thermoscientific

Model 85 Instruction Manual

Mercury Probe

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ThermoFisher SCIENTIFIC

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WEEE Compliance

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC. It is marked with the following symbol:

Thermo Fisher Scientific has contracted with one or more recycling/disposal companies in each EU Member State, and this product should be disposed of or recycled through them. Further information on Thermo Fisher Scientific's compliance with these Directives, the recyclers in your country, and information on Thermo Fisher Scientific products which may assist the detection of substances subject to the RoHS Directive are available at: www.thermo.com/WEEERoHS.

About This Manual

This manual provides information about installing, maintaining, and servicing the Model 85 Mercury Probe. It also contains important alerts to ensure safe operation and prevent equipment damage. The manual is organized into the following chapters and appendixes to provide direct access to specific operation and service information.

- Chapter 1 "Introduction" provides an overview of the product, describes the construction and operating principle of the flow assembly.
- Chapter 2 "Installation" describes how to prepare the probe enclosure, how to install the particulate deflector, and includes umbilical plumbing hookup.
- Chapter 3 "Preventive Maintenance and Servicing" provides maintenance information, replacement procedures, and a replacement parts list. It also includes contact information for product support for product information.
- Chapter 4 "System Description" provides an overview and describes the function of the system components.
- Appendix A "Warranty" is a copy of the warranty statement.

Safety

Review the following information carefully before using the Model 85 Mercury Probe. This manual provides specific information on how to operate the extraction probe, however if the Model 85 Mercury Probe is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Safety and Equipment Damage Alerts

This manual contains important information to alert you to potential safety hazards and risks of equipment damage. Refer to the following types of alerts you may see in this manual.

Safety and Equipment Damage Alert Descriptions

Alert		Description
	**DANGER**	A hazard is present that will result in death or serious personal injury if the warning is ignored. ▲
	**WARNING**	A hazard is present or an unsafe practice can result in serious personal injury if the warning is ignored. ▲
	**CAUTION**	The hazard or unsafe practice could result in minor to moderate personal injury if the warning is ignored. ▲
	**Equipment Damage**	The hazard or unsafe practice could result in property damage if the warning is ignored. ▲

Safety and Equipment Damage Alerts in this Manual

Alert		Description
	**WARNING**	The service procedures in this manual are restricted to qualified service personnel only. ▲ If the equipment is operated in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired. ▲ Probe is HOT. Wear appropriate PPE (personal protective equipment). ▲
	**Equipment Damage**	Do not attempt to lift the probe by the cover or other external fittings. ▲

WEEE Symbol

The following symbol and description identify the WEEE marking used on the instrument and in the associated documentation.

Symbol	Description
	Marking of electrical and electronic equipment which applies to electrical and electronic equipment falling under the Directive 2002/96/EC (WEEE) and the equipment that has been put on the market after 13 August 2005. ▲

Where to Get Help

Service is available from exclusive distributors worldwide. Contact one of the phone numbers below for product support and technical information or visit us on the web at www.thermoscientific.com/aqi.

1-866-282-0430 Toll Free

1-508-520-0430 International

We continue to support our customers with advanced online resources. Our Air Quality Instruments Online Library allows our customers access to product documents and information on a constant basis.

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Chapter 1
Introduction

The Model 85 Mercury (Hg) Mercury Probe is configured as one component of Thermo Fisher Scientific's integrated Hg Continuous Emission Monitoring System (CEMS). Thermo Fisher Scientific's Mercury Freedom™ System is comprised of a Hg Analyzer (Model 80*i*), a Hg Calibrator (Model 81*i*), a Hg Probe Controller (Model 82*i*), and a Hg Extraction Probe (Model 85) along with additional peripheral components, e.g., zero air supply, umbilical, instrument rack, etc. The Model 85 Mercury Probe, with built-in dilution, has been designed specifically to monitor gaseous Hg emissions from coal-fired power plants and cement kiln factories.

The probe is housed in an aluminum enclosure and is designed to meet NEMA 4X specifications. To prevent sample condensation, key elements (Dilution Module and Bypass Pump) have been mounted between heated aluminum blocks that can be maintained at temperatures as high as 250 °C.

The probe enclosure also houses an accumulator tank for back purging of the stinger (blow back). External to the enclosure is a section with the electrical connections and solenoids for stinger blow back, cal gas, and chlorine gas (Cl_2), (if applicable).

A special 4-inch adapted mounting flange has been supplied with the Stinger Assembly for installation onto the port of the stack or duct for the U.S. and China market. A DIN flange is supplied for E.U. applications.

Clean dry pressurized (~90 psig) air feeds two electronic pressure regulators in the Model 82*i* (Figure 1–1), which adjust and maintain output pressure to the Model 85 Probe Eductor and Blow Back pneumatics. Pressurized (~65 psig) Hg-free zero air feeds a third electronic regulator in the Model 82*i*, which adjusts and maintains dilution air pressure to the Model 85 Probe Dilution Module. Also contained within the Model 82*i* are three electronic pressure transducers associated with the individual regulators, as well as an electronic vacuum transducer monitoring the Dilution Module vacuum in the Model 85.

The Model 85 Mercury Probe is an extraction probe which includes a particulate filter, built in dilution module and high temperature thermal converter for reducing oxidized Hg to elemental Hg for subsequent analysis by the Model 80*i* Mercury Analyzer.

The Model 82*i* provides both 220 and 110 AC voltage to the Model 85 Probe. 220 VAC powers the probe's stinger heater and probe flow heaters. 110 VAC powers the Total Hg converter as well as four (4) probe solenoid valves for Cal/Zero gas, Stinger blow back, and Cl_2.

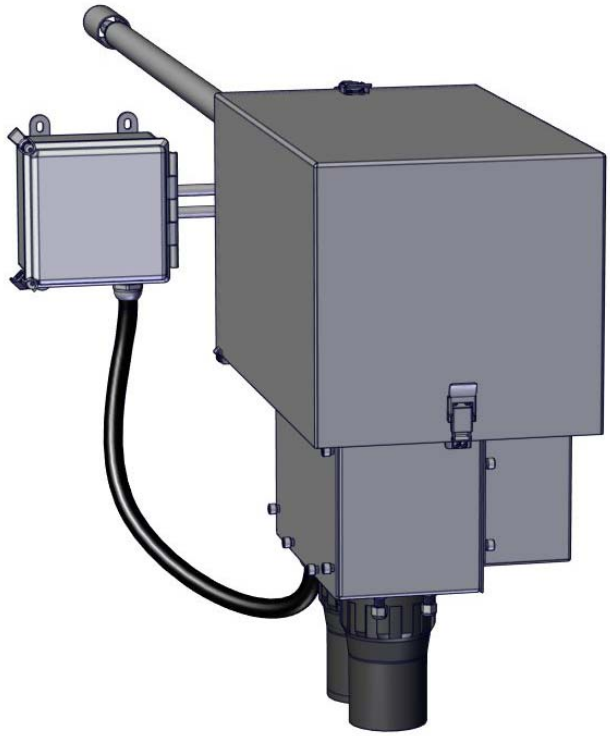


Figure 1–1. Model 85 Mercury Probe

Construction of the Probe Flow Filter Assembly

The probe filter assembly contains a porous filter element. This filter element is a diffusion-bonded, sintered seamless porous tube with a 0.5 micron grade.

A filter housing tube surrounds the tubular element, creating a minimum-volume annular plenum for sample collection. A high-efficiency gas eductor induces axial flow through the filter element.

The sample is then pulled through an orifice by the dilution assembly. The dilution sample is directed to the manifold that has connections to the elemental umbilical tubing, the converter and HgT umbilical tubing, and a dump for the excess diluted sample.

Chapter 2
Installation

The installation of Model 85 involves several steps:

Preliminary Site Work

The Model 85 Mercury Probe is a mercury extraction probe designed to be a direct replacement for the Model 83*i* Extraction Probe. The flange is 4-inch ANSI, or Euro DN65/PN6 (150 lb.), and the power and air requirements are the same as the existing system. If you are replacing an existing probe, such as the 83*i* probe, please perform the following preliminary site work steps.

WARNING Do not attempt to lift the probe by the cover or other external fittings. ▲

1. It is critical that the existing system that is going to be connected to the Model 85 is operating correctly, with proper power and air supply.

2. In the 80*i* menu turn OFF Component power to the Probe, Converter, Oxidizer, and Stinger.

3. Shut OFF sample pump at instrument rack.

4. Shut down 82*i* power and remove 85 probe cover.

5. Close the chlorine cylinder valve and disconnect the line from the probe if applicable (if probe contains the oxidizer option).

6. Disconnect all electrical and pneumatic connections between the umbilical and the probe.

7. Remove probe from stack flange.

Unpacking

Use the following procedure to unpack the probe.

