Model 83*i*

Instruction Manual
Extraction Probe
Part Number 101187-00
25Jan2008

Thermo
SCIENTIFIC

Specifications, terms and pricing are subject to change. Not all products are available in all countries. Please consult your local sales representative for details.

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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 83*i* Extraction 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 of the inertial filter and the operating principle of the inertial filter tube.
- Chapter 2 “Installation” describes how to prepare the enclosure, how to install the slurry cup, 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 extraction probe. This manual provides specific information on how to operate the extraction probe, however if the extraction 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**	If the equipment is operated in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired. ▲
		The service procedures in this manual are restricted to qualified service personnel only. ▲
	**Equipment Damage**	Do not attempt to lift the analyzer by the cover or other external fittings. ▲
		This adjustment should only be performed by an instrument service technician. ▲

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.thermo.com/aqi.

1-866-282-0430 Toll Free

1-508-520-0430 International

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Chapter 1
Introduction

The Model 83*i* Mercury (Hg) Extraction 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 Mercury Extraction Probe (Model 83*i*) along with additional peripheral components, e.g., zero air supply, umbilical, instrument rack, etc. The Model 83*i* Extraction Probe with built-in diluting probe has been designed specifically to monitor gaseous Hg emissions from coal-fired power plants.

The system is housed in a stainless steel enclosure and is designed to meet NEMA 4X specifications. To prevent sample condensation, all key elements (Inertial Filter, Diluting Probe and Sample Eductor) have been mounted between heated aluminum blocks that can be maintained at temperatures as high as 250 °C.

The enclosure also houses an accumulator tank for back purging of the inertial filter tube (blow back). External to the enclosure is a section with the electrical connections, solenoids for filter and stinger blow back, cal gas, an Hg spike, a differential pressure transducer, and an additional pressure transducer for the pressure at the critical orifice.

A special 4-inch adapted mounting flange has been supplied for installation onto the port of the stack or duct.

Clean dry pressurized (~85 psig) air feeds two electronic pressure regulators in the Model 82*i* (Figure 1–1), which adjust and maintain output pressure to the Model 83*i* 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 83*i* 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 83*i*.

The Model 83*i* extraction probe includes an inertial filter with a built in dilution module and high temperature thermal converter for reducing oxidized Hg to elemental for subsequent analysis by the Model 80*i* Mercury Analyzer.

The Model 82*i* provides both 220 and 110 AC voltage to the Model 83*i* Probe. 220 VAC powers the probe's stinger heater and inertial filter/eductor heater. 110 VAC powers the Total Hg converter as well as four (4) probe solenoid valves for Cal/Zero gas, Stinger blow back, Filter blow back, and Hg spike. The Model 82*i* also receives two (2) 4-20 ma signals from the probe critical orifice pressure transducer and the fast loop Venturi pressure transducer.

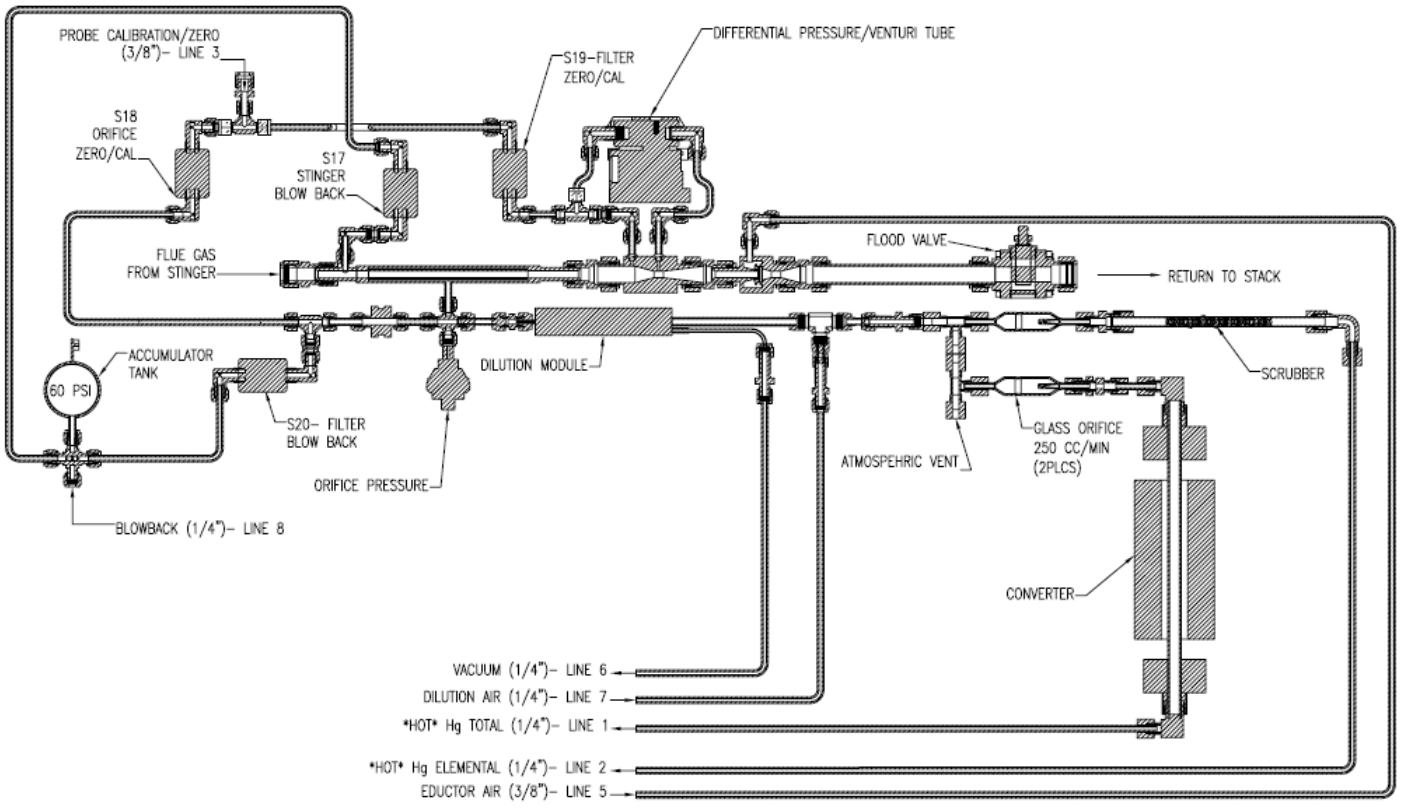


Figure 1–1. Model 83*i* Probe Flow Schematic

Construction of the Inertial Filter

The inertial filter is a filter assembly with a porous filter element that can be cleaned in situ by simple blow back. This filter element is a silica coated 316L stainless steel 10-inch long 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.

Operating Principle of the Inertial Filter Tube

A high-velocity gas flow (70 to 100 fps) will develop axially through the porous filter tube. From this mainstream flow, a clean sample flow will develop radially through the porous tube wall at a very low face velocity (0.005 fps), passing into the housing annulus and out the sample tube.

The ballistic effect of particle inertia will prevent particles entrained in the high-velocity axial gas flow from depositing on or penetrating the porous filter wall. The low radial velocity also inhibits particles from penetrating the porous wall.

Superfine particles that do enter the porous media form a permeable surface cake or “dynamic membrane” of approximately 0.010 to 0.015-inch deep. This membrane then becomes the effective filter medium, and it bars the passage of contaminants much smaller than the filter pore size. Scouring or abrasive damage to the porous wall is prevented by the presence of a thin zero-velocity Prandtl boundary layer.

While the filter is on-stream, sample flow continues without interruption so representative samples are constantly furnished. The housing annulus has a very low volume, to minimize sample dwell time and ensure fresh samples.

Chapter 2
Installation

The installation procedure of Model 83*i* involves several steps:

Preparing the Enclosure

The Model 83*i* is supplied with a 3-inch Strain Relief Assembly to accommodate the recommended Heated Umbilical Cord (Figure 2–1). Some disassembly will be required to mount the enclosure to the process port. Both preparatory stages are described below.

Equipment Damage Do not attempt to lift the product by the cover or other external fittings. ▲

There is a bulkhead fitting used as an atmospheric dump on the bottom of the enclosure. Take care not to damage. ▲

1. Remove the two (large) side panels from the enclosure, by rotating the compression latches counter clockwise. Both panels are identical. Maintain inward pressure on the center of the panel while unlatching to prevent panel from dropping (Figure 2–1).

2. Remove the (small) rear panel from the enclosure. The internal section inside the enclosure is now fully accessible.

DANGER Use caution when removing a panel, especially if it has the potential to free fall or be blown by the wind. ▲

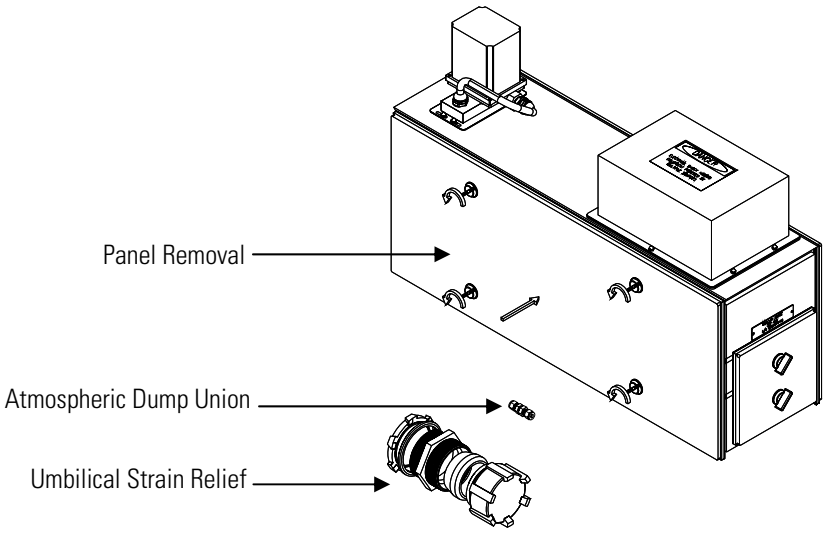


Figure 2–1. Panel Removal and Umbilical Strain Relief:

Fast Loop Assembly Removal

The following step may be skipped. It is a weight reduction technique for installations where less weight and more room inside the enclosure may be beneficial.

Equipment Damage This adjustment should only be performed by an instrument service technician. ▲

1. Using a 5/32-inch Allen head wrench while gripping the 10-32 thumb nuts, remove the two (2) sets towards the left side of the illustration and refasten them in the holes on the outside of the fast loop support table (Figure 2–2). Repeat for set on right side of illustration.

