EXFG
Oxygen Analyzer System

Installation Guide

EXFG Probe

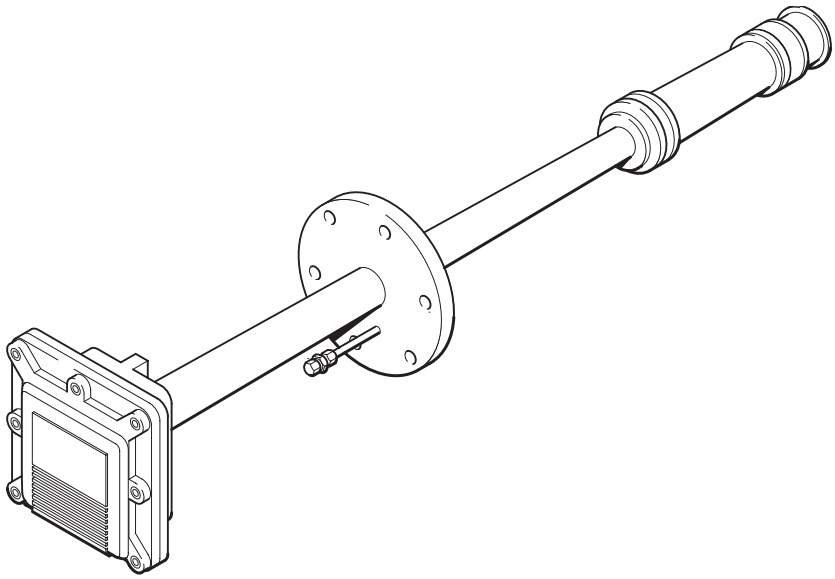


ABB Process Analytics

ABB PROCESS ANALYTICS

The Company

ABB Process Analytics specializes in the engineering, manufacture, sale and support of high quality, highly functional, analytical instrumentation for on-line analysis of process streams.

ABB Process Analytics is committed to quality leadership in the on-line analyser industry. The Company-wide, world-wide commitment is well expressed in the **quality statement** for ABB Process Analytics:

'We will conform to requirements and deliver defect-free products on time, to satisfy the needs of our internal and external customers.'

Use of Instructions

Warning.
An instruction that draws attention to the risk of injury or death.

Note.
Clarification of an instruction or additional information.

Caution.
An instruction that draws attention to the risk of damage to the product, process or surroundings.

Information.
Further reference for more detailed information or technical details.

Although **Warning** hazards are related to personal injury, and **Caution** hazards are associated with equipment or property damage, it must be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process system performance leading to personal injury or death. Therefore, comply fully with all **Warning** and **Caution** notices.

Health and Safety

To ensure that our products are safe and without risk to health, the following points must be noted:

1. The relevant sections of these instructions must be read carefully before proceeding.
2. Warning labels on containers and packages must be observed.
3. Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
4. Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and/or temperature.
5. Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
6. When disposing of chemicals ensure that no two chemicals are mixed.

Safety advice concerning the use of the equipment described in this manual or any relevant hazard data sheets (where applicable) may be obtained from the Company address on the back cover, together with servicing and spares information.

CONTENTS

1 INTRODUCTION

1.1 Documentation

Documentation for the EXFG Oxygen Analyzer System is shown in Fig. 1.1.

The **Standard Documentation Pack** is supplied with all instruments.

The **Supplementary Manuals** supplied depend on the specification of the instrument.

1.2 Certification

The EXFG Probe described in this manual is regarded as a certified flameproof enclosure EEx d IIB T3 (–20 to 55°C) conforming to EN50014 (1993) and EN50018 (1995). As such it is safe for use in Zone 1 hazardous areas both in and out of a flue duct (copies of the certificate are available on request).

However, when the T_{amb} of 55°C is exceeded at the sensor end of the probe by process temperature, certification is not invalidated as the hazard is that of the process and not of the certified probe.

Warning. Maximum process pressure 1.1 bar absolute. Certification is invalidated if this pressure is exceeded.