1. Remove foam block from inside of probe.

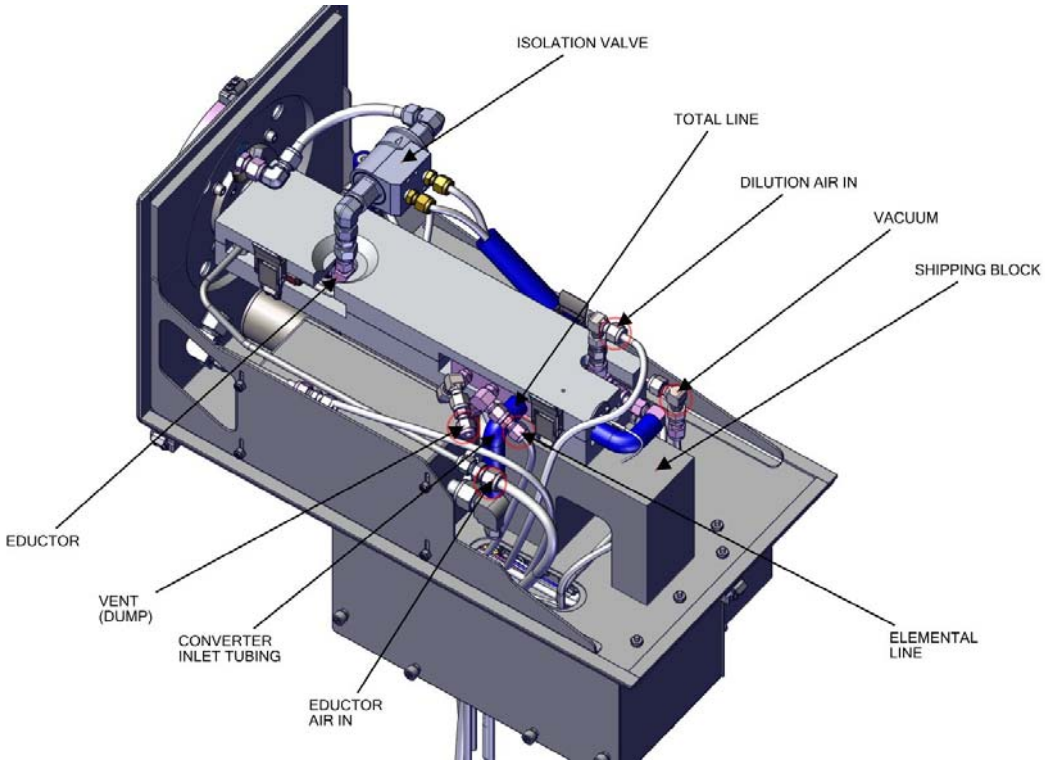


Figure 2–1. Shipping Blocks Side View

Installation

Use the following procedure to install the probe.

1. Install umbilical strain relief (2.9-inch). If using a dual umbilical, install the optional 2.9-inch strain relief. If using a single umbilical, install the 2.9-inch plug that came in the accessory kit.

   Install 1/4-inch bulkheads. Connect the 11-inch PTFE tubing from chlorine valve to chlorine bulkhead. Connect 19-inch tubing from fitting on left side of probe manifold to vent bulkhead.

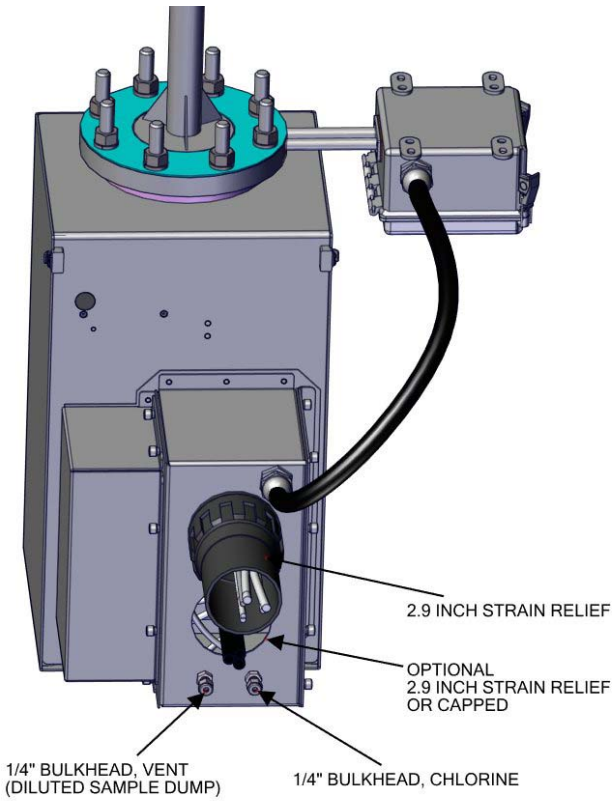


Figure 2–2. Strain Reliefs with Bulkhead Fittings

2. Connect the stainless steel tubing from the total line bulkhead to the converter inlet (Figure 2–1).

3. Using PTFE tape, thread the black particulate deflector on to the end of the stinger.

Figure 2–3. Particulate Deflector Connected

4. Install stinger assembly first into the stack flange, ensure electrical junction box is on the left as you face the stack. Ensure gasket is installed between stinger flange and stack flange, attach stinger assembly to stack, and tighten bolts evenly so the gasket is sealed flat.

5. Remove nuts and washers from the four bolts facing away from stack, mount probe onto bolts with blue gasket. **It is critical to make sure the hole in the blue gasket is at the 12 o'clock position or the probe will not work properly (bypass return to stack)**. Add lock washers and nuts inside of probe. It is very important to tighten the nut evenly so that the gasket seals all the way around the flange.

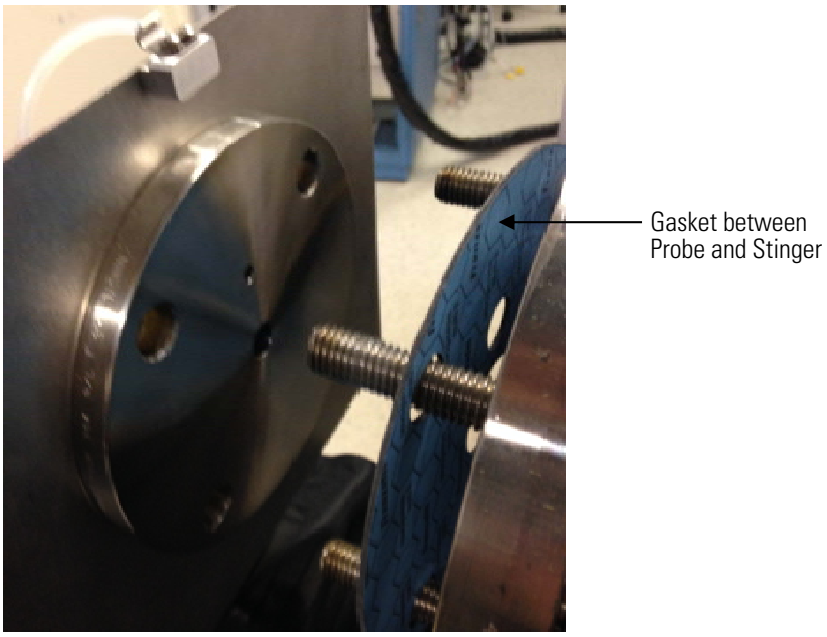


Figure 2–4. Mounting the Stinger Assembly to Probe

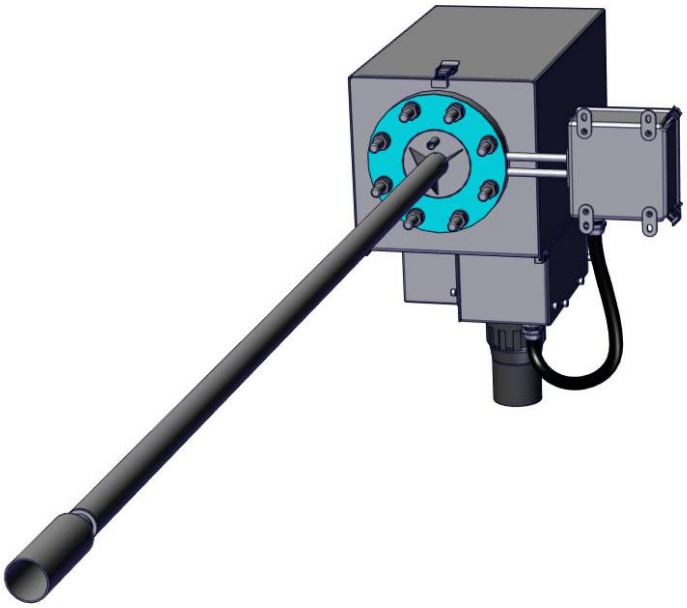


Figure 2–5. Model 85 with Singer Assembly Installed

6. For single umbilical application, put umbilical through 2.9-inch strain relief. Feed all electrical lines through to terminal strip. Ensure umbilical is not hanging on the wires and tubes. For dual umbilical applications, bring the pneumatic tubing through the 2.9-inch strain relief. Pull the electrical bundle through the 2.9-inch strain relief.

7. If probe comes equipped with a heated stainless steel tubing for a Hovacal attachment, use the supplied Kynar bulkhead to connect the Hovacal to the stainless steel tubing. When tubing is not in use, cap bulkhead with the supplied Kynar plug.

Wiring

Use the following wiring diagram to connect the Model 85.

1. Wire stinger and umbilical according to Figure 2–6 and Figure 2–7. Note there will be some unused wires. These should be individually wrapped with electrical tape and secured to the bundle away from ground.

