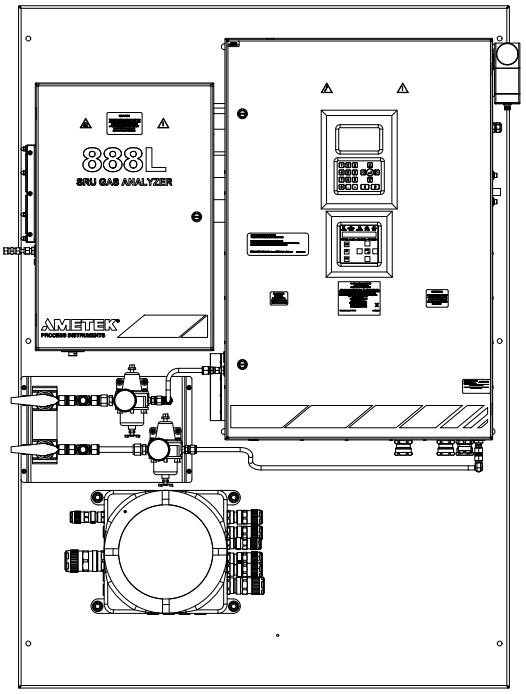
AMETEK®
PROCESS INSTRUMENTS

ESSENTIAL HEALTH and SAFETY

888L Tail Gas Analyzer
ATEX/IECEx



PN 883056903, Rev C

To obtain a PDF of this manual, visit our Products page at www.AMETEKpi.com.

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Overview

About This Document

This document describes the essential health and safety requirements for the components that make up the 888L Analyzer intended for use in explosive atmosphere locations (Zone 1).

The procedures and information discussed in this document include only the steps to install, operate, and perform maintenance on the 888L Analyzer. They do, however, include all relevant safety warnings and cautions to ensure the safety of personnel and the analyzer in explosive atmosphere locations.

[For complete and detailed descriptions of the procedures discussed in this guide, refer to the analyzer *User Manual*.]

AMETEK takes great effort to ensure that its translations of documents into foreign languages are accurate and complete. However, in the case of any discrepancies between the English version and the translated version, the original English version shall take precedence. AMETEK will not assume liability for any such discrepancies, or issues arising from them.

Important Safety Information

Warnings, Cautions, Notes

WARNINGS, CAUTIONS, and NOTES contained in this manual emphasize critical instructions as follows:

Important information that should not be overlooked.

An operating procedure which, if not strictly observed, may result in personal injury or environmental contamination.

An operating procedure which, if not strictly observed, may result in damage to the equipment.

Burn hazard. Hot surface. Do not touch, allow to cool before servicing.

Grounding

Instrument grounding is mandatory. Performance specifications and safety protection are void if instrument is operated from an improperly grounded power source.

Verify ground continuity of all equipment before applying power.

Personnel and Equipment Safety Information

Before working with the 888L ATEX-IECEx Essential Health and Safety Requirements document, read and understand the following Notes, Warnings, and Cautions, regarding safety and other required information. Additional Notes, Warnings, and Cautions included in individual procedures in this document (and in the analyzer *User Manual*) indicate special conditions to consider during installation, before opening the analyzer covers or doors, and while working on the analyzer.

High voltages are present in the analyzer housings. Always disconnect power and/or external power sources to the analyzer before opening any covers or doors on the analyzer to check or perform maintenance on any components within the enclosures.

If it is necessary to open the analyzer's covers or doors while the circuits are live, first monitor the area for flammable gases and proceed only when the area is safe.

When the Electronics Enclosure and/or other enclosures are open, take appropriate precautions to avoid electrical shock. Hazardous voltages are present inside.

All electrical connections, adjustments, or servicing of the analyzer should be performed only by properly trained and qualified personnel.

All electrical connections, materials, and methods (plus all safety standards and procedures) must be made in compliance with local wiring regulations and electrical code for the hazardous area, as specified by the Owner Company, local electrical-inspection authority, and National/EU regulations.

Follow appropriate regulatory and/or company procedures to lock out the analyzer while working on the analyzer electronics.

Verify ground continuity of all equipment before applying power. For electrical shock protection, the analyzer must be operated from a grounded power source that has a securely connected protective ground contact.

The glass Xenon Flash Lamp is under high internal pressure which could result in flying glass fragments if ruptured. Handle the tube with care to avoid dropping it, subjecting it to impacts, applying excessive force to it, or scratching it.

While handling a flash lamp, always wear protective devices (face mask, clothing) to prevent possible injury, especially to hand and face areas.

Before working on the sample system, confirm that the system has been purged with Zero fluid and is isolated (blocked in) from the process.

The Cell Oven Enclosure and components inside this enclosure are hot; always wear protective devices to avoid burning yourself.

Check the sample probe installation, sample connections at analyzer, and sample return for leaks before opening sample inlet ball valve and sample return valve.

The sample gas contains highly toxic and corrosive substances. Proper personal protective equipment including fresh air breathing apparatus, eye protection, and skin protection MUST BE worn when installing the sample tap and/or opening the main Oven chamber for inspection or maintenance.

The sample gas contains highly toxic and corrosive substances. Analyzed sample must be returned to the process or vented to a safe area.

THIS ENCLOSURE IS PROTECTED BY PURGING
Enclosure shall not be opened unless the area is known to be non-hazardous, or unless all devices within have been de-energized. Power shall not be restored after enclosure has been opened until the enclosure has been purged in accordance with the purge system start-up instructions.

Warning Labels

These symbols may appear on the instrument to alert you of existing conditions.

Protective Conductor Terminal
(BORNIER DE L'ECRAN DE PROTECTION)
Schutzerde

Caution – Risk of electric shock
(ATTENTION – RISQUE DE DÉCHARGE ÉLECTRIQUE)
Achtung – Hochspannung Lebensgefahr

Caution – Refer to accompanying documents
(ATTENTION – SE RÉFERER AUX DOCUMENTS JOINTS)
Achtung – Beachten Sie beiliegende Dokumente

CAUTION – Hot Surface
(ATTENTION – SURFACE CHAUDE)
Achtung – Heiße Oberfläche

About the 888L Tail Gas Analyzer

Classified, Hazardous Area Protection Components and Functions

The analyzer must be installed and operated in accordance with this instruction manual. [For complete details about the operation of the purge system, refer to the analyzer *User Manual*.]

General Overview

The AMETEK 888L Tail Gas Analyzer uses photometric analysis to continuously monitor hydrogen sulfide (H2S) and sulfur dioxide (SO2) present in the tail gas stream of a Claus plant, and provides four 4–20 mA, analog outputs into a maximum 1000 ohm load. These analog outputs are proportional to volumetric gas concentration for H2S and SO2.

The analyzer consists of an Analyzer Panel, Probe Enclosure and Connecting Sample Bundle (heated sample line which connects the Analyzer Panel to the Probe Enclosure). The connecting bundle may be up to 20 m long. The Analyzer Panel consists of an Electronics Enclosure; a Temperature-Controlled Oven Enclosure; and a Customer Connection Enclosure. These enclosures are assembled onto a rigid mounting stainless steel panel (Analyzer Panel) for support.

The Probe Enclosure is attached to the end of the connecting bundle and mounts directly to the process pipe with a certified Ex "eb" junction box mounted to the top right side.

The Connecting Sample bundle is provided by the end user and must comply with all certification requirements for the hazardous area. Installation of the bundle must be in accordance with standard IEC/EN 60079-14:2013.

The analyzer is designed for outdoor, explosive atmosphere installations. The 888L Tail Gas Analyzer is designed to comply with requirements for electrical equipment in Zone 1 classified Explosive Atmospheres. The methods of protection used include Type "pxb" (pressurized enclosure), Type "eb" (increased safety), and Type "db" (flameproof enclosure). The purge system, redundant heater control, and enclosure designs assure that the system will not ignite surrounding gases. For this reason, any repairs must not bypass these safety considerations and must use only recommended components. The purge system consists of a regulated supply of instrument air, the Electronics Enclosure, and purge exhaust vent.

The Purge Controller monitors the enclosure pressure and interrupts mains power in the event pressure is lost. A disconnect assembly within a flameproof enclosure isolates all external signals should mains power be disconnected.

After the instrument air supply has been connected to the analyzer and turned on, the system is to be purged for approximately 3 to 10 minutes to ensure ten (10) full exchanges of air within the purged enclosure. The flow is controlled by the Purge Controller through an exhaust vent. Once the controller senses that there have been ten air exchanges within the enclosure, mains power is connected to the electronics.

When the Electronics Enclosure is opened or the pressurization gas supply is lost, the Purge Controller will disconnect mains power which, in turn, will disconnect all signal wiring. The analyzer should not be used without purge protection unless the area is known to be non-hazardous.

The analyzer may only be energized with permission of the works manager or his proxy. Permission may only be given when it has been determined that an explosive atmosphere is not present or when the necessary protective measures against explosion hazards have been taken ("hot permit") during the time that the system is energized.

The analyzer enclosure may not be opened when energized if an explosive atmosphere is present.

For normal analyzer operation, the purge system must be on.

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Specifications

888L Tail Gas Analyzer Specifications

For a complete listing of all analyzer specifications, refer to the 888L Analyzer *User Manual*.

Utility Requirements

Electrical	**Analyzer Enclosure and Probe Enclosure:** 100 VAC (90–110 VAC), 47–63 Hz, 500 Watts Analyzer Panel + 400 watts Probe Enclosure OR 120 VAC (105–132 VAC), 47–63 Hz, 500 Watts Analyzer Panel + 400 watts Probe Enclosure OR 240 VAC (209–264 VAC), 47–63 Hz, 500 Watts Analyzer Panel + 400 watts Probe Enclosure **Sample Bundle:** Maximum current of 20 Amps, Maximum voltage of 240 VAC (209–264 VAC), 47–63 Hz
Environmental Conditions	Ambient Temperature Limit: -20 °C to +60 °C (-4 °F to +140 °F) Ingress Rating: IP 65 Note: The analyzer must be shaded from direct sunlight.
Enclosures	Electronics and Oven Enclosures, backplate, and keypad are 316 stainless steel.
Pressure Ratings	Instrument Air: Pressure 379–517 kPa (55–75 PSIG / 3.8–5.2 barg)
Ranges	Standard Range: 0–2 % H2S and 0–1 % SO2 High Range: 0–4 % H2S and 0–2 % SO2 Other ranges available upon request.
Performance	All performance specifications are based on a normal operation that includes periodic Zero and photo span Calibration. Accuracy: ±1 % of full–scale range Reproducibility: ±1 % of full–scale range Repeatability: <1 % of full–scale range Noise: ±0.5 % of full–scale range Zero Drift: <0.5 % of full scale range Response Time: 90 % in less than 15 seconds, typical with photo noise at default

