PRO3000

Instruction Manual
Full Extractive Probe Assembly
Part Number 111983-00
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Thermo SCIENTIFIC

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A. The Thermo Fisher Scientific (TFS) PRO3000 is shipped ready for operation. Immediate inspection of the TFS PRO3000 should follow upon receipt. Inventory of the container should be checked against the enclosed packing list. If there is a shortage of items, the operator should immediately contact TFS. If the contents are damaged, the carrier and TFS should be notified immediately.

B. The following documents are necessary to support claims:

1. Original freight bill and bill of lading.

2. Original invoice or photocopy of original invoice.

3. Copy of the packing list.

4. Photographs of damaged equipment and container.

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REVISION HISTORY			
Revision No.	Revision	Pages Affected	Revision Date
0	First issue	All	May 30, 2008
1	Added heated probe barrel information	All	Sept 8, 2008

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1.0 PRODUCT DESCRIPTION

1.1 Introduction

The installation and operation manual provides instruction for basic installation, preventive maintenance, corrective maintenance, and trouble shooting procedures for the PRO3000 full extractive probe assembly that was developed to provide a lower cost, more reliable alternative to existing sampling systems. This manual contains four sections:

Section 1 -Product Description: Hardware description, instrument operating parameters, and physical characteristics.

Section 2 -Theory of Operation: Complete functional description.

Section 3 -Installation and Operation: Instructions for installation and operation of the probe assembly.

Section 4 -Maintenance: Routine inspection, trouble shooting, corrective procedures, and repair/replacement for major assemblies.

1.2 Probe Assembly Hardware

The PRO3000 probe assembly consists of an enclosure containing a probe barrel (optional heated probe barrel), a heated filter assembly, purge/calibration gas valves and temperature controlling electronics (see Figure 1.2-1). The PRO3000 is attached to the stack by a four-inch pipe flange, or may be fitted with a 2.5, 3 or 6-inch flange to suit existing sampling ports. The probe barrel is inserted into the stack through an opening in the back of the assembly enclosure.

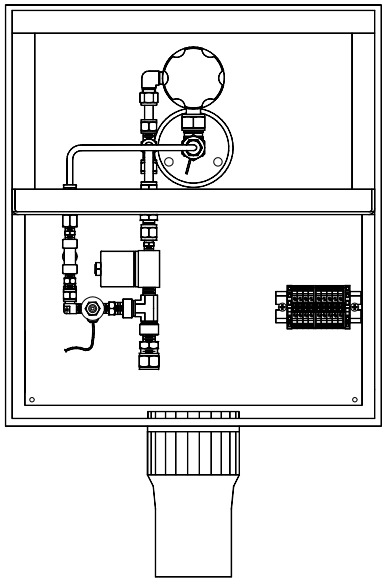

Figure 1.2-1 PRO3000 Probe Box

The probe assembly consists of a stainless steel probe barrel and a heated filter assembly shown in Figure 1.2-2. A heated, high capacity, sub-micron filter is housed in a stainless steel filter body that is located within the heated filter assembly, and can be easily replaced during preventive maintenance. The sampling probe barrel is typically a section of heavy wall tubing with an outer diameter of 5/8 inches and an inner diameter of .425 inches. Material for the probe barrel is selected for compatibility with the process stream and is most frequently supplied in 316 stainless steel.

The sample probe is housed in a fiberglass enclosure that measures approximately 20 inches (H) by 20 inches (W) by 10 inches (D). The enclosure is designed to protect instruments and electrical controls from highly corrosive atmospheres. Enclosure material other than the standard fiberglass may be selected to suit special ambient conditions at the sampling point.

