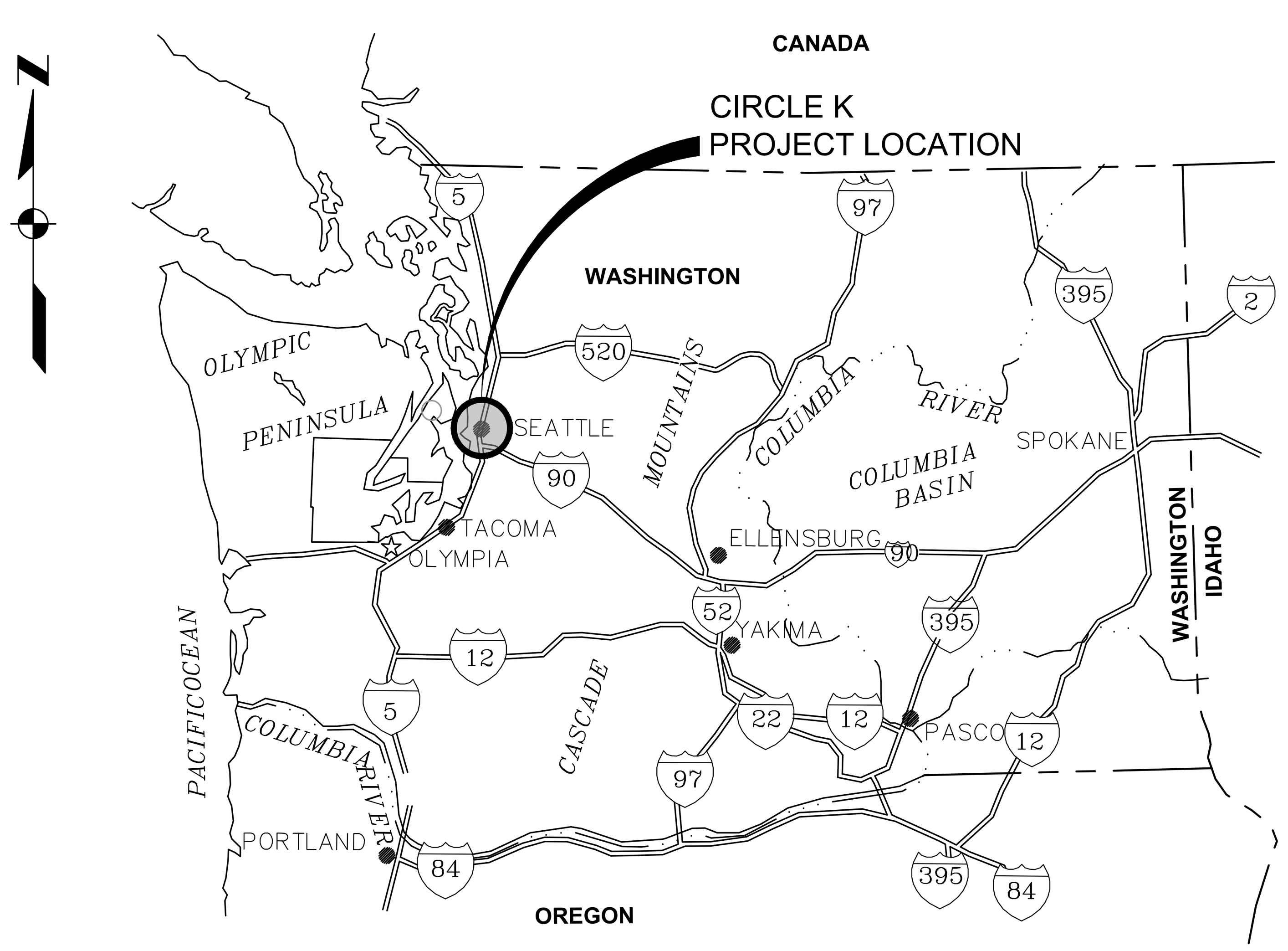
Attach photos of damage here:

Appendix D

Record Drawings



LOCATION MAP
SCALE: NTS



VICINITY MAP
SCALE: NTS

DEPARTMENT OF ECOLOGY
State of Washington

SITE: CIRCLE K 1461, CSID #5089

PROJECT: ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION

LOCATION: 2350 24TH AVE E, SEATTLE, KING COUNTY, WASHINGTON 98112

BUILDING	CODE SUMMARY - 2018 SBC (SEATTLE BUILDING CODE) 2018 SEBC (SEATTLE EXISTING BUILDING CODE)	
FILTRATION SEABOX	HISTORIC PERMIT NUMBER	674948
	PROJECT DESCRIPTION	A TEMPORARY TREATMENT SYSTEM ENCLOSURE, ALONG WITH ACCESSORY EQUIPMENT FOR REMEDIATION OF ON-SITE GROUNDWATER CONTAMINATION, WILL BE PLACED IN THE PARKING LOT OF AN EXISTING RETAIL BUSINESS. TEMPORARY FENCING TO BE PLACED AROUND THE ENCLOSURE AND ACCESSORY EQUIPMENT.
	CONSTRUCTION TYPE	TYPE V-B PER SBC 602.5
		MODIFIED METAL SHIPPING CONTAINER TO HOUSE
		REMEDIATION PROCESSING EQUIPMENT AND SUPPLIES
	BUILDING ELEMENT FIRE RESISTANCE	0-HOUR RATING AS PER SBC TABLE 601 FOR TYPE V-B CONSTRUCTION.
	EXTERIOR WALL FIRE RESISTANCE	0-HOUR RATING AS PER CBC TABLE 602 FOR TYPE V-B CONSTRUCTION.
	(BASED ON SEPARATION DISTANCE)	
	ALLOWABLE AREA	8,500 SF PER SBC TABLE 506.2
	ACTUAL AREA	160 SF
	ALLOWABLE HEIGHT	40'-0" FEET / 1-STORY PER SBC TABLES 504.3 AND 504.4
	ACTUAL HEIGHT / STORY	9'-0"+/- FEET / 1-STORY
	OCCUPANCY CLASSIFICATIONS	F-1 MODERATE HAZARD INDUSTRIAL PER SBC 306.1
	OCCUPANCY SEPARATIONS	NOT APPLICABLE
	OCCUPANT LOAD	2 PER SBC TABLE 1004.5
	HVAC	CONDITIONED FOR FREEZE PROTECTION
	VENTILATION	PROVIDED PER SBC SECTION 1202.1
	ALLOWABLE OPENING AREA	10% PER SBC TABLE 705.8
	ENERGY CODE	
	INSULATION - ROOF	R-10 RIGID INSULATION
	INSULATION - ABOVE GRADE WALLS	R-13 RIGID INSULATION
	ACCESSIBILITY	NOT REQUIRED PER SBC SECTION 1103.2.9
	CHEMICAL STORAGE	NON-HAZARDOUS; SEE ATTACHED CHEMICAL LIST
	SPRINKLER SYSTEM	NOT REQUIRED PER SBC SECTION 903.2.4
	SMOKE DETECTION	NOT REQUIRED PER SBC SECTION 909
	SMOKE AND HEAT VENTS	NOT REQUIRED PER SBC SECTION 910
	FIRE ALARM	NOT REQUIRED PER SBC SECTION 907.2.4
	FIRE PROTECTION REQUIREMENTS	1 HYDRANT WITHIN 250' OF STRUCTURE
	FIRE FLOW	1,500 GPM FOR 2 HOURS PER SFC TABLE B105.1(2)
APPLICABLE CODES	2018 SEATTLE BUILDING CODE (SBC)	
	2018 SEATTLE EXISTING BUILDING CODE (SEBC)	
	2020 NATIONAL ELECTRICAL CODE (NEC)	
	WITH 2020 SEATTLE ELECTRICAL CODE REPLACEMENT PAGES	
	2018 SEATTLE ENERGY CODE	
	2018 SEATTLE FIRE CODE	
	2024 SEATTLE MUNICIPAL CODE, TITLE 23 - LAND USE CODE	
	2018 SEATTLE MECHANICAL CODE	
	2018 SEATTLE PLUMBING CODE	

4455 REGISTERED ARCHITECT MARK PRESTON STATE OF WASHINGTON

DRAWING INDEX

RECORD DRAWING

This record drawing has been prepared based on unverified information compiled and provided by others to the preparer. The preparer is not responsible for any inaccuracies, errors, or omissions which may have been incorporated into the document. Users of this record drawing assume all risk of loss resulting from its use. Users of this document in editable electronic formats are cautioned against use without first determining whether changes may have been made subsequent to its preparation. The original signed and sealed copy of this document is the only true record of the contract document.

NO	REVISION	DATE	BY

DESIGNED

DRAWN

CHECKED

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

DEPARTMENT OF ECOLOGY State of Washington

Kennedy Jenks

TITLE SHEET, VICINITY AND LOCATION MAPS, AND DRAWING INDEX

SCALE AS SHOWN
JOB NO 2196008.00
DATE MAY 2025
SHEET 1 OF 24
G-01

ABBREVIATIONS

'	FOOT, FEET
"	INCH, INCHES
&	AND
AC	ASPHALTIC CONCRETE, ALTERNATING CURRENT
ACFM	ACTUAL CUBIC FEET PER MINUTE
AW	ASPHALT WALK
BGS	BELOW GROUND SURFACE
BLRD	BOLLARD
CB	CATCH BASIN, CIRCUIT BREAKER
CFM	CUBIC FEET PER MINUTE
CLR	CLEARANCE
CONC	CONCRETE
CRZ	CRITICAL ROOT ZONE
CSBC	CRUSHED SURFACING BASE COURSE
CW	CONCRETE WALK
DO	DISSOLVED OXYGEN
DRWY	DRIVEWAY
DS	DOWN SPOUT
ECAB	ELECTRICAL CABINET
EHH	ELECTRIC HANDHOLE
EM	ELECTRIC METER
EXIST	EXISTING
FF	FINISHED FLOOR
FFE	FINISHED FLOOR ELEVATION
FLT	FILTER
FT	FEET
G	GAS
GAC	GRANULAR ACTIVATED CARBON
GAL	GALLON(-S)
GPM	GALLONS PER MINUTE
HDPE	HIGH DENSITY POLYETHYLENE
HG	MERCURY
HP	HIGH-PERFORMANCE POLYPROPYLENE
HYD	HYDRANT
IBC	INTERNATIONAL BUILDING CODE
IE	INVERT ELEVATION
LB(-S)	POUND(-S)
MAX	MAXIMUM
MIC	MONUMENT IN CASE
MIL(-S)	ONE-THOUSANDTH OF AN INCH
MIN	MINIMUM
MPT	MALE PIPE THREAD
MW	MONITORING WELL
(N)	NEW
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NTS	NOT TO SCALE
OP	OVERHEAD POWER
O2	OXYGEN
OX	OXIDIZER
P	UNDERGROUND POWER
PED SIG	PEDESTRIAN SIGNAL
PLC	PROGRAMMABLE LOGIC CONTROLLER
PSE	PUGET SOUND ENERGY
PPLT	POWER POLE WITH LUMINAIRE
PVC	POLYVINYL CHLORIDE
RW	REMEDIATION WELL
SCADA	SUPERVISORY CONTROL AND DATE ACQUISITION
SCFM	STANDARD CUBIC FEET PER MINUTE
SD	STORM DRAIN
SDMH	STORM DRAIN MANHOLE
SDOT	SEATTLE DEPARTMENT OF TRANSPORTATION
SS	SANITARY SEWER
SSD	SUB-SLAB DEPRESSURIZATION
SW	SLANT WELL
TYP	TYPICAL
VFD	VARIABLE FREQUENCY DRIVE (AC)
VP	VAPOR PIN
W	WATER, WIDE, WIDTH, WIRE
WM	WATER METER
WV	WATER VALVE
YD	YARD DRAIN

NOTES

GENERAL

1. PORTIONS OF THIS PROJECT ARE WITHIN CITY OF SEATTLE RIGHT OF WAY. CONTRACTOR SHALL CONFORM TO CITY OF SEATTLE ENCROACHMENT PERMIT REQUIREMENTS.
2. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH WSDOT STANDARDS.
3. ALL WORK SHALL CONFORM TO THE 2023 EDITION OF THE CITY OF SEATTLE STANDARD SPECIFICATIONS, THE 2023 EDITION OF THE CITY OF SEATTLE STANDARD PLANS; AND SEATTLE DEPARTMENT OF TRANSPORTATION DIRECTOR'S RULE 01-2017 RIGHT-OF-WAY OPENING AND RESTORATION RULES. A COPY OF THESE DOCUMENTS SHALL BE ON SITE DURING CONSTRUCTION.
4. THESE DESIGN DOCUMENTS HAVE BEEN PREPARED BASED ON INFORMATION PRESENTED IN THE REPORT TITLED "GEOTECHNICAL ENGINEERING SERVICES" PREPARED BY HWA GEOSCIENCES DATED 15 JULY 2021 (GEOTECHNICAL REPORT). CONTRACTOR SHALL COMPLY WITH THE RECOMMENDATIONS INCLUDED IN THIS REPORT.
5. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT EXISTING IMPROVEMENTS WHICH ARE TO REMAIN IN PLACE FROM DAMAGE. ALL IMPROVEMENTS DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE EXPEDITIOUSLY REPAIRED OR RECONSTRUCTED AT THE CONTRACTOR'S EXPENSE WITHOUT ADDITIONAL COMPENSATION.
6. ALL BUILDING COORDINATES ARE TO OUTSIDE CORNER OF COLUMN OR BUILDING.
7. CONTRACTOR SHALL RESTORE ALL SURVEY MONUMENTS THAT ARE DAMAGED OR DESTROYED DURING CONSTRUCTION.
8. PROJECT WORK OCCURS IN A STORE PARKING LOT AND ADJACENT SIDEWALK. CONTRACTOR SHALL PROVIDE SPACE FOR PUBLIC PARKING AND MAINTAIN PEDESTRIAN ACCESS TO THE STORES AT ALL TIMES DURING CONSTRUCTION. SEE SHEET C-02 FOR FURTHER DETAIL.

UTILITIES

1. LOCATIONS OF UNDERGROUND UTILITIES SHOWN ON THE DRAWINGS WERE OBTAINED FROM AVAILABLE RECORDS AND ARE SHOWN IN THEIR APPROXIMATE LOCATION. THERE IS NO GUARANTEE THAT ALL EXISTING PIPELINES AND OBSTRUCTIONS ARE SHOWN OR THAT LOCATIONS INDICATED ARE ACCURATE. PRIOR TO THE START OF CONSTRUCTION, THE CONTRACTOR SHALL POTHOLE TO DETERMINE ACTUAL LOCATION AND ELEVATION OF ALL EXISTING UTILITIES IN AND AROUND THE AREAS OF NEW CONSTRUCTION.
2. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT ALL REMAINING EXISTING UTILITIES WHETHER SHOWN OR NOT SHOWN.
3. PRIOR TO ANY CONNECTION TO AN EXISTING UTILITY, THE CONTRACTOR SHALL COORDINATE WITH THE UTILITY OWNER.
4. PRIOR TO ANY EXCAVATION IN THE VICINITY OF ANY EXISTING UNDERGROUND FACILITIES, INCLUDING ALL WATER, SEWER, STORM DRAIN, GAS, PETROLEUM PRODUCTS, OR OTHER PIPELINES; ALL BURIED ELECTRIC POWER, COMMUNICATIONS, OR TELEVISION CABLES; ALL TRAFFIC SIGNAL AND STREET LIGHTING FACILITIES; AND ALL ROADWAY, STATE HIGHWAY, AND RAILROAD RIGHTS-OF-WAY, THE CONTRACTOR SHALL NOTIFY THE RESPECTIVE AUTHORITIES REPRESENTING THE OWNERS OR AGENCIES RESPONSIBLE FOR SUCH FACILITIES TO FACILITATE A TIMELY MANNER OF WORK SO THAT A REPRESENTATIVE OF SAID OWNERS OR AGENCIES CAN BE PRESENT DURING SUCH WORK IF THEY SO DESIRE. IN THE CASE OF THE UNDERGROUND UTILITY SERVICE ALERT CENTER, THIS NOTICE WILL GIVE THEM TIME TO MARK THE LOCATION OF THE UTILITIES. THE CONTRACTOR SHALL ALSO NOTIFY UNDERGROUND SERVICES ALERT (USA) AT (811) IN ACCORDANCE WITH THE SPECIFICATIONS TO FACILITATE A TIMELY MANNER OF WORK, PRIOR TO SUCH EXCAVATION.
5. MAINTAIN A MINIMUM OF 1' VERTICAL SEPARATION WHEN CROSSING GAS MAINS OR SERVICES. MAINTAIN A MINIMUM OF 3' HORIZONTAL SEPARATION WHEN RUNNING PARALLEL TO GAS MAINS OR SERVICES.
6. IF HP PIPE OR GREATER THAN 4 INCH DIAMETER PIPE IS ENCOUNTERED, PLEASE CONTACT PSE INSPECTOR PRIOR TO WORKING NEAR THE ENCOUNTERED PIPES. PSE PI INSPECTOR CONTACT INFORMATION:
   GLENN HUDEN: 206-396-4159, GLENN.HUDEN@PSE.COM.
7. COORDINATE WITH PSE CUSTOMER CONSTRUCTION SERVICES (1-888-321-7779) AND A PSE PROJECT MANAGER FOR RELOCATION OF GAS MAINS AND SERVICES AS NEEDED.
8. WORK WITHIN 10 FEET OF ACTIVE TROLLEY LINES OR WHERE WORK IMPACTS THE TROLLEY ROUTE REQUIRES DEACTIVATION OF TROLLEY LINES. CONTRACTOR SHALL COORDINATE WITH KING COUNTY FOR DEACTIVATION. TROLLEY IMPACTS CONTACT INFORMATION:
   PHONE: 206-477-1150, EMAIL: TROLLEY.IMPACTS@KINGCOUNTY.GOV

PERMITTING

1. CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLYING WITH THE REQUIREMENTS OF ALL PERMITS OBTAINED FOR THE PROJECT.
2. THE FOLLOWING PERMITS HAVE BEEN OBTAINED BY ECOLOGY AND ARE INCORPORATED INTO THE CONTRACT:
   A. UNDERGROUND INJECTION CONTROL PERMIT.
   B. STATE ENVIRONMENTAL POLICY ACT REVIEW.
3. THE FOLLOWING PERMITS HAVE BEEN OBTAINED BY ECOLOGY AND WILL BE TRANSFERRED OVER TO THE CONTRACTOR:
   A. CITY OF SEATTLE DEPARTMENT OF TRANSPORTATION STREET-USE PERMIT.
   B. KING COUNTY METRO TRANSIT OVERHEAD BUS POWER SHUTDOWN.
4. THIS PROJECT IS EXEMPT FROM THE AIR DISCHARGE PERMIT FROM THE PUGET SOUND CLEAN AIR AGENCY. THE CONTRACTOR DOES NOT HAVE TO APPLY FOR THIS PERMIT BUT MUST COMPLY WITH THE SUBSTANTIVE REQUIREMENTS OF THE PERMIT.
5. THE FOLLOWING PERMITS SHALL BE OBTAINED DIRECTLY BY THE CONTRACTOR. THIS LIST IS NOT ALL-INCLUSIVE. CONTRACTOR IS RESPONSIBLE FOR CONFIRMING WHAT PERMITS APPLY TO THE WORK AND OBTAINING THEM IN A TIMELY MANNER TO SUPPORT THE OVERALL PROJECT SCHEDULE.
   A. NOTIFICATION OF WELL CONSTRUCTION.
   B. DISCHARGE PERMITS.
   C. CITY OF SEATTLE BUILDING PERMITS.
   D. NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM CONSTRUCTION STORMWATER GENERAL PERMIT.
   E. CITY OF SEATTLE DEPARTMENT OF TRANSPORTATION PARKING PERMITS.

NOISE CONTROL

1. SEE SPECIFICATION 01 57 19.12 NOISE CONTROL FOR NOISE LIMITATIONS DETAILS. CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLYING WITH THE NOISE LIMITATIONS INCLUDED IN THIS SPECIFICATION.
2. CONSTRUCTION NOISE SHALL BE LIMITED TO THE FOLLOWING TIMES:
   7:00 AM TO 10:00PM, WEEKDAYS
   9:00 AM TO 10:00PM, WEEKENDS AND HOLIDAYS.
3. CONTRACTOR SHALL SUBMIT A NOISE CONTROL WORK PLAN MEETING THE REQUIREMENTS SPECIFIED IN SPECIFICATIONS 01 57 19.12.

TREE PROTECTION NOTES

1. CONTRACTOR SHALL PREPARE A TREE, VEGETATION AND SOIL PROTECTION PLAN (TVSPP), IF WORK FALLS WITHIN CRITICAL ROOT ZONE A. NOTE AND PHOTOGRAPH CONDITIONS AND MATERIALS IN EXISTING TREE PITS INCLUDING PAVERS FOR REVIEW BY SDOT URBAN FORESTRY.
2. CONTRACTOR SHALL NOTIFY THE ENGINEER AND SDOT URBAN FORESTRY 72 HOURS MIN. PRIOR TO BOTH DEMOLITION AND EXCAVATION WITHIN THE TREE DRIP LINE.
3. AIR SPADING REQUIRED
   ALL TRENCH EXCAVATION IN THE TREE DRIPLINE SHALL BE PERFORMED TO FULL DEPTH AND WIDTH OF EXCAVATION WITH AN AIRSPADE UNDER THE SUPERVISION OF SDOT URBAN FORESTRY ARBORIST. WATER SLUICING IS NOT ALLOWED. RETAIN ALL STRUCTURAL ROOTS (1 INCH OR GREATER) ACROSS TRENCHES. SDOT URBAN FORESTRY ARBORIST TO DIRECT ROOT PRUNING IF NECESSARY.
4. AVOID DAMAGE TO ROOTS DURING CONCRETE SAWCUTTING, DEMOLITION, EXCAVATION AND TRENCHING.
5. REMOVE PAVEMENT WITHIN TREE DRIPLINE BY SAWCUTTING FREQUENTLY (12 TO 18-INCHES O.C.) TO ALLOW SMALL PIECES TO BREAK OUT. IF PART OF PAVEMENT IS FIRMLY ATTACHED TO ROOTS GREATER THAN 1-INCH, PRUNE ROOTS UNDER SUPERVISION OF SDOT URBAN FORESTRY ARBORIST.
6. PROTECT TREE ROOTS AFTER EXPOSURE DUE TO CONCRETE REMOVAL, AIRSPADING AND OTHER CONSTRUCTION ACTIVITY. ONLY EXCAVATE AND EXPOSE AREAS OF ROOTS THAT CAN BE BACKFILLED AND COVERED WITHIN ONE WORKING DAY. MAINTAIN MOIST SUBGRADE CONDITIONS UNTIL NEW CONCRETE IS INSTALLED.
7. TRENCH BACKFILL IN CRITICAL ROOT ZONE SHALL BE COS MINERAL AGGREGATE TYPE 24 OR 22. USE OF BACKHOE IN TREE DRIPLINE IS PROHIBITED.
8. KEEP TREE ADEQUATELY WATERED UNTIL SIDEWALK IS REPLACED.

GENERAL NOTES FOR SDOT STREET IMPROVEMENT PLANS

1. ALL WORK SHALL CONFORM TO THE 2023 EDITION OF CITY OF SEATTLE STANDARD SPECIFICATIONS, THE 2023 EDITION OF THE CITY OF SEATTLE STANDARD PLANS; AND SEATTLE DEPARTMENT OF TRANSPORTATION DIRECTOR'S RULE 01-2017 RIGHT-OF-WAY OPENING AND RESTORATION RULES. A COPY OF THESE DOCUMENTS SHALL BE ON SITE DURING CONSTRUCTION.
2. A COPY OF THE APPROVED PLAN MUST BE ON SITE WHENEVER CONSTRUCTION IS IN PROGRESS.
3. ERRORS AND OMISSIONS ON THE PERMITTED PLANS MUST BE CORRECTED BY THE ENGINEER AND APPROVED BY THE CITY OF SEATTLE.
4. ALL PERMITS REQUIRED FOR WORK WITHIN THE PUBLIC RIGHT OF WAY MUST BE OBTAINED PRIOR TO THE START OF CONSTRUCTION.
5. PRIOR TO THE START OF CONSTRUCTION WITHIN THE RIGHT OF WAY, THE PERMITTEE SHALL SCHEDULE AND ATTEND A PRECONSTRUCTION MEETING WITH THE CITY OF SEATTLE DEPARTMENT OF TRANSPORTATION.
6. PERMITTEE SHALL CONTACT SEATTLE DEPARTMENT OF TRANSPORTATION, STREET USE INSPECTOR A MINIMUM OF 2 BUSINESS DAYS PRIOR TO NEEDING AN INSPECTION.
7. ALL DAMAGE TO CITY INFRASTRUCTURE CAUSED BY THE CONSTRUCTION SHALL BE IMMEDIATELY REPORTED AND REPAIRED AS REQUIRED BY THE SEATTLE DEPARTMENT OF TRANSPORTATION. TO REPORT DAMAGE TO SPU INFRASTRUCTURE, INCLUDING ANY SEWAGE RELEASE OR BLOCKAGE, CALL 206-386-1800.
8. THE APPROVED PLANS SHALL SHOW THE APPROXIMATE AREA OF PAVEMENT RESTORATION BASED ON THE DEPTH OF UTILITY CUTS AND/OR THE AREA OF CURB AND/OR PAVEMENT TO BE REMOVED AND REPLACED. THE ACTUAL LIMITS OF THE PAVEMENT RESTORATION SHALL BE PER THE DIRECTOR'S RULE 01-2017, RIGHT-OF-WAY OPENING AND RESTORATION RULE AND WILL BE DETERMINED IN THE FIELD BY THE SEATTLE DEPARTMENT OF TRANSPORTATION STREET USE INSPECTOR PRIOR TO THE PAVEMENT RESTORATION. FOR SPU WATER SERVICES, APPLICANT MUST SHOW THE PAVEMENT RESTORATION LIMITS FOR THE PROPOSED AND THE EXISTING WATER SERVICES TO BE RETIRED, INCLUDING SERVICES THAT ARE OUTSIDE THE PROJECT AREA, BUT SERVE THE PARCEL.
9. DATUM: NAVD88 AND NAD 83 (2011) 2010.00 EPOCH.
10. SURVEYING AND STAKING OF ALL IMPROVEMENTS IN THE PUBLIC RIGHT OF WAY SHALL BE COMPLETED PRIOR TO CONSTRUCTION. PERMITTEE TO STAKE THE CURB AT THE CENTERLINE OF DRAINAGE GRATES PER STANDARD PLAN 260A. SURVEY GRADE SHEETS MUST BE SUBMITTED AND APPROVED BY THE SEATTLE DEPARTMENT OF TRANSPORTATION AT LEAST 2 BUSINESS DAYS PRIOR TO CONSTRUCTION.
11. IF AN EXISTING CURB IS TO BE REMOVED AND REPLACED IN THE SAME LOCATION THE PERMITTEE SHALL PROVIDE THE STREET USE INSPECTOR A PLAN WITH EXISTING FLOW LINE AND TOP OF CURB ELEVATIONS IDENTIFIED. PERMITTEE TO STAKE THE LOCATION OF THE EXISTING CURB PRIOR TO DEMOLITION.
12. THE PERMITTEE MUST BE RESPONSIBLE FOR REFERENCING AND REPLACING ALL SURVEY MONUMENTS THAT MAY BE DISTURBED, DESTROYED OR REMOVED BY THE PROJECT AND 2 WORKING DAYS, PRIOR TO THE WORK, MUST FILE AN APPLICATION FOR PERMIT TO REMOVE OR DESTROY A SURVEY MONUMENT WITH THE WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES, PURSUANT TO WAC 332-120. THE PERMITTEE MUST PROVIDE THE ENGINEER AND SPU LAND SURVEY WITH A COPY OF THE APPROVED PERMIT AND COMPLETION REPORT. SEE STANDARD SPECIFICATION 1- 07.28 ITEM 17.
13. THE PERMITTEE SHALL SUBMIT ALL APPLICABLE DOCUMENTS REQUIRED UNDER SECTION 1-05.3 OF THE STANDARD SPECIFICATIONS PRIOR TO CONSTRUCTION. A MATERIAL SOURCE FORM FOR ALL MATERIALS TO BE PLACED IN THE RIGHT OF WAY AND MIX DESIGNS FOR ALL ASPHALT, CONCRETE AND AGGREGATES TO BE PLACED IN THE RIGHT OF WAY MUST BE SUBMITTED TO THE SEATTLE DEPARTMENT OF TRANSPORTATION FOR REVIEW AND APPROVAL PRIOR TO BEGINNING CONSTRUCTION. A REVISED MATERIAL SOURCE FORM AND MIX DESIGNS MUST BE SUBMITTED FOR REVIEW AND APPROVAL PRIOR TO PLACEMENT OF ANY SUBSTITUTE MATERIALS.
14. THE PERMITTEE SHALL NOTIFY THE SEATTLE FIRE DEPARTMENT DISPATCHER (206-386-1495) AT LEAST TWENTY-FOUR (24) HOURS IN ADVANCE OF ALL WATER SERVICE INTERRUPTIONS, HYDRANT SHUTOFFS, AND STREET CLOSURES OR OTHER ACCESS BLOCKAGE. THE PERMITTEE SHALL ALSO NOTIFY THE DISPATCHER OF ALL NEW, RELOCATED, OR ELIMINATED HYDRANTS RESULTING FROM THIS WORK.
15. THE PERMITTEE SHALL LOCATE AND PROTECT ALL CASTINGS AND UTILITIES DURING CONSTRUCTION.
16. THE PERMITTEE SHALL CONTACT THE UNDERGROUND UTILITIES LOCATOR SERVICE (811) AT LEAST 48 HOURS PRIOR TO CONSTRUCTION.
17. IT IS THE SOLE RESPONSIBILITY OF THE PERMITTEE TO VERIFY THE ACCURACY OF ALL UTILITY LOCATIONS SHOWN AND TO FURTHER DISCOVER AND AVOID ANY OTHER UTILITIES NOT SHOWN WHICH MAY BE AFFECTED BY THE IMPLEMENTATION OF THIS PLAN.
18. THE PERMITTEE SHALL ADJUST ALL EXISTING MAINTENANCE HOLE RIMS, DRAINAGE STRUCTURE LIDS, VALVE BOXES, AND UTILITY ACCESS STRUCTURES TO FINISH GRADE WITHIN AREAS AFFECTED BY THE PROPOSED IMPROVEMENTS.
19. THE PERMITTEE SHALL FOLLOW SPU CORE TAP PROCEDURES FOR ALL NEW CONNECTIONS TO EXISTING SEWER OR DRAINAGE MAINS OR STRUCTURES. CONTRACTORS ARE NOT ALLOWED TO CORE INTO MAINS OR STRUCTURES WITHOUT PRIOR APPROVAL FROM SPU- DWW. TO SCHEDULE CORE CUT CONTACT SPU-DWW AT 206-615-0511 A MINIMUM OF 2 BUSINESS DAYS IN ADVANCE.
20. ALL UTILITY SERVICE CONNECTIONS SHOWN ON THIS PLAN REQUIRE SEPARATE PERMITS.
21. THE PERMITTEE SHALL PROVIDE FOR ALL TESTING AS REQUIRED BY THE STREET USE INSPECTOR.
22. INSPECTION AND ACCEPTANCE OF ALL WORK IN THE PUBLIC RIGHT-OF-WAY SHALL BE DONE BY REPRESENTATIVES OF THE CITY OF SEATTLE. IT SHALL BE THE PERMITTEE'S RESPONSIBILITY TO COORDINATE AND SCHEDULE APPROPRIATE INSPECTIONS ALLOWING FOR PROPER ADVANCE NOTICE. THE SEATTLE DEPARTMENT OF TRANSPORTATION STREET USE INSPECTOR MAY REQUIRE REMOVAL AND RECONSTRUCTION OF ANY ITEMS PLACED IN THE RIGHT OF WAY THAT DO NOT MEET CITY STANDARDS OR THAT WERE CONSTRUCTED WITHOUT APPROPRIATE INSPECTIONS.
23. THE PERMITTEE SHALL PROVIDE A PLAN FOR STORMWATER AND EROSION CONTROL AND INSTALL, MAINTAIN AND REMOVE TEMPORARY FACILITIES PER SECTION 8-01. AS CONSTRUCTION PROGRESSES AND CONDITIONS DICTATE, ADDITIONAL CONTROL FACILITIES MAY BE REQUIRED. DURING THE COURSE OF CONSTRUCTION IT SHALL BE THE OBLIGATION AND RESPONSIBILITY OF THE PERMITTEE TO ADDRESS ANY NEW CONDITIONS THAT MAY BE CREATED BY THE PERMITTEE'S ACTIVITIES AND TO PROVIDE ADDITIONAL FACILITIES THAT MAY BE NEEDED TO PROTECT ADJACENT PROPERTIES.
24. ALL DISTURBED SOILS MUST BE AMENDED PER STANDARD PLAN 142 AND SECTION 8-02 OF THE STANDARD SPECIFICATIONS UNLESS WITHIN ONE FOOT OF A CURB OR SIDEWALK, THREE FEET OF A UTILITY STRUCTURE (E.G. WATER METER, UTILITY POLE, HAND HOLE, ETC.), OR THE DRIPLINE OF AN EXISTING TREE.
25. ALL TRAFFIC CONTROL SHALL BE IN ACCORDANCE WITH THE CITY OF SEATTLE TRAFFIC CONTROL MANUAL FOR IN-STREET WORK. AN APPROVED TRAFFIC CONTROL PLAN WILL BE REQUIRED FOR ALL ARTERIAL STREETS, HIGH IMPACT AREAS AND CONSTRUCTION HUBS PRIOR TO BEGINNING CONSTRUCTION.
26. PERMITTEE SHALL NOTIFY KING COUNTY METRO AT 206- 477-1140 FOURTEEN DAYS IN ADVANCE OF ANY IMPACT TO TRANSIT OPERATIONS. CALL 206-477-1150 FOR ANY COORDINATION RELATED TO KING COUNTRY METRO TROLLEY (INCLUDING SLU AND FIRST HILL STREET CAR). CONTACT KING COUNTY METRO TWO MONTHS PRIOR FOR ANY TROLLEY DE-ENERGIZING REQUESTS.
27. COORDINATE PARKING/LOADING SIGN(S) AND PAY STATION REMOVAL / RELOCATION AND INSTALLATION WITH SEATTLE DEPARTMENT OF TRANSPORTATION CURB SPACE MANAGEMENT AT 206-684-5370 WITH AT LEAST 10 BUSINESS DAYS' NOTICE. SIGNPOSTS ARE TO BE INSTALLED IN ACCORDANCE WITH STANDARD PLANS 616, 620, 621A, 621B, 625, & 626.
28. ALL STREET NAME SIGNS MUST BE INSTALLED BY SEATTLE DEPARTMENT OF TRANSPORTATION AT THE PERMITTEE'S EXPENSE.
29. ALL WORK PERFORMED BY SEATTLE CITY LIGHT, SEATTLE PUBLIC UTILITIES, AND OTHER UTILITIES TO INSTALL, REPAIR, REMOVE OR RELOCATE UTILITIES SHALL BE DONE AT THE PERMITTEE'S EXPENSE.
30. PERMITTEE MUST CONTACT THE SEATTLE DEPARTMENT OF PARKS AND RECREATION TO APPLY FOR A SEPARATE PERMIT IF WORKING WITHIN A DESIGNATED PARK BOULEVARD.
31. CARE SHALL BE EXERCISED WHEN EXCAVATING OR REMOVING PAVEMENT NEAR EXISTING CHARGED WATER MAINS. CAST IRON WATER MAINS ARE KNOWN TO BE SENSITIVE TO EXCESSIVE VIBRATION. COORDINATE PROTECTION METHODS WITH SPU.

EXCAVATION

1. PETROLEUM-IMPACTED SOIL IS PRESENT AT THE SITE. PETROLEUM-IMPACTED SOIL AND OTHER NATIVE MATERIAL GENERATED FROM EXCAVATIONS WILL BE FIELD SCREENED TO CONFIRM THE PRESENCE OF VOLATILE COMPOUNDS IN ACCORDANCE WITH SPECIFICATION 01 75 19. SOIL WILL BE PROFILED AND DISPOSED OF OFFSITE IN ACCORDANCE WITH SPECIFICATION 31 00 00.
2. TRENCH EXCAVATION DEPTHS SHALL BE LESS THAN 3 FEET DEEP IN ALL AREAS. TRENCH SIDES SHALL BE VERTICAL IN PAVED AREAS, IN ACCORDANCE WITH SPECIFICATION 31 00 00. IN ACCORDANCE WITH SPECIFICATION 31 00 00 1.07, IF PEA GRAVEL IS ENCOUNTERED WITHIN TRENCH EXCAVATIONS, CONTRACTOR SHALL SLOPE TRENCH SIDES AT MINIMUM 1.5H:1V TO MAINTAIN SLOPE STABILITY OR USE TRENCH BOXES OR OTHER TEMPORARY SHORING EQUIPMENT, AS NEEDED.
3. BUILDING FOUNDATIONS SHALL BE PROTECTED IN PLACE. CONTRACTOR SHALL STOP WORK IF BUILDING FOUNDATION IS DISCOVERED AND NOTIFY THE ENGINEER.
4. CONTRACTOR SHALL BACKFILL AND COMPACT IN ACCORDANCE WITH SPECIFICATION 31 00 00 AND THE GEOTECHNICAL REPORT.

RECORD DRAWING

NO	REVISION	DATE	BY

DESIGNED
DRAWN
CHECKED

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON

CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

DEPARTMENT OF ECOLOGY State of Washington

Kennedy Jenks

NOTES AND ABBREVIATIONS

SCALE AS SHOWN
JOB NO 2196008.00
DATE MAY 2025
SHEET 2 OF 24
G-02

Plot Date: 5/6/2025 8:09 AM

User: RICHARD HILLS

File: C:\bms\kjce-pw\d0181581\2196008\00-G-03.DWG

CALLOUTS AND SHORTHAND SYMBOLS

- SHEET KEYNOTE
- CENTERLINE
- DIAMETER
- APPROXIMATELY
- ANGLE
- BUILDING GRID LABEL OR ACCESSORY NUMBER
- ##-## DOOR
- XXX ROOM
- ## WALL
- ##-## WINDOW

REVISION SYMBOLS

CLOUDED AREA INDICATES CHANGED INFORMATION; NUMBER IN TRIANGLE INDICATES THE DRAWING VERSION AND MATCHES WITH REVISION INFORMATION IN THE REVISION BLOCK WITHIN THE DRAWING BORDER

PIPING - SINGLE LINE

- OR CONNECTED
- NOT CONNECTED

VALVES AND GATES

- GATE VALVE (NORMALLY OPEN, NORMALLY CLOSED)
- GLOBE VALVE (NORMALLY OPEN, NORMALLY CLOSED)
- CHECK VALVE
- BUTTERFLY VALVE
- BALL VALVE (NORMALLY OPEN, NORMALLY CLOSED)
- VACUUM RELIEF/AIR INLET VALVE (AV)
- PRESSURE RELIEF VALVE (PREL)
- 3-WAY VALVE
- PNEUMATIC ACTUATOR
- PRESSURE REDUCING VALVE, SELF-CONTAINED

SYMBOLOGY

- NORTH ARROW
- NEW
- EXISTING
- FUTURE
- EXISTING LINEAR ELEMENTS TO BE REMOVED OR DEMOLISHED
- EXISTING NON-LINEAR ELEMENTS TO BE REMOVED OR DEMOLISHED
- BREAK LINE
- NATIVE EARTH (IN SECTION)
- ENGINEERED FILL (IN SECTION)
- SAND OR GROUT (IN PLAN AND SECTION)
- GRAVEL (IN PLAN AND SECTION)
- AGGREGATE BASE (IN PLAN AND SECTION)
- CRUSHED ROCK (IN PLAN AND SECTION)
- CONCRETE (IN PLAN AND SECTION)
- CROSSING UTILITIES: UTILITY CROSSING UNDERNEATH; UTILITY CROSSING OVER

EQUIPMENT

CENTRIFUGAL PUMPS

- HORIZONTAL

MIXERS

- VERTICAL

CROSS-REFERENCING SYMBOLS

FOUND ON DRAWING WHERE DETAIL, SECTION, OR ELEVATION IS CALLED OUT

- 1 / C-15: DETAIL NUMBER; SHEET ON WHICH DETAIL IS DRAWN
- A / A-13: SECTION LETTER; SHEET ON WHICH SECTION IS DRAWN

FOUND ON DRAWING WHERE DETAIL, SECTION, OR ELEVATION IS DRAWN

- 1 / C-4 DETAIL TITLE, SCALE: DETAIL NUMBER; SHEET ON WHICH DETAIL IS CALLED OUT
- A / A-5 SECTION TITLE, SCALE: SECTION LETTER; SHEET ON WHICH SECTION IS CUT

PIPING ACCESSORIES AND FITTINGS

- FLANGE
- Y STRAINER
- CHEMICAL PIPING FLEXIBLE CONNECTION/ FLEXIBLE HOSE
- DRAIN

VALVE AND GATE OPERATORS

- S SOLENOID
- M MOTOR
- DIAPHRAGM

MISCELLANEOUS

- PLATE AND FRAME HEAT EXCHANGER
- M

RECORD DRAWING

This record drawing has been prepared based on unverified information compiled and provided by others to the preparer. The preparer is not responsible for any inaccuracies, errors, or omissions which may have been incorporated into the document. Users of this record drawing assume all risk of loss resulting from its use. Users of this document in editable electronic formats are cautioned against use without first determining whether changes may have been made subsequent to its preparation. The original signed and sealed copy of this document is the only true record of the contract document.

NO	REVISION	DATE	BY

DESIGNED

DRAWN

CHECKED

DEPARTMENT OF ECOLOGY State of Washington

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON

CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

Kennedy Jenks

LEGEND AND SYMBOLS

SCALE AS SHOWN
JOB NO 2196008.00
DATE MAY 2025
SHEET 3 OF 24
G-03

REMEDIATION SYSTEM OPERATION NOTES:

THE FOLLOWING NOTES DESCRIBE SYSTEM OPERATIONS AFTER CONSTRUCTION, AND ARE INTENTED SOLELY TO INFORM THE CONTRACTOR OF DESIGN INTENTIONS AND GUIDE CONSTRUCTION EFFORTS.

1. SYSTEM WILL BE OPERATED TO ALLOW WELLS USED FOR EXTRACTION TO ALSO BE USED FOR REINJECTION AND VICE VERSA. OPERATION OF WELLS FOR EXTRACTION OR REINJECTION WILL BE BASED ON SITE CONDITIONS, WELL LOCATIONS, CONCENTRATIONS OF THE CONTAMINANTS OF CONCERN, AND THE OVERALL REMEDIATION PROGRESS.

2. GROUNDWATER INITIALLY EXTRACTED FROM THE SYSTEM IS EXPECTED TO BE DISCHARGED TO THE SANITARY SEWER VIA GRAVITY. ONCE GROUNDWATER CONCENTRATIONS ARE AMENABLE TO BIOREMEDIATION VIA REINJECTION, WATER WILL BE TRANSFERRED TO MIXING TANK FOR AMENDMENT PRIOR TO REINJECTION. EXCESS WATER WILL GRAVITY FLOW TO THE SANITARY SEWER. VOLUMES AND FLOW RATES WILL BE DETERMINED DURING OPERATION.

3. VAPOR WILL BE DIRECTED THROUGH THE TEMPORARY OXIDIZER FOR THE FIRST SEVERAL MONTHS OF OPERATION UNTIL CONCENTRATIONS OF THE CONTAMINANTS OF CONCERN HAVE DECREASED TO A LEVEL SUITABLE FOR TREATMENT VIA THE VAPOR GAC VESSELS. THE OXIDIZER WILL THEN BE REMOVED AND VAPOR WILL BE DIRECTED THROUGH THE GAC VESSELS PRIOR TO DISCHARGE.

4. SURFACTANTS WILL BE ADDED FIRST TO THE WATER PRIOR TO REINJECTION TO RELEASE ADDITIONAL HYDROCARBONS FROM THE SOIL. THEN BACTERIA AND NUTRIENT FEED WILL BE ADDED TO THE WATER PRIOR TO REINJECTION TO CREATE A MICROBIAL POPULATION TO DEGRADE THE HYDROCARBONS IN SITU.

RECORD DRAWING

This record drawing has been prepared based on unverified information compiled and provided by others to the preparer. The preparer is not responsible for any inaccuracies, errors, or omissions which may have been incorporated into the document. Users of this record drawing assume all risk of loss resulting from its use. Users of this document in editable electronic formats are cautioned against use without first determining whether changes may have been made subsequent to its preparation. The original signed and sealed copy of this document is the only true record of the contract document.

NO	REVISION	DATE	BY

DESIGNED

DRAWN

CHECKED

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON

CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

Kennedy Jenks

TREATMENT SYSTEM SCHEMATIC

SCALE: AS SHOWN
JOB NO: 2196008.00
DATE: MAY 2025
SHEET 4 OF 24
G-04

Plot Date: 5/6/2025 8:10 AM
User: RICHARD HILLS
pw:\\kjce-pw.bentley.com:kjce-pw\Documents\Clients\WA Department of Ecology\Projects\Circle K Cleanup_2196008.00\10-Design\10.06-Drawings\General\2196008-G-04

Plot Date: 5/6/2025 8:11 AM
User: RICHARD HILLS
pw:\\kjce-pw.bentley.com:kjce-pw\Documents\Clients\WA Department of Ecology\Projects\Circle K Cleanup_2196008.00\10-Design\10.06-Drawings\Civil\KJ_Site_Civil_SHEET.DWG

NOTES:

1. SOLENOIDS SHALL BE RATED FOR CONTINUOUS OPERATION.
2. RW-10 GOES TO 16 FEET BGS.

RECORD DRAWING

This record drawing has been prepared based on unverified information compiled and provided by others to the preparer. The preparer is not responsible for any inaccuracies, errors, or omissions which may have been incorporated into the document. Users of this record drawing assume all risk of loss resulting from its use. Users of this document in editable electronic formats are cautioned against use without first determining whether changes may have been made subsequent to its preparation. The original signed and sealed copy of this document is the only true record of the contract document.

NO	REVISION	DATE	BY

DESIGNED

DRAWN

CHECKED

DEPARTMENT OF ECOLOGY State of Washington

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON

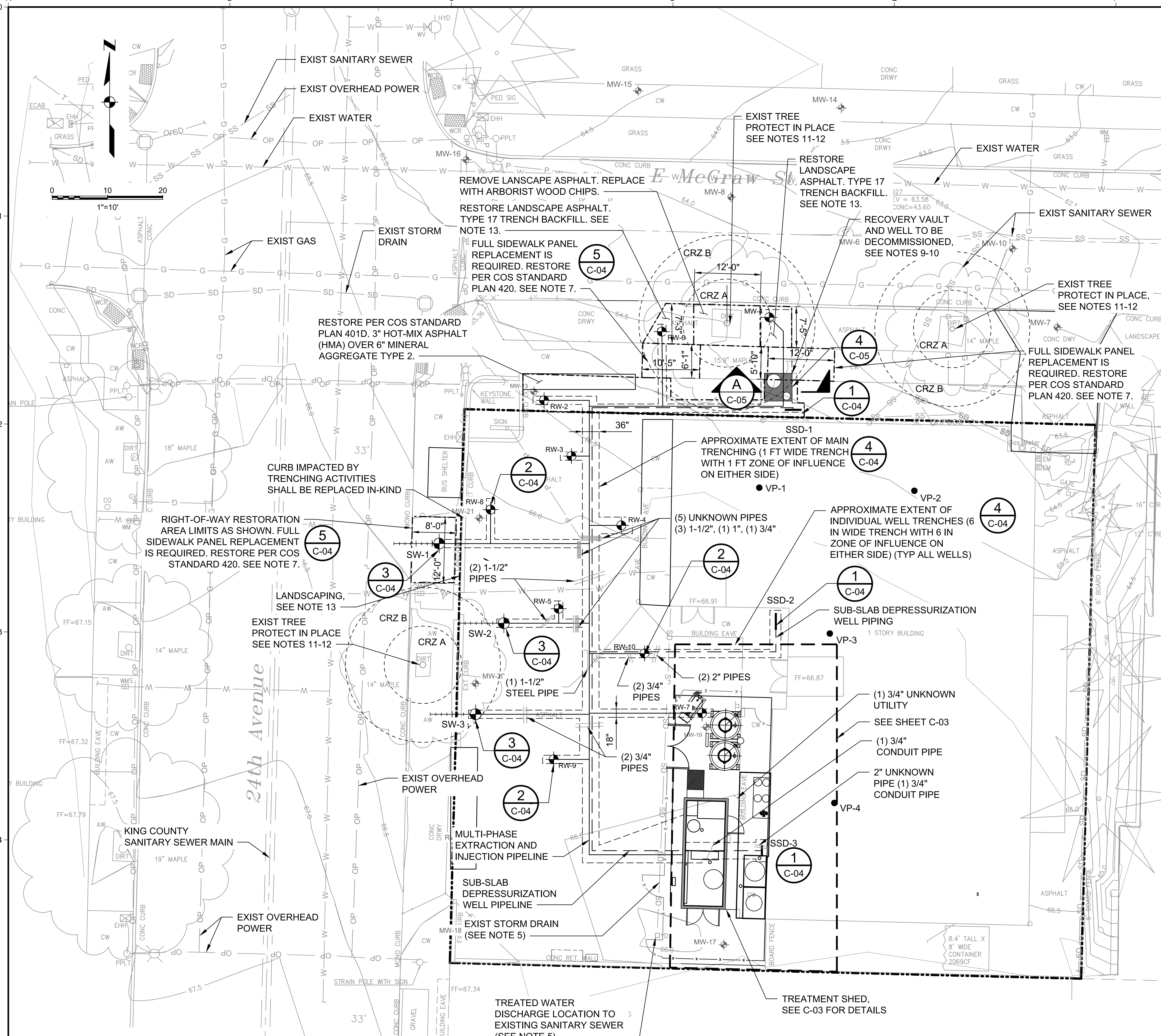
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

Kennedy Jenks

PROCESS FLOW DIAGRAM

SCALE	AS SHOWN
JOB NO	2196008.00
DATE	MAY 2025
SHEET	5 OF 24
	G-05

Plot Date: 5/20/2025 6:56 AM
User: RICHARD HILLS



GENERAL SHEET NOTES

1. WELL TERMINOLOGY:
   1A. MW = EXISTING MONITORING WELL
   1B. RW = REMEDIATION WELL (EITHER EXISTING OR TO BE INSTALLED)
   1C. VP = VAPOR MONITORING PIN TO BE INSTALLED
   1D. SW = SLANT WELL TO BE INSTALLED
2. SLANT WELLS SHALL BE INSTALLED AT 30 DEGREES TO A DEPTH OF 20 FEET. HORIZONTAL EXTENT (APPROXIMATELY 10 FEET) SHOWN ON PLAN VIEW. RADIUS OF INFLUENCE OF SLANT WELLS CENTERED OVER MIDPOINT OF WELL CASING SHOWN.
3. VAPOR PINS ARE SHOWN AT APPROXIMATE LOCATIONS. EXACT LOCATIONS SHALL BE COORDINATED WITH ENGINEER AND OWNER.
4. ABOVEGROUND REMEDIATION SYSTEM PIPING IS SHOWN ON SHEET C-02.
5. STORM DRAIN IS CONNECTED TO SANITARY SEWER.
6. CONTRACTOR SHALL RELOCATE ALL EXISTING SIGNAGE TO CHAIN LINK FENCE, OR TO POSTS WEST OF THE FENCE.
7. TRENCHING LIMITS THAT IMPACT CONCRETE SIDEWALK SHALL BE RESTORED PER CITY OF SEATTLE (COS) STANDARD PLAN NO. 420 (SEE DETAIL 5 ON SHEET C-04). ASPHALT WALKWAY AND SIDEWALK PANEL TO BE REPLACED PER SEATTLE DEPARTMENT OF TRANSPORTATION DIRECTOR'S RULE 01-2017. TRENCH BACKFILL SHALL CONSIST OF CONTROL DENSITY FILL PER CITY OF SEATTLE STANDARD SPECIFICATION 2-10.2(3)A2 (EXCEPT WITHIN 10 FEET OF STEAM PIPES PER DIRECTOR'S RULE 01-2017 7.4.2.1) OR MINERAL AGGREGATE TYPE 17 PER STANDARD SPECIFICATION 9-03.14 AND COMPACTED PER STANDARD SPECIFICATION 2.11.3(1).
8. TRENCHING LIMITS SHOWN HEREON WITHIN PROPERTY BOUNDARY ARE APPROXIMATIONS ONLY. TRENCHING LIMITS IN RIGHT-OF-WAY SHALL BE ADHERED TO DURING CONSTRUCTION. EXACT TRENCHING LIMITS SHALL BE AT THE DISCRETION OF THE CONTRACTOR AND MINIMIZED TO THE EXTENT NECESSARY TO COMPLETE THE WORK. TRENCHING SHALL ONLY OCCUR WITHIN THE CIRCLE K PARKING LOT AND SURROUNDING SIDEWALK. TRENCHING IMPACTS EXTRUDED CURB ON SITE, REPLACE CURBS TO MATCH EXISTING.
9. WELL SHALL BE DECOMMISSIONED IN ACCORDANCE WITH ECOLOGY WAC 173-160-381 BY A DRILLER LICENSED IN THE STATE OF WASHINGTON. DRILLER SHALL FILE A NOTICE OF INTENT TO ECOLOGY TO DECOMMISSION THE WELL AND SUBMIT A DECOMMISSIONING REPORT TO ECOLOGY WITHIN 30 DAYS OF COMPLETION, PER WAC 173-160-141.
10. WITHIN THE VAULT, NEATLY CUT AND REMOVE ANY EQUIPMENT AND PLUG ALL CONNECTIONS (INLETS, OUTLETS, OPENINGS, ETC.) PER DETAIL 4 ON SHEET C-05. FILL VAULT TO GRADE WITH BACKFILL PER DETAIL 4 ON SHEET C-04 ON SHEET C-04 AND SPECIFICATION SECTION 31 00 00. RESURFACE AND PAVE VAULT FOOTPRINT AND IMPACT SURROUNDING AREA IN ACCORDANCE WITH SPECIFICATION SECTION 32 12 16.13.
11. CONTRACTOR SHALL PROTECT TREES AND VEGETATION IN RIGHT-OF-WAY DURING DRILLING AND TRENCHING IN ACCORDANCE WITH CITY OF SEATTLE STANDARD SPECIFICATION 8-01.3(2)B AND STANDARD PLAN 133. EXCAVATION IS NOT ALLOWED IN CRITICAL ROOT ZONE A (CRZ A). FIELD ADJUSTMENTS MAY BE ALLOWED TO MODIFY TRENCH LIMITS AND/OR DRILLING LOCATIONS IF NECESSARY TO PROTECT TREE ROOTS IN PLACE. PROPOSED FIELD ADJUSTMENTS SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW AND APPROVAL.
12. CONTRACTOR SHALL PROTECT TREES IN ACCORDANCE WITH CITY OF SEATTLE STANDARD PLAN 132A FOR WORK LASTING MORE THAN 30 DAYS AND PLAN 132B FOR WORK LASTING 30 DAYS OR LESS. IF PAVEMENT AROUND TREE IS IMPACTED, RESTORE TREE PIT IN ACCORDANCE WITH CITY OF SEATTLE STANDARD PLAN 424B.
13. ANY LANDSCAPING (PLANTS, SOIL, MULCH, ETC.) IMPACTED BY CONTRACTOR ACTIVITIES SHALL BE RESTORED PER CITY OF SEATTLE STANDARD SPECIFICATION 8-01.3(2)B AND PLAN NO. 142. TRENCH BACKFILL SHALL CONSIST OF MINERAL AGGREGATE TYPE 17 PER CITY OF SEATTLE STANDARD SPECIFICATION 9-03.14 AND COMPACTED PER STANDARD SPECIFICATION 2.11.3(1).
14. CONTRACTOR SHALL MAINTAIN A MINIMUM 4 FOOT WIDE WALKWAY BETWEEN EDGE OF WELLHEAD SKIRT AND FRONT OR BACK OF CURB, AS APPLICABLE.

NEW REMEDIATION WELLS TO BE INSTALLED

RW-8	N:236950.38	E:1278394.71
RW-9	N:236909.25	E:1278406.10
RW-10	N:236924.38	E:1278422.51

NEW SLANT WELLS TO BE INSTALLED

SW-1	N:236943.23	E:1278385.44
SW-2	N:236929.86	E:1278397.11
SW-3	N:236913.40	E:1278392.00

EXISTING MONITORING AND REMEDIATION WELLS

MW-4	N:236985.00	E:1278447.91
RW-2	N:236970.10	E:1278404.38
RW-3	N:236960.04	E:1278409.31
RW-4	N:236947.52	E:1278418.32
RW-5	N:236932.47	E:1278407.00
RW-6	N:236982.51	E:1278425.63
RW-7	N:236913.61	E:1278432.90

LEGEND

- WELL TO BE USED FOR EXTRACTION/INJECTION (NEW AND EXISTING, SEE NOTE 1 AND WELL TABLES BELOW)
- EXISTING WELL NOT USED FOR EXTRACTION/INJECTION
- NEW SLANT WELL (SEE NOTE 2)
- EXTRACTION AND INJECTION PIPING
- SUB-SLAB DEPRESSURIZATION PIPING
- SUB-SLAB DEPRESSURIZATION WELL
- APPROXIMATE EXTENT OF TRENCH (SEE NOTE 7 AND 8)
- CHAIN LINK FENCE
- VAPOR MONITORING PIN (SEE NOTE 3)
- G — EXISTING GAS LINE
- W — EXISTING WATER LINE
- OP — EXISTING OVERHEAD POWER LINE
- SS — EXISTING SANITARY SEWER LINE
- P — EXISTING UNDERGROUND ELECTRICAL LINE
- SD — EXISTING STORM DRAIN
- PROPERTY BOUNDARY
- RIGHT-OF-WAY RESTORATION (SEE NOTES 7, 8, 11, 12 AND 13)
- CRITICAL ROOT ZONE EXTENTS
- UNKNOWN/UNMARKED UTILITY ENCOUNTERED DURING TRENCHING

RECORD DRAWING

This record drawing has been prepared based on unverified information compiled and provided by others to the preparer. The preparer is not responsible for any inaccuracies, errors, or omissions which may have been incorporated into the document. Users of this record drawing assume all risk of loss resulting from its use. Users of this document in editable electronic formats are cautioned against use without first determining whether changes may have been made subsequent to its preparation. The original signed and sealed copy of this document is the only true record of the contract document.

NO	REVISION	DATE	BY

SCALES 0 — 10"

DESIGNED
DRAWN
CHECKED

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON

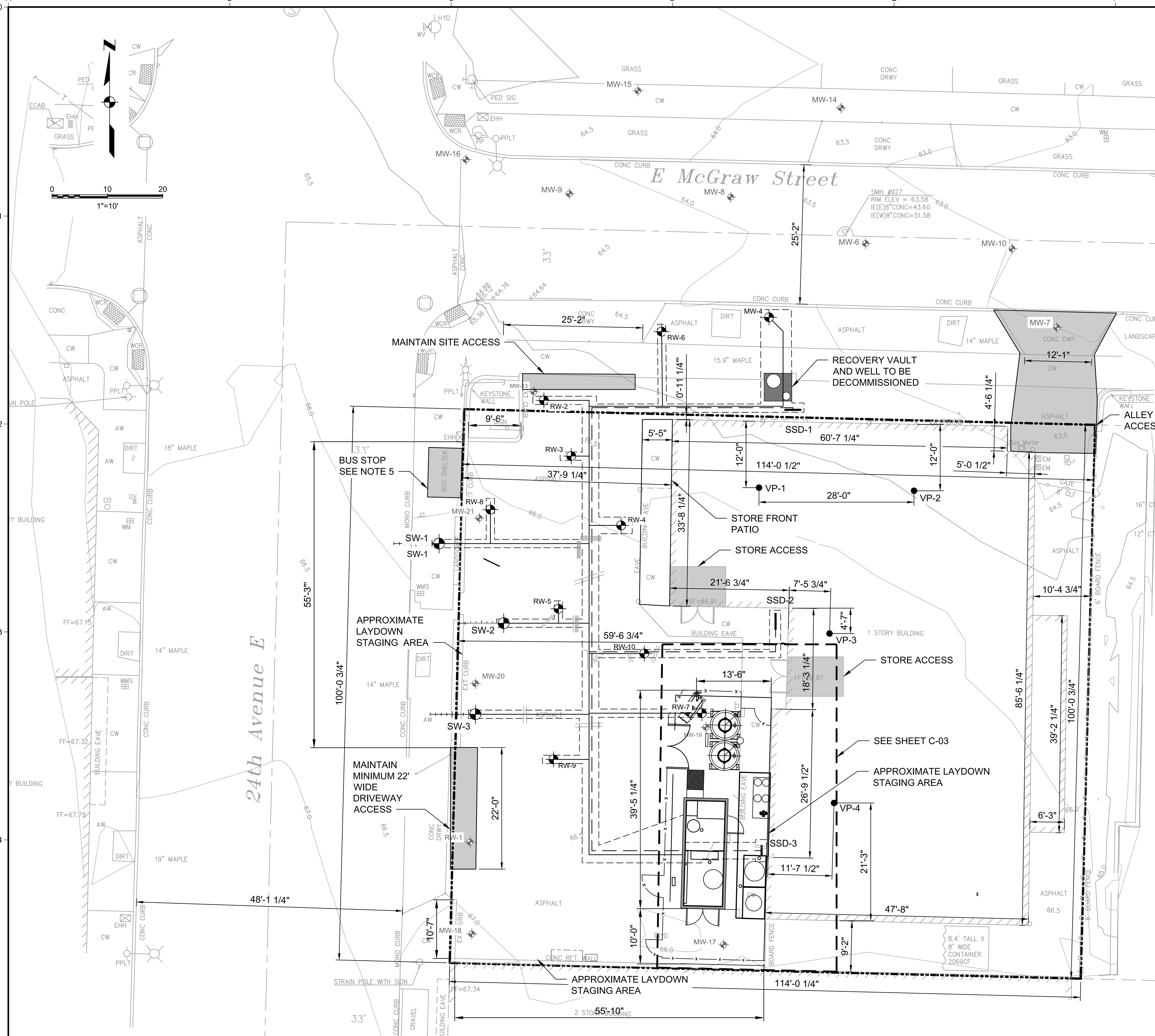
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

Kennedy Jenks

OVERALL SITE PLAN AND SYSTEM LAYOUT

SCALE 1" = 10'
JOB NO 2196008.00
DATE MAY 2025
SHEET 6 OF 24
C-01

File: C:\bms\kjce-pw\d0181574\219600800-C-01.dwg



SITE PLAN INFORMATION

ADDRESS: 2350 24TH AVE E, SEATTLE, WA 98112; INTERSECTION OF 24TH AVE E AND E MCGRAW ST. (ADDRESS ALSO IDENTIFIED AS 2401 E MCGRAW ST, SEATTLE, WA 98112).

OWNER'S NAME: CHOUNG KUK JIN AND KATHY KYUNG
PROPERTY NAME: JAY'S DRY CLEANERS

LEGAL DESCRIPTION: PIKES 2ND ADD TO UNION CITY 1 & 2 LESS E 6 FT
PLAT BLACK: 29
PLAT LOT: 1-2
QUARTER-SECTION-TOWNSHIP-RANGE: NW-21-25-4
KING COUNTY ASSESSOR'S PARCEL NUMBER: 678820-1335

HISTORIC RELATED PERMIT NUMBERS: 674948

TOTAL RESTORATION SURFACE AREA: 1,215 SF
TOTAL VOLUME OF EXCAVATION AND BACKFILL: 160 CY

DISCHARGE AUTHORIZATION:
KING COUNTY INDUSTRIAL WASTE (KCIW) WASTEWATER DISCHARGE AUTHORIZATION (WDA) NO. 4614-01 TO JAY'S CLEANERS - CIRCLE K 1461 TREATMENT SYSTEM. ISSUED MARCH 31, 2023.
EFFECTIVE DATE: APRIL 7, 2023
EXPIRATION DATE: APRIL 6, 2028

GENERAL SHEET NOTES

1. DIMENSIONS SHOWN ARE THE MAXIMUM ALLOWABLE FOR LAYDOWN STAGING AREAS. AREAS MAY NEED TO BE REDUCED TO ALIGN WITH EXISTING FEATURES SUCH AS CURBS OR ALLOW FOR VEHICLE AND PEDESTRIAN TRAFFIC AND SHALL BE SECURED BY TEMPORARY FENCING.
2. CONTRACTOR SHALL PROVIDE TRAFFIC CONTROL USING CONTRACTOR MEANS AND METHODS SUCH AS PHASED CONSTRUCTION, TRAFFIC RATED TRENCH LIDS, SIGNAGE, TEMPORARY FENCING, AND OTHER, AS NEEDED TO MAINTAIN VEHICLE AND PEDESTRIAN ACCESS TO THE STORES.
3. CONTRACTOR WORK AREA SHALL BE CLEARLY DELINEATED AND FENCED OFF TO PREVENT PUBLIC ENTRANCE, WHILE STILL MAINTAINING STORE ACCESS AT ALL TIMES DURING CONSTRUCTION.
4. CONTRACTOR SHALL SECURE ANY CITY PERMITTING RELATED TO TRAFFIC CONTROL INCLUDING PROVIDING TRAFFIC CONTROL PLANS, CITY RIGHT OF WAY WORK, AND KING METRO FOR WORK NEAR THE BUS STOP WHICH MAY REQUIRE WEEKEND WORK.
5. CONTRACTOR SHALL OBTAIN ALL PERMITS NECESSARY FOR CONSTRUCTION WITHIN THE RIGHT-OF-WAY AND MAINTAIN FULL ACCESS TO THE BUS STOP AT ALL TIMES DURING CONSTRUCTION.
6. PIPE ROUTING IS APPROXIMATE. CONTRACTOR SHALL PROVIDE INDIVIDUAL LINES TO EACH WELL PER P&ID DRAWINGS.
7. CONTRACTOR SHALL SUBMIT A WORK SEQUENCING PLAN DESCRIBING THE METHOD IN WHICH ALL REQUIRED ACCESS POINTS SHALL BE PROPERLY MAINTAINED. DETAILS ON THE WORK SEQUENCING PLAN REQUIREMENTS ARE INCLUDED IN SPECIFICATION SECTION 01 33 00.
8. CONTRACTOR SHALL NOT PLACE HEAVY EQUIPMENT IN LAYDOWN STAGING AREA ALONG SOUTH SIDE OF THE PROPERTY BOUNDARY.
9. VAPOR PINS ARE SHOWN AT APPROXIMATE LOCATIONS.

LEGEND

- WELL TO BE USED FOR EXTRACTION/INJECTION (NEW AND EXISTING, SEE NOTE 1 AND WELL TABLES ON SHEET C-01)
- EXISTING WELL NOT USED FOR EXTRACTION/INJECTION
- NEW SLANT WELL (SEE NOTE 2)
- EXTRACTION AND INJECTION PIPING
- SUB-SLAB DEPRESSURIZATION PIPING
- SUB-SLAB DEPRESSURIZATION WELL
- APPROXIMATE EXTENT OF TRENCH
- CHAIN LINK FENCE
- VAPOR MONITORING PIN
- SITE AND STORE ACCESS AREAS
- PROPERTY LINE

RECORD DRAWING

This record drawing has been prepared based on unverified information compiled and provided by others to the preparer. The preparer is not responsible for any inaccuracies, errors, or omissions which may have been incorporated into the document. Users of this record drawing assume all risk of loss resulting from its use. Users of this document in editable electronic formats are cautioned against use without first determining whether changes may have been made subsequent to its preparation. The original signed and sealed copy of this document is the only true record of the contract document.

NO	REVISION	DATE	BY

SCALES 0 — 10"

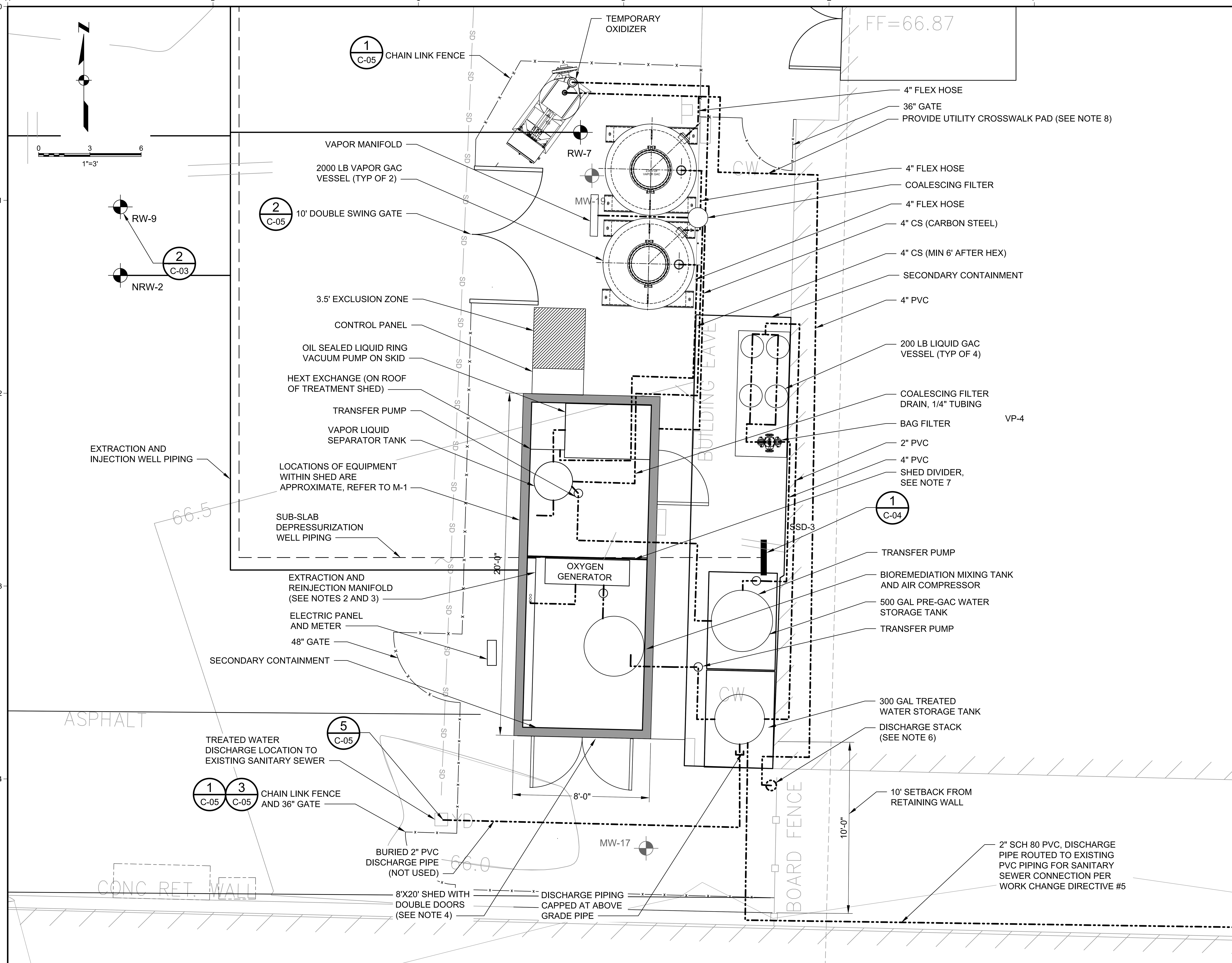
DESIGNED
DRAWN
CHECKED

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

DEPARTMENT OF ECOLOGY State of Washington
Kennedy Jenks

SITE PLAN STAGING AREAS

SCALE 1" = 10'
JOB NO 2196008.00
DATE MAY 2025
SHEET 7 OF 24
C-02



GENERAL SHEET NOTES

1. WELL TERMINOLOGY:
   1A. MW = EXISTING MONITORING WELL
   1B. RW = REMEDIATION WELL (EITHER EXISTING OR TO BE INSTALLED
2. ALL MANIFOLDS SHALL BE EQUIPPED WITH GATE VALVE, SAMPLE PORTS, AND 1/4" TAP FOR FLOW INSERTION.
3. EXTRACTION AND REINJECTION MANIFOLDS SHALL BE EQUIPPED WITH CONTROL VALVES AND FLOW METER FOR EACH WELL.
4. PIPING AND VALVES SHALL BE STACKED VERTICALLY ALONG EQUIPMENT ENCLOSURE WALL FOR ACCESS TO FLOW PATH AND MEASUREMENTS.
5. CONTRACTOR SHALL RECREATE ALL PARKING SPACES AFFECTED BY THE REMEDIATION SYSTEM AS SHOWN ON SHEET C-06 INCLUDING REPAINTING PARKING LOT STRIPING AND HANDICAP SYMBOLS, AND REPLACING EXISTING CURBS WITH NEW CURBS.
6. INSTALL ANY NECESSARY PIPE SUPPORTS TO DISCHARGE STACK TO EXTEND TOP OF STACK TO 3 FEET ABOVE THE ROOF. DISCHARGE STACK PIPE SUPPORTS SHALL BE CONTRACTOR DESIGNED AND SUBMITTED TO THE ENGINEER FOR APPROVAL.
7. DIVIDER AND SHED CONSTRUCTION SHALL MEET IBC AND NFPA REQUIREMENTS TO SEPARATE ZONES. SHED CONSTRUCTION SHALL INCLUDE DIVIDER TO SEPARATE UNCLASSIFIED AND CLASS 1, DIVISION 2 RATED EQUIPMENT OR CONTRACTOR SHALL PROVIDE TWO SEPARATE SHEDS INSTALLED ADJACENT TO EACH OTHER.
8. PIPE ROUTING IS APPROXIMATE. FIELD ROUTE AS NEEDED TO MAINTAIN PATHWAYS AND ACCESS TO EQUIPMENT AND VALVES. PROVIDE STEP OVERS/RAMPS WHERE REQUIRED OR ELEVATE TO MINIMUM 7 FEET ABOVE GROUND TO MAINTAIN ACCESS PER SPECIFICATIONS. PROVIDE LOW POINT DRAINS AND HIGH POINT VENTS AS NEEDED. CONTRACTOR DESIGNED SUPPORTS SHALL BE FAVORABLY APPROVED BY ENGINEER. EXCEPT AS MAY BE REQUIRED FOR THE DISCHARGE STACK, SUPPORTS SHALL NOT BE ANCHORED TO THE BUILDING WALL, AWNING, ROOF, OR COLUMNS.
9. TREATMENT SYSTEM SHALL BE COMMISSIONED IN ACCORDANCE WITH SPECIFICATION SECTION 01 77 00.
10. EQUIPMENT AND PIPING LOCATIONS ARE SHOWN FOR CONCEPTUAL PURPOSES ONLY. ACTUAL EQUIPMENT AND PIPING LOCATIONS SHALL BE COORDINATED BY THE CONTRACTOR.

LEGEND

- EXTRACTION AND INJECTION PIPING
- SUB-SLAB DEPRESSURIZATION WELL PIPING
- REMEDIATION SYSTEM PROCESS PIPING (SEE NOTE 4)
- CHAIN LINK FENCE
- SUB-SLAB DEPRESSURIZATION WELL
- VAPOR MONITORING PIN
- WELL TO BE USED FOR EXTRACTION/INJECTION (NEW AND EXISTING, SEE NOTE 1 AND WELL TABLES ON SHEET C-01)
- EXISTING WELL NOT USED FOR EXTRACTION/INJECTION

RECORD DRAWING

This record drawing has been prepared based on unverified information compiled and provided by others to the preparer. The preparer is not responsible for any inaccuracies, errors, or omissions which may have been incorporated into the document. Users of this record drawing assume all risk of loss resulting from its use. Users of this document in editable electronic formats are cautioned against use without first determining whether changes may have been made subsequent to its preparation. The original signed and sealed copy of this document is the only true record of the contract document.

NO	REVISION	DATE	BY
1	SEATTLE DEPARTMENT OF TRANSPORTATION PERMIT	10/09/2023	CMW

SCALES 0 — 10"

DESIGNED
DRAWN
CHECKED

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

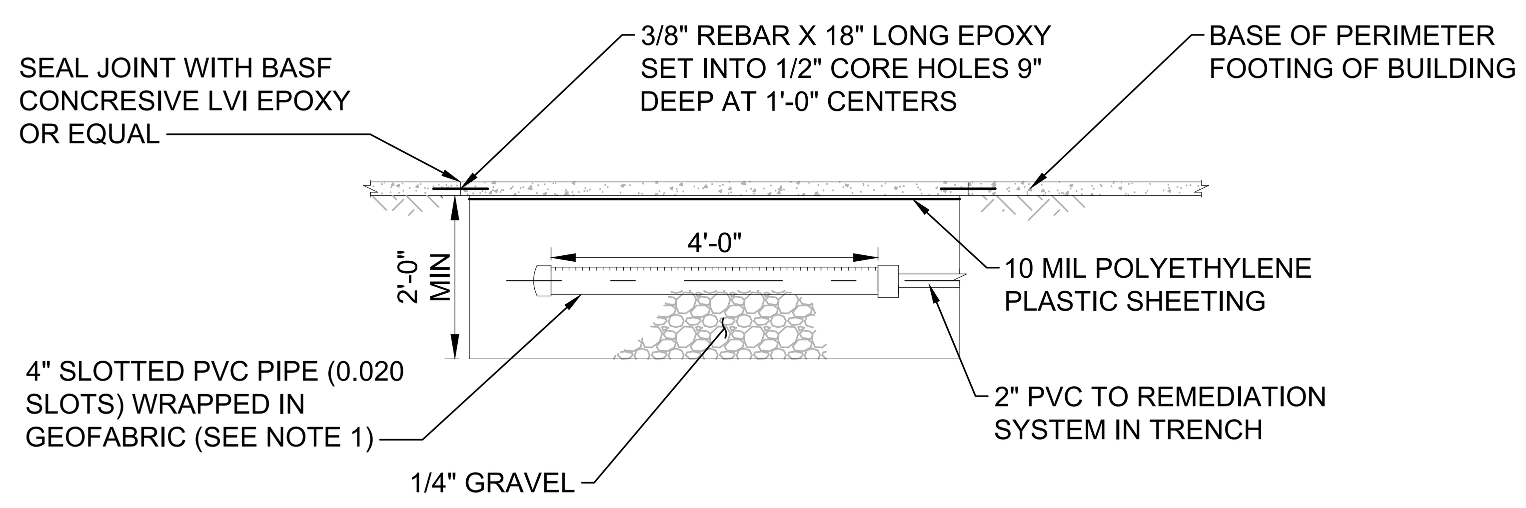
Kennedy Jenks

REMEDIATION SYSTEM LAYOUT

SCALE 1" = 10'
JOB NO 2196008.00
DATE MAY 2025
SHEET 8 OF 24
C-03

Plot Date: 5/7/2025 7:51 AM

User: RICHARD HILLS

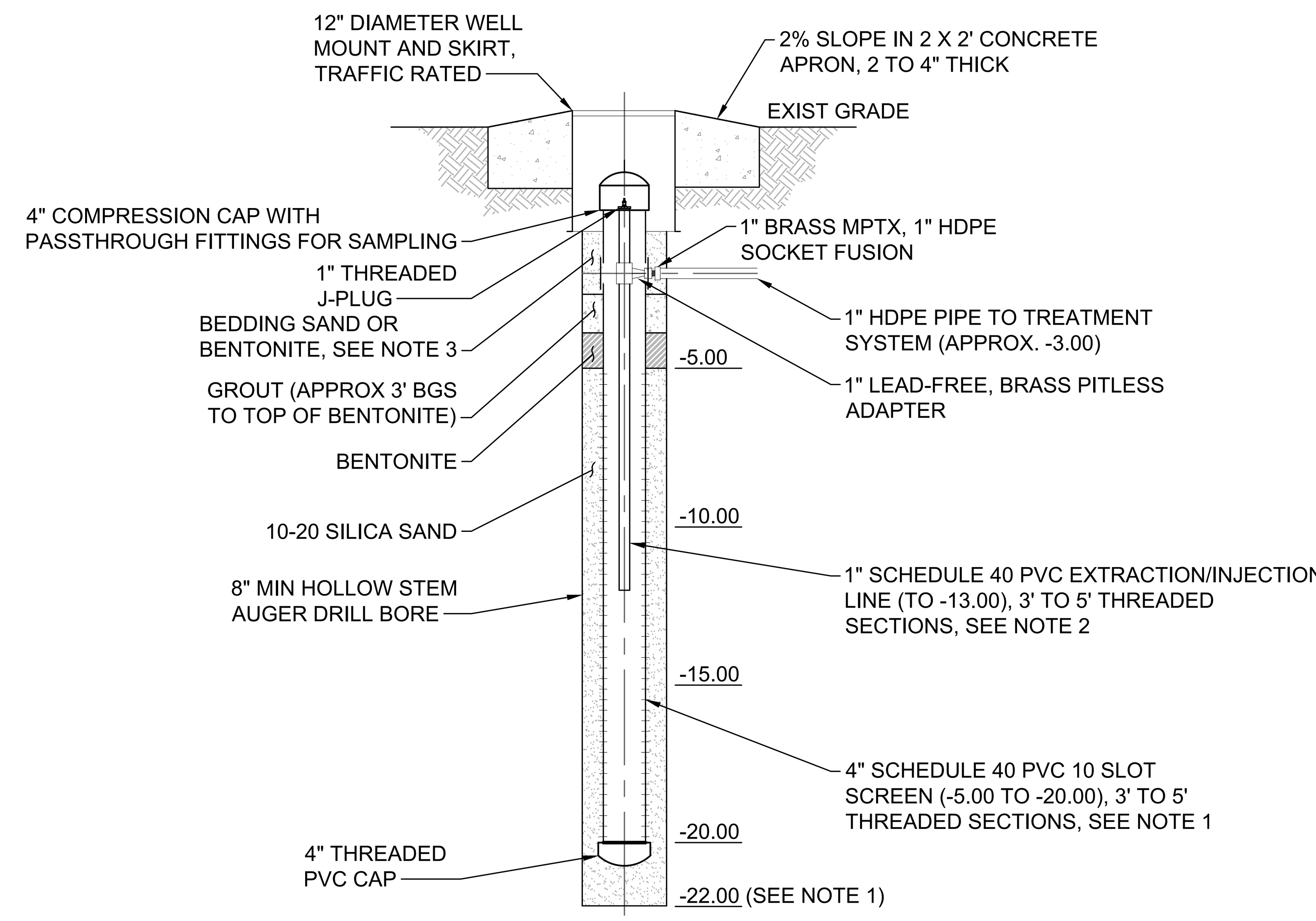


NOTES:

1. GEOFABRIC SHALL BE NONWOVEN POLYPROPYLENE GEOTEXTILE, SUCH AS MIRAFI 140N, OR EQUAL.
2. SUB-SLAB DEPRESSURIZATION (SSD) WELL SHALL BE INSTALLED AT LEAST 1 FOOT BELOW THE BOTTOM OF ANY PERIMETER FOOTING OF THE BUILDING.

1 C-01 SUB-SLAB DEPRESSURIZATION WELL

SCALE: 1/2" = 1'

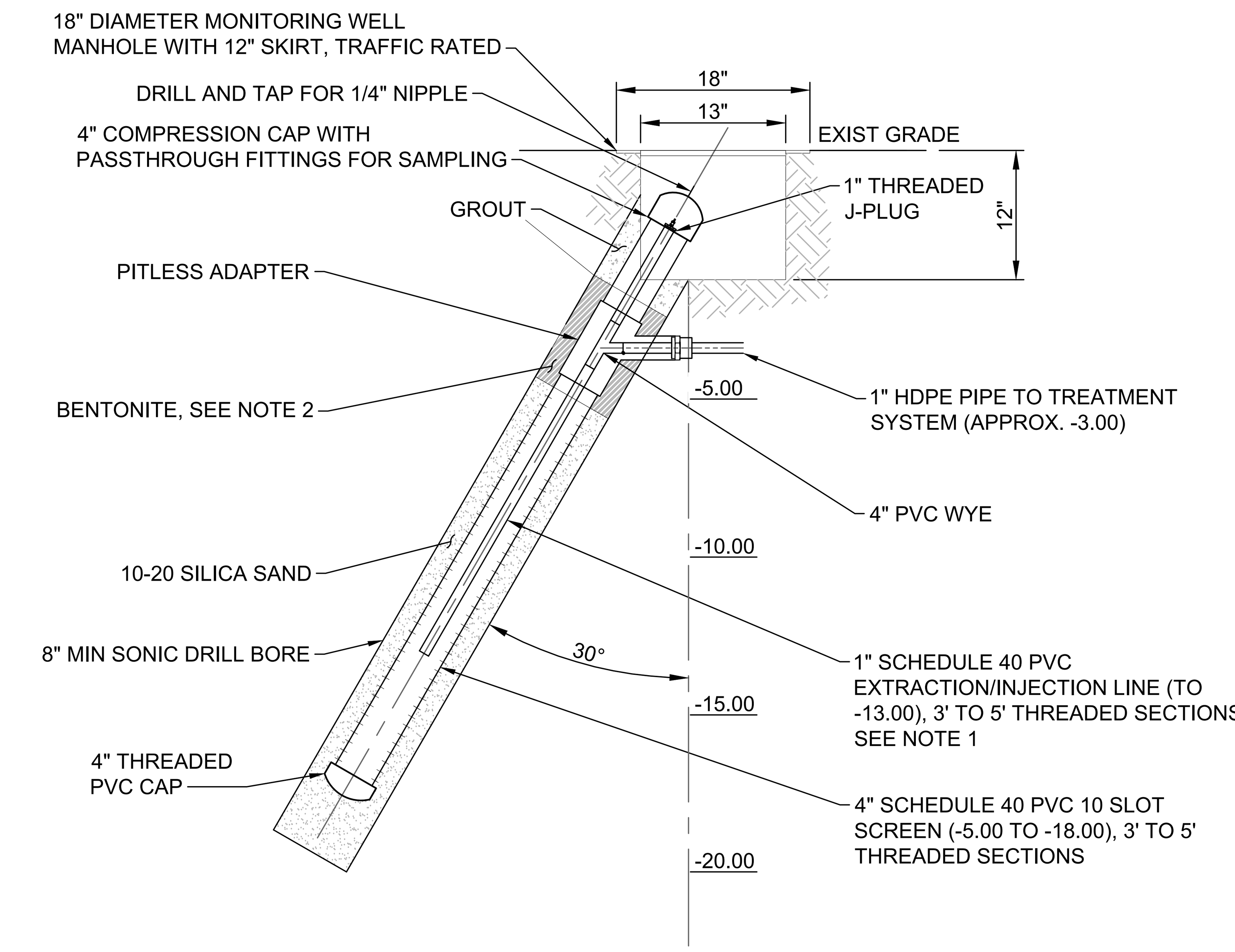


NOTES:

1. WELL RW-10 DRILLED TO 30 FT BGS WITH A SCREEN INTERVAL FROM 25 TO 30 FT BGS. IN RW-10 THE EXTRACTION/INJECTION LINE SHALL EXTEND TO - 16 FT BGS.
2. PIPING SHALL EXTEND TO LOW GROUND WATER ELEVATION OR A MINIMUM OF 13' BGS.
3. AFTER INSTALLATION OF COUPLING AND PITLESS ADAPTER, CONTRACTOR SHALL BACKFILL WITH MINIMUM 3" BENTONITE AND THEN COMPACT PER SPECIFICATIONS.

2 C-01 VERTICAL WELL

SCALE: NTS

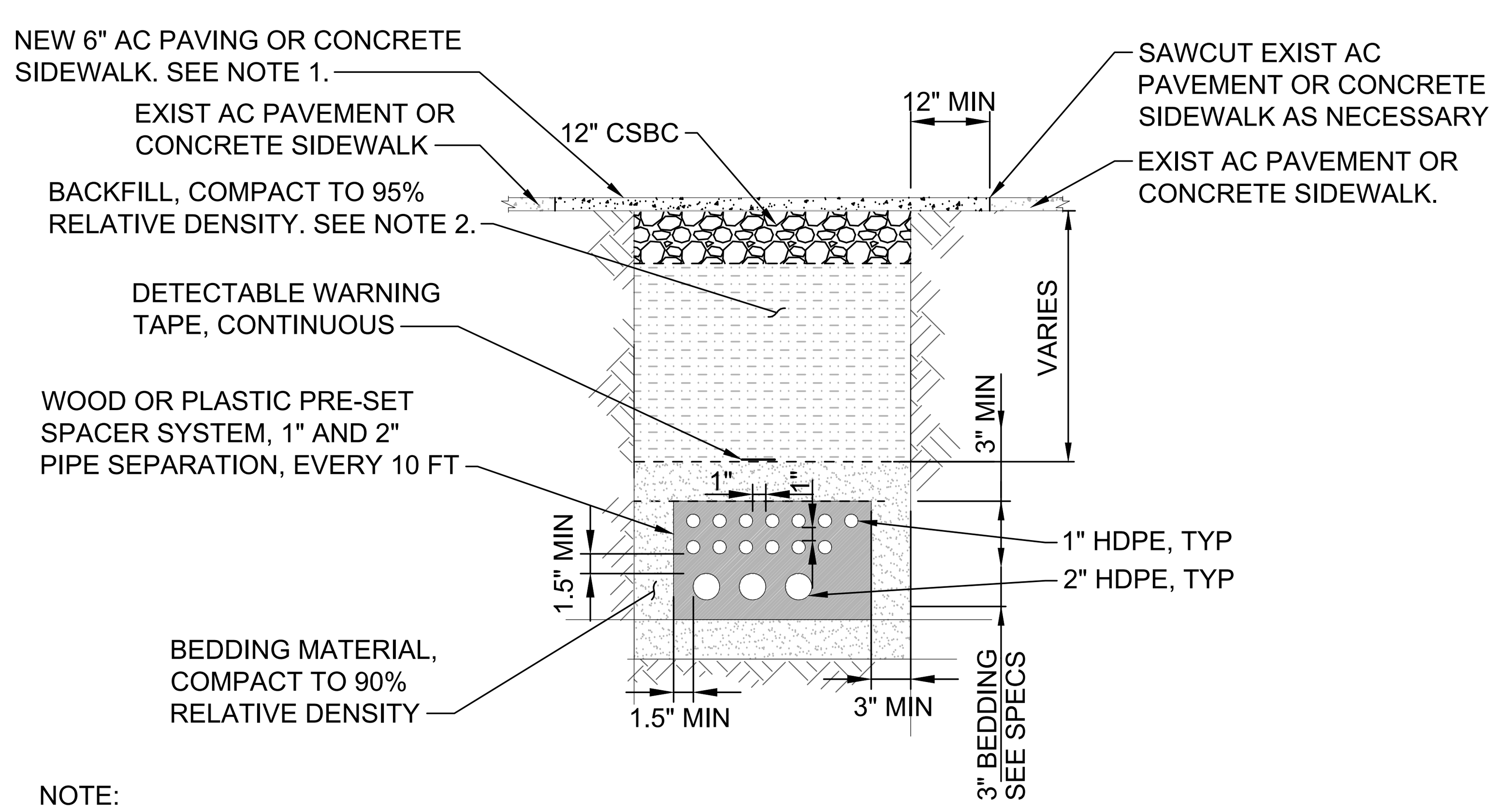


NOTES:

1. PIPING SHALL EXTEND TO LOW GROUND WATER ELEVATION OR A MINIMUM OF 13' BGS.
2. AFTER INSTALLATION OF WYE, CONTRACTOR SHALL BACKFILL WITH MINIMUM 3" BENTONITE AND THEN COMPACT PER SPECIFICATIONS.

3 C-01 SLANT WELL

SCALE: NTS



NOTE:

1. NEW AC PAVING OVER CRUSHED SURFACING BASE COURSE COMPACTED TO 95% RELATIVE DENSITY. AC PAVING SHALL BE MINIMUM OF 6" THICK. REMOVE EXISTING PAVEMENT AND BASE FOR THE FULL WIDTH OF THE TRENCH. RESTORE SIDEWALK PER CITY OF SEATTLE STANDARD PLAN 420 (SEE DETAIL 5 ON THIS SHEET). FULL SIDEWALK PANEL REPLACEMENT REQUIRED PER SEATTLE DEPARTMENT OF TRANSPORTATION DIRECTOR'S RULE 01-2017.
2. TRENCH BACKFILL SHALL CONSIST OF CONTROL DENSITY FILL PER CITY OF SEATTLE STANDARD SPECIFICATION 2-10.2(3)A2 (EXCEPT WITHIN 10-FT OF STEAM PIPES PER DIRECTOR'S RULE 01-2017 7.4.2.1) OR MINERAL AGGREGATE TYPE 17 PER STANDARD SPECIFICATION 9-03.14 AND COMPACTED PER STANDARD SPECIFICATION 2.11.3(1).
3. ARRANGEMENT OF 1" HDPE AND 2" PVC PIPES IN PRE-SET SPACER SYSTEM SHALL BE AT THE DISCRETION OF THE CONTRACTOR. SEPARATION AROUND 1" PIPE SHALL BE 1" MINIMUM. SEPARATION AROUND 2" PIPE SHALL BE 1.5" MINIMUM.

4 C-01 TRENCH SECTION

SCALE: NTS

RECORD DRAWING

This record drawing has been prepared based on unverified information compiled and provided by others to the preparer. The preparer is not responsible for any inaccuracies, errors, or omissions which may have been incorporated into the document. Users of this record drawing assume all risk of loss resulting from its use. Users of this document in editable electronic formats are cautioned against use without first determining whether changes may have been made subsequent to its preparation. The original signed and sealed copy of this document is the only true record of the contract document.

NO	REVISION	DATE	BY

DESIGNED

DRAWN

CHECKED

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON

CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

Kennedy Jenks

CIVIL SECTIONS AND DETAILS - I

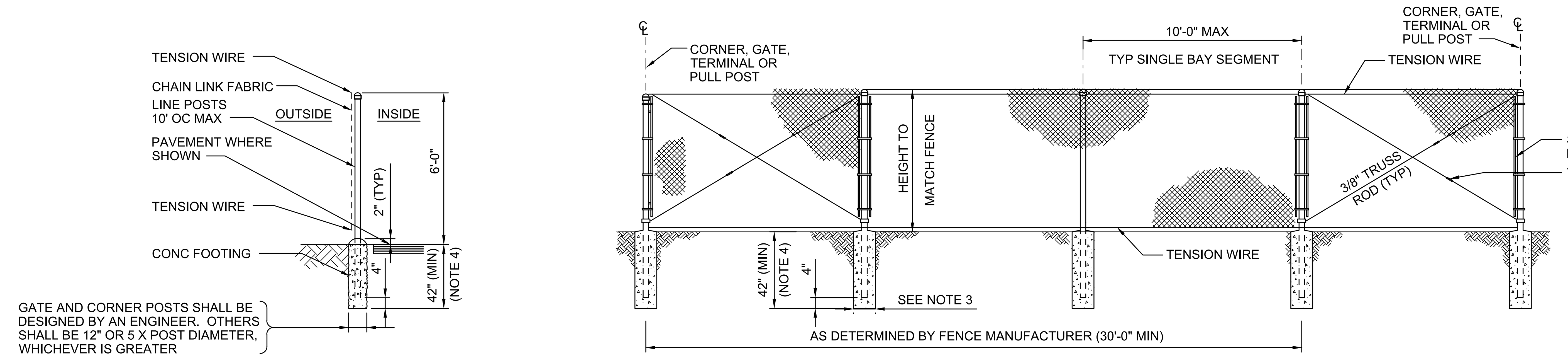
SCALE: AS SHOWN

JOB NO: 2196008.00

DATE: MAY 2025

SHEET 9 OF 24

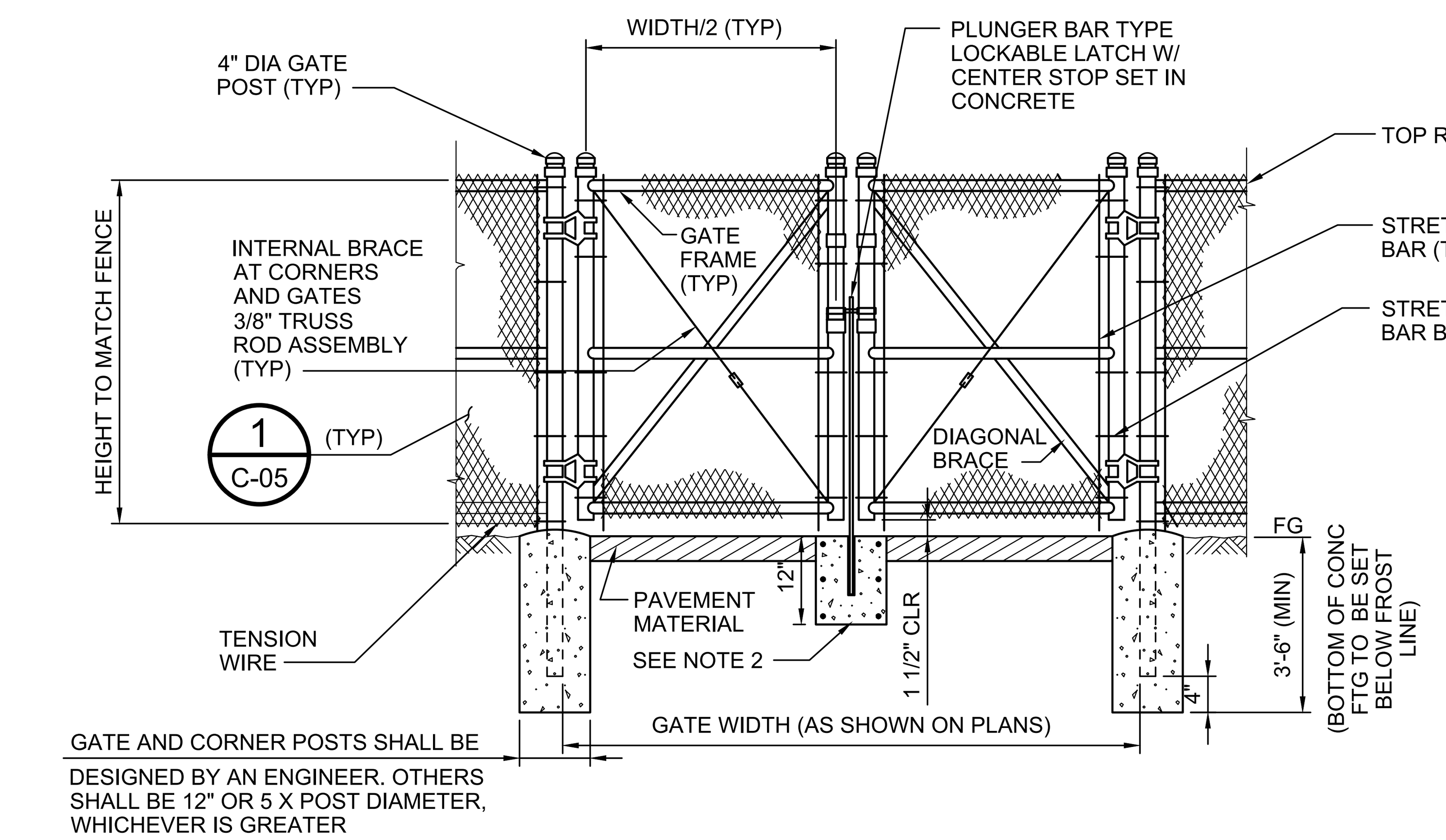
C-04



NOTES:

1. SEE SPECIFICATIONS FOR FENCE MATERIAL, COATINGS, AND INSTALLATION REQUIREMENTS.
2. EXTENSION ARM MAY BE TURNED IN AT OPTION OF OWNER.
3. LINE POSTS FOOTINGS SHALL BE 12" OR 5 X POST DIAMETER, WHICHEVER IS GREATER.
4. BOTTOM OF CONC FTG TO BE SET BELOW FROST LINE.
5. FENCE SHALL INCLUDE PRIVACY SCREEN MATERIAL WOVEN INTO CHAIN LINK FENCE. PRIVACY SCREEN MATERIAL SHALL BE DARK GREY COLOR OR OTHER COLOR AGREED UPON WITH THE OWNER.
6. CONCRETE SHALL HAVE A MINIMUM 28 DAY COMPRESSIVE STRENGTH OF 4,000 PSI AS MEASURED IN ACCORDANCE WITH ASTM C39.
7. MIX DESIGN
   7.1 FIELD TEST RECORDS: SUBMIT IN ACCORDANCE WITH ACI 318 CHAPTER 5.3
   7.2 WATER/CEMENT RATIO: 0.5 MAX
   7.3 AIR CONTENT: 4% +/- 1% IN ACCORDANCE WITH ASTM C231
8. CEMENTITIOUS MATERIALS
   8.1 MINIMUM CONTENT: 570 LBS/CU YD
   8.2 PORTLAND CEMENT: ASTM C150, TYPE II LOW ALKALI
   8.3 FLYASH: ASTM C618, CLASS F, NOT TO EXCEED 20% OF TOTAL CEMENTITIOUS MATERIALS.
9. AGGREGATE
   9.1 COARSE: CONFORM TO ASTM C33, 1-INCH MAX AGGREGATE
   9.2 FINE: CONFORM TO TABLE 1 OF ASTM C33
10. ADMIXTURES
   10.1 AIR ENTRAINING: ASTM C260
   10.2 WATER REDUCING: ASTM C494, TYPE A
11. CONCRETE CONSTRUCTION SHALL CONFORM TO ACI 301-10, 318-11, AND ACI 347.
12. CONCRETE SHALL BE PLACED AND CURED BETWEEN 50 AND 90 DEGREES F.
13. PROVIDE SF-2.0 FINISH AT FORMED SURFACES IN ACCORDANCE WITH ACI 301.
14. PROVIDE TROWEL FINISH AT HORIZONTAL SURFACES IN ACCORDANCE WITH ACI 301.
15. UNLESS OTHERWISE NOTED, ALL EXPOSED EDGES AND CORNERS SHALL BE CHAMFERED 3/4-INCH.
16. REINFORCING BARS SHALL BE ASTM A615-GRADE 60.
17. WELDED WIRE FABRIC SHALL CONFORM TO ASTM A185.
18. ARRANGEMENT AND DETAINING OF REINFORCING STEEL, INCLUDING BAR SUPPORTS AND SPACERS, SHALL BE IN ACCORDANCE WITH THE LATEST ACI 315 DETAILING MANUAL.
19. REINFORCING SHALL LAP IN ACCORDANCE WITH ACI 318-11.
20. DIMENSIONS TO REINFORCING ARE TO BAR CENTERLINES, UNLESS NOTED OTHERWISE BAR COVER IS CLEAR DISTANCE BETWEEN THE BAR AND THE CONCRETE SURFACE. UNLESS SHOWN OTHERWISE, BAR COVER SHALL NOT BE LESS THE 1 1/2 INCH.
21. POST DIAMETER SHALL BE DEFERRED SUBMITTAL BY THE CONTRACTOR.

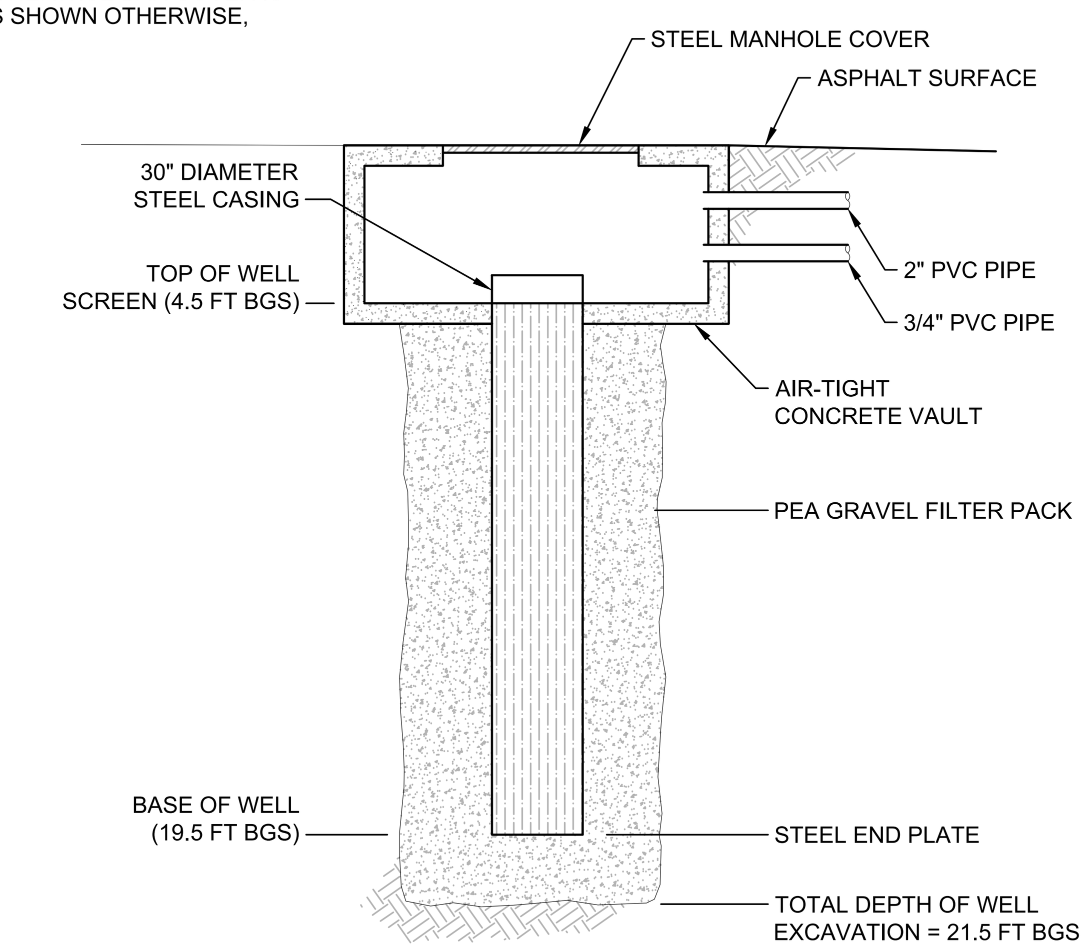
1 C-03 CHAIN LINK FENCE
SCALE: NTS



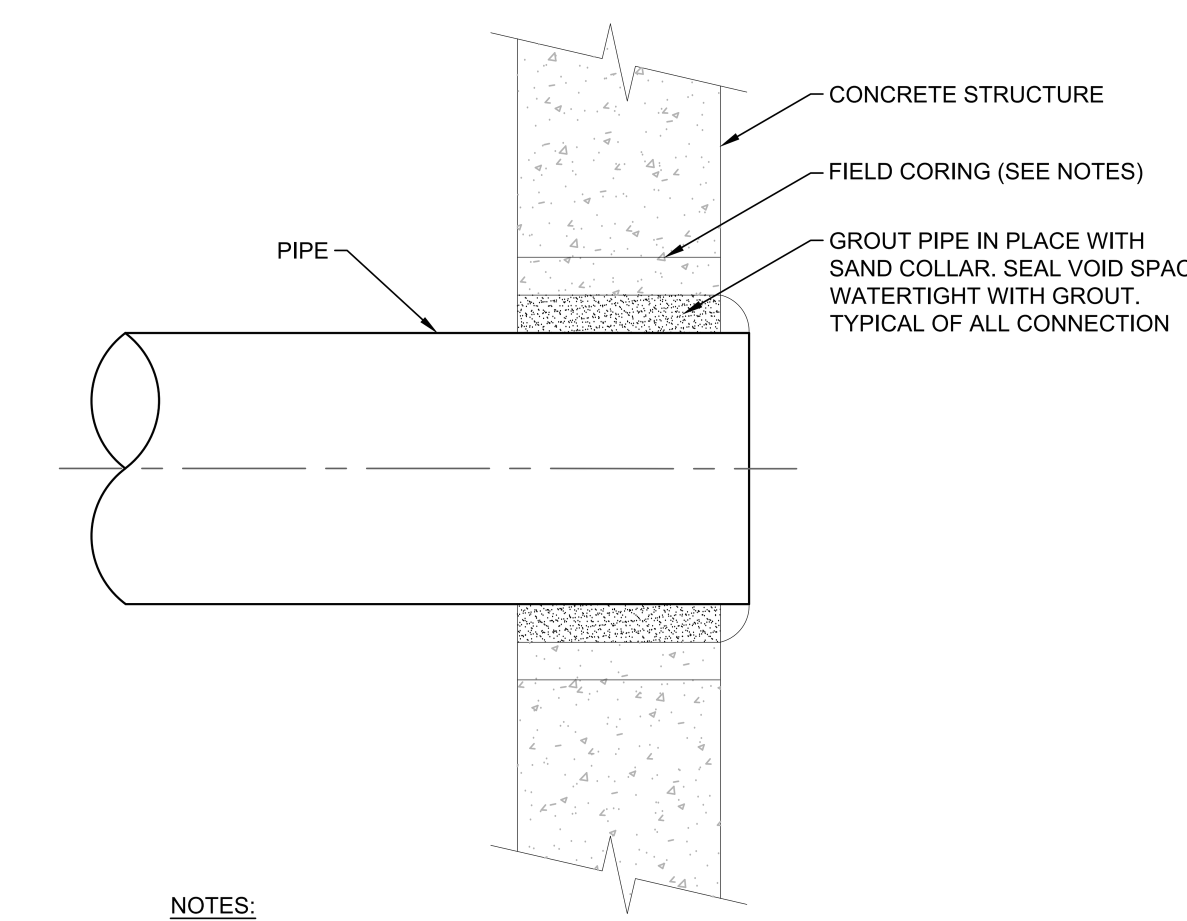
NOTES:

1. SEE SPECIFICATIONS FOR FENCE MATERIAL, COATINGS, AND INSTALLATION REQUIREMENTS.
2. 12" DIAMETER X 18" DEEP CONCRETE STOP W/ 20 GA STEEL PLUNGER SLEEVE, DIA = ROD OD +1/2".
3. POST DIAMETER SHALL BE DEFERRED SUBMITTAL BY THE CONTRACTOR.

2 C-03 DOUBLE LEAF SWING GATE
SCALE: NTS



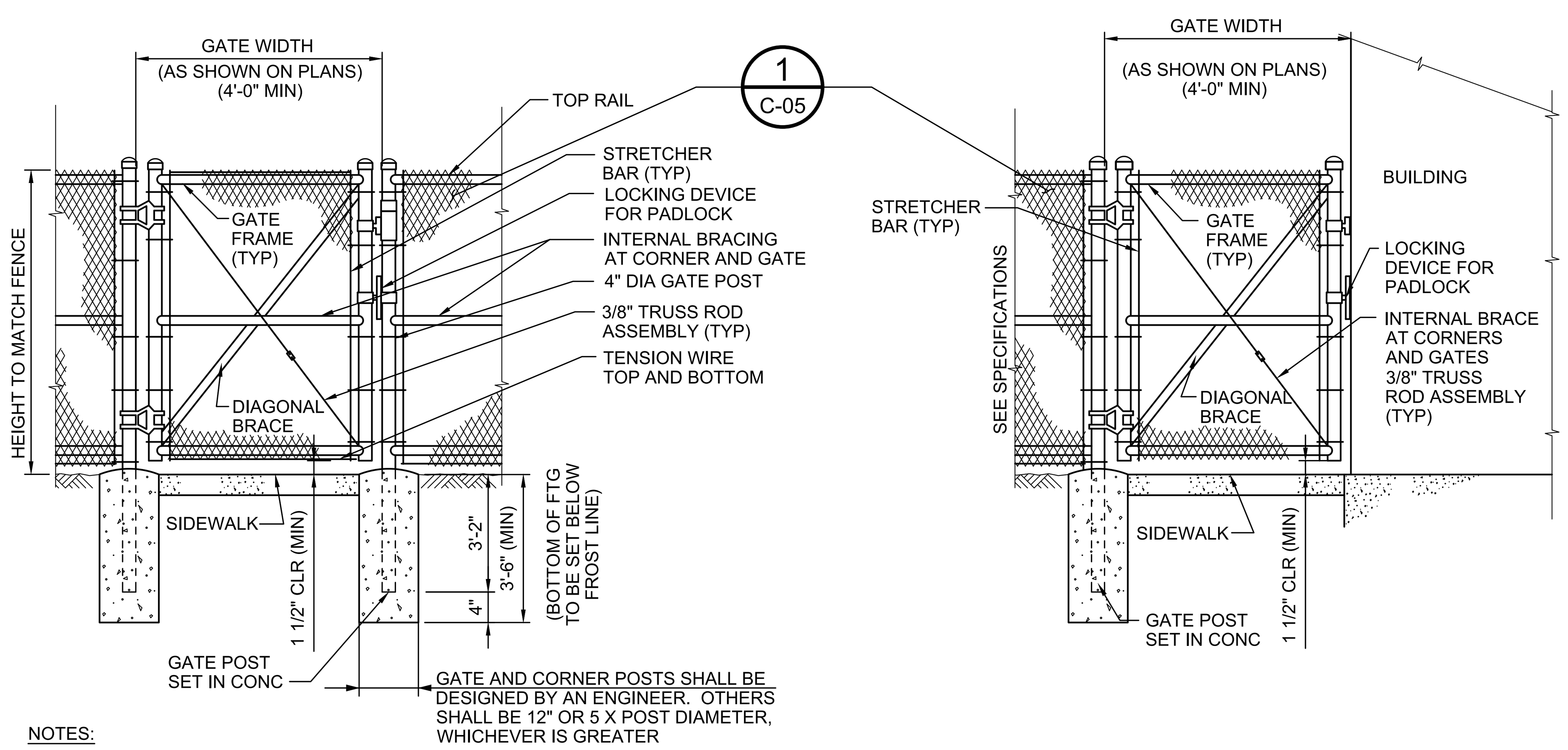
A C-01 RECOVERY WELL AND VAULT
SCALE: NTS



NOTES:

1. CONTRACTOR SHALL NEATLY CORE DRILL OPENINGS FOR THESE UTILITY CONNECTION IN THE FIELD BASED ON SPECIFIC UTILITY SIZE AND LOCATION. CORE DRILL OPENING SIZES SHALL BE MINIMIZED AS NECESSARY TO MAKE THE UTILITY CONNECTION.
2. CONTRACTOR SHALL MAKE ALL CORE DRILLED OPENINGS WATERTIGHT WITH NON-SHRINK GROUT.
3. GROUT SHALL MEET THE REQUIREMENTS OF ASTM C 1107 FOR HYDRAULIC-CEMENT NON-SHRINK GROUT, HAVE A 25 TO 30 SECOND FLUID CONSISTENCY ACCORDING TO ASTM C 939, HAVE A MINIMUM WORKING TIME OF 30 MINUTES, HAVE MINIMUM COMPRESSIVE STRENGTH OF 7,500 PSI @ 28 DAYS WHEN PREPARED IN FLUID CONSISTENCY, AND NOT CONTAIN POWDERED ALUMINUM.

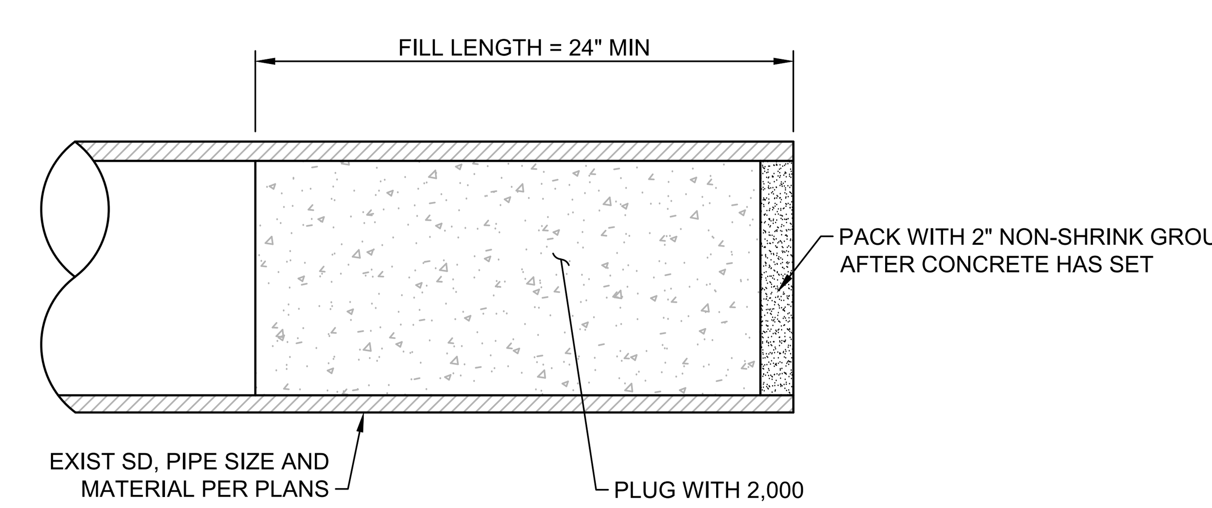
5 C-03 PIPE TO CATCH BASIN CONNECTOR
SCALE: NTS



NOTES:

1. SEE SPECS FOR FENCE MATERIAL, COATINGS, AND INSTALLATION REQUIREMENTS.
2. GATE TO BE INSTALLED WITH KEEPER TO SECURE IN OPEN POSITION.
3. GATES LESS THAN 8'-0" IN WIDTH SHALL BE SINGLE LEAF.
4. POST DIAMETER SHALL BE DEFERRED SUBMITTAL BY THE CONTRACTOR.

3 C-03 SINGLE LEAF SWING GATE
SCALE: NTS



4 C-01 PIPE PLUG
SCALE: NTS

RECORD DRAWING

This record drawing has been prepared based on unverified information compiled and provided by others to the preparer. The preparer is not responsible for any inaccuracies, errors, or omissions which may have been incorporated into the document. Users of this record drawing assume all risk of loss resulting from its use. Users of this document in editable electronic formats are cautioned against use without first determining whether changes may have been made subsequent to its preparation. The original signed and sealed copy of this document is the only true record of the contract document.

NO	REVISION	DATE	BY

SCALES
0 — 1"
0 — 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

DESIGNED	RJA
DRAWN	RJA
CHECKED	BEF

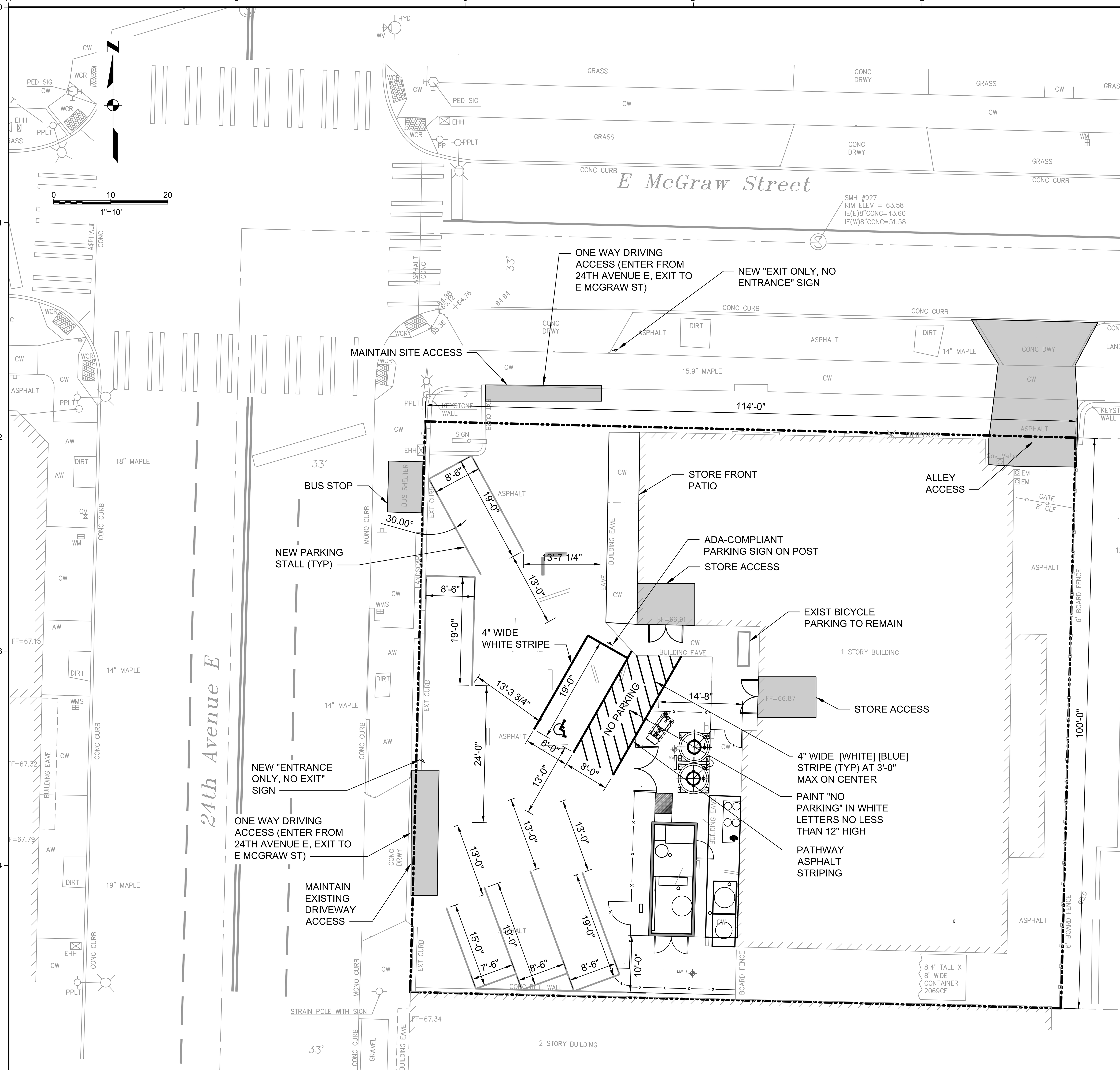
DEPARTMENT OF ECOLOGY State of Washington

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

Kennedy Jenks

CIVIL SECTIONS AND DETAILS - II

SCALE	
JOB NO	2196008.00
DATE	MAY 2025
SHEET	10 OF 24
	C-05



GENERAL SHEET NOTES

FLOOR AREA RATIO PER SMC 23.47A.013:
SITE AREA: 11,400 S.F.
EXISTING BUILDING AREA: 4,770 S.F.
NEW CONTAINER AREA: 160 S.F.
TOTAL FLOOR AREA: 4,930 S.F.
BUILDING HEIGHT: 16'± (LESS THAN 30')

FAR PER TABLE A, SMC 23.47.013: 2.5
FAR RATIO: 4,930 / 11,400 = .433 < 2.5 - COMPLIES

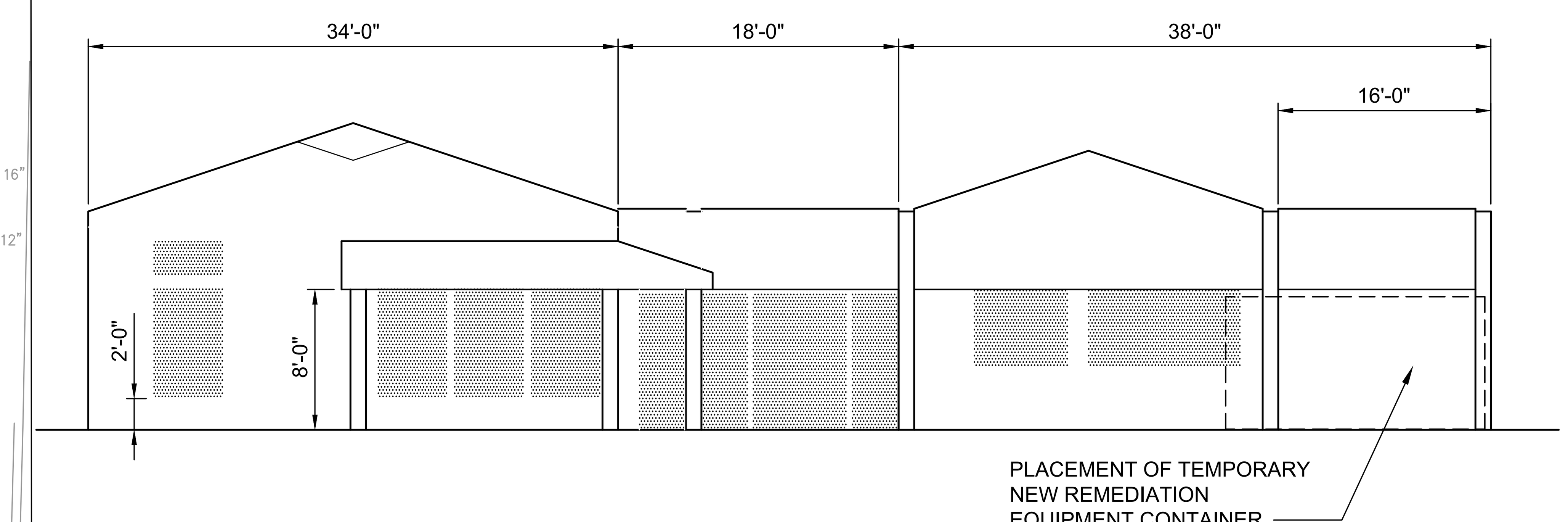
PARKING PER SMC 23.54.015
TOTAL FLOOR AREA: 4,930 S.F.
(LESS FLOOR AREA DISCOUNT PER SMC 23.54.015.D.1 OF 1,500 S.F.)
CALCULATED FLOOR AREA: 3,430 S.F.

REQUIRED PARKING PER TABLE A, SMC 23.54.015, USE B.10:
(1) SPACE PER 500 SQUARE FEET.
CALCULATED PARKING: 6.86; USE (7) STALLS
50% PARKING STALL REDUCTION PER SMC 23.54.020.F.2 = 3.5; USE (6) STALLS.

EXISTING NON-CONFORMING PARKING LOCATION PERMITTED UNDER 674948

EXISTING (1) LONG-TERM AND (1) SHORT-TERM BICYCLE PARKING AT BUILDING ENTRANCE TO REMAIN UNCHANGED. (SMC 23.54.015 TAB LE D, USE A.6)

SEATTLE ENERGY CODE (SEC):
PER SEC C402.1.2 EQUIPMENT BUILDINGS:
NEW CONTAINER IS TO BE CONDITIONED (HEAT ONLY, NO COOLING)
NEW CONTAINER AREA: 160 S.F.
NOT INTENDED FOR HUMAN OCCUPANCY
HEATING SYSTEM: 0.5 KW
HEATING THERMOSTAT SET POINT: NOT MORE THAN 50 DEGREES F.
AVERAGE WALL AND ROOF U-FACTOR: LESS THAN 0.200



ELEVATION VIEW
SCALE: NOT TO SCALE

SBC: 503.1.2 - BUILDINGS ON THE SAME LOT

THESE STRUCTURES WILL BE CONSIDERED AS PORTIONS OF ONE BUILDING PER 503.1.2.

AGGREGATE AREA OF ALL OCCUPANCIES (F-2, B, AND M): 4,930 SF
MINIMUM ALLOWABLE AREA PER TABLE 506.2 (NS, TYPE V B, F-2 OCCUPANCY): 13,000 SF
MINIMUM ALLOWABLE AREA PER TABLE 506.2 (NS, TYPE V B, B OCCUPANCY): 9,000 SF
MINIMUM ALLOWABLE AREA PER TABLE 506.2 (NS, TYPE V B, M OCCUPANCY): 9,000 SF

REQUIRED SEPARATION OF OCCUPANCIES PER TABLE 508.4:
F-2 AND B OCCUPANCIES - NO SEPARATION REQUIREMENT
B AND M OCCUPANCIES - NO SEPARATION REQUIREMENT
M AND F-2 OCCUPANCIES - NOT APPLICABLE AT THIS BUILDING

STREET LEVEL DEVELOPMENT STANDARDS PER SMC 23.47A.008:

A.2A ALL BUILDING STREET-FACING FACADES HAVE WINDOWS AND ENTRYWAYS.

A.2B SINGLE BLANK SEGMENT OF 16' LENGTH AT SOUTH END OF FACADE. NEW TEMPORARY CONTAINER TO BE PLACED IN THIS LOCATON.

A.2C BLANK FACADE SEGMENTS EQUAL 38.8 PERCENT OF THE WIDTH OF THE STRUCTURE FACADE ALONG THE STREET.

B.2A TRANSPARENT STREET FACING FACADE EQUALS 61.2 PERCENT.

B.3A NEW NON-RESIDENTIAL STRUCTURE (TEMPORARY CONTAINER) OF 160 S.F. IS LESS THAN 600 S.F. THRESHOLD FOR DEPTH PROVISION REQUIREMETS.

C.1 CURRENT BUILDING USE IS MINI-MARKET AND LAUNDRY.

C.4 OVERHEAD WEATHER PROTECTION IS PROVIDED ALONG 80 PERCENT OF THE STREET FRONTAGE OF THE STRUCTURE.

TABLE A FOR 23.471.008.C: TWO (2) SMALL COMMERCIAL SPACES ARE PROVIDED IN THE EXISTING 4,770 S.F. STRUCTURE

RECORD DRAWING

This record drawing has been prepared based on unverified information compiled and provided by others to the preparer. The preparer is not responsible for any inaccuracies, errors, or omissions which may have been incorporated into the document. Users of this record drawing assume all risk of loss resulting from its use. Users of this document in editable electronic formats are cautioned against use without first determining whether changes may have been made subsequent to its preparation. The original signed and sealed copy of this document is the only true record of the contract document.

NO	REVISION	DATE	BY
-	---	--/--/----	---

SCALES 0 10"

DESIGNED
DRAWN
CHECKED

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

Kennedy Jenks

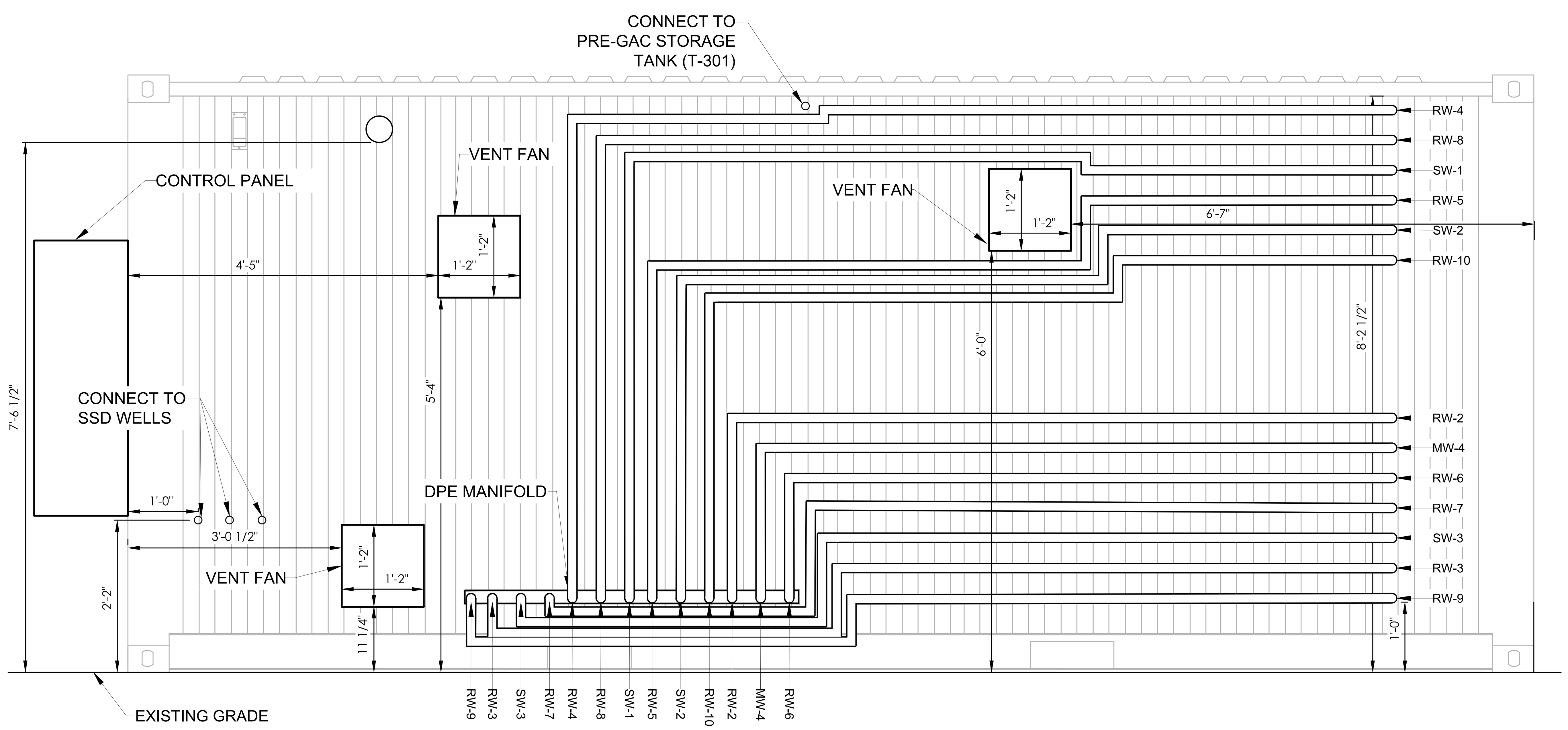
SITE PLAN PARKING AREAS

SCALE 1" = 10'
JOB NO 2196008.00
DATE MAY 2025
SHEET 11 OF 24
C-06

Plot Date: 5/6/2025 8:50 AM
User: RICHARD HILLS
File: C:\bms\kjce-pw\d0181574\2196000800-C-06.dwg

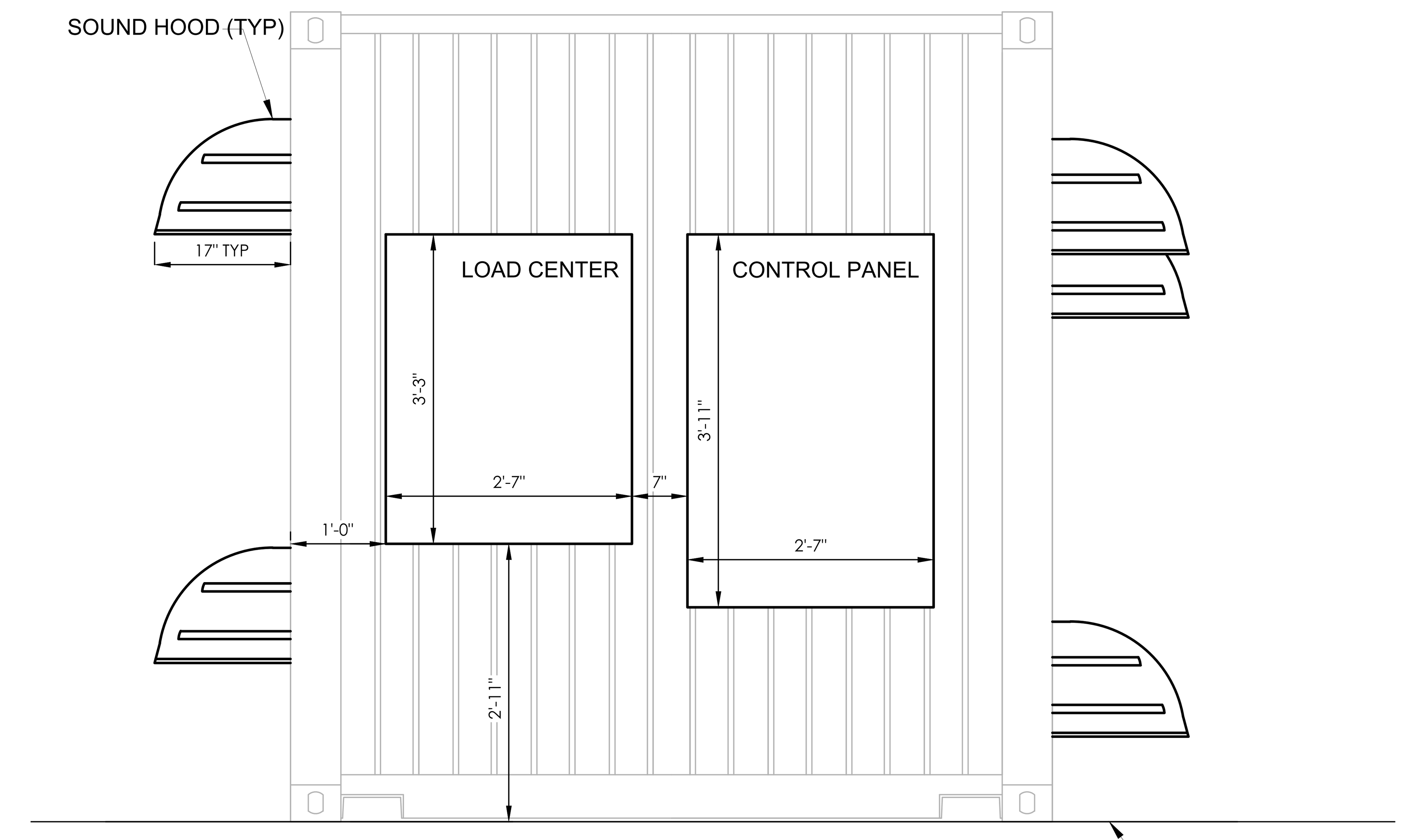
Plot Date: 5/6/2025 8:53 AM

User: RICHARD HILLS



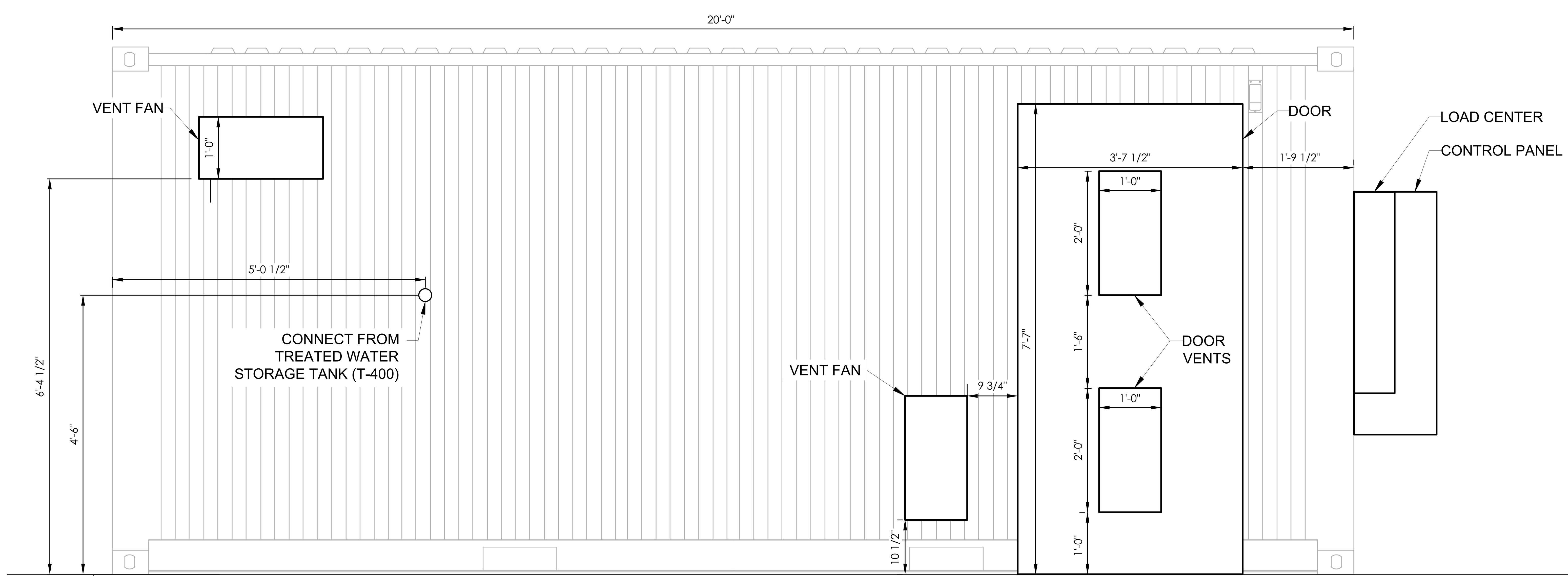
WEST SIDE SECTION VIEW

SCALE: 3/4" = 1'-0"



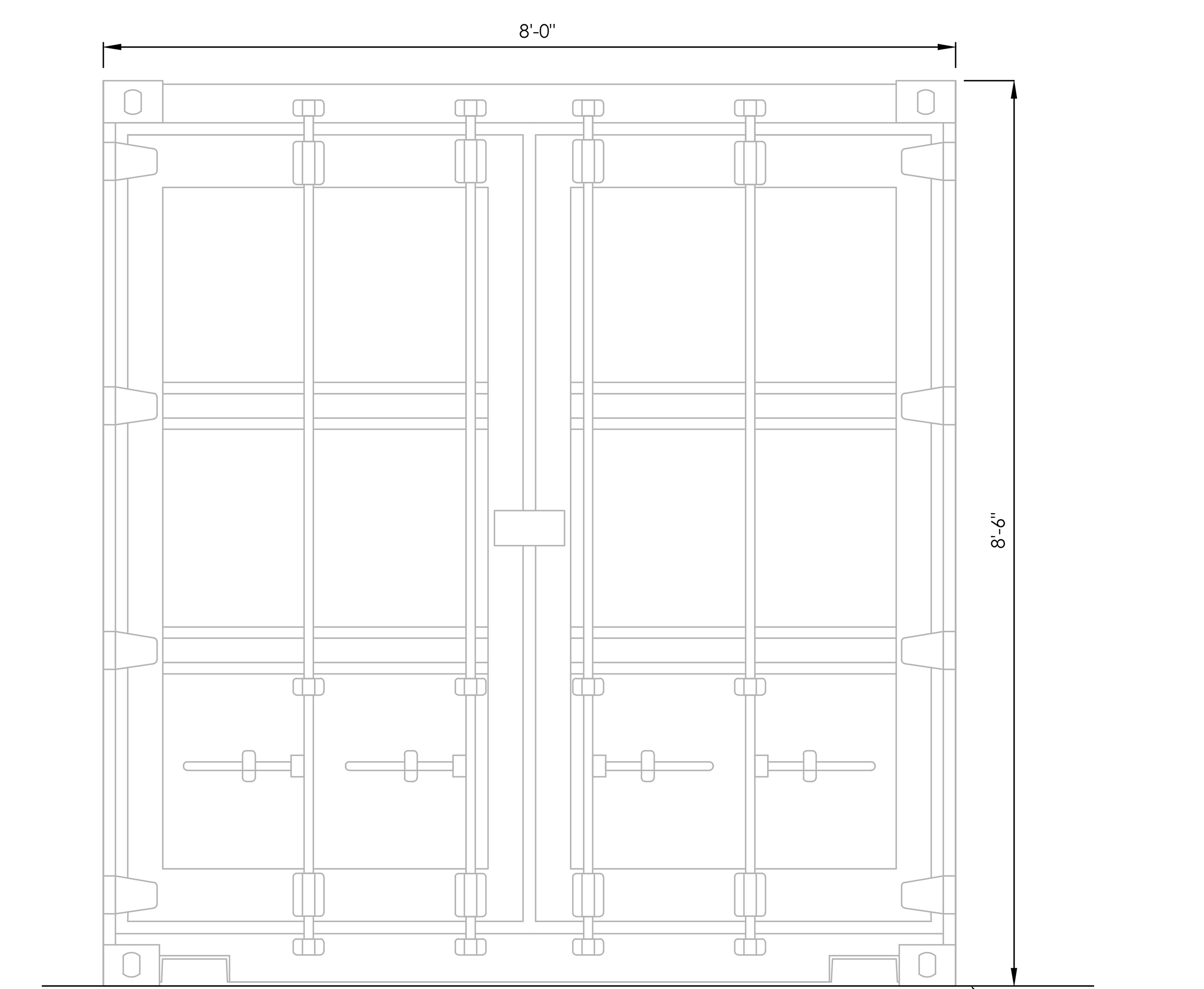
NORTH SIDE SECTION VIEW

SCALE: 3/4" = 1'-0"



EAST SIDE SECTION VIEW

SCALE: 3/4" = 1'-0"



SOUTH SIDE SECTION VIEW

SCALE: 3/4" = 1'-0"

RECORD DRAWING

This record drawing has been prepared based on unverified information compiled and provided by others to the preparer. The preparer is not responsible for any inaccuracies, errors, or omissions which may have been incorporated into the document. Users of this record drawing assume all risk of loss resulting from its use. Users of this document in editable electronic formats are cautioned against use without first determining whether changes may have been made subsequent to its preparation. The original signed and sealed copy of this document is the only true record of the contract document.

NO	REVISION	DATE	BY
-	---	--/--/----	---

SCALES 0 — 10"

DESIGNED

DRAWN

CHECKED

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON

CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

DEPARTMENT OF ECOLOGY State of Washington

Kennedy Jenks

CONTAINER ELEVATION VIEWS

SCALE 1" = 10'

JOB NO 2196008.00

DATE MAY 2025

SHEET 12 OF 24

C-07

File: C:\bms\kjce-pw\d0181574\219600800-C-07.dwg

ABBREVIATIONS

'	FOOT, FEET
"	INCH, INCHES
#	NUMBER
%	PERCENT
&	AND
@	AT
±	APPROXIMATELY
<	LESS THAN
=	EQUALS
>	GREATER THAN
A	AMPERE(-S)
A/C	AIR CONDITIONING
A/D	ANALOG TO DIGITAL
A/M	AUTO/MANUAL
ABAN(-D)	ABANDON(-ED)
AC	ALTERNATING CURRENT
AF	AMPERE FRAME
AFCI	ARC-FAULT CIRCUIT INTERRUPTER
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AI	ANALOG INPUT
AIC	AMPERES INTERRUPTING CAPACITY
ANN	ANNUNCIATOR
ANT	ANTENNA
AO	ANALOG OUTPUT
APPROX	APPROXIMATE(-LY)
ARCH	ARCHITECT(-URAL)
AS	AMMETER SWITCH
ASD	ADJUSTABLE SPEED DRIVE (DC)
AT	AMPERE TRIP
ATS	AUTOMATIC TRANSFER SWITCH
AUTO	AUTOMATIC
AUX	AUXILIARY
AWG	AMERICAN WIRE GAGE
BATT	BATTERY
BC	BARE COPPER
BKR	BREAKER
C	CONDUCTOR, CONTACT
C/S	CONSTANT SPEED
CAB	CABINET
CALC(S)	CALCULATION(S)
CAT	CATEGORY
CB	CATCH BASIN
CCTV	CLOSED-CIRCUIT TELEVISION
CHEM	CHEMI(-CAL, -STRY)
CID1	CLASSIFICATION I, DIVISION 1
CID2	CLASSIFICATION I, DIVISION 2
CKT	CIRCUIT
CLR	CLEAR(-ANCE)
CLSM	CONTROLLED LOW STRENGTH MATERIAL
CO	CONDUIT ONLY
COAX	COAXIAL
COM	COMMON
COMM	COMMUNICATION
COND	CONDUIT
CPT	CONTROL POWER TRANSFORMER
CR	CONTROL RELAY
CT	CURRENT TRANSFORMER
CTRL	CONTROL
CU IN	CUBIC INCH(-ES)
DC	DIRECT CURRENT
DCS	DISTRIBUTED CONTROL SYSTEM
DEG	DEGREE(-S)
DEG C	DEGREES CELSIUS
DEG F	DEGREES FARENHEIT
DEMO	DEMOLISH
DI	DISCRETE INPUT
DIA	DIAMETER
DIAG	DIAGRAM
DISC	DISCONNECT
DISTR	DISTRIBUTION
DO	DISCRETE OUTPUT
DPDT	DOUBLE POLE, DOUBLE THROW
DPST	DOUBLE POLE, SINGLE THROW
DR	DOOR
DTL(-S)	DETAIL(-S)
DUP	DUPLEX
EFFIC	EFFICIENCY
EFFL	EFFLUENT
ELEC	ELECTRIC(-AL)
ELEM	ELEMENTARY
EMERG	EMERGENCY
ENCL	ENCLOSURE
ENET	ETHERNET
ENGR	ENGINEER
EPA	ENVIRONMENTAL PROTECTION AGENCY
EQPM	EQUIPMENT
EST	ESTIMATE(-D)
E-STOP	EMERGENCY STOP
ETC	ET CETERA
ETM	ELAPSED TIME METER
EUSERC	ELECTRIC UTILITY SERVICE EQUIPMENT REQUIREMENTS COMMITTEE
EXIST	EXISTING
EXP	EXPANSION
EXT	EXTERNAL
FA	FIRE ALARM
FACIL	FACILIT(-Y, -IES)
FC	FAIL CLOSED
FDR	FEEDER
FIG	FIGURE
FLA	FULL LOAD AMPERES
FLEX	FLEXIBLE
FO	FIBER OPTIC, FAIL OPEN
FREQ	FREQUENCY
FT	FOOT, FEET
FU	FUSE
FUT	FUTURE
FVNR	FULL VOLTAGE, NON REVERSING
FVR	FULL VOLTAGE, REVERSING
FWD	FORWARD
G	GROUND (ELECTRICAL)
GAC	GRANULAR ACTIVATED CARBON
GAL	GALLON(-S)
GFCI	GROUND-FAULT CIRCUIT INTERRUPTER
GND	GROUND
GRS	GALVANIZED RIGID STEEL
H	HIGH, HEIGHT
HD	HEAT DETECTOR
HDPE	HIGH DENSITY POLYETHYLENE
HGR	HANGER
HH	HANDHOLE
HMI	HUMAN MACHINE INTERFACE
HOA	HAND-OFF-AUTOMATIC
HOR	HAND-OFF-REMOTE
HP	HORSEPOWER
HR(S)	HOUR(-S)
HTR	HEATER
HVAC	HEATING, VENTILATING, AND AIR CONDITIONING
HZ	HERTZ (CYCLES PER SECOND)
I&C	INSTRUMENTATION AND CONTROL
I/O	INPUT/OUTPUT
IEEE	INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS
IL	INDICATING LIGHT
IN	INCH(-ES)
INST	INSTANTANEOUS
INSTR	INSTRUMENT(-ATION)
IP	INTERNET PROTOCOL
IR	INFRARED
IS	INTRINSICALLY SAFE
ISA	INTERNATIONAL SOCIETY OF AUTOMATION
ISO	ISOLAT(-E, -ION)
ISR	INTRINSICALLY SAFE RELAY
JB	JUNCTION BOX
KA	KILOAMPERE(-S)
KCMIL	THOUSANDS OF CIRCULAR MILS
KHZ	KILOHERTZ
KV	KILOVOLT(-S)
KVA	KILOVOLT-AMPERE(-S)
KVAR	KILOVOLT-AMPERE(-S) REACTIVE
KVARH	KILOVOLT-AMPERE REACTIVE HOUR(-S)
KW	KILOWATT(-S)
KWH	KILOWATT HOUR(-S)
L	LENGTH, LINE
LA	LIGHTNING ARRESTER
LAN	LOCAL AREA NETWORK
LB(-S)	POUND(-S)
LCP	LOCAL CONTROL PANEL
LCS	LOCAL CONTROL STATION
LEL	LOWER EXPLOSIVE LIMIT
LOC	LOCATION
LOR	LOCAL-OFF-REMOTE
LOTO	LOCK-OUT, TAG-OUT
LP	LIGHTING PANELBOARD
L-R	LOCAL-REMOTE
LS	LIMIT SWITCH
LT	LIGHT
LTG	LIGHTING
LV	LOW VOLTAGE
mA	MILLIAMPERE(-S)
MAX	MAXIMUM
MCB	MAIN CIRCUIT BREAKER
MCC	MOTOR CONTROL CENTER
MCP	MOTOR CIRCUIT PROTECTOR
MECH	MECHANICAL
MFR	MANUFACTURER
MH	MANHOLE
MHZ	MEGAHERTZ
MIL(-S)	ONE-THOUSANDTH OF AN INCH
MIN	MINIMUM, MINUTE(-S)
MISC	MISCELLANEOUS
MLO	MAIN LUGS ONLY
MM	MULTIMODE
MOCP	MAXIMUM OVERCURRENT PROTECTION
MOD(-S)	MODIF(-Y, -ICATIONS)
MOV	MOTOR OPERATED VALVE
MT(-D, -G)	MOUNT(-ED, -ING)
MTR	MOTOR
MTS	MANUAL TRANSFER SWITCH
MV	MEDIUM VOLTAGE
N	NORTH, NEUTRAL
N/A	NOT APPLICABLE
NAOCL	SODIUM HYPOCHLORITE
NAOH	SODIUM HYDROXIDE
NC	NORMALLY CLOSED
NEC	NATIONAL ELECTRICAL CODE (NFPA 70)
NECA	NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION
NEMA	NATIONAL ELECTRICAL MANUFACTURER'S ASSOCIATION
NETA	INTERNATIONAL ELECTRICAL TESTING ASSOCIATION
NFC	NOT FOR CONSTRUCTION
NFPA	NATIONAL FIRE PROTECTION ASSOCIATION
NH3	AMMONIA
NIC	NOT IN CONTRACT
NO	NORMALLY OPEN, NUMBER
NORM	NORMAL
NTS	NOT TO SCALE
O/C	OPEN/CLOSE
O3	OZONE
ODP	OPEN DRIP PROOF
OFCI	OWNER FURNISHED, CONTRACTOR INSTALLED
OIT	OPERATOR INTERFACE TERMINAL
OL	THERMAL OVERLOAD RELAY
ORIG	ORIGINAL
OSC	OPEN/STOP/CLOSE
OT	OVER TEMPERATURE
P	POLE
PA	PUBLIC ADDRESS
PB	PULLBOX, PUSHBUTTON
PC(-S)	PIECE(-S), PHOTOCELL
PCC	POINT OF COMMON COUPLING
PE	PHOTOELECTRIC
PF	POWER FACTOR
PFR	POWER FACTOR RELAY
PH	PHASE
PLC	PROGRAMMABLE LOGIC CONTROLLER
PM	POWER MONITOR
PNL	PANEL
PNLBD	PANELBOARD
POE	POWER OVER ETHERNET
PP	POWER POLE
PRI	PRIMARY
PRV	PRESSURE RELIEF VALVE, PRESSURE REDUCING VALVE
PS	POWER SUPPLY
PT(-S)	POTENTIAL TRANSFORMER
PVC	POLYVINYL CHLORIDE
PWR	POWER
R, RAD	RADIUS
RCPT	RECEPTACLE
RCT	REPEAT CYCLE TIMER
RIO	REMOTE INPUT/OUTPUT
RM	ROOM
RMT	REMOTE
RPM	REVOLUTIONS PER MINUTE
RST	RESET
RT	RESET TIMER
RTU	REMOTE TELEMETRY UNIT
RVSS	REDUCED VOLTAGE, SOLID STATE
S/S	START/STOP
SCADA	SUPERVISORY CONTROL AND DATA ACQUISITION
SCR	SILICON CONTROLLED RECTIFIER
SD	SMOKE DETECTOR
SEC	SECONDARY
SER	SERVICE ENTRANCE RATED
SGNL	SIGNAL
(SH)	SHIELDED
SHT	SHEET
SM	SINGLEMODE
SP	SET POINT
SPD	SURGE PROTECTIVE DEVICE
SPDT	SINGLE POLE, DOUBLE THROW
SPEC(-S)	SPECIFICATION(-S)
SS	STAINLESS STEEL, SOLID STATE
STB	SHORTING TERMINAL BLOCK
STD(-S)	STANDARD(-S)
STL	STEEL
STP	SHIELDED TWISTED PAIR
STRC	STRUCTUR(-E, -AL)
SWBD	SWITCHBOARD
SWGR	SWITCHGEAR
SYNC	SYNCHRONIZING
T	TIME(-R)
TB	TERMINAL BLOCK
TC	TRAY CABLE
TCP	TRANSMISSION CONTROL PROTOCOL
TEFC	TOTALLY ENCLOSED FAN COOLED
TEL	TELEPHONE
TEMP	TEMPERATURE, TEMPORARY
TENV	TOTALLY ENCLOSED NON-VENTILATED
THRU	THROUGH
TOT	TOTAL, TOTALIZE(R)
TSTAT	THERMOSTAT
TYP	TYPICAL
UG	UNDERGROUND
UL	UNDERWRITERS LABORATORIES
UNKN	UNKNOWN
UPS	UNINTERRUPTIBLE POWER SUPPLY
UTP	UNSHIELDED TWISTED PAIR
UV	ULTRAVIOLET
V	VOLTS
V/S	VARIABLE SPEED
VA	VOLT-AMPERES
VAR	VARIES, VARIABLE, VOLT-AMPERES REACTIVE
VCP	VENDOR CONTROL PANEL
VFD	VARIABLE FREQUENCY DRIVE (AC)
VFI	VACUUM FAULT INTERRUPTER
VS	VOLTMETER SWITCH
W	WIDE, WIDTH, WIRE, WATTS, WEST
W/	WITH
W/O	WITHOUT
WAN	WIDE AREA NETWORK
WHDM	WATT-HOUR DEMAND METER
WHM	WATT-HOUR METER
WP	WEATHERPROOF, WEATHER PROTECTED
WR	WEATHER RESISTANT
WTP	WATER TREATMENT PLANT
WTR	WATER
WW	WASTEWATER
WWTP	WASTEWATER TREATMENT PLANT
XFMR	TRANSFORMER
XP	EXPLOSION PROOF

ELECTRICAL NOTES

1. THIS IS A GENERALIZED LEGEND SHEET. THIS CONTRACT MAY NOT USE ALL INFORMATION SHOWN.
2. THE INSTALLATION OF ALL EQUIPMENT, RACEWAYS, CONDUCTORS, AND CABLES SHOWN ON THESE DRAWINGS OR DESCRIBED IN THE SPECIFICATIONS SHALL CONFORM TO THE REQUIREMENTS SET FORTH IN THE LATEST EDITIONS OF THE NATIONAL ELECTRICAL CODE AND ALL APPLICABLE LOCAL CODES AND UTILITY COMPANY STANDARDS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO CONTACT THE UTILITY COMPANY AND VERIFY THEIR REQUIREMENTS.
3. ELECTRICAL CONTRACTOR SHALL VISIT THE SITE PRIOR TO BIDDING THE PROJECT TO VERIFY THE SCOPE OF WORK WITH FIELD CONDITIONS. PARTICULAR ATTENTION SHOULD BE GIVEN TO NEW CONDUIT RUNS IN EXISTING BUILDINGS.
4. NOTIFY THE ENGINEER IMMEDIATELY IN WRITING IF CONFLICTS IN EQUIPMENT LOCATIONS ARE DISCOVERED OR IF PROBLEMS ARISE DUE TO FIELD CONDITIONS, LACK OF INFORMATION OR ANY OTHER REASON. NO PAYMENT WILL BE MADE FOR CHANGES WHICH HAVE NOT BEEN FAVORABLY REVIEWED BY THE ENGINEER.
5. CONDUIT ROUTING SHOWN ON PLAN DRAWINGS IS DIAGRAMMATIC ONLY. RACEWAYS SHALL BE INSTALLED IN A MANNER TO PREVENT CONFLICTS WITH EQUIPMENT OR STRUCTURAL CONDITIONS. EXPOSED RACEWAYS SHALL BE INSTALLED PARALLEL OR PERPENDICULAR TO BEAMS AND WALLS. REFER ALSO TO THE CONTRACT SPECIFICATIONS.
6. VERIFY THE EXACT LOCATION OF TERMINAL BOXES AND CONDUIT ENTRANCES TO ALL EQUIPMENT AGAINST APPROVED SHOP DRAWINGS BEFORE STUBBING UP CONDUITS. CONDUIT STUB-UPS SHALL NOT BE MORE THAN 6 INCHES FROM THE CENTERLINE OF TERMINAL BOXES.
7. CONNECTIONS BETWEEN RIGID CONDUIT AND MOTOR TERMINAL BOXES OR SIMILAR EQUIPMENT SUBJECT TO VIBRATION SHALL BE FLEXIBLE LIQUID-TIGHT CONDUIT.
8. CONDUITS SHALL BE TERMINATED SO AS TO PERMIT NEAT CONNECTION TO MOTORS AND OTHER EQUIPMENT.
9. CONDUITS FOR FUTURE EQUIPMENT OR EXTENSIONS SHALL BE TERMINATED AS SHOWN IN THE DETAILS OR AS SPECIFIED.
10. LOCATIONS OF PULLBOXES ARE APPROXIMATE. COORDINATE EXACT LOCATION IN THE FIELD TO ENSURE 6 INCHES (MINIMUM) CLEARANCE FROM MECHANICAL PIPING FLOW LINES.
11. ONLY MAJOR PULLBOXES ARE SHOWN. PROVIDE ADDITIONAL PULLBOXES WHERE REQUIRED TO MAKE A WORKABLE INSTALLATION.
12. PERFORM WORK IN ACCORDANCE WITH THE DETAILS WHETHER OR NOT THEY ARE REFERENCED ON THE DRAWINGS.
13. VERIFY ALL COLOR REQUIREMENTS BEFORE ORDERING MATERIALS.
14. THE WIRING DIAGRAMS, QUANTITY AND SIZE OF WIRES AND CONDUIT REPRESENT A SUGGESTED ARRANGEMENT BASED UPON SELECTED STANDARD COMPONENTS OF ELECTRICAL EQUIPMENT. MODIFICATIONS ACCEPTABLE TO THE ENGINEER MAY BE MADE BY THE CONTRACTOR TO ACCOMMODATE EQUIPMENT ACTUALLY PURCHASED. THE BASIC SEQUENCE AND METHOD OF CONTROL MUST BE MAINTAINED AS INDICATED ON THE DRAWINGS AND/OR SPECIFICATIONS.
15. REFER TO THE MECHANICAL DRAWINGS FOR CERTAIN CONTROL DIAGRAMS, EXACT LOCATIONS OF MECHANICAL EQUIPMENT, AND FOR CERTAIN CONNECTIONS TO BE MADE TO ELECTRICAL CIRCUITS.
16. CONDUIT SIZE AND FILL SHALL BE AS INDICATED ON THE CONDUIT AND CABLE SCHEDULES. WHERE NO SIZE IS SHOWN, THE CONDUIT SHALL BE SIZED IN ACCORDANCE WITH THE LATEST EDITION OF THE NATIONAL ELECTRICAL CODE ADOPTED BY THE AUTHORITY HAVING JURISDICTION. MINIMUM CONDUIT SIZE IS 3/4 INCH, EXCEPT WHERE ENCASED OR BURIED. MINIMUM ENCASED OR BURIED CONDUIT SIZE IS 1 INCH.
17. PROVIDE EXPANSION OR EXPANSION AND DEFLECTION FITTINGS FOR ALL CONDUIT RUNS CROSSING EXPANSION JOINTS. REFER TO THE STRUCTURAL DRAWINGS FOR LOCATIONS OF EXPANSION JOINTS.
18. PROVIDE 3/16 INCH NYLON PULL ROPE IN EACH EMPTY CONDUIT.
19. FOR LIGHTING AND RECEPTACLE SYSTEMS, ONLY CIRCUIT NUMBERS ARE SHOWN. PROVIDE ALL NECESSARY CONDUITS, WIRES, FITTINGS, JUNCTION BOXES AND NECESSARY COMPONENTS SHOWN OR NOT SHOWN ON THE DRAWINGS, TO MAKE THE ELECTRICAL INSTALLATION COMPLETE AND OPERATIONAL. SIZE CONDUITS AND WIRING IN ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE. ALL CONDUIT RUNS SHALL BE CONCEALED UNLESS INDICATED OTHERWISE. CIRCUIT LOADING SHALL BE AS INDICATED IN THE PANEL SCHEDULES. ALL LIGHTING AND RECEPTACLE CIRCUITS SHALL INCLUDE GROUND WIRE.
20. MOUNT LUMINAIRES ACCORDING TO THE MOUNTING HEIGHT GIVEN ON THE DRAWINGS, WITH THE DISTANCE BEING MEASURED FROM THE BOTTOM OF THE LUMINAIRE TO THE FINISHED FLOOR. PROVIDE APPROPRIATE BRACKETS AND HARDWARE FOR MOUNTING.
21. ALL RECEPTACLES IN OUTDOOR AND ANTICIPATED WET AREAS SHALL BE GROUND FAULT CIRCUIT INTERRUPTER RECEPTACLES WITH WEATHERPROOF WHILE IN-USE COVERS.
22. ALL FREE STANDING ELECTRICAL EQUIPMENT AND CONTROL PANELS SHALL BE SET ON CONCRETE HOUSEKEEPING PADS WITH LEVELING CHANNELS EMBEDDED IN THE PAD.
23. ALL PANELBOARDS SHALL BE MOUNTED SO THAT THE DISTANCE FROM THE CENTERLINE OF THE TOP CIRCUIT BREAKER OPERATING HANDLE IN THE UPPERMOST POSITION TO THE FINISHED FLOOR SHALL NOT EXCEED 6'-7".
24. ALL SURFACE MOUNTED PANELS AND PANELBOARDS ON THE INTERIOR OF EXTERIOR WALLS ABOVE GRADE OR IN OTHER LOCATIONS CONSIDERED DAMP OR WET SHALL BE MOUNTED SO AS TO MAINTAIN A 1/4 INCH (MINIMUM) AIR SPACE BETWEEN THE ENCLOSURE AND THE WALL.
25. PROVIDE LOCKOUTS IN STRICT ACCORDANCE WITH OWNER'S REQUIREMENTS.
26. REFER TO THE SINGLE LINE DIAGRAMS, EQUIPMENT ELEVATIONS, PANELBOARD SCHEDULES, AND COMPONENT/DEVICE LABELS IN THE CONTROL SCHEMATICS FOR NAMEPLATE INFORMATION. SEE THE CONTRACT SPECIFICATIONS FOR NAMEPLATE SIZE, COLOR, MATERIAL, AND PLACEMENT REQUIREMENTS.
27. "NORMAL" STATUS OF SWITCHES OR CONTACTS SHOWN IN CONTROL SCHEMATICS IS THE SHELF POSITION.

ELECTRICAL DEMOLITION NOTES

1. BIDDING CONTRACTORS SHALL VISIT THE SITE TO ASSESS THE SCOPE OF DEMOLITION, REMOVAL AND MODIFICATION WORK.
2. ELECTRICAL CONTRACTOR AND THE OWNER SHALL DE-ENERGIZE ALL WIRING PRIOR TO REMOVAL OF EQUIPMENT, DEVICES, MOTORS INSTRUMENTATION, CONTROL PANELS, ETC. CONTRACTOR SHALL OBTAIN PRIOR APPROVAL FROM THE OWNER.
3. EXPOSED RACEWAYS: REMOVE CONDUIT, WIRES, AND BOXES. PATCH TO MATCH EXISTING. FINISH ALL OPENINGS LEFT IN WALLS AND FLOORS.
4. CONCEALED CONDUITS IN THE SLAB: REMOVE EXISTING WIRES TO THE EXTENT POSSIBLE AND ABANDON CONDUITS IN THE SLAB. CUT CONDUIT FLUSH AND PATCH THE FLOOR TO MATCH EXISTING.
5. CONTROL PANELS: ELECTRICAL CONTRACTOR SHALL DE-ENERGIZE AND REMOVE ALL CONDUIT AND WIRE AS DESCRIBED IN NOTES 3 AND 4. CONTRACTOR SHALL REMOVE PANELS AS NOTED ON THE CONTRACT DRAWINGS.
6. MOTOR CONTROL CENTERS: DISCONNECT AND REMOVE ALL CONDUITS AND WIRING TO EXISTING STARTERS AND/OR BREAKERS, PANELBOARDS, BRANCH CIRCUITS, INTERLOCKS AND STATUS WIRING WITHIN MCC.
7. REFER TO THE CONTRACT SPECIFICATIONS FOR ADDITIONAL ELECTRICAL DEMOLITION AND REMOVAL REQUIREMENTS.

RECORD DRAWING

NO	REVISION	DATE	BY

DESIGNED

DRAWN

CHECKED

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON

CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

DEPARTMENT OF ECOLOGY State of Washington

Kennedy Jenks

GENERAL ELECTRICAL ABBREVIATIONS AND NOTES

SCALE AS SHOWN
JOB NO 2196008.00
DATE MAY 2025
SHEET 13 OF 24
E-01

SINGLE LINE DIAGRAM SYMBOLS

BUS

BUS (EXISTING)

FEEDER

FEEDER (EXISTING)

X — AMPS FRAME; 100A / 70A; AMPS TRIP
LOW VOLTAGE THERMAL-MAGNETIC CIRCUIT BREAKER
3-POLE EXCEPT WHERE NOTED
X = CIRCUIT NUMBER OR LOCATION (SEE ELEVATION)

X — AMPS CONTINUOUS; 100A / MCP
LOW VOLTAGE MOTOR CIRCUIT PROTECTOR
3-POLE EXCEPT WHERE NOTED
X = CIRCUIT NUMBER OR LOCATION (SEE ELEVATION)

400AF / 200AT
LOW VOLTAGE DRAWOUT CIRCUIT BREAKER
INCLUDING L-S-I-G SETTINGS UNLESS NOTED OTHERWISE
L = LONG TIME
S = SHORT TIME
I = INSTANTANEOUS
G = GROUND FAULT

52 — MEDIUM VOLTAGE DRAWOUT CIRCUIT BREAKER

FVNR # — FULL VOLTAGE COMBINATION STARTER
WITH CONTROL POWER TRANSFORMER
\# = NEMA SIZE
FVR = REVERSING TYPE
FVNR = NON-REVERSING TYPE

RVSS A — REDUCED VOLTAGE STARTER
WITH CONTROL POWER TRANSFORMER
RATING IN AMPERES AS INDICATED
RVSS = SOLID STATE TYPE
RVAT = AUTO-TRANSFORMER TYPE

VFD A — VARIABLE FREQUENCY DRIVE
WITH CONTROL POWER TRANSFORMER
RATING IN AMPERES AS INDICATED

30A — DISCONNECT SWITCH
3 POLE EXCEPT WHERE NOTED
RATING IN AMPERES AS INDICATED

30A / 25A — FUSED DISCONNECT SWITCH
3 POLE EXCEPT WHERE NOTED
RATINGS IN AMPERES AS INDICATED

480:120 (3) — POTENTIAL TRANSFORMER
RATIO AND NUMBER OF PT'S AS INDICATED

(3) — CURRENT TRANSFORMER
RATIO AND NUMBER OF CT'S AS INDICATED

* — METERING DEVICE
* = METER TYPE
WHM = WATT HOUR METER; VM = VOLTMETER
WM = WATT METER; PFM = POWER FACTOR METER
AM = AMMETER; SSM = SOLID STATE METER

\# — RELAY DEVICE FUNCTION
\# PER ANSI NUMBER C37.2

15/25	AUTO SYNCHRONIZER RELAY	50/51N	INST/TIME RESIDUALLY CONNECTED GND OVERCURRENT
25	SYNCHRONISM CHECK RELAY	51G	GND FAULT RELAY
27	UNDERVOLTAGE RELAY	52	POWER CIRCUIT BREAKER
27/59	UNDER/OVERVOLTAGE RELAY	55	POWER FACTOR TRIP RELAY
32	DIRECTIONAL POWER RELAY	60	VOLTAGE BALANCE
37	UNDERCURRENT RELAY	62	TIME DELAY
38	HIGH TEMP (BEARING)	65	GOVERNOR LOAD SHARING/SOFT LANDING CONTROL
39	VIBRATION RELAY	66	TIME BETWEEN STARTS RELAY
40	LOSS OF FIELD/UNDER EXCITATION RELAY	67	DIRECTIONAL REVERSE VAR/KW RELAY
41	FIELD CONTACTOR	71L	LOW OIL LEVEL RELAY
43	SELECTOR SWITCH	81O/U	OVER/UNDER FREQUENCY RELAY
46	CURRENT IMBALANCE RELAY	83	CONTROL POWER TRANSFORMER
47	PHASE SEQUENCE/FAILURE RELAY	86	UTILITY LOCKOUT RELAY
48	GROUND FAULT INCOMPLETE SEQUENCE RELAY	87TL	TRANSFORMER DIFFERENTIAL RELAY
49	HIGH TEMP (OIL OR STATOR)	87M	MOTOR DIFFERENTIAL RELAY
50/51	INST/TIME OVERCURRENT RELAY	90	VAR/PF AND CROSS CURRENT COMPENSATION CONTROLLER
50/51G	INST/TIME DIRECTLY CONNECTED GND OVERCURRENT RELAY		

K — KEY INTERLOCK

ST — SHUNT TRIP

SSMP — SOLID STATE MOTOR PROTECTIVE DEVICE

SPD — SURGE PROTECTIVE DEVICE

EARTH GROUND CONNECTION

LIGHTNING ARRESTOR AND SURGE CAPACITOR

HP, FLA — MOTOR
HORSEPOWER AND FULL LOAD AMPERES AS INDICATED

\# KW, A — PACKAGED EQUIPMENT
LOAD (IN KW OR KVA) AND AMPERES AS INDICATED

MOV — ELECTRICAL MOTOR OPERATED VALVE
WITH INTEGRAL REVERSING STARTER

TERMINATOR / POTHEAD

POWER OR DISTRIBUTION TRANSFORMER
CONFIGURATION AND RATING AS INDICATED

DELTA-WYE

DELTA-WYE GROUNDED

DELTA-DELTA

GEN — GENERATOR
RATINGS AS INDICATED

AUTOMATIC OR MANUAL TRANSFER SWITCH
RATING AND CONFIGURATION AS INDICATED

5 — CAPACITOR
RATING IN KVAR AS INDICATED

A SEC — NEUTRAL GROUNDING RESISTOR
CURRENT RATING IN AMPERES AS NOTED
TIME RATING IN SECONDS AS NOTED

\# — CONTACTOR
NUMBER INDICATES NEMA SIZE

OVERLOAD (THERMAL OR SOLID STATE)

5A — FUSE
SIZE AS INDICATED

AS — AMMETER SWITCH

VS — VOLTMETER SWITCH

RECEPTACLE, 120V

SPECIAL RECEPTACLE, 208V OR 240V, 1-PHASE

SPECIAL/WELDING RECEPTACLE, 208V OR 240V, 3-PHASE

SPECIAL RECEPTACLE, 480V, 3-PHASE

CONTROL SCHEMATIC SYMBOLS

CONDUCTORS - NOT CONNECTED

CONDUCTORS - CONNECTED

TERMINAL

** # — CONTROL DEVICE COIL
** = TYPE
CR = CONTROL RELAY
TD = TIME DELAY RELAY
ISR = INTRINSICALLY SAFE RELAY
PC = PHOTOCELL

CR 1 — XXXX, XXXX
NORMALLY OPEN CONTACT LINE REFERENCE
NORMALLY CLOSED CONTACT LINE REFERENCE

SV-# — SOLENOID COIL

CR# CR# — CONTACT
NORMALLY OPEN / CLOSED

MCP, 5A — CIRCUIT BREAKER OR MCP AS NOTED
1-POLE / 3-POLE

OL — OVERLOAD (THERMAL OR SOLID STATE)

DISCONNECT SWITCH
1-POLE / 3-POLE

M — MOTOR

CONTROL POWER TRANSFORMER

BATTERY

5A — FUSE
RATING IN AMPERES

EARTH GROUND CONNECTION

CHASSIS GROUND CONNECTION
(NOT NECESSARILY EARTH GROUNDED)

DI — DIGITAL INPUT TO PLC/RTU/DCS

DIGITAL OUTPUT FROM PLC/RTU/DCS
NORMALLY OPEN

DIGITAL OUTPUT FROM PLC/RTU/DCS
NORMALLY CLOSED

AI — ANALOG INPUT TO PLC/RTU/DCS
4-20 mA (UNLESS INDICATED OTHERWISE)

AO — ANALOG OUTPUT FROM PLC/RTU/DCS
4-20 mA (UNLESS INDICATED OTHERWISE)

SINGLE POLE SWITCH
NORMALLY OPEN / CLOSED

H O A; XOO; OOX — THREE-POSITION SELECTOR SWITCH
X: INDICATES CONTACTS CLOSED
H-O-A: HAND-OFF-AUTO
L-O-R: LOCAL-OFF-REMOTE
O-S-C: OPEN-STOP-CLOSE

L R; XOO; OOX — TWO-POSITION SELECTOR SWITCH
X: INDICATES CONTACTS CLOSED
L-R: LOCAL-REMOTE
O-C: OPEN-CLOSE
A-M: AUTO-MANUAL

O S C; XOO; OOX — THREE-POSITION SELECTOR SWITCH
WITH SPRING-RETURN MOMENTARY CONTACT

E-STOP E-STOP — EMERGENCY PUSHBUTTON
NORMALLY OPEN / CLOSED

PUSHBUTTON
NORMALLY OPEN / CLOSED

MULTI-POSITION SELECTOR SWITCH

X — PUSH-TO-TEST INDICATING LIGHT
X = COLOR
A = AMBER
B = BLUE
G = GREEN
R = RED
W = WHITE

X — INDICATING LIGHT

ETM — ELAPSED TIME METER

BUZZER

BELL

HORN

RESISTANCE TEMPERATURE DETECTOR (RTD)

HEATER

COMMUNICATION JACK
(ETHERNET UNLESS INDICATED OTHERWISE)

RECEPTACLE, 120V

NGR — NEUTRAL GROUNDING RESISTOR

1 — LOCATION SYMBOL
LEGEND SHOWN ON SCHEMATIC DRAWINGS
ALL DEVICES ARE LOCATED IN THE MCC
UNLESS INDICATED OTHERWISE

POTENTIOMETER

REACTOR (LINE OR LOAD DEPENDING ON PLACEMENT)

SENSING SWITCHES		
CLOSE ON		SENSED VARIABLE
RISING	FALLING	
FS	FS	FLOW
LS	LS	LEVEL
PS	PS	PRESSURE
TS	TS	TEMPERATURE

LIMIT SWITCHES	
ZS	NORMALLY OPEN,CLOSE ON REACHING LIMIT
ZS	NORMALLY CLOSED, OPEN ON REACHING LIMIT

TORQUE SWITCH
NORMALLY CLOSED, OPEN ON INCREASING TORQUE

TIMED CONTACTS			
SYMBOL	NORMAL	OPEN TO CLOSED	CLOSED TO OPEN
TR	OPEN	DELAYED	INSTANTANEOUS
TR	CLOSED	INSTANTANEOUS	DELAYED
TR	OPEN	INSTANTANEOUS	DELAYED
TR	CLOSED	DELAYED	INSTANTANEOUS

RECORD DRAWING

NO	REVISION	DATE	BY

DESIGNED
DRAWN
CHECKED

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

Kennedy Jenks

GENERAL ELECTRICAL LEGEND - I

SCALE: AS SHOWN
JOB NO: 2196008.00
DATE: MAY 2025
SHEET 14 OF 24
E-02

PLAN SYMBOLS

CONDUIT AND RACEWAYS

CONDUIT - MULTIPLE IN DUCT BANK
MULTIPLE CONDUIT RUN
CONDUIT - ENCASED OR UNDERGROUND
CONDUIT - EXPOSED OR CONCEALED
P-135 — CALLOUT INDICATING CONDUIT PER SCHEDULE
HOME RUN TO PANELBOARD OR AS INDICATED (3/4 " CONDUIT, 2 #12, 1 #12 GND UNLESS INDICATED OTHERWISE)
FLEXIBLE CONDUIT
CONDUIT RUN, CONTINUES ON SAME SHEET OR AS NOTED
CONDUIT - CAPPED OR SEALED
OPEN CIRCLE DENOTES UPWARD CONDUIT RISER
SEMI CIRCLE DENOTES DOWNWARD CONDUIT RISER
J — JUNCTION BOX
HH-# — UNDERGROUND RACEWAY HANDHOLE DIMENSIONS AS NOTED
MH-# — UNDERGROUND RACEWAY MANHOLE DIMENSIONS AS NOTED

EQUIPMENT

M — MOTOR
PANEL OR CABINET - AS LABELED SWBD, SWGR, MCC, LP, PNLBD, PLC, ETC

GROUNDING

BARE COPPER GROUND TO GROUND WIRE IN SLAB, OR UNDERGROUND GROUND GRID, SIZE AS NOTED
GROUND CONNECTION - BOLTED
GROUND CONNECTION - EXOTHERMICALLY WELDED
GROUND ROD - IN WELL WITH BOX
GROUND ROD - BURIED

FIRE PROTECTION

F — FIRE ALARM PULL STATION
FIRE ALARM STROBE
FIRE ALARM HORN
FIRE ALARM HORN/STROBE
SD — SMOKE DETECTOR
HD — HEAT DETECTOR

LIGHTING

A / * — LUMINAIRE CALLOUT
A = LUMINAIRE TYPE
* = APPROXIMATE MOUNTING HEIGHT AFF
CLG = CEILING MOUNT
(SEE LUMINAIRE SCHEDULE FOR MORE DETAILS)

X-#a — LUMINAIRE - STRIP OR TROFFER TYPE (SWITCHED/UNSWITCHED)
X = LIGHTING PANEL DESIGNATION
# = CIRCUIT NUMBER
a = SWITCH DESIGNATION

WALL MOUNTED LUMINAIRE (SWITCHED/UNSWITCHED)
PENDANT/CEILING MOUNTED LUMINAIRE (SWITCHED/UNSWITCHED)
POLE, BRACKET, ARM, AND MOUNTED LUMINAIRE
RECESSED CAN LUMINAIRE (SWITCHED/UNSWITCHED)
EMERGENCY LUMINAIRE WITH SELF CONTAINED BATTERY
WALL/CEILING MOUNTED EXIT LIGHT DIRECTIONAL ARROW WHERE INDICATED, SHADED AREA INDICATES ILLUMINATED FACE

$ X-#a * — LIGHT SWITCH
X = LIGHTING PANEL DESIGNATION
# = CIRCUIT NUMBER
a = SWITCH DESIGNATION
* = SWITCH TYPE
1 — 1 WAY
3 — 3 WAY
4 — 4 WAY
D — DIMMER

M — MOTION SENSOR
O — OCCUPANCY SENSOR
PC — PHOTOCELL
TC — TIME CLOCK

RECEPTACLES

X-# * — DUPLEX RECEPTACLE, 120V, WALL MOUNT NEMA 5-20R CONFIGURATION
X = LIGHTING PANEL DESIGNATION
# = CIRCUIT NUMBER
* = RECEPTACLE TYPE
WP — WEATHERPROOF
XP — EXPLOSION PROOF
GFCI — GROUND FAULT CIRCUIT INTERRUPTER

X-# * — DUPLEX RECEPTACLE, 120V, FLOOR MOUNT NEMA 5-20R CONFIGURATION

X-# A — SINGLE SPECIAL RECEPTACLE, 208V OR 240V, 1-PHASE
X = PANEL DESIGNATION
# = CIRCUIT NUMBER
A = AMPERAGE

X-# A — SINGLE SPECIAL/WELDING RECEPTACLE, 208V OR 240V, 3-PHASE
X = PANEL DESIGNATION
# = CIRCUIT NUMBER
A = AMPERAGE

X-# A — SINGLE SPECIAL RECEPTACLE, 480V, 3-PHASE
X = PANEL DESIGNATION
# = CIRCUIT NUMBER
A = AMPERAGE

SECURITY AND COMMUNICATION

ANTENNA

VC * — VIDEO CAMERA
* = TYPE
F — FIXED
PTZ — PAN-TILT-ZOOM
360 — 360 DEGREE FIXED

* — SECURITY ACCESS DEVICE
* = TYPE
CR — CARD READER
KS — KEY SWITCH
KP — KEYPAD
RF — RADIO FREQUENCY ID

TELEPHONE OUTLET WALL MOUNTED/FLOOR MOUNTED
DATA OUTLET WALL MOUNTED/FLOOR MOUNTED
TELEPHONE/DATA COMBINATION OUTLET WALL MOUNTED/FLOOR MOUNTED
TV — TELEVISION ANTENNA/CABLE OUTLET

MISCELLANEOUS

DISCONNECT SAFETY SWITCH
INSTRUMENT

$ X-# * — SWITCH - SPECIAL PURPOSE
X = LIGHTING PANEL DESIGNATION
# = CIRCUIT NUMBER
* = SWITCH TYPE
M — MOTOR RATED
K — KEY OPERATED
T — TIMER

T — THERMOSTAT

RECORD DRAWING

This record drawing has been prepared based on unverified information compiled and provided by others to the preparer. The preparer is not responsible for any inaccuracies, errors, or omissions which may have been incorporated into the document. Users of this record drawing assume all risk of loss resulting from its use. Users of this document in editable electronic formats are cautioned against use without first determining whether changes may have been made subsequent to its preparation. The original signed and sealed copy of this document is the only true record of the contract document.

NO	REVISION	DATE	BY

DESIGNED
DRAWN
CHECKED

DEPARTMENT OF ECOLOGY State of Washington

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

Kennedy Jenks

GENERAL ELECTRICAL LEGEND - II

SCALE	AS SHOWN
JOB NO	2196008.00
DATE	MAY 2025
SHEET	15 OF 24
	E-03

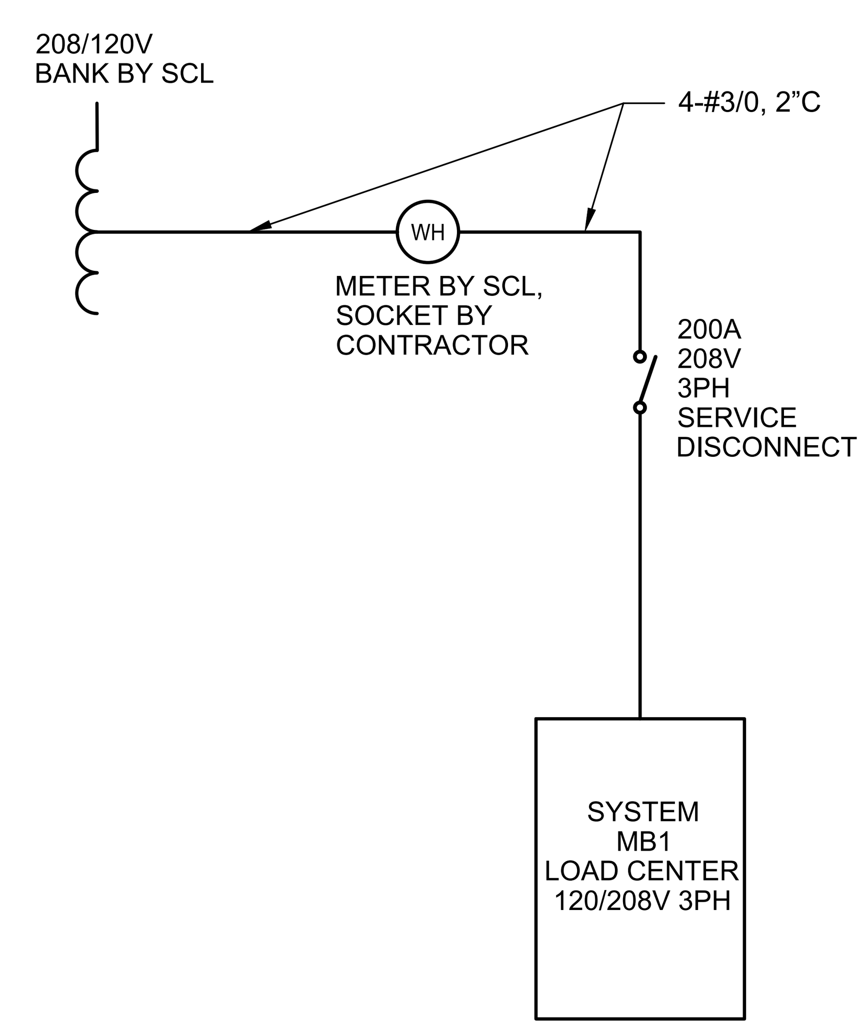
Plot Date: 5/9/2025 9:23 AM

User: RICARDO MEJIA

pw:\\kjce-pw.bentley.com:kjce-pw\Documents\Clients\WA Department of Ecology\Projects\Circle K Cleanup_2196008.00\10-Design\10.06-Drawings\Electrical\219600800-E-04

GENERAL SHEET NOTES

1. ELECTRICAL LOADS ARE DOCUMENTED ON CP-1.



RECORD DRAWING

This record drawing has been prepared based on unverified information compiled and provided by others to the preparer. The preparer is not responsible for any inaccuracies, errors, or omissions which may have been incorporated into the document. Users of this record drawing assume all risk of loss resulting from its use. Users of this document in editable electronic formats are cautioned against use without first determining whether changes may have been made subsequent to its preparation. The original signed and sealed copy of this document is the only true record of the contract document.

NO	REVISION	DATE	BY

DESIGNED

DRAWN

CHECKED

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON

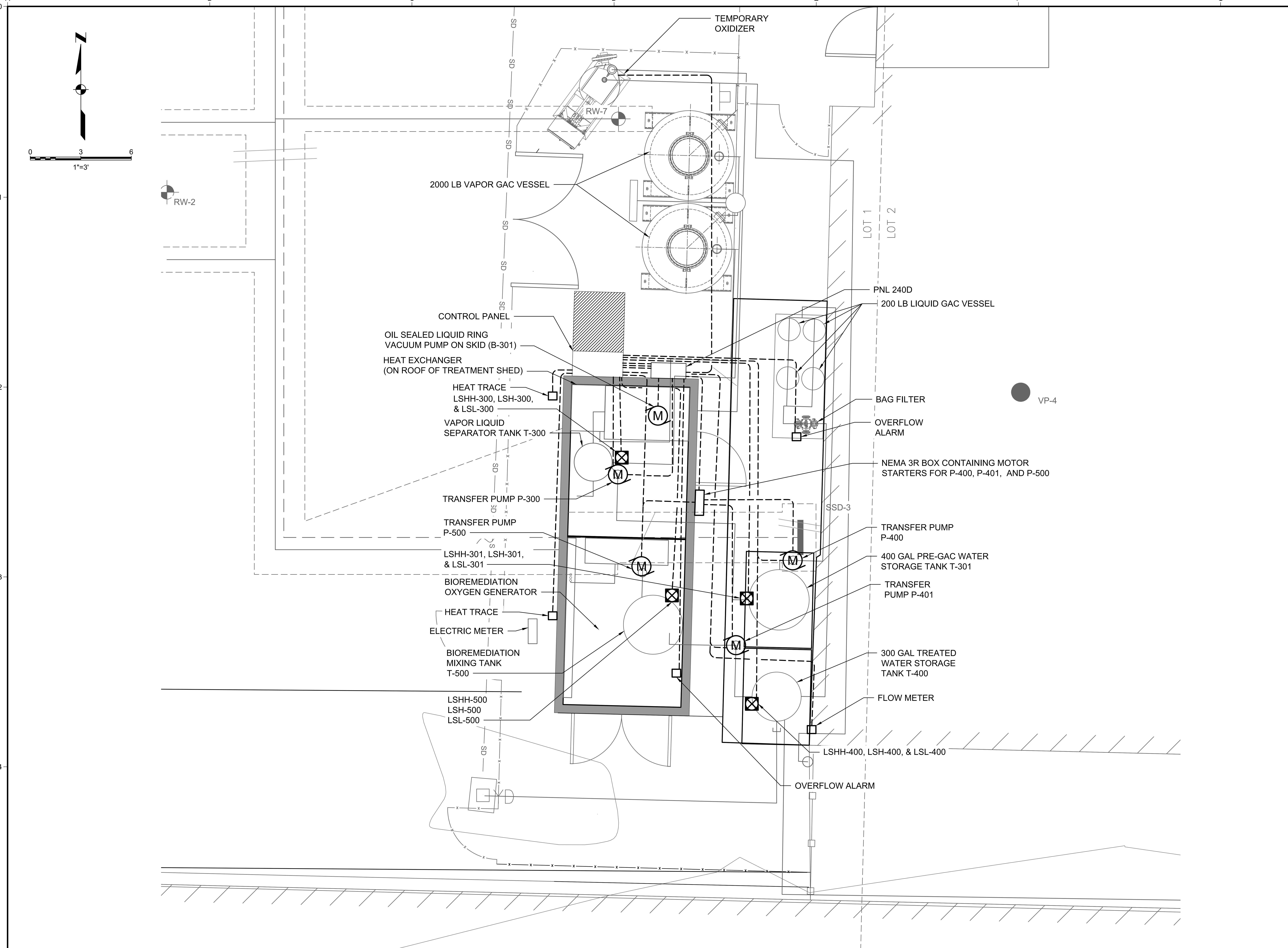
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

Kennedy Jenks

ELECTRICAL
PANEL SCHEDULE AND THREE LINE DIAGRAM

SCALE	AS SHOWN
JOB NO	2196008.00
DATE	MAY 2025
SHEET	16 OF 24

E-04



GENERAL SHEET NOTES

1. ALL CONDUITS SHOWN ARE SCHEMATIC, AND NOT THE ACTUAL PATH FROM ONE END TO THE OTHER. ROUTE ALL CONDUITS UNDER PAVEMENT OR OVERHEAD AS NECESSARY TO AVOID TRIPPING OR OTHER HAZARDS. UNDER PAVEMENT CONDUIT MAY BE PVC SCHEDULE 80. ABOVE GROUND AND TRANSITIONAL PIECES SHALL BE RIGID GALVANIZED STEEL CONDUIT. SIZE IN COMPLIANCE WITH CONDUIT FILL REQUIREMENTS OF THE NATIONAL ELECTRICAL CODE.
2. PROVIDE EQUIPMENT AS SHOWN IN PREFABRICATED SHELTER STRUCTURE. PREWIRED TO ALL INTERNAL ELECTRICAL COMPONENTS, AND WIRED TO EXTERNAL ABUTTING PANELS FOR CONTROL AND POWER. THE "VACUUM BLOWER" UNIT AND ASSOCIATED EQUIPMENT HAVE BEEN EVALUATED AS MAKING THE ENCLOSED SPACE CLASS 1, GROUP D, DIVISION 2 PER NEC ARTICLE 501, AND MUST BE INSTALLED IN COMPLIANCE WITH INSTALLATIONS IN SUCH A SPACE. THE "DO-IT" UNIT AND ASSOCIATED EQUIPMENT ARE UNCLASSIFIED IN AN ENCLOSED SPACE. THE CONTRACTOR MAY MITIGATE THE CLASSIFIED SPACE BY MAKING ALL EQUIPMENT IN A SINGLE SPACE SUITABLE FOR DIVISION 2 OR MAY SEPARATE THE EQUIPMENT INTO TWO SPACES. PROVIDE ALL SEALS AND OTHER APPURTENANCES REQUIRED BY NEC AT THE BOUNDARY BETWEEN THE CLASSIFIED SPACE AND THE EXTERIOR OF THE SHELTER.
3. PROVIDE CONTROL PANEL WITH PROGRAMMABLE LOGIC CONTROLLER (PLC) FOR ALL EQUIPMENT AT THE SITE. CONTRACTOR SHALL COORDINATE INTERNAL SHELTER WIRING AND EXTERNAL WIRING AS SHOWN. PROVIDE LOCAL HMI FUNCTIONALITY AND AUTODIALING OF ALARM CONDITIONS. SEE SPECIFICATION 02 71 00 (GROUNDWATER TREATMENT) FOR DETAILS REGARDING FUNCTION OF CONTROL AND COMMUNICATION SYSTEM.
4. PANEL PNL-240D IS SHOWN WITH ALL CIRCUITS FOR THE SITE ANTICIPATED, BOTH INTERNAL AND EXTERNAL TO THE SHELTER. CONNECT ALL INTERNAL LOADS FROM THE SHELTER AND ALL EXTERNAL LOADS AS SHOWN. IF ACTUAL LOADS DEVIATE FROM INDICATED LOADS, OR ADDITIONAL LOADS ARE ADDED OR INDICATED LOADS ARE DELETED, CONTRACTOR SHALL PREPARE REVISED PANEL SCHEDULE AND LOAD SUMMARY TO SUBMIT TO AHJ FOR APPROVAL.
5. LOCATIONS SHOWN ARE FOR CONCEPTUAL PURPOSES ONLY. ACTUAL EQUIPMENT AND PIPING LOCATIONS SHALL BE COORDINATED BY THE CONTRACTOR.

RECORD DRAWING

This record drawing has been prepared based on unverified information compiled and provided by others to the preparer. The preparer is not responsible for any inaccuracies, errors, or omissions which may have been incorporated into the document. Users of this record drawing assume all risk of loss resulting from its use. Users of this document in editable electronic formats are cautioned against use without first determining whether changes may have been made subsequent to its preparation. The original signed and sealed copy of this document is the only true record of the contract document.

NO	REVISION	DATE	BY

SCALES 0 3'

DESIGNED
DRAWN
CHECKED

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

Kennedy Jenks

ELECTRICAL
SITE PLAN

SCALE 1" = 3'
JOB NO 2196008.00
DATE MAY 2025
SHEET 17 OF 24
E-05

Plot Date: 5/9/2025 8:37 AM
User: RICARDO MEJIA
pw:\\kjce-pw.bentley.com:kjce-pw\Documents\Clients\WA Department of Ecology\Projects\Circle K Cleanup_2196008.00\10-Design\10.06-Drawings\Electrical\2196000800-E-05

INSTRUMENT CALLOUTS AND TAG SCHEMA

FIRST LETTER
SUCCEEDING LETTER(S)
LIT
123
LOOP NUMBER (SEE NOTE 5)

TYPICAL TAG FORMAT
LIT-123 INSTRUMENT TAG NUMBER
LIT FUNCTIONAL IDENTIFICATION
L FIRST LETTER
IT SUCCEEDING LETTER(S)
123 LOOP NUMBER

EXPANDED TAG FORMAT
20LIT-123A INSTRUMENT TAG NUMBER
20 AREA NUMBER
LIT FUNCTIONAL IDENTIFICATION
L FIRST LETTER
IT SUCCEEDING LETTER(S)
123 LOOP NUMBER
A OPTIONAL SUFFIX

	FIRST LETTER (1)		SUCCEEDING LETTERS (15)		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS (2)(3)(4)		ALARM		
B	BURNER, COMBUSTION (2)		USER'S CHOICE (5)	USER'S CHOICE (5)	USER'S CHOICE (5)
C	USER'S CHOICE (3a)(5)			CONTROL (23a)(23e)	CLOSED (27b)
D	DENSITY	DIFFERENTIAL	DAMPER		
E	VOLTAGE (2)		SENSOR (PRIMARY ELEMENT)		
F	FLOW, FLOW RATE (2)	RATIO (FRACTION) (2b)			
G	USER'S CHOICE		GLASS, VIEWING DEVICE (16)		
H	HAND (2)				HIGH (27A)(28A)(29)
I	CURRENT (ELECTRICAL)(2)		INDICATE (17)		
J	POWER (2)		SCAN (18)		
K	TIME, TIME SCHEDULE (2)	TIME RATE OF CHANGE (12c)(13)		CONTROL STATION (24)	
L	LEVEL (2)		LIGHT (19)		LOW (27b)(28)(29)
M	MOISTURE	MOMENTARY			MIDDLE, INTERMEDIATE
N	USER'S CHOICE (5)		USER'S CHOICE (5)	USER'S CHOICE (5)	USER'S CHOICE (5)
O	USER'S CHOICE (5)		ORIFICE, RESTRICTION		OPEN (27a)
P	PRESSURE, VACUUM (2)		POINT (TEST) CONNECTION		
Q	QUANTITY (2)	INTEGRATE, TOTALIZE	INTEGRATE, TOTALIZE		
R	RADIATION (2)		RECORD (20)		RUN
S	SPEED, FREQUENCY (2)	SAFETY (14)		SWITCH (23b)	STOP
T	TEMPERATURE (2)			TRANSMIT	
U	MULTI VARIABLE (2)(6)		MULTIFUNCTION (21)	MULTIFUNCTION (21)	MULTIFUNCTION (21)
V	VIBRATION, MECHANICAL ANALYSIS (2)(4)(7)			VALVE, DAMPER, OR LOUVER (23c)(23e)	
W	WEIGHT, FORCE (2)		WELL, PROBE		
X	UNCLASSIFIED (8)	X AXIS (11c)	ACCESSORY DEVICES (22) UNCLASSIFIED (8)	UNCLASSIFIED (8)	UNCLASSIFIED (8)
Y	EVENT, STATE, PRESENCE (2)(9)	Y AXIS (11c)		RELAY, COMPUTE, CONVERT	
Z	POSITION, DIMENSION (2)	Z AXIS (11c), SAFETY INSTRUMENTED SYSTEM (30)		DRIVER, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	

NOTE: NUMBERS IN PARANTHESES REFER TO EXPLANATORY NOTES IN ANSI/ISA-5.1-2009, SECTION 4.2

	LOCATED IN FIELD VISIBLE AT LOCATION OPERATOR ACCESSIBLE	LOCATED ON MAIN PANEL VISIBLE ON PANEL FRONT OPERATOR ACCESSIBLE	LOCATED IN MAIN PANEL CABINET NOT VISIBLE ON PANEL FRONT NOT OPERATOR ACCESSIBLE	LOCATED ON SECONDARY PANEL VISIBLE ON PANEL FRONT OPERATOR ACCESSIBLE	LOCATED IN SECONDARY PANEL CABINET NOT VISIBLE ON PANEL FRONT NOT OPERATOR ACCESSIBLE
SHARED DISPLAY SHARED CONTROL	A B	A B	A B	A B	A B
PROGRAMMABLE LOGIC CONTROL	A B	A B	A B	A B	A B
COMPUTER FUNCTION	A B C D	A B C D	A B C D	A B C D	A B C D
INSTRUMENT	A B C D	A B C D	A B C D	A B C D	A B C D
PILOT LIGHT	A B C D	A B C D		A B C D	

E F G
A B HH H L LL
A B HH H L LL
A B C D

DISPLAY AND CONTROL SYMBOLS FOR ANALOG MEASURED VARIABLES MAY ALSO INDICATE THE PRESENCE OF DERIVED SETPOINTS USED FOR ALARM GENERATION

LETTER MAPPING:
A: IDENTIFICATION LETTERS (SEE TABLE OR REFER TO ANSI/ISA-5.1-2009; TABLE 4.1)
B: LOOP NUMBER
C: USER DESCRIPTOR/FUNCTION DESIGNATION (SEE LIST THIS SHEET)
D: MEASUREMENT (REFER TO ANSI/ISA-5.1-2009; TABLE 5.2.2)
E: PROCESS CONTROL DESCRIPTOR LINE 1
F: PROCESS CONTROL DESCRIPTOR LINE 2
G: PROCESS CONTROL DESCRIPTOR LINE 3

PLC I/O

A B DISCRETE INPUT
A B ANALOG INPUT
A B DISCRETE OUTPUT
A B ANALOG OUTPUT
A B COMMUNICATION INPUT/OUTPUT (LINETYPE INDICATES PROTOCOL)
ISR INTRINSICALLY SAFE RELAY
LSA LIGHTNING SURGE ARRESTER

MISCELLANEOUS

OFF-SHEET CONNECTORS (ARROW IN DIRECTION OF PROCESS OR CONTROL)

TO/FROM EQUIPMENT ID ← EQUIPMENT TO/FROM IDENTIFIER
I-### X
LINE IDENTIFICATION
TO/FROM DRAWING REFERENCE

TO/FROM EQUIPMENT ID
I-### X
TO/FROM EQUIPMENT ID
I-### X

TOUCHING BUBBLES INDICATE A SINGLE INSTRUMENT OR COMPONENT PERFORMING MULTIPLE FUNCTIONS, OR AN INSTRUMENT WITH INTEGRAL TRANSMITTER

INSTRUMENT WITH REMOTE TRANSMITTER

RELAY INTERLOCK
REFER TO CONTROL SCHEMATICS AND/OR PROCESS CONTROL NARRATIVES FOR BEHAVIOR

FUNCTION DESIGNATIONS

SWITCHES		ANALYTICAL INSTRUMENTS	
A/M	AUTO-MANUAL	ALK	ALKALINITY
ESTOP	EMERGENCY STOP	CL2*	CHLORINE CONCENTRATION
F-R	FORWARD-REVERSE	COMB	COMBUSTIBLE GAS
HOA	HAND-OFF-AUTO	COND	CONDUCTIVITY
HOR	HAND-OFF-REMOTE	DO	DISSOLVED OXYGEN
L/R	LOCAL-REMOTE	H2S	HYDROGEN SULFIDE
LOR	LOCAL-OFF-REMOTE	LEL	LOWER EXPLOSIVE LIMIT
O/C	OPEN-CLOSE	NO3	NITRATE
OCA	OPEN-CLOSE-AUTO	O2	OXYGEN CONCENTRATION
O-O	ON-OFF	O3	OZONE
OSC	OPEN-STOP-CLOSE	ORP	OXIDATION REDUCTION POTENTIAL
POT	POTENTIOMETER	PH	HYDROGEN ION CONCENTRATION
RST	RESET	SO2	SULFUR DIOXIDE
S-S	START-STOP	TH	TOTAL HARDNESS
		TURB	TURBIDITY
		UV	ULTRAVIOLET TRANSMITTANCE OR INTENSITY
		*	NOTED AS TOTAL OR FREE

INSTRUMENT AND EQUIPMENT SERVICES

IA INSTRUMENT AIR SUPPLY (SEE NOTE 4)
ES ELECTRICAL SERVICE (DIFFERENT VOLTAGES ARE SPECIFICALLY NOTED)
POE POWER OVER ETHERNET

LINE SYMBOLOGY

NEW WORK (NOT SCREENED)
EXISTING (SCREENED)
FUTURE (LONG DASH, SHORT DASH)
PROCESS - PRIMARY
PROCESS - SECONDARY
PROCESS - DRAIN
MISCELLANEOUS INSTRUMENT CONNECTION
ELECTRIC BINARY SIGNAL (DISCRETE)
ELECTRICAL SIGNAL (ANALOG)
INSTRUMENT INTERNAL SIGNAL
DATA LINK (SOFTWARE) CONNECTION
CAPILLARY SIGNAL
ELECTROMAGNETIC (RADAR) GUIDED SIGNAL
ELECTROMAGNETIC (RADAR) UNGUIDED/FREE AIR SIGNAL
HYDRAULIC LINK OR CONNECTION
MECHANICAL LINK OR CONNECTION
PNEUMATIC BINARY SIGNAL
PNEUMATIC SIGNAL
P — P — P PROPRIETARY SIGNAL
C — C — C CONTROLNET SIGNAL
D — D — D DEVICENET SIGNAL
E — E — E ETHERNET (TCP/IP) SIGNAL
M — M — M MODBUS (2-WIRE) SIGNAL
PB — PB — PB PROFIBUS SIGNAL
FO — FO — FO FIBER OPTIC SIGNAL
LINE BREAK OR GAP
SIGNAL LINE ARROW
SIGNAL LINES - CONNECTED
SIGNAL LINES - NOT CONNECTED

SIGNAL PROCESSING FUNCTIONS

Σ SUMMING
Δ DIFFERENCE
∫ INTEGRAL
d/dt DERIVATIVE
X MULTIPLYING
÷ DIVIDING
ⁿ√ ROOT EXTRACTION
√ SQUARE ROOT
xⁿ EXPONENTIAL
> HIGH SELECTING
< LOW SELECTING
± BIAS
NONLINEAR OR UNSPECIFIED FUNCTION
/ CONVERT:
E - VOLTAGE
I - CURRENT
P - PNEUMATIC
A - ANALOG
B - BINARY
H - HYDRAULIC
O - ELECTROMAGNETIC/SONIC
R - RESISTANCE (ELECTRICAL)
D - DIGITAL

TYPICAL CONNECTIONS

IN-LINE DEVICE
DIRECT CONNECTION TO PROCESS
TEMPERATURE ELEMENT WITH WELL
FILLED SYSTEM, DIAPHRAGM SEAL CONNECTION
SONIC SENSING
CONDUCTIVE SENSING
ELECTROMAGNETIC (RADAR) SENSING
FLOAT SENSING
BUBBLER SENSING

NOTES

1. SEE THE GENERAL AND ELECTRICAL DISCIPLINE DRAWINGS FOR ADDITIONAL SYMBOLS AND ABBREVIATIONS.
2. SEE THE GENERAL DISCIPLINE DRAWINGS FOR EQUIPMENT DESIGNATIONS AND PROCESS IDENTIFICATION CODES.
3. THIS IS A GENERALIZED LEGEND SHEET. SEE ALSO ISA S5.1, S5.3 AND S7.3.
4. FOR INSTRUMENT AIR QUALITY STANDARDS, REFER TO ISA RP7.7.
5. WHERE LOOP NUMBERS EXCEED THE LENGTH AVAILABLE WITHIN A BUBBLE, THE LOWER HALF OF THE BUBBLE MAY APPEAR BROKEN TO ALLOW SPACE FOR THE LOOP NUMBER.
6. SEE SPECIFICATION 17010 FOR COMPLETE DETAILS OF LOOP DRAWING AND INTERCONNECTION DRAWING SUBMITTAL REQUIREMENTS.
7. POWER SUPPLIES FOR INSTRUMENT LOOPS OR SYSTEMS SHALL BE PROVIDED BY THE INSTRUMENTATION SUPPLIER TO MEET THE VOLTAGE AND CURRENT REQUIREMENTS OF THE COMPONENTS IN EACH LOOP OR SYSTEM.
8. FIELD SWITCHES FOR ELECTRICAL MOTOR OPERATION SHALL BE SUPPLIED BY THE ELECTRICAL CONTRACTOR UNLESS THEY ARE PART OF A VENDOR PACKAGE.

RECORD DRAWING

NO	REVISION	DATE	BY

DESIGNED
DRAWN
CHECKED

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

Kennedy Jenks

P&ID LEGEND

SCALE AS SHOWN
JOB NO 2196008.00
DATE MAY 2025
SHEET 18 OF 24
I-01

Plot Date: 5/20/2025 9:52 AM
User: RICHARD HILLS
pw:\\kjce-pw.bentley.com:kjce-pw\Documents\Clients\WA Department of Ecology\Projects\Circle K Cleanup_2196008.00\10-Design\10.06-Drawings\Civil\KJ_Site_Civil_SHEET.DWG

NOTE:
FOR FURTHER DETAIL, REFER TO THE P&ID DRAWINGS, PREPARED BY PRM FILTRATION, INCLUDED AT THE END OF THIS DRAWING SET FOR INFORMATIONAL PURPOSES.

NOTES:

1. STEEL OR METAL FITTINGS AND VALVES SHALL BE USED WHERE STEEL PIPING IS LOCATED.
2. TREATMENT SYSTEM SHALL BE COMMISSIONED IN ACCORDANCE WITH SPECIFICATION SECTION 01 77 00.
3. LOCATION FOR INSTALLATION OF TEMPORARY DS 300 PITOT TUBE AND DIFFERENTIAL PRESSURE GAUGE FOR STARTUP TESTING.

RECORD DRAWING

This record drawing has been prepared based on unverified information compiled and provided by others to the preparer. The preparer is not responsible for any inaccuracies, errors, or omissions which may have been incorporated into the document. Users of this record drawing assume all risk of loss resulting from its use. Users of this document in editable electronic formats are cautioned against use without first determining whether changes may have been made subsequent to its preparation. The original signed and sealed copy of this document is the only true record of the contract document.

NO	REVISION	DATE	BY

DESIGNED
DRAWN
CHECKED

DEPARTMENT OF ECOLOGY State of Washington

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

Kennedy Jenks

P&ID - I

SCALE AS SHOWN
JOB NO 2196008.00
DATE MAY 2025
SHEET 19 OF 24
I-02

NOTE:
FOR FURTHER DETAIL, REFER TO THE P&ID DRAWINGS, PREPARED BY PRM FILTRATION, INCLUDED AT THE END OF THIS DRAWING SET FOR INFORMATIONAL PURPOSES.

NOTE:

1. STEEL OR METAL FITTINGS AND VALVES SHALL BE USED WHERE STEEL PIPING IS LOCATED. CONNECTIONS USING DISSIMILAR MATERIALS SHALL BE PROHIBITED.
2. FLOW AT FI 400 SHALL BE BETWEEN 4-20 GPM TO ENSURE THAT FLOW THROUGH LIQUID GAC VESSELS IS AT LEAST 2 GPM AND AT MOST 10 GPM.

RECORD DRAWING

This record drawing has been prepared based on unverified information compiled and provided by others to the preparer. The preparer is not responsible for any inaccuracies, errors, or omissions which may have been incorporated into the document. Users of this record drawing assume all risk of loss resulting from its use. Users of this document in editable electronic formats are cautioned against use without first determining whether changes may have been made subsequent to its preparation. The original signed and sealed copy of this document is the only true record of the contract document.

NO	REVISION	DATE	BY

DESIGNED
DRAWN
CHECKED

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON
CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

Kennedy Jenks

P&ID - II

SCALE AS SHOWN
JOB NO 2196008.00
DATE MAY 2025
SHEET 20 OF 24
I-03

Plot Date: 5/20/2025 9:51 AM
User: RICHARD HILLS
pw:\\kjce-pw.bentley.com:kjce-pw\Documents\Clients\WA Department of Ecology\Projects\Circle K Cleanup_2196008.00\10-Design\10.06-Drawings\Civil\KJ_Site,Civil_SHEET.DWG

NOTE:
FOR FURTHER DETAIL, REFER TO THE P&ID DRAWINGS, PREPARED BY PRM FILTRATION, INCLUDED AT THE END OF THIS DRAWING SET FOR INFORMATIONAL PURPOSES.

RECORD DRAWING

This record drawing has been prepared based on unverified information compiled and provided by others to the preparer. The preparer is not responsible for any inaccuracies, errors, or omissions which may have been incorporated into the document. Users of this record drawing assume all risk of loss resulting from its use. Users of this document in editable electronic formats are cautioned against use without first determining whether changes may have been made subsequent to its preparation. The original signed and sealed copy of this document is the only true record of the contract document.

NO	REVISION	DATE	BY

DESIGNED CMW
DRAWN RM
CHECKED LGR

DEPARTMENT OF ECOLOGY State of Washington

WASHINGTON STATE DEPARTMENT OF ECOLOGY
BELLEVUE, WASHINGTON

CIRCLE K SITE 1461 ENVIRONMENTAL REMEDIATION SYSTEM INSTALLATION
SEATTLE, WASHINGTON

Kennedy Jenks

P&ID - III

SCALE AS SHOWN
JOB NO 2196008.00
DATE MAY 2025
SHEET 21 OF 24
I-04

Plot Date: 4/30/2024 4:14 PM

User: CAYLA WHITESIDE

File: C:\bms\kjce-pw\d0181574\219600800-CSC-01.dwg

CONSTRUCTION STORMWATER CONTROL (CSC) GENERAL NOTES

1. A FIRST GROUND DISTURBANCE INSPECTION IS REQUIRED PRIOR TO START OF WORK ON ALL SITES WITH LAND DISTURBING ACTIVITY. SCHEDULE A FIRST GROUND DISTURBANCE INSPECTION FOR AN ISSUED BUILDING PERMIT AT 206-684-8900 OR ONLINE AS DESCRIBED AT http://www.seattle.gov/sdci/inspections/site-development-inspections
2. THE APPLICANT SHALL DESIGNATE AN EROSION AND SEDIMENT CONTROL (ESC) SUPERVISOR WHO SHALL BE RESPONSIBLE FOR THE INSTALLATION AND MAINTENANCE OF EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICES (BMPS). FOR LARGE CONSTRUCTION PROJECTS, THE ESC SUPERVISOR SHOULD BE A CERTIFIED EROSION AND SEDIMENT CONTROL LEAD (CESCL). PROVIDE THE NAME AND PHONE NUMBER OF THE ESC SUPERVISOR TO THE SITE INSPECTOR AT THE FIRST GROUND DISTURBANCE INSPECTION.
3. BMPS SHALL BE INSTALLED PRIOR TO STARTING CONSTRUCTION TO ENSURE SEDIMENT–LADEN WATER DOES NOT LEAVE THE PROJECT SITE OR ENTER ROADSIDE DITCHES, STORM DRAINS, SURFACE WATERS, OR WETLANDS.
4. THE BMPS INCLUDED IN THIS PLAN ARE THE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. THE APPLICANT IS RESPONSIBLE FOR ENSURING THAT BMPS ARE MODIFIED AS NEEDED FOR UNEXPECTED STORM EVENTS OR OTHER UNFORESEEN CIRCUMSTANCES, AND TO ACCOUNT FOR CHANGING SITE CONDITIONS.
5. ANY AREAS OF DISTURBED SOIL THAT WILL NOT BE WORKED FOR TWO CONSECUTIVE DAYS DURING THE WET SEASON (OCT 1 TO APRIL 30) OR SEVEN DAYS DURING THE DRY SEASON (MAY 1 TO SEPT 30) SHALL BE IMMEDIATELY STABILIZED WITH APPROVED BMPS METHODS (E.G. STRAW, MULCH, PLASTIC COVERING, COLD MIX, ETC.)
6. GRADING AND/OR SOIL DISTURBING ACTIVITIES MAY BE LIMITED OR PROHIBITED FOR CERTAIN SITES SUBJECT TO ECA STANDARDS (I.E. ECA STEEP SLOPES, LANDSLIDE PRONE AREAS, ETC.) BETWEEN OCTOBER 31ST AND APRIL 1ST. IF NOTED IN THE GEOTECHNICAL SPECIAL INSPECTIONS REQUIREMENTS, A GRADING SEASON EXTENSION LETTER (GSEL) ISSUED BY SDCI IS REQUIRED FOR ALL GRADING AND/OR SOIL DISTURBING ACTIVITIES DURING THIS PERIOD. THE GEOTECHNICAL SPECIAL INSPECTOR MUST SUBMIT ELECTRONIC APPLICATIONS FOR A GSEL USING THE SDCI PROJECT PORTAL. ALLOW FOUR TO SIX WEEKS FOR PROCESSING. FAILURE TO OBTAIN THE GSEL PRIOR TO OCTOBER 31 MAY RESULT IN A WORK STOPPAGE.
7. CITY STREETS AND SIDEWALKS SHALL BE KEPT CLEAN AT ALL TIMES. NO MATERIAL SHALL BE STORED ON CITY STREETS OR SIDEWALKS WITHOUT A STREET USE PERMIT FROM THE SEATTLE DEPARTMENT OF TRANSPORTATION (SDOT).
8. POLLUTION CONTROL MEASURES SHALL BE FOLLOWED TO ENSURE THAT NO LIQUID PRODUCTS OR CONTAMINATED WATER ENTERS ANY STORM DRAINAGE FACILITIES OR OTHERWISE LEAVES THE PROJECT SITE. ANY HAZARDOUS MATERIALS OR LIQUID PRODUCTS THAT HAVE THE POTENTIAL TO POLLUTE RUNOFF SHALL BE STORED AND DISPOSED OF PROPERLY.
9. ENSURE THAT WASHOUT FROM CONCRETE TRUCKS IS PERFORMED OFF–SITE OR IN DESIGNATED CONCRETE WASHOUT AREAS ONLY. DO NOT WASH OUT CONCRETE TRUCKS ONTO THE GROUND, OR TO STORM DRAINS OR OPEN DITCHES. DO NOT DUMP EXCESS CONCRETE ONSITE, EXCEPT IN DESIGNATED CONCRETE WASHOUT AREAS.
10. ALL AREAS OF DISTURBED SOIL SHALL BE FULLY STABILIZED WITH THE APPROPRIATE SOIL AMENDMENT AND COVER MEASURES AT COMPLETION OF THE PROJECT. TYPICAL COVER MEASURES INCLUDE LANDSCAPING OR HYDROSEED WITH MULCH.

CONSTRUCTION STORMWATER CONTROL (CSC) PLAN REQUIREMENTS / NARRATIVE

SHOW TEMPORARY AND PERMANENT BEST MANAGEMENT PRACTICES (BMPS) IN THE PLAN VIEW OF THIS SHEET THAT WILL ACCOMPLISH THE MINIMUM REQUIREMENTS DESCRIBED IN THE NARRATIVE BELOW. THE BMPS SHOWN IN THE PLAN VIEW OF THIS PLAN ARE THE MINIMUM REQUIRED. ADDITIONAL BMPS ARE REQUIRED WHEN MINIMUM CONTROLS ARE NOT SUFFICIENT TO PREVENT EROSION OR TRANSPORT OF SEDIMENT OR OTHER POLLUTANTS FROM THE SITE.

- MARK CLEARING LIMITS
- DELINEATE ENVIRONMENTALLY CRITICAL AREAS
- RETAIN TOP LAYER AND NATIVE VEGETATION
- ESTABLISH CONSTRUCTION ACCESS
- PROTECT DOWNSTREAM PROPERTIES AND RECEIVING WATERS
- PREVENT EROSION AND SEDIMENT TRANSPORT FROM THE SITE
- STABILIZE SOILS
- PROTECT SLOPES
- PROTECT STORM DRAINS
- STABILIZE CHANNEL AND OUTLETS
- CONTROL POLLUTANTS
- CONTROL DEWATERING
- MAINTAIN AND INSPECT BMPs
- EXECUTE CONSTRUCTION STORMWATER CONTROL PLAN
- MINIMIZE OPEN TRENCHES
- PHASE THE PROJECT
- INSTALL PERMANENT FLOW CONTROL AND WATER QUALITY FACILITIES
- PROTECT STORMWATER BMPs PRIOR TO, DURING, AND AFTER CONSTRUCTION

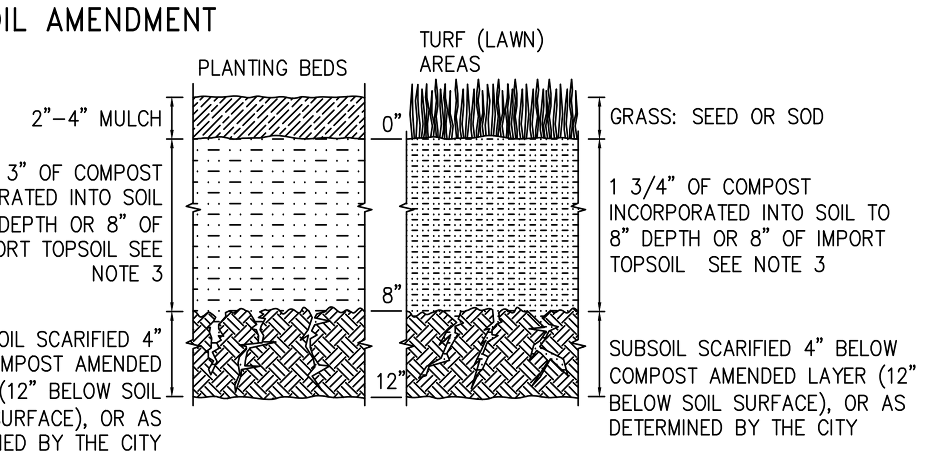
POST CONSTRUCTION SOIL MANAGEMENT PLAN

AT THE END OF PROJECT, ALL AREAS DISTURBED AND NOT COVERED WITH A HARD SURFACE MUST BE AMENDED PER THE SOIL AMENDMENT DETAIL BELOW AND PROBE TO 12–INCHES AT THE SITE FINAL INSPECTION.

LABEL ALL AREAS DISTURBED AND NOT COVERED WITH A HARD SURFACE AS ONE OF THE FOLLOWING: SA (SOIL AMENDMENT AREA) or ND (NON–DISTURBED AREA).

- NON–DISTURBED AREA (ND): VEGETATED AREAS THAT WILL NOT BE SUBJECT TO LAND DISTURBING ACTIVITY DO NOT REQUIRE SOIL AMENDMENT IF THEY ARE FENCED AND CONTINUOUSLY PROTECTED THROUGHOUT CONSTRUCTION. THE FENCING MUST BE IN PLACE AT THE FIRST GROUND DISTURBANCE INSPECTION. NO DISTURBANCE, INCLUDING VEHICLE TRAFFIC OR MATERIAL STORAGE, IS ALLOWED IN THESE AREAS UNTIL FINAL INSPECTION.
- SOIL AMENDMENT AREA (SA): VEGETATED OR COMPOST AREAS (TURF AND LANDSCAPE) MUST BE AMENDED PER THE SOIL AMENDMENT DETAIL. THIS INCLUDES AREAS IMPACTED BY CLEARING AND GRADING, STOCKPILING, SITE ACCESS, PATHWAYS AND MATERIALS OR EQUIPMENT STORAGE.

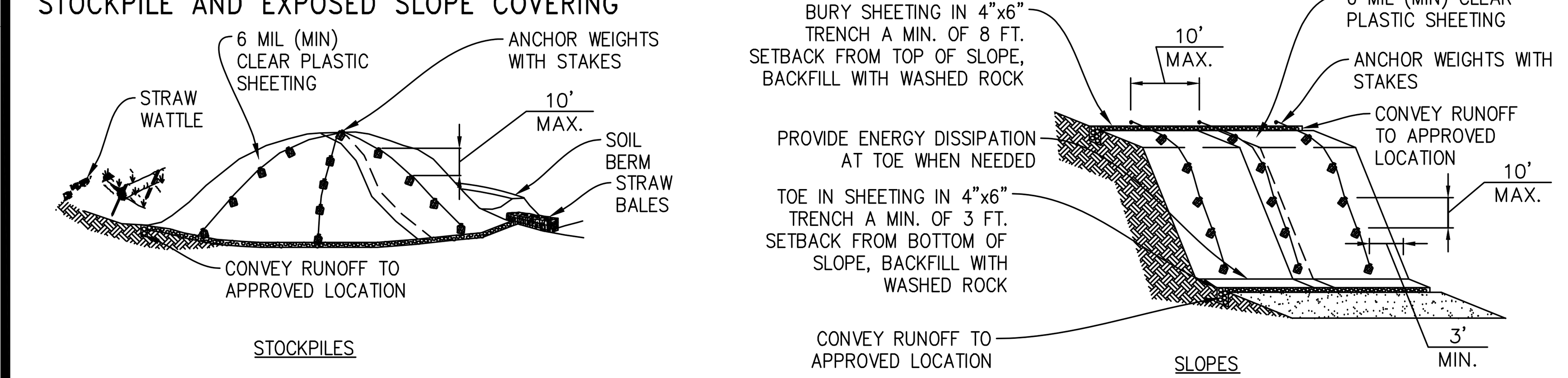
SOIL AMENDMENT



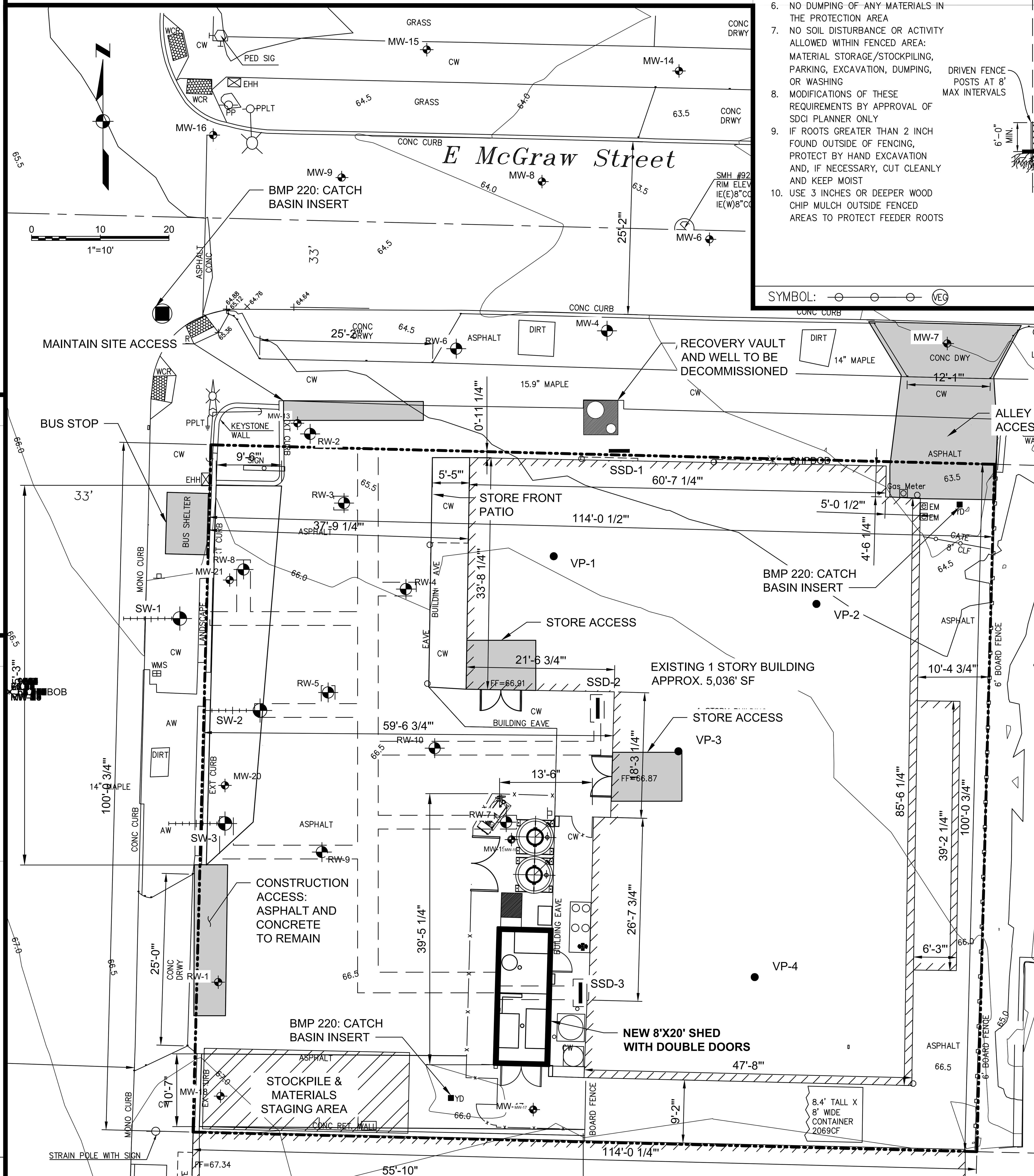
NOTES:
1. POST CONSTRUCTION SOIL AMENDMENT IS REQUIRED ON ALL AREAS NOT COVERED BY HARD SURFACE WHERE SOIL IS DISTURBED DURING CONSTRUCTION.
2. SOIL AMENDMENT MUST PASS A 12 INCH MINIMUM PROBE TEST.
3. IMPORT TOPSOIL, IF USED, MUST MEET THE REQUIREMENTS OF THE SEATTLE STORMWATER MANUAL, VOL. 1, SECTIONS 5.1.5.1 AND 5.1.5.3.

SYMBOL: (SA) AREA REQUIRING SOIL AMENDMENT (ND) NON–DISTURBED AREA (SOIL AMENDMENT NOT REQUIRED)

STOCKPILE AND EXPOSED SLOPE COVERING



SYMBOL: (SP)



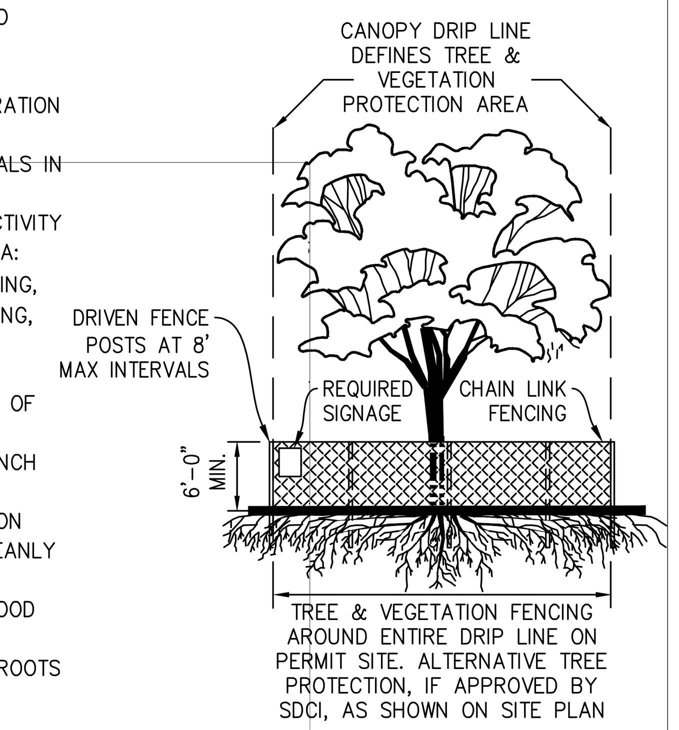
TREE & VEGETATION PROTECTION

TREE PROTECTION FENCING AND SIGN

1. CHAIN LINK FENCE REQUIRED (NO ORANGE CONSTRUCTION FENCE OR PLYWOOD)
2. MINIMUM 6' HIGH
3. FENCE SHALL BE SUPPORTED BY RIGID POSTS DRIVEN INTO THE GROUND AT 8' MAXIMUM INTERVALS
4. MUST BE INSTALLED PRIOR TO DEMOLITION OR GROUND DISTURBANCE
5. KEPT IN PLACE FOR THE DURATION OF CONSTRUCTION
6. NO DUMPING OF ANY MATERIALS IN THE PROTECTION AREA
7. NO SOIL DISTURBANCE OR ACTIVITY ALLOWED WITHIN FENCED AREA: MATERIAL STORAGE/STOCKPILING, PARKING, EXCAVATION, DUMPING, OR WASHING
8. MODIFICATIONS OF THESE REQUIREMENTS BY APPROVAL OF SDCI PLANNER ONLY
9. IF ROOTS GREATER THAN 2 INCH FOUND OUTSIDE OF FENCING, PROTECT BY HAND EXCAVATION AND, IF NECESSARY, CUT CLEANLY AND KEEP MOIST
10. USE 3 INCHES OR DEEPER WOOD CHIP MULCH OUTSIDE FENCED AREAS TO PROTECT FEEDER ROOTS

VEGETATION PROTECTION (DOES NOT APPLY TO TREES)

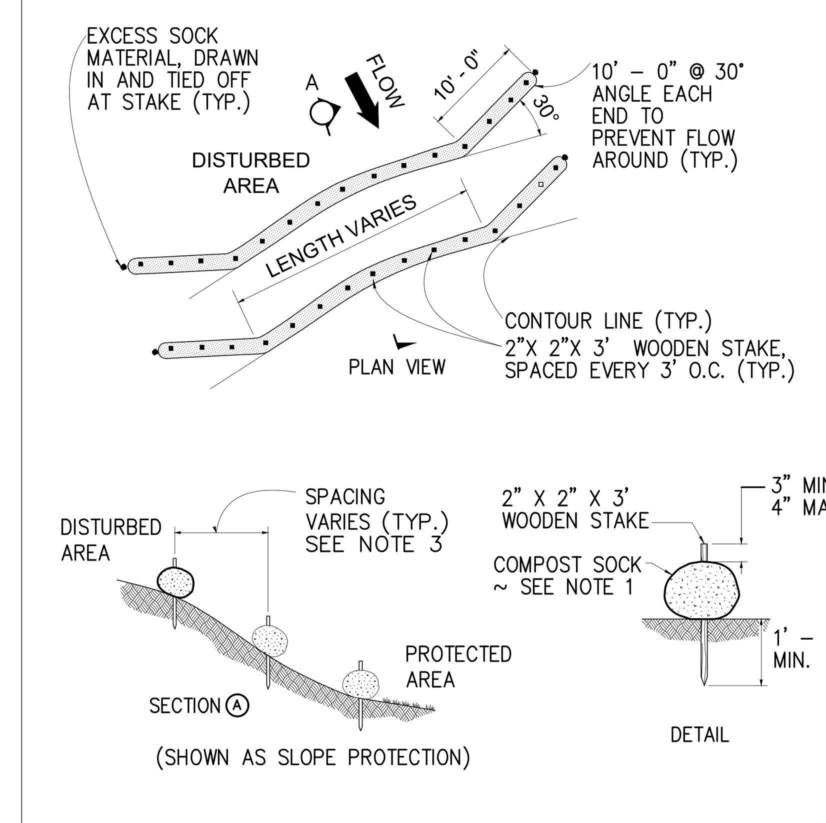
1. ORANGE MESH OR SIMILAR OPEN MATERIAL
2. PROTECT VEGETATION OUTSIDE CONSTRUCTION ZONE WITH FENCING AS SHOWN



LINK TO REQUIRED TREE PROTECTION SIGNAGE:

SYMBOL: (VEG)

COMPOST SOCK



1. COMPOST SOCK SHALL BE IN ACCORDANCE WITH STANDARD SPECIFICATION 9.14.4(9). COMPOST SOCK SHALL BE A MINIMUM OF 10" IN DIAMETER OR SIZED TO SUIT CONDITIONS AS SPECIFIED BY THE ENGINEER.
2. ALWAYS INSTALL COMPOST SOCK PERPENDICULAR TO SLOPE AND ALONG CONTOUR LINES.
3. REMOVE SEDIMENT FROM THE UP SLOPE SIDE OF THE COMPOST SOCK WHEN ACCUMULATION HAS REACHED 1/2 OF THE EFFECTIVE HEIGHT OF THE COMPOST SOCK.
4. MAY BE USED IN PLACE OF FILTER FENCE FOR PREMIER CONTROL.

SYMBOL: (CS)

GENERAL SHEET NOTES

1. STORMWATER FROM ROOF DRAINS DISCHARGE TO CURB WEEP HOLES THAT DRAIN TO STORMWATER MAIN. PARKING LOT CATCH BASIN DISCHARGES TO SANITARY SEWER MAIN.
2. EXISTING DRIVEWAYS SHALL REMAIN PAVED. ALL TRUCKS ENTERING AND LEAVING THE SITE WILL REMAIN ON PAVED ROADS.
3. TRENCH EXCAVATIONS SHALL BE BACKFILLED AS SOON AS POSSIBLE.
4. ANY WATER ACCUMULATED IN TRENCHES WILL BE PUMPED INTO 55-GALLON DRUMS STORED ON SITE. WATER WILL THEN BE CHARACTERIZED FOR OFFSITE DISPOSAL AFTER CONSTRUCTION IS COMPLETED.
5. TRENCH EXCAVATIONS WILL BE COVERED WITH PLASTIC SHEETING TO PREVENT CONTACT OF STORMWATER WITH SOIL UNTIL EXCAVATION HAS BEEN BACKFILLED.
6. ANY SEDIMENT OR SOIL TRACKED ONTO THE SITE WILL BE SWEPT UP WITHIN 30 MINUTES OF OCCURRENCE.
7. ANY STOCKPILES USED WILL BE UNDERLAIN, AND COVERED, WITH PLASTIC SHEETING OF A SIZE SUBSTANTIALLY LARGER THAN THE PILE AND SECURED AS REQUIRED PRIOR TO LEAVING THE SITE ON A DAILY BASIS. STOCKPILE COVERS WILL BE SECURED AGAINST MOVEMENT BY WIND.

LEGEND

- WELL TO BE USED FOR EXTRACTION/INJECTION (NEW AND EXISTING, SEE NOTE 1 AND WELL TABLES ON SHEET C-02)
- EXISTING WELL NOT USED FOR EXTRACTION/INJECTION
- NEW SLANT WELL (SEE NOTE 1)
- SUB-SLAB DEPRESSURIZATION WELL
- APPROXIMATE EXTENT OF TRENCH
- CHAIN LINK FENCE
- VAPOR MONITORING PIN (SEE NOTE 2)
- SITE AND STORE ACCESS AREAS
- PROPERTY LINE
- STOCKPILE & MATERIALS STAGING AREA
- BMP C220: CATCH BASIN INSERT

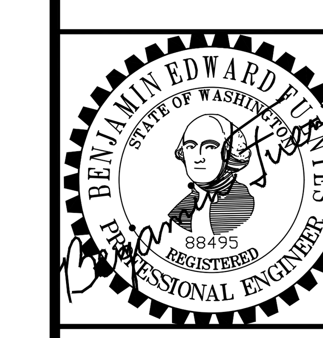
THE CITY OF SEATTLE
DEPARTMENT OF CONSTRUCTION & INSPECTIONS
APPROVED
Subject to Errors and Omissions
05/17/2024

TEMPLATE VERSION: 2021-06-08

CITY OF SEATTLE
DEPARTMENT OF CONSTRUCTION AND INSPECTIONS

STANDARD CONSTRUCTION STORMWATER CONTROL AND POST CONSTRUCTION SOIL MANAGEMENT (CSC/SOIL) PLAN

APPLICANT PLAN SET



SDCI PERMIT NO.: 6996584-CN

ADDRESS: -----

SEATTLE, WA

DESIGNED BY CMW:
DRAWN BY: CMW
CHECKED BY: RPH
DATE: 01/17/2024

STANDARD CSC/SOIL PLAN

SHEET SDW - 01

DRAINAGE & WASTEWATER CONTROL PLAN REQUIREMENTS

THIS PLAN SHALL SHOW A SITE PLAN INCLUDING ALL DRAINAGE FEATURES (HARD SURFACES, BMPS, DRAIN LINES, CATCH BASINS, INLETS, PUMPS, ETC.) AND ALL SIDE SEWER FEATURES (SERVICE DRAIN SIDE SEWERS AND SANITARY SIDE SEWERS AND THEIR APPROVED POINTS OF CONNECTION).

SEE VOLUME 1, CHAPTER 8 OF THE 2021 SEATTLE STORMWATER MANUAL FOR SITE AND DRAINAGE ELEMENTS REQUIRED ON THIS PLAN. THE STORMWATER MANUAL AND CAD TEMPLATES FOR THIS PLAN ARE AVAILABLE AT THE FOLLOWING LINK: http://www.seattle.gov/sdci/codes/codes-we-enforce-(a-z)/stormwater-code

SITE AND DRAINAGE CONTROL SUMMARY SHEET

COMPLETE THE ELECTRONIC ON-SITE STORMWATER MANAGEMENT CALCULATOR AND INSERT THE SITE AND DRAINAGE CONTROL SUMMARY SHEET BELOW. THE ELECTRONIC DOCUMENT IS AVAILABLE ON THE DPD STORMWATER CODE WEBSITE: http://www.seattle.gov/sdci/codes/codes-we-enforce-(a-z)/stormwater-code

SEE THE INSTRUCTIONS TAB IN THE EXCEL FILE FOR GUIDANCE TO SELECT AND DOCUMENT THE ON-SITE STORMWATER MANAGEMENT BMPS IF REQUIRED.

On-site Stormwater Management Calculator
Site and Drainage Control Summary

Version 01-04-2023

To use the On-Site List Calculator you must select "Enable Content" when the Security Warning appears.

Project Information

Site Address	2350 24th Ave E, Seattle, WA 98112	SDCI Project Number	6996584-CN
Primary Contact	Dale Myers	SDOT Project Number	SUUMP0000620
Project Type	Remediation	Primary Contact E-mail or Phone	DAMY461@ECY.WA.GOV

Is this project "Closely Related" to other SDCI construction permits/projects? ○ Yes ◉ No

"Closely Related" SDCI Construction Permit Numbers

Is this project associated with a Short Plat or Subdivision? ○ Yes ◉ No SDCI MUP Number

Was the project lot created or altered in size after Jan 1, 2016? No

Total Site Area	11,400	sf	Total Closely Related and/or Short Plat/Subdivision Site Area		sf
Total New plus Replaced Hard Surface Area (NPRHS)	635	sf			
Total New and/or Replaced Lawn/Landscaping	0	sf	Total Closely Related and/or Short Plat/Subdivision NPRHS		sf
Undisturbed and Protected Site Area	0	sf			
Total Existing Hard Surface Area To Remain	11,400	sf	Total Existing Hard Surface Area (Prior to Project)	11,400	sf

Site Information

Note: Reference the Preliminary Assessment Report (PAR) to complete this section.

Approved Point of Stormwater Discharge	Curb Weep Hole
Drainage Basin	Designated Receiving Water
Is the downstream drainage system considered Capacity Constrained by SPU?	No
Approved Point of Wastewater Discharge	Public Sanitary Sewer Main
Approved Point of Sub-Surface Discharge	On Site Infiltration

Required Flow Control Standard ☐ Pre-Developed Pasture ☐ Pre-Developed Forest ☐ Peak Control ☐ Wetland Protection ☐ Existing Conditions ☑ None

Project will permanently discharge groundwater? No

Required Water Quality Treatment Standard ☐ Oil Control ☐ Enhanced ☐ Basic ☑ None

Total Pollution Generating Hard Surface Area 0 sf w/ Closely Related/Short Plat/Subdiv. sf

Total Pollution Generating Pervious Surface Area 0 sf w/ Closely Related/Short Plat/Subdiv. sf

Environmentally Critical Areas No

☐ Steep Slope ☐ Potential Slide ☐ Riparian Corridor ☐ Wetland ☐ Liquefaction ☐ Flood Prone ☐ Landfill ☐ Known Landslide ☐ Fish / Wildlife ☐ Peat / Groundwater Management ☐ Shoreline Habitat

Is there soil and/or groundwater contamination on this site? Yes Source Control is required Yes

Infiltration Information

Is infiltration investigation required?

Is infiltration on the site feasible?

Site Measured Infiltration Rate x Infiltration Rate Correction Factor = 0 Site Design Inf Rate

On-site Stormwater Management (select List Approach or Performance Standard) OSM not required

☐ On-site List Approach (Pre-sized) Calculator -- Complete the Surface tabs and BMP Sizing tabs (Most commonly used)

☐ On-site Performance Standard -- Stormwater modeling by Civil Engineer (Also for No Off-site Point of Discharge)

Number of roof areas 0

Number of other surface areas 0 Enter number of surface areas and hit Enter

Surface	Surfaces Description	On-site BMP	Contrib. Area (sf)	Facility Size (sf)	Facility Configuration

Total New/Replaced Roof Area	0		Total Roof Area Managed	0
Total New/Replaced Other Surface Area	0		Total Other Surface Managed	0
Total Area Managed	0	sf	Total Volume Managed On Site	0 gal
Estimated compost required for soil amendment	0	cy	*Volume of compost will be verified by the Inspector.*	

Missing or invalid reference
File: ..\d0181575\OSM.pdf

seattle.gov

ON-SITE STORMWATER MANAGEMENT PLANTINGS

PLANTING GENERAL NOTES
1. PLANTS SHALL BE SITED ACCORDING TO SUN, SOIL, WIND AND MOISTURE REQUIREMENTS.
2. AT A MINIMUM, PROVISIONS MUST BE MADE FOR SUPPLEMENTAL IRRIGATION DURING THE FIRST TWO GROWING SEASONS.

BIORETENTION CELLS, PLANTERS AND RAIN GARDEN NOTES
1. FOR A LIST OF APPROVED PLANTS FOR BIORETENTION/RAIN GARDEN FACILITIES, SEE APPENDIX E, SECTION E-9 OF THE SEATTLE STORMWATER MANUAL.
2. VEGETATION COVERAGE OF SELECTED PLANS MUST ACHIEVE 90-PERCENT COVERAGE WITHIN 2 YEARS OR ADDITIONAL PLANTINGS SHALL BE PROVIDED. UNLESS DESIGNED BY A LICENSED LANDSCAPE ARCHITECT, PROVIDE A MINIMUM OF 1 PLANT PER EVERY 2 SQUARE FEET OF BIORETENTION BOTTOM AND SLOPED SIDE AREA.
3. PROVIDE A MINIMUM OF THREE DIFFERENT SPECIES OF SHRUBS AND HERBACEOUS PLANTS IN EACH FACILITY.

VEGETATED ROOF NOTES
1. APPROPRIATE PLANTS INCLUDE SUCCULENTS, GRASSES, HERBS, AND WILDFLOWERS THAT ARE ADAPTED TO HARSH CONDITIONS. PLANTS MAY BE INSTALLED AS PRE-GROWN MATS, INDIVIDUAL PLUGS, CUTTINGS, OR SPREAD AS SEEDS.
2. VEGETATION COVERAGE OF SELECTED PLANS MUST ACHIEVE 80-PERCENT COVERAGE WITHIN 2 YEARS OR ADDITIONAL PLANTINGS SHALL BE PROVIDED.
3. A LANDSCAPE MANAGEMENT PLAN SHALL BE DEVELOPED AND IMPLEMENTED.

STORMWATER FACILITIES/CONTROL OPERATIONS & MAINTENANCE REQUIREMENTS

ALL STORMWATER FACILITIES/CONTROLS SHALL BE OPERATED AND MAINTAINED IN ACCORDANCE WITH THE REQUIREMENTS OF THE 2021 SEATTLE STORMWATER MANUAL, APPENDIX G.

SIDE SEWER AND DRAINAGE PERMIT NOTES

1. SIDE SEWERS AND DRAINAGE FACILITIES SHALL BE CONSTRUCTED PER THE "REQUIREMENTS FOR DESIGN OF SIDE SEWERS (DRAINAGE & WASTEWATER)" DIRECTORS' RULE DPD 4-2011/2011-004 AND PER THE "2021 SEATTLE STORMWATER MANUAL" DIRECTORS' RULE SDCI 10-2021/SPU DWW-200.
2. A SEPARATE DRAINAGE AND SIDE SEWER PERMIT IS REQUIRED FOR ALL ONSITE DRAINAGE ELEMENTS AND SIDE SEWERS/SERVICE DRAINS. APPROVAL OF THIS PLAN IS REQUIRED PRIOR TO OBTAINING A DRAINAGE AND SIDE SEWER PERMIT.
3. RE-USE OF EXISTING SIDE SEWERS WHEN THERE WILL BE AN INCREASE IN LIVING UNITS REQUIRES THE EVALUATION AND CERTIFICATION (PE EVAL/CERT) OF THE EXISTING SIDE SEWER BY A PROFESSIONAL ENGINEER PRIOR TO FINALIZING THE SIDE SEWER AND DRAINAGE PERMIT. IN MOST CASES, THE SIDE SEWER MUST BE LINED ALL THE WAY TO THE MAIN. SEE DIRECTORS RULE 4-2011V.M AND SMC 21.16.240.
4. IN ORDER TO ADD UNITS TO AN EXISTING SIDE SEWER, A CERTIFIED LETTER STATING THE INTENT TO ADD UNITS TO THE SHARED SIDE SEWER MUST BE SENT TO ALL PROPERTY OWNERS OF PARCELS SERVED BY THE SHARED SIDE SEWER AT LEAST 30 DAYS PRIOR TO APPLYING FOR THE SIDE SEWER PERMIT. SMC 21.16.240.C. A RECEIPT OF CERTIFIED MAILING AND THE CERTIFICATION/ATTESTATION OF MAILING NOTIFICATION MUST BE SUBMITTED TO SDCI PRIOR TO PERMIT ISSUANCE.
5. DEVIATIONS FROM THE APPROVED DRAINAGE AND WASTEWATER CONTROL PLAN REQUIRE A FORMAL POST-SUBMITTAL REVISION FOR PLAN REVIEW AND APPROVAL. POST-SUBMITTAL REVISIONS MUST BE SUBMITTED ELECTRONICALLY THROUGH THE SDCI PROJECT PORTAL.

AS-BUILT MEASUREMENTS / NOTES

THIS SECTION IS TO BE COMPLETED AFTER THE DRAINAGE, WASTEWATER, AND SIDE SEWER FEATURES HAVE BEEN INSTALLED. FOR INSTRUCTIONS TO PREPARE THE AS-BUILT PLAN, SEE SDCI TIP #504.

SDCI SIDE SEWER AND DRAINAGE PERMIT #

MEASUREMENTS IN THE RIGHT-OF-WAY
1. DISTANCE FROM CENTERLINE OF DOWSTREAM MH TO CENTERLINE OF NEW SERVICE CONNECTION
2. SIDE SEWER INTERSECTION WITH PROPERTY LINE - DEPTH
3. SIDE SEWER INSTERSECTION WITH PROPERTY LINE - DISTANCE

PIPE LINERS

☐ PIPE LINER INSTALLED ON PRIVATE PROPERTY

☐ PIPE LINER INSTALLED IN THE RIGHT-OF-WAY

NOTES FOR PLAN VIEW

DETAILS: SELECT THE APPLICABLE DETAILS AND SHOW THEM HERE. PROVIDE AN ADDITIONAL SHEET IF NEEDED.

NOTES

1. TREATED WATER DISCHARGE TO EXISTING STORM DRAIN CONNECTED TO SANITARY SEWER IS PERMITTED UNDER KING COUNTY INDUSTRIAL WASTE (KCIW) WASTEWATER DISCHARGE AUTHORIZATION NO. 4614-01.

LEGEND

WELL TO BE USED FOR EXTRACTION/INJECTION (NEW AND EXISTING, SEE NOTE 1 AND WELL TABLES ON SHEET C-02)

EXISTING WELL NOT USED FOR EXTRACTION/INJECTION

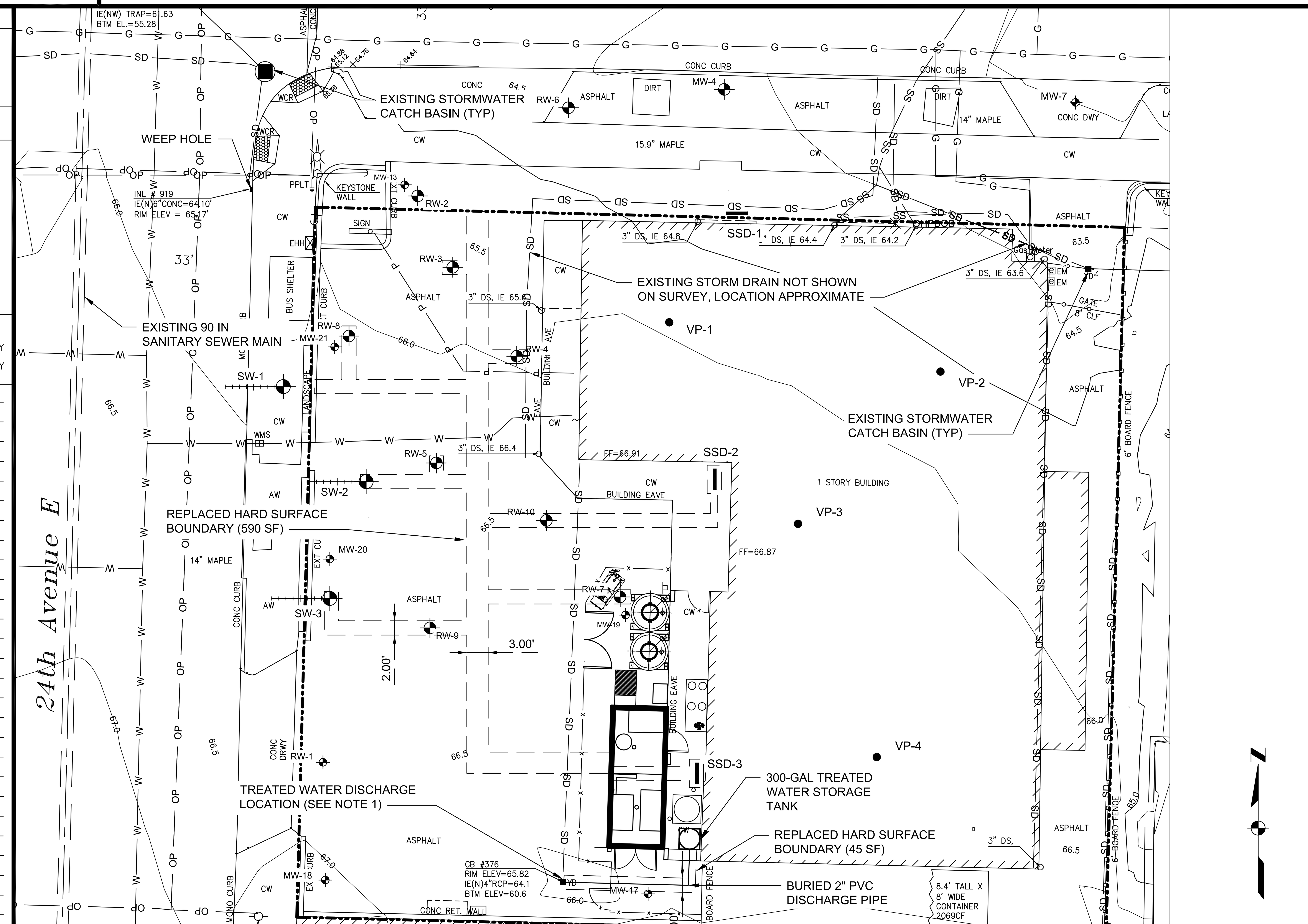
NEW SLANT WELL (SEE NOTE 1)

SUB-SLAB DEPRESSURIZATION WELL

CHAIN LINK FENCE

VAPOR MONITORING PIN

PROPERTY LINE



ABBREVIATIONS

SSS	SANITARY SIDE SEWER
SD	STORM SERVICE DRAIN/ DRAINAGE SIDE SEWER
FD	FOOTING DRAIN PUBLIC
PSD	STORM DRAIN MAINLINE
PS	PUBLIC COMBINED MAINLINE
PSS	PUBLIC SANITARY SEWER MAINLINE

THE CITY OF SEATTLE
DEPARTMENT OF CONSTRUCTION & INSPECTIONS
APPROVED
Subject to Errors and Omissions
05/17/2024

TEMPLATE VERSION: 2021-06-18

CITY OF SEATTLE
DEPARTMENT OF CONSTRUCTION AND INSPECTIONS

DRAINAGE AND WASTEWATER CONTROL (DWC) PLAN

APPLICANT PLAN SET

BENJAMIN EDWARD FORSTER
STATE OF WASHINGTON
88495
REGISTERED PROFESSIONAL ENGINEER

SDCI PERMIT NO.: 6996584-CN

ADDRESS: 2350 24TH AVE E SEATTLE, WA

DESIGNED BY: CMW

DRAWN BY: CMW

CHECKED BY: BEF

DWC PLAN

SHEET SDW - 02

Plot Date: 4/30/2024 4:15 PM

User: CAYLA WHITESIDE

File: C:\bms\kjce-pw\d0181574\219600800-CSC-02.dwg

General Structural Notes

THE FOLLOWING APPLY UNLESS SHOWN OTHERWISE ON THE DRAWINGS

CRITERIA

1. ALL MATERIALS, WORKMANSHIP, DESIGN, AND CONSTRUCTION SHALL CONFORM TO THE DRAWINGS, SPECIFICATIONS, AND THE 2018 SEATTLE BUILDING CODE.

2. DESIGN LOADING CRITERIA:
   MANUFACTURING
   FLOOR LIVE LOAD (LIGHT MANUFACTURING) . . . . 125 PSF
   MISCELLANEOUS LOADS
   ROOF MECHANICAL . . . . 1500 LBS
   DEFLECTION CRITERIA
   LIVE LOAD DEFLECTION L/360
   TOTAL LOAD DEFLECTION L/240
   ENVIRONMENTAL LOADS
   SNOW . . . . Ce=1.0, Is=1.0, Ct=1.1, Pg=20 PSF
   WIND . . . . GCpi=0.18, 110 MPH, RISK CATEGORY II, EXPOSURE "B"
   EARTHQUAKE . . . ANALYSIS PROCEDURE: EQUIVALENT LATERAL FORCE PROCEDURE
   LATERAL SYSTEM: LIGHT FRAMED SHEAR WALLS, Vs=2.5 KIPS. SITE CLASS=D, Ss=1.39, Sds=1.0, S1=0.49, SD1=0.88, Cs=0.56, SDC D, Ie=1.0, R=3.5

3. STRUCTURAL DRAWINGS SHALL BE USED IN CONJUNCTION WITH CIVIL DRAWINGS FOR BIDDING AND CONSTRUCTION. CIVIL DRAWINGS ARE THE PRIME CONTRACT DRAWINGS. ANY DISCREPANCIES FOUND AMONG THE DRAWINGS, THE SPECIFICATION, THESE GENERAL NOTES AND THE SITE CONDITIONS SHALL BE REPORTED TO GLACIAL ENVIRONMENTAL SERVICES (GENERAL CONTRACTOR), WHO SHALL CORRECT SUCH DISCREPANCY IN WRITING. ANY WORK DONE BY THE GENERAL CONTRACTOR AFTER DISCOVERY OF SUCH DISCREPANCY SHALL BE DONE AT THE GENERAL CONTRACTOR'S RISK.

4. PRIMARY STRUCTURAL ELEMENTS NOT DIMENSIONED ON THE STRUCTURAL PLANS AND DETAILS SHALL BE LOCATED BY THE CIVIL PLANS AND DETAILS.

5. ALL STRUCTURAL SYSTEMS, WHICH ARE TO BE COMPOSED OF COMPONENTS TO BE FIELD ERECTED, SHALL BE SUPERVISED BY THE SUPPLIER DURING MANUFACTURING, DELIVERY, HANDLING, STORAGE AND ERECTION IN ACCORDANCE WITH INSTRUCTIONS PREPARED BY THE SUPPLIER.

STEEL

6. STRUCTURAL STEEL DESIGN, FABRICATION, AND ERECTION SHALL BE BASED ON:
   A. AISC 360 AND SECTION 2205.2 OF THE INTERNATIONAL BUILDING CODE.

7. ROLLED SHAPES INCLUDING PLATES, SHALL CONFORM TO ASTM A36, FY = 36 KSI. STEEL PIPE SHALL CONFORM TO ASTM A-53, TYPE E OR S, GRADE B, Fy = 35 KSI. STRUCTURAL TUBING SHALL CONFORM TO ASTM A500, GRADE B, FY = 42 KSI (ROUND), FY = 46 KSI (SQUARE AND RECTANGULAR). CONNECTION BOLTS SHALL CONFORM TO ASTM A307.

8. ALL STEEL EXPOSED TO THE WEATHER OR IN CONTACT WITH GROUND SHALL BE CORROSION PROTECTED BY GALVANIZATION OR PROVIDED WITH EXTERIOR PAINT SYSTEM, UNLESS OTHERWISE NOTED. EXISTING CONTAINER COMPONENTS ARE EXCLUDED.

9. ALL WELDING SHALL BE IN CONFORMANCE WITH AISC AND AWS STANDARDS AND SHALL BE PERFORMED BY WABO CERTIFIED WELDERS USING E70XX ELECTRODES.

GEOTECHNICAL

10. FOUNDATION NOTES: ALLOWABLE SOIL PRESSURE AND LATERAL EARTH PRESSURE ARE ASSUMED AND THEREFORE MUST BE VERIFIED BY A QUALIFIED SOILS ENGINEER OR APPROVED BY THE BUILDING OFFICIAL. IF SOILS ARE FOUND TO BE OTHER THAN ASSUMED, NOTIFY THE STRUCTURAL ENGINEER FOR POSSIBLE FOUNDATION REDESIGN.

    FOOTINGS SHALL BEAR ON FIRM, UNDISTURBED EARTH AT LEAST 18" BELOW ADJACENT FINISHED GRADE.

    ALLOWABLE SOIL PRESSURE. . . . . 1500 PSF
    ALLOWABLE PASSIVE EARTH PRESSURE (FS OF 1.5 INCLUDED). . . . . . . 250 PCF
    COEFFICIENT OF FRICTION (FS OF 1.5 INCLUDED). 0.3

WOOD

11. FRAMING LUMBER SHALL BE KILN DRIED OR MC-19, AND GRADED AND MARKED IN CONFORMANCE WITH WCLIB STANDARD GRADING RULES FOR WEST COAST LUMBER NO. 17. FURNISH TO THE FOLLOWING MINIMUM STANDARDS: DOUGLAS-FIR-LARCH OR HEM-FIR NO. 2.

12. WOOD FASTENERS: NAIL SIZES SPECIFIED ON DRAWINGS ARE BASED ON THE FOLLOWING SPECIFICATIONS:
    10d - 3" x 0.148", 16d BOX - 3-1/2" x 0.135".

13. WOOD FRAMING NOTES--THE FOLLOWING APPLY UNLESS OTHERWISE SHOWN ON THE PLANS: WALL FRAMING: REFER ARCHITECTURAL DRAWINGS FOR THE SIZE OF ALL WALLS. ALL STUDS SHALL BE SPACED AT 16" O.C. UNO. TWO STUDS MINIMUM SHALL BE PROVIDED AT THE END OF ALL WALLS. WHERE SHOWN, FASTEN 15/32"CDX PLYWOOD TO STUD WALL. NAIL PANEL EDGES WITH 8D @ 16"OC. BLOCK PANEL EDGES WITH 2x LAID FLAT AND NAIL PANELS TO INTERMEDIATE SUPPORTS WITH 8D @ 12"OC.

CONCRETE

14. CONCRETE SHALL BE MIXED, PROPORTIONED, CONVEYED AND PLACED IN ACCORDANCE WITH ACI 301, INCLUDING TESTING PROCEDURES. CONCRETE SHALL ATTAIN A 28-DAY STRENGTH OF f'c = 3,000 PSI AND MIX SHALL CONTAIN NOT LESS THAN 5-1/2 SACKS OF CEMENT PER CUBIC YARD AND SHALL BE PROPORTIONED TO PRODUCE A SLUMP OF 5" OR LESS. REQUIRED CONCRETE STRENGTH IS BASED ON THE DURABILITY REQUIREMENTS OF SECTION 1904 OF THE IBC. DESIGN STRENGTH IS f'c = 2,500 PSI.

15. REINFORCING STEEL SHALL CONFORM TO ASTM A615 (INCLUDING SUPPLEMENT S1), GRADE 60, FY = 60,000 PSI. PLACE REINFORCEMENT WITHOUT SPLICES.

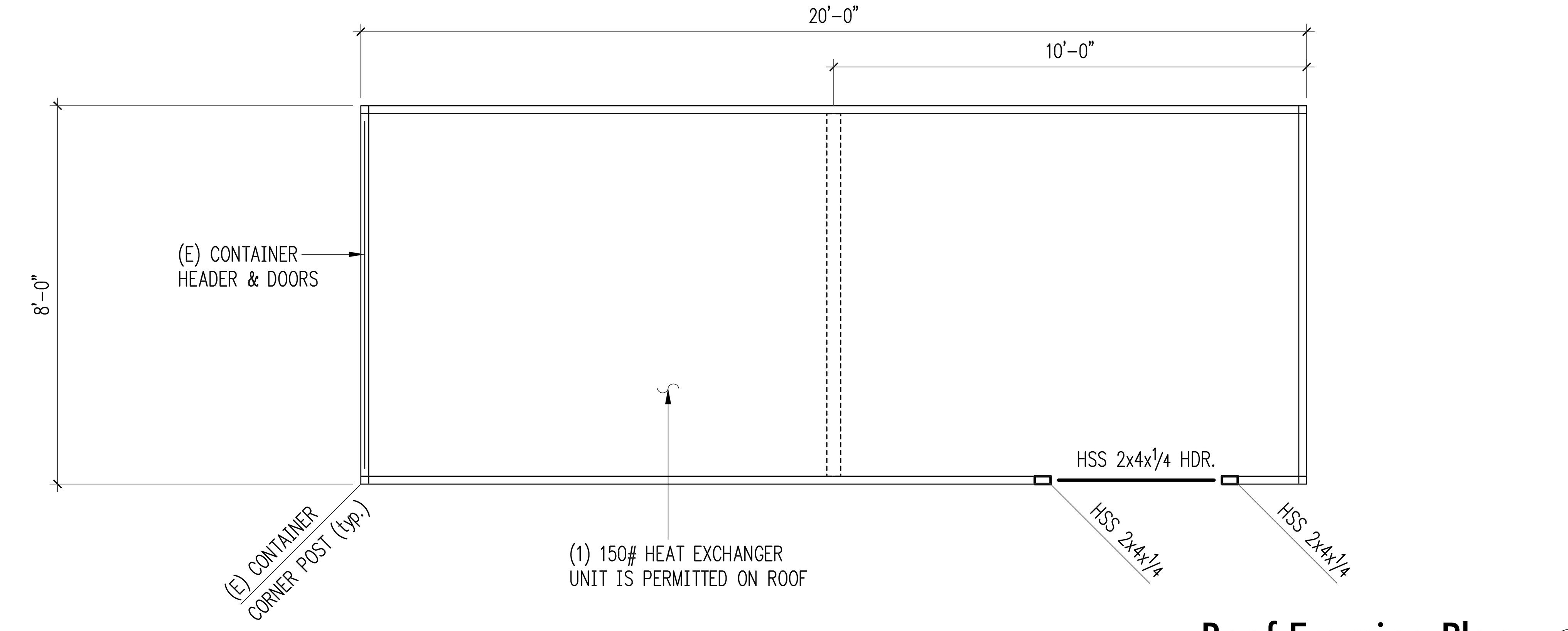
16. CONCRETE PROTECTION (COVER) FOR REINFORCING STEEL SHALL BE AS FOLLOWS:

    FOOTINGS AND OTHER UNFORMED SURFACES CAST AGAINST AND PERMANENTLY EXPOSED TO EARTH . . . . 3"

    FORMED SURFACES EXPOSED TO EARTH OR WEATHER (#5 BARS OR SMALLER) . . . . 1-1/2"

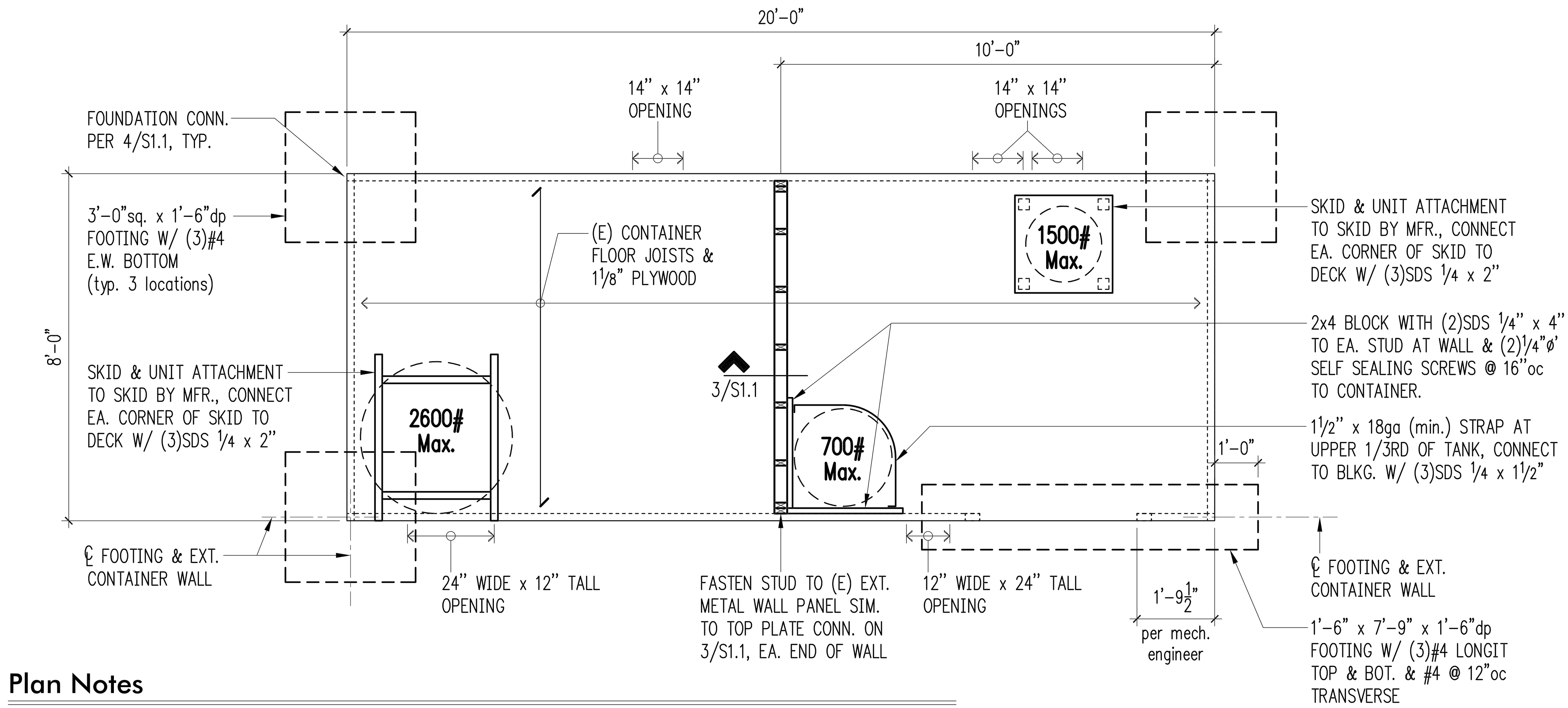
1

FOR REFERENCE ONLY



Roof Framing Plan

Scale: 3/8" = 1'-0"



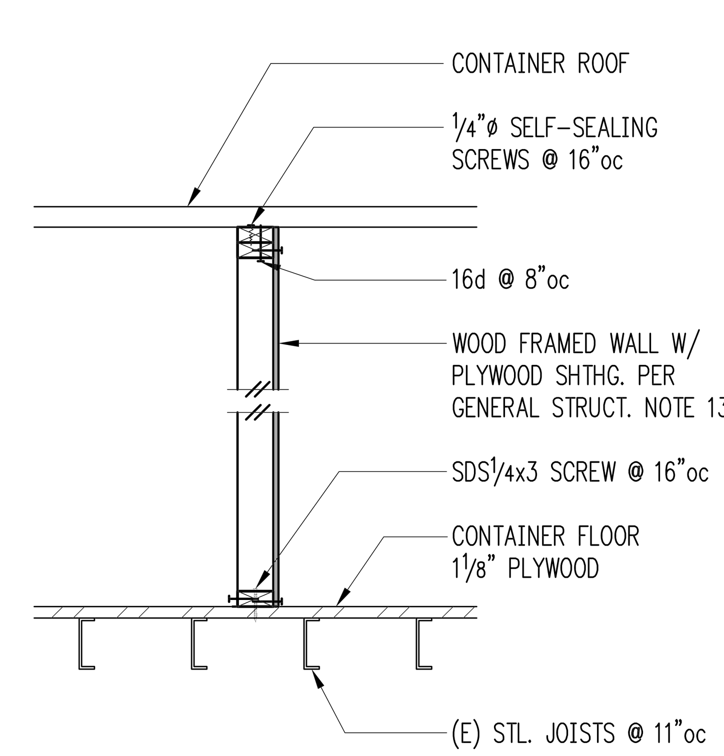
Plan Notes

1. SIDE WALLS MAY BE DRILLED FOR PIPING. MAX. 6"ø HOLE W/ (2) HOLE DIAMETERS CLEAR BETWEEN ADJACENT HOLES.
2. (E) CONTAINER FLOOR: 1 1/8" PLYWOOD OVER 5" STEEL CHANNELS @ 11"oc.
3. EXISTING CONTAINER SHALL BE 20'-0" LONG ISO CERTIFIED CARGO CONTAINER.
4. ALL FOUNDATIONS ARE CAST-IN-PLACE CONCRETE PER GENERAL STRUCTURAL NOTES 14, 15, AND 16.
5. AT PERIMETER OF CONTAINER BASE, FORKLIFT HOLES SHALL BE LEFT OPEN FOR UNDERFLOOR VENTILATION.

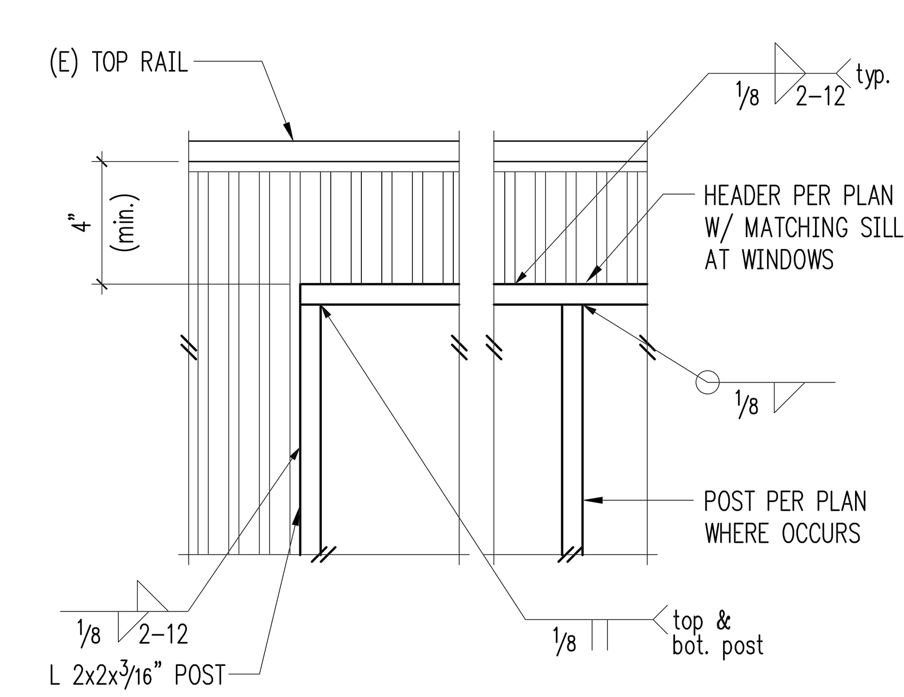
1

Container Floor Framing Plan

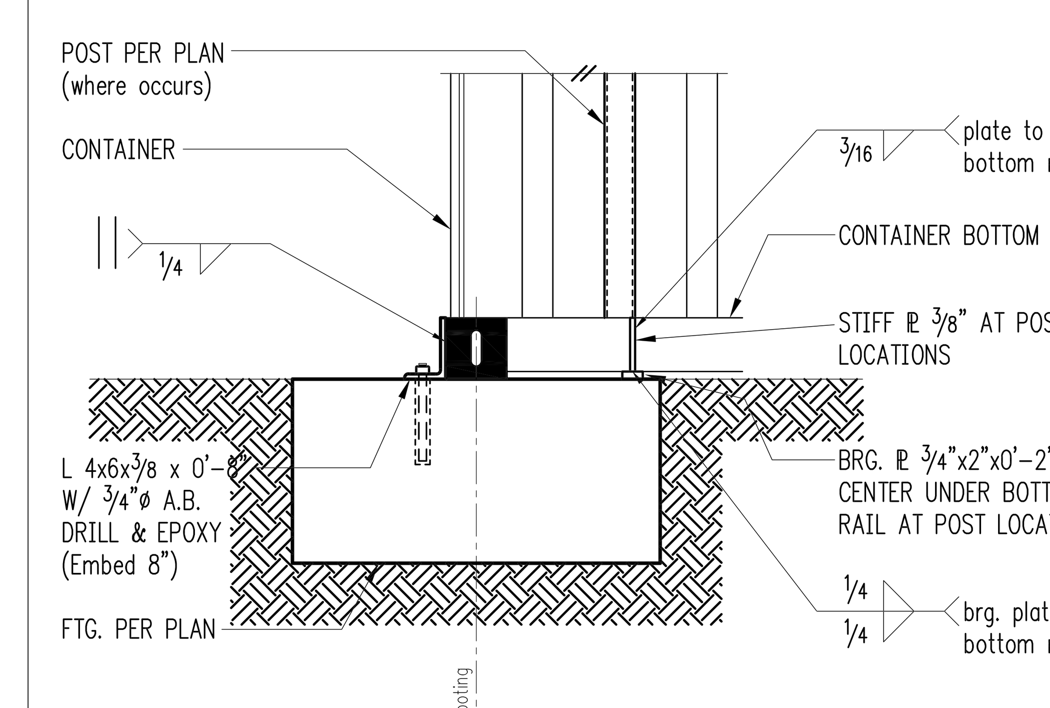
Scale: 3/8" = 1'-0"



Typical Partition Wall 2



Typical Header 3



Typical Footing 4

STRUCTURAL ENGINEERING

SEATTLE
2124 Third Avenue, Suite 100
Seattle, WA 98121
TACOMA
934 Broadway, Suite 100
Tacoma, WA 98402
CENTRAL WASHINGTON
414 N Pearl Street, Suite 8
Ellensburg, WA 98926
206.443.6212
ssfengineers.com

BRIAN P. RITTERER, STATE OF WASHINGTON, 53241, REGISTERED PROFESSIONAL ENGINEER

DRAWN:	SJB
DESIGN:	BPR
CHECKED:	BPR
APPROVED:	BPR

REVISIONS:

1	Permit Correction 2	Apr. 22, 2024

JURISDICTIONAL APPROVAL STAMP:

THE CITY OF SEATTLE
DEPARTMENT OF CONSTRUCTION & INSPECTIONS
APPROVED
Subject to Errors and Omissions
05/17/2024

PROJECT TITLE:

Circle K
Equipment Enclosure
2350 24th Ave E
Seattle, WA 98112

ARCHITECT:

Glacier Environmental Services

ISSUE:

Permit

SHEET TITLE:

General Structural Notes, Framing Plans, and Details

SCALE:	3/4" = 1'-0" U.N.O.
DATE:	March 28, 2024
PROJECT NO:	10846-2024-01
SHEET NO:	S1.1

8 x 20 SEABOX GENERAL ARRANGEMENT DETAIL

ENTIRE SYSTEM IS 3RD PARTY CERTIFIED

CONTROL PANEL

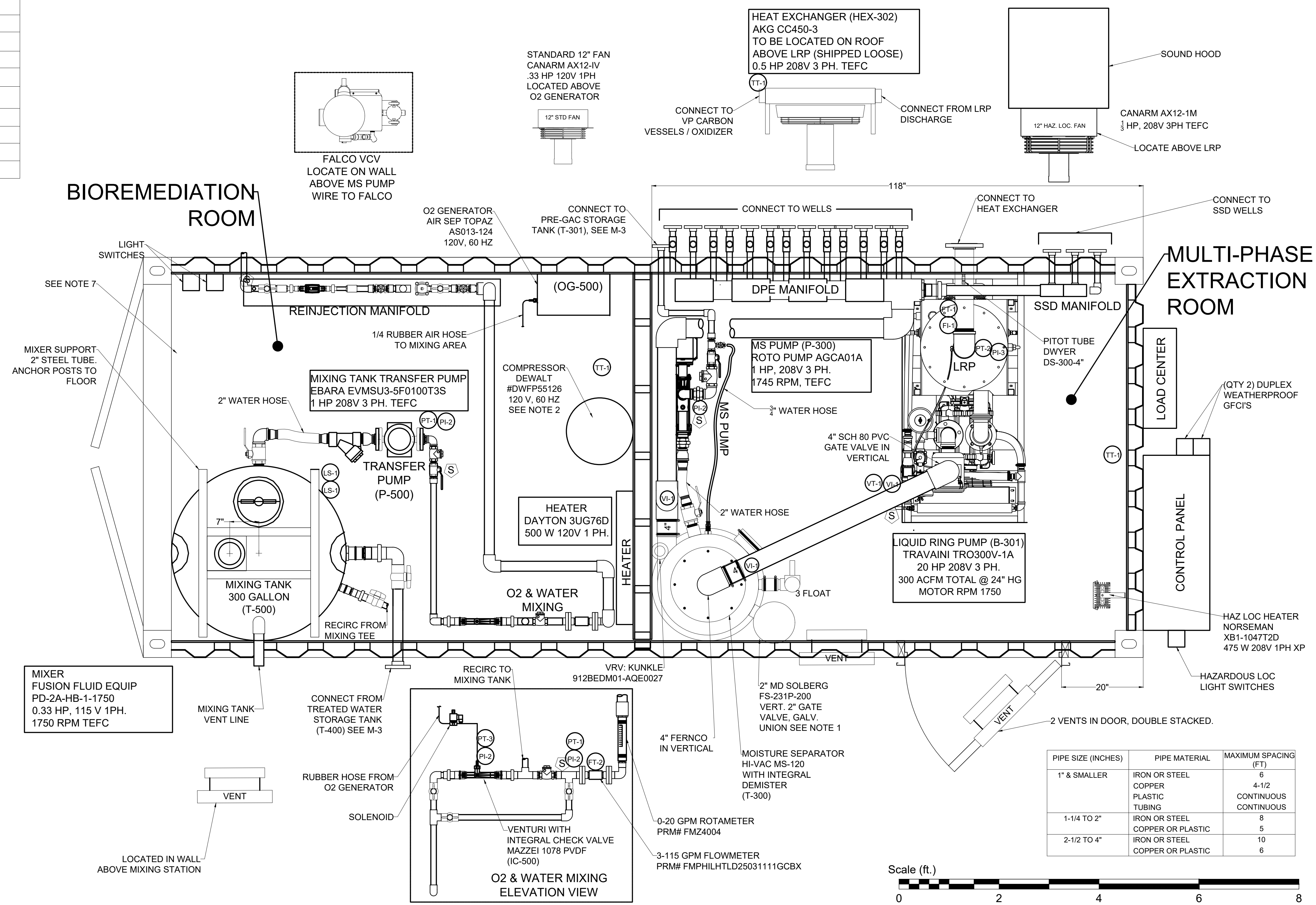
1. PANEL LISTING	508&698a
2. DEADFRONT	YES
3. VOLTAGE	120/208V THREE PHASE WYE
4. PHASE	3
5. AUTO RESTART	YES
6. BREAKERS IN PANEL	YES
7. HOUR METERS	YES
8. AMP METERS	NO
9. HOA AND RESET BUTTON	YES
10. OXIDIZER INTERLOCK	YES
11. PLC	SIEMENS
12. 7/24 TIMER	SIEMENS
13. SURGE PROTECTOR	YES
14. PHASE MONITOR	NO
15. PANEL TRANSFORMER	NO
16 FAN IN PANEL	NO
17. TELEMETRY	SIEMENS
18. TELEMETRY SERVICE	PRM
19. BATTERY BACKUP	YES

NOTES:
1. 1" MS TANK DRAIN LOCATED BELOW MANUAL DILUTION
2. PNEUMATIC ACTUATORS ON DPE MANIFOLD VALVES WILL BE CONNECTED TO COMPRESSOR LOCATED IN NON-HAZARDOUS SIDE.
3. WALLS & CEILING SHALL HAVE R-13 INSULATION AND WOOD FRAMING AND WILL ADD 4" THICKNESS ON ALL SIDES. FLOOR TO HAVE R10 INSULATION.
4. HAZ. LOC. LIGHT IN MPE ROOM. STD LIGHT IN BIOREMEDIATION ROOM.
5. SOUND HOODS TO BE LOCATED OVER ALL VENTS IN MPE ROOM ONLY, INCLUDING LRP HX VENT.
6. LIQUID RING PUMP WILL SIT ON ¾" RUBBER MAT.
7. 4-1/2" BERM WILL BE PROVIDED AROUND PERIMETER OF BOTH ROOMS. FLOOR WILL BE COATED AND SEALED TO ACT AS SECONDARY CONTAINMENT.
8. ALL PRESSURE/VACUUM GAUGES SHALL INCLUDE BRASS ISOLATION VALVES
9. ANY PLUMBING ON FLOOR IN WALKWAY AREAS REQUIRES A STEPOVER.
10. MINIMIZE PROTRUSION OUTSIDE ON DPE MANIFOLD PENETRATIONS

LOOSE EQUIPMENT:
1. POST LRP HEAT EXCHANGER (AFTERCOOLER) TO BE PROVIDED LOOSE AND FIELD PIPED BY OTHERS.
2. FALCO 300 CATALYTIC OXIDIZER. SUPPLIED WITH SOLBERG HDL-PSG344/2-300 COALESCER TO BE INSTALLED BEFORE FALCO INLET. VCV INSTALLED IN LRP ROOM TO BE REMOVED AND RETURNED WITH FALCO AT THE END OF RENTAL.
3. VAPOR PHASE CARBON VESSELS: (2) VP-2000. EACH FILLED WITH 2000 LBS OF REACTIVATED CARBON. EACH ALSO INCLUDES 1" SS DRAINS, (3)PRESSURE INDICATORS (PI-3) AND 4" ALUMINUM CAMLOCK CONNECTIONS.
3. PRE-LGAC WATER STORAGE TANK SKID (M-3).
4. TREATED WATER SKID (M-3).
5. LGAC SKID(M-4).
6. QTY 4 ANCHOR POSTS: PRM# TRAILSEABOXANCHORX
7. DWYER DS-300 PITOT TUBE AND DIFF. PRES GAUGE (FI-1) FOR STARTUP TESTING OF DPE WELLS
8. SPARE SS STRAINER BASKET SIZED FOR #2 TRADE SIZE BAG
9. QTY 25 OF 25 MICRON BAG FILTERS
10. QTY 25 OF 50 MICRON BAG FILTERS

PRM PARTS LIST

PRM PARTS	DESCRIPTION	PRM #	QTY
PI-1	0-50 PSI LF GAUGE	PGCNBTY630251850PSI	0
PI-2	0-100 PSI PRES GAUGE	PGCNBTY6302514100PSI	3
PI-3	0-10PSI PRES GAUGE	PGCNBTY630251310PSI	4
PI-4	-15 HG- 100 PSI LF GAUGE	PGCNBTY6301515HG100PSI	1
VI-1	0-30" HG LF GAUGE	PGCNBTY630252230HG	3
TT-1	0-392 TEMP TRANSMITTER	CONTD148WD	3
PT-1	0-100 PSI PRES TRANSMITTER	PT100PSICABLE025MNPTX	2
PT-2	0-100"WC PRES TRANSMITTER	PGTLFMI100WCX	1
PT-3	-15 TO 30 PSIG PRES TRANS.	PT15V165PSI24VDCX	1
VT-1	0-30" VACUUM TRANSMITTER	PT100030HG025MNPTX	1
FT-1	0-5"WC DPT	PGTLFMI005WCX	1
FT-2	3-115 GPM FLOW TRANS.	FMPHILHTLD25031111GCBX	1
FI-1	0-5"WC DIFF PRES. GAUGE	DPGJH0005X	1
LS-1	FLOAT LEVEL SWITCH	FLSLSCF07X7X	2



PIPE SIZE (INCHES)	PIPE MATERIAL	MAXIMUM SPACING (FT)
1" & SMALLER	IRON OR STEEL	6
	COPPER	4-1/2
	PLASTIC	CONTINUOUS
	TUBING	CONTINUOUS
1-1/4 TO 2"	IRON OR STEEL	8
	COPPER OR PLASTIC	5
2-1/2 TO 4"	IRON OR STEEL	10
	COPPER OR PLASTIC	6

PRMFiltration

Product Recovery Management Inc.

CLIENT:	PROJECT TITLE:	SHEET TITLE:	QUOTE #:	PROJECT NUMBER:
GLACIER ENVIRONMENTAL SERVICES, INC PO BOX 1097 MUKILTEO, WA 98275	MULTI PHASE VACUUM EXTRACTION SYSTEM CIRCLE K 1461 ENVIRONMENTAL CLEANUP 2350 24TH AVE E SEATTLE, KING COUNTY, WASHINGTON 98112	SEABOX GENERAL ARRANGEMENT	PRM-9844	WO-8135
			DATE: 12/1/23	DRAWN BY: MTW

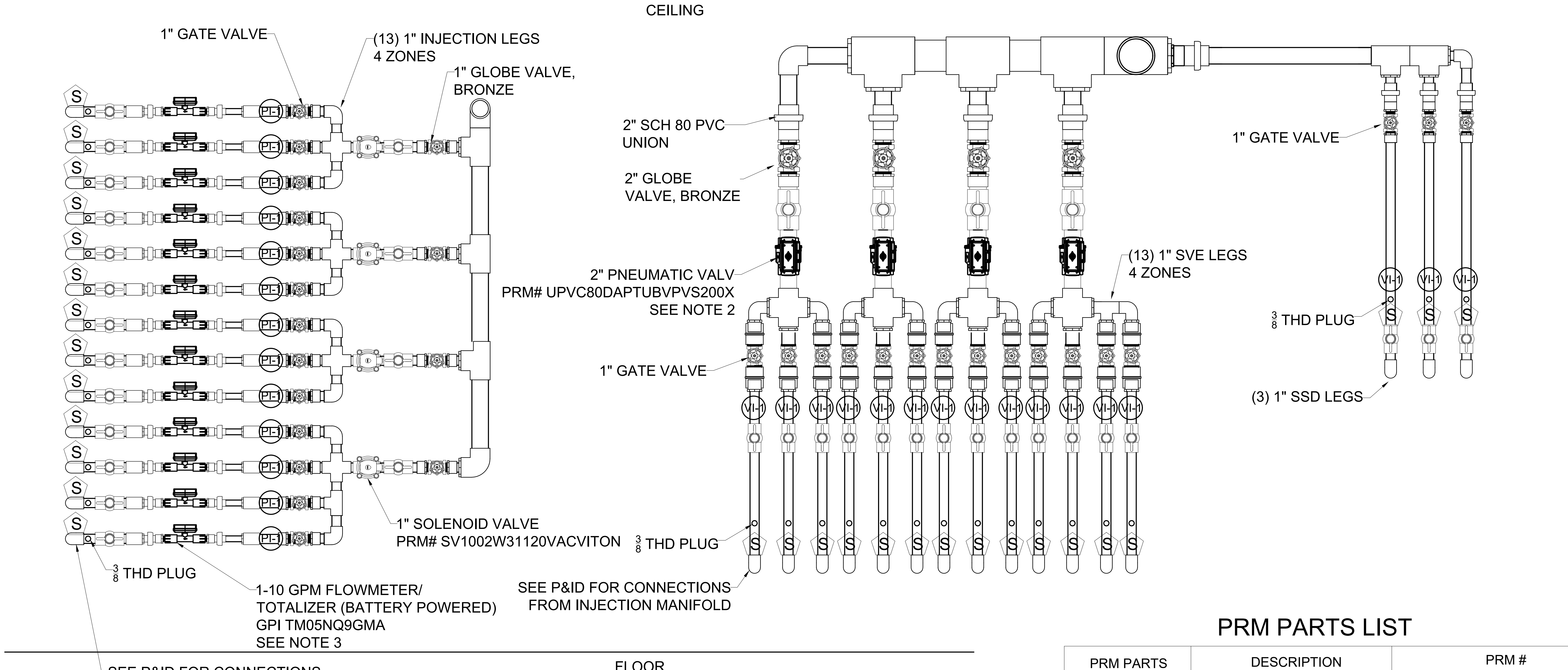
NO.	REVISION	DATE
1	AS-BUILTS	04/08/24
2	CLIENT LABELS	06/11/24

DRAWING NUMBER: M-1

REINJECTION MANIFOLD ELEVATION DETAIL

DPE MANIFOLD ELEVATION DETAIL

SSD MANIFOLD ELEVATION DETAIL



NOTES:

1. DPE MANIFOLD: ONE OR TWO ZONES MAY BE LOCATED ON PARTITION WALL IF EXTRA SPACE IS REQUIRED
2. COMPRESSED AIR REQUIRED FOR ACTUATION OF 2" PNEUMATIC VALVES ON DPE MANIFOLD TO BE PROVIDED BY COMPRESSOR LOCATED IN INJECTION SIDE OF SEABOX.
3. ALLOW 10 PIPE DIAMETERS STRAIGHT PIPE UPSTREAM OF FLOWMETERS AND 5 PIPE DIAMETERS DOWNSTREAM.

PRM PARTS LIST

PRM PARTS	DESCRIPTION	PRM #	QTY
VI-1	0-30" HG LF GAUGE	PGCNBTY630252230HG	16
PI-1	0-30 PSI GAUGE	PGCNBTY630251230PSI	13

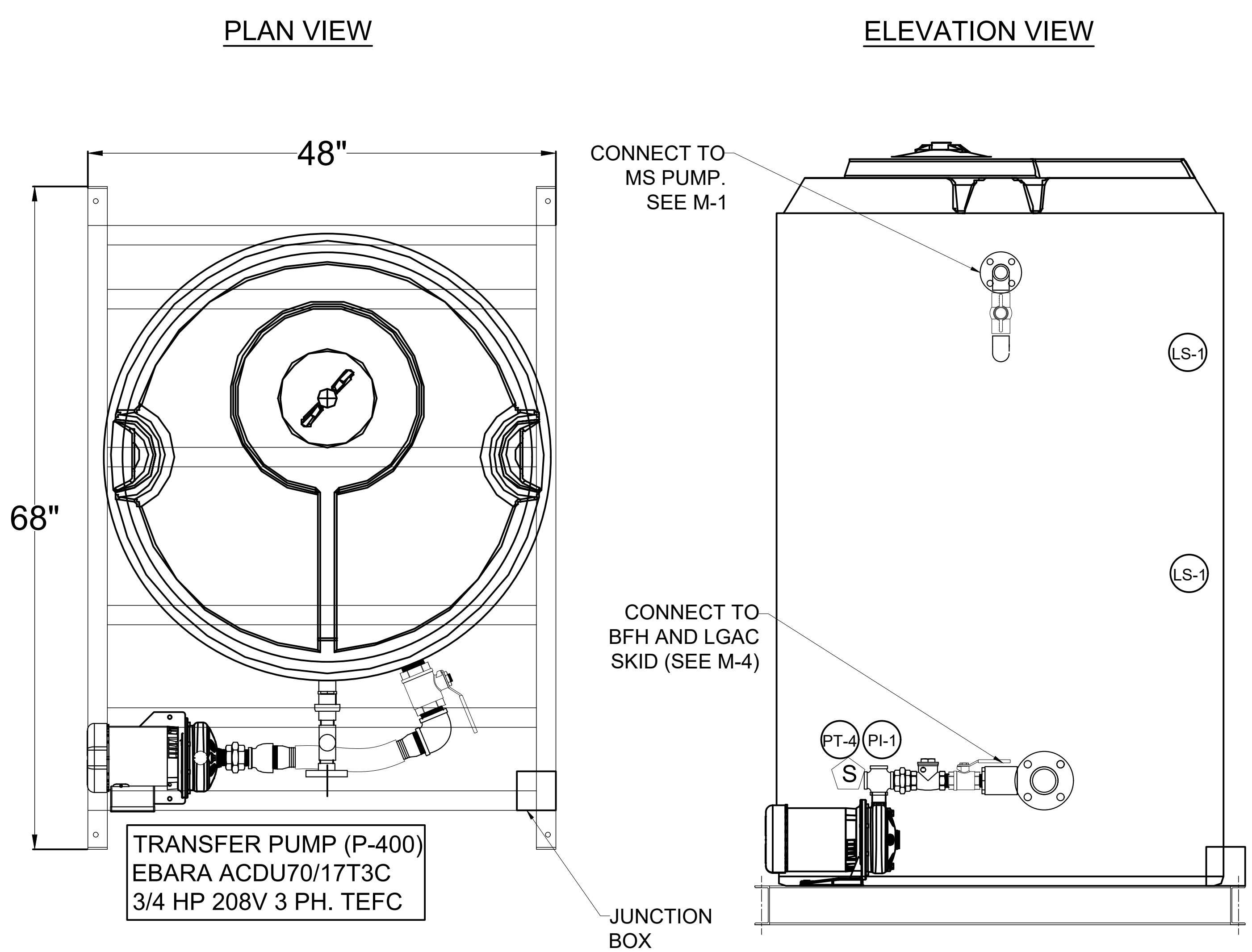
Scale (ft.)
0 2 4

PRMFiltration

CLIENT: GLACIER ENVIRONMENTAL SERVICES, INC PO BOX 1097 MUKILTEO, WA 98275	PROJECT TITLE: MULTI PHASE VACUUM EXTRACTION SYSTEM CIRCLE K 1461 ENVIRONMENTAL CLEANUP 2350 24TH AVE E SEATTLE, KING COUNTY, WASHINGTON 98112	SHEET TITLE: REINJECTION / DPE / SSD MANIFOLD ELEVATION DETAILS	QUOTE #: PRM-9844	PROJECT NUMBER: WO-8135	NO.	REVISION	DATE	DRAWING NUMBER: M-2
			DATE: 12/1/23	DRAWN BY: MTW	1	AS-BUILTS	04/08/24	
					2	CLIENT LABELS	06/11/24	

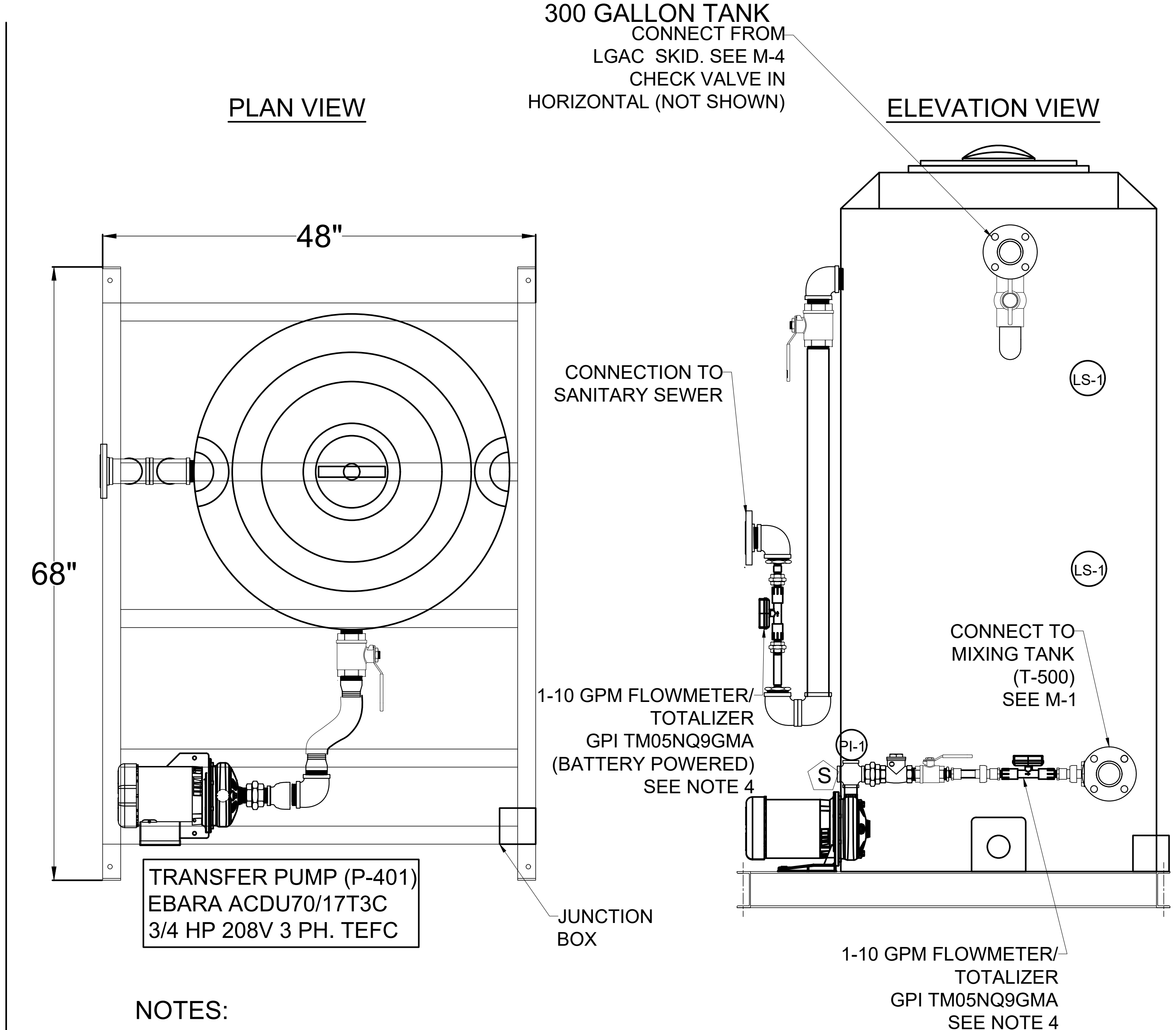
PRE-GAC WATER STORAGE TANK SKID (T-301)

500 GALLON TANK



TREATED WATER STORAGE TANK SKID (T-400)

300 GALLON TANK



NOTES:
1. TANKS ATTACH TO SKIDS VIA GUY KITS
2. PIPE SUPPORTS TO BE PROVIDED AS NEEDED
3. ALL ELECTRICAL PRE-WIRED TO JUNCTION BOX
4. ALLOW 10 PIPE DIAMETERS STRAIGHT PIPE UPSTREAM OF FLOWMETERS AND 5 PIPE DIAMETERS DOWNSTREAM.

SKID CONSTRUCTION NOTES
1. SKID PAINT DETAILS:
   1.1. PRIMER: EPOXY PRIMER (HBE-400)
   1.2. PAINT: BATTLESHIP GREY ACRYLIC URETHANE FINISH (AUE-100)
2. MATERIAL: 4X2 CS CHANNEL

Scale (ft.)
0 2 4

PRM PARTS LIST

PRM PARTS	DESCRIPTION	PRM #	QTY
PI-1	0-50 PSI LF GAUGE	PGCNBTY630251850PSI	2
PT-4	0-50 PSI TRANSMITTER	PT50PPSI24VDCX	1
LS-1	FLOAT LEVEL SWITCH	FLSLSCF07X7X	4

PRMFiltration

CLIENT: GLACIER ENVIRONMENTAL SERVICES, INC
PO BOX 1097
MUKILTEO, WA 98275

PROJECT TITLE: MULTI PHASE VACUUM EXTRACTION SYSTEM
CIRCLE K 1461 ENVIRONMENTAL CLEANUP
2350 24TH AVE E
SEATTLE, KING COUNTY, WASHINGTON 98112

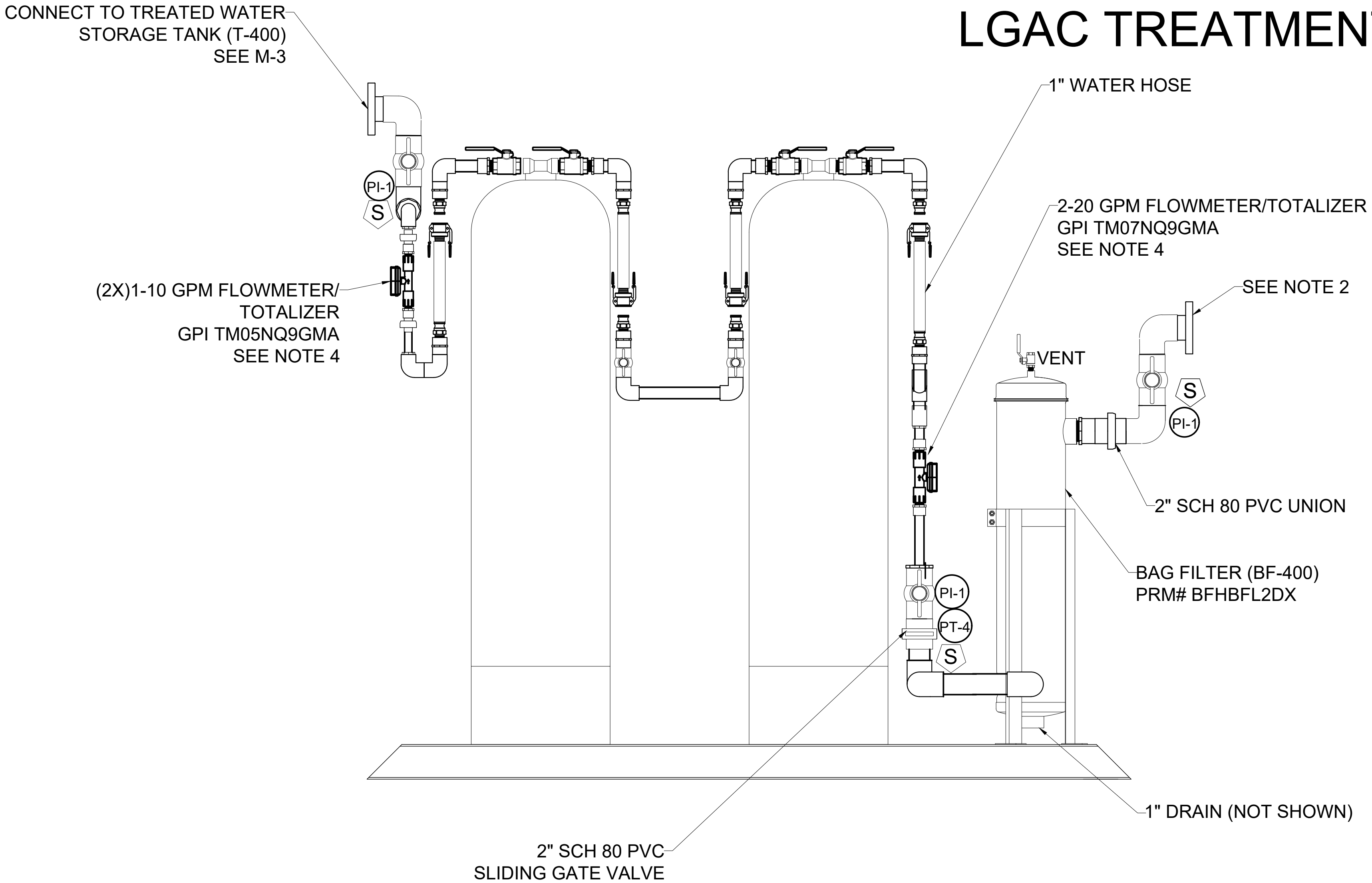
SHEET TITLE: STORAGE TANK SKIDS

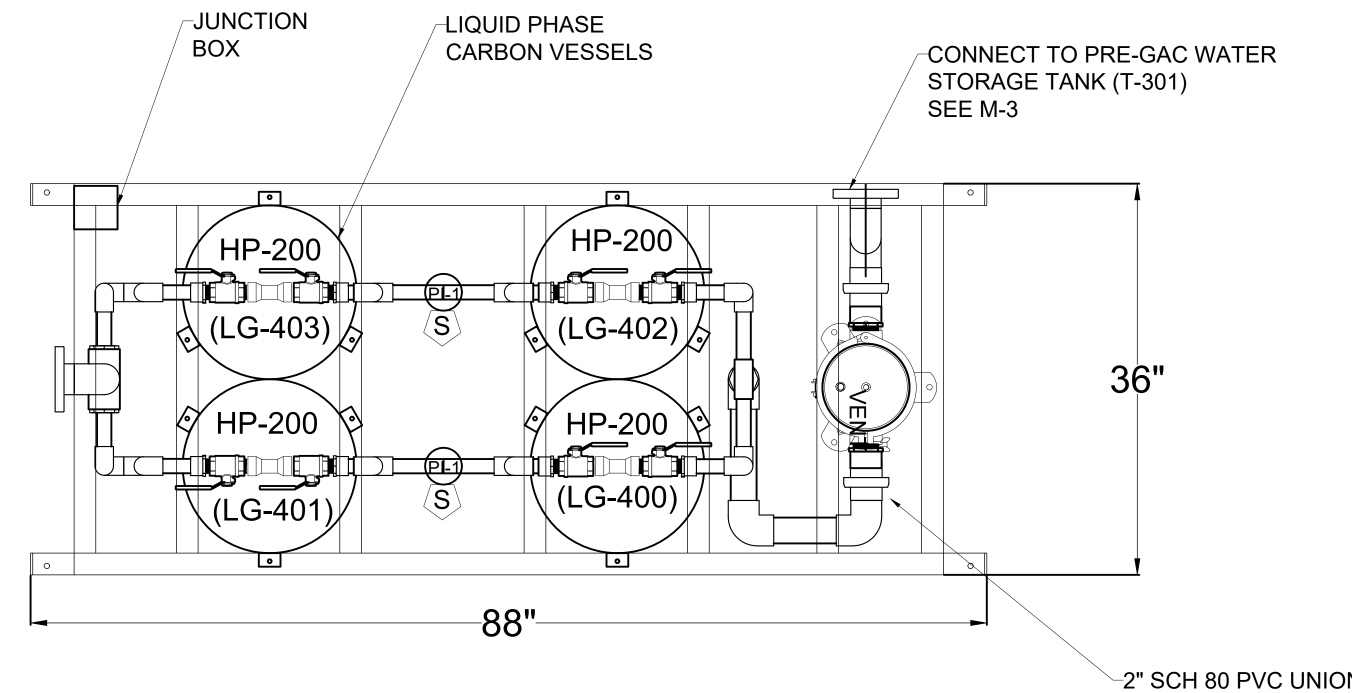
QUOTE #: PRM-9844
PROJECT NUMBER: WO-8135
DATE: 12/1/23
DRAWN BY: MTW

NO.	REVISION	DATE
1	AS-BUILTS	04/08/24
2	CLIENT LABELS	06/11/24

DRAWING NUMBER: M-3

LGAC TREATMENT SKID





NOTES:
1. PIPE SUPPORTS TO BE PROVIDED AS NEEDED
2. BAG FILTER INLET PLUMBING SHOWN ON RIGHT HAND SIDE FOR DRAWING CLARITY- SEE PLAN DETAIL.
3. ALL ELECTRICAL PRE-WIRED TO JUNCTION BOX.
4.ALLOW 10 PIPE DIAMETERS STRAIGHT PIPE UPSTREAM OF FLOWMETERS AND 5 PIPE DIAMETERS DOWNSTREAM.