Cell Battery Type	Primary Lithium polycarbon monofluoride (Li/CF(n)) Size: 20 mm Coin Cell Operating Temp: -30 °C to +80 °C Nominal Voltage: 3.3 V Minimum Internal Resistance: 3.1 mΩ Capacity: 190 mAh Weight: 2.5 g Dimensions: 3.2 mm (H) X 20 mm (D) ±0.3 mm
Calibration	Factory calibrated; Automatic Calibration capability (no hazardous or toxic Calibration gases are needed)
Communication	• Local User Interface AMEVision; 4.2" LCD color, 1/4 VGA display; 19-key piezoelectric keypad (suitable for use with a gloved hand) • Analog Outputs Four (4) 4–20 mA analog outputs are electronically isolated from the controller, but not each other. • Digital Outputs System Alarm, Data Valid, and two (2) configurable digital outputs (30 VAC, 60 VDC, 10 VA, maximum, resistive load only) • Serial Communications RS-485 serial communication; Modbus RTU; two-wire half-duplex; Modbus query rate limited to 30 queries per second. Modbus TCP supports a single TCP master. • Ethernet Fast Ethernet; 100 Mbit/s. Modbus query rate limited to 30 queries per second. Modbus TCP supports a single TCP master. • USB Connectivity USB 2.0 and USB 3.0 • Remote Inputs One (1) digital input for remote Auto-Calibration
Purge Alarm	Rating: 2 Amps, 240 VAC Resistive Alarm Connection: Loss of Purge Pressure; Form C Contact

888 Tail Gas Analyzer Directives and Standards

Explosive Atmosphere ATEX/ IECEx CB	General Safety Certification, using the following standards: IEC/EN 61010–1:2010 (Third Edition) Explosive Atmosphere Certification (Ex db eb [ib] pxb IIC T3 Gb)/ (II 2 G): IEC/EN 60079–0:2017, Ed. 7.0 IEC/EN 60079–1:2014, Ed. 7.0 IEC/EN 60079–2: 2014, Ed. 6.0 IEC/EN 60079–7: 2015+AMD1:2017, Ed. 5.1 **X Condition:** **The flameproof joint of the disconnect enclosure has different values from those specified in the tables of the IEC 60079–1 standard. For any repair, contact the manufacturer.**
EMC	Using the following standards: IEC/EN 61000–6–4: 2007 + A1:2011 IEC/EN 55011: 2009 + A1:2010 IEC/EN 61000–6–2: 2005 IEC/EN 61000–4–2: 2009 IEC/EN 61000–4–3:2006+ A2:2010 IEC/EN 61000–4–4:2012 IEC/EN 61000–4–5:2014 IEC/EN 61000–4–6: 2014 IEC/EN 61000–4–11: 2004 IEC/EN 61326–1: 2013

Analyzer Marking

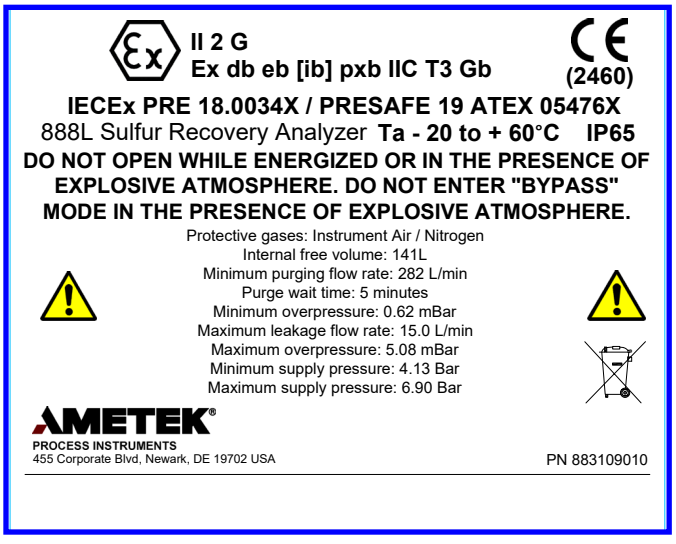

Figure 1.
888L Analyzer label.

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Pre-Installation Requirements

Installation drawings found in this section are for typical installations. Customer drawings (CDs) supplied with the system supersede the drawings included here.

The installation of the analyzer must be in accordance with all of the customer (end user) and local regulatory standards and procedures. There are no operator-serviceable components inside the analyzer. Refer service requirements to qualified personnel.

Read this entire section before beginning installation of the 888L Analyzer. Failure to do so, and / or use of the analyzer in a manner not specified in this manual, may impair the protection against fire, electrical shock and personal injury originally provided by this equipment.

Unpacking and Inspection

Remove components from the packing case(s) carefully; check contents against packing list. Open the enclosures and inspect all components for obvious damage and broken/loose parts or fittings.

If equipment is damaged, notify the carrier and contact AMETEK Service (https://www.ametekpi.com/customersupport/requestsupport) immediately if parts are missing or damage is found, and to verify if damaged parts will require replacement prior to safely installing and operating the analyzer/equipment.

Personnel Technical Level Required for Installation

Installation must be performed by qualified persons in accordance with IEC 60079-11 and IEC 60079-14. Prior to installation please consult the local codes in order to understand what is acceptable. To the extent this information is not consistent with local codes, the local codes should be followed. **It is recommended that only trained personnel perform these installation steps.**

Probe Site Preparation

The 888L Tail Gas Analyzer is approved for installation in hazardous areas classified as Zone 1.

The Probe must be installed on a horizontal run of the tail gas pipe. A site plan should be prepared defining the system mounting location and provisions for power/data interconnect wiring. It is highly recommended that a servicing platform equipped with safety railings be installed at the analyzer mounting site.

Space Requirements

Refer to Figures 2.1 and 2.2 (or the "Field Unit Installation" drawing from the Customer Drawing Package). The analyzer weighs approximately 110 kg (243 lb).

Mechanical Installation

Installation Guidelines

- If using an existing sample tap, make sure that it is internally free of solidified sulfur.
- The 888L returns the sample to process through the annular space around the O.D. of the probe tube. In most cases, the 1/2-inch O.D. probe tube will be running through a 1-inch bore, leaving a 1/4-inch annulus for sample return. If this annular space is blocked with sulfur, the analyzer's aspirator cannot function properly and may impede sample flow.
- The Probe Assembly mounting flange has threaded studs, (flat washers and nuts provided), welded to the flange. Leave adequate clearance under the probe assembly for ease in re-installing the nuts. When lowering the *probe assembly* onto the sample tap, guide the studs into the corresponding holes on the sample tap flange, then attach the flat washers and nuts. Make sure that fittings or other objects do not interfere with rotation of the nuts.

A gasket is recommended between the analyzer flange and process valve to prevent process gas leaks.

- The analyzer is shipped with the Demister, sample valve and sample probe packaged separately from the Cell Oven Enclosure to protect the Demister during shipping. Installation instructions provide assembly details.
- Install the sample probe only after the probe assembly is already in place on the sample tap to minimize escape of process gas.

It will be necessary to open the steam-jacketed ball valve on the sample tap during the probe installation process; be sure the valve handle is accessible after probe installation.

- Be careful when removing the Demister temperature sensing probe (RTD) from the Cell Oven Enclosure when installing the probe. The RTD is not designed to be bent.

Sample Tap Preparation

The Probe Assembly is pipe-mounted to the process pipe using a probe, ball valve and flange.

The sample pipe contains highly toxic and corrosive substances. Proper personal protective equipment including fresh air breathing apparatus, eye protection, and skin protection MUST BE worn when installing the sample tap.

As an additional precaution against escape of toxic gases, AMETEK recommends that a blind flange be installed on the sample tap flange until the probe assembly is installed.

Note the bolt-hole pattern and orientation of the probe assembly mounting flange in Figure 2.1. The tail gas pipe flange bolt pattern must line up with the probe assembly flange bolt pattern. This will provide two possible probe assembly mounting orientations. AMETEK recommends that the probe assembly be installed with the backplate parallel to the tail gas pipe.

Ensure that all parts of the sample tap, from the very beginning of the installation process, are kept heated at a minimum 150 °C and insulated from the process pipe to the bottom of the probe assembly (including flanges). This will prevent plugging the sample tap with solid sulfur which would interfere with commissioning the probe assembly.

AMETEK recommends that a heated, 1-inch ball valve with a 2-inch, 150 lb raised face flange (AMETEK PN 203176001 Steam Jacketed Ball Valve or equivalent) be installed on the nozzle.

To install the sample tap:

1. Install the recommended weld neck (two-inch, 150 lb raised face flange) at a 90° angle to the top of a horizontal run of the tail gas pipe.

2. Mount the probe assembly directly to this valve flange. Ensure that it is installed plumb and level or the probe assembly will not stand straight upon installation (minor angles will not affect analyzer operation). If it is necessary to stand the probe assembly off the process pipe by more than 12 inches, use a steam jacketed spool piece. If nozzle length is less than six inches, a heat trace is not necessary. If the nozzle is six to 12 inches, it should be heat-traced at a minimum of 150 °C. Weld necks greater than 12 inches in length are not recommended.

Never place the probe assembly at such a standoff distance that a sample probe length greater than five feet is required.

3. The sample tap valve handle should be installed so that the handle must be turned down (toward the pipe) to open the valve. If it is installed in such a way that the handle must be turned up (toward the analyzer) to open the valve, the probe enclosure may interfere with its being able to fully open.

Installation Drawings

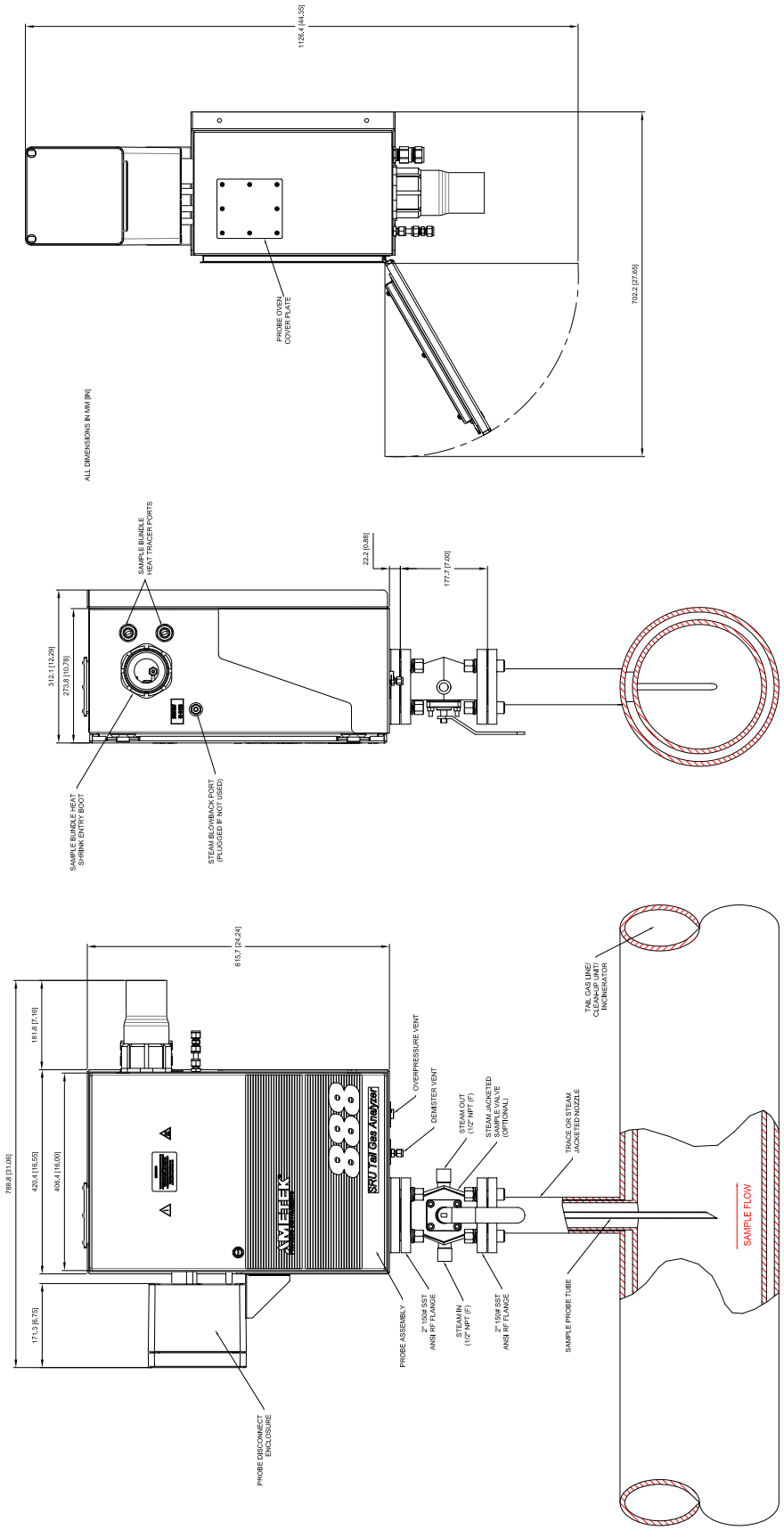


Figure 2.1.
Installation Drawing.