2. Disconnect tubing fittings (Figure 2–3) using two (2) 9/16-inch open end wrenches.

3. Remove the two (2) remaining screw/thumbnut sets and set aside.

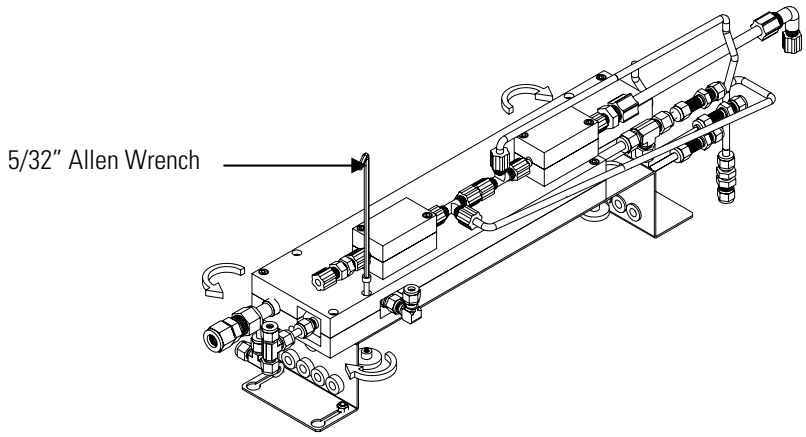


Figure 2–2. Thumbnut Removal

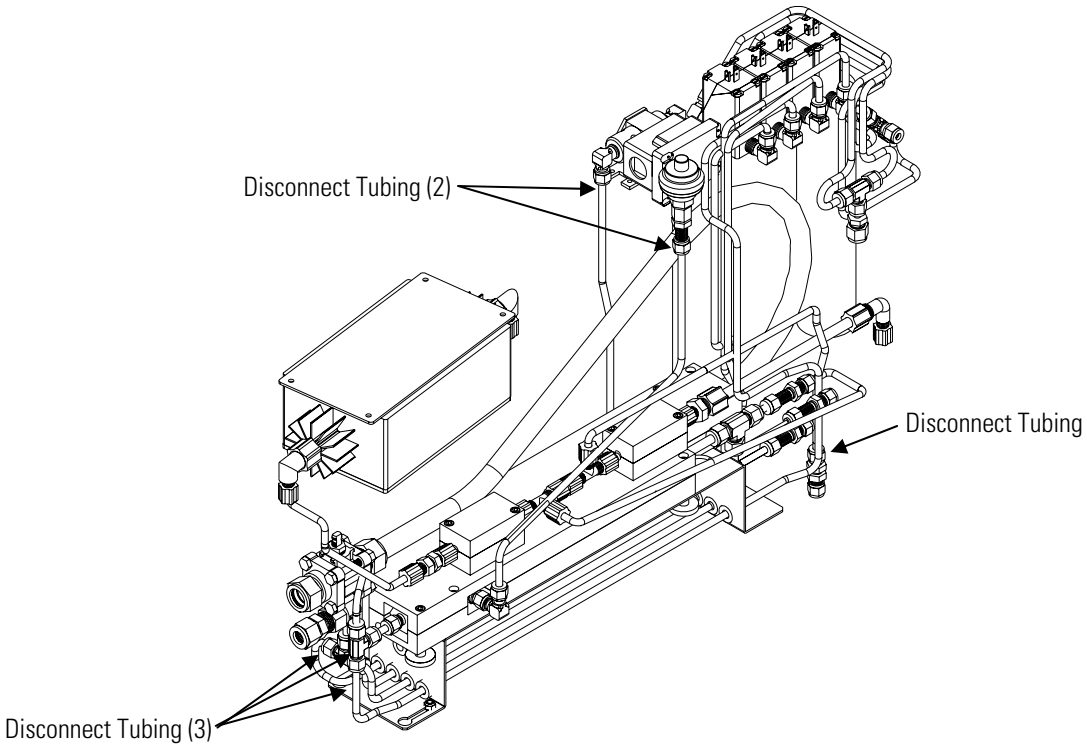


Figure 2–3. Fitting Removal

4. Remove valve cover (Figure 2–4).

5. Using a small slotted screwdriver, disconnect the wiring for the fire rod heaters terminals 11, 12, 13 (Figure 3-5), and the thermostat terminals 14 and 15. Refer to "Factory Wiring" on page 3-8.

6. Remove the fast loop assembly (Figure 2–5).

Refer to "Factory Plumbing" on page 3-4 when reattaching tubing.

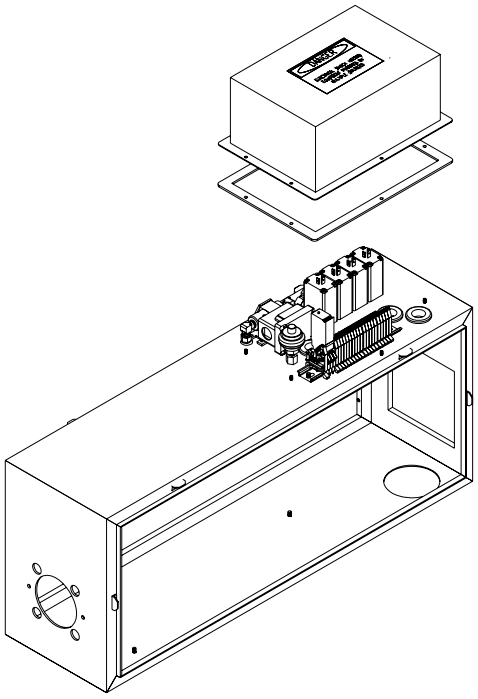


Figure 2–4. Valve Cover Removal

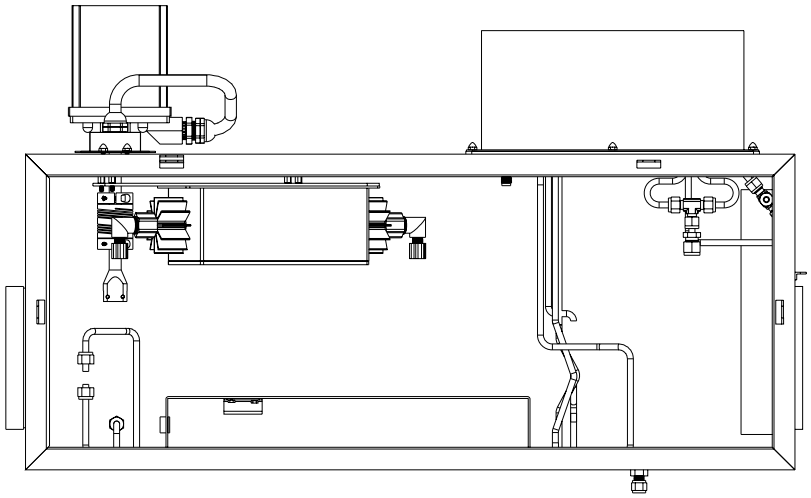


Figure 2–5. Fast Loop Assembly Removed

Stinger, Return Tube, and Stinger Heater Installation

This procedure sets the sample and return tube in their optimum position.

1. Loosen, but do not remove, the three (3) nylon insert nuts that secure the fast loop assembly table to the enclosure and slide table all the way towards the front.

2. On a bench or floor, taking care not to damage the atmospheric dump port (remove if necessary), line the mantel up with probe enclosure (Figure 2–6) with 3/4-inch fitting in 12 o'clock position.

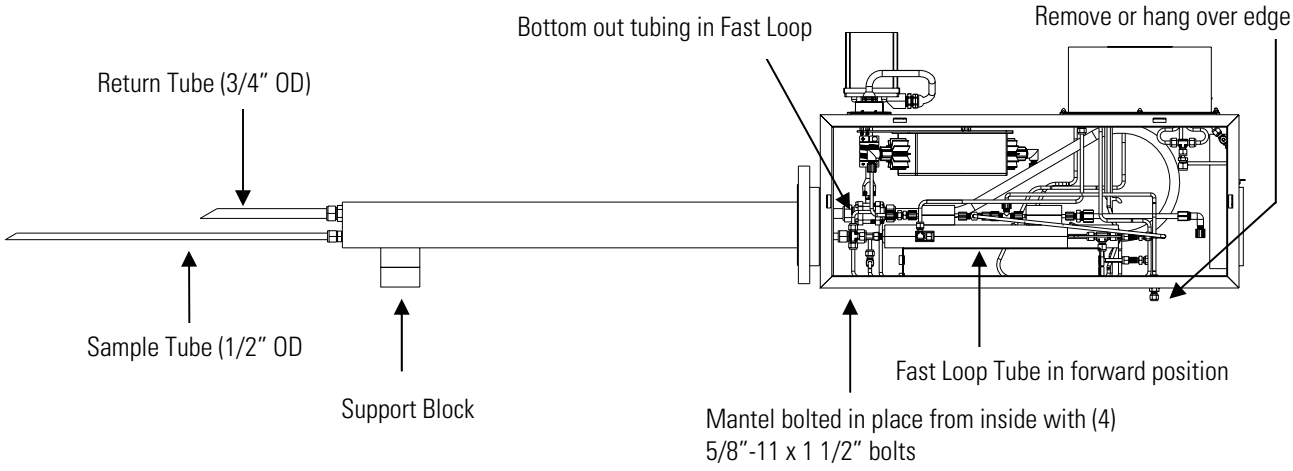


Figure 2–6. Stinger and Return Tube Adjustment

3. Bolt mantel in place with four (4) 5/8-inch-11 x 1 1/2-inch bolts and split lock washers.

4. Slide return tube and sample tube through mantel bottoming out in fast loop.

5. Compress fittings onto tubes at fast loop, keeping tubes in orientation.

6. Compress fittings at mantel end.

7. Loosen fast loop fitting and disassemble mantel from probe.

8. Stretch coiled heater out to 3 to 5 inches beyond length of mantel.

9. Using a clockwise twisting motion, screw stinger heater onto tube until bottoming out in mantel (Figure 2–7).

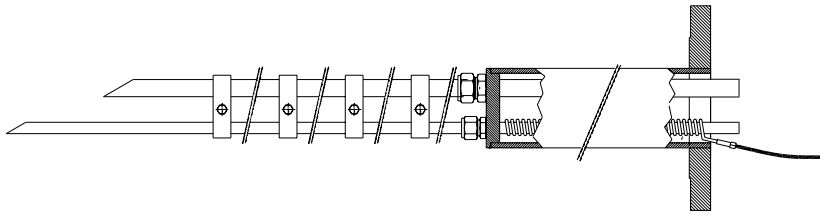


Figure 2–7. Stinger Heater Installation

Stinger Clamp Installation

Every 18-inches, add a stinger clamp (Figure 2–7).

Slurry Cup Installation

Use the following procedure to install the slurry cup (Figure 2–8).

1. Separate the slurry cup and stinger tube clamp by 1/2-inch and using a 9/64-inch Allen head wrench lock in place on tube.

2. Bottom out stinger tube in cup, draw a line at back side of tube clamp, and slide slurry cup assembly approximately 3/8-inch away from stinger tube. The line drawn will be the same distance away from the clamp as the stinger tube tip is from the inside wall of the slurry cup.