PRM PARTS LIST

PRM PARTS	DESCRIPTION	PRM #	QTY
PI-1	0-50 PSI LF GAUGE	PGCNBTY630251850PSI	5
PT-4	0-50 PSI TRANSMITTER	PT50PPSI24VDCX	1

SKID CONSTRUCTION NOTES
1. SKID PAINT DETAILS:
   - 1.1. PRIMER: EPOXY PRIMER (HBE-400)
   - 1.2. PAINT: BATTLESHIP GREY ACRYLIC URETHANE FINISH (AUE-100)
2. MATERIAL: 4X2 CS CHANNEL

Scale (ft.)
0 2 4

PRMFiltration

CLIENT: GLACIER ENVIRONMENTAL SERVICES, INC PO BOX 1097 MUKILTEO, WA 98275	PROJECT TITLE: MULTI PHASE VACUUM EXTRACTION SYSTEM CIRCLE K 1461 ENVIRONMENTAL CLEANUP 2350 24TH AVE E SEATTLE, KING COUNTY, WASHINGTON 98112	SHEET TITLE: LGAC TREATMENT SKID	QUOTE #: PRM-9844	PROJECT NUMBER: WO-8135		DRAWING NUMBER: M-4
			DATE: 12/1/23	DRAWN BY: MTW		

NO.	REVISION	DATE
1	AS-BUILTS	04/08/24
2	CLIENT LABELS	06/11/24

LINE IDENTIFICATION CODES

LINE NUMBERING

PROCESS PIPE

W"-XXX-YY-ZZ

- PIPE SCHEDULE IF APPLICABLE
- PIPING MATERIAL
- PROCESS LINE ABBREVIATION
- LINE SIZE (INCHES)

PIPING MATERIAL IDENTIFICATION

AL	ALUMINUM
CPVC	CHLORINATED POLYVINYL CHLORIDE
CS	CARBON STEEL
COP	COPPER
CPP	CORRUGATED PLASTIC PIPE
CIP	CAST IRON PIPE
DIP	DUCTILE IRON PIPE
FH	FLEXIBLE HOSE
GAL	GALVANIZED STEEL PIPE
NYL	NYLON
PE	POLYETHYLENE PIPE
PP	POLYPROPYLENE PIPE
PVC	POLYVINYL PIPE
RUB	RUBBER HOSE
SS	STAINLESS STEEL
TEF	TEFLON TUBING

PROCESS LINE ABBREVIATIONS

AIR	AIR, ATMOSPHERIC PRESSURE
BW	BACKWASH
CA	COMPRESSED AIR
CD	CONDENSATE
CF	CHEMICAL FEED
CGW	CONTAMINATED GROUNDWATER
D	DRAIN
EFF	EFFLUENT
EXH	EXHAUST
GW	GROUNDWATER
LFG	LANDFILL GAS
NPW	NON-POTABLE WATER
P	PRODUCT
PR	PROCESS FLOW
PROP	PROPANE
PW	POTABLE WATER
S	SANITARY
SL	SLUDGE
SP	SAMPLE PORT
STS	STORM SEWER
TF	TOTAL FLUIDS
V	VENT
VAP	VAPOR

LINE CODING

- PROCESS FLOW
- PNEUMATIC SIGNAL
- WIRELESS SIGNAL

ELECTRICAL SIGNALS

- 4-20mA / LOW VOLTAGE
- LINE VOLTAGE
- IS

VALVE AND PIPING SYMBOLS

- GLOBE VALVE
- GATE VALVE
- BUTTERFLY VALVE
- CHECK VALVE
- PLUG VALVE
- 3-WAY VALVE
- ANGLE VALVE
- RELIEF VALVE/VACUUM BREAKER
- BALL VALVE
- GLOBE VALVE
- SELF-CONTAINING PRESSURE REGULATING VALVE
- NEEDLE VALVE
- BP BACKFLOW PREVENTER
- NO NORMALLY OPEN
- NC NORMALLY CLOSED
- FLEXIBLE HOSE
- FLEXIBLE COUPLING
- MOTOR DRIVEN
- BASKET TYPE STRAINER
- Y-TYPE STRAINER
- DUPLEX STRAINER
- SLEEVE COUPLING (SC)
- FLOOR DRAIN
- EQUIPMENT DRAIN
- CLEANOUT (CO)
- REMOVABLE PLUG
- REMOVABLE CAP
- EXHAUST TO ATMOSPHERE (INSIDE)
- EXHAUST TO ATMOSPHERE (OUTSIDE)
- REDUCER
- UNION
- QUICK DISCONNECT COUPLING
- BF BLIND FLANGE
- FLANGE
- DAMPER
- TEST PORT WITH STOP COCK VALVE

VALVE OPERATOR SYMBOLS

- S SOLENOID
- M MOTOR, ELECTRIC
- P PNEUMATIC
- DIAPHRAGM WITH POSITIONER
- HANDWHEEL OR LEVER
- CHAINWHEEL

PRIMARY ELEMENT SYMBOLS - FLOW

- ORIFICE PLATE
- PITOT TUBE
- THERMAL MASS FLOW METER
- ROTOMETER
- FLUME
- WEIR
- TURBINE OR PROPELLOR TYPE METER
- MAGNETIC FLOW METER
- TOTALING FLOW METER

EQUIPMENT SYMBOLS

- PUMP
- PNEUMATIC DIAPHRAGM PUMP
- LIQUID RING VACUUM PUMP
- BLOWER
- AIR COMPRESSOR
- POSITIVE DISPLACEMENT PUMP
- SCREW COMPRESSOR

INSTRUMENT IDENTIFICATION

FIT 100A

FIT-100A

- SUFFIX (NOT NORMALLY USED)
- LOOP NUMBER
- SUCCEEDING LETTERS
- FIRST LETTER

FUNCTIONAL ABBREVIATIONS

DO	DISSOLVED OXYGEN	OC	OPEN-CLOSE
FC	FAIL CLOSED	OO	ON-OFF (MAINTAINED)
FI	FAIL INTERMINATE	ORP	OXIDATION REDUCTION POTENTIAL
FL	FAIL LOCKED	OSC	OPEN-STOP-CLOSE (MOMENTARY)
FO	FAIL OPEN	SS	START-STOP (MONENTARY)
HOA	HAND-OFF-AUTOMATIC	>	HIGH SELECT
I/I	CURRENT-TO-CURRENT	<	LOW SELECT
I/P	CURRENT-TO-PNEUMATIC		
LEL	LOWER EXPLOSIVE LIMIT		
LR	LOCAL-REMOTE		

S SAMPLE PORT

GENERAL INSTRUMENT SYMBOLS

- LOCALLY MOUNTED
- FRONT-OF PANEL MOUNTED
- BACK-OF-PANEL MOUNTED
- I INTERLOCK
- P PURGE
- PLC FUNCTION BLOCK

INSTRUMENT IDENTIFICATION TABLE

	FIRST LETTER		SUCCEEDING LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER FLAME				
C	CONDUCTIVITY			CONTROL	CLOSE
D	DENSITY (SP, GR)	DIFFERENTIAL		DRIVE	
E	VOLTAGE		PRIMARY ELEMENT		
F	FLOW RATE	RATIO			
G	GAUGING (DIMENSIONAL)		GLASS		
H	HAND (MANUAL)				HIGH
I	CURRENT		INDICATE		
J	POWER	SCAN			
K	TIME OR SCHEDULE			CONTROL STATION	
L	LEVEL		LIGHT (PILOT)		LOW
M	MOISTURE OR HUMIDITY				MIDDLE
N					
O			ORIFICE		OPEN
P	PRESSURE		POINT (TEST)		
Q	QUANT. OR EVENT	INTEGRATE			
R	RADIOACTIVITY		RECORD OR PRINT		
S	SPEED OR FREQ.	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	ULTRAVIOLET		MULTIFUNCTION		
V	VACUUM	VISCOSITY		VALVE OR DAMPER	
W	WEIGHT OR FORCE		WELL		
X	THERMOCOUPLE		UNCLASSIFIED		
Y	VIBRATION			RELAY OR COMPUTE	
Z	POSITION			DRIVE, ACTUATE	

PRMFiltration

CLIENT: GLACIER ENVIRONMENTAL SERVICES, INC
PO BOX 1097
MUKILTEO, WA 98275

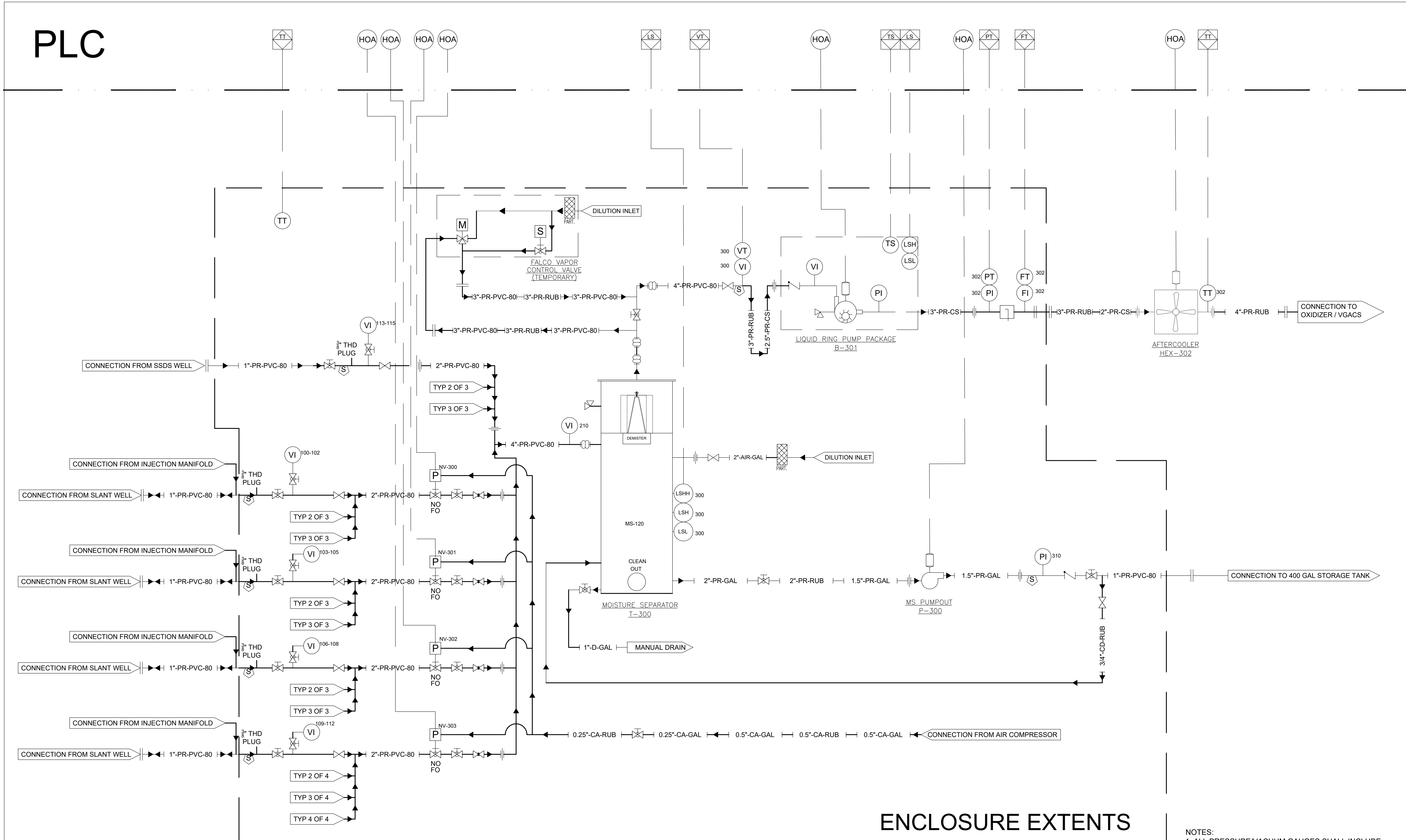
PROJECT TITLE: MULTI PHASE VACUUM EXTRACTION SYSTEM
CIRCLE K 1461 ENVIRONMENTAL CLEANUP
2350 24TH AVE E
SEATTLE, KING COUNTY, WASHINGTON 98112

SHEET TITLE: PROCESS & INSTRUMENTATION DIAGRAM LEGEND

QUOTE #: PRM-9844
PROJECT NUMBER: WO-8135
DATE: 12/1/23
DRAWN BY: MTW

NO.	REVISION	DATE
1	AS-BUILTS	04/08/24
2	CLIENT LABELS	06/11/24

DRAWING NUMBER: P&ID-1



NOTES:
1. ALL PRESSURE/VACUUM GAUGES SHALL INCLUDE BRASS ISOLATION VALVES

PRMFiltration

Product Recovery Management Inc.

CLIENT:
GLACIER ENVIRONMENTAL SERVICES, INC
PO BOX 1097
MUKILTEO, WA 98275

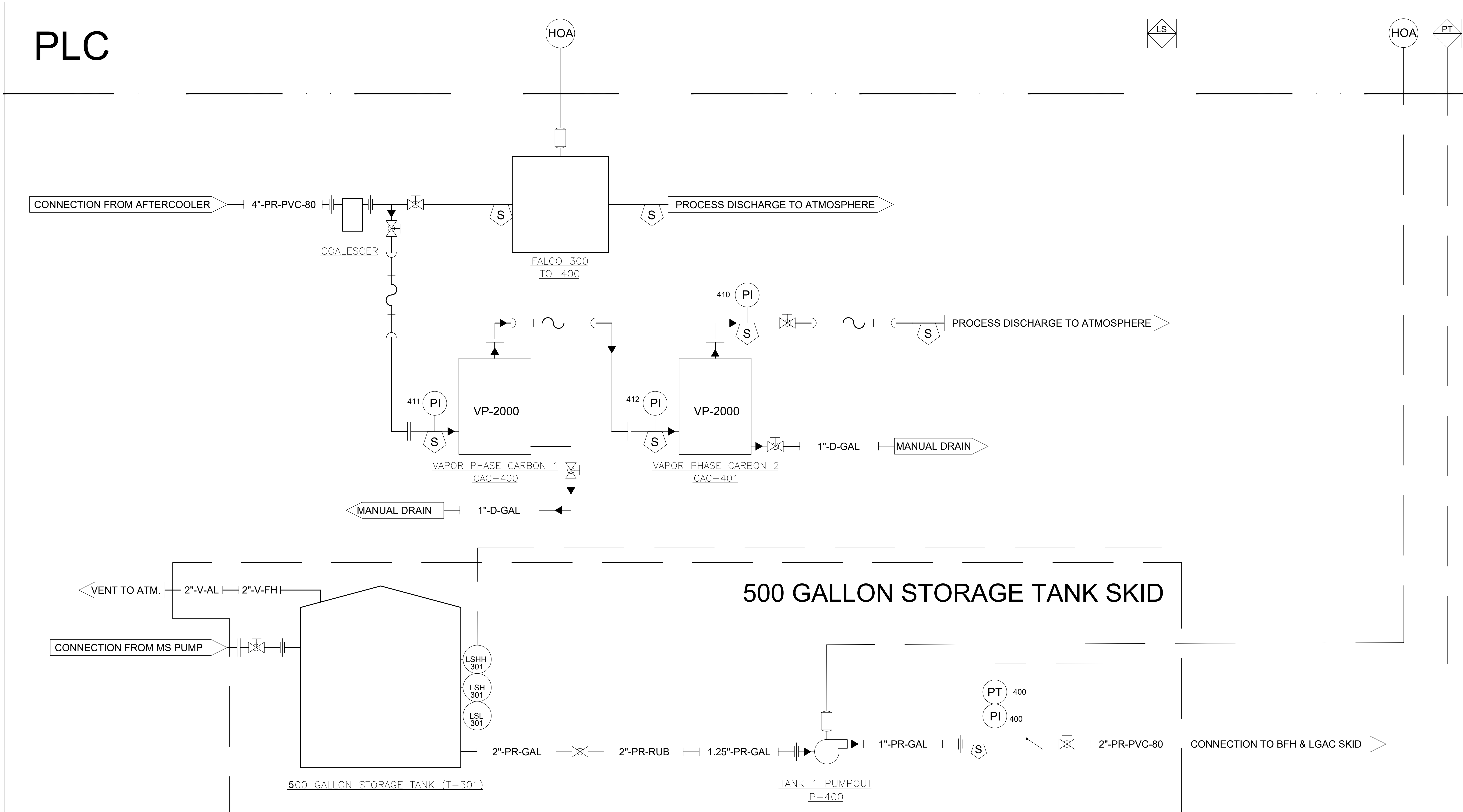
PROJECT TITLE:
MULTI PHASE VACUUM EXTRACTION SYSTEM
CIRCLE K 1461 ENVIRONMENTAL CLEANUP
2350 24TH AVE E
SEATTLE, KING COUNTY, WASHINGTON 98112

SHEET TITLE:
PROCESS & INSTRUMENTATION INLET MANIFOLDS, MS TANK, & LRP

QUOTE #: PRM-9844
PROJECT NUMBER: WO-8135
DATE: 12/1/23
DRAWN BY: MTW

NO.	REVISION	DATE
1	AS-BUILTS	04/08/24
2	CLIENT LABELS	06/11/24

DRAWING NUMBER: P&ID-2

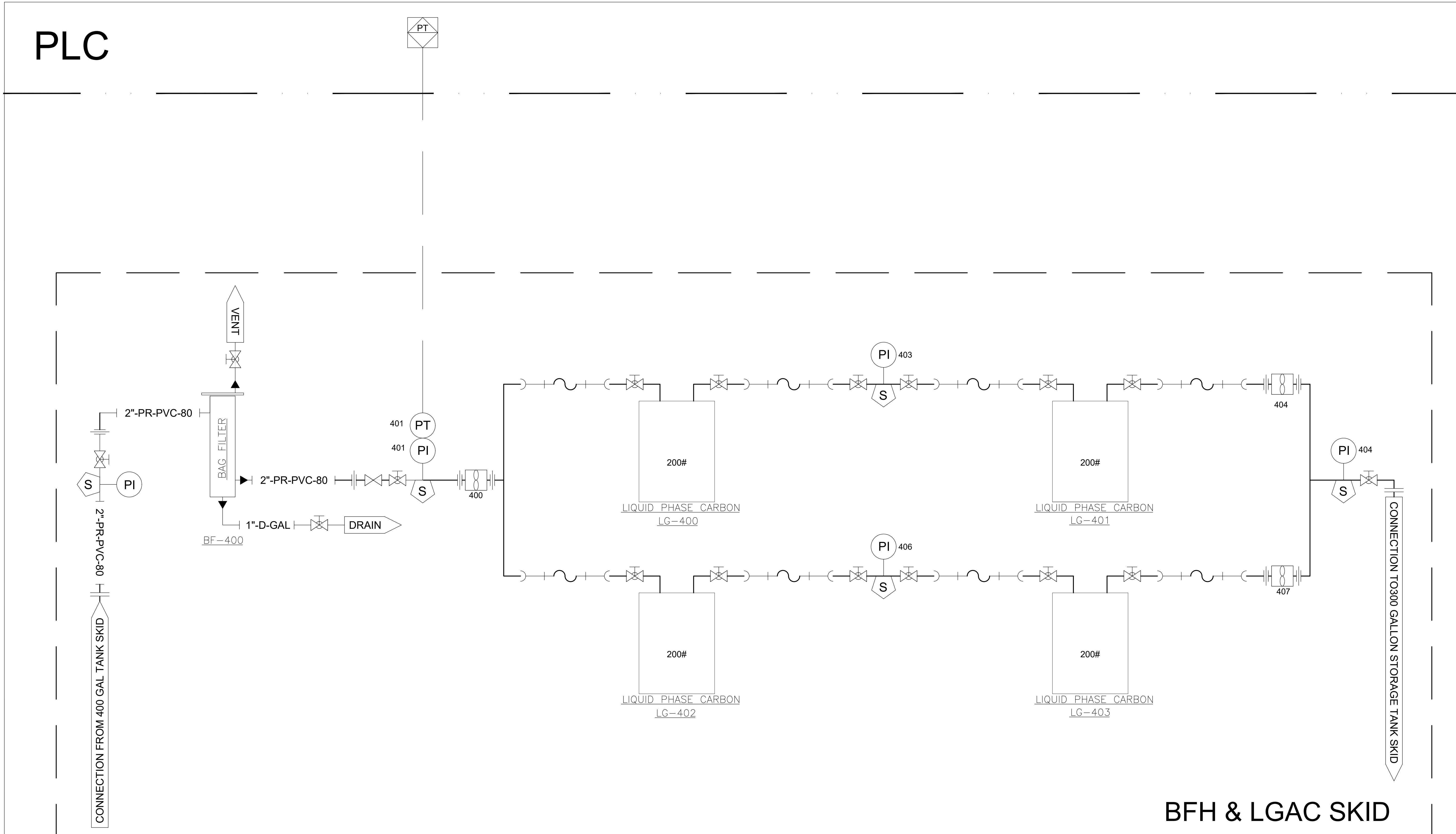


NOTES:
1. PRM IS NOT RESPONSIBLE FOR MAKING CONNECTIONS TO/FROM/BETWEEN FALCO AND CARBON VESSELS
2. ALL PRESSURE/VACUUM GAUGES SHALL INCLUDE BRASS ISOLATION VALVES

PRM Filtration	Product Recovery Management Inc. This information is proprietary and confidential. No copies or reproductions allowed without the express written consent of PRM Inc.	CLIENT: GLACIER ENVIRONMENTAL SERVICES, INC PO BOX 1097 MUKILTEO, WA 98275	PROJECT TITLE: MULTI PHASE VACUUM EXTRACTION SYSTEM CIRCLE K 1461 ENVIRONMENTAL CLEANUP 2350 24TH AVE E SEATTLE, KING COUNTY, WASHINGTON 98112	SHEET TITLE: PROCESS & INSTRUMENTATION VGACs & 500 GALLON STORAGE TANK SKID	QUOTE #: PRM-9844 / DATE: 12/1/23	PROJECT NUMBER: WO-8135 / DRAWN BY: MTW

NO.	REVISION	DATE
1	AS-BUILTS	04/08/24
2	CLIENT LABELS	06/11/24

DRAWING NUMBER: P&ID-3



NOTES:
1. ALL PRESSURE/VACUUM GAUGES SHALL INCLUDE BRASS ISOLATION VALVES

PRMFiltration

CLIENT:
GLACIER ENVIRONMENTAL SERVICES, INC
PO BOX 1097
MUKILTEO, WA 98275

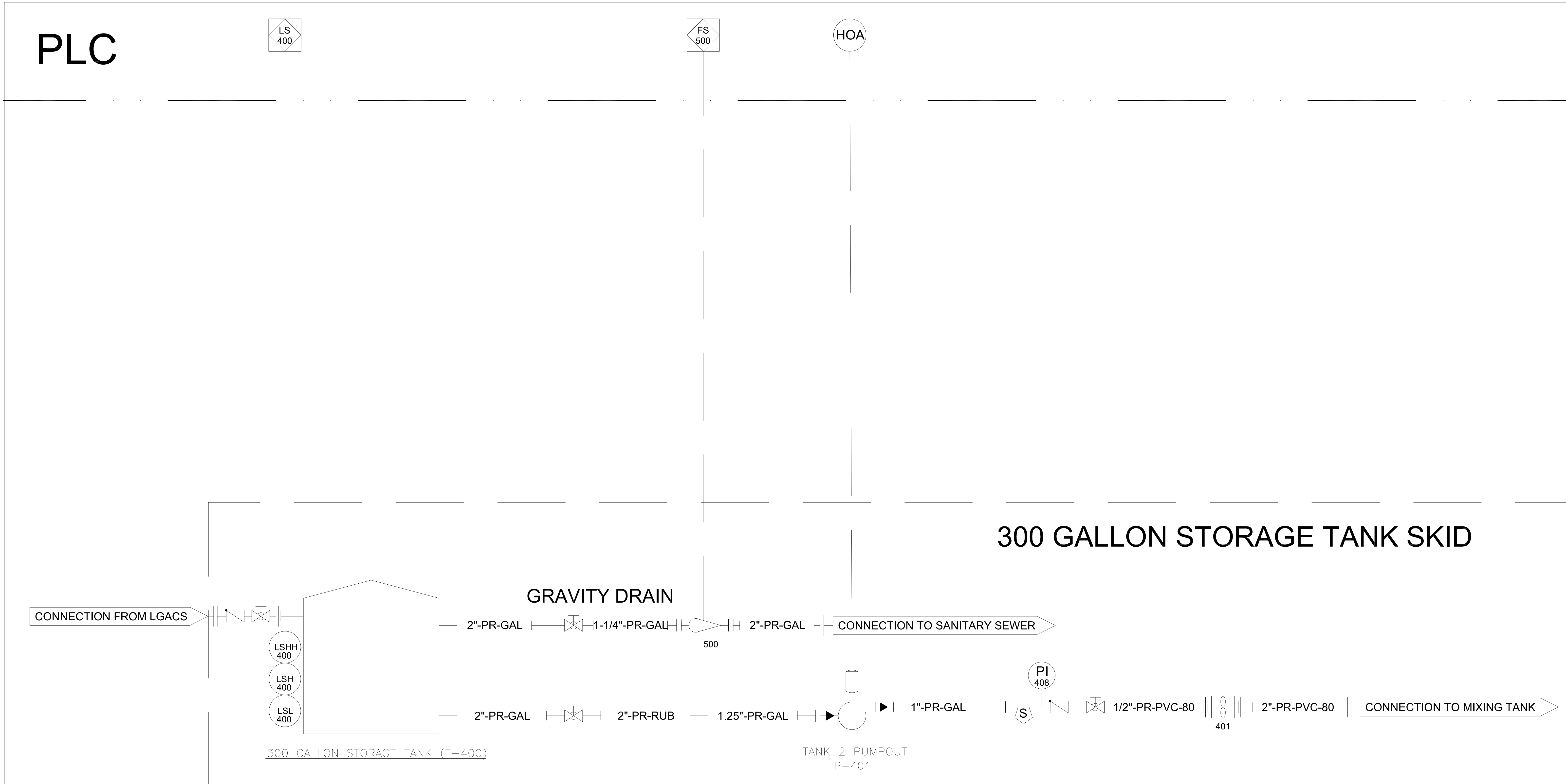
PROJECT TITLE:
MULTI PHASE VACUUM EXTRACTION SYSTEM
CIRCLE K 1461 ENVIRONMENTAL CLEANUP
2350 24TH AVE E
SEATTLE, KING COUNTY, WASHINGTON 98112

SHEET TITLE:
PROCESS & INSTRUMENTATION
BFH & LGAC SKID

QUOTE #:	PROJECT NUMBER:
PRM-9844	WO-8135
DATE: 12/1/23	DRAWN BY: MTW

NO.	REVISION	DATE
1	AS-BUILTS	04/08/24
2	CLIENT LABELS	06/11/24

DRAWING NUMBER:
P&ID-4



NOTES:
1. ALL PRESSURE/VACUUM GAUGES SHALL INCLUDE BRASS ISOLATION VALVES

PRMFiltration

Product Recovery Management Inc.
This information is proprietary and confidential. No copies or reproductions allowed without the express written consent of PRM Inc.

CLIENT:
GLACIER ENVIRONMENTAL SERVICES, INC
PO BOX 1097
MUKILTEO, WA 98275

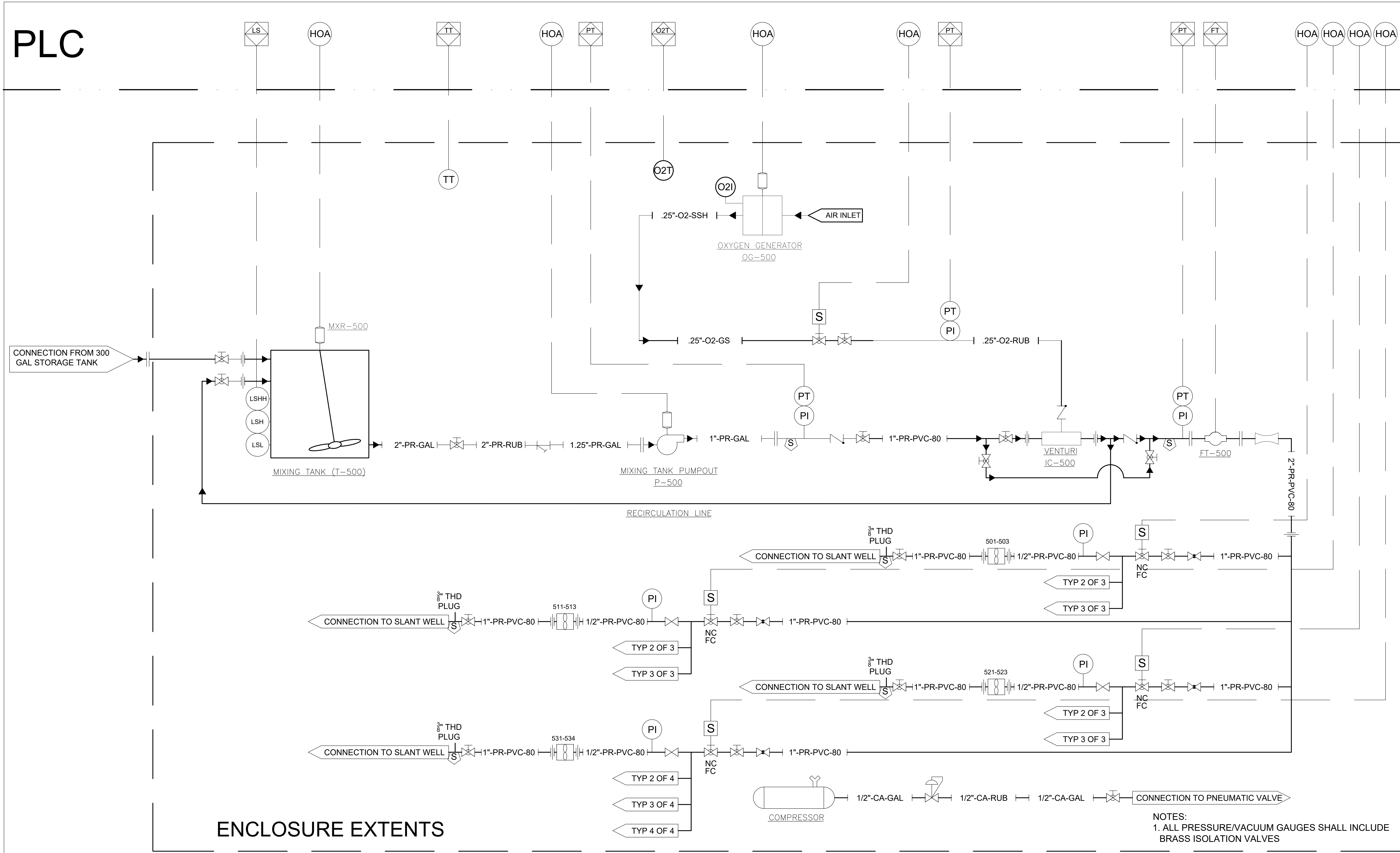
PROJECT TITLE:
MULTI PHASE VACUUM EXTRACTION SYSTEM
CIRCLE K 1461 ENVIRONMENTAL CLEANUP
2350 24TH AVE E
SEATTLE, KING COUNTY, WASHINGTON 98112

SHEET TITLE:
PROCESS & INSTRUMENTATION 300 GALLON STORAGE TANK SKID

QUOTE #:	PROJECT NUMBER:
PRM-9844	WO-8135
DATE:	DRAWN BY:
12/1/23	MTW

NO.	REVISION	DATE
1	AS-BUILTS	04/08/24
2	CLIENT LABELS	06/11/24
3	LABEL UPDATES	07/15/24
4	AS-BUILTS	08/23/24
5	CO-#1	04/10/25

DRAWING NUMBER:
P&ID-5

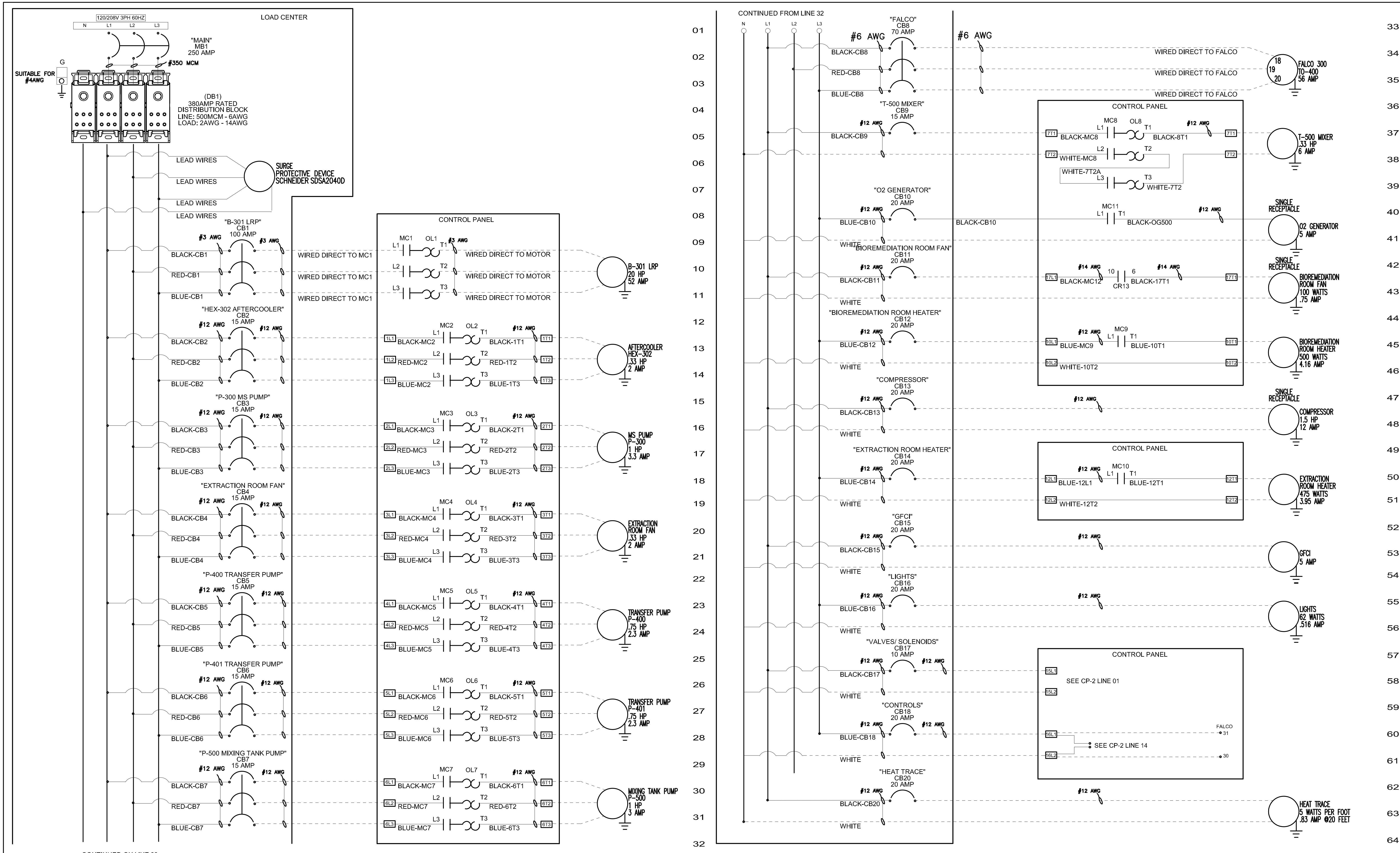


PRMFiltration

Product Recovery Management Inc.

CLIENT: GLACIER ENVIRONMENTAL SERVICES, INC PO BOX 1097 MUKILTEO, WA 98275	PROJECT TITLE: MULTI PHASE VACUUM EXTRACTION SYSTEM CIRCLE K 1461 ENVIRONMENTAL CLEANUP 2350 24TH AVE E SEATTLE, KING COUNTY, WASHINGTON 98112	SHEET TITLE: PROCESS & INSTRUMENTATION BIO-REMEDIATION	QUOTE #: PRM-9844	PROJECT NUMBER: WO-8135		DRAWING NUMBER: P&ID-6
			DATE: 12/1/23	DRAWN BY: MTW		

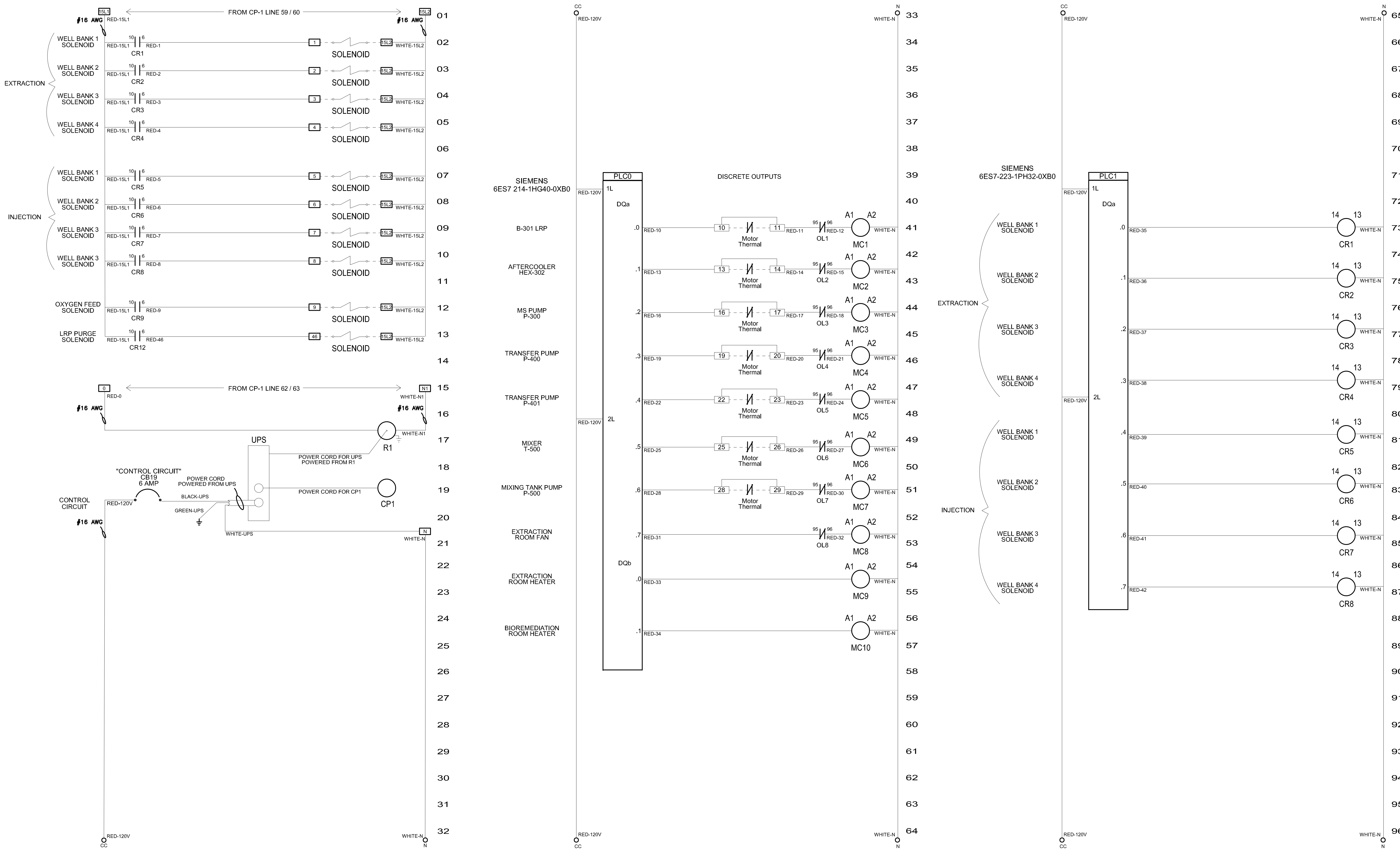
NO.	REVISION	DATE
1	AS-BUILTS	04/08/24
2	CLIENT LABELS	06/11/24



PRMFiltration	Product Recovery Management Inc. This information is proprietary and confidential. No copies or reproductions allowed without the express written consent of PRM Inc.	CLIENT: GLACIER ENVIRONMENTAL SERVICES, INC. 7509 212TH STREET SW EDMONDS, WASHINGTON 98026	PROJECT TITLE: CIRCLE K 1461 2350 24TH AVE E. SEATTLE, KING COUNTY WASHINGTON 98112	SHEET TITLE: CONTROL SCHEMATIC	DRAWING NUMBER: CP-1

CAD FILE:	PROJECT NUMBER:	SCALE:
GLACIER	8135	NTS
DATE:	DRAWN BY:	MET FILE:
11/17/23	CATLIN	SN0693

NO.	REVISION	DATE
1	As Built	4/1/2024



PRMFiltration

Product Recovery Management Inc.

This information is proprietary and confidential. No copies or reproductions allowed without the express written consent of PRM Inc.

CLIENT:
GLACIER ENVIRONMENTAL SERVICES, INC.
7509 212TH STREET SW
EDMONDS, WASHINGTON 98026

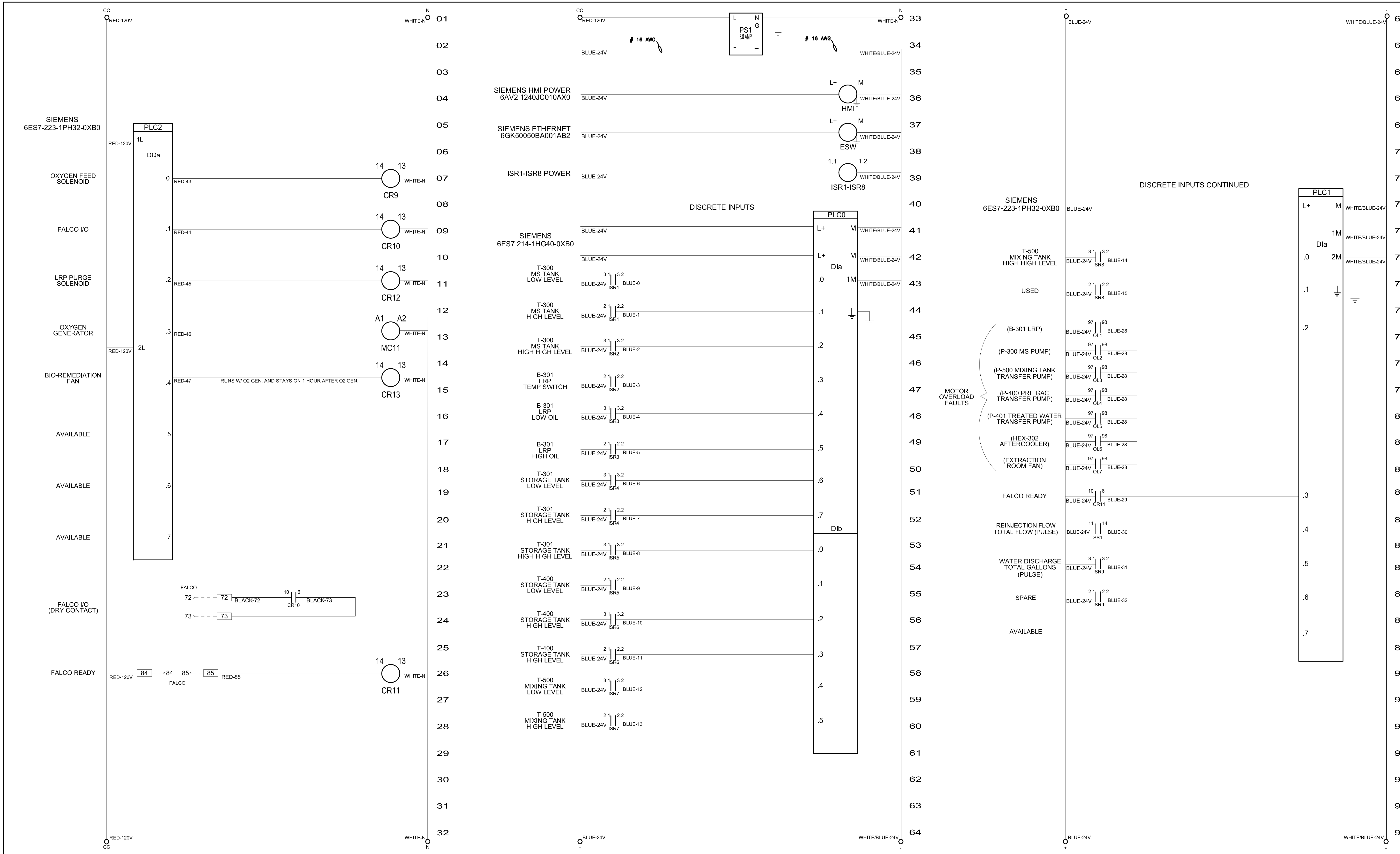
PROJECT TITLE:
CIRCLE K 1461
2350 24TH AVE E.
SEATTLE, KING COUNTY
WASHINGTON 98112

SHEET TITLE:
CONTROL SCHEMATIC

CAD FILE:	PROJECT NUMBER:	SCALE:
GLACIER	8135	NTS
DATE:	DRAWN BY:	MET FILE:
11/17/23	CATLIN	SN0693

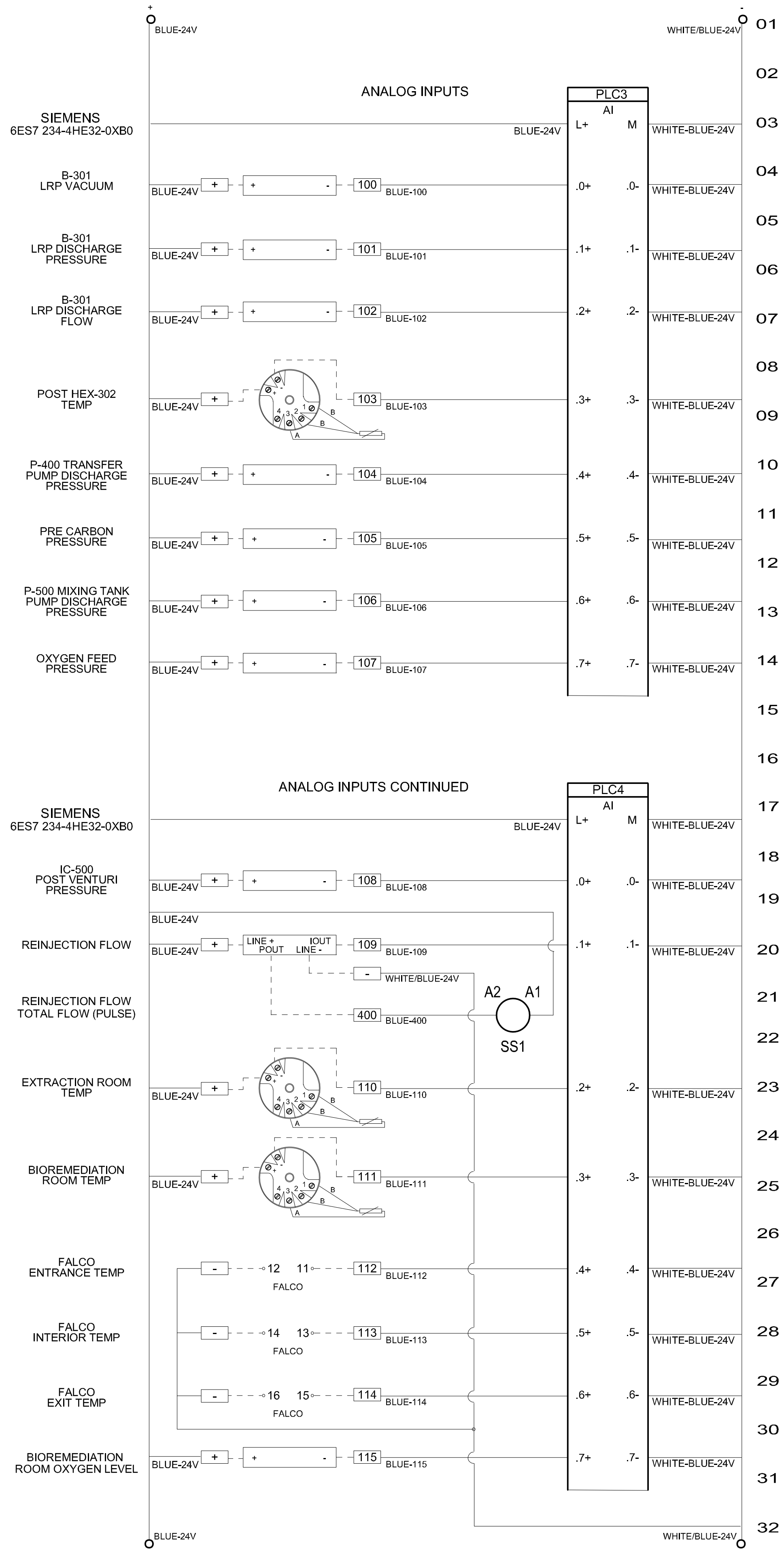
NO.	REVISION	DATE
1	As Built	4/1/2024

DRAWING NUMBER:
CP-2

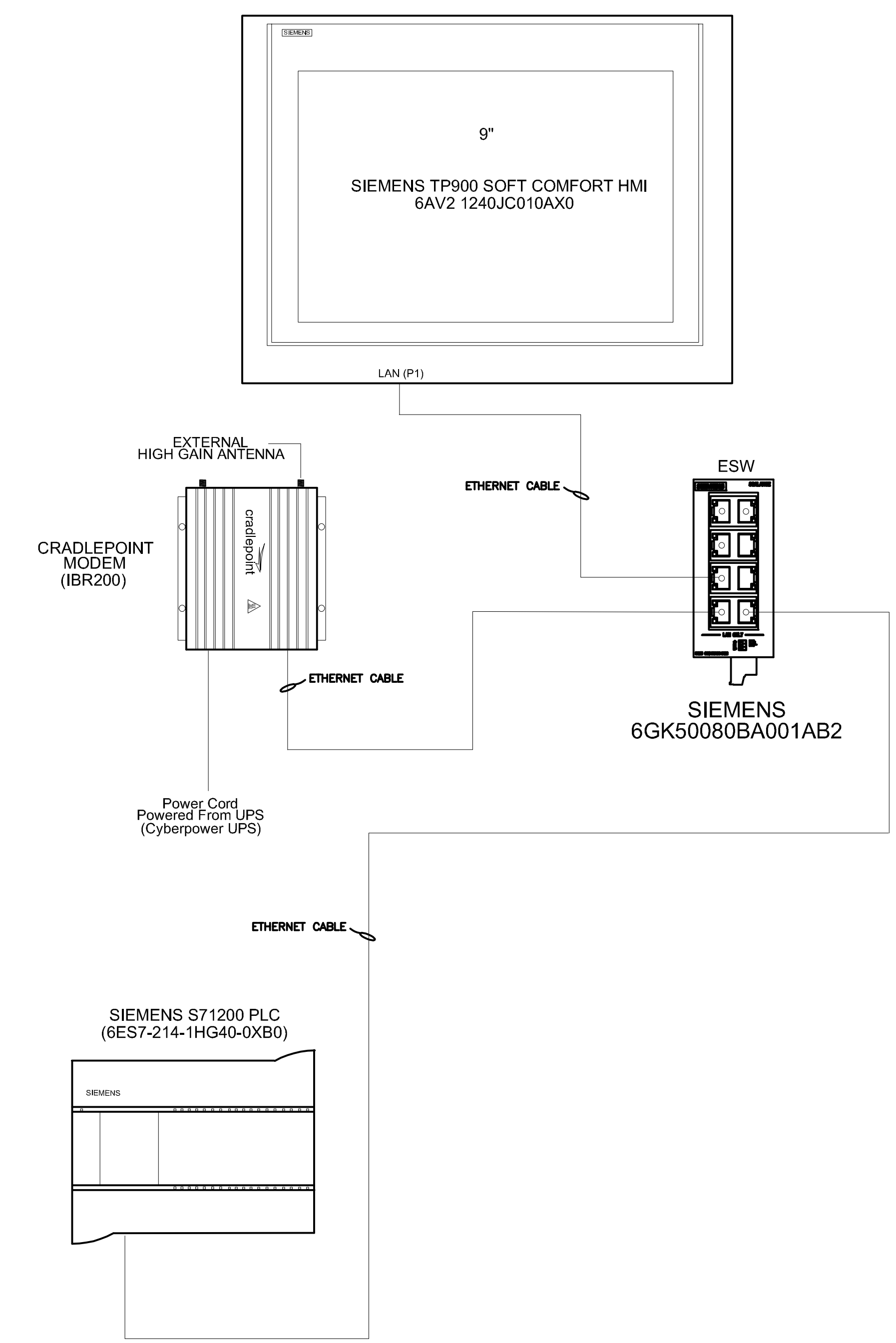


PRM Filtration	Product Recovery Management Inc. This information is proprietary and confidential. No copies or reproductions allowed without the express written consent of PRM Inc.	CLIENT: GLACIER ENVIRONMENTAL SERVICES, INC. 7509 212TH STREET SW EDMONDS, WASHINGTON 98026	PROJECT TITLE: CIRCLE K 1461 2350 24TH AVE E. SEATTLE, KING COUNTY WASHINGTON 98112	SHEET TITLE: CONTROL SCHEMATIC	CAD FILE: GLACIER; PROJECT NUMBER: 8135; SCALE: NTS; DATE: 11/17/23; DRAWN BY: CATLIN; MET FILE: SN0693	DRAWING NUMBER: CP-3

NO.	REVISION	DATE
1	As Built	4/1/2024
2	Water Discharge Totalizer	12/2/24



NETWORKING



PRMFiltration

Product Recovery Management Inc.

CLIENT: GLACIER ENVIRONMENTAL SERVICES, INC. 7509 212TH STREET SW EDMONDS, WASHINGTON 98026

PROJECT TITLE: CIRCLE K 1461 2350 24TH AVE E. SEATTLE, KING COUNTY WASHINGTON 98112

SHEET TITLE: CONTROL SCHEMATIC & NETWORKING MAP

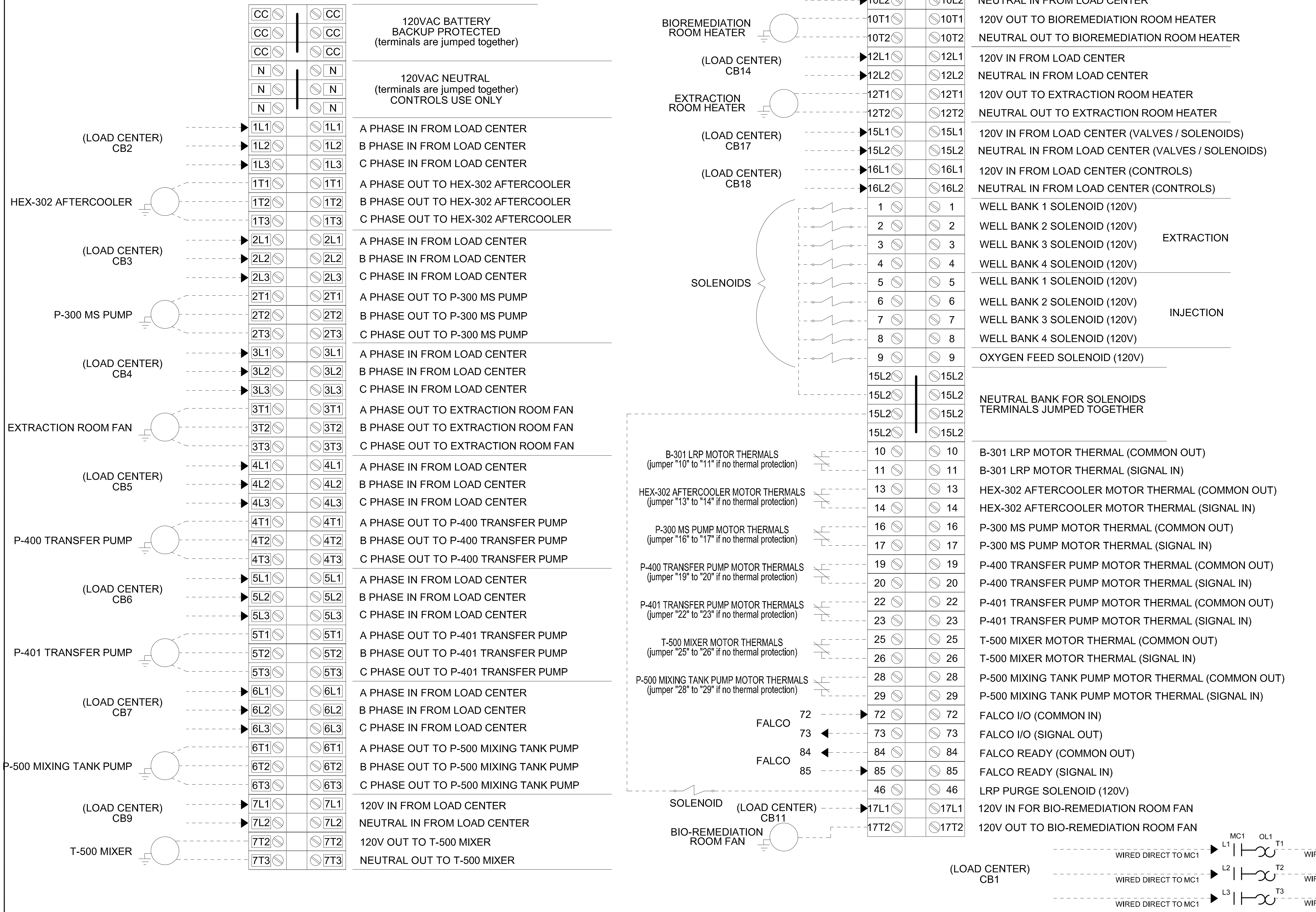
CAD FILE:	PROJECT NUMBER:	SCALE:
GLACIER	8135	NTS
DATE:	DRAWN BY:	MET FILE:
11/17/23	CATLIN	SN0693

NO.	REVISION	DATE
1	As Built	4/1/2024

DRAWING NUMBER: CP-4

TERM1: 89 (ALL)
PARTITION: 1
END CLAMP: 2

LINE VOLTAGE TERMINALS



I.D.	GLACIER8135 (DWG #8135
Voltage	120/208V
Phase	3
Panel FLA	162
Frequency	60hz
SCCR	10ka
Largest Motor: 20hp, 52 fla	
Nema Rating: 4	

PANEL CLASSIFICATION: UL508A / UL698A

PRMFiltration

Product Recovery Management Inc.

CLIENT: GLACIER ENVIRONMENTAL SERVICES, INC. 7509 212TH STREET SW EDMONDS, WASHINGTON 98026

PROJECT TITLE: CIRCLE K 1461 2350 24TH AVE E. SEATTLE, KING COUNTY WASHINGTON 98112

SHEET TITLE: LINE TERMINAL DEFINITIONS

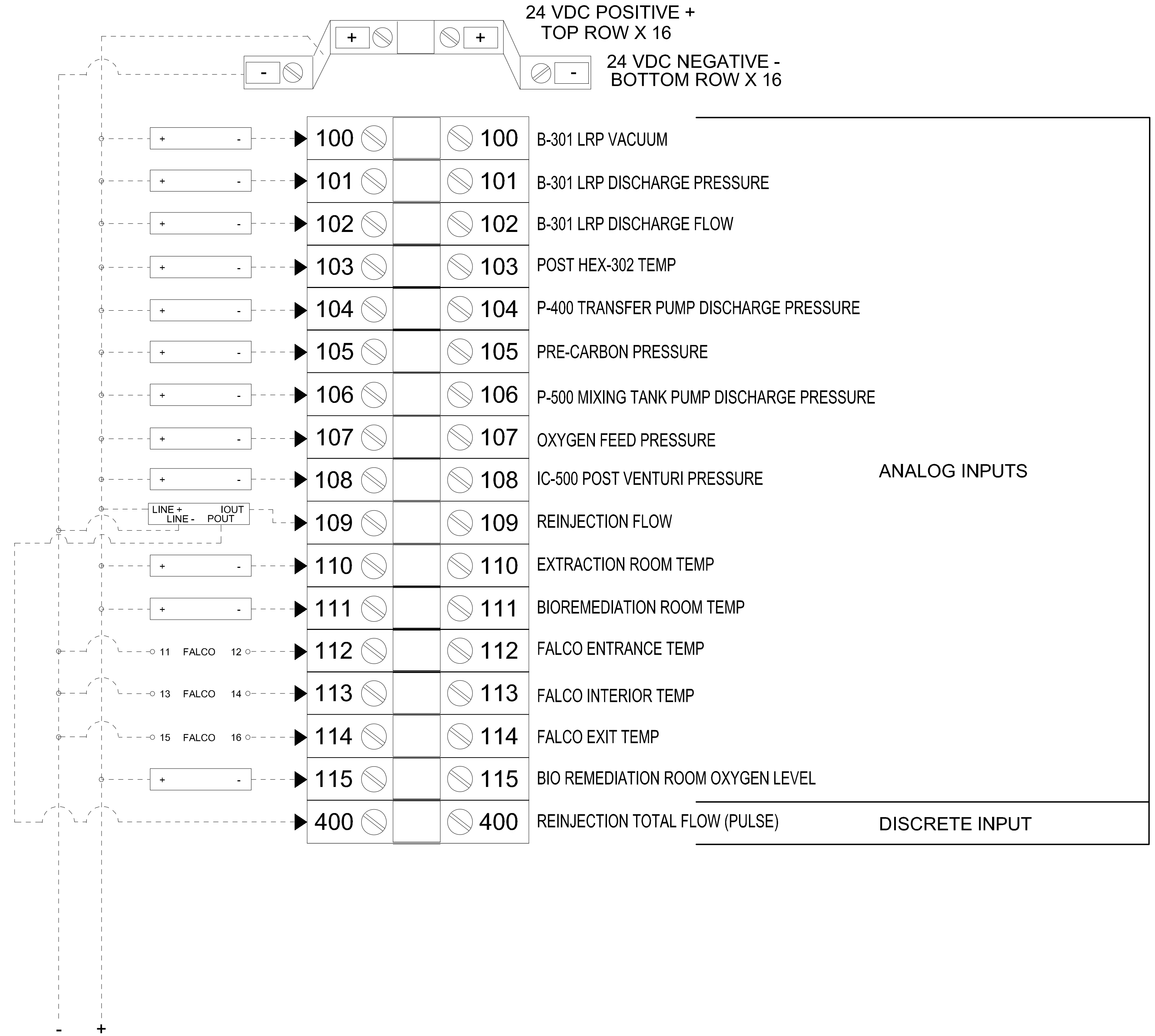
CAD FILE:	PROJECT NUMBER:	SCALE:
GLACIER	8135	NTS
DATE:	DRAWN BY:	MET FILE:
11/17/23	CATLIN	SN0693

NO.	REVISION	DATE
1	As Built	4/1/2024

DRAWING NUMBER: CP-5

TERM3: 16 (+ / -)
TERM2: 17 (100 - 400)
PARTITION: 2
END CLAMP: 2

LOW VOLTAGE TERMINALS

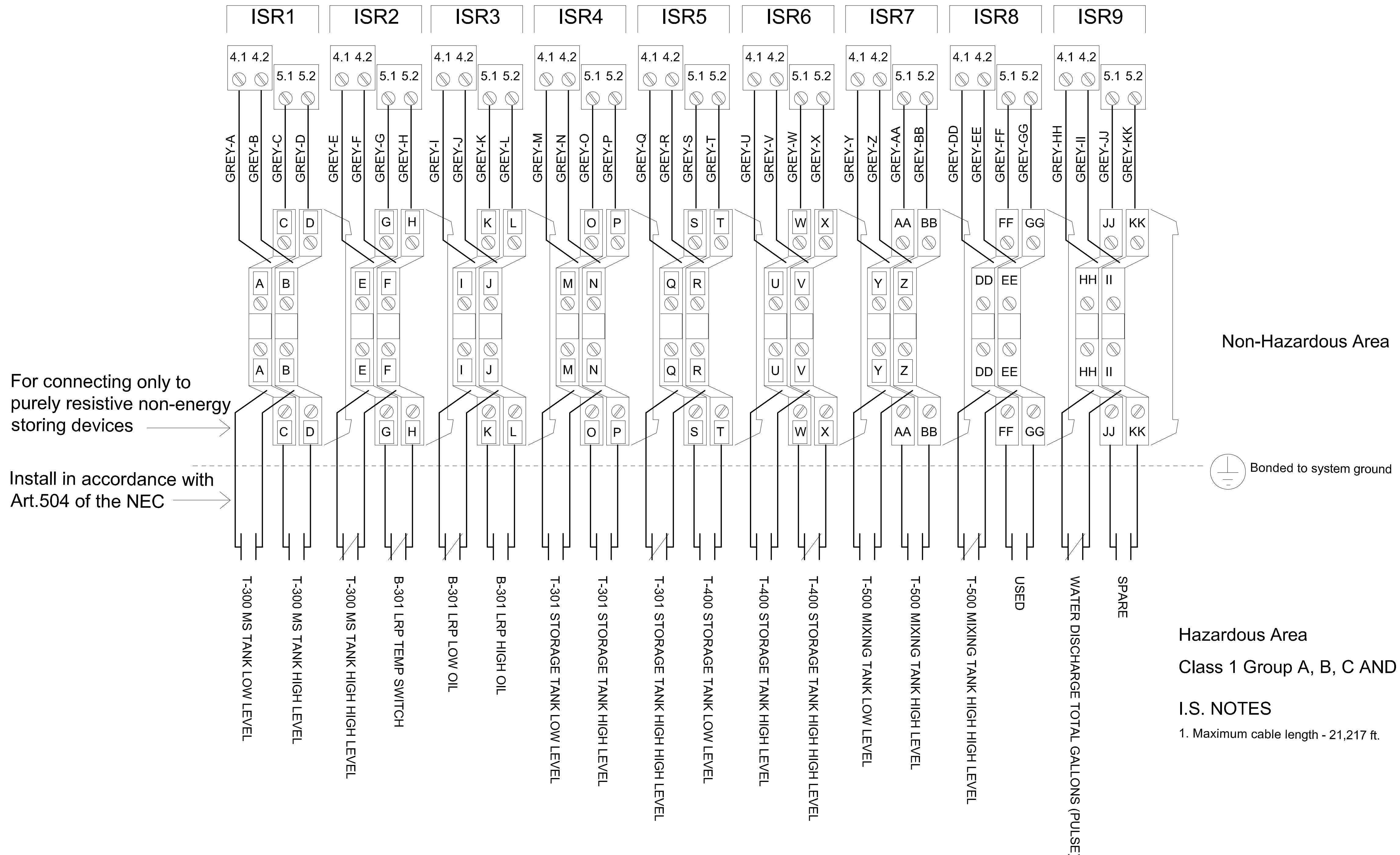


PRMFiltration	Product Recovery Management Inc. This information is proprietary and confidential. No copies or reproductions allowed without the express written consent of PRM Inc.	CLIENT: GLACIER ENVIRONMENTAL SERVICES, INC. 7509 212TH STREET SW EDMONDS, WASHINGTON 98026	PROJECT TITLE: CIRCLE K 1461 2350 24TH AVE E. SEATTLE, KING COUNTY WASHINGTON 98112	SHEET TITLE: LOW TERMINAL DEFINITIONS	CAD FILE: GLACIER / DATE: 11/17/23	PROJECT NUMBER: 8135 / DRAWN BY: CATLIN	SCALE: NTS / MET FILE: SN0693	DRAWING NUMBER: CP-6

NO.	REVISION	DATE
1	As Built	4/1/2024

TERM4 = 18
PARTITION: 1
END CLAMP: 2

** TERMINAL "CC" PURPOSELY OMITTED



Hazardous Area

Class 1 Group A, B, C AND D

I.S. NOTES

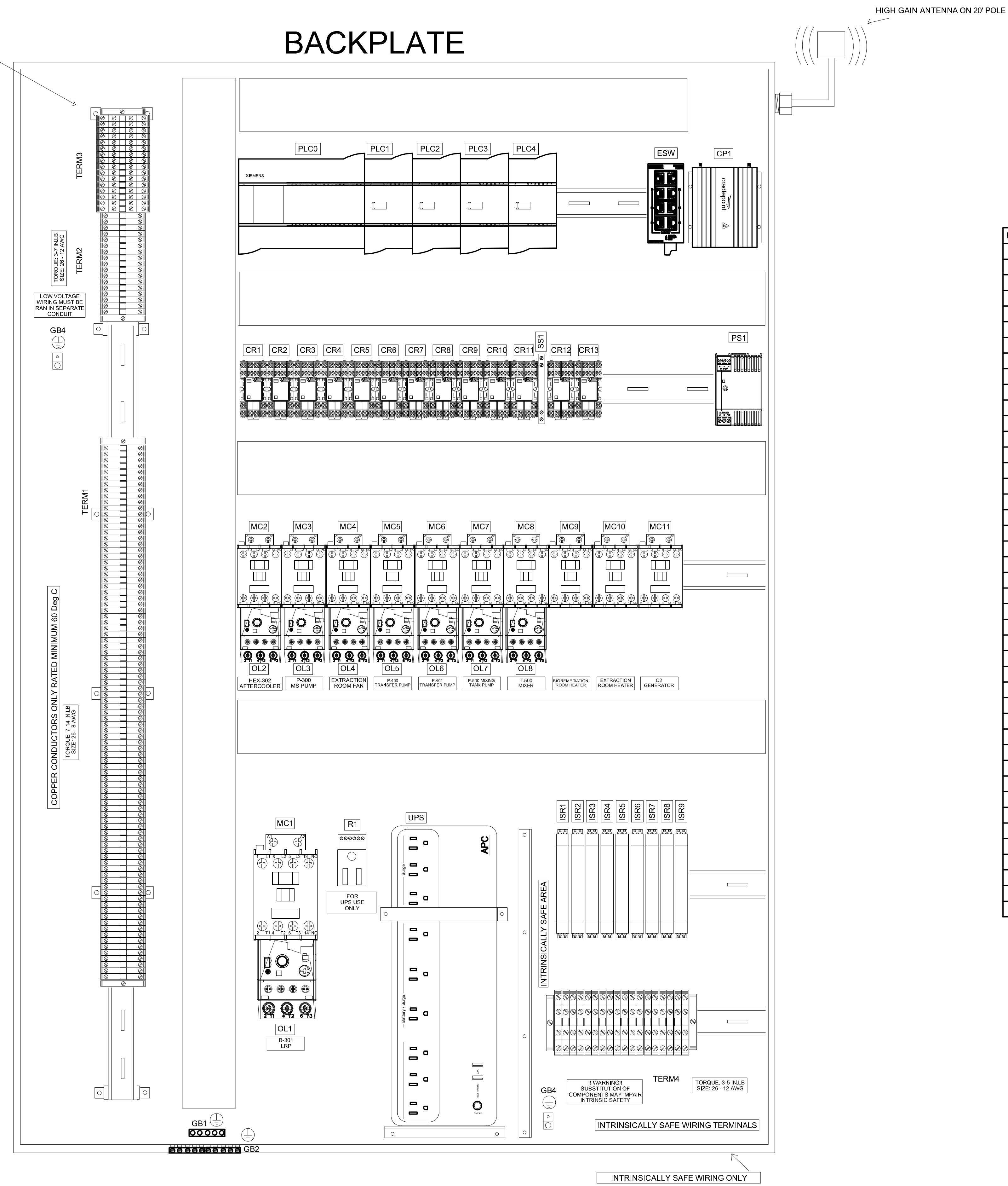
1. Maximum cable length - 21,217 ft.

PRMFiltration	Product Recovery Management Inc. This information is proprietary and confidential. No copies or reproductions allowed without the express written consent of PRM Inc.	CLIENT: GLACIER ENVIRONMENTAL SERVICES, INC. 7509 212TH STREET SW EDMONDS, WASHINGTON 98026	PROJECT TITLE: CIRCLE K 1461 2350 24TH AVE E. SEATTLE, KING COUNTY WASHINGTON 98112	SHEET TITLE: INTRINSICALLY SAFE TERMINAL DEFINITIONS	CAD FILE: GLACIER / DATE: 11/17/23	PROJECT NUMBER: 8135 / DRAWN BY: CATLIN	SCALE: NTS / MET FILE: SN0693	DRAWING NUMBER: CP-7

NO.	REVISION	DATE
1	As Built	4/1/2024
2	Water Discharge Totalizer	12/2/24

Terminal strip need to be as far right as reasonable.

BACKPLATE



Qty.	Drawing I.D.	Part No.	Description
		Enclosures	
1		28260	Technomatic 32x48x12 w/ Backplate
		Backplate	
1	PLC0	6ES7 214-1HG40-0XB0	Siemens S71200 PLC
1	PLC1	6ES72231PH320XB0	Siemens 8 Discrete Input 8 Relay Output Module
1	PLC2	6ES72231PH320XB0	Siemens 8 Discrete Input 8 Relay Output Module
1	PLC3	6ES72314HF320XB0	Siemens 8 Analog Input Module
1	PLC4	6ES72314HF320XB0	Siemens 8 Analog Input Module
1	ESW	6GK50050BA001AB2	Siemens 5 Port Ethernet Switch
1	CP1	IBR200	Cradlepoint Modem
13	CR1-CR13	D4L-110VAC	Rele 120vac Ice Cube Relay
13	CR1-CR13	ES-15/4	Rele Ice Cube Relay Base
1	SS1	8950820000	Weidmuller Solid State Relay
1	PS1	6EP1332-5BA20	Siemens 24VDC Power Supply
10	MC2-MC11	3RT20161AK61	Siemens Motor Controller
1	OL2	3RU21161CB0	Siemens Motor Overload 1.8 - 2.5 amp
1	OL3	3RU21161EB0	Siemens Motor Overload 2.8 - 4.0 amp
1	OL4	3RU21161CB0	Siemens Motor Overload 1.8 - 2.5 amp
1	OL5	3RU21161DB0	Siemens Motor Overload 2.2 - 3.2 amp
1	OL6	3RU21161DB0	Siemens Motor Overload 2.2 - 3.2 amp
1	OL7	3RU21161EB0	Siemens Motor Overload 2.8 - 4.0 amp
1	OL8	3RU21161HB0	Siemens Motor Overload 5.5 - 8.0 amp
1	MC1	3RT20381AK60	Siemens Motor Controller
1	OL1	3RU21364QB0	Siemens Motor Overload 47 - 57 amp
1	R1	635OL-080523	Wiedmuller 15amp GFCI
1	UPS	BE850G2	APC 850va Uniturupted Power Supply
2		PS5266-X	Pass & Seymour Male Plug End
9	ISR1-ISR9	2865476	Phoenix Contact Intrinsically Safe Barrier / Relay
90	TERM1	1020200000	Weidmuller Terminal Blocks
17	TERM2	1020000000	Weidmuller Terminal Blocks
16	TERM3	1021500000	Wiedmuller Terminal Blocks Tan 2 Tier
18	TERM4	1021580000	Wiedmuller Terminal Blocks Blue 2 Tier
1		1050000000	Wiedmuller Terminal Block Partition Plate
1		1059100000	Wiedmuller Terminal Block Partition Plate
1		1059180000	Wiedmuller Terminal Block Partition Plate
6		1061200000	Wiedmuller Terminal Block End Clamp
1	GB1	PK5GTA	Square D Equipment Grounding Bar Kit
1	GB2	PK7GTA	Siemens Equipment Grounding Bar Kit
2	GB4	OEC99001	Single Grounding Lug 4-14AWG
	AS NEEDED		80x60 Wire Duct
1	Antenna	WMMG-7-27-5SP	Rok Bro's High Gain Antenna
20'	Antenna		1 1/4" EMT

PRMFiltration

Product Recovery Management Inc.

This information is proprietary and confidential. No copies or reproductions allowed without the express written consent of PRM Inc.

CLIENT:
GLACIER ENVIRONMENTAL SERVICES, INC.
7509 212TH STREET SW
EDMONDS, WASHINGTON 98026

PROJECT TITLE:
CIRCLE K 1461
2350 24TH AVE E.
SEATTLE, KING COUNTY
WASHINGTON 98112

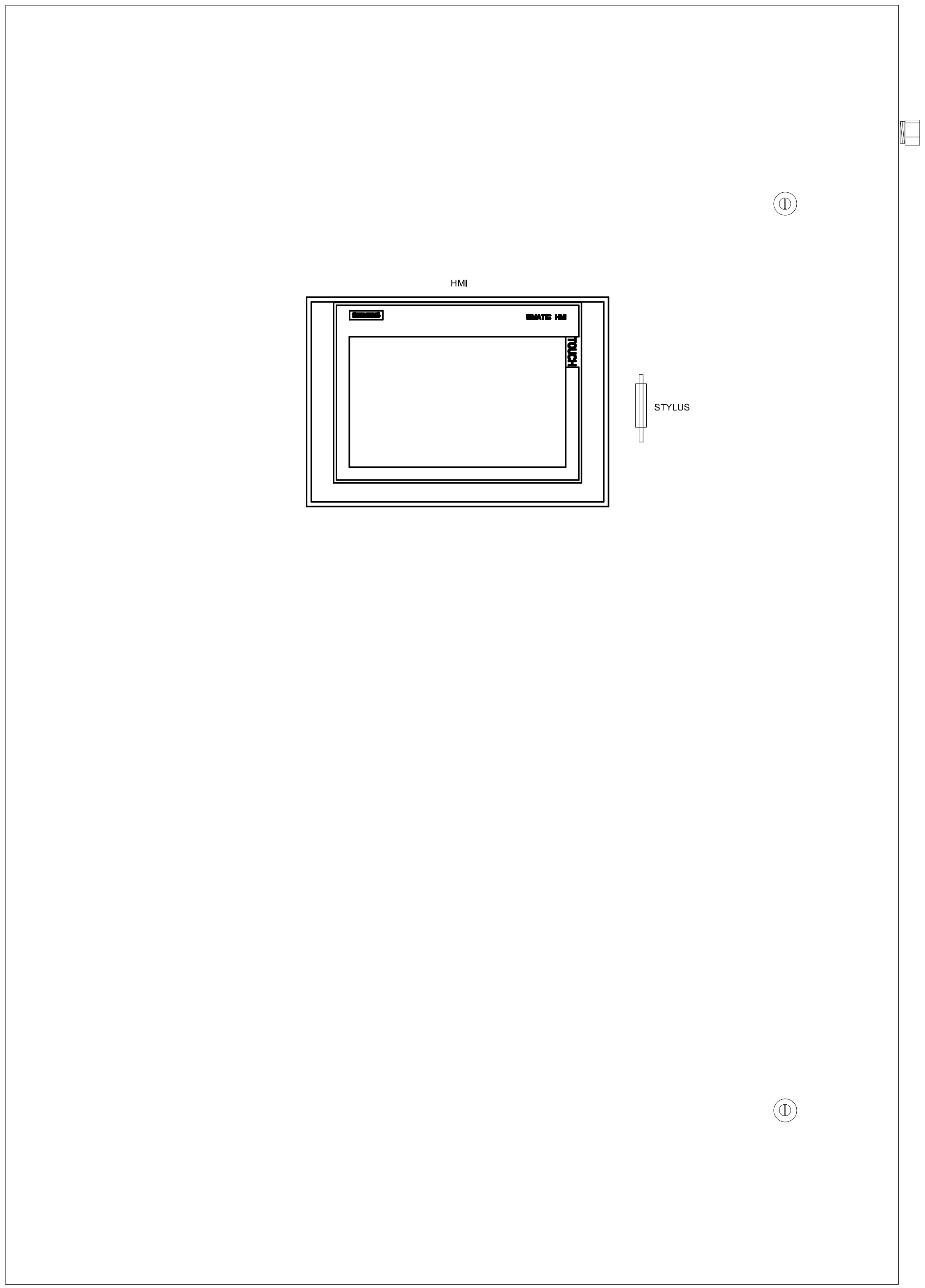
SHEET TITLE:
LAYOUT & BILL OF MATERIAL

CAD FILE:	PROJECT NUMBER:	SCALE:
GLACIER	8135	NTS
DATE: 11/17/23	DRAWN BY: CATLIN	MET FILE: SN0693

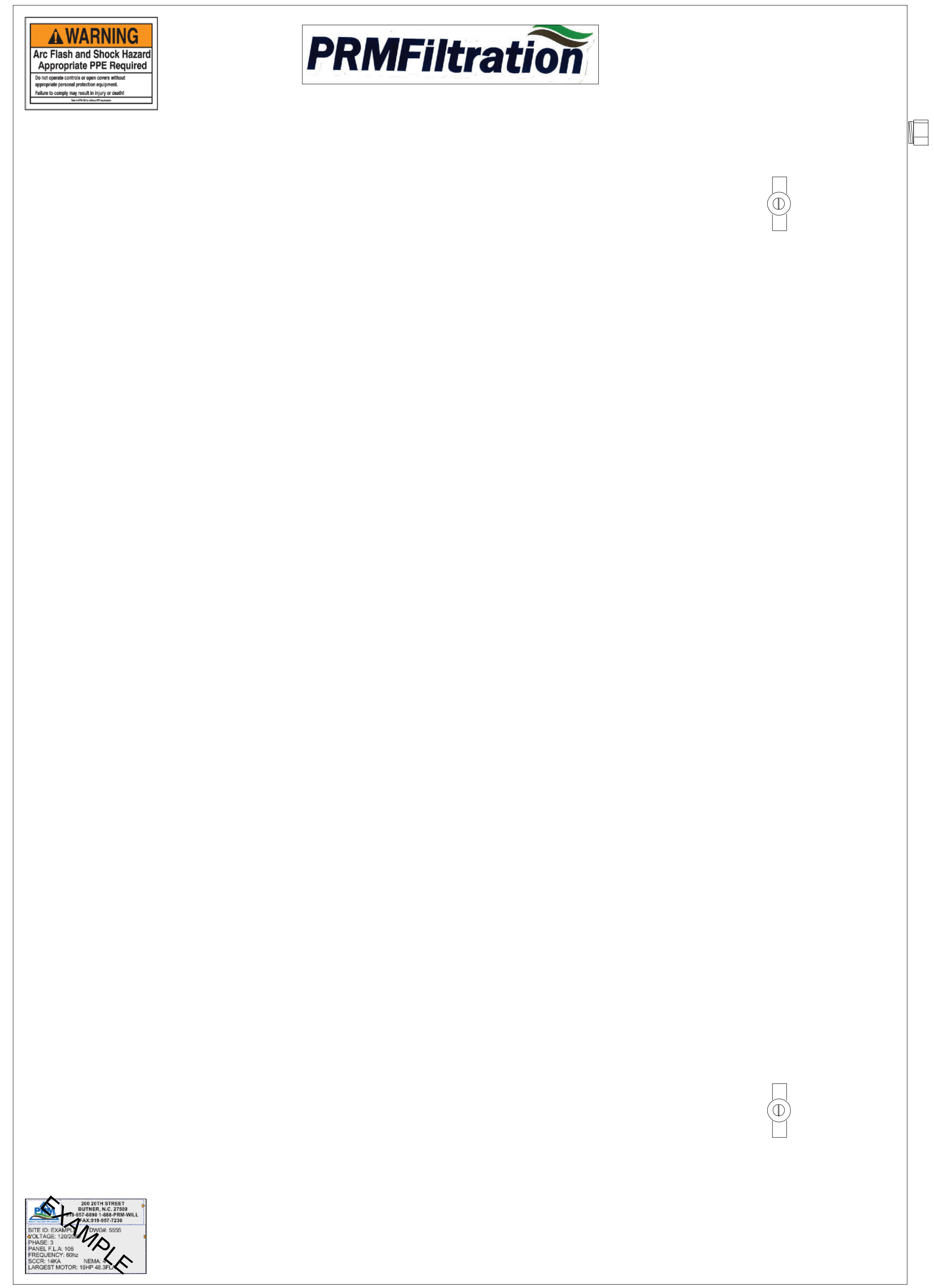
NO.	REVISION	DATE
1	As Built	4/1/2024
2	Water Discharge Totalizer	12/2/24

DRAWING NUMBER:
CP-8

(HINGE ON RIGHT SIDE)
INTERIOR DOOR



EXTERIOR DOOR



Qty.	Drawing I.D.	Part No.	Description
		Door	
1	HMI	6AV2 1240JC010AX0	Siemens 9-inch Soft Comfort Touch Panel
1	HMI	N/A	Soft Tip Stylus
1	HMI	Classic-1-1003	PenPal Stylus Holder

PRMFiltration

Product Recovery Management Inc.

CLIENT:
GLACIER ENVIRONMENTAL SERVICES, INC.
7509 212TH STREET SW
EDMONDS, WASHINGTON 98026

PROJECT TITLE:
CIRCLE K 1461
2350 24TH AVE E.
SEATTLE, KING COUNTY
WASHINGTON 98112

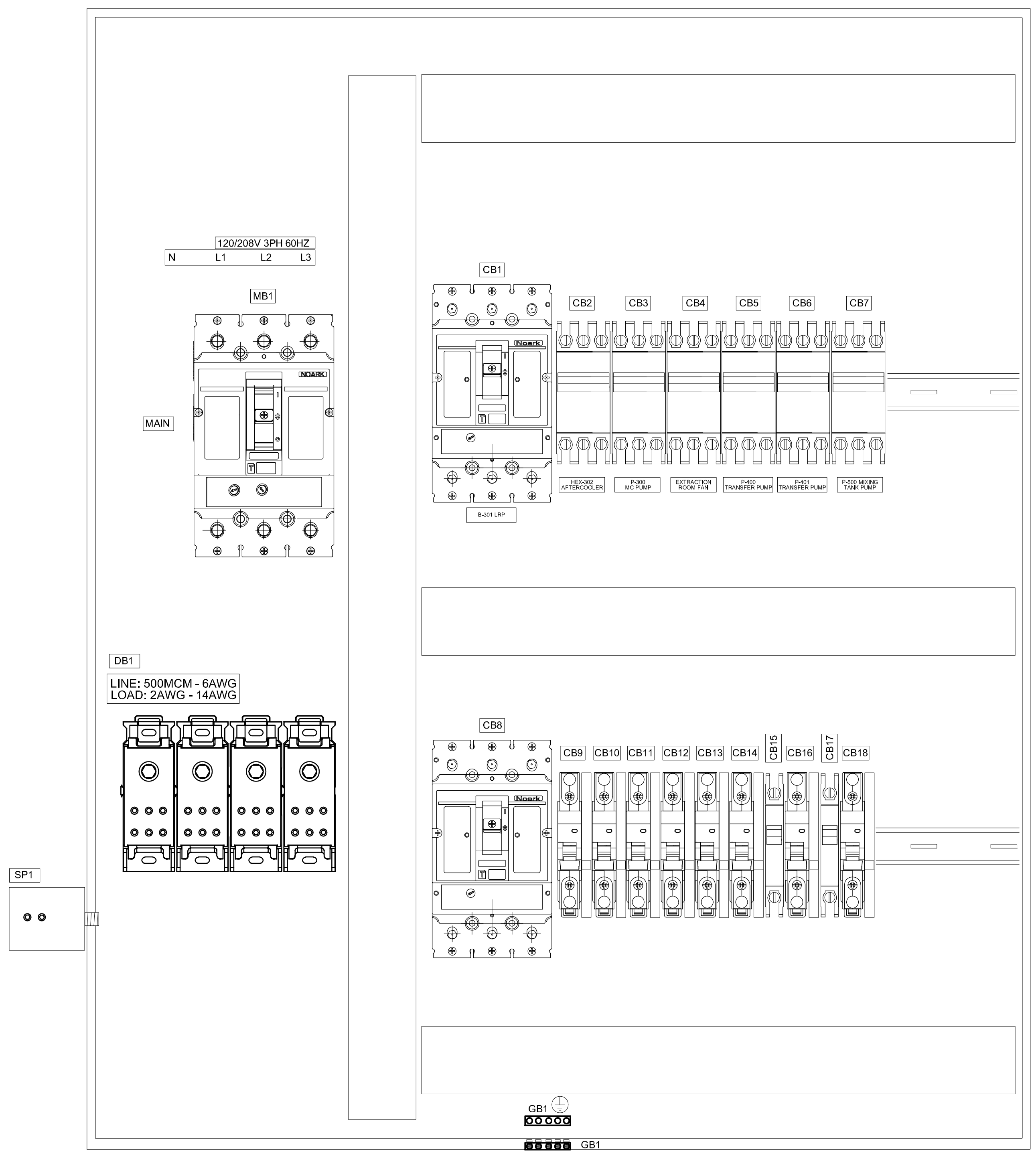
SHEET TITLE:
LAYOUT & BILL OF MATERIAL

CAD FILE:	PROJECT NUMBER:	SCALE:
GLACIER	8135	NTS
DATE:	DRAWN BY:	MET FILE:
11/17/23	CATLIN	SN0693

NO.	REVISION	DATE
1	As Built	4/1/2024

DRAWING NUMBER:
CP-9

BACKPLATE



Qty.	Drawing I.D.	Part No.	Description
		Enclosures	
1		28220	Technomatic 32x40x12 w/ Backplate
		Backplate	
1	MB1	M2N250T3L	Noark 250amp 208v 3 Pole Circuit Breaker
1	CB1	M1N100T3L	Noark 100amp 208v 3 Pole Circuit Breaker
1	CB2	5SJ4318-7HG41	Siemens 15amp 208v 3 Pole Circuit Breaker
1	CB3	5SJ4318-7HG41	Siemens 15amp 208v 3 Pole Circuit Breaker
1	CB4	5SJ4318-7HG41	Siemens 15amp 208v 3 Pole Circuit Breaker
1	CB5	5SJ4318-7HG41	Siemens 15amp 208v 3 Pole Circuit Breaker
1	CB6	5SJ4318-7HG41	Siemens 15amp 208v 3 Pole Circuit Breaker
1	CB7	5SJ4318-7HG41	Siemens 15amp 208v 3 Pole Circuit Breaker
1	CB8	M1N70T3L	Noark 70amp 208v 3 Pole Circuit Breaker
1	CB9	B1NQ1D20	Noark 20amp 120v Single Pole Circuit Breaker
1	CB10	B1NQ1D20	Noark 20amp 120v Single Pole Circuit Breaker
1	CB11	B1NQ1D20	Noark 20amp 120v Single Pole Circuit Breaker
1	CB12	B1NQ1D20	Noark 20amp 120v Single Pole Circuit Breaker
1	CB13	B1NQ1D20	Noark 20amp 120v Single Pole Circuit Breaker
1	CB14	B1NQ1D20	Noark 20amp 120v Single Pole Circuit Breaker
1	CB15	B1NQ1D20	Noark 20amp 120v Single Pole Circuit Breaker
1	CB16	B1NQ1D10	Noark 10amp 120v Single Pole Circuit Breaker
1	CB17	B1NQ1D6	Noark 6amp 120v Single Pole Circuit Breaker
1	GB1	PK5GTA	Square D Equipment Grounding Bar Kit
1	GB4	OEC99001	Single Grounding Lug 4-14AWG
AS NEEDED			60X80 Wire Duct

PRMFiltration

Product Recovery Management Inc.

CLIENT:	PROJECT TITLE:	SHEET TITLE:	CAD FILE:	PROJECT NUMBER:	SCALE:
GLACIER ENVIRONMENTAL SERVICES, INC. 7509 212TH STREET SW EDMONDS, WASHINGTON 98026	CIRCLE K 1461 2350 24TH AVE E. SEATTLE, KING COUNTY WASHINGTON 98112	LOAD CENTER LAYOUT & BILL OF MATERIAL	GLACIER	8135	NTS
			DATE:	DRAWN BY:	MET FILE:
			11/17/23	CATLIN	SN0693

NO.	REVISION	DATE
1	As Built	1/26/24

DRAWING NUMBER: CP-10

Appendix E

Vendor-Supplied Documentation

NOTES ADDED BY
GLACIER 10/24

Design & Operations Submittal Document

Multi-Phase Extraction System
Circle K 1461 Environmental Cleanup

September 5, 2023

Prepared for:

Glacier Environmental Services Inc.
PO Box 1097
Mukilteo, WA 98275

Prepared by:

Product Recovery Management, Inc.
200 20th St
Butner, North Carolina 27509
(919) 957-8890

TABLE OF CONTENTS

SECTION 1

EQUIPMENT SPECIFICATIONS

PRM 9844

System Enclosure
8' x 20' Seabox shipping container (one trip unit)
• Plywood treated floor
• Double end doors and a single side door
• Framed interior with R-10 value insulation
• Wall vents throughout for proper ventilation.
• Process room to be rated and wired for Class 1 Div II in classification
• Thermostatically controlled hazardous location exhaust fan with fan guard for classified side, exterior louver and exterior finger guard.
• Hazardous location LED lights w/ switch
• Hazardous location Heater
• Partition wall to separate controls and non-haz equipment
• Standard lighting, ventilation and heating in Bio-Remediation room
• Includes full fabrication of treatment system, including plumbing, electrical, and thorough testing as well as labeling.

Inlet Manifold for Vertical & Horizontal Wells
• 2" Inlet manifold will be plumbed into 4 zones
• Each of the 4 zones will consist of the following equipment:
• 2' Ball Valves
• 2" Solenoid Valves

solenoid and pneumatic? check excel file

• (3) Three of the zones will have 3 legs, and (1) zone will have 4 legs
• Each of the 13 legs will be plumbed with the following equipment:
• 1" Gate valve
• 1" Ball valve

not supplied, correct?

• Sample port
• Rotometer
• 0-30" Hg Vacuum gauge
• Plumbed to exterior of enclosure for others to connect to

Inlet Manifold - SSD Slant wells
• 2" SVE Inlet manifold will be plumbed with 3 legs
• Each of the 3 legs will consist of the following equipment:
• 1" Gate valve
• 1" Ball valve
• Sample port

not supplied, correct?

• Rotometer
• 0-30" Hg Vacuum gauge
• Plumbed to exterior of enclosure for others to connect to

Liquid Ring Pump System
• Travaini liquid ring pump model TRVX657/1Y-C/F
• Nominal Capacity : 300 ACFM @ 29" Hg***
• Maximum Vacuum : 29" Hg
• Pump Speed : 1750 RPM
• Pump Materials : Cast iron housing; ductile iron impeller; 420 SS shaft
• Shaft Seals : SiC/C faced mechanical seals with Viton elastomers
• Electric Motor : 20 HP; 1750 RPM; 230/460V/3 Ph/60 Hz; TEFC, Premium Efficiency motor rated for Class 1, Division 2 Hazardous Locations
• Monoblock assembly complete with flexible coupling and guard
• Sealing Fluid Recirculation System:
• Sealing fluid separator tank/reservoir with sight gauge, pressure gauge, temperature gauge and drain valve
• Separator element

• NEMA-4 rated high temperature switch
• Temperature Control Valve
• High & Low level switch
• Air-cooled heat exchanger
• Complete charge of DynaLube, long life seal fluid
• Inlet Check valve
• Inlet Vacuum gauge
• Vacuum relief valve assembly with filter silencer
• Automatic unloading valve with filter silencer
• Inlet filter assembly
• Vacuum Transmitter and gauge
• Pressure transmitter and gauge
• Temperature transmitter and gauge
• Pitot tube and differential pressure gauge for local flow reading
• Differential pressure transmitter for remote reading
• AKG Model CC450-3 Heat Exchanger will be sent loose for others to install on exterior.
• See options below for PRM to provide an elevated frame for the HEX to be mount to on exterior once system arrives.
• Discharge exhaust to side of enclosure, others will plumb exhaust to vapor treatment equipment.

Moisture Separator
• PRM model MS-120 moisture separator, aluminum construction. Designed for hi-vac application and dual phase extraction.
• Centrifugal design with bolt down lid and 6" clean out.
• Solberg 235P inlet filter, filter will be integral to MS tank design
• Kunkle automatic vacuum relief valve provided to protect blower.
• 1” manual drain valve
• 2” Gate valve for dilution air mounted on MS tank. Includes inlet filter/silencer
• 0-30” Hg Vacuum gauge
• Sight glass assembly mounted to side of tank with 3 float stem switch to control transfer pump, and high level shut off
See Option for upgrade to MS-200

MS Transfer Pump
• ~~Continental Pump Model CPML56~~ Roto Pump AGCA01A progressive cavity transfer pump
• Coupled to a 1.5 HP 208V 3 phase TEFC motor
• Ball valves and unions on the inlet and discharge
• Pres gauge, check valve, ball valve, valved sample port, ~~and PRM Pulse water meter~~ plumbed on discharge side
• Discharge piping will plumb to side of enclosure for others to connect to.

Vapor Phase Carbon Vessels
• (2) PRM VP-2000 Vapor Phase Carbon Vessels
• Each Filled with 2000 lbs of Granulated 4x10 Re-Activated Carbon
• 4" inlet/out connection ports
• Drain valve
• Pressure gauges and sample ports
• Camlock connections on ports for connections to be made by others

Storage Tank & Pump Skid - Prior to Liquid Filtration
• 425 Gallon Poly Storage Tank
• Equipped with ~~Sight glass assembly mounted to side of tank with 3 float stem~~ 2 teardrop float switch to control transfer pump, and high level shut off
• Tank and Pump will be mounted/plumbed/wired on an aluminum skid.
• Terminations will end on skid for others to connect in the field

Transfer Pump
• Ebara Model CDU70 centrifugal transfer pump
• Coupled to a 3/4 HP 208V 3 phase TEFC motor
• Ball valves and unions on the inlet and discharge
• Pres gauge, check valve, ball valve, valved sample port
• Pressure transmitter
• Discharge piping will plumb to edge of skid for others to connect to Bag filter

Bag Filtration & Carbon Filter Skid
• PRM Bag Filter housings, 8" Dia x 30" long
• 2" I/O, 100 psi rating, 100 gpm rating
• SS Strainer basket sized for #2 trade size bag
• One spare basket will be provided
• (25) count of 25 micron bag filters included
• Pressure transmitter
• ~~Flowmeter~~ Rotameters
• Ball valves on inlet and outlet
• Pressure gauges and sample ports

Liquid Phase Carbon Vessels
• (4) PRM HP-200 Liquid Phase Carbon Vessels
• Each Filled with 200lbs of Granulated 8x30 Carbon
• ~~2"~~ 1" inlet/out connection ports
~~• Drain valve~~
• Pressure gauges and sample ports
• Interconnecting hoses and camlock connections
• Flowmeters
• Control valves
Bag Filter and Carbon vessels will all be mounted/plumbed on an aluminum skid.
Plumbing/Hoses will reach edge of skid for others to connect to

Storage Tank & Pump Skid - Post Liquid Filtration
• 300 Gallon Poly Storage Tank
• Equipped with Sight glass assembly mounted to side of tank ~~with 3 float stem~~ and teardrop float switch to control transfer pump, and high level shut off
• Tank and Pump will be mounted/plumbed/wired on an aluminum skid.
• Terminations will end on skid for others to connect in the field

Transfer Pump
• Ebara Model CDU70 centrifugal transfer pump
• Coupled to a 3/4 HP 208V 3 phase TEFC motor
• Ball valves and unions on the inlet and discharge
• Pres gauge, check valve, ball valve, valved sample port
• Discharge piping will plumb to edge of skid for others to connect to Sanitary Sewer

BIO - REMEDIATION SYSTEM
Mixing Tank
• 295 Gallon poly mixing tank
• Ebara EVMSU(L)3-5 1 HP, 230V, 1P multi stage pump
• Equipped with Sight glass assembly mounted to side of tank with ~~3 float stem~~ teardrop float switch to control transfer pump, and high level shut off.
• 2-in tank bung w/ manual drain valve
• Fusion Fluid Equip. ridgid mixing pump w/ 0.33 HP, 1750 RPM, 115/230V motor and 4-in 316 SS impeller
• 2-in PVC strainer

~~• Mazzei 1-in Nylon mixing nozzle for recirculation line~~

Oxygen Generator & Injection System

• One (1) AirSep Topaz oxygen concentrator w/ oxygen concentration monitor, with rotameter, flow control valve and pressure gauge.
• Up to 12 SCFH and 95% O2 Conc. output.
• Painted steel enclosure
• Integrated air compressor and PSA system
• 0.01-Micron air filter
• Pressure relief valve.
• Mazzei ~~1038~~ 1078 PVDF venturi equipped with flow control valves.
• At 10 gpm, 35 mg/l dissolved oxygen should be achieved.
• Pre/Post venturi SS pressure gauges and transmitters with 4-20mA output
• Suction compound pressure transmitter -15 to 30 psi w/ 4-20 mA output
• Teflon lined 1-in electromag flow meter with direct read totalizer, flow rate and 4-20 mA output.
• 2-20 gpm water flow rotameter
• Venturi bypass valve and piping
• Recirculation/ flow control line back to 300 gallon mixing tank.
• Controls will be integrated into the main PRM packaged system.

Main System Industrial Control Panel

• NEMA 4 enclosure will mount on exterior of the enclosure. Panel will be 3rd party certified.
• Hand-Off-Auto switches and green running lights and red alarm lights on HMI
• Intrinsically safe relays for all switches were applicable
• Contacts and relays
• Motor starters with thermal overload and circuit protection.
• Siemens S7-1200PLC with color HMI touch screen
• 9" color Comfort HMI with complete HMI system control
• Remote I/O mounted in panel board
• Includes all license fees, Smartservice for Internet based connectivity and control via secure log in.
• All reporting will be via email or text messaging through a messaging service.
• PRM to provide wireless service that will be pre-programmed prior to system arrival. Service will be good till the end of the calendar year. Additional years will be invoiced in Jan for all proceeding years, current rate is $1,050 / year which is subject to change based on market increases.
• GFCI all weather outlet located underneath control panel
• Standard lightning protection module
• CyberPower 825 UPS and surge protector
• System will restart automatically if it is safe to do so.

SCADA Interface

PRM uses a program interface that is accessible locally or remotely through our secure internet connection. PRM has thousands of connected SCADA interfaces in the field and the interface below is a typical representation of a typical remediation system. PRM has the flexibility to customize per client request.

System Load Center

• PRM has placed all circuit breakers in an adjacent 200A load center Main Breaker panel. The load center serves to minimize risk of Arc Flash or Shock hazards associated with operations and troubleshooting of the system.
• 200 Amp 208 V, 3 phase load center with main breaker mounted on exterior of enclosure
• Individual circuit breakers for branch circuit protection of individual motors and loads
• Breaker locks will be provided for each breaker in the panel.
• Breaker panel is properly grounded and bonded and will comply with all provisions for grounding as specified in the 2011 NEC.
• Main power will enter load center and all distribution of power shall be made from here.

Miscellaneous

• Delivery will be via truck, unloading provision must be onsite at time of delivery
• Skids with equipment to be located outside the enclosed system:
• Will ship loose for others to connect to main system
• Will not include heat tracing, this will need to be provided, installed, and wired onsite by others
• Will be wired (where applicable) to junction box at edge of skid for onsite electrician to connect
• HEX will also ship loose to be installed/plumbed/wired on exterior of enclosure by others.
• Includes 1 year warranty
• Includes (2) O&M manuals
• Two sets of as builts one-line electrical drawings
• Includes submittal package for approval prior to construction
• Includes two days of on-site startup and training

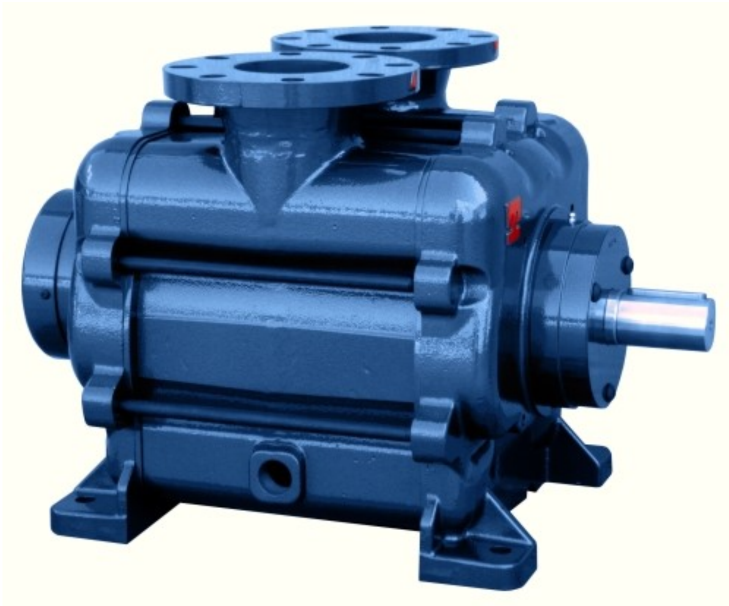
Power at the above referenced facility is: 120/208V three phase WYE

MPE EQUIPMENT

B-301

TRVX650 Single Stage Liquid Ring Vacuum Pump

TRAVAINI PUMPS USA®
Liquid Ring & Rotary Vane Vacuum Pumps and Systems
200 Newsome Drive
Yorktown, VA 23693
1-800-535-4243
www.Travaini.com



Pressure Range	25-760 TORR
Capacity	310 CFM
Features	Single-Stage vacuum pump with external bearings, vari-port design
Shaft Sealing Options	Mechanical seal (standard) Double mechanical seal Stuffing box
Options	Bareshaft pump Coupled to electric motor Monoblock
Optional Accessories	Available as a component in larger assembly

Technical Data

PUMP TYPE		TRVX657
Speed	RPM	1780
Motor - installed power	HP	20
Average service liquid flow	GPM	10
Noise level at 150 Torr	dB(A)	79dB
Max Vacuum	Torr	25

*Standard Materials of Construction***

<table>
<tr><th>Part No.</th><th>Description</th><th>F</th><th>RX</th><th>RA</th><th>A3</th></tr>
<tr><td>106</td><td>Suction casing</td><td colspan="3" rowspan="3">Cast iron</td><td rowspan="5">Stainless steel AISI 316</td></tr>
<tr><td>107</td><td>Discharge casing</td></tr>
<tr><td>110</td><td>Impeller housing</td></tr>
<tr><td>137</td><td>Port plate</td><td colspan="3">Stainless steel AISI 316</td></tr>
<tr><td>210</td><td>Shaft</td><td colspan="2">Stainless steel AISI 420</td><td>Stainless steel AISI 316</td></tr>
<tr><td>357</td><td>Bearing housing</td><td colspan="4">Cast iron</td></tr>
<tr><td>230</td><td>Impeller</td><td>Ductile iron</td><td>Stainless steel AISI 304</td><td colspan="2">Stainless steel AISI 316</td></tr>
</table>

Model Designation

TRVX657/C/RA	
T	Travaini manufacturer
R	Liquid ring pump
V	Single stage vacuum pump With vari-port design
X	Design revision
65	Flange size (mm)
7	Hydraulic size
C	Shaft sealing: C = Mechanical seal C2 = Double mechanical seal B = Packing seal
RA	Materials of construction (see table)

**Special materials available upon request
-Request for information on our WATERSEAL and DYNASEAL engineered vacuum systems
-For further information please consult Travaini Pumps USA.

REF: JM/CGZ	Date 8/14/2019		No:

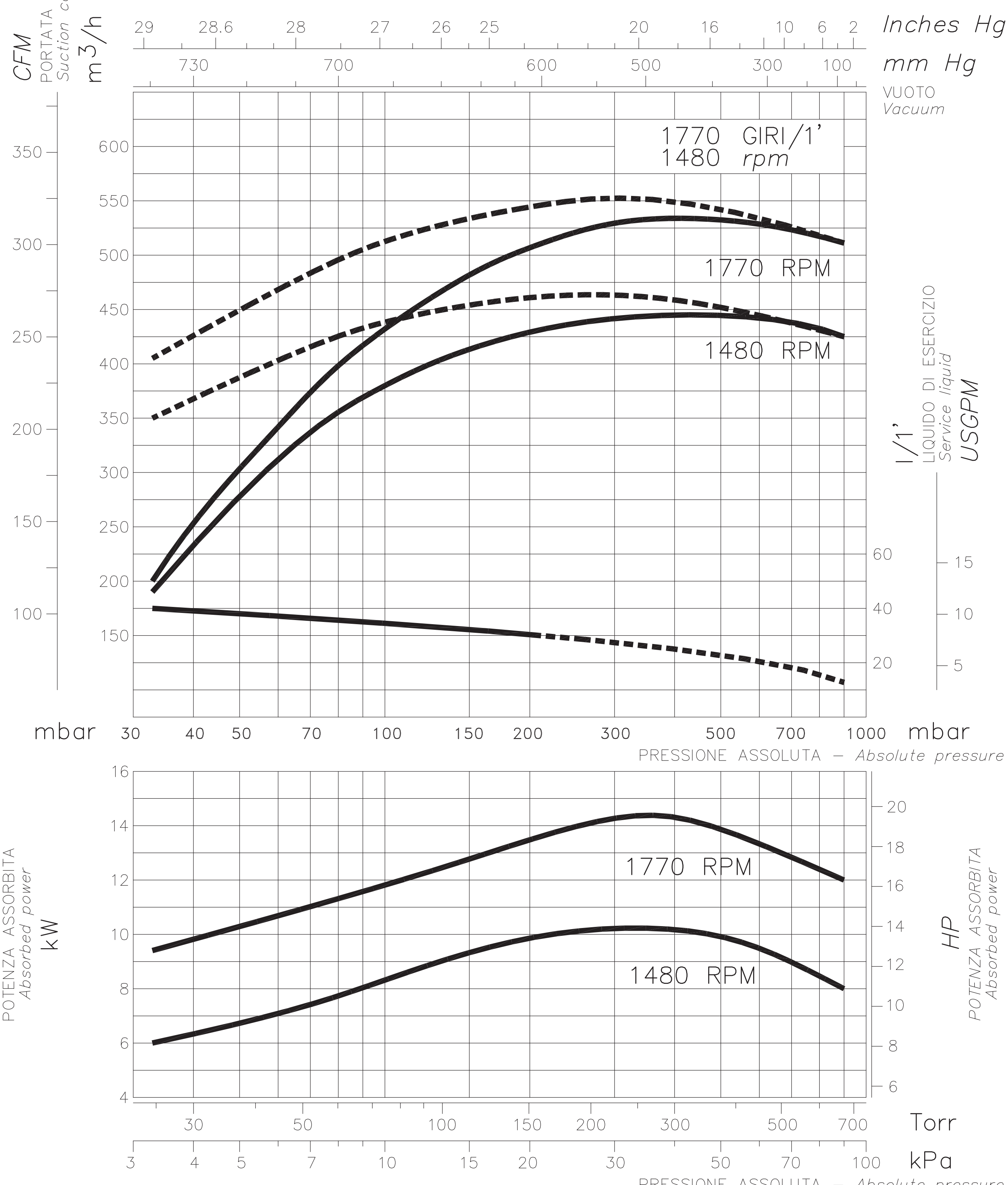
DIAGRAMMA DI FUNZIONAMENTO
Performance curves

POMPA PER VUOTO AD ANELLO DI LIQUIDO
Liquid ring vacuum pump

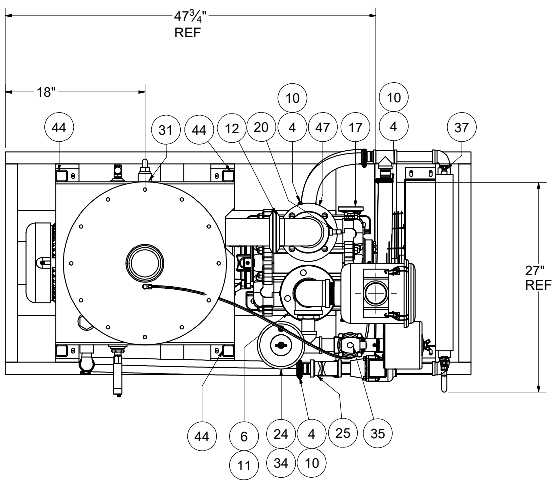
TIPO
Type
TRVX 657

TRAVAINI PUMPS® USA
Liquid Ring & Rotary Vane Vacuum Pumps and Systems

I DATI RIPORTATI SONO RIFERITI A –		*Data refers to :*
ARIA SECCA A 20 °C	———	*Dry air at 20 °C (68 °F)*
ARIA SATURA A 20 °C	- - - - -	*Saturated air at 20 °C (68 °F)*
LIQUIDO DI ESERCIZIO	ACQUA – *Water*	*Service liquid*
TEMPERATURA LIQUIDO DI ESERCIZIO	15 °C – *(59 °F)*	*Service liquid temperature*
PRESSIONE DI SCARICO	1013 mbar	*Discharge pressure*
TOLLERANZE	10%	*Tolerance*



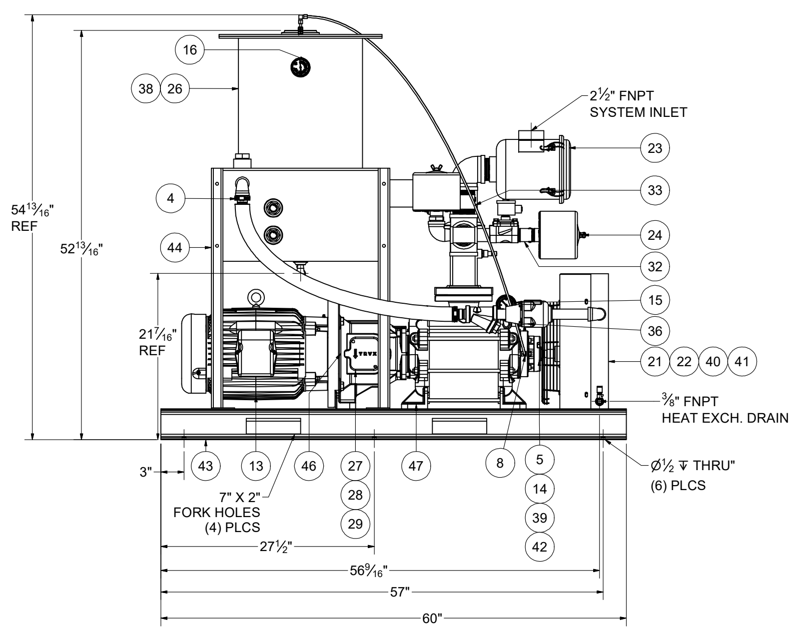
RIF.–*Ref.:* E.Z./C.T.	DATA–*Date:* 05–2018	SOST.–*Repl.:* 7257.150.01.01–02	N°.: 7257.150.02.01–02

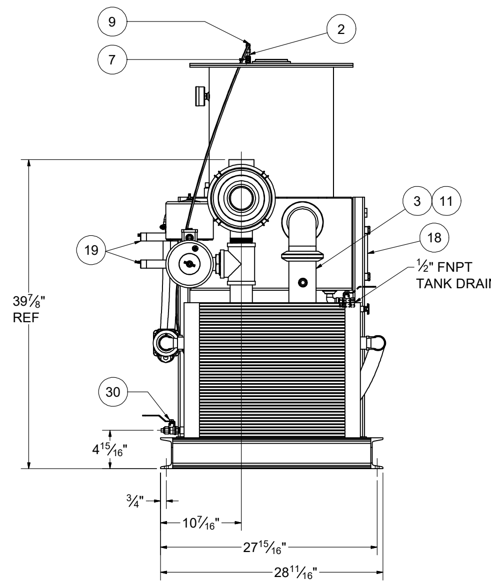


BILL OF MATERIALS			
ITEM	QTY	DESCRIPTION	PART NUMBER
41	1	WIRE GUARD, 12"	925-0012-B000
42	1	RADIAL SEAL RING 45mm X 65mm	942 145650603
43	1	BASEPLATE, TRVX 657 TRO300V CS	950-1807-0310
44	4	LEG, SEPARATOR 1-1/2" X 31" X 11 GUAGE CS	955-9703-2110
45	13	OIL, DYNALUBE (GAL NOT SHOWN)	971-0022-A000
46	1	ADAPTER, MBLOCK FOR TRVX 657 256TC FRAME	AMB-657-256TC
47	1	TRVX 657/1Y-C/F	RVX65 00023

BILL OF MATERIALS			
ITEM	QTY	DESCRIPTION	PART NUMBER
1	80	HOSE, FLEX 1 1/4" ID BLACK RUBBER (NOT SHOWN)	100-0125-0000
2	1	TUBING, STAINLESS STEEL 1/4"	100-SCAV-0003
3	1	INLET PIPING ASSEMBLY, 4" W/ 1-1/4" HALF COUPLING	1055-2302-1310
4	6	CLAMP, HOSE 1.594" TO 1.812" ID	106-0175-1100
5	1	KEY SHAFT .25" X .25" X 2" LG	110-0202-0917
6	1	FLANGE 2.5" 150# CS ANSI	162-0250-7011
7	1	FITTING, 1/4" MNPT X 1/4" TUBE	170-0025-3000
8	1	FITTING, 1/4" MNPT X 1/4" TUBE 90 DEG ELBOW	170-0025-3001
9	1	FITTING, UNION ELBOW BRASS COMPRESSION	170-0025-3002
10	6	FITTING, RED. 1" MNPT X 1-1/4" HOSE	170-0125-3000
11	2	GASKET, FLAT 4.25" OD X 2.5" ID	176-0503-0001
12	1	COUPLING, FLEX 3" 90 CS/BUNA	190-0300-A001
13	1	MOTOR, 20HP 4P TEFC 256TC 3PH/230/460V/60HZ	231-0200-C000
14	1	STUB SHAFT TRVX 650/1-C	325 95S100040
15	1	GAUGE, VAC 0-30" HgV BRASS	400-0025-F000
16	1	GAUGE, PRESSURE 0/15 PSIG BRASS	402-0025-F001
17	1	GAUGE, TEMP 20/240° F 304 SST	410-0050-F001
18	1	GAUGE, LEVEL 6" X 1/2" NPT ALU/BRASS/VITON	420-0050-A008
19	2	SWITCH, LEVEL 1" XP BRS/304SS FLOAT	465-0100-A000
20	1	SWITCH, HI-TEMP. N4 NC 225°F	470-0050-C001
21	1	HEAT EXCHANGER 19-1/4" X 24-3/8" 1 PASS AL	535-1925-B001
22	1	FAN, 12" BLADE CW/PUSH/EXHAUST	550-1204-B001
23	1	FILTER, INLET 2-1/2" 210 SCFM POLYESTER	600-0250-A001
24	2	FILTER, SILENCER 1-1/4" FNPT 60 SCFM	602-0125-A001
25	1	STRAINER, Y 1" FNPT CI 20 MESH	660-0100-C000
26	1	SEP ELEMENT TRO300V	680-1215-C001
27	1	COUPLING, DRIVE 8S 38MM CI	702-0800-B038
28	1	COUPLING, DRIVE 8S 1.625 CI	702-0800-B162
29	1	ELEMENT, COUPLING SIZE 8-JE	752-0800-B001
30	1	VALVE, BALL 3/8" THD. SP BRASS/BRASS/PTFE	801-0037-B000
31	1	VALVE, BALL 1/2" THD. SP BRASS/BRASS/PTFE	801-0050-B000
32	1	VALVE, CK HNG 1-1/4" THD CS/BUNA	820-0125-B000
33	1	VALVE, CK HNG 2-1/2" THD CS/BUNA SPRING	820-0250-B006
34	1	VALVE, VACUUM RELIEF 1-1/4" 316 SST	852-0125-C000
35	1	VALVE, SOL 1-1/4" THD N4 NC 60/120V 0 PSI BRASS/BUNA	855-0125-B003
36	1	VALVE, TEMP CONTROL 1" FNPT 170° F CI	864-0100-A000
37	1	VALVE, PETCOCK 1/4" MNPT BRASS	890-0025-A000
38	1	TANK, SEPARATOR DYNASEAL 3" INLET CS	904-0301-0101
39	1	GRUB SCREW M6X16 AISI 316SS	909806016041
40	1	SHROUD, FAN 12" CS FOR TRO250/300/400	920-9610-2510

NOTES:
1. SECURE SYSTEM ON FLAT AND LEVEL SURFACE
2. PLUG ANY UNUSED PORTS WITH SQUARE HEAD NPT PLUGS
3. CLEARANCE REQUIRED TO SERVICE ITEM #23 IS 12"
4. CLEARANCE REQUIRED TO SERVICE ITEM #24 IS 5"
5. CLEARANCE REQUIRED TO SERVICE ITEM #25 IS 6"
6. CLEARANCE REQUIRED TO SERVICE ITEM #26 IS 18"





TOLERANCES
DECIMAL ± .0625
FRACTIONAL ± 1/16
ANGULAR ± 0° 30' 00"
UNLESS OTHERWISE SPECIFIED IN DRAWING

SHEET NO. SHEET 1 OF 6
PART NO. DS0078
DWG BY: LA | CHK BY: RR | DATE 6/21/2023
APPROVED BY: RR | SCALE: 1 = 8

TRAVAINI PUMPS USA
Liquid Ring & Rotary Vane Vacuum Pumps and Systems

DESCRIPTION TRO300V-1A 20HP
MODEL NO. DS0078 | DWG NO. 2306211-D | REV A

CUSTOMER APPROVAL REQUIRED

CUSTOMER SIGNATURE :______________________________

DATE OF APPROVAL :______________________________

PRM MOISTURE SEPARATORS

T-300

PRM Moisture Separators or Knockout Tanks are custom designed for your project requirements. Standard ranges from 200 to 1800 CFM Vapor Flow and 15 inHg Vacuum.

Specifications:

- Heavy Duty Carbon Steel, Aluminum, or Stainless Steel Construction
- Epoxy Coated Interior
- UV Resistant Coated Exterior
- FEA/CAD Engineering Design
- Tangential Inlet with Baffle Plate
- Integral Inline Demister
- Internal Centrifugal Isolation Ring
- Inlet Particulate Filter
- Clean Out Access Port Near Bottom
- PVC Clear Sight Tube
- Drain Valve
- Inlet and Outlet Connections Can Be Flanged or Threaded

Model #	Max Air Flow (CFM)	Liquid Capacity (Gal)
MS-30	200	18
MS-60	300	30
MS-80	400	38
MS-120	450	55
MS-200	600	98
MS-400	1800	124

**** Options and Services ****

- Medium and High Vacuum Units Available. Medium Vacuum units operate 15-20 inHg High Vacuum units operate 20-29.9 inHg
- High Vapor Flow up to 2500 CFM
- Skid Mounting
- Float Controls for Automated Level Control and Alarm Conditions
- UL 508A and 698A Control Panel with Wireless Telemetry for Remote Monitoring
- Vapor Flow Measurement Devices
- Transfer Pump Packages with Instrumentation for Fluid Processing
- Installation and Field Integration Services
- Startup and Operations Services

Models 912, 913, 918, 919 ASME Section VIII, Steam/Air/Gas/ Liquid, 'UV' National Board Certified. Also available for Vacuum Service

Pressure and Temperature Limits

Models 912, 913, 918, 919: – Steam
3 to 250 psig [-20 to 17 barg][1]
-60° to 406°F [-51° to 208°C]

Models 912, 918: – Air/Gas/Liquid
3 to 300 psig [-20 to 21 barg]
-60° to 406°F [-51° to 208°C]

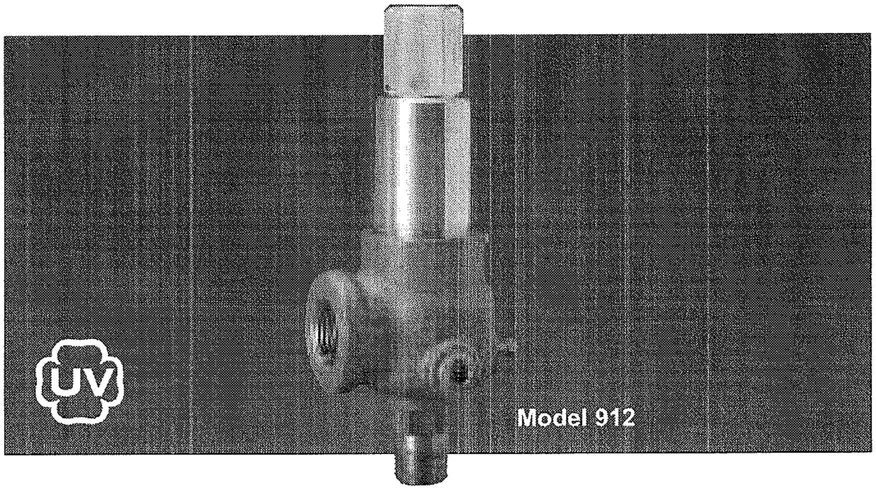
Models 913, 919: – Air/Gas/Liquid
3 to 900 psig [-20 to 62 barg]
-60° to 406°F [-51° to 208°C]

Vacuum – 6- through 29-inch HG
[200 through 1000 mbarg] – 300°F [149°C]

Maximum back pressure 50 psig [3 barg]
- threaded cap and packed lever

Applications

- Air/gas compressors - intercoolers - aftercoolers.
- Liquid filled pressure vessels/systems - ASME Section VIII (UV).
- Pressure vessels - containing gas, air, liquid or steam. Including tanks and receivers.
- Vacuum systems including pumps, tanks and equipment.
- Optional materials for low temperature - cryogenic applications.
- Oil/gas separators.
- Overpressure relief and protection of pumps, tanks, lines and hydraulic systems.
- By-pass relief or pressure regulation.



Features and Benefits

- **Available** with soft seat.
- **Threaded cap** is standard (back pressure tight).
- **Hex on valve nozzle** provides for easy installation.
- **Single control ring** offers easy adjustability of blowdown.
- **Pivoting disc design** corrects misalignment and offers exceptional performance.
- **Guide to nozzle ratio** reduces friction.
- **Full nozzle design** for optimum flow performance.
- **Threaded side outlet** for piped off discharge to eliminate fugitive emissions.

Model Descriptions

Model 912: Full nozzle design. SS warn ring and disc with brass/bronze base. Bronze/brass body and bonnet.

Model 913: Full nozzle design. Bronze/ brass body and bonnet. 316 SS trim (base, disc and disc holder).

Model 918: Same as Model 912 except resilient seat/seal. Superior 'leak-free' performance.

Model 919: Same as Model 913 except resilient seat/seal. Superior 'leak-free' performance. Bronze body and bonnet. 316 SS trim (base, disc and disc holder).

Options

- Threaded cap. (Variation 01)
- Threaded cap with gag. (Variation 02)
- Plain lever. (Variation 03)
- Plain lever with gag. (Variation 04)
- Plain lever with vibration dampener. (Variation 05)
- Packed lever. (Variation 06)
- Packed lever with gag. (Variation 07)

Note

1. ASME standard valves for air or steam service must have lift lever. For steam boilers and generators.

Models 912, 913, 918, 919 ASME Section VIII, Steam/Air/Gas/ Liquid, 'UV' National Board Certified. Also available for Vacuum Service

Service Recommendations for Resilient Seat/Seal Materials

Seat/Seal Materials[1]	Service Recommendation
BUNA-N (-40° to 200°F) [-40° to 93°C]	Air, Anhydrous Ammonia, Butane, Carbon Dioxide, Diesel Oil, Ethyl Chloride, Ethyl Ether, Freons #11 and 12, Fuel Oil, Gasoline, Helium, Hydrogen Sulphide, Kerosene, Lube Oil, Natural Gas, Nitrogen, Oxygen (Gas), Propane, Propylene, Sulphur Dioxide, Vinyl Chloride
Viton® A (-10° to 406°F) [-23° to 208°C]	Acetone, Air, Amyl Alcohol, Aniline, Benzine, Butane, Carbon Disulphide, Carbon Tetrachloride Dowtherm 'A' and 'E', Ethyl Chloride, Ethylene, Ethylene Glycol, Ethyl Alcohol, Gasoline, Hexane, Hydrogen Sulphide, Isobutyl Alcohol, JP - 4 Fuel, JP - 5 Fuel, Kerosene, Lube Oil, Natural Gas, Naphtha, Nitrogen, Propane, Propylene, Propyl Alcohol, Sulphur Dioxide, Toluene, Trichloroethylene, Turpentine, Water, Xylene
Silicone (-100° to 406°F) [-73° to 208°C]	Air, Helium, Nitrogen, Oxygen (Gas)
Ethylene Propylene (-70° to 400°F) [-57° to 205°C]	Steam, Hot Water
Neoprene (-45° to 300°F)[-43° to 149°C]	Air, Anhydrous Ammonia, Butane, Butyl Alcohol, Castor Oil Denatured Alcohol, Ethanol, Ethyl Alcohol, Freons (12, 13, 14 and 22), Glycols, Natural Gas and Silicate Esters

Note

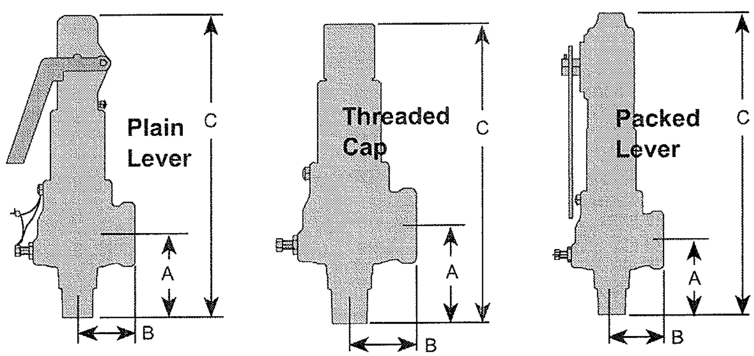
1. These recommendations are a guide only. For the final selection of the proper material, your experience with available elastomers of various lading fluids should be considered.

Specifications

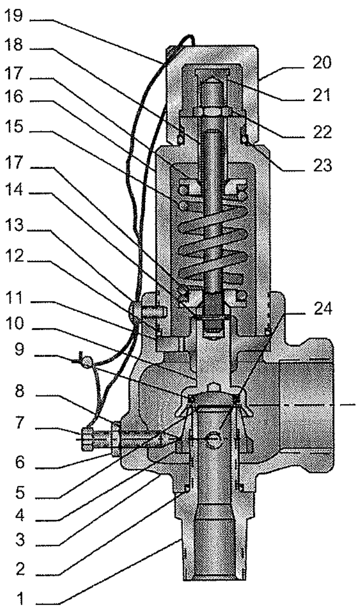
Model[2] Number	Orifice	Connections ANSI Standard Inlet		Connections ANSI Standard Outlet		Maximum Set Pressure psig [barg] 912-918[4]		Maximum Set Pressure psig [barg] 913-919[5]		Dimensions, in [mm] A		B		C Plain Lever		C Threaded Cap		C Packed Lever		Approx. Weight lb [kg]	
9*BDC	D	1/2"	[12.7]	3/4"	[19.0]	300	[20.7]	900	[62.1]	2 3/8	[60]	1 5/8	[41]	8 3/8	[213]	7 1/4	[184]	9	[229]	3	[1.4]
9*BDC	D	1/2"	[12.7]	1"	[25.4]	300	[20.7]	900	[62.1]	2 3/8	[60]	1 5/8	[41]	8 3/8	[213]	7 1/4	[184]	9	[229]	3	[1.4]
9*BDD[3]	D	3/4"	[19.0]	3/4"	[19.0]	—	—	900	[62.1]	2 3/8	[60]	1 5/8	[41]	8 3/8	[213]	7 1/4	[184]	9	[229]	3	[1.4]
9*BDE[3]	D	1"	[25.4]	1"	[25.4]	—	—	900	[62.1]	2 5/8	[67]	1 5/8	[41]	8 5/8	[219]	7 1/2	[191]	9 1/8	[232]	3	[1.4]
9*BED	E	3/4"	[19.0]	1 1/4"	[31.8]	300	[20.7]	900	[62.1]	2 5/8	[67]	2	[51]	8 3/4	[222]	7 5/8	[194]	9 3/8	[238]	4	[1.8]
9*BEF[3]	E	1 1/4"	[31.8]	1 1/4"	[31.8]	—	—	900	[62.1]	3	[76]	2	[51]	9 1/8	[232]	8	[203]	9 3/4	[248]	4	[1.8]
9*BFE	F	1"	[25.4]	1 1/2"	[38.1]	300	[20.7]	600	[41.4]	2 7/8	[73]	2 3/8	[60]	9 7/8	[251]	8 3/4	[222]	10 1/2	[267]	6	[2.7]
9*BFG[3]	F	1 1/2"	[38.1]	1 1/2"	[38.1]	—	—	600	[41.4]	3	[76]	2 3/8	[60]	10	[254]	8 7/8	[225]	10 5/8	[270]	6	[2.7]
9*BGF	G	1 1/4"	[31.8]	2"	[50.8]	300	[20.7]	600	[41.4]	3 1/4	[89]	2 5/8	[67]	11 1/4	[286]	10 1/8	[257]	11 3/4	[298]	8	[3.6]
9*BGH[3]	G	2"	[50.8]	2"	[50.8]	—	—	600	[41.4]	3 1/4	[89]	2 5/8	[67]	11 1/4	[286]	10 1/8	[257]	11 3/4	[298]	8	[3.6]
9*BHG	H	1 1/2"	[38.1]	2 1/2"	[63.5]	300	[20.7]	500	[34.5]	3 1/2	[89]	2 3/4	[70]	13	[330]	11 1/8	[283]	12 1/2	[318]	11	[5.0]
9*BJH	J[6]	2"	[50.8]	3"	[76.2]	300	[20.7]	500	[34.5]	4	[102]	3 1/4	[89]	14 1/2	[368]	12 1/2	[318]	15 1/8	[384]	15	[6.8]

Notes

1. Maximum temperature controlled by resilient seat/seal material.
2. Replace asterisk with desired Model Number. Data applicable to all models.
3. Available with SS trim only.
4. Maximum pressure on steam is 250°F.
5. Maximum pressure on steam is 300°F.
6. For C dimensions: pressures above 200 psig [14 barg] add 1.25-inch [31.8 mm] to the overall height.



Models 912, 913, 918, 919 ASME Section VIII, Steam/Air/Gas/Liquid, 'UV' National Board Certified. Also available for Vacuum Service



Parts and Materials - Models 912, 913, 918, 919 Threaded Cap

No.	Part Name	Materials
1	Nozzle[1]	Brass, B21 Alloy 485, (SS, A351-CF8M[1] Models 913, 919 only)
2	O-ring Body	Teflon®
3	Body	Bronze, B584 Alloy 84400
4	Warn Ring	SS, A743-CF8M
5	Disc[2]	SS, A479-316
6	Set Screw Nut	Brass, B16
7	Set Screw	Brass, B16
8	Seal	Teflon®
9	Retainer Ring	SS, A313-316
10	Disc Holder	Brass, B16, (SS A351-CF8M Models 913, 919 only)
11	Guide[3]	Brass, B16
12	Bonnet O-ring	Teflon®
13	Screw	SS, Commercial 18-8
14	Coiled Spring Pin	SS, A313-302
15	Spring	Steel A231/A231M, Cadmium Plated SS: A313-302 SS: A313-316 Alloy steel: A681-H12
16	Bonnet[4]	Brass, B16
17	Spring Step	Brass, B16
18	Stem	Brass, B16
19	Wire and Seal	SS wire and Lead seal, Commercial
20	Cap	Brass, B16
21	Compression Screw	Brass, B16
22	Jam Nut	Brass, B16
23	Cap O-ring	BUNA-N
24	Body Plug[5]	Brass, B16
25	Guide Guide Locknut Shield	Brass, B16 Brass, B16 SS, A167-316
26	Disc Holder Spindle	Brass, B16 (Model 912 only) Brass, B16 (Model 912 only)

Notes

1. F through J orifice nozzle material is Bronze, B62.
2. Material / Letter Designation

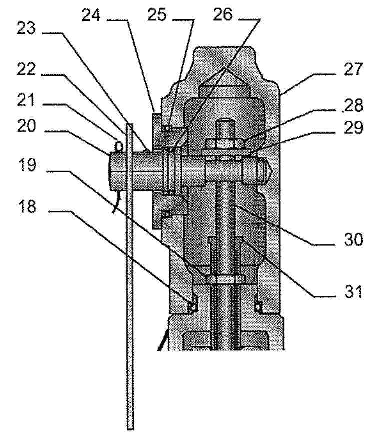
Material	Letter Designation
Viton®-A	A
BUNA-N	B
Silicone	S

3. G through J orifice guide material is Bronze, B584, Alloy 84400.
4. F through J orifice bonnet material is Bronze, B584, Alloy 84400.
5. Body plug and tapped hole not available for liquid service.

Models 912, 913, 918, 919 ASME Section VIII, Steam/Air/Gas/Liquid, 'UV' National Board Certified. Also available for Vacuum Service

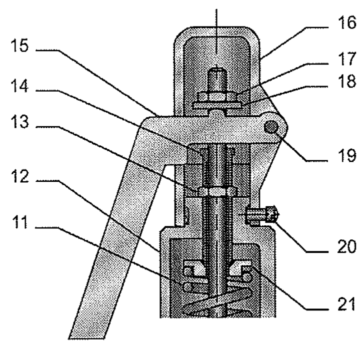
Parts and Materials - Model 912 Packed Lever

No.	Part Name	Materials
18	Cap O-ring	BUNA-N 70 Duro, Commercial
19	Jam Nut	Brass, B16
20	Lift Cam	SS, A743 CF8M
21	Cotter Pin	Steel, Commercial
22	Lever	Zinc Plated Steel, A108
23	Drive Screw	SS, Commercial
24	Retainer Nut	Brass, B16
25	Retainer O-ring	BUNA-N 70 Duro, Commercial
26	Lift Cam O-ring	BUNA-N 70 Duro, Commercial
27	Cap	Bronze, B584 Alloy 84400
28	Lift Nut	SS, A479 316
29	Lift Washer	SS, A479 316
30	Stem	Brass, B16
31	Compression Screw	Brass, B16
32	Coiled Spring Pin	SS, A313 302
33	Body Plug[4]	Brass, B16
34	Guide Guide Locknut Shield	Brass, B16 Brass, B16 SS, A167 316



Parts and Materials - Model 912 Plain Lever

No.	Part Name	Materials
11	Spring	Cadmium plated steel: A231/A231M SS: A313-302 SS: A313-316 Alloy steel: A681-H12
12	Bonnet[3]	Brass, B16
13	Jam Nut	Brass, B16
14	Compression Screw	Brass, B16
15	Lever	Steel Cadmium Plated, A109
16	Cap	Brass, B179
17	Lift Nut	SS, A479-316
18	LIft Washer	SS, A479-316
19	Rivet	Steel, Commercial
20	Screw	SS, Commercial GR. 18-8
21	Spring Step	Brass, B16
22	Disc Holder Spindle	Brass, B16 Brass, B16



Models 912, 913, 918, 919 ASME Section VIII, Steam/Air/Gas/Liquid, 'UV' National Board Certified. Also available for Vacuum Service

Model Number/Order Guide

Model Number Position	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Example	9	1	2	B	J	H	M	0	1	—	K	C	0	3	0	0

Model
912
913
918
919

Connection Model
B - Male x Female Threaded or NPT

Orifice
D G
E H
F J

Inlet Size
C - 1/2-inch [15 mm] F - 1$^1/_4$-inch [32 mm]
D - 3/4-inch [18 mm] G - 1$^1/_2$-inch [40 mm]
E - 1-inch [25 mm] H - 2-inch [50 mm]

Seat/Seal Material
M - Metal-to-metal
B - BUNA-N 200°F [93°C]
E - EPR 350°F [177°C]
S - Silicone 406°F [208°C]
V - Viton® 406°F [208°C]
N - Neoprene 300°F [149°C]

Variation (01 through 99)
Number provided only by manufacturer to cover specific feature or option.
01 - Threaded cap
02 - Threaded cap with gag
03 - Plain lever
04 - Plain lever with gag
05 - Plain lever with vibration dampener
06 - Packed lever
07 - Packed lever with gag

Design Revision
Indicates non-interchangeable revision. Dash (-) if original design.

Valve Service
J - Liquid ASME Section VIII (Standard Cap/Packed Lever only)
K - Air/Gas ASME Section VIII (Plain Lever/Packed Lever required for air)
L - Steam ASME Section VIII (Plain Lever/Packed Lever required)
M - Liquid (Standard Cap/Packed Lever only)
Q - Vacuum (Standard Cap/Packed Lever only)

Spring Material
E - SS

Set Pressure
3 psig [0.2 barg] (0003) through 900 psig [62 barg] (0900)
Vacuum 6-inch HG [200 mbarg] (0006) through 29-inch HG [1000 mbarg] (0029)

0027

18

PRM has stainless steel 1 Float, 2 Float, 3 Float, and 4 Float stem assemblies for level control use in environmental systems.

PRM float stems are kept in stock for immediate delivery.

Features:

- Stem and Floats are 316 Stainless Steel
- Delrin® Retention Rings
- Polycarbonate Centering Disc
- Industrially Hardened, Rated for Millions of Cycles
- Stem is 1/2"OD and Connection is 1/4"NPT
- All Assemblies come with 25' Petroleum Resistant PVC Shielded Probe Cable.
- RoHS Compliant

PRM can custom build a float assembly for your project requirements –contact *sales@prmfiltration.com* with your specifications for a quick quotation. Custom assemblies can ship within 24 hours of approval.

Rotameters for Air Sparge and Vapor Extraction

PRMFiltration

- Designed For Vapor Extraction, Air Sparge and other industrial air flow applications.
- Scaled for standard cubic feet per minute (SCFM) and can be used on pressure and high vacuum applications.
- Meter sizes designed to provide an ample working range and are less prone to failure through impact exposure.
- Larger than comparable meters on the market which provides a fine scale control for a higher degree of accuracy.

Specifications:

- Materials:
  - ◊ Body: Acrylic with PVC (gray) or Polypropylene (white) replaceable end tails
  - ◊ 304 SS Float and travel rod
  - ◊ Viton® O-rings and seals
- Maximum 85 psig pressure rating
- Maximum Temperature rating of 125°F
- Accuracy: +/- 4% of full scale flow

SCFM scale based on 1 atm air @ 68° F
Rotameter readings must be adjusted for pressure and temperature. Discover more about air flow readings: https://www.prmfiltration.com/scfm-acfm-calculator

Options:

PRM can provide meters scaled for custom applications. Typical lead time is 3-5 weeks from time of order. Custom meters require a minimum quantity commitment of 50 meters.

FMDFG03: 0.3-3 scfm
1/2" FNPT
8" tall
1.3" OD

FMDFG15: 1-8 scfm
1/2" FNPT
8" tall
1.3" OD

FMDFG25: 1-15 scfm
1" FNPT
10.5" tall
2" OD

FMDFG40: 2-25 scfm
1.5" MNPT
12" tall
2" OD

FMDFG4050:
5-50 scfm
1.5" MNPT
12" tall
2" OD

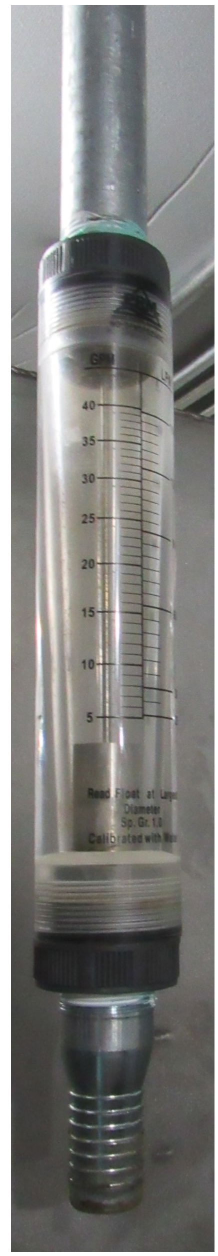
FMDFG50: 10-100 scfm
2" FNPT
13.5" tall
3" OD

FMDFG51: 20-200 scfm
2" FNPT
13.5" tall
3" OD

INSTALLATION & USE:
PRM rotameters are available in a broad choice of flow ranges with direct reading scales for air, gas or water. Installation, operation and maintenance are very simple and only a few common sense precautions must be observed to assure long, trouble-free service.

Before proceeding with the installation of your PRM Rotameter, check to be sure you have the model and flow range you require. PRM Flowmeters are designed for use at pressures up to 85 psi and temperatures up to 125°F. DO NOT EXCEED THESE LIMITS!
The installation should not be exposed to strong chlorine atmospheres or solvents such as benzene, acetone, carbon tetrachloride, etc. The mounting panel should be free of excessive vibration since it may prevent the unit from operating properly.

Inlet Piping Run: It is good practice to approach the flowmeter inlet with as few elbows and restrictions as possible. In every case the inlet piping should be at least as large as the connection to the flowmeter. Discharge Piping: As on the inlet, discharge piping should be at least as large as the flowmeter connection.



POSITION AND MOUNTING All PRM Rotameters must be mounted in a vertical position with the inlet connection at the bottom and outlet at the top .

It is important to understand that a rotameter is affected by variations in temperature and air pressure. This rotameter has been calibrated at the Standard operating conditions of 14.7 psia (0 psi) pressure and 70° F. When using the rotameter at a different temperature and pressure than where it was calibrated, the following formula will provide a correction factor:

$$Q_2 = Q_1 \times \sqrt{\frac{P_1 \times T_2}{P_2 \times T_1}}$$

Where: **Q1 = Actual or Observed Flowmeter Reading**
Q2 = Standard Flow Corrected for Pressure and Temperature
P1 = Actual Pressure (14.7 psia + Gauge Pressure)
P2 = Standard Pressure (14.7 psia, which is 0 psig)
T1 = Actual Temperature (460 R + Temp °F)
T2 = Standard Temperature (530 R, which is 70°F)

1. Misalignment will damage the meter!
Flowmeter must be installed in an exact vertical plane to ensure accuracy. Be certain of proper plumbing alignments. Misalignment may cause the o-ring seals to leak. The meter body material can be damaged by UV rays. Do not install in direct sunlight.

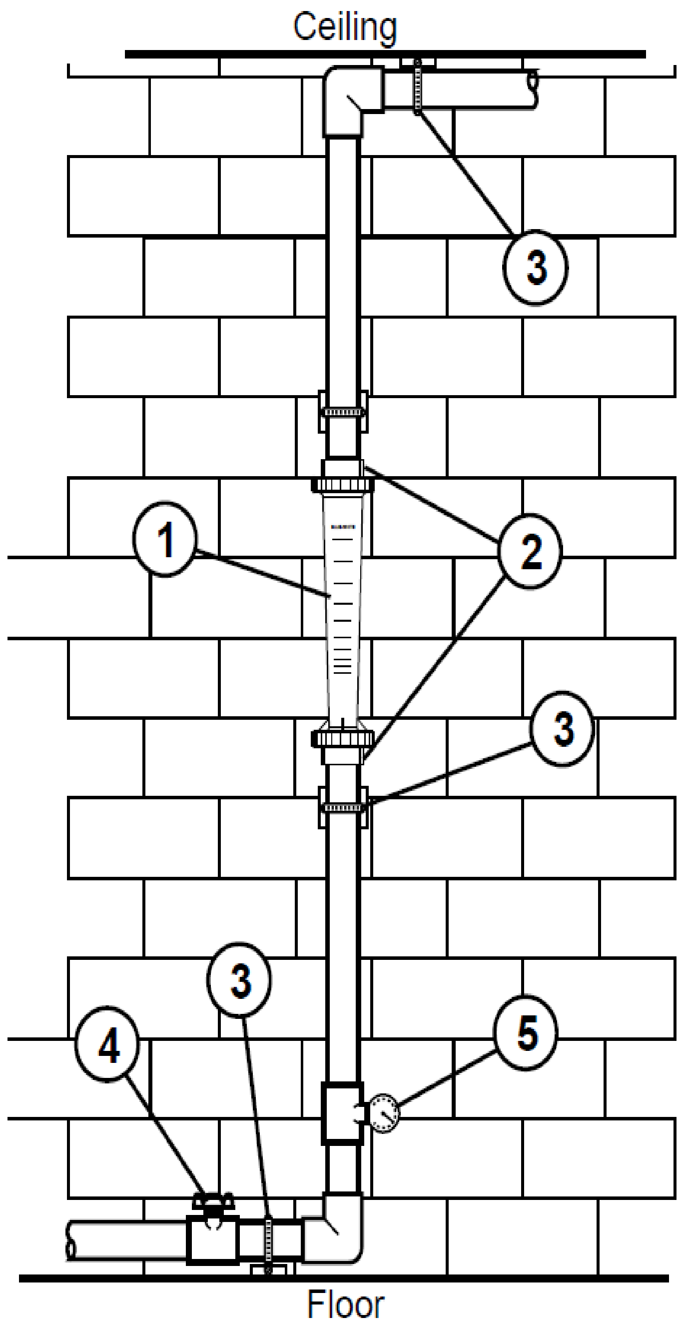
2. Pipe dope and glue will damage the meter!
Use only Teflon® tape on the threaded adapters. If you are installing your flowmeter to a glued pipe configuration, install the flowmeter after all glued fittings are dried and lines are purged of all fumes. Never hold the meter body with pliers or like tools. Union nuts should be hand tightened only. DO NOT OVER-TIGHTEN!

3. Vibration and heavy loads will damage the meter! Wall, floor and ceiling mounts and supports must be carefully aligned with the meter body and sturdy enough to support the plumbing and prevent vibration. Never allow the flowmeter to support the weight of related piping.

4. Solenoid valves will damage the meter!
Avoid a system that will impose a sudden burst of flow to the meter. Such a burst will cause the float to impact the float stop with destructive force. Solenoid valves, or other quick opening valves cannot be used unless meter is protected against sudden bursts of flow.

5. High pressures and temperatures will damage the meter! The maximum acceptable temperature and pressure is interdependent. The maximum acceptable working pressure is dependent on the actual fluid temperature. The maximum acceptable fluid temperature is dependent on the actual working pressure.

Maximum 85 psig pressure rating
Maximum Temperature rating of 125°F



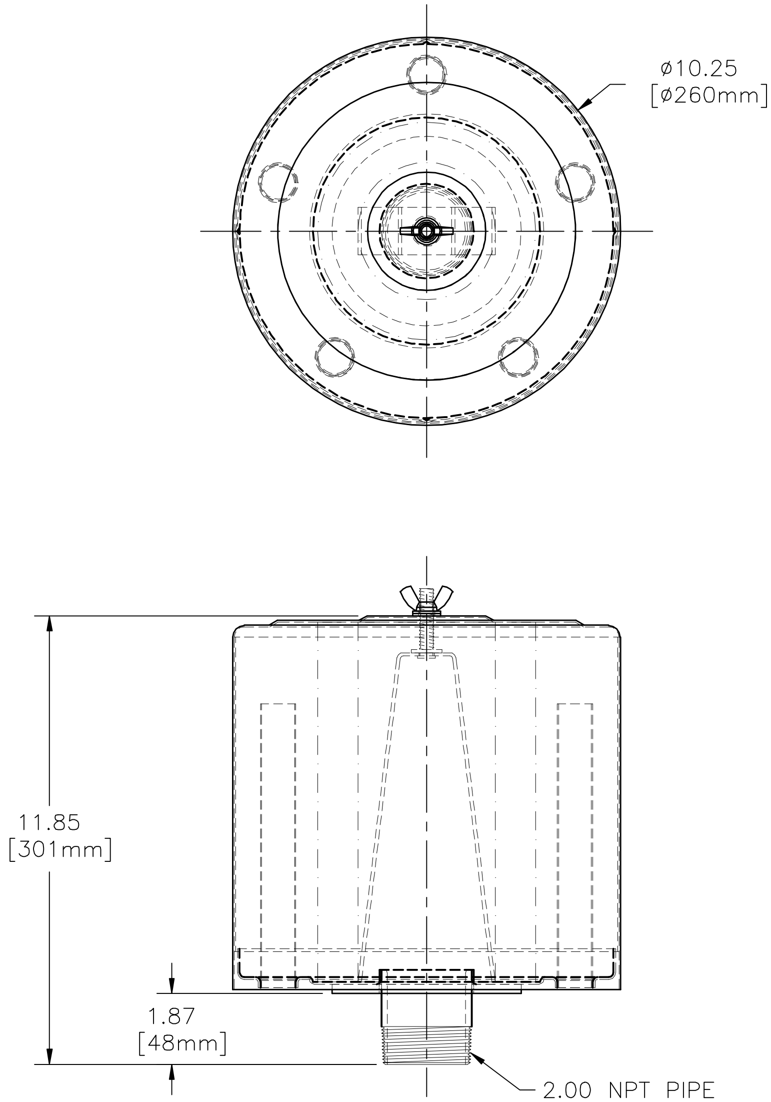
Models 910, 911, 912, 913, 916, 917, 918, 919

Non-code Vacuum Air (English, SCFM) Flow Coefficient = 0.878

Set Inches Mercury	Orifice Area, in^2					
	D (0.1213)	E (0.2157)	F (0.3369)	G (0.553)	H (0.864)	J (1.415)
6	24	43	68	111	173	284
7	26	45	71	117	182	298
8	27	47	74	121	189	310
9	27	49	76	125	195	320
10	28	50	78	128	199	327
11	28	51	79	129	202	331
12	29	51	80	131	204	334
13	29	51	80	131	204	335
14	29	51	80	131	204	335
15	29	51	80	131	204	335
16	29	51	80	131	204	335
17	29	51	80	131	204	335
18	29	51	80	131	204	335
19	29	51	80	131	204	335
20	29	51	80	131	204	335
21	29	51	80	131	204	335
22	29	51	80	131	204	335
23	29	51	80	131	204	335
24	29	51	80	131	204	335
25	29	51	80	131	204	335
26	29	51	80	131	204	335
27	29	51	80	131	204	335
28	29	51	80	131	204	335
29	29	51	80	131	204	335

DILUTION AIR INLET

REVISIONS						
ZONE	REV	DESCRIPTION	ECN #	CHG BY	DATE	APP'D



REPLACEMENT ELEMENT#	231P
MATERIAL	POLYESTER
CFM FLOW	300
SURFACE AREA	4.5 SQ. FT.
I.D.	3.63
O.D.	5.75
HEIGHT	9.50

MODEL#	HOUSING MATERIAL	FINISH
FS-231P-200	STAINLESS STEEL	NONE

UNLESS OTHERWISE SPECIFIED:
-DIMENSIONS ARE IN INCHES
-REF: APPROXIMATE DIMENSIONS, NO TOLERANCES APPLY
-TOLERANCES ARE:
DECIMALS: .XX ±.25 .XXX ±.125
ANGLES ±2°

CUSTOMER APPROVAL:

SOLBERG MANUFACTURING INC.
1151 W. ARDMORE AVE.
ITASCA, IL 60143
630/773-1363

DESCRIPTION: FS-231P-200

SALES REP.: A. SPICER

APPROVALS	DATE
DRAWN: CRW	04/24/03
APPROVED: C.W.	04/24/03

SHEET: 1 of 1 | SHEET SIZE: C | SCALE: 1:2

DRAWING NUMBER: SD10995 | REV: —

VAPOR TREATMENT EQUIPMENT

HEX-302

AKG®

CC

SERIES

Compressed Air Aftercoolers

- Advanced Technology Design Provides Compact Cooling
- Electric, or Air Motors Available from Stock
- Canadian Registry Numbers Available

Moisture Separators

- 99% Efficient Over a Wide Range of Air Flow
- Low Pressure Drop
- Light Weight All Aluminum Construction

Performance

AFTERCOOLERS

The CC Series is a complete aftercooler package designed to work on most models of rotary and piston air compressors. To select the appropriate model, simply determine compressor horsepower, and select the model from the chart.

Rotary Compresser

Air Compressor Horsepower	Internal Airflow Maximun CFM	Recommended CC Series Model Number
20 HP	113	CC100
25-40 HP	245	CC200
50-75 HP	539	CC450
100-125 HP	785	CC600
150-200 HP	1,569	CC1000
225-350 HP	2,300	CC1600
400-500 HP	3,016	CC2000
550-700 HP	4,316	CC2500
750-1000 HP	4,800	CC3500

Piston Compressor

Air Compressor Horsepower	Internal Airflow Maximum CFM	Recommended CC Series Model Number
20 HP	83	CC100
25-30 HP	181	CC200
40-70 HP	432	CC450
75-100 HP	638	CC600
125-200 HP	1,256	CC1000
225-300 HP	2,133	CC1600
350-400 HP	2,400	CC2000
500-600 HP	3,458	CC2500
700-850 HP	4,800	CC3500

Sizing Notes, Recommendations Are Based On The Following:

Heat Removal: Aftercooler=Compressor horsepower x 1.15 (motor service factor) x .17 (this assumes 17% of input horsepower is rejected to heat)

15°F Approach Temperature: Compressor air outlet temperature - ambient air temperature

Temperatures: Ambient Air Temperature + 15° F = Compressed Air Outlet Temperature

Flows: Compressor Horsepower x 4.5 = SCFM Air Flow

All flow rates are based on less than a 4 PSI pressure drop @ 100 PSI operating & 100° F ambient and 50% relative humidity

SEPARATORS

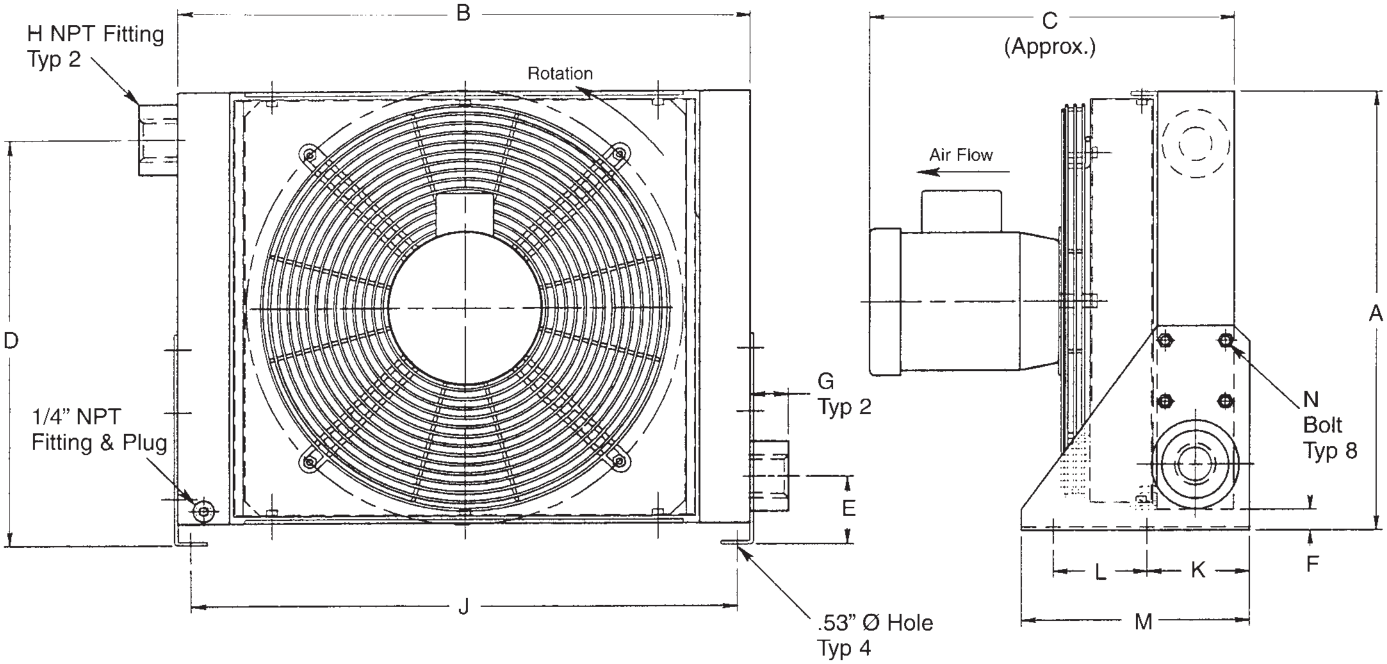
Aftercooler	Separator	Separator Maximum Capacity
CC100	MS300E	375 CFM
CC200	MS300G	375 CFM
CC450	MS750H	925 CFM
CC600	MS750H	925 CFM
CC1000	MS1700I	2100 CFM
CC1600	MS1700J	2100 CFM
CC2000	CONSULT FACTORY	
CC2500	CONSULT FACTORY	
CC3500	CONSULT FACTORY	

Pressure drop is 1.0 PSI at the above flow rates. Reference Bulletin #MSB-2 For additional details.

Sales@SouthwestThermal.com | p. 888-226-8522 f. 805-484-0049 | www.AKGcoolers.com

Dimensions

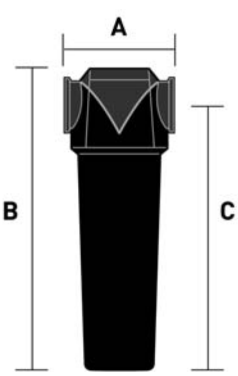
AFTERCOOLERS



MODEL SIZE	A	B	C Approx.	D	E	F	G	H (NPT)	J	K	L	M	N	Approx. NET	Weights Shipping
CC100	12.64	15.94	14.72	10.86	2.52	0.75	1.18	1.00	14.65	3.94	3.50	8.19	M8x10 Bolt	30	40
CC200	16.30	19.88	15.59	14.53	2.52	0.75	1.77	1.50	18.66	3.94	3.50	8.19	M8x10 Bolt	50	60
CC450	21.00	26.38	17.75	18.81	3.15	1.00	1.77	2.00	25.19	4.92	4.53	10.98	M10x20 Bolt	95	137
CC600	23.19	30.31	18.74	21.02	3.15	1.00	1.77	2.00	29.13	4.92	4.53	10.98	M10x20 Bolt	125	163
CC1000	27.72	37.00	22.60	25.23	4.33	1.85	1.77	2.50	37.80	5.91	7.87	16.00	M12x20 Bolt	195	240
CC1600	35.90	40.94	24.76	30.83	4.33	1.85	1.77	3.00	37.80	5.91	7.87	16.00	M12x20 Bolt	296	350
CC2000	37.44	42.91	29.84	30.55	10.91	2.08	1.77	4.00	43.62	5.39	7.87	15.47	M12x20 Bolt	320	380
CC2500	44.25	48.82	30.28	34.25	11.57	1.57	1.77	4.00	49.29	5.39	7.87	15.47	M12x20 Bolt	440	505
CC3500	57.87	52.76	33.82	43.98	17.56	3.35	2	4.00*	50.55	7.80	10.00	20.00	¾x1½ Bolt	550	645

* SAE 4-BOLT FLANGES MAY BE CONVERTED TO NPT BY ADDING "- AD" TO THE END OF THE MODEL CODE
* Dimensions in inches. *Weights in pounds. * Air connections my be reversed. * We reserve the right to make reasonable changes without notice.

Moisture Separators



MODEL	PIPE SIZE	A	B	C	WEIGHTS (LBS)
MS 85C	½" NPT	3.8	9.3	7.9	3
MS 300D	¾" NPT	5.1	10.8	9.2	7
MS 300E	1" NPT				
MS 300G	1½" NPT				
MS 750H	2" NPT	6.7	17	15	15
MS 1700I	2½" NPT	8.1	19.9	17.5	25
MS 1700J	3" NPT				

- Dimensions are in inches.
- We reserve the right to make reasonable design changes without notice.

Motor Specifications

ELECTRIC MOTOR DATA

Model Size	HP RPM	Motor Frame	SINGLE PHASE Voltage	SINGLE PHASE Hz	SINGLE PHASE Full Load Amps 230 V	THREE PHASE Voltage	THREE PHASE Hz	THREE PHASE Full Load Amps 230 V.
CC100	1/3 3450	IEC 63	115/230	60	2.6	208-230/460 190/380	60 50	1.1
CC200	1/2 3450	IEC 71			3.5	208-230/460 190/380	60 50	1.6
CC450	1/2 1725	NEMA 56C	115-230/460	60	4.0	208-230/460	60*	2.0
CC600	1 1725	NEMA 56C	115-230/460	60	6.4	208-230/460	60*	3.8
CC1000	2 1725	NEMA 56C	115/230	60	9.2	208-230/460	60*	6.2
CC1600	5 1725	NEMA 184TC	230	60	23	208-230/460	60*	13.2
CC2000	7.5 1725	NEMA 213TC	CONSULT FACTORY			208-230/460	60*	19.6
CC2500	7.5 1725	NEMA 213TC				208-230/460	60*	19.6
CC3500	10 1725	NEMA 213TC				208-230/460	60*	26.0

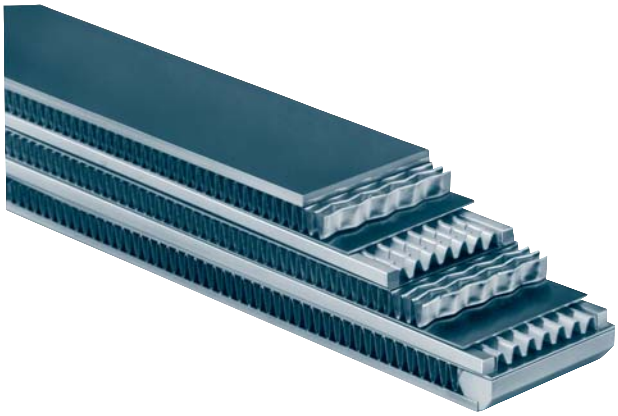
*Electric motors are TEFC and are not thermally protected.
*Actual rating may vary with motor brand. Check motor nameplate for actual rating.
*Motor RPM is reduced by 1/6 for 50 Hz service.
* - 3 Phase motors available in 50 Hz.

AIR MOTOR DATA

Model Number	Air Pressure To Motor (PSI)	Motor Air Consumption (CFM)	Air Motor Connection Size	FAN RPM
CC100	30	10	1/4" NPT	3450
CC200	60	17	1/4" NPT	3450
CC450	40	25	1/4" NPT	1725
CC600	40	25	1/4" NPT	1725
CC1000	50	70	1/2" NPT	1725
CC1600	60	150	1 1/4" NPT	1725
CC2000	80	200	1 1/4" NPT	1725
CC2500	80	200	1 1/4" NPT	1725
CC3500	100	240	1 1/4" NPT	1725

*Air pressure to motor ***Must*** be regulated and lubricated.
****Do Not Exceed*** fan RPM listed above.
*Mufflers are included with all motors.

Features



- Advanced Technology Designs
- Up to 60% smaller than Conventional Fin and Tube Designs
- Rugged Bar & Plate Design
- Reduced Air Side Fouling
- Competitive Prices
- Shipments Available From Stock

Specifications

AFTERCOOLER

RATINGS:

Maximum Working Pressure....................................250 PSI
Maximum Working Temperature...............................250°F

MATERIALS:

Cooler...Alumium
Shroud ....Powder Painted Steel
Fan Guard ....Zinc Plated Steel
Fan Blade ....Polypropylene Blades
Aluminum Hub
Mounting Brackets..............................Powder Painted Steel

MOISTURE SEPARATOR

RATINGS:

Maximum Working ....250 PSI
Maximum Working Temperature...............................150°F
Minimum Recommended Temperature.........................35°F

Materials:

Moisture Separator ....Aluminum Housing with Stainless Steel or Plastic Internals

Ordering Information

AFTERCOOLER

☐ — ☐ — ☐ — ☐

SERIES
CC=Series

MODEL SIZE
SELECTED

MOTOR DATA
0=No Motor
1= Single Phase
2=Air Motor
3=Three Phase
575=575 Volt

CUSTOM FEATURE
R=Reverse Air Flow
AD=SAE to NPT Adapters Installed
H=Heresite Coating/Core Assembly
CRN Canadian Registry, 250 PSI

MOISTURE SEPARATOR

☐ — ☐ — ☐

SERIES
MS=Series

MODEL SIZE
SELECTED

DRAIN OPTION
Blank=Float Type Drain Included
ND=No Drain Included

Sales@SouthwestThermal.com | p. 888-226-8522 f. 805-484-0049 | www.AKGcoolers.com

PRM Vapor Carbon Systems

VP-2000

PRODUCT RECOVERY MANAGEMENT

Absolute Quality is our Goal… Genuine Service is our Habit!

PRM offers the VP Series Carbon where standard air flow volumes are required with minimal backpressure. These units include a false bottom and distributor screen to allow for more even distribution and lower pressure drops.

STANDARD SPECIFICATIONS:

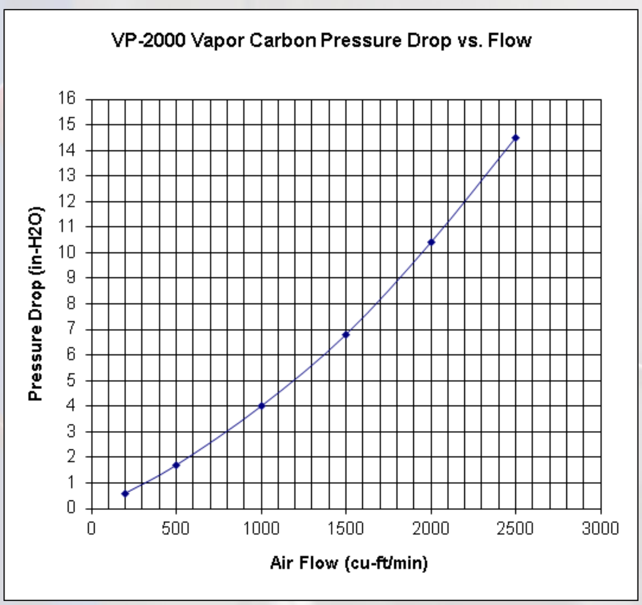
VP-2000:

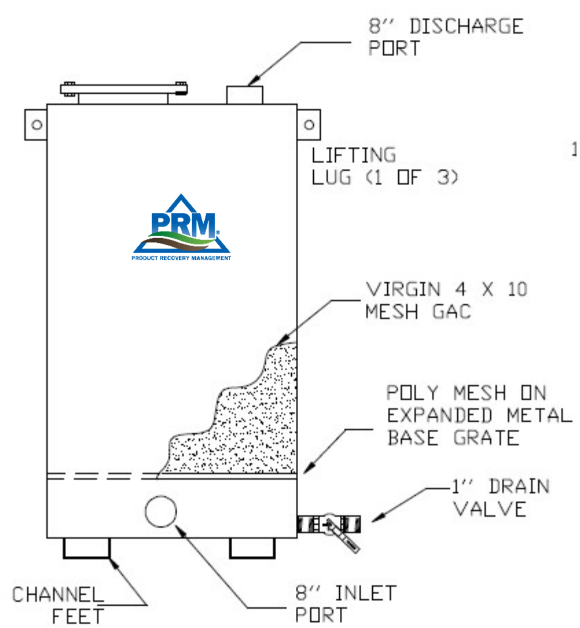
- **64” Diameter x 72” Tall**
- **2000 lbs 4 x 10 Vapor Phase GAC**
- **8 inch Flanged Inlet/Outlet**
- **Aluminum, Carbon Steel or Stainless Steel**

- **False bottom allows for even distribution, lower pressure drop, and no channeling**
- **Open top drum allows for easy carbon access and change-out**

Custom inlet and outlet connections available

Availability: Typical lead time is 2-4 weeks





Product Recovery Management, Incorporated
(888) TREAT-IT
888-873-2848 • 919-957-8890 • www.prm-net.com • sales@prm-net.com
Butner, NC • Webster, NY • Lakeland, FL

* Actual equipment specifications may vary. Please contact Product Recovery Management, Inc. for additional details. E-05 (VP2000)

TO-400

FALCO 300 SPECIFICATIONS

The FALCO 300 electric catalytic oxidizer treats air streams contaminated with volatile organic compounds. The catalyst provides VOC destruction efficiencies up to 99.5%. Operation, including startup, is fully automatic. Control system accurately regulates input loading and temperatures. The controls adjust a FALCO Vapor Control Valve (VCV) to maintain safe maximum input concentrations. Automatic shutdown results if temperatures exceed limits.

A spiral plate heat exchanger provides efficient heat recovery and a bypass valve allows for adjustment of heat recovery. Low heat recovery enables operation at high vapor concentration. High heat recovery minimizes energy use during operation at low input vapor concentration. At 780 ppmv (Gasoline) and 300 scfm, sufficient heat is recovered to preheat the inflow without supplementary electric energy.

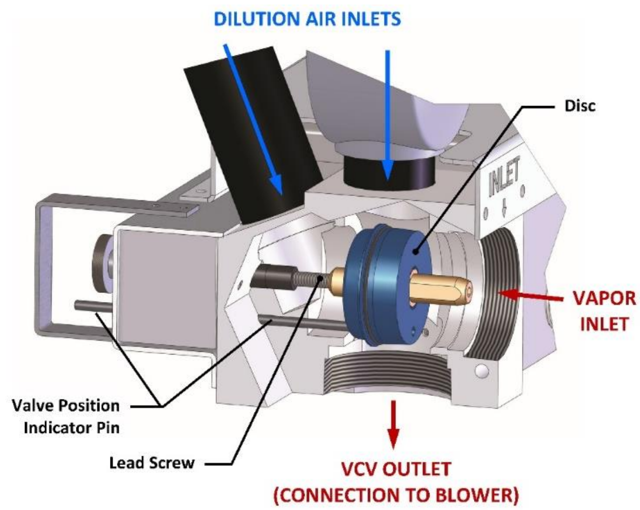
The FALCO 300 has a massive catalyst volume for its rated capacity, providing longer life and poison resistance than monolith type catalysts. If necessary, the catalyst can be replaced on site in one hour.

- **CAPACITY** — 100-350 scfm
- **MAXIMUM INPUT LOADING** — 250 lb/day petroleum hydrocarbons @ 350 scfm
- **VAPOR CONTROL** — FALCO Vapor Control Valve (VCV)
- **CATALYST DESTRUCTION EFFICIENCY** — Up to 99.5%
- **CATALYST TEMPERATURE RANGE** — 330-620ºC (626-1148ºF)
- **CATALYST** — Packed bed 2.5 cubic feet. Platinum on 1/8" ceramic beads standard. Optional catalyst available for chlorinated solvents.
- **HEAT EXCHANGER** — 304 Stainless steel spiral plate. 73% thermal efficiency @ 300 scfm (adjustable)
- **HEATER (Electric)** — 27 kW, Solid state switching (SCR power control) with high limit
- **CONSTRUCTION** — Stainless steel and aluminum
- **WEIGHT** — 885 lb. with flame arrestor
- **DIMENSIONS** — 73" high (excluding 5' stack) X 70" long X 29" wide
Fits in the back of a pick-up truck
- **POWER REQUIREMENTS** — HEATER 3Ø: 56 amp @ 208 VAC (20.3 kW) *or* 65 amp @ 240 VAC (27 kW)
Optional: 33 amp @ 480 VAC (27 kW) *or* 38 amp @ 415 VAC (27 kW)

HEATER 1Ø: 56.5 @ 240 VAC (13.5 kW)

CONTROLS: 120 VAC, 60 Hz
Optional: 120 VAC, 50 Hz
- **APPROVALS** — Third party certification for use in Class 1, Div 2, Group D, T2C Hazardous locations extending up to 41" above the ground.

FALCO 100/300 Vapor Control Valve (VCV)

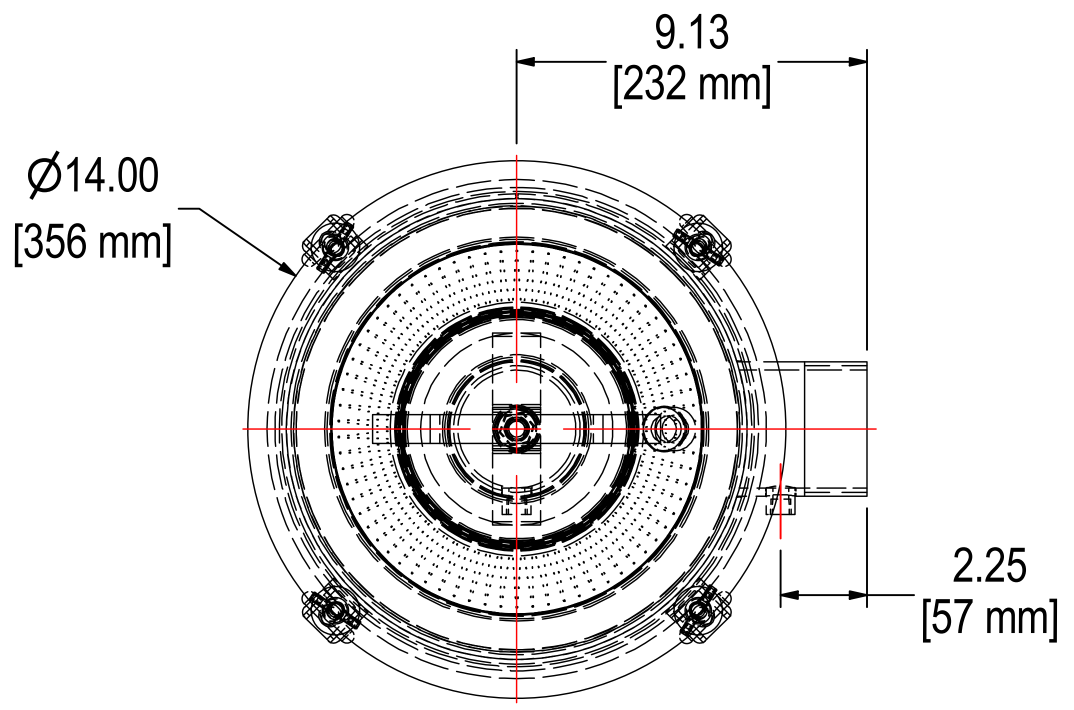


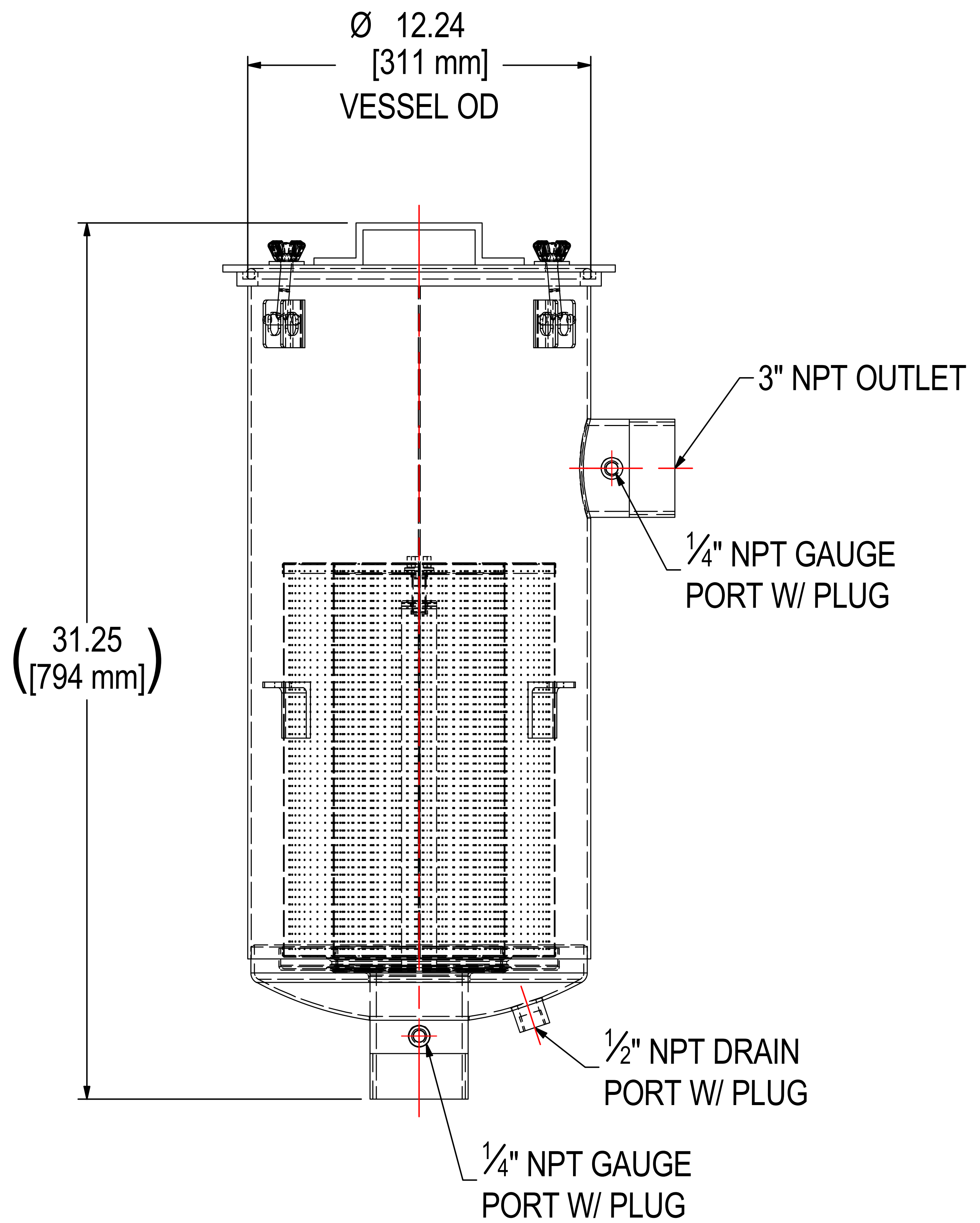
Falmouth Products Vapor Control Valve (VCV) is installed inline on the vacuum side of the extraction blower. The VCV enables the FALCO to start up, operate automatically, and cooperate with the temperature controllers to regulate input vapors. The VCV minimizes power use by accurately maintaining maximum input concentration consistent with the heat recovery adjustment.

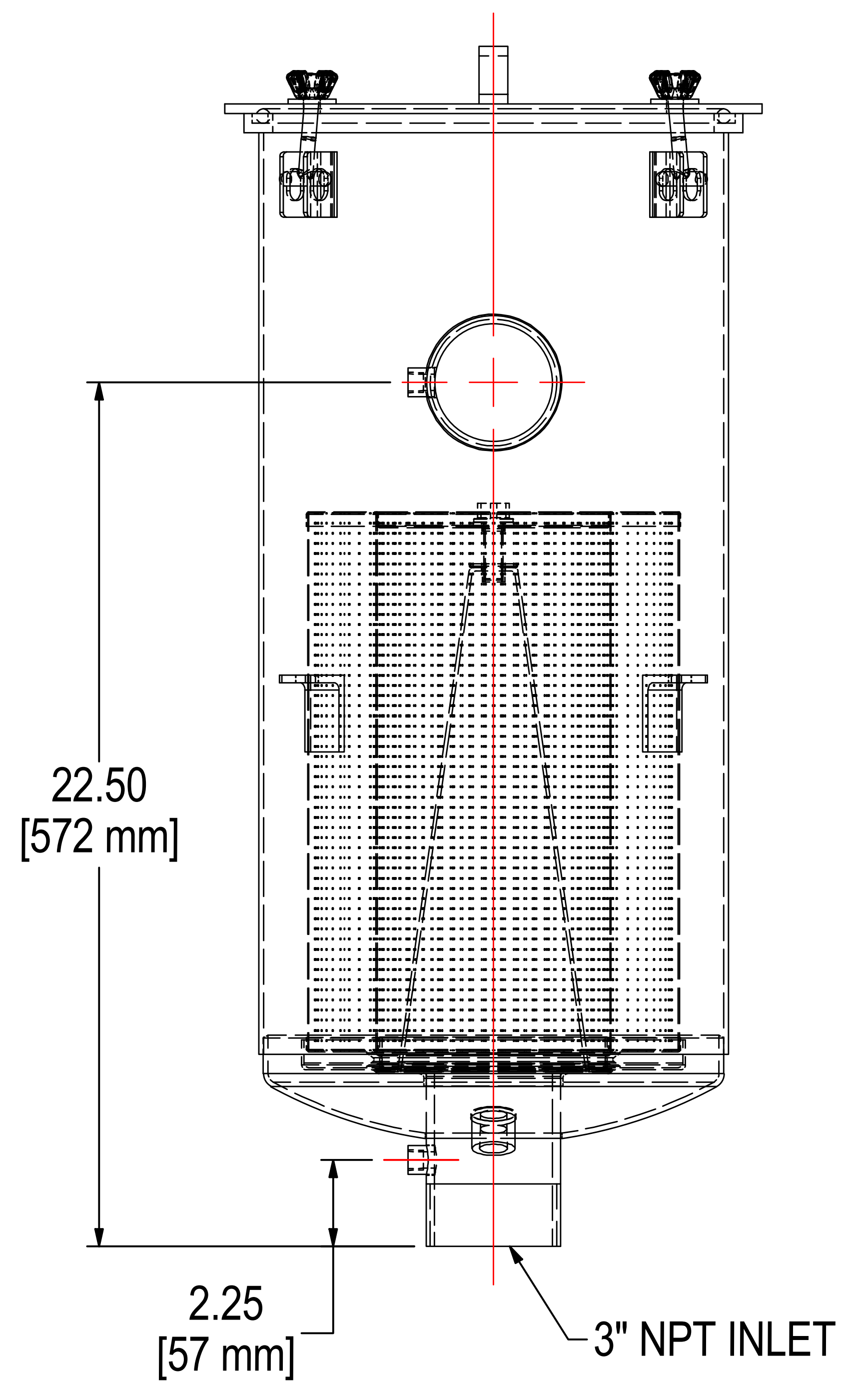
The VCV includes a valve body with two valve seats, valve disc, and a gear motor. The motor progressively opens and closes the valve in response to input from the oxidizer’s three temperature controllers. The valve simultaneously regulates dilution air and source vapors by positioning the valve disc. Controller rate alarms regulate how quickly the VCV introduces vapors. A solenoid valve provides rapid introduction of dilution air, regardless of valve position. The VCV automatically returns to its closed position each time FALCO power is cycled.

- Provides precise vapor control in Soil Vapor Extraction (SVE) applications.
- Third Party Approval for use in Class 1, Division 2, Group D, T3C hazardous locations
- Valve body, dilution tee, mounting bracket, and top cover are fabricated from 6061 T6 aluminum. The belt guard and lead screw are 304 stainless steel
- Weatherproof design for continuous outdoor operation includes valve body heater and Delrin valve disc to prevent ice buildup
- ACME thread lead screw provides low friction and long life
- Indicator pin shows valve position, knob shows direction of motion
- Terminal blocks allow straightforward field wiring to FALCO
- 3” Dilution air filter
- Explosion proof 2” solenoid valve for rapid introduction of dilution air.
- Aluminum bracket for mounting on fence or wall
- Low pressure drop (3” H_2O @ 300 CFM)
- Weight 50 lbs. Height 33”, Width 14.5”, Length 21”

REV	DESCRIPTION	ECN #	CHG BY	DATE	APP'D
A	UPDATED TO CURRENT LAYOUT	17860	NAD	12/03/19	TAS







ELEMENT SPECS		
PART NUMBER	PSG344/2	
MATERIAL	COALESCING	
FLOW RATE	500 CFM	850 m³/hr
SURFACE AREA	-	-
I.D.	6.00"	152mm
O.D.	9.75"	248mm
HEIGHT	14.06"	357mm

MODEL #: HDL-PSG344/2-300 **MATERIAL:** CARBON STEEL **FINISH:** WHITE POWDER

SOLBERG®
Filtration • Separation • Silencing
630.773.1363 • www.solbergmfg.com

TOLERANCES

DIMENSIONS ARE FOR REFERENCE ONLY. ALL DIMENSIONS ARE SUBJECT TO CHANGE UPON PRODUCTION.

UNLESS OTHERWISE SPECIFIED:
- DIMENSIONS ARE IN INCHES
- REF: APPROXIMATE DIMENSIONS, NO TOLERANCES APPLY
- FINISH: BREAK EDGES TO .005-.020 RADIUS/CHAMFER

MODEL NUMBER: HDL-PSG344/2-300

SHEET: 1 OF 1

DESCRIPTION: HDL-PSG344/2-300, WHITE

PROJECT: SD10019

DRAWN BY: CRW **DATE:** 3/4/2014

APPROVED BY: CRW **DATE:** 3/4/2014

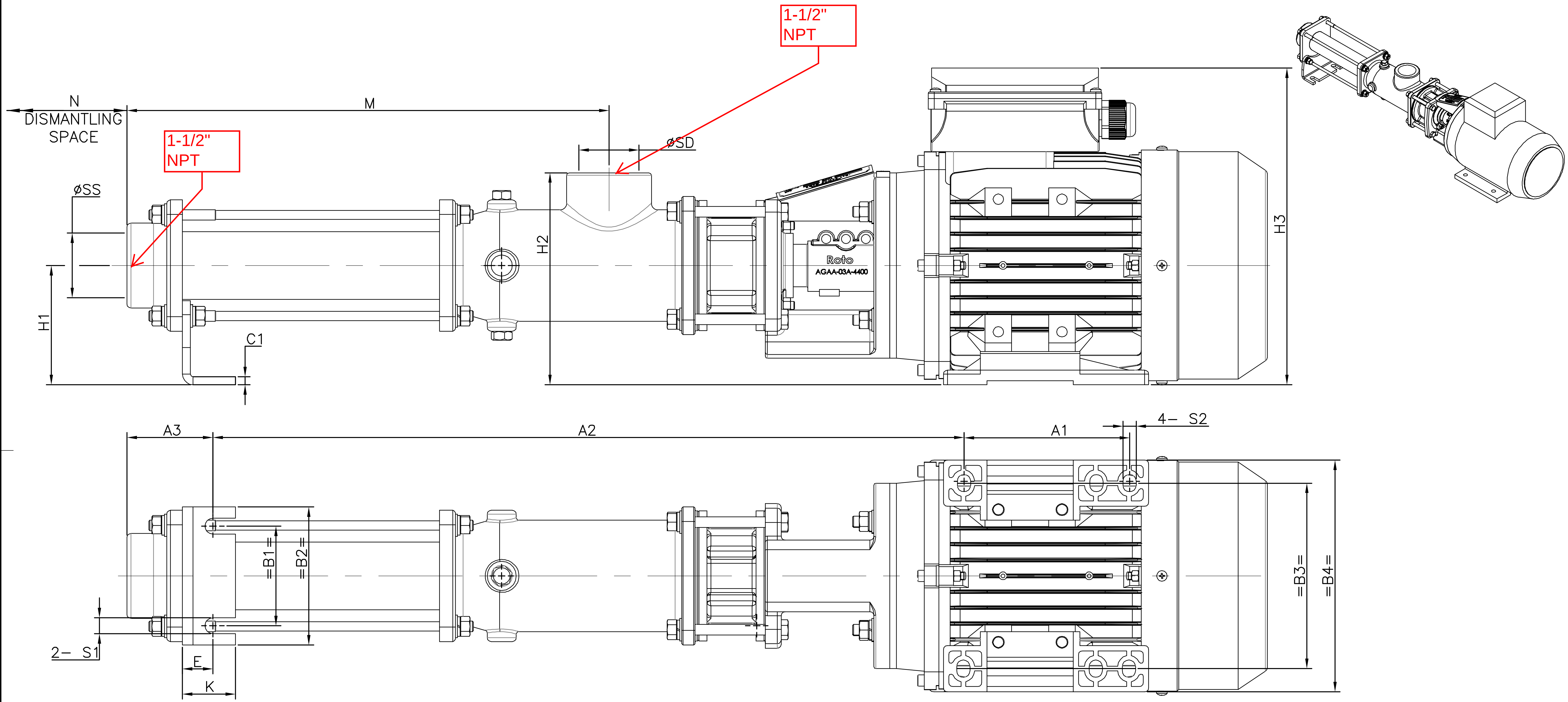
REV: A

WATER TREATMENT EQUIPMENT

DIMENSIONAL DRAWING OF AGCA SERIES PUMP

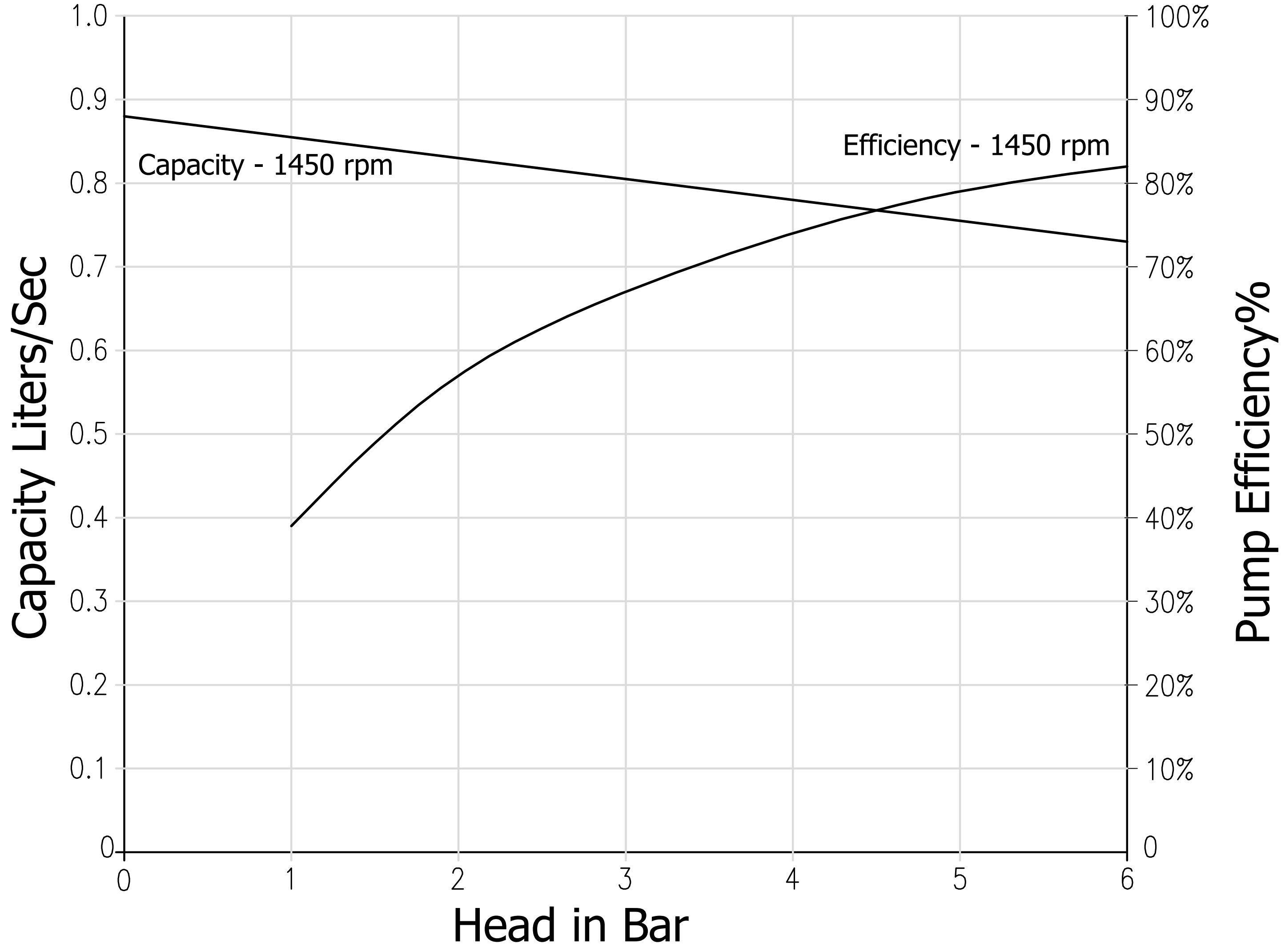
DRAWING No.

DD–72–001–00

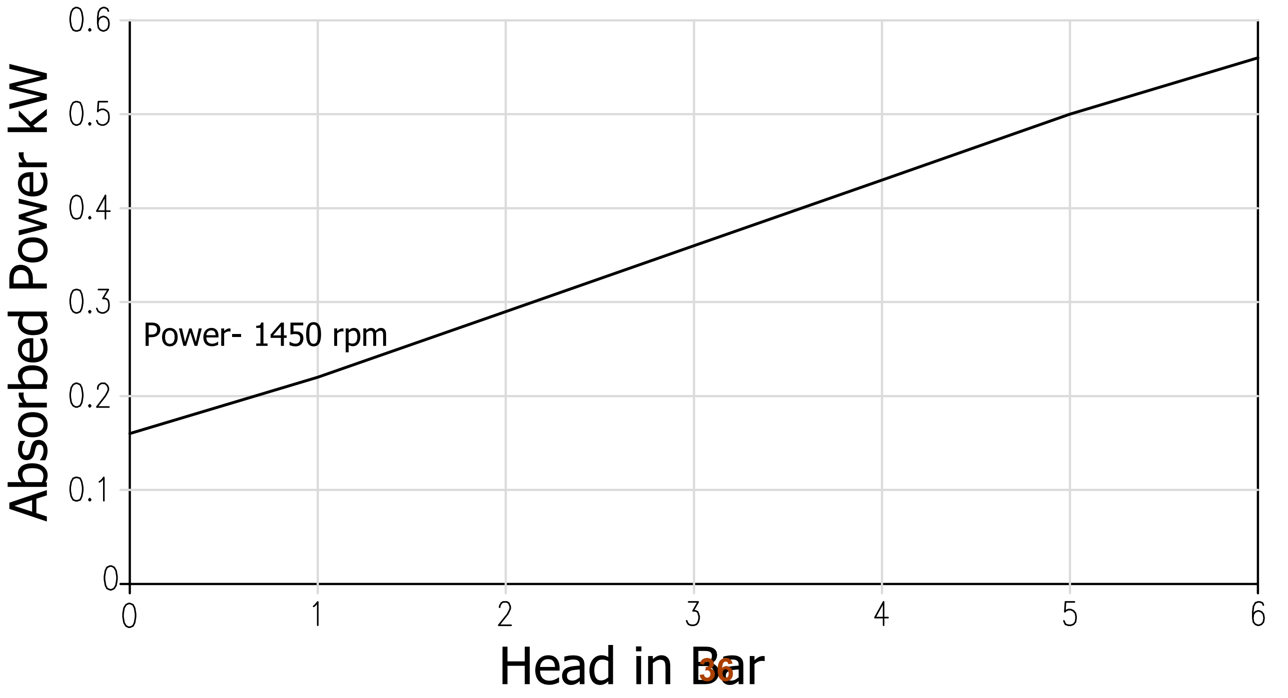


TYPE OF PUMP	BASIC DIMENSIONS																		MOTOR DATA				
	A1	A2	A3	B1	B2	B3	B4	C1	E	H1	H2	H3	K	L	M	N	S1	S2	ØSD	ØSS	FRAME SIZE	FACE MOUNTING DIA	SHAFT DIA	KW	RPM
AGCA-01A	100	440	65	75	104	125	160	6	23	80	135	222	40	705	266	180	12	10	Rp 1-1/2"	Rp 1-1/2"	80	120	19	0.37	960
AGCA-01A	100	440	65	75	104	125	160	6	23	80	135	222	40	705	266	180	12	10	Rp 1-1/2"	Rp 1-1/2"	80	120	19	0.75	1450
AGCA-01B	125	632	65	75	104	140	175	6	23	90	160	239	40	926	429	320	12	10	Rp 1-1/2"	Rp 1-1/2"	90	140	24	0.75	960
AGCA-01B	125	632	65	75	104	140	175	6	23	90	160	239	40	926	429	320	12	10	Rp 1-1/2"	Rp 1-1/2"	90	140	24	1.1	1450
AGCA-03A	125	567	65	75	104	140	175	6	23	90	160	239	40	861	364	240	12	10	Rp 1-1/2"	Rp 1-1/2"	90	140	24	0.75	960
AGCA-03A	125	567	65	75	104	140	175	6	23	90	160	239	40	861	364	240	12	10	Rp 1-1/2"	Rp 1-1/2"	90	140	24	1.1	1450
AGCA-03B	140	761	68	75	104	160	198	6	26	100	170	270	40	1109	544	430	12	12	Rp 1-1/2"	Rp 1-1/2"	100	160	28	2.2	1450
AGCA-05A	140	586	72	75	104	160	198	6	26	100	180	270	40	938	344	210	12	12	Rp 2"	Rp 2"	100	160	28	2.2	1450
AGCA-07A	140	734	73	85	115	190	220	6	27	112	192	296	44	1077	486	350	12	12	Rp 2"	Rp 2"	112	160	28	4.0	1450

AGCA-01A



Capacity Liters/Sec
Pump Efficiency%
Capacity - 1450 rpm
Efficiency - 1450 rpm
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0
0
1
2
3
4
5
6
Head in Bar



Absorbed Power kW
Power- 1450 rpm
0.6
0.5
0.4
0.3
0.2
0.1
0
0
1
2
3
4
5
6
Head in Bar

Storage Tanks

www.prmfiltration.com

PRM is a national distributor of polyethylene storage tanks and has a large variety in stock for various applications.

Absolute Quality:

PRM stocks Ace Roto-Mold tanks which are well known for their high quality in the industrial and agricultural container market.

PRM stocks vertical and free standing leg horizontal tanks in a variety of sizes from 6 gallons to 6000 gallons at our Butner Facility. Contact PRM for your next storage tank. We probably have what you need in stock for quick pick up or delivery.

Contact PRM for more details on the capacities and dimensions of all available storage tanks. **919-957-8890**

Features:

- Manufactured from medium or high density polyethylene with UV inhibitors.
- Tank walls are translucent for level viewing and include gallon indicators
- NSF/ANSI standard 61

Also available:
6 and 12 gallon fuel tanks designed for containment of gasoline and diesel fuels.

PRM FILTRATION

(888) TREAT-IT

888-873-2848 • 919-957-8890 • www.prmfiltration.com • sales@prmfiltration.com

Butner, NC • Webster, NY • Lakeland, FL

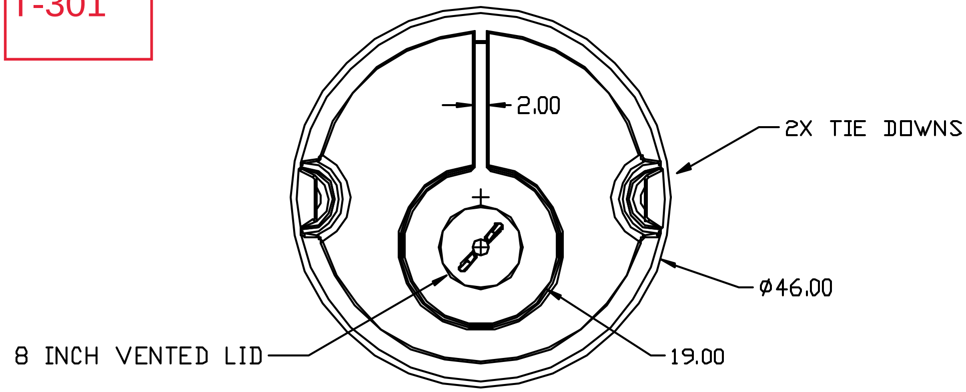
* Actual equipment specifications may vary. PRM Filtration is a division of Product Recovery Management, Inc.

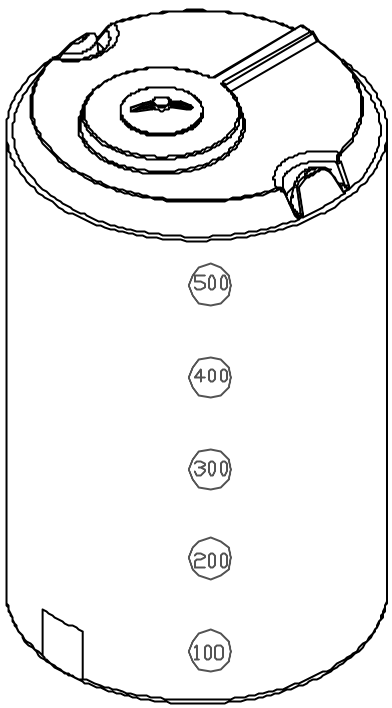
PROPRIETARY DATA

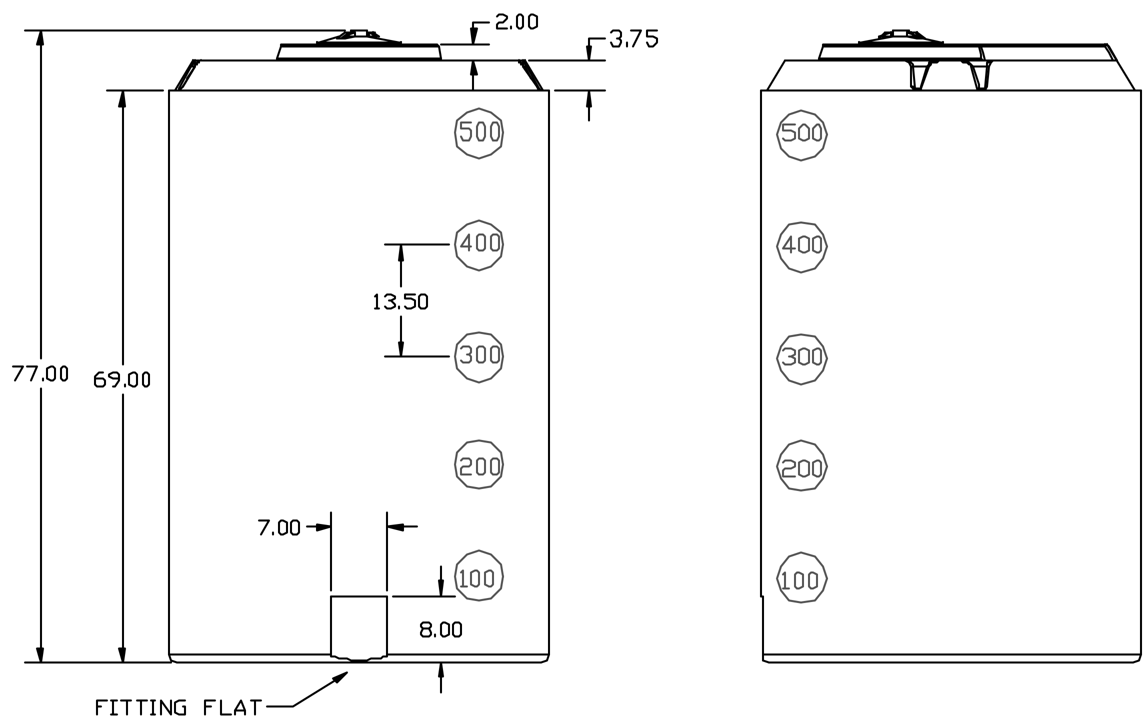
T-301

VT0500-46

1. SPECIFIC GRAVITY IS 1.75
2. 1 PIECE ROTATIONALLY MOLDED
3. TRANSLUCENT
4. FDA APPROVED RESIN
5. CALIBRATED IN GALLONS
6. THREE YEAR WARRANTY
7. UV STABILIZED
8. LARGER LID AVAILABLE







REV	DESCRIPTION	DATE	APPRD

ALL DIMENSIONS ARE IN DECIMAL INCHES
TOLERANCES UNLESS OTHERWISE SPECIFIED
± 1% @ 68° F

DRAWN / DATE
NVE 8/19/15

APPRD. / DATE
DHJ 9/21/15

THIRD ANGLE PROJECTION
ANSI 14.5M

MATERIAL

HDPE OR EQUIVALENT
REFERENCE MATERIAL DATA SHEET
FOR SPECIFIC PROPERTIES.

NOTES:
1. BLUE, GREEN, YELLOW, BLACK, OR WHITE COLOR
2. SHOT WEIGHT 118 LBS.
3. NOM. WALL @.248

38

Ace Roto-Mold
A DIVISION OF DEN HARTOG INDUSTRIES, INC.
4018 HWY. 61 BLVD., BOX 421, HOSPERS, IOWA 51238

CLIENT / DESCRIPTION
500 GALLON Ø46" VERTICAL TANK

SCALE
N.S.

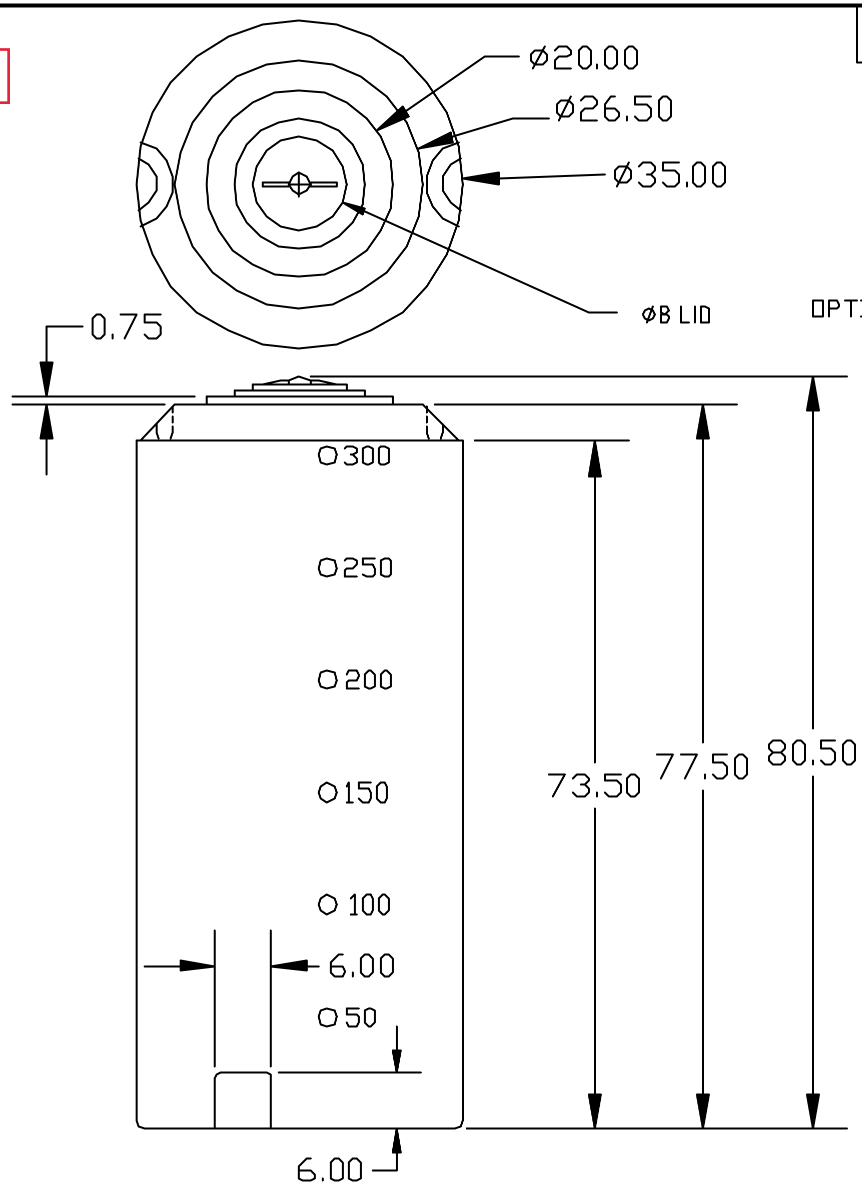
PART NO.
VT0500-46

PROPRIETARY DATA

T-400

VT0300-35 | A

1. 1 PIECE ROTATIONALLY MOLDED
2. SPECIFIC GRAVITY 1.75
3. TRANSLUCENT
4. UV STABILIZED
5. FDA APPROVED RESIN
6. CALIBRATED IN GAL.
7. 3 YEAR WARRANTY
8. LARGER LID AVAILABLE



A	ADD TIE DOWNS	3-5-03	
REV	DESCRIPTION	DATE	APPRD

DRAWN / DATE: DHJ 12/11/93

APPRD. / DATE

MATERIAL: HDPE OR EQUIVALENT. REFERENCE MATERIAL DATA SHEET FOR SPECIFIC PROPERTIES.

Ace Roto-Mold
A DIVISION OF DEN HARTOG INDUSTRIES, INC.
4010 HWY. 60 BLVD., BOX 421, HOSPERS, IOWA 51238

ALL DIMENSIONS ARE IN DECIMAL INCHES
TOLERANCES UNLESS OTHERWISE SPECIFIED
± 1% @ 68° F

THIRD ANGLE PROJECTION
ANSI 14.5M

NOTES:
1. BLUE, GREEN, WHITE
YELLOW, GREY, OR BLACK COLOR
2. SHOT WEIGHT 86 LBS.
3. .241 NOM. WALL

CLIENT / DESCRIPTION: 300 GALLON VERTICAL TANK

SCALE: N.S.

PART NO. VT0300-35

LS-1

FLOAT LEVEL SWITCHES

www.prmfiltration.com

LS-CF07 Float Level Switches

PRM offers rugged and reliable industrial float level switches for starting or stopping pumps, opening or closing valves, or activating level alarms. Can be wired as tank fill or as low level cut out protection. Float Level Switches consist of a heavy duty polypropylene float molded directly onto a three core PVC cable.

FEATURES:

- Automatically turns on and off
- Adjustable switching level with included cable weight
- Simple Installation and use, instructions included

SPECIFICATIONS:

NORMALLY OPEN
VOLTAGE: 125/250VAC, 24VDC
MAXIMUM CURRENT: 16(4) A, 50-60 Hz
MAX. TEMPERATURE: 120°F
PROTECTION RATING: IP68
CE ISO9001 COMPLIANT

FLSLSCF07X3X:

LS-CF07 FLOAT LEVEL SWITCH,

3 METER PVC CABLE

FLSLSCF07X7X:

LS-CF07 FLOAT LEVEL SWITCH,

7.6 METER PVC CABLE

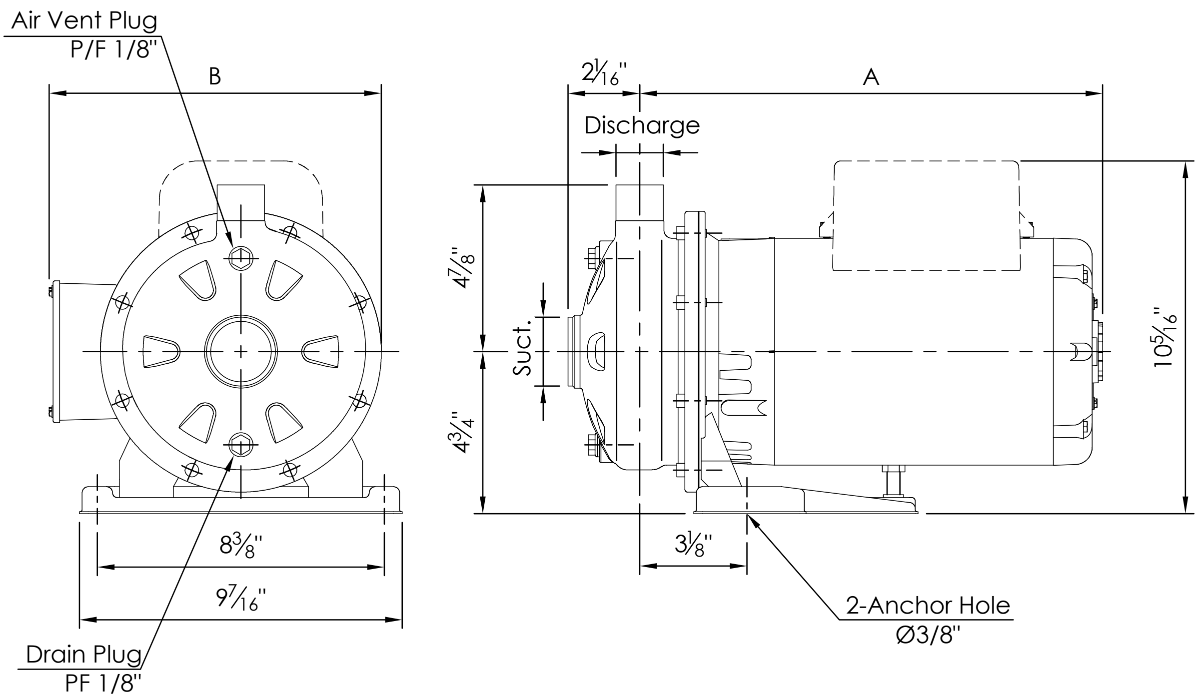
PRM FILTRATION
(888) TREAT-IT
888-873-2848 • 919-957-8890 • www.prmfiltration.com • sales@prmfiltration.com
Butner, NC • Webster, NY • Lakeland, FL

P-400 & 401

Model CDU

EBARA Stainless Steel Centrifugal Pumps

Pump Dimensions



Model CDU, 2-Pole Motor

Model	Size	Pump Size – NPT (Inch)		Dimension (Inch)		Unit Weight (lbs.)			
						Single Phase		Three Phase	
		Suction	Discharge	A	B	ODP	TEFC	ODP	TEFC
CDU70/0-1/2HP	1 x 1 1/4 x 4 1/2	1 1/4	1	14 11/16	9 1/8	36	41	31	31
CDU70/1-3/4HP	1 x 1 1/4 x 4 1/2	1 1/4	1	15 3/16	9 1/8	36	41	31	31
CDU70/3-1 1/2HP	1 x 1 1/4 x 5 3/16	1 1/4	1	16 3/16	9 1/8	47	50	39	39
CDU70/5A-2HP	1 x 1 1/4 x 6 3/16	1 1/4	1	16 5/8	9 1/8	51	58	44	48
CDU70/5B-2HP	1 x 1 1/4 x 6 3/16	1 1/4	1	16 5/8	9 1/8	51	58	44	48
CDU120/1-1HP	1 x 1 1/4 x 4 1/2	1 1/4	1	15 11/16	9 1/8	41	46	33	32
CDU120/3-1 1/2HP	1 x 1 1/4 x 5 3/16	1 1/4	1	16 3/16	9 1/8	47	50	39	39
CDU120/5-3HP	1 x 1 1/4 x 6 3/16	1 1/4	1	17 3/8	9 1/8	59	66	51	60
CDU200/1-1 1/2HP	1 x 1 1/2 x 4 1/2	1 1/2	1	16 3/16	9 1/8	47	50	39	39
CDU200/3-3HP	1 x 1 1/2 x 5 3/16	1 1/2	1	17 3/8	9 1/8	58	65	50	59
CDU200/5-3HP	1 x 1 1/2 x 5 11/16	1 1/2	1	17 3/8	9 1/8	58	65	50	59

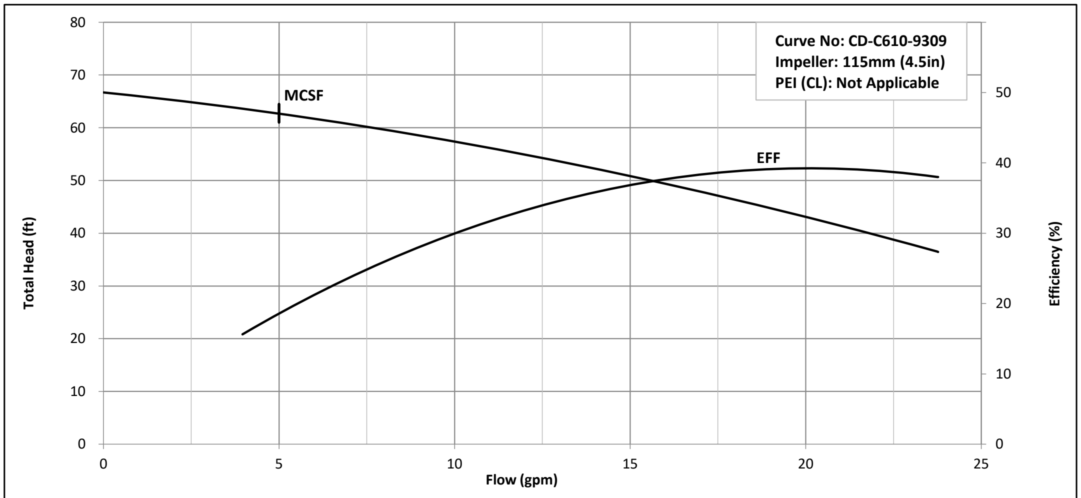
Model CDU, 4-Pole Motor

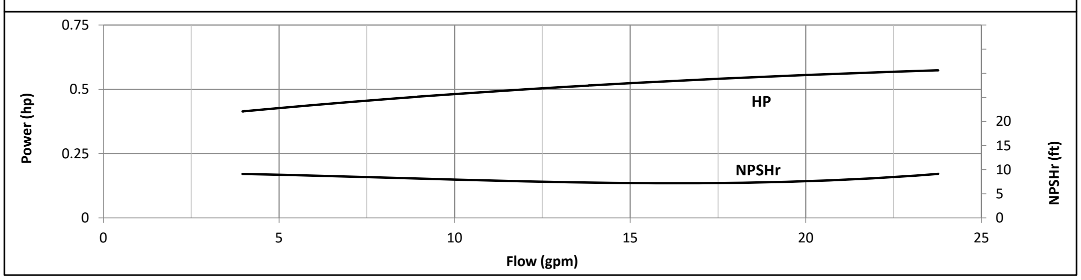
Model	Size	Pump Size – NPT (Inch)		Dimension (Inch)		Unit Weight (lbs.)			
						Single Phase		Three Phase	
		Suction	Discharge	A	B	ODP	TEFC	ODP	TEFC
CDU4120/5-1/3HP	1 x 1 1/4 x 6 3/16	1 1/4	1	13 11/16	9 5/16	32	31	31	30
CDU4200/5-1/2HP	1 x 1 1/2 x 5 11/16	1 1/2	1	14 11/16	9 5/16	35	31	31	31

Model CDU **EBARA Stainless Steel Centrifugal Pumps**

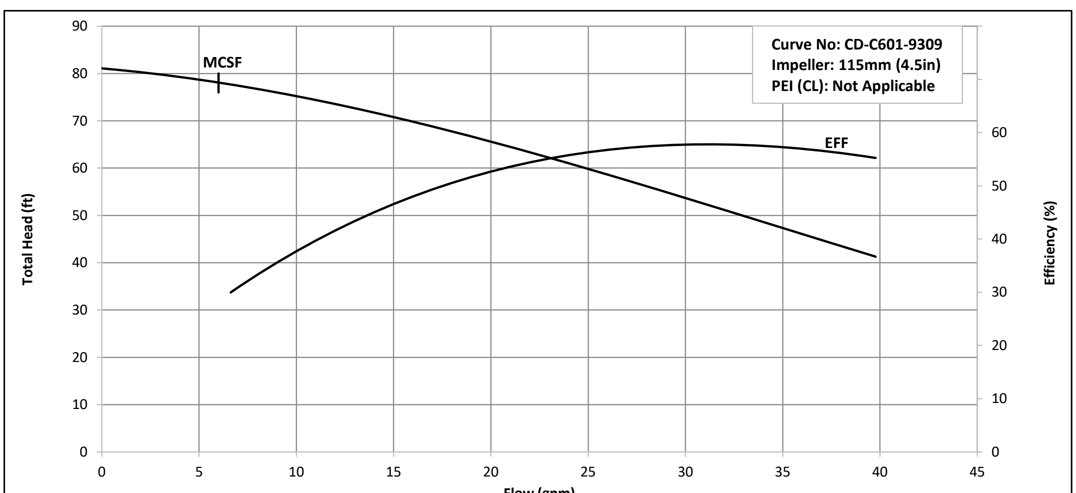
Performance Curves

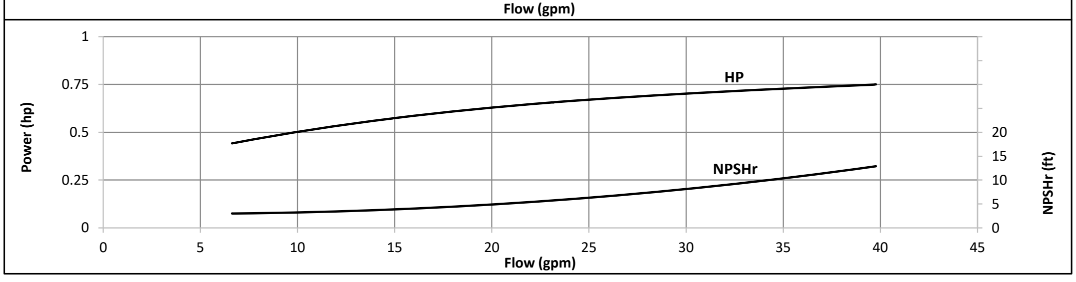
CDU70/0-1/2 HP Nominal Speed: 3450 RPM Size: 1 x 1 1/4 x 4 1/2





CDU70/1-3/4 HP Nominal Speed: 3450 RPM Size: 1 x 1 1/4 x 4 1/2





BF-400

#2 SS BANDED CLAMP DUAL PORT FILTER HOUSING

PRMFiltration

Low Pressure Banded Clamp Filter Housing, #2 Size, 304 Stainless Steel.
Industrial Filter Housings provide excellent filtration in both industrial and chemical applications.

Standard design pressure 100 PSI maximum, design, materials, and construction conform to CE and ASME code.

Typical Features Include:

- 304 Stainless Steel Construction
- Trade Size # 2 Housing (8 x 30)
- 2 Inch NPT Inlet and Outlet Connections, Dual Port features outlets on the side and on the bottom for multiple piping options.
- 304 SS NPT End Plug Included to Close Off Outlet Not Being Used
- 100 GPM Flow Rate
- Viton® O-rings standard
- 100 psig Maximum Working Pressure
- Operating Temperature: normal range of 50°F - 90°F. Variance outside of this temperature range will affect maximum operating pressure rating. Liquids operating at elevated temperatures pose a risk of burns.
- Stainless Steel Strainer Basket and Internal Bag Support Rack
- Drain Port and Mounting Stand
- Quick Opening Clamp Top

PRM PART #: BFHBFL2DX

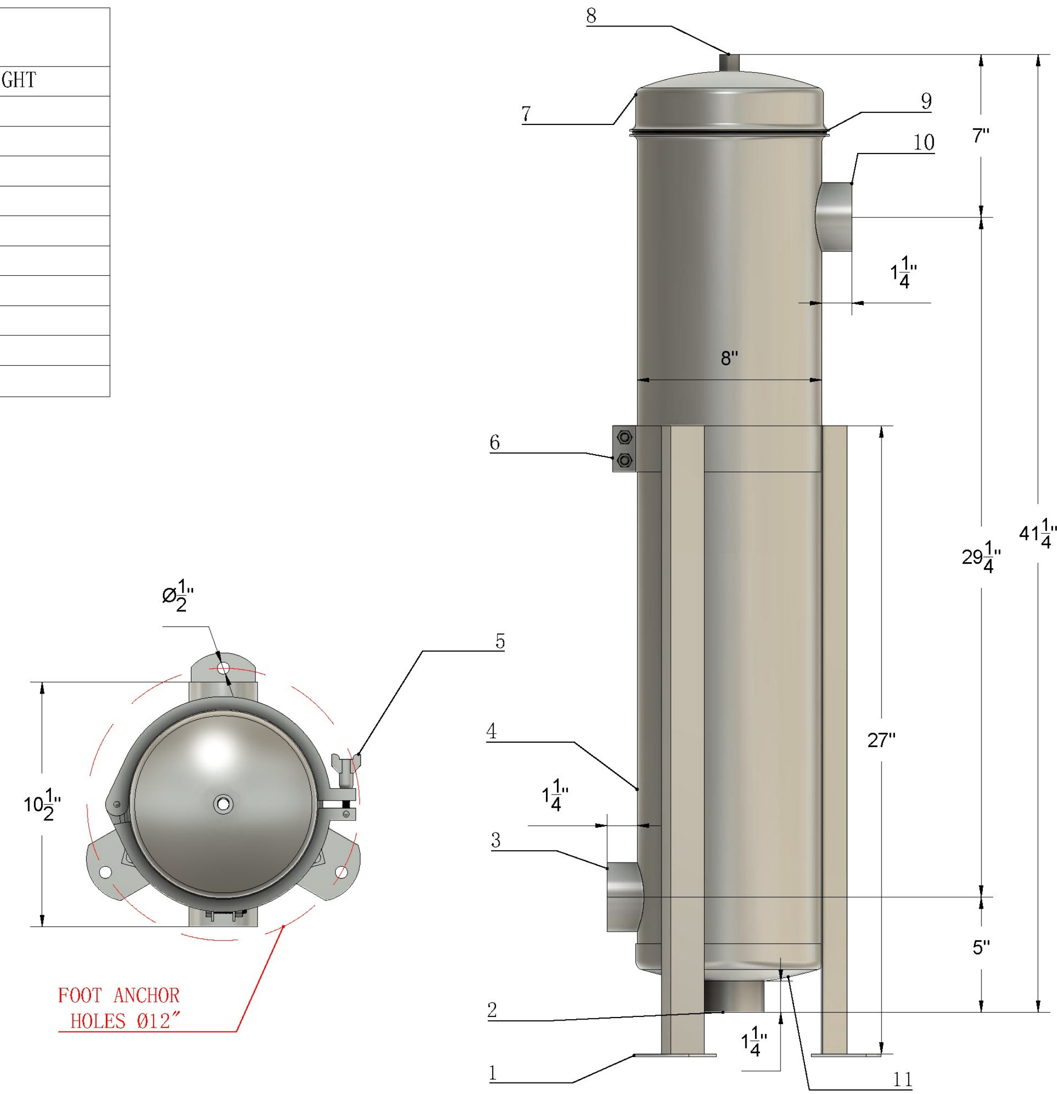
** Options and Services **

- Skid mounting, pre plumbed filter array
- Steel, Stainless Steel, or PVC Piping with Valves
- Custom Integration Into Existing Systems
- Replacement Bag Filters available in stock – Uses 7-1/16" dia x 32" L #2 Size Filter Bags

NO.	ITEM	QTY	MATERIAL	NOTES
1	LEG	3	304 SS	ADJUSTABLE HEIGHT
2	DRAIN	1	304 SS	2″ NPT
3	OUTLET	1	304 SS	2″ NPT
4	SHELL	1	304 SS	
5	LID CLAMP	1	304 SS	
6	SHELL CLAMP	1	304 SS	
7	TOP HEAD	1	304 SS	
8	EXHAUST VENT	1	304 SS	$\frac{1}{4}$″ NPT
9	O-RING	1	VITON	
10	INLET	1	304 SS	2″ NPT
11	BOTTOM HEAD	1	304 SS	

NOTES:

1. PRM FILTRATION IS ONLY A SUPPLIER OF THIS EQUIPMENT.
2. PRM IS NOT RESPONSIBLE FOR SPECIFYING THIS PRODUCT FOR THE APPLICATION.
3. BUYERS AND/OR USER SHOULD REQUIRE AN ENGINEER FOR ENSURING THAT THE PROPER EQUIPMENT IS INSTALLED FOR THE APPLICATION INCLUDING ALL PROPER SAFETY PRACTICES.
4. PRM IS NOT RESPONSIBLE FOR ANY DAMAGES TO PROPERTY AND/OR INJURY/DEATH RELATED TO IMPROPER INSTALLATION. FILTRATION EQUIPMENT INSTALLATIONS SHOULD ALWAYS INCLUDE ANCILLARY SAFETY DEVICES AND/OR OPERATIONAL PRACTICES.
5. IT IS AGREED THAT PRM NOR ITS OWNERS HAVE LIABILITY WITH THE INSTALLATION AND OPERATION OF THESE OR OTHER PRODUCTS PURCHASED FROM PRM.
6. ALLOW UP TO $\frac{1}{4}$″ TOLERANCE ON ALL MEASUREMENTS.
7. MODEL LINK: https://a360.co/3zPObmW



PRMFiltration

Product Recovery Management Inc.
This information is proprietary and confidential.
No copies or reproductions allowed without the express written consent of PRM, Inc.

SHEET TITLE: #2 SS BANDED CLAMP DUAL PORT FILTER HOUSING BFHBFL2DX

DATE: 03/14/2023

NO.	REVISION	DATE

DRAWING NUMBER: D-1

PRM Carbon Systems - HP- 90 & HP- 200

PRMFiltration

The HP Series Carbon units are used on remediation systems where standard flow volumes are required with minimal backpressure. These units offer a 25% freeboard area for excellent back-wash ratios. Typical applications are groundwater remediation for VOCs or industrial sites with similar applications. Several media types are available for removal of more specific compounds such as metals and other contaminants. Aggregate media specifically designed to be backwashed is also available.

APPLICATIONS:

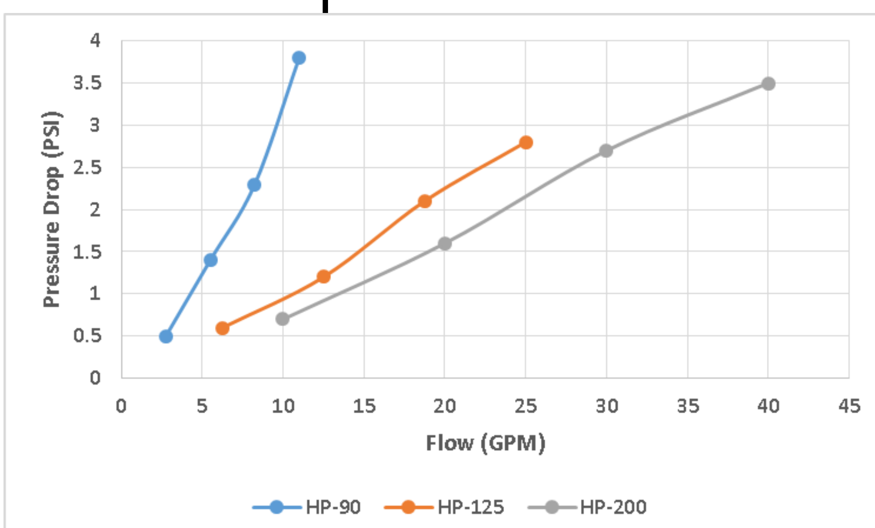
- Remediation of contaminated water streams
- Designed to operate at high pressures without sacrificing efficiency

STANDARD SPECIFICATIONS:

- Pressures up to 125 psi
- Fiberglass construction for lightweight strength
- Inlet and outlet diffusers for even flow and back-washing
- Heavy duty base for vertical free standing operation

HP-90 Carbon Unit
INLET/OUTLET: 3/4"
SIZE: 13" Diameter x 54" Height
CARBON: 90 lbs.
DRY WEIGHT: 130 lbs.

HP-200 Carbon Unit
INLET/OUTLET: 1"
SIZE: 16" Diameter x 65" Height
CARBON: 200 lbs.
DRY WEIGHT: 240 lbs.



AVAILABILITY: Build Item: Allow 2 to 4 weeks for manufacturing and shipping

Rotameters for Water Applications

PRMFiltration

PRM offers rotameters for Water Flow Applications. PRM rotameters are designed to provide an ample working range and are less prone to failure through impact exposure.

PRM Water Rotameters are scaled for gallons per minute or liters per minute in different flow ranges and sizes.

Standard Features:

- **Clear Acrylic Body**
- **304 Stainless Steel Float and Travel Rod**
- **NPT Connections**
- **Viton O-Rings**
- **PVC (dark gray) or Polypropylene (white) End Tails**
- **Accuracy ± 4%**
- **Maximum Pressure: 85 psig**
- **Maximum Temperature: 125°F**
- **UV Resistant**

PRM Water Rotameters

- FMZ40045GPM: 1-5 GPM, 1/2" FNPT
- FMZ400410GPM: 1-10 GPM, 1" FNPT
- FMZ4004: 1-20 GPM , 1" FNPT
- FMDFG2540G: 5-40 GPM, 1" FNPT
- FMDFG52: 40-120 GPM, 2" FNPT

Options

PRM can provide meters scaled for custom applications. Typical lead time is 3-5 weeks from time of order. Custom meters require a minimum quantity commitment of 50 meters.

Rotameters for Water Applications

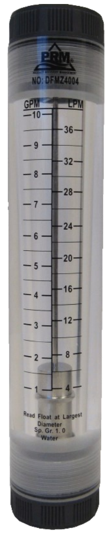
PRMFiltration

FMZ40045GPM

1-5 GPM

1/2” FNPT

8.25” tall



FMZ400410GPM

1-10 GPM

1” FNPT

10.5” tall

FMZ4004

2-20 GPM

1” FNPT

10.5” tall

FMDFG2540G

5-40 GPM

1” FNPT

10.5” tall

FMDFG52

40-120 GPM

2” FNPT

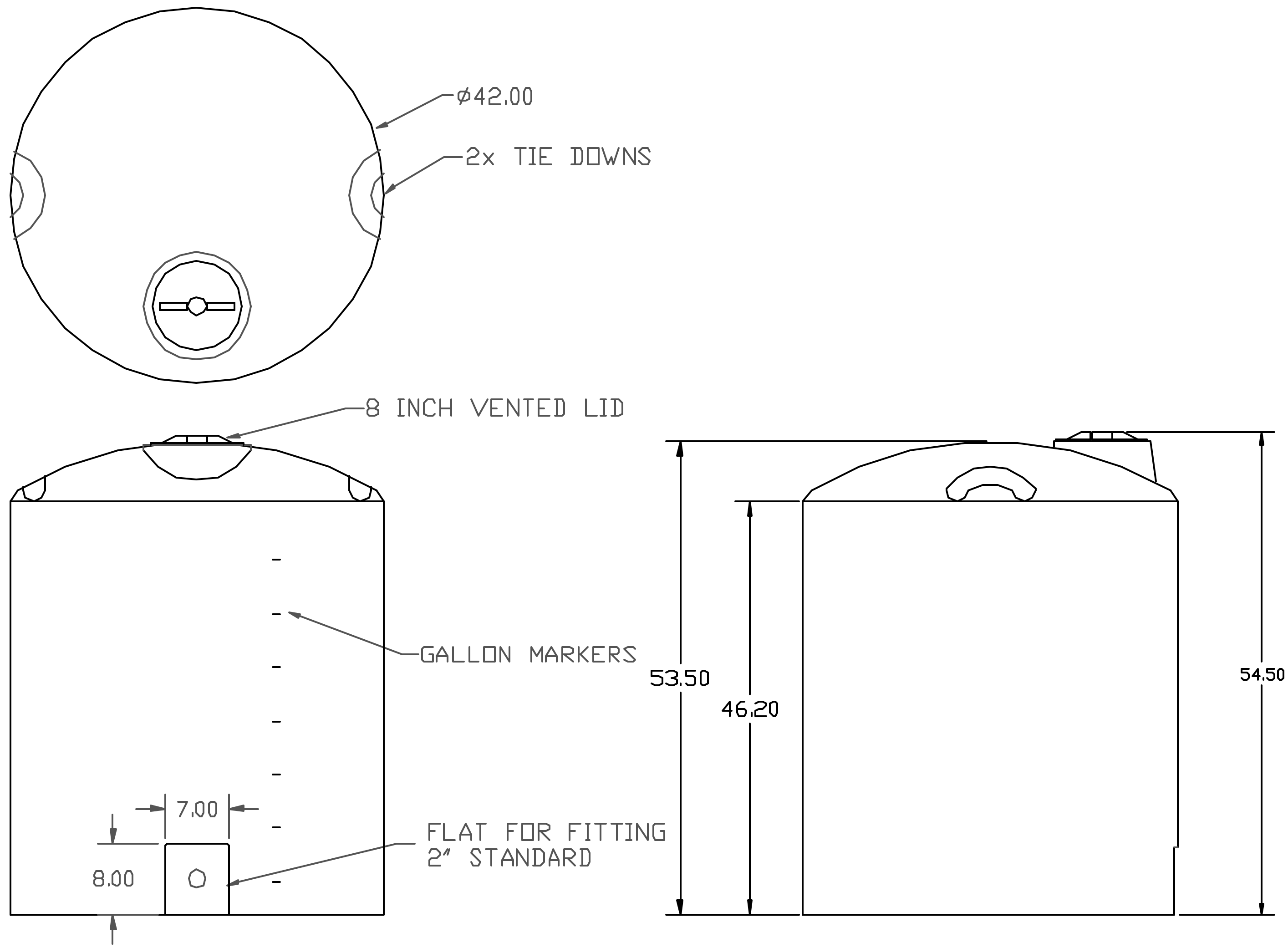
13.5” tall

BIO-REMEDIATION EQUIPMENT

T-500

PROPRIETARY DATA

VT0300-42 A



A	NEW DRAWING FORMAT	10/26/15	NVE
REV	DESCRIPTION	DATE	APPRD

ALL DIMENSIONS ARE IN DECIMAL INCHES
TOLERANCES UNLESS OTHERWISE SPECIFIED
± 1% @ 68° F

DRAWN / DATE: DHJ 3/11/04

APPRD. / DATE:

THIRD ANGLE PROJECTION
ANSI 14.5M

MATERIAL

HDPE OR EQUIVALENT
REFERENCE MATERIAL DATA SHEET
FOR SPECIFIC PROPERTIES.

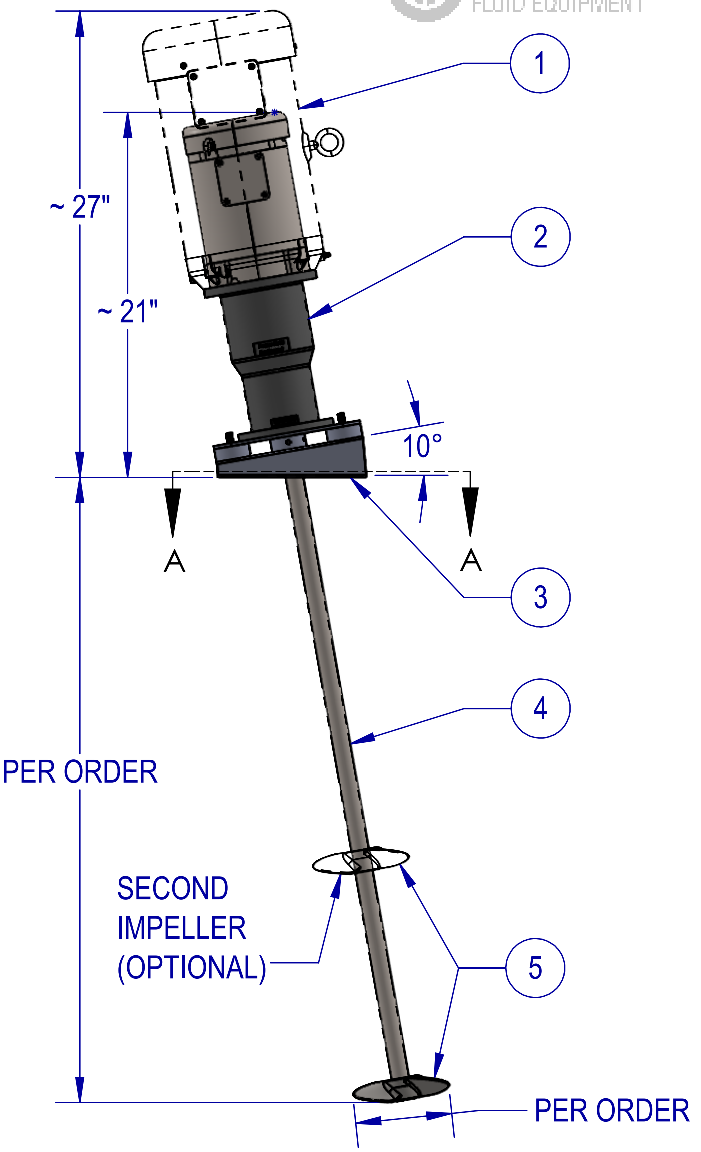
NOTES:
1. WHITE, BLACK, BLUE, GREEN, GREY, AND YELLOW COLOR
2. SHOT WEIGHT 72 LBS.
3. NOM. WALL @ .17
4. OPTIONAL 16" VENTED LID

Ace Roto-Mold
A DIVISION OF DEN HARTOG INDUSTRIES, INC.
4018 HWY. 61 BLVD., BOX 421, HOSPERS, IOWA 51238

CLIENT / DESCRIPTION
300 GALLON VERTICAL TANK

SCALE: N.S.

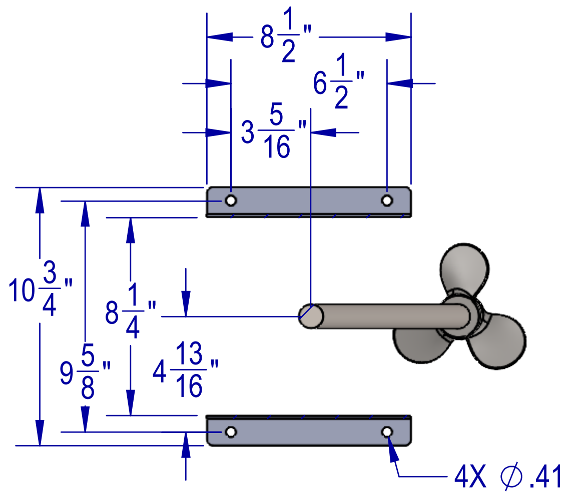
PART NO.: VT0300-42



ITEM	QTY	DESCRIPTION
1	1	MOTOR - INDUSTRIAL DUTY, HP PER ORDER, PAINTED FINISH
2	1	BEARING HOUSING - ALUMINUM, WITH HOLLOW BORE COUPLING, PAINTED FINISH
3	1	ANGLE RISER MOUNT ASSEMBLY W/ STAINLESS PLATE AND ISOLATION MOUNTS
4	1	SHAFT - 316 STAINLESS STEEL SHAFT LENGTH AND DIAMETER PER ORDER
5	1+	IMPELLER - 316 STAINLESS STEEL MARINE-TYPE IMPELLER, SIZE AND QTY PER ORDER

ANGLE RISER DETAIL

SECTION A-A
SCALE 1:8



STANDARD FEATURES

- CAST ALUMINUM HOUSING
- DUAL ABEC-RATED BEARINGS
- STAINLESS PLATE MOUNT
- STAINLESS ANGLE RISERS
- STAINLESS ARBOR
- STAINLESS FASTENERS

AVAILABLE UPGRADES

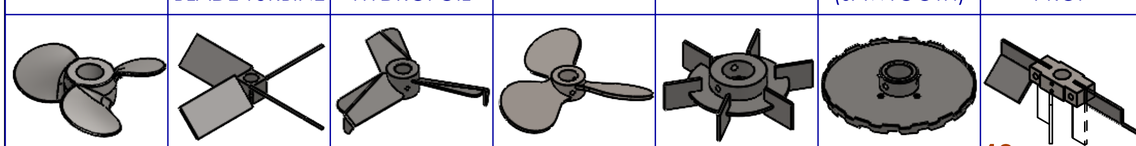
- ALL STAINLESS MIXER W/CAST STAINLESS HOUSING
- SPECIAL ALLOYS
- SANITARY FINISHES
- SHAFT COATINGS
- THREADED SANITARY COUPLINGS
- RIGID COUPLINGS
- VARIOUS IMPELLERS SIZES, STYLES, AND QTY
- DIGITAL TACHOMETER

SPEED TABLE	
1750 RPM	STANDARD
1150 RPM	OPTIONAL
3600 RPM	OPTIONAL

EST WT. 64-84 LBS (DEPENDING ON HP AND OPTIONS)

TYPICAL IMPELLER OPTIONS

MARINE PROP	PBT - PITCH BLADE TURBINE	PF3 HYDROFOIL	BIOPROP	RUSHTON	COWLES (SAWTOOTH)	FOLDING PROP



	NAME	DATE
DRAWN	SB	7/15/22
CHECKED	MB	8/22/22

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES. NO TOLERANCES IMPLIED
DO NOT SCALE DRAWING

PROPRIETARY AND CONFIDENTIAL

TITLE: FUSION PRO PD-A
ANGLE RISER MOUNT MIXER
DIRECT DRIVE ELECTRIC

SIZE	DWG. NO.	REV
A	SALES-PD-#A-#	B
SCALE: 1:10	WEIGHT:	SHEET 1 OF 1

MODEL DESIGNATION

Models EVMSU 1, 3, 5, 10, 15, 20
EVMSUL 1, 3, 5, 10, 15, 20

EVMSU L F H N P 3 - 2 F 0050 D 1 S

- Model Type: EBARA Vertical Multistage
- (none) 304 SS Construction
  L - 316 SS Construction
- (none) 2 Pole Configuration
  F - 4 Pole Configuration
- (none) Vertical Configuration
  H - Horizontal Configuration
- (none) Standard NPSH
  N - Low NPSH
- (none) Standard Working Pressure
  P - Increased Working Pressure
- Nominal Size
- Total number of impellers
- Piping Connection Type
  - F = Round ANSI compatible flange
  - N = Oval flange
  - L = Loose ANSI compatible flange
  - V = Victaulic
- Horsepower
- D - Open Drip Proof (ODP)
  T - Totally Enclosed Fan Cooled (TEFC)
- 1 - Single Phase
  3 - Three Phase
- Mechanical Seal (see list below)

Horsepower

0030=1/3 HP	0500=5.0 HP
0050=1/2 HP	0750=7.5 HP
0075=3/4 HP	1000=10 HP
0100=1.0 HP	1500=15 HP
0150=1.5 HP	2000=20 HP
0200=2.0 HP	2500=25 HP
0300=3.0 HP	

EVMSU Mechanical seal types

S = Silicon Carbide/Carbon/FPM*
G = Silicon Carbide+Graphite/Silicon Carbide/FPM
E = Silicon Carbide/Carbon/EPDM
R = Silicon Carbide+Graphite/Silicon Carbide/EPDM
X = Special order seal materials (consult factory)

*NSF/ANSI/CAN 61 & 372 certified configuration

Models EVMSUG 32, 45, 64
EVMSU(L) 32, 45, 64
EVMUG 32, 45, 64

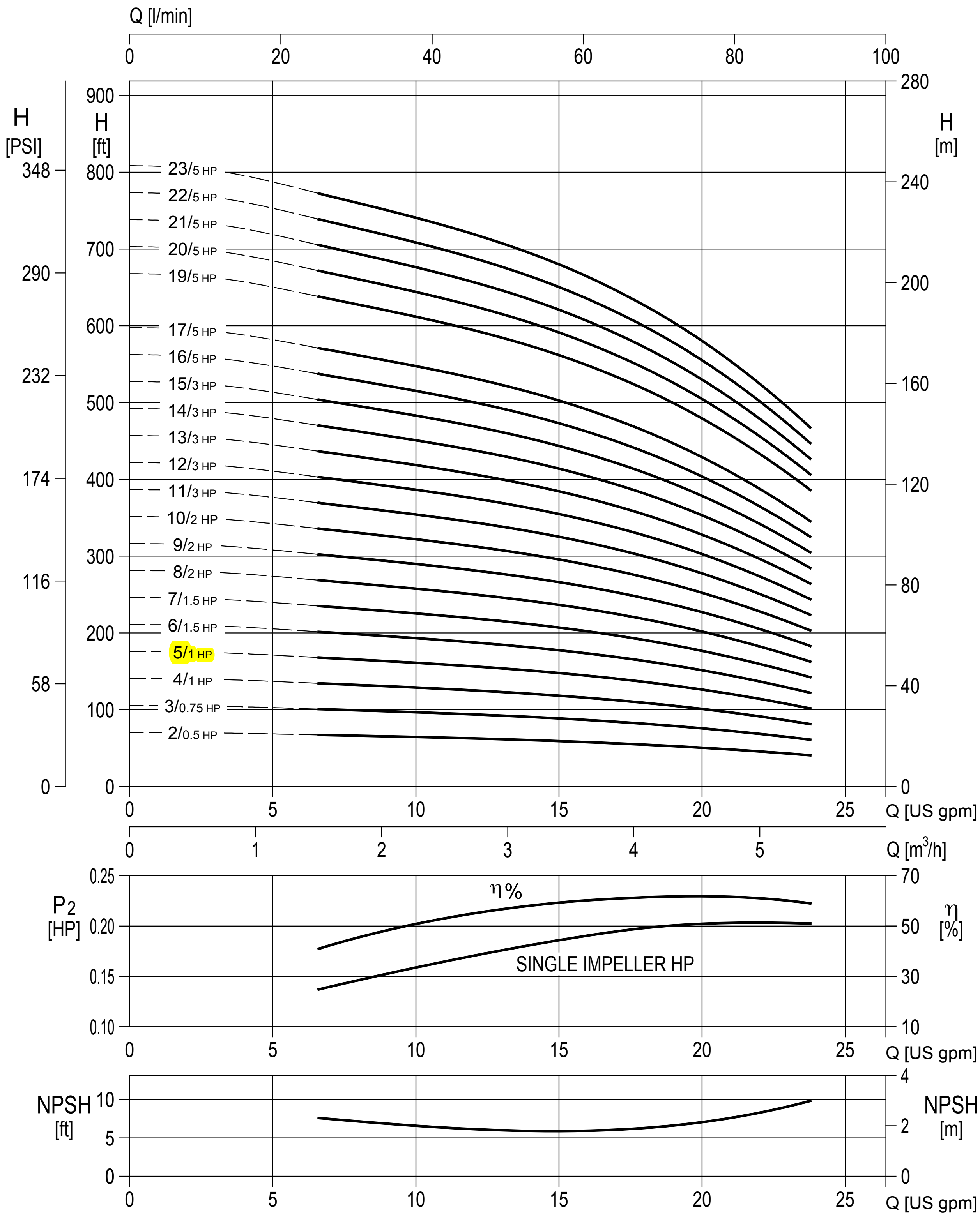
EVMSU G L 32 - 2 - 1 F 0750 T 3 S

- Model Type: EBARA Vertical Multistage (USA)
- G - 304 SS Pump with Cast Iron Bottom Casing
- (none) 304 SS Pump with 304 SS Bottom Casing
- L - 316 SS Construction
- Nominal size
- Total number of impellers
- Numbers of reduced diameter impellers
- Standard Connections
- Horsepower
- T-Totally Enclosed Fan Cooled
  D- Open Drip Proof
- 1 - Single Phase
  3 - Three Phase
- Mechanical Seal (see list above)

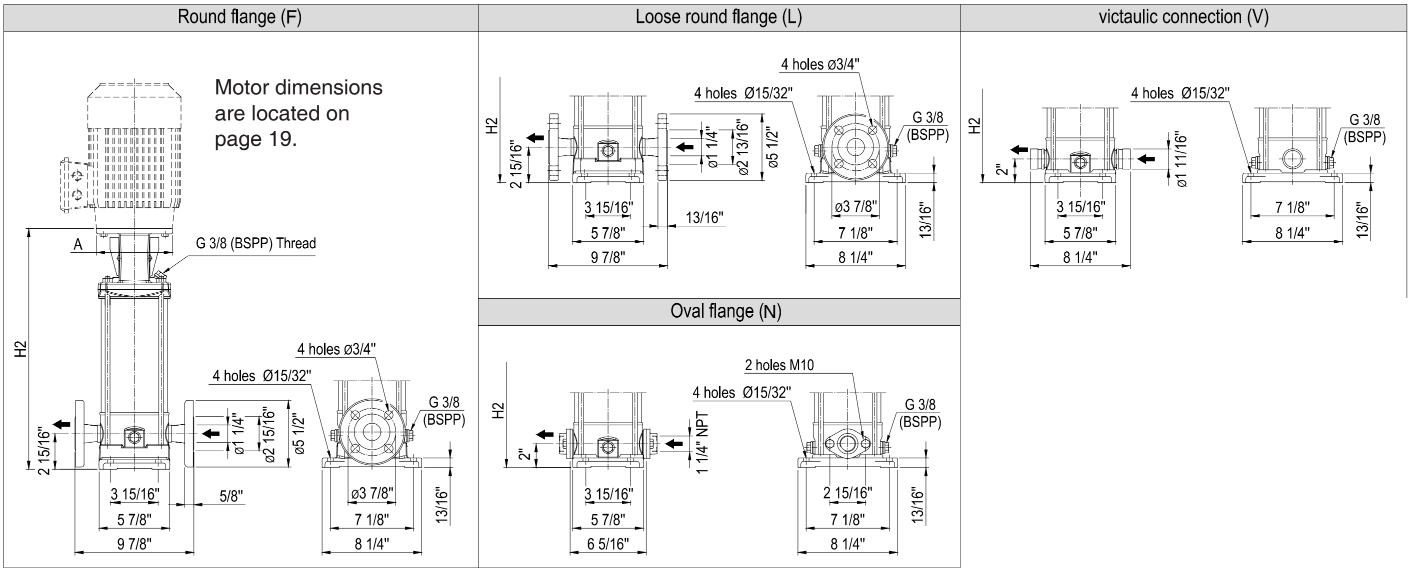
Horsepower

0500=5 HP	2500=25 HP
0750=7.5 HP	3000=30 HP
1000=10 HP	4000=40HP
1500=15 HP	5000=50 HP
2000=20 HP	6000=60 HP

PERFORMANCE CURVES
EVMSU3 1/2HP - 5HP
EVMSU3 2 - EVMSU3 23 Nominal Speed: 3500 RPM 300# ANSI 1¼" 4-Bolt



TECHNICAL DATA
EVMSU(L)3
DIMENSIONS



EVMSU(L)3		Motor Frame						Round flange (F) Loose round flange (LF)				Oval flange (N)				victaulic connection (V)			
		TEFC			ODP			TEFC		ODP		TEFC		ODP		TEFC		ODP	
Pump Model	Pmax [psi]	HP	NEMA Frame	A	HP	NEMA Frame	A	H2	Pump Weight	H2	Pump Weight	H2	Pump Weight	H2	Pump Weight	H2	Pump Weight	H2	Pump Weight
EVMSU(L)3-2	230	0.5	56C	6 5/8"	0.5	56C	6 5/8"	11 7/8"	24.9 lb	11 7/8"	24.9 lb	10 7/8"	23.3 lb	10 7/8"	23.3 lb	10 7/8"	23.1 lb	10 7/8"	23.1 lb
EVMSU(L)3-3	230	0.75	56C	6 5/8"	0.75	56C	6 5/8"	12 11/16"	25.8 lb	12 11/16"	25.8 lb	11 11/16"	24.2 lb	11 11/16"	24.2 lb	11 11/16"	24.2 lb	11 11/16"	24.2 lb
EVMSU(L)3-4	230	1	56C	6 5/8"	1	56C	6 5/8"	13 9/16"	26.7 lb	13 9/16"	26.7 lb	12 9/16"	25.4 lb	12 9/16"	25.4 lb	12 9/16"	25.2 lb	12 9/16"	25.2 lb
EVMSU(L)3-5	230	1	56C	6 5/8"	1	56C	6 5/8"	14 3/8"	27.8 lb	14 3/8"	27.8 lb	13 3/8"	26.3 lb	13 3/8"	26.3 lb	13 3/8"	26.1 lb	13 3/8"	26.1 lb
EVMSU(L)3-6	230	1.5	56C	6 5/8"	1.5	56C	6 5/8"	15 3/16"	28.7 lb	15 3/16"	28.7 lb	14 3/16"	27.2 lb	14 3/16"	27.2 lb	14 3/16"	27.0 lb	14 3/16"	27.0 lb
EVMSU(L)3-7	230	1.5	56C	6 5/8"	1.5	56C	6 5/8"	16"	29.6 lb	16"	29.6 lb	15"	28.1 lb	15"	28.1 lb	15"	28.1 lb	15"	28.1 lb
EVMSU(L)3-8	230	2	56C	6 5/8"	2	56C	6 5/8"	16 13/16"	30.2 lb	16 13/16"	30.2 lb	15 13/16"	28.9 lb	15 13/16"	28.9 lb	15 13/16"	28.6 lb	15 13/16"	28.6 lb
EVMSU(L)3-9	230	2	56C	6 5/8"	2	56C	6 5/8"	17 11/16"	31.1 lb	17 11/16"	31.1 lb	16 11/16"	29.7 lb	16 11/16"	29.7 lb	16 11/16"	29.5 lb	16 11/16"	29.5 lb
EVMSU(L)3-10	230	2	56C	6 5/8"	2	56C	6 5/8"	18 1/2"	32.2 lb	18 1/2"	32.2 lb	17 1/2"	30.6 lb	17 1/2"	30.6 lb	17 1/2"	30.4 lb	17 1/2"	30.4 lb
EVMSU(L)3-11	230	3	145TC	6 5/8"	3	145TC	6 5/8"	19 5/16"	33.1 lb	19 5/16"	33.1 lb	18 5/16"	31.5 lb	18 5/16"	31.5 lb	18 5/16"	31.3 lb	18 5/16"	31.3 lb
EVMSU(L)3-12	230	3	145TC	6 5/8"	3	145TC	6 5/8"	20 1/8"	33.7 lb	20 1/8"	33.7 lb	19 1/8"	32.4 lb	19 1/8"	32.4 lb	19 1/8"	32.2 lb	19 1/8"	32.2 lb
EVMSU(L)3-13	230	3	145TC	6 5/8"	3	145TC	6 5/8"	21"	35.5 lb	21"	35.5 lb	20"	33.9 lb	20"	33.9 lb	20"	33.9 lb	20"	33.9 lb
EVMSU(L)3-14	230	3	145TC	6 5/8"	3	145TC	6 5/8"	21 13/16"	36.4 lb	21 13/16"	36.4 lb	20 13/16"	34.8 lb	20 13/16"	34.8 lb	20 13/16"	34.8 lb	20 13/16"	34.8 lb
EVMSU(L)3-15	230	3	184TC	9 1/16"	Consult Factory			26 1/8"	42.5 lb	Consult Factory		25 1/8"	41.2 lb	Consult Factory		25 1/8"	40.9 lb	Consult Factory	
EVMSU(L)3-16	375	5	184TC	9 1/16"	5	184TC	9 1/16"	26 15/16"	44.7 lb	26 15/16"	44.7 lb	-	-	-	-	25 15/16"	43.1 lb	25 15/16"	43.1 lb
EVMSU(L)3-17	375	5	184TC	9 1/16"	5	184TC	9 1/16"	27 13/16"	45.8 lb	27 13/16"	45.8 lb	-	-	-	-	26 13/16"	44.0 lb	26 13/16"	44.0 lb
EVMSU(L)3-19	375	5	184TC	9 1/16"	5	184TC	9 1/16"	29 7/16"	47.8 lb	29 7/16"	47.8 lb	-	-	-	-	28 7/16"	46.0 lb	28 7/16"	46.0 lb
EVMSU(L)3-20	375	5	184TC	9 1/16"	5	184TC	9 1/16"	30 1/4"	48.7 lb	30 1/4"	48.7 lb	-	-	-	-	29 1/4"	47.1 lb	29 1/4"	47.1 lb
EVMSU(L)3-21	375	5	184TC	9 1/16"	5	184TC	9 1/16"	31 1/16"	49.8 lb	31 1/16"	49.8 lb	-	-	-	-	30 1/16"	48.0 lb	30 1/16"	48.0 lb
EVMSU(L)3-22	375	5	184TC	9 1/16"	5	184TC	9 1/16"	31 15/16"	50.6 lb	31 15/16"	50.6 lb	-	-	-	-	30 15/16"	49.1 lb	30 15/16"	49.1 lb
EVMSU(L)3-23	375	5	184TC	9 1/16"	5	184TC	9 1/16"	32 3/4"	51.7 lb	32 3/4"	51.7 lb	-	-	-	-	31 3/4"	50.0 lb	31 3/4"	50.0 lb

Model also available in 182TC/184TC frame (shaded)   (Flange rating: ANSI 300LB)

A Chart Industries Company

OG-500

PSA Oxygen Generator

Topaz Series

Specifically designed for reliability, energy efficiency, and ease-of-use, there are thousands of Topaz PSA Oxygen Generators currently in use throughout the world. The Topaz's ability to deliver up to 95.5% oxygen concentration make it a great fit for a wide range of commercial applications.

Features

- Self-contained (includes air compressor)
- Heavy duty metal enclosure
- Wall or rack-mount design
- Advanced Engineering
- Ozone/high temperature process tubing
- Quick release fittings for ease of maintenance
- Optional oxygen concentration monitor

Typical Applications

Manufacturing

- Jewelry/Brazing/Soldering
- Thermal/Chemical Oxidation

Artistic

- Glass Work/Blowing

Environmental

- Ozone (Generator) Feed Gas
- Environmental Remediation
- Waste/Water Treatment

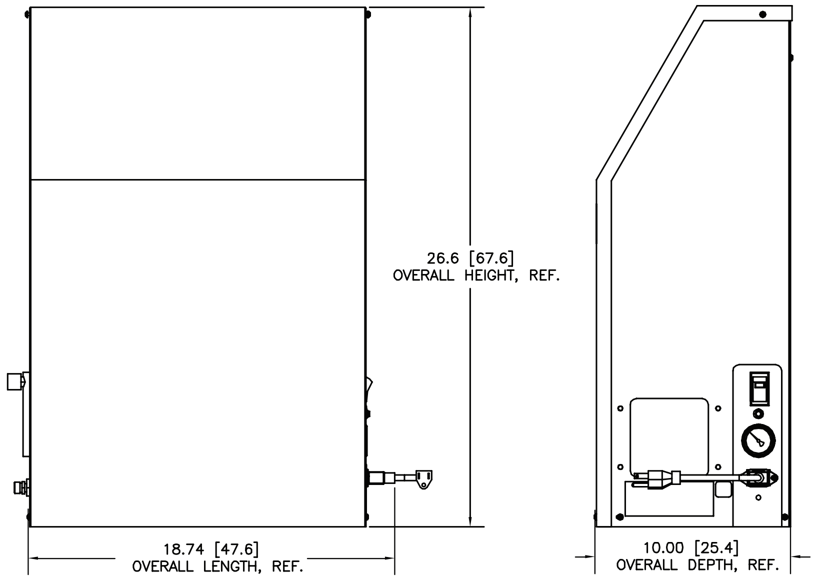
Additional

- Fish Farming

Specifications

	Topaz	Topaz Plus	Topaz Ultra
Product Characteristics			
Product Flow[1]	6 LPM (12 SCFH)	8 LPM (17 SCFH)	10 LPM (21 SCFH)
Product Pressure	9 psig (62 kPa)	20 psig (138 kPa)	20 psig (138 kPa)
Product Concentration (nominal)	93%	93%	90%
Product Dew Point	-100°F (-73°C)	-100°F (-73°C)	-100°F (-73°C)
Dimensions (W x D x H) (nominal)	19 x 10 x 27 in (48 x 25 x 68 cm)	19 x 10 x 27 in (48 x 25 x 68 cm)	19 x 10 x 27 in (48 x 25 x 68 cm)
Weight	53 lb (24 kg) [Add 2 lb (0.9 kg) for 220 V ~ unit] [Add 20 lb (9 kg) for Stainless]	56 lb (25 kg) [Add 4 lb (0.9 kg) for 220 V ~ unit] [Add 20 lb (9 kg) for Stainless]	58 lb (26 kg) [Add 4 lb (0.9 kg) for 220 V ~ unit] [Add 20 lb (9 kg) for Stainless]
Physical Connection Product Gas Outlet	¼″ NPT-M/B-M size oxygen adapter	¼″ NPT-M/B-M size oxygen adapter	¼″ NPT-M/B-M size oxygen adapter
Ambient Operating Conditions	Locate the oxygen generator in a well-ventilated area that is protected from weather elements and remains between 40°F (4°C) and 112°F (44°C)		
Control Power Requirements (Single Phase)	100V ~ ±10%, 50 or 60 Hz, 5.5 A 120V ~ ±10%, 60 Hz, 5.0 A 220V ~ ±10%, 50 Hz, 2.5 A	120V ~ ±10%, 60 Hz, 5.0 A 220V ~ ±10%, 50 Hz, 2.5 A	120V ~ ±10%, 60 Hz, 6.0 A 220V ~ ±10%, 50 Hz, 3.0 A

[1] LPM (Liters per minute) gas measured at 1 atmosphere and 21°C / SCF (Standard cubic foot) gas measured at 1 atmosphere and 70°F



Note: All dimensions are nominal.

Ordering Information

Model	Part Number	Description
Topaz	AS013-105	120 V ~ ±10%, 60 Hz, with painted aluminum enclosure
	AS013-106	220 V ~ ±10%, 50 Hz, with painted aluminum enclosure
	AS013-107	220 V ~ ±10%, 60 Hz, with painted aluminum enclosure
	AS013-115	120 V ~ ±10%, 60 Hz, with stainless steel enclosure
	AS013-120	220 V ~ ±10%, 50 Hz, with stainless steel enclosure
	AS013-124	120 V ~ ±10%, 60 Hz, with painted aluminum enclosure & oxygen concentration monitor (LED indicator)
	AS013-125	220 V ~ ±10%, 50 Hz, with painted aluminum enclosure & oxygen concentration monitor (LED indicator)
Topaz Plus	AS018-101	120 V ~ ±10%, 60 Hz, with painted aluminum enclosure
	AS018-102	220 V ~ ±10%, 50 Hz, with painted aluminum enclosure
	AS018-110	220 V ~ ±10%, 60 Hz, with painted aluminum enclosure
	AS018-111	120 V ~ ±10%, 60 Hz, with painted aluminum enclosure & oxygen concentration monitor (LED indicator)
	AS018-115	220 V ~ ±10%, 60 Hz, with stainless steel enclosure
Topaz Ultra	AS123-2	220 V ~ ±10%, 50 Hz, with painted aluminum enclosure
	AS123-3	220 V ~ ±10%, 50 Hz, with stainless steel enclosure
	AS123-7	120 V ~ ±10%, 60 Hz, with painted aluminum enclosure
	AS123-8	120 V ~ ±10%, 60 Hz, with painted aluminum enclosure & oxygen concentration monitor (LED indicator)
	AS123-9	120 V ~ ±10%, 60 Hz, with stainless steel enclosure
	AS123-10	120 V ~ ±10%, 60 Hz, with stainless steel enclosure & oxygen concentration monitor (LED indicator)

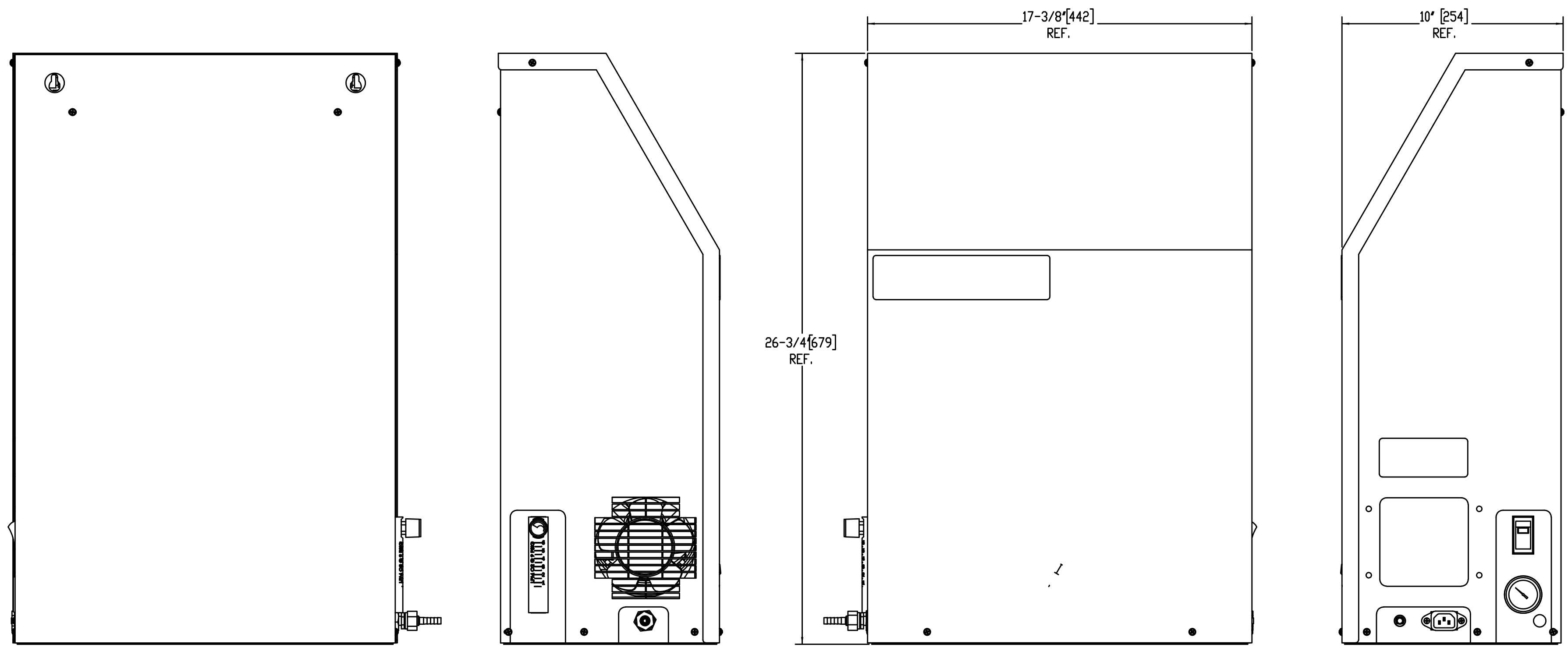
Shipping Information	Topaz	Topaz Plus	Topaz Ultra
Class	92.5	92.5	92.5
Commodity Classification Number	8421.39.8040	8421.39.8040	8421.39.8040
Dimensions (W x D x H)	21 x 12 x 29 in (53 x 31 x 74 cm)	21 x 12 x 29 in (53 x 31 x 74 cm)	21 x 12 x 29 in (53 x 31 x 74 cm)
Gross Weight	61 lb (28 kg) [Add 4 lb (1.8 kg) for 220 V ~unit] [Add 20 lb (9 kg) for Stainless]	64 lb (29 kg) [Add 4 lb (1.8 kg) for 220 V ~ unit] [Add 20 lb (9 kg) for Stainless]	66 lb (30 kg) [Add 4 lb (1.8 kg) for 220 V ~ unit] [Add 20 lb (9 kg) for Stainless]

Warranty: 1 Year Parts and Factory Labor*

* An unprotected or inadequately ventilated environment, or improper control power may cause damage to the oxygen generator not covered under warranty.

All performance ratings based on an ambient temperature up to 100°F (38°C), up to 1,000 feet elevation, and 80% relative humidity.

A Chart Industries Company
260 Creekside Drive
Buffalo, NY 14228-2075 U.S.A.
Tel: (716) 691-0202 • Fax: (716) 691-1255
www.airsepcpd.com • cpd@airsep.com
ML-IND0001 C



REV	ECO	REVISION DESCRIPTION	BY	APPD.	DATE
G	CONC-5595	REDRAWN IN SOLIDWORKS	B.S.B.	B.M.	08/10/23
F	CONC-5296	ADDED FA002-1	B.S.B.	B.M.	04/08/22
E	CONC-2054	UPDATED DRAWING TO REFLECT MEDICAL BOM	J.E.S.	D.P.M.	01/11/16
D	11C-010	CORRECTING BOM FOR AS013-25 AND -125	D.T.G.	A.H.	02/22/11

THIRD ANGLE PROJECTION

DRAWN BY: B.S.B.
CHK'D BY: S.P.M.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES [MM]
TOLERANCES:
FRACTIONAL ± 1/16 [1.6]
ANGLES ± 0.5°
2 PLACE DECIMAL ± 0.03 [.8]
3 PLACE DECIMAL ± 0.005 [.13]

MATERIAL: SEE BOM

FINISH: N/A

AIRSEP Corporation
Buffalo, New York 14228

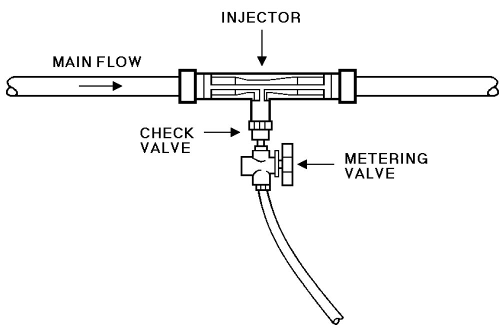
PART NO. SEE APPLICATION TABLE

TITLE: AIRSEP, TOPAZ W/ COMP

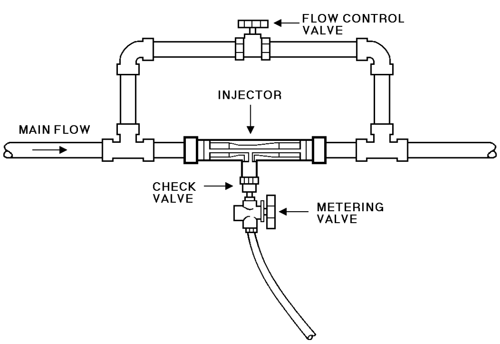
SIZE D | DWG. NO. AS013 | REV G

SCALE: 1:2.5 | DO NOT SCALE DRAWING | SHEET 1 OF 1

INJECTORS



Installed directly in the main flow line with total flow of the system moving thru the injector.



Injector installed in main flow line with flow control valve on by-pass line.

FEATURES

- Trouble-free, long life operation.
- Energy efficient.
- Efficient ozone mass transfer.
- Molded in glass reinforced Polypropylene and natural Kynar PVDF.
- Chlorine and ozone resistant PVDF.
- Mazzei® Injectors are high efficiency, Venturi-type, differential pressure injectors. A pressure difference between the inlet and outlet of the injector creates a vacuum inside the body, which results in suction through the suction port. The suction can then be used to inject and mix water treatment chemicals into the water.
- Mazzei Injectors have a unique and patented design that permits them to start suction in most models when the outlet pressure is only 20% less than the inlet pressure. Full suction capacity is reached when the pressure difference is approximately 50%.
- Operating costs are lower than less efficient systems which require additional pumps for chemical injection.
- Mazzei Injectors are trouble free as there are no moving parts or electrical connections, and are molded from chemical resistant 20% glass filled Polypropylene, and natural Kynar PVDF, resulting in a long life expectancy.

ORDER INFORMATION:
6030-(Size No.) MAZZEI INJECTOR, Black Glass Reinforced Polypropylene

Size No.	Mazzei Model No.	Inlet & Outlet Size MNPT (in.)	Suction Port Size (in.)	Price Each
-010	287	1/2	3/16 Hose Shank	$24.50
-020	484	1/2	1/4 MNPT	34.50
-030	584	3/4	1/4 MNPT	34.50
-040	1078	1	1/2 MNPT	59.00
-050	1583	1-1/2	1/2 MNPT	83.00
-060	2081	2	1-1/4 MNPT	180.00

ORDER INFORMATION:
6031-(Size No.) MAZZEI INJECTOR, Natural Kynar PVDF

Size No.	Inlet & Outlet Size MNPT (in.)	Suction Port Size (in.)	Price Each
-010	1/2	3/16 Hose Shank	$38.00
-020	1/2	1/4 MNPT	64.00
-030	3/4	1/4 MNPT	64.00
-040	1	1/2 MNPT	130.00
-050	2	1/2 MNPT	295.00
-060	4	DUAL 2 MPT	1,200.00

829.110.110	Polypro
829.110.120	PVDF

LIQUID/GAS INJECTION WORKSHEET

To properly size a liquid or gas injector, please answer these questions:

1. Estimated injector inlet pressure ______ (PSIG).
2. Estimated injector outlet pressure ______ (PSIG), e.g. the total dynamic pressure downstream of the injector.
3. Total system flow rate ______ (GPM), e.g. the maximum water flow of system.
4. What material do you want to inject? ____________
5. How much of item 4 do you want to inject? ______ (GPH, L/M, or SCFH).
circle one

FT-2 FI-500

PRM Electromagnetic Flow Meter

The PRM EFM-DN series meters are flow totalizing meters that can be used to provide rate flow and totalized flow of various liquids such as water, polymers, surfactants and other chemicals. These meters are non-invasive electromagnetic meters designed for harsh applications and long life with excellent accuracy. Unlike paddlewheel, vortex or other mechanical meters, there are no moving parts through the entire measuring chamber and accuracy is increased while maintenance requirements are decreased. The entire flow chamber consists of a PTFE liner to ensure absolute chemical compatibility.

Specifications:

- Size: 1/2” - 3” Flange ANSI 150#
- Temp. Range: -4°F to 300° F
- Max. Pressure: 230 psi
- Liner Material: PTFE
- Body and Flange: Carbon Steel
- Flow Range:
  1/2 inch: 1-42 GPM
  1 inch: 3-115 GPM
  2 Inch: 15-466 GPM
  3 Inch: 40-1193 GPM
- Power: 24VDC
- Signal Output:
  4-20mA and pulse output
- IP67 Protective Covering, Explosion-Proof for Class 1, Div. 2 Locations
- Accuracy: ±0.5%
- Meter is calibrated for water

PRM Part #

1/2 Inch - FMPHILHTLD15031111GCBX

1 Inch - FMPHILHTLD25031111GCBX

2 Inch - FMPHILHTLD50031111GCBX

3 Inch - FMPHILHTLD80031111GCBX

** Options **

Hart Communications protocol

Hastelloy or Titanium Effect sensors.

Multi-Jet Water Meters with Pulse Output

PRMFiltration

Brass Water Meters for indicating flow totalization of water. Designed for long service life and maintenance-free operation, even under harsh conditions.

Features:

- Pulse Output Components
- All Meters have Hydrocarbon Resistant Seals and will not be damaged by dissolved amounts of free product
- Sealed Dry Dial for Clear Readings
- Internal Strainer to Protect Meter from Particulate Damage

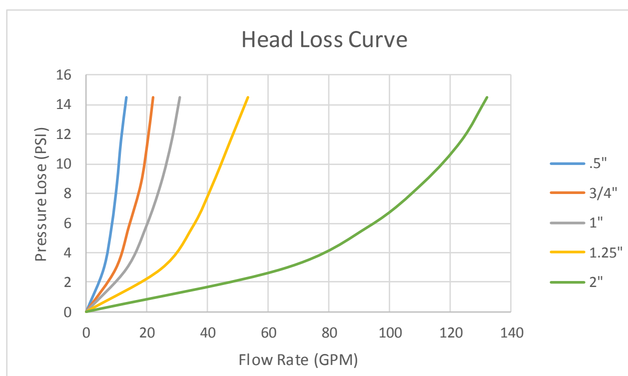
Specifications:

- Class: B
- Accuracy: Transitional Flow: ± 5%
  Nominal Flow: ± 2%
- Maximum Water Temperature: 104°F
- Maximum Water Pressure: 150 psi
- Mounting Orientation:
  1/2" and 3/4" Horizontal or Vertical
  1" to 2" Horizontal Mounting

Materials:

- Body: Brass, polyethylene
- Couplings: Brass
- Measuring Chamber: Polyethylene
- Paint: Epoxy Coated
- Seal: Viton

Contains lead, not for use with potable water



PRM Part Number: Description

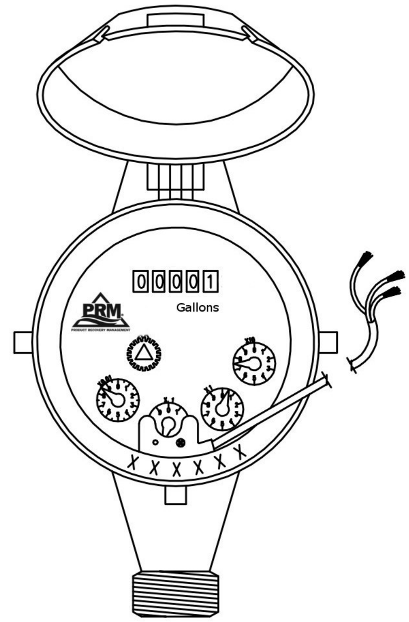
FI-501-534

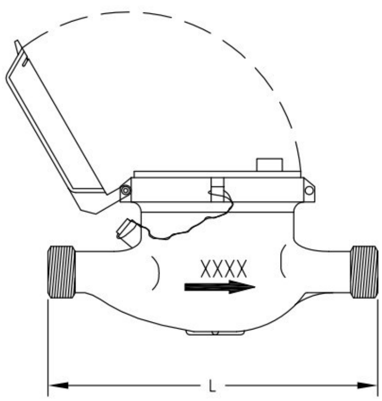
FI-401

WM050PVX— 1/2" NPT multi-jet water meter
WM075PVX— 3/4" NPT multi-jet water meter
WM100PVX— 1" NPT multi-jet water meter
WM125PVX— 1-1/4" NPT multi-jet water meter
WM150PVX— 1-1/2" NPT multi-jet water meter
WM200PVX— 2" NPT multi-jet water meter

Multi-Jet Water Meters with Pulse Output

PRMFiltration





Pulse Rates can be manually changed.
Factory Set Pulse Rates:
WM050PVX: 1 pulse per gallon
WM075PVX: 1 pulse per gallon
WM100PVX: 1 pulse per 10 gallons
WM125PVX: 1 pulse per 10 gallons
WM150PVX: 1 pulse per 10 gallons
WM200PVX: 1 pulse per 10 gallons

						Max. Flow	Nom. Flow Range
Part #:	**Size:**	**Length (in)**	**Length with NPT adapters**	**Height (in)**	**Weight (lbs.)**	**Gallons Per Minute**	
WM050PVX	1/2" NPT	7	10.5	4.75	3	10	1-10
WM075PVX	3/4" NPT	8	12	4.75	3.5	20	1-20
WM100PVX	1" NPT	10.5	14.5	4.5	5.5	30	2-30
WM125PVX	1-1/4" NPT	10.5	15.5	5	8	50	3-50
WM150PVX	1-1/2" NPT	12	18	6.5	12	75	4-75
WM200PVX	2" NPT	12	18	6.5	14	130	5-130

Information in this drawing is provided for reference only.

GENERAL EQUIPMENT

Vacuum Transmitters

PRMFiltration

PRM stocks Vacuum Transmitters built to withstand the harsh environments of the remediation industry.

Features:

- Range: 0-30 inHg
- Power: 24 VDC
- 4~20 mA Output
- Accuracy of ± 0.25% full-scale
- Temperature Range: -40-185°F
- Body Materials: 316 Stainless Steel
- Connection: 1/4” NPT

Available with IP68 Enclosure
(IP68 Enclosure has 1/2” NPT connection)

PRM Part Numbers:

PT100030HG025MNPTX
IP68 Enclosure: PT100030HGXPX

Pressure Transmitters

PRMFiltration

PRM Pressure Transmitters are built to withstand the harsh environments of the remediation industry. Accuracy: +/-0.25%FS, Working Temp: 14°F to 176°F

PT5PSICABLE025MNPTX
Range: 0-5 PSI
Material: 304 SS
Output: 4~20mA
Power: 24 VDC
Connection: 1/4 MNPT

PT50PSI24VDCX
Range: 0-50 PSI
Material: 304 SS
Output: 4~20mA
Power: 24 VDC
Connection: 1/4 MNPT

PT100PSICABLE025MNPTX
Range: 0-100 PSI
Material: 304 SS
Output: 0-10 VDC
Connection: 1/4 MNPT

PT145PSI24VDCX
Range: 0-145 PSI
Material: 304 SS
Output: 4~20mA
Power: 24 VDC
Connection: 1/4 MNPT

PT1000200PSIXPX
Range: 0-200 PSI
Output: 4~20mA
Power: 24VDC
Connection: 1/2 MNPT 316 SS
Enclosure: 2088 Type, Anti-Explosion

PTYD322II050PSIX
Range: 0-50 PSI
Output: 4~20mA
Power: 24VDC
Connection: 1/4 MNPT 316 SS
Enclosure: 2088 Type, Anti-Explosion with LCD Display

PTYD322II0145PISX
Range: 0-145 PSI
Output: 4~20mA
Power: 24 VDC
Connection: 1/4 MNPT 316 SS
Enclosure: 2088 Type, Anti-Explosion with LCD Display

Differential Pressure Transmitters

PRMFiltration

PRM Pressure Transmitters are built to withstand the harsh environments of the remediation industry. Accuracy: +/-0.25%FS, Working Temp: 14°F to 176°F

PGTYDDPTI040WCX
0-40"WC; 1/4” MNPT; 316 SS;
24VDC; 4~20 mA Output;
3 Meter Cable; 7 PSI MAX.

PGTYDDPTII100PSIX
0-100 PSI; 1/4” FNPT; 316 SS;
24VDC; 4~20 mA Output;
3 Meter Cable;
Max. Static Pressure 300 PSI

PGTYDDPTLI040WCX
With LCD Display; 0-40” WC;
1/4” FNPT; 316 SS; 24VDC; 4~20 mA Output;
3 Meter Cable; 7 PSI MAX.

PGTYD322DP040WCX
2088 Type (XP)
with LCD Display; 0-40” WC
1/4" FNPT; 316SS; 24VDC;
4~20 mA Output;
3Meter Cable; 7 PSI MAX.

PGTYD322DP100WCX
2088 Type (XP)
with LCD Display; 0-100” WC
1/4" FNPT; 316SS; 24VDC;
4~20 mA Output;
3 Meter Cable; 7 PSI MAX.

FT-1

PGTLFMI001WCX
0-1"WC; 24VDC;
4~20 mA Output;
30 PSI Max.

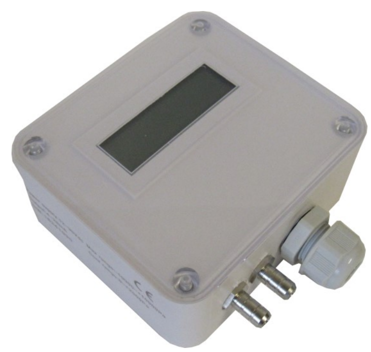
PGTLFMI005WCX
0-5"WC; 24VDC;
4~20 mA Output;
30 PSI Max.

PGTLFMI010WCX
0-10"WC; 24VDC;
4~20 mA Output;
30 PSI Max.

PGTLFMI040WCX
0-40"WC; 24VDC;
4~20 mA Output;
30 PSI Max.

PT-2

PGTLFMI100WCX
0-100"WC; 24VDC;
4~20 mA Output;
30 PSI Max.



PGTLFMII010WCX
With LCD Display
0-10"WC; 24VDC;
4~20 mA Output;
30 PSI Max.

TT-1

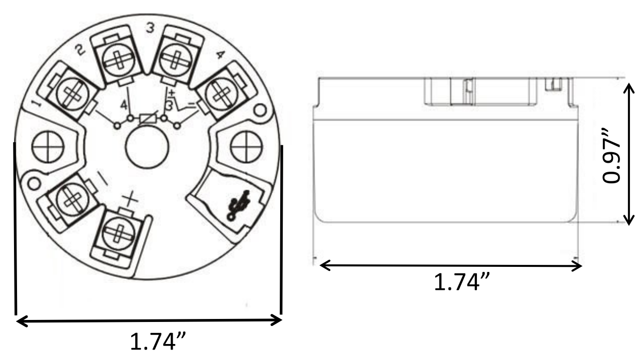
Temperature Transmitters

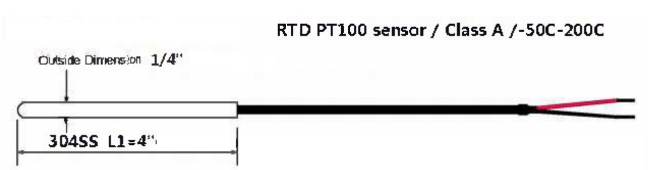
PRM Filtration

PRM Temperature Transmitters are low cost temperature transmitters used with multiple sensor type inputs in any single point measurement applications. This unit saves cost in cabling and installation costs over wiring directly and delivers superior measurement accuracy and reliability.

Features:

- DIN B style head mount transmitter
- 4-20 mA analog protocol
- Single sensor capability with sensor inputs (RTD).
- Standard transmitter design provides flexible and reliable performance in process environments
- Programmable temperature range:
  RTD: 0°F to 392°F
  Need programmable USB Adapter
- Accuracy: 0.25%
  Offers improved measurement accuracy and reliability over direct-wiring a sensor to the digital control system.
- Stability: Long time stability
  Max. R-Drift 0.04% after 1000h @ 392**°F**





PRM Part # CONTD148WD

PRM PRESSURE GAUGES

Pressure gauges measure positive pressure. The most common type of gauge, they're used with pumps, filters, regulators, and in process lines.

Features:

Brass or 304 SS Connections:
Brass connections are used with noncorrosive liquids and gas. For corrosive environments that could damage brass, choose a gauge with a stainless steel connection. PRM Gauges either have bottom connections or back connections.

Dry or Liquid Filled:
Gauges with a dry dial work well for most applications. For environments prone to vibration, gauges with a liquid-filled dial suppress needle flutter for more accurate readings and extend the life of the gauge. Liquid filled gauges have an elastomeric vent/fill plug tip which can be easily cut (after installation) to permit case venting. This is recommended for all liquid filled gauges, especially those with maximum pressure ratings of 100 psi and under. This will compensate for atmospheric changes that could effect the calibration of the filled gauge.

Pressure Range:
Choose a gauge with a range that is approximately double your normal operating pressure. The maximum operating pressure of your application should not exceed 75% of the maximum pressure of the gauge.

Full-Scale Accuracy:
Full-scale accuracy applies to readings for the entire pressure range. Gauges are typically assigned an accuracy grade from 4A to D.
PRM Gauges are Grade B (±1.6% Accuracy)
Ambient Temperature Range: -20°F to 140°F

Dual Scale Readings:
PRM gauges feature Dual Scale readings.

PGCNBTY63035130PSI
0-30 psi, 0-2 bar
2 Inch Dial
Steel Case
Back Mount
1/4” Brass Connector

PGCNBTY630352100PSI
0-100 psi, 0-7 bar
2 Inch Dial
Steel Case
Back Mount
1/4” Brass Connector

PGCNBTY63045260WC
0-60”WC, 0-2 psi
2.5 Inch Dial
Chrome Plated Case
Back Mount
1/4” Brass Connector

PGCNBTY630453100WC
0-100”WC, 0-3.5 psi
2.5 Inch Dial
Chrome Plated Case
Back Mount
1/4” Brass Connector

PGCNBTY6307511150WC
0-150”WC, 0-5 psi
2.5 Inch Dial
Stainless Steel Case
Bottom Mount
1/4” SS Connector

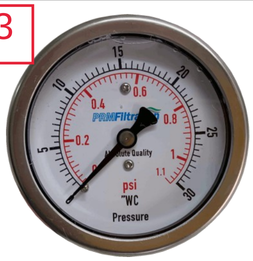
PGCNBTY63075130PSI
0-30 psi, 0-2 bar
2.5 Inch Dial
Stainless Steel Case
Back Mount
1/4” Stainless Steel Connector
Clean Gauge for Oxygen Service

PGCNBTY63076130PSI
-30 to 30 psi, -2 to 2 bar
2.5 Inch Dial
Stainless Steel Case
Bottom Mount
1/4” Stainless Steel Connector
Compound Gauge for Oxygen Service

PRM LIQUID FILLED PRESSURE GAUGES

PRMFiltration

PI-3



PGCNBTY63065530WC
0-30"WC, 0-1 psi
2.5" Stainless Steel Case
Back 1/4" Brass Connector

PGCNBTY630454B150WC
0-150"WC, 0-5 psi
2.5" Stainless Steel Case
Back 1/4" Brass Connector

PGCNBTY630251310PSI
0-10 psi, 0-0.7 bar
2.5" Stainless Steel Case
Bottom 1/4" Brass Connect

PGCNBTY63015230PSISS
0-30 psi, 0-2 bar
2.5" Stainless Steel Case
Back 1/4" SS Connector

PGCNBTY630251130PSI
0-30 psi, 0-2 bar
2.5" Stainless Steel Case
Bottom 1/4" Brass Connect

PGCNBTY630251230PSI
0-30 psi, 0-2 bar
2.5" Stainless Steel Case
Back 1/4" Brass Connector

PGCNBTY63015350PSISS
0-50 psi, 0-3.5 bar
2.5" Stainless Steel Case
Bottom 1/4" SS Connector

PGCNBTY630251850PSI
0-50 psi, 0-3.5 bar
2.5" Stainless Steel Case
Bottom 1/4" Brass Connect

PI-1

PGCNBTY6302518B50PSI
0-50 psi, 0-3.5 bar
2.5" Stainless Steel Case
Back 1/4" Brass Connector

PI-2

PGCNBTY6302515100PSI
0-100 psi, 0-7 bar
2.5" Stainless Steel Case
Back 1/4" Brass Connector

PGCNBTY6302514100PSI
0-100 psi, 0-7 bar
2.5" Stainless Steel Case
Bottom 1/4" Brass Connect

PGCNBTY6301524100PSISS
0-100 psi, 0-7 bar
2.5" Stainless Steel Case
Bottom 1/4" SS Connector

PGCNBTY630151150PSI
0-150 psi, 0-10 bar
2.5" Stainless Steel Case
Bottom 1/4" SS Connector

PGCNBTY6302516200PSI
0-200 psi, 0-14 bar
2.5" Stainless Steel Case
Back 1/4" Brass Connector

PGCNBTY6302517200PSI
0-200 psi, 0-14 bar
2.5" Stainless Steel Case
Bottom 1/4" Brass Connect

PGCNBTY63025251000PSI
0-1000 psi, 0-70 bar
2.5" Stainless Steel Case
Back 1/4" Brass Connector

PRM LIQUID FILLED PRESSURE GAUGES

PRMFiltration

<u>PGCNBTY1000150130PSI</u>
0-30 psi, 0-2 bar
4" Stainless Steel Case,
Internals and Fitting.
Bottom 1/2" Diaphragm
Connection

<u>PGCNBTY6308511300PSI</u>
0-300 psi, 0-20 bar
2.5" 316 Stainless Steel
Case, Internals, and Fitting
Bottom 1/4" Diaphragm
Connector

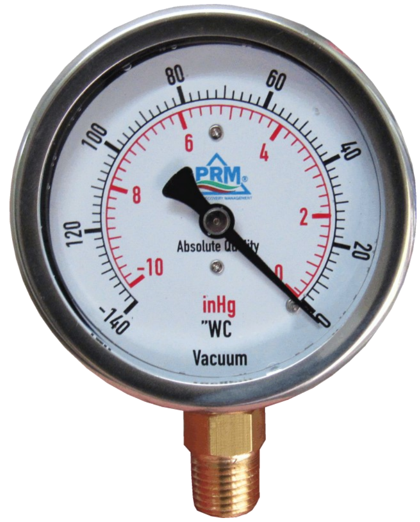
<u>PGCNBTY630951200PSI</u>
0-200 psi, 0-14 bar
2.5" Stainless Steel Case
and Internals
Bottom 1.5" SS Tri-clamp
Connector

<u>PGCNBTY6301530HG30PSI</u>
-30 to 30 psi, -1 to 2 bar
2.5 Inch Dial
Stainless Steel Case
Back Mount
1/4" Stainless Steel Connector
Compound Gauge

<u>PGCNBTY6301515HG100PSI</u>
-30 to 100 psi, -1 to 7 bar
2.5 Inch Dial
Stainless Steel Case
Back Mount
1/4" Stainless Steel Connector
Compound Gauge

PRM VACUUM GAUGES

Vacuum gauges measure negative pressure. They are commonly used with vacuum pumps and in suction lines to measure and display vacuum.



Features:

Brass or 304 SS Connections:
Brass connections are used with noncorrosive liquids and gas. For corrosive environments that could damage brass, choose a gauge with a stainless steel connection. PRM Gauges either have bottom connections or back connections.

Dry or Liquid Filled:
Gauges with a dry dial work well for most applications. For environments prone to vibration, gauges with a liquid-filled dial suppress needle flutter for more accurate readings and extend the life of the gauge. Liquid filled gauges have an elastomeric vent/fill plug tip which can be easily cut (after installation) to permit case venting. This is recommended for all liquid filled gauges, especially those with maximum pressure ratings of 100 psi and under. This will compensate for atmospheric changes that could effect the calibration of the filled gauge.

Vacuum Range:
Choose a gauge with a range that is approximately double your normal operating pressure. The maximum operating vacuum pressure of your application should not exceed 75% of the maximum range of the gauge.

Full-Scale Accuracy:
Full-scale accuracy applies to readings for the entire vacuum. Gauges are typically assigned an accuracy grade from 4A to D.
PRM Gauges are Grade B (±1.6% Accuracy)
Ambient Temperature Range: -20°F to 140°F

Dual Scale Readings:
PRM gauges feature Dual Scale readings.

PGCNBTY63035330HG
-30 to 0 inHg, -1 to 0 bar
2 Inch Dial
Steel Case
Back Mount
1/4” Brass Connector

PGCNBTY630451160WCV
-160 to 0 ”WC, -6 to 0 psi
2.5 Inch Dial
Chrome Case
Bottom Mount
1/4” Brass Connector

PGCNBTY630454160WCV
-160 to 0 “WC, -12 to 0 inHg
2.5 Inch Dial
Chrome Case
Back Mount
1/4” Brass Connector

PGCNBTY6307511V150WCV
–150 to 0 “WC, -11 to 0 inHg
2.5 Inch Dial
Stainless Steel Case
Bottom Mount
1/4” SS Connector

PGCNBTY630453100WCV
-100 to 0 “WC, -7 to 0 inHg
2.5 Inch Dial
Chrome Case
Back Mount
1/4” Brass Connector

PGCNBTY630453J100WCV
-100 to 0 “WC, -7 to 0 inHg
2.5 Inch Dial
Chrome Case
Bottom Mount
1/4” Brass Connector

PGCNBTY630452J60WCV
-60 to 0 “WC, -4 to 0 inHg
2.5 Inch Dial
Chrome Case
Bottom Mount
1/4” Brass Connector

PGCNBTY630452H60WCV
-60 to 0 “WC, -4 to 0 inHg
2.5 Inch Dial
Chrome Case
Back Mount
1/4” Brass Connector

PRM LIQUID FILLED VACUUM GAUGES

PRMFiltration

PGCNBTY63065630WCV
-30 to 0 "WC, -2 to 0 inHg
2.5 Inch Dial
Stainless Steel Case
Back Mount
1/4" Brass Connector

PGCNBTY63065210HG
-140 to 0 "WC, -10 to 0 inHg
2.5 Inch Dial
Stainless Steel Case
Back Mount
1/4" Brass Connector

PGCNBTY630652J10HG
-140 to 0 "WC, -10 to 0 inHg
2.5 Inch Dial
Stainless Steel Case
Bottom Mount
1/4" Brass Connector

VI-1

PGCNBTY630252130HG
-30 to 0 inHg, -1 to 0 bar
2.5 Inch Dial
Stainless Steel Case
Bottom Mount
1/4" Brass Connector

PGCNBTY630252230HG
-30 to 0 inHg, -1 to 0 bar
2.5 Inch Dial
Stainless Steel Case
Back Mount
1/4" Brass Connector

PGCNBTY630651200WCV
-200 to 0 "WC, -15 to 0 inHg
2.5 Inch Dial
Stainless Steel Case
Back Mount
1/4" Brass Connector

DIFFERENTIAL PRESSURE GAUGES

PRMFiltration

Low Pressure Differential Gauges with Dial Indicator measures the difference between two pressure measurements. They are commonly used to monitor air-handling equipment such as fans and blowers.

Specifications:

Material: Aluminum

Dimensions: 4-3/4” dia. X 2-3/16” deep

Weight: 1 lb. 2 oz.

Connections: 1/8” female NPT high and low pressure taps, duplicated, one pair side and one pair back.

Accuracy: ± 4% of full scale at 70° F

Pressure Rating: 15 PSI

Ambient Temp. Range: 20°-140° F

For use with air or compatible gases only, not for use with Hydrogen gas.

FI-1

PART NUMBER	RANGE
DPGJH2000025X	0-0.25 INCHES WC
DPGJH200005X	0-0.5 INCHES WC
DPGJH20001X	0-1 INCHES WC
DPGJH20002X	0-2 INCHES WC
DPGJH20005X	0-5 INCHES WC
DPGJH20006X	0-6 INCHES WC
DPGJH200010X	0-10 INCHES WC
DPGJH200015X	0-15 INCHES WC
DPGJH200020X	0-20 INCHES WC
DPGJH2000100X	0-100 INCHES WC

CONTROLS EQUIPMENT

AX SERIES MOTOR

EXPLOSION PROOF MOTOR

AX - SHUTTER MOUNTED FANS

Designed for Industrial, Commercial & Farming applications.

The AX series exhaust fan is a sturdily constructed, direct drive, horizontal discharge fan that is typically use for general ventilation of factories, garages, warehouses and other industrial or commercial buildings. The AX fans are available in multiple single-speed variations as well as two-speed and variable speed models.
The AX series housings are constructed of heavy duty aluminum with built in shutters that automatically open when the fan starts and gravity closes when the fan stops.

FEATURES

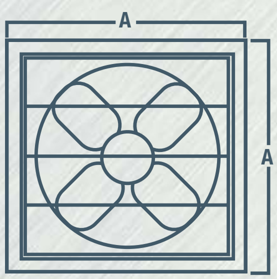
- Sturdily constructed from all-aluminum extrusions.
- Heavy duty OSHA motor mount/guard is standard.
- Heavy gauge, welded steel rod with plated finish.
- Totally enclosed air over motor with overload protection.