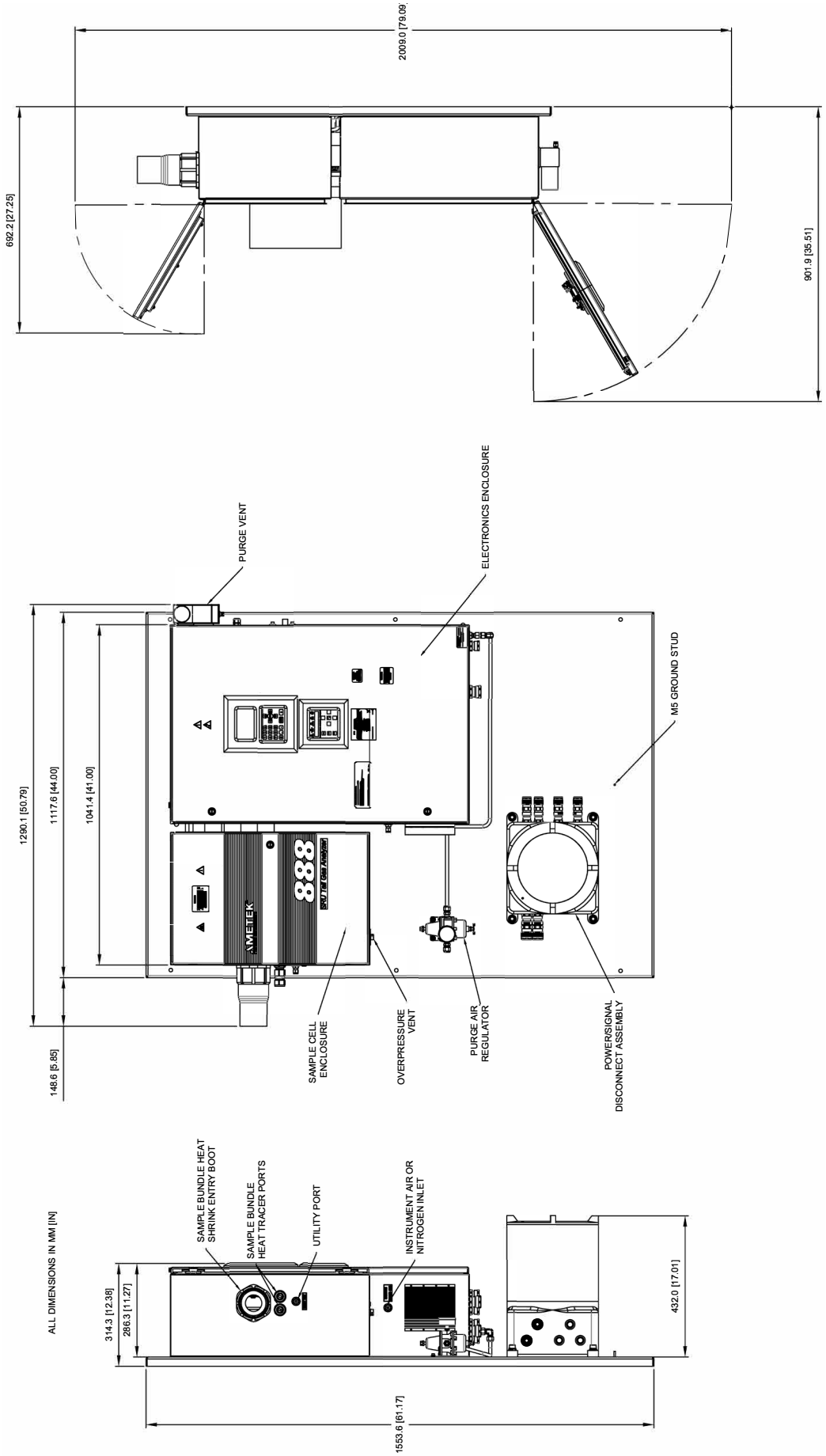


Figure 2.2.
Installation Drawing.

Installing the 888L Analyzer

The sample gas contains highly toxic and corrosive substances. Proper personal protective equipment including fresh air breathing apparatus, eye protection, and skin protection MUST BE worn when installing the sample tap.

Refer to Figures 3.1 and 3.2 or 3.3 for locations of system components.

To install the analyzer:

1. Locate and remove the bolts, nuts, washers, and lock washers from the mounting hardware bag. Retain this hardware for use in Step 5.

2. The sample return valve (**FV2**), located at the bottom of the aspirator, is a 3/8-inch valve which is closed when the handle is in a horizontal position and open when in a vertical position.

*Verify that this valve (***FV2***) is* CLOSED *(horizontal) before proceeding. If it is left open, toxic gases from the tail gas line can flow back through the sample system while the probe is being installed.*

3. Verify that the main sample valve on the tail gas pipe is closed. At this point, ALL PERSONNEL IN THE IMMEDIATE AREA MUST USE FRESH-AIR BREATHING APPARATUS.

4. Remove the blind flange from the main sample valve. Test to make sure that the valve is not leaking toxic process gases. If toxic gases are not detected in the area, it is safe to remove the fresh-air apparatus until the probe installation (Step 7).

5. Install a gasket on the top of the steam-jacketed main sample valve. Using suitable lifting equipment, lower the probe assembly into place so that:

    - The probe assembly back plate is parallel with the tail gas pipe, and

    - The sample inlet ball valve and main sample valve flange bolt patterns line up. Use the nuts, washers, and lock washers (set aside in Step 1) to bolt the flanges together. Use a calibrated torque wrench to torque the bolts in a cross pattern to 54.25 N-m (40 ft.-lb).

The integrity of the connection between the analyzer sample inlet flange to the tail gas pipe flange is critical as it provides the primary support for the analyzer.

6. Remove the screws from the probe oven cover plate at the top of the oven enclosure. Set aside the eight (8) screws. The cover plate must be removed prior to installing the probe. The screws must be reinstalled and tightened after probe installation.

7. Prepare the probe. The probe tube is 1/2-inch diameter, 316 stainless steel tubing. The probe supplied is ~910 mm (36 inches) long. Cut the probe to a length that results in the probe's end extending into the pipe 1/4 to 1/2 of its diameter.

Refer to Figures 2.1, 2.2, 3.1, 3.2, and 3.3 for probe installation drawings. See also "Installing the Probe" in the following pages.

Installing the Probe

Refer to Figures 2.1, 2.2, 3.1, 3.2, 3.3, 4, 5.1, and 5.2 for location of all inlet, valve, and vent locations and component part numbers.

1. Install the probe into the 1/2-inch tube fitting on the sample inlet ball valve (**FV1**) using the supplied stainless steel ferrule. Make sure the fitting is tight and leak free.

    - Make sure the flange fitting components (nut, SST ferrule, and Teflon® seal) are loosely installed on the flange fitting.
    - Verify that the sample inlet ball valve (**FV1**) is closed.
    - Scribe a mark on the probe just under the ball valve to aid in orienting the probe correctly.

All personnel in the immediate area MUST wear fresh-air breathing apparatus for the remaining installation steps. Do not remove breathing apparatus until installation is complete and all fittings have been checked for toxic gas leaks.

2. Install the probe through the sample inlet flange, main process valve, and into the process:

    - Lower the probe/valve assembly through the top of the Cell Oven Enclosure. Slide the probe tube down into the flange fitting. Tighten the compression fitting enough to create a seal around the probe while still allowing the probe to slide. Refer to Figures 3.1 and 3.2. Depending on the length of the probe, it may be necessary to remove the valve handle for the valve to fit through the opening in the top of the Cell Oven Enclosure. If this is the case, the handle must be placed in the closed position before removing the handle.
    - Verify that the analyzer sample inlet ball valve (**FV1**) is closed and remains closed. Continue to slide the probe down through the flange. When the probe tip touches the ball of the main sample valve, back the probe out 1/2-inch and etch a mark on the probe at the top of the flange tube fitting. Open the main sample valve slightly and check for leaks, continue inserting the probe as far as possible. Fully tighten the flange compression fitting. This etched mark will be used for probe removal and replacement.
    - Follow instructions in the analyzer *User Manual* for installation of the probe.