2. Connect Probe, Oxidizer, and Converter Thermocouples. Connect all probe heaters and valves according to Figure 2–8.

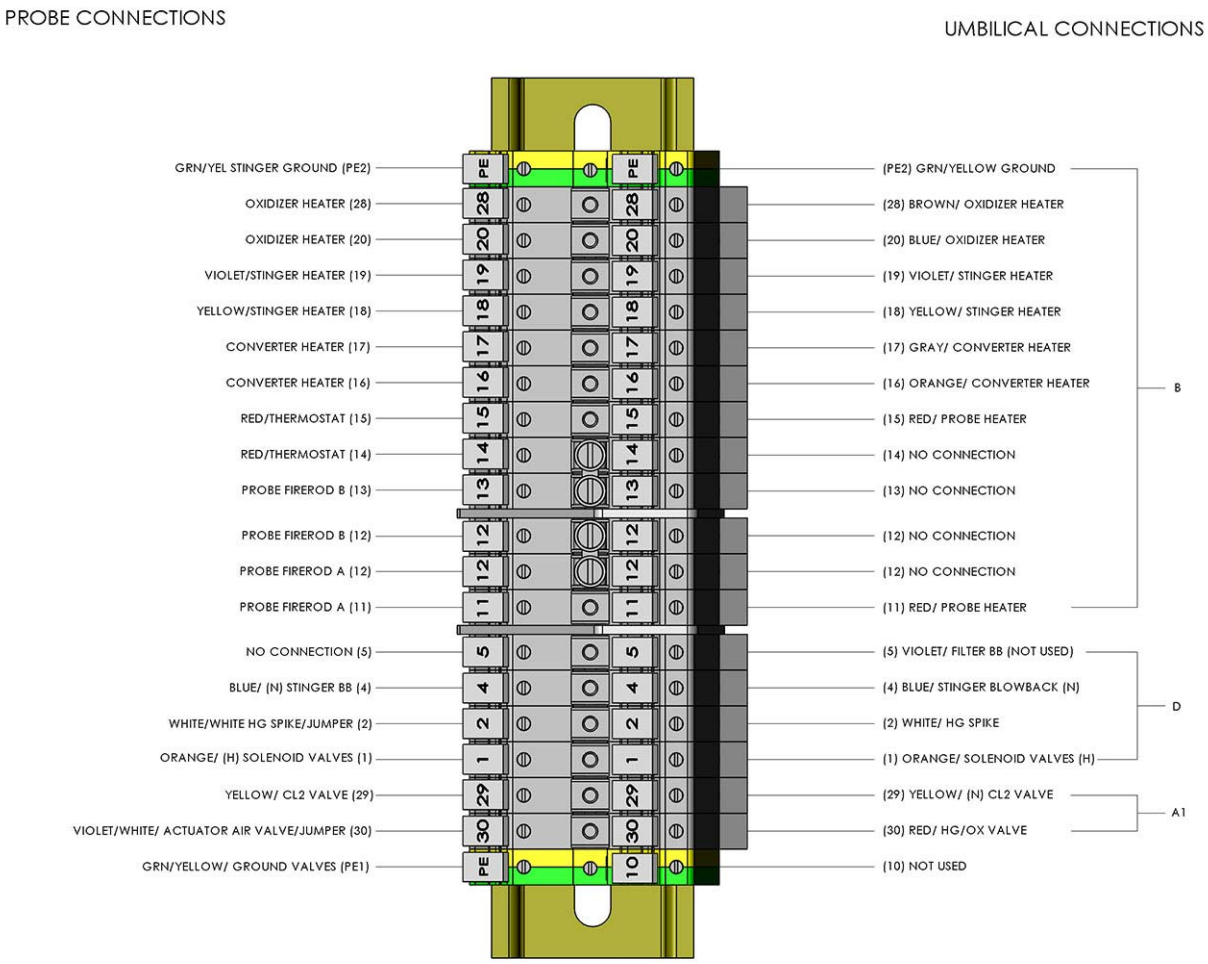


Figure 2–6. Probe Wiring Diagram, ANSI Probe with Oxidizer

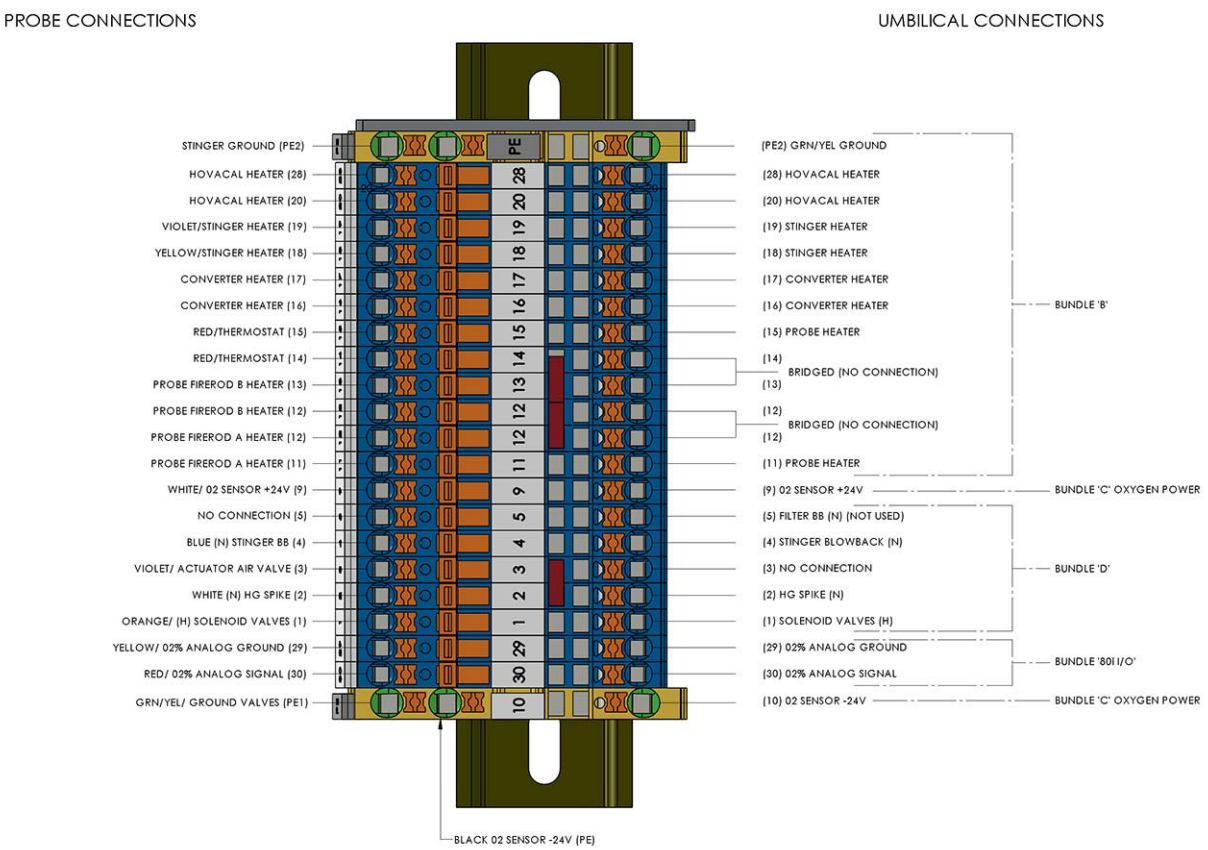


Figure 2–7. Probe Wiring Diagram, DIN Probe with Hovacal Connection

Plumbing

Use the following procedure to connect PFA tubing to probe.

1. Feed tubes 1 (Total Hg), 2 (Elemental Hg), 5 (Eductor Air), 6 (Vacuum) and 7 (Dilution air) up through the slot on the bottom of the Model 85 chassis. Attach according to the following plumbing diagram (Figure 2–8).