3. Using 9/64-inch Allen head wrench lock in place.

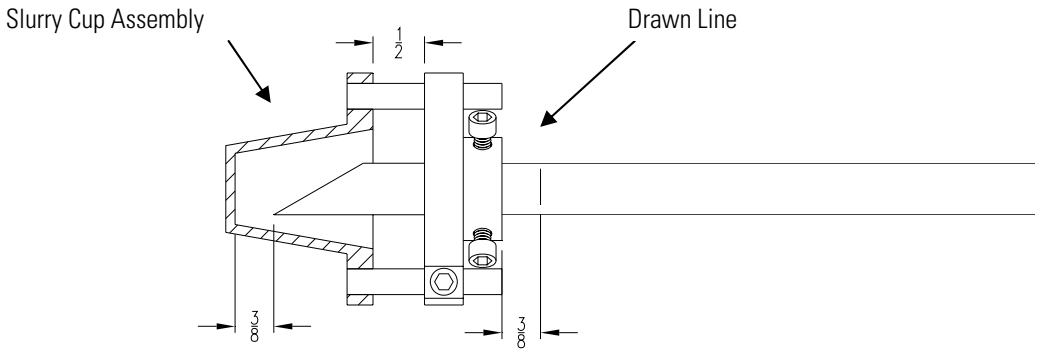


Figure 2–8. Slurry Cup Installation

Mounting the Mantel to Stack

Depending on work area, manpower, and other site specific criteria, you may opt to install the mantel and probe at once, or the mantel first, and then the probe.

Note The stack sample port must be installed on stack prior to mantel installation. Consult factory for further details. For more information, see "Service Locations" on page 3-22. ▲

Use the following procedure to mount the mantel to stack.

1. Align mantel thru holes (Figure 2–9) to stack sample port thru holes, so probe is in desired position. Refer to Figure 2–10 and install hardware in four places.

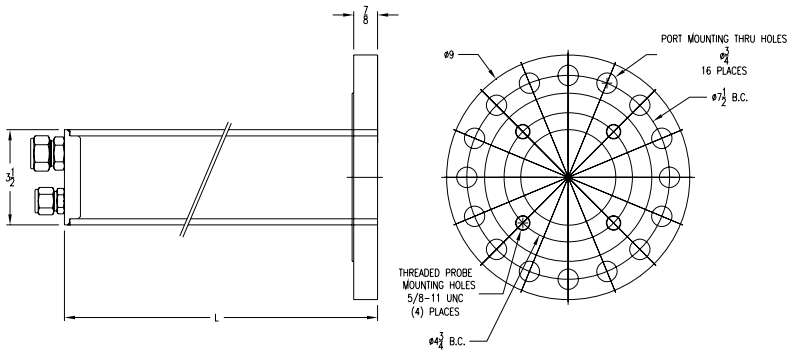


Figure 2–9. Mantel with Universal Mounting Flange

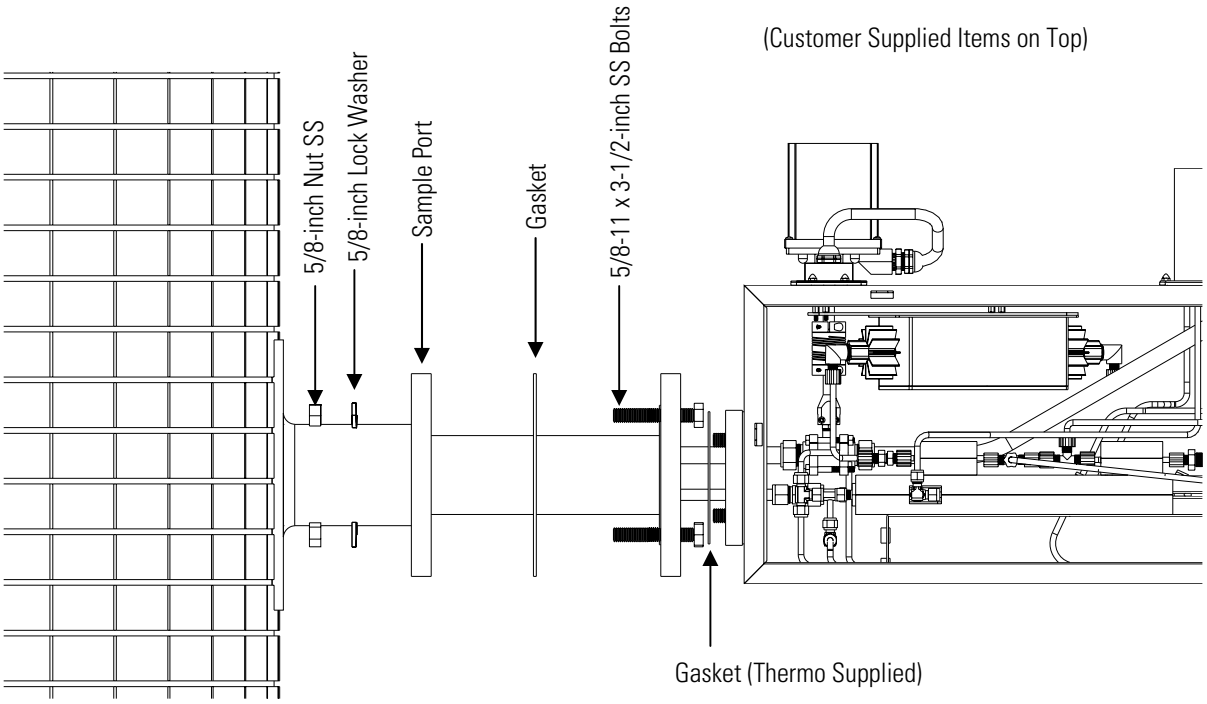


Figure 2–10. Mantel Mount

Umbilical Plumbing Hookup

Figure 2–11 shows the umbilical plumbing hookup.

After mounting probe and securing umbilical cord (hot line) in probe with 3-inch strain relief, make the above connections. Note line #4 is a spare.

Refer to Figure 2–12 and Figure 2–13 for umbilical wiring hookup.