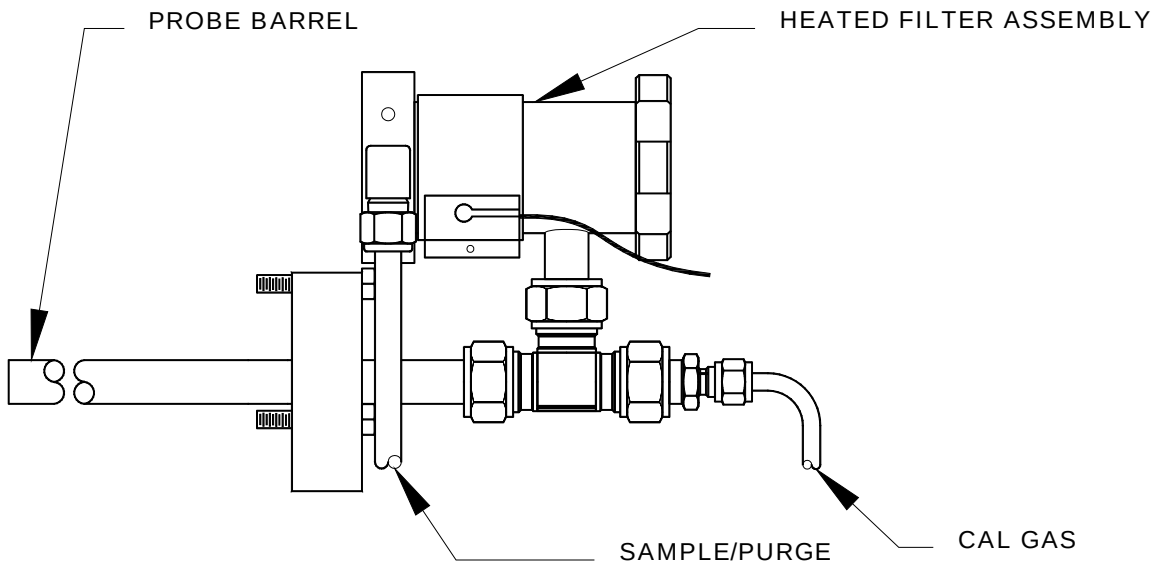

Figure 1.2-2 PRO3000 Heated Probe Assembly

1.3 Specifications

The PRO3000 probe assembly was designed to operate within the following specifications.

Power Requirements:	120 VAC, 300 Watts (1300 Watts if equipped with heated probe barrel)
Power Connection:	CSA/UL Approved screw terminal. Terminal wire capacity up to 10 AWG.
Ambient Operating Temperature Range:	-25° C (-13° F) to 50° C (122° F)
Maximum Process Temperature:	600° C (1112° F)
Calibration Gas Flow Rate:	5.0 L/min minimum
Instrument Air Supply:	60 PSIG minimum 80 PSIG maximum via 1/2 inch tubing - 0.300 inch I.D. min.
Heated Filter Assembly Temperature:	300° F ± 5° F
Heated Probe Barrel Assembly Temperature:	300° F ± 5° F
Materials of Construction:	
Enclosure:	Fiberglass Stainless Steel (optional)
Mounting Flange:	Stainless Steel, 4 inch standard pipe Optional: 2.5 to 6 inch
Heated Filter Body:	316 Stainless Steel
Probe Barrel:	316 Stainless Steel Hastelloy C-276 (optional)
Connecting Lines/ Sample Lines:	Teflon
Weight of Probe Assembly:	39 lbs. (17.7 kg) 52.5 lbs. (23.8 kg) with heated probe

2.0 THEORY OF OPERATION

2.1 General

The PRO3000 full extractive probe assembly is used to extract and condition a continuous sample from a stack or duct for transport to a gas analysis system.

2.2 Gas Flow Functional Description

Operation of the probe assembly consists of three modes: Sampling, Purge, and Calibration Modes.

2.2.1 Sampling Mode

Process gas enters the sampling system at the probe barrel tip. The process gas moves down the probe barrel at a flow rate of 2.5-5 L/min. From the sampling probe, the gas enters the probe enclosure and flows into the heated filter, shown in cross section in Figure 2.2.1-1.