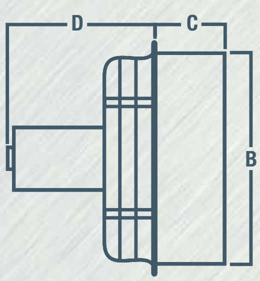
C US

SINGLE PHASE	THREE PHASE	BLADE DIAMETER	RPM	HP (SINGLE PHASE)	VOLTAGE (SINGLE PHASE)	AMPS (FLA) (SINGLE PHASE)	WEIGHT (LBS)	dB(A) @5 ft	CFM @ STATIC PRESSURE 0.00"	0.10"	0.125"	0.25"	FRAMING DIMENSIONS
SINGLE SPEED - VARIABLE SPEED FANS													
AX12-1V	AX12-1*	12"	1700	1/3	115/230	5.0/2.5	26	63	1650	1560	1525	1400	14" X 14"
AX12-1VHE	-	12"	1450	1/15	115	1.0	22	60	1350	1290	1275	1150	14" X 14"
AX14-1V	AX14-1*	14"	1700	1/3	115/230	5.0/2.5	29	67	2170	2030	1950	1900	16" X 16"
AX14-1VHE	-	14"	1450	1/15	115	1.0	25	64	1600	1525	1500	1300	16" X 16"
AX16-1V	AX16-1*	16"	1700	1/3	115/230	5.0/2.5	30	68	2570	2470	2410	2260	18" X 18"
AX16-1VHE	-	16"	1450	1/15	115	1.0	26	63	1850	1750	1700	1550	18" X 18"
AX18-1V	AX18-1*	18"	1700	1/3	115/230	3.8/1.9	36	71	3150	3000	2900	2575	20" X 20"
AX20-1V	AX20-1*	20"	1700	1/3	115/230	3.8/1.9	39	77	3620	3420	3340	3120	22" X 22"
AX24-1V	AX24-1*	24"	1100	1/2	115/230	6.4/3.2	43	72	5500	5400	5310	5100	26" X 26"
SINGLE SPEED FANS													
AX12-2	--	12"	1625	1/4	115	1.8	27	63	1640	1540	1510	1390	14" X 14"
AX14-2	--	14"	1625	1/4	115	1.8	30	67	2170	2070	2030	1860	16" X 16"
AX16-2	--	16"	1625	1/4	115	1.8	31	68	2370	2270	2210	2060	18" X 18"
AX18-2	--	18"	1625	1/3	115	4.0	37	73	3200	3090	3040	2920	20" X 20"
AX20-2	--	20"	1625	1/3	115	4.0	39	77	3420	3220	3170	2920	22" X 22"
AX24-2	--	24"	1100	1/3	115	5.4	45	70	5000	4500	4300	3600	26" X 26"
AX30-2	--	30"	1100	1/2	115/230	6.4/3.2	72	82	8000	7000	6000	5000	33" X 33"
AX36-7	--	36"	850	1/2	115/230	6.6/3.3	88	72	12000	11000	10500	9500	39" X 39"
TWO SPEED FANS													
AX08-3	--	8"	1600/1300	1/40	115	0.5	14	48	400/330	320/260	280/230	180/140	12" X 12"
AX10-3	--	10"	1600/1300	1/40	115	0.5	14	56	690/580	590/460	570/390	550/340	12" X 12"
AX12-3	--	12"	1725/1140	1/4	115	3.4	27	64	1670/1100	1600/950	1575/900	1450/625	14" X 14"
AX14-3	--	14"	1725/1140	1/4	115	3.4	31	67	2190/1440	2080/1325	2000/1300	1950/850	16" X 16"
AX16-3	--	16"	1725/1140	1/4	115	3.4	34	69	2580/1770	2480/1620	2430/1560	2270/1020	18" X 18"
AX18-3	--	18"	1725/1140	1/3	115	5.3/2.9	38	74	3200/2310	3050/2030	2950/1960	2625/1750	20" X 20"
AX20-3	--	20"	1725/1140	1/3	115	5.3/2.9	41	77	3640/2420	3440/2270	3360/2210	3140/1890	22" X 22"
SINGLE SPEED EXPLOSION PROOF FANS (Explosion Proof Motors are CLASS 1 - GROUP C & D and CLASS 2 - GROUP F & G)													
AX12-4	AX12-4*	12"	1725	1/3	115/208-230	6.6/3.1-3.3	49	63	1670	1600	1575	1450	14" X 14"
AX14-4	AX14-4*	14"	1725	1/3	115/208-230	6.6/3.1-3.3	49	67	2190	2080	2000	1950	16" X 16"
AX16-4	AX16-4*	16"	1725	1/3	115/208-230	6.6/3.1-3.3	51	68	2580	2480	2430	2270	18" X 18"
AX18-4	AX18-4*	18"	1725	1/3	115/208-230	6.6/3.1-3.3	56	73	3200	3050	2950	2625	20" X 20"
AX20-4	AX20-4*	20"	1725	1/3	115/208-230	6.6/3.1-3.3	57	77	3640	3440	3360	3140	22" X 22"
AX24-4	AX24-4*	24"	1725	1/3	115/208-230	6.6/3.1-3.3	57	77	5520	5410	5330	5130	26" X 26"

For three phase motors, substitute "*" with "M" for 208-230/460 volt or "P" for 575 volt
Other voltages in single or three phase are available. 50HZ voltages are available. Consult factory.

DIMENSIONS





MODEL	A	B	C	D AX	D AX-4~
AX08	14 3/4"	11 3/4"	5"	6 1/2"	-
AX10	14 3/4"	11 3/4"	5"	6 1/2"	-
AX12	16 3/4"	13 3/4"	5"	11"	13 3/4"
AX14	18 3/4"	15 3/4"	5"	11"	13 3/4"
AX16	20 3/4"	17 3/4"	5"	11"	13 3/4"
AX18	22 3/4"	19 3/4"	5"	11 1/4"	14"
AX20	24 3/4"	21 3/4"	5"	11 1/4"	14"
AX24	28 3/4"	25 3/4"	5"	11"	13 3/4"
AX30	35 1/4"	32 3/4"	5"	13 1/4"	-
AX36	41 1/4"	38 3/4"	5"	13 1/2"	-

~ Explosion Proof Motor

ACCESSORIES

- Speed controls
- Thermostats
- Front guard
- Weather hoods

For a complete listing on all available accessories, see page 15.
For a complete listing of all available hoods, see page 11.
For a complete listing of all available control options, see pages 25-26.

ACCESSORIES FOR AX & P SERIES FANS

ACCESSORIES

FRONT GUARD FOR AX & P SERIES FANS

- 18 gauge galvanized 3/4” expanded metal screen.

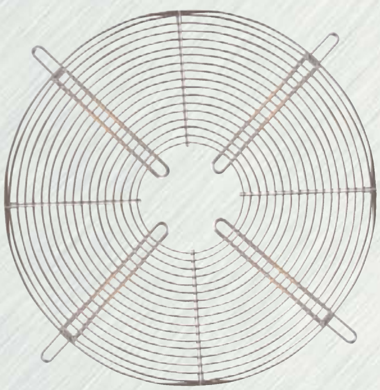
FITS FAN	FRONT GUARD
8"	XFG8-10
10"	XFG8-10
12"	XFG12
14"	XFG14
16"	XFG16
18"	XFG18
20"	XFG20
24"	XFG24
30"	XFG30
36"	XFG36

PANEL SLEEVES FOR P SERIES

- Sleeves are 9 1/2” deep.

FITS FAN	SLEEVES
8"	PSL08
10"	PSL10
12"	PSL12
14"	PSL14
16"	PSL16
18"	PSL18
20"	PSL20
24"	PSL24
30"	PSL30
36"	PSL36

REPLACEMENT GUARDS



FITS FAN	MODEL #	DESCRIPTION
8"	2X115	8” - 10” OSHA motor mount
10"	2X115	8” - 10” OSHA motor mount
12"	2X116	12” OSHA motor mount
14"	2X117	14” - 16” OSHA motor mount
16"	2X117	14” - 16” OSHA motor mount
18"	2X118	18” - 20” OSHA motor mount
20"	2X118	18” - 20” OSHA motor mount
24"	2X119	24” OSHA motor mount
30"	2X113	30” OSHA motor mount
36"	2X114	36” OSHA motor mount

MOTORIZED & GRAVITY DAMPERS FOR FRESH AIR INTAKE

BACK DRAFT DAMPER

FITS FAN	MODEL #	
	MOTORIZED DAMPERS	BACK DRAFT DAMPERS
8”	SX3210X10	SR3210X10
10”	SX3210X10	SR3210X10
12”	SX3212X12	SR3212X12
14”	SX3214X14	SR3214X14
16”	SX3216X16	SR3216X16
18”	SX3218X18	SR3218X18
20”	SX3220X20	SR3220X20
24”	SX3224X24	SR3224X24
30”	SX3230X30	SR3230X30
36”	SX3236X36	SR3236X36

MOTORIZED DAMPER

The Motorized dampers listed above are 110V.
For 230V, replace X with Y.
For 24V AC, replace X with Z.

Explosion-Proof Natural Convection Heater - XB

The Norseman™ XB Series convection heater, with ratings up to 5000 watts, is designed for heating spaces where explosive substances are or may be present. The Norseman™ XB is available with either $_{C}$CSA$_{US}$ or CE ATEX approvals. All units can be fitted with an externally adjustable thermostat.

With the Norseman™ XB, you get a safe and reliable heater with a handsome appearance and state-of-the-art design.

Applications

Typical applications for the Norseman™ XB include:

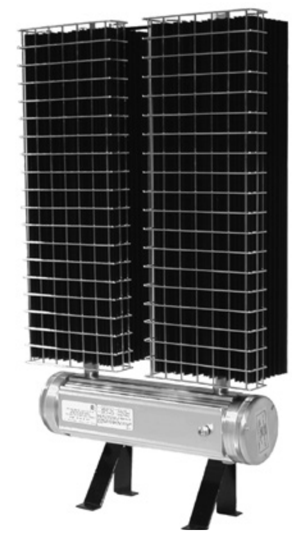
- Control cabinets and small enclosures
- Storage rooms for paints and cleaners
- Grain elevators
- Flour mills
- Spray booths
- Gas plants
- Pump houses
- Marine and offshore
- Oil platforms
- Cleaning and dyeing plants

Selection of Temperature Code

Refer to the atmospheric condition table (Table 2, page 6) at the beginning of this catalog for detailed selection data for the temperature code.

To minimize cost and physical size of the heater, select the heater with the highest temperature code that suits the environment. In Table 8 and Table 9, page 14 a check mark (✓) under the temperature code indicates that the surface temperature of the heater will not exceed the coded value listed in the atmospheric conditions table (Table 2, page 6) at the beginning of this catalog.

Construction & Installation



The Norseman™ XB explosion-proof convection heaters utilize Thermon Heating Systems' unique copper free aluminum extruded convector and patented ***x-Max***® terminal housing. Large convector surface area and high mass fins ensure safe and efficient low temperature heat transfer to the environment. Convectors are black anodized to resist oxidation and maximize heat transfer.

The ***x-Max***® housing can be equipped with multiple tapped conduit entries throughout its length to facilitate installation. A track and trolley system and threaded covers at each end allow easy access to internal components.

All units, except the single heat sink units, have a built-in terminal block for simplified electrical connection.

The Norseman™ XB units are intended for wall or floor mounting with the heater positioned vertically as shown. Dual purpose brackets for floor or wall mounting and wire guards are supplied as standard.

Special Wattage & Lengths

Table 10, page 14 lists the maximum design wattages for the four standard heat sink lengths and configurations.

If standard units listed in Table 8 and Table 9, page 14 do not suit your application, a special unit based on Table 10, page 14 can be supplied (check factory).

Model Coding* - $_{C}$CSA$_{US}$

XB	- 4	300	T3B	3	- 1	- T
Model Series	Heat Sink Length in (mm)	Wattage	Temperature Code	Heater Voltage	Phase	Options
	1 - 5.2 (130)	Watts x 10	T3B - 329°F (165°C)	1 - 120V	1 - 1 Phase	T - Thermostat
	3 - 11.8 (300)		T3A - 356°F (180°C)	2 - 208V	3 - 3 Phase	R - Moisture-Resistant Design
	4 - 18.5 (470)		T2D - 215°C (419°F)	3 - 240V		M - Special Mechanical Features
	6 - 25.2 (640)		T2C - 230°C (446°F)	7 - 480V		E - Special Electrical Feature
				8 - 600V		H - High Ambient (70°C)

*This nomenclature illustration is intended primarily to explain how a product part number is defined. Not all wattage, size and temperature code combinations are available. Please consult Table 9, page 14 for availability.

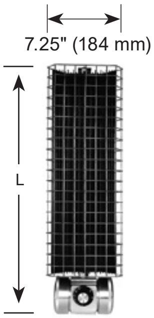


Figure 6 – XB Single Unit (XB1)

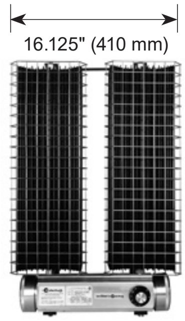


Figure 7 – XB Double Unit (XB2)

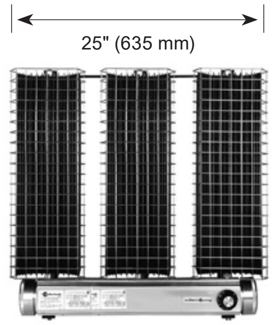


Figure 8 –XB Triple Unit (XB3)

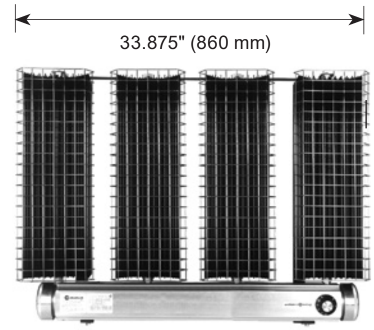


Figure 9 – XB Quadruple Unit (XB4)

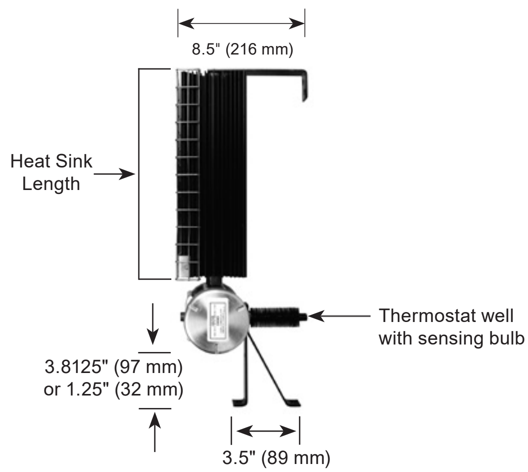


Figure 10 – XB Side View Floor Mounting

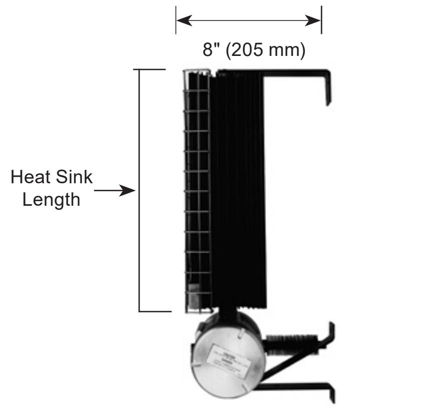


Figure 11 – XB Side View Wall Mounting

Table 8 – Norseman™ XB Explosion-Proof Natural Convection Heaters - Standard XB Heaters

<table>
<tr><th rowspan="3">W</th><th colspan="9">Standard Voltages</th><th rowspan="2">'L' Dim.</th><th colspan="4">Temperature Code</th><th rowspan="2">Weight</th><th colspan="2">Part No.</th></tr>
<tr><th>120</th><th colspan="2">208</th><th colspan="2">240</th><th colspan="2">480</th><th colspan="2">600</th><th rowspan="2">T2D</th><th rowspan="2">T3B</th><th rowspan="2">T4A</th><th rowspan="2">T6</th><th rowspan="2">Class I Div. 1, 2, Groups A, B, C & D Class II Div. 1, Groups E, F & G Class III Div. 1</th><th rowspan="2">Class I Div. 1, Groups A, B, C & D</th></tr>
<tr><th>1Ø</th><th>1Ø</th><th>3Ø</th><th>1Ø</th><th>3Ø</th><th>1Ø</th><th>3Ø</th><th>1Ø</th><th>3Ø</th><th>in (mm)</th><th>lbs (kg)</th></tr>
<tr><td>475</td><td rowspan="8">✓</td><td rowspan="9">✓</td><td>–</td><td rowspan="9">✓</td><td>–</td><td>–</td><td>–</td><td>–</td><td>–</td><td>10.0 (254)</td><td rowspan="9">✓</td><td rowspan="9" colspan="3">–</td><td>10 (4.5)</td><td rowspan="9">–</td><td>XB1-1047T2D</td></tr>
<tr><td>750</td><td>–</td><td>–</td><td>–</td><td>–</td><td>–</td><td>–</td><td>16.7 (424)</td><td>15 (6.8)</td><td>XB1-3075T2D</td></tr>
<tr><td>1000</td><td>–</td><td>–</td><td>✓</td><td>–</td><td>✓</td><td>–</td><td>23.4 (594)</td><td>20 (9.1)</td><td>XB1-4100T2D</td></tr>
<tr><td>1250</td><td>–</td><td>–</td><td>✓</td><td>–</td><td>✓</td><td>–</td><td>30.1 (765)</td><td>25 (11.3)</td><td>XB1-6125T2D</td></tr>
<tr><td>1500</td><td>✓</td><td>✓</td><td>✓</td><td>–</td><td>–</td><td>–</td><td>16.7 (424)</td><td>30 (13.6)</td><td>XB2-3150T2D</td></tr>
<tr><td>2000</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>23.4 (594)</td><td>40 (18.1)</td><td>XB2-4200T2D</td></tr>
<tr><td>3000</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>23.4 (594)</td><td>60 (27.2)</td><td>XB3-4300T2D</td></tr>
<tr><td>3750</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>30.1 (765)</td><td>75 (34.0)</td><td>XB3-6375T2D</td></tr>
<tr><td>4500</td><td>–</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>30.1 (765)</td><td>100 (45.4)</td><td>XB4-6450T2D</td></tr>
</table>

Table 9 – Norseman™ XB Explosion-Proof Natural Convection Heaters - Other Models Available

W	Standard Voltages									'L' Dim.	Temperature Code				Weight	Part No.	
	120	208		240		480		600								Class I Div 1, 2 Group A, B, C & D Class II Div 1 Group E, F & G Class III Div 1	Class I Div 1 Group A, B, C & D
	1Ø	1Ø	3Ø	1Ø	3Ø	1Ø	3Ø	1Ø	3Ø	in (mm)	T2D	T3B	T4A	T6	lbs (kg)		
50		–	–	–	–	–	–	–	–	10.0 (254)		✓	✓	✓	10 (4.5)	XB1-1005T6	–
100		–	–	–	–	–	–	–	–	10.0 (254)		✓	✓	–	10 (4.5)	XB1-1010T4A	–
175		–	–	–	–	–	–	–	–	10.0 (254)		✓	✓	–	10 (4.5)	XB1-1017T4A	–
200		✓	–	✓	–	–	–	–	–	30.1 (765)		✓	✓	✓	25 (11.3)	XB1-6020T6	–
300		–	–	–	–	–	–	–	–	10.0 (254)		✓	–	–	10 (4.5)	XB1-1030T3B	–
400		✓	✓	✓	✓	–	–	–	–	30.1 (765)		✓	✓	✓	50 (22.7)	XB2-6040T6	–
450		✓	–	✓	–	✓	–	✓	–	30.1 (765)		✓	✓	–	25 (11.3)	XB1-6045T4A	–
475		✓	–	✓	–	–	–	–	–	16.7 (424)		✓	–	–	15 (6.8)	XB1-3047T3B	–
600		✓	✓	✓	✓	–	–	–	–	30.1 (765)		✓	✓	✓	75 (34.0)	XB3-6060T6	–
750		–	–	–	–	–	–	–	–	10.0 (254)		–	–	–	20 (9.1)	–	XB2-1075T2D
800		✓	✓	✓	✓	–	–	–	–	30.1 (765)		✓	✓	✓	100 (45.4)	XB4-6080T6	–
850		✓	–	✓	–	✓	–	✓	–	30.1 (765)		✓	✓	–	50 (22.7)	XB2-6085T4A	–
1000		–	–	–	–	–	–	–	–	10.0 (254)		–	–	–	30 (13.6)	–	XB3-1100T2D
1000		✓	✓	✓	✓	–	–	–	–	23.4 (594)		✓	–	–	40 (18.1)	XB2-4100T3B	–
1000	✓	✓	✓	✓	✓	–	✓	–	–	16.7 (424)	✓	✓	–	–	45 (20.4)	XB3-3100T3B	–
1250		✓	✓	✓	✓	✓	✓	✓	✓	30.1 (765)		✓	✓	–	75 (34.0)	XB3-6125T4A	–
1250		–	–	–	–	–	–	–	–	10.0 (254)		–	–	–	30 (13.6)	–	XB3-1125T2D
1350		✓	✓	✓	–	✓	–	✓	–	30.1 (765)		–	–	–	25 (11.3)	–	XB1-6135T2D
1500		–	–	–	–	–	–	–	–	10.0 (254)		–	–	–	40 (18.1)	–	XB4-1150T2D
1500		✓	✓	✓	✓	–	✓	✓	✓	23.4 (594)		✓	–	–	60 (27.2)	XB3-4150T3B	–
1500		✓	✓	✓	✓	✓	✓	✓	✓	30.1 (765)		✓	–	–	50 (22.7)	XB2-6150T3B	–
1600		✓	✓	✓	✓	✓	✓	✓	–	30.1 (765)		✓	✓	–	100 (45.4)	XB4-6160T4A	–
2000		✓	✓	✓	✓	–	–	–	–	16.7 (424)		–	–	–	45 (20.4)	–	XB3-3200T2D
2250		✓	✓	✓	✓	–	–	–	–	23.4 (594)		✓	–	–	80 (36.3)	XB4-4225T3B	–
2250		✓	✓	✓	✓	✓	✓	✓	✓	30.1 (765)		✓	–	–	75 (34.0)	XB3-6225T3B	–
2500		✓	✓	✓	✓	✓	✓	✓	–	16.7 (424)		–	–	–	60 (27.2)	–	XB4-3250T2D
2500		✓	✓	✓	✓	✓	✓	✓	✓	30.1 (765)		–	–	–	50 (22.7)	–	XB2-6250T2D
3000		✓	✓	✓	✓	✓	✓	✓	✓	30.1 (765)		✓	–	–	100 (45.4)	XB4-6300T3B	–
3750		✓	✓	✓	✓	✓	✓	✓	✓	23.4 (594)		–	–	–	80 (36.3)	–	XB4-4375T2D
5000	–	✓	✓	✓	✓	✓	✓	✓	✓	30.1 (765)	✓	–	–	–	100 (45.4)	–	XB4-6500T2D

Table 10 – Norseman™ Maximum Heater Wattages

Heat Sink Length	Type	Temperature Code			
		T2D	T3B	T4A	T6
5" (130 mm)	XB1	475	300	190	95
	XB2	938	–	–	–
	XB3	1314	–	–	–
	XB4	1524	–	–	–
12" (300 mm)	XB1	783	498	294	142
	XB2	1520	988	570	266
	XB3	2173	–	–	–
	XB4	2608	–	–	–
19" (470 mm)	XB1	1021	684	380	209
	XB2	2033	1282	722	342
	XB3	3049	1881	1026	456
	XB4	3780	–	–	–
25" (640 mm)	XB1	1353	831	451	237
	XB2	2688	1615	864	408
	XB3	4018	2308	1254	612
	XB4	5130	3230	1653	836

Thermostats

Thermon Heating Systems offers a wide variety of explosion-proof thermostats to suit most every need.

All Norseman™ XB series heaters can be fitted with integral line voltage thermostats which are available either externally adjustable or tamper-proof; factory installed or as field installed kit.

Remote thermostat mounting is also available.

Refer to Explosion-Proof Thermostats - XT, page 20 of this Norseman™ catalog when selecting the appropriate thermostat for the desired application.

Accessories

Wire Guards and Baffles: All units are equipped with wire guards.

'Gull wing' shaped bright aluminum rear baffles are standard with Norseman™ XB units rated for T2D temperature code (shipped separately).

Table 11 – High Ambient Norseman™ XB Explosion-Proof Natural Convection Heaters

W	Standard Voltages									'L' Dim.	Temperature Code			Weight	Part No.
	120	208		240		480		600							
	1Ø	1Ø	3Ø	1Ø	3Ø	1Ø	3Ø	1Ø	3Ø	in (mm)	T3	T3C	T4A	lbs (kg)	Class I Div 1, 2, Group A, B, C & D Class II Div 1 Group E, F & G Class III Div 1
50		–	–	–	–	–	–	–	–	10.0 (254)	✓	✓	✓	10 (4.5)	XB1-1005T4A
100		–	–	–	–	–	–	–	–	10.0 (254)	✓	✓	–	10 (4.5)	XB1-1010T3C
175		–	–	–	–	–	–	–	–	10.0 (254)	✓	✓	–	10 (4.5)	XB1-1017T3C
200		✓	–	✓	–	–	–	–	–	30.1 (765)	✓	✓	✓	25 (11.3)	XB1-6020T4A
300		–	–	–	–	–	–	–	–	10.0 (254)	✓	–	–	10 (4.5)	XB1-1030T3
400		✓	✓	✓	✓	–	–	–	–	30.1 (765)	✓	✓	✓	50 (22.7)	XB2-6040T4A
450		✓	–	✓	–	✓	–	✓	–	30.1 (765)	✓	✓	–	25 (11.3)	XB1-6045T3C
475		✓	–	✓	–	–	–	–	–	16.7 (424)	✓	–	–	15 (6.8)	XB1-3047T3
600		✓	✓	✓	✓	–	–	–	–	30.1 (765)	✓	✓	✓	75 (34.0)	XB3-6060T4A
800	✓	✓	✓	✓	✓	–	–	–	–	30.1 (765)	✓	✓	✓	100 (45.4)	XB4-6080T4A
850		✓	–	✓	–	✓	–	✓	–	30.1 (765)	✓	✓	–	50 (22.7)	XB2-6085T3C
1000		✓	✓	✓	✓	–	–	–	–	23.4 (594)	✓	–	–	40 (18.1)	XB2-4100T3
1000		✓	✓	✓	✓	–	✓	–	–	16.7 (424)	✓	–	–	45 (20.4)	XB3-3100T3
1250		✓	✓	✓	✓	✓	✓	✓	✓	30.1 (765)	✓	✓	–	75 (34.0)	XB3-6125T3C
1500		✓	✓	✓	✓	–	✓	✓	✓	23.4 (594)	✓	–	–	60 (27.2)	XB3-4150T3
1500		✓	✓	✓	✓	✓	✓	✓	✓	30.1 (765)	✓	–	–	50 (22.7)	XB2-6150T3
1600		✓	✓	✓	✓	✓	✓	✓	–	30.1 (765)	✓	✓	–	100 (45.4)	XB4-6160T3C
2250		✓	✓	✓	✓	–	–	–	–	23.4 (594)	✓	–	–	80 (36.3)	XB4-4225T3
2250		✓	✓	✓	✓	✓	✓	✓	✓	30.1 (765)	✓	–	–	75 (34.0)	XB3-6225T3
3000		✓	✓	✓	✓	✓	✓	✓	✓	30.1 (765)	✓	–	–	100 (45.4)	XB4-6300T3

Table 12 – High Ambient Norseman™ Maximum Heater Wattages

Heat Sink Length	Type	Temperature Code		
		T3	T3C	T4A
5" (130 mm)	XB1	300	190	95
12" (300 mm)	XB1	498	294	142
	XB2	988	570	266
	XB3	1425	–	–
19" (470 mm)	XB1	684	380	209
	XB2	1282	722	342
	XB3	1881	1026	456
	XB4	2375	–	–
25" (640 mm)	XB1	831	451	237
	XB2	1615	864	408
	XB3	2308	1254	612
	XB4	3230	1653	836

High Ambient Option

The Norseman™ XB Series heater is now available with a high ambient hazardous location rating up to 70°C. This option is ideal for high ambient chemical storage facilities or gas sampling applications. Refer to Table 11, page 15 for Norsemen™ XB units available in high ambient.

Thermostats

Thermon Heating Systems offers a wide variety of explosion-proof thermostats to suit most every need.

All Norseman™ XB series heaters can be fitted with integral line voltage thermostats which are available either externally adjustable or tamper-proof; factory installed or as field installed kit.

Remote thermostat mounting is also available.

Refer to Explosion-Proof Thermostats - XT, page 20 of this Norseman™ catalog when selecting the appropriate thermostat for the desired application.

Accessories

Wire Guards: All units are equipped with wire guards.

Norseman™ XB Explosion-Proof Natural Convection Heater Standard Features (CE ATEX)

Suitable for the following hazardous location classification:

- EX II 2G Ex d IIC T3 or T4 Gb ITS 05ATEX13473 (See Table 13, page 16)
- Universal support leg for wall or floor mounting
- High surface area black anodized heat emitter with integral tubular heating elements
- Patented ***x-Max***® housing with slide out terminal block trolley simplifies installation and servicing
- Nickel plated wire guards on all models

Table 13 – Norseman™ XB Explosion-Proof Natural Convection Heater Specifications for T3 and T4 Units, Hazardous Location Rating (CE ATEX)

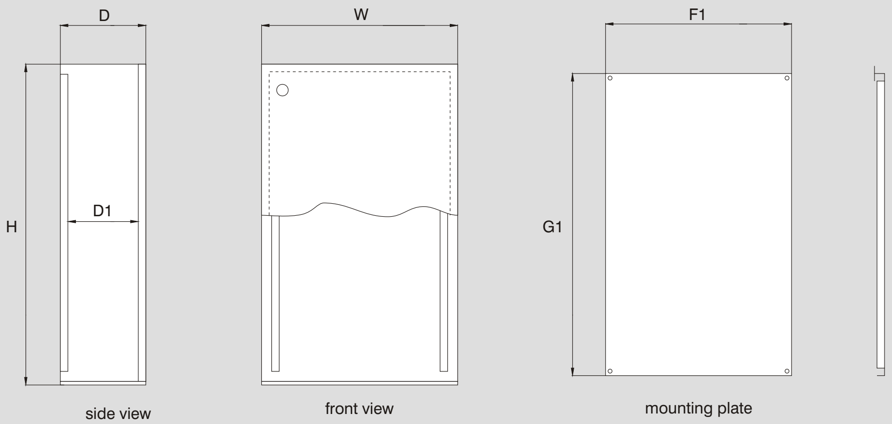
W	Reference Figure (p. 21)	V	Phase	'L' Dim.	Approx. Weight	Part No.	T-Code
				in (mm)	lbs (kg)		
399	6	110				XB1-3040T3B	T3
475	6	120				XB1-3047T3B	T3
399	6	220		16.7 (424)	15 (6.8)	XB1-3040T3B	T3
436	6	230				XB1-3043T3B	T3
475	6	240				XB1-3047T3B	T3
840	7	110				XB2-4084T3B	T3
1000	7	120				XB2-4100T3B	T3
840	7	220		23.4 (594)	40 (18.1)	XB2-4084T3B	T3
918	7	230				XB2-4092T3B	T3
1000	7	240				XB2-4100T3B	T3
1260	8	110	1			XB3-4126T3B	T3
1500	8	120				XB3-4150T3B	T3
1260	8	220		23.4 (594)	60 (27.2)	XB3-4126T3B	T3
1378	8	230				XB3-4138T3B	T3
1500	8	240				XB3-4150T3B	T3
714	7	220				XB2-6071T4A	T4
781	7	230		30.1 (765)	50 (22.7)	XB2-6078T4A	T4
850	7	240				XB2-6085T4A	T4
1891	8	220				XB3-6189T3B	T3
2066	8	230		30.1 (765)	75 (34.0)	XB3-6207T3B	T3
2250	8	240				XB3-6225T3B	T3

W	Reference Figure (p. 21)	V	Phase	'L' Dim.	Approx. Weight	Part No.	T-Code
				in (mm)	lbs (kg)		
2101		220	1			XB3-4210T3	
2296		230	1	23.4 (594)	60 (27.2)	XB3-4230T3	
2500		240	1			XB3-4250T3	
2521		220	1			XB3-6252T3	
2755		230	1	30.1 (765)	75 (34.0)	XB3-6276T3	
3000		240	1			XB3-6300T3	
1260		380	3			XB3-4126T3B	
1378		400	3	23.4 (594)	60 (27.2)	XB3-4138T3B	
1500		415	3			XB3-4150T3B	
1891	8	380	3			XB3-6189T3B	T3
2066		400	3	30.1 (765)	75 (34.0)	XB3-6207T3B	
2250		415	3			XB3-6225T3B	
2101		380	3			XB3-4210T3	
2296		400	3	23.4 (594)	60 (27.2)	XB3-4230T3	
2500		415	3			XB3-4250T3	
2521		380	3			XB3-6252T3	
2755		400	3	30.1 (765)	75 (34.0)	XB3-6276T3	
3000		415	3			XB3-6300T3	

“2800” Wall Mounted Enclosures

“2800”: Enclosure with polyurethane gasket. Completely welded, solid front door, internal plate. Gland plate models available upon request. Powder coated in RAL 7032.
Sold separately: mounting plates, mounting brackets. Nema 4/12. UL/CUL approved. IP55.

c UL US LISTED

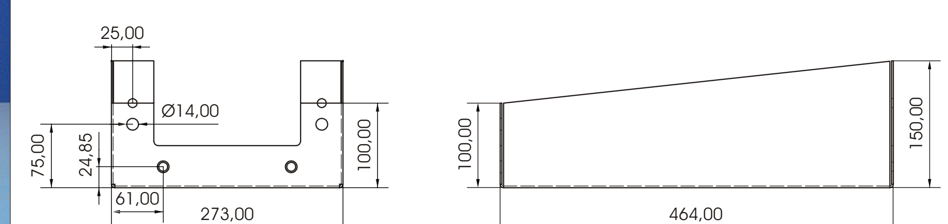


Boxes “2800”

W=in	8.11	8.11	10.00	10.00	12.00	12.00	12.00	12.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	16.00	19.92	19.92	23.85	19.92	19.92	19.92
H=in	12.00	12.00	12.00	12.00	12.00	12.00	16.00	16,00	16.00	16.00	19.92	19.92	19.92	23.85	23.85	23.85	19.92	19.92	16.00	23.85	23.85	23.85
D=in	5.91	7.87	5.91	7.87	5.91	5.91	5.91	7.87	5.91	7.87	5.91	7.87	9.84	5.91	7.87	9.84	7.87	9.84	7.87	5.91	7.87	9.84
W=mm	206	206	256	256	306	306	306	306	406	406	406	406	406	406	406	406	506	506	606	506	506	506
H=mm	306	306	306	306	306	306	406	406	406	406	506	506	506	606	606	606	506	506	406	606	606	606
D=mm	150	200	150	200	150	200	150	200	150	200	150	200	250	150	200	250	200	250	200	150	200	250
Code	**28020**	**28030**	**28035**	**28036**	**28040**	**28041**	**28060**	**28070**	**28100**	**28110**	**28115**	**28116**	**28117**	**28119**	**28120**	**28130**	**28134**	**28135**	**28140**	**28171**	**28172**	**28173**
F1=in	6.70	6.70	8.66	8.66	10.63	10.63	10.63	10.63	14.57	14.57	14.57	14.57	14.57	14.57	14.57	14.57	18.50	18.50	21.65	17.72	17.72	17.72
G1=in	9.,84	9.84	9.84	9.84	9.84	9.84	13.78	13.78	13.78	13.78	17.72	17.72	17.72	21.65	21.65	21.65	17.72	17.72	14.57	21.65	21.65	21.65
D1=in	5.43	7.20	5.43	7.20	5.43	7.20	5.43	7.20	5.43	7.20	5.43	7.20	9.17	5.43	7.20	9.17	7.20	9.7	7.20	5.43	7.01	9.17
F1=mm	170	170	220	220	270	270	270	270	370	370	370	370	370	370	370	370	470	470	550	470	470	470
G1=mm	250	250	250	250	250	250	350	350	350	350	450	450	450	550	550	550	450	450	370	550	550	550
D1=mm	138	183	138	183	138	183	138	183	138	183	138	183	233	138	183	233	183	233	183	128	178	233
Doors	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Weight (Kg)	5.2	5.8	6.4	7	7	7.6	9.6	9.9	10	10.5	14.5	15.1	15.9	16.5	17	19.1	16.5	17	17	18.2	19.5	21

Boxes “2800”

W=in	23.85	19.92	19.92	23.85	23.85	23.85	23.85	23.85	23.85	23.85	23.85	23.85	31.73	31.73	31.73	31.73	31.73	31.73	23.85	31.73	31.73	31.73
H=in	23.85	27.80	27.80	23.85	31.73	31.73	31.73	35.67	35.67	35.67	39.61	39.61	31.73	31.73	39.61	39.61	39.61	39.61	47.48	47.48	47.48	47.48
D=in	7.87	7.87	9.84	9.84	7.87	9.84	11.81	7.87	9.84	11.81	9.84	11.81	11.81	15.75	7.87	9.84	11.81	15.75	11.81	9.84	11.81	15.75
W=mm	606	506	506	606	606	606	606	606	606	606	606	606	806	806	806	806	806	806	606	806	806	806
H=mm	606	706	706	606	806	806	806	906	906	906	1006	1006	806	806	1006	1006	1006	1006	1206	1206	1206	1206
D=mm	200	200	250	250	200	250	300	200	250	300	250	300	300	400	200	250	300	400	300	250	300	400
Code	**28174**	**28175**	**28176**	**28177**	**28179**	**28180**	**28190**	**28192**	**28193**	**28194**	**28195**	**28196**	**28200**	**28210**	**28218**	**28219**	**28220**	**28230**	**28240**	**28250**	**28260**	**28270**
F1=in	21.65	17.72	17.72	21.65	21.65	21.65	21.65	21.65	21.65	21.65	21.65	21.65	29.53	29.53	29.53	29.53	29.53	29.53	21.65	29.53	29.53	29.53
G1=in	21.65	25.59	25.59	21.65	29.53	29.53	29.53	33.46	33.46	33.46	37.40	37.40	29.53	29.53	37.40	37.40	37.40	37.40	45.28	45.28	45.28	45.28
D1=in	7.01	7.01	8.98	8.98	7.01	8.98	10.94	7.01	8.98	10.94	8.98	10.94	10.94	14.88	7.01	8.98	10.94	14.88	10.94	8.98	10.94	14.88
F1=mm	550	450	450	550	550	550	550	550	550	550	550	550	750	750	750	750	750	750	550	750	750	750
G1=mm	550	650	650	550	750	750	750	850	850	850	950	950	750	750	950	950	950	950	1150	1150	1150	1150
D1=mm	178	178	228	228	178	228	278	178	228	278	228	278	278	378	178	228	278	378	278	228	278	378
Doors	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Weight (kg)	23.6	23	24.5	25	29.2	30.8	32.5	32.5	34.7	36.7	37.5	39.8	38.5	44.5	45.6	47.5	49.7	52	46	55.4	59	61



Floor stand kit, available in painted or stainless steel. Height: 6”, 12”, 15” and 18”
Width: same as any of our “2800 series” enclosures. Part #: add “LG” to enclosure number

SIEMENS

Engineered with
TIA Portal

SIMATIC S7-1200 Basic Controller

The compact device that offers simple engineering with the TIA Portal

Intuitive, efficient, and proven –
TIA Portal redefines engineering.

siemens.com/s7-1200

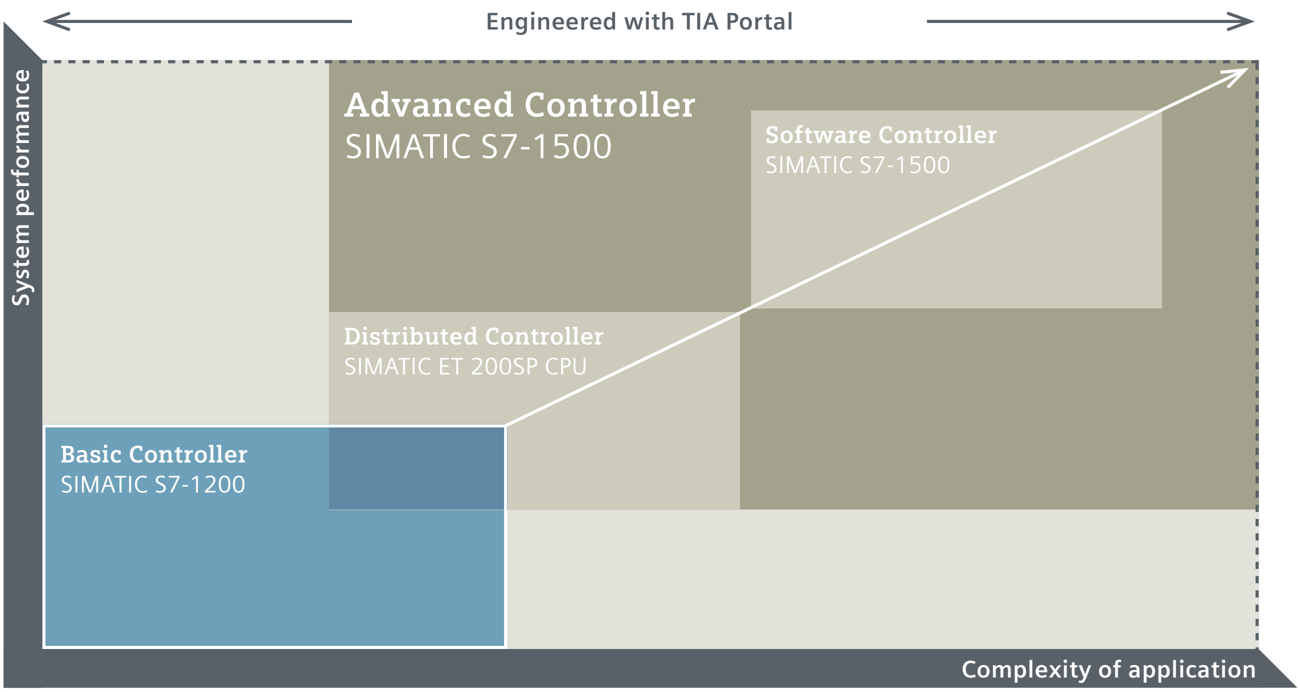
SIMATIC S7-1200 Basic Controller All in one!

SIMATIC S7-1200 Basic Controllers are the ideal choice when it comes to performing automation tasks in the low- to mid-performance range with maximum flexibility and efficiency. They deliver convincing results thanks to their comprehensive range of technological functions and integrated IOs, as well as their compact, space-saving design. Thanks to standardized remote control protocols, you can connect SIMATIC S7-1200 controllers directly to your control center without any programming effort.

A further decisive benefit is the incorporation of all SIMATIC controllers into the Totally Integrated Automation Portal (TIA Portal): all SIMATIC controllers have access to a shared database, a standardized operating concept, and integrated services, such as communication protocols like PROFINET.

That means reduced engineering effort and faster commissioning for you. The user-friendly and innovative operation of the TIA Portal, as well as the integrated system diagnostics, also contribute to efficient working.

SIMATIC controllers support automation solutions that are scalable in performance and functionality, and thus cost-efficient in every case. The functionality of the SIMATIC S7-1200 controllers is seamlessly continued by the SIMATIC S7-1500 controllers that have been developed for more complex tasks and that are also available in a compact version. This universality means you benefit from uniform sequences and thus maximum efficiency in engineering, operation, and maintenance, and when migrating to new systems.



Scalable performance and functionality for consistent and efficient engineering: The functionality of the SIMATIC S7-1200 controllers is seamlessly continued by the SIMATIC S7-1500 devices. This makes subsequent expansions easier and more cost-effective.

This is what the S7-1200 controllers offer you:

- **Innovative design and easy operation**
  Compact construction with integrated IOs and flexibility due to the board concept
- **Security Integrated**
  Security thanks to protected access to the CPU and program copy protection
- **Technology Integrated**
  Incorporated functions and flexible connection of drives
- **Versatile diagnostics**
  System diagnostics indicate error messages in plain-text in the TIA Portal on the HMI or web server
- **Efficient engineering**
  With SIMATIC STEP 7 Basic in the TIA Portal
- **New: Safety Integrated**
  Fail-safe CPUs for the execution of standard and safety-related programs
- **Flexible integration into all network structures**
  PROFINET, PROFIBUS, AS-i, IO-Link, CANopen or even connection to remote control centers

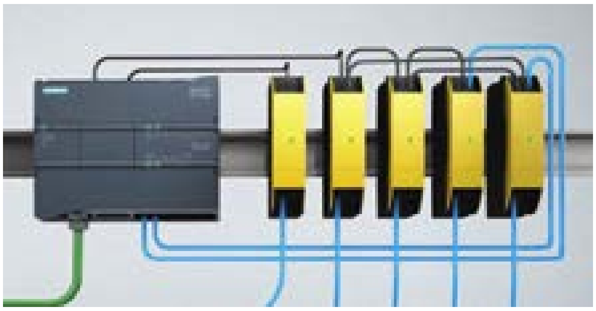
The first microcontroller in both standard and safety versions

The S7-1200 CPUs with Safety Integrated can additionally assume the monitoring of safety functions – e.g. protective door with tumbler. The fail-safe sensors and actuators are connected by means of fail-safe signal modules.

Advantages at a glance

- Optimum integration of the safety functions into the overall sequence of production processes
- Efficient engineering in the TIA Portal
- Savings can be made even with just using a few safety features

Standard controller in combination with an external safety-relay solution



- Complex wiring of the safety function (for feedback and possible functional dependencies)
- Fault diagnosis only possible by means of onboard LEDs and not on a central HMI panel

Integrated safety solution with a fail-safe controller of the S7-1200 series

- Reduced effort required for wiring
  All information (e.g. signal states and diagnoses) is already available in the system
- Efficient fault diagnosis centrally on an HMI panel

Central processing units

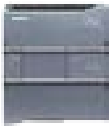
Standard modules

CPU 1211C

50 KB, DI 6 x 24 V DC, DQ 4 x 24 V DC or 4 x RLY, AI 2 x 10 bit 0–10 V DC, expandable to 3 CM

	Article No.
DC / DC / DC	6ES7 211-1AE40-0XB0
AC / DC / RLY	6ES7 211-1BE40-0XB0
DC / DC / RLY	6ES7 211-1HE40-0XB0

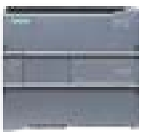
CPU 1212C



75 KB, DI 8 x 24 V DC, DQ 6 x 24 V DC or 6 x RLY, AI 2 x 10 bit 0–10 V DC, expandable to 3 CM + 2 SM

	Article No.
DC / DC / DC	6ES7 212-1AE40-0XB0
AC / DC / RLY	6ES7 212-1BE40-0XB0
DC / DC / RLY	6ES7 212-1HE40-0XB0

CPU 1214C



100 KB, DI 14 x 24 V DC, DQ 10 x 24 V DC or 10 x RLY, AI 2 x 10 bit 0–10 V DC, expandable to 3 CM + 8 SM

	Article No.
DC / DC / DC	6ES7 214-1AG40-0XB0
AC / DC / RLY	6ES7 214-1BG40-0XB0
DC / DC / RLY	6ES7 214-1HG40-0XB0

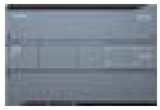
Also available as SIPLUS S7-1200 for use under extreme environmental conditions.
For more information, see siemens.com/siplus-extreme

CPU 1215C

125 KB, DI 14 x 24 V DC, DQ 10 x 24 V DC or 10 x RLY, AI 2 x 10 bit 0–10 V DC, AQ 2 x 10 bit, 0 to 20 mA, expandable to 3 CM + 8 SM

	Article No.
DC / DC / DC	6ES7 215-1AG40-0XB0
AC / DC / RLY	6ES7 215-1BG40-0XB0
DC / DC / RLY	6ES7 215-1HG40-0XB0

CPU 1217C

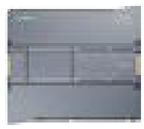


150 KB, DI 10 x 24 V DC, 4 x 1.5 V differential, DQ 6 x 24 V DC, 4 x 1.5 V differential, AI 2 x 10 bit 0–10 V DC, AQ 2 x 10 bit 0–20 mA, line driver IO for (1 MHz ±1.5 V), expandable to 3 CM + 8 SM

	Article No.
DC / DC / DC	6ES7 217-1AG40-0XB0

Fail-safe modules

CPU 1214FC



125 KB, DI 14 x 24 V DC, DQ 10 x 24 V DC or 10 x RLY, AI 2 x 10 bit 0–10 V DC

	Article No.
DC / DC / DC	6ES7 214-1AF40-0XB0
DC / DC / RLY	6ES7 214-1HF40-0XB0

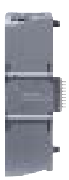
CPU 1215FC

150 KB, DI 14 x 24 V DC, DQ 10 x 24 V DC or 10 x RLY, AI 2 x 10 bit 0–10 V DC, AI 2 x 10 bit, 0 to 20 mA

	Article No.
DC / DC / DC	6ES7 215-1AF40-0XB0
DC / DC / RLY	6ES7 215-1HF40-0XB0

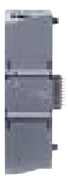
Communication

Communications modules



	Article No.
CM 1241 RS232	6ES7 241-1AH32-0XB0
CM 1241 RS422/485	6ES7 241-1CH32-0XB0
CM 1243-2 AS-i master	3RK7 243-2AA30-0XB0
DCM 1271 AS-i data decoupling	3RK7 271-1AA30-0AA0
CM 1242-5 PROFIBUS DP slave	6GK7 242-5DX30-0XE0
CM 1243-5 PROFIBUS DP master	6GK7 243-5DX30-0XE0

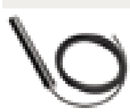
Communications processors



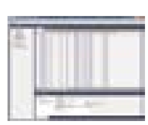
	Article No.
CP 1242-7 GPRS	6GK7 242-7KX31-0XE0
CP 1243-7 LTE	6GK7 243-7KX30-0XE0
CP 1243-1 Security	6GK7 243-1BX30-0XE0
CP 1243-1 DNP3 protocol	6GK7 243-1JX30-0XE0
CP 1243-1 IEC 60870-5-104 protocol	6GK7 243-1PX30-0XE0
CP 1243-1 PCC (Plant Cloud Connect)	6GK7243-1HX30-0XE0
CP 1243-8 IRC ST7 protocol	6GK7243-8RX30-0XE0

Telecontrol and teleservice

	Article No.
TS adapter IE Basic	6ES7 972-0EB00-0XA0
TS adapter IE Advanced	6ES7 972-0EA00-0XA0
TS module	
TS module modem	6ES7 972-0MM00-0XA0
TS module ISDN	6ES7 972-0MD00-0XA0
TS module RS232	6ES7 972-0MS00-0XA0
TS module GSM	6GK7 972-0MG00-0XA0



Quad-band GSM / UMTS / LTE ANT794-4MR antenna	6NH9 860-1AA00



Control center connection	
Telecontrol Server Basic 8	6NH9 910-0AA21-0AA0
Telecontrol Server Basic 64	6NH9 910-0AA21-0AB0
Telecontrol Server Basic 256	6NH9 910-0AA21-0AC0

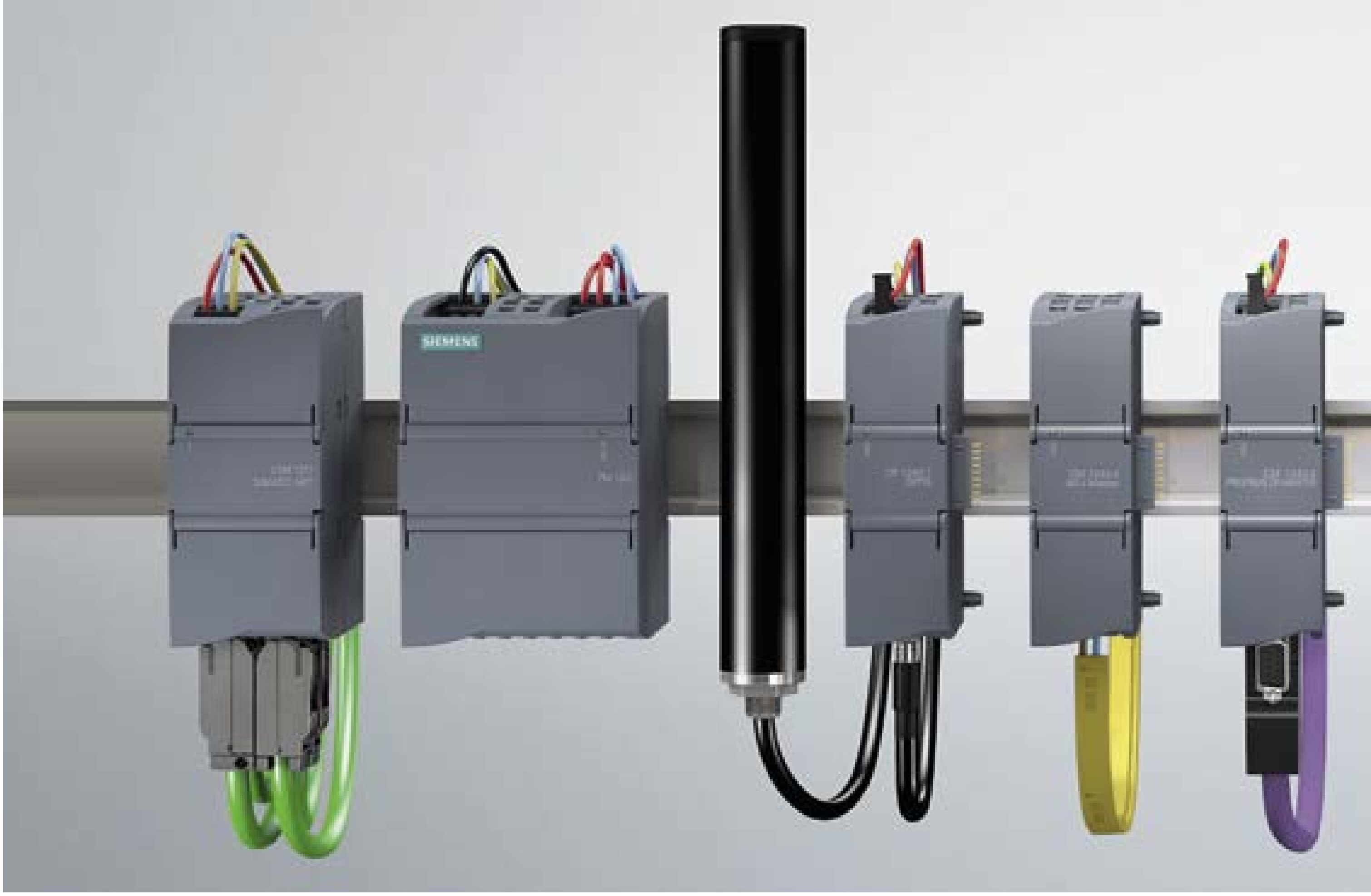
Further Telecontrol products are also available, for more details, see siemens.com/telecontrol

Partner product

	Article No.
HMS CM CAN Open	21620

Communications board

	Article No.
CB 1241 RS485	6ES7 241-1CH30-1XB0



Signal modules

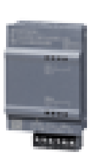
Signal modules – digital

	Article No.
SM 1221 DC	
DI 8 x 24 V DC	6ES7 221-1BF32-0XB0
DI 16 x 24 V DC	6ES7 221-1BH32-0XB0
SM 1222 DC	
DQ 8 x 24 V DC 0.5 A	6ES7 222-1BF32-0XB0
DQ 16 x 24 V DC 0.5 A	6ES7 222-1BH32-0XB0
SM 1222 RLY	
DQ 8 x RLY 30 V DC/250 V AC 2 A	6ES7 222-1HF32-0XB0
DQ 16 x RLY 30 V DC/250 V AC 2 A	6ES7 222-1HH32-0XB0
DQ 8 x RLY switchover 30 V DC/250 V AC 2 A	6ES7 222-1XF32-0XB0
SM 1223 DC/DC	
DI 8 x 24 V DC, DQ 8 x 24 V DC 0.5 A	6ES7 223-1BH32-0XB0
DI 16 x 24 V DC, DQ 16 x 24 V DC 0.5 A	6ES7 223-1BL32-0XB0
SM 1223 DC/RLY	
DI 8 x 24 V DC, DQ 8 x RLY 30 V DC/250 V AC 2 A	6ES7 223-1PH32-0XB0
DI 16 x 24 V DC, DQ 16 x RLY 30 V DC/250 V AC 2 A	6ES7 223-1PL32-0XB0
SM 1223 AC/RLY	
DI 8 x 120/250 V AC, DQ 8 x RLY 30 V DC/250 V AC 2 A	6ES7 223-1QH32-0XB0

Signal modules – analog

	Article No.
SM 1231 AI	
AI 4 x 13 bit ±10 V DC, ±5 V DC, ±2.5 V DC or 4–20 mA	6ES7 231-4HD32-0XB0
AI 8 x 13 bit ±10 V DC, ±5 V DC, ±2.5 V DC or 4–20 mA	6ES7 231-4HF32-0XB0
AI 4 x 16 bit ±10 V DC, ±5 V DC, ±2.5 V DC, ±1.25 V DC or 4–20 mA	6ES7 231-5ND32-0XB0
SM 1231 RTD	
AI 4 x RTD x 16 bit	6ES7 231-5PD32-0XB0
AI 8 x RTD x 16 bit	6ES7 231-5PF32-0XB0
Types: Platinum (Pt), copper (Cu), nickel (Ni) or resistance element	
SM 1231 TC	
AI 4 x TC x 16 bit	6ES7 231-5QD32-0XB0
AI 8 x TC x 16 bit	6ES7 231-5QF32-0XB0
Types: J, K, T, E, R, S, N, C, TXK/XK(L), voltage range: ±80 mV	
SM 1232 AQ	
AQ 2 x 14 bit ±10 V DC or 4 – 20 mA	6ES7 232-4HB32-0XB0
AQ 4 x 14 bit ±10 V DC or 4 – 20 mA	6ES7 232-4HD32-0XB0
SM 1234 AI/AQ	
AI 4 x 13 bit ±10 V DC, ±5 V DC, ±2.5 V DC or 4 – 20 mA, AQ 2 x 14 bit ±10 V DC or 4 – 20 mA	6ES7 234-4HE32-0XB0

Signal boards



	Article No.
SB 1221 DC* 200 kHz	
DI 4 x 5 V DC*	6ES7 221-3AD30-0XB0
DI 4 x 24 V DC*	6ES7 221-3BD30-0XB0
SB 1222 DC 200 kHz	
DQ 4 x 5 V DC 0.1 A	6ES7 222-1AD30-0XB0
DQ 4 x 24 V DC 0.1 A	6ES7 222-1BD30-0XB0
SB 1223 DC*/DC	
DI 2 x 24 V DC*/DQ 2 x 24 V DC 0.5 A	6ES7 223-0BD30-0XB0
SB 1223 DC*/DC 200 kHz	
DI 2 x 5 V DC*/DQ 2 x 5 V DC 0.1 A	6ES7 223-3AD30-0XB0
DI 2 x 24 V DC*/DQ 2 x 24 V DC 0.1 A	6ES7 223-3BD30-0XB0
SB 1232 AQ	
AQ 1 x 12 bit ±10 V DC or 0 – 20 mA	6ES7 232-4HA30-0XB0
SB 1231 AI	
AI 1 x 12 bit ±10 V DC, ±5 V DC, ±2.5 V DC or 0 – 20 mA	6ES7 231-4HA30-0XB0
SB 1231 RTD	
AI 1 x RTD x 16 bit, type: Platinum (Pt)	6ES7 231-5PA30-0XB0
SB 1231 TC	
AI 1 x TC x 16 bit, types: J, K voltage range: ± 80 mV	6ES7 231-5QA30-0XB0

*Sourcing input

Signal modules – fail-safe

	Article No.
SM 1226 F-DQ 2 x relay	
F-DQ RLY 2 x 5 A 30 V DC/250 V AC	6ES7 226-6RA32-0XB0
SM 1226 F-DQ 4 x 24 V DC	
F-DQ 4 x 2 A 24 V DC	6ES7 226-6DA32-0XB0
SM 1226 F-DI 16 x 24 V DC	
F-DI 16 x 24 V DC	6ES7 226-6BA32-0XB0

Engineering framework

SIMATIC STEP 7 software

	Article No.
SIMATIC STEP 7 SP1 Basic V13	
	6ES7 822-0AA03-0YA5
Software Update Service SIMATIC STEP 7 Basic	
	6ES7 822-0AA00-0YL0
Upgrade SIMATIC STEP 7 Basic V11–V12 to V13	
Floating license	6ES7 822-0AA03-0YE5
SIMATIC STEP 7 Safety Basic V13 SP1	
Floating license	6ES7833-1FB13-0YA5
Software Update Service STEP 7 Safety Basic – Standard	
	6ES7833-1FD00-0YX2

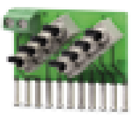
Accessories

		Article No.
BB 1297	Battery board (long-term backup of real-time clock [RTC])	6ES7 297-0AX30-0XA0

Memory card

4 MB (optional)	6ES7 954-8LC02-0AA0
12 MB (optional)	6ES7 954-8LE02-0AA0
24 MB (optional)	6ES7 954-8LF02-0AA0
256 MB (optional)	6ES7 954-8LL02-0AA0
2 GB (optional)	6ES7 954-8LP01-0AA0
32 GB (optional)	6ES7954-8LT02-0AA0

Digital input simulators



Simulator (8 positions for CPU 1211C/1212C)	6ES7 274-1XF30-0XA0
Simulator (14 positions for CPU 1214C/1215C)	6ES7 274-1XH30-0XA0
Simulator (14 positions for CPU 1217C)	6ES7 274-1XK30-0XA0

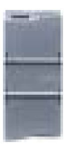
Analog input simulators

Potentiometer: for all CPUs	6ES7 274-1XA30-0XA0

Expansion cable for signal module

2.0 m	6ES7 290-6AA30-0XA0

CSM 1277



4-port unmanaged switch, 4 x RJ45 sockets, 10/100 Mbit/s	6GK7 277-1AA10-0AA0

Technology

Article No.

IO-Link

SM 1278 IO-Link master	6ES7 278-4BD32-0XB0

SIWAREX weighing modules

SIWAREX WP231, non-automatic weighing machine	7MH4 960-2AA01
SIWAREX WP241, belt scales	7MH4 960-4AA01

Condition monitoring

SM 1281 condition monitoring; as from Dec. 2015	6AT8007-1AA10-0AA0

Power modules

Article No.

PM 1207

Input: 120/230 V AC, 50/60 Hz, 1.2 A/0.67 A Output: 24 V DC/2.5 A	6EP1 332-1SH71

Operator control and monitoring

Article No.

SIMATIC HMI KP300 Basic mono PN

Operation using keys, 3" FSTN display, monochrome, adjustable backlighting color (white, red, green, yellow)

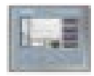
PROFINET	6AV6 647-0AH11-3AX0

SIMATIC HMI KP400 Basic color PN

Operation using keys, high-resolution 4" TFT widescreen display, 256 colors

PROFINET	6AV6 647-0AJ11-3AX0

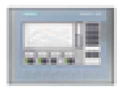
SIMATIC HMI KTP400 Basic



Operation using touchscreen + keys, 4" TFT widescreen display, 65,536 colors

PROFINET	6AV2 123-2DB03-0AX0

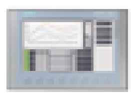
SIMATIC HMI KTP700 Basic



Operation using touchscreen + keys, 7" TFT widescreen display, 65,536 colors, PROFINET or PROFIBUS

PROFINET	6AV2 123-2GB03-0AX0
PROFIBUS	6AV2 123-2GA03-0AX0

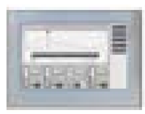
SIMATIC HMI KTP900 Basic



Operation using touchscreen + keys, 9" TFT widescreen display, 65,536 colors

PROFINET	6AV2 123-2JB03-0AX0

SIMATIC HMI KTP1200 Basic



Operation using touchscreen + keys, 12" TFT widescreen display, 65,536 colors, PROFINET or PROFIBUS

PROFINET	6AV2 123-2MB03-0AX0
PROFIBUS	6AV2 123-2MA03-0AX0

For more information, see **www.siemens.com/basic-panels**

Identification systems

Article No.

SIMATIC RF120C

Communications module for direct connection of SIMATIC identification systems to the SIMATIC S7-1200

6GT2002-0LA00

SIMATIC RF200

RFID system in the HF range, compact and cost-efficient, easy connection to the automation system

6GT2821-

For more information, see www.siemens.com/rf200

SIMATIC RF300

RFID system in the HF range, high-capacity data memory and high-speed recording, easy connection to the automation system

6GT2801-

For more information, see www.siemens.com/rf300

SIMATIC MV400

Optical code reading system for barcodes, data matrix codes (DMC), text recognition (OCR), verification

6GF34-

For more information, see www.siemens.com/codereader

For more information, see:

siemens.com/s7-1200

Discover the highlights of the SIMATIC S7-1200:

- New: SIMATIC S7-1200 F-CPU
- New: Firmware 4.1
- Automation Tasks (Tutorials)
- Customer references

SIMATIC S7-1200 – see for yourself!

Subject to change without prior notice
Article No.: DFFA-B10053-00-7600
Dispo 06336
170/74181 WS 09155.
Printed in Germany

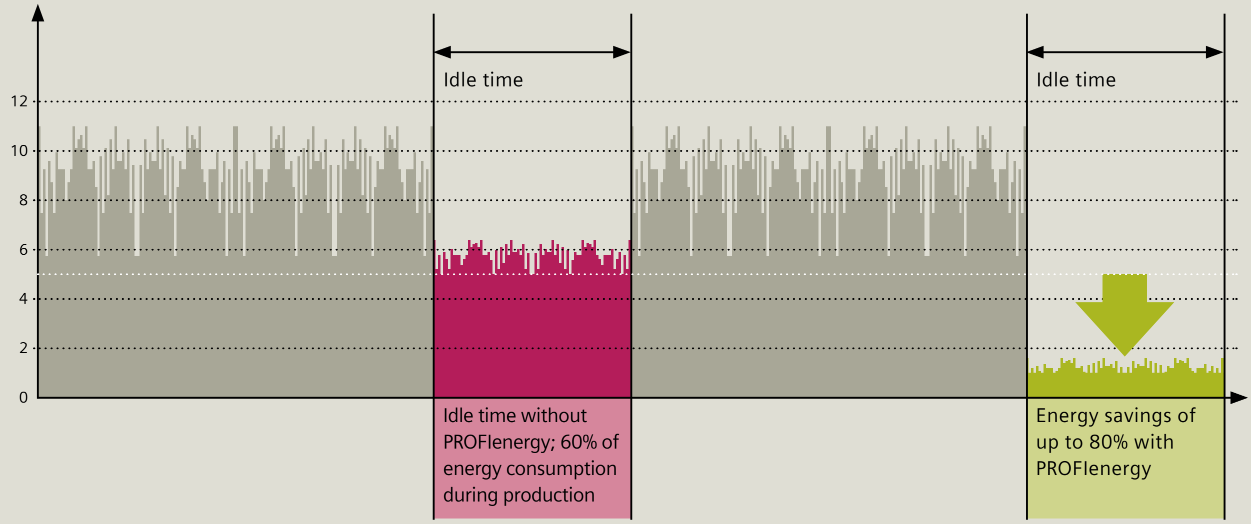
Follow us at
twitter.com/siemensindustry
youtube.com/siemens

Siemens AG
Digital Factory
P.O. Box 48 48
90026 Nuremberg
Germany

SIMATIC HMI Comfort Panels – the HMI family with integrated high-end functionality

The first choice for complex applications
For operator control and monitoring, SIMATIC HMI products are “state of the art.” They are the intelligent response to increasingly complex processes and stringent requirements for the operation of machines and plants. The newly developed SIMATIC HMI Comfort Panels are the first choice for solving complex HMI applications.

- Integrated functionality across all display sizes
- Brilliant widescreen displays with dimmable LED backlight
- Upright portrait installation possible for all touch devices
- 100 percent data security
- Innovative commissioning and service concept
- Intelligent energy management with PROFIenergy
- Option package printer driver for PDF printing / HTML printing / PostScript printing / Brother QL-650TD



Optimally utilize production breaks with PROFIenergy
PROFIenergy actively controls the current consumption of all automation components:

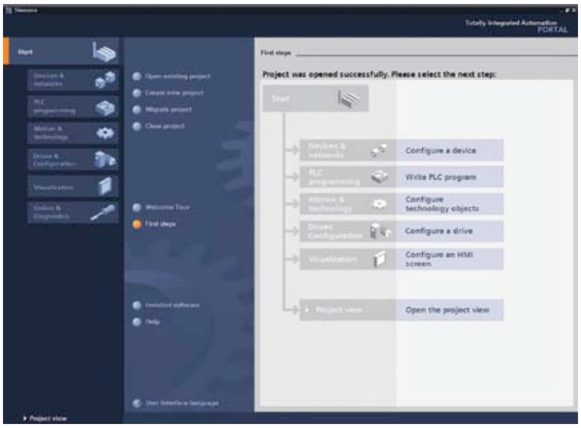
- Individual loads or entire production units are switched off when they are not required for the production process.
- Coordinated switching ensures a high degree of plant reliability.
- The easy integration of existing standards ensures continuous investment protection.

SIMATIC HMI Comfort Panels support PROFIenergy and also utilize any additional advantages of PROFINET, the open Ethernet standard for automation.

Totally Integrated Automation Portal – the engineering framework for all automation tasks

Intuitive, efficient, proven
The Totally Integrated Automation Portal (TIA Portal) is the innovative engineering framework that offers a uniform engineering environment for programming and configuring control, visualization and drive solutions.

The new SIMATIC HMI Comfort Panels are seamlessly integrated in the TIA Portal via WinCC. This innovative engineering framework represents the key to the full performance capacity of Totally Integrated Automation.



With its intuitive user interface, efficient navigation, and proven technology, the TIA Portal offers users an integrated platform for implementing automation solutions – for any sector, anywhere in the world.

SIMATIC HMI Comfort Panels – maximum practicality, maximum performance

Complex processes place high demands on the ruggedness and functionality of HMI devices. SIMATIC HMI Comfort Panels are state-of-the-art. They offer high performance, integrated functionality, and high quality aluminum fronts* for demanding applications. They are available in sizes from 4" to 22" – all with high-resolution and dimmable widescreen displays with LED backlight. SIMATIC HMI Comfort Panels can be optimally adapted to any application and the frameless design visually complements any machine.

* with a size of 7" or larger

1. Extremely flexible across all sizes

- Versions in sizes of 4", 7", 9", 12" and 15" with touch or keys and 19" and 22" with touch; the 4" touch device features additional keys.
- All touch devices can be installed upright (in portrait format) to maximize space in the plant or for special machine designs.
- Integrated high-end functionality: archives, VB scripts and various viewers for displaying plant documentation – e.g. as PDFs – and Internet pages by default.

3. Data protection at any time

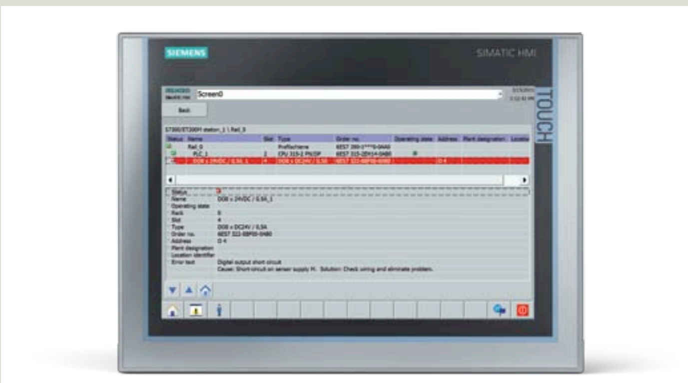
- Full protection against voltage failure of the complete device, the recipes and the archives in RDB format on SIMATIC HMI plug-in memory cards ensures the retention of process-relevant data in case of power failures. Supports plant certification in accordance with the FDA guidelines.
- Savings in hardware costs – no additional uninterruptible power supply required.

2. Brilliant displays in widescreen format

- Up to 40 percent larger visualization area than conventional displays. Complex operating screens can also be clearly displayed and divided into sections for application control and application monitoring.
- The high resolution, 16 million colors, and a wide viewing angle up to 170°, allow optimal readability and a detailed process display.
- The brightness of the LED backlight can be dimmed by up to 100 percent to adapt to the lighting conditions of the application. This saves energy and increases the service life of the display.

4. Optimum convenience, even during commissioning

- Simple download of projects via low-cost standard cables.
- Rapid commissioning – all Ethernet settings are already made during configuration.
- Increased plant availability due to an innovative service concept.
- Transfer of panel data to a further device: Simply replug the system card – confirm – get going.



5. Precise diagnostics made easy

- When connected to SIMATIC Controllers, diagnostic information can be read out directly via the Comfort Panel.
- Cost savings – no additional diagnostic hardware is required.
- Increased plant availability; faults can be found more quickly, leading to less downtime.

7. Can be used in many sectors and regions

- Certified according to ATEX for Ex zones 2 and 22 for use in hazardous areas**.
- Marine approval due to dimmable LED backlight.

** Partially in preparation

6. Easy to operate

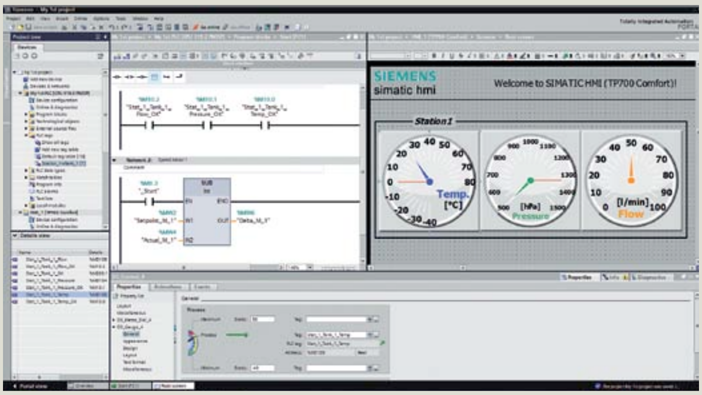
- Intuitive, fast entries due to familiar and easy-to-operate operator control similar to that of a mobile phone keypad.
- All function keys are equipped with LEDs. The keys that need to be pressed can be indicated to help facilitate operator guidance.
- For additional operating reliability, all of the keys provide tactile feedback when pressed. This is important, for example, when working with gloves.

8. More interfaces – less hardware costs

- Easy integration in existing system structures and networks thanks to PROFIBUS and PROFINET standard interfaces. From the 7" device upwards, two PROFINET interfaces with integrated network switch are available, from the 15" device upwards, an additional third PROFINET interface is integrated.
- Audio In/Audio Out interface for playback of sound files via the integrated Media Player.
- Easy connection of external devices such as printers, USB flash drives, mouse, or keyboard via two integrated USB host interfaces.
- Additional USB device interface for low-cost project download via standard cables.

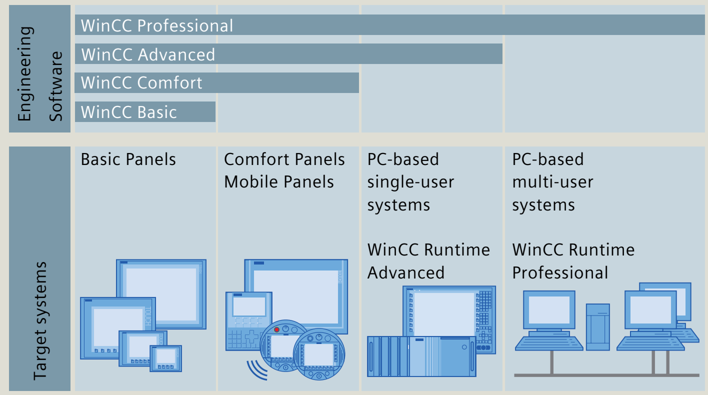
Seamless configuration of all SIMATIC HMI devices with SIMATIC WinCC in the TIA Portal

SIMATIC WinCC in the TIA Portal stands for maximum configuration efficiency and integrated engineering on the basis of Basic Panels and Comfort Panels, down to PC-based multi-user systems. The software offers ready-to-use objects, reusable faceplates and intelligent tools, and permits the implementation of multilingual projects. SIMATIC WinCC in the TIA Portal is available in different levels graded according to price and performance. They are based on each other and are optimally



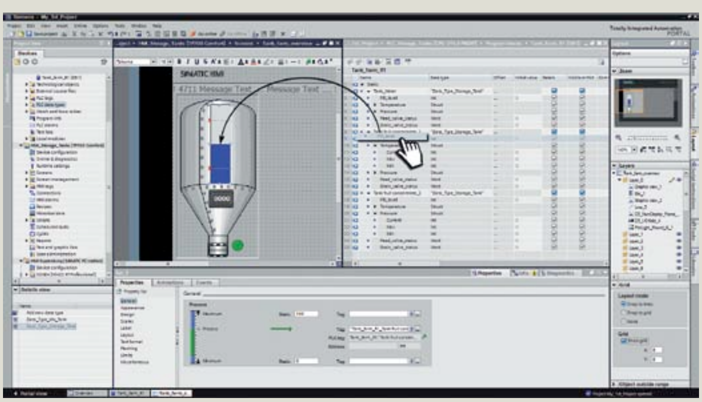
1. Optimum interaction between the controller and HMI

- All shared functions are displayed identically.
- Intelligent editors are context-sensitive and show only those functions that can be used: functions, properties, libraries.
- Thanks to split screen techniques, several editors can be opened at the same time so that data can be exchanged using drag & drop.
- The shared database ensures data consistency throughout the entire automation project – resulting in fewer errors and compact transparent projects.



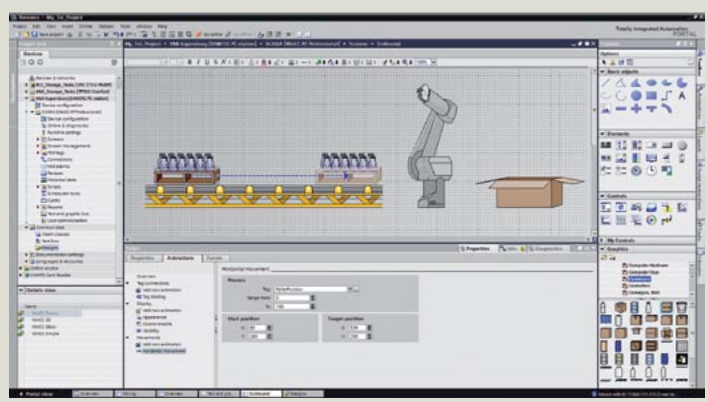
2. Scalability of Basic Panels

- Investment protection is ensured.
- Integrated engineering of all SIMATIC HMI devices for all HMI applications.
- Scalability of the respective runtime basic system due to corresponding options such as machine-level distributed operating stations with WinCC Sm@rtServer.



3. Intuitive user interface with maximum convenience

- The embedding of various editors in a shared working environment ensures the constant availability of all data and an easy overview of the project data.
- The intuitive operating concept of SIMATIC WinCC in the TIA Portal is based on the familiar Windows technology and editors, which are adapted to the configuration tasks.
- For engineering, a task-orientated environment focused on the current work flow is used.



4. Intelligent tools for efficient configuration

- Complex tasks such as the definition of paths of motion or the creation of fundamental operator prompting are simplified by means of graphical configuration.
- Table-based editors simplify the generation and processing of similar types of object, e.g. tags, texts, or messages.
- Comfortable search and change functions facilitate object searching, central variable rewiring as well as text searching and replacing throughout the project.

Technical Data

					
	KP400 Comfort	**KTP400 Comfort**	**TP700 Comfort**	**KP700 Comfort**	**TP900 Comfort**
	4" Key	**4" Touch + Key**	**7" Touch**	**7" Key**	**9" Touch**
Display	TFT widescreen, 16 million colors, LED backlight 100% dimmable, viewing angle 170°				
Size (in inches)	4		7		9
Resolution (W x H in pixels)	480 x 272		800 x 480		
MTBF of backlight (at 25 °C in h)	80,000	80,000 h	80,000 h	80,000 h	80,000 h
Front dimensions (in mm)	152 x 188	140 x 116	214 x 158	308 x 204	274 x 190
Control elements	Membrane keypad	Touch screen, Membrane keypad	Touch screen	Membrane keypad	Touch screen
Function keys (programmable) / system keys	8 (w. LED) / •	4 (w. LED) / •	–	24 (w. LED) / •	–
External keyboard / mouse / printer	USB / USB / USB				
Memory					
User memory	4 MByte		12 MByte		
Memory for options / recipes[2]	4 MByte / 512 KByte		12 MByte / 2 MByte		
Interfaces					
Serial / MPI / PROFIBUS DP	•[1] / • / •				
PROFINET (Ethernet)	1		2 (integrated switch)		
USB host / USB device	1 / 1		2 / 1		
Slot for CF / Multi Media / SD	– / • / •				
Functionality if configured with WinCC (TIA Portal)					
Alarm logging (number of alarms / alarm classes)	2000 / 32 (incl. alarm buffer)		4000 / 32 (incl. alarm buffer)		
Process screens	500				
Tags	1024		2048		
Vector graphics	•				
Bar graphs / curve diagrams	• / f (t), f (x)				
Faceplates	•				
Recipes	100		300		
Archiving	10		50		
Visual Basic Scripts	50		100		
Programming device	STATUS / CONTROL, diagnostics viewer				
Connection to controller					
SIMATIC S7 / SIMATIC WinAC	• / •				
SIMATIC S5 / SIMATIC 505	– / –				
SINUMERIK / SIMOTION	– / –				
Allen Bradley / Mitsubishi	• / •				
Modicon / Omron	• / •				
Options, application					
Sm@rtServer / audit / logon	• / • / •				
OPC-Server / Internet Explorer	• / •				
Order No.					
Comfort Panel	6AV2124-1DC01-0AX0	6AV2124-2DC01-0AX0	6AV2124-0GC01-0AX0	6AV2124-1GC01-0AX0	6AV2124-0JC01-0AX0

Starter kits*) for Comfort Panels are available via the Internet: **siemens.com/comfort-panels-starter-kits**

1) RS232 with adapter   2) integrated flash, expandable via memory card   3) Maximum brightness reduced by 50%; dimming extends MTBF (screen saver, PROFIenergy)

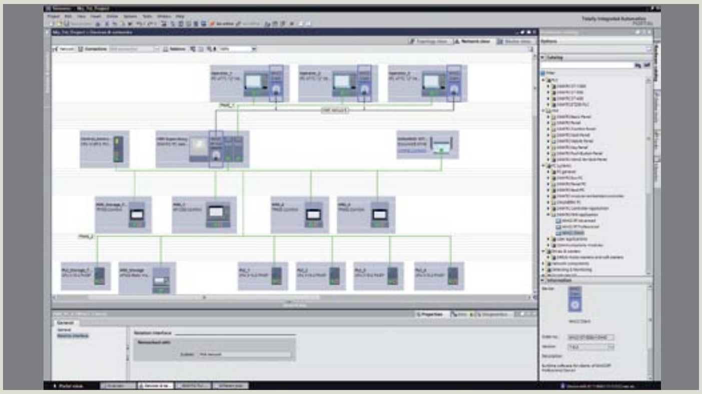
SIMATIC HMI Comfort Panels

						
KP900 Comfort	**TP1200 Comfort**	**KP1200 Comfort**	**TP1500 Comfort**	**KP1500 Comfort**	**TP1900 Comfort**	**TP2200 Comfort**
9" Key	**12" Touch**	**12" Key**	**15" Touch**	**15" Key**	**19" Touch**	**22" Touch**
	12		15		19	22
	1280 x 800				1366 x 768	1920 x 1080
80,000 h	80,000 h	80,000 h	80,000 h	80,000 h	50,000 h	30,000 h
362 x 230	330 x 241	454 x 289	415 x 310	483 x 310	483 x 337	560 x 380
Membrane keypad	Touch screen	Membrane keypad	Touch screen	Membrane keypad	Touch screen	Touch screen
26 (w. LED) / •	–	34 (w. LED) / •	–	36 (m. LED) / •	–	–
			24 MByte			
			24 MByte / 4MByte			
			2 (integr. switch) + 1			
			6000 / 32 (incl. alarm buffer)			
			750			
			4096			
			500			
			50			
			200			
6AV2124-1JC01-0AX0	6AV2124-0MC01-0AX0	6AV2124-1MC01-0AX0	6AV2124-0QC02-0AX0	6AV2124-1QC02-0AX0	6AV2124-0UC02-0AX0	6AV2124-0XC02-0AX0

*Contains SIMATIC HMI Comfort Panel, Ethernet cable 2 m, SIMATIC HMI Memory Card 2 GB, 10 cover foils (on packages with touch panel), SIMATIC WinCC Comfort, SIMATIC HMI Manual Collection tailored to the individual HMI device classes. The higher software package always includes the configuration options of the lower package. Existing projects can thus simply continue to be used when migrating to a more powerful SIMATIC HMI device. Existing investments are optimally protected.

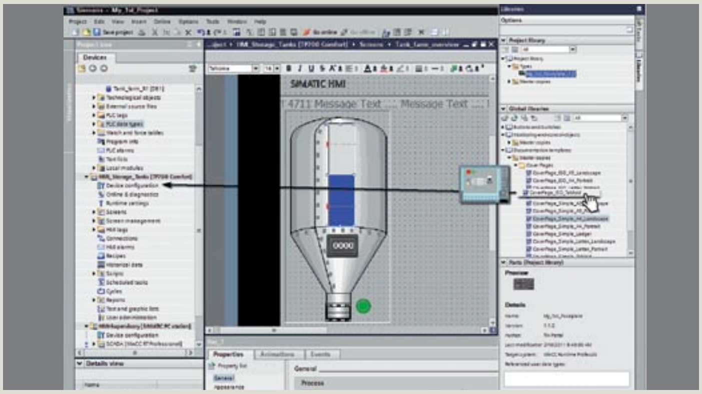
5. Reusable faceplates

- SIMATIC WinCC in the TIA Portal comprises numerous objects supporting scaling and dynamization, which facilitate the creation of faceplates and their archiving in a library.
- The faceplates can be reused throughout the project or for individual machines.
- Centralized modification control of the blocks ensures consistency.



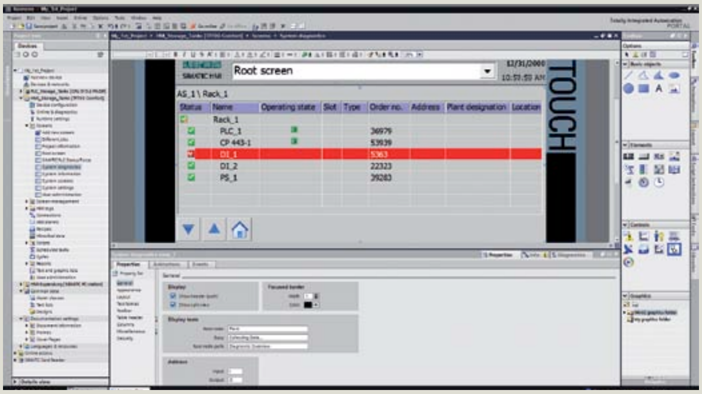
7. Clear configuration of devices and network topologies

- A core task in creating the application is configuring and parameterizing the hardware and networks.
- In the network view, the user can define connections between the different automation devices as well as the configuration of clients and servers.
- Client/server applications are also configured simply and efficiently by means of the software.



6. Comprehensive library concept

- Included and user-defined program blocks and faceplates as well as readily configured modules and devices are managed in libraries in a structured manner.
- This also applies to screens, tags, and alarms including their properties.
- They are available for further programming tasks or configurations.



8. Integrated system diagnostics

- System diagnostics is an integral element of the TIA Portal.
- Reduced engineering expenditures and minimized fault frequency through fault detection and signaling.
- Users have the option of integrating new modules by simply regenerating the hardware configuration – no further programming is required.

Model #: CP825AVRLCD

UPC: 649532108251

The Intelligent LCD Series CP825AVRLCD UPS, designed for mid- to high-end computer systems, is the only UPS in its class to feature the combined power of AVR line conditioning, multifunction LCD readout, compact footprint, and "Green UPS" cost-reducing technology.

The patented GreenPower UPS™ technology used in this UPS unit significantly reduces energy-usage and cooling costs associated with UPS power protection. In fact, the GreenPower UPS™ advanced circuitry bypass reduces energy use by up to 75% compared to a traditional UPS design. As a result, you can expect to save up to $55 annually (varies based on usage and regional kilowatt per hour costs) by using GreenPower UPS™ technology. Click here for additional information about cost-reducing GreenPower UPS™ technology.

Real-time system vitals can be viewed using this Crystal-Blue display. The unit can be conveniently mounted in a workstation cabinet, or directly on a desktop. The CP825AVRLCD guards against surges/spikes, and offers battery backup in the event of brownouts, or total power loss. The unit's unique combination of advanced energy-saving circuitry and shielded Ultra-Quiet design also make it the quietest compact UPS available for office and home office settings.

Automatic Voltage Regulation (AVR) ensures that all your electronics are receiving clean power and maintains a safe voltage level. PowerPanel Personal Edition Management Software automatically saves and closes open files and then shuts down the computer system in an intelligent and orderly manner.

The Intelligent LCD Series is also equipped with full dataline protection: RJ11/RJ45 (phone, fax, Ethernet, network, DSL) and RG-6 coax (DSS, cable modem, satellite, cable TV). “Surge-Only” outlets are perfect for the addition of peripherals such as monitors, printers, scanners, iPods, or CD/DVD players.

CyberPower stands behind its products by offering an industry-leading 3-year warranty, professional Technical Support, and a Connected Equipment Guarantee of $200,000.

- Intelligent LCD Diagnostic Display: The innovative front panel LCD can be used to display detailed information on the status of your UPS and current power conditions. The LCD displays 9 different diagnostics: Load/Current Level, Runtime, Battery Level, Battery In Use, Input Voltage, Output Voltage, Overload, Silent Mode, Normal Operation Mode.
- Automatic Voltage Regulation (AVR) - AVR technology will stabilize the AC signal and maintain a safe voltage level without switching to battery-mode. This conserves battery life, and delivers a cleaner signal to your connected equipment.
- GreenPower UPS™ - GreenPower UPS™ technology significantly reduces UPS energy costs by bypassing the AVR transformer when incoming AC power is clean. This not only dramatically reduces utility consumption, but also reduces heat dissipation and system noise.
- Ultra-Quiet UPS - The combination of an advanced ventilation design, high-end system components, and GreenPower UPS™ technology give CyberPower UPS systems the lowest sound emissions in its class. This makes our UPS perfect for desktop applications, audio/video installations, and quiet workstation environments.
- PowerPanel PE™ Smart Management Software – In event of a power outage, PowerPanel saves your open files and will hibernate your PC to increase the run-time on the UPS unit. PowerPanel is quickly and easily installed on any Windows-based PC and is designed to utilize minimal system resources. Diagnostic screens give immediate visuals of the UPS’s status, and also include system notifications, event/data logging, and scheduled shutdowns.
- 3-year Warranty - CyberPower will replace your unit if damaged within 3 years of purchase date. We stand behind our products and guarantee quality. CyberPower also offers a #1 rated technical support team that will assist you with product, installation, or warranty concerns --- Free of Charge!
- Windows Vista ™ compatible - Our Power Management software has been fully tested and is compatible with Windows 200x, Server, XP, and Vista.

Technical Specifications

General	
Model #	CP825AVRLCD
UPS Topology	Line-Interactive
Energy Saving	Yes - Green-UPS Energy Saving Technology
Input	
Voltage	90 - 140V
Frequency	57 - 63Hz
Plug Type	NEMA 5-15P
Cord Length	6 ft
Output	
VA	825
Watts	450
Automatic Voltage Regulation	Yes
On Battery Waveform	Simulated Sine Wave
Outlets - Total	8
Outlets - Battery & Surge	4 x NEMA 5-15R
Outlets - Surge-Only	4 x NEMA 5-15R
Transfer Time	4 ms
Battery	
Runtime at Full-Load	2 Minutes
Runtime at Half-Load	8 Minutes
Battery Specification	1 x 12V/9Ah
Surge Protection and Filtering	
Surge Suppression	1030 Joules
Phone / Ethernet RJ11 / RJ45	1 x RJ11/45 Combo (One-in/One-out)
Coax Protection RG6	1 x RG-6
Management & Communications	
Indicators	Multifunction LCD Readout
USB Port	1 x HID Compliant
Serial Port	None
Software	PowerPanel Personal Edition
SNMP / HTTP Remote Monitoring	Not Available
Physical	
Dimensions (WxHxD)	11" x 6.5" x 3.5"
Weight	14 lbs.
Warranty	
Product Warranty	3-year warranty. Free Tech Support.
Connected Equipment Guarantee	Lifetime
CEG Amount	$200,000

SECTION 2

DRAWINGS

REVISED
10/24/2023

8 x 20 SEABOX GENERAL ARRANGEMENT DETAIL

ENTIRE SYSTEM IS 3RD PARTY CERTIFIED

CONTROL PANEL

1. PANEL LISTING	508&698a
2. DEADFRONT	YES
3. VOLTAGE	120/208V THREE PHASE WYE
4. PHASE	3
5. AUTO RESTART	YES
6. BREAKERS IN PANEL	YES
7. HOUR METERS	YES
8. AMP METERS	NO
9. HOA AND RESET BUTTON	YES
10. OXIDIZER INTERLOCK	YES
11. PLC	SIEMENS
12. 7/24 TIMER	SIEMENS
13. SURGE PROTECTOR	YES
14. PHASE MONITOR	NO
15. PANEL TRANSFORMER	NO
16 FAN IN PANEL	NO
17. TELEMETRY	SIEMENS
18. TELEMETRY SERVICE	PRM
19. BATTERY BACKUP	YES

NOTES:

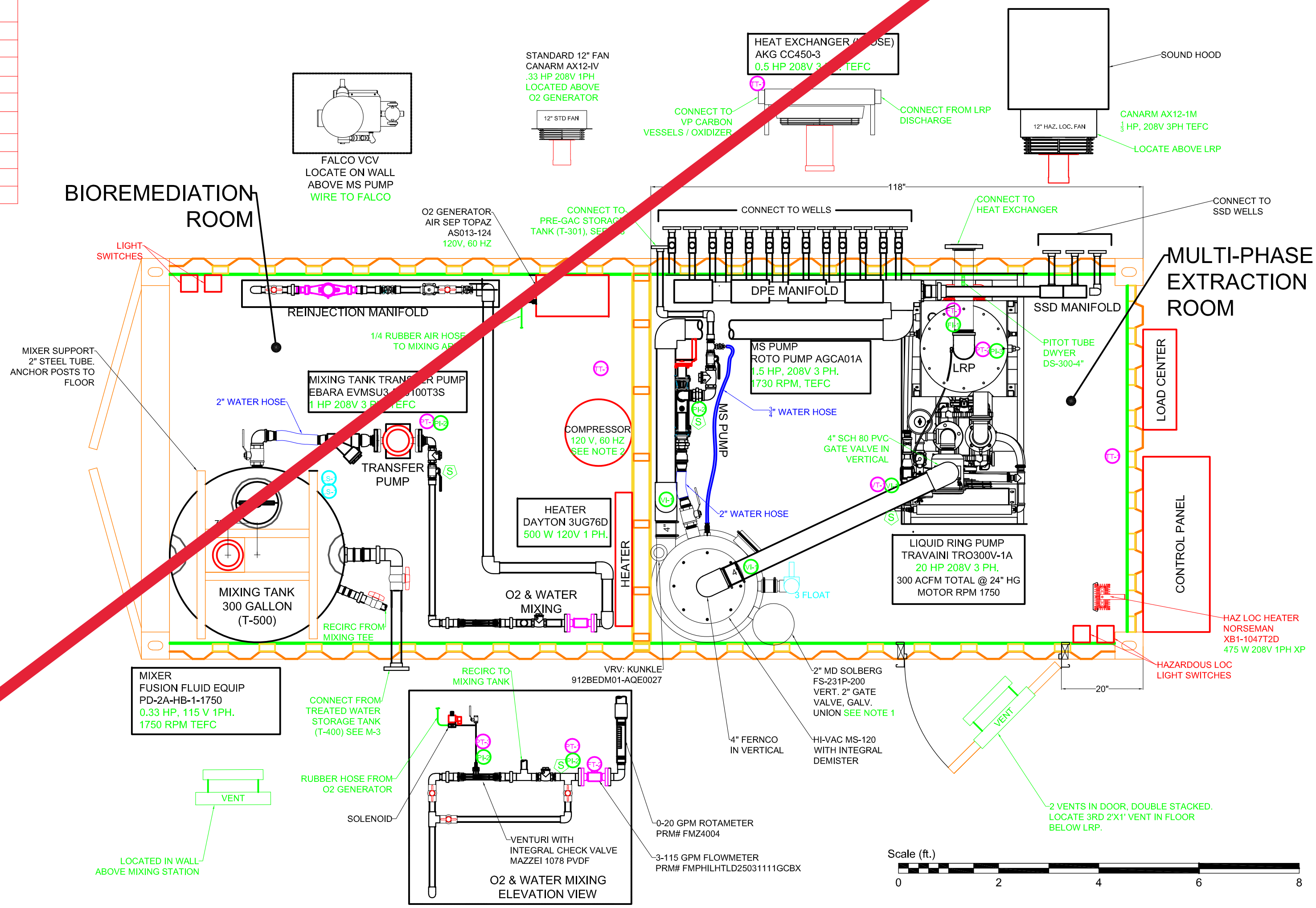
1. 1" MS TANK DRAIN LOCATED BELOW MANUAL DILUTION
2. PNEUMATIC ACTUATORS ON DPE MANIFOLD VALVES WILL BE CONNECTED TO COMPRESSOR LOCATED IN NON-HAZARDOUS SIDE.
3. WALLS & CEILING SHALL HAVE R-10 INSULATION AND WOOD FRAMING
4. HAZ. LOC. LIGHT IN MPE ROOM. STD LIGHT IN BIOREMEDIATION ROOM.
5. SOUND HOODS TO BE LOCATED OVER ALL VENTS IN MPE ROOM ONLY.
6. LIQUID RING PUMP WILL SIT ON ¾" RUBBER MAT.

LOOSE EQUIPMENT:

1. POST LRP HEAT EXCHANGER (AFTERCOOLER) TO BE PROVIDED LOOSE AND FIELD PIPED BY OTHERS.
2. FALCO 300 CATALYTIC OXIDIZER. SUPPLIED WITH SOLBERG HDL-PSG344/2-300 COALESCER TO BE INSTALLED BEFORE FALCO INLET. VCV INSTALLED IN LRP ROOM TO BE REMOVED AND RETURNED WITH FALCO AT THE END OF RENTAL.
3. VAPOR PHASE CARBON VESSELS: (2) VP-2000. EACH FILLED WITH 2000 LBS OF REACTIVATED CARBON. EACH ALSO INCLUDES 1" SS DRAINS, PRESSURE INDICATORS AND 4" ALUMINUM CAMLOCK CONNECTIONS.
3. PRE-LGAC WATER STORAGE TANK SKID (M-3).
4. TREATED WATER SKID (M-3).
5. LGAC SKID(M-4).
6. QTY 4 ANCHOR POSTS: PRM# TRAILSEABOXANCHORX

PRM PARTS LIST

PRM PARTS	DESCRIPTION	PRM #	QTY
PI-1	0-50 PSI LF GAUGE	PGCNBTY630251850PSI	0
PI-2	0-100 PSI PRES GAUGE	PGCNBTY6302514100PSI	3
PI-3	0-30"WC LF GAUGE	PGCNBTY63065530WC	1
PI-4	-15 HG- 100 PSI LF GAUGE	PGCNBTY6301515HG100PSI	1
VI-1	0-30" HG LF GAUGE	PGCNBTY630252230HG	3
TT-1	0-392 TEMP TRANSMITTER	CONTD148WD	3
PT-1	0-100 PSI PRES TRANSMITTER	PT100PSICABLE0[illegible]NPTX	2
PT-2	0-100"WC PRES TRANSMITTER	PGTLFM[illegible]WCX	1
PT-3	-15 TO 30 PSIG PRES TRANS.	PT15V[illegible]PSI24VDCX	1
VT-1	0-30" VACUUM TRANSMITTER	PT1[illegible]0HG025MNPTX	1
FT-1	0-5"WC DPT	PGTLFMI005WCX	1
FT-2	3-115 GPM FLOW TRANS.	[illegible]MPHILHTLD25031111GCBX	1
FI-1	0-5"WC DIFF PRES. GAUGE	DPGJH0005X	1
LS-1	FLOAT LEVEL SWIT[illegible]	FLSLSCF07X7X	2



PRMFiltration	Product Recovery Management Inc. This information is proprietary and confidential. No copies or reproductions allowed without the express written consent of PRM Inc.	CLIENT: GLACIER ENVIRONMENTAL SERVICES, INC PO BOX 1097 MUKILTEO, WA 98275	PROJECT TITLE: MULTI PHASE VACUUM EXTRACTION SYSTEM CIRCLE K 1461 ENVIRONMENTAL CLEANUP 2350 24TH AVE E SEATTLE, KING COUNTY, WASHINGTON 98112	SHEET TITLE: SEABOX GENERAL ARRANGEMENT	QUOTE #: PRM-9844 DATE: 08/31/23	PROJECT NUMBER: WO-8135 DRAWN BY: MTW

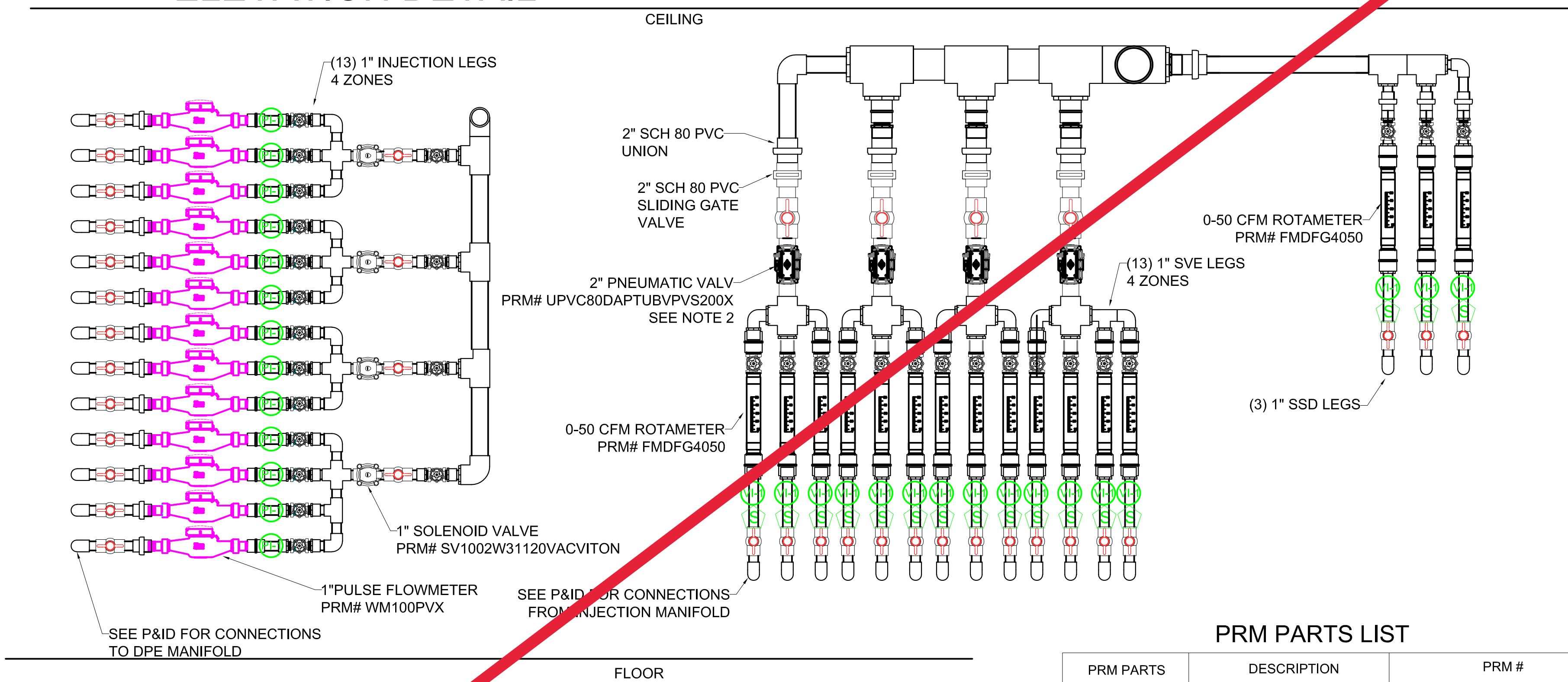
NO.	REVISION	DATE

DRAWING NUMBER: M-1

REINJECTION MANIFOLD ELEVATION DETAIL

DPE MANIFOLD ELEVATION DETAIL

SSD MANIFOLD ELEVATION DETAIL



PRM PARTS LIST

PRM PARTS	DESCRIPTION	PRM #	QTY
VI-1	0-30" HG LF GAUGE	PGCNBTY630252230HG	16
PI-1	0-30 PSI GAUGE	PGCNBTY630251230PSI	13

NOTES:

1. DPE MANIFOLD: ONE OR TWO ZONES MAY BE LOCATED ON PARTITION WALL IF EXTRA SPACE IS REQUIRED
2. COMPRESSED AIR REQUIRED FOR ACTUATION OF 2 PNEUMATIC VALVES ON DPE MANIFOLD TO BE PROVIDED BY COMPRESSOR LOCATED IN INJECTION SIDE OF SKIDBOX.

Scale (ft.)

0 2 4

PRMFiltration

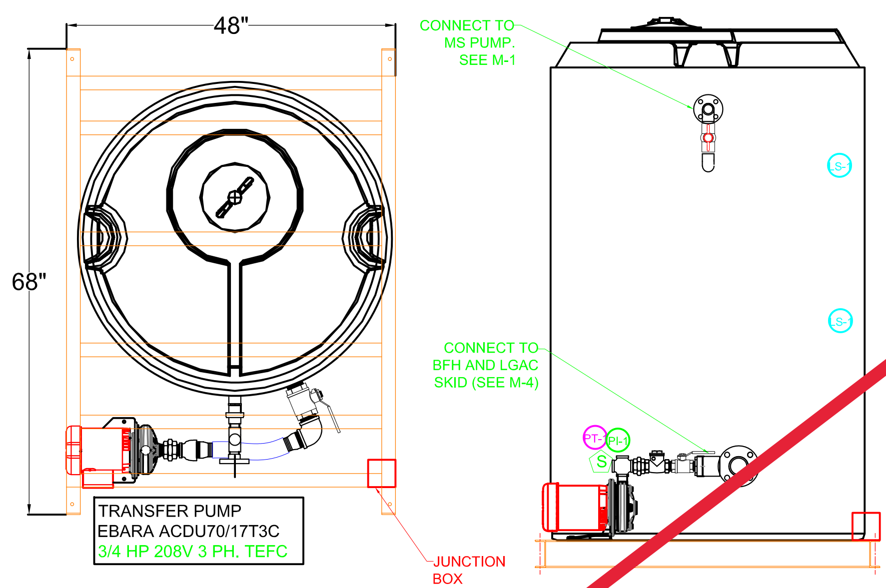
Product Recovery Management Inc.

CLIENT:	GLACIER ENVIRONMENTAL SERVICES, INC PO BOX 1097 MUKILTEO, WA 98275
PROJECT TITLE:	MULTI PHASE VACUUM EXTRACTION SYSTEM CIRCLE K 1461 ENVIRONMENTAL CLEANUP 2350 24TH AVE E SEATTLE, KING COUNTY, WASHINGTON 98112
SHEET TITLE:	REINJECTION / DPE / SSD MANIFOLD ELEVATION DETAILS
QUOTE #:	PRM-9844
PROJECT NUMBER:	WO-8135
DATE:	8-31-23
DRAWN BY:	MTW
DRAWING NUMBER:	M-2

NO.	REVISION	DATE

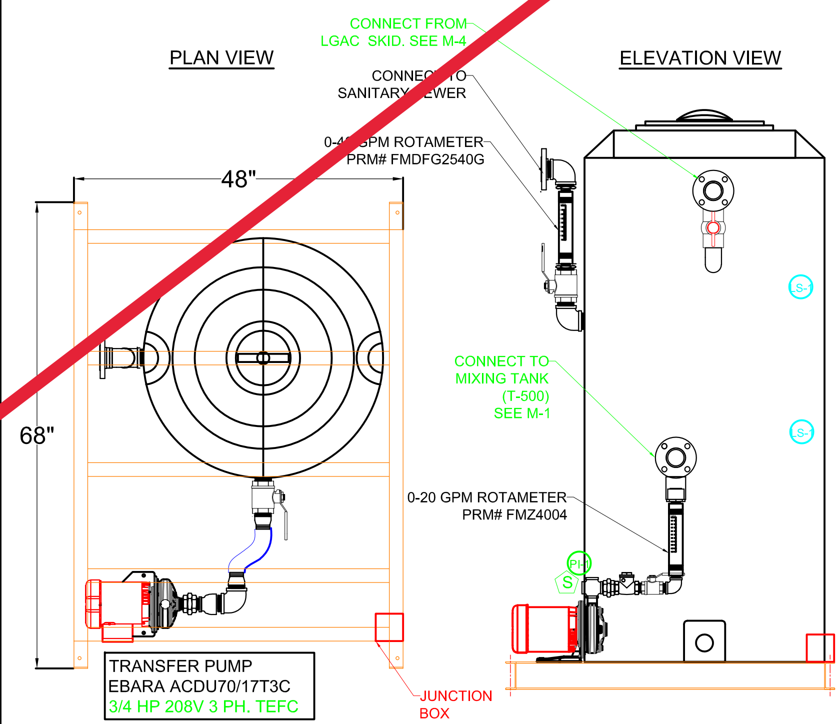
PRE-GAC WATER STORAGE TANK SKID (T-301)

500 GALLON TANK



TREATED WATER STORAGE TANK SKID (T-400)

300 GALLON TANK



NOTES:
1. TANKS ATTACH TO SKIDS VIA GUY KITS
2. PIPE SUPPORTS TO BE PROVIDED AS NEEDED
3. ALL ELECTRICAL PRE-WIRED TO JUNCTION BOX

SKID CONSTRUCTION NOTES
1. SKID PAINT DETAILS:
   1.1. PRIMER: EPOXY PRIMER (HBE-400)
   1.2. PAINT: BATTLESHIP GREY ACRYLIC URETHANE FINISH (AUE-100)
2. MATERIAL: 4X2 CS CHANNEL

PRM PARTS LIST

PRM PARTS	DESCRIPTION	PRM #	QTY
PI-1	0-50 PSI LF GAUGE	PGCNBTY630251850PSI	2
PT-1	0-50 PSI TRANSMITTER	PT50PPSI24VDCX	1
LS-1	FLOAT LEVEL SWITCH	FLSLSCF07X7X	4

Scale (ft.)
0 2 4

PRM Filtration

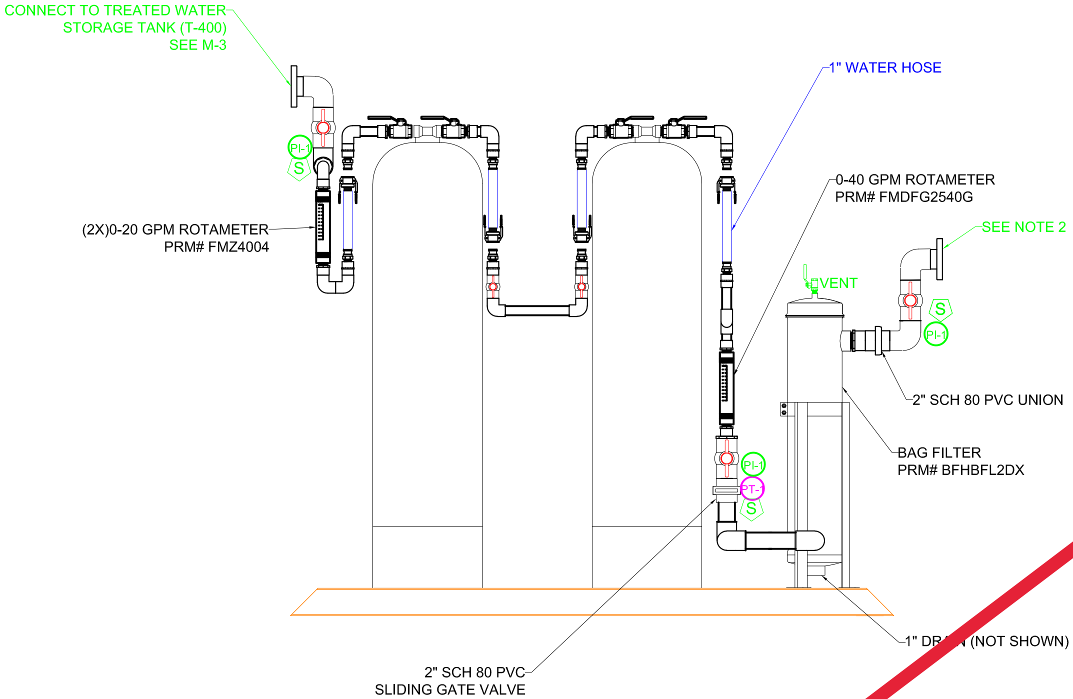
Product Recovery Management Inc.

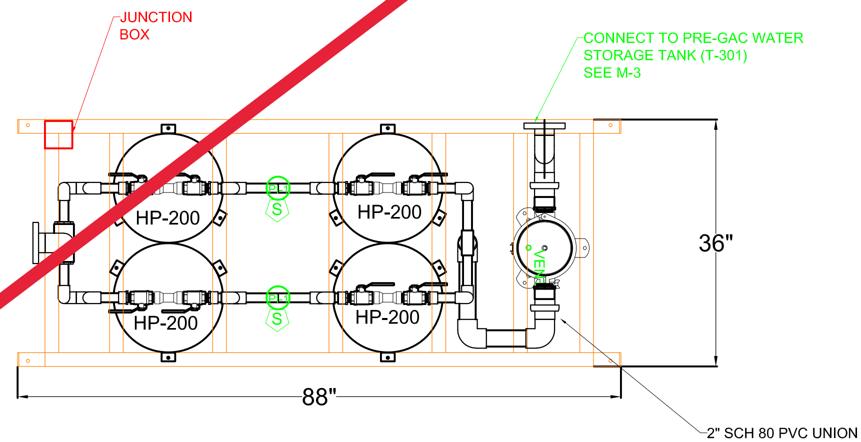
CLIENT: GLACIER ENVIRONMENTAL SERVICES, INC
PO BOX 1097
MUKILTEO, WA 98275

PROJECT TITLE: MULTI PHASE VACUUM EXTRACTION SYSTEM
CIRCLE K 1461 ENVIRONMENTAL CLEANUP
2350 24TH AVE E
SEATTLE, KING COUNTY, WASHINGTON 98112

SHEET TITLE: STORAGE TANK SKIDS

QUOTE #:	PROJECT NUMBER:	NO.	REVISION	DATE	DRAWING NUMBER:
PRM-9844	WO-8135				M-3
DATE: 08/31/23	DRAWN BY: MTW				





PRM PARTS LIST

PRM PARTS	DESCRIPTION	PRM #	QTY
PI-1	0-50 PSI LF GAUGE	PGCNBTY630251850PSI	5
PT-1	0-50 PSI TRANSMITTER	PT50PPSI24VDCX	1

NOTES:
1. PIPE SUPPORTS TO BE PROVIDED AS NEEDED
2. BAG FILTER INLET PLUMBING SHOWN ON RIGHT HAND SIDE FOR DRAWING CLARITY- SEE PLAN DETAIL.
3. ALL ELECTRICAL PRE-WIRED TO JUNCTION BOX.

SKID CONSTRUCTION NOTES
1. SKID PAINT DETAILS:
   1.1. PRIMER: EPOXY PRIMER (HBE-400)
   1.2. PAINT: BATTLESHIP GREY ACRYLIC URETHANE FINISH (AUE-100)
2. MATERIAL: 4X2 CS CHANNEL

Scale (ft.)
0 2 4

PRMFiltration

Product Recovery Management Inc.

CLIENT:
GLACIER ENVIRONMENTAL SERVICES, INC
PO BOX 1097
MUKILTEO, WA 98275

PROJECT TITLE:
MULTI PHASE VACUUM EXTRACTION SYSTEM
CIRCLE K 1461 ENVIRONMENTAL CLEANUP
2350 24TH AVE E
SEATTLE, KING COUNTY, WASHINGTON 98112

SHEET TITLE:
LGAC TREATMENT SKID

QUOTE #:	PROJECT NUMBER:
PRM-9844	WO-8135
DATE:	DRAWN BY:
08/31/23	MTW

NO.	REVISION	DATE

DRAWING NUMBER:
M-4

LINE IDENTIFICATION CODES

LINE NUMBERING

W"-XXX-YY-ZZ

- PROCESS PIPE
- PIPE SCHEDULE IF APPLICABLE
- PIPING MATERIAL
- PROCESS LINE ABBREVIATION
- LINE SIZE (INCHES)

PIPING MATERIAL IDENTIFICATION

AL	ALUMINUM
CPVC	CHLORINATED POLYVINYL CHLORIDE
CS	CARBON STEEL
COP	COPPER
CPP	CORRUGATED PLASTIC PIPE
CIP	CAST IRON PIPE
DIP	DUCTILE IRON PIPE
FH	FLEXIBLE HOSE
GAL	GALVANIZED STEEL PIPE
NYL	NYLON
PE	POLYETHYLENE PIPE
PP	POLYPROPYLENE PIPE
PVC	POLYVINYL PIPE
RUB	RUBBER HOSE
SS	STAINLESS STEEL
TEF	TEFLON TUBING

PROCESS LINE ABBREVIATIONS

AIR	AIR, ATMOSPHERIC PRESSURE
BW	BACKWASH
CA	COMPRESSED AIR
CD	CONDENSATE
CF	CHEMICAL FEED
CGW	CONTAMINATED GROUNDWATER
D	DRAIN
EFF	EFFLUENT
EXH	EXHAUST
GW	GROUNDWATER
LFG	LANDFILL GAS
NPW	NON-POTABLE WATER
P	PRODUCT
PR	PROCESS FLOW
PROP	PROPANE
PW	POTABLE WATER
S	SANITARY
SL	SLUDGE
SP	SAMPLE PORT
STS	STORM SEWER
TF	TOTAL FLUIDS
V	VENT
VAP	VAPOR

LINE CODING

- PROCESS FLOW
- PNEUMATIC SIGNAL
- WIRELESS SIGNAL

ELECTRICAL SIGNALS

- 4-20mA / LOW VOLTAGE
- LINE VOLTAGE
- IS

VALVE AND PIPING SYMBOLS

- GLOBE VALVE
- GATE VALVE
- BUTTERFLY VALVE
- CHECK VALVE
- PLUG VALVE
- 3-WAY VALVE
- ANGLE VALVE
- RELIEF VALVE/VACUUM BREAKER
- BALL VALVE
- GLOBE VALVE
- SELF-CONTAINING PRESSURE REGULATING VALVE
- NEEDLE VALVE
- BP BACKFLOW PREVENTER
- NO NORMALLY OPEN
- NC NORMALLY CLOSED
- FLEXIBLE HOSE
- FLEXIBLE COUPLING
- MOTOR DRIVEN
- BASKET TYPE STRAINER
- Y-TYPE STRAINER
- DUPLEX STRAINER
- SLEEVE COUPLING (SC)
- FLOOR DRAIN
- EQUIPMENT DRAIN
- CLEANOUT (CO)
- REMOVABLE PLUG
- REMOVABLE CAP
- EXHAUST TO ATMOSPHERE (INSIDE)
- EXHAUST TO ATMOSPHERE (OUTSIDE)
- REDUCER
- UNION
- QUICK DISCONNECT COUPLING
- BF BLIND FLANGE
- FLANGE
- DAMPER
- TEST PORT WITH ...P COCK VALVE

VALVE OPERATOR SYMBOLS

- S SOLENOID
- M MOTOR, ELECTRIC
- P PNEUMATIC
- DIAPHRAGM WITH POSITIONER
- HANDWHEEL OR LEVER
- CHAINWHEEL

PRIMARY ELEMENT SYMBOLS - FLOW

- ORIFICE PLATE
- PITOT TUBE
- THERMAL MASS FLOW METER
- ROTOMETER
- FLUME
- WEIR
- TURBINE OR PROPELLOR TYPE METER
- MAGNETIC FLOW METER
- TOTALING FLOW METER

EQUIPMENT SYMBOLS

- PUMP
- PNEUMATIC DIAPHRAGM PUMP
- LIQUID RING VACUUM PUMP
- BLOWER
- AIR COMPRESSOR
- POSITIVE DISPLACEMENT PUMP
- SCREW COMPRESSOR

INSTRUMENT IDENTIFICATION

FIT 100A

FIT-100A

- SUFFIX (NOT NORMALLY USED)
- LOOP NUMBER
- SUCCEEDING LETTERS
- FIRST LETTER

FUNCTIONAL ABBREVIATIONS

DO	DISSOLVED OXYGEN	OC	OPEN-CLOSE
FC	FAIL CLOSED	OO	ON-OFF (MAINTAINED)
FI	FAIL INTERMINATE	ORP	OXIDATION REDUCTION POTENTIAL
FL	FAIL LOCKED	OSC	OPEN-STOP-CLOSE (MOMENTARY)
FO	FAIL OPEN	SS	START-STOP (MONENTARY)
HOA	HAND-OFF-AUTOMATIC	>	HIGH SELECT
I/I	CURRENT-TO-CURRENT	<	LOW SELECT
I/P	CURRENT-TO-PNEUMATIC		
LEL	LOWER EXPLOSIVE LIMIT		
LR	LOCAL-REMOTE		

S SAMPLE PORT

GENERAL INSTRUMENT SYMBOLS

- LOCALLY MOUNTED
- FRONT-OF PANEL MOUNTED
- BACK-OF-PANEL MOUNTED
- I INTERLOCK
- P PURGE
- PLC FUNCTION BLOCK

INSTRUMENT IDENTIFICATION TABLE

	FIRST LETTER		SUCCEEDING LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER FLAME				
C	CONDUCTIVITY			CONTROL	CLOSE
D	DENSITY (SP, GR)	DIFFERENTIAL		DRIVE	
E	VOLTAGE		PRIMARY ELEMENT		
F	FLOW RATE	RATIO			
G	GAUGING (DIMENSIONAL)		GLASS		
H	HAND (MANUAL)				HIGH
I	CURRENT		INDICATE		
J	POWER	SCAN			
K	TIME OR SCHEDULE			CONTROL STATION	
L	LEVEL		LIGHT (PILOT)		LOW
M	MOISTURE OR HUMIDITY				MIDDLE
N					
O			ORIFICE		OPEN
P	PRESSURE		POINT (TEST)		
Q	QUANT. OR EVENT	INTEGRATE			
R	RADIOACTIVITY		RECORD OR PRINT		
S	SPEED OR FREQ.	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	ULTRAVIOLET		MULTIFUNCTION		
V	VACUUM	VISCOSITY		VALVE OR DAMPER	
W	WEIGHT OR FORCE		WELL		
X	THERMOCOUPLE		UNCLASSIFIED		
Y	VIBRATION			RELAY OR COMPUTE	
Z	POSITION			DRIVE, ACTUATE	

Product Recovery Management Inc.

CLIENT: GLACIER ENVIRONMENTAL SERVICES, INC
PO BOX 1097
MUKILTEO, WA 98275

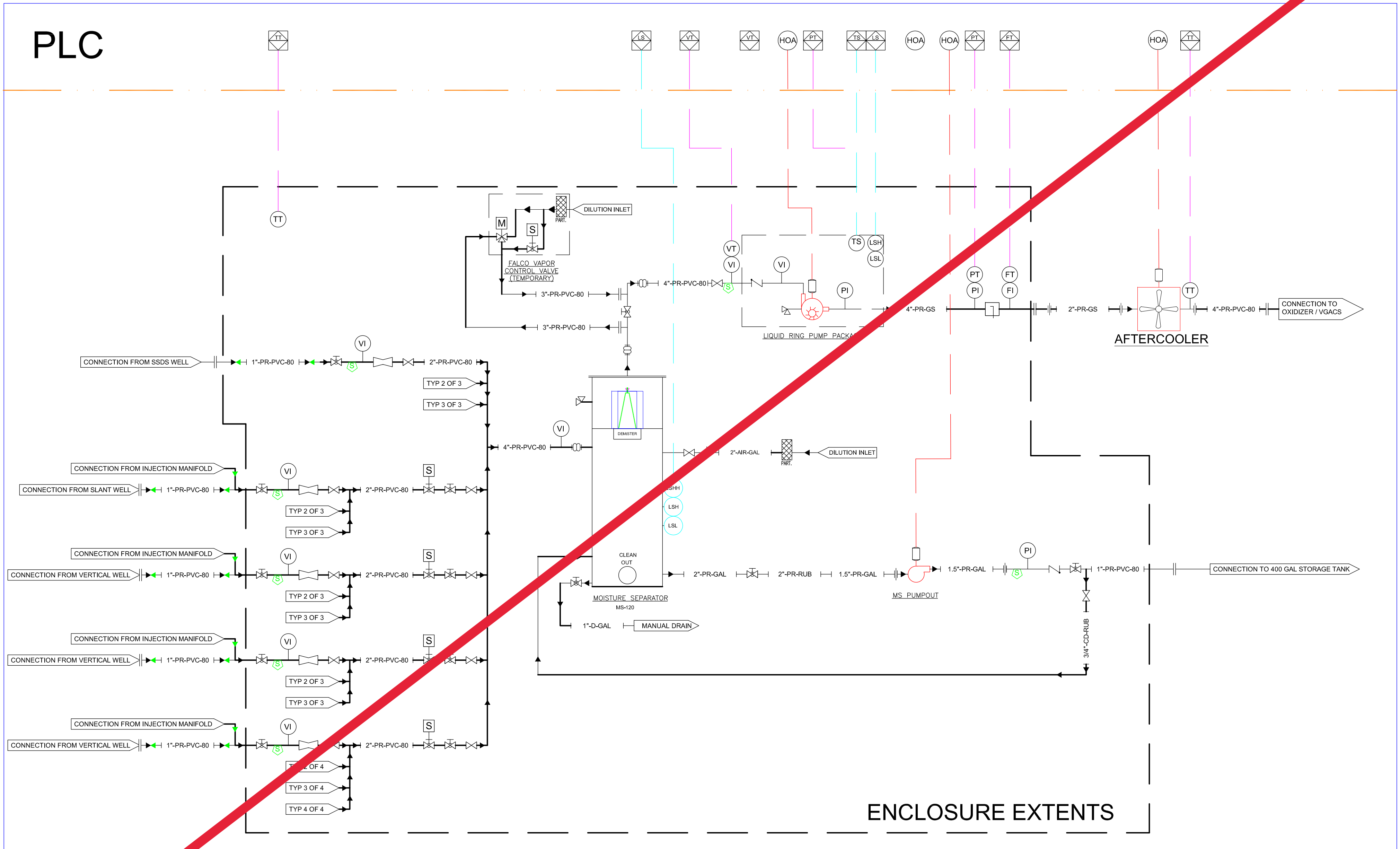
PROJECT TITLE: MULTI PHASE VACUUM EXTRACTION SYSTEM
CIRCLE K 1461 ENVIRONMENTAL CLEANUP
2350 24TH AVE E
SEATTLE, KING COUNTY, WASHINGTON 98112

SHEET TITLE: PROCESS & INSTRUMENTATION DIAGRAM LEGEND

QUOTE #:	PROJECT NUMBER:
PRM-9844	WO-8135
DATE: 08/31/23	DRAWN BY: MTW

NO.	REVISION	DATE

DRAWING NUMBER: P&ID-1

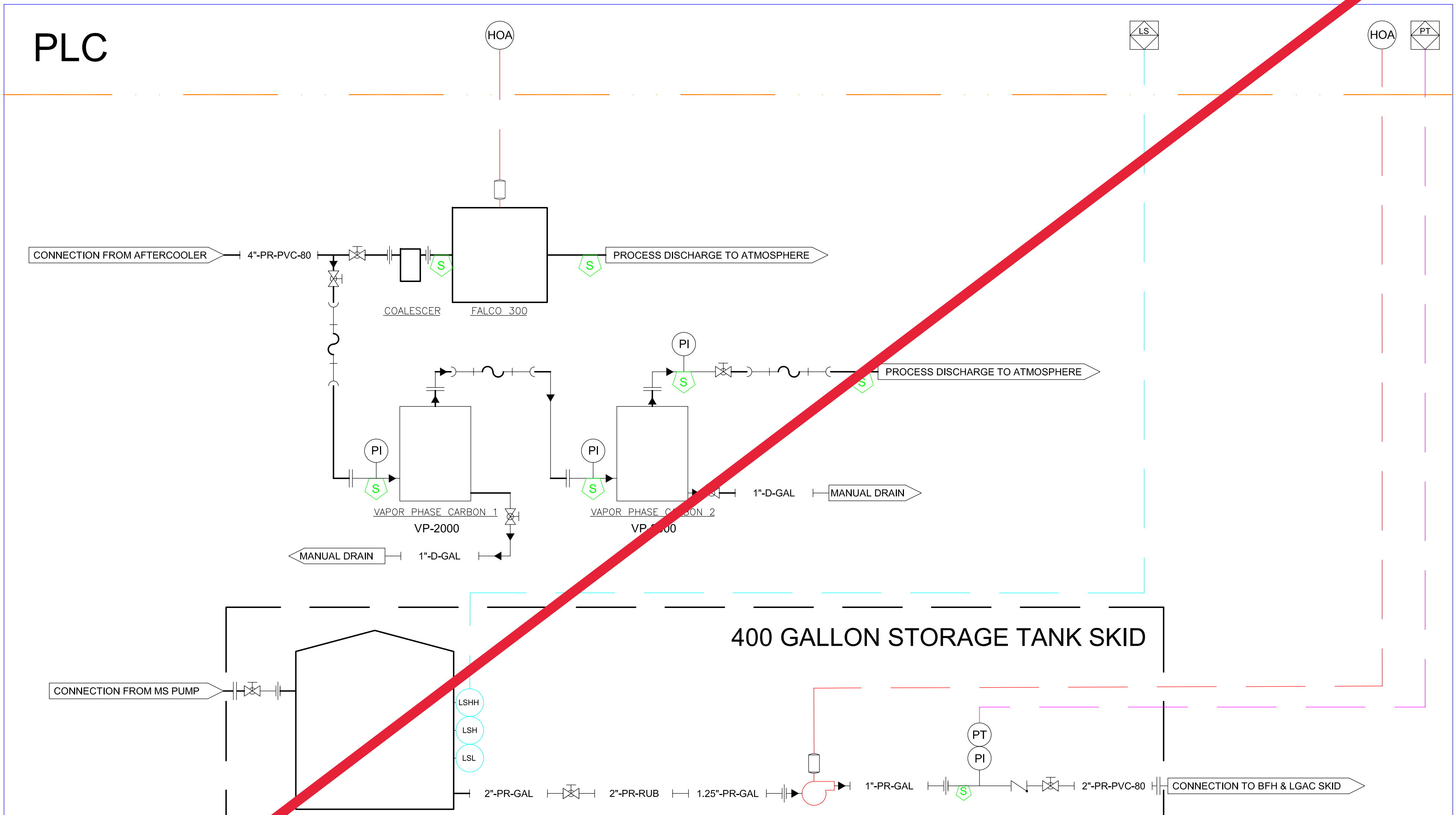


PRMFiltration

Product Recovery Management Inc.

CLIENT:	GLACIER ENVIRONMENTAL SERVICES, INC PO BOX 1097 MUKILTEO, WA 98275
PROJECT TITLE:	MULTI PHASE VACUUM EXTRACTION SYSTEM CIRCLE K 1461 ENVIRONMENTAL CLEANUP 2350 24TH AVE E SEATTLE, KING COUNTY, WASHINGTON 98112
SHEET TITLE:	PROCESS & INSTRUMENTATION INLET MANIFOLDS, MS TANK, & LRP
QUOTE #:	PRM-9844
PROJECT NUMBER:	WO-8135
DATE:	07/10/23
DRAWN BY:	LXL
DRAWING NUMBER:	P&ID-2

NO.	REVISION	DATE

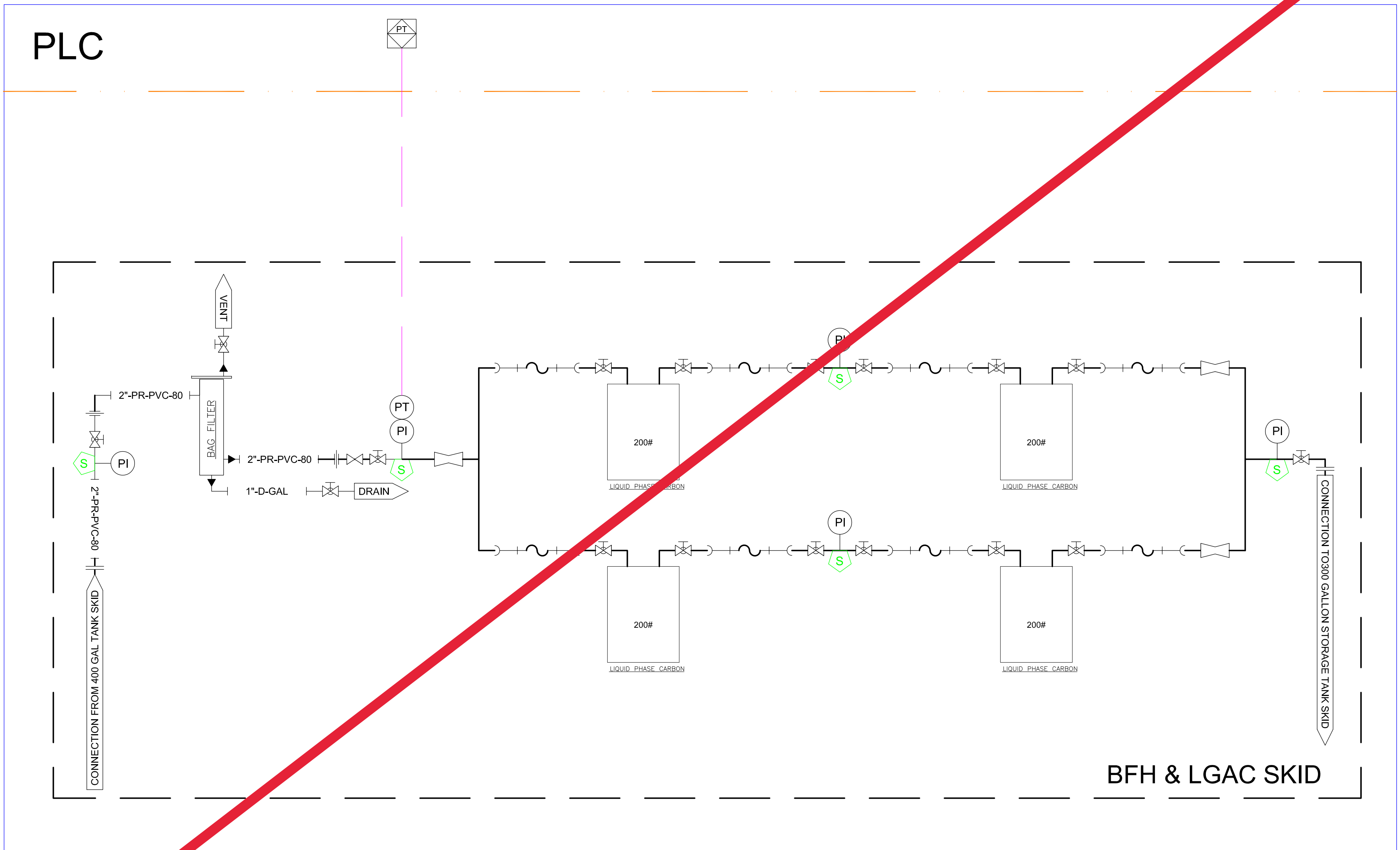


NOTES:
1. PRM IS NOT RESPONSIBLE FOR MAKING CONNECTIONS TO/FROM/BETWEEN FALCO AND CARBON VESSELS

PRMFiltration

CLIENT:	GLACIER ENVIRONMENTAL SERVICES, INC PO BOX 1097 MUKILTEO, WA 98275
PROJECT TITLE:	MULTI PHASE VACUUM EXTRACTION SYSTEM CIRCLE K 1461 ENVIRONMENTAL CLEANUP 2350 24TH AVE E SEATTLE, KING COUNTY, WASHINGTON 98112
SHEET TITLE:	PROCESS & INSTRUMENTATION VGACs & 400 GALLON STORAGE TANK SKID
QUOTE #:	PRM-9844
PROJECT NUMBER:	WO-8135
DATE:	07/10/23
DRAWN BY:	LXL
DRAWING NUMBER:	P&ID-3

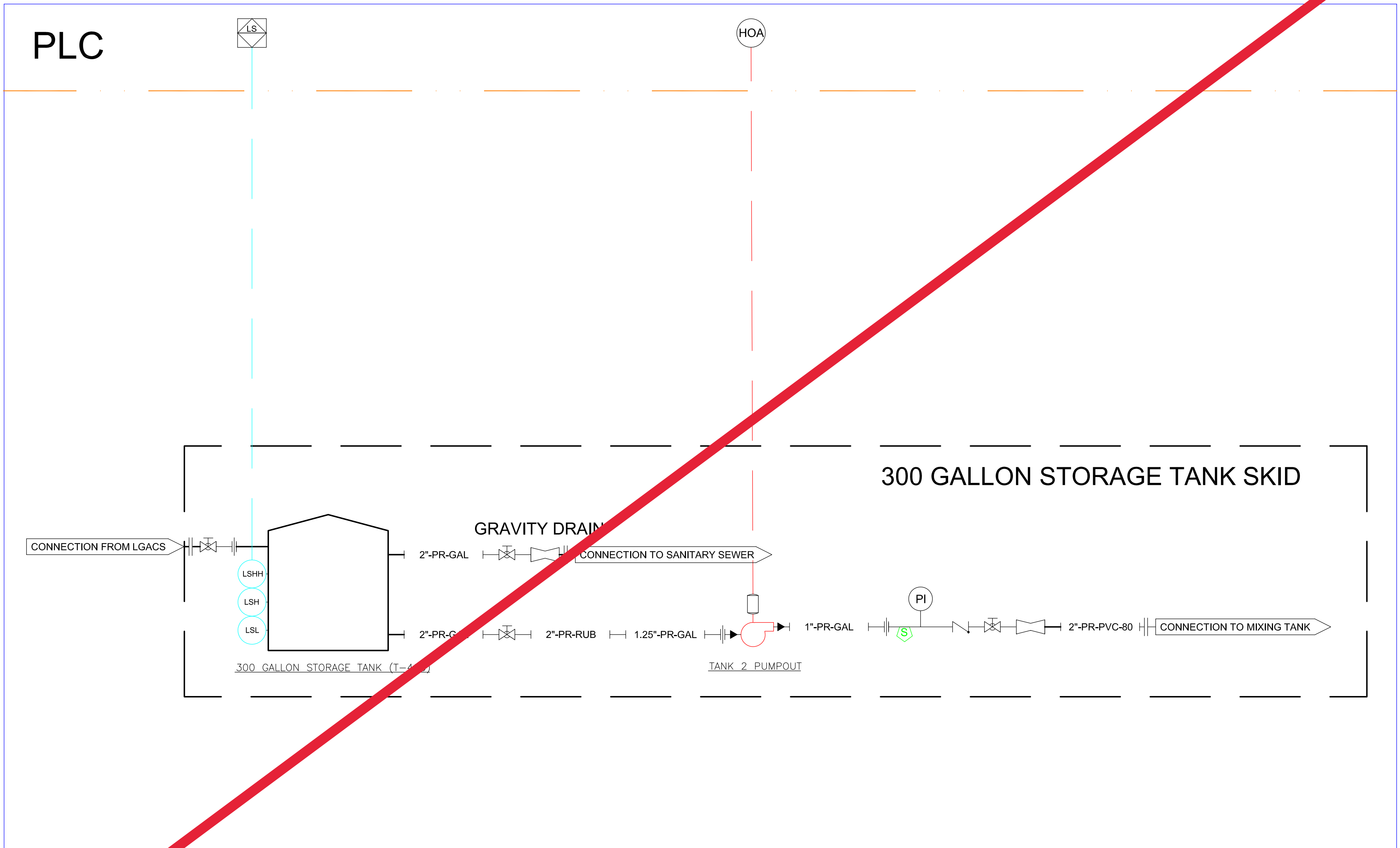
NO.	REVISION	DATE



PRM Filtration

Product Recovery Management Inc.

CLIENT:	PROJECT TITLE:	SHEET TITLE:	QUOTE #:	PROJECT NUMBER:	DATE:	DRAWN BY:	NO.	REVISION	DATE	DRAWING NUMBER:
GLACIER ENVIRONMENTAL SERVICES, INC PO BOX 1097 MUKILTEO, WA 98275	MULTI PHASE VACUUM EXTRACTION SYSTEM CIRCLE K 1461 ENVIRONMENTAL CLEANUP 2350 24TH AVE E SEATTLE, KING COUNTY, WASHINGTON 98112	PROCESS & INSTRUMENTATION BFH & LGAC SKID	PRM-9844	WO-8135	08/31/23	MTW				P&ID-4



PRM Filtration

Product Recovery Management Inc.
This information is proprietary and confidential. No copies or reproductions allowed without the express written consent of PRM Inc.

CLIENT:
GLACIER ENVIRONMENTAL SERVICES, INC
PO BOX 1097
MUKILTEO, WA 98275

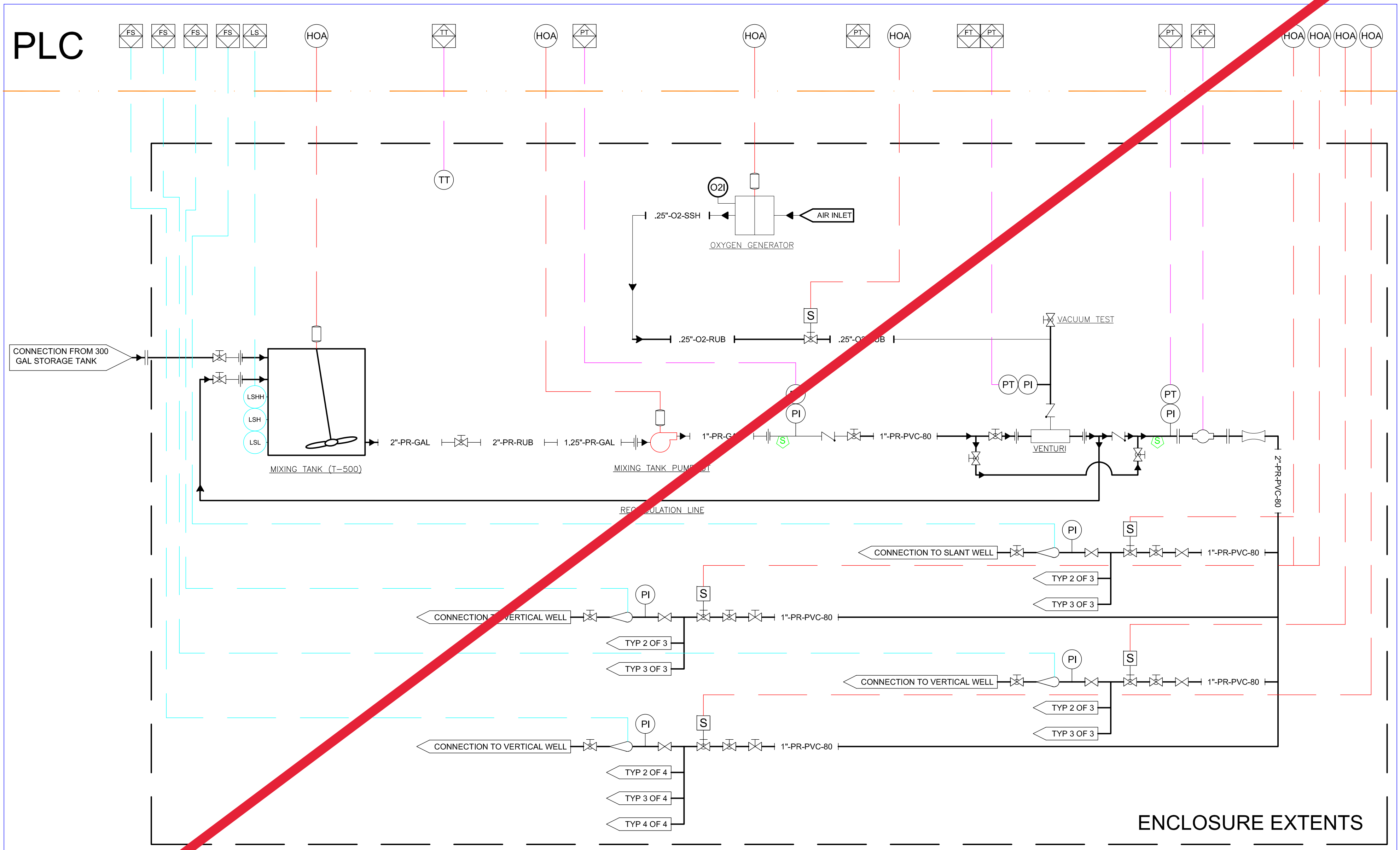
PROJECT TITLE:
MULTI PHASE VACUUM EXTRACTION SYSTEM
CIRCLE K 1461 ENVIRONMENTAL CLEANUP
2350 24TH AVE E
SEATTLE, KING COUNTY, WASHINGTON 98112

SHEET TITLE:
PROCESS & INSTRUMENTATION 300 GALLON STORAGE TANK SKID

QUOTE #:	PROJECT NUMBER:
PRM-9844	WO-8135
DATE: 08/31/23	DRAWN BY: MTW

NO.	REVISION	DATE

DRAWING NUMBER: P&ID-5



PRM Filtration

Product Recovery Management Inc.

CLIENT: GLACIER ENVIRONMENTAL SERVICES, INC PO BOX 1097 MUKILTEO, WA 98275	PROJECT TITLE: MULTI PHASE VACUUM EXTRACTION SYSTEM CIRCLE K 1461 ENVIRONMENTAL CLEANUP 2350 24TH AVE E SEATTLE, KING COUNTY, WASHINGTON 98112	SHEET TITLE: PROCESS & INSTRUMENTATION BIO-REMEDIATION	QUOTE #: PRM-9844	PROJECT NUMBER: WO-8135	NO.	REVISION	DATE	DRAWING NUMBER: P&ID-6
			DATE: 08/31/23	DRAWN BY: MTW				

SECTION 3

OPERATIONS AND MAINTENANCE

SECTION 4

SIGNATURE PAGE

PRM CORPORATE
200 20th Street
Butner, North Carolina 27509
(919) 957-8890
(888) TREAT-IT (873-2848)
(919) 957-7230 Fax
www.prmfiltration.com

To: Glacier Environmental Services, Inc.

Date: September 5, 2023

RE: Multi-Phase Extraction System

Client ID:

Submittal Approval:

- ☐ Approved without Changes
- ☐ Approved as noted
- ☐ Revise and resubmit
- ☐ Other, Please note:

Signature: ______________________

Print Name: ____________________

Title: _________________________

Date: _________________________

System production starts from this date.

Comments:

____

____

____

____

Sent to: Chris Phillips

Please return via email to chris.phillips@prmfiltration.com. System fabrication will not begin until this form has been returned to PRM. Please contact me via phone at (919) 957-8890 to confirm receipt of the submittal form.

PRMFiltration SPARTOX™

- **Remediation Systems**
- **Air Strippers**
- **Oil Water Separators**
- **Thermal Oxidizers**
- **Vapor Extraction**
- **Air Sparging**
- **Dual Phase Extraction**
- **Total Fluids Recovery**
- **Pumps**
- **Landfill Gas Equipment**
- **Skimmers**
- **Bailers**
- **Sampling Supplies**

Submittal Approval Sheet

KJ Notes:

1. PRM confirms there is a virtual Emergency stop on the HMI, labeled "system stop".

2. PRM confirms there is a run time meter for the LRP (B-301) on the HMI.

Type	Reset	Sensor Type	User Selectable	Action	Email Notification	Shutdown	Triggered by
LRP B-301 VACUUM ALARM LOW (B-301)	AUTO RESET WITH 30SEC DELAY	4-20ma	YES	Visual Alarm	YES	ALARM NOTIFICATION ONLY	VT-300 SET POINT
LRP VACUUM ALARM HIGH (B-301)	LATCH WITH MANUAL RESET	4-20ma	YES	Visual Alarm	YES	LRP BLOWER SHUTDOWN	VT-300 SET POINT
LRP DISCHARGE PRESSURE HIGH (B-301) (for Vapor carbon/Falco unit)	LATCH WITH MANUAL RESET	4-20ma	YES	Visual Alarm	YES	LRP BLOWER SHUTDOWN	PT-302
POST HEX-301 HIGH TEMP ALARM	LATCH WITH MANUAL RESET	4-20ma	YES	Visual Alarm	YES	LRP BLOWER SHUTDOWN	TT-302
TRANSFER PUMP DISCH HIGH PRESS (P-400)	LATCH WITH MANUAL RESET	4-20ma	YES	Visual Alarm	YES	TRANSFER PUMP P-400 SHUTDOWN	PT-400
PRE CARBON HIGH PRESSURE ALARM (for liquid carbon)	LATCH WITH MANUAL RESET	4-20ma	YES	Visual Alarm	YES	LRP BLOWER SHUTDOWN	PT-401
MIXING TANK PMP HIGH DISCHARGE PRESS (P-500)	LATCH WITH MANUAL RESET	4-20ma	YES	Visual Alarm	YES	TRANSFER PUMP P-500 SHUTDOWN	PT-501
OXYGEN FEED HIGH PRESSURE ALARM	LATCH WITH MANUAL RESET	4-20ma	YES	Visual Alarm	YES	System Shutdown	PT-502 SET POINT
OXYGEN FEED LOW PRESSURE ALARM	AUTO RESET WITH 30SEC DELAY	4-20ma	YES	Visual Alarm	YES	System Shutdown	PT-502 SET POINT
POST VENTURI HIGH PRESSURE ALARM	LATCH WITH MANUAL RESET	4-20ma	YES	Visual Alarm	YES	shut off mixing pump P-500 SHUTDOWN	PT-503 SET POINT
POST VENTURI LOW PRESSURE ALARM	AUTO RESET WITH 30SEC DELAY	4-20ma	YES	Visual Alarm	YES	indication only ALARM NOTIFICATION ONLY	PT-503 SET POINT
EXTRACTION ROOM HIGH TEMP ALARM	LATCH WITH MANUAL RESET	4-20ma	YES	Visual Alarm	YES	System Shutdown	TT-100 SET POINT
EXTRACTION ROOM LOW TEMP ALARM	LATCH WITH MANUAL RESET	4-20ma	YES	Visual Alarm	YES	System Shutdown	TT-100 SET POINT
BIOREMEDIATION RM HIGH TEMP ALARM	LATCH WITH MANUAL RESET	4-20ma	YES	Visual Alarm	YES	System Shutdown	TT-500 SET POINT
BIOREMEDIATION RM LOW TEMP ALARM	LATCH WITH MANUAL RESET	4-20ma	YES	Visual Alarm	YES	System Shutdown	TT-500 SET POINT
MS HIGH HIGH LEVEL ALARM (T-300)	AUTO RESET WITH LOW LEVEL ALARM	DIGITAL INPUT	NO	Visual Alarm	YES	LRP BLOWER SHUTDOWN	LSHH-300
LRP HIGH TEMP SWITCH (B-301)	LATCH WITH MANUAL RESET	DIGITAL INPUT	NO	Visual Alarm	YES	LRP BLOWER SHUTDOWN	INTERNAL TEMP SWITCH ON LRP
LRP LOW OIL SWITCH (B-301)	LATCH WITH MANUAL RESET	DIGITAL INPUT	NO	Visual Alarm	YES	LRP BLOWER SHUTDOWN	INTERNAL LEVEL SWITCH ON LRP
LRP HIGH OIL SWITCH (B-301)	LATCH WITH MANUAL RESET	DIGITAL INPUT	NO	Visual Alarm	YES	LRP BLOWER SHUTDOWN	INTERNAL LEVEL SWITCH ON LRP
STORAGE TANK HIGH LEVEL (T-301)	LATCH WITH MANUAL RESET	DIGITAL INPUT	NO	Visual Alarm	YES	TRANSFER PUMP P-300 SHUTDOWN	LSHH-301
STORAGE TANK HIGH LEVEL (T-400)	LATCH WITH MANUAL RESET	DIGITAL INPUT	NO	Visual Alarm	YES	TRANSFER PUMP P-400 SHUTDOWN	LSHH-400
MIXING TANK HIGH LEVEL (T-500)	LATCH WITH MANUAL RESET	DIGITAL INPUT	NO	Visual Alarm	YES	TRANSFER PUMP P-401 SHUTDOWN	LSHH-500
MOTOR OVERLOAD ALARM	RESET ON OVERLOAD	DIGITAL INPUT	NO	Visual Alarm	YES	System Shutdown	OL1 THRU OL8, LOCATED IN PANEL
FALCO READY	AUTO ON WITH FALCO READY SIGNAL	DIGITAL INPUT	NO	Visual Alarm	NO	READY SIGNAL FOR LFG	SEE FALCO FOR FAULT

GLACIER8135

Project							
Name:	GLACIER8135	**Creation time:**	5/2/2012 6:54:46 PM	**Last change**	3/29/2024 5:50:01 PM	**Author:**	klc
Last modified by:	klc	**Version:**					
Comment:							

Operating system	
Name	**Description**
Operating system	Microsoft Windows 10 Pro
Version of the operating system	6.3.9600.0
Operating system service pack	
Version of the Internet Explorer	11.3636.19041.0
Computer name	PRMW47
User name	PRMW47\klc
Installation path of the TIA Portal	C:\Program Files\Siemens\Automation\Portal V15

Components		
Name	**Version**	**Release**
TIA Portal Multiuser Server V14 - TIA Portal Multiuser Server Single Setup-Package V14.0 SP1 (MUSERVERV14)	V14.0 + SP1	V14.00.01.00_12.01.00.01
TIA Portal Multiuser Server V15 - TIA Portal Multiuser Server Single Setup-Package V15.0 Upd3 (MUSERVERV15)	V15.0 + Upd3	V15.00.00.03_04.01.00.01
TIA Portal Project Server V17 - TIA Portal Project Server Single SetupPackage V17.0 (MUSERVERV17)	V17.0	V17.00.00.00_43.02.00.01
TIA Administrator - AWB Licensing Module V1.0 + SP4 (TIAADMIN)	V1.0 + SP4	V01.00.04.00_01.18.00.04
TIA Administrator - AWB Software Management V1.0 + SP4 (TIAADMIN)	V1.0 + SP4	V01.00.04.00_01.18.00.04
TIA Administrator - TIA UMC Agent Configurator Module V1.0 + SP4 (TIAADMIN)	V1.0 + SP4	V01.00.04.00_01.18.00.04
TIA Administrator - TIA Administrator V1.0 SP4 (TIAADMIN)	V1.0 + SP4	V01.00.04.00_01.18.00.04
Totally Integrated Automation Portal V15 - TIA Portal Single SetupPackage V15.0 (TIAP15)	V15.0 UPD1	V15.00.00.01_03.01.00.01
Siemens Totally Integrated Automation Portal V15 - HM All Editions Single SetupPackage V15.0 UPD1 (TIAP15)	V15.0 UPD1	V15.00.00.01_03.01.00.01
Siemens Totally Integrated Automation Portal V15 - HM NoBasic Single Se-tupPackage V15.0 UPD1 (TIAP15)	V15.0 UPD1	V15.00.00.01_03.01.00.01
Siemens Totally Integrated Automation Portal V15 - Hardware Support Base Package 0 V15.0 (TIAP15)	V15.0	V15.00.00.00_01.01.00.02
Siemens Totally Integrated Automation Portal V15 - Multiuser Client Single SetupPackage V15.0 + Upd1 (TIAP15)	V15.0 + Upd1	V15.00.00.01_03.01.00.01
Siemens Totally Integrated Automation Portal V15 - Startdrive G110M, G120, G120C, G120D, G120P V15.0 + Upd1 (TIAP15)	V15.0 + Upd1	V15.00.00.01_17.01.00.03
Siemens Totally Integrated Automation Portal V15 - Startdrive Hardware Support Base Package 1 V15.0 (TIAP15)	V15.0	V15.00.00.00_47.00.00.00
Siemens Totally Integrated Automation Portal V15 - Startdrive Hardware Support Base Package 1 V15.0 (TIAP15)	V15.0	V15.00.00.00_47.00.00.00
Siemens Totally Integrated Automation Portal V15 - STARTDRIVE-COMMON V15.0 + Upd1 (TIAP15)	V15.0 + Upd1	V15.00.00.01_17.01.00.03
Siemens Totally Integrated Automation Portal V15 - STARTDRIVE-COMMON-SAT V15.0 + Upd1 (TIAP15)	V15.0 + Upd1	V15.00.00.01_17.01.00.03
Siemens Totally Integrated Automation Portal V15 - Startdrive G130, G150, S120, S150, SINAMICS MV V15.0 + Upd1 (TIAP15)	V15.0 + Upd1	V15.00.00.01_17.01.00.03
Siemens Totally Integrated Automation Portal V15 - STEP 7 Single Setup-Package V15.0 UPD1 (TIAP15)	V15.0 UPD1	V15.00.00.01_03.01.00.01
Siemens Totally Integrated Automation Portal V15 - Hardware Support Base Package 02 V15.0 (TIAP15)	V15.0	V15.00.00.00_01.01.00.02
Siemens Totally Integrated Automation Portal V15 - Hardware Support Base Package 03 V15.0 (TIAP15)	V15.0	V15.00.00.00_01.01.00.02
Siemens Totally Integrated Automation Portal V15 - Hardware Support Base Package 04 V15.0 (TIAP15)	V15.0	V15.00.00.00_01.01.00.02
Siemens Totally Integrated Automation Portal V15 - Support Base Package TO-01 V15.0 (TIAP15)	V15.0	V15.00.00.00_01.01.00.02
Siemens Totally Integrated Automation Portal V15 - Support Base Package TO-02 V15.0 (TIAP15)	V15.0	V15.00.00.00_01.01.00.02
Siemens Totally Integrated Automation Portal V15 - Hardware Support Base Package WCF-01 V15.0 (TIAP15)	V15.0	V15.00.00.00_01.01.00.02
Siemens Totally Integrated Automation Portal V15 - TIACOMPCHECK Single SetupPackage V15.0 + Upd1 (TIAP15)	V15.0 + Upd1	V15.00.00.01_03.01.00.01
Siemens Totally Integrated Automation Portal V15 - Simatic Single Setup-Package V15.0 UPD1 (TIAP15)	V15.0 UPD1	V15.00.00.01_03.01.00.01
Siemens Totally Integrated Automation Portal V15 - WinCC Single Setup-Package V15.0 UPD1 (TIAP15)	V15.0 UPD1	V15.00.00.01_03.01.00.01
Siemens Totally Integrated Automation Portal V15 - Openness SetupPack-age V15.0 + Upd1 (TIAP15)	V15.0 + Upd1	V15.00.00.01_03.01.00.01
Siemens Totally Integrated Automation Portal V15 - WinCC Transfer Current All Single SetupPackage V15.0 UPD1 (TIAP15)	V15.0 UPD1	V15.00.00.01_03.01.00.01
Siemens Totally Integrated Automation Portal V15 - WinCC Transfer Current CAP Single SetupPackage V15.0 UPD1 (TIAP15)	V15.0 UPD1	V15.00.00.01_03.01.00.01
Siemens Totally Integrated Automation Portal V15 - WinCC Transfer Manda-tory Single SetupPackage V15.0 UPD1 (TIAP15)	V15.0 UPD1	V15.00.00.01_03.01.00.01
User Management Component - UserManagementComponentx64 V2.9 SP3 (UMC64)	V2.9 + SP3	V02.09.03.00_12.03.00.03
User Management Component - umtrayiconx64 V2.9 + SP3 (UMC64)	V2.9 + SP3	V02.09.03.00_12.03.00.03
WinCC Runtime Advanced V17.0 - SIMATIC WinCC Runtime Advanced V17.0 (HMIRTM_V11)	V17.0	V17.00.00.00_43.02.00.01
WinCC Runtime Advanced V17.0 - HMIRTM Tagging Package 01 Single Se-tupPackage V17.0 (HMIRTM_V11)	V17.0	V17.00.00.00_43.02.00.01
Migration Tool TIA V16.0 - MIGTOOL Single SetupPackage V16.0 (MIG16)	V16.0	V16.00.00.00_31.02.00.01

Name	Version	Release
Siemens Migration Tool TIA V16.0 - STEP 7 Safety Option Migration Setup-Package V16.0 (MIG16)	V16.0	V16.00.00.00_31.02.00.01
Siemens Totally Integrated Automation Portal V15 - Simatic Single Setup-Package 32 Bit V15.0 (TIAP15)	V15.0	V15.00.00.00_26.01.00.01
Siemens Totally Integrated Automation Portal V15 - WinCC Single Setup-Package 32 Bit V15.0 (TIAP15)	V15.0	V15.00.00.00_26.01.00.01
SIMATIC HMI License Manager Panel Plugin (x64)	17.0.0.0	V17.00.00.00_43.02.00.01
SIMATIC WinCC Runtime Advanced Driver (x64)	17.0.0.0	V17.00.00.00_43.02.00.01
SIMATIC NCM FWL 64	5.6.0.3	K5.6.0.3_1.1.0.2
NCM GPRS 64	01.02.00.00	V1.2.0.0_2.1.0.1
SIMATIC PLCSIM 64	15.01.00	15.01.00.00_17.00.02.01
SIMATIC Device Drivers	9.3	09.03.00.00_01.05.00.06
Automation Access Control Component	4.0	K04.00.01.00_01.01.00.01
Automation Software Updater	02.03.0000	V02.03.00.00_01.01.00.48
SIMATIC Colour Editor	5.2.2.0	K5.2.2.0_2.1.0.1
SIMATIC HMIProvider	7.0	K07.00.03.00_01.01.00.01
License Logon Interface	4.0	K04.00.03.00_01.01.00.02
SIEMENS OPC	3.9	03.09.11.01_01.01.00.02
SIMATIC HMI ProSave	17.0.0.0	V17.00.00.00_43.02.00.01
SIMATIC HMI Symbol Library	17.0.0.0	V17.00.00.00_43.02.00.01
SIMATIC HMI Touch Input	17.0.0.0	V17.00.00.00_43.02.00.01
SIMATIC Version View	1.7.12.0	K1.7.12.0_1.1.0.1
SIMATIC Common Services	5.3.15.0	K5.3.15.0_1.1.0.1
SIMATIC Device Drivers WoW	29.3	29.03.00.00_01.05.00.06
SIMATIC Event Database	5.6	05.06.02.02_01.01.00.01
SIMATIC GRAPH-Visualisierung	5.2.4.0	K5.2.4.0_1.1.0.1
SIMATIC GSD CONTROL	3.5.7.0	K3.5.7.0_2.1.0.1
SIMATIC GSD Interpreter	2.10.0.0	V2.10.0.0_7.1.0.1
SIMATIC Interface Editor	5.4.24.0	K5.4.24.0_1.1.0.1
SIMATIC Extended Interfaces	5.7.0.0	V5.7.0.0_5.1.0.1
SIMATIC LanguageSupportTool	5.8.4.0	K5.8.4.0_2.1.0.1
SIMATIC Condition Editor	5.6.2.0	K5.6.2.0_1.1.0.1
SIMATIC NCM	5.7.0.0	V5.7.0.0_12.1.0.2
SIMATIC Process Diagnosis Base	5.7.0.1	K5.7.0.1_4.1.0.1
SIMATIC Process Diagnosis Database	5.7.0.0	V5.7.0.0_5.1.0.1
SIMATIC DIAGNOSTIC REPEATER GUI CTRL	5.2.3.0	K5.2.3.0_1.1.0.1
SIMATIC Grid Control	3.0.1.0	K3.0.1.0_2.1.0.1
SIMATIC S7-Status-OCX	5.3.14.0	K5.3.14.0_1.1.0.1
SIMATIC Technological Parameter Assignment	5.3.12.0	K5.3.12.0_3.1.0.1
SIMATIC X-Ref Control	5.2.10.0	K5.2.10.0_1.1.0.1
SIMATIC STEP 7 Help Viewer	1.0.6.0	K1.0.6.0_4.1.0.1
SIMATIC SCL Compiler	5.7.0.0	V5.7.0.0_4.1.0.1
SeCon	2.7	V02.07.02.00_01.01.00.04
SIMATIC SCS	K7.4.2.0	V07.04.02.00_01.19.00.02
SIMATIC WinCC Common Archiving	K7.3.45.0	V07.03.45.00_01.13.00.01
WinCC Runtime Advanced Simulator	17.0.0.0	V17.00.00.00_43.02.00.01

Products		
Name	**Version**	**Release**
TIA Portal Multiuser Server	V14.0 SP1	V14.00.01.00_12.01.00.01
TIA Portal Multiuser Server	V15.0 Upd3	V15.00.00.03_04.01.00.01
TIA Portal Project Server	V17.0	V17.00.00.00_43.02.00.01
TIA Administrator	V1.0	01.00.04.00_01.18.00.04
SIMATIC STEP 7 Professional	V14.0 SP1	V14.00.01.00_12.01.00.01
SIMATIC WinCC Basic	V14.0 SP1	V14.00.01.00_12.01.00.01
SINAMICS G110M, G120, G120C, G120D, G120P	V15.0	V15.00.00.01_17.01.00.03
SINAMICS G130, G150, S120, S150, SINAMICS MV	V15.0	V15.00.00.01_17.01.00.03
SIMATIC STEP 7 Professional - WinCC Advanced	V15.0 Upd1	V15.00.00.01_03.01.00.01
User Management Component	V2.9	V02.09.00.00_00.00.00.00
UMC Status Application	V1.0	V01.00.00.00_01.01.00.01
SIMATIC WinCC Runtime Advanced Simulation	V17.0	V17.00.00.00_43.02.00.01
Migration Tool TIA	V16.0	V16.00.00.00_31.02.00.01
SIMATIC STEP 7 Basic	V13.0 SP2	V13.00.02.00_10.01.00.01
SIMATIC WinCC Professional	V13.0 SP2	V13.00.02.00_10.01.00.01
Automation License Manager Professional 2021	V6.0 + SP9 + Upd2	06.00.09.02_01.01.00.02
S7-PLCSIM Professional	V5.4 + SP8	V05.04.08.01_01.24.00.01
SIMATIC ProSave	V17.0	V17.00.00.00_43.02.00.01
SIMATIC S7-Block Privacy Professional 2021	V1.0 + SP5	K1.0.5.0_7.1.0.1
SIMATIC S7-GRAPH Professional 2021	V5.7	V5.7.0.0_7.1.0.4
SIMATIC S7-SCL Professional 2021	V5.7	V5.7.0.0_6.1.0.1
STEP 7 Professional 2021	V5.7	V5.7.0.0_12.1.0.2
SIMATIC S7-Web2PLC Professional 2021	V1.0 + SP3	K1.0.3.0_8.1.0.1

GLACIER8135

PLC_1 [CPU 1214C DC/DC/Rly]

PLC_1					
Project information					
Name	PLC_1	**Author**	klc	**Comment**	
Slot	1	**Rack**	0		
Catalog information					
Short designation	CPU 1214C DC/DC/Rly	**Description**	Work memory 100 KB; 24VDC power supply with DI14 x 24VDC SINK/SOURCE, DQ10 x relay and AI2 on board; 6 high-speed counters and 4 pulse outputs on board; signal board expands on-board I/O; up to 3 communication modules for serial communication; up to 8 signal modules for I/O expansion; 0.04 ms/1000 instructions; PROFINET interface for programming, HMI and PLC to PLC communication	**Article number**	6ES7 214-1HG40-0XB0
Firmware version	V4.2				

Connection resources

	Station resources - Reserved - Maximum	Station resources - Reserved - Configured	Station resources - Dynamic - Configured	Module resources - PLC_1 [CPU 1214C DC/DC/Rly] - Configured
Maximum number of resources:		62	6	68
	Maximum	Configured	Configured	Configured
PG communication:	4	-	-	-
HMI communication:	12	1	0	1
S7 communication:	8	0	0	0
Open user communication:	8	0	0	0
Web communication:	30	-	-	-
Other communication:	-	-	0	0
Total resources used:		1	0	1
Available resources:		61	6	67

Overview of addresses\Overview of addresses\Overview of addresses

Inputs	True	**Outputs**	True	**Address gaps**	False
Slot	True				

Type	Addr. from	Addr. to	Module	PIP	Device name	Device number	Size	Master / IO system	Rack	Slot
I	0	1	DI14/DQ10_1	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	2 Bytes	-	0	1 1
O	0	1	DI14/DQ10_1	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	2 Bytes	-	0	1 1
I	64	67	AI 2_1	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	4 Bytes	-	0	1 2
I	1000	1003	HSC_1	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	4 Bytes	-	0	1 16
I	1004	1007	HSC_2	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	4 Bytes	-	0	1 17
I	1008	1011	HSC_3	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	4 Bytes	-	0	1 18
I	1012	1015	HSC_4	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	4 Bytes	-	0	1 19
I	1016	1019	HSC_5	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	4 Bytes	-	0	1 20
I	1020	1023	HSC_6	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	4 Bytes	-	0	1 21
O	1000	1001	Pulse_1	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	2 Bytes	-	0	1 32
O	1002	1003	Pulse_2	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	2 Bytes	-	0	1 33
O	1004	1005	Pulse_3	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	2 Bytes	-	0	1 34
O	1006	1007	Pulse_4	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	2 Bytes	-	0	1 35
I	8	8	DI 8x24VDC/DQ 8xRelay_1	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	1 Bytes	-	0	2
O	8	8	DI 8x24VDC/DQ 8xRelay_1	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	1 Bytes	-	0	2
I	144	159	AI 8x13BIT_2	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	16 Bytes	-	0	5
I	128	143	AI 8x13BIT_1	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	16 Bytes	-	0	4
I	9	9	DI 8x24VDC/DQ 8xRelay_2	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	1 Bytes	-	0	3
O	9	9	DI 8x24VDC/DQ 8xRelay_2	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	1 Bytes	-	0	3

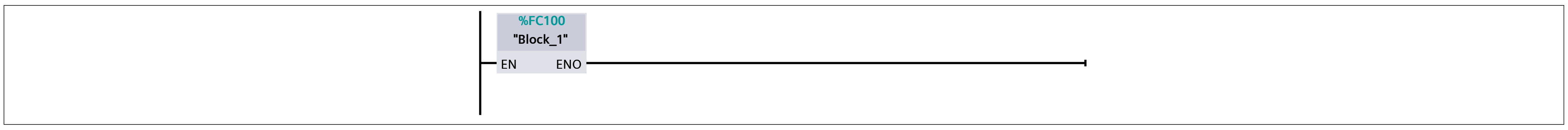
GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks

Main [OB1]

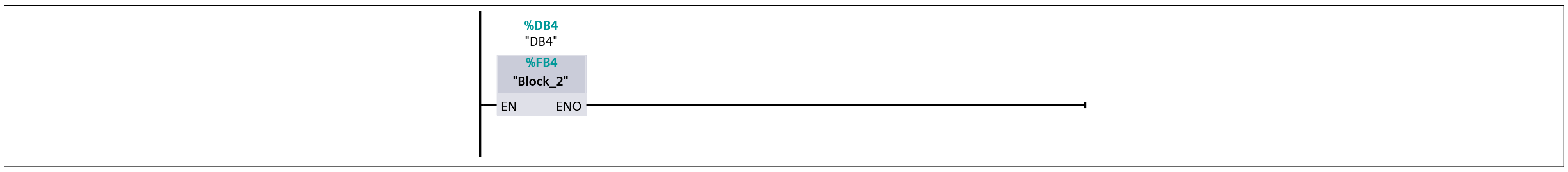
Main Properties							
General							
Name	Main	**Number**	1	**Type**	OB	**Language**	LAD
Numbering	Automatic						
Information							
Title	"Main Program Sweep (Cy-cle)"	**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value
Temp		
Constant		

Network 1:



Network 2:



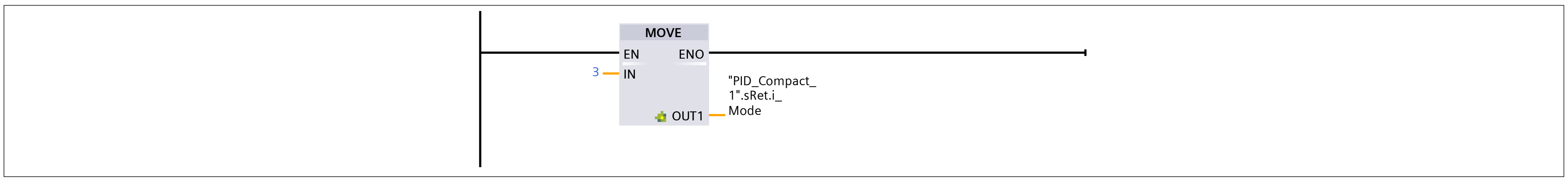
GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks

Startup [OB100]

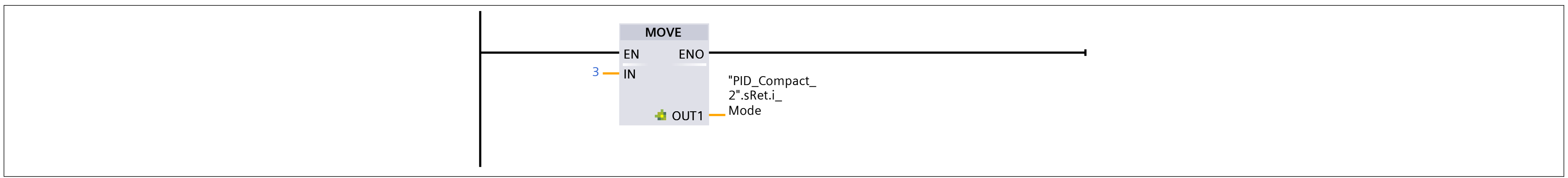
Startup Properties							
General							
Name	Startup	**Number**	100	**Type**	OB	**Language**	LAD
Numbering	Automatic						
Information							
Title	"Complete Restart"	**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value
Input		
LostRetentive	Bool	
LostRTC	Bool	
Temp		
Constant		

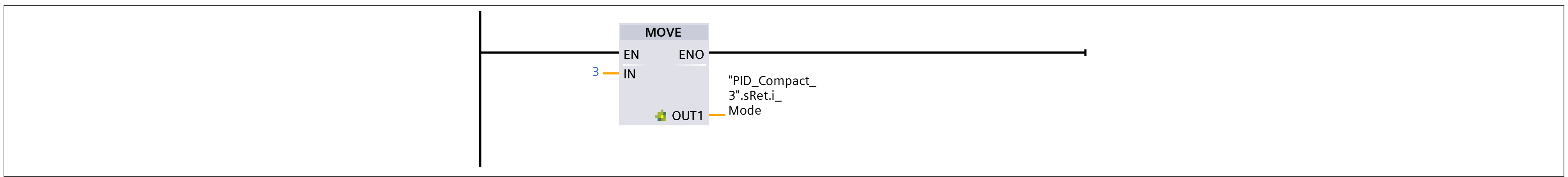
Network 1:



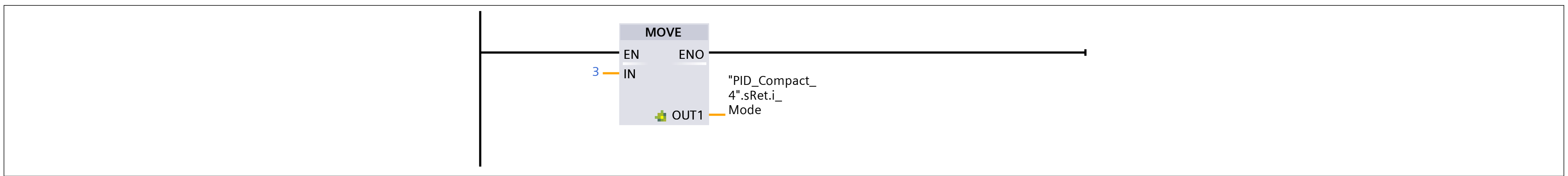
Network 2:



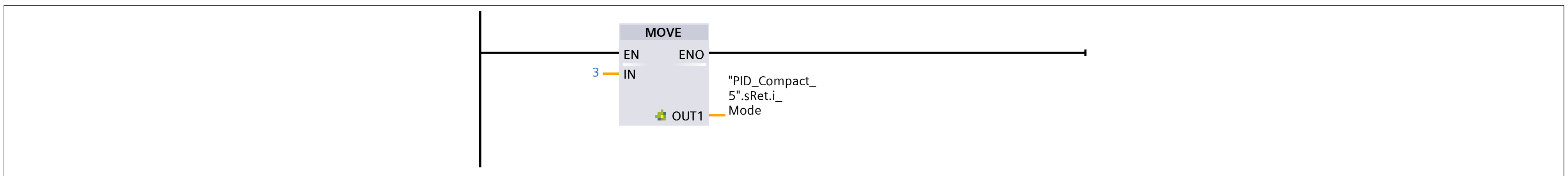
Network 3:



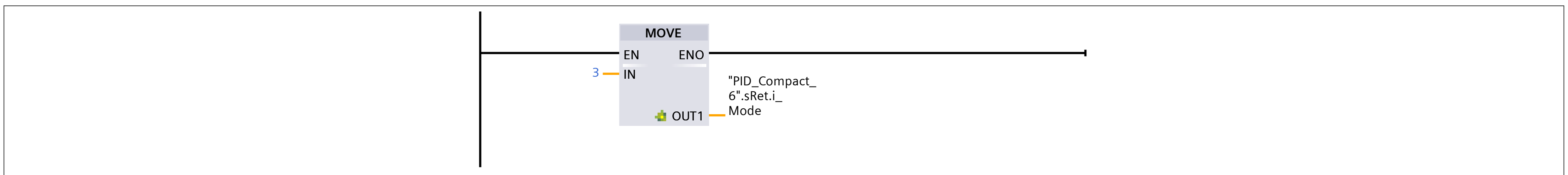
Network 4:



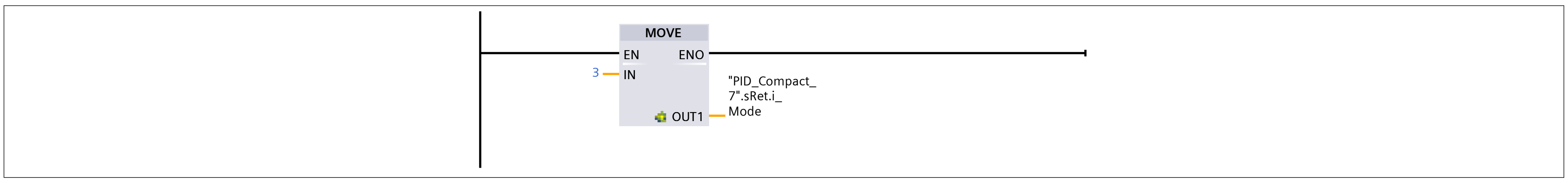
Network 5:



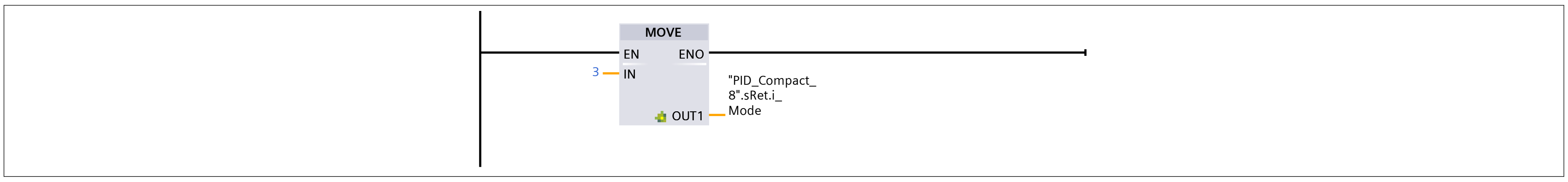
Network 6:



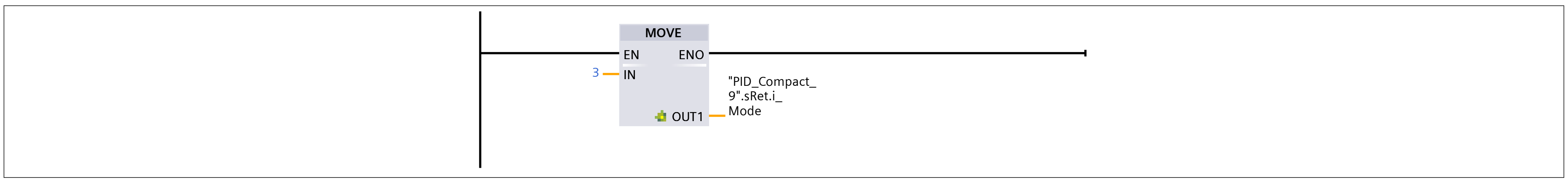
Network 7:



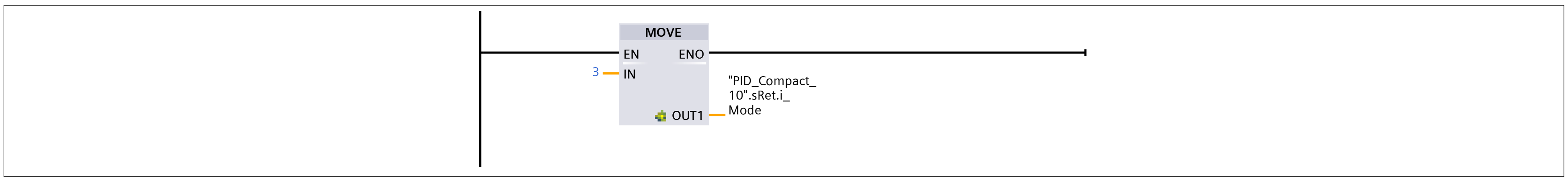
Network 8:



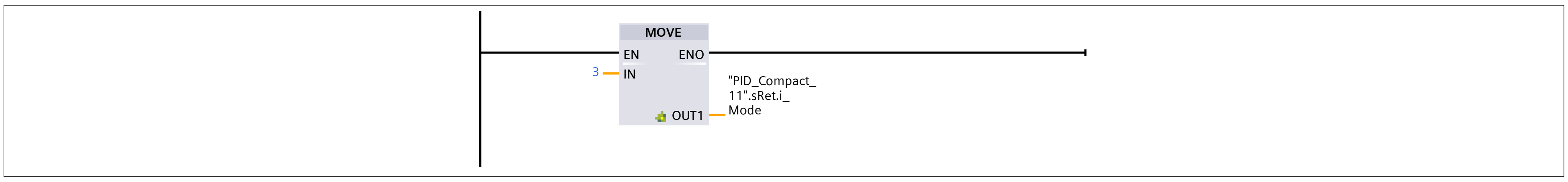
Network 9:



Network 10:



Network 11:



GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks

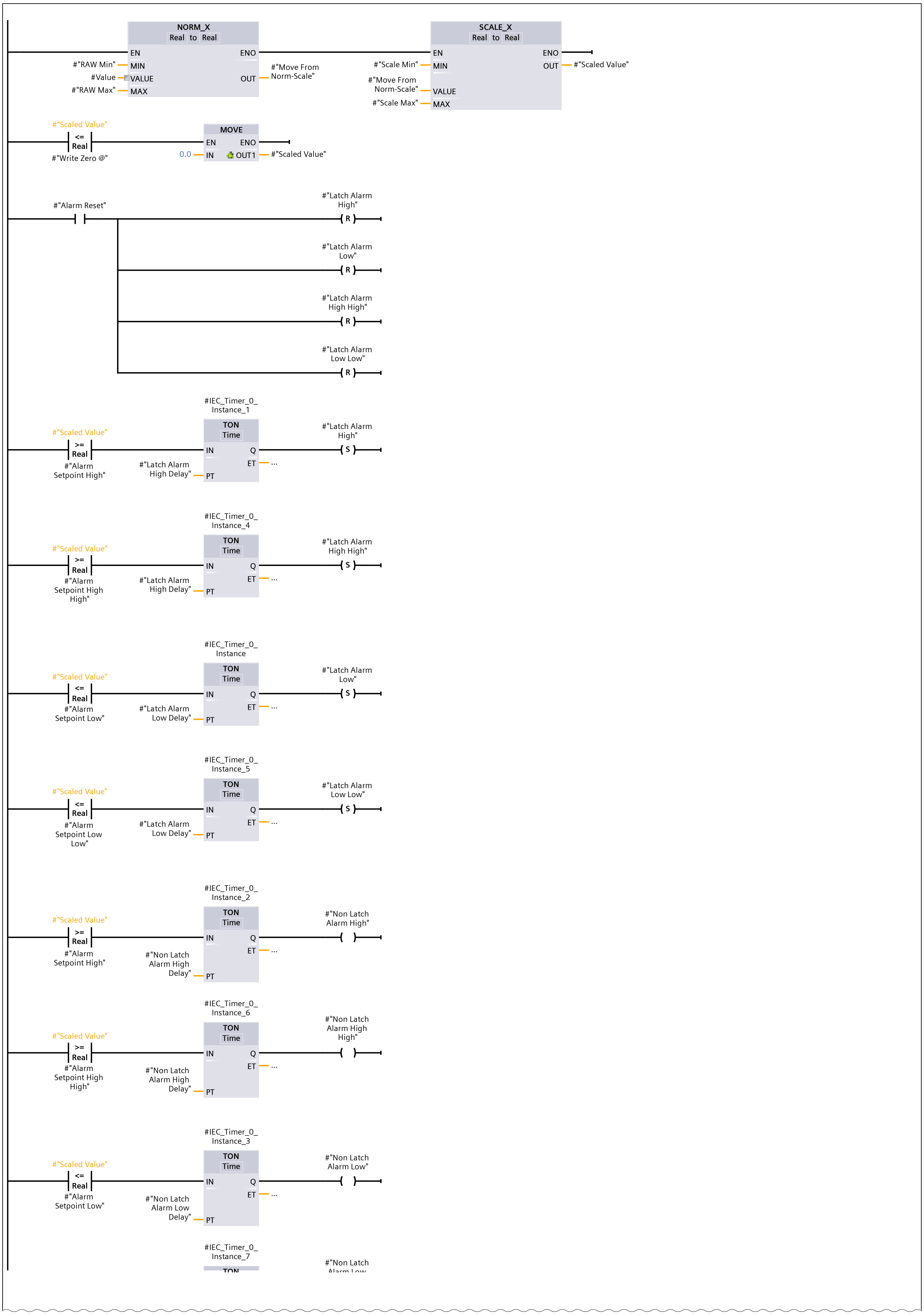
Scale Block [FB2]

Scale Block Properties							
General							
Name	Scale Block	**Number**	2	**Type**	FB	**Language**	LAD
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value	Retain
Input			
Value	Int	0	Non-retain
Scale Min	Real	0.0	Non-retain
Scale Max	Real	0.0	Non-retain
RAW Min	Real	0.0	Non-retain
RAW Max	Real	0.0	Non-retain
Write Zero @	Real	0.0	Non-retain
Alarm Setpoint High	Real	0.0	Non-retain
Alarm Setpoint High High	Real	0.0	Non-retain
Alarm Setpoint Low	Real	0.0	Non-retain
Alarm Setpoint Low Low	Real	0.0	Non-retain
Latch Alarm High Delay	Time	T#0ms	Non-retain
Latch Alarm Low Delay	Time	T#0ms	Non-retain
Non Latch Alarm High Delay	Time	T#0ms	Non-retain
Non Latch Alarm Low Delay	Time	T#0ms	Non-retain
Alarm Reset	Bool	false	Non-retain
Output			
Non Latch Alarm High	Bool	false	Non-retain
Non Latch Alarm High High	Bool	false	Non-retain
Non Latch Alarm Low	Bool	false	Non-retain
Non Latch Alarm Low Low	Bool	false	Non-retain
Latch Alarm High	Bool	false	Non-retain
Latch Alarm High High	Bool	false	Non-retain
Latch Alarm Low	Bool	false	Non-retain
Latch Alarm Low Low	Bool	false	Non-retain
Scaled Value	Real	0.0	Non-retain
InOut			
Static			
Move From Norm-Scale	Real	0.0	Non-retain
IEC_Timer_0_Instance	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_1	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_2	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_3	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_4	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_5	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_6	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_7	IEC_TIMER		Non-retain
Temp			
Constant			

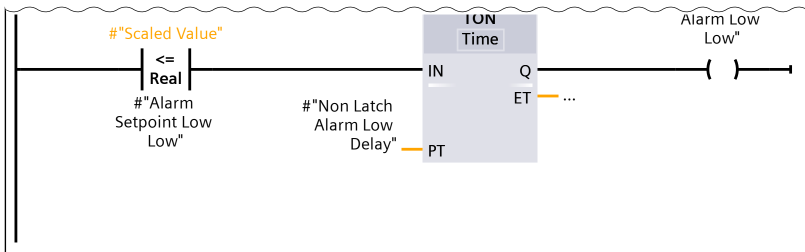
Network 1:

Network 1: (1.1 / 2.1)



Network 1: (2.1 / 2.1)

1.1 (Page5 - 2)



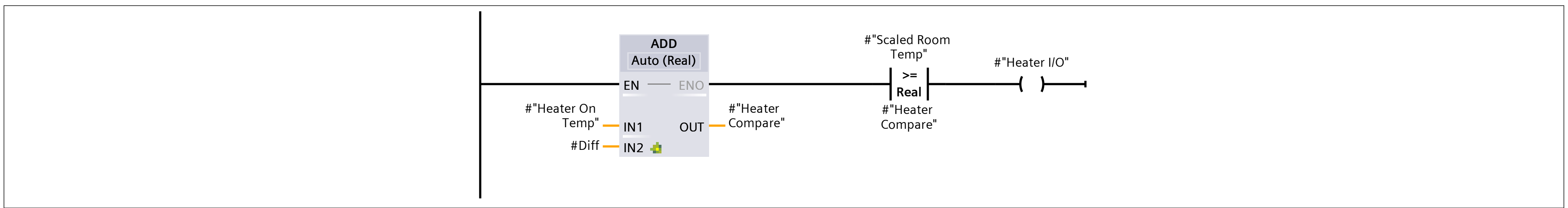
GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks

HEATER/FAN CONTROL [FB3]

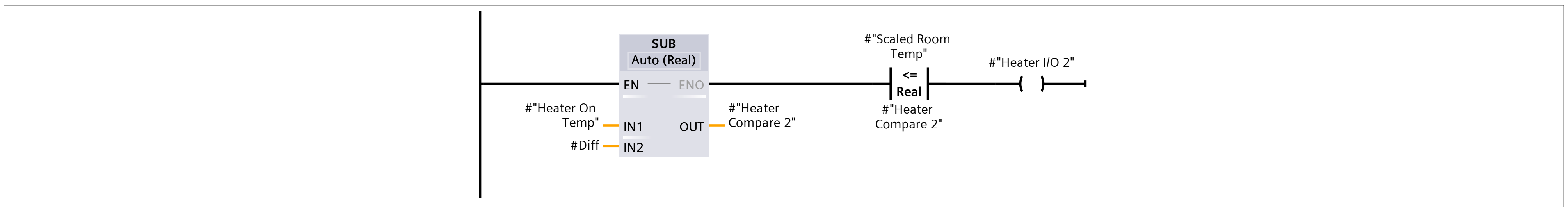
HEATER/FAN CONTROL Properties							
General							
Name	HEATER/FAN CONTROL	**Number**	3	**Type**	FB	**Language**	LAD
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value	Retain
▼ Input			
Scaled Room Temp	Real	0.0	Non-retain
Heater On Temp	Real	0.0	Non-retain
Fan On Temp	Real	0.0	Non-retain
Diff	Real	0.0	Non-retain
▼ Output			
Heater Start	Bool	false	Non-retain
Fan Start	Bool	false	Non-retain
InOut			
▼ Static			
Heater Compare	Real	0.0	Non-retain
Heater Compare 2	Real	0.0	Non-retain
Fan Compare	Real	0.0	Non-retain
Fan Compare 2	Real	0.0	Non-retain
Heater I/O	Bool	false	Non-retain
Heater I/O 2	Bool	false	Non-retain
Fan I/O	Bool	false	Non-retain
Fan I/O 2	Bool	false	Non-retain
IEC_Timer_0_Instance	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_1	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_2	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_3	IEC_TIMER		Non-retain
Temp			
Constant			

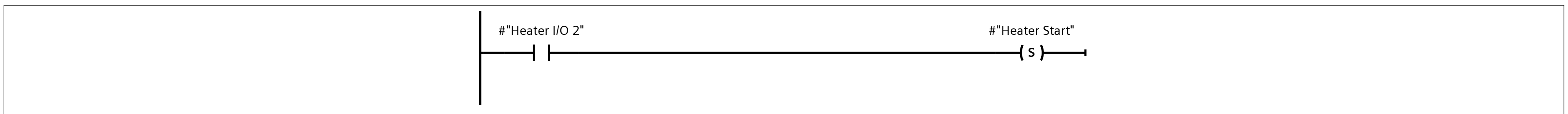
Network 1:



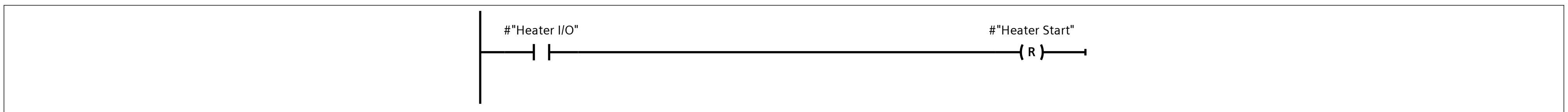
Network 2:



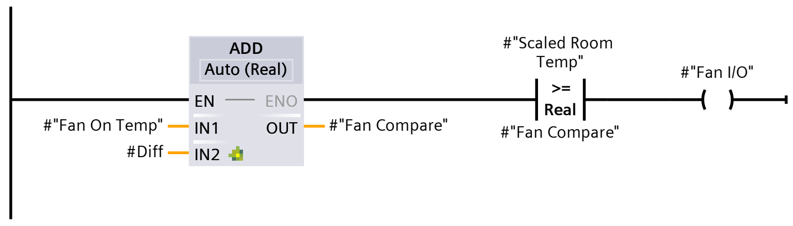
Network 3:



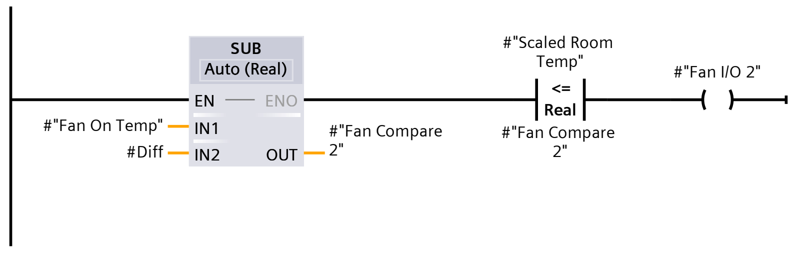
Network 4:



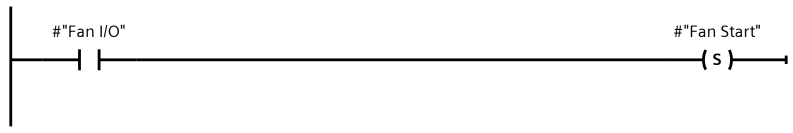
Network 5:



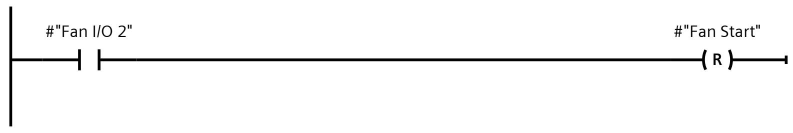
Network 6:



Network 7:



Network 8:



GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks

Hour Meter Call Block [FB5]

Hour Meter Call Block Properties							
General							
Name	Hour Meter Call Block	**Number**	5	**Type**	FB	**Language**	LAD
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value	Retain
Input			
Output			
InOut			
▼ Static			
HM1	Real	0.0	Retain
HM2	Real	0.0	Retain
HM3	Real	0.0	Retain
HM4	Real	0.0	Retain
HM5	Real	0.0	Retain
HM6	Real	0.0	Retain
HM7	Real	0.0	Retain
HM8	Real	0.0	Retain
HM9	Real	0.0	Retain
HM10	Real	0.0	Retain
HM11	Real	0.0	Retain
Temp			
Constant			

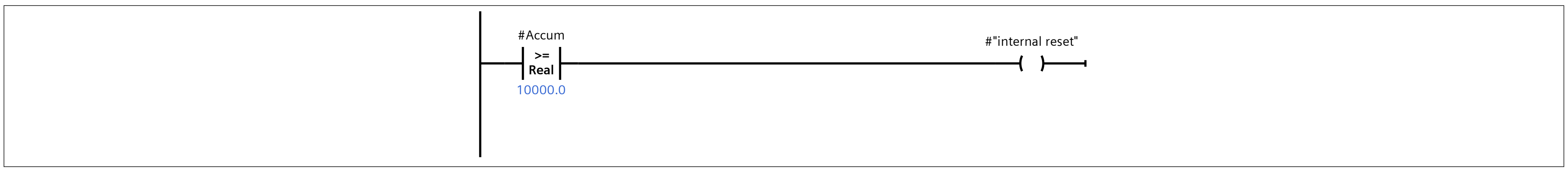
GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks

Totalizer_1 [FB60]

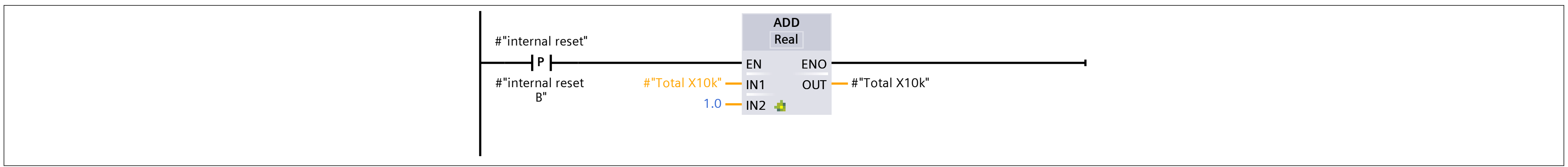
Totalizer_1 Properties							
General							
Name	Totalizer_1	**Number**	60	**Type**	FB	**Language**	LAD
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value
▼ Input		
Value	Real	0.0
Intervall	Time	T#0ms
Cycle	Time	T#0ms
Reset	Bool	false
▼ Output		
Total X10k	Real	0.0
Total	Real	0.0
InOut		
▼ Static		
Accum	Real	0.0
IEC_Timer_0_Instance	IEC_TIMER	
▼ Temp		
internal reset B	Bool	
internal reset	Bool	
Intervall_real	Real	
Cycle_real	Real	
Intervall_dint	DInt	
Cycle_dint	DInt	
Constant		

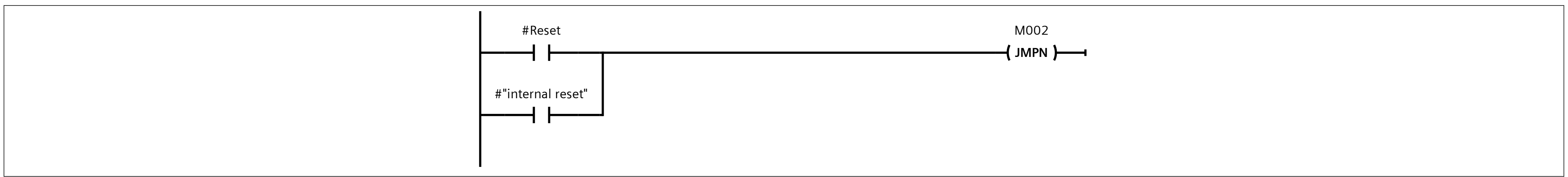
Network 1:



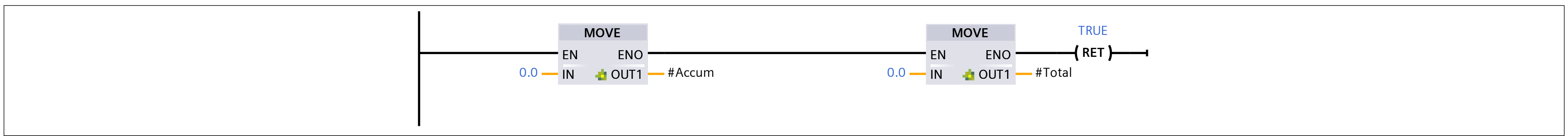
Network 2:



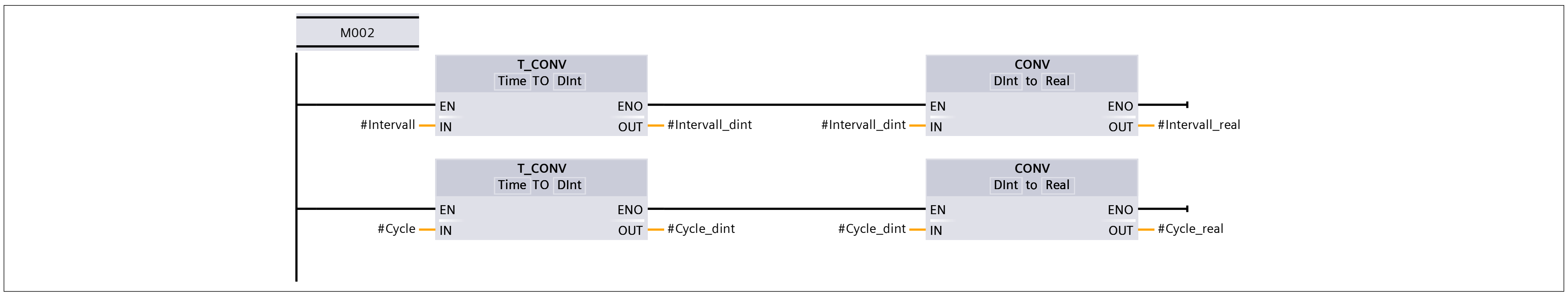
Network 3:



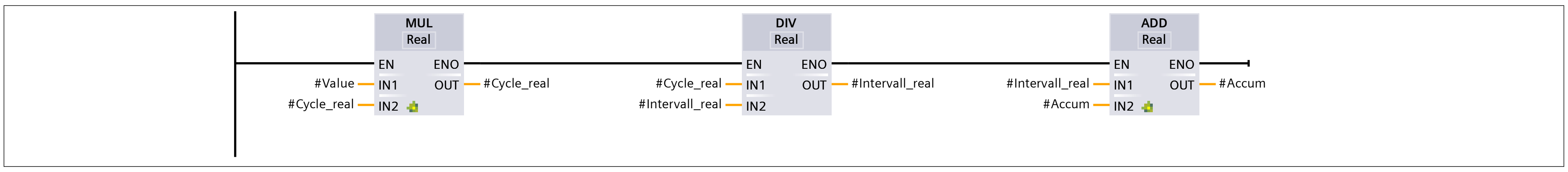
Network 4:



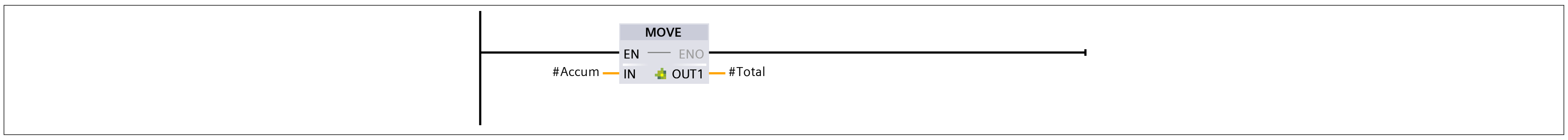
Network 5:



Network 6:



Network 7:



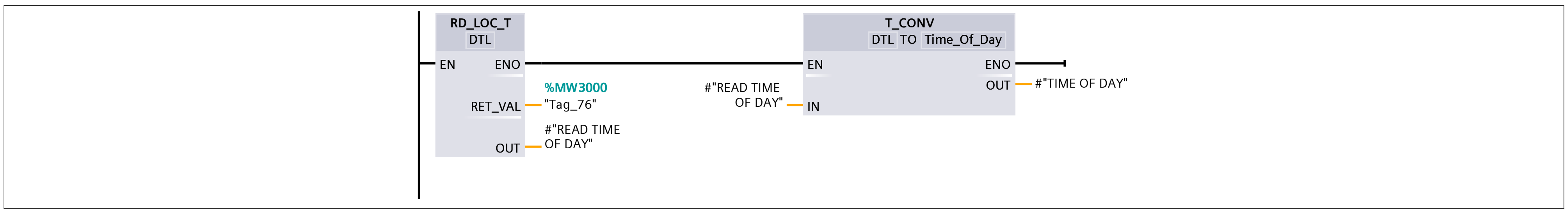
GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks

TOD TIMER [FB9]

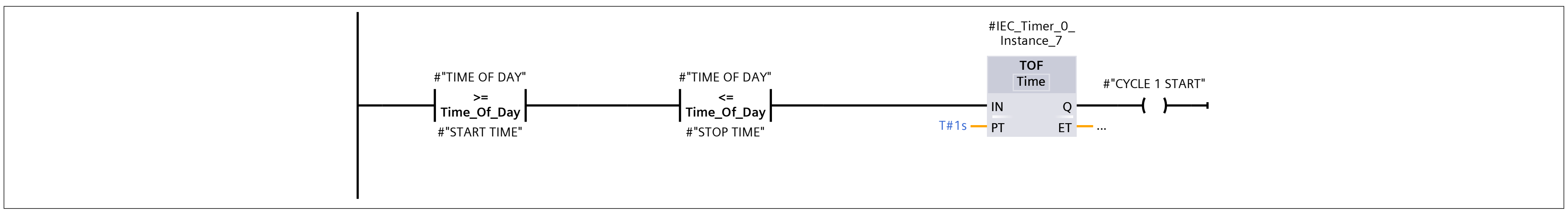
TOD TIMER Properties							
General							
Name	TOD TIMER	**Number**	9	**Type**	FB	**Language**	LAD
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value	Retain
▼ Input			
START TIME	Time_Of_Day	TOD#00:00:00	Non-retain
STOP TIME	Time_Of_Day	TOD#00:00:00	Non-retain
▼ Output			
TOD TIMER START	Bool	false	Non-retain
InOut			
▼ Static			
CYCLE 1 START	Bool	false	Non-retain
CYCLE 2 START	Bool	false	Non-retain
CYCLE 3 START	Bool	false	Non-retain
CYCLE 4 START	Bool	false	Non-retain
CYCLE 1 STOP	Bool	false	Non-retain
CYCLE 2 STOP	Bool	false	Non-retain
CYCLE 3 STOP	Bool	false	Non-retain
CYCLE 4 STOP	Bool	false	Non-retain
CYCLE 1 TMR GO	Bool	false	Non-retain
CYCLE 2 TMR GO	UDInt	0	Non-retain
CYCLE 3 TMR GO	Bool	false	Non-retain
CYCLE 4 TMR GO	Bool	false	Non-retain
TIME OF DAY	Time_Of_Day	TOD#00:00:00	Non-retain
READ TIME OF DAY	DTL	DTL#1970-01-01-00:00:00	Non-retain
IEC_Timer_0_Instance	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_1	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_2	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_3	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_4	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_5	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_6	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_7	IEC_TIMER		Non-retain
Temp			
Constant			

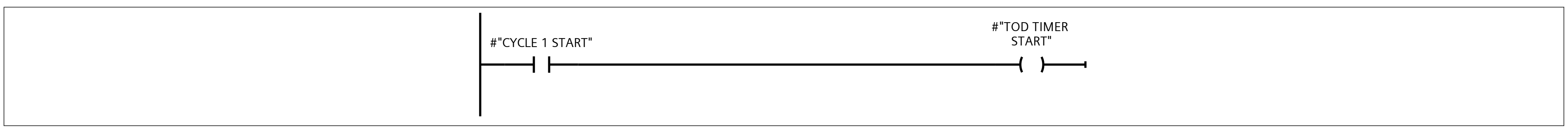
Network 1:



Network 2:



Network 3:



GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks

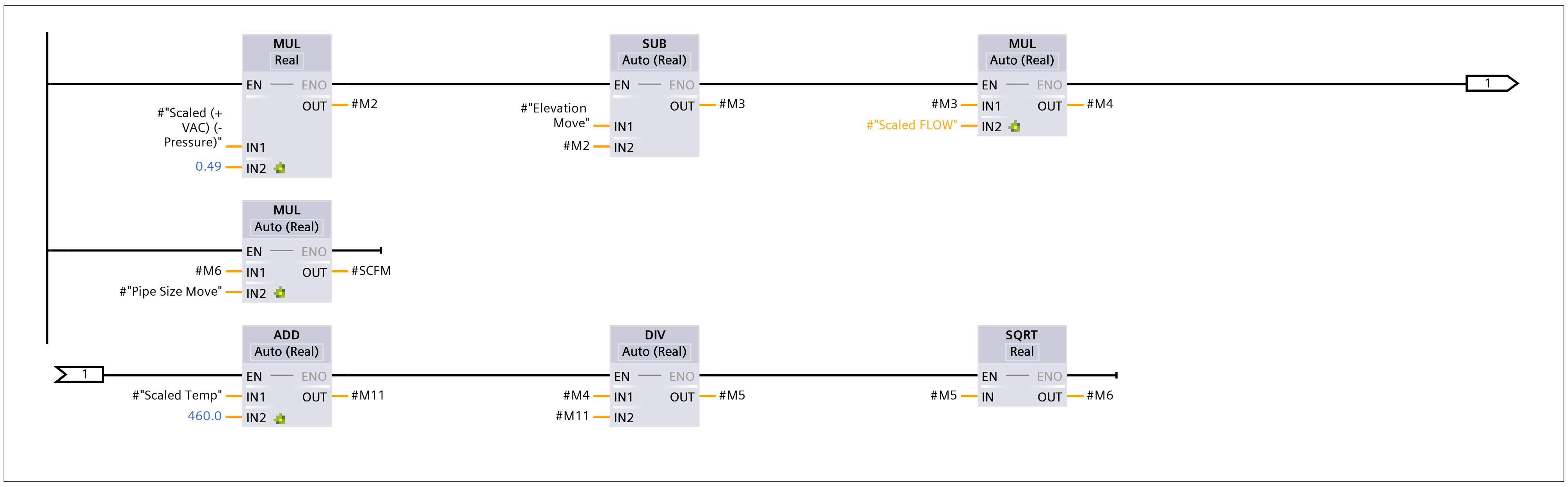
Flow [FB6]

Flow Properties							
General							
Name	Flow	**Number**	6	**Type**	FB	**Language**	LAD
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

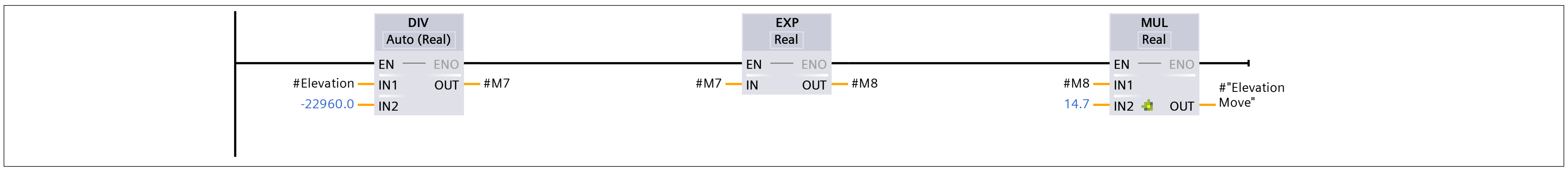
Name	Data type	Default value	Retain
▼ Input			
Unscaled FLOW	Int	0	Non-retain
Scale Min	Real	0.0	Non-retain
Scale Max	Real	0.0	Non-retain
RAW Min	Real	0.0	Non-retain
RAW Max	Real	0.0	Non-retain
Write Zero @	Real	0.0	Non-retain
Alarm Setpoint High	Real	0.0	Non-retain
Alarm Setpoint High High	Real	0.0	Non-retain
Alarm Setpoint Low	Real	0.0	Non-retain
Alarm Setpoint Low Low	Real	0.0	Non-retain
Latch Alarm High Delay	Time	T#0ms	Non-retain
Latch Alarm Low Delay	Time	T#0ms	Non-retain
Non Latch Alarm High Delay	Time	T#0ms	Non-retain
Non Latch Alarm Low Delay	Time	T#0ms	Non-retain
Alarm Reset	Bool	false	Non-retain
Scaled Temp	Real	0.0	Non-retain
Scaled (+VAC) (-Pressure)	Real	0.0	Non-retain
Elevation	Real	0.0	Non-retain
Pipe ID	Real	0.0	Non-retain
K Factor	Real	0.0	Non-retain
▼ Output			
Non Latch Alarm High	Bool	false	Non-retain
Non Latch Alarm High High	Bool	false	Non-retain
Non Latch Alarm Low	Bool	false	Non-retain
Non Latch Alarm Low Low	Bool	false	Non-retain
Latch Alarm High	Bool	false	Non-retain
Latch Alarm High High	Bool	false	Non-retain
Latch Alarm Low	Bool	false	Non-retain
Latch Alarm Low Low	Bool	false	Non-retain
Scaled FLOW	Real	0.0	Non-retain
SCFM	Real	0.0	Non-retain
InOut			
▼ Static			
Move From Norm-Scale	Real	0.0	Non-retain
Elevation Move	Real	0.0	Non-retain
Pipe Size Move	Real	0.0	Non-retain
M1	Real	0.0	Non-retain
M2	Real	0.0	Non-retain
M3	Real	0.0	Non-retain
M4	Real	0.0	Non-retain
M5	Real	0.0	Non-retain
M6	Real	0.0	Non-retain
M7	Real	0.0	Non-retain
M8	Real	0.0	Non-retain
M9	Real	0.0	Non-retain
m10	Real	0.0	Non-retain
M12	Real	0.0	Non-retain
M11	Real	0.0	Non-retain
IEC_Timer_0_Instance_1	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_4	IEC_TIMER		Non-retain
IEC_Timer_0_Instance	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_5	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_2	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_6	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_3	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_7	IEC_TIMER		Non-retain
Temp			
Constant			

Network 1:

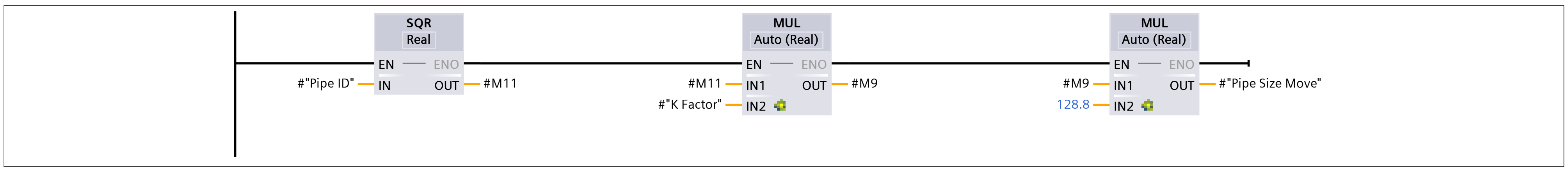
Network 1:



Network 2:

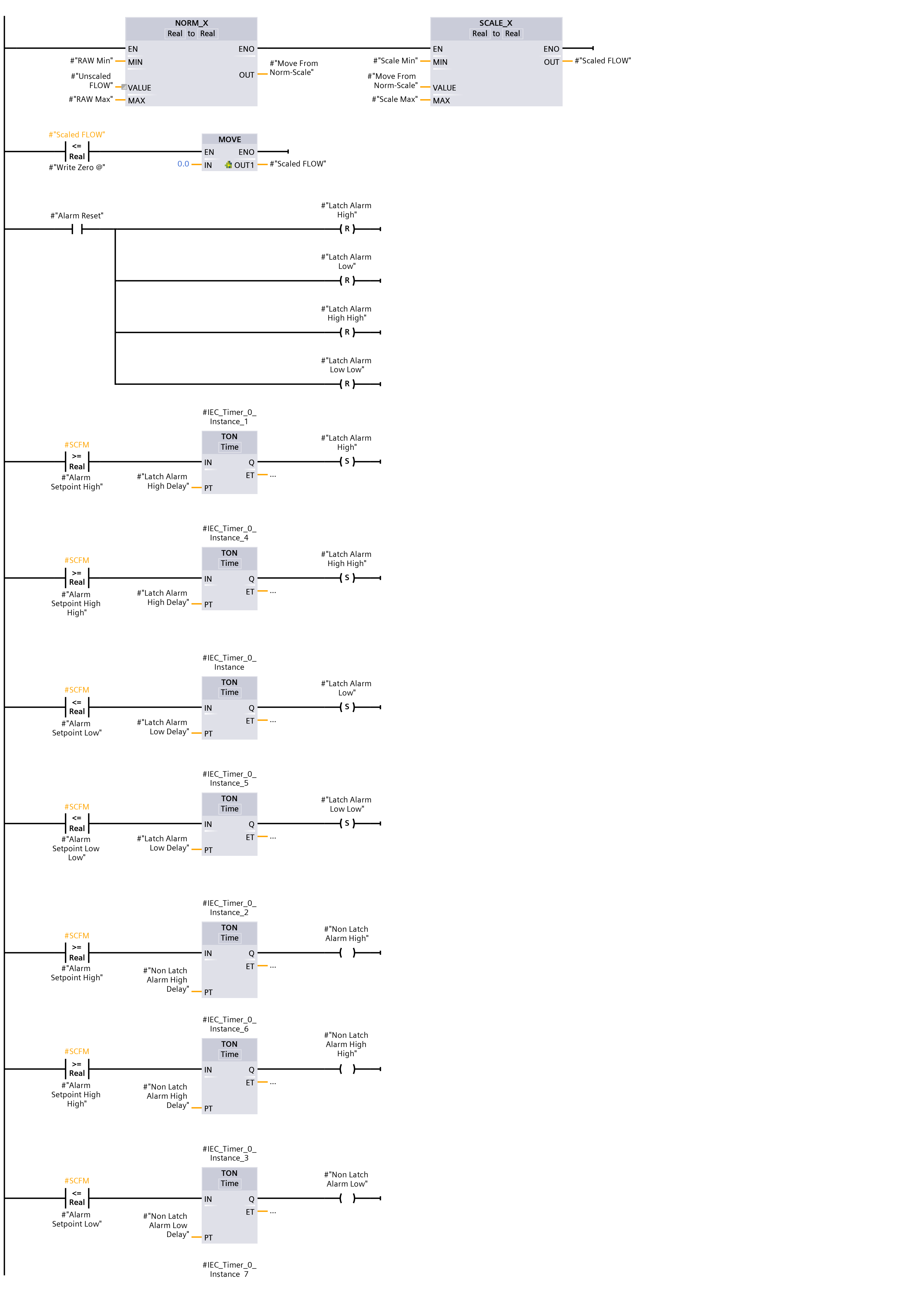


Network 3:



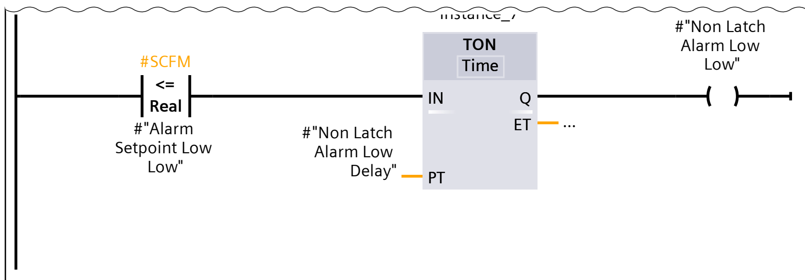
Network 4:

Network 4: (1.1 / 2.1)



Network 4: (2.1 / 2.1)

1.1 (Page10 - 3)



GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks

DB4 [DB4]

DB4 Properties							
General							
Name	DB4	**Number**	4	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
Input			
Output			
InOut			
▼ Static			
math 1	Real	0.0	False
math 2	Real	0.0	False
math 3	Real	0.0	False
math 4	Real	0.0	False
math 5	Real	0.0	False
math 6	Real	0.0	False
math 7	Real	0.0	False
math 8	Real	0.0	False
HM1	Real	0.0	True
HM2	Real	0.0	True
HM3	Real	0.0	True
HM4	Real	0.0	True
HM5	Real	0.0	True
HM6	Real	0.0	True
HM7	Real	0.0	True
HM8	Real	0.0	True
HM9	Real	0.0	True
HM10	Real	0.0	True
HM11	Real	0.0	True
HM12	Real	0.0	True
HM 13	Real	0.0	True
HM 14	Real	0.0	True
HM 15	Real	0.0	True
HM 16	Real	0.0	True
SCALED LRP VACUUM	Real	0.0	False
SCALED LRP DISCHARGE PRESSURE (B-301)	Real	0.0	False
SCALED LRP DISCHARGE FLOW (B-301)	Real	0.0	False
SCALED POST HEAT EXCHANGER TEMP (HEX-302)	Real	0.0	False
SCALED TRANSFER PUMP DISCHARGE PRESSURE (P-400)	Real	0.0	False
SCALED PRE CARBON PRESSURE	Real	0.0	False
SCALED MIXING TANK PUMP DISCHARGE PRESSURE (P-500)	Real	0.0	False
SCALED OXYGEN FEED PRESSURE	Real	0.0	False
SCALED POST VENTURI PRESSURE (IC-500)	Real	0.0	False
SCALED REINJECTION FLOW	Real	0.0	False
SCALED EXTRACTION ROOM TEMP	Real	0.0	False
SCALED BIOREMEDIATION ROOM TEMP	Real	0.0	False
SCALED FALCO ENTRANCE TEMP	Real	0.0	False
SCALED FALCO INTERNAL TEMP	Real	0.0	False
SCALED FALCO EXIT TEMP	Real	0.0	False
DISCHAGE TOTAL	Real	0.0	True
SVE BLOWER AMPS	Real	0.0	False
SPARGE AMPS	Real	0.0	False
HIGH SPARGE 1 AMPS	Real	0.0	False
HIGH SPARGE 2 AMPS	Real	0.0	False
setpoint 1	Real	0.0	True
setpoint 2	Real	0.0	True
setpoint 3	Real	0.0	True
setpoint 4	Real	0.0	True
setpoint 5	Real	0.0	True
setpoint 6	Real	0.0	True
setpoint 7	Real	0.0	True
setpoint 8	Real	0.0	True
setpoint 9	Real	0.0	True
setpoint 10	Real	0.0	True
setpoint 11	Real	0.0	True
setpoint 12	Real	0.0	True
setpoint 13	Real	0.0	True
setpoint 14	Real	0.0	True
setpoint 15	Real	0.0	True
setpoint 16	Real	0.0	True
setpoint 17	Real	0.0	True
setpoint 18	Real	0.0	True

Name	Data type	Start value	Retain
setpoint 19	Real	0.0	True
setpoint 20	Real	0.0	True
setpoint 21	Real	0.0	True
setpoint 22	Real	0.0	True
setpoint 23	Real	0.0	True
setpoint 24	Real	0.0	True
setpoint 25	Real	0.0	True
setpoint 26	Real	0.0	True
setpoint 27	Real	0.0	True
setpoint 28	Real	0.0	True
setpoint 29	Real	0.0	True
setpoint 30	Real	0.0	True
setpoint 31	Real	0.0	True
setpoint 32	Real	0.0	True
setpoint 33	Real	0.0	True
setpoint 34	Real	0.0	True
setpoint 35	Real	0.0	True
setpoint 36	Real	0.0	True
setpoint 37	Real	0.0	True
setpoint 38	Real	0.0	True
setpoint 39	Real	0.0	True
setpoint 40	Real	0.0	True
setpoint 41	Real	0.0	True
setpoint 42	Real	0.0	True
setpoint 43	Real	0.0	True
setpoint 44	Real	0.0	True
setpoint 45	Real	0.0	True
setpoint 46	Real	0.0	True
setpoint 47	Real	0.0	True
setpoint 48	Real	0.0	True
setpoint 49	Real	0.0	True
setpoint 50	Real	0.0	True
setpoint 51	Real	0.0	True
setpoint 52	Real	0.0	True
setpoint 53	Real	0.0	True
setpoint 54	Real	0.0	True
setpoint 55	Real	0.0	True
setpoint 56	Real	0.0	True
setpoint 57	Real	0.0	True
setpoint 58	Real	0.0	True
setpoint 59	Real	0.0	True
setpoint 60	Real	0.0	True
setpoint 61	Real	0.0	True
setpoint 62	Real	0.0	True
setpoint 63	Real	0.0	True
setpoint 64	Real	0.0	True
setpoint 65	Real	0.0	True
setpoint 66	Real	0.0	True
setpoint 67	Real	0.0	True
setpoint 68	Real	0.0	True
setpoint 69	Real	0.0	True
setpoint 70	Real	0.0	True
setpoint 71	Real	0.0	True
setpoint 72	Real	0.0	True
setpoint 100	Real	0.0	True
setpoint 101	Real	0.0	True
setpoint 102	Real	0.0	True
setpoint 103	Real	0.0	True
setpoint 104	Real	0.0	True
setpoint 105	Real	0.0	True
setpoint 200	Real	0.0	True
setpoint 201	Real	0.0	True
setpoint 202	Real	0.0	True
setpoint 203	Real	0.0	True
setpoint 204	Real	0.0	True
setpoint 205	Real	0.0	True
setpoint 206	Real	0.0	True
PULSECOUNTER	Real	0.0	True
MANUALINPUTFORTOTAL	Real	0.0	True
MANUALINPUTFOR TOTAL2	Real	0.0	True
INJECTION FLOW TOTAL	Real	0.0	True
INJECTION FLOW TOTAL 2	Real	0.0	True
MS TOTAL	Real	0.0	True
OWS TOTAL	Real	0.0	True
DISCHARGE TOTAL	Real	0.0	True
MS PUMP TOTAL	Real	0.0	False
GW 1 TOTAL	Real	0.0	True
GW 2 TOTAL	Real	0.0	True
GW 3 TOTAL	Real	0.0	True

Name	Data type	Start value	Retain
GW 4 TOTAL	Real	0.0	True
GW 5 TOTAL	Real	0.0	True
GW 6 TOTAL	Real	0.0	True
GW 7 TOTAL	Real	0.0	False
GW 8 TOTAL	Real	0.0	False
GW 9 TOTAL	Real	0.0	False
GW 10 TOTAL	Real	0.0	False
TIME OF DAY	DTL	DTL#1970-01-01-00:00:00	False
Move PID 1	Real	0.0	False
Move PID 2	Real	0.0	False
Move PID 3	Real	0.0	False
Move PID 4	Real	0.0	False
Move PID 5	Real	0.0	False
Move PID 6	Real	0.0	False
Move PID 7	Real	0.0	False
Move PID 8	Real	0.0	False
Move PID 9	Real	0.0	False
Move PID 10	Real	0.0	False
Move PID 11	Real	0.0	False
Move PID 12	Real	0.0	False
Move PID 13	Real	0.0	False
Move PID 14	Real	0.0	False
Move PID 15	Real	0.0	False
Move PID 16	Real	0.0	False
Move PID 17	Real	0.0	False
Move PID 18	Real	0.0	False
Move PID 19	Real	0.0	False
Move PID 20	Real	0.0	False
Move PID 21	Real	0.0	False
Move PID 22	Real	0.0	False
T1 ON	Time_Of_Day	TOD#00:00:00	True
T1 OFF	Time_Of_Day	TOD#00:00:00	True
T2 ON	Time_Of_Day	TOD#00:00:00	True
T2 OFF	Time_Of_Day	TOD#00:00:00	True
T3 ON	Time_Of_Day	TOD#00:00:00	True
T3 OFF	Time_Of_Day	TOD#00:00:00	True
T4 ON	Time_Of_Day	TOD#00:00:00	True
T4 OFF	Time_Of_Day	TOD#00:00:00	True
T5 ON	Time_Of_Day	TOD#00:00:00	True
T5 OFF	Time_Of_Day	TOD#00:00:00	True
T6 ON	Time_Of_Day	TOD#00:00:00	True
T6 OFF	Time_Of_Day	TOD#00:00:00	True
T7 ON	Time_Of_Day	TOD#00:00:00	True
T7 OFF	Time_Of_Day	TOD#00:00:00	True
T8 ON	Time_Of_Day	TOD#00:00:00	True
T8 OFF	Time_Of_Day	TOD#00:00:00	True
T9 ON	Time_Of_Day	TOD#00:00:00	True
T9 OFF	Time_Of_Day	TOD#00:00:00	True
T10 ON	Time_Of_Day	TOD#00:00:00	True
T10 OFF	Time_Of_Day	TOD#00:00:00	True
LT1	Time	T#0ms	True
LT2	Time	T#0ms	True
LT3	Time	T#0ms	True
LT4	Time	T#0ms	True
LT5	Time	T#0ms	True
LT6	Time	T#0ms	True
AUTO OILER CYCLE TIME	Time	T#0ms	True
AUTO OILER OIL TIME	Time	T#0ms	True
HOUR METER_Instance	"HOUR METER"		False
HOUR METER_Instance_1	"HOUR METER"		False
HEATER/FAN CONTROL_Instance	"HEATER/FAN CONTROL"		False
Scale Block_Instance_5	"Scale Block"		False
Scale Block_Instance	"Scale Block"		False
Scale Block_Instance_1	"Scale Block"		False
Scale Block_Instance_2	"Scale Block"		False
HEATER/FAN CONTROL_Instance_1	"HEATER/FAN CONTROL"		False
IEC_Timer_0_Instance	IEC_TIMER		False
IEC_Timer_0_Instance_1	IEC_TIMER		False
IEC_Timer_0_Instance_2	IEC_TIMER		False
IEC_Timer_0_Instance_3	IEC_TIMER		False
IEC_Timer_0_Instance_4	IEC_TIMER		False
IEC_Timer_0_Instance_5	IEC_TIMER		False
IEC_Timer_0_Instance_6	IEC_TIMER		False
IEC_Timer_0_Instance_7	IEC_TIMER		False
IEC_Timer_0_Instance_8	IEC_TIMER		False
IEC_Timer_0_Instance_9	IEC_TIMER		False
IEC_Timer_0_Instance_10	IEC_TIMER		False
IEC_Timer_0_Instance_11	IEC_TIMER		False
Flow_Instance	"Flow"		False

Name	Data type	Start value	Retain
IEC_Timer_0_Instance_12	IEC_TIMER		False
IEC_Timer_0_Instance_13	IEC_TIMER		False
Scale Block_Instance_18	"Scale Block"		False
Scale Block_Instance_3	"Scale Block"		False
HEATER/FAN CONTROL_Instance_2	"HEATER/FAN CONTROL"		False
Scale Block_Instance_4	"Scale Block"		False
Scale Block_Instance_6	"Scale Block"		False
Scale Block_Instance_7	"Scale Block"		False
Scale Block_Instance_8	"Scale Block"		False
HOUR METER_Instance_2	"HOUR METER"		False
IEC_Timer_0_Instance_14	IEC_TIMER		False
IEC_Timer_0_Instance_15	IEC_TIMER		False
Scale Block_Instance_9	"Scale Block"		False
Scale Block_Instance_10	"Scale Block"		False
HOUR METER_Instance_3	"HOUR METER"		False
IEC_Timer_0_Instance_16	IEC_TIMER		False
IEC_Timer_0_Instance_17	TON_TIME		False
IEC_Timer_0_Instance_18	TON_TIME		False
HOUR METER_Instance_4	"HOUR METER"		False
Scale Block_Instance_11	"Scale Block"		False
HEATER/FAN CONTROL_Instance_3	"HEATER/FAN CONTROL"		False
CYCLE TIMER_Instance	"CYCLE TIMER"		False
IEC_Timer_0_Instance_19	TOF_TIME		False
Flow_Instance_1	"Flow"		False
SINA_SPEED_Instance	"SINA_SPEED"		False
SINA_SPEED_Instance_1	"SINA_SPEED"		False
SINA_PARA_S_Instance	"SINA_PARA_S"		False
IEC_Timer_0_Instance_20	TON_TIME		False
IEC_Timer_0_Instance_21	TOF_TIME		False
SINA_PARA_S_Instance_1	"SINA_PARA_S"		False
IEC_Timer_0_Instance_22	TOF_TIME		False
IEC_Timer_0_Instance_23	TOF_TIME		False
Flow_Instance_2	"Flow"		False
Scale Block_Instance_12	"Scale Block"		False
Scale Block_Instance_13	"Scale Block"		False
Scale Block_Instance_14	"Scale Block"		False
Scale Block_Instance_15	"Scale Block"		False
Scale Block_Instance_16	"Scale Block"		False
Scale Block_Instance_17	"Scale Block"		False
Scale Block_Instance_19	"Scale Block"		False
Scale Block_Instance_20	"Scale Block"		False
Scale Block_Instance_21	"Scale Block"		False
Scale Block_Instance_22	"Scale Block"		False
Scale Block_Instance_23	"Scale Block"		False
Scale Block_Instance_24	"Scale Block"		False
Scale Block_Instance_25	"Scale Block"		False
Scale Block_Instance_26	"Scale Block"		False
Scale Block_Instance_27	"Scale Block"		False
Flow_Instance_3	"Flow"		False
Flow_Instance_4	"Flow"		False
Flow_Instance_5	"Flow"		False
Flow_Instance_6	"Flow"		False
HOUR METER_Instance_5	"HOUR METER"		False
HOUR METER_Instance_6	"HOUR METER"		False
SINA_SPEED_Instance_2	"SINA_SPEED"		False
SINA_PARA_S_Instance_2	"SINA_PARA_S"		False
SINA_PARA_S_Instance_3	"SINA_PARA_S"		False
IEC_Timer_0_Instance_24	TON_TIME		False
IEC_Timer_0_Instance_25	TOF_TIME		False
IEC_Timer_0_Instance_26	TON_TIME		False
IEC_Timer_0_Instance_27	TON_TIME		False
IEC_Timer_0_Instance_28	TOF_TIME		False
TOD TIMER_Instance	"TOD TIMER"		False
TOD TIMER_Instance_1	"TOD TIMER"		False
TOD TIMER_Instance_2	"TOD TIMER"		False
TOD TIMER_Instance_3	"TOD TIMER"		False
Scale Block_Instance_28	"Scale Block"		False
Flow_Instance_7	"Flow"		False
Scale Block_Instance_29	"Scale Block"		False
Scale Block_Instance_30	"Scale Block"		False
Scale Block_Instance_31	"Scale Block"		False
Scale Block_Instance_32	"Scale Block"		False
HOUR METER_Instance_7	"HOUR METER"		False
HOUR METER_Instance_8	"HOUR METER"		False
HOUR METER_Instance_9	"HOUR METER"		False
Flow_Instance_8	"Flow"		False

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks

Block_3_DB [DB3]

Block_3_DB Properties							
General							
Name	Block_3_DB	**Number**	3	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
▼ Input			
HM START	Bool	false	True
RESET	Bool	false	False
▼ Output			
HM VALUE	Real	0.0	True
InOut			
▼ Static			
HM COUTER	Real	0.0	True
IEC_Timer_0_Instance	IEC_TIMER		False
IEC_Counter_0_Instance	IEC_COUNTER		False
COUNTER	Word	16#0	True
TRIGGER 1	Bool	false	False
TRIGGER 2	Bool	false	False
TRIGGER 3	Bool	false	False
IEC_Counter_0_Instance_1	IEC_COUNTER		False
IEC_Timer_0_Instance_1	TOF_TIME		False
IEC_Timer_0_Instance_2	TOF_TIME		False

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks

HOUR METER_DB [DB5]

HOUR METER_DB Properties							
General							
Name	HOUR METER_DB	**Number**	5	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
▼ Input			
HM START	Bool	false	True
RESET	Bool	false	False
▼ Output			
HM VALUE	Real	0.0	True
InOut			
▼ Static			
HM COUTER	Real	0.0	True
IEC_Timer_0_Instance	IEC_TIMER		False
IEC_Counter_0_Instance	IEC_COUNTER		False
COUNTER	Word	16#0	True
TRIGGER 1	Bool	false	False
TRIGGER 2	Bool	false	False
TRIGGER 3	Bool	false	False
IEC_Counter_0_Instance_1	IEC_COUNTER		False
IEC_Timer_0_Instance_1	TOF_TIME		False
IEC_Timer_0_Instance_2	TOF_TIME		False

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks

HOUR METER_DB_1 [DB12]

HOUR METER_DB_1 Properties							
General							
Name	HOUR METER_DB_1	**Number**	12	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
Input			
HM START	Bool	false	True
RESET	Bool	false	False
Output			
HM VALUE	Real	0.0	True
InOut			
Static			
HM COUTER	Real	0.0	True
IEC_Timer_0_Instance	IEC_TIMER		False
IEC_Counter_0_Instance	IEC_COUNTER		False
COUNTER	Word	16#0	True
TRIGGER 1	Bool	false	False
TRIGGER 2	Bool	false	False
TRIGGER 3	Bool	false	False
IEC_Counter_0_Instance_1	IEC_COUNTER		False
IEC_Timer_0_Instance_1	TOF_TIME		False
IEC_Timer_0_Instance_2	TOF_TIME		False

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks

HOUR METER_DB_2 [DB13]

HOUR METER_DB_2 Properties							
General							
Name	HOUR METER_DB_2	**Number**	13	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
▼ Input			
HM START	Bool	false	True
RESET	Bool	false	False
▼ Output			
HM VALUE	Real	0.0	True
InOut			
▼ Static			
HM COUTER	Real	0.0	True
IEC_Timer_0_Instance	IEC_TIMER		False
IEC_Counter_0_Instance	IEC_COUNTER		False
COUNTER	Word	16#0	True
TRIGGER 1	Bool	false	False
TRIGGER 2	Bool	false	False
TRIGGER 3	Bool	false	False
IEC_Counter_0_Instance_1	IEC_COUNTER		False
IEC_Timer_0_Instance_1	TOF_TIME		False
IEC_Timer_0_Instance_2	TOF_TIME		False

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks

HOUR METER_DB_3 [DB16]

HOUR METER_DB_3 Properties							
General							
Name	HOUR METER_DB_3	**Number**	16	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
▼ Input			
HM START	Bool	false	True
RESET	Bool	false	False
▼ Output			
HM VALUE	Real	0.0	True
InOut			
▼ Static			
HM COUTER	Real	0.0	True
IEC_Timer_0_Instance	IEC_TIMER		False
IEC_Counter_0_Instance	IEC_COUNTER		False
COUNTER	Word	16#0	True
TRIGGER 1	Bool	false	False
TRIGGER 2	Bool	false	False
TRIGGER 3	Bool	false	False
IEC_Counter_0_Instance_1	IEC_COUNTER		False
IEC_Timer_0_Instance_1	TOF_TIME		False
IEC_Timer_0_Instance_2	TOF_TIME		False

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks

HOUR METER_DB_4 [DB6]

HOUR METER_DB_4 Properties							
General							
Name	HOUR METER_DB_4	**Number**	6	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
Input			
HM START	Bool	false	True
RESET	Bool	false	False
Output			
HM VALUE	Real	0.0	True
InOut			
Static			
HM COUTER	Real	0.0	True
IEC_Timer_0_Instance	IEC_TIMER		False
IEC_Counter_0_Instance	IEC_COUNTER		False
COUNTER	Word	16#0	True
TRIGGER 1	Bool	false	False
TRIGGER 2	Bool	false	False
TRIGGER 3	Bool	false	False
IEC_Counter_0_Instance_1	IEC_COUNTER		False
IEC_Timer_0_Instance_1	TOF_TIME		False
IEC_Timer_0_Instance_2	TOF_TIME		False

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks

HOUR METER_DB_5 [DB7]

HOUR METER_DB_5 Properties							
General							
Name	HOUR METER_DB_5	**Number**	7	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
▼ Input			
HM START	Bool	false	True
RESET	Bool	false	False
▼ Output			
HM VALUE	Real	0.0	True
InOut			
▼ Static			
HM COUTER	Real	0.0	True
IEC_Timer_0_Instance	IEC_TIMER		False
IEC_Counter_0_Instance	IEC_COUNTER		False
COUNTER	Word	16#0	True
TRIGGER 1	Bool	false	False
TRIGGER 2	Bool	false	False
TRIGGER 3	Bool	false	False
IEC_Counter_0_Instance_1	IEC_COUNTER		False
IEC_Timer_0_Instance_1	TOF_TIME		False
IEC_Timer_0_Instance_2	TOF_TIME		False

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks

HOUR METER_DB_6 [DB8]

HOUR METER_DB_6 Properties							
General							
Name	HOUR METER_DB_6	**Number**	8	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
▼ Input			
HM START	Bool	false	True
RESET	Bool	false	False
▼ Output			
HM VALUE	Real	0.0	True
InOut			
▼ Static			
HM COUTER	Real	0.0	True
IEC_Timer_0_Instance	IEC_TIMER		False
IEC_Counter_0_Instance	IEC_COUNTER		False
COUNTER	Word	16#0	True
TRIGGER 1	Bool	false	False
TRIGGER 2	Bool	false	False
TRIGGER 3	Bool	false	False
IEC_Counter_0_Instance_1	IEC_COUNTER		False
IEC_Timer_0_Instance_1	TOF_TIME		False
IEC_Timer_0_Instance_2	TOF_TIME		False

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks

HOUR METER_DB_7 [DB18]

HOUR METER_DB_7 Properties							
General							
Name	HOUR METER_DB_7	**Number**	18	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
▼ Input			
HM START	Bool	false	True
RESET	Bool	false	False
▼ Output			
HM VALUE	Real	0.0	True
InOut			
▼ Static			
HM COUTER	Real	0.0	True
IEC_Timer_0_Instance	IEC_TIMER		False
IEC_Counter_0_Instance	IEC_COUNTER		False
COUNTER	Word	16#0	True
TRIGGER 1	Bool	false	False
TRIGGER 2	Bool	false	False
TRIGGER 3	Bool	false	False
IEC_Counter_0_Instance_1	IEC_COUNTER		False
IEC_Timer_0_Instance_1	TOF_TIME		False
IEC_Timer_0_Instance_2	TOF_TIME		False

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks

Totalizer_DB [DB60]

Totalizer_DB Properties							
General							
Name	Totalizer_DB	**Number**	60	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Start value	Retain
Input			
Value	Real	0.0	True
Intervall	Time	T#0ms	True
Cycle	Time	T#0ms	True
Reset	Bool	false	True
Output			
Total X10k	Real	0.0	True
Total	Real	0.0	True
InOut			
Static			
Accum	Real	0.0	True
IEC_Timer_0_Instance	IEC_TIMER		True

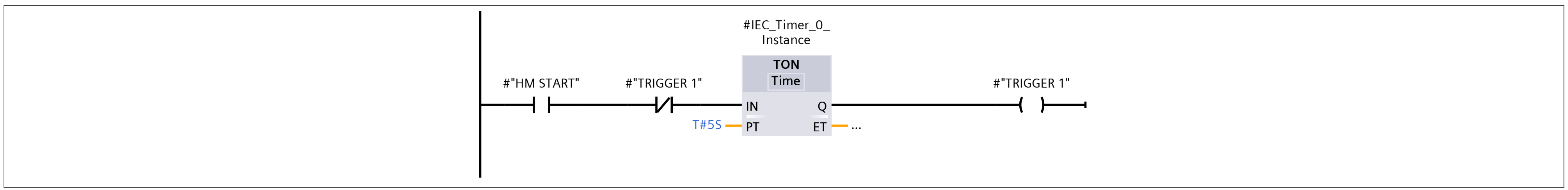
GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks

HOUR METER [FB1]

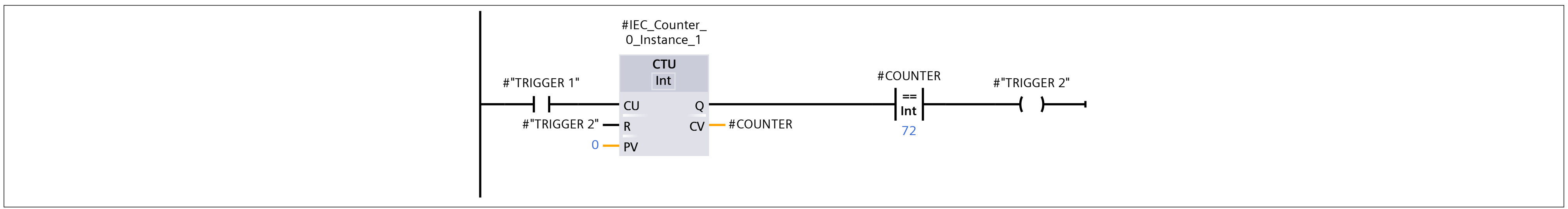
HOUR METER Properties							
General							
Name	HOUR METER	**Number**	1	**Type**	FB	**Language**	LAD
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value	Retain
▼ Input			
HM START	Bool	false	Retain
RESET	Bool	false	Non-retain
▼ Output			
HM VALUE	Real	0.0	Retain
InOut			
▼ Static			
HM COUTER	Real	0.0	Retain
IEC_Timer_0_Instance	IEC_TIMER		Non-retain
IEC_Counter_0_Instance	IEC_COUNTER		Non-retain
COUNTER	Word	16#0	Retain
TRIGGER 1	Bool	false	Non-retain
TRIGGER 2	Bool	false	Non-retain
TRIGGER 3	Bool	false	Non-retain
IEC_Counter_0_Instance_1	IEC_COUNTER		Non-retain
IEC_Timer_0_Instance_1	TOF_TIME		Non-retain
IEC_Timer_0_Instance_2	TOF_TIME		Non-retain
Temp			
Constant			

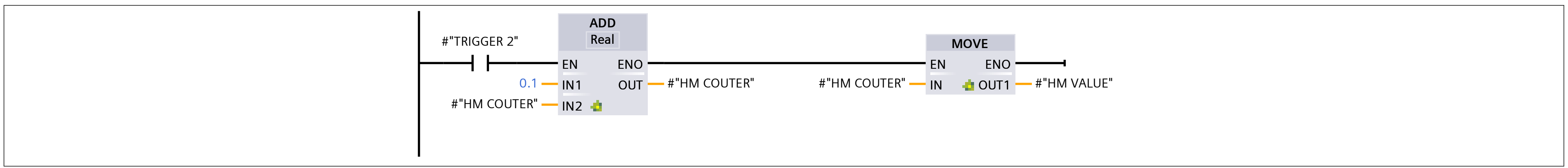
Network 2:



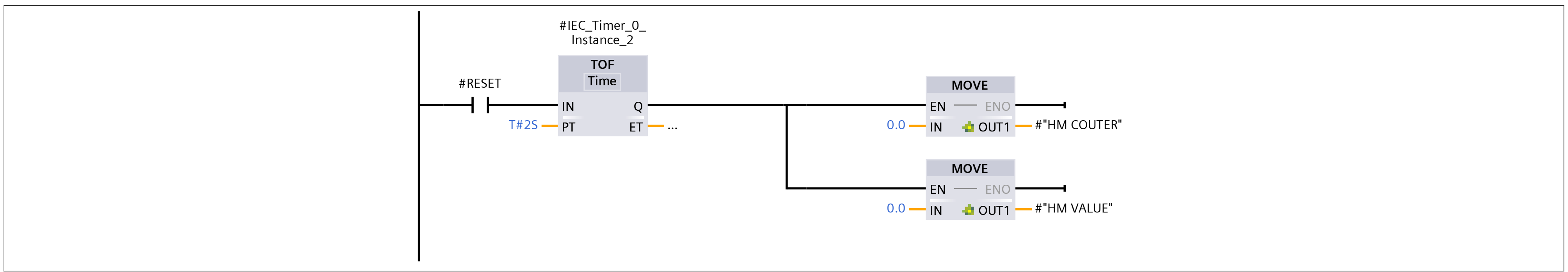
Network 3:



Network 4:



Network 5:



GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks

CYCLE TIMER [FB7]

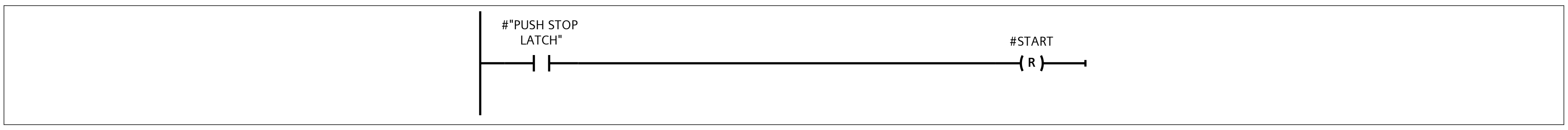
CYCLE TIMER Properties							
General							
Name	CYCLE TIMER	**Number**	7	**Type**	FB	**Language**	LAD
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

Name	Data type	Default value	Retain
▼ Input			
PUSH START LATCH	Bool	false	Non-retain
PUSH STOP LATCH	Bool	false	Non-retain
Delay Start	Time	T#0ms	Retain
TIMER 1 SET	Time	T#0ms	Retain
TIMER 2 SET	Time	T#0ms	Retain
TIMER 3 SET	Time	T#0ms	Retain
TIMER 4 SET	Time	T#0ms	Retain
TIMER 5 SET	Time	T#0ms	Retain
TIMER 6 SET	Time	T#0ms	Retain
▼ Output			
DELAY START ACTIVE	Bool	false	Non-retain
TIMER 1 START	Bool	false	Non-retain
TIMER 2 START	Bool	false	Non-retain
TIMER 3 START	Bool	false	Non-retain
TIMER 4 START	Bool	false	Non-retain
TIMER 5 START	Bool	false	Non-retain
DELAY START TR	Time	T#0ms	Retain
1ST TIMER TR	Time	T#0ms	Retain
2ND TIMER TR	Time	T#0ms	Retain
3RD TIMER TR	Time	T#0ms	Retain
4TH TIMER TR	Time	T#0ms	Retain
5TH TIMER TR	Time	T#0ms	Retain
FINAL REST TR	Time	T#0ms	Retain
RUNNING	Bool	false	Non-retain
InOut			
▼ Static			
CURRENT CYCLE 1 MOVE	Time	T#0ms	Non-retain
CURRENT CYCLE 2 MOVE	Time	T#0ms	Non-retain
CURRENT CYCLE 3 MOVE	Time	T#0ms	Non-retain
CURRENT CYCLE 4 MOVE	Time	T#0ms	Non-retain
CURRENT CYCLE 5 MOVE	Time	T#0ms	Non-retain
CURRENT CYCLE 6 MOVE	Time	T#0ms	Non-retain
CURRENT CYCLE 7 MOVE	Time	T#0ms	Non-retain
TIMER 1 GO	Bool	false	Non-retain
TIMER 2 GO	Bool	false	Non-retain
TIMER 3 GO	Bool	false	Non-retain
TIMER 4 GO	Bool	false	Non-retain
TIMER 5 GO	Bool	false	Non-retain
TIMER 6 GO	Bool	false	Non-retain
RESET ALL	Bool	false	Non-retain
TIMER 2 READY	Bool	false	Non-retain
TIMER 3 READY	Bool	false	Non-retain
TIMER 4 READY	Bool	false	Non-retain
TIMER 5 READY	Bool	false	Non-retain
TIMER 6 READY	Bool	false	Non-retain
TIMER 7 READY	Bool	false	Non-retain
TIMER 1 STOP	Bool	false	Non-retain
TIMER 2 STOP	Bool	false	Non-retain
TIMER 3 STOP	Bool	false	Non-retain
TIMER 4 STOP	Bool	false	Non-retain
TIMER 5 STOP	Bool	false	Non-retain
TIMER 6 STOP	Bool	false	Non-retain
START	Bool	false	Non-retain
IEC_Timer_0_Instance	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_1	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_2	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_3	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_4	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_5	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_6	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_7	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_8	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_9	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_10	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_11	IEC_TIMER		Non-retain

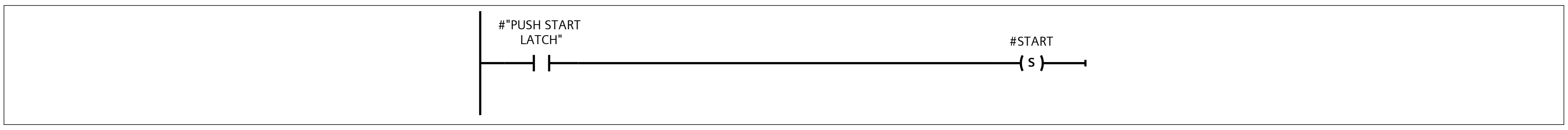
Name	Data type	Default value	Retain
IEC_Timer_0_Instance_12	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_13	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_14	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_15	IEC_TIMER		Non-retain
Temp			
Constant			

Network 1:

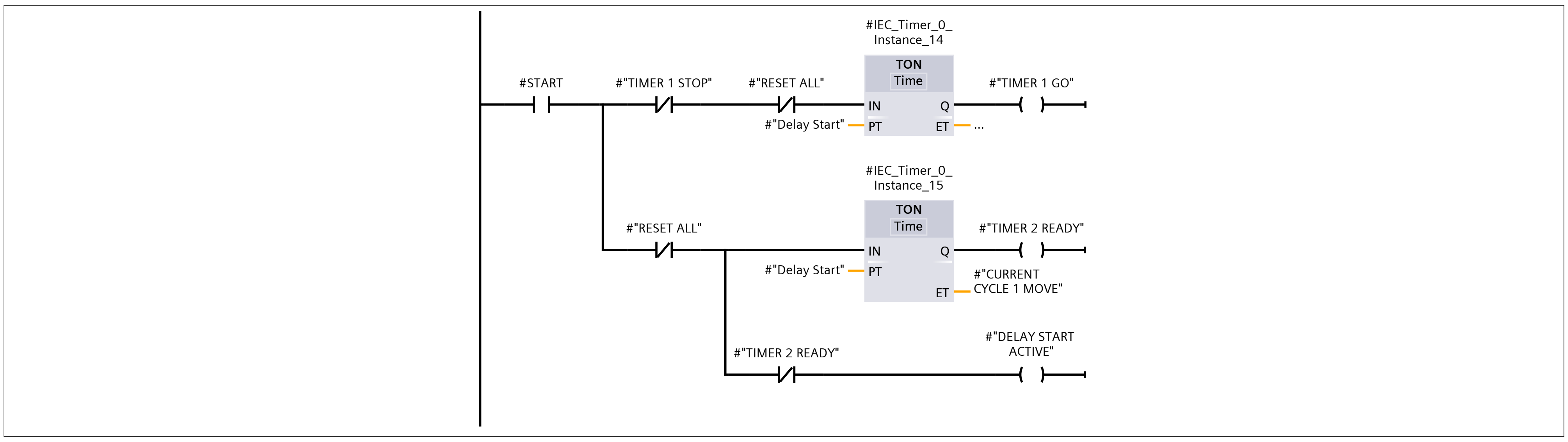
Network 2:



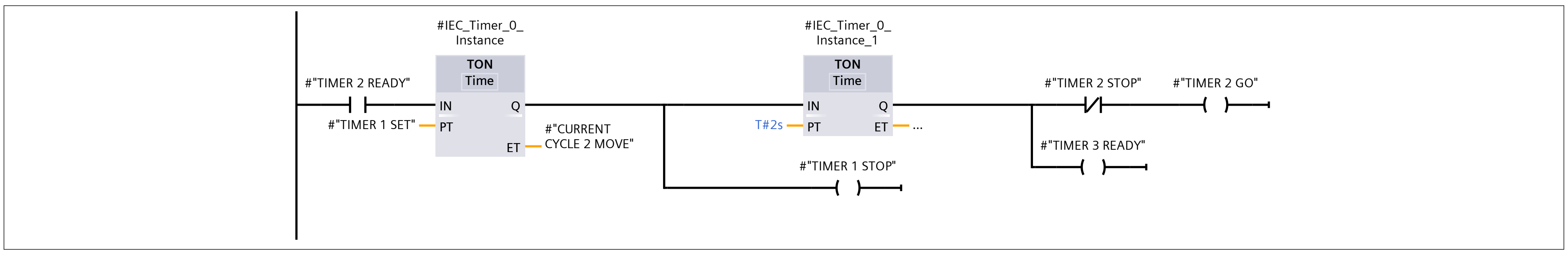
Network 3:



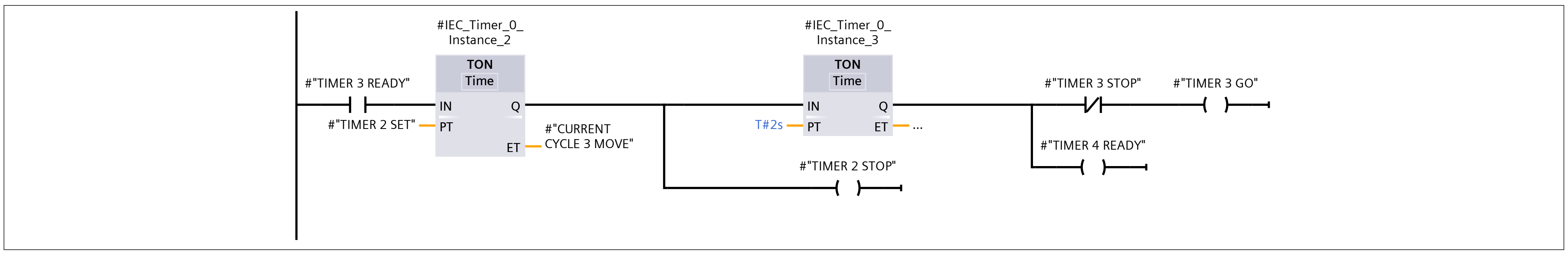
Network 4:



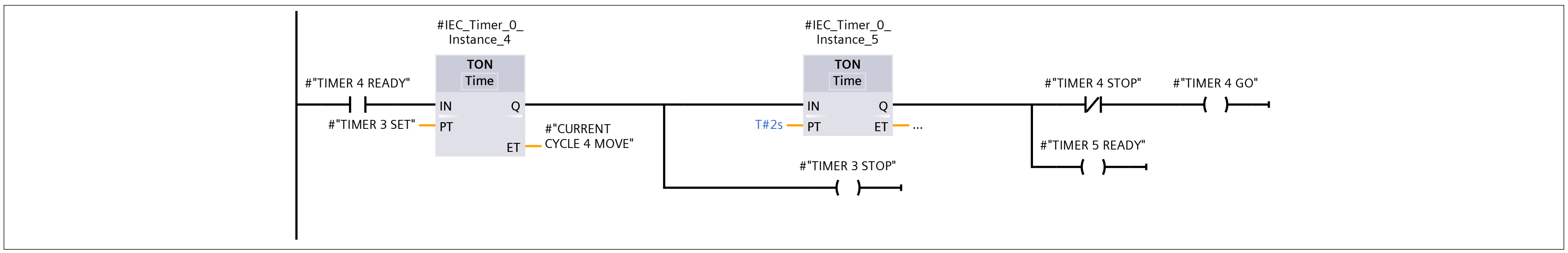
Network 5:



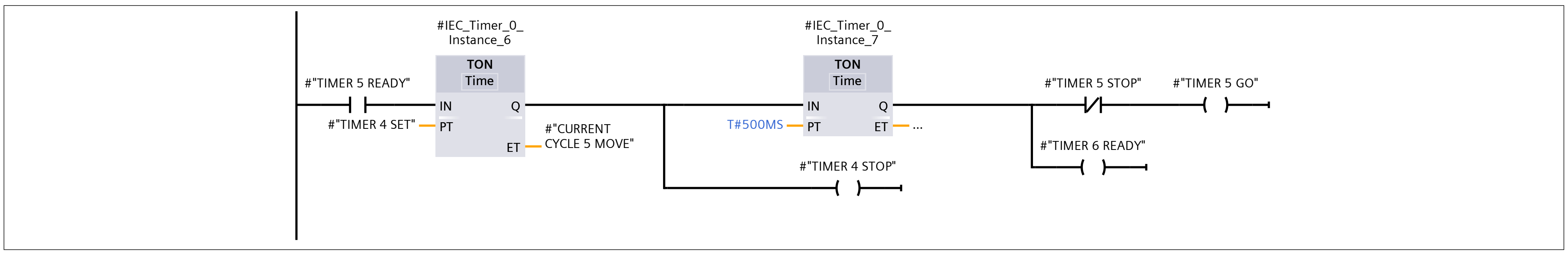
Network 6:



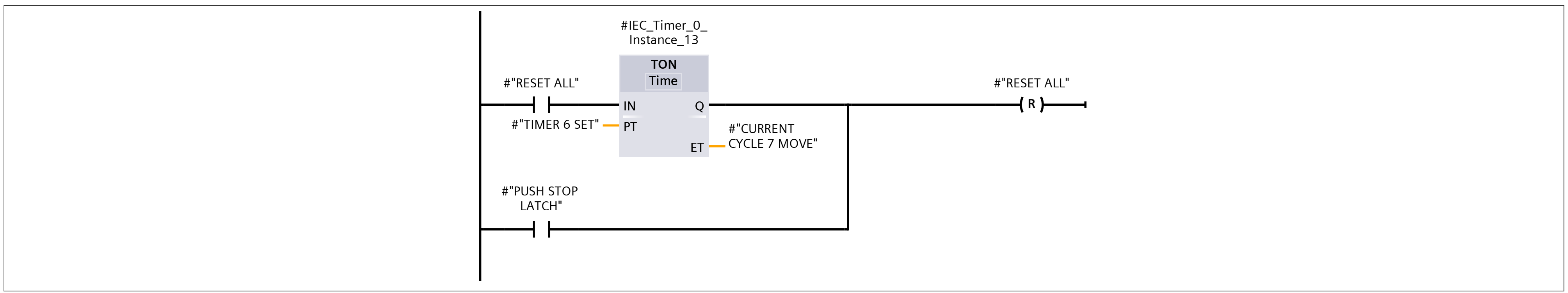
Network 7:



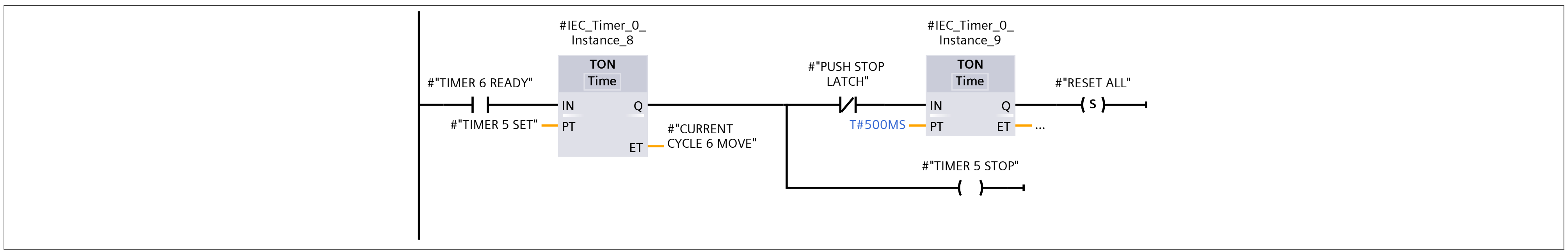
Network 8:



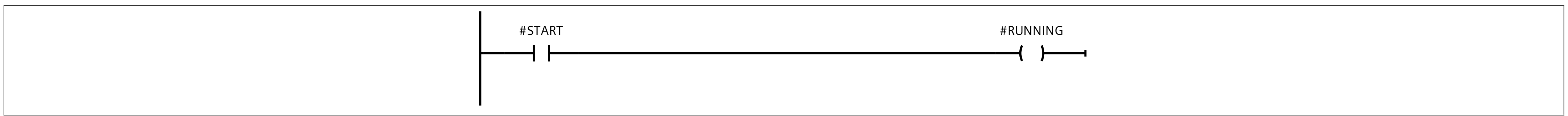
Network 9:



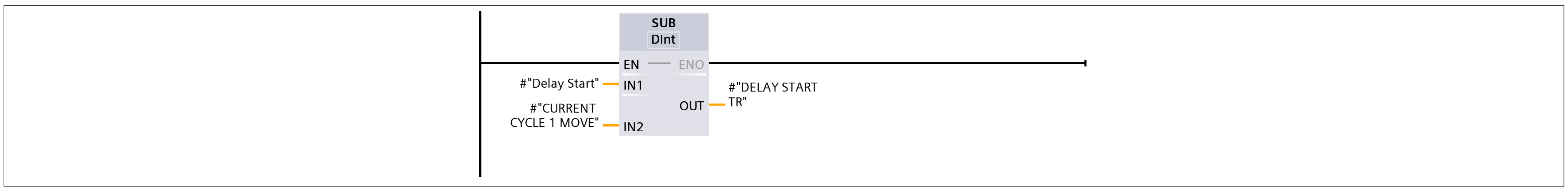
Network 10:



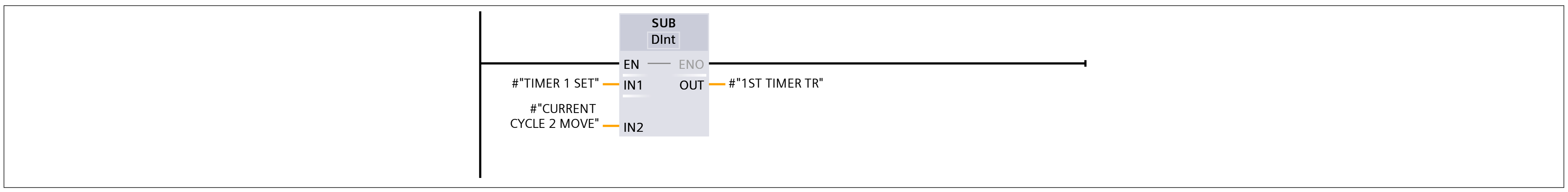
Network 11:



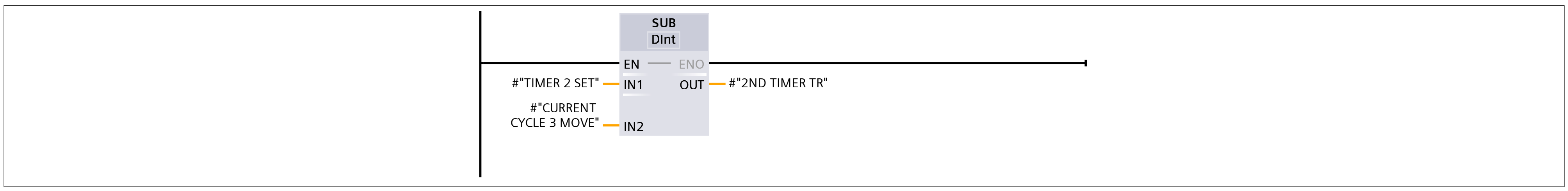
Network 12:



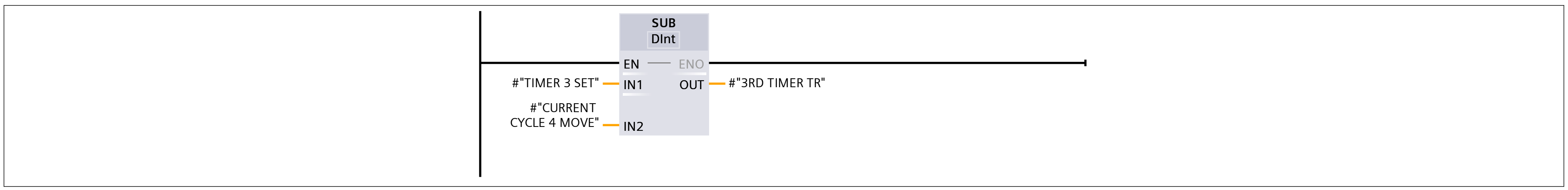
Network 13:



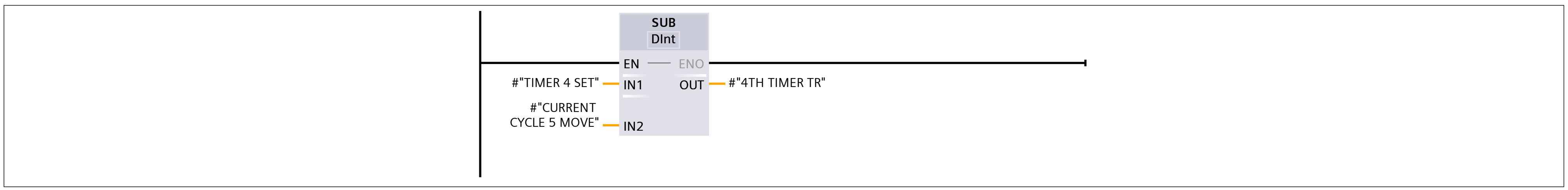
Network 14:



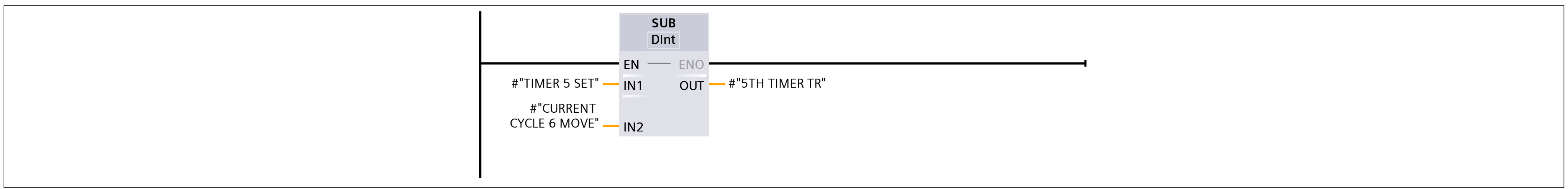
Network 15:



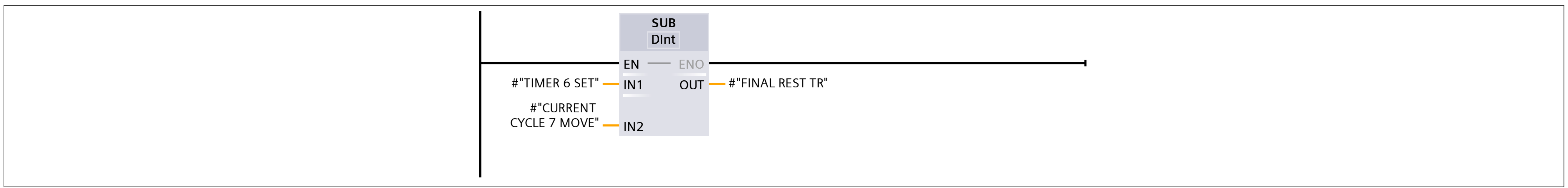
Network 16:



Network 17:



Network 18:



GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks

SINA_SPEED [FB285]

SINA_SPEED Properties							
General							
Name	SINA_SPEED	**Number**	285	**Type**	FB	**Language**	SCL
Numbering	Automatic						

Information							
Title	'Speed Control with SINAMICS and S7'	**Author**	DRVDPS7	**Comment**	Copyright (C) Siemens AG 2012. All Rights Reserved. Confidential -- SINA_SPEED: Drehzahlregelung mit dem Antriebsbaustein SINAMICS S120/G120 <-> S7-1200 -- Ersteller: Siemens AG Erlangen A&D MC PM Datum: 07.07.10 Vers.:2.1 Ã„nderung: J.B. Typical Team 07.12.12 2.2 Umsetzung in SCL / TIA Ã„nderung: J.B. Typical Team 29.04.13 2.3 1. "Q" an den AusgÃ¤nge entfernen 2. Neuer Ausgang PwrInhibit Ã„nderung: J.B. Typical Team 28.06.13 2.4 Ã„nderung HW-Zugriff Ã¼ber LOG2MOD Ã„nderung: J.B. Typical Team 18.07.13 2.5 Ã„nderung HW-Zugriff Ã¼ber zwei HW-EingÃ¤nge Ã„nderung: J.B. Typical Team 17.07.14 3.0 Optimmierung Ã„nderung: J.B. Typical Team 30.07.14 4.0 Festlegung auf einheitlicher neuer Version 4.0 Ã„nderung: P.Z. Typical Team 03.12.15 4.1 Schnittstelle an Programmierleitfadeb TIA-Potal angepasst zusÃ¤tzlicher Eingang "ConfigAxis" fÃ¼r STW-Bits Ã„nderung: G.F. Typical Team 01.03.16 4.2 Sollwert auf INT - Grenzen begrenzt Ã„nderung: F.G. Typical Team 13.09.16 4.3 Ausgabewerte am Ausgang "Status" angepasst Ã„nderung: G.F. Typical Team 11.01.17 5.0 - Festlegung auf einheitlicher neuer Version 5.0 Bibliothek V7 Funktion: Drehzahlregelung mit dem Antriebsbaustein SINAMICS S120/G120 <-> S7-1200 *** ***FB283*** ***	**Family**	DRIVES
Version	5.0	**User-defined ID**	SINA_SPD				

Name	Data type	Default value	Retain
▼ Input			
EnableAxis	Bool	0	Non-retain
AckError	Bool	0	Non-retain
SpeedSp	Real	0.0	Non-retain
RefSpeed	Real	0.0	Non-retain
ConfigAxis	Word	16#003F	Non-retain
HWIDSTW	HW_IO	0	Non-retain
HWIDZSW	HW_IO	0	Non-retain
▼ Output			
AxisEnabled	Bool	0	Non-retain
Lockout	Bool	0	Non-retain
ActVelocity	Real	0.0	Non-retain
Error	Bool	0	Non-retain
Status	Word	0	Non-retain
DiagId	Word	16#0000	Non-retain
InOut			
▼ Static			
sxSendBuf	Struct		Non-retain
sxRecvBuf	Struct		Non-retain
▼ Temp			
piRetSFC	Int		
piCount	Int		
prVelocity	Real		
pdRecvBuf	DWord		
pdSendBuf	DWord		
phLAddr	HW_IO		
swSendBuf	Array[0..1] of Word		
swRecvBuf	Array[0..1] of Word		
Constant			

```

//===============================================================================
//SIEMENS AG
//(c)Copyright 2017 All Rights Reserved
//-------------------------------------------------------------------------------
// Library: DriveLib
// Tested with: S7-1516-3 PN/DP V1.8
// Engineering: TIA Portal V14
// Restrictions: -
// Requirements: S7-1200 / S7-1500
// Functionality: cyclic communication between a SINAMICS a PLC.
// If in HWConfig Std.TLG 1 is projected 2 PZD-words are exchanged
// in every bus cycle.
// The parametrisation of these words is described in the manual of the
// SINAMICS
//===============================================================================

// Schreibdaten zusammenstellen
// Steuerword aufbereiten

#sxSendBuf.STW1.%X0 := #EnableAxis;
#sxSendBuf.STW1.%X1 := #ConfigAxis.%X0;
#sxSendBuf.STW1.%X2 := #ConfigAxis.%X1;
#sxSendBuf.STW1.%X3 := #ConfigAxis.%X2;
#sxSendBuf.STW1.%X4 := #ConfigAxis.%X3;
#sxSendBuf.STW1.%X5 := #ConfigAxis.%X4;
#sxSendBuf.STW1.%X6 := #ConfigAxis.%X5;
#sxSendBuf.STW1.%X10 := TRUE;
#sxSendBuf.STW1.%X11 := #ConfigAxis.%X6;
#sxSendBuf.STW1.%X7 := #AckError;

// Geschwindigkeit
IF #RefSpeed <> 0 THEN
  #prVelocity := #SpeedSp * (16384.0 / #RefSpeed);
  // Limit REAL - Variable to INT - Limits
  IF #prVelocity > 32767 THEN
  #prVelocity := 32767;
  ELSIF #prVelocity < -32768 THEN
  #prVelocity := -32768;
  ELSE
  ; // not needed
  END_IF;
  #sxSendBuf.Velocity := INT_TO_WORD(REAL_TO_INT(#prVelocity));

ELSE
  #sxSendBuf.Velocity := W#16#0;
END_IF;
#swSendBuf[0] := #sxSendBuf.STW1;
#swSendBuf[1] := #sxSendBuf.Velocity;

//Prozessdaten zur Signalbaugruppe schreiben
#piRetSFC := DPWR_DAT(LADDR := #HWIDSTW,
           RECORD := #swSendBuf);
```

```

// Fehler der RÃ¼ckmeldung ausgeben
#DiagId := INT_TO_WORD(#piRetSFC);

//kein Fehler beim Schreiben
IF #piRetSFC = 0 THEN

  //kein Fehler beim Schreiben
  IF #piRetSFC = 0 THEN

  //Prozessdaten von der Signalbaugruppe lesen
  #piRetSFC := DPRD_DAT(LADDR := #HWIDZSW,
                RECORD => #swRecvBuf);

  // Fehler der RÃ¼ckmeldung ausgeben
  #DiagId := INT_TO_WORD(#piRetSFC);
  END_IF;

  //Fehler beim Lesen (Profibus-Kommunikation unterbrochen)
  IF #piRetSFC <> 0 THEN

  // Fehler
  #Error := TRUE;
  #Status := 16#8600;

  // Zustandsworte lÃ¶schen
  #sxRecvBuf.ZSW1.%X8 := 0;
  #sxRecvBuf.ZSW1.%X9 := 0;
  #sxRecvBuf.ZSW1.%X10 := 0;
  #sxRecvBuf.ZSW1.%X11 := 0;
  #sxRecvBuf.ZSW1.%X12 := 0;
  #sxRecvBuf.ZSW1.%X13 := 0;
  #sxRecvBuf.ZSW1.%X14 := 0;
  #sxRecvBuf.ZSW1.%X15 := 0;
  #sxRecvBuf.ZSW1.%X0 := 0;
  #sxRecvBuf.ZSW1.%X1 := 0;
  #sxRecvBuf.ZSW1.%X2 := 0;
  #sxRecvBuf.ZSW1.%X3 := 0;
  #sxRecvBuf.ZSW1.%X4 := 0;
  #sxRecvBuf.ZSW1.%X5 := 0;
  #sxRecvBuf.ZSW1.%X6 := 0;
  #sxRecvBuf.ZSW1.%X7 := 0;


  (*#sxRecvBuf.sxZSW1.SpDev := 0;
 #sxRecvBuf.sxZSW1.Pcd := 0;
 #sxRecvBuf.sxZSW1.Comp := 0;
 #sxRecvBuf.sxZSW1.CurLim := 0;
 #sxRecvBuf.sxZSW1.Brake := 0;
 #sxRecvBuf.sxZSW1.Motover := 0;
 #sxRecvBuf.sxZSW1.Dir := 0;
 #sxRecvBuf.sxZSW1.Invover := 0;
 #sxRecvBuf.sxZSW1.Rts := 0;
 #sxRecvBuf.sxZSW1.Rdy := 0;
 #sxRecvBuf.sxZSW1.IOp := 0;
 #sxRecvBuf.sxZSW1.Fault := 0;
 #sxRecvBuf.sxZSW1.NoOff2 := 0;
 #sxRecvBuf.sxZSW1.NoOff3 := 0;
 #sxRecvBuf.sxZSW1.Inhibit := 0;
 #sxRecvBuf.sxZSW1.Alarm := 0;*)

  #sxRecvBuf.Velocity := W#16#00;

  // Werte auslesen
  ELSE
  #sxRecvBuf.ZSW1 := #swRecvBuf[0];
  #sxRecvBuf.Velocity := #swRecvBuf[1];

  // ZSW1 aufbereiten
  #AxisEnabled := #sxRecvBuf.ZSW1.%X2;
  #Error := #sxRecvBuf.ZSW1.%X3 OR #sxRecvBuf.ZSW1.%X6;
  #Lockout := #sxRecvBuf.ZSW1.%X6;

  // Fehler auswerten
  IF #sxRecvBuf.ZSW1.%X3 THEN
    #Status := 16#8401;
  ELSIF #sxRecvBuf.ZSW1.%X6 THEN
    #Status := 16#8402;
  ELSE
    #Status := 16#7002;
  END_IF;

  (*#Busy := #sxRecvBuf.sxZSW1.IOp;
 #Error := #sxRecvBuf.sxZSW1.Fault OR #sxRecvBuf.sxZSW1.Inhibit;
 #PwrInhibit := #sxRecvBuf.sxZSW1.Inhibit;

 // Fehler auswerten
 IF #sxRecvBuf.sxZSW1.Fault THEN
```

```
 #ErrorId := 1;
 ELSIF #sxRecvBuf.sxZSW1.Inhibit THEN
 #ErrorId := 2;
 ELSE
 #ErrorId := 0;
 END_IF;*)

  // Geschwindigkeit
  IF #RefSpeed <> 0 THEN
    #ActVelocity := INT_TO_REAL(WORD_TO_INT(#sxRecvBuf.Velocity)) / (16384.0 / #RefSpeed);
  ELSE
    #ActVelocity := 0.0;
  END_IF;
  END_IF;
ELSE

  // Fehler
  #Error := TRUE;
  #Status := 16#8601;

END_IF;
```

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks

SINA_PARA_S [FB287]

SINA_PARA_S Properties							
General							
Name	SINA_PARA_S	**Number**	287	**Type**	FB	**Language**	SCL
Numbering	Automatic						

Information							
Title	'one parameter exchange between SINAMICS and S7'	**Author**	DRVDPS7	**Comment**	Copyright (C) Siemens AG 2012. All Rights Reserved. Confidential -- SINA_PARA_S: Austausch eines beliebigen Parameter zwischen SINAMICS S120/ G120 <-> S7 -- Ersteller: J.B. Typical Team Datum: 25.06.14 Vers.:3.0 Übernahme vom SINA_PARA Verion 2.9 und Abänderung zu SINA_PARA_S Austausch nur noch eines Parameters Änderung: J.B. Typical Team 08.07.14 3.1 Fehlerkorrektur und Initialisierung Änderung Änderung: J.B. Typical Team 30.07.14 4.0 Festlegung auf einheitlicher neuer Version 4.0 Änderung: G.F. Typical Team 20.05.15 4.1 Fehler bei der Umrechnung der Parameterwerte behoben Änderung: G.F. Typical Team 15.09.15 4.2 Defaultwert des Parameters AxisNo von 0 auf 1 geändert Änderung: G.F. Typical Team 06.10.15 4.3 Defaultwert des Parameters Done von 0 auf 1 geändert Änderung: J.B. Typical Team 08.12.15 4.4 1. Wenn beim Parameter "Lesen" ein Fehler zurück gemeldet wird, soll das "Schreiben" abgebrochen werden 2. Für den Datentyp DWORD mit/ohne Vorzeichen neuer Ablageort (statt REAL nun DINT) 3. Neue Ausgangsvariable Ready = Lesen/Schreiben der Parameter abgeschlossen 4. Austauch der Parameter kann jetzt abgebrochen werden 5. Warnung durch Initialisierung elimininiert 6. Eingang Laddr in hardwareId umbenannt Änderung: G.F. Typical Team 24.11.16 4.5 - Fehlerausgabe bei unbekannten Datentyp (ErrorId := 5) - Datentyp 10 (OctetString) wird unterstützt - Datentyp 13 (TimeDifference) wird unterstützt - Fehler bei Auftrag abbrechen behoben Änderung: G.F. Typical Team 11.01.17 5.0 - Festlegung auf einheitlicher neuer Version 5.0 Bibliothek V7 Funktion: Austausch eines beliebigen Parameter zwischen SINAMICS S120/G120 <-> S7 **	**Family**	DRIVES

					******************** ******************** ******************** ******************** ******************** ***** ******************** ******************** ******************** *********FB283******** ******************** ******************** ******************** **** ******************** ******************** ******************** ******************** ******************** ******************** ******************** *****		
Version	5.0	**User-defined ID**	SINA_PAS				

Name	Data type	Default value	Retain
▼ Input			
Start	Bool	0	Non-retain
ReadWrite	Bool	0	Non-retain
Parameter	Int	1	Non-retain
Index	Int	0	Non-retain
ValueWrite1	Real	0.0	Non-retain
ValueWrite2	DInt	0	Non-retain
AxisNo	Byte	16#01	Non-retain
hardwareId	HW_IO	0	Non-retain
▼ Output			
Ready	Bool	0	Non-retain
Busy	Bool	0	Non-retain
Done	Bool	1	Non-retain
ValueRead1	Real	0.0	Non-retain
ValueRead2	DInt	0	Non-retain
Format	Byte	16#00	Non-retain
ErrorNo	Word	16#0000	Non-retain
Error	Bool	0	Non-retain
ErrorId	DWord	0	Non-retain
DiagId	Word	16#0000	Non-retain
InOut			
▼ Static			
sbWrError	Bool	0	Non-retain
sbWrDone	Bool	0	Non-retain
sbRdError	Bool	0	Non-retain
sbWrBusy	Bool	0	Non-retain
sbRdBusy	Bool	0	Non-retain
sbWrStart	Bool	0	Non-retain
sbRdStart	Bool	0	Non-retain
sbWrStart1	Bool	0	Non-retain
sbRdStart1	Bool	0	Non-retain
sbWrStart2	Bool	0	Non-retain
sbRdStart2	Bool	0	Non-retain
sbStart	Bool	0	Non-retain
sbReady	Bool	0	Non-retain
sbRead	Bool	0	Non-retain
sbWrite	Bool	0	Non-retain
sbParaNo	Bool	0	Non-retain
sbBusy	Bool	0	Non-retain
sbError	Bool	0	Non-retain
sbDone	Bool	0	Non-retain
syFormat	Byte	16#00	Non-retain
syAxisNo	Byte	0	Non-retain
siReqRef	Int	0	Non-retain
siErrorId	Int	0	Non-retain
siErrorCount	Int	0	Non-retain
siMaxErrCount	Int	12500	Non-retain
swParaError	Word	WORD#16#0000	Non-retain
sxReqParaMulti	Struct		Non-retain
sxChaParaMulti	Struct		Non-retain
sxRespParaMulti	Struct		Non-retain
RDREC_1	RDREC		
WRREC_1	WRREC		
siLenHeader	Int	4	Non-retain
siLenParaMulti	Int	6	Non-retain
siLenChaPara	Int	12	Non-retain
▼ Temp			
piCount	Int		

Name	Data type	Default value	Retain
piPointer	Int		
piLenTele	Int		
piRetSFC	Int		
pwWordHigh	Word		
pwWordLow	Word		
pwWord1	Word		
pwWord2	Word		
pdDWordHigh	DWord		
pdDWordLow	DWord		
pdStatus	DWord		
pbValidSFB	Bool		
piLenSFB	UInt		
pwErrorNo	Word		
Constant			

```

//=============================================================================
//SIEMENS AG
//(c)Copyright 2017 All Rights Reserved
//-----------------------------------------------------------------------------
// Library: DriveLib
// Tested with: S7-1516-3 PN/DP V1.8
// Engineering: TIA Portal V14
// Restrictions: -
// Requirements: S7-1200 / S7-1500
// Functionality: read and write one parameter from/to a Sinamics
//
//=============================================================================

// Auftrag "Parameter lesen" bzw. Auftrag "Parameter schreiben" wird nicht mehr ausgeführt
IF NOT #sbBusy THEN
  #sbParaNo := TRUE;
  #syAxisNo := #AxisNo;
END_IF;

// Starten
IF #Start AND NOT #sbStart AND NOT #sbBusy THEN

  #sbReady := False;
  #sbError := False;
  #sbBusy := False;

  // Auftrag "Parameter lesen" erkennen
  IF NOT #ReadWrite THEN
  #sbRead := True;
  #sbWrStart := True;
  #sbRdStart := False;

  #sbWrite := False;
  #sbWrStart1 := False;
  #sbRdStart1 := False;
  #sbWrStart2 := False;
  #sbRdStart2 := False;

  // Referenzauftragsnummer erzeugen
  #siReqRef := #siReqRef + 1;

  // bei Überschreitung wieder zurücksetzen und von vorne (Wertebereich von 0-255)
  IF #siReqRef > 255 THEN
    #siReqRef := 0;
  END_IF;

  // Auftrag "Parameter schreiben" erkennen
  ELSE
  #sbWrite := True;
  #sbWrStart1 := True;
  #sbRdStart1 := False;
  #sbWrStart2 := False;
  #sbRdStart2 := False;

  #sbRead := False;
  #sbWrStart := False;
  #sbRdStart := False;

  // Referenzauftragsnummer erzeugen
  #siReqRef := #siReqRef + 1;

  // bei Überschreitung wieder zurücksetzen und von vorne (Wertebereich von 0-255)
  IF #siReqRef > 255 THEN
    #siReqRef := 0;
  END_IF;
  END_IF;

  // Fehler 4 und 5 wieder zurücknehmen
  IF (#siErrorId = 4) OR (#siErrorId = 5) THEN
  #sbError := False;
```

```
  #siErrorId := 0;
  END_IF;
END_IF;

// "Start commando" Flanke merken
#sbStart := #Start;

// Abbrechen
IF NOT #Start THEN

  #siErrorCount := 0;
  // Schreib - oder Lesevorgang abbrechen
  #sbRead := False;
  #sbWrStart := False;
  #sbRdStart := False;

  #sbWrite := False;
  #sbWrStart1 := False;
  #sbRdStart1 := False;
  #sbWrStart2 := False;
  #sbRdStart2 := False;

  // Auftag ist noch beschäftigt => Fehler ausgeben
  IF #sbBusy THEN
  #sbError := True;
  #siErrorId := 4;
  #sbBusy := False;
  END_IF;
END_IF;


// Auftrag "Parameter lesen" wurde ausgelöst
IF #sbParaNo AND #sbRead AND NOT #sbWrite THEN

  // Auftrag "Parameter lesen" vorbereiten und abschicken
  IF #sbWrStart THEN

  // Ablöschen des Sendepuffers
  // Parameternummer des Parameters
  #sxReqParaMulti.sxParaAdress.siParaNo := 0;

  // Subindex des Parameters
  #sxReqParaMulti.sxParaAdress.siIndex := 0;

  // Auftrags-HEADER erstellen
  // Auftragsreferenz
  #sxReqParaMulti.sxHeader.syReqRef := INT_TO_BYTE(#siReqRef);

  // Auftragskennung 0x01=Request Parameters
  #sxReqParaMulti.sxHeader.syReqId := B#16#01;

  // Achse
  #sxReqParaMulti.sxHeader.syAxisNo := #syAxisNo;

  // Anzahl Parameter
  #sxReqParaMulti.sxHeader.syParaNo := B#16#01;

  // Auftrags-PARAMETERADRESSE erstellen
  // Parameternummer des Parameters
  #sxReqParaMulti.sxParaAdress.siParaNo := #Parameter;

  // Subindex des Parameters
  #sxReqParaMulti.sxParaAdress.siIndex := #Index;

  // SCHREIBEN AZYKLISCH
  #piLenTele := #siLenHeader + #siLenParaMulti;
  #WRREC_1(REQ := True,                                 // Startimpuls
       ID := #hardwareId,                           // Diagnoseadresse
       INDEX := 47,                                    // Rahmentyp
       LEN := INT_TO_UINT(#piLenTele),               // maximale Länge
       DONE => #sbWrDone,                             // Schreibauftrag beendet
       BUSY => #sbWrBusy,                             // Slave beschäftigt
       ERROR => #sbWrError,                            // Fehler beim Schreiben
       STATUS => #pdStatus,                             // Status[1] = Error => Status[2] Error Decode + Status[3] Error Code
       RECORD := #sxReqParaMulti);                     // Zeiger auf zu schreibenen Datensatzes

  // Ausgänge setzen
  #sbBusy := #sbWrBusy;
  #sbDone := #sbWrDone;

  // Fehler auswerten
  IF #sbWrError THEN

    // Fehlerstatus aus dem Doppelwort filtern und weitergeben
    #pwWord1 := DWORD_TO_WORD(SHR(IN := (#pdStatus AND DW#16#FFFF00), N := 8));

    // Fehlerstatus setzen
```

```
    #siErrorId := 3;
    #DiagId := #pwWord1;

    //Temporärer Fehler: #pdStatus = 80A7, 80B5, 80C0, 80C1, 80C2, 80C3 oder 80C4 zulassen und nocheinmal versuchen
    IF NOT (#pwWord1 = DW#16#80A7) AND NOT (#pwWord1 = DW#16#80B5) AND NOT (#pwWord1 = DW#16#80C0) AND
    NOT (#pwWord1 = DW#16#80C1) AND NOT (#pwWord1 = DW#16#80C2) AND NOT (#pwWord1 = DW#16#80C3) AND
    NOT (#pwWord1 = DW#16#80C4) THEN

    // Wiederholungsauftrag wieder zurücknehmen
    #sbWrStart := False;
    #sbRdStart := False;
    #sbRead := False;

    // Fehler ausgeben
    #sbError := #sbWrError;

    ELSE
    // Fehlerwiederholauftrag ??
    IF #siErrorCount = #siMaxErrCount THEN

      // Wiederholungsauftrag wieder zurücknehmen
      #sbWrStart := False;
      #sbRdStart := False;
      #sbRead := False;

      //Fehlerzähler zurücksetzen
      #siErrorCount := 0;


      // Fehler ausgeben
      #sbError := #sbWrError;

      // nix tun bis Zähler überläuft
    ELSE
      #siErrorCount := #siErrorCount + 1;
    END_IF;
    END_IF;

    // kein Fehler beim SCHEIBEN AZYKLISCH und Auftrag fertig
  ELSIF NOT #sbWrBusy AND #sbWrDone THEN

    // Fehlerkennung zurücknehmen
    IF #siErrorId = 3 THEN
    #siErrorId := 0;
    #sbError := False;
    END_IF;

    #DiagId := W#16#00;

    // Schreibauftrag fertig melden und Leseantrag anstossen
    #sbWrStart := False;
    #sbRdStart := True;
  END_IF;
  END_IF; // Auftrag "Parameter lesen" vorbereiten und abschicken

  // vom Auftrag "Parameter lesen" die Antwort abwarten und dann auswerten
  IF #sbRdStart THEN

  // Ablöschen des Empfangspuffers
  #sxRespParaMulti.sxHeader.syReqRef := B#16#00;
  #sxRespParaMulti.sxHeader.syReqId := B#16#00;
  #sxRespParaMulti.sxHeader.syAxisNo := B#16#00;
  #sxRespParaMulti.sxHeader.syParaNo := B#16#00;

  FOR #piCount := 1 TO #siLenParaMulti DO
    #sxRespParaMulti.sxData[#piCount] := B#16#00;
  END_FOR;

  // LESEN AZYKLISCH
  #piLenTele := #siLenHeader + #siLenParaMulti;
  #RDREC_1(REQ := True,                              // Startimpuls
       ID := #hardwareId,                       // Diagnoseadresse
       INDEX := 47,                                // Rahmentyp
       MLEN := INT_TO_UINT(#piLenTele),           // maximale Länge
       VALID => #pbValidSFB,                       // neuer Datensatz empfangen und gültig
       BUSY => #sbRdBusy,                         // Slave beschäftigt
       ERROR => #sbRdError,                        // Fehler beim Schreiben
       STATUS => #pdStatus,                         // Status[1] = Error => Status[2] Error Decode + Status[3] Error Code
       LEN => #piLenSFB,                         // Länge des gelesenen Datensatzes
       RECORD := #sxRespParaMulti);                 // Zeiger auf gelesenen Datensatz

  // Ausgänge setzen
  #sbBusy := #sbRdBusy;
  #sbDone := #pbValidSFB;

  // Fehler auswerten
  IF #sbRdError THEN
```

```
  // Fehlerstatus aus dem Doppelwort filtern und weitergeben
  #pwWord1 := DWORD_TO_WORD(SHR(IN := (#pdStatus AND DW#16#FFFF00), N := 8));

  // Fehlerstatus setzen
  #siErrorId := 3;
  #DiagId := #pwWord1;

  //Temporärer Fehler: #pdStatus = 80A7, 80B5, 80C0, 80C1, 80C2, 80C3 oder 80C4 zulassen und nocheinmal versuchen
  IF NOT (#pwWord1 = DW#16#80A7) AND NOT (#pwWord1 = DW#16#80B5) AND NOT (#pwWord1 = DW#16#80C0) AND
  NOT (#pwWord1 = DW#16#80C1) AND NOT (#pwWord1 = DW#16#80C2) AND NOT (#pwWord1 = DW#16#80C3) AND
  NOT (#pwWord1 = DW#16#80C4) THEN

  // Wiederholungsauftrag wieder zurücknehmen
  #sbWrStart := False;
  #sbRdStart := False;
  #sbRead := False;

  // Fehler ausgeben
  #sbError := #sbRdError;

  ELSE
  // Fehlerwiederholauftrag ??
  IF #siErrorCount = #siMaxErrCount THEN

    // Wiederholungsauftrag wieder zurücknehmen
    #sbWrStart := False;
    #sbRdStart := False;
    #sbRead := False;

    //Fehlerzähler zurücksetzen
    #siErrorCount := 0;


    // Fehler ausgeben
    #sbError := #sbRdError;

    // nix tun bis Zähler überläuft
  ELSE
    #siErrorCount := #siErrorCount + 1;
  END_IF;
  END_IF;

  // Fehler : die Auftragsreferenz der Antwort übertimmt nicht mit der Auftragsreferenz der Anfrage überein
ELSIF NOT (#siReqRef = BYTE_TO_INT(#sxRespParaMulti.sxHeader.syReqRef)) AND NOT #sbRdBusy AND #pbValidSFB THEN
  #siErrorId := 1;
  #sbError := True;
  #sbDone := False;

  // Wiederholungsauftrag wieder zurücknehmen
  #sbWrStart := False;
  #sbRdStart := False;
  #sbRead := False;

  // Fehler : falsche Auftragskennung zurück erhalten
ELSIF NOT (#sxRespParaMulti.sxHeader.syReqId = B#16#81 OR #sxRespParaMulti.sxHeader.syReqId = B#16#01) AND
  NOT #sbRdBusy AND #pbValidSFB THEN
  #siErrorId := 1;
  #sbError := True;
  #sbDone := False;

  // Wiederholungsauftrag wieder zurücknehmen
  #sbWrStart := False;
  #sbRdStart := False;
  #sbRead := False;

  // Fehler : die angeforderte Anzahl Parameter entspricht nicht der übermittelten Anzahl Parameter überein
ELSIF NOT (#sxRespParaMulti.sxHeader.syParaNo = B#16#01) AND NOT #sbRdBusy AND #pbValidSFB THEN
  #siErrorId := 1;
  #sbError := True;
  #sbDone := False;

  // Wiederholungsauftrag wieder zurücknehmen
  #sbWrStart := False;
  #sbRdStart := False;
  #sbRead := False;

  // Fehler : die Achse entspricht nicht der übergebenen Achse
ELSIF NOT (#syAxisNo = #sxRespParaMulti.sxHeader.syAxisNo) AND NOT #sbRdBusy AND #pbValidSFB THEN
  #siErrorId := 1;
  #sbError := True;
  #sbDone := False;

  // Wiederholungsauftrag wieder zurücknehmen
  #sbWrStart := False;
  #sbRdStart := False;
  #sbRead := False;

  // kein Fehler beim LESEN AZYKLISCH und Auftrag fertig
```

```
  ELSIF NOT #sbRdBusy AND #pbValidSFB THEN

    // die angefragten Parameter auswerten und im Puffer abspeichern

    // ermitteltes Format des Parameters abspeichern
    #syFormat := #sxRespParaMulti.sxData[1];

    // Format = Error ? = > gesendeter Parameter fehlerhaft
    IF (BYTE_TO_INT(#sxRespParaMulti.sxData[1]) = 68) THEN

    // Format = Error, zwei Bytes zu übermittelten Fehlernummer zusammenfassen
    #pwWordHigh := SHL(IN := BYTE_TO_WORD(#sxRespParaMulti.sxData[3]), N := 8);
    #pwWordLow := BYTE_TO_WORD(#sxRespParaMulti.sxData[4]);

    #sbError := True;

    // ermittelte Fehlernummer im Puffer abspeichern
    #ErrorNo := #pwWordHigh XOR #pwWordLow;

    // Die Fehlerhaftigkeit des erkannten Parameter in der Fehlernummer eintragen
    #swParaError := #swParaError OR W#16#01;

    // Format = Byte ? = > gesendeter Parameter ein Byte lang ohne Vorzeichen
    ELSIF (#sxRespParaMulti.sxData[1] = B#16#41) OR (#sxRespParaMulti.sxData[1] = B#16#05) THEN

    // ermittelter Parameterwert eintragen (Byte)
    #ValueRead1 := USINT_TO_REAL(BYTE_TO_USINT(#sxRespParaMulti.sxData[3]));
    #ValueRead2 := 0;

    // ermittelte Fehlernummer im Puffer zurücksetzen
    #ErrorNo := W#16#00;

    // Die Fehlerhaftigkeit des erkannten Parameter in der Fehlernummer löschen
    #swParaError := #swParaError AND W#16#FFFE;

    // Format = Byte ? = > gesendeter Parameter ein Byte lang mit Vorzeichen
    ELSIF (#sxRespParaMulti.sxData[1] = B#16#02) THEN

    // ermittelter Parameterwert eintragen (Byte)
    #ValueRead1 := SINT_TO_REAL(BYTE_TO_SINT(#sxRespParaMulti.sxData[3]));
    #ValueRead2 := 0;

    // ermittelte Fehlernummer im Puffer zurücksetzen
    #ErrorNo := W#16#00;

    // Die Fehlerhaftigkeit des erkannten Parameter in der Fehlernummer löschen
    #swParaError := #swParaError AND W#16#FFFE;

    // Format = Word ? = > gesendeter Parameter zwei Bytes lang ohne Vorzeichen
    ELSIF (#sxRespParaMulti.sxData[1] = B#16#42) OR (#sxRespParaMulti.sxData[1] = B#16#06)
    OR (#sxRespParaMulti.sxData[1] = B#16#0A) THEN

    // Format = Word, zwei Bytes zu übermitteltem Parameterwert zusammenfassen
    #pwWordHigh := SHL(IN := BYTE_TO_WORD(#sxRespParaMulti.sxData[3]), N := 8);
    #pwWordLow := BYTE_TO_WORD(#sxRespParaMulti.sxData[4]);
    #pwWord1 := #pwWordHigh XOR #pwWordLow;

    // ermittelter Parameterwert eintragen (Word)
    #ValueRead1 := UINT_TO_REAL(WORD_TO_UINT(#pwWord1));
    #ValueRead2 := 0;

    // ermittelte Fehlernummer im Puffer zurücksetzen
    #ErrorNo := W#16#00;

    // Die Fehlerhaftigkeit des erkannten Parameter in der Fehlernummer löschen
    #swParaError := #swParaError AND W#16#FFFE;

    // Format = Word ? = > gesendeter Parameter zwei Bytes lang mit Vorzeichen
    ELSIF (#sxRespParaMulti.sxData[1] = B#16#03) THEN

    // Format = Word, zwei Bytes zu übermitteltem Parameterwert zusammenfassen
    #pwWordHigh := SHL(IN := BYTE_TO_WORD(#sxRespParaMulti.sxData[3]), N := 8);
    #pwWordLow := BYTE_TO_WORD(#sxRespParaMulti.sxData[4]);
    #pwWord1 := #pwWordHigh XOR #pwWordLow;

    // ermittelter Parameterwert eintragen (Word)
    #ValueRead1 := INT_TO_REAL(WORD_TO_INT(#pwWord1));
    #ValueRead2 := 0;

    // ermittelte Fehlernummer im Puffer zurücksetzen
    #ErrorNo := W#16#00;

    // Die Fehlerhaftigkeit des erkannten Parameter in der Fehlernummer löschen
    #swParaError := #swParaError AND W#16#FFFE;

    // Format = Double Word ? = > gesendeter Parameter vier Bytes lang ohne Vorzeichen
    ELSIF (#sxRespParaMulti.sxData[1] = B#16#43) OR (#sxRespParaMulti.sxData[1] = B#16#07) OR
    (#sxRespParaMulti.sxData[1] = B#16#0D) THEN
```

```
    // Format = Double Word, vier Bytes zu übermitteltem Parameterwert zusammenfassen
    #pwWordHigh := SHL(IN := BYTE_TO_WORD(#sxRespParaMulti.sxData[3]), N := 8);
    #pwWordLow := BYTE_TO_WORD(#sxRespParaMulti.sxData[4]);
    #pwWord1 := #pwWordHigh XOR #pwWordLow;

    #pwWordHigh := SHL(IN := BYTE_TO_WORD(#sxRespParaMulti.sxData[5]), N := 8);
    #pwWordLow := BYTE_TO_WORD(#sxRespParaMulti.sxData[6]);
    #pwWord2 := #pwWordHigh XOR #pwWordLow;

    #pdDWordHigh := SHL(IN := WORD_TO_DWORD(#pwWord1), N := 16);
    #pdDWordLow := WORD_TO_DWORD(#pwWord2);

    // ermittelter Parameterwert eintragen (Word)
    #ValueRead1 := 0.0;
    #ValueRead2 := DWORD_TO_DINT(#pdDWordHigh XOR #pdDWordLow);

    // ermittelte Fehlernummer im Puffer zurücksetzen
    #ErrorNo := W#16#00;

    // Die Fehlerhaftigkeit des erkannten Parameter in der Fehlernummer löschen
    #swParaError := #swParaError AND W#16#FFFE;

    // Format = Double Word ? = > gesendeter Parameter vier Bytes lang mit Vorzeichen
    ELSIF (#sxRespParaMulti.sxData[1] = B#16#04) THEN

    // Format = Double Word, vier Bytes zu übermitteltem Parameterwert zusammenfassen
    #pwWordHigh := SHL(IN := BYTE_TO_WORD(#sxRespParaMulti.sxData[3]), N := 8);
    #pwWordLow := BYTE_TO_WORD(#sxRespParaMulti.sxData[4]);
    #pwWord1 := #pwWordHigh XOR #pwWordLow;

    #pwWordHigh := SHL(IN := BYTE_TO_WORD(#sxRespParaMulti.sxData[5]), N := 8);
    #pwWordLow := BYTE_TO_WORD(#sxRespParaMulti.sxData[6]);
    #pwWord2 := #pwWordHigh XOR #pwWordLow;

    #pdDWordHigh := SHL(IN := WORD_TO_DWORD(#pwWord1), N := 16);
    #pdDWordLow := WORD_TO_DWORD(#pwWord2);

    // ermittelter Parameterwert eintragen (Word)
    #ValueRead1 := 0.0;
    #ValueRead2 := DWORD_TO_DINT(#pdDWordHigh XOR #pdDWordLow);

    // ermittelte Fehlernummer im Puffer zurücksetzen
    #ErrorNo := W#16#00;

    // Die Fehlerhaftigkeit des erkannten Parameter in der Fehlernummer löschen
    #swParaError := #swParaError AND W#16#FFFE;

    // Format = Double Word ? = > gesendeter Parameter vier Bytes lang (FloatingPoint)
    ELSIF (#sxRespParaMulti.sxData[1] = B#16#08) THEN

    // Format = Double Word, vier Bytes zu übermitteltem Parameterwert zusammenfassen
    #pwWordHigh := SHL(IN := BYTE_TO_WORD(#sxRespParaMulti.sxData[3]), N := 8);
    #pwWordLow := BYTE_TO_WORD(#sxRespParaMulti.sxData[4]);
    #pwWord1 := #pwWordHigh XOR #pwWordLow;

    #pwWordHigh := SHL(IN := BYTE_TO_WORD(#sxRespParaMulti.sxData[5]), N := 8);
    #pwWordLow := BYTE_TO_WORD(#sxRespParaMulti.sxData[6]);
    #pwWord2 := #pwWordHigh XOR #pwWordLow;

    #pdDWordHigh := SHL(IN := WORD_TO_DWORD(#pwWord1), N := 16);
    #pdDWordLow := WORD_TO_DWORD(#pwWord2);

    // ermittelter Parameterwert eintragen (Word)
    #ValueRead1 := DWORD_TO_REAL(#pdDWordHigh XOR #pdDWordLow);
    #ValueRead2 := 0;

    // ermittelte Fehlernummer im Puffer zurücksetzen
    #ErrorNo := W#16#00;

    // Die Fehlerhaftigkeit des erkannten Parameter in der Fehlernummer löschen
    #swParaError := #swParaError AND W#16#FFFE;

    // Unbekanter Datentyp
    ELSE

    #siErrorId := 5;
    #sbError := True;
    #sbDone := False;
    // Die Fehlerhaftigkeit des erkannten Parameter in der Fehlernummer eintragen
    #swParaError := #swParaError OR W#16#01;

    END_IF;

    // Fehlerkennung zurücknehmen
    IF (#siErrorId = 3) OR (#siErrorId = 1) THEN
    #siErrorId := 0;
    #sbError := False;
```

```
    END_IF;

    #DiagId := W#16#00;

    // Auftrag : Parameter lesen ist abgeschlossen
    #sbRdStart := False;
    #sbRead := False;
  END_IF; // kein Fehler beim LESEN AZYKLISCH und Auftrag fertig
  END_IF; // vom Auftrag "Parameter lesen" die Antwort abwarten und dann auswerten
END_IF; // Auftrag "Parameter lesen" wurde ausgelöst

// Auftrag "Parameter schreiben" wurde ausgelöst
IF #sbParaNo AND NOT #sbRead AND #sbWrite THEN

  // Auftrag "Parameter schreiben" bzw. "ändern" besteht aus zwei Aufträgen
  // 1. Teilauftrag "Parameter lesen"
  // 2. Teilauftrag "Parameter schreiben bzw. ändern"

  // 1. Teilauftrag "Parameter lesen" vorbereiten und abschicken
  IF #sbWrStart1 THEN

  // Ablöschen des Sendepuffers
  // Parameternummer des Parameters
  #sxReqParaMulti.sxParaAdress.siParaNo := 0;

  // Subindex des Parameters
  #sxReqParaMulti.sxParaAdress.siIndex := 0;

  // Auftrags-HEADER erstellen
  // Auftragsreferenz
  #sxReqParaMulti.sxHeader.syReqRef := INT_TO_BYTE(#siReqRef);

  // Auftragskennung 0x01=Request Parameters
  #sxReqParaMulti.sxHeader.syReqId := B#16#01;

  // Achse
  #sxReqParaMulti.sxHeader.syAxisNo := #syAxisNo;

  // Anzahl Parameter
  #sxReqParaMulti.sxHeader.syParaNo := B#16#01;

  // Auftrags-PARAMETERADRESSE erstellen
  // Parameternummer des Parameters
  #sxReqParaMulti.sxParaAdress.siParaNo := #Parameter;

  // Subindex des Parameters
  #sxReqParaMulti.sxParaAdress.siIndex := #Index;

  // SCHREIBEN AZYKLISCH
  #piLenTele := #siLenHeader + #siLenParaMulti;
  #WRREC_1(REQ := True,                             // Startimpuls
       ID := #hardwareId,                      // Diagnoseadresse
       INDEX := 47,                               // Rahmentyp
       LEN := INT_TO_UINT(#piLenTele),          // maximale Länge
       DONE => #sbWrDone,                        // Schreibauftrag beendet
       BUSY => #sbWrBusy,                        // Slave beschäftigt
       ERROR => #sbWrError,                       // Fehler beim Schreiben
       STATUS => #pdStatus,                        // Status[1] = Error => Status[2] Error Decode + Status[3] Error Code
       RECORD := #sxReqParaMulti);                 // Zeiger auf zu schreibenen Datensatz

  // Ausgänge setzen
  #sbBusy := #sbWrBusy;
  #sbDone := #sbWrDone;

  // Fehler auswerten
  IF #sbWrError THEN

    // Fehlerstatus aus dem Doppelwort filtern und weitergeben
    #pwWord1 := DWORD_TO_WORD(SHR(IN := (#pdStatus AND DW#16#FFFF00), N := 8));

    // Fehlerstatus setzen
    #siErrorId := 3;
    #DiagId := #pwWord1;

    //Temporärer Fehler: #pdStatus = 80A7, 80B5, 80C0, 80C1, 80C2, 80C3 oder 80C4 zulassen und nocheinmal versuchen
    IF NOT (#pwWord1 = DW#16#80A7) AND NOT (#pwWord1 = DW#16#80B5) AND NOT (#pwWord1 = DW#16#80C0) AND
    NOT (#pwWord1 = DW#16#80C1) AND NOT (#pwWord1 = DW#16#80C2) AND NOT (#pwWord1 = DW#16#80C3) AND
    NOT (#pwWord1 = DW#16#80C4) THEN

    // Wiederholungsauftrag wieder zurücknehmen
    #sbWrStart1 := False;
    #sbRdStart1 := False;
    #sbWrite := False;

    // Fehler ausgeben
    #sbError := #sbWrError;