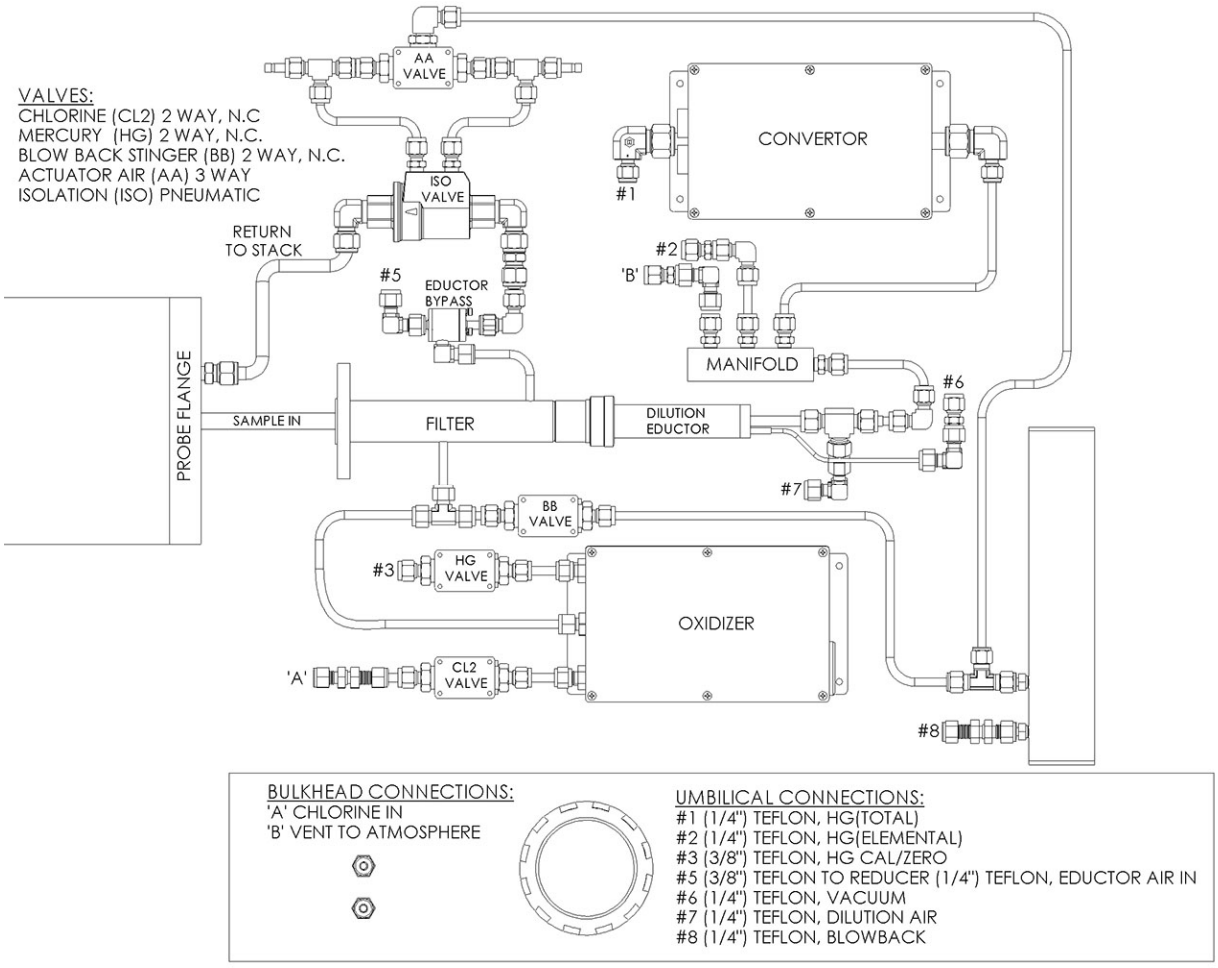


Figure 2–8. ANSI Probe, Cross-section of Plumbing with Oxidizer Assembly

2. Attach tube 3 (3/8-inch Hg Cal Gas) to the Hg solenoid valve. Attach tube 8 (1/4-inch Blowback) to the accumulator tank.

3. Connect Chlorine line to Chlorine bulk head (installed on bottom of probe). Do not confuse with diluted sample dump bulkhead. Internally, the chlorine bulkhead is connected to the valve assembly.

4. Plumb the rest of the umbilical lines according to Table 2–1 and Table 2–2.

Table 2–1. Umbilical Plumbing, ANSI Probe with Oxidizer

From	Tube O.D.	To
Umbilical #1, Hg(t)	1/4-inch	Converter Out
Umbilical #2, Hg(0)	1/4-inch	Center Fitting from Manifold
Umbilical #3, Cal/Zero In	3/8-inch	Reducer Fitting from Hg Valve Bottom
Umbilical #4, Spare	3/8-inch	
Umbilical #5, Eductor Air In	3/8-inch	Reducing Union from Preheater Tube
Umbilical #6, Vacuum	1/4-inch	Vacuum Line
Umbilical #7, Dilution Air In	1/4-inch	Dilution Eductor Air In
Umbilical #8, Blowback	1/4-inch	Bulkhead from Accumulator Tank
Chlorine Tank	1/4-inch	CL2 Bulkhead (located at bottom of probe)

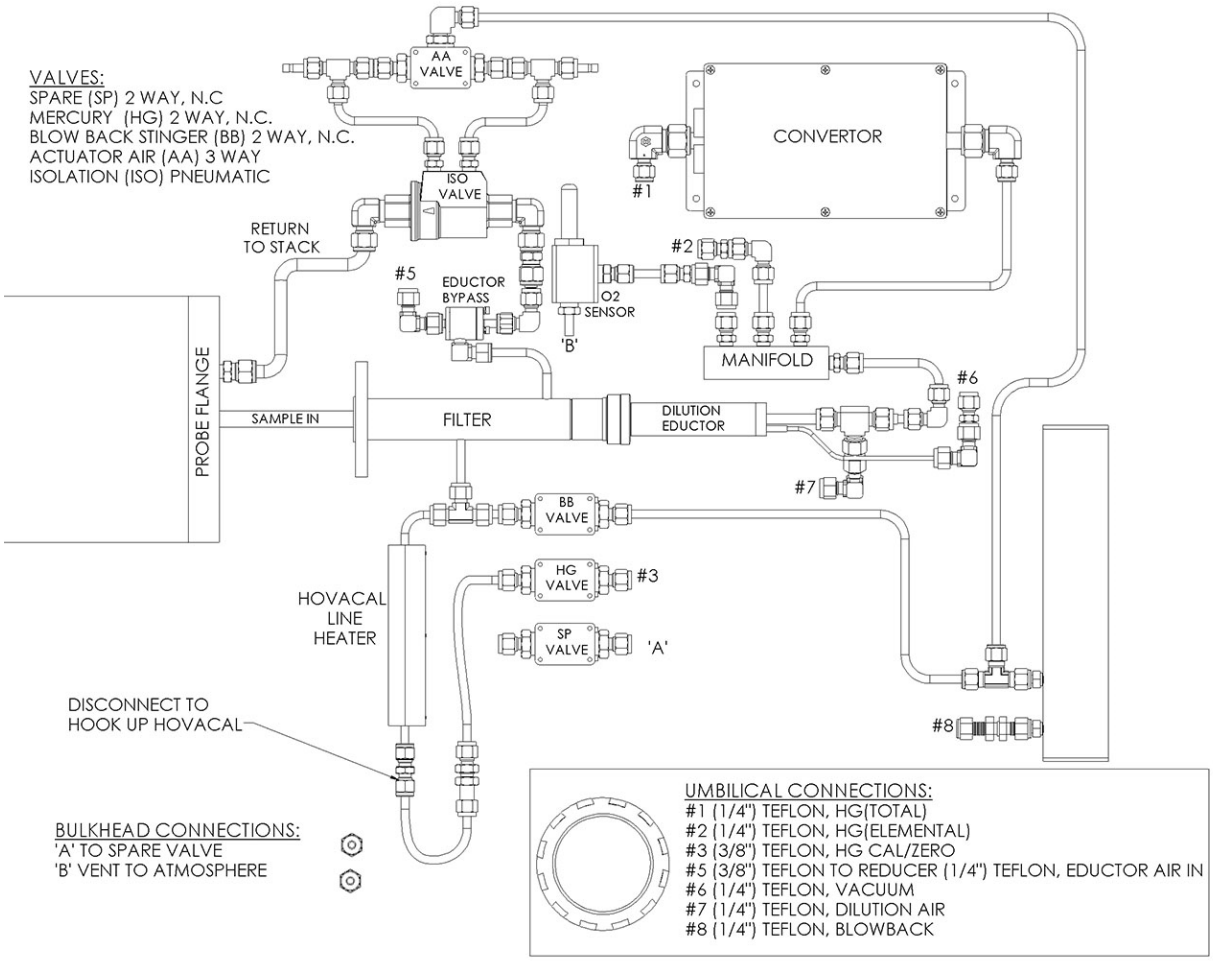


Figure 2–9. DIN Probe, Cross-section of Plumbing with Hovacal Tubing

Table 2–2. Umbilical Plumbing, DIN Probe with Hovacal Connections

From	Tube O.D.	To
Umbilical #1, Hg(t)	1/4-inch	Converter Out
Umbilical #2, Hg(0)	1/4-inch	Center Fitting from Manifold
Umbilical #3,Cal/Zero In	3/8-inch	Reducer Fitting from Hg Valve Bottom
Umbilical #4, Spare	3/8-inch	
Umbilical #5, Eductor Air In	3/8-inch	Reducing Union from Preheater Tube
Umbilical #6, Vacuum	1/4-inch	Vacuum Line
Umbilical #7, Dilution Air In	1/4-inch	Dilution Eductor Air In
Umbilical #8, Blowback	1/4-inch	Bulkhead from Accumulator Tank

Thermocouple Connections

If required, use the following procedure to assemble thermocouples (Figure 2–10). Using a medium or small size slotted screw driver, remove the thermocouple connector cover.

1. Loosen the compression screws inside the connector.

2. Attach the red umbilical lead labeled TC 1 to the - side of the connector by sliding the stripped lead through the connector grommet between the metal plates and tightening the screw.

3. Repeat step 3 for the yellow umbilical lead into the + side.

4. Reinstall cover.

5. Repeat above for TC 2.

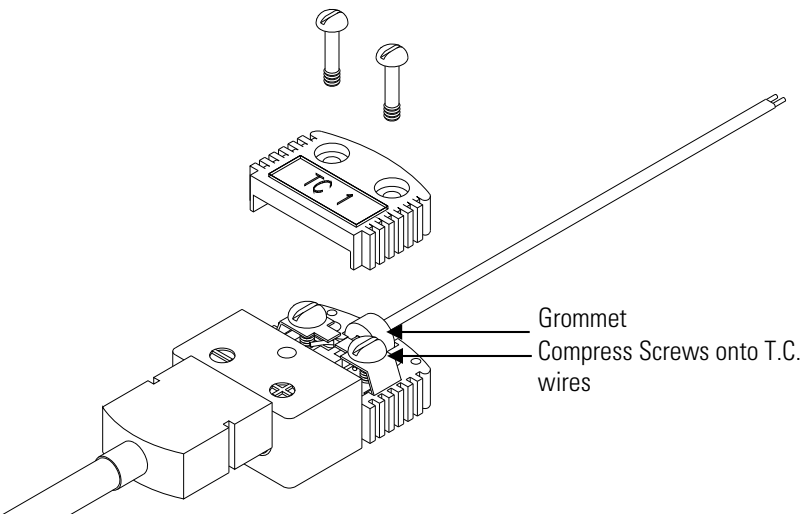


Figure 2–10. Thermocouple Connections

Power up and Verification

Use the following procedure to power up and verify connection to the probe.