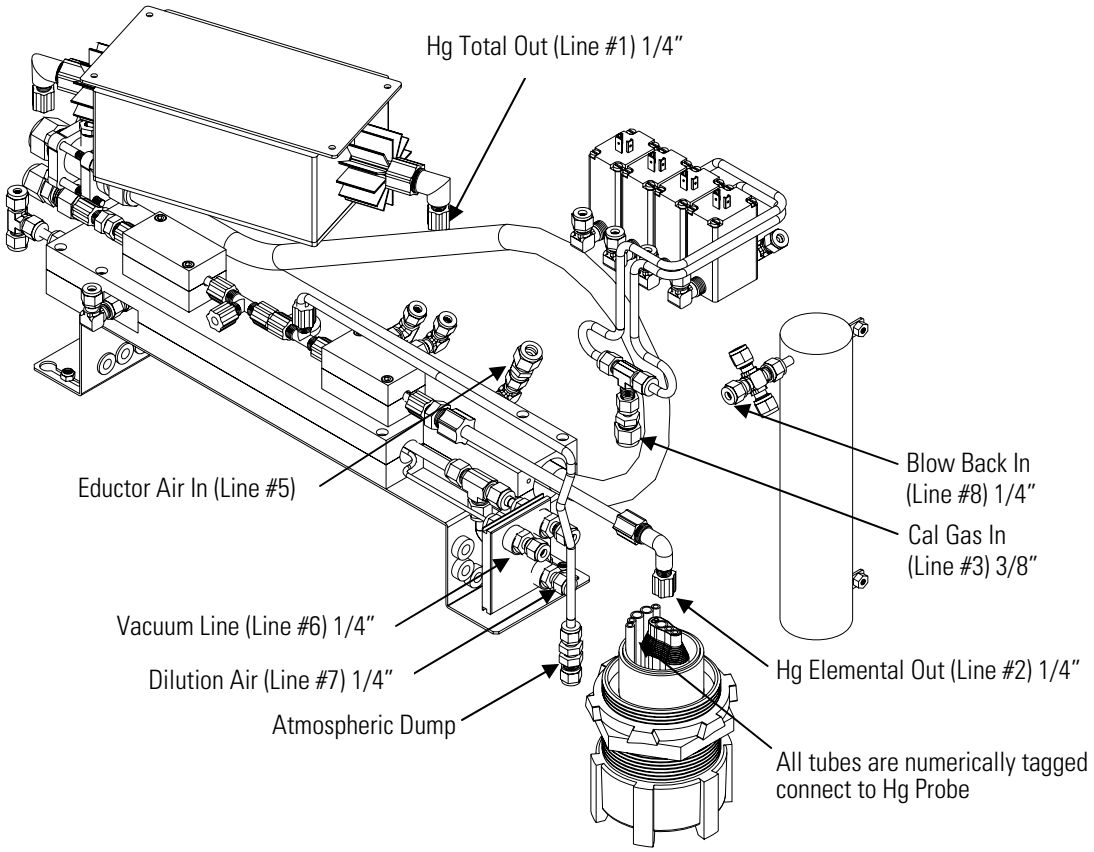


Figure 2–11. Umbilical Plumbing Hookup

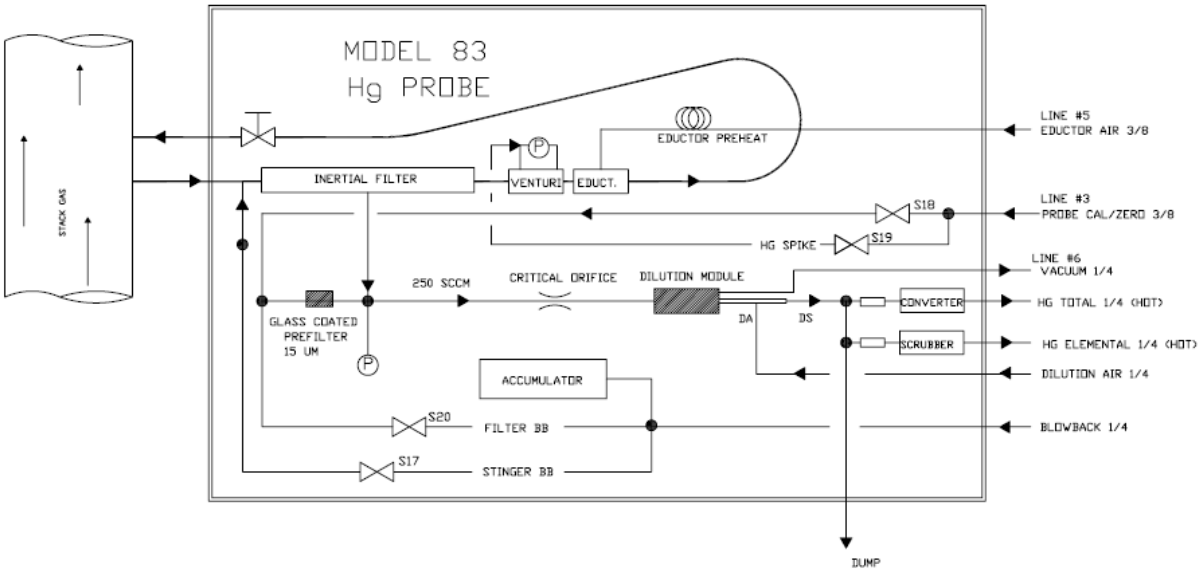
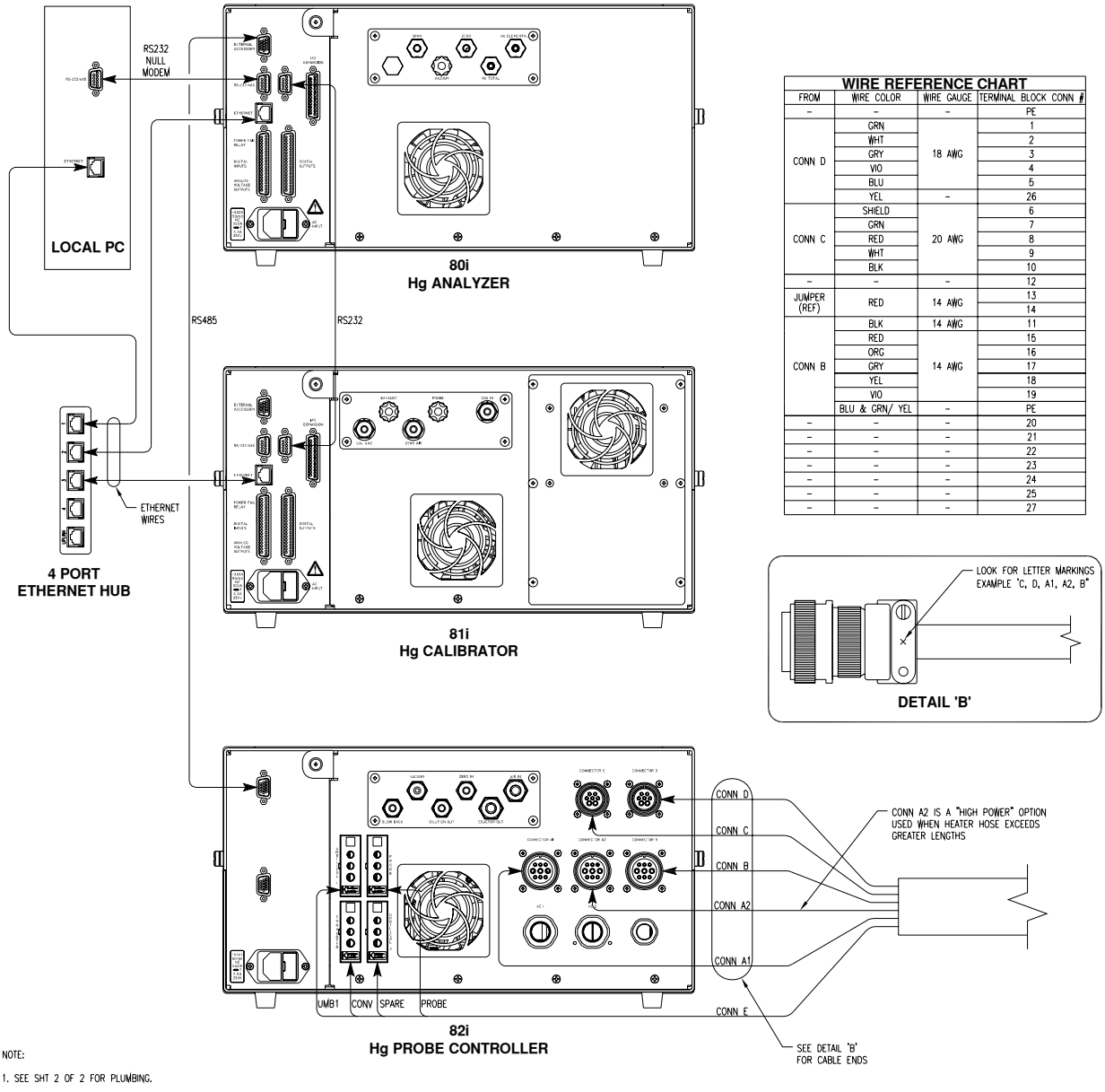


Figure 2–12. System Plumbing Diagram



WIRE REFERENCE CHART			
FROM	WIRE COLOR	WIRE GAUGE	TERMINAL BLOCK CONN #
–	–	–	PE
CONN D	GRN	18 AWG	1
	WHT		2
	GRY		3
	VIO		4
	BLU		5
	YEL	–	26
CONN C	SHIELD	20 AWG	6
	GRN		7
	RED		8
	WHT		9
	BLK		10
–	–	–	12
JUMPER (REF)	RED	14 AWG	13
			14
CONN B	BLK	14 AWG	11
	RED	14 AWG	15
	ORG		16
	GRY		17
	YEL		18
	VIO		19
	BLU & GRN/ YEL	–	PE
–	–	–	20
–	–	–	21
–	–	–	22
–	–	–	23
–	–	–	24
–	–	–	25
–	–	–	27

Figure 2–13. Field Wiring 1

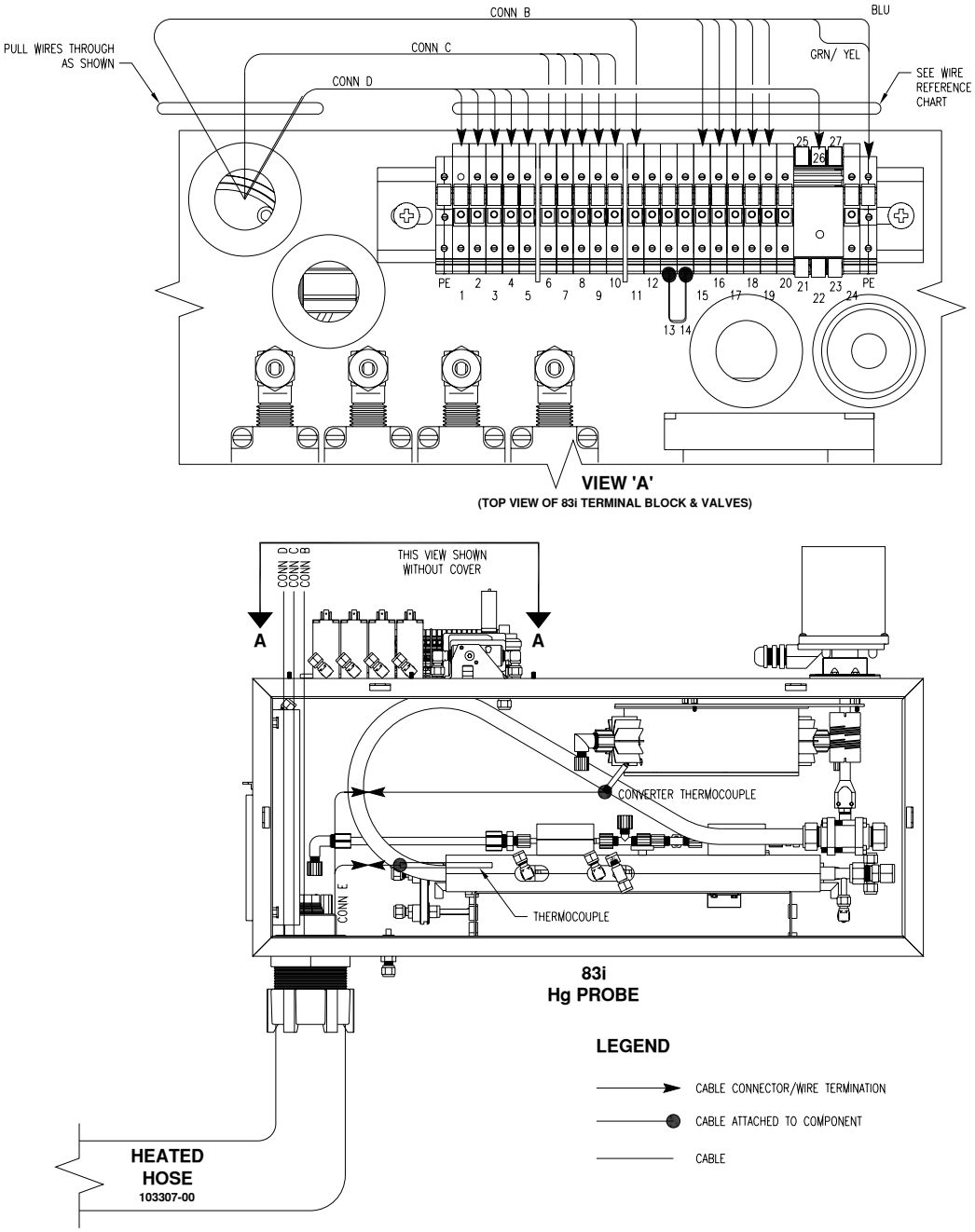


Figure 2–14. Field Wiring 2

Thermocouple Connections

Use the following procedure to connect the thermocouple (Figure 2–15). 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.

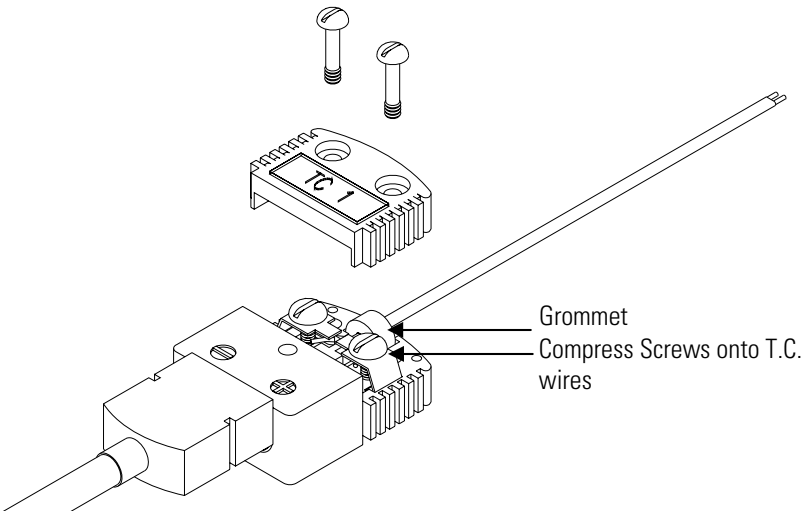


Figure 2–15. Thermocouple Connections

Chapter 3
Preventive Maintenance and Servicing

This chapter includes the following maintenance information and replacement procedures that should be performed on the Model 83*i* to ensure proper operation (or is an "expendable" item not covered under warranty). Expendable items are indicated by an asterisk (*) in the "Model 83*i* Replacement Parts" table. 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 83*i*.