```

```
    ELSE
    // Fehlerwiederholauftrag ??
    IF #siErrorCount = #siMaxErrCount THEN

      // Wiederholungsauftrag wieder zurücknehmen
      #sbWrStart1 := False;
      #sbRdStart1 := False;
      #sbWrite := False;

      //Fehlerzähler zurücksetzen
      #siErrorCount := 0;


      // Fehler ausgeben
      #sbError := #sbWrError;
      // nix tun bis Zähler überläuft
    ELSE
      #siErrorCount := #siErrorCount + 1;
    END_IF;
    END_IF;

    // kein Fehler beim SCHEIBEN AZYKLISCH und Auftrag fertig
  ELSIF NOT #sbWrBusy AND #sbWrDone THEN

    // Fehlerkennung zurücknehmen
    IF (#siErrorId = 3) THEN
    #siErrorId := 0;
    #sbError := False;
    END_IF;

    #DiagId := W#16#00;

    // Schreibauftrag fertig melden und Leseantrag anstossen
    #sbWrStart1 := False;
    #sbRdStart1 := True;
  END_IF;
  END_IF; // 1. Teilauftrag "Parameter lesen" vorbereiten und abschicken

  // vom 1. Teilauftrag "Parameter lesen" die Antwort abwarten und dann auswerten
  IF #sbRdStart1 THEN

  // Ablöschen des Empfangspuffers
  #sxRespParaMulti.sxHeader.syReqRef := B#16#00;
  #sxRespParaMulti.sxHeader.syReqId := B#16#00;
  #sxRespParaMulti.sxHeader.syAxisNo := B#16#00;
  #sxRespParaMulti.sxHeader.syParaNo := B#16#00;

  FOR #piCount := 1 TO #siLenParaMulti DO
    #sxRespParaMulti.sxData[#piCount] := B#16#00;
  END_FOR;

  // LESEN AZYKLISCH
  #piLenTele := #siLenHeader + #siLenParaMulti;
  #RDREC_1(REQ := True,                              // Startimpuls
       ID := #hardwareId,                        // Diagnoseadresse
       INDEX := 47,                                 // Rahmentyp
       MLEN := INT_TO_UINT(#piLenTele),            // maximale Länge
       VALID => #pbValidSFB,                        // neuer Datensatz empfangen und gültig
       BUSY => #sbRdBusy,                          // Slave beschäftigt
       ERROR => #sbRdError,                         // Fehler beim Schreiben
       STATUS => #pdStatus,                          // Status[1] = Error => Status[2] Error Decode + Status[3] Error Code
       LEN => #piLenSFB,                          // Länge des gelesenen Datensatzes
       RECORD := #sxRespParaMulti);                  // Zeiger auf gelesenen Datensatz

  // Ausgänge setzen
  #sbBusy := #sbRdBusy;
  #sbDone := #pbValidSFB;

  // Fehler auswerten
  IF #sbRdError THEN
    // Fehlerstatus aus dem Doppelwort filtern und weitergeben
    #pwWord1 := DWORD_TO_WORD(SHR(IN := (#pdStatus AND DW#16#FFFF00), N := 8));

    // Fehlerstatus setzen
    #siErrorId := 3;
    #DiagId := #pwWord1;

    //Temporärer Fehler: #pdStatus = 80A7, 80B5, 80C0, 80C1, 80C2, 80C3 oder 80C4 zulassen und nocheinmal versuchen
    IF NOT (#pwWord1 = DW#16#80A7) AND NOT (#pwWord1 = DW#16#80B5) AND NOT (#pwWord1 = DW#16#80C0) AND
    NOT (#pwWord1 = DW#16#80C1) AND NOT (#pwWord1 = DW#16#80C2) AND NOT (#pwWord1 = DW#16#80C3) AND
    NOT (#pwWord1 = DW#16#80C4) THEN

    // Wiederholungsauftrag wieder zurücknehmen
    #sbWrStart1 := False;
    #sbRdStart1 := False;
    #sbWrite := False;

```

```
    // Fehler ausgeben
    #sbError := #sbRdError;

    ELSE
    // Fehlerwiederholauftrag ??
    IF #siErrorCount = #siMaxErrCount THEN

      // Wiederholungsauftrag wieder zurücknehmen
      #sbWrStart1 := False;
      #sbRdStart1 := False;
      #sbWrite := False;

      //Fehlerzähler zurücksetzen
      #siErrorCount := 0;


      // Fehler ausgeben
      #sbError := #sbRdError;

      // nix tun bis Zähler überläuft
    ELSE
      #siErrorCount := #siErrorCount + 1;
    END_IF;
    END_IF;

    // Fehler : die Auftragsreferenz der Antwort übertimmt nicht mit der Auftragsreferenz der Anfrage überein
  ELSIF NOT (#siReqRef = BYTE_TO_INT(#sxRespParaMulti.sxHeader.syReqRef)) AND NOT #sbRdBusy AND #pbValidSFB THEN
    #siErrorId := 1;
    #sbError := True;
    #sbDone := False;

    // Wiederholungsauftrag wieder zurücknehmen
    #sbWrStart1 := False;
    #sbRdStart1 := False;
    #sbWrite := False;

    // Fehler : falsche Auftragskennung zurück erhalten
  ELSIF NOT (#sxRespParaMulti.sxHeader.syReqId = B#16#81 OR #sxRespParaMulti.sxHeader.syReqId = B#16#01) AND
    NOT #sbRdBusy AND #pbValidSFB THEN
    #siErrorId := 1;
    #sbError := True;
    #sbDone := False;

    // Wiederholungsauftrag wieder zurücknehmen
    #sbWrStart1 := False;
    #sbRdStart1 := False;
    #sbWrite := False;

    // Fehler : die angeforderte Anzahl Parameter entspricht nicht der übermittelten Anzahl Parameter überein
  ELSIF NOT (#sxRespParaMulti.sxHeader.syParaNo = B#16#01) AND NOT #sbRdBusy AND #pbValidSFB THEN
    #siErrorId := 1;
    #sbError := True;
    #sbDone := False;

    // Wiederholungsauftrag wieder zurücknehmen
    #sbWrStart1 := False;
    #sbRdStart1 := False;
    #sbWrite := False;

    // Fehler : die Achse entspricht nicht der übergebenen Achse
  ELSIF NOT (#syAxisNo = #sxRespParaMulti.sxHeader.syAxisNo) AND NOT #sbRdBusy AND #pbValidSFB THEN
    #siErrorId := 1;
    #sbError := True;
    #sbDone := False;

    // Wiederholungsauftrag wieder zurücknehmen
    #sbWrStart1 := False;
    #sbRdStart1 := False;
    #sbWrite := False;

    // kein Fehler beim LESEN AZYKLISCH und Auftrag fertig
  ELSIF NOT #sbRdBusy AND #pbValidSFB THEN

    // die angefragten Parameter auswerten und im Puffer abspeichern
    // ermitteltes Format des Parameters abspeichern
    #syFormat := #sxRespParaMulti.sxData[1];

    // Format = Error ? = > gesendeter Parameter fehlerhaft
    IF (BYTE_TO_INT(#sxRespParaMulti.sxData[1]) = 68) THEN

    // Format = Error, zwei Bytes zu übermittelten Fehlernummer zusammenfassen
    #pwWordHigh := SHL(IN := BYTE_TO_WORD(#sxRespParaMulti.sxData[3]), N := 8);
    #pwWordLow := BYTE_TO_WORD(#sxRespParaMulti.sxData[4]);

    #sbError := True;

    // ermittelte Fehlernummer im Puffer abspeichern
    #ErrorNo := #pwWordHigh XOR #pwWordLow;
```

```

    // Die Fehlerhaftigkeit des erkannten Parameter in der Fehlernummer eintragen
    #swParaError := #swParaError OR W#16#01;

    // Format = Byte ? = > gesendeter Parameter ein Byte lang
    ELSIF (#sxRespParaMulti.sxData[1] = B#16#41) OR
    (#sxRespParaMulti.sxData[1] = B#16#02) OR (#sxRespParaMulti.sxData[1] = B#16#05) THEN

    // ermittelte Fehlernummer im Puffer zurücksetzen
    #ErrorNo := W#16#00;

    // Die Fehlerhaftigkeit des erkannten Parameter in der Fehlernummer löschen
    #swParaError := #swParaError AND W#16#FFFE;

    // Format = Word ? = > gesendeter Parameter zwei Bytes lang
    ELSIF (#sxRespParaMulti.sxData[1] = B#16#42) OR (#sxRespParaMulti.sxData[1] = B#16#03)
    OR (#sxRespParaMulti.sxData[1] = B#16#06) OR (#sxRespParaMulti.sxData[1] = B#16#0A) THEN

    // ermittelte Fehlernummer im Puffer zurücksetzen
    #ErrorNo := W#16#00;

    // Die Fehlerhaftigkeit des erkannten Parameter in der Fehlernummer löschen
    #swParaError := #swParaError AND W#16#FFFE;


    // Format = Double Word ? = > gesendeter Parameter vier Bytes lang
    ELSIF (#sxRespParaMulti.sxData[1] = B#16#43) OR (#sxRespParaMulti.sxData[1] = B#16#04) OR
    (#sxRespParaMulti.sxData[1] = B#16#07) OR (#sxRespParaMulti.sxData[1] = B#16#08) OR
    (#sxRespParaMulti.sxData[1] = B#16#0D) THEN

    // ermittelte Fehlernummer im Puffer zurücksetzen
    #ErrorNo := W#16#00;

    // Die Fehlerhaftigkeit des erkannten Parameter in der Fehlernummer löschen
    #swParaError := #swParaError AND W#16#FFFE;

    // Unbekanter Datentyp
    ELSE

    #siErrorId := 5;
    #sbError := True;
    #sbDone := False;
    // Die Fehlerhaftigkeit des erkannten Parameter in der Fehlernummer eintragen
    #swParaError := #swParaError OR W#16#01;

    END_IF;

    // Fehlerkennung zurücknehmen
    IF (#siErrorId = 3) OR (#siErrorId = 1) THEN
    #siErrorId := 0;
    #sbError := False;
    END_IF;

    #DiagId := W#16#00;

    // 1. Teilauftrag "Parameter lesen" ist abgeschlossen
    #sbRdStart1 := False;

    // einer der gesendeten Parameter ist fehlerhaft => Abbruch, kein "Parameter schreiben" erforderlich
    IF (#swParaError = W#16#00) THEN
    #sbWrStart2 := True;
    ELSE
    #sbWrStart2 := False;
    END_IF;
  END_IF; // kein Fehler beim LESEN AZYKLISCH und Auftrag fertig
  END_IF; // vom 1. Teilauftrag "Parameter lesen" die Antwort abwarten und dann auswerten

  // 2. Teilauftrag "Parameter schreiben bzw. ändern" vorbereiten und abschicken
  IF #sbWrStart2 THEN

  // Ablöschen des Sendepuffers
  FOR #piCount := 1 TO #siLenChaPara DO
    // Parameteradresse und Parameterwert des Parameters
    #sxChaParaMulti.sxData[#piCount] := B#16#00;
  END_FOR;

  // Auftrags-HEADER erstellen
  // Auftragsreferenz
  #sxChaParaMulti.sxHeader.syReqRef := INT_TO_BYTE(#siReqRef);

  // Auftragskennung 0x01=Request Parameters | 0x02=Change Parameters
  #sxChaParaMulti.sxHeader.syReqId := B#16#02;

  // Achse
  #sxChaParaMulti.sxHeader.syAxisNo := #syAxisNo;

  // Anzahl Parameter
  #sxChaParaMulti.sxHeader.syParaNo := B#16#01;
```

```

// Auftrags-PARAMETERADRESSE erstellen
// Attribute of parameters (0x10=Value, 0x30=Text)
#sxChaParaMulti.sxData[1] := B#16#10;

// No. of elements (DEC: for single elements=1)
#sxChaParaMulti.sxData[2] := B#16#01;

// Parameternummer des Parameters
#sxChaParaMulti.sxData[4] := INT_TO_BYTE(#Parameter);
#sxChaParaMulti.sxData[3] := WORD_TO_BYTE(SHR(IN := INT_TO_WORD(#Parameter), N := 8));

// Subindex des Parameters
#sxChaParaMulti.sxData[6] := INT_TO_BYTE(#Index);
#sxChaParaMulti.sxData[5] := WORD_TO_BYTE(SHR(IN := INT_TO_WORD(#Index), N := 8));

// Auftrags-PARAMETERVALUE erstellen
// Format (BYTE, WORD, DWORD des Parameterwert übergeben
#sxChaParaMulti.sxData[7] := #syFormat;

// Number of value
#sxChaParaMulti.sxData[8] := B#16#01;

// Value of parameter in Bytes
IF (#syFormat = B#16#41) OR
  (#syFormat = B#16#02) OR (#syFormat = B#16#05) THEN

  #sxChaParaMulti.sxData[9] := WORD_TO_BYTE(DWORD_TO_WORD(DINT_TO_DWORD(REAL_TO_DINT(#ValueWrite1))));
  #sxChaParaMulti.sxData[10] := 16#00;  //WORD_TO_BYTE(DWORD_TO_WORD(SHR(IN := DINT_TO_DWORD(REAL_TO_DINT(#Value-Write1)), N := 8)));

  // Value of parameter in Word
ELSIF (#syFormat = B#16#42) OR (#syFormat = B#16#03) OR
  (#syFormat = B#16#06) OR (#syFormat = B#16#0A) THEN

  #sxChaParaMulti.sxData[10] := WORD_TO_BYTE(DWORD_TO_WORD(DINT_TO_DWORD(REAL_TO_DINT(#ValueWrite1))));
  #sxChaParaMulti.sxData[9] := WORD_TO_BYTE(DWORD_TO_WORD(SHR(IN := DINT_TO_DWORD(REAL_TO_DINT(#ValueWrite1)), N := 8)));

  // Value of parameter in DWord
ELSIF (#syFormat = B#16#43) OR (#syFormat = B#16#04) OR
  (#syFormat = B#16#07) OR (#syFormat = B#16#0D) THEN

  #sxChaParaMulti.sxData[12] := WORD_TO_BYTE(DWORD_TO_WORD(DINT_TO_DWORD(#ValueWrite2)));
  #sxChaParaMulti.sxData[11] := WORD_TO_BYTE(DWORD_TO_WORD(SHR(IN := DINT_TO_DWORD(#ValueWrite2), N := 8)));
  #sxChaParaMulti.sxData[10] := WORD_TO_BYTE(DWORD_TO_WORD(SHR(IN := DINT_TO_DWORD(#ValueWrite2), N := 16)));
  #sxChaParaMulti.sxData[9] := WORD_TO_BYTE(DWORD_TO_WORD(SHR(IN := DINT_TO_DWORD(#ValueWrite2), N := 24)));


  // Value of parameter in DWord (FloatingPoint)
ELSIF (#syFormat = B#16#08) THEN

  #sxChaParaMulti.sxData[12] := WORD_TO_BYTE(DWORD_TO_WORD(REAL_TO_DWORD(#ValueWrite1)));
  #sxChaParaMulti.sxData[11] := WORD_TO_BYTE(DWORD_TO_WORD(SHR(IN := REAL_TO_DWORD(#ValueWrite1), N := 8)));
  #sxChaParaMulti.sxData[10] := WORD_TO_BYTE(DWORD_TO_WORD(SHR(IN := REAL_TO_DWORD(#ValueWrite1), N := 16)));
  #sxChaParaMulti.sxData[9] := WORD_TO_BYTE(DWORD_TO_WORD(SHR(IN := REAL_TO_DWORD(#ValueWrite1), N := 24)));

END_IF;

// SCHREIBEN AZYKLISCH
#piLenTele := #siLenHeader + #siLenChaPara;
#WRREC_1(REQ := True,                             // Startimpuls
     ID := #hardwareId,                      // Diagnoseadresse
     INDEX := 47,                               // Rahmentyp
     LEN := INT_TO_UINT(#piLenTele),            // maximale Länge
     DONE => #sbWrDone,                          // Schreibauftrag beendet
     BUSY => #sbWrBusy,                          // Slave beschäftigt
     ERROR => #sbWrError,                         // Fehler beim Schreiben
     STATUS => #pdStatus,                          // Status[1] = Error => Status[2] Error Decode + Status[3] Error Code
     RECORD := #sxChaParaMulti);                   // Zeiger auf zu schreibenen Datensatzes

// Ausgänge setzen
#sbBusy := #sbWrBusy;
#sbDone := #sbWrDone;

// Fehler auswerten
IF #sbWrError THEN
  // Fehlerstatus aus dem Doppelwort filtern und weitergeben
  #pwWord1 := DWORD_TO_WORD(SHR(IN := (#pdStatus AND DW#16#FFFF00), N := 8));

  // Fehlerstatus setzen
  #siErrorId := 3;
  #sbError := False;
  #DiagId := #pwWord1;

  //Temporärer Fehler: #pdStatus = 80A7, 80B5, 80C0, 80C1, 80C2, 80C3 oder 80C4 zulassen und nocheinmal versuchen
  IF NOT (#pwWord1 = DW#16#80A7) AND NOT (#pwWord1 = DW#16#80B5) AND NOT (#pwWord1 = DW#16#80C0) AND
```

```
    NOT (#pwWord1 = DW#16#80C1) AND NOT (#pwWord1 = DW#16#80C2) AND NOT (#pwWord1 = DW#16#80C3) AND
    NOT (#pwWord1 = DW#16#80C4) THEN

    // Wiederholungsauftrag wieder zurücknehmen
    #sbWrStart2 := False;
    #sbRdStart2 := False;
    #sbWrite := False;

    // Fehler ausgeben
    #sbError := #sbWrError;

    ELSE
    // Fehlerwiederholauftrag ??
    IF #siErrorCount = #siMaxErrCount THEN

      // Wiederholungsauftrag wieder zurücknehmen
      #sbWrStart2 := False;
      #sbRdStart2 := False;
      #sbWrite := False;

      //Fehlerzähler zurücksetzen
      #siErrorCount := 0;


      // Fehler ausgeben
      #sbError := #sbWrError;

      // nix tun bis Zähler überläuft
    ELSE
      #siErrorCount := #siErrorCount + 1;
    END_IF;
    END_IF;

    // kein Fehler beim SCHEIBEN AZYKLISCH und Auftrag fertig
  ELSIF NOT #sbWrBusy AND #sbWrDone THEN
    // Fehlerkennung zurücknehmen
    #DiagId := W#16#00;

    // Schreibauftrag fertig melden und Leseantrag anstossen
    #sbWrStart2 := False;
    #sbRdStart2 := True;
  END_IF;
  END_IF; // 2. Teilauftrag "Parameter schreiben bzw. ändern" vorbereiten und abschicken

  // vom 2. Teilauftrag "Parameter schreiben bzw. ändern" die Antwort abwarten und dann auswerten
  IF #sbRdStart2 THEN

  // Ablöschen des Empfangspuffers
  #sxRespParaMulti.sxHeader.syReqRef := B#16#00;
  #sxRespParaMulti.sxHeader.syReqId := B#16#00;
  #sxRespParaMulti.sxHeader.syAxisNo := B#16#00;
  #sxRespParaMulti.sxHeader.syParaNo := B#16#00;

  FOR #piCount := 1 TO #siLenParaMulti DO
    #sxRespParaMulti.sxData[#piCount] := B#16#00;
  END_FOR;

  // LESEN AZYKLISCH
  #piLenTele := #siLenHeader + #siLenParaMulti;
  #RDREC_1(REQ := True,                                   // Startimpuls
       ID := #hardwareId,                            // Diagnoseadresse
       INDEX := 47,                                     // Rahmentyp
       MLEN := INT_TO_UINT(#piLenTele),               // maximale Länge
       VALID => #pbValidSFB,                            // neuer Datensatz empfangen und gültig
       BUSY => #sbRdBusy,                             // Slave beschäftigt
       ERROR => #sbRdError,                             // Fehler beim Schreiben
       STATUS => #pdStatus,                              // Status[1] = Error => Status[2] Error Decode + Status[3] Error
Code
       LEN => #piLenSFB,                              // Länge des gelesenen Datensatzes
       RECORD := #sxRespParaMulti);                      // Zeiger auf gelesenen Datensatz

  // Ausgänge setzen
  #sbBusy := #sbRdBusy;
  #sbDone := #pbValidSFB;

  // Fehler auswerten
  IF #sbRdError THEN
    // Fehlerstatus aus dem Doppelwort filtern und weitergeben
    #pwWord1 := DWORD_TO_WORD(SHR(IN := (#pdStatus AND DW#16#FFFF00), N := 8));

    // Fehlerstatus setzen
    #siErrorId := 3;
    #DiagId := #pwWord1;

    //Temporärer Fehler: #pdStatus = 80A7, 80B5, 80C0, 80C1, 80C2, 80C3 oder 80C4 zulassen und nocheinmal versuchen
    IF NOT (#pwWord1 = DW#16#80A7) AND NOT (#pwWord1 = DW#16#80B5) AND NOT (#pwWord1 = DW#16#80C0) AND
    NOT (#pwWord1 = DW#16#80C1) AND NOT (#pwWord1 = DW#16#80C2) AND NOT (#pwWord1 = DW#16#80C3) AND
    NOT (#pwWord1 = DW#16#80C4) THEN
```

```

    // Wiederholungsauftrag wieder zurücknehmen
    #sbWrStart2 := False;
    #sbRdStart2 := False;
    #sbWrite := False;

    // Fehler ausgeben
    #sbError := #sbRdError;

    ELSE
    // Fehlerwiederholauftrag ??
    IF #siErrorCount = #siMaxErrCount THEN

      // Wiederholungsauftrag wieder zurücknehmen
      #sbWrStart2 := False;
      #sbRdStart2 := False;
      #sbWrite := False;

      //Fehlerzähler zurücksetzen
      #siErrorCount := 0;


      // Fehler ausgeben
      #sbError := #sbRdError;

      // nix tun bis Zähler überläuft
    ELSE
      #siErrorCount := #siErrorCount + 1;
    END_IF;
    END_IF;

    // Fehler : die Auftragsreferenz der Antwort übertimmt nicht mit der Auftragsreferenz der Anfrage überein
  ELSIF NOT (#siReqRef = BYTE_TO_INT(#sxRespParaMulti.sxHeader.syReqRef)) AND NOT #sbRdBusy AND #pbValidSFB THEN
    #siErrorId := 1;
    #sbError := True;
    #sbDone := False;

    // Wiederholungsauftrag wieder zurücknehmen
    #sbWrStart2 := False;
    #sbRdStart2 := False;
    #sbWrite := False;

    // Fehler : falsche Auftragskennung zurück erhalten
  ELSIF NOT (#sxRespParaMulti.sxHeader.syReqId = B#16#82 OR #sxRespParaMulti.sxHeader.syReqId = B#16#02) AND
    NOT #sbRdBusy AND #pbValidSFB THEN
    #siErrorId := 1;
    #sbError := True;
    #sbDone := False;

    // Wiederholungsauftrag wieder zurücknehmen
    #sbWrStart2 := False;
    #sbRdStart2 := False;
    #sbWrite := False;

    // Fehler : die angeforderte Anzahl Parameter entspricht nicht der übermittelten Anzahl Parameter überein
  ELSIF NOT (#sxRespParaMulti.sxHeader.syParaNo = B#16#01) AND NOT #sbRdBusy AND #pbValidSFB THEN
    #siErrorId := 1;
    #sbError := True;
    #sbDone := False;

    // Wiederholungsauftrag wieder zurücknehmen
    #sbWrStart2 := False;
    #sbRdStart2 := False;
    #sbWrite := False;

    // Fehler : die Achse entspricht nicht der übergebenen Achse
  ELSIF NOT (#syAxisNo = #sxRespParaMulti.sxHeader.syAxisNo) AND NOT #sbRdBusy AND #pbValidSFB THEN
    #siErrorId := 1;
    #sbError := True;
    #sbDone := False;

    // Wiederholungsauftrag wieder zurücknehmen
    #sbWrStart2 := False;
    #sbRdStart2 := False;
    #sbWrite := False;

    // kein Fehler beim LESEN AZYKLISCH und Auftrag fertig
  ELSIF NOT #sbRdBusy AND #pbValidSFB THEN

    // 2. Teilauftrag "Parameter schreiben bzw. ändern" negative Rückmeldung erhalten
    IF #sxRespParaMulti.sxHeader.syReqId = B#16#82 THEN

    // die angefragten Parameter auswerten und im Puffer abspeichern
    // Format des Parameters auswerten, bei Format = Error Fehler auswerten
    IF (BYTE_TO_INT(#sxRespParaMulti.sxData[1]) = 68) THEN

      // Fehlerwert ermitteln und abspeichern
      // Format = Word, zwei Bytes zu übermitteltem Parameterwert zusammenfassen
```

```
      #pwWordHigh := SHL(IN := BYTE_TO_WORD(#sxRespParaMulti.sxData[3]), N := 8);
      #pwWordLow := BYTE_TO_WORD(#sxRespParaMulti.sxData[4]);
      #pwWord1 := #pwWordHigh XOR #pwWordLow;

      #sbError := True;

      // ermittelte Fehlernummer im Puffer zurücksetzen
      #ErrorNo := W#16#00;

      #ErrorNo := #pwWord1;

      // Die Fehlerhaftigkeit des erkannten Parameter in der Fehlernummer eintragen
      #swParaError := #swParaError OR W#16#01;

    ELSE

      // Die Fehlerhaftigkeit des erkannten Parameter in der Fehlernummer löschen
      #swParaError := #swParaError AND W#16#FFFE;

      // ermittelte Fehlernummer im Puffer zurücksetzen
      #ErrorNo := W#16#00;
    END_IF;
    END_IF; // 2. Teilauftrag "Parameter schreiben bzw. ändern" negative Rückmeldung erhalten

    // Fehlerkennung zurücknehmen
    IF (#siErrorId = 3) OR (#siErrorId = 1) THEN
    #siErrorId := 0;
    #sbError := False;
    END_IF;

    #DiagId := W#16#00;

    // 2. Teilauftrag "Parameter schreiben bzw. ändern" ist abgeschlossen
    #sbRdStart2 := False;
    #sbWrite := False;

  END_IF; // kein Fehler beim LESEN AZYKLISCH und Auftrag fertig
  END_IF; // vom 2. Teilauftrag "Parameter schreiben bzw. ändern" die Antwort abwarten und dann auswerten
END_IF; // Auftrag "Parameter schreiben" wurde ausgelöst

#pdDWordHigh := SHL(IN := INT_TO_DWORD(#siErrorId), N := 16);
#pdDWordLow := WORD_TO_DWORD(#swParaError);

// ermittelter Parameterwert eintragen (Word)
#ErrorId := #pdDWordHigh XOR #pdDWordLow;

// Initialisierung von Ausgängen
#Busy := #sbBusy;
#Error := #sbError;
#Format := #syFormat;
// Änderung wegen verhalten von Ready
#Done := #sbDone;
// Prüfen, ob Auftrag abgeschlossen ist
IF ((#Error OR #Done) AND NOT #sbReady) THEN
  #Ready := True;
  #sbReady := True;
ELSE
  #Ready := False;
END_IF;
```

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks

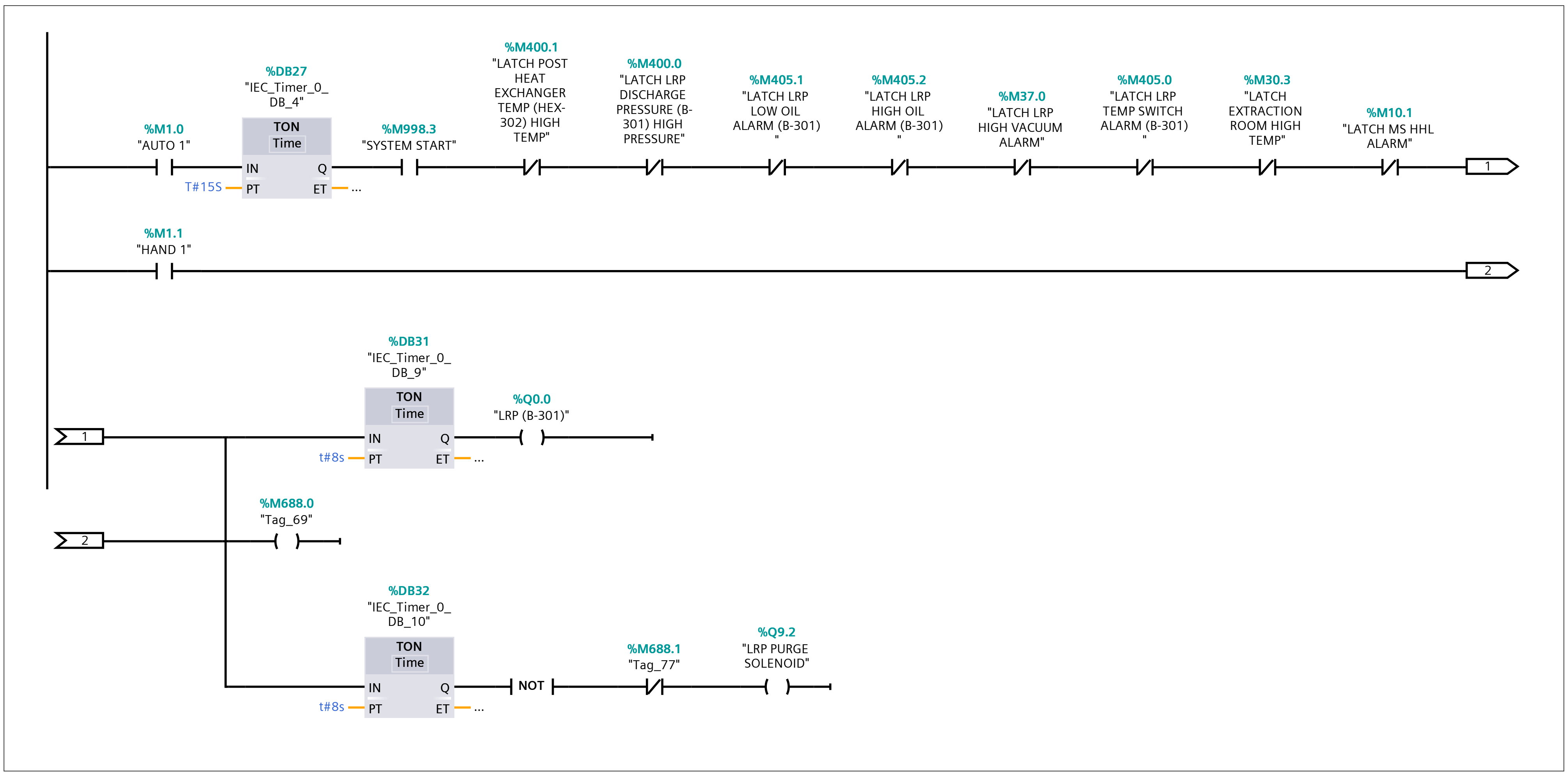
Block_1 [FC100]

Block_1 Properties							
General							
Name	Block_1	**Number**	100	**Type**	FC	**Language**	LAD
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

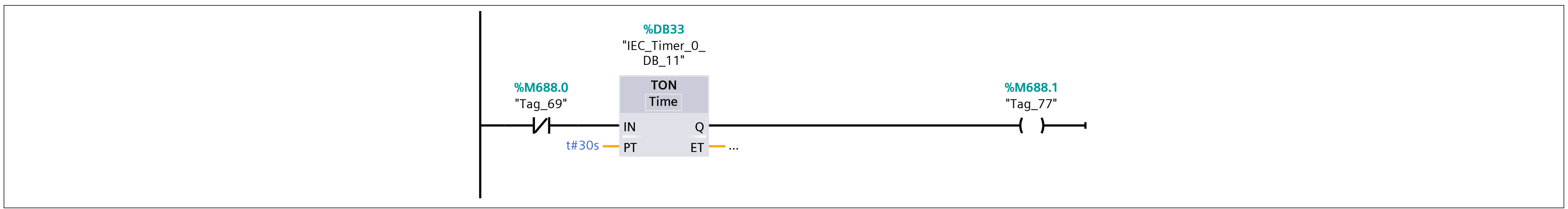
Name	Data type	Default value
Input		
Output		
InOut		
Temp		
Constant		
▼ Return		
Block_1	Void	

Network 1:

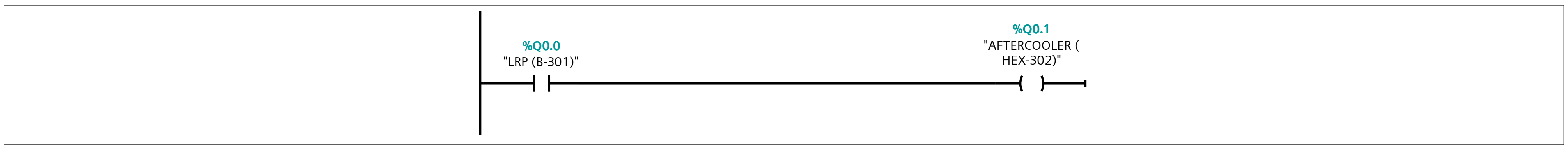
Network 1:



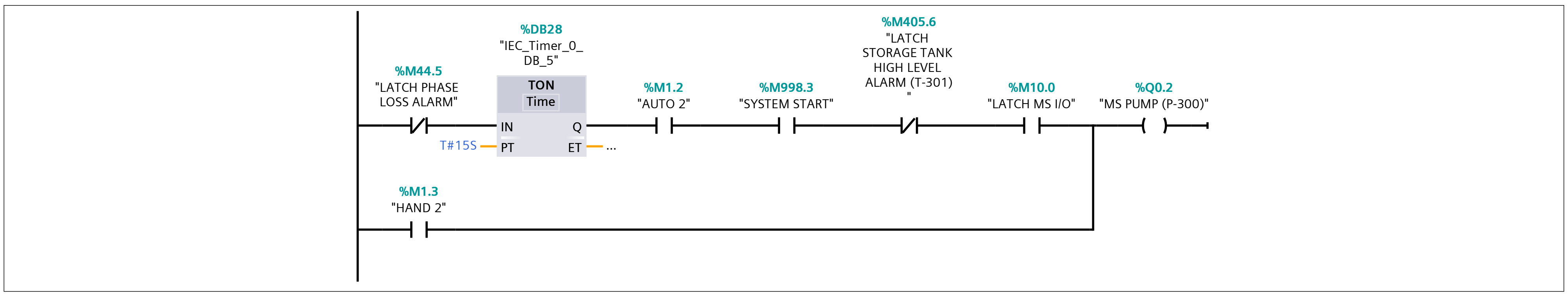
Network 2:



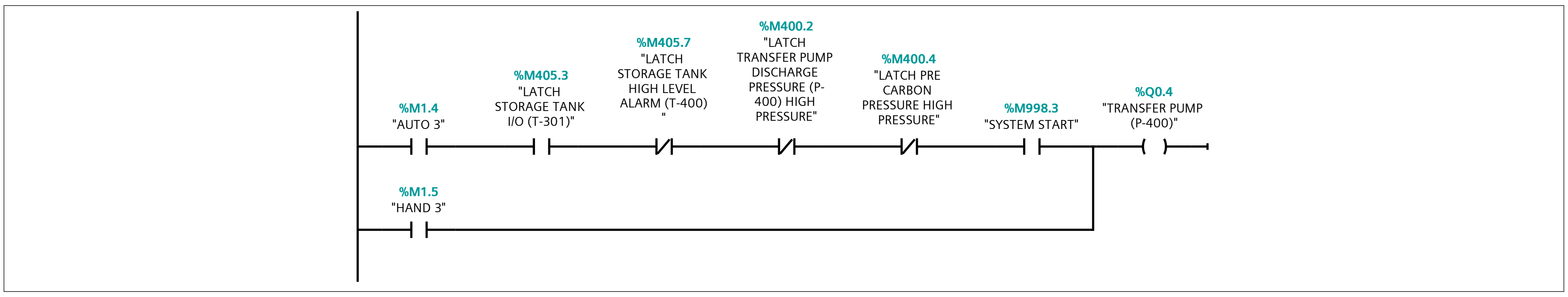
Network 3:



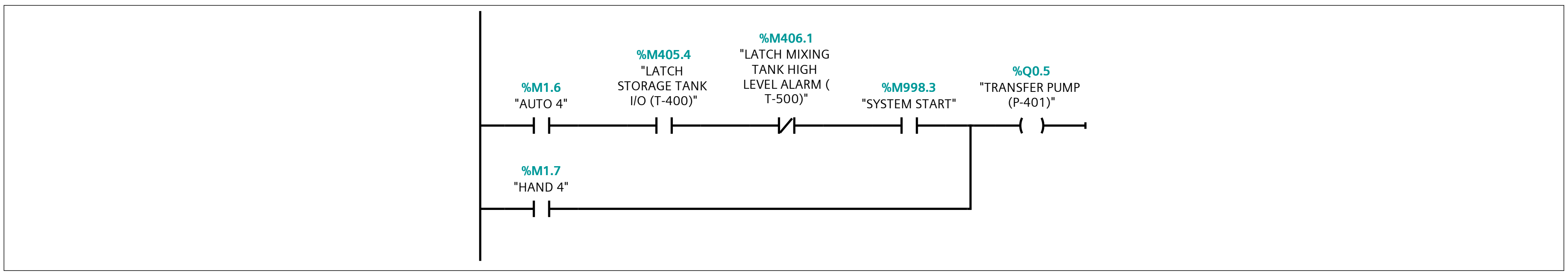
Network 4:



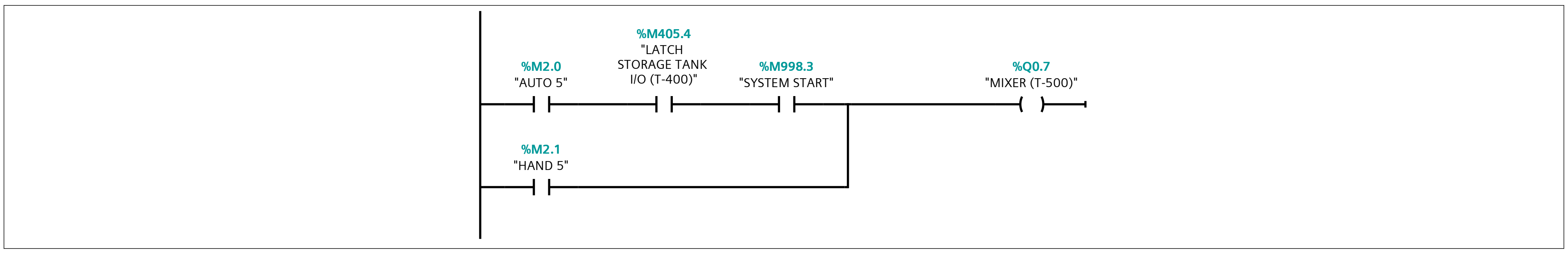
Network 5:



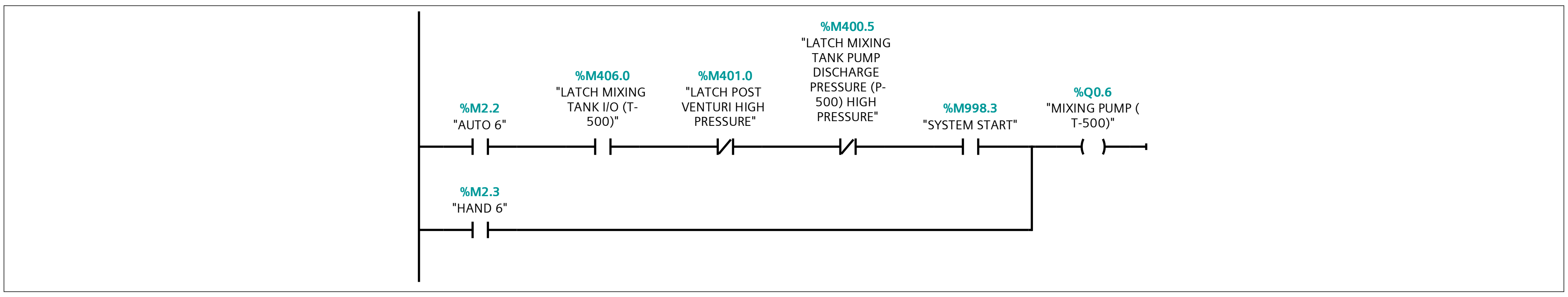
Network 6:



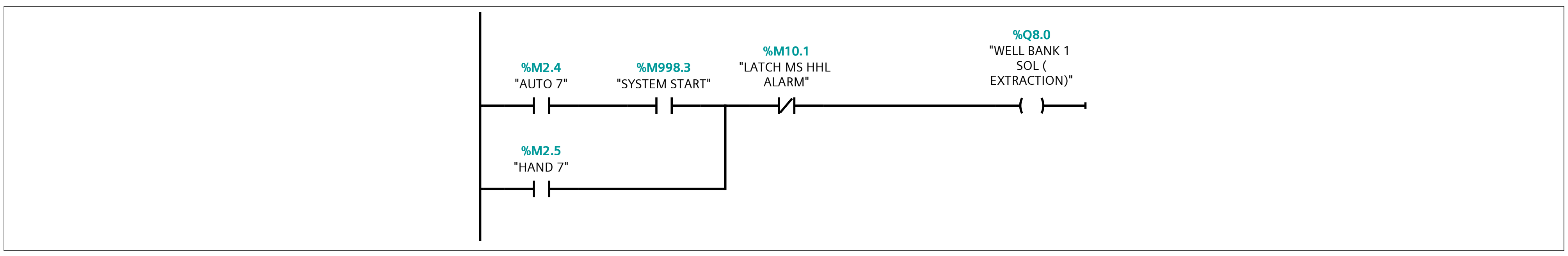
Network 7:



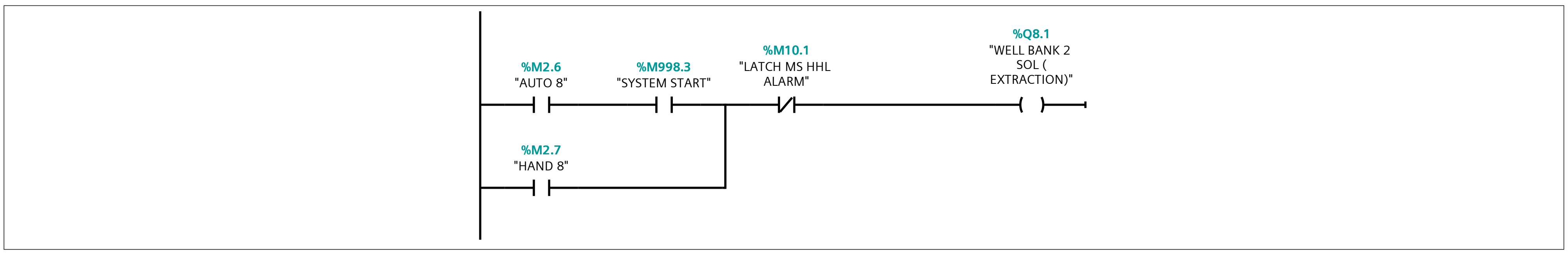
Network 8:



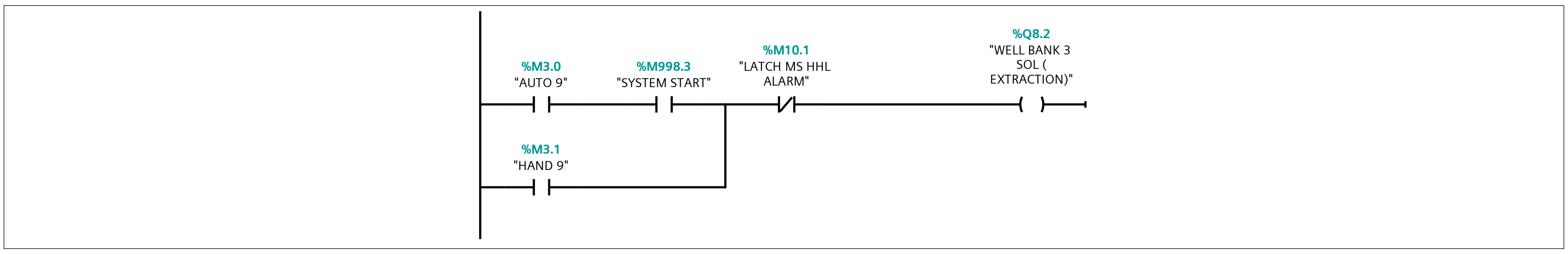
Network 9:



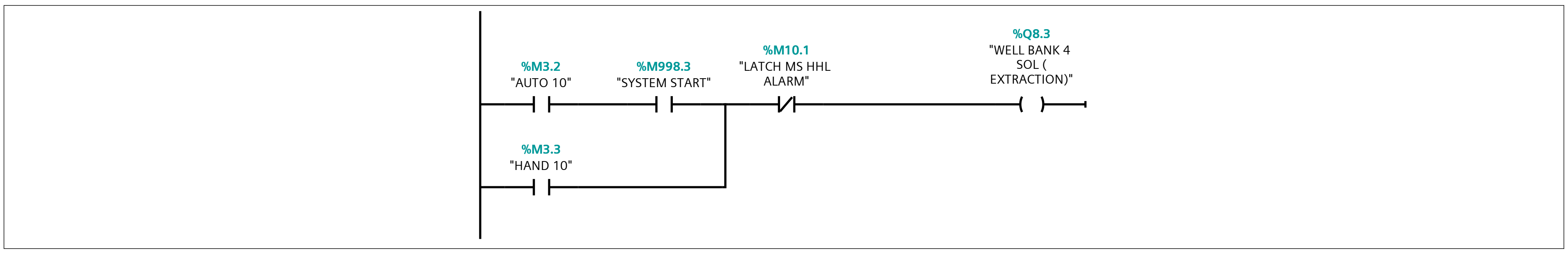
Network 10:



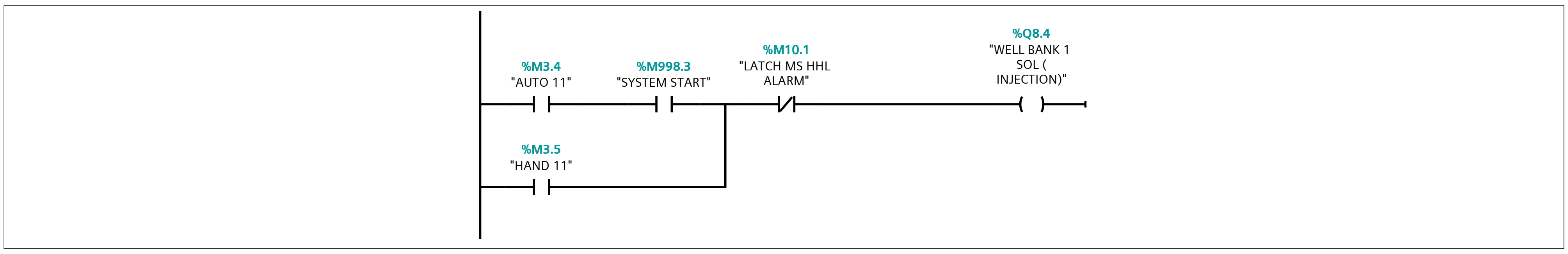
Network 11:



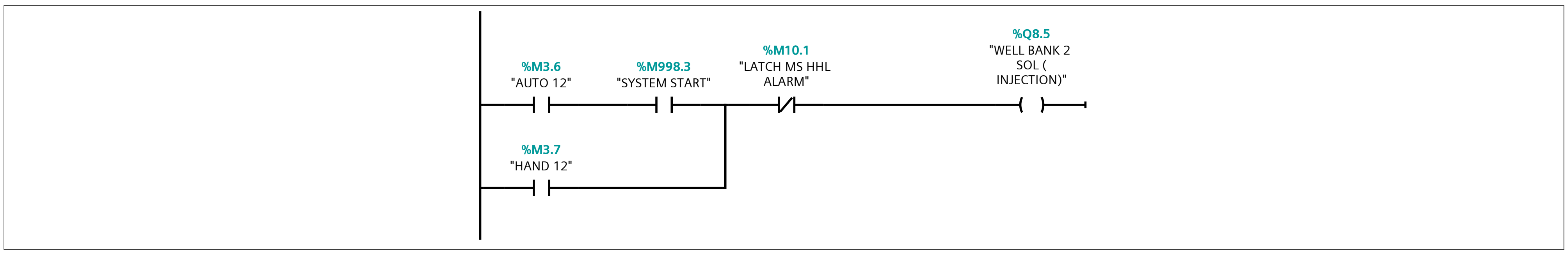
Network 12:



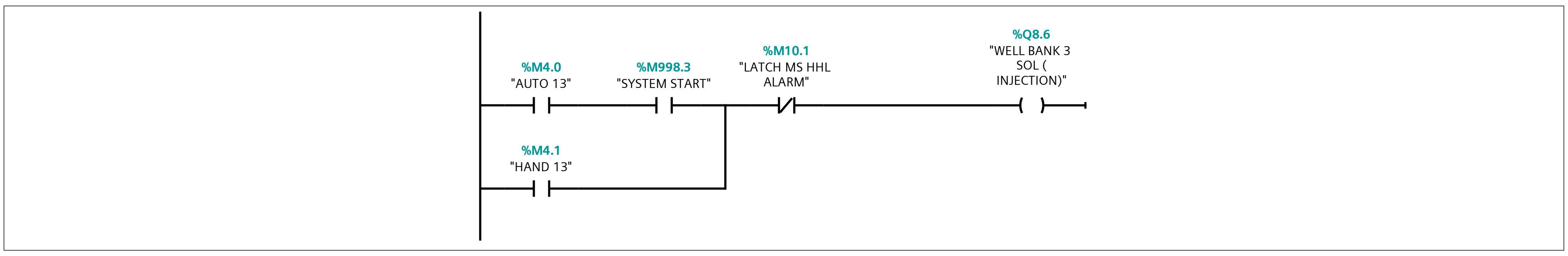
Network 13:



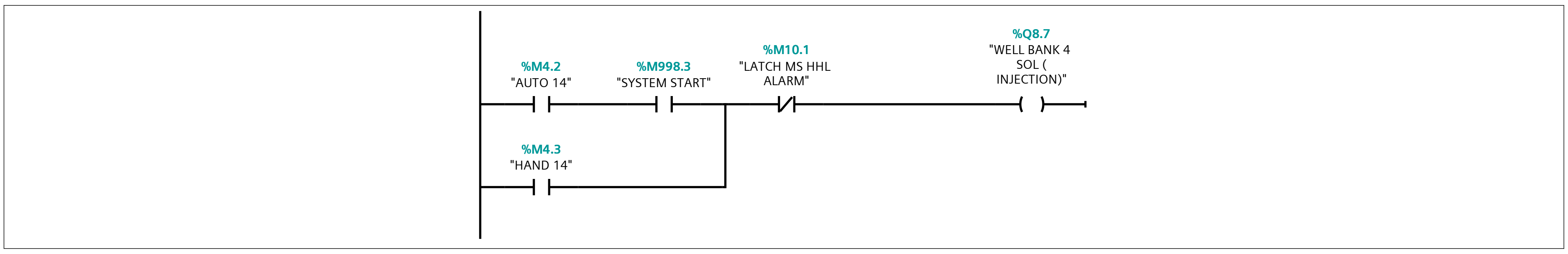
Network 14:



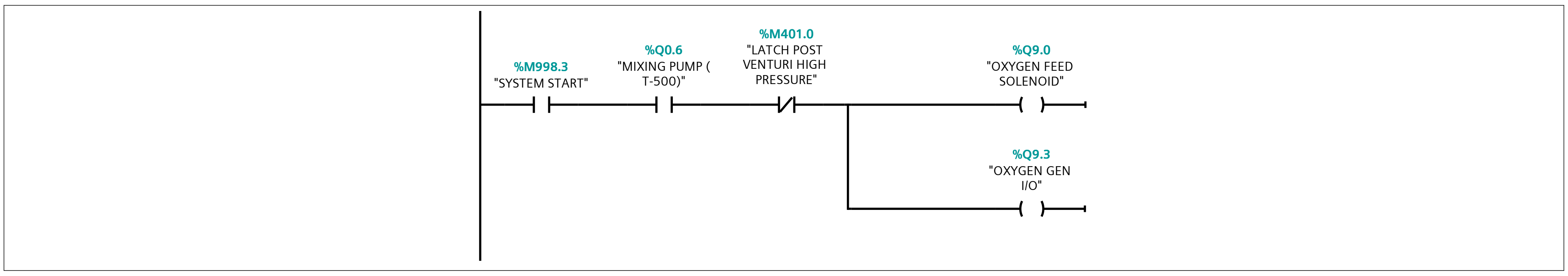
Network 15:



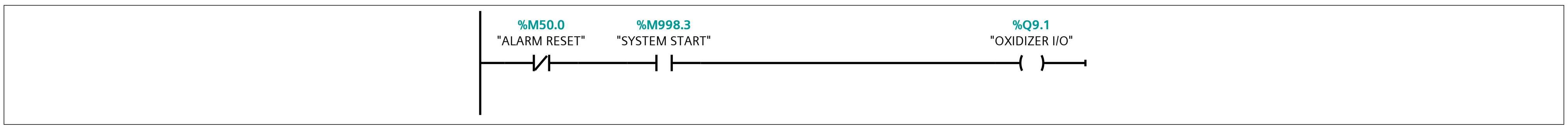
Network 16:



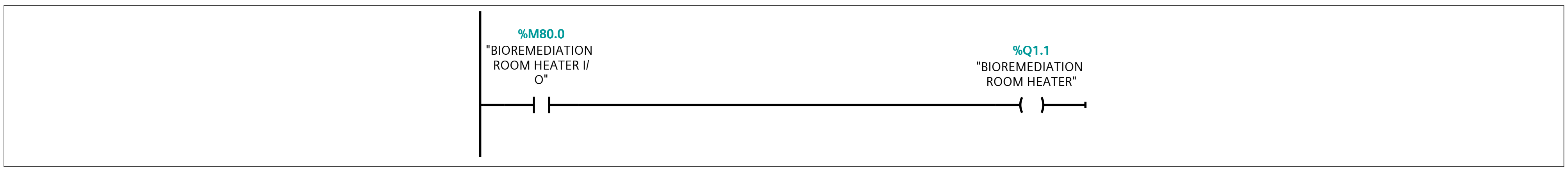
Network 17:



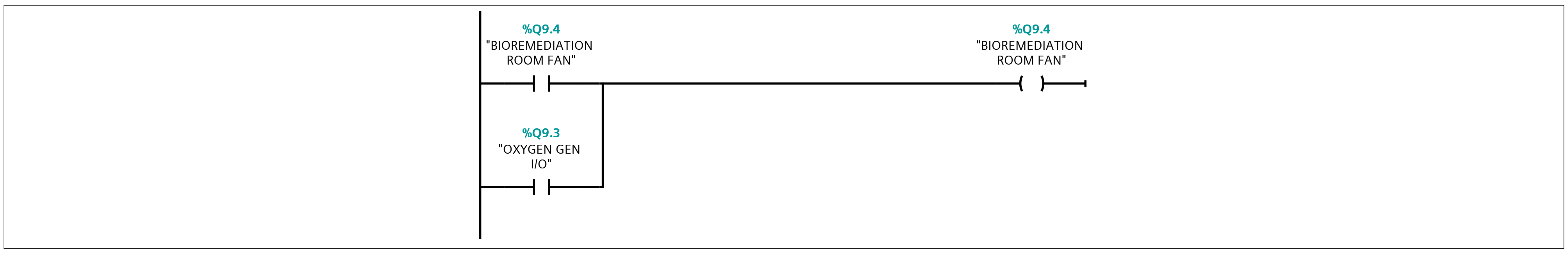
Network 18:



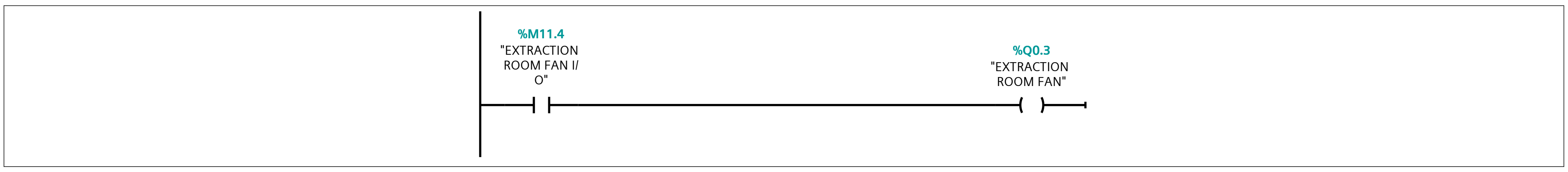
Network 19:



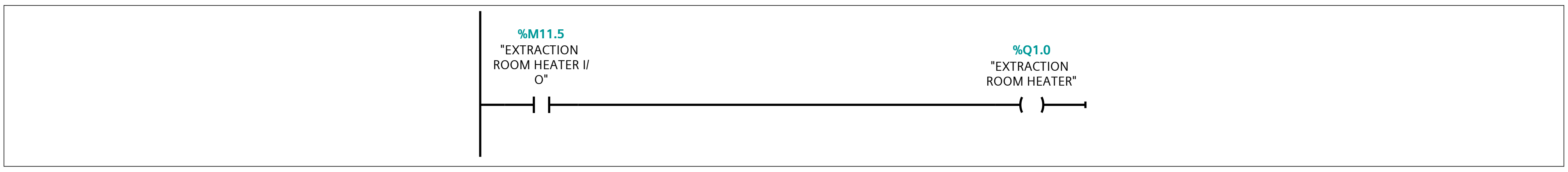
Network 20:



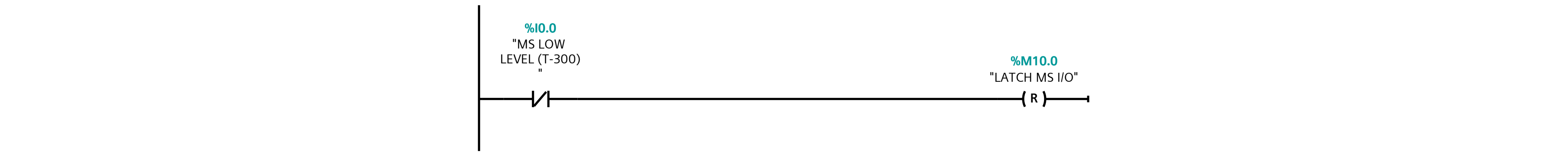
Network 21:



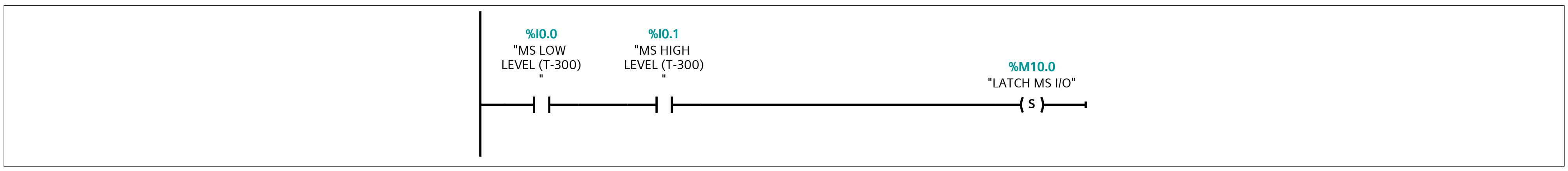
Network 22:



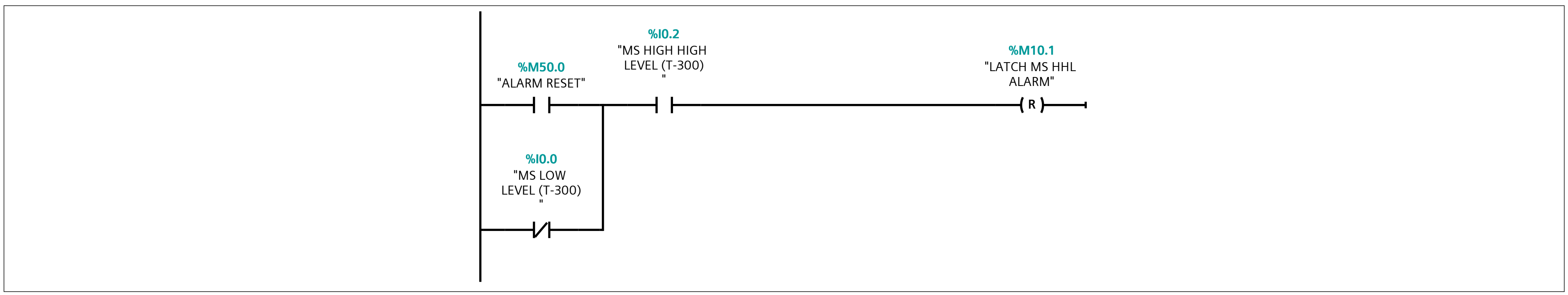
Network 23:



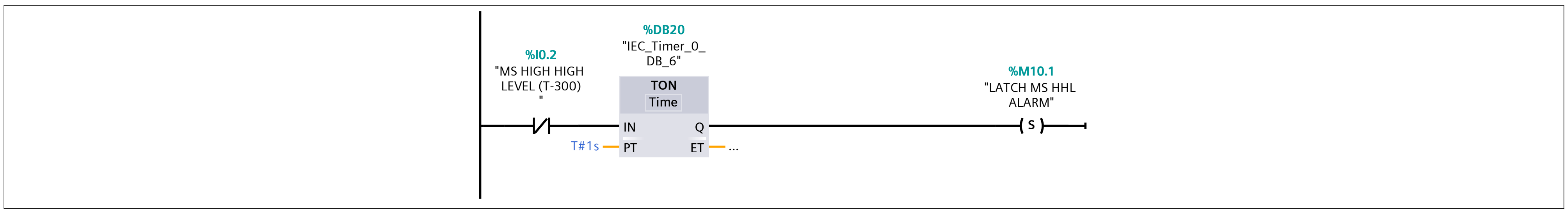
Network 24:



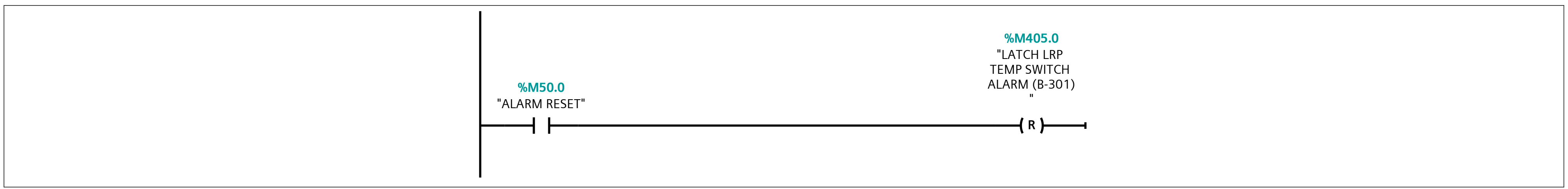
Network 25:



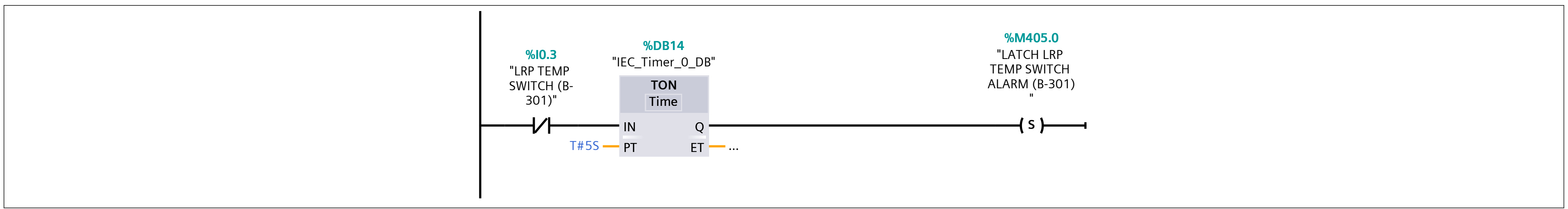
Network 26:



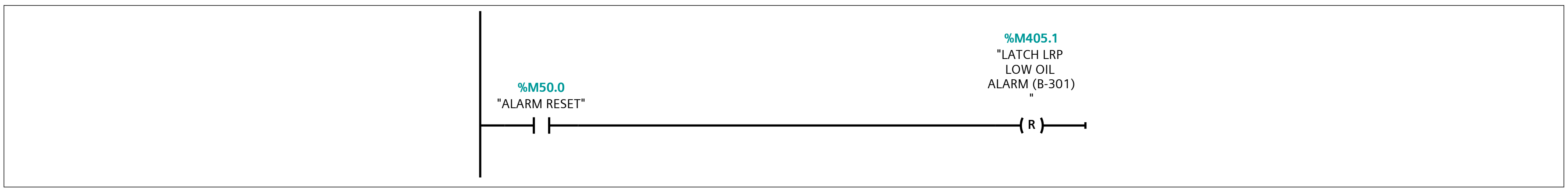
Network 27:



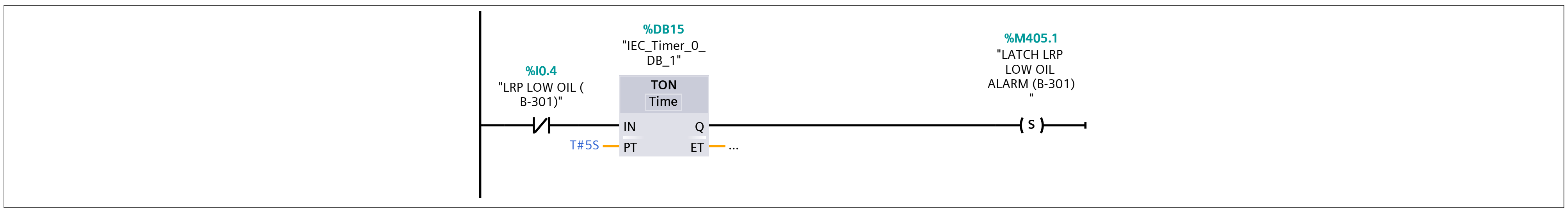
Network 28:



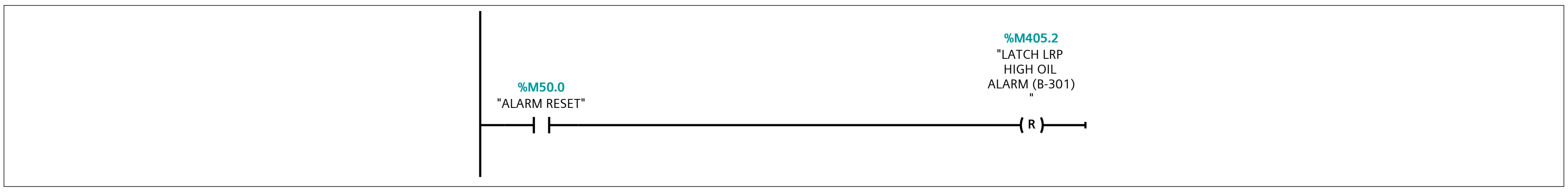
Network 29:



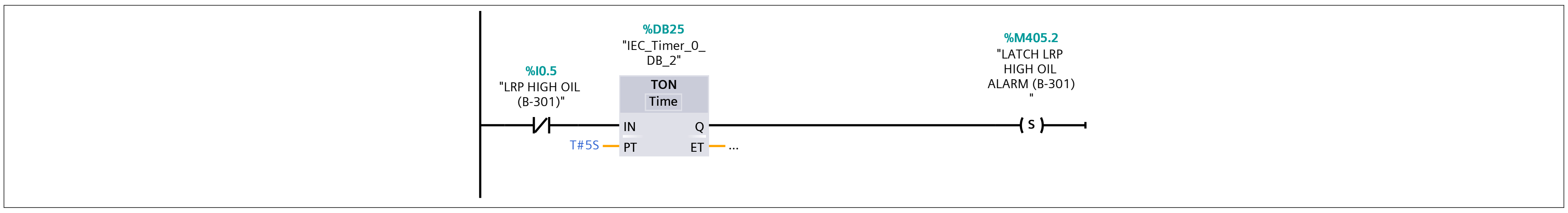
Network 30:



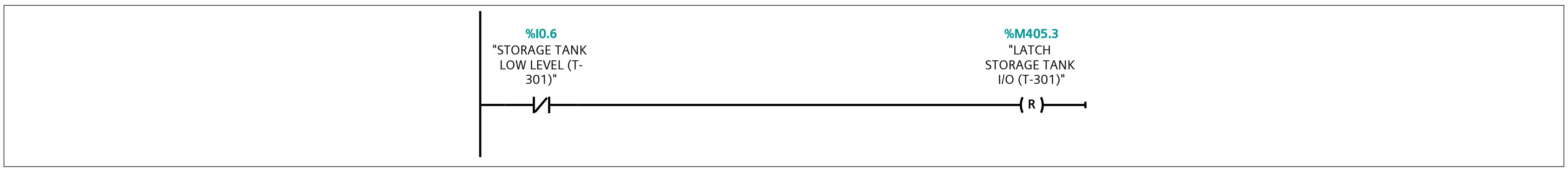
Network 31:



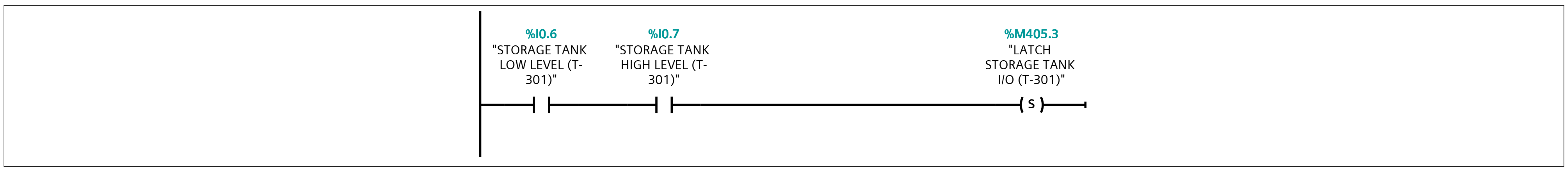
Network 32:



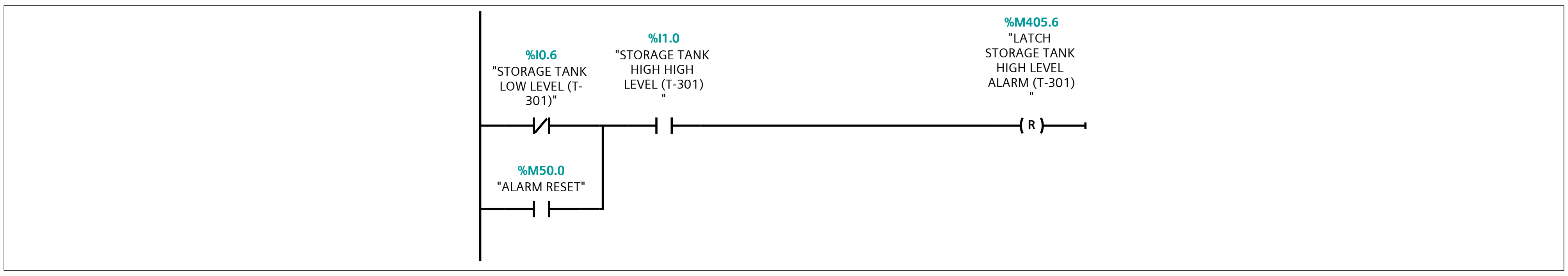
Network 33:



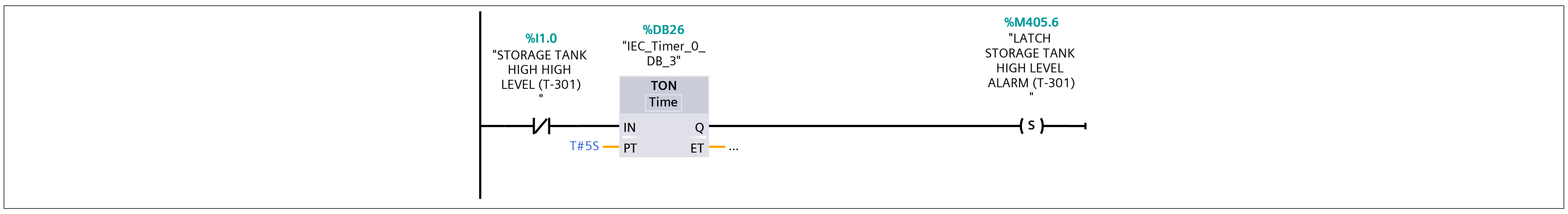
Network 34:



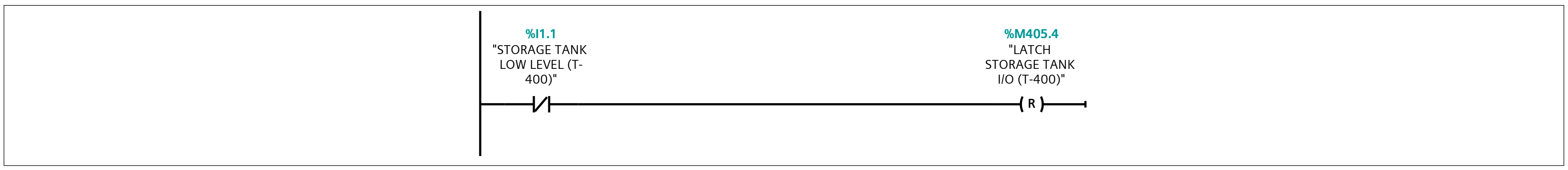
Network 35:



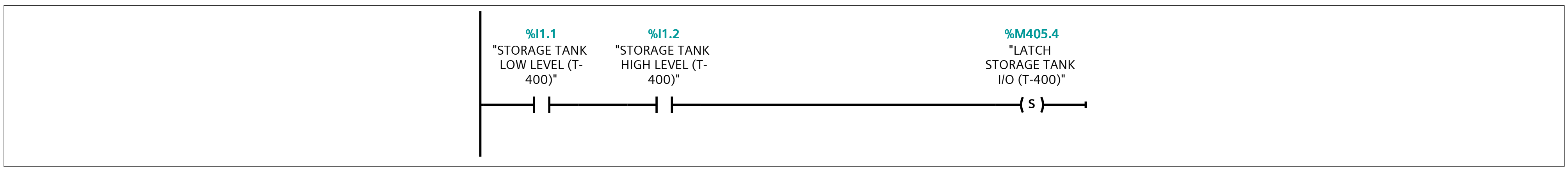
Network 36:



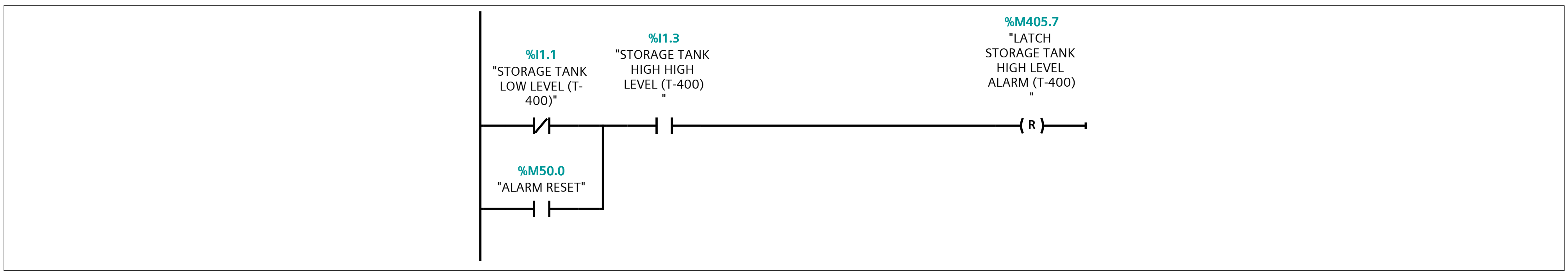
Network 37:



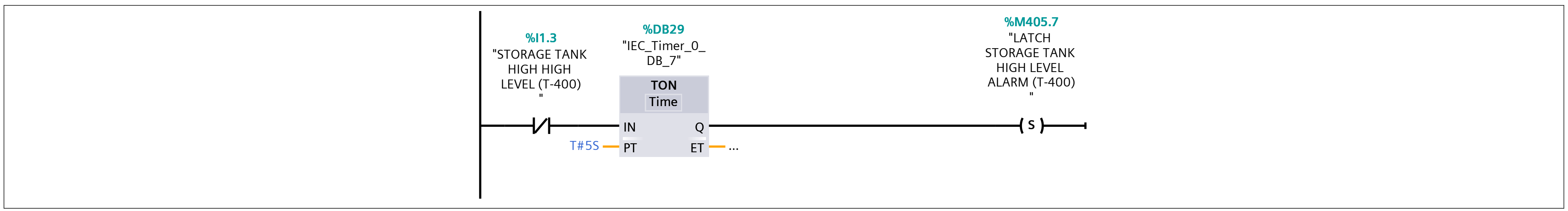
Network 38:



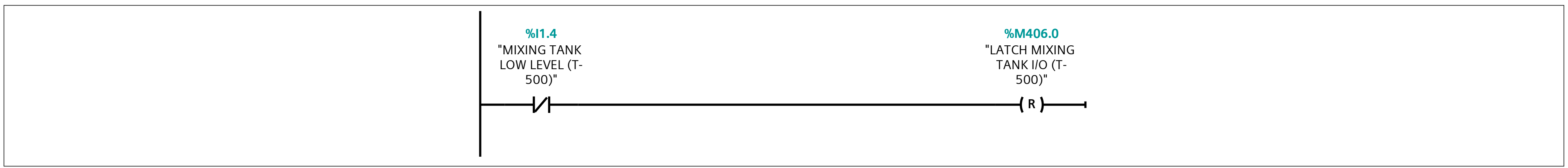
Network 39:



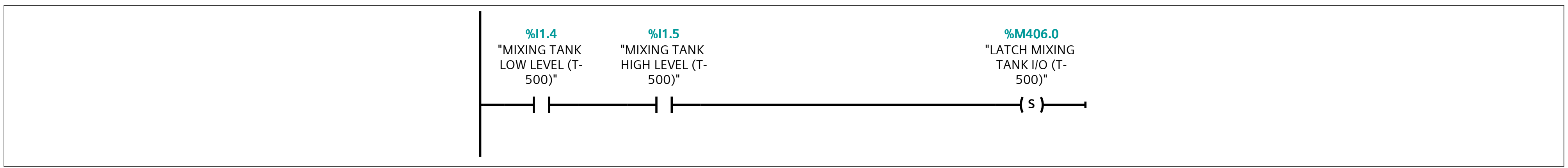
Network 40:



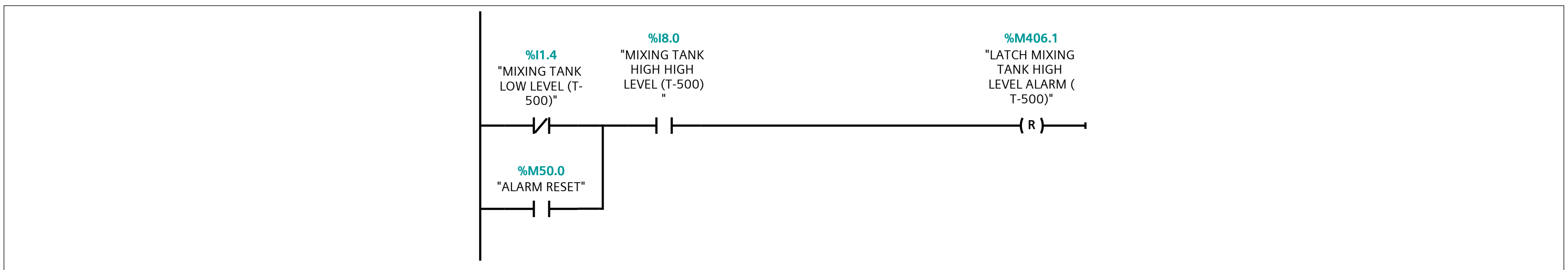
Network 41:



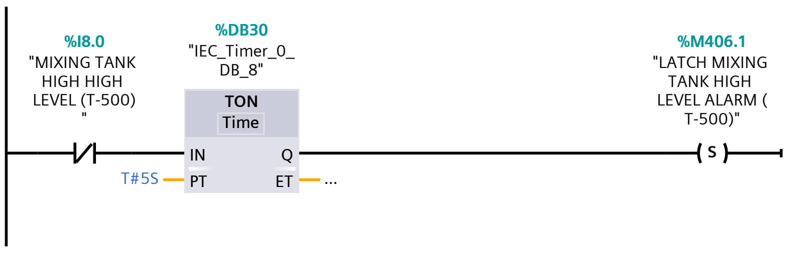
Network 42:



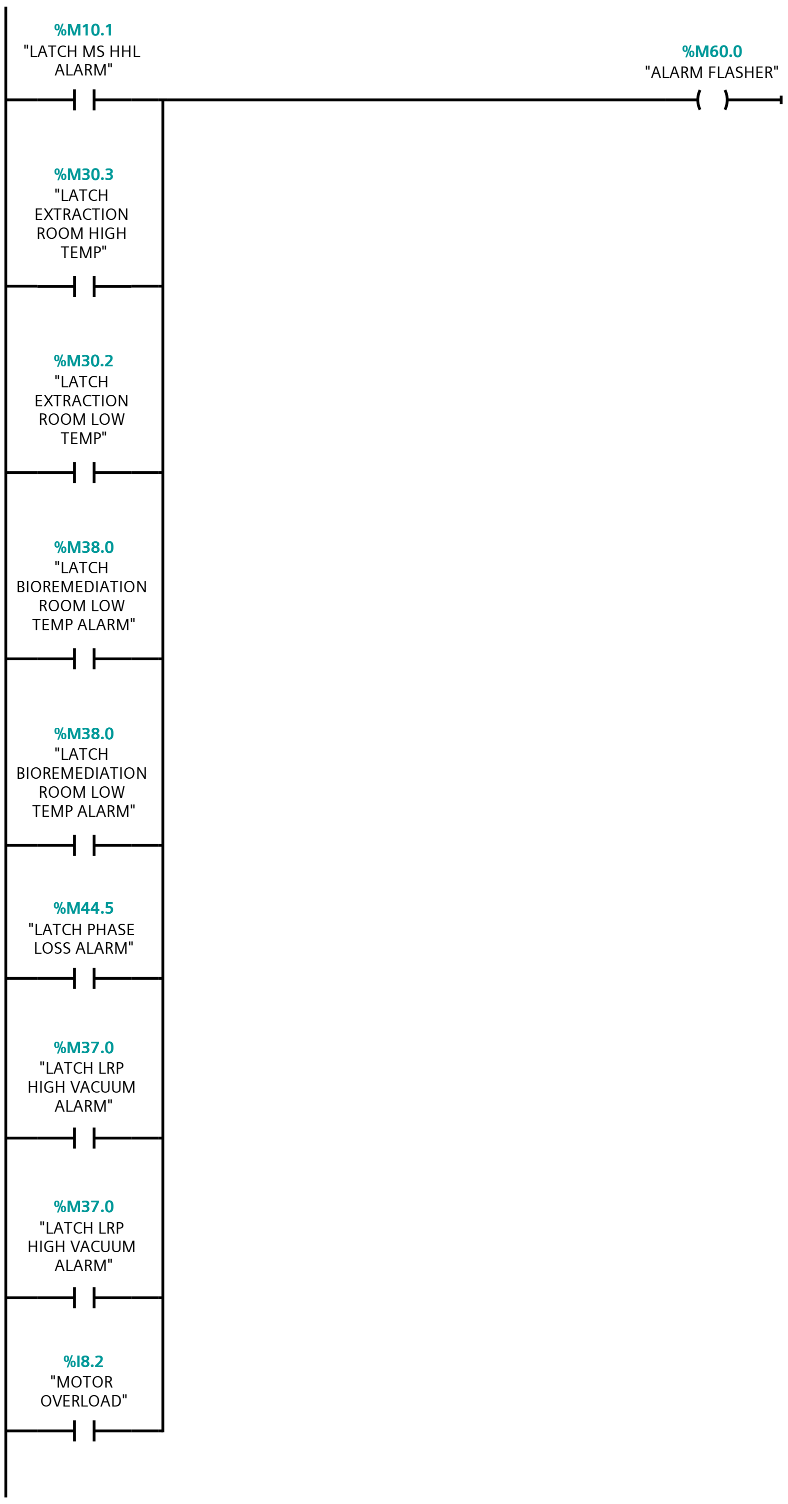
Network 43:



Network 44:


%I8.0
"MIXING TANK HIGH HIGH LEVEL (T-500) "
%DB30
"IEC_Timer_0_DB_8"
TON
Time
IN
Q
T#5S
PT
ET
...
%M406.1
"LATCH MIXING TANK HIGH LEVEL ALARM (T-500)"
S

Network 45:


%M10.1
"LATCH MS HHL ALARM"
%M60.0
"ALARM FLASHER"
%M30.3
"LATCH EXTRACTION ROOM HIGH TEMP"
%M30.2
"LATCH EXTRACTION ROOM LOW TEMP"
%M38.0
"LATCH BIOREMEDIATION ROOM LOW TEMP ALARM"
%M38.0
"LATCH BIOREMEDIATION ROOM LOW TEMP ALARM"
%M44.5
"LATCH PHASE LOSS ALARM"
%M37.0
"LATCH LRP HIGH VACUUM ALARM"
%M37.0
"LATCH LRP HIGH VACUUM ALARM"
%I8.2
"MOTOR OVERLOAD"

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks

Block_2 [FB4]

Block_2 Properties							
General							
Name	Block_2	**Number**	4	**Type**	FB	**Language**	LAD
Numbering	Automatic						
Information							
Title		**Author**		**Comment**		**Family**	
Version	0.1	**User-defined ID**					

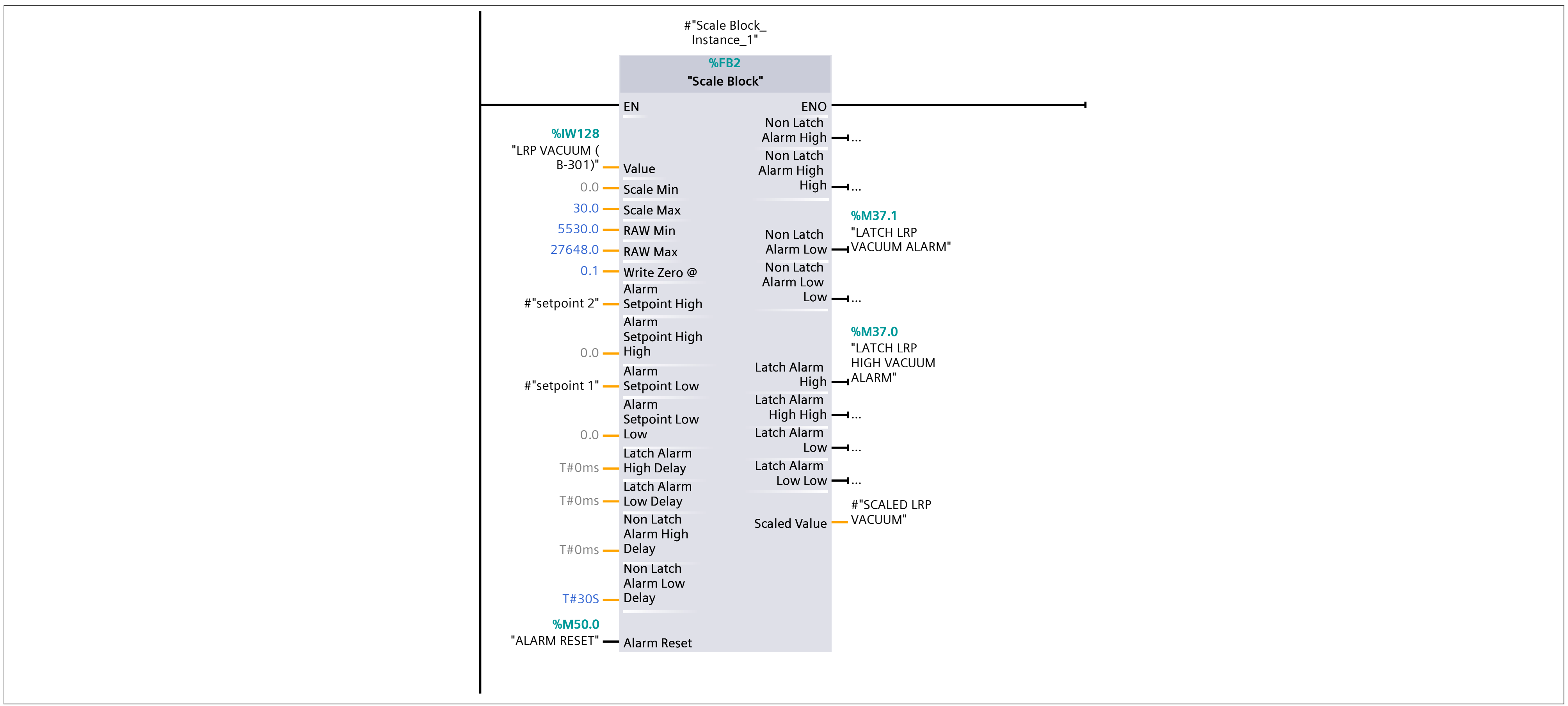
Name	Data type	Default value	Retain
Input			
Output			
InOut			
▼ Static			
math 1	Real	0.0	Non-retain
math 2	Real	0.0	Non-retain
math 3	Real	0.0	Non-retain
math 4	Real	0.0	Non-retain
math 5	Real	0.0	Non-retain
math 6	Real	0.0	Non-retain
math 7	Real	0.0	Non-retain
math 8	Real	0.0	Non-retain
HM1	Real	0.0	Retain
HM2	Real	0.0	Retain
HM3	Real	0.0	Retain
HM4	Real	0.0	Retain
HM5	Real	0.0	Retain
HM6	Real	0.0	Retain
HM7	Real	0.0	Retain
HM8	Real	0.0	Retain
HM9	Real	0.0	Retain
HM10	Real	0.0	Retain
HM11	Real	0.0	Retain
HM12	Real	0.0	Retain
HM 13	Real	0.0	Retain
HM 14	Real	0.0	Retain
HM 15	Real	0.0	Retain
HM 16	Real	0.0	Retain
SCALED LRP VACUUM	Real	0.0	Non-retain
SCALED LRP DISCHARGE PRESSURE (B-301)	Real	0.0	Non-retain
SCALED LRP DISCHARGE FLOW (B-301)	Real	0.0	Non-retain
SCALED POST HEAT EXCHANGER TEMP (HEX-302)	Real	0.0	Non-retain
SCALED TRANSFER PUMP DISCHARGE PRESSURE (P-400)	Real	0.0	Non-retain
SCALED PRE CARBON PRESSURE	Real	0.0	Non-retain
SCALED MIXING TANK PUMP DISCHARGE PRESSURE (P-500)	Real	0.0	Non-retain
SCALED OXYGEN FEED PRESSURE	Real	0.0	Non-retain
SCALED POST VENTURI PRESSURE (IC-500)	Real	0.0	Non-retain
SCALED REINJECTION FLOW	Real	0.0	Non-retain
SCALED EXTRACTION ROOM TEMP	Real	0.0	Non-retain
SCALED BIOREMEDIATION ROOM TEMP	Real	0.0	Non-retain
SCALED FALCO ENTRANCE TEMP	Real	0.0	Non-retain
SCALED FALCO INTERNAL TEMP	Real	0.0	Non-retain
SCALED FALCO EXIT TEMP	Real	0.0	Non-retain
DISCHAGE TOTAL	Real	0.0	Retain
SVE BLOWER AMPS	Real	0.0	Non-retain
SPARGE AMPS	Real	0.0	Non-retain
HIGH SPARGE 1 AMPS	Real	0.0	Non-retain
HIGH SPARGE 2 AMPS	Real	0.0	Non-retain
setpoint 1	Real	0.0	Retain
setpoint 2	Real	0.0	Retain
setpoint 3	Real	0.0	Retain
setpoint 4	Real	0.0	Retain
setpoint 5	Real	0.0	Retain
setpoint 6	Real	0.0	Retain
setpoint 7	Real	0.0	Retain
setpoint 8	Real	0.0	Retain
setpoint 9	Real	0.0	Retain
setpoint 10	Real	0.0	Retain
setpoint 11	Real	0.0	Retain
setpoint 12	Real	0.0	Retain
setpoint 13	Real	0.0	Retain
setpoint 14	Real	0.0	Retain
setpoint 15	Real	0.0	Retain
setpoint 16	Real	0.0	Retain
setpoint 17	Real	0.0	Retain
setpoint 18	Real	0.0	Retain

Name	Data type	Default value	Retain
setpoint 19	Real	0.0	Retain
setpoint 20	Real	0.0	Retain
setpoint 21	Real	0.0	Retain
setpoint 22	Real	0.0	Retain
setpoint 23	Real	0.0	Retain
setpoint 24	Real	0.0	Retain
setpoint 25	Real	0.0	Retain
setpoint 26	Real	0.0	Retain
setpoint 27	Real	0.0	Retain
setpoint 28	Real	0.0	Retain
setpoint 29	Real	0.0	Retain
setpoint 30	Real	0.0	Retain
setpoint 31	Real	0.0	Retain
setpoint 32	Real	0.0	Retain
setpoint 33	Real	0.0	Retain
setpoint 34	Real	0.0	Retain
setpoint 35	Real	0.0	Retain
setpoint 36	Real	0.0	Retain
setpoint 37	Real	0.0	Retain
setpoint 38	Real	0.0	Retain
setpoint 39	Real	0.0	Retain
setpoint 40	Real	0.0	Retain
setpoint 41	Real	0.0	Retain
setpoint 42	Real	0.0	Retain
setpoint 43	Real	0.0	Retain
setpoint 44	Real	0.0	Retain
setpoint 45	Real	0.0	Retain
setpoint 46	Real	0.0	Retain
setpoint 47	Real	0.0	Retain
setpoint 48	Real	0.0	Retain
setpoint 49	Real	0.0	Retain
setpoint 50	Real	0.0	Retain
setpoint 51	Real	0.0	Retain
setpoint 52	Real	0.0	Retain
setpoint 53	Real	0.0	Retain
setpoint 54	Real	0.0	Retain
setpoint 55	Real	0.0	Retain
setpoint 56	Real	0.0	Retain
setpoint 57	Real	0.0	Retain
setpoint 58	Real	0.0	Retain
setpoint 59	Real	0.0	Retain
setpoint 60	Real	0.0	Retain
setpoint 61	Real	0.0	Retain
setpoint 62	Real	0.0	Retain
setpoint 63	Real	0.0	Retain
setpoint 64	Real	0.0	Retain
setpoint 65	Real	0.0	Retain
setpoint 66	Real	0.0	Retain
setpoint 67	Real	0.0	Retain
setpoint 68	Real	0.0	Retain
setpoint 69	Real	0.0	Retain
setpoint 70	Real	0.0	Retain
setpoint 71	Real	0.0	Retain
setpoint 72	Real	0.0	Retain
setpoint 100	Real	0.0	Retain
setpoint 101	Real	0.0	Retain
setpoint 102	Real	0.0	Retain
setpoint 103	Real	0.0	Retain
setpoint 104	Real	0.0	Retain
setpoint 105	Real	0.0	Retain
setpoint 200	Real	0.0	Retain
setpoint 201	Real	0.0	Retain
setpoint 202	Real	0.0	Retain
setpoint 203	Real	0.0	Retain
setpoint 204	Real	0.0	Retain
setpoint 205	Real	0.0	Retain
setpoint 206	Real	0.0	Retain
PULSECOUNTER	Real	0.0	Retain
MANUALINPUTFORTOTAL	Real	0.0	Retain
MANUALINPUTFOR TOTAL2	Real	0.0	Retain
INJECTION FLOW TOTAL	Real	0.0	Retain
INJECTION FLOW TOTAL 2	Real	0.0	Retain
MS TOTAL	Real	0.0	Retain
OWS TOTAL	Real	0.0	Retain
DISCHARGE TOTAL	Real	0.0	Retain
MS PUMP TOTAL	Real	0.0	Non-retain
GW 1 TOTAL	Real	0.0	Retain
GW 2 TOTAL	Real	0.0	Retain
GW 3 TOTAL	Real	0.0	Retain

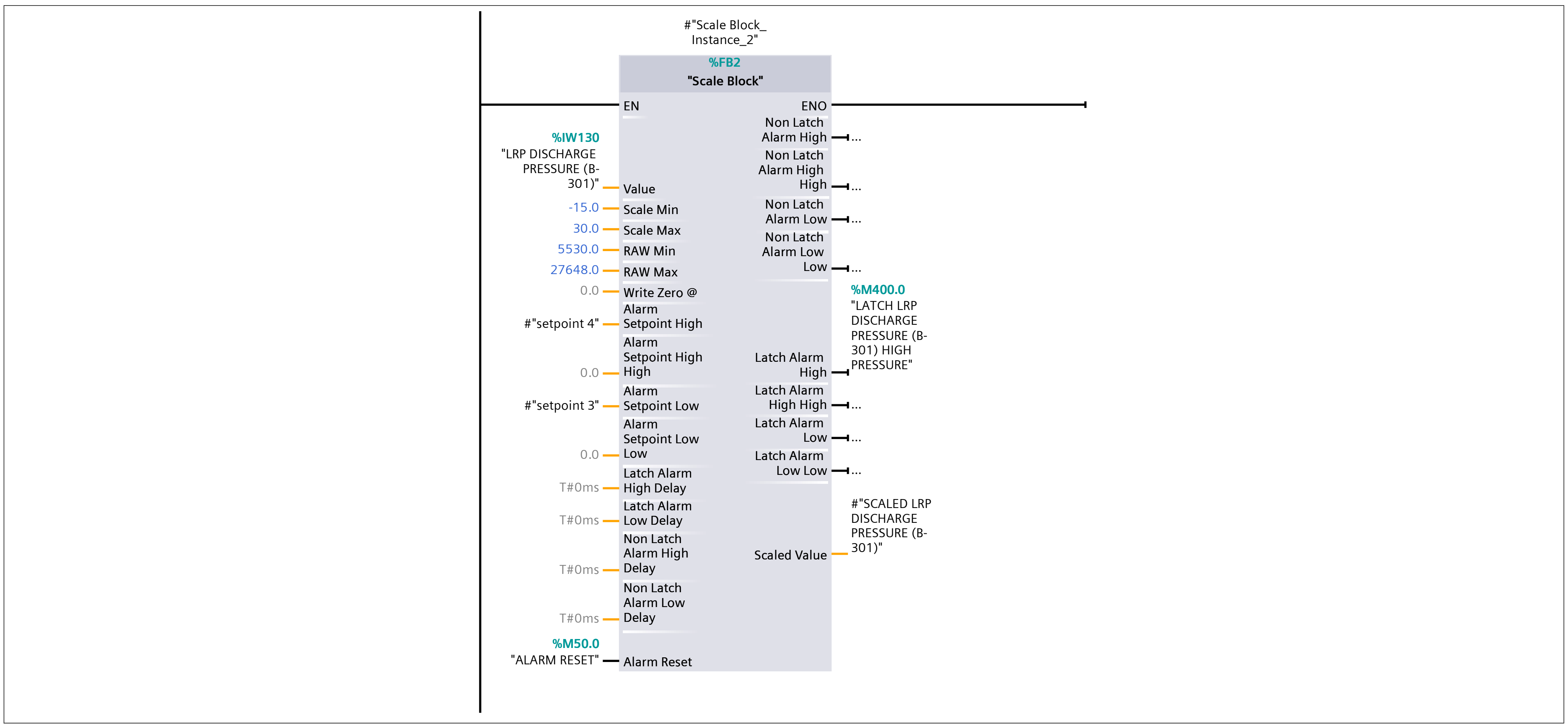
Name	Data type	Default value	Retain
GW 4 TOTAL	Real	0.0	Retain
GW 5 TOTAL	Real	0.0	Retain
GW 6 TOTAL	Real	0.0	Retain
GW 7 TOTAL	Real	0.0	Non-retain
GW 8 TOTAL	Real	0.0	Non-retain
GW 9 TOTAL	Real	0.0	Non-retain
GW 10 TOTAL	Real	0.0	Non-retain
TIME OF DAY	DTL	DTL#1970-01-01-00:00:00	Non-retain
Move PID 1	Real	0.0	Non-retain
Move PID 2	Real	0.0	Non-retain
Move PID 3	Real	0.0	Non-retain
Move PID 4	Real	0.0	Non-retain
Move PID 5	Real	0.0	Non-retain
Move PID 6	Real	0.0	Non-retain
Move PID 7	Real	0.0	Non-retain
Move PID 8	Real	0.0	Non-retain
Move PID 9	Real	0.0	Non-retain
Move PID 10	Real	0.0	Non-retain
Move PID 11	Real	0.0	Non-retain
Move PID 12	Real	0.0	Non-retain
Move PID 13	Real	0.0	Non-retain
Move PID 14	Real	0.0	Non-retain
Move PID 15	Real	0.0	Non-retain
Move PID 16	Real	0.0	Non-retain
Move PID 17	Real	0.0	Non-retain
Move PID 18	Real	0.0	Non-retain
Move PID 19	Real	0.0	Non-retain
Move PID 20	Real	0.0	Non-retain
Move PID 21	Real	0.0	Non-retain
Move PID 22	Real	0.0	Non-retain
T1 ON	Time_Of_Day	TOD#00:00:00	Retain
T1 OFF	Time_Of_Day	TOD#00:00:00	Retain
T2 ON	Time_Of_Day	TOD#00:00:00	Retain
T2 OFF	Time_Of_Day	TOD#00:00:00	Retain
T3 ON	Time_Of_Day	TOD#00:00:00	Retain
T3 OFF	Time_Of_Day	TOD#00:00:00	Retain
T4 ON	Time_Of_Day	TOD#00:00:00	Retain
T4 OFF	Time_Of_Day	TOD#00:00:00	Retain
T5 ON	Time_Of_Day	TOD#00:00:00	Retain
T5 OFF	Time_Of_Day	TOD#00:00:00	Retain
T6 ON	Time_Of_Day	TOD#00:00:00	Retain
T6 OFF	Time_Of_Day	TOD#00:00:00	Retain
T7 ON	Time_Of_Day	TOD#00:00:00	Retain
T7 OFF	Time_Of_Day	TOD#00:00:00	Retain
T8 ON	Time_Of_Day	TOD#00:00:00	Retain
T8 OFF	Time_Of_Day	TOD#00:00:00	Retain
T9 ON	Time_Of_Day	TOD#00:00:00	Retain
T9 OFF	Time_Of_Day	TOD#00:00:00	Retain
T10 ON	Time_Of_Day	TOD#00:00:00	Retain
T10 OFF	Time_Of_Day	TOD#00:00:00	Retain
LT1	Time	T#0ms	Retain
LT2	Time	T#0ms	Retain
LT3	Time	T#0ms	Retain
LT4	Time	T#0ms	Retain
LT5	Time	T#0ms	Retain
LT6	Time	T#0ms	Retain
AUTO OILER CYCLE TIME	Time	T#0ms	Retain
AUTO OILER OIL TIME	Time	T#0ms	Retain
HOUR METER_Instance	"HOUR METER"		
HOUR METER_Instance_1	"HOUR METER"		
HEATER/FAN CONTROL_Instance	"HEATER/FAN CONTROL"		
Scale Block_Instance_5	"Scale Block"		
Scale Block_Instance	"Scale Block"		
Scale Block_Instance_1	"Scale Block"		
Scale Block_Instance_2	"Scale Block"		
HEATER/FAN CONTROL_Instance_1	"HEATER/FAN CONTROL"		
IEC_Timer_0_Instance	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_1	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_2	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_3	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_4	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_5	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_6	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_7	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_8	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_9	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_10	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_11	IEC_TIMER		Non-retain
Flow_Instance	"Flow"		

Name	Data type	Default value	Retain
IEC_Timer_0_Instance_12	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_13	IEC_TIMER		Non-retain
Scale Block_Instance_18	"Scale Block"		
Scale Block_Instance_3	"Scale Block"		
HEATER/FAN CONTROL_Instance_2	"HEATER/FAN CONTROL"		
Scale Block_Instance_4	"Scale Block"		
Scale Block_Instance_6	"Scale Block"		
Scale Block_Instance_7	"Scale Block"		
Scale Block_Instance_8	"Scale Block"		
HOUR METER_Instance_2	"HOUR METER"		
IEC_Timer_0_Instance_14	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_15	IEC_TIMER		Non-retain
Scale Block_Instance_9	"Scale Block"		
Scale Block_Instance_10	"Scale Block"		
HOUR METER_Instance_3	"HOUR METER"		
IEC_Timer_0_Instance_16	IEC_TIMER		Non-retain
IEC_Timer_0_Instance_17	TON_TIME		Non-retain
IEC_Timer_0_Instance_18	TON_TIME		Non-retain
HOUR METER_Instance_4	"HOUR METER"		
Scale Block_Instance_11	"Scale Block"		
HEATER/FAN CONTROL_Instance_3	"HEATER/FAN CONTROL"		
CYCLE TIMER_Instance	"CYCLE TIMER"		
IEC_Timer_0_Instance_19	TOF_TIME		Non-retain
Flow_Instance_1	"Flow"		
SINA_SPEED_Instance	"SINA_SPEED"		
SINA_SPEED_Instance_1	"SINA_SPEED"		
SINA_PARA_S_Instance	"SINA_PARA_S"		
IEC_Timer_0_Instance_20	TON_TIME		Non-retain
IEC_Timer_0_Instance_21	TOF_TIME		Non-retain
SINA_PARA_S_Instance_1	"SINA_PARA_S"		
IEC_Timer_0_Instance_22	TOF_TIME		Non-retain
IEC_Timer_0_Instance_23	TOF_TIME		Non-retain
Flow_Instance_2	"Flow"		
Scale Block_Instance_12	"Scale Block"		
Scale Block_Instance_13	"Scale Block"		
Scale Block_Instance_14	"Scale Block"		
Scale Block_Instance_15	"Scale Block"		
Scale Block_Instance_16	"Scale Block"		
Scale Block_Instance_17	"Scale Block"		
Scale Block_Instance_19	"Scale Block"		
Scale Block_Instance_20	"Scale Block"		
Scale Block_Instance_21	"Scale Block"		
Scale Block_Instance_22	"Scale Block"		
Scale Block_Instance_23	"Scale Block"		
Scale Block_Instance_24	"Scale Block"		
Scale Block_Instance_25	"Scale Block"		
Scale Block_Instance_26	"Scale Block"		
Scale Block_Instance_27	"Scale Block"		
Flow_Instance_3	"Flow"		
Flow_Instance_4	"Flow"		
Flow_Instance_5	"Flow"		
Flow_Instance_6	"Flow"		
HOUR METER_Instance_5	"HOUR METER"		
HOUR METER_Instance_6	"HOUR METER"		
SINA_SPEED_Instance_2	"SINA_SPEED"		
SINA_PARA_S_Instance_2	"SINA_PARA_S"		
SINA_PARA_S_Instance_3	"SINA_PARA_S"		
IEC_Timer_0_Instance_24	TON_TIME		Non-retain
IEC_Timer_0_Instance_25	TOF_TIME		Non-retain
IEC_Timer_0_Instance_26	TON_TIME		Non-retain
IEC_Timer_0_Instance_27	TON_TIME		Non-retain
IEC_Timer_0_Instance_28	TOF_TIME		Non-retain
TOD TIMER_Instance	"TOD TIMER"		
TOD TIMER_Instance_1	"TOD TIMER"		
TOD TIMER_Instance_2	"TOD TIMER"		
TOD TIMER_Instance_3	"TOD TIMER"		
Scale Block_Instance_28	"Scale Block"		
Flow_Instance_7	"Flow"		
Scale Block_Instance_29	"Scale Block"		
Scale Block_Instance_30	"Scale Block"		
Scale Block_Instance_31	"Scale Block"		
Scale Block_Instance_32	"Scale Block"		
HOUR METER_Instance_7	"HOUR METER"		
HOUR METER_Instance_8	"HOUR METER"		
HOUR METER_Instance_9	"HOUR METER"		
Flow_Instance_8	"Flow"		
Temp			
Constant			

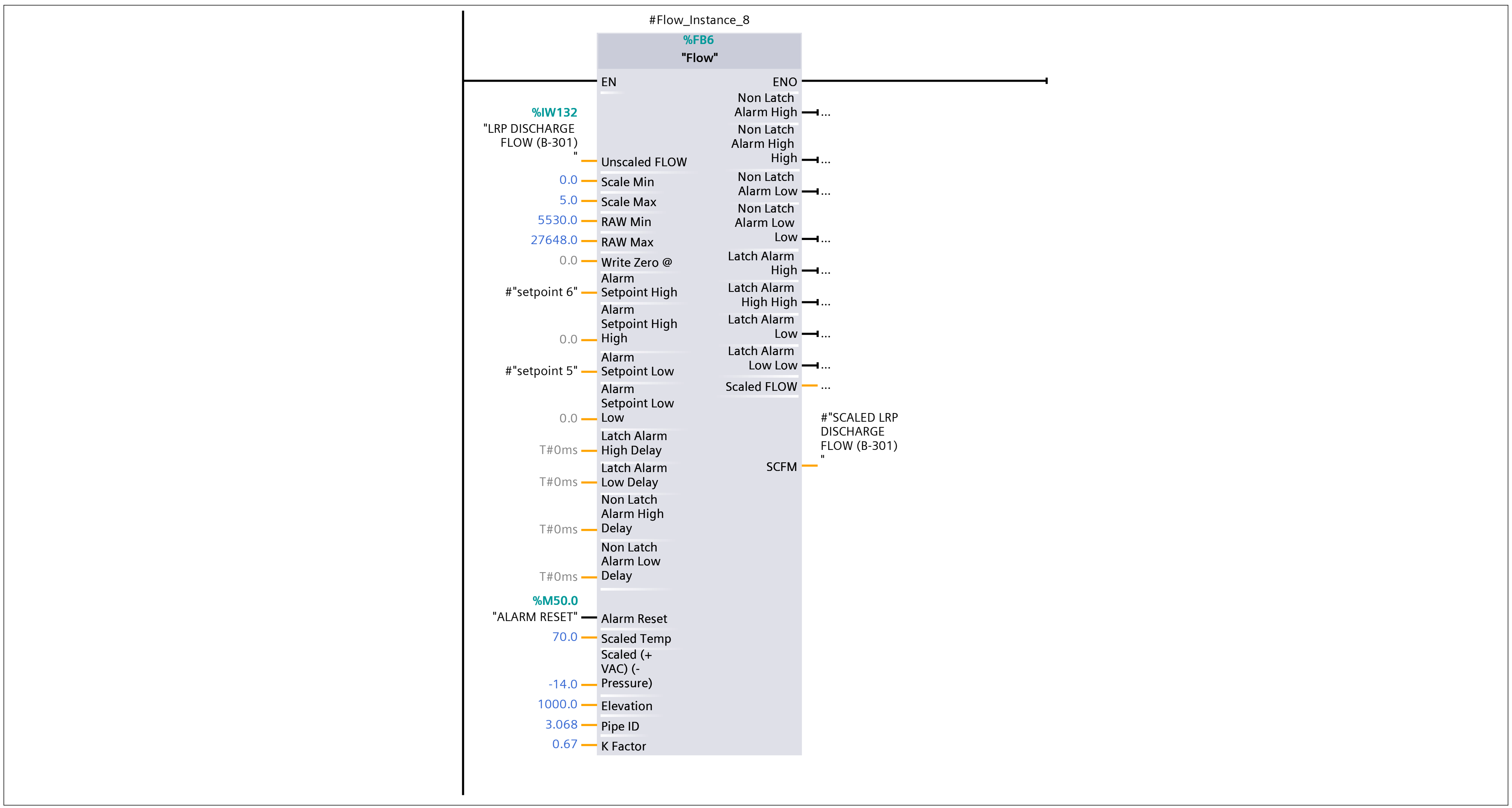
Network 1:



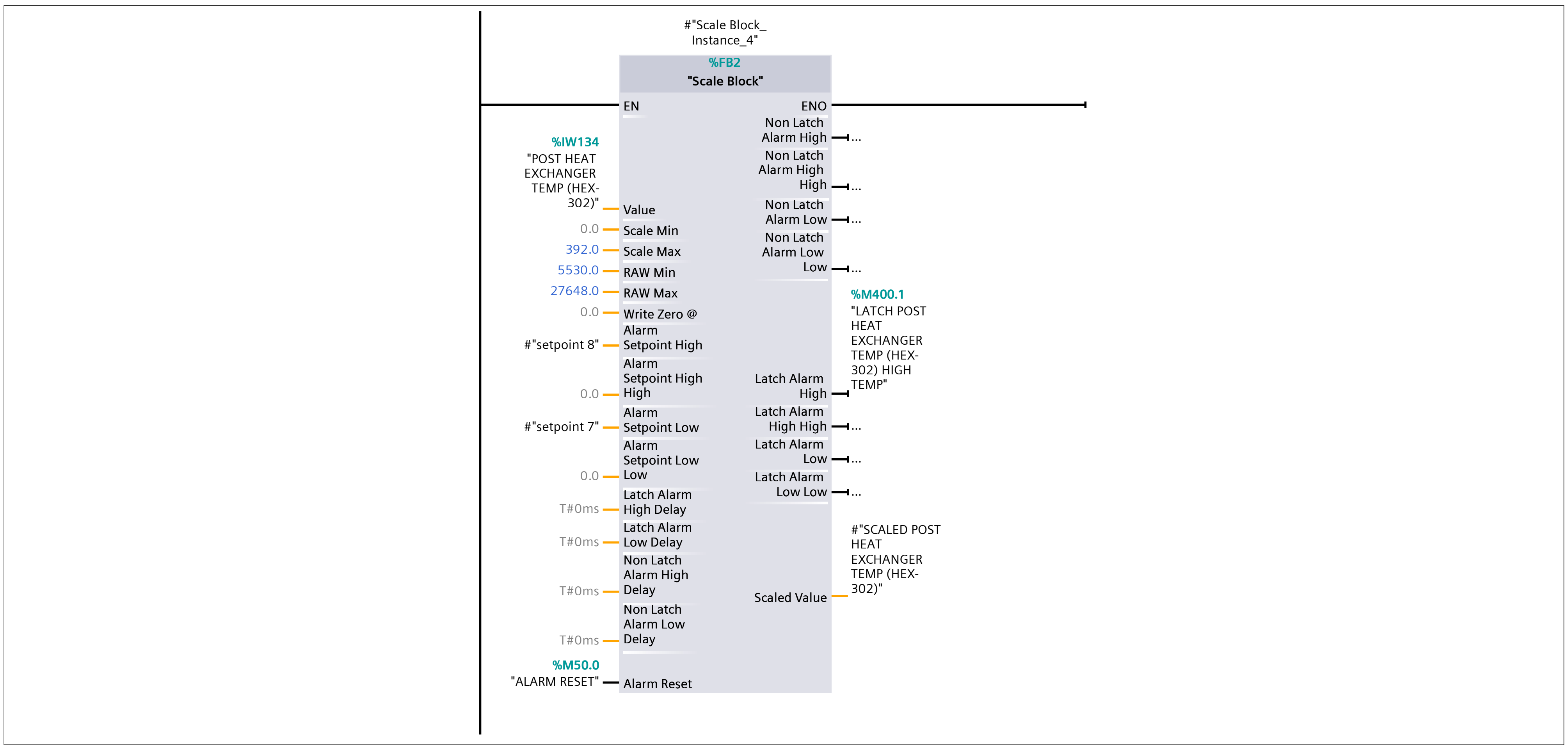
Network 2:



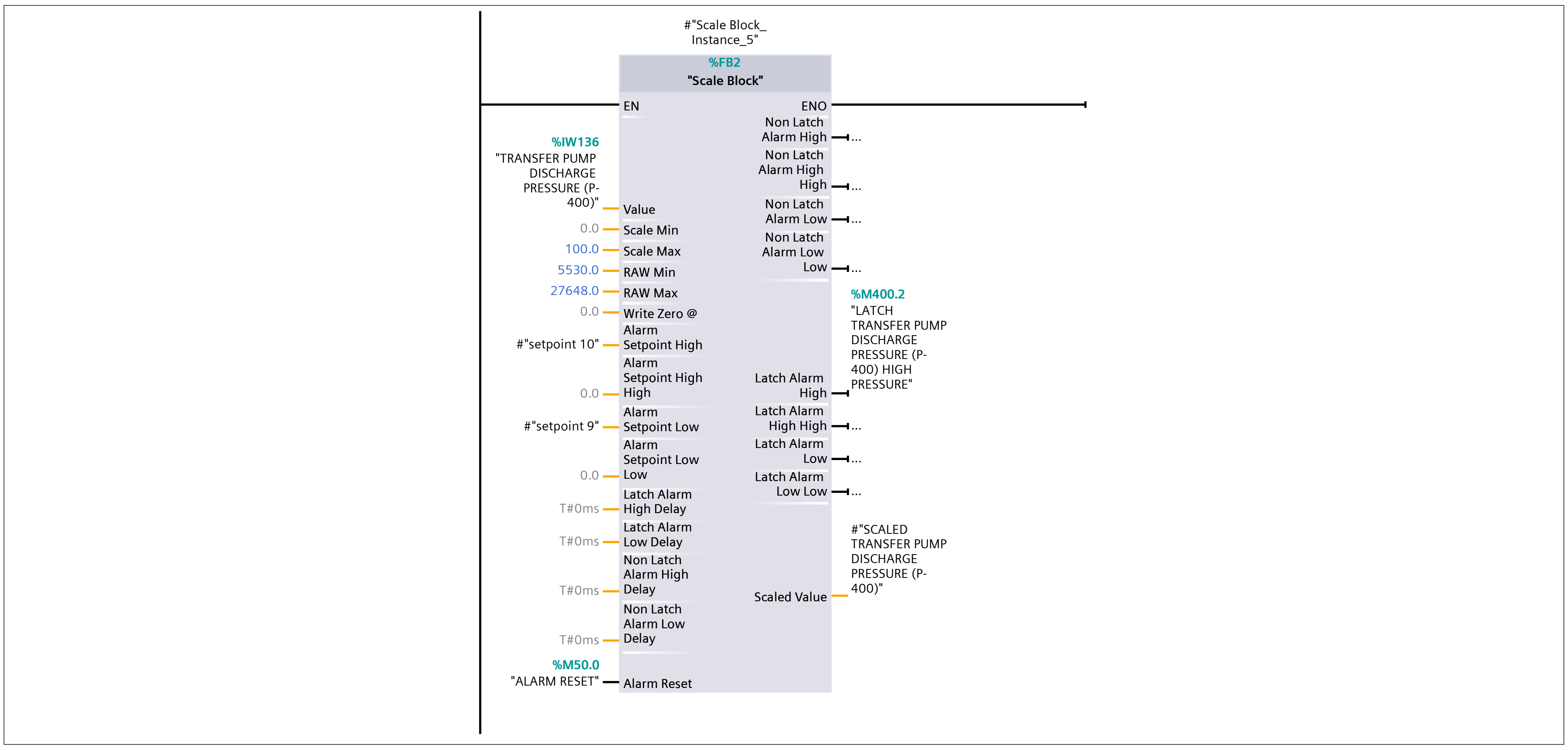
Network 3:



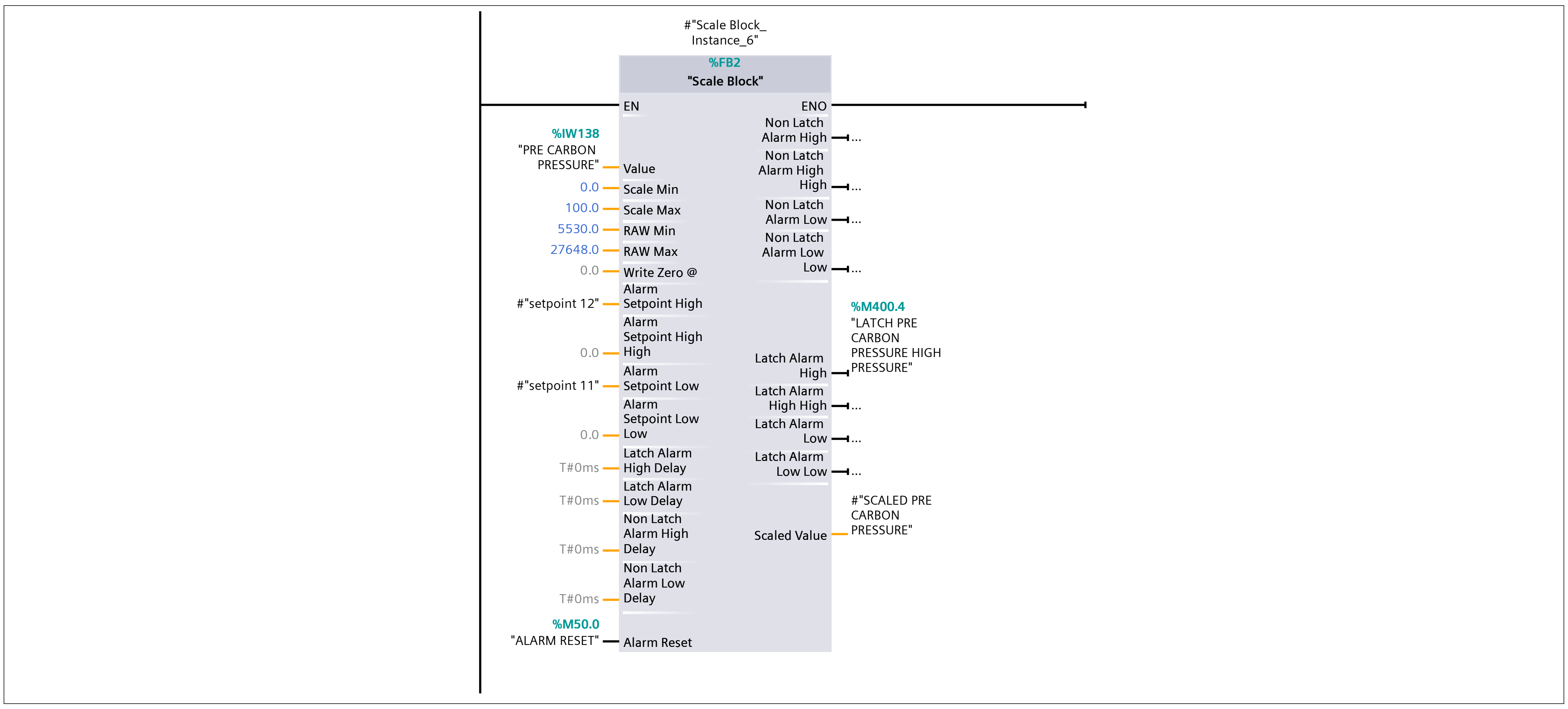
Network 4:



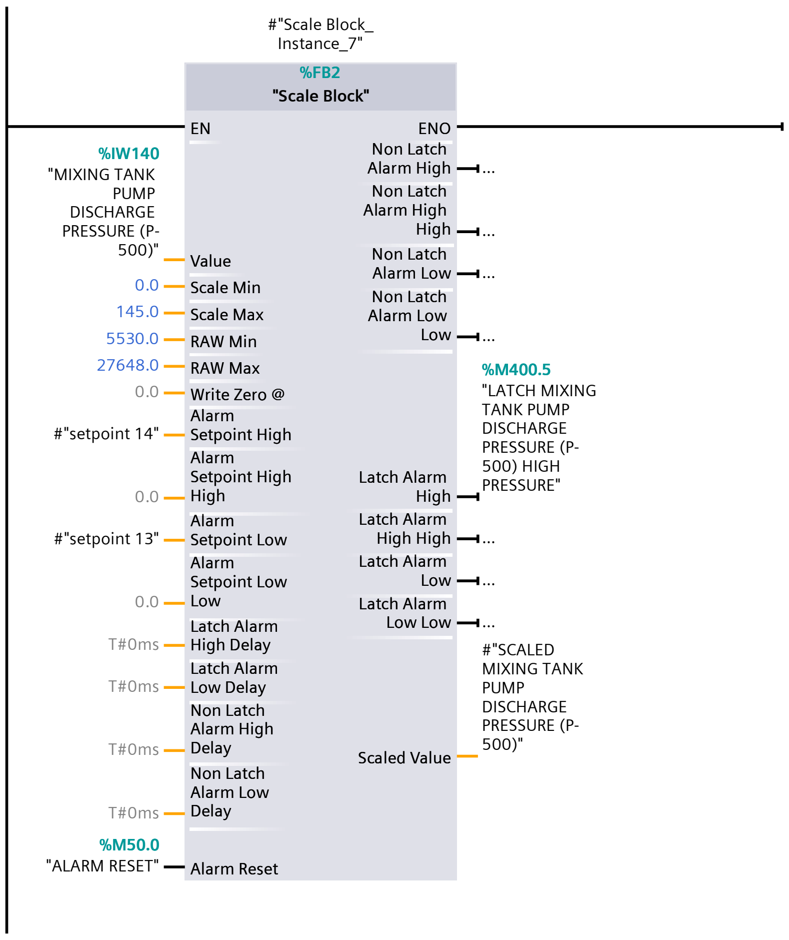
Network 5:



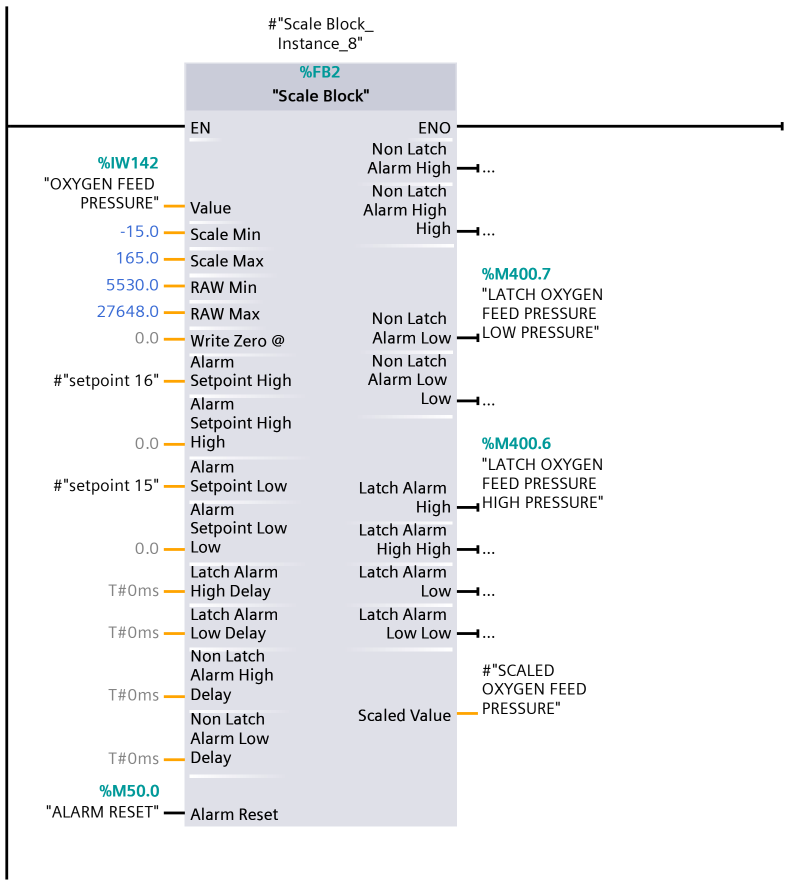
Network 6:



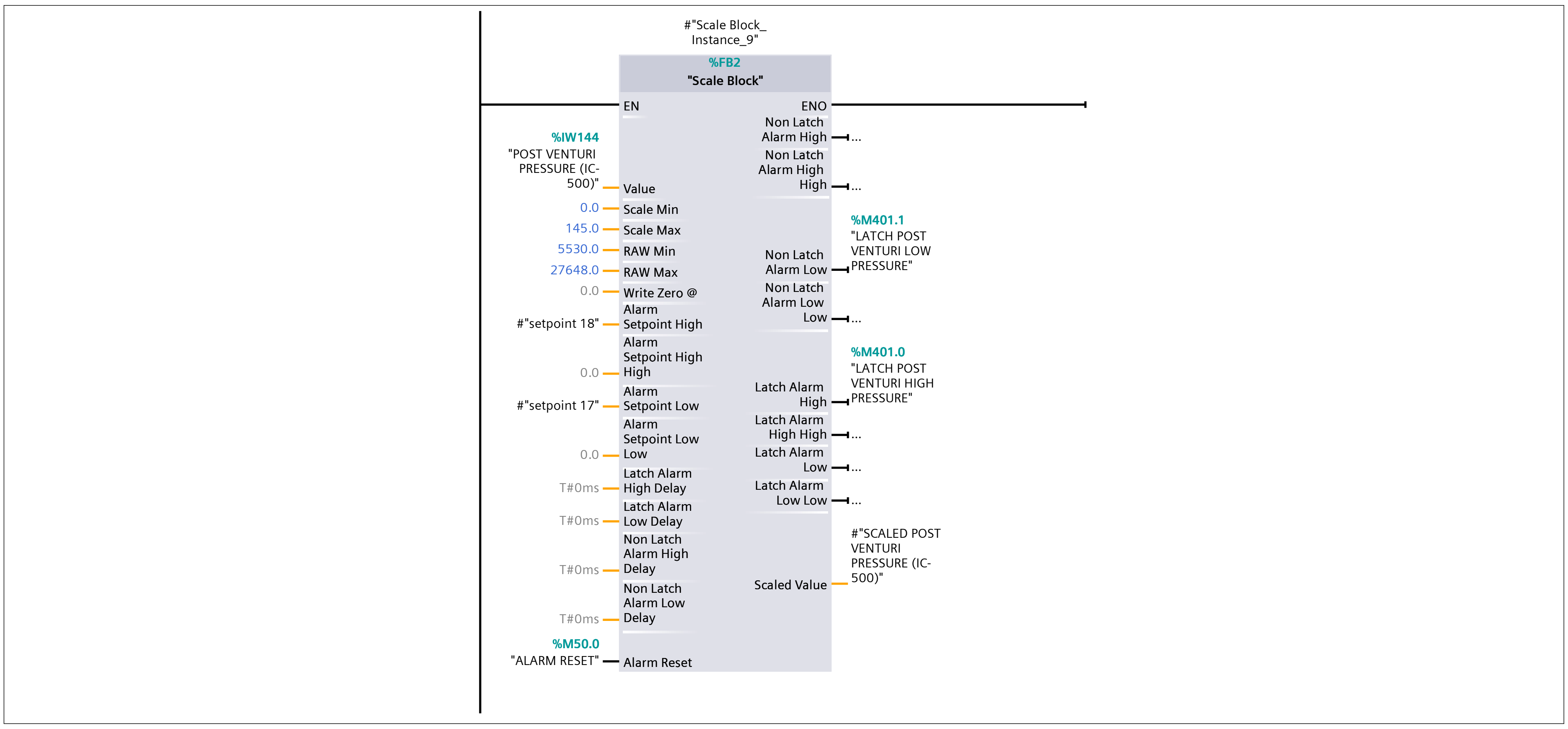
Network 7:



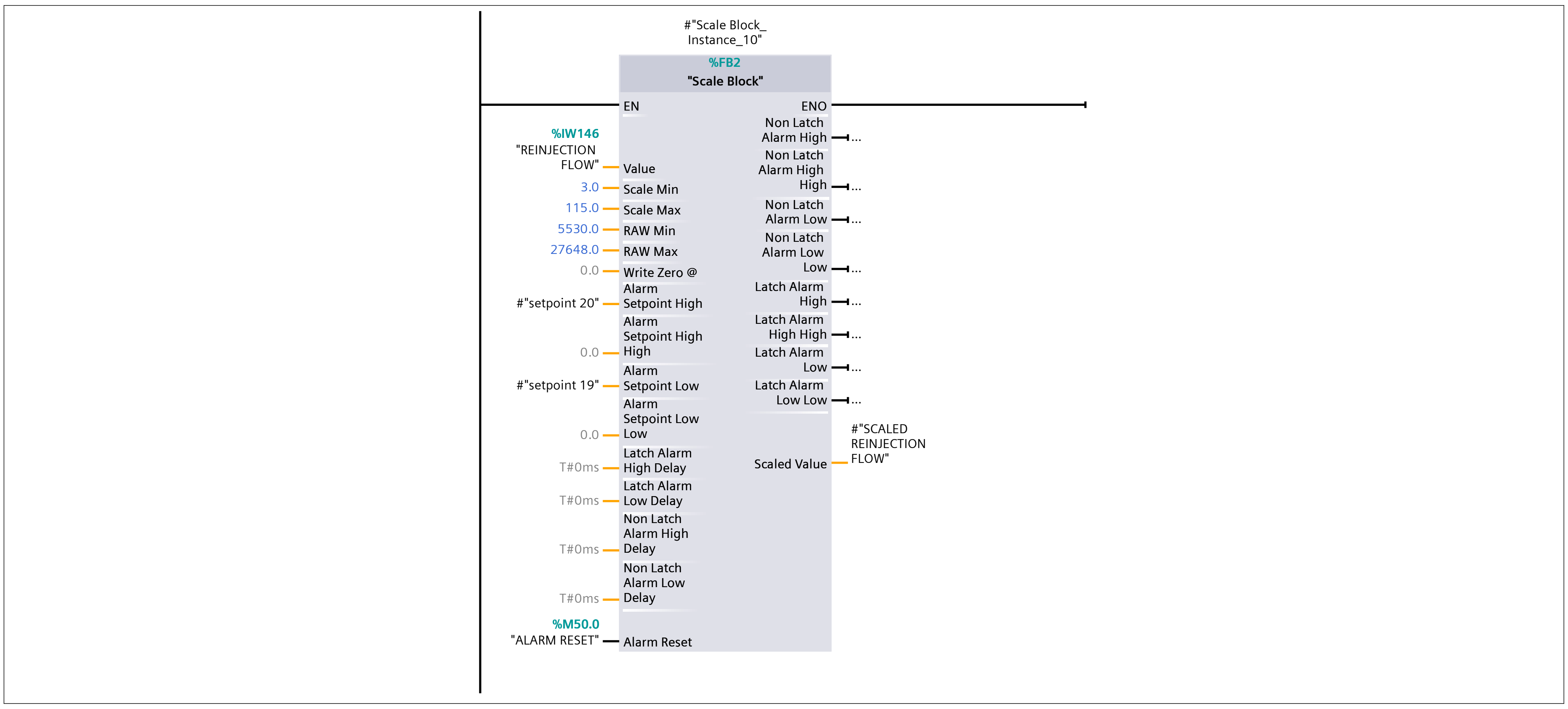
Network 8:



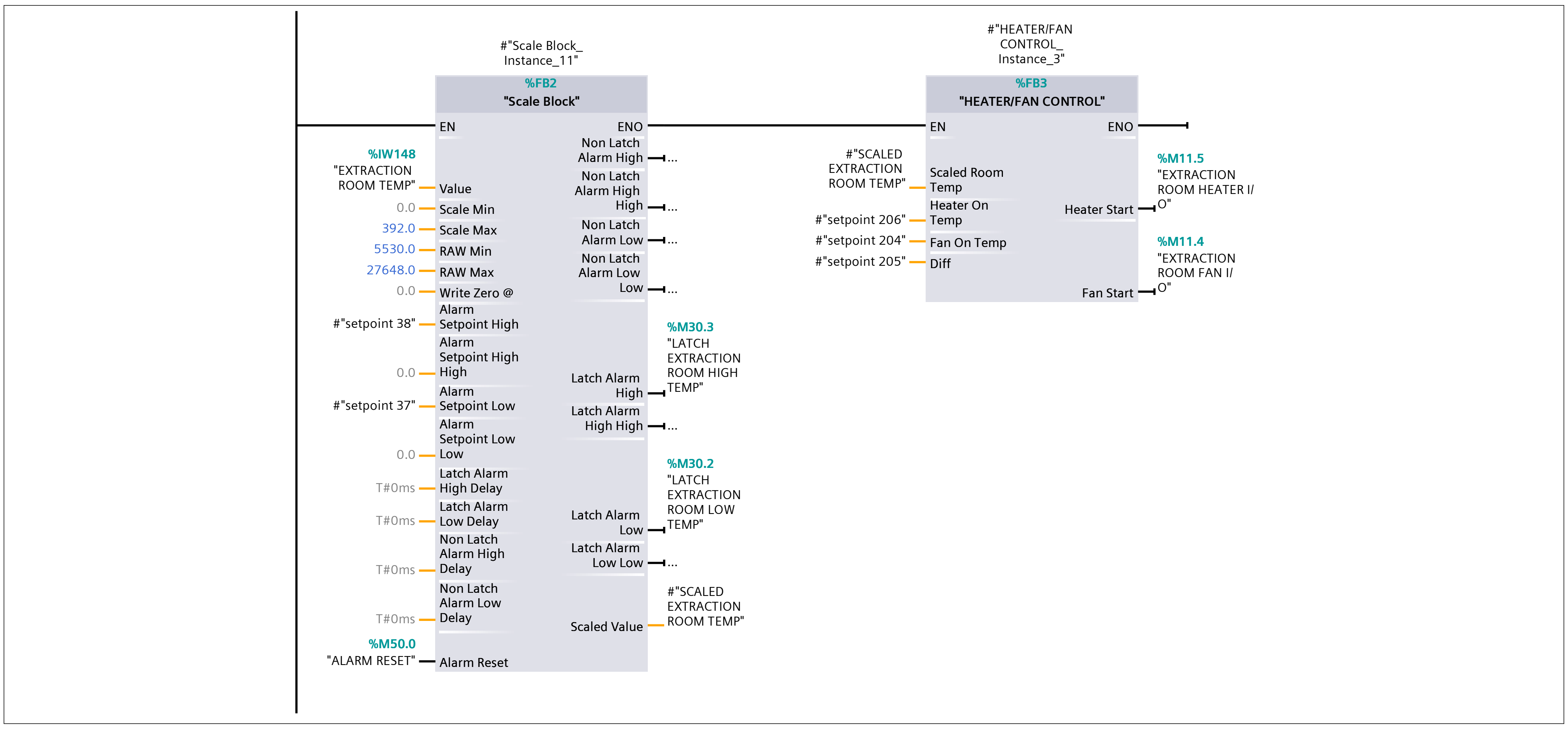
Network 9:



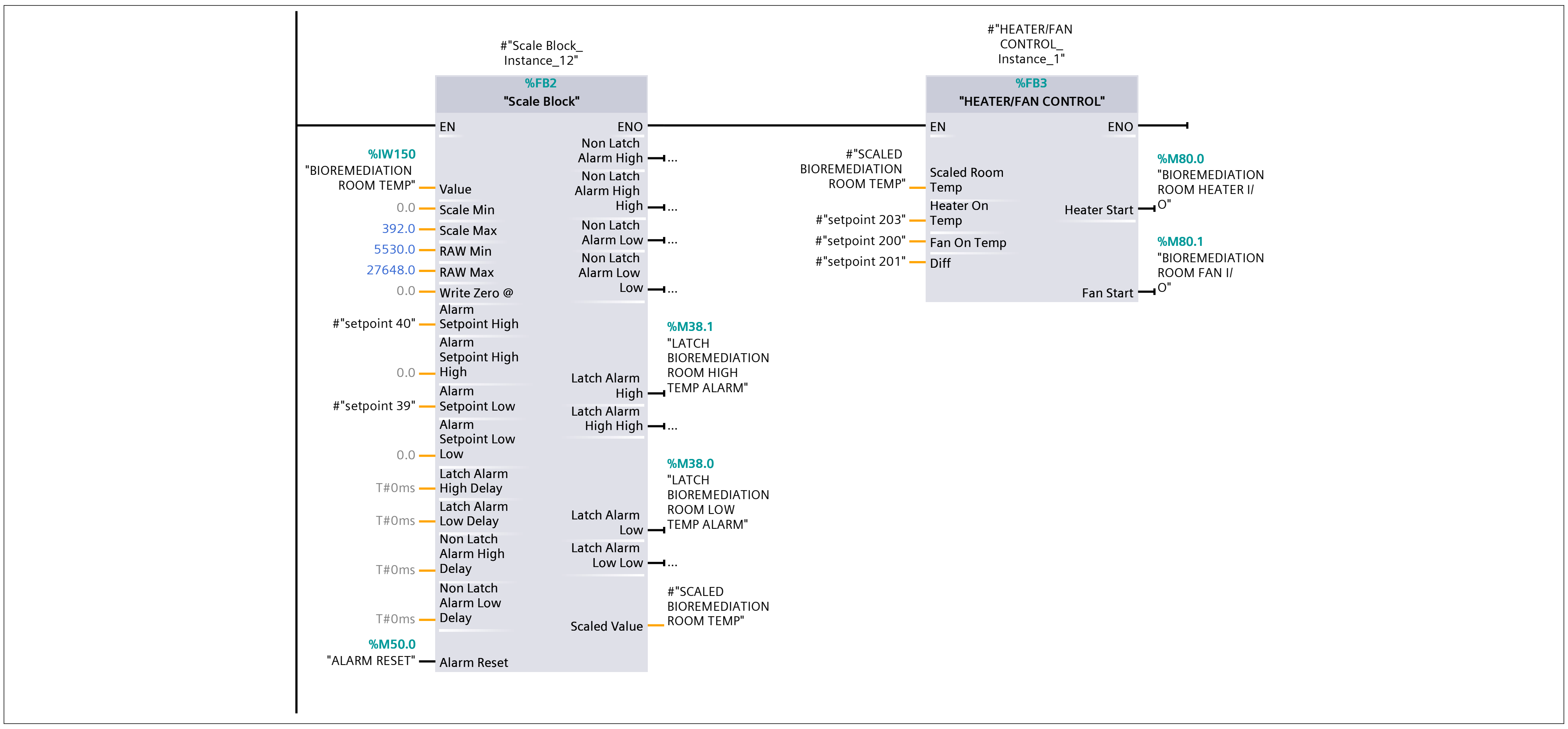
Network 10:



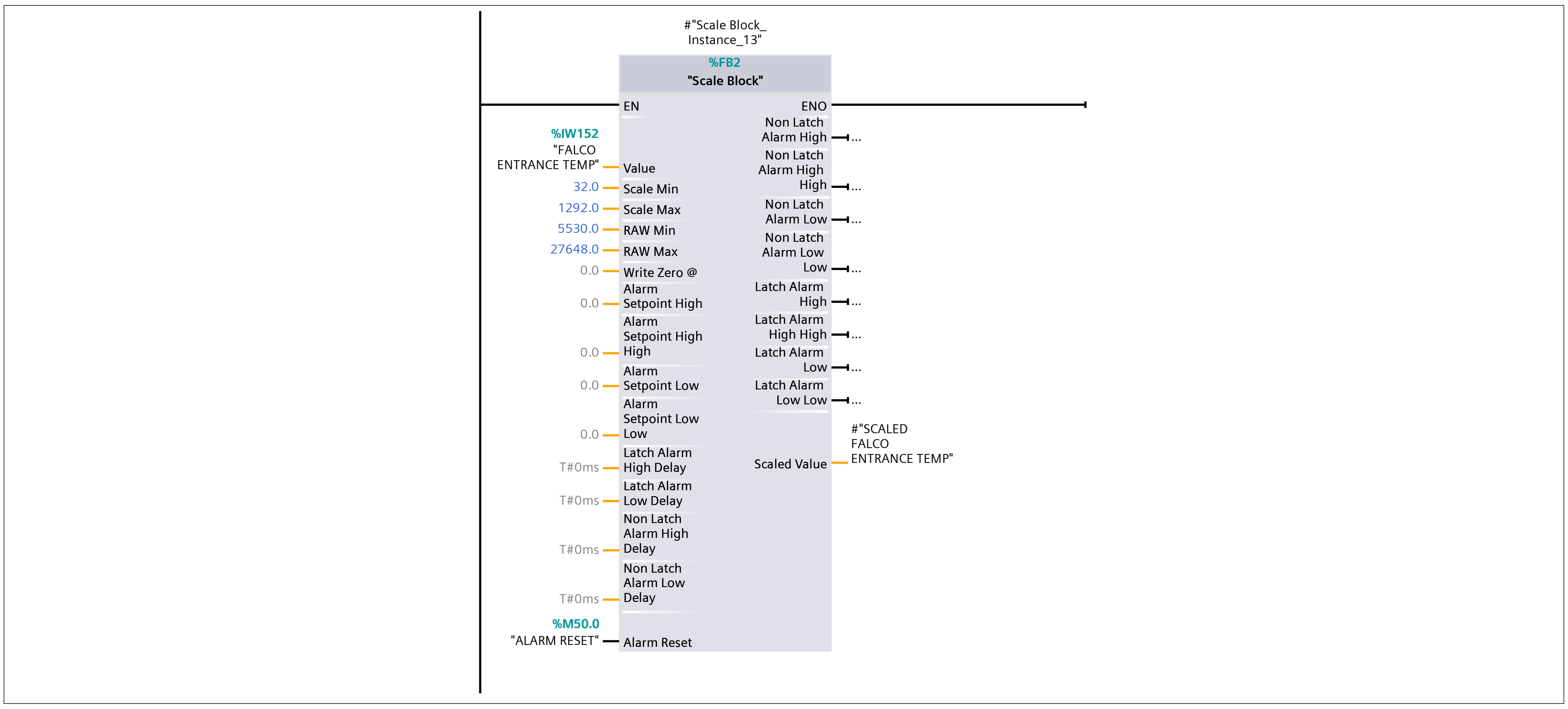
Network 11:



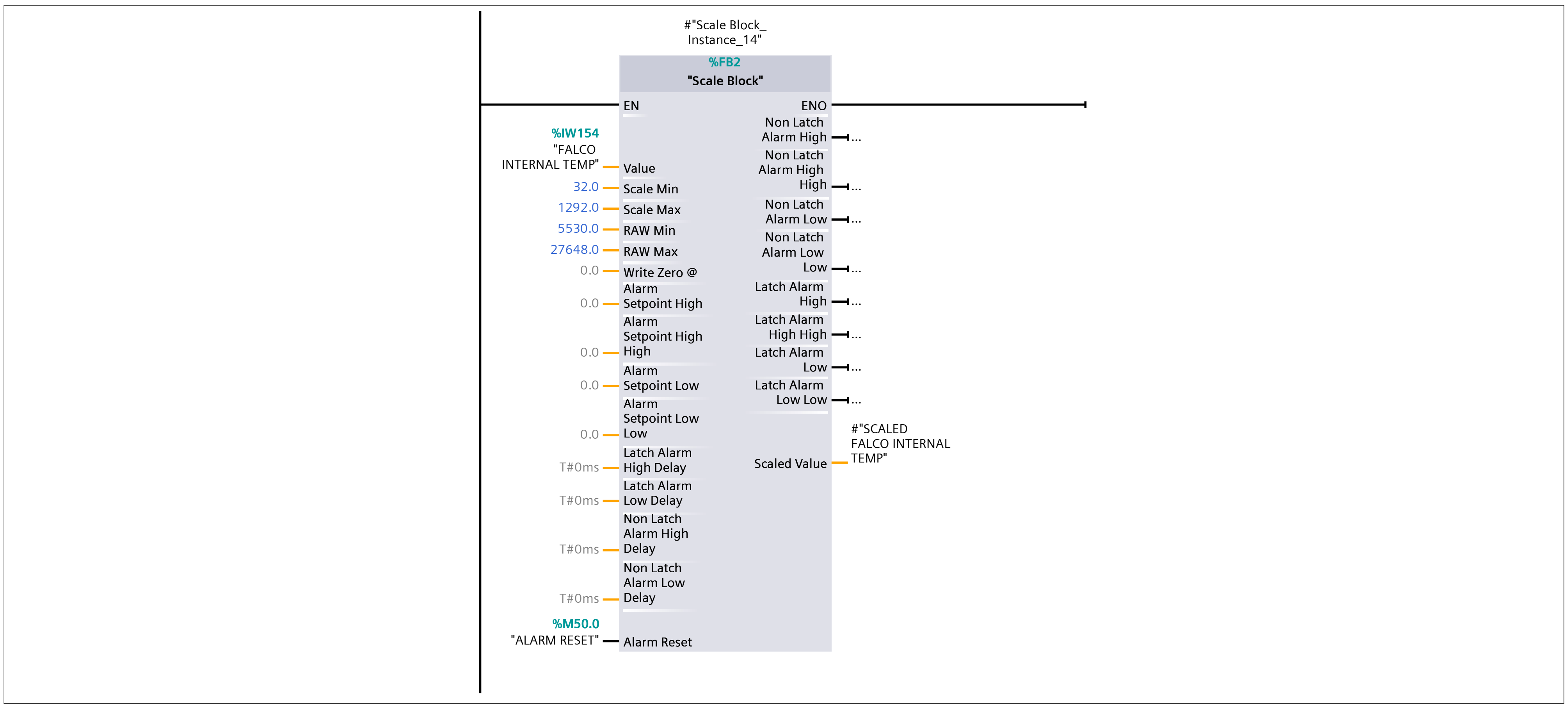
Network 12:



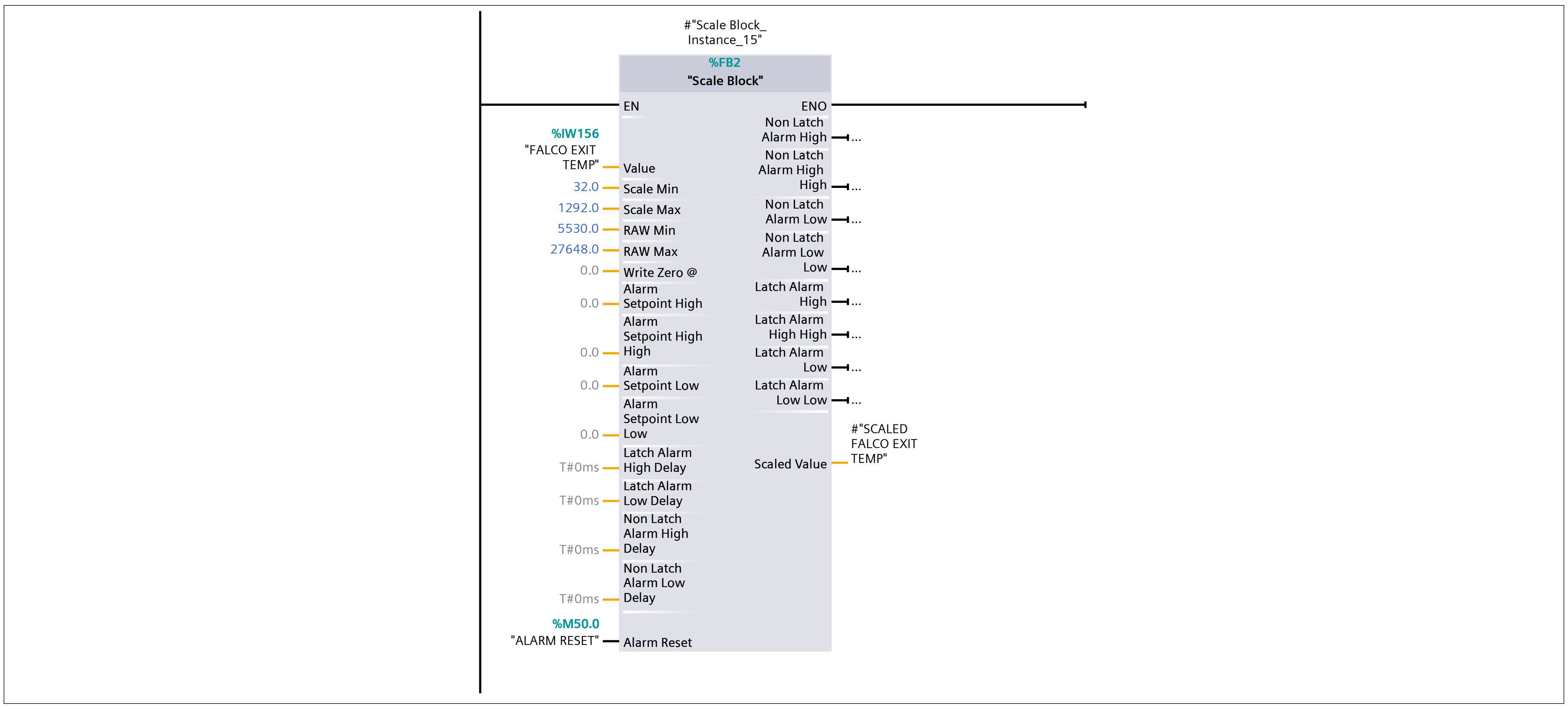
Network 13:



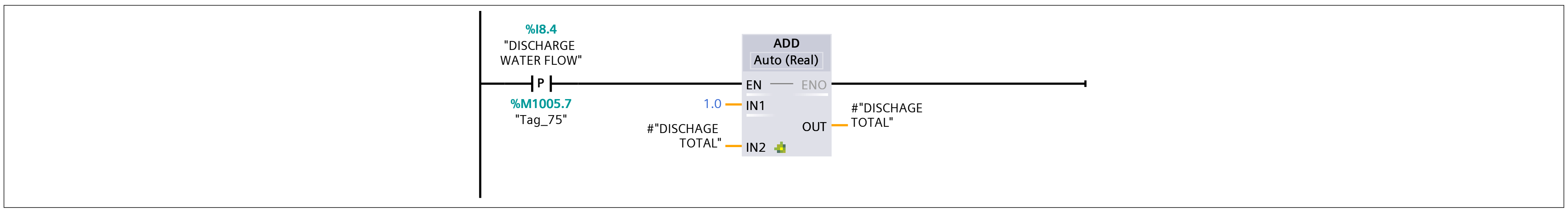
Network 14:



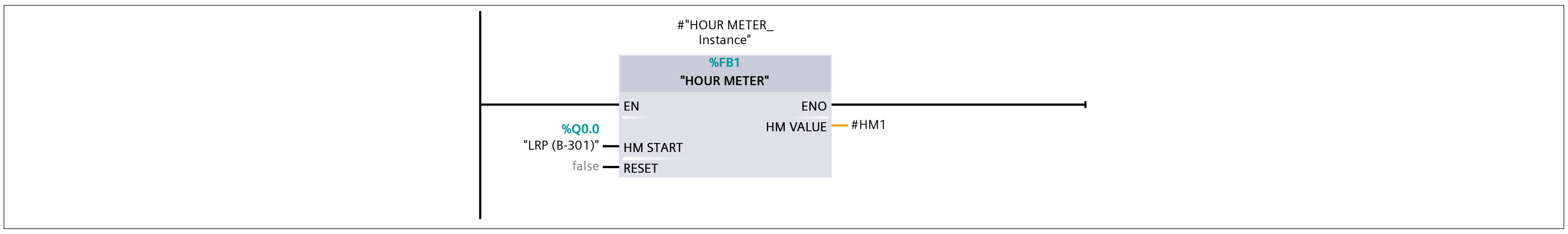
Network 15:



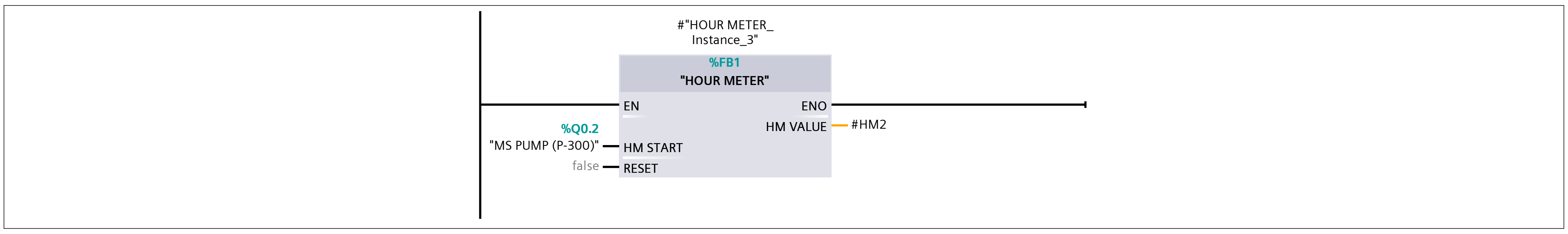
Network 16:



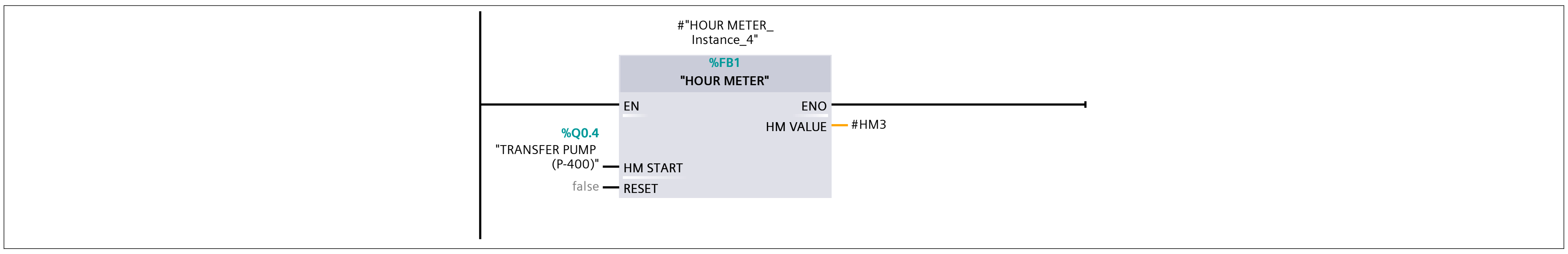
Network 17:



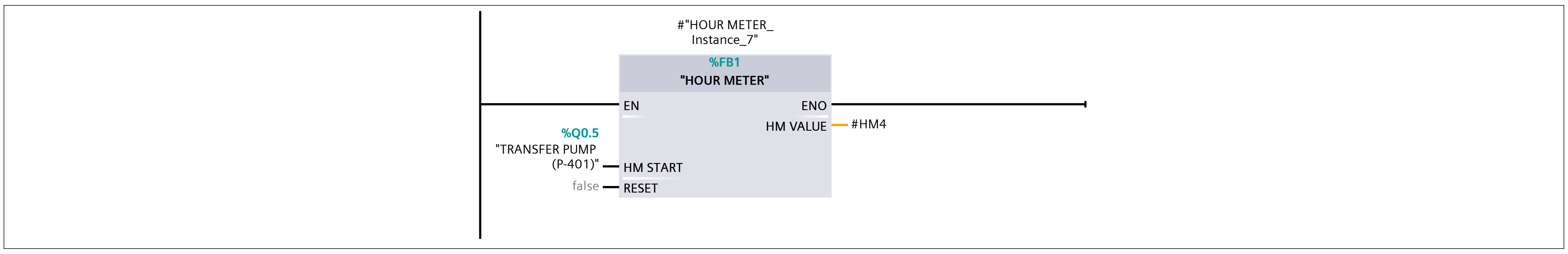
Network 18:



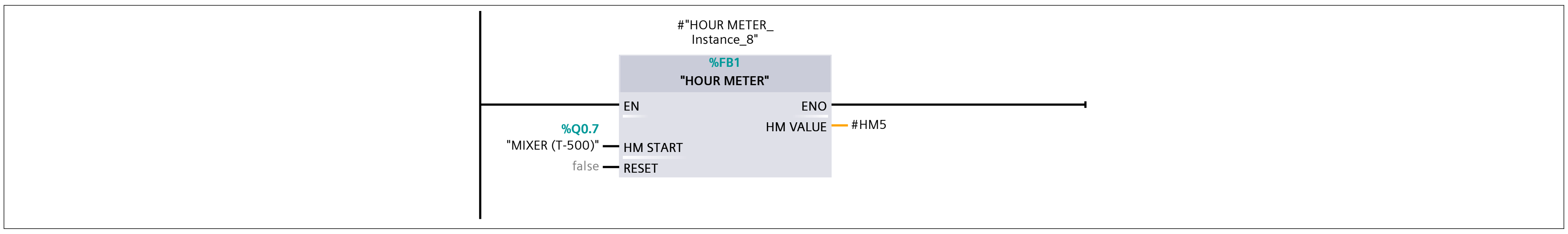
Network 19:



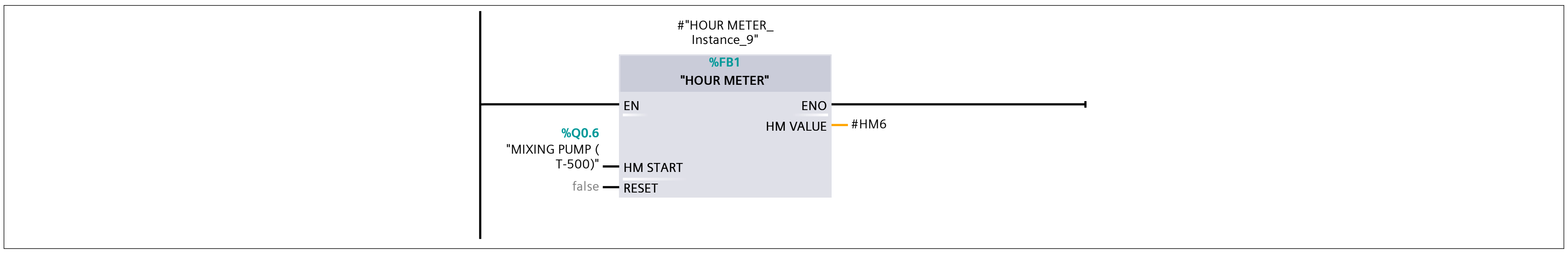
Network 20:



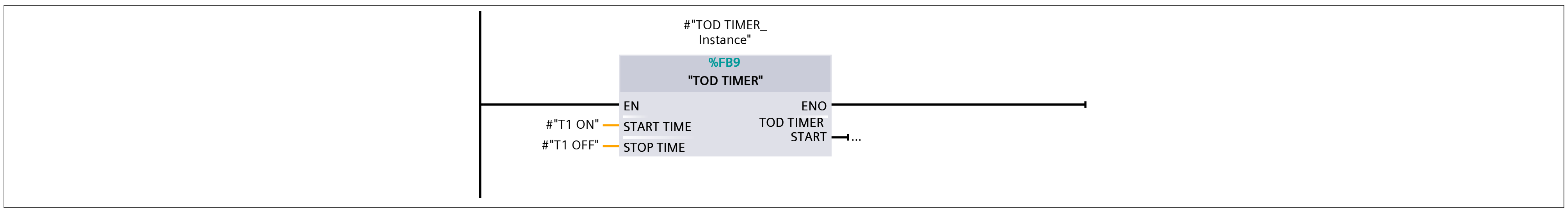
Network 21:



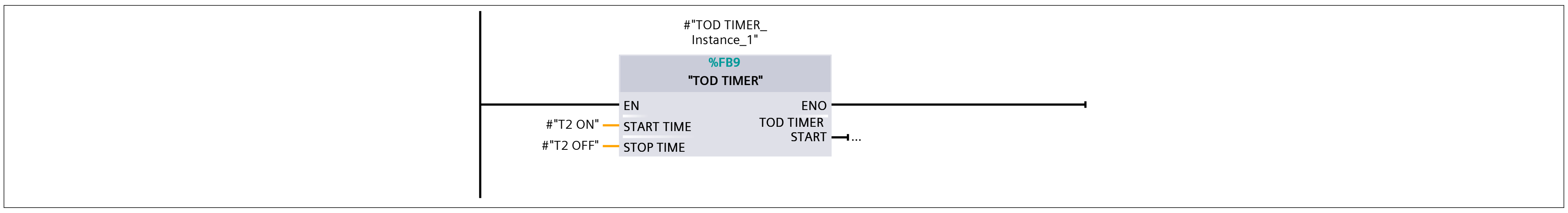
Network 22:



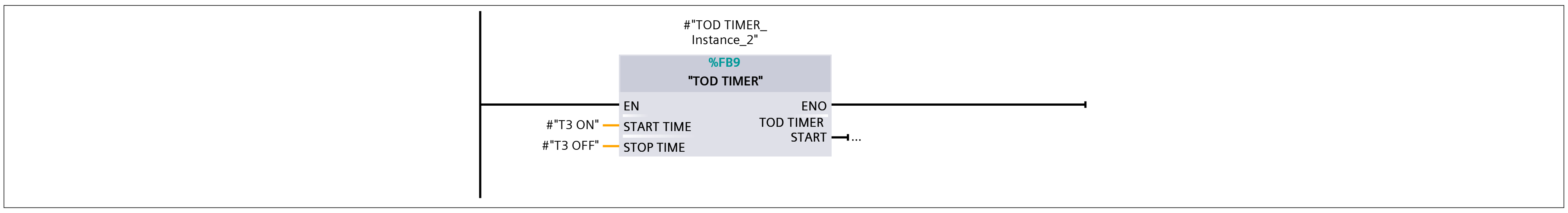
Network 23:



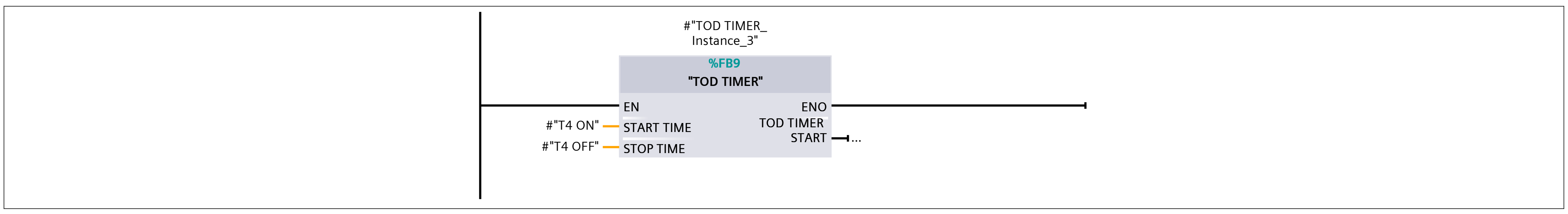
Network 24:



Network 25:



Network 26:



GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks / System blocks / Program resources

IEC_Timer_0_DB_6 [DB20]

IEC_Timer_0_DB_6 Properties							
General							
Name	IEC_Timer_0_DB_6	**Number**	20	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**	Simatic	**Comment**		**Family**	IEC
Version	1.0	**User-defined ID**	IEC_TMR				

Name	Data type	Start value	Retain
▼ Static			
PT	Time	T#0ms	False
ET	Time	T#0ms	False
IN	Bool	false	False
Q	Bool	false	False

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks / System blocks / Program resources

PID_Compact [FB1130]

PID_Compact Properties							
General							
Name	PID_Compact	**Number**	1130	**Type**	FB	**Language**	LAD
Numbering	Automatic						
Information							
Title	Compact PID_Controller with self-tuning	**Author**	SIMATIC	**Comment**		**Family**	
Version	1.2	**User-defined ID**	PID_Cmpt				

Name	Data type	Default value	Retain
▼ Input			
Setpoint	Real	0.0	Non-retain
Input	Real	0.0	Non-retain
Input_PER	Word	16#0	Non-retain
ManualEnable	Bool	false	Non-retain
ManualValue	Real	0.0	Non-retain
Reset	Bool	false	Non-retain
▼ Output			
ScaledInput	Real	0.0	Non-retain
Output	Real	0.0	Non-retain
Output_PER	Word	16#0	Non-retain
Output_PWM	Bool	false	Non-retain
SetpointLimit_H	Bool	false	Non-retain
SetpointLimit_L	Bool	false	Non-retain
InputWarning_H	Bool	false	Non-retain
InputWarning_L	Bool	false	Non-retain
State	Int	0	Non-retain
Error	DWord	16#0	Non-retain
InOut			
▼ Static			
sd_VersionID	DWord	DW#16#01020002	Non-retain
sb_ResOld	Bool	false	Non-retain
sb_TMBeginExec	Bool	false	Non-retain
sb_GetCycleTime	Bool	true	Non-retain
sb_EnCyclEstimation	Bool	true	Non-retain
sb_EnCyclMonitoring	Bool	true	Non-retain
sb_Startup	Bool	false	Non-retain
sb_RunModeByStartup	Bool	true	Non-retain
sby_EsData_1	Byte	16#0	Non-retain
sby_EsData_2	Byte	16#0	Non-retain
si_TMCnt	Int	0	Non-retain
si_Unit	Int	0	Non-retain
si_Type	Int	0	Non-retain
si_SveModeByRes	Int	0	Non-retain
sd_Warning	DWord	16#0	Non-retain
st_TMEnd	Time	T#0MS	Non-retain
sr_TMDiff	Real	0.0	Non-retain
sr_TMDiffMax	Real	0.0	Non-retain
sr_TMDiffMaxMed	Real	0.0	Non-retain
sr_TMDiffSum	Real	0.0	Non-retain
sBackUp	Struct		Non-retain
sPid_Calc	Struct		Non-retain
sPid_Cmpt	Struct		Non-retain
sParamCalc	Struct		Non-retain
sRet	Struct		Retain

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks / System blocks / Program resources

IEC_Timer_0_DB_4 [DB27]

IEC_Timer_0_DB_4 Properties							
General							
Name	IEC_Timer_0_DB_4	**Number**	27	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**	Simatic	**Comment**		**Family**	IEC
Version	1.0	**User-defined ID**	IEC_TMR				

Name	Data type	Start value	Retain
▼ Static			
PT	Time	T#0ms	False
ET	Time	T#0ms	False
IN	Bool	false	False
Q	Bool	false	False

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks / System blocks / Program resources

IEC_Timer_0_DB_5 [DB28]

IEC_Timer_0_DB_5 Properties							
General							
Name	IEC_Timer_0_DB_5	**Number**	28	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**	Simatic	**Comment**		**Family**	IEC
Version	1.0	**User-defined ID**	IEC_TMR				

Name	Data type	Start value	Retain
▼ Static			
PT	Time	T#0ms	False
ET	Time	T#0ms	False
IN	Bool	false	False
Q	Bool	false	False

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks / System blocks / Program resources

IEC_Timer_0_DB [DB14]

IEC_Timer_0_DB Properties							
General							
Name	IEC_Timer_0_DB	**Number**	14	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**	Simatic	**Comment**		**Family**	IEC
Version	1.0	**User-defined ID**	IEC_TMR				

Name	Data type	Start value	Retain
▼ Static			
PT	Time	T#0ms	False
ET	Time	T#0ms	False
IN	Bool	false	False
Q	Bool	false	False

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks / System blocks / Program resources

IEC_Timer_0_DB_1 [DB15]

IEC_Timer_0_DB_1 Properties							
General							
Name	IEC_Timer_0_DB_1	**Number**	15	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**	Simatic	**Comment**		**Family**	IEC
Version	1.0	**User-defined ID**	IEC_TMR				

Name	Data type	Start value	Retain
▼ Static			
PT	Time	T#0ms	False
ET	Time	T#0ms	False
IN	Bool	false	False
Q	Bool	false	False

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks / System blocks / Program resources

IEC_Timer_0_DB_2 [DB25]

IEC_Timer_0_DB_2 Properties							
General							
Name	IEC_Timer_0_DB_2	**Number**	25	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**	Simatic	**Comment**		**Family**	IEC
Version	1.0	**User-defined ID**	IEC_TMR				

Name	Data type	Start value	Retain
▼ Static			
PT	Time	T#0ms	False
ET	Time	T#0ms	False
IN	Bool	false	False
Q	Bool	false	False

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks / System blocks / Program resources

IEC_Timer_0_DB_3 [DB26]

IEC_Timer_0_DB_3 Properties							
General							
Name	IEC_Timer_0_DB_3	**Number**	26	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**	Simatic	**Comment**		**Family**	IEC
Version	1.0	**User-defined ID**	IEC_TMR				

Name	Data type	Start value	Retain
▼ Static			
PT	Time	T#0ms	False
ET	Time	T#0ms	False
IN	Bool	false	False
Q	Bool	false	False

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks / System blocks / Program resources

IEC_Timer_0_DB_7 [DB29]

IEC_Timer_0_DB_7 Properties							
General							
Name	IEC_Timer_0_DB_7	**Number**	29	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**	Simatic	**Comment**		**Family**	IEC
Version	1.0	**User-defined ID**	IEC_TMR				

Name	Data type	Start value	Retain
▼ Static			
PT	Time	T#0ms	False
ET	Time	T#0ms	False
IN	Bool	false	False
Q	Bool	false	False

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks / System blocks / Program resources

IEC_Timer_0_DB_8 [DB30]

IEC_Timer_0_DB_8 Properties							
General							
Name	IEC_Timer_0_DB_8	**Number**	30	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**	Simatic	**Comment**		**Family**	IEC
Version	1.0	**User-defined ID**	IEC_TMR				

Name	Data type	Start value	Retain
▼ Static			
PT	Time	T#0ms	False
ET	Time	T#0ms	False
IN	Bool	false	False
Q	Bool	false	False

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks / System blocks / Program resources

IEC_Timer_0_DB_9 [DB31]

IEC_Timer_0_DB_9 Properties							
General							
Name	IEC_Timer_0_DB_9	**Number**	31	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**	Simatic	**Comment**		**Family**	IEC
Version	1.0	**User-defined ID**	IEC_TMR				

Name	Data type	Start value	Retain
▼ Static			
PT	Time	T#0ms	False
ET	Time	T#0ms	False
IN	Bool	false	False
Q	Bool	false	False

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks / System blocks / Program resources

IEC_Timer_0_DB_10 [DB32]

IEC_Timer_0_DB_10 Properties							
General							
Name	IEC_Timer_0_DB_10	**Number**	32	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**	Simatic	**Comment**		**Family**	IEC
Version	1.0	**User-defined ID**	IEC_TMR				

Name	Data type	Start value	Retain
▼ Static			
PT	Time	T#0ms	False
ET	Time	T#0ms	False
IN	Bool	false	False
Q	Bool	false	False

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Program blocks / System blocks / Program resources

IEC_Timer_0_DB_11 [DB33]

IEC_Timer_0_DB_11 Properties							
General							
Name	IEC_Timer_0_DB_11	**Number**	33	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**	Simatic	**Comment**		**Family**	IEC
Version	1.0	**User-defined ID**	IEC_TMR				

Name	Data type	Start value	Retain
▼ Static			
PT	Time	T#0ms	False
ET	Time	T#0ms	False
IN	Bool	false	False
Q	Bool	false	False

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Technology objects

PID_Compact_1 [DB1]

PID_Compact_1 Properties							
General							
Name	PID_Compact_1	**Number**	1	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**	SIMATIC	**Comment**		**Family**	
Version	1.2	**User-defined ID**	PID_Cmpt				

Name	Data type	Start value	Retain
▼ Input			
Setpoint	Real	0.0	False
Input	Real	0.0	False
Input_PER	Word	16#0	False
ManualEnable	Bool	false	False
ManualValue	Real	0.0	False
Reset	Bool	false	False
▼ Output			
ScaledInput	Real	0.0	False
Output	Real	0.0	False
Output_PER	Word	16#0	False
Output_PWM	Bool	false	False
SetpointLimit_H	Bool	false	False
SetpointLimit_L	Bool	false	False
InputWarning_H	Bool	false	False
InputWarning_L	Bool	false	False
State	Int	0	False
Error	DWord	16#0	False
InOut			
▼ Static			
sd_VersionID	DWord	DW#16#01020002	False
sb_ResOld	Bool	false	False
sb_TMBeginExec	Bool	false	False
sb_GetCycleTime	Bool	true	False
sb_EnCyclEstimation	Bool	true	False
sb_EnCyclMonitoring	Bool	true	False
sb_Startup	Bool	false	False
sb_RunModeByStartup	Bool	true	False
sby_EsData_1	Byte	1	False
sby_EsData_2	Byte	1	False
si_TMCnt	Int	0	False
si_Unit	Int	0	False
si_Type	Int	0	False
si_SveModeByRes	Int	0	False
sd_Warning	DWord	16#0	False
st_TMEnd	Time	T#0MS	False
sr_TMDiff	Real	0.0	False
sr_TMDiffMax	Real	0.0	False
sr_TMDiffMaxMed	Real	0.0	False
sr_TMDiffSum	Real	0.0	False
sBackUp	Struct		False
sPid_Calc	Struct		False
sPid_Cmpt	Struct		False
sParamCalc	Struct		False
sRet	Struct		True

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Technology objects

PID_Compact_2 [DB2]

PID_Compact_2 Properties							
General							
Name	PID_Compact_2	**Number**	2	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**	SIMATIC	**Comment**		**Family**	
Version	1.2	**User-defined ID**	PID_Cmpt				

Name	Data type	Start value	Retain
▼ Input			
Setpoint	Real	0.0	False
Input	Real	0.0	False
Input_PER	Word	16#0	False
ManualEnable	Bool	false	False
ManualValue	Real	0.0	False
Reset	Bool	false	False
▼ Output			
ScaledInput	Real	0.0	False
Output	Real	0.0	False
Output_PER	Word	16#0	False
Output_PWM	Bool	false	False
SetpointLimit_H	Bool	false	False
SetpointLimit_L	Bool	false	False
InputWarning_H	Bool	false	False
InputWarning_L	Bool	false	False
State	Int	0	False
Error	DWord	16#0	False
InOut			
▼ Static			
sd_VersionID	DWord	DW#16#01020002	False
sb_ResOld	Bool	false	False
sb_TMBeginExec	Bool	false	False
sb_GetCycleTime	Bool	true	False
sb_EnCyclEstimation	Bool	true	False
sb_EnCyclMonitoring	Bool	true	False
sb_Startup	Bool	false	False
sb_RunModeByStartup	Bool	true	False
sby_EsData_1	Byte	1	False
sby_EsData_2	Byte	1	False
si_TMCnt	Int	0	False
si_Unit	Int	0	False
si_Type	Int	0	False
si_SveModeByRes	Int	0	False
sd_Warning	DWord	16#0	False
st_TMEnd	Time	T#0MS	False
sr_TMDiff	Real	0.0	False
sr_TMDiffMax	Real	0.0	False
sr_TMDiffMaxMed	Real	0.0	False
sr_TMDiffSum	Real	0.0	False
sBackUp	Struct		False
sPid_Calc	Struct		False
sPid_Cmpt	Struct		False
sParamCalc	Struct		False
sRet	Struct		True

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Technology objects

PID_Compact_3 [DB9]

PID_Compact_3 Properties							
General							
Name	PID_Compact_3	**Number**	9	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**	SIMATIC	**Comment**		**Family**	
Version	1.2	**User-defined ID**	PID_Cmpt				

Name	Data type	Start value	Retain
▼ Input			
Setpoint	Real	0.0	False
Input	Real	0.0	False
Input_PER	Word	16#0	False
ManualEnable	Bool	false	False
ManualValue	Real	0.0	False
Reset	Bool	false	False
▼ Output			
ScaledInput	Real	0.0	False
Output	Real	0.0	False
Output_PER	Word	16#0	False
Output_PWM	Bool	false	False
SetpointLimit_H	Bool	false	False
SetpointLimit_L	Bool	false	False
InputWarning_H	Bool	false	False
InputWarning_L	Bool	false	False
State	Int	0	False
Error	DWord	16#0	False
InOut			
▼ Static			
sd_VersionID	DWord	DW#16#01020002	False
sb_ResOld	Bool	false	False
sb_TMBeginExec	Bool	false	False
sb_GetCycleTime	Bool	true	False
sb_EnCyclEstimation	Bool	true	False
sb_EnCyclMonitoring	Bool	true	False
sb_Startup	Bool	false	False
sb_RunModeByStartup	Bool	true	False
sby_EsData_1	Byte	16#01	False
sby_EsData_2	Byte	16#01	False
si_TMCnt	Int	0	False
si_Unit	Int	0	False
si_Type	Int	0	False
si_SveModeByRes	Int	0	False
sd_Warning	DWord	16#0	False
st_TMEnd	Time	T#0MS	False
sr_TMDiff	Real	0.0	False
sr_TMDiffMax	Real	0.0	False
sr_TMDiffMaxMed	Real	0.0	False
sr_TMDiffSum	Real	0.0	False
sBackUp	Struct		False
sPid_Calc	Struct		False
sPid_Cmpt	Struct		False
sParamCalc	Struct		False
sRet	Struct		True

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Technology objects

PID_Compact_4 [DB10]

PID_Compact_4 Properties							
General							
Name	PID_Compact_4	**Number**	10	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**	SIMATIC	**Comment**		**Family**	
Version	1.2	**User-defined ID**	PID_Cmpt				

Name	Data type	Start value	Retain
▼ Input			
Setpoint	Real	0.0	False
Input	Real	0.0	False
Input_PER	Word	16#0	False
ManualEnable	Bool	false	False
ManualValue	Real	0.0	False
Reset	Bool	false	False
▼ Output			
ScaledInput	Real	0.0	False
Output	Real	0.0	False
Output_PER	Word	16#0	False
Output_PWM	Bool	false	False
SetpointLimit_H	Bool	false	False
SetpointLimit_L	Bool	false	False
InputWarning_H	Bool	false	False
InputWarning_L	Bool	false	False
State	Int	0	False
Error	DWord	16#0	False
InOut			
▼ Static			
sd_VersionID	DWord	DW#16#01020002	False
sb_ResOld	Bool	false	False
sb_TMBeginExec	Bool	false	False
sb_GetCycleTime	Bool	true	False
sb_EnCyclEstimation	Bool	true	False
sb_EnCyclMonitoring	Bool	true	False
sb_Startup	Bool	false	False
sb_RunModeByStartup	Bool	true	False
sby_EsData_1	Byte	16#01	False
sby_EsData_2	Byte	16#01	False
si_TMCnt	Int	0	False
si_Unit	Int	0	False
si_Type	Int	0	False
si_SveModeByRes	Int	0	False
sd_Warning	DWord	16#0	False
st_TMEnd	Time	T#0MS	False
sr_TMDiff	Real	0.0	False
sr_TMDiffMax	Real	0.0	False
sr_TMDiffMaxMed	Real	0.0	False
sr_TMDiffSum	Real	0.0	False
sBackUp	Struct		False
sPid_Calc	Struct		False
sPid_Cmpt	Struct		False
sParamCalc	Struct		False
sRet	Struct		True

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Technology objects

PID_Compact_5 [DB11]

PID_Compact_5 Properties							
General							
Name	PID_Compact_5	**Number**	11	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**	SIMATIC	**Comment**		**Family**	
Version	1.2	**User-defined ID**	PID_Cmpt				

Name	Data type	Start value	Retain
▼ Input			
Setpoint	Real	0.0	False
Input	Real	0.0	False
Input_PER	Word	16#0	False
ManualEnable	Bool	false	False
ManualValue	Real	0.0	False
Reset	Bool	false	False
▼ Output			
ScaledInput	Real	0.0	False
Output	Real	0.0	False
Output_PER	Word	16#0	False
Output_PWM	Bool	false	False
SetpointLimit_H	Bool	false	False
SetpointLimit_L	Bool	false	False
InputWarning_H	Bool	false	False
InputWarning_L	Bool	false	False
State	Int	0	False
Error	DWord	16#0	False
InOut			
▼ Static			
sd_VersionID	DWord	DW#16#01020002	False
sb_ResOld	Bool	false	False
sb_TMBeginExec	Bool	false	False
sb_GetCycleTime	Bool	true	False
sb_EnCyclEstimation	Bool	true	False
sb_EnCyclMonitoring	Bool	true	False
sb_Startup	Bool	false	False
sb_RunModeByStartup	Bool	true	False
sby_EsData_1	Byte	16#01	False
sby_EsData_2	Byte	16#01	False
si_TMCnt	Int	0	False
si_Unit	Int	0	False
si_Type	Int	0	False
si_SveModeByRes	Int	0	False
sd_Warning	DWord	16#0	False
st_TMEnd	Time	T#0MS	False
sr_TMDiff	Real	0.0	False
sr_TMDiffMax	Real	0.0	False
sr_TMDiffMaxMed	Real	0.0	False
sr_TMDiffSum	Real	0.0	False
sBackUp	Struct		False
sPid_Calc	Struct		False
sPid_Cmpt	Struct		False
sParamCalc	Struct		False
sRet	Struct		True

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Technology objects

PID_Compact_6 [DB17]

PID_Compact_6 Properties							
General							
Name	PID_Compact_6	**Number**	17	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**	SIMATIC	**Comment**		**Family**	
Version	1.2	**User-defined ID**	PID_Cmpt				

Name	Data type	Start value	Retain
▼ Input			
Setpoint	Real	0.0	False
Input	Real	0.0	False
Input_PER	Word	16#0	False
ManualEnable	Bool	false	False
ManualValue	Real	0.0	False
Reset	Bool	false	False
▼ Output			
ScaledInput	Real	0.0	False
Output	Real	0.0	False
Output_PER	Word	16#0	False
Output_PWM	Bool	false	False
SetpointLimit_H	Bool	false	False
SetpointLimit_L	Bool	false	False
InputWarning_H	Bool	false	False
InputWarning_L	Bool	false	False
State	Int	0	False
Error	DWord	16#0	False
InOut			
▼ Static			
sd_VersionID	DWord	DW#16#01020002	False
sb_ResOld	Bool	false	False
sb_TMBeginExec	Bool	false	False
sb_GetCycleTime	Bool	true	False
sb_EnCyclEstimation	Bool	true	False
sb_EnCyclMonitoring	Bool	true	False
sb_Startup	Bool	false	False
sb_RunModeByStartup	Bool	true	False
sby_EsData_1	Byte	16#01	False
sby_EsData_2	Byte	16#01	False
si_TMCnt	Int	0	False
si_Unit	Int	0	False
si_Type	Int	0	False
si_SveModeByRes	Int	0	False
sd_Warning	DWord	16#0	False
st_TMEnd	Time	T#0MS	False
sr_TMDiff	Real	0.0	False
sr_TMDiffMax	Real	0.0	False
sr_TMDiffMaxMed	Real	0.0	False
sr_TMDiffSum	Real	0.0	False
sBackUp	Struct		False
sPid_Calc	Struct		False
sPid_Cmpt	Struct		False
sParamCalc	Struct		False
sRet	Struct		True

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Technology objects

PID_Compact_7 [DB19]

PID_Compact_7 Properties							
General							
Name	PID_Compact_7	**Number**	19	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**	SIMATIC	**Comment**		**Family**	
Version	1.2	**User-defined ID**	PID_Cmpt				

Name	Data type	Start value	Retain
▼ Input			
Setpoint	Real	0.0	False
Input	Real	0.0	False
Input_PER	Word	16#0	False
ManualEnable	Bool	false	False
ManualValue	Real	0.0	False
Reset	Bool	false	False
▼ Output			
ScaledInput	Real	0.0	False
Output	Real	0.0	False
Output_PER	Word	16#0	False
Output_PWM	Bool	false	False
SetpointLimit_H	Bool	false	False
SetpointLimit_L	Bool	false	False
InputWarning_H	Bool	false	False
InputWarning_L	Bool	false	False
State	Int	0	False
Error	DWord	16#0	False
InOut			
▼ Static			
sd_VersionID	DWord	DW#16#01020002	False
sb_ResOld	Bool	false	False
sb_TMBeginExec	Bool	false	False
sb_GetCycleTime	Bool	true	False
sb_EnCyclEstimation	Bool	true	False
sb_EnCyclMonitoring	Bool	true	False
sb_Startup	Bool	false	False
sb_RunModeByStartup	Bool	true	False
sby_EsData_1	Byte	16#01	False
sby_EsData_2	Byte	16#01	False
si_TMCnt	Int	0	False
si_Unit	Int	0	False
si_Type	Int	0	False
si_SveModeByRes	Int	0	False
sd_Warning	DWord	16#0	False
st_TMEnd	Time	T#0MS	False
sr_TMDiff	Real	0.0	False
sr_TMDiffMax	Real	0.0	False
sr_TMDiffMaxMed	Real	0.0	False
sr_TMDiffSum	Real	0.0	False
sBackUp	Struct		False
sPid_Calc	Struct		False
sPid_Cmpt	Struct		False
sParamCalc	Struct		False
sRet	Struct		True

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Technology objects

PID_Compact_8 [DB21]

PID_Compact_8 Properties							
General							
Name	PID_Compact_8	**Number**	21	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**	SIMATIC	**Comment**		**Family**	
Version	1.2	**User-defined ID**	PID_Cmpt				

Name	Data type	Start value	Retain
▼ Input			
Setpoint	Real	0.0	False
Input	Real	0.0	False
Input_PER	Word	16#0	False
ManualEnable	Bool	false	False
ManualValue	Real	0.0	False
Reset	Bool	false	False
▼ Output			
ScaledInput	Real	0.0	False
Output	Real	0.0	False
Output_PER	Word	16#0	False
Output_PWM	Bool	false	False
SetpointLimit_H	Bool	false	False
SetpointLimit_L	Bool	false	False
InputWarning_H	Bool	false	False
InputWarning_L	Bool	false	False
State	Int	0	False
Error	DWord	16#0	False
InOut			
▼ Static			
sd_VersionID	DWord	DW#16#01020002	False
sb_ResOld	Bool	false	False
sb_TMBeginExec	Bool	false	False
sb_GetCycleTime	Bool	true	False
sb_EnCyclEstimation	Bool	true	False
sb_EnCyclMonitoring	Bool	true	False
sb_Startup	Bool	false	False
sb_RunModeByStartup	Bool	true	False
sby_EsData_1	Byte	16#01	False
sby_EsData_2	Byte	16#01	False
si_TMCnt	Int	0	False
si_Unit	Int	0	False
si_Type	Int	0	False
si_SveModeByRes	Int	0	False
sd_Warning	DWord	16#0	False
st_TMEnd	Time	T#0MS	False
sr_TMDiff	Real	0.0	False
sr_TMDiffMax	Real	0.0	False
sr_TMDiffMaxMed	Real	0.0	False
sr_TMDiffSum	Real	0.0	False
sBackUp	Struct		False
sPid_Calc	Struct		False
sPid_Cmpt	Struct		False
sParamCalc	Struct		False
sRet	Struct		True

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Technology objects

PID_Compact_9 [DB22]

PID_Compact_9 Properties							
General							
Name	PID_Compact_9	**Number**	22	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**	SIMATIC	**Comment**		**Family**	
Version	1.2	**User-defined ID**	PID_Cmpt				

Name	Data type	Start value	Retain
▼ Input			
Setpoint	Real	0.0	False
Input	Real	0.0	False
Input_PER	Word	16#0	False
ManualEnable	Bool	false	False
ManualValue	Real	0.0	False
Reset	Bool	false	False
▼ Output			
ScaledInput	Real	0.0	False
Output	Real	0.0	False
Output_PER	Word	16#0	False
Output_PWM	Bool	false	False
SetpointLimit_H	Bool	false	False
SetpointLimit_L	Bool	false	False
InputWarning_H	Bool	false	False
InputWarning_L	Bool	false	False
State	Int	0	False
Error	DWord	16#0	False
InOut			
▼ Static			
sd_VersionID	DWord	DW#16#01020002	False
sb_ResOld	Bool	false	False
sb_TMBeginExec	Bool	false	False
sb_GetCycleTime	Bool	true	False
sb_EnCyclEstimation	Bool	true	False
sb_EnCyclMonitoring	Bool	true	False
sb_Startup	Bool	false	False
sb_RunModeByStartup	Bool	true	False
sby_EsData_1	Byte	16#01	False
sby_EsData_2	Byte	16#01	False
si_TMCnt	Int	0	False
si_Unit	Int	0	False
si_Type	Int	0	False
si_SveModeByRes	Int	0	False
sd_Warning	DWord	16#0	False
st_TMEnd	Time	T#0MS	False
sr_TMDiff	Real	0.0	False
sr_TMDiffMax	Real	0.0	False
sr_TMDiffMaxMed	Real	0.0	False
sr_TMDiffSum	Real	0.0	False
sBackUp	Struct		False
sPid_Calc	Struct		False
sPid_Cmpt	Struct		False
sParamCalc	Struct		False
sRet	Struct		True

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Technology objects

PID_Compact_10 [DB23]

PID_Compact_10 Properties							
General							
Name	PID_Compact_10	**Number**	23	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**	SIMATIC	**Comment**		**Family**	
Version	1.2	**User-defined ID**	PID_Cmpt				

Name	Data type	Start value	Retain
▼ Input			
Setpoint	Real	0.0	False
Input	Real	0.0	False
Input_PER	Word	16#0	False
ManualEnable	Bool	false	False
ManualValue	Real	0.0	False
Reset	Bool	false	False
▼ Output			
ScaledInput	Real	0.0	False
Output	Real	0.0	False
Output_PER	Word	16#0	False
Output_PWM	Bool	false	False
SetpointLimit_H	Bool	false	False
SetpointLimit_L	Bool	false	False
InputWarning_H	Bool	false	False
InputWarning_L	Bool	false	False
State	Int	0	False
Error	DWord	16#0	False
InOut			
▼ Static			
sd_VersionID	DWord	DW#16#01020002	False
sb_ResOld	Bool	false	False
sb_TMBeginExec	Bool	false	False
sb_GetCycleTime	Bool	true	False
sb_EnCyclEstimation	Bool	true	False
sb_EnCyclMonitoring	Bool	true	False
sb_Startup	Bool	false	False
sb_RunModeByStartup	Bool	true	False
sby_EsData_1	Byte	16#01	False
sby_EsData_2	Byte	16#01	False
si_TMCnt	Int	0	False
si_Unit	Int	0	False
si_Type	Int	0	False
si_SveModeByRes	Int	0	False
sd_Warning	DWord	16#0	False
st_TMEnd	Time	T#0MS	False
sr_TMDiff	Real	0.0	False
sr_TMDiffMax	Real	0.0	False
sr_TMDiffMaxMed	Real	0.0	False
sr_TMDiffSum	Real	0.0	False
sBackUp	Struct		False
sPid_Calc	Struct		False
sPid_Cmpt	Struct		False
sParamCalc	Struct		False
sRet	Struct		True

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Technology objects

PID_Compact_11 [DB24]

PID_Compact_11 Properties							
General							
Name	PID_Compact_11	**Number**	24	**Type**	DB	**Language**	DB
Numbering	Automatic						
Information							
Title		**Author**	SIMATIC	**Comment**		**Family**	
Version	1.2	**User-defined ID**	PID_Cmpt				

Name	Data type	Start value	Retain
▼ Input			
Setpoint	Real	0.0	False
Input	Real	0.0	False
Input_PER	Word	16#0	False
ManualEnable	Bool	false	False
ManualValue	Real	0.0	False
Reset	Bool	false	False
▼ Output			
ScaledInput	Real	0.0	False
Output	Real	0.0	False
Output_PER	Word	16#0	False
Output_PWM	Bool	false	False
SetpointLimit_H	Bool	false	False
SetpointLimit_L	Bool	false	False
InputWarning_H	Bool	false	False
InputWarning_L	Bool	false	False
State	Int	0	False
Error	DWord	16#0	False
InOut			
▼ Static			
sd_VersionID	DWord	DW#16#01020002	False
sb_ResOld	Bool	false	False
sb_TMBeginExec	Bool	false	False
sb_GetCycleTime	Bool	true	False
sb_EnCyclEstimation	Bool	true	False
sb_EnCyclMonitoring	Bool	true	False
sb_Startup	Bool	false	False
sb_RunModeByStartup	Bool	true	False
sby_EsData_1	Byte	16#01	False
sby_EsData_2	Byte	16#01	False
si_TMCnt	Int	0	False
si_Unit	Int	0	False
si_Type	Int	0	False
si_SveModeByRes	Int	0	False
sd_Warning	DWord	16#0	False
st_TMEnd	Time	T#0MS	False
sr_TMDiff	Real	0.0	False
sr_TMDiffMax	Real	0.0	False
sr_TMDiffMaxMed	Real	0.0	False
sr_TMDiffSum	Real	0.0	False
sBackUp	Struct		False
sPid_Calc	Struct		False
sPid_Cmpt	Struct		False
sParamCalc	Struct		False
sRet	Struct		True

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / PLC tags / Default tag table [261]

PLC tags

	Name	Data type	Address	Retain
	ALARM RESET	Bool	%M50.0	True
	ALARM FLASHER	Bool	%M60.0	True
	DAY OF WEEK	USInt	%MB500	True
	HOUR	USInt	%MB501	True
	Tag_32	DWord	%MD528	True
	AUTO 1	Bool	%M1.0	True
	HAND 1	Bool	%M1.1	True
	AUTO 2	Bool	%M1.2	True
	HAND 2	Bool	%M1.3	True
	AUTO 3	Bool	%M1.4	True
	HAND 3	Bool	%M1.5	True
	AUTO 4	Bool	%M1.6	True
	HAND 4	Bool	%M1.7	True
	AUTO 5	Bool	%M2.0	True
	HAND 5	Bool	%M2.1	True
	AUTO 6	Bool	%M2.2	True
	HAND 6	Bool	%M2.3	True
	AUTO 7	Bool	%M2.4	True
	HAND 7	Bool	%M2.5	True
	AUTO 8	Bool	%M2.6	True
	HAND 8	Bool	%M2.7	True
	AUTO 9	Bool	%M3.0	True
	HAND 9	Bool	%M3.1	True
	AUTO 10	Bool	%M3.2	True
	HAND 10	Bool	%M3.3	True
	AUTO 11	Bool	%M3.4	True
	HAND 11	Bool	%M3.5	True
	AUTO 12	Bool	%M3.6	True
	HAND 12	Bool	%M3.7	True
	AUTO 13	Bool	%M4.0	True
	HAND 13	Bool	%M4.1	True
	AUTO 14	Bool	%M4.2	True
	HAND 14	Bool	%M4.3	True
	AUTO 15	Bool	%M4.4	True
	HAND 15	Bool	%M4.5	True
	AUTO 16	Bool	%M4.6	True
	HAND 16	Bool	%M4.7	True
	LATCH MS I/O	Bool	%M10.0	True
	LATCH MS HHL ALARM	Bool	%M10.1	True
	HOME PRESSED	Bool	%M999.0	True
	ANIMATED LOGO	Bool	%M999.1	True
	Tag_2	Bool	%M299.7	True
	Tag_3	Bool	%M999.7	True
	Tag_4	Int	%MW400	True
	Tag_5	DWord	%MD420	True
	BIOREMEDIATION ROOM HEATER I/O	Bool	%M80.0	True
	BIOREMEDIATION ROOM FAN I/O	Bool	%M80.1	True
	Tag_6	Int	%MW200	True
	Tag_10	DWord	%MD510	True
	Tag_11	Int	%MW520	True
	Tag_12	DWord	%MD530	True
	Tag_13	Int	%MW540	True
	Tag_14	DWord	%MD550	True
	Tag_15	Int	%MW560	True
	Tag_16	DWord	%MD570	True
	Tag_17	Int	%MW580	True
	Tag_18	DWord	%MD590	True
	Tag_19	Int	%MW600	True

	Name	Data type	Address	Retain
	Tag_20	DWord	%MD610	True
	Tag_21	Int	%MW620	True
	Tag_22	DWord	%MD630	True
	Tag_23	Int	%MW640	True
	Tag_24	DWord	%MD650	True
	Tag_25	Int	%MW660	True
	Tag_26	DWord	%MD670	True
	EXTRACTION ROOM FAN I/O	Bool	%M11.4	True
	Tag_1	Bool	%M900.0	True
	Tag_27	Bool	%M900.1	True
	Tag_28	Bool	%M900.2	True
	Tag_29	Bool	%M900.3	True
	Tag_30	Bool	%M900.4	True
	Tag_31	Bool	%M900.5	True
	Tag_33	Bool	%M900.6	True
	Tag_34	Bool	%M900.7	True
	LATCH EXTRACTION ROOM LOW TEMP	Bool	%M30.2	True
	LATCH EXTRACTION ROOM HIGH TEMP	Bool	%M30.3	True
	EXTRACTION ROOM HEATER I/O	Bool	%M11.5	True
	Tag_36	Bool	%M30.6	True
	LATCH PHASE LOSS ALARM	Bool	%M44.5	True
	Tag_7	Bool	%M901.0	True
	Tag_8	Bool	%M901.1	True
	Tag_35	Bool	%M47.1	True
	Tag_37	Bool	%M97.3	True
	TMR1 go	Bool	%M200.0	True
	tmr 5 go	Bool	%M201.0	True
	tmr1 stop	Bool	%M200.1	True
	tmr2 go	Bool	%M200.2	True
	tmr2 stop	Bool	%M200.3	True
	tmr3 go	Bool	%M200.4	True
	tmr 3 stop	Bool	%M200.5	True
	tmr 4 go	Bool	%M200.6	True
	tmr 4 stop	Bool	%M200.7	True
	tmr 5 stop	Bool	%M201.1	True
	tmr 6 go	Bool	%M201.2	True
	tmr 6 stop	Bool	%M201.3	True
	SYSTEM START	Bool	%M998.3	True
	Tag_40	Bool	%M996.5	True
	Tag_41	Bool	%M301.7	True
	Tag_42	Bool	%M301.5	True
	Tag_43	Bool	%M301.6	True
	Tag_44	Bool	%M300.7	True
	MS 1 RAN	Bool	%M302.0	True
	MS HIGH HIGH LEVEL (T-300)	Bool	%I0.2	False
	MS LOW LEVEL (T-300)	Bool	%I0.0	False
	MS HIGH LEVEL (T-300)	Bool	%I0.1	False
	LATCH LRP HIGH VACUUM ALARM	Bool	%M37.0	True
	LATCH LRP VACUUM ALARM	Bool	%M37.1	True
	Tag_48	Bool	%M37.5	True
	Tag_49	Bool	%M37.6	True
	Tag_50	Bool	%M37.7	True
	LATCH BIOREMEDIATION ROOM LOW TEMP ALARM	Bool	%M38.0	True
	LATCH BIOREMEDIATION ROOM HIGH TEMP ALARM	Bool	%M38.1	True
	Tag_51	Bool	%M39.5	True
	START	Bool	%M41.0	True
	STOP	Bool	%M41.1	True
	Tag_9	DWord	%MD240	True
	Tag_38	Bool	%M40.3	True
	DELAY START	Bool	%M40.2	True
	Tag_39	Bool	%M49.0	True
	Tag_45	Bool	%M31.1	True

	Name	Data type	Address	Retain
	Tag_46	Bool	%M32.4	True
	Tag_47	Bool	%M32.5	True
	Tag_52	Word	%MW1000	False
	Tag_53	Word	%MW1020	False
	Tag_54	Word	%MW1040	False
	Tag_55	Word	%MW1060	False
	Tag_56	Int	%MW260	True
	Tag_57	DWord	%MD280	True
	Tag_58	Bool	%M121.0	True
	Tag_59	Bool	%M121.1	True
	Tag_62	Bool	%M100.2	True
	Tag_63	Bool	%M100.3	True
	Tag_64	Bool	%M100.4	True
	Tag_65	Bool	%M100.5	True
	Tag_68	Bool	%M101.0	True
	Tag_70	Bool	%M101.2	True
	Tag_72	Bool	%M101.5	True
	Tag_73	Bool	%M101.6	True
	Tag_74	Bool	%M101.7	True
	Tag_78	Bool	%M102.3	True
	Tag_79	Bool	%M102.4	True
	Tag_80	Bool	%M102.5	True
	Tag_84	Bool	%M103.1	True
	Tag_85	Bool	%M103.2	True
	Tag_86	Bool	%M103.3	True
	Tag_88	Bool	%M103.5	True
	Tag_89	Bool	%M103.6	True
	Tag_60	Int	%MW280	True
	Tag_61	DWord	%MD300	True
	Tag_66	Bool	%M121.2	True
	Tag_67	DWord	%MD400	True
	Tag_71	Bool	%M1000.7	False
	Tag_75	Bool	%M1005.7	False
	Tag_76	Int	%MW3000	False
	MS PUMP (P-300)	Bool	%Q0.2	False
	OXIDIZER READY	Bool	%I8.3	False
	MOTOR OVERLOAD	Bool	%I8.2	False
	DISCHARGE WATER FLOW	Bool	%I8.4	False
	LRP TEMP SWITCH (B-301)	Bool	%I0.3	False
	LRP LOW OIL (B-301)	Bool	%I0.4	False
	LRP HIGH OIL (B-301)	Bool	%I0.5	False
	STORAGE TANK LOW LEVEL (T-301)	Bool	%I0.6	False
	STORAGE TANK HIGH LEVEL (T-301)	Bool	%I0.7	False
	STORAGE TANK HIGH HIGH LEVEL (T-301)	Bool	%I1.0	False
	STORAGE TANK LOW LEVEL (T-400)	Bool	%I1.1	False
	STORAGE TANK HIGH LEVEL (T-400)	Bool	%I1.2	False
	STORAGE TANK HIGH HIGH LEVEL (T-400)	Bool	%I1.3	False
	MIXING TANK LOW LEVEL (T-500)	Bool	%I1.4	False
	MIXING TANK HIGH LEVEL (T-500)	Bool	%I1.5	False
	MIXING TANK HIGH HIGH LEVEL (T-500)	Bool	%I8.0	False
	LRP (B-301)	Bool	%Q0.0	False
	AFTERCOOLER (HEX-302)	Bool	%Q0.1	False
	BIOREMEDIATION ROOM HEATER	Bool	%Q1.1	False
	EXTRACTION ROOM HEATER	Bool	%Q1.0	False
	MIXING PUMP (T-500)	Bool	%Q0.6	False
	OXYGEN FEED SOLENOID	Bool	%Q9.0	False
	OXIDIZER I/O	Bool	%Q9.1	False
	LRP PURGE SOLENOID	Bool	%Q9.2	False
	BIOREMEDIATION ROOM TEMP	Int	%IW150	False
	EXTRACTION ROOM TEMP	Int	%IW148	False
	LRP VACUUM (B-301)	Int	%IW128	False
	LRP DISCHARGE PRESSURE (B-301)	Int	%IW130	False

	Name	Data type	Address	Retain
	LRP DISCHARGE FLOW (B-301)	Int	%IW132	False
	POST HEAT EXCHANGER TEMP (HEX-302)	Int	%IW134	False
	TRANSFER PUMP DISCHARGE PRESSURE (P-400)	Int	%IW136	False
	PRE CARBON PRESSURE	Int	%IW138	False
	MIXING TANK PUMP DISCHARGE PRESSURE (P-500)	Int	%IW140	False
	OXYGEN FEED PRESSURE	Int	%IW142	False
	POST VENTURI PRESSURE (IC-500)	Int	%IW144	False
	REINJECTION FLOW	Int	%IW146	False
	FALCO ENTRANCE TEMP	Int	%IW152	False
	FALCO INTERNAL TEMP	Int	%IW154	False
	FALCO EXIT TEMP	Int	%IW156	False
	WELL BANK 1 SOL (EXTRACTION)	Bool	%Q8.0	False
	WELL BANK 2 SOL (EXTRACTION)	Bool	%Q8.1	False
	WELL BANK 3 SOL (EXTRACTION)	Bool	%Q8.2	False
	WELL BANK 4 SOL (EXTRACTION)	Bool	%Q8.3	False
	WELL BANK 1 SOL (INJECTION)	Bool	%Q8.4	False
	WELL BANK 2 SOL (INJECTION)	Bool	%Q8.5	False
	WELL BANK 3 SOL (INJECTION)	Bool	%Q8.6	False
	WELL BANK 4 SOL (INJECTION)	Bool	%Q8.7	False
	LATCH LRP DISCHARGE PRESSURE (B-301) HIGH PRESSURE	Bool	%M400.0	True
	LATCH POST HEAT EXCHANGER TEMP (HEX-302) HIGH TEMP	Bool	%M400.1	True
	LATCH TRANSFER PUMP DISCHARGE PRESSURE (P-400) HIGH PRESSURE	Bool	%M400.2	True
	LATCH PRE CARBON PRESSURE HIGH PRESSURE	Bool	%M400.4	True
	LATCH MIXING TANK PUMP DISCHARGE PRESSURE (P-500) HIGH PRES-SURE	Bool	%M400.5	True
	LATCH OXYGEN FEED PRESSURE HIGH PRESSURE	Bool	%M400.6	True
	LATCH OXYGEN FEED PRESSURE LOW PRESSURE	Bool	%M400.7	True
	LATCH POST VENTURI HIGH PRESSURE	Bool	%M401.0	True
	LATCH POST VENTURI LOW PRESSURE	Bool	%M401.1	True
	LATCH LRP TEMP SWITCH ALARM (B-301)	Bool	%M405.0	True
	LATCH LRP LOW OIL ALARM (B-301)	Bool	%M405.1	True
	LATCH LRP HIGH OIL ALARM (B-301)	Bool	%M405.2	True
	LATCH STORAGE TANK I/O (T-301)	Bool	%M405.3	True
	LATCH STORAGE TANK I/O (T-400)	Bool	%M405.4	True
	LATCH STORAGE TANK HIGH LEVEL ALARM (T-301)	Bool	%M405.6	True
	LATCH STORAGE TANK HIGH LEVEL ALARM (T-400)	Bool	%M405.7	True
	LATCH MIXING TANK I/O (T-500)	Bool	%M406.0	True
	LATCH MIXING TANK HIGH LEVEL ALARM (T-500)	Bool	%M406.1	True
	EXTRACTION ROOM FAN	Bool	%Q0.3	False
	MIXER (T-500)	Bool	%Q0.7	False
	TRANSFER PUMP (P-401)	Bool	%Q0.5	False
	TRANSFER PUMP (P-400)	Bool	%Q0.4	False
	Tag_69	Bool	%M688.0	True
	Tag_77	Bool	%M688.1	True
	OXYGEN GEN I/O	Bool	%Q9.3	False
	BIOREMEDIATION ROOM FAN	Bool	%Q9.4	False

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / PLC tags / Default tag table [261]

User constants

User constants			
	Name	Data type	Value

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / PLC data types

System data types

This folder is empty.

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Watch and force tables

Force table

Name	Address	Display format	Force value

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly]

Traces

Name

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Traces

Measurements

This folder is empty.

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Traces

Combined measurements

Name

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly]

PLC alarm text lists

This folder is empty.

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Local modules

DI 8x24VDC/DQ 8xRelay_1

DI 8x24VDC/DQ 8xRelay_1					
General\Project information					
Name	DI 8x24VDC/DQ 8xRelay_1	**Author**	klc	**Comment**	
Slot	2				
General\Catalog information					
Short designation	SM 1223 DI8/DQ8 x relay	**Description**	Digital input/output module DI8 x 24VDC SINK/SOURCE and DQ8 x relay; configurable input delay; plug-in terminal blocks	**Article number**	6ES7 223-1PH32-0XB0
Firmware version	V2.0				
DI 8/DQ 8\Project information					
Name	DI 8x24VDC/DQ 8xRelay_1	**Comment**			
DI 8/DQ 8\Digital inputs\Input filters					
I8.0 - I8.3	6.40ms	**I8.4 - I8.7**	6.40ms		
DI 8/DQ 8\Digital inputs\Channel0					
Channel address	I8.0				
DI 8/DQ 8\Digital inputs\Channel1					
Channel address	I8.1				
DI 8/DQ 8\Digital inputs\Channel2					
Channel address	I8.2				
DI 8/DQ 8\Digital inputs\Channel3					
Channel address	I8.3				
DI 8/DQ 8\Digital inputs\Channel4					
Channel address	I8.4				
DI 8/DQ 8\Digital inputs\Channel5					
Channel address	I8.5				
DI 8/DQ 8\Digital inputs\Channel6					
Channel address	I8.6				
DI 8/DQ 8\Digital inputs\Channel7					
Channel address	I8.7				
DI 8/DQ 8\Digital outputs					
Reaction to CPU STOP	Use substitute value				
DI 8/DQ 8\Digital outputs\Channel0					
Channel address	Q8.0	**Substitute a value of 1 on a change from RUN to STOP.**	0		
DI 8/DQ 8\Digital outputs\Channel1					
Channel address	Q8.1	**Substitute a value of 1 on a change from RUN to STOP.**	0		
DI 8/DQ 8\Digital outputs\Channel2					
Channel address	Q8.2	**Substitute a value of 1 on a change from RUN to STOP.**	0		
DI 8/DQ 8\Digital outputs\Channel3					
Channel address	Q8.3	**Substitute a value of 1 on a change from RUN to STOP.**	0		
DI 8/DQ 8\Digital outputs\Channel4					
Channel address	Q8.4	**Substitute a value of 1 on a change from RUN to STOP.**	0		
DI 8/DQ 8\Digital outputs\Channel5					
Channel address	Q8.5	**Substitute a value of 1 on a change from RUN to STOP.**	0		
DI 8/DQ 8\Digital outputs\Channel6					
Channel address	Q8.6	**Substitute a value of 1 on a change from RUN to STOP.**	0		
DI 8/DQ 8\Digital outputs\Channel7					
Channel address	Q8.7	**Substitute a value of 1 on a change from RUN to STOP.**	0		
DI 8/DQ 8\I/O addresses\Input addresses					
Start address	8.0	**End address**	8.7	**Organization block**	0
Process image	0				
DI 8/DQ 8\I/O addresses\Output addresses					
Start address	8.0	**End address**	8.7	**Organization block**	0
Process image	0				

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Local modules

DI 8x24VDC/DQ 8xRelay_2

DI 8x24VDC/DQ 8xRelay_2					
General\Project information					
Name	DI 8x24VDC/DQ 8xRelay_2	**Author**	klc	**Comment**	
Slot	3				
General\Catalog information					
Short designation	SM 1223 DI8/DQ8 x relay	**Description**	Digital input/output module DI8 x 24VDC SINK/SOURCE and DQ8 x relay; configurable input delay; plug-in terminal blocks	**Article number**	6ES7 223-1PH32-0XB0
Firmware version	V2.0				
DI 8/DQ 8\Project information					
Name	DI 8x24VDC/DQ 8xRelay_2	**Comment**			
DI 8/DQ 8\Digital inputs\Input filters					
I9.0 - I9.3	6.40ms	**I9.4 - I9.7**	6.40ms		
DI 8/DQ 8\Digital inputs\Channel0					
Channel address	I9.0				
DI 8/DQ 8\Digital inputs\Channel1					
Channel address	I9.1				
DI 8/DQ 8\Digital inputs\Channel2					
Channel address	I9.2				
DI 8/DQ 8\Digital inputs\Channel3					
Channel address	I9.3				
DI 8/DQ 8\Digital inputs\Channel4					
Channel address	I9.4				
DI 8/DQ 8\Digital inputs\Channel5					
Channel address	I9.5				
DI 8/DQ 8\Digital inputs\Channel6					
Channel address	I9.6				
DI 8/DQ 8\Digital inputs\Channel7					
Channel address	I9.7				
DI 8/DQ 8\Digital outputs					
Reaction to CPU STOP	Use substitute value				
DI 8/DQ 8\Digital outputs\Channel0					
Channel address	Q9.0	**Substitute a value of 1 on a change from RUN to STOP.**	0		
DI 8/DQ 8\Digital outputs\Channel1					
Channel address	Q9.1	**Substitute a value of 1 on a change from RUN to STOP.**	0		
DI 8/DQ 8\Digital outputs\Channel2					
Channel address	Q9.2	**Substitute a value of 1 on a change from RUN to STOP.**	0		
DI 8/DQ 8\Digital outputs\Channel3					
Channel address	Q9.3	**Substitute a value of 1 on a change from RUN to STOP.**	0		
DI 8/DQ 8\Digital outputs\Channel4					
Channel address	Q9.4	**Substitute a value of 1 on a change from RUN to STOP.**	0		
DI 8/DQ 8\Digital outputs\Channel5					
Channel address	Q9.5	**Substitute a value of 1 on a change from RUN to STOP.**	0		
DI 8/DQ 8\Digital outputs\Channel6					
Channel address	Q9.6	**Substitute a value of 1 on a change from RUN to STOP.**	0		
DI 8/DQ 8\Digital outputs\Channel7					
Channel address	Q9.7	**Substitute a value of 1 on a change from RUN to STOP.**	0		
DI 8/DQ 8\I/O addresses\Input addresses					
Start address	9.0	**End address**	9.7	**Organization block**	0
Process image	0				
DI 8/DQ 8\I/O addresses\Output addresses					
Start address	9.0	**End address**	9.7	**Organization block**	0
Process image	0				

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Local modules

AI 8x13BIT_1

AI 8x13BIT_1					
General\Project information					
Name	AI 8x13BIT_1	**Author**	klc	**Comment**	
Slot	4				
General\Catalog information					
Short designation	SM 1231 AI8	**Description**	Analog input module AI8 x 13 bits; plug-in terminal blocks; input: 2.5V, 5V, 10V and 0/4 to 20mA; configurable frequency suppression; configurable smoothing; configurable diagnostics	**Article number**	6ES7 231-4HF32-0XB0
Firmware version	V2.0				
AI 8\Project information					
Name	AI 8x13BIT_1	**Comment**			
AI 8\Module diagnostics					
Enable power supply diagnostics	1	**Additional diagnostics may be selected for each input/output.**			
AI 8\Analog inputs\Noise reduction					
Integration time	50 Hz (20 ms)				
AI 8\Analog inputs\Channel0					
Channel address	IW128	**Measurement type**	Current	**Current range**	0..20 mA
Smoothing	Weak (4 cycles)			**Enable broken wire diagnostics**	0
Enable overflow diagnostics	1	**Enable underflow diagnostics**	1		
AI 8\Analog inputs\Channel1					
Channel address	IW130	**Measurement type**	Current	**Current range**	0..20 mA
Smoothing	Weak (4 cycles)			**Enable broken wire diagnostics**	0
Enable overflow diagnostics	1	**Enable underflow diagnostics**	1		
AI 8\Analog inputs\Channel2					
Channel address	IW132	**Measurement type**	Current	**Current range**	0..20 mA
Smoothing	Weak (4 cycles)			**Enable broken wire diagnostics**	0
Enable overflow diagnostics	1	**Enable underflow diagnostics**	1		
AI 8\Analog inputs\Channel3					
Channel address	IW134	**Measurement type**	Current	**Current range**	0..20 mA
Smoothing	Weak (4 cycles)			**Enable broken wire diagnostics**	0
Enable overflow diagnostics	1	**Enable underflow diagnostics**	1		
AI 8\Analog inputs\Channel4					
Channel address	IW136	**Measurement type**	Current	**Current range**	0..20 mA
Smoothing	Weak (4 cycles)			**Enable broken wire diagnostics**	0
Enable overflow diagnostics	1	**Enable underflow diagnostics**	1		
AI 8\Analog inputs\Channel5					
Channel address	IW138	**Measurement type**	Current	**Current range**	0..20 mA
Smoothing	Weak (4 cycles)			**Enable broken wire diagnostics**	0
Enable overflow diagnostics	1	**Enable underflow diagnostics**	1		
AI 8\Analog inputs\Channel6					
Channel address	IW140	**Measurement type**	Current	**Current range**	0..20 mA
Smoothing	Weak (4 cycles)			**Enable broken wire diagnostics**	0
Enable overflow diagnostics	1	**Enable underflow diagnostics**	1		
AI 8\Analog inputs\Channel7					
Channel address	IW142	**Measurement type**	Current	**Current range**	0..20 mA
Smoothing	Weak (4 cycles)			**Enable broken wire diagnostics**	0
Enable overflow diagnostics	1	**Enable underflow diagnostics**	1		
AI 8\I/O addresses\Input addresses					
Start address	128	**End address**	143	**Organization block**	0
Process image	0				

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Local modules

AI 8x13BIT_2

AI 8x13BIT_2					
General\Project information					
Name	AI 8x13BIT_2	**Author**	klc	**Comment**	
Slot	5				
General\Catalog information					
Short designation	SM 1231 AI8	**Description**	Analog input module AI8 x 13 bits; plug-in terminal blocks; input: 2.5V, 5V, 10V and 0/4 to 20mA; configurable frequency suppression; configurable smoothing; configurable diagnostics	**Article number**	6ES7 231-4HF32-0XB0
Firmware version	V2.0				
AI 8\Project information					
Name	AI 8x13BIT_2	**Comment**			
AI 8\Module diagnostics					
Enable power supply diagnostics	1	**Additional diagnostics may be selected for each input/output.**			
AI 8\Analog inputs\Noise reduction					
Integration time	50 Hz (20 ms)				
AI 8\Analog inputs\Channel0					
Channel address	IW144	**Measurement type**	Current	**Current range**	0..20 mA
Smoothing	Weak (4 cycles)			**Enable broken wire diagnostics**	0
Enable overflow diagnostics	1	**Enable underflow diagnostics**	1		
AI 8\Analog inputs\Channel1					
Channel address	IW146	**Measurement type**	Current	**Current range**	0..20 mA
Smoothing	Weak (4 cycles)			**Enable broken wire diagnostics**	0
Enable overflow diagnostics	1	**Enable underflow diagnostics**	1		
AI 8\Analog inputs\Channel2					
Channel address	IW148	**Measurement type**	Current	**Current range**	0..20 mA
Smoothing	Weak (4 cycles)			**Enable broken wire diagnostics**	0
Enable overflow diagnostics	1	**Enable underflow diagnostics**	1		
AI 8\Analog inputs\Channel3					
Channel address	IW150	**Measurement type**	Current	**Current range**	0..20 mA
Smoothing	Weak (4 cycles)			**Enable broken wire diagnostics**	0
Enable overflow diagnostics	1	**Enable underflow diagnostics**	1		
AI 8\Analog inputs\Channel4					
Channel address	IW152	**Measurement type**	Current	**Current range**	0..20 mA
Smoothing	Weak (4 cycles)			**Enable broken wire diagnostics**	0
Enable overflow diagnostics	1	**Enable underflow diagnostics**	1		
AI 8\Analog inputs\Channel5					
Channel address	IW154	**Measurement type**	Current	**Current range**	0..20 mA
Smoothing	Weak (4 cycles)			**Enable broken wire diagnostics**	0
Enable overflow diagnostics	1	**Enable underflow diagnostics**	1		
AI 8\Analog inputs\Channel6					
Channel address	IW156	**Measurement type**	Current	**Current range**	0..20 mA
Smoothing	Weak (4 cycles)			**Enable broken wire diagnostics**	0
Enable overflow diagnostics	1	**Enable underflow diagnostics**	1		
AI 8\Analog inputs\Channel7					
Channel address	IW158	**Measurement type**	Current	**Current range**	0..20 mA
Smoothing	Weak (4 cycles)			**Enable broken wire diagnostics**	0
Enable overflow diagnostics	1	**Enable underflow diagnostics**	1		
AI 8\I/O addresses\Input addresses					
Start address	144	**End address**	159	**Organization block**	0
Process image	0				

GLACIER8135 / PLC_1 [CPU 1214C DC/DC/Rly] / Distributed I/O

PROFINET IO-System (100): PN/IE_1

PROFINET IO-System					
General					
IO controller:	PLC_1	**Name:**	PROFINET IO-System	**Number:**	100
Use name as extension for the PROFINET device name.	False				
Hardware identifier					
Hardware identifier	272				
Overview of addresses\Overview of addresses\Overview of addresses					
Inputs	True	**Outputs**	True	**Address gaps**	False
Slot	True				

Type	Addr. from	Addr. to	Module	PIP	Device name	Device number	Size	Master / IO system	Rack	Slot
I	0	1	DI14/DQ10_1	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	2 Bytes	-	0	1 1
O	0	1	DI14/DQ10_1	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	2 Bytes	-	0	1 1
I	64	67	AI 2_1	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	4 Bytes	-	0	1 2
I	1000	1003	HSC_1	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	4 Bytes	-	0	1 16
I	1004	1007	HSC_2	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	4 Bytes	-	0	1 17
I	1008	1011	HSC_3	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	4 Bytes	-	0	1 18
I	1012	1015	HSC_4	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	4 Bytes	-	0	1 19
I	1016	1019	HSC_5	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	4 Bytes	-	0	1 20
I	1020	1023	HSC_6	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	4 Bytes	-	0	1 21
O	1000	1001	Pulse_1	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	2 Bytes	-	0	1 32
O	1002	1003	Pulse_2	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	2 Bytes	-	0	1 33
O	1004	1005	Pulse_3	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	2 Bytes	-	0	1 34
O	1006	1007	Pulse_4	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	2 Bytes	-	0	1 35
I	8	8	DI 8x24VDC/DQ 8xRelay_1	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	1 Bytes	-	0	2
O	8	8	DI 8x24VDC/DQ 8xRelay_1	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	1 Bytes	-	0	2
I	144	159	AI 8x13BIT_2	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	16 Bytes	-	0	5
I	128	143	AI 8x13BIT_1	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	16 Bytes	-	0	4
I	9	9	DI 8x24VDC/DQ 8xRelay_2	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	1 Bytes	-	0	3
O	9	9	DI 8x24VDC/DQ 8xRelay_2	Automatic update	PLC_1 [CPU 1214C DC/DC/Rly]	-	1 Bytes	-	0	3

GLACIER8135

HMI_1 [TP900 Comfort]

HMI_1	
General	
Name	HMI_1

GLACIER8135 / HMI_1 [TP900 Comfort]

Runtime settings

General

Start screen	home	**Load name information**	Checked	**Default template**	
Default style of the project	Unchecked	**Style of the HMI device**	WinCC Dark V 1.0.1	**Adapt font size to style**	Unchecked
Screen resolution	800, 480	**Color depth**	32 bit	**Lock task switching**	Unchecked
Project ID	0	**Logging language**	en-US		

Services

Sm@rtAccess or service: start Sm@rtServer	Checked	**Operate as OPC server**	Unchecked	**Sm@rtAccess: SIMATIC HMI HTTP server**	Unchecked
Sm@rtAccess: Web service (SOAP)	Unchecked	**Sm@rtService: HTML pages**	Checked	**Name of SMTP server**	mail.prmsmtp.com
Port	25	**Name of the SMTP sender**	remote@prmsmtp.com	**SMTP authentication**	remote@prmsmtp.com
SMTP login	remote@prmsmtp.com	**Secure connection for SMTP**	Unchecked		

Screens

Bit selection for appearance analysis	Off	**Bit selection for text and graphic lists**	Off	**Display limit values as a tooltip**	Checked
Show script comments	Unchecked	**Scrolling mode**	Scroll indicator		

Keyboard

Use screen keyboard	Checked	**Release button on exit**	Unchecked

Good Manufacturing Practice

Configuration conforms to GMP	Unchecked

Alarms

Controller alarms

Buffer overflow	10 %	**Acknowledgment group text**	QGR	**Reporting**	Checked
Use alarm class color	Unchecked	**Use help texts for system diagnostics**	Checked	**System event duration**	2 Seconds
S7 diagnostic alarms with numbers only	Unchecked	**S7 diagnostic alarms with numbers and texts**	Unchecked	**SIMOTION diagnostic alarms**	Unchecked
Connection	HMI_connection	**Display classes**	0-16		

User administration

Change initial password	Unchecked	**Change logoff time**	Checked	**Enable limit for logon attempts**	Checked
Invalid logon attempts	3	**Logon with password**	Unchecked	**Group-specific rights**	Unchecked
Password aging	Unchecked	**Validity period**	90	**Warning period**	7
Password generations	3	**At least one special character**	Unchecked	**At least one number**	Unchecked
Minimum password length	3	**SIMATIC Logon**	Unchecked	**Apply user administration from**	WinDomain
Server name		**Port number**	16389	**Windows domain**	
Encrypted SIMATIC Logon	Checked				

Language & font

Preset runtime language	English (United States)

English (United States)

Runtime language	Checked	**Fixed font 1**	Tahoma	**Fixed font 2**	Courier New
Default font	Tahoma, 13 Pixel	**Configured font 1**		**Configured font 2**	

OPC settings

OPC UA server port number	4870	**OPC UA server URL**	opc.tcp://[HostName]:4870	**No OPC UA server security**	Checked
No OPC UA server security	Checked	**OPC UA server with 128-bit RSA cryptographic system**	Checked	**OPC UA server with 128-bit RSA cryptographic system without signature**	Unchecked
OPC UA server with 128-bit RSA cryptographic system for signatures	Unchecked	**OPC UA server with 128-bit cryptographic system for signatures and encryption**	Checked		

Tag settings

Replace the separators on each sub-level of the path of the PLC tag:	Checked	**Compatibility mode: Set '_' between the PLC tags and the first-level element.**	Unchecked	**Replace the '.' character if the name of the HMI tag is created from the PLC tag name**	Checked
Use '_' as the replacement character	Checked	**Use ';' as the replacement character**	Unchecked	**Replace the characters '[' and ']' if the name of the HMI tag is created from the PLC tag name**	Checked
Use '{' and '}' as replacement characters	Checked	**Use '(' and ')' as replacement characters**	Unchecked		

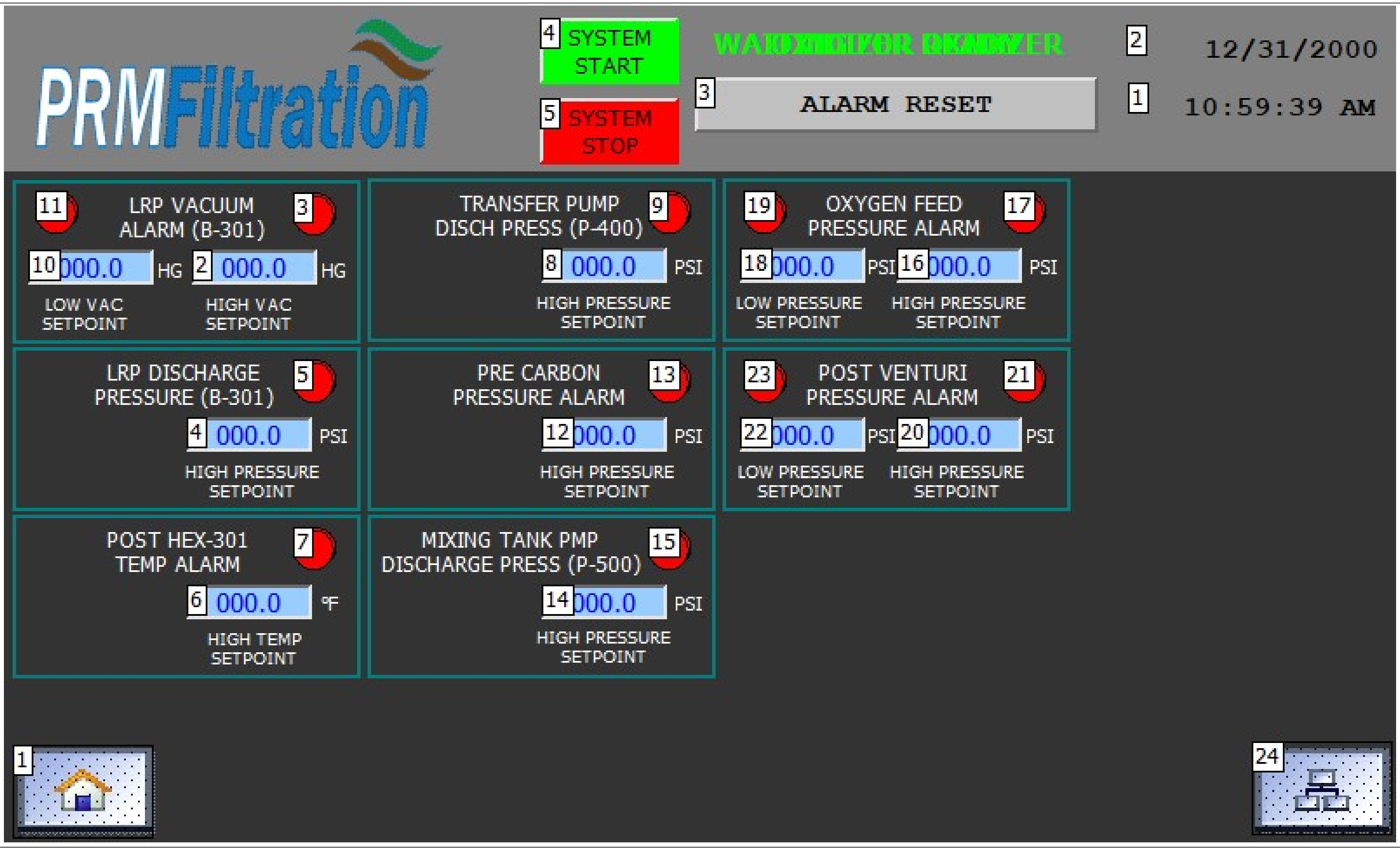
Settings for the prefix 'PLC' in the HMI tag name

Connection	HMI_connection	**PLC name as prefix in the HMI tag name**	Unchecked

GLACIER8135 / HMI_1 [TP900 Comfort] / Screens

ALARM SCREEN

Hardcopy of ALARM SCREEN



Name	ALARM SCREEN	**Background color**	51, 51, 51	**Grid color**	0, 0, 0
Number	5	**Template**		**Tooltip**	

Graphic view_3

Type	Graphic view	**Name**	Graphic view_3	**X position**	8
Y position	331	**Width**	79	**Height**	50
Layer	0 - Layer_0	**Graphic**	Graphic_75	**Fit graphic to size**	Stretch graphic

Button_1

Type	Button	**Name**	Button_1	**X position**	5
Y position	329	**Width**	81	**Height**	54
Mode	Invisible	**Text OFF**	<#0> <#0 Type = Dynamic parameter; Tag = RunClockByte; Display type: = Decimal; Display format = 999;>	**Text ON**	<#0> <#0 Type = Dynamic parameter; Tag = RunClockByte; Display type: = Decimal; Display format = 999;>

Dynamizations\Tag connection

Property name	Process value	**Tag**	RunClockByte

Dynamizations\Event

Event name	Click

Function list\ActivateScreen

Screen name	home	**Object number**	0

Rectangle_4

Type	Rectangle	**Name**	Rectangle_4	**X position**	5
Y position	5	**Width**	200	**Height**	94
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	0, 126, 128

Text Field_11

Type	Text field	**Name**	Text Field_11	**X position**	64
Y position	10	**Width**	88	**Height**	32
Layer	0 - Layer_0	**Font**	Tahoma, 12px	**Text**	LRP VACUUM ALARM (B-301)

Text Field_16

Type	Text field	**Name**	Text Field_16	**X position**	114
Y position	69	**Width**	53	**Height**	26
Layer	0 - Layer_0	**Font**	Tahoma, 9px	**Text**	HIGH VAC SETPOINT

IO Field_7

Type	I/O field	**Name**	IO Field_7	**X position**	108
Y position	45	**Width**	72	**Height**	20
Layer	0 - Layer_0	**Mode**	Input	**Font**	Tahoma, 15px

Dynamizations\Tag connection			
Property name	Process value	**Tag**	DB4_setpoint 2

Symbol Library_6

Type	Symbol library	**Name**	Symbol Library_6	**X position**	166
Y position	12	**Width**	25	**Height**	25
Layer	0 - Layer_0	**Background color**	255, 153, 204	**Background fill style**	Transparent
Dynamizations\Appearance					
Tag - Cycle	LATCH LRP HIGH VACUUM ALARM -	**Data type**	Range	**Range**	0..0
Foreground color	198, 195, 198	**Background color**	148, 150, 148	**Flashing**	No
Range	1..1	**Foreground color**	255, 0, 0	**Background color**	255, 0, 0
Flashing	No				

Text Field_1

Type	Text field	**Name**	Text Field_1	**X position**	181
Y position	48	**Width**	18	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	HG

Rectangle_1

Type	Rectangle	**Name**	Rectangle_1	**X position**	5
Y position	101	**Width**	200	**Height**	94
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	0, 126, 128

Text Field_2

Type	Text field	**Name**	Text Field_2	**X position**	50
Y position	106	**Width**	107	**Height**	32
Layer	0 - Layer_0	**Font**	Tahoma, 12px	**Text**	LRP DISCHARGE PRESSURE (B-301)

Text Field_3

Type	Text field	**Name**	Text Field_3	**X position**	180
Y position	143	**Width**	20	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	PSI

Text Field_4

Type	Text field	**Name**	Text Field_4	**X position**	102
Y position	165	**Width**	81	**Height**	26
Layer	0 - Layer_0	**Font**	Tahoma, 9px	**Text**	HIGH PRESSURE SETPOINT

IO Field_1

Type	I/O field	**Name**	IO Field_1	**X position**	105
Y position	141	**Width**	72	**Height**	20
Layer	0 - Layer_0	**Mode**	Input	**Font**	Tahoma, 15px
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_setpoint 4		

Symbol Library_1

Type	Symbol library	**Name**	Symbol Library_1	**X position**	166
Y position	108	**Width**	25	**Height**	25
Layer	0 - Layer_0	**Background color**	255, 153, 204	**Background fill style**	Transparent
Dynamizations\Appearance					
Tag - Cycle	LATCH LRP DISCHARGE PRESSURE (B-301) HIGH PRESSURE -	**Data type**	Range	**Range**	0..0
Foreground color	198, 195, 198	**Background color**	148, 150, 148	**Flashing**	No
Range	1..1	**Foreground color**	255, 0, 0	**Background color**	255, 0, 0
Flashing	No				

Rectangle_11

Type	Rectangle	**Name**	Rectangle_11	**X position**	5
Y position	197	**Width**	200	**Height**	94
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	0, 126, 128

Text Field_43

Type	Text field	**Name**	Text Field_43	**X position**	57
Y position	202	**Width**	86	**Height**	32
Layer	0 - Layer_0	**Font**	Tahoma, 12px	**Text**	POST HEX-301 TEMP ALARM

Text Field_44

Type	Text field	**Name**	Text Field_44	**X position**	180
Y position	239	**Width**	15	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	°F

Text Field_46

Type	Text field	**Name**	Text Field_46	**X position**	115
Y position	261	**Width**	58	**Height**	26
Layer	0 - Layer_0	**Font**	Tahoma, 9px	**Text**	HIGH TEMP SETPOINT

IO Field_16

Type	I/O field	**Name**	IO Field_16	**X position**	105
Y position	237	**Width**	72	**Height**	20
Layer	0 - Layer_0	**Mode**	Input	**Font**	Tahoma, 15px
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_setpoint 8		

Symbol Library_19

Type	Symbol library	**Name**	Symbol Library_19	**X position**	166
Y position	204	**Width**	25	**Height**	25
Layer	0 - Layer_0	**Background color**	255, 153, 204	**Background fill style**	Transparent
Dynamizations\Appearance					
Tag - Cycle	LATCH POST HEAT EXCHANGER TEMP (HEX-302) HIGH TEMP -	**Data type**	Range	**Range**	0..0
Foreground color	198, 195, 198	**Background color**	148, 150, 148	**Flashing**	No
Range	1..1	**Foreground color**	255, 0, 0	**Background color**	255, 0, 0
Flashing	No				

Rectangle_13

Type	Rectangle	**Name**	Rectangle_13	**X position**	209
Y position	4	**Width**	200	**Height**	94
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	0, 126, 128

Text Field_49

Type	Text field	**Name**	Text Field_49	**X position**	246
Y position	9	**Width**	123	**Height**	32
Layer	0 - Layer_0	**Font**	Tahoma, 12px	**Text**	TRANSFER PUMP DISCH PRESS (P-400)

Text Field_50

Type	Text field	**Name**	Text Field_50	**X position**	384
Y position	46	**Width**	20	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	PSI

Text Field_51

Type	Text field	**Name**	Text Field_51	**X position**	304
Y position	68	**Width**	81	**Height**	26
Layer	0 - Layer_0	**Font**	Tahoma, 9px	**Text**	HIGH PRESSURE SETPOINT

IO Field_18

Type	I/O field	**Name**	IO Field_18	**X position**	309
Y position	44	**Width**	72	**Height**	20
Layer	0 - Layer_0	**Mode**	Input	**Font**	Tahoma, 15px
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_setpoint 10		

Symbol Library_22

Type	Symbol library	**Name**	Symbol Library_22	**X position**	370
Y position	11	**Width**	25	**Height**	25
Layer	0 - Layer_0	**Background color**	255, 153, 204	**Background fill style**	Transparent
Dynamizations\Appearance					
Tag - Cycle	LATCH TRANSFER PUMP DISCHARGE PRESSURE (P-400) HIGH PRESSURE -	**Data type**	Range	**Range**	0..0
Foreground color	198, 195, 198	**Background color**	148, 150, 148	**Flashing**	No
Range	1..1	**Foreground color**	255, 0, 0	**Background color**	255, 0, 0
Flashing	No				

Text Field_54

Type	Text field	**Name**	Text Field_54	**X position**	20
Y position	69	**Width**	53	**Height**	26
Layer	0 - Layer_0	**Font**	Tahoma, 9px	**Text**	LOW VAC SETPOINT

IO Field_20

Type	I/O field	**Name**	IO Field_20	**X position**	14
Y position	45	**Width**	72	**Height**	20
Layer	0 - Layer_0	**Mode**	Input	**Font**	Tahoma, 15px
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_setpoint 1		

Text Field_55

Type	Text field	**Name**	Text Field_55	**X position**	87
Y position	48	**Width**	18	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	HG

Symbol Library_25

Type	Symbol library	**Name**	Symbol Library_25	**X position**	18
Y position	11	**Width**	25	**Height**	25

Layer	0 - Layer_0	**Background color**	255, 153, 204	**Background fill style**	Transparent
Dynamizations\Appearance					
Tag - Cycle	LATCH SVE LRP VACUUM ALARM -	**Data type**	Range	**Range**	0..0
Foreground color	198, 195, 198	**Background color**	148, 150, 148	**Flashing**	No
Range	1..1	**Foreground color**	255, 0, 0	**Background color**	255, 0, 0
Flashing	No				

Rectangle_14

Type	Rectangle	**Name**	Rectangle_14	**X position**	209
Y position	101	**Width**	200	**Height**	94
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	0, 126, 128

Text Field_8

Type	Text field	**Name**	Text Field_8	**X position**	256
Y position	106	**Width**	103	**Height**	32
Layer	0 - Layer_0	**Font**	Tahoma, 12px	**Text**	PRE CARBON PRESSURE ALARM

Text Field_10

Type	Text field	**Name**	Text Field_10	**X position**	384
Y position	143	**Width**	20	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	PSI

Text Field_22

Type	Text field	**Name**	Text Field_22	**X position**	306
Y position	165	**Width**	81	**Height**	26
Layer	0 - Layer_0	**Font**	Tahoma, 9px	**Text**	HIGH PRESSURE SETPOINT

IO Field_2

Type	I/O field	**Name**	IO Field_2	**X position**	309
Y position	141	**Width**	72	**Height**	20
Layer	0 - Layer_0	**Mode**	Input	**Font**	Tahoma, 15px
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_setpoint 12		

Symbol Library_5

Type	Symbol library	**Name**	Symbol Library_5	**X position**	370
Y position	108	**Width**	25	**Height**	25
Layer	0 - Layer_0	**Background color**	255, 153, 204	**Background fill style**	Transparent
Dynamizations\Appearance					
Tag - Cycle	LATCH PRE CARBON PRESSURE HIGH PRESSURE -	**Data type**	Range	**Range**	0..0
Foreground color	198, 195, 198	**Background color**	148, 150, 148	**Flashing**	No
Range	1..1	**Foreground color**	255, 0, 0	**Background color**	255, 0, 0
Flashing	No				

Rectangle_2

Type	Rectangle	**Name**	Rectangle_2	**X position**	209
Y position	197	**Width**	200	**Height**	94
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	0, 126, 128

Text Field_5

Type	Text field	**Name**	Text Field_5	**X position**	215
Y position	202	**Width**	153	**Height**	32
Layer	0 - Layer_0	**Font**	Tahoma, 12px	**Text**	MIXING TANK PMP DISCHARGE PRESS (P-500)

Text Field_6

Type	Text field	**Name**	Text Field_6	**X position**	384
Y position	239	**Width**	20	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	PSI

Text Field_7

Type	Text field	**Name**	Text Field_7	**X position**	304
Y position	260	**Width**	81	**Height**	26
Layer	0 - Layer_0	**Font**	Tahoma, 9px	**Text**	HIGH PRESSURE SETPOINT

IO Field_3

Type	I/O field	**Name**	IO Field_3	**X position**	309
Y position	237	**Width**	72	**Height**	20
Layer	0 - Layer_0	**Mode**	Input	**Font**	Tahoma, 15px
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_setpoint 14		

Symbol Library_3

Type	Symbol library	**Name**	Symbol Library_3	**X position**	370
Y position	204	**Width**	25	**Height**	25
Layer	0 - Layer_0	**Background color**	255, 153, 204	**Background fill style**	Transparent

Dynamizations\Appearance					
Tag - Cycle	LATCH MIXING TANK PUMP DIS-CHARGE PRESSURE (P-500) HIGH PRES-SURE -	**Data type**	Range	**Range**	0..0
Foreground color	198, 195, 198	**Background color**	148, 150, 148	**Flashing**	No
Range	1..1	**Foreground color**	255, 0, 0	**Background color**	255, 0, 0
Flashing	No				

Rectangle_3

Type	Rectangle	**Name**	Rectangle_3	**X position**	413
Y position	4	**Width**	200	**Height**	94
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	0, 126, 128

Text Field_9

Type	Text field	**Name**	Text Field_9	**X position**	460
Y position	9	**Width**	103	**Height**	32
Layer	0 - Layer_0	**Font**	Tahoma, 12px	**Text**	OXYGEN FEED PRESSURE ALARM

Text Field_12

Type	Text field	**Name**	Text Field_12	**X position**	588
Y position	46	**Width**	20	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	PSI

Text Field_13

Type	Text field	**Name**	Text Field_13	**X position**	508
Y position	68	**Width**	81	**Height**	26
Layer	0 - Layer_0	**Font**	Tahoma, 9px	**Text**	HIGH PRESSURE SETPOINT

IO Field_5

Type	I/O field	**Name**	IO Field_5	**X position**	513
Y position	44	**Width**	72	**Height**	20
Layer	0 - Layer_0	**Mode**	Input	**Font**	Tahoma, 15px
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_setpoint 16		

Symbol Library_4

Type	Symbol library	**Name**	Symbol Library_4	**X position**	574
Y position	11	**Width**	25	**Height**	25
Layer	0 - Layer_0	**Background color**	255, 153, 204	**Background fill style**	Transparent
Dynamizations\Appearance					
Tag - Cycle	LATCH OXYGEN FEED PRESSURE HIGH PRESSURE -	**Data type**	Range	**Range**	0..0
Foreground color	198, 195, 198	**Background color**	148, 150, 148	**Flashing**	No
Range	1..1	**Foreground color**	255, 0, 0	**Background color**	255, 0, 0
Flashing	No				

Text Field_14

Type	Text field	**Name**	Text Field_14	**X position**	495
Y position	46	**Width**	20	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	PSI

Text Field_18

Type	Text field	**Name**	Text Field_18	**X position**	419
Y position	68	**Width**	76	**Height**	26
Layer	0 - Layer_0	**Font**	Tahoma, 9px	**Text**	LOW PRESSURE SETPOINT

IO Field_6

Type	I/O field	**Name**	IO Field_6	**X position**	423
Y position	44	**Width**	72	**Height**	20
Layer	0 - Layer_0	**Mode**	Input	**Font**	Tahoma, 15px
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_setpoint 15		

Symbol Library_7

Type	Symbol library	**Name**	Symbol Library_7	**X position**	425
Y position	11	**Width**	25	**Height**	25
Layer	0 - Layer_0	**Background color**	255, 153, 204	**Background fill style**	Transparent
Dynamizations\Appearance					
Tag - Cycle	LATCH OXYGEN FEED PRESSURE LOW PRESSURE -	**Data type**	Range	**Range**	0..0
Foreground color	198, 195, 198	**Background color**	148, 150, 148	**Flashing**	No
Range	1..1	**Foreground color**	255, 0, 0	**Background color**	255, 0, 0
Flashing	No				

Rectangle_5

Type	Rectangle	**Name**	Rectangle_5	**X position**	413
Y position	101	**Width**	200	**Height**	94
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	0, 126, 128

Text Field_19

Type	Text field	**Name**	Text Field_19	**X position**	459
Y position	106	**Width**	103	**Height**	32
Layer	0 - Layer_0	**Font**	Tahoma, 12px	**Text**	POST VENTURI PRESSURE ALARM

Text Field_20

Type	Text field	**Name**	Text Field_20	**X position**	586
Y position	143	**Width**	20	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	PSI

Text Field_21

Type	Text field	**Name**	Text Field_21	**X position**	507
Y position	165	**Width**	81	**Height**	26
Layer	0 - Layer_0	**Font**	Tahoma, 9px	**Text**	HIGH PRESSURE SETPOINT

IO Field_9

Type	I/O field	**Name**	IO Field_9	**X position**	513
Y position	141	**Width**	72	**Height**	20
Layer	0 - Layer_0	**Mode**	Input	**Font**	Tahoma, 15px
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_setpoint 18		

Symbol Library_9

Type	Symbol library	**Name**	Symbol Library_9	**X position**	574
Y position	108	**Width**	25	**Height**	25
Layer	0 - Layer_0	**Background color**	255, 153, 204	**Background fill style**	Transparent
Dynamizations\Appearance					
Tag - Cycle	LATCH POST VENTURI HIGH PRESSURE -	**Data type**	Range	**Range**	0..0
Foreground color	198, 195, 198	**Background color**	148, 150, 148	**Flashing**	No
Range	1..1	**Foreground color**	255, 0, 0	**Background color**	255, 0, 0
Flashing	No				

Text Field_24

Type	Text field	**Name**	Text Field_24	**X position**	495
Y position	143	**Width**	20	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	PSI

Text Field_25

Type	Text field	**Name**	Text Field_25	**X position**	420
Y position	165	**Width**	76	**Height**	26
Layer	0 - Layer_0	**Font**	Tahoma, 9px	**Text**	LOW PRESSURE SETPOINT

IO Field_10

Type	I/O field	**Name**	IO Field_10	**X position**	423
Y position	141	**Width**	72	**Height**	20
Layer	0 - Layer_0	**Mode**	Input	**Font**	Tahoma, 15px
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_setpoint 17		

Symbol Library_10

Type	Symbol library	**Name**	Symbol Library_10	**X position**	425
Y position	108	**Width**	25	**Height**	25
Layer	0 - Layer_0	**Background color**	255, 153, 204	**Background fill style**	Transparent
Dynamizations\Appearance					
Tag - Cycle	LATCH POST VENTURI LOW PRESSURE -	**Data type**	Range	**Range**	0..0
Foreground color	198, 195, 198	**Background color**	148, 150, 148	**Flashing**	No
Range	1..1	**Foreground color**	255, 0, 0	**Background color**	255, 0, 0
Flashing	No				

Graphic view_1

Type	Graphic view	**Name**	Graphic view_1	**X position**	719
Y position	331	**Width**	79	**Height**	50
Layer	0 - Layer_0	**Graphic**	Graphic_87	**Fit graphic to size**	Stretch graphic

Button_2

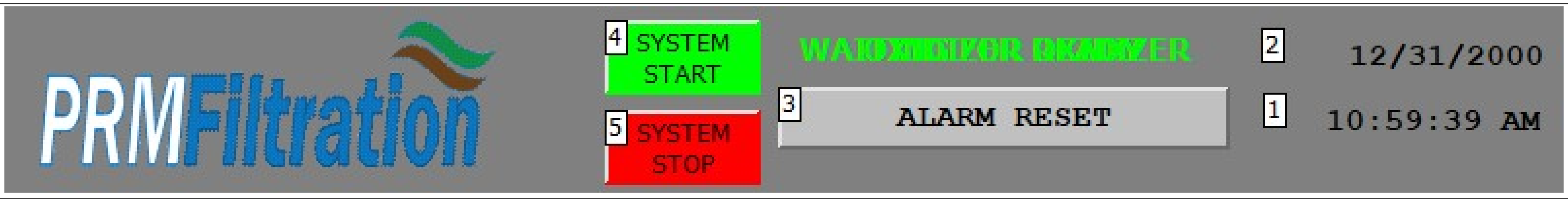
Type	Button	**Name**	Button_2	**X position**	717
Y position	327	**Width**	81	**Height**	54
Mode	Invisible	**Text OFF**	<#0> <#0 Type = Dynamic parameter; Tag = RunClockByte; Display type: = Decimal; Display format = 999;>	**Text ON**	<#0> <#0 Type = Dynamic parameter; Tag = RunClockByte; Display type: = Decimal; Display format = 999;>
Dynamizations\Tag connection					
Property name	Process value	**Tag**	RunClockByte		

Dynamizations\Event	
Event name	Click

Function list\ActivateScreen

Screen name	ALARM SCREEN 2	**Object number**	0

Hardcopy of Permanent area



Name	Permanent area	**Background color**	128, 128, 128	**Grid color**	0, 0, 0
Height	95	**Active layer**	0		

Date/time field_1

Type	Date/time field	**Name**	Date/time field_1	**X position**	646
Y position	44	**Width**	144	**Height**	30
Mode	Input/output	**Font**	Courier New, 16px, style=Bold		

Date/time field_2

Type	Date/time field	**Name**	Date/time field_2	**X position**	645
Y position	11	**Width**	147	**Height**	30
Mode	Input/output	**Font**	Courier New, 16px, style=Bold		

Button_2

Type	Button	**Name**	Button_2	**X position**	397
Y position	41	**Width**	232	**Height**	32
Mode	Text	**Text OFF**	ALARM RESET	**Text ON**	Text
Dynamizations\Appearance					
Tag - Cycle	ALARM FLASHER -	**Data type**	Range	**Range**	0..0
Foreground color	0, 0, 0	**Background color**	214, 211, 206	**Flashing**	No
Range	1..1	**Foreground color**	0, 0, 0	**Background color**	255, 0, 0
Flashing	Yes				

Dynamizations\Event	
Event name	Press

Function list\SetBit

Tag	ALARM RESET

Dynamizations\Event	
Event name	Release

Function list\ResetBit

Tag	ALARM RESET

Button_1

Type	Button	**Name**	Button_1	**X position**	308
Y position	7	**Width**	80	**Height**	38
Mode	Text	**Text OFF**	SYSTEM START	**Text ON**	Text

Dynamizations\Event	
Event name	Click

Function list\SetBit

Tag	SYSTEM START

Dynamizations\Appearance					
Tag - Cycle	SYSTEM START -	**Data type**	Range	**Range**	0..0
Foreground color	0, 0, 0	**Background color**	192, 192, 192	**Flashing**	No
Range	1..1	**Foreground color**	0, 0, 0	**Background color**	0, 255, 0
Flashing	No				

Button_3

Type	Button	**Name**	Button_3	**X position**	308
Y position	53	**Width**	80	**Height**	38
Mode	Text	**Text OFF**	SYSTEM STOP	**Text ON**	Text

Dynamizations\Event	
Event name	Click

Function list\ResetBit

Tag	SYSTEM START

Dynamizations\Appearance					
Tag - Cycle	SYSTEM START -	**Data type**	Range	**Range**	0..0
Foreground color	0, 0, 0	**Background color**	255, 0, 0	**Flashing**	No
Range	1..1	**Foreground color**	0, 0, 0	**Background color**	192, 192, 192
Flashing	No				

Text field_1

Type	Text field	**Name**	Text field_1	**X position**	405
Y position	10	**Width**	226	**Height**	23
Layer	0 - Layer_0	**Font**	Tahoma, 16px, style=Bold	**Text**	WAITING FOR OXIDIZER
Dynamizations\Visibility					
Tag - Cycle	OXIDIZER READY -	**Data type**	Range	**Start range**	0
End range	0	**Visibility**	Visible		

Text field_5

Type	Text field	**Name**	Text field_5	**X position**	438
Y position	10	**Width**	162	**Height**	23
Layer	0 - Layer_0	**Font**	Tahoma, 16px, style=Bold	**Text**	OXIDIZER READY
Dynamizations\Visibility					
Tag - Cycle	OXIDIZER READY -	**Data type**	Range	**Start range**	1
End range	1	**Visibility**	Visible		

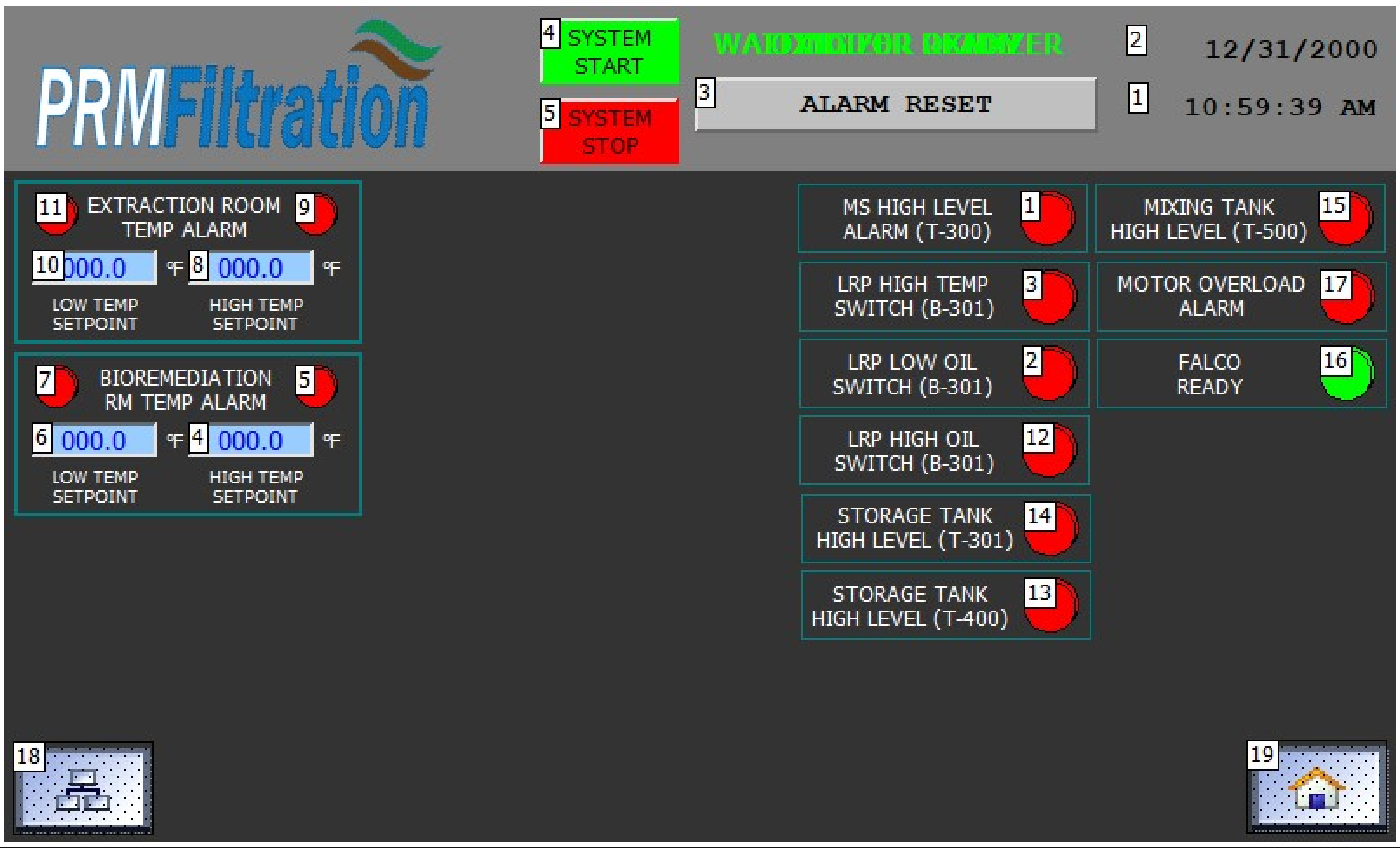
Graphic view_1

Type	Graphic view	**Name**	Graphic view_1	**X position**	17
Y position	5	**Width**	235	**Height**	78
Layer	0 - Layer_0	**Graphic**	logoPRM	**Fit graphic to size**	Stretch graphic

GLACIER8135 / HMI_1 [TP900 Comfort] / Screens

ALARM SCREEN 2

Hardcopy of ALARM SCREEN 2



Name	ALARM SCREEN 2	**Background color**	51, 51, 51	**Grid color**	0, 0, 0
Number	2	**Template**		**Tooltip**	

Rectangle_15

Type	Rectangle	**Name**	Rectangle_15	**X position**	456
Y position	7	**Width**	167	**Height**	40
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	0, 126, 128

Symbol Library_17

Type	Symbol library	**Name**	Symbol Library_17	**X position**	584
Y position	11	**Width**	32	**Height**	32
Layer	0 - Layer_0	**Background color**	255, 153, 204	**Background fill style**	Transparent
Dynamizations\Appearance					
Tag - Cycle	LATCH MS HHL ALARM -	**Data type**	Range	**Range**	0..0
Foreground color	198, 195, 198	**Background color**	148, 150, 148	**Flashing**	No
Range	1..1	**Foreground color**	255, 0, 0	**Background color**	255, 0, 0
Flashing	No				

Text Field_41

Type	Text field	**Name**	Text Field_41	**X position**	480
Y position	11	**Width**	90	**Height**	32
Layer	0 - Layer_0	**Font**	Tahoma, 12px	**Text**	MS HIGH LEVEL ALARM (T-300)

Rectangle_16

Type	Rectangle	**Name**	Rectangle_16	**X position**	457
Y position	96	**Width**	167	**Height**	40
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	0, 126, 128

Symbol Library_14

Type	Symbol library	**Name**	Symbol Library_14	**X position**	585
Y position	100	**Width**	32	**Height**	32
Layer	0 - Layer_0	**Background color**	255, 153, 204	**Background fill style**	Transparent
Dynamizations\Appearance					
Tag - Cycle	LATCH LRP LOW OIL ALARM (B-301) -	**Data type**	Range	**Range**	0..0
Foreground color	198, 195, 198	**Background color**	148, 150, 148	**Flashing**	No
Range	1..1	**Foreground color**	255, 0, 0	**Background color**	255, 0, 0
Flashing	No				

Text Field_34

Type	Text field	**Name**	Text Field_34	**X position**	474
Y position	100	**Width**	96	**Height**	32
Layer	0 - Layer_0	**Font**	Tahoma, 12px	**Text**	LRP LOW OIL SWITCH (B-301)

Rectangle_17

Type	Rectangle	**Name**	Rectangle_17	**X position**	457
Y position	52	**Width**	167	**Height**	40
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	0, 126, 128

Symbol Library_20

Type	Symbol library	**Name**	Symbol Library_20	**X position**	585
Y position	56	**Width**	32	**Height**	32
Layer	0 - Layer_0	**Background color**	255, 153, 204	**Background fill style**	Transparent
Dynamizations\Appearance					
Tag - Cycle	LATCH LRP TEMP SWITCH ALARM (B-301) -	**Data type**	Range	**Range**	0..0
Foreground color	198, 195, 198	**Background color**	148, 150, 148	**Flashing**	No
Range	1..1	**Foreground color**	255, 0, 0	**Background color**	255, 0, 0
Flashing	No				

Text Field_35

Type	Text field	**Name**	Text Field_35	**X position**	475
Y position	55	**Width**	96	**Height**	32
Layer	0 - Layer_0	**Font**	Tahoma, 12px	**Text**	LRP HIGH TEMP SWITCH (B-301)

Rectangle_5

Type	Rectangle	**Name**	Rectangle_5	**X position**	6
Y position	104	**Width**	200	**Height**	94
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	0, 126, 128

Text Field_19

Type	Text field	**Name**	Text Field_19	**X position**	53
Y position	109	**Width**	103	**Height**	32
Layer	0 - Layer_0	**Font**	Tahoma, 12px	**Text**	BIOREMEDIATION RM TEMP ALARM

Text Field_20

Type	Text field	**Name**	Text Field_20	**X position**	181
Y position	146	**Width**	15	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	°F

Text Field_21

Type	Text field	**Name**	Text Field_21	**X position**	116
Y position	168	**Width**	58	**Height**	26
Layer	0 - Layer_0	**Font**	Tahoma, 9px	**Text**	HIGH TEMP SETPOINT

IO Field_9

Type	I/O field	**Name**	IO Field_9	**X position**	106
Y position	144	**Width**	72	**Height**	20
Layer	0 - Layer_0	**Mode**	Input	**Font**	Tahoma, 15px
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_setpoint 40		

Symbol Library_9

Type	Symbol library	**Name**	Symbol Library_9	**X position**	167
Y position	111	**Width**	25	**Height**	25
Layer	0 - Layer_0	**Background color**	255, 153, 204	**Background fill style**	Transparent
Dynamizations\Appearance					
Tag - Cycle	LATCH BIOREMEDIATION ROOM HIGH TEMP ALARM -	**Data type**	Range	**Range**	0..0
Foreground color	198, 195, 198	**Background color**	148, 150, 148	**Flashing**	No
Range	1..1	**Foreground color**	255, 0, 0	**Background color**	255, 0, 0
Flashing	No				

Text Field_24

Type	Text field	**Name**	Text Field_24	**X position**	91
Y position	146	**Width**	15	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	°F

Text Field_25

Type	Text field	**Name**	Text Field_25	**X position**	26
Y position	168	**Width**	53	**Height**	26
Layer	0 - Layer_0	**Font**	Tahoma, 9px	**Text**	LOW TEMP SETPOINT

IO Field_10

Type	I/O field	**Name**	IO Field_10	**X position**	16
Y position	144	**Width**	72	**Height**	20
Layer	0 - Layer_0	**Mode**	Input	**Font**	Tahoma, 15px
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_setpoint 39		

Symbol Library_10

Type	Symbol library	**Name**	Symbol Library_10	**X position**	18
Y position	111	**Width**	25	**Height**	25
Layer	0 - Layer_0	**Background color**	255, 153, 204	**Background fill style**	Transparent
Dynamizations\Appearance					
Tag - Cycle	LATCH BIOREMEDIATION ROOM LOW TEMP ALARM -	**Data type**	Range	**Range**	0..0
Foreground color	198, 195, 198	**Background color**	148, 150, 148	**Flashing**	No
Range	1..1	**Foreground color**	255, 0, 0	**Background color**	255, 0, 0
Flashing	No				

Rectangle_6

Type	Rectangle	**Name**	Rectangle_6	**X position**	6
Y position	5	**Width**	200	**Height**	94
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	0, 126, 128

Text Field_15

Type	Text field	**Name**	Text Field_15	**X position**	46
Y position	10	**Width**	115	**Height**	32
Layer	0 - Layer_0	**Font**	Tahoma, 12px	**Text**	EXTRACTION ROOM TEMP ALARM

Text Field_17

Type	Text field	**Name**	Text Field_17	**X position**	181
Y position	47	**Width**	15	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	°F

Text Field_23

Type	Text field	**Name**	Text Field_23	**X position**	116
Y position	69	**Width**	58	**Height**	26
Layer	0 - Layer_0	**Font**	Tahoma, 9px	**Text**	HIGH TEMP SETPOINT

IO Field_4

Type	I/O field	**Name**	IO Field_4	**X position**	106
Y position	45	**Width**	72	**Height**	20
Layer	0 - Layer_0	**Mode**	Input	**Font**	Tahoma, 15px
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_setpoint 38		

Symbol Library_2

Type	Symbol library	**Name**	Symbol Library_2	**X position**	167
Y position	12	**Width**	25	**Height**	25
Layer	0 - Layer_0	**Background color**	255, 153, 204	**Background fill style**	Transparent
Dynamizations\Appearance					
Tag - Cycle	LATCH EXTRACTION ROOM HIGH TEMP(1) -	**Data type**	Range	**Range**	0..0
Foreground color	198, 195, 198	**Background color**	148, 150, 148	**Flashing**	No
Range	1..1	**Foreground color**	255, 0, 0	**Background color**	255, 0, 0
Flashing	No				

Text Field_26

Type	Text field	**Name**	Text Field_26	**X position**	91
Y position	47	**Width**	15	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	°F

Text Field_27

Type	Text field	**Name**	Text Field_27	**X position**	26
Y position	69	**Width**	53	**Height**	26
Layer	0 - Layer_0	**Font**	Tahoma, 9px	**Text**	LOW TEMP SETPOINT

IO Field_8

Type	I/O field	**Name**	IO Field_8	**X position**	16
Y position	45	**Width**	72	**Height**	20
Layer	0 - Layer_0	**Mode**	Input	**Font**	Tahoma, 15px
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_setpoint 37		

Symbol Library_8

Type	Symbol library	**Name**	Symbol Library_8	**X position**	18
Y position	12	**Width**	25	**Height**	25
Layer	0 - Layer_0	**Background color**	255, 153, 204	**Background fill style**	Transparent
Dynamizations\Appearance					
Tag - Cycle	LATCH EXTRACTION ROOM LOW TEMP(1) -	**Data type**	Range	**Range**	0..0
Foreground color	198, 195, 198	**Background color**	148, 150, 148	**Flashing**	No
Range	1..1	**Foreground color**	255, 0, 0	**Background color**	255, 0, 0
Flashing	No				

Rectangle_1

Type	Rectangle	**Name**	Rectangle_1	**X position**	457
Y position	140	**Width**	167	**Height**	40
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	0, 126, 128

Symbol Library_1

Type	Symbol library	**Name**	Symbol Library_1	**X position**	585
Y position	144	**Width**	32	**Height**	32
Layer	0 - Layer_0	**Background color**	255, 153, 204	**Background fill style**	Transparent
Dynamizations\Appearance					
Tag - Cycle	LATCH LRP HIGH OIL ALARM (B-301) -	**Data type**	Range	**Range**	0..0
Foreground color	198, 195, 198	**Background color**	148, 150, 148	**Flashing**	No
Range	1..1	**Foreground color**	255, 0, 0	**Background color**	255, 0, 0
Flashing	No				

Text Field_1

Type	Text field	**Name**	Text Field_1	**X position**	475
Y position	144	**Width**	96	**Height**	32
Layer	0 - Layer_0	**Font**	Tahoma, 12px	**Text**	LRP HIGH OIL SWITCH (B-301)

Rectangle_2

Type	Rectangle	**Name**	Rectangle_2	**X position**	458
Y position	229	**Width**	167	**Height**	40
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	0, 126, 128

Symbol Library_3

Type	Symbol library	**Name**	Symbol Library_3	**X position**	586
Y position	233	**Width**	32	**Height**	32
Layer	0 - Layer_0	**Background color**	255, 153, 204	**Background fill style**	Transparent
Dynamizations\Appearance					
Tag - Cycle	LATCH STORAGE TANK HIGH LEVEL ALARM (T-400) -	**Data type**	Range	**Range**	0..0
Foreground color	198, 195, 198	**Background color**	148, 150, 148	**Flashing**	No
Range	1..1	**Foreground color**	255, 0, 0	**Background color**	255, 0, 0
Flashing	No				

Text Field_2

Type	Text field	**Name**	Text Field_2	**X position**	462
Y position	233	**Width**	117	**Height**	32
Layer	0 - Layer_0	**Font**	Tahoma, 12px	**Text**	STORAGE TANK HIGH LEVEL (T-400)

Rectangle_3

Type	Rectangle	**Name**	Rectangle_3	**X position**	458
Y position	185	**Width**	167	**Height**	40
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	0, 126, 128

Symbol Library_4

Type	Symbol library	**Name**	Symbol Library_4	**X position**	586
Y position	189	**Width**	32	**Height**	32
Layer	0 - Layer_0	**Background color**	255, 153, 204	**Background fill style**	Transparent
Dynamizations\Appearance					
Tag - Cycle	LATCH STORAGE TANK HIGH LEVEL ALARM (T-301) -	**Data type**	Range	**Range**	0..0
Foreground color	198, 195, 198	**Background color**	148, 150, 148	**Flashing**	No
Range	1..1	**Foreground color**	255, 0, 0	**Background color**	255, 0, 0
Flashing	No				

Text Field_3

Type	Text field	**Name**	Text Field_3	**X position**	465
Y position	188	**Width**	117	**Height**	32
Layer	0 - Layer_0	**Font**	Tahoma, 12px	**Text**	STORAGE TANK HIGH LEVEL (T-301)

Rectangle_4

Type	Rectangle	**Name**	Rectangle_4	**X position**	627
Y position	7	**Width**	167	**Height**	40
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	0, 126, 128

Symbol Library_5

Type	Symbol library	**Name**	Symbol Library_5	**X position**	755
Y position	11	**Width**	32	**Height**	32
Layer	0 - Layer_0	**Background color**	255, 153, 204	**Background fill style**	Transparent
Dynamizations\Appearance					
Tag - Cycle	LATCH MIXING TANK HIGH LEVEL ALARM (T-500) -	**Data type**	Range	**Range**	0..0
Foreground color	198, 195, 198	**Background color**	148, 150, 148	**Flashing**	No
Range	1..1	**Foreground color**	255, 0, 0	**Background color**	255, 0, 0
Flashing	No				

Text Field_4

Type	Text field	**Name**	Text Field_4	**X position**	634
Y position	11	**Width**	117	**Height**	32
Layer	0 - Layer_0	**Font**	Tahoma, 12px	**Text**	MIXING TANK HIGH LEVEL (T-500)

Rectangle_7

Type	Rectangle	**Name**	Rectangle_7	**X position**	628
Y position	96	**Width**	167	**Height**	40
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	0, 126, 128

Symbol Library_6

Type	Symbol library	**Name**	Symbol Library_6	**X position**	756
Y position	100	**Width**	32	**Height**	32
Layer	0 - Layer_0	**Background color**	255, 153, 204	**Background fill style**	Transparent
Dynamizations\Appearance					
Tag - Cycle	OXIDIZER READY -	**Data type**	Range	**Range**	0..0
Foreground color	198, 195, 198	**Background color**	148, 150, 148	**Flashing**	No
Range	1..1	**Foreground color**	0, 255, 0	**Background color**	0, 255, 0
Flashing	No				

Text Field_5

Type	Text field	**Name**	Text Field_5	**X position**	672
Y position	100	**Width**	42	**Height**	32
Layer	0 - Layer_0	**Font**	Tahoma, 12px	**Text**	FALCO READY

Rectangle_8

Type	Rectangle	**Name**	Rectangle_8	**X position**	628
Y position	52	**Width**	167	**Height**	40
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	0, 126, 128

Symbol Library_7

Type	Symbol library	**Name**	Symbol Library_7	**X position**	756
Y position	56	**Width**	32	**Height**	32
Layer	0 - Layer_0	**Background color**	255, 153, 204	**Background fill style**	Transparent
Dynamizations\Appearance					
Tag - Cycle	MOTOR OVERLOAD -	**Data type**	Range	**Range**	0..0
Foreground color	198, 195, 198	**Background color**	148, 150, 148	**Flashing**	No
Range	1..1	**Foreground color**	255, 0, 0	**Background color**	255, 0, 0
Flashing	No				

Text Field_6

Type	Text field	**Name**	Text Field_6	**X position**	638
Y position	55	**Width**	112	**Height**	32
Layer	0 - Layer_0	**Font**	Tahoma, 12px	**Text**	MOTOR OVERLOAD ALARM

Graphic view_1

Type	Graphic view	**Name**	Graphic view_1	**X position**	7
Y position	331	**Width**	79	**Height**	50
Layer	0 - Layer_0	**Graphic**	Graphic_87	**Fit graphic to size**	Stretch graphic

Button_2

Type	Button	**Name**	Button_2	**X position**	5
Y position	327	**Width**	81	**Height**	54
Mode	Invisible	**Text OFF**	<#0> <#0 Type = Dynamic parameter; Tag = RunClockByte; Display type: = Decimal; Display format = 999;>	**Text ON**	<#0> <#0 Type = Dynamic parameter; Tag = RunClockByte; Display type: = Decimal; Display format = 999;>
Dynamizations\Tag connection					
Property name	Process value	**Tag**	RunClockByte		

Dynamizations\Event	
Event name	Click

Function list\ActivateScreen

Screen name	ALARM SCREEN	**Object number**	0

Graphic view_3

Type	Graphic view	**Name**	Graphic view_3	**X position**	717
Y position	330	**Width**	79	**Height**	50
Layer	0 - Layer_0	**Graphic**	Graphic_75	**Fit graphic to size**	Stretch graphic

Button_1

Type	Button	**Name**	Button_1	**X position**	714
Y position	326	**Width**	81	**Height**	54

Mode	Invisible	**Text OFF**	<#0> <#0 Type = Dynamic parameter; Tag = RunClockByte; Display type: = Decimal; Display format = 999;>	**Text ON**	<#0> <#0 Type = Dynamic parameter; Tag = RunClockByte; Display type: = Decimal; Display format = 999;>

Dynamizations\Tag connection

Property name	Process value	**Tag**	RunClockByte

Dynamizations\Event

Event name	Click

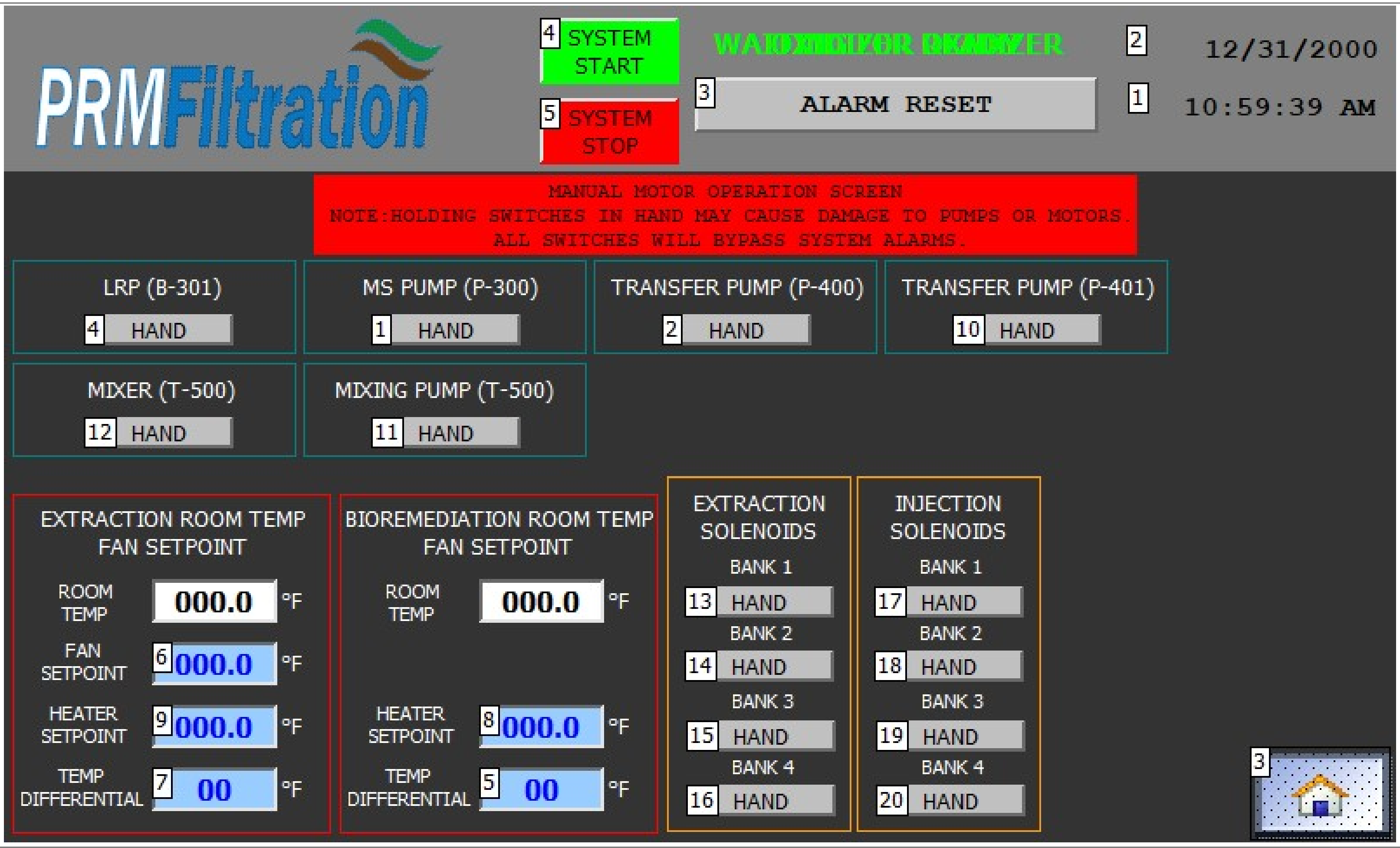
Function list\ActivateScreen

Screen name	home	**Object number**	0

GLACIER8135 / HMI_1 [TP900 Comfort] / Screens

HAND SCREEN

Hardcopy of HAND SCREEN



Name	HAND SCREEN	**Background color**	51, 51, 51	**Grid color**	0, 0, 0
Number	3	**Template**		**Tooltip**	

Rectangle_1

Type	Rectangle	**Name**	Rectangle_1	**X position**	172
Y position	51	**Width**	163	**Height**	54
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	0, 126, 128

Text field_1

Type	Text field	**Name**	Text field_1	**X position**	204
Y position	56	**Width**	105	**Height**	20
Layer	0 - Layer_0	**Font**	Tahoma, 13px	**Text**	MS PUMP (P-300)

Text Field_8

Type	Text field	**Name**	Text Field_8	**X position**	178
Y position	2	**Width**	473	**Height**	46
Layer	0 - Layer_0	**Font**	Courier New, 11px	**Text**	MANUAL MOTOR OPERATION SCREEN NOTE:HOLDING SWITCHES IN HAND MAY CAUSE DAMAGE TO PUMPS OR MOTORS. ALL SWITCHES WILL BYPASS SYSTEM ALARMS.