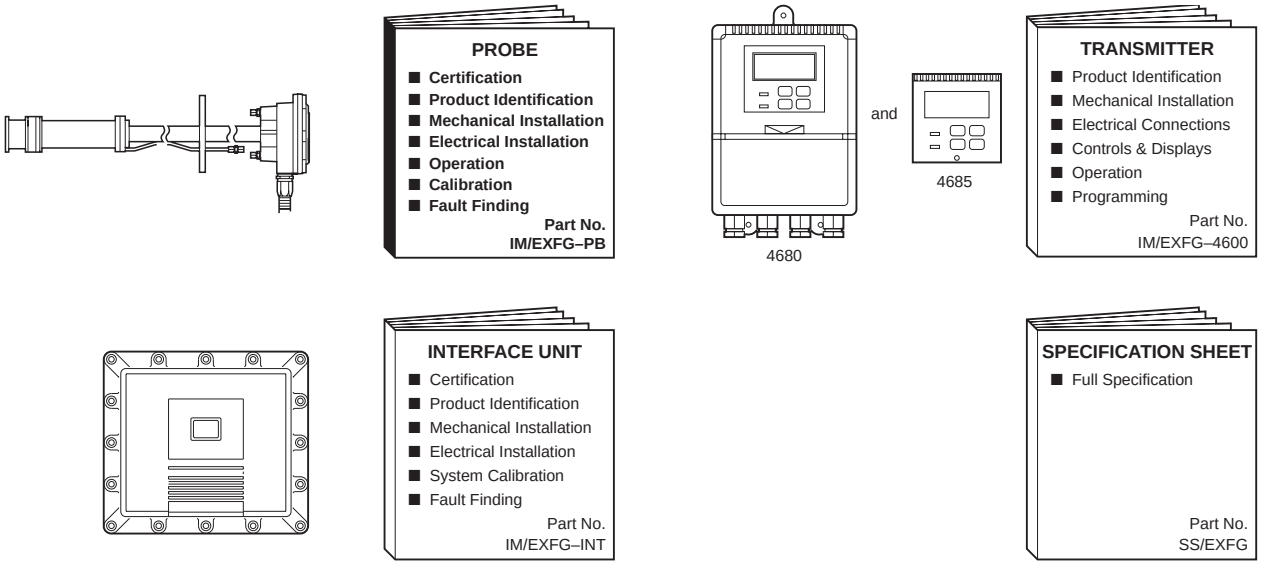


Fig. 1.1 EXFG Documentation

1.3 System Overview – Fig. 1.2

The EXFG Oxygen Probe measures oxygen concentration in flue gas using an in situ (‘wet analysis’) method. The 'wet analysis' method avoids measurement error (typically 20% of reading higher than the actual value) which would be introduced by a sampling system using the ‘dry analysis’ method.

System equipment comprises the EXFG Oxygen Probe (flue-mounted), an EXFG Interface Electronics Unit and an EXFG Oxygen Transmitter. During operation, a zirconia cell within the EXFG Probe is controlled by the EXFG Interface Electronics Unit at a temperature of 700°C. This temperature is maintained by a probe heater and control thermocouple assembly. A trip thermocouple is fitted to ensure the surface temperature of the probe never exceeds T3 (200°C). If the heater control circuitry fails 'unsafe' a mechanically interlocked power supply trip relay operates cutting the power supply to the probe. Therefore the system fails 'safe'.

Warning. The probe must be only be connected to the EXFG Interface Electronics Unit, otherwise probe certification may be invalidated.

An output generated at the zirconia cell is processed in the EXFG interface electronics unit into a 4 to 20mA retransmission signal representing 25% to 0.25% O_2.