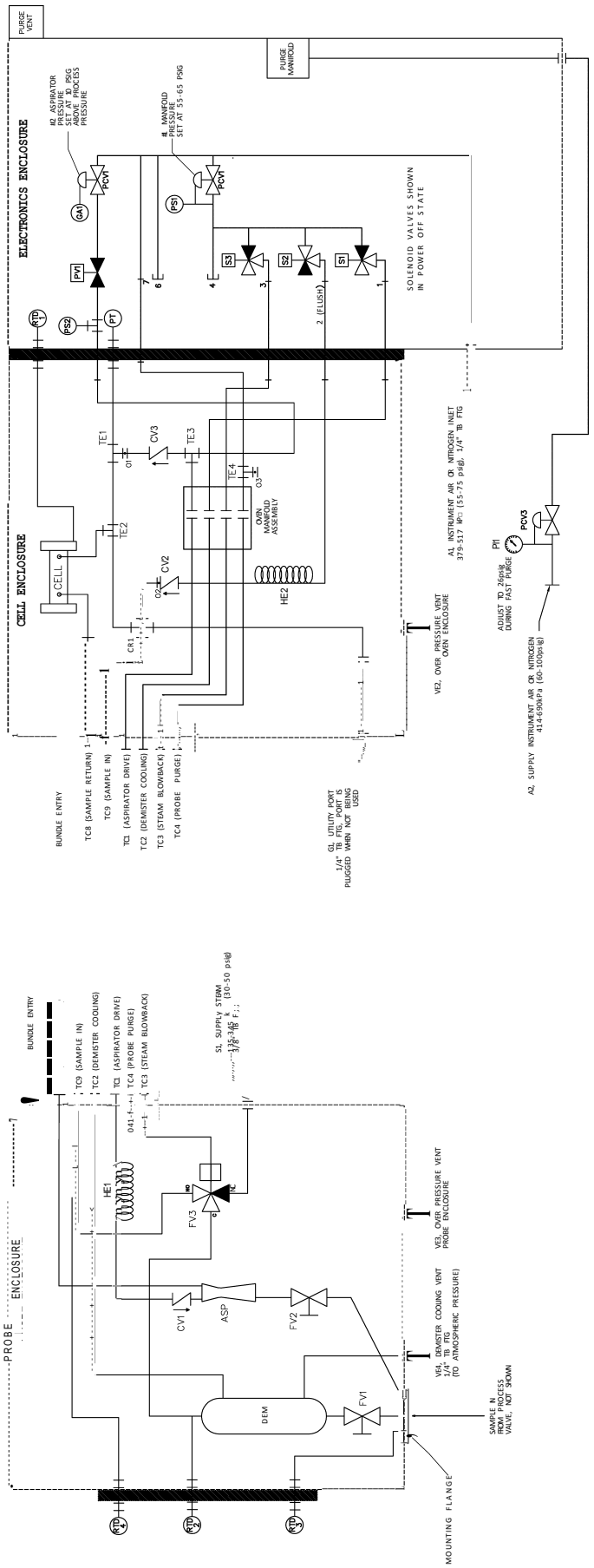


Figure 3.1.
Flow Diagram.

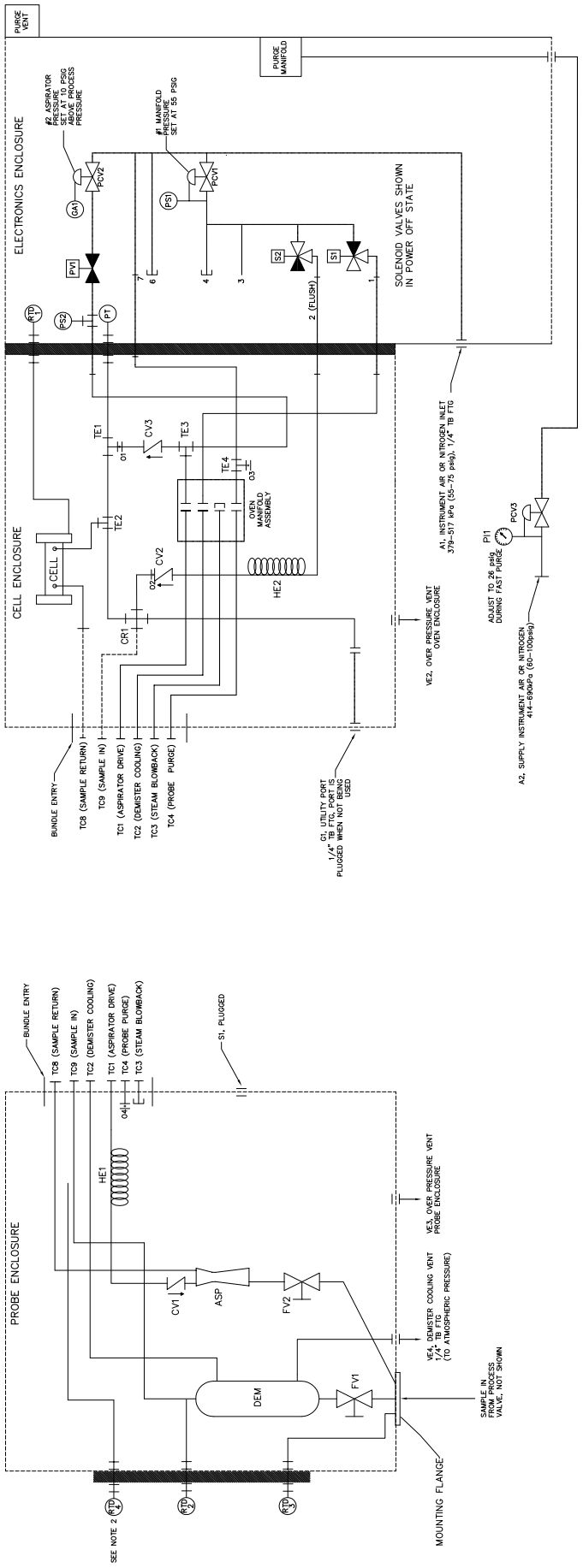


Figure 3.2.
Flow Diagram for No Steam blowback.

Item	Description	Part No.
FV1	Valve, Sample Inlet	271446001
DEM	Demister Assembly	883026903S
	Demister Pad Assembly	883026904S
	Demister Pad, Teflon	880136901
	Demister Pad, Stainless Steel	880063901
FV2	Valve, Sample Return	883037901S
CELL	Cell, Sample Return	883034901S
	Cell Body, 5 Inch	883077001
	Window, Fused Silica, 1.5 Inch	200887001
	O-Ring, Viton	202813028
	Gasket, Teflon	880420001
ASP	Aspirator	407300902S
FV3	Valve, Steam/Cell Isolation	883096001S
CV1, CV3	Check Valve, Aspirator	272105001S
CV2	Check Valve, Zero Flush w/Orifice	883035901
TE1	Tee, Pressure Transducer w/Orifice	883035902
TE2, TE3, TE4	Union Tee	203340010
CR1	Union Cross	203196001
O3, O4	Orifice, 400 Micron	272080001
O2	Orifice, 200 Micron	273454002
O1	Orifice, 50 Micron	273455002
HE1	Heat Exchanger, Aspirator Drive	883027901_TUBE_CS
HE2	Heat Exchanger, Zero Flush	883027901_TUBE_DS
PCV1	Pressure Regulator, Manifold, 0-100 PSIG	301-0431
PCV2	Pressure Regulator, Aspirator, 0-30 PSIG	301-0430
PCV3	Pressure Regulator, Purge, 0-60 PSIG	203188000
PS1	Pressure Sensor, Manifold, 0-100 PSIG	403464901
PS2	Pressure Sensor, Aspirator, 0-30 PSIG	403464903
S1, S2, S3	Solenoid valves (Demister, Zero Flush, Steam Blowback/Cell Isolation, Aspirator)	301-0424
PV1	Valve, Proportional Control, Aspirator	883038901
RTD1	RTD, Cell	883095001S
RTD2	RTD, Demister	883095003S
RTD3	RTD, Flange	883095004S
RTD4	RTD, Probe Enclosure	883095005S
PT	Pressure Transducer, 0-50 PSIG	883038902S
GA1	Gauge, Aspirator, 0-30PSIG	251744000

Figure 3.3
Parts Legend (refer to Figures 3.1 and 3.2).

Installing the Demister

*Take necessary precautions to ensure that neither the analyzer sample inlet ball valve (**FV1**) nor the sample return valve (**FV2**) are inadvertently opened during the Demister installation procedure.*

1. Place the Demister on top of the sample inlet ball valve (**FV1**). Make sure that the 1/8-inch tube fitting is facing the Electronics Enclosure.

2. Connect the Demister to the 3/4-inch compression fitting located atop the sample inlet ball valve, making sure that the 1/8-inch compression fitting located near the top of the Demister is oriented facing the probe disconnect enclosure.

3. Align the Demister RTD located in the probe disconnect enclosure with the 1/8-inch compression fitting on the Demister from Step 2. It may be necessary to slightly loosen the compression fitting on the sample inlet flange then slightly pull up on the probe/assembly. Loosen only as required and retighten the sample inlet flange fitting after the Demister has been properly aligned.

Make sure that the seal between the probe tube and the compression fitting is maintained so that no process gas leaks around the fitting.

4. Gently insert the Demister RTD into the 1/8-inch port of the Demister until the RTD hits the wall of the Demister, then remove the Demister RTD 6 mm (1/4-inch). Tighten the 1/8-inch compression fitting onto the RTD.

5. Mate the outlet of the Demister (and Calibration gas port depending on sample system selection) to the installed sample system components.

6. Install the remaining tubing connections packaged separately. Refer to the flow diagram in the customer drawing package for appropriate connections.

7. Using recommended tightening procedures, verify that all compression fittings inside the Cell Oven Enclosure are tightened.

8. Test all sample tap connections and the sample inlet ball valve to make sure there are no toxic process gas leaks. When satisfied that no leaks are present, remove the breathing apparatus and proceed with the remainder of the start-up procedure.

9. Remove handle of the steam-jacketed main sample ball valve to ensure valve cannot be closed while the sample probe is in place. Secure handle nearby so that it is available when needed.

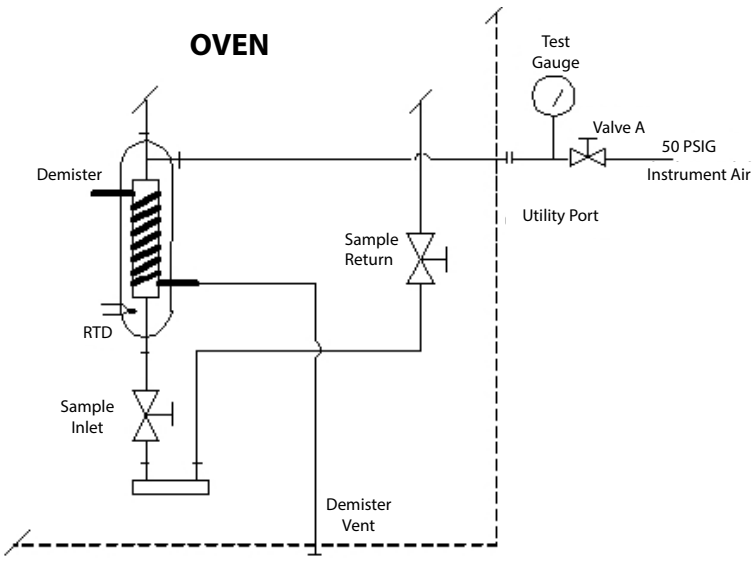


Figure 4.
Sample System Leak Test.

Installing the Analyzer

1. Mount the 888L Analyzer in an upright vertical position. Use appropriate fasteners to mount the analyzer back plate and ensure that there is space to make connections to the disconnect casting.

2. Route the sample bundle through the provided heat shrink boot of the analyzer. Connect the sample inlet and outlet lines of the analyzer to the appropriate lines of the sample bundle using the 1/4-inch fittings provided.

3. Connect all pneumatic connections of the sample bundle to their corresponding connections in the Cell Oven Enclosure. These connections can include Aspirator Drive, Zero Flush, Demister Cooling, Steam Blowback actuation, and Oven Trickle Purge. See Figures 3.1 and 3.2 for the locations of these connections.

4. Route the sample bundle through the provided heat shrink boot of the probe assembly. Connect the sample inlet and outlet lines of the probe assembly to the appropriate lines of the sample bundle using the 1/4-inch fittings provided.

5. Connect all pneumatic connections of the sample bundle to their corresponding connections in the probe assembly. These connections can include Aspirator Drive, Zero Flush, Demister Cooling, Steam Blowback actuation, and Oven Trickle Purge.