The filter element is temperature controlled at 300° F ± 5° F by a band heater element and an external electronic temperature controller. The filter element is selected for its inertness to the process gas and is a borosilicate glass fiber element having collection efficiency rating of 0.1 micron. The filter element may be removed by removing the filter cap. A port is provided to introduce purge air and calibration gas. The heated filter body is fabricated from 316 stainless steel to minimize sample contamination due to unwanted reactions with the process gas.

After passing through the heated filter element, the filtered process gas flows through a heat traced umbilical which is maintained at 300°F ±5° F.

Process gas is pulled through the heated filter and the heated Teflon® sample line by a sample transport pump located in sample chiller assembly in the remote analysis system. From the sample line, the process gas flows through a sample chiller, an orifice protection filter, through a flow control orifice and then through the sample transport pump to the bypass vent. This bypass vent flow is used to establish a reasonable transport time (usually less than 20 seconds). The bypass flow can be used by other gas analyzers attached to the bypass vent. The flow control orifice is selected to obtain a desired flow rate to the remote analyzer. This sample is then drawn to a gas analyzer via an internal pump in order to generate an electrical signal proportional to the specific gas being analyzed. From the remote analyzer, the diluted process gas flows to a vent manifold.

2.2.2 Purge Mode

The probe is cleaned periodically by introducing high-pressure purge air from the purge air solenoid valve (SV1 & SV2) into the filter body and exiting into the process through the sample probe. The analysis system controller operates the purge solenoid valve automatically. A manual purge may be initiated from the controller at any time but the preferred method is to automatically energize the purge/cal gas solenoid valve. Purge frequencies may vary from every 15 minutes for applications with extremely heavy particulate concentrations to several hours for cleaner applications. The purge pulse lasts approximately 10 seconds. Longer purge times

could result in heated filter cooling.

2.2.3 Calibration Mode

The PRO3000 probe assembly is calibrated by passing a gas of known concentration through all the components in the sample analysis system and adjusting the response of the gas analysis system to equal the value of the known calibration gas. Calibrating in this manner allows for compensation of the total system for losses in filter elements or other pneumatic components, and in process gas flow rates. A typical calibration gas flow path is as follows:

From the calibration cylinder, the calibration gas flows from a flow controlling device and calibration gas valve located in the valve/ switch chassis, through the calibration gas line to the cal gas check valve and then to the cal gas inlet in the tee fitting which supports the heated filter assembly. The gas enters the filter body through the calibration gas inlet. The remote calibration gas solenoid valve allows the flow of calibration gas to be initiated remotely through a controller in the remote analysis system. From the inlet tee fitting, the calibration gas passes through all system components at the same flow rates and conditions as the process sample gas.

3.0 INSTALLATION AND OPERATION

3.1 Site Location and Preparation

The 40 CFR Performance Specification Two (2) provides a guide to proper site selection and lists several points that should be considered for most applications. The most accurate readings will usually be obtained when the guidelines of Performance Specification Two (2) are followed.

The PRO3000 extractive probe conditioning assembly is installed on a four (4) inch pipe flange. The pipe flange must be installed on a pipe nipple extending six (6) inches from the outer wall of the stack. The pipe nipple is used to allow clearance behind the conditioning assembly for installation of the four (4) 1/2-inch X 1 3/4-inch stainless steel mounting bolts. Also allow a clear space, at least the width of the probe enclosure, in front of the enclosure door to allow the door to be opened. The four (4) inch pipe flange must be aligned as shown in Figure 3.1-1. A slip-type pipe flange is recommended to insure that the conditioning assembly can be leveled.

The extractive probe assembly should be installed in a location that will allow maintenance personnel access to the front of the enclosure. All maintenance can be performed from the front of the unit.

3.2 Limitations at the Probe Site

The placement of the PRO3000 probe assembly is important to achieve its maximum reliability.