1. Turn power ON to the 82*i*.

2. Turn On sample pump and ensure that the Chamber pressure is below 90 mmHg.

3. In the 80*i* menu ensure all temperatures in the probe are reading near ambient temperatures.

Note System gas mode will be in blow back until probe temperature reaches the setpoint. ▲

4. In the 80*i* menu turn on Stinger component power.

5. In the 80*i* menu turn on Probe component power (monitor temperature to ensure it reaches the setpoint of 220 °C).

6. In the 80*i* menu turn on Converter component power (monitor temperature to ensure it reaches the setpoint of 760 °C).

7. In the 80*i* menu turn on Oxidizer component power (monitor temperature to ensure it reaches the setpoint of 400 °C).

   If the probe is equipped with the optional heated Hovacal Line instead of an oxidizer, set the temperature setpoint to 250 °C. This will heat the Hovacal tubing to the specified temperature.

8. Ensure probe covers are on.

Note Heater circuits are powered on one at a time so that proper thermocouple and heater connection may be verified. ▲

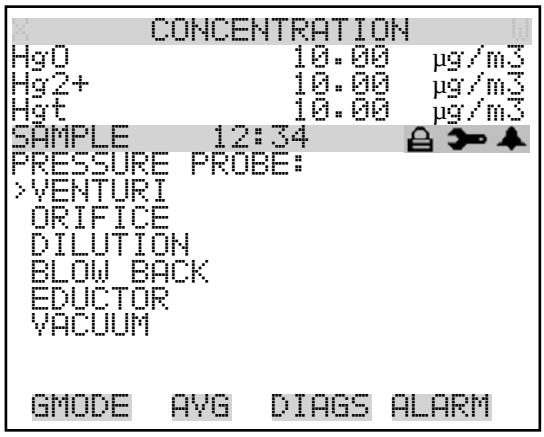
9. Check Probe pressures to ensure proper operation. (Venturi and Orifice pressure are not used in Model 85.)

   a. Eductor set and reading to 10 psig

   b. Dilution Air Pressure set and reading 30–50 psig

c. Dilution Vacuum reading >19 in Hg

d. Blowback Pressure set and reading 60 psig



10. After burn in conditioning overnight, zero and calibrate the system. Use 15-minute zero and 15-minute span at 8.1 ug/m^3. See 80*i* Analyzer Manual and System Manual.

11. Set the 80*i* to perform an automatic zero and span calibration every 24 hours.

Chapter 3
Preventive Maintenance and Servicing

This chapter includes the following maintenance information and replacement procedures that should be performed on the Model 85 to ensure proper operation. All plumbing type replacements should be followed-up with a leak test. For details, see the following:

Safety Precautions

Read the safety precautions before beginning any procedures in this chapter.

WARNING The service procedures in this manual are restricted to qualified service representatives. ▲

If the equipment is operated in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired. ▲

Replacement Parts List

Table 3–1 lists the replacement parts for the Model 85.

Note The recommended replacement interval is site specific; therefore, these are only guidelines. ▲

Table 3–1. Model 85 Replacement Parts

Part Number	Description	Replacement Interval
102728-00	Ceramic Converter Heater	As needed
104500-01	Converter Core, 9-inch, with ferrules	3–6 months
100429-00	Thermocouple, Converter	As needed
115126-00	Manifold Assembly w/orifices	As needed
116470-00	Sample Manifold Orifices	As needed
115452-00	Ejector Pump (Eductor Pump)	As needed
102624-02	Dilution Module	As needed
115451-00	O-ring, High Temp[1]	As needed/Annual
117204-00	Filter, Stainless Steel, Glass Coated	Annual
116771-00	Lubricant, High Vacuum LVP, with PTFE	As needed
116772-00	Spring, Compression, Stainless Steel	As needed
105479-00	Strain Relief, 2.9-inch	As needed
117883-00	Plug, Seal, Knock Out 3.5-inch	As needed
104301-07	Chlorine Orifice	As needed
115615-00	Particulate Deflector	As needed
115494-00	Stinger Assembly (ANSI)	As needed
116318-00	Stinger Assembly (DIN)	As needed
118815-00	Dilution Orifice, Critical	As needed
115441-00	Blue Insulation Sleeve	As needed
115063-00	Probe Cover, Complete Assembly	As needed
118855-00	Probe Cover, Insulation Kit	As needed
118132-00	Filter Service Kit[1, 2]	6 months
119392-00	Isolation Valve Assembly	As needed
119253-00	O2 Sensor and Cable Assembly	As needed
118846-00	O2 Sensor Board	As needed

[1]Before installing o-ring, lubricate it lightly with part 116771-00.

[2]Filter Service Kit includes one filter 117204-00, four o-rings 115451-00, two core assemblies with ferrules 104500-01, and one thermocouple 100429-00.

Replacement Tubing List

Table 3–2 lists the replacement tubing parts for the Model 85.

Depending on the conditions of the stack or duct annual or more/less frequent, replacement of factory tubing should be performed. An ideal time would be shut-down.

Table 3–2. Replacement Tubing List

Part Number	Description	Replacement Interval
115461-00	Eductor Inlet	As needed
115439-00	Manifold In	As needed
104719-00	Oxidizer Inlets	As needed
115440-00	Oxidizer Outlet	As needed
116376-00	Converter Inlet	As needed
119385-00	Converter Outlet	As needed
116335-00	Hovacal Line	As needed

Factory Plumbing

Table 3–3 and Table 3–4 lists the internal factory plumbing.

Table 3–3. Internal Factory Plumbing, ANSI Probe with Oxidizer

From	Tubing, Length	To
CL2 Bulkhead	1/4" PFA, 11"	CL2 Valve, Bottom
Manifold P3, Dump	1/4" PFA, 19"	Vent Port, Thru Slot 2
Accumulator Tank Tee, Bottom	1/4" PFA, 13"	BB Sting Valve, Bottom
Accumulator Tank Tee, Middle	1/4" PFA, 15-3/4"	Actuator Air Valve, Side (3-way)
Actuator Air Valve, Top (NO)	1/4" PFA, 15"	Isolation Valve, Right
Actuator Air Valve, Bottom (NC)	1/4" PFA, 28"	Isolation Valve, Left
Isolation Valve	3/8" PFA, 6"	Stack Return
BB Sting Valve, Top	1/4" PFA, 14.5"	Mantle Port Tee, Top
Hg Valve, Top	1/4" PFA, 18.375"	Oxidizer, Right
CL2 Valve, Top	1/4" PFA, 18"	Oxidizer, Left
Oxidizer Out, Center	P/N: 115440-00	Mantle Port Tee, Bottom
Manifold, P1	P/N: 116376-00 (ref)	Converter Inlet

Table 3–4. Internal Factory Plumbing, DIN Probe with Hovacal Connection

From	Tubing, Length	To
O2 Sensor, Thru Slot 2	1/4" PFA, 17"	Manifold, P3
Accumulator Tank Tee, Bottom	1/4" PFA, 13"	BB Sting Valve, Bottom
Accumulator Tank Tee, Middle	1/4" PFA, 15-3/4"	Actuator Air Valve, Side
Actuator Air Valve, Top	1/4" PFA, 15"	Isolation Valve, Right
Actuator Air Valve, Bottom	1/4" PFA, 28"	Isolation Valve, Left
Isolation Valve	3/8" PFA, 6"	Stack Return
BB Sting Valve, Top	1/4" PFA, 14.5"	Mantle Port Cross, Top
Hg Valve, Top	1/4" PFA, 18"	Enclosure Bulkhead
Manifold P1	P/N: 116376-00 (ref)	Converter Inlet
Hg Enclosure Bulkhead	1/4" PFA, 8"	Hovacal Inlet

Factory Wiring

Table 3–5 and Table 3–6 lists the factory wiring for the Model 85.