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

Table 3–1. Model 83*i* Replacement Parts

Part Number	Description	Replacement Interval
102728-00	Ceramic Heater	As needed
102385-00	Core Assembly–Hg Converter	3–6 months
102624-00	Dilution Eductor	As needed
101074-00	Filter, 15 Micron	Annual
103555-00	Filter, Inertial (coated)	As needed or cleaned
103571-00	Fitting Adapter Assembly	As needed
101610-00	Gasket, Valve Cover*	As needed
101129-00	Grommet, 7/8-inch Silicone	As needed
102706-00	Hg Scrubber	3–6 months
103435-00	Orifice Pressure Transducer Assembly	As needed
102163-00	Orifice, Critical	As needed
2126.051	Orifice, Glass	As needed
103622-00	Preventive Maintenance Kit*	Annual
103556-00	Slurry Cup Assembly	As needed or cleaned
25505026	Strain Relief Assembly	As needed
102623-00	Sulfinert Cross	As needed
100429-00	Thermocouple Probe/Converter	Annual
103699-00	Valve Assembly	As needed
103434-00	Venturi Differential Pressure Transducer Assembly	As needed or cleaned
103570-00	Venturi Tube Assembly	As needed
100634-00	Graphite Ferrule, 1/2-inch*	When replacing stinger tube or as needed
100635-00	Graphite Ferrule, 3/4-inch*	When replacing return tube or as needed
103709-00	Stinger Clamp Assembly	As needed
103657-00	Stinger Heater, up to 3 feet	As needed

Part Number	Description	Replacement Interval
103658-XX	Stinger Heater, 3–6-feet	As needed
101605-00	Thermostat	As needed
102307-00	Fire Rod (Probe Heater)	As needed
101707-00	Probe Scrubber	As needed
102989-00	Critical Orifice Stainless, Coated	As needed
103212-00	Vacuum Transducer Assembly	As needed
104235-00	Fuse Kit	As needed
103699-00	Solenoid Valve Assembly	As needed

*Expendable item not covered by warranty.

Factory Plumbing

Table 3–1 lists the replacement tubing parts for the Model 83*i*. Refer to Figure 3–1 through Figure 3–4 to identify the component location. These figure illustrations and table allow for easy tube reattachment or replacement.

Replacement Tubing List

Table 3–1 lists the replacement tubing parts for the Model 83*i*. Refer to Figure 3–1 through Figure 3–4 to identify the component location.

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 3–1. Replacement Tubing

Number	Description	Tubing Length	Nut Fittings
1	Orifice to Converter	7″	(2) 1/4″ Teflon
2	Critical Orifice to Pressure Transducer	18″	(2) 1/4″ S.S.
3	Dilution Module to Orifice Tee	25″	1/4″ Teflon, 1/4″ Glass Coated S.S.
4	Orifice Tee to Atmospheric Dump	33″	1/4″ Teflon, 1/4″ S.S.
5	Hi pressure Side-Diffxducer to Eductor	16″	(2) 1/4″ S.S.
6	Lo pressure Side-Diffxducer to Eductor	19″	(2) 1/4″ S.S.
7	Tee to Hg Spike Valve	14″	(2) 1/4″ S.S.
8	Tee to Cal/Zero Valve	13″	(2) 1/4″ S.S.
9	Hg Spike Valve to Spike Port	42″	(2) 1/4″ S.S.

Number	Description	Tubing Length	Nut Fittings
10	Cal/Zero Valve to Calibration Port	45″	(2) 1/4″ S.S.
11	Filter BB Valve to Filter Port	52″	(2) 1/4″ S.S.
12	Stinger BB Valve to Singer Port	46″	(2) 1/4″ S.S.
13	Accumulator Tank to Filter BB Valve	16″	(2) 1/4″ S.S.
14	Accumulator Tank to Stinger BB Valve	16″	(2) 1/4″ S.S.