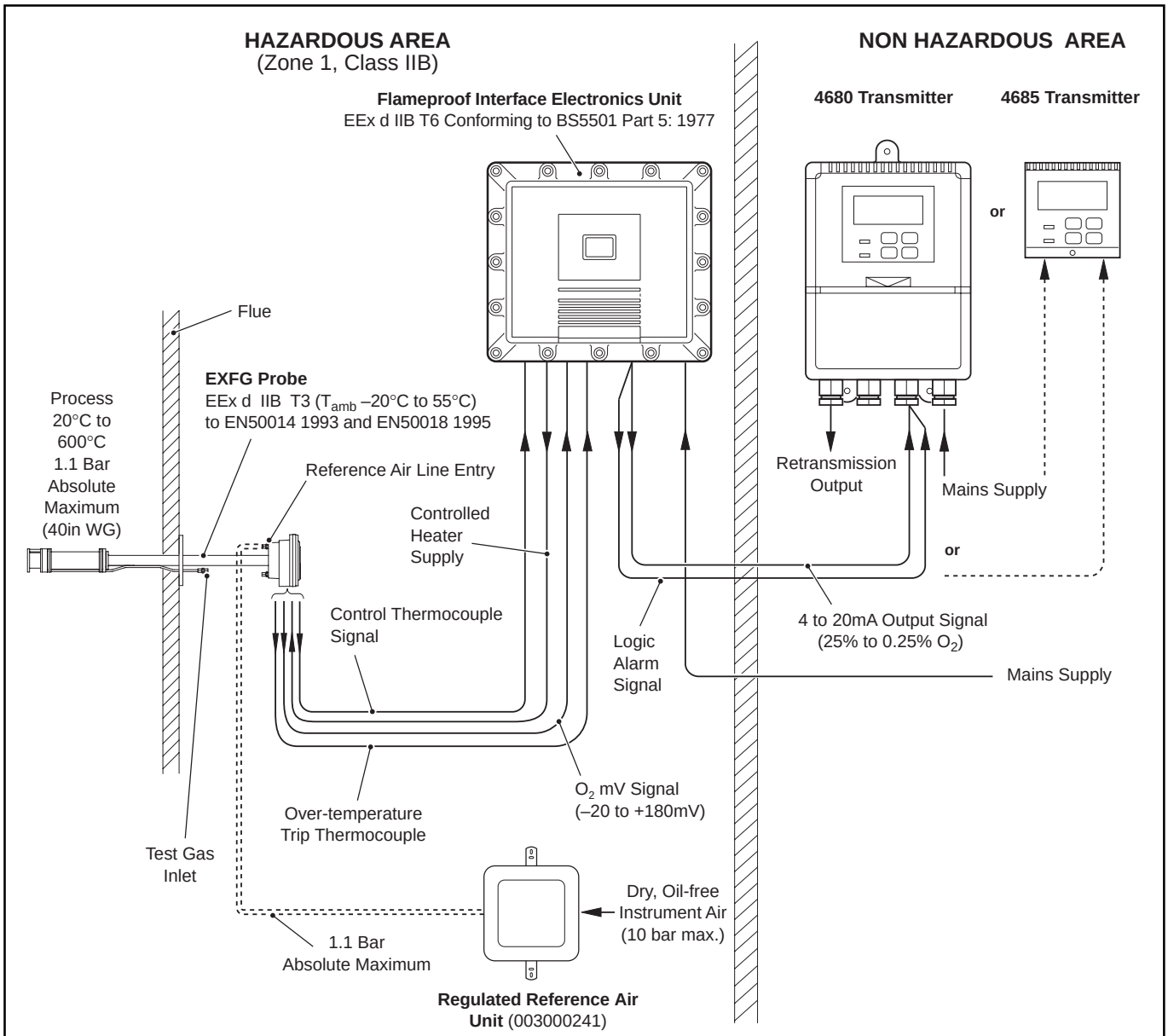


Fig. 1.2 System Schematic

1.4 Principle of Operation – Fig. 1.3

The probe's zirconia cell is a thimble-shaped sensing element fitted with inner and outer electrodes at its closed end. The inner electrode is exposed to the flue gas entering the open end of the cell; the outer electrode is supplied with reference air from a regulator and is therefore exposed to a constant partial pressure of oxygen. The cell is held at a constant 700°C by a heater and control thermocouple.

Because zirconia is an electrolyte which conducts only oxygen ions at temperatures in excess of 600°C, the voltage generated between the electrodes (i.e. the cell output) is a function of the ratio of the oxygen partial pressure difference between the reference electrode and the measuring electrode and its temperature. Therefore, any change in the oxygen partial pressure of the flue gas at the exposed electrode produces a change in the cell output voltage as dictated by the Nernst equation.

Cell output voltage increases logarithmically with decreasing oxygen, thus giving high sensitivity at low oxygen levels.