Table 3–5. Internal Factory Wiring, ANSI Probe with Oxidizer

From	Part Number	Through Slot	Color	Terminal Block #
Valves	105452-02	Slot 4	Green/Yellow	PE 1
Hg/Ox Jumper to 2	103433-02		White	30 to 2
Actuator Air	103433-02	Slot 4	Violet	30
CL2 Valve	103433-02	Slot 4	Yellow	29
Valves	103733-02	Slot 4	Orange	1
Hg Spike	103433-02	Slot 4	White	2
Stinger BB	103433-02	Slot 4	Blue	4
Actuator Air	103433-02	Slot 4	Violet	30
Probe Firerod A	102307-00	Slot 1	Tan/Brown	11
Probe Firerod A	102307-00	Slot 1	Tan/Brown	12
Probe Firerod B	102307-00	Slot 1	Tan/Brown	12
Probe Firerod B	102307-00	Slot 1	Tan/Brown	13
Thermostat	103422-01	Slot 1	Red	14
Thermostat	103422-02	Slot 1	Red	15
Converter	102304-01	Slot 1	Tan	16
Converter	102304-01	Slot 1	Tan	17
Stinger		Slot 4	Yellow	18
Stinger		Slot 4	Violet	19
Oxidizer	104874-00	Slot 1	Tan/Brown	20
Oxidizer	104874-00	Slot 1	Tan/Brown	28
Stinger Ground		Slot 4	Green/Yellow	PE 2
Bridge	102399-04			12-12
Bridge	102399-04			13-14

Table 3–6. Internal Factory Wiring, DIN Probe with Hovacal Connection

From	Part Number	Through Slot	Color	Terminal Block #
Valves	119331-00	Slot 4	Green/Yellow	PE 1
O2 Board	119336-00		Black	10
O2 Board	119336-00		Red	30
O2 Board	119336-00		Yellow	29
O2 Board	119336-00		White	9
Valves	119331-00	Slot 4	Orange	1
Hg Spike	119331-00	Slot 4	White	2
Actuator Air	119331-00	Slot 4	Violet	3
Stinger BB	119331-00	Slot 4	Blue	4
Probe Firerod A	102307-00		Tan/Brown	11
Probe Firerod A	102307-00	Slot 1	Tan/Brown	12
Probe Firerod B	102307-00	Slot 1	Tan/Brown	12
Probe Firerod B	102307-00	Slot 1	Tan/Brown	13
Thermostat	103422-01	Slot 1	Red	14
Thermostat	103422-02	Slot 1	Red	15
Converter	102304-01	Slot 1	Tan	16
Converter	102304-01	Slot 1	Tan	17
Stinger		Slot 4	Yellow	18
Stinger		Slot 4	Violet	19
Hovacal Heater	104874-00	Slot 1	Tan/Brown	20
Hovacal Heater	104874-00	Slot 1	Tan/Brown	28
Stinger Ground		Slot 4	Green/Yellow	PE 2
Jumper Bridge	119366-00			2-3
Jumper Bridge	119366-00			12-12
Jumper Bridge	119366-00			13-14

Stinger Cleaning and Filter Replacement

Use the following procedure to replace the filter and o-ring (Figure 3–2).

Equipment Required:

O-ring/O-ring lubricant

1/2-inch bore brush

Wooden stick or dowel

Pliers

WARNING The service procedures in this manual are restricted to qualified service representatives. ▲

Note Every time you open the dilution module/filter nut, you will have to replace the o-ring seal. ▲

1. Record Dilution and Eductor pressures.

2. In the 80*i* menu turn OFF Probe component power, the sample pump and set the dilution air and eductor air down to 0 psi. (**This is important.**) The system must be in stinger blowback during this procedure.

WARNING Probe is HOT. Wear appropriate PPE (personal protective equipment). ▲

3. Remove isolation valve from top of educator.

4. Open the four clamps that hold the top and bottom aluminum heater blocks together.

5. Remove top aluminum block and put off to the side. Be careful of the thermocouple wire.

6. Loosen the grooved nut that seals the dilution module to the sample weldment.

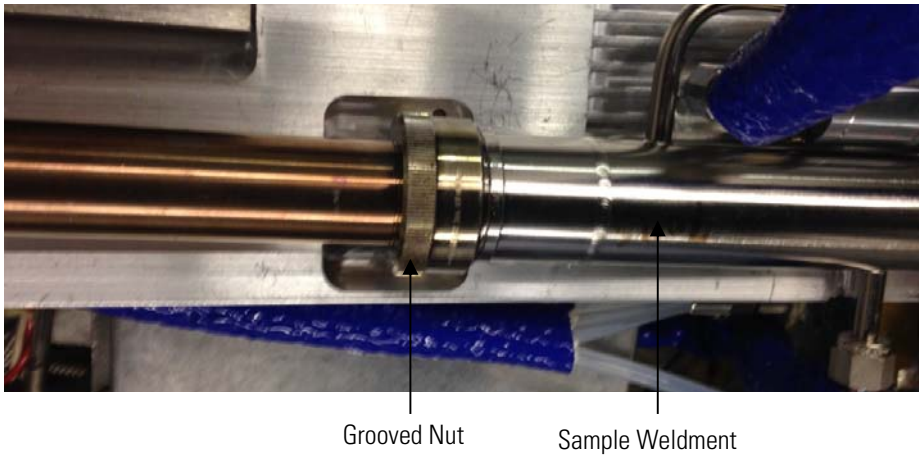


Figure 3–1. Removal of Dilution Filter

7. Remove PTFE tubing from Dilution Air In.

8. Remove PTFE tubing from Vacuum Line.

9. Disconnect 1/4-inch glass-coated tube from the orifice manifold block and pull dilution module backward (be careful to not bend the 1/8-inch vacuum line).

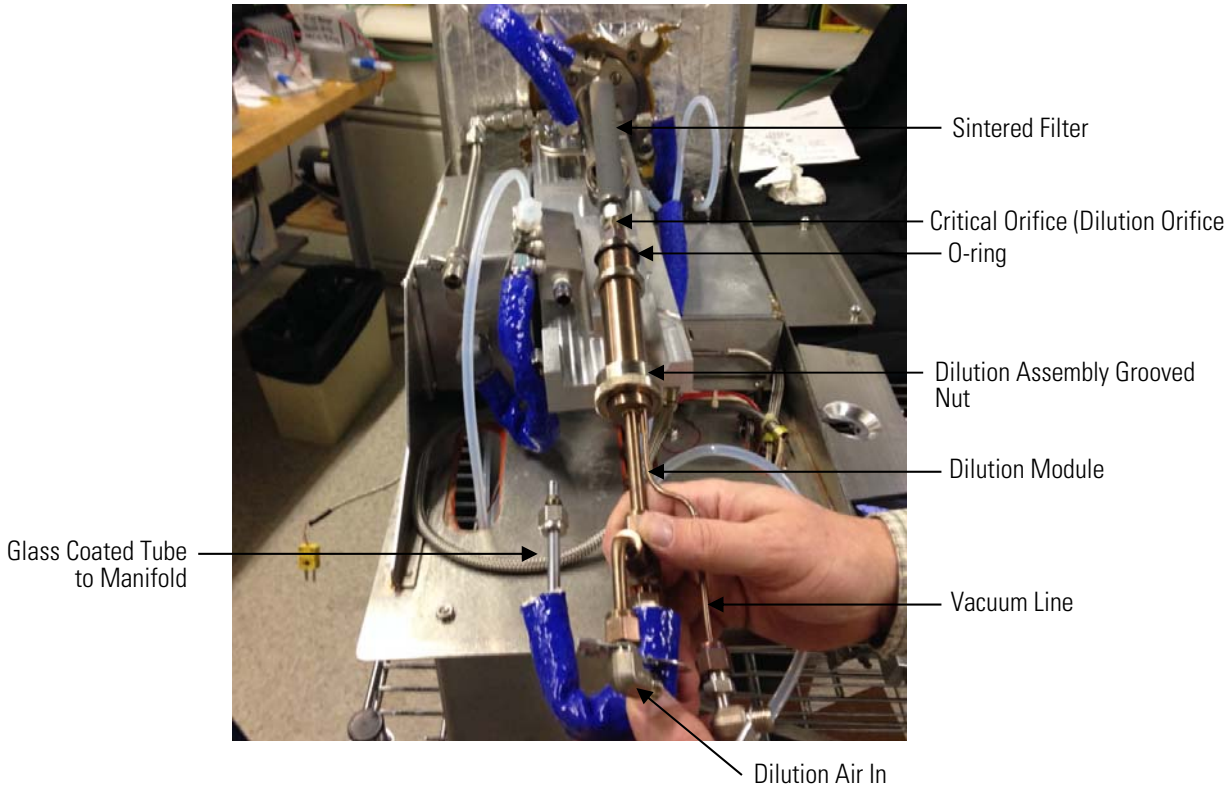


Figure 3–2. Probe Flow Disassembly

10. If cleaning the filter, loosen the nut that is closest to the filter and separate the filter from the dilution module. The union fitting that is between the dilution module and the filter is the dilution orifice and should not be removed from the dilution module.

11. With the filter and dilution module removed you should be able to clean out the stinger tube with 1/2-inch bore brush (it is open all the way to the stack).

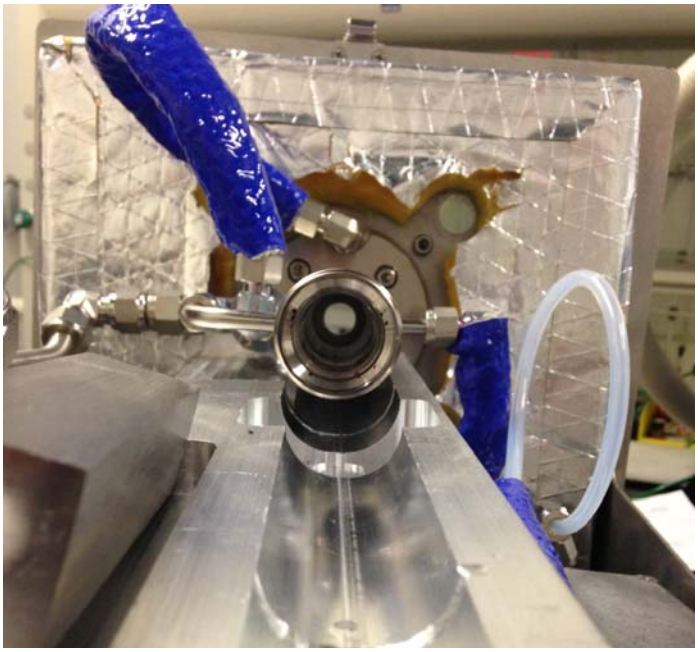


Figure 3–3. Probe with Dilution Module Assembly Removed

12. Using a wooden stick or dowel, clean any o-ring particles out of the opening before replacing the filter and dilution module back into the sample weldment. Take care **not to scratch** the glass coating.

13. Apply high vacuum grease (116771-00) lightly and evenly onto o-ring (115451-00). Assembly as shown in Figure 3–4.

Note If entire flow assembly was removed, perform leak test. ▲

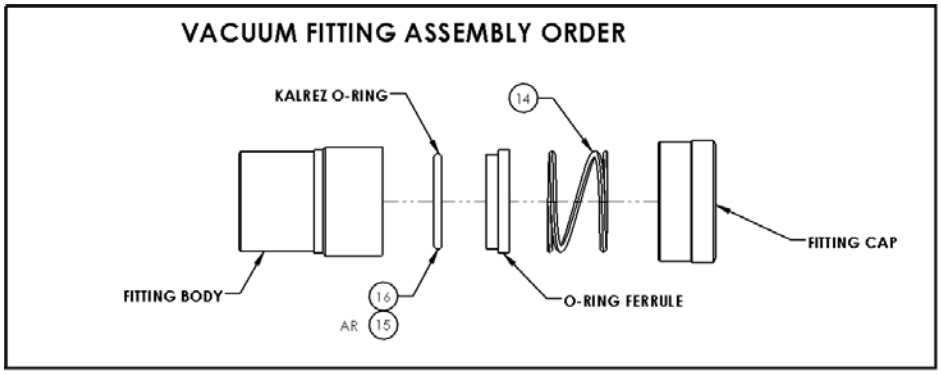


Figure 3–4. O-ring Assembly with Lubricant

14. Using a new o-ring, attach cleaned or new filter to Dilution Assembly. Insert assembly into sample weldment. Tighten the grooved nut with a pair of pliers.

15. Tighten fitting from the glass coated manifold tubing, Dilution Air In tubing, and Vacuum line tubing.

16. Replace top aluminum heated block, clamp securely to the lower aluminum heated block and replace the probe enclosure cover.

17. In the 80*i* menu turn ON Probe component power. Ensure probe reaches setpoint. Turn on the sample pump and set the dilution air back to the initial recorded pressures. (**This is important.**)

18. When the probe has reached setpoint temperature, carefully re-tighten the grooved nut with a pair of pliers. This is to ensure that the o-ring is sealed and no leaks exist in the sample weldment.

Converter Thermocouple Replacement

Use the following procedure to replace the converter thermocouple (Figure 3–5).

Equipment Required:

Thermocouple

WARNING The service procedures in this manual are restricted to qualified service representatives. ▲

1. Unplug thermocouple from umbilical hookup.
2. Snip any tie wraps holding the thermocouple in place.
3. Replace thermocouple and reassemble in reverse order.

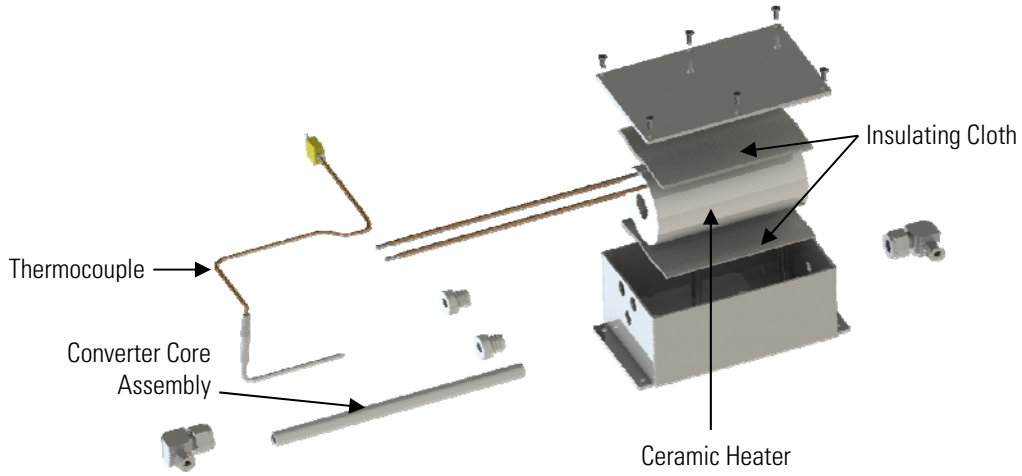


Figure 3–5. Converter Assembly Replacements

Converter Core Assembly Replacement

Use the following procedure to replace the converter core assembly.

Equipment Required:

Converter core assembly

Open-end wrenches, 11/16-inch and 15/16-inch

WARNING The service procedures in this manual are restricted to qualified service representatives. ▲

1. Allow converter to cool.

2. Using a 15/16-inch and 11/16-inch open end wrench, loosen fittings compressed on core assembly.

3. Slide out core assembly.

4. Install new core and reassemble in reverse order. Use new PFA ferrules, 105325-00.

Converter Heater Replacement

Use the following procedure to replace the heater (Figure 3–5).

Equipment Required:

Ceramic heater

Open-end wrenches, 11/16-inch and 15/16-inch

Nut driver, 11/32-inch

Phillips screwdriver

WARNING The service procedures in this manual are restricted to qualified service representatives. ▲

1. Allow converter to cool.
2. Using an 11/16-inch and 15/16-inch open end wrench, loosen fittings compressed on core assembly.
3. Remove core assembly.
4. Disconnect wiring in upper assembly. Refer to Table 3–5 on page 3-5.
5. Using a Phillips head screwdriver, remove four screws mounting the converter assembly to the probe enclosure.
6. Using a Phillips head screwdriver, remove six screws holding converter cover in place.
7. Install new heater and reassemble in reverse order.

Leak Testing

The Flow Assembly can be tested for leaks by plugging all the openings except two. A vacuum gauge and a pump will be connected to the fittings that are left open.

Use the following procedure to perform a leak test.

Equipment Required:

Stainless steel or PTFE caps, 1/2-inch, 3/4-inch, and 1/4-inch

Pump

Ball valve, 1/4-inch

Vacuum gauge

WARNING The service procedures in this manual are restricted to qualified service representatives. ▲

1. Plug the flange end of the flow assembly. Or mount the flange to the gasket in order to seal the open end.

2. Using 6 plugs, plug (cap) the fittings as shown in Figure 3–6.

3. Connect a vacuum gauge to the elbow on the vacuum port. Take care not to damage the 1/8-inch tubing.

4. Connect a vacuum pump (such as Welch pump 2561 or equivalent) to a ball valve. Attach the ball valve in line with the Dilution Air Input port.

5. Open the ball valve and turn the pump on.

6. After about 15 seconds, close the ball valve. Turn pump off and observe the vacuum gauge.

   The vacuum gauge should remain constant. If leaks are present, the vacuum gauge will approach zero (a leak rate of 0.25 in/Hg per 5 minute period is acceptable).

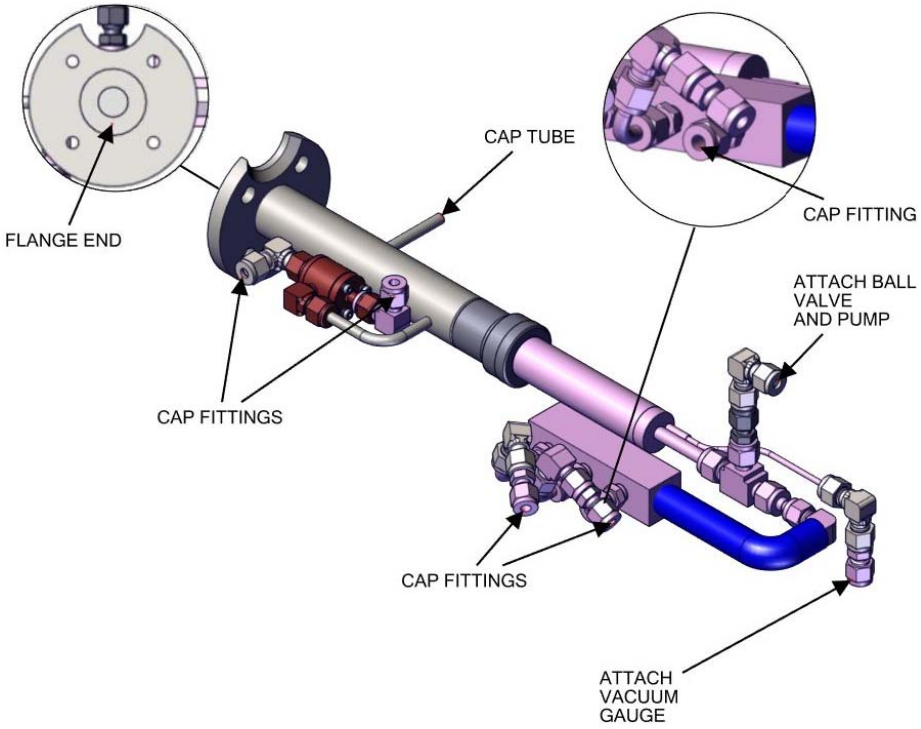


Figure 3–6. Flow Assembly Leak Test

Service Locations

For additional assistance, Thermo Fisher Scientific has service available from exclusive distributors worldwide. Contact one of the phone numbers below for product support and technical information or visit us on the web at www.thermo.com/aqi.