3.2.1 Stack Temperature Extremes

The PRO3000 probe barrel may be supplied using several different materials. Specific limitations for each probe barrel type must be considered separately.

A) 316 stainless steel probe barrel

A 316 stainless steel probe barrel is used at temperatures up to 1200° F with lengths up to six (6) feet. Additional lengths can be use with the optional probe barrel support.

B) Hastelloy C-276 Probe Barrel:

A Hastelloy C-276 probe barrel may be used in installations that require abrasion resistant material for the probe with lengths up to six (6) feet. Additional lengths can be use with the optional probe barrel support. It is best to use the shortest possible probe barrel length for response times and consistent with good sampling practice.

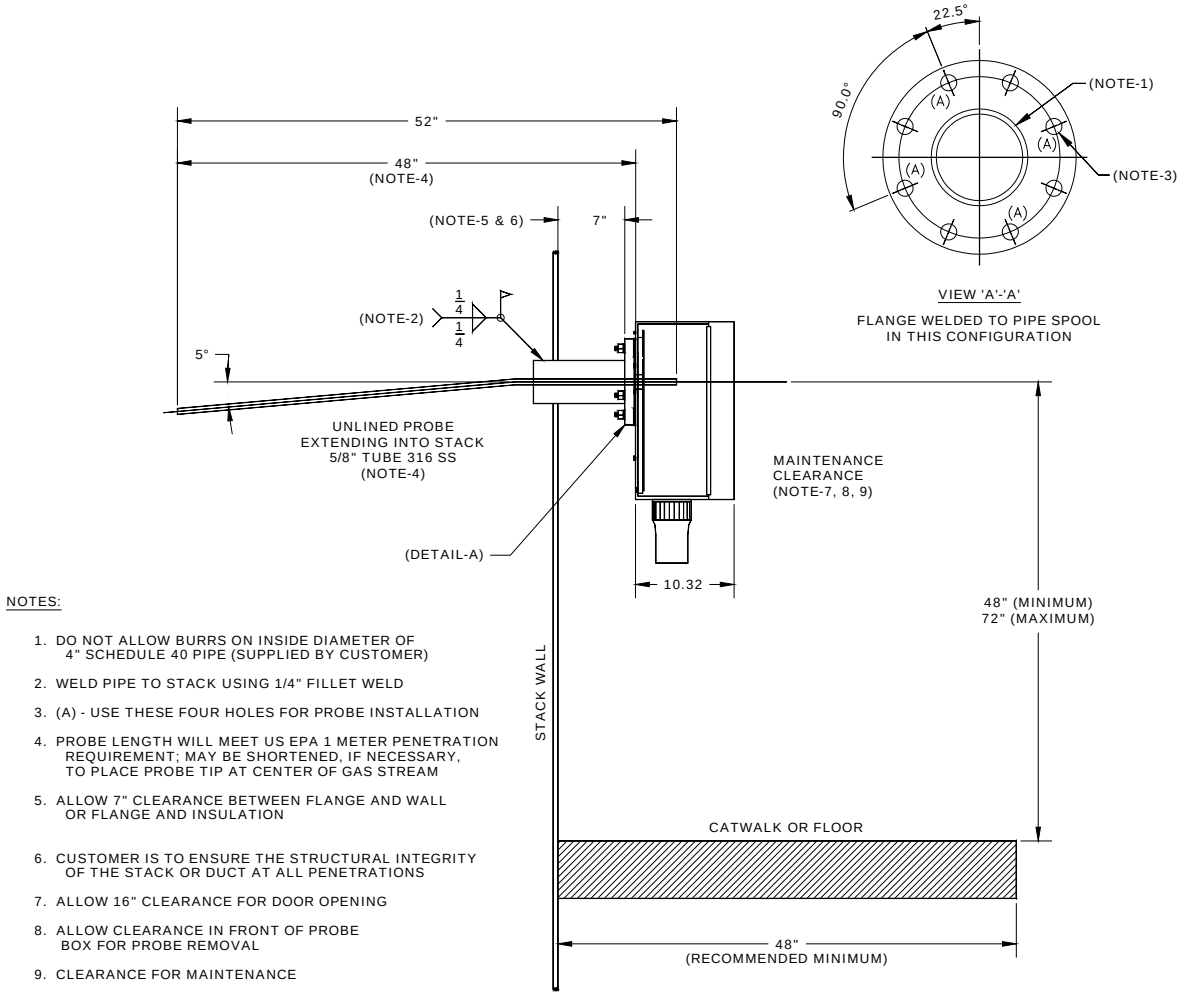

Figure 3.1-1 PRO3000 Probe Box Installation

3.2.2 Ambient Temperature Extremes

The PRO3000 probe assembly may be operated at a maximum ambient temperature of 50° C (140° F). Optimum operation of the sampling system will always be achieved if a sampling location is selected with moderate temperatures.

3.2.3 Process Pressure