Button_1

Type	Button	**Name**	Button_1	**X position**	211
Y position	82	**Width**	86	**Height**	18
Mode	Text	**Text OFF**	HAND	**Text ON**	Text
Dynamizations\Appearance					
Tag - Cycle	HAND 2 -	**Data type**	Range	**Range**	0..0
Foreground color	0, 0, 0	**Background color**	214, 211, 206	**Flashing**	No
Range	1..1	**Foreground color**	0, 0, 0	**Background color**	0, 255, 0
Flashing	No				

Dynamizations\Event	
Event name	Press

Function list\SetBit

Tag	HAND 2

Dynamizations\Event	
Event name	Release

Function list\ResetBit

Tag	HAND 2

Rectangle_9

Type	Rectangle	**Name**	Rectangle_9	**X position**	339

Y position	51	**Width**	163	**Height**	54
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	0, 126, 128

Text field_23

Type	Text field	**Name**	Text field_23	**X position**	347
Y position	56	**Width**	149	**Height**	20
Layer	0 - Layer_0	**Font**	Tahoma, 13px	**Text**	TRANSFER PUMP (P-400)

Button_8

Type	Button	**Name**	Button_8	**X position**	378
Y position	82	**Width**	86	**Height**	18
Mode	Text	**Text OFF**	HAND	**Text ON**	Text
Dynamizations\Appearance					
Tag - Cycle	HAND 3 -	**Data type**	Range	**Range**	0..0
Foreground color	0, 0, 0	**Background color**	214, 211, 206	**Flashing**	No
Range	1..1	**Foreground color**	0, 0, 0	**Background color**	0, 255, 0
Flashing	No				

Dynamizations\Event	
Event name	Press

Function list\SetBit

Tag	HAND 3

Dynamizations\Event	
Event name	Release

Function list\ResetBit

Tag	HAND 3

Graphic view_3

Type	Graphic view	**Name**	Graphic view_3	**X position**	719
Y position	334	**Width**	79	**Height**	50
Layer	0 - Layer_0	**Graphic**	Graphic_75	**Fit graphic to size**	Stretch graphic

Button_2

Type	Button	**Name**	Button_2	**X position**	716
Y position	330	**Width**	81	**Height**	54
Mode	Invisible	**Text OFF**	<#0> <#0 Type = Dynamic parameter; Tag = RunClockByte; Display type: = Decimal; Display format = 999;>	**Text ON**	<#0> <#0 Type = Dynamic parameter; Tag = RunClockByte; Display type: = Decimal; Display format = 999;>
Dynamizations\Tag connection					
Property name	Process value	**Tag**	RunClockByte		

Dynamizations\Event	
Event name	Click

Function list\ActivateScreen

Screen name	home	**Object number**	0

Rectangle_2

Type	Rectangle	**Name**	Rectangle_2	**X position**	5
Y position	51	**Width**	163	**Height**	54
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	0, 126, 128

Text field_2

Type	Text field	**Name**	Text field_2	**X position**	55
Y position	56	**Width**	72	**Height**	20
Layer	0 - Layer_0	**Font**	Tahoma, 13px	**Text**	LRP (B-301)

Button_14

Type	Button	**Name**	Button_14	**X position**	46
Y position	82	**Width**	86	**Height**	18
Mode	Text	**Text OFF**	HAND	**Text ON**	Text
Dynamizations\Appearance					
Tag - Cycle	HAND 1 -	**Data type**	Range	**Range**	0..0
Foreground color	0, 0, 0	**Background color**	214, 211, 206	**Flashing**	No
Range	1..1	**Foreground color**	0, 0, 0	**Background color**	0, 255, 0
Flashing	No				

Dynamizations\Event	
Event name	Press

Function list\SetBit

Tag	HAND 1

Dynamizations\Event	
Event name	Release

Function list\ResetBit

Tag	HAND 1

Rectangle_6

Type	Rectangle	**Name**	Rectangle_6	**X position**	193
Y position	185	**Width**	183	**Height**	195
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	255, 0, 0

Text Field_11

Type	Text field	**Name**	Text Field_11	**X position**	194
Y position	189	**Width**	181	**Height**	36
Layer	0 - Layer_0	**Font**	Tahoma, 13px	**Text**	BIOREMEDIATION ROOM TEMP FAN SETPOINT

IO Field_7

Type	I/O field	**Name**	IO Field_7	**X position**	273
Y position	234	**Width**	72	**Height**	25
Layer	0 - Layer_0	**Mode**	Output	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_SCALED BIOREMEDIATION ROOM TEMP		

Text Field_13

Type	Text field	**Name**	Text Field_13	**X position**	345
Y position	237	**Width**	16	**Height**	18
Layer	0 - Layer_0	**Font**	Tahoma, 12px	**Text**	°F

Text Field_14

Type	Text field	**Name**	Text Field_14	**X position**	218
Y position	232	**Width**	35	**Height**	30
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	ROOM TEMP

Text Field_16

Type	Text field	**Name**	Text Field_16	**X position**	196
Y position	338	**Width**	75	**Height**	30
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	TEMP DIFFERENTIAL

IO Field_8

Type	I/O field	**Name**	IO Field_8	**X position**	273
Y position	342	**Width**	72	**Height**	25
Layer	0 - Layer_0	**Mode**	Input	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_setpoint 201		

Text Field_17

Type	Text field	**Name**	Text Field_17	**X position**	345
Y position	345	**Width**	16	**Height**	18
Layer	0 - Layer_0	**Font**	Tahoma, 12px	**Text**	°F

Rectangle_7

Type	Rectangle	**Name**	Rectangle_7	**X position**	5
Y position	185	**Width**	183	**Height**	195
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	255, 0, 0

Text Field_18

Type	Text field	**Name**	Text Field_18	**X position**	19
Y position	189	**Width**	156	**Height**	36
Layer	0 - Layer_0	**Font**	Tahoma, 13px	**Text**	EXTRACTION ROOM TEMP FAN SETPOINT

Text Field_19

Type	Text field	**Name**	Text Field_19	**X position**	20
Y position	266	**Width**	53	**Height**	30
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	FAN SETPOINT

IO Field_9

Type	I/O field	**Name**	IO Field_9	**X position**	85
Y position	270	**Width**	72	**Height**	25
Layer	0 - Layer_0	**Mode**	Input	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_setpoint 204		

IO Field_10

Type	I/O field	**Name**	IO Field_10	**X position**	85
Y position	234	**Width**	72	**Height**	25

Layer	0 - Layer_0	**Mode**	Output	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_SCALED EXTRACTION ROOM TEMP		

Text Field_20

Type	Text field	**Name**	Text Field_20	**X position**	157
Y position	237	**Width**	16	**Height**	18
Layer	0 - Layer_0	**Font**	Tahoma, 12px	**Text**	°F

Text Field_21

Type	Text field	**Name**	Text Field_21	**X position**	30
Y position	232	**Width**	35	**Height**	30
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	ROOM TEMP

Text Field_22

Type	Text field	**Name**	Text Field_22	**X position**	157
Y position	273	**Width**	16	**Height**	18
Layer	0 - Layer_0	**Font**	Tahoma, 12px	**Text**	°F

Text Field_3

Type	Text field	**Name**	Text Field_3	**X position**	8
Y position	338	**Width**	75	**Height**	30
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	TEMP DIFFERENTIAL

IO Field_11

Type	I/O field	**Name**	IO Field_11	**X position**	85
Y position	342	**Width**	72	**Height**	25
Layer	0 - Layer_0	**Mode**	Input	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_setpoint 205		

Text Field_24

Type	Text field	**Name**	Text Field_24	**X position**	157
Y position	345	**Width**	16	**Height**	18
Layer	0 - Layer_0	**Font**	Tahoma, 12px	**Text**	°F

Text Field_4

Type	Text field	**Name**	Text Field_4	**X position**	208
Y position	302	**Width**	53	**Height**	30
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	HEATER SETPOINT

IO Field_1

Type	I/O field	**Name**	IO Field_1	**X position**	273
Y position	306	**Width**	72	**Height**	25
Layer	0 - Layer_0	**Mode**	Input	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_setpoint 203		

Text Field_5

Type	Text field	**Name**	Text Field_5	**X position**	345
Y position	309	**Width**	16	**Height**	18
Layer	0 - Layer_0	**Font**	Tahoma, 12px	**Text**	°F

Text Field_6

Type	Text field	**Name**	Text Field_6	**X position**	20
Y position	302	**Width**	53	**Height**	30
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	HEATER SETPOINT

IO Field_2

Type	I/O field	**Name**	IO Field_2	**X position**	85
Y position	306	**Width**	72	**Height**	25
Layer	0 - Layer_0	**Mode**	Input	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_setpoint 206		

Text Field_7

Type	Text field	**Name**	Text Field_7	**X position**	157
Y position	309	**Width**	16	**Height**	18
Layer	0 - Layer_0	**Font**	Tahoma, 12px	**Text**	°F

Rectangle_3

Type	Rectangle	**Name**	Rectangle_3	**X position**	506
Y position	51	**Width**	163	**Height**	54
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	0, 126, 128

Text field_9

Type	Text field	**Name**	Text field_9	**X position**	514
Y position	56	**Width**	149	**Height**	20
Layer	0 - Layer_0	**Font**	Tahoma, 13px	**Text**	TRANSFER PUMP (P-401)

Button_3

Type	Button	**Name**	Button_3	**X position**	545
Y position	82	**Width**	86	**Height**	18
Mode	Text	**Text OFF**	HAND	**Text ON**	Text
Dynamizations\Appearance					
Tag - Cycle	HAND 4 -	**Data type**	Range	**Range**	0..0
Foreground color	0, 0, 0	**Background color**	214, 211, 206	**Flashing**	No
Range	1..1	**Foreground color**	0, 0, 0	**Background color**	0, 255, 0
Flashing	No				

Dynamizations\Event	
Event name	Press

Function list\SetBit

Tag	HAND 4

Dynamizations\Event	
Event name	Release

Function list\ResetBit

Tag	HAND 4

Rectangle_4

Type	Rectangle	**Name**	Rectangle_4	**X position**	172
Y position	110	**Width**	163	**Height**	54
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	0, 126, 128

Text field_10

Type	Text field	**Name**	Text field_10	**X position**	188
Y position	115	**Width**	130	**Height**	20
Layer	0 - Layer_0	**Font**	Tahoma, 13px	**Text**	MIXING PUMP (T-500)

Button_4

Type	Button	**Name**	Button_4	**X position**	211
Y position	141	**Width**	86	**Height**	18
Mode	Text	**Text OFF**	HAND	**Text ON**	Text
Dynamizations\Appearance					
Tag - Cycle	HAND 6 -	**Data type**	Range	**Range**	0..0
Foreground color	0, 0, 0	**Background color**	214, 211, 206	**Flashing**	No
Range	1..1	**Foreground color**	0, 0, 0	**Background color**	0, 255, 0
Flashing	No				

Dynamizations\Event	
Event name	Press

Function list\SetBit

Tag	HAND 6

Dynamizations\Event	
Event name	Release

Function list\ResetBit

Tag	HAND 6

Rectangle_5

Type	Rectangle	**Name**	Rectangle_5	**X position**	5
Y position	110	**Width**	163	**Height**	54
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	0, 126, 128

Text field_25

Type	Text field	**Name**	Text field_25	**X position**	46
Y position	115	**Width**	89	**Height**	20
Layer	0 - Layer_0	**Font**	Tahoma, 13px	**Text**	MIXER (T-500)

Button_5

Type	Button	**Name**	Button_5	**X position**	46
Y position	141	**Width**	86	**Height**	18
Mode	Text	**Text OFF**	HAND	**Text ON**	Text
Dynamizations\Appearance					
Tag - Cycle	HAND 5 -	**Data type**	Range	**Range**	0..0
Foreground color	0, 0, 0	**Background color**	214, 211, 206	**Flashing**	No
Range	1..1	**Foreground color**	0, 0, 0	**Background color**	0, 255, 0
Flashing	No				

Dynamizations\Event	
Event name	Press

Function list\SetBit

Tag	HAND 5

Dynamizations\Event	
Event name	Release

Function list\ResetBit

Tag	HAND 5

Rectangle_8

Type	Rectangle	**Name**	Rectangle_8	**X position**	381
Y position	175	**Width**	106	**Height**	204
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	255, 153, 0

Text field_26

Type	Text field	**Name**	Text field_26	**X position**	394
Y position	180	**Width**	80	**Height**	36
Layer	0 - Layer_0	**Font**	Tahoma, 13px	**Text**	EXTRACTION SOLENOIDS

Button_6

Type	Button	**Name**	Button_6	**X position**	391
Y position	238	**Width**	86	**Height**	18
Mode	Text	**Text OFF**	HAND	**Text ON**	Text
Dynamizations\Appearance					
Tag - Cycle	HAND 7 -	**Data type**	Range	**Range**	0..0
Foreground color	0, 0, 0	**Background color**	214, 211, 206	**Flashing**	No
Range	1..1	**Foreground color**	0, 0, 0	**Background color**	0, 255, 0
Flashing	No				

Dynamizations\Event	
Event name	Press

Function list\SetBit

Tag	HAND 7

Dynamizations\Event	
Event name	Release

Function list\ResetBit

Tag	HAND 7

Text Field_27

Type	Text field	**Name**	Text Field_27	**X position**	416
Y position	218	**Width**	39	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	BANK 1

Button_7

Type	Button	**Name**	Button_7	**X position**	391
Y position	275	**Width**	86	**Height**	18
Mode	Text	**Text OFF**	HAND	**Text ON**	Text
Dynamizations\Appearance					
Tag - Cycle	HAND 8 -	**Data type**	Range	**Range**	0..0
Foreground color	0, 0, 0	**Background color**	214, 211, 206	**Flashing**	No
Range	1..1	**Foreground color**	0, 0, 0	**Background color**	0, 255, 0
Flashing	No				

Dynamizations\Event	
Event name	Press

Function list\SetBit

Tag	HAND 8

Dynamizations\Event	
Event name	Release

Function list\ResetBit

Tag	HAND 8

Text Field_28

Type	Text field	**Name**	Text Field_28	**X position**	416
Y position	256	**Width**	39	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	BANK 2

Button_9

Type	Button	**Name**	Button_9	**X position**	392
Y position	315	**Width**	86	**Height**	18

Mode	Text	**Text OFF**	HAND	**Text ON**	Text
Dynamizations\Appearance					
Tag - Cycle	HAND 9 -	**Data type**	Range	**Range**	0..0
Foreground color	0, 0, 0	**Background color**	214, 211, 206	**Flashing**	No
Range	1..1	**Foreground color**	0, 0, 0	**Background color**	0, 255, 0
Flashing	No				

Dynamizations\Event	
Event name	Press

Function list\SetBit

Tag	HAND 9

Dynamizations\Event	
Event name	Release

Function list\ResetBit

Tag	HAND 9

Text Field_29

Type	Text field	**Name**	Text Field_29	**X position**	417
Y position	295	**Width**	39	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	BANK 3

Button_10

Type	Button	**Name**	Button_10	**X position**	392
Y position	352	**Width**	86	**Height**	18
Mode	Text	**Text OFF**	HAND	**Text ON**	Text
Dynamizations\Appearance					
Tag - Cycle	HAND 10 -	**Data type**	Range	**Range**	0..0
Foreground color	0, 0, 0	**Background color**	214, 211, 206	**Flashing**	No
Range	1..1	**Foreground color**	0, 0, 0	**Background color**	0, 255, 0
Flashing	No				

Dynamizations\Event	
Event name	Press

Function list\SetBit

Tag	HAND 10

Dynamizations\Event	
Event name	Release

Function list\ResetBit

Tag	HAND 10

Text Field_30

Type	Text field	**Name**	Text Field_30	**X position**	417
Y position	333	**Width**	39	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	BANK 4

Rectangle_10

Type	Rectangle	**Name**	Rectangle_10	**X position**	490
Y position	175	**Width**	106	**Height**	204
Layer	0 - Layer_0	**Background color**	51, 51, 51	**Border color**	255, 153, 0

Text field_31

Type	Text field	**Name**	Text field_31	**X position**	507
Y position	180	**Width**	71	**Height**	36
Layer	0 - Layer_0	**Font**	Tahoma, 13px	**Text**	INJECTION SOLENOIDS

Button_11

Type	Button	**Name**	Button_11	**X position**	500
Y position	238	**Width**	86	**Height**	18
Mode	Text	**Text OFF**	HAND	**Text ON**	Text
Dynamizations\Appearance					
Tag - Cycle	HAND 11 -	**Data type**	Range	**Range**	0..0
Foreground color	0, 0, 0	**Background color**	214, 211, 206	**Flashing**	No
Range	1..1	**Foreground color**	0, 0, 0	**Background color**	0, 255, 0
Flashing	No				

Dynamizations\Event	
Event name	Press

Function list\SetBit

Tag	HAND 11

Dynamizations\Event	
Event name	Release

Function list\ResetBit

Tag	HAND 11

Text Field_32

Type	Text field	**Name**	Text Field_32	**X position**	525
Y position	218	**Width**	39	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	BANK 1

Button_12

Type	Button	**Name**	Button_12	**X position**	500
Y position	275	**Width**	86	**Height**	18
Mode	Text	**Text OFF**	HAND	**Text ON**	Text
Dynamizations\Appearance					
Tag - Cycle	HAND 12 -	**Data type**	Range	**Range**	0..0
Foreground color	0, 0, 0	**Background color**	214, 211, 206	**Flashing**	No
Range	1..1	**Foreground color**	0, 0, 0	**Background color**	0, 255, 0
Flashing	No				

Dynamizations\Event	
Event name	Press

Function list\SetBit

Tag	HAND 12

Dynamizations\Event	
Event name	Release

Function list\ResetBit

Tag	HAND 12

Text Field_33

Type	Text field	**Name**	Text Field_33	**X position**	525
Y position	256	**Width**	39	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	BANK 2

Button_13

Type	Button	**Name**	Button_13	**X position**	501
Y position	315	**Width**	86	**Height**	18
Mode	Text	**Text OFF**	HAND	**Text ON**	Text
Dynamizations\Appearance					
Tag - Cycle	HAND 13 -	**Data type**	Range	**Range**	0..0
Foreground color	0, 0, 0	**Background color**	214, 211, 206	**Flashing**	No
Range	1..1	**Foreground color**	0, 0, 0	**Background color**	0, 255, 0
Flashing	No				

Dynamizations\Event	
Event name	Press

Function list\SetBit

Tag	HAND 13

Dynamizations\Event	
Event name	Release

Function list\ResetBit

Tag	HAND 13

Text Field_34

Type	Text field	**Name**	Text Field_34	**X position**	526
Y position	295	**Width**	39	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	BANK 3

Button_15

Type	Button	**Name**	Button_15	**X position**	501
Y position	352	**Width**	86	**Height**	18
Mode	Text	**Text OFF**	HAND	**Text ON**	Text
Dynamizations\Appearance					
Tag - Cycle	HAND 14 -	**Data type**	Range	**Range**	0..0
Foreground color	0, 0, 0	**Background color**	214, 211, 206	**Flashing**	No
Range	1..1	**Foreground color**	0, 0, 0	**Background color**	0, 255, 0
Flashing	No				

Dynamizations\Event	
Event name	Press

Function list\SetBit

Tag	HAND 14

Dynamizations\Event	
Event name	Release

Function list\ResetBit

Tag	HAND 14

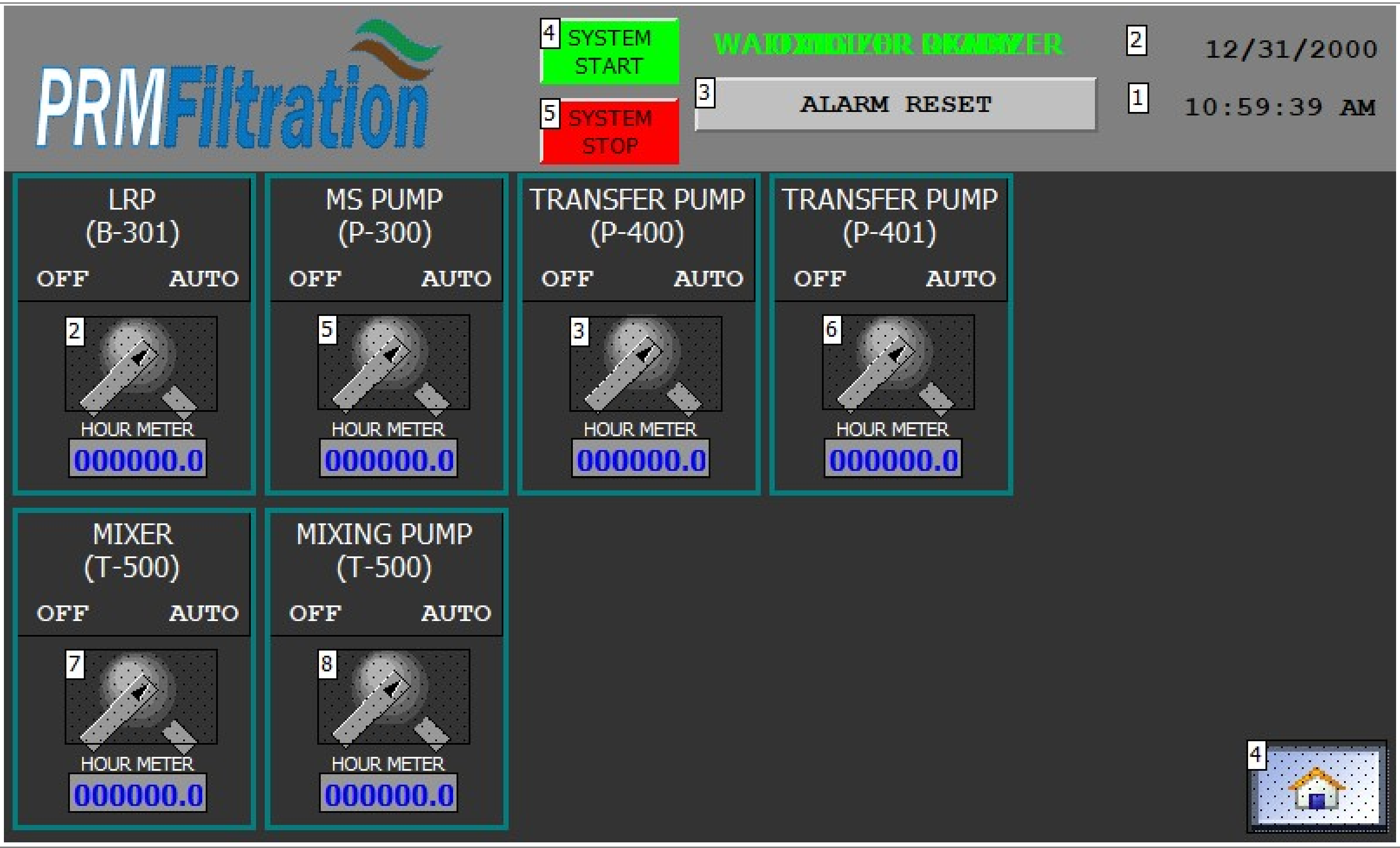
Text Field_35

Type	Text field	**Name**	Text Field_35	**X position**	526
Y position	333	**Width**	39	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	BANK 4

GLACIER8135 / HMI_1 [TP900 Comfort] / Screens

HOA Screen

Hardcopy of HOA Screen



Name	HOA Screen	**Background color**	51, 51, 51	**Grid color**	128, 128, 128
Number	13	**Template**	Template	**Tooltip**	

Button_16

Type	Button	**Name**	Button_16	**X position**	12
Y position	440	**Width**	180	**Height**	30
Mode	Text	**Text OFF**	HOME SCREEN	**Text ON**	Text

Dynamizations\Event	
Event name	Click

Function list\ActivateScreen

Screen name	home	**Object number**	0

Graphics View_3

Type	Graphic view	**Name**	Graphics View_3	**X position**	49
Y position	81	**Width**	64	**Height**	64
Layer	0 - Layer_0	**Graphic**	Selector switch 3 (left)	**Fit graphic to size**	Stretch graphic
Dynamizations\Visibility					
Tag - Cycle	AUTO 1 -	**Data type**	Range	**Start range**	0
End range	0	**Visibility**	Visible		

Graphics View_4

Type	Graphic view	**Name**	Graphics View_4	**X position**	41
Y position	79	**Width**	64	**Height**	64
Layer	0 - Layer_0	**Graphic**	Selector switch 3 (right)	**Fit graphic to size**	Stretch graphic
Dynamizations\Visibility					
Tag - Cycle	AUTO 1 -	**Data type**	Range	**Start range**	1
End range	1	**Visibility**	Visible		

Text Field_4

Type	Text field	**Name**	Text Field_4	**X position**	6
Y position	3	**Width**	136	**Height**	72
Layer	0 - Layer_0	**Font**	Tahoma, 16px	**Text**	LRP (B-301)

Text Field_5

Type	Text field	**Name**	Text Field_5	**X position**	17
Y position	51	**Width**	37	**Height**	22
Layer	0 - Layer_0	**Font**	Courier New, 16px, style=Bold	**Text**	OFF
Dynamizations\Appearance					
Tag - Cycle	LRP (B-301) -	**Data type**	Range	**Range**	0..0
Foreground color	255, 0, 0	**Background color**	255, 0, 0	**Flashing**	No
Range	1..1	**Foreground color**	255, 255, 255	**Background color**	255, 255, 255
Flashing	No				

Text Field_6

Type	Text field	**Name**	Text Field_6	**X position**	93
Y position	51	**Width**	48	**Height**	22
Layer	0 - Layer_0	**Font**	Courier New, 16px, style=Bold	**Text**	AUTO
Dynamizations\Appearance					
Tag - Cycle	LRP (B-301) -	**Data type**	Range	**Range**	0..0
Foreground color	255, 255, 255	**Background color**	255, 255, 255	**Flashing**	No
Range	1..1	**Foreground color**	0, 255, 0	**Background color**	0, 255, 0
Flashing	No				

Rectangle_4

Type	Rectangle	**Name**	Rectangle_4	**X position**	5
Y position	1	**Width**	140	**Height**	185
Layer	0 - Layer_0	**Background color**	255, 255, 255	**Border color**	0, 126, 128

Button_2

Type	Button	**Name**	Button_2	**X position**	35
Y position	83	**Width**	88	**Height**	55
Mode	Invisible	**Text OFF**	<#0> <#0 Type = Dynamic parameter; Tag = RunClockByte; Display type: = Decimal; Display format = 999;>	**Text ON**	<#0> <#0 Type = Dynamic parameter; Tag = RunClockByte; Display type: = Decimal; Display format = 999;>
Dynamizations\Tag connection					
Property name	Process value	**Tag**	RunClockByte		

Dynamizations\Event	
Event name	Click

Function list\InvertBit

Tag	AUTO 1

Text Field_18

Type	Text field	**Name**	Text Field_18	**X position**	833
Y position	56	**Width**	48	**Height**	22
Layer	0 - Layer_0	**Font**	Courier New, 16px, style=Bold	**Text**	AUTO

Graphics View_5

Type	Graphic view	**Name**	Graphics View_5	**X position**	339
Y position	79	**Width**	64	**Height**	64
Layer	0 - Layer_0	**Graphic**	Selector switch 3 (left)	**Fit graphic to size**	Stretch graphic
Dynamizations\Visibility					
Tag - Cycle	AUTO 3 -	**Data type**	Range	**Start range**	0
End range	0	**Visibility**	Visible		

Graphics View_6

Type	Graphic view	**Name**	Graphics View_6	**X position**	331
Y position	77	**Width**	64	**Height**	64
Layer	0 - Layer_0	**Graphic**	Selector switch 3 (right)	**Fit graphic to size**	Stretch graphic
Dynamizations\Visibility					
Tag - Cycle	AUTO 3 -	**Data type**	Range	**Start range**	1
End range	1	**Visibility**	Visible		

Text Field_2

Type	Text field	**Name**	Text Field_2	**X position**	296
Y position	3	**Width**	136	**Height**	72
Layer	0 - Layer_0	**Font**	Tahoma, 16px	**Text**	TRANSFER PUMP (P-400)

Text Field_3

Type	Text field	**Name**	Text Field_3	**X position**	307
Y position	51	**Width**	37	**Height**	22
Layer	0 - Layer_0	**Font**	Courier New, 16px, style=Bold	**Text**	OFF
Dynamizations\Appearance					
Tag - Cycle	TRANSFER PUMP (P-400) -	**Data type**	Range	**Range**	0..0
Foreground color	255, 0, 0	**Background color**	255, 0, 0	**Flashing**	No
Range	1..1	**Foreground color**	255, 255, 255	**Background color**	255, 255, 255
Flashing	No				

Text Field_8

Type	Text field	**Name**	Text Field_8	**X position**	383
Y position	51	**Width**	48	**Height**	22
Layer	0 - Layer_0	**Font**	Courier New, 16px, style=Bold	**Text**	AUTO
Dynamizations\Appearance					
Tag - Cycle	TRANSFER PUMP (P-400) -	**Data type**	Range	**Range**	0..0
Foreground color	255, 255, 255	**Background color**	255, 255, 255	**Flashing**	No
Range	1..1	**Foreground color**	0, 255, 0	**Background color**	0, 255, 0
Flashing	No				

Rectangle_2

Type	Rectangle	**Name**	Rectangle_2	**X position**	295

Y position	1	**Width**	140	**Height**	185
Layer	0 - Layer_0	**Background color**	255, 255, 255	**Border color**	0, 126, 128

Button_4

Type	Button	**Name**	Button_4	**X position**	325
Y position	83	**Width**	88	**Height**	55
Mode	Invisible	**Text OFF**	<#0> <#0 Type = Dynamic parameter; Tag = RunClockByte; Display type: = Decimal; Display format = 999;>	**Text ON**	<#0> <#0 Type = Dynamic parameter; Tag = RunClockByte; Display type: = Decimal; Display format = 999;>
Dynamizations\Tag connection					
Property name	Process value	**Tag**	RunClockByte		

Dynamizations\Event	
Event name	Click

Function list\InvertBit

Tag	AUTO 3

IO Field_1

Type	I/O field	**Name**	IO Field_1	**X position**	37
Y position	153	**Width**	80	**Height**	23
Layer	0 - Layer_0	**Mode**	Output	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_HM1		

Text field_20

Type	Text field	**Name**	Text field_20	**X position**	43
Y position	139	**Width**	69	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	HOUR METER

Graphic view_3

Type	Graphic view	**Name**	Graphic view_3	**X position**	717
Y position	330	**Width**	79	**Height**	50
Layer	0 - Layer_0	**Graphic**	Graphic_75	**Fit graphic to size**	Stretch graphic

Button_1

Type	Button	**Name**	Button_1	**X position**	714
Y position	326	**Width**	81	**Height**	54
Mode	Invisible	**Text OFF**	<#0> <#0 Type = Dynamic parameter; Tag = RunClockByte; Display type: = Decimal; Display format = 999;>	**Text ON**	<#0> <#0 Type = Dynamic parameter; Tag = RunClockByte; Display type: = Decimal; Display format = 999;>
Dynamizations\Tag connection					
Property name	Process value	**Tag**	RunClockByte		

Dynamizations\Event	
Event name	Click

Function list\ActivateScreen

Screen name	home	**Object number**	0

IO Field_2

Type	I/O field	**Name**	IO Field_2	**X position**	326
Y position	153	**Width**	80	**Height**	23
Layer	0 - Layer_0	**Mode**	Output	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_HM3		

Text field_1

Type	Text field	**Name**	Text field_1	**X position**	332
Y position	139	**Width**	69	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	HOUR METER

Graphics View_1

Type	Graphic view	**Name**	Graphics View_1	**X position**	194
Y position	79	**Width**	64	**Height**	64
Layer	0 - Layer_0	**Graphic**	Selector switch 3 (left)	**Fit graphic to size**	Stretch graphic
Dynamizations\Visibility					
Tag - Cycle	AUTO 2 -	**Data type**	Range	**Start range**	0
End range	0	**Visibility**	Visible		

Graphics View_2

Type	Graphic view	**Name**	Graphics View_2	**X position**	186
Y position	77	**Width**	64	**Height**	64
Layer	0 - Layer_0	**Graphic**	Selector switch 3 (right)	**Fit graphic to size**	Stretch graphic
Dynamizations\Visibility					
Tag - Cycle	AUTO 2 -	**Data type**	Range	**Start range**	1
End range	1	**Visibility**	Visible		

Text Field_7

Type	Text field	**Name**	Text Field_7	**X position**	151
Y position	3	**Width**	136	**Height**	72
Layer	0 - Layer_0	**Font**	Tahoma, 16px	**Text**	MS PUMP (P-300)

Text Field_9

Type	Text field	**Name**	Text Field_9	**X position**	162
Y position	51	**Width**	37	**Height**	22
Layer	0 - Layer_0	**Font**	Courier New, 16px, style=Bold	**Text**	OFF
Dynamizations\Appearance					
Tag - Cycle	MS PUMP (P-300) -	**Data type**	Range	**Range**	0..0
Foreground color	255, 0, 0	**Background color**	255, 0, 0	**Flashing**	No
Range	1..1	**Foreground color**	255, 255, 255	**Background color**	255, 255, 255
Flashing	No				

Text Field_10

Type	Text field	**Name**	Text Field_10	**X position**	238
Y position	51	**Width**	48	**Height**	22
Layer	0 - Layer_0	**Font**	Courier New, 16px, style=Bold	**Text**	AUTO
Dynamizations\Appearance					
Tag - Cycle	MS PUMP (P-300) -	**Data type**	Range	**Range**	0..0
Foreground color	255, 255, 255	**Background color**	255, 255, 255	**Flashing**	No
Range	1..1	**Foreground color**	0, 255, 0	**Background color**	0, 255, 0
Flashing	No				

Rectangle_1

Type	Rectangle	**Name**	Rectangle_1	**X position**	150
Y position	1	**Width**	140	**Height**	185
Layer	0 - Layer_0	**Background color**	255, 255, 255	**Border color**	0, 126, 128

Button_3

Type	Button	**Name**	Button_3	**X position**	180
Y position	82	**Width**	88	**Height**	55
Mode	Invisible	**Text OFF**	<#0> <#0 Type = Dynamic parameter; Tag = RunClockByte; Display type: = Deci-mal; Display format = 999;>	**Text ON**	<#0> <#0 Type = Dynamic parameter; Tag = RunClockByte; Display type: = Deci-mal; Display format = 999;>
Dynamizations\Tag connection					
Property name	Process value	**Tag**	RunClockByte		

Dynamizations\Event	
Event name	Click

Function list\InvertBit

Tag	AUTO 2

IO Field_3

Type	I/O field	**Name**	IO Field_3	**X position**	181
Y position	153	**Width**	80	**Height**	23
Layer	0 - Layer_0	**Mode**	Output	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_HM2		

Text field_11

Type	Text field	**Name**	Text field_11	**X position**	187
Y position	139	**Width**	69	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	HOUR METER

Graphics View_7

Type	Graphic view	**Name**	Graphics View_7	**X position**	484
Y position	79	**Width**	64	**Height**	64
Layer	0 - Layer_0	**Graphic**	Selector switch 3 (left)	**Fit graphic to size**	Stretch graphic
Dynamizations\Visibility					
Tag - Cycle	AUTO 4 -	**Data type**	Range	**Start range**	0
End range	0	**Visibility**	Visible		

Graphics View_8

Type	Graphic view	**Name**	Graphics View_8	**X position**	476
Y position	77	**Width**	64	**Height**	64
Layer	0 - Layer_0	**Graphic**	Selector switch 3 (right)	**Fit graphic to size**	Stretch graphic
Dynamizations\Visibility					
Tag - Cycle	AUTO 4 -	**Data type**	Range	**Start range**	1
End range	1	**Visibility**	Visible		

Text Field_17

Type	Text field	**Name**	Text Field_17	**X position**	441
Y position	3	**Width**	136	**Height**	72
Layer	0 - Layer_0	**Font**	Tahoma, 16px	**Text**	TRANSFER PUMP (P-401)

Text Field_22

Type	Text field	**Name**	Text Field_22	**X position**	452
Y position	51	**Width**	37	**Height**	22
Layer	0 - Layer_0	**Font**	Courier New, 16px, style=Bold	**Text**	OFF
Dynamizations\Appearance					
Tag - Cycle	TRANSFER PUMP (P-401) -	**Data type**	Range	**Range**	0..0
Foreground color	255, 0, 0	**Background color**	255, 0, 0	**Flashing**	No
Range	1..1	**Foreground color**	255, 255, 255	**Background color**	255, 255, 255
Flashing	No				

Text Field_23

Type	Text field	**Name**	Text Field_23	**X position**	528
Y position	51	**Width**	48	**Height**	22
Layer	0 - Layer_0	**Font**	Courier New, 16px, style=Bold	**Text**	AUTO
Dynamizations\Appearance					
Tag - Cycle	TRANSFER PUMP (P-401) -	**Data type**	Range	**Range**	0..0
Foreground color	255, 255, 255	**Background color**	255, 255, 255	**Flashing**	No
Range	1..1	**Foreground color**	0, 255, 0	**Background color**	0, 255, 0
Flashing	No				

Rectangle_5

Type	Rectangle	**Name**	Rectangle_5	**X position**	440
Y position	1	**Width**	140	**Height**	185
Layer	0 - Layer_0	**Background color**	255, 255, 255	**Border color**	0, 126, 128

Button_6

Type	Button	**Name**	Button_6	**X position**	470
Y position	82	**Width**	88	**Height**	55
Mode	Invisible	**Text OFF**	<#0> <#0 Type = Dynamic parameter; Tag = RunClockByte; Display type: = Deci-mal; Display format = 999;>	**Text ON**	<#0> <#0 Type = Dynamic parameter; Tag = RunClockByte; Display type: = Deci-mal; Display format = 999;>
Dynamizations\Tag connection					
Property name	Process value	**Tag**	RunClockByte		

Dynamizations\Event	
Event name	Click

Function list\InvertBit

Tag	AUTO 4

IO Field_6

Type	I/O field	**Name**	IO Field_6	**X position**	471
Y position	153	**Width**	80	**Height**	23
Layer	0 - Layer_0	**Mode**	Output	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_HM4		

Text field_24

Type	Text field	**Name**	Text field_24	**X position**	477
Y position	139	**Width**	69	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	HOUR METER

Graphics View_9

Type	Graphic view	**Name**	Graphics View_9	**X position**	49
Y position	273	**Width**	64	**Height**	64
Layer	0 - Layer_0	**Graphic**	Selector switch 3 (left)	**Fit graphic to size**	Stretch graphic
Dynamizations\Visibility					
Tag - Cycle	AUTO 5 -	**Data type**	Range	**Start range**	0
End range	0	**Visibility**	Visible		

Graphics View_10

Type	Graphic view	**Name**	Graphics View_10	**X position**	41
Y position	271	**Width**	64	**Height**	64
Layer	0 - Layer_0	**Graphic**	Selector switch 3 (right)	**Fit graphic to size**	Stretch graphic
Dynamizations\Visibility					
Tag - Cycle	AUTO 5 -	**Data type**	Range	**Start range**	1
End range	1	**Visibility**	Visible		

Text Field_25

Type	Text field	**Name**	Text Field_25	**X position**	6
Y position	195	**Width**	136	**Height**	72
Layer	0 - Layer_0	**Font**	Tahoma, 16px	**Text**	MIXER (T-500)

Text Field_26

Type	Text field	**Name**	Text Field_26	**X position**	17
Y position	243	**Width**	37	**Height**	22
Layer	0 - Layer_0	**Font**	Courier New, 16px, style=Bold	**Text**	OFF

Dynamizations\Appearance					
Tag - Cycle	MIXER (T-500) -	**Data type**	Range	**Range**	0..0
Foreground color	255, 0, 0	**Background color**	255, 0, 0	**Flashing**	No
Range	1..1	**Foreground color**	255, 255, 255	**Background color**	255, 255, 255
Flashing	No				

Text Field_27

Type	Text field	**Name**	Text Field_27	**X position**	93
Y position	243	**Width**	48	**Height**	22
Layer	0 - Layer_0	**Font**	Courier New, 16px, style=Bold	**Text**	AUTO
Dynamizations\Appearance					
Tag - Cycle	MIXER (T-500) -	**Data type**	Range	**Range**	0..0
Foreground color	255, 255, 255	**Background color**	255, 255, 255	**Flashing**	No
Range	1..1	**Foreground color**	0, 255, 0	**Background color**	0, 255, 0
Flashing	No				

Rectangle_6

Type	Rectangle	**Name**	Rectangle_6	**X position**	5
Y position	193	**Width**	140	**Height**	185
Layer	0 - Layer_0	**Background color**	255, 255, 255	**Border color**	0, 126, 128

Button_7

Type	Button	**Name**	Button_7	**X position**	35
Y position	274	**Width**	88	**Height**	55
Mode	Invisible	**Text OFF**	<#0> <#0 Type = Dynamic parameter; Tag = RunClockByte; Display type: = Decimal; Display format = 999;>	**Text ON**	<#0> <#0 Type = Dynamic parameter; Tag = RunClockByte; Display type: = Decimal; Display format = 999;>
Dynamizations\Tag connection					
Property name	Process value	**Tag**	RunClockByte		

Dynamizations\Event	
Event name	Click

Function list\InvertBit

Tag	AUTO 5

IO Field_7

Type	I/O field	**Name**	IO Field_7	**X position**	37
Y position	345	**Width**	80	**Height**	23
Layer	0 - Layer_0	**Mode**	Output	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_HM5		

Text field_28

Type	Text field	**Name**	Text field_28	**X position**	43
Y position	331	**Width**	69	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	HOUR METER

Graphics View_11

Type	Graphic view	**Name**	Graphics View_11	**X position**	194
Y position	271	**Width**	64	**Height**	64
Layer	0 - Layer_0	**Graphic**	Selector switch 3 (left)	**Fit graphic to size**	Stretch graphic
Dynamizations\Visibility					
Tag - Cycle	AUTO 6 -	**Data type**	Range	**Start range**	0
End range	0	**Visibility**	Visible		

Graphics View_12

Type	Graphic view	**Name**	Graphics View_12	**X position**	186
Y position	269	**Width**	64	**Height**	64
Layer	0 - Layer_0	**Graphic**	Selector switch 3 (right)	**Fit graphic to size**	Stretch graphic
Dynamizations\Visibility					
Tag - Cycle	AUTO 6 -	**Data type**	Range	**Start range**	1
End range	1	**Visibility**	Visible		

Text Field_29

Type	Text field	**Name**	Text Field_29	**X position**	151
Y position	195	**Width**	136	**Height**	72
Layer	0 - Layer_0	**Font**	Tahoma, 16px	**Text**	MIXING PUMP (T-500)

Text Field_30

Type	Text field	**Name**	Text Field_30	**X position**	162
Y position	243	**Width**	37	**Height**	22
Layer	0 - Layer_0	**Font**	Courier New, 16px, style=Bold	**Text**	OFF
Dynamizations\Appearance					
Tag - Cycle	MIXING PUMP (T-500) -	**Data type**	Range	**Range**	0..0
Foreground color	255, 0, 0	**Background color**	255, 0, 0	**Flashing**	No
Range	1..1	**Foreground color**	255, 255, 255	**Background color**	255, 255, 255
Flashing	No				

Text Field_31

Type	Text field	**Name**	Text Field_31	**X position**	238
Y position	243	**Width**	48	**Height**	22
Layer	0 - Layer_0	**Font**	Courier New, 16px, style=Bold	**Text**	AUTO
Dynamizations\Appearance					
Tag - Cycle	MIXING PUMP (T-500) -	**Data type**	Range	**Range**	0..0
Foreground color	255, 255, 255	**Background color**	255, 255, 255	**Flashing**	No
Range	1..1	**Foreground color**	0, 255, 0	**Background color**	0, 255, 0
Flashing	No				

Rectangle_7

Type	Rectangle	**Name**	Rectangle_7	**X position**	150
Y position	193	**Width**	140	**Height**	185
Layer	0 - Layer_0	**Background color**	255, 255, 255	**Border color**	0, 126, 128

Button_8

Type	Button	**Name**	Button_8	**X position**	180
Y position	274	**Width**	88	**Height**	55
Mode	Invisible	**Text OFF**	<#0> <#0 Type = Dynamic parameter; Tag = RunClockByte; Display type: = Decimal; Display format = 999;>	**Text ON**	<#0> <#0 Type = Dynamic parameter; Tag = RunClockByte; Display type: = Decimal; Display format = 999;>
Dynamizations\Tag connection					
Property name	Process value	**Tag**	RunClockByte		

Dynamizations\Event	
Event name	Click

Function list\InvertBit

Tag	AUTO 6

IO Field_8

Type	I/O field	**Name**	IO Field_8	**X position**	181
Y position	345	**Width**	80	**Height**	23
Layer	0 - Layer_0	**Mode**	Output	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_HM6		

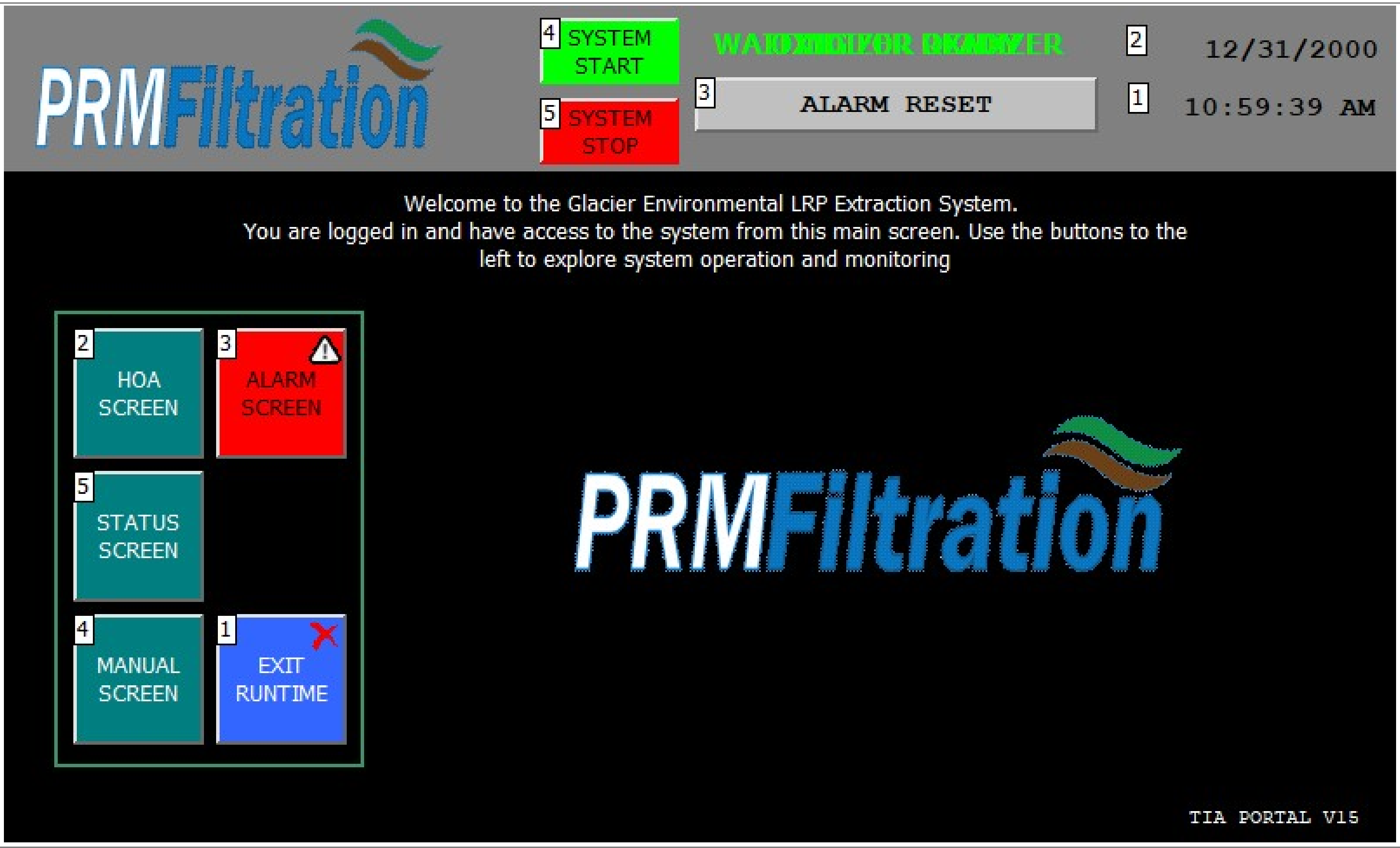
Text field_32

Type	Text field	**Name**	Text field_32	**X position**	187
Y position	331	**Width**	69	**Height**	17
Layer	0 - Layer_0	**Font**	Tahoma, 11px	**Text**	HOUR METER

GLACIER8135 / HMI_1 [TP900 Comfort] / Screens

home

Hardcopy of home



Name	home	**Background color**	0, 0, 0	**Grid color**	0, 0, 0
Number	14	**Template**	Template	**Tooltip**	

Clock_1

Type	Clock	**Name**	Clock_1	**X position**	461
Y position	452	**Width**	178	**Height**	24
Analog	Unchecked	**Graphic**		**Font**	Tahoma, 16px

Text Field_1

Type	Text field	**Name**	Text Field_1	**X position**	132
Y position	8	**Width**	550	**Height**	52
Layer	0 - Layer_0	**Font**	Tahoma, 13px	**Text**	Welcome to the Glacier Environmental LRP Extraction System. You are logged in and have access to the system from this main screen. Use the buttons to the left to explore system operation and monitoring

Rectangle_1

Type	Rectangle	**Name**	Rectangle_1	**X position**	29
Y position	80	**Width**	178	**Height**	262
Layer	0 - Layer_0	**Background color**	0, 0, 0	**Border color**	51, 153, 102

Button_19

Type	Button	**Name**	Button_19	**X position**	122
Y position	254	**Width**	75	**Height**	75
Mode	Text	**Text OFF**	EXIT RUNTIME	**Text ON**	Text

Dynamizations\Event	
Event name	Click

Function list\StopRuntime

Mode	Runtime

Clock_2

Type	Clock	**Name**	Clock_2	**X position**	411
Y position	449	**Width**	178	**Height**	24
Analog	Unchecked	**Graphic**		**Font**	Tahoma, 16px

Text Field_3

Type	Text field	**Name**	Text Field_3	**X position**	38
Y position	0	**Width**	10	**Height**	10
Layer	0 - Layer_0	**Font**	Tahoma, 15px, style=Italic	**Text**	

Button_20

Type	Button	**Name**	Button_20	**X position**	40
Y position	90	**Width**	75	**Height**	75
Mode	Text	**Text OFF**	HOA SCREEN	**Text ON**	Text

Dynamizations\Event	
Event name	Click

Function list\ActivateScreen

Screen name	HOA Screen	**Object number**	0

Button_17

Type	Button	**Name**	Button_17	**X position**	122
Y position	90	**Width**	75	**Height**	75
Mode	Text	**Text OFF**	ALARM SCREEN	**Text ON**	Text
Dynamizations\Appearance					
Tag - Cycle	ALARM FLASHER -	**Data type**	Range	**Range**	0..0
Foreground color	0, 0, 0	**Background color**	214, 214, 206	**Flashing**	No
Range	1..1	**Foreground color**	0, 0, 0	**Background color**	255, 0, 0
Flashing	Yes				

Dynamizations\Event	
Event name	Click

Function list\ActivateScreen

Screen name	ALARM SCREEN	**Object number**	0

Text field_4

Type	Text field	**Name**	Text field_4	**X position**	678
Y position	361	**Width**	103	**Height**	18
Layer	0 - Layer_0	**Font**	Courier New, 11px	**Text**	TIA PORTAL V15

Button_3

Type	Button	**Name**	Button_3	**X position**	40
Y position	254	**Width**	75	**Height**	75
Mode	Text	**Text OFF**	MANUAL SCREEN	**Text ON**	Text

Dynamizations\Event	
Event name	Click

Function list\ActivateScreen

Screen name	HAND SCREEN	**Object number**	0

Button_1

Type	Button	**Name**	Button_1	**X position**	40
Y position	172	**Width**	75	**Height**	75
Mode	Text	**Text OFF**	STATUS SCREEN	**Text ON**	Text

Dynamizations\Event	
Event name	Click

Function list\ActivateScreen

Screen name	STATUS SCREEN	**Object number**	0

Graphic view_3

Type	Graphic view	**Name**	Graphic view_3	**X position**	172
Y position	255	**Width**	24	**Height**	23
Layer	0 - Layer_0	**Graphic**	Graphic_79	**Fit graphic to size**	Stretch graphic

Graphic view_4

Type	Graphic view	**Name**	Graphic view_4	**X position**	171
Y position	90	**Width**	27	**Height**	25
Layer	0 - Layer_0	**Graphic**	Graphic_81	**Fit graphic to size**	Stretch graphic

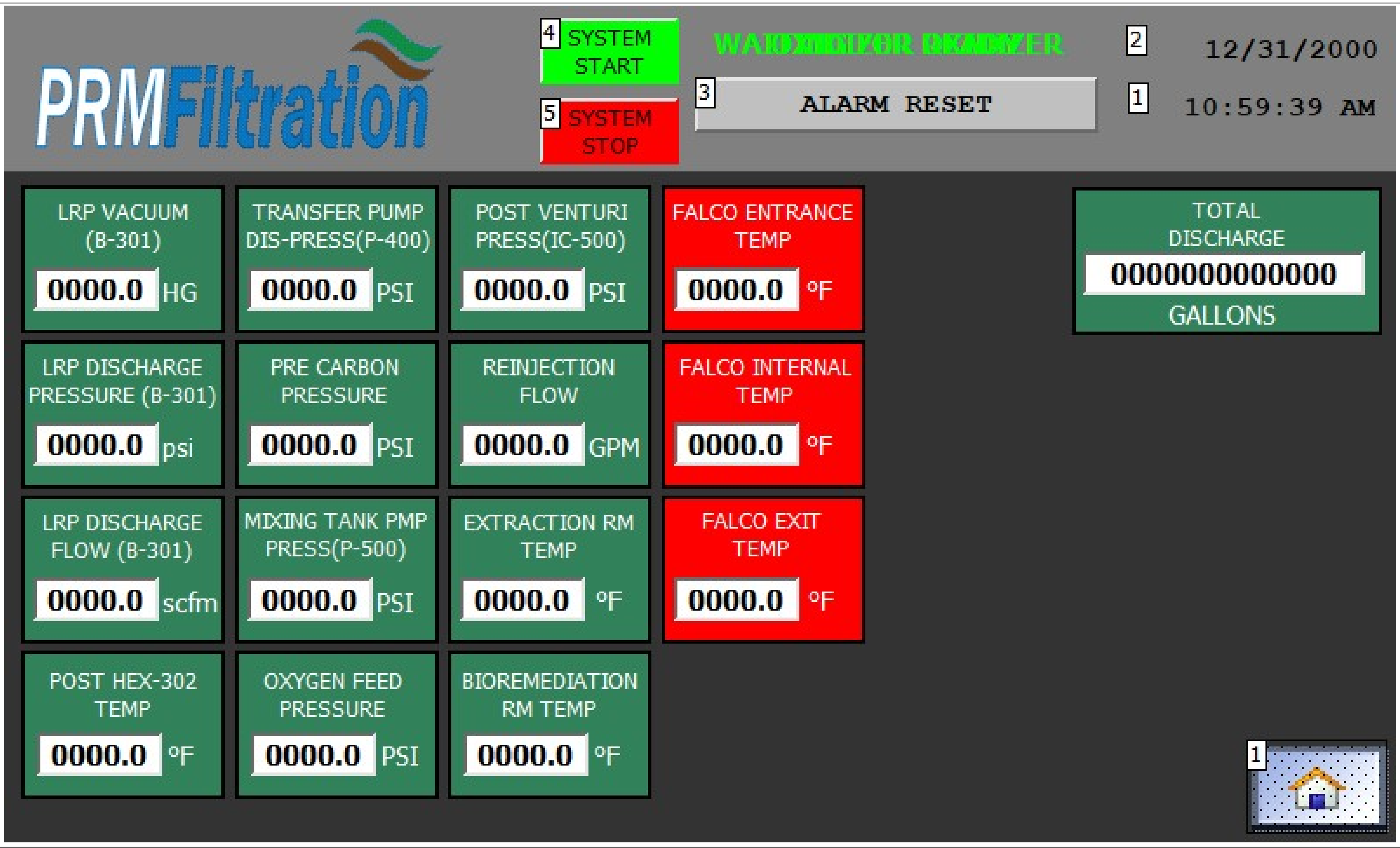
Graphic view_1

Type	Graphic view	**Name**	Graphic view_1	**X position**	326
Y position	137	**Width**	352	**Height**	94
Layer	0 - Layer_0	**Graphic**	logoPRM	**Fit graphic to size**	Stretch graphic

GLACIER8135 / HMI_1 [TP900 Comfort] / Screens

STATUS SCREEN

Hardcopy of STATUS SCREEN



Name	STATUS SCREEN	**Background color**	51, 51, 51	**Grid color**	0, 0, 0
Number	1	**Template**		**Tooltip**	

Graphic view_3

Type	Graphic view	**Name**	Graphic view_3	**X position**	717
Y position	330	**Width**	79	**Height**	50
Layer	0 - Layer_0	**Graphic**	Graphic_75	**Fit graphic to size**	Stretch graphic

Button_1

Type	Button	**Name**	Button_1	**X position**	714
Y position	326	**Width**	81	**Height**	54
Mode	Invisible	**Text OFF**	<#0> <#0 Type = Dynamic parameter; Tag = RunClockByte; Display type: = Deci-mal; Display format = 999;>	**Text ON**	<#0> <#0 Type = Dynamic parameter; Tag = RunClockByte; Display type: = Deci-mal; Display format = 999;>
Dynamizations\Tag connection					
Property name	Process value	**Tag**	RunClockByte		

Dynamizations\Event	
Event name	Click

Function list\ActivateScreen

Screen name	home	**Object number**	0

Rectangle_5

Type	Rectangle	**Name**	Rectangle_5	**X position**	10
Y position	275	**Width**	117	**Height**	85
Layer	0 - Layer_0	**Background color**	49, 130, 90	**Border color**	0, 0, 0

Text Field_9

Type	Text field	**Name**	Text Field_9	**X position**	24
Y position	282	**Width**	89	**Height**	36
Layer	0 - Layer_0	**Font**	Tahoma, 13px	**Text**	POST HEX-302 TEMP

IO Field_5

Type	I/O field	**Name**	IO Field_5	**X position**	19
Y position	322	**Width**	72	**Height**	25
Layer	0 - Layer_0	**Mode**	Output	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_SCALED POST HEAT EXCHANGER TEMP (HEX-302)		

Text Field_10

Type	Text field	**Name**	Text Field_10	**X position**	92
Y position	324	**Width**	19	**Height**	22

Layer	0 - Layer_0	**Font**	Tahoma, 15px	**Text**	°F

Rectangle_8

Type	Rectangle	**Name**	Rectangle_8	**X position**	10
Y position	8	**Width**	117	**Height**	85
Layer	0 - Layer_0	**Background color**	49, 130, 90	**Border color**	0, 0, 0

Text Field_15

Type	Text field	**Name**	Text Field_15	**X position**	29
Y position	13	**Width**	79	**Height**	36
Layer	0 - Layer_0	**Font**	Tahoma, 13px	**Text**	LRP VACUUM (B-301)

IO Field_8

Type	I/O field	**Name**	IO Field_8	**X position**	17
Y position	55	**Width**	72	**Height**	25
Layer	0 - Layer_0	**Mode**	Output	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_SCALED LRP VACUUM		

Text Field_18

Type	Text field	**Name**	Text Field_18	**X position**	89
Y position	58	**Width**	24	**Height**	22
Layer	0 - Layer_0	**Font**	Tahoma, 15px	**Text**	HG

Rectangle_15

Type	Rectangle	**Name**	Rectangle_15	**X position**	614
Y position	9	**Width**	178	**Height**	85
Layer	0 - Layer_0	**Background color**	49, 130, 90	**Border color**	0, 0, 0

Text Field_29

Type	Text field	**Name**	Text Field_29	**X position**	667
Y position	12	**Width**	71	**Height**	36
Layer	0 - Layer_0	**Font**	Tahoma, 13px	**Text**	TOTAL DISCHARGE

IO Field_15

Type	I/O field	**Name**	IO Field_15	**X position**	620
Y position	46	**Width**	162	**Height**	25
Layer	0 - Layer_0	**Mode**	Output	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_DISCHAGE TOTAL		

Text Field_30

Type	Text field	**Name**	Text Field_30	**X position**	667
Y position	71	**Width**	66	**Height**	22
Layer	0 - Layer_0	**Font**	Tahoma, 15px	**Text**	GALLONS

Rectangle_1

Type	Rectangle	**Name**	Rectangle_1	**X position**	10
Y position	97	**Width**	117	**Height**	85
Layer	0 - Layer_0	**Background color**	49, 130, 90	**Border color**	0, 0, 0

Text Field_1

Type	Text field	**Name**	Text Field_1	**X position**	12
Y position	102	**Width**	112	**Height**	36
Layer	0 - Layer_0	**Font**	Tahoma, 13px	**Text**	LRP DISCHARGE PRESSURE (B-301)

IO Field_1

Type	I/O field	**Name**	IO Field_1	**X position**	17
Y position	144	**Width**	72	**Height**	25
Layer	0 - Layer_0	**Mode**	Output	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_SCALED LRP DISCHARGE PRES-SURE (B-301)		

Text Field_2

Type	Text field	**Name**	Text Field_2	**X position**	89
Y position	147	**Width**	21	**Height**	22
Layer	0 - Layer_0	**Font**	Tahoma, 15px	**Text**	psi

Rectangle_3

Type	Rectangle	**Name**	Rectangle_3	**X position**	10
Y position	186	**Width**	117	**Height**	85
Layer	0 - Layer_0	**Background color**	49, 130, 90	**Border color**	0, 0, 0

Text Field_4

Type	Text field	**Name**	Text Field_4	**X position**	20
Y position	191	**Width**	96	**Height**	36
Layer	0 - Layer_0	**Font**	Tahoma, 13px	**Text**	LRP DISCHARGE FLOW (B-301)

IO Field_3

Type	I/O field	**Name**	IO Field_3	**X position**	17
Y position	233	**Width**	72	**Height**	25
Layer	0 - Layer_0	**Mode**	Output	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_SCALED LRP DISCHARGE FLOW (B-301)		

Text Field_5

Type	Text field	**Name**	Text Field_5	**X position**	89
Y position	236	**Width**	36	**Height**	22
Layer	0 - Layer_0	**Font**	Tahoma, 15px	**Text**	scfm

Rectangle_9

Type	Rectangle	**Name**	Rectangle_9	**X position**	133
Y position	275	**Width**	117	**Height**	85
Layer	0 - Layer_0	**Background color**	49, 130, 90	**Border color**	0, 0, 0

Text Field_16

Type	Text field	**Name**	Text Field_16	**X position**	147
Y position	282	**Width**	84	**Height**	36
Layer	0 - Layer_0	**Font**	Tahoma, 13px	**Text**	OXYGEN FEED PRESSURE

IO Field_9

Type	I/O field	**Name**	IO Field_9	**X position**	142
Y position	322	**Width**	72	**Height**	25
Layer	0 - Layer_0	**Mode**	Output	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_SCALED OXYGEN FEED PRESSURE		

Text Field_17

Type	Text field	**Name**	Text Field_17	**X position**	215
Y position	324	**Width**	26	**Height**	22
Layer	0 - Layer_0	**Font**	Tahoma, 15px	**Text**	PSI

Rectangle_11

Type	Rectangle	**Name**	Rectangle_11	**X position**	133
Y position	8	**Width**	117	**Height**	85
Layer	0 - Layer_0	**Background color**	49, 130, 90	**Border color**	0, 0, 0

Text Field_21

Type	Text field	**Name**	Text Field_21	**X position**	137
Y position	13	**Width**	110	**Height**	36
Layer	0 - Layer_0	**Font**	Tahoma, 13px	**Text**	TRANSFER PUMP DIS-PRESS(P-400)

IO Field_11

Type	I/O field	**Name**	IO Field_11	**X position**	140
Y position	55	**Width**	72	**Height**	25
Layer	0 - Layer_0	**Mode**	Output	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_SCALED TRANSFER PUMP DIS-CHARGE PRESSURE (P-400)		

Text Field_22

Type	Text field	**Name**	Text Field_22	**X position**	212
Y position	58	**Width**	26	**Height**	22
Layer	0 - Layer_0	**Font**	Tahoma, 15px	**Text**	PSI

Rectangle_12

Type	Rectangle	**Name**	Rectangle_12	**X position**	133
Y position	97	**Width**	117	**Height**	85
Layer	0 - Layer_0	**Background color**	49, 130, 90	**Border color**	0, 0, 0

Text Field_23

Type	Text field	**Name**	Text Field_23	**X position**	151
Y position	102	**Width**	78	**Height**	36
Layer	0 - Layer_0	**Font**	Tahoma, 13px	**Text**	PRE CARBON PRESSURE

IO Field_12

Type	I/O field	**Name**	IO Field_12	**X position**	140
Y position	144	**Width**	72	**Height**	25
Layer	0 - Layer_0	**Mode**	Output	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_SCALED PRE CARBON PRESSURE		

Text Field_24

Type	Text field	**Name**	Text Field_24	**X position**	212
Y position	147	**Width**	26	**Height**	22
Layer	0 - Layer_0	**Font**	Tahoma, 15px	**Text**	PSI

Rectangle_13

Type	Rectangle	**Name**	Rectangle_13	**X position**	133
Y position	186	**Width**	117	**Height**	85
Layer	0 - Layer_0	**Background color**	49, 130, 90	**Border color**	0, 0, 0

Text Field_25

Type	Text field	**Name**	Text Field_25	**X position**	136
Y position	190	**Width**	109	**Height**	36
Layer	0 - Layer_0	**Font**	Tahoma, 13px	**Text**	MIXING TANK PMP PRESS(P-500)

IO Field_13

Type	I/O field	**Name**	IO Field_13	**X position**	140
Y position	233	**Width**	72	**Height**	25
Layer	0 - Layer_0	**Mode**	Output	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_SCALED MIXING TANK PUMP DISCHARGE PRESSURE (P-500)		

Text Field_26

Type	Text field	**Name**	Text Field_26	**X position**	212
Y position	236	**Width**	26	**Height**	22
Layer	0 - Layer_0	**Font**	Tahoma, 15px	**Text**	PSI

Rectangle_14

Type	Rectangle	**Name**	Rectangle_14	**X position**	255
Y position	275	**Width**	117	**Height**	85
Layer	0 - Layer_0	**Background color**	49, 130, 90	**Border color**	0, 0, 0

Text Field_27

Type	Text field	**Name**	Text Field_27	**X position**	261
Y position	282	**Width**	105	**Height**	36
Layer	0 - Layer_0	**Font**	Tahoma, 13px	**Text**	BIOREMEDIATION RM TEMP

IO Field_14

Type	I/O field	**Name**	IO Field_14	**X position**	264
Y position	322	**Width**	72	**Height**	25
Layer	0 - Layer_0	**Mode**	Output	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_SCALED BIOREMEDIATION ROOM TEMP		

Text Field_28

Type	Text field	**Name**	Text Field_28	**X position**	337
Y position	324	**Width**	19	**Height**	22
Layer	0 - Layer_0	**Font**	Tahoma, 15px	**Text**	°F

Rectangle_16

Type	Rectangle	**Name**	Rectangle_16	**X position**	255
Y position	8	**Width**	117	**Height**	85
Layer	0 - Layer_0	**Background color**	49, 130, 90	**Border color**	0, 0, 0

Text Field_31

Type	Text field	**Name**	Text Field_31	**X position**	269
Y position	13	**Width**	91	**Height**	36
Layer	0 - Layer_0	**Font**	Tahoma, 13px	**Text**	POST VENTURI PRESS(IC-500)

IO Field_16

Type	I/O field	**Name**	IO Field_16	**X position**	262
Y position	55	**Width**	72	**Height**	25
Layer	0 - Layer_0	**Mode**	Output	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_SCALED POST VENTURI PRESSURE (IC-500)		

Text Field_32

Type	Text field	**Name**	Text Field_32	**X position**	334
Y position	58	**Width**	26	**Height**	22
Layer	0 - Layer_0	**Font**	Tahoma, 15px	**Text**	PSI

Rectangle_17

Type	Rectangle	**Name**	Rectangle_17	**X position**	255
Y position	97	**Width**	117	**Height**	85
Layer	0 - Layer_0	**Background color**	49, 130, 90	**Border color**	0, 0, 0

Text Field_35

Type	Text field	**Name**	Text Field_35	**X position**	273
Y position	102	**Width**	80	**Height**	36
Layer	0 - Layer_0	**Font**	Tahoma, 13px	**Text**	REINJECTION FLOW

IO Field_18

Type	I/O field	**Name**	IO Field_18	**X position**	262
Y position	144	**Width**	72	**Height**	25
Layer	0 - Layer_0	**Mode**	Output	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_SCALED REINJECTION FLOW		

Text Field_36

Type	Text field	**Name**	Text Field_36	**X position**	334
Y position	147	**Width**	34	**Height**	22
Layer	0 - Layer_0	**Font**	Tahoma, 15px	**Text**	GPM

Rectangle_18

Type	Rectangle	**Name**	Rectangle_18	**X position**	255
Y position	186	**Width**	117	**Height**	85
Layer	0 - Layer_0	**Background color**	49, 130, 90	**Border color**	0, 0, 0

Text Field_37

Type	Text field	**Name**	Text Field_37	**X position**	262
Y position	191	**Width**	102	**Height**	36
Layer	0 - Layer_0	**Font**	Tahoma, 13px	**Text**	EXTRACTION RM TEMP

IO Field_19

Type	I/O field	**Name**	IO Field_19	**X position**	262
Y position	233	**Width**	72	**Height**	25
Layer	0 - Layer_0	**Mode**	Output	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_SCALED EXTRACTION ROOM TEMP		

Rectangle_21

Type	Rectangle	**Name**	Rectangle_21	**X position**	378
Y position	8	**Width**	117	**Height**	85
Layer	0 - Layer_0	**Background color**	255, 0, 0	**Border color**	0, 0, 0

Text Field_41

Type	Text field	**Name**	Text Field_41	**X position**	382
Y position	13	**Width**	108	**Height**	36
Layer	0 - Layer_0	**Font**	Tahoma, 13px	**Text**	FALCO ENTRANCE TEMP

IO Field_21

Type	I/O field	**Name**	IO Field_21	**X position**	385
Y position	55	**Width**	72	**Height**	25
Layer	0 - Layer_0	**Mode**	Output	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_SCALED FALCO ENTRANCE TEMP		

Rectangle_22

Type	Rectangle	**Name**	Rectangle_22	**X position**	378
Y position	97	**Width**	117	**Height**	85
Layer	0 - Layer_0	**Background color**	255, 0, 0	**Border color**	0, 0, 0

Text Field_43

Type	Text field	**Name**	Text Field_43	**X position**	386
Y position	102	**Width**	103	**Height**	36
Layer	0 - Layer_0	**Font**	Tahoma, 13px	**Text**	FALCO INTERNAL TEMP

IO Field_22

Type	I/O field	**Name**	IO Field_22	**X position**	385

Y position	144	**Width**	72	**Height**	25
Layer	0 - Layer_0	**Mode**	Output	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_SCALED FALCO INTERNAL TEMP		

Rectangle_23

Type	Rectangle	**Name**	Rectangle_23	**X position**	378
Y position	186	**Width**	117	**Height**	85
Layer	0 - Layer_0	**Background color**	255, 0, 0	**Border color**	0, 0, 0

Text Field_45

Type	Text field	**Name**	Text Field_45	**X position**	399
Y position	190	**Width**	73	**Height**	36
Layer	0 - Layer_0	**Font**	Tahoma, 13px	**Text**	FALCO EXIT TEMP

IO Field_23

Type	I/O field	**Name**	IO Field_23	**X position**	385
Y position	233	**Width**	72	**Height**	25
Layer	0 - Layer_0	**Mode**	Output	**Font**	Tahoma, 16px, style=Bold
Dynamizations\Tag connection					
Property name	Process value	**Tag**	DB4_SCALED FALCO EXIT TEMP		

Text Field_38

Type	Text field	**Name**	Text Field_38	**X position**	338
Y position	235	**Width**	19	**Height**	22
Layer	0 - Layer_0	**Font**	Tahoma, 15px	**Text**	°F

Text Field_42

Type	Text field	**Name**	Text Field_42	**X position**	460
Y position	235	**Width**	19	**Height**	22
Layer	0 - Layer_0	**Font**	Tahoma, 15px	**Text**	°F

Text Field_44

Type	Text field	**Name**	Text Field_44	**X position**	459
Y position	146	**Width**	19	**Height**	22
Layer	0 - Layer_0	**Font**	Tahoma, 15px	**Text**	°F

Text Field_46

Type	Text field	**Name**	Text Field_46	**X position**	459
Y position	57	**Width**	19	**Height**	22
Layer	0 - Layer_0	**Font**	Tahoma, 15px	**Text**	°F

GLACIER8135 / HMI_1 [TP900 Comfort] / Screen management / Templates

Template

Hardcopy of Template

Name	Template	**Background color**	192, 192, 192	**Grid color**	0, 0, 0
Tab sequence in fore-ground	Checked	**Active layer**	0		

GLACIER8135 / HMI_1 [TP900 Comfort] / Screen management

Pop-up screens

This folder is empty.

GLACIER8135 / HMI_1 [TP900 Comfort] / Screen management / Slide-in screens

Slide-in screen bottom

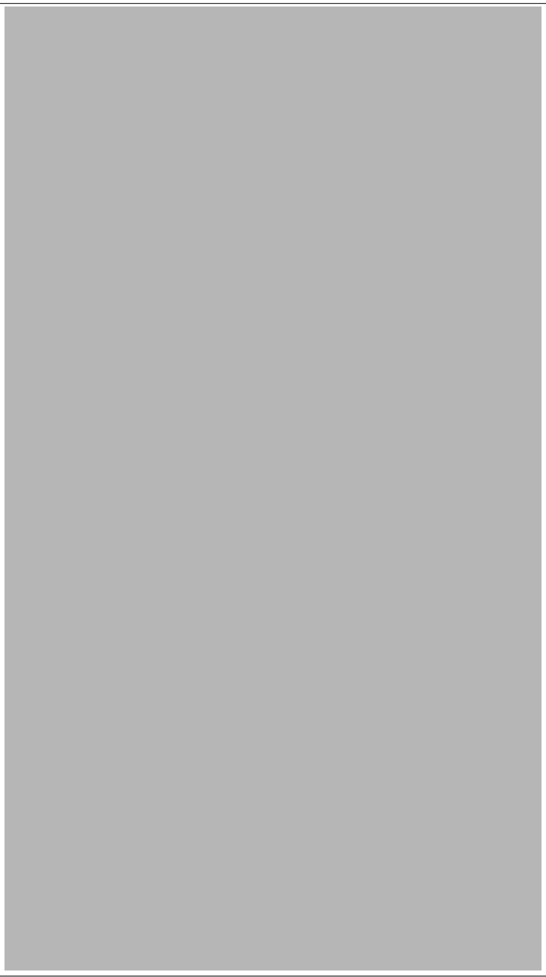
Hardcopy of Slide-in screen bottom

Name	Slide-in screen bottom	**Activate slide-in screen**	Unchecked	**Width**	800
Height	160	**Active layer**	0		

GLACIER8135 / HMI_1 [TP900 Comfort] / Screen management / Slide-in screens

Slide-in screen left

Hardcopy of Slide-in screen left

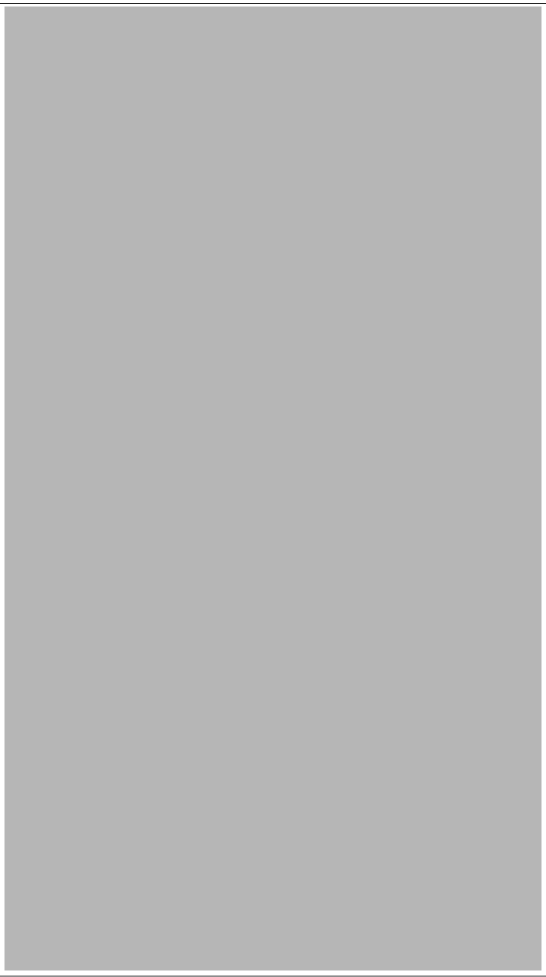


Name	Slide-in screen left	**Activate slide-in screen**	Unchecked	**Width**	267
Height	480	**Active layer**	0		

GLACIER8135 / HMI_1 [TP900 Comfort] / Screen management / Slide-in screens

Slide-in screen right

Hardcopy of Slide-in screen right



Name	Slide-in screen right	**Activate slide-in screen**	Unchecked	**Width**	267
Height	480	**Active layer**	0		

GLACIER8135 / HMI_1 [TP900 Comfort] / Screen management / Slide-in screens

Slide-in screen top

Hardcopy of Slide-in screen top

Name	Slide-in screen top	**Activate slide-in screen**	Unchecked	**Width**	800
Height	160	**Active layer**	0		

GLACIER8135 / HMI_1 [TP900 Comfort] / Screen management

Global screen

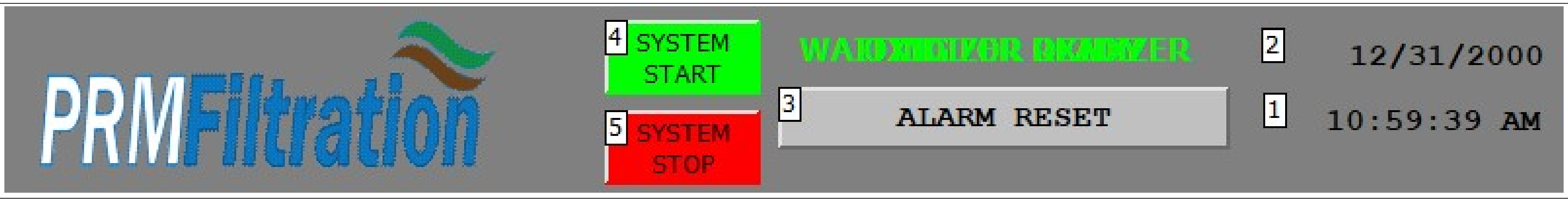
Hardcopy of Global screen

Name	Global screen	**Background color**	182, 182, 182	**Grid color**	0, 0, 0

GLACIER8135 / HMI_1 [TP900 Comfort] / Screen management

Permanent area

Hardcopy of Permanent area



Name	Permanent area	**Background color**	128, 128, 128	**Grid color**	0, 0, 0
Height	95	**Active layer**	0		

Date/time field_1

Type	Date/time field	**Name**	Date/time field_1	**X position**	646
Y position	44	**Width**	144	**Height**	30
Mode	Input/output	**Font**	Courier New, 16px, style=Bold		

Date/time field_2

Type	Date/time field	**Name**	Date/time field_2	**X position**	645
Y position	11	**Width**	147	**Height**	30
Mode	Input/output	**Font**	Courier New, 16px, style=Bold		

Button_2

Type	Button	**Name**	Button_2	**X position**	397
Y position	41	**Width**	232	**Height**	32
Mode	Text	**Text OFF**	ALARM RESET	**Text ON**	Text
Dynamizations\Appearance					
Tag - Cycle	ALARM FLASHER -	**Data type**	Range	**Range**	0..0
Foreground color	0, 0, 0	**Background color**	214, 211, 206	**Flashing**	No
Range	1..1	**Foreground color**	0, 0, 0	**Background color**	255, 0, 0
Flashing	Yes				

Dynamizations\Event	
Event name	Press

Function list\SetBit

Tag	ALARM RESET

Dynamizations\Event	
Event name	Release

Function list\ResetBit

Tag	ALARM RESET

Button_1

Type	Button	**Name**	Button_1	**X position**	308
Y position	7	**Width**	80	**Height**	38
Mode	Text	**Text OFF**	SYSTEM START	**Text ON**	Text

Dynamizations\Event	
Event name	Click

Function list\SetBit

Tag	SYSTEM START

Dynamizations\Appearance					
Tag - Cycle	SYSTEM START -	**Data type**	Range	**Range**	0..0
Foreground color	0, 0, 0	**Background color**	192, 192, 192	**Flashing**	No
Range	1..1	**Foreground color**	0, 0, 0	**Background color**	0, 255, 0
Flashing	No				

Button_3

Type	Button	**Name**	Button_3	**X position**	308
Y position	53	**Width**	80	**Height**	38
Mode	Text	**Text OFF**	SYSTEM STOP	**Text ON**	Text

Dynamizations\Event	
Event name	Click

Function list\ResetBit

Tag	SYSTEM START

Dynamizations\Appearance					
Tag - Cycle	SYSTEM START -	**Data type**	Range	**Range**	0..0
Foreground color	0, 0, 0	**Background color**	255, 0, 0	**Flashing**	No
Range	1..1	**Foreground color**	0, 0, 0	**Background color**	192, 192, 192
Flashing	No				

Text field_1

Type	Text field	**Name**	Text field_1	**X position**	405
Y position	10	**Width**	226	**Height**	23
Layer	0 - Layer_0	**Font**	Tahoma, 16px, style=Bold	**Text**	WAITING FOR OXIDIZER
Dynamizations\Visibility					
Tag - Cycle	OXIDIZER READY -	**Data type**	Range	**Start range**	0
End range	0	**Visibility**	Visible		

Text field_5

Type	Text field	**Name**	Text field_5	**X position**	438
Y position	10	**Width**	162	**Height**	23
Layer	0 - Layer_0	**Font**	Tahoma, 16px, style=Bold	**Text**	OXIDIZER READY
Dynamizations\Visibility					
Tag - Cycle	OXIDIZER READY -	**Data type**	Range	**Start range**	1
End range	1	**Visibility**	Visible		

Graphic view_1

Type	Graphic view	**Name**	Graphic view_1	**X position**	17
Y position	5	**Width**	235	**Height**	78
Layer	0 - Layer_0	**Graphic**	logoPRM	**Fit graphic to size**	Stretch graphic

GLACIER8135 / HMI_1 [TP900 Comfort] / HMI tags

Default tag table [251]

Tag_ScreenNumber

Name	Tag_ScreenNumber	**Display name**		**Address**	
Connection	<Internal tag>	**Data type**	UInt	**Length**	2

Dynamizations\Event	
Event name	Value change

Function list\ActivateScreenByNumber

Screen number	Tag_ScreenNumber	**Object number**	0

ALARM FLASHER

Name	ALARM FLASHER	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

ALARM FLASHER

ALARM RESET

Name	ALARM RESET	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

ALARM RESET

DB4_PULSECOUNTER

Name	DB4_PULSECOUNTER	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_MANUALINPUTFORTOTAL

Name	DB4_MANUALINPUTFORTOTAL	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 1

Name	DB4_setpoint 1	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 2

Name	DB4_setpoint 2	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 3

Name	DB4_setpoint 3	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 4

Name	DB4_setpoint 4	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 5

Name	DB4_setpoint 5	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 6

Name	DB4_setpoint 6	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 7

Name	DB4_setpoint 7	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 8

Name	DB4_setpoint 8	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 9

Name	DB4_setpoint 9	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 10

Name	DB4_setpoint 10	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 20

Name	DB4_setpoint 20	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 14

Name	DB4_setpoint 14	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 15

Name	DB4_setpoint 15	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 16

Name	DB4_setpoint 16	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 51

Name	DB4_setpoint 51	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 50

Name	DB4_setpoint 50	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 53

Name	DB4_setpoint 53	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 52

Name	DB4_setpoint 52	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 30

Name	DB4_setpoint 30	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 29

Name	DB4_setpoint 29	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 11

Name	DB4_setpoint 11	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 30(1)

Name	DB4_setpoint 30(1)	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 31

Name	DB4_setpoint 31	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 12

Name	DB4_setpoint 12	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 18

Name	DB4_setpoint 18	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 19

Name	DB4_setpoint 19	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 22

Name	DB4_setpoint 22	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 23

Name	DB4_setpoint 23	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 24

Name	DB4_setpoint 24	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 25

Name	DB4_setpoint 25	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 26

Name	DB4_setpoint 26	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 27

Name	DB4_setpoint 27	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 28

Name	DB4_setpoint 28	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 32

Name	DB4_setpoint 32	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 34

Name	DB4_setpoint 34	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 60

Name	DB4_setpoint 60	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 61

Name	DB4_setpoint 61	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 62

Name	DB4_setpoint 62	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 63

Name	DB4_setpoint 63	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_HM1

Name	DB4_HM1	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_HM2

Name	DB4_HM2	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_HM3

Name	DB4_HM3	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_HM4

Name	DB4_HM4	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_HM5

Name	DB4_HM5	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_HM6

Name	DB4_HM6	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_MANUALINPUTFOR TOTAL2

Name	DB4_MANUALINPUTFOR TOTAL2	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 36

Name	DB4_setpoint 36	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 38

Name	DB4_setpoint 38	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 41

Name	DB4_setpoint 41	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 43

Name	DB4_setpoint 43	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 44

Name	DB4_setpoint 44	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 39

Name	DB4_setpoint 39	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 59

Name	DB4_setpoint 59	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 13

Name	DB4_setpoint 13	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 17

Name	DB4_setpoint 17	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 21

Name	DB4_setpoint 21	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 33

Name	DB4_setpoint 33	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 42

Name	DB4_setpoint 42	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 35

Name	DB4_setpoint 35	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 45

Name	DB4_setpoint 45	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 46

Name	DB4_setpoint 46	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 47

Name	DB4_setpoint 47	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 48

Name	DB4_setpoint 48	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 49

Name	DB4_setpoint 49	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 54

Name	DB4_setpoint 54	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 55

Name	DB4_setpoint 55	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 56

Name	DB4_setpoint 56	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

AUTO 1

Name	AUTO 1	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

AUTO 1

AUTO 2

Name	AUTO 2	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

AUTO 2

AUTO 3

Name	AUTO 3	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

AUTO 3

AUTO 4

Name	AUTO 4	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

AUTO 4

AUTO 5

Name	AUTO 5	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

AUTO 5

HAND 1

Name	HAND 1	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

HAND 1

HAND 2

Name	HAND 2	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

HAND 2

HAND 3

Name	HAND 3	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

HAND 3

HAND 4

Name	HAND 4	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

HAND 4

HAND 5

Name	HAND 5	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

HAND 5

AUTO 6

Name	AUTO 6	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

AUTO 6

AUTO 7

Name	AUTO 7	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

AUTO 7

AUTO 8

Name	AUTO 8	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

AUTO 8

AUTO 9

Name	AUTO 9	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

AUTO 9

AUTO 10

Name	AUTO 10	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

AUTO 10

AUTO 11

Name	AUTO 11	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

AUTO 11

AUTO 12

Name	AUTO 12	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

AUTO 12

HAND 6

Name	HAND 6	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

HAND 6

HAND 7

Name	HAND 7	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

HAND 7

HAND 8

Name	HAND 8	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

HAND 8

HAND 9

Name	HAND 9	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

HAND 9

HAND 10

Name	HAND 10	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

HAND 10

HAND 11

Name	HAND 11	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

HAND 11

HAND 12

Name	HAND 12	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

HAND 12

DB4_setpoint 100

Name	DB4_setpoint 100	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_HM7

Name	DB4_HM7	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_HM8

Name	DB4_HM8	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_HM9

Name	DB4_HM9	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_HM10

Name	DB4_HM10	**Display name**		**Address**	

Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_HM11

Name	DB4_HM11	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_HM12

Name	DB4_HM12	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_Move PID 1

Name	DB4_Move PID 1	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 200

Name	DB4_setpoint 200	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 201

Name	DB4_setpoint 201	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 202

Name	DB4_setpoint 202	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 203

Name	DB4_setpoint 203	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 204

Name	DB4_setpoint 204	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 205

Name	DB4_setpoint 205	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

AUTO 13

Name	AUTO 13	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

AUTO 13

AUTO 14

Name	AUTO 14	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

AUTO 14

AUTO 15

Name	AUTO 15	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

AUTO 15

AUTO 16

Name	AUTO 16	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

AUTO 16

DB4_HM 13

Name	DB4_HM 13	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_HM 14

Name	DB4_HM 14	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_HM 15

Name	DB4_HM 15	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_HM 16

Name	DB4_HM 16	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

HAND 13

Name	HAND 13	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

HAND 13

HAND 14

Name	HAND 14	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

HAND 14

HAND 15

Name	HAND 15	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

HAND 15

HAND 16

Name	HAND 16	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

HAND 16

DB4_setpoint 101

Name	DB4_setpoint 101	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 102

Name	DB4_setpoint 102	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_Move PID 3

Name	DB4_Move PID 3	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_Move PID 5

Name	DB4_Move PID 5	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 57

Name	DB4_setpoint 57	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 58

Name	DB4_setpoint 58	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

LATCH MS HHL ALARM

Name	LATCH MS HHL ALARM	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH MS HHL ALARM

LATCH MS I/O

Name	LATCH MS I/O	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH MS I/O

ANIMATED LOGO

Name	ANIMATED LOGO	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

ANIMATED LOGO

HOME PRESSED

Name	HOME PRESSED	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

HOME PRESSED

DB4_T10 ON

Name	DB4_T10 ON	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Time_Of_Day	**Length**	4

DB4_T10 OFF

Name	DB4_T10 OFF	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Time_Of_Day	**Length**	4

DB4_T1 ON

Name	DB4_T1 ON	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Time_Of_Day	**Length**	4

DB4_T1 OFF

Name	DB4_T1 OFF	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Time_Of_Day	**Length**	4

DB4_T2 ON

Name	DB4_T2 ON	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Time_Of_Day	**Length**	4

DB4_T2 OFF

Name	DB4_T2 OFF	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Time_Of_Day	**Length**	4

DB4_T3 ON

Name	DB4_T3 ON	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Time_Of_Day	**Length**	4

DB4_T3 OFF

Name	DB4_T3 OFF	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Time_Of_Day	**Length**	4

DB4_T4 ON

Name	DB4_T4 ON	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Time_Of_Day	**Length**	4

DB4_T4 OFF

Name	DB4_T4 OFF	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Time_Of_Day	**Length**	4

DB4_T5 ON

Name	DB4_T5 ON	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Time_Of_Day	**Length**	4

DB4_T5 OFF

Name	DB4_T5 OFF	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Time_Of_Day	**Length**	4

DB4_T6 ON

Name	DB4_T6 ON	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Time_Of_Day	**Length**	4

DB4_T6 OFF

Name	DB4_T6 OFF	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Time_Of_Day	**Length**	4

DB4_T7 ON

Name	DB4_T7 ON	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Time_Of_Day	**Length**	4

DB4_T7 OFF

Name	DB4_T7 OFF	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Time_Of_Day	**Length**	4

DB4_T8 ON

Name	DB4_T8 ON	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Time_Of_Day	**Length**	4

DB4_T8 OFF

Name	DB4_T8 OFF	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Time_Of_Day	**Length**	4

DB4_T9 ON

Name	DB4_T9 ON	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Time_Of_Day	**Length**	4

DB4_T9 OFF

Name	DB4_T9 OFF	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Time_Of_Day	**Length**	4

DB4_setpoint 64

Name	DB4_setpoint 64	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 65

Name	DB4_setpoint 65	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 66

Name	DB4_setpoint 66	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 67

Name	DB4_setpoint 67	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 68

Name	DB4_setpoint 68	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 69

Name	DB4_setpoint 69	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 70

Name	DB4_setpoint 70	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_Move PID 7

Name	DB4_Move PID 7	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_Move PID 9

Name	DB4_Move PID 9	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_Move PID 11

Name	DB4_Move PID 11	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_Move PID 13

Name	DB4_Move PID 13	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_Move PID 15

Name	DB4_Move PID 15	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_Move PID 17

Name	DB4_Move PID 17	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_Move PID 19

Name	DB4_Move PID 19	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_Move PID 21

Name	DB4_Move PID 21	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_LT1

Name	DB4_LT1	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Time	**Length**	4

DB4_LT2

Name	DB4_LT2	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Time	**Length**	4

DB4_LT3

Name	DB4_LT3	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Time	**Length**	4

DB4_LT4

Name	DB4_LT4	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Time	**Length**	4

DB4_LT5

Name	DB4_LT5	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Time	**Length**	4

DB4_LT6

Name	DB4_LT6	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Time	**Length**	4

DB4_AUTO OILER CYCLE TIME

Name	DB4_AUTO OILER CYCLE TIME	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Time	**Length**	4

DB4_AUTO OILER OIL TIME

Name	DB4_AUTO OILER OIL TIME	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Time	**Length**	4

DB4_MS TOTAL

Name	DB4_MS TOTAL	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_OWS TOTAL

Name	DB4_OWS TOTAL	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_GW 1 TOTAL

Name	DB4_GW 1 TOTAL	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_GW 2 TOTAL

Name	DB4_GW 2 TOTAL	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_GW 3 TOTAL

Name	DB4_GW 3 TOTAL	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_GW 4 TOTAL

Name	DB4_GW 4 TOTAL	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_GW 5 TOTAL

Name	DB4_GW 5 TOTAL	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_GW 6 TOTAL

Name	DB4_GW 6 TOTAL	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

LATCH EXTRACTION ROOM HIGH TEMP

Name	LATCH EXTRACTION ROOM HIGH TEMP	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH EXTRACTION ROOM HIGH TEMP

LATCH EXTRACTION ROOM LOW TEMP

Name	LATCH EXTRACTION ROOM LOW TEMP	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH EXTRACTION ROOM LOW TEMP

LATCH PHASE LOSS ALARM

Name	LATCH PHASE LOSS ALARM	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH PHASE LOSS ALARM

MOTOR OVERLOAD

Name	MOTOR OVERLOAD	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

MOTOR OVERLOAD

DB4_GW 7 TOTAL

Name	DB4_GW 7 TOTAL	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_GW 8 TOTAL

Name	DB4_GW 8 TOTAL	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_GW 9 TOTAL

Name	DB4_GW 9 TOTAL	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

SYSTEM START

Name	SYSTEM START	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

SYSTEM START

DB4_DISCHARGE TOTAL

Name	DB4_DISCHARGE TOTAL	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_SCALED EXTRACTION ROOM TEMP

Name	DB4_SCALED EXTRACTION ROOM TEMP	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

LATCH EXTRACTION ROOM HIGH TEMP(1)

Name	LATCH EXTRACTION ROOM HIGH TEMP(1)	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH EXTRACTION ROOM HIGH TEMP

LATCH EXTRACTION ROOM LOW TEMP(1)

Name	LATCH EXTRACTION ROOM LOW TEMP(1)	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH EXTRACTION ROOM LOW TEMP

MS PUMP (P-300)

Name	MS PUMP (P-300)	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

MS PUMP (P-300)

DB4_SCALED LRP VACUUM

Name	DB4_SCALED LRP VACUUM	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_SCALED BIOREMEDIATION ROOM TEMP

Name	DB4_SCALED BIOREMEDIATION ROOM TEMP	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

LATCH SVE LRP VACUUM ALARM

Name	LATCH SVE LRP VACUUM ALARM	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH LRP VACUUM ALARM

LATCH LRP HIGH VACUUM ALARM

Name	LATCH LRP HIGH VACUUM ALARM	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH LRP HIGH VACUUM ALARM

LATCH BIOREMEDIATION ROOM HIGH TEMP ALARM

Name	LATCH BIOREMEDIATION ROOM HIGH TEMP ALARM	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH BIOREMEDIATION ROOM HIGH TEMP ALARM

LATCH BIOREMEDIATION ROOM LOW TEMP ALARM

Name	LATCH BIOREMEDIATION ROOM LOW TEMP ALARM	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH BIOREMEDIATION ROOM LOW TEMP ALARM

DB4_math 3

Name	DB4_math 3	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_math 4

Name	DB4_math 4	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_Move PID 2

Name	DB4_Move PID 2	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_SVE BLOWER AMPS

Name	DB4_SVE BLOWER AMPS	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_SPARGE AMPS

Name	DB4_SPARGE AMPS	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

LATCH PHASE LOSS ALARM(1)

Name	LATCH PHASE LOSS ALARM(1)	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH PHASE LOSS ALARM

DB4_setpoint 37

Name	DB4_setpoint 37	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 40

Name	DB4_setpoint 40	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_DISCHAGE TOTAL

Name	DB4_DISCHAGE TOTAL	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_setpoint 206

Name	DB4_setpoint 206	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

OXIDIZER READY

Name	OXIDIZER READY	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

OXIDIZER READY

DB4_SCALED LRP DISCHARGE PRESSURE (B-301)

Name	DB4_SCALED LRP DISCHARGE PRES-SURE (B-301)	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_SCALED LRP DISCHARGE FLOW (B-301)

Name	DB4_SCALED LRP DISCHARGE FLOW (B-301)	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_SCALED POST HEAT EXCHANGER TEMP (HEX-302)

Name	DB4_SCALED POST HEAT EXCHANGER TEMP (HEX-302)	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_SCALED TRANSFER PUMP DISCHARGE PRESSURE (P-400)

Name	DB4_SCALED TRANSFER PUMP DIS-CHARGE PRESSURE (P-400)	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_SCALED PRE CARBON PRESSURE

Name	DB4_SCALED PRE CARBON PRESSURE	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_SCALED MIXING TANK PUMP DISCHARGE PRESSURE (P-500)

Name	DB4_SCALED MIXING TANK PUMP DIS-CHARGE PRESSURE (P-500)	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_SCALED OXYGEN FEED PRESSURE

Name	DB4_SCALED OXYGEN FEED PRESSURE	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_SCALED POST VENTURI PRESSURE (IC-500)

Name	DB4_SCALED POST VENTURI PRESSURE (IC-500)	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_SCALED REINJECTION FLOW

Name	DB4_SCALED REINJECTION FLOW	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_SCALED FALCO ENTRANCE TEMP

Name	DB4_SCALED FALCO ENTRANCE TEMP	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_SCALED FALCO INTERNAL TEMP

Name	DB4_SCALED FALCO INTERNAL TEMP	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

DB4_SCALED FALCO EXIT TEMP

Name	DB4_SCALED FALCO EXIT TEMP	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Real	**Length**	4

LRP (B-301)

Name	LRP (B-301)	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LRP (B-301)

TRANSFER PUMP (P-400)

Name	TRANSFER PUMP (P-400)	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

TRANSFER PUMP (P-400)

TRANSFER PUMP (P-401)

Name	TRANSFER PUMP (P-401)	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

TRANSFER PUMP (P-401)

MIXER (T-500)

Name	MIXER (T-500)	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

MIXER (T-500)

MIXING PUMP (T-500)

Name	MIXING PUMP (T-500)	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

MIXING PUMP (T-500)

LATCH LRP DISCHARGE PRESSURE (B-301) HIGH PRESSURE

Name	LATCH LRP DISCHARGE PRESSURE (B-301) HIGH PRESSURE	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH LRP DISCHARGE PRESSURE (B-301) HIGH PRESSURE

LATCH POST HEAT EXCHANGER TEMP (HEX-302) HIGH TEMP

Name	LATCH POST HEAT EXCHANGER TEMP (HEX-302) HIGH TEMP	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH POST HEAT EXCHANGER TEMP (HEX-302) HIGH TEMP

LATCH TRANSFER PUMP DISCHARGE PRESSURE (P-400) HIGH PRESSURE

Name	LATCH TRANSFER PUMP DISCHARGE PRESSURE (P-400) HIGH PRESSURE	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH TRANSFER PUMP DISCHARGE PRESSURE (P-400) HIGH PRESSURE

LATCH PRE CARBON PRESSURE HIGH PRESSURE

Name	LATCH PRE CARBON PRESSURE HIGH PRESSURE	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH PRE CARBON PRESSURE HIGH PRESSURE

LATCH MIXING TANK PUMP DISCHARGE PRESSURE (P-500) HIGH PRESSURE

Name	LATCH MIXING TANK PUMP DIS-CHARGE PRESSURE (P-500) HIGH PRES-SURE	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH MIXING TANK PUMP DISCHARGE PRESSURE (P-500) HIGH PRESSURE

LATCH OXYGEN FEED PRESSURE LOW PRESSURE

Name	LATCH OXYGEN FEED PRESSURE LOW PRESSURE	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH OXYGEN FEED PRESSURE LOW PRESSURE

LATCH OXYGEN FEED PRESSURE HIGH PRESSURE

Name	LATCH OXYGEN FEED PRESSURE HIGH PRESSURE	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH OXYGEN FEED PRESSURE HIGH PRESSURE

LATCH POST VENTURI LOW PRESSURE

Name	LATCH POST VENTURI LOW PRESSURE	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH POST VENTURI LOW PRESSURE

LATCH POST VENTURI HIGH PRESSURE

Name	LATCH POST VENTURI HIGH PRESSURE	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH POST VENTURI HIGH PRESSURE

LATCH LRP TEMP SWITCH ALARM (B-301)

Name	LATCH LRP TEMP SWITCH ALARM (B-301)	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH LRP TEMP SWITCH ALARM (B-301)

LATCH LRP LOW OIL ALARM (B-301)

Name	LATCH LRP LOW OIL ALARM (B-301)	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH LRP LOW OIL ALARM (B-301)

LATCH LRP HIGH OIL ALARM (B-301)

Name	LATCH LRP HIGH OIL ALARM (B-301)	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH LRP HIGH OIL ALARM (B-301)

LATCH STORAGE TANK HIGH LEVEL ALARM (T-301)

Name	LATCH STORAGE TANK HIGH LEVEL ALARM (T-301)	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH STORAGE TANK HIGH LEVEL ALARM (T-301)

LATCH STORAGE TANK HIGH LEVEL ALARM (T-400)

Name	LATCH STORAGE TANK HIGH LEVEL ALARM (T-400)	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH STORAGE TANK HIGH LEVEL ALARM (T-400)

LATCH MIXING TANK HIGH LEVEL ALARM (T-500)

Name	LATCH MIXING TANK HIGH LEVEL ALARM (T-500)	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH MIXING TANK HIGH LEVEL ALARM (T-500)

LATCH MIXING TANK I/O (T-500)

Name	LATCH MIXING TANK I/O (T-500)	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH MIXING TANK I/O (T-500)

LATCH MS HHL ALARM(1)

Name	LATCH MS HHL ALARM(1)	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH MS HHL ALARM

LATCH MS I/O(1)

Name	LATCH MS I/O(1)	**Display name**		**Address**	

Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH MS I/O

LATCH STORAGE TANK I/O (T-301)

Name	LATCH STORAGE TANK I/O (T-301)	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH STORAGE TANK I/O (T-301)

LATCH STORAGE TANK I/O (T-400)

Name	LATCH STORAGE TANK I/O (T-400)	**Display name**		**Address**	
Connection	HMI_connection	**Data type**	Bool	**Length**	1

LATCH STORAGE TANK I/O (T-400)

GLACIER8135 / HMI_1 [TP900 Comfort]

Connections

HMI_connection

Name	HMI_connection	Communication driver	SIMATIC S7 1200	Comment	

GLACIER8135 / HMI_1 [TP900 Comfort] / HMI alarms

Discrete alarms

This folder is empty.

GLACIER8135 / HMI_1 [TP900 Comfort] / HMI alarms

Analog alarms

This folder is empty.

GLACIER8135 / HMI_1 [TP900 Comfort] / HMI alarms

Alarm groups

This folder is empty.

GLACIER8135 / HMI_1 [TP900 Comfort] / HMI alarms

Alarm classes

Acknowledgement

Name	Acknowledgement	**Display name**	A	**ID**	35
Alarm log	<No log>				

Diagnosis events

Name	Diagnosis events	**Display name**	S7	**ID**	4
Alarm log	<No log>				

Errors

Name	Errors	**Display name**	!	**ID**	1
Alarm log	<No log>				

No Acknowledgement

Name	No Acknowledgement	**Display name**	NA	**ID**	36
Alarm log	<No log>				

System

Name	System	**Display name**	$	**ID**	3
Alarm log	<No log>				

System_Acknowledgement

Name	System_Acknowledgement	**Display name**	System_Acknowledgement	**ID**	33
Alarm log	<No log>				

System_No_Acknowledgement

Name	System_No_Acknowledgement	**Display name**	System_No_Acknowledgement	**ID**	34
Alarm log	<No log>				

Warnings

Name	Warnings	**Display name**		**ID**	2
Alarm log	<No log>				

GLACIER8135 / HMI_1 [TP900 Comfort] / HMI alarms

Controller alarms

This folder is empty.

GLACIER8135 / HMI_1 [TP900 Comfort] / HMI alarms

System events

This folder is empty.

GLACIER8135 / HMI_1 [TP900 Comfort]

Recipes

This folder is empty.

GLACIER8135 / HMI_1 [TP900 Comfort] / Historical data

Datalogs

Analog

Name	Analog	**Storage location**	CSV file (ASCII)	**Path**	\Storage Card USB\

Logging_tag_24

Name	Logging_tag_24	**Process tag**	DB4_SCALED EXTRACTION ROOM TEMP	**Process tag type**	Analog

Logging_tag_4

Name	Logging_tag_4	**Process tag**	DB4_SCALED LRP VACUUM	**Process tag type**	Analog

Logging_tag_16

Name	Logging_tag_16	**Process tag**	DB4_SCALED BIOREMEDIATION ROOM TEMP	**Process tag type**	Analog

Logging_tag_17

Name	Logging_tag_17	**Process tag**	DB4_DISCHAGE TOTAL	**Process tag type**	Analog

Logging_tag_1

Name	Logging_tag_1	**Process tag**	DB4_SCALED LRP DISCHARGE PRES-SURE (B-301)	**Process tag type**	Analog

Logging_tag_2

Name	Logging_tag_2	**Process tag**	DB4_SCALED LRP DISCHARGE FLOW (B-301)	**Process tag type**	Analog

Logging_tag_3

Name	Logging_tag_3	**Process tag**	DB4_SCALED POST HEAT EXCHANGER TEMP (HEX-302)	**Process tag type**	Analog

Logging_tag_5

Name	Logging_tag_5	**Process tag**	DB4_SCALED TRANSFER PUMP DIS-CHARGE PRESSURE (P-400)	**Process tag type**	Analog

Logging_tag_6

Name	Logging_tag_6	**Process tag**	DB4_SCALED PRE CARBON PRESSURE	**Process tag type**	Analog

Logging_tag_7

Name	Logging_tag_7	**Process tag**	DB4_SCALED MIXING TANK PUMP DIS-CHARGE PRESSURE (P-500)	**Process tag type**	Analog

Logging_tag_8

Name	Logging_tag_8	**Process tag**	DB4_SCALED OXYGEN FEED PRESSURE	**Process tag type**	Analog

Logging_tag_9

Name	Logging_tag_9	**Process tag**	DB4_SCALED POST VENTURI PRESSURE (IC-500)	**Process tag type**	Analog

Logging_tag_10

Name	Logging_tag_10	**Process tag**	DB4_SCALED REINJECTION FLOW	**Process tag type**	Analog

Logging_tag_11

Name	Logging_tag_11	**Process tag**	DB4_SCALED FALCO ENTRANCE TEMP	**Process tag type**	Analog

Logging_tag_12

Name	Logging_tag_12	**Process tag**	DB4_SCALED FALCO INTERNAL TEMP	**Process tag type**	Analog

Logging_tag_13

Name	Logging_tag_13	**Process tag**	DB4_SCALED FALCO EXIT TEMP	**Process tag type**	Analog

Discrete

Name	Discrete	**Storage location**	CSV file (ASCII)	**Path**	\Storage Card USB\

Logging_tag_3

Name	Logging_tag_3	**Process tag**	LATCH MS HHL ALARM	**Process tag type**	Binary

Logging_tag_22

Name	Logging_tag_22	**Process tag**	LATCH PHASE LOSS ALARM	**Process tag type**	Binary

Logging_tag_23

Name	Logging_tag_23	Process tag	LATCH EXTRACTION ROOM HIGH TEMP	Process tag type	Binary

Logging_tag_24

Name	Logging_tag_24	Process tag	LATCH EXTRACTION ROOM LOW TEMP	Process tag type	Binary

Logging_tag_1

Name	Logging_tag_1	Process tag	LATCH BIOREMEDIATION ROOM HIGH TEMP ALARM	Process tag type	Binary

Logging_tag_2

Name	Logging_tag_2	Process tag	LATCH BIOREMEDIATION ROOM LOW TEMP ALARM	Process tag type	Binary

Logging_tag_12

Name	Logging_tag_12	Process tag	LATCH PHASE LOSS ALARM(1)	Process tag type	Binary

Logging_tag_15

Name	Logging_tag_15	Process tag	LATCH LRP HIGH VACUUM ALARM	Process tag type	Binary

Logging_tag_4

Name	Logging_tag_4	Process tag	LATCH LRP DISCHARGE PRESSURE (B-301) HIGH PRESSURE	Process tag type	Binary

Logging_tag_5

Name	Logging_tag_5	Process tag	LATCH LRP HIGH OIL ALARM (B-301)	Process tag type	Binary

Logging_tag_6

Name	Logging_tag_6	Process tag	LATCH LRP LOW OIL ALARM (B-301)	Process tag type	Binary

Logging_tag_7

Name	Logging_tag_7	Process tag	LATCH LRP TEMP SWITCH ALARM (B-301)	Process tag type	Binary

Logging_tag_8

Name	Logging_tag_8	Process tag	LATCH SVE LRP VACUUM ALARM	Process tag type	Binary

Logging_tag_9

Name	Logging_tag_9	Process tag	LATCH MIXING TANK HIGH LEVEL ALARM (T-500)	Process tag type	Binary

Logging_tag_10

Name	Logging_tag_10	Process tag	LATCH MIXING TANK I/O (T-500)	Process tag type	Binary

Logging_tag_11

Name	Logging_tag_11	Process tag	LATCH MIXING TANK PUMP DIS-CHARGE PRESSURE (P-500) HIGH PRES-SURE	Process tag type	Binary

Logging_tag_13

Name	Logging_tag_13	Process tag	LATCH MS HHL ALARM(1)	Process tag type	Binary

Logging_tag_14

Name	Logging_tag_14	Process tag	LATCH MS I/O(1)	Process tag type	Binary

Logging_tag_16

Name	Logging_tag_16	Process tag	LATCH OXYGEN FEED PRESSURE HIGH PRESSURE	Process tag type	Binary

Logging_tag_17

Name	Logging_tag_17	Process tag	LATCH OXYGEN FEED PRESSURE LOW PRESSURE	Process tag type	Binary

Logging_tag_18

Name	Logging_tag_18	Process tag	LATCH POST HEAT EXCHANGER TEMP (HEX-302) HIGH TEMP	Process tag type	Binary

Logging_tag_19

Name	Logging_tag_19	Process tag	LATCH POST VENTURI HIGH PRESSURE	Process tag type	Binary

Logging_tag_20

Name	Logging_tag_20	Process tag	LATCH POST VENTURI LOW PRESSURE	Process tag type	Binary

Logging_tag_21

Name	Logging_tag_21	**Process tag**	LATCH PRE CARBON PRESSURE HIGH PRESSURE	**Process tag type**	Binary

Logging_tag_25

Name	Logging_tag_25	**Process tag**	LATCH STORAGE TANK HIGH LEVEL ALARM (T-301)	**Process tag type**	Binary

Logging_tag_26

Name	Logging_tag_26	**Process tag**	LATCH STORAGE TANK HIGH LEVEL ALARM (T-400)	**Process tag type**	Binary

Logging_tag_27

Name	Logging_tag_27	**Process tag**	LATCH STORAGE TANK I/O (T-301)	**Process tag type**	Binary

Logging_tag_28

Name	Logging_tag_28	**Process tag**	LATCH STORAGE TANK I/O (T-400)	**Process tag type**	Binary

Logging_tag_29

Name	Logging_tag_29	**Process tag**	LATCH TRANSFER PUMP DISCHARGE PRESSURE (P-400) HIGH PRESSURE	**Process tag type**	Binary

GLACIER8135 / HMI_1 [TP900 Comfort] / Historical data

AlarmLogs

This folder is empty.

GLACIER8135 / HMI_1 [TP900 Comfort] / Scripts

VB scripts

This folder is empty.

GLACIER8135 / HMI_1 [TP900 Comfort]

Scheduled tasks

Return To Home

Name	Return To Home	**Trigger**	1 Hour	**Task type**	Function list

Dynamizations\Event			
Event name	Tag trigger	**Trigger**	<cyclic> - 1 h

Task_1

Name	Task_1	**Trigger**	Daily	**Task type**	Function list

Dynamizations\Event	
Event name	Tag trigger

GLACIER8135 / HMI_1 [TP900 Comfort]

Cycles

1 h

Name	1 h	**Cycle time**	1	**Cycle unit**	Hour

1 min

Name	1 min	**Cycle time**	1	**Cycle unit**	Minute

1 s

Name	1 s	**Cycle time**	1	**Cycle unit**	Second

10 min

Name	10 min	**Cycle time**	10	**Cycle unit**	Minute

10 s

Name	10 s	**Cycle time**	10	**Cycle unit**	Second

100 ms

Name	100 ms	**Cycle time**	100	**Cycle unit**	Millisecond

12hr

Name	12hr	**Cycle time**	12	**Cycle unit**	Hour

2 s

Name	2 s	**Cycle time**	2	**Cycle unit**	Second

2MIN

Name	2MIN	**Cycle time**	2	**Cycle unit**	Minute

5 min

Name	5 min	**Cycle time**	5	**Cycle unit**	Minute

5 s

Name	5 s	**Cycle time**	5	**Cycle unit**	Second

500 ms

Name	500 ms	**Cycle time**	500	**Cycle unit**	Millisecond

Cycle_1

Name	Cycle_1	**Cycle time**	18	**Cycle unit**	Hour

GLACIER8135 / HMI_1 [TP900 Comfort] / Reports

Report_1

Name	Report_1	**With header**	Checked	**With footer**	Checked
With title page	Unchecked	**With back page**	Unchecked		

Header

Hardcopy of Header

Name	Header

Detail page 1

Hardcopy of Detail page 1

Name	Detail page 1

Footer

Hardcopy of Footer

Name	Footer

GLACIER8135 / HMI_1 [TP900 Comfort] / Text and graphic lists

Text lists

_OFF_ON

Name	_OFF_ON	List range	Value/Range	Comment	

Value: 0

Entry type	Single value	Text	OFF

Value: 1

Entry type	Single value	Text	ON

TextList_ScreenNames

Name	TextList_ScreenNames	List range	Value/Range	Comment	

Value: 1

Entry type	Single value	Text	HOME SCREEN

Value: 2

Entry type	Single value	Text	ALARM SCREEN

Value: 3

Entry type	Single value	Text	HAND SCREEN

Value: 4

Entry type	Single value	Text	STATUS SCREEN

Value: 5

Entry type	Single value	Text	System screens

Value: 6

Entry type	Single value	Text	SIMATIC PLC Status/Force

Value: 7

Entry type	Single value	Text	Project information

Value: 8

Entry type	Single value	Text	Different jobs

Value: 9

Entry type	Single value	Text	System settings

Value: 10

Entry type	Single value	Text	User administration

Value: 11

Entry type	Single value	Text	System information

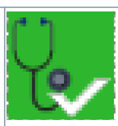
GLACIER8135 / HMI_1 [TP900 Comfort] / Text and graphic lists

Graphic lists

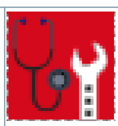
@DiagnosticsStates

Name	@DiagnosticsStates	List range	Value/Range	Comment	

Value: 0

Graphic: @Diagnostics_StateGood	
Entry type	Single value

Value: 1

Graphic: @Diagnostics_StateBad	
Entry type	Single value

GLACIER8135 / HMI_1 [TP900 Comfort] / User administration

User

admin

Name	admin	**Number**	1	**Automatic logoff**	Checked
Logoff time	20	**Groups**	Administrator group;		

User

Name	User	**Number**	2	**Automatic logoff**	Checked
Logoff time	20	**Groups**	Administrator group;		

GLACIER8135 / HMI_1 [TP900 Comfort] / User administration

Groups

Administrator group

Name	Administrator group	**Display name**	Administrator group	**Number**	1
Authorizations	User administration; Monitor; Oper-ate;				

Users

Name	Users	**Display name**	Users	**Number**	2
Authorizations	Operate;				

GLACIER8135 / HMI_1 [TP900 Comfort] / User administration

Authorizations

Monitor

Name	Monitor	**Authorization**	Monitor	**Authorization number**	2

Operate

Name	Operate	**Authorization**	Operate	**Authorization number**	3

user

Name	user	**Authorization**	Authorization_1	**Authorization number**	4

User administration

Name	User administration	**Authorization**	User administration	**Authorization number**	1

GLACIER8135

Ungrouped devices

This folder is empty.

GLACIER8135

Security settings

This folder is empty.

GLACIER8135 / Common data

Alarm classes

Alarm classes			
Name	**Display name**	**Acknowledgment**	**Priority**
System_Acknowledgement	System_Acknowledgement	True	0
System_No_Acknowledgement	System_No_Acknowledgement	False	0
Acknowledgement	A	True	0
No Acknowledgement	NA	False	0

GLACIER8135 / Common data

Logs

This folder is empty.

GLACIER8135 / Common data

Styles

This folder is empty.

GLACIER8135 / Languages & resources

Project languages

Languages
Reference language
English (United States)

Editing language
English (United States)

Other project languages
Empty

GLACIER8135 / Languages & resources / Project texts

Project texts

Project texts		
English (United States)	**Category**	**Reference**
	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\Scale Block [FB2]\Network 1\Comment
	Other text category	GLACIER8135\Comment
	Comment Text Category	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\SIMATIC 1200 station_1\Comment
	Comment Text Category	Pulse_3\Comment
	Comment Text Category	Pulse_4\Comment
	Comment Text Category	PROFINET interface_1\Comment
	Comment Text Category	Port_1\Comment
	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\Warnings\alarmclass name not set_1\AlarmClassData_IDisplayNaming_DisplayName
	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\System_Acknowledgement\\AlarmClassData_IDisplayNaming_DisplayName
	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\System_No_Acknowledgement\\AlarmClassData_IDisplayNaming_DisplayName
	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\Acknowledgement\\AlarmClassData_IDisplayNaming_DisplayName
	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\No Acknowledgement\\AlarmClassData_IDisplayNaming_DisplayName
	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\home\Text Field_3\Text
"Complete Restart"	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\Startup [OB100]\Block title
"Main Program Sweep (Cycle)"	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\Main [OB1]\Block title
!	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\Errors\alarmclass name not set\AlarmClassData_IDisplayNaming_DisplayName
!!	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\Safety warnings\alarmclass name not set_4\AlarmClassData_IDisplayNaming_DisplayName
$	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\System\alarmclass name not set_2\AlarmClassData_IDisplayNaming_DisplayName
	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Button_2\Text OFF
	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Button_2\Text ON
	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Button_4\Text OFF
	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Button_4\Text ON
	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_2\Text ON
	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_2\Text OFF
	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Button_1\Text ON
	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Button_1\Text OFF
	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Button_1\Text ON
	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Button_1\Text OFF
	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Button_1\Text ON
	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Button_1\Text OFF
	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Button_3\Text ON
	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Button_3\Text OFF
	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Button_6\Text ON
	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Button_6\Text OFF
	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Button_7\Text ON
	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Button_7\Text OFF
	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Button_8\Text ON
	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Button_8\Text OFF
	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Button_2\Text ON
	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Button_2\Text OFF
	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN 2\Button_2\Text ON
	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN 2\Button_2\Text OFF
	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN 2\Button_1\Text ON
	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN 2\Button_1\Text OFF
ALARM SCREEN	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\home\Button_17\Text OFF
BIOREMEDIATION ROOM TEMP FAN SETPOINT	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text Field_11\Text
BIOREMEDIATION RM TEMP ALARM	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN 2\Text Field_19\Text
BIOREMEDIATION RM TEMP	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_27\Text
EXIT RUNTIME	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\home\Button_19\Text OFF
EXTRACTION RM TEMP	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_37\Text
EXTRACTION ROOM TEMP FAN SETPOINT	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text Field_18\Text
EXTRACTION ROOM TEMP ALARM	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN 2\Text Field_15\Text
EXTRACTION SOLENOIDS	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text field_26\Text
FALCO ENTRANCE TEMP	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_41\Text
FALCO EXIT TEMP	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_45\Text
FALCO INTERNAL TEMP	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_43\Text
FALCO READY	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN 2\Text Field_5\Text
FAN SETPOINT	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text Field_19\Text

English (United States)	Category	Reference
HEATER SETPOINT	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text Field_4\Text
HEATER SETPOINT	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text Field_6\Text
HIGH PRESSURE SETPOINT	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_4\Text
HIGH PRESSURE SETPOINT	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_51\Text
HIGH PRESSURE SETPOINT	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_22\Text
HIGH PRESSURE SETPOINT	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_7\Text
HIGH PRESSURE SETPOINT	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_13\Text
HIGH PRESSURE SETPOINT	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_21\Text
HIGH TEMP SETPOINT	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_46\Text
HIGH TEMP SETPOINT	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN 2\Text Field_21\Text
HIGH TEMP SETPOINT	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN 2\Text Field_23\Text
HIGH VAC SETPOINT	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_16\Text
HOA SCREEN	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\home\Button_20\Text OFF
INJECTION SOLENOIDS	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text field_31\Text
LOW PRESSURE SETPOINT	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_18\Text
LOW PRESSURE SETPOINT	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_25\Text
LOW TEMP SETPOINT	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN 2\Text Field_25\Text
LOW TEMP SETPOINT	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN 2\Text Field_27\Text
LOW VAC SETPOINT	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_54\Text
LRP DISCHARGE FLOW (B-301)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_4\Text
LRP DISCHARGE PRESSURE (B-301)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_2\Text
LRP DISCHARGE PRESSURE (B-301)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_1\Text
LRP HIGH OIL SWITCH (B-301)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN 2\Text Field_1\Text
LRP HIGH TEMP SWITCH (B-301)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN 2\Text Field_35\Text
LRP LOW OIL SWITCH (B-301)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN 2\Text Field_34\Text
LRP VACUUM (B-301)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_15\Text
LRP VACUUM ALARM (B-301)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_11\Text
LRP (B-301)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Text Field_4\Text
MANUAL MOTOR OPERATION SCREEN NOTE:HOLDING SWITCHES IN HAND MAY CAUSE DAMAGE TO PUMPS OR MOTORS. ALL SWITCHES WILL BYPASS SYSTEM ALARMS.	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text Field_8\Text
MANUAL SCREEN	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\home\Button_3\Text OFF
MIXER (T-500)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Text Field_25\Text
MIXING PUMP (T-500)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Text Field_29\Text
MIXING TANK PMP DISCHARGE PRESS (P-500)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_5\Text
MIXING TANK PMP PRESS(P-500)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_25\Text
MIXING TANK HIGH LEVEL (T-500)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN 2\Text Field_4\Text
MOTOR OVERLOAD ALARM	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN 2\Text Field_6\Text
MS HIGH LEVEL ALARM (T-300)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN 2\Text Field_41\Text
MS PUMP (P-300)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Text Field_7\Text
OXYGEN FEED PRESSURE ALARM	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_9\Text
OXYGEN FEED PRESSURE	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_16\Text
POST HEX-301 TEMP ALARM	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_43\Text
POST HEX-302 TEMP	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_9\Text
POST VENTURI PRESS(IC-500)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_31\Text
POST VENTURI PRESSURE ALARM	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_19\Text

English (United States)	Category	Reference
PRE CARBON PRESSURE ALARM	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_8\Text
PRE CARBON PRESSURE	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_23\Text
REINJECTION FLOW	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_35\Text
ROOM TEMP	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text Field_14\Text
ROOM TEMP	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text Field_21\Text
STATUS SCREEN	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\home\Button_1\Text OFF
STORAGE TANK HIGH LEVEL (T-301)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN 2\Text Field_3\Text
STORAGE TANK HIGH LEVEL (T-400)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN 2\Text Field_2\Text
SYSTEM START	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screen management\Permanent area\Button_1\Text OFF
SYSTEM STOP	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screen management\Permanent area\Button_3\Text OFF
TEMP DIFFERENTIAL	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text Field_16\Text
TEMP DIFFERENTIAL	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text Field_3\Text
TOTAL DISCHARGE	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_29\Text
TRANSFER PUMP (P-400)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Text Field_2\Text
TRANSFER PUMP (P-401)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Text Field_17\Text
TRANSFER PUMP DISCH PRESS (P-400)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_49\Text
TRANSFER PUMP DIS-PRESS(P-400)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_21\Text
Welcome to the Glacier Environmental LRP Extraction System. You are logged in and have access to the system from this main screen. Use the buttons to the left to explore system operation and monitoring	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\home\Text Field_1\Text
°F	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_44\Text
°F	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text Field_13\Text
°F	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text Field_17\Text
°F	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text Field_20\Text
°F	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text Field_22\Text
°F	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text Field_24\Text
°F	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_10\Text
°F	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text Field_5\Text
°F	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text Field_7\Text
°F	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_28\Text
°F	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_38\Text
°F	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_42\Text
°F	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_44\Text
°F	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_46\Text
°F	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN 2\Text Field_20\Text
°F	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN 2\Text Field_24\Text
°F	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN 2\Text Field_17\Text
°F	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN 2\Text Field_26\Text
0-->1; 1 = Enable the drive (OFF2 / OFF 3 are 1 in default status) (OFF1 = 0-->1)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\EnableAxis
1 = Acknowledge drive error	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\AckError
1 = Drive is enabled	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\AxisEnabled
1 = Drive lockout active	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\Lockout
1 = Error (FB and Infeed)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\Error
A	Alarm class text	GLACIER8135\Acknowledgement\AlarmClassData_IDisplayNaming_DisplayName
A	Alarm class text	GLACIER8135\Acknowledgement\ShortName
A	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\Errors\AcknowledgedText
A	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\Warnings\AcknowledgedText
A	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\System\AcknowledgedText
A	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\Diagnosis events\AcknowledgedText
A	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\System_Acknowledgement\Acknowledged-Text
A	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\System_No_Acknowledgement\Acknowl-edgedText
A	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\Acknowledgement\AcknowledgedText
A	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\No Acknowledgement\AcknowledgedText
A	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\Safety warnings\AcknowledgedText
Actual in [U/min]	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\ActVelocity
Administrator group	HMI runtime	GLACIER8135\HMI_1 [TP900 Comfort]\User administration\Administrator group\DisplayName
ALARM RESET	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screen management\Permanent area\Button_2\Text OFF
ALARM SCREEN	HMI runtime	GLACIER8135\HMI_1 [TP900 Comfort]\Text and graphic lists\TextList_ScreenNames \Text_list_entry_2\Text
Antriebsobjekt ID	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\syAxisNo
Attribute of parameters (0x10=Value, 0x30=Text)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sxReqPara-Multi.sxParaAdress.syAttr
Authorization_1	HMI runtime	GLACIER8135\HMI_1 [TP900 Comfort]\User administration\user\ShortName

English (United States)	Category	Reference
Authorize 'User administration' for managing users in the user view in Runtime.	HMI comment	GLACIER8135\HMI_1 [TP900 Comfort]\User administration\User administration\Comment
AUTO	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Text Field_6\Text
AUTO	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Text Field_18\Text
AUTO	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Text Field_8\Text
AUTO	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Text Field_10\Text
AUTO	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Text Field_23\Text
AUTO	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Text Field_27\Text
AUTO	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Text Field_31\Text
Axis (0x0=Axis A | 0x1=Axis B)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sxReqParaMulti.sxHeader.syAxisNo
Axis (0x0=Axis A | 0x1=Axis B)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sxRespParaMulti.sxHeader.syAxisNo
Axis (0x0=Axis A | 0x1=Axis B)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sxChaParaMulti.sxHeader.syAxisNo
BANK 1	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text Field_27\Text
BANK 1	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text Field_32\Text
BANK 2	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text Field_28\Text
BANK 2	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text Field_33\Text
BANK 3	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text Field_29\Text
BANK 3	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text Field_34\Text
BANK 4	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text Field_30\Text
BANK 4	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text Field_35\Text
binary programmed input to control all functions in the telegram without its own function block input	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\ConfigAxis
Buffer of Recv-Value	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\pdRecvBuf
Buffer of Send-Value	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\pdSendBuf
Commando "Read"	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sbRead
Commando "Write"	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sbWrite
Compact PID_Controller with self-tuning	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\System blocks\Program resources\PID_Compact [FB1130]\Block title
Configured diagnosis address of the module (DEC) for WRREC and RDREC Output variables	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\hardwareId
Copyright (C) Siemens AG 2012. All Rights Reserved. Confidential -- SINA_PARA_S: Austausch eines beliebigen Parameter zwischen SINAMICS S120/G120 <-> S7 --- Ersteller: J.B. Typical Team Datum: 25.06.14 Vers.:3.0 Übernahme vom SINA_PARA Verion 2.9 und Abänderung zu SINA_PARA_S Austausch nur noch eines Parameters Änderung: J.B. Typical Team 08.07.14 3.1 Fehlerkorrektur und Initialisierung Änderung Änderung: J.B. Typical Team 30.07.14 4.0 Festlegung auf einheitlicher neuer Version 4.0 Änderung: G.F. Typical Team 20.05.15 4.1 Fehler bei der Umrechnung der Parameterwerte behoben Änderung: G.F. Typical Team 15.09.15 4.2 Defaultwert des Parameters AxisNo von 0 auf 1 geändert Änderung: G.F. Typical Team 06.10.15 4.3 Defaultwert des Parameters Done von 0 auf 1 geändert Änderung: J.B. Typical Team 08.12.15 4.4 1. Wenn beim Parameter "Lesen" ein Fehler zurück gemeldet wird, soll das "Schreiben" abgebrochen werden 2. Für den Datentyp DWORD mit/ohne Vorzeichen neuer Ablageort (statt REAL nun DINT) 3. Neue Ausgangsvariable Ready = Lesen/Schreiben der Parameter abgeschlossen 4. Austauch der Parameter kann jetzt abgebrochen werden 5. Warnung durch Initialisierung elimininiert 6. Eingang Laddr in hardwareId umbenannt Änderung: G.F. Typical Team 24.11.16 4.5 - Fehlerausgabe bei unbekannten Datentyp (ErrorId := 5) - Datentyp 10 (OctetString) wird unterstützt - Datentyp 13 (TimeDifference) wird unterstützt - Fehler bei Auftrag abbrechen behoben Änderung: G.F. Typical Team 11.01.17 5.0 - Festlegung auf einheitlicher neuer Version 5.0 Bibliothek V7 Funktion: Austausch eines beliebigen Parameter zwischen SINAMICS S120/G120 <-> S7 **FB283**	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\Block comment

English (United States)	Category	Reference
Copyright (C) Siemens AG 2012. All Rights Reserved. Confidential -- SINA_SPEED: Drehzahlregelung mit dem Antriebsbaustein SINAMICS S120/ G120 <-> S7-1200 --- Ersteller: Siemens AG Erlangen A&D MC PM Datum: 07.07.10 Vers.:2.1 Ã„nderung: J.B. Typical Team 07.12.12 2.2 Umsetzung in SCL / TIA Ã„nderung: J.B. Typical Team 29.04.13 2.3 1. "Q" an den AusgÃ¤nge entfernen 2. Neuer Ausgang PwrInhibit Ã„nderung: J.B. Typical Team 28.06.13 2.4 Ã„nderung HW-Zugriff Ã¼ber LOG2MOD Ã„nderung: J.B. Typical Team 18.07.13 2.5 Ã„nderung HW-Zugriff Ã¼ber zwei HW-EingÃ¤nge Ã„nderung: J.B. Typical Team 17.07.14 3.0 Optimmierung Ã„nderung: J.B. Typical Team 30.07.14 4.0 Festlegung auf einheitlicher neuer Version 4.0 Ã„nderung: P.Z. Typical Team 03.12.15 4.1 Schnittstelle an Programmierleitfadeb TIA-Potal angepasst zusÃ¤tzlicher Eingang "ConfigAxis" fÃ¼r STW-Bits Ã„nderung: G.F. Typical Team 01.03.16 4.2 Sollwert auf INT - Grenzen begrenzt Ã„nderung: F.G. Typical Team 13.09.16 4.3 Ausgabewerte am Ausgang "Status" angepasst Ã„nderung: G.F. Typical Team 11.01.17 5.0 - Festlegung auf einheitlicher neuer Version 5.0 Bibliothek V7 Funktion: Drehzahlregelung mit dem Antriebsbaustein SINAMICS S120/G120 <-> S7-1200 ** **FB283***	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\Block comment
Data record written with SFB WRREC	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sbWrDone
Different jobs	HMI runtime	GLACIER8135\HMI_1 [TP900 Comfort]\Text and graphic lists\TextList_ScreenNames \Text_list_entry_8\Text
Empfangspuffer Static variables	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\swRecvBuf
Error codes of the cyclic system funtion blocks DPWR / DPRD_DAT	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\DiagId
Error number	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\pwErrorNo
Error number (see table below)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\ErrorNo
Error of parameter	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\swParaError
Error or faults are active	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\Error
Error or faults are active	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sbError
Error when reading with SFB RDREC	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sbRdError
Error when writing with SFB WRREC	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sbWrError
Extended communication error Static variables	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\DiagId
Feedback of velocity	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\sxRecvBuf.Velocity
Format of the value (Format 0x40..0x44)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\Format
Format of the value (Format 0x40..0x44)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\syFormat
Freely available counter variable	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\piCount
Freely available counter variable 3	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\piCount
Freely available pointer array variable	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\piPointer
Function block fault Id	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\siErrorId
GALLONS	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_30\Text
GPM	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_36\Text
HAND	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_1\Text OFF
HAND	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_8\Text OFF
HAND	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_14\Text OFF
HAND	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_3\Text OFF
HAND	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_4\Text OFF
HAND	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_5\Text OFF
HAND	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_6\Text OFF
HAND	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_7\Text OFF
HAND	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_9\Text OFF
HAND	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_10\Text OFF
HAND	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_11\Text OFF
HAND	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_12\Text OFF
HAND	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_13\Text OFF
HAND	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_15\Text OFF
HAND SCREEN	HMI runtime	GLACIER8135\HMI_1 [TP900 Comfort]\Text and graphic lists\TextList_ScreenNames \Text_list_entry_3\Text
Hardware Identifer actual value slot	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\HWIDZSW
Hardware Identifer set point slot	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\HWIDSTW

English (United States)	Category	Reference
Help variable of dword	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\pdDWordLow
Help variable of dword	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\pdDWordHigh
Help variable of word	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\pwWordHigh
Help variable of word	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\pwWordLow
Help variable of word	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\pwWord1
Help variable of word	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\pwWord2
HG	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_1\Text
HG	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_55\Text
HG	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_18\Text
HOME SCREEN	HMI runtime	GLACIER8135\HMI_1 [TP900 Comfort]\Text and graphic lists\TextList_ScreenNames \Text_list_entry_1\Text
HOME SCREEN	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Button_16\Text OFF
HOUR METER	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Text field_20\Text
HOUR METER	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Text field_1\Text
HOUR METER	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Text field_11\Text
HOUR METER	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Text field_24\Text
HOUR METER	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Text field_28\Text
HOUR METER	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Text field_32\Text
I	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\Errors\ComingText
I	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\Warnings\ComingText
I	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\System\ComingText
I	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\Diagnosis events\ComingText
I	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\System_Acknowledgement\ComingText
I	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\System_No_Acknowledgement\ComingText
I	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\Acknowledgement\ComingText
I	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\No Acknowledgement\ComingText
I	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\Safety warnings\ComingText
IO	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\Errors\ComingGoingText
IO	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\Warnings\ComingGoingText
IO	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\System\ComingGoingText
IO	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\Diagnosis events\ComingGoingText
IO	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\System_Acknowledgement\ComingGoingText
IO	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\System_No_Acknowledgement\ComingGoingText
IO	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\Acknowledgement\ComingGoingText
IO	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\No Acknowledgement\ComingGoingText
IO	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\Safety warnings\ComingGoingText
Job finished	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sbDone
Length of telegram of buffer	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\piLenTele
Length of telegram of data for change parameter Temporary variables	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\siLenChaPara
Length of telegram of data for request and response	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\siLenParaMulti
Length of telegram of header	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\siLenHeader
LRP (B-301)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text field_2\Text
max. temporary error counter	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\siMaxErrCount
MIXER (T-500)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text field_25\Text
MIXING PUMP (T-500)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text field_10\Text
Mode of operation disturbance	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\ErrorId
Mode of operation is explained	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\Busy
Mode of operation is explained	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sbBusy
Mode of operation without mistake finishes	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\Done
Monitor	HMI runtime	GLACIER8135\HMI_1 [TP900 Comfort]\User administration\Monitor\ShortName
'Monitor' authorization.	HMI comment	GLACIER8135\HMI_1 [TP900 Comfort]\User administration\Monitor\Comment
MS PUMP (P-300)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text field_1\Text
NA	Alarm class text	GLACIER8135\No Acknowledgement\AlarmClassData_IDisplayNaming_DisplayName
NA	Alarm class text	GLACIER8135\No Acknowledgement\ShortName
No. of elements (DEC: for single elements=1)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sxReqParaMulti.sxParaAdress.syElemNo
No. of parameters (DEC: for single parameters=1)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sxChaParaMulti.sxHeader.syParaNo
No. of parameters (DEC: for single parameters=1)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sxRespParaMulti.sxHeader.syParaNo
No. of parameters (DEC: for single parameters=1)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sxReqParaMulti.sxHeader.syParaNo
Number of parameter (number 1..65535)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\Parameter
Number of parameter (Number 1..65535)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sxReqParaMulti.sxParaAdress.siParaNo
O	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\Errors\GoingText
O	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\Warnings\GoingText
O	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\System\GoingText
O	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\Diagnosis events\GoingText
O	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\System_Acknowledgement\GoingText
O	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\System_No_Acknowledgement\GoingText
O	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\Acknowledgement\GoingText
O	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\No Acknowledgement\GoingText
O	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\Safety warnings\GoingText
Object ID of drive	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\AxisNo
OFF	HMI runtime	GLACIER8135\HMI_1 [TP900 Comfort]\Text and graphic lists_OFF_ON\Text_list_entry_2\Text

English (United States)	Category	Reference
OFF	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Text Field_5\Text
OFF	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Text Field_3\Text
OFF	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Text Field_9\Text
OFF	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Text Field_22\Text
OFF	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Text Field_26\Text
OFF	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Text Field_30\Text
ON	HMI runtime	GLACIER8135\HMI_1 [TP900 Comfort]\Text and graphic lists_OFF_ON\Text_list_entry_1\Text
'one parameter exchange between SINAMICS and S7'	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\Block title
Operate	HMI runtime	GLACIER8135\HMI_1 [TP900 Comfort]\User administration\Operate\ShortName
'Operate' authorization.	HMI comment	GLACIER8135\HMI_1 [TP900 Comfort]\User administration\Operate\Comment
OXIDIZER READY	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screen management\Permanent area\Text field_5\Text
Parameter address	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sxReqParaMulti.sxParaAdress
Parameter address (Attribute/Value (BYTE), Number of Elements (BYTE), Parameter number (2 BYTES), Subindex (2 BYTES),Parameter value (Format/Error (BYTE), Number of Values/Value of Error (BYTE), Value (BYTE or WORD or DWORD)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sxChaParaMulti.sxData
Parameter value (Format/Error (BYTE), Number of Values/Value of Error (BYTE), Value (BYTE or WORD or DWORD)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sxRespParaMulti.sxData
Positive edge of Ready	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sbReady
Positive edge of Start commando	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sbStart
Project information	HMI runtime	GLACIER8135\HMI_1 [TP900 Comfort]\Text and graphic lists\TextList_ScreenNames\Text_list_entry_7\Text
psi	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_2\Text
PSI	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_3\Text
PSI	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_50\Text
PSI	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_10\Text
PSI	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_6\Text
PSI	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_17\Text
PSI	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_22\Text
PSI	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_24\Text
PSI	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_26\Text
PSI	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_32\Text
PSI	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_12\Text
PSI	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_14\Text
PSI	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_20\Text
PSI	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\ALARM SCREEN\Text Field_24\Text
QGR	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\Runtime settings\HmiAlarmSettingsData\AcknowledgementGroupText
Read consistent data of an IO (sub)module	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\System blocks\Program resources\DPWR_DAT_SFC [SFC15]\Block title
Read or write parameter order ready	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\Ready
Read Task busy SFB 52 RDREC sind beschäftigt	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sbRdBusy
Receive buffer	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\sxRecvBuf
Reference number of request	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\siReqRef
Request header	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sxChaParaMulti.sxHeader
Request header	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sxRespParaMulti.sxHeader
Request header	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sxReqParaMulti.sxHeader
Request ID (0x1=Read | 0x2=Write)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sxRespParaMulti.sxHeader.syReqId
Request ID 0x1=Read	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sxReqParaMulti.sxHeader.syReqId
Request ID 0x2=Write	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sxChaParaMulti.sxHeader.syReqId
Request reference (Request ID, mirrored in response)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sxReqParaMulti.sxHeader.syReqRef
Request reference (Request ID, mirrored in response)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sxChaParaMulti.sxHeader.syReqRef
Request reference (Request ID, mirrored in response)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sxRespParaMulti.sxHeader.syReqRef
S7	Alarm text	GLACIER8135\HMI_1 [TP900 Comfort]\HMI alarms\Diagnosis events\alarmclass name not set_3\AlarmClassData_IDisplayNaming_DisplayName
scfm	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\STATUS SCREEN\Text Field_5\Text
Send buffer	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\sxSendBuf
Sendepuffer	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\swSendBuf
Setpoint of velocity	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\sxSendBuf.Velocity
SIMATIC PLC Status/Force	HMI runtime	GLACIER8135\HMI_1 [TP900 Comfort]\Text and graphic lists\TextList_ScreenNames\Text_list_entry_6\Text
'Speed Control with SINAMICS and S7'	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\Block title
Speed standardises with the standardisation factor	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\SpeedSp
Standardisation factor of speed	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\RefSpeed
Start addr from the I/O process image area of mod (DEC) for DPWR_DAT/DPRD_DAT	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\phLAddr
Start command for read or write parameter	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\Start
Start read job	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sbRdStart
Start read job (first part of read commando)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sbRdStart1
Start read job (second part of read commando)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sbRdStart2
Start write job	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sbWrStart
Start write job (first part of write commando)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sbWrStart1

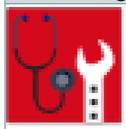
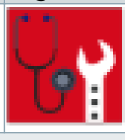
English (United States)	Category	Reference
Start write job (second part of write comman-do)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sbWrStart2
Status for fault analysis	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\piRetSFC
Status for fault analysis	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\piRetSFC
Status length for SFB call	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\piLenSFB
Status output (7002 = FB in operation; 8xxx = error description - read the manual)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\Status
STATUS SCREEN	HMI runtime	GLACIER8135\HMI_1 [TP900 Comfort]\Text and graphic lists\TextList_ScreenNames \Text_list_entry_4\Text
Status SFB	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\pbValidSFB
Status[1] = Error => Status[2] Error Decode + Status[3] Error Code	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\pdStatus
STW1sxSTW1 : STRUCT Bit08 : BOOL:=False; // ST-Wort-1 Bit 08 --> Reserve Bit09 : BOOL:=False; // ST-Wort-1 Bit 09 --> Reserve Bit10 : BOOL:=True; // ST-Wort-1 Bit 10 --> FÃ¼hrung durch PLC Dir : BOOL:=False; // ST-Wort-1 Bit 11 --> Direction Bit12 : BOOL:=False; // ST-Wort-1 Bit 12 --> Halte-bremse unbedingt Ã¶ffnen Bit13 : BOOL:=False; // ST-Wort-1 Bit 13 --> Motorpo-tenziometer Sollwert hÃ¶her Bit14 : BOOL:=False; // ST-Wort-1 Bit 14 --> Motorpo-tenziometer Sollwert tiefer Bit15 : BOOL:=False; // ST-Wort-1 Bit 15 --> Reserviert Off1 : BOOL:=False; // ST-Wort-1 Bit 00 --> OFF1/ON (flanks acceptance) Off2 : BOOL:=True; // ST-Wort-1 Bit 01 --> OFF2/ON (enable possible) Off3 : BOOL:=True; // ST-Wort-1 Bit 02 --> OFF3/ON (enable possible) InvEn : BOOL:=True; // ST-Wort-1 Bit 03 --> En-able controller RampEn : BOOL:=True; // ST-Wort-1 Bit 04 --> Ramp enable RampOn : BOOL:=True; // ST-Wort-1 Bit 05 --> Ramp On SpEn : BOOL:=True; // ST-Wort-1 Bit 06 --> Speed set point enable AckFlt : BOOL:=False; // ST-Wort-1 Bit 07 --> Acknowledge fault END_STRUCT;	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\sxSend-Buf.STW1
Subindex (number 0..65535)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\Index
Subindex (Number 1..65535)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sxReqPara-Multi.sxParaAdress.siIndex
System information	HMI runtime	GLACIER8135\HMI_1 [TP900 Comfort]\Text and graphic lists\TextList_ScreenNames \Text_list_entry_11\Text
System screens	HMI runtime	GLACIER8135\HMI_1 [TP900 Comfort]\Text and graphic lists\TextList_ScreenNames \Text_list_entry_5\Text
System settings	HMI runtime	GLACIER8135\HMI_1 [TP900 Comfort]\Text and graphic lists\TextList_ScreenNames \Text_list_entry_9\Text
System_Acknowledgement	Alarm class text	GLACIER8135\System_Acknowledgement\AlarmClassData_IDisplayNaming_DisplayName
System_Acknowledgement	Alarm class text	GLACIER8135\System_Acknowledgement\ShortName
System_No_Acknowledgement	Alarm class text	GLACIER8135\System_No_Acknowledgement\AlarmClassData_IDisplayNaming_DisplayName
System_No_Acknowledgement	Alarm class text	GLACIER8135\System_No_Acknowledgement\ShortName
Telegramm for change parameter value, multi-parameter	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sxChaPara-Multi
Telegramm for request/change parameter val-ue, multi-parameter	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sxReqPara-Multi
Telegramm for response parameter value, multi-parameter	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sxRespPar-aMulti
temporary error counter of retry job	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\siError-Count
Text	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HOA Screen\Button_16\Text ON
Text	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screen management\Permanent area\Button_2\Text ON
Text	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_1\Text ON
Text	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_8\Text ON
Text	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\home\Button_19\Text ON
Text	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\home\Button_20\Text ON
Text	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\home\Button_17\Text ON
Text	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\home\Button_3\Text ON
Text	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\home\Button_1\Text ON
Text	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screen management\Permanent area\Button_1\Text ON
Text	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screen management\Permanent area\Button_3\Text ON
Text	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_14\Text ON
Text	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_3\Text ON
Text	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_4\Text ON
Text	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_5\Text ON
Text	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_6\Text ON
Text	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_7\Text ON
Text	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_9\Text ON
Text	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_10\Text ON
Text	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_11\Text ON
Text	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_12\Text ON
Text	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_13\Text ON
Text	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Button_15\Text ON
The 'Administrator' group is initially granted all rights.	HMI comment	GLACIER8135\HMI_1 [TP900 Comfort]\User administration\Administrator group\Comment
The count of parameter are Okay	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sbParaNo
The user 'Administrator' is assigned to the 'Ad-ministrator' group.	HMI comment	GLACIER8135\HMI_1 [TP900 Comfort]\User administration\admin\Comment
The 'Users' group is initially granted 'Operat-ing' rights.	HMI comment	GLACIER8135\HMI_1 [TP900 Comfort]\User administration\Users\Comment
TIA PORTAL V15	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\home\Text field_4\Text

English (United States)	Category	Reference
TRANSFER PUMP (P-400)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text field_23\Text
TRANSFER PUMP (P-401)	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screens\HAND SCREEN\Text field_9\Text
True if date and time are lost	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\Startup [OB100]\LostRTC
True if retentive data are lost	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\Startup [OB100]\LostRetentive
Type of job 0 = read parameter, 1 = write parameter	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\ReadWrite
User administration	HMI runtime	GLACIER8135\HMI_1 [TP900 Comfort]\User administration\User administration\ShortName
User administration	HMI runtime	GLACIER8135\HMI_1 [TP900 Comfort]\Text and graphic lists\TextList_ScreenNames \Text_list_entry_10\Text
Users	HMI runtime	GLACIER8135\HMI_1 [TP900 Comfort]\User administration\Users\DisplayName
Value of the read parameter (byte, word, float)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\ValueRead1
Value of the read parameter (dint)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\ValueRead2
Value of the write parameter (byte, word, float)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\ValueWrite1
Value of the write parameter (dint)	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\ValueWrite2
velocity	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\prVelocity
WAITING FOR OXIDIZER	HMI screen	GLACIER8135\HMI_1 [TP900 Comfort]\Screen management\Permanent area\Text field_1\Text
Write consistent data of an IO (sub)module	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\System blocks\Program resources \DPRD_DAT_SFC [SFC14]\Block title
Write Task busy SFB 53 WRREC sind beschäftigt	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_PARA_S [FB287]\sbWrBusy
ZSW1sxZSW1 : STRUCT SpDev : BOOL:=False; // ZSW-Wort-1 = Schleppfehler im Toleranzbereich Pcd : BOOL:=False; // ZSW-Wort-1 = PZD-FÃ¼hrung erreicht Comp : BOOL:=False; // ZSW-Wort-1 = Zielposition erreicht CurLim : BOOL:=False; // ZSW-Wort-1 = Referenzpunkt gesetzt Brake : BOOL:=False; // ZSW-Wort-1 = Haltebremse Ã¶ffnen Motover : BOOL:=False; // ZSW-Wort-1 = keine Warnung Ãœbertemperatur Motor Dir : BOOL:=False; // ZSW-Wort-1 = Direction Invover : BOOL:=False; // ZSW-Wort-1 = keine Warnung thermische Ãœberlast Leistungsteil Rts : BOOL:=False; // ZSW-Wort-1 = Ready to power up / to start Rdy : BOOL:=False; // ZSW-Wort-1 = Ready to operate IOp : BOOL:=False; // ZSW-Wort-1 = In operation (operation enabled) Fault : BOOL:=False; // ZSW-Wort-1 = Fault present NoOff2 : BOOL:=False; // ZSW-Wort-1 = OFF2 inactive NoOff3 : BOOL:=False; // ZSW-Wort-1 = OFF3 inactive Inhibit : BOOL:=False; // ZSW-Wort-1 = Power ON inhibit active Alarm : BOOL:=False; // ZSW-Wort-1 = Alarm / Warning present END_STRUCT;	Block comment	GLACIER8135\PLC_1 [CPU 1214C DC/DC/Rly]\Program blocks\SINA_SPEED [FB285]\sxRecvBuf.ZSW1

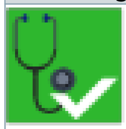
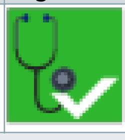
GLACIER8135 / Languages & resources

Project graphics

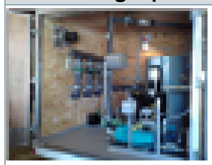
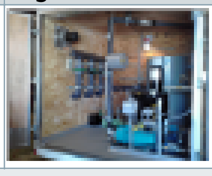
@Diagnostics_StateBad

Standard graphic	English (United States)
	
▶ *Dithering mode*	
Same color	Same color
▶ *Smoothing*	
Unchecked	Unchecked

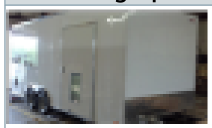
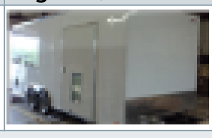
@Diagnostics_StateGood

Standard graphic	English (United States)
	
▶ *Dithering mode*	
Same color	Same color
▶ *Smoothing*	
Unchecked	Unchecked

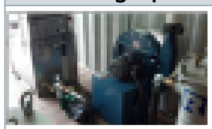
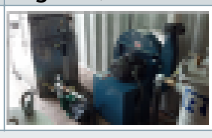
0510121020c

Standard graphic	English (United States)
	
▶ *Dithering mode*	
Same color	Same color
▶ *Smoothing*	
Unchecked	Unchecked

2012-05-07_13-02-32_565

Standard graphic	English (United States)
	
▶ *Dithering mode*	
Same color	Same color
▶ *Smoothing*	
Unchecked	Unchecked

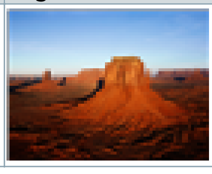
2012-06-01_12-11-09_494

Standard graphic	English (United States)
	
▶ *Dithering mode*	
Same color	Same color
▶ *Smoothing*	
Unchecked	Unchecked

3xlzc011.mlr

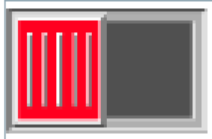
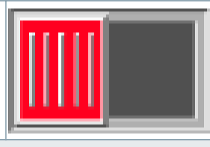
Standard graphic	English (United States)
	
▶ *Dithering mode*	
Same color	Same color
▶ *Smoothing*	
Unchecked	Unchecked

Desert

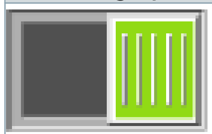
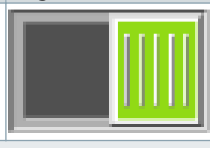
Standard graphic	English (United States)
	

Standard graphic	English (United States)
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

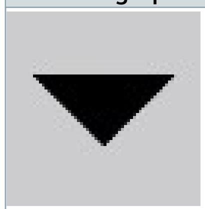
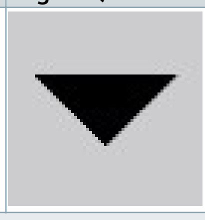
DIP_Horizontal_Off_256c

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

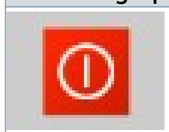
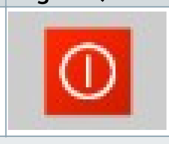
DIP_Horizontal_On_256c

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

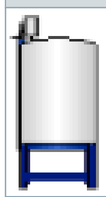
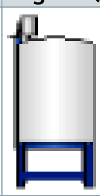
Down_Arrow

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

ExitRuntime_HMI_1

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

Graphic_1

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

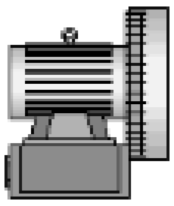
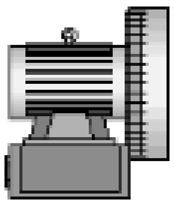
Graphic_10

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

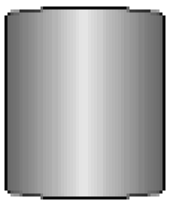
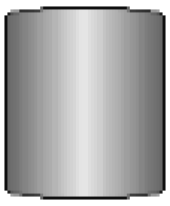
Graphic_104

Standard graphic	English (United States)
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

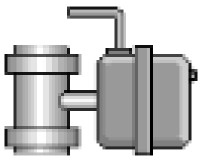
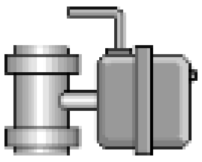
Graphic_11

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

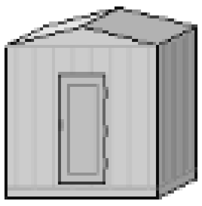
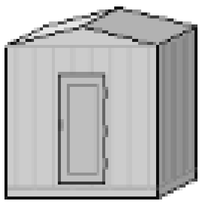
Graphic_12

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

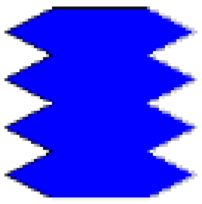
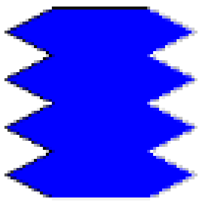
Graphic_13

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

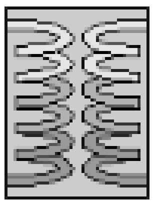
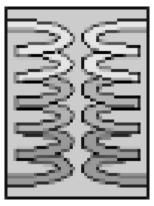
Graphic_14

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

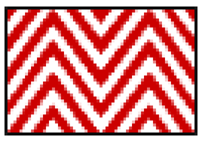
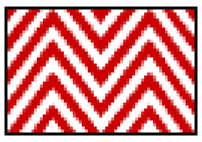
Graphic_15

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

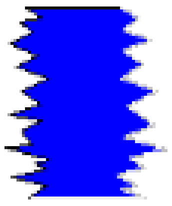
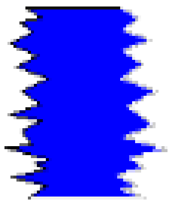
Graphic_16

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

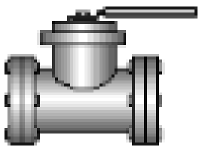
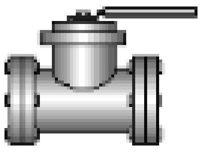
Graphic_17

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

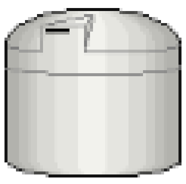
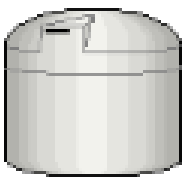
Graphic_18

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

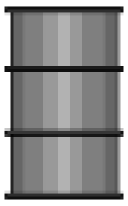
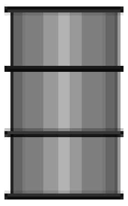
Graphic_19

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

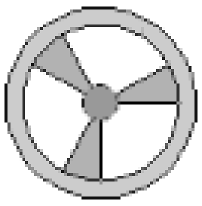
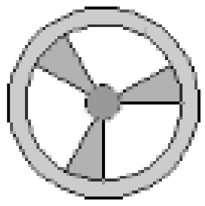
Graphic_2

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

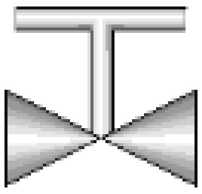
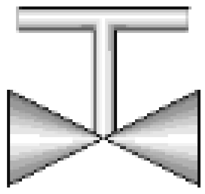
Graphic_20

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

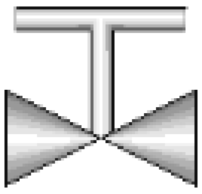
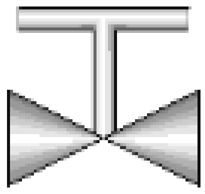
Graphic_21

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

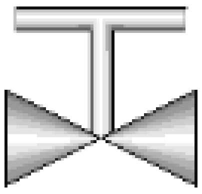
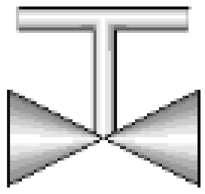
Graphic_22

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

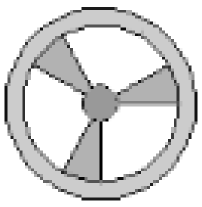
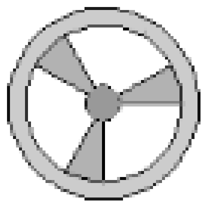
Graphic_23

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

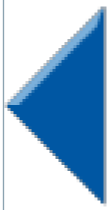
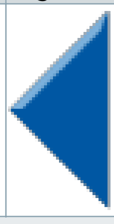
Graphic_24

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

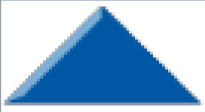
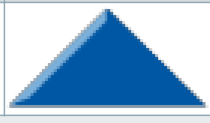
Graphic_25

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

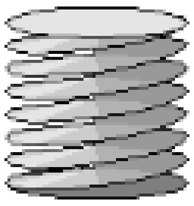
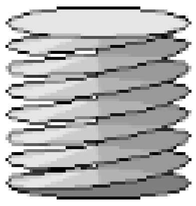
Graphic_26

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

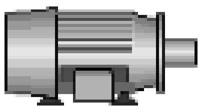
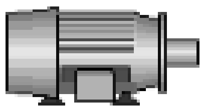
Graphic_27

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

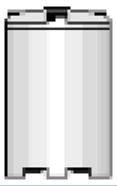
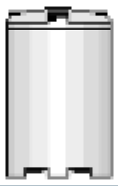
Graphic_28

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

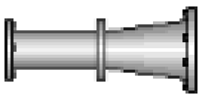
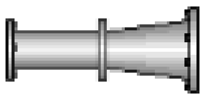
Graphic_29

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

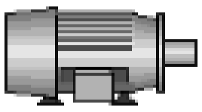
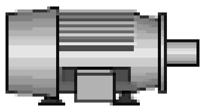
Graphic_3

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

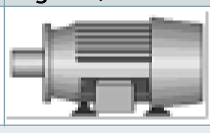
Graphic_30

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

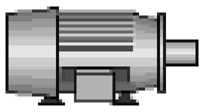
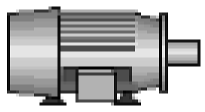
Graphic_31

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

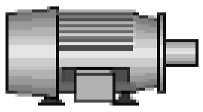
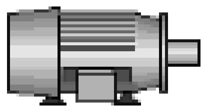
Graphic_32

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

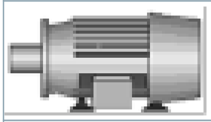
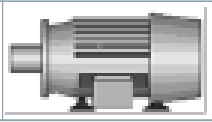
Graphic_33

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

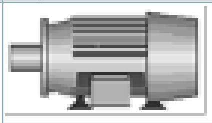
Graphic_34

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

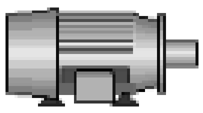
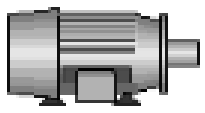
Graphic_35

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

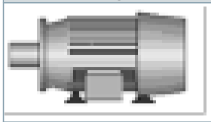
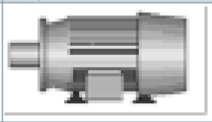
Graphic_36

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

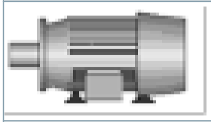
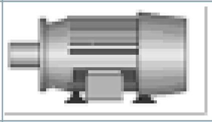
Graphic_37

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

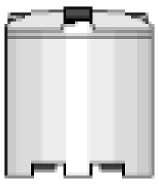
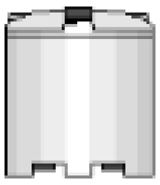
Graphic_38

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

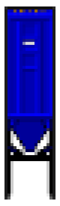
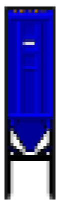
Graphic_39

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

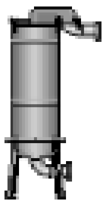
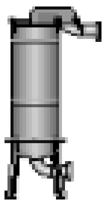
Graphic_4

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

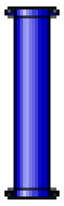
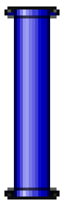
Graphic_40

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

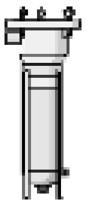
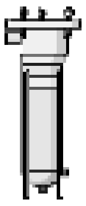
Graphic_41

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

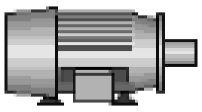
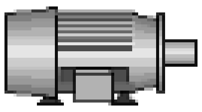
Graphic_42

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

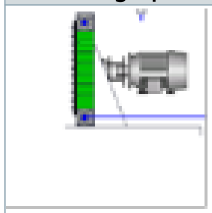
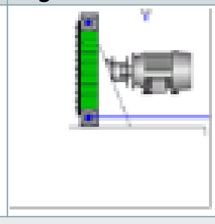
Graphic_43

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

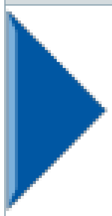
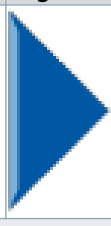
Graphic_44

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

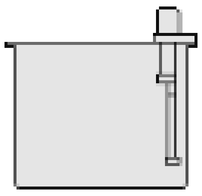
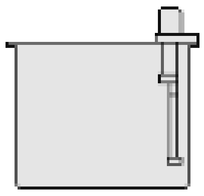
Graphic_45

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

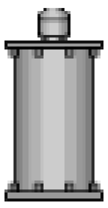
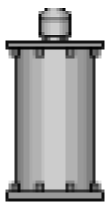
Graphic_46

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

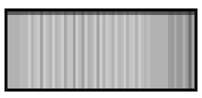
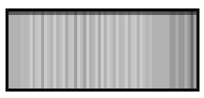
Graphic_47

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

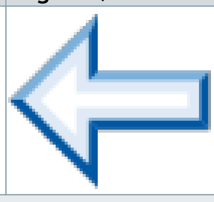
Graphic_48

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

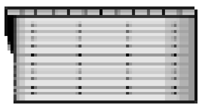
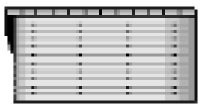
Graphic_49

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

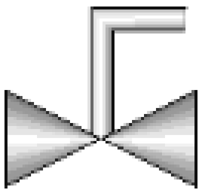
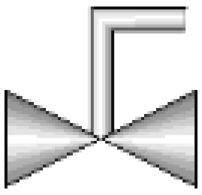
Graphic_5

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

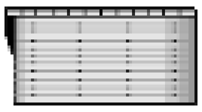
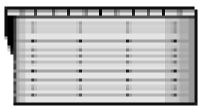
Graphic_50

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

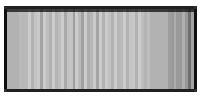
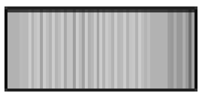
Graphic_51

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

Graphic_52

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

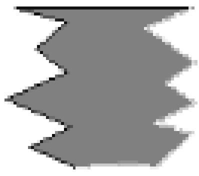
Graphic_53

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

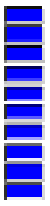
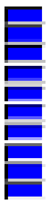
Graphic_54

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

Graphic_55

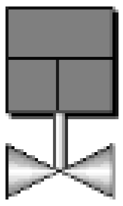
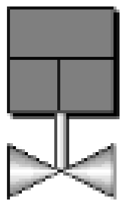
Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

Graphic_56

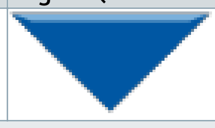
Standard graphic	English (United States)
	

Standard graphic	English (United States)
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

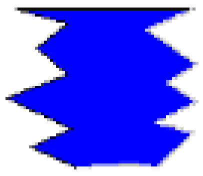
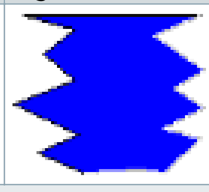
Graphic_57

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

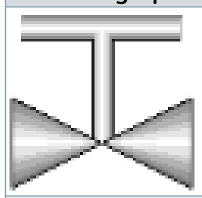
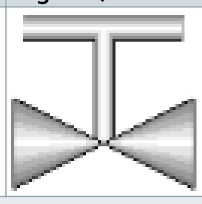
Graphic_58

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

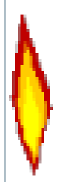
Graphic_59

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

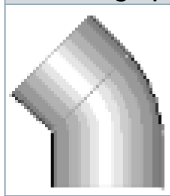
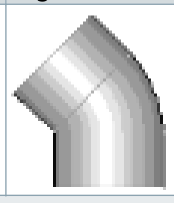
Graphic_6

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

Graphic_60

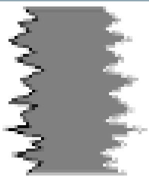
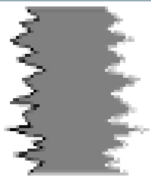
Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

Graphic_61

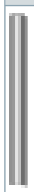
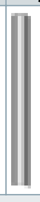
Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color

Standard graphic	English (United States)
Smoothing	
Unchecked	Unchecked

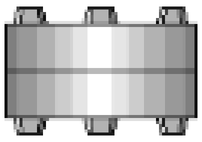
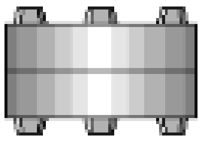
Graphic_62

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

Graphic_63

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

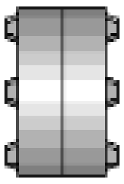
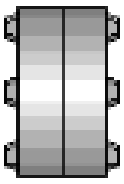
Graphic_64

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

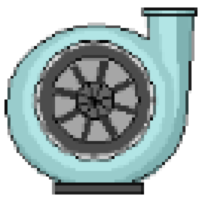
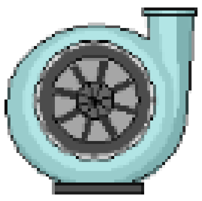
Graphic_65

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

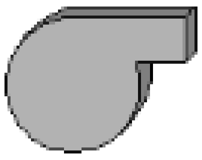
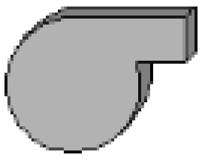
Graphic_66

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

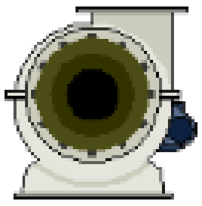
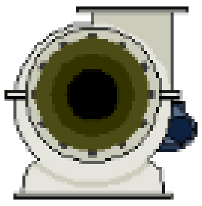
Graphic_67

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

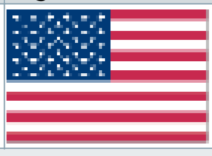
Graphic_68

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

Graphic_69

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

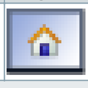
Graphic_7

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

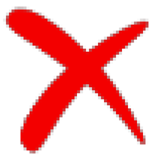
Graphic_70

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

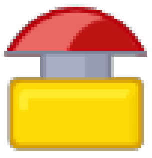
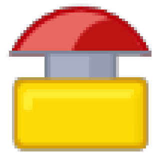
Graphic_75

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

Graphic_79

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

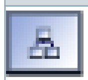
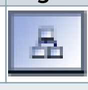
Graphic_8

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

Graphic_81

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

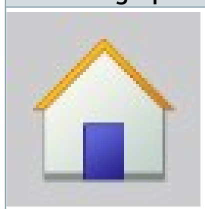
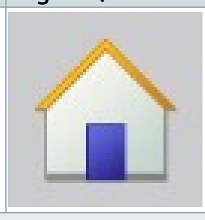
Graphic_87

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

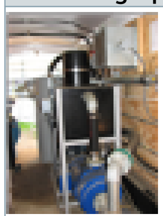
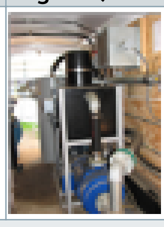
Graphic_9

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

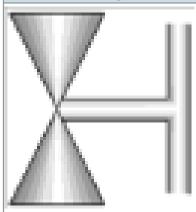
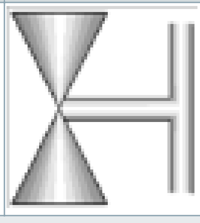
Home

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

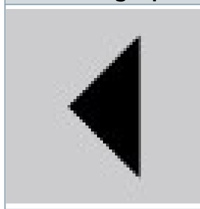
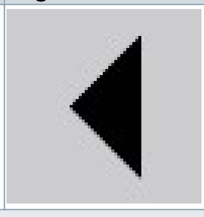
IMG_0041

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

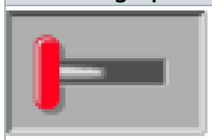
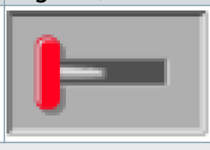
kt0tei42.nu3

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

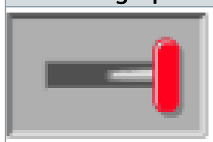
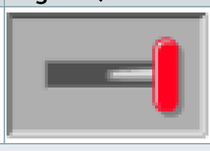
Left_Arrow

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

Lever_Horizontal_1_Off_256c

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

Lever_Horizontal_1_On_256c

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

logo

Standard graphic	English (United States)
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

Logo of HMI_1

Standard graphic	English (United States)
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

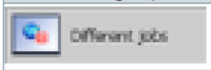
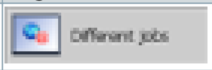
logoPRM

Standard graphic	English (United States)
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

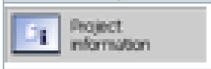
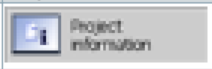
NavigateHome_HMI_1

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

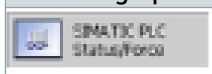
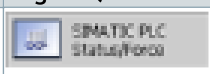
Navigates to Different jobs for HMI_1

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

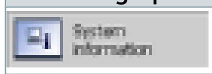
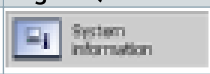
Navigates to Project information for HMI_1

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

Navigates to SIMATIC PLC Status/Force for HMI_1

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

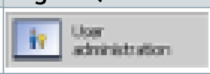
Navigates to System information for HMI_1

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

Navigates to System settings for HMI_1

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

Navigates to User administration for HMI_1

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

PRM Filtration logo FINAL

Standard graphic	English (United States)
PRM	PRM
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

PRM_logo

Standard graphic	English (United States)
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

PRM_logo_1

Standard graphic	English (United States)
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

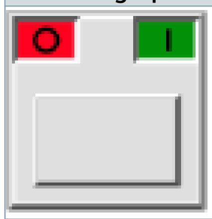
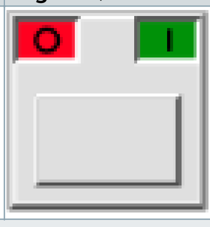
prmlogo (2)

Standard graphic	English (United States)
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

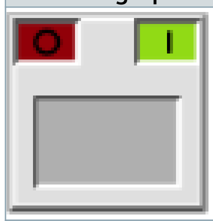
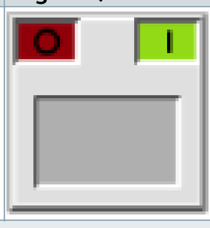
prmsign

Standard graphic	English (United States)
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

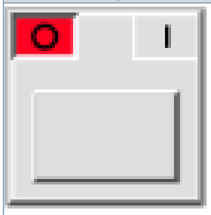
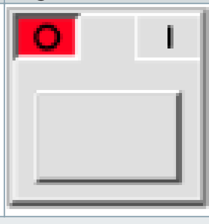
Pushbutton_RG_Off_256c

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

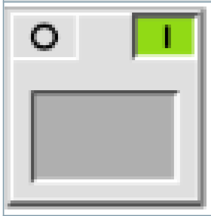
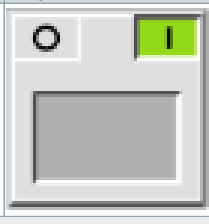
Pushbutton_RG_On_256c

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

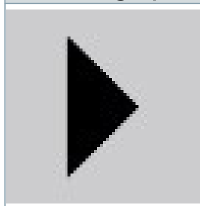
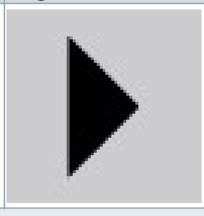
Pushbutton_RNGN_Off_256c

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

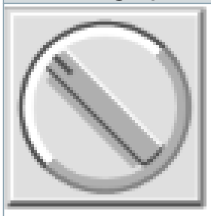
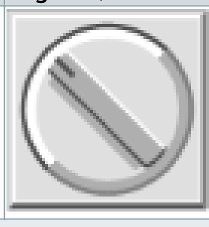
Pushbutton_RNGN_On_256c

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

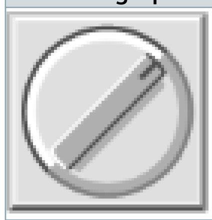
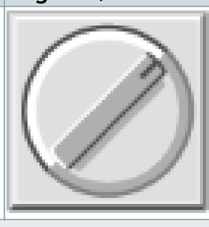
Right_Arrow

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

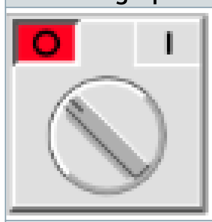
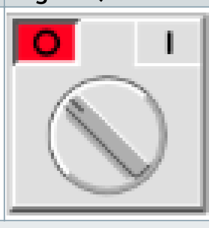
Rotary_N_Off_256c

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

Rotary_N_On_256c

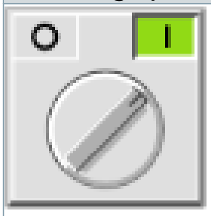
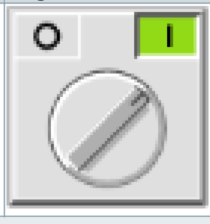
Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

Rotary_RNGN_Off_256c

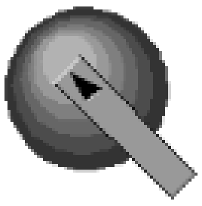
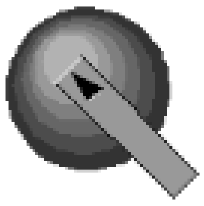
Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color

Standard graphic	English (United States)
Smoothing	
Unchecked	Unchecked

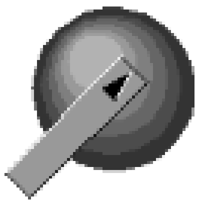
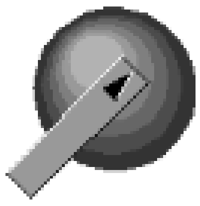
Rotary_RNGN_On_256c

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

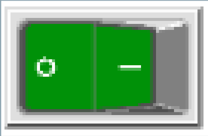
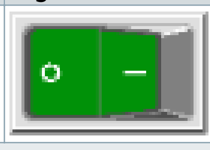
Selector switch 3 (left)

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

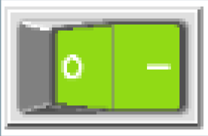
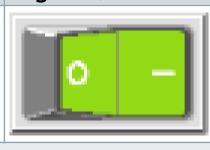
Selector switch 3 (right)

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

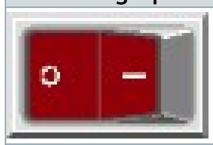
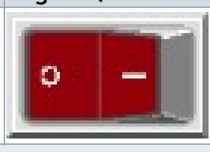
Toggle_Horizontal_G_Off_256c

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

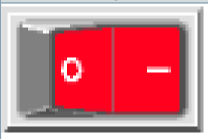
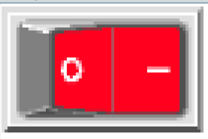
Toggle_Horizontal_G_On_256c

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

Toggle_Horizontal_R_Off_256c

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

Toggle_Horizontal_R_On_256c

Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

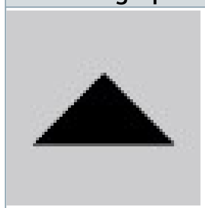
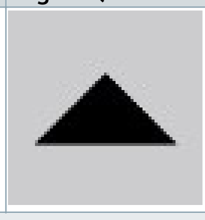
unnamed

Standard graphic	English (United States)
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

Untitled22

Standard graphic	English (United States)
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

Up_Arrow

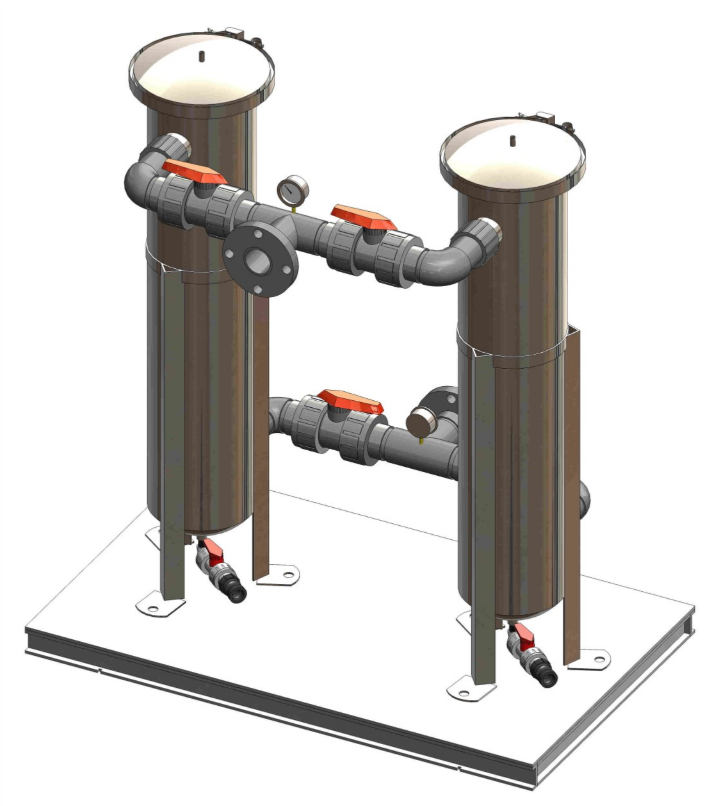
Standard graphic	English (United States)
	
Dithering mode	
Same color	Same color
Smoothing	
Unchecked	Unchecked

PRM Bag Filter Housings – Low Pressure Banded Housing

PRODUCT RECOVERY MANAGEMENT

Absolute Quality is our Goal... Genuine Service is our Habit!

Absolute Quality: PRM provides banded top style bag filter housings for your remediation and industrial filtration needs. Our units come standard in stainless steel and are available as a stand– alone bare unit or completely plumbed and ready to go when it reaches the project site.



Typical Features Include:

- 304 Stainless Steel Construction
- 8"x 30" Trade Size # 2 Housing
- 2" NPT Inlet and Outlet Connections
- Viton® O-rings standard
- 100 psi Maximum Working Pressure
- Stainless Steel Strainer Basket and Internal Bag Support Rack
- Drain Port and Mounting Stand
- Quick Opening Clamp Top
- Safety Release Vent for Maintenance

** Options and Services **

- Skid Mounting, Pre Plumbed Filter Arrays
- Steel, Stainless Steel, or PVC Piping with Valves
- Custom Integration Into Existing Systems
- Design Assistance
- Field Installation, Startup, and Operations
- Replacement Bag filters available in stock (5, 10, 25, 50, and 100 Micron rated filters)
- Custom Built Filter Packages Per Your Specs

Product Recovery Management, Incorporated

(888) TREAT-IT

888-873-2848 • 919-957-8890 • www.prm-net.com • sales@prm-net.com

Butner, NC • Webster, NY • Lakeland, FL

* Actual equipment specifications may vary. Please contact Product Recovery Management, Inc. for additional details. E-13(1A)

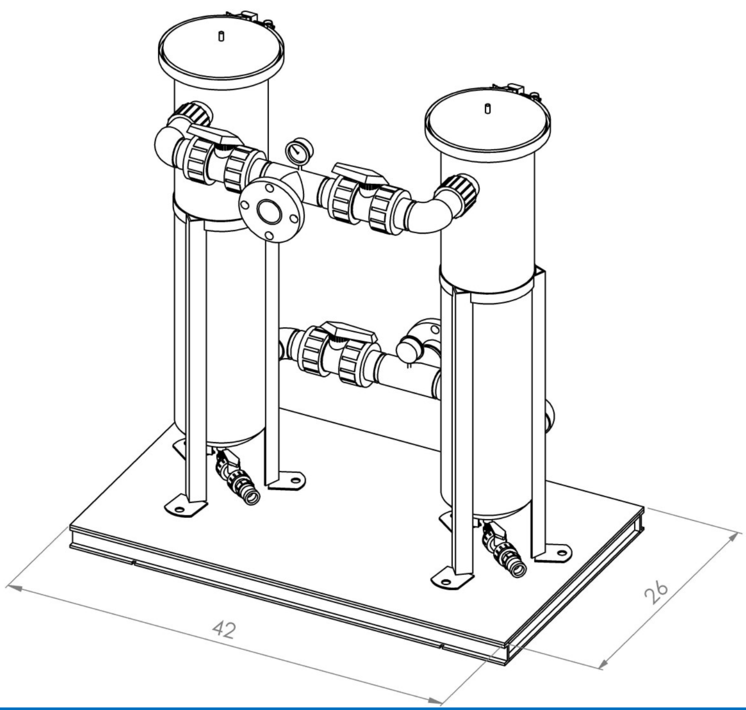
PRM Bag Filter Housings – Low Pressure Banded Housing

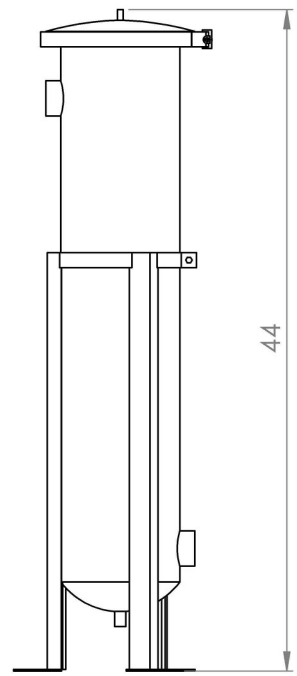
PRODUCT RECOVERY MANAGEMENT

Absolute Quality is our Goal… Genuine Service is our Habit!

Product Name	PRM Part No.
Bag Filter Housings 8x30, 304 SS, 2” NPT In/Out Dual System Skid	DBFSFGX2HBFL2

Product Name	PRM Part No.
Bag Filter Housing 8x30, 304 SS, 2” NPT In/Out Single Housing Only	DBFHBFL2





Product Name	PRM part no.
100 Micron Bag Filters #2	DBFPE100P2S
50 Micron Bag Filters #2	DBFPE50P2S
25 Micron Bag Filters #2	DBFPE25P2S
10 Micron Bag Filters #2	DBFPE10P2S
5 Micron Bag Filters #2	DBFPE5P2S

Product Recovery Management, Incorporated

(888) TREAT-IT

888-873-2848 • 919-957-8890 • www.prm-net.com • sales@prm-net.com

Butner, NC • Webster, NY • Lakeland, FL

* Actual equipment specifications may vary. Please contact Product Recovery Management, Inc. for additional details.

PRM Carbon Systems - HP- 90 & HP- 200

PRMFiltration

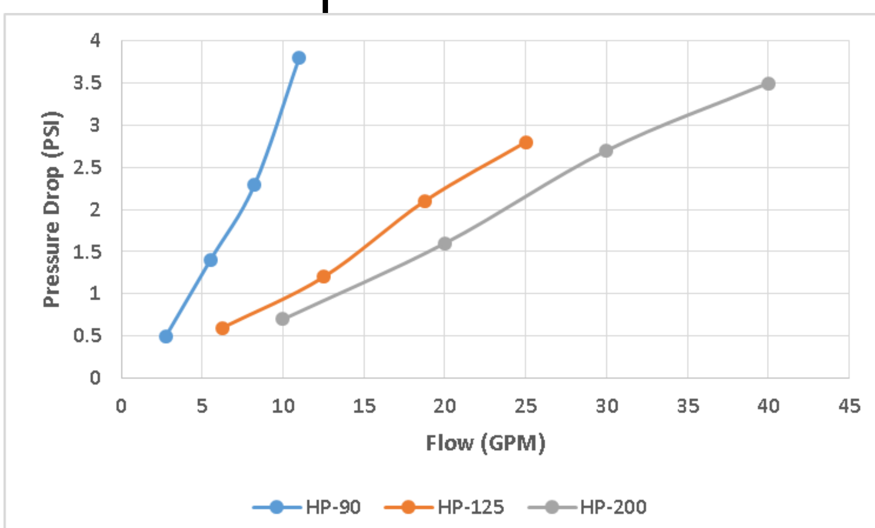
The HP Series Carbon units are used on remediation systems where standard flow volumes are required with minimal backpressure. These units offer a 25% freeboard area for excellent back-wash ratios. Typical applications are groundwater remediation for VOCs or industrial sites with similar applications. Several media types are available for removal of more specific compounds such as metals and other contaminants. Aggregate media specifically designed to be backwashed is also available.

APPLICATIONS:
- Remediation of contaminated water streams
- Designed to operate at high pressures without sacrificing efficiency

STANDARD SPECIFICATIONS:
- Pressures up to 125 psi
- Fiberglass construction for lightweight strength
- Inlet and outlet diffusers for even flow and back-washing
- Heavy duty base for vertical free standing operation

HP-90 Carbon Unit
INLET/OUTLET: 3/4"
SIZE: 13" Diameter x 54" Height
CARBON: 90 lbs.
DRY WEIGHT: 130 lbs.

HP-200 Carbon Unit
INLET/OUTLET: 1"
SIZE: 16" Diameter x 65" Height
CARBON: 200 lbs.
DRY WEIGHT: 240 lbs.



AVAILABILITY: Build Item: Allow 2 to 4 weeks for manufacturing and shipping

888-TREAT-IT • www.prmfiltration.com • sales@prmfiltration.com

L-mag Electromagnetic Flowmeter Converter

User's Manual

L-mag311BSeries

January **2015**

CONTENTS

1. The product function introduction

1.1 Basic function

- Low-frequency square-wave exciting， exciting frequency： 1/16 power frequency、1/20power frequency、1/25 power frequency;
- High-frequency square-wave exciting，exciting frequency：1/2 power frequency（for grouting liquid measure）；
- Exciting current can be selected for 125mA、187.5mA、250mA；
- No need to add empty pipeline measurement, and can measure continuously, alarm by fixed value;
- Current speed range：0.1 --- 15m/s，current speed resolution：0.5mm/s;
- AC high-frequency switching power，range of voltage：85VAC --- 250VAC;
- DC 24V switching power，range of voltage：20VDC --- 36VDC；
- Network function：MODBUS、HARTcommunication interface（choose）；
- Chinese or English displaying mode, (other languages can be set)；
- Three integrator gross inside, respective register: Forward gross, reverse gross and minus value gross.

1.2 Especial function

- Recording time when power turn-off, to record power broken time of instrument system automatically and recruit to count the missing flux；
- Recording function of hour gross, to record the flux gross by hour, fit for timed measure;
- Infrared handing telecontrol keyboard， all the functions of far-untouched controlling converter.

1.3 Normal operating conditions

Ambient Temperature Ranges：fission –10～+60℃；

Relative Humidity：5%～90%;

Power Supply: 85～250V，45～63Hz (single-phase AC).

Dissipation Power: <20W（ After connecting sensor）.

1.4 Type of connecting with sensors

- The integrated circinal shells: circinal shells, shells connect with the flange directly, explosion-proof;

2. Basic circuit of converter

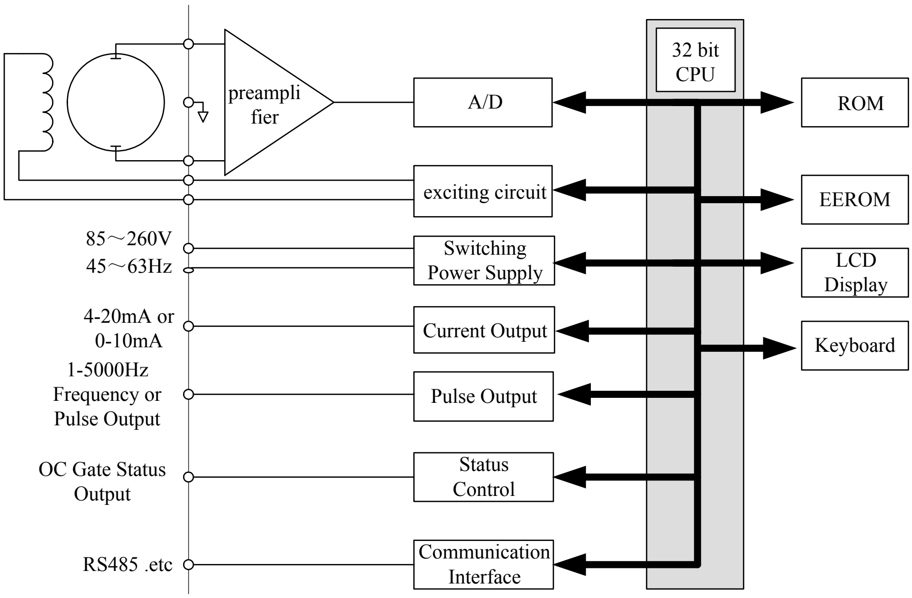


Fig.2. 1 Structure Of Converter's Circuit

The converter can supply exciting current to the coil in the sensor of electronetic flowmeters， the head amplifier amplifies the electromotive force from the sensor and converts it into standard signals of current or frequency so that the signals can be used for displaying, controlling and processing. See structure of converter circuit shown in Fig.2.1。

3. Index of technical performance

3.1 Standard of implement

The design, production and instrument of **L-magB** Electromagnetic Flowmeter Converter implement《JJG-1033-2007 Electromagnetic Flowmeters》。

3.2 Basic parameters and performance index

3.2.1 Pipe's inside diameter of relative sensor (mm):

3、6、10、15、20、25、32、40、50、65、80、100、125、150、200、250、300、350、400、450、500、600、700、800、900、1000、1200、1400、1600、1800、2000、2200、2400、2600、2800、3000;

3.2.2 Request of relative sensor

Sensitivity of sensor signal: under 1m/s, output 150μV ~200μV;

For L-magB electromagnetic flowmeter signal converters, there are four currents of 62.5 mA in exciting loop, which make up of 250mA, and every 62.5mA is controlled by one 20Ω exact resistance. So user can choose different exciting current by changing the number of exact resistance.

The current will be 250mA when the signal converters leave factory, as such, if there are three exact resistance, the current will be 187.5 mA; if two, 125mA;

Resistance of sensor exciting coil:

500mA exciting current: 20 ~ 30Ω;

250mA exciting current: 50 ~ 60Ω;

187mA exciting current: 60 ~ 80Ω;

125mA exciting current: 100 ~ 120Ω;

3.2.3 Measure precision for assembly

Table 3.1 V_S：Setting measurement range (m/s)

Diameter(mm)	Range(m/s)	Accuracy
3 ～ 20	≤0.3	±0.25%FS
	0.3～1	±1.0R
	1～15	±0.5%R
25 ～600	0.1～0.3	±0.25%FS
	0.3～1	±0.5%R
	1～15	±0.3%R
700～3000	＜0.3	±0.25%FS
	0.3～1	±1.0%R
	1～15	±0.5%R
%FS：for relative ranges；%R：for relative value of measurement		

3.2.4 Simulated current output

Load resistor: 0~1.5kΩ (0~10mA); 0~750Ω (4~20mA). Basic Errors: 0.1%±10μA.

3.2.5 Digital frequency output

Frequency output range: 1～5000Hz；

Output electric isolate: Photoelectric isolate. Isolate voltage: > 1000VDC；

Frequency output drive: output by field-effect transistors, the highest subjected voltage is 36VDC，maximum of output current is 250 mA.

3.2.6 Digital pulse output

Pulse output value: 0.001～1.000 m^3 / cp、

0.001～1.000 Ltr / cp、

0.001～1.000 USG / cp；

0.001～1.000 UKG / cp;

Pulse output width: 50ms,

Pulse output isolate: photo electricity isolate. Isolate voltage: > 1000VDC；

Pulse output drive: output by field-effect transistors, the highest subjected voltage is 36VDC，maximum of output current is 250 mA.

3.2.7 Alarm output

Alarm output junction：ALMH--- upper limit; ALML--- lower limit;

Output isolate: photo electricity isolate. Isolate voltage: > 1000VDC;

Alarm output drive: output by Darlington pipe, the highest subjected voltage is 36VDC，maximum of output current is 250 mA.

3.2.8 Digital communication port and protocol

MODBUS interface: format of RTU.

HART interface: designed by standard of HART , if you choose our hand held unit , you can display the measure value on line,and setting the parameters.

3.2.9 Electric isolate

Insulated voltage between simulated input and simulated output should be higher than 500V;

Insulated voltage between simulated input and alarm power supply should be higher than 500V;

Insulated voltage between simulated input and AC power supply should be higher than 500V;

Insulated voltage between simulated output and AC power supply should be higher than 500V;

Insulated voltage between simulated output and earth should be higher than 500V;

Insulated voltage between pulse output and AC power supply should be higher than 500V;

Insulated voltage between pulse output and earth should be higher than 500V;

Insulated voltage between alarm output and AC power supply should be higher than 500V;

Insulated voltage between alarm output and earth should be higher than 500V;

4.1 Operation converter

4.1 define keys and LCD screen display

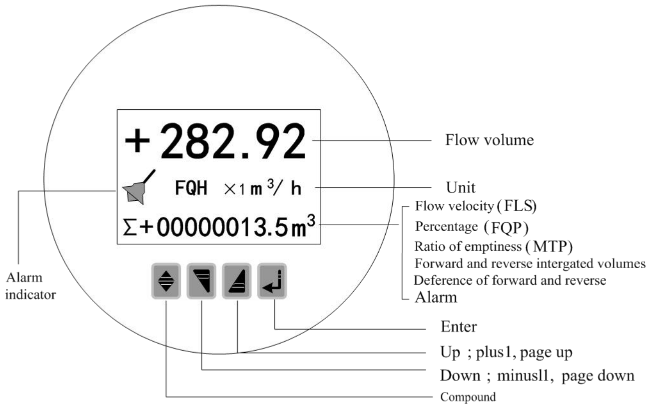


Fig. 4.1 Keys on circinal panel and big LCD display

Note: When measuring, pushing down "Compound Key + Enter" will appear password of changing state, base on distinction of secrecy, and change the password as we provide. Then pushing "Compound Key + Enter" again, and you can inter the state of setting parameter. If want to return to the running state, push "Enter" for several seconds.

4.2 Connections of sensor

4.2.1 Links and labels of connectors in Circinal Model

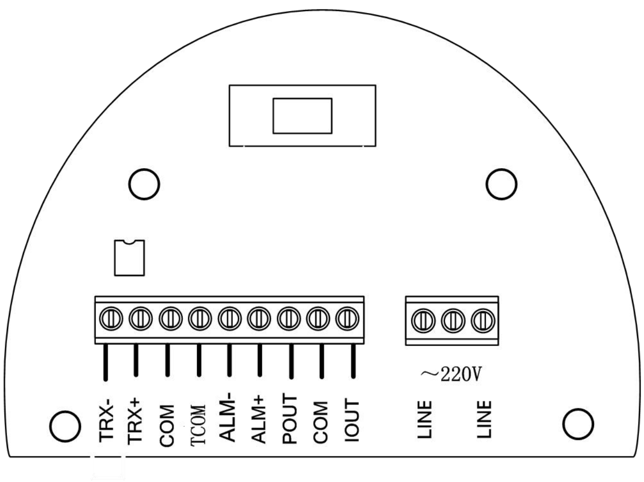


Fig.4.2 Connectors in circinal model

Symbols and Description of Connectors in Circinal Panel

IOUT：	Output Current for Flow Measurement
COM：	Output Current (Ground) for Flow Measurement
POUT：	Frequency(Pulse) Output for Bi-directional Flow
COM：	Frequency (Pulse) Output (Ground)
ALM-：	Alarm Output for Low Limit
ALM+：	Alarm Output for Upper Limit
COM：	Alarm Output (Ground)
TRX＋：	+Communication Input Signal(RS485-A)
TRX－：	-Communication Input Signal(RS485-B)
TCOM	232 Communication ground
LINE：	220V（24V）Power Supply
LINE：	220V（24V）Power Supply

4.2.2Labels and connection of signal lines in circinal model

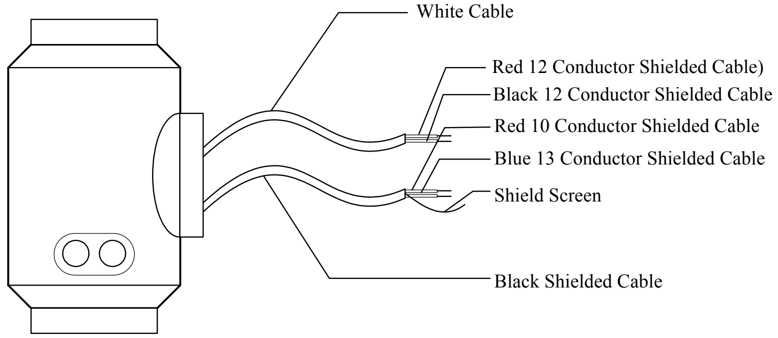


Fig.4.3 Labels and connection of signal lines in circinal model

Signal lines labels in circinal model:

White twisted-pair cable (for exciting current): 12 Conductors (Red)

12 Conductors (Black)

Black shielded twisted-pair cable: 10 Conductors (Red) connected to “Signals 1”

13 Conductors (Blue) connected to “Signals 2”

Shielded Conductor connected to "Signal Ground"

4.3 Characteristic and connection of cable

4.3.1 Flux signal line

When separated models of converters are assembled with sensors for measuring flow of fluid which conductivity is larger than 50μS/cm, PVVP 2*0.2 mm^2 model cable (metal shielded signal cable covered with PVC) can be used as communication cable for flow signals. The length of signal cable should be less than 100 m. Signal cables have to be connected to sensors that were assembled by producers. Connections of signal cables are shown Fig.4.3 for circle-shaped models, respectively.

The converter can output equivalent level of shielded exciting signal voltage so that interference to flow measurement signals can reduced by means of lowering the distributed capacitance of communication cable. When measured conductivity is less than 50μS/cm or signals are transferred in remote distances, double-conductor and double-shielded signal cable at equivalent level of voltage can be used. For example, special STT3200 cable or BTS model signal cable (triple-shielded) can be used for signal communication.

4.3.2 Exciting current cable

Two conductor and insulating rubber- covered cables can be used as exciting current cables. Suggested model is RVVP2*0.3mm^2 . Length of exciting current cable should be equal to that of signal cable. When the model STT3200 cables are used for exciting current and signals, two cables can be put together as one cable.

4.3.3 Output and power line

All cables for signals transferring and power supply have to be prepared by users. However, it should be careful to choose the cables that meet the upper limit load of consuming current.

Pulse current output, alarm current output and external power supply can be seen in Fig.4.3(a). When inductive load is connected to converter, diode should be used as in

Fig.4.3(b).

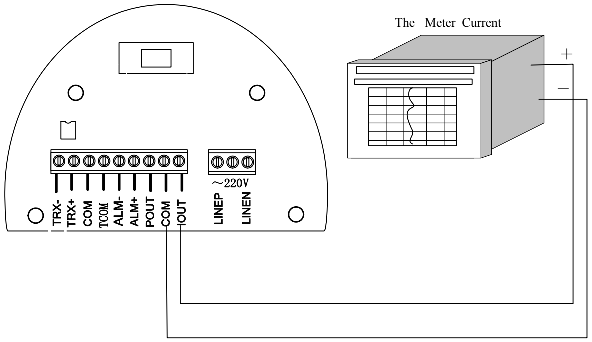


Fig.4.3 (a) Output current circuit

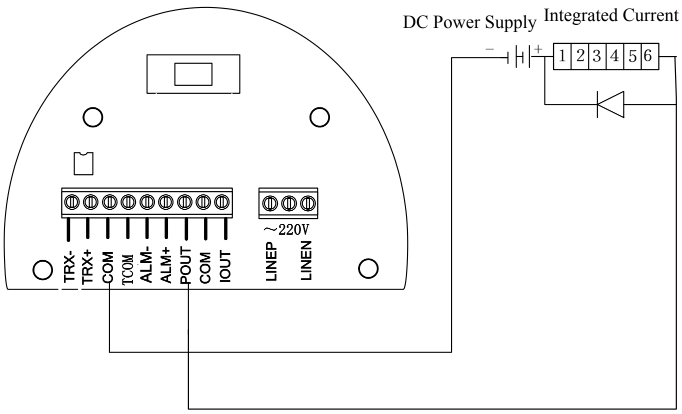


Fig.4.3 (b) Connection of electro-magnet counter

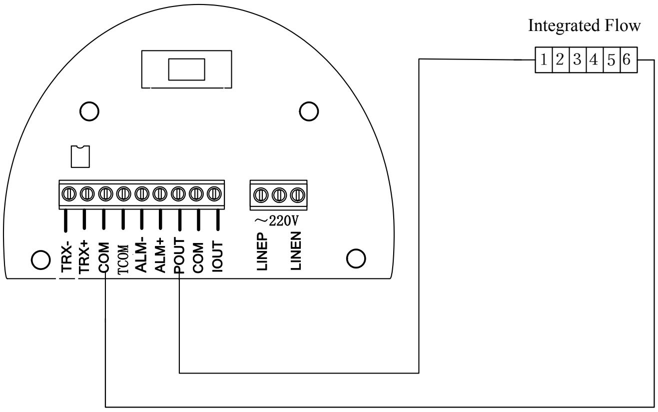


Fig.4.3 (c) Connection of electronic counter

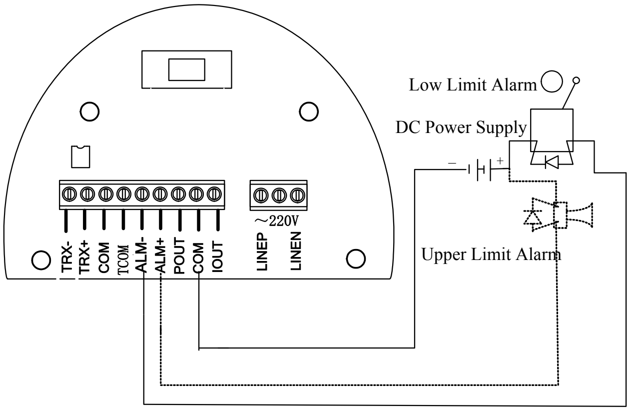


Fig.4.3 (d) Connection of alarm output

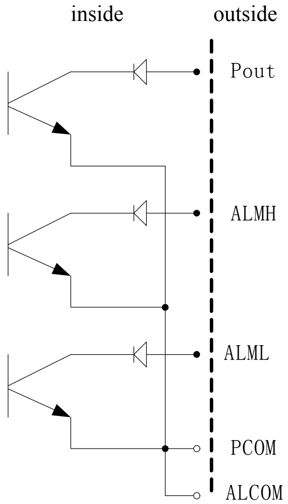


Fig.4.3（e）Connection of OC gate

4.3.4 The grounding requirements when installing convert

Convert shell's earth terminal PE should use grounding copper wire which is less than 1.6mm2. The ground resistance from convert's shell to ground should less than 10Ω.

First, purple copper tube should be cut into 1700 mm long (the copper tube can be lengthened according to the need) to make the nail buried 1500 mm into the ground(Note : when burying nail, sprinkling a layer of broken charcoal at the top of nail, and then saline irrigation).

Then, 4mm2 purple copper wire should be welded to the nail. At last, connecting ground wire to convert's flange, ground ring and pipeline's flange. It is shown in figure 4.3(f).

Note: Stainless steel must be used when fixing ground screws, spring washers and flat washers.

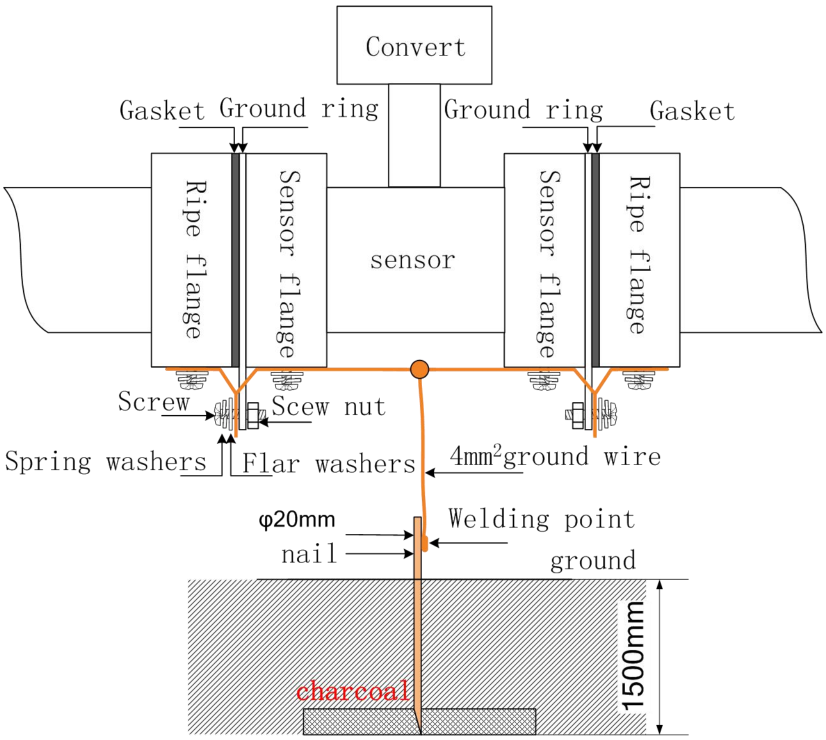


Fig.4.3（f） Grounding

4.4 Digital output and calculate

Digital output means frequency output and pulse output, and both of them use the same output point, so user can choose only one type of them but not both.

4.4.1 Frequency output

Frequency output range is 0～5000HZ, and corresponding the percent of flux.

$$F=\frac{\text{Measure value}}{\text{Full scale value}} \bullet \text{ frequency range}$$

The up limit of frequency output can be adjusted. It can be chosen from 0 ~ 5000HZ, and also can be chosen low frequency: such as 0 ~ 1000HZ or 0 ~ 5000HZ.

Frequency output mode general can be used in control application, because it responses the percent flux. Users can choose pulse output when the equipment is applied to count.

4.4.2 Pulse output mode:

Pulse output mainly applies in count mode. A pulse output delegates a unit flux, such as 1L or $1M^3$ etc. Pulse output unit divide into0.001L, 0.01L, 0.1L, 1L, $0.001M^3$, $0.01M^3$, $0.1M^3$, 1 M^3，0.001UKG，0.01UKG，0.1UKG，1UKG，0.001USG，0.01USG，0.1USG，1USG。When users choose the pulse unit, they should notice the match of the flux range of flowmeter and pulse unit. For volume flux, count formula as follows:

$Q_L=0.0007854\times D^2\times V$ (L/S)

Or $Q_M=0.0007854\times D^2\times V\times 10^{-3}$ (M^3/S)

Note: D-nozzle (mm)

V-velocity of flow (m/s)

The oversize flux and too small pulse unit will be made the pulse output over the up limit. Generally, pulse output should be controlled below 3000P/S. However, the too small flux and too large pulse unit will be made the instrument exports a pulse long time.

Otherwise, pulse output is different from frequency output. When pulse output cumulates a pulse unit, it exports a pulse. Therefore, pulse output is not equality. Generally, measure pulse output should chooseto count instrument, but not frequent instrument.

4.4.3 The connection of digital output

Digital output has tow connected points: digital output connected point, digital ground point, and symbol as follows:

POUT ----- digital output point;

PCOM ----- digital ground point;

POUT is collector plough output, user may refer to next circuit to connect.

4.4.4 The connection of digital voltage output

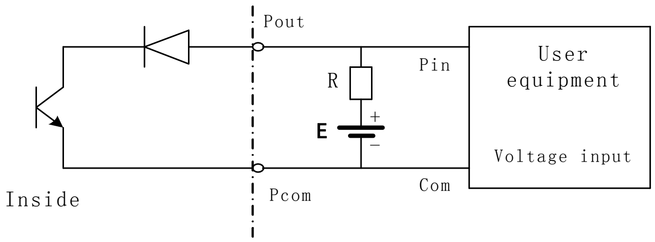


Fig.4.4(a) The connection of digital voltage output

4.4.5 Digital output connect photoelectricity coupling (PLC etc.)

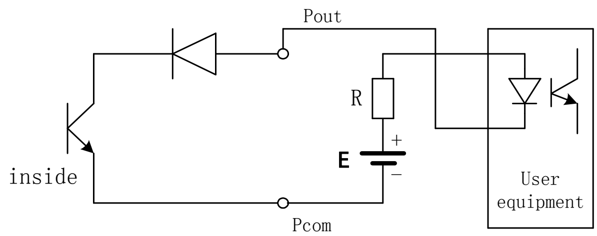


Fig.4.4(b) Digital output connect photoelectricity coupling

Commonly user’s photoelectricity coupling current is about 10mA, so about E/R=10mA, E=5～24V.

4.4.6 Digital output connect relay

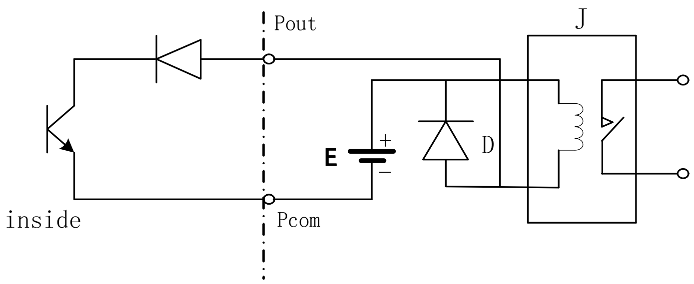


Fig.4.4（c） Digital output connect relay

Commonly relay needs E as 12V or 24V. D is extend diode, now most middle relays has this diode inside. If not have, user can connect one outside.

Table of digital output parameter:

POUT

Parameter	Test condition	Mini	Typical	Max	Unit
Volatge	IC=100 mA	3	24	36	V
Current	Vol≤1.4V	0	300	350	mA
Frequency	IC=100mA Vcc=24V	0	5000	7500	HZ
High voltage	IC=100mA	Vcc	Vcc	Vcc	V
Low voltage	IC=100mA	0.9	1.0	1.4	V

4.5 Simulation signal output and calculate

4.5.1 Simulation signal output

There are two signal system: 0～10mA and 4～20mA, user can select from parameter setting.

Simulation signal output inner is 24V under0~20mA, it can drive 750Ω resistance.

The percent flux of simulation signal output:

$$I_0 = \frac{\text{Measure value}}{\text{Full scale value}} \bullet \text{the scale of current} + \text{the zero point of current}$$

The current zero is 0 when 0~10mA, and the current zero is 4mA when 4~20mA.

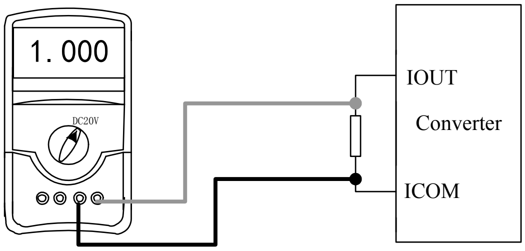
It can be advanced simulation signal output distinguish. User can select the range of measure.

The manufacture’s parameter have been adjusted, it can’t need adjust. If have abnormity, it can consult 4.5.2.

4.5.2 Simulation Signal Output Adjust

(1)The Converter adjust preparative

When the converter is running 15 minutes, the inner of converter becomes stabilization. Preparative 0.1% amperemeter or 250Ω、 0.1% voltage instrument.



(2)Current zero correct

When the converter getting into parameter setting, selecting to "Analog Zero" and enter to it. The standard of signal fountain getting to "0".Adjust parameter make amperemeter is 4mA(±0.004mA).

(3)The full scale current correct

To select "Anlg Range" to enter.Adjust the converter parameter make amperemeter is 20mA(±0.004mA)

Adjust the current zero and the full range, the current function of the converter reached exactness.The line degree of current output of conversion should be controlled within the scope of 0.1%

(4) Current line degree checking

You can place the standard signal source in 75%、50%、25%,and check the line degree of current output。

4.5.3 L-magB electromagnetic flowmeter converter's connection of current output:

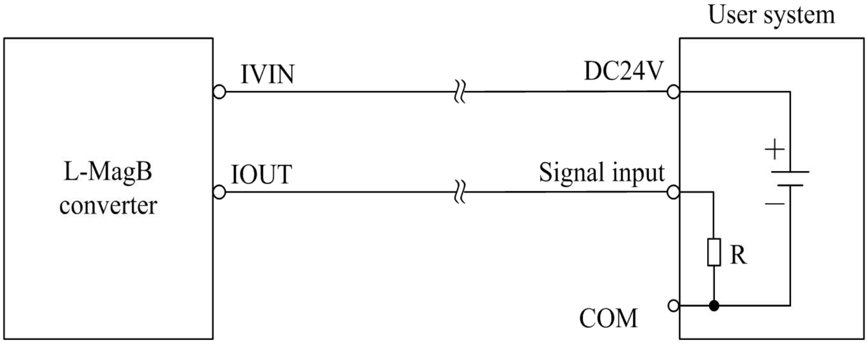


Fig.4.5 (a) L_MagB two connection

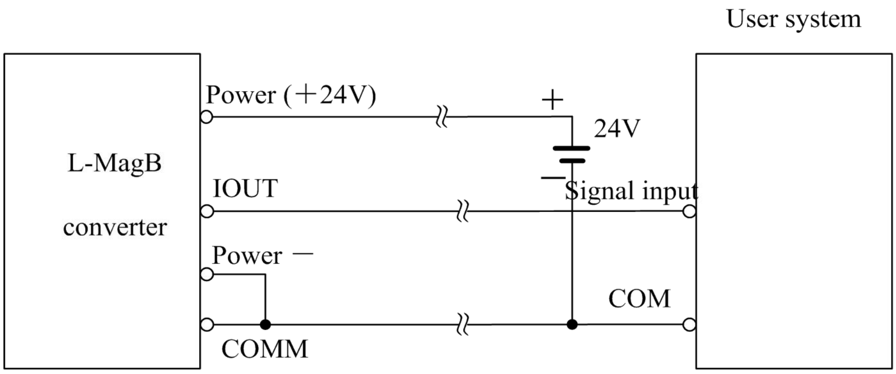


Fig.4.5 (b) L_MagB three connection(power supply and current output are not insulated)

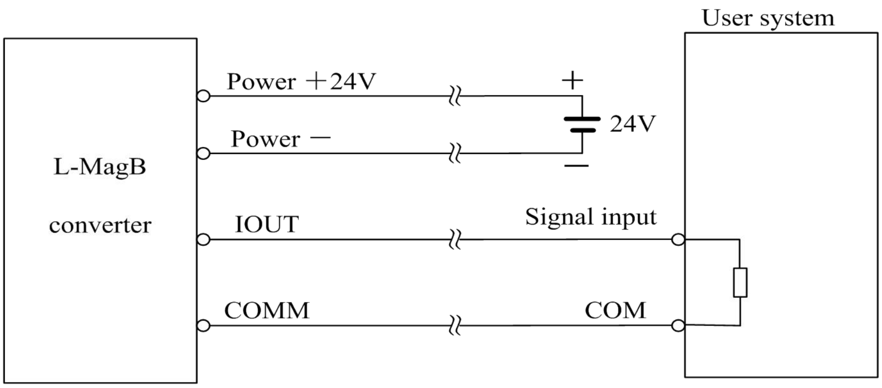


Fig.4.5 (c) L_MagB four connection(power supply and current output are insulated)

5. Setting parameters

After L-magB electromagnetic flowmeter converter and sensor connect to the pipe (no matter demarcate or use), may do the next work first:

- Connect the pipe fore-and-aft the sensors tighten.
- Make sure the sensor connects the earth.
- Make sure the liquid stillness when regulating zero of the instrument.
- Make sure the oxidation velum of sensor makes steadily (electrode and liquid contact continuously about 48 hours).

5.1 **L-magB** parameters and setting

When electrify, the instrument comes into measure way automatically, and under this way it can do all the functions and display data. Under the parameter setting way, user can set the parameter by the four keys.

5.1.1 Keys function

a) Keys' function in self- testing way

"Down" key: Selecting displayed data on lower line in turn;

"Up" key: Selecting displayed data on higher line in turn;

"Compound" key + "Enter" key: Come into parameter setting

"Enter" key: Press it to come into the picture of select function.

Under the measure, adjust of the LCD contract is used "Compound" key + "Up" key or "Compound" key + "Down" key for several seconds;

b) Function keys for parameters setting

"Down" key: Subtract 1 from the number at cursor area;

"Up" key: Plus 1 to the number at cursor area;

"Compound" key + "Down" key: Cursor turns left;

"Compound" key + "Up" key: Cursor turns right;

"Enter" key: In/Out submenu;

"Enter" key: Press for two seconds under any state and will return to automate measure way.

Note: 1) When use "Compound" key, you should press "Compound" key and "Up" or "Down" both;

2) It will return to the measure way automatically after 3 minutes when under the parameter setting way;

3) Direct select of zero correction about the flow, you can move the cursor to

the left + or - , and use “Down” or “Up” to switch;

5.1.2 Function keys for setting parameters

To set or correct working parameters, the converter should be running in parameters setting way instead of measuring status. In measuring status, push “Compound”+“Enter” keys getting to the select of parameter and transfer password (0000), and then correct the password with one of the new passwords that are provided by manufacturer. Finally, push the “Compound”+“Enter” keys to work in Parameters Setting Way.

There are 6 Passwords in design and among them 4 for deferent operators in secret and 2 are fixed passwords for system operation.

5.1.3. Functions select menu

Push “Compound”+“Enter” keys to the functions select menu, push “Up” or “Down” keys to select, there are two functions:

Code	Functions	Notes
1	Parameters Set	Select this function; It can enter the picture of parameter.
2	Clr Total Rec	Select this function， It can be gross reset operation.
3	Fact Modif Rec	Select this function, It can be check the factor ‘s modif Record

5.1.3.1 Parameters Set

Press “Compound”+“Enter” key, it displays “Parameters Set” function. Input password. Press “Compound”+“Enter” key, it getting to Parameters Setting status.

5.1.3.2 Clr Total Rec

To push “Compound”+“Enter” keys getting to the select of parameter, then push “Up” key to “Clr Total Rec”, input the passwords. When the passwords becomes “00000”, this function is done, the gross is 0 in the instrument.

5.1.3.3 Fact Modif Rec

To push “Compound”+“Enter” keys getting to the select of parameter, then push “Up” key to “Fact Modif Rec”(Detail consult the AppendixThree)

5.1.4 Setting Parameters in Menu

There are 54parameters of L-magB, user can set every parameter. The List of Parameters is shown below:

Setting Parameters in Menu

Code	**Parameter words**	**Setting Way**	**Grades**	**Range**
1	Language	Select	2	English
2	Comm Addres	Set count	2	0～99
3	Baud Rate	Select	2	600～14400
4	Snsr Size	Select	2	3～3000
5	Flow Unit	Select	2	L/h、L/m、L/s、m^3/h、m^3/m、m^3/s、UKG、USG
6	Flow Range	Set count	2	0～99999
7	Flow Rspns	Select	2	1～50
8	Flow Direct	Select	2	Plus/ Reverse
9	Flow Zero	Set count	2	0～±9999
10	Flow Cutoff	Set count	2	0～599.99%
11	Cutoff Ena	Select	2	Enable/Disable
12	Total Unit	Select	2	0.001m^3～1m^3、0.001L～1L、0.001UKG～1UKG、0.001USG～1USG
13	SegmaN Ena	Select	2	Enable/Disable
14	Analog Type	Select	2	0～10mA /4～20mA
15	Pulse Type	Select	2	Freque / Pulse
16	Pulse Fact	Select	2	0.001m^3～1m^3、0.001L～1L、0.001UKG～1UKG、0.001USG～1USG
17	Freque Max	Select	2	1～ 5999 HZ
18	Mtsnsr Ena	Select	2	Enable/Disable
19	Mtsnsr Trip	Set count	2	59999 %
20	Alm Hi Ena	Select	2	Enable/Disable
21	Alm Hi Val	Set count	2	000.0～ 599.99 %

22	Alm Lo Ena	Select	2	Enable/Disable
23	Alm Lo Val	Set count	2	000.0～599.99 %
24	Sys Alm Ena	Select	2	Enable/Disable
25	Clr Sum Key	Set count	3	0～99999
26	Snsr Code1	User set	4	Finished Y M
27	Snsr Code2	User set	4	Product number
28	Field Type	Select	4	Type1,2,3
29	Sensor Fact	Set count	4	0.0000～5.9999
30	Line CRC Ena	Select	4	Enable/Disable
31	Lineary CRC1	User set	4	Set Velocity
32	Lineary Fact 1	User set	4	0.0000～1.9999
33	Lineary CRC2	User set	4	Set Velocity
34	Lineary Fact 2	User set	4	0.0000～1.9999
35	Lineary CRC3	User set	4	Set Velocity
36	Lineary Fact 3	User set	4	0.0000～1.9999
37	Lineary CRC4	User set	4	Set Velocity
38	Lineary Fact4	User set	4	0.0000～1.9999
39	FwdTotal Lo	Correctable	5	00000～99999
40	FwdTotal Hi	Correctable	5	00000～9999
41	RevTotal Lo	Correctable	5	00000～99999
42	RevTotal Hi	Correctable	5	00000～9999
43	PlsntLmtEna	Select	5	Enable/Disable
44	PlsntLmtVal	Select	5	0.010～0.800m/s
45	Plsnt Delay	Select	5	400～2500ms
46	Pass Word 1	User correct	5	00000～99999
47	Pass Word 2	User correct	5	00000～99999
48	Pass Word 3	User correct	5	00000～99999
49	Pass Word 4	User correct	5	00000～99999
50	Analog Zero	Set count	5	0.0000～1.9999
51	Anlg Range	Set count	5	0.0000～3.9999
52	Meter Fact	Set count	5	0.0000～5.9999
53	MeterCode 1	Factory set	6	Finished Y /M
54	MeterCode 2	Factory set	6	Product Serial No

Parameters of converters can decide the running status, process and output ways as well as state of output. Correct option and setting of parameters can keep the converters running optimally and get higher accuracies of output bother in display and in measurement.

There are 6 grades of passwords for setting parameters function. Grades 1 to grade 5 of passwords are for users and grade 6 of password is for manufacturer. Users can reset their passwords of grades 1~4 in grade 5.

Users can check converters parameters in any grade of password. However, if users want to change parameters pf converters, deferent grade of parameters have to be used by the users.

Grade 1 of password (set by manufacturer as 00521): users can only read parameter.

Grade 2 of password (set by manufacturer as 03210): users can change 1~24 parameters.

Grade 3 of password (set by manufacturer as 06108): users can change 1~25parameters.

Grade 4 of password (set by manufacturer as 07206): users can change 1~38parameters.

Grade 5 of password (Fixed): users can change 1~52 parameters.

Password Grade 5 can be set by skilled users. Grade 4 is mainly used for resetting total volume in password. Grades 1~3 can be set by any one who can be chosen by users.

5.2 Details Parameters

5.2.1 Language

There are 1 languages for L-magB converter operation. They can be set by users according to the users needs.

5.2.2 Comm Addres

It means this instrument's address when communicates with many, and has 01~99, holding the 0.

5. 2.3 Baud Rate

600, 1200, 2400, 4800, 9600, 19200, baud rate.

5.2.4 Snsr Size

L-magB converters can be equipped with some deferent sensors that have deferent diameter of measuring pipes. The pipes in deferent diameters from 3mm to 3000mm can be chosen in relative table.

5.2.5 Flow unit

The flow unit can choose form the parameters (L/s、L/m、L/h、m^3/s、m^3/m、m^3/h、UKG 、 USG),and the user can choose the proper unit according to the technological requirement and using habit.

5.2.6 Flow Range

Flow range means upper limit value, and lower limit value is set “0” automatically. So, it makes the range, and makes the relation of percent display, frequency output and current output with flow:

percent display = (flow measure / measure range) * 100 %;

frequency output = (flow measure / measure range) * frequency full;

current output = (flow measure / measure range) * current full + base point;

pulse output will not affect.

5.2.7 Flow Rspns

It means time of filter measure value. The long one can enhance the stability of flow display and output digital, and fits for gross add up of pulse flow; the short one means fast respond rate, and fits for production control. It is set by select.

5.2.8 Flow Direct

If users think the direct and design are differ, just change the direct parameter is OK, but not change exciting or signal.

5.2.9 Flow zero

Make sure the sensor is full of flow, and the flow is stillness. Flow zero is shown as velocity of flow, mm/s.

FS = ○ ○ ○ ○ ○
± ○ ○ ○ ○ ○

Converter's zero-flow correction displays like this:

Upper small words: FS means measure value of zero;

Lower large words: correction value of zero.

When FS is not "0", make FS = 0. Note: if change the value on next line and FS increases, please change the "+, -" to correct FS to zero.

Flow zero is the compound value of the sensor, and should be recorded in sensor list and band. The unit will be mm/s, and the sign will be opposite with correction value.

5.2.10 Flow cutoff

Flow cutoff is set in percentage of Upper Limit Range of flow, and users can delete all Negligible Small Signals of flow volume, velocity and percentage out of displaying and outputting them. Sometimes user can delete output of current output signal and frequency (pulse) output signal only to have flow, velocity and percentage being displayed.

5.2.11 Total Unit

Converter display is counter with 9 bits, and the max is 999999999.

Integrator units are L, m^3 、UKG、USG (liter, stere,Ukgal,USgal).

Flow integrator value: 0.001L、 0.010L、 0.100L、 1.000L

0.001m^3、 0.010m^3、 0.100m^3、 1.000m^3;

0.001UKG、0.010UKG、0.100UKG、1.000UKG,

0.001USG、0.010USG、 0.100USG、1.000USG。

5.2.12 SegmaN Ena

When "SegmaN Ena" is "enable", if the flow flows, the sensor will export pulse and current。When it is “disable”, the sensor will export pulse as “0” and current as “0”(4mA or 0mA) for the flow flows reversals.

5.2.13 Output currents

Output current types can be chosen by users as 1~10mA or 4~20mA practically.

5.2.14 Analog Type

Two kinds of Pulse Outputs are can be chosen: Frequency Output and Pulse Output. Frequency Output is continuous square waveform and Pulse output is a serial wave of square wave. Frequency output is mainly used for instant flow and total integrated flow in short time measurement. Frequency output can be chosen in equivalent frequency unit and volume of integrated flow can be displayed. Frequency Output can be used in long time measurement for total integrated flow with volume units.

5.2.15 Pulse Type

Frequency output and pulse output are usually from OC gates so that DC power supplies and load resistors have to be required (See Part 4.4).

5.2.16 Pulse Fact

Equivalent pulse Unit is referred to one pulse for value of flow. The range of pulse equivalent can be chosen:

Pulse Equivalent	Flow	Pulse Equivalent	Flow
1	0.001L/cp	9	0.001USG/cp
2	0.01L/cp	10	0.01 USG /cp
3	0.1L/cp	11	0.1 USG /cp
4	1.0L/cp	12	1.0 USG /cp
5	0.001m^3/cp	13	0.001UKG/cp
6	0.01m^3/cp	14	0.01 UKG /cp
7	0.1m^3/cp	15	0.1 UKG /cp
8	1.0m^3/cp	16	1.0 UKG /cp

Under the same flow, the smaller pulse, the higher frequency output, and the smaller error will be. The highest pulse output is 100cp/s, and mechanism electromagnetic counter can get 25 frequency/s.

5.2.17 Freque Max

Frequency output range is as the upper limit of flow measure, just the percent flow 100%. Frequency output upper limit can be selected between 1～5000Hz.

The state of empty pipe can be detected with the function of converter. In the case of Empty Pipe Alarm, if the pipe was empty, the signals of analog output and digital output would be zero and displayed flow would be zero, too.

5.2.18Mtsnsr Ena

The state of empty pipe can be detected with the function of converter. In the case of Empty Pipe Alarm, if the pipe was empty, the signals of analog output and digital output would be zero and displayed flow would be zero, too.

5.2.19Mtsnsr Trip

When the pipe is full of liquid (whether flowing or not), the parameter of "Mtsnsr" could be modified more easily. The parameter displayed upper line is real MTP, and the parameter displayed bellow is the "Mtsnsr trip" that should be set. When setting "Mtsnsr trip", you could be according to the real MTP, the value that should be set is usually three to five times of real MTP.

5.2.20 Alm Hi Ena

Users can choose "Enable" or "Disable".

5.2.21 Alm Hi Val

The parameter of upper limit alarm is percentage of flow range and can be set in the way of setting one numerical value between 0%~199.9%.When the value of flow percentage is larger than the value of setting value, the converter outputs the alarm signal.

5. 2.22Alm Lo

The same as upper limit alarm.

5.2.23 Sys Alm Ena

Selecting Enable will have the function, and selecting Disable will cancel the function.

5.2.24 Clr Sum Key

User use more than 3 byte code to enter ,Then set this password in Clr Total Rec.

5.2.25 Snsr Code

It is referred to the produced date of sensor and the serial number of product that can keep the sensors coefficient right and accurate.

5.2.26 Sensor Fact

“Sensor Coefficient” is printed on the Label of the sensor when it is made in factory. The “sensor coefficient” has to be set into Sensor Coefficient Parameter when it runs with converter.

5.2.27 Field Type

L-magB affords three exciting frequency types: 1/16 frequency (type 1), 1/20frequency (type 2), 1/25 frequency (type 3)。 The small-bore one should use 1/16 frequency, and large-bore one should use 1/20 or 1/25 frequency. When using, please select type 1 first, if the zero of velocity is too high, select the type 2 or type 3.

Note: Demarcate on which exciting type, working on it only.

5.2.28 FwdTotal Lo、hi

Positive total volume high byte and low byte can change forthcoming and reverse total value, and be used to maintenance and instead.

User use 5 byte code to enter, and can modify the positive accumulating volume (∑+). Usually, it is unsuitable to exceed the maximum the counter set（999999999）.

5.2.29 RevTotal Lo、hi

User use 5 byte code to enter, and can modify the negative accumulating volume (∑-).

Usually, it is unsuitable to exceed the minimum the counter set（999999999）.

5.2.30 PlsntLmtEn

For paper pulp, slurry and other serosity, the flow measure will have "cuspidal disturb", because the solid grain friction or concussion the measure electrode. L-magB converters use variation restrain arithmetic to conquer the disturbing by designing three parameters to select disturb character.

Set it "enable", start variation restrain arithmetic; set it "disable", close variation restrain arithmetic.

5.2.31PlsntLmtVl

This coefficient can disturb the variation of cuspidal disturb, and calculate as percent of flow velocity, thus ten grades: 0.010m/s, 0.020m/s, 0030m/s, 0.050m/s, 0.080m/s, 0.100m/s, 0.200m/s, 0.300m/s, 0.500m/s, 0.800m/s, and the smaller percent, the higher delicacy of cuspidal restrain.

Note: when using it, must test for select by the fact, and sometimes it is not the higher delicacy is good.

5.2.32 PlsntDelay

This coefficient can select the width of time of restrain cuspidal disturb and the unit is ms. If the duration is shorter than flow change in some time, L-magB will think it is cuspidal disturb, and if it is longer, L-magB will think it is natural. It also needs to select parameter in fact.

5.2.33User's password 1~4

Users can use 5 grades of passwords to correct these passwords.

5.2.34Analog Zero

When the converters are made in the factory, output current has been calibrated to zero scale, that is, accurate 0mA or 4mA output.

5.2.35Anlg Range

When the converters is made in the factory, output current have been calibrated to full scale, that is, accurate 10mA or 20mA output.

5.2.36Meter Fact

This fact is the special one of sensor-made-factory and the factory use this fact to unite L-magB electromagnetic flowmeters converters to make sure all the instruments can interchange by 0.1%.

5.2.37 MeterCode 1 and 2

Converter code records the date of manufacturing and serial number of converter.

6. Infrared telecontrol function keys

The operation of the infrared-hand-remote control keyboard is the same with the operation of the instrument. When use it, please keep the infrared transmitter of the infrared-hand-remote control keyboard and the receiver of the instrument parallel, with the distance of about one meter.

Concrete operation referring to the figure:

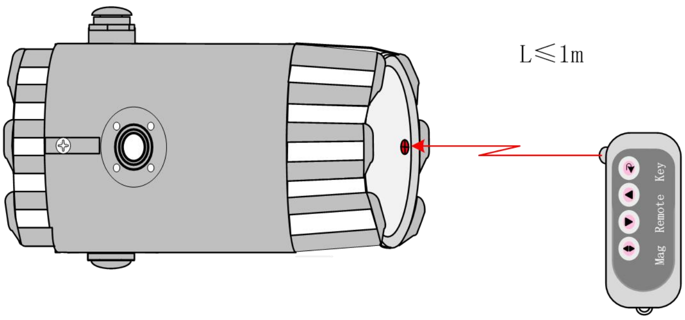


Fig6.1: The communication figure of the infrared-hand-remote control keyboard and the instrument

7. Alarm information

PCB of electromagnetic flowmeters converters uses SMT, so for user, it is unable to service, and cannot open the shell of converter.

L-mag-Bseries Intelligent converters have self-diagnose function. Without trouble of power and hardware circuit, the normal trouble can be alarmed correctly. This information displays  on the left of LCD. The trouble is like this:

FQH ---- Flow high limit alarm; FQL ---- Flow low limit alarm;

FGP ---- Flow empty pipe alarm; SYS ---- System exciting alarm.

UPPER ALARM ---- Flow high limit alarm;

LOWER ALARM ---- Flow empty pipe alarm;

LIQUID ALARM ---- Flow empty pipe alarm;

SYSTEM ALARM ---- System exciting alarm.

8. Troubleshooting

8.1 No display:

a) Check the power supply connection;

b) Check the power fuse to see for OK;

c) Check the contrast of LCD and regulate it to working state;

8.2 Exciting alarm

a) Check if the exciting cables EX1 and EX2 did not connected;

b) Check if the total resistance of sensor's exciting coil resistances less than 150Ω;

c) If a) and b) are OK, the converter is failed.

8.3 Empty pipe alarm

* If measured fluid full of testing pipe of sensor;
* When shorting circuit three connectors SIG 1, SIG 2, SIGGND of converter, and no "Empty Alarm" displayed then the converter works OK. In this case, it is possible that conductivity of measured fluid may be small or empty threshold of empty pipe and range of empty pipe are set wrongly.
* Check if the signal cable is OK;

* Check if the electro-poles are OK or not.

Let the flow is zero, then the displayed conductivity should be less than 100%.

Resistances of SIG1 to SIGGND and SIG2 to SIGGND are all less than 50kΩ (conductivity of water) during measurement operation. (It is better to test the resistances by means of multimeter with pointer to see the charging process well.)

* The DC voltage should be less than 1V between DS1 and DS2 testing the voltage by means of multimeter. If DC voltage is larger than 1V, the electro poles of sensor were polluted that have to be cleaned.

8.4 Measure flow disallow

* If measured fluid full of testing pipe of sensor;
* Check if the signal cable is OK;
* Check the sensor modulus and sensor zero whether set as the sensor escutcheon or leave factory checkout.

9. L-magB encasement and reserve

9.1 L-magB encasement

L-magB electromagnetic flowmeter converter is packed as vacuum, and can insulate wet. The bag is L-magB's appropriative one, if the bag is open, it will not product of original factory.

Installation Manual, Certificate of Product and Packing List are all with the L-magB converter.

9.2 Shipping and storage

To prevent the product from damage during shipping, keep the original package of manufacturer. The products should be stored in storehouse that meets following conditions:

a) Keep off raining and moisture;

b) Keep off heavy vibration, and strike;

c) Ambient temperature -20～+60℃；

d) Humidity less than 80%.

Appendix One: Selection of exciting frequency（re.）

L-magB afford three exciting frequency types: 1/16 frequency (type 1), 1/20 frequency (type 2), 1/25 frequency (type 3). The small-bore one should use 1/16 frequency, and large-bore one should use 1/20 or 1/25 frequency. When using, please select type 1 first, if the zero of velocity is too high, select the type 2 or type 3.

In the user's sensor that L-magB gives, often the sensor is not fit for the L-magB converters, at this time can do like this:

(1) Small exciting loop resist

If the exciting loop resist is smaller than the sensor's request, can series resist to get the total value. The series resist's power should be more than one time of fact, for example, series 10Ω on 250mA current, the power will be 3W.

(2) Large exciting loop resist (change exciting current)

If the exciting loop resist is larger than the sensor's request, can change the exciting current, for example, if exciting loop resist is 70Ω, for 250mA this is larger, so can change the current to 187mA.

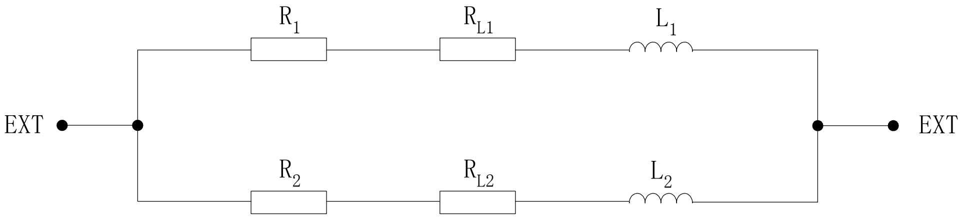
(3) Large exciting loop resist (change loop connect)

If the exciting loop resist is larger than the sensor's request, can change the connect of loop, for example, if exciting loop resist is 200Ω, every exciting loop resist is 100Ω, parallel connection the upper and lower loop is OK.

According the analysis, change the connect of exciting loop, measure from either head of exciting loop,

Total resist = $(R1 + R_{L1})$ parallel connection $(R2 + R_{L2}) \leq 120\Omega$;

(As the Fig. R_1, R_2----addition resists; R_{L1}, R_{L2}----exciting resists)



Total resist = ($R_1 + R_{L1}$) parallel connection ($R_2 + R_{L2}$) $\leq 120\Omega$;

(as the Fig. R_1, R_2----addition resists; R_{L1}, R_{L2}----exciting resists)

(4) Sensor exciting current steady time so long (inductance is too large)

For this question, firstly changing exciting type, select 1/16 or 1/25 frequency.

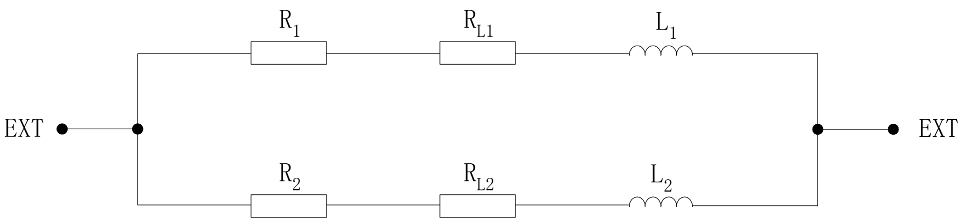
If cannot content, change connect of exciting loop.

Exciting current transition time $\tau = L / R$

L ---- Exciting loop inductance; R ---- exciting loop resist.

So decrease L and increase R both can decrease τ.

According the analysis, change the connect of exciting loop, measure from either head of exciting loop,



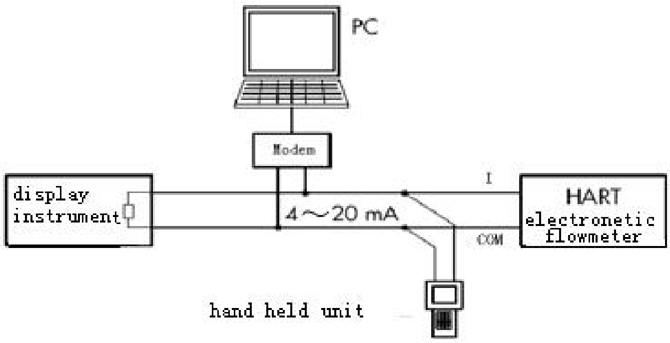
Total resist = ($R1 + R_{L1}$) parallel connection ($R2 + R_{L2}$) $\leq 120\Omega$;

(As the Fig. R_1, R_2----addition resists; R_{L1}, R_{L2}----exciting resists)

Appendix Two:HART function explaination

1. HART Bus network fig

HART Bus transfers data-signal through signal line which value is from 4 to 20mA.For this reason,it can save local data communication line and implement data communication.Its adaptive for local using.The local network fig composed by HART Bus is as follows:



2. Instruction for setting of the converter

1. If you use the handset of our company, you need to set the meter address to 1 and set the baud rate to 4800;

2. If you use other handset such as 375 or 275, you need to set the meter address to 2 and set the baud rate to 4800; (This function is according to the real object please)

3 If the communication mode, the address or the baud rate of the meter is not set correctly, the handset can't set the parameters.

3.Matters need attention of HART using function meter

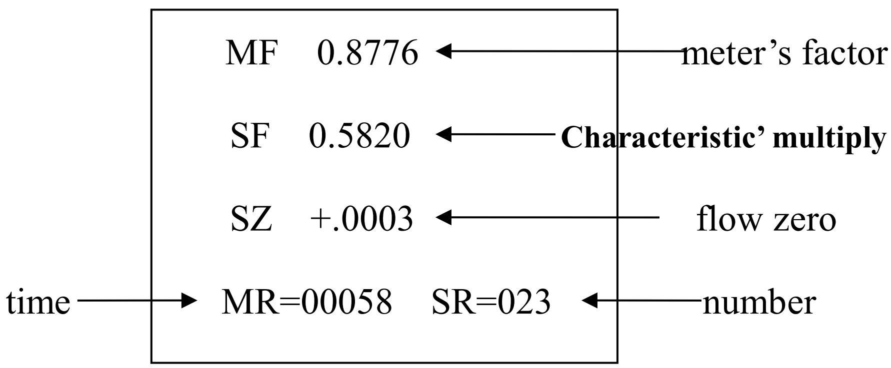
1) Load which is parallel connection between electrical flowmeter and Hand held uint and HARTMODEM is on polarity.
2) Resistance of circuit should be greater than 200Ω,less than 500Ω.
3) Hand held uint and HARTMODEM shouldn't be connection in series in current circuit.

set the baud rate to 4800;

.

AppendixThreeThefunction of protecting the Characteristic Flow Factor

L-Mag-B converter has a function of protecting the Characteristic Flow Factor. The key content is that the factor could not be modified easily. MagB converter increases a new function to record the modified procedure and modified times of flow zero, sensor factor, and meter factor, any change of these three factors could be recorded. The sensor factor and modifying times could be recorded in Test Report, and when next time testing the factor in Test Report and factor in the convertor are compared to check whether the Characteristic Flow Factor has been changed. The detail about the Characteristic Flow Factor protection function can be found in the appendix.



Attention！

The last record is displayed when this item is first entered, if you want to browse the history records press “down key”, and could search for the last record to the thirty-two record ahead. Finally the times of record modified (MR) should be written down on the paper before next time test.

AppendixFour:311Bserieswithnonlinearamendmentfunctio nAdditional Instruction

Nonlinear amendment function， in principle is used for line regulation of low flow which under 0.3m/s. The function is designed to four amendments, and divided into four flow velocity points and four correction factors.

Nonlinear amendment coefficient works on the basis of the original transducer calibration coefficient, so please close nonlinear amendment function before calibrating the transducer coefficient, and open the function to realize nonlinear amendment after calibrating. Set correction points and correction factors according to the nonlinear segment of transducer, if be the appropriate settings, do not have to recalibration.

As a rule, the flow velocity which calculated form transducer coefficient is called original flow velocity, and the other which gained from non-linear amendment is called correction flow velocity. The relationship between them is shown as following:

a. Correction point 1 > Original flow velocity ≥ Correction point 2:

   Correction flow velocity = Correction coefficient 1 × Original flow velocity

b. Correction point 2 > Original flow velocity ≥ Correction point 3:

   Correction flow velocity = Correction coefficient 2 × Original flow velocity

c. Correction point 3 > Original flow velocity ≥ Correction point 4:

   Correction flow velocity = Correction coefficient 3 × Original flow velocity

d. Correction point 4 > Original flow velocity ≥ 0:

   Correction flow velocity = Correction coefficient 4 × Original flow velocity

Notice: Correction points must satisfy the following relationship:

Correction point 1＞Correction point 2＞Correction point 3＞Correction point 4

The intermediate value of correction coefficient is 1.0000， when bigger than it is considered as positive coefficient (increase), and smaller is considered as negative coefficient (decrease).

AC INFINITY

AIRLIFT SERIES

SHUTTER EXHAUST FAN SYSTEM

USER MANUAL

WELCOME

Thank you for choosing AC Infinity. We are committed to product quality and friendly customer service. If you have any questions or suggestions, please don't hesitate to contact us. Visit www.acinfinity.com and click contact for our contact information.

EMAIL
support@acinfinity.com

WEB
www.acinfinity.com

LOCATION
Los Angeles, CA

MANUAL CODE AL2109X2

PRODUCT	MODEL	UPC-A
AIRLIFT S10	AC-ALS10	819137021433
AIRLIFT S12	AC-ALS12	819137021440
AIRLIFT S14	AC-ALS14	819137021457
AIRLIFT S16	AC-ALS16	819137021464
AIRLIFT T10	AC-ALT10	819137020900
AIRLIFT T12	AC-ALT12	819137020917
AIRLIFT T14	AC-ALT14	819137020924
AIRLIFT T16	AC-ALT16	819137020948
AIRLIFT T18	AC-ALT18	819137020948
AIRLIFT T20	AC-ALT20	819137020955
AIRLIFT T22	AC-ALT22	819137020962
AIRLIFT T30	AC-ALT30	819137020986
AIRLIFT T36	AC-ALT36	819137020993

SERIOUS INJURY OR DEATH. Please do not touch the fan's impeller and blades. Secure all nearby objects including wires and cables from coming into contact with the fan’s impeller and blades. Use caution when deciding where to install this fan.

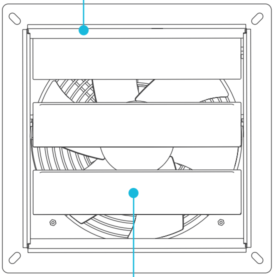
MANUAL INDEX

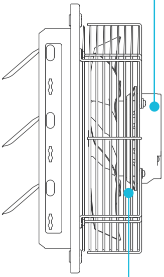
KEY FEATURES

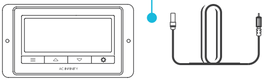
HEAVY DUTY BUILD
Fans are enclosed in steel and wire guards to withstand shocks and harsh environments.

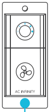
EFFICIENT EC-MOTOR
PWM controlled EC-motor enables precise speed control, low noise, and higher energy efficiency.

SMART CONTROLLER
Fetures automation controls that activate the fan according to temperature, humidity, timer, and schedules.









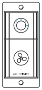
WEATHERPROOF
The shutter fan unit is sealed to Ingress Protection 44 standards to be resistant to liquid and dust.

DUAL BALL BEARINGS
Long life bearings rated at 67,000 hours. Also allows the fan to be mounted in any direction.

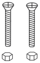
SPEED CONTROLLER
Single button controller with circular readout display that enables fan speed control in eight speeds.

PRODUCT CONTENTS

AIRLIFT S-SERIES



SPEED
CONTROLLER
(x1)

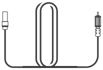


MACHINE SCREWS
(WALL MOUNT)
(x2)

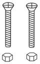
WOOD SCREWS
(WALL MOUNT)
(x2)

AIRLIFT T-SERIES

SMART
CONTROLLER
(x1)



SENSOR
PROBE
(x1)

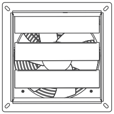


MACHINE SCREWS
(WALL MOUNT)
(x2)

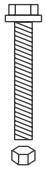
WOOD SCREWS
(WALL MOUNT)
(x2)

WOOD SCREWS
(WALL HANG)
(x2)

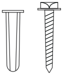
FAN UNIT



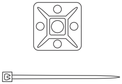
SHUTTER
FAN UNIT
(x1)



MACHINE SCREWS
(SHUTTER MOUNT)
(x4)



WOOD SCREWS
(SHUTTER MOUNT)
(x4)



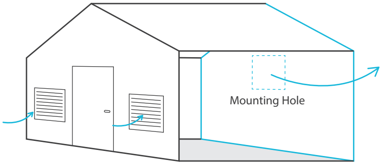
WIRE
TIES
(x4)

INSTALLATION

STEP 1

When installing in a large room like a green house, barn, or garage, it is recommended that the shutter fan should be mounted on the opposite side of any ventilation openings for better air circulation.

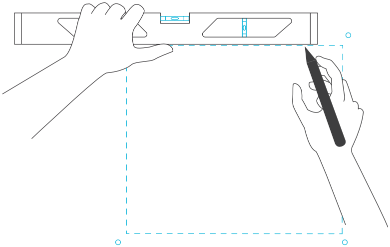
The fan should also be positioned higher in the room to exhaust out heated air, which will rise on its own due to natural convection.



STEP 2

Measure the dimensions of the shutter fan's mounting frame which will go through the wall. Select a location on the wall where you will be mounting the fan. Please make sure that the wall is free of any wires or pipes.

Using the measurements of the shutter fan, use a level and ruler to draw an outline of the area to be drilled and cut.

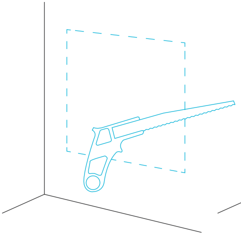


INSTALLATION

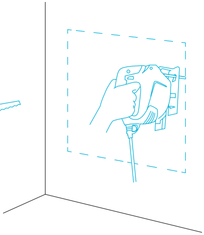
STEP 3

Depending on your mounting surface material, use the appropriate tools to cut into the wall.

Use a drill or a hand saw to create an opening large enough to insert a saw blade or jigsaw inside the outlined area of the wall panel.



Thinner Woods or Plastic

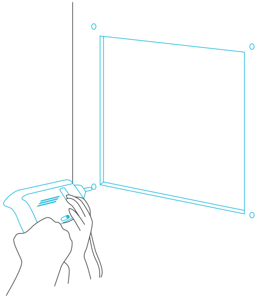


Woods, Tougher Plastic or, Metal

STEP 4

Position the shutter fan through the hole cut in step 3. Use it to measure the positioning of the mounting screws then remove the fan unit.

Then using a drill bit, create the four mounting holes.

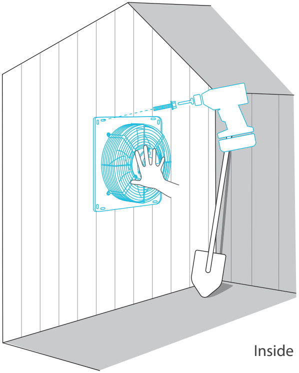


INSTALLATION

STEP 5

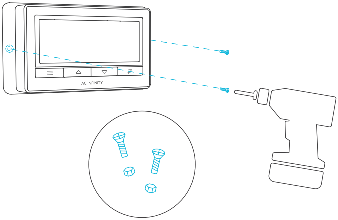
From inside the room, position the shutter fan back into the opening of the fan. Make sure the controller connectors and power cord is on the inside of the room. Then, use the included hardware to secure the fan.

If you are using your own shutter, remove the AIRLIFT's shutter by unscrewing the nuts and bolts from the fan guard. Reassemble the fan guard onto your existing shutter by reapplying the nuts and bolts in the same mounting locations.



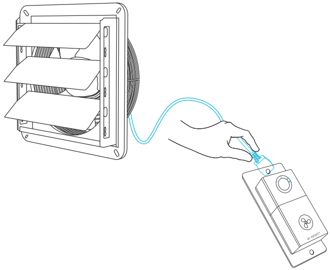
STEP 6

Once the fan is mounted securely you can then mount the controller using the included hardware. Place the controller near the fan in order to power the controller.

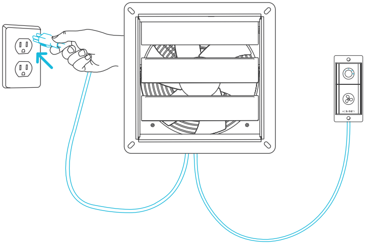


POWERING AND SETUP
S-SERIES

STEP 1
Plug the shutter fan's 4-pin Molex connector into the speed controller's port at the top.

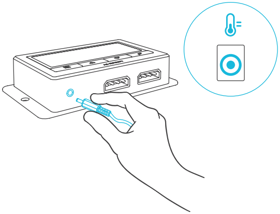


STEP 2
Plug the fans power cord into an AC power outlet to power the fan and controller.

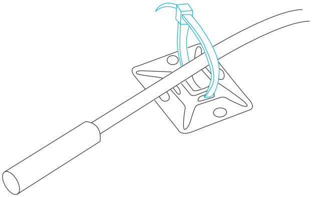


POWERING AND SETUP
T-SERIES

STEP 1
Locate the connector plug of the sensor probe and plug it into the bottom of the thermal controller.

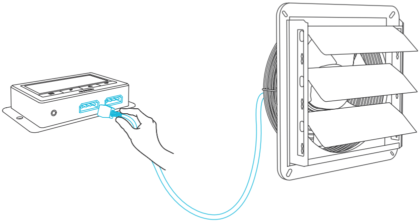


STEP 2
Secure the sensor probe head near by, preferably in the hottest area of the room. You can use the wire tie to secure the probe away from the fan blades.

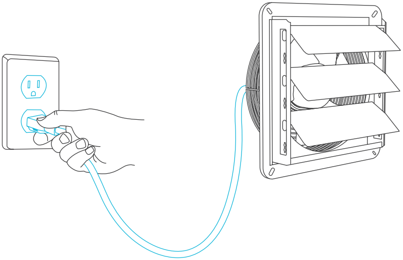


POWERING AND SETUP
T-SERIES

STEP 3
Connect the Molex end from the fan into the bottom of the controller.

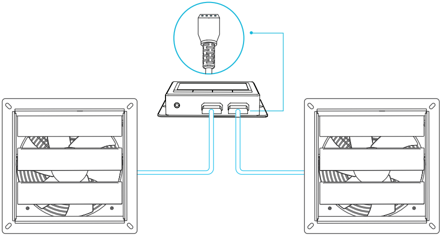


STEP 4
Plug the fans power cord into an AC power outlet to power the fan and controller.

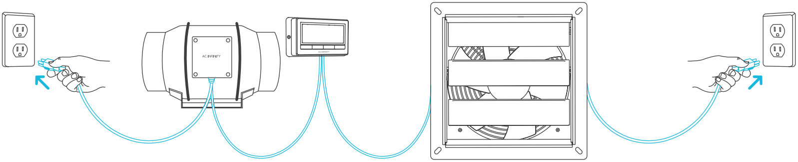


DAISY CHAIN AND SETUP

The fan controller can power up to two compatible fans to share the same programming.
(The illustration below is for T-Series model only.)



The controller included is compatible with AC Infinity fan models that contain an EC-motor. Typically, EC-motor fans will have a separate cord coming out of it for the power and the controller. The compatible fans do not need to be the same model or part of the same product series.

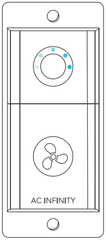


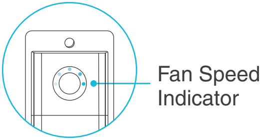
EC Motor - Compatible

PROGRAMMING

FAN SPEED ADJUSTING

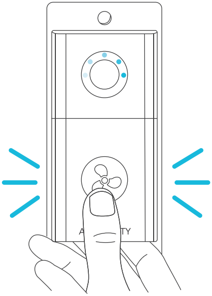
The controller features a single button that controls the fan speed from 0-8. Pressing the speed button increases the fan speed in one unit increments. Pressing the button at the 8 setting will set the fan speed back to 0.





POWERING ON AND OFF

Holding the speed button for 4 seconds will turn the fan OFF. Pressing it again from OFF will turn the fan ON at its last speed setting.



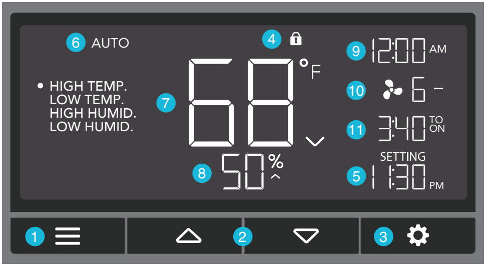
PROGRAMMING

1. MODE BUTTON
Cycles through the controller's available modes: OFF, ON, AUTO (4 triggers), TIMER TO ON, TIMER TO OFF, CYCLE (On and Off), and SCHEDULE (On and Off).

2. UP/DOWN BUTTONS
Adjusts the value of your current mode. The up button increases and down button decreases the setting. Hold both to reset values to OFF or 0.

3. SETTING BUTTON
Cycles through the controller's available settings: DISPLAY, °F/ °C, CLOCK, CALIB. T°/ H%, and TRANS. T°/ H%.

4. STATUS ICONS
Flashes or displays the alert icons from the controller. Icons include Timer Alert and Display Lock.



5. USER SETTING
Displays the value of your current mode. Use the up and down buttons to adjust the value.

6. CONTROLLER MODE
Displays the controller's current mode. Pressing the mode button cycles through the available modes.

7. PROBE TEMPERATURE
Displays the current temperature that the probe is detecting. Shows "--" if no probe is plugged in. Includes a trend indicator that signals a rise, steady, or fall in temperature within the last hour.

8. PROBE HUMIDITY
Displays the current humidity that the probe is measuring. Shows "--" if no probe is plugged in. Includes a trend indicator that signals a rise, steady, or fall in temperature within the last hour.

9. CURRENT TIME
Displays the current time. The internal battery sustains the clock so it does not default to 00:00 if power is cut off. Please see page 23 for instructions on how to set up the clock time.

10. FAN SPEED
Displays the current speed in which the fan is running. Includes a trend indicator that signals if the fan is currently rising, falling or holding steady.

11. COUNTDOWN
Displays the countdown of the TIMER TO ON, TIMER TO OFF, CYCLE, or SCHEDULE modes.TO ON shows the amount of time left before the fan turns on. TO OFF shows the amount of time left before the fan turns off.

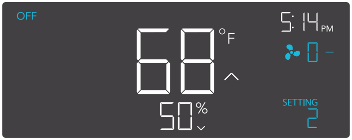
PROGRAMMING

CONTROLLER MODES

Pressing the mode button will cycle through the controller's available programming modes: OFF, ON, AUTO (4 triggers), TIMER TO ON, TIMER TO OFF, CYCLE (On and Off), and SCHEDULE (On and Off).

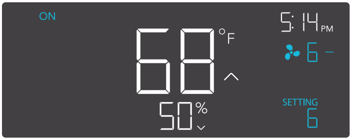
OFF MODE

Your fan will not run while in this mode. However, the fan speed set while in this mode establishes the minimum speed in other modes. When the fan is triggered to turn OFF in all other modes, it will instead run at the speed set here.



ON MODE

Your fan will actively run at the speed set here, regardless of the probe's reading. The ON mode also serves as the maximum speed setting the other modes will run in.

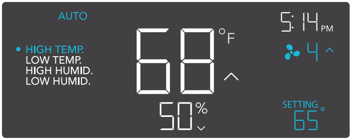


AUTO MODE (HIGH TEMPERATURE TRIGGER)

Pressing the up or down button sets the high temperature trigger. The fans will activate if the probe's reading meets or exceeds this threshold.

Once triggered, the fan will gradually ramp up to the speed set in ON mode. If the probe's reading falls below this trigger point, the fans will gradually slow down to a stop or at the speed set in OFF mode.

You may set this trigger below the low temperature trigger to create a specific range in which the fan is active.



Note that this trigger can activate as long as you are in AUTO Mode, even if you are viewing a different trigger within AUTO Mode.

If there is a speed set in OFF Mode other than zero, the fans will run at that speed when triggered to turn off.

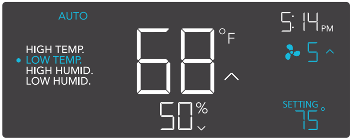
PROGRAMMING

AUTO MODE (LOW TEMPERATURE TRIGGER)

Pressing the up or down button sets the low temperature trigger. The fans will activate if the probe's reading meets or falls below this threshold.

Once triggered, the fan will gradually ramp up to the speed set in ON mode. If the probe's reading rises above this trigger point, the fans will gradually slow down to a stop or at the speed set in OFF mode.

You may set this trigger above the high temperature trigger to create a specific range in which the fan is active.



Note that this trigger can activate as long as you are in AUTO Mode, even if you are viewing a different trigger within AUTO Mode.

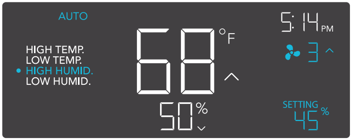
If there is a speed set in OFF Mode other than zero, the fans will run at that speed when triggered to turn off.

AUTO MODE (HIGH HUMIDITY TRIGGER)

Pressing the up or down button sets the high humidity trigger. The fans will activate if the probe's reading meets or exceeds this threshold.

Once triggered, the fan will gradually ramp up to the speed set in ON mode. If the probe's reading falls below this trigger point, the fans will gradually slow down to a stop or at the speed set in OFF mode.

You may set this trigger below the low humidity trigger to create a specific range in which the fan is active.



Note that this trigger can activate as long as you are in AUTO Mode, even if you are viewing a different trigger within AUTO Mode.

If there is a speed set in OFF Mode other than zero, the fans will run at that speed when triggered to turn off.

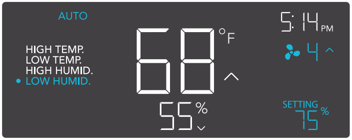
PROGRAMMING

AUTO MODE (LOW HUMIDITY TRIGGER)

Pressing the up or down button sets the low humidity trigger. The fans will activate if the probe's reading meets or falls below this threshold.

Once triggered, the fan will gradually ramp up to the speed set in ON mode. If the probe's reading rises above this trigger point, the fans will gradually slow down to a stop or at the speed set in OFF Mode.

You may set this trigger above the high humidity trigger to create a range in which the fan is active.



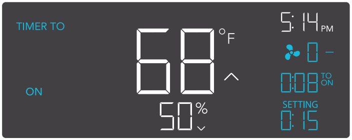
Note that this trigger can activate as long as you are in AUTO Mode, even if you are viewing a different trigger within AUTO Mode.

If there is a speed set in OFF Mode other than zero, the fans will run at that speed when triggered to turn off.

TIMER TO ON MODE

Pressing the up or down button sets a countdown time. Once the timer ends, the fans will trigger to run at the speed set in ON Mode. If there is a speed set in OFF Mode, the fans will run at that speed during the countdown.

The countdown will begin if no buttons are pressed for 5 seconds. The time left on the countdown is displayed below the current fan speed. Leaving the timer mode while the countdown is running will pause it until you return to this mode.



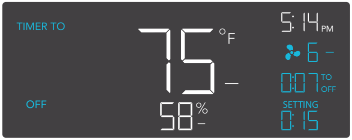
If there is a speed set in OFF Mode other than zero, the fans will run at that speed when triggered to turn off.

PROGRAMMING

TIMER TO OFF MODE

Pressing the up or down button sets a countdown time. The fans will run at the speed set in ON Mode until the countdown ends. If there is a speed set in OFF Mode, the fans will run at that speed after the end of the countdown.

The countdown will begin if no buttons are pressed for 5 seconds. The time left on the countdown is displayed below the current fan speed. Leaving the timer mode while the countdown is running will pause it until you return to this mode.

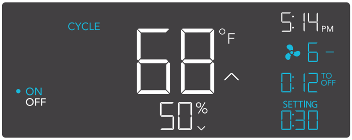


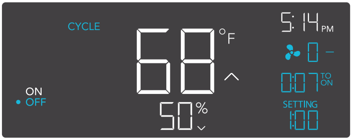
If there is a speed set in OFF Mode other than zero, the fans will run at that speed when triggered to turn off.

CYCLE MODE (ON AND OFF)

Set an on duration and an off duration for the fan to cycle through continuously. Press the up or down button to first set a duration for the fan to activate. Then press the mode button again and set a duration for the fan to deactivate. When the fan is activated, it will run at the speed set in ON Mode. When the fan is deactivated, it will run at the speed set in OFF Mode.

The countdown will begin if no buttons are pressed for 5 seconds. The time left on the countdown before the next on or off phase is displayed below the current fan speed. Leaving the cycle mode while the countdown is running will pause it until you return to this mode.





If there is a speed set in OFF Mode other than zero, the fans will run at that speed when triggered to turn off.

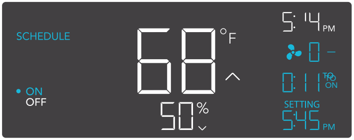
PROGRAMMING

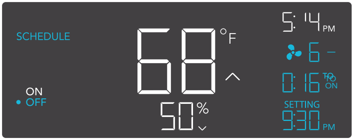
SCHEDULE MODE (ON AND OFF)

Sets an on clock-time and an off clock-time schedule for the fan to follow daily. Press the up or down button to first set up an on clock-time to trigger ON mode, then press the mode button to set an off clock-time to trigger OFF mode. Please be sure to set the current clock time under settings.

When the fan is triggered to activate, it will run at the speed set in ON Mode. When the fan is triggered to deactivate, it will run at the speed set in OFF Mode.

The countdown will begin if no buttons are pressed for 5 seconds. The time left on the countdown before the next on or off phase is displayed below the current fan speed. The fan will not follow this schedule if you leave this mode. If you re-enter the Schedule Mode, it will continue to follow the latest schedule you have set.





If there is a speed set in OFF Mode other than zero, the fans will run at that speed when triggered to turn off.

PROGRAMMING

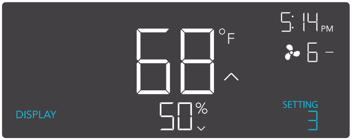
CONTROLLER SETTINGS

Pressing the setting button will cycle through the controller's available settings: DISPLAY, °F/ °C, CLOCK, CALIB. T°, CALIB. H%, TRANS. T°, and TRANS. H%.

DISPLAY SETTING

Adjusts the display brightness and auto-dimming. Press the up or down button to cycle through levels 1, 2, 3, A2 and A3; 3 being the highest brightness setting, while 1 is the lowest. In settings 1, 2 and 3, the display will stay at that brightness level and will not automatically dim the display.

A2 and A3 will set the brightness level at 2 and 3, respectively, and will dim down the brightness level 1 when the controller is not being used after 15 seconds.

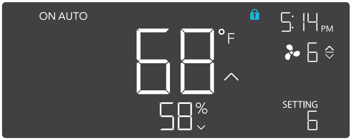


TOGGLING THE DISPLAY

Lock the controller by holding the setting button.

Press the setting button to turn the display off. Pressing the setting button again will turn the display back on.

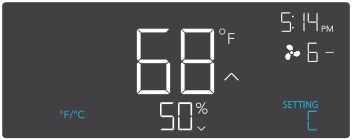
Programs will still run in the background while the LCD screen is off.



PROGRAMMING

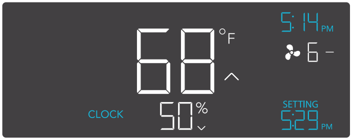
°F/°C SETTING

Changes the displayed units to Fahrenheit or Celsius. Press the up or down button to cycle through F and C. All displayed units will automatically convert when adjusting this setting.



CLOCK SETTING

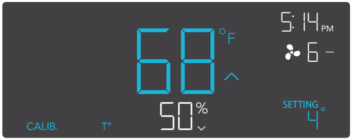
Adjusts the current clock time. Press the up or down button to increase or decrease the time. Once you cycle through 12:00 each time, the units will automatically change to AM or PM. The clock time is located at the top right corner of the display.



PROGRAMMING

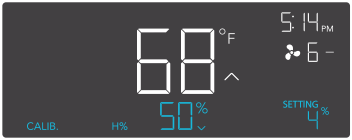
CALIBRATION TEMPERATURE SETTING

Adjusts the temperature reading the sensor probe is measuring. Press the up or down button to increase or decrease the data figure in 2°F (or 1°C) increments. The calibration cycle ranges from -8°F to 8°F (or -4°C to 4°C) and will be applied to the sensor probe's measurements.



CALIBRATION HUMIDITY SETTING

Adjusts the relative humidity reading the sensor probe is measuring. Press the up or down button to increase or decrease the data figure in 1% increments. The calibration cycle ranges from -8% to 8% and will be applied to the sensor probe's measurements.



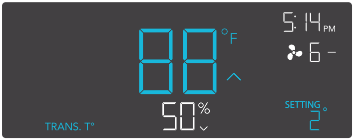
PROGRAMMING

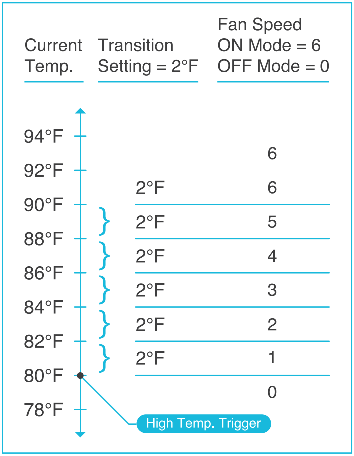
TRANSITION TEMPERATURE SETTING

Adjusts the transition threshold between the fan speeds in the AUTO Mode temperature triggers.

Press the up or down button to cycle through 0°F to 8°F (0°C to 4°C) and set a transition threshold. The fan speed will be set one level above the OFF Mode speed when the sensor temperature first meets or exceeds the high temperature trigger. For every transition threshold crossed, the fan speed will ramp up by one speed level, up until it reaches the speed set in ON Mode.

In this example, your high temperature trigger is set at 80°F, the OFF Mode speed is 0, and the ON Mode speed is 6. If the transition threshold is set to 0°F, then the fan will trigger to run at speed 6 when the sensor temperature meets or exceeds 80°F. However, if the transition threshold is set to 2°F, then the fan will trigger to run at speed 1 when it meets or exceeds 80°F. It will then step up to speed 2 when meeting or exceeding 82°F, speed 3 at 84°F, speed 4 at 86°F, and speed 5 at 88°F. From 90°F on, it will run at speed 6, the speed set in ON Mode.





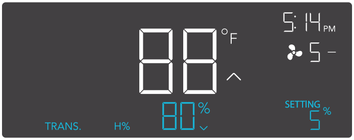
PROGRAMMING

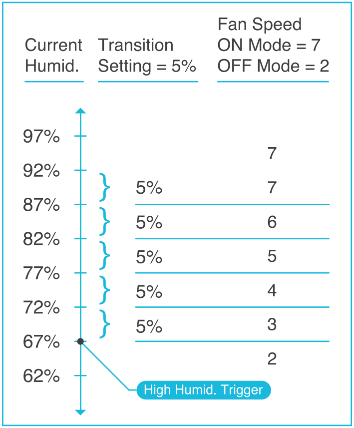
TRANSITION HUMIDITY SETTING

Adjusts the transition threshold between the fan speeds in the AUTO Mode humidity triggers.

Press the up or down button to cycle through 0% to 8% to set a transition threshold. The fan speed will be set one level above the OFF Mode speed when the sensor humidity first meets or exceeds the high humidity trigger. For every transition threshold crossed, the fan speed will ramp up by one speed level, up until it reaches the speed set in ON Mode.

In this example, your high humidity trigger is set at 67%, the OFF Mode speed is 2, and the ON Mode speed is 7. If the transition threshold is set to 0%, then the fan will trigger to run at speed 7 when the sensor humidity meets or exceeds 67%. However, if the transition threshold is set to 5%, then the fan will trigger to run at speed 3 when it meets or exceeds 67%. It will then step up to speed 4 when meeting or exceeding 72%, speed 5 at 77%, and speed 6 at 82%. From 87% on, it will run at speed 7, the speed set in ON Mode.

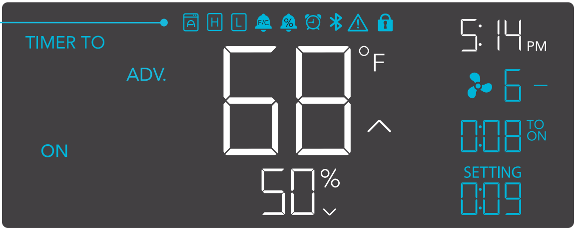




PROGRAMMING

ALERT ICONS

The alert icons are displayed at the top of the screen. Icons may flash when the controller signals an alert to notify you of any triggered function or alarm.



ADVANCE PROGRAMMING

Displays when an advance program set in the app is active. "ADV." will appear and override the controller if an automation program is in use.

HIGH TEMPERATURE ALARM

Flashes and beeps with an alert if the temperature rises above the trigger point set in the app. Continues to flash until the temperature falls below the trigger point.

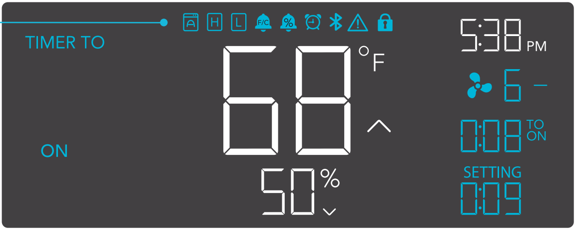
LOW TEMPERATURE ALARM

Flashes and beeps with an alert if the temperature falls below the trigger point set in the app. Continues to flash until the temperature rises above the trigger point.

HIGH HUMIDITY ALARM

Flashes and beeps with an alert if the humidity rises above the trigger point set in the app. Continues to flash until the humidity falls below the trigger point.

PROGRAMMING



LOW HUMIDITY ALARM
Flashes and beeps with an alert if the humidity falls below the trigger point set in the app. Continues to flash until the humidity rises above the trigger point.

TIMER ALERT
Flashes when a countdown has completed for TIMER TO ON, TIMER TO OFF, CYCLE, or SCHEDULE Mode.

BLUETOOTH
Appears when the physical controller is connected to the app via Bluetooth.

CHECK FAN ALERT
Flashes when the fan's probe senses interference to its functioning. Check the fan for possible issues. If the fan is not working, please see the warranty page for replacement information.

DISPLAY LOCK ALERT
Displays when you lock the controller. The icon will flash and beep if you attempt to adjust the controller while it is still locked.

OTHER SETTINGS

FACTORY RESET

Holding the mode, up, and down buttons together for 5 seconds will reset your controller and restore factory settings. This clears all user parameters in each controller mode and setting.

HOLD +

CONTROLLER LOCK

Holding the setting button will lock the controller in your current mode. While your controller is locked, no parameters may be adjusted, nor will you be able to switch modes. Holding the power button again will unlock the controller.

HOLD +

HIDE SCREEN

Lock the controller so no settings can be adjusted. See above. Then press the setting button to turn the display off. Pressing it again will turn the display back on. Programs will still run in the background while the LCD screen is off.

PRESS +

JUMP TO OFF MODE

Holding the mode button for 3 seconds while in any mode or setting will automatically jump to OFF Mode. This function is disabled if the controller is locked.

HOLD +

RESET TO OFF OR ZERO (0)

Holding the up and down buttons together for 2 seconds will reset the value of your current mode to OFF or 0. Pressing either the up or down button will return the value to the mode's last setting.

HOLD +

AUTO INCREASING OR DECREASING

Holding the up or down button will increase or decrease the user setting automatically until you release them.

HOLD +

HOLD +

DOWNLOAD THE APP

THE AC INFINITY APP

The AC Infinity app enables you to connect with the next generation of our intelligent controllers, giving you access to advance programs and environmental data.

1

Download the AC Infinity app from the App Store or Play Store.

2

Open the AC Infinity app. Follow the instructions in the app to pair your controller with the app.

Download on the App Store

GET IT ON Google Play

3

Scan the QR code below or visit our website at www.acinfinity.com for more information on the AC Infinity app.

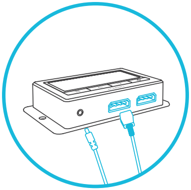
ADD A DEVICE

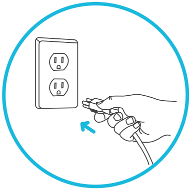
1

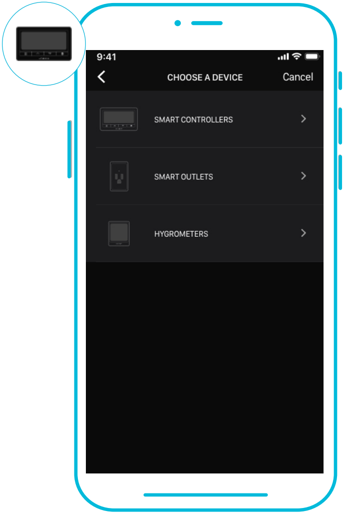
Connect the fan and probe into your controller. Plug the fan into a wall outlet.

2

Launch the app. Tap the (+) button, then "SMART CONTROLLERS", and select CONTROLLER 67 to begin pairing.







Please note: Bluetooth must be enabled on your mobile device before starting the pairing process.

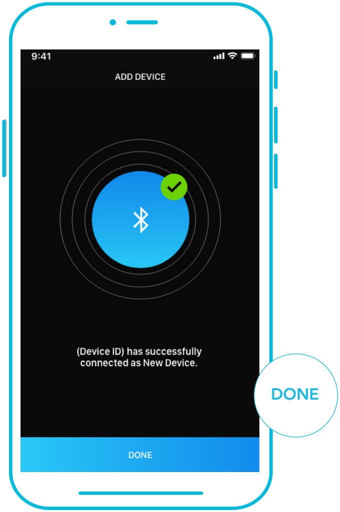
ADD A DEVICE

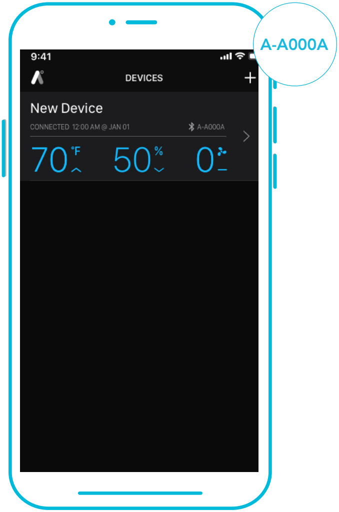
3

Tap DONE button to complete the pairing process.

4

Your controller will appear in your smart device with a unique ID.





Please note: When pairing the app around multiple controllers, move your mobile device closer to your desired controller.

APP PROGRAMMING

1. MODE BUTTON

Dropdown displays all available controller modes: OFF, ON, AUTO, TIMER TO ON, TIMER TO OFF, CYCLE, and SCHEDULE.

2. TEMPERATURE/HUMIDITY

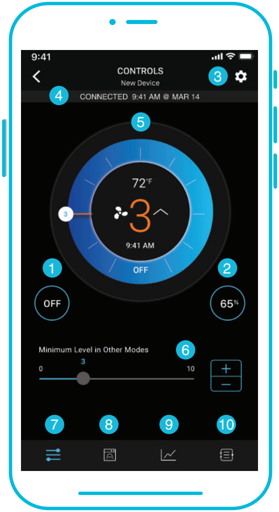
Toggles between current temperature and humidity readings.

3. SETTINGS

Adjusts app settings including Device Name, Temperature Display, Device Brightness, Fan Speed Transitions, and Calibrations.

4. CONNECTION STATUS

Displays the last time and date the app is paired with the controller and whether or not they are currently connected.



5. CONTROL WHEEL

Lays out your current mode's controls and displays temperature/humidity, current settings, and time.

6. SLIDERS

Adjusts the setting of your current mode. Slide left to decrease and slight right to increase. The (+/-) steppers may also be used.

7. CONTROLS TAB

Gives access to the controller mode dashboard, control wheel, mode button, temperature/humidity button, and sliders.

8. ADV. PROGRAMMING

Creates automated activations, alarms, and push notifications.

9. DATA TAB

Logs and stores all temperature and humidity information. Tracks trends and distribution. Data can be sorted by hour, day, week, month, and year.

10. HISTORY LOG

Logs all advance programming notifications and controller activity. Can be filtered by controller functions.

APP PROGRAMMING

CONTROLS TAB

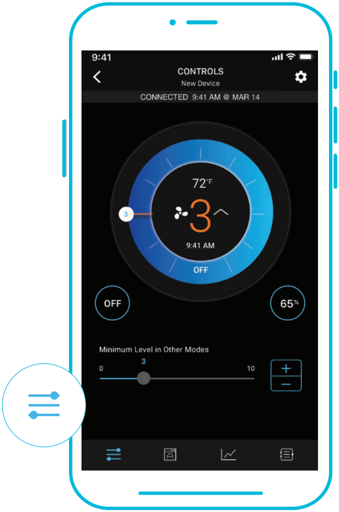
Contains all controller modes including the OFF, ON, AUTO, TIMER TO ON, TIMER TO OFF, CYCLE and SCHEDULE modes.

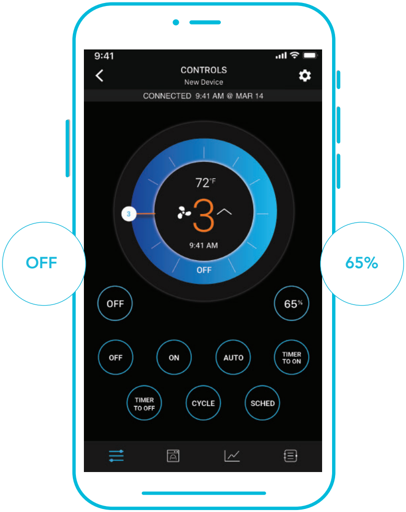
1

Tap the paired device to enter the Controls tab, where you can adjust the controller modes.

2

Tap the menu button to access the controller modes. Tap the temperature/humidity button to switch between readings.





APP PROGRAMMING

CONTROLS TAB

The control wheel displays the temperature/humidity, current settings, and time.

3

Use the wheel hands, (+/-) stepper, or sliders to set your parameters.

4

Use the toggle switch to activate or deactivate any climate triggers.

APP PROGRAMMING

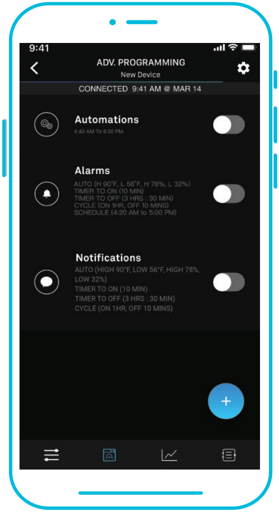
ADVANCE PROGRAMMING

Creates automated activations, alarms, and push notifications. The adjustable modes in each program include those listed in controls tab.

Once an advance program completes its programming (i.e. scheduling), the app will no longer override the controller's onboard settings. Only when the advance program activates will the app override the controller.

Programs can be edited by tapping on them, deactivated by tapping on the toggle switch, or deleted by swiping right and tapping DELETE.

All activity is logged in the History Logs tab.



APP PROGRAMMING

ADVANCE PROGRAMMING - AUTOMATION

Each automation can support one mode at a time. To automate multiple modes, you must create additional programs, except for TIMER TO ON and TIMER TO OFF in automation. The app will override the controller while an automation is active.

1

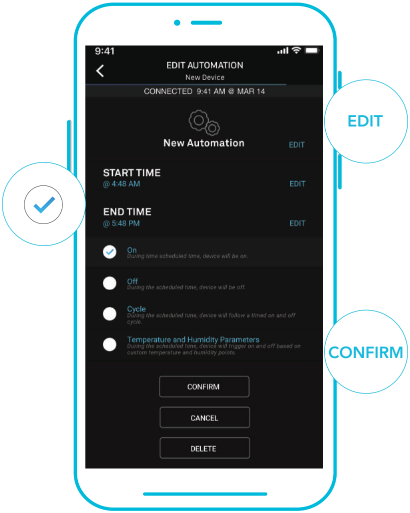
Tap the (+) button to create an automation program.

Set a start time and end time using the time picker. Then select your desired mode to trigger. Choose between ON mode, OFF mode, CYCLE mode, or Temperature and Humidity.

When selecting CYCLE mode, use the sliders to set your CYCLE ON and CYCLE OFF timers.

When selecting Temperature and Humidity, use the sliders to select and the toggle switch to activate or deactivate them.

Tap CONFIRM to save the program.



APP PROGRAMMING

ADVANCE PROGRAMMING - ALARMS

Alarms will tell your controller to beep whenever your fan switches on or off as a result of the mode(s) you select in the program. Choose between AUTO, TIMER TO ON, TIMER TO OFF, CYCLE and SCHEDULE modes. Alarm programming will also have a climate points setting in which the alarm will go off when temperature and humidity hits a high or low point.

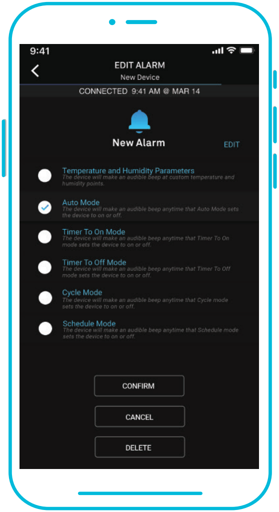
2

Tap the (+) button to create an alarm program. You may select multiple modes to trigger an alarm in a single program.

When selecting Temperature and Humidity, use the sliders to select and the toggle switch to activate or deactivate them.

You may edit the name of the program by tapping EDIT.

Tap CONFIRM to save the program.



APP PROGRAMMING

ADVANCE PROGRAMMING - NOTIFICATIONS

Notification programs will send push notifications to your mobile device whenever your fan switches on or off as a result of the mode(s) you select in the program. Choose between AUTO, TIMER TO ON, TIMER TO OFF, CYCLE and SCHEDULE modes. Notification programming will also have a climate points setting in which you receive push notifications when temperature and humidity hits a high or low point.

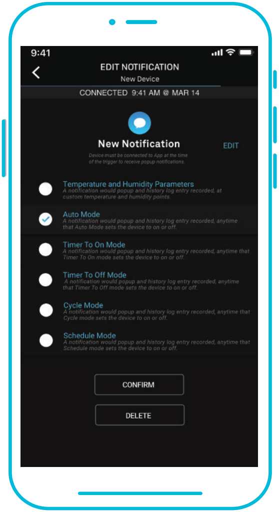
3

Tap the (+) button to create a notification program. You may select multiple modes to trigger an alarm in a single program.

When selecting Temperature and Humidity, use the sliders to select and the toggle switch to activate or deactivate them.

You may edit the name of the program by tapping EDIT.

Tap CONFIRM to save the program.



APP PROGRAMMING

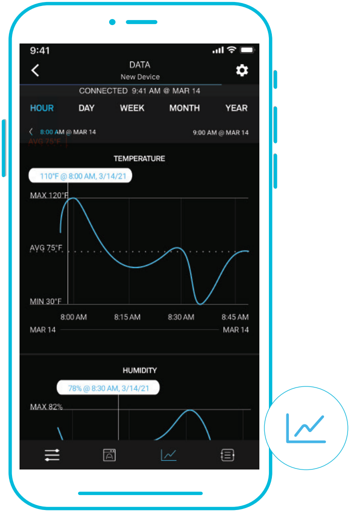
DATA TAB

Logs and stores all temperature and humidity information. Readings are displayed in fluctuation charts and bar graphs and can be viewed in hours, days, weeks, months, and years. Data can be exported as a spreadsheet and sent to other devices by tapping EXPORT CSV DATA.

1

The Fluctuation Charts readout displays the detected temperature or humidity over a given timespan. Swipe left or right to scroll through the readings. As you scroll, the dotted line will move up or down and display the average reading of the timespan you selected.

The maximum reading of the given time span is displayed at the top of the chart, while the minimum reading is displayed at the bottom of the chart.



APP PROGRAMMING

DATA TAB

The fluctuation charts and bar graphs allow you to see trends in temperature and humidity and enable you to make the necessary adjustments to your space. Tap on any point in the charts and graphs to see detailed information on the picket.

2

Bar Graphs - This readout displays how often a detected temperature or humidity point occurs over a given timespan.

The minimum and maximum readings of the given timespan are displayed at the top of the graph.

APP PROGRAMMING

HISTORY LOG

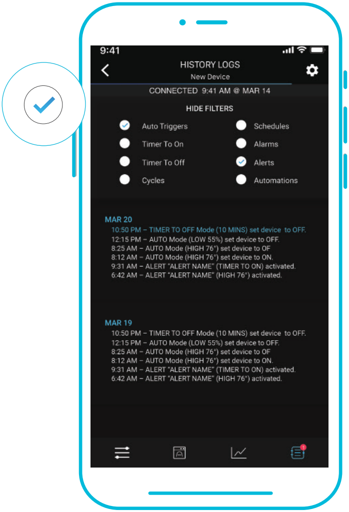
Logs all advance programming notifications and controller activity. Entries can be filtered by controller functions and programming including triggers, timers, cycles, schedules, automation, alarms, and notifications.

1

Swipe up and down to scroll through the history log.

2

Tap "SHOW FILTERS" to reveal activity options. Unchecked functions will filter them from the log.



APP SETTINGS

SETTINGS

Tap the gear icon to access the settings. Sets all controller-related parameters including Device Name, Temperature Display, Screen Brightness, Transitions, and Calibrations. Tap CONFIRM to save your settings. Tapping CANCEL will leave the settings menu without saving changes. Tapping DELETE DEVICE will unpair your controller from the app.

DEVICE NAME

Supports a maximum of 20 characters.

TEMPERATURE DISPLAY

Toggles between Celsius and Fahrenheit scales.

DEVICE BRIGHTNESS

Sets the controller screen brightness using three standard levels [1, 2, and 3] and two auto-dimming levels [A2 and A3].

TRANSITION TEMPERATURE AND HUMIDITY

Adjusts the degree to which the fan speed steps up or down in level. The fan speed will change by one for every multiple of this transition setting between the set and current climate condition.

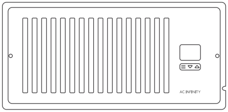
CALIBRATION TEMPERATURE AND HUMIDITY

Adjusts the controller's temperature and humidity readings to match your other measuring device's readings. The calibration will apply the changes on the app and the controller.

AC INFINITY PRODUCTS

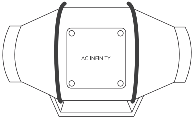
Register Booster Fans

The AIRTAP series is a line of register booster fans designed to quietly increase airflow coming from your central heat and air conditioning systems, increasing comfort for your home. Features a thermal controller with intelligent programming that will automatically adjust airflow strength in response to heating and cooling temperatures you have set.



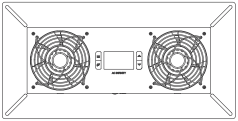
Duct Fans

The CLOUDLINE series is a line of duct fans designed to quietly ventilate AV rooms and closets, as well as various DIY air circulation and exhaust projects. Features a thermal controller with intelligent programming that will automatically adjust duct fan speeds in response to changing temperatures.



Crawlspace Fans

The AIRTITAN is a line of weather-proof fans designed to provide ventilation, odor, and moisture control for crawl spaces and basements. It features a digital controller with intelligent programming that will adjust airflow strength in response to high and low temperatures, as well as humidity.



Discover the latest innovations in cooling and ventilation at acinfinity.com

WARRANTY

This warranty program is our commitment to you, the product sold by AC Infinity will be free from defects in manufacturing for a period of two years from the date of purchase. If a product is found to have a defect in material or workmanship, we will take the appropriate actions defined in this warranty to resolve any issues.

The warranty program applies to any order, purchase, receipt, or use of any products sold by AC Infinity or our authorized dealerships. The program covers products that have become defective, malfunctioned, or expressively if the product becomes unusable. The warranty program goes into effect on the date of purchase. The program will expire two years from the date of purchase. If your product becomes defective during that period, AC Infinity will replace your product with a new one or issue you a full refund.

The warranty program does not cover abuse or misuse. This includes physical damage, submersion of the product in water, incorrect Installation such as wrong voltage input, and misuse for any reason other than intended purposes. AC Infinity is not responsible for consequential loss or incidental damages of any nature caused by the product. We will not warrant damage from normal wear such as scratches and dings.

To initiate a product warranty claim, please contact our customer service team at support@acinfinity.com

100% GUARANTEE 100%

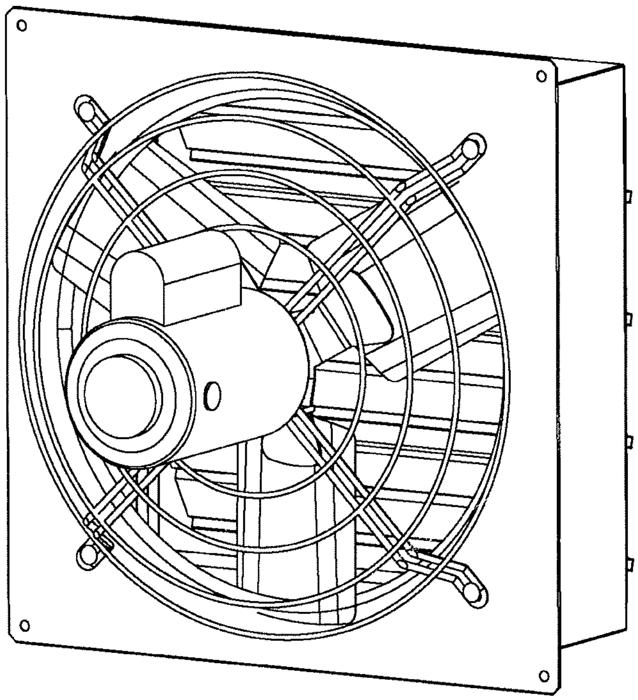
If you run into any issues with this product, contact us and we'll happily issue a replacement or a full refund!

www.acinfinity.com

CANARM®

Standard Exhaust Fans

Instruction Manual



WARRANTY

CANARM Ltd. warrants every new fan to be free of defects in material and workmanship, to the extent that, within a period of one year from the date of purchase CANARM Ltd. shall either repair or replace at CANARM's option, any unit or part thereof, returned freight prepaid, and found to be defective.
This warranty does not include any labour or transportation costs incidental to the removal and reinstallation of the unit at the user's premises.
Components repaired or replaced are warranted through the remainder of the original warranty period only.
This warranty applies to the original purchaser-user only; it is null and void in case of alteration, accident, abuse, neglect, and operation not in accordance with instructions.

NOTICE: No warranty claims will be honored by CANARM Ltd. unless prior authorization is obtained.

Installation or Product problems? Do not return to store of purchase.
Contact Canarm Service at 1-800-265-1833 (CANADA) 1-800-267-4427 (U.S.A.)
1-800-567-2513 (EN FRANCAIS) Monday to Friday 8:00 - 5:00pm e.s.t.

CANARM®

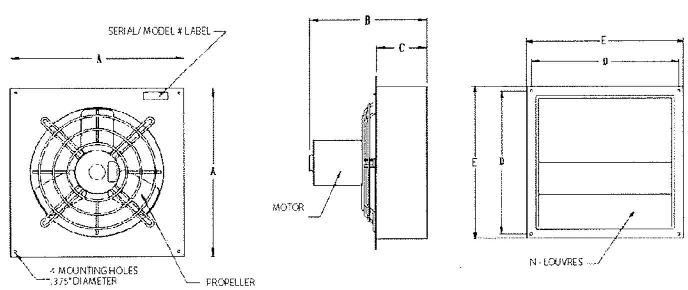
Instruction Manual for Standard Exhaust Fans

Read Instructions Completely Before Installation & Save For Reference

Congratulations on the purchase of your quality built direct drive, wall exhaust ventilation fan. All of these models use totally enclosed ball bearing motors with thermal over load protection. Variable speed motors are high efficiency motors which save on electrical costs and can be run as a single speed motor. The motors are mounted on heavy gauge welded steel rod motor mounts that have a powder coated finish. Fans come fully assembled and 100% of fans are tested for proper operation before shipping.

Standard Fans:

These models have a rugged, welded steel box housing with a powder coated finish and aluminum or plastic exhaust louvers that are supported by long life nylon bushings. The louvers open automatically when the fan starts up and close when the fan stops.



Fan Dimensions							
Fan Size	A	B	C	D	E	N	Framing
8"	13-1/4"	10"	4"	12"	10-3/4"	2	11x11
10"	15-1/4"	10"	4"	14"	12-3/4"	2	13x13
12"	17-1/4"	14"	6"	16"	14-3/4"	3	15x15
14"	19-1/4"	14"	6"	18"	16-3/4"	3	17x17
16"	21-1/4"	14"	6"	20"	18-3/4"	4	19x19
18"	23-1/4"	15"	6"	22"	20-3/4"	4	21x21
20"	25-1/4"	16"	6"	24"	22-3/4"	5	23x23
24"	29-1/4"	16"	6"	28"	26-3/4"	5	27x27
30"	35-1/4"	19"	6"	34"	32-3/4"	8	33x33
36"	41-1/4"	16"	6"	40"	38-3/4"	10	39x39

Explosion Proof Fans:

Explosion proof fans are equipped with explosion proof motors and aluminum blades so sparks cannot occur if a metal object obstructs the blade path. Explosion proof fans have the same quality welded steel box housing and heavy gauge welded guard as the standard fans. These fans should be used to ventilate hazardous areas. Locations are considered hazardous if the atmosphere contains or may contain gas, vapor, or dust in explosive quantities.

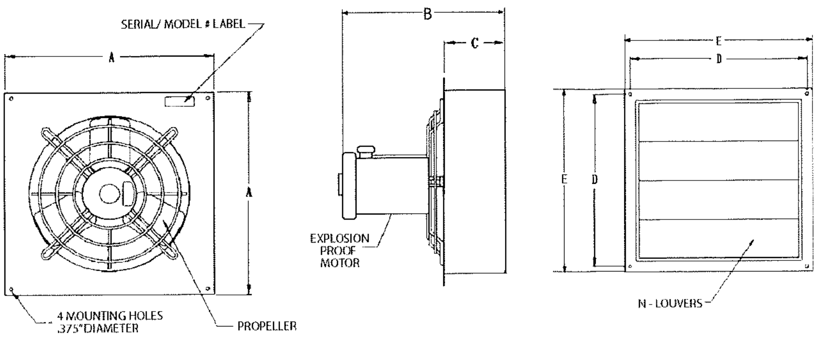
The motor ambient temperature is not to exceed +40ºC or -25ºC unless the motor nameplate specifically permits another value. Canarm explosion proof fans are approved for the hazardous classifications below only.

Class 1, Division 1 (Gases, Vapors)

~~Group A~~	Acetylene
~~Group B~~	Butadiene, ethylene oxide, hydrogen, Propylene oxide
Group C	Acetaldehyde, cyclopropane, diethlether, Ethylene, isoprene
Group D	Acetone, acrylonitrile, ammonia, benzene, Butane, ethylene dichloride, gasoline, hexane, methane, methanol, naphtha, propane, propylene styrene, toluene, vinyl, acetate, vinyl chloride, xylene

Class 2, Division 1 (Combustible Dusts)

~~Group E~~	Aluminum, magnesium and other metal dusts with similar characteristics
Group F	Carbon black, coke or coal dust
Group G	Flour, starch or graindust



Fan Dimensions							
Fan Size	A	B	C	D	E	N	Framing
12"	17-1/4"	20-1/2"	6"	16"	14-3/4"	3	15x15
18"	23-1/4"	20-1/2"	6"	22"	20-3/4"	4	21x21
24"	29-1/4"	20-1/2"	6"	28"	26-3/4"	5	27x27

INSTALLATION

Installation is fast and simple. A sturdy framed wall opening should be prepared in advance to the size indicated for your fan in the charts above. With lag bolts for wooden frames or nut, bolt and lock washers for steel frames, secure the fan using the four mounting holes provided, one in each corner of the fan.

ELECTRICAL CONNECTIONS

WARNING: BE SURE POWER IS OFF AT THE ELECTRICAL PANEL BEFORE WIRING.

WARNING: ALL ELECTRICAL WORK SHOULD BE PERFORMED BY A QUALIFIED ELECTRICIAN.
These fans are supplied with single, two or variable speed motors. Single and two speed motors are 120V only. Variable speed motors are dual voltage. All dual voltage motors are pre-wired at 240V in our factory. Rewire motor as per motor nameplate if running fan at 120V. Please see the motor nameplate for wiring diagram. Make electrical connections in motor connection box as per the motor nameplate. Follow ***Chart #1*** for wire sizes. Two speed fans require a two speed control or 3 position toggle switch to change from high/ low/off. See wiring diagram with control for 2 speed wiring instructions.

CHART# 1

Table A Minimum Wire Sizes for Three-Phase Motors

Motor HP	25 to 50 Feet			100 Feet			150 to 200 Feet		
	200V	230V	460V	200V	230V	460V	200V	230V	460V
1/8	14(18)*	14(18)*	14(18)*	14(18)*	14(18)*	14(18)*	14(16)*	14(16)*	14(18)*
1/6	14(18)*	14(18)*	14(18)*	14(18)*	14(18)*	14(18)*	14	14(16)*	14(18)*
1/4	14(18)*	14(18)*	14(18)*	14(16)*	14(18)*	14(18)*	14	14	14(18)*
1/3	14(18)*	14(18)*	14(18)*	14(16)*	14(16)*	14(18)*	12	14	14(18)*
1/2	14(16)*	14(18)*	14(18)*	12	14(16)*	14(18)*	10	12	14(18)*
3/4	14(16)*	14(16)*	14(18)*	12	14	14(18)*	10	10	14(16)*
1	14	14(16)*	14(18)*	12	12	14(18)*	8	10	14(16)*
1-1/2	12	14	14(18)*	10	10	14(16)*	6	8	14
2	12	12	14(18)*	8	10	14(16)*	6	6	12
3	10	12	14(18)*	6	8	14	4	6	12

Motor HP	25 Feet			100 Feet			150 to 200 Feet		
	200V	230V	460V	200V	230V	460V	200V	230V	460V
1/8	14(18)*	14(18)*	14	14(18)*	12	14(18)*	10	8	14
1/6	14(16)*	14(18)*	12	14(18)*	10	14(16)*	6	6	12
1/4	14	14(18)*	10	14(16)*	8	14	6	4	10
1/3	14	14(18)*	10	14(16)*	8	14	6	4	10
1/2	12	14(18)*	8	14	6	12	4	3	8
3/4	10	14(16)*	6	12	4	10	2	1	6
1	10	14(16)*	6	12	4	10	2	1	6
1-1/2	8	14	6	12	3	8	1	1/0	6
2	8	14	4	10	2	8	1/0	2/0	4
3	6	12	3	8	1/0	6	2/0	4/0	3

Table B Minimum Wire Sizes for Single-Phase Motors

NOTE:
- NEC Article 310-5 - * Minimum conductor size for general wiring at 115-440VAC is number 14AWG.
- Above wire sizes based on approximate 5% voltage drop during starting; copper conductors; and 75ºC type THHW, THW, THWN, RH, RHW insulation etc. For aluminum wire, increase two wire size steps minimum. See NEC Article 310 for ampacities af aluminum conductors.
- Type S, SO, SJ, SJO, etc flexible cable wire sizes. See NEC Article 400 for ampacity.

OPERATION

WARNING: VARIABLE SPEED FANS SHOULD HAVE THE MINIMUM SPEED SET TO OPEN LOUVERS AT LEAST ONE INCH FOR PROPER MOTOR COOLING AND TO PREVENT MOTOR FAILURE.
All fans are direct drive. Fans with variable speed motors can be operated as an energy efficient single speed fan or in variable operation with the proper controller. As mentioned above two speed fans require a two speed control or 3 position toggle switch to change from high speed to low and off.

WARNING: GUARDING SHOULD BE USED IF FANS ARE MOUNTED LOWER THAN SEVEN FEET (2 METRES) OFF FLOOR OR GROUND LEVEL.

ACCESSORIES

Canarm provides a complete line of manual and thermostatic controls. Canarm also offers wall mount exhaust shutter kits, replacement shutter sets, and weather protection hoods.

MAINTENANCE

Motors are equipped with automatic overload protection and may restart without warning. Always disconnect from power before attempting service. Motor, blade and louvers should be kept clean of any buildup to prevent premature motor failure and to achieve proper performance. Automatic louvers should be kept operating freely. As with all mechanical equipment scheduled inspections should include checking that all hardware is secure and blade set screws are tight.

WARRANTY

CANARM Ltd. warrants every new fan to be free of defects in material and workmanship, to the extent that, within a period of one year from the date of purchase CANARM Ltd. shall either repair or replace at CANARM's option, any unit or part thereof, returned freight prepaid, and found to be defective.
This warranty does not include any labour or transportation costs incidental to the removal and reinstallation of the unit at the user's premises.
Components repaired or replaced are warranted through the remainder of the original warranty period only.
This warranty applies to the original purchaser-user only; it is null and void in case of alteration, accident, abuse, neglect, and operation not in accordance with instructions.

NOTICE: No warranty claims will be honored by CANARM Ltd. unless prior authorization is obtained.

CANARM®

CANARM LTD.
2157 PARKEDALE AVENUE
BROCKVILLE, ONTARIO K6V 5V6
TELEPHONE: (613) 342-5424
FAX: 1-800-263-4598
E-MAIL: agsales@canarm.ca

CANARM LTEE.
8500 RUE GRENACHE
ANJOU, QUEBEC H1J 2B1
TELEPHONE: (514) 353-2255
FAX: (514) 353-2522
E-MAIL: agsales@canarm.ca

Stainless Steel Multi-Jet Water Meters with Pulse Output

PRMFiltration

Stainless Steel Water Meters for indicating flow totalization of water with pulse output. Stainless Steel offers additional corrosion resistance when totalizing liquids with corrosive or chemical elements. Designed for long service life and maintenance-free operation, even under harsh conditions.

Features:

- Pulse Output Components
- All Meters have Hydrocarbon Resistant Seals and will not be damaged by dissolved amounts of free product
- Sealed Dry Dial for Clear Readings
- Internal Strainer to Protect Meter from Particulate Damage

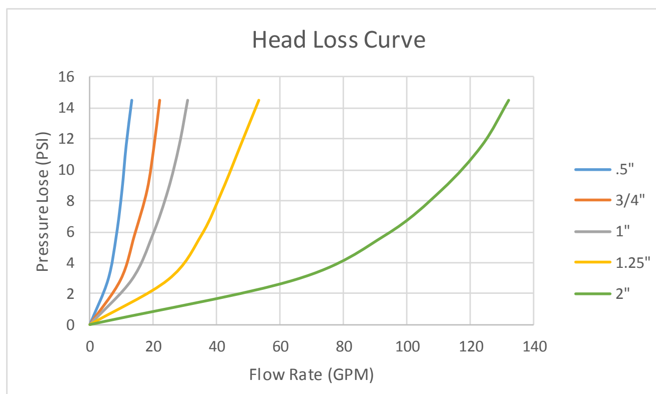
Specifications:

- Class: B
- Accuracy: Transitional Flow: ± 5%
  Nominal Flow: ± 2%
- Maximum Water Temperature: 104°F
- Maximum Water Pressure: 150 psi
- Mounting Orientation:
  1/2” and 3/4” Horizontal or Vertical
  1” to 2” Horizontal Mounting

Materials:

- Body: 304 Stainless Steel, polyethylene
- Couplings: 304 Stainless Steel
- Measuring Chamber: Polyethylene
- Seal: Viton, HDPE

Not NSF certified

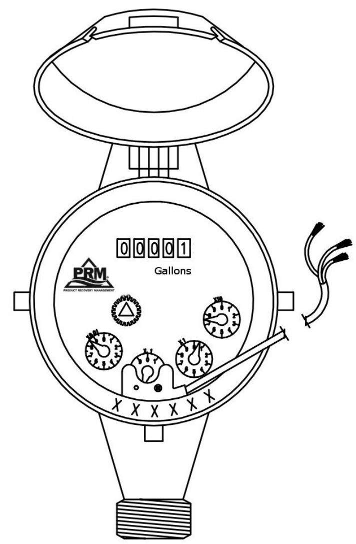


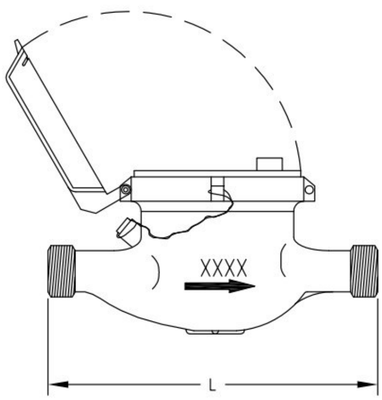
PRM Part Number: Description

WM050SSPVX— 1/2” NPT multi-jet water meter
WM075SSPVX— 3/4” NPT multi-jet water meter
WM100SSPVX— 1” NPT multi-jet water meter
WM125SSPVX— 1-1/4” NPT multi-jet water meter
WM200SSPVX—2” NPT multi-jet water meter
WMFL200SSPVX— 2” Flanged SS water meter

Stainless Steel Water Meters with Pulse Output

PRMFiltration





Factory Set Pulse Rates:

WM050SSPVX: 1 pulse per gallon

WM075SSPVX: 1 pulse per gallon

WM100SSPVX: 1 pulse per 10 gallons

WM125SSPVX: 1 pulse per 10 gallons

WM150SSPVX: 1 pulse per 10 gallons

WM200SSPVX: 1 pulse per 10 gallons

						Max. Flow	Nom. Flow Range
Part #	**Size**	**Length**	**Length with NPT adapters**	**Height**	**Weight**	**Gallons Per Minute**	
WM050SSPVX	1/2" NPT	7”	10.5”	4.75”	3 lbs.	10	1-10
WM075SSPVX	3/4" NPT	8”	12”	4.75”	3.5 lbs.	20	1-20
WM100SSPVX	1" NPT	9”	13”	4.5”	5.5 lbs.	30	2-30
WM125SSPVX	1-1/4" NPT	9”	13”	5”	6 lbs.	50	3-50
WM200SSPVX	2” NPT	12”	18”	6.5”	15 lbs.	130	5-130
WM200FLSSPVX	2" FLANGE	10.5”	N/A	6.5”	25 lbs.	130	5-130

Information in this drawing is provided for reference only.

(888-TREAT-IT) • www.prmfiltration.com • sales@prmfiltration.com

AKG®

CC

SERIES

Compressed Air Aftercoolers

- Advanced Technology Design Provides Compact Cooling
- Electric, or Air Motors Available from Stock
- Canadian Registry Numbers Available

Moisture Separators

- 99% Efficient Over a Wide Range of Air Flow
- Low Pressure Drop
- Light Weight All Aluminum Construction

Sales@SouthwestThermal.com | p. 888-226-8522 f. 805-484-0049 | www.AKGcoolers.com

Performance

AFTERCOOLERS

The CC Series is a complete aftercooler package designed to work on most models of rotary and piston air compressors. To select the appropriate model, simply determine compressor horsepower, and select the model from the chart.

Rotary Compresser

Air Compressor Horsepower	Internal Airflow Maximun CFM	Recommended CC Series Model Number
20 HP	113	CC100
25-40 HP	245	CC200
50-75 HP	539	CC450
100-125 HP	785	CC600
150-200 HP	1,569	CC1000
225-350 HP	2,300	CC1600
400-500 HP	3,016	CC2000
550-700 HP	4,316	CC2500
750-1000 HP	4,800	CC3500

Piston Compressor

Air Compressor Horsepower	Internal Airflow Maximum CFM	Recommended CC Series Model Number
20 HP	83	CC100
25-30 HP	181	CC200
40-70 HP	432	CC450
75-100 HP	638	CC600
125-200 HP	1,256	CC1000
225-300 HP	2,133	CC1600
350-400 HP	2,400	CC2000
500-600 HP	3,458	CC2500
700-850 HP	4,800	CC3500

Sizing Notes, Recommendations Are Based On The Following:

Heat Removal: Aftercooler=Compressor horsepower x 1.15 (motor service factor) x .17 (this assumes 17% of input horsepower is rejected to heat)

15°F Approach Temperature: Compressor air outlet temperature - ambient air temperature

Temperatures: Ambient Air Temperature + 15° F = Compressed Air Outlet Temperature

Flows: Compressor Horsepower x 4.5 = SCFM Air Flow

All flow rates are based on less than a 4 PSI pressure drop @ 100 PSI operating & 100° F ambient and 50% relative humidity

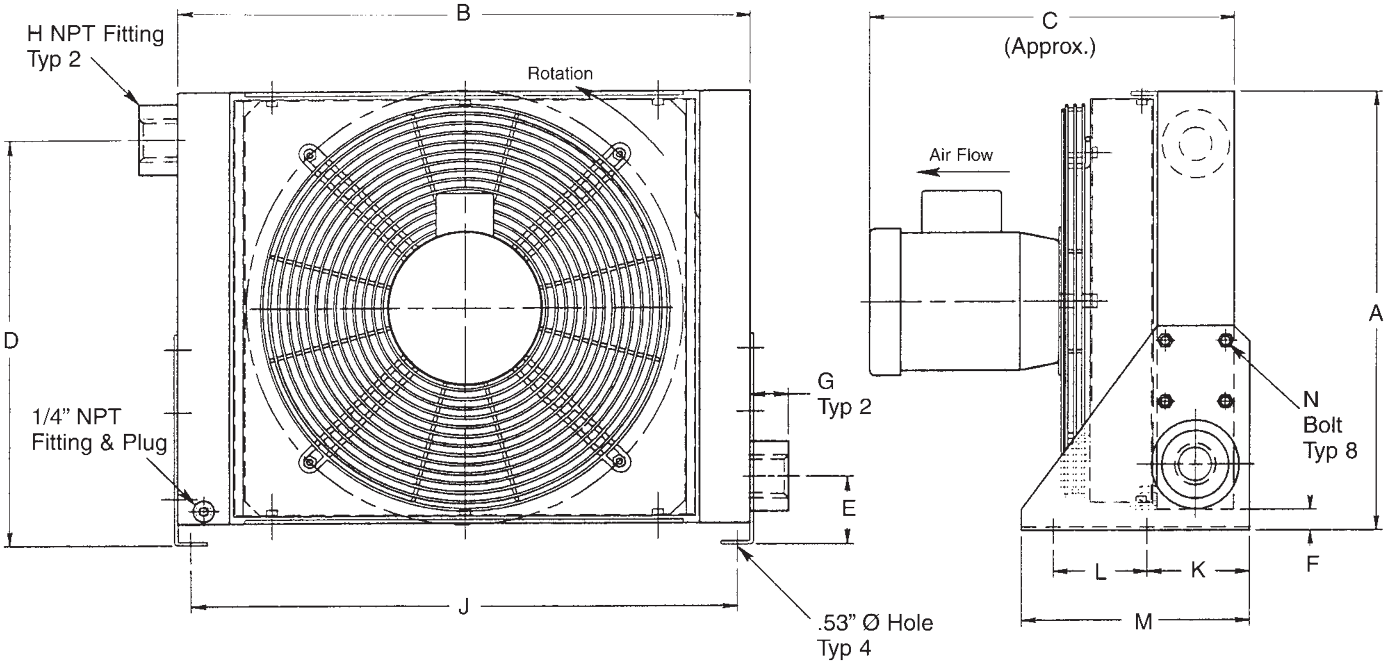
SEPARATORS

Aftercooler	Separator	Separator Maximum Capacity
CC100	MS300E	375 CFM
CC200	MS300G	375 CFM
CC450	MS750H	925 CFM
CC600	MS750H	925 CFM
CC1000	MS1700I	2100 CFM
CC1600	MS1700J	2100 CFM
CC2000	CONSULT FACTORY	
CC2500	CONSULT FACTORY	
CC3500	CONSULT FACTORY	

Pressure drop is 1.0 PSI at the above flow rates. Reference Bulletin #MSB-2 For additional details.

Dimensions

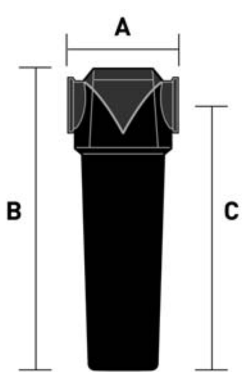
AFTERCOOLERS



MODEL SIZE	A	B	C Approx.	D	E	F	G	H (NPT)	J	K	L	M	N	Approx. NET	Weights Shipping
CC100	12.64	15.94	14.72	10.86	2.52	0.75	1.18	1.00	14.65	3.94	3.50	8.19	M8x10 Bolt	30	40
CC200	16.30	19.88	15.59	14.53	2.52	0.75	1.77	1.50	18.66	3.94	3.50	8.19	M8x10 Bolt	50	60
CC450	21.00	26.38	17.75	18.81	3.15	1.00	1.77	2.00	25.19	4.92	4.53	10.98	M10x20 Bolt	95	137
CC600	23.19	30.31	18.74	21.02	3.15	1.00	1.77	2.00	29.13	4.92	4.53	10.98	M10x20 Bolt	125	163
CC1000	27.72	37.00	22.60	25.23	4.33	1.85	1.77	2.50	37.80	5.91	7.87	16.00	M12x20 Bolt	195	240
CC1600	35.90	40.94	24.76	30.83	4.33	1.85	1.77	3.00	37.80	5.91	7.87	16.00	M12x20 Bolt	296	350
CC2000	37.44	42.91	29.84	30.55	10.91	2.08	1.77	4.00	43.62	5.39	7.87	15.47	M12x20 Bolt	320	380
CC2500	44.25	48.82	30.28	34.25	11.57	1.57	1.77	4.00	49.29	5.39	7.87	15.47	M12x20 Bolt	440	505
CC3500	57.87	52.76	33.82	43.98	17.56	3.35	2	4.00*	50.55	7.80	10.00	20.00	¾x1½ Bolt	550	645

* SAE 4-BOLT FLANGES MAY BE CONVERTED TO NPT BY ADDING "- AD" TO THE END OF THE MODEL CODE
* Dimensions in inches. *Weights in pounds. * Air connections my be reversed. * We reserve the right to make reasonable changes without notice.

Moisture Separators



MODEL	PIPE SIZE	A	B	C	WEIGHTS (LBS)
MS 85C	½" NPT	3.8	9.3	7.9	3
MS 300D	¾" NPT	5.1	10.8	9.2	7
MS 300E	1" NPT				
MS 300G	1½" NPT				
MS 750H	2" NPT	6.7	17	15	15
MS 1700I	2½" NPT	8.1	19.9	17.5	25
MS 1700J	3" NPT				

- Dimensions are in inches.
- We reserve the right to make reasonable design changes without notice.

Motor Specifications

ELECTRIC MOTOR DATA

<table>
<tr><th rowspan="2">Model Size</th><th rowspan="2">HP RPM</th><th rowspan="2">Motor Frame</th><th colspan="3">SINGLE PHASE</th><th colspan="3">THREE PHASE</th></tr>
<tr><th>Voltage</th><th>Hz</th><th>Full Load Amps 230 V</th><th>Voltage</th><th>Hz</th><th>Full Load Amps 230 V.</th></tr>
<tr><td>CC100</td><td>1/3
3450</td><td>IEC 63</td><td rowspan="2">115/230</td><td rowspan="2">60</td><td>2.6</td><td>208-230/460
190/380</td><td>60
50</td><td>1.1</td></tr>
<tr><td>CC200</td><td>1/2
3450</td><td>IEC 71</td><td>3.5</td><td>208-230/460
190/380</td><td>60
50</td><td>1.6</td></tr>
<tr><td>CC450</td><td>1/2
1725</td><td>NEMA 56C</td><td>115-230/460</td><td>60</td><td>4.0</td><td>208-230/460</td><td>60*</td><td>2.0</td></tr>
<tr><td>CC600</td><td>1
1725</td><td>NEMA 56C</td><td>115-230/460</td><td>60</td><td>6.4</td><td>208-230/460</td><td>60*</td><td>3.8</td></tr>
<tr><td>CC1000</td><td>2
1725</td><td>NEMA 56C</td><td>115/230</td><td>60</td><td>9.2</td><td>208-230/460</td><td>60*</td><td>6.2</td></tr>
<tr><td>CC1600</td><td>5
1725</td><td>NEMA 184TC</td><td>230</td><td>60</td><td>23</td><td>208-230/460</td><td>60*</td><td>13.2</td></tr>
<tr><td>CC2000</td><td>7.5
1725</td><td>NEMA 213TC</td><td rowspan="3" colspan="3">CONSULT
FACTORY</td><td>208-230/460</td><td>60*</td><td>19.6</td></tr>
<tr><td>CC2500</td><td>7.5
1725</td><td>NEMA 213TC</td><td>208-230/460</td><td>60*</td><td>19.6</td></tr>
<tr><td>CC3500</td><td>10
1725</td><td>NEMA 213TC</td><td>208-230/460</td><td>60*</td><td>26.0</td></tr>
</table>

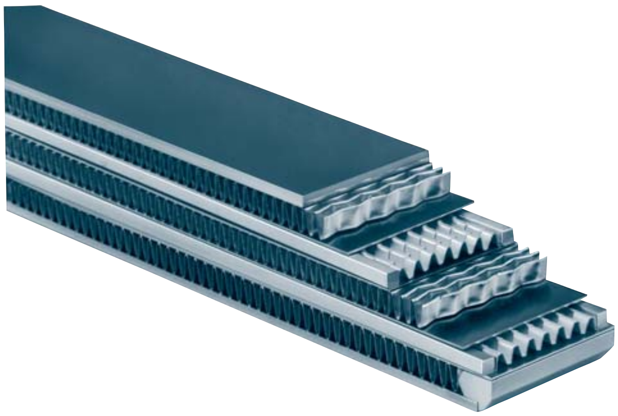
*Electric motors are TEFC and are not thermally protected.
*Actual rating may vary with motor brand. Check motor nameplate for actual rating.
*Motor RPM is reduced by 1/6 for 50 Hz service.
* - 3 Phase motors available in 50 Hz.

AIR MOTOR DATA

Model Number	Air Pressure To Motor (PSI)	Motor Air Consumption (CFM)	Air Motor Connection Size	FAN RPM
CC100	30	10	1/4″ NPT	3450
CC200	60	17	1/4″ NPT	3450
CC450	40	25	1/4″ NPT	1725
CC600	40	25	1/4″ NPT	1725
CC1000	50	70	1/2″ NPT	1725
CC1600	60	150	1 1/4″ NPT	1725
CC2000	80	200	1 1/4″ NPT	1725
CC2500	80	200	1 1/4″ NPT	1725
CC3500	100	240	1 1/4″ NPT	1725

*Air pressure to motor ***Must*** be regulated and lubricated.
****Do Not Exceed*** fan RPM listed above.
*Mufflers are included with all motors.

Features



- Advanced Technology Designs
- Up to 60% smaller than Conventional Fin and Tube Designs
- Rugged Bar & Plate Design
- Reduced Air Side Fouling
- Competitive Prices
- Shipments Available From Stock

Specifications

AFTERCOOLER

RATINGS:

Maximum Working Pressure ....250 PSI
Maximum Working Temperature ....250°F

MATERIALS:

Cooler ....Alumium
Shroud ....Powder Painted Steel
Fan Guard ....Zinc Plated Steel
Fan Blade ....Polypropylene Blades
Aluminum Hub
Mounting Brackets ....Powder Painted Steel

MOISTURE SEPARATOR

RATINGS:

Maximum Working ....250 PSI
Maximum Working Temperature ....150°F
Minimum Recommended Temperature..........................35°F

Materials:

Moisture Separator ....Aluminum Housing with Stainless Steel or Plastic Internals

Ordering Information

AFTERCOOLER

[ ] — [ ] — [ ] — [ ]

SERIES
CC=Series

MODEL SIZE
SELECTED

MOTOR DATA
0=No Motor
1= Single Phase
2=Air Motor
3=Three Phase
575=575 Volt

CUSTOM FEATURE
R=Reverse Air Flow
AD=SAE to NPT Adapters Installed
H=Heresite Coating/Core Assembly
CRN Canadian Registry, 250 PSI

MOISTURE SEPARATOR

[ ] — [ ] — [ ]

SERIES
MS=Series

MODEL SIZE
SELECTED

DRAIN OPTION
Blank=Float Type Drain Included
ND=No Drain Included

Operating Instructions & Parts Manual

3ENA5 thru 3ENA9, 3ENC1 thru 3ENC6, 3UG76D thru 3UG80D, 3UG82D thru 3UG87D, 3KB35D thru 3KB42D and 4TM76D

Please read and save these instructions. Read carefully before attempting to assemble, install, operate or maintain the product described. Protect yourself and others by observing all safety information. Failure to comply with instructions could result in personal injury and/or property damage! Retain instructions for future reference.

Dayton® Electric Baseboard Heaters

Description

Residential and commercial grade electric convector baseboards provide primary, secondary or supplemental heating for new construction or remodeling applications. Baseboard heaters can be used in single family homes, apartments, modular or mobile homes as well as commercial, industrial and institutional construction. Baseboard heaters must be thermostatically controlled for efficient, safe operation. A thermostat is not provided with this heater.

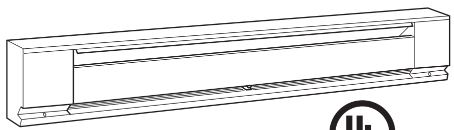


Figure 1

File #E256626

Specifications

HEATER AMPERE RATING

Model No.	Residential 120 Volt	208 Volt	240 Volt	277 Volt
3UG76D	4.2	–	–	–
3UG77D	6.3	–	–	–
3UG78D	8.3	–	–	–
3UG79D	10.4	–	–	–
3UG80D	12.5	–	–	–
3UG82D	–	1.8	2.1	–
3UG83D	–	2.7	3.1	–
3UG84D	–	3.6	4.2	–
3UG85D	–	4.5	5.2	–
3UG86D	–	5.4	6.3	–
3UG87D	–	7.2	8.3	–
4TM76D	–	8.7	10.4	–

Net Volumes of Wiring Compartment		
Description	**Cubic Inches**	**Cubic Centimeters**
Heater Only (Each Wiring Compartment)	14.96	241
Heater W/SP Thermostat	11.18	180
Heater W/DP Thermostat	11.18	180
Heater W/Duplex Receptacle	11.18	180

Model No.	Commercial 120 Volt	208 Volt	240 Volt	277 Volt
3ENC4	–	1.4	1.6	1.8
3ENC5	–	2.0	2.3	2.7
3KB35D	–	2.7	3.1	3.6
3KB36D	–	3.4	3.9	4.5
3KB37D	–	4.1	4.7	5.4
3KB38D	–	5.4	6.3	7.2
3ENC6	–	6.8	7.8	9.0
3ENC1	–	2.4	–	–
3ENC2	–	3.6	–	–
3KB39D	–	4.8	–	–
3KB40D	–	6.0	–	–
3KB41D	–	7.2	–	–
3KB42D	–	9.6	–	–
3ENC3	–	12.0	–	–
3ENA5	4.2	–	–	–
3ENA6	6.3	–	–	–
3ENA7	8.3	–	–	–
3ENA8	10.4	–	–	–
3ENA9	12.5	–	–	–

Total Amps	Minimum AWG Wire Size (Copper)	Circuit Breaker or Fuse Size
0 thru 12	#14	15 amp
12.1 thru 16	#12	20 amp

Unpacking

Check heater to make sure it has not been damaged in shipping. Do not install or attempt to operate the heater if damaged. Return to place of purchase or file claim with freight carrier.

General Safety Information

IMPORTANT INSTRUCTIONS

WHEN USING ELECTRICAL APPLIANCES, BASIC PRECAUTIONS SHOULD ALWAYS BE FOLLOWED TO REDUCE THE RISK OF FIRE, ELECTRIC SHOCK, AND INJURY TO PERSONS, INCLUDING THE FOLLOWING:

1. Read all instructions before installing or using the heater.
2. A heater has hot and arcing or sparking parts inside, Do not use in areas where gasoline or flammable liquids are used or stored.
3. This heater is hot when in use. To avoid burns, do not let bare skin touch hot surfaces. Keep combustible materials, such as furniture, pillows, bedding, papers, clothes, and curtains away from heater.
4. To prevent a possible fire, do not block air intakes or exhaust in any manner.
5. Do not insert or allow foreign objects to enter any ventilation or exhaust opening as this may cause an electric shock or fire, or damage the heater.
6. Serious injury or death could result from electric shock. Make sure electrical power supply circuit coming to heater is disconnected at main disconnect or service panel before installing or servicing this heater.

SAVE THESE INSTRUCTIONS

Form 5S6788

Printed in USA
09663
Version 0

Part No. 5200-2692-004
ECR 38673
MAR030
02/11

Dayton®

Dayton® Electric Baseboard Heaters

ENGLISH

Installation Instructions

This Heater is designed to provide years of efficient, trouble free operation as a primary or supplementary heat source for residential and commercial applications. Baseboard heaters must be thermostatically controlled for efficient, safe operation. A thermostat is not provided with this heater. However, a single or double pole thermostat accessory is available for installation into this heater at your place of purchase, or the heater may be connected to any suitable wall mounted thermostat that will meet the electrical load requirements. Installation or use of this product in any manner not described herein will void the warranty and could result in injury, damage to property, or permanent damage to heater.

⚠WARNING ***TO REDUCE THE RISK OF FIRE AND ELECTRIC SHOCK OR INJURY TO PERSONS, OBSERVE THE FOLLOWING:***

1. Serious injury or death could result from electric shock. Make sure electrical power supply circuit coming to heater is disconnected at main disconnect or service panel before installing this heater.
2. Wiring procedures and connections must be in accordance with the National Electrical Code (NEC) and local codes. Refer to Wiring Diagrams Figure 6. Make sure all electrical connections are tight to prevent possible overheating. Use copper supply wire only.
3. Verify the electrical power supply voltage matches the voltage rating as printed on the heater nameplate, see NAMEPLATE illustration on Page 5.

⚠CAUTION ***Never connect a heater to a voltage greater than the nameplate voltage as this will damage the heater and could cause a fire.***

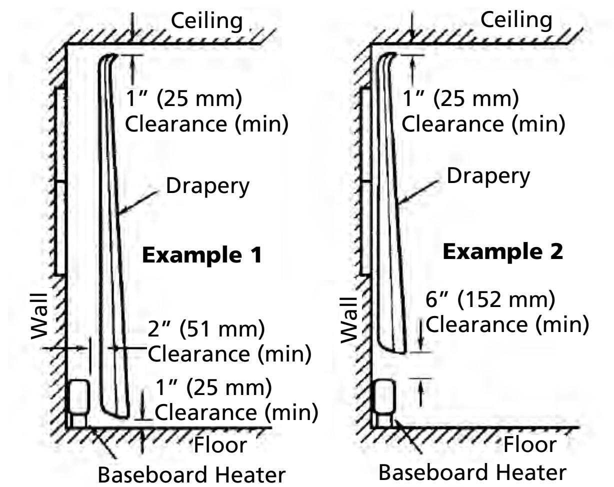


Figure 2 – Position of Drapery near Heater

4. Do not install the heater against combustible low-density cellulose fiberboard surfaces, against or below vinyl wall coverings, or below any materials that may be damaged by heat such as vinyl or plastic blinds, curtains, etc.
5. Do not install heater below an electrical convenience receptacle (outlet).

⚠CAUTION ***Heater Operates at High Temperatures. Keep Electrical Cords (including telephone and computer cables), Drapes, and Other Furnishings Away From Heater.***

6. For efficient and safe operation, we recommend maintaining a minimum of 6 inches (152 mm) clearance above and in front of the heater at all times. See Figure 2 for minimum clearance requirements for drapery.
7. To reduce the risk of fire, do not store or use gasoline or other flammable vapors or liquids in the vicinity of the heater.
8. Do not install heater upside down or in any position other than as shown in this manual. Caution label with word "TOP" must be at the top when heater is installed.
9. Do not recess heater in wall or install heater inside any type enclosure as this will cause heater to overheat and could create a hazard.
10. When mounting heater, if bottom mounting holes are used (see Figure 5), make sure screws do not damage supply wiring in the area behind heater.
11. Do not remove or bypass the safety limit control (Safety Cutout) as this could allow heater to become a fire hazard – see Figure 6.