6. See Figures 3.1 and 3.2 for the locations of these connections.

Electrical Connections

Check ground continuity to all electrical enclosures before applying power.

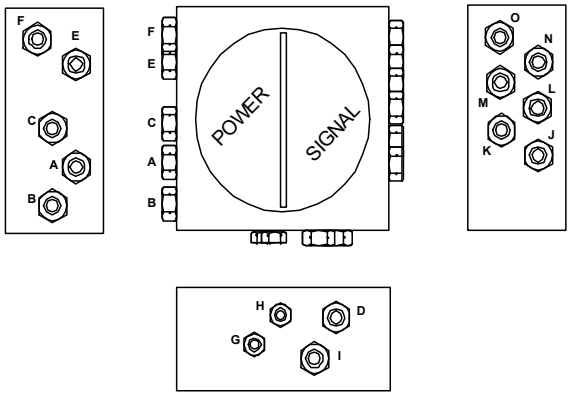
Connections to the AC source must be made only by qualified electricians. AC source must be single-phase, grounded-neutral type.

Cable glands suitable for use in a Zone 1 area must be used for all field wiring. The disconnect enclosure has been machined to accept M16 and M20-size glands.

The Customer Connection Enclosure of the 888L must be terminated in accordance with country and local electrical codes.

1. The 888L Analyzer is considered outdoor, permanently connected and stationary equipment. It is supplied, as ordered by the customer, configured as either a 120 VAC or a 240 VAC unit and contains voltage-dependent subassemblies. Do not attempt conversion in the field by unqualified personnel. Power requirements for the equipment are found both in the Specifications section of this manual and on the labels applied near the power inlet located on the equipment or inside the Electronics Enclosure door.

2. AC mains power connection to the analyzer is made in the disconnect assembly. All cabling, connections, and terminations at the disconnect assembly must be appropriately certified for use in the hazardous location. AC power must be three-wire, single phase, with line hot (18 AWG), grounded neutral (AWG 18), and separate earth/protective ground (PE) (14 AWG). The analyzer must be externally grounded to an M5 stud via a 14 AWG wire located to the right side of the disconnect assembly. Refer to Figure 2.2 for connection details. DO NOT CONNECT SPLIT-PHASE POWER TO THIS ANALYZER. Multiple pre-drilled holes are provided for power and signal cable gland entry/installation. Refer to Figure 5.1 for hole location and designations. If the incoming power cable is too large, a separate (customer provided) junction box must be provided that can accept the main cable and suitable jumpers used from this box to the analyzer's junction box. Ensure that all unused pre-drilled holes are plugged with hardware appropriate to the area classification.



External Cable Glands

Ref	Armored	Customer Supplied	Size	Cable ID	Description
A	No	Yes	M16	N/A	Bundle RTD #1
B	No	Yes	M16	N/A	Bundle RTD #2
C	Yes	No	M32	CCA4	Probe Signal
D	Yes	Yes	M20	N/A	Mains
E	Yes	Yes	M20	N/A	Bundle Power
F	Yes	No	M20	CCA3	Probe Power
G,H,I	No	Yes	M20	N/A	Customer Signal
J	No	No	M20	CC4	Probe Controller
K	No	No	M20	CC2	Alarms and Remote IO
L	No	No	M20	CC1	Analog Outputs & RS-485
M	No	No	M20	CC3	Ethernet
N	Yes	No	M20	CCA1	Purge System Power
O	Yes	No	M20	CCA2	Analyzer Power

Figure 5.1.
Disconnect Assembly.

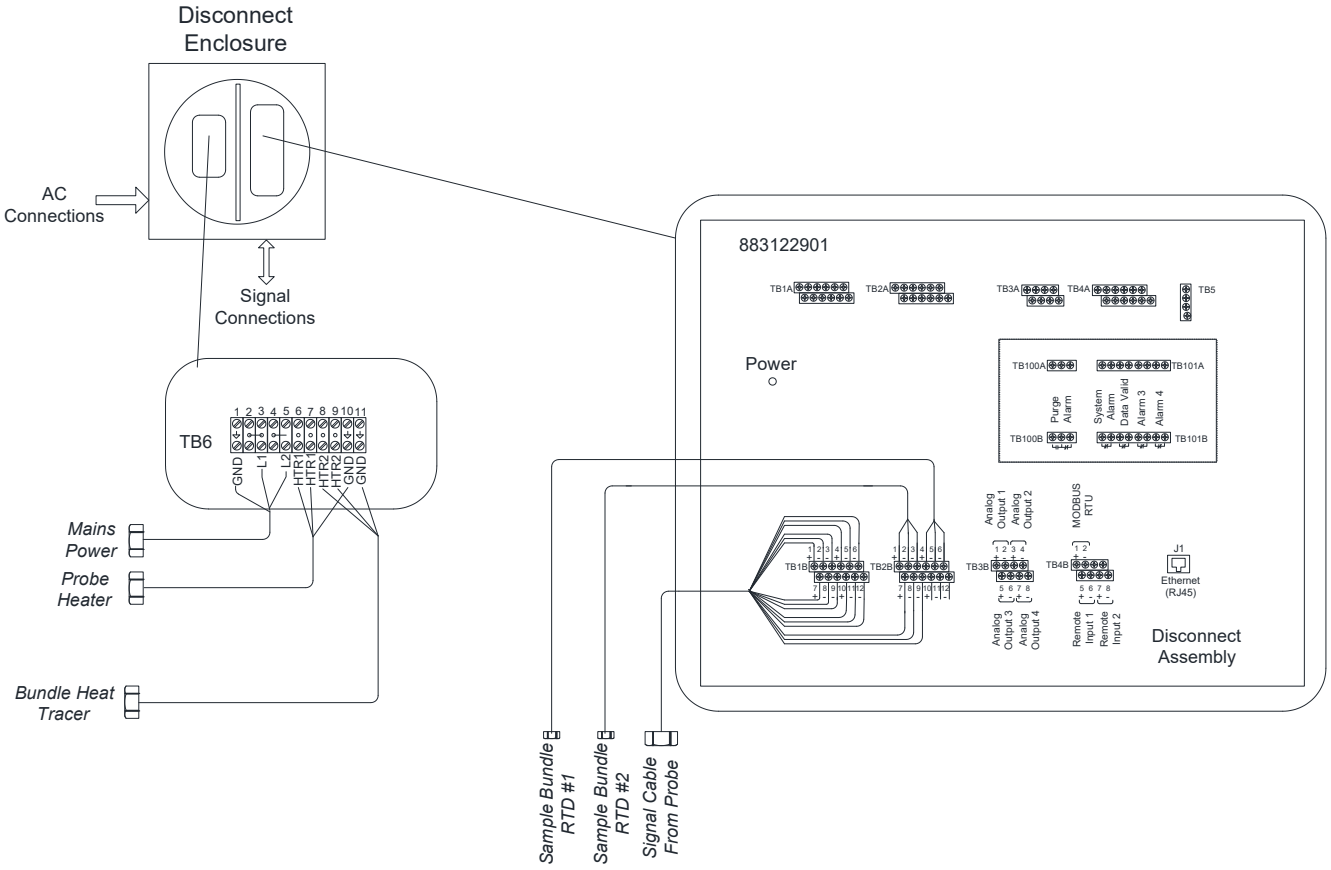


Figure 5.2.
Signal Connections.

As a permanently connected piece of equipment without an accessible power switch, the installation must have the following characteristics:

- The installation must include an external disconnect device, such as a switch or circuit breaker, included as part of the installation. The electrical specifications of this device must accommodate the power and environmental requirements of the equipment for the particular application.
- This disconnect device must be in close proximity to the equipment and in easy reach of an operator.
- The device must be permanently marked as the disconnect device for this equipment.

Signal I/O connections are also made in the same flameproof enclosure mounted below the Electronics Enclosure. Refer to Figure 5.2 for details. All customer wiring must have a minimum working voltage of 300 VRMS. Refer to the Specifications section for customer signal input voltage and current restrictions. A separate junction box may be required if the signal cables are too large for the cable glands provided.

*If a remote indication of Loss of Purge is desired, locations 1, 2, and 3 on terminal block **TB100B** (Figure 5.2) can be used. Refer to Specifications for more information regarding the Loss of Purge contact.*

System Start-Up and Operation

[For complete details about the operation of the analyzer, refer to the analyzer *User Manual*.]

Leak Checking

Before power is applied and before the sample inlet valve is opened to the process gas stream, it is necessary to ensure that no leaks are present in the sample system.

It is recommended that the sample system be leak checked after any maintenance or modifications.

Leak Checking (Without Power)

Necessary equipment:
Pressure gauge, Shut-off valve, and a regulated air supply. Arrange the components as indicated below.

Regulated Air Supply → Shut-Off Valve → Pressure Gauge → Calibration Port of Analyzer

To leak check the sample system:

1. Turn off AC power.
2. Close both the sample inlet and sample return valves located inside the Cell Oven Enclosure.
3. Connect the external Calibration port to a source of regulated instrument air set to 50 PSIG. Refer to Figure 4.
4. Open Valve A to pressurize the system for at least 15 seconds. Record that pressure.
5. Shut off Valve A and after a period of 15 minutes, record the pressure.
6. The pressure must not drop more than 1 PSIG over this time period.

Purging the Electronic Enclosure

A Purge Controller and vent system maintain a positive pressure preventing explosive gases from entering the Electronics Enclosure. On start-up, the Purge Controller will automatically monitor the purge gas flow to ensure a minimum of ten (10) air exchanges before providing power to the Electronics Enclosure. The Purge Controller then monitors the Electronics Enclosure's internal pressure. In the event that positive pressure is lost, power will be disconnected from the electronics. All input and output signals are disconnected by relays in the disconnect assembly should power be interrupted by the Purge Controller.

A regulated supply of instrument air must be connected to the purge gas regulator. The regulator is located to the right of the Electronics Enclosure.

Maximum non-hazardous area voltage must not exceed 250 V.

Once the analyzer is installed on a process gas pipe, instrument air pressure must be maintained at all times, even when the analyzer is powered down or off-line, to keep corrosive gases and moisture out of the enclosures and prevent damage.