The sampling system should not be installed in sampling locations that have pressures which exceed ± 30 inches H_2O. Positive pressure ducts are a special problem in that the maintenance is complicated by process gases escaping into the area of the maintenance personnel when the filter body is opened for maintenance. Positive pressure stacks or ducts may be easily sampled if a small portion of the stream can be vented to atmosphere and the probe is then allowed to sample this atmospheric vent. The probe typically extracts between 2.5 and 5.0 L/min.

3.3 General Installation

3.3.1 Probe Assembly Enclosure

The probe assembly is shipped in two separate containers. The probe enclosure is installed first and then the probe is installed through an opening in the back of the enclosure into the stack. To install the probe assembly, perform the steps as outlined in the following three sections.

Probe Enclosure Installation

Install the enclosure on the four (4) inch flange using a proper flange gasket and four 1/2 inch X 1 3/4 inch stainless steel bolts, (See Figure 3.3.1-2).

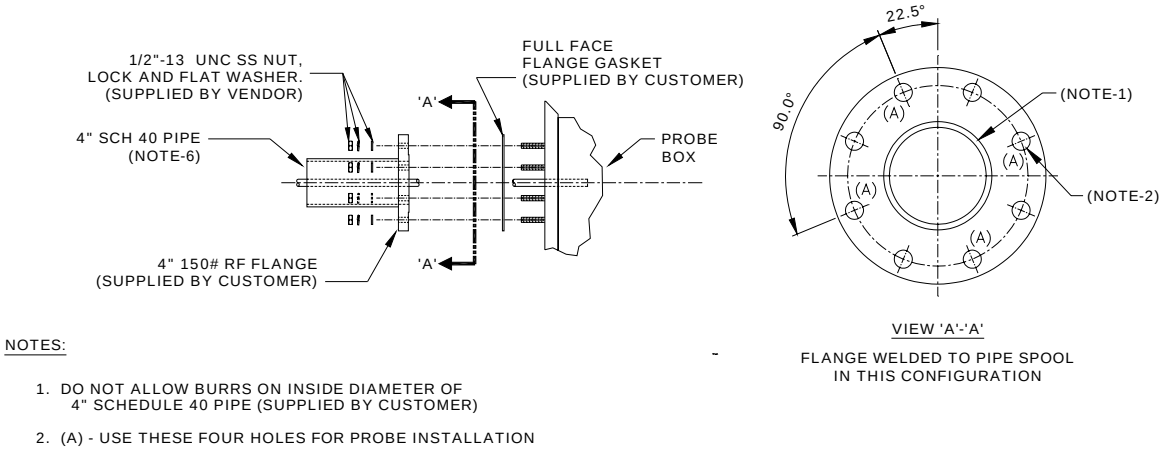

Figure 3.3.1-2 Customer Pipe Spool Installation

A) Inspect the probe barrel assembly for proper flange spacing and orientation (factory set), Figure 3.3.1-2.