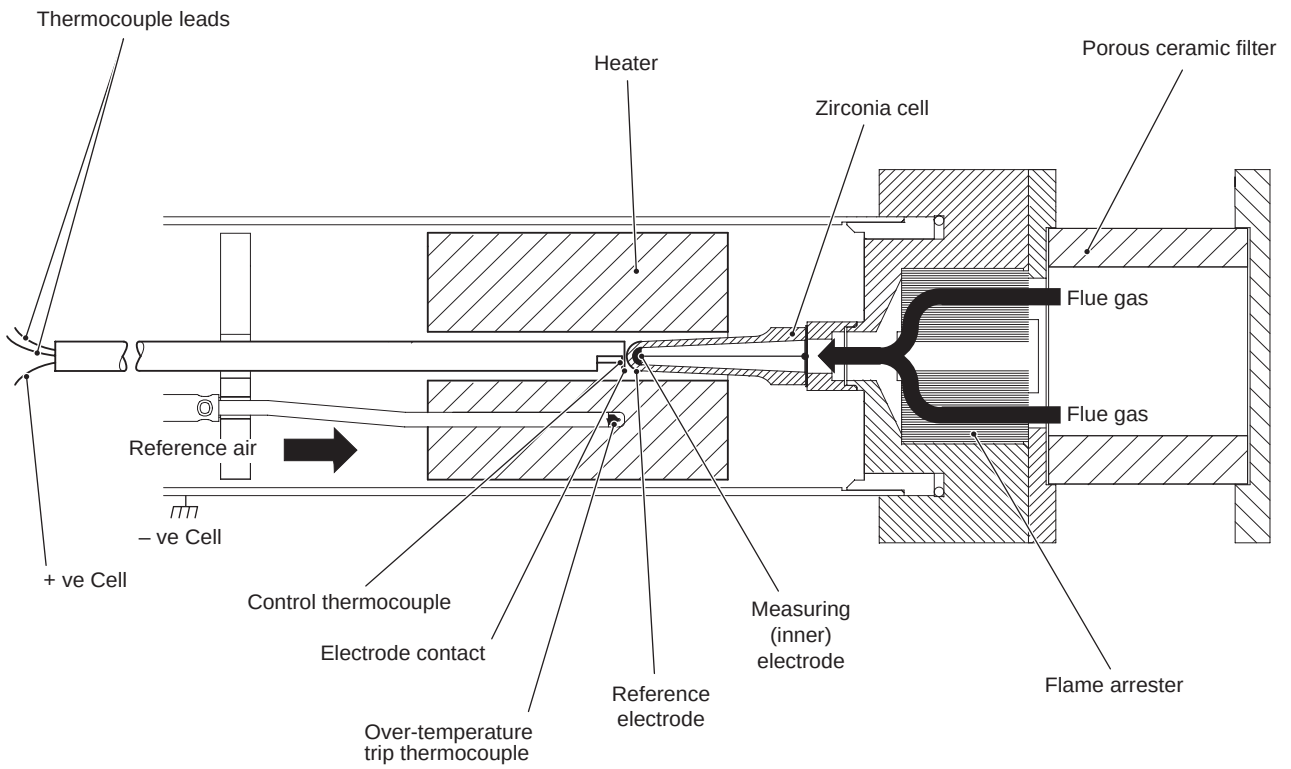


Fig. 1.3 Probe Construction

2.1 Checking the Code Number – Fig. 2.1

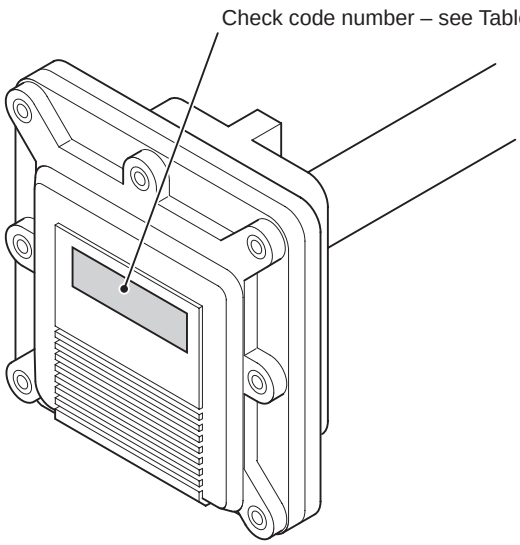


Fig. 2.1 Checking the Code Number

EXFG Oxygen Analyzer System		EXFG/	X	X	X	000
EXFG Probe	Not supplied		0			
	1.64ft (0.5m) insertion length – with standard flange		1			
	3.281ft (1.0m) insertion length – with standard flange		2			
	6.562 (2.0m) insertion length – with standard flange		3			
	1.64ft (0.5m) insertion length – with ANSI flange		4			
	3.281ft (1.0m) (insertion length) – with ANSI flange		5			
	6.562 (2.0m) insertion length – with ANSI flange		6			
Flexible Conduits	No conduits			0		
	19.68ft (6.0m) Single conduit assembly – combined signal/power			1		
	32.81ft (10.0m) Single conduit assembly – combined signal/power			2		
	19.68ft (6.0m) Dual conduit assembly – separate signal/power (comprising one signal conduit and one power conduit)			3		
	32.81ft (10.0m) Dual conduit assembly – separate signal/power (comprising one signal conduit and one power conduit)			4		
or						
Dual Special Cables		(ordered separately)				
	SWA signal cable – EXFG/0194 (per metre, 100 metre max.) 25/20mm reducer – B11274 (qty. 2 rqd.) 20mm barrier gland – (qty. 2 rqd.) *and* SWA power cable – EXFG/0195 (per metre, 100 metre max.) 20mm barrier gland – B11275 (qty. 2 rqd.)					
Mounting Plate	Not supplied				0	
	Mounting plate assembly – standard flange only				1	

Table 2.1 Code Number Interpretation

2.2 Accessories Check

2.2.1 Test Gas Connector Kit – Fig. 2.2

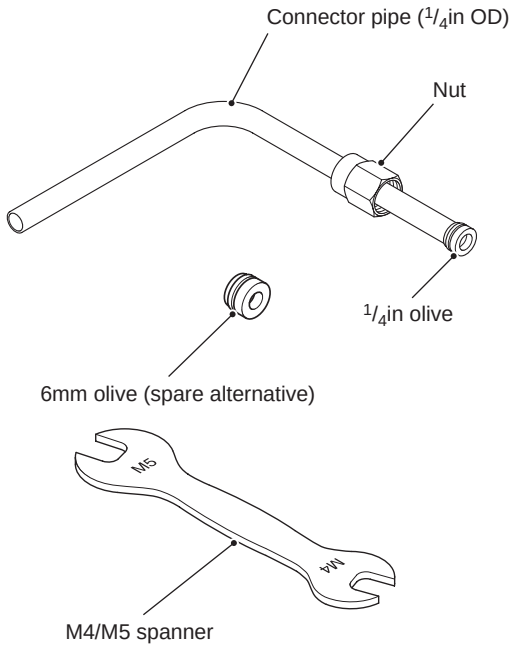
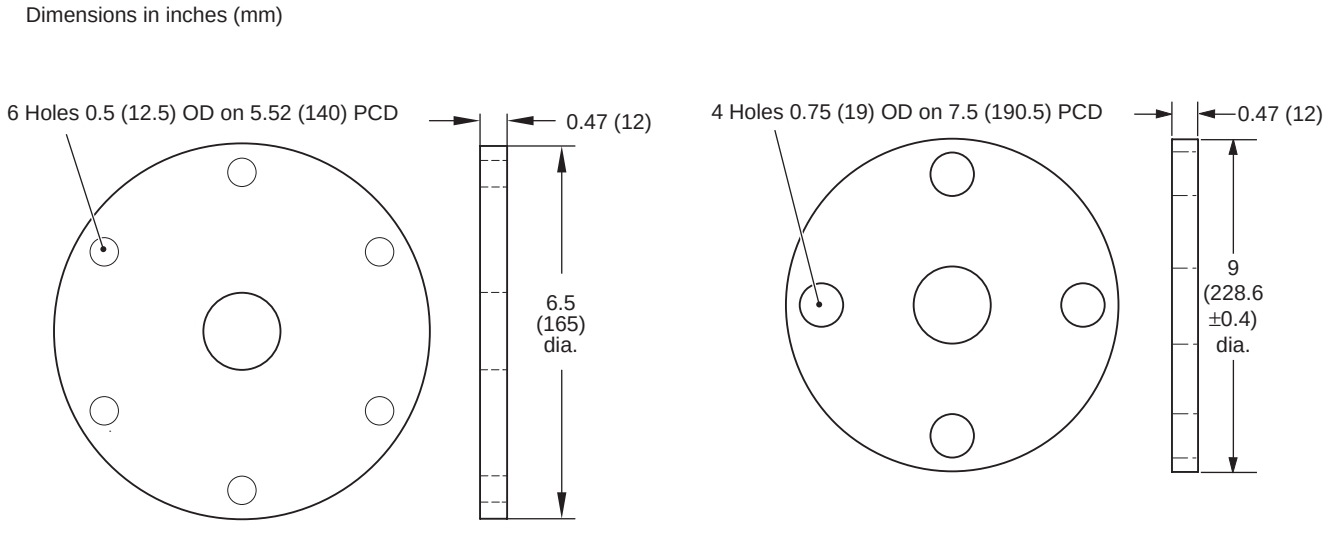


Fig. 2.2 Test Gas Connector Kit Components

2.2.2 Probe Flange – Fig. 2.3



A – Standard Flange

B – ANSI Flange (equivalent to 4in 150lb flange)

Fig. 2.3 Probe Flanges

2.2.3 Mounting Plates – Fig. 2.4

In addition to the probe flange, the probe may also be supplied with a mounting plate assembly if specified – see Table 2.1. A mounting plate is required if there is no existing mounting on the flue or boiler.

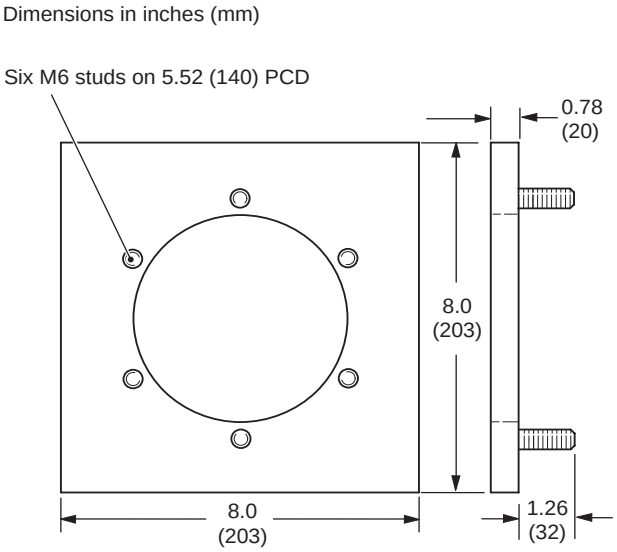


Fig. 2.4 Mounting Plate (Standard Only)

Warning. Maximum process pressure 1.1 bar absolute. Certification is invalidated if this pressure is exceeded.

Caution. Handle with care. Avoid mechanical shock to prevent damage to the probe's internal ceramic components.

3.1 Siting – Figs. 3.1 and 3.2

Select a position where the intake is located in the main stream of flue gas. Gas temperature must be in the range 20°C to 600°C.

Avoid positions where obstructions or bends may impede gas flow or prevent insertion, or subsequent removal, of the probe.

Probe dimensions are shown in Fig 3.1. A clearance of at least 1 inch (25mm) in excess of the overall probe length is necessary for installation or removal procedures.

The probe can be supplied with 19.68ft (6m) or 32.81ft (10m) of flexible conduit as standard which contains cables for connection to the Interface Electronics Unit. The probe head can accept two conduits for separate routing of signal and power cables if required. Special cables complete with appropriate glands can be provided in lengths up to 328.1ft (100m) maximum. The special cable option is only available as a dual cable configuration comprising separate power and signal cables.

Caution. Thermal shock may break the zirconia cell if the flue is cleaned using a high pressure water hose. If this method of cleaning is used, remove the probe from the flue prior to cleaning.

Dimensions in inches (mm)

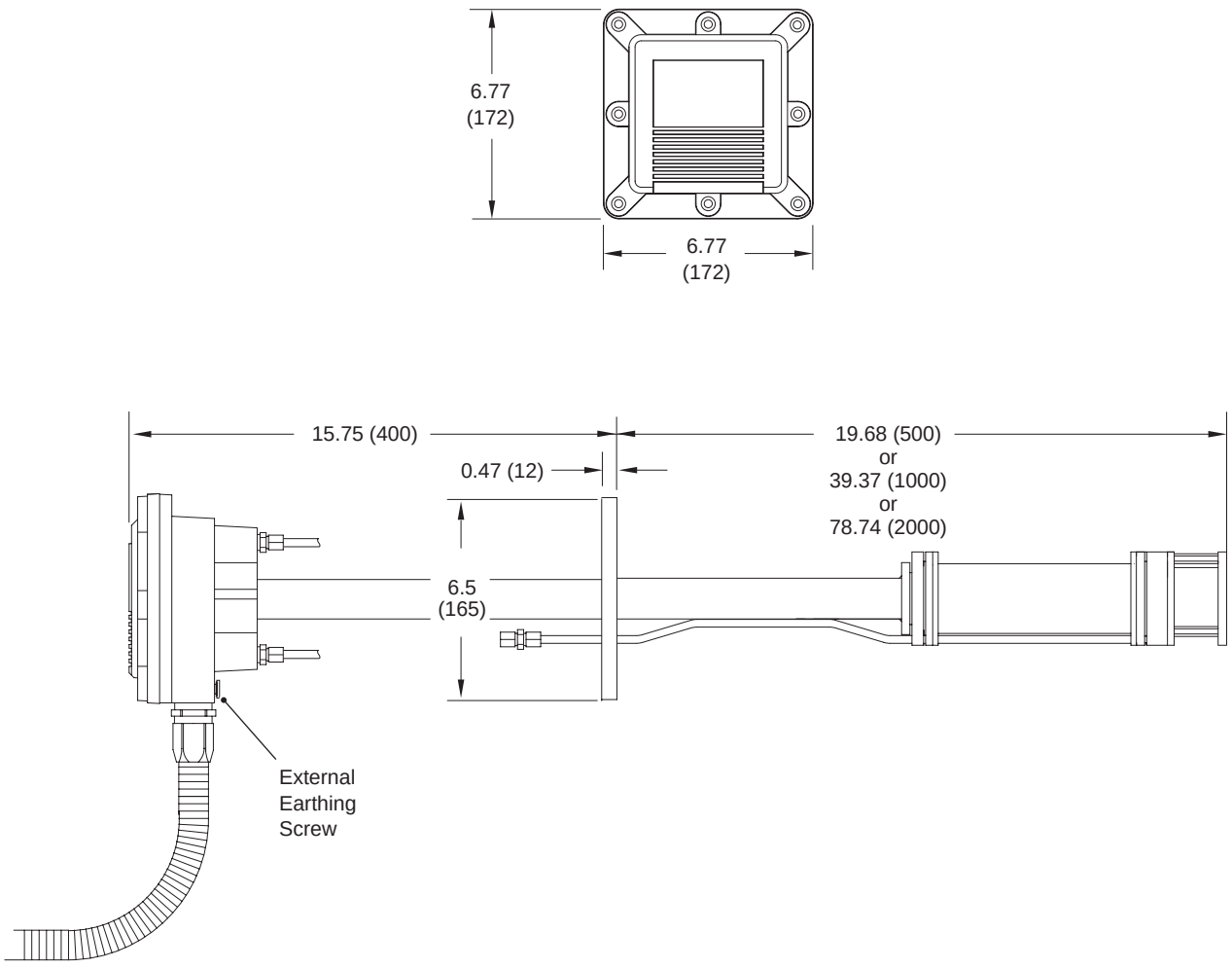


Fig. 3.1 Overall Dimensions

…3 INSTALLATION

…3.1 Siting – Figs. 3.1 and 3.2

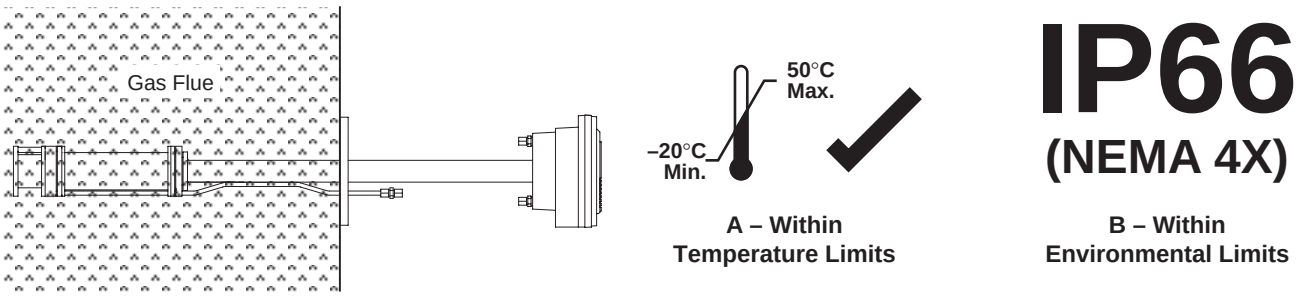


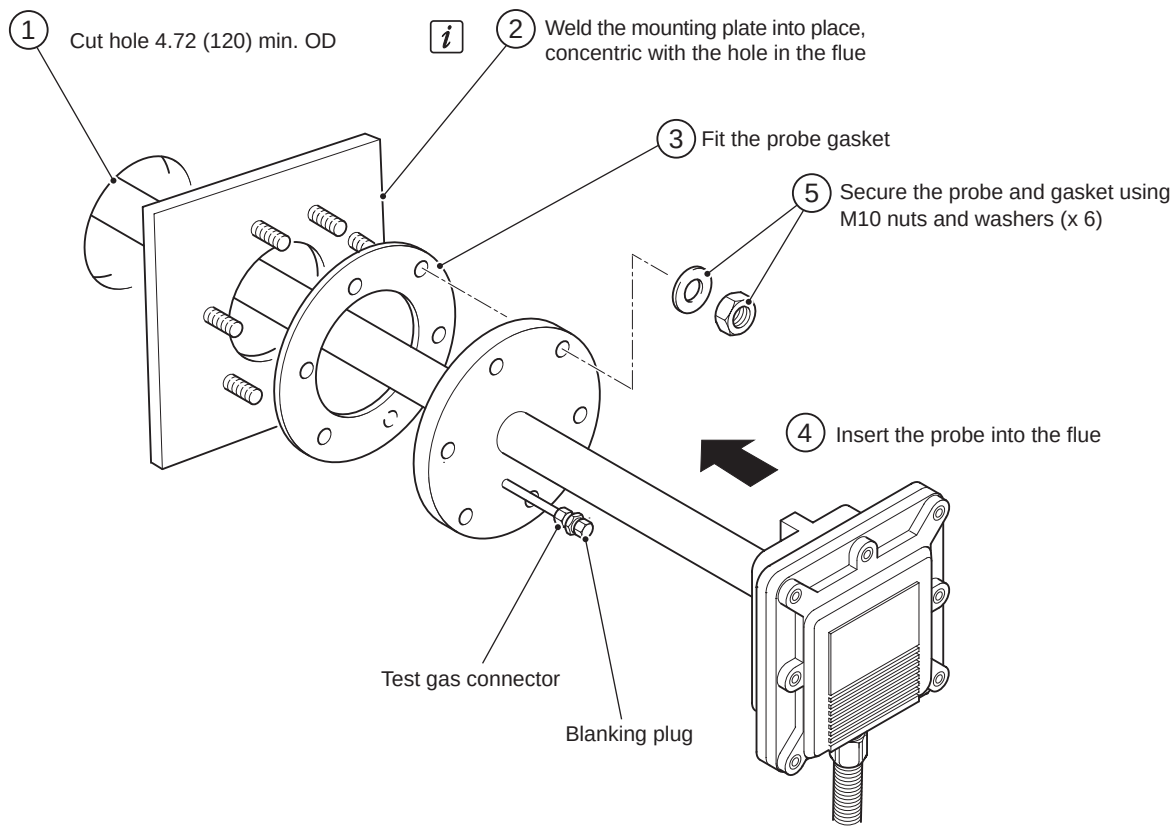
Fig. 3.2 Siting Requirements

3.2 Mounting – Fig. 3.3

Warning.

- Installation and repair must only be carried out by the manufacturer, authorized agents or persons conversant with the construction standards for hazardous area certified equipment.
- Installation must conform to BS5345.

Dimensions in inches (mm)



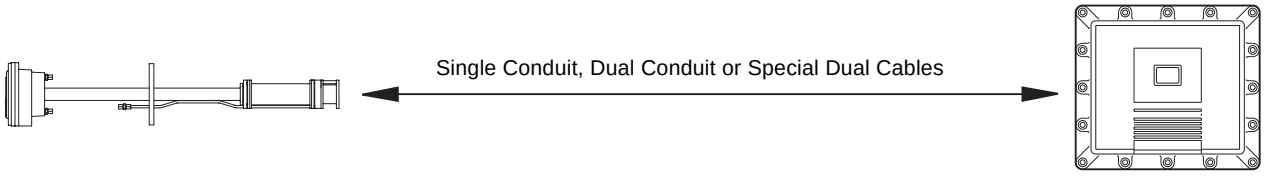
Information. Alternatively, drill and bolt the plate to the flue. If this method is used fit a suitable gasket between the plate and the flue wall.

Fig. 3.3 Mounting Procedure

4.1 Conduit, Cable and Gland Specifications

Caution.

- Installation and repair must only be carried out by the manufacturer, authorized agents or persons conversant with the construction standards for hazardous area certified equipment. The specifications described in Table 4.1 are for **system electrical requirements only**. Only specifications shown may be used to conform to BS5345, EN50014 and EN50018.
- All cables must conform to BS5345 for flameproof 'd' type enclosures for mechanical construction.
- EEx d glands used on the Interface Electronics Unit must be of the EEx d 'Barrier Gland' type with BASEEFA certification as the enclosure is over 2 liters volume, has a source of ignition within and is designed for use in Zone 1 areas (reference BS5345 part 3).



Single Conduit – combined signal and power	
19.68ft (6.0m)	Signal/power conduit assembly fitted with M25 BASEEFA certified EEx d barrier glands each end (part no. EXFG/0060)
or	
32.81ft (10.0m) length	Signal/power conduit assembly fitted with M25 BASEEFA certified EEx d barrier glands each end (part no. EXFG/0061)
Dual Conduit – separate signal and power	
19.68ft (6.0m) length	Signal conduit assembly fitted with M25 BASEEFA certified EEx d barrier glands each end (part no. EXFG/0062) **and** power conduit assembly fitted with M20 BASEEFA certified EEx d barrier glands each end (part no. EXFG/0063)
or	
32.81ft (10.0m) length	Signal conduit assembly fitted with M25 BASEEFA certified EEx d barrier glands each end (part no. EXFG/0064) **and** power conduit assembly fitted with M20 BASEEFA certified EEx d barrier glands each end (part no. EXFG/0065)
Dual Cable – separate signal and power	
Length to order (maximum length 328.10ft (100.0m))	Special signal cable, steel-wire armoured (part no. EXFG/0194) supplied with M25 BASEEFA certified EEx d barrier glands for each end (part no. B11274 – M25/20 reducers, plus B11275 20mm barrier glands) **and** special power cable, steel-wire armoured and screened, 3-core (part no. EXFG/0195) supplied with M20 BASEEFA certified EEx d barrier glands for each end (part no. B11275)

Table 4.1 Conduit/Cable and Gland Specifications – EXFG Interface Electronics Unit to EXFG Probe

4.2 Conduit and Cable Options

The probe is available with one of three connection options – see Table 2.1 for code numbers. Options are:

a) Single conduit – 19.68ft (6.0m) or 32.81ft (10.0m) lengths, comprising; one conduit for signal and heater power leads,

b) Dual conduits – 19.68ft (6.0m) or 32.81ft (10.0m) lengths, comprising; one conduit for signal leads, one conduit for the heater power lead,

c) Dual special cables – for lengths up to 328.10ft (100.0m), comprising; one special cable for signal leads, one special cable for the heater power lead.

A 0.23in (6mm) external earthing point is fitted on the probe head base – see Fig. 3.1. For connections to the Interface Electronics Unit, refer to *Section 4* of the *EXFG Interface Electronics Unit Guide*.

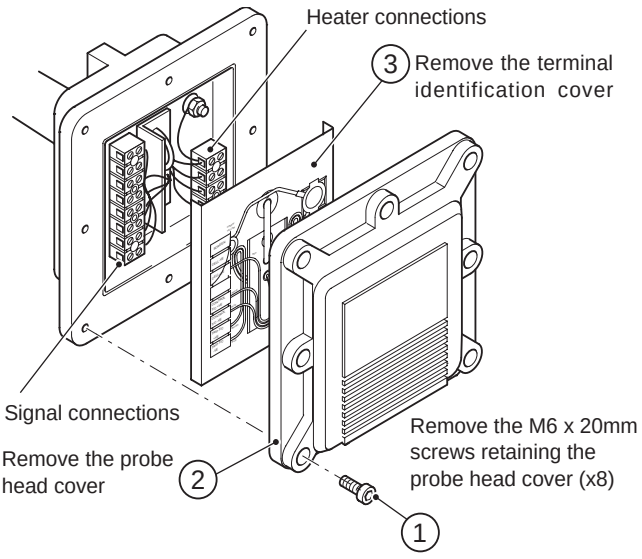


Fig. 4.1 Access to Probe Terminals

4.2.1 Access to Probe Terminals – Fig. 4.1

Warning. Once commissioned, the enclosure must not be opened when a flammable atmosphere is present.

4.2.2 Single Conduit Probe Connections – Fig. 4.2

When making connections, ensure that the cables are routed correctly as shown in Fig. 4.2 (single conduit), Fig. 4.3 (dual conduit) or Fig. 4.4 (dual cable).