NOTICE TO OWNERS

Certain fabrics discolor in time from indirect sunlight and normal room temperature – mostly organic and synthetic material. They will discolor more rapidly when exposed to direct sunlight and warm currents. Hang drapes to provide minimum of 2" (51 mm) air space between heater front and nearest drape fold as shown in Example 1, Figure 2 or 6" (152 mm) airspace between top of heater and bottom of drapes as shown in Example 2, Figure 2. Allow

Models 3ENA5 thru 3ENA9, 3ENC1 thru 3ENC6, 3UG76D thru 3UG80D, 3UG82D thru 3UG87D, 3KB35D thru 3KB42D, and 4TM76D

E N G L I S H

Installation Instructions (Continued)

minimum clearance of 1” (25 mm) from drapes to ceiling and to top of floor covering to permit air circulation as shown in Example 1, Figure 2.

FLOORS AND CARPETING

Heaters may be mounted directly on any floor surface, including carpeting. Where wall-to-wall carpets are installed after the baseboard installation, the carpeting can be run up to the front and around the heater body, providing it does not obstruct air flow. (Maximum 3/4” [19 mm] thick).

1. Remove wiring compartment cover at end of heater where power supply cable is to enter. Determine desired mounting location (Figure 3), position heater to wall as intended and mark wall (or floor) at location where power supply is to enter heater.

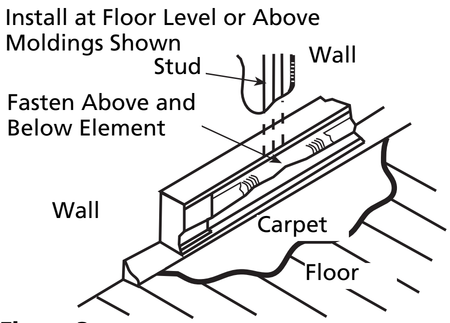


Figure 3

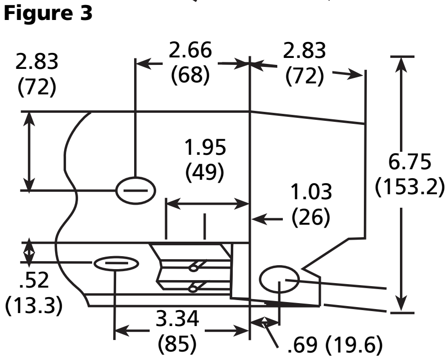


Figure 4 – Wiring Compartment Dimensions – in. (mm)

NOTE: Make sure the caution label with the word “TOP” is at the top of the heater. For most efficient operation locate heaters along outside wall under windows. Position heater so it can be secured to wall stud. Power cable must enter heater through one of the knock-outs provided in wiring compartment. See Figure 4.

2. Drill hole in wall (or floor) at desired location for power supply entry. Install power supply wiring to heater and thermostat location as determined by thermostat option selected. Allow approximately 10 to 12” (254 mm to 305 mm) of wire at heater for connections.
3. If any other Dayton accessories are to be used with this heater, refer to installation instructions provided with the accessory for proper installation and wiring.
4. **Wireway Cover – Commercial Baseboard Only**
   a. The wireway cover is a factory installed feature of Dayton commercial baseboard heaters. Two cables or four individual conductors plus two ground wires may be routed through the wireway. Refer to page 1 for maximum current loads.
   b. To gain access to wireway, lay heater face down and remove two screws as shown in Figure 5. Remove the knockouts in the channel areas of both terminal boxes.
   c. Insert the plastic bushings from the parts kit (in wiring compartment) in the knockout holes.
   d. Wire heater according to Figure 6. Reattach the wireway cover using the two screws.
5. Loosen screw in built-in cable clamp or remove desired knockout from heater wiring compartment (Figures 4 and 5). Install power cable into wiring compartment allowing at least 6” (152 mm) of cable for connection to heater. To install two power cables using the built-in cable clamp, bend tab covering second hole up and back to rear wall of wiring compartment. If built-in cable clamp is not used, install approved cable connector (not included) in desired knockout.
6. Position heater to wall (use cross stamped perforations as a guide, see Figure 5) and secure through the top row of predrilled mounting holes using at least two fasteners, one at each end of the heater. If the unit is mounted above the floor to allow carpet installation under the heater, two additional mounting holes are supplied at each end below the

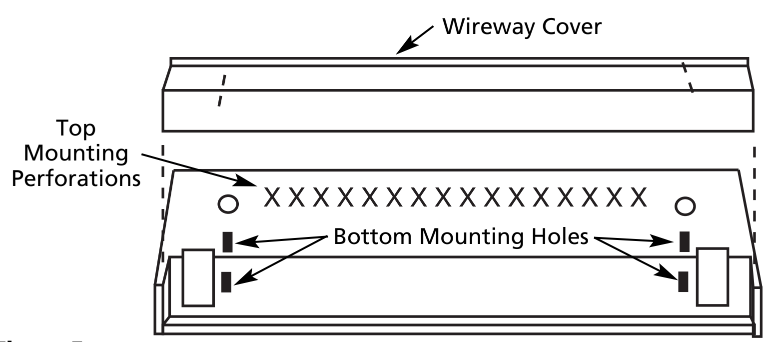


Figure 5

Dayton® Electric Baseboard Heaters

E N G L I S H

Installation Instructions (Continued)

element. This will allow you to screw into the sill plate if the unit does not span across two wall studs.

⚠CAUTION ***When using bottom mounting holes, (to prevent a possible shock or fire hazard) make sure you do not drive the screws through or damage the power supply wire.***

7. Connect the supply cable grounding wire to the bare copper pigtail in wiring compartment.
8. After making sure the electrical power coming to the heater is turned off at main switch panel follow the desired wiring diagram, as shown in Figure 6, to connect the power supply to the heater using approved wire nuts.

⚠WARNING ***To prevent a possible fire, make sure all wire connections are tight.***

NOTE: When accessories are installed, use wiring diagram supplied with the accessory.

9. If front cover was removed, reinstall by hooking the top edge on the support bracket(s). Then push down to latch onto the support bracket(s).
10. Replace wiring compartment cover.
11. Follow instructions accompanying thermostat for installation and wiring thermostat. See Figure 7 for typical thermostat wiring diagrams.

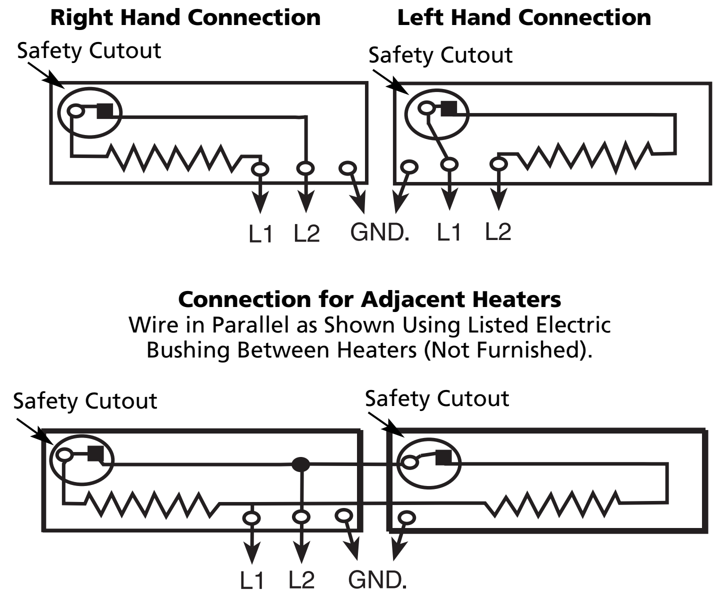
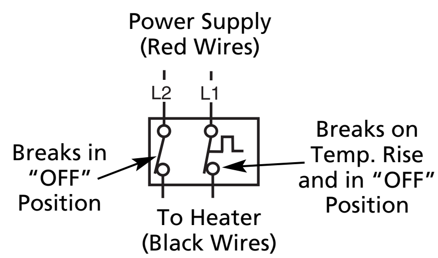


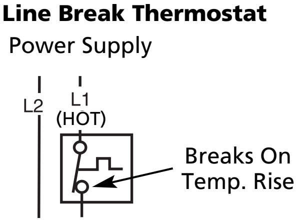
Figure 6

Double Line Break Thermostat



Double line break thermostats have an "OFF" switch that is open only when the thermostat is put in the "OFF" position

Single Line Break Thermostat



Single line break thermostats DO NOT have an "OFF" position and will operate at a temperature below its minimum set point

Figure 7 – Typical Thermostats

Operation Instructions

1. This heater must be properly installed before it is used.
2. After the baseboard system has been completely installed, all thermostats should be turned to LOW or NO HEAT. Then turn on breakers. Wait 3 to 5 minutes and check to see that none of the heaters are operating. If operating, disconnect power and check wiring. If none are operating then turn thermostats to highest position and wait 3 to 5 minutes. Check to see that all heater(s) are operating. Should any not be operating, disconnect power and check wiring.
3. Allow entire system to operate steadily for 1/2 hour. This should remove oily residue from manufacturing. (Some smoking may occur).
4. Select the setting for comfort on all thermostats.

Models 3ENA5 thru 3ENA9, 3ENC1 thru 3ENC6, 3UG76D thru 3UG80D, 3UG82D thru 3UG87D, 3KB35D thru 3KB42D, and 4TM76D

Maintenance Instructions

Your heater will give you years of service and comfort with only minimum care. To assure efficient operation follow the simple instructions below.

1. The user can perform some basic cleaning of the heater. All other servicing is to be done by qualified service personnel.
2. Because of the convection heating principle which depends upon a circulation of air through the finned element, dust will collect between the fins. The heater should be cleaned regularly for maximum efficiency.

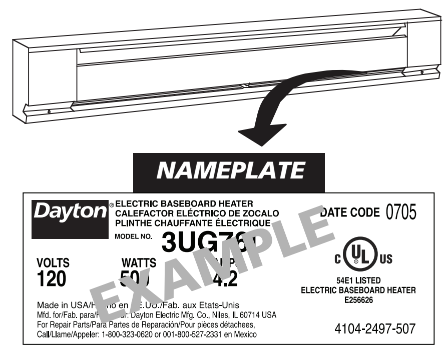
⚠CAUTION ***Fins May Cause Cuts, Do Not Touch.***

⚠WARNING ***Before cleaning, make sure the power has been turned off at the circuit breaker panel, and that the heating element is cool.***

3. With front cover removed, a vacuum cleaner with proper attachments can easily be worked along the top and bottom of the finned element to clear it of dust deposits.
4. The baked enamel finish of the heater may be cleaned with a slightly damp rag if desired, however wax cleaners or polished should not be used as these waxes may vaporize when the heater is in operation and cause discoloration.
5. Replace front cover, wiring compartment covers, all screws removed during disassembly and when cleaning is complete, restore power.

PAINTING

Painting of this baseboard is not necessary unless to match room decor. To paint, first rough up the exterior with steel wool. Paint only the exterior of the cabinet. Do not allow paint on the element and high limit capillary tube. Use a high quality enamel paint.



For Repair Parts, call 1-800-323-0620

24 hours a day – 365 days a year

Please provide following information:
-Model number
-Serial number (if any)
-Part description and number as shown in parts list

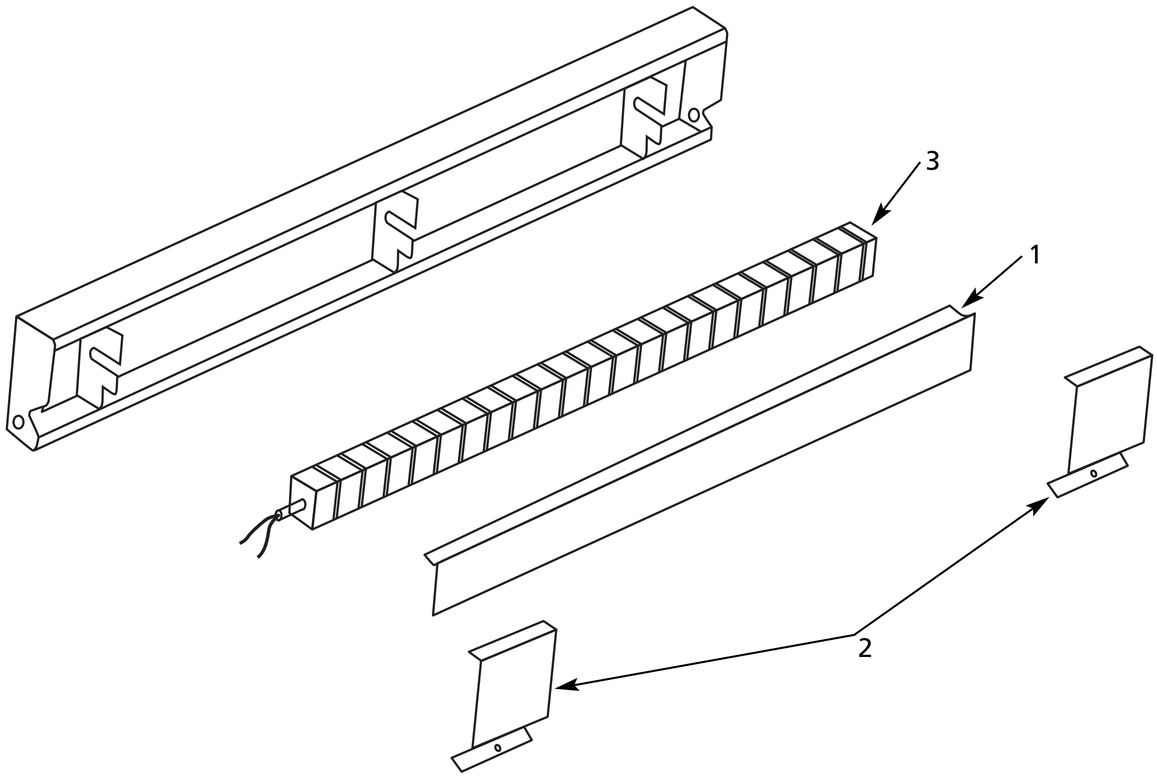


Figure 8 – Repair Parts Illustration for Electric Baseboard Heaters

Repair Parts List for Electric Baseboard Heaters

Ref. No.	Description	3UG76D/ 3UG82D	3UG77D/ 3UG83D	3UG78D/ 3UG84D	3UG79D/ 3UG85D	Qty.
	Length	2′ 6″	3′	4′	5′	
1	Front Cover	14022122116	14022122117	14022122118	14022122119	1
2	Junction Box Cover	14022261000	14022261000	14022261000	14022261000	2
3	Element 120V	18022056007	18022056011	18022044017	18022044023	1
	240V	18022056005	18022056009	18022044015	18022044021	1

Ref. No.	Description	3UG80D/ 3UG86D	3UG87D	4TM76D	Qty.
	Length	6′	8′	8′	
1	Front Cover	14022122120	14022122121	14022122121	1
2	Junction Box Cover	14022261000	14022261000	14022261000	2
3	Element 120V	18022094015	–	–	1
	240V	18022044027	18022044033	18022044045	1

For Repair Parts, call 1-800-323-0620

24 hours a day – 365 days a year

Please provide following information:
-Model number
-Serial number (if any)
-Part description and number as shown in parts list

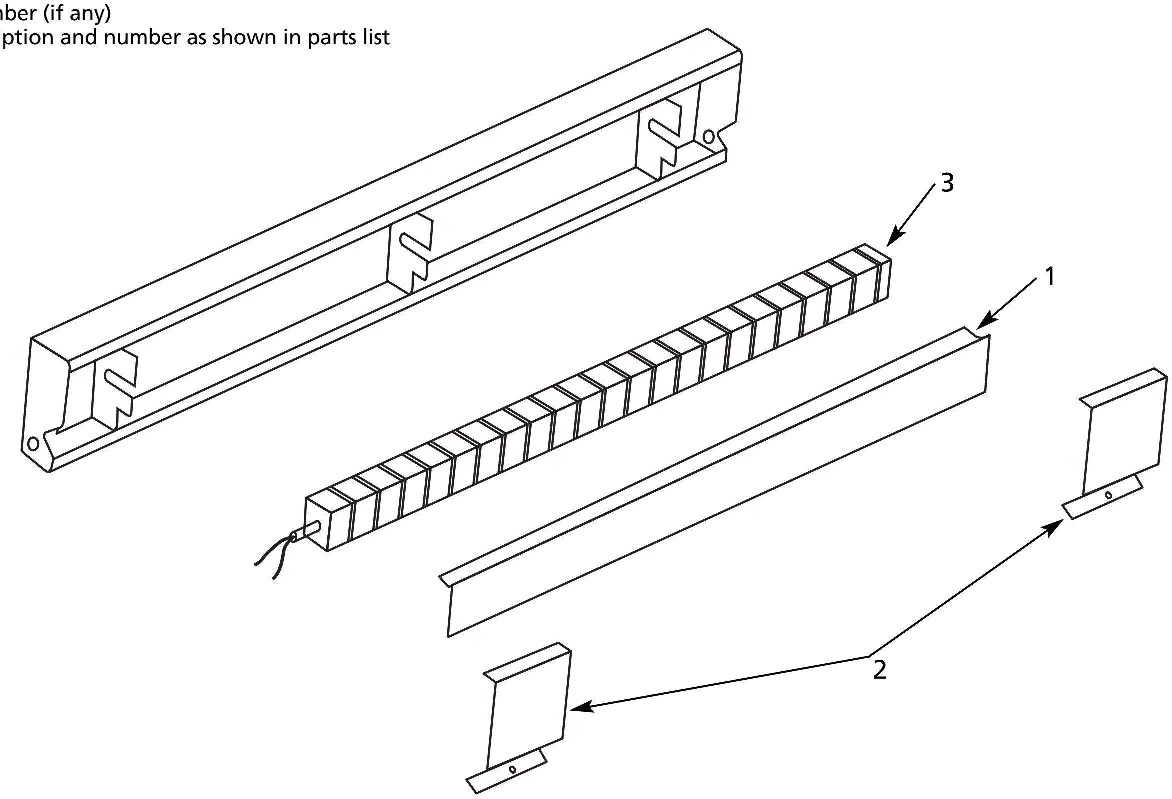


Figure 9 – Repair Parts Illustration for Electric Baseboard Heaters

Repair Parts List for Electric Baseboard Heaters

Ref. No.	Description	3ENA5/ 3ENC1/ 3ENC4	3ENA6/ 3ENC2/ 3ENC5	3ENA7/ 3KB39D/ 3KB35D	3ENA8/ 3KB40D/ 3KB36D	Qty.
	Length	2′ 6″	3′	4′	5′	
1	Front Cover	14022122040	14022122041	14022122042	14022122043	1
2	Junction Box Cover	14022261003	14022261003	14022261003	14022261003	2
3	Element 120V	18022056007	18022056011	18022044017	18022044023	1
	208V	18022056006	18022056010	18022044016	18022044022	1
	277V	18022056004	18022056008	18022044014	18022044020	1

Ref. No.	Description	3ENA9 3KB41D 3KB37D	3KB42D 3KB38D	3ENC3 3ENC6	Qty.
	Length	6′	8′	8′	1
1	Front Cover	14022122044	14022122045	14022122045	1
2	Junction Box Cover	14022261003	14022261003	14022261003	2
3	Element 120V	18022094015	–	–	1
	208V	18022044028	18022044034	18022044044	1
	277V	18022044026	18022044032	18022044046	1

Dayton® Electric Baseboard Heaters

E N G L I S H

LIMITED WARRANTY

DAYTON ONE-YEAR LIMITED WARRANTY. *DAYTON® ELECTRIC BASEBOARD HEATERS, MODELS COVERED IN THIS MANUAL, ARE WARRANTED BY DAYTON ELECTRIC MFG. CO. (DAYTON) TO THE ORIGINAL USER AGAINST DEFECTS IN WORKMANSHIP OR MATERIALS UNDER NORMAL USE FOR ONE YEAR AFTER DATE OF PURCHASE. ANY PART WHICH IS DETERMINED TO BE DEFECTIVE IN MATERIAL OR WORKMANSHIP AND RETURNED TO AN AUTHORIZED SERVICE LOCATION, AS DAYTON DESIGNATES, SHIPPING COSTS PREPAID, WILL BE, AS THE EXCLUSIVE REMEDY, REPAIRED OR REPLACED AT DAYTON'S OPTION. FOR LIMITED WARRANTY CLAIM PROCEDURES, SEE "PROMPT DISPOSITION" BELOW. THIS LIMITED WARRANTY GIVES PURCHASERS SPECIFIC LEGAL RIGHTS WHICH VARY FROM JURISDICTION TO JURISDICTION.*

LIMITATION OF LIABILITY. *TO THE EXTENT ALLOWABLE UNDER APPLICABLE LAW, DAYTON'S LIABILITY FOR CONSEQUENTIAL AND INCIDENTAL DAMAGES IS EXPRESSLY DISCLAIMED. DAYTON'S LIABILITY IN ALL EVENTS IS LIMITED TO AND SHALL NOT EXCEED THE PURCHASE PRICE PAID.*

WARRANTY DISCLAIMER. *A DILIGENT EFFORT HAS BEEN MADE TO PROVIDE PRODUCT INFORMATION AND ILLUSTRATE THE PRODUCTS IN THIS LITERATURE ACCURATELY; HOWEVER, SUCH INFORMATION AND ILLUSTRATIONS ARE FOR THE SOLE PURPOSE OF IDENTIFICATION, AND DO NOT EXPRESS OR IMPLY A WARRANTY THAT THE PRODUCTS ARE MERCHANTABLE, OR FIT FOR A PARTICULAR PURPOSE, OR THAT THE PRODUCTS WILL NECESSARILY CONFORM TO THE ILLUSTRATIONS OR DESCRIPTIONS. EXCEPT AS PROVIDED BELOW, NO WARRANTY OR AFFIRMATION OF FACT, EXPRESSED OR IMPLIED, OTHER THAN AS STATED IN THE "LIMITED WARRANTY" ABOVE IS MADE OR AUTHORIZED BY DAYTON.*

Technical Advice and Recommendations, Disclaimer. *Notwithstanding any past practice or dealings or trade custom, sales shall not include the furnishing of technical advice or assistance or system design. Dayton assumes no obligations or liability on account of any unauthorized recommendations, opinions or advice as to the choice, installation or use of products.*

Product Suitability. *Many jurisdictions have codes and regulations governing sales, construction, installation, and/or use of products for certain purposes, which may vary from those in neighboring areas. While attempts are made to assure that Dayton products comply with such codes, Dayton cannot guarantee compliance, and cannot be responsible for how the product is installed or used. Before purchase and use of a product, review the product applications, and all applicable national and local codes and regulations, and be sure that the product, installation, and use will comply with them.*

Certain aspects of disclaimers are not applicable to consumer products; e.g., (a) some jurisdictions do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you; (b) also, some jurisdictions do not allow a limitation on how long an implied warranty lasts, consequently the above limitation may not apply to you; and (c) by law, during the period of this Limited Warranty, any implied warranties of implied merchantability or fitness for a particular purpose applicable to consumer products purchased by consumers, may not be excluded or otherwise disclaimed.

Prompt Disposition. *A good faith effort will be made for prompt correction or other adjustment with respect to any product which proves to be defective within limited warranty. For any product believed to be defective within limited warranty, first write or call dealer from whom the product was purchased. Dealer will give additional directions. If unable to resolve satisfactorily, write to Dayton at address below, giving dealer's name, address, date, and number of dealer's invoice, and describing the nature of the defect. Title and risk of loss pass to buyer on delivery to common carrier. If product was damaged in transit to you, file claim with carrier.*

Manufactured for Dayton Electric Mfg. Co., 5959 W. Howard St., Niles, Illinois 60714-4014 U.S.A.

Por favor lea y guarde estas instrucciones. Léalas cuidadosamente antes de tratar de montar, instalar, operar o dar mantenimiento al producto aquí descrito. Protéjase usted mismo y a los demás observando toda la información de seguridad. ¡El no cumplir con las instrucciones puede ocasionar daños, tanto personales como a la propiedad! Guarde estas instrucciones para referencia en el futuro.

Calentadores Eléctricos de Zócalo Dayton®

Descripción

Los calentadores de zócalo por convección eléctrica de capacidad comercial y residencial proporcionan calefacción primaria, secundaria y suplementaria en las aplicaciones de construcción nueva o remodelación. Los calentadores de zócalo pueden utilizarse en las casas unifamiliares, departamentos, casas modulares o móviles, así como en las edificaciones comerciales, industriales e institucionales. Los calentadores de zócalo deben controlarse con un termostato para lograr un funcionamiento seguro y eficaz. No se incluye un termostato con este calentador.

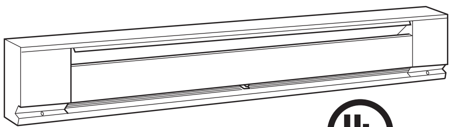


Figura 1 Archivo #E256626

Especificaciones

CAPACIDAD DE AMPERIOS DEL CALENTADOR

Modelo No.	Residencial 120 Voltios	208 Voltios	240 Voltios	277 Voltios
3UG76D	4.2	–	–	–
3UG77D	6.3	–	–	–
3UG78D	8.3	–	–	–
3UG79D	10.4	–	–	–
3UG80D	12.5	–	–	–
3UG82D	–	1.8	2.1	–
3UG83D	–	2.7	3.1	–
3UG84D	–	3.6	4.2	–
3UG85D	–	4.5	5.2	–
3UG86D	–	5.4	6.3	–
3UG87D	–	7.2	8.3	–
4TM76D	–	8.7	10.4	–

Volúmenes Netos de los Compartimientos de Cables Descripción	Pulg. Cúbicas	Centímetros Cúbicos
Sólo el calentador (cada compartimiento de cables)	14.96	241
Calentador con Termostato SP	11.18	180
Calentador con Termostato DP	11.18	180
Calentador con Receptáculo Doble	11.18	180

Modelo No.	Comercial 120 Voltios	208 Voltios	240 Voltios	277 Voltios
3ENC4	–	1.4	1.6	1.8
3ENC5	–	2.0	2.3	2.7
3KB35D	–	2.7	3.1	3.6
3KB36D	–	3.4	3.9	4.5
3KB37D	–	4.1	4.7	5.4
3KB38D	–	5.4	6.3	7.2
3ENC6	–	6.8	7.8	9.0
3ENC1	–	2.4	–	–
3ENC2	–	3.6	–	–
3KB39D	–	4.8	–	–
3KB40D	–	6.0	–	–
3KB41D	–	7.2	–	–
3KB42D	–	9.6	–	–
3ENC3	–	12.0	–	–
3ENA5	4.2	–	–	–
3ENA6	6.3	–	–	–
3ENA7	8.3	–	–	–
3ENA8	10.4	–	–	–
3ENA9	12.5	–	–	–

Amperaje Total	Calibre AWG Mínimo del Cable (Cobre)	Capacidad del Corta-circuito o Fusible
0 a 12	#14	15 amp
12.1 a 16	#12	20 amp

ESPAÑOL

Desempaque

Revise el calentador para asegurarse que éste no se haya dañado durante el envío. No instale ni intente usar el calentador si está dañado. Devuélvalo al establecimiento donde lo adquirió o presente un reclamo a la compañía de transporte.

Información de Seguridad General

INSTRUCCIONES IMPORTANTES

CUANDO SE UTILICEN APARATOS ELÉCTRICOS, SIEMPRE DEBERÁN SEGUIRSE LAS MEDIDAS DE PRECAUCIÓN BÁSICAS PARA REDUCIR EL RIESGO DE INCENDIO, CHOQUE ELÉCTRICO Y LESIONES A LAS PERSONAS, INCLUYENDO LAS SIGUIENTES:

1. Lea todas las instrucciones antes de instalar o utilizar el calentador.
2. Los calentadores tienen en su interior piezas calientes y productoras de arcos eléctricos o chispas eléctricas. No los utilice en las áreas donde se emplee o almacene gasolina o líquidos inflamables.
3. Este calentador está caliente cuando se utiliza. Para evitar quemaduras, no permita que la piel expuesta toque las superficies calientes. Mantenga lejos del calentador los materiales combustibles, tales como muebles, almohadas, ropas de cama, papeles, vestimentas y cortinas.
4. Para evitar un posible incendio, no bloquee de ninguna manera las entradas o salidas de aire.

Impreso en EE.UU.
09663
Versión 0

Part No. 5200-2692-004
ECR 38673
MAR030
02/11

Dayton®

Calentadores Eléctricos de Zócalo Dayton®

Información de Seguridad General (Continuación)

5. No inserte ni permita que objetos extraños entren en ninguna abertura de ventilación o escape, ya que esto podría causar un choque eléctrico, o incendio o daños al calentador.
6. Los electrochoques pueden causar lesiones graves o la muerte. Asegúrese de desconectar el circuito de suministro de energía eléctrica para el calentador en el panel principal de servicio o de desconexión antes de instalar o darle mantenimiento a este calentador.

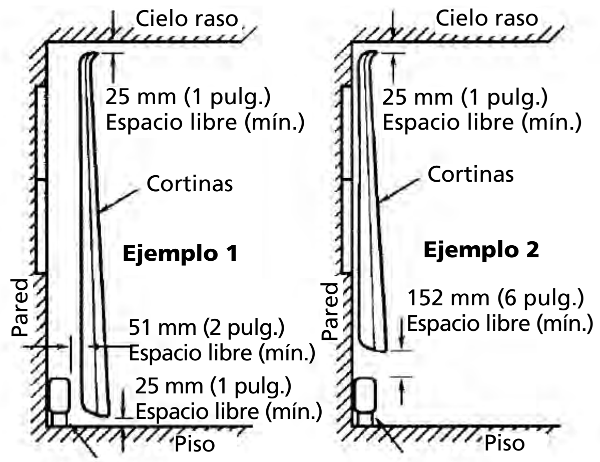


Figura 2 – Posición de las Cortinas Cerca del Calentador

CONSERVE ESTAS INSTRUCCIONES

Instrucciones de Instalación

Este Calentador está diseñado para proporcionar años de funcionamiento eficaz y sin problemas como una fuente de calefacción primaria o suplementaria, en aplicaciones residenciales y comerciales. Los calentadores de zócalo deben controlarse con un termostato para lograr un funcionamiento seguro y eficaz. No se incluye un termostato con este calentador. Sin embargo, hay disponible un accesorio de termostato unipolar o bipolar que puede instalarse en este calentador en el establecimiento donde lo compre, o, el calentador puede conectarse a cualquier termostato de montaje en pared adecuado que satisfaga los requisitos de carga eléctrica. La instalación o el uso de este producto en cualquier forma no descrita aquí anularán la garantía y pueden resultar en lesiones, daños a la propiedad o daño permanente al calentador.

⚠ ADVERTENCIA ***PARA REDUCIR EL RIESGO DE INCENDIO Y ELECTROCHOQUE O LESIONES A LAS PERSONAS, OBSERVE LO SIGUIENTE:***

1. Los electrochoques pueden causar lesiones graves o la muerte. Asegúrese de desconectar el circuito de suministro de energía eléctrica para el calentador en el panel principal de servicio o de desconexión antes de instalar este calentador.
2. Los procedimientos de cableado y las conexiones deben cumplir con el Código Eléctrico Nacional (NEC) y los códigos locales. Consulte los Diagramas Eléctricos en la Figura 6. Asegúrese que todas las conexiones eléctricas estén bien apretadas para evitar un posible sobrecalentamiento. Utilice sólo conductores de suministro de cobre.
3. Verifique que el voltaje de alimentación suministrado al calentador coincida con el valor de capacidad de voltaje impreso en la placa de identificación del calentador. Consulte la ilustración de la “Placa de Identificacion” en la página 5.

⚠ ATENCIÓN ***Nunca conecte un calentador a un voltaje mayor que el voltaje indicado en la placa de identificación, ya que esto dañará el calentador y podría causar un incendio.***

4. No instale el calentador contra superficies de panel de fibra de baja densidad combustibles, contra o debajo de recubrimientos de vinilo de paredes, o debajo de cualesquiera materiales que podrían ser dañados por el calor, tales como cortinas, persianas de plástico o vinilo, etc.
5. No instale el calentador debajo de un receptáculo eléctrico de conveniencia (tomacorrientes).

⚠ ATENCIÓN ***El calentador funciona a altas temperaturas. Mantenga los cordones eléctricos (incluyendo cables de computadora y teléfono), las cortinas y otros enseres lejos del calentador.***

6. Para un funcionamiento eficaz y seguro, recomendamos mantener un espacio libre mínimo de 152 mm (6 pulg.) por encima y enfrente del calentador en todo momento. Consulte la Figura 2 para ver los requisitos de espacio libre mínimo para cortinas.
7. Para disminuir el riesgo de incendio, no almacene ni utilice gasolina u otros líquidos o vapores inflamables cerca del calentador.
8. No instale el calentador en posición invertida o en cualquier posición otra que como se muestra en este manual. La etiqueta de precaución con la palabra “TOP” (Arriba) deberá estar en la parte superior del calentador cuando se instala el mismo.
9. No empotre el calentador en la pared ni lo instale dentro de algún tipo de recinto cerrado, ya que esto ocasionará que el calentador se sobrecaliente y podría crear un riesgo.

Modelos 3ENA5 a 3ENA9, 3ENC1 a 3ENC6, 3UG76D a 3UG80D, 3UG82D a 3UG87D, 3KB35D a 3KB42D y 4TM76D

Instrucciones de Instalación (Continuación)

10. Al montar el calentador, si se utiliza los orificios de montaje inferiores (consulte la Figura 5), asegúrese que los tornillos no dañen el cableado de suministro en el área que está detrás del calentador.
11. No retire ni ignore el control de límite de seguridad (Interruptor de seguridad), porque eso puede permitir que el calentador se convierta en un peligro de incendio – consulte la Figura 6.

AVISO PARA LOS PROPIETARIOS

Algunas telas se descoloran con el paso del tiempo por la simple exposición a la luz solar indirecta y a las temperaturas ambiente normales; especialmente los materiales orgánicos y sintéticos. Éstas tienden a descolorarse más rápidamente cuando están expuestas a la luz solar directa y a corrientes tibias. Cuelgue las cortinas en forma que deje un espacio de aire mínimo de 51 mm (2 pulg.) entre el frente del calentador y el pliego más cercano de la cortina, como se muestra en el Ejemplo 1 en la Figura 2, o un espacio de aire de 152 mm (6 pulg.) entre la parte superior del calentador y la parte inferior de las cortinas como se muestra en el Ejemplo 2 en la Figura 2. Deje un espacio libre mínimo de 25 mm (1 pulg.) desde las cortinas hasta el cielo raso y hasta la cubierta superior del piso para permitir la circulación del aire como se muestra en el Ejemplo 1 en la Figura 2.

PISOS Y ALFOMBRAS

Los calentadores pueden montarse directamente en cualquier superficie de piso, incluyendo los pisos alfombrados. En los lugares donde se instalen alfombras de pared a pared después de la instalación del calentador de zócalo, puede instalarse éstas hasta el frente y alrededor del cuerpo del calentador, siempre y cuando no se obstruya la circulación del aire. (Un grosor máximo de 19 mm [3/4 pulg.]).

1. Retire la cubierta del compartimiento de cableado en el extremo del calentador por donde entra el cable de alimentación eléctrica. Determine la ubicación de montaje deseada (Figura 3), coloque el calentador contra la pared como debe ser y marque en la pared (o en el piso) el punto o lugar por donde va a entrar la alimentación eléctrica al calentador.

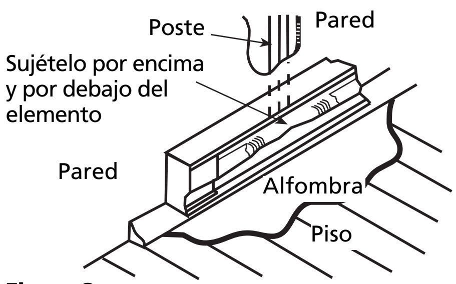


Figura 3

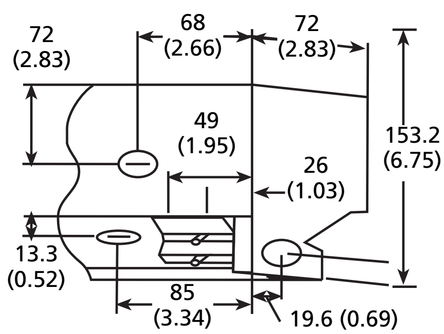


Figura 4 – Dimensiones del Compartimiento de Cableado – en mm (pulg.)

AVISO: Asegúrese que la etiqueta de precaución con la palabra "TOP" (Arriba) esté en la parte superior del calentador. Para un funcionamiento más eficaz, sitúe los calentadores a lo largo de la pared exterior debajo de las ventanas. Sitúe el calentador de manera que se pueda fijar éste en los postes o maderos de la pared. El cable de alimentación debe entrar al calentador a través de uno de los agujeros ciegos proporcionados en el compartimiento de cableado. Consulte la Figura 4.

2. Perfore un agujero en la pared (o el piso) en el punto deseado para la entrada del suministro eléctrico. Instale el cable de alimentación eléctrica para el calentador y para la posición del termostato según como lo determine la opción de termostato seleccionada. Deje aproximadamente de 254 mm a 305 mm (10 a 12 pulg.) de cable en el calentador para hacer las conexiones.
3. Si van a utilizarse otros accesorios Dayton con este calentador, consulte las instrucciones de instalación suministradas con el accesorio para instalar y conectar todo en forma correcta.
4. **Cubierta del Conducto de Cables – Sólo en los Calentadores de Zócalo Comerciales**
   a. La cubierta del conducto de cables es una característica instalada en la fábrica de los calentadores de zócalo comerciales Dayton. Dos cables o cuatro conductores individuales más dos cables de conexión a tierra pueden encaminarse a través del conducto de cables. Consulte la página 1 para ver las cargas de corriente máximas.
   b. Para tener acceso al conducto de cables, tienda el calentador con la cara abajo y extraiga dos tornillos como se muestra en la Figura 5. Destape los agujeros ciegos en las áreas de canal de ambas cajas de empalme.
   c. Inserte los bujes de plástico del juego de piezas (en el compartimiento de cableado) en los agujeros ciegos.
   d. Realice las conexiones del calentador de acuerdo con la Figura 6. Vuelva a instalar la cubierta del conducto de cables usando los dos tornillos.
5. Afloje el tornillo en la abrazadera de cable incorporada o destape el agujero ciego deseado en el compartimiento de cableado del calentador (Figuras 4 y 5). Instale el cable de alimentación dentro

Calentadores Eléctricos de Zócalo Dayton®

Instrucciones de Instalación (Continuación)

del compartimiento de cableado, dejando al menos 152 mm (6 pulg.) de cable para hacer la conexión al calentador. Para instalar dos cables de alimentación usando la abrazadera de cables incorporada, doble la lengüeta que cubre el segundo agujero hacia arriba y hacia atrás hasta la pared posterior del compartimiento de cableado. Si no se utiliza la abrazadera de cables incorporada, instale un conector de cable aprobado (no incluido) en el agujero ciego deseado.

6. Coloque el calentador contra la pared (utilice las perforaciones estampadas con una cruz como una guía; consulte la Figura 5) y fíjelo a través de la hilera superior de orificios de montaje preperforados, usando al menos dos sujetadores, uno en cada extremo del calentador. Si la unidad se monta un tanto elevada sobre el piso para permitir la instalación de una alfombra debajo del calentador, se suministran dos orificios de montaje adicionales en cada extremo, debajo del elemento. Esto le permitirá a usted atornillar el calentador en la solera inferior si la longitud de la unidad no alcanza dos postes o maderos de la pared.

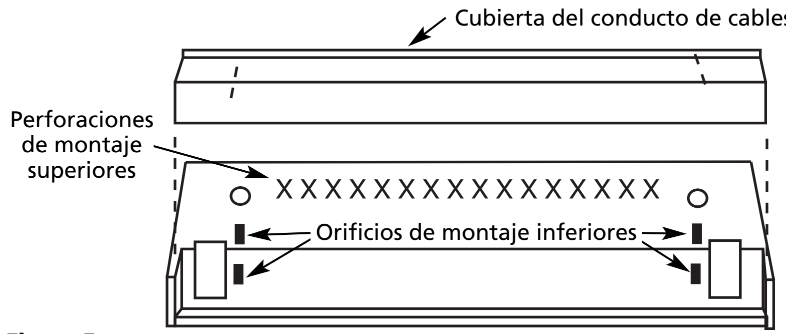


Figura 5

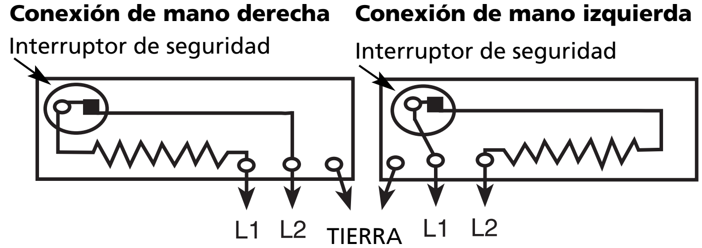
⚠ ATENCIÓN ***Cuando utilice los orificios de montaje inferiores, asegúrese de no dañar ni atornillar los tornillos a través de los conductores de alimentación eléctrica (para evitar un posible electrochoque o riesgo de incendio).***

7. Acople el cable de conexión a tierra del cable de alimentación al conductor flexible de cobre sin aislamiento en el compartimiento de cableado.
8. Después de asegurarse que se haya desconectado la alimentación eléctrica para el calentador en el panel del interruptor principal, siga el diagrama eléctrico deseado, según como se muestra en la Figura 6, para conectar la alimentación eléctrica para el calentador usando tuercas para cables aprobadas.

⚠ ADVERTENCIA ***Para evitar un posible incendio, asegúrese que todas las conexiones alámbricas estén bien apretadas.***

AVISO: Cuando se instalan accesorios, utilice el diagrama eléctrico suministrado con el accesorio.

Conexión de mano derecha **Conexión de mano izquierda**



Conexión para calentadores adyacentes
Conecte en paralelo como se muestra usando el buje eléctrico indicado entre los calentadores (no suministrado).

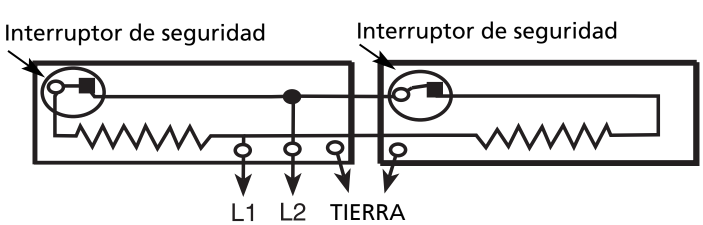
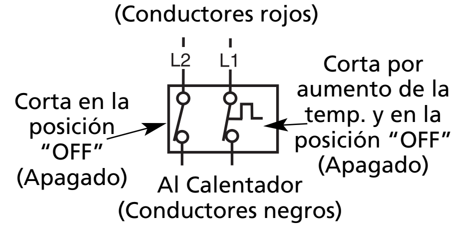


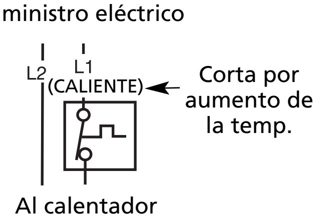
Figura 6

Termostato de interrupción de doble línea



Los termostatos de interrupción de doble línea tienen un interruptor "OFF" (Apagado) que sólo se abre cuando se pone el termostato en la posición "OFF" (Apagado)

Termostato de interrupción de línea única



Los termostatos de interrupción de línea única NO tienen una posición "OFF" (Apagado) y funcionarán a una temperatura inferior a su temperatura mínima preestablecida.

Figura 7 – Termostatos Típicos

Modelos 3ENA5 a 3ENA9, 3ENC1 a 3ENC6, 3UG76D a 3UG80D, 3UG82D a 3UG87D, 3KB35D a 3KB42D y 4TM76D

Instrucciones de Instalación (Continuación)

9. Si se ha desmontado la cubierta frontal, vuelva a instalarla, enganchando el borde superior en la pieza o piezas de soporte. Luego presione hacia abajo para engancharla en la pieza o piezas de soporte.
10. Vuelva a instalar la cubierta del compartimiento de cableado.
11. Siga las instrucciones suministradas con el termostato para instalar y conectar el termostato. Consulte la Figura 7, página 4, para ver los diagramas eléctricos de los termostatos típicos.

Instrucciones de Operación

1. Se debe instalar correctamente este calentador antes de usarlo.
2. Después de instalar todo el sistema de calentadores de zócalo, se recomienda disponer todos los termostatos a LOW (Bajo Calor) o NO HEAT (Sin Calefacción). Luego conecte los interruptores. Espere 3 a 5 minutos y compruebe que ninguno de los calentadores esté funcionando. Si uno o más están funcionando, desconecte la alimentación eléctrica y revise el cableado. Si ninguno está funcionando, entonces ponga el termostato en la posición más alta y espere 3 a 5 minutos. Compruebe que todos los calentadores estén funcionando. Si alguno no funciona, desconecte la alimentación eléctrica y revise el cableado.
3. Permita que todo el sistema funcione constantemente durante 1/2 hora. Esto deberá eliminar todo residuo del proceso de fabricación. (Es posible que se produzca un poco de humo).
4. Seleccione el ajuste de comodidad en todos los termostatos.

Instrucciones de Mantenimiento

Su calentador le brindará años de servicio y comodidad con sólo un cuidado mínimo. Para garantizar un funcionamiento eficaz, siga las instrucciones sencillas que se dan a continuación.

1. El usuario puede realizar algunas operaciones de limpieza básica en el calentador. Todo otro tipo de mantenimiento deberá realizarlo el personal calificado de servicio.
2. Debido al principio de calefacción por convección, el cual depende de una circulación de aire a través del elemento con aletas, el polvo se acumulará en las aletas. El calentador debe limpiarse en forma regular para obtener la eficacia máxima.

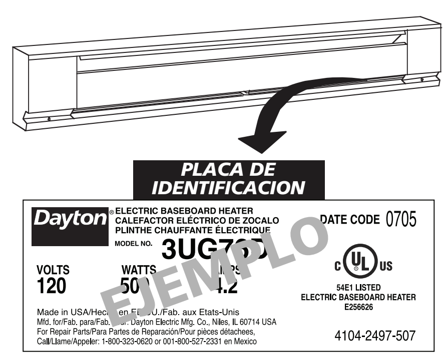
⚠ ADVERTENCIA ***Las aletas pueden producir cortes. No las toque.***

⚠ ADVERTENCIA ***Antes de limpiar, asegúrese que se haya cortado la alimentación eléctrica para la unidad en el panel del cortacircuito y que el elemento del calentador esté frío.***

3. Con la cubierta frontal del calentador retirada, puede utilizarse una aspiradora equipada con los aditamentos adecuados para limpiar fácilmente el polvo acumulado en las partes superior e inferior de los elementos con aletas.
4. El acabado de esmalte secado al horno del calentador puede limpiarse con un trapo ligeramente húmedo, sin embargo no debe utilizarse limpiadores ni lustradores de cera, ya que estas ceras podrían vaporizarse cuando el calentador funciona y producir un cambio de color.
5. Vuelva a instalar la cubierta frontal, las cubiertas del compartimiento de cableado, todos los tornillos que haya extraído durante el desmontaje, y restablezca la alimentación cuando termine la limpieza.

PINTURA

No es necesario pintar este calentador de zócalo a menos que se quiera hacer eso para que el color de la unidad coincida con la decoración de la habitación. Para pintar la unidad, primero lije el exterior de la misma con lana de acero. Pinte únicamente el exterior del gabinete. No permita que caiga pintura en el elemento ni en el tubo capilar de límite alto. Utilice una pintura de esmalte de alta calidad.



Para Obtener Partes de Reparación en México Llame al 001-800-527-2331 en EE.UU. Llame al 1-800-323-0620

Servicio permanente – 24 horas al día al año

Por favor proporciónenos la siguiente información:
-Número de modelo
-Número de serie (si lo tiene)
-Descripción de la parte y número que le corresponde en la lista de partes

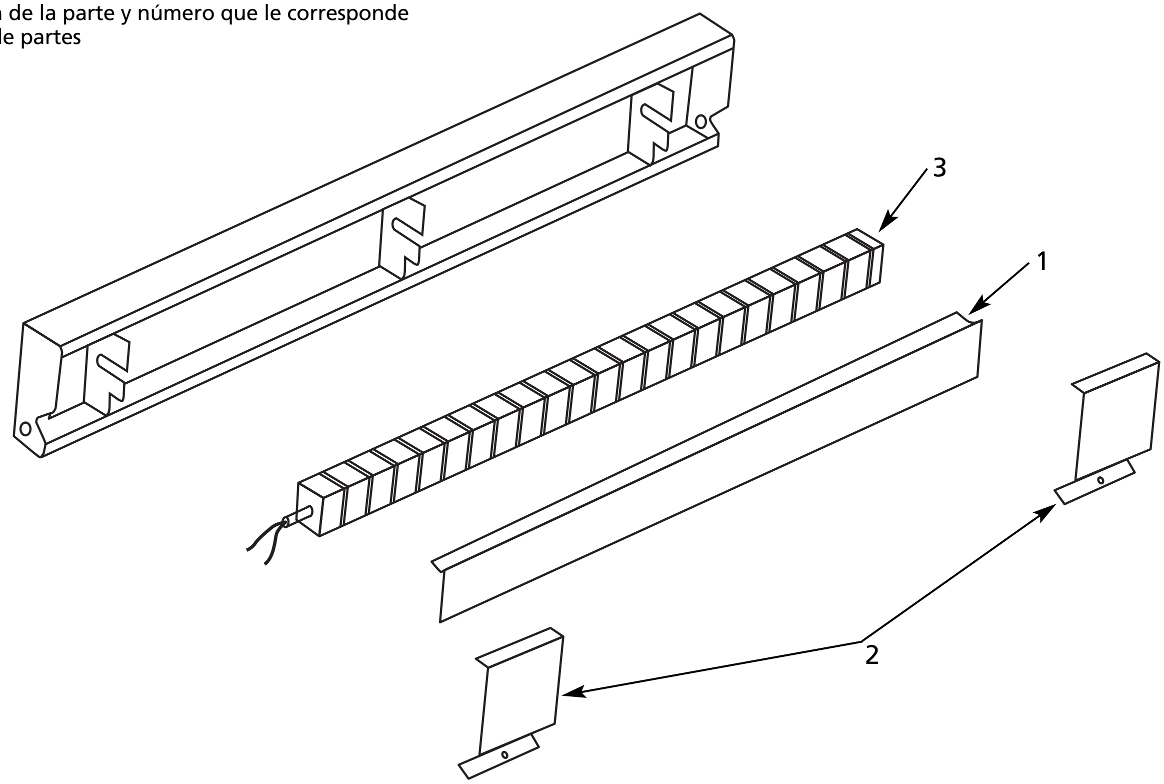


Figura 8 – Ilustración de las Partes de Reparación para los Calentadores Eléctricos de Zócalo

E S P A Ñ O L

Lista de Partes de Reparación para los Calentadores Eléctricos de Zócalo

No. de Ref.	Descripción	3UG76D/ 3UG82D	3UG77D/ 3UG83D	3UG78D/ 3UG84D	3UG79D/ 3UG85D	Cant.
	Longitud	0.76 m	0.9 m	1.2 m	1.5 m	
1	Cubierta frontal	14022122116	14022122117	14022122118	14022122119	1
2	Cubierta de la caja de empalmes	14022261000	14022261000	14022261000	14022261000	2
3	Elemento 120V	18022056007	18022056011	18022044017	18022044023	1
	240V	18022056005	18022056009	18022044015	18022044021	1

No. de Ref.	Descripción	3UG80D/ 3UG86D	3UG87D	4TM76D	Cant.
	Longitud	1.8 m	2.4 m	2.4 m	
1	Cubierta frontal	14022122120	14022122121	14022122121	1
2	Cubierta de la caja de empalmes	14022261000	14022261000	14022261000	2
3	Elemento 120V	18022094015	–	–	1
	240V	18022044027	18022044033	18022044045	1

Para Obtener Partes de Reparación en México Llame al 001-800-527-2331 en EE.UU. Llame al 1-800-323-0620

Servicio permanente – 24 horas al día al año

Por favor proporciónenos la siguiente información:
-Número de modelo
-Número de serie (si lo tiene)
-Descripción de la parte y número que le corresponde en la lista de partes

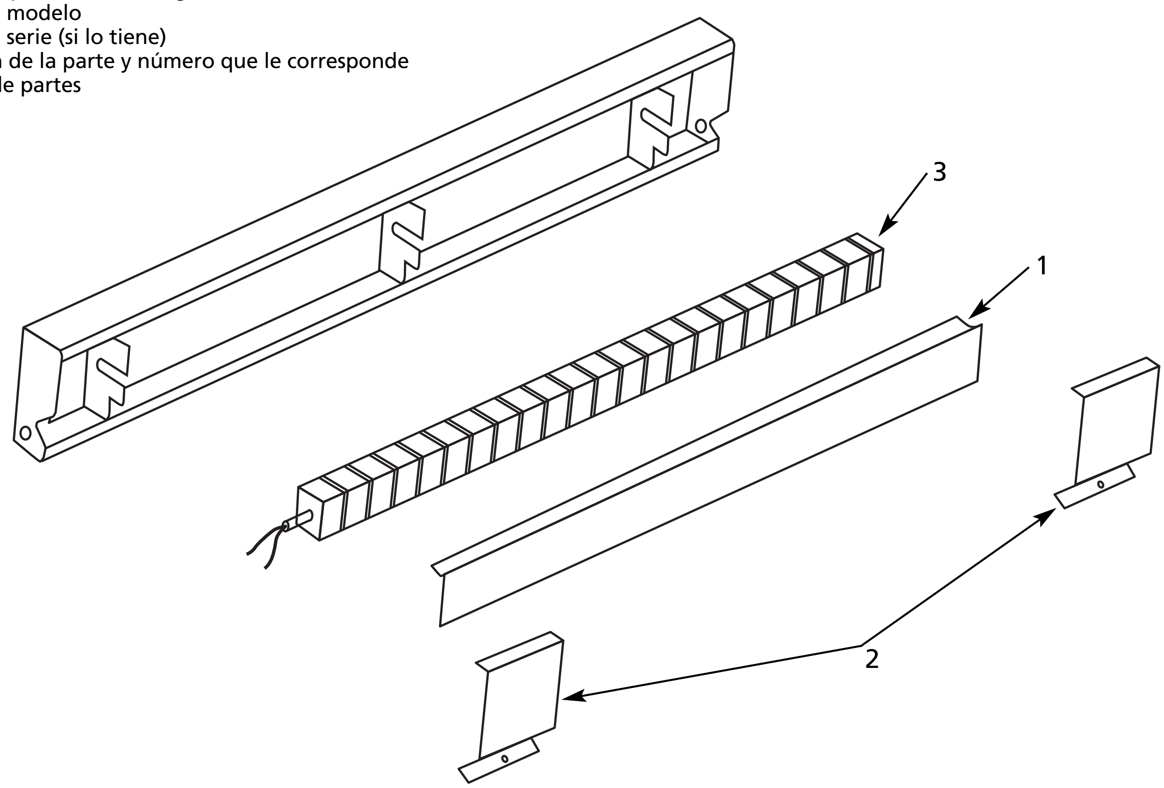


Figura 9 – Ilustración de las Partes de Reparación para los Calentadores Eléctricos de Zócalo

Lista de Partes de Reparación para los Calentadores Eléctricos de Zócalo

No. de Ref.	Descripción	3ENA5/ 3ENC1/ 3ENC4	3ENA6/ 3ENC2/ 3ENC5	3ENA7/ 3KB39D/ 3KB35D	3ENA8/ 3KB40D/ 3KB36D	Cant.
	Longitud	0.76 m	0.9 m	1.2 m	1.5 m	
1	Cubierta frontal	14022122040	14022122041	14022122042	14022122043	1
2	Cubierta de la caja de empalmes	14022261003	14022261003	14022261003	14022261003	2
3	Elemento 120V	18022056007	18022056011	18022044017	18022044023	1
	208V	18022056006	18022056010	18022044016	18022044022	1
	277V	18022056004	18022056008	18022044014	18022044020	1

No. de Ref.	Descripción	3ENA9 3KB41D 3KB37D	3KB42D 3KB38D	3ENC3 3ENC6	Cant.
Longitud		1.8 m	2.4 m	2.4 m	1
1	Cubierta frontal	14022122044	14022122045	14022122045	1
2	Cubierta de la caja de empalmes	14022261003	14022261003	14022261003	2
3	Elemento 120V	18022094015	–	–	1
	208V	18022044028	18022044034	18022044044	1
	277V	18022044026	18022044032	18022044046	1

Calentadores Eléctricos de Zócalo Dayton®

GARANTIA LIMITADA

GARANTIA LIMITADA DE DAYTON POR UN AÑO. *DAYTON ELECTRIC MFG. CO. (DAYTON) LE GARANTIZA AL USUARIO ORIGINAL QUE LOS MODELOS TRATADOS EN ESTE MANUAL DE LOS CALENTADORES ELECTRICOS DE ZOCALO DAYTON® ESTAN LIBRES DE DEFECTOS EN LA MANO DE OBRA O EL MATERIAL, CUANDO SE LES SOMETE A USO NORMAL, POR UN AÑO A PARTIR DE LA FECHA DE COMPRA. CUALQUIER PARTE QUE SE HALLE DEFECTUOSA, YA SEA EN EL MATERIAL O EN LA MANO DE OBRA, Y SEA DEVUELTA (CON LOS COSTOS DE ENVIO PAGADOS POR ADELANTADO) A UN CENTRO DE SERVICIO AUTORIZADO DESIGNADO POR DAYTON, SERA REPARADA O REEMPLAZADA (NO EXISTE OTRA POSIBILIDAD) SEGUN LO DETERMINE DAYTON. PARA OBTENER INFORMACION SOBRE LOS PROCEDIMIENTOS DE RECLAMO CUBIERTOS EN LA GARANTIA LIMITADA, VEA LA SECCION "ATENCION OPORTUNA" QUE APARECE MAS ADELANTE. ESTA GARANTIA LIMITADA CONFIERE AL COMPRADOR DERECHOS LEGALES ESPECIFICOS QUE VARIAN DE JURISDICCION A JURISDICCION.*

LIMITES DE RESPONSABILIDAD. *EN LA MEDIDA EN QUE LAS LEYES APLICABLES LO PERMITAN, LA RESPONSABILIDAD DE DAYTON POR LOS DAÑOS EMERGENTES O INCIDENTALES ESTA EXPRESAMENTE EXCLUIDA. LA RESPONSABILIDAD DE DAYTON EXPRESAMENTE ESTA LIMITADA Y NO PUEDE EXCEDER EL PRECIO DE COMPRA PAGADO POR EL ARTICULO.*

EXCLUSION DE RESPONSABILIDAD DE LA GARANTIA. *SE HAN HECHO ESFUERZOS DILIGENTES PARA PROPORCIONAR INFORMACION E ILUSTRACIONES APROPIADAS SOBRE EL PRODUCTO EN ESTE MANUAL; SIN EMBARGO, ESTA INFORMACION Y LAS ILUSTRACIONES TIENEN COMO UNICO PROPOSITO LA IDENTIFICACION DEL PRODUCTO Y NO EXPRESAN NI IMPLICAN GARANTIA DE QUE LOS PRODUCTOS SEAN VENDIBLES O ADECUADOS PARA UN PROPOSITO EN PARTICULAR NI QUE SE AJUSTAN NECESARIAMENTE A LAS ILUSTRACIONES O DESCRIPCIONES. CON EXCEPCION DE LO QUE SE ESTABLECE A CONTINUACION, DAYTON NO HACE NI AUTORIZA NINGUNA GARANTIA O AFIRMACION DE HECHO, EXPRESA O IMPLICITA, QUE NO SEA ESTIPULADA EN LA "GARANTIA LIMITADA" ANTERIOR.*

ESPAÑOL

Consejo Técnico y Recomendaciones, Exclusiones de Responsabilidad. *A pesar de las prácticas, negociaciones o usos comerciales realizados previamente, las ventas no deberán incluir el suministro de consejo técnico o asistencia o diseño del sistema. Dayton no asume ninguna obligación o responsabilidad por recomendaciones, opiniones o consejos no autorizados sobre la elección, instalación o uso de los productos.*

Adaptación del Producto. *Muchas jurisdicciones tienen códigos o regulaciones que rigen la venta, la construcción, la instalación y/o el uso de productos para ciertos propósitos que pueden variar con respecto a los aplicables a las zonas vecinas. Si bien se trata de que los productos Dayton cumplan con dichos códigos, no se puede garantizar su conformidad y no se puede hacer responsable por la forma en que se instale o use su producto. Antes de comprar y usar el producto, revise su aplicación y todos los códigos y regulaciones nacionales y locales aplicables y asegúrese de que el producto, la instalación y el uso los cumplan.*

Ciertos aspectos de limitación de responsabilidad no se aplican a productos al consumidor; es decir (a) algunas jurisdicciones no permiten la exclusión ni limitación de daños incidentales o consecuentes, de modo que las limitaciones o exclusiones anteriores quizás no apliquen en su caso; (b) asimismo, algunas jurisdicciones no permiten limitar el plazo de una garantía implícita, por lo tanto, la limitación anterior quizás no aplique en su caso; y (c) por ley, mientras la Garantía Limitada esté vigente no podrán excluirse ni limitarse en modo alguno ninguna garantía implícita de comercialización o de idoneidad para un propósito en particular aplicables a los productos al consumidor adquiridos por éste.

Atención Oportuna. *Se hará un esfuerzo de buena fe para corregir puntualmente, o hacer otros ajustes, con respecto a cualquier producto que resulte defectuoso dentro de los términos de esta garantía limitada. En el caso de que encuentre un producto defectuoso y que esté cubierto dentro de los límites de esta garantía haga el favor de escribir primero, o llame, al distribuidor a quien le compró el producto. El distribuidor le dará las instrucciones adicionales. Si no puede resolver el problema en forma satisfactoria, escriba a Dayton a la dirección a continuación, dando el nombre del distribuidor, su dirección, la fecha y el número de la factura del distribuidor y describa la naturaleza del defecto. La propiedad del artículo y el riesgo de pérdida pasan al comprador en el momento de la entrega del artículo a la compañía de transporte. Si el producto se daña durante el transporte, debe presentar su reclamo a la compañía transportista.*

Fabricado para Dayton Electric Mfg. Co., 5959 W. Howard St., Niles, Illinois 60714-4014 EE.UU.

Lire et conserver ces instructions. Il faut les lire attentivement avant de commencer à assembler, installer, faire fonctionner ou entretenir l'appareil décrit. Pour se protéger et protéger autrui, observer toutes les informations sur la sécurité. Négliger d'appliquer ces instructions peut causer des blessures corporelles et/ou des dommages matériels! Conserver ces instructions pour références ultérieures.

Plinthes chauffantes électriques de Dayton®

Description

Les plinthes convecteurs électriques de classe résidentielle et commerciale fournissent un chauffage secondaire ou d'appoint pour les nouvelles constructions ou les applications de remaniement. Les plinthes chauffantes peuvent être utilisées dans des maisons familiales, des appartements, des maisons modulaires ou mobiles, tout comme dans des constructions commerciales, industrielles et institutionnelles. Les plinthes chauffantes doivent être à commande thermostatique pour que leur fonctionnement soit efficace et sécuritaire. Aucun thermostat n'est fourni avec cette plinthe chauffante.

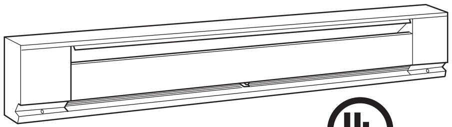


Figure 1 Liste n° E256626

Spécifications

INTENSITÉ NOMINALE D'UNE PLINTHE CHAUFFANTE

Classe résidentielle				
N° de modèle	**120 volts**	**208 volts**	**240 volts**	**277 volts**
3UG76D	4,2	–	–	–
3UG77D	6,3	–	–	–
3UG78D	8,3	–	–	–
3UG79D	10,4	–	–	–
3UG80D	12,5	–	–	–
3UG82D	–	1,8	2,1	–
3UG83D	–	2,7	3,1	–
3UG84D	–	3,6	4,2	–
3UG85D	–	4,5	5,2	–
3UG86D	–	5,4	6,3	–
3UG87D	–	7,2	8,3	–
4TM76D	–	8,7	10,4	–

Volumes nets du compartiment de câblage		
Description	**Pouces cubes**	**Centimètres cubes**
Plinthe chauffante seulement (chaque compartiment de câblage)	14,96	241
Plinthe chauffante avec thermostat à polarité simple	11,18	180
Plinthe chauffante avec thermostat à polarité double	11,18	180
Plinthe chauffante avec prise de courant double	11,18	180

Classe commerciale				
N° de modèle	**120 volts**	**208 volts**	**240 volts**	**277 volts**
3ENC4	–	1,4	1,6	1,8
3ENC5	–	2,0	2,3	2,7
3KB35D	–	2,7	3,1	3,6
3KB36D	–	3,4	3,9	4,5
3KB37D	–	4,1	4,7	5,4
3KB38D	–	5,4	6,3	7,2
3ENC6	–	6,8	7,8	9,0
3ENC1	–	2,4	–	–
3ENC2	–	3,6	–	–
3KB39D	–	4,8	–	–
3KB40D	–	6,0	–	–
3KB41D	–	7,2	–	–
3KB42D	–	9,6	–	–
3ENC3	–	12,0	–	–
3ENA5	4,2	–	–	–
3ENA6	6,3	–	–	–
3ENA7	8,3	–	–	–
3ENA8	10,4	–	–	–
3ENA9	12,5	–	–	–

Ampérage total	Calibre AWG minimum Calibre du fil (cuivre)	Taille du disjoncteur ou du fusible
0 à 12	n° 14	15 A
12,1 à 16	n° 12	20 A

Déballage

Vérifier la plinthe chauffante et s'assurer qu'elle n'a pas subi de dommages lors du transport. Ne pas installer ou tenter d'utiliser une plinthe chauffante endommagée. La retourner au vendeur ou déposer une réclamation auprès du transporteur.

Consignes générales de sécurité

INSTRUCTIONS IMPORTANTES

LORS DE L'UTILISATION D'APPAREILS ÉLECTRIQUES, TOUJOURS PRENDRE DES PRÉCAUTIONS AFIN DE RÉDUIRE LES RISQUES D'INCENDIE, DE CHOC ÉLECTRIQUE OU DE BLESSURES, ET APPLIQUER LES CONSIGNES SUIVANTES :

1. Lire toutes les instructions avant d'installer ou d'utiliser la plinthe chauffante.
2. Une plinthe chauffante comporte des pièces chaudes qui produisent un arc électrique ou forment des étincelles à l'intérieur. Ne pas l'utiliser dans des endroits où sont utilisés ou entreposés de l'essence ou des liquides inflammables.
3. Cette plinthe chauffante est chaude lorsqu'elle est utilisée. Pour éviter des brûlures, ne pas laisser la peau nue entrer en contact avec les surfaces chaudes. Garder les matériaux combustibles à l'écart de la plinthe chauffante, notamment les meubles, les oreillers, la literie, les papiers, les vêtements et les draperies.
4. Afin d'éviter un risque d'incendie, ne pas bloquer les entrées ou les sorties d'air d'une quelconque manière.

FRANÇAIS

Imprimé aux États-Unis
09663
Version 0

Part No. 5200-2692-004
ECR 38673
MAR030
02/11

Plinthes chauffantes électriques de Dayton®

Consignes générales de sécurité (suite)

5. Ne pas insérer ou laisser des corps étrangers pénétrer dans toute ouverture de ventilation ou de sortie, car cela pourrait provoquer un choc électrique, un incendie ou endommager la plinthe chauffante.
6. Un choc électrique peut entraîner des blessures graves voire la mort. S'assurer que l'alimentation électrique de la plinthe chauffante est coupée au niveau de l'interrupteur ou du panneau de service principal avant toute installation ou toute réparation.

CONSERVER CES INSTRUCTIONS

Instructions d'installation

Cette plinthe chauffante est conçue pour fonctionner pendant des années sans problème comme source de chauffage primaire ou secondaire dans des applications résidentielles ou commerciales. Les plinthes chauffantes doivent être à commande thermostatique pour que leur fonctionnement soit efficace et sécuritaire. Aucun thermostat n'est fourni avec cette plinthe chauffante. Toutefois un thermostat unipolaire ou bipolaire, disponible chez le vendeur, peut être installé. La plinthe chauffante peut également être connectée à tout thermostat mural conforme aux exigences de charge électrique. Une installation ou une utilisation de ce produit non conforme de quelque manière que ce soit avec les directives ci-incluses annule la garantie et peut entraîner des blessures, des dommages matériels ou encore endommager en permanence la plinthe chauffante.

⚠ AVERTISSEMENT ***AFIN DE RÉDUIRE LE RISQUE D'INCENDIE ET DE CHOC ÉLECTRIQUE OU DE BLESSURE, RESPECTER LES CONSIGNES SUIVANTES :***

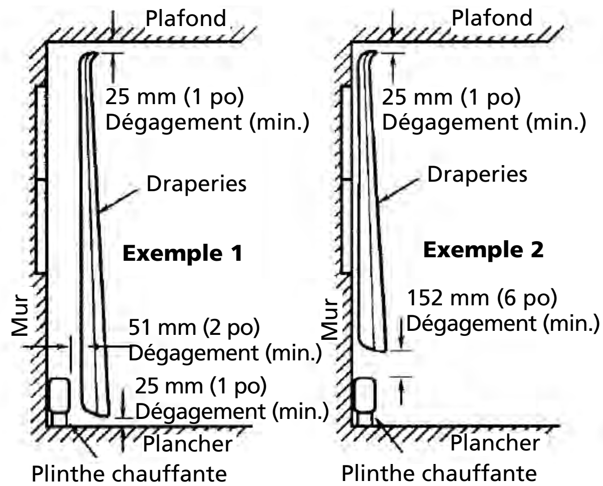


Figure 2 – Position des draperies à proximité de la plinthe chauffante

1. Un choc électrique peut entraîner des blessures graves voire la mort. S'assurer que l'alimentation électrique vers la plinthe chauffante est coupée au niveau de l'interrupteur ou du panneau de service principal avant d'effectuer l'installation.
2. Les procédures de câblage et de connexion doivent être conformes au Code national de l'électricité et aux codes locaux. Se reporter aux schémas de câblage Figure 6. Vérifier que toutes les connexions électriques sont bien serrées pour éviter tout risque de surchauffe. N'utiliser que des câbles d'alimentation en cuivre.
3. Vérifier que la tension d'alimentation électrique correspond à celle qui est imprimée sur la plaque signalétique de la plinthe chauffante, voir l'illustration de la PLAQUE SIGNALÉTIQUE, page 5.

⚠ ATTENTION ***Ne jamais utiliser une plinthe chauffante à une tension supérieure à celle indiquée sur la plaque signalétique car cela endommagerait la plinthe chauffante et risquerait de provoquer un incendie.***

4. Ne pas installer la plinthe chauffante contre des surfaces combustibles composées de panneaux en fibres de cellulose de faible densité, contre du papier peint en vinyle, ou sous tout matériau qui risque d'être endommagé par la chaleur (vinyle, stores en plastique, draperies, etc.).
5. Ne pas installer la plinthe chauffante sous une prise de courant confort.

⚠ ATTENTION ***La plinthe chauffante fonctionne à des températures élevées. Tenir à l'écart de la plinthe chauffante, les cordons électriques (y compris les câbles de téléphone et d'ordinateur), les draperies, et tout autre article d'ameublement.***

6. Pour une utilisation efficace, il est conseillé de prévoir un dégagement de 6 po (152 mm) au miniumum, au-dessus et devant la plinthe chauffante en tout temps. Voir la Figure 2 pour connaître le dégagement minimum par rapport à des draperies.
7. Pour réduire les risques d'incendie, ne pas entreposer ni utiliser d'essence ou d'autres vapeurs ou liquides inflammables à proximité de la plinthe chauffante.
8. Ne pas installer la plinthe chauffante à l'envers ou dans toute autre position autre que celle indiquée dans ce manuel. L'étiquette de mise en garde portant le mot « TOP » doit être apposée sur la partie supérieure de la plinthe chauffante lorsque cette dernière est installée.

Modèles 3ENA5 à ENA9, 3ENC1 à 3ENC6, 3UG76D à 3UG80D, 3UG82D à 3UG87D, 3KB35D à 3KB42D et 4TM76D

Instructions d'installation (suite)

9. Ne pas encastrer la plinthe chauffante dans un mur ni l'installer dans une enceinte de quelque type que ce soit car cela provoquerait une surchauffe et pourrait créer un danger.
10. Si les trous de montage par le bas sont utilisés pour le montage (voir Figure 5), vérifier que les vis n'endommagent pas le câblage d'alimentation dans la zone située à l'arrière de la plinthe chauffante.
11. Ne pas enlever ou contourner le limiteur thermique de sécurité (coupe-circuit de sécurité) car la plinthe chauffante pourrait alors poser un risque d'incendie – voir la Figure 6.

AVIS AUX PROPRIÉTAIRES

Certains tissus, pour la plupart synthétiques ou organiques, se décolorent avec le temps ou sous l'effet de la lumière indirecte du soleil ou encore de la température normale d'une pièce. Ils subissent une décoloration plus rapide s'ils sont exposés à la lumière directe du soleil ou à des courants d'air chaud. Suspendre les draperies de manière à prévoir un dégagement de 51 mm (2 po) au minimum entre l'avant de la plinthe chauffante et les replis les plus proches des draperies, comme l'indique l'exemple 1 de la Figure 2, ou un dégagement de 152 mm (6 po) entre la partie supérieure de la plinthe chauffante et la partie inférieure des draperies, comme l'indique l'exemple 2 de la Figure 2. Prévoir un dégagement de 25 mm (1 po) au minimum entre les draperies et le plafond et la partie supérieure du revêtement de plancher pour permettre une circulation de l'air, comme l'indique l'exemple 1 de la Figure 2.

PLANCHERS ET TAPIS

Les plinthes chauffantes peuvent être montées directement sur n'importe quelle surface de plancher, y compris sur des tapis. Lorsqu'un tapis mural est installé après le montage de la plinthe chauffante, le tapis peut arriver jusqu'à l'avant et autour du corps de la plinthe chauffante, tant qu'il n'obstrue pas la circulation de l'air (épaisseur maximale de 19 mm [3/4 po]).

1. Déposer le couvercle du compartiment de câblage à l'extrémité de la plinthe chauffante, à l'entrée du câble d'alimentation. Déterminer l'emplacement de montage (Figure 3), placer la plinthe chauffante contre le mur à l'endroit prévu et marquer le mur (ou le plancher) à l'arrivée de l'alimentation électrique de la plinthe chauffante.

Installer au niveau du plancher ou par-dessus les moulures comme indiqué

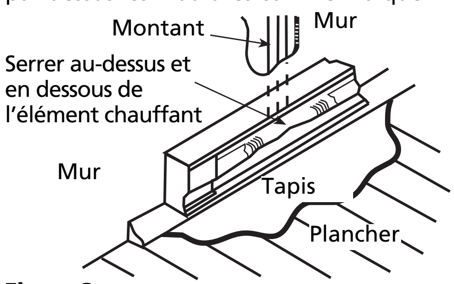


Figure 3

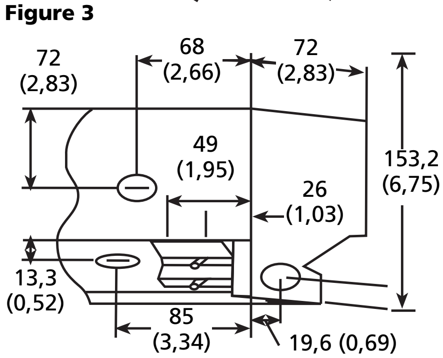


Figure 4 – Dimensions du compartiment de câblage – mm (po)

REMARQUE : S'assurer que l'étiquette de mise en garde avec le mot « TOP » est bien apposée sur la partie supérieure de la plinthe chauffante. Pour obtenir le fonctionnement le plus efficace, placer la plinthe chauffante le long d'un mur extérieur, sous les fenêtres. Placer la plinthe chauffante de manière à la fixer sur un montant du mur. Le câble d'alimentation électrique doit entrer dans la plinthe chauffante par une des alvéoles défonçables du compartiment de câblage. Voir la Figure 4.

2. Percer un trou dans le mur (ou dans le plancher) à l'emplacement prévu pour l'arrivée de l'alimentation électrique. Installer le câblage d'alimentation électrique pour la plinthe chauffante et pour le thermostat suivant le type de thermostat choisi. Prévoir environ 254 à 305 mm (10 à 12 po) de câble au niveau de la plinthe chauffante pour effectuer les connexions.
3. Si tout autre accessoire Dayton est utilisé avec cette plinthe chauffante, consulter les instructions d'installation fournies avec l'accessoire pour installer correctement le câblage.
4. **Couvercle de goulotte guide-fils – Plinthes commerciales seulement**
   a. Le couvercle de goulotte guide-fils est installé à l'usine pour les plinthes chauffantes commerciales de Dayton. Deux câbles ou quatre conducteurs individuels, plus deux fils de terre peuvent être acheminés par la goulotte guide-fils. Se reporter à la page 1 pour connaître les charges maximales de courant.
   b. Pour accéder à la goulotte guide-fils, poser la plinthe chauffante avec sa face vers le sol et enlever les deux vis comme indiqué à la Figure 5. Enlever toutes les alvéoles défonçables dans les parties profilées des deux boîtes à bornes.
   c. Insérer les douilles en plastique de la trousse de pièces (dans le compartiment de câblage) dans les alvéoles défonçables.
   d. Câbler la plinthe chauffante selon les indications de la Figure 6. Remettre en place le couvercle de la goulotte guide-fils en utilisant les deux vis.
5. Desserrer la vis du collier de serrage intégré ou enlever les alvéoles défonçables du compartiment de câblage de la plinthe chauffante Figures 4 et 5). Installer le câblage d'alimentation dans le compartiment de câblage en prévoyant 152 mm (6 po)

FRANÇAIS

Plinthes chauffantes électriques de Dayton®

Instructions d'installation (suite)

de câble au minimum pour connecter la plinthe chauffante. Pour installer deux câbles d'alimentation en utilisant le collier de serrage intégré, plier l'onglet qui recouvre le deuxième trou vers la paroi arrière du compartiment de câblage. Si le collier de serrage intégré n'est pas utilisé, installer un connecteur de câble approuvé (non inclus) dans l'alvéole voulue.

6. Placer la plinthe chauffante contre le mur (utiliser les perforations en croix comme guide, voir la Figure 5) et fixer solidement à travers la rangée supérieure des trous de montage pré-percés en utilisant au moins deux attaches, une à chaque extrémité de la plinthe chauffante. Si l'appareil est monté au-dessus du plancher pour permettre l'installation d'un tapis sous la plinthe chauffante, deux trous de montage supplémentaires sont disponibles à chaque extrémité sous l'élément chauffant. Ceci permet de visser dans la lisse d'assise si l'appareil ne peut être fixé sur deux montants adjacents.

⚠ ATTENTION ***Lorsque les trous de montage par le bas sont utilisés, (afin d'éviter un risque***

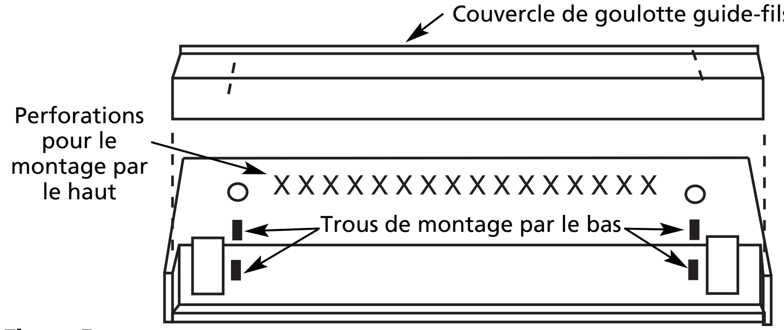


Figure 5

de choc électrique ou d'incendie) s'assurer de ne pas visser à travers le fil d'alimentation électrique et de ne pas l'endommager.

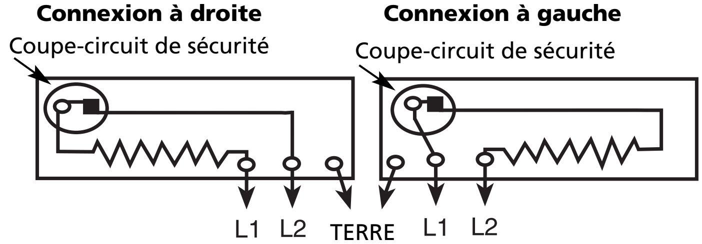
7. Connecter le fil de terre du câble d'alimentation électrique à la queue de cochon en cuivre située dans le compartiment de câblage.
8. Après s'être assuré que l'alimentation électrique de la plinthe chauffante est coupée au niveau de l'interrupteur du panneau principal, suivre le schéma de câblage correspondant, comme dans la Figure 6, pour connecter l'alimentation électrique à la plinthe chauffante en utilisant des serre-fils approuvés.

⚠ AVERTISSEMENT ***Pour éviter les risques d'incendie, s'assurer que toutes les connexions sont serrées.***

REMARQUE : Une fois les accessoires installés, utiliser le schéma de câblage fourni avec les accessoires.

9. Si le couvercle avant a été enlevé, le réinstaller en accrochant le rebord supérieur sur le ou les supports. Pousser ensuite le loquet vers le bas sur le ou les supports.
10. Remettre en place le couvercle du compartiment de câblage.
11. Suivre les instructions qui accompagnent le thermostat pour l'installer avec son câblage. Voir la Figure 7 pour les schémas de câblage typiques.

Connexion à droite **Connexion à gauche**



Connexion pour plinthes chauffantes adjacentes
Câbler en parallèle comme indiqué, en utilisant entre les plinthes chauffantes, les douilles électriques indiquées sur la liste (non fournies).

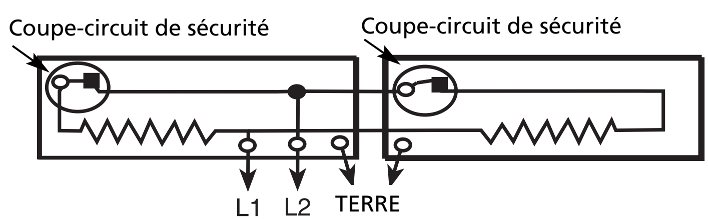
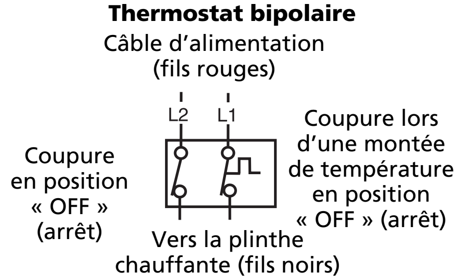


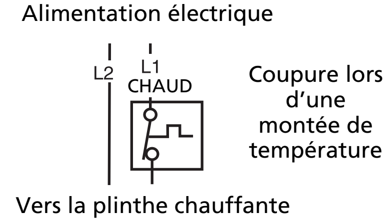
Figure 6

Thermostat bipolaire



Les thermostats bipolaires comportent un contacteur d'arrêt « OFF » qui est ouvert uniquement lorsque le thermostat est à la position « OFF ».

Thermostat unipolaire



Les thermostats unipolaires N'ONT PAS de position d'arrêt « OFF » et fonctionnent à une température inférieure au point de réglage minimal.

Figure 7 – Thermostat typique

FRANÇAIS

Modèles 3ENA5 à ENA9, 3ENC1 à 3ENC6, 3UG76D à 3UG80D, 3UG82D à 3UG87D, 3KB35D à 3KB42D et 4TM76D

Instructions d'utilisation

1. Cette plinthe chauffante doit être installée adéquatement avant d'être utilisée.
2. Une fois l'installation des plinthes terminée, tous les thermostats doivent être placés sur LOW (bas) ou NO HEAT (pas de chaleur). Mettre ensuite les disjoncteurs sous tension. Attendre de 3 à 5 minutes et vérifier qu'aucune plinthe chauffante ne fonctionne. Sinon débrancher l'alimentation et vérifier le câblage. Si aucune plinthe chauffante ne fonctionne, placer les thermostats à la position maximale et attendre de 3 à 5 minutes. Vérifier que la/les plinthe(s) chauffante(s) fonctionne(nt). Si une plinthe chauffante ne fonctionne pas, couper l'alimentation et vérifier le câblage.
3. Laisser tout le système fonctionner régulièrement pendant 1/2 heure. Ceci devrait éliminer tout résidu d'huile de l'usine. (Il peut y avoir de la fumée.)
4. Régler tous les thermostats pour obtenir une température confortable.

Instructions d'entretien

Cette plinthe chauffante est conçue pour fonctionner pendant des années et procurer un confort grâce à un entretien minimal. Afin d'assurer une utilisation efficace, suivre les instructions simples ci-après.

1. L'utilisateur peut effectuer un nettoyage de base de la plinthe chauffante. Tout autre entretien doit être effectué par un technicien agréé.
2. La nature du principe de chauffage par convexion qui dépend de la circulation de l'air entre les ailettes de l'élément chauffant entraîne l'accumulation de poussière entre ces dernières. Nettoyer régulièrement la plinthe chauffante pour obtenir une efficacité maximale.

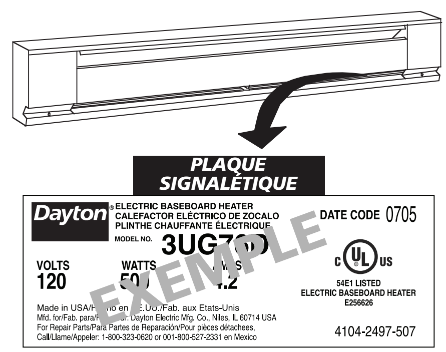
⚠ ATTENTION ***Les ailettes peuvent provoquer des coupures, ne pas les toucher.***

⚠ AVERTISSEMENT ***Avant d'effectuer le nettoyage, s'assurer que l'alimentation électrique a été coupée au niveau du panneau du disjoncteur et que l'élément chauffant a refroidi.***

3. Lorsque le couvercle avant est enlevé, un aspirateur muni des accessoires appropriés peut être utilisé pour faciliter le nettoyage de la partie supérieure et inférieure de l'élément chauffant à ailettes et enlever les dépôts de poussière.
4. Le fini émail cuit de la plinthe chauffante peut être nettoyé avec un chiffon légèrement humide, au besoin. Cependant, ne pas utiliser de nettoyant cire ou de cire de polissage car ces cires peuvent former des vapeurs lorsque la plinthe chauffante fonctionne et provoquer des décolorations.
5. Remettre le couvercle avant et rétablir l'alimentation lorsque le nettoyage est terminé.

PEINTURE

Il n'est pas nécessaire de peindre cette plinthe chauffante, à moins que l'on ne désire apparier sa couleur avec celles de la pièce. Pour la peindre, brosser d'abord l'extérieur avec une laine d'acier. Peindre seulement l'extérieur du caisson. Ne pas laisser de peinture sur l'élément chauffant et sur le tube capillaire de limite supérieure. Utiliser une peinture émail de bonne qualité.



FRANÇAIS

Pour commander des pièces détachées, composer sans frais le 1-800-323-0620

24 heures par jour – 365 jours par an

Fournir les informations suivantes :
-Numéro de modèle
-Numéro de série (s'il y en a un)
-Description et numéro de pièce comme indiqué sur la liste des pièces

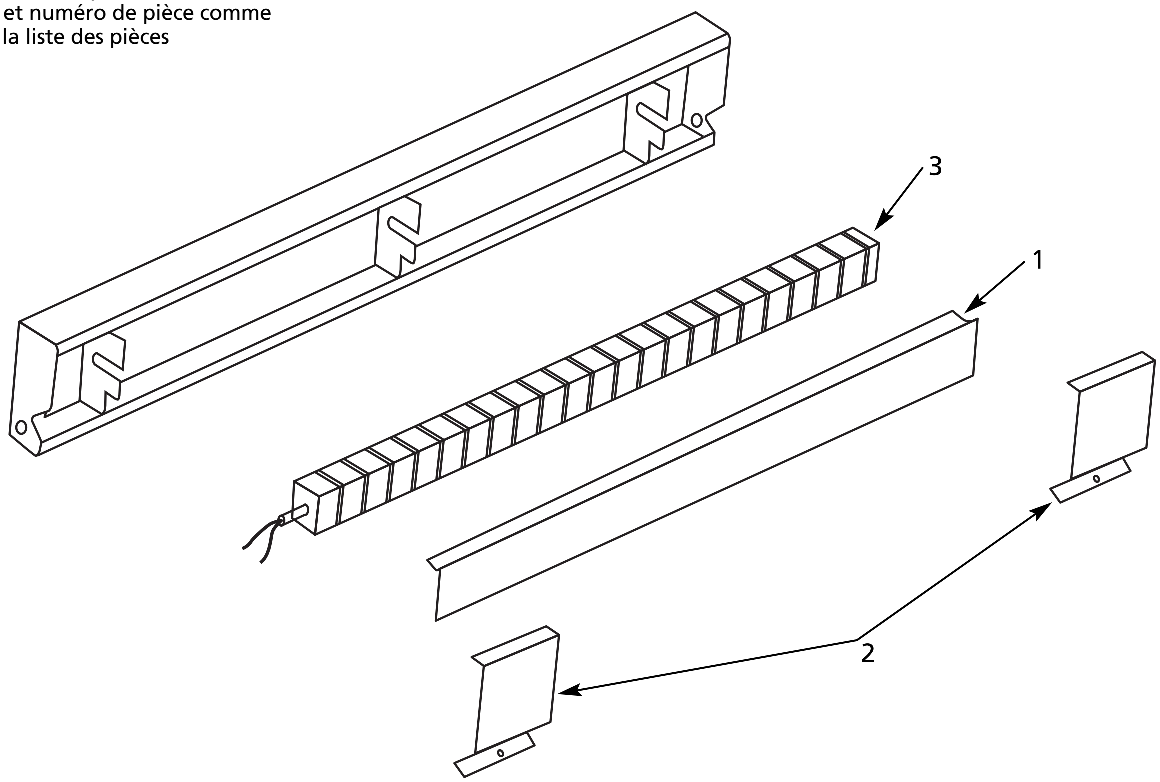


Figure 8 – Illustration des pièces détachées pour plinthes chauffantes électriques

Liste des pièces détachées pour plinthes chauffantes électriques

N° de réf.	Description	3UG76D/ 3UG82D	3UG77D/ 3UG83D	3UG78D/ 3UG84D	3UG79D/ 3UG85D	Qté
	Longueur	0,76 m	0,9 m	1,2 m	1,5 m	
1	Couvercle avant	14022122116	14022122117	14022122118	14022122119	1
2	Couvercle du boîtier de raccordement	14022261000	14022261000	14022261000	14022261000	2
3	Élément chauffant 120 V	18022056007	18022056011	18022044017	18022044023	1
	240 V	18022056005	18022056009	18022044015	18022044021	1

N° de réf.	Description	3UG80D/ 3UG86D	3UG87D	4TM76D	Qté
	Longueur	1,8 m	2,4 m	2,4 m	
1	Couvercle avant	14022122120	14022122121	14022122121	1
2	Couvercle du boîtier de raccordement	14022261000	14022261000	14022261000	2
3	Élément chauffant 120 V	18022094015	–	–	1
	240 V	18022044027	18022044033	18022044045	1

FRANÇAIS

Pour commander des pièces détachées, composer sans frais le 1-800-323-0620

24 heures par jour – 365 jours par an

Fournir les informations suivantes :
-Numéro de modèle
-Numéro de série (s'il y en a un)
-Description et numéro de pièce comme indiqué sur la liste des pièces

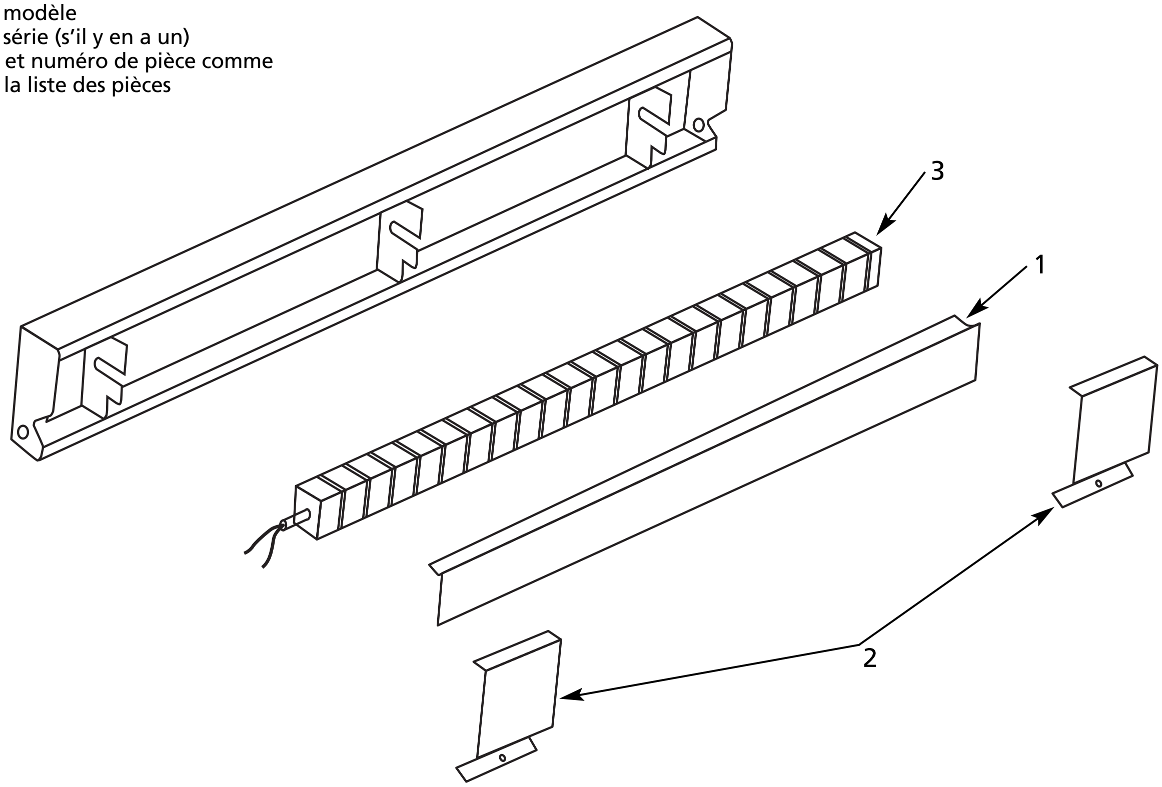


Figure 9 – Illustration des pièces détachées pour plinthes chauffantes électriques

Liste des pièces détachées pour plinthes chauffantes électriques

N° de réf.	Description		3ENA5/ 3ENC1/ 3ENC4	3ENA6/ 3ENC2/ 3ENC5	3ENA7/ 3KB39D/ 3KB35D	3ENA8/ 3KB40D/ 3KB36D	Qté
	Longueur		0,76 m	0,9 m	1,2 m	1,5 m	
1	Couvercle avant		14022122040	14022122041	14022122042	14022122043	1
2	Couvercle du boîtier de raccordement		14022261003	14022261003	14022261003	14022261003	2
3	Élément chauffant	120 V	18022056007	18022056011	18022044017	18022044023	1
		208 V	18022056006	18022056010	18022044016	18022044022	1
		277 V	18022056004	18022056008	18022044014	18022044020	1

N° de réf.	Description		3ENA9/ 3KB41D/ 3KB37D	3KB42D/ 3KB38D	3ENC3/ 3ENC6	Qté
	Longueur		1,8 m	2,4 m	2,4 m	1
1	Couvercle avant		14022122044	14022122045	14022122045	1
2	Couvercle du boîtier de raccordement		14022261003	14022261003	14022261003	2
3	Élément chauffant	120 V	18022094015	–	–	1
		208 V	18022044028	18022044034	18022044044	1
		277 V	18022044026	18022044032	18022044046	1

F R A N Ç A I S

Plinthes chauffantes électriques de Dayton®

GARANTIE LIMITÉE

GARANTIE LIMITÉE D'UN AN FOURNIE PAR DAYTON. *LES MODÈLES DE PLINTHES CHAUFFANTES ÉLECTRIQUES DE DAYTON® COUVERTS DANS CE MANUEL SONT GARANTIS PAR DAYTON ELECTRIC MFG.CO. AU PREMIER UTILISATEUR CONTRE TOUT DÉFAUT DE FABRICATION OU DE MATÉRIAU DANS DES CONDITIONS D'UTILISATION NORMALES DURANT UN AN À COMPTER DE LA DATE D'ACHAT. TOUTE PIÈCE PRÉSENTANT, SELON DAYTON, DES DÉFAUTS DE FABRICATION OU DE MATÉRIAU ET RETOURNÉE À UN CENTRE DE SERVICE AGRÉÉ DÉSIGNÉ PAR DAYTON, PORT PAYÉ, SERA RÉPARÉE OU REMPLACÉE AU CHOIX DE DAYTON, À TITRE DE RECOURS EXCLUSIF. VOIR LES PROCÉDURES DE RÉCLAMATIONS SOUS GARANTIE SOUS LA RUBRIQUE « PROMPT RÈGLEMENT », CI-APRÈS. LA PRÉSENTE GARANTIE DONNE AUX ACHETEURS DES DROITS SPÉCIFIQUES QUI VARIENT SELON LES JURIDICTIONS.*

LIMITES DE RESPONSABILITÉ. *DANS LA MESURE PERMISE AU TITRE DE LA LOI APPLICABLE, DAYTON DÉCLINE EXPRESSÉMENT TOUTE RESPONSABILITÉ POUR TOUT DOMMAGE ACCESSOIRE ET INDIRECT. LA RESPONSABILITÉ DE DAYTON EST DANS TOUS LES CAS LIMITÉE ET NE SAURAIT DÉPASSER LE PRIX D'ACHAT.*

CLAUSE D'EXONÉRATION DE GARANTIE. *DAYTON S'EST DILIGEMMENT EFFORCÉE D'ILLUSTRER ET DE DÉCRIRE DE MANIÈRE EXACTE LES PRODUITS DE CETTE BROCHURE. CEPENDANT, CES ILLUSTRATIONS ET CES DESCRIPTIONS NE SONT DONNÉES QU'À TITRE D'IDENTIFICATION ET NE GARANTISSENT PAS EXPRESSÉMENT OU IMPLICITEMENT QUE LES PRODUITS SONT DE QUALITÉ MARCHANDE OU ADAPTÉS À UN USAGE PARTICULIER, OU QU'ILS SERONT NÉCESSAIREMENT CONFORMES AUX ILLUSTRATIONS OU AUX DESCRIPTIONS FOURNIES. SAUF DISPOSITIONS CONTRAIRES CI-DESSOUS, AUCUNE GARANTIE OU AFFIRMATION DE FAIT, EXPRESSE OU IMPLICITE, AUTRE QUE CELLE ÉNONCÉE À LA RUBRIQUE « GARANTIE LIMITÉE » CI-DESSUS, N'EST FOURNIE OU AUTORISÉE PAR DAYTON.*

Conseils et recommandations techniques; clause d'exonération. *Nonobstant toute pratique ou action commerciale ayant eu cours dans le passé ou toute coutume du secteur d'activité, les ventes n'incluront pas la fourniture de conseils en matière de conception de système ou de résolution de problèmes techniques. Dayton n'assume aucune obligation ni responsabilité en ce qui concerne les recommandations, opinions ou conseils non autorisés relatifs au choix, à l'installation ou à l'utilisation des produits.*

Adéquation du produit. *Dans de nombreuses juridictions, les codes et les réglementations qui régissent les ventes, la construction, l'installation et/ou l'utilisation de produits pour certains usages peuvent être différents de ceux de régions avoisinantes. Bien que Dayton se soit efforcée de rendre ses produits conformes à ces codes, la société ne peut en garantir la conformité et ne saurait être responsable de la manière dont les produits sont installés ou utilisés. Avant d'acheter et d'utiliser un produit, il est conseillé d'étudier son application ainsi que les codes et réglementations nationaux et locaux, et de s'assurer de la conformité à ces codes de ces produits, de leur installation et de leur utilisation.*

Certains aspects des dénis de garantie ne sont pas applicables aux produits de consommation. par exemple (a) certaines juridictions n'autorisent pas l'exclusion ou la limitation des dommages accessoires ou indirects, de sorte que la limitation ou l'exclusion susmentionnée peut ne pas s'appliquer à votre cas; (b) en outre, certaines juridictions n'autorisent pas de limite sur la durée d'une garantie implicite, par conséquent la limite susmentionnée peut ne pas s'appliquer à votre cas; et (c) en vertu de la loi, durant la période de garantie limitée, toute garantie implicite de qualité marchande ou d'adéquation à un usage particulier applicable aux produits de consommation achetés par des consommateurs, est susceptible de ne pas pouvoir être exclue ou autrement déniée.

Prompt règlement. *Dayton s'efforcera en toute bonne foi de faire les rectifications ou autres ajustements prévus pour tout produit qui s'avère défectueux durant la période de garantie limitée. Pour tout produit jugé défectueux durant la période de garantie limitée, contacter tout d'abord le concessionnaire où l'appareil a été acheté. Le concessionnaire fournira des instructions supplémentaires. S'il est impossible de résoudre le problème de façon satisfaisante, écrire à Dayton à l'adresse ci-dessous, en indiquant le nom et l'adresse du concessionnaire, la date et le numéro de la facture du concessionnaire, ainsi que la nature du défaut constaté. Le titre et le risque de perte passent à l'acheteur au moment de la livraison par le transporteur. Si le produit a été endommagé pendant le transport, une réclamation doit être faite auprès du transporteur.*

Fabriqué pour Dayton Electric Mfg. Co., 5959 W. Howard St., Niles, Illinois 60714-4014 États-Unis

F R A N Ç A I S

CCI Thermal Technologies INC.
Heating and Filtration Solutions

Norseman™

TYPE XB EXPLOSION-PROOF CONVECTION PANEL HEATER

INSTALLATION, OPERATION & MAINTENANCE INSTRUCTIONS

1.0 SPECIAL NOTICES

1.1 The following special notices highlight important information in the installation and maintenance sections. Each serves a special purpose and is displayed in the format shown:

CAUTION — This symbol indicates a potentially hazardous situation, which, if not avoided, can result in personal injury or damage to the equipment.

CAUTION — This symbol indicates a potentially hazardous situation, which, if not avoided, may be a shock hazard.

WARNING — This symbol indicates an imminently hazardous situation, which, if not avoided, could result in death or serious injury.

2.0 PRE-INSTALLATION

2.1 Initially, inspect the heater for possible damage due to shipping and handling. Claims for shipping damages shall be placed with the carrier.

2.2 Check the heater nameplate to ensure that the heater area classification and temperature code are suitable for the hazardous area classification. For details of hazardous locations with potential for explosion, refer to the Canadian Electrical Code or National Electrical Code.

2.3 Check to ensure that the heater voltage is the same as the supply voltage.

2.4 The heater must be installed by qualified personnel in strict compliance with national and local electrical codes.

WARNING — **DO NOT CONNECT THE HEATER TO AN ELECTRICAL SUPPLY VOLTAGE OTHER THAN THAT SHOWN ON THE PRODUCT NAMEPLATE.**

3.0 INSTALLATION - GENERAL REQUIREMENTS

3.1 Norseman™ XB heaters are approved for wall or floor mounting with the terminal housing at the bottom. Ensure that is the wall sufficiently strong to support the heater which, depending on the model, could weigh up to 100 lbs (45 kg). Otherwise use the brackets supplied to stand the heater on the floor.

3.2 Do not recess the Norseman™ XB heater into the wall. Use of the brackets supplied will ensure that the minimum spacing from the wall of 3.75” (95 mm) is maintained.

3.3 If more than one heater is being installed, maintain at least 3” (76 mm) between adjacent heater extrusions. NEVER INSTALL ONE HEATER ABOVE THE OTHER.

3.4 The Norseman™ XB heater relies on natural convection and “black heat” radiation to transfer heat to the surroundings. Try to maintain a 12” (300 mm) clearance and NEVER LESS THAN 6” (150 mm) clearance in front of and at the sides of the heater.

3.5 Use guard rails in front of the heater if there is a possibility that moving equipment could come in contact with the heater.

4.0 INSTALLATION - REFLECTOR BAFFLES

4.1 REFLECTOR BAFFLES (T2D units only). Refer to Figure 1 when installing reflector baffles.

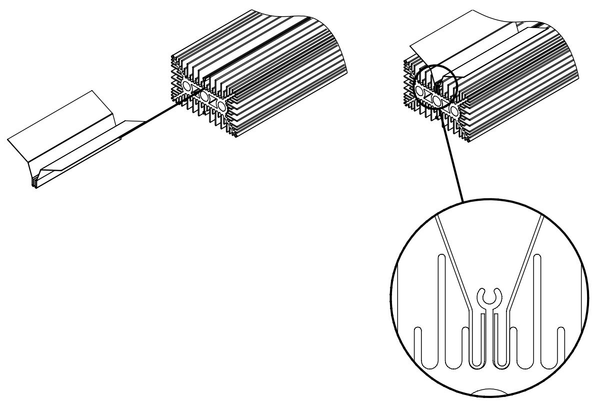


FIGURE 1 - REFLECTOR BAFFLES INSTALLATION

TABLE 1 - REFLECTOR BAFFLE PAIRS PER HEAT SINK

Heat Sink Extrusion Length		# of Pairs	Size	
in	mm		in	mm
5.1	130	0	-	-
11.8	300	1	8	203
18.5	470	2	8	203
25.2	640	1	24	610

NOTE: Baffles are only required for units with a T2D temperature code rating.

4.2 Position heater front face down on a flat surface.

4.3 With the fold in the baffle positioned between the keyhole fin and the adjacent short fin, slide reflector baffles onto the back of heat sink.

4.4 Ensure reflector baffles are secure in place and flush with the top of the heat sink. If reflector baffles move freely, open the fold with a screw driver to improve the friction and reinstall baffles.

CAUTION

THE HEATERS SURFACE IS HOT WHEN THE HEATER IS ENERGIZED. KEEP ALL COMBUSTIBLES AWAY FROM THE HEATER AND MAINTAIN THE RECOMMENDED INSTALLATION CLEARANCES AT ALL TIMES.

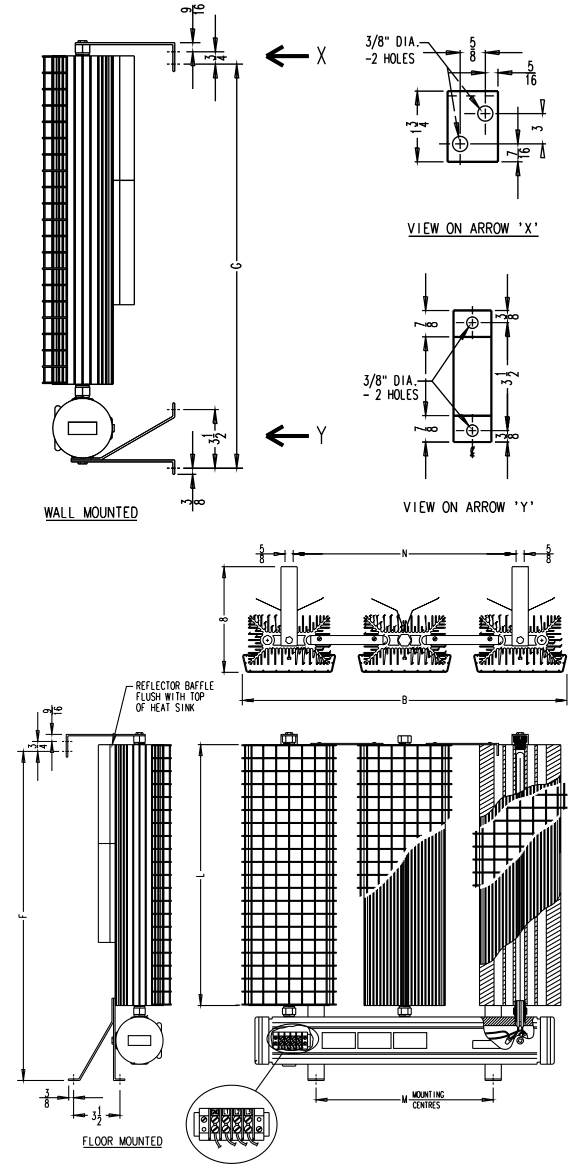


FIGURE 2 - DIMENSIONS & MOUNTING DETAILS

TABLE 2 - HEATER DIMENSIONS

Unit	B	F	G	M	N	L
	in (mm)	in (mm)	in (mm)	in (mm)	in (mm)	in (mm)
XB1	7.250 (184)	10.250 (260)	9.625 (244)	-	-	5.125 (130)
XB1		17.000 (432)	16.375 (416)			11.875 (300)
XB1		23.625 (600)	23.000 (584)			18.500 (471)
XB1		30.375 (772)	29.750 (756)			25.250 (640)
XB2	16.125 (410)	10.250 (260)	9.625 (244)	7.125 (181)	8.250 (210)	5.125 (130)
XB2		17.000 (432)	16.375 (416)			11.875 (300)
XB2		23.625 (600)	23.000 (584)			18.500 (471)
XB2		30.375 (772)	29.750 (756)			15.250 (640)
XB3	25.000 (635)	10.250 (260)	9.625 (244)	13.750 (349)	17.125 (435)	5.125 (130)
XB3		17.000 (432)	16.375 (416)			11.875 (300)
XB3		23.625 (600)	23.000 (584)			18.500 (471)
XB3		30.375 (772)	29.750 (756)			15.250 (640)
XB4	33.875 (860)	10.250 (260)	9.625 (244)	22.625 (575)	26.000 (664)	5.125 (130)
XB4		17.000 (432)	16.375 (416)			11.875 (300)
XB4		23.625 (600)	23.000 (584)			18.500 (471)
XB4		30.375 (772)	29.750 (756)			15.250 (640)

5.0 WALL MOUNTING

5.1 Install heater with the supplied hardware in accordance with the Figures and instructions below.

Step 1: Secure wall and stabilizing brackets to mounting surface (Figure 3).

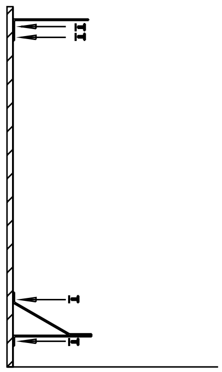


FIGURE 3 - INSTALL MOUNTING BRACKET

Step 2: Position heater face down on floor with terminal box towards mounting brackets. (Ensure that baffles are installed [see section 3.6 of this manual]). Angle heater such that the terminal box rests on bottom of wall bracket. Lift top of heater and align with top stabilizing brackets.

Secure with supplied 1/4”-20 hex bolts and lock washers (Figure 4).

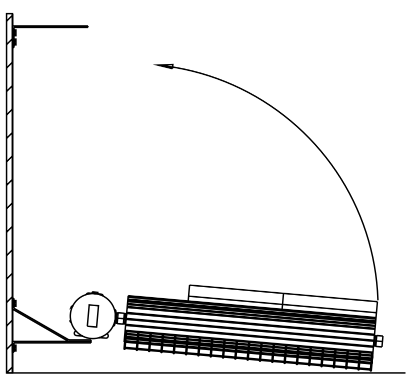


FIGURE 4 - WALL MOUNTING DIAGRAM

Step 3: Secure bottom of heater to wall mounting brackets with supplied 1/4”-20 hex bolts and lock washers (Figure 5).

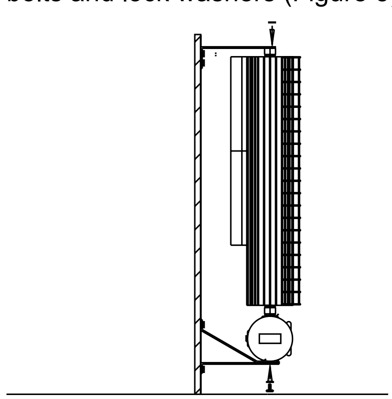


FIGURE 5 - ATTACH HEATER TO MOUNTING BRACKETS

6.0 FLOOR MOUNTING

Step 1: Position heater face down on the floor with terminal box towards the wall (Figure 6).

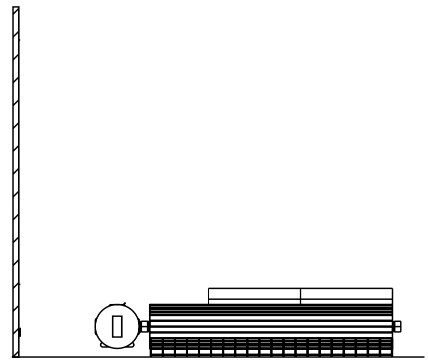


FIGURE 6 - FLOOR MOUNTING DIAGRAM

Step 2: Fasten top stabilizing bracket(s) and floor mounting bracket(s) to the unit. Floor mounting brackets may be mounted in one of three orientations (Figure 7).

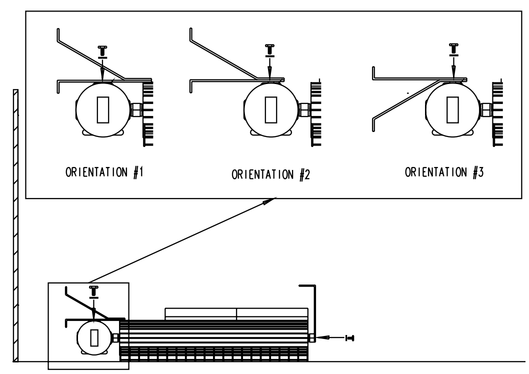


FIGURE 7 - INSTALL MOUNTING BRACKET TO HEATER

Step 3: Lift top of unit and position heater vertically against the wall. Secure stabilizing and floor mounting brackets to the mounting surfaces (Figure 8).

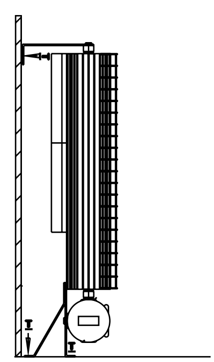


FIGURE 8 - ATTACH HEATER TO FLOOR AND WALL

CAUTION

NEVER INSTALL ONE HEATER ABOVE THE OTHER.

TO ENSURE SAFE OPERATION, HEATER MUST BE INSTALLED, AS SHOWN IN FIGURES 5 & 8. INSTALLATION WITH FINS IN THE INCORRECT ORIENTATION MAY RESULT IN AN UNSAFE CONDITION (REFER TO TABLE 1).

> **WARNING**
>
> **IMPROPER ORIENTATION OF THE HEATER COULD AFFECT THE SAFE AND RELIABLE OPERATION OF THE HEATER.**

7.0 THERMOSTAT INSTALLATION

7.1 FACTORY INSTALLED - For shipping purposes the thermostat well (located at back of unit) has not been installed.

Position thermostat bulb perpendicular to housing being careful not to kink the capillary. Slide well over bulb and screw into place. Make sure that a minimum 5 threads engagement is achieved.

7.2 FIELD INSTALLED KIT - Most Norseman™ XB units are suitable for field installation of a thermostat kit with the operator shaft hole on the front side of the unit and plugged with a socket head cap screw. If a thermostat is to be field installed, check to verify that you have been supplied with the correct thermostat kit. Single phase heaters use a single pole thermostat as supplied in kit number XTKW04481. Three phase heaters use a double pole thermostat as supplied in kit number XTKW04483. Follow the instructions supplied with the kit.

8.0 WIRING

8.1 Whenever hazardous materials are present, ensure that the terminal housing covers are secure before powering the heater.

8.2 Use supply wires suitable for 221°F (105°C).

8.3 Use approved conduit and conduit seals as required by the code for hazardous locations.

8.4 To provide maximum protection each Norseman™ XB heater should be fused individually using the nearest standard fuse size which is not less than 120% of the expected line current.

8.5 All heaters come factory prewired and ready for direct connection to the power supply leads.

(a) Connect the power leads to terminals marked L1 and L2 for single phase and L1, L2 & L3 for three phase heaters as shown in Figure 9.

(b) Connect the ground wire to the ground connection located in the heater terminal housing.

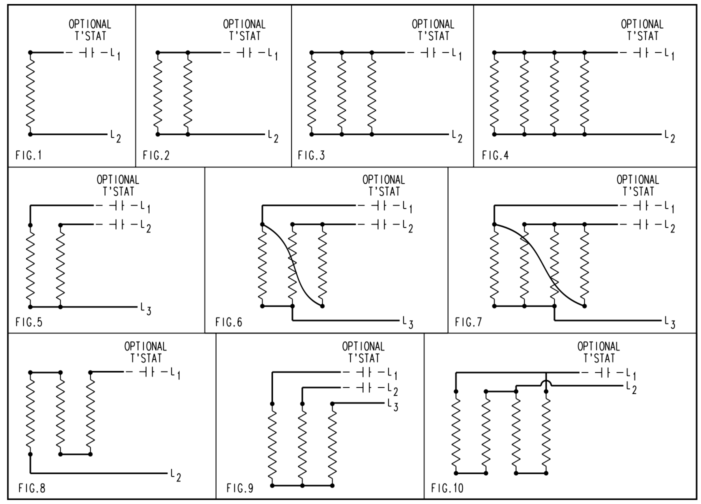


FIGURE 9 - WIRING DIAGRAM

TABLE 3 - REPLACEMENT THERMOSTATS

Part No.	Wiring Diagram (Figure 9) 1Ø	3Ø
XB1-1005T6	Fig. 1	-
XB1-1010T4A		
XB1-1017T4A		
XB1-1030T3B		
XB1-1047T2D		
XB1-3047T3B		
XB1-3075T2D		
XB1-4100T2D		
XB1-6020T6		
XB1-6045T4A		
XB1-6125T2D		
XB1-6135T2D		
XB2-1075T2D	Fig. 2	Fig. 5
XB2-3150T2D		
XB2-4100T3B		
XB2-4200T2D		
XB2-6040T6		
XB2-6085T4A		
XB2-6150T3B		
XB2-6250T2D		
XB3-1100T2D	Fig. 3 (Except XB3-4150T3B 600V & XB3-6125T4A 600V use Fig. 8)	Fig. 6 (Except XB3-4150T3B 600V & XB3-6125T4A 600V use Fig. 9)
XB3-1125T2D		
XB3-3100T3B		
XB3-3200T2D		
XB3-4150T3B		
XB3-4300T2D		
XB3-6060T6		
XB3-6125T4A		
XB3-6225T3B		
XB3-6375T2D		
XB4-1150T2D	Fig. 4 (Except XB4-6160T4A 600V & XB3-3250T2D 600V use Fig. 10)	Fig. 7
XB4-3250T2D		
XB4-4225T3B		
XB4-4375T2D		
XB4-6080T6		
XB4-6160T4A		
XB4-6300T3B		
XB4-6450T2D		
XB4-6500T2D		

WARNING WHENEVER HAZARDOUS MATERIALS ARE PRESENT, ENSURE THAT THE TERMINAL HOUSING COVERS, PLUGS, ETC., ARE SECURED (BUT NOT OVER-TIGHTENED) BEFORE ENERGIZING THE HEATER.

CAUTION ALL CIRCUITS MUST BE IN THE OPEN POSITION BEFORE REMOVING JUNCTION OR TERMINAL BOX COVERS.

CAUTION USE SUPPLY WIRES SUITABLE FOR 221°F (105°C). SUPPLY WIRES ARE TO BE FUSED WITH APPROPRIATELY SIZED HRC FUSING.

WARNING USE APPROVED CONDUIT AND CONDUIT SEALS AS REQUIRED BY HAZARDOUS LOCATION STANDARDS.

CAUTION ENSURE THAT NO POWER IS CONNECTED TO THE EQUIPMENT PRIOR TO MAKING ANY CONNECTIONS.

9.0 START-UP

9.1 For heaters with a tamper-proof thermostat, to set temperature, disconnect the power and remove the socket head cap screw. Set the thermostat to the desired room temperature with a screw driver and replace cap screw.

9.2 For heaters with an externally adjustable thermostat, set thermostat to desired temperature by adjusting the dial.

NOTE: The thermostat temperature range is 0° - 100°F (-18° - 40°C) with an operating differential of 5 - 7°F (3 - 4°C).

9.3 Install the terminal box cover and tighten securely.

9.4 Check to ensure that all plugs, screws, and covers are securely in place.

9.5 Check associated electrical equipment.

9.6 Check that all wall/floor mounting bracket connections are tight.

9.7 Turn on the supply power.

WARNING TO PREVENT UNSAFE OPERATION OF THE HEATER DO NOT EXCEED THE MAXIMUM ALLOWABLE AMBIENT OPERATING TEMPERATURE OF 104°F (40°C).

10.0 MAINTENANCE

10.1 Periodically inspect the heater installation to ensure that all connections, fittings, plugs, screws, covers, etc. are tight and free of corrosion.

10.2 Check that the reflector baffles (if required) have not moved upwards or downwards in relation to the heat sink.

10.3 Check the extrusions of the heater for dust and debris. A blast of compressed air is recommended for cleaning the heat sink. If air is not available, disconnect the power supply to the heater and when cool, wipe it down with a damp cloth or soft brush. Remove wire guards prior to cleaning.

WARNING DISCONNECT POWER FROM THE HEATER BEFORE PERFORMING ANY MAINTENANCE. FAILURE TO DO SO CAN RESULT IN PROPERTY DAMAGE, INJURY OR DEATH.

CAUTION DO NOT USE WATER TO CLEAN HEATER.

10.4 The heat sink is anodized or painted black to ensure that the maximum area code temperature is not exceeded. After an extended period of use or in extremely harsh environments the anodization/paint may wear away leaving bare surfaces. For continued safe operation, these surfaces must be repainted. When repainting use only black high temperature resistant paint.

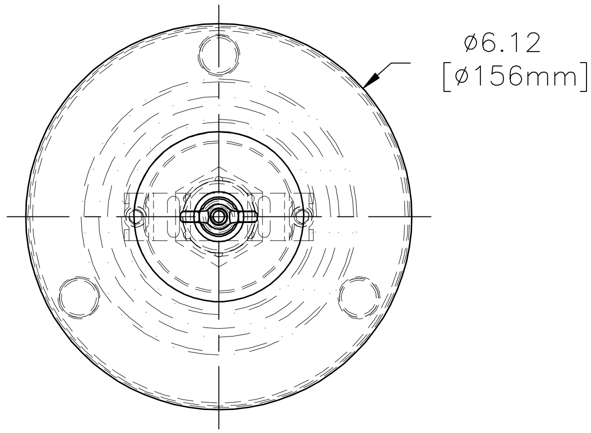
10.5 Except for thermostat replacement, field repair of the heater shall not be normally undertaken. In the event that the heater must be repaired, contact the factory for a return authorization number.

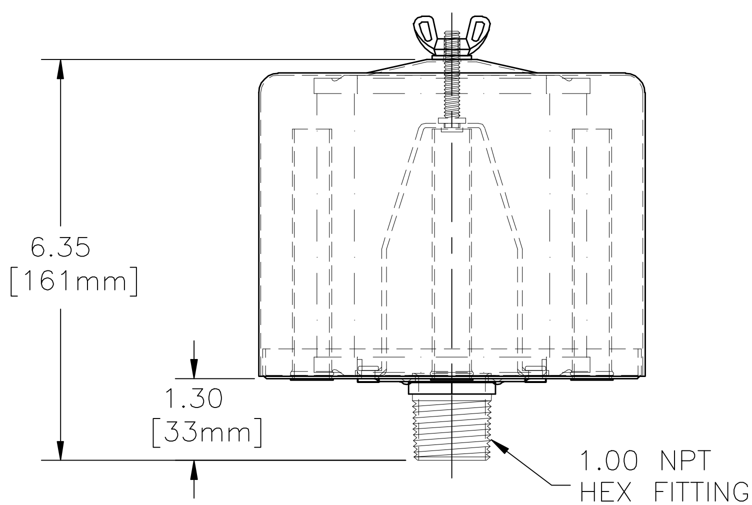
11.0 SPARE PARTS

TABLE 4 - REPLACEMENT THERMOSTATS

Voltage	Thermostat Part No.
One Phase Heaters	XTKW04481
Three Phase Heaters	XTKW04483

REVISIONS						
ZONE	REV	DESCRIPTION	CDR #	CHG BY	DATE	APP'D





REPLACEMENT ELEMENT# 19P	
MATERIAL	POLYESTER
CFM FLOW	100
SURFACE AREA	1.5 SQ. FT.
I.D.	3.00
O.D.	4.38
HEIGHT	4.75

MODEL#	HOUSING MATERIAL	FINISH
FS-19P-100	CARBON STEEL	BAKED ENAMEL BLACK

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:
FRACTIONS: ±1/4
DECIMALS: .XX ±.125
.XXX ±.063
ANGLES ±2

CUSTOMER APPROVAL:
DATE:

SALES REP.: M. CARROLL

APPROVALS	DATE
DRAWN: CRW	10/09/02
ENGINEER:	
APPROVED:	

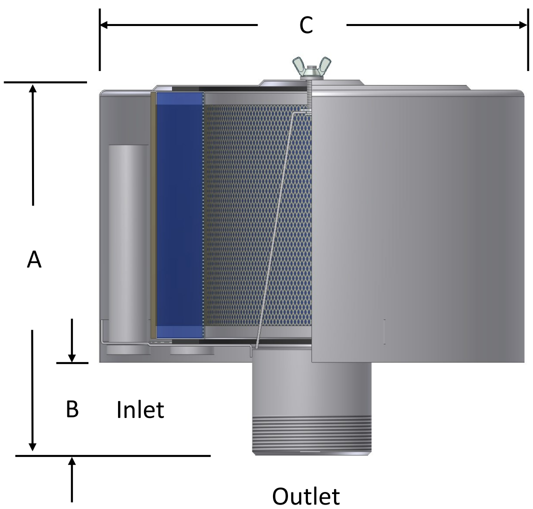
SOLBERG MANUFACTURING INC.
1151 W. ARDMORE AVE.
ITASCA, IL 60143
630/773-1363

DESCRIPTION: FS-19P-100
SCALE: 1:1.5
SHEET: 1 of 1
WT. MAX.:
SIZE: C
MATERIAL: SEE TABLE
FINISH: SEE TABLE
DRAWING NUMBER: SD10813

Compact Filter Silencers
FS Series 1/2"-6"MPT, 4"-6"FLG

Features

- Fully drawn weatherhood
- Tubular silencing design - tubes are positioned to maximize attenuation and air flow while minimizing pressure drop
- Corrosion resistant carbon steel construction
- Powder coat finish



Technical Specifications

- Temp (continuous): min -15°F (-26°C) max 220°F (104°C)
- Filter change out differential: 15-20" H_2O over initial Δ P
- Pressure drop graphs available upon request
- Polyester: 99%+ removal efficiency standard to 5 micron
- Paper: 99%+ removal efficiency standard to 2 micron

Options

ATEX Available

- Tap holes available
- Pressure drop indicator (See page 3-12)
- Various media for different environments
- Stainless steel construction
- Various nonstandard finishes and connection styles
- Side Access Silencer Filters (LQB Series) for space restricted enclosures (select models)

Tidbit: Charlie Solberg Sr. "Senior" designed our first filter silencer in 1966. The FS-15 size filter was created for small air compressors.

www.solbergmfg.com • sales@solbergmfg.com • Sales: 630.773.1363 • Fax: 630.773.0727

SOLBERG®

Compact Filter Silencers
FS Series 1/2"-6"MPT, 4"-6"FLG

MPT Outlet Assemblies

MPT Outlet	Assembly SCFM Rating	Assembly Part Number Polyester	Assembly Part Number Paper	Dimensions - inches A	Dimensions - inches B	Dimensions - inches C	No. of Silencing Tubes	Approx. Wt. lbs	Replacement Element Part No. Polyester	Replacement Element Part No. Paper	Element SCFM Rating
1/2"	10	FS-15-050	FS-14-050	3 7/16	1	6	1	2	15	14	35
3/4"	25	FS-15-075	FS-14-075	4	1 1/4	6	2	2	15	14	35
1"	35	FS-15-100	FS-14-100	4	1 5/16	6	3	2	15	14	35
1"	55	FS-19P-100	FS-18P-100	6 3/8	1 4/16	6	3	3	19P	18P	100
1 1/4"	70	FS-19P-125	FS-18P-125	6 3/4	1 5/8	6	5	3	19P	18P	100
1 1/2"	85	FS-19P-150	FS-18P-150	6 3/4	1 5/8	6	5	4	19P	18P	100
2"	135	FS-31P-200	FS-30P-200	7 1/2	2 3/8	10	5	8	31P	30P	195
2"	135	FS-231P-200	FS-230P-200	12	2 3/8	10	5	14	231P	230P	300
2 1/2"	195	FS-31P-250	FS-30P-250	7 1/2	2 1/2	10	5	8	31P	30P	195
2 1/2"	195	FS-231P-250	FS-230P-250	12 3/8	2 5/8	10	9	15	231P	230P	300
3"	300	FS-231P-300	FS-230P-300	12 3/4	3 1/8	10 1/4	9	15	231P	230P	300
3"	300	FS(12)-235P-300	FS(12)-234P-300	12 7/8	2 11/16	12 1/4	3	29	235P	234P	570
3"	300	FS-275P-300	FS-274P-300	13	3	16	9	33	275P	274P	1100
4"	520	FS(12)-235P-400	FS(12)-234P-400	13 7/8	3 11/16	12 1/4	6	29	235P	234P	570
4"	520	FS-275P-400	FS-274P-400	14	4	16	9	34	275P	274P	1100
5"	800	FS-245P-500	FS-244P-500	14	4 1/8	16	14	33	245P	244P	880
5"	800	FS-275P-500	FS-274P-500	14	4 1/8	16	14	36	275P	274P	1100
6"	1100	FS-275P-600	FS-274P-600	15	5 1/8	16	18	38	275P	274P	1100

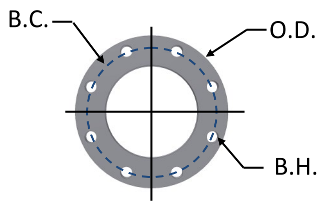
See Filter Silencer Technical Data section for sizing guidelines.

Flange Outlet Assemblies

Flange Outlet	Assembly SCFM Rating	Assembly Part Number Polyester	Assembly Part Number Paper	Dimensions - inches A	Dimensions - inches B	Dimensions - inches C	No. of Silencing Tubes	Approx. Wt. lbs	Replacement Element Part No. Polyester	Replacement Element Part No. Paper	Element SCFM Rating
4"	520	FS(12)-235P-400F	FS(12)-234P-400F	13 7/8	3 11/16	12 1/4	6	32	235P	234P	570
4"	520	FS-275P-400F	FS-274P-400F	14	4	16	9	39	275P	274P	1100
5"	800	FS-245P-500F	FS-244P-500F	14	4 1/8	16	14	38	245P	244P	880
5"	800	FS-275P-500F	FS-274P-500F	14	4 1/8	16	14	41	275P	274P	1100
6"	1100	FS-275P-600F	FS-274P-600F	15	5 1/8	16	18	42	275P	274P	1100

See Filter Silencer Technical Data section for sizing guidelines.

125/150# Pattern Flg	Dimensions - inches O.D.	Dimensions - inches B.C.	Dimensions - inches B.H.	No. of Holes	Flange Thickness
4"	9	7 1/2	0.75	8	0.5
5"	10	8 1/2	0.88	8	0.5
6"	11	9 1/2	0.88	8	0.5



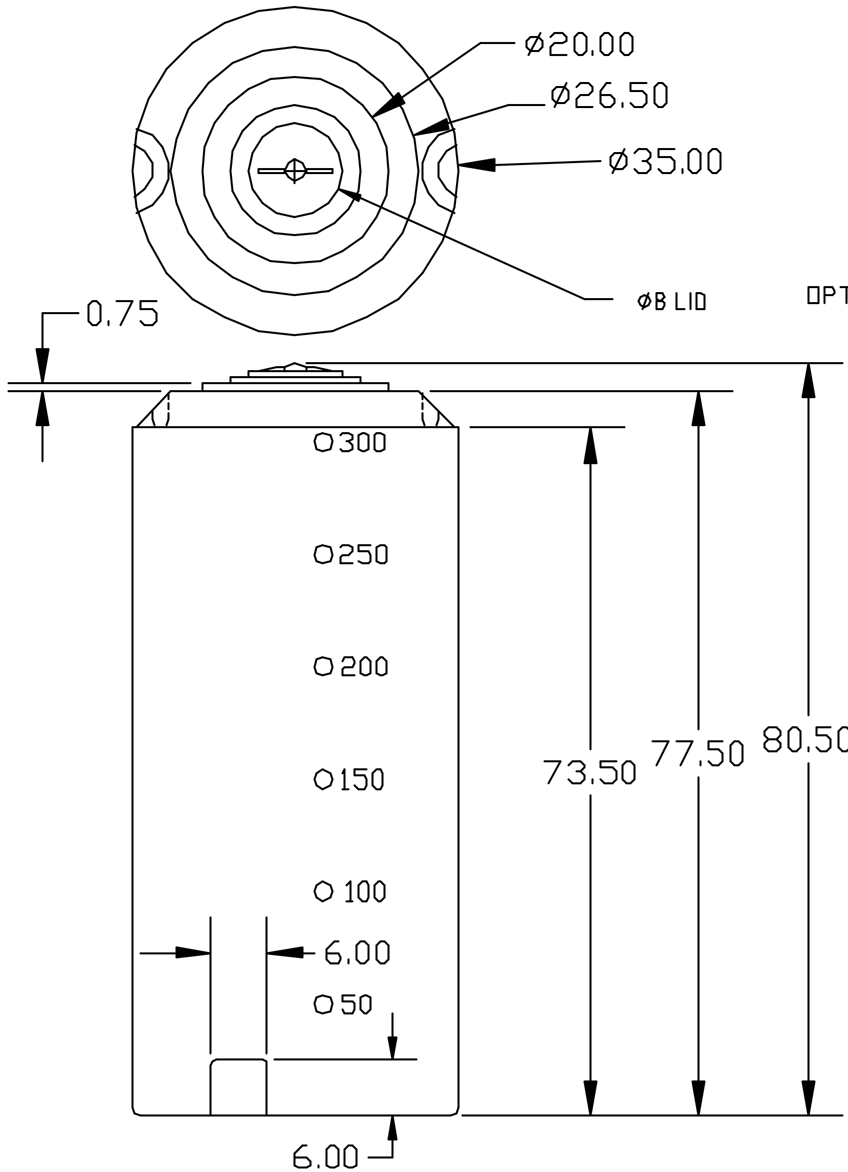
O.D.: Outside Diameter
B.C.: Bolt Circle
B.H.: Bolt Hole

Note: Model offerings and design parameters may change without notice. See www.solbergmfg.com for most current offering.

VT0300-35 | A

PROPRIETARY DATA

1. 1 PIECE ROTATIONALLY MOLDED
2. SPECIFIC GRAVITY 1.75
3. TRANSLUCENT
4. UV STABILIZED
5. FDA APPROVED RESIN
6. CALIBRATED IN GAL.
7. 3 YEAR WARRANTY
8. LARGER LID AVAILABLE



OPTIONAL 16 INCH LID

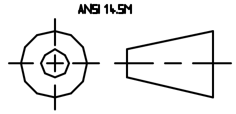
A	ADD TIE DOWNS	3-5-03	
REV	DESCRIPTION	DATE	APPRD

DRAWN / DATE
DHJ 12/11/93

APPRD. / DATE

ALL DIMENSIONS ARE IN DECIMAL INCHES
TOLERANCES UNLESS OTHERWISE SPECIFIED
± 1% @ 68° F

THIRD ANGLE PROJECTION
ANSI 14.5M



MATERIAL

HDPE OR EQUIVALENT
REFERENCE MATERIAL DATA SHEET
FOR SPECIFIC PROPERTIES.

NOTES:
1. BLUE, GREEN, WHITE
YELLOW, GREY, OR BLACK COLOR
2. SHOT WEIGHT 86 LBS.
3. .241 NOM. WALL

Ace Roto-Mold
A DIVISION OF DEN HARTOG INDUSTRIES,INC.
4018 HWY. 60 BLVD., BOX 421, HOSPERS, IOWA 51238

CLIENT / DESCRIPTION
300 GALLON VERTICAL TANK

SCALE
N.S.

PART NO.
VT0300-35

Pressure Transmitters

PRMFiltration

PRM Pressure Transmitters are built to withstand the harsh environments of the remediation industry. Accuracy: +/-0.25%FS, Working Temp: 14°F to 176°F

PT5PSICABLE025MNPTX
Range: 0-5 PSI
Material: 304 SS
Output: 4~20mA
Power: 24 VDC
Connection: 1/4 MNPT

PT50PSI24VDCX
Range: 0-50 PSI
Material: 304 SS
Output: 4~20mA
Power: 24 VDC
Connection: 1/4 MNPT

PT100PSICABLE025MNPTX
Range: 0-100 PSI
Material: 304 SS
Output: 0-10 VDC
Connection: 1/4 MNPT

PT145PSI24VDCX
Range: 0-145 PSI
Material: 304 SS
Output: 4~20mA
Power: 24 VDC
Connection: 1/4 MNPT

PT1000200PSIXPX
Range: 0-200 PSI
Output: 4~20mA
Power: 24VDC
Connection: 1/2 MNPT 316 SS
Enclosure: 2088 Type, Anti-Explosion

PTYD322II050PSIX
Range: 0-50 PSI
Output: 4~20mA
Power: 24VDC
Connection: 1/4 MNPT 316 SS
Enclosure: 2088 Type, Anti-Explosion with LCD Display

PTYD322II0145PISX
Range: 0-145 PSI
Output: 4~20mA
Power: 24 VDC
Connection: 1/4 MNPT 316 SS
Enclosure: 2088 Type, Anti-Explosion with LCD Display

Differential Pressure Transmitters

PRMFiltration

PRM Pressure Transmitters are built to withstand the harsh environments of the remediation industry. Accuracy: +/-0.25%FS, Working Temp: 14°F to 176°F

PGTYDDPTI040WCX
0-40"WC; 1/4" MNPT; 316 SS;
24VDC; 4~20 mA Output;
3 Meter Cable; 7 PSI MAX.

PGTYDDPTII100PSIX
0-100 PSI; 1/4" FNPT; 316 SS;
24VDC; 4~20 mA Output;
3 Meter Cable;
Max. Static Pressure 300 PSI

PGTYDDPTLI040WCX
With LCD Display; 0-40" WC;
1/4" FNPT; 316 SS; 24VDC; 4~20 mA Output;
3 Meter Cable; 7 PSI MAX.

PGTYD322DP040WCX
2088 Type (XP)
with LCD Display; 0-40" WC
1/4" FNPT; 316SS; 24VDC;
4~20 mA Output;
3Meter Cable; 7 PSI MAX.

PGTYD322DP100WCX
2088 Type (XP)
with LCD Display; 0-100" WC
1/4" FNPT; 316SS; 24VDC;
4~20 mA Output;
3 Meter Cable; 7 PSI MAX.

Micro Differential Pressure Transmitters

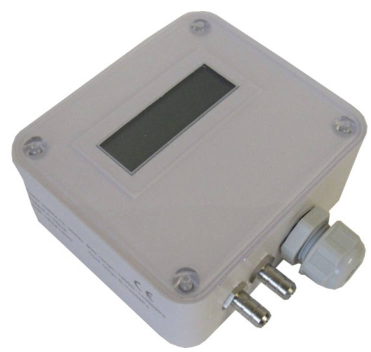
PGTLFMI001WCX
0-1"WC; 24VDC;
4~20 mA Output;
30 PSI Max.

PGTLFMI005WCX
0-5"WC; 24VDC;
4~20 mA Output;
30 PSI Max.

PGTLFMI010WCX
0-10"WC; 24VDC;
4~20 mA Output;
30 PSI Max.

PGTLFMI040WCX
0-40"WC; 24VDC;
4~20 mA Output;
30 PSI Max.

PGTLFMI100WCX
0-100"WC; 24VDC;
4~20 mA Output;
30 PSI Max.



PGTLFMII010WCX
With LCD Display
0-10"WC; 24VDC;
4~20 mA Output;
30 PSI Max.

PRM Rotameters

PRODUCT RECOVERY MANAGEMENT

Absolute Quality is our Goal… Genuine Service is our Habit!

Designed For Vapor Extraction and Air Sparge Applications

Unsurpassed Quality. PRM offers the DFG series rotameters for SVE/AS Applications. PRM rotameters are scaled for standard cubic feet per minute (scfm) and can be used on pressure applications and high vacuum applications.

What makes our Rotameters different. PRM has seen many misapplications through the years, especially in the remediation industry. We have designed meter sizes that provide an ample working range and are less prone to failure through impact exposure. The DFG meters are larger than the competition which provides a fine scale control for a higher degree of accuracy.

You need it. We build it. PRM can provide meters scaled for custom applications. Typical lead time is 3-5 weeks from time of order. Custom meters require a minimum quantity commitment of typically 50 meters.

Standard Features Include:

- Maximum 100 psig pressure rating
- Maximum Temperature rating of 160F
- SCFM scale based on 1atm air @ 68 Degrees Fahrenheit
- Acrylic body with replaceable end tails
- 316 SS plunger and travel rod
- Viton O-rings and seals

** Models **

- DFG03: 0.3-3 scfm, ½"NPT, 8.25" tall, 1.3" diameter
- DFG15: 1-8 scfm, ½"NPT, 8.5" tall, 1.3" diameter
- DFG25: 1-15 scfm, 1" NPT, 10.5" tall, 2" diameter
- DFG40: 2-25 scfm, 1.5" NPT, 12" tall, 2" diameter
- DFG50: 10-100 scfm, 2" NPT, 15" tall, 2" diameter

** Options **

- Flow limit switches
- Stainless Steel End Connections
- Flow Range Limit Snubbers

Custom Scaled Meters Available.
Contact PRM to Discuss Your Rotameter Needs!

Office Locations

Durham, NC • Atlanta, GA • Webster, NY • Raymond, NH • Lakeland, FL • Pensacola, FL

888-TREAT-IT • 919-957-8890 • www.prm-net.com • sales@prm-net.com

FLOAT LEVEL SWITCHES

www.prmfiltration.com

LS-CF07 Float Level Switches

PRM offers rugged and reliable industrial float level switches for starting or stopping pumps, opening or closing valves, or activating level alarms. Can be wired as tank fill or as low level cut out protection. Float Level Switches consist of a heavy duty polypropylene float molded directly onto a three core PVC cable.

FEATURES:

- Automatically turns on and off
- Adjustable switching level with included cable weight
- Simple Installation and use, instructions included

SPECIFICATIONS:

NORMALLY OPEN
VOLTAGE: 125/250VAC, 24VDC
MAXIMUM CURRENT: 16(4) A, 50-60 Hz
MAX. TEMPERATURE: 120°F
PROTECTION RATING: IP68
CE ISO9001 COMPLIANT

FLSLSCF07X3X:

LS-CF07 FLOAT LEVEL SWITCH,

3 METER PVC CABLE

FLSLSCF07X7X:

LS-CF07 FLOAT LEVEL SWITCH,

7.6 METER PVC CABLE

* Actual equipment specifications may vary. Please contact Product Recovery Management, Inc. for additional details.

Models:
CDU*
CDX
2CDU*
2CDX

Instruction and Operation Manual

NSF®

Certified to
NSF/ANSI 61, ANNEX G

* NSF/ANSI 61 Annex G listed models: CDU, 2CDU

EBARA Fluid Handling

EBARA International Corporation

Contents

⚠ WARNING

IMPORTANT SAFETY INSTRUCTIONS
Rules for Safe Installation and Operation

1. Read these rules and instructions carefully. Failure to follow them could cause serious bodily injury and/or property damage.
2. Check your local codes before installing. You must comply with their rules
3. For maximum safety, this product should be connected to a grounded circuit equipped with a ground fault interrupter device.
4. Before installing this product, have the electrical circuit checked by an electrician to make sure it is properly grounded.
5. Before installing or servicing your pump, BE CERTAIN pump power source is disconnected.
6. Make sure the line voltage and frequency of the electrical current supply agrees with the motor wiring. If motor is dual voltage type, BE SURE it is wired correctly for your power supply.
7. Complete pump and piping system MUST be protected against below freezing temperature. Failure to do so could cause severe damage and void the warranty.
8. Avoid system pressures that may exceed one and a half times the operating point selected from the pump performance curve.
9. Do not run your pump dry. If it is, there will be damage to the pump seal.

General Description

CDU, 2CDU, CDX, 2CDX model pumps may be used for the pumping of clean water and other fluids compatible with 304 stainless steel. These pumps are not to be used for handling dirty water or water with suspended solids, water containing acids, or corrosive liquids, seawater, and flammable or dangerous liquids. Please see pump specifications for fluid temperature ranges. These pumps are not designed to run without water.

2CDU/2CDXU model pumps and CDU/CDXU model pumps are similar in function and construction. The differences between the models include:

- single impeller vs. twin impeller
- flow rate
- heads
- weight
- dimensions.

Please see the technical specifications in this manual for more detailed descriptions.

Rules for Safe Installation and Operation

PACKAGE CONTENTS

1. Be sure all parts have been furnished and that nothing has been damaged in shipment.
2. The catalog lists all parts included with package. A packing list packed with pump, also lists contents.
3. OPEN PACKAGES AND MAKE THIS CHECK BEFORE GOING TO JOBSITE.

PIPING – Pipes must line up and not be forced into position by unions. Piping should be independently supported near the pump so that no strain will be placed on the pump casing. Where any noise is objectionable, pump should be insulated from the piping with rubber connections. Always keep pipe size as large as possible and use a minimum of fittings to reduce friction losses.

SUCTION PIPING – Suction pipe should be direct and as short as possible. It should be at least one size larger than suction inlet tapping and should have a minimum of elbows and fittings (5 to 6 pipe diameters of straight pipe before inlet is recommended). The piping should be laid out so that it slopes upward to pump without dips or high points so that air pockets are eliminated. The highest point in the suction piping should be the pump inlet except where liquid flows to the pump inlet under pressure.

The suction pipe must be tight and free of air leaks or pump will not operate properly.

DISCHARGE PIPING – Discharge piping should never be smaller than pump tapping and should preferably be one size larger. A gate valve should always be installed in discharge line for throttling if capacity is not correct. To protect the pump from water hammer and to prevent backflow, a check valve should be installed in the discharge line between the pump and gate valve.

ELECTRICAL CONNECTIONS – Be sure motor wiring is connected for voltage being used. Unit should be connected to a separate circuit. A fused disconnect switch or circuit breaker must be used in this circuit. Wire of sufficient size should be used to keep voltage drop to a maximum of 5%.

Single phase motors have built-in overload protection. Flexible metallic conduit should be used to protect the motor leads.

PRIMING – The pump must be primed before starting. The pump casing and suction piping must be filled with water before starting motor. Remove vent plug in top of casing while pouring in priming water. A hand pump or ejector can be used for priming when desired. When water is poured into pump to prime, remove all air before starting motor.

STARTING – When the pump is up to operating speed, open the discharge valve to obtain desired capacity or pressure.
WARNING! DO NOT ALLOW THE PUMP TO RUN WITH THE DISCHARGE VALVE TIGHTLY CLOSED. IF THE PUMP RUNS FOR AN EXTENDED PERIOD OF TIME WITHOUT LIQUID BEING DISCHARGED, THE LIQUID IN THE PUMP CASE CAN GET EXTREMELY HOT CAUSING SEVERE DAMAGE TO THE PUMP AND POSSIBLY CAUSE INJURY TO PEOPLE.

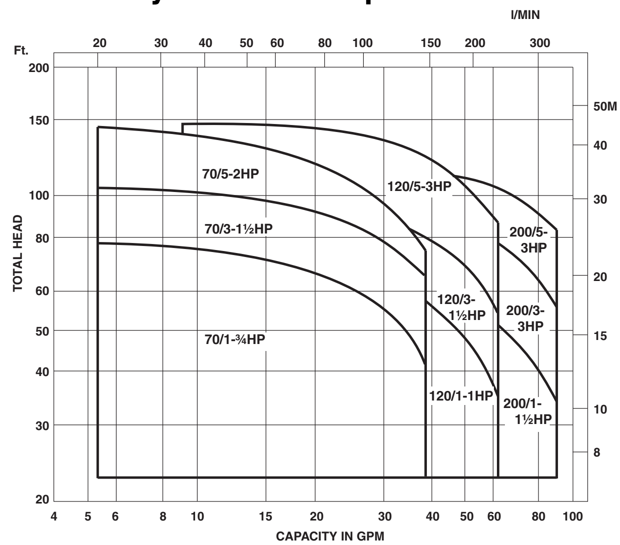
ROTATION – All single phase motors are single rotation and leave factory with proper rotation. Three phase motors should be checked to ensure proper rotation

FREEZING – Care should be taken to prevent the pump from freezing during cold weather. It may be necessary, when there is any possibility of this, to drain the pump casing when not in operation. Drain by removing the pipe plug in the bottom of the casing.

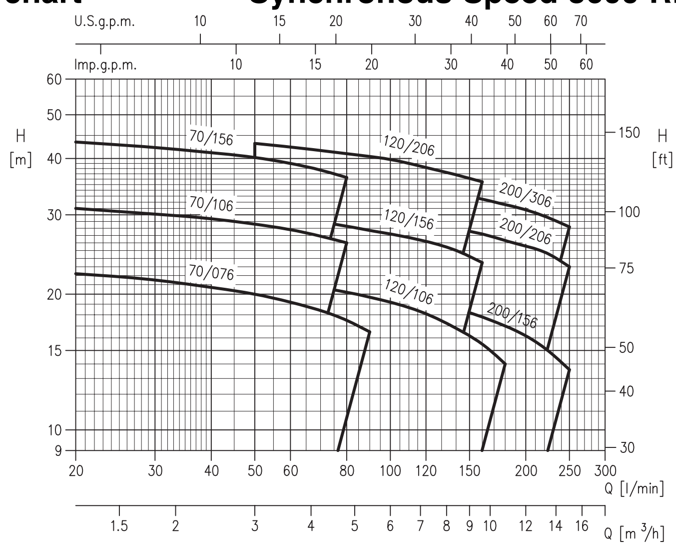
ROTARY SEAL – PRO STEEL pumps are fitted only with rotary seal. This seal is recommended for LIQUIDS free from abrasives.

LOCATION OF UNIT – The pump should be installed as near to the liquid source as is practical so that the static suction head (vertical distance from the center line of the pump to water level) is maximized, and so that a short, direct suction pipe may be used. The capacity of a centrifugal pump is reduced when the unit is operated under a high suction lift. The piping should be as free from turns and bends as possible, as elbows and fittings greatly increase friction loss. Place the unit so that it is readily accessible for service and maintenance and on a solid foundation, which provides a rigid and vibration-free support. Protect the pump against flooding and excess moisture.

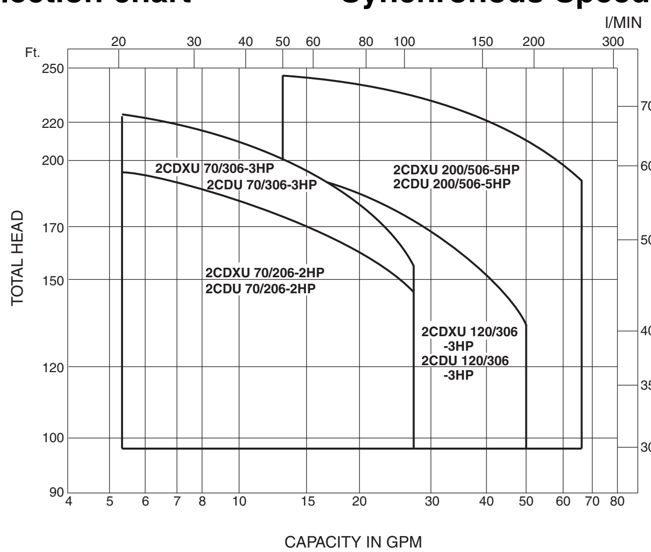
Model CDU Selection chart Synchronous Speed 3450 RPM



Model CDX Selection chart Synchronous Speed 3600 RPM



Model 2CDU/2CDX Selection chart Synchronous Speed 3600 RPM



Specifications – CDX

	Standard	Optional
Size Suction Discharge	 1 1/4" NPT Thread 1 1/2" NPT Thread 1" NPT Thread	
Range of HP	3/4 HP to 3 HP	
Range of Performance Capacity Head	 5.5 to 68 GPM at 3600 RPM 40 to 130 feet at 3600 RPM	
Liquid handled Type of liquid Temperature Working pressure	 Clean water Maximum: 140°F (60°C) Maximum: 8 PSI	
Materials Casing Impeller (closed type) Shaft Bracket Shaft Seal	 304 Stainless Steel 304 Stainless Steel 303 Stainless Steel Aluminum Mechanical Seal Carbon/Ceramic/NBR	 Consult factory for additional seal options
Direction of Rotation	Clockwise when viewed from motor end	
Motor Type Speed Single Phase Three Phase Motor Protection Bearing	 TEFC/IP55 60 Hz, 3600 RPM (2 poles) 230V 230/460V Built-in overload protection (single phase) Sealed Ball Bearing	

Specifications – CDU

	Standard	Optional
Size		
Suction	CDU70 – 1¼" NPT thread CDU120 – 1¼" NPT thread CDU200 – 1½" NPT thread	
Discharge	1" NPT thread	
Range of HP	¾ HP to 3 HP	
Range of Performance		
Capacity	5.5 to 95 GPM at 3450 RPM	
Head	26 to 144 feet at 3450 RPM	
Liquid handled		
Type of liquid	Water	
Temperature	212°F (100°C)	Max. 250°F (121°C) with optional high temperature seal
Max. working pressure	125 PSI (9 Bar)	
Materials		
Casing	304L Stainless Steel	
Impeller (closed type)	304L Stainless Steel	
Shaft	Stainless Steel	
Bracket	Aluminum	
Shaft Seal	Mechanical Seal – Type 21	High temperature version Mild chemical version
Direction of Rotation	Clockwise when viewed from motor end	
Motor		
Type	NEMA 56J Frame	
Speed	60 Hz, 3450 RPM (2 poles)	60Hz, 1725 RPM (4 poles)
Single Phase	TEFC – ¾ HP to 3 HP ODP – ¾ HP to 3 HP, 115/230V	Explosion proof – consult factory
Three Phase	TEFC – ¾ HP to 3 HP ODP – ¾ HP to 3 HP, 208-230/460V	Washdown duty – consult factory
Bearing	Ball Bearing	
Motor Protection	Built-in overload protection (single phase)	

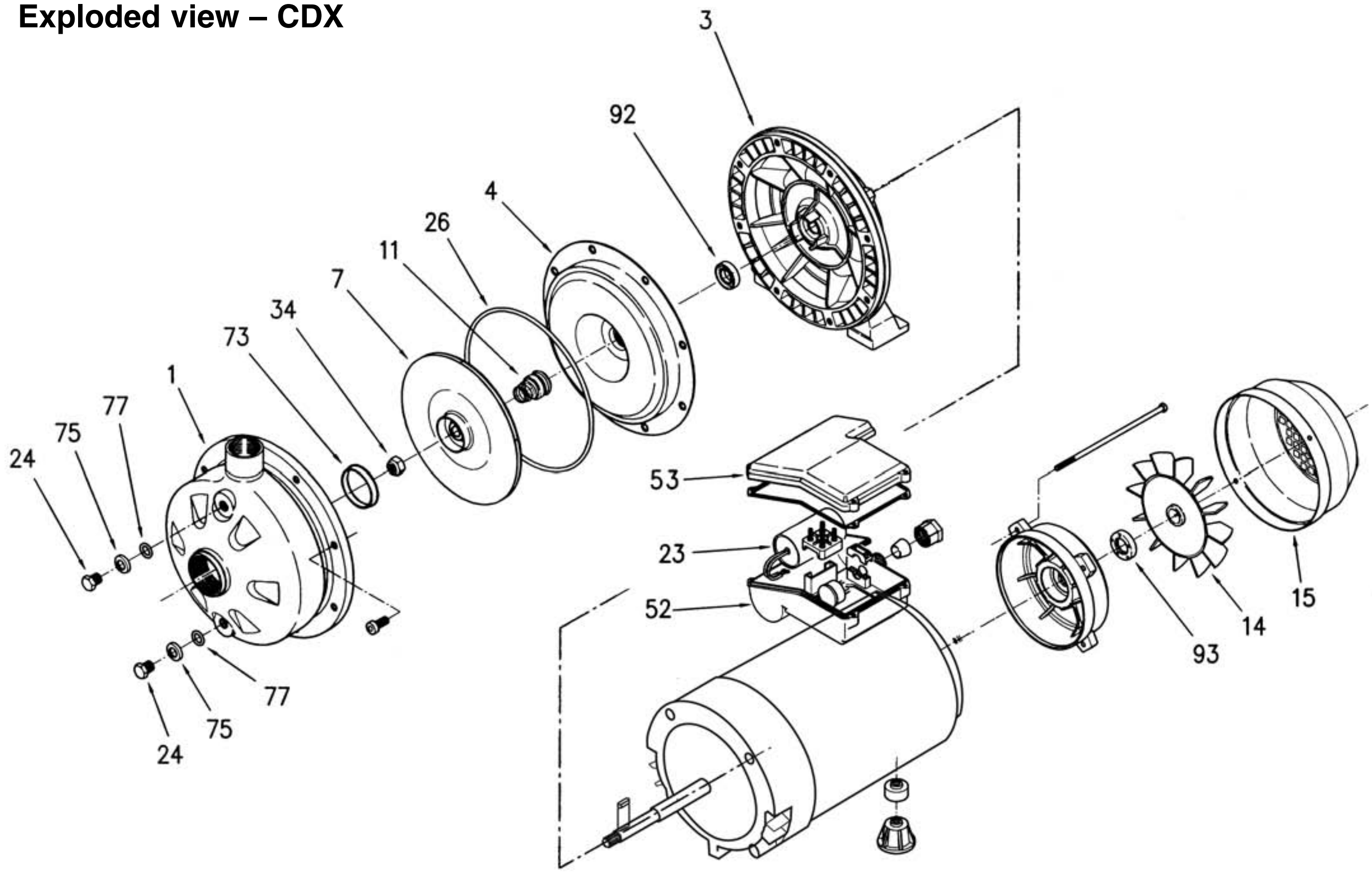
Specifications – 2CDXU

	Standard	Optional
Size		
Suction	2CDXU70 – 1¼" NPT Thread 2CDXU120 – 1¼" NPT Thread 2CDXU200 – 1½" NPT Thread	
Discharge	1" NPT Thread	
Range of HP	2 HP to 5 HP	
Range of Performance		
Capacity	5.5 to 66 GPM at 3600 RPM	
Head	98 to 245 feet at 3600 RPM	
Liquid handled		
Type of liquid	Clean water	
Temperature	Maximum: 212°F (100°C)	
Working pressure	Maximum: 125 PSI (9 Bar)	
Materials		
Casing	304L Stainless Steel	
Impeller (closed type)	304L Stainless Steel	
Shaft	304L Stainless Steel	
Bracket	Aluminum or Cast iron	
Shaft Seal	Mechanical Seal – Carbon/Ceramic	Consult factory for optional seal types
Direction of Rotation	Clockwise when viewed from motor end	
Motor		
Type	TEFC/IP55	
Speed	60 Hz, 3450 RPM (2 poles)	
Three Phase	230/460V	
Motor Casing	Aluminum	
Bearing	Ball Bearing	

Specifications – 2CDU

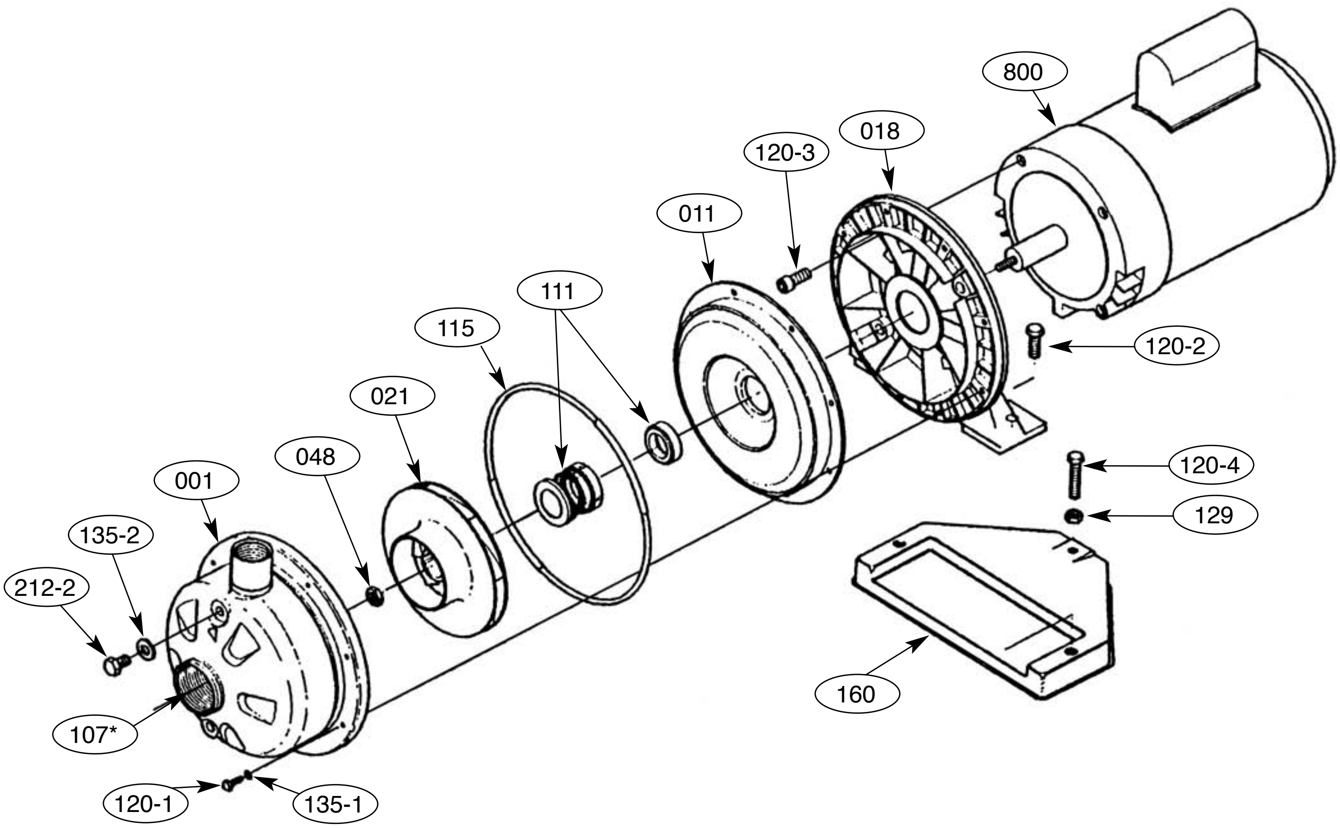
	Standard	Optional
Size		
Suction	2CDU70 – 1¼" NPT Thread 2CDU120 – 1¼" NPT Thread 2CDU200 – 1½" NPT Thread	
Discharge	1" NPT Thread	
Range of HP	2 HP to 5 HP	
Range of Performance		
Capacity	5.5 to 66 GPM at 3600 RPM	
Head	98 to 245 feet at 3600 RPM	
Liquid handled		
Type of liquid	Clean water	
Temperature	Maximum: 212°F (100°C)	Maximum: 250°F (121°C) with optional high temperature seal
Working pressure	Maximum: 125 PSI (9 Bar)	
Materials		
Casing	304L Stainless Steel	
Impeller (closed type)	304L Stainless Steel	
Shaft	304L Stainless Steel	
Bracket	Cast iron	
Shaft Seal	Mechanical Seal – Type 21	High temperature version Mild chemical version
Direction of Rotation	Clockwise when viewed from motor end	
Motor		
Type	NEMA 56J Frame	
Speed	60 Hz, 3450 RPM (2 poles)	
Single Phase	TEFC – 2 HP to 5 HP ODP – 2 HP to 3 HP, 115/230V	Explosion proof – consult factory
Three Phase	TEFC – 2 HP to 5 HP ODP – 2 HP to 3 HP, 208-230/460V	Washdown duty – consult factory
Motor Protection	Built-in overload protection (single phase)	
Bearing	Ball Bearing	

Exploded view – CDX



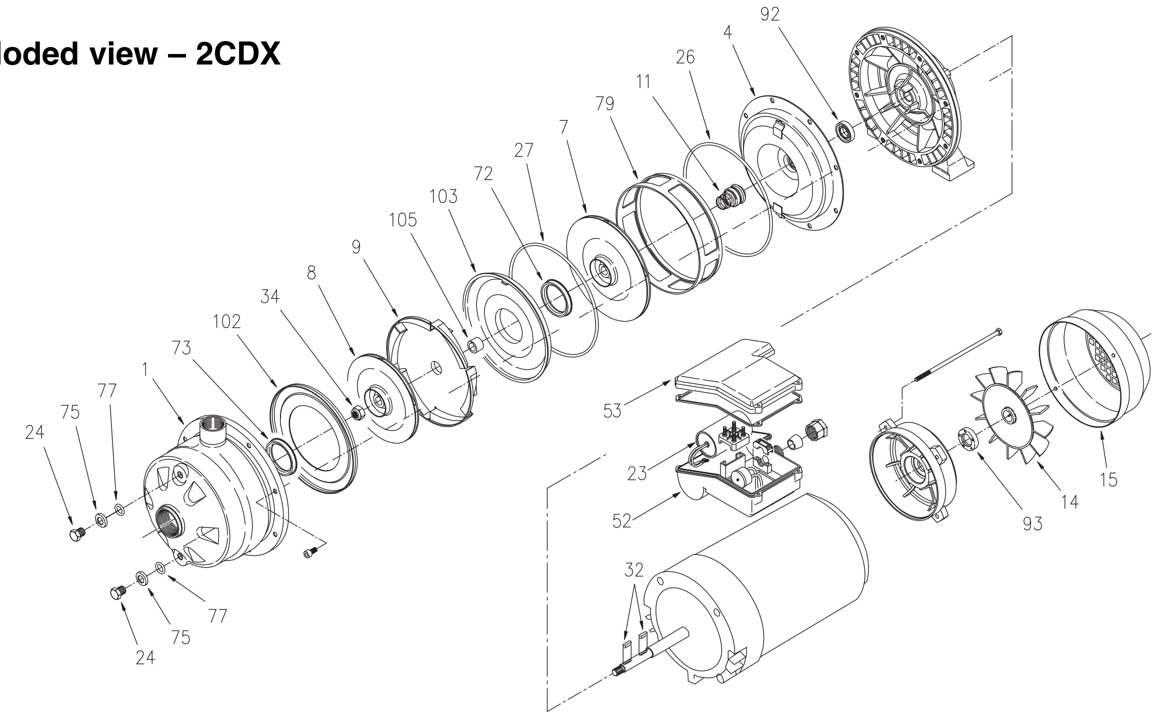
Location No.	Part Name	Material	No. for 1 Unit
001	Casing	304 Stainless	1
003	Motor bracket	Cast Aluminum	1
004	Casing cover	304 Stainless	1
007	Impeller	304 Stainless	1
011	Mechanical seal	Carbon/Ceramic	1
014	Fan	Polypropolene	1
015	Fan Cover	Steel	1
023	Capacitor	Single Phase only	1
024	Priming/Drain plug	303 Stainless	2
026	O-Ring	NBR	1
032	Key	304 Stainless	1
034	Impeller nut	304 Stainless	1
052	Terminal box	Plastic	1
053	Terminal cover	Plastic	1
073	Casing ring	NBR	1
075	Washer	304 Stainless	2
077	O-ring	NBR	2
092	Lip seal	–	1
093	Lip seal	–	1

Sectional view – CDU



Part No.	Part Name	Material	No. for 1 Unit
001	Casing	304L Stainless	1
011	Casing cover	304L Stainless	1
018	Bracket	Aluminum	1
021	Impeller	304L Stainless	1
048	Impeller nut	304L Stainless	1
107*	Casing ring (*CDU 70 series only)	Viton	1
111	Mechanical seal	—	1
115	O-Ring	Viton	1
120-1	Bolt	304L Stainless	8
120-2	Bolt	304L Stainless	2
120-3	Bolt	304L Stainless	4
120-4	Bolt	304L Stainless	1
129	Nut	304L Stainless	1
135-1	Washer	304L Stainless	8
135-2	Washer	Aluminum	2
160	Base	Steel	1
212-2	Plug	304L Stainless	2
800	Motor	—	1

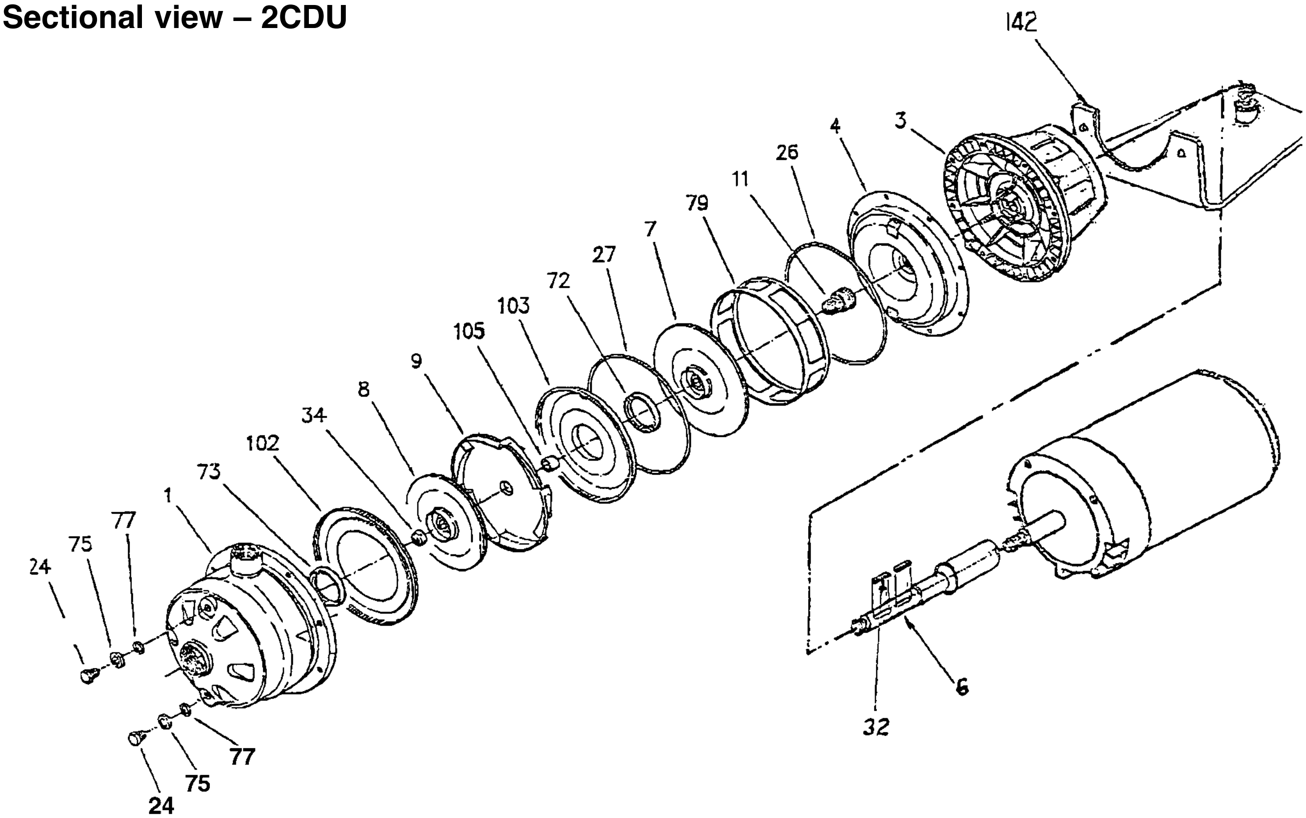
Exploded view – 2CDX



Location No.	Part Name	Material	No. for 1 Unit
1	Casing	304 Stainless	1
4	Casing cover	304 Stainless	1
7	Impeller	304 Stainless	1
8	Impeller	304 Stainless	1
9	Diffuser	304 Stainless	1
11	Mechanical seal	Carbon/Ceramic	1
14	Fan	Polypropolene	1
15	Fan cover	Steel	1
23*	Capacitor*	*Single phase only	1
24	Priming plug	303 Stainless	2
26	O-Ring	Viton	1
27	O-Ring	Viton	1
32	Key	304 Stainless	2
34	Impeller nut	304 Stainless	1
52	Terminal box	Polypropolene	1
53	Terminal cover	Polypropolene	1
72	Casing ring	Viton	1
73	Casing ring	Viton	1
75	Washer	304 Stainless	2
77	O-ring	Viton	2
79	Spacer diffuser	304 Stainless	1
92	Lip seal	–	1
93	Lip seal	–	1
102	Suction cover	304 Stainless	1
103	Conveyor cover	304 Stainless	1
105	Sleeve	304 Stainless	1

Note: Capacitor for Single Phase ONLY

Sectional view – 2CDU



Location No.	Part Name	Material	No. for 1 Unit
001	Casing	304 Stainless	1
003	Motor bracket	Cast Aluminum	1
004	Casing cover	304 Stainless	1
006	Shaft extension	304 Stainless	1
007	Impeller	304 Stainless	1
008	Impeller	304 Stainless	1
009	Diffuser	304 Stainless	1
011	Mechanical Seal Type 21	Carbon/Ceramic	1
024	Priming plug/Drain plug	303 Stainless	2
026	O-Ring	Viton	1
027	O-Ring	Viton	1
032	Key	Stainless	2
034	Impeller nut	304 Stainless/Nylon	1
072	Casing ring	Viton	2
073	Casing ring	Viton	1
075	Washer	304 Stainless	2
077	O-ring	Viton	2
079	Spacer diffuser	304 Stainless	1
102	Suction cover	304 Stainless	1
103	Conveyor cover	304 Stainless	1
105	Sleeve	304 Stainless	1
142	Base	Steel	1

Mounting Instructions

Mounting the Assembly

Do not operate the pump unless the assembly is securely and properly mounted.

Misalignment of the motor/pump assembly or not having the assembly reasonably level may cause pump vibration, noisy operation, fluid leaks, or air leaks and air locks in the suction pipe.

1. Place the motor/pump assembly in its intended operating position.

2. Level the pump through the centerline of the motor/pump assembly suction port.

WARNING

Initial Operation

Make certain the motor is not connected to a power source until the motor is properly assembled and mounted. Serious personal injury or damage to the motor/pump assembly could occur if the motor is activated improperly.

Only certified electricians should make electrical connections.

1. Prime the pump by adding fluid to the volute case through the top plug.To properly prime the pump, venting may be required.

2. Check the nameplate on the motor to determine the correct wiring procedure for your intended power source and if the motor is single or three phase. Connect the motor to a power source by following the wiring procedure on the motor's nameplate.

Note:

a. Single phase motors are typically dual voltage. In some cases, three phase motors are tri-voltage. Check the nameplate and follow the proper wiring procedure for the voltage you are using. Improperly wiring the motor could result in damage to the motor.

b. Three phase motors require a control box. Install overload protection to help prevent motor damage.

c. Depending on the wiring, three phase motors may start in reverse. Interchange any two power leads to change the starting direction and pump rotation.

- Always follow correct operating procedures.
- Always disconnect the motor/pump assembly from all power sources before servicing the pump or motor.
- Periodically check all power connections, bolts, screws, and the motor's mounting.
- Failure to properly follow assembly and operating instructions could result in damage to the pump and motor.
- Failure to properly install the impeller and impeller nut could result in damage to the pump and could cause serious personal injury.

Maintenance

Service
Keep ventilation openings clear of extraneous objects which may hinder free flow of air thru motor. Motor bearings are lubricated during manufacture. Additional lubrication is not required during their normal lifetime.

CAUTION

Draining
The pump and piping should always be protected against freezing temperatures. If there is any danger of freezing, the unit should be drained. To drain the pump, remove the drain plug at the bottom of the volute, and remove the priming plug to vent the pump. Drain all piping.

Disassembly Instructions – CDU, CDX, 2CDU, 2CDX

All pumping parts can be removed from case without disturbing the piping.

WARNING

POWER SUPPLY – Open the power supply switch contacts and remove fuses. Disconnect the electrical wiring from the motor.

VOLUTE CASE
(a) Drain pump case by removing drain plugs.
(b) Remove the bolts securing volute case to pump bracket.
(c) Pry volute case from casing cover with a screwdriver.

IMPELLER
CDU – Hold the motor shaft with a screwdriver in the shaft end slot. Remove the impeller nut. Grasp and turn the impeller counterclockwise (as viewed from pump end).
CDX, 2CDX, 2CDU – Hold the motor shaft with a screwdriver in the shaft end slot. Use a wrench to remove the impeller nut. Slide impellers from the shaft.

SEAL
(a) Remove the rotating part of the seal by pulling it off the shaft.
(b) The stationary seat can be pressed from the casing cover.

CHECK LIST FOR EXAMINATION OF PUMP PARTS
IMPELLER - Replace the impeller if any vane is broken, excessive erosion shows, or if labyrinth surfaces are worn. Impeller nut should be replaced if damaged.

MECHANICAL SEAL - Seal face, O-ring and sealing members should be free of burrs and dirt. Complete seal assembly should be replaced if not in perfect condition.

SHAFT- Shaft surface under seal must be clean, smooth and without any grooves. It should be replaced if necessary.

VOLUTE AND SEAL PLATE LABYRINTH SURFACES (Wear Rings)- If worn, replace the necessary part. If furnished with pressed in wear rings, only the rings need be replaced.

NOTE
If replacement parts are ordered, please furnish the following information to your EBARA distributor:
1. Reference Numbers
2. Description of Pump Part
3. EBARA Model Number and Serial Number on the Nameplate.

CDU/CDX Assembly Instructions

Position the pump on its end with the shaft up. The work surface should be level, capable of supporting the motor.

> **⚠ WARNING**
>
> Make certain the motor is not connected to a power source. Do not install or assemble the pump on a motor connected to a power source. Serious injury could occur if the motor activates during pump assembly.

Assembling the Pump

1. Position the motor bracket on the motor with the mounting feet toward the motor. Cross-tighten bolts to factory recommended torque of 6 ft. lbs.
2. Using finger pressure only, firmly press the stationary seal seat into the casing cover. Press the seat until it evenly bottoms out in the seat cavity.
3. Be careful not to damage the stationary seal.
   a. Position the casing cover over the the motor shaft.
   b. Align the casing cover holes with the motor bracket holes.
   c. Firmly press the casing cover into position. (Casing cover may need to be tapped into place by using a rubber mallet.)
4. Ensure all seals have good contact.
   a. Carefully press the rotating seal assembly onto the motor shaft. Ensure the face of the seal assembly has solid, square contact with the stationary seal seat.
   b. The seal retainer must seal against the motor shaft.
   c. Position the seal spring and seal washer. CDX pumps do not require seal spring washers.
5. Failure to properly install the impeller and the impeller nut could result in the impeller spinning off the shaft in three phase applications (when the motor may start in reverse rotation).
   For CDU pumps:
   a. While holding the seal spring in place, thread the impeller clockwise onto the motor shaft.
   b. Use a screwdriver to hold the motor shaft stationary. Turn the impeller on the shaft until it spins down and bottoms out. Make certain that the impeller is firmly bottomed and sealed.
   c. Install the impeller nut onto the shaft in the same manner as the impeller was installed. Make certain the impeller nut is firmly sealed against the impeller. Apply lock tite to the impeller nut before installing.
   For CDX pumps:
   a. Position key in keyway on shaft
   b. Slide impeller onto shaft
   c. Tighten impeller nut.
6. Position the Viton O-ring over the casing cover. Do not cut nick or damage the O-ring during installation.
7. *The discharge can be positioned in the direction desired.*
   a. Position the pump volute casing over the casing cover.
   b. Rotate the discharge to the desired direction.
   c. Align the bolt holes and secure the case to the casing cover with lock washers and cap screws.
   d. Cross tighten the bolts to 3.4 lbs (factory recommended torque). Overtightening may result in stripping of the motor bracket threads.
8. Position the mounting base on the pump and secure with cap screws.
9. Place the bolt and lock nut on the back of the mounting base. Adjust the bolt height to support the motor and tighten the lock nut to secure the bolt height.
10. Rotate the impeller to ensure proper alignment.

Assembly Instructions – Models 2CDU, 2CDX

For 2CDX start with step # 3.

1. Apply thread locker to the shaft extension. Thread shaft extension on to the motor shaft. Tighten to 10Nm (7.5 ftlb).
2. Attach motor bracket to the motor cross tightening the bolts. 8 Nm (6 ftlbs)
3. Install stationary seal in the casing cover. Press the seal until it evenly bottoms out in the seat cavity.
4. Carefully press the casing cover onto the motor bracket. Be sure to align the casing cover bolt-holes with the bolt-holes in the motor bracket.
5. Carefully press the rotating seal assembly onto the motor shaft. Ensure that the face of the seal assembly has solid, square contact with the stationary seat. Position the seal spring and spring washer. (2CDX pumps do not require a seal spring washer.)
6. Install the casing cover o-ring. Do not nick or cut the o-ring.
7. Install key in the location to accept the delivery side impeller. Reference the parts list to ensure the proper part number impeller is in the proper position.
8. Install sleeve and key for the suction side impeller.
9. Install diffuser spacer. Be sure to align the diffuser spacer notch with the casing cover spigot.
10. Install the o-ring on the conveyor cover.
11. Assemble the conveyor cover being sure to align the casing cover notch with the diffuser spacer spigot.
12. Install the diffuser.
13. Slide the suction side impeller onto the shaft into its proper position. Reference the parts list to ensure the proper part number impeller is in the proper position.
14. Install the suction cover.
15. Thread the self locking nut onto the shaft and tighten

For 2CDU, go to step 16.A For 2CDX, go to step 16.

16. Place casing onto the assembly, aligning the holes of the casing with the holes of the casing cover and the motor bracket. Thread the casing bolts and crass tighten to 8 Nm (6ft lbs) Go to step 19.
17. Place casing onto the assembly aligning the holes of the casing with the holes of the casing cover and motor bracket. Thread the M6x 16 bolts into the upper side holes. Thread the M6 X 30 bolts in the lower side holes. Cross tighten the casing bolts to 8Nm (6 ftlbs)
18. Fit the base onto the bolts protruding from the lower side holes. Using lock washers and nuts secure the base to the assembly.
19. Install nut and screw in the jack screw position in the base. Set the pump on a horizontal surface and loosen jack screw until it comes in contact with the bottom of the motor.
20. Rotate pump shaft to ensure proper alignment of assembly. Pump shaft should rotate with out rubbing if assembly is installation is correct.

Troubleshooting

TROUBLE	POSSIBLE CAUSE	TROUBLESHOOTING
Pump does not run.	Faulty connection of power supply circuit. Wrong wiring of control circuit. Bound shaft Mechanical seal faces stuck together Faulty motor Damage to bearing	Check power supply circuit. Correct control circuit. Remove cause of obstruction. Release seal by turning shaft. Repair or replace motor. Repair or replace any damaged bearing.
Pump does not pump water. Inadequate quantity.	Considerable voltage drop. Rotation direction reversed. Lack of priming. High discharge head. Large piping loss. Clogged foot valve. Leakage from suction piping. Too high suction lift. Low water level.	Check incoming power. Correct rotation direction. Re-prime the pump. Re-examine the plan. Re-examine the plan. Clear foot valve suction. Check and repair suction piping. Re-install as per instructions. Foot valve in ample immersion.
Overcurrent	Considerable fluctuation of power supply voltage. Considerable voltage drop. Low head and overflow rate. Damaged bearing.	Check incoming power. Check incoming power. Throttle flow rate at outlet. Replace any damaged bearing.
Pump vibrates, excessive operating noise	Beyond rated capacity. Below minimum flow. Improper piping. Damaged bearing. Foreign matter clogging cooling fan.	Reduce flow rate. Consult distributor Secure piping again. Replace any damaged bearing. Remove foreign matter.
Pressurizing application. Pump starts and soon stops	Too limited pressure switch setting.	Replace pressure switch to wider range. Check and repair leaks.
Pump does not stop	Leakage in system. Too high pressure setting.	Reduce max pressure setting to the lower in pressure switch.

MAINTENANCE:

The pump does not require special maintenance.
The following rules must be observed for safe operation:
If the pump is not going to be used for a long period, the pump should be drained of water and flushed with clean water.
Where the pump is exposed to freezing temperatures, it should always be left drained when not in use.

*All specifications subject to change without notice.

Complete enclosed Registration Card and return to Ebara International Corporation.

EBARA INTERNATIONAL CORPORATION
ROCK HILL, SOUTH CAROLINA
COMMERCIAL PUMP/ PRODUCTS LIMITED WARRANTY
(EXCEPT MODEL EPPD SUMP PUMPS)

Ebara International Corporation, Rock Hill, SC ("EIC-RH") warrants to the original purchaser only ("Customer") that the EIC-RH Commercial Pump/Product ("Pump") will be free of defects in workmanship and material for a period of twelve (12) months from the date of installation or eighteen (18) months from the date of shipment by EIC-RH, whichever comes first, provided that notification of any such defect is promptly given in writing to EIC-RH. Customer may be required at EIC-RH's request to verify that it is the Customer of the Pump and that the Pump was installed and operated in accordance with EIC-RH's instructions.

EIC-RH's sole obligation under this warranty will be to repair or replace with a new or reconditioned Pump, such Pump as has failed or has been found to be defective during the warranty period, or at EIC-RH's sole option, to refund to the customer an equitable part of the purchase price. In no event shall EIC-RH's cost responsibility exceed the initial purchase price paid by the Customer for the Pump.

EIC-RH shall be liable only for the cost of the Pump, or the cost of repair or replacement of any defective Pump. Customer shall be responsible for labor, cost of removal and installation at Customer's premises, transportation and insurance costs to EIC-RH and any other incidental costs.

This warranty is void and does not apply if damage is caused by improper installation, improper maintenance, accident, alteration, abuse, misuse or if the Pump has been disassembled prior to warranty evaluation without written authorization from EIC-RH.

Warranty service and information for return procedures will be provided by EIC-RH upon receipt of written notice describing the defect or problem to:

Ebara International Corporation
Warranty/Claims
1651 Cedar Line Drive
Rock Hill, SC 29730
803-327-5005 Phone
803-327-5097 Fax

THE FOREGOING WARRANTY IS THE SOLE AND EXCLUSIVE WARRANTY ON THIS PUMP, AND ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE DISCLAIMED AND EXCLUDED FROM THE TERMS OF THIS WARRANTY. EIC-RH'S SOLE OBLIGATION IN CASE OF ANY DEFECT WILL BE TO PROVIDE THE WARRANTY SERVICE SPECIFIED ABOVE. THE FOREGOING IS CUSTOMER'S SOLE AND EXCLUSIVE REMEDY, WHETHER IN CONTRACT, TORT OR OTHERWISE AND EIC-RH SHALL NOT BE LIABLE FOR ANY CONSEQUENTIAL OR INCIDENTAL DAMAGES OF ANY KIND WHATSOEVER.

Contact your dealer or supplier
for more information about other EBARA products

EBARA Fluid Handling

1651 Cedar Line Drive • Rock Hill, SC 29730
(t) 803 327 5005 • (f) 803 327 5097
info@pumpsebara.com • **www.pumpsebara.com**

EFHCD(X)U2CD(X)U1204 0213

Contents

*Note: *Model CDU is Certified to NSF/ANSI/CAN 61 & NSF/ANSI 372*

Model Designation

CDU		70/1	7	D	1	1

MODEL TYPE
- **CDU –** Stainless Steel Centrifugal

SPEED
- **(none) –** .3500 RPM
- **4 –** 1750 RPM

CASING AND IMPELLER SIZE

70/0	**120/1**	**200/1**
70/1	**120/3**	**200/3**
70/3	**120/5**	**200/5**
70/5A		
70/5B		

MOTOR HP
- **3 –** 1/3 HP
- **5 –** 1/2 HP
- **7 –** 3/4 HP
- **10 –** 1 HP
- **15 –** 1 1/2 HP
- **20 –** 2 HP
- **30 –** 3 HP

MOTOR ENCLOSURE
- **D –** ODP
- **T –** TEFC
- **W –** Washdown
- **X –** Explosion Proof

PHASE
- **1 –** single phase
- **3 –** three phase

MECHANICAL SEAL TYPE
- **G –** Carbon/Ceramic/Buna (Cup Seat)
- **H –** Carbon/Ni-resist/Viton (Cup Seat)
- **GO –** Carbon/Ceramic/Buna (O-Ring Seat)
- **CO –** Carbon/Ceramic/Viton (O-Ring Seat)
- **HO –** Carbon/Ni-resist/Viton (O-Ring Seat)
- **EPDM –** Carbon/Ceramic/EPDM (Cup Seat)
- **SCCV –** Si-Carbide/Carbon/Viton (Cup Seat)
- **VSC –** Si-Carbide/Si-Carbide/Viton (O-Ring Seat)
- **ESC –** Si-Carbide/Si-Carbide/EPDM (O-Ring Seat)

Model Designation

CDX	M	70/	20	6	S2

MODEL TYPE
CDX – Single stage pump

PHASE DESIGNATION
M – Single Phase
(none) – Three Phase

HYDRAULIC CODE
70/
120/
200/

RATED HP
07 – 3/4 HP
10 – 1 HP
20 – 2HP
30 – 3HP

HERTZ
6 – 60Hz

PHASE/VOLT
S1 – single phase, 115 Volt
S2 – single phase, 230 Volt
T2 – three phase, 230/460 Volt

Model CDU
EBARA Stainless Steel Centrifugal Pumps
Specifications

	Standard	Optional
Size		
Suction	CDU70 – 1 1/4" NPT thread CDU120 – 1 1/4" NPT thread CDU200 – 1 1/2" NPT thread	
Discharge	1" NPT thread	
Range of HP	1/2 HP to 3 HP	
Range of Performance		
Capacity	5.5 to 95 GPM at 3450 RPM	
Head	26 to 144 feet at 3450 RPM	
Liquid handled		
Type of liquid	Water	
Temperature	Range: 23°F (-5°C) to 212°F (100°C)	Max. 250°F (121°C) with optional high temperature seal
Max. working pressure	125 PSI (9 Bar)	
Materials		
Casing	304L Stainless Steel	
Impeller (closed type)	304L Stainless Steel	
Shaft	Stainless Steel	
Bracket	Aluminum	
Shaft Seal	Mechanical Seal – Type 21	High temperature version Mild chemical version
Bearing	Ball Bearing	
Direction of Rotation	Clockwise when viewed from motor end	
Motor		
Type	NEMA 56J Frame	
Speed	60 Hz, 3450 RPM (2 poles)	
Single Phase	TEFC – 1/2 HP to 3 HP ODP – 1/2 HP to 3 HP, 115/230V	Explosion proof – consult factory
Three Phase	TEFC – 1/2 HP to 3 HP ODP – 1/2 HP to 3 HP, 208-230/460V	Washdown duty – consult factory
Motor Protection	Built-in overload protection (single phase)	

Model CDX

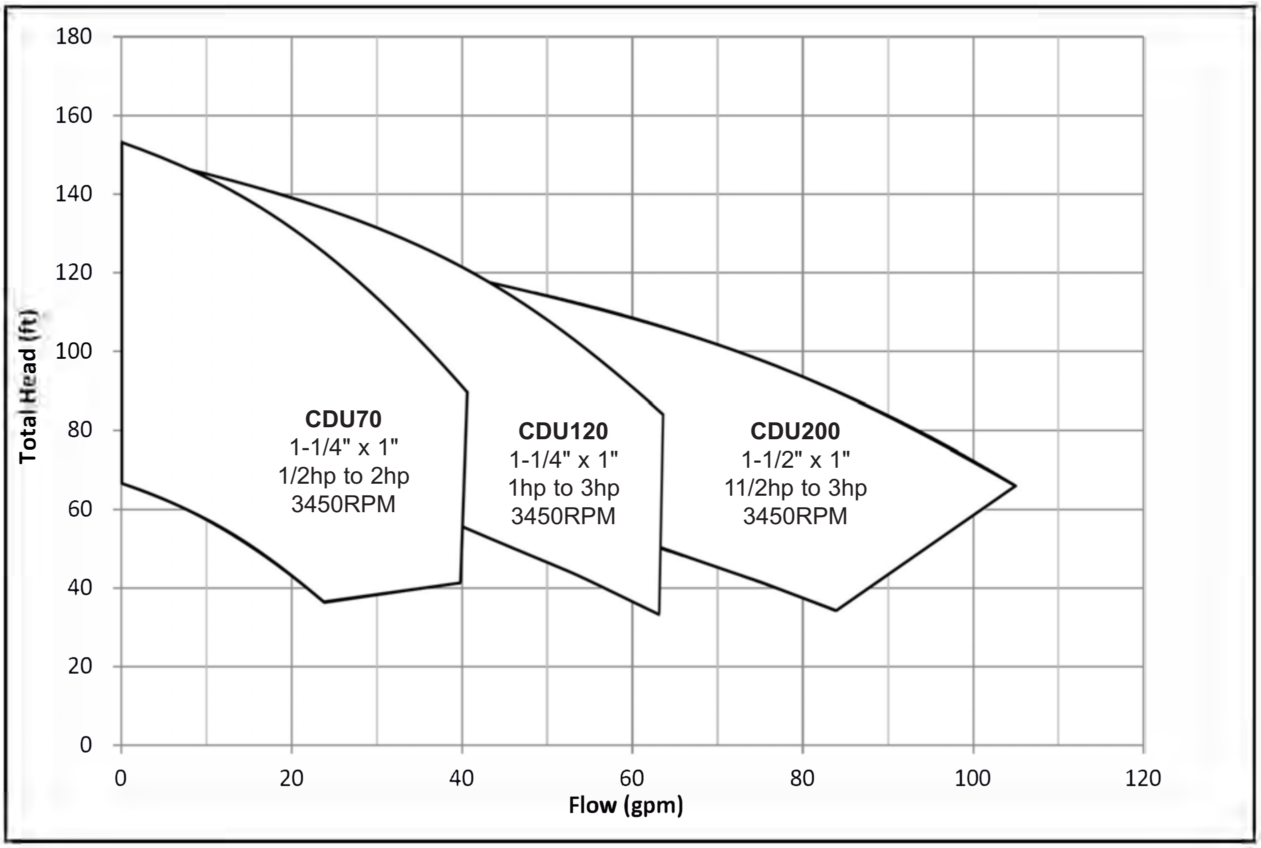
Specifications

	Standard	Optional
Size		
Suction	$1^1/_4$" NPT Thread $1^1/_2$" NPT Thread	
Discharge	1" NPT Thread	
Range of HP	$^3/_4$ HP to 3 HP	
Range of Performance		
Capacity	5.5 to 68 GPM at 3600 RPM	
Head	40 to 130 feet at 3600 RPM	
Liquid handled		
Type of liquid	Clean water	
Temperature	Range: 23°F (-5°C) to 140°F (60°C)	
Working pressure	Maximum: 116 PSI	
Materials		
Casing	304 Stainless Steel	
Impeller (closed type)	304 Stainless Steel	
Shaft	303 Stainless Steel	
Bracket	Aluminum	
Shaft Seal	Mechanical Seal Carbon/Ceramic/NBR	Consult factory for additional seal options
Direction of Rotation	Clockwise when viewed from motor end	
Motor		
Type	TEFC/IP55	
Speed	60 Hz, 3600 RPM (2 poles)	
Single Phase	230V	
Three Phase	230/460V	
Motor Protection	Built-in overload protection (single phase)	
Bearing	Sealed Ball Bearing	

Model CDU

Selection Chart

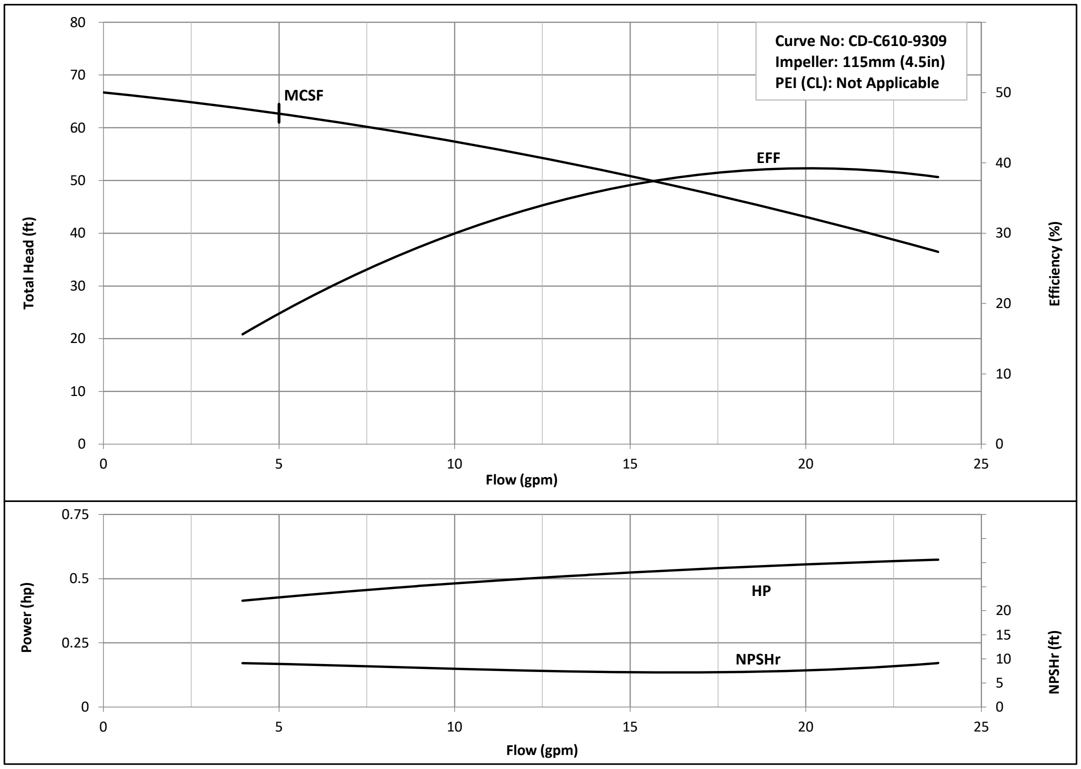
Nominal Speed 3450 RPM



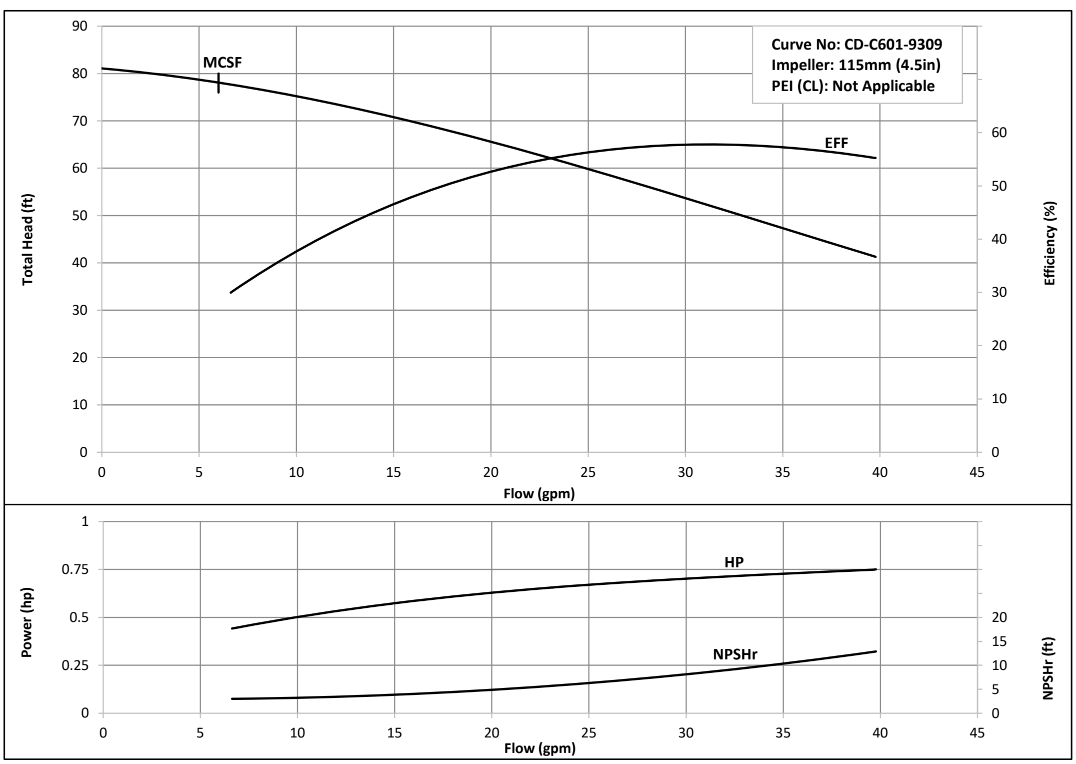
Model CDU — EBARA Stainless Steel Centrifugal Pumps

Performance Curves

CDU70/0-$^{1}/_{2}$ HP — Nominal Speed: 3450 RPM — Size: 1 x 1$^{1}/_{4}$ x 4$^{1}/_{2}$

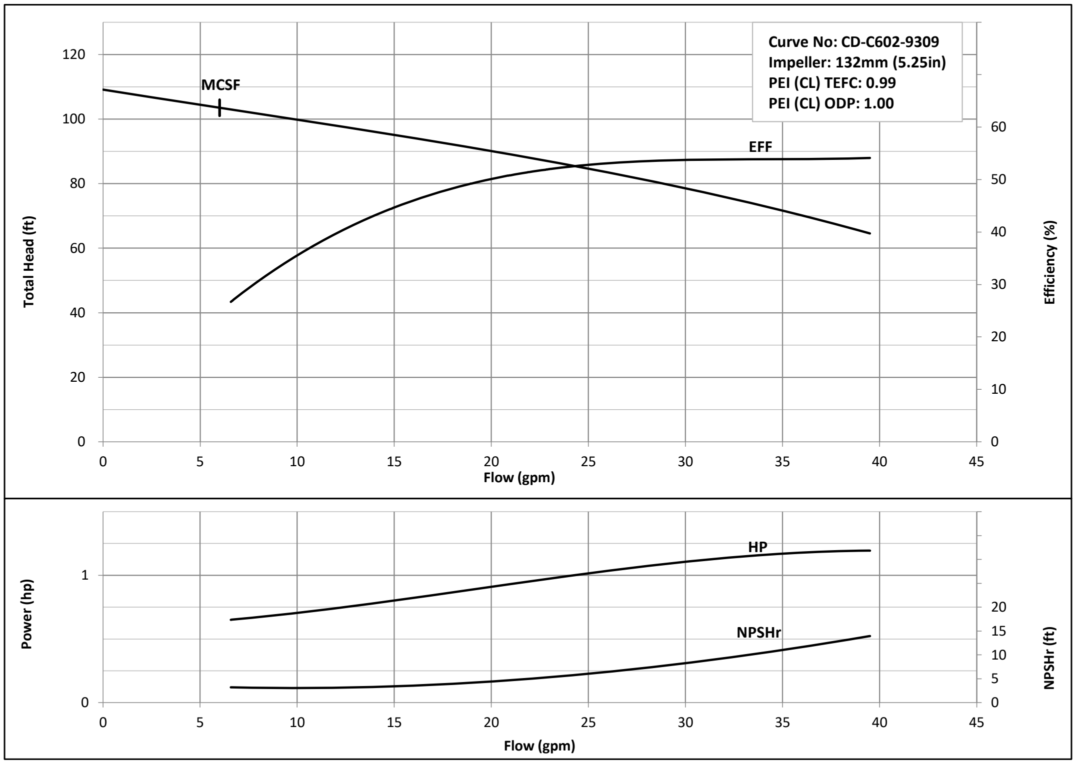


CDU70/1-$^{3}/_{4}$ HP — Nominal Speed: 3450 RPM — Size: 1 x 1$^{1}/_{4}$ x 4$^{1}/_{2}$

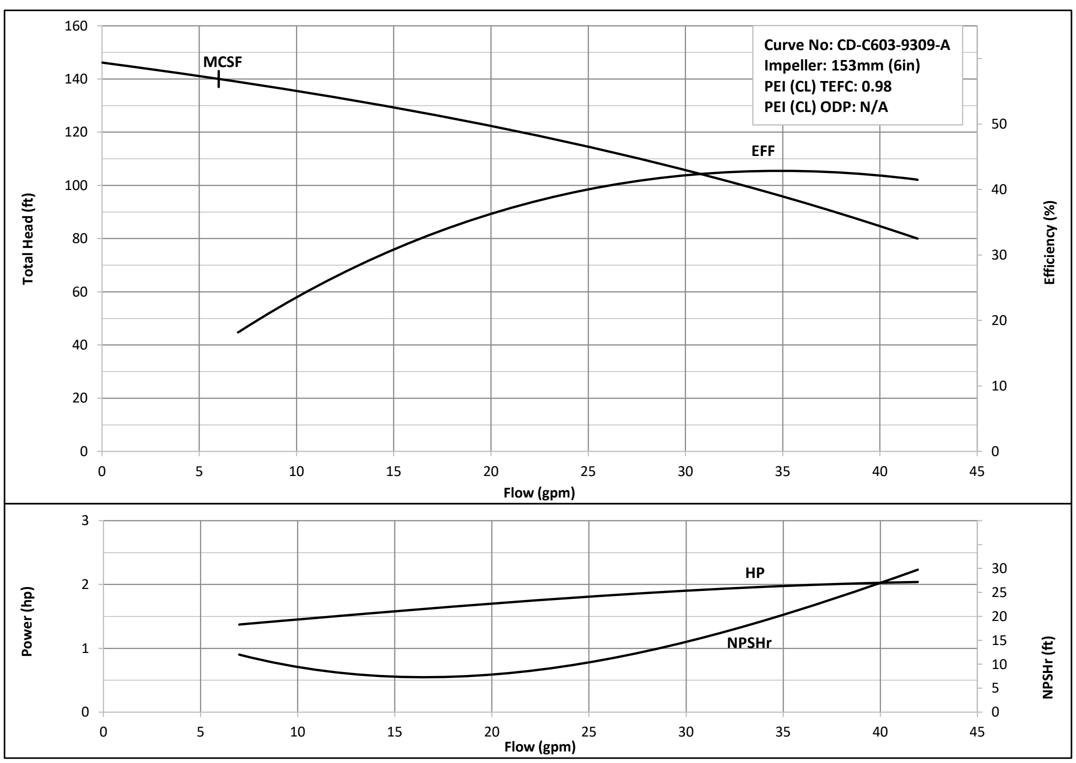


Performance Curves

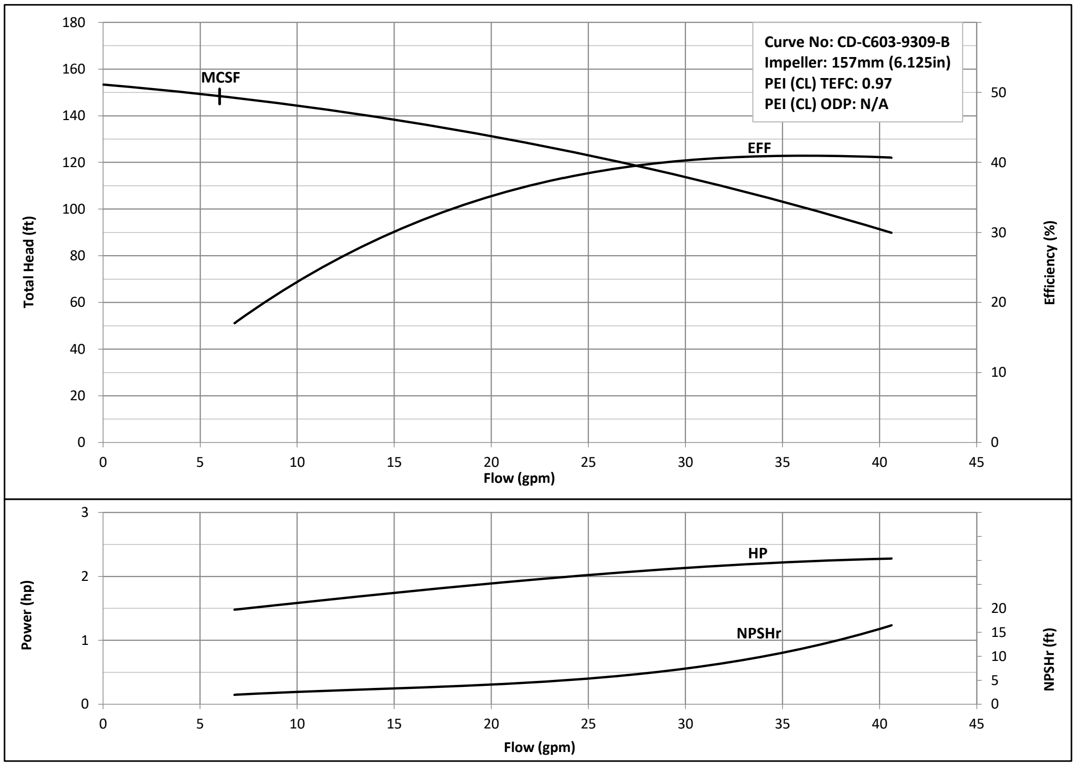
CDU70/3-1½ HP Nominal Speed: 3450 RPM Size: 1 x 1¼ x 5³⁄₁₆



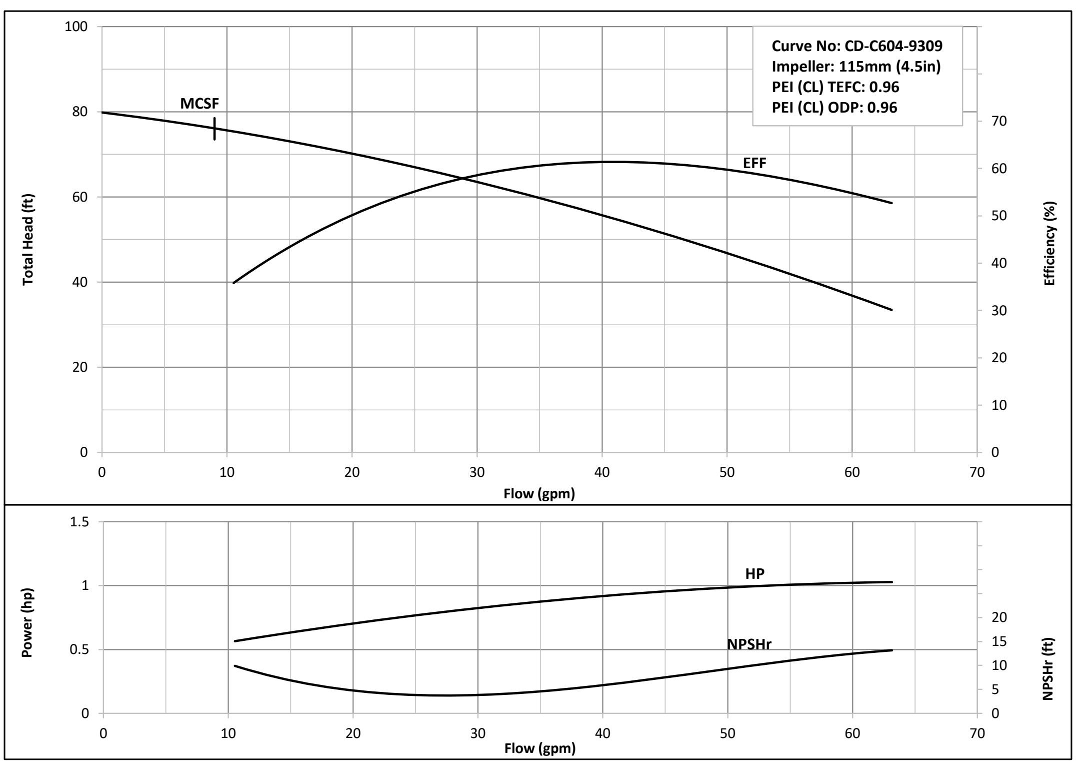
CDU70/5A- 2 HP Nominal Speed: 3450 RPM Size: 1 x 1¼ x 6



CDU70/5B-2HP Nominal Speed: 3450 RPM Size: 1 x 1$\frac{1}{4}$ x 6$\frac{3}{16}$



CDU120/1 1 HP Nominal Speed: 3450 RPM Size: 1 x 1$\frac{1}{4}$ x 4$\frac{1}{2}$

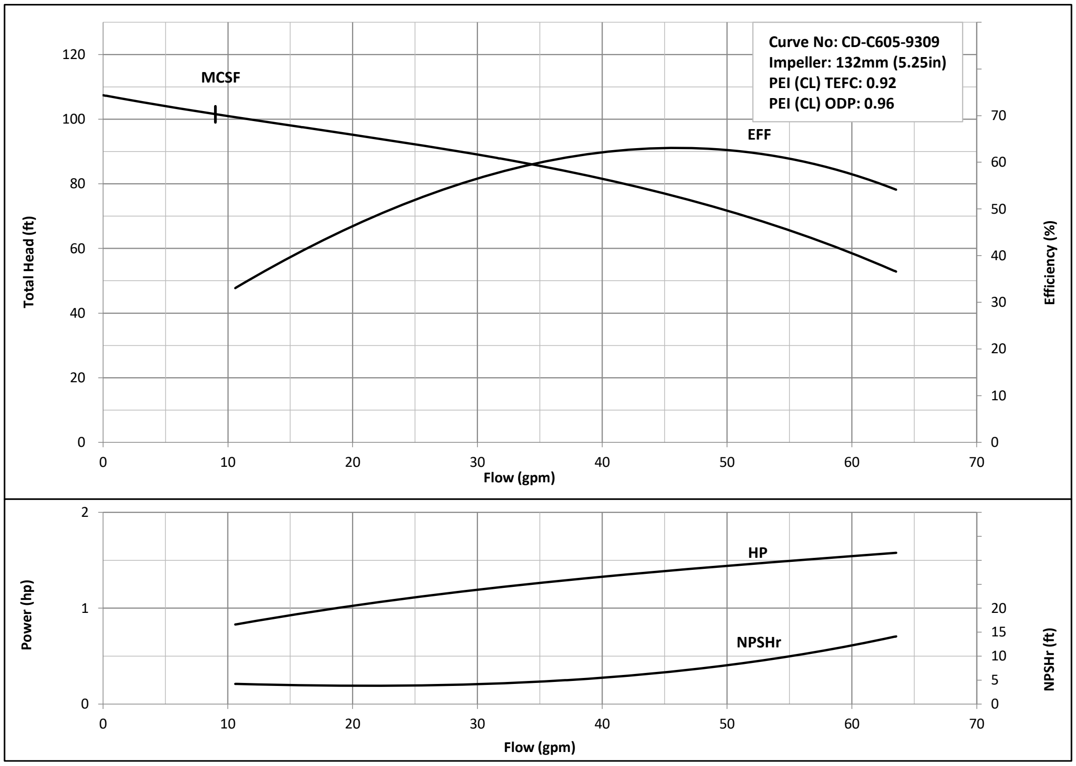


Model CDU

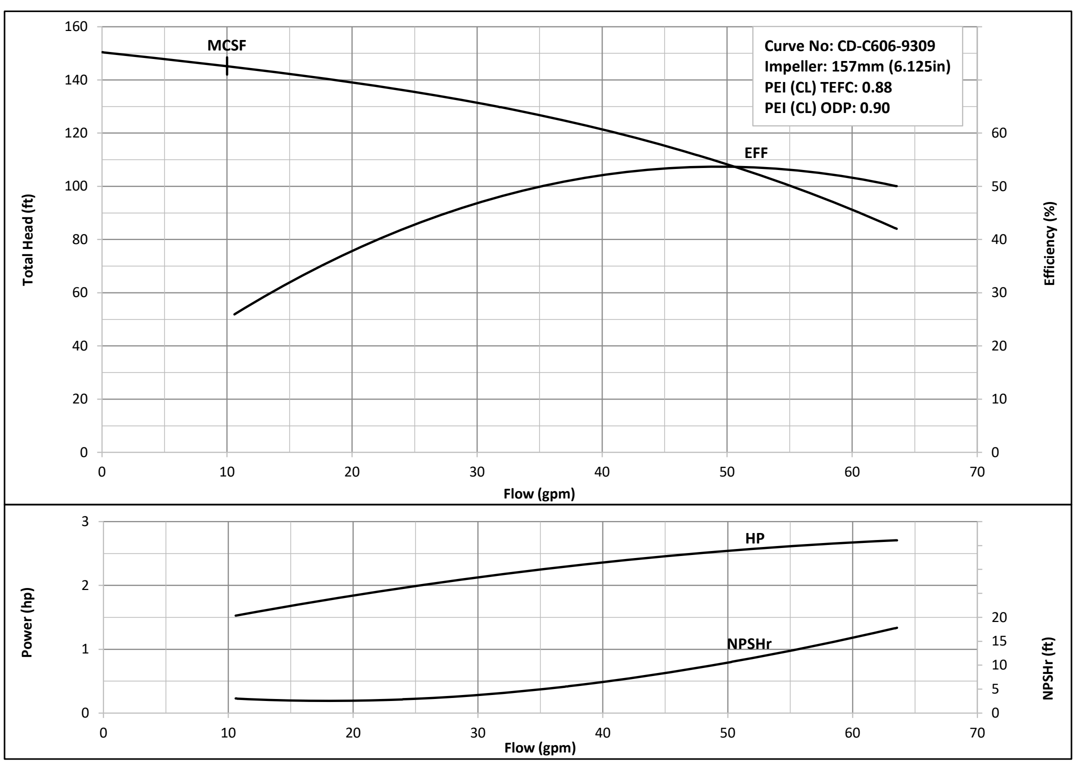
EBARA Stainless Steel Centrifugal Pumps

Performance Curves

CDU120/3-1 1/2 HP Nominal Speed: 3450 RPM Size: 1 x 1 1/4 x 5 3/16



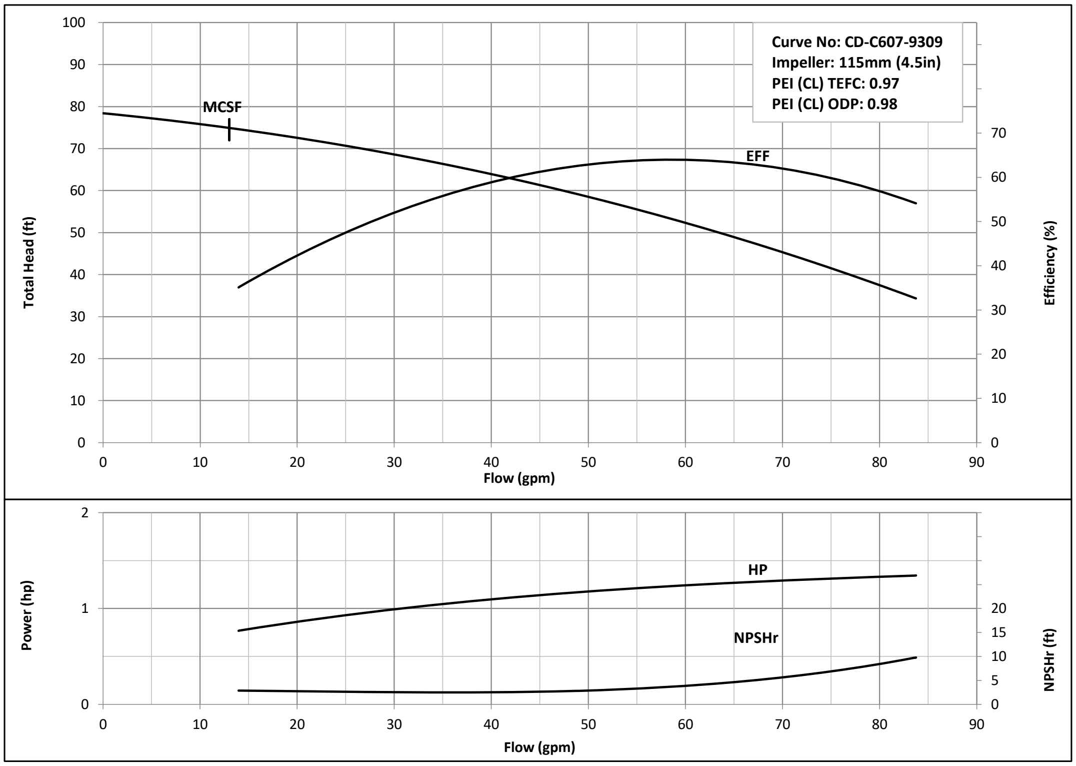
CDU120/5- 3 HP Nominal Speed: 3450 RPM Size: 1 x 1 1/4 x 6 3/16



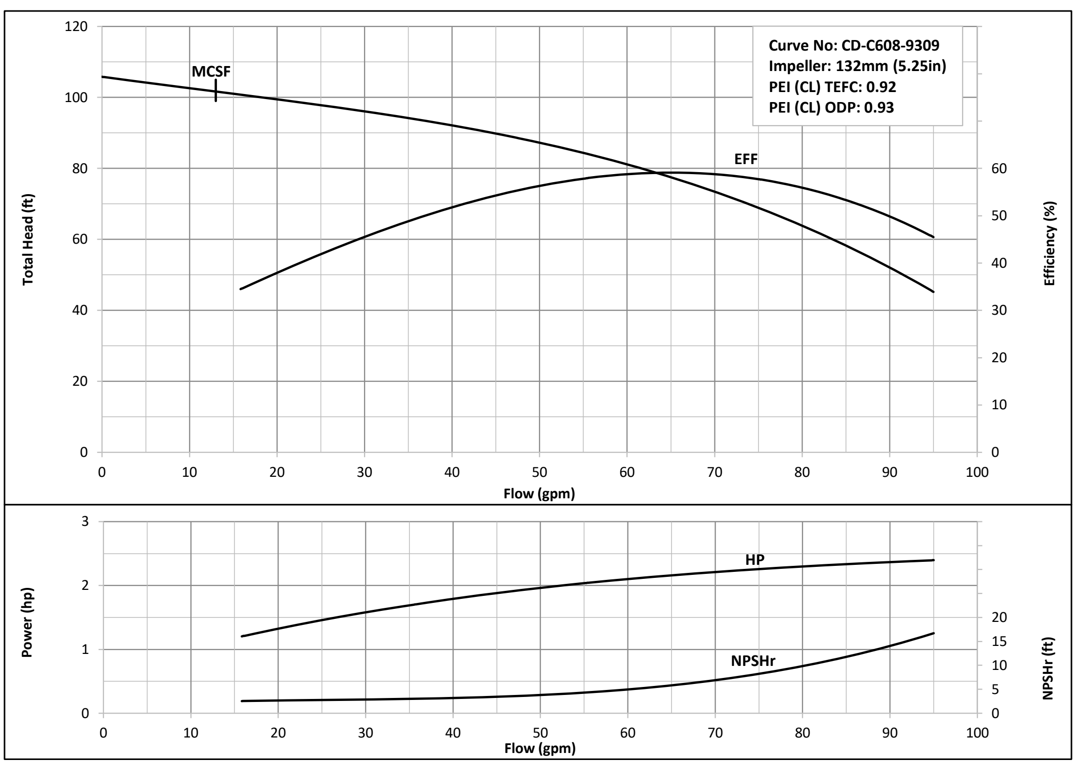
Model CDU — EBARA Stainless Steel Centrifugal Pumps

Performance Curves

CDU200/1-1½ HP — Nominal Speed: 3450 RPM — Size: 1 x 1½ x 4½



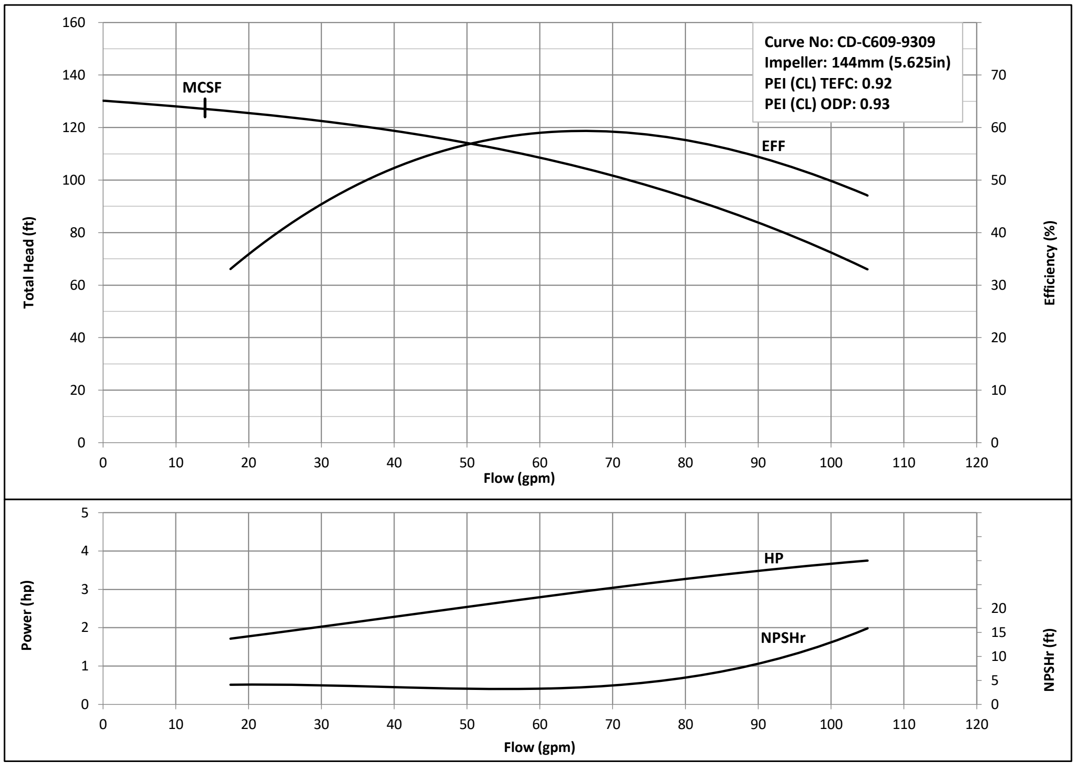
CDU200/3-3 HP — Nominal Speed: 3450 RPM — Size: 1 x 1½ x 5 3/16



Model CDU — EBARA Stainless Steel Centrifugal Pumps

Performance Curves

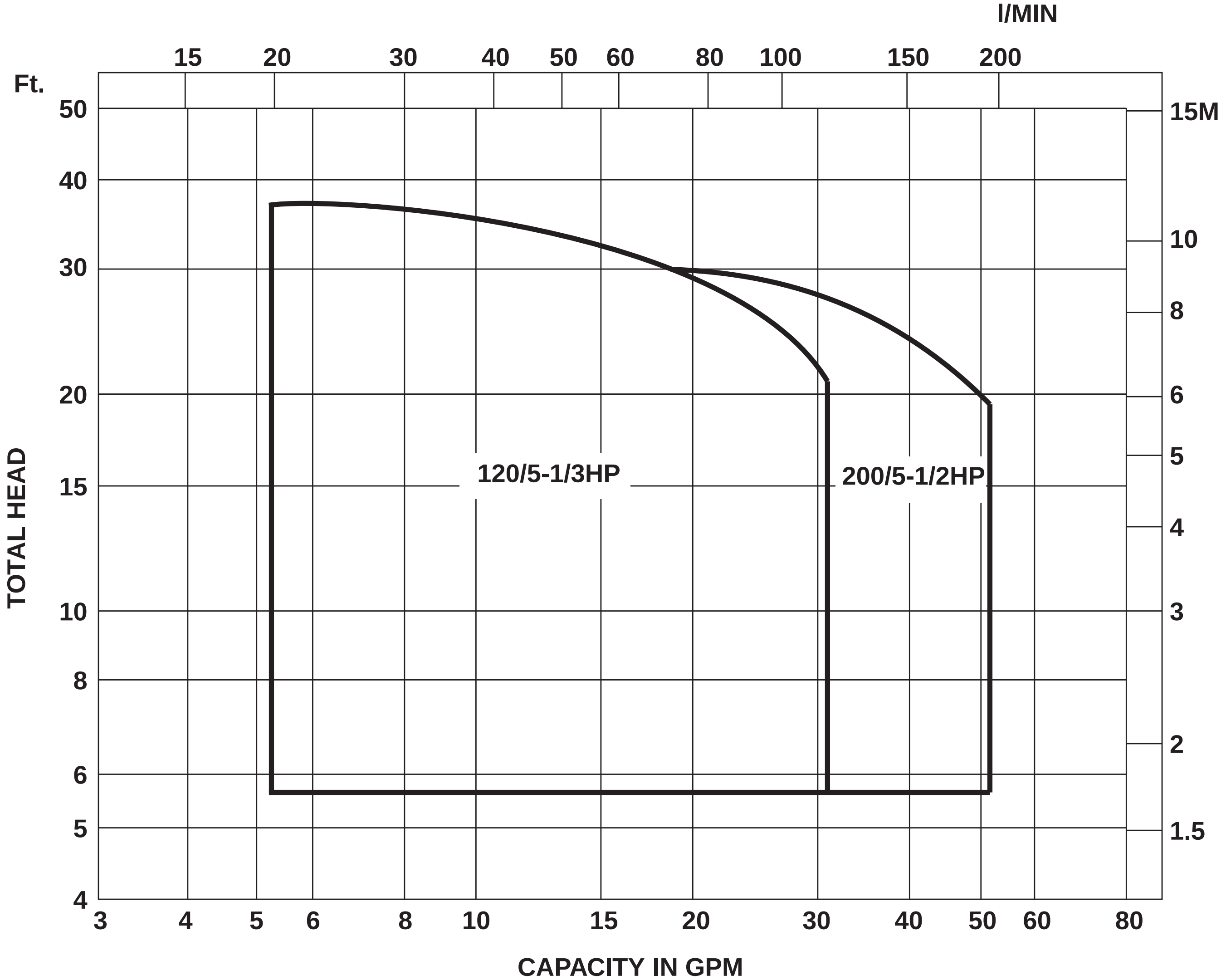
CDU200/5-3HP — Nominal Speed: 3450 RPM — Size: 1 x 1 1/2 x 5 11/16



Model CDU **EBARA Stainless Steel Centrifugal Pumps**

Selection chart

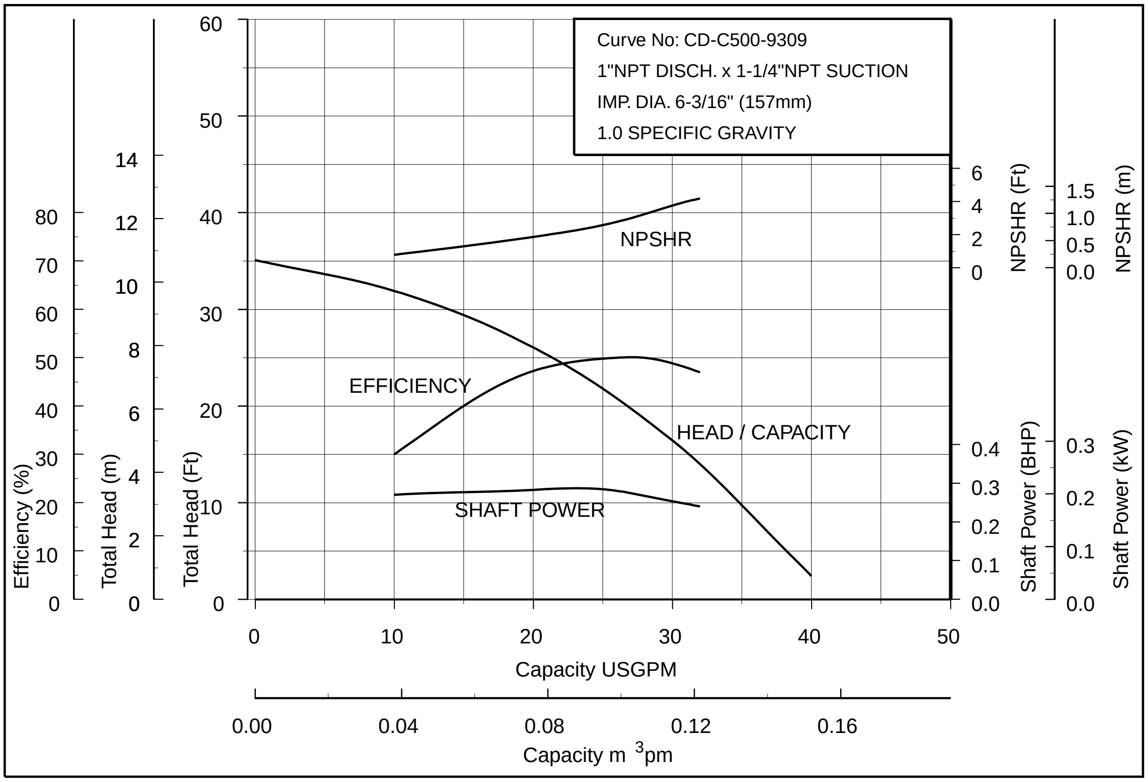
Nominal Speed 1725 RPM



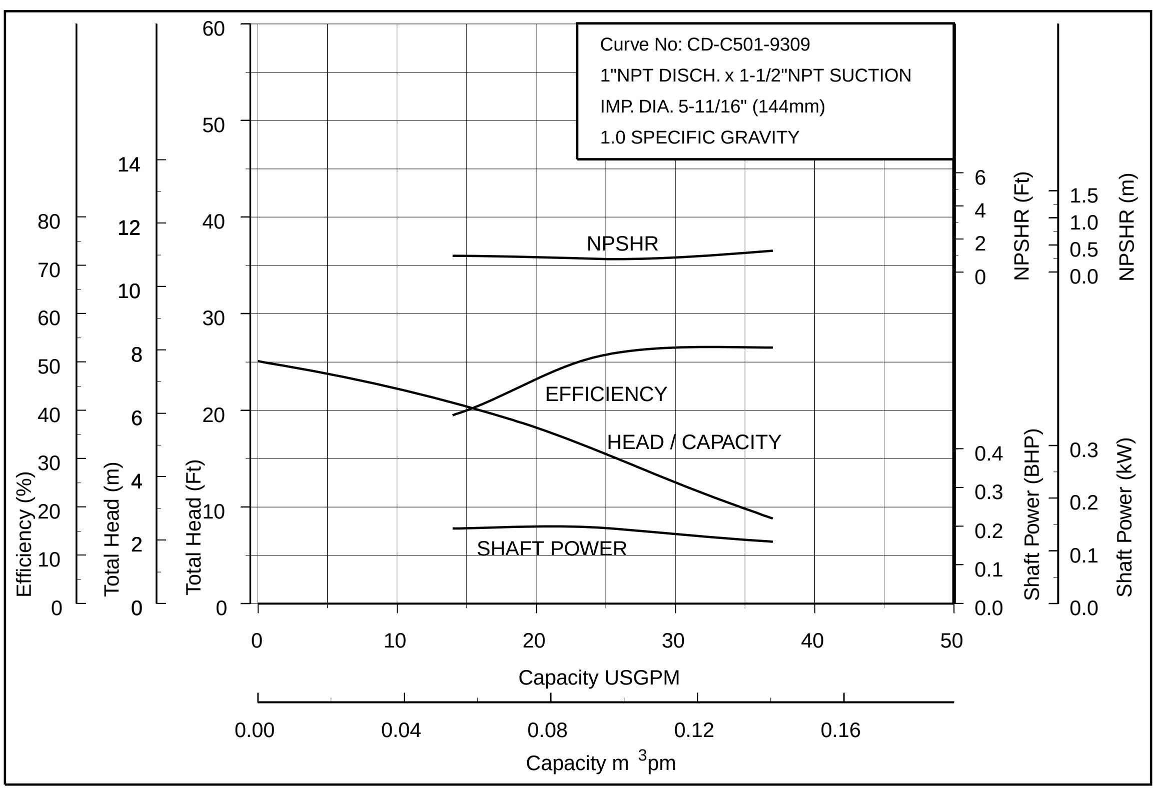
Model CDU **EBARA Stainless Steel Centrifugal Pumps**

Performance Curves

CDU4 120/5-1/3 HP Nominal Speed: 1725 RPM Size: 1 x 1 1/4 x 6 3/16



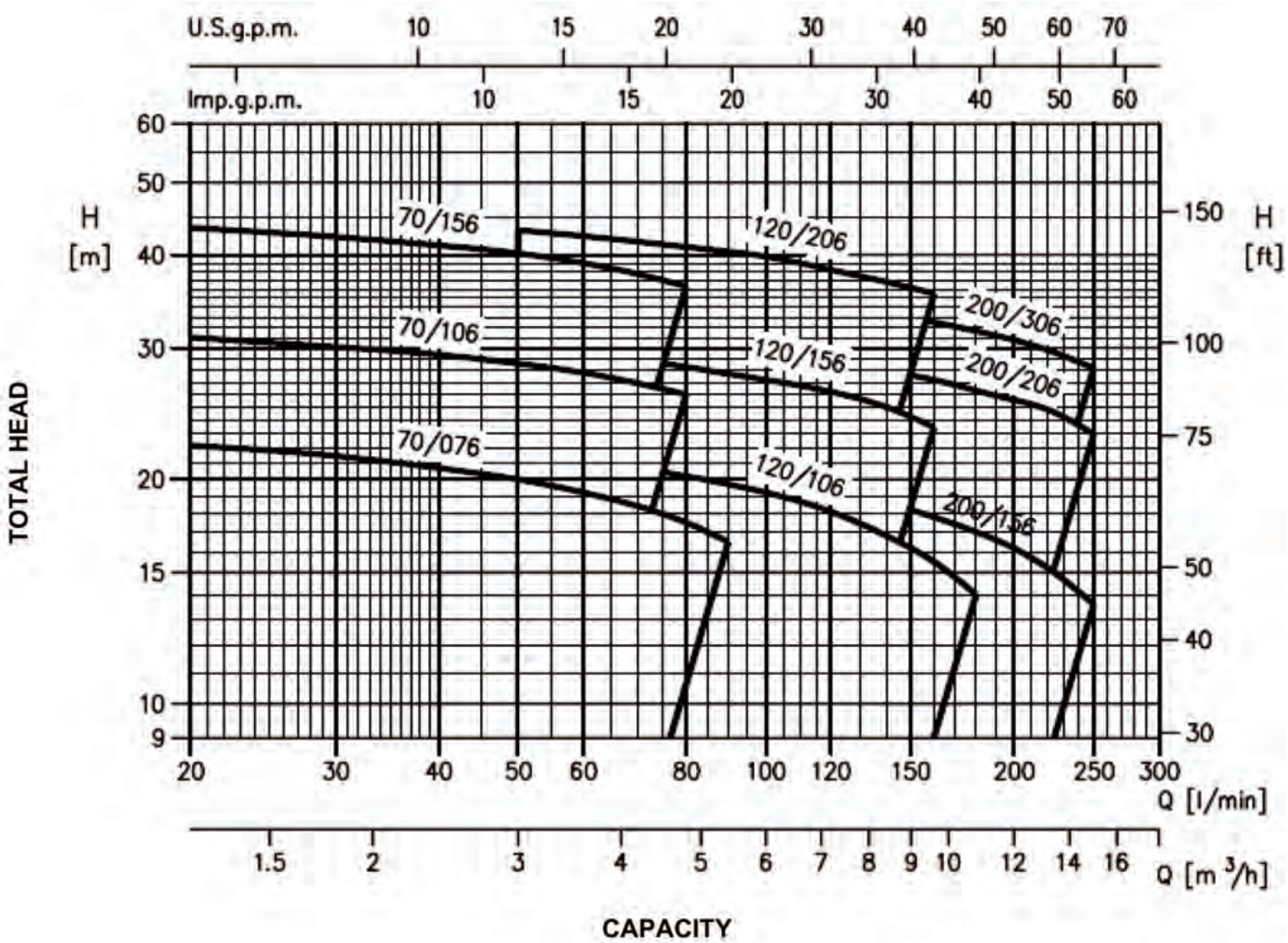
CDU4 200/5-1/2 HP Nominal Speed: 1725 RPM Size: 1 x 1 1/2 x 5 11/16



Model CDX

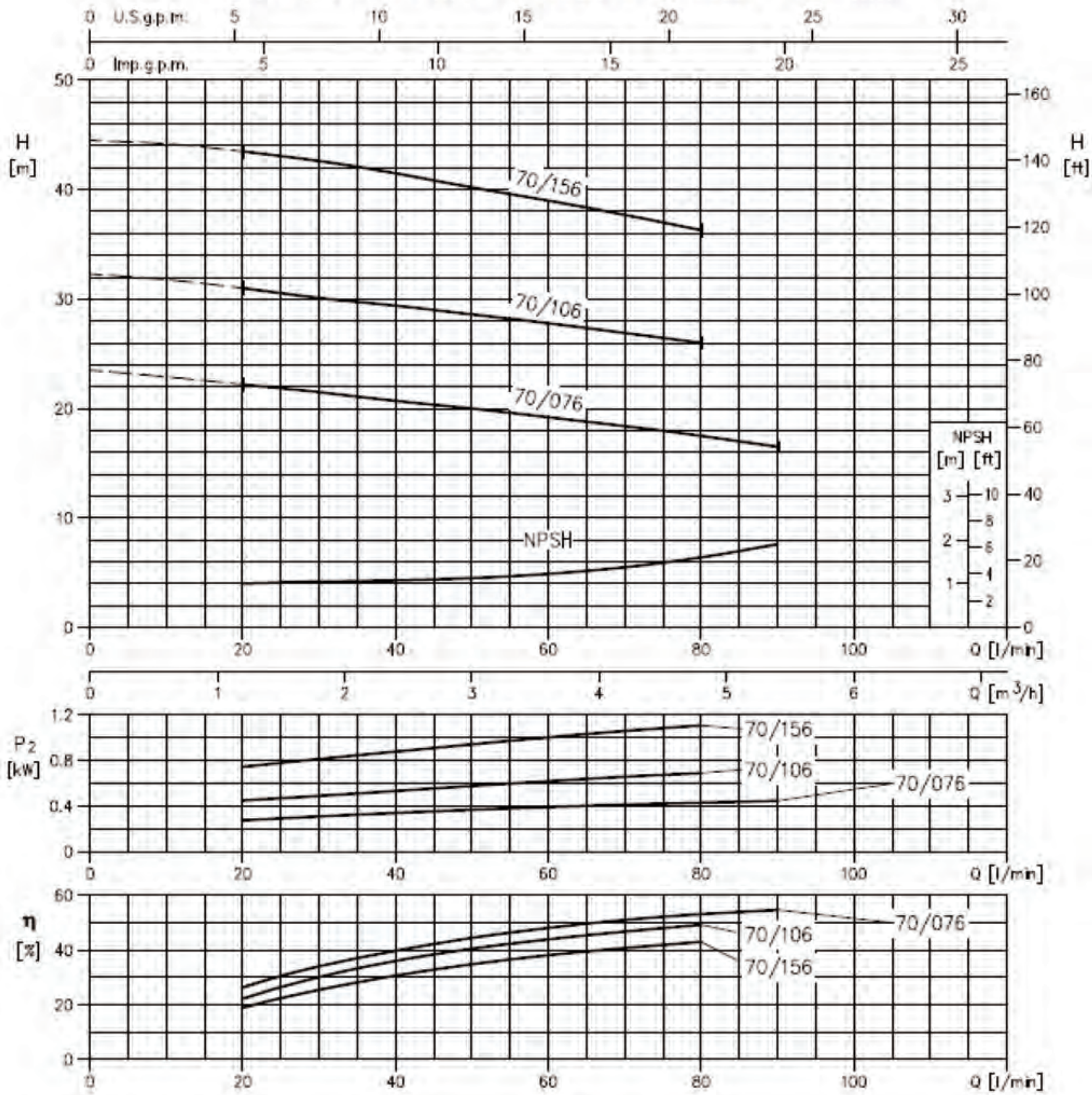
EBARA Stainless Steel Centrifugal Pumps

Selection Chart



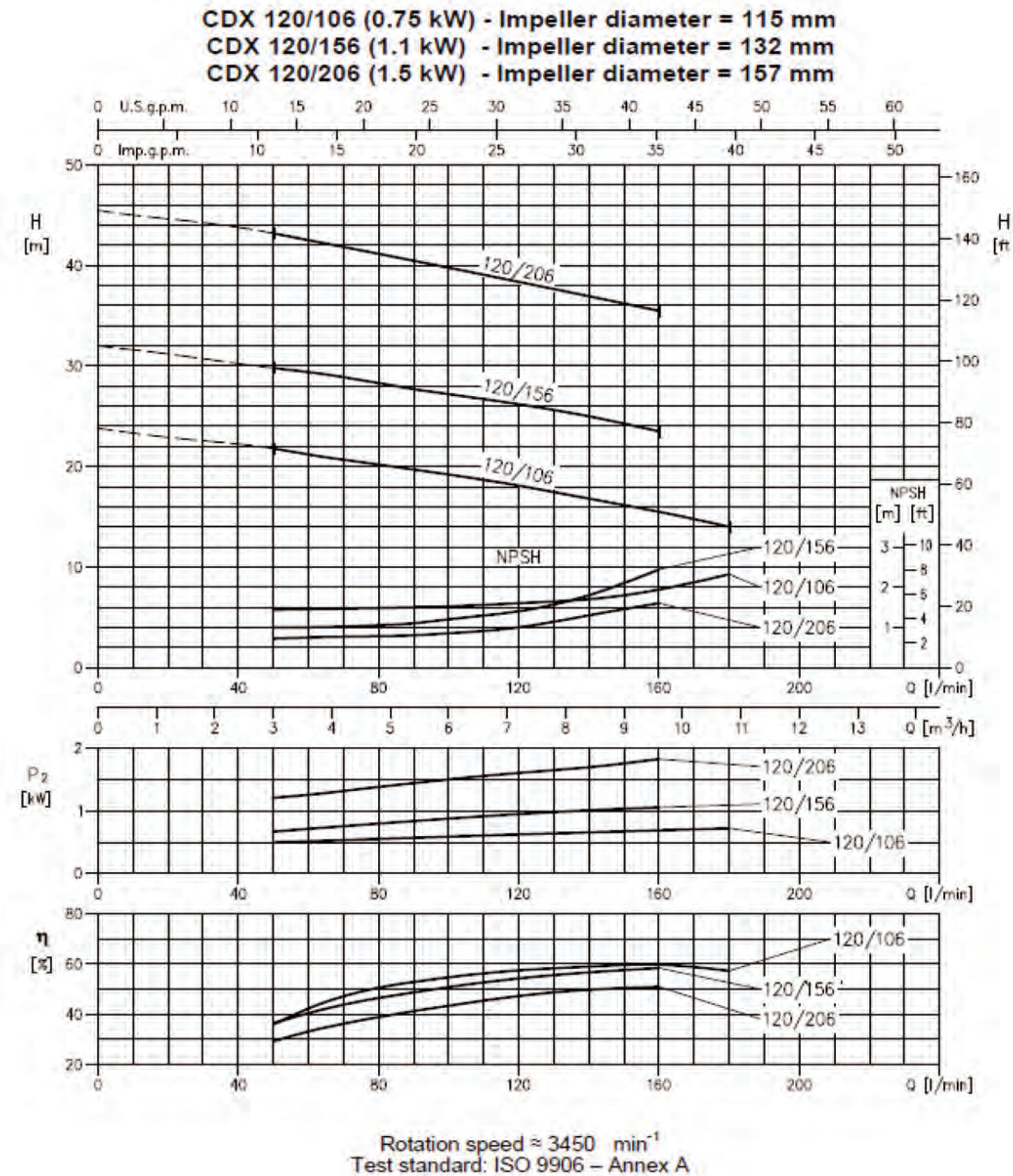
Performance Curves

CDX 70/076 (0.55 kW) - Impeller diameter = 115 mm
CDX 70/106 (0.75 kW) - Impeller diameter = 132 mm
CDX 70/156 (1.1 kW) - Impeller diameter = 157 mm



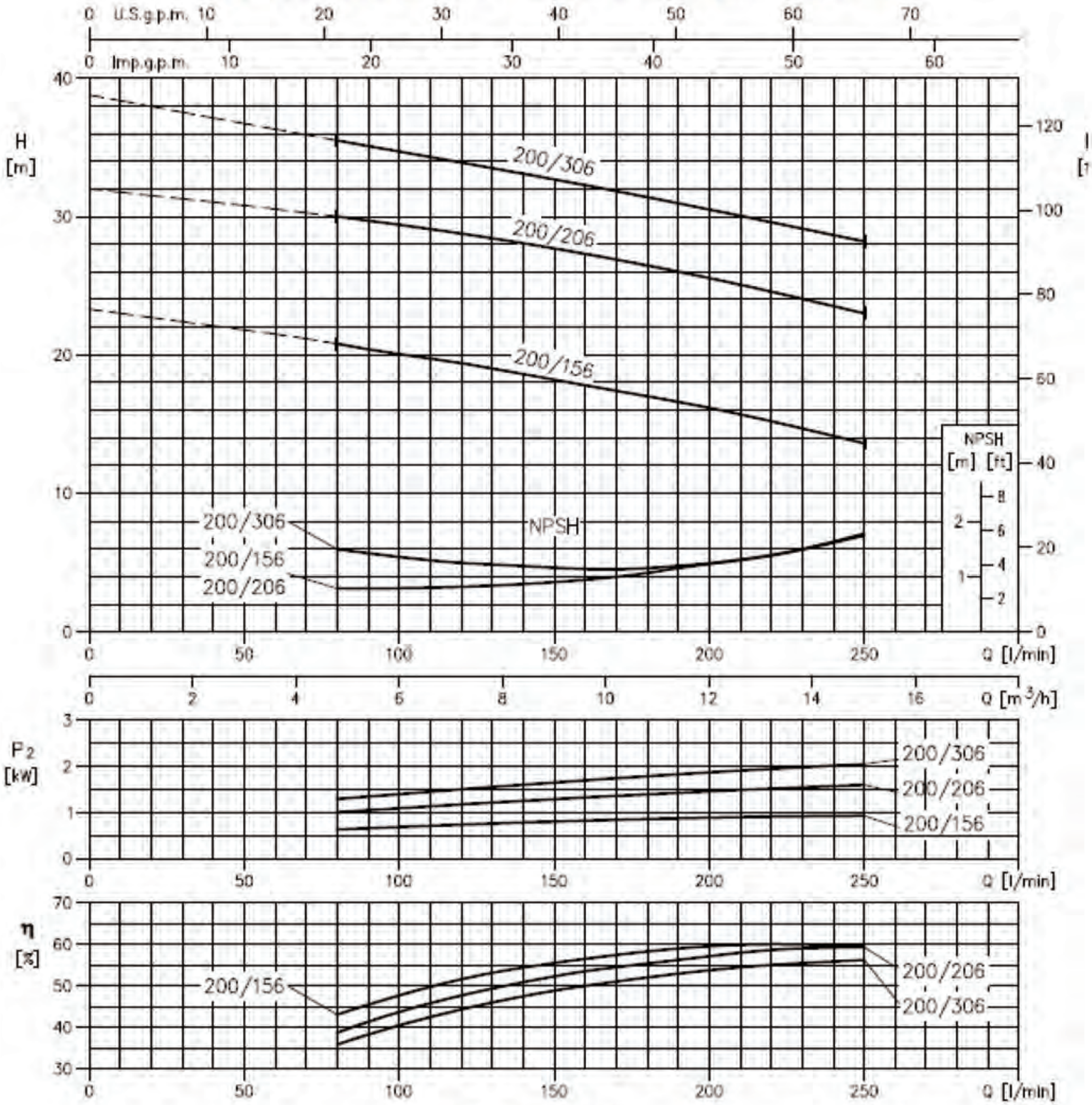
Rotation speed ≈ 3450 min^{-1}
Test standard: ISO 9906 – Annex A

Performance Curves



Performance Curves

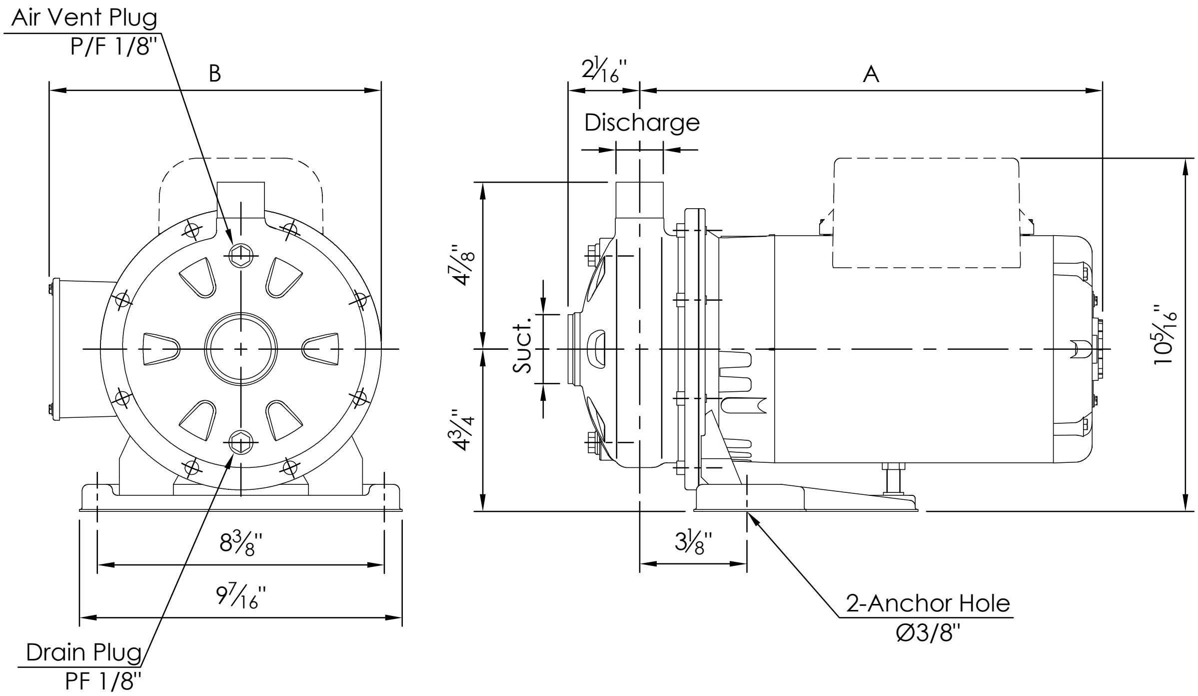
CDX 200/156 (1.1 kW) - Impeller diameter = 115 mm
CDX 200/206 (1.5 kW) - Impeller diameter = 132 mm
CDX 200/306 (2.2 kW) - Impeller diameter = 144 mm



Rotation speed ≈ 3450 min^{-1}
Test standard: ISO 9906 – Annex A

Model CDU — EBARA Stainless Steel Centrifugal Pumps

Pump Dimensions



Model CDU, 2-Pole Motor

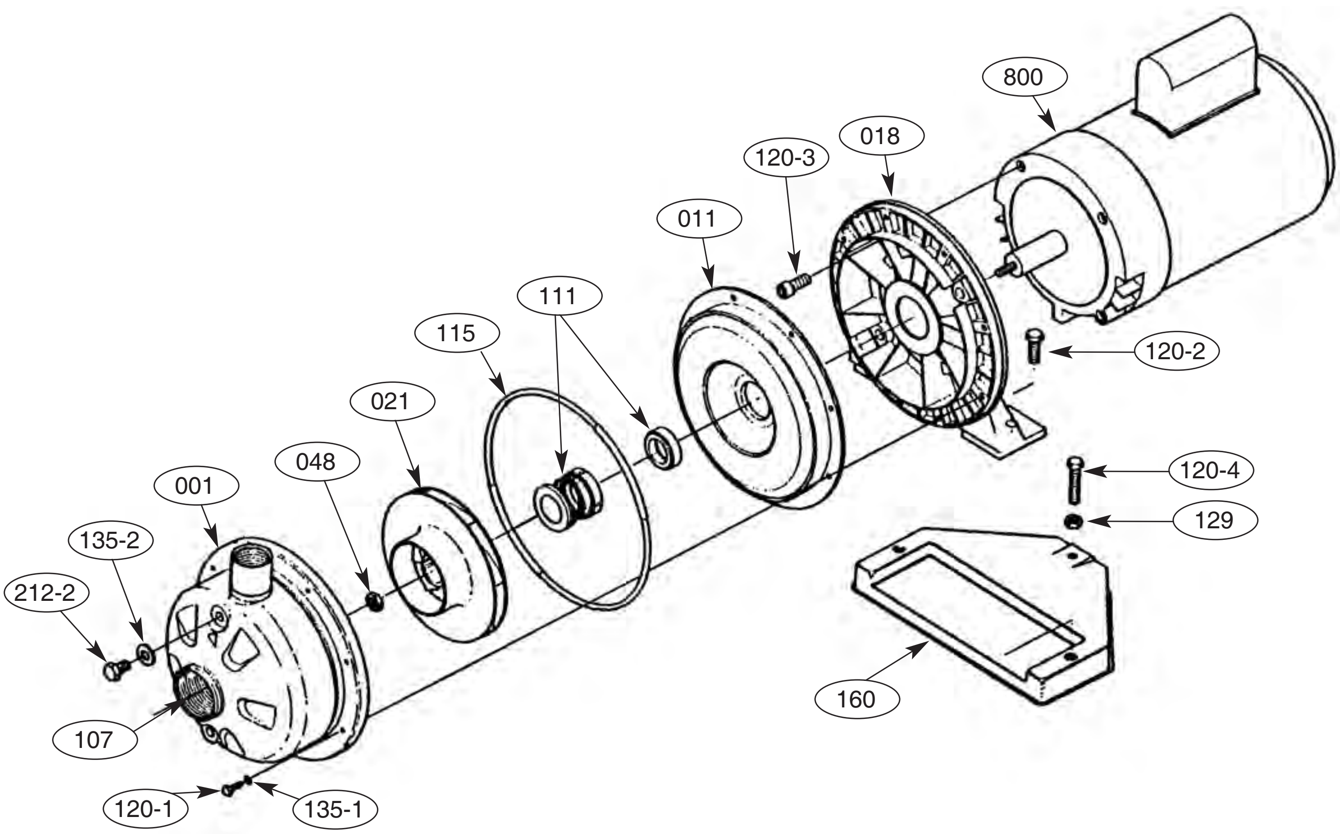
Model	Size	Pump Size – NPT (Inch)		Dimension (Inch)		Unit Weight (lbs.)			
						Single Phase		Three Phase	
		Suction	Discharge	A	B	ODP	TEFC	ODP	TEFC
CDU70/0-1/2HP	1 x 1 1/4 x 4 1/2	1 1/4	1	14 11/16	9 1/8	36	41	31	31
CDU70/1-3/4HP	1 x 1 1/4 x 4 1/2	1 1/4	1	15 3/16	9 1/8	36	41	31	31
CDU70/3-1 1/2HP	1 x 1 1/4 x 5 3/16	1 1/4	1	16 3/16	9 1/8	47	50	39	39
CDU70/5A-2HP	1 x 1 1/4 x 6 3/16	1 1/4	1	16 5/8	9 1/8	51	58	44	48
CDU70/5B-2HP	1 x 1 1/4 x 6 3/16	1 1/4	1	16 5/8	9 1/8	51	58	44	48
CDU120/1-1HP	1 x 1 1/4 x 4 1/2	1 1/4	1	15 11/16	9 1/8	41	46	33	32
CDU120/3-1 1/2HP	1 x 1 1/4 x 5 3/16	1 1/4	1	16 3/16	9 1/8	47	50	39	39
CDU120/5-3HP	1 x 1 1/4 x 6 3/16	1 1/4	1	17 3/8	9 1/8	59	66	51	60
CDU200/1-1 1/2HP	1 x 1 1/2 x 4 1/2	1 1/2	1	16 3/16	9 1/8	47	50	39	39
CDU200/3-3HP	1 x 1 1/2 x 5 3/16	1 1/2	1	17 3/8	9 1/8	58	65	50	59
CDU200/5-3HP	1 x 1 1/2 x 5 11/16	1 1/2	1	17 3/8	9 1/8	58	65	50	59

Model CDU, 4-Pole Motor

Model	Size	Pump Size – NPT (Inch)		Dimension (Inch)		Unit Weight (lbs.)			
						Single Phase		Three Phase	
		Suction	Discharge	A	B	ODP	TEFC	ODP	TEFC
CDU4120/5-1/3HP	1 x 1 1/4 x 6 3/16	1 1/4	1	13 11/16	9 5/16	32	31	31	30
CDU4200/5-1/2HP	1 x 1 1/2 x 5 11/16	1 1/2	1	14 11/16	9 5/16	35	31	31	31

Model CDU **EBARA Stainless Steel Centrifugal Pumps**

Sectional View

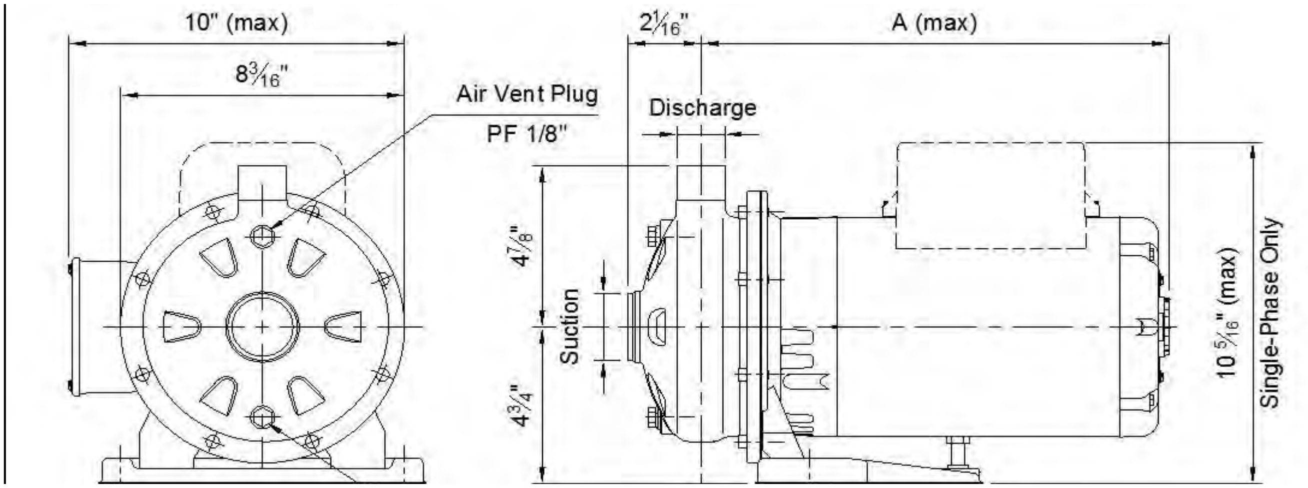


Part No.	Part Name	Material	No. for 1 Unit
001	Casing	304L Stainless	1
011	Casing cover	304L Stainless	1
018	Bracket	Aluminum	1
021	Impeller	304L Stainless	1
048	Impeller nut	304L Stainless	1
107	Casing ring	Viton	1
111	Mechanical seal	—	1
115	O-Ring	Viton	1
120-1	Bolt	304L Stainless	8
120-2	Bolt	304L Stainless	2
120-3	Bolt	304L Stainless	4
120-4	Bolt	304L Stainless	1
129	Nut	304L Stainless	1
135-1	Washer	304L Stainless	8
135-2	Washer	304L Stainless	2
160	Base	Steel	1
212-2	Plug	304L Stainless	2
800	Motor	—	1

Model CDX/CDXM

EBARA Stainless Steel Centrifugal Pumps

Pump Dimensions



Dimensions: inch

Phase	Model	HP	A	B	C	H	H1	H2	H3 [3~]	M	M1	N	N1	R	V [3~]
Three	CDX 70/076	0.75	8 3/16	12 5/8	7 1/8	9 1/16	4 3/16	4 7/8	8 1/8	1 15/16	1 1/2	4 3/4	6 5/16	4 1/4	M16x1.5
	CDX 70/106	1	8 3/16	12 5/8	7 1/8	9 1/16	4 3/16	4 7/8	8 1/8	1 15/16	1 1/2	4 3/4	6 5/16	4 1/4	M16x1.5
	CDX 70/156	1.5	8 3/16	13 1/16	7 1/8	9 1/16	4 3/16	4 7/8	8 1/8	1 15/16	1 1/2	4 3/4	6 5/16	4 1/4	M16x1.5
	CDX 120/106	1	8 3/16	12 5/8	7 1/8	9 1/16	4 3/16	4 7/8	8 1/8	1 15/16	1 1/2	4 3/4	6 5/16	4 1/4	M16x1.5
	CDX 120/156	1.5	8 3/16	13 1/16	7 1/8	9 1/16	4 3/16	4 7/8	8 1/8	1 15/16	1 1/2	4 3/4	6 5/16	4 1/4	M16x1.5
	CDX 120/206	2	8 3/16	14 1/8	7 13/16	9 1/16	4 3/16	4 7/8	8 7/8	2 3/16	1 9/16	5 1/2	7 1/16	4 1/8	M20x1.5
	CDX 200/156	1.5	8 3/16	12 5/8	7 1/8	9 1/16	4 3/16	4 7/8	8 1/8	1 15/16	1 1/2	4 3/4	6 5/16	4 1/4	M16x1.5
	CDX 200/206	2	8 3/16	14 1/8	7 13/16	9 1/16	4 3/16	4 7/8	8 7/8	2 3/16	1 9/16	5 1/2	7 1/16	4 1/8	M20x1.5
	CDX 200/306	3	9 1/8	14 1/8	7 13/16	9 13/16	4 5/8	5 3/16	9 5/16	2 3/16	1 9/16	5 1/2	7 1/16	4 1/8	M20x1.5

Dimensions: mm

Phase	Model	HP	A	B	C	H	H1	H2	H3 [3~]	M	M1	N	N1	R	V [3~]
Three	CDX 70/076	0.75	208	320	181	229.5	106	123.5	207	50	38	120	160	108	M16x1.5
	CDX 70/106	1	208	320	181	229.5	106	123.5	207	50	38	120	160	108	M16x1.5
	CDX 70/156	1.5	208	332	181	229.5	106	123.5	207	50	38	120	160	108	M16x1.5
	CDX 120/106	1	208	320	181	229.5	106	123.5	207	50	38	120	160	108	M16x1.5
	CDX 120/156	1.5	208	332	181	229.5	106	123.5	207	50	38	120	160	108	M16x1.5
	CDX 120/206	2	208	359	198.5	229.5	106	123.5	225	55	40	140	180	105.5	M20x1.5
	CDX 200/156	1.5	208	320	181	229.5	106	123.5	207	50	38	120	160	108	M16x1.5
	CDX 200/206	2	208	359	198.5	229.5	106	123.5	225	55	40	140	180	105.5	M20x1.5
	CDX 200/306	3	232	359	198.5	250	118	132	237	55	40	140	180	105.5	M20x1.5

Dimensions: inch

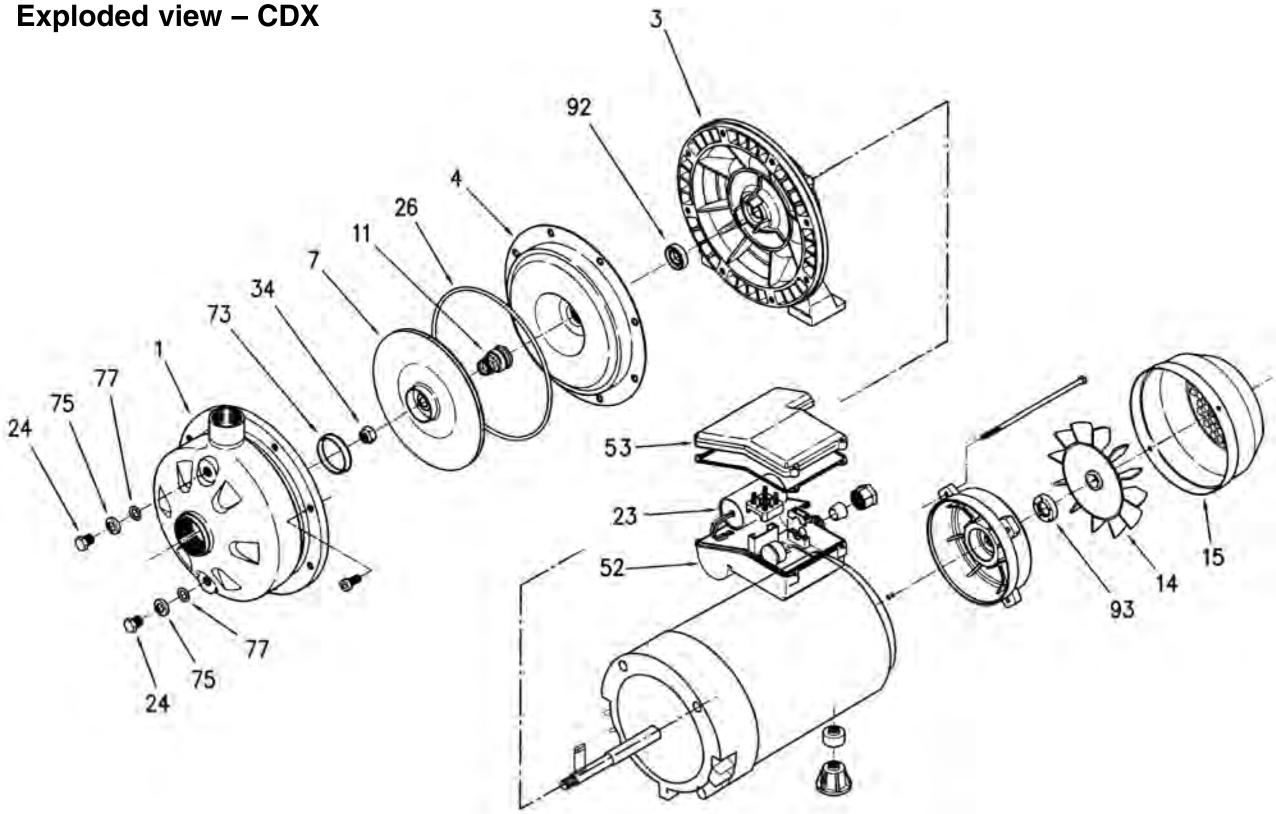
Phase	Model	HP	A	B	C	H	H1	H2	H4 [1~]	M	M1	N	N1	R	T [1~]
Single	CDXM 70/076	0.75	8 3/16	12 5/8	7 1/8	9 1/16	4 3/16	4 7/8	8 1/2	1 15/16	1 1/2	4 3/4	6 5/16	4 1/4	PG 11
	CDXM 70/106	1	8 3/16	12 5/8	7 1/8	9 1/16	4 3/16	4 7/8	8 1/2	1 15/16	1 1/2	4 3/4	6 5/16	4 1/4	PG 11
	CDXM 70/156	1.5	8 3/16	12 5/8	7 1/8	9 1/16	4 3/16	4 7/8	8 1/2	1 15/16	1 1/2	4 3/4	6 5/16	4 1/4	PG 11
	CDXM 120/106	1	8 3/16	12 5/8	7 1/8	9 1/16	4 3/16	4 7/8	8 1/2	1 15/16	1 1/2	4 3/4	6 5/16	4 1/4	PG 11
	CDXM 120/156	1.5	8 3/16	12 5/8	7 1/8	9 1/16	4 3/16	4 7/8	8 1/2	1 15/16	1 1/2	4 3/4	6 5/16	4 1/4	PG 11
	CDXM 120/206	2	8 3/16	13 11/16	7 13/16	9 1/16	4 3/16	4 7/8	9 13/16	2 3/16	1 9/16	5 1/2	7 1/16	4 1/8	PG 13.5
	CDXM 200/156	1.5	8 3/16	12 5/8	7 1/8	9 1/16	4 3/16	4 7/8	8 1/2	1 15/16	1 1/2	4 3/4	6 5/16	4 1/4	PG 11
	CDXM 200/206	2	8 3/16	13 11/16	7 13/16	9 1/16	4 3/16	4 7/8	9 5/16	2 3/16	1 9/16	5 1/2	7 1/16	4 1/8	PG 13.5

Dimensions: mm

Phase	Model	HP	A	B	C	H	H1	H2	H4 [1~]	M	M1	N	N1	R	T [1~]
Single	CDXM 70/076	0.75	208	321	181	229.5	106	123.5	216	50	38	120	160	108	PG 11
	CDXM 70/106	1	208	321	181	229.5	106	123.5	216	50	38	120	160	108	PG 11
	CDXM 70/156	1.5	208	321	181	229.5	106	123.5	216	50	38	120	160	108	PG 11
	CDXM 120/106	1	208	321	181	229.5	106	123.5	216	50	38	120	160	108	PG 11
	CDXM 120/156	1.5	208	321	181	229.5	106	123.5	216	50	38	120	160	108	PG 11
	CDXM 120/206	2	208	347	198.5	229.5	106	123.5	249	55	40	140	180	105.5	PG 13.5
	CDXM 200/156	1.5	208	321	181	229.5	106	123.5	216	50	38	120	160	108	PG 11
	CDXM 200/206	2	208	347	198.5	229.5	106	123.5	237	55	40	140	180	105.5	PG 13.5

Sectional View

Exploded view – CDX



Location No.	Part Name	Material	No. for 1 Unit
001	Casing	304 Stainless	1
003	Motor bracket	Cast Aluminum	1
004	Casing cover	304 Stainless	1
007	Impeller	304 Stainless	1
011	Mechanical seal	Carbon/Ceramic	1
014	Fan	Polypropolene	1
015	Fan Cover	Steel	1
023	Capacitor	Single Phase only	1
024	Priming/Drain plug	304 Stainless	2
026	O-Ring	NBR	1
032	Key	304 Stainless	1
034	Impeller nut	304 Stainless	1
052	Terminal box	Plastic	1
053	Terminal cover	Plastic	1
073	Casing ring	NBR	1
075	Washer	304 Stainless	2
077	O-ring	NBR	2
092	Lip seal	–	1
093	Lip seal	–	1

Electrical Data

3/4 to 1 HP, Single Phase, 115V

Hz	Poles	Phase	Output (HP)	Voltage (V)	Applicable Model
60	2	Single	0.75-1	115	CDXM70

Name-Plate Rating	MOTOR MODEL		70/076	70/106
	Output	HP	0.75	1
		KW	0.55	0.75
	Phase		1	1
	Poles		2	2
	Volts		115	115
	Amperes		7.5	9.4
	Speed		3430	3450
	Insulation Class		F	F
Capacity of Capacitor µF		Start	-	-
		Run	45	60
No Load Test	Amperes		3.22	6.23
	Watts		230	354
Resistance at 20°C	Ohms		1.357	0.921
100% Load	Current		7.7	9.6
	Efficiency		65.0	66.1
	Power Factor		97.2	89.2
	Speed		3449	3445
Locked Rotor Torque			0.40	0.68
Start Current			28.1	40.94
Number Starts per Hour			30	
Voltage Tolerance			±6	

Model CDX/CDXM

EBARA Stainless Steel Centrifugal Pumps

Electrical Data

3/4 to 2 HP, Single Phase, 230V

Hz	Poles	Phase	Output (HP)	Voltage (V)	Applicable Model
60	2	Single	0.75-2	230	CDXM

			70/076	70/106	70/156	120/106	120/156	120/206	200/156	200/206
Name-Plate Rating	MOTOR MODEL		70/076	70/106	70/156	120/106	120/156	120/206	200/156	200/206
	Output	HP	0.75	1	1	1	1.5	2	1.5	2
		KW	0.55	0.75	1.1	0.75	1.1	1.5	1.1	1.5
	Phase		1	1	1	1	1	1	1	1
	Poles		2	2	2	2	2	2	2	2
	Volts		230	230	230	230	230	230	230	230
	Amperes		3.4	5.2	7.9	5.2	7.2	11.3	6.7	10.2
	Speed		3420	3430	3425	3425	3440	3475	3450	3490
	Insulation Class		F	F	F	F	F	F	F	F
Capacity of Capacitor µF		Start	-	-	-	-	-	-	-	-
		Run	12.5	14	25	14	25	35	20	35
No Load Test	Amperes		2.8	2.95	3.94	2.95	3.94	5.73	5.05	5.73
	Watts		335	325	502	325	502	529	485	529
Resistance at 20°C	Ohms		5.19	3.5	2.082	3.5	2.082	0.96	2.166	0.96
100% Load	Current		4.09	5.3	7.2	5.3	7.2	10.5	6.7	10.5
	Efficiency		62.1	67.7	70.1	67.7	70.1	80.3	67.7	80.3
	Power Factor		91.8	81.4	91.6	81.4	91.6	88.7	90.9	88.7
	Speed		3429	3512	3458	3512	3458	6492	3459	3492
Locked Rotor Torque			0.53	0.66	0.82	0.66	0.82	1.49	0.82	1.49
Start Current			17.34	19.9	23.9	20.1	23.9	32.6	23.9	32.6
Number Starts per Hour			30							
Voltage Tolerance			±6							

Model CDX

Electrical Data

3/4 to 3 HP, Three Phase, 230V

Hz	Poles	Phase	Output (HP)	Voltage (V)	Applicable Model
60	2	Three	0.75-3	230	CDX

			70/076	70/106	70/156	120/106	120/156	120/206	200/156	200/206	200/306
Name-Plate Rating	MOTOR MODEL		70/076	70/106	70/156	120/106	120/156	120/206	200/156	200/206	200/306
	Output	HP	0.75	1	1	1	1.5	2	1.5	2	3
		KW	0.55	0.75	1.1	0.75	1.1	1.5	1.1	1.5	2.2
	Phase		3	3	3	3	3	3	3	3	3
	Poles		2	2	2	2	2	2	2	2	2
	Volts		230	230	230	230	230	230	230	230	230
	Amperes		1.9	2.9	3.8	2.8	4	7.5	3.8	7.5	7.5
	Speed		3330	3450	3350	3350	3375	3480	3380	3500	3360
	Insulation Class		F	F	F	F	F	F	F	F	F
No Load Test	Amperes		1.12	2.02	2.52	2.02	2.52	4.6	2.52	4.6	4.6
	Watts		134	158	82	158	82	114	82	114	114
Resistance at 20°C	Ohms		12.6	7.06	3.2	7.06	3.2	1.34	3.2	1.34	1.34
100% Load	Current		1.98	2.8	4.28	2.8	4.28	8.16	4.28	8.16	8.16
	Efficiency		63.2	68.1	82.74	68.1	82.7	82.9	82.3	82.9	84.1
	Power Factor		73.6	74.2	76.3	74.2	76.3	77	76.3	77	77
	Speed		3418	3436	3447	3436	3447	3480	3447	3480	3480
Locked Rotor Torque			2.54	4.17	7.55	4.17	7.55	12.41	7.55	12.41	12.41
Start Current			6.55	17.2	25.7	17.2	25.7	58.23	25.7	58.23	58.23
Number Starts per Hour			30								
Voltage Tolerance			±10								

Model CDX

EBARA Stainless Steel Centrifugal Pumps

Electrical Data

3/4 to 3 HP, Three Phase, 460V

Hz	Poles	Phase	Output (HP)	Voltage (V)	Applicable Model
60	2	Three	0.75-3	460	CDX

			70/076	70/106	70/156	120/106	120/156	120/206	200/156	200/206	200/306
Name-Plate Rating	MOTOR MODEL		70/076	70/106	70/156	120/106	120/156	120/206	200/156	200/206	200/306
	Output	HP	0.75	1	1.5	1	1.5	2	1.5	2	3
		KW	0.55	0.75	1.1	0.75	1.1	1.5	1.1	1.5	2.2
	Phase		3	3	3	3	3	3	3	3	3
	Poles		2	2	2	2	2	2	2	2	2
	Volts		460	460	460	460	460	460	460	460	460
	Amperes		1.2	1.6	2.2	1.7	2.2	4.1	2.2	4.1	4.1
	Speed		3330	3450	3350	3350	3375	3480	3380	3500	3360
	Insulation Class		F	F	F	F	F	F	F	F	F
No Load Test	Amperes		0.65	1.17	1.27	1.17	1.27	2.30	1.27	2.30	2.3
	Watts		134	158	82	158	82	114	82	114	114
Resistance at 20°C	Ohms		37.9	21.2	9.6	21.2	9.6	4.01	9.6	4.01	4.01
100% Load	Current		1.15	1.62	2.15	1.62	2.15	4.10	2.15	4.10	4.10
	Efficiency		63.2	68.1	84.44	68.1	84.44	87.4	84.44	87.4	87.4
	Power Factor		73.6	74.2	76.3	74.2	76.3	77	76.3	77	77
	Speed		3418	3436	3447	3436	3447	3480	3447	3480	3480
Locked Rotor Torque			3.37	5.53	9.98	5.53	9.98	16.41	9.98	16.41	16.41
Start Current			3.28	8.60	17.2	8.60	17.2	38.9	17.2	38.9	38.9
Number Starts per Hour			30								
Voltage Tolerance			±10								

Models 912, 913, 918, 919 ASME Section VIII, Steam/Air/Gas/ Liquid, 'UV' National Board Certified. Also available for Vacuum Service

Model 912

Pressure and Temperature Limits

Models 912, 913, 918, 919: – Steam
3 to 250 psig [-20 to 17 barg][1]
-60° to 406°F [-51° to 208°C]

Models 912, 918: – Air/Gas/Liquid
3 to 300 psig [-20 to 21 barg]
-60° to 406°F [-51° to 208°C]

Models 913, 919: – Air/Gas/Liquid
3 to 900 psig [-20 to 62 barg]
-60° to 406°F [-51° to 208°C]

Vacuum – 6- through 29-inch HG
[200 through 1000 mbarg] – 300°F [149°C]

Maximum back pressure 50 psig [3 barg]
- threaded cap and packed lever

Applications

- Air/gas compressors - intercoolers - aftercoolers.
- Liquid filled pressure vessels/systems - ASME Section VIII (UV).
- Pressure vessels - containing gas, air, liquid or steam. Including tanks and receivers.
- Vacuum systems including pumps, tanks and equipment.
- Optional materials for low temperature - cryogenic applications.
- Oil/gas separators.
- Overpressure relief and protection of pumps, tanks, lines and hydraulic systems.
- By-pass relief or pressure regulation.

Features and Benefits

- **Available** with soft seat.
- **Threaded cap** is standard (back pressure tight).
- **Hex on valve nozzle** provides for easy installation.
- **Single control ring** offers easy adjustability of blowdown.
- **Pivoting disc design** corrects misalignment and offers exceptional performance.
- **Guide to nozzle ratio** reduces friction.
- **Full nozzle design** for optimum flow performance.
- **Threaded side outlet** for piped off discharge to eliminate fugitive emissions.

Model Descriptions

Model 912: Full nozzle design. SS warn ring and disc with brass/bronze base. Bronze/brass body and bonnet.

Model 913: Full nozzle design. Bronze/ brass body and bonnet. 316 SS trim (base, disc and disc holder).

Model 918: Same as Model 912 except resilient seat/seal. Superior 'leak-free' performance.

Model 919: Same as Model 913 except resilient seat/seal. Superior 'leak-free' performance. Bronze body and bonnet. 316 SS trim (base, disc and disc holder).

Options

- Threaded cap. (Variation 01)
- Threaded cap with gag. (Variation 02)
- Plain lever. (Variation 03)
- Plain lever with gag. (Variation 04)
- Plain lever with vibration dampener. (Variation 05)
- Packed lever. (Variation 06)
- Packed lever with gag. (Variation 07)

Note

1. ASME standard valves for air or steam service must have lift lever. For steam boilers and generators.

Models 912, 913, 918, 919 ASME Section VIII, Steam/Air/Gas/ Liquid, ‘UV’ National Board Certified. Also available for Vacuum Service

Service Recommendations for Resilient Seat/Seal Materials

Seat/Seal Materials[1]	Service Recommendation
BUNA-N (-40° to 200°F) [-40° to 93°C]	Air, Anhydrous Ammonia, Butane, Carbon Dioxide, Diesel Oil, Ethyl Chloride, Ethyl Ether, Freons #11 and 12, Fuel Oil, Gasoline, Helium, Hydrogen Sulphide, Kerosene, Lube Oil, Natural Gas, Nitrogen, Oxygen (Gas), Propane, Propylene, Sulphur Dioxide, Vinyl Chloride
Viton® A (-10° to 406°F) [-23° to 208°C]	Acetone, Air, Amyl Alcohol, Aniline, Benzine, Butane, Carbon Disulphide, Carbon Tetrachloride Dowtherm ‘A’ and ‘E’, Ethyl Chloride, Ethylene, Ethylene Glycol, Ethyl Alcohol, Gasoline, Hexane, Hydrogen Sulphide, Isobutyl Alcohol, JP - 4 Fuel, JP - 5 Fuel, Kerosene, Lube Oil, Natural Gas, Naphtha, Nitrogen, Propane, Propylene, Propyl Alcohol, Sulphur Dioxide, Toluene, Trichloroethylene, Turpentine, Water, Xylene
Silicone (-100° to 406°F) [-73° to 208°C]	Air, Helium, Nitrogen, Oxygen (Gas)
Ethylene Propylene (-70° to 400°F) [-57° to 205°C]	Steam, Hot Water
Neoprene (-45° to 300°F)[-43° to 149°C]	Air, Anhydrous Ammonia, Butane, Butyl Alcohol, Castor Oil Denatured Alcohol, Ethanol, Ethyl Alcohol, Freons (12, 13, 14 and 22), Glycols, Natural Gas and Silicate Esters

Note

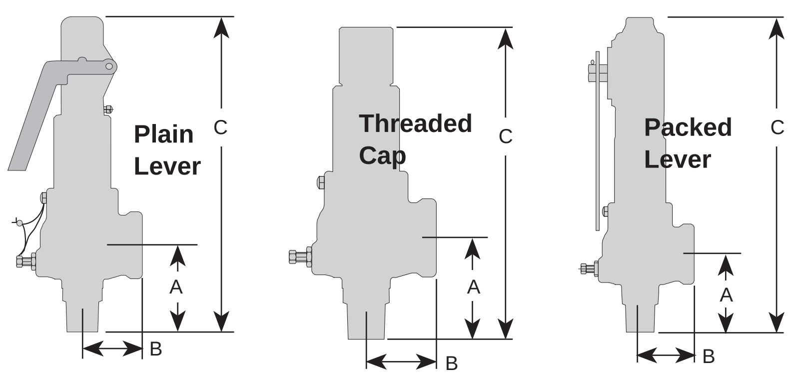
1. These recommendations are a guide only. For the final selection of the proper material, your experience with available elastomers of various lading fluids should be considered.

Specifications

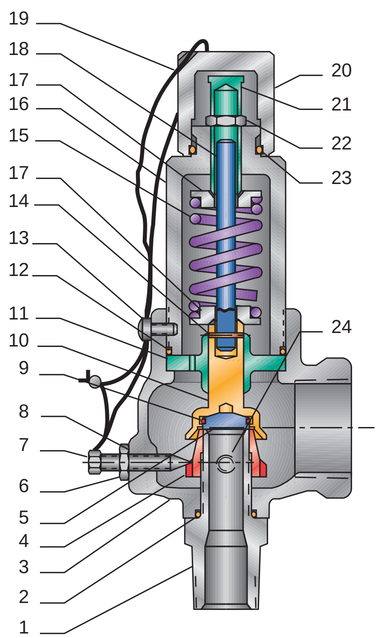
Model[2] Number	Orifice	Connections ANSI Standard Inlet	Connections ANSI Standard Outlet	Maximum Set Pressure psig [barg] 912-918[4]	Maximum Set Pressure psig [barg] 913-919[5]	Dimensions, in [mm] A	B	C Plain Lever	C Threaded Cap	C Packed Lever	Approx. Weight lb [kg]
9*BDC	D	1/2” [12.7]	3/4” [19.0]	300 [20.7]	900 [62.1]	2 3/8 [60]	1 5/8 [41]	8 3/8 [213]	7 1/4 [184]	9 [229]	3 [1.4]
9*BDC	D	1/2” [12.7]	1” [25.4]	300 [20.7]	900 [62.1]	2 3/8 [60]	1 5/8 [41]	8 3/8 [213]	7 1/4 [184]	9 [229]	3 [1.4]
9*BDD[3]	D	3/4” [19.0]	3/4” [19.0]	— —	900 [62.1]	2 3/8 [60]	1 5/8 [41]	8 3/8 [213]	7 1/4 [184]	9 [229]	3 [1.4]
9*BDE[3]	D	1” [25.4]	1” [25.4]	— —	900 [62.1]	2 5/8 [67]	1 5/8 [41]	8 5/8 [219]	7 1/2 [191]	9 1/8 [232]	3 [1.4]
9*BED	E	3/4” [19.0]	1 1/4” [31.8]	300 [20.7]	900 [62.1]	2 5/8 [67]	2 [51]	8 3/4 [222]	7 5/8 [194]	9 3/8 [238]	4 [1.8]
9*BEF[3]	E	1 1/4” [31.8]	1 1/4” [31.8]	— —	900 [62.1]	3 [76]	2 [51]	9 1/8 [232]	8 [203]	9 3/4 [248]	4 [1.8]
9*BFE	F	1” [25.4]	1 1/2” [38.1]	300 [20.7]	600 [41.4]	2 7/8 [73]	2 3/8 [60]	9 7/8 [251]	8 3/4 [222]	10 1/2 [267]	6 [2.7]
9*BFG[3]	F	1 1/2” [38.1]	1 1/2” [38.1]	— —	600 [41.4]	3 [76]	2 3/8 [60]	10 [254]	8 7/8 [225]	10 5/8 [270]	6 [2.7]
9*BGF	G	1 1/4” [31.8]	2” [50.8]	300 [20.7]	600 [41.4]	3 1/4 [89]	2 5/8 [67]	11 1/4 [286]	10 1/8 [257]	11 3/4 [298]	8 [3.6]
9*BGH[3]	G	2” [50.8]	2” [50.8]	— —	600 [41.4]	3 1/4 [89]	2 5/8 [67]	11 1/4 [286]	10 1/8 [257]	11 3/4 [298]	8 [3.6]
9*BHG	H	1 1/2” [38.1]	2 1/2” [63.5]	300 [20.7]	500 [34.5]	3 1/2 [89]	2 3/4 [70]	13 [330]	11 1/8 [283]	12 1/2 [318]	11 [5.0]
9*BJH	J[6]	2” [50.8]	3” [76.2]	300 [20.7]	500 [34.5]	4 [102]	3 1/4 [89]	14 1/2 [368]	12 1/2 [318]	15 1/8 [384]	15 [6.8]

Notes

1. Maximum temperature controlled by resilient seat/seal material.
2. Replace asterisk with desired Model Number. Data applicable to all models.
3. Available with SS trim only.
4. Maximum pressure on steam is 250°F.
5. Maximum pressure on steam is 300°F.
6. For C dimensions: pressures above 200 psig [14 barg] add 1.25-inch [31.8 mm] to the overall height.



Models 912, 913, 918, 919 ASME Section VIII, Steam/Air/Gas/ Liquid, 'UV' National Board Certified. Also available for Vacuum Service



Parts and Materials - Models 912, 913, 918, 919 Threaded Cap

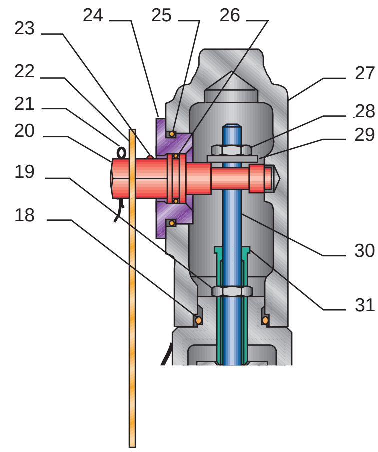
No.	Part Name	Materials
1	Nozzle[1]	Brass, B21 Alloy 485, (SS, A351-CF8M[1] Models 913, 919 only)
2	O-ring Body	Teflon®
3	Body	Bronze, B584 Alloy 84400
4	Warn Ring	SS, A743-CF8M
5	Disc[2]	SS, A479-316
6	Set Screw Nut	Brass, B16
7	Set Screw	Brass, B16
8	Seal	Teflon®
9	Retainer Ring	SS, A313-316
10	Disc Holder	Brass, B16, (SS A351-CF8M Models 913, 919 only)
11	Guide[3]	Brass, B16
12	Bonnet O-ring	Teflon®
13	Screw	SS, Commercial 18-8
14	Coiled Spring Pin	SS, A313-302
15	Spring	Steel A231/A231M, Cadmium Plated SS: A313-302 SS: A313-316 Alloy steel: A681-H12
16	Bonnet[4]	Brass, B16
17	Spring Step	Brass, B16
18	Stem	Brass, B16
19	Wire and Seal	SS wire and Lead seal, Commercial
20	Cap	Brass, B16
21	Compression Screw	Brass, B16
22	Jam Nut	Brass, B16
23	Cap O-ring	BUNA-N
24	Body Plug[5]	Brass, B16
25	Guide Guide Locknut Shield	Brass, B16 Brass, B16 SS, A167-316
26	Disc Holder Spindle	Brass, B16 (Model 912 only) Brass, B16 (Model 912 only)

Notes

1. F through J orifice nozzle material is Bronze, B62.
2. | Material | Letter Designation |
   |---|---|
   | Viton®-A | A |
   | BUNA-N | B |
   | Silicone | S |
3. G through J orifice guide material is Bronze, B584, Alloy 84400.
4. F through J orifice bonnet material is Bronze, B584, Alloy 84400.
5. Body plug and tapped hole not available for liquid service.

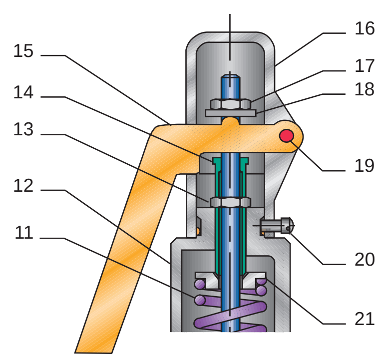
Models 912, 913, 918, 919 ASME Section VIII, Steam/Air/Gas/ Liquid, 'UV' National Board Certified. Also available for Vacuum Service

Parts and Materials - Model 912 Packed Lever



No.	Part Name	Materials
18	Cap O-ring	BUNA-N 70 Duro, Commercial
19	Jam Nut	Brass, B16
20	Lift Cam	SS, A743 CF8M
21	Cotter Pin	Steel, Commercial
22	Lever	Zinc Plated Steel, A108
23	Drive Screw	SS, Commercial
24	Retainer Nut	Brass, B16
25	Retainer O-ring	BUNA-N 70 Duro, Commercial
26	Lift Cam O-ring	BUNA-N 70 Duro, Commercial
27	Cap	Bronze, B584 Alloy 84400
28	Lift Nut	SS, A479 316
29	Lift Washer	SS, A479 316
30	Stem	Brass, B16
31	Compression Screw	Brass, B16
32	Coiled Spring Pin	SS, A313 302
33	Body Plug[4]	Brass, B16
34	Guide Guide Locknut Shield	Brass, B16 Brass, B16 SS, A167 316

Parts and Materials - Model 912 Plain Lever



No.	Part Name	Materials
11	Spring	Cadmium plated steel: A231/A231M SS: A313-302 SS: A313-316 Alloy steel: A681-H12
12	Bonnet[3]	Brass, B16
13	Jam Nut	Brass, B16
14	Compression Screw	Brass, B16
15	Lever	Steel Cadmium Plated, A109
16	Cap	Brass, B179
17	Lift Nut	SS, A479-316
18	LIft Washer	SS, A479-316
19	Rivet	Steel, Commercial
20	Screw	SS, Commercial GR. 18-8
21	Spring Step	Brass, B16
22	Disc Holder Spindle	Brass, B16 Brass, B16

Models 912, 913, 918, 919 ASME Section VIII, Steam/Air/Gas/Liquid, 'UV' National Board Certified. Also available for Vacuum Service

Model Number/Order Guide

Model Number Position	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Example	9	1	2	B	J	H	M	0	1	—	K	C	0	3	0	0

Model (positions 0–2)
912
913
918
919

Connection Model (position 3)
B - Male x Female Threaded or NPT

Orifice (position 4)

D	G
E	H
F	J

Inlet Size (position 5)

C	-	1/2-inch	[15 mm]	F	-	1 1/4-inch	[32 mm]
D	-	3/4-inch	[18 mm]	G	-	1 1/2-inch	[40 mm]
E	-	1-inch	[25 mm]	H	-	2-inch	[50 mm]

Seat/Seal Material (position 6)
M - Metal-to-metal
B - BUNA-N 200°F [93°C]
E - EPR 350°F [177°C]
S - Silicone 406°F [208°C]
V - Viton® 406°F [208°C]
N - Neoprene 300°F [149°C]

Variation (01 through 99) (positions 7–8)
Number provided only by manufacturer to cover specific feature or option.
01 - Threaded cap
02 - Threaded cap with gag
03 - Plain lever
04 - Plain lever with gag
05 - Plain lever with vibration dampener
06 - Packed lever
07 - Packed lever with gag

Design Revision (position 9)
Indicates non-interchangeable revision. Dash (-) if original design.