B) Install the probe flange gasket (factory supplied) over the process end of the probe barrel to be used to seal process gases from the enclosure.

C) Insert the probe barrel assembly through the flange porthole in the back of the enclosure with the bend downward. Align the three-hole probe-mounting flange and flange gasket to the three-hole pattern of the enclosure flange porthole.

D) Insert the three (3) supplied 1/4-20 X 1-3/4 inch bolts through the probe mounting flange into the threaded holes, and tighten.

E) If equipped with a heated probe barrel, connect the probe barrel heater leads and the probe barrel RTD leads to the terminal strip in the lower compartment.

Probe Head Installation

A) Connect the sample/purge tube.

B) Connect the calibration tube.

C) Connect the probe filter heater band heater to the terminal strip in the lower compartment. Verify that the band heater is tightly clamped to the heated filter body.

D) Insert the temperature controller RTD into the hole provided, install the retaining screw and connect the leads to the terminal strip in the lower compartment.

Check all connections.

3.3.2 Calibration Gas Line

Connect the Teflon® calibration gas line to the appropriate 3/8" inch stainless steel compression tube fitting located on the right side of support plate in the enclosure.

3.3.3 Air Supply/Sample Line

Connect the Teflon® sample line and purge air line to the appropriate 3/8-inch compression type tube fittings located on the left side of support plate in the enclosure. The maximum length for the sample and calibration lines varies with individual applications. (Refer to the specific installation drawings for each application.)

3.3.4 Control and Signal Lines

The control and signal lines are part of the tubing/wiring umbilical. Connect the control lines and signal lines using specified shielded cable for the heated filter temperature control and signal. (Refer to specific installation drawings for each application.)

3.4 Probe Assembly Start-up

The probe assembly may be started up as follows:

A) Locate the probe head temperature controller, located in the probe controller CTL3000 in the rack. Confirm that the proper parameters are entered into the temperature controllers (Refer to the CTL3000 series probe controller manual).

B) Verify that the band heater is tightly clamped to the heated filter body.

C) Turn on the controller AC power switch at the rack.

D) Insert a thermocouple temperature probe in one of the test port located above the RTD port in the heated filter body and allow the temperature to stabilize. This temperature should be 300°

F.

E) Increase or decrease the temperature adjustment of the CTL3000 heated filter temperature controller to obtain a probe head temperature of 300° F ± 5° F. Allow temperature to stabilize to confirm that the heater circuitry is controlling properly. The temperature of the heated filter may be adjusted as required. (If equipped with a heated probe barrel, perform the same adjustment on the heated probe barrel temperature controller.)

F) Turn on the main air supply from the air clean-up assembly (if supplied) and adjust the air supply to 60PSI.

G) Initiate a purge cycle on the probe assembly from the system controller.

The PRO3000 probe assembly is now ready to be calibrated with the complete monitoring system.

4.0 MAINTENANCE

4.1 General

The following procedures are designed to allow the maintenance technician to accomplish all necessary maintenance procedures on the PRO3000 probe assembly.

4.2 Required Maintenance Equipment

To perform maintenance on the sample system, the following equipment is required.
A. Normal hand tools

4.3 Heated Filter Replacement

NOTE: The existing heated filter must be replaced with a new one each time the filter cap is removed, (the filter is slightly crushed to seal). Once a crushed filter is removed, it will not seal properly and can not be used again.

CAUTION: THE STAINLESS STEEL FILTER BODY OPERATES AT 300° F AND CAN CAUSE SEVERE BURNS. USE EXTREME CARE WHEN WORKING IN THE UPPER SECTION OF THE PROBE ENCLOSURE.

A) Remove the heated filter cap.

B) Remove the filter from the mandrill of the heated filter cap.

C) Inspect the filter body and cap for particulate accumulation around the filter seats. Clean the filter body and seat by wiping with a soft cloth.