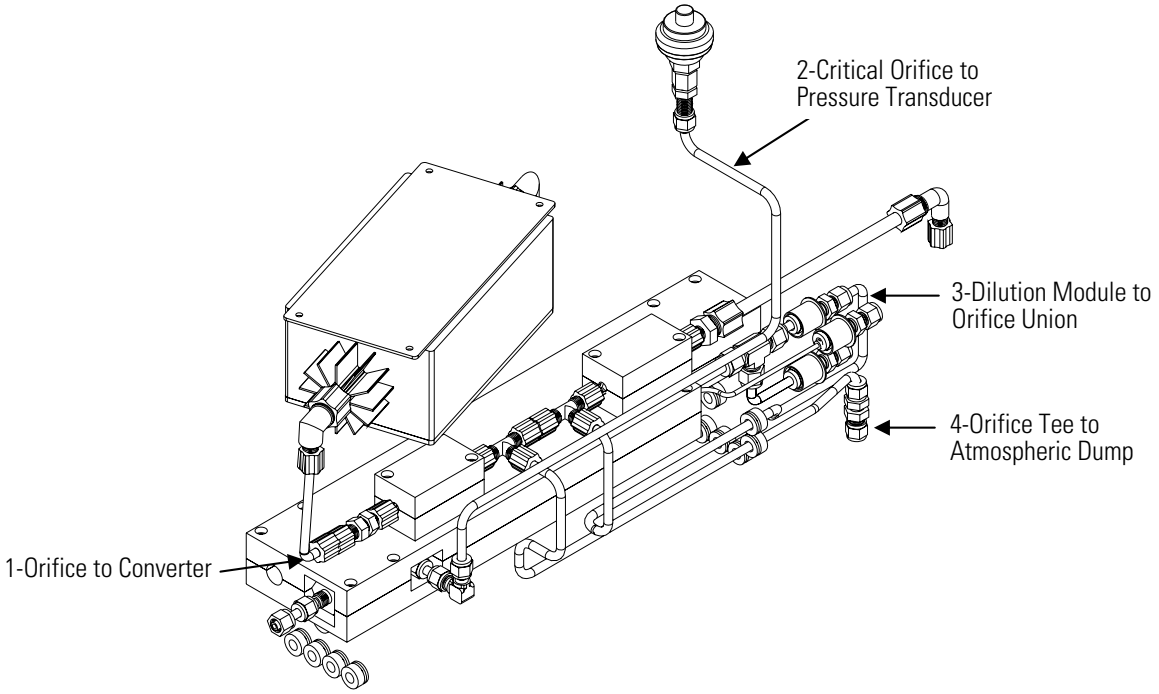


Figure 3–1. Plumbing Line Replacements

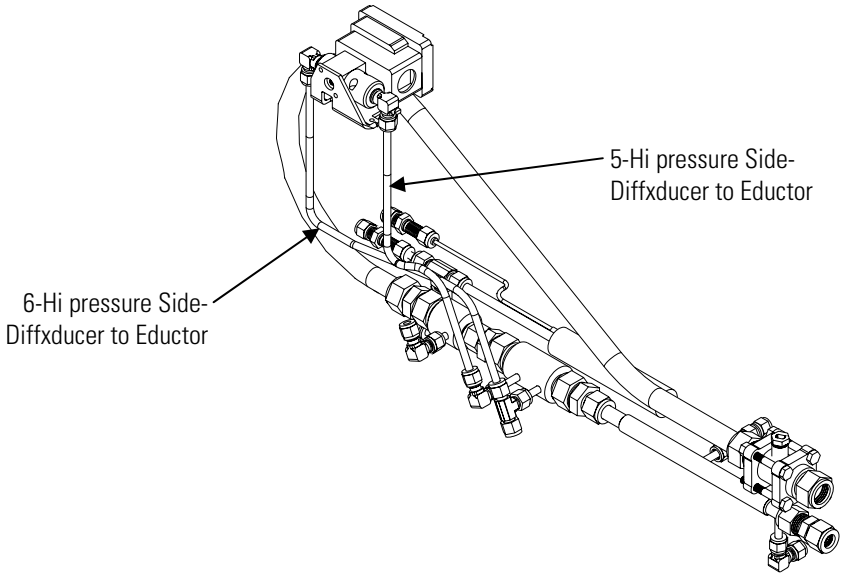


Figure 3–2. Eductor to Pressure Differential Transducer Plumbing

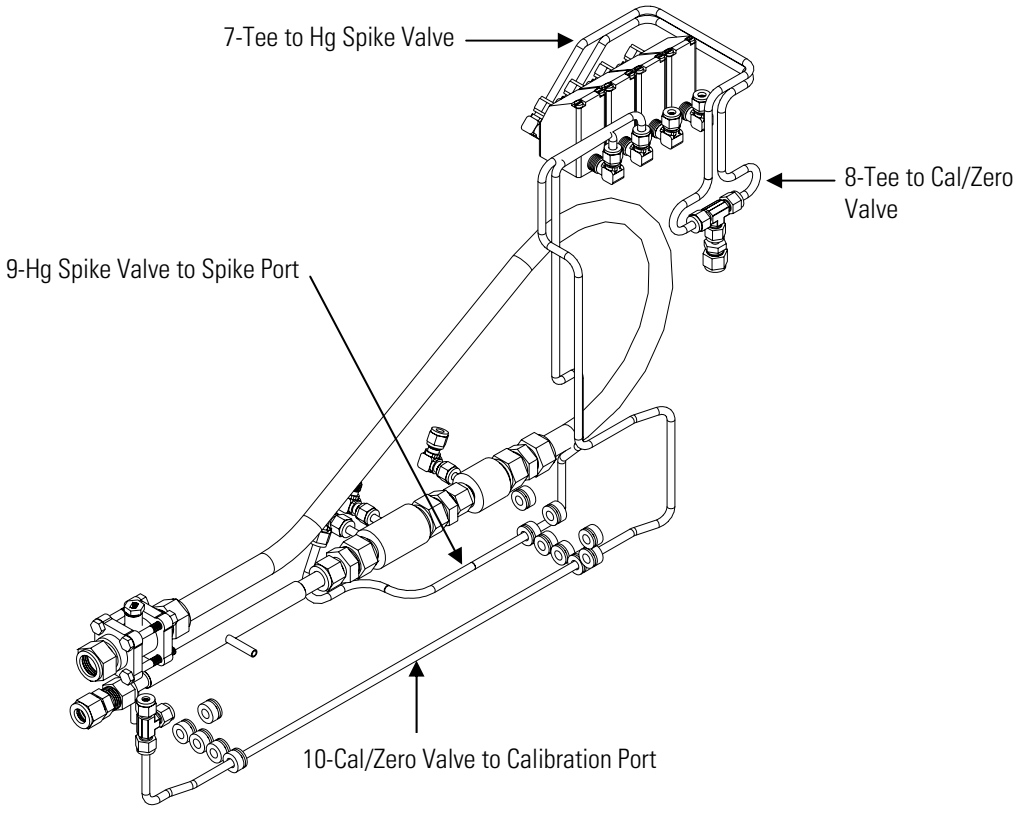


Figure 3–3. Cal/Zero Valve and Hg Spike Valve Plumbing

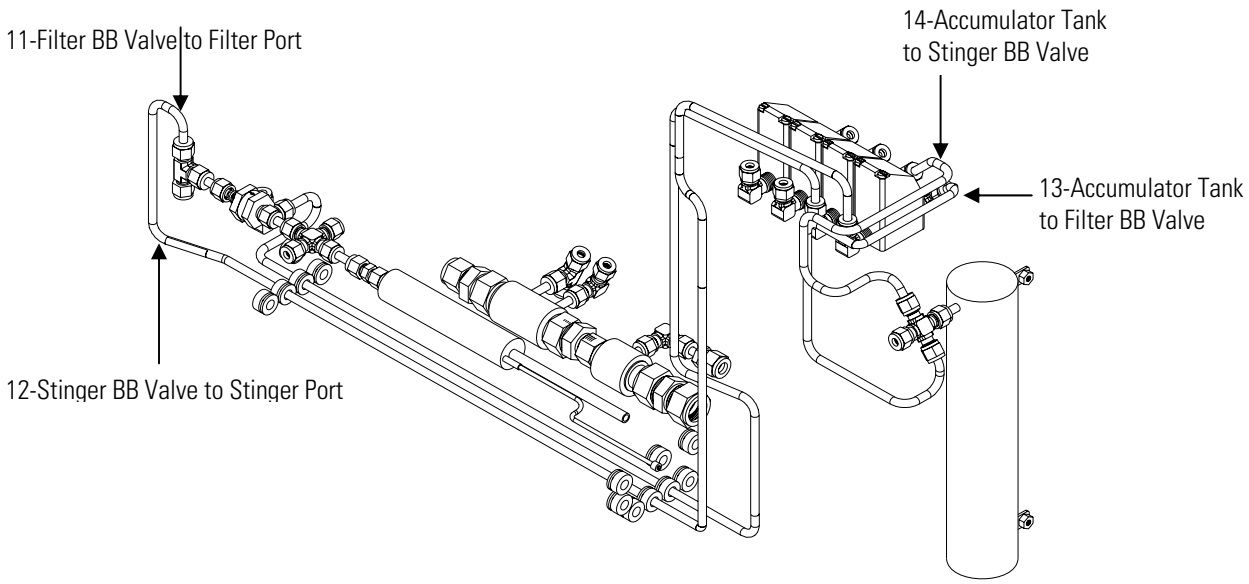


Figure 3–4. Filter Blow Back and Stinger Blow Back Valve Plumbing

Factory Wiring

Figure 3–5 and Figure 3–6 shows the factory wiring for the Model 83*i*.

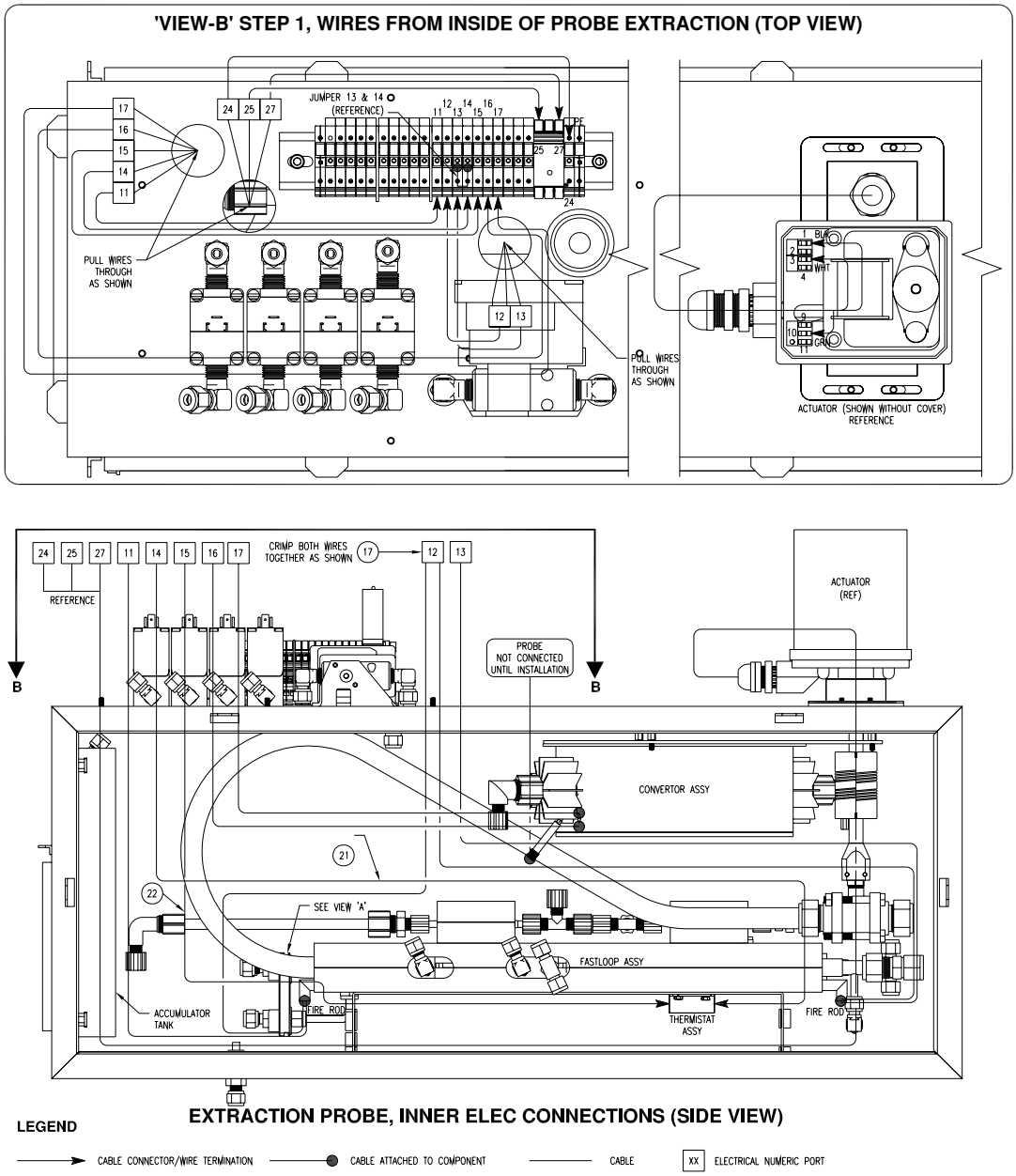
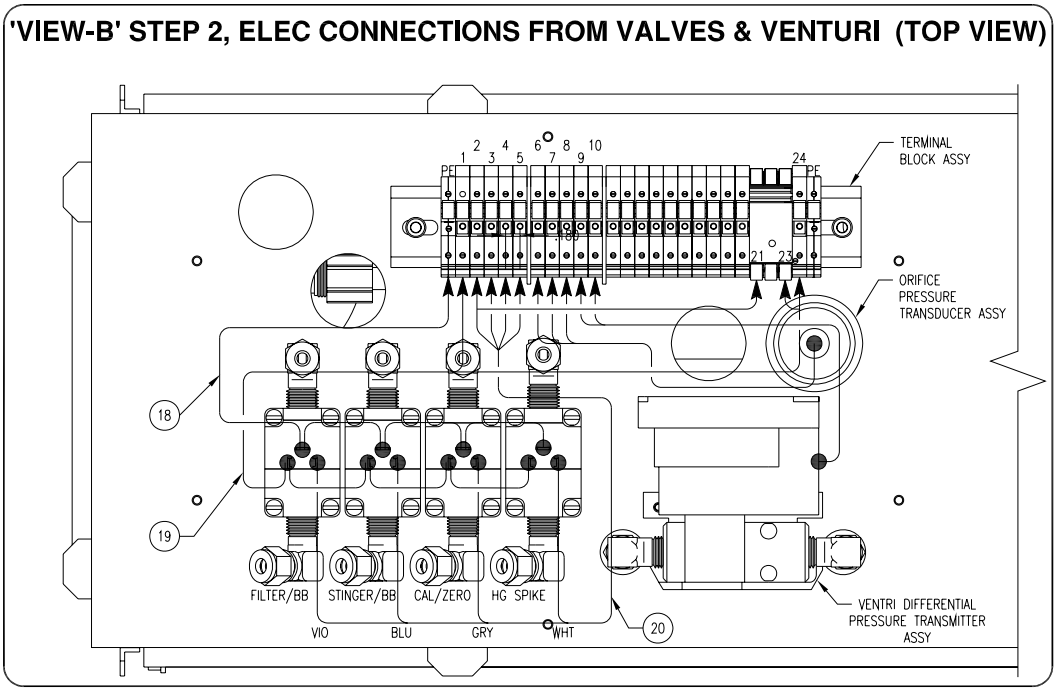


Figure 3–5. Factory Wiring 1



WIRE REFERENCE CHART

FROM	WIRE COLOR	WIRE GAUGE	TERMINAL BLOCK CONN #
VALVES	GRN/ YEL	18 AWG	PE
VALVES	GRN	18 AWG	1 & 24 & 23
Hg SPIKE, VALVE	WHT	18 AWG	2 & 21
CAL ZERO, VALVE	GRAY	18 AWG	3
STINGER/ BB, VALVE	BLU	18 AWG	4
FILTER/ BB, VALVE	VIO	18 AWG	5
ORFICE PRES TRANS	SHIELD	–	6
ORFICE PRES TRANS	BLK	20 AWG	7
ORFICE PRES TRANS	RED	20 AWG	8
VENTRI DIF PRESSURE	WHT	20 AWG	9
VENTRI DIF PRESSURE	BLK	20 AWG	10
FIRE ROD	ORG/ BRN	–	11
FIRE ROD/ FIRE ROD	ORG/ BRN	–	12
FIRE ROD	ORG/ BRN	–	13
THERMISTAT	RED	14 AWG	14
THERMISTAT	RED	14 AWG	15
CONVERTOR	TAN	–	16
CONVERTOR	TAN	–	17

TERMINAL BLOCKS 13 & 14 SHORTED TOGETHER VIA JUMPER

WIRE REFERENCE CHART

FROM	WIRE COLOR	WIRE GAUGE	TERMINAL BLOCK CONN #
ACTUATOR (REF)	GRN	–	24
ACTUATOR (REF)	BLK	–	25
ACTUATOR (REF)	WHT	–	27

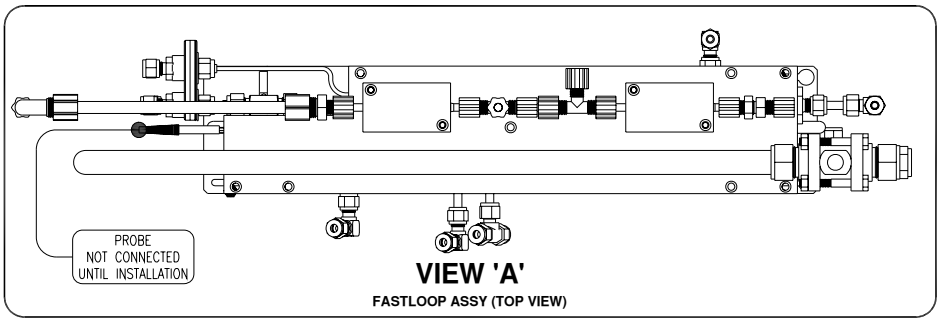


Figure 3–6. Factory Wiring 2

Hg Scrubber Replacement

Use the following procedure to replace the Hg scrubber (Figure 3–7).