Sequence of Events: Turning On Power to the Enclosure

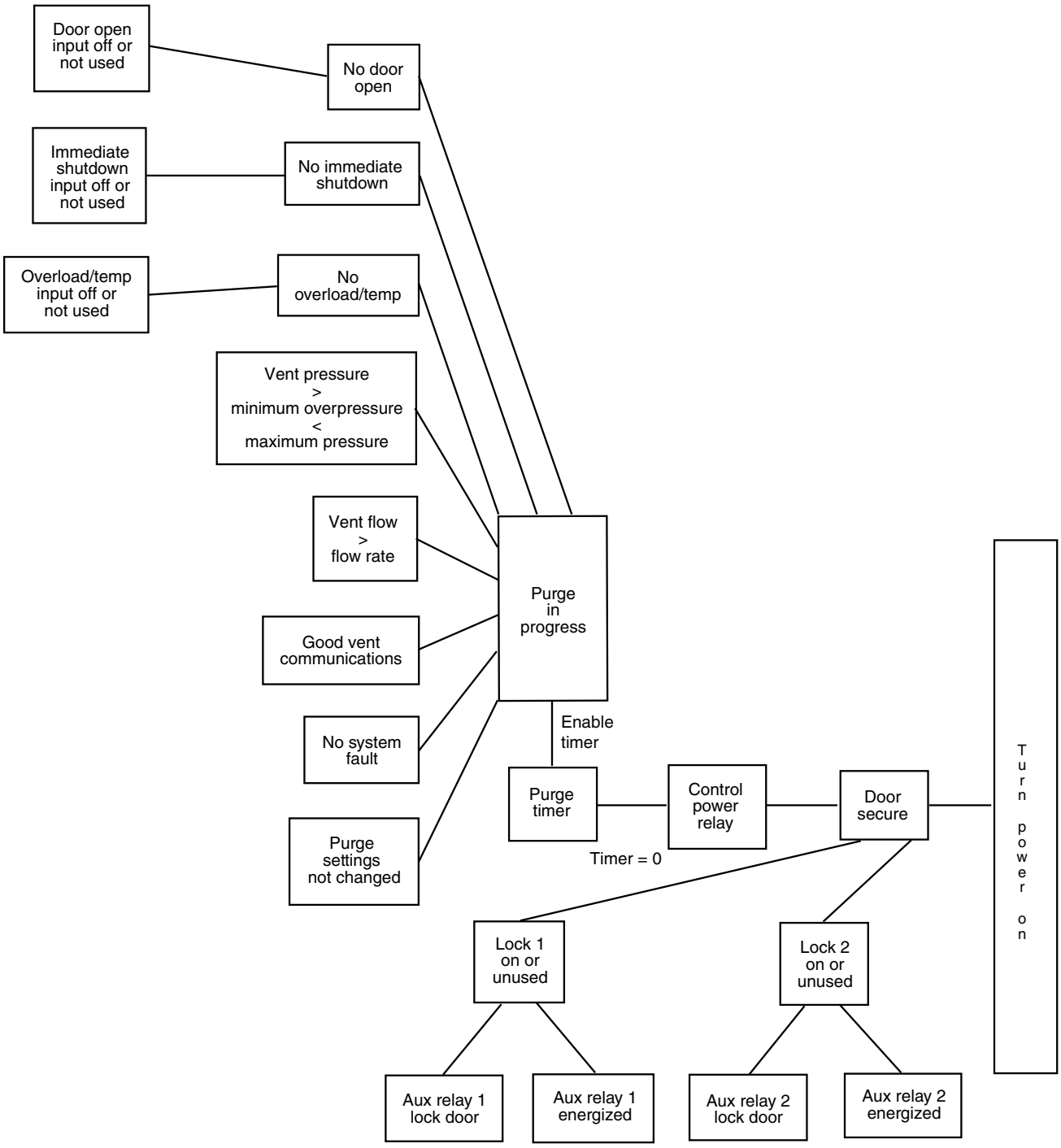


Figure 6.1.
Sequence table.

Turning Off Power to the Enclosure

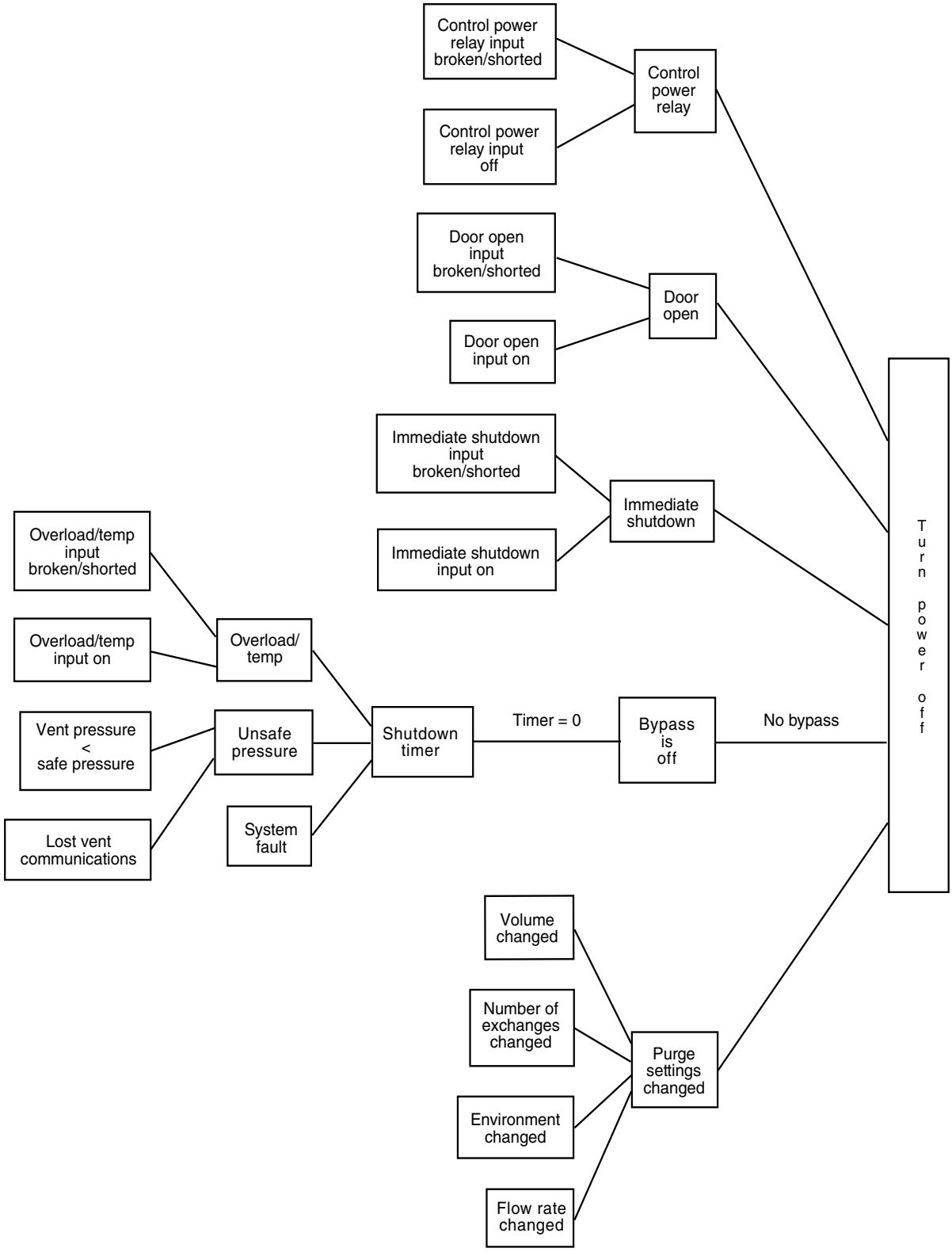


Figure 6.2.
Sequence table.

The installer must install a second pressure regulator on the input of the unit to mitigate any risk from a single regulator failure in the system.

Resistance between barrier ground and equipment ground must not exceed 1 Ohm.

Wiring for alarm circuit and supply circuit must be routed separately or each must be protected by a grounded-shield cable.

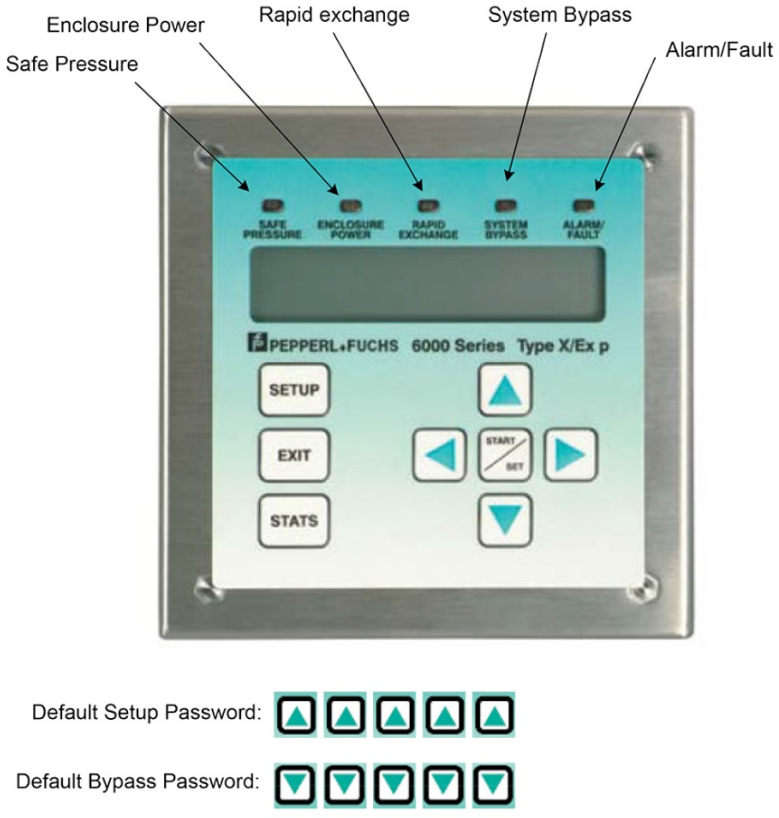


Figure 6.3.
Electronic Purge System.

For the Electrical Enclosure Purge System to operate properly the enclosure's door must be securely closed.

Adjusting the Purge Controller

The Purge Controller is programmed at the factory to run automatically. However, it may be necessary to make adjustments based on the utilities present at the installation site.

To adjust the Purge Controller:

1. Connect a regulated source of instrument air to the purge regulator.

2. Locate the terminal block inside the disconnect assembly. Apply AC mains power to the terminal block.

3. Once power has been applied, the Purge Controller will start a fast purge of the Electronics Enclosure.

   If a fast purge does not start:
   Check the BLUE **Safe Pressure** indicator on the Purge Controller to ensure that it is turned on.

   *If the BLUE **Safe Pressure** indicator is not turned On:*
   - Locate the Purge Adjustment Valve on the right-hand side of the Electronics Enclosure. Use a flat-blade screwdriver to adjust the pressure.

   - Turn the valve slowly counter-clockwise until the BLUE indicator turns on ensuring that the Purge Controller senses sufficient pressure in the Electronics Enclosure.

4. The Purge Controller will purge the Electronics Enclosure for a minimum of ten (10) air exchanges. After a short period, the time remaining for the fast purge will be displayed on the Purge Controller. Once the time displays, it will take five (5) minutes for the fast purge to complete.

5. The gauge on the purge inlet regulator at the right side of the panel should read a nominal 180 kPa (26 PSI) during the fast purge. Adjust the regulator if necessary to read the nominal pressure.

6. Once the fast purge is complete, the Purge Controller will connect power to the analyzer electronics. The flow rate will drop noticeably and the gauge on the purge regulator will increase several PSI. This change in the pressure reading is normal. Do not readjust the regulator.

Refer to the Pepperl and Fuchs 6000 Series Purge Controller Manual for further details on the Purge Controller.

Default passwords are indicated in Figure 6.3.

Entering BYPASS Mode

In order to open the Electronics Enclosure with analyzer power on, the Purge Controller must be put into **Bypass** mode.

1. On the Purge Controller User Interface, press the **Setup** button and enter the System Password (see Figure 6.3). Press **Start/Set** to enter the setup menu.