D) Install a **new** filter element onto the cap mandrill, then insert the cap and filter into the filter body. Tighten the filter cap until it contacts the filter body.

4.4Trouble Shooting

4.4.1 Zero Drift - Full System

Zero drift is independent of the dilution system, as any dilution of a zero gas will still cause a zero indication on the analyzer. Check the analyzer location for large temperature changes or other changes in the analyzer utilities. Please see the system manual for zero drift calculations.

4.4.2 Span Drift - Full System

Span drift may be caused by many different variables throughout the monitoring system. Most problems with the sampling system will be indicated by a failure to pass the daily span calibration. Failure to pass the daily calibration is subdivided into several different

problem areas that would cause a high or low indication on daily calibration. For each possible problem, a corrective action is listed. Please see the system manual for span drift calculations.

4.4.3 Low Sample Flow Rate

Possible Problem - Leak between filter body and probe barrel, sample outlet or purge inlet.

Corrective Action: Remove the probe barrel/heated filter assembly, plug the probe barrel and sample outlet and pressurize to 30 psi. Check for a leak at the probe barrel, sample outlet fitting or cal gas inlet. If a leak is detected, tighten the fitting and repeat the leak check.

Possible Problem -Leak around filter cap.

Corrective Action: Replace cap o-ring.

4.4.4 Low Span Reading

Possible Problem -Dirty Main Filter element.

Corrective Action: Replace filter element.

Possible Problem -Leak at filter body cap.

Corrective Action: Replace filter cap o-ring. Replace filter.

Possible Problem -Leak at sample and cal gas valve connections.

Corrective Action: Check for leaks. Tighten connections as required.

Possible Problem -Leaky purge/cal gas valve.

Corrective Action: Replace valve.

4.4.5 High Dew Point/Condensation in Sample Lines

Possible Problem -Failure of filter heaters or solid state relay.

Corrective Action: Check heater and heater solid state relay. Replace if defective.

5.0 Returning Assemblies for Repair

Should it become necessary to return any assembly, sub-assembly, or component for repair or replacement, contact the factory prior to shipment for specific information such as return authorization number, shipping instructions, price, time to repair, etc. Also include pertinent facts describing the nature of the problem. Ship all components to the following:

Thermo Fisher Scientific

5.1 Obtaining Replacement Parts The following information must be included in all purchase orders for parts:

A. TFS Model and S/N of major assembly
B. Part Number (found in parts tables)
C. Description of part

5.2 Spare Parts List, PRO3000

Part Number	Description	Recommended Quantity
25503012	O-ring, filter body	2*
26002018	Filter, 0.1 Micron, STD	4*
45510062	Valve, 2 way NC 120V 1/4NPT-3/16 orifice	1*
53010098	Heater band, 300 Watt, 1.5” wide, 120 VAC	2*
53040025	RTD, .25” x 1.5”	1*
53040051**	HEATER, ROD, 95", 120VAC, 1000W	1*
53040128**	RTD, PROBE, 24" 316 SHEATH, 12" FG	1*

* THESE PARTS ARE RECOMMENDED AS A MINIMUM FROM THE TFS SERVICE DEPARTMENT TO AID IN ACQUIRING 98 % UP TIME.

**THESE PARTS USED IN THE HEATED PROBE ONLY.

6.0 APPENDIX A

Drawing #	Rev	Sheet	Description
07040004	0	1 of 1	Filter, Assy, Heated, Extractive, Fiber Filter
07990181	0	1 of 1	Probe, Assy, Heated Barrel, for PRO3000
XXXX7121	0,	1 of 1	Source Extractive Probe Flow Diagram
XXXX7131	0,	1 of 1	Source Extractive Probe Wiring Diagram
XXXX7151	0,	1 of 2	Source Extractive Probe Assembly
XXXX7151	0,	2 of 2	Source Extractive Probe Assembly

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