Equipment Required:

Hg Scrubber

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

1. Disconnect Teflon® fittings at glass orifice and umbilical line. There is no need to remove block tops.

2. Replace scrubber and reassemble in reverse order.

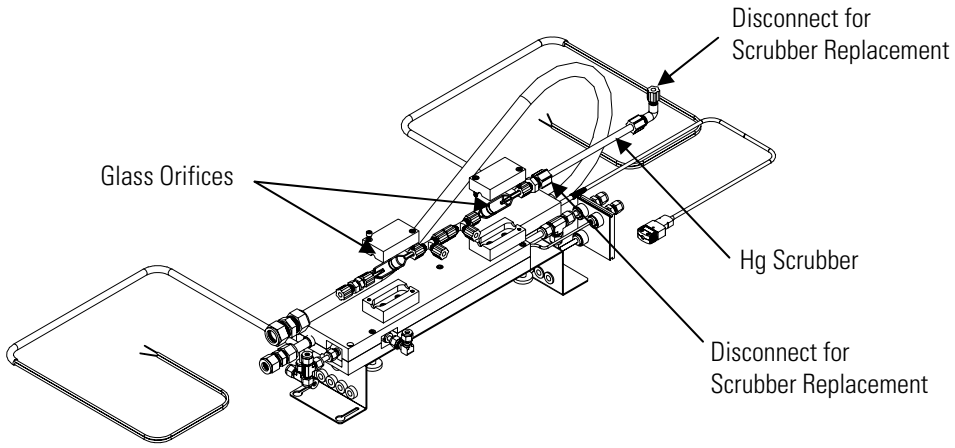


Figure 3–7. Hg Scrubber, Glass Orifice Replacement

Glass Orifice Replacement

Use the following procedure to replace either glass orifices (Figure 3–7).

Equipment Required:

Glass Orifice

Open-end wrenches, 5/8-inch and 15/16-inch

Allen wrench, 5/32-inch

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

1. Using a 5/32-inch Allen wrench, remove block tops and the two (2) cap head screws per block.

2. Gently lift orifices/fittings out of blocks and disconnect fittings.

3. Remove old orifice and replace with new one in the orientation shown and reassemble in reverse order.

Dilution Eductor Replacement

Use the following procedure to replace the dilution eductor (Figure 3–8).

Equipment Required:

Dilution Eductor

Open-end wrenches, 1/2-inch and 9/16-inch

Allen wrench, 5/32-inch

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

1. Disconnect associated plumbing.

2. Remove five (5) sets of 10-32 cap screws/thumbnuts.

3. Remove fast loop top block with or without orifice locks attached.

4. Loosen three (3) fast loop table nylon insert nuts and slide table back.

5. Using a 1/2-inch and 9/16-inch open-end wrench, disconnect the dilution eductor.

6. Replace the dilution eductor and reassemble in reverse order.

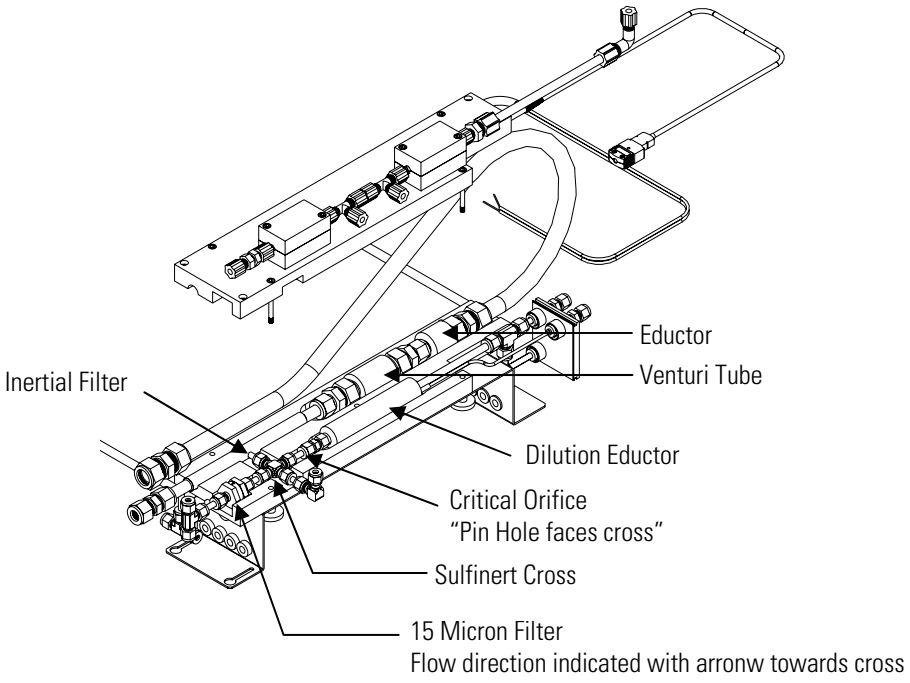


Figure 3–8. Fast Loop Assembly Replacements

Note When replacing parts, use appropriate open-end wrenches and make orientation of part. ▲

Inertial Filter Replacement

Use the following procedure to replace the inertial filter (Figure 3–8). Replace only after the probe has cooled, or use heat resistant gloves.

Equipment Required:

Inertial filter

Open-end wrenches, 1-1/8-inch, 1-1/16-inch, 7/8-inch, and 9/16-inch

Allen wrench, 5/32-inch

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

1. Using a 1-1/8-inch and 1-1/16-inch open-end wrench, disconnect return tube.

2. Using a 1-16-inch and 7/8-inch open-end wrench, disconnect stinger tube.

3. Remove 5 sets of 10-32 cap screws/thumbnuts.

4. Remove fast loop top block with or without orifice blocks attached.

5. Loosen three (3) fast loop table nylon insert nuts and slide table back.

6. Using a 1-1/16-inch, 7/8-inch, and 9/16-inch open-end wrench, replace the inertial filter and reassemble in reverse order.

Note Contaminated filters that are removed can be refurbished by Thermo Fisher Scientific. For more information, see "Service Locations" on page 3-22. ▲

Critical Orifice Replacement

Use the following procedure to replace the critical orifice (Figure 3–8).

Equipment Required:

Critical orifice

Open-end wrenches, 1-1/8-inch, 1-1/16-inch, 7/8-inch, and 9/16-inch

Allen wrench, 5/32-inch

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

1. Using a 1-1/8-inch and 1-1/16-inch open-end wrench, disconnect return tube.

2. Using a 1-16-inch and 7/8-inch open-end wrench, disconnect stinger tube.

3. Remove 5 sets of 10-32 cap screws/thumbnuts.

4. Remove fast loop top block with or without orifice blocks attached.

5. Loosen three (3) fast loop table nylon insert nuts and slide table back.

Sulfinert Cross Replacement

Use the following procedure to replace the sulfinert cross (Figure 3–8).

Equipment Required:

Sulfinert cross

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

1. Disconnect associated plumbing.
2. Remove 5 sets of 10-32 cap screws/thumbnuts.
3. Remove fast loop top block with or without orifice locks attached.
4. Loosen three (3) fast loop table nylon insert nuts and slide table back.
5. Replace the sulfinert cross and reassemble in reverse order.

15 Micron Filter Replacement

Use the following procedure to replace the 15 micron filter (Figure 3–8).

Equipment Required:

15 Micron filter

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

1. Disconnect associated plumbing.
2. Remove 5 sets of 10-32 cap screws/thumbnuts.
3. Remove fast loop top block with or without orifice locks attached.
4. Loosen three (3) fast loop table nylon insert nuts and slide table back.
5. Replace the 15 micron filter seated flat with the arrow on top pointing at the cross union and assemble in reverse.

Thermocouple Replacement

Use the following procedure to replace the Thermocouple (Figure 3–9).

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.

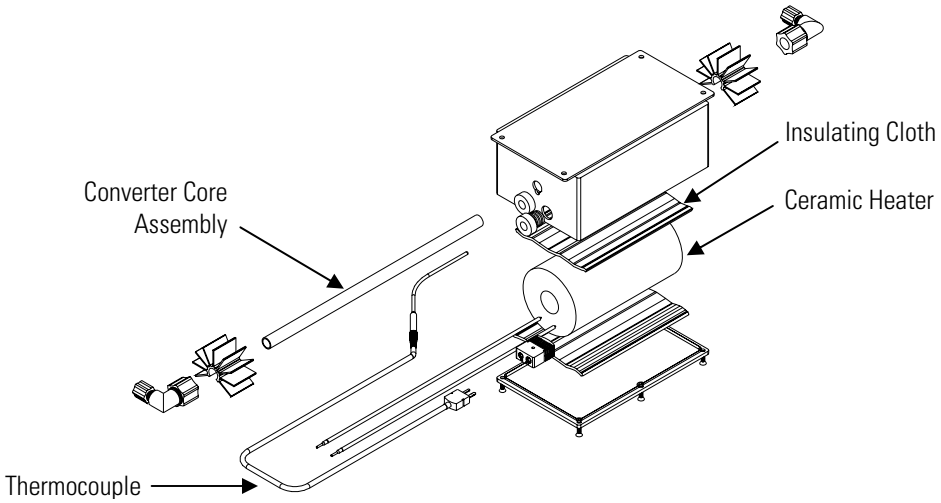


Figure 3–9. Converter Assembly Replacements

Converter Core Assembly Replacement

Use the following procedure to replace the converter core assembly (Figure 3–9).

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 reassembly in reverse.

Converter Heater Replacement

Use the following procedure to replace the heater (Figure 3–9).

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 "Factory Wiring" on page 3-8.

5. Using an 11/32-inch nut driver, remove four (4) nuts mounting the converter assembly to the top of the probe.

6. Using a Phillips head screwdriver, remove six (6) screws holding converter in place.

7. Install new heater and reassemble in reverse order.

Valve Cover Gasket/Grommet Replacement

Use the following procedure to replace the valve cover gasket or grommet (Figure 3–10).

Equipment Required:

Valve cover gasket

Grommets, 7/8-inch silicone

Extra long nut driver, 5/16-inch

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

1. Using a 5/16-inch extra long nut driver, remove six (6) acorn nuts. The cover is a convenient place to keep parts while working on the probe.