2. Scroll to **Bypass Control** and press **Start/Set**. Enter the **Bypass** password (see Figure 6.3) and press **Start/Set** to enter the **Bypass** menu.

3. Scroll to **Bypass Enable** and press **Start/Set**. Select **Yes** and then press **Start/Set**. At the **Setting Correct** screen, select "**Y**" and then press **Start/Set**.

4. Scroll to **Bypass On** and press **Start/Set**. Select "**On**" and then press **Start/Set**. At the **Setting Correct** screen, select "**Y**" and then press **Start/Set**.

5. An ORANGE light should appear above **System Bypass** on the Purge Controller User Interface. Press **Exit** twice to return to the Purge Controller User Interface main screen.

Starting Normal Operation

1. Connect the air supply and set the pressure regulator for approximately 55–75 PSIG.

2. Back off the Aspirator Regulator (**PCV2**) by manually turning the adjustment knob on the Aspirator Regulator counter-clockwise to reduce pressure to 0 PSIG. See Figure 8.

3. Open the sample inlet ball valve (**FV1**) and the sample return valve (**FV2**) at the bottom of the aspirator. Close and tighten the latches on the Cell Oven Enclosure.

4. Verify that the Electronics Enclosure and Cell Oven Enclosure doors are closed and properly secured.

5. Apply AC power and note the screen activity on the Purge Controller User Interface.

The analyzer will start in Period 1 "Special Flush" and will step to Period 2 "Flush & Zero" when the default Period 1 timer times out. Instrument Air will be flowing back through the sample system; this prevents sample gas from entering the system until the sample cabinet is up to proper operating temperature (nominally 150 °C). Refer to the Timing Table (Figure 10).

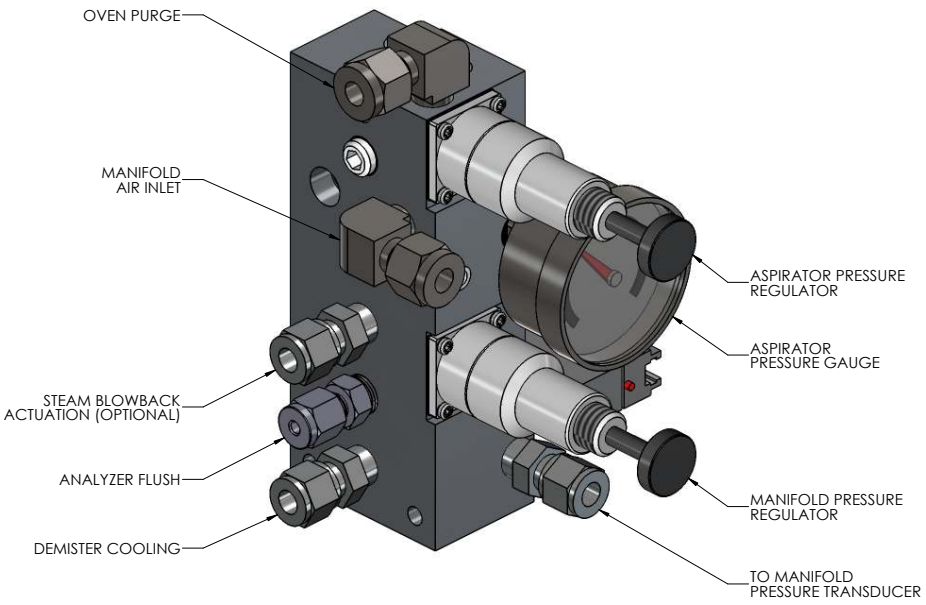


Figure 7.
Solenoid Manifold Assembly.

When the analyzer components reach operating temperature, the controller will perform an Auto-Zero of the photometer and then enter Period 3 "Sample Flush."

CAUTION

Sample will not flow through the cell until positive flow is attained by adjusting the aspirator pressure.

Allow 2–4 hours for complete thermal stabilization of sample cell and Demister.

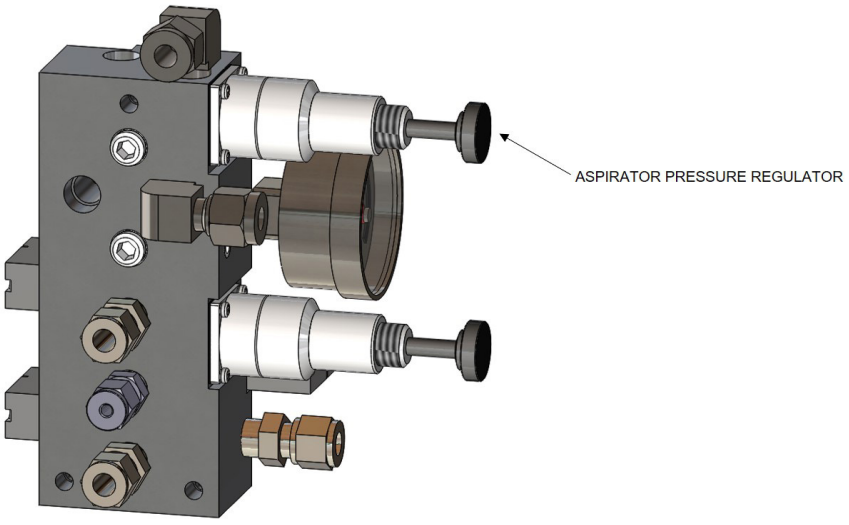


Figure 8.
Aspirator Pressure Regulator.

Setting the Sample Gas Flow

To set the sample gas flow, navigate to the menu item **CONFIGURE** on the **HOME** screen and press the (**ENTER**) key.

Figure 9.1.
HOME screen.

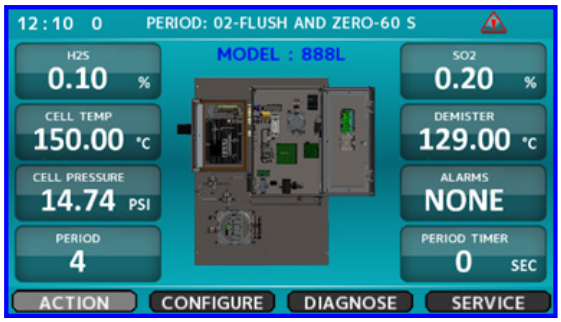


Figure 9.2.
Controller Home screen.

Use the right and left navigation arrows to advance to the **PRESSURES** screen. Press the **ENTER** key to select the **PRESSURES** menu.

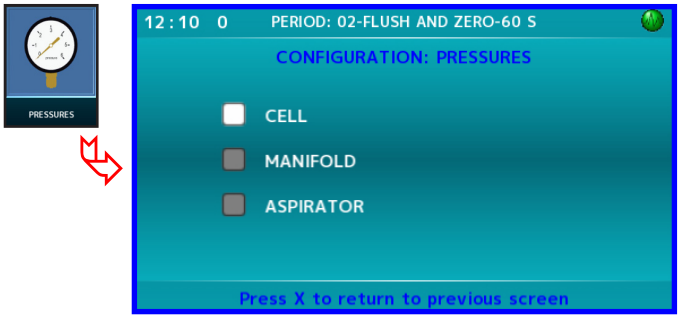


Figure 9.3.
Configuration Pressure screen.

Use the arrow keys to navigate to **Aspirator Pressure Configuration** and press the **ENTER** key.

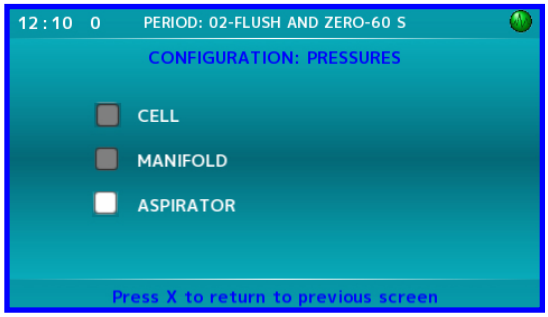


Figure 9.5.
Configuration screen.

1. Place the purge system in to **Bypass Mode**. Refer to the section "Entering BYPASS Mode" in this document, and to Figure 6.1, 6.2, and 6.3.

2. Locate the Aspirator Regulator pressure gauge (see Figure 7). Set the Aspirator Regulator pressure until the gauge reads approximately 10 PSI above the process pressure.

Neutral, de-activated position

3. Make sure the Aspirator Override is in the **No** position.

4. Check that the flow setpoint is set to 1.5.

5. The analyzer will now regulate sample flow automatically in Period 4 "Measure."

6. Press the '**X**' key to exit to the previous screen (Figure 9.4).

7. Press '**#**' to exit to the Controller **HOME** screen.

Analyzer Timing/Logic Table

All 888L Analyzer functions are broken down into 14 Timing periods. See Figure 10.

- Periods 1–4 are the normal "Sample Cycle" and "Zero Cycle" periods.
- Periods 1–11 are fully programmable and are run for a length of time in seconds.
- Periods 12–14 are special "Hold" state periods.

Descriptions of events during various timing periods are for typical operation only. Some events can be altered by changing period timers.

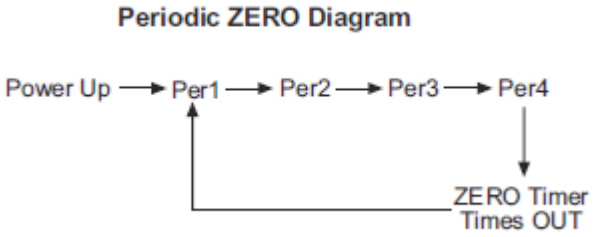
Period		Name	Time (s)	SV1 Demister Normally Closed	SV2-Flush Solenoid Normally Open		SV3-Steam Blowback Solenoid Normally Closed	FV3-Steam Blowback Valve Steam Blowback Normally Closed	SV5-Aspirator Solenoid Normally Closed	PV1-Aspirator Proportional Valve Normally Closed	Analog Outputs	Next Period	Data Valid Relay
Zero Calibration	1	Special Flush	0	Controlling	De-energized	Open	De-energized	Closed	De-energized	Closed	Hold	2	Off
	2	Flush & Zero	60	Controlling	De-energized	Open	De-energized	Closed	De-energized	Closed	Hold	3	Off
Sample Cycle	3	Sample Flush	60	Controlling	Energized	Closed	De-energized	Closed	Controlling	Open	Hold	4	Off
	4	Track Sample	N/A	Controlling	Energized	Closed	De-energized	Closed	Controlling	Open	Tracking	Note 2	On
Zero and Photo-span Calibration	5	Flush & Zero	60	Controlling	De-energized	Open	De-energized	Closed	De-energized	Closed	Hold	6	Off
	6	Track Zero	0	Controlling	De-energized	Open	De-energized	Closed	De-energized	Closed	Hold	7	Off
	7	Photospan Calibration	60	Controlling	De-energized	Open	De-energized	Closed	De-energized	Closed	Hold	8 or 9 Note 3	Off
	8	Track Photo Calibration	10	Controlling	De-energized	Open	De-energized	Closed	De-energized	Closed	Hold	3	Off
Steam Blow-back Cycle	9	Pre-Steam Flush	10	Controlling	De-energized	Open	De-energized	Closed	De-energized	Closed	Hold	10	Off
	10	Steam Blow Back	20	Controlling	De-energized	Open	Energized	Open	De-energized	Closed	Hold	11	Off
	11	Post Steam Flush	60	Controlling	De-energized	Open	De-energized	Closed	De-energized	Closed	Hold	5	Off
Special Periods	12	Continuous Flush	N/A	Controlling	De-energized	Open	De-energized	Closed	De-energized	Closed	Hold	Note 1	Off
	13	Continuous Hold	N/A	Controlling	Energized	Closed	De-energized	Closed	De-energized	Closed	Hold	Note 1	Off
	14	Continuous Sample	N/A	Controlling	Energized	Closed	De-energized	Closed	Controlling	Open	Hold	Note 1	Off

Figure 10.
Analyzer Timing/Logic table.