Valve Service (position 10)
J - Liquid ASME Section VIII (Standard Cap/Packed Lever only)
K - Air/Gas ASME Section VIII (Plain Lever/Packed Lever required for air)
L - Steam ASME Section VIII (Plain Lever/Packed Lever required)
M - Liquid (Standard Cap/Packed Lever only)
Q - Vacuum (Standard Cap/Packed Lever only)

Spring Material (position 11)
E - SS

Set Pressure (positions 12–15)
3 psig [0.2 barg] (0003) through 900 psig [62 barg] (0900)
Vacuum 6-inch HG [200 mbarg] (0006) through 29-inch HG [1000 mbarg] (0029)

Models 920, 921, 927

ASME Section I Steam (English, lb/h) - Flow Coefficient = 0.878[1]

Set Pressure (psig)	Orifice Area, in² D (0.1213)	E (0.2157)	F (0.3369)	G (0.553)	H (0.864)	J (1.415)
15	174	309	482	792	1237	2026
25	228	406	635	1042	1628	2665
35	283	504	787	1292	2018	3305
45	338	601	939	1541	2408	3944
55	393	699	1091	1791	2798	4583
65	448	796	1243	2041	3189	5222
75	504	896	1399	2297	3589	5877
85	560	996	1556	2554	3991	6536
95	617	1097	1713	2812	4393	7194
100	645	1147	1791	2940	4594	7523
125	786	1398	2183	3583	5599	9169
150	927	1649	2575	4227	6604	10815
175	1068	1900	2967	4870	7609	12461
200	1209	2150	3359	5513	8614	14107
225	1350	2401	3751	6156	9619	15753
250	1492	2652	4143	6800	10624	17399
275	1633	2903	4534	7443	11629	19045
300	1774	3154	4926	8086	12634	20691
325	1915	3405	5318	8730	13639	22337
350	2056	3656	5710	9373	14644	23983
375	2197	3907	6102	10016	15649	25629
400	2338	4158	6494	10659	16654	27275
425	2479	4409	6886	11303	17659	28921
450	2620	4660	7278	11946	18664	30567
475	2761	4910	7670	12589	19669	32212
500	2902	5161	8061	13232	20674	33858
525	3044	5412	8453	13876	—	—
550	3185	5663	8845	14519	—	—
575	3326	5914	9237	15162	—	—
600	3467	6165	9629	15805	—	—
625	3608	6416	—	—	—	—
650	3749	6667	—	—	—	—
675	3890	6918	—	—	—	—
700	4031	7169	—	—	—	—
725	4172	7419	—	—	—	—
750	4313	7670	—	—	—	—
775	4455	7921	—	—	—	—
800	4596	8172	—	—	—	—

Note

1. Pressure and Temperature Limitations
Steam Section I - 'V' Special Use
15 to 800 psig
-20° to 800°F

Models 920, 921, 927

Note

1. Pressure and Temperature Limitations
   Steam Section I - ‘V’ Special Use
   1 to 55 barg
   -28° to 427°C

ASME Section I Steam [Metric, kg/h] - Flow Coefficient = 0.878[1]

Set Pressure [barg]	Orifice Area, cm² D [0.7826]	E [1.3916]	F [2.1735]	G [3.5677]	H [5.574]	J [9.129]
1.1	81	144	225	370	578	946
2.0	114	202	315	518	809	1325
3.0	150	266	415	682	1065	1745
4.0	186	330	516	846	1322	2165
5.0	222	395	617	1013	1582	2591
6.0	259	461	720	1182	1846	3024
7.0	296	527	823	1351	2111	3457
8.0	333	593	926	1520	2375	3890
9.0	371	659	1029	1689	2640	4323
10.0	408	725	1132	1859	2904	4756
12.0	482	857	1339	2197	3433	5622
14.0	556	989	1545	2536	3961	6488
16.0	630	1121	1751	2874	4490	7354
18.0	705	1253	1957	3212	5019	8220
20.0	779	1385	2163	3551	5548	9086
22.0	853	1517	2369	3889	6077	9952
24.0	927	1649	2576	4228	6605	10818
26.0	1002	1781	2782	4566	7134	11684
28.0	1076	1913	2988	4905	7663	12550
30.0	1150	2045	3194	5243	8192	13416
32.0	1224	2177	3400	5582	8720	14282
34.0	1299	2309	3607	5920	9249	15148
36.0	1373	2441	3813	6259	—	—
38.0	1447	2573	4019	6597	—	—
40.0	1521	2705	4225	6935	—	—
42.0	1596	2837	—	—	—	—
44.0	1670	2969	—	—	—	—
46.0	1744	3101	—	—	—	—
48.0	1818	3233	—	—	—	—
50.0	1893	3365	—	—	—	—
52.0	1967	3497	—	—	—	—
54.0	2041	3629	—	—	—	—
58.0	2190	3893	—	—	—	—
62.0	2338	4157	—	—	—	—

Models 910, 911, 912, 913, 916, 917, 918, 919

Non-code[1] and ASME Section VIII Air (English, SCFM) - Flow Coefficient = 0.878

Set Pressure (psig)	Orifice Area, in² D (0.1213)	E (0.2157)	F (0.3369)	G (0.553)	H (0.864)	J (1.415)
3	28	50	77	127	198	325
4	32	57	89	146	228	374
5	36	64	99	163	255	417
6	39	70	109	178	278	456
7	42	75	117	192	300	491
8	45	80	125	205	320	524
9	48	85	132	217	338	554
10	50	89	139	228	356	583
11	52	93	145	238	372	610
12	54	97	151	248	388	635
13	57	101	157	258	403	660
14	59	104	163	267	417	683
15	64	114	177	291	455	745
25	83	148	232	380	594	972
35	104	185	288	474	740	1212
45	125	223	348	571	893	1462
55	147	261	408	669	1046	1713
65	168	299	467	767	1199	1963
75	190	337	527	865	1352	2214
85	211	376	587	963	1505	2464
95	233	414	646	1061	1658	2715
100	243	433	676	1110	1734	2840
125	297	528	825	1355	2116	3466
150	351	624	974	1599	2499	4093
175	405	719	1124	1844	2881	4719
200	458	815	1273	2089	3264	5345
225	512	910	1422	2334	3646	5971
250	566	1006	1571	2578	4029	6598
275	619	1101	1720	2823	4411	7224
300	673	1197	1869	3068	4793	7850
325	727	1292	2018	3313	5176	8477
350	780	1388	2167	3558	5558	9103
375	834	1483	2316	3802	5941	9729
400	888	1579	2466	4047	6323	10355
425	941	1674	2615	4292	6705	10982
450	995	1769	2764	4537	7088	11608
475	1049	1865	2913	4781	7470	12234
500	1102	1960	3062	5026	7853	12861
550	1210	2151	3360	5516	—	—
600	1317	2342	3658	6005	—	—
650	1425	2533	—	—	—	—
700	1532	2724	—	—	—	—
750	1639	2915	—	—	—	—
800	1747	3106	—	—	—	—

Notes

1. No code stamp or 'NB' on nameplate below 15 psig set.
2. Pressure Limitations
   Models 910, 916: 3 to 900 psig
   Models 911, 917: 3 to 900 psig
   Models 912, 918: 3 to 250 psig
   Models 913, 919: 3 to 900 psig

Models 910, 911, 912, 913, 916, 917, 918, 919

Notes

1. No code stamp or 'NB' on nameplate below 1.1 barg set.
2. Pressure Limitations
   Models 910, 916: 0.2 to 62 barg
   Models 911, 917: 0.2 to 62 barg
   Models 912, 918: 0.2 to 17 barg
   Models 913, 919: 0.2 to 62 barg

Non-code[1] and ASME Section VIII Air [Metric, Nm³/h] - Flow Coefficient = 0.878

Set Pressure [barg]	Orifice Area, cm^2					
	D [0.7826]	E [1.3916]	F [2.1735]	G [3.5677]	H [5.574]	J [9.129]
0.2	45	80	126	206	322	528
0.5	71	126	196	323	504	825
1.0	98	175	273	448	700	1147
2.0	151	268	419	687	1074	1758
3.0	202	359	561	920	1438	2355
4.0	253	451	704	1155	1805	2956
5.0	305	542	847	1390	2172	3557
6.0	356	634	990	1625	2538	4157
7.0	408	725	1133	1860	2905	4758
8.0	459	817	1276	2094	3272	5359
9.0	511	908	1419	1329	3639	5960
10.0	562	1000	1562	2564	4006	6560
12.0	665	1183	1848	3033	4739	7762
14.0	768	1366	2134	3503	5473	8963
16.0	871	1549	2420	3972	6206	10165
18.0	974	1733	2706	4442	6940	11366
20.0	1077	1916	2992	4911	7673	12567
22.0	1180	2099	3278	5381	8407	13769
24.0	1283	2282	3564	5851	9141	14970
26.0	1386	2465	3850	6320	9874	16172
28.0	1489	2648	4136	6790	10608	17373
30.0	1592	2831	4422	7259	11341	18574
32.0	1695	3015	4708	7729	12075	19776
34.0	1798	3198	4994	8198	12808	20977
36.0	1901	3381	5280	8668	—	—
38.0	2004	3564	5567	9137	—	—
40.0	2107	3747	5853	9607	—	—
42.0	2210	3930	—	—	—	—
44.0	2313	4113	—	—	—	—
46.0	2416	4297	—	—	—	—
48.0	2519	4480	—	—	—	—
50.0	2622	4663	—	—	—	—
52.0	2725	4846	—	—	—	—
54.0	2828	5029	—	—	—	—
56.0	2931	5212	—	—	—	—
58.0	3034	5395	—	—	—	—
60.0	3137	5579	—	—	—	—
62.0	3240	5762	—	—	—	—

Models 910, 911, 912, 913

Non-code[1] and ASME Section VIII Steam (English, lb/h) - Flow Coefficient = 0.878

Set Pressure (psig)	Orifice Area, in2					
	D (0.1213)	E (0.2157)	F (0.3369)	G (0.553)	H (0.864)	J (1.415)
3	87	155	242	398	621	1017
4	100	178	278	456	712	1167
5	111	197	308	506	791	1295
6	121	215	336	551	861	1410
7	130	231	360	591	924	1513
8	138	245	383	628	981	1607
9	145	258	403	662	1035	1694
10	152	271	423	694	1084	1776
11	159	282	441	724	1131	1852
12	165	293	458	752	1175	1924
13	171	304	474	778	1216	1992
14	176	313	489	803	1255	2056
15	179	319	498	818	1278	2092
25	234	416	650	1068	1668	2732
35	292	519	810	1330	2078	3404
45	352	626	978	1605	2508	4108
55	412	733	1146	1880	2938	4811
65	473	841	1313	2155	3368	5515
75	533	948	1481	2430	3797	6219
85	593	1055	1648	2706	4227	6923
95	654	1163	1816	2981	4657	7627
100	684	1216	1900	3118	4872	7979
125	835	1484	2319	3806	5946	9738
150	986	1753	2737	4493	7020	11498
175	1136	2021	3156	5181	8095	13257
200	1287	2289	3575	5869	9169	15017
225	1438	2557	3994	6556	10243	16776
250	1589	2826	4413	7244	11318	18536
275	1740	3094	4832	7932	12392	20295
300	1891	3362	5251	8619	13467	22055
325	2041	3630	5670	9307	14541	23814
350	2192	3898	6089	9994	15615	25574
375	2343	4167	6508	10682	16690	27333
400	2494	4435	6927	11370	17764	29093
425	2645	4703	7346	12057	18838	30852
450	2796	4971	7765	12745	19913	32612
475	2946	5239	8183	13433	20987	34371
500	3097	5508	8602	14120	22061	36131
550	3399	6044	9440	15496	—	—
600	3701	6581	10278	16871	—	—
650	4002	7117	—	—	—	—
700	4304	7653	—	—	—	—
750	4606	8190	—	—	—	—
800	4907	8726	—	—	—	—

Notes

1. No code stamp or ‘NB’ on nameplate below 15 psig set.
2. Pressure Limitations
   Model 910: 3 to 900 psig
   Model 911: 3 to 900 psig
   Model 912: 3 to 250 psig
   Model 913: 3 to 300 psig

Models 910, 911, 912, 913

Notes

1. No code stamp or 'NB' on nameplate below 1.1 barg set.
2. Pressure Limitations
   Model 910: 0.2 to 62 barg
   Model 911: 0.2 to 62 barg
   Model 912: 0.2 to 17.2 barg
   Model 913: 0.2 to 20.7 barg

Non-code[1] and ASME Section VIII Steam, [Metric, kg/h] - Flow Coefficient = 0.878

Set Pressure [barg]	Orifice Area, cm² D [0.7826]	E [1.3916]	F [2.1735]	G [3.5677]	H [5.574]	J [9.129]
0.2	39	69	108	177	277	453
0.5	60	106	166	272	425	697
1.0	81	144	225	369	577	945
2.0	116	207	323	529	827	1355
3.0	156	277	432	709	1108	1815
4.0	195	347	542	890	1391	2278
5.0	235	418	653	1071	1673	2741
6.0	275	488	763	1252	1956	3204
7.0	314	559	873	1433	2239	3666
8.0	354	629	983	1614	2521	4129
9.0	394	700	1093	1795	2804	4592
10.0	433	771	1204	1976	3087	5055
12.0	513	912	1424	2337	3652	5981
14.0	592	1053	1644	2699	4217	6907
16.0	671	1194	1865	3061	4782	7832
18.0	751	1335	2085	3423	5348	8758
20.0	830	1476	2306	3785	5913	9684
22.0	910	1617	2526	4146	6478	10610
24.0	989	1758	2746	4508	7043	11535
26.0	1068	1900	2967	4870	7609	12461
28.0	1148	2041	3187	5232	8174	13387
30.0	1227	2182	3408	5594	8739	14313
32.0	1306	2323	3628	5955	9304	15238
34.0	1386	2464	3849	6317	9870	16164
36.0	1465	2605	4069	6679	—	—
38.0	1544	2746	4289	7041	—	—
40.0	1624	2887	4510	7403	—	—
42.0	1703	3029	—	—	—	—
44.0	1783	3170	—	—	—	—
46.0	1862	3311	—	—	—	—
48.0	1941	3452	—	—	—	—
50.0	2021	3593	—	—	—	—
52.0	2100	3734	—	—	—	—
54.0	2179	3875	—	—	—	—
56.0	2259	4016	—	—	—	—
58.0	2338	4157	—	—	—	—
60.0	2417	4299	—	—	—	—
62.0	2497	4440	—	—	—	—

Models 910, 911, 912, 913, 916, 917, 918, 919

Non-code[1] and ASME VIII Liquid (English, GPM) - Flow Coefficient = 0.710

Set Pressure (psig)	Orifice Area, in²					
	D (0.1213)	E (0.2157)	F (0.3369)	G (0.553)	H (0.864)	J (1.415)
3	6	11	17	27	42	69
4	7	12	19	31	49	80
5	8	14	21	35	55	90
6	8	15	23	38	60	98
7	9	16	25	41	65	106
8	10	17	27	44	69	113
9	10	18	29	47	73	120
10	11	19	30	50	77	127
11	11	20	32	52	81	133
12	12	21	33	54	85	139
13	12	22	34	56	88	144
14	13	23	36	57	92	150
15	14	25	39	63	99	162
25	17	31	48	79	123	202
35	20	36	56	93	145	237
45	23	41	64	105	164	269
55	26	45	71	116	181	297
65	28	49	77	126	197	323
75	30	53	83	136	212	347
85	32	56	88	144	225	369
95	34	60	93	153	238	390
100	34	61	95	156	244	400
125	38	68	107	175	273	448
150	42	75	117	192	299	490
175	45	81	126	207	323	530
200	49	86	135	221	346	566
225	52	92	143	235	367	601
250	54	97	151	247	387	633
275	57	101	158	259	405	664
300	60	106	165	271	423	694
325	62	110	172	282	441	722
350	64	114	178	293	457	749
375	67	118	185	303	473	775
400	69	122	191	313	489	801
425	71	126	197	323	504	825
450	73	129	202	332	519	849
475	75	133	208	341	533	873
500	77	136	213	350	547	895
550	81	143	224	367	—	—
600	84	150	234	383	—	—
650	88	156	—	—	—	—
700	91	161	—	—	—	—
750	94	167	—	—	—	—
800	97	173	—	—	—	—

Notes

1. No code stamp or 'NB' on nameplate below 15 psig set.
2. Pressure Limitations
   Model 910, 916: 3 to 900 psig
   Model 911, 917: 3 to 900 psig
   Model 912, 918: 3 to 250 psig
   Model 913, 919: 3 to 300 psig

Models 910, 911, 912, 913, 916, 917, 918, 919

Notes

1. No code stamp or 'NB' on nameplate below 1.1 barg set.
2. Pressure Limitations
   Model 910, 916: 0.2 to 62 barg
   Model 911, 917: 0.2 to 62 barg
   Model 912, 918: 0.2 to 17.2 barg
   Model 913, 919: 0.2 to 20.7 barg

Non-code[1] and ASME Section VIII Liquid, [Metric m³/h] - Flow Coefficient = 0.710

Set Pressure [barg]	Orifice Area, cm² D [0.783]	E [1.392]	F [2.174]	G [3.568]	H [5.574]	J [9.129]
0.2	1	2	4	6	9	15
0.5	2	4	6	10	15	24
1.0	3	6	9	14	22	36
2.0	4	7	12	19	30	49
3.0	5	9	14	23	37	60
4.0	6	11	16	27	42	69
5.0	7	12	18	30	47	77
6.0	7	13	20	33	52	85
7.0	8	14	22	36	56	92
8.0	8	15	23	38	60	98
9.0	9	16	25	41	63	104
10.0	9	17	26	43	67	110
12.0	10	18	29	47	73	120
14.0	11	20	31	51	79	130
16.0	12	21	33	54	85	139
18.0	13	22	35	57	90	147
20.0	13	24	37	61	95	155
22.0	14	25	39	63	99	162
24.0	15	26	40	66	104	170
26.0	15	27	42	69	108	177
28.0	16	28	44	72	112	183
30.0	16	29	45	74	116	190
32.0	17	30	47	77	120	196
34.0	17	31	48	79	123	202
36.0	18	32	49	81	—	—
38.0	18	33	51	83	—	—
40.0	19	33	52	86	—	—
42.0	19	34	—	—	—	—
44.0	20	35	—	—	—	—
46.0	20	36	—	—	—	—
48.0	21	37	—	—	—	—
50.0	21	37	—	—	—	—
52.0	21	38	—	—	—	—
54.0	22	39	—	—	—	—
56.0	22	40	—	—	—	—
58.0	23	40	—	—	—	—
60.0	23	41	—	—	—	—
62.0	23	42	—	—	—	—

Models 910, 911, 912, 913, 916, 917, 918, 919

Non-code Liquid - 25% Accumulation (English, GPM) - Flow Coefficient = 0.710

Set Pressure (psig)	Orifice Area, in² D (0.1213)	E (0.2157)	F (0.3369)	G (0.553)	H (0.864)	J (1.415)
3	6	11	18	29	45	74
4	7	13	20	33	52	85
5	8	15	23	37	58	95
6	9	16	25	41	64	105
7	10	17	27	44	69	113
8	10	18	29	47	74	121
9	11	20	30	50	78	128
10	12	21	32	53	82	135
11	12	22	34	55	86	142
12	13	23	35	58	90	148
13	13	23	37	60	94	154
14	14	24	38	62	98	160
15	14	25	39	65	101	165
25	18	33	51	83	130	213
35	22	38	60	99	154	253
45	25	44	68	112	175	286
55	27	48	75	124	193	317
65	29	52	82	134	210	344
75	32	56	88	144	226	370
85	34	60	94	154	240	394
95	36	63	99	163	254	416
100	37	65	102	167	261	427
125	41	73	114	186	291	477
150	45	80	124	204	319	523
175	48	86	134	221	345	565
200	52	92	144	236	369	604
225	55	98	152	250	391	640
250	58	103	161	264	412	675
275	61	108	169	277	432	708
300	63	113	176	289	451	739
325	66	117	183	301	470	769
350	68	122	190	312	488	799
375	71	126	197	323	505	827
400	73	130	203	334	521	854
425	75	134	210	344	537	880
450	78	138	216	354	553	905
475	80	142	221	364	568	930
500	82	145	227	373	583	954
550	86	153	238	391	—	—
600	90	159	249	409	—	—
650	93	166	—	—	—	—
700	97	172	—	—	—	—
750	100	178	—	—	—	—
800	103	184	—	—	—	—
850	107	190	—	—	—	—

Note

1. Pressure Limitations
   Models 910, 916: 3 to 900 psig
   Models 911, 917: 3 to 900 psig
   Models 912, 918: 3 to 250 psig
   Models 913, 919: 3 to 300 psig

Models 910, 911, 912, 913, 916, 917, 918, 919

Note

1. Pressure Limitations
   Models 910, 916: 0.2 to 62 barg
   Models 911, 917: 0.2 to 62 barg
   Models 912, 918: 0.2 to 17.2 barg
   Models 913, 919: 0.2 to 20.7 barg

Non-code Liquid - 25% Accumulation, [Metric, m³/h]
Flow Coefficient = 0.710

Set Pressure [barg]	Orifice Area, cm² D [0.783]	E [1.392]	F [2.174]	G [3.568]	H [5.574]	J [9.129]
0.2	1	3	4	6	10	17
0.5	2	4	6	10	16	26
1.0	3	6	9	14	23	37
2.0	4	8	12	20	32	52
3.0	5	10	15	25	39	64
4.0	6	11	18	29	45	74
5.0	7	13	20	32	50	83
6.0	8	14	22	35	55	90
7.0	8	15	23	38	60	98
8.0	9	16	25	41	64	104
9.0	9	17	26	43	68	111
10.0	10	18	28	46	71	117
12.0	11	19	30	50	78	128
14.0	12	21	33	54	84	138
16.0	13	23	35	58	90	148
18.0	13	24	37	61	96	157
20.0	14	25	39	65	101	165
22.0	15	26	41	68	106	173
24.0	16	28	43	71	110	181
26.0	16	29	45	74	115	188
28.0	17	30	47	76	119	195
30.0	17	31	48	79	123	202
32.0	18	32	50	82	128	209
34.0	18	33	51	84	131	215
36.0	19	34	53	87	—	—
38.0	20	35	54	89	—	—
40.0	20	36	56	91	—	—
42.0	21	36	—	—	—	—
44.0	21	37	—	—	—	—
46.0	21	38	—	—	—	—
48.0	22	39	—	—	—	—
50.0	22	40	—	—	—	—
52.0	23	41	—	—	—	—
54.0	23	41	—	—	—	—
56.0	24	42	—	—	—	—
58.0	24	43	—	—	—	—
60.0	25	44	—	—	—	—
62.0	25	44	—	—	—	—

Models 910, 911, 912, 913, 916, 917, 918, 919

Non-code Vacuum Air (English, SCFM) Flow Coefficient = 0.878

Set Inches Mercury	Orifice Area, in² D (0.1213)	E (0.2157)	F (0.3369)	G (0.553)	H (0.864)	J (1.415)
6	24	43	68	111	173	284
7	26	45	71	117	182	298
8	27	47	74	121	189	310
9	27	49	76	125	195	320
10	28	50	78	128	199	327
11	28	51	79	129	202	331
12	29	51	80	131	204	334
13	29	51	80	131	204	335
14	29	51	80	131	204	335
15	29	51	80	131	204	335
16	29	51	80	131	204	335
17	29	51	80	131	204	335
18	29	51	80	131	204	335
19	29	51	80	131	204	335
20	29	51	80	131	204	335
21	29	51	80	131	204	335
22	29	51	80	131	204	335
23	29	51	80	131	204	335
24	29	51	80	131	204	335
25	29	51	80	131	204	335
26	29	51	80	131	204	335
27	29	51	80	131	204	335
28	29	51	80	131	204	335
29	29	51	80	131	204	335

Models 910, 911, 912, 913, 916, 917, 918, 919

Non-code Vacuum Air [Metric, Nm³/h] - Flow Coefficient = 0.878

Set Pressure [mbarg]	Orifice Area, cm² D [0.7826]	E [1.3916]	F [2.1735]	G [3.5677]	H [5.574]	J [9.129]
200	40	71	111	182	285	466
225	42	74	115	189	296	485
250	43	76	119	196	306	501
275	44	78	123	201	314	515
300	45	80	125	206	321	526
325	46	82	127	209	327	535
350	46	83	129	212	331	542
375	47	83	130	214	334	548
400	47	84	131	215	336	551
425	47	84	132	216	337	553
450	47	84	132	216	337	552
475	47	84	132	216	338	553
500	47	84	132	216	338	553
525	47	84	132	216	338	553
550	47	84	132	216	338	553
575	47	84	132	216	338	553
600	47	84	132	216	338	553
625	47	84	132	216	338	553
650	47	84	132	216	338	553
675	47	84	132	216	338	553
700	47	84	132	216	338	553
725	47	84	132	216	338	553
750	47	84	132	216	338	553
775	47	84	132	216	338	553
800	47	84	132	216	338	553
845	47	84	132	216	338	553
850	47	84	132	216	338	553
875	47	84	132	216	338	553
900	47	84	132	216	338	553
925	47	84	132	216	338	553
950	47	84	132	216	338	553
975	47	84	132	216	338	553
1000	47	84	132	216	338	553

PRM Carbon Systems - HP- 90 & HP- 200

PRMFiltration

The HP Series Carbon units are used on remediation systems where standard flow volumes are required with minimal backpressure. These units offer a 25% freeboard area for excellent back-wash ratios. Typical applications are groundwater remediation for VOCs or industrial sites with similar applications. Several media types are available for removal of more specific compounds such as metals and other contaminants. Aggregate media specifically designed to be backwashed is also available.

APPLICATIONS:

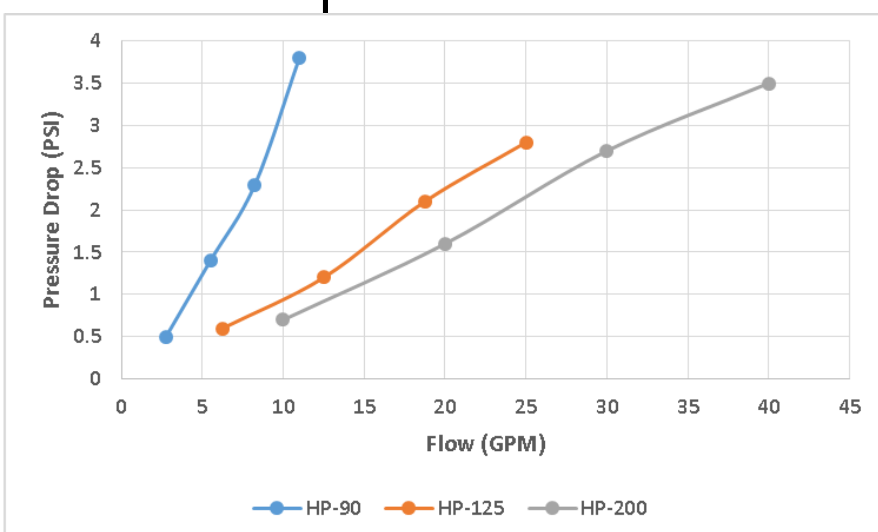
- Remediation of contaminated water streams
- Designed to operate at high pressures without sacrificing efficiency

STANDARD SPECIFICATIONS:

- Pressures up to 125 psi
- Fiberglass construction for lightweight strength
- Inlet and outlet diffusers for even flow and back-washing
- Heavy duty base for vertical free standing operation

HP-90 Carbon Unit
INLET/OUTLET: 3/4"
SIZE: 13" Diameter x 54" Height
CARBON: 90 lbs.
DRY WEIGHT: 130 lbs.

HP-200 Carbon Unit
INLET/OUTLET: 1"
SIZE: 16" Diameter x 65" Height
CARBON: 200 lbs.
DRY WEIGHT: 240 lbs.



AVAILABILITY: Build Item: Allow 2 to 4 weeks for manufacturing and shipping

888-TREAT-IT • www.prmfiltration.com • sales@prmfiltration.com

TM SERIES
(WATER METERS)

FLOMEC®

TM SERIES®
water meters

FLOMEC® TM Series Water Meters are accurate, economical and designed to last. Choose TM Water Meters for water processing and irrigation applications:

- Meets Schedule 80 PVC specifications
- Standard low-profile display
- Seven sizes with three fitting types available
- Flow rates from 1 to 600 gallons per minute (3.8 to 2271 L/min)

SPECIFICATIONS

Fitting Type:	Schedule 80 Spigot (Pipe) End		
	NPT (Female)		
	BSP (Female) (1 in., 1-1/2 in., & 2 in. meters only)		
	150# ANSI Flange or DIN 100 Flange (3 in. & 4 in. meters only)		
Meter Sizes Available:	½ in., ¾ in., 1 in., 1-½ in., 2 in., 3 in., 4 in.		
Flow Range:	½ in. (05)	1 - 10 GPM	(3.8 - 38 L/min)
	¾ in. (07)	2 - 20 GPM	(7.6 - 76 L/min)
	1 in. (10)	5 - 50 GPM	(19 - 190 L/min)
	1-½ in. (15)	10 - 100 GPM	(38 - 380 L/min)
	2 in. (20)	20 - 200 GPM	(76 - 760 L/min)
	3 in. (30)	40 - 400 GPM	(151 - 1514 L/min)
	4 in. (40)	60 - 600 GPM	(227 - 2271 L/min)
Accuracy (% of Reading):	± 3.0%		
Pressure Rating (½ - 2 in.):	225 psi (15.3 bar) @ 73° F (23° C)		
BSP	150 psi (10.3 bar) @ 73° F (23° C)		
Pressure Rating (3 - 4 in.):	225 psi (15.3 bar) @ 73° F (23° C)		
DIN	135 psi (9.1 bar) @ 73° F (23° C)		
For CE Applications	135 psi (9.1 bar) @ 73° F (23° C)		
Operating Temperature Range:	+32° F to +140° F (0° C to +60° C)**		
Typical K-Factor:	½ in. (05)	2,500 PPG (660 Pulses/L)	
	¾ in. (07)	1,100 PPG (291 Pulses/L)	
	1 in. (10)	565 PPG (149 Pulses/L)	
	1-½ in. (15)	215 PPG (57 Pulses/L)	
	2 in. (20)	100 PPG (26 Pulses/L)	
	3 in. (30)	43 PPG (11 Pulses/L)	
	4 in. (40)	17 PPG (4.5 Pulses/L)	
Wetted Materials (½ - 2 in.):	Housing:	PVC	
	Bearings:	96% Alumina Ceramic	
	Shaft:	Tungsten Carbide	
	Rotor:	PVDF	
	Rings:	316 Stainless Steel	
Wetted Materials (3 - 4 in.):	Housing:	PVC	
	Bearings:	PEEK	
	Shaft & Thrust Washers:	Stainless Steel	
	Rotor & Nose Cone:	Acetal	
	Signal Generator:	Ferrite	
Calibration Certificate:	N.I.S.T. – Certification available		

**PVC pressure rating will incrementally decrease above 73° F (23° C).

FEATURES / BENEFITS

- Easy to install
- Displays in gallons, litres and cubic feet
- Indicates Batch, Cumulative Totals and Rate of Flow
- Available in Spigot, NPT, BSP (1 in., 1-½ in. and 2 in. only), 150# ANSI Flange (3 in. and 4 in. only) and DIN Flange (3 in. and 4 in. only) fittings
- Non-volatile totals means amounts are retained when batteries are replaced or power is lost
- Alkaline battery life: 2 years

APPLICATIONS

- OEM water treatment equipment / skids
- Sub-metering of facility water usage
- Waste water treatment equipment
- Irrigation
- Batching
- Plant process water
- Water based cooling systems
- Chemical feed systems
- Monitoring clean fluids
- Cooling towers
- Blending

CERTIFICATIONS

CE

TM SERIES (WATER METERS)

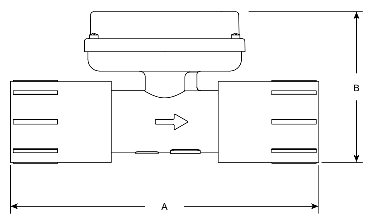
DIMENSIONS

Meter Size & Fitting	Length	Height	Width
05 Spigot	4.3 in. (109 mm)	2.5 in. (63 mm)	2.1 in. (53 mm)
05 NPT	6.0 in. (152 mm)	2.7 in. (68 mm)	2.1 in. (53 mm)
07 Spigot	4.4 in. (112 mm)	2.7 in. (68 mm)	2.1 in. (53 mm)
07 NPT	6.1 in. (155 mm)	2.9 in. (73 mm)	2.1 in. (53 mm)
10 Spigot	4.5 in. (114 mm)	2.9 in. (73 mm)	2.1 in. (53 mm)
10 NPT / BSP	6.5 in. (165 mm)	3.1 in. (79 mm)	2.1 in. (53 mm)
15 Spigot	5.4 in. (137 mm)	3.6 in. (91 mm)	2.1 in. (53 mm)
15 NPT / BSP	7.6 in. (193 mm)	3.8 in. (96 mm)	2.3 in. (58 mm)

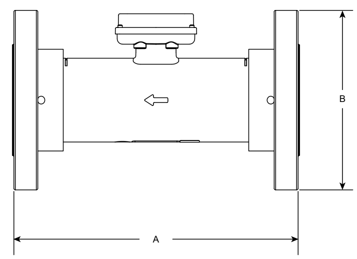
Meter Size & Fitting	Length	Height	Width
20 Spigot	5.5 in. (140 mm)	4.1 in. (104 mm)	2.4 in. (61 mm)
20 NPT / BSP	7.9 in. (200 mm)	4.4 in. (112 mm)	3.5 in. (89 mm)
30 Spigot	11.5 in. (292 mm)	5.34 in. (136 mm)	3.5 in. (89 mm)
40 Spigot	13.5 in. (343 mm)	6.34 in. (161 mm)	4.5 in. (114 mm)

Meter Size & Fitting	Length	Height	Width
30 NPT	14.7 in. (373 mm)	5.78 in. (147 mm)	4.37 in. (111 mm)
40 NPT	17.0 in. (432 mm)	6.7 in. (170 mm)	5.87 in. (149 mm)
30 ANSI Flange	12.0 in. (305 mm)	7.5 in. (190 mm)	7.5 in. (190 mm)
40 ANSI Flange	14.0 in. (356 mm)	9.0 in. (229 mm)	9.0 in. (229 mm)

Length guidelines are estimates; actual length can vary up to ± ½ in.(13 mm).
P9 & 42 Electronics adds 0.90 in. (23 mm) to height.



½ in. thru 2 in.



3 in. & 4 in.

ACCESSORIES

Part No.	Description
113275-10	FM Approved Remote Kit - Q9 Display (will not make meter FM Approved)
125260-02	90° Display Adapter Kit – Q9 Display
125100-10	4-20Ma / Pulse out put module

Appendix F

Monitoring Form Templates

SYSTEM MONITORING FORM
CIRCLE K - PHASE 1: MULTI-PHASE EXTRACTION

Name & Company: ______ System On on Arrival? (circle): yes no

Date/time of data collection: ______ System Hours:

Weather:

Phase 1: Multiphase Extraction, all wells in extraction mode.

Barometric pressure (psi):	Barometric Pressure source:
Ambient Temperature (°F):	Ambient Temperature source:
Noise (dBA): If above 60 dBA, notify KJ personnel	Noise measurement source:

Moisture Separator Drained? (circle) Yes No

Approximate volume (gal):

Catalytic Oxidizer Installed? (circle) Yes No

Effluent Vapor VOC Conc (ppm):

PID Calibration Performed? (circle) Yes No

PID Calibration	Zero Gas	Span Gas
Calibration Value (ppm):		
Instrument Reading (ppm):		

Active Alarm Conditions (circle, note affected equipment):

1. No Alarm
2. High Water Level — Tank(s):
3. Low Water Level — Tank(s):
4. High Pressure — Equipment:
5. Low Pressure — Equipment:
6. System Shutdown — Equipment:
7. Temperature — Equipment:
8. Other:

Wells - Injection/Extraction (At Manifold)

Well ID	Pres/Vac (psi)	Flow (cfm)	PID (ppm)	Valve (Open Closed, fraction)
RW-2				
RW-3				
RW-4				
RW-5				
RW-6				
RW-7				
RW-8				
RW-9				
RW-10				
SW-1				
SW-2				
SW-3				
MW-4				
Well ID	**Pres/Vac (psi)**	**Flow (cfm)**	**PID (ppm)**	**Valve (O/C, fraction)**
SSD-1				
SSD-2				
SSD-3				
VP-1				
VP-2				
VP-3				
VP-4				

Treatment System

Location	ID	Temp (°F)	Pres/Vac (psi)	Flow (cfm/gpm)	PID (ppm)
Before MS	VI 210				
After MS	PI 310				
Before Blower	VI 300				
After Blower	PI/FI 302				
At Heat Exchanger	TT-302				
Before Vapor GAC	PI 411				
Vapor GAC Midpoint**	PI 412				
After Vapor GAC**	PI 410				
After Pump P-400	PI 400				
Before Bag Filter	PI-405				
After Bag Filter**	FI 400/PI 401				
Midpoint Liquid GAC 1**	PI 403				
After Liquid GAC 1	FE-404				
Midpoint Liquid GAC 2**	PI 406				
After Liquid GAC 2	FE-407				
After Liquid GAC**	PI-404				
Catalytic Oxidizer Temperatures (°F)		T1 Entrance:	T2 Exit:	T3 Interior:	
Catalytic Oxidizer PID (ppm)		Pre:		Post:	

Flow Totalizer Readings	Date	Time	Total Flow (gal)
FT 500			
FT 500			

** Location for collection of air or water sample for laboratory analysis.

Comments/Maintenance Activities:

Permit Discharge Limits (see permits):

Air: 200 scfm Water: 3 gpm / 4500 gpd

If exceeded, notify Kennedy Jenks personnel.

Notes: psi = pounds/square inch; cfm = cubic feet per minute; ppm = parts per million; gal = gallons; MS = vapor liquid separator; GAC = granular activated carbon

SYSTEM MONITORING FORM
CIRCLE K - PHASE 2: SURFACTANT REINJECTION

Name & Company: | System On on Arrival? (circle): yes no
Date/time of data collection: | System Hours:
Weather: | *Phase 2: Surfactant Reinjection, note mode for well groups.*

Barometric pressure (psi):	Barometric Pressure source:
Ambient Temperature (°F):	Ambient Temperature source:
Noise (dBA): If above 60 dBA, notify KJ personnel	Noise measurement source:

Moisture Separator Drained? (circle) Yes No
Approximate volume (gal):

Well Group Modes (Extraction, Injection, Rest):				
	Group 1		Group 3	
	Group 2		Group 4	

PID Calibration Performed? (circle) Yes No

PID Calibration	Zero Gas	Span Gas
Calibration Value (ppm):		
Instrument Reading (ppm):		

Active Alarm Conditions (circle, indicate affected equipment):

1. No Alarm		8. Other:
2. High Water Level	Tank(s):	
3. Low Water Level	Tank(s):	
4. High Pressure	Equipment:	
5. Low Pressure	Equipment:	
6. System Shutdown	Equipment:	
7. Temperature	Equipment:	

Surfactant Added? (circle) Yes No Type & Volume (lbs):

Wells - Injection/Extraction (At Manifold)

Well ID	Well Group #	Pres/Vac (Inj only, psi)	Flow (cfm/gpm)	PID (ppm)	Valve (Open Closed, fraction)
RW-2	4				
RW-3	1				
RW-4	2				
RW-5	3				
RW-6	4				
RW-7	1				
RW-8	2				
RW-9	1				
RW-10	3				
SW-1	2				
SW-2	3				
SW-3	1				
MW-4	4				

Well ID	Mode	Pres/Vac (psi)	Flow (cfm)	PID (ppm)	Valve (O/C, fraction)
SSD-1	Ext.				
SSD-2	Ext.				
SSD-3	Ext.				
VP-1					
VP-2					
VP-3					
VP-4					

Treatment System

Location	ID	Temp (°F)	Pres/Vac (psi)	Flow (cfm/gpm)	PID (ppm)
Before MS	VI 210				
After MS	PI 310				
Before Blower	VI 300				
After Blower	PI/FI 302				
At Heat Exchanger	TT-302				
Before Vapor GAC	PI 411				
Vapor GAC Midpoint**	PI 412				
After Vapor GAC**	PI 410				
After Pump P-400	PI 400				
Before Bag Filter	PI-405				
After Bag Filter**	FI 400/PI 401				
Midpoint Liquid GAC 1**	PI 403				
After Liquid GAC 1	FE-404				
Midpoint Liquid GAC 2**	PI 406				
After Liquid GAC 2	FE-407				
After Liquid GAC**	PI-404				
To GW Recirc.	FI-401/PI-408				
After Mixing Tank T-500	PI-501/IC-500				
Pre-Injection	PI-503/FT-500				
At Oxygen Generator	PI-502				

Flow Totalizer Readings	Date	Time	Total Flow (gal)
FT 500			
FT 500			

** Location for collection of air/water sample for laboratory analysis.

Comments/Maintenance Activities:

Permit Discharge Limits:

Air: 200 scfm Water: 3 gpm / 4500 gpd

If exceeded, notify Kennedy Jenks personnel.

Notes: psi = pounds/square inch; cfm = cubic feet per minute; ppm = parts per million; gal = gallons; MS = vapor liquid separator; GAC = granular activated carbon; gpm = gallons per minute; lb = pounds

SYSTEM MONITORING FORM
CIRCLE K - PHASE 3: ENHANCED BIOREMEDIATION

Name & Company: System On on Arrival? (circle): yes no

Date/time of data collection: System Hours:

Weather: *Phase 3: Enhanced Bioremediation, note mode for well groups.*

Barometric pressure (psi):	Barometric Pressure source:
Ambient Temperature (°F):	Ambient Temperature source:
Noise (dBA): If above 60 dBA, notify KJ personnel	Noise measurement source:

Moisture Separator Drained? (circle) Yes No
Approximate volume (gal):

Well Group Modes (Extraction, Injection, Rest):			
Group 1		Group 3	
Group 2		Group 4	

PID Calibration Performed? (circle) Yes No

PID Calibration	Zero Gas	Span Gas
Calibration Value (ppm):		
Instrument Reading (ppm):		

Active Alarm Conditions (circle, indicate affected equipment):
1. No Alarm 8. Other:
2. High Water Level Tank(s):
3. Low Water Level Tank(s):
4. High Pressure Equipment:
5. Low Pressure Equipment:
6. System Shutdown Equipment:
7. Temperature Equipment:

Amendments Added? (circle) Yes No Type & Volume (lbs):

Wells - Injection/Extraction (At Manifold)

Well ID	Well Group #	Pres/Vac (psi)	Flow (cfm/gpm)	PID (ppm)	Valve (Open Closed, fraction)
RW-2	4				
RW-3	1				
RW-4	2				
RW-5	3				
RW-6	1				
RW-7	4				
RW-8	2				
RW-9	1				
RW-10	3				
SW-1	2				
SW-2	3				
SW-3	4				
MW-4+	1				

Well ID	Mode	Pres/Vac (psi)	Flow (cfm)	PID (ppm)	Valve (O/C, fraction)
SSD-1	Ext.				
SSD-2	Ext.				
SSD-3	Ext.				
VP-1					
VP-2					
VP-3					
VP-4					

Treatment System

Location	ID	Temp (°F)	Pres/Vac (psi)	Flow (cfm/gpm)	PID (ppm)
Before MS	VI 210				
After MS	PI 310				
Before Blower	VI 300				
After Blower	PI/FI 302				
At Heat Exchanger	TT-302				
Before Vapor GAC	PI 411				
Vapor GAC Midpoint**	PI 412				
After Vapor GAC**	PI 410				
After Pump P-400	PI 400				
Before Bag Filter	PI-405				
After Bag Filter**	FI 400/PI 401				
Midpoint Liquid GAC 1**	PI 403				
After Liquid GAC 1	FE-404				
Midpoint Liquid GAC 2**	PI 406				
After Liquid GAC 2	FE-407				
After Liquid GAC**	PI-404				
To GW Recirc.	FI-401/PI-408				
After Mixing Tank T-500	PI-501/IC-500				
Pre-Inection	PI-503/FT-500				
At Oxygen Generator	PI-502				

Flow Totalizer Readings	Date	Time	Total Flow (gal)
FT 500			
FT 500			

** Location for collection of air or water sample for laboratory analysis.

Comments/Maintenance Activities:

Permit Discharge Limits:
Air: 200 scfm Water: 3 gpm / 4500 gpd
If exceeded, notify Kennedy Jenks personnel.

Notes: psi = pounds/square inch; cfm = cubic feet per minute; ppm = parts per million; gal = gallons; KO = knock-out/vapor liquid separator; GAC = granular activated carbon; gpm = gallons per minute; lb = pounds

SYSTEM MAINTENANCE FORM
CIRCLE K REMEDIATION SYSTEM

Name & Company:
Date/time of data collection:
Weather:

Equipment/Wellheads	Inspected?	Condition	Notes on Maintenance Activities Performed
RW-2			
RW-3			
RW-4			
RW-5			
RW-6			
RW-7			
RW-8			
RW-9			
RW-10			
SW-1			
SW-2			
SW-3			
MW-4			
SSD-1, 2, 3			
Vapor Pins 1-4			
Injection Manifold			
Extraction Manifold			
Piping			
MS Tank (T-300)			
Pump P-300			
Pump P-400			
Pump P-401			
Pump P-500			
Tank T-301			
Tank T-400			
Mixing Tank (T-500)			
Bag Filter (BF-400)			
Liquid GAC LG-400			
Liquid GAC LG-401			
Liquid GAC LG-402			
Liquid GAC LG-403			
Liquid Ring Pump B-301			
Heat Exchanger			
Catalytic Oxidizer			
Vapor GAC-400			
Vapor GAC-401			
Control Panel/PLC			
Alarms			
Flow Meters			
Temp/Press Gauges			
Valves			

Comments

Mandatory Electrical Inspection Form

START UP INSPECTION	DATE ______________________________
ELECTRICAL NOTES:	
SIGNATURE ____________________________________	

WEEK 1 INSPECTION	DATE ______________________________
ELECTRICAL NOTES:	
SIGNATURE ____________________________________	

2 MONTH INSPECTION	DATE ______________________________
ELECTRICAL NOTES:	
SIGNATURE ____________________________________	

ANNUAL INSPECTION	DATE ______________________________
ELECTRICAL NOTES:	
SIGNATURE ____________________________________	

Please email the completed form to warrantyfulfillment@prmfiltration.com

Appendix G

Standard Operating Guidelines

Title: **Environmental Data Collection**

Document Number: **SOG-001**

Revision Number: **0**

Reviewed:	______________________ Quality Control Manager	12/1/2023 Date
Approved:	______________________ Project Manager	12/1/2023 Date

Environmental Data Collection

1. Purpose

The objective of this Standard Operating Guideline (SOG) is to set criteria for content entry and form of field logbooks, identify the minimum information that should be collected on field sampling log sheets, and provide quality assurance/quality control (QA/QC) during environmental data collection.

2. Scope

This guideline is applicable during all Engineering/Remediation Resources Group, Inc. (ERRG) projects requiring environmental data collection.

3. References

U.S. Environmental Protection Agency (EPA), 2001. "Environmental Investigations Standard Operating Procedures and Quality Assurance Manual." 980 College Station Road, Athens, Georgia. November. Online Address: <https://nepis.epa.gov/>.

EPA, 2005. "Uniform Federal Policy for Quality Assurance Project Plans, Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs – Part 1: UFP-QAPP Manual." Final, Version 1. EPA-505-B-04-900A. Intergovernmental Data Quality Task Force. March 2005. Online Address: <https://www.epa.gov/fedfac/uniform-federal-policy-quality-assurance-project-plans-evaluating-assessing-and-documenting>.

EPA, 2012. "Uniform Federal Policy for Quality Assurance Project Plans, Optimized UFP-QAPP Worksheets." 505-B-04-900A. Intergovernmental Data Quality Task Force. March. Online Address: <https://www.epa.gov/fedfac/optimized-uniform-federal-policy-quality-assurance-project-plans-worksheets>.

EPA, 2020. "Contract Laboratory Program Guidance for Field Samplers." OLEM 9240.0-51 / USEPA 540-R-20-005. Office of Superfund Remediation and Technology Innovation. November. Online Address: <https://www.epa.gov/clp/clp-information-field-samplers>.

Nielsen Environmental Field School, 1997. "Field Notebook Guidelines."

4. Definition of Terms

Site Logbook — Logbook that is an index of all activities performed at the site. Specific entries are summaries of each day's activities and are part of the project file.

Field Logbook — Logbooks used at field sites that contain detailed information on-site activities, including dates, times, personnel names, activities conducted, equipment used, weather conditions, etc. Field logbooks are used by a variety of different field personnel and are part of the project file.

Sample — A part of a larger lot, usually a volume, area, period or population.

Grab Sample — An individual sample collected from a single location at a specific time or period of time.

Composite Sample — series of discrete, equal samples (or "aliquots") which are combined or "composited." A composite sample represents the average characteristics of the population under consideration.

De-ionized Water — Water that has been treated by passing it through a standard de-ionizing resin column. At a minimum, the finished water should contain no detectable heavy metals or other inorganic compounds (i.e., at or above analytical detection limits) as defined by a standard Inductively Coupled Argon Plasma Spectrophotometer (ICP) (or equivalent) scan. De-ionized water obtained by other methods is acceptable, if it meets the above analytical criteria. Organic-free water may be substituted for de-ionized water.

Environmental sample — A sample collected to provide data regarding environmental processes, conditions, and effects of pollutants on human health and ecology.

Waste sample — A sample collected to provide data regarding the presence of pollutants in waste materials or processes.

5. Equipment

The following is an example list of equipment and supplies that may be used during environmental field activities:

- Field logbook and/or forms
- Site-specific plans
- Watch
- GPS receiver and handheld computer
- Digital camera
- Sample containers
- Disposable sampling equipment such as scoops and bailers
- Clean paper towels
- Waterproof black ink markers
- Ruler or tape measure

6. Responsibilities

6.1. PROCEDURE RESPONSIBILITY

The Project Quality Control Manager or Project Manager is responsible for maintenance, management, and revision of this SOG. Questions, comments, or suggestions about this SOG should be sent to the Project Quality Control Manager or Project Manager.

6.2. PROJECT RESPONSIBILITY

ERRG employees performing this task, or any portion thereof, are responsible for meeting the requirements of this procedure. ERRG employees conducting technical review of task performance also are responsible for following appropriate portions of this SOG.

For those projects where the activities of this SOG are conducted, the Project Manager, or designee, is responsible for ensuring that those activities are conducted in accordance with this and other appropriate procedures. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (i.e., check prints, calculations, reports, etc.) that the requirements of this SOG have been met. Such documentation shall be retained as part of the project file.

7. Procedure

7.1. FIELD LOGBOOK

7.1.1. General

Whenever possible, each site, as applicable, will have one current site logbook, which will serve as an index of all activities performed at the site. Making entries into the site logbook is initiated at the start of the first on-site activity. Summary entries are made for every day that on-site activities take place. The details of all field activities shall be recorded in separate field logbooks. Multiple field logbooks may be used depending upon the number of different types of field personnel conducting activities at the site. These field logbooks and the site logbook shall be made part of the project file.

Information recorded in field logbooks includes observations, data, calculations, time, weather, and descriptions of the data collection activity, methods, instruments, and results. Additionally, the field logbook may contain descriptions of wastes, biota, geologic material, and site features including sketches, maps, or drawings as appropriate.

7.1.2. Preparation

Site personnel responsible for maintaining field logbooks must be familiar with the SOGs for all tasks to be performed. The field logbook will be assigned to an individual responsible for its care and maintenance. Field logbooks are part of the project file and should remain with project documentation when not in use. Field logbooks shall be bound with lined, consecutively numbered pages. All pages must be numbered prior to initial use of the field logbook.

The following information shall be recorded inside the front cover of the field logbook:

- Person and organization to whom the book is assigned
- Phone number(s)
- Project start date
- Project name
- ERRG project number
- ERRG Personnel's Name
- Sequential book number (if applicable)

The first five pages of the field logbook shall be reserved for a table of contents. Mark the first page with the heading "Table of Contents" and enter the following:

TABLE OF CONTENTS

Date/Description	Page
(Start Date/Reserved for Table of Contents)	1-5

The remaining pages of the table of contents will be designated as such with "TOC" written on the top center of each page.

7.1.3. Site Activities

The following requirements must be met when using a field logbook:

- Record work, observations, quantities of materials, calculations, drawings, and related information directly in the field logbook. If data collection forms are specified by an activity-specific work plan, the information on the form need not be duplicated in the field logbook.
- Any forms used to record site information must be referenced in the field logbook.
- Information should be factual and unbiased.

- Do not start a new page until the previous one is full or has been marked with a single diagonal line so that additional entries cannot be made. Use both sides of each page.
- Write in black, indelible ink. Do not write in pencil unless working in wet conditions.
- Do not erase or blot out any entry. Before an entry has been signed and dated, changes may be made; however, care must be taken not to remove what was originally written. Indicate any deletion with a single line through the material to be deleted. A change should be initiated.
- Do not remove any pages from the field logbook.
- Do not use loose paper and copy into the field logbook later.
- Record sufficient information to completely document field activities.
- All entries should be neat and legible.

Specific requirements for field logbook entries include the following:

- Initial and date each page.
- Sign and date the final page of entries for each day.
- Initial and date all changes.
- If multiple site personnel will record information in the field logbook on the same day, then each person must sign out the field logbook by inserting the following:

  Above notes written by:

  ______________________________ (Sign Name)

  ______________________________ (Print Name)

  ______________________________ (Date)

- A new person recording information in the field logbook must sign and print his/her name before additional entries are made.
- Draw a diagonal line through the remainder of the final page at the end of the day.
- Record the following information on a daily basis:
  - Date and time
  - Name of the individual making the entry
  - Description of the activity being conducted including well, boring, sampling, and location number as appropriate
  - Unusual site conditions

- Weather conditions (i.e., temperature, cloud cover, precipitation, wind direction, and speed) and other pertinent data)
- People on site
- Level of personal protection to be used
- Arrival and departure time of site visitors
- Arrival and departure time of equipment
- Sample pickup (chain-of-custody form numbers, carrier, time)
- Sampling activities and sample log sheet numbers
- Start and completion of borehole, trench, and monitoring well installation or sampling activity
- Health and safety issues
- Instrumentation calibration details

Entries into the field logbook shall be preceded with the time of the observation. The field activities should be recorded frequently, particularly any events or measurements that are critical to the activity being logged. All measurements made and samples collected must be recorded unless otherwise documented by automatic methods (e.g., data logger) or on a separate form required by an operating procedure. In such cases, the field logbook must reference the automatic data record or form.

While sampling, record observations such as color and odor. Indicate the locations from which samples are being taken, sample identification numbers, the order of filling bottles, sample volumes, and parameters to be analyzed. If field duplicate samples are being collected, note the duplicate pair sample identification numbers. If samples are collected that will be used for matrix spike and matrix spike/matrix spike duplicate analysis, record that information in the field logbook.

A sketch of the activity location may be warranted. All maps or sketches made in the field logbook should have descriptions of the features shown. Maps and sketches should be oriented so that north is toward the top of the page and will include a direction indicator.

Other events and observations that should be recorded include (but are not limited to) the following:

- Changes in weather that impact field activities
- Subcontractor activities
- Deviations from procedures outlined in any governing documents, including the reason for the deviation
- Problems, downtime, or delays
- Upgrade or downgrade of personal protective equipment

7.1.4. Post-Site Activities

To guard against the loss of data due to damage or disappearance of field logbooks, copies of completed logbooks shall be securely stored at the local ERRG office.

At the conclusion of each activity or phase of site work, the individual responsible for the field logbook will ensure that all entries have been appropriately signed and dated, and that corrections were made properly (single lines drawn through incorrect information, then initialed, coded, and dated). The completed field logbook shall be submitted to the project file.

7.1.5. Restrictions and Limitations

Field logbooks constitute the official record of on-site technical work, investigations, and data collection activities. Their use, control, and ownership are restricted to activities pertaining to specific field operations conducted by ERRG personnel and their subcontractors. They are documents that may be used in court to indicate and defend dates, personnel, procedures, and techniques employed during site activities. Entries made in these field logbooks should be factual, clear, precise, and as objective as possible. Field logbooks, and entries within, are not to be used for personal use.

7.2. FIELD SAMPLING LOGSHEETS

Field sampling log sheets can be prepared to address the specific needs of each project. All field sampling log sheets shall be completed in black, indelible ink. Any corrections shall be made by crossing out the incorrect information with a single line and placing the edited data above or beside the incorrect data. The following information is the minimum that should be included on the field sampling log sheet:

7.2.1. Site Information

- Site name
- Project number
- Weather conditions

7.2.2. Sample Information

- Date
- Time of sample collection
- Name of field technician
- Media being sampled
- Sample location (sketch as appropriate)
- Associated photograph log number (as appropriate)

- GPS reading (as appropriate)
- Sample number
- Sample description
- Sample container and preservative (if any)
- Comments and observations (if any)
- QC samples collected

7.2.3. Equipment Information

- Equipment used to collect the sample
- Equipment decontamination technique
- Field instrument calibration
- Field instrument readings

7.2.4. Analytical

- Analysis to be performed
- Analytical laboratory

7.3. QUALITY ASSURANCE/QUALITY CONTROL

8. Field Sampling Quality Control Considerations

This section provides guidelines for establishing quality control procedures for sampling activities. Strict adherence to all the standard operating procedures outlined in this subsection forms the basis for an acceptable sampling quality assurance program.

8.1. EXPERIENCE REQUIREMENTS

There is no substitute for field experience. Field experience is gained by on the-job training using the "buddy" system. Each new employee will accompany an experienced employee on as many different types of field studies as possible. During this training period, the new employee will be permitted to perform all facets of field investigations, including sampling, under the direction and supervision of senior field personnel.

8.2. TRACEABILITY REQUIREMENTS

All sample collection and measurement activities will be traceable through field records to the person collecting the sample or making the measurement. All maintenance and calibration records for sampling and measurement equipment (where appropriate) will be kept so that they are similarly traceable.

8.3. FIELD SAMPLE CUSTODY PROCEDURES

A sample is in the custody of a field sampler, shipping agent, or analytical laboratory employee/sample custodian if:

- it is in his/her possession;
- it is in his/her view, after being in his/her possession;
- it was in his/her possession and then placed under lock and key; or
- it is maintained in a designated secure area.

8.3.1. Sample Labels

Sample labels convey information unique to each sample and thus serve to prevent misidentification of samples as specified in the ERRG SOG for Sample Packaging and Shipping (SOG-007). The field sampler shall attach a sample label to each sample container at the time of sampling. Labels should be completed with indelible ink and should be protected from water with clear tape. Any errors made on a sample label shall be corrected as described in the "Error Correction" section of this SOG. Each sample label shall note the following information:

- project identification, sampling location, and job number;
- name or initials of field sampler;
- sample identification (ID) number;
- analysis required and sample preservation (if applicable);
- sampling date; and
- local standard time of sample collection, using a 24-hour clock notation.

The field sampler is responsible for maintaining a field log that chronicles and summarizes all field activities performed during a given workday. Should an erroneous entry be made, the error shall be corrected as described in the "Error Correction" section of this SOG. Field logs shall include the following information at a minimum:

- sampling site;
- sampling location;

- sampling depth (below ground surface [bgs], if applicable);
- sample matrix;
- sample appearance;
- volume of sample collected;
- map of sample locations if possible;
- field measurements (if applicable);
- type of sampling equipment used;
- names of all individuals present during sampling;
- sample collection dates and times, using a 24-hour clock notation;
- sample ID numbers;
- type and number of sample containers used per sampling site;
- designation of quality control samples (e.g., blanks, splits, or duplicates); and
- analysis required and sample preservation (if applicable).

Logbooks are intended to provide sufficient information to enable participants or others to reconstruct events that occurred during field activities. The notes allow interested parties, not present in the field at the time of sampling, to obtain insight into the field conditions surrounding any particular sampling event, as well as the methodology used by the field samplers. Logbooks are also admissible as evidence in legal proceedings. As such, the logbook entries should be factual, detailed, and objective. All field log entries must be signed and dated by the sampler.

8.3.2. Chain-of-Custody

The field sampler shall fill out a COC record after each sample is collected as specified in the ERRG SOG for Sample Packaging and Shipping (SOG-007). The COC record is necessary to physically trace sample possession from the time of collection to submission to the laboratory. The record(s) shall be filled out once the sample is collected and shall contain the following information:

- project/contract number;
- project name and sampling site;
- site contact (e.g., Project Manager);
- names of field samplers and their signatures;
- sample ID number;
- sampling date;

- local standard time of sample collection, using a 24-hour clock notation;
- sample matrix;
- number of containers submitted for each sample;
- analyses requested;
- turnaround time requested for analyses;
- preservation of sample containers (if applicable);
- name and address of analytical laboratory;
- means of transmittal to the analytical laboratory or storage facility (including carrier and tracking number, if applicable); and
- any general comments, instructions to the analytical laboratory, or unusual circumstances. These may include:
  - indication that a particular sample was split with an owner, operator, or government agency;
  - instruction to the analytical laboratory to spike a sample;
  - indication of problems encountered during an attempt to transfer a sample; or
  - lack of preservation due "sample reaction."

General comments, instructions to the analytical laboratory, or unusual circumstances shall be recorded in the “Comments” or “Special Instructions” section of the COC. Should an error be made on the COC, the error shall be corrected as described in the “Error Correction” section of this SOG.

In the event that multiple analytical laboratories are used at a site, a separate COC record shall be completed for each laboratory or storage facility. Each COC record shall indicate the number of coolers transmitted to that particular laboratory or storage facility.

8.3.3. Custody Seals

Custody seals are used to detect whether samples have been subjected to tampering following sample collection and prior to the time of analysis as specified in the ERRG SOG for Sample Packaging and Shipping (SOG-007). The seal shall be attached in such a way that it is necessary to break the seal in order to open the container.

Coolers: Two or more custody seals shall also be affixed to the outside of the shipping container or cooler prior to shipment through a commercial carrier (e.g., Federal Express).

Sample Containers: Not all projects require custody seals on sample containers; however, when a custody seal is required, a signed and dated seal shall be affixed to each sample such that the seal must be broken to open the sample container.

8.3.4. Error Correction

All errors made on the sample label, in the logbook, or on the COC shall be corrected with a single line drawn through the error, followed by the entry of the correct information. The individual making the correction shall then initial the correction and indicate the date on which the correction was made. The erroneous information shall not be obliterated. If an error is discovered on a sample label that has been taped to protect it from water, the label shall be discarded and a new, correct label shall be affixed to the sample. Should an error be made on a custody seal, the seal shall be discarded, and a new seal shall be affixed to the sample container. A description of an error correction made to the sample label or COC shall be entered in the logbook.

8.4. TRANSFER OF CUSTODY IN GENERAL

The field sampler is personally responsible for the care and custody of the samples until they are transferred or shipped to the analytical laboratory. The COC, initiated by the field sampler during sampling, shall document only those samples it accompanies during shipment (i.e., the COC is the record of the contents of a particular cooler). All samples shall be accompanied by a field-completed COC.

The field sampler must relinquish the samples to a person; however, if this is not possible then the samples can be relinquished and placed under lock and key or into a designated secure area with controlled access. If samples are left in a designated secure area, then they will be separated from other samples in the same area by a physical barrier.

If samples are to be received by the laboratory or a courier the following day AND the field sampler will not be present at the time of pick-up then it is the field sampler's responsibility to find a technical person to be responsible for receiving the samples and then relinquishing them to the courier or lab.

8.4.1. Transfer of Custody for Shipment

There are two main routes to transfer samples to the analytical laboratory or storage facility:

- by land or air through a commercial shipping courier, or
- by land through a non-commercial courier, field samplers, or other responsible party to whom the samples can be relinquished directly.

Additionally, guidelines on sample packaging and shipping is specified in ERRG SOG for Sample Packaging and Shipping (SOG-007).

8.5. SAMPLE PRESERVATION

Preservatives required for routine analyses of samples collected are found in the Site-specific Sampling and Analysis Plan (SAP) or Quality Assurance Project Plan (QAPP). All chemical preservatives used will be supplied by the laboratory. All samples requiring preservation should be preserved immediately upon collection in the field. Records of sample preservation, including ice, will be documented in the field logbooks.

Samples that should not be preserved in the field are:

1. Those collected within a hazardous waste site that are known or thought to be highly contaminated with toxic materials which may be highly reactive. Barrel, drum, closed container, spillage, or other source samples from hazardous waste sites are not to be preserved with any chemical.
2. Those that have extremely low or high pH or samples that may generate potentially dangerous gases.

All samples preserved with chemicals will be clearly identified by indication on the sample tag, label, or container that the sample is preserved. If samples normally requiring preservation were not preserved, field records should clearly specify the reason. Samples shipped by air will not be preserved with nitric acid, hydrochloric acid, sodium hydroxide, or sulfuric acid in excess of the amount specified in the SAP/QAPP.

8.6. SAMPLE COLLECTION PRECAUTIONS

In order to prevent cross-contamination during sample collection, the following precautions at a minimum will be taken:

1. A clean pair of new, non-powdered, disposable latex gloves will be worn each time a different location is sampled, and the gloves should be donned immediately prior to sampling. The gloves should not come into contact with the media being sampled.
2. Sample containers for source samples or samples suspected of containing high concentrations of contaminants will be placed in separate plastic bags immediately after collecting, tagging, etc.
3. Sample collection activities should proceed progressively from the least suspected contaminated area to the most suspected contaminated area.
4. If possible, samples of known or suspected low concentrations and samples from the source or known or suspected high concentrations should be collected by different field teams. If different field teams cannot be used, the samples with known or suspected low concentrations should be collected first and placed in separate ice chests or shipping containers, if possible.
5. If possible, one member of the field sampling team should record all of the field notes, collect GPS data, etc., while the other member(s) collect the samples.

6. When sampling surface water and sediment at the same location, the water sample should always be collected before the sediment sample is collected.
7. Sampling equipment should be constructed of Teflon®, stainless steel, high-density polyethylene (HDPE), or glass that has been properly pre-cleaned according to the SOG for Equipment/Personnel Decontamination (SOG-008) or as required by the project specific SAP/QAPP.

Upon returning from the field, unused sample containers will be returned to the laboratory that provided them.

Opened bags or boxes of latex gloves returning from the field will be segregated from unopened gloves and will not be re-used for sample collection on other projects. Open bags or boxes of sampling materials that cannot be definitively determined to be clean will be disposed.

8.7. SAMPLE HANDLING AND MIXING

Once a sample has been collected, it may have to be transferred into separate containers for different analyses. Sample transfer should be done as soon as possible. If necessary, aqueous samples may be collected into a single, larger container for homogenization and transferred into individual sample containers. However, aqueous samples collected for volatile organic compounds, oil and grease, bacteria, sulfides, and phenols analyses may not be transferred using this procedure.

It is extremely important that waste (when appropriate), soil, and sediment samples be mixed thoroughly to ensure that the sample is representative of the sample media. The most common method of mixing is referred to as quartering. The quartering procedure should be performed as follows:

1. The material in the sample pan should be divided into quarters and each quarter should be mixed individually.
2. Two quarters should then be mixed to form halves.
3. The two halves should be mixed to form a homogenous matrix.

This procedure should be repeated several times until the sample is adequately mixed. If round bowls are used for sample mixing, adequate mixing is achieved by stirring the material in a circular fashion, reversing direction, and occasionally turning the material over.

8.8. SPECIAL HANDLING OF SAMPLES FOR VOLATILE ORGANIC COMPOUNDS ANALYSIS

Water samples to be analyzed for volatile organic compounds should be stored in 40-ml septum vials with screw cap. The vials should be completely filled to prevent volatilization, and extreme caution should be exercised when filling a vial to avoid any turbulence which could also produce volatilization. The sample should be carefully poured down the side of the vial to minimize turbulence. As a rule, it is best to gently pour the last few drops into the vial so that surface tension holds the water in a convex meniscus. The cap is then applied, and some overflow is lost, but the air space in the bottle is eliminated. After capping, turn the bottle over and tap it to check for bubbles. If a bubble or bubbles are present, the vial should be topped off using a minimal amount of sample to re-establish the meniscus. Care should be taken not to flush any preservative out of the vial during topping off. If, after topping off and capping the vial, bubbles are still present, a new vial should be obtained, and the sample re-collected.

8.9. SAMPLE STORAGE AND TRANSPORT

After collection, sample handling should be minimized. Field samplers should use extreme care to ensure that samples are not contaminated during storage. Collected samples are typically stored in coolers. To reduce the risk of cross contamination, smaller sample containers such as 8-ounce glass jars, 40-mL VOA vials, and one-liter amber bottles should be placed inside of sealed, plastic bags before being placed in the cooler. If ice is required for preservation of the samples, the ice should be contained in a plastic bag or some equivalent container to prevent the potential for cross contamination of the samples by water produced from melting ice. If ice is used, the coolers should be checked regularly, and water should be drained as needed. Custody of samples will be maintained according to the ERRG SOG for Sample Packaging and Shipping (SOG-007).

Samples will either be transported to the analytical laboratory by field samplers or shipped by a carrier. Shipping of samples will be conducted in accordance with the ERRG SOG for Sample Packaging and Shipping (SOG-007).

9. Quality Control Samples

Quality control samples are collected during field studies for various purposes, among which are to isolate site effects (control samples), to define background conditions (background sample), and to evaluate field/laboratory variability (spikes and blanks, trip blanks, duplicate, split samples, etc.). QC samples to be collected for the project are found in the SAP/QAPP.

9.1. EQUIPMENT BLANK

Purpose: Equipment Blanks are collected to evaluate field sampling procedures and equipment decontamination procedures.

Description: Equipment Blank samples consist of ASTM Type II water (analyte-free, deionized water) collected from a final rinse of sampling equipment after the decontamination procedure has been performed. ASTM Type II water is best obtained from the laboratory. If ASTM Type II water or equivalent is not available, then a Source Blank sample of the unused final rinse water must be submitted for analysis as described in Section 7.6. The Equipment Blank is analyzed by the same methods as the field samples. The procedures for collecting an Equipment Blank are as follows:

1. Decontaminate the equipment following the procedures in the SAP/QAPP.
2. Pour ASTM Type II water into, over or pump through the equipment.
3. Collect the water running off the equipment in the sample containers.
4. Seal and label the samples appropriately.
5. Place the samples in a cooler containing sufficient ice for storage or shipment.

Frequency: The frequency of collection will vary for each project but in general Equipment Blank samples will be collected at a rate of one sample per piece of sampling equipment per sampling team per day unless specified differently in the SAP/QAPP. Equipment Blank samples should be collected at least once per sampling event and anytime sampling procedures or personnel change.

9.2. FIELD DUPLICATE

Purpose: Field duplicate samples are used to assess error associated with sample heterogeneity, sample methodology and analytical procedures.

Description: Field duplicates consist of two samples of the same matrix collected at the same time and location (to the extent possible), using the same sampling techniques. Field duplicates will be analyzed for the same analytes as the original samples at the same laboratory.

Frequency: Field duplicates are collected at a frequency of 5% of the total samples or one duplicate for every twenty field samples collected. Additionally, a minimum of one duplicate per media, per event will be collected.

9.3. MATRIX SPIKE/MATRIX SPIKE DUPLICATES (MS/MSD)

Purpose: MS/MSD samples are used to measure the performance of the analytical method relative to the specific sample matrix of interest.

Description: An MS/MSD sample is an additional volume of a sample that is used by the laboratory to determine if there are interferences between the matrix and the analytical procedure. The analytical laboratory will spike the MS/MSD samples with known concentrations of target analytes and subject the sample to the entire analytical procedure in order to measure the appropriateness of the method for the matrix by measuring the spiked analyte recovery. MS/MSD results are an indication of any positive or negative influences of the sample matrix in the analytical procedure.

Frequency: MS/MSDs are collected at a frequency of 5 percent or one set of MS/MSD samples for every twenty field samples, unless otherwise indicated in the SAP/QAPP.

9.4. SOURCE BLANK

Purpose: Source Blank, also termed Field Blank, samples are used to verify the analyte-free water does not contain the analytes of concern for the site.

Description: Source Blank samples are collected from water used to rinse equipment at the site to verify it does not contain detectable concentrations of analytes of concern. Source Blank samples are collected when the water is not ASTM Type II water or there is no analytical data to verify the water is analyte-free. The Source Blank sample is analyzed for the same contaminants as the environmental samples at the site.

Frequency: Source blanks should be collected at a frequency of one per batch or lot of water used with a minimum of one per sampling event. Water purchased for decontamination typically has a batch or lot number on the container.

9.5. TEMPERATURE BLANKS

Purpose: Temperature Blanks are used by the laboratory to measure the temperature of the cooler upon arrival at the laboratory.

Description: A temperature blank is a container of tap water that is shipped in each cooler containing field samples and ice.

Frequency: Every cooler containing samples requiring refrigeration should have a Temperature blank.

9.6. TRIP BLANK

Purpose: Trip Blanks are used to check that VOCs and TPH-gas are not introduced to the collected samples during handling, storage, or shipment from the field to the laboratory.

Description: Trip Blanks are hydrochloric acid-preserved, ASTM Type II water (analyte-free, deionized water) prepared by the laboratory in 40-mL VOA vials that will be carried to the field, stored with samples collected for volatile analysis, and returned to the laboratory for volatile analysis. Trip Blanks will be analyzed for VOCs only, which includes BTEX. The laboratory will ship the trip blanks with the requested sample containers. If the Trip Blanks received from the laboratory contain visible bubbles, then the Trip Blank condition should be documented in the project files, field logs, and the lab should be contacted. The Trip Blank sample must remain with the VOC samples from the time the VOC sample is collected to the time it is received by the laboratory. The Trip Blank should be coded by the laboratory to reference back to a specific lot of sample containers and specific shipment. The Trip Blank is not to be opened by ERRG staff.

Frequency: A minimum of one trip blank will be submitted to the laboratory for analysis with every container of samples for VOC analysis.

Title:	**Field Equipment Calibration**
Document Number:	**SOG-002**
Revision Number:	**0**

Reviewed:	______________________ Quality Control Manager	12/1/2023 Date
Approved:	______________________ Project Manager	12/1/2023 Date

1. Purpose

This standard operating procedure (SOG) is intended to provide general guidance and methods for using a field meter to measure water quality parameters from groundwater or surface water that is being purged, sampled, or monitored.

2. Scope

This SOG is applicable to all ERRG projects where water quality monitoring is required using a water quality meter. The water quality meter may be a stand-alone meter or it may be a combined multi-probe unit used to measure temperature, pH, specific conductance, and other water quality parameters. The most common methods used for measuring water quality are instruments that measure in-situ parameters in one of the following two ways:

- Water is extracted from its source using a pump and measured in a flow-through cell or in some instances captured and then measured in individual aliquots. This method is preferred when monitoring wells are sampled for laboratory analysis of chemical parameters, and groundwater purging is required.
- The meter is submerged directly into the sample source, such as a monitoring well or surface water body, to collect in-situ monitoring parameters.

3. References

ASTM International, 2014. ASTM D6634M-14, "Standard Guide for Selection of Purging and Sampling Devices for Ground-Water Monitoring Wells."

ASTM International, 2019. ASTM D4448-01, "Standard Guide for Sampling Ground-Water Monitoring Wells."

U.S. Environmental Protection Agency (EPA), 2014. "Contract Laboratory Program Guidance for Field Samplers." OSWER 9200.2-147 / EPA-540-R-014-013. Office of Superfund Remediation and Technology Innovation. October. Online Address: <https://www.epa.gov/sites/production/files/2015-03/documents/samplers_guide.pdf>.

4. Definition of Terms

Water Quality Meter—A device used to measure specific field parameters indicative of water quality, such as temperature, pH, specific conductance, and other parameters. The meter may be a stand-alone unit or it may be a combined multi-probe unit.

Pump—An electric-, compressed air-, or inert gas-driven device that raises liquids by means of pressure or suction. The types of pumps that should be used for water quality monitoring should be chosen based on the well size and depth, the type of contaminants, and the specific factors affecting the overall performance of the sampling or monitoring effort. The types of pumps that may be used include centrifugal, peristaltic, centrifugal submersible, gas displacement, and bladder pumps.

pH—The negative log of the hydrogen ion concentration (-log10 [H+]); a measure of the acidity or alkalinity of a solution, numerically equal to 7 for neutral solutions, increasing with increasing alkalinity and decreasing with increasing acidity. The scale is 0 to 14.

Turbidity—A measure of overall water clarity determined by measurement of the degree to which light traveling through a water column is scattered by the suspended organic (including algae) and inorganic particles. Turbidity is commonly measured in nephelometric turbidity units (NTU) but may also be measured in jackson turbidity units (JTU).

Specific Conductance (SC)—A measure of how well water can conduct an electrical current. Conductivity increases with an increasing amount and mobility of ions such as chloride, nitrate, sulfate, phosphate, sodium, magnesium, calcium, and iron, and can be used as an indicator of water pollution. The unit of conductance is expressed as microsiemens (1/1,000,000 siemen) per centimeter, or µS/cm.

Oxidation-Reduction (Redox) Potential—A measure in volts of the affinity of a substance for electrons compared with hydrogen. Liquids that are more strongly electronegative than hydrogen (i.e., capable of oxidizing) have positive redox potentials. Liquids less electronegative than hydrogen (i.e., capable of reducing) have negative redox potentials.

Dissolved Oxygen (DO)—Refers to the amount of oxygen expressed as mg/L (milligram per liter) that is contained in water. The amount of oxygen that can be held by water depends on the water temperature, salinity, purity, and pressure.

Salinity—The amount of dissolved salts in water, generally expressed in parts per thousand (ppt).

5. Responsibilities

5.1. PROCEDURE RESPONSIBILITY

The Quality Control Manager or Project Manager is responsible for maintenance, management, and revision of this SOG. Questions, comments, or suggestions about this SOG should be sent to the Quality Control Manager or Project Manager.

5.2. PROJECT RESPONSIBILITY

ERRG employees performing this task, or any portion thereof, are responsible for meeting the requirements of this SOG. ERRG employees conducting technical review of task performance are also responsible for following appropriate portions of this SOG.

For those projects where the activities of this SOG are conducted, the Project Manager, or designee, is responsible for ensuring that those activities are conducted in accordance with this and other appropriate SOPs. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (i.e., daily logs, checkprints, calculations, reports, etc.) that the requirements of this SOP have been met. Such documentation shall be retained as part of the project file.

6. Procedure

6.1. EQUIPMENT

The following equipment is recommended for use in performing water quality measurements:

- Water quality meter(s) with a flow through cell (if desired)
- Spare parts such as alkaline batteries (if used) and sensor probes
- Pump and discharge hose and line for use with a flow-through cell
- Paper towels or lint-free wipes
- De-ionized water
- Sample gloves
- Calibration solutions for all parameters being measured; within expiration dates
- Plastic sheeting
- Logbook or log sheets

6.2. GENERAL INSTRUCTIONS

- Ensure that the measuring range of the instrument(s) encompasses the expected sample concentration or units.
- Before going into the field, locate all necessary field supplies such as de-ionized water, calibration solutions, decontamination supplies, and spare parts.
- Consult the instrument's operating manual as well as the project-specific sampling plan to verify that you have prepared the proper equipment and supplies to successfully complete the work.

6.3. CALIBRATION

Calibration must be performed at least once per day during operation. Calibrate the meter according to the instrument's operating manual. If sampling and monitoring is being performed for long periods of time, periodically check the instrument calibration using the operating manual's recommended frequency.

To avoid limiting the field personnel to one particular model, only general calibration instructions are presented in this procedure.

- Locate a clean, protected area in which to set up and calibrate the instrument. Ensure that sufficient supplies of de-ionized water, clean paper towels, buffer solutions, and standard solutions are available.
- Inspect the meter and probes for damage. Some of the probes are very delicate or have a thin membrane installed over the probe. Be careful when handling the meter and probes so as not to damage them. If damaged, replace probes in accordance with the instrument's operating manual or obtain a different meter.
- Turn on the meter and allow it to "warm-up" for the manufacturer-specified time (usually 15 to 30 minutes). Check the battery power to determine if the meter has sufficient power to operate for the monitoring period. Replace the batteries, if necessary.
- Calibrate the meter according to the instrument's operating manual. In general, calibration is performed by immersing the probe(s) in aliquots of calibration standard solution(s) and following certain meter keystrokes to set the calibration for each parameter. Do not immerse the probe into the stock container of the solution. Always transfer a small amount of the solution into a separate container to calibrate the probe(s). If calibrating for multiple parameters using more than one solution, be sure to wipe off and rinse the probe with de-ionized water between solutions.
- Recheck each parameter after calibration by immersing the probe into the calibration solution and reading it like a sample reading. If the agreement is not within 25 percent of the solution's known concentration, repeat the calibration process with a new solution aliquot.
- Discard the used calibration solution aliquots into an appropriate waste container when finished.
- Record the calibration data in the field logbook or log sheet.

6.4. OPERATION OF THE INSTRUMENT

- If using a flow-through cell system, attach the extraction pump and lines in accordance with the pump and meter manufacturer's instructions. Allow the lines to fill and the probes to become immersed before switching the instrument to its measurement mode.
- If using a down-hole system, allow a few minutes for the probe to stabilize before taking a reading.
- Operate the meter in accordance with the instrument's operating manual.

- Collect the field parameter reading(s) per the project requirements, and record them in a field logbook or on log sheets.
- Decontaminate the meter before collecting data from the next sample source. For a flow-through system, flush the lines with three line volumes of de-ionized water or replace with new ones between samples.

Title: **Soil Gas and Vapor Sampling**

Document Number: **SOG-003**

Revision Number: **0**

Reviewed:	Quality Control Manager	12/1/2023	Date
Approved:	Project Manager	12/1/2023	Date

Soil Gas and Vapor Sampling

1. Purpose

This standard operating procedure (SOG) provides the standard practice for performing process soil gas/vapor monitoring and sampling for soil vapor extraction (SVE), multi-phase extraction (MPE) system and air sparging (AS) remediation systems. This SOG includes the minimum required steps and quality checks that employees and subcontractors are to follow when performing the subject task.

2. Scope

This SOG describes Engineering/Remediation Resources Group, Inc. (ERRG) standards for measuring vacuum and pressure, temperature, and flow rate from treatment system process pipelines and equipment, from extraction and injection wells, and from dedicated monitoring points. This SOG also describes the standards for collecting soil gas/vapor samples for field screening and laboratory chemical analysis from treatment system process pipelines, extraction wells, and dedicated monitoring points. Practitioners should be advised that certain regulatory jurisdictions may prefer or specify sampling procedures that differ from those presented here or from standard U.S. Environmental Protection Agency (EPA) methods.

The following table presents typical and/or recommended monitoring and sampling parameters for each treatment process:

System Location	Monitoring Location	Matrix	Equipment	Field Parameter
SVE Wells and Vacuum Process Pipelines	Temperature Monitoring Points	Soil Vapor	Infrared thermometer	Temperature (°F or optional °C)
	Vacuum Monitoring Points		Portable digital manometer, Magnehelic® or oil-filled vacuum gauge	Vacuum (inches of water [in. water] or other units, Pascals/ pounds per square inch [psi])
	Flow Monitoring Points (all flow monitoring points must also have a vacuum or pressure measurement)		Differential pressure gauge (Digital manometer or averaging pitot tube)	Pressure difference (in. water/Pascals/psi) for flow calculation
			Air flow meter (fixed or portable) preferably portable, digital, intrinsically safe thermal anemometer	Velocity or Volumetric Flow Rate (ft/sec, optional m/sec or acfm or m^3/hr)
	Vapor Monitoring Points		PID or FID (from Tedlar® bag, if sample location under vacuum)	VOCs, calibrated to isobutylene or hexane, in parts per million by volume (ppmv) or parts per billion by volume (ppbv)

System Location	Monitoring Location	Matrix	Equipment	Field Parameter
MPE Wells	Vacuum Process Pipelines Vacuum Monitoring Points	Soil Vapor, Groundwater, Free Phase Liquid	Thermometer	Temperature (°F)[a]
			Portable digital manometer, Magnehelic® or oil-filled vacuum gauge	Vacuum (in. water/psi/Pascals)[a]
			Differential pressure Gauge or in-line air velocity or volumetric flow meter in liquid-free stream	Flow Rate (ft/sec or metric units)[a]
			PID or FID (from Tedlar® bag)	VOCs (ppmv/ppbv)[a]
Vapor Treatment System	Influent and Effluent	Soil Vapor	Thermometer	Temperature (°F)
			Portable digital manometer, Magnehelic® or oil-filled vacuum gauge	Pressure (psi/in. water/Pascals)
			Differential pressure gauge or in-line flow meter or volumetric flow meter in liquid-free stream	Flow Rate (ft/sec)
			PID or FID (from Tedlar® bag or as specified by regulatory agency or permit)	VOCs (ppmv/ppbv)
AS Wells	Pressure Process Pipelines Pressure Monitoring Well Points	Injection (ambient) Air	Pressure gauges	Pressure (psi/in. water/Pascals)
			Rotameter or portable thermal flow meter in isolated by-pass	Flow Rate (ft/sec or metric equivalent)
General Site	Within Site Boundaries	Ambient Air	Thermometer	Ambient air temp (°F)
			Barometer	Barometric pressure
		Groundwater	Interface probe	Groundwater Level Fluctuation

Notes:

a. Readings may be affected by moisture/liquids in the vapor stream. A moisture/vapor separator may be required at the inlet to the monitoring equipment to obtain accurate readings.

2.1. CONSIDERATIONS

Consult the specific procedures that are developed for each project where SVE, MPE, and AS are used. Most projects will have a site-specific Operation, Maintenance, and Monitoring (OM&M) Plan, which details requirements and procedures for safely operating the treatment process and provides specifics on the type and quantity of samples that are required for process sampling and monitoring. At a minimum, the following should be considered and reviewed when planning for process monitoring and sampling:

- Results of the monitoring and sampling are used to determine treatment system performance, including contaminant mass removal rates, actual radius of influence, and qualitative cleanup progress. Actual clean up progress is based on soil and groundwater sampling that is performed periodically and at the conclusion of the operation of the system.
- If sampling and monitoring are performed around electric-powered and motorized equipment. The OM&M Plan and the Health and Safety Plan should be reviewed prior to performing activities to understand the electrical and mechanical safety procedures.
- The OM&M Plan should be reviewed prior to monitoring, and sampling is performed to understand system operational procedures including system operational objectives, routine operational procedures, start-stop procedures, emergency shutdown procedures, monitoring and sample locations.
- The air permit regulations should be reviewed for the system to verify that the proper laboratory analysis, field monitoring, and reporting requirements are being performed.

3. References

U.S. Army Corps of Engineers, 1999. "Multi-Phase Air Sparging Extraction, EM-1110-1-4010." Washington, DC. June 1.

U.S. Army Corps of Engineers, 2002. "Soil Vapor Extraction and Bioventing, EM-1110-1-4001." Washington, DC. June 3.

U.S. Army Corps of Engineers, 2013. "In-Situ Air Sparging, EM-200-1-19." Washington, DC. December 31.

Leeson, A., P.C. Johnson, R.L. Johnson, C.M. Vogel, R.E. Hinchee, M. Marley, T. Peargrin, C.L. Bruce, I.L. Amerson, C.T. Coonfare, R.D. Gillespie, and D.B. McWhorter, 2002. Air Sparging Design Paradigm. Battelle Press. Columbus, Ohio. August 12.

ASTM International, 2016. D5092M-16 "Standard Practice for Design and Installation of Groundwater Monitoring Wells."

4. Definition of Terms

Soil Vapor Extraction (SVE)—The application of vacuum to a well screened primarily in the unsaturated vadose zone for the purpose of volatilizing and extracting volatile organic compounds (VOCs) or a portion of a semivolatile organic compound (SVOC) from the soil in the vapor phase.

Multi-Phase Extraction (MPE)—The vacuum-enhanced simultaneous extraction of contaminated soil vapor and subsurface liquids. The primary purpose of MPE is to extract volatile fractions of petroleum and chlorinated hydrocarbons from the subsurface vadose zone and capillary fringe in vapor phase, as well as volatile to non-volatile fractions of petroleum and chlorinated hydrocarbons in separate and dissolved-phase liquids from the shallow saturated zone.

Air Sparging—The application of pressurized ambient air to a well screened in the saturated zone for the purpose of volatilizing VOCs or a portion of an SVOC from the groundwater in the vapor phase.

Vadose Zone—The hydrogeological region extending from the soil surface to the top of the principal water table; commonly referred to as the "unsaturated zone."

Capillary Fringe—The lower subdivision of the vadose zone immediately above the water table, in which the interstices are filled with water under pressure less than that of the atmosphere; being continuous with the water below the water table but held above it by surface tension.

Vapor Monitoring Point (VMP)—A well installed with screens in the subsurface vadose zone and used to monitor vacuum and pressures and not generally used for extraction or injection. The VMP is also used to collect vapor samples for field and laboratory analysis.

5. Responsibilities

5.1. PROCEDURE RESPONSIBILITY

The Quality Control Manager (QC) or Project Manager is responsible for maintenance, management, and revision of this SOG. Questions, comments, or suggestions on this technical SOG should be sent to the QC Manager or Project Manager.

5.2. PROJECT RESPONSIBILITY

ERRG employees performing this task, or any portion thereof, are responsible for meeting the requirements of this SOG. ERRG employees conducting technical review of task performance are also responsible for following appropriate portions of this SOG.

For those projects where the activities of this SOG are conducted, the Project Manager, or designee, is responsible for ensuring that those activities are conducted in accordance with this and other appropriate SOGs. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (i.e., daily logs, checkprints, calculations, reports, etc.) that the requirements of this SOG have been met. Such documentation shall be retained as project records.

6. Procedure

6.1. GENERAL REQUIREMENTS FOR VAPOR MONITORING AND SAMPLING

The following processes should be utilized to complete vapor monitoring and sampling activities for SVE, MPE, and AS applications:

- Data reporting
- Ambient air monitoring
- AS pressure measurement
- SVE/MPE vacuum measurement
- Vapor monitoring point pressure measurement
- Temperature measurement
- Flow rate monitoring

Descriptions of each of these processes are provided in subsections below.

6.1.1. Equipment and Supplies

The following equipment and supplies should be utilized to perform this task:

- Field logbook
- Field data forms
- Cooler with ice
- Magnehelic® vacuum gauge or portable digital vacuum, pressure, and pressure differential manometer or oil-filled gauges
- Thermometer (may be combined with other instruments)
- Barometer
- Rotameter (or portable digital thermal flow meter)
- Pressure gauges (oil-filled or portable digital manometer as above)
- Tygon® tubing (Teflon™ or nylon tubing may be specified for selected contaminants and applications)

6.1.2. Data Reporting

During all monitoring events, the following data should be recorded into the field logbook and appropriate log form for each monitoring activity completed. Please note that each monitoring activity will include additional information that will also be recorded.

- Monitoring and/or sample location
- Date and time collected
- Field Technician
- Parameters monitored and/or sample type collected

6.1.3. Ambient Air Monitoring

Temperature measurements are collected by reading the temperature shown on the thermometer directly. Barometric pressure readings are obtained by reading the pressure directly from the barometer. Both readings are then recorded in the appropriate logbook or form. Because temperature and barometric pressure do not change substantially in local regions, readings from nearby, similar National Weather Service, or military airfields can also be used if site data is not available.

6.1.4. Air Sparging Pressure Measurement

Pressure measurements on the air sparging wells should be made by reading the pressure directly from either the air sparging well headers or air sparging wells using a dial pressure gauge attached to a monitoring port. After the pressure is read, the value is recorded into the field logbook or appropriate vapor monitoring form.

6.1.5. Vacuum Measurement

Vacuum measurements from vacuum monitoring points should be made by attaching one end of an appropriately sized length of Tygon® tubing onto the monitoring and sampling port located on the VMP or well and the other end onto the hose barb present on the appropriate Magnahelic® gauge. The vacuum reading will then be read directly from the Magnahelic® gauge. This reading is recorded into the field logbook or appropriate vapor monitoring form.

6.1.6. Temperature Measurements

Temperature measurements of SVE/MPE/AS wells/process pipeline should be made by placing the end of the thermometer into the air stream at the monitoring port, or by directly reading a temperature gauge installed upstream and downstream of the blower, at the inlet and optional intermediate locations, and at the outlet of the vapor treatment system. After allowing the thermometer to equilibrate per the manufacturer instructions, the temperature reading should be read directly from the thermometer. This reading is recorded into the field logbook or appropriate vapor monitoring form.

6.1.7. Flow Rate Monitoring

Air Flow Monitoring Using a Pitot Tube (SVE, MPE, and AS Wells, Headers, and Effluent)

Air flow measurements at SVE/MPE/AS wells, headers (if required), and the system effluent should be made by attaching one end of an appropriately sized length of Tygon® tubing onto the pitot tube monitoring point and the other end onto the hose barb present on the appropriate differential pressure gauge. The flow rate will then be read directly in inches of water column. The reading will then be converted to feet per second using a conversion table. This information is recorded in the logbook or appropriate form.

Air Flow Monitoring Using a Rotameter (for use with Lower Flow Systems)

Air flow measurement at wells and headers (if required) can be made by directly reading the flow from a rotameter that is installed in-line. Where in-line meters are not installed, measurements can be made by diverting the air stream from an individual well or header through a rotameter. The rotameter will first be connected to in-line flow monitoring ports (using pneumatic quick couplings and appropriate hose) located before and after the ball valve at the top of the well or the ball valve located in-line on the header. The rotameter should be leveled after it is connected, and then the flow monitoring ports should be opened, and the inline ball valve should be closed. The flow rate will then be read directly in cubic feet per minute (cfm) from the rotameter. This information is recorded in the logbook or appropriate form.

Air Flow Monitoring Using a Thermal Flow Meter (for Portability and Precision)

Routine measurements of flow or measurements used as checks on fixed, in-line flow meters for quality assurance purposes can be accomplished with a portable, digital flow meter. These meters are very sensitive and amenable for flow measurement with a telescopic probe in a variety of pipe sizes and shapes. These meters also have a thermometer installed for use in internal flow calculations that may also be read on a digital screen for recording. All flow measurements, whether speeds or volumetric flow rates, must have an accompanying vacuum or pressure reading to correct for pressure-induced density differences to compute flow rates in standard cubic feet per minute or metric equivalents. Thermal flow mater measurements should be collected from a port located in a straight section of pipe at least 7.5 pipe diameters downstream and 3 pipe diameters upstream from anything that may cause a disturbance in air flow.

6.2. VAPOR MONITORING AND FIELD ANALYSES

The procedures described in the subsections below should be used to collect routine process vapor samples for field analyses.

6.2.1. Equipment and Supplies

The following equipment and supplies should be used to perform this task:

- PID
- Vacuum desiccator sampling kit (including a vacuum desiccator, pump, tubing, and Tedlar® or similar bag)
- Field logbook
- Field log forms

6.2.2. Sample Collection for Field Analysis

Vapor samples need to be collected from the system because many of the vapor parameters measured during vapor monitoring events cannot be monitored directly from system monitoring and sampling ports. Vapor samples are collected in 1-liter Tedlar® bags.

- An appropriate length of Tygon® tubing should be attached to the sampling and monitoring port (equipped with a 0.25-inch valve and barbed fitting or a quick connect fitting) such that the sampling equipment can be safety handled while collecting the sample. The sampling ports may be located on SVE wells, MPE wells, VMPs, and the process piping.
- Sampling with the system offline:
  - When sampling points from wells or VMPs, Tygon® tubing (or specified material) should be attached to a vacuum pump (skip this step when sampling the process discharge).
  - The well or VMP will then be purged of static air, by using the vacuum pump, for approximately 3-5 minutes prior to sample collection. Actual purge time will depend on the volume of air in the well and the rate of airflow through the vacuum pump. (skip this step when sampling the process discharge)
  - After the sample location is purged, a Tedlar® bag should be connected to the inside port of the vacuum desiccator and the bag valve opened. The desiccator is then closed, enclosing the bag inside the unit.
  - Tygon® tubing (or specified material) will then be used to connect the influent port on the desiccator to the sampling port on the wells, VMP, or discharge point.
  - Tygon® tubing (or specified material) will also be used to connect the vacuum pump to the effluent port on vacuum desiccator.

  - The vacuum pump will then be turned on and the sample valve located on the effluent port of the desiccator opened, allowing the Tedlar® bag to fill with vapor from the sample point. Please note that the SVE or MPE system needs to be operational when collecting a sample from the system effluent using this method.
  - After the Tedlar® bag is about one-half to three-quarters full, the desiccator valve is closed, and the vacuum pump is turned off.
- Sampling with the system online:
  - Samples will be collected at the appropriate manifold leg for each well or VMP from the system process piping.
  - The gate valve at the corresponding manifold leg will be partially closed to allow for collection of an extracted vapor sample along the system process piping.
  - Tygon® or other tubing will be attached to the sample port on the manifold leg.
- The valve on the Tedlar® bag is then closed and the bag then removed from the desiccator. The bag should be placed into a cooler with ice if field analyses are not immediately performed. The sample in the bag is typically analyzed for total VOCs (by PID).

6.2.3. Total VOC Measurements

A PID (Rae Systems MiniRae 3000, RKI GX-6000, or similar) is connected directly to the valve on the Tedlar® bag, containing the vapor sample. The Tedlar® bag valve is opened, and the properly calibrated instrument should be activated. The total VOC measurements (as ppmv or ppbv calibrated to isobutylene or hexane in accordance with site-specific plans) are read directly from the instrument display and recorded in the proper logbook or form. Correction factors can be used to convert measurements to other analytes of interest, if the instrument is calibrated using a different calibration analyte.

6.3. VAPOR SAMPLE COLLECTION FOR LABORATORY ANALYSES

The procedures described in the subsections below should be utilized to collect vapor samples for laboratory analyses.

6.3.1. Equipment and Supplies

- Tygon® tubing (or Teflon, nylon, or other specified material)
- Summa canister
- Vacuum pump
- Field logbook
- Field log forms

6.3.2. Sample Collection Procedure

Vapor sample collection for laboratory analysis procedures include the following:

- An appropriate length of Tygon® tubing (or other specified material) should be attached to the sampling and monitoring port (0.25-inch valve) such that the sampling equipment can be safely handled while collecting the sample. These ports usually are located on SVE wells, MPE wells, VMPs, at the inlet to the treatment system, and the system effluent.
- Sampling with the system offline:
  - When sampling points from wells or VMPs, Tygon® or other tubing should be attached from the sample port to a vacuum pump.
  - The well or VMP will then be purged of static air using the vacuum pump for approximately 5 minutes prior to sample collection. Actual purge time will depend on the volume of air in the well and the rate of airflow through the vacuum pump. (skip this step when sampling the system effluent).
  - After the well or VMP is purged, the vacuum pump should be disconnected from the Tygon® or other tubing.
  - The vacuum pressure in the summa canister is read and recorded from the gauge on the canister or a portable vacuum gauge is connected to measure the vacuum.
- Sampling with the system online:
  - Samples will be collected at the appropriate manifold leg for each well or VMP from the system process piping.
  - The gate valve at the corresponding manifold leg will be partially closed to allow for collection of an extracted vapor sample along the system process piping.
  - Tygon® or other tubing will be attached to the sample port on the manifold leg.
- The vacuum pressure in the summa canister is read and recorded from the gauge on the canister or a portable vacuum gauge is connected to measure the vacuum.
- The Summa canister will then be attached to the Tygon® or other tubing and the sampling port valve opened.
- The Summa canister valve will then be opened, releasing the vacuum within the canister (while leaving some residual vacuum in the canister that is recorded on the sampling form), causing a sample of air to be drawn into the canister.
- The Summa canister valve will then be closed, the reading on the vacuum gauge read and recorded (or a portable vacuum gauge is attached to measure the vacuum), and the sample submitted to the laboratory, unpreserved for analysis per requirements of the project's analytical program.
- All sampling information should be recorded in the logbook or appropriate log form.

Title: **Photoionization Detector Vapor Analyzer Procedures**

Document Number: **SOG-004**

Revision Number: **0**

Reviewed: ______________________ 12/1/2023
Quality Control Manager — Date

Approved: ______________________ 12/1/2023
Project Manager — Date

1. Purpose

This standard operating guideline (SOG) provides the procedures that will be followed by field staff for operation and calibration of a photoionization detector (PID) used for analyzing volatile organic compound (VOC) vapor concentrations in soil vapor points or from system sample ports. PIDs are additionally used for safety monitoring of ambient air and detecting leakage of volatiles. The most commonly used PID models include the MiniRAE 3000 and RKI GX-6000. Personnel responsible for using the PID should first read and thoroughly familiarize themselves with the instrument instruction manual.

2. Scope

This SOG describes standards for operation and calibration of PIDs for projects executed by ERRG. The SOG addresses technical requirements and required documentation.

3. References

These practices and information are useful in the operation and calibration of PIDs are presented in following references:

U.S Environmental Protection Agency. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (EISOPQAM). USEPA, Region 4, SESD, Enforcement and Investigations Branch, Athens, GA. November 2001.

4. Equipment

The following is an example list of equipment and supplies used during PID operation and calibration:

- PID
- Calibration Gas
- Regulator for calibration gas cylinder
- Approximately 6 inches of Teflon® tubing
- Tedlar bag (optional)
- Commercially supplied zero grade air (optional)
- Sharpie
- Battery charger
- Moisture traps

- PID manual
- Field logbook or data sheets

5. Responsibilities

5.1. PROCEDURE RESPONSIBILITY

The Quality Control Manager or Project Manager is responsible for maintenance, management, and revision of this SOG. Questions, comments, or suggestions about this SOG should be sent to the Quality Control Manager or Project Manager.

5.2. PROJECT RESPONSIBILITY

ERRG employees performing this task, or any portion thereof, are responsible for meeting the requirements of this procedure. ERRG employees conducting technical review of task performance also are responsible for following appropriate portions of this SOG.

For those projects where the activities of this SOG are conducted, the Project Manager, or designee, is responsible for ensuring that those activities are conducted in accordance with this and other appropriate procedures. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (i.e., checkprints, calculations, reports, etc.) that the requirements of this SOG have been met. Such documentation shall be retained as part of the project file.

6. PID Operation and Calibration

The PID is a non-specific vapor/gas detector. The unit generally consists of a hand-held probe that houses a PID, consisting of an ultraviolet (UV) lamp, two electrodes, and a small fan which pulls ambient air into the probe inlet tube. The probe is connected to a readout/control box that consists of electronic control circuits, a readout display, and the system battery. Units are available with UV lamps having an energy from 9.5 electron volts (eV) to 11.7 eV. The PID analyzer measures the concentration of trace gas present in the atmosphere by photoionization. Photoionization occurs when an atom or molecule absorbs a photon of sufficient energy to release an electron and become a positive ion. This will occur when the ionization potential of the molecule (in electron volts (eV)) is less than the energy of the photon. The source of photons is an ultraviolet lamp in the probe unit. Lamps are available with energy ratings ranging from 9.5 eV to 11.7 eV.

6.1. OPERATION

Turn on the unit and allow it to warm up. Check to see if the intake fan is functioning; if so, the probe will vibrate slightly and a distinct sound will be audible when holding the probe casing next to the ear. Also, verify on the readout display that the UV lamp is lit. Calibrate the instrument as described below, following the manufacturer's instructions. Record the calibration information in the field records. The instrument is now operational. Readings should be recorded in the field logbook or field sheets. When the PID is not being used or between monitoring intervals, the unit may be switched off to conserve battery power and UV lamp life; however, a "bump" test should be performed each time the unit is turned on and prior to taking additional measurements. To perform a bump test, connect the outlet tubing from a Tedlar bag containing a small amount of span gas to the inlet tubing on the unit and record the reading. If the reading is not within the tolerance specified in the project plan, the unit must be recalibrated. At the end of each day, recheck the calibration. The check will follow the same procedures as the initial calibration, except that no adjustment will be made to the instrument. Record the information in the field records. Recharge the battery after each use. When transporting, ensure that the instrument is packed in its stored condition in order to prevent damage.

6.2. CALIBRATION

Preliminary steps, such as battery charging, check-out, calibration, and maintenance should be conducted in a non-hazardous environment. The PID must be calibrated in order to display concentrations in units equivalent to ppm or ppb, depending on the model. First a supply of zero air (ambient air or from a supplied source), containing no ionizable gases or vapors is used to set the zero point. A span gas, containing a known concentration of a photoionization gas or vapor, is then used to set the sensitivity. Calibrate the instrument according to the manufacturer's instructions. Record the instrument model and identification number, the initial and adjusted meter readings, the calibration gas composition and concentration, and the date and the time in the field records. If the calibration cannot be achieved or if the span setting resulting from calibration is 0.0, then the lamp must be cleaned.

Isobutylene of known concentration is the most common span gas used for PID calibration. The selected gas should have an ionization potential similar to that of the vapors to be monitored, if known. The concentration should be at 50- 75% of the range in which the instrument is to be calibrated. Refer to the manufacturer's instructions for the technical specifications of the instrument being used. The operating concentration range is typically 0.1 to 2,000 ppm isobutylene equivalent. Certain instrument models can operate at concentrations between 0 to 5,000 ppb.

6.3. TROUBLESHOOTING

One convenient method for periodically confirming instrument response is to hold the sensor probe next to the tip of a Sharpie. A significant reading should readily be observed. Air currents or drafts in the vicinity of the probe tip may cause fluctuations in readings. A fogged or dirty lamp, due to operation in a humid or dusty environment, may cause erratic or fluctuating readings. The PID should never be operated without the moisture trap in place. Moving the instrument from a cool or air-conditioned area to a warmer area may cause moisture to condense on the UV lamp and produce unstable readings. A zero reading on the meter should not necessarily be interpreted as an absence of air contaminants. The detection capabilities of the PID are limited to those compounds that will be ionized by the particular probe used. Many volatile compounds have a low odor threshold. A lack of meter response in the presence of odors does not necessarily indicate instrument failure. When high vapor concentrations enter the ionization chamber in the PID the unit can become saturated or “flooded”. Remove the unit to a fresh air environment to allow the vapors to be completely ionized and purged from the unit.

Calibration of the PID will be conducted at the frequency specified in the site-specific sampling and analysis plan or the manufacturer’s instructions. In the absence of project-specific guidance, calibration will be performed at the beginning of each day of sampling and will be checked at the end of the sampling day. The instrument should also be calibrated whenever instrument operation is suspect or drift is observed. The PID will sample a calibration gas of known concentration. The instrument must agree with the calibration gas within ±10%. If the instrument responds outside this tolerance, it must be recalibrated. Checks of the instrument response should be conducted periodically and documented in the field records.

Regardless of which gas is used for calibration, the instrument will respond to all analytes present in the sample that can be detected by the type of lamp used in the PID. Moisture will generate a positive interference in the concentration measured for a PID and is characterized by a slow increase in the reading as the measurement is made. Care must be taken to minimize uptake of moisture to the extent possible. Refer to the manufacturers’ instructions for care, cleaning, and maintenance. Uptake of soil into the PID must be avoided as it will compromise instrument performance by blocking the probe, causing a positive interference, or dirtying the PID lamp. Refer to the manufacturers’ instructions for care, cleaning, and maintenance. The user should listen to the pitch of the sampling pump. Any changes in pitch may indicate a blockage and corrective action should be initiated.

7. Data Management

Vapor monitoring with the PID will be documented in a bound field logbook, or on field forms, and retained in the project files, in accordance with SOG-001, Environment Data Collection. The following information is to be recorded:

- Project name and number.
- Date and time of use
- PID manufacturer, model, and serial number.
- Calibration gas used.
- Calibration check at beginning and end of day (meter readings before adjustment).
- Readings (monitoring data obtained).
- Any signs of suspect meter readings and corrective actions taken.
- Instrument checks and response verifications – e.g., battery check, sharpie response

Title: **Measuring Groundwater Levels**

Document Number: **SOG-005**

Revision Number: **0**

Reviewed:	Quality Control Manager	12/1/2023 Date
Approved:	Project Manager	12/1/2023 Date

1. Purpose

The purpose of this standard operating guidelines (SOG) is to provide methods and procedures for measurement of groundwater levels, as well as measuring light nonaqueous-phase liquids (LNAPL). Groundwater levels can either be determined as part of the well purging and sampling effort or be independently determined to construct groundwater elevation contour maps.

2. Scope

This SOG is applicable to all Engineering/Remediation Resources Group, Inc. (ERRG) projects where groundwater level measurements are taken.

3. References

U.S. Department of the Interior, 1977 (updated 1984). National Handbook of Recommended Methods for Water Data Acquisition, Chapter 2. Reston, Virginia.

U.S. Environmental Protection Agency, 1986. "RCRA Groundwater Monitoring Technical Enforcement Guidance Document." OSWER-9950.1. U.S. Government Printing Office, Washington, DC. Online Address: <https://www.epa.gov/enforcement/rcra-ground-water-monitoring-technical-enforcement-guidance-document-tegd>.

U.S. Environmental Protection Agency, 1991. "Environmental Compliance Branch, Standard Operating Procedures and Quality Assurance Manual." Region IV, Environmental Services Division. Athens, Georgia. U.S. Government Printing Office, Washington, DC.

U.S. Department of Defense, 2013. "DoD Environmental Field Sampling Handbook." Specifically Chapter 8, "Groundwater Sampling." April. Online Address: <https://denix.osd.mil/edqw/home/edqw-home-documents/manuals/dod-environmental-field-sampling-handbook/>.

4. Definition of Terms

Bailer—A cylindrical acrylic container with a valve at the bottom and open at the top, or a valve at both the top and the bottom, for admission of fluid. For the purposes of measuring nonaqueous phase liquids (NAPL) thickness, bailers must be constructed of a clear material. Some are available with graduated markings on the side to allow easier measurement. Bailers are used with a thin nylon line or "chord" made of similar material to lower the bailer into the well and retrieve liquid. Some bailers are supplied with a connectable measuring tape. Bailers used for product measurement or sampling should never be used for purging or collecting water samples.

DNAPL – Dense nonaqueous phase liquids (DNAPLs) are chemicals or mixtures of chemicals that have two major characteristics in common: they are heavier than water, and they are only slightly soluble in water. These two physical characteristics mean that when released into the environment in sufficient quantity, they can move through soils and groundwater until they encounter a sufficiently resistant layer that will impede further mass vertical movement and allow the liquid to pool. Depending upon the nature of the release, the movement through the subsurface soils can be quite complex as the liquid follows the path of least resistance. Examples of DNAPLs commonly consist of chlorinated hydrocarbon-based products such as perchloroethene, trichloroethene, 1,1,1-trichloroethane, etc., or mixtures thereof.

Double Check-Valve Bailer—A bailer containing a floating ball at the top and bottom of the bailer. Lowering the bailer into liquid causes both balls to float, allowing water or product to enter the cylinder. Raising the bailer through water or product causes both balls to settle, effectively trapping a discrete section of liquid so that it can be brought to the surface. Since a double check-valve bailer is preferred for sampling or measuring DNAPL because it is capable of isolating a discrete liquid sample at any depth within the well, it can also be used for both "floating" and "sinking" product.

Electronic Measuring Device—Commercial probe and cable designed to register a signal when the probe contacts water. The cable must have graduations to 0.01 feet. Commonly referred to as a groundwater level meter or sounder.

LNAPL - Light nonaqueous-phase liquids that have a lower volumetric mass density than water. Certain products form layers that float upon the water column and are termed light nonaqueous-phase liquid (LNAPL). LNAPL can commonly consist of petroleum-based product such as gasoline, diesel, jet fuel, and petroleum byproducts.

Measuring Tape—Steel or plastic tape with graduations to 0.01 feet. The tape shall not stretch more than 0.05 feet under normal use.

Product Probe (Interface Probe or Immiscible Layer Probe)—A device that can detect the presence of LNAPL, DNAPL, or water in wells and piezometers. The device is generally a probe connected to a measuring tape and a reel. The probe usually contains an electrical conductivity sensor to determine if the probe is in water and an optical sensor to determine if the probe is in liquid. The device contains a receiver with an audio and visual signal that indicates when phase changes occur.

Product—For the purposes of this SOG, product refers to nonaqueous phase liquid (NAPL) (i.e., one that does not contain water) that forms discrete immiscible layers in wells or piezometers.

Single Check-Valve Bailer—A bailer that is open at the top and contains a floating ball at the bottom. Lowering the bailer into liquid allows the bottom ball to float, allowing floating product (LNAPL) or water liquids to enter the bailer.

5. Responsibilities

5.1. PROCEDURE RESPONSIBILITY

The Quality Control (QC) or Project Manager is responsible for maintenance, management, and revision of this SOG. Questions, comments, or suggestions about this SOG should be sent to the QC Manager or Project Manager.

5.2. PROJECT RESPONSIBILITY

ERRG employees performing this task, or any portion thereof, are responsible for meeting the requirements of this SOG. ERRG employees conducting technical review of task performance are also responsible for following appropriate portions of this SOG.

For those projects where the activities of this SOG are conducted, the Project Manager, or designee, is responsible for ensuring that those activities are conducted in accordance with this and other appropriate SOGs. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (i.e., checkprints, calculations, reports, etc.) that the requirements of this SOG have been met. Such documentation shall be retained as part of the project records.

6. Procedure

The following equipment should be used when measuring groundwater levels:

- Decontaminated, weighted tape with graduations to 0.01 feet. The weight should be sufficient to ensure plumbness of the tape, but slender enough so as not to raise the water level significantly when submerged in the water.
- Decontaminated, commercial electronic water-level measuring device.
- Engineer’s rule, graduated to 0.01 feet.
- Product probe and meter.

Two techniques are discussed below: the measuring tape method and the electronic method. This procedure also addresses the basic operation of two types of equipment used to measure NAPLs in monitoring wells and piezometers: product probes and clear bailers. Clear bailers include both single- and double-check valve bailers. Double-check valve bailers are recommended for measuring DNAPLs. The equipment should be capable of measuring to an accuracy of 0.01 feet.

Several problems can arise in measuring product thickness using either product probes or clear bailers. Product probes can malfunction or indicate a false level, particularly when measuring emulsified, degraded, weathered, or viscous product that sticks to the probe sensors. When the thickness of the product layer in a well is greater than the length of the bailer, the product layer cannot be accurately measured with the bailer. Consequently, it is recommended that both product probe and bailer methods be used to measure product thickness. Program- or project-specific work plans should identify the specific equipment to be used.

6.1. PLANNING AND PREPARATION

Planning and preparation for water level measurement activities involves the following:

- Field personnel conducting the measurements should review the project-specific documents (by the project manager or designee) regarding the objectives and scope of the activity that include pertinent information such as the following:
  - Specific wells and piezometers to be measured
  - Past measurement results in wells and piezometers to be measured, including presence and type(s) of NAPL. Water level measurements will be organized in terms of lowest to highest chemical concentration, based on past measurement results, to avoid cross contamination between wells.
  - Requirements of this SOG and pertinent project-specific requirements and procedures for groundwater levels/NAPL measurement
  - All pertinent health and safety issues and requirements, including those contained in the project-specific health and safety plan(s), relative to work activities
  - Any other pertinent historical and site information
- Field personnel conducting measurement activities should read the instructions and be familiar with the operation of product probes and other equipment to be used in the field.
- All field measurement equipment should be calibrated according to manufacturer’s specifications and appropriate project-specific requirements and procedures.

6.2. WEIGHTED STEEL TAPE

The following procedure should be utilized when measuring groundwater levels with a measuring tape:

1. Prior to taking a measurement and between wells, decontaminate the probe and tape measure in accordance with applicable ERRG- and project-specific procedures. Such procedures should consider and incorporate manufacturer’s recommendations for decontamination. It is important to conduct thorough decontamination to prevent cross-contamination between wells. During decontamination, all measuring tapes should be inspected for kinks, cracks, or tears and, if present, repaired or replaced with undamaged equipment.

2. Isolate your working zone in accordance with applicable project-specific requirements. Visually inspect the vault, box, or well casing to ensure that it is undamaged, properly labeled, and secured. Any damage or problems with the wellhead should be noted on appropriate forms.
3. Unlock the well cover and remove the cap from the well casing.
4. Locate the reference point on the well casing. Any well without permanent reference points or marks should be brought to the attention of the site supervisor or as per project-specific requirements.
5. Don a pair of clean gloves.
6. Slowly lower the weighted tape down the well until the bottom is reached, indicated by a bump and sudden slack in the line.
7. Straighten the tape out, remove the slack, and measure the distance at the reference point.
8. Record the reading at the reference point as depth to bottom (DTB).
9. Withdraw the tape from the well and record the reading at the wet and dry interface as depth to water (DTW).
10. Determine the water column length as (DTB-DTW) and record as the depth of the water column (DWC).
11. Dry and decontaminate the wetted portion of the tape.

6.3. ELECTRONIC MEASUREMENT

The following procedure should be utilized when measuring groundwater levels with an electronic water-level measuring device:

1. Prior to taking a measurement and between wells, decontaminate the probe and tape measure in accordance with applicable ERRG- and project-specific procedures. Such procedures should consider and incorporate manufacturer's recommendations for decontamination. It is important to conduct thorough decontamination to prevent cross-contamination between wells. During decontamination, all measuring tapes should be inspected for kinks, cracks, or tears and, if present, repaired or replaced with undamaged equipment.
2. Isolate your working zone in accordance with applicable project-specific requirements. Visually inspect the vault, box, or well casing to ensure that it is undamaged, properly labeled, and secured. Any damage or problems with the wellhead should be noted on appropriate forms.
3. Check for proper instrument response by inserting the probe in water. Fix or replace the instrument as needed.
4. Unlock the well cover and remove the cap from the well casing.
5. Locate the reference point on the well casing. Any well without permanent reference points or marks should be brought to the attention of the site supervisor or as per project-specific requirements.

6. Don a pair of clean gloves.
7. Slowly lower the probe down the well until the signal indicates that water has been contacted.
8. Record the reading at the reference point as DTW.
9. Withdraw the probe and repeat steps 5 and 6. Duplicate measurements should agree within 0.02 feet. If not, continue with measurements until 0.02 feet precision is achieved.
10. Lower the probe until the bottom of the well is reached, as indicated by slack in the line.
11. Pull slightly to remove the slack, measure at the reference point, and record as DTB. Many weighted electronic water level probes have the water level sensor at the top of the weight and have the zero depth at the sensor. The length from the bottom of the weight to water level sensor must be added to the DTB measurement.
12. Determine the water column length as (DTB-DTW) and record as DWC.
13. Remove the probe from the well and decontaminate it.

6.4. LIGHT NONAQUEOUS-PHASE LIQUIDS

Oil or other LNAPL may be floating on the water in selected wells. If so, measure the LNAPL level and the water level using the following procedures:

6.4.1. Product Probe Measurement Procedure

The standard or basic procedure for measuring NAPL thickness using a product probe is described below.

1. Prior to taking a measurement and between wells, decontaminate the probe and tape measure in accordance with applicable ERRG- and project-specific procedures. Such procedures should consider and incorporate manufacturer’s recommendations for decontamination. It is important to conduct thorough decontamination to prevent cross-contamination between wells. During decontamination, all measuring tapes should be inspected for kinks, cracks, or tears and, if present, repaired or replaced with undamaged equipment.
2. Isolate your working zone in accordance with applicable project-specific requirements. Visually inspect the vault, box, or well casing to ensure that it is undamaged, properly labeled, and secured. Any damage or problems with the wellhead should be noted on appropriate forms.
3. Don a pair of clean gloves.
4. Uncap the well and monitor the air space immediately above the open casing per the project-specific Health and Safety Plan. Observe if any air is flowing into or out of the casing. For 2- and 4-inch-diameter wells, a latex glove may be briefly placed on top of the well casing and held tight to observe the presence of vacuum or pressure in the well. If such conditions are observed, they should be noted on the appropriate form. The probe should not be placed inside the well until the flow of air has ceased. Wells that are screened through a plume undergoing anaerobic degradation of hydrocarbons may produce dangerous hydrogen sulfide or methane gases. Wells screened in an aerobically degrading plume may produce carbon dioxide or carbon monoxide. It

is strongly recommended to carry fixed gas and hydrocarbon gas detectors in the field to monitor gas concentration in such wells. If it is determined that the well can safely be allowed to vent and stabilize, product measurement may continue once the airflow stops and pressure equalizes.

5. Locate the reference point on the well casing. Any well without permanent reference points or marks should be brought to the attention of the site supervisor or as per project-specific requirements.
6. Slowly lower the oil-water interface probe down the well until the signal indicates that the first liquid layer (LNAPL, water, or DNAPL) has been contacted. Review the instrument instructions for the indicator light or tone for each type of layer. Measure the depth of the first layer to the reference point on the well casing and record it on the appropriate form.
7. Continue lowering the probe slowly to measure the depth to the next layer interface or the bottom of the well. Measure the depth of the first layer to the reference point on the well casing and record it on the appropriate form.
8. Once measurements are complete, remove the probe from the well. Cap and relock the well. Decontaminate instruments following appropriate ERRG- and project-specific procedures.

6.4.2. Bailer Measurement Procedure

The standard or basic procedure for measuring NAPL thickness using a bailer is described below.

1. Don a pair of clean gloves.
2. Prior to taking a measurement and between wells, decontaminate the bailer and measuring tape (if supplied and used) according to applicable ERRG- and project-specific procedures. It is important to conduct thorough decontamination to prevent cross-contamination between wells. During decontamination, all bailers should be inspected for any cracks or holes, and measuring tapes should be inspected for kinks, cracks, or tears. If present, repair or replace with undamaged equipment. If a nylon bailer line is used, cut and properly dispose of any used line, and attach new line to the bailer.
3. If product interface probe measurements are to be used in conjunction with a bailer, the probe measurements should first be made, recorded, and noted by field personnel taking the measurements.
4. If bailer measurements are to be taken without product interface probe measurements, isolate the work zone and inspect and document wellhead conditions per step 2 in Section 6.4.1 above. Uncap the well and monitor and observe the open wellhead per step 3 in Section 6.4.1 above.
5. For LNAPL Measurement: Measure the depths to product and water with the product probe and mark the depths on the bailer chord with a rubber band or twine. Measure the length and diameter of the bailer. Lower the bailer into the well until the liquid surface is encountered.
6. After reaching the first (top) liquid surface, lower the bailer into liquid not exceeding three quarters of its total length. Use the measuring tape if available to determine the depth to which the bailer should be lowered to recover the LNAPL product. If no product interface probe measurement is

available, slowly lower the bailer trying to feel the first contact with the liquid while the bailer is descending inside the well. Once the contact is felt, the bailer's descent should be halted. The bailer should then be slowly lowered no more than three quarters of its total length to avoid overtopping.

7. Allow sufficient length of time for the floating LNAPL liquid to stabilize between the bailer and well before pulling the bailer out. Once sufficient time has elapsed, retrieve the bailer and visually inspect for product. Note any appropriate conditions observed in the bailer on appropriate forms. Such conditions include the following:
   - Color and clarity of the product
   - Odor and viscosity of the product
   - Length of product column in bailer compared to overall length of bailer
   - Evidence of any dripping, sand deposits, or problems with the bailer valves
   - Evidence of overtopping or complete run-through of the product column
8. Note that the product thickness inside the bailer will represent the thickness inside the well as long as the bailer intake diameter equals the bailer body diameter and the bailer is submerged in product only. Measure the product thickness inside the bailer and record on the appropriate form. If product thickness is less than the length of the bailer intake, and the bailer intake diameter is smaller than the diameter of the bailer, the collected product thickness inside the bailer is NOT representative of the product thickness in the well.
9. Empty the bailer contents into a glass bottle or suitable container (chemically compatible with product). Label and store the product container in a suitable and safe location for subsequent disposal as per project-specific requirements and procedures.
10. For DNAPL measurement: Measure the depths to the water/product interface and bottom of the well with the product probe. Calculate the thickness of the product layer and make sure the double check valve bailer is long enough to not over-top the product in the well. Measure and record the length and diameter of the bailer. Place the bailer in the well and slowly run the bailer to the bottom of the well.
11. Allow sufficient length of time for the product (DNAPL) to stabilize between the bailer and the well before pulling the bailer out. Once sufficient time has elapsed, retrieve the bailer and visually inspect for product. Note any appropriate conditions on the appropriate forms. Such conditions include the following:
   - Color and clarity of the product
   - Odor and viscosity of the product
   - Length of product column in bailer compared to overall length of bailer
   - Evidence of any dripping, sand deposits, or problems with the bailer valves
   - Evidence of overtopping or complete run-through of the product column
12. Note that the product thickness inside the bailer will represent the thickness inside the well as long as the bailer intake diameter equals the bailer body diameter and the bailer is submerged in

product only. Measure the product thickness inside the bailer and record on the appropriate form. If product thickness is less than the length of the bailer intake, and the bailer intake diameter is smaller than the diameter of the bailer, the collected product thickness inside the bailer is NOT representative of the product thickness in the well.

13. Empty the bailer contents into a glass bottle or suitable container (chemically compatible with product). Label and store the product container in a suitable and safe location for subsequent disposal as per project-specific requirements and procedures.
14. Cap and re-lock the well. Decontaminate equipment following appropriate ERRG- and/or project-specific procedures. Remove any equipment used to isolate the wellhead. Check and make sure all forms are completed and signed, as required.

6.4.3. Documentation

All information will be recorded in field documentation and will include the following information:

- Project name and number
- Well identification number
- Date and time of each measurement
- Depth to water (measured to the specified tolerance)
- Depth to and description of any non-aqueous phase liquid encountered such as color, odor, and viscosity (this may be determined by checking for product attached to the tip of the probe once it is removed from the well)
- Weather conditions
- Comments, including any problems encountered

Title: **Groundwater Sampling**

Document Number: **SOG-006**

Revision Number: **0**

Reviewed:	Quality Control Manager	12/1/2023 Date
Approved:	Project Manager	12/1/2023 Date

1. Purpose

This standard operating guideline (SOG) is intended to provide guidance for groundwater sampling using low-flow sampling methods. Low-flow or micro-purge sampling is a method of collecting samples from a well that does not require the removal of large volumes of water from the well and therefore does not overly agitate the water and suspended particles or potentially aspirate volatile organic compounds (VOCs). This The method entails the removal of water directly from the screened interval without disturbing any stagnant water above the screen by pumping the well at low enough flow rates to maintain minimal drawdown of the water column followed by in-line sample collection. Typical flow rates for low-flow sampling range from 0.1 liter per minute (L/min) to 0.5 L/min depending on site characteristics.

2. Scope

This SOG is applicable to all Engineering/Remediation Resources Group, Inc. (ERRG) projects where groundwater samples will be collected from a monitoring well using low-flow or micro-purge methods and where no project- and program-specific procedure is in use. This procedure applies to all field personnel and subcontractors who collect or handle water samples.

3. References

ASTM International (ASTM) D6634M-14, “Standard Guide for Selection of Purging and Sampling Devices for Ground-Water Monitoring Wells.”

ASTM D6452-18, “Standard Guide for Purging Methods for Wells Used for Groundwater Quality Investigations.”

ASTM D6771-18, “Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations.”

ASTM D4448-01, “Standard Guide for Sampling Ground-Water Monitoring Wells.”

U.S. Environmental Protection Agency (EPA), 2005. “Uniform Federal Policy for Quality Assurance Project Plans, Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs – Part 1: UFP-QAPP Manual.” Final, Version 1. EPA-505-B-04-900A. Intergovernmental Data Quality Task Force. March 2005. Online Address: <https://www.epa.gov/fedfac/uniform-federal-policy-quality-assurance-project-plans-evaluating-assessing-and-documenting>.

EPA, 2012. “Uniform Federal Policy for Quality Assurance Project Plans, Optimized UFP-QAPP Worksheets.” 505-B-04-900A. Intergovernmental Data Quality Task Force. March. Online Address: <https://www.epa.gov/fedfac/optimized-uniform-federal-policy-quality-assuranceproject-plans-worksheets>.

EPA, 2014. "Contract Laboratory Program Guidance for Field Samplers." OSWER 9240.2-147 / EPA 540-R-014-013. Office of Superfund Remediation and Technology Innovation. October. Online at <https://www.epa.gov/sites/production/files/2015-03/documents/samplers_guide.pdf>

EPA, Region 1, 2017. "Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells, SOP EQASOP-GW4, Revision 4." September 19. Online Address: <https://www.epa.gov/quality/low-stress-low-flow-purging-and-sampling-procedure-collection-groundwater-samples-monitoring>

4. Definition of Terms

Field Blank — A field blank (FB) is a drinking water sample of chemical-free reagent water placed in a sample container in the laboratory and processed, extracted, and analyzed in the same manner as a field sample, including shipment to the sampling site, exposure to sampling site conditions, storage, preservation, and all analytical procedures. The purpose of the FB is to determine if method analytes or other interferences are present in the field environment.

Low-Flow Sampling — A sampling technique using well purge rates that do not result in significant changes in the formation seepage velocity as evidenced by the water elevation in the well.

Micro-Purge sampling — Another term used for low-flow sampling because pre-sampling groundwater purging is performed at flow rates two to three orders of magnitude less than typical bailer or pump methods.

Primary Groundwater Flow Zone — The preferred area for sampling within the groundwater well screen that is based on high(er) permeability and/or high(er) chemical concentrations.

Pump — An electric, compressed air, or inert gas driven device that raises liquids by means of pressure or suction. The types of pumps used for well purging should be chosen based on the well size and depth, the type of contaminants, and the specific factors affecting the overall performance of the sampling effort. Low-flow and micro-purge sampling is performed using specially constructed pumps, usually of centrifugal, peristaltic, or centrifugal submersible design, with low draw rates (<1.0 L/min). If contaminants are volatile in nature a bladder pump must be used.

Well-Purging — The action of removing groundwater using mechanical means from a monitoring well prior to collecting groundwater samples. Purging removes stagnant groundwater from the column allowing the groundwater surrounding the well screen to enter the collection zone.

5. Responsibilities

5.1. PROCEDURE RESPONSIBILITY

The Quality Control (QC) Manager or Project Manager is responsible for maintenance, management, and revision of this SOG. Questions, comments, or suggestions about this SOG should be sent to the QC Manager or Project Manager.

5.2. PROJECT RESPONSIBILITY

ERRG employees performing this task, or any portion thereof, are responsible for meeting the requirements of this SOG and using materials of a construction specified in the project plans or applicable to the contaminants of concern and other aspects of the sampling effort. These may include well diameter, well construction materials, depth to water, and the presence of dense nonaqueous-phase liquid (DNAPL) or light nonaqueous-phase liquid (LNAPL) contaminants. ERRG employees conducting technical review of task performance are also responsible for following appropriate portions of this SOG.

For those projects where the activities of this SOG are conducted, the Project Manager, or designee, is responsible for ensuring that those activities are conducted in accordance with this and other appropriate SOGs. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (i.e., daily logs, checkprints, calculations, reports, etc.) that the requirements of this SOG have been met. Such documentation shall be retained as part of the project file.

6. Procedure

Low-flow and micro-purge sampling involves removing water directly from the screened interval with minimal disturbance to stagnant water above the screen as evidenced by no significant lowering of the water table. Since it is not based upon the removal of well volumes, it requires in-line monitoring of water quality parameters (i.e., pH, specific conductivity, temperature, dissolved oxygen, redox potential, and turbidity) to determine when the groundwater sample zone has stabilized. The sample is then collected directly from the discharge tubing.

6.1. CONSIDERATIONS

The following variables should be considered in planning for low-flow purging and sampling:

- **Recharge capacity of each well:** The recharge capacity of a well will determine how fast the well should be purged. The purge rate should be no greater than the recharge rate of the groundwater zone to prevent water table drawdown.

- **Well construction details, including well depth, diameter, screened interval, screen size, material of construction, and depth to water table:** The diameter and well depth will determine the size of the pump and the depth from which the pump will draw groundwater. Peristaltic and suction draw pumps are only viable at depths of less than 25 feet. The pump intake should be placed at the mid-point of the well screen for well screens up to 10 feet long. If the well screen is longer than 10 feet then then pump intake should be set with the primary groundwater flow zone.
- **Pump:** Low-flow purging and sampling can be used in any well that can be pumped at a constant rate of not more than 0.5 L/min. Continuous discharge and cycle discharge pumps with adjustable flow rate controls should be used to avoid causing continuous drawdown. Whenever possible, dedicated pumps should be installed to avoid disturbing the water column.
- **Groundwater quality, including type and concentration of chemical compounds present:** Low-flow methods can be used for all types of aqueous-phase contamination, including VOCs, semivolatile organic compounds, metals, pesticides, polychlorinated biphenyls, radionuclides, and microbiological constituents. Pump parts and tubing should be made of materials that are compatible with the chemicals of interest. Pump placement may depend upon the chemical present such that the intake maybe lowered within the well screen for DNAPLs and raised for LNAPLs.

6.2. EQUIPMENT

The following equipment is recommended for use in conducting low-flow or micro-purge well purging:

- Pump and discharge tubing and line constructed of compatible materials capable of draw rates between 0.1 and 1 L/min
- Water level meter accurate to 0.1 feet at a minimum.
- Swabbing materials
- Water quality meter with a flow through cell. The meter will be calibrated for pH, specific conductance, temperature, dissolved oxygen, redox potential, and turbidity unless otherwise specified in site specific sampling documents
- Photoionization detector (PID) – calibrated (if screening for VOCs is required)
- Graduated cylinder and stopwatch/timer.
- Drums, buckets, or tanks to contain the purge water
- Field logbook or sheets
- Calculator
- Calibration solutions for all parameters being measured, within expiration dates
- Paper towels or lint-free wipes
- Plastic sheeting to spread around sampling area
- Sample gloves

- Sample containers, preservatives, and labels
- Ice and Ziploc-type bags

6.3. PRE-PURGING

To prevent cross-contamination of other wells on site, upgradient and background wells should be sampled first. The procedure for pre-sampling is as follows:

- Perform a visual inspection at the well and surrounding area to evaluate any possible structural damage.
- Prepare the area surrounding the well by placing plastic sheeting on the ground surface to prevent potential cross-contamination of the pump and discharge hose or sample equipment and materials.
- Place and secure the drum, bucket, tank, or suitable purge water container in close proximity to the well for collection and storage of purge water. Purge water must be containerized and disposed of in the manner specified in the project and program plan or as the client directs. Never return purge water to the well. If in doubt or where requirements are not specified, handle all purge water as waste and dispose of it accordingly.
- If performing VOC screening, measure and record the background organic vapors in the ambient air using a PID, in accordance with manufacturer recommendations.
- Open the well casing, remove the well cap, and immediately measure and record the organic vapor levels from the head space within the well casing using a PID, in accordance with the manufacturer's recommendations.
- Measure the depth to the static water level and the depth to the bottom of the well using the water level meter in accordance with ERRG SOG-005, Measuring Groundwater Levels.

6.4. WELL PURGING

The procedure for well purging is as follows:

- Review and understand the proper operating and maintenance instruction for each type of pump that is used prior to placing the pump in the well.
- Assemble the pump and discharge line in accordance with the manufacturer's instructions. Ensure the pump discharge line is long enough so that the pump intake can be located within the well screen area and the discharge end can reach the purge water container.
- Slowly lower the pump into the well until it is submerged and at the desired pumping depth.
- Some wells may include a dedicated pump that is already placed in the well along the well screen. If this is the case, review well construction data to verify the proper placement of the pump intake. [Note: pump intake depth will be dependent on the goals and objectives of the sampling. If the objective is to capture LNAPL, the intake should be set near the top of the well screen. If

the objective is to capture DNAPL, the intake should be set near the bottom of the well screen. If there is heterogeneous soil outside the well, the pump intake should be set wherever the sampler believes the contamination is present. If the soils are homogeneous or there is no clear indication of where the contamination might be (no preferential pathways), then the pump intake should be set at the approximate middle of the well screen.] Inspect the location where the discharge line and pump support cable exit the well to determine that they are in the proper position (markings should be present at the well head to show this).

- Connect the pump discharge to the flow-through cell with the water quality meter in accordance with the manufacturer's procedure.
- Start the pump at the lowest speed and slowly increase until discharge begins. Check the water level and adjust the pump speed until there is little or no drawdown (less than 0.3 feet). If the drawdown exceeds 0.3 feet but the water level remains stable, then continue purging the well and monitor groundwater parameters for stability. If the recharge rate of the well is less than the lowest purge rate of the pump and the well is essentially dewatered during purging, then the well can be sampled as soon as the water level recovers to 80 percent of the original water column. If the well takes considerable time to recover (i.e., longer than 2 hours), samples may be collected either at the end of day or first thing the following day. The pump intake should not be moved during the purging or recovery periods. Using a graduated cylinder and a stopwatch (or timer) adjust the pump speed such that the discharge flow rate is ideally between 0.1 to 0.5 L/min. Discharge rates can be up to 1 L/min, but higher rates have been shown to affect the reproducibility of VOC analytical results.
- Collection of water quality parameters should begin after one volume of the flow-through cell and tubing has been purged. Monitor and record subsequent parameters for stability at set intervals, where a minimum of at least 3 flow-through cell volumes have been purged (approximately 3 to 5 minutes, depending on the flow-through cell volume and purge rate). ERRG standard water quality parameters include pH, conductivity, temperature, dissolved oxygen, redox potential, and turbidity; however, review the site sampling documents to determine if there are site specific parameters and criteria.
- Collect the sample following the procedure below when all monitored water quality parameters are stable, as indicated by three consecutive readings differing by less than the following criteria, unless otherwise noted in site specific sampling documentation:
  - pH = + 0.1 units
  - Conductivity = 10 percent
  - Temperature = 10 percent
  - dissolved oxygen = 10 percent for values greater than 0.5 milligrams per liter (mg/L)
  - redox potential = 10 percent
  - turbidity = 10 percent for values greater than 5 nephelometric turbidity units (NTUs)

6.5. SAMPLE COLLECTION

The procedure for sample collection is as follows:

- Prepare the sample bottles and preservatives required for the sampling.
- Don a pair of clean gloves.
- Collect the sample from the pump discharge line immediately after purging. The sample must be collected before the flow through cell.
- Fill volatile organic analysis (VOA) vials first (reduce the flow rate of the pump discharge) allowing the liquid to slowly fill the container without agitation and obtain a meniscus slightly above the top of the vial.
- Cap and check all VOA vials for entrained air by slowly tipping and observing for bubbles. If any are present, discard the sample and collect again according to the above-listed procedures.
- Field filter for dissolved parameters using an in-line filter cartridge sized according to the flow characteristic of the sampling pump. Use a new filter for each sample and ensure the membrane is properly wetted before sample collection. If the filter is plugged, replace the filter cartridge before continuing to collect the sample.
- Continue filling all required sample bottles. The pump speed may be increased to the original purge rate.
- Add preservatives to the samples as needed and place the sample bottles on ice. Note that most sample bottles come with preservatives already added. If such is the case, do not overfill the bottles.
- Replace the well cap, if required, and lock the cover.
- Record the sampling information.
- Secure the area by removing equipment and materials, properly dispose of plastic sheeting and other disposable sampling materials and close the purge water container(s).
- Decontaminate the pumping equipment and sampling equipment in accordance with SOP-008, Equipment/Personnel Decontamination. The pumping equipment should not be decontaminated if it is dedicated to the well.

Title: **Sample Packaging and Shipping**

Document Number: **SOG-007**

Revision Number: **0**

Reviewed:	Quality Control Manager	12/1/2023 Date
Approved:	Project Manager	12/1/2023 Date

1. Purpose

The purpose of this standard operating guideline (SOG) is to provide the requirements for completion and attachment of sample labels on environmental sample containers, completion of written chain-of-custody (COC) documentation, completion and attachment of custody seals on environmental samples and shipping containers, and general instructions for the packaging and shipping of nonhazardous samples.

2. Scope

This SOG is applicable to all Engineering/Remediation Resources Group, Inc. (ERRG) efforts where samples are collected and transferred among parties, including to off-site testing facilities. Nonhazardous samples are those that do not meet any hazard class definitions found in Title 49 Code of Federal Regulations (49 CFR) Parts 107 through 178, including materials designated as Class 9 materials and materials that represent Reportable Quantities (hazardous substances). In general, most soil, air, and aqueous samples do not meet any of the U.S. Department of Transportation's (DOT) hazardous materials definitions.

3. References

U.S. Environmental Protection Agency (EPA), 2005. "Uniform Federal Policy for Quality Assurance Project Plans, Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs – Part 1: UFP-QAPP Manual." Final, Version 1. EPA-505-B-04-900A. Intergovernmental Data Quality Task Force. March 2005. Online Address: <https://www.epa.gov/fedfac/uniform-federal-policy-quality-assurance-project-plans-evaluating-assessing-and-documenting>.

EPA, 2012. "Uniform Federal Policy for Quality Assurance Project Plans, Optimized UFP-QAPP Worksheets." 505-B-04-900A. Intergovernmental Data Quality Task Force. March. Online Address: <https://www.epa.gov/fedfac/optimized-uniform-federal-policy-quality-assurance-project-plans-worksheets>.

EPA, 2019. "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA publication SW-846, Third Edition, Final Updates I (1993), II (1995), IIA (1994), IIB (1995), III (1997), IIIA (1999), IIIB (2005), IV (2008), V (2015), VI (Phase I, 2017), VI (Phase II, 2018), VI (Phase III, 2019), VII (Phase I, 2019), and VII (Phase II, 2019)." Online Address: <https://www.epa.gov/hw-sw846>.

EPA, 2020. "Contract Laboratory Program Guidance for Field Samplers." OLEM 9240.0-51 / EPA 540-R-20-005. Office of Superfund Remediation and Technology Innovation. November. Online Address: <https://www.epa.gov/clp/clp-information-field-samplers>.

U.S. Department of Transportation Regulations, 49 CFR Parts 107 through 178.

IATA, *Dangerous Goods Regulations Manual*, current edition.

4. Definition of Terms

Custody — The legal term used to define control and evidence of traceability of an environmental sample. A sample is in an individual's custody when it is in the person's physical possession, is in view of the person, is locked in a container controlled by the person, or has been placed into a designated secure area by the person.

Chain-of-Custody Form — A form used to document and track custody and transfers of a sample from collection to analysis or placement in a designated secure area within the testing facility.

Chain-of-Custody Continuation Page — Additional page(s) that may be included with a COC form. The continuation page contains information for additional samples contained within the sample storage or shipping container.

Project Contact – The ERRG person responsible for coordinating laboratory analyses and the person the laboratory shall contact to address analytical issues.

Turnaround Time – The time required for the laboratory to prepare, analyze, and report analytical results to the Project Contact. The turnaround time begins once the laboratory accepts custody of the samples.

Sample Label — Any writing surface with an adhesive backing that can be used to document sample identification information. The sample label is attached to the sample container as a means of identification and, in some commercially available or laboratory-supplied containers, may be preattached. All the laboratories ERRG works with provide sample labels or prelabeled containers in their sample container supply kits.

Custody — The legal term used to define control and evidence of traceability of an environmental sample. A sample is in an individual's custody if it is in the person's physical possession, is in view of the person, has been locked in a container controlled by the person, or has been placed into a designated secure area by the person.

Custody Seal — Commercially available thin strips of adhesive paper with write-in lines for the date, time, and identification of the using party. Custody seals are placed over the caps of sample containers, if possible, and always along the cover seals of shipping containers as a means to detect tampering before arrival at the testing facility. All of the laboratories ERRG works with provide custody seals in their sample container supply kits.

Air Waybill — Also known as a consignment note, dispatch note, or waybill. A contract between the shipper and the carrier, which provides key information for the shipper and a unique shipment number that is used for tracking the shipment.

Bubble Wrap — Plastic sheeting with entrained air bubbles for protective and insulative packaging purposes.

Shipping Container — Any hard-sided container meeting DOT's or IATA's general packaging requirements (e.g., coolers, cardboard boxes).

5. Responsibilities

5.1. PROCEDURE RESPONSIBILITY

The Quality Control (QC) Manager or Project Manager is responsible for maintenance, management, and revision of this SOG. Questions, comments, or suggestions about this SOG should be directed to the QC Manager or Project Manager.

5.2. PROJECT RESPONSIBILITY

ERRG employees performing this task, or any portion thereof, are responsible for meeting the requirements of this SOG. ERRG employees conducting technical review of task performance also are responsible for following appropriate portions of this SOG.

For those projects where the activities of this SOG are conducted, the Project Manager, or designee, is responsible for ensuring that those activities are conducted in accordance with this and other appropriate SOGs. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (i.e., daily logs, checkprints, calculations, reports, etc.) that the requirements of this SOG have been met. Such documentation shall be retained as part of the project file.

6. Procedure

6.1. CHAIN OF CUSTODY

6.1.1. Documentation

All COC documentation shall be completed in black, indelible ink. All corrections shall be performed using standard single-line cross-out methods, and the initials of the individual making the change must be included beside the corrected entry.

6.1.2. Continuation Pages

Continuation pages may be used if the COC form is full and additional space is required to document samples, sample containers, shipping containers, and coolers. The total number of pages must be filled out on the COC form and continuation page(s). All samples entered onto a continuation page must be included in the same cooler and shipping container as those on the COC form itself.

6.1.3. Header Information

- Each COC form shall be assigned a unique Document Reference Number — use the project or proposal number followed by a unique numeric sequence or current date (if only one cooler is sent per day). Continuation pages shall contain the same Document Reference Number as the COC form with which they are associated. The project team shall maintain a log of COC Document Reference Numbers.
- The page identifier and total page count section shall be completed. Total pages include the COC form and any attached continuation pages.
- Project number, name, and location information shall be completed for all forms.
- If available, the laboratory Purchase Order Number shall be included on the appropriate line.
- The name and phone number of the Project Contact.
- The shipment date shall be provided on the applicable lines.
- If shipping by carrier, the waybill and airbill number shall be included. (Note: couriers will not sign custody documents. Therefore, inclusion of the waybill and airbill number on the COC form is the only means of documenting the transfer to the carrier.)
- Laboratory destination and contact information shall be provided.
- The sampler(s) names shall be provided on the appropriate line. This line shall include all persons whose initials appear on any of the sample containers to provide the laboratory with a means of cross-referencing containers.
- The “Send Report To” information shall be completed. If multiple reports and locations are needed, the information shall be provided on a separate page included with the COC documentation.

6.1.4. Sample Information Section (Including on Continuation Page)

During sampling, each sample must be entered on the COC form at the time of collection to document possession of the sample. The sampler must not wait until sampling is completed before entering samples onto the COC.

- Complete the sample ID number for each line. If there are multiple container types for a sample, use additional lines to indicate the needed information.
- Ensure that the sample description matches the description on the sample label; the laboratory will use this information for cross-referencing.
- Provide the collection date and time, which must match those on the sample label and field logbook and logsheets.
- Indicate the matrix of the sample. If a sample has multiple matrix types, then use multiple lines.
- List the container types and preservatives in the header line of the “Container” section of the COC and indicate the number of containers for each sample.

- Write in and check the analyses requested boxes for each line. The appropriate method number (e.g., EPA Method 8260C) must be written, as well as the method name or commonly known abbreviation (e.g., VOCs).
- Indicate the turnaround time requested for each sample.
- Use the special instructions section to provide important information to the laboratory (e.g., samples that may require dilution or samples that will need to be composited by the laboratory). This section may also be used to inform the laboratory of additional information contained in attachments to the COC documentation.
- Include the quality control (QC) and data package level required for the samples.

6.1.5. Custody Transfer Section

- The first "Relinquished By" space must be completed by the individual who will either transfer the samples or seal the shipping container.
- If the samples will be transferred to a courier, write the courier and carrier company in the "Received By" box and enter the date and time the shipping container was closed.
- All other transfers must be performed in person, and the relinquisher must witness the signing by the receiver.
- A copy of the COC form and all associated continuation pages should be maintained in the project file.

6.2. SAMPLE LABELING

- All sample labels must be completed in black, indelible ink. All corrections must be made using standard single-line cross-out methods, and the initials of the individual making the change must be included beside the corrected entry.
- Sample labels should be completed and attached as samples are collected. Do not wait until final packaging to attach and complete the sample labels.
- Sample labels must be attached to the non-sealing portion of the container. Do not place labels on or across sample container caps.
- If the laboratory has provided prelabeled containers, make sure to fill all containers for each parameter set needed. Laboratory prelabeled containers are often bar coded, and it is important to provide a complete container set for each sample.
- The following information must be recorded on the sample label:
  - Sample identification number
  - Date and time collected
  - Initials of person(s) responsible for collection
  - Preservative (if any)
- If a space is provided, the "Analysis Requested" should also be added.

- If a description is provided, then it must match the description on the COC form for cross-referencing purposes.
- Cover the completed and attached label with clear plastic tape to prevent bleeding of the ink if it becomes wet.

6.3. CUSTODY SEAL

6.3.1. Completing the Custody Seal Information

- All custody seals must be completed in black, indelible ink. All corrections must be made using standard single-line cross-out methods, and the initials of the individual making the change must be included beside the corrected entry.
- Each custody seal attached to a sample or shipping container must be completed by writing the date and signing with the full signature of the person responsible for the sealing of the sample.
- If a space is provided, the time should also be added.

6.3.2. Attaching the Custody Seals

Whenever possible, custody seals should be attached over the sample container lids during actual sampling and not when the samples are packaged for shipment. This step will provide confidence in legal custody and will demonstrate non tampering during the sample collection process.

Do not attach custody seals to volatile organic compound (VOC) sample containers because contamination may occur. For VOC sample containers, the custody seal should be used to seal the folded, resealable plastic bag that holds the sample containers.

- For sample jars, the completed custody seal should be placed across the top of the lid with the edges below the lid and jar interface and attached to the jar material. This step will require the visible breaking of the seal to open the container.
- For soil sample sleeves, the completed custody seal should be placed across both end caps with the edges below the cap and sleeve interfaces and attached to the jar material. This step will require the visible breaking of the seal to open the container.
- If it is unfeasible to place custody seals on each sample container, or in instances when it is appropriate to document whether the cooler has been opened, custody seals may be placed on the cooler or other package. Place at least two custody seals on the cooler or package on different sides of the cooler or package such that the custody seal cannot be bypassed.
- Sample coolers and shipping containers should have custody seals attached in such a manner that the seal extends lengthwise from the top edge of the lid to the side of the cooler and container. A minimum of two custody seals should be placed on the shipping container lid with one seal covering the front edge and one seal covering the back or side edge of the lid (do not place seal on a hinged side where the seal would remain intact if the cooler was open).

6.4. SAMPLE PACKAGING AND SHIPPING

6.4.1. Packaging

The following procedures are for samples that should be kept chilled during shipment (preservation requirement of 4 ± 2 degrees Celsius). Procedures for packaging samples that do not require temperature control will be the same except no ice will be required and samples may be packaged in a cardboard shipping box.

- Prepare ice for shipment. Frozen water bottles or technical ice sheets (such as Techni-Ice™) are recommended. Blue ice (gel packs) or wet ice may be used. If using wet ice, double-bag the ice in gallon or quarter zip-top plastic bags to create ice packs. Note, that wet ice and frozen water bottles may not be permitted with some shipping carriers (e.g., air cargo).
- Ensure that the shipping container (cooler or box, as appropriate) is clean and in good condition. Use tape and seal off the cooler drain on the inside and outside to prevent potential leakage.
- Place packing material (bubble wrap, foam, or packing paper) inside of the shipping container to provide a soft impact surface (i.e., on bottom and sides).
- Place a liner inside the shipping container (cooler or box, as appropriate). Liners can be large plastic trash bags or similar material.
- Inspect each sample container to ensure it is properly labeled and listed on the COC document.
- Wrap each glass or plastic container with sufficient bubble wrap to minimize the risk of breaking.
- Place a layer of ice on the bottom of the cooler, then a layer of samples. Place ice between and on top of the samples so ice is touching all sides of the sample containers. Repeat as necessary, ending with a final layer of ice on top of the samples.
  - Pack the largest/heaviest sample containers at the bottom of the shipping container (cooler or box, as appropriate). Place small sample containers wrapped in bubble wrap securely between and above the large sample containers.
  - For longer transit times, increase the amount of ice being used in each layer or around the sides of the containers.
- When sufficiently full, seal the inner protective liner (e.g., tape or tie plastic bag shut), and place additional packing material on top of the bag and on the sides to minimize shifting of containers during shipment.
- Place the completed, original COC document inside a zip-top plastic bag and tape it to the inside of the lid of the shipping container. The date/time the container was relinquished to the carrier should be noted on the COC document. Note: Be sure to maintain a copy of the completed COC document for project records.
- Secure the shipping container closed with packing tape, duct tape, or other tear-resistant adhesive strips. Strapping tape is recommended for heavy coolers. Taping should be performed to ensure the lid cannot open during transport.

- Place a custody seal on two separate portions of the cooler lid, to provide evidence that the lid has not been opened prior to receipt by the intended recipient, in accordance with Section 6.3.

6.4.2. Shipping

6.4.2.1. All Sample Shipments

The following steps apply to all sample shipments.

- Apply orientation arrows on two opposite faces of the shipping container (e.g., front and back or both ends). Apply "Fragile" sticker(s) if the shipment contains glass containers.
- The air waybill must be attached to the top of each shipping container, with the name and address of the receiver and shipper clearly visible. Maintain a copy of the air waybill with tracking information for the project file.

6.4.2.2. Shipment Coordination

- After tendering a shipment, notify the receiving laboratory of the intended delivery date and number of shipping containers. Provide a copy of the air waybill/tracking information and COC document to the analytical laboratory.
- Maintain a tracking log from the carrier to ensure the shipment is delivered and does not experience shipping delays.

6.4.3. Recordkeeping

- A copy of all completed shipping documents (COC form, commercial invoice, air waybill, etc.) should be maintained for the project record.

Title:	**Equipment/Personnel Decontamination**
Document Number:	**SOG-008**
Revision Number:	**0**

Reviewed:	V Smick	12/1/2023
	Quality Control Manager	Date
Approved:	[signature]	12/1/2023
	Project Manager	Date

1. Purpose

This standard operating guideline (SOG) defines the Engineering/Remediation Resources Group, Inc. (ERRG) standard that must be implemented for decontamination of non-disposable sampling equipment that comes in direct contact with the sample media and decontamination of personnel performing sampling activities. The benefits of its use include the following:

- Minimizing the spread of contaminants within a study area and from site to site
- Reducing the potential for worker exposure by means of contact with contaminated sampling equipment
- Improving data quality and reliability

2. Scope

This SOG applies to all instances where nondisposable sampling equipment is used for sample collection or when field personnel may come in contact with contaminants. This SOG is not intended to address decontamination of peristaltic or other sampling pumps and tubing. The steps outlined in this SOG must be executed between each distinct sample data point.

3. References

U.S. Environmental Protection Agency (EPA), 2020. "Field Equipment Cleaning and Decontamination." SESDPROC-205-R3. Region 4, Science and Ecosystem Support Division, 980 College Station Road, Athens, Georgia. June 22. Online at: <https://www.epa.gov/quality/field-equipment-cleaning-and-decontamination>.

EPA, 2020. "Contract Laboratory Program Guidance for Field Samplers." OLEM 9240.0-51 / USEPA 540-R-20-005. Office of Superfund Remediation and Technology Innovation. November. Online at: <https://www.epa.gov/clp/clp-information-field-samplers>.

4. Definition of Terms

Soap — A standard brand of phosphate-free laboratory detergent, such as Liquinox®.

Organic Desorbing Agent — A solvent used for removing organic compounds. The specific solvent would depend upon the type of organic compound to be removed.

Inorganic Desorbing Agent — An acid solution for use in removing trace metal compounds. The specific acid solution would depend upon the type of inorganic compound to be removed.

Tap water — Water obtained from any municipal water treatment system. An untreated potable water supply can be used as a substitute for tap water if the water does not contain the chemicals of concern.

Analyte-free water (deionized water) — Water that has been treated by passing through a standard deionizing resin column, and through either distillation or activated carbon units to remove organic compounds. At a minimum, the finished water should contain no detectable heavy metals or other inorganic compounds and no detectable organic compounds (i.e., at or above analytical method detection limits). Analyte-free water obtained by other methods is acceptable, as long as it meets the above analytical criteria.

Other solvents may be substituted for a particular purpose if required.

5. Responsibilities

5.1. PROCEDURE RESPONSIBILITY

The Quality Control (QC) Manager or Project Manager is responsible for maintenance, management, and revision of this SOG. Questions, comments, or suggestions about this SOG should be sent to the QC Manager or Project Manager.

5.2. PROJECT RESPONSIBILITY

ERRG employees performing this task, or any portion thereof, are responsible for meeting the requirements of this SOG. ERRG employees conducting technical review of task performance are also responsible for following appropriate portions of this SOG.

For those projects where the activities of this SOG are conducted, the Project Manager, or designee, is responsible for ensuring that those activities are conducted in accordance with this and other appropriate SOGs. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (i.e., daily logs, checkprints, calculations, reports, etc.) that the requirements of this SOG have been met. Such documentation shall be retained as part of the project file.

6. Procedure

6.1. HEALTH AND SAFETY

Health and safety procedures shall be implemented based on the site-specific decontamination protocol. Health and safety procedures shall consider the potential use of either dangerous solvents or corrosive liquids during the decontamination process.

6.2. EQUIPMENT

Decontamination equipment will vary depending on the site-specific contaminants and data quality objectives but should include decontamination solutions, tools to remove contamination and prevent cross-contamination, health and safety equipment, and waste disposal equipment. The following are examples of each type of equipment:

- Decontamination Solutions
  - Nonphosphate soap (such as Liquinox®)
  - Solvents inorganic or organic removal (such as acetone, hexane, nitric acid, etc.)
  - Tap water
  - Distilled/deionized water
- Decontamination Tools/Supplies
  - Brushes (large and small)
  - Plastic sheeting to place over the ground or working surface in the decontamination area
  - Paper towels
  - Collection tubs or buckets
  - Sprayers for solutions
- Health and Safety Equipment
  - Appropriate personal protective equipment in accordance with the site-specific health and safety plan
- Waste Disposal
  - Trash bags
  - Waste containers such as metal or plastic 55-gallon drums or 5-gallon buckets

6.3. IMPLEMENTATION

A decontamination area shall be established. A separate collection container needs to be available for each of the first four steps. Each type of water and soap solution can be placed in hand-held sprayers made of inert material. The analyte-free water shall be placed in a container that is free of any chemicals of concern. Special containers will be needed if solvents or acid solutions are used. For example, an acid solution cannot be placed in a sprayer that has any metal parts that will come in contact with the acid solution.

The minimum steps for decontamination are as follows:

1. Remove particulate matter and other surface debris using appropriate tools such as a brush, paper towel, or hand-held sprayer filled with tap water.

2. Scrub the surfaces of the sampling equipment using tap water and soap solution and a second brush made of inert material.
3. Rinse sampling equipment thoroughly with tap water.
4. Rinse sampling equipment thoroughly with analyte-free water (not necessary if sampling for disposal profiling purposes).
5. Place sampling equipment on a clean surface appropriate for the chemicals of concern and allow to air dry.

The use of solvents and acid solutions will be dependent on the site-specific conditions. A site with a high probability of high concentrations of compounds or with waste material present will require additional decontamination procedures.

Most ERRG projects sampling projects require personnel to don Level D personal protective equipment (PPE). Level D at a minimum includes disposal nitrile or work gloves when handling materials, safety toed boots, safety glasses, and hard hat (when applicable). If higher levels of PPE are required additional steps may be required.

All perform the following procedures between sampling locations and/or before leaving the site:

1. Decontaminate and rinse all reusable equipment as outlined above.
2. Discard disposable nitrile gloves and any materials used for decontaminating equipment into appropriate waste bin/contractor waste bags.
3. Wash hands, if possible, and don new disposable nitrile gloves when continuing to perform field activities.
4. Decontaminate boots if they came in contact with potentially contaminated materials.

It is ERRG policy to containerize and manage all decontamination fluids in accordance with SOG-009, Handling and Disposal of Investigation-Derived Waste. This policy will be followed unless the client specifically directs an alternate procedure in writing.

Title:	**Handling and Disposal of Investigation-Derived Waste**
Document Number:	**SOG-009**
Revision Number:	**0**

Reviewed: ______________________ 12/1/2023
Quality Control Manager Date

Approved: ______________________ 12/1/2023
Project Manager Date

ERRG

1. Purpose

This standard operating procedure (SOG) describes the minimum requirements for the safe handling and disposal of investigation-derived waste during environmental field activities by Engineering/Remediation Resources Group, Inc. (ERRG) personnel.

2. References

ERRG SOG-008, Equipment/Personnel Decontamination

3. Definition of Terms

Drum Staging–The arrangement of drums in a logical and orderly manner.

Immediately Dangerous to Life and Health (IDLH)–IDLH concentrations are determined by the National Institute for Occupational Safety and Health (NIOSH). IDLH concentrations aid in the selection of PPE when extremely corrosive materials or chemical concentrations are being handled. This includes materials suspected of causing significant overexposure if absorbed through the skin.

Level A–A fully encapsulating suit worn over a self-contained breathing apparatus. Clothing items includes chemical-resistant coverall, gloves, and boots. Specific materials and clothing items are selected on the basis of task-specific chemicals and hazards.

Level B–Routine work clothing in addition to a supplied-air respirator; chemical-resistant gloves, coveralls and boots or shoe covers. Clothing materials and styles are selected on the basis of task-specific chemicals and hazards.

Operator–A person who has been trained in accordance with safety specifications and training programs and has been qualified through demonstrating the knowledge, experience, and ability to perform the assigned task.

Personal Protective Equipment (PPE)–equipment used to protect personnel from exposure to hazardous materials or conditions.

4. Responsibilities

4.1. SITE SUPERVISORS

Site supervisors are responsible for implementing safe work practices for drum handling. Site supervisors will observe and document employee drum handling technique to verify that personnel who routinely handle drums understand and follow SOG guidelines. Site supervisors may instruct associates in the safe handling of drums during project implementation.

4.2. HEALTH AND SAFETY MANAGER

Designated safety person required to prepare health and safety plans and its amendments, routinely audit the site to verify that the health and safety plan requirements are being met and provide guidance to site supervisors in selection of the appropriate personal protective equipment (PPE), including downgrading of respiratory protection.

4.3. FIELD PERSONNEL

Field personnel are responsible for complying with SOG and safe work practices for drum handling. Field personnel are prohibited from handling drums without the required personal protective equipment and training.

5. Procedure

Drums are handled for purposes of staging, characterization, transporting, storage, and disposal. All drums and containers used will meet the appropriate U.S. Department of Transportation (DOT), Occupational Safety and Health Administration, and U.S. Environmental Protection Agency regulations for the waste they contain. Drum handling can be extremely dangerous; thus, drums will only be handled when absolutely necessary as the potential for leaks, rupture and exposure increases with the amount of handling. Personnel involved in drum handling will have prior training on potential hazards and safe work practices for these activities. Personnel will immediately notify their supervisor or the site safety officer of any changing conditions and new information that appears during drum handling.

5.1. HAZARDS

Hazards associated with drum handling operations include detonation, fire, explosion, vapor generation and both chemical and physical hazards. Chemical hazards, including harmful agent inhalation, ingestion, injection, and skin absorption, are directly related to the contents of the drum. Special care will be taken to ensure employees are knowledgeable in the contents of the drum they are handling through review of Safety Data Sheet (SDS) information, the NIOSH pocket guide, and reference chemical guides. There is a potential for an accidental release and subsequent exposure to chemicals when performing and drum handling operation.

Physical hazards include, but are not limited to, crushing injuries to the hands and feet; cuts; punctures; slips, trips and falls; eye injuries from protruding or flying objects; and strains and sprains.

5.2. PERSONAL PROTECTIVE EQUIPMENT

Personnel equipment and supplies necessary for drum handling include:

- Level B PPE will be worn when working with unknowns.
- Level A PPE will be worn when extremely corrosive materials or chemical concentrations IDLH are suspected. This includes materials suspected of causing significant overexposure, if absorbed through the skin.
- Fire extinguishers.
- Non-sparking tools.
- Spill absorbent material (loose or in pads or booms).
- Direct reading instruments for air monitoring.

Drum handling operations may be performed at downgraded PPE levels based on the types of chemicals being handled. Minimum PPE required for handling of drums with known contents include:

- Approved safety glasses (face shield and chemical splash goggles if a splash hazard exists)
- Nitrile gloves (or double surgical nitrile gloves taped at the wrist)
- Leather gloves (while handling drums)
- Approved safety boots
- Work uniform (Tyvek suits may be required when packing).
- Communication equipment (portable radio, hand signals, telephones, as appropriate)

In addition to the required equipment listed above, depending on the drum contents, each individual assigned to these tasks may be required to have the following items available and will don the appropriate articles in the event of a release, or if conditions warrant:

- **Respiratory protection.** Air-Purifying Respirator with appropriate cartridges. The appropriate respirator cartridge will generally consist of organic vapor and acid gas and high-efficiency particulate air (HEPA) combination cartridge unless a specific hazard exists such as formaldehyde or mercury
- **Protective clothing.** Chemical resistant fabric such as poly-coated Tyvek or Saranex-coated Tyvek, which will provide adequate protection against the existing hazard.

A qualified Site Supervisor will determine the initial level of respiratory protection and PPE in accordance with the approved site health and safety plan, as well as guidance from and consultation with the designated Health and Safety Manager.

5.3. STORING INVESTIGATION-DERIVED WASTE

During environmental investigations, soil and liquid waste is generated from various activities, such as drilling soil borings, purge water from groundwater sampling, and rinse water from decontamination.

When waste materials are generated, place them directly into US-DOT approved 55-gallon drums, separating soil and liquid waste. Drums are not to be filled completely and should provide sufficient outage so that the containers will not be overfull if their contents expand under sealed conditions. After filling a drum, seal it securely using socket wrench, or similar tool (typically 15/16-inch socket).

All drums should be labeled for storage or shipment. Use non-hazardous waste labels or "pending analysis" labels unless materials are expected to be potentially hazardous. Information that must be included on a label includes contents, generator (Washington State Department of Ecology), site location/address, accumulation date, point of contact. During an ongoing investigation, use a drum log to track the contents and quantity of waste materials.

Do not discard PPE or other items such as Tyvek, gloves, equipment, or trash into drums containing soils or liquids. Disposable protective equipment, trash, and other materials should be disposed of in separate appropriate waste containers, in accordance with SOG-008, Equipment/Personnel Decontamination.

5.4. PRE-INSPECTION

When practical, drums and containers will be inspected, and their integrity will be assured prior to being moved. When it is not practical to inspect a drum or container prior to being moved because of storage conditions (i.e., buried beneath the earth, stacked behind other drums, stacked several tiers high in a pile, etc.), the drum will be moved to an accessible location and inspected prior to further handling.

Prior to handling, drums will be inspected for potential hazards. Personnel will look for:

- Symbols, words, or other marks on the drum indicating that its contents are hazardous, e.g., radioactive, explosive, corrosive, toxic, flammable.
- Symbols, words, or other marks on a drum indicating that it contains discarded laboratory chemicals, reagents, or other potentially dangerous materials in small-volume individual containers.
- Signs of deterioration such as corrosion, rust, and leaks.
- Signs that the drum is under pressure, such as swelling and bulging.
- Drum type (stainless steel, polyethylene, fiberboard, etc.).
- Configuration of the drumhead.

- Looseness of bungs, lids, and caps.
- Bulging of contents indicating pressure. If the container appears to be pressurized, the Site Supervisor and Safety Officer will be notified. A Hazard Assessment will then be completed and approved.
- Burrs or loose metal on drums.
- Keep body parts away from possible hazards and use caution while manipulating drums in tight spaces. Do not cross your feet or hands when rolling drums.

5.5. SAFE WORK PRACTICES

All drums and containers will be approached cautiously until their contents and condition has been characterized. The following procedures will be followed for drum handling:

- Site operations shall be organized to minimize the amount of drum and container movement.
- Prior to movement of drums or containers, employees tasked with moving drums or containers will be warned of the potential hazards associated with the contents of the drums or containers.
- Drums will be handled one at a time or multiples if drums are secure on a pallet.
- When moving drums or containers, a spill kit with a suitable quantity of absorbent material will be kept available and used in areas where spills, leaks, or ruptures occur.
- Continuous communication shall be maintained between the drum or container handlers and the site safety and health officer until handling operations are complete.
- Associates are prohibited from standing, walking or sitting on drums.
- Associates will avoid the swing radius of drums during lifting and hoisting. Walking or standing under suspended loads is prohibited.
- All ignition sources must be removed from a 75-foot radius around drum handling activities.
- Drums that appear in imminent danger of failing will be overpacked as soon as possible.
- Mechanical devices will be used to move drums due to their weight. Drums may weigh 200 to 600 pounds.
- When lifting drums, operators must have a clear view of the path of the drum. Spotters will be used if the operator's view is blocked.
- When using slings, yokes or other lifting devices to move drums, personnel assisting the lift will move away a safe distance from the area before the drum is lifted.
- Critically swollen drums will not be handled until pressure is relieved.
- Where explosive or shock-sensitive contents are suspected and the potential of incorrect storage is in question, a Hazard Assessment will be completed and approved. The procedure for handling

explosive or shock-sensitive material may include mechanical remote opening devices. Employees will be trained in the devices use before such a device is used.

- Any drum or container that is not labeled or suspected to be mislabeled will be treated as containing a hazardous substance and treated accordingly until the contents are positively identified and labeled.

5.6. DRUM TRUCKS

The following procedures apply to the movement of drums using a drum truck:

- Workers will wear leather gloves and steel-toed safety boots.
- Operators must have a clear view of the path of the drum. A spotter will be used if the operator's view is blocked.
- The drum truck will be square with the resting drum at initiation.
- The slide handle will be attached securely to the top of the drum.
- Let the truck carry the load. It is necessary to apply pressure with the foot to the drum truck pivot bar, located behind and towards the bottom of the truck, while pulling back on the handles. The operator needs only balance and push.
- Avoid walking backwards with a drum truck.
- When going down an incline, keep the truck ahead so that it can be observed at all times.
- Move the drum truck at safe speeds. Do not run. Keep the drum truck constantly under control.

5.7. DRUM STAGING

The following procedures will be followed for drum staging:

- Drums will be staged in a logical and orderly manner.
- The arrangement of drums will allow adequate aisles for entrance and exit when working around the drums.
- Movement of drums will be kept to a minimum.
- Drums of like contents will be staged together and away from drums of incompatible contents.
- Gas cylinders will be staged in a cool shaded area.
- Potentially explosive and shock-sensitive drums will be stored at a location distant from other site activities and in a diked, fenced area.

5.8. DRUM OPENING AND SAMPLING

The following procedures will be followed for drum opening and sampling:

- Air monitoring will be performed at the drum opening before and during opening.
- Access to the drum opening area will be limited to essential personnel only.
- Where explosive or shock-sensitive contents are suspected and the potential of incorrect storage is in question, a Hazard Assessment will be completed and approved, and appropriate training will be completed before opening. Fire suppression equipment and air monitoring equipment will be available and protected from potential explosions.
- Drums or containers known to contain radioactive material will not be handled until their hazard to employees has been properly assessed.
- If the drum shows signs of bulging or swelling, excess pressure can be relieved by gently cracking the bung prior to opening.
- Non-sparking tools will be used for drum opening such as plastic, bronze or beryllium.
- Only one drum at a time will be opened. Drums will be left open only as long as is necessary to take samples. Drums will be closed and resealed as quickly as possible.
- Sampling of drum or container contents will be performed in accordance with a sampling procedure which is part of the site safety and health plan developed for and available to employees and others at the specific worksite.
- Samplers will stand to the side of an open drum and avoid leaning over the opening.
- If drum lid is unable to be replaced securely, the drum will be overpacked and its contents off-loaded.

Sampling equipment will be decontaminated between drums to avoid cross-contamination and mixtures of incompatible compounds.

5.9. TRAINING

Any person who handles drums will have been trained and have demonstrated the ability to do so in accordance with safety specifications and training programs. This will be supplemented with site-specific, hands-on training. Training shall cover the following topics:

- The purposes and procedures for drum staging, opening, characterization, removal, demolition, and disposal.
- Hazards of drum handling including detonation, fire, explosion, vapor generation, and physical injury.
- Proper inspection of drums and their associated hazards.
- Drum characterization criteria warranting the use of air monitoring.
- The safe operation of handling equipment, such as forklifts and drum trucks.

Title: **Electrical Safety**

Document Number: **SOG-010**

Reviewed:	V Smith	12/1/2023
	Quality Control Manager	Date
Approved:	[signature]	12/1/2023
	Project Manager	Date

1. Purpose

This SOG addresses safe work practices for workers whose job responsibilities entail interaction with electrical equipment and systems with potential exposure to energized electrical equipment and circuit parts as well as other workers whose exposure to electrical hazards is unintentional or not recognized as part of their job responsibilities. The highest risk for injury from electrical hazards for other workers is unintentional contact with overhead power lines and electric shock from machines, tools, and appliances.

2. Scope

This SOG applies to all ERRG employees and subcontractors working on or near exposed energized electrical conductors or circuit parts on ERRG project sites.

3. References

- Title 29 CFR 1910 Subpart S – Electrical
- Title 29 CFR § 1910.147 "The control of hazardous energy (Lockout/Tagout/Try)"
- Title 29 CFR §§ 1910.332 "Electrical Training"
- Title 29 CFR § 1910.269 "Electric power generation, transmission, and distribution"
- Title 29 CFR §1926 Subpart S – Electrical
- Washington Administrative Code (WAC) 296-155-53409, Table 4
- NFPA 70E® – Standard for Electrical Safety in the Workplace®, 2018 Edition
- NFPA 70® – National Electrical Code® (NEC®)

4. Definition of Terms

Affected employee—An employee who operates or uses machinery or equipment that is having service or maintenance performed under Lockout/Tagout, or anyone whose job requires work in an area in which servicing, construction or maintenance is being performed under Lockout /Tagout.

Arc Rating—The value attributed to materials that describes their performance to exposure to an electrical arc discharge. The arc rating is expressed in cal/cm^2 and is derived from the determined value of the arc thermal performance value (ATPV) or energy of breakopen threshold (E_{BT}) (should a material system exhibit a breakopen response below the ATPV value). Arc rating is reported as either ATPV or E_{BT}, whichever is the lower value.

Arc Blast—The explosive expansion of the surrounding air and metal in the path of an arc flash creating high pressures exceeding hundreds to thousands of pounds per square ft and sound in excess of 160 dB and expel molten metal and debris in excess of 700 mph.

Arc Flash—A short circuit that flashes from one, exposed live conductor to another or to ground. The resulting ionized air creates superheated plasma that can reach temperatures of 35,000° F. The incident energy of an arc flash is usually measured in calories/ per square centimeter (cal/cm^2).

Arc Thermal Performance Value (ATVP)—Used to rate the protection limit of flame-resistant clothing and flash suits. The value is usually presented in calories per centimeter squared (cal/cm^2).

Barricade—A physical obstruction such as tapes, cones, or A-frame-type wood or metal structures intended to provide a warning about and to limit access to a hazardous area.

Barrier—A physical obstruction that is intended to prevent contact with equipment or live parts or to prevent unauthorized access to a work area.

Circuit Breaker—A device designed to open and close a circuit by non-automatic means and to open the circuit automatically on a predetermined overcurrent without damage to itself when properly applied within its' rating.

Conductive—Suitable for carrying electric current.

Contractor—For the purpose of this SOG, a contractor is any non-ERRG personnel or non-facility ERRG personnel who will engage in work activities where a potential exposure to electrical energy exists.

De-energized—Free from any electrical connection to a source of potential difference and from electrical charge; not having the potential difference from that of the earth.

Electrical Hazard—A dangerous condition such that contact or equipment failure can result in electric shock, arc flash burn, thermal burn, or blast.

Electrical Safety—Recognizing hazards associated with the use of electrical energy and taking precautions so that hazards do not cause injury or death.

Electrically Safe Work Condition—A state in which the conductor or circuit path to be worked on or near has been disconnected from energized parts, locked/tagged in accordance with established standards, tested to ensure the absence of voltage, and grounded if determined necessary.

Energized—Electrically connected to or having a source of voltage.

Exposed (live parts)—Capable of being inadvertently touched or approached nearer than a safe distance by a person. It is applied to parts that are not suitably guarded, isolated, or insulated.

Feeder—All circuit conductors between the service equipment, the source of a separately derived system, or other power supply source and the final branch-circuit over current device.

Flame-Resistant (FR) —The property of a material whereby combustion is prevented, terminated, or inhibited following the application of a flaming or non-flaming source of ignition, with or without subsequent removal of the ignition source.

Flash Hazard—A dangerous condition associated with the release of energy caused by an electric arc.

Flash Hazard Analysis—A study investigating a worker's potential exposure to arc-flash energy, conducted for the purpose of injury prevention, the determination of safe work practices and the appropriate levels of PPE.

Flash Protection Boundary—An approach limit at a distance from exposed live parts within which a person could receive a second-degree burn if an electrical arc flash were to occur.

Flash Suit—A complete FR clothing and equipment system that covers the entire body, except for the hands and feet. This includes pants, jacket, and bee-keeper-type hood fitted with a face shield.

Incident Energy—The amount of energy impressed on a surface, a certain distance from the source, generated during an electrical arc event. One of the units used to measure incident energy is calories per centimeter squared (cal/cm^2).

Limited Approach Boundary—An approach limit at a distance from an exposed live part within which a shock hazard exists and only qualified personnel may enter.

PPE Category—Defines the incident energy category of an arc flash to determine the PPE required during performance of specific electrical maintenance and operations tasks. Hazard/Risk category numbers range from 1 to 4. (Selection of Arc-Rated Clothing and Other PPE When the Incident Energy Analysis is Used, NFPA 70E®, Table 130.5(G))

Prohibited Approach Boundary—An approach limit at a distance from an exposed live part within which work is considered the same as making contact with the live part.

Qualified Person—One who has the skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training on the hazards involved.

Routine Task—A task or activity that is a part of regular or customary course of work that can be completed in accordance with established practices.

Restricted Approach Boundary—An approach limit at a distance from an exposed live part within which there is an increased risk of shock, which is due to electrical arc-over combined with inadvertent movement, for personnel working near the live part.

Shock Hazard—The dangerous condition associated with the possible release of energy caused by contact or approach to live parts.

Standard Personal Protective Equipment (PPE)—Hardhat, safety glasses with side shields, natural fiber under garments, pants or coveralls or FR clothing, hearing protection (ear plugs or muffs) and steel toed or non-conductive leatherwork boots.

Unqualified Person—A person who is not a qualified person.

Working Near (live parts)—Any activity inside a Limited Approach Boundary.

Working On (live parts) —Coming in contact with live parts with the hands, feet, or other body parts, with tools, probes, or with test equipment, regardless of the PPE a person is wearing.

5. Responsibilities

ERRG does not self-perform any live or high voltage electrical work and would defer responsibilities to a licensed/certified electrician for such work. The responsibilities below are for personnel regarding electrical safety.

5.1. MANAGERS AND SUPERVISORS

- Ensure that all aspects of this SOG and/or client's site Electrical Safety Program are followed and complied with.
- Ensure that all personnel and authorized visitors on ERRG property or ERRG controlled sites follow the site electrical safety program.
- Administer disciplinary action when violations occur.
- Ensure that all resources that are necessary for the implementation and management of this SOG and/or site Electrical Safety Program are provided.
- Perform a root cause analysis of all electrical safety incidents, including near misses, with the Corporate Health & Safety Manager (HSM).

5.2. FIELD SUPERVISORS

- Administer the site Electrical Safety Program.
- Designate, obtain and maintain the electrical safety equipment including PPE, utilized in supporting the site Electrical Safety Program.
- Ensure that operations personnel are fully trained and comply with the site Electrical Safety Program.
- Administer disciplinary action to operations personnel who violate the site Electrical Safety Program.
- Determine if subcontractor(s), when employed, will engage in activities that require use of this SOG or the site's Electrical Safety Program.
- Participate in electrical safety incident investigations, including near misses.

5.3. EMPLOYEES

- Consider electrical safety of first importance in the performance of all related duties. Each employee is responsible for personal safety and the safety of others.
- Implement this SOG and/or the site Electrical Safety Program.
- Stop work and/or communicate any concerns regarding electrical safety if asked to perform a task in which they feel they are not adequately trained, or generally feel uncomfortable concerning the given task.
- Ensure that guards or protective measures are satisfactory for the conditions.
- Comply with established work methods and the use of protective equipment.

5.4. SITE SAFETY AND HEALTH OFFICER

- Determine if the subcontractor(s) will engage in activities that require use of this SOG and/or the site's written Electrical Safety Program or the subcontractor's written procedure.
- Ensure that all subcontractor employees are informed and knowledgeable of this SOG and any site electrical safety program requirements that are applicable to the contract employee's work.
- Ensure that the subcontractor adheres to this SOG and/or the site's electrical safety program.
- Ensure that if the subcontractor's Electrical Safety Program is used in lieu of the site's procedure, it affords a level of protection that is equal to or exceeds the protection of this SOG and/or the site's requirements. The HSM's (or equivalent) approval is required prior to allowing a subcontractor to use their own program.
- Participate in all incident investigations involving electrical safety, including near misses that involve project personnel.

6. General Requirements

Work may not be performed when adverse weather conditions would make the work hazardous even after the work practices required by this section are employed. All work locations will be safely accessible whenever work is to be performed. Sufficient access and working space will be provided and maintained for all electric equipment to permit ready and safe operation and maintenance of such equipment. Illumination will be provided as needed to perform the work safely. ERRG strictly prohibits actions taken by employees or subcontractors that place them or others in unnecessarily dangerous situations.

Attempts should always be made to perform work on electrical circuits with the circuit de-energized. Work on energized (live) circuits will be evaluated to determine that all potential hazards (job safety analysis) are addressed and eliminated where possible.

Appropriate personal protective shields, barriers, or insulating materials and/or tools will be utilized to protect employees from potential burns/shock when working on electrical circuits in confined or enclosed spaces.

Load ratings of stringing lines, pulling lines, conductor grips, load-bearing hardware and accessories, rigging, and hoists may not be exceeded.

Personnel will not enter spaces containing exposed energized parts unless correct illumination is provided for safe working conditions.

Electrical grounds will be installed when work is performed on circuits of 600 volts and above. The Site's Electrical Grounding Procedure will be followed for the installation, removal, and audit of electrical grounds.

Post and maintain in plain view of the operator and driver on each crane, derrick, power shovel, drilling rig, hay loader, hay stacker, pile driver, or similar apparatus, a durable warning sign legible at 12 feet reading: "Unlawful To Operate This Equipment Within 10 Feet Of High-Voltage Lines of 50,000 Volts Or Less." In addition to the above wording, the following statement in small lettering shall be provided on the warning sign: "For Minimum Clearances of High-Voltage Lines in Excess of 50,000 Volts, See Washington Administrative Code (WAC) 296-155-53409, Table 4" The erection, operation or dismantling of any boom-type lifting or hoisting equipment, or any part thereof, closer than the minimum clearances from energized overhead high-voltage lines set forth will be prohibited.

7. Safe Work Procedures

Each project task where electrical hazards apply will implement the procedures listed, as applicable.

- Identify purpose of the task
- Identify the qualifications and number of employees to be involved
  - If training is required, ensure workers are properly trained prior to exposure to the hazard.
  - If a licensed electrician is required, ensure the subcontractor is properly trained and licensed.
- Identify the hazards and assessment of risks of the task(s) - The SSHO or Project Manager is responsible for ensuring a pre-work risk assessment is conducted for the electrical work to be performed.
  - Remove the electrical hazard or de-energize, if possible.
  - Perform a risk assessment if the hazard cannot be removed. The risk assessment should anticipate unexpected events, identify shock, and arc flash hazards as well as other hazards, minimize hazards, and identify controls, tools, equipment, and PPE to be used. Table 130.5(C), "Estimate of the Likelihood of Occurrence of an Arc Flash Incident for ac and dc Systems" in Section 10 (Attachments) can assist in this risk assessment.
  - Plan every job and document first time procedures.
  - Protect employees from shock, burn, blast, and other hazards due to the working environment.
  - Use the right tools for the job.
  - Assess people's abilities.
  - Audit these principles.
- Identify the limits of approach
  - For unqualified persons
  - For qualified persons
- Identify safe work practices to be used
- Identify required personal protective equipment (PPE)
- Identify required insulating tools and materials involved
- Identify any special precautionary techniques
- Review electrical single-line diagrams and/or equipment details
- Review reference data

7.1. INSPECTION

- Inspect/evaluate the electrical equipment. Employees will inspect each safety device, tool or piece of equipment each time it is used and to use only those in good condition. ERRG requires the use of safety devices and safeguards where applicable. Defective equipment and tools will be tagged and placed out of service.
- Reel handling equipment, including pulling and tensioning devices, must be in safe operating condition and will be leveled and aligned.

- Insulating equipment found to be defective or damaged will be immediately removed from service. A system, such as tagging, will be used to ensure defective equipment will not be used by other workers.
- Insulated gloves, sleeves and blankets must be visually inspected and electrically re-tested periodically at prescribed intervals or when found to be damaged or defective. Gloves, sleeves, and blankets shall be marked to indicate compliance with the re-test schedule and shall be marked with either the date tested, or the date the next test is due.
- Maintain the electrical equipment's insulation and enclosure integrity.
- Before elevated structures, such as poles or towers, are subjected to such stresses as climbing or the installation or removal of equipment may impose, a qualified individual will ascertain that the structures can sustain the additional or unbalanced stresses. If the pole or other structure cannot withstand the loads which will be imposed, it will be braced or otherwise supported to prevent failure.

7.2. SAFE WORK PRACTICES

Electrical safe work practices include, but are not limited to, the following:

- Consider every electrical conductor or circuit part energized until proven otherwise. Conductors and parts of electrical equipment that have been de-energized but not been locked or tagged out will be treated as live parts.
- Prohibit bare-hand contact made with exposed energized electrical conductors or circuit parts with a voltage rating of 50 volts or more.
- Consider de-energizing an electrical conductor or circuit part and making it safe to work on as a potentially hazardous task.
- Use procedures as "tools" to identify the hazards and develop plans to eliminate/control the hazards.
- Train employees to qualify them for working in an environment influenced by the presence of electrical energy.
- Identify/categorize tasks to be performed on or near exposed energized electrical conductors and circuit parts.
- Identify and use precautions appropriate to the working environment.

7.2.1. Pre-work Safety Briefing

A pre-work safety briefing must be performed to identify the procedures for working on or near live parts operating at 50 volts or more or where an electrical hazard exists before work is started. Electrical safety procedures include, but are not limited to, the information in Section 7.

A brief discussion of whether the work involved is routine and if the employee, by virtue of training and experience, can reasonably be expected to recognize and avoid hazards involved in the job. A more extensive discussion should be conducted if the work is complicated or particularly hazardous or the employee cannot be expected to recognize and avoid the hazards involved with the job. A review of the Activity Hazard Analysis for the task must be performed.

7.2.2. Work Zone and Limits of Approach

The work area will be adequately marked, designated, or otherwise indicated so that potential hazards are readily apparent to unqualified people not associated with the task.

Workers will utilize signs, labels, tags, and color coding as necessary to address issues of demarcation of hazards covered by this SOG and/or a client's Electrical Safety Program. To protect employees from falling into holes into which poles are to be placed, the holes will be attended by employees or physically guarded whenever anyone is working nearby. Barriers, or other equivalent measures will be used to minimize the possibility that conductors and cables being installed or removed will contact energized power lines or equipment.

Demarcation of electrical hazards can be made via permanent or temporary means, based on the hazard.

- Permanent demarcation features can be affixed if an electrical hazard exists on a continuous basis as required by the client/owner of the site.
- Markings must conform to NFPA 70E® regarding demarcation and clearly designate the restricted approach boundary and required PPE necessary to permit entry.
- Temporary demarcation features will be removed upon completion of the associated activity, project or task and return of the site to a safe condition.

7.2.3. Working on Exposed Electric Conductors or Parts that may be Energized

Safety-related work practices will be used to safeguard employees from injury while they are working on or near exposed electric conductors or circuit parts that are or can become energized.

- While any employee is exposed to contact with parts of fixed electric equipment or circuits which have been deenergized, the circuits energizing the parts shall be locked out or tagged or both.
- When performing work with live line tools, minimum approach distances will be maintained. Conductor support tools, such as link sticks, strain carriers, and insulator cradles, may be permitted for use, provided that the clear insulation is at least as long as the insulator string or the minimum distance specified for the operating voltage. When performing work with live line tools, minimum approach distances 29 CFR §1910.333 Table S-5 will be maintained.

- Live parts to which an employee might be exposed will be put into an electrically safe work condition utilizing site lockout/tagout/try procedure, before an employee works on or near them, unless the work on energized components introduces additional or increased hazards or is infeasible due to equipment design or operational limitations.
- Prior to performing any work on energized circuits, a pre-job briefing will be conducted.
- Only qualified people may work on energized conductors or equipment connected to energized high-voltage systems. Except for replacing fuses, operating switches, or other operations that do not require the employee to contact energized high-voltage conductors or energized parts of equipment, clearing “trouble” or in emergencies involving hazard to life or property, no such employee will be assigned to work alone. Employees in training (e.g., apprentices), who are qualified by experience and training, will be permitted to work on energized conductors or equipment connected to high-voltage systems while under the supervision or instruction of a qualified electrical worker (e.g., journeyman).
- Only qualified people may work on electric circuit parts or equipment that have not been deenergized. Such people will be capable of working safely on energized circuits and will be familiar with the proper use of special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools.
- Portable ladders must have nonconductive siderails if they are used where the employee or the ladder could contact exposed energized parts.

7.2.4. Work Around Overhead Power Lines

All overhead power lines must be approached as follows:

- Overhead power lines will be de-energized, if possible, before work with boom or heavy equipment begins.
- No equipment will approach an overhead power line within the OSHA safe approach distance, based on known or posted line voltage.
- A spotter is always required to monitor safe approach distance, including line sway.

7.2.4.1. Electrical Hazard Analysis.

- If the live parts operating at 50 volts or more are not placed in an electrically safe condition, other safety-related work practices will be used to protect employees who could be exposed to the electrical hazards involved.
- Such work practices will protect each employee from arc flash and from direct contact with any part of the body, or indirectly through some other conductive object, with live parts that operate at 50 volts or more.
- The work practices that are used will be suitable for the conditions under which the work is to be performed and for the voltage level of the live parts.

- Appropriate safety-related work practices will be determined before any person approaches exposed live parts within the Limited Approach Boundary by using both shock hazard analysis and flash hazard analysis.

7.2.4.2. Shock Hazard Analysis.

A shock hazard analysis will determine the voltage to which personnel will be exposed, boundary requirements, and the personal protective equipment necessary to minimize the possibility of electrical shock to personnel.

7.2.4.3. Shock Protection Boundaries.

The shock protection boundaries identified, as Limited, Restricted, and Prohibited Approach Boundaries are applicable to the situation in which approaching personnel are exposed to live parts.

7.2.4.4. Approach to Exposed Live Parts Operating at 50 Volts or More.

No qualified person will approach or take any conductive object closer to exposed live parts operating at 50 volts or more than the Restricted Approach Boundary unless any of the following apply:

- Insulating equipment designed for the voltage levels to be encountered will be provided and employees will be instructed to use the equipment. No person, firm, or corporation, or agent of same, will require or permit any employee to perform any function in proximity to energized high-voltage lines; to enter upon any land, building, or other premises and there engage in any excavation, demolition, construction, repair, or other operation; or to erect, install, operate, or store in or upon such premises any tools, machinery, equipment, materials, or structures (including scaffolding, house moving, well drilling, pile driving, or hoisting equipment) unless and until danger from accidental contact with high-voltage lines has been effectively guarded against.
- The qualified person is insulated or guarded from the live parts operating at 50 volts or more (insulating gloves or insulating gloves and sleeves are considered insulation only regarding the energized parts upon which work is being performed), and no un-insulated part of the qualified person's body crosses the Prohibited Approach Boundary.
- The live part operating at 50 volts or more is insulated from the qualified person and from any other conductive object at a different potential.
- The qualified person is insulated from any other conductive object as during live-line bare-hand work.
- The qualified person adheres to the approach distances in 29 CFR §1910.333 Table S-5.
- Work by qualified people is only allowed when proper illumination is provided.
- Ladder work will only be performed using a ladder with non-conductive siderails.

7.2.4.5. Approach by Unqualified Persons.

Unqualified persons will not be permitted to enter areas containing electrical equipment unless the electrical conductors and equipment involved are in an electrically safe working condition and must always maintain a 20-foot clearance distance.

7.2.4.6. Working At or Close to the Limited Approach Boundary.

When one or more unqualified persons are working at or close to the Limited Approach Boundary, the designated person in charge of the workspace where the electrical hazard exists will cooperate with the designated person in charge of the unqualified person(s) to ensure all work can be performed safely. This will include advising the unqualified person(s) of the electrical hazard present and warning him or her to stay outside of the Limited Approach Boundary.

7.2.4.7. Entering the Limited Approach Boundary.

Where there is a need for an unqualified person(s) to cross the Limited Approach Boundary, a qualified person will advise him or her of the possible hazards and continuously escort the unqualified person(s) while inside the Limited Approach Boundary. Under no circumstances will the escorted unqualified person(s) be permitted to cross the Restricted Approach Boundary. See NFPA 70E Table 130.4(D)(a), Table 130.4(D)(b) Approach Boundaries to Live Parts table in in Section 10 (Attachments).

7.2.4.8. Flash Hazard Analysis.

A flash hazard analysis will be done, where required, to protect personnel from the possibility of being injured by an arc flash. The analysis will determine the Flash Protection Boundary and the personal protective equipment that people within the Flash Protection Boundary will use.

- Flash Protection Boundary.
  - For systems that are 600 volts or less, the Flash Protection Boundary will be 4 feet, based on the product of clearing times of 6 cycles (0.1 second) and the available bolted fault current of 50 kA or any combination not exceeding 300 kA cycles (5000 ampere seconds).
  - For clearing times and bolted fault currents other than 300 kA cycles, or under engineering supervision, the Flash Boundary will alternatively be permitted to be calculated in accordance with the formula referenced in NFPA 70E 130.3 (A).
  - At voltage levels above 600 volts, the Flash Protection Boundary is the distance at which the incident energy equals 5 J/cm2 (1.2 cal/cm^2). For situations where fault-clearing time is 0.1 second (or faster), the Flash Protection Boundary is the distance at which the incident energy level equals 6.24 J/cm2 (1.5 cal/cm^2).

  Note: In lieu of the above, each site has the option to use the tables in Section 10 (Attachments) to determine acceptable levels of employee protection for given circuits.

8. Personal Protective Equipment

Project managers or safety staff should select PPE that is appropriate for the work and in accordance with NFPA 70E®. Annex H provides the "Guidance on Selection of Protective Clothing and Other Personal Protective Equipment (PPE)." In general Table H.2 should be followed. Table H.2 – "Simplified Two-Category, Arc-Rated Clothing System." The use of Table H.2 is a simplified approach to provide minimum PPE for electrical workers within facilities with large and diverse electrical systems. The clothing listed in Table H.2 fulfills the minimum arc-rated clothing requirements of Table 130.7(C)(15)(a), Table 130.7(C)(15)(b), and Table 130.7(C)(15)(c). The clothing systems listed in Table H.2 (below) should be used with the other PPE appropriate for the arc flash PPE category.

Table H.2 Simplified Two-Category, Arc-Rated Clothing System

Clothing[a]	Applicable Situations
Everyday Work Clothing Arc-rated long-sleeve shirt with arc-rated pants (minimum arc rating of 8) or Arc-rated coveralls (minimum arc rating of 8)	Situations where a risk assessment indicates that PPE is required and where Table 130.7(C)(15)(a) and Table 130.7(C)(15)(b) specify arc flash PPE category 1 or 2[b]
Arc Flash Suit A total clothing system consisting of arc-rated shirt and pants and/or arc-rated coveralls and/or arc flash coat and pants (clothing system minimum arc rating of 40)	Situations where a risk assessment indicates that PPE is required and where Table 130.7(C)(15)(a) and Table 130.7(C)(15)(b) specify arc flash PPE category 3 or 4[b]

a - Note that other PPE listed in Table 130.7(C)(15)(c), which include arc-rated face shields or arc flash suit hoods, arc-rated hard hat liners, safety glasses or safety goggles, hard hats, hearing protection, heavy-duty leather gloves, rubber insulating gloves, and leather protectors, could be required. The arc rating for a garment is expressed in cal/cm^2.

b- The estimated available fault current capacities and fault clearing times or arcing durations are listed in the text of Table 130.7(C)(15)(a) and Table 130.7(C)(15)(b). For power systems with greater than the estimated available fault current capacity or with longer than the assumed fault clearing times, Table H.2 cannot be used and arc flash PPE must be determined and selected by means of an incident energy analysis in accordance with 130.5(G).

PPE will be laundered, and equipment maintained and inspected in accordance with the applicable process and timeframes as specified by NFPA 70E® and/or the manufacturer's specifications, whichever is more restrictive/conservative. Conductive articles of jewelry or apparel (such as watchbands, bracelets, rings, key chains, necklaces, metalized aprons, cloth with conductive thread, or metal headgear) may not be worn if they might contact exposed energized parts. However, such articles may be worn if they are rendered nonconductive by covering, wrapping, or other insulating means.

9. Training

Training requirements apply to workers who, while performing their assigned work tasks, face the risk of electrical hazards that are not controlled by design or engineering means. Depending on work tasks, the following training is required. Individuals who may require this training are also listed below.

- Electrical safety-related work practices that pertain to their respective job assignments - field supervisors, SSHO, employees
- NFPA 70E® (current edition) - managers and supervisors, field supervisors, SSHO, employees
- Hazardous energy control program (ERRG Training Module and Corporate Health and Safety Programs Manual Section 17) - field supervisors, SSHO, employees
    - This energy control training and periodic inspections to ensure that before any employee performs any servicing or maintenance on a machine or equipment where the unexpected energizing, startup or release of stored energy could occur and cause injury, the machine or equipment will be isolated from the energy source and rendered inoperative in accordance with 29 CFR §1910.147.
    - Each authorized employee will receive training in the recognition of applicable hazardous energy sources, the type and magnitude of the energy available in the workplace, and the methods and means necessary for energy isolation and control. This includes limitations of tags (if used).
    - Each affected employee will be instructed in the purpose and use of the energy control procedure. This includes limitations of tags (if used).
    - All other employees whose work operations are or may be in an area where energy control procedures may be utilized, will be instructed about the procedure, and about the prohibition relating to attempts to restart or reenergize machines or equipment which are locked out or tagged out. This includes limitations of tags (if used).
- First Aid/CPR - Employees will be instructed/retrained on the methods of first aid and emergency procedures, such as approved methods for resuscitation, if their duties warrant such training.
- Live-line bare-hand technique on energized circuits – if applicable, employees will be trained in the technique and in the safety requirements. Employees will receive refresher training as required by 29 CFR §1910.269.

9.1. FREQUENCY

Training is required before the employee is exposed to the electrical hazard(s) and at least every 3 years for qualified persons. Retraining will be provided for all authorized and affected employees whenever there is a change in their job assignments, a change in machines, equipment or processes that present a new hazard, or when there is a change in the energy control procedures. Additional retraining will also be conducted whenever a periodic inspection reveals, or whenever the employer has reason to believe that there are deviations from or inadequacies in the employee's knowledge or use of the energy control procedures.

9.2. TRAINING TYPE

Training will consist of classroom, on-the-job, or a combination of the two. The degree of training provided will be determined by the risk to the employee. Employee risk evaluation is determined by site survey, potential tasks, and review of acceptable approach boundaries.

9.2.1. Qualified Person

A Qualified Person will be identified by site management as trained and knowledgeable of the construction and operation of equipment or a specific work method and be trained to recognize and avoid electrical hazards that might be present with the respect to that equipment or work method.

The Qualified Person will also be familiar with the proper use of the special precautionary techniques, personal protective equipment, including arc-flash, insulating and shielding materials, and insulated tools and test equipment. A person can be considered qualified with respect to certain equipment and methods but still unqualified for others.

Qualified Persons that are permitted to work within the Limited Approach Boundary, at a minimum, will be additionally trained in the following:

- The skills and techniques to distinguish exposed energized parts from other parts of electrical equipment.
- The skills and techniques necessary to determine the nominal voltage of exposed parts.
- The approach distances specified in Table 130.4(D)(a) and Table 130.4(D)(b) and the corresponding voltages to which the qualified person will be exposed.
- The decision-making process necessary to do the following:
  - Perform the job safety planning
  - Identify electrical hazards
  - Assess the associated risk
  - Select the appropriate risk control methods and PPE

Employees working on or near exposed energized electrical conductors or circuit parts will be trained in methods of release of victims from contact with exposed energized conductors or circuit parts.

9.2.2. Unqualified Persons

All employees (including “unqualified persons”) will be trained in and be familiar with any electrical safety practices related to the potential risks of the site or facility meeting the minimum requirements necessary for their safety.

10. Attachments

Extracted tables from NFPA 70E® (2018 Edition) listed below are presented after Section 10.

- Table 130.4(D)(a) – Shock Protection Approach Boundaries to Exposed Energized Electrical Conductors or Circuit Parts of Alternating Current Systems
- Table 130.4(D)(b) – Shock Protection Approach Boundaries to Exposed Energized Electrical Conductors or Circuit Parts of Direct-Current Voltage Systems
- Table 130.5(C) – Estimate of the Likelihood of Occurrence of an Arc Flash Incident for ac and dc Systems
- Table 130.7(C)(15)(a) – Arc-Flash PPE Categories for Alternating Current (ac) Systems
- Table 130.7(C)(15)(b) – Arc-Flash PPE Categories for Direct Current (dc) Systems

Enviro Safetech
Your SAFETY is Our Business
2160-B Oakland Road, San Jose, CA 95131
tel: (408) 943-9090 fax: (408) 943-9292
web: www.envirosafetech.com

NFPA 70E Tables

N **Table 130.4(D)(a) Shock Protection Approach Boundaries to Exposed Energized Electrical Conductors or Circuit Parts for Alternating-Current Systems**

(1)	(2)	(3)	(4)
	Limited Approach Boundary[b]		
Nominal System Voltage Range, Phase to Phase[a]	Exposed Movable Conductor[c]	Exposed Fixed Circuit Part	Restricted Approach Boundary[b]; Includes Inadvertent Movement Adder
Less than 50 V	Not specified	Not specified	Not specified
50 V–150 V[d]	3.0 m (10 ft 0 in.)	1.0 m (3 ft 6 in.)	Avoid contact
151 V–750 V	3.0 m (10 ft 0 in.)	1.0 m (3 ft 6 in.)	0.3 m (1 ft 0 in.)
751 V–15 kV	3.0 m (10 ft 0 in.)	1.5 m (5 ft 0 in.)	0.7 m (2 ft 2 in.)
15.1 kV–36 kV	3.0 m (10 ft 0 in.)	1.8 m (6 ft 0 in.)	0.8 m (2 ft 9 in.)
36.1 kV–46 kV	3.0 m (10 ft 0 in.)	2.5 m (8 ft 0 in.)	0.8 m (2 ft 9 in.)
46.1 kV–72.5 kV	3.0 m (10 ft 0 in.)	2.5 m (8 ft 0 in.)	1.0 m (3 ft 6 in.)
72.6 kV–121 kV	3.3 m (10 ft 8 in.)	2.5 m (8 ft 0 in.)	1.0 m (3 ft 6 in.)
138 kV–145 kV	3.4 m (11 ft 0 in.)	3.0 m (10 ft 0 in.)	1.2 m (3 ft 10 in.)
161 kV–169 kV	3.6 m (11 ft 8 in.)	3.6 m (11 ft 8 in.)	1.3 m (4 ft 3 in.)
230 kV–242 kV	4.0 m (13 ft 0 in.)	4.0 m (13 ft 0 in.)	1.7 m (5 ft 8 in.)
345 kV–362 kV	4.7 m (15 ft 4 in.)	4.7 m (15 ft 4 in.)	2.8 m (9 ft 2 in.)
500 kV–550 kV	5.8 m (19 ft 0 in.)	5.8 m (19 ft 0 in.)	3.6 m (11 ft 8 in.)
765 kV–800 kV	7.2 m (23 ft 9 in.)	7.2 m (23 ft 9 in.)	4.9 m (15 ft 11 in.)

Notes:
(1) For arc flash boundary, see 130.5(A).
(2) All dimensions are distance from exposed energized electrical conductors or circuit part to employee.
[a]For single-phase systems above 250 volts, select the range that is equal to the system's maximum phase-to-ground voltage multiplied by 1.732.
[b]See definition in Article 100 and text in 130.4(D)(2) and Informative Annex C for elaboration.
[c]*Exposed movable conductors* describes a condition in which the distance between the conductor and a person is not under the control of the person. The term is normally applied to overhead line conductors supported by poles.
[d]This includes circuits where the exposure does not exceed 120 volts nominal.

N **Table 130.4(D)(b) Shock Protection Approach Boundaries to Exposed Energized Electrical Conductors or Circuit Parts for Direct-Current Voltage Systems**

(1)	(2)	(3)	(4)
	Limited Approach Boundary		
Nominal Potential Difference	Exposed Movable Conductor*	Exposed Fixed Circuit Part	Restricted Approach Boundary; Includes Inadvertent Movement Adder
Less than 50 V	Not specified	Not specified	Not specified
50 V–300 V	3.0 m (10 ft 0 in.)	1.0 m (3 ft 6 in.)	Avoid contact
301 V–1 kV	3.0 m (10 ft 0 in.)	1.0 m (3 ft 6 in.)	0.3 m (1 ft 0 in.)
1.1 kV–5 kV	3.0 m (10 ft 0 in.)	1.5 m (5 ft 0 in.)	0.5 m (1 ft 5 in.)
5 kV–15 kV	3.0 m (10 ft 0 in.)	1.5 m (5 ft 0 in.)	0.7 m (2 ft 2 in.)
15.1 kV–45 kV	3.0 m (10 ft 0 in.)	2.5 m (8 ft 0 in.)	0.8 m (2 ft 9 in.)
45.1 kV– 75 kV	3.0 m (10 ft 0 in.)	2.5 m (8 ft 0 in.)	1.0 m (3 ft 6 in.)
75.1 kV–150 kV	3.3 m (10 ft 8 in.)	3.0 m (10 ft 0 in.)	1.2 m (3 ft 10 in.)
150.1 kV–250 kV	3.6 m (11 ft 8 in.)	3.6 m (11 ft 8 in.)	1.6 m (5 ft 3 in.)
250.1 kV–500 kV	6.0 m (20 ft 0 in.)	6.0 m (20 ft 0 in.)	3.5 m (11 ft 6 in.)
500.1 kV–800 kV	8.0 m (26 ft 0 in.)	8.0 m (26 ft 0 in.)	5.0 m (16 ft 5 in.)

Note: All dimensions are distance from exposed energized electrical conductors or circuit parts to worker.
**Exposed movable conductor* describes a condition in which the distance between the conductor and a person is not under the control of the person. The term is normally applied to overhead line conductors supported by poles.

Table 130.5(C) Estimate of the Likelihood of Occurrence of an Arc Flash Incident for ac and dc Systems

Task	Equipment Condition	Likelihood of Occurrence*
Reading a panel meter while operating a meter switch. Performing infrared thermography and other non-contact inspections outside the restricted approach boundary. This activity does not include opening of doors or covers. Working on control circuits with exposed energized electrical conductors and circuit parts, nominal 125 volts ac or dc, or below without any other exposed energized equipment over nominal 125 volts ac or dc, including opening of hinged covers to gain access. Examination of insulated cable with no manipulation of cable. For dc systems, insertion or removal of individual cells or multi-cell units of a battery system in an open rack. For dc systems, maintenance on a single cell of a battery system or multi-cell units in an open rack.	Any	No
For ac systems, work on energized electrical conductors and circuit parts, including voltage testing. For dc systems, working on energized electrical conductors and circuit parts of series-connected battery cells, including voltage testing. Removal or installation of CBs or switches. Opening hinged door(s) or cover(s) or removal of bolted covers (to expose bare, energized electrical conductors and circuit parts). For dc systems, this includes bolted covers, such as battery terminal covers. Application of temporary protective grounding equipment, after voltage test. Working on control circuits with exposed energized electrical conductors and circuit parts, greater than 120 volts. Insertion or removal of individual starter buckets from motor control center (MCC). Insertion or removal (racking) of circuit breakers (CBs) or starters from cubicles, doors open or closed. Insertion or removal of plug-in devices into or from busways. Examination of insulated cable with manipulation of cable. Working on exposed energized electrical conductors and circuit parts of equipment directly supplied by a panelboard or motor control center. Insertion or removal of revenue meters (kW-hour, at primary voltage and current). Removal of battery conductive intercell connector covers. For dc systems, working on exposed energized electrical conductors and circuit parts of utilization equipment directly supplied by a dc source. Opening voltage transformer or control power transformer compartments. Operation of outdoor disconnect switch (hookstick operated) at 1 kV through 15 kV. Operation of outdoor disconnect switch (gang-operated, from grade) at 1 kV through 15 kV.	Any	Yes
Operation of a CB, switch, contactor, or starter. Voltage testing on individual battery cells or individual multi-cell units. Removal or installation of covers for equipment such as wireways, junction boxes, and cable trays that does not expose bare, energized electrical conductors and circuit parts. Opening a panelboard hinged door or cover to access dead front overcurrent devices. Removal of battery nonconductive intercell connector covers.	Normal	No
Maintenance and testing on individual battery cells or individual multi-cell units in an open rack Insertion or removal of individual cells or multi-cell units of a battery system in an open rack. Arc-resistant switchgear Type 1 or 2 (for clearing times of less than 0.5 sec with a prospective fault current not to exceed the arc-resistant rating of the equipment) and metal enclosed interrupter switchgear, fused or unfused of arc resistant type construction, 1 kV through 15 kV. Insertion or removal (racking) of CBs from cubicles; Insertion or removal (racking) of ground and test device; or Insertion or removal (racking) of voltage transformers on or off the bus.	Abnormal	Yes

Table 130.5(C) ***Continued***

Task	Equipment Condition	Likelihood of Occurrence*
Equipment condition considered to be "normal" if all of the following circumstances apply: (1) The equipment is properly installed in accordance with the manufacturer's recommendations and applicable industry codes and standards. (2) The equipment is properly maintained in accordance with the manufacturer's recommendations and applicable industry codes and standards. (3) The equipment is used in accordance with instructions included in the listing and labeling and in accordance with manufacturer's instructions. (4) Equipment doors are closed and secured. (5) Equipment covers are in place and secured. (6) There is no evidence of impending failure such as arcing, overheating, loose or bound equipment parts, visible damage, or deterioration.		

*As defined in this standard, the two components of risk are the likelihood of occurrence of injury or damage to health and the severity of injury or damage to health that results from a hazard. Risk assessment is an overall process that involves estimating both the likelihood of occurrence and severity to determine if additional protective measures are required. The estimate of the likelihood of occurrence contained in this table does not cover every possible condition or situation, nor does it address severity of injury or damage to health. Where this table identifies "No" as an estimate of likelihood of occurrence, it means that an arc flash incident is not likely to occur. Where this table identifies "Yes" as an estimate of likelihood of occurrence, it means that additional protective measures are required to be selected and implemented according to the hierarchy of risk control identified in 110.1(H).

Informational Note No. 1: An example of a standard that provides information for arc-resistant switchgear referred to in Table 130.5(C) is IEEE C37.20.7, *Guide for Testing Metal-Enclosed Switchgear Rated Up to 38 kV for Internal Arcing Faults.*

Informational Note No. 2: Improper or inadequate maintenance can result in increased fault clearing time of the overcurrent protective device, thus increasing the incident energy. Where equipment is not properly installed or maintained, PPE selection based on incident energy analysis or the PPE category method might not provide adequate protection from arc flash hazards.

Informational Note No. 3: Both larger and smaller available fault currents could result in higher incident energy. If the available fault current increases without a decrease in the fault clearing time of the overcurrent protective device, the incident energy will increase. If the available fault current decreases, resulting in a longer fault clearing time for the overcurrent protective device, incident energy could also increase.

Informational Note No. 4: The occurrence of an arcing fault inside an enclosure produces a variety of physical phenomena very different from a bolted fault. For example, the arc energy resulting from an arc developed in the air will cause a sudden pressure increase and localized overheating. Equipment and design practices are available to minimize the energy levels and the number of procedures that could expose an employee to high levels of incident energy. Proven designs such as arc-resistant switchgear, remote racking (insertion or removal), remote opening and closing of switching devices, high-resistance grounding of low-voltage and 5000-volt (nominal) systems, current limitation, and specification of covered bus or covered conductors within equipment are available to reduce the risk associated with an arc flash incident. See Informative O for safety-related design requirements.

Informational Note No. 5: For additional direction for performing maintenance on overcurrent protective devices, see Chapter 2, Safety-Related Maintenance Requirements.

Informational Note No. 6: See IEEE 1584, *Guide for Performing Arc Flash Calculations*, for more information regarding incident energy and the arc flash boundary for three-phase systems.

Table 130.7(C)(15)(a) Arc-Flash PPE Categories for Alternating Current (ac) Systems

Equipment	Arc-Flash PPE Category	Arc-Flash Boundary
Panelboards or other equipment rated 240 volts and below Parameters: Maximum of 25 kA available fault current; maximum of 0.03 sec (2 cycles) fault clearing time; minimum working distance 455 mm (18 in.)	1	485 mm (19 in.)
Panelboards or other equipment rated greater than 240 volts and up to 600 volts Parameters: Maximum of 25 kA available fault current; maximum of 0.03 sec (2 cycles) fault clearing time; minimum working distance 455 mm (18 in.)	2	900 mm (3 ft)
600-volt class motor control centers (MCCs) Parameters: Maximum of 65 kA available fault current; maximum of 0.03 sec (2 cycles) fault clearing time; minimum working distance 455 mm (18 in.)	2	1.5 m (5 ft)
600-volt class motor control centers (MCCs) Parameters: Maximum of 42 kA available fault current; maximum of 0.33 sec (20 cycles) fault clearing time; minimum working distance 455 mm (18 in.)	4	4.3 m (14 ft)
600-volt class switchgear (with power circuit breakers or fused switches) and 600-volt class switchboards Parameters: Maximum of 35 kA available fault current; maximum of up to 0.5 sec (30 cycles) fault clearing time; minimum working distance 455 mm (18 in.)	4	6 m (20 ft)
Other 600-volt class (277 volts through 600 volts, nominal) equipment Parameters: Maximum of 65 kA available fault current; maximum of 0.03 sec (2 cycles) fault clearing time; minimum working distance 455 mm (18 in.)	2	1.5 m (5 ft)
NEMA E2 (fused contactor) motor starters, 2.3 kV through 7.2 kV Parameters: Maximum of 35 kA available fault current; maximum of up to 0.24 sec (15 cycles) fault clearing time; minimum working distance 910 mm (36 in.)	4	12 m (40 ft)
Metal-clad switchgear, 1 kV through 15 kV Parameters: Maximum of 35 kA available fault current; maximum of up to 0.24 sec (15 cycles) fault clearing time; minimum working distance 910 mm (36 in.)	4	12 m (40 ft)
Arc-resistant switchgear 1 kV through 15 kV [for clearing times of less than 0.5 sec (30 cycles) with an available fault current not to exceed the arc-resistant rating of the equipment], and metal-enclosed interrupter switchgear, fused or unfused of arc-resistant-type construction, 1 kV through 15 kV Parameters: Maximum of 35 kA available fault current; maximum of up to 0.24 sec (15 cycles) fault clearing time; minimum working distance 910 mm (36 in.)	N/A (doors closed) 4 (doors open)	N/A (doors closed) 12 m (40 ft)
Other equipment 1 kV through 15 kV Parameters: Maximum of 35 kA available fault current; maximum of up to 0.24 sec (15 cycles) fault clearing time; minimum working distance 910 mm (36 in.)	4	12 m (40 ft)

Note: For equipment rated 600 volts and below and protected by upstream current-limiting fuses or current-limiting circuit breakers sized at 200 amperes or less, the arc flash PPE category can be reduced by one number but not below arc flash PPE category 1.

Informational Note to Table 130.7(C)(15)(a): The following are typical fault clearing times of overcurrent protective devices:

(1) 0.5 cycle fault clearing time is typical for current limiting fuses when the fault current is within the current limiting range.

(2) 1.5 cycle fault clearing time is typical for molded case circuit breakers rated less than 1000 volts with an instantaneous integral trip.

(3) 3.0 cycle fault clearing time is typical for insulated case circuit breakers rated less than 1000 volts with an instantaneous integral trip or relay operated trip.

(4) 5.0 cycle fault clearing time is typical for relay operated circuit breakers rated 1 kV to 35 kV when the relay operates in the instantaneous range (i.e., "no intentional delay").

(5) 20 cycle fault clearing time is typical for low-voltage power and insulated case circuit breakers with a short time fault clearing delay for motor inrush.

(6) 30 cycle fault clearing time is typical for low-voltage power and insulated case circuit breakers with a short time fault clearing delay without instantaneous trip.

Informational Note No. 1: See Table 1 of IEEE 1584TM, *Guide for Performing Arc Flash Hazard Calculations*, for further information regarding Notes b through d.

Informational Note No. 2: An example of a standard that provides information for arc-resistant switchgear referred to in Table 130.7(C)(15)(a) is IEEE C37.20.7, *Guide for Testing Metal-Enclosed Switchgear Rated Up to 38 kV for Internal Arcing Faults.*

Table 130.7(C)(15)(b) Arc-Flash PPE Categories for Direct Current (dc) Systems

Equipment	Arc-Flash PPE Category	Arc-Flash Boundary
Storage batteries, dc switchboards, and other dc supply sources Parameters: Greater than or equal to 100 V and less than or equal to 250 V Maximum arc duration and minimum working distance: 2 sec @ 455 mm (18 in.)		
Available fault current less than 4 kA	2	900 mm (3 ft)
Available fault current greater than or equal to 4 kA and less than 7 kA	2	1.2 m (4 ft)
Available fault current greater than or equal to 7 kA and less than 15 kA	3	1.8 m (6 ft)
Storage batteries, dc switchboards, and other dc supply sources Parameters: Greater than 250 V and less than or equal to 600 V Maximum arc duration and minimum working distance: 2 sec @ 455 mm (18 in.)		
Available fault current less than 1.5 kA	2	900 mm (3 ft)
Available fault current greater than or equal to 1.5 kA and less than 3 kA	2	1.2 m (4 ft)
Available fault current greater than or equal to 3 kA and less than 7 kA	3	1.8 m (6 ft.)
Available fault current greater than or equal to 7 kA and less than 10 kA	4	2.5 m (8 ft)

Notes

(1) Apparel that can be expected to be exposed to electrolyte must meet both of the following conditions:

(a) Be evaluated for electrolyte protection

Informational Note: ASTM F1296, *Standard Guide for Evaluating Chemical Protective Clothing*, contains information on evaluating apparel for protection from electrolyte.

(b) Be arc-rated

Informational Note: ASTM F1891, *Standard Specifications for Arc Rated and Flame Resistant Rainwear*, contains information on evaluating arc-rated apparel.

(2) A two-second arc duration is assumed if there is no overcurrent protective device (OCPD) or if the fault clearing time is not known. If the fault clearing time is known and is less than 2 seconds, an incident energy analysis could provide a more representative result.

Informational Note No. 1: When determining available fault current, the effects of cables and any other impedances in the circuit should be included. Power system modeling is the best method to determine the available short-circuit current at the point of the arc. Battery cell short-circuit current can be obtained from the battery manufacturer. See Informative Annex D.5 for the basis for table values and alternative methods to determine dc incident energy. Methods should be used with good engineering judgment.

Informational Note No. 2: The methods for estimating the dc arc-flash incident energy that were used to determine the categories for this table are based on open-air incident energy calculations. Open-air calculations were used because many battery systems and other dc process systems are in open areas or rooms. If the specific task is within an enclosure, it would be prudent to consider additional PPE protection beyond the value shown in this table. Research with ac arc flash has shown a multiplier of as much as 3× for arc-in-a-box [508 mm (20 in.) cube] versus open air. Engineering judgment is necessary when reviewing the specific conditions of the equipment and task to be performed, including the dimensions of the enclosure and the working distance involved.

CLASS	TEST AC VOLTS	USE AC VOLTS	USE DC VOLTS	LABEL COLOR	LABEL IMAGE
00	2,500	500	750	Beige	
0	5,000	1,000	1,500	Red	
1	10,000	7,500	11,250	White	
2	20,000	17,000	25,500	Yellow	
3	30,000	26,500	39,750	Green	
4	40,000	36,000	54,000	Orange	

Appendix H

Compliance Monitoring Plan (CMP) and Sampling and Analysis Plan / Quality Assurance Project Plan (SAP/QAPP)

Kennedy Jenks
32001 32nd Avenue South, Suite 100
Federal Way, Washington 98001
253-835-6400

Compliance Monitoring Plan

Circle K 1461
Seattle, Washington 98112

Revised 15 November 2024

Prepared for

DEPARTMENT OF ECOLOGY
State of Washington

3190 160th Avenue SE
Bellevue, Washington 98008-5452

KJ Project No. 2196008*00

Compliance Monitoring Plan
Signature Page

Site: Circle K 1461

Facility Site Identification Number (FSID):

Cleanup Site Identification Number (CSID): #5089

Address: 2350 24th Avenue East, Seattle, Washington

Document Name: Circle K 1461 – Compliance Monitoring Plan (CMP)

Document Date: November 2024

Signature below indicates review and approval of the Compliance Monitoring Plan and agreement that the anticipated sampling and analytical methods are sufficient to meet the quality objectives of the Circle K Environmental Remediation System Monitoring Program.

Washington State
Department of Ecology:

11/15/2024

Dale Myers Date
Ecology Site Manager
Phone: (425) 649-4426
e-mail: damy461@ecy.wa.gov

Kennedy/Jenks Consultants, Inc.
Project Manager:

11/15/2024

Ryan Hultgren Date
Title: Project Manager
Phone: (253) 835-6432
e-mail: RyanHultgren@KennedyJenks.com

Table of Contents

List of Tables

List of Figures

List of Acronyms

bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylene
CAP	cleanup action plan
CD	Consent Decree No. 82-2-08095-8, April 1992
CLARC	Cleanup Levels and Risk Calculation
CMP	Compliance Monitoring Plan
COC	contaminants of concern
CUL	cleanup level
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
EPA	U.S. Environmental Protection Agency
GRO	Gasoline Range Organics
HASP	Health and Safety Plan
IDW	investigation-derived waste
Kennedy Jenks	Kennedy/Jenks Consultants, Inc.
LEL	lower explosive limit
LNAPL	light non-aqueous phase liquid
MPE	multi-phase extraction
MTCA	Model Toxics Control Act
MW	monitoring well
O&M	operations and maintenance
PID	photoionization detector
ppbv	part per billion by volume
QAPP	Quality Assurance Project Plan
RI/FS	Remedial Investigation and Feasibility Study
RW	remediation well
SAP	Sampling and Analysis Plan
SSD	sub-slab depressurization
SW	slanted remediation well
UST	underground storage tank
VI	vapor intrusion
VOC	volatile organic compound
WAC	Washington Administrative Code

Section 1: Introduction

This Compliance Monitoring Plan (CMP) describes specific activities and requirements for compliance monitoring associated with the cleanup action planned for the Circle K 1461 Station #1461 located at 2350 24th Avenue East in Seattle, Washington in King County (Site) (see Figure 1). The Site is currently operating as a convenience store and dry cleaner.

This document is intended to be used in conjunction with other Site-specific project documents, including the following:

- Remedial Investigation and Feasibility Study (RI/FS) Report, Former Circle K Site [Kennedy/Jenks Consultants, Inc. (Kennedy Jenks) 2017]
- Engineering Design Report (EDR), Former Circle K Site 1461, Seattle, Washington (Kennedy Jenks 2021a)
- Health and Safety Plan (HASP) (Kennedy Jenks 2021b)
- Project Manual for the Circle K 1461 Environmental Remediation System Installation Seattle, Washington (Project Manual) (Kennedy Jenks 2022)
- Operations and Maintenance Manual (O&M Manual) [Kennedy Jenks 2024a]
- Sampling and Analysis Plan / Quality Assurance Project Plan (SAP/QAPP) [Kennedy Jenks 204b)]

This CMP has been prepared to fulfill requirements of the Model Toxics Control Act (MTCA) regulations published in Washington Administrative Code (WAC) WAC 173-340-410 and WAC 173-340-400(a)(xiv). This Site is listed on the Washington State Department of Ecology (Ecology) Site Information System and Hazardous Sites List as Circle K 1461, under cleanup site ID 5086 and facility/site ID 2322.

1.1 Project Description and Cleanup Action Overview

A remedial action is planned to address petroleum hydrocarbon-impacted soil and groundwater at the Site. Hydrocarbons detected in soil and groundwater have been attributed to a leaking underground storage tank (UST) that was discovered in August 1989. A Multi-Phase Extraction (MPE) system was installed and operated to reduce concentrations of Gasoline Range Organics (GRO) and benzene, toluene, ethylbenzene, and xylene (BTEX) in the soil and groundwater below the Site. Groundwater, soil, and vapor samples will be collected periodically to monitor treatment progress.

In April 1992, Ecology entered into Consent Decree No. 82-2-08095-8 (CD) with Mr. Kuk Jin Choung and Ms. Kathy-Kyung D. Choung, owners of the property, to conduct a RI/FS and develop a cleanup action plan (CAP) for the Site. After completion of the RI/FS and CAP, the CD requires performance of the cleanup action to protect human health and the environment in accordance with Model Toxics Control Act (MTCA) regulations. The RI/FS and

CAP were finalized in December 2017. Implementation of the CAP is continuing under the CD with Ecology oversight, under Ecology contract number C2100069.

The Site history and planned cleanup action are described in detail in the RI/FS, CAP, and EDR. The findings presented in the RI/FS Report (Kennedy Jenks 2017) included the most current data set for the Site. A general summary overview is provided below in Section 1.2.

1.2 Previous Remedial and Investigation Activities

In 1989, a leak was discovered in one of the four onsite gasoline USTs. It was estimated that approximately 4,000 to 6,000 gallons of gasoline were released to the subsurface. Following the discovery of the release, all six onsite USTs and the pump island were removed. In addition, approximately 900 cubic yards (cy) of petroleum hydrocarbon-containing soil (PCS) were excavated and removed from the Site. The property was redeveloped in 1990 and 1991 and currently includes a single one-story building operated as a retail dry cleaning store (Jay's Cleaners) and a convenience store (Mont's Market).

Additional remedial and investigation activities were conducted between 1989 and 2006 including installation of and sampling groundwater monitoring wells, light non-aqueous phase liquid (LNAPL) recovery, groundwater extraction and treatment, soil vapor extraction (SVE), and enhanced fluid recovery (EFR). A Draft RI/FS was completed for the Site in 2009 by Ecology (Ecology 2009). Additional RI field activities were completed by Kennedy Jenks in 2016 and 2017 to address data gaps remaining after the Draft RI/FS. The locations of monitoring and remediation wells installed through the 2016/2017 investigation plus proposed remediation wells for the MPE system are presented in Figure 2. Additional details regarding the pre-2016 RI remedial systems and subsequent investigations are summarized in the RI/FS (Kennedy Jenks 2017) and the EDR (Kennedy Jenks 2021a).

1.2.1 Contaminants of Concern

The RI/FS identified GRO and BTEX constituents related to former fueling activities at the Site as the primary contaminants of concern (COCs). GRO and BTEX constituents are present in soil and groundwater at concentrations above MTCA Method A cleanup levels (CULs). Toluene, ethylbenzene, and xylenes are also COCs and are present at concentrations above MTCA Method A CULs in Site media where GRO and/or benzene are also reported. Reported concentrations of GRO and benzene are used to describe the extent of impacted media in the following sections.

1.2.2 Impacted Soil

Based on analytical results and field observations, the vertical extent of GRO concentrations exceeding the soil MTCA Method A CUL appears to be generally limited to the zone from 8 to greater than 20 feet bgs. The horizontal extent of GRO-impacted soil (approximately 5,300 square feet) is generally located beneath the onsite parking lot and may extend beneath the onsite building and into the roadways to the north and west of the property as shown in Figure 3. The lateral and vertical extents of benzene, toluene, ethylbenzene, and xylenes concentrations that exceed the soil CUL appear to coincide with the distribution of GRO; therefore, targeting the zone in which GRO concentrations exceed soil CULs for remediation will also address cleanup of the aromatic gasoline constituents.

1.2.3 Impacted Groundwater

There are currently 19 groundwater monitoring wells and nine multi-purpose wells on Site. Monitoring wells MW-1 through MW-16 were installed in 1989. Monitoring wells MW-17, MW-18, and MW-19 and nine multi-purpose wells (MW-20, MW-21, and RW-1 through RW-7) were installed on Site as part of the RI activities in 2016 and 2017. Table 1 lists existing monitoring and remediation wells and six proposed new remediation wells, along with the installation date and screen interval. Six of the wells (MW-1, MW-2, MW-3, MW-5, MW-12, and MW-13) have been abandoned and are not shown in Table 1. Locations of existing wells are shown on Figure 2**Error! Reference source not found.**. Existing wells will be utilized as part of the monitoring program and as part of the remedial system design. The planned remedial action will include the installation of three new multi-purpose remediation wells (RW-8, RW-9, and RW-10) and three new slanted remediation wells (SW-1, SW-2, and SW-3).

Petroleum hydrocarbons in groundwater at the Site are limited to dissolved-phase impacts; LNAPL was last measured in Site monitoring wells (MW-4, MW-8, MW-9, and MW-13) in October 2006 [EA Engineering, Science, and Technology, Inc. (EA) 2006] and was not observed in monitoring wells during RI groundwater monitoring events in 2016 and 2017 (Kennedy Jenks 2017). The extent of dissolved-phase petroleum hydrocarbons (approximately 10,900 square feet) and related compounds is bounded on the north side of East McGraw Street, and generally extends beneath the onsite parking lot as shown in Figure 3. Dissolved-phase impacts may also extend beneath the onsite building and to the west beneath 24th Avenue East, though groundwater impacts are bounded along the western side of the street.

1.2.4 Vapor Intrusion Assessment

Kennedy Jenks conducted an initial (Tier 1) assessment of the potential for vapor intrusion (VI) into the main Site structure and adjacent residences following the methods described in the EPA's *Technical Guide for Addressing Petroleum Vapor Intrusion at Leaking Underground Storage Tank Sites* (EPA 2015). The results of the Tier 1 assessment are presented in the RI/FS (Kennedy Jenks 2017) and are summarized as follows:

- The occupied on-property commercial structure is within the lateral VI inclusion zone based on the maximum benzene, toluene, and xylene concentrations detected in groundwater near the building.

- Although groundwater at the Site is typically encountered approximately 10 feet bgs adjacent to the building, exceeding EPA's vertical groundwater separation distance criterion of 6 feet for bio-attenuation of petroleum hydrocarbons, the presence of underground utilities could provide a preferential pathway(s) for soil vapors to enter the onsite building. Consequently, the VI pathway into the onsite structure is considered potentially complete pending further characterization of preferential vapor pathways.

- The potential for VI into nearby residential structures appears to be very low based upon the proximity of the soil and groundwater contamination to such structures; however, in the absence of additional sampling at the residential properties to confirm subsurface conditions, the VI pathway for off-property residential areas must be regarded as potentially complete.

1.3 Purpose of the CMP

The purpose of this CMP is to satisfy the requirements of WAC 173-340-410 and WAC 173-340-400(a)(xiv) and those established under the 1992 CD.

The CMP provides a description of the compliance monitoring requirements for the cleanup action, including protection monitoring, performance monitoring, and confirmational monitoring as described in WAC 173-340-410:

- Protection Monitoring. Protection monitoring is performed during the cleanup action to confirm that human health and the environment are adequately protected during the construction and operation and maintenance period of the cleanup action as described in the health and safety plan.

- Performance Monitoring. Performance monitoring is performed during the cleanup action and includes sampling and analysis of environmental media to ensure that cleanup standards have been attained during the cleanup action, and, as appropriate, demonstrating attainment of other performance standards including construction quality control and permit compliance.

- Confirmational Monitoring. Confirmational monitoring is performed following the cleanup action to confirm the long-term effectiveness of the cleanup action once cleanup standards, and if appropriate, remediation levels or other performance standards, have been attained.

The CMP is presented in Section 3 and includes a summary of the required compliance monitoring sampling during and after the cleanup action.

Section 2: Organization and Responsibilities

As previously discussed, the cleanup action at the Site is being performed under the 1992 CD and managed by Ecology. The primary parties responsible for implementation of the cleanup action and compliance monitoring include the following:

Ecology:	Project Coordinator Dale Myers Northwest Regional Office, Bellevue, Washington
Consultant:	Kennedy/Jenks Consultants, Inc. Ryan Hultgren Federal Way, Washington
Construction Contractor:	Glacier Environmental Services, Inc. (Glacier)
Operations and Maintenance (O&M) Contractor:	Engineering/Remediation Resources Group, Inc. (ERRG)

2.1 Compliance Monitoring Responsibilities

The general areas of responsibility for the primary parties involved with implementation of the cleanup action, with respect to compliance monitoring, are summarized below:

- **Ecology.** The cleanup action is being managed by Ecology under the 1992 CD. Ecology is also the primary regulatory agency providing oversight of the project. Ecology will provide review and approval of planned sampling frequency and analytical tests, and review of analytical results (during the cleanup action) for the onsite vapor and water treatment systems, soil and groundwater samples, and imported fill materials.

- **Consultant.** The consultant will perform oversight of construction activities and sampling performed by the Construction Contractor. The consultant will also work with the O&M Contractor to ensure that the needed data are collected during remediation system operation and will provide engineering services as needed to troubleshoot system issues.

- **Construction Contractor.** The Construction Contractor is responsible for performing construction-related activities at the Site as described in the EDR and Project Manual. Monitoring and sampling related activities performed by the contractor are anticipated to include:

  - Installation of four new Vapor Pin® sample devices in the property building, three new sub-slab depressurization (SSD) horizontal wells below grade in gravel located on the north and west sides of the building, and six new remediation wells.

    - Soil screening and chemical sampling of soil from the soil borings for new remediation wells, excavated soil from piping trenches and drilling cuttings for waste disposal characterization, and imported fill materials.
    - Collection of water samples from new remediation wells development water and decontamination water from equipment cleaning for water waste disposal characterization.
    - Collection of vapor samples from SSD wells and Vapor Pin® sampling devices for field analysis. Samples may also be collected for laboratory analysis.
- **O&M Contractor.** The O&M Contractor is responsible for performing operation, maintenance and monitoring of the remediation system as described in the EDR and Operations and Maintenance Manual (O&M Manual). The O&M Contractor is anticipated to conduct the following compliance monitoring sampling activities during remediation system operation and following shutdown:
    - Collection of effluent water samples from the onsite water treatment system for laboratory analysis.
    - Collection of influent and effluent vapor samples from the onsite vapor treatment system and from individual extraction wells for field and laboratory analysis.
    - Collection of vapor samples from SSD wells and Vapor Pin® sampling devices.
    - Collection of groundwater samples from monitoring wells for performance monitoring (at startup, quarterly for two years, semiannually for remaining years of system operation) and confirmation monitoring (quarterly until results from four consecutive quarters are below Site cleanup levels).
    - Collection of confirmation soil samples to demonstrate Site cleanup levels have been achieved in soil.
    - Collection of soil and/or water samples for waste disposal characterization.

Note: This document only describes responsibilities related to sampling and analysis of soil, vapor, and water samples. Other project responsibilities for each party are discussed in greater detail in other project documents (EDR, Project Manual, O&M Manual, SAP/QAPP, etc.).

2.2 Project Schedule

A general remedial action schedule, as required in WAC 173-340-400(4)(a)(vi), is outlined below.

The design plans and construction specifications were completed in fourth quarter 2022. The construction contractor was selected in first quarter 2024. The installation of the system is expected to be completed in 13 to 15 weeks as outlined below. Operation of the system is expected to occur over a 3- to 10-year period.

Estimated Project Schedule

- Stage 1. Mobilization and Well Installation – 2 weeks
- Stage 2. Vapor Monitoring Equipment Installation – 1 week
- Stage 3. Excavation and Trenching, Soil Screening and Sampling – 3 weeks
- Stage 4. Treatment System Installation – 3 to 4 weeks
- Stage 5. Installation of Electrical Components – 1 Week
- Stage 6. Site Restoration – 1 week
- Stage 7. Demobilization and Final Completion – 2 to 3 weeks
- Stage 8. Operation and Compliance Monitoring – 3 to 12 years

As indicated above, each stage will be completed consecutively. The actual time required to complete the remedial action may vary depending on Site conditions, weather conditions, and the rate of decrease in the constituents in the groundwater and vapor on Site.

Groundwater and vapor monitoring will be conducted during system operation (Stage 8). Confirmation monitoring will be conducted once the remediation system is no longer actively operating and will include soil sampling to confirm soil meets Site CULs, and groundwater monitoring until four consecutive quarters of groundwater sampling results meet Site CULs. The specific wells, laboratory analytes, and sampling frequency may be modified for groundwater monitoring events as determined by Ecology.

Section 3: Compliance Monitoring

This section describes the compliance monitoring activities that will be performed at the Site as part of the remedial action. Compliance monitoring activities identified in this section will fulfill requirements for ongoing monitoring of this remedial action in accordance with MTCA (WAC 173-340-410).

Existing Site monitoring wells not included as part of the remedial action will remain onsite for possible future use during confirmation monitoring. The locations of these monitoring wells are shown on Figure 2.

3.1 Protection Monitoring

Health and safety measures are required for those individuals working at and visiting the Site. Remediation contractors working at the Site will prepare a Site-specific HASP (under separate cover) for their employees, which will describe health and safety measures, including any protection monitoring necessary during construction (Construction Contractor) and O&M (O&M Contractor) activities. In addition, the consultant will prepare a separate HASP for compliance monitoring tasks to be performed by its personnel during the remediation system construction and operation phases, and the subsequent confirmation monitoring phase.

The remediation contractors will have primary responsibility for implementation of the HASP during the construction and maintenance phases of the cleanup action, including protection monitoring for their personnel, including subcontractors, visitors, and the general public (the onsite businesses will remain open during the remedial action). Protection monitoring by the contractors will also include measures, as necessary, for protection of surrounding communities and the environment during construction and will be specified in their Site HASP.

During construction and operation and maintenance activities, contractors will confirm that human health and the environment are protected in accordance with their Site HASP and federal and local regulations. Within the contractors' Site HASPs, details will be included on procedures for vapor and air space monitoring for protection of Site workers.

Specific protection monitoring on the property will include vapor monitoring to assess the possibility of a vapor intrusion pathway into the property building. Protection vapor monitoring will be conducted via the sampling of three SSD wells on the north and west sides of the building and sampling of four Vapor Pin® sampling devices installed within the building. Vapor monitoring will also continue through site restoration activities (performance monitoring).

Approximate locations of the SSD wells are shown on Sheet C-01 of the Project Manual. The SSD wells will be monitored for total volatile organic compounds (VOCs) using a photoionization detector (PID) capable of measurements at low-detection ranges, with a resolution of 1 part per billion by volume (ppbv) or less; also known as a ppb PID. Monitoring will also be performed using a multi-gas meter (four-gas meter) to measure percent lower explosive limit (% LEL), oxygen, carbon dioxide, and total VOCs. SSD wells be monitored using a ppb PID and four-gas meter biannually, as well as between different states of remedial system operation: before startup (baseline sampling), before changing to Granular Activated Carbon (GAC) operations, before changing to surfactant injection, and before changing to enhanced biodegradation.

Approximate locations of the vapor pins are shown in Figure 3 (as well as Sheet C-01). Vapor pins will be monitored quarterly using a ppb PID and four-gas meter, as noted in the O&M Manual.

3.2 Performance Monitoring

Performance monitoring is required in conjunction with the remedial action, to confirm that the remedial action has attained Site CULs and met remedial action objectives (RAOs). The scope of activities includes:

- Collection of soil samples for characterization (from soil borings during installation of six remediation wells) and for construction quality control (i.e., testing of imported fill materials).
- Collection of soil and water samples for waste disposal profile development (i.e., stockpiled soil, well development water, groundwater sampling purge water, vapor treatment system condensate).
- Collection of groundwater samples from a selection of monitoring wells during remedial system operation to evaluate cleanup progress, optimize treatment corridors, and attainment of cleanup levels.
- Collection of water samples from the water treatment system (effluent) to monitor compliance with permit discharge criteria and when to progress through the three phases of the remedial system operation.
- Collection of vapor samples from the SSD wells on the north and west sides of the property building and Vapor Pin® sampling devices installed in the building to assess vapor intrusion.
- Collection of vapor samples from the vapor treatment system (influent and effluent) and individual extraction remediation wells to demonstrate compliance with substantial emissions requirements.

Performance monitoring tasks associated with the cleanup action are summarized below for soil, groundwater, and vapor matrices.

3.2.1 Soil Monitoring

Performance soil monitoring to be conducted by the Construction Contractor during construction activities will include soil screening and soil sampling including the following:

- Field screening each soil boring, and collection and laboratory analysis of up to two soil samples from each of the soil borings for proposed, new vertical remediation wells (RW-8, RW-9, and RW-10) and slanted remediation wells (SW-1, SW-2, and SW-3) (Figure 1). Soil samples will be submitted for laboratory chemical analysis of GRO by

Northwest Total Petroleum Hydrocarbons in Gasoline Range (NWTPH-Gx) and BTEX by EPA Method 8260B to 1) further delineate the nature and extent of impacts to soil and groundwater and 2) for investigation derived waste (IDW) disposal characterization purposes.

- Field screening and collection and laboratory analysis of soil samples from soil stockpiles generated during system installation for waste characterization, if required (i.e., if waste cannot be profiled using existing RI data). Required chemical analyses for soil samples will be determined based on generator knowledge and the requirements of the waste disposal facility.

- Collection and laboratory analysis of representative samples of imported fill materials for chemical analysis. [Note: This is the Construction Contractor's responsibility; however, this sampling may also be performed by the Consultant for verification purposes.] Required chemical analyses for soil samples will be determined by Ecology and the Consultant.

3.2.2 Groundwater Monitoring

Performance groundwater monitoring to be conducted by the Construction Contractor during construction activities will include collection and laboratory analysis of water samples from remediation well development water and cleaning water for waste disposal characterization.

Performance groundwater monitoring to be conducted by the O&M Contractor during remediation system operation will include:

- Collection of water samples from the influent and effluent of the liquid treatment system, in accordance with recommendations from the City of Seattle and King County. [Note: This sampling is the Contractor's responsibility; however, to ensure accuracy of the results, the Consultant will also perform periodic independent monitoring.]

- Collection of groundwater samples from monitoring wells during system operation. During initial operation and transitions between treatment methods, monitoring may be conducted more often at selected wells.

3.2.3 Vapor Monitoring

Performance Vapor Monitoring to be conducted by the O&M Contractor during remediation system operation will include:

- Performance of the vapor treatment system will be confirmed via sampling and analysis of the influent and effluent vapors, in accordance with recommendations from the Puget Sound Clean Air Agency (PSCAA). The influent and effluent vapors will be sampled monthly for the first two quarters of system operation and quarterly thereafter for field and laboratory analyses of VOCs. Additional details on vapor performance monitoring are included in the O&M Manual and SAP/QAPP.

- Vapor monitoring to assess the possibility of a vapor intrusion pathway into the property building will be conducted during remediation system operation. Vapor monitoring will be conducted via collection of vapor samples from Vapor Pin® sample devices installed in the building (Figure 3) and the SSD wells located on the north and west sides of the building (Sheet C-01 in the Project Manual). Field testing of vapor samples collected from the site will be conducted using a ppb PID for total VOCs and a 4-gas meter to measure % LEL, oxygen, carbon dioxide, and VOCs. Vapor samples may also be collected for laboratory analysis of VOCs based on field measurement results.

3.3 Confirmation Monitoring

Confirmation monitoring will be conducted to assess the long-term effectiveness of the remedial action once cleanup standards have been attained and/or once the remediation system is no longer actively operating. Confirmation monitoring at the Site will include:

- Soil sampling to confirm soil meets Site cleanup levels, and
- Four consecutive quarters of groundwater monitoring to show that groundwater concentrations meet Site cleanup levels.

Additional details on the sampling locations, sampling methods, analyses to be performed and sampling frequency for soil and groundwater confirmation monitoring activities at the Site are included in the SAP/QAPP (under separate cover). The location(s) and depth(s) for collection of confirmation soil samples will be determined in accordance with applicable Ecology guidance and will be approved by Ecology prior to collecting samples.

Confirmation groundwater monitoring events will be performed following completion of the remediation system operation. Groundwater samples will be collected from monitoring wells located on and off the properly to demonstrate attainment of Site cleanup levels. These wells are identified as “Compliance Wells” in Table 1. Groundwater monitoring will be ceased in wells after laboratory data from four consecutive quarters of monitoring indicate GRO and BTEX concentrations in groundwater samples are below the Site cleanup levels. Those wells will then be removed from the groundwater monitoring program, but not decommissioned.

The specific wells, laboratory analytes, and sampling frequency may be modified for subsequent monitoring events as determined by Ecology.

3.4 Cleanup Requirements

3.4.1 Remedial Action Objectives

The objective of the cleanup action is to reduce potential risks to human health and the environment. Because the Site is zoned as “Neighborhood-Commercial,” the proposed soil cleanup standards must be protective of unrestricted land use. Specific risk-based remedial action objectives include:

- Reduce the potential for human contact with soil and groundwater containing COCs at concentrations exceeding the selected CULs.
- Protect groundwater quality by addressing dissolved phase petroleum hydrocarbons exceeding the selected CULs.

- Reduce the potential for human exposure to vapors (primarily vapor intrusion into buildings) associated with soil and groundwater containing COCs at concentrations exceeding the selected CULs.

3.4.2 Cleanup and Screening Levels

The cleanup standards for soil and groundwater, as selected in the RI/FS and presented in the CAP, are noted below per WAC 173-340-400(4)(a)(i).

- **Soil:** MTCA Method A soil CULs for unrestricted land use based on WAC 173-340-740 and/or obtained from Ecology's Cleanup Levels and Risk Calculation (CLARC) database. For those compounds where MTCA Method A levels may not be available, soil CULs will be based on MTCA Method B values and/or leaching to groundwater values.

- **Groundwater:** MTCA Method A groundwater CULs for fuel components (GRO and BTEX constituents) based on WAC 173-340-740 and/or obtained from Ecology's CLARC database. For those compounds where MTCA Method A levels may not be available, groundwater CULs will be based on MTCA Method B values.

- **Vapor Intrusion:** Screening levels for soil gas will be based on MTCA Method B groundwater screening levels for the vapor intrusion pathway obtained from Ecology's CLARC database. If sub-slab soil gas samples are collected, they will be compared to Method B sub-slab soil gas screening levels obtained from Ecology's CLARC database.

CULs for unrestricted land uses are proposed as part of the cleanup standards for this Site. These standards are protective of human exposure via direct contact pathway and are protective of groundwater and surface water. The CULs are summarized in Table 2.

Groundwater CULs selected for the Site are based on MTCA Method A CULs for fuel components (GRO and BTEX). MTCA Method A groundwater CULs for GRO and BTEX were selected for fuel components because they are the most applicable and protective standards for gasoline-range hydrocarbon compounds (including BTEX).

3.4.3 Points of Compliance

The points of compliance, based on the potential chemical exposure routes, are those points where cleanup levels established for the Site shall be achieved.

The points of compliance for Site media were established as follows:

- **Soil:** Based on WAC 173-340-740, the point of compliance for soil is as follows:
    - Throughout the Site for protection of groundwater.
    - From the ground surface to the depth of shallow groundwater for possible VI.
    - From the ground surface to a depth of 15 feet below grade for protection of humans based on direct contact.

- **<u>Groundwater:</u>** In accordance with WAC 173-340-720(8), throughout the Site from the uppermost saturated zone to the lowest depth potentially affected by Site contaminants.

- **<u>Air:</u>** In accordance with WAC 174-340-750(6), in ambient air throughout the Site.

Section 4: Reporting

At the completion of construction, an As Built Report will be prepared in accordance with WAC 173-340-400(6)(b)(ii). The Engineer responsible for the oversight of construction will prepare as built drawings incorporating drawing markups provided by the Construction Contractor and a report documenting construction. The report will also contain an opinion from the Engineer, based on testing results and inspections, as to whether the cleanup action has been constructed in substantial compliance with the plans and specifications and related documents.

The responsibilities, content, and frequency for data reporting and remedial progress reporting to Ecology during operation and maintenance of the MPE system and compliance monitoring will be as provided in Section 8.4 of the SAP/QAPP.

Deliverables will be provided to Ecology electronically in MS Word, Excel, and/or Adobe PDF formats for all documents, as appropriate.

References

EA Engineering, Science, and Technology, Inc. 2006. Circle K Station #1461, Groundwater Summary for October 2006, Recommendations for Additional Cleanup Action Tests. 21 November 2006.

Kennedy/Jenks Consultants, Inc., 2021a. Engineering Design Report, Former Circle K Site 1461, Seattle, Washington. 10 December 2021.

Kennedy/Jenks Consultants, Inc., 2021b. Site-Specific Health and Safety Plan, Former Circle K Site, 2350 24th Ave East, Seattle, Washington 98112. 12 December 2021.

Kennedy/Jenks Consultants. 2022. Project Manual for the Circle K Site 1461 Environmental Remediation System Installation Seattle, Washington. December 2022.

Kennedy/Jenks Consultants, Inc., 2024a. Final Operations and Maintenance Manual Environmental Remediation System, Circle K 1461, Seattle, Washington. November 2024.

Kennedy/Jenks Consultants, Inc., 2024b. Sampling and Analysis Plan/Quality Assurance Project Plan, Circle K 1461, Seattle, Washington. November 2024.

Washington State Department of Ecology. 1995. Guidance on Sampling and Data Analysis Methods. Publication No. 94-49.

Washington State Department of Ecology. Revised 2016. Guidance for Remediation of Petroleum Contaminated Sites. Publication No. 10-09-057. June 2016

Washington State Department of Ecology. Revised 2022. Guidance for Evaluating Vapor Intrusion in Washington State. Publication No. 09-09-047. March 2022.

Tables

Table 1: Summary of Groundwater Monitoring and Remediation Wells

FORMER CIRCLE K SITE 1461
Seattle, Washington

Monitoring Well ID	Date Installed	Well Status	Well Use	Well Diameter (inches)	Screened Interval (feet bgs)	Easting (US Survey Feet)	Northing (US Survey Feet)
MW-2	09/11/1989	Existing	Monitoring Well	2	5.5-20.9	1278287.96	236985.88
MW-6	10/02/1989	Existing	Monitoring Well	2	5-20.4	1278462.46	236998.42
MW-7	10/02/1989	Existing	Monitoring Well	2	5-20.2	1278497.04	236983.26
MW-8	10/03/1989	Existing	Compliance Well	2	5-20.3	1278438.10	237006.82
MW-9	10/03/1989	Existing	Compliance Well	2	5-21.2	1278408.96	237007.40
MW-10	10/03/1989	Existing	Compliance Well	2	5-20.4	1278488.93	236997.48
MW-11	10/04/1989	Existing	Monitoring Well	2	5-20.0	1278384.53	237065.31
MW-13	12/20/1989	Existing	Compliance Well	2	4-19.0	1278402.55	236971.66
MW-14	12/20/1989	Existing	Compliance Well	2	4-19.3	1278458.03	237022.92
MW-15	12/21/1989	Existing	Compliance Well	2	4-18.7	1278421.35	237026.01
MW-16	12/21/1989	Existing	Compliance Well	2	4-19.2	1278390.29	237013.58
MW-17	08/01/2016	Existing	Compliance Well	2	4-19	1278436.82	236871.78
MW-18	08/01/2016	Existing	Compliance Well	2	5-15	1278391.36	236873.73
MW-19	09/23/2016	Existing	Compliance Well	2	5-20	1278433.66	236911.07
MW-20	09/23/2016	Existing	Compliance Well	4	5-20	1278392.00	236918.95
MW-21	09/23/2016	Existing	Compliance Well	4	5-20	1278392.68	236948.84
RW-1	02/07/2017	Existing	Compliance Well	4	5.5-20.5	1278390.95	236890.20
MW-4	09/12/1989	Existing	Remediation Well	2	4-18.8	1278447.91	236985.00
RW-2	02/09/2017	Existing	Remediation Well	4	5-20	1278404.38	236970.10
RW-3	02/09/2017	Existing	Remediation Well	4	5-20	1278409.31	236960.04
RW-4	02/08/2017	Existing	Remediation Well	4	5-20	1278418.32	236947.52
RW-5	02/08/2017	Existing	Remediation Well	4	5-20	1278407.00	236932.47
RW-6	02/10/2017	Existing	Remediation Well	4	5-20	1278425.63	236982.51
RW-7	02/07/2017	Existing	Remediation Well	4	5.0-20.0	1278432.90	236913.61
RW-8	02/07/2024	Existing	Remediation Well	4	5-20	1278394.71	236950.38
RW-9	02/08/2024	Existing	Remediation Well	4	5-20	1278403.54	236904.78
RW-10	02/08/2024	Existing	Remediation Well	4	25-30	1278422.51	236924.38
SW-1	02/10/2024	Existing	Slant Remediation Well	4	5-18	1278385.44	236943.23
SW-2	02/12/2024	Existing	Slant Remediation Well	4	5-18	1278397.11	236929.86
SW-3	02/09/2024	Existing	Slant Remediation Well	4	5-18	1278392.00	236913.40

Notes:

Monitoring Well	Existing monitoring well for groundwater level measurements only
Compliance Well	Existing monitoring well for groundwater compliance monitoring
Remediation Well	Existing injection/extraction remediation well
Remediation Well	New remediation well; easting and northing data are approximate
Slant Remediation Well	New slanted remediation well; easting and northing data are approximate

bgs = below ground surface
TBD = to be determined
Easting and Northing data provided in horizontal datum NAD 83, Washington North State Plane Coordinates in U.S. Survey feet.
Coordinates for well locations RW-1 through RW-10, SW-1, SW-2, and SW-3 are approximate.

Kennedy Jenks

Table 2: Summary of Site Cleanup Levels and Screening Levels

FORMER CIRCLE K SITE 1461
Seattle, Washington

Media / COCs	Value and Units	Cleanup Level / Screening Level Source
Soil		
Gasoline-Range Organics (GRO)	100 mg/kg (w/o benzene)	MTCA Method A Soil Cleanup Levels (CULs) for Unrestricted Land Use - Washington State Administrative Code (WAC) 173-340-740, Table 740-1.
	30 mg/kg (with benzene)	
Benzene	0.03 mg/kg	
Toluene	7 mg/kg	
Ethylbenzene	6 mg/kg	
Xylenes	9 mg/kg	
Groundwater		
Gasoline-Range Organics (GRO)	1,000 µg/L (w/o benzene)	MTCA Method A Groundwater CULs - WAC 173-340-720, Table 720-1.
	800 µg/L (with benzene)	
Benzene	5 µg/L	
Toluene	1,000 µg/L	
Ethylbenzene	700 µg/L	
Xylenes	1,000 µg/L	
Soil Gas / Vapor		
Gasoline-Range Organics (GRO)	1,500 µg/m^3 (425 ppbv)	MTCA Method B Noncancer Sub-Slab Soil Gas Screening Level - Cleanup Levels and Risk Calculation (CLARC) Vapor Intrusion Method B Table - July 2022
Benzene	460 µg/m^3 (140 ppbv)	
Toluene	76,000 µg/m^3 (20,160 ppbv)	
Ethylbenzene	15,000 µg/m^3 (3,450 ppbv)	
Xylenes	1,500 µg/m^3 (345 ppbv)	

Notes:
COCs = contaminants of concern
mg/kg = milligrams per kilogram
µg/L = micrograms per liter
µg/m^3 = micrograms per cubic meter
ppbv = parts per billion by volume

Figures

\\kjc.local\KJC-Root\KJ-Office\FWY\Data\Projects\2016\1696010.00 WA DOE Circle K Site Assessment\GIS\Events\20210517_DataGapsTM\Figure1_VicinityMapv2.mxd

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors,

Legend

Site Location

N

0 200 400

Scale: Feet

Kennedy Jenks

Former Circle K Site
Seattle, Washington

Site Location and Vicinity Map

KJ 2196008*00

Figure 1

Note:
1. All locations are approximate.

Legend

- Existing Well
- Existing Well to be Used for Extraction/Injection
- New Extraction/Injection Well
- New Slant Well
- New Vapor Monitoring Pin
- Parcel Boundary

Notes:
1. All locations are approximate.

N

0 15 30

Scale: Feet

Kennedy Jenks

Former Circle K Site
Seattle, Washington

Well Locations Map

KJ 2196008*00

Figure 2

Legend

- Existing Well
- Existing Well to be Used for Extraction/Injection
- New Extraction/Injection Well
- New Slant Well
- New Vapor Monitoring Pin
- Parcel Boundary
- Approximate Extent of Gasoline-Range Organics and/or Benzene in Groundwater above MTCA Method A Cleanup Levels
- Approximate Extent of Gasoline-Range Organics and/or Benzene in Soil above MTCA Method A Cleanup Levels

Notes:
1. All locations are approximate.
2. GRO = gasoline range organics
3. CUL = clean up levels

N

0 15 30
Scale: Feet

Kennedy Jenks

Former Circle K Site
Seattle, Washington

Approximate Extents of GRO and Benzene Impacts to Soil and Groundwater

KJ 2196008*00

Figure 3

Kennedy Jenks
32001 32nd Avenue South, Suite 300
Federal Way, Washington 98001
253-835-6400

Final Sampling and Analysis Plan/ Quality Assurance Project Plan

Circle K 1461
Seattle, Washington 98112

Revised 22 November 2024

Prepared for

DEPARTMENT OF ECOLOGY
State of Washington

3190 160th Avenue SE
Bellevue, Washington 98008-5452

KJ Project No. 2196008*00

Final Sampling and Analysis Plan/ Quality Assurance Project Plan Signature Page

Site: Circle K 1461

Facility Site Identification Number (FSID): 2322

Cleanup Site Identification Number (CSID): #5089

Address: 2350 24th Avenue East, Seattle, Washington

Document Name: Circle K 1461– Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP)

Document Date: November 2024

Signature below indicates review and approval of the Quality Assurance Project Plan and agreement that the anticipated sampling and analytical methods are sufficient to meet the quality objectives of the Circle K Environmental Remediation System Monitoring Program.

Washington State Department of Ecology:

____

Dale Myers Date
Ecology Site Manager
Phone: (425) 649-4426
e-mail: damy461@ecy.wa.gov

Kennedy/Jenks Consultants, Inc. Project Manager:

____

Ryan Hultgren Date
Title: Project Manager
Phone: (253) 835-6432
e-mail: RyanHultgren@KennedyJenks.com

Data validation reviewer (QAPP review, data validation):

____

Rhonda Reilly Date
Title: Quality Validation Reviewer
Phone: (253) 835-6400
e-mail: RhondaReilly@kennedyjenks.com

Table of Contents

Table of Contents (cont'd)

List of Tables

List of Figures

List of Appendices

List of Acronyms

ARAR	applicable, relevant, and appropriate requirement
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, xylenes
°C	degrees Celsius
CFR	Code of Federal Regulations

Table of Contents (cont'd)

CMP	Compliance Monitoring Plan
COC	contaminant of concern
CUL	cleanup level
DCE	dichloroethene
DI	distilled/deionized
DO	dissolved oxygen
DOT	Department of Transportation
DSARS	Document Storage and Retrieval System
Ecology	Washington State Department of Ecology
EDR	Engineering Design Report
EIM	Environmental Information Management
EIW	extraction/injection well
EPA	U.S. Environmental Protection Agency
GAC	granular activated carbon
GRO	gasoline-range organics
HASP	Health and Safety Plan
ID	identification
IDW	investigation-derived waste
ISIS	Integrated Site Information System
Kennedy Jenks	Kennedy/Jenks Consultants, Inc.
LEL	lower explosive limit
LNAPL	light non-aqueous phase liquid
MDL	method detection limit
MPE	multi-phase extraction
MQO	measurement quality objective
MRL	method reporting limit
MS	matrix spike
MSD	matrix spike duplicate
MTCA	Model Toxics Control Act
NIST	National Institute of Standards and Technology
NWTPH-Gx	Northwest Total Petroleum Hydrocarbons as Gasoline Extended
O&M	Operations and Maintenance
ORP	oxidation-reduction potential
OSHA	Occupational Safety and Health Administration
PCE	tetrachloroethene
PID	photoionization detector
ppb	parts per billion
PPE	personal protective equipment

ppm	parts per million
PQL	practical quantitation limit
PSCAA	Puget Sound Clean Air Agency
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance and quality control
QC	quality control
R	recovery
RCRA 8	Resource Conservation and Recovery Act Eight
RI	Remedial Investigation
RI/FS	Remedial Investigation and Feasibility Study
RPD	relative percent difference
SAP	Sampling and Analysis Plan
SOG	Standard Operating Guideline
SSD	sub-slab depressurization
SVOC	semi-volatile organic compound
TCE	trichloroethene
TPH	total petroleum hydrocarbon
UST	underground storage tank
VC	vinyl chloride
VI	vapor intrusion
VOA	volatile organic analysis
VOC	volatile organic compound
WAC	Washington Administrative Code

Section 1: Introduction and Background

The purpose of this Sampling and Analysis Plan/Quality Assurance Project Plan (SAP/QAPP) is to document the sampling procedures and protocols for the compliance monitoring activities at the Circle K 1461 site (Site) in Seattle, Washington. This SAP/QAPP is also intended to satisfy the technical requirements of the Washington Administrative Code (WAC) 173-340-820 and other Washington State Department of Ecology (Ecology) policies and/or procedures.

The SAP/QAPP describes sample collection, handling, and analysis procedures, including quality assurance and quality control (QA/QC) requirements. The SAP/QAPP also includes a discussion of the rationale and requirements (sampling frequency and analyses) for groundwater, soil, and vapor sampling at the Site in accordance with the Compliance Monitoring Plan (CMP) prepared under separate cover [Kennedy/Jenks Consultants, Inc. (Kennedy Jenks) 2022]. The CMP provides a description of the compliance monitoring requirements for the cleanup action, including protection monitoring, performance monitoring, and confirmational monitoring as described in WAC 173-340-410.

Specific information required by WAC 173-340-820 and provided in this document includes:

- Purpose and objectives of the data collection including QA/QC.
- Organization and responsibilities for sampling and analysis activities.
- Requirements for sampling activities:
  - Project schedule
  - Rationale for location and frequency of sampling and parameters to be analyzed
  - Procedures for installation of sampling devices
  - Procedures for sample collection and handling including decontamination for equipment and personnel
  - Procedures for management of waste materials generated by sampling activities
  - Description of QA/QC samples
  - Sample labeling, packaging, and chain-of-custody protocols
  - Procedures for splitting samples.
- Procedures for sample analyses and reporting including analytical laboratory detection/reporting limits, analytical methods, QA/QC procedures, data reporting, and data validation.

This SAP/QAPP is intended to be used in conjunction with other site-specific project documents, including the following:

- Remedial Investigation and Feasibility Study (RI/FS) Report, Former Circle K Site (Kennedy Jenks 2017)
- Engineering Design Report, Former Circle K Site 1461, Seattle, Washington (EDR) (Kennedy Jenks 2021a)
- Health and Safety Plan (HASP) (Kennedy Jenks 2021b)
- Bid Set Project Manual for the Circle K 1461 Environmental Remediation System Installation Seattle, Washington (Project Manual) (Kennedy Jenks 2023)
- Operations and Maintenance (O&M) Manual Environmental Remediation System, Circle K 1461 Seattle, Washington (O&M Manual) (Kennedy Jenks 2024a)
- CMP, Circle K 1461 Seattle, Washington (Kennedy Jenks 2024b)

1.1 Project Description

The Site is located at 2350 24th Avenue East in Seattle, Washington. The property currently includes a single one-story building operated as a retail dry cleaning store (Jay's Cleaners) and a convenience store (Mont's Market).

A remedial action is planned to address petroleum hydrocarbon-affected soil and groundwater at the Site. Hydrocarbons detected in soil and groundwater have been attributed to a leaking underground storage tank (UST) that was discovered in August 1989. Following the discovery of the release, all six onsite USTs and the pump island were removed. In addition, approximately 900 cubic yards (cy) of petroleum hydrocarbon-containing soil (PCS) were excavated and removed from the site. Additional remedial and investigation activities were conducted between 1989 and 2006 including installation of and sampling monitoring wells, light non-aqueous phase liquid (LNAPL) recovery, groundwater extraction and treatment, soil vapor extraction (SVE), and enhanced fluid recovery (EFR). LNAPL has not been detected in a monitoring well since October 2006 [EA Engineering, Science, and Technology, Inc. (EA) 2006].

In April 1992, Ecology entered into Consent Decree No. 82-2-08095-8 (CD) with Mr. Kuk Jin Choung and Ms. Kathy-Kyung D. Choung, owners of the property, to conduct a RI/FS and develop a cleanup action plan (CAP) for the site. After completion of the RI/FS and CAP, the CD requires performance of the cleanup action to protect human health and the environment in accordance with Model Toxic Control Act (MTCA) regulations. The RI/FS and CAP were finalized in December 2017. Implementation of the CAP is continuing under the CD with Ecology oversight, under Ecology contract number C2100069.

The site history and planned cleanup action are described in detail in the RI/FS, EDR, O&M Manual, and CMP.

1.2 Contaminants of Concern

The RI/FS identified Total Petroleum Hydrocarbons (TPH) as Gasoline-Range Organics (GRO) and benzene, toluene, ethylbenzene, and xylene (BTEX) related to former fueling activities at the site as the primary contaminants of concern (COCs). GRO and BTEX constituents are present in soil and groundwater at concentrations above MTCA Method A cleanup levels (CULs). Toluene, ethylbenzene, and xylenes are also COCs and are present at concentrations above MTCA Method A CULs in site media where GRO and/or benzene are also reported. Reported concentrations of GRO and benzene were used in the RI/FS and EDR to describe the extent of impacted media.

1.3 Cleanup Action Overview

A Multi-Phase Extraction (MPE) system was installed and will be operated to reduce concentrations of GRO and BTEX in the soil and groundwater below the Site. Groundwater, soil, and vapor samples will be collected periodically to monitor treatment progress. The remedial action using the MPE System is presented in the EDR, prepared for Ecology in December 2021 (Kennedy Jenks 2021) and in the Project Manual (Kennedy Jenks 2023).

The MPE system is designed to incorporate three (3) new vertical wells and three (3) new slant wells along with seven (7) existing wells into a single extraction/injection system for a total of 13 remediation wells. Each extraction/injection well (EIW) within the network of remediation wells is individually connected to both the extraction and injection manifolds in the treatment system enclosure (Treatment Shed) located on site. The wells are organized into four (4) groups of either three (3) or four (4) remediation wells (see Table 1). Three sub-slab depressurization (SSD) wells and four Vapor Pin® sampling devices will be installed to assess the possibility of a vapor intrusion pathway into the property building.

It is planned that the system will operate in three phases over the life of the system:

1. **Phase 1 – Multi-phase extraction**. The EIWs will be operated to extract groundwater and soil vapor from the subsurface for treatment. Extraction will occur from all wells and all sub-slab depressurization locations. The water treatment train consists of a bag filter, two pairs of granular activated carbon (GAC) vessels plumbed in series, a mixing tank in which surfactants, bacteria, and/or nutrients can be added, and an oxygen generator. Water can be discharged to the City of Seattle (City) sanitary sewer system before the mixing tank or reinjected to the wells through the injection manifold. Vapors will be treated with the catalytic oxidizer until extraction vapor concentrations are reduced to 500 parts per million (ppm); when this concentration is reached, the catalytic oxidizer will be removed, and GAC will be employed for air treatment. Treated air will be discharged through an exhaust pipe. The use of the catalytic oxidizer is estimated to last from 1 to 3 months. GAC will be employed until groundwater concentrations stabilize and approach asymptotic levels, approximately 6 to 12 months, after which Phase 2 will commence.

2. **Phase 2 – Surfactant reinjection**. When groundwater concentrations stabilize and approach asymptotic levels, the system will begin reinjection with surfactant addition. Surfactants in the reinjected water will act to liberate hydrocarbons adsorbed to soils. Reinjection and extraction will occur until the liquid phase concentrations have dropped

to a level indicative of asymptotic performance of the surfactant reinjection. Phase 2 duration is estimated to be 6 months.

3. **Phase 3 – Enhanced bioremediation.** Once Phase 2 is complete the surfactant reinjection will be replaced with oxygen/nutrient addition to the reinjected water. Operation will be rotated between the four sets of wells monthly to quarterly based on the monitoring results. Enhanced bioremediation will be conducted until the site constituents of concern have been reduced significantly in the wells or site cleanup levels have been reached. Phase 3 duration is estimated to last for 24 to 84 months.

The system is designed to operate continuously, except for shutdowns for maintenance, replacement of media, or as-needed monitoring.

1.4 Compliance Monitoring

Compliance monitoring is required in conjunction with installation and operation of the remedial system (protection and performance monitoring) and for the duration of the compliance period to confirm that the remedial action has attained site CULs and met remedial action objectives (RAOs) (confirmation monitoring). The CMP (Kennedy Jenks 2022) details the compliance monitoring that will be carried out during installation and operation of the remedial system. Site cleanup levels are presented in Table 2. Kennedy Jenks has prepared this SAP/QAPP to support this field sampling and data collection effort. Soil, groundwater, and vapor sample collection activities will include:

- Collection of soil samples for characterizing soil during installation of six remediation wells, developing waste disposal profiles for soil generated during construction activities, profiling imported soil for backfilling excavations, and confirmation soil sample collection after remedial system operation has ended.

- Collection of groundwater samples from a selection of monitoring wells for performance monitoring during remedial system operation and for confirmation monitoring to demonstrate the long-term effectiveness of the cleanup action once cleanup standards have been attained.

- Collection of discharge water samples from the water treatment system and point of discharge to the sanitary sewer (when applicable).

- Collection of vapor samples from the vapor treatment system (influent and effluent), individual extraction remediation wells, vapor monitoring pins, and SSD wells.

This SAP/QAPP will be amended if compliance monitoring indicates additional activities are necessary.

1.5 Document organization

The remainder of this document is organized as follows:

- Section 1: Introduction and Background

- Section 2: Organization and Responsibilities
- Section 3: Quality Assurance Project Plan
- Section 4: Field Sampling Activities
- Section 5: Field Documentation
- Section 6: Quality Control
- Section 7: Calibration, Testing, Inspection, and Maintenance of Equipment, Instrumentation and Supplies
- Section 8: Data Management Review and Reporting

Section 2: Organization and Responsibilities

As previously discussed, the cleanup action at the site is being performed under a Consent Decree and managed by Ecology. The primary parties responsible for implementation of the cleanup action and compliance monitoring include the following:

Ecology:	Project Coordinator Dale Myers Northwest Regional Office, Bellevue, Washington
Consultant:	Kennedy/Jenks Consultants, Inc. Ryan Hultgren Federal Way, Washington

Remediation Contractors:

Construction Contractor:	Glacier Environmental Services, Inc. (Glacier).
Operations and Maintenance (O&M) Contractor:	Engineering/Remediation Resource Group (ERRG).

2.1 Compliance Monitoring Responsibilities

The general areas of responsibility for the primary parties involved with implementation of the cleanup action, with respect to compliance monitoring, are summarized below:

- **Ecology.** The cleanup action is being managed by Ecology under a Consent Decree. Ecology is also the primary regulatory agency providing oversight of the project. Ecology will review and approve this SAP/QAPP; ensure that the proposed work will meet the requirements of this SAP/QAPP; coordinate property access; oversee work performed by the remediation contractors; review reports evaluating and summarizing project activities, sampling results (including onsite vapor and water treatment systems, soil and groundwater samples, waste characterization, and imported fill materials), and further-action, if any; conduct site visits as needed; update Ecology's Integrated Site Information System (ISIS) database; and provide technical assistance to site owners as needed.

- **Consultant.** The consultant will perform oversight for construction activities in accordance with the Project Manual and sampling performed by the Construction Contractor. The consultant will also work with the O&M Contractor to ensure that the needed data are collected during remediation system operation and will provide engineering services as needed to troubleshoot system issues. Remediation system operation is described in the O&M Manual. The consultant will also assist Ecology to review analytical laboratory results, QC data collected, and review data summary reports prepared by the remediation contractors for submittal to Ecology. Where applicable, the consultant will report deficiencies in sample collection, preservation, handling, test methods, or documentation; initiate and support technical audits and corrective action that may arise from deficiencies in sample collection, preservation, handling, test methods, or documentation.

- **Remediation Contractors.** There will be two primary remediation contractors, the Construction Contractor will be responsible for installation of the remediation system and the O&M Contractor will be responsible for operation, monitoring, and maintenance of the system. The remediation contractors will complete activities defined in this SAP/QAPP, following standard sampling protocols and record and document all field data as defined in this SAP/QAPP. Contractors will verify the proper functioning of all equipment before beginning field activities and ensure the proper number, type, and quantity of sample containers, including preservation requirements, are available for field activities. Other responsibilities include communicating data quality objectives to the analytical laboratories analyzing compliance monitoring samples and assembling project teams to implement field work and coordinate sample analyses.

  - **Construction Contractor.** The Construction Contractor is responsible for performing construction-related activities at the site as described in the EDR and Project Manual. Sampling performed by the contractor is anticipated to include soil screening and chemical sampling of soil from soil borings, excavated soil for waste disposal characterization, and imported fill materials, and chemical sampling of water from well development, equipment cleaning, and from excavations for water waste disposal characterization.

  - **O&M Contractor.** The O&M Contractor is responsible for performing operation, maintenance and monitoring of the remediation system as described in the EDR and O&M Manual. Sampling performed by the O&M Contractor is anticipated to include periodic (e.g., daily, weekly, monthly, quarterly) sampling of the influent and effluent of the onsite water treatment system and the effluent of the onsite vapor treatment system. The O&M Contractor will also perform vapor monitoring of individual monitoring wells and vapor monitoring pins. The O&M contractor will also conduct performance groundwater monitoring at startup and then quarterly for the first two years and twice a year thereafter during system operation.

- **Analytical Laboratory.** The analytical laboratory(ies) analyzing and reporting results for compliance monitoring samples will understand and follow sampling objectives outlined in this SAP/QAPP and perform requested analyses using appropriate test methods specified in this QAPP. The laboratories will prepare analytical laboratory reports for review by the respective Construction or O&M Contractor, as well as by the Consultant, and Ecology, including all relevant data and QC reports; communicate analytical problems, issues, or concerns to the environmental consultant in a timely manner; and initiate corrective action when deficiencies in sample collection, preservation, handling, test methods, or documentation are identified internally by the contract analytical laboratory, or by the remediation contractors and/or Consultant and Ecology.

The Consultant, Construction Contractor, and O&M Contractor will each prepare a site-specific HASP, which will describe health and safety measures to be followed by their workers while conducting site visits and compliance monitoring field activities. All subcontractors providing support during sampling will be required to maintain their own HASP documenting their health and safety procedures.

Personnel, including subcontractors, must obtain the proper training to recognize and protect themselves from hazardous chemicals known or suspected to be present at the site. All field personnel are required to have appropriate Occupational Safety and Health Administration (OSHA) health and safety training for hazardous waste sites per 29 Code of Federal Regulations (CFR) 1910.120, supplemented by annual refresher courses. Environmental consultants are responsible for ensuring that their personnel are informed about and trained on relevant OSHA and Washington Industrial Safety and Health Act (WISHA) guidelines.

Note: This SAP/QAPP only describes responsibilities related to sampling and analysis of soil, vapor, and water samples. Other project responsibilities for each party are discussed in greater detail in other project documents (CMP, EDR, Project Manual, and O&M Manual).

2.2 Project Schedule

A general remedial action schedule, as required in WAC 173-340-400(4)(a)(vi), is outlined below.

The design plans and construction specifications were completed in the first quarter of 2023. A Construction Contractor was selected in the first quarter of 2023. The installation of the system began in first quarter 2024 with the installation of the three (3) new vertical wells and three (3) new slant remediation wells. The remainder of the system installation stages, as outlined below, occurred during the second, third and fourth quarters of 2024. Operation of the system is expected to occur over a 3- to 10-year period. For the purposes of this document, system operation was estimated to have a duration of 5.5 years and confirmation monitoring was estimated to have a duration of 2.5 years, for a total of 8 years of system operation.

Estimated Project Schedule

- Stage 1. Mobilization and Well Installation – 2 weeks
- Stage 2. Vapor Monitoring Equipment Installation – 1 week
- Stage 3. Excavation and Trenching, Soil Screening and Sampling – 3 weeks
- Stage 4. Treatment System Installation – 3 to 4 weeks
- Stage 5. Installation of Electrical Components – 1 Week
- Stage 6. Site Restoration – 1 week
- Stage 7. Demobilization and Final Completion – 2 to 3 weeks
- Stage 8. Operation and Compliance Monitoring – 3 to 10 years

As indicated above, each stage will be completed consecutively. The actual time required to complete the remedial action may vary depending on site conditions, weather conditions, and the rate of decrease in the constituents in the groundwater and vapor on site.

Groundwater and vapor monitoring will be conducted during system operation. Confirmation monitoring will be conducted once the remediation system is no longer actively operating and will include soil sampling to confirm soil meets site CULs, and quarterly groundwater monitoring in compliance monitoring wells until four consecutive quarters of groundwater sampling results meet site CULs.

Section 3: Quality Assurance Project Plan

The primary goal of sampling and analysis for the Circle K 1461 monitoring is to collect groundwater, water, soil, and vapor monitoring data during cleanup activities and for the duration of the compliance period, to confirm CUL attainment and achievement of remedial action outcomes.

The purpose of the QAPP is to identify the QA/QC protocols necessary to achieve the site-specific objectives for sample collection and analysis. Data acquired must be collected in accordance with QA/QC requirements (i.e., the QAPP). Records will be maintained to document all activities performed and data generated during implementation of the site investigation.

3.1 Sampling Objectives

The objective of field sampling activities is to monitor groundwater, water, soil, and vapor during and following remedial action. The groundwater, water, soil, and vapor samples will be submitted to a Washington State-accredited laboratory for analysis of the primary COCs, GRO and BTEX, along with additional analyses for waste disposal profiling, demonstration of compliance with vapor and water treatment discharge permits and authorizations, and evaluation for transitioning through the three phases of remedial system operation. The data acquired during the sampling event(s) and remedial system operation each year will be used to prepare Remedial System Progress Reports as described in Section 8.4.

3.2 Sampling Process Design

The monitoring and sampling processes associated with protection, performance, and confirmation monitoring and proposed schedule are summarized in Section 4 and in Table 3. Table 3 also includes activities associated with the operation and maintenance of the remediation system that are described in more detail in the O&M Manual, and not extensively covered in this SAP/QAPP.

The total number of groundwater, water, soil, and vapor samples expected to be collected over an assumed eight-year (8-year) operation of the system are included in Tables 4, 5, 6, and 7. These tables assume the following phase durations:

- Phase 1: One (1) year
- Phase 2: Six (6) months
- Phase 3: Four (4) years
- Confirmation Monitoring: Two (2) years and six (6) months

3.3 Measurement Quality Objectives

Measurement quality objectives (MQOs) are qualitative or quantitative statements of the precision, accuracy (or bias), representativeness, completeness, comparability, and sensitivity necessary for the data to fulfill project objectives. Routine procedures for measuring precision and accuracy include use of quality control samples [i.e., replicate analyses, check or laboratory control samples, matrix spikes (MS), and procedural blanks]. MQOs and QC procedures identified for the groundwater monitoring program are described in the following. In addition to the MQOs discussed in this SAP/QAPP, the laboratory shall follow other QC measures for instrument calibration and laboratory performance specified in the applicable methods and according to the laboratory's Standard Operating Guidelines (SOGs).

3.3.1 Precision

Precision is an appraisal of the reproducibility of a set of measurements. Precision can be better defined as the variability of a group of measurements compared to their average value. Variability for environmental monitoring programs contains both an analytical component and a field component.

Analytical precision will be evaluated by the analyses of matrix spike duplicate (MSD) and laboratory duplicate samples, which can be mathematically expressed as the relative percent difference (RPD) between duplicate sample analyses. RPD is calculated using the following equation:

$$RPD = \frac{C_1 - C_2}{\overline{C}}\ x\,100$$

where:

C_1 = First concentration value or recovery value measured for a variable

C_2 = Second concentration value or recovery value measured for a variable

The frequency of the performance of MSD and laboratory duplicate samples, where applicable, is usually one per batch (which typically consists of up to 20 samples) for each sample matrix received.

Field duplicate samples will be submitted blind to the laboratory to determine field variability. Frequency of field duplicate samples is discussed in Section 7.1.1.

Precision quantities will be calculated for analyses with method reporting limits of the same order of magnitude and with detected concentrations greater than or equal to five times the method reporting limits. In instances where no criteria have been established (e.g., field duplicates), RPD project goals will be 50 percent for well-homogenized soil samples and 30 percent for water samples.

3.3.2 Bias and Accuracy

Bias is the systematic or persistent distortion of a measurement process that causes error in one direction. Accuracy refers to how close a measurement is to the true value. Bias and accuracy will be evaluated by the analysis of MS samples and laboratory control samples and can be mathematically expressed as the percent recovery of an analyte that has been used to fortify a field sample or clean laboratory matrix sample at a known concentration prior to analysis. The percent recovery (R) for a MS sample is calculated as follows:

$$R = \frac{(\mathrm{SSR - SR})}{\mathrm{SA}} * 100$$

Where:

SSR = Spiked sample result

SR = Sample result

SA = Spike added.

The following calculation is used to determine R for a laboratory control sample or reference material:

$$R = \frac{RM}{RC} * 100$$

Where:

RM = Reference material result

RC = Known reference concentration

Results of MS and laboratory control samples will be evaluated to the laboratory's control limits. Control limits are defined as the mean recovery, plus or minus three standard deviations, of the 20 data points, with the warning limits set as the mean, plus or minus two standard deviations. The laboratory will review the QC samples and surrogate standard recoveries for each analysis to ensure that internal QC data lie within the limits of acceptability. The laboratory will investigate any suspect trends and take appropriate corrective actions

Field blank samples and method blank samples will also be used to evaluate bias of the data. Results for field and method blanks can reflect systematic bias that results from contamination of samples during collection or analysis. Analytes detected in field or method blank samples will be evaluated as potential indicators of bias.

3.3.3 Representativeness

Representativeness concerns the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Where appropriate, sampling locations will be selected on both systematic and biased (judgmental) sampling bases to spatially cover the study area. Sampling locations are described in Section 3.

3.3.4 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system. Completeness will be measured for each set of data received by dividing the number of valid measurements actually obtained by the number of valid measurements that were planned. Although 100 percent is the goal for completeness, 90 percent is the minimum acceptable level.

3.3.5 Comparability

Comparability is a qualitative QA criterion that expresses the confidence in the ability to compare one data set with another. Comparability among data sets is achieved through the use of similar sampling procedures and analytical methods. Sampling procedures will be performed as specified in Section 5. Analytical procedures will be conducted according to the methods discussed in this SAP/QAPP.

3.3.6 Sensitivity

Sensitivity is the capability of a method or instrument to discriminate between measurement responses representing different levels of the variable of interest. The method detection limit (MDL) is defined as the statistically calculated minimum amount that can be measured with 99 percent confidence that the reported value is greater than zero. MDLs are specified in the individual methods and are developed by the laboratory for each analyte of interest representing the aqueous and solid matrices within the capability of an analytical method.

The method reporting limit (MRL) or practical quantitation limit (PQL) is the lowest value to which the laboratory will report an unqualified quantitative result for an analyte. The PQL is always greater than the statistically determined MDL. The PQLs required for this project are such that data can be compared to the lowest possible applicable, relevant, and appropriate requirements (ARARs) suitable for the site. Target PQLs for sample laboratory analyses across all media in this SAP/QAPP are presented in Tables 8, 9, and 10.

Section 4: Field Sampling Activities

This section describes the objectives, locations, and methods for compliance monitoring field activities, including laboratory analyses, types of samples collected, sampling frequencies, sampling procedures, sample identification, decontamination, and waste disposal, that will be performed at the site as part of the remedial action. Sampling procedures presented in this section are generic and intended to be suitable for a variety of site conditions. The Remediation Contractors (i.e., Construction Contractor and O&M Contractor) will prepare SOGs that their staff will follow to complete applicable sampling and monitoring tasks. It is anticipated that the remediation contractors will prepare SOGs to address one or more the following tasks, depending on contractor roles:

- Environmental Data Collection
- Borehole Logging
- Surface and Shallow Soil Sampling
- Boring and Subsurface Soil Sampling
- Test Pit / Excavation Sampling
- Soil Gas and Vapor Sampling
- Photoionization Detector (PID) Vapor Analyzer Procedures
- Well Construction and Development
- Measuring Groundwater Levels
- Groundwater Sampling
- Sample Packaging and Shipping
- Equipment Decontamination
- Personnel Decontamination
- Handling and Disposal of Investigation-Derived Waste

The remediation contractors will provide their SOGs to Ecology for review and approval prior to implementation. Ecology-approved SOGs will be included in Appendix A of this SAP/QAPP. It is anticipated that the specific procedures followed to implement this SAP/QAPP will be modified in the field as needed to address site-specific conditions.

Compliance monitoring activities identified in the CMP and in this section will fulfill requirements for ongoing monitoring of this remedial action in accordance with MTCA (WAC 173-340-410) and WAC 173-340-400(a)(xiv). The CMP provides a description of the compliance monitoring requirements for the cleanup action, including protection monitoring, performance monitoring, and confirmational monitoring as described in WAC 173-340-410. Expected soil, groundwater, and vapor sample collection activities under each monitoring phase are provided below. Sampling frequency and locations are also detailed in Table 3.

Protection Monitoring. Protection monitoring is performed during the cleanup action to confirm that human health and the environment are adequately protected during the construction and maintenance period of the cleanup action as described in the HASP.

- The remediation contractors will have primary responsibility for implementation of their HASPs during the construction and maintenance phases of the cleanup action, including protection monitoring for their personnel (e.g., vapor and air space monitoring), including subcontractors, visitors, and the general public (the onsite businesses will remain open during the remedial action). Protection monitoring by the remediation contractors will also include measures, as necessary, for protection of surrounding communities and the environment during construction and will be specified in their site HASP.

- Specific protection monitoring on the property will include vapor monitoring to assess the possibility of a vapor intrusion pathway into the property building. Protection vapor monitoring will be conducted via the sampling of three SSD wells on the north and west sides of the building and sampling of four vapor pins installed within the building. Vapor monitoring will also continue through site restoration activities (performance monitoring). Field vapor measurements and vapor samples for laboratory analysis collected at the SSD wells and vapor pins are identified in Table 5.

- In addition, the consultant will prepare a separate HASP for compliance monitoring tasks to be performed by its personnel during the remediation system construction and operation phases, and the subsequent confirmational monitoring phase.

Performance Monitoring. Performance monitoring is performed during the cleanup action and includes sampling and analysis of environmental media to ensure that cleanup standards have been attained during the cleanup action, and, as appropriate, demonstrating attainment of other performance standards including construction quality control and permit compliance. Performance monitoring will include the following:

- Collection of soil samples for characterization (from soil borings during installation of six remediation wells) and for construction quality control (i.e., testing of imported fill materials).

- Collection of vapor samples from the SSD wells on the north and west sides of the property building and vapor pins installed in the building to assess vapor intrusion. See Table 5.

- Collection of vapor samples from the vapor treatment system (influent and effluent) and individual extraction remediation wells to determine when to change vapor treatment methods and to demonstrate compliance with substantial emissions requirements. See Table 5.

- Collection of water samples from the water treatment system to monitor compliance with permit discharge criteria and when to progress through the three phases of the remedial system operation. See Table 6.

- Collection of groundwater samples from a selection of monitoring wells during remedial system operation to evaluate cleanup progress. See Table 7.

- Collection of samples for waste disposal profile development (i.e., stockpiled soil, well development water, groundwater sampling purge water, vapor treatment system condensate).

Confirmational Monitoring. Confirmational monitoring is performed following the cleanup action to confirm the long-term effectiveness of the cleanup action. Confirmation monitoring will include the following.

- Collection of soil samples from soil borings advanced within the treatment area to demonstrate compliance with site-specific soil CULs. See Table 4.

- Collection of groundwater samples quarterly from monitoring wells to demonstrate attainment of site-specific groundwater CULs for four consecutive quarters. See Table 7.

- Collection of soil and water samples (if needed) for waste disposal profiles.

4.1 Sample Analyses

This section provides a description of the anticipated field and laboratory analytical testing that will be performed during the remedial action and subsequent monitoring, and the analytical testing facilities that will be used.

4.1.1 Field and Laboratory Analytical Methods

Most of the soil and water samples collected during the construction and operation phases of the remedial system will be performed by an offsite fixed laboratory. Volatile organic compound (VOC) concentrations in vapor samples will be analyzed by a combination of field meters and offsite fixed laboratories.

All laboratories will be accredited by Ecology for the analyses being performed. Qualifications for the selected laboratories will be submitted to Ecology for review and approval prior to the start of onsite work.

The following analytical methods will be used for groundwater, water, soil, and vapor samples. Information regarding the specific analyses and sampling frequency for different media is presented in the following sections. Sample container, preservative, and holding time requirements for the analyses listed below are provided in Table 11. Additional information regarding the analytical method reporting limit requirements and laboratory QA/QC is provided in Sections 3 and 6. Field measurements will be made using portable instruments appropriate for the parameters being measured and will be calibrated daily (refer to Section 7).

Vapor samples from the vapor treatment system (influent and effluent) and individual extraction wells and sub-slab soil gas samples from the vapor pins and SSD wells will be analyzed for one or more of the following:

- Field analysis of TPH, total VOCs, oxygen, carbon dioxide, and combustible gas concentrations in influent and effluent vapor samples from the vapor treatment system and in soil gas samples from the SSD wells and vapor pins.
  - TPH will be measured as hexane or its equivalent in the field with a photoionization detector (PID) using a 10.6 electron volt (eV) lamp and 100 ppm isobutylene gas for calibration. PIDs with different detection ranges and resolutions will be used depending on the measured vapor or soil gas source:
    - MiniRAE 2000, MiniRAE 3000, or UltraRAE 3000 (or equal), with a detection range of 0 to 9999 ppm and resolution 0.1 ppm; hereafter referred to as a “PID.” For measurement of vapor treatment system influent and effluent and extracted air from wells.
    - ppbRAE 3000 (or equal), with a detection range of 0 to 9999 parts per billion (ppb) and resolution of 1 ppb; hereafter referred to as a “ppb PID.” For measurement of soil gas from vapor pins and SSD wells.
  - Vapor and soil gas measurements will also be performed using a multi-gas meter (also known as a four-gas meter) to measure total VOCs, oxygen, carbon dioxide, and combustible gas [reported as percent lower explosive limit (% LEL)] concentrations. Meter option and specifications:
    - RKI Eagle 2; detection ranges – total VOCs (0 to 2000 ppm), oxygen (0 to 40% oxygen), carbon dioxide (range varies but 0 to 40% is recommended), % LEL (0 to 100%).
- Laboratory analytical measurement of TPH/BTEX using United States Environmental Protection Agency (EPA) method TO-15 in effluent vapor samples from the vapor treatment system and from individual wells operating in extraction mode.
- Soil gas samples from vapor pins and/or SSD wells may also be collected for laboratory analysis of TPH/BTEX using EPA Method TO-15 if field measurements are above screening criteria specified in Section 4.2.7.3 (vapor pins) and Section 4.2.7.4 (SSD wells).

Field screening methods for soil samples will include headspace analysis using a PID, which is described further in Section 4.2.1.

Soil samples will be submitted for laboratory analysis for the primary COCs (Table 4):

- GRO by Ecology Method Northwest Total Petroleum Hydrocarbons as Gasoline Extended (NWTPH-Gx).
- BTEX by EPA Method 8260B.

Water treatment system samples will be submitted for laboratory analysis of the following constituents (Table 6):

- GRO by Ecology Method Northwest Total Petroleum Hydrocarbons as Gasoline by (NWTPH-Gx).
- BTEX using EPA Method 8260B.
- Selected Chlorinated Volatile Organic Compounds (Selected CVOCs) by EPA Method 8260B.
  - Tetrachloroethylene (PCE),
  - Trichloroethylene (TCE),
  - cis-1,2-dichloroethylene (cis-1,2-DCE),
  - trans-1,2-dichloroethylene (trans-1,2-DCE), and
  - Vinyl chloride (VC).
- FOG (Nonpolar Fat, Oil, and Grease) by EPA Method 1664, Revision A or B.

Water samples collected at the point of discharge to the sanitary sewer will be analyzed for the following constituents during Phase 3 of system operation in addition to the constituents identified for the water treatment system samples above:

- Nitrate by EPA Method 353.2
- Orthophosphate by EPA Method 365.1

Field parameter monitoring for groundwater will be conducted during the monitoring well purging process prior to sample collection at each well location:

- Dissolved oxygen (DO), oxidation-reduction potential (ORP), pH, specific conductivity, and temperature measured in the field using portable meter(s) equipped with appropriate probes either down-well or with a flow-through cell.
- Turbidity using analytical method SM1230 or a portable field meter.

Groundwater samples will be submitted for laboratory analysis of GRO and BTEX and additional constituents depending on the system operation phase (Phases 1, 2, and 3) and confirmation monitoring as shown in Table 7:

- GRO by Ecology Method Northwest Total Petroleum Hydrocarbons as Gasoline Extended (NWTPH-Gx).
- BTEX by EPA Method 8260B.

- Nitrate by EPA Method 353.2 (Phases 2 and 3)
- Orthophosphate by EPA Method 365.1 (Phases 2 and 3)
- Monitored natural attenuation (MNA) Parameters (Confirmation Monitoring):
    - Nitrate by EPA Method 353.2.
    - Sulfate by EPA Method 9056A.
    - Dissolved iron and dissolved manganese by EPA Method 6020.
    - Dissolved methane by EPA Method RSK-175.

Groundwater or water samples may also be analyzed for one or more of the following parameters as listed below. The analytical protocols are subject to confirmation at the conclusion of the permitting activities:

- Oil and grease by EPA Method 1664A
- Resource Conservation and Recovery Act Eight (RCRA 8) metals by EPA Method 6020 (arsenic, barium, cadmium, chromium, lead, selenium, and silver) and by EPA Method 7470 (mercury).
- Ammonia nitrogen by EPA Method 350.1
- VOCs by EPA Method 8260

Additional analyses may be required for characterization of waste materials, imported fill materials (to confirm the O&M Contractor’s results), or water samples including one or more of the following:

- VOCs using EPA Method 8260B.
- Semi-Volatile Organic Compounds (SVOCs) by EPA Method 8270E.
- Polycyclic aromatic hydrocarbons (PAHs) using EPA Method 8270E in select ion monitoring (SIM) mode.
- RCRA 8 metals using EPA Method 6010 (arsenic, barium, cadmium, chromium, lead, selenium, and silver) and by EPA Method 7471 (mercury).
- Total Petroleum Hydrocarbons (TPH) as GRO by method NWTPH-Gx.
- TPH as Diesel-Range Organics (DRO) by method NWTPH-Dx without silica gel cleanup (SGC) preparation.
- Polychlorinated biphenyls (PCBs) using EPA Method 8082B.

- Chlorinated pesticides by EPA Method 8081A.
- Toxicity Characteristic Leaching Procedure (TCLP) RCRA 8 metals extracted using EPA Method 1311 and analyzed using EPA Method 6000/7000 series (if required by the waste disposal facility).

4.1.2 Sample Location Identification

Sampling locations will be assigned unique identifiers that incorporate the media, sample type, sampling depth (if applicable), and sample location number.

Names for depth specific samples (e.g., soil from borings), will include the sample depth interval in the sample name. For example, a soil sample collected from 4 to 5 feet below ground surface (bgs) from the boring for well RW-8, would be identified as: RW-8-SO-(4.0-5.0).

- The location name is RW-8
- The media is soil (SO)
- The sample depth is from 4 to 5 feet bgs (4.0-5.0)

Names for vapor samples from vapor pins and SSD wells will include the sampling port location, well name, vapor point name; flow direction (e.g., E = extraction, I = injection); media type (V = vapor, W = water); and sampling date in “YYYYMMDD” format. For example, the sample name SSD-1-VE-(20250906) is explained below:

- The location name is SSD-1
- Media is vapor (V)
- The remediation system was operating in extraction mode (E)
- The sample date is 6 September 2025 (20250906)

Names for vapor or liquid samples from the remediation system will include the sampling port location, process identification; flow direction (e.g., E = extraction, I = injection); media type (V = vapor, W = water); and sampling date in “YYYYMMDD” format. For example, the sample name GAC-400-VE-(20250906)

- The location name is GAC-400
- Media is vapor (V)
- The remediation system was operating in extraction mode (E)
- The sample date is 6 September 2025 (20250906)

Sampling port locations and identifiers are included in the drawings in the Project Manual and in the monitoring forms in Appendix F of the O&M Manual.

Names for groundwater samples collected from individual monitoring wells at the wellheads will include the well name; media type (W = water); and sampling date in “YYYYMMDD” format. For example, MW-14-W-(20250906).

- The location name is MW-14
- Media is water (W)
- The sample date is 6 September 2025 (20250906)

4.2 Sampling Procedures

This section presents the anticipated sampling methods and frequency for sampling of environmental media (soil, vapor, and water) for compliance monitoring during the remedial action and provides an overview of sampling methodologies. Sampling procedures presented in this section are generic and intended to be suitable for a variety of site conditions. The Construction Contractor and O&M Contractor of will prepare SOGs, for Ecology’s review and approval, to conduct applicable (to each contractor) sampling and monitoring tasks.

All samples must be collected in a manner consistent with the media being sampled and the analytes of interest. Additional methods may be used with the approval of the Ecology Project Manager. Some sources for the appropriate sampling methods include, but are not limited to:

- Guidance for Remediation of Petroleum Contaminated Sites. Publication No. 10-09-057 (Petroleum Remediation Guidance) (Ecology 2016).
- Standard Operating Procedure EAP099, Version 1.0: Purging and Sampling Monitoring Wells for General Chemistry Parameters. Publication No. 18-03-214 (Standard Operating Procedure EAP099) (Ecology 2018).
- Guidance for Evaluating Vapor Intrusion (VI) in Washington State. Publication No. 09-09-047 (VI Guidance) (Ecology 2022).
- Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations (Low-Flow Standard Practice) (ASTM 2018).
- Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846), Chapter 10. (EPA 2007). Describes sampling techniques for various media, including soils, sediments, air, water, etc.

The use of proper sample containers and appropriate preservation techniques when collecting samples is important. Samples will always be collected in containers supplied by the analytical laboratory. This ensures that the container has been properly cleaned and that the analytical laboratory will have sufficient sample material to conduct the requested test. Samples must also be properly preserved, or they may be rejected.

Table 11 summarizes common sample containers, preservation techniques, and holding times for the requested analytes. Specific sampling methods for media of interest and planned sampling and monitoring activities are discussed in greater detail in the following sections. The sections are generally organized by media – soil, vapor, water, and groundwater sampling activities.

4.2.1 Soil Field Screening

Field screening soil will be performed to characterize soil borings for remediation well installations, to monitor the progress of excavation activities including segregation of suspected contaminated versus suspected clean native soil, and to characterize confirmation monitoring soil samples prior to laboratory analysis.

Field screening of soil materials for the presence of petroleum impacts will typically include the following:

- Visual observation of staining and other discoloration.
- Olfactory observation of petroleum hydrocarbon odors.
- Water-sheen testing for the presence of hydrocarbon sheen.
- Headspace analysis for organic vapors using a PID and headspace technique.

Field screening methodologies for the above techniques as well as for logging soil borings and collecting soil samples for laboratory analysis from the new remediation wells are described in the Project Manual (Division 33 – Utilities; Section 33 11 53.13 – Remediation Wells, parts 3.02 and 3.03).

4.2.2 Soil Sample Collection

Collection of soil samples for laboratory analyses will be in accordance with the Construction and O&M Contractors' SOGs (Appendix A).

Soil samples will be collected from stockpiled soil from piping trench excavations, imported backfill, soil borings advanced for the installation of six new remediation wells and from confirmation soil borings after the active remedy (operation of MPE system) has been completed, and from drummed soil for waste characterization.

Collection of soil samples from soil borings will be dependent on the selected drilling method(s) (e.g., hollow stem auger, sonic drilling, or direct push) and sampling device (e.g., split spoon sampler or continuous sampling with disposable polyethylene liners). Soil samples for lithologic logging and chemical and physical analysis will be collected by driving the appropriate sampling device to the desired depth followed by removal of the sampling device to retrieve the sample. Soil in the sampling device will be classified in the field in general accordance with the visual-manual procedure of the Unified Soil Classification System (ASTM D-2488-90). The Munsell Color Classification may also be used.

Soil samples for volatile chemical analyses (e.g., GRO and BTEX) will be collected from the sampling device (e.g., split spoon sampler or polyethylene liner) using EPA sampling method 5035: soil samples will be collected using a handheld coring device, such as a TerraCore™ or EazyDraw Syringe® & PowerStop Handle® sampler, or other approved coring device, and the "cored" soil will be placed directly into containers provided by the analytical laboratory with appropriate sample preservative and sealed.

Samples for non-volatile constituent analyses will be collected directly from the sampling device into clean sampling containers provided by the analytical laboratory and sealed. Soil samples will be collected using a clean stainless-steel spoon or trowel, disposable sample scoops compatible with chemical constituents, or by hand using a new pair of nitrile gloves. Reusable sampling equipment will be decontaminated prior to sample collection at each location. Decontamination and cleaning procedures are presented in Section 4.3 and will be included in Remediation Contractor SOGs.

Samples of stockpiled soil (and imported backfill if required to sample at the backfill source) for volatile chemical analyses will be collected using EPA sampling method 5035 directly from the stockpiles themselves or from excavation equipment (i.e., backhoe or excavator). Samples collected from a backhoe or excavator bucket will be collected from the center of the bucket or from an area of soil that has not been in contact with the surface of the bucket. Samples for non-volatile chemical analyses will be collected using a clean stainless-steel spoon or trowel, disposable sample scoop, or by hand using a new pair of gloves.

A sample label will be completed with the sample name, collection time and date, sample depth interval (as applicable), sampling method, and requested laboratory analyses, and affixed to the sample bottles. Sealed and labeled sample containers will be immediately placed and kept in a cooler chilled with ice until transfer to an accredited laboratory under chain-of-custody procedures and documentation. Samples will be maintained at a stable temperature of 4 ± 2 degrees Celsius.

These sample details along with a description of the physical soil conditions, sample container size, and containment and management of excess soil (e.g., drilling cuttings) will be recorded in the field book, drilling log (for soil borings), and on the laboratory chain-of-custody. Field Documentation is discussed further in Section 5.

Soil samples submitted to the analytical laboratory but not marked for initial analysis shall be archived by the analytical laboratory for possible follow-up analyses. Archived samples shall be frozen to extend hold times, if needed.

4.2.3 Remediation Well Installation Soil Samples

Three new vertical remediation wells and three new slant remediation wells will be installed by the Construction Contractor as described in the Project Manual (Division 33 – Section 33 11 53.13 – Remediation Wells).

At least two soil samples shall be collected at each soil boring location for laboratory analysis of GRO by method NWTPH-Gx and BTEX by EPA Method 8260B as follows:

- One sample from the unsaturated zone (above 5 feet bgs)
- One sample from the presumed smear zone (5 to 10 feet bgs)

Additional soil samples will be collected if potential petroleum hydrocarbon impacts in soil are identified based on field screening observations and the depth interval is not represented by other samples. Soil samples for GRO and BTEX analysis will be in accordance with SOGs and methods for collection soil samples for volatile analyses (EPA sampling method 5035) as described in Section 4.2.2.

Soil samples submitted to the analytical laboratory but not marked for initial analysis shall be archived by the analytical laboratory for possible follow-up analyses. Archived samples shall be frozen to extend hold times, if needed.

4.2.4 Excavated Soil Characterization

Prior to the start of trench excavation activities for installation of subsurface injection/extraction piping and other equipment, separate stockpile areas will be established by the Construction Contractor for onsite storage of suspected impacted and not impacted soil pending transport offsite for disposal. These stockpile areas will be constructed and maintained as described in the EDR and Project Manual for the duration of the project (i.e., until all excavated soil is transported offsite).

During trench excavation activities, native soil which does not appear to be impacted by COCs will be stockpiled separately from soil suspected to be contaminated by COCs. Soil samples will be collected from stockpiled soil and submitted for laboratory analysis to develop waste profiles for offsite disposal. Native soil shall not be reused for backfill.

Due to the small footprint of the site, it is possible that excavation of trenches for piping installation will be conducted in stages and will include multiple smaller excavation areas. The locations and sizes of the excavation areas will be determined by the Construction Contractor.

The soil excavation and evaluation process is described in greater detail in the following sections.

4.2.4.1 Native Soil Excavation and Stockpiling

The general process for assessment, excavation, stockpiling, and characterization sampling of waste soils generated during remedial system installation excavation activities is described below:

- Existing data provided in the RI/FS, EDR and Project Manual will be used as general guidance to estimate the volume of soil to be excavated for installation of system piping and other subsurface work, and the potential for the soil to be contaminated by COCs.
- Field screening of soil will be performed during excavation. Field screening may include visual and olfactory observation, water sheen testing, and PID headspace measurements.
- Excavated soil that does not exhibit field indications of COC impacts will be placed in a separate stockpile from soil suspected to be contaminated by COCs.

- Each stockpile will be numbered consecutively (i.e., SP1, SP2, etc., or similar) and the location will be documented in field notes and maps. The area of the site from which each stockpile was derived will also be documented.
- Soil samples will be collected from each stockpile as described below in Section 4.2.4.
- Stockpile soil samples will be analyzed for VOCs, RCRA 8 metals, GRO, and DRO and/or other analyses required by the disposal facility using the analytical methods described in Section 4.1. Whether sample analyses are conducted on an expedited turn-around basis will be at the discretion of the Contractor.
- Soil stockpiles will be underlain and covered with plastic sheeting pending receipt of analytical results.

4.2.4.2 Stockpile Sampling Frequency

The number of samples recommended by Ecology for stockpile characterization, based on the guidelines presented in Ecology's *Guidance for Remediation of Petroleum Contaminated Sites* dated June 2016, is summarized below:

Cubic Yards of Soil	Number of Samples for Chemical Analysis
0 – 100	3
101 – 500	5
501 – 1,000	7
1,001 – 2,000	10
>200	10 + 1 for each additional 500 cubic yards

The quantity of excavated material for the project is estimated to be approximately 300 cubic yards or less, based on the size of the trenching excavation areas and anticipated trench depth. Based on Ecology's recommended sampling frequency, a 300 cubic yard stockpile would require 5 samples for characterization. However, the number of stockpiles and sizes will be determined by the Construction Contractor based on the amount and locations of excavation areas and based on field conditions encountered. The number of characterization samples collected from each pipe will be based on the above table.

Stockpile soil samples will be collected as discrete grab samples with hand tools 6 to 12 inches beneath the surface of the pile and immediately preserved. Sample locations will be collected where field instrument readings (e.g., PID) or field observations of potential impacts (e.g., visual staining or odors) indicate contamination is most likely present. If field instruments and/or field observations do not indicate contamination, the stockpile will be divided into sections, with the number of sections equivalent to the number of samples for chemical analysis based on stockpile volume, and a sample from each section will be collected.

4.2.5 Waste Characterization Sampling

Sampling for waste characterization may be performed during the remedial action based on the requirements of the selected waste disposal facilities. Ideally, the profiles for disposal waste materials will be established using existing data from RI sampling prior to the start of field activities.

Existing data will be submitted to the waste disposal facilities prior to the start of onsite work; however, it is possible that the facilities will require additional data (i.e., data for additional analytes or for verification of contaminant concentrations) as soil and groundwater samples were most recently collected in 2016. It is anticipated that data for VOCs, RCRA 8 metals, GRO, and DRO would be required for waste disposal profile development. However, the number of samples by media and chemical analytes would be based on the requirements of the disposal facility and could include any of the analyses listed in Section 4.1.1.

Media possibly requiring additional waste characterization sampling are anticipated to include the following:

- Petroleum-contaminated soil (PCS). PCS would initially be stockpiled onsite and soil samples would be collected from the stockpile(s). The characterization samples would be submitted for laboratory analysis (on an expedited turn-around basis) based on the requirements of the disposal facility. If the profile for PCS disposal is established using prior site data, additional sampling of PCS during the remedial action may not be necessary.

- Drilling cuttings. Soil cuttings from remediation well installation, if not included in the profile for excavated soil, would be sampled for waste characterization as required by the offsite disposal facility.

- Water treatment effluent water. If effluent from the onsite treatment system does not meet the permit standards (refer to Section 4.2.8), offsite disposal may be required. In this case, samples would be collected from onsite holding tanks for laboratory analysis as required by the disposal facility.

- Vapor liquid separator condensate. Condensate from the vapor liquid separator of the MPE system will be pumped into 55-gallon drums and sampled for laboratory analysis as required by the offsite disposal facility for waste characterization.

- Purge water. Well development, sampling purge water, and sampling equipment decontamination water may be sampled for waste characterization if analytical data from previous monitoring is insufficient to establish a waste disposal profile. Samples would be collected from purge water stored temporarily onsite in 55-gallon drums for laboratory analysis as required by the disposal facility.

- Spent GAC generated during operation of the MPE system will be removed using a vacuum extraction device and placed in U.S. Department of Transportation (DOT)-approved 55-gallon drums or supersacks, characterized, sealed and hauled from the site under a waste manifest. The carbon will be analyzed using the Toxicity Characteristic Leaching Procedure (TCLP) and disposed at an offsite facility. The carbon will be analyzed annually to update the disposal profile.

The Construction Contractor and O&M Contractor will each provide SOGs for sampling and general handing of waste materials.

4.2.6 Imported Fill Materials Sampling

The remediation Construction Contractor will request analytical data for all backfill materials being imported to the site and will submit the data, if any is provided, to Ecology for review and approval as described in the EDR and bid specifications. The Consultant will also review analytical data for backfill materials and provide an assessment of the suitability of the material for use as backfill onsite to Ecology.

If the data provided by the supplier is determined by Ecology to be inadequate, or is not available, the Construction Contractor shall collect samples of proposed backfill materials for chemical analysis. Analyses performed for each proposed backfill material source will be based on data needs identified by Ecology and including SVOCs, VOCs, PCBs, PAHs, chlorinated pesticides, RCRA 8 metals, GRO, and DRO using the analytical methods specified in Section 3.1.1. The consultant may also independently collect and analyze a limited number of samples to verity the contractor’s results.

For each proposed backfill material, the sampling frequency will be one, five-point composited soil sample for each 500 yards of imported soil.

4.2.7 Vapor Sampling Activities

Protection and performance monitoring on the property will include vapor monitoring to assess the possibility of a vapor intrusion pathway into the property building. Vapor (soil gas) monitoring will be conducted via the sampling of the three SSD horizontal wells and four vapor pins.

Four (4) Vapor Pin ® monitoring points will be installed through the floor slab inside of the property building (approximate locations shown in Figure 2) in accordance with manufacturer details and as described in the Project Manual. The vapor pins are designed to be used for gas sampling to monitor sub-slab soil vapor.

Three 4-foot-long SSD horizontal wells constructed of 3-inch diameter polyvinyl chloride (PVC) slotted pipes will be installed below grade in gravel as described in the Project Manual. The SSD wells are located on the north and west sides of the on-site building as shown on Drawing C-01 in the Project Manual. The SSD wells are connected downstream of the piping manifold to allow for a negative vacuum to be applied beneath the on-site building to mitigate potential vapor intrusion into the on-site building during system operations.

Additional performance vapor monitoring will include sampling the individual wells in operation and the influent and effluent of the vapor treatment system. The vapor treatment train of the MPE system consists of a temporary catalytic oxidizer to be used at system startup and a pair of vapor GAC vessels piped in series to be used once vapor contaminant concentrations are low enough for their use. Treated air is discharged through an exhaust pipe.

As a remediation project, the project is required to comply with the substantial requirements of the Puget Sound Clean Air Agency (PSCAA), however obtaining a PSCAA permit is not required. The MPE system will be operated to meet the substantial requirements of PSCAA permits for operating this type of equipment. Refer to Appendix B of the O&M Manual for PSCAA soil remediation operation and monitoring requirements for vapor treatment via a catalytic oxidizer and activated carbon system.

In accordance with recommendations from PSCAA, influent and effluent vapor samples will be collected from the system for analysis of TPH and BTEX by use of a hand held instrument (e.g., a PID) capable of detecting concentrations at the levels expected, EPA Reference Method 8260B, EPA Method 8021, EPA Method TO-15, EPA Method 8015, or other equivalent method approved by PSCAA, according to the frequency identified in Tables 3 and 5.

Vapor samples will be collected during the construction phase by the Construction Contractor and during system operation by the O&M Contractor. Vapor samples will be collected and analyzed in accordance with Ecology's VI Guidance (Ecology 2022).

4.2.7.1 Vapor Samples from Individual Wells

Total VOC concentrations will be measured for individual wells in operation using field (PID and/or ppb PID) and laboratory methods at the corresponding manifold legs. Samples of vapor for laboratory analysis will be collected using Summa canisters and submitted for analysis by EPA Method TO-15.

Sample collection will be performed as indicated in the Ecology-approved O&M Contractor-supplied SOGs in Appendix A. Field VOC concentrations will be measured using either a standard PID or ppb PID as defined in Section 3.1.1, depending on concentration levels.

4.2.7.2 Vapor Treatment System Samples

Field total VOC concentrations will be measured at several sampling ports located throughout the treatment train using either a standard PID or ppb PID as defined in Section 3.1.1, depending on concentration levels.

Vapor samples for laboratory analysis will be collected at the frequency identified in Table 5 using Summa canisters and submitted for analysis by EPA Method TO-15. Samples will be collected at the combined inflow sample port after the vapor/liquid separator, and at the combined effluent sample port prior to air discharge. The sample ports are shown on the construction drawings in Appendix D of the O&M Manual.

Sampling ports for field measurements are located as follows:

- Prior to the catalytic oxidizer (when installed)
- Prior to, at the midpoint of, and after vapor GAC vessels
- Prior to air discharge

4.2.7.3 Vapor Monitoring Pins

Total VOCs, oxygen, carbon dioxide, and combustible gas (% LEL) concentrations will be measured in sub-slab soil gas grab samples collected from the four Vapor Pin® sampling devices using a ppb PID and four-gas meter. Samples will be collected by purging each location with a vacuum pump to remove three (3) purge volumes at the location before collecting an air sample in a Tedlar® bag with a vacuum box sampler. The sample will then be tested with the handheld instrument, and if field measurements of total VOCs concentrations in a vapor pin soil gas sample is above 425 ppb and/or if combustible gas is measured above 20% LEL, a soil gas sample for laboratory analysis of VOCs by TO-15 will be collected from the Vapor Pin® sampling device for confirmation. Laboratory results will be compared to sub-slab soil gas screening levels provided in Table 2, to determine if modifications to the remedial system operation and/or other corrective actions may be required.

4.2.7.4 SSD Wells

Total VOCs, oxygen, carbon dioxide, and combustible gas concentrations will be measured in soil gas grab samples from the manifold sampling ports of the three SSD wells using a ppb PID and four-gas meter. Sample collection methods will be the same as for the Vapor Pin® sample devices. If field measurements of total VOCs concentrations in a SSD well soil gas sample is above 425 ppb and/or if combustible gas is measured above 20% LEL, a soil gas sample for laboratory analysis of VOCs by TO-15 will be collected from the SSD well.

The above sampling locations are subject to change after the substantial requirements set by PSCAA.

4.2.8 Water Treatment System Sampling

Samples will be collected from the onsite water treatment system during the construction phase and operation phase of the cleanup actions. The water treatment train consists of a bag filter, two pairs of GAC vessels plumbed in series, a mixing tank in which surfactants, bacteria, and/or nutrients can be added, and an oxygen generator. Water can be discharged to the City of Seattle (City) sanitary sewer system before the mixing tank or reinjected to the wells through the injection manifold. Design requirements for the water treatment system are included in the Project Manual.

On March 31, 2023, the King County Industrial Waste (KCIW) Program issued a Wastewater Discharge Authorization (WDA) (No. 4614-01) to Jay's Cleaners – Circle K 1461 Treatment System (see Appendix A of the O&M manual). The Construction Contractor will have responsibility for compliance with the WDA during construction and the O&M Contractor will have responsibility for compliance during the operation of the remedial system.

Water samples to evaluate treatment efficiency and/or demonstrate compliance with the WDA will be collected from four (4) sampling points associated with the water treatment system: at the influent to the liquid GAC vessel trains (1 sample point), at the midpoint of each train (2 sample points), and at the combined effluent from the two trains (1 sample point). Sample results for the combined effluent sampling point will be used to report water concentrations prior to discharge to the sanitary sewer. Water samples and analytes will be collected as identified in Table 6. pH and turbidity will also be measured during each sampling event using a calibrated portable field meter.

Effluent limits based on the KCIW WDA include the following:

Analyte / Parameter	Indicator Level (i.e., Discharge Limit)
GRO	250 µg/L
Benzene	70 µg/L
Toluene	1,400 µg/L
Ethylbenzene	1,700 µg/L

Analyte / Parameter	Indicator Level (i.e., Discharge Limit)
Xylenes, Total	2,200 µg/L
PCE	240 µg/L
TCE	500 µg/L[1]
cis-1,2-DCE	1,000 µg/L[2]
trans-1,2-DCE	1,000 µg/L[2]
VC	12 µg/L
Nonpolar fats, oil, and grease (FOG)	100 mg/L
Turbidity	25 NTU
pH	5.0-12.0 (standard units)

Notes:

µg/L = micrograms per liter
mL/L = milliliter per liter
NTU = Nephelometric turbidity unit
1. Chapter 173-303 WAC: Dangerous Waste Regulation
2. Based on the Permissible Exposure Limit of total 1,2-dichloroethylene divided 50% to the *cis*-isomer and 50% to the *trans*-isometer.

Measurement of settleable solids, hydrogen sulfide, and explosivity must be collected at the point of discharge to the sanitary sewer if the operating limits specified in the KCIW WDA are exceeded (see Appendix A of the O&M manual). Additional samples may be collected from the sampling ports or holding tanks for characterization if effluent limits are exceeded. A separate binder will be maintained to document all monitoring samples and results (field measurements, laboratory analytical reports, and daily inspection reports).

Monitoring results from the liquid treatment system will be confirmed via sampling and analysis of the influent and effluent liquid streams, in accordance with the requirements of the KCIW WDA for the City sanitary sewer.

4.2.9 Groundwater Monitoring

Groundwater monitoring will be performed following completion of the construction phase of the remedial action, and at periodic intervals afterward to evaluate attainment of cleanup levels (performance monitoring) during remedial system operation and during confirmation monitoring after the remedial action. Each groundwater monitoring and sampling event will include measurement of groundwater levels (and LNAPL levels, if applicable) (collectively known as liquid levels) in site monitoring and remediation wells (as accessible) and collection of groundwater samples for laboratory analysis from selected monitoring wells. Though LNAPL has not been observed in a site monitoring well since October 2006 (EA 2006), its presence will be monitored during groundwater monitoring events. The number and selection of wells may vary during performance and confirmation monitoring based on remedial action progress.

4.2.9.1 Liquid Level Measurements

Liquid level measurements will be obtained prior to purging monitoring wells for groundwater sample collection. Liquid levels will be measured with an electronic water level indicator and/or electronic oil-water interface indicator if presence of LNAPL is suspected. All liquid levels will be recorded to the nearest 0.01 foot. Measurements will be referenced to the top of the well casing on the north side. The probe of the level indicator will be decontaminated between wells with a detergent wash, followed by two distilled water rinses. Groundwater table elevations will be calculated by subtracting the depth to the groundwater table from the casing rim elevations (surveyed casing rim elevations are referenced to the North American Vertical Datum of 1988).

4.2.9.2 Groundwater Sampling Method

Low-flow purging will be the default method for groundwater sampling. Other purge methods will not be used without Ecology approval. Groundwater samples will be collected in accordance with low-flow purging and sampling guidance documents including:

- Ecology's *Standard Operating Procedure EAP099, Version 1.0: Purging and Sampling Monitoring Wells for General Chemistry Parameters. Publication No. 18-03-214* (Ecology 2018) and

- ASTM's *Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations* (ASTM 2018).

The wells will be purged using an appropriate pump (e.g., peristaltic pump, submersible pump, dedicated pump, etc.) for groundwater level conditions. New dedicated tubing will be installed in each well prior to purging the well. The tubing inlet (or pump intake) will be placed within the screened interval of the well or a few inches off the bottom, depending on the static water level.

Field parameter monitoring for groundwater will be conducted during the purging process prior to sample collection at each well location. Field parameters will be measured using a portable meter equipped with separate probes for temperature, pH, specific conductivity, ORP, and DO. The probe will be installed down-well or in an in-line flow-through cell during the purging process. Turbidity will also be measured using a separate field meter. Meter readings will be recorded at minimum 5-minute intervals during the purging process, including a final reading taken at the completion of purging for each well location. Purging will continue until stabilization criteria (per O&M Contractor's groundwater sampling SOG) for each parameter have been met.