1-866-282-0430 Toll Free

1-508-520-0430 International

Chapter 4
System Description

The System Description chapter provides and overview of the Model 85 describes the function of the system components and provides a typical system plumbing hookup per the following:

The Model 85 Mercury Probe is a mercury extraction probe designed for use in the Thermo Freedom continuous emissions monitoring system. The probe weighs approximately sixty-five pounds and consists of a 3-inch mounting flange, and isolated electrical and pneumatic compartments.

The pneumatic compartment houses an Hg cal/zero valve, stinger blow back valve, Cl_2 valve, and a Phoenix™ DIN-rail block for all electrical connections.

The main compartment consists of a probe flow assembly, converter assembly, and a 2.9-inch strain relief for the umbilical cord. An additional 2.9-inch strain relief is available for applications using dual umbilical configurations.

The probe flow assembly consists of a particulate filter, critical orifice, bypass pump assembly, and dilution eductor assembly, all of which are entombed in heated aluminum blocks. The manifold inlet is attached to

the diluted sample line of the dilution eductor. The manifold has three outlets. The left outlet is vented to a dump, the middle outlet contains an orifice which connects to the Elemental line, and the right outlet contains an orifice and connects to the Converter inlet tubing.

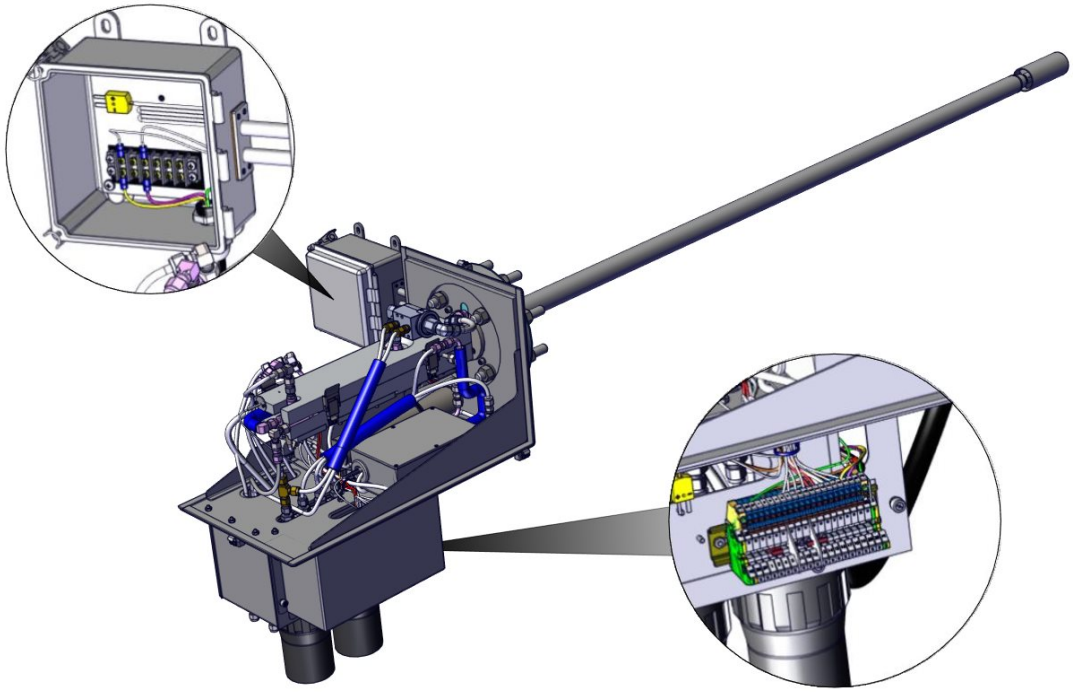


Figure 4–1. Model 85 Mercury Probe

Converter Assembly

Operating at 760 °C, the converter disassociates the salts and oxides of mercury to give elemental mercury. This, along with the elemental already passing through, gives the total mercury of the sample.

Probe Flow Assembly

This assembly, which is heated, contains all of the sample inlet components. It keeps the components at or near 220 °C.

Dilution Module

The dilution module dilutes the sample with zero air and delivers it to the analyzer via the scrubber or converter and heated umbilical cord.

Critical Dilution Orifice

The critical orifice provides a constant flow being pulled by the dilution module. It is located between the dilution assembly and probe filter.

Probe Filter

The probe filter is a porous filter element that can be cleaned in situ by filter blow back mode.

A filter housing tube surrounds the element, creating a minimum-volume annular plenum for sample collection.

Accumulator Tank

The accumulator tank allows the blow back valve to blast the sample inlet system with a volumetric force of air.

Valves

There are four valves: Hg cal/zero, Cl_2, filter blow back (not used), and stinger blow back.

Manifold Critical Sample Orifices

The critical orifices maintain a balance of flow between the elemental and total channels. They are part of the manifold assembly.

Stinger/Heater Assembly

The heater is mounted around the portion of the stinger that is located in the probe barrel assembly. The mantle assembly is mounted to the probe box and passes through the stack outer wall to the inner wall. The stinger assembly can be mounted with a 4-inch mounting flange or a DIN mounting flange.

Oxidizer Assembly

The oxidizer assembly converts a known amount of elemental Hg to an oxidized form (i.e. mercuric chloride or mercuric bromide).

Heated Hovacal Line

The E.U. version of the Model 85 Mercury Probe comes equipped with a heated line for the Hovacal, in place of the oxidizer assembly. This glass coated S.S. line is used during Hovacal audits. It should be kept at a constant temperature of 250 °C even when not being used in order to reduce cold spots.

Isolation Valve Assembly

The isolation valve is open during sample mode. It is closed during system zero and system span so that the probe is flooded with calibration gas.

Oxygen Sensor

For DIN model probes, an oxygen sensor is included for oxygen compensation during sample mode. This is located attached to the probe vent bulkhead.

Appendix A
Warranty

Seller warrants that the Products will operate or perform substantially in conformance with Seller's published specifications and be free from defects in material and workmanship, when subjected to normal, proper and intended usage by properly trained personnel, for the period of time set forth in the product documentation, published specifications or package inserts. If a period of time is not specified in Seller's product documentation, published specifications or package inserts, the warranty period shall be one (1) year from the date of shipment to Buyer for equipment and ninety (90) days for all other products (the "Warranty Period"). Seller agrees during the Warranty Period, to repair or replace, at Seller's option, defective Products so as to cause the same to operate in substantial conformance with said published specifications; provided that (a) Buyer shall promptly notify Seller in writing upon the discovery of any defect, which notice shall include the product model and serial number (if applicable) and details of the warranty claim; (b) after Seller's review, Seller will provide Buyer with service data and/or a Return Material Authorization ("RMA"), which may include biohazard decontamination procedures and other product-specific handling instructions; and (c) then, if applicable, Buyer may return the defective Products to Seller with all costs prepaid by Buyer. Replacement parts may be new or refurbished, at the election of Seller. All replaced parts shall become the property of Seller. Shipment to Buyer of repaired or replacement Products shall be made in accordance with the Delivery provisions of the Seller's Terms and Conditions of Sale. Consumables, including but not limited to lamps, fuses, batteries, bulbs and other such expendable items, are expressly excluded from the warranty under this warranty.

Notwithstanding the foregoing, Products supplied by Seller that are obtained by Seller from an original manufacturer or third party supplier are not warranted by Seller, but Seller agrees to assign to Buyer any warranty rights in such Product that Seller may have from the original manufacturer or third party supplier, to the extent such assignment is allowed by such original manufacturer or third party supplier.

In no event shall Seller have any obligation to make repairs, replacements or corrections required, in whole or in part, as the result of (i) normal wear and tear, (ii) accident, disaster or event of force majeure, (iii) misuse, fault or negligence of or by Buyer, (iv) use of the Products in a manner for which

they were not designed, (v) causes external to the Products such as, but not limited to, power failure or electrical power surges, (vi) improper storage and handling of the Products or (vii) use of the Products in combination with equipment or software not supplied by Seller. If Seller determines that Products for which Buyer has requested warranty services are not covered by the warranty hereunder, Buyer shall pay or reimburse Seller for all costs of investigating and responding to such request at Seller's then prevailing time and materials rates. If Seller provides repair services or replacement parts that are not covered by the warranty provided in this warranty, Buyer shall pay Seller therefor at Seller's then prevailing time and materials rates. ANY INSTALLATION, MAINTENANCE, REPAIR, SERVICE, RELOCATION OR ALTERATION TO OR OF, OR OTHER TAMPERING WITH, THE PRODUCTS PERFORMED BY ANY PERSON OR ENTITY OTHER THAN SELLER WITHOUT SELLER'S PRIOR WRITTEN APPROVAL, OR ANY USE OF REPLACEMENT PARTS NOT SUPPLIED BY SELLER, SHALL IMMEDIATELY VOID AND CANCEL ALL WARRANTIES WITH RESPECT TO THE AFFECTED PRODUCTS.

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