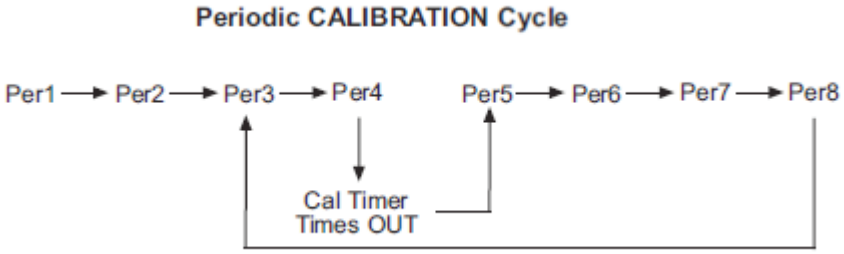
Normal Timing Sequence

Figure 10 shows the sequential timing Periods 1 through 14. When power is first applied, the controller starts at Period 1 and cycles through to Period 4, the "Sample Tracking" period. Sample tracking continues indefinitely until one of the following events occurs:

1. When the Zero Timer times out, normally a Zero Cycle is started immediately, but when the option is available, a Steam Blow Back Cycle can also be started (see Step 4 for Steam Blow Back). When this timer times out, the Zero cycle begins at Period 1, steps to Period 2 where the Zero Offset values are recorded, steps to Period 3, and on to Period 4. This cycle, 1 → 2 → 3 → 4 → 1 and so on, constitutes the normal sampling operation loop.



2. When the Calibration Timer times out, a Calibration Cycle starts immediately. The Calibration cycle begins at Period 5 in which the Zero Offset values are recorded, it then tracks the Zero values through Period 6, steps to Period 7 where the photo span values are verified or adjusted, tracks the span values through Period 8, and returns to Period 3 to resume the normal sampling cycle 3 → 4 and so on.



3. When the Calibration Timer times out and the following occurs, then a Steam Blow Back Cycle is started instead of a Calibration Cycle:

    - The Zero Period parameter, which defines the number of Zero or Calibration cycles between Steam Blowback cycles, is not equal to zero; and

    - The Zero Period number of Zero or Calibration cycles have elapsed since the last Steam Blowback.

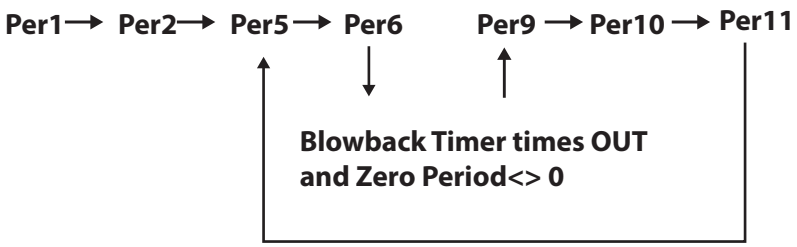
4. Steam Blow Back Cycle.

    - Period 9 – flushes the system with air

    - Period 10 – Steam is flushed back through the Demister and probe

    - Period 11 flushes the system with air again before beginning the Calibration cycle by jumping to Period 5.

Periodic STEAM BLOW BACK Diagram



NOTE

If using the automatic Steam Blowback function, do not set Blowback Interval to a value less than "16" or run the cycle more than once a day.

WARNING

If your analyzer requires Steam Blowback to run more than once a day, please contact the AMETEK Service Department.

For more detailed information concerning the analyzer periods and timing sequence, refer to the *User Manual*.

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Maintenance and Troubleshooting

Generally, little maintenance is required to ensure the analyzer remains operating at peak efficiency, other than that described in the "Removal and Replacement of Major System Components" [located in the Troubleshooting and Maintenance chapter of the *User Manual*].This maintenance, which includes parts that require scheduled replacement and cleaning, is intended to ensure continued and proper operation of the analyzer.

[Refer to other sections in the Troubleshooting and Maintenance chapter of the analyzer *User Manual* for procedures to replace the parts.]

Before performing maintenance on the analyzer, be sure to follow appropriate actions and precautions to prepare the analyzer for service, such as properly isolating the analyzer from the sample gas stream/duct, back purging the sample line ("Flush/Zero" mode), powering down the analyzer (unless it is necessary to keep the analyzer operating), and opening the Electronics Enclosure.

For certain procedures, such as replacing source lamps, it is not required to isolate the analyzer sampling system from the sample gas stream.

[These procedures can be found in the Troubleshooting and Maintenance chapter of the analyzer *User Manual*.]

You must take precautions against ESD (electrostatic discharge) damage while performing the following operations. Precautions include using a wrist strap working on a grounded work surface, and storing electronic assemblies in anti-static packaging.

Always disconnect power and/or external power sources to the analyzer before opening any covers or doors on the analyzer to check on any components or to perform maintenance within the enclosures.

If it is necessary to open the analyzer's covers or doors while the circuits are live, first monitor the area for flammable gases and proceed only when the area is safe.

Cleaning/Replacing Parts in the Sampling System

For information about how to determine if and when analyzer parts require cleaning or replacement, refer to appropriate sections in the Troubleshooting and Maintenance chapter of the analyzer User Manual.

To clean and/or replace parts in the analyzer sampling system:

1. Manually Zero the analyzer ("Flush/Zero" mode), isolate the analyzer sampling system from the sample gas stream, and power down the analyzer as described in the analyzer *User Manual*.

2. Continue with the procedures to disassemble, clean or replace parts, and reassemble the appropriate sampling system components and all associated sample system tubing.

3. Restore power to the analyzer as described in procedures in the analyzer *User Manual*.

4. Perform a leak (pressure) check on all sample system fittings that were disconnected/reconnected.

Other Maintenance

If it is necessary to perform maintenance on the analyzer while its circuits are alive and with its Electronics Enclosure door open, first monitor the area for flammable gases and proceed only when the area is safe.

When the Electronics Enclosure is open, take appropriate precautions to avoid electrical shock. Hazardous voltages are present inside.

If a procedure for a certain maintenance task is not described in the analyzer *User Manual*, contact AMETEK Service Personnel for details about performing the required maintenance.

When performing equipment maintenance in hazardous areas, all safety standards and procedures must be followed, as specified by the Owner Company, local electrical-inspection authority, and National/EU regulations.

Sample System Leakage Test

After performing any maintenance procedures such as replacement of parts or cleaning of the analyzer components, you must check the sample system to determine if any of the procedures has affected the integrity of the sample system.

The sample system should be charged with instrument air, sealed off, and checked after a period of time for a drop in pressure.

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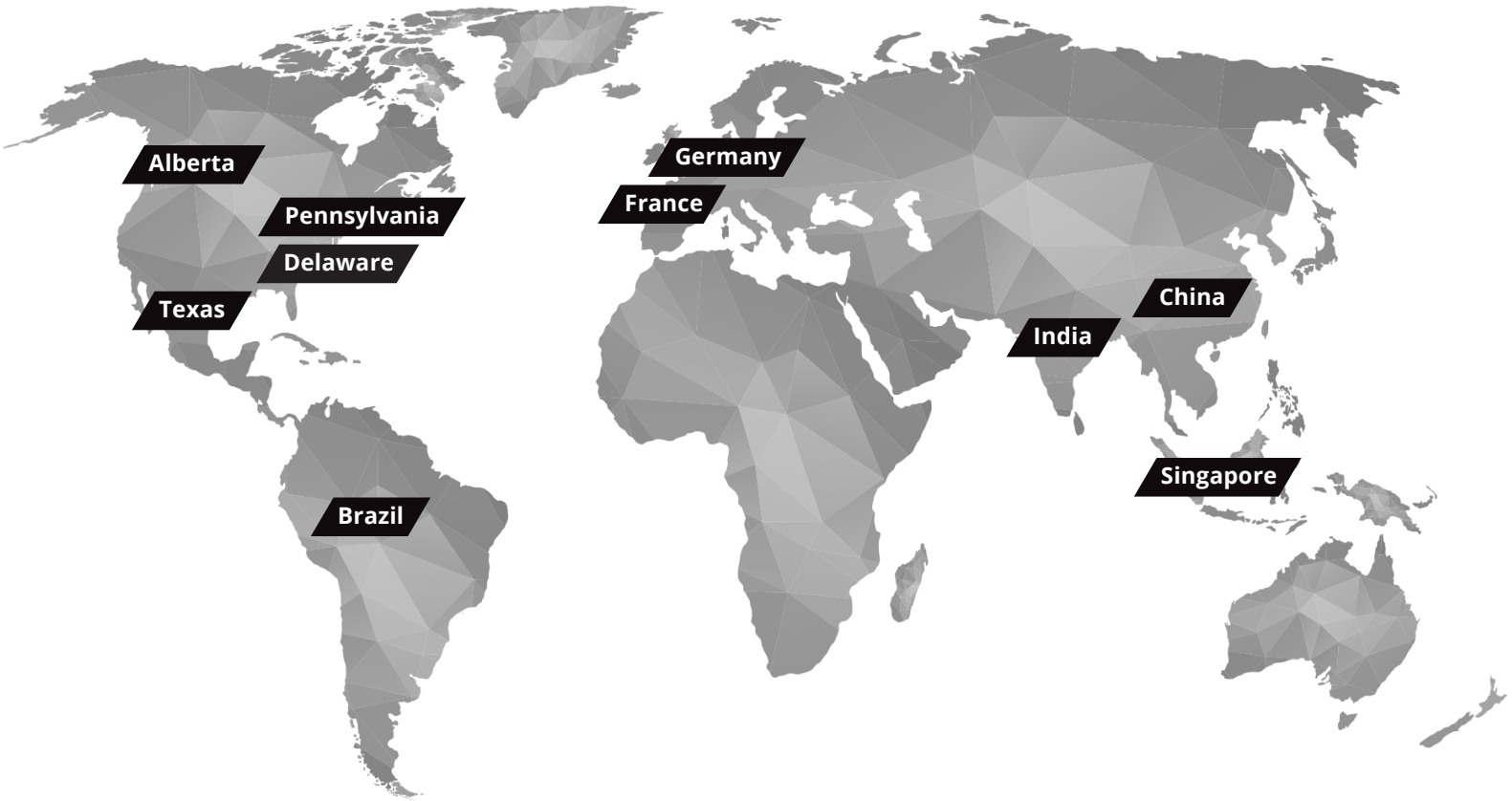

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AMETEK® PROCESS INSTRUMENTS

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