After purging, a grab groundwater sample is collected (using the pump) and transferred to the appropriate sample containers in accordance with the O&M Contractor's groundwater sampling SOG.

Quality control samples will be collected in accordance with Section 6. Purge methods and monitoring parameters will be documented on the purge and sample form (Example form included in Appendix F of the O&M Manual). The dedicated tubing will either be stored in each respective well for reuse or be removed after all wells are sampled and will be disposed of as Investigation-derived waste (IDW).

The O&M Contractor will provide SOGs for groundwater level measurements and low-flow groundwater sampling techniques including field parameter stabilizing criteria.

4.2.9.3 Performance Groundwater Monitoring

Performance groundwater monitoring will be conducted during system operation by the O&M Contractor to confirm that the remedial action has attained the site CULs. During initial operation and transitions between treatment methods, monitoring may be conducted more often at selected wells. The sampling frequency for performance groundwater monitoring is identified in Table 7.

Groundwater samples will be collected from up to thirteen (13) monitoring wells for groundwater performance monitoring as follows:

- Performance Monitoring (13 wells): MW-6, MW-8, MW-9, MW-13, MW-14, MW-15, MW-16, MW-17, MW-18, MW-19, MW-20, MW-21, and RW-1
- Performance Monitoring Subset (8 wells) (more frequent monitoring during system startup and during Phases 2 and 3): MW-8, MW-9, MW-13, MW-14, MW-16, MW-19, MW-20, and MW-21

These 13 wells were selected to represent elevated dissolved phase GRO and BTEX concentrations (MW-8, MW-9, MW-13, MW-17, MW-19, MW-20, and MW-21) or non-detect or reported concentrations near or below CULs (MW-6, MW-14, MW-15, MW-16, MW-18, and RW-1). The wells around the COC-impacted extents will be used to monitor potential expansion / retraction of the petroleum hydrocarbon-impacted groundwater areas.

Groundwater samples collected from the thirteen performance monitoring wells during Phase 1 of the remedial system operation will be analyzed for GRO and BTEX concentrations. During Phases 2 and 3, samples from the eight wells in the performance monitoring subset will be analyzed for GRO and BTEX plus nitrate and orthophosphate.

Off-Property wells MW-2, MW-7, MW-10, and MW-11 will be sampled for GRO and BTEX at system startup to confirm consistency with previous sampling results. For the remaining performance monitoring events, these four wells will be used for groundwater flow direction evaluations only. Previous groundwater samples from these four wells have not contained GRO or BTEX concentrations above cleanup levels.

The groundwater sampling frequency varies by well designation (e.g., performance monitoring vs. performance monitoring subset). It is anticipated that the eight wells in the subset group will be sampled as follows during Phases 1, 2, and 3 of the remedial system operation over the assumed course of five and a half (5.5) years (66 months):

- Phase 1 (1 year): At remedial system startup, then monthly for 6 months, then quarterly for two quarters; GRO and BTEX only.
- Phase 2 (0.5 year): Monthly for 3 months, then one quarterly event; GRO, BTEX, nitrate, and orthophosphate.
- Phase 3 (4 years): Monthly for 3 months, then five quarterly events, two and a half (2.5) years of semiannual sampling; GRO, BTEX, nitrate, and orthophosphate.

The other five wells would be sampled as follows:

- Phases 1, 2 and 3 combined: At remedial system startup, then monthly for 6 months, followed by quarterly events for 24 months (2 years), and then semiannual events for the remaining 36 months (3 years); 21 events over 5.5 years for GRO and BTEX.

Table 7 summarizes the frequency of performance monitoring groundwater sampling events and target laboratory analyses for the two groups of monitoring wells.

The specific wells, laboratory analytes, and sampling frequency presented above may be modified for subsequent performance monitoring events as determined by Ecology.

4.2.9.4 Confirmation Groundwater Monitoring

Confirmation monitoring will be conducted to assess the long-term effectiveness of the remedial action once cleanup standards have been attained and/or once the remediation system is no longer actively operating. Confirmation monitoring at the site will include soil sampling to confirm soil meets site cleanup levels (see Table 4) and conducting quarterly groundwater monitoring until four consecutive quarters of results demonstrate that groundwater has met site cleanup levels (Table 7).

Identification of location(s) and depth(s) for collection of confirmation soil samples will be discussed with Ecology prior to collecting samples.

Groundwater samples will be collected from monitoring wells located on and off the properly to demonstrate attainment of Site cleanup levels. These wells are identified as “Compliance Wells” in Table 1. The samples to be collected are identified in Table 7. Confirmation groundwater monitoring will include collection of samples from the following 13 monitoring wells on a quarterly basis:

- On-Property: MW-17, MW-18, MW-19, MW-20, MW-21, RW-1
- Off-Property: MW-6, MW-8, MW-9, MW-13, MW-14, MW-15, MW-16

Off-Property wells MW-2, MW-7, MW-10, and MW-11 will be used for groundwater flow direction measurements only. Previous groundwater samples from these four wells have not contained GRO or BTEX concentrations above cleanup levels.

Groundwater monitoring will be ceased in individual wells after laboratory data from four consecutive quarters of monitoring indicate GRO and BTEX concentrations in groundwater samples are less than Site cleanup levels. Those wells will then be removed from the groundwater monitoring program, but not decommissioned. A minimum of four quarterly confirmation groundwater monitoring events would be conducted to confirm attainment of groundwater site cleanup levels in each monitoring well.

The specific wells, laboratory analytes, and sampling frequency may be modified for subsequent monitoring events as determined by Ecology.

4.2.9.5 Natural Attenuation Parameters

Groundwater sampling for field and laboratory-analyzed natural attenuation parameters will be conducted during confirmation sampling in general accordance with Ecology’s *Guidance on Remediation of Petroleum-Contaminated Groundwater by Natural Attenuation,* dated July 2005 (NA Guidance) (Ecology 2005).

Primary geochemical indicators of natural attenuation including dissolved oxygen, redox potential, pH, specific conductivity, and temperature will be measured in the field during the purging process prior to sample collection at each well location.

Secondary geochemical indicators including nitrate, sulfate, dissolved iron, dissolved manganese, methane (dissolved) and alkalinity will be analyzed by the laboratory using the analytical methods described in Section 4.1.1. Samples for dissolved iron and dissolved manganese will be collected at the end of the purging process after field-filtering through a 45-micron inline filter.

Sample collection frequency for laboratory-analyzed secondary geochemical indicators will be based on attainment of site CULs during confirmation monitoring. Samples will be collected for secondary geochemical indicators during the first and third quarters of the first year of confirmation monitoring from the eight (8) performance subset wells. Depending on attainment of CULs in each well and contamination plume stability, the frequency, number and location of wells may be modified for subsequent monitoring events as determined by Ecology. Wells to be sampled for laboratory-analyzed natural attenuation parameters are identified in Table 7.

4.3 Equipment and Personnel Decontamination

To the greatest extent possible, disposable and/or dedicated personal protective and sampling equipment will be used to avoid cross-contamination. All non-disposable sampling equipment [e.g., drilling equipment, core barrels, sampling tools (i.e., stainless-steel spoons, trowels, bowls, etc.), and field meters] will be cleaned between sample locations to avoid cross-contamination in accordance with procedures described in the Construction and O&M Contractors' SOGs for equipment and personnel decontamination. To the extent possible, sampling using non-disposable sampling equipment will begin at locations suspected to be least contaminated, progressing to the most contaminated locations.

It is anticipated that all fieldwork will be conducted according to the HASP using Level "D" personal protective equipment (PPE). In accordance with the decontamination procedures described in the SOGs, disposable PPE and equipment will be placed in appropriate disposal containers.

The following cleaning procedures will be used as the minimum requirements for all non-disposable equipment used to collect routine samples undergoing organic or inorganic constituent analyses:

- Clean with tap water and non-phosphate detergent using a brush if necessary to remove particulate matter and surface films. Equipment may be steam cleaned (using high-pressure hot water) as an alternative to brushing. PVC or plastic items should not be steam cleaned.

- Rinse with tap water. Repeat cleaning and tap water rinse as needed to remove particulate matter and surface films.

  [NOTE: If tap water is suspected to be contaminated, use containerized drinking water or distilled/deionized (DI) water.]

- Final rinse with tap water.
- Additional final rinse with distilled/DI water.

  [NOTE: Each rinse may be performed with distilled/DI water if desired, but only the final rinse needs to be performed with distilled/DI water.]
- Air-dry the equipment completely.
- Store the cleaned equipment in a clean container.

Decontamination will be conducted in a central location, upwind and away from suspected contaminant sources. Equipment rinsate blanks (see Section 6) will be collected as a QA/QC measure for the decontamination procedures on a daily basis when non-disposable equipment is used.

4.4 Investigation Derived Waste (IDW) Handling

IDW generated during construction, remedial system operation, and compliance monitoring activities at the site are anticipated to include excavated soil, drilling soil cuttings, well purge and development water, equipment decontamination water, vapor treatment condensation water. Because these IDW materials may be contaminated, each IDW type will be containerized separately pending characterization for disposal. These materials will be placed in DOT-approved 55-gallon drums and temporarily stored onsite pending characterization and offsite disposal. All drums will be labeled to indicate contents, name and address of the generator, and the date and origin/location of collection. IDW drums will be placed in a configuration that allows room for inspections, operations and maintenance, and handling.

The Construction and O&M Contractors will be responsible for waste management at the Site, which includes containerizing and securing the IDW, and labeling, staging, and profiling the IDW for ultimate disposal within a timely manner and in accordance with their SOGs. Final disposal of IDW will be completed by the Construction Contractor and O&M Contractor on behalf of Ecology. Handling and disposal of IDW procedures that will be followed by the remediation contractors' personnel and subcontractors will be provided in SOGs provided each contractor.

PPE (i.e., gloves, etc.) and disposable sampling materials [i.e., tubing, sampling scoops, cleaning supplies (paper towels) etc.] will be disposed of at a state-permitted, licensed, or registered municipal or industrial solid waste landfill.

IDW will be disposed of promptly after characterization is performed. The IDW characterization process is outlined in EPA's (1991) *Management of Investigation-Derived Wastes During Site Inspections* and EPA's (1992) *Guide to Management of Investigation-Derived Wastes*. Classification of IDW will also follow the regulations as published in Dangerous Waste Regulations (WAC 173-303) and/or Water Quality Regulations on the basis of the laboratory analyses. IDW will also be evaluated as required by WAC 173-303-100 State Only Dangerous Waste. Once the IDW is characterized, the Construction Contractor or O&M Contractor (as applicable) will make a determination and adequately document the proper management and/or disposal. Pending the waste disposal subcontractor's schedule, the IDW will be removed from the Site for disposal no more than 30 days from the end of its generation.

Section 5: Field Documentation

To ensure that samples are correctly identified and tracked, careful sample documentation and custody procedures will be used during the Circle K 1461 monitoring event to maintain sample integrity during collection, transport, storage, and analysis.

Field sampling personnel will be responsible for maintaining proper documentation and custody procedures from sample collection until samples are transferred to the analytical laboratory or a commercial freight carrier. The environmental consultant will review and approve all field documentation. The analytical laboratory will be responsible for maintaining sample custody and documentation from the time the analytical laboratory receives the samples until final sample disposal. Field documentation and sample chain-of-custody requirements are discussed below.

5.1 Documentation of Field Activities

A field logbook will be maintained by the sampling team. Field logbooks will be waterproof pages in bound notebooks. All entries to field logbooks, and all other field documentation, will be made using indelible ink. Any errors will be corrected by drawing a single line through the incorrect entry, entering the correct information, and dating and initialing the change. After project completion, all field logbooks will be stored in the final project file.

Daily entries into the logbook will generally include the information listed below, but information recorded on field forms (i.e., purge forms, etc.) need not be duplicated in the field logbook.

- Date
- Personnel onsite (including visitors)
- Weather conditions
- Type(s) of field equipment used
- Field equipment calibration methods (if applicable)
- Sample location
- Date and time of sample collection
- Sample identification number
- Description of sampling location
- Sample type (e.g., duplicates)
- Photographs (including general field activities, soil borings, and sample locations)
- Issues encountered and/or corrective actions

- Any deviations from the SAP/QAPP
- Any other observations that may be relevant to the specific field program or activities that may affect the resulting analytical data.

5.2 Photographs

Where practical, photographs will be taken to document field activities, including monitoring well conditions. Also, a small whiteboard may be included in the photograph to list the sample name, date, and time of collection.

In order for these photographs to be effective documentation, the accompanying information should be entered into the field logbook, or on a field map:

- Date
- Time
- Name of photographer
- Site name
- General direction faced when photograph was taken
- Any other appropriate comments (e.g., weather).

5.3 Sample Field Forms

Field sampling personnel may complete field sample forms for soil, vapor, and groundwater. As previously noted, data entered on field forms do not need to be duplicated in the field notebook.

5.4 Field Chain-of-Custody Procedures

All samples will be placed immediately in appropriate containers with appropriate preservatives per the analytical method requirements (see Table 11). The filled containers should be tightly sealed, the outer surface wiped to remove any loose particulates, and stored in a dedicated cooler with ice (or ice packs) pending transport to the analytical laboratory.

Samples will be labeled with the following information:

- Project name/location
- Sample identification number
- Date and time of sample collection
- Preservative (if applicable)
- Analyses to be performed

- Sample matrix (i.e., groundwater,)
- Sampler's name or initials.

Chain-of-custody procedures provide an accurate written record of sample possession from the time of collection through analytical laboratory analysis. A sample is considered in custody *only* when one of the following applies:

- It is in an authorized person's immediate possession.
- It is in view of an authorized person after being in that person's physical possession.
- It is in a secure area, restricted to authorized personnel only, after having been in an authorized person's physical possession.

Each chain-of-custody form will be completed properly to ensure that sample custody is documented, appropriate samples have been collected, and scheduled analyses are assigned correctly. All entries will be made using indelible ink. Any errors will be corrected by drawing a single line through the incorrect entry, entering the correct information, and then initialing and dating the change. Analytical laboratories typically provide a chain-of-custody form that they prefer. At a minimum, these forms will contain the following information:

- Sample identification
- Date and time of sample collection
- Sample matrix (i.e., groundwater)
- Number and type of containers per sample
- Preservative (if applicable)
- Analyses to be performed
- Sampler's name and initials
- Release and acceptance information, including date, location, and sampler's signature.

Custody seals must be used when samples are shipped to the analytical laboratory, or when they are delivered to the analytical laboratory after hours. The seals must be signed by the field personnel and be affixed to the sample cooler in a way that would necessitate breaking the seal in order to open the cooler. If the samples are delivered directly to the analytical laboratory by the sampler, sample seals are not necessary.

If the samples are shipped via a commercial carrier, the carrier will relinquish samples to the analytical laboratory upon arrival, and the analytical laboratory personnel will complete the chain-of-custody form. The chain-of-custody forms will be sealed in plastic zip-lock bags (or similar) and secured to the top of the lid inside the cooler with tape.

5.4.1 Analytical Laboratory Chain-of-Custody Procedures

A signed chain-of-custody form will be obtained from the analytical laboratory custodian after the samples have been received and sample condition recorded. Upon receipt by the analytical laboratory, samples will be checked carefully to ensure that sample containers are not broken or leaking, proper preservation methods have been followed [including receipt at 4 degrees Celsius (°C) ± 2°C when applicable], and labels and custody seals are intact. Each chain-of-custody form will be verified for accuracy and completeness, and any discrepancies will be brought to the attention of the environmental consultant or Ecology Project Manager. From the time of receipt, the analytical laboratory will use its standard internal chain-of-custody procedures to ensure that the samples are tracked through completion of the analytical process.

Sample custody will be maintained within the analytical laboratory's secure facility until disposal. Following sample analysis and throughout the holding time, the analytical laboratory will archive any remaining sample material for all samples (100 percent). The analytical laboratory will be responsible for sample disposal, which will be conducted in accordance with all applicable local, state, and federal regulations.

5.5 Handling/Referring Possible Violations

If, during the course of this work, questionable practices or site conditions are noted, it is incumbent upon the field personnel to suitably document these facts, without compromising the objectives of the project. A summary of these observations will be forwarded to the Ecology Project Manager following completion of onsite activities.

Section 6: Quality Control

QC is the implementation, monitoring, and documentation of the quality processes and procedures. Every procedural aspect, from project planning, sample collection, laboratory analysis, to data assessment, imparts a significant and often critical bearing on environmental decisions.

QC samples to be used to evaluate analytical data in terms of the quality criteria parameters include duplicate samples, equipment-rinsate blanks, trip blanks, temperature blanks, method blanks, and/or MS/MSD. These include QC samples prepared in the field and by the analytical laboratory. Method-specific QC procedures are detailed in the analytical laboratory's statement of qualifications (SOQs) and will be available upon request. The minimum requirements of the analytical laboratory's QA/QC plan include the frequency of QC sample analysis, acceptance criteria (control limits), and corrective actions and also describe the holding time criteria to be used to assess data quality.

6.1 Field QC Requirements Samples

For field sampling, QC samples are used to assess sample collection techniques and environmental conditions during sample collection and transport. For this project, field QC samples include equipment rinsate blanks, duplicate samples, trip blanks, and temperature blanks. QC samples and frequency of collection are discussed in the following sections and identified for each soil, groundwater, water, or vapor sampling event in Tables 4 through 7. A summary of specifications for containers, holding times, preservation, and handling for each matrix and analysis group is shown in Table 11.

6.1.1 Equipment Rinsate Blanks

Equipment rinsate blank samples will be collected at the frequency of one per day that non-disposable field equipment is used (expected for soil samples only, see Table 4). Rinsate blanks will be collected by filling appropriate sample containers in the field with laboratory prepared organic-free water that has been passed through decontaminated reusable sampling equipment. Field blanks will be used to assess variability in decontamination procedures.

6.1.2 Duplicate Samples

Duplicate samples may be used to assess variability in sampling techniques. A duplicate sample pair is typically a single grab sample that is split into two samples during collection. For each duplicate sample pair, one sample is labeled with the sample identification and the other is labeled with a blind duplicate sample identification. This sample pair is then submitted to the same analytical laboratory as two separate samples. Precision will be evaluated by calculating the RPD between the field duplicate samples, as described in Section 3.3.1. The RPD will be calculated for field duplicate pairs for each analyte whose measured values are greater than the RL. The frequency for duplicate samples shall typically be one per 20 investigative samples, with a minimum of one duplicate within each media per sampling event. Duplicate samples are identified in Tables 4 through 7.

6.1.3 Trip Blank Sample

Trip blank samples will be collected when soil, water, and/or groundwater samples for volatile organic compounds (VOCs) are collected. Volatile organic samples are susceptible to contamination by diffusion of organic contaminants through the sample vials. Therefore, trip blank samples will be submitted to monitor for possible sampling contamination during shipment if VOC analyses are performed. Trip blank samples will be prepared by the analytical laboratory by filling volatile organic analysis (VOA) vials with organic-free water and acid preservative and shipping the blank samples with the clean sample containers. Trip blank samples will accompany the sample containers through collection and shipment to the laboratory and will be stored with the samples. If samples for VOC analysis are not collected, a field blank will be collected each day. Field blanks will be collected by filling appropriate sample containers in the field with laboratory prepared organic-free water. Trip blanks samples are identified in Tables 4 through 7.

6.1.4 Temperature Blanks

A temperature blank is used to monitor temperature preservation of samples transported to the contract analytical laboratory. The temperature blank is distilled water stored in a glass/plastic vial or jar, and is typically provided by the analytical laboratory. A temperature blank should be included with each sample cooler submitted for chemical analysis. Upon receipt by the analytical laboratory, the sample custodian will measure and record the temperature of the blank sample.

Temperature blanks are commonly used to evaluate the effectiveness of preservation requirements (e.g., chilling samples on ice during shipment to the analytical laboratory) and application of appropriate data qualifiers when blank results indicate the potential for elevated temperatures to affect field samples during transport to the analytical laboratory. Typically, the temperature blank must be within the criteria of 4±2°C (2°C to 6°C).

Section 7: Calibration, Testing, Inspection, and Maintenance of Equipment, Instrumentation, and Supplies

All field analytical instruments and equipment will be tested, inspected, and maintained according to the manufacturer's guidelines and recommendations. Data collected from improperly functioning equipment will not be used. The equipment testing, inspection, and maintenance logs for all equipment must be made available to the Ecology Project Manager, and/or their representative upon request.

7.1 Calibration

Calibration refers to the process of verifying, adjusting, or fine-tuning the measurements reported by a given instrument to agree with known values. In general, the calibration process involves analyzing commercially prepared calibration standards of known concentrations or values, which span either the measurement range of the instrument or the range of values anticipated to be encountered in a given investigation. The measured value produced by the instrument is then compared to the published value for that calibration standard, and the difference is compared to project, method, or instrument acceptance criteria. If the difference between the published and measured values for the calibration standard is smaller than the acceptance criteria, then the instrument is considered to be in calibration. If the difference is greater than the applicable acceptance criteria, the instrument is considered to be out of calibration and must be recalibrated in accordance with manufacturer's recommendations before any measurements made with the device can be considered valid. Field equipment calibration procedures and requirements are described in the following sections.

7.2 Field Equipment Calibration

Field instruments and meters will be calibrated, at a minimum, on a daily basis, and as needed to maintain calibration during each field day. Instruments and meters will be calibrated using the manufacturer's recommended procedures and appropriate calibration standards. A field log will be maintained with calibration dates, times, and results (as appropriate) for each instrument and meter. For instruments and meters that are factory-calibrated (i.e., not intended for daily calibration), a reference standard will be measured daily.

Field instruments and meters anticipated to be used for compliance monitoring during the remedial action include:

- PID and ppb PID calibrated daily using 100 ppm isobutylene gas and as needed to maintain calibration.
- Four-gas multimeter calibrated daily using vendor-provided calibration gases
- Multi-parameter probe for water quality parameters including temperature, specific conductivity, pH, redox potential, and dissolved oxygen calibrated daily and as needed to maintain calibration (no calibration required for temperature).
- Turbidity meter field checked daily and as needed.

Instrument calibration procedures are described in the SOGs provided in Appendix A.

Field calibration standards will be obtained from the National Institute of Standards and Technology (NIST), EPA Cooperative Research and Development Agreement vendors, American Association of Laboratory Accreditation vendors, or other reliable commercial sources. For the purposes of field instrument calibration, vendor standards will not be diluted. Before each use, standards will be checked for signs of deterioration (e.g., discoloration, formation of precipitates, and changes in concentrations), and will be discarded if deterioration is suspected or the expiration date identified by the vendor has passed.

For corrective action, if calibration of a field instrument is outside the criteria at the beginning of the day, the instrument will be recalibrated with new standards. If recalibration is unsuccessful, the unit will be repaired or replaced.

All field analytical instruments and equipment will be tested, inspected, and maintained according to the manufacturer's guidelines and recommendations. Data collected from improperly functioning equipment will not be used. The equipment testing, inspection, and maintenance logs for all equipment must be made available to the Ecology Project Manager, and/or their representative upon request.

7.3 Equipment Testing, Inspection, and Maintenance

A preventive maintenance program is necessary to promote the timely and effective completion of a measurement effort for field programs. The preventive maintenance program will be designed to minimize the downtime of crucial sampling or analytical equipment due to unexpected component failure. Efforts will focus on establishing maintenance responsibilities, maintenance schedules for major or critical instrumentation and apparatus, and an adequate inventory of critical spare parts and equipment.

7.3.1 Field Equipment/Instruments

The field equipment used for sampling will be maintained and used according to the manufacturer's directions. The field team leader will ensure that each piece of equipment is operational and is inspected on a regular basis. Any preventive maintenance or repair conducted in the field will be recorded in the field logbook or other appropriate field forms. If equipment is determined to be damaged, in need of maintenance, or otherwise unusable, it will be immediately taken out of service until such time that it can be repaired or replaced. The field team leader will be responsible for inspecting and testing the field equipment to verify it is in acceptable condition before the item is put back into service. Backup instruments and equipment will be available onsite or within a short turnaround time to avoid delays in the field schedule. Field instruments will be checked and calibrated before they are shipped or carried to the field and will be checked and calibrated before use. Calibration checks will be performed as specified in the manufacturer's directions.

7.4 Inspection/Acceptance of Supplies and Consumables

All supplies and consumables will be examined for damage or other characteristics that would otherwise compromise data quality.

Section 8: Data Management, Review, and Reporting

8.1 Laboratory Data Reporting

The analytical laboratory is responsible for providing sufficient laboratory documentation such that the sample results are traceable to the field samples, and the analytical data can be verified and validated by an independent third-party reviewer, if applicable. All analytical laboratory data packages will contain the following information:

- Cover letter
- Chain-of-custody forms
- Summary of sample results
- Summary of QC results.

The minimum information to be presented for each sample for each parameter or parameters group:

- Client sample number and analytical laboratory sample number
- Sample matrix
- Date of extraction/preparation and date/time of analysis
- Dilution factors
- Sample weights/volumes used in sample preparation/analysis
- Identification of analytical instrument
- Analytical method
- Detection/quantitation and reporting limits
- Definitions of any data qualifiers used.

The minimum QC summary information to be presented for each sample for each parameter or parameter group will include:

- Surrogate standard recovery results
- Matrix QC results (MS/MSD, duplicate)
- Method blank results
- Laboratory duplicate results and control limits

- Analytical laboratory check standard results
- Initial and continuing calibration results and control limits.

8.2 Data Management

Field data recorded during sampling and monitoring events (e.g., depth to groundwater measurements, groundwater, soil or vapor sample identifications, dates and times, etc.), will be recorded on field data sheets, in a hardbound field book, or hand-held computers. Field data will be reported to the Ecology Project Manager and/or their representative upon request, through monthly updates, and in the Remedial Progress Evaluation Reports (Section 8.4).

Data will also be managed and stored using the following Ecology databases:

- Environmental data (including field measurements) and sample results will be uploaded by the O&M Contractor to Ecology's Environmental Information Management (EIM) System on a quarterly basis. The analytical laboratory will provide data in a format compatible with EIM, in addition to any other reporting formats.
- The O&M Contractor will provide electronic copies [e.g., laboratory-provided PDF and/or electronic data deliverable (EDD) files as applicable] of all final analytical data for compliance monitoring and sampling to Ecology via email or file sharing application.
- Maps and reports submitted to Ecology will be stored in Document Storage and Retrieval System (DSARS).
- Site photographs submitted to Ecology will be stored in Photo and Image Management System (PIMS).

8.3 Data Review and Validation

This section discusses data review and verification procedures and requirements.

Field and analytical laboratory data generated from sampling activities will be reviewed and verified. Field data entered into databases will be verified. Errors identified during the verification of data will be corrected prior to release of the final data.

The analytical laboratory is responsible for verifying analytical results prior to the submittal of the final laboratory data report. Initially, all analytical data generated by the analytical laboratory are verified by the laboratory. During the analysis process, the analyst and the laboratory QA Manager verify that the results have met various performance-based control limits (e.g., surrogate recoveries and continuing calibration). Nonconformance of various method QC requirements and control limits warrants the re-analysis and/or re-extraction of a sample.

Data validation will be conducted in accordance with applicable sections of EPA's Contract Laboratory Program National Functional Guidelines for Organic Data Review (EPA 2020). For each data package, the Kennedy Jenks' QA Officer will conduct a review of the QC results. If data do not meet required criteria, they will be flagged with data qualifiers as specified under the action portion of each requirement of the functional guidelines (EPA 2020). Data validation procedures will entail evaluating the following:

- Holding times (check to see whether samples were analyzed within the specified holding time)
- Method blank results [check to see whether analytes were present in method blank samples and that a blank was analyzed every 20 samples (or more often) for each matrix]
- Surrogate recovery results for organic analyses (check to see whether surrogate recoveries met control limits)
- Laboratory control sample results (check to see whether laboratory control samples met control limits)
- Field duplicate results
- Laboratory duplicate results (check to see whether duplicate analyses were conducted every 20 samples for each matrix or at least for each batch of samples, where applicable, and that control limits were met)
- MS/MSD results for all relevant analyses (check to see whether MS/MSDs were analyzed every 20 samples for each matrix or at least for each batch of samples, where applicable, and that control limits were met)
- Reported detection limits for analyses (check to see whether the detection/reporting limits were adequate for comparison to appropriate regulatory criteria).

The QA Officer will prepare a QA memorandum for each data package describing the results of the data validation and describing any qualifiers that are added to the data. Limitations to the usability of the data will also be discussed in the memorandum.

8.4 Data Reporting

Reporting during remedial system operation includes:

- Monthly Updates:
    - O&M Contractor will provide Ecology with monthly tracking of project schedule, budget, scope of work, and deliverables, including but not limited to:
        - Timely notification of change to scope, schedule, or budget.
        - Timely notification to Ecology Site Manager/Contract Officer when 75% of the budget has been spent.
        - Preparation of a brief Monthly Progress Update for Ecology, due by the 15th day of each following month, through the duration of system

operations and into the confirmation monitoring phase after MPE system shutdown, including:

        - Summary of operations, monitoring, and maintenance activities performed during the reporting period.
        - Summary of operations, monitoring, and maintenance activities to be performed in the next month.
        - Comparison of work completed to scheduled activities.
        - Potential problems identified and suggested resolutions.
        - Deliverables submitted during the reporting period.
        - EIM field and laboratory analytical results submitted during the reporting period.
    - O&M Contractor will attend routine, Monthly Progress Update calls, approximately 30-minutes in duration, between the Ecology Site Manager and Contractor’s Project Manager.

- Monthly Remedial Progress Evaluation Reports
    - O&M Contractor will prepare and submit a report to Ecology for the first month of each remedial system operating phase (Phases 1, 2, and 3) and the confirmation monitoring phase.
    - Submittal will be on or before the 28th day of the following month to allow time for data tabulation and validation of laboratory analytical results.
- Quarterly Remedial Progress Evaluation Reports
    - O&M Contractor will prepare and submit a report to Ecology for the first, second, and third quarter per year of remedial system operation and confirmation monitoring.
    - Submittal will be on or before the 28th day of the month following the end of the quarter to allow time for data tabulation and validation of laboratory analytical results.
- Annual Remedial Progress Reports
    - O&M Contractor will prepare and submit an annual report to Ecology for each year of remedial system operation and confirmation monitoring. The annual report will be prepared in place of a fourth quarterly remedial progress evaluation report.

- A draft annual report will be due to Ecology for review by February 15th of the following year. A final annual report will be updated to incorporate Ecology's comments.

The monthly and quarterly reports will include a summary of activities completed during the preceding reporting period (month or quarter) as applicable for conducted activities, including:

- Summary of operations, monitoring, sampling, and maintenance activities.
- Operational information on the MPE system performance including tables summarizing recorded field system measurements.
- Groundwater level measurement data.
- Tables summarizing field analytical results.
- Tables summarizing laboratory analytical data for vapor, discharge water, groundwater, and/or soil samples collected during the reporting period, including comparison to applicable PSCAA, KCIW, and MTCA cleanup levels.
- Concentration trend graphs for GRO and benzene in effluent samples from the air treatment system and water treatment system.
- Analytical laboratory reports and data validation reports for sample analysis results collected during the applicable reporting period.
- IDW manifests from the reporting period.
- Conclusions and recommendations for future remedial actions based on MPE system operation and compliance monitoring field and analytical data collected.

The annual report will include a summary of activities completed during the year, and tables summarizing collected data since the beginning of system operation and compliance monitoring as described in this document and listed below:

- Summary of operations, monitoring, and maintenance activities.
- Operational information on the MPE system performance including tables summarizing recorded field system measurements.
- Groundwater level measurement data.
- Tables summarizing field analytical results.
- Tables summarizing laboratory analytical data for vapor, discharge water, groundwater, and/or soil samples, including comparison to applicable PSCAA, KCIW, and/or MTCA cleanup levels.

- Concentration trend graphs for GRO and benzene in effluent samples from the air treatment system and water treatment system.

- Concentration trend graphs for GRO and benzene concentrations in groundwater for the thirteen (13) performance monitoring wells.

- Analytical reports from the laboratory and data validation reports for sample analysis results collected during the fourth quarter reporting period.

- IDW manifests from the fourth quarter reporting period.

- Conclusions and recommendations for future remedial actions based on MPE system operation and compliance monitoring field and analytical data collected.

All reports will include copies of field notebooks or field sampling data sheets, laboratory analytical data reports, and chain-of-custody documents. All final reports will be filed with the Ecology Project Manager and will be uniquely identified by the Site identification (ID) number in Ecology's ISIS database. Project records will be maintained in the site's ISIS file in accordance with Ecology's Record Retention Schedule.

Deliverables will be provided to Ecology electronically in MS Word, Excel, and/or Adobe PDF formats for all documents, as appropriate. As determined by Ecology, the preparation and submittal frequency of the Remedial Progress Evaluation Report may be modified during the three phases of system operation and compliance monitoring.

8.5 Data Usability

Laboratory data generated in accordance with this SAP/QAPP will be considered usable for site characterization and evaluation of the effectiveness of the remedial action unless the data validation process described herein results in rejection of data. Rejected data will not be used to support site characterization or any other project objective.

After environmental data have been reviewed, verified, and validated in accordance with the procedures described in this SAP/QAPP, the data must further be evaluated to determine whether project data quality objectives have been achieved. Data quality objectives may be evaluated by a review of the sampling design and methods to verify that these were implemented as planned and are adequate to support project objectives, a review of any issues brought up during data review and validation, and an evaluation of the limitations of the collected data.

Any report or technical memorandum in which data for this project is reported will discuss potential impacts of data usability and will clearly define limitations associated with the data.

References

ASTM International. 2018. Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations. 1 September 2018.

EA Engineering, Science, and Technology, Inc. 2006. Circle K Station #1461, Groundwater Summary for October 2006, Recommendations for Additional Cleanup Action Tests. 21 November 2006.

Kennedy/Jenks Consultants, Inc., 2021a. Engineering Design Report, Former Circle K Site 1461, Seattle, Washington. 10 December 2021.

Kennedy/Jenks Consultants, Inc. 2021b. Site-Specific Health and Safety Plan, Former Circle K Site, 2350 24th Ave East, Seattle, Washington 98112. 12 December 2021.

Kennedy/Jenks Consultants, Inc. 2023a. Bid Set Project Manual for the Circle K 1461 Environmental Remediation System Installation, Seattle, Washington. January 2023.

Kennedy/Jenks Consultants, Inc. 2024a. Operations and Maintenance Manual Environmental Remediation System, Circle K 1461, Seattle, Washington. November 2024.

Kennedy/Jenks Consultants, Inc. 2024b. Compliance Monitoring Plan, Circle K 1461, 2350 24th Ave East, Seattle, Washington 98112. November 2024.

King County Industrial Waste Program. 2016. Sampling Procedure of Customers Free-Floating Polar Fats, Oils, and Grease (FF-FOG). Version 001. 1 February 2016.

U.S. Environmental Protection Agency. 1991. Management of Investigation-Derived Wastes During Site Inspections. Office of Emergency and Remedial Response. EPA/540/G-91/009. May.

U.S. Environmental Protection Agency. 1992. Guide to Management of Investigation-Derived Wastes. Office of Solid Waste and Emergency Response. 9345.3-03F3. January.

U.S. Environmental Protection Agency. 1996. Ground Water Issue. Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedure. Document No. EPA/540/S-95/504. April 1996.

U.S. Environmental Protection Agency. 2007. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846), Chapter 10. Revision 3. February.

U.S. Environmental Protection Agency. 2020. National Functional Guidelines for Organic Superfund Methods Data Review, United States Environmental Protection Agency Office of Superfund Remediation and Technology Innovation (OSRTI), November 2020.

Washington State Department of Ecology. 1995. Guidance on Sampling and Data Analysis Methods. Publication No. 94-49.

Washington State Department of Ecology. Revised 2016. Guidance for Remediation of Petroleum Contaminated Sites. Publication No. 10-09-057. June 2016.

Washington State Department of Ecology. 2018. Standard Operating Procedure EAP099, Version 1.0. Purging and Sampling Monitoring Wells for General Chemistry Parameters. Publication No. 18-03-214. April 2018.

Washington State Department of Ecology. Revised 2022. Guidance for Evaluating Vapor Intrusion in Washington State. Publication No. 09-09-047. March 2022.

Tables

TABLE 1
GROUNDWATER MONITORING AND REMEDIATION WELLS
CIRCLE K 1461, SEATTLE, WA

Monitoring Well ID	Date Installed	Well Status	Easting (feet)	Northing (feet)	MPE Well Group	Well Diameter (inches)	Screened Interval (feet bgs)	Top of Casing Elevation (feet amsl)	Well Use	Water Levels	Performance Monitoring	Performance Monitoring - Subset	Confirmation Monitoring
MW-2	09/11/1989	Existing	1278287.96	236985.88	--	2	5.5-20.9	69.79	Monitoring Well	X	--	--	--
MW-6	10/02/1989	Existing	1278462.46	236998.42	--	2	5-20.4	63.13	Compliance Well	X	X	--	X
MW-7	10/02/1989	Existing	1278497.04	236983.26	--	2	5-20.2	62.66	Monitoring Well	X	--	--	--
MW-8	10/03/1989	Existing	1278438.10	237006.82	--	2	5-20.3	63.59	Compliance Well	X	X	X	X
MW-9	10/03/1989	Existing	1278408.96	237007.40	--	2	5-21.2	64.3	Compliance Well	X	X	X	X
MW-10	10/03/1989	Existing	1278488.93	236997.48	--	2	5-20.4	62.86	Monitoring Well	X	--	--	--
MW-11	10/04/1989	Existing	1278384.53	237065.31	--	2	5-20.0	63.59	Monitoring Well	X	--	--	--
MW-13	12/20/1989	Existing	1278402.55	236971.66	--	2	4-19.0	65.08	Compliance Well	X	X	X	X
MW-14	12/20/1989	Existing	1278458.03	237022.92	--	2	4-19.3	63.3	Compliance Well	X	X	X	X
MW-15	12/21/1989	Existing	1278421.35	237026.01	--	2	4-18.7	64.18	Compliance Well	X	X	--	X
MW-16	12/21/1989	Existing	1278390.29	237013.58	--	2	4-19.2	64	Compliance Well	X	X	X	X
MW-17	08/01/2016	Existing	1278436.82	236871.78	--	2	4-19	65.98	Compliance Well	X	X	--	X
MW-18	08/01/2016	Existing	1278391.36	236873.73	--	2	5-15	66.73	Compliance Well	X	X	--	X
MW-19	09/23/2016	Existing	1278433.66	236911.07	--	2	5-20	66.36	Compliance Well	X	X	X	X
MW-20	09/23/2016	Existing	1278392.00	236918.95	--	4	5-20	66.17	Compliance Well	X	X	X	X
MW-21	09/23/2016	Existing	1278392.68	236948.84	--	4	5-20	65.89	Compliance Well	X	X	X	X
RW-1	02/07/2017	Existing	1278390.95	236890.20	--	4	5.5-20.5	--	Compliance Well	X	X	--	X
MW-4	09/12/1989	Existing	1278447.91	236985.00	1	2	4-18.8	63.62	Remediation Well	X	--	--	--
RW-2	02/09/2017	Existing	1278404.38	236970.10	4	4	5-20	--	Remediation Well	X	--	--	--
RW-3	02/09/2017	Existing	1278409.31	236960.04	1	4	5-20	--	Remediation Well	X	--	--	--
RW-4	02/08/2017	Existing	1278418.32	236947.52	2	4	5-20	--	Remediation Well	X	--	--	--
RW-5	02/08/2017	Existing	1278407.00	236932.47	3	4	5-20	--	Remediation Well	X	--	--	--
RW-6	02/10/2017	Existing	1278425.63	236982.51	1	4	5-20	--	Remediation Well	X	--	--	--
RW-7	02/07/2017	Existing	1278432.90	236913.61	4	4	5.0-20.0	--	Remediation Well	X	--	--	--
RW-8	02/07/2024	Existing	1278394.71	236950.38	2	4	5-20	--	Remediation Well	X	--	--	--
RW-9	02/08/2024	Existing	1278403.54	236904.78	1	4	5-20	--	Remediation Well	X	--	--	--
RW-10	02/08/2024	Existing	1278422.51	236924.38	3	4	25-30	--	Remediation Well	X	--	--	--
SW-1	02/10/2024	Existing	1278385.44	236943.23	2	4	5-18	--	Slant Remediation Well	--	--	--	--
SW-2	02/12/2024	Existing	1278397.11	236929.86	3	4	5-18	--	Slant Remediation Well	--	--	--	--
SW-3	02/09/2024	Existing	1278392.00	236913.40	4	4	5-18	--	Slant Remediation Well	--	--	--	--

Notes:

Monitoring Well	Existing monitoring well for groundwater level measurements only
Compliance Well	Existing monitoring well for groundwater compliance monitoring
Remediation Well	Existing injection/extraction remediation well
Remediation Well	New remediation well; easting and northing data are approximate
Slant Remediation Well	New slanted remediation well; easting and northing data are approximate

bgs = below ground surface
TBD = to be determined
X = Monitoring activity to be performed.
-- = not applicable
Coordinates for well locations RW-8, RW-9, RW-10, SW-1, SW-2, and SW-3 are approximate.

Estimated number of monitoring events (and samples from each well) do not include quality control (QC) samples such as trip blanks, duplicates, rinseate blanks, etc.
MPE = multiphase extraction

TABLE 2

SUMMARY OF SITE CLEANUP LEVELS AND SCREENING LEVELS
CIRCLE K 1461, SEATTLE, WA

Media / COCs	Value and Units	Cleanup Level / Screening Level Source
Soil		
Gasoline-Range Organics (GRO)	100 mg/kg (w/o benzene)	MTCA Method A Soil Cleanup Levels (CULs) for Unrestricted Land Use - Washington State Administrative Code (WAC) 173-340-740, Table 740-1.
	30 mg/kg (with benzene)	
Benzene	0.03 mg/kg	
Toluene	7 mg/kg	
Ethylbenzene	6 mg/kg	
Xylenes	9 mg/kg	
Groundwater		
Gasoline-Range Organics (GRO)	1,000 µg/L (w/o benzene)	MTCA Method A Groundwater CULs - WAC 173-340-720, Table 720-1.
	800 µg/L (with benzene)	
Benzene	5 µg/L	
Toluene	1,000 µg/L	
Ethylbenzene	700 µg/L	
Xylenes	1,000 µg/L	
Soil Gas / Vapor		
Gasoline-Range Organics (GRO)	1,500 µg/m^3 (425 ppbv)	MTCA Method B Noncancer Sub-Slab Soil Gas Screening Level - Cleanup Levels and Risk Calculation (CLARC) Vapor Intrusion Method B Table - July 2022
Benzene	460 µg/m^3 (140 ppbv)	
Toluene	76,000 µg/m^3 (20,160 ppbv)	
Ethylbenzene	15,000 µg/m^3 (3,450 ppbv)	
Xylenes	1,500 µg/m^3 (345 ppbv)	

Notes:
COCs = contaminants of concern
mg/kg = milligrams per kilogram
µg/L = micrograms per liter
µg/m^3 = micrograms per cubic meter
ppbv = parts per billion by volume

TABLE 3

MONITORING SCHEDULE
CIRCLE K 1461, SEATTLE, WA

Parameter	Media	Location	Frequency[a]	Equipment	Notes
Vacuum	Air	Individual Wells	Quarterly	Dwyer 477AV-3 Digital, Dwyer Magnehelic vacuum gauge, or equal.	See O&M Manual.
		Treatment System	Monthly	None	See O&M Manual Section 5.1.1 for exact pressure indicator numbers.
Barometric Pressure	Air	Ambient	Monthly	Dwyer 477AV-3 Digital, Dwyer Magnehelic vacuum gauge, or equal.	With measurement of vacuum at individual wells and treatment system locations. See O&M Manual.
Airflow	Air	Individual Wells	Quarterly for first year of operation, then as needed	Dwyer 471B Thermo-Anemometer, TSI TA430 Airflow Velocity meter, or equal.	See O&M Manual.
		Treatment System	Monthly	None	Air permit compliance, see O&M Manual. At FE/FIT 302.
VOC, Soil Gas Concentrations (Field, PID)[b]	Air	Individual Wells	Quarterly during Phase 1, then as needed	PID (MiniRAE 2000 or 3000 series, or equal)	Phase 1: Multi-phase Extraction
		Vapor Pins	Quarterly	Low-Detection PID (ppbRAE 3000 or equal) and Four-Gas Meter (RKI Eagle 2 or equal)	Protection Monitoring - see SAP/QAPP
		Sub-slab Depressurization Wells	Semiannually	Low-Detection PID (ppbRAE 3000 or equal) and Four-Gas Meter (RKI Eagle 2 or equal)	Protection Monitoring - see SAP/QAPP
		Treatment System	Quarterly	PID (MiniRAE 2000 or 3000 series, or equal)	Air permit compliance, see O&M manual
VOC Concentration (Lab)	Air	Individual Wells	At startup, then as needed	Summa Canister	
		Treatment System	Monthly for two quarters, then quarterly[c]	Summa Canister	Air permit compliance, see O&M manual
		Vapor Pins	As needed	Summa Canister	If elevated field soil gas results
		Sub-slab Depressurization Wells	As needed	Summa Canister	If elevated field soil gas results

MONITORING SCHEDULE
CIRCLE K 1461, SEATTLE, WA

Parameter	Media	Location	Frequency(a)	Equipment	Notes
Groundwater Flow	Water	Individual Wells at Manifold	Monthly	None	Injection flowrate during Phase 2: Surfactant Reinjection and Phase 3: Enhanced Bioremediation.
		Treatment System	Monthly	None	See O&M Manual Section 5.1.3 for exact flow indicator numbers.
GRO/BTEX Concentration (Lab)	Water	Individual Wells at Wellhead	At startup, then quarterly and semiannual (c)	Pump, tubing, and glass sample jars	Performance monitoring wells, see SAP/QAPP
		Individual Wells at Wellhead	At startup, then monthly, quarterly, semiannual (d)	Pump, tubing, and glass sample jars	Subset of Performance monitoring wells, see SAP/QAPP
		Individual Wells at Wellhead	Quarterly after system shutdown	Pump, tubing, and glass sample jars	Confirmation monitoring at select wells, see SAP/QAPP
		Treatment System	Monthly for two quarters, then quarterly(c)	Glass sample jars	Discharge permit compliance
Nitrate/Orthophosphate (Lab)	Water	Individual Wells at Wellhead	Monthly at startup of Phases 2 & 3, then quarterly, semiannual	Glass sample jars	Subset of Performance monitoring wells Phases 2 & 3, see SAP/QAPP
		Discharge to Sanitary Sewer	Quarterly for first year of Phase 3, then semiannually	Glass sample jars	Injection/extraction schedule(d)
Noise	Air	Treatment Shed	Quarterly	Hand-held dBA noise level meter	City of Seattle noise ordinance(e)
Temperature	Air	Treatment System	Monthly	None	See O&M Manual.
		Ambient	Monthly	Dwyer 471B Thermo-Anemometer, TSI TA430 Airflow Velocity meter, or equal.	See O&M Manual.

Notes:
(a) Frequency will be adjusted over the life of the system. Blanks indicate no specified frequency.
(b) A portable four-gas meter will be used to measure concentrations of total volatile organic compounds (VOCs), oxygen, carbon dioxide, and combustible gas [(reported as percent lower explosive limit (%LEL)]. Total VOCs will also be measured using a portable photoionization detector (PID) (e.g., MiniRAE 2000 or 3000 series, or equal) and/or a low-detection PID (e.g. ppbRAE 3000, or equal).
(c) Monitoring at startup, monthly for 6 months, then after two years of quarterly monitoring, monitoring frequency shall be semiannual during remedial system operation.
(d) Subset of wells, monitoring at startup, monthly for 6 months, then combinations of monthly, quarterly, and semiannual monitoring during remedial system operation.
(e) If nitrate result is greater than 5 milligrams per liter (mg/L) or orthophosphate result is greater than 10 mg/L, the Idle Well Group timing should be increased.
(f) If the result is greater than 60 dBA, notify Kennedy Jenks personnel, determine the source of excessive noise, and implement sound reducing measures.

TABLE 4

SUMMARY OF CONFIRMATION SOIL SAMPLE COLLECTION
CIRCLE K 1461, SEATTLE, WA

	Count of Confirmation Soil Samples[a]					Count of Quality Control (QC) Samples			
	Confirmation Soil Borings (Minimum 2 samples per boring)				Total Soil Samples	QC Blind Field Duplicate	QC Trip Blank	QC Equipment Rinse Blank[b]	Total QC Samples
Phase	**Count of Soil Borings**	**GRO & BTEX (minimum)**	**GRO & BTEX (additional)**	**Moisture Content (1 per soil sample)**	**Per Event**	**GRO & BTEX**	**GRO & BTEX**	**GRO & BTEX**	**Per Event**
Confirmation	8	16	2	18	18	1	2	2	5
Total number of samples		16	2	18	18	1	2	2	5
Total number of events		1	1	1	1	1	1	1	1
Sample Matrix		soil	soil	soil	soil	soil	water	water	Soil & water

Notes:

(a) Minimum of two soil samples will be collected from each of eight (8) confirmation soil borings for laboratory analyses
- Total Petroleum Hydrocarbons as Gasoline Range Organics (GRO) by NWTPH-Gx
- Benzene, toluene, ethylbenzene, and xylenes (BTEX) by EPA Method 8260.
- EPA Sampling Method 5035 for GRO and BTEX samples
- Separate 8-ounce glass jar of soil will be collected for moisture content. Chemical results to be reported on dry weight basis by laboratory.

(b) QC Equipment Rinse Blank or Field Blank - To be determined if QC Field Blank samples or QC Equipment Rinse Samples required based on soil sampling tools.

TABLE 5

SUMMARY OF COMPLIANCE VAPOR MONITORING AND SAMPLE COLLECTION
CIRCLE K 1461, SEATTLE, WA

			Count of Field Vapor Measurements[a]					Count of Vapor Samples for Laboratory Analysis[b]						
			SSD Wells (3 wells)	Vapor Pins (4 pins)	Well Manifold (13 wells)	Treatment System (Influent, Midpoint, Effluent)	Total Samples	SSD Wells (3 wells)	Vapor Pins (4 pins)	Well Manifold (13 wells)	Treatment System (Influent, Effluent)	Total Samples	QC Blind Field Duplicate	Total QC Samples
Phase	Sampling Event	Elapsed time (years)	Total VOCs, O_2, CO_2, Combustible Gas	Total VOCs, O_2, CO_2, Combustible Gas	Total VOCs	Total VOCs	Per Event	VOCs (including BTEX) [d]	VOCs (including BTEX)	VOCs (including BTEX)	VOCs (including BTEX)	Per Event	VOCs (including BTEX)	Per Event
Phase 1	Startup	0	--	--	--	--	0	--	--	13	--	13	1	1
Phase 1	Monthly 1	--	--	4	13	5	22	--	--	--	2	2	0	0
Phase 1	Monthly 2	--	--	--	--	--	0	--	--	--	2	2	0	0
Phase 1	Monthly 3	0.25	--	--	--	--	0	--	--	--	2	2	0	0
Phase 1	Monthly 4	--	--	4	13	5	22	--	--	--	2	2	0	0
Phase 1	Monthly 5	--	--	--	--	--	0	--	--	--	2	2	0	0
Phase 1	Monthly 6	0.5	3	--	--	--	3	--	--	--	2	2	0	0
Phase 1	Quarterly 1	0.75	--	4	13	5	22	--	--	--	2	2	0	0
Phase 1	Quarterly 2	1	3	4	13	5	25	--	--	--	2	2	0	0
Phase 2	Quarterly 1	1.25	--	4	--	5	9	--	--	--	2	2	0	0
Phase 2	Quarterly 2	1.5	3	4	--	5	12	--	--	--	2	2	0	0
Phase 3	Quarterly 1	1.75	--	4	--	5	9	--	--	--	2	2	0	0
Phase 3	Quarterly 2	2	3	4	--	5	12	--	--	--	2	2	0	0
Phase 3	Quarterly 3	2.25	--	4	--	5	9	--	--	--	2	2	0	0
Phase 3	Quarterly 4	2.5	3	4	--	5	12	--	--	--	2	2	0	0
Phase 3	Semiannual 1	3	3	8	--	10	21	--	--	--	2	2	0	0
Phase 3	Semiannual 2	3.5	3	8	--	10	21	--	--	--	2	2	0	0
Phase 3	Semiannual 3	4	3	8	--	10	21	--	--	--	2	2	0	0
Phase 3	Semiannual 4	4.5	3	8	--	10	21	--	--	--	2	2	0	0
Phase 3	Semiannual 5	5	3	8	--	10	21	--	--	--	2	2	0	0
Phase 3	Semiannual 6	5.5	3	8	--	10	21	--	--	--	2	2	0	0
Phase 1 to 3	As Needed 1	--	--	--	13	--	13	3	4	13	--	Up to 20	1	1
Phase 1 to 3	As Needed 2	--	--	--	13	--	13	3	4	13	--	Up to 20	1	1
Phase 1 to 3	As Needed 3	--	--	--	13	--	13	3	4	13	--	Up to 20	1	1
Phase 1 to 3	As Needed 4	--	--	--	13	--	13	3	4	13	--	Up to 20	1	1
Phase 1 to 3	As Needed 5	--	--	--	13	--	13	3	4	--	--	Up to 7	0	0
Confirmation	Quarterly 1	5.75	--	4	--	--	4	--	--	--	--	0	--	0
Confirmation	Quarterly 2	6	3	4	--	--	7	--	--	--	--	0	--	0
Confirmation	Quarterly 3	6.25	--	4	--	--	4	--	--	--	--	0	--	0
Confirmation	Quarterly 4	6.5	3	4	--	--	7	--	--	--	--	0	--	0
Confirmation	Quarterly 5	6.75	--	4	--	--	4	--	--	--	--	0	--	0
Confirmation	Quarterly 6	7	3	4	--	--	7	--	--	--	--	0	--	0
Confirmation	Quarterly 7	7.25	--	4	--	--	4	--	--	--	--	0	--	0
Confirmation	Quarterly 8	7.5	3	4	--	--	7	--	--	--	--	0	--	0
Confirmation	Quarterly 9	7.75	--	4	--	--	4	--	--	--	--	0	--	0
Confirmation	Quarterly 10	8	3	4	--	--	7	--	--	--	--	0	--	0
First 22 Months of Operation: Total # of Field Measurements/Laboratory Samples			**12**	**32**	**52**	**40**	**136**	**0**	**0**	**13**	**24**	**37**	**1**	**1**
First 22 Months of Operation: # of Events			**4**	**8**	**4**	**8**	**9**	**0**	**0**	**1**	**12**	**13**	**1**	**1**
Total # of Field Measurements/ Laboratory Samples			**48**	**128**	**117**	**110**	**403**	**15**	**20**	**65**	**40**	**140**	**5**	**5**
Total # of Events			**16**	**32**	**9**	**16**	**32**	**5**	**5**	**5**	**20**	**26**	**5**	**5**

Notes:

(a) Collected using a standard photoionization detector (PID) or low-detection PID (ppb PID) (depending on concentration levels) for VOCs and four-gas meter for VOCs, Oxygen (O_2), Carbon Dioxide (CO_2), and Combustible Gas.

(b) Collected via summa canisters and submitted for laboratory analysis.

(c) Volatile organic compounds (VOCs) reported will include full list of VOCs compounds based on selected analytical laboratory, at a minimum including benzene, toluene, ethylbenzene, and total xylenes.

TABLE 6

SUMMARY OF COMPLIANCE WATER TREATMENT SYSTEM SAMPLE COLLECTION
CIRCLE K 1461, SEATTLE, WA

			Count of Water Samples for Laboratory Analysis							Count of Quality Control Samples				
			Midpoint of each liquid GAC train[(a)]	Discharge to Sanitary Sewer (1 location)[(b)]	Treatment System (4 locations)[(c)]	Discharge to Sanitary Sewer (1 location)	Treatment System (As Needed)[(d)]	Discharge to Sanitary Sewer (As Needed)[(e)]	Total Samples	QC Blind Field Duplicate			QC Trip Blank	Total QC Samples
Phase	**Sampling Event**	**Elapsed time (years)**	**BTEX, CVOCs[(f)]**	**BTEX, CVOCs, FOG[(f)]**	**GRO, BTEX[(f)]**	**NO3, PO4[(f)]**	**NO3, PO4, GRO, BTEX, CVOCs, FOG, pH, Turbidity[(f)(g)]**	**Settleable Solids, Hydrogen Sulfide, Explosivity, pH, Turbidity[(e)(f)]**	**Per Event**	**BTEX, CVOCs**	**GRO**	**FOG**	**GRO, BTEX, CVOCs**	**Per Event**
Phase 1	Monthly 1	--	4	1	4	--	--	--	9	2	1	1	4	8
Phase 1	Monthly 2	--	4	1	4	--	--	--	9	2	1	1	4	8
Phase 1	Monthly 3	0.25	4	1	4	--	--	--	9	2	1	1	4	8
Phase 1	Monthly 4	--	4	1	4	--	--	--	9	2	1	1	4	8
Phase 1	Monthly 5	--	4	1	4	--	--	--	9	2	1	1	4	8
Phase 1	Monthly 6	0.5	4	1	4	--	--	--	9	2	1	1	4	8
Phase 1	Quarterly 1	0.75	12	3	4	--	--	--	19	3	1	1	12	17
Phase 1	Quarterly 2	1	12	3	4	--	--	--	19	3	1	1	12	17
Phase 2	Quarterly 1	1.25	12	3	4	--	--	--	19	3	1	1	12	17
Phase 2	Quarterly 2	1.5	12	3	4	--	--	--	19	3	1	1	12	17
Phase 3	Quarterly 1	1.75	12	3	4	1	--	--	20	3	1	1	12	17
Phase 3	Quarterly 2	2	12	3	4	1	--	--	20	3	1	1	12	17
Phase 3	Quarterly 3	2.25	12	3	4	1	--	--	20	3	1	1	12	17
Phase 3	Quarterly 4	2.5	12	3	4	1	--	--	20	3	1	1	12	17
Phase 3	Semiannual 1	3	24	6	4	1	--	--	35	6	1	2	24	33
Phase 3	Semiannual 2	3.5	24	6	4	1	--	--	35	6	1	2	24	33
Phase 3	Semiannual 3	4	24	6	4	1	--	--	35	6	1	2	24	33
Phase 3	Semiannual 4	4.5	24	6	4	1	--	--	35	6	1	2	24	33
Phase 3	Semiannual 5	5	24	6	4	1	--	--	35	6	1	2	24	33
Phase 3	Semiannual 6	5.5	24	6	4	1	--	--	35	6	1	2	24	33
Phase 1 to 3	As Needed 1	--	--	--	--	--	1	1	1	1	1	1	1	4
Phase 1 to 3	As Needed 2	--	--	--	--	--	1	1	1	1	1	1	1	4
Phase 1 to 3	As Needed 3	--	--	--	--	--	1	1	1	1	1	1	1	4
Phase 1 to 3	As Needed 4	--	--	--	--	--	1	1	1	1	1	1	1	4
Phase 1 to 3	As Needed 5	--	--	--	--	--	1	1	1	1	1	1	1	4
Phase 1 to 3	As Needed 6	--	--	--	--	--	1	1	1	1	1	1	1	4
Phase 1 to 3	As Needed 7	--	--	--	--	--	1	1	1	1	1	1	1	4
Phase 1 to 3	As Needed 8	--	--	--	--	--	1	1	1	1	1	1	1	4
Phase 1 to 3	As Needed 9	--	--	--	--	--	1	1	1	1	1	1	1	4
Phase 1 to 3	As Needed 10	--	--	--	--	--	1	1	1	1	1	1	1	4
	Total number of samples		**264**	**66**	**80**	**10**	**10**	**10**	**430**	**82**	**30**	**36**	**274**	**422**
	Total number of events		**20**	**20**	**20**	**10**	**10**	**10**	**30**	**30**	**30**	**30**	**30**	**30**

Notes:
(a) Collected weekly during discharge to sanitary sewer in accordance with KCIW WDA requirements. If no discharge, no sample required. Sample frequency may be reduced if requested and approved by KCIW.
(b) Collected monthly during discharge to sanitary sewer in accordance with KCIW WDA requirements. If no discharge, no sample required.
(c) Treatment System sample locations: Influent to liquid GAC vessel trains, midpoint of each train, effluent of liquid GAC vessel trains.
(d) Samples collected from sampling ports or holding tanks to characterize wastewater if effluent limits specified in the KCIW WDA are exceeded. Parameters to be determined based on exceedances.
(e) Only if operating criteria specified in the KCIW WDA are exceeded. Settleable solids shall be a field test us ing Imhoff cone. Hydrogen sulfide and explosivity meassured using a field meter.
(f) Laboratory analyses (see SAP/QAPP for analytical methods):
GRO: Total Petroleum Hydrocarbons as Gasoline Range Organics (GRO)
BTEX: Benzene, Toluene, Ethylbenzene, and Total Xylenes
CVOCs: Selected chlorinated volatile organic compounds (CVOCs) including tetrachloroethylene (PCE), trichloroethylene (TCE),
cis-1,2-dichloroethylene (cis-1,2-DCE), trans-1,2-dichloroethylene (trans-1,2-DCE), and vinyl chloride
FOG: Nonpolar Fat, Oil, and Grease
NO3: Nitrate as nitrogen
PO4: Total orthophosphate
(g) pH and Turbidity collected in the field using a calibrated portable field meter.

TABLE 7

SUMMARY OF COMPLIANCE GROUNDWATER SAMPLE COLLECTION
CIRCLE K 1461, SEATTLE, WA

			Count of Monitoring Well Samples for Laboratory Analysis[a]							Count of Quality Control Samples for Laboratory Analysis				
			Off-Property Monitoring (4 wells)	Performance Monitoring (5 wells)	Performance Monitoring Subset (8 wells)				Total Well Samples	QC Blind Field Duplicate			QC Trip Blank	Total QC Samples
Phase	Sampling Event	Elapsed time (years)	GRO & BTEX	GRO & BTEX	Sampling Event	GRO & BTEX	Nitrate & Ortho-phosphate	MNA Parameters	Per Event	GRO & BTEX	Nitrate & Ortho-phosphate	MNA Parameters	GRO & BTEX	Per Event
Phase 1	Startup	0	4	5	Startup	8	--	--	17	1	--	--	3	4
Phase 1	Monthly 1		--	5	Monthly 1	8	--	--	13	1	--	--	2	3
Phase 1	Monthly 2		--	5	Monthly 2	8	--	--	13	1	--	--	2	3
Phase 1	Monthly 3	0.25	--	5	Monthly 3	8	--	--	13	1	--	--	2	3
Phase 1	Monthly 4		--	5	Monthly 4	8	--	--	13	1	--	--	2	3
Phase 1	Monthly 5		--	5	Monthly 5	8	--	--	13	1	--	--	2	3
Phase 1	Monthly 6	0.5	--	5	Monthly 6	8	--	--	13	1	--	--	2	3
Phase 1	Quarterly 1	0.75	--	5	Quarterly 1	8	--	--	13	1	--	--	2	3
Phase 1	Quarterly 2	1	--	5	Quarterly 2	8	--	--	13	1	--	--	2	3
Phase 2					Monthly 1	8	8	--	8	1	1	--	2	3
Phase 2					Monthly 2	8	8	--	8	1	1	--	2	3
Phase 2	Quarterly 1	1.25	--	5	Monthly 3	8	8	--	13	1	1	--	2	3
Phase 2	Quarterly 2	1.5	--	5	Quarterly 1	8	8	--	13	1	1	--	2	3
Phase 3					Monthly 1	8	8	--	8	1	1	--	2	3
Phase 3					Monthly 2	8	8	--	8	1	1	--	2	3
Phase 3	Quarterly 1	1.75	--	5	Monthly 3	8	8	--	13	1	1	--	2	3
Phase 3	Quarterly 2	2	--	5	Quarterly 1	8	8	--	13	1	1	--	2	3
Phase 3	Quarterly 3	2.25	--	5	Quarterly 2	8	8	--	13	1	1	--	2	3
Phase 3	Quarterly 4	2.5	--	5	Quarterly 3	8	8	--	13	1	1	--	2	3
Phase 3		2.75	--		Quarterly 4	8	8	--	8	1	1	--	2	3
Phase 3	Semiannual 1	3	--	5	Quarterly 5	8	8	--	13	1	1	--	2	3
Phase 3	Semiannual 2	3.5	--	5	Semiannual 1	8	8	--	13	1	1	--	2	3
Phase 3	Semiannual 3	4	--	5	Semiannual 2	8	8	--	13	1	1	--	2	3
Phase 3	Semiannual 4	4.5	--	5	Semiannual 3	8	8	--	13	1	1	--	2	3
Phase 3	Semiannual 5	5	--	5	Semiannual 4	8	8	--	13	1	1	--	2	3
Phase 3	Semiannual 6	5.5	--	5	Semiannual 5	8	8	--	13	1	1	--	2	3
Confirmation	Quarterly 1	5.75	--	5	Quarterly 1	8	--	8	13	1	--	1	2	3
Confirmation	Quarterly 2	6	--	5	Quarterly 2	8	--	--	13	1	--	--	2	3
Confirmation	Quarterly 3	6.25	--	5	Quarterly 3	8	--	8	13	1	--	1	2	3
Confirmation	Quarterly 4	6.5	--	5	Quarterly 4	8	--	--	13	1	--	--	2	3
Confirmation	Quarterly 5	6.75	--	5	Quarterly 5	8	--	--	13	1	--	--	2	3
Confirmation	Quarterly 6	7	--	5	Quarterly 6	8	--	--	13	1	--	--	2	3
Confirmation	Quarterly 7	7.25	--	5	Quarterly 7	8	--	--	13	1	--	--	2	3
Confirmation	Quarterly 8	7.5	--	5	Quarterly 8	8	--	--	13	1	--	--	2	3
Confirmation	Quarterly 9	7.75	--	5	Quarterly 9	8	--	--	13	1	--	--	2	3
Confirmation	Quarterly 10	8	--	5	Quarterly 10	8	--	--	13	1	--	--	2	3
22 Months of Operation: Number of samples			**4**	**65**		**136**	**64**	**0**	**205**	**17**	**8**	**0**	**35**	**52**
22 Months of Operation: Numberof events			**1**	**13**		**17**	**8**	**0**	**17**	**17**	**8**	**0**	**17**	**17**
	Total number of samples		**4**	**155**		**288**	**136**	**16**	**447**	**36**	**17**	**2**	**73**	**109**
	Total number of events		**1**	**31**		**36**	**17**	**2**	**36**	**36**	**17**	**2**	**36**	**36**

Notes:

(a) Groundwater samples will be collected from up to 17 monitoring wells during each event. The wells have been divided into three groups based on sampling frequency and laboratory analyses:
- Off-Property Monitoring (4 wells) sampled at startup only: MW-2, MW-7, MW-10, and MW-11.
- Performance Monitoring (5 wells): MW-6, MW-15, MW-17, MW-18, and RW-1
- Performance Monitoring Subset (8 wells) (more frequent monitoring and additional laboratory analyses during Phases 2 and 3): MW-8, MW-9, MW-13, MW-14, MW-16, MW-19, MW-20, and MW-21

(b) Groundwater and Quality Control samples will be submitted for analysis of one or more of the following. Refer to SAP/QAPP for analytical methods.
- Total Petroleum Hydrocarbons as Gasoline Range Organics (GRO) by NWTPH-Gx, and Benzene, toluene, ethylbenzene, and xylenes (BTEX) by EPA Method 8260.
- Nitrate and Total Orthophosphate - See SAPP/QAPP for laboratory analytical methods.
- Monitored natural attenuation (MNA) Parameters: nitrate, sulfate, dissolved manganese, dissolved iron, and methane - See SAPP/QAPP for laboratory analytical methods.

TABLE 8

SUMMARY OF TARGET PQLS FOR SOIL SAMPLES
CIRCLE K 1461, SEATTLE, WA

Analyte	CAS Number	Method	MDL	Target PQL	Units
NWTPH-Gx					
GASOLINE RANGE ORGANICS (C6-C12)	GROC6C12	NWTPHGX	0.0339	0.1	mg/kg
NWTPH-Dx Without Silica Gel Cleanup					
DIESEL RANGE ORGANICS	DRO2	NWTPHDX-SGT		4	mg/kg
RESIDUAL RANGE ORGANICS	RRO	NWTPHDX-SGT		10	mg/kg
Volatile Organic Compounds					
ACETONE	67-64-1	SW8260B	0.0365	0.05	mg/kg
ACRYLONITRILE	107-13-1	SW8260B	0.0036	0.0125	mg/kg
BENZENE	71-43-2	SW8260B	0.0005	0.001	mg/kg
BROMOBENZENE	108-86-1	SW8260B	0.0009	0.0125	mg/kg
BROMODICHLOROMETHANE	75-27-4	SW8260B	0.0007	0.0025	mg/kg
BROMOFORM	75-25-2	SW8260B	0.0012	0.025	mg/kg
BROMOMETHANE	74-83-9	SW8260B	0.0020	0.0125	mg/kg
N-BUTYLBENZENE	104-51-8	SW8260B	0.0053	0.0125	mg/kg
SEC-BUTYLBENZENE	135-98-8	SW8260B	0.0029	0.0125	mg/kg
TERT-BUTYLBENZENE	98-06-6	SW8260B	0.0020	0.005	mg/kg
CARBON TETRACHLORIDE	56-23-5	SW8260B	0.0009	0.005	mg/kg
CHLOROBENZENE	108-90-7	SW8260B	0.0002	0.0025	mg/kg
DIBROMOCHLOROMETHANE	124-48-1	SW8260B	0.0006	0.0025	mg/kg
CHLOROETHANE	75-00-3	SW8260B	0.0017	0.005	mg/kg
CHLOROFORM	67-66-3	SW8260B	0.0010	0.0025	mg/kg
CHLOROMETHANE	74-87-3	SW8260B	0.0044	0.0125	mg/kg
2-CHLOROTOLUENE	95-49-8	SW8260B	0.0009	0.0025	mg/kg
4-CHLOROTOLUENE	106-43-4	SW8260B	0.0005	0.005	mg/kg
1,2-DIBROMO-3-CHLOROPROPANE (DBCP)	96-12-8	SW8260B	0.0039	0.025	mg/kg
1,2-DIBROMOETHANE	106-93-4	SW8260B	0.0006	0.0025	mg/kg
DIBROMOMETHANE	74-95-3	SW8260B	0.0008	0.005	mg/kg
1,2-DICHLOROBENZENE	95-50-1	SW8260B	0.0004	0.005	mg/kg
1,3-DICHLOROBENZENE	541-73-1	SW8260B	0.0006	0.005	mg/kg
1,4-DICHLOROBENZENE	106-46-7	SW8260B	0.0007	0.005	mg/kg
DICHLORODIFLUOROMETHANE	75-71-8	SW8260B	0.0016	0.0025	mg/kg
1,1-DICHLOROETHANE	75-34-3	SW8260B	0.0005	0.0025	mg/kg
1,2-DICHLOROETHANE	107-06-2	SW8260B	0.0006	0.0025	mg/kg
1,1-DICHLOROETHENE	75-35-4	SW8260B	0.0006	0.0025	mg/kg
CIS-1,2-DICHLOROETHENE	156-59-2	SW8260B	0.0007	0.0025	mg/kg
TRANS-1,2-DICHLOROETHENE	156-60-5	SW8260B	0.0010	0.005	mg/kg
1,2-DICHLOROPROPANE	78-87-5	SW8260B	0.0014	0.005	mg/kg
1,1-DICHLOROPROPENE	563-58-6	SW8260B	0.0008	0.0025	mg/kg
1,3-DICHLOROPROPANE	142-28-9	SW8260B	0.0005	0.005	mg/kg
CIS-1,3-DICHLOROPROPENE	10061-01-5	SW8260B	0.0008	0.0025	mg/kg
TRANS-1,3-DICHLOROPROPENE	10061-02-6	SW8260B	0.0011	0.005	mg/kg
2,2-DICHLOROPROPANE	594-20-7	SW8260B	0.0014	0.0025	mg/kg
DI-ISOPROPYL ETHER (DIPE)	108-20-3	SW8260B	0.0004	0.001	mg/kg
ETHYLBENZENE	100-41-4	SW8260B	0.0007	0.0025	mg/kg
HEXACHLOROBUTADIENE	87-68-3	SW8260B	0.0060	0.025	mg/kg
ISOPROPYLBENZENE	98-82-8	SW8260B	0.0004	0.0025	mg/kg
CYMENE (P-ISOPROPYLTOLUENE)	99-87-6	SW8260B	0.0026	0.005	mg/kg
METHYL ETHYL KETONE (2-BUTANONE)	78-93-3	SW8260B	0.0635	0.1	mg/kg
METHYLENE CHLORIDE	75-09-2	SW8260B	0.0066	0.025	mg/kg
METHYL ISOBUTYL KETONE (MIBK)	108-10-1	SW8260B	0.0023	0.025	mg/kg
METHYL TERT-BUTYL ETHER	1634-04-4	SW8260B	0.0004	0.001	mg/kg
NAPHTHALENE	91-20-3	SW8260B	0.0049	0.0125	mg/kg
N-PROPYLBENZENE	103-65-1	SW8260B	0.0010	0.005	mg/kg
STYRENE	100-42-5	SW8260B	0.0002	0.0125	mg/kg
1,1,1,2-TETRACHLOROETHANE	630-20-6	SW8260B	0.0009	0.0025	mg/kg
1,1,2,2-TETRACHLOROETHANE	79-34-5	SW8260B	0.0007	0.0025	mg/kg
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE (FREON 113)	76-13-1	SW8260B	0.0008	0.0025	mg/kg
TETRACHLOROETHENE (PCE)	127-18-4	SW8260B	0.0009	0.0025	mg/kg
TOLUENE	108-88-3	SW8260B	0.0013	0.005	mg/kg
1,2,3-TRICHLOROBENZENE	87-61-6	SW8260B	0.0073	0.0125	mg/kg

SUMMARY OF TARGET PQLS FOR SOIL SAMPLES
CIRCLE K 1461, SEATTLE, WA

Analyte	CAS Number	Method	MDL	Target PQL	Units
1,2,4-TRICHLOROBENZENE	120-82-1	SW8260B	0.0044	0.0125	mg/kg
1,1,1-TRICHLOROETHANE	71-55-6	SW8260B	0.0009	0.0025	mg/kg
1,1,2-TRICHLOROETHANE	79-00-5	SW8260B	0.0006	0.0025	mg/kg
TRICHLOROETHENE (TCE)	79-01-6	SW8260B	0.0006	0.001	mg/kg
TRICHLOROFLUOROMETHANE	75-69-4	SW8260B	0.0008	0.0025	mg/kg
1,2,3-TRICHLOROPROPANE	96-18-4	SW8260B	0.0016	0.0125	mg/kg
1,2,4-TRIMETHYLBENZENE	95-63-6	SW8260B	0.0016	0.005	mg/kg
1,2,3-TRIMETHYLBENZENE	526-73-8	SW8260B	0.0016	0.005	mg/kg
1,3,5-TRIMETHYLBENZENE	108-67-8	SW8260B	0.0020	0.005	mg/kg
VINYL CHLORIDE	75-01-4	SW8260B	0.0012	0.0025	mg/kg
XYLENE, TOTAL	1330-20-7	SW8260B	0.0009	0.0065	mg/kg
Polycyclic Aromatic Hydrocarbons (PAHs) -SIM					
ANTHRACENE	120-12-7	SW8270CSIM	0.002	0.006	mg/kg
ACENAPHTHENE	83-32-9	SW8270CSIM	0.002	0.006	mg/kg
ACENAPHTHYLENE	208-96-8	SW8270CSIM	0.002	0.006	mg/kg
BENZO(A)ANTHRACENE	56-55-3	SW8270CSIM	0.002	0.006	mg/kg
BENZO(A)PYRENE	50-32-8	SW8270CSIM	0.002	0.006	mg/kg
BENZO(B)FLUORANTHENE	205-99-2	SW8270CSIM	0.002	0.006	mg/kg
BENZO(G,H,I)PERYLENE	191-24-2	SW8270CSIM	0.002	0.006	mg/kg
BENZO(K)FLUORANTHENE	207-08-9	SW8270CSIM	0.002	0.006	mg/kg
CHRYSENE	218-01-9	SW8270CSIM	0.002	0.006	mg/kg
DIBENZ(A,H)ANTHRACENE	53-70-3	SW8270CSIM	0.002	0.006	mg/kg
FLUORANTHENE	206-44-0	SW8270CSIM	0.002	0.006	mg/kg
FLUORENE	86-73-7	SW8270CSIM	0.002	0.006	mg/kg
INDENO(1,2,3-C,D)PYRENE	193-39-5	SW8270CSIM	0.002	0.006	mg/kg
NAPHTHALENE	91-20-3	SW8270CSIM	0.004	0.02	mg/kg
PHENANTHRENE	85-01-8	SW8270CSIM	0.002	0.006	mg/kg
PYRENE	129-00-0	SW8270CSIM	0.002	0.006	mg/kg
1-METHYLNAPHTHALENE	90-12-0	SW8270CSIM	0.004	0.02	mg/kg
2-METHYLNAPHTHALENE	91-57-6	SW8270CSIM	0.004	0.02	mg/kg
2-CHLORONAPHTHALENE	91-58-7	SW8270CSIM	0.005	0.02	mg/kg
Semi-Volatile Organic Compounds					
ACENAPHTHENE	83-32-9	SW8270C	0.0054	0.0333	mg/kg
ACENAPHTHYLENE	208-96-8	SW8270C	0.0047	0.0333	mg/kg
ANTHRACENE	120-12-7	SW8270C	0.0059	0.0333	mg/kg
BENZIDINE	92-87-5	SW8270C	0.0626	1.67	mg/kg
BENZO(A)ANTHRACENE	56-55-3	SW8270C	0.0059	0.0333	mg/kg
BENZO(B)FLUORANTHENE	205-99-2	SW8270C	0.0062	0.0333	mg/kg
BENZO(K)FLUORANTHENE	207-08-9	SW8270C	0.0059	0.0333	mg/kg
BENZO(G,H,I)PERYLENE	191-24-2	SW8270C	0.0061	0.0333	mg/kg
BENZO(A)PYRENE	50-32-8	SW8270C	0.0062	0.0333	mg/kg
BIS(2-CHLOROETHOXY) METHANE	111-91-1	SW8270C	0.0100	0.333	mg/kg
BIS(2-CHLOROETHYL) ETHER	111-44-4	SW8270C	0.0110	0.333	mg/kg
2,2'-OXYBIS(1-CHLORO)PROPANE	108-60-1	SW8270C	0.0144	0.333	mg/kg
4-BROMOPHENYL PHENYL ETHER	101-55-3	SW8270C	0.0117	0.333	mg/kg
2-CHLORONAPHTHALENE	91-58-7	SW8270C	0.0059	0.0333	mg/kg
4-CHLOROPHENYL PHENYL ETHER	7005-72-3	SW8270C	0.0116	0.333	mg/kg
CHRYSENE	218-01-9	SW8270C	0.0066	0.0333	mg/kg
DIBENZ(A,H)ANTHRACENE	53-70-3	SW8270C	0.0092	0.0333	mg/kg
1,2-DICHLOROBENZENE	95-50-1	SW8270C	0.0099	0.333	mg/kg
1,3-DICHLOROBENZENE	541-73-1	SW8270C	0.0101	0.333	mg/kg
1,4-DICHLOROBENZENE	106-46-7	SW8270C	0.0099	0.333	mg/kg
3,3'-DICHLOROBENZIDINE	91-94-1	SW8270C	0.0123	0.333	mg/kg
2,4-DINITROTOLUENE	121-14-2	SW8270C	0.0096	0.333	mg/kg
2,6-DINITROTOLUENE	606-20-2	SW8270C	0.0109	0.333	mg/kg
FLUORANTHENE	206-44-0	SW8270C	0.0060	0.0333	mg/kg
FLUORENE	86-73-7	SW8270C	0.0054	0.0333	mg/kg
HEXACHLOROBENZENE	118-74-1	SW8270C	0.0118	0.333	mg/kg
HEXACHLOROBUTADIENE	87-68-3	SW8270C	0.0112	0.333	mg/kg
HEXACHLOROCYCLOPENTADIENE	77-47-4	SW8270C	0.0175	0.333	mg/kg
HEXACHLOROETHANE	67-72-1	SW8270C	0.0131	0.333	mg/kg

SUMMARY OF TARGET PQLS FOR SOIL SAMPLES
CIRCLE K 1461, SEATTLE, WA

Analyte	CAS Number	Method	MDL	Target PQL	Units
INDENO(1,2,3-C,D)PYRENE	193-39-5	SW8270C	0.0094	0.0333	mg/kg
ISOPHORONE	78-59-1	SW8270C	0.0102	0.333	mg/kg
NAPHTHALENE	91-20-3	SW8270C	0.0084	0.0333	mg/kg
NITROBENZENE	98-95-3	SW8270C	0.0116	0.333	mg/kg
N-NITROSODIMETHYLAMINE	62-75-9	SW8270C	0.0494	0.333	mg/kg
N-NITROSODIPHENYLAMINE	86-30-6	SW8270C	0.0252	0.333	mg/kg
N-NITROSODI-N-PROPYLAMINE	621-64-7	SW8270C	0.0111	0.333	mg/kg
PHENANTHRENE	85-01-8	SW8270C	0.0066	0.0333	mg/kg
BENZYL BUTYL PHTHALATE	85-68-7	SW8270C	0.0104	0.333	mg/kg
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	SW8270C	0.0422	0.333	mg/kg
DI-N-BUTYL PHTHALATE	84-74-2	SW8270C	0.0114	0.333	mg/kg
DIETHYL PHTHALATE	84-66-2	SW8270C	0.0110	0.333	mg/kg
DIMETHYL PHTHALATE	131-11-3	SW8270C	0.0706	0.333	mg/kg
DI-N-OCTYL PHTHALATE	117-84-0	SW8270C	0.0225	0.333	mg/kg
PYRENE	129-00-0	SW8270C	0.0065	0.0333	mg/kg
1,2,4-TRICHLOROBENZENE	120-82-1	SW8270C	0.0104	0.333	mg/kg
4-CHLORO-3-METHYLPHENOL (CRESOL)	59-50-7	SW8270C	0.0108	0.333	mg/kg
2-CHLOROPHENOL	95-57-8	SW8270C	0.0110	0.333	mg/kg
2,4-DICHLOROPHENOL	120-83-2	SW8270C	0.0097	0.333	mg/kg
2,4-DIMETHYLPHENOL	105-67-9	SW8270C	0.0087	0.333	mg/kg
4,6-DINITRO-2-METHYLPHENOL	534-52-1	SW8270C	0.0755	0.333	mg/kg
2,4-DINITROPHENOL	51-28-5	SW8270C	0.0779	0.333	mg/kg
2-NITROPHENOL	88-75-5	SW8270C	0.0119	0.333	mg/kg
4-NITROPHENOL	100-02-7	SW8270C	0.0104	0.333	mg/kg
PENTACHLOROPHENOL	87-86-5	SW8270C	0.0090	0.333	mg/kg
PHENOL	108-95-2	SW8270C	0.0134	0.333	mg/kg
2,4,6-TRICHLOROPHENOL	88-06-2	SW8270C	0.0107	0.333	mg/kg
Metals					
ARSENIC	7440-38-2	SW6010B	0.52	2	mg/kg
BARIUM	7440-39-3	SW6010B	0.09	0.5	mg/kg
CADMIUM	7440-43-9	SW6010B	0.05	0.5	mg/kg
CHROMIUM, TOTAL	7440-47-3	SW6010B	0.13	1	mg/kg
LEAD	7439-92-1	SW6010B	0.21	0.5	mg/kg
SELENIUM	7782-49-2	SW6010B	0.76	2	mg/kg
SILVER	7440-22-4	SW6010B	0.13	1	mg/kg
Mercury					
MERCURY	7439-97-6	SW7471A	0.02	0.04	mg/kg
Conventional Parameters					
BROMIDE	24959-67-9	SW9056A	3.55	10	mg/kg
CHLORIDE (AS CL)	16887-00-6	SW9056A	9.20	20	mg/kg
FLUORIDE	16984-48-8	SW9056A	0.86	2	mg/kg
NITROGEN, NITRATE (AS N)	N_NO3	SW9056A	0.56	10	mg/kg
NITRITE	NO2	SW9056A	0.51	10	mg/kg
NITROGEN, NITRATE-NITRITE	NO3NO2N	SW9056A	1.06	20	mg/kg
SULFATE (AS SO4)	14808-79-8	SW9056A	12.9	50	mg/kg
PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS P)	PORTHO	SW9056A	0.36	1	mg/kg
PHOSPHORUS, TOTAL	7723-14-0	SW9056A	0.79	2	mg/kg
GUANIDINE NITRATE	506-93-4	SW9056MOD	2.15	5	mg/kg
PHOSPHATE, ORTHO-	14265-44-2	SW9056A	1.19	5	mg/kg
Organochlorine Pesticides					
ALDRIN	309-00-2	SW8081	0.004	0.02	mg/kg
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	319-84-6	SW8081	0.004	0.02	mg/kg
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	319-85-7	SW8081	0.004	0.02	mg/kg
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	319-86-8	SW8081	0.003	0.02	mg/kg
GAMMA-BHC (LINDANE)	58-89-9	SW8081	0.003	0.02	mg/kg
CHLORDANE	12789-03-6	SW8081	0.103	0.3	mg/kg
4,4'-DDD	72-54-8	SW8081	0.004	0.02	mg/kg
4,4'-DDE	72-55-9	SW8081	0.004	0.02	mg/kg
4,4'-DDT	50-29-3	SW8081	0.006	0.02	mg/kg
DIELDRIN	60-57-1	SW8081	0.003	0.02	mg/kg

SUMMARY OF TARGET PQLS FOR SOIL SAMPLES
CIRCLE K 1461, SEATTLE, WA

Analyte	CAS Number	Method	MDL	Target PQL	Units
ENDOSULFAN	115-29-7	SW8081	0.004	0.02	mg/kg
BETA ENDOSULFAN (ENDOSULFAN II)	33213-65-9	SW8081	0.003	0.02	mg/kg
ENDOSULFAN SULFATE	1031-07-8	SW8081	0.004	0.02	mg/kg
ENDRIN	72-20-8	SW8081	0.004	0.02	mg/kg
ENDRIN ALDEHYDE	7421-93-4	SW8081	0.003	0.02	mg/kg
ENDRIN KETONE	53494-70-5	SW8081	0.007	0.02	mg/kg
HEXACHLOROBENZENE	118-74-1	SW8081	0.003	0.02	mg/kg
HEPTACHLOR	76-44-8	SW8081	0.004	0.02	mg/kg
HEPTACHLOR EPOXIDE	1024-57-3	SW8081	0.003	0.02	mg/kg
METHOXYCHLOR	72-43-5	SW8081	0.005	0.02	mg/kg
TOXAPHENE	8001-35-2	SW8081	0.124	0.4	mg/kg
Herbicides					
2,4-D (2-(2,4-DICHLOROPHENOXY)-ACETIC ACID))	94-75-7	SW8151	0.01	0.07	mg/kg
DALAPON	75-99-0	SW8151	0.01	0.07	mg/kg
2,4-DB (4-(2,4-DICHLOROPHENOXY)BUTANOIC ACID)	94-82-6	SW8151	0.03	0.07	mg/kg
DICAMBA	1918-00-9	SW8151	0.02	0.07	mg/kg
DICHLORPROP	120-36-5	SW8151	0.02	0.07	mg/kg
DINOSEB	88-85-7	SW8151	0.01	0.07	mg/kg
MCPA (2-METHYL-4-CHLOROPHENOXY ACETIC ACID)	94-74-6	SW8151	0.44	6.5	mg/kg
MCPP (2-(2-METHYL-4-CHLOROPHENOXY) PROPANOIC ACID)	93-65-2	SW8151	0.37	6.5	mg/kg
2,4,5-T (ACETIC ACID, (2,4,5-TRICHLOROPHENOXY)-)	93-76-5	SW8151	0.01	0.07	mg/kg
2,4,5-TP (SILVEX)	93-72-1	SW8151	0.01	0.07	mg/kg
Polychlorinated Biphenyls (PCBs)					
PCB-1016 (Aroclor 1016)	12674-11-2	SW8082	0.01	0.034	mg/kg
PCB-1221 (Aroclor 1221)	11104-28-2	SW8082	0.01	0.034	mg/kg
PCB-1232 (Aroclor 1232)	11141-16-5	SW8082	0.01	0.034	mg/kg
PCB-1242 (Aroclor 1242)	53469-21-9	SW8082	0.01	0.034	mg/kg
PCB-1248 (Aroclor 1248)	12672-29-6	SW8082	0.01	0.017	mg/kg
PCB-1254 (Aroclor 1254)	11097-69-1	SW8082	0.01	0.017	mg/kg
PCB-1260 (Aroclor 1260)	11096-82-5	SW8082	0.01	0.017	mg/kg
Herbicides by HPLC					
2,4-D (2-(2,4-dichlorophenoxy)-acetic acid))	94-75-7	SW8321	0.005	0.02	mg/kg
DALAPON	75-99-0	SW8321	0.003	0.02	mg/kg
2,4-DB (4-(2,4-dichlorophenoxy)butanoic acid)	94-82-6	SW8321	0.009	0.02	mg/kg
DICAMBA	1918-00-9	SW8321	0.004	0.02	mg/kg
DICHLORPROP	120-36-5	SW8321	0.003	0.02	mg/kg
DINOSEB	88-85-7	SW8321	0.002	0.02	mg/kg
MCPA (2-methyl-4-chlorophenoxy acetic acid)	94-74-6	SW8321	0.003	0.02	mg/kg
MCPP (2-(2-methyl-4-chlorophenoxy) propanoic acid)	93-65-2	SW8321	0.002	0.02	mg/kg
2,4,5-T (Acetic acid, (2,4,5-trichlorophenoxy)-)	93-76-5	SW8321	0.007	0.02	mg/kg
2,4,5-TP (SILVEX)	93-72-1	SW8321	0.002	0.02	mg/kg

Notes:

(a) Target Practical Quantitation Level (PQL) values presented in this table are based on method reporting limits (MRLs) from Pace National Analytical, Mt Juliet, Tennessee (Pace).

(b) PQLs from selected analytical laboratories to be verified prior to start of field sampling activities.

Abbreviations:

na = not applicable for matrix
µg/kg = micrograms per kilogram
µg/L = micrograms per liter
mg/kg = milligrams per kilogram
pg/g = picograms per gram
PQL = Practical Quantitation Limit
MRL = Method Reporting Limit
SIM = Select Ion Monitoring

TABLE 9

SUMMARY OF TARGET PQLS FOR VAPOR AND SOIL GAS SAMPLES
CIRCLE K 1461, SEATTLE, WA

Analyte	CAS Number	Method	MDL	PQL	Units
Volatile Organic Compounds					
ACETONE	67-64-1	TO-15	0.58	1.25	ppbv
ALLYL CHLORIDE (3-CHLOROPROPENE)	107-05-1	TO-15	0.11	0.20	ppbv
BENZENE	71-43-2	TO-15	0.07	0.20	ppbv
BENZYL CHLORIDE	100-44-7	TO-15	0.06	0.20	ppbv
BROMODICHLOROMETHANE	75-27-4	TO-15	0.07	0.20	ppbv
BROMOFORM	75-25-2	TO-15	0.07	0.60	ppbv
BROMOMETHANE	74-83-9	TO-15	0.10	0.20	ppbv
1,3-BUTADIENE	106-99-0	TO-15	0.10	2.00	ppbv
CARBON DISULFIDE	75-15-0	TO-15	0.10	0.20	ppbv
CARBON TETRACHLORIDE	56-23-5	TO-15	0.07	0.20	ppbv
CHLOROBENZENE	108-90-7	TO-15	0.08	0.20	ppbv
CHLOROETHANE	75-00-3	TO-15	0.10	0.20	ppbv
CHLOROFORM	67-66-3	TO-15	0.07	0.20	ppbv
CHLOROMETHANE	74-87-3	TO-15	0.10	0.20	ppbv
2-CHLOROTOLUENE	95-49-8	TO-15	0.08	0.20	ppbv
CYCLOHEXANE	110-82-7	TO-15	0.08	0.20	ppbv
DIBROMOCHLOROMETHANE	124-48-1	TO-15	0.07	0.20	ppbv
1,2-DIBROMOETHANE	106-93-4	TO-15	0.07	0.20	ppbv
1,2-DICHLOROBENZENE	95-50-1	TO-15	0.13	0.20	ppbv
1,3-DICHLOROBENZENE	541-73-1	TO-15	0.18	0.20	ppbv
1,4-DICHLOROBENZENE	106-46-7	TO-15	0.06	0.20	ppbv
1,2-DICHLOROETHANE	107-06-2	TO-15	0.07	0.20	ppbv
1,1-DICHLOROETHANE	75-34-3	TO-15	0.07	0.20	ppbv
1,1-DICHLOROETHENE	75-35-4	TO-15	0.08	0.20	ppbv
CIS-1,2-DICHLOROETHENE	156-59-2	TO-15	0.08	0.20	ppbv
TRANS-1,2-DICHLOROETHENE	156-60-5	TO-15	0.07	0.20	ppbv
1,2-DICHLOROPROPANE	78-87-5	TO-15	0.08	0.20	ppbv
CIS-1,3-DICHLOROPROPENE	10061-01-5	TO-15	0.07	0.20	ppbv
TRANS-1,3-DICHLOROPROPENE	10061-02-6	TO-15	0.07	0.20	ppbv
1,4-DIOXANE (P-DIOXANE)	123-91-1	TO-15	0.08	0.20	ppbv
ETHANOL	64-17-5	TO-15	0.27	1.25	ppbv
ETHYLBENZENE	100-41-4	TO-15	0.08	0.20	ppbv
4-ETHYLTOLUENE	622-96-8	TO-15	0.08	0.20	ppbv
TRICHLOROFLUOROMETHANE	75-69-4	TO-15	0.08	0.20	ppbv
DICHLORODIFLUOROMETHANE	75-71-8	TO-15	0.14	0.20	ppbv
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE (FREON 113)	76-13-1	TO-15	0.08	0.20	ppbv
1,2-DICHLOROTETRAFLUOROETHANE	76-14-2	TO-15	0.09	0.20	ppbv
N-HEPTANE	142-82-5	TO-15	0.10	0.20	ppbv
HEXACHLOROBUTADIENE	87-68-3	TO-15	0.11	0.63	ppbv
N-HEXANE	110-54-3	TO-15	0.21	0.63	ppbv
ISOPROPYLBENZENE	98-82-8	TO-15	0.08	0.20	ppbv
METHYLENE CHLORIDE	75-09-2	TO-15	0.10	0.20	ppbv
2-HEXANONE	591-78-6	TO-15	0.13	1.25	ppbv
METHYL ETHYL KETONE (2-BUTANONE)	78-93-3	TO-15	0.08	1.25	ppbv
METHYL ISOBUTYL KETONE (MIBK)	108-10-1	TO-15	0.08	1.25	ppbv
METHYL METHACRYLATE	80-62-6	TO-15	0.09	0.20	ppbv
METHYL TERT-BUTYL ETHER	1634-04-4	TO-15	0.06	0.20	ppbv
NAPHTHALENE	91-20-3	TO-15	0.35	0.63	ppbv
ISOPROPANOL	67-63-0	TO-15	0.26	1.25	ppbv
PROPYLENE	115-07-1	TO-15	0.09	1.25	ppbv

SUMMARY OF TARGET PQLS FOR VAPOR AND SOIL GAS SAMPLES
CIRCLE K 1461, SEATTLE, WA

Analyte	CAS Number	Method	MDL	PQL	Units
STYRENE	100-42-5	TO-15	0.08	0.20	ppbv
1,1,2,2-TETRACHLOROETHANE	79-34-5	TO-15	0.07	0.20	ppbv
TETRACHLOROETHENE (PCE)	127-18-4	TO-15	0.08	0.20	ppbv
TETRAHYDROFURAN	109-99-9	TO-15	0.07	0.20	ppbv
TOLUENE	108-88-3	TO-15	0.09	0.50	ppbv
1,2,4-TRICHLOROBENZENE	120-82-1	TO-15	0.15	0.63	ppbv
1,1,1-TRICHLOROETHANE	71-55-6	TO-15	0.07	0.20	ppbv
1,1,2-TRICHLOROETHANE	79-00-5	TO-15	0.08	0.20	ppbv
TRICHLOROETHENE (TCE)	79-01-6	TO-15	0.07	0.20	ppbv
1,2,4-TRIMETHYLBENZENE	95-63-6	TO-15	0.08	0.20	ppbv
1,3,5-TRIMETHYLBENZENE	108-67-8	TO-15	0.08	0.20	ppbv
2,2,4-TRIMETHYLPENTANE	540-84-1	TO-15	0.13	0.20	ppbv
VINYL CHLORIDE	75-01-4	TO-15	0.09	0.20	ppbv
BROMOETHENE (VINYL BROMIDE)	593-60-2	TO-15	0.09	0.20	ppbv
VINYL ACETATE	108-05-4	TO-15	0.12	0.20	ppbv
XYLENE, TOTAL	1330-20-7	TO-15	0.14	0.60	ppbv
XYLENE, M,P-	XYLENES1314	TO-15	0.14	0.40	ppbv
XYLENE, O-	95-47-6	TO-15	0.08	0.20	ppbv
TPH GC/MS LOW FRACTION	8006-61-9	TO-15	39.7	200	ppbv

Notes:

(a) Target Practical Quantitation Level (PQL) values presented in this table are based on method reporting limits (MRLs) from Pace National Analytical, Mt Juliet, Tennessee (Pace).

(b) PQLs from selected analytical laboratories to be verified prior to start of field sampling activities.

Abbreviations:

na = not applicable for matrix
ppbv = parts per billion by volume
PQL = Practical Quantitation Limit
MRL = Method Reporting Limit

SUMMARY OF TARGET PQLS FOR WATER SAMPLES
CIRCLE K 1461, SEATTLE, WA

Analyte	CAS Number	METHOD	MDL	Target PQL	Units
NWTPH-Gx					
TOTAL PETROLEUM HYDROCARBONS (TPH) (C6-C12)	TPHC6C12	NWTPHGX	31.6	100	ug/L
NWTPH-Dx without silica gel cleanup					
DIESEL RANGE ORGANICS	DRO2	NWTPHDX-SGT		200	ug/L
RESIDUAL RANGE ORGANICS	RRO	NWTPHDX-SGT		250	ug/L
Volatile Organic Compounds					
ACETONE	67-64-1	SW8260B	11.3	50	ug/L
ACROLEIN	107-02-8	SW8260B	2.54	50	ug/L
ACRYLONITRILE	107-13-1	SW8260B	0.671	10	ug/L
BENZENE	71-43-2	SW8260B	0.0941	1	ug/L
BROMOBENZENE	108-86-1	SW8260B	0.118	1	ug/L
BROMODICHLOROMETHANE	75-27-4	SW8260B	0.136	1	ug/L
BROMOFORM	75-25-2	SW8260B	0.129	1	ug/L
BROMOMETHANE	74-83-9	SW8260B	0.605	5	ug/L
N-BUTYLBENZENE	104-51-8	SW8260B	0.157	1	ug/L
SEC-BUTYLBENZENE	135-98-8	SW8260B	0.125	1	ug/L
TERT-BUTYLBENZENE	98-06-6	SW8260B	0.127	1	ug/L
CARBON TETRACHLORIDE	56-23-5	SW8260B	0.128	1	ug/L
CHLOROBENZENE	108-90-7	SW8260B	0.116	1	ug/L
DIBROMOCHLOROMETHANE	124-48-1	SW8260B	0.14	1	ug/L
CHLOROETHANE	75-00-3	SW8260B	0.192	5	ug/L
CHLOROFORM	67-66-3	SW8260B	0.111	5	ug/L
CHLOROMETHANE	74-87-3	SW8260B	0.96	2.5	ug/L
2-CHLOROTOLUENE	95-49-8	SW8260B	0.106	1	ug/L
4-CHLOROTOLUENE	106-43-4	SW8260B	0.114	1	ug/L
1,2-DIBROMO-3-CHLOROPROPANE (DBCP)	96-12-8	SW8260B	0.276	5	ug/L
1,2-DIBROMOETHANE	106-93-4	SW8260B	0.126	1	ug/L
DIBROMOMETHANE	74-95-3	SW8260B	0.122	1	ug/L
1,2-DICHLOROBENZENE	95-50-1	SW8260B	0.107	1	ug/L
1,3-DICHLOROBENZENE	541-73-1	SW8260B	0.11	1	ug/L
1,4-DICHLOROBENZENE	106-46-7	SW8260B	0.12	1	ug/L
DICHLORODIFLUOROMETHANE	75-71-8	SW8260B	0.374	5	ug/L
1,1-DICHLOROETHANE	75-34-3	SW8260B	0.1	1	ug/L
1,2-DICHLOROETHANE	107-06-2	SW8260B	0.0819	1	ug/L
1,1-DICHLOROETHENE	75-35-4	SW8260B	0.188	1	ug/L
CIS-1,2-DICHLOROETHENE	156-59-2	SW8260B	0.126	1	ug/L
TRANS-1,2-DICHLOROETHENE	156-60-5	SW8260B	0.149	1	ug/L
1,2-DICHLOROPROPANE	78-87-5	SW8260B	0.149	1	ug/L
1,1-DICHLOROPROPENE	563-58-6	SW8260B	0.142	1	ug/L
1,3-DICHLOROPROPANE	142-28-9	SW8260B	0.11	1	ug/L
CIS-1,3-DICHLOROPROPENE	10061-01-5	SW8260B	0.111	1	ug/L
TRANS-1,3-DICHLOROPROPENE	10061-02-6	SW8260B	0.118	1	ug/L
2,2-DICHLOROPROPANE	594-20-7	SW8260B	0.161	1	ug/L
DI-ISOPROPYL ETHER (DIPE)	108-20-3	SW8260B	0.105	1	ug/L
ETHYLBENZENE	100-41-4	SW8260B	0.137	1	ug/L
HEXACHLOROBUTADIENE	87-68-3	SW8260B	0.337	1	ug/L
ISOPROPYLBENZENE	98-82-8	SW8260B	0.105	1	ug/L
CYMENE (P-ISOPROPYLTOLUENE)	99-87-6	SW8260B	0.12	1	ug/L
METHYL ETHYL KETONE (2-BUTANONE)	78-93-3	SW8260B	1.19	10	ug/L
METHYLENE CHLORIDE	75-09-2	SW8260B	0.43	5	ug/L
METHYL ISOBUTYL KETONE (MIBK)	108-10-1	SW8260B	0.478	10	ug/L
METHYL TERT-BUTYL ETHER	1634-04-4	SW8260B	0.101	1	ug/L
NAPHTHALENE	91-20-3	SW8260B	1	5	ug/L
N-PROPYLBENZENE	103-65-1	SW8260B	0.0993	1	ug/L
STYRENE	100-42-5	SW8260B	0.118	1	ug/L
1,1,1,2-TETRACHLOROETHANE	630-20-6	SW8260B	0.147	1	ug/L
1,1,2,2-TETRACHLOROETHANE	79-34-5	SW8260B	0.133	1	ug/L
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE (FREON 113)	76-13-1	SW8260B	0.18	1	ug/L
TETRACHLOROETHENE (PCE)	127-18-4	SW8260B	0.3	1	ug/L
TOLUENE	108-88-3	SW8260B	0.278	1	ug/L

TABLE 10

SUMMARY OF TARGET PQLS FOR WATER SAMPLES
CIRCLE K 1461, SEATTLE, WA

Analyte	CAS Number	METHOD	MDL	Target PQL	Units
1,2,3-TRICHLOROBENZENE	87-61-6	SW8260B	0.23	1	ug/L
1,2,4-TRICHLOROBENZENE	120-82-1	SW8260B	0.481	1	ug/L
1,1,1-TRICHLOROETHANE	71-55-6	SW8260B	0.149	1	ug/L
1,1,2-TRICHLOROETHANE	79-00-5	SW8260B	0.158	1	ug/L
TRICHLOROETHENE (TCE)	79-01-6	SW8260B	0.19	1	ug/L
TRICHLOROFLUOROMETHANE	75-69-4	SW8260B	0.16	5	ug/L
1,2,3-TRICHLOROPROPANE	96-18-4	SW8260B	0.237	2.5	ug/L
1,2,4-TRIMETHYLBENZENE	95-63-6	SW8260B	0.322	1	ug/L
1,2,3-TRIMETHYLBENZENE	526-73-8	SW8260B	0.104	1	ug/L
1,3,5-TRIMETHYLBENZENE	108-67-8	SW8260B	0.104	1	ug/L
VINYL CHLORIDE	75-01-4	SW8260B	0.234	1	ug/L
XYLENE, TOTAL	1330-20-7	SW8260B	0.174	3	ug/L
Methane by RSK175					
Methane	74-82-8	RSK175		10	ug/L
Polycyclic Aromatic Hydrocarbons (PAHs) -SIM					
ANTHRACENE	120-12-7	SW8270CSIM	0.019	0.05	ug/L
ACENAPHTHENE	83-32-9	SW8270CSIM	0.019	0.05	ug/L
ACENAPHTHYLENE	208-96-8	SW8270CSIM	0.0171	0.05	ug/L
BENZO(A)ANTHRACENE	56-55-3	SW8270CSIM	0.0203	0.05	ug/L
BENZO(A)PYRENE	50-32-8	SW8270CSIM	0.0184	0.05	ug/L
BENZO(B)FLUORANTHENE	205-99-2	SW8270CSIM	0.0168	0.05	ug/L
BENZO(G,H,I)PERYLENE	191-24-2	SW8270CSIM	0.0184	0.05	ug/L
BENZO(K)FLUORANTHENE	207-08-9	SW8270CSIM	0.0202	0.05	ug/L
CHRYSENE	218-01-9	SW8270CSIM	0.0179	0.05	ug/L
DIBENZ(A,H)ANTHRACENE	53-70-3	SW8270CSIM	0.016	0.05	ug/L
FLUORANTHENE	206-44-0	SW8270CSIM	0.027	0.1	ug/L
FLUORENE	86-73-7	SW8270CSIM	0.0169	0.05	ug/L
INDENO(1,2,3-C,D)PYRENE	193-39-5	SW8270CSIM	0.0158	0.05	ug/L
NAPHTHALENE	91-20-3	SW8270CSIM	0.0917	0.25	ug/L
PHENANTHRENE	85-01-8	SW8270CSIM	0.018	0.05	ug/L
PYRENE	129-00-0	SW8270CSIM	0.0169	0.05	ug/L
1-METHYLNAPHTHALENE	90-12-0	SW8270CSIM	0.0687	0.25	ug/L
2-METHYLNAPHTHALENE	91-57-6	SW8270CSIM	0.0674	0.25	ug/L
2-CHLORONAPHTHALENE	91-58-7	SW8270CSIM	0.0682	0.25	ug/L
Semi-Volatile Organic Compounds					
ACENAPHTHENE	83-32-9	SW8270C	0.0886	1	ug/L
ACENAPHTHYLENE	208-96-8	SW8270C	0.0921	1	ug/L
ANTHRACENE	120-12-7	SW8270C	0.0804	1	ug/L
BENZIDINE	92-87-5	SW8270C	3.74	10	ug/L
BENZO(A)ANTHRACENE	56-55-3	SW8270C	0.199	1	ug/L
BENZO(B)FLUORANTHENE	205-99-2	SW8270C	0.13	1	ug/L
BENZO(K)FLUORANTHENE	207-08-9	SW8270C	0.12	1	ug/L
BENZO(G,H,I)PERYLENE	191-24-2	SW8270C	0.121	1	ug/L
BENZO(A)PYRENE	50-32-8	SW8270C	0.0381	1	ug/L
BIS(2-CHLOROETHOXY) METHANE	111-91-1	SW8270C	0.116	10	ug/L
BIS(2-CHLOROETHYL) ETHER	111-44-4	SW8270C	0.137	10	ug/L
2,2'-OXYBIS(1-CHLORO)PROPANE	108-60-1	SW8270C	0.21	10	ug/L
4-BROMOPHENYL PHENYL ETHER	101-55-3	SW8270C	0.0877	10	ug/L
2-CHLORONAPHTHALENE	91-58-7	SW8270C	0.0648	1	ug/L
4-CHLOROPHENYL PHENYL ETHER	7005-72-3	SW8270C	0.0926	10	ug/L
CHRYSENE	218-01-9	SW8270C	0.13	1	ug/L
DIBENZ(A,H)ANTHRACENE	53-70-3	SW8270C	0.0644	1	ug/L
1,2-DICHLOROBENZENE	95-50-1	SW8270C	0.0713	10	ug/L
1,3-DICHLOROBENZENE	541-73-1	SW8270C	0.132	10	ug/L
1,4-DICHLOROBENZENE	106-46-7	SW8270C	0.0942	10	ug/L
3,3'-DICHLOROBENZIDINE	91-94-1	SW8270C	0.212	10	ug/L
2,4-DINITROTOLUENE	121-14-2	SW8270C	0.0983	10	ug/L
2,6-DINITROTOLUENE	606-20-2	SW8270C	0.25	10	ug/L
FLUORANTHENE	206-44-0	SW8270C	0.102	1	ug/L
FLUORENE	86-73-7	SW8270C	0.0844	1	ug/L

SUMMARY OF TARGET PQLS FOR WATER SAMPLES
CIRCLE K 1461, SEATTLE, WA

Analyte	CAS Number	METHOD	MDL	Target PQL	Units
HEXACHLOROBENZENE	118-74-1	SW8270C	0.0755	1	ug/L
HEXACHLOROBUTADIENE	87-68-3	SW8270C	0.0968	10	ug/L
HEXACHLOROCYCLOPENTADIENE	77-47-4	SW8270C	0.0598	10	ug/L
HEXACHLOROETHANE	67-72-1	SW8270C	0.127	10	ug/L
INDENO(1,2,3-C,D)PYRENE	193-39-5	SW8270C	0.279	1	ug/L
ISOPHORONE	78-59-1	SW8270C	0.143	10	ug/L
NAPHTHALENE	91-20-3	SW8270C	0.159	1	ug/L
NITROBENZENE	98-95-3	SW8270C	0.297	10	ug/L
N-NITROSODIMETHYLAMINE	62-75-9	SW8270C	0.998	10	ug/L
N-NITROSODIPHENYLAMINE	86-30-6	SW8270C	2.37	10	ug/L
N-NITROSODI-N-PROPYLAMINE	621-64-7	SW8270C	0.261	10	ug/L
PHENANTHRENE	85-01-8	SW8270C	0.112	1	ug/L
BENZYL BUTYL PHTHALATE	85-68-7	SW8270C	0.765	3	ug/L
BIS(2-ETHYLHEXYL) PHTHALATE	117-81-7	SW8270C	0.895	3	ug/L
DI-N-BUTYL PHTHALATE	84-74-2	SW8270C	0.453	3	ug/L
DIETHYL PHTHALATE	84-66-2	SW8270C	0.287	3	ug/L
DIMETHYL PHTHALATE	131-11-3	SW8270C	0.26	3	ug/L
DI-N-OCTYL PHTHALATE	117-84-0	SW8270C	0.932	3	ug/L
PYRENE	129-00-0	SW8270C	0.107	1	ug/L
1,2,4-TRICHLOROBENZENE	120-82-1	SW8270C	0.0698	10	ug/L
4-CHLORO-3-METHYLPHENOL (CRESOL)	59-50-7	SW8270C	0.131	10	ug/L
2-CHLOROPHENOL	95-57-8	SW8270C	0.133	10	ug/L
2,4-DICHLOROPHENOL	120-83-2	SW8270C	0.102	10	ug/L
2,4-DIMETHYLPHENOL	105-67-9	SW8270C	0.0636	10	ug/L
4,6-DINITRO-2-METHYLPHENOL	534-52-1	SW8270C	1.12	10	ug/L
2,4-DINITROPHENOL	51-28-5	SW8270C	5.93	10	ug/L
2-NITROPHENOL	88-75-5	SW8270C	0.117	10	ug/L
4-NITROPHENOL	100-02-7	SW8270C	0.143	10	ug/L
PENTACHLOROPHENOL	87-86-5	SW8270C	0.313	10	ug/L
PHENOL	108-95-2	SW8270C	4.33	10	ug/L
2,4,6-TRICHLOROPHENOL	88-06-2	SW8270C	0.1	10	ug/L
Metals					
ARSENIC	7440-38-2	SW6020	0.25	1	ug/L
ARSENIC,DISSOLVED	7440-38-2	SW6020	0.25	1	ug/L
BARIUM	7440-39-3	SW6020	0.381	2	ug/L
BARIUM, DISSOLVED	7440-39-3	SW6020	0.381	2	ug/L
CADMIUM	7440-43-9	SW6020	0.16	0.5	ug/L
CADMIUM,DISSOLVED	7440-43-9	SW6020	0.16	0.5	ug/L
CHROMIUM, TOTAL	7440-47-3	SW6020	0.54	1	ug/L
CHROMIUM,DISSOLVED	7440-47-3	SW6020	0.54	1	ug/L
IRON	7439-89-6	SW6020	220	5000	ug/L
IRON,DISSOLVED	7439-89-6	SW6020	220	5000	ug/L
LEAD	7439-92-1	SW6020	0.24	1	ug/L
LEAD,DISSOLVED	7439-92-1	SW6020	0.24	1	ug/L
MANGANESE, DISSOLVED	7439-96-5	SW6020		25	ug/L
SELENIUM	7782-49-2	SW6020	0.38	1	ug/L
SELENIUM,DISSOLVED	7782-49-2	SW6020	0.38	1	ug/L
SILVER	7440-22-4	SW6020	0.31	0.5	ug/L
SILVER,DISSOLVED	7440-22-4	SW6020	0.31	0.5	ug/L
Mercury					
MERCURY	7439-97-6	SW7470A	0.1	0.2	ug/L
MERCURY,DISSOLVED	7439-97-6	SW7470A	0.1	0.2	ug/L
Conventional Parameters					
ALKALINITY, TOTAL (AS CACO3)	ALK	SM2320B	8450	20000	ug/L
TURBIDITY	TURBIDITY	A2130B	0.20	0.4	NTU
NITROGEN, NITRATE-NITRITE	NO3NO2N	E353.2	50	100	ug/L

SUMMARY OF TARGET PQLS FOR WATER SAMPLES
CIRCLE K 1461, SEATTLE, WA

Analyte	CAS Number	METHOD	MDL	Target PQL	Units
Anions					
BROMIDE	24959-67-9	SW9056A	353	1000	ug/L
CHLORIDE (AS CL)	16887-00-6	SW9056A	379	1000	ug/L
FLUORIDE	16984-48-8	SW9056A	64	150	ug/L
NITROGEN, NITRATE (AS N)	N_NO3	SW9056A	48	100	ug/L
NITRITE	NO2	SW9056A	42	100	ug/L
PHOSPHATE, ORTHO-	14265-44-2	SW9056A	0	100	ug/L
SULFATE (AS SO4)	14808-79-8	SW9056A	594	5000	ug/L
GUANIDINE NITRATE	506-93-4	SW9056MOD	98	500	ug/L
CHLORATE	14866-68-3	SW9056A	24	50	ug/L
Polychlorinated Biphenyls (PCBs)					
PCB-1016 (Aroclor 1016)	12674-11-2	SW8082	0.01981	0.5	ug/L
PCB-1221 (Aroclor 1221)	11104-28-2	SW8082	0.02443	0.5	ug/L
PCB-1232 (Aroclor 1232)	11141-16-5	SW8082	0.02133	0.5	ug/L
PCB-1242 (Aroclor 1242)	53469-21-9	SW8082	0.02424	0.5	ug/L
PCB-1248 (Aroclor 1248)	12672-29-6	SW8082	0.01354	0.5	ug/L
PCB-1254 (Aroclor 1254)	11097-69-1	SW8082	0.01813	0.5	ug/L
PCB-1260 (Aroclor 1260)	11096-82-5	SW8082	0.0146	0.5	ug/L
Herbicides by HPLC					
2,4-D (2-(2,4-DICHLOROPHENOXY)-ACETIC ACID))	94-75-7	SW8321	1.0026	2	ug/L
DALAPON	75-99-0	SW8321	0.6214	2	ug/L
2,4-DB (4-(2,4-DICHLOROPHENOXY)BUTANOIC ACID)	94-82-6	SW8321	1.0014	2	ug/L
DICAMBA	1918-00-9	SW8321	0.5477	2	ug/L
DICHLORPROP	120-36-5	SW8321	0.3665	2	ug/L
DINOSEB	88-85-7	SW8321	0.6385	2	ug/L
MCPA (2-METHYL-4-CHLOROPHENOXY ACETIC ACID)	94-74-6	SW8321	0.3629	2	ug/L
MCPP (2-(2-METHYL-4-CHLOROPHENOXY) PROPANOIC ACID)	93-65-2	SW8321	0.3233	2	ug/L
2,4,5-T (ACETIC ACID, (2,4,5-TRICHLOROPHENOXY)-)	93-76-5	SW8321	0.5725	2	ug/L
2,4,5-TP (SILVEX)	93-72-1	SW8321	0.8068	2	ug/L
Herbicides					
2,4-D (2-(2,4-dichlorophenoxy)-acetic acid))	94-75-7	SW8151	0.547	2	ug/L
DALAPON	75-99-0	SW8151	0.344	2	ug/L
2,4-DB (4-(2,4-dichlorophenoxy)butanoic acid)	94-82-6	SW8151	0.302	2	ug/L
DICAMBA	1918-00-9	SW8151	0.245	2	ug/L
DICHLORPROP	120-36-5	SW8151	1.04	2	ug/L
DINOSEB	88-85-7	SW8151	0.25	2	ug/L
MCPA (2-methyl-4-chlorophenoxy acetic acid)	94-74-6	SW8151	13.1	100	ug/L
MCPP (2-(2-methyl-4-chlorophenoxy) propanoic acid)	93-65-2	SW8151	66	100	ug/L
2,4,5-T (Acetic acid, (2,4,5-trichlorophenoxy)-)	93-76-5	SW8151	0.258	2	ug/L
2,4,5-TP (SILVEX)	93-72-1	SW8151	0.335	2	ug/L
Organochlorine Pesticides					
ALDRIN	309-00-2	SW8081	0.0198	0.05	ug/L
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	319-84-6	SW8081	0.0172	0.05	ug/L
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	319-85-7	SW8081	0.0208	0.05	ug/L
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	319-86-8	SW8081	0.015	0.05	ug/L
GAMMA-BHC (LINDANE)	58-89-9	SW8081	0.0209	0.05	ug/L
CHLORDANE	12789-03-6	SW8081	0.0198	5	ug/L
4,4'-DDD	72-54-8	SW8081	0.0177	0.05	ug/L
4,4'-DDE	72-55-9	SW8081	0.0154	0.05	ug/L
4,4'-DDT	50-29-3	SW8081	0.0198	0.05	ug/L
DIELDRIN	60-57-1	SW8081	0.0162	0.05	ug/L
ENDOSULFAN	115-29-7	SW8081	0.016	0.05	ug/L
BETA ENDOSULFAN (ENDOSULFAN II)	33213-65-9	SW8081	0.0164	0.05	ug/L
ENDOSULFAN SULFATE	1031-07-8	SW8081	0.0217	0.05	ug/L
ENDRIN	72-20-8	SW8081	0.0161	0.05	ug/L
ENDRIN ALDEHYDE	7421-93-4	SW8081	0.0237	0.05	ug/L
ENDRIN KETONE	53494-70-5	SW8081	0.0219	0.05	ug/L
HEXACHLOROBENZENE	118-74-1	SW8081	0.0176	0.05	ug/L

SUMMARY OF TARGET PQLS FOR WATER SAMPLES
CIRCLE K 1461, SEATTLE, WA

Analyte	CAS Number	METHOD	MDL	Target PQL	Units
HEPTACHLOR	76-44-8	SW8081	0.0148	0.05	ug/L
HEPTACHLOR EPOXIDE	1024-57-3	SW8081	0.0183	0.05	ug/L
METHOXYCHLOR	72-43-5	SW8081	0.0193	0.05	ug/L
TOXAPHENE	8001-35-2	SW8081	0.168	0.5	ug/L

Notes:

(a) Target Practical Quantitation Level (PQL) values presented in this table are based on method reporting limits (MRLs) from Pace National Analytical, Mt Juliet, Tennessee (Pace).

(b) PQLs from selected analytical laboratories to be verified prior to start of field sampling activities.

Abbreviations:

na = not applicable for matrix

μg/L = micrograms per liter

PQL = Practical Quantitation Limit

MRL = Method Reporting Limit

SIM = Select Ion Monitoring

TABLE 11

SAMPLING CONTAINERS, PRESERVATION, AND HOLDING TIMES
CIRCLE K 1461, SEATTLE, WA

Sampling Container, Preservation and Holding Times					
Matrix	**Analyte**	**Method**	**Container(s) per sample**	**Preservation**	**Holding Time**
Solid	% Moisture	SM 2540G	1 - 8oz glass jar	4 ± 2°C	14 days
Solid	Volatile Organic Compounds (VOCs)	EPA 8260B	1 - 40-mL amber jar	4 ± 2°C, Methanol	14 days
Solid	Gasoline-Range Organics (GRO)	NWTPH-Gx (gasoline extended)	1 - 40-mL amber jar	4 ± 2°C, Methanol	14 days
Solid	Semivolatile Organic Compounds (SVOCs)	EPA 8270E	1 - 8oz glass jar	4 ± 2°C	14 days extraction / 40 days analyzed
Solid	Polycyclic Aromatic Hydrocarbons (PAHs)	EPA 8270E-SIM	1 - 8oz glass jar	4 ± 2°C	14 days extraction / 40 days analyzed
Solid	Diesel- and Oil-Range Organics (DRO and ORO)	NWTPH-Dx (diesel extended) without Silica Gel Cleanup	1 - 8oz glass jar	4 ± 2°C	14 days extraction / 40 days analyzed
Solid	Metals (arsenic, barium, cadimium, chromium, lead, selenium, silver)	EPA 6010B	1 - 8oz glass jar	4 ± 2°C	6 months
Solid	Metals (mercury)	EPA 7471A	1 - 8oz glass jar	4 ± 2°C	28 days
Solid	TCLP Leachate (metals)	EPA 1311	1 - 8oz glass jar	4 ± 2°C	6 months (28 days mercury)
Solid	Polychlorinated Biphenyls (PCBs)	EPA 8082	1 - 8oz glass jar	4 ± 2°C	365 days extraction / 40 days analyzed
Solid	Organochlorine Pesticides	EPA 8081	1 - 8oz glass jar	4 ± 2°C	14 days extraction / 40 days analyzed
Solid	Chlorinated herbicides	EPA 8151	1 - 8oz glass jar	4 ± 2°C	14 days extraction / 40 days analyzed
Water	Volatile Organic Compounds (VOCs)	EPA 8260B	3 x 40 mL glass vials	4 ± 2°C, HCl	14 days
Water	Gasoline-Range Organics (GRO)	NWTPH-Gx (gasoline extended)	2 x 40 mL glass vials	4 ± 2°C, HCl	14 days
Water	Diesel- and Oil-Range Organics (DRO and ORO)	NWTPH-Dx (diesel extended) without Silica Gel Cleanup	2 x 40 mL glass vials	4 ± 2°C, HCl	14 days extraction / 40 days analyzed
Water	Nitrate	EPA 353.2	1 – 250 mL HDPE	4 ± 2°C, H2SO4	28 days
Water	Orthophosphate	EPA 365.1	1 – 100 mL glass	4 ± 2°C	48 hours
Water	Nonpolar Fat, Oil, and Grease (FOG)	EPA 1664, Revision A or B	2 - 1000 mL glass	4 ± 2°C, HCl	28 days
Water	Semivolatile Organic Compounds (SVOCs)	EPA 8270E	2 - 100 mL amber glass	4 ± 2°C	7 days extraction / 40 days analyzed
Water	Polycyclic Aromatic Hydrocarbons (PAHs)	EPA 8270E-SIM	2 - 40 mL vials	4 ± 2°C	7 days extraction / 40 days analyzed
Water	Total Metals (arsenic, barium, cadimium, chromium, lead, selenium, silver)	EPA 6020	1 – 250 mL HDPE	4 ± 2°C, HNO3	180 days
Water	Total Metals (mercury)	EPA 7470A	1 – 250 mL HDPE	4 ± 2°C, HNO3	28 days
Water	Polychlorinated Biphenyls (PCBs)	EPA 8082	2 - 100 mL amber glass	4 ± 2°C	365 days
Water	Organochlorine Pesticides	EPA 8081	2 - 100 mL amber glass	4 ± 2°C	7 days
Solid	Chlorinated herbicides	EPA 8151	1 - 8oz glass jar	4 ± 2°C	7 days extraction / 40 days analyzed
Air	Volatile Organic Compounds (VOCs)	TO-15	Summa Canister	Not applicable	30 days

Notes:
PAHs = polycyclic aromatic hydrocarbons
PCBs = polychlorinated biphenyls
TCLP = Toxicity Characteristic Leaching Procedure

Chemical Preservatives:
HCl = hydrochloric acid
NaOH = sodium hydroxide
ZnAc = zinc acetate
H2SO4 = sulfuric acid
HNO3 = nitric acid

Figures

\\kjc.local\KJC-Root\KJ-Office\FWY\Data\Projects\2016\1696010.00 WA DOE Circle K Site Assessment\GIS\Events\20210517_DataGapsTM\Figure1_VicinityMapv2.mxd

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors,

Legend

Site Location

N

0 200 400

Scale: Feet

Note:
1. All locations are approximate.

Kennedy Jenks

Former Circle K Site
Seattle, Washington

Site Location and Vicinity Map

K/J 2196008*00

Figure 1

Path: H:\GIS_CloudProjects\WA DOE\Circle K\SAP\Figure2_SiteMap.mxd ©2022 Kennedy/Jenks Consultants

Legend

- Existing Well
- Existing Well to be Used for Extraction/Injection
- New Extraction/Injection Well
- New Slant Well
- New Vapor Monitoring Pin
- Parcel Boundary

Notes:
1. All locations are approximate.

Kennedy Jenks

Former Circle K Site
Seattle, Washington

Well Locations Map

K/J 2196008*00

Figure 2

Legend

- Existing Well
- Existing Well to be Used for Extraction/Injection
- New Extraction/Injection Well
- New Slant Well
- New Vapor Monitoring Pin
- Parcel Boundary
- Approximate Extent of Gasoline-Range Organics and/or Benzene in Groundwater above MTCA Method A Cleanup Levels
- Approximate Extent of Gasoline-Range Organics and/or Benzene in Soil above MTCA Method A Cleanup Levels

Notes:
1. All locations are approximate.
2. GRO = gasoline range organics
3. CUL = clean up levels

N

0 15 30

Scale: Feet

Kennedy Jenks

Former Circle K Site
Seattle, Washington

Approximate Extents of GRO and Benzene Impacts to Soil and Groundwater

K/J 2196008*00

Figure 3

Appendix A

Standard Operating Guidelines

Title: **Environmental Data Collection**

Document Number: **SOG-001**

Revision Number: **0**

Reviewed: ______________________ 12/1/2023
Quality Control Manager Date

Approved: ______________________ 12/1/2023
Project Manager Date

1. Purpose

The objective of this Standard Operating Guideline (SOG) is to set criteria for content entry and form of field logbooks, identify the minimum information that should be collected on field sampling log sheets, and provide quality assurance/quality control (QA/QC) during environmental data collection.

2. Scope

This guideline is applicable during all Engineering/Remediation Resources Group, Inc. (ERRG) projects requiring environmental data collection.

3. References

U.S. Environmental Protection Agency (EPA), 2001. "Environmental Investigations Standard Operating Procedures and Quality Assurance Manual." 980 College Station Road, Athens, Georgia. November. Online Address: <https://nepis.epa.gov/>.

EPA, 2005. "Uniform Federal Policy for Quality Assurance Project Plans, Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs – Part 1: UFP-QAPP Manual." Final, Version 1. EPA-505-B-04-900A. Intergovernmental Data Quality Task Force. March 2005. Online Address: <https://www.epa.gov/fedfac/uniform-federal-policy-quality-assurance-project-plans-evaluating-assessing-and-documenting>.

EPA, 2012. "Uniform Federal Policy for Quality Assurance Project Plans, Optimized UFP-QAPP Worksheets." 505-B-04-900A. Intergovernmental Data Quality Task Force. March. Online Address: <https://www.epa.gov/fedfac/optimized-uniform-federal-policy-quality-assurance-project-plans-worksheets>.

EPA, 2020. "Contract Laboratory Program Guidance for Field Samplers." OLEM 9240.0-51 / USEPA 540-R-20-005. Office of Superfund Remediation and Technology Innovation. November. Online Address: <https://www.epa.gov/clp/clp-information-field-samplers>.

Nielsen Environmental Field School, 1997. "Field Notebook Guidelines."

4. Definition of Terms

Site Logbook — Logbook that is an index of all activities performed at the site. Specific entries are summaries of each day's activities and are part of the project file.

Field Logbook — Logbooks used at field sites that contain detailed information on-site activities, including dates, times, personnel names, activities conducted, equipment used, weather conditions, etc. Field logbooks are used by a variety of different field personnel and are part of the project file.

Sample — A part of a larger lot, usually a volume, area, period or population.

Grab Sample — An individual sample collected from a single location at a specific time or period of time.

Composite Sample — series of discrete, equal samples (or "aliquots") which are combined or "composited." A composite sample represents the average characteristics of the population under consideration.

De-ionized Water — Water that has been treated by passing it through a standard de-ionizing resin column. At a minimum, the finished water should contain no detectable heavy metals or other inorganic compounds (i.e., at or above analytical detection limits) as defined by a standard Inductively Coupled Argon Plasma Spectrophotometer (ICP) (or equivalent) scan. De-ionized water obtained by other methods is acceptable, if it meets the above analytical criteria. Organic-free water may be substituted for de-ionized water.

Environmental sample — A sample collected to provide data regarding environmental processes, conditions, and effects of pollutants on human health and ecology.

Waste sample — A sample collected to provide data regarding the presence of pollutants in waste materials or processes.

5. Equipment

The following is an example list of equipment and supplies that may be used during environmental field activities:

- Field logbook and/or forms
- Site-specific plans
- Watch
- GPS receiver and handheld computer
- Digital camera
- Sample containers
- Disposable sampling equipment such as scoops and bailers
- Clean paper towels
- Waterproof black ink markers
- Ruler or tape measure

6. Responsibilities

6.1. PROCEDURE RESPONSIBILITY

The Project Quality Control Manager or Project Manager is responsible for maintenance, management, and revision of this SOG. Questions, comments, or suggestions about this SOG should be sent to the Project Quality Control Manager or Project Manager.

6.2. PROJECT RESPONSIBILITY

ERRG employees performing this task, or any portion thereof, are responsible for meeting the requirements of this procedure. ERRG employees conducting technical review of task performance also are responsible for following appropriate portions of this SOG.

For those projects where the activities of this SOG are conducted, the Project Manager, or designee, is responsible for ensuring that those activities are conducted in accordance with this and other appropriate procedures. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (i.e., check prints, calculations, reports, etc.) that the requirements of this SOG have been met. Such documentation shall be retained as part of the project file.

7. Procedure

7.1. FIELD LOGBOOK

7.1.1. General

Whenever possible, each site, as applicable, will have one current site logbook, which will serve as an index of all activities performed at the site. Making entries into the site logbook is initiated at the start of the first on-site activity. Summary entries are made for every day that on-site activities take place. The details of all field activities shall be recorded in separate field logbooks. Multiple field logbooks may be used depending upon the number of different types of field personnel conducting activities at the site. These field logbooks and the site logbook shall be made part of the project file.

Information recorded in field logbooks includes observations, data, calculations, time, weather, and descriptions of the data collection activity, methods, instruments, and results. Additionally, the field logbook may contain descriptions of wastes, biota, geologic material, and site features including sketches, maps, or drawings as appropriate.

7.1.2. Preparation

Site personnel responsible for maintaining field logbooks must be familiar with the SOGs for all tasks to be performed. The field logbook will be assigned to an individual responsible for its care and maintenance. Field logbooks are part of the project file and should remain with project documentation when not in use. Field logbooks shall be bound with lined, consecutively numbered pages. All pages must be numbered prior to initial use of the field logbook.

The following information shall be recorded inside the front cover of the field logbook:

- Person and organization to whom the book is assigned
- Phone number(s)
- Project start date
- Project name
- ERRG project number
- ERRG Personnel's Name
- Sequential book number (if applicable)

The first five pages of the field logbook shall be reserved for a table of contents. Mark the first page with the heading "Table of Contents" and enter the following:

TABLE OF CONTENTS

Date/Description	Page
(Start Date/Reserved for Table of Contents)	1-5

The remaining pages of the table of contents will be designated as such with "TOC" written on the top center of each page.

7.1.3. Site Activities

The following requirements must be met when using a field logbook:

- Record work, observations, quantities of materials, calculations, drawings, and related information directly in the field logbook. If data collection forms are specified by an activity-specific work plan, the information on the form need not be duplicated in the field logbook.
- Any forms used to record site information must be referenced in the field logbook.
- Information should be factual and unbiased.

- Do not start a new page until the previous one is full or has been marked with a single diagonal line so that additional entries cannot be made. Use both sides of each page.
- Write in black, indelible ink. Do not write in pencil unless working in wet conditions.
- Do not erase or blot out any entry. Before an entry has been signed and dated, changes may be made; however, care must be taken not to remove what was originally written. Indicate any deletion with a single line through the material to be deleted. A change should be initiated.
- Do not remove any pages from the field logbook.
- Do not use loose paper and copy into the field logbook later.
- Record sufficient information to completely document field activities.
- All entries should be neat and legible.

Specific requirements for field logbook entries include the following:

- Initial and date each page.
- Sign and date the final page of entries for each day.
- Initial and date all changes.
- If multiple site personnel will record information in the field logbook on the same day, then each person must sign out the field logbook by inserting the following:

  Above notes written by:

  ______________________________ (Sign Name)

  ______________________________ (Print Name)

  ______________________________ (Date)

- A new person recording information in the field logbook must sign and print his/her name before additional entries are made.
- Draw a diagonal line through the remainder of the final page at the end of the day.
- Record the following information on a daily basis:
  - Date and time
  - Name of the individual making the entry
  - Description of the activity being conducted including well, boring, sampling, and location number as appropriate
  - Unusual site conditions

- Weather conditions (i.e., temperature, cloud cover, precipitation, wind direction, and speed) and other pertinent data)
- People on site
- Level of personal protection to be used
- Arrival and departure time of site visitors
- Arrival and departure time of equipment
- Sample pickup (chain-of-custody form numbers, carrier, time)
- Sampling activities and sample log sheet numbers
- Start and completion of borehole, trench, and monitoring well installation or sampling activity
- Health and safety issues
- Instrumentation calibration details

Entries into the field logbook shall be preceded with the time of the observation. The field activities should be recorded frequently, particularly any events or measurements that are critical to the activity being logged. All measurements made and samples collected must be recorded unless otherwise documented by automatic methods (e.g., data logger) or on a separate form required by an operating procedure. In such cases, the field logbook must reference the automatic data record or form.

While sampling, record observations such as color and odor. Indicate the locations from which samples are being taken, sample identification numbers, the order of filling bottles, sample volumes, and parameters to be analyzed. If field duplicate samples are being collected, note the duplicate pair sample identification numbers. If samples are collected that will be used for matrix spike and matrix spike/matrix spike duplicate analysis, record that information in the field logbook.

A sketch of the activity location may be warranted. All maps or sketches made in the field logbook should have descriptions of the features shown. Maps and sketches should be oriented so that north is toward the top of the page and will include a direction indicator.

Other events and observations that should be recorded include (but are not limited to) the following:

- Changes in weather that impact field activities
- Subcontractor activities
- Deviations from procedures outlined in any governing documents, including the reason for the deviation
- Problems, downtime, or delays
- Upgrade or downgrade of personal protective equipment

7.1.4. Post-Site Activities

To guard against the loss of data due to damage or disappearance of field logbooks, copies of completed logbooks shall be securely stored at the local ERRG office.

At the conclusion of each activity or phase of site work, the individual responsible for the field logbook will ensure that all entries have been appropriately signed and dated, and that corrections were made properly (single lines drawn through incorrect information, then initialed, coded, and dated). The completed field logbook shall be submitted to the project file.

7.1.5. Restrictions and Limitations

Field logbooks constitute the official record of on-site technical work, investigations, and data collection activities. Their use, control, and ownership are restricted to activities pertaining to specific field operations conducted by ERRG personnel and their subcontractors. They are documents that may be used in court to indicate and defend dates, personnel, procedures, and techniques employed during site activities. Entries made in these field logbooks should be factual, clear, precise, and as objective as possible. Field logbooks, and entries within, are not to be used for personal use.

7.2. FIELD SAMPLING LOGSHEETS

Field sampling log sheets can be prepared to address the specific needs of each project. All field sampling log sheets shall be completed in black, indelible ink. Any corrections shall be made by crossing out the incorrect information with a single line and placing the edited data above or beside the incorrect data. The following information is the minimum that should be included on the field sampling log sheet:

7.2.1. Site Information

- Site name
- Project number
- Weather conditions

7.2.2. Sample Information

- Date
- Time of sample collection
- Name of field technician
- Media being sampled
- Sample location (sketch as appropriate)
- Associated photograph log number (as appropriate)

- GPS reading (as appropriate)
- Sample number
- Sample description
- Sample container and preservative (if any)
- Comments and observations (if any)
- QC samples collected

7.2.3. Equipment Information

- Equipment used to collect the sample
- Equipment decontamination technique
- Field instrument calibration
- Field instrument readings

7.2.4. Analytical

- Analysis to be performed
- Analytical laboratory

7.3. QUALITY ASSURANCE/QUALITY CONTROL

8. Field Sampling Quality Control Considerations

This section provides guidelines for establishing quality control procedures for sampling activities. Strict adherence to all the standard operating procedures outlined in this subsection forms the basis for an acceptable sampling quality assurance program.

8.1. EXPERIENCE REQUIREMENTS

There is no substitute for field experience. Field experience is gained by on the-job training using the "buddy" system. Each new employee will accompany an experienced employee on as many different types of field studies as possible. During this training period, the new employee will be permitted to perform all facets of field investigations, including sampling, under the direction and supervision of senior field personnel.

8.2. TRACEABILITY REQUIREMENTS

All sample collection and measurement activities will be traceable through field records to the person collecting the sample or making the measurement. All maintenance and calibration records for sampling and measurement equipment (where appropriate) will be kept so that they are similarly traceable.

8.3. FIELD SAMPLE CUSTODY PROCEDURES

A sample is in the custody of a field sampler, shipping agent, or analytical laboratory employee/sample custodian if:

- it is in his/her possession;
- it is in his/her view, after being in his/her possession;
- it was in his/her possession and then placed under lock and key; or
- it is maintained in a designated secure area.

8.3.1. Sample Labels

Sample labels convey information unique to each sample and thus serve to prevent misidentification of samples as specified in the ERRG SOG for Sample Packaging and Shipping (SOG-007). The field sampler shall attach a sample label to each sample container at the time of sampling. Labels should be completed with indelible ink and should be protected from water with clear tape. Any errors made on a sample label shall be corrected as described in the "Error Correction" section of this SOG. Each sample label shall note the following information:

- project identification, sampling location, and job number;
- name or initials of field sampler;
- sample identification (ID) number;
- analysis required and sample preservation (if applicable);
- sampling date; and
- local standard time of sample collection, using a 24-hour clock notation.

The field sampler is responsible for maintaining a field log that chronicles and summarizes all field activities performed during a given workday. Should an erroneous entry be made, the error shall be corrected as described in the "Error Correction" section of this SOG. Field logs shall include the following information at a minimum:

- sampling site;
- sampling location;

- sampling depth (below ground surface [bgs], if applicable);
- sample matrix;
- sample appearance;
- volume of sample collected;
- map of sample locations if possible;
- field measurements (if applicable);
- type of sampling equipment used;
- names of all individuals present during sampling;
- sample collection dates and times, using a 24-hour clock notation;
- sample ID numbers;
- type and number of sample containers used per sampling site;
- designation of quality control samples (e.g., blanks, splits, or duplicates); and
- analysis required and sample preservation (if applicable).

Logbooks are intended to provide sufficient information to enable participants or others to reconstruct events that occurred during field activities. The notes allow interested parties, not present in the field at the time of sampling, to obtain insight into the field conditions surrounding any particular sampling event, as well as the methodology used by the field samplers. Logbooks are also admissible as evidence in legal proceedings. As such, the logbook entries should be factual, detailed, and objective. All field log entries must be signed and dated by the sampler.

8.3.2. Chain-of-Custody

The field sampler shall fill out a COC record after each sample is collected as specified in the ERRG SOG for Sample Packaging and Shipping (SOG-007). The COC record is necessary to physically trace sample possession from the time of collection to submission to the laboratory. The record(s) shall be filled out once the sample is collected and shall contain the following information:

- project/contract number;
- project name and sampling site;
- site contact (e.g., Project Manager);
- names of field samplers and their signatures;
- sample ID number;
- sampling date;

- local standard time of sample collection, using a 24-hour clock notation;
- sample matrix;
- number of containers submitted for each sample;
- analyses requested;
- turnaround time requested for analyses;
- preservation of sample containers (if applicable);
- name and address of analytical laboratory;
- means of transmittal to the analytical laboratory or storage facility (including carrier and tracking number, if applicable); and
- any general comments, instructions to the analytical laboratory, or unusual circumstances. These may include:
    - indication that a particular sample was split with an owner, operator, or government agency;
    - instruction to the analytical laboratory to spike a sample;
    - indication of problems encountered during an attempt to transfer a sample; or
    - lack of preservation due "sample reaction."

General comments, instructions to the analytical laboratory, or unusual circumstances shall be recorded in the “Comments” or “Special Instructions” section of the COC. Should an error be made on the COC, the error shall be corrected as described in the “Error Correction” section of this SOG.

In the event that multiple analytical laboratories are used at a site, a separate COC record shall be completed for each laboratory or storage facility. Each COC record shall indicate the number of coolers transmitted to that particular laboratory or storage facility.

8.3.3. Custody Seals

Custody seals are used to detect whether samples have been subjected to tampering following sample collection and prior to the time of analysis as specified in the ERRG SOG for Sample Packaging and Shipping (SOG-007). The seal shall be attached in such a way that it is necessary to break the seal in order to open the container.

Coolers: Two or more custody seals shall also be affixed to the outside of the shipping container or cooler prior to shipment through a commercial carrier (e.g., Federal Express).

Sample Containers: Not all projects require custody seals on sample containers; however, when a custody seal is required, a signed and dated seal shall be affixed to each sample such that the seal must be broken to open the sample container.

8.3.4. Error Correction

All errors made on the sample label, in the logbook, or on the COC shall be corrected with a single line drawn through the error, followed by the entry of the correct information. The individual making the correction shall then initial the correction and indicate the date on which the correction was made. The erroneous information shall not be obliterated. If an error is discovered on a sample label that has been taped to protect it from water, the label shall be discarded and a new, correct label shall be affixed to the sample. Should an error be made on a custody seal, the seal shall be discarded, and a new seal shall be affixed to the sample container. A description of an error correction made to the sample label or COC shall be entered in the logbook.

8.4. TRANSFER OF CUSTODY IN GENERAL

The field sampler is personally responsible for the care and custody of the samples until they are transferred or shipped to the analytical laboratory. The COC, initiated by the field sampler during sampling, shall document only those samples it accompanies during shipment (i.e., the COC is the record of the contents of a particular cooler). All samples shall be accompanied by a field-completed COC.

The field sampler must relinquish the samples to a person; however, if this is not possible then the samples can be relinquished and placed under lock and key or into a designated secure area with controlled access. If samples are left in a designated secure area, then they will be separated from other samples in the same area by a physical barrier.

If samples are to be received by the laboratory or a courier the following day AND the field sampler will not be present at the time of pick-up then it is the field sampler's responsibility to find a technical person to be responsible for receiving the samples and then relinquishing them to the courier or lab.

8.4.1. Transfer of Custody for Shipment

There are two main routes to transfer samples to the analytical laboratory or storage facility:

- by land or air through a commercial shipping courier, or
- by land through a non-commercial courier, field samplers, or other responsible party to whom the samples can be relinquished directly.

Additionally, guidelines on sample packaging and shipping is specified in ERRG SOG for Sample Packaging and Shipping (SOG-007).

8.5. SAMPLE PRESERVATION

Preservatives required for routine analyses of samples collected are found in the Site-specific Sampling and Analysis Plan (SAP) or Quality Assurance Project Plan (QAPP). All chemical preservatives used will be supplied by the laboratory. All samples requiring preservation should be preserved immediately upon collection in the field. Records of sample preservation, including ice, will be documented in the field logbooks.

Samples that should not be preserved in the field are:

1. Those collected within a hazardous waste site that are known or thought to be highly contaminated with toxic materials which may be highly reactive. Barrel, drum, closed container, spillage, or other source samples from hazardous waste sites are not to be preserved with any chemical.
2. Those that have extremely low or high pH or samples that may generate potentially dangerous gases.

All samples preserved with chemicals will be clearly identified by indication on the sample tag, label, or container that the sample is preserved. If samples normally requiring preservation were not preserved, field records should clearly specify the reason. Samples shipped by air will not be preserved with nitric acid, hydrochloric acid, sodium hydroxide, or sulfuric acid in excess of the amount specified in the SAP/QAPP.

8.6. SAMPLE COLLECTION PRECAUTIONS

In order to prevent cross-contamination during sample collection, the following precautions at a minimum will be taken:

1. A clean pair of new, non-powdered, disposable latex gloves will be worn each time a different location is sampled, and the gloves should be donned immediately prior to sampling. The gloves should not come into contact with the media being sampled.
2. Sample containers for source samples or samples suspected of containing high concentrations of contaminants will be placed in separate plastic bags immediately after collecting, tagging, etc.
3. Sample collection activities should proceed progressively from the least suspected contaminated area to the most suspected contaminated area.
4. If possible, samples of known or suspected low concentrations and samples from the source or known or suspected high concentrations should be collected by different field teams. If different field teams cannot be used, the samples with known or suspected low concentrations should be collected first and placed in separate ice chests or shipping containers, if possible.
5. If possible, one member of the field sampling team should record all of the field notes, collect GPS data, etc., while the other member(s) collect the samples.

6. When sampling surface water and sediment at the same location, the water sample should always be collected before the sediment sample is collected.
7. Sampling equipment should be constructed of Teflon®, stainless steel, high-density polyethylene (HDPE), or glass that has been properly pre-cleaned according to the SOG for Equipment/Personnel Decontamination (SOG-008) or as required by the project specific SAP/QAPP.

Upon returning from the field, unused sample containers will be returned to the laboratory that provided them.

Opened bags or boxes of latex gloves returning from the field will be segregated from unopened gloves and will not be re-used for sample collection on other projects. Open bags or boxes of sampling materials that cannot be definitively determined to be clean will be disposed.

8.7. SAMPLE HANDLING AND MIXING

Once a sample has been collected, it may have to be transferred into separate containers for different analyses. Sample transfer should be done as soon as possible. If necessary, aqueous samples may be collected into a single, larger container for homogenization and transferred into individual sample containers. However, aqueous samples collected for volatile organic compounds, oil and grease, bacteria, sulfides, and phenols analyses may not be transferred using this procedure.

It is extremely important that waste (when appropriate), soil, and sediment samples be mixed thoroughly to ensure that the sample is representative of the sample media. The most common method of mixing is referred to as quartering. The quartering procedure should be performed as follows:

1. The material in the sample pan should be divided into quarters and each quarter should be mixed individually.
2. Two quarters should then be mixed to form halves.
3. The two halves should be mixed to form a homogenous matrix.

This procedure should be repeated several times until the sample is adequately mixed. If round bowls are used for sample mixing, adequate mixing is achieved by stirring the material in a circular fashion, reversing direction, and occasionally turning the material over.

8.8. SPECIAL HANDLING OF SAMPLES FOR VOLATILE ORGANIC COMPOUNDS ANALYSIS

Water samples to be analyzed for volatile organic compounds should be stored in 40-ml septum vials with screw cap. The vials should be completely filled to prevent volatilization, and extreme caution should be exercised when filling a vial to avoid any turbulence which could also produce volatilization. The sample should be carefully poured down the side of the vial to minimize turbulence. As a rule, it is best to gently pour the last few drops into the vial so that surface tension holds the water in a convex meniscus. The cap is then applied, and some overflow is lost, but the air space in the bottle is eliminated. After capping, turn the bottle over and tap it to check for bubbles. If a bubble or bubbles are present, the vial should be topped off using a minimal amount of sample to re-establish the meniscus. Care should be taken not to flush any preservative out of the vial during topping off. If, after topping off and capping the vial, bubbles are still present, a new vial should be obtained, and the sample re-collected.

8.9. SAMPLE STORAGE AND TRANSPORT

After collection, sample handling should be minimized. Field samplers should use extreme care to ensure that samples are not contaminated during storage. Collected samples are typically stored in coolers. To reduce the risk of cross contamination, smaller sample containers such as 8-ounce glass jars, 40-mL VOA vials, and one-liter amber bottles should be placed inside of sealed, plastic bags before being placed in the cooler. If ice is required for preservation of the samples, the ice should be contained in a plastic bag or some equivalent container to prevent the potential for cross contamination of the samples by water produced from melting ice. If ice is used, the coolers should be checked regularly, and water should be drained as needed. Custody of samples will be maintained according to the ERRG SOG for Sample Packaging and Shipping (SOG-007).

Samples will either be transported to the analytical laboratory by field samplers or shipped by a carrier. Shipping of samples will be conducted in accordance with the ERRG SOG for Sample Packaging and Shipping (SOG-007).

9. Quality Control Samples

Quality control samples are collected during field studies for various purposes, among which are to isolate site effects (control samples), to define background conditions (background sample), and to evaluate field/laboratory variability (spikes and blanks, trip blanks, duplicate, split samples, etc.). QC samples to be collected for the project are found in the SAP/QAPP.

9.1. EQUIPMENT BLANK

Purpose: Equipment Blanks are collected to evaluate field sampling procedures and equipment decontamination procedures.

Description: Equipment Blank samples consist of ASTM Type II water (analyte-free, deionized water) collected from a final rinse of sampling equipment after the decontamination procedure has been performed. ASTM Type II water is best obtained from the laboratory. If ASTM Type II water or equivalent is not available, then a Source Blank sample of the unused final rinse water must be submitted for analysis as described in Section 7.6. The Equipment Blank is analyzed by the same methods as the field samples. The procedures for collecting an Equipment Blank are as follows:

1. Decontaminate the equipment following the procedures in the SAP/QAPP.
2. Pour ASTM Type II water into, over or pump through the equipment.
3. Collect the water running off the equipment in the sample containers.
4. Seal and label the samples appropriately.
5. Place the samples in a cooler containing sufficient ice for storage or shipment.

Frequency: The frequency of collection will vary for each project but in general Equipment Blank samples will be collected at a rate of one sample per piece of sampling equipment per sampling team per day unless specified differently in the SAP/QAPP. Equipment Blank samples should be collected at least once per sampling event and anytime sampling procedures or personnel change.

9.2. FIELD DUPLICATE

Purpose: Field duplicate samples are used to assess error associated with sample heterogeneity, sample methodology and analytical procedures.

Description: Field duplicates consist of two samples of the same matrix collected at the same time and location (to the extent possible), using the same sampling techniques. Field duplicates will be analyzed for the same analytes as the original samples at the same laboratory.

Frequency: Field duplicates are collected at a frequency of 5% of the total samples or one duplicate for every twenty field samples collected. Additionally, a minimum of one duplicate per media, per event will be collected.

9.3. MATRIX SPIKE/MATRIX SPIKE DUPLICATES (MS/MSD)

Purpose: MS/MSD samples are used to measure the performance of the analytical method relative to the specific sample matrix of interest.

Description: An MS/MSD sample is an additional volume of a sample that is used by the laboratory to determine if there are interferences between the matrix and the analytical procedure. The analytical laboratory will spike the MS/MSD samples with known concentrations of target analytes and subject the sample to the entire analytical procedure in order to measure the appropriateness of the method for the matrix by measuring the spiked analyte recovery. MS/MSD results are an indication of any positive or negative influences of the sample matrix in the analytical procedure.

Frequency: MS/MSDs are collected at a frequency of 5 percent or one set of MS/MSD samples for every twenty field samples, unless otherwise indicated in the SAP/QAPP.

9.4. SOURCE BLANK

Purpose: Source Blank, also termed Field Blank, samples are used to verify the analyte-free water does not contain the analytes of concern for the site.

Description: Source Blank samples are collected from water used to rinse equipment at the site to verify it does not contain detectable concentrations of analytes of concern. Source Blank samples are collected when the water is not ASTM Type II water or there is no analytical data to verify the water is analyte-free. The Source Blank sample is analyzed for the same contaminants as the environmental samples at the site.

Frequency: Source blanks should be collected at a frequency of one per batch or lot of water used with a minimum of one per sampling event. Water purchased for decontamination typically has a batch or lot number on the container.

9.5. TEMPERATURE BLANKS

Purpose: Temperature Blanks are used by the laboratory to measure the temperature of the cooler upon arrival at the laboratory.

Description: A temperature blank is a container of tap water that is shipped in each cooler containing field samples and ice.

Frequency: Every cooler containing samples requiring refrigeration should have a Temperature blank.

9.6. TRIP BLANK

Purpose: Trip Blanks are used to check that VOCs and TPH-gas are not introduced to the collected samples during handling, storage, or shipment from the field to the laboratory.

Description: Trip Blanks are hydrochloric acid-preserved, ASTM Type II water (analyte-free, deionized water) prepared by the laboratory in 40-mL VOA vials that will be carried to the field, stored with samples collected for volatile analysis, and returned to the laboratory for volatile analysis. Trip Blanks will be analyzed for VOCs only, which includes BTEX. The laboratory will ship the trip blanks with the requested sample containers. If the Trip Blanks received from the laboratory contain visible bubbles, then the Trip Blank condition should be documented in the project files, field logs, and the lab should be contacted. The Trip Blank sample must remain with the VOC samples from the time the VOC sample is collected to the time it is received by the laboratory. The Trip Blank should be coded by the laboratory to reference back to a specific lot of sample containers and specific shipment. The Trip Blank is not to be opened by ERRG staff.

Frequency: A minimum of one trip blank will be submitted to the laboratory for analysis with every container of samples for VOC analysis.

Title:	**Field Equipment Calibration**
Document Number:	**SOG-002**
Revision Number:	**0**

Reviewed:	Quality Control Manager	12/1/2023 Date
Approved:	Project Manager	12/1/2023 Date

1. Purpose

This standard operating procedure (SOG) is intended to provide general guidance and methods for using a field meter to measure water quality parameters from groundwater or surface water that is being purged, sampled, or monitored.

2. Scope

This SOG is applicable to all ERRG projects where water quality monitoring is required using a water quality meter. The water quality meter may be a stand-alone meter or it may be a combined multi-probe unit used to measure temperature, pH, specific conductance, and other water quality parameters. The most common methods used for measuring water quality are instruments that measure in-situ parameters in one of the following two ways:

- Water is extracted from its source using a pump and measured in a flow-through cell or in some instances captured and then measured in individual aliquots. This method is preferred when monitoring wells are sampled for laboratory analysis of chemical parameters, and groundwater purging is required.
- The meter is submerged directly into the sample source, such as a monitoring well or surface water body, to collect in-situ monitoring parameters.

3. References

ASTM International, 2014. ASTM D6634M-14, "Standard Guide for Selection of Purging and Sampling Devices for Ground-Water Monitoring Wells."

ASTM International, 2019. ASTM D4448-01, "Standard Guide for Sampling Ground-Water Monitoring Wells."

U.S. Environmental Protection Agency (EPA), 2014. "Contract Laboratory Program Guidance for Field Samplers." OSWER 9200.2-147 / EPA-540-R-014-013. Office of Superfund Remediation and Technology Innovation. October. Online Address: <https://www.epa.gov/sites/production/files/2015-03/documents/samplers_guide.pdf>.

4. Definition of Terms

Water Quality Meter—A device used to measure specific field parameters indicative of water quality, such as temperature, pH, specific conductance, and other parameters. The meter may be a stand-alone unit or it may be a combined multi-probe unit.

Pump—An electric-, compressed air-, or inert gas-driven device that raises liquids by means of pressure or suction. The types of pumps that should be used for water quality monitoring should be chosen based on the well size and depth, the type of contaminants, and the specific factors affecting the overall performance of the sampling or monitoring effort. The types of pumps that may be used include centrifugal, peristaltic, centrifugal submersible, gas displacement, and bladder pumps.

pH—The negative log of the hydrogen ion concentration (-log10 [H+]); a measure of the acidity or alkalinity of a solution, numerically equal to 7 for neutral solutions, increasing with increasing alkalinity and decreasing with increasing acidity. The scale is 0 to 14.

Turbidity—A measure of overall water clarity determined by measurement of the degree to which light traveling through a water column is scattered by the suspended organic (including algae) and inorganic particles. Turbidity is commonly measured in nephelometric turbidity units (NTU) but may also be measured in jackson turbidity units (JTU).

Specific Conductance (SC)—A measure of how well water can conduct an electrical current. Conductivity increases with an increasing amount and mobility of ions such as chloride, nitrate, sulfate, phosphate, sodium, magnesium, calcium, and iron, and can be used as an indicator of water pollution. The unit of conductance is expressed as microsiemens (1/1,000,000 siemen) per centimeter, or µS/cm.

Oxidation-Reduction (Redox) Potential—A measure in volts of the affinity of a substance for electrons compared with hydrogen. Liquids that are more strongly electronegative than hydrogen (i.e., capable of oxidizing) have positive redox potentials. Liquids less electronegative than hydrogen (i.e., capable of reducing) have negative redox potentials.

Dissolved Oxygen (DO)—Refers to the amount of oxygen expressed as mg/L (milligram per liter) that is contained in water. The amount of oxygen that can be held by water depends on the water temperature, salinity, purity, and pressure.

Salinity—The amount of dissolved salts in water, generally expressed in parts per thousand (ppt).

5. Responsibilities

5.1. PROCEDURE RESPONSIBILITY

The Quality Control Manager or Project Manager is responsible for maintenance, management, and revision of this SOG. Questions, comments, or suggestions about this SOG should be sent to the Quality Control Manager or Project Manager.

5.2. PROJECT RESPONSIBILITY

ERRG employees performing this task, or any portion thereof, are responsible for meeting the requirements of this SOG. ERRG employees conducting technical review of task performance are also responsible for following appropriate portions of this SOG.

For those projects where the activities of this SOG are conducted, the Project Manager, or designee, is responsible for ensuring that those activities are conducted in accordance with this and other appropriate SOPs. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (i.e., daily logs, checkprints, calculations, reports, etc.) that the requirements of this SOP have been met. Such documentation shall be retained as part of the project file.

6. Procedure

6.1. EQUIPMENT

The following equipment is recommended for use in performing water quality measurements:

- Water quality meter(s) with a flow through cell (if desired)
- Spare parts such as alkaline batteries (if used) and sensor probes
- Pump and discharge hose and line for use with a flow-through cell
- Paper towels or lint-free wipes
- De-ionized water
- Sample gloves
- Calibration solutions for all parameters being measured; within expiration dates
- Plastic sheeting
- Logbook or log sheets

6.2. GENERAL INSTRUCTIONS

- Ensure that the measuring range of the instrument(s) encompasses the expected sample concentration or units.
- Before going into the field, locate all necessary field supplies such as de-ionized water, calibration solutions, decontamination supplies, and spare parts.
- Consult the instrument's operating manual as well as the project-specific sampling plan to verify that you have prepared the proper equipment and supplies to successfully complete the work.

6.3. CALIBRATION

Calibration must be performed at least once per day during operation. Calibrate the meter according to the instrument's operating manual. If sampling and monitoring is being performed for long periods of time, periodically check the instrument calibration using the operating manual's recommended frequency.

To avoid limiting the field personnel to one particular model, only general calibration instructions are presented in this procedure.

- Locate a clean, protected area in which to set up and calibrate the instrument. Ensure that sufficient supplies of de-ionized water, clean paper towels, buffer solutions, and standard solutions are available.
- Inspect the meter and probes for damage. Some of the probes are very delicate or have a thin membrane installed over the probe. Be careful when handling the meter and probes so as not to damage them. If damaged, replace probes in accordance with the instrument's operating manual or obtain a different meter.
- Turn on the meter and allow it to "warm-up" for the manufacturer-specified time (usually 15 to 30 minutes). Check the battery power to determine if the meter has sufficient power to operate for the monitoring period. Replace the batteries, if necessary.
- Calibrate the meter according to the instrument's operating manual. In general, calibration is performed by immersing the probe(s) in aliquots of calibration standard solution(s) and following certain meter keystrokes to set the calibration for each parameter. Do not immerse the probe into the stock container of the solution. Always transfer a small amount of the solution into a separate container to calibrate the probe(s). If calibrating for multiple parameters using more than one solution, be sure to wipe off and rinse the probe with de-ionized water between solutions.
- Recheck each parameter after calibration by immersing the probe into the calibration solution and reading it like a sample reading. If the agreement is not within 25 percent of the solution's known concentration, repeat the calibration process with a new solution aliquot.
- Discard the used calibration solution aliquots into an appropriate waste container when finished.
- Record the calibration data in the field logbook or log sheet.

6.4. OPERATION OF THE INSTRUMENT

- If using a flow-through cell system, attach the extraction pump and lines in accordance with the pump and meter manufacturer's instructions. Allow the lines to fill and the probes to become immersed before switching the instrument to its measurement mode.
- If using a down-hole system, allow a few minutes for the probe to stabilize before taking a reading.
- Operate the meter in accordance with the instrument's operating manual.

- Collect the field parameter reading(s) per the project requirements, and record them in a field logbook or on log sheets.
- Decontaminate the meter before collecting data from the next sample source. For a flow-through system, flush the lines with three line volumes of de-ionized water or replace with new ones between samples.

Title: **Soil Gas and Vapor Sampling**

Document Number: **SOG-003**

Revision Number: **0**

Reviewed: ______________________ 12/1/2023
Quality Control Manager — Date

Approved: ______________________ 12/1/2023
Project Manager — Date

Soil Gas and Vapor Sampling

1. Purpose

This standard operating procedure (SOG) provides the standard practice for performing process soil gas/vapor monitoring and sampling for soil vapor extraction (SVE), multi-phase extraction (MPE) system and air sparging (AS) remediation systems. This SOG includes the minimum required steps and quality checks that employees and subcontractors are to follow when performing the subject task.

2. Scope

This SOG describes Engineering/Remediation Resources Group, Inc. (ERRG) standards for measuring vacuum and pressure, temperature, and flow rate from treatment system process pipelines and equipment, from extraction and injection wells, and from dedicated monitoring points. This SOG also describes the standards for collecting soil gas/vapor samples for field screening and laboratory chemical analysis from treatment system process pipelines, extraction wells, and dedicated monitoring points. Practitioners should be advised that certain regulatory jurisdictions may prefer or specify sampling procedures that differ from those presented here or from standard U.S. Environmental Protection Agency (EPA) methods.

The following table presents typical and/or recommended monitoring and sampling parameters for each treatment process:

System Location	Monitoring Location	Matrix	Equipment	Field Parameter
SVE Wells and Vacuum Process Pipelines	Temperature Monitoring Points	Soil Vapor	Infrared thermometer	Temperature (°F or optional °C)
	Vacuum Monitoring Points		Portable digital manometer, Magnehelic® or oil-filled vacuum gauge	Vacuum (inches of water [in. water] or other units, Pascals/ pounds per square inch [psi])
	Flow Monitoring Points (all flow monitoring points must also have a vacuum or pressure measurement)		Differential pressure gauge (Digital manometer or averaging pitot tube)	Pressure difference (in. water/Pascals/psi) for flow calculation
			Air flow meter (fixed or portable) preferably portable, digital, intrinsically safe thermal anemometer	Velocity or Volumetric Flow Rate (ft/sec, optional m/sec or acfm or m^3/hr)
	Vapor Monitoring Points		PID or FID (from Tedlar® bag, if sample location under vacuum)	VOCs, calibrated to isobutylene or hexane, in parts per million by volume (ppmv) or parts per billion by volume (ppbv)

System Location	Monitoring Location	Matrix	Equipment	Field Parameter
MPE Wells	Vacuum Process Pipelines Vacuum Monitoring Points	Soil Vapor, Groundwater, Free Phase Liquid	Thermometer	Temperature (°F)[a]
			Portable digital manometer, Magnehelic® or oil-filled vacuum gauge	Vacuum (in. water/psi/Pascals)[a]
			Differential pressure Gauge or in-line air velocity or volumetric flow meter in liquid-free stream	Flow Rate (ft/sec or metric units)[a]
			PID or FID (from Tedlar® bag)	VOCs (ppmv/ppbv)[a]
Vapor Treatment System	Influent and Effluent	Soil Vapor	Thermometer	Temperature (°F)
			Portable digital manometer, Magnehelic® or oil-filled vacuum gauge	Pressure (psi/in. water/Pascals)
			Differential pressure gauge or in-line flow meter or volumetric flow meter in liquid-free stream	Flow Rate (ft/sec)
			PID or FID (from Tedlar® bag or as specified by regulatory agency or permit)	VOCs (ppmv/ppbv)
AS Wells	Pressure Process Pipelines Pressure Monitoring Well Points	Injection (ambient) Air	Pressure gauges	Pressure (psi/in. water/Pascals)
			Rotameter or portable thermal flow meter in isolated by-pass	Flow Rate (ft/sec or metric equivalent)
General Site	Within Site Boundaries	Ambient Air	Thermometer	Ambient air temp (°F)
			Barometer	Barometric pressure
		Groundwater	Interface probe	Groundwater Level Fluctuation

Notes:

a. Readings may be affected by moisture/liquids in the vapor stream. A moisture/vapor separator may be required at the inlet to the monitoring equipment to obtain accurate readings.

2.1. CONSIDERATIONS

Consult the specific procedures that are developed for each project where SVE, MPE, and AS are used. Most projects will have a site-specific Operation, Maintenance, and Monitoring (OM&M) Plan, which details requirements and procedures for safely operating the treatment process and provides specifics on the type and quantity of samples that are required for process sampling and monitoring. At a minimum, the following should be considered and reviewed when planning for process monitoring and sampling:

- Results of the monitoring and sampling are used to determine treatment system performance, including contaminant mass removal rates, actual radius of influence, and qualitative cleanup progress. Actual clean up progress is based on soil and groundwater sampling that is performed periodically and at the conclusion of the operation of the system.
- If sampling and monitoring are performed around electric-powered and motorized equipment. The OM&M Plan and the Health and Safety Plan should be reviewed prior to performing activities to understand the electrical and mechanical safety procedures.
- The OM&M Plan should be reviewed prior to monitoring, and sampling is performed to understand system operational procedures including system operational objectives, routine operational procedures, start-stop procedures, emergency shutdown procedures, monitoring and sample locations.
- The air permit regulations should be reviewed for the system to verify that the proper laboratory analysis, field monitoring, and reporting requirements are being performed.

3. References

U.S. Army Corps of Engineers, 1999. "Multi-Phase Air Sparging Extraction, EM-1110-1-4010." Washington, DC. June 1.

U.S. Army Corps of Engineers, 2002. "Soil Vapor Extraction and Bioventing, EM-1110-1-4001." Washington, DC. June 3.

U.S. Army Corps of Engineers, 2013. "In-Situ Air Sparging, EM-200-1-19." Washington, DC. December 31.

Leeson, A., P.C. Johnson, R.L. Johnson, C.M. Vogel, R.E. Hinchee, M. Marley, T. Peargrin, C.L. Bruce, I.L. Amerson, C.T. Coonfare, R.D. Gillespie, and D.B. McWhorter, 2002. Air Sparging Design Paradigm. Battelle Press. Columbus, Ohio. August 12.

ASTM International, 2016. D5092M-16 "Standard Practice for Design and Installation of Groundwater Monitoring Wells."

4. Definition of Terms

Soil Vapor Extraction (SVE)—The application of vacuum to a well screened primarily in the unsaturated vadose zone for the purpose of volatilizing and extracting volatile organic compounds (VOCs) or a portion of a semivolatile organic compound (SVOC) from the soil in the vapor phase.

Multi-Phase Extraction (MPE)—The vacuum-enhanced simultaneous extraction of contaminated soil vapor and subsurface liquids. The primary purpose of MPE is to extract volatile fractions of petroleum and chlorinated hydrocarbons from the subsurface vadose zone and capillary fringe in vapor phase, as well as volatile to non-volatile fractions of petroleum and chlorinated hydrocarbons in separate and dissolved-phase liquids from the shallow saturated zone.

Air Sparging—The application of pressurized ambient air to a well screened in the saturated zone for the purpose of volatilizing VOCs or a portion of an SVOC from the groundwater in the vapor phase.

Vadose Zone—The hydrogeological region extending from the soil surface to the top of the principal water table; commonly referred to as the “unsaturated zone.”

Capillary Fringe—The lower subdivision of the vadose zone immediately above the water table, in which the interstices are filled with water under pressure less than that of the atmosphere; being continuous with the water below the water table but held above it by surface tension.

Vapor Monitoring Point (VMP)—A well installed with screens in the subsurface vadose zone and used to monitor vacuum and pressures and not generally used for extraction or injection. The VMP is also used to collect vapor samples for field and laboratory analysis.

5. Responsibilities

5.1. PROCEDURE RESPONSIBILITY

The Quality Control Manager (QC) or Project Manager is responsible for maintenance, management, and revision of this SOG. Questions, comments, or suggestions on this technical SOG should be sent to the QC Manager or Project Manager.

5.2. PROJECT RESPONSIBILITY

ERRG employees performing this task, or any portion thereof, are responsible for meeting the requirements of this SOG. ERRG employees conducting technical review of task performance are also responsible for following appropriate portions of this SOG.

For those projects where the activities of this SOG are conducted, the Project Manager, or designee, is responsible for ensuring that those activities are conducted in accordance with this and other appropriate SOGs. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (i.e., daily logs, checkprints, calculations, reports, etc.) that the requirements of this SOG have been met. Such documentation shall be retained as project records.

6. Procedure

6.1. GENERAL REQUIREMENTS FOR VAPOR MONITORING AND SAMPLING

The following processes should be utilized to complete vapor monitoring and sampling activities for SVE, MPE, and AS applications:

- Data reporting
- Ambient air monitoring
- AS pressure measurement
- SVE/MPE vacuum measurement
- Vapor monitoring point pressure measurement
- Temperature measurement
- Flow rate monitoring

Descriptions of each of these processes are provided in subsections below.

6.1.1. Equipment and Supplies

The following equipment and supplies should be utilized to perform this task:

- Field logbook
- Field data forms
- Cooler with ice
- Magnehelic® vacuum gauge or portable digital vacuum, pressure, and pressure differential manometer or oil-filled gauges
- Thermometer (may be combined with other instruments)
- Barometer
- Rotameter (or portable digital thermal flow meter)
- Pressure gauges (oil-filled or portable digital manometer as above)
- Tygon® tubing (Teflon™ or nylon tubing may be specified for selected contaminants and applications)

6.1.2. Data Reporting

During all monitoring events, the following data should be recorded into the field logbook and appropriate log form for each monitoring activity completed. Please note that each monitoring activity will include additional information that will also be recorded.

- Monitoring and/or sample location
- Date and time collected
- Field Technician
- Parameters monitored and/or sample type collected

6.1.3. Ambient Air Monitoring

Temperature measurements are collected by reading the temperature shown on the thermometer directly. Barometric pressure readings are obtained by reading the pressure directly from the barometer. Both readings are then recorded in the appropriate logbook or form. Because temperature and barometric pressure do not change substantially in local regions, readings from nearby, similar National Weather Service, or military airfields can also be used if site data is not available.

6.1.4. Air Sparging Pressure Measurement

Pressure measurements on the air sparging wells should be made by reading the pressure directly from either the air sparging well headers or air sparging wells using a dial pressure gauge attached to a monitoring port. After the pressure is read, the value is recorded into the field logbook or appropriate vapor monitoring form.

6.1.5. Vacuum Measurement

Vacuum measurements from vacuum monitoring points should be made by attaching one end of an appropriately sized length of Tygon® tubing onto the monitoring and sampling port located on the VMP or well and the other end onto the hose barb present on the appropriate Magnahelic® gauge. The vacuum reading will then be read directly from the Magnahelic® gauge. This reading is recorded into the field logbook or appropriate vapor monitoring form.

6.1.6. Temperature Measurements

Temperature measurements of SVE/MPE/AS wells/process pipeline should be made by placing the end of the thermometer into the air stream at the monitoring port, or by directly reading a temperature gauge installed upstream and downstream of the blower, at the inlet and optional intermediate locations, and at the outlet of the vapor treatment system. After allowing the thermometer to equilibrate per the manufacturer instructions, the temperature reading should be read directly from the thermometer. This reading is recorded into the field logbook or appropriate vapor monitoring form.

6.1.7. Flow Rate Monitoring

Air Flow Monitoring Using a Pitot Tube (SVE, MPE, and AS Wells, Headers, and Effluent)

Air flow measurements at SVE/MPE/AS wells, headers (if required), and the system effluent should be made by attaching one end of an appropriately sized length of Tygon® tubing onto the pitot tube monitoring point and the other end onto the hose barb present on the appropriate differential pressure gauge. The flow rate will then be read directly in inches of water column. The reading will then be converted to feet per second using a conversion table. This information is recorded in the logbook or appropriate form.

Air Flow Monitoring Using a Rotameter (for use with Lower Flow Systems)

Air flow measurement at wells and headers (if required) can be made by directly reading the flow from a rotameter that is installed in-line. Where in-line meters are not installed, measurements can be made by diverting the air stream from an individual well or header through a rotameter. The rotameter will first be connected to in-line flow monitoring ports (using pneumatic quick couplings and appropriate hose) located before and after the ball valve at the top of the well or the ball valve located in-line on the header. The rotameter should be leveled after it is connected, and then the flow monitoring ports should be opened, and the inline ball valve should be closed. The flow rate will then be read directly in cubic feet per minute (cfm) from the rotameter. This information is recorded in the logbook or appropriate form.

Air Flow Monitoring Using a Thermal Flow Meter (for Portability and Precision)

Routine measurements of flow or measurements used as checks on fixed, in-line flow meters for quality assurance purposes can be accomplished with a portable, digital flow meter. These meters are very sensitive and amenable for flow measurement with a telescopic probe in a variety of pipe sizes and shapes. These meters also have a thermometer installed for use in internal flow calculations that may also be read on a digital screen for recording. All flow measurements, whether speeds or volumetric flow rates, must have an accompanying vacuum or pressure reading to correct for pressure-induced density differences to compute flow rates in standard cubic feet per minute or metric equivalents. Thermal flow mater measurements should be collected from a port located in a straight section of pipe at least 7.5 pipe diameters downstream and 3 pipe diameters upstream from anything that may cause a disturbance in air flow.

6.2. VAPOR MONITORING AND FIELD ANALYSES

The procedures described in the subsections below should be used to collect routine process vapor samples for field analyses.

6.2.1. Equipment and Supplies

The following equipment and supplies should be used to perform this task:

- PID
- Vacuum desiccator sampling kit (including a vacuum desiccator, pump, tubing, and Tedlar® or similar bag)
- Field logbook
- Field log forms

6.2.2. Sample Collection for Field Analysis

Vapor samples need to be collected from the system because many of the vapor parameters measured during vapor monitoring events cannot be monitored directly from system monitoring and sampling ports. Vapor samples are collected in 1-liter Tedlar® bags.

- An appropriate length of Tygon® tubing should be attached to the sampling and monitoring port (equipped with a 0.25-inch valve and barbed fitting or a quick connect fitting) such that the sampling equipment can be safety handled while collecting the sample. The sampling ports may be located on SVE wells, MPE wells, VMPs, and the process piping.
- Sampling with the system offline:
  - When sampling points from wells or VMPs, Tygon® tubing (or specified material) should be attached to a vacuum pump (skip this step when sampling the process discharge).
  - The well or VMP will then be purged of static air, by using the vacuum pump, for approximately 3-5 minutes prior to sample collection. Actual purge time will depend on the volume of air in the well and the rate of airflow through the vacuum pump. (skip this step when sampling the process discharge)
  - After the sample location is purged, a Tedlar® bag should be connected to the inside port of the vacuum desiccator and the bag valve opened. The desiccator is then closed, enclosing the bag inside the unit.
  - Tygon® tubing (or specified material) will then be used to connect the influent port on the desiccator to the sampling port on the wells, VMP, or discharge point.
  - Tygon® tubing (or specified material) will also be used to connect the vacuum pump to the effluent port on vacuum desiccator.

  - The vacuum pump will then be turned on and the sample valve located on the effluent port of the desiccator opened, allowing the Tedlar® bag to fill with vapor from the sample point. Please note that the SVE or MPE system needs to be operational when collecting a sample from the system effluent using this method.
  - After the Tedlar® bag is about one-half to three-quarters full, the desiccator valve is closed, and the vacuum pump is turned off.
- Sampling with the system online:
  - Samples will be collected at the appropriate manifold leg for each well or VMP from the system process piping.
  - The gate valve at the corresponding manifold leg will be partially closed to allow for collection of an extracted vapor sample along the system process piping.
  - Tygon® or other tubing will be attached to the sample port on the manifold leg.
- The valve on the Tedlar® bag is then closed and the bag then removed from the desiccator. The bag should be placed into a cooler with ice if field analyses are not immediately performed. The sample in the bag is typically analyzed for total VOCs (by PID).

6.2.3. Total VOC Measurements

A PID (Rae Systems MiniRae 3000, RKI GX-6000, or similar) is connected directly to the valve on the Tedlar® bag, containing the vapor sample. The Tedlar® bag valve is opened, and the properly calibrated instrument should be activated. The total VOC measurements (as ppmv or ppbv calibrated to isobutylene or hexane in accordance with site-specific plans) are read directly from the instrument display and recorded in the proper logbook or form. Correction factors can be used to convert measurements to other analytes of interest, if the instrument is calibrated using a different calibration analyte.

6.3. VAPOR SAMPLE COLLECTION FOR LABORATORY ANALYSES

The procedures described in the subsections below should be utilized to collect vapor samples for laboratory analyses.

6.3.1. Equipment and Supplies

- Tygon® tubing (or Teflon, nylon, or other specified material)
- Summa canister
- Vacuum pump
- Field logbook
- Field log forms

6.3.2. Sample Collection Procedure

Vapor sample collection for laboratory analysis procedures include the following:

- An appropriate length of Tygon® tubing (or other specified material) should be attached to the sampling and monitoring port (0.25-inch valve) such that the sampling equipment can be safely handled while collecting the sample. These ports usually are located on SVE wells, MPE wells, VMPs, at the inlet to the treatment system, and the system effluent.
- Sampling with the system offline:
  - When sampling points from wells or VMPs, Tygon® or other tubing should be attached from the sample port to a vacuum pump.
  - The well or VMP will then be purged of static air using the vacuum pump for approximately 5 minutes prior to sample collection. Actual purge time will depend on the volume of air in the well and the rate of airflow through the vacuum pump. (skip this step when sampling the system effluent).
  - After the well or VMP is purged, the vacuum pump should be disconnected from the Tygon® or other tubing.
  - The vacuum pressure in the summa canister is read and recorded from the gauge on the canister or a portable vacuum gauge is connected to measure the vacuum.
- Sampling with the system online:
  - Samples will be collected at the appropriate manifold leg for each well or VMP from the system process piping.
  - The gate valve at the corresponding manifold leg will be partially closed to allow for collection of an extracted vapor sample along the system process piping.
  - Tygon® or other tubing will be attached to the sample port on the manifold leg.
- The vacuum pressure in the summa canister is read and recorded from the gauge on the canister or a portable vacuum gauge is connected to measure the vacuum.
- The Summa canister will then be attached to the Tygon® or other tubing and the sampling port valve opened.
- The Summa canister valve will then be opened, releasing the vacuum within the canister (while leaving some residual vacuum in the canister that is recorded on the sampling form), causing a sample of air to be drawn into the canister.
- The Summa canister valve will then be closed, the reading on the vacuum gauge read and recorded (or a portable vacuum gauge is attached to measure the vacuum), and the sample submitted to the laboratory, unpreserved for analysis per requirements of the project's analytical program.
- All sampling information should be recorded in the logbook or appropriate log form.

Title: **Photoionization Detector Vapor Analyzer Procedures**

Document Number: **SOG-004**

Revision Number: **0**

Reviewed: ______________________ 12/1/2023
Quality Control Manager — Date

Approved: ______________________ 12/1/2023
Project Manager — Date

Photoionization Detector Vapor Analyzer Procedures

1. Purpose

This standard operating guideline (SOG) provides the procedures that will be followed by field staff for operation and calibration of a photoionization detector (PID) used for analyzing volatile organic compound (VOC) vapor concentrations in soil vapor points or from system sample ports. PIDs are additionally used for safety monitoring of ambient air and detecting leakage of volatiles. The most commonly used PID models include the MiniRAE 3000 and RKI GX-6000. Personnel responsible for using the PID should first read and thoroughly familiarize themselves with the instrument instruction manual.

2. Scope

This SOG describes standards for operation and calibration of PIDs for projects executed by ERRG. The SOG addresses technical requirements and required documentation.

3. References

These practices and information are useful in the operation and calibration of PIDs are presented in following references:

U.S Environmental Protection Agency. Environmental Investigations Standard Operating Procedures and Quality Assurance Manual (EISOPQAM). USEPA, Region 4, SESD, Enforcement and Investigations Branch, Athens, GA. November 2001.

4. Equipment

The following is an example list of equipment and supplies used during PID operation and calibration:

- PID
- Calibration Gas
- Regulator for calibration gas cylinder
- Approximately 6 inches of Teflon® tubing
- Tedlar bag (optional)
- Commercially supplied zero grade air (optional)
- Sharpie
- Battery charger
- Moisture traps

- PID manual
- Field logbook or data sheets

5. Responsibilities

5.1. PROCEDURE RESPONSIBILITY

The Quality Control Manager or Project Manager is responsible for maintenance, management, and revision of this SOG. Questions, comments, or suggestions about this SOG should be sent to the Quality Control Manager or Project Manager.

5.2. PROJECT RESPONSIBILITY

ERRG employees performing this task, or any portion thereof, are responsible for meeting the requirements of this procedure. ERRG employees conducting technical review of task performance also are responsible for following appropriate portions of this SOG.

For those projects where the activities of this SOG are conducted, the Project Manager, or designee, is responsible for ensuring that those activities are conducted in accordance with this and other appropriate procedures. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (i.e., checkprints, calculations, reports, etc.) that the requirements of this SOG have been met. Such documentation shall be retained as part of the project file.

6. PID Operation and Calibration

The PID is a non-specific vapor/gas detector. The unit generally consists of a hand-held probe that houses a PID, consisting of an ultraviolet (UV) lamp, two electrodes, and a small fan which pulls ambient air into the probe inlet tube. The probe is connected to a readout/control box that consists of electronic control circuits, a readout display, and the system battery. Units are available with UV lamps having an energy from 9.5 electron volts (eV) to 11.7 eV. The PID analyzer measures the concentration of trace gas present in the atmosphere by photoionization. Photoionization occurs when an atom or molecule absorbs a photon of sufficient energy to release an electron and become a positive ion. This will occur when the ionization potential of the molecule (in electron volts (eV)) is less than the energy of the photon. The source of photons is an ultraviolet lamp in the probe unit. Lamps are available with energy ratings ranging from 9.5 eV to 11.7 eV.

6.1. OPERATION

Turn on the unit and allow it to warm up. Check to see if the intake fan is functioning; if so, the probe will vibrate slightly and a distinct sound will be audible when holding the probe casing next to the ear. Also, verify on the readout display that the UV lamp is lit. Calibrate the instrument as described below, following the manufacturer's instructions. Record the calibration information in the field records. The instrument is now operational. Readings should be recorded in the field logbook or field sheets. When the PID is not being used or between monitoring intervals, the unit may be switched off to conserve battery power and UV lamp life; however, a "bump" test should be performed each time the unit is turned on and prior to taking additional measurements. To perform a bump test, connect the outlet tubing from a Tedlar bag containing a small amount of span gas to the inlet tubing on the unit and record the reading. If the reading is not within the tolerance specified in the project plan, the unit must be recalibrated. At the end of each day, recheck the calibration. The check will follow the same procedures as the initial calibration, except that no adjustment will be made to the instrument. Record the information in the field records. Recharge the battery after each use. When transporting, ensure that the instrument is packed in its stored condition in order to prevent damage.

6.2. CALIBRATION

Preliminary steps, such as battery charging, check-out, calibration, and maintenance should be conducted in a non-hazardous environment. The PID must be calibrated in order to display concentrations in units equivalent to ppm or ppb, depending on the model. First a supply of zero air (ambient air or from a supplied source), containing no ionizable gases or vapors is used to set the zero point. A span gas, containing a known concentration of a photoionization gas or vapor, is then used to set the sensitivity. Calibrate the instrument according to the manufacturer's instructions. Record the instrument model and identification number, the initial and adjusted meter readings, the calibration gas composition and concentration, and the date and the time in the field records. If the calibration cannot be achieved or if the span setting resulting from calibration is 0.0, then the lamp must be cleaned.

Isobutylene of known concentration is the most common span gas used for PID calibration. The selected gas should have an ionization potential similar to that of the vapors to be monitored, if known. The concentration should be at 50- 75% of the range in which the instrument is to be calibrated. Refer to the manufacturer's instructions for the technical specifications of the instrument being used. The operating concentration range is typically 0.1 to 2,000 ppm isobutylene equivalent. Certain instrument models can operate at concentrations between 0 to 5,000 ppb.

6.3. TROUBLESHOOTING

One convenient method for periodically confirming instrument response is to hold the sensor probe next to the tip of a Sharpie. A significant reading should readily be observed. Air currents or drafts in the vicinity of the probe tip may cause fluctuations in readings. A fogged or dirty lamp, due to operation in a humid or dusty environment, may cause erratic or fluctuating readings. The PID should never be operated without the moisture trap in place. Moving the instrument from a cool or air-conditioned area to a warmer area may cause moisture to condense on the UV lamp and produce unstable readings. A zero reading on the meter should not necessarily be interpreted as an absence of air contaminants. The detection capabilities of the PID are limited to those compounds that will be ionized by the particular probe used. Many volatile compounds have a low odor threshold. A lack of meter response in the presence of odors does not necessarily indicate instrument failure. When high vapor concentrations enter the ionization chamber in the PID the unit can become saturated or "flooded". Remove the unit to a fresh air environment to allow the vapors to be completely ionized and purged from the unit.

Calibration of the PID will be conducted at the frequency specified in the site-specific sampling and analysis plan or the manufacturer's instructions. In the absence of project-specific guidance, calibration will be performed at the beginning of each day of sampling and will be checked at the end of the sampling day. The instrument should also be calibrated whenever instrument operation is suspect or drift is observed. The PID will sample a calibration gas of known concentration. The instrument must agree with the calibration gas within ±10%. If the instrument responds outside this tolerance, it must be recalibrated. Checks of the instrument response should be conducted periodically and documented in the field records.

Regardless of which gas is used for calibration, the instrument will respond to all analytes present in the sample that can be detected by the type of lamp used in the PID. Moisture will generate a positive interference in the concentration measured for a PID and is characterized by a slow increase in the reading as the measurement is made. Care must be taken to minimize uptake of moisture to the extent possible. Refer to the manufacturers' instructions for care, cleaning, and maintenance. Uptake of soil into the PID must be avoided as it will compromise instrument performance by blocking the probe, causing a positive interference, or dirtying the PID lamp. Refer to the manufacturers' instructions for care, cleaning, and maintenance. The user should listen to the pitch of the sampling pump. Any changes in pitch may indicate a blockage and corrective action should be initiated.

7. Data Management

Vapor monitoring with the PID will be documented in a bound field logbook, or on field forms, and retained in the project files, in accordance with SOG-001, Environment Data Collection. The following information is to be recorded:

- Project name and number.
- Date and time of use
- PID manufacturer, model, and serial number.
- Calibration gas used.
- Calibration check at beginning and end of day (meter readings before adjustment).
- Readings (monitoring data obtained).
- Any signs of suspect meter readings and corrective actions taken.
- Instrument checks and response verifications – e.g., battery check, sharpie response

Title:	**Measuring Groundwater Levels**
Document Number:	**SOG-005**
Revision Number:	**0**

Reviewed: ______________________ 12/1/2023
Quality Control Manager — Date

Approved: ______________________ 12/1/2023
Project Manager — Date

Measuring Groundwater Levels

1. Purpose

The purpose of this standard operating guidelines (SOG) is to provide methods and procedures for measurement of groundwater levels, as well as measuring light nonaqueous-phase liquids (LNAPL). Groundwater levels can either be determined as part of the well purging and sampling effort or be independently determined to construct groundwater elevation contour maps.

2. Scope

This SOG is applicable to all Engineering/Remediation Resources Group, Inc. (ERRG) projects where groundwater level measurements are taken.

3. References

U.S. Department of the Interior, 1977 (updated 1984). National Handbook of Recommended Methods for Water Data Acquisition, Chapter 2. Reston, Virginia.

U.S. Environmental Protection Agency, 1986. "RCRA Groundwater Monitoring Technical Enforcement Guidance Document." OSWER-9950.1. U.S. Government Printing Office, Washington, DC. Online Address: <https://www.epa.gov/enforcement/rcra-ground-water-monitoring-technical-enforcement-guidance-document-tegd>.

U.S. Environmental Protection Agency, 1991. "Environmental Compliance Branch, Standard Operating Procedures and Quality Assurance Manual." Region IV, Environmental Services Division. Athens, Georgia. U.S. Government Printing Office, Washington, DC.

U.S. Department of Defense, 2013. "DoD Environmental Field Sampling Handbook." Specifically Chapter 8, "Groundwater Sampling." April. Online Address: <https://denix.osd.mil/edqw/home/edqw-home-documents/manuals/dod-environmental-field-sampling-handbook/>.

4. Definition of Terms

Bailer—A cylindrical acrylic container with a valve at the bottom and open at the top, or a valve at both the top and the bottom, for admission of fluid. For the purposes of measuring nonaqueous phase liquids (NAPL) thickness, bailers must be constructed of a clear material. Some are available with graduated markings on the side to allow easier measurement. Bailers are used with a thin nylon line or "chord" made of similar material to lower the bailer into the well and retrieve liquid. Some bailers are supplied with a connectable measuring tape. Bailers used for product measurement or sampling should never be used for purging or collecting water samples.

DNAPL – Dense nonaqueous phase liquids (DNAPLs) are chemicals or mixtures of chemicals that have two major characteristics in common: they are heavier than water, and they are only slightly soluble in water. These two physical characteristics mean that when released into the environment in sufficient quantity, they can move through soils and groundwater until they encounter a sufficiently resistant layer that will impede further mass vertical movement and allow the liquid to pool. Depending upon the nature of the release, the movement through the subsurface soils can be quite complex as the liquid follows the path of least resistance. Examples of DNAPLs commonly consist of chlorinated hydrocarbon-based products such as perchloroethene, trichloroethene, 1,1,1-trichloroethane, etc., or mixtures thereof.

Double Check-Valve Bailer—A bailer containing a floating ball at the top and bottom of the bailer. Lowering the bailer into liquid causes both balls to float, allowing water or product to enter the cylinder. Raising the bailer through water or product causes both balls to settle, effectively trapping a discrete section of liquid so that it can be brought to the surface. Since a double check-valve bailer is preferred for sampling or measuring DNAPL because it is capable of isolating a discrete liquid sample at any depth within the well, it can also be used for both “floating” and “sinking” product.

Electronic Measuring Device—Commercial probe and cable designed to register a signal when the probe contacts water. The cable must have graduations to 0.01 feet. Commonly referred to as a groundwater level meter or sounder.

LNAPL - Light nonaqueous-phase liquids that have a lower volumetric mass density than water. Certain products form layers that float upon the water column and are termed light nonaqueous-phase liquid (LNAPL). LNAPL can commonly consist of petroleum-based product such as gasoline, diesel, jet fuel, and petroleum byproducts.

Measuring Tape—Steel or plastic tape with graduations to 0.01 feet. The tape shall not stretch more than 0.05 feet under normal use.

Product Probe (Interface Probe or Immiscible Layer Probe)—A device that can detect the presence of LNAPL, DNAPL, or water in wells and piezometers. The device is generally a probe connected to a measuring tape and a reel. The probe usually contains an electrical conductivity sensor to determine if the probe is in water and an optical sensor to determine if the probe is in liquid. The device contains a receiver with an audio and visual signal that indicates when phase changes occur.

Product—For the purposes of this SOG, product refers to nonaqueous phase liquid (NAPL) (i.e., one that does not contain water) that forms discrete immiscible layers in wells or piezometers.

Single Check-Valve Bailer—A bailer that is open at the top and contains a floating ball at the bottom. Lowering the bailer into liquid allows the bottom ball to float, allowing floating product (LNAPL) or water liquids to enter the bailer.

5. Responsibilities

5.1. PROCEDURE RESPONSIBILITY

The Quality Control (QC) or Project Manager is responsible for maintenance, management, and revision of this SOG. Questions, comments, or suggestions about this SOG should be sent to the QC Manager or Project Manager.

5.2. PROJECT RESPONSIBILITY

ERRG employees performing this task, or any portion thereof, are responsible for meeting the requirements of this SOG. ERRG employees conducting technical review of task performance are also responsible for following appropriate portions of this SOG.

For those projects where the activities of this SOG are conducted, the Project Manager, or designee, is responsible for ensuring that those activities are conducted in accordance with this and other appropriate SOGs. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (i.e., checkprints, calculations, reports, etc.) that the requirements of this SOG have been met. Such documentation shall be retained as part of the project records.

6. Procedure

The following equipment should be used when measuring groundwater levels:

- Decontaminated, weighted tape with graduations to 0.01 feet. The weight should be sufficient to ensure plumbness of the tape, but slender enough so as not to raise the water level significantly when submerged in the water.
- Decontaminated, commercial electronic water-level measuring device.
- Engineer's rule, graduated to 0.01 feet.
- Product probe and meter.

Two techniques are discussed below: the measuring tape method and the electronic method. This procedure also addresses the basic operation of two types of equipment used to measure NAPLs in monitoring wells and piezometers: product probes and clear bailers. Clear bailers include both single- and double-check valve bailers. Double-check valve bailers are recommended for measuring DNAPLs. The equipment should be capable of measuring to an accuracy of 0.01 feet.

Several problems can arise in measuring product thickness using either product probes or clear bailers. Product probes can malfunction or indicate a false level, particularly when measuring emulsified, degraded, weathered, or viscous product that sticks to the probe sensors. When the thickness of the product layer in a well is greater than the length of the bailer, the product layer cannot be accurately measured with the bailer. Consequently, it is recommended that both product probe and bailer methods be used to measure product thickness. Program- or project-specific work plans should identify the specific equipment to be used.

6.1. PLANNING AND PREPARATION

Planning and preparation for water level measurement activities involves the following:

- Field personnel conducting the measurements should review the project-specific documents (by the project manager or designee) regarding the objectives and scope of the activity that include pertinent information such as the following:
  - Specific wells and piezometers to be measured
  - Past measurement results in wells and piezometers to be measured, including presence and type(s) of NAPL. Water level measurements will be organized in terms of lowest to highest chemical concentration, based on past measurement results, to avoid cross contamination between wells.
  - Requirements of this SOG and pertinent project-specific requirements and procedures for groundwater levels/NAPL measurement
  - All pertinent health and safety issues and requirements, including those contained in the project-specific health and safety plan(s), relative to work activities
  - Any other pertinent historical and site information
- Field personnel conducting measurement activities should read the instructions and be familiar with the operation of product probes and other equipment to be used in the field.
- All field measurement equipment should be calibrated according to manufacturer's specifications and appropriate project-specific requirements and procedures.

6.2. WEIGHTED STEEL TAPE

The following procedure should be utilized when measuring groundwater levels with a measuring tape:

1. Prior to taking a measurement and between wells, decontaminate the probe and tape measure in accordance with applicable ERRG- and project-specific procedures. Such procedures should consider and incorporate manufacturer's recommendations for decontamination. It is important to conduct thorough decontamination to prevent cross-contamination between wells. During decontamination, all measuring tapes should be inspected for kinks, cracks, or tears and, if present, repaired or replaced with undamaged equipment.

2. Isolate your working zone in accordance with applicable project-specific requirements. Visually inspect the vault, box, or well casing to ensure that it is undamaged, properly labeled, and secured. Any damage or problems with the wellhead should be noted on appropriate forms.
3. Unlock the well cover and remove the cap from the well casing.
4. Locate the reference point on the well casing. Any well without permanent reference points or marks should be brought to the attention of the site supervisor or as per project-specific requirements.
5. Don a pair of clean gloves.
6. Slowly lower the weighted tape down the well until the bottom is reached, indicated by a bump and sudden slack in the line.
7. Straighten the tape out, remove the slack, and measure the distance at the reference point.
8. Record the reading at the reference point as depth to bottom (DTB).
9. Withdraw the tape from the well and record the reading at the wet and dry interface as depth to water (DTW).
10. Determine the water column length as (DTB-DTW) and record as the depth of the water column (DWC).
11. Dry and decontaminate the wetted portion of the tape.

6.3. ELECTRONIC MEASUREMENT

The following procedure should be utilized when measuring groundwater levels with an electronic water-level measuring device:

1. Prior to taking a measurement and between wells, decontaminate the probe and tape measure in accordance with applicable ERRG- and project-specific procedures. Such procedures should consider and incorporate manufacturer's recommendations for decontamination. It is important to conduct thorough decontamination to prevent cross-contamination between wells. During decontamination, all measuring tapes should be inspected for kinks, cracks, or tears and, if present, repaired or replaced with undamaged equipment.
2. Isolate your working zone in accordance with applicable project-specific requirements. Visually inspect the vault, box, or well casing to ensure that it is undamaged, properly labeled, and secured. Any damage or problems with the wellhead should be noted on appropriate forms.
3. Check for proper instrument response by inserting the probe in water. Fix or replace the instrument as needed.
4. Unlock the well cover and remove the cap from the well casing.
5. Locate the reference point on the well casing. Any well without permanent reference points or marks should be brought to the attention of the site supervisor or as per project-specific requirements.

6. Don a pair of clean gloves.
7. Slowly lower the probe down the well until the signal indicates that water has been contacted.
8. Record the reading at the reference point as DTW.
9. Withdraw the probe and repeat steps 5 and 6. Duplicate measurements should agree within 0.02 feet. If not, continue with measurements until 0.02 feet precision is achieved.
10. Lower the probe until the bottom of the well is reached, as indicated by slack in the line.
11. Pull slightly to remove the slack, measure at the reference point, and record as DTB. Many weighted electronic water level probes have the water level sensor at the top of the weight and have the zero depth at the sensor. The length from the bottom of the weight to water level sensor must be added to the DTB measurement.
12. Determine the water column length as (DTB-DTW) and record as DWC.
13. Remove the probe from the well and decontaminate it.

6.4. LIGHT NONAQUEOUS-PHASE LIQUIDS

Oil or other LNAPL may be floating on the water in selected wells. If so, measure the LNAPL level and the water level using the following procedures:

6.4.1. Product Probe Measurement Procedure

The standard or basic procedure for measuring NAPL thickness using a product probe is described below.

1. Prior to taking a measurement and between wells, decontaminate the probe and tape measure in accordance with applicable ERRG- and project-specific procedures. Such procedures should consider and incorporate manufacturer’s recommendations for decontamination. It is important to conduct thorough decontamination to prevent cross-contamination between wells. During decontamination, all measuring tapes should be inspected for kinks, cracks, or tears and, if present, repaired or replaced with undamaged equipment.
2. Isolate your working zone in accordance with applicable project-specific requirements. Visually inspect the vault, box, or well casing to ensure that it is undamaged, properly labeled, and secured. Any damage or problems with the wellhead should be noted on appropriate forms.
3. Don a pair of clean gloves.
4. Uncap the well and monitor the air space immediately above the open casing per the project-specific Health and Safety Plan. Observe if any air is flowing into or out of the casing. For 2- and 4-inch-diameter wells, a latex glove may be briefly placed on top of the well casing and held tight to observe the presence of vacuum or pressure in the well. If such conditions are observed, they should be noted on the appropriate form. The probe should not be placed inside the well until the flow of air has ceased. Wells that are screened through a plume undergoing anaerobic degradation of hydrocarbons may produce dangerous hydrogen sulfide or methane gases. Wells screened in an aerobically degrading plume may produce carbon dioxide or carbon monoxide. It

is strongly recommended to carry fixed gas and hydrocarbon gas detectors in the field to monitor gas concentration in such wells. If it is determined that the well can safely be allowed to vent and stabilize, product measurement may continue once the airflow stops and pressure equalizes.

5. Locate the reference point on the well casing. Any well without permanent reference points or marks should be brought to the attention of the site supervisor or as per project-specific requirements.
6. Slowly lower the oil-water interface probe down the well until the signal indicates that the first liquid layer (LNAPL, water, or DNAPL) has been contacted. Review the instrument instructions for the indicator light or tone for each type of layer. Measure the depth of the first layer to the reference point on the well casing and record it on the appropriate form.
7. Continue lowering the probe slowly to measure the depth to the next layer interface or the bottom of the well. Measure the depth of the first layer to the reference point on the well casing and record it on the appropriate form.
8. Once measurements are complete, remove the probe from the well. Cap and relock the well. Decontaminate instruments following appropriate ERRG- and project-specific procedures.

6.4.2. Bailer Measurement Procedure

The standard or basic procedure for measuring NAPL thickness using a bailer is described below.

1. Don a pair of clean gloves.
2. Prior to taking a measurement and between wells, decontaminate the bailer and measuring tape (if supplied and used) according to applicable ERRG- and project-specific procedures. It is important to conduct thorough decontamination to prevent cross-contamination between wells. During decontamination, all bailers should be inspected for any cracks or holes, and measuring tapes should be inspected for kinks, cracks, or tears. If present, repair or replace with undamaged equipment. If a nylon bailer line is used, cut and properly dispose of any used line, and attach new line to the bailer.
3. If product interface probe measurements are to be used in conjunction with a bailer, the probe measurements should first be made, recorded, and noted by field personnel taking the measurements.
4. If bailer measurements are to be taken without product interface probe measurements, isolate the work zone and inspect and document wellhead conditions per step 2 in Section 6.4.1 above. Uncap the well and monitor and observe the open wellhead per step 3 in Section 6.4.1 above.
5. For LNAPL Measurement: Measure the depths to product and water with the product probe and mark the depths on the bailer chord with a rubber band or twine. Measure the length and diameter of the bailer. Lower the bailer into the well until the liquid surface is encountered.
6. After reaching the first (top) liquid surface, lower the bailer into liquid not exceeding three quarters of its total length. Use the measuring tape if available to determine the depth to which the bailer should be lowered to recover the LNAPL product. If no product interface probe measurement is

available, slowly lower the bailer trying to feel the first contact with the liquid while the bailer is descending inside the well. Once the contact is felt, the bailer's descent should be halted. The bailer should then be slowly lowered no more than three quarters of its total length to avoid overtopping.

7. Allow sufficient length of time for the floating LNAPL liquid to stabilize between the bailer and well before pulling the bailer out. Once sufficient time has elapsed, retrieve the bailer and visually inspect for product. Note any appropriate conditions observed in the bailer on appropriate forms. Such conditions include the following:
   - Color and clarity of the product
   - Odor and viscosity of the product
   - Length of product column in bailer compared to overall length of bailer
   - Evidence of any dripping, sand deposits, or problems with the bailer valves
   - Evidence of overtopping or complete run-through of the product column
8. Note that the product thickness inside the bailer will represent the thickness inside the well as long as the bailer intake diameter equals the bailer body diameter and the bailer is submerged in product only. Measure the product thickness inside the bailer and record on the appropriate form. If product thickness is less than the length of the bailer intake, and the bailer intake diameter is smaller than the diameter of the bailer, the collected product thickness inside the bailer is NOT representative of the product thickness in the well.
9. Empty the bailer contents into a glass bottle or suitable container (chemically compatible with product). Label and store the product container in a suitable and safe location for subsequent disposal as per project-specific requirements and procedures.
10. For DNAPL measurement: Measure the depths to the water/product interface and bottom of the well with the product probe. Calculate the thickness of the product layer and make sure the double check valve bailer is long enough to not over-top the product in the well. Measure and record the length and diameter of the bailer. Place the bailer in the well and slowly run the bailer to the bottom of the well.
11. Allow sufficient length of time for the product (DNAPL) to stabilize between the bailer and the well before pulling the bailer out. Once sufficient time has elapsed, retrieve the bailer and visually inspect for product. Note any appropriate conditions on the appropriate forms. Such conditions include the following:
    - Color and clarity of the product
    - Odor and viscosity of the product
    - Length of product column in bailer compared to overall length of bailer
    - Evidence of any dripping, sand deposits, or problems with the bailer valves
    - Evidence of overtopping or complete run-through of the product column
12. Note that the product thickness inside the bailer will represent the thickness inside the well as long as the bailer intake diameter equals the bailer body diameter and the bailer is submerged in

product only. Measure the product thickness inside the bailer and record on the appropriate form. If product thickness is less than the length of the bailer intake, and the bailer intake diameter is smaller than the diameter of the bailer, the collected product thickness inside the bailer is NOT representative of the product thickness in the well.

13. Empty the bailer contents into a glass bottle or suitable container (chemically compatible with product). Label and store the product container in a suitable and safe location for subsequent disposal as per project-specific requirements and procedures.
14. Cap and re-lock the well. Decontaminate equipment following appropriate ERRG- and/or project-specific procedures. Remove any equipment used to isolate the wellhead. Check and make sure all forms are completed and signed, as required.

6.4.3. Documentation

All information will be recorded in field documentation and will include the following information:

- Project name and number
- Well identification number
- Date and time of each measurement
- Depth to water (measured to the specified tolerance)
- Depth to and description of any non-aqueous phase liquid encountered such as color, odor, and viscosity (this may be determined by checking for product attached to the tip of the probe once it is removed from the well)
- Weather conditions
- Comments, including any problems encountered

Title:	**Groundwater Sampling**
Document Number:	**SOG-006**
Revision Number:	**0**

Reviewed: ______________________ 12/1/2023
Quality Control Manager Date

Approved: ______________________ 12/1/2023
Project Manager Date

1. Purpose

This standard operating guideline (SOG) is intended to provide guidance for groundwater sampling using low-flow sampling methods. Low-flow or micro-purge sampling is a method of collecting samples from a well that does not require the removal of large volumes of water from the well and therefore does not overly agitate the water and suspended particles or potentially aspirate volatile organic compounds (VOCs). This The method entails the removal of water directly from the screened interval without disturbing any stagnant water above the screen by pumping the well at low enough flow rates to maintain minimal drawdown of the water column followed by in-line sample collection. Typical flow rates for low-flow sampling range from 0.1 liter per minute (L/min) to 0.5 L/min depending on site characteristics.

2. Scope

This SOG is applicable to all Engineering/Remediation Resources Group, Inc. (ERRG) projects where groundwater samples will be collected from a monitoring well using low-flow or micro-purge methods and where no project- and program-specific procedure is in use. This procedure applies to all field personnel and subcontractors who collect or handle water samples.

3. References

ASTM International (ASTM) D6634M-14, "Standard Guide for Selection of Purging and Sampling Devices for Ground-Water Monitoring Wells."

ASTM D6452-18, "Standard Guide for Purging Methods for Wells Used for Groundwater Quality Investigations."

ASTM D6771-18, "Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations."

ASTM D4448-01, "Standard Guide for Sampling Ground-Water Monitoring Wells."

U.S. Environmental Protection Agency (EPA), 2005. "Uniform Federal Policy for Quality Assurance Project Plans, Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs – Part 1: UFP-QAPP Manual." Final, Version 1. EPA-505-B-04-900A. Intergovernmental Data Quality Task Force. March 2005. Online Address: <https://www.epa.gov/fedfac/uniform-federal-policy-quality-assurance-project-plans-evaluating-assessing-and-documenting>.

EPA, 2012. "Uniform Federal Policy for Quality Assurance Project Plans, Optimized UFP-QAPP Worksheets." 505-B-04-900A. Intergovernmental Data Quality Task Force. March. Online Address: <https://www.epa.gov/fedfac/optimized-uniform-federal-policy-quality-assuranceproject-plans-worksheets>.

EPA, 2014. "Contract Laboratory Program Guidance for Field Samplers." OSWER 9240.2-147 / EPA 540-R-014-013. Office of Superfund Remediation and Technology Innovation. October. Online at <https://www.epa.gov/sites/production/files/2015-03/documents/samplers_guide.pdf>

EPA, Region 1, 2017. "Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells, SOP EQASOP-GW4, Revision 4." September 19. Online Address: <https://www.epa.gov/quality/low-stress-low-flow-purging-and-sampling-procedure-collection-groundwater-samples-monitoring>

4. Definition of Terms

Field Blank — A field blank (FB) is a drinking water sample of chemical-free reagent water placed in a sample container in the laboratory and processed, extracted, and analyzed in the same manner as a field sample, including shipment to the sampling site, exposure to sampling site conditions, storage, preservation, and all analytical procedures. The purpose of the FB is to determine if method analytes or other interferences are present in the field environment.

Low-Flow Sampling — A sampling technique using well purge rates that do not result in significant changes in the formation seepage velocity as evidenced by the water elevation in the well.

Micro-Purge sampling — Another term used for low-flow sampling because pre-sampling groundwater purging is performed at flow rates two to three orders of magnitude less than typical bailer or pump methods.

Primary Groundwater Flow Zone — The preferred area for sampling within the groundwater well screen that is based on high(er) permeability and/or high(er) chemical concentrations.

Pump — An electric, compressed air, or inert gas driven device that raises liquids by means of pressure or suction. The types of pumps used for well purging should be chosen based on the well size and depth, the type of contaminants, and the specific factors affecting the overall performance of the sampling effort. Low-flow and micro-purge sampling is performed using specially constructed pumps, usually of centrifugal, peristaltic, or centrifugal submersible design, with low draw rates (<1.0 L/min). If contaminants are volatile in nature a bladder pump must be used.

Well-Purging — The action of removing groundwater using mechanical means from a monitoring well prior to collecting groundwater samples. Purging removes stagnant groundwater from the column allowing the groundwater surrounding the well screen to enter the collection zone.

5. Responsibilities

5.1. PROCEDURE RESPONSIBILITY

The Quality Control (QC) Manager or Project Manager is responsible for maintenance, management, and revision of this SOG. Questions, comments, or suggestions about this SOG should be sent to the QC Manager or Project Manager.

5.2. PROJECT RESPONSIBILITY

ERRG employees performing this task, or any portion thereof, are responsible for meeting the requirements of this SOG and using materials of a construction specified in the project plans or applicable to the contaminants of concern and other aspects of the sampling effort. These may include well diameter, well construction materials, depth to water, and the presence of dense nonaqueous-phase liquid (DNAPL) or light nonaqueous-phase liquid (LNAPL) contaminants. ERRG employees conducting technical review of task performance are also responsible for following appropriate portions of this SOG.

For those projects where the activities of this SOG are conducted, the Project Manager, or designee, is responsible for ensuring that those activities are conducted in accordance with this and other appropriate SOGs. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (i.e., daily logs, checkprints, calculations, reports, etc.) that the requirements of this SOG have been met. Such documentation shall be retained as part of the project file.

6. Procedure

Low-flow and micro-purge sampling involves removing water directly from the screened interval with minimal disturbance to stagnant water above the screen as evidenced by no significant lowering of the water table. Since it is not based upon the removal of well volumes, it requires in-line monitoring of water quality parameters (i.e., pH, specific conductivity, temperature, dissolved oxygen, redox potential, and turbidity) to determine when the groundwater sample zone has stabilized. The sample is then collected directly from the discharge tubing.

6.1. CONSIDERATIONS

The following variables should be considered in planning for low-flow purging and sampling:

- **Recharge capacity of each well:** The recharge capacity of a well will determine how fast the well should be purged. The purge rate should be no greater than the recharge rate of the groundwater zone to prevent water table drawdown.

- **Well construction details, including well depth, diameter, screened interval, screen size, material of construction, and depth to water table:** The diameter and well depth will determine the size of the pump and the depth from which the pump will draw groundwater. Peristaltic and suction draw pumps are only viable at depths of less than 25 feet. The pump intake should be placed at the mid-point of the well screen for well screens up to 10 feet long. If the well screen is longer than 10 feet then then pump intake should be set with the primary groundwater flow zone.
- **Pump:** Low-flow purging and sampling can be used in any well that can be pumped at a constant rate of not more than 0.5 L/min. Continuous discharge and cycle discharge pumps with adjustable flow rate controls should be used to avoid causing continuous drawdown. Whenever possible, dedicated pumps should be installed to avoid disturbing the water column.
- **Groundwater quality, including type and concentration of chemical compounds present:** Low-flow methods can be used for all types of aqueous-phase contamination, including VOCs, semivolatile organic compounds, metals, pesticides, polychlorinated biphenyls, radionuclides, and microbiological constituents. Pump parts and tubing should be made of materials that are compatible with the chemicals of interest. Pump placement may depend upon the chemical present such that the intake maybe lowered within the well screen for DNAPLs and raised for LNAPLs.

6.2. EQUIPMENT

The following equipment is recommended for use in conducting low-flow or micro-purge well purging:

- Pump and discharge tubing and line constructed of compatible materials capable of draw rates between 0.1 and 1 L/min
- Water level meter accurate to 0.1 feet at a minimum.
- Swabbing materials
- Water quality meter with a flow through cell. The meter will be calibrated for pH, specific conductance, temperature, dissolved oxygen, redox potential, and turbidity unless otherwise specified in site specific sampling documents
- Photoionization detector (PID) – calibrated (if screening for VOCs is required)
- Graduated cylinder and stopwatch/timer.
- Drums, buckets, or tanks to contain the purge water
- Field logbook or sheets
- Calculator
- Calibration solutions for all parameters being measured, within expiration dates
- Paper towels or lint-free wipes
- Plastic sheeting to spread around sampling area
- Sample gloves

- Sample containers, preservatives, and labels
- Ice and Ziploc-type bags

6.3. PRE-PURGING

To prevent cross-contamination of other wells on site, upgradient and background wells should be sampled first. The procedure for pre-sampling is as follows:

- Perform a visual inspection at the well and surrounding area to evaluate any possible structural damage.
- Prepare the area surrounding the well by placing plastic sheeting on the ground surface to prevent potential cross-contamination of the pump and discharge hose or sample equipment and materials.
- Place and secure the drum, bucket, tank, or suitable purge water container in close proximity to the well for collection and storage of purge water. Purge water must be containerized and disposed of in the manner specified in the project and program plan or as the client directs. Never return purge water to the well. If in doubt or where requirements are not specified, handle all purge water as waste and dispose of it accordingly.
- If performing VOC screening, measure and record the background organic vapors in the ambient air using a PID, in accordance with manufacturer recommendations.
- Open the well casing, remove the well cap, and immediately measure and record the organic vapor levels from the head space within the well casing using a PID, in accordance with the manufacturer's recommendations.
- Measure the depth to the static water level and the depth to the bottom of the well using the water level meter in accordance with ERRG SOG-005, Measuring Groundwater Levels.

6.4. WELL PURGING

The procedure for well purging is as follows:

- Review and understand the proper operating and maintenance instruction for each type of pump that is used prior to placing the pump in the well.
- Assemble the pump and discharge line in accordance with the manufacturer's instructions. Ensure the pump discharge line is long enough so that the pump intake can be located within the well screen area and the discharge end can reach the purge water container.
- Slowly lower the pump into the well until it is submerged and at the desired pumping depth.
- Some wells may include a dedicated pump that is already placed in the well along the well screen. If this is the case, review well construction data to verify the proper placement of the pump intake. [Note: pump intake depth will be dependent on the goals and objectives of the sampling. If the objective is to capture LNAPL, the intake should be set near the top of the well screen. If

the objective is to capture DNAPL, the intake should be set near the bottom of the well screen. If there is heterogeneous soil outside the well, the pump intake should be set wherever the sampler believes the contamination is present. If the soils are homogeneous or there is no clear indication of where the contamination might be (no preferential pathways), then the pump intake should be set at the approximate middle of the well screen.] Inspect the location where the discharge line and pump support cable exit the well to determine that they are in the proper position (markings should be present at the well head to show this).

- Connect the pump discharge to the flow-through cell with the water quality meter in accordance with the manufacturer's procedure.
- Start the pump at the lowest speed and slowly increase until discharge begins. Check the water level and adjust the pump speed until there is little or no drawdown (less than 0.3 feet). If the drawdown exceeds 0.3 feet but the water level remains stable, then continue purging the well and monitor groundwater parameters for stability. If the recharge rate of the well is less than the lowest purge rate of the pump and the well is essentially dewatered during purging, then the well can be sampled as soon as the water level recovers to 80 percent of the original water column. If the well takes considerable time to recover (i.e., longer than 2 hours), samples may be collected either at the end of day or first thing the following day. The pump intake should not be moved during the purging or recovery periods. Using a graduated cylinder and a stopwatch (or timer) adjust the pump speed such that the discharge flow rate is ideally between 0.1 to 0.5 L/min. Discharge rates can be up to 1 L/min, but higher rates have been shown to affect the reproducibility of VOC analytical results.
- Collection of water quality parameters should begin after one volume of the flow-through cell and tubing has been purged. Monitor and record subsequent parameters for stability at set intervals, where a minimum of at least 3 flow-through cell volumes have been purged (approximately 3 to 5 minutes, depending on the flow-through cell volume and purge rate). ERRG standard water quality parameters include pH, conductivity, temperature, dissolved oxygen, redox potential, and turbidity; however, review the site sampling documents to determine if there are site specific parameters and criteria.
- Collect the sample following the procedure below when all monitored water quality parameters are stable, as indicated by three consecutive readings differing by less than the following criteria, unless otherwise noted in site specific sampling documentation:
  - pH = + 0.1 units
  - Conductivity = 10 percent
  - Temperature = 10 percent
  - dissolved oxygen = 10 percent for values greater than 0.5 milligrams per liter (mg/L)
  - redox potential = 10 percent
  - turbidity = 10 percent for values greater than 5 nephelometric turbidity units (NTUs)

6.5. SAMPLE COLLECTION

The procedure for sample collection is as follows:

- Prepare the sample bottles and preservatives required for the sampling.
- Don a pair of clean gloves.
- Collect the sample from the pump discharge line immediately after purging. The sample must be collected before the flow through cell.
- Fill volatile organic analysis (VOA) vials first (reduce the flow rate of the pump discharge) allowing the liquid to slowly fill the container without agitation and obtain a meniscus slightly above the top of the vial.
- Cap and check all VOA vials for entrained air by slowly tipping and observing for bubbles. If any are present, discard the sample and collect again according to the above-listed procedures.
- Field filter for dissolved parameters using an in-line filter cartridge sized according to the flow characteristic of the sampling pump. Use a new filter for each sample and ensure the membrane is properly wetted before sample collection. If the filter is plugged, replace the filter cartridge before continuing to collect the sample.
- Continue filling all required sample bottles. The pump speed may be increased to the original purge rate.
- Add preservatives to the samples as needed and place the sample bottles on ice. Note that most sample bottles come with preservatives already added. If such is the case, do not overfill the bottles.
- Replace the well cap, if required, and lock the cover.
- Record the sampling information.
- Secure the area by removing equipment and materials, properly dispose of plastic sheeting and other disposable sampling materials and close the purge water container(s).
- Decontaminate the pumping equipment and sampling equipment in accordance with SOP-008, Equipment/Personnel Decontamination. The pumping equipment should not be decontaminated if it is dedicated to the well.

Title: **Sample Packaging and Shipping**

Document Number: **SOG-007**

Revision Number: **0**

Reviewed: V Smuick ______ 12/1/2023
Quality Control Manager — Date

Approved: ______ 12/1/2023
Project Manager — Date

1. Purpose

The purpose of this standard operating guideline (SOG) is to provide the requirements for completion and attachment of sample labels on environmental sample containers, completion of written chain-of-custody (COC) documentation, completion and attachment of custody seals on environmental samples and shipping containers, and general instructions for the packaging and shipping of nonhazardous samples.

2. Scope

This SOG is applicable to all Engineering/Remediation Resources Group, Inc. (ERRG) efforts where samples are collected and transferred among parties, including to off-site testing facilities. Nonhazardous samples are those that do not meet any hazard class definitions found in Title 49 Code of Federal Regulations (49 CFR) Parts 107 through 178, including materials designated as Class 9 materials and materials that represent Reportable Quantities (hazardous substances). In general, most soil, air, and aqueous samples do not meet any of the U.S. Department of Transportation's (DOT) hazardous materials definitions.

3. References

U.S. Environmental Protection Agency (EPA), 2005. "Uniform Federal Policy for Quality Assurance Project Plans, Evaluating, Assessing, and Documenting Environmental Data Collection and Use Programs – Part 1: UFP-QAPP Manual." Final, Version 1. EPA-505-B-04-900A. Intergovernmental Data Quality Task Force. March 2005. Online Address: <https://www.epa.gov/fedfac/uniform-federal-policy-quality-assurance-project-plans-evaluating-assessing-and-documenting>.

EPA, 2012. "Uniform Federal Policy for Quality Assurance Project Plans, Optimized UFP-QAPP Worksheets." 505-B-04-900A. Intergovernmental Data Quality Task Force. March. Online Address: <https://www.epa.gov/fedfac/optimized-uniform-federal-policy-quality-assurance-project-plans-worksheets>.

EPA, 2019. "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, EPA publication SW-846, Third Edition, Final Updates I (1993), II (1995), IIA (1994), IIB (1995), III (1997), IIIA (1999), IIIB (2005), IV (2008), V (2015), VI (Phase I, 2017), VI (Phase II, 2018), VI (Phase III, 2019), VII (Phase I, 2019), and VII (Phase II, 2019)." Online Address: <https://www.epa.gov/hw-sw846>.

EPA, 2020. "Contract Laboratory Program Guidance for Field Samplers." OLEM 9240.0-51 / EPA 540-R-20-005. Office of Superfund Remediation and Technology Innovation. November. Online Address: <https://www.epa.gov/clp/clp-information-field-samplers>.

U.S. Department of Transportation Regulations, 49 CFR Parts 107 through 178.

IATA, *Dangerous Goods Regulations Manual*, current edition.

4. Definition of Terms

Custody — The legal term used to define control and evidence of traceability of an environmental sample. A sample is in an individual's custody when it is in the person's physical possession, is in view of the person, is locked in a container controlled by the person, or has been placed into a designated secure area by the person.

Chain-of-Custody Form — A form used to document and track custody and transfers of a sample from collection to analysis or placement in a designated secure area within the testing facility.

Chain-of-Custody Continuation Page — Additional page(s) that may be included with a COC form. The continuation page contains information for additional samples contained within the sample storage or shipping container.

Project Contact – The ERRG person responsible for coordinating laboratory analyses and the person the laboratory shall contact to address analytical issues.

Turnaround Time – The time required for the laboratory to prepare, analyze, and report analytical results to the Project Contact. The turnaround time begins once the laboratory accepts custody of the samples.

Sample Label — Any writing surface with an adhesive backing that can be used to document sample identification information. The sample label is attached to the sample container as a means of identification and, in some commercially available or laboratory-supplied containers, may be preattached. All the laboratories ERRG works with provide sample labels or prelabeled containers in their sample container supply kits.

Custody — The legal term used to define control and evidence of traceability of an environmental sample. A sample is in an individual's custody if it is in the person's physical possession, is in view of the person, has been locked in a container controlled by the person, or has been placed into a designated secure area by the person.

Custody Seal — Commercially available thin strips of adhesive paper with write-in lines for the date, time, and identification of the using party. Custody seals are placed over the caps of sample containers, if possible, and always along the cover seals of shipping containers as a means to detect tampering before arrival at the testing facility. All of the laboratories ERRG works with provide custody seals in their sample container supply kits.

Air Waybill — Also known as a consignment note, dispatch note, or waybill. A contract between the shipper and the carrier, which provides key information for the shipper and a unique shipment number that is used for tracking the shipment.

Bubble Wrap — Plastic sheeting with entrained air bubbles for protective and insulative packaging purposes.

Shipping Container — Any hard-sided container meeting DOT's or IATA's general packaging requirements (e.g., coolers, cardboard boxes).

5. Responsibilities

5.1. PROCEDURE RESPONSIBILITY

The Quality Control (QC) Manager or Project Manager is responsible for maintenance, management, and revision of this SOG. Questions, comments, or suggestions about this SOG should be directed to the QC Manager or Project Manager.

5.2. PROJECT RESPONSIBILITY

ERRG employees performing this task, or any portion thereof, are responsible for meeting the requirements of this SOG. ERRG employees conducting technical review of task performance also are responsible for following appropriate portions of this SOG.

For those projects where the activities of this SOG are conducted, the Project Manager, or designee, is responsible for ensuring that those activities are conducted in accordance with this and other appropriate SOGs. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (i.e., daily logs, checkprints, calculations, reports, etc.) that the requirements of this SOG have been met. Such documentation shall be retained as part of the project file.

6. Procedure

6.1. CHAIN OF CUSTODY

6.1.1. Documentation

All COC documentation shall be completed in black, indelible ink. All corrections shall be performed using standard single-line cross-out methods, and the initials of the individual making the change must be included beside the corrected entry.

6.1.2. Continuation Pages

Continuation pages may be used if the COC form is full and additional space is required to document samples, sample containers, shipping containers, and coolers. The total number of pages must be filled out on the COC form and continuation page(s). All samples entered onto a continuation page must be included in the same cooler and shipping container as those on the COC form itself.

6.1.3. Header Information

- Each COC form shall be assigned a unique Document Reference Number — use the project or proposal number followed by a unique numeric sequence or current date (if only one cooler is sent per day). Continuation pages shall contain the same Document Reference Number as the COC form with which they are associated. The project team shall maintain a log of COC Document Reference Numbers.
- The page identifier and total page count section shall be completed. Total pages include the COC form and any attached continuation pages.
- Project number, name, and location information shall be completed for all forms.
- If available, the laboratory Purchase Order Number shall be included on the appropriate line.
- The name and phone number of the Project Contact.
- The shipment date shall be provided on the applicable lines.
- If shipping by carrier, the waybill and airbill number shall be included. (Note: couriers will not sign custody documents. Therefore, inclusion of the waybill and airbill number on the COC form is the only means of documenting the transfer to the carrier.)
- Laboratory destination and contact information shall be provided.
- The sampler(s) names shall be provided on the appropriate line. This line shall include all persons whose initials appear on any of the sample containers to provide the laboratory with a means of cross-referencing containers.
- The “Send Report To” information shall be completed. If multiple reports and locations are needed, the information shall be provided on a separate page included with the COC documentation.

6.1.4. Sample Information Section (Including on Continuation Page)

During sampling, each sample must be entered on the COC form at the time of collection to document possession of the sample. The sampler must not wait until sampling is completed before entering samples onto the COC.

- Complete the sample ID number for each line. If there are multiple container types for a sample, use additional lines to indicate the needed information.
- Ensure that the sample description matches the description on the sample label; the laboratory will use this information for cross-referencing.
- Provide the collection date and time, which must match those on the sample label and field logbook and logsheets.
- Indicate the matrix of the sample. If a sample has multiple matrix types, then use multiple lines.
- List the container types and preservatives in the header line of the “Container” section of the COC and indicate the number of containers for each sample.

- Write in and check the analyses requested boxes for each line. The appropriate method number (e.g., EPA Method 8260C) must be written, as well as the method name or commonly known abbreviation (e.g., VOCs).
- Indicate the turnaround time requested for each sample.
- Use the special instructions section to provide important information to the laboratory (e.g., samples that may require dilution or samples that will need to be composited by the laboratory). This section may also be used to inform the laboratory of additional information contained in attachments to the COC documentation.
- Include the quality control (QC) and data package level required for the samples.

6.1.5. Custody Transfer Section

- The first "Relinquished By" space must be completed by the individual who will either transfer the samples or seal the shipping container.
- If the samples will be transferred to a courier, write the courier and carrier company in the "Received By" box and enter the date and time the shipping container was closed.
- All other transfers must be performed in person, and the relinquisher must witness the signing by the receiver.
- A copy of the COC form and all associated continuation pages should be maintained in the project file.

6.2. SAMPLE LABELING

- All sample labels must be completed in black, indelible ink. All corrections must be made using standard single-line cross-out methods, and the initials of the individual making the change must be included beside the corrected entry.
- Sample labels should be completed and attached as samples are collected. Do not wait until final packaging to attach and complete the sample labels.
- Sample labels must be attached to the non-sealing portion of the container. Do not place labels on or across sample container caps.
- If the laboratory has provided prelabeled containers, make sure to fill all containers for each parameter set needed. Laboratory prelabeled containers are often bar coded, and it is important to provide a complete container set for each sample.
- The following information must be recorded on the sample label:
  - Sample identification number
  - Date and time collected
  - Initials of person(s) responsible for collection
  - Preservative (if any)
- If a space is provided, the "Analysis Requested" should also be added.

- If a description is provided, then it must match the description on the COC form for cross-referencing purposes.
- Cover the completed and attached label with clear plastic tape to prevent bleeding of the ink if it becomes wet.

6.3. CUSTODY SEAL

6.3.1. Completing the Custody Seal Information

- All custody seals must be completed in black, indelible ink. All corrections must be made using standard single-line cross-out methods, and the initials of the individual making the change must be included beside the corrected entry.
- Each custody seal attached to a sample or shipping container must be completed by writing the date and signing with the full signature of the person responsible for the sealing of the sample.
- If a space is provided, the time should also be added.

6.3.2. Attaching the Custody Seals

Whenever possible, custody seals should be attached over the sample container lids during actual sampling and not when the samples are packaged for shipment. This step will provide confidence in legal custody and will demonstrate non tampering during the sample collection process.

Do not attach custody seals to volatile organic compound (VOC) sample containers because contamination may occur. For VOC sample containers, the custody seal should be used to seal the folded, resealable plastic bag that holds the sample containers.

- For sample jars, the completed custody seal should be placed across the top of the lid with the edges below the lid and jar interface and attached to the jar material. This step will require the visible breaking of the seal to open the container.
- For soil sample sleeves, the completed custody seal should be placed across both end caps with the edges below the cap and sleeve interfaces and attached to the jar material. This step will require the visible breaking of the seal to open the container.
- If it is unfeasible to place custody seals on each sample container, or in instances when it is appropriate to document whether the cooler has been opened, custody seals may be placed on the cooler or other package. Place at least two custody seals on the cooler or package on different sides of the cooler or package such that the custody seal cannot be bypassed.
- Sample coolers and shipping containers should have custody seals attached in such a manner that the seal extends lengthwise from the top edge of the lid to the side of the cooler and container. A minimum of two custody seals should be placed on the shipping container lid with one seal covering the front edge and one seal covering the back or side edge of the lid (do not place seal on a hinged side where the seal would remain intact if the cooler was open).

6.4. SAMPLE PACKAGING AND SHIPPING

6.4.1. Packaging

The following procedures are for samples that should be kept chilled during shipment (preservation requirement of 4 ± 2 degrees Celsius). Procedures for packaging samples that do not require temperature control will be the same except no ice will be required and samples may be packaged in a cardboard shipping box.

- Prepare ice for shipment. Frozen water bottles or technical ice sheets (such as Techni-Ice^{TM}) are recommended. Blue ice (gel packs) or wet ice may be used. If using wet ice, double-bag the ice in gallon or quarter zip-top plastic bags to create ice packs. Note, that wet ice and frozen water bottles may not be permitted with some shipping carriers (e.g., air cargo).
- Ensure that the shipping container (cooler or box, as appropriate) is clean and in good condition. Use tape and seal off the cooler drain on the inside and outside to prevent potential leakage.
- Place packing material (bubble wrap, foam, or packing paper) inside of the shipping container to provide a soft impact surface (i.e., on bottom and sides).
- Place a liner inside the shipping container (cooler or box, as appropriate). Liners can be large plastic trash bags or similar material.
- Inspect each sample container to ensure it is properly labeled and listed on the COC document.
- Wrap each glass or plastic container with sufficient bubble wrap to minimize the risk of breaking.
- Place a layer of ice on the bottom of the cooler, then a layer of samples. Place ice between and on top of the samples so ice is touching all sides of the sample containers. Repeat as necessary, ending with a final layer of ice on top of the samples.
  - Pack the largest/heaviest sample containers at the bottom of the shipping container (cooler or box, as appropriate). Place small sample containers wrapped in bubble wrap securely between and above the large sample containers.
  - For longer transit times, increase the amount of ice being used in each layer or around the sides of the containers.
- When sufficiently full, seal the inner protective liner (e.g., tape or tie plastic bag shut), and place additional packing material on top of the bag and on the sides to minimize shifting of containers during shipment.
- Place the completed, original COC document inside a zip-top plastic bag and tape it to the inside of the lid of the shipping container. The date/time the container was relinquished to the carrier should be noted on the COC document. Note: Be sure to maintain a copy of the completed COC document for project records.
- Secure the shipping container closed with packing tape, duct tape, or other tear-resistant adhesive strips. Strapping tape is recommended for heavy coolers. Taping should be performed to ensure the lid cannot open during transport.

- Place a custody seal on two separate portions of the cooler lid, to provide evidence that the lid has not been opened prior to receipt by the intended recipient, in accordance with Section 6.3.

6.4.2. Shipping

6.4.2.1. All Sample Shipments

The following steps apply to all sample shipments.

- Apply orientation arrows on two opposite faces of the shipping container (e.g., front and back or both ends). Apply “Fragile” sticker(s) if the shipment contains glass containers.
- The air waybill must be attached to the top of each shipping container, with the name and address of the receiver and shipper clearly visible. Maintain a copy of the air waybill with tracking information for the project file.

6.4.2.2. Shipment Coordination

- After tendering a shipment, notify the receiving laboratory of the intended delivery date and number of shipping containers. Provide a copy of the air waybill/tracking information and COC document to the analytical laboratory.
- Maintain a tracking log from the carrier to ensure the shipment is delivered and does not experience shipping delays.

6.4.3. Recordkeeping

- A copy of all completed shipping documents (COC form, commercial invoice, air waybill, etc.) should be maintained for the project record.

Title: **Equipment/Personnel Decontamination**

Document Number: **SOG-008**

Revision Number: **0**

Reviewed: ______________________ 12/1/2023
Quality Control Manager — Date

Approved: ______________________ 12/1/2023
Project Manager — Date

Equipment/Personnel Decontamination

1. Purpose

This standard operating guideline (SOG) defines the Engineering/Remediation Resources Group, Inc. (ERRG) standard that must be implemented for decontamination of non-disposable sampling equipment that comes in direct contact with the sample media and decontamination of personnel performing sampling activities. The benefits of its use include the following:

- Minimizing the spread of contaminants within a study area and from site to site
- Reducing the potential for worker exposure by means of contact with contaminated sampling equipment
- Improving data quality and reliability

2. Scope

This SOG applies to all instances where nondisposable sampling equipment is used for sample collection or when field personnel may come in contact with contaminants. This SOG is not intended to address decontamination of peristaltic or other sampling pumps and tubing. The steps outlined in this SOG must be executed between each distinct sample data point.

3. References

U.S. Environmental Protection Agency (EPA), 2020. "Field Equipment Cleaning and Decontamination." SESDPROC-205-R3. Region 4, Science and Ecosystem Support Division, 980 College Station Road, Athens, Georgia. June 22. Online at: <https://www.epa.gov/quality/field-equipment-cleaning-and-decontamination>.

EPA, 2020. "Contract Laboratory Program Guidance for Field Samplers." OLEM 9240.0-51 / USEPA 540-R-20-005. Office of Superfund Remediation and Technology Innovation. November. Online at: <https://www.epa.gov/clp/clp-information-field-samplers>.

4. Definition of Terms

Soap — A standard brand of phosphate-free laboratory detergent, such as Liquinox®.

Organic Desorbing Agent — A solvent used for removing organic compounds. The specific solvent would depend upon the type of organic compound to be removed.

Inorganic Desorbing Agent — An acid solution for use in removing trace metal compounds. The specific acid solution would depend upon the type of inorganic compound to be removed.

Tap water — Water obtained from any municipal water treatment system. An untreated potable water supply can be used as a substitute for tap water if the water does not contain the chemicals of concern.

Analyte-free water (deionized water) — Water that has been treated by passing through a standard deionizing resin column, and through either distillation or activated carbon units to remove organic compounds. At a minimum, the finished water should contain no detectable heavy metals or other inorganic compounds and no detectable organic compounds (i.e., at or above analytical method detection limits). Analyte-free water obtained by other methods is acceptable, as long as it meets the above analytical criteria.

Other solvents may be substituted for a particular purpose if required.

5. Responsibilities

5.1. PROCEDURE RESPONSIBILITY

The Quality Control (QC) Manager or Project Manager is responsible for maintenance, management, and revision of this SOG. Questions, comments, or suggestions about this SOG should be sent to the QC Manager or Project Manager.

5.2. PROJECT RESPONSIBILITY

ERRG employees performing this task, or any portion thereof, are responsible for meeting the requirements of this SOG. ERRG employees conducting technical review of task performance are also responsible for following appropriate portions of this SOG.

For those projects where the activities of this SOG are conducted, the Project Manager, or designee, is responsible for ensuring that those activities are conducted in accordance with this and other appropriate SOGs. Project participants are responsible for documenting information in sufficient detail to provide objective documentation (i.e., daily logs, checkprints, calculations, reports, etc.) that the requirements of this SOG have been met. Such documentation shall be retained as part of the project file.

6. Procedure

6.1. HEALTH AND SAFETY

Health and safety procedures shall be implemented based on the site-specific decontamination protocol. Health and safety procedures shall consider the potential use of either dangerous solvents or corrosive liquids during the decontamination process.

6.2. EQUIPMENT

Decontamination equipment will vary depending on the site-specific contaminants and data quality objectives but should include decontamination solutions, tools to remove contamination and prevent cross-contamination, health and safety equipment, and waste disposal equipment. The following are examples of each type of equipment:

- Decontamination Solutions
  - Nonphosphate soap (such as Liquinox®)
  - Solvents inorganic or organic removal (such as acetone, hexane, nitric acid, etc.)
  - Tap water
  - Distilled/deionized water
- Decontamination Tools/Supplies
  - Brushes (large and small)
  - Plastic sheeting to place over the ground or working surface in the decontamination area
  - Paper towels
  - Collection tubs or buckets
  - Sprayers for solutions
- Health and Safety Equipment
  - Appropriate personal protective equipment in accordance with the site-specific health and safety plan
- Waste Disposal
  - Trash bags
  - Waste containers such as metal or plastic 55-gallon drums or 5-gallon buckets

6.3. IMPLEMENTATION

A decontamination area shall be established. A separate collection container needs to be available for each of the first four steps. Each type of water and soap solution can be placed in hand-held sprayers made of inert material. The analyte-free water shall be placed in a container that is free of any chemicals of concern. Special containers will be needed if solvents or acid solutions are used. For example, an acid solution cannot be placed in a sprayer that has any metal parts that will come in contact with the acid solution.

The minimum steps for decontamination are as follows:

1. Remove particulate matter and other surface debris using appropriate tools such as a brush, paper towel, or hand-held sprayer filled with tap water.

2. Scrub the surfaces of the sampling equipment using tap water and soap solution and a second brush made of inert material.
3. Rinse sampling equipment thoroughly with tap water.
4. Rinse sampling equipment thoroughly with analyte-free water (not necessary if sampling for disposal profiling purposes).
5. Place sampling equipment on a clean surface appropriate for the chemicals of concern and allow to air dry.

The use of solvents and acid solutions will be dependent on the site-specific conditions. A site with a high probability of high concentrations of compounds or with waste material present will require additional decontamination procedures.

Most ERRG projects sampling projects require personnel to don Level D personal protective equipment (PPE). Level D at a minimum includes disposal nitrile or work gloves when handling materials, safety toed boots, safety glasses, and hard hat (when applicable). If higher levels of PPE are required additional steps may be required.

All perform the following procedures between sampling locations and/or before leaving the site:

1. Decontaminate and rinse all reusable equipment as outlined above.
2. Discard disposable nitrile gloves and any materials used for decontaminating equipment into appropriate waste bin/contractor waste bags.
3. Wash hands, if possible, and don new disposable nitrile gloves when continuing to perform field activities.
4. Decontaminate boots if they came in contact with potentially contaminated materials.

It is ERRG policy to containerize and manage all decontamination fluids in accordance with SOG-009, Handling and Disposal of Investigation-Derived Waste. This policy will be followed unless the client specifically directs an alternate procedure in writing.

Title: **Handling and Disposal of Investigation-Derived Waste**

Document Number: **SOG-009**

Revision Number: **0**

Reviewed: ______________________ 12/1/2023
Quality Control Manager Date

Approved: ______________________ 12/1/2023
Project Manager Date

Handling and Disposal of Investigation-Derived Waste

1. Purpose

This standard operating procedure (SOG) describes the minimum requirements for the safe handling and disposal of investigation-derived waste during environmental field activities by Engineering/Remediation Resources Group, Inc. (ERRG) personnel.

2. References

ERRG SOG-008, Equipment/Personnel Decontamination

3. Definition of Terms

Drum Staging–The arrangement of drums in a logical and orderly manner.

Immediately Dangerous to Life and Health (IDLH)–IDLH concentrations are determined by the National Institute for Occupational Safety and Health (NIOSH). IDLH concentrations aid in the selection of PPE when extremely corrosive materials or chemical concentrations are being handled. This includes materials suspected of causing significant overexposure if absorbed through the skin.

Level A–A fully encapsulating suit worn over a self-contained breathing apparatus. Clothing items includes chemical-resistant coverall, gloves, and boots. Specific materials and clothing items are selected on the basis of task-specific chemicals and hazards.

Level B–Routine work clothing in addition to a supplied-air respirator; chemical-resistant gloves, coveralls and boots or shoe covers. Clothing materials and styles are selected on the basis of task-specific chemicals and hazards.

Operator–A person who has been trained in accordance with safety specifications and training programs and has been qualified through demonstrating the knowledge, experience, and ability to perform the assigned task.

Personal Protective Equipment (PPE)–equipment used to protect personnel from exposure to hazardous materials or conditions.

4. Responsibilities

4.1. SITE SUPERVISORS

Site supervisors are responsible for implementing safe work practices for drum handling. Site supervisors will observe and document employee drum handling technique to verify that personnel who routinely handle drums understand and follow SOG guidelines. Site supervisors may instruct associates in the safe handling of drums during project implementation.

4.2. HEALTH AND SAFETY MANAGER

Designated safety person required to prepare health and safety plans and its amendments, routinely audit the site to verify that the health and safety plan requirements are being met and provide guidance to site supervisors in selection of the appropriate personal protective equipment (PPE), including downgrading of respiratory protection.

4.3. FIELD PERSONNEL

Field personnel are responsible for complying with SOG and safe work practices for drum handling. Field personnel are prohibited from handling drums without the required personal protective equipment and training.

5. Procedure

Drums are handled for purposes of staging, characterization, transporting, storage, and disposal. All drums and containers used will meet the appropriate U.S. Department of Transportation (DOT), Occupational Safety and Health Administration, and U.S. Environmental Protection Agency regulations for the waste they contain. Drum handling can be extremely dangerous; thus, drums will only be handled when absolutely necessary as the potential for leaks, rupture and exposure increases with the amount of handling. Personnel involved in drum handling will have prior training on potential hazards and safe work practices for these activities. Personnel will immediately notify their supervisor or the site safety officer of any changing conditions and new information that appears during drum handling.

5.1. HAZARDS

Hazards associated with drum handling operations include detonation, fire, explosion, vapor generation and both chemical and physical hazards. Chemical hazards, including harmful agent inhalation, ingestion, injection, and skin absorption, are directly related to the contents of the drum. Special care will be taken to ensure employees are knowledgeable in the contents of the drum they are handling through review of Safety Data Sheet (SDS) information, the NIOSH pocket guide, and reference chemical guides. There is a potential for an accidental release and subsequent exposure to chemicals when performing and drum handling operation.

Physical hazards include, but are not limited to, crushing injuries to the hands and feet; cuts; punctures; slips, trips and falls; eye injuries from protruding or flying objects; and strains and sprains.

5.2. PERSONAL PROTECTIVE EQUIPMENT

Personnel equipment and supplies necessary for drum handling include:

- Level B PPE will be worn when working with unknowns.
- Level A PPE will be worn when extremely corrosive materials or chemical concentrations IDLH are suspected. This includes materials suspected of causing significant overexposure, if absorbed through the skin.
- Fire extinguishers.
- Non-sparking tools.
- Spill absorbent material (loose or in pads or booms).
- Direct reading instruments for air monitoring.

Drum handling operations may be performed at downgraded PPE levels based on the types of chemicals being handled. Minimum PPE required for handling of drums with known contents include:

- Approved safety glasses (face shield and chemical splash goggles if a splash hazard exists)
- Nitrile gloves (or double surgical nitrile gloves taped at the wrist)
- Leather gloves (while handling drums)
- Approved safety boots
- Work uniform (Tyvek suits may be required when packing).
- Communication equipment (portable radio, hand signals, telephones, as appropriate)

In addition to the required equipment listed above, depending on the drum contents, each individual assigned to these tasks may be required to have the following items available and will don the appropriate articles in the event of a release, or if conditions warrant:

- **Respiratory protection.** Air-Purifying Respirator with appropriate cartridges. The appropriate respirator cartridge will generally consist of organic vapor and acid gas and high-efficiency particulate air (HEPA) combination cartridge unless a specific hazard exists such as formaldehyde or mercury
- **Protective clothing.** Chemical resistant fabric such as poly-coated Tyvek or Saranex-coated Tyvek, which will provide adequate protection against the existing hazard.

A qualified Site Supervisor will determine the initial level of respiratory protection and PPE in accordance with the approved site health and safety plan, as well as guidance from and consultation with the designated Health and Safety Manager.

5.3. STORING INVESTIGATION-DERIVED WASTE

During environmental investigations, soil and liquid waste is generated from various activities, such as drilling soil borings, purge water from groundwater sampling, and rinse water from decontamination.

When waste materials are generated, place them directly into US-DOT approved 55-gallon drums, separating soil and liquid waste. Drums are not to be filled completely and should provide sufficient outage so that the containers will not be overfull if their contents expand under sealed conditions. After filling a drum, seal it securely using socket wrench, or similar tool (typically 15/16-inch socket).

All drums should be labeled for storage or shipment. Use non-hazardous waste labels or “pending analysis” labels unless materials are expected to be potentially hazardous. Information that must be included on a label includes contents, generator (Washington State Department of Ecology), site location/address, accumulation date, point of contact. During an ongoing investigation, use a drum log to track the contents and quantity of waste materials.

Do not discard PPE or other items such as Tyvek, gloves, equipment, or trash into drums containing soils or liquids. Disposable protective equipment, trash, and other materials should be disposed of in separate appropriate waste containers, in accordance with SOG-008, Equipment/Personnel Decontamination.

5.4. PRE-INSPECTION

When practical, drums and containers will be inspected, and their integrity will be assured prior to being moved. When it is not practical to inspect a drum or container prior to being moved because of storage conditions (i.e., buried beneath the earth, stacked behind other drums, stacked several tiers high in a pile, etc.), the drum will be moved to an accessible location and inspected prior to further handling.

Prior to handling, drums will be inspected for potential hazards. Personnel will look for:

- Symbols, words, or other marks on the drum indicating that its contents are hazardous, e.g., radioactive, explosive, corrosive, toxic, flammable.
- Symbols, words, or other marks on a drum indicating that it contains discarded laboratory chemicals, reagents, or other potentially dangerous materials in small-volume individual containers.
- Signs of deterioration such as corrosion, rust, and leaks.
- Signs that the drum is under pressure, such as swelling and bulging.
- Drum type (stainless steel, polyethylene, fiberboard, etc.).
- Configuration of the drumhead.

- Looseness of bungs, lids, and caps.
- Bulging of contents indicating pressure. If the container appears to be pressurized, the Site Supervisor and Safety Officer will be notified. A Hazard Assessment will then be completed and approved.
- Burrs or loose metal on drums.
- Keep body parts away from possible hazards and use caution while manipulating drums in tight spaces. Do not cross your feet or hands when rolling drums.

5.5. SAFE WORK PRACTICES

All drums and containers will be approached cautiously until their contents and condition has been characterized. The following procedures will be followed for drum handling:

- Site operations shall be organized to minimize the amount of drum and container movement.
- Prior to movement of drums or containers, employees tasked with moving drums or containers will be warned of the potential hazards associated with the contents of the drums or containers.
- Drums will be handled one at a time or multiples if drums are secure on a pallet.
- When moving drums or containers, a spill kit with a suitable quantity of absorbent material will be kept available and used in areas where spills, leaks, or ruptures occur.
- Continuous communication shall be maintained between the drum or container handlers and the site safety and health officer until handling operations are complete.
- Associates are prohibited from standing, walking or sitting on drums.
- Associates will avoid the swing radius of drums during lifting and hoisting. Walking or standing under suspended loads is prohibited.
- All ignition sources must be removed from a 75-foot radius around drum handling activities.
- Drums that appear in imminent danger of failing will be overpacked as soon as possible.
- Mechanical devices will be used to move drums due to their weight. Drums may weigh 200 to 600 pounds.
- When lifting drums, operators must have a clear view of the path of the drum. Spotters will be used if the operator’s view is blocked.
- When using slings, yokes or other lifting devices to move drums, personnel assisting the lift will move away a safe distance from the area before the drum is lifted.
- Critically swollen drums will not be handled until pressure is relieved.
- Where explosive or shock-sensitive contents are suspected and the potential of incorrect storage is in question, a Hazard Assessment will be completed and approved. The procedure for handling

explosive or shock-sensitive material may include mechanical remote opening devices. Employees will be trained in the devices use before such a device is used.

- Any drum or container that is not labeled or suspected to be mislabeled will be treated as containing a hazardous substance and treated accordingly until the contents are positively identified and labeled.

5.6. DRUM TRUCKS

The following procedures apply to the movement of drums using a drum truck:

- Workers will wear leather gloves and steel-toed safety boots.
- Operators must have a clear view of the path of the drum. A spotter will be used if the operator's view is blocked.
- The drum truck will be square with the resting drum at initiation.
- The slide handle will be attached securely to the top of the drum.
- Let the truck carry the load. It is necessary to apply pressure with the foot to the drum truck pivot bar, located behind and towards the bottom of the truck, while pulling back on the handles. The operator needs only balance and push.
- Avoid walking backwards with a drum truck.
- When going down an incline, keep the truck ahead so that it can be observed at all times.
- Move the drum truck at safe speeds. Do not run. Keep the drum truck constantly under control.

5.7. DRUM STAGING

The following procedures will be followed for drum staging:

- Drums will be staged in a logical and orderly manner.
- The arrangement of drums will allow adequate aisles for entrance and exit when working around the drums.
- Movement of drums will be kept to a minimum.
- Drums of like contents will be staged together and away from drums of incompatible contents.
- Gas cylinders will be staged in a cool shaded area.
- Potentially explosive and shock-sensitive drums will be stored at a location distant from other site activities and in a diked, fenced area.

5.8. DRUM OPENING AND SAMPLING

The following procedures will be followed for drum opening and sampling:

- Air monitoring will be performed at the drum opening before and during opening.
- Access to the drum opening area will be limited to essential personnel only.
- Where explosive or shock-sensitive contents are suspected and the potential of incorrect storage is in question, a Hazard Assessment will be completed and approved, and appropriate training will be completed before opening. Fire suppression equipment and air monitoring equipment will be available and protected from potential explosions.
- Drums or containers known to contain radioactive material will not be handled until their hazard to employees has been properly assessed.
- If the drum shows signs of bulging or swelling, excess pressure can be relieved by gently cracking the bung prior to opening.
- Non-sparking tools will be used for drum opening such as plastic, bronze or beryllium.
- Only one drum at a time will be opened. Drums will be left open only as long as is necessary to take samples. Drums will be closed and resealed as quickly as possible.
- Sampling of drum or container contents will be performed in accordance with a sampling procedure which is part of the site safety and health plan developed for and available to employees and others at the specific worksite.
- Samplers will stand to the side of an open drum and avoid leaning over the opening.
- If drum lid is unable to be replaced securely, the drum will be overpacked and its contents off-loaded.

Sampling equipment will be decontaminated between drums to avoid cross-contamination and mixtures of incompatible compounds.

5.9. TRAINING

Any person who handles drums will have been trained and have demonstrated the ability to do so in accordance with safety specifications and training programs. This will be supplemented with site-specific, hands-on training. Training shall cover the following topics:

- The purposes and procedures for drum staging, opening, characterization, removal, demolition, and disposal.
- Hazards of drum handling including detonation, fire, explosion, vapor generation, and physical injury.
- Proper inspection of drums and their associated hazards.
- Drum characterization criteria warranting the use of air monitoring.
- The safe operation of handling equipment, such as forklifts and drum trucks.

Title: **Electrical Safety**

Document Number: **SOG-010**

Reviewed:	V Smith (signature)	12/1/2023
	Quality Control Manager	Date
Approved:	(signature)	12/1/2023
	Project Manager	Date

ERRG

1. Purpose

This SOG addresses safe work practices for workers whose job responsibilities entail interaction with electrical equipment and systems with potential exposure to energized electrical equipment and circuit parts as well as other workers whose exposure to electrical hazards is unintentional or not recognized as part of their job responsibilities. The highest risk for injury from electrical hazards for other workers is unintentional contact with overhead power lines and electric shock from machines, tools, and appliances.

2. Scope

This SOG applies to all ERRG employees and subcontractors working on or near exposed energized electrical conductors or circuit parts on ERRG project sites.

3. References

- Title 29 CFR 1910 Subpart S – Electrical
- Title 29 CFR § 1910.147 "The control of hazardous energy (Lockout/Tagout/Try)"
- Title 29 CFR §§ 1910.332 "Electrical Training"
- Title 29 CFR § 1910.269 "Electric power generation, transmission, and distribution"
- Title 29 CFR §1926 Subpart S – Electrical
- Washington Administrative Code (WAC) 296-155-53409, Table 4
- NFPA 70E® – Standard for Electrical Safety in the Workplace®, 2018 Edition
- NFPA 70® – National Electrical Code® (NEC®)

4. Definition of Terms

Affected employee—An employee who operates or uses machinery or equipment that is having service or maintenance performed under Lockout/Tagout, or anyone whose job requires work in an area in which servicing, construction or maintenance is being performed under Lockout /Tagout.

Arc Rating—The value attributed to materials that describes their performance to exposure to an electrical arc discharge. The arc rating is expressed in cal/cm^2 and is derived from the determined value of the arc thermal performance value (ATPV) or energy of breakopen threshold (E_{BT}) (should a material system exhibit a breakopen response below the ATPV value). Arc rating is reported as either ATPV or E_{BT}, whichever is the lower value.

Arc Blast—The explosive expansion of the surrounding air and metal in the path of an arc flash creating high pressures exceeding hundreds to thousands of pounds per square ft and sound in excess of 160 dB and expel molten metal and debris in excess of 700 mph.

Arc Flash—A short circuit that flashes from one, exposed live conductor to another or to ground. The resulting ionized air creates superheated plasma that can reach temperatures of 35,000° F. The incident energy of an arc flash is usually measured in calories/ per square centimeter (cal/cm^2).

Arc Thermal Performance Value (ATVP)—Used to rate the protection limit of flame-resistant clothing and flash suits. The value is usually presented in calories per centimeter squared (cal/cm^2).

Barricade—A physical obstruction such as tapes, cones, or A-frame-type wood or metal structures intended to provide a warning about and to limit access to a hazardous area.

Barrier—A physical obstruction that is intended to prevent contact with equipment or live parts or to prevent unauthorized access to a work area.

Circuit Breaker—A device designed to open and close a circuit by non-automatic means and to open the circuit automatically on a predetermined overcurrent without damage to itself when properly applied within its' rating.

Conductive—Suitable for carrying electric current.

Contractor—For the purpose of this SOG, a contractor is any non-ERRG personnel or non-facility ERRG personnel who will engage in work activities where a potential exposure to electrical energy exists.

De-energized—Free from any electrical connection to a source of potential difference and from electrical charge; not having the potential difference from that of the earth.

Electrical Hazard—A dangerous condition such that contact or equipment failure can result in electric shock, arc flash burn, thermal burn, or blast.

Electrical Safety—Recognizing hazards associated with the use of electrical energy and taking precautions so that hazards do not cause injury or death.

Electrically Safe Work Condition—A state in which the conductor or circuit path to be worked on or near has been disconnected from energized parts, locked/tagged in accordance with established standards, tested to ensure the absence of voltage, and grounded if determined necessary.

Energized—Electrically connected to or having a source of voltage.

Exposed (live parts)—Capable of being inadvertently touched or approached nearer than a safe distance by a person. It is applied to parts that are not suitably guarded, isolated, or insulated.

Feeder—All circuit conductors between the service equipment, the source of a separately derived system, or other power supply source and the final branch-circuit over current device.

Flame-Resistant (FR) —The property of a material whereby combustion is prevented, terminated, or inhibited following the application of a flaming or non-flaming source of ignition, with or without subsequent removal of the ignition source.

Flash Hazard—A dangerous condition associated with the release of energy caused by an electric arc.

Flash Hazard Analysis—A study investigating a worker's potential exposure to arc-flash energy, conducted for the purpose of injury prevention, the determination of safe work practices and the appropriate levels of PPE.

Flash Protection Boundary—An approach limit at a distance from exposed live parts within which a person could receive a second-degree burn if an electrical arc flash were to occur.

Flash Suit—A complete FR clothing and equipment system that covers the entire body, except for the hands and feet. This includes pants, jacket, and bee-keeper-type hood fitted with a face shield.

Incident Energy—The amount of energy impressed on a surface, a certain distance from the source, generated during an electrical arc event. One of the units used to measure incident energy is calories per centimeter squared (cal/cm^2).

Limited Approach Boundary—An approach limit at a distance from an exposed live part within which a shock hazard exists and only qualified personnel may enter.

PPE Category—Defines the incident energy category of an arc flash to determine the PPE required during performance of specific electrical maintenance and operations tasks. Hazard/Risk category numbers range from 1 to 4. (Selection of Arc-Rated Clothing and Other PPE When the Incident Energy Analysis is Used, NFPA 70E®, Table 130.5(G))

Prohibited Approach Boundary—An approach limit at a distance from an exposed live part within which work is considered the same as making contact with the live part.

Qualified Person—One who has the skills and knowledge related to the construction and operation of the electrical equipment and installations and has received safety training on the hazards involved.

Routine Task—A task or activity that is a part of regular or customary course of work that can be completed in accordance with established practices.

Restricted Approach Boundary—An approach limit at a distance from an exposed live part within which there is an increased risk of shock, which is due to electrical arc-over combined with inadvertent movement, for personnel working near the live part.

Shock Hazard—The dangerous condition associated with the possible release of energy caused by contact or approach to live parts.

Standard Personal Protective Equipment (PPE)—Hardhat, safety glasses with side shields, natural fiber under garments, pants or coveralls or FR clothing, hearing protection (ear plugs or muffs) and steel toed or non-conductive leatherwork boots.

Unqualified Person—A person who is not a qualified person.

Working Near (live parts)—Any activity inside a Limited Approach Boundary.

Working On (live parts) —Coming in contact with live parts with the hands, feet, or other body parts, with tools, probes, or with test equipment, regardless of the PPE a person is wearing.

5. Responsibilities

ERRG does not self-perform any live or high voltage electrical work and would defer responsibilities to a licensed/certified electrician for such work. The responsibilities below are for personnel regarding electrical safety.

5.1. MANAGERS AND SUPERVISORS

- Ensure that all aspects of this SOG and/or client's site Electrical Safety Program are followed and complied with.
- Ensure that all personnel and authorized visitors on ERRG property or ERRG controlled sites follow the site electrical safety program.
- Administer disciplinary action when violations occur.
- Ensure that all resources that are necessary for the implementation and management of this SOG and/or site Electrical Safety Program are provided.
- Perform a root cause analysis of all electrical safety incidents, including near misses, with the Corporate Health & Safety Manager (HSM).

5.2. FIELD SUPERVISORS

- Administer the site Electrical Safety Program.
- Designate, obtain and maintain the electrical safety equipment including PPE, utilized in supporting the site Electrical Safety Program.
- Ensure that operations personnel are fully trained and comply with the site Electrical Safety Program.
- Administer disciplinary action to operations personnel who violate the site Electrical Safety Program.
- Determine if subcontractor(s), when employed, will engage in activities that require use of this SOG or the site's Electrical Safety Program.
- Participate in electrical safety incident investigations, including near misses.

5.3. EMPLOYEES

- Consider electrical safety of first importance in the performance of all related duties. Each employee is responsible for personal safety and the safety of others.
- Implement this SOG and/or the site Electrical Safety Program.
- Stop work and/or communicate any concerns regarding electrical safety if asked to perform a task in which they feel they are not adequately trained, or generally feel uncomfortable concerning the given task.
- Ensure that guards or protective measures are satisfactory for the conditions.
- Comply with established work methods and the use of protective equipment.

5.4. SITE SAFETY AND HEALTH OFFICER

- Determine if the subcontractor(s) will engage in activities that require use of this SOG and/or the site's written Electrical Safety Program or the subcontractor's written procedure.
- Ensure that all subcontractor employees are informed and knowledgeable of this SOG and any site electrical safety program requirements that are applicable to the contract employee's work.
- Ensure that the subcontractor adheres to this SOG and/or the site's electrical safety program.
- Ensure that if the subcontractor's Electrical Safety Program is used in lieu of the site's procedure, it affords a level of protection that is equal to or exceeds the protection of this SOG and/or the site's requirements. The HSM's (or equivalent) approval is required prior to allowing a subcontractor to use their own program.
- Participate in all incident investigations involving electrical safety, including near misses that involve project personnel.

6. General Requirements

Work may not be performed when adverse weather conditions would make the work hazardous even after the work practices required by this section are employed. All work locations will be safely accessible whenever work is to be performed. Sufficient access and working space will be provided and maintained for all electric equipment to permit ready and safe operation and maintenance of such equipment. Illumination will be provided as needed to perform the work safely. ERRG strictly prohibits actions taken by employees or subcontractors that place them or others in unnecessarily dangerous situations.

Attempts should always be made to perform work on electrical circuits with the circuit de-energized. Work on energized (live) circuits will be evaluated to determine that all potential hazards (job safety analysis) are addressed and eliminated where possible.

Appropriate personal protective shields, barriers, or insulating materials and/or tools will be utilized to protect employees from potential burns/shock when working on electrical circuits in confined or enclosed spaces.

Load ratings of stringing lines, pulling lines, conductor grips, load-bearing hardware and accessories, rigging, and hoists may not be exceeded.

Personnel will not enter spaces containing exposed energized parts unless correct illumination is provided for safe working conditions.

Electrical grounds will be installed when work is performed on circuits of 600 volts and above. The Site's Electrical Grounding Procedure will be followed for the installation, removal, and audit of electrical grounds.

Post and maintain in plain view of the operator and driver on each crane, derrick, power shovel, drilling rig, hay loader, hay stacker, pile driver, or similar apparatus, a durable warning sign legible at 12 feet reading: "Unlawful To Operate This Equipment Within 10 Feet Of High-Voltage Lines of 50,000 Volts Or Less." In addition to the above wording, the following statement in small lettering shall be provided on the warning sign: "For Minimum Clearances of High-Voltage Lines in Excess of 50,000 Volts, See Washington Administrative Code (WAC) 296-155-53409, Table 4" The erection, operation or dismantling of any boom-type lifting or hoisting equipment, or any part thereof, closer than the minimum clearances from energized overhead high-voltage lines set forth will be prohibited.

7. Safe Work Procedures

Each project task where electrical hazards apply will implement the procedures listed, as applicable.

- Identify purpose of the task
- Identify the qualifications and number of employees to be involved
  - If training is required, ensure workers are properly trained prior to exposure to the hazard.
  - If a licensed electrician is required, ensure the subcontractor is properly trained and licensed.
- Identify the hazards and assessment of risks of the task(s) - The SSHO or Project Manager is responsible for ensuring a pre-work risk assessment is conducted for the electrical work to be performed.
  - Remove the electrical hazard or de-energize, if possible.
  - Perform a risk assessment if the hazard cannot be removed. The risk assessment should anticipate unexpected events, identify shock, and arc flash hazards as well as other hazards, minimize hazards, and identify controls, tools, equipment, and PPE to be used. Table 130.5(C), "Estimate of the Likelihood of Occurrence of an Arc Flash Incident for ac and dc Systems" in Section 10 (Attachments) can assist in this risk assessment.
  - Plan every job and document first time procedures.
  - Protect employees from shock, burn, blast, and other hazards due to the working environment.
  - Use the right tools for the job.
  - Assess people's abilities.
  - Audit these principles.
- Identify the limits of approach
  - For unqualified persons
  - For qualified persons
- Identify safe work practices to be used
- Identify required personal protective equipment (PPE)
- Identify required insulating tools and materials involved
- Identify any special precautionary techniques
- Review electrical single-line diagrams and/or equipment details
- Review reference data

7.1. INSPECTION

- Inspect/evaluate the electrical equipment. Employees will inspect each safety device, tool or piece of equipment each time it is used and to use only those in good condition. ERRG requires the use of safety devices and safeguards where applicable. Defective equipment and tools will be tagged and placed out of service.
- Reel handling equipment, including pulling and tensioning devices, must be in safe operating condition and will be leveled and aligned.

- Insulating equipment found to be defective or damaged will be immediately removed from service. A system, such as tagging, will be used to ensure defective equipment will not be used by other workers.
- Insulated gloves, sleeves and blankets must be visually inspected and electrically re-tested periodically at prescribed intervals or when found to be damaged or defective. Gloves, sleeves, and blankets shall be marked to indicate compliance with the re-test schedule and shall be marked with either the date tested, or the date the next test is due.
- Maintain the electrical equipment's insulation and enclosure integrity.
- Before elevated structures, such as poles or towers, are subjected to such stresses as climbing or the installation or removal of equipment may impose, a qualified individual will ascertain that the structures can sustain the additional or unbalanced stresses. If the pole or other structure cannot withstand the loads which will be imposed, it will be braced or otherwise supported to prevent failure.

7.2. SAFE WORK PRACTICES

Electrical safe work practices include, but are not limited to, the following:

- Consider every electrical conductor or circuit part energized until proven otherwise. Conductors and parts of electrical equipment that have been de-energized but not been locked or tagged out will be treated as live parts.
- Prohibit bare-hand contact made with exposed energized electrical conductors or circuit parts with a voltage rating of 50 volts or more.
- Consider de-energizing an electrical conductor or circuit part and making it safe to work on as a potentially hazardous task.
- Use procedures as "tools" to identify the hazards and develop plans to eliminate/control the hazards.
- Train employees to qualify them for working in an environment influenced by the presence of electrical energy.
- Identify/categorize tasks to be performed on or near exposed energized electrical conductors and circuit parts.
- Identify and use precautions appropriate to the working environment.

7.2.1. Pre-work Safety Briefing

A pre-work safety briefing must be performed to identify the procedures for working on or near live parts operating at 50 volts or more or where an electrical hazard exists before work is started. Electrical safety procedures include, but are not limited to, the information in Section 7.

A brief discussion of whether the work involved is routine and if the employee, by virtue of training and experience, can reasonably be expected to recognize and avoid hazards involved in the job. A more extensive discussion should be conducted if the work is complicated or particularly hazardous or the employee cannot be expected to recognize and avoid the hazards involved with the job. A review of the Activity Hazard Analysis for the task must be performed.

7.2.2. Work Zone and Limits of Approach

The work area will be adequately marked, designated, or otherwise indicated so that potential hazards are readily apparent to unqualified people not associated with the task.

Workers will utilize signs, labels, tags, and color coding as necessary to address issues of demarcation of hazards covered by this SOG and/or a client's Electrical Safety Program. To protect employees from falling into holes into which poles are to be placed, the holes will be attended by employees or physically guarded whenever anyone is working nearby. Barriers, or other equivalent measures will be used to minimize the possibility that conductors and cables being installed or removed will contact energized power lines or equipment.

Demarcation of electrical hazards can be made via permanent or temporary means, based on the hazard.

- Permanent demarcation features can be affixed if an electrical hazard exists on a continuous basis as required by the client/owner of the site.
- Markings must conform to NFPA 70E® regarding demarcation and clearly designate the restricted approach boundary and required PPE necessary to permit entry.
- Temporary demarcation features will be removed upon completion of the associated activity, project or task and return of the site to a safe condition.

7.2.3. Working on Exposed Electric Conductors or Parts that may be Energized

Safety-related work practices will be used to safeguard employees from injury while they are working on or near exposed electric conductors or circuit parts that are or can become energized.

- While any employee is exposed to contact with parts of fixed electric equipment or circuits which have been deenergized, the circuits energizing the parts shall be locked out or tagged or both.
- When performing work with live line tools, minimum approach distances will be maintained. Conductor support tools, such as link sticks, strain carriers, and insulator cradles, may be permitted for use, provided that the clear insulation is at least as long as the insulator string or the minimum distance specified for the operating voltage. When performing work with live line tools, minimum approach distances 29 CFR §1910.333 Table S-5 will be maintained.

- Live parts to which an employee might be exposed will be put into an electrically safe work condition utilizing site lockout/tagout/try procedure, before an employee works on or near them, unless the work on energized components introduces additional or increased hazards or is infeasible due to equipment design or operational limitations.
- Prior to performing any work on energized circuits, a pre-job briefing will be conducted.
- Only qualified people may work on energized conductors or equipment connected to energized high-voltage systems. Except for replacing fuses, operating switches, or other operations that do not require the employee to contact energized high-voltage conductors or energized parts of equipment, clearing “trouble” or in emergencies involving hazard to life or property, no such employee will be assigned to work alone. Employees in training (e.g., apprentices), who are qualified by experience and training, will be permitted to work on energized conductors or equipment connected to high-voltage systems while under the supervision or instruction of a qualified electrical worker (e.g., journeyman).
- Only qualified people may work on electric circuit parts or equipment that have not been deenergized. Such people will be capable of working safely on energized circuits and will be familiar with the proper use of special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools.
- Portable ladders must have nonconductive siderails if they are used where the employee or the ladder could contact exposed energized parts.

7.2.4. Work Around Overhead Power Lines

All overhead power lines must be approached as follows:

- Overhead power lines will be de-energized, if possible, before work with boom or heavy equipment begins.
- No equipment will approach an overhead power line within the OSHA safe approach distance, based on known or posted line voltage.
- A spotter is always required to monitor safe approach distance, including line sway.

7.2.4.1. Electrical Hazard Analysis.

- If the live parts operating at 50 volts or more are not placed in an electrically safe condition, other safety-related work practices will be used to protect employees who could be exposed to the electrical hazards involved.
- Such work practices will protect each employee from arc flash and from direct contact with any part of the body, or indirectly through some other conductive object, with live parts that operate at 50 volts or more.
- The work practices that are used will be suitable for the conditions under which the work is to be performed and for the voltage level of the live parts.

- Appropriate safety-related work practices will be determined before any person approaches exposed live parts within the Limited Approach Boundary by using both shock hazard analysis and flash hazard analysis.

7.2.4.2. Shock Hazard Analysis.

A shock hazard analysis will determine the voltage to which personnel will be exposed, boundary requirements, and the personal protective equipment necessary to minimize the possibility of electrical shock to personnel.

7.2.4.3. Shock Protection Boundaries.

The shock protection boundaries identified, as Limited, Restricted, and Prohibited Approach Boundaries are applicable to the situation in which approaching personnel are exposed to live parts.

7.2.4.4. Approach to Exposed Live Parts Operating at 50 Volts or More.

No qualified person will approach or take any conductive object closer to exposed live parts operating at 50 volts or more than the Restricted Approach Boundary unless any of the following apply:

- Insulating equipment designed for the voltage levels to be encountered will be provided and employees will be instructed to use the equipment. No person, firm, or corporation, or agent of same, will require or permit any employee to perform any function in proximity to energized high-voltage lines; to enter upon any land, building, or other premises and there engage in any excavation, demolition, construction, repair, or other operation; or to erect, install, operate, or store in or upon such premises any tools, machinery, equipment, materials, or structures (including scaffolding, house moving, well drilling, pile driving, or hoisting equipment) unless and until danger from accidental contact with high-voltage lines has been effectively guarded against.
- The qualified person is insulated or guarded from the live parts operating at 50 volts or more (insulating gloves or insulating gloves and sleeves are considered insulation only regarding the energized parts upon which work is being performed), and no un-insulated part of the qualified person's body crosses the Prohibited Approach Boundary.
- The live part operating at 50 volts or more is insulated from the qualified person and from any other conductive object at a different potential.
- The qualified person is insulated from any other conductive object as during live-line bare-hand work.
- The qualified person adheres to the approach distances in 29 CFR §1910.333 Table S-5.
- Work by qualified people is only allowed when proper illumination is provided.
- Ladder work will only be performed using a ladder with non-conductive siderails.

7.2.4.5. Approach by Unqualified Persons.

Unqualified persons will not be permitted to enter areas containing electrical equipment unless the electrical conductors and equipment involved are in an electrically safe working condition and must always maintain a 20-foot clearance distance.

7.2.4.6. Working At or Close to the Limited Approach Boundary.

When one or more unqualified persons are working at or close to the Limited Approach Boundary, the designated person in charge of the workspace where the electrical hazard exists will cooperate with the designated person in charge of the unqualified person(s) to ensure all work can be performed safely. This will include advising the unqualified person(s) of the electrical hazard present and warning him or her to stay outside of the Limited Approach Boundary.

7.2.4.7. Entering the Limited Approach Boundary.

Where there is a need for an unqualified person(s) to cross the Limited Approach Boundary, a qualified person will advise him or her of the possible hazards and continuously escort the unqualified person(s) while inside the Limited Approach Boundary. Under no circumstances will the escorted unqualified person(s) be permitted to cross the Restricted Approach Boundary. See NFPA 70E Table 130.4(D)(a), Table 130.4(D)(b) Approach Boundaries to Live Parts table in in Section 10 (Attachments).

7.2.4.8. Flash Hazard Analysis.

A flash hazard analysis will be done, where required, to protect personnel from the possibility of being injured by an arc flash. The analysis will determine the Flash Protection Boundary and the personal protective equipment that people within the Flash Protection Boundary will use.

- Flash Protection Boundary.
  - For systems that are 600 volts or less, the Flash Protection Boundary will be 4 feet, based on the product of clearing times of 6 cycles (0.1 second) and the available bolted fault current of 50 kA or any combination not exceeding 300 kA cycles (5000 ampere seconds).
  - For clearing times and bolted fault currents other than 300 kA cycles, or under engineering supervision, the Flash Boundary will alternatively be permitted to be calculated in accordance with the formula referenced in NFPA 70E 130.3 (A).
  - At voltage levels above 600 volts, the Flash Protection Boundary is the distance at which the incident energy equals 5 J/cm2 (1.2 cal/cm^2). For situations where fault-clearing time is 0.1 second (or faster), the Flash Protection Boundary is the distance at which the incident energy level equals 6.24 J/cm2 (1.5 cal/cm^2).

  Note: In lieu of the above, each site has the option to use the tables in Section 10 (Attachments) to determine acceptable levels of employee protection for given circuits.

8. Personal Protective Equipment

Project managers or safety staff should select PPE that is appropriate for the work and in accordance with NFPA 70E®. Annex H provides the "Guidance on Selection of Protective Clothing and Other Personal Protective Equipment (PPE)." In general Table H.2 should be followed. Table H.2 – "Simplified Two-Category, Arc-Rated Clothing System." The use of Table H.2 is a simplified approach to provide minimum PPE for electrical workers within facilities with large and diverse electrical systems. The clothing listed in Table H.2 fulfills the minimum arc-rated clothing requirements of Table 130.7(C)(15)(a), Table 130.7(C)(15)(b), and Table 130.7(C)(15)(c). The clothing systems listed in Table H.2 (below) should be used with the other PPE appropriate for the arc flash PPE category.

Table H.2 Simplified Two-Category, Arc-Rated Clothing System

Clothing[a]	Applicable Situations
Everyday Work Clothing Arc-rated long-sleeve shirt with arc-rated pants (minimum arc rating of 8) or Arc-rated coveralls (minimum arc rating of 8)	Situations where a risk assessment indicates that PPE is required and where Table 130.7(C)(15)(a) and Table 130.7(C)(15)(b) specify arc flash PPE category 1 or 2b
Arc Flash Suit A total clothing system consisting of arc-rated shirt and pants and/or arc-rated coveralls and/or arc flash coat and pants (clothing system minimum arc rating of 40)	Situations where a risk assessment indicates that PPE is required and where Table 130.7(C)(15)(a) and Table 130.7(C)(15)(b) specify arc flash PPE category 3 or 4b

a - Note that other PPE listed in Table 130.7(C)(15)(c), which include arc-rated face shields or arc flash suit hoods, arc-rated hard hat liners, safety glasses or safety goggles, hard hats, hearing protection, heavy-duty leather gloves, rubber insulating gloves, and leather protectors, could be required. The arc rating for a garment is expressed in cal/cm^2.

b- The estimated available fault current capacities and fault clearing times or arcing durations are listed in the text of Table 130.7(C)(15)(a) and Table 130.7(C)(15)(b). For power systems with greater than the estimated available fault current capacity or with longer than the assumed fault clearing times, Table H.2 cannot be used and arc flash PPE must be determined and selected by means of an incident energy analysis in accordance with 130.5(G).

PPE will be laundered, and equipment maintained and inspected in accordance with the applicable process and timeframes as specified by NFPA 70E® and/or the manufacturer's specifications, whichever is more restrictive/conservative. Conductive articles of jewelry or apparel (such as watchbands, bracelets, rings, key chains, necklaces, metalized aprons, cloth with conductive thread, or metal headgear) may not be worn if they might contact exposed energized parts. However, such articles may be worn if they are rendered nonconductive by covering, wrapping, or other insulating means.

9. Training

Training requirements apply to workers who, while performing their assigned work tasks, face the risk of electrical hazards that are not controlled by design or engineering means. Depending on work tasks, the following training is required. Individuals who may require this training are also listed below.

- Electrical safety-related work practices that pertain to their respective job assignments - field supervisors, SSHO, employees
- NFPA 70E® (current edition) - managers and supervisors, field supervisors, SSHO, employees
- Hazardous energy control program (ERRG Training Module and Corporate Health and Safety Programs Manual Section 17) - field supervisors, SSHO, employees
  - This energy control training and periodic inspections to ensure that before any employee performs any servicing or maintenance on a machine or equipment where the unexpected energizing, startup or release of stored energy could occur and cause injury, the machine or equipment will be isolated from the energy source and rendered inoperative in accordance with 29 CFR §1910.147.
  - Each authorized employee will receive training in the recognition of applicable hazardous energy sources, the type and magnitude of the energy available in the workplace, and the methods and means necessary for energy isolation and control. This includes limitations of tags (if used).
  - Each affected employee will be instructed in the purpose and use of the energy control procedure. This includes limitations of tags (if used).
  - All other employees whose work operations are or may be in an area where energy control procedures may be utilized, will be instructed about the procedure, and about the prohibition relating to attempts to restart or reenergize machines or equipment which are locked out or tagged out. This includes limitations of tags (if used).
- First Aid/CPR - Employees will be instructed/retrained on the methods of first aid and emergency procedures, such as approved methods for resuscitation, if their duties warrant such training.
- Live-line bare-hand technique on energized circuits – if applicable, employees will be trained in the technique and in the safety requirements. Employees will receive refresher training as required by 29 CFR §1910.269.

9.1. FREQUENCY

Training is required before the employee is exposed to the electrical hazard(s) and at least every 3 years for qualified persons. Retraining will be provided for all authorized and affected employees whenever there is a change in their job assignments, a change in machines, equipment or processes that present a new hazard, or when there is a change in the energy control procedures. Additional retraining will also be conducted whenever a periodic inspection reveals, or whenever the employer has reason to believe that there are deviations from or inadequacies in the employee's knowledge or use of the energy control procedures.

9.2. TRAINING TYPE

Training will consist of classroom, on-the-job, or a combination of the two. The degree of training provided will be determined by the risk to the employee. Employee risk evaluation is determined by site survey, potential tasks, and review of acceptable approach boundaries.

9.2.1. Qualified Person

A Qualified Person will be identified by site management as trained and knowledgeable of the construction and operation of equipment or a specific work method and be trained to recognize and avoid electrical hazards that might be present with the respect to that equipment or work method.

The Qualified Person will also be familiar with the proper use of the special precautionary techniques, personal protective equipment, including arc-flash, insulating and shielding materials, and insulated tools and test equipment. A person can be considered qualified with respect to certain equipment and methods but still unqualified for others.

Qualified Persons that are permitted to work within the Limited Approach Boundary, at a minimum, will be additionally trained in the following:

- The skills and techniques to distinguish exposed energized parts from other parts of electrical equipment.
- The skills and techniques necessary to determine the nominal voltage of exposed parts.
- The approach distances specified in Table 130.4(D)(a) and Table 130.4(D)(b) and the corresponding voltages to which the qualified person will be exposed.
- The decision-making process necessary to do the following:
  - Perform the job safety planning
  - Identify electrical hazards
  - Assess the associated risk
  - Select the appropriate risk control methods and PPE

Employees working on or near exposed energized electrical conductors or circuit parts will be trained in methods of release of victims from contact with exposed energized conductors or circuit parts.

9.2.2. Unqualified Persons

All employees (including “unqualified persons”) will be trained in and be familiar with any electrical safety practices related to the potential risks of the site or facility meeting the minimum requirements necessary for their safety.

10. Attachments

Extracted tables from NFPA 70E® (2018 Edition) listed below are presented after Section 10.

- Table 130.4(D)(a) – Shock Protection Approach Boundaries to Exposed Energized Electrical Conductors or Circuit Parts of Alternating Current Systems
- Table 130.4(D)(b) – Shock Protection Approach Boundaries to Exposed Energized Electrical Conductors or Circuit Parts of Direct-Current Voltage Systems
- Table 130.5(C) – Estimate of the Likelihood of Occurrence of an Arc Flash Incident for ac and dc Systems
- Table 130.7(C)(15)(a) – Arc-Flash PPE Categories for Alternating Current (ac) Systems
- Table 130.7(C)(15)(b) – Arc-Flash PPE Categories for Direct Current (dc) Systems

Enviro Safetech
Your SAFETY is Our Business
2160-B Oakland Road, San Jose, CA 95131
tel: (408) 943-9090 fax: (408) 943-9292
web: www.envirosafetech.com

NFPA 70E Tables

N **Table 130.4(D)(a) Shock Protection Approach Boundaries to Exposed Energized Electrical Conductors or Circuit Parts for Alternating-Current Systems**

(1)	(2)	(3)	(4)
	Limited Approach Boundary[b]		Restricted Approach Boundary[b]; Includes Inadvertent Movement Adder
Nominal System Voltage Range, Phase to Phase[a]	Exposed Movable Conductor[c]	Exposed Fixed Circuit Part	
Less than 50 V	Not specified	Not specified	Not specified
50 V–150 V[d]	3.0 m (10 ft 0 in.)	1.0 m (3 ft 6 in.)	Avoid contact
151 V–750 V	3.0 m (10 ft 0 in.)	1.0 m (3 ft 6 in.)	0.3 m (1 ft 0 in.)
751 V–15 kV	3.0 m (10 ft 0 in.)	1.5 m (5 ft 0 in.)	0.7 m (2 ft 2 in.)
15.1 kV–36 kV	3.0 m (10 ft 0 in.)	1.8 m (6 ft 0 in.)	0.8 m (2 ft 9 in.)
36.1 kV–46 kV	3.0 m (10 ft 0 in.)	2.5 m (8 ft 0 in.)	0.8 m (2 ft 9 in.)
46.1 kV–72.5 kV	3.0 m (10 ft 0 in.)	2.5 m (8 ft 0 in.)	1.0 m (3 ft 6 in.)
72.6 kV–121 kV	3.3 m (10 ft 8 in.)	2.5 m (8 ft 0 in.)	1.0 m (3 ft 6 in.)
138 kV–145 kV	3.4 m (11 ft 0 in.)	3.0 m (10 ft 0 in.)	1.2 m (3 ft 10 in.)
161 kV–169 kV	3.6 m (11 ft 8 in.)	3.6 m (11 ft 8 in.)	1.3 m (4 ft 3 in.)
230 kV–242 kV	4.0 m (13 ft 0 in.)	4.0 m (13 ft 0 in.)	1.7 m (5 ft 8 in.)
345 kV–362 kV	4.7 m (15 ft 4 in.)	4.7 m (15 ft 4 in.)	2.8 m (9 ft 2 in.)
500 kV–550 kV	5.8 m (19 ft 0 in.)	5.8 m (19 ft 0 in.)	3.6 m (11 ft 8 in.)
765 kV–800 kV	7.2 m (23 ft 9 in.)	7.2 m (23 ft 9 in.)	4.9 m (15 ft 11 in.)

Notes:
(1) For arc flash boundary, see 130.5(A).
(2) All dimensions are distance from exposed energized electrical conductors or circuit part to employee.
[a]For single-phase systems above 250 volts, select the range that is equal to the system's maximum phase-to-ground voltage multiplied by 1.732.
[b]See definition in Article 100 and text in 130.4(D)(2) and Informative Annex C for elaboration.
[c]*Exposed movable conductors* describes a condition in which the distance between the conductor and a person is not under the control of the person. The term is normally applied to overhead line conductors supported by poles.
[d]This includes circuits where the exposure does not exceed 120 volts nominal.

N **Table 130.4(D)(b) Shock Protection Approach Boundaries to Exposed Energized Electrical Conductors or Circuit Parts for Direct-Current Voltage Systems**

(1)	(2)	(3)	(4)
	Limited Approach Boundary		Restricted Approach Boundary; Includes Inadvertent Movement Adder
Nominal Potential Difference	Exposed Movable Conductor*	Exposed Fixed Circuit Part	
Less than 50 V	Not specified	Not specified	Not specified
50 V–300 V	3.0 m (10 ft 0 in.)	1.0 m (3 ft 6 in.)	Avoid contact
301 V–1 kV	3.0 m (10 ft 0 in.)	1.0 m (3 ft 6 in.)	0.3 m (1 ft 0 in.)
1.1 kV–5 kV	3.0 m (10 ft 0 in.)	1.5 m (5 ft 0 in.)	0.5 m (1 ft 5 in.)
5 kV–15 kV	3.0 m (10 ft 0 in.)	1.5 m (5 ft 0 in.)	0.7 m (2 ft 2 in.)
15.1 kV–45 kV	3.0 m (10 ft 0 in.)	2.5 m (8 ft 0 in.)	0.8 m (2 ft 9 in.)
45.1 kV– 75 kV	3.0 m (10 ft 0 in.)	2.5 m (8 ft 0 in.)	1.0 m (3 ft 6 in.)
75.1 kV–150 kV	3.3 m (10 ft 8 in.)	3.0 m (10 ft 0 in.)	1.2 m (3 ft 10 in.)
150.1 kV–250 kV	3.6 m (11 ft 8 in.)	3.6 m (11 ft 8 in.)	1.6 m (5 ft 3 in.)
250.1 kV–500 kV	6.0 m (20 ft 0 in.)	6.0 m (20 ft 0 in.)	3.5 m (11 ft 6 in.)
500.1 kV–800 kV	8.0 m (26 ft 0 in.)	8.0 m (26 ft 0 in.)	5.0 m (16 ft 5 in.)

Note: All dimensions are distance from exposed energized electrical conductors or circuit parts to worker.
**Exposed movable conductor* describes a condition in which the distance between the conductor and a person is not under the control of the person. The term is normally applied to overhead line conductors supported by poles.

Table 130.5(C) Estimate of the Likelihood of Occurrence of an Arc Flash Incident for ac and dc Systems

Task	Equipment Condition	Likelihood of Occurrence*
Reading a panel meter while operating a meter switch. Performing infrared thermography and other non-contact inspections outside the restricted approach boundary. This activity does not include opening of doors or covers. Working on control circuits with exposed energized electrical conductors and circuit parts, nominal 125 volts ac or dc, or below without any other exposed energized equipment over nominal 125 volts ac or dc, including opening of hinged covers to gain access. Examination of insulated cable with no manipulation of cable. For dc systems, insertion or removal of individual cells or multi-cell units of a battery system in an open rack. For dc systems, maintenance on a single cell of a battery system or multi-cell units in an open rack.	Any	No
For ac systems, work on energized electrical conductors and circuit parts, including voltage testing. For dc systems, working on energized electrical conductors and circuit parts of series-connected battery cells, including voltage testing. Removal or installation of CBs or switches. Opening hinged door(s) or cover(s) or removal of bolted covers (to expose bare, energized electrical conductors and circuit parts). For dc systems, this includes bolted covers, such as battery terminal covers. Application of temporary protective grounding equipment, after voltage test. Working on control circuits with exposed energized electrical conductors and circuit parts, greater than 120 volts. Insertion or removal of individual starter buckets from motor control center (MCC). Insertion or removal (racking) of circuit breakers (CBs) or starters from cubicles, doors open or closed. Insertion or removal of plug-in devices into or from busways. Examination of insulated cable with manipulation of cable. Working on exposed energized electrical conductors and circuit parts of equipment directly supplied by a panelboard or motor control center. Insertion or removal of revenue meters (kW-hour, at primary voltage and current). Removal of battery conductive intercell connector covers. For dc systems, working on exposed energized electrical conductors and circuit parts of utilization equipment directly supplied by a dc source. Opening voltage transformer or control power transformer compartments. Operation of outdoor disconnect switch (hookstick operated) at 1 kV through 15 kV. Operation of outdoor disconnect switch (gang-operated, from grade) at 1 kV through 15 kV.	Any	Yes
Operation of a CB, switch, contactor, or starter. Voltage testing on individual battery cells or individual multi-cell units. Removal or installation of covers for equipment such as wireways, junction boxes, and cable trays that does not expose bare, energized electrical conductors and circuit parts. Opening a panelboard hinged door or cover to access dead front overcurrent devices. Removal of battery nonconductive intercell connector covers.	Normal	No
Maintenance and testing on individual battery cells or individual multi-cell units in an open rack Insertion or removal of individual cells or multi-cell units of a battery system in an open rack. Arc-resistant switchgear Type 1 or 2 (for clearing times of less than 0.5 sec with a prospective fault current not to exceed the arc-resistant rating of the equipment) and metal enclosed interrupter switchgear, fused or unfused of arc resistant type construction, 1 kV through 15 kV. Insertion or removal (racking) of CBs from cubicles; Insertion or removal (racking) of ground and test device; or Insertion or removal (racking) of voltage transformers on or off the bus.	Abnormal	Yes

Table 130.5(C) ***Continued***

Task	Equipment Condition	Likelihood of Occurrence*
Equipment condition considered to be "normal" if all of the following circumstances apply: (1) The equipment is properly installed in accordance with the manufacturer's recommendations and applicable industry codes and standards. (2) The equipment is properly maintained in accordance with the manufacturer's recommendations and applicable industry codes and standards. (3) The equipment is used in accordance with instructions included in the listing and labeling and in accordance with manufacturer's instructions. (4) Equipment doors are closed and secured. (5) Equipment covers are in place and secured. (6) There is no evidence of impending failure such as arcing, overheating, loose or bound equipment parts, visible damage, or deterioration.		

*As defined in this standard, the two components of risk are the likelihood of occurrence of injury or damage to health and the severity of injury or damage to health that results from a hazard. Risk assessment is an overall process that involves estimating both the likelihood of occurrence and severity to determine if additional protective measures are required. The estimate of the likelihood of occurrence contained in this table does not cover every possible condition or situation, nor does it address severity of injury or damage to health. Where this table identifies "No" as an estimate of likelihood of occurrence, it means that an arc flash incident is not likely to occur. Where this table identifies "Yes" as an estimate of likelihood of occurrence, it means that additional protective measures are required to be selected and implemented according to the hierarchy of risk control identified in 110.1(H).

Informational Note No. 1: An example of a standard that provides information for arc-resistant switchgear referred to in Table 130.5(C) is IEEE C37.20.7, *Guide for Testing Metal-Enclosed Switchgear Rated Up to 38 kV for Internal Arcing Faults.*

Informational Note No. 2: Improper or inadequate maintenance can result in increased fault clearing time of the overcurrent protective device, thus increasing the incident energy. Where equipment is not properly installed or maintained, PPE selection based on incident energy analysis or the PPE category method might not provide adequate protection from arc flash hazards.

Informational Note No. 3: Both larger and smaller available fault currents could result in higher incident energy. If the available fault current increases without a decrease in the fault clearing time of the overcurrent protective device, the incident energy will increase. If the available fault current decreases, resulting in a longer fault clearing time for the overcurrent protective device, incident energy could also increase.

Informational Note No. 4: The occurrence of an arcing fault inside an enclosure produces a variety of physical phenomena very different from a bolted fault. For example, the arc energy resulting from an arc developed in the air will cause a sudden pressure increase and localized overheating. Equipment and design practices are available to minimize the energy levels and the number of procedures that could expose an employee to high levels of incident energy. Proven designs such as arc-resistant switchgear, remote racking (insertion or removal), remote opening and closing of switching devices, high-resistance grounding of low-voltage and 5000-volt (nominal) systems, current limitation, and specification of covered bus or covered conductors within equipment are available to reduce the risk associated with an arc flash incident. See Informative O for safety-related design requirements.

Informational Note No. 5: For additional direction for performing maintenance on overcurrent protective devices, see Chapter 2, Safety-Related Maintenance Requirements.

Informational Note No. 6: See IEEE 1584, *Guide for Performing Arc Flash Calculations*, for more information regarding incident energy and the arc flash boundary for three-phase systems.

Table 130.7(C)(15)(a) Arc-Flash PPE Categories for Alternating Current (ac) Systems

Equipment	Arc-Flash PPE Category	Arc-Flash Boundary
Panelboards or other equipment rated 240 volts and below Parameters: Maximum of 25 kA available fault current; maximum of 0.03 sec (2 cycles) fault clearing time; minimum working distance 455 mm (18 in.)	1	485 mm (19 in.)
Panelboards or other equipment rated greater than 240 volts and up to 600 volts Parameters: Maximum of 25 kA available fault current; maximum of 0.03 sec (2 cycles) fault clearing time; minimum working distance 455 mm (18 in.)	2	900 mm (3 ft)
600-volt class motor control centers (MCCs) Parameters: Maximum of 65 kA available fault current; maximum of 0.03 sec (2 cycles) fault clearing time; minimum working distance 455 mm (18 in.)	2	1.5 m (5 ft)
600-volt class motor control centers (MCCs) Parameters: Maximum of 42 kA available fault current; maximum of 0.33 sec (20 cycles) fault clearing time; minimum working distance 455 mm (18 in.)	4	4.3 m (14 ft)
600-volt class switchgear (with power circuit breakers or fused switches) and 600-volt class switchboards Parameters: Maximum of 35 kA available fault current; maximum of up to 0.5 sec (30 cycles) fault clearing time; minimum working distance 455 mm (18 in.)	4	6 m (20 ft)
Other 600-volt class (277 volts through 600 volts, nominal) equipment Parameters: Maximum of 65 kA available fault current; maximum of 0.03 sec (2 cycles) fault clearing time; minimum working distance 455 mm (18 in.)	2	1.5 m (5 ft)
NEMA E2 (fused contactor) motor starters, 2.3 kV through 7.2 kV Parameters: Maximum of 35 kA available fault current; maximum of up to 0.24 sec (15 cycles) fault clearing time; minimum working distance 910 mm (36 in.)	4	12 m (40 ft)
Metal-clad switchgear, 1 kV through 15 kV Parameters: Maximum of 35 kA available fault current; maximum of up to 0.24 sec (15 cycles) fault clearing time; minimum working distance 910 mm (36 in.)	4	12 m (40 ft)
Arc-resistant switchgear 1 kV through 15 kV [for clearing times of less than 0.5 sec (30 cycles) with an available fault current not to exceed the arc-resistant rating of the equipment], and metal-enclosed interrupter switchgear, fused or unfused of arc-resistant-type construction, 1 kV through 15 kV Parameters: Maximum of 35 kA available fault current; maximum of up to 0.24 sec (15 cycles) fault clearing time; minimum working distance 910 mm (36 in.)	N/A (doors closed) 4 (doors open)	N/A (doors closed) 12 m (40 ft)
Other equipment 1 kV through 15 kV Parameters: Maximum of 35 kA available fault current; maximum of up to 0.24 sec (15 cycles) fault clearing time; minimum working distance 910 mm (36 in.)	4	12 m (40 ft)

Note: For equipment rated 600 volts and below and protected by upstream current-limiting fuses or current-limiting circuit breakers sized at 200 amperes or less, the arc flash PPE category can be reduced by one number but not below arc flash PPE category 1.

Informational Note to Table 130.7(C)(15)(a): The following are typical fault clearing times of overcurrent protective devices:

(1) 0.5 cycle fault clearing time is typical for current limiting fuses when the fault current is within the current limiting range.

(2) 1.5 cycle fault clearing time is typical for molded case circuit breakers rated less than 1000 volts with an instantaneous integral trip.

(3) 3.0 cycle fault clearing time is typical for insulated case circuit breakers rated less than 1000 volts with an instantaneous integral trip or relay operated trip.

(4) 5.0 cycle fault clearing time is typical for relay operated circuit breakers rated 1 kV to 35 kV when the relay operates in the instantaneous range (i.e., "no intentional delay").

(5) 20 cycle fault clearing time is typical for low-voltage power and insulated case circuit breakers with a short time fault clearing delay for motor inrush.

(6) 30 cycle fault clearing time is typical for low-voltage power and insulated case circuit breakers with a short time fault clearing delay without instantaneous trip.

Informational Note No. 1: See Table 1 of IEEE 1584TM, *Guide for Performing Arc Flash Hazard Calculations*, for further information regarding Notes b through d.

Informational Note No. 2: An example of a standard that provides information for arc-resistant switchgear referred to in Table 130.7(C)(15)(a) is IEEE C37.20.7, *Guide for Testing Metal-Enclosed Switchgear Rated Up to 38 kV for Internal Arcing Faults.*

Table 130.7(C)(15)(b) Arc-Flash PPE Categories for Direct Current (dc) Systems

Equipment	Arc-Flash PPE Category	Arc-Flash Boundary
Storage batteries, dc switchboards, and other dc supply sources Parameters: Greater than or equal to 100 V and less than or equal to 250 V Maximum arc duration and minimum working distance: 2 sec @ 455 mm (18 in.)		
Available fault current less than 4 kA	2	900 mm (3 ft)
Available fault current greater than or equal to 4 kA and less than 7 kA	2	1.2 m (4 ft)
Available fault current greater than or equal to 7 kA and less than 15 kA	3	1.8 m (6 ft)
Storage batteries, dc switchboards, and other dc supply sources Parameters: Greater than 250 V and less than or equal to 600 V Maximum arc duration and minimum working distance: 2 sec @ 455 mm (18 in.)		
Available fault current less than 1.5 kA	2	900 mm (3 ft)
Available fault current greater than or equal to 1.5 kA and less than 3 kA	2	1.2 m (4 ft)
Available fault current greater than or equal to 3 kA and less than 7 kA	3	1.8 m (6 ft.)
Available fault current greater than or equal to 7 kA and less than 10 kA	4	2.5 m (8 ft)

Notes

(1) Apparel that can be expected to be exposed to electrolyte must meet both of the following conditions:

(a) Be evaluated for electrolyte protection

Informational Note: ASTM F1296, *Standard Guide for Evaluating Chemical Protective Clothing*, contains information on evaluating apparel for protection from electrolyte.

(b) Be arc-rated

Informational Note: ASTM F1891, *Standard Specifications for Arc Rated and Flame Resistant Rainwear*, contains information on evaluating arc-rated apparel.

(2) A two-second arc duration is assumed if there is no overcurrent protective device (OCPD) or if the fault clearing time is not known. If the fault clearing time is known and is less than 2 seconds, an incident energy analysis could provide a more representative result.

Informational Note No. 1: When determining available fault current, the effects of cables and any other impedances in the circuit should be included. Power system modeling is the best method to determine the available short-circuit current at the point of the arc. Battery cell short-circuit current can be obtained from the battery manufacturer. See Informative Annex D.5 for the basis for table values and alternative methods to determine dc incident energy. Methods should be used with good engineering judgment.

Informational Note No. 2: The methods for estimating the dc arc-flash incident energy that were used to determine the categories for this table are based on open-air incident energy calculations. Open-air calculations were used because many battery systems and other dc process systems are in open areas or rooms. If the specific task is within an enclosure, it would be prudent to consider additional PPE protection beyond the value shown in this table. Research with ac arc flash has shown a multiplier of as much as 3× for arc-in-a-box [508 mm (20 in.) cube] versus open air. Engineering judgment is necessary when reviewing the specific conditions of the equipment and task to be performed, including the dimensions of the enclosure and the working distance involved.

CLASS	TEST AC VOLTS	USE AC VOLTS	USE DC VOLTS	LABEL COLOR	LABEL IMAGE
00	2,500	500	750	Beige	
0	5,000	1,000	1,500	Red	
1	10,000	7,500	11,250	White	
2	20,000	17,000	25,500	Yellow	
3	30,000	26,500	39,750	Green	
4	40,000	36,000	54,000	Orange	

Appendix I

Startup and Shutdown Diagrams

Photo 1 - HOME SCREEN

Photo 2 - HOA SCREEN

Photo 3 - ALARM SCREEN #1

Photo 4 - ALARM SCREEN #2

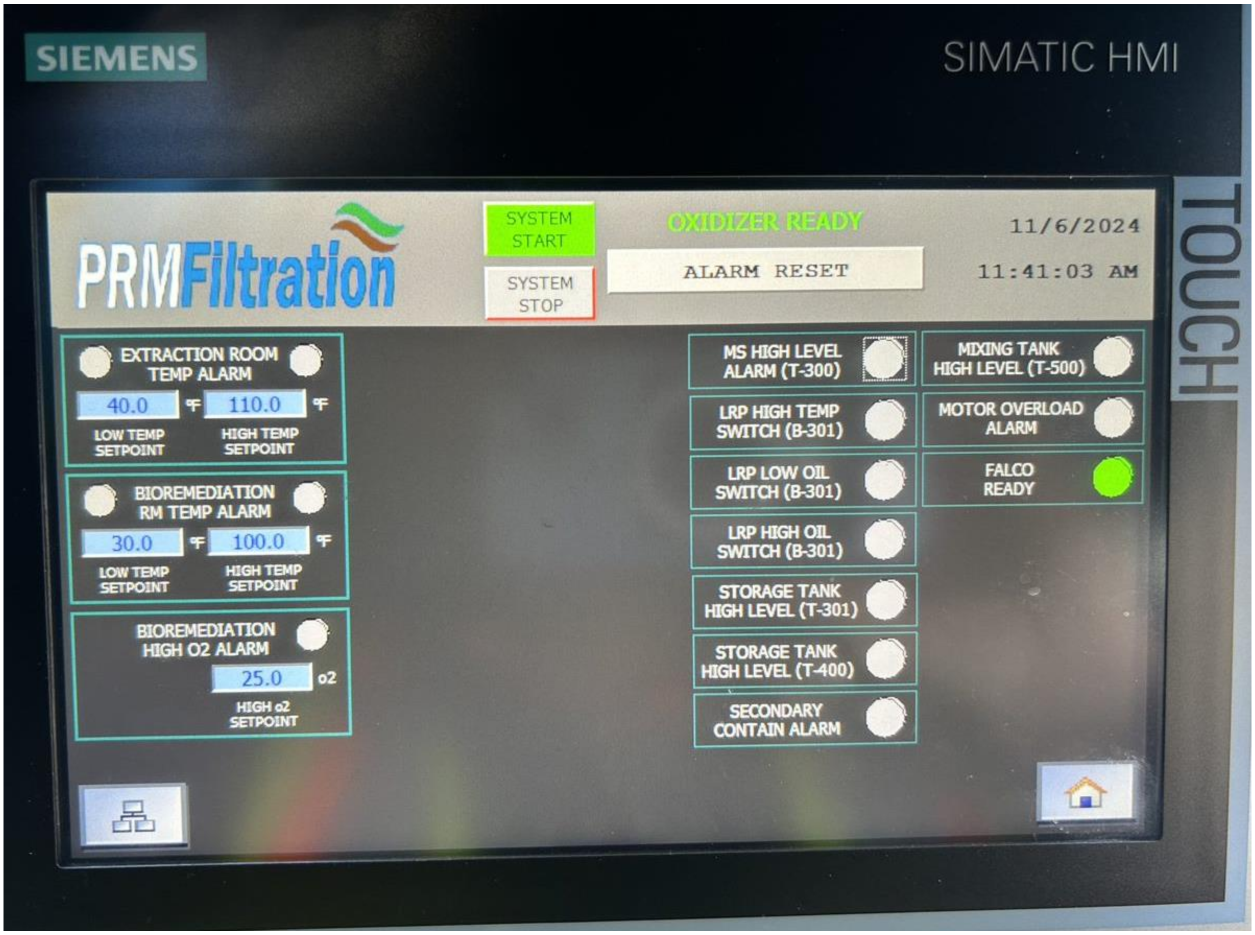


Photo 5 - STATUS SCREEN

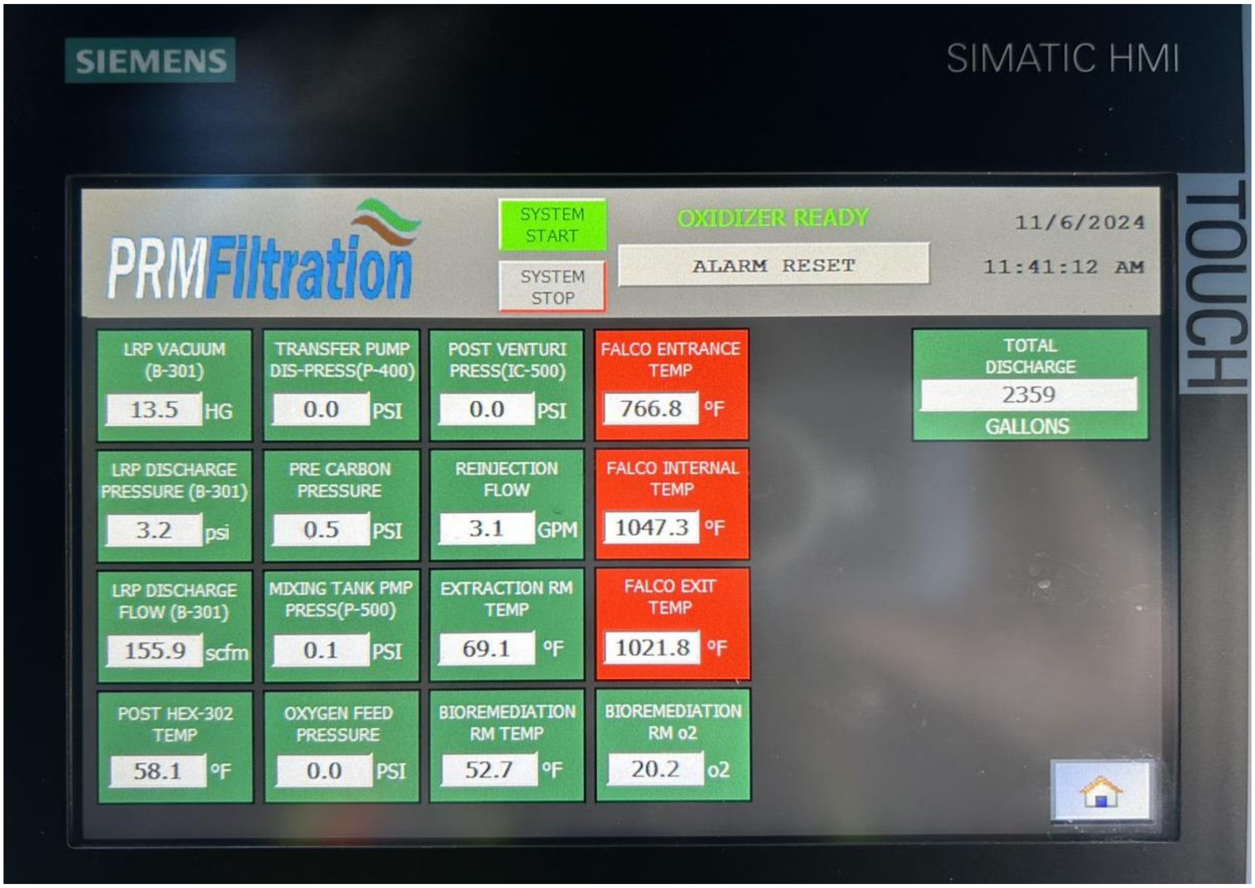


Photo 6 - MANUAL SCREEN