2. Replace gasket and/or grommets and reinstall valve cover.

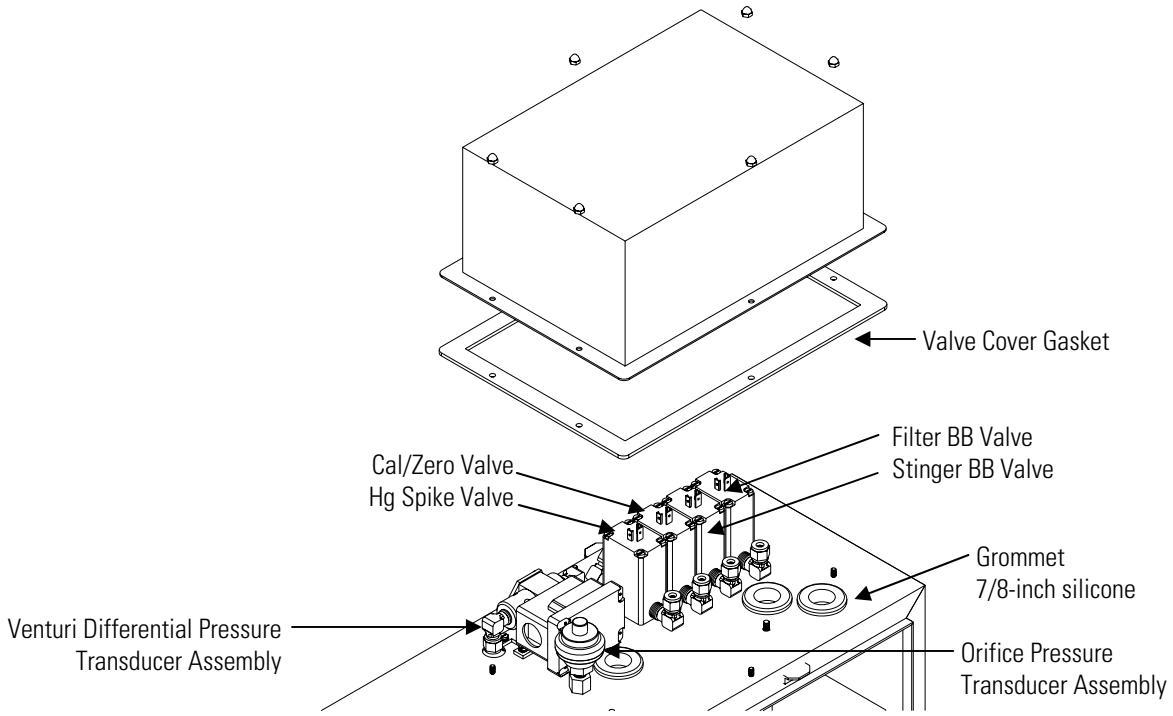


Figure 3–10. Valve Assembly, Orifice Replacement

Valve Assembly Replacement

Use the following procedure to replace the valve assembly (Figure 3–10).

Equipment Required:

Valve assembly

Extra long nut driver, 5/16-inch

Medium slotted screwdriver

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

1. Using a 5/16-inch extra long nut driver, remove six (6) acorn nuts. The cover is a convenient place to keep parts while working on the probe.

2. Identify which valve is to be replaced (labels on probe).

3. Unplug flag-lugs on top of valve. Refer to Figure 3–5 on page 3-8.

4. Using a medium size slotted screwdriver, remove four (4) M4x10 metric screws and lock washers from inside the probe.

5. Replace valve in same orientation and reassemble in reverse order.

Orifice Pressure Transducer Assembly Replacement

Use the following procedure to replace the orifice pressure transducer assembly (Figure 3–10).

Equipment Required:

Orifice pressure transducer assembly

Extra long nut driver, 5/16-inch

Open-end wrenches, 5/8-inch and 3/4-inch

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

1. Using a 5/16-inch extra long nut driver, remove six (6) acorn nuts. The cover is a convenient place to keep parts while working on the probe.

2. Disconnect wiring in upper assembly. Refer to “Factory Wiring” on page 3-8.

3. Using a 5/8-inch and 3/4-inch open end wrench, remove orifice pressure transducer assembly.

4. Replace transducer assembly and reassemble in reverse order.

Venturi Pressure Differential Transducer Assembly Replacement

Use the following procedure to replace the venture pressure differential transducer assembly (Figure 3–10).

Equipment Required:

Venturi pressure differential transducer assembly

Extra long nut driver, 5/16-inch

Nut drive, 1/4-inch

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

1. Using a 5/16-inch extra long nut driver, remove six (6) acorn nuts. The cover is a convenient place to keep parts while working on the probe.

2. Disconnect tubing and wiring. Refer to "Factory Plumbing" on page 3-4 and "Factory Wiring" on page 3-8.

3. Using a 1/4-inch nut driver, remove the two (2) mounting screws holding the transducer to it bracket.

4. Replace transducer assembly and reassemble in reverse order.

Fast Loop Assembly Replacement

Refer to "Fast Loop Assembly Removal" in chapter 2, "Installation".

Note The Fast Loop Assembly should be sent in for periodic cleaning. For additional service assistance, see "Service Locations" on page 3-22 at the end of this chapter. ▲

Stinger Heater Replacement

Use the following procedure to replace the stinger heater.

Equipment Required:

Stinger heater

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

1. Snip any wire clamps holding heater cables in place. Disconnect wiring from terminal block.

2. Remove fast loop assembly by loosening nuts and graphite ferrules.

3. Remove small access door in back.

4. Pull off heater with a counter clockwise twist.

5. Install new heater and reassemble in reverse order.

Stinger Graphite Ferrules Replacement

Use the following procedure to replace the stinger graphite ferrules.

Equipment Required:

Stinger graphite ferrules

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

1. Loosen stinger or ball valve nut on stack side of probe.
2. Loosen three nuts securing fast loop table assembly to floor.
3. Slide fast loop table to full rear position.
4. Replace ferrules and reassembly in reverse.

Stinger Clamp Replacement

Refer to Figure 2–7 on page 2-6 to replace the stinger clamp. This is only necessary for lengths of 2 feet or more past the mantle exit.

Eductor Replacement

Refer to Figure 3–8 on page 3-12 to replace the eductor.

Venturi Tube Replacement

Refer to Figure 3–8 on page 3-12 to replace the venturi tube assembly.

Leak Testing Fast Loop

Use the following procedure to perform a leak test.

Equipment Required:

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

Teflon caps, 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. Cap the following plumbing connections within the 83*i* Extraction Probe:
   - 1/2-inch Inlet Union (SS)
   - 3/4-inch Outlet Union (SS)
   - 1/4-inch Atmospheric Dump (Teflon)
   - 1/4-inch Dilution Air Inlet (Dilution Module)
   - 1/4-inch Converter Outlet (Teflon)
   - 1/4-inch Scrubber Outlet (Teflon)

2. Connect a vacuum gauge to the 1/4-inch vacuum port located on the dilution module.

3. Connect a Welch pump (Model 2561 or equivalent) to the 3/8-inch eductor port. Insert a 1/4-inch ball valve between the pump inlet and the eductor port. Place the valve in the OPEN position and turn the pump ON. The pump will evacuate the volume within the fast loop, converter, Hg scrubber, and dilution module.

4. Allow the pump to run for approximately 10 minutes, at which time the vacuum gauge should read approximately 28–30 inches of mercury. Close the ball valve and turn the pump OFF. If there are any leaks, the vacuum should decrease toward zero (ambient), not to exceed .25 in/Hg within a five-minute period.

5. If the probe passes, return 83*i* to operational configuration. If the probe doesn't pass, troubleshoot as required to locate the leak.

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 83*i* describes the function of the system components and provides a typical system plumbing hookup per the following:

The Model 83*i* Extraction Probe was designed for use in the Thermo Freedom continuous emissions monitoring system. The probe weighs approximately ninety-five pounds and consists of a 2-inch mounting flange, 2 side access panels, a rear access panel, an isolated electrical compartment and the main compartment.

The electrical compartment houses an Hg spike valve, filter blow back valve, stinger blow back valve, Cal/zero valve, a Venturi tube differential pressure transducer, a pressure transducer for the critical orifice, a relay for the ball valve actuator, and a Phoenix™ DIN-rail block for all electrical connections.

The main compartment consists of a “fast loop” assembly, converter assembly, a flood valve system, and a 3-inch strain relief for the umbilical cord.

The fast loop assembly consists of an inertial filter, particulate filter, critical orifice, main eductor assembly, dilution eductor assembly, venturi tube assembly, and a pressure tap, all of which are entombed in a heated aluminum block. Attached to the top of the heated block are two additional blocks each containing a glass orifice one for the total Hg line and the other for the elemental Hg line. There is a double tee Teflon union between the two orifices. One tee is vented to the atmosphere and the other is attached to the diluted sample line of the dilution eductor.

The flood valve system consists of a ball valve, an actuator and flex couplings.

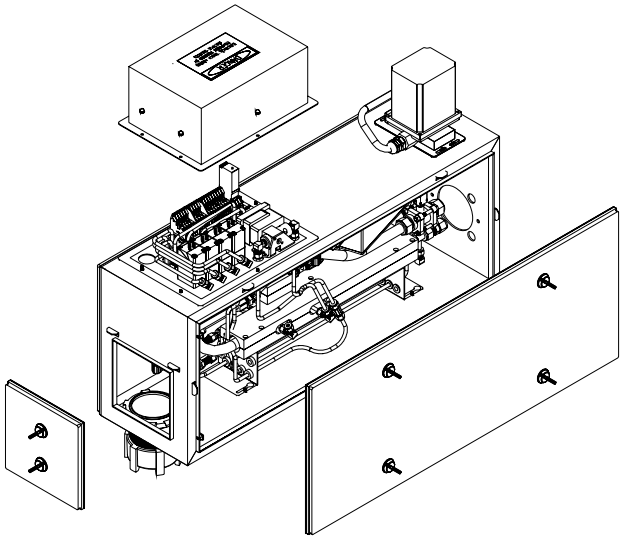


Figure 4–1. Model 83*i* System Description

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.

Scrubber Assembly

The scrubber assembly absorbs any of the salts or oxides of mercury. This gives you just the elemental mercury of the sample. The fact that there is the ability to distinguish between the two, allows speciation of the sample content.

Fast Loop Assembly

The fast loop assembly maintains a constant purge of the sample from and back to the stack. It has a high flow in comparison to the sample inlet flow.

Orifice Block

The orifice block, 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.

Venturi Tube Assembly

The venturi tube assembly provides a pressure differential that is measured by a pressure transducer to determine dilution ratio.

Critical Orifice

The critical orifice provides a constant flow being pulled by the dilution module.

Pre-Filter

The pre-filter eliminates any particles larger than 15 um to get into the sample system.

Transducers

There are two 4-20 mA pressure transducers: one measures the venturi pressure, and the other measures the orifice pressure.

Inertial Filter

The basic unit of the inertial filter is a filter assembly with a porous filter element that can be cleaned in situ by simple blow back. This filter element is a sulfinert coated 316L stainless steel 10-inch long 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.

Accumulator Tank

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

Valves

There are four valves: calibration, spike, filter blow back, and stinger blow back.

Critical Orifices

The critical orifices maintain a balance of flow between the elemental and total channels.

Stinger/Heater Assembly

The heater is mounted around the portion of the stinger that is located in the mantle assembly. The mantle assembly is mounted to the probe box and passes through the stack outer wall to the inner wall. The stinger extends to at least three feet into the inner stack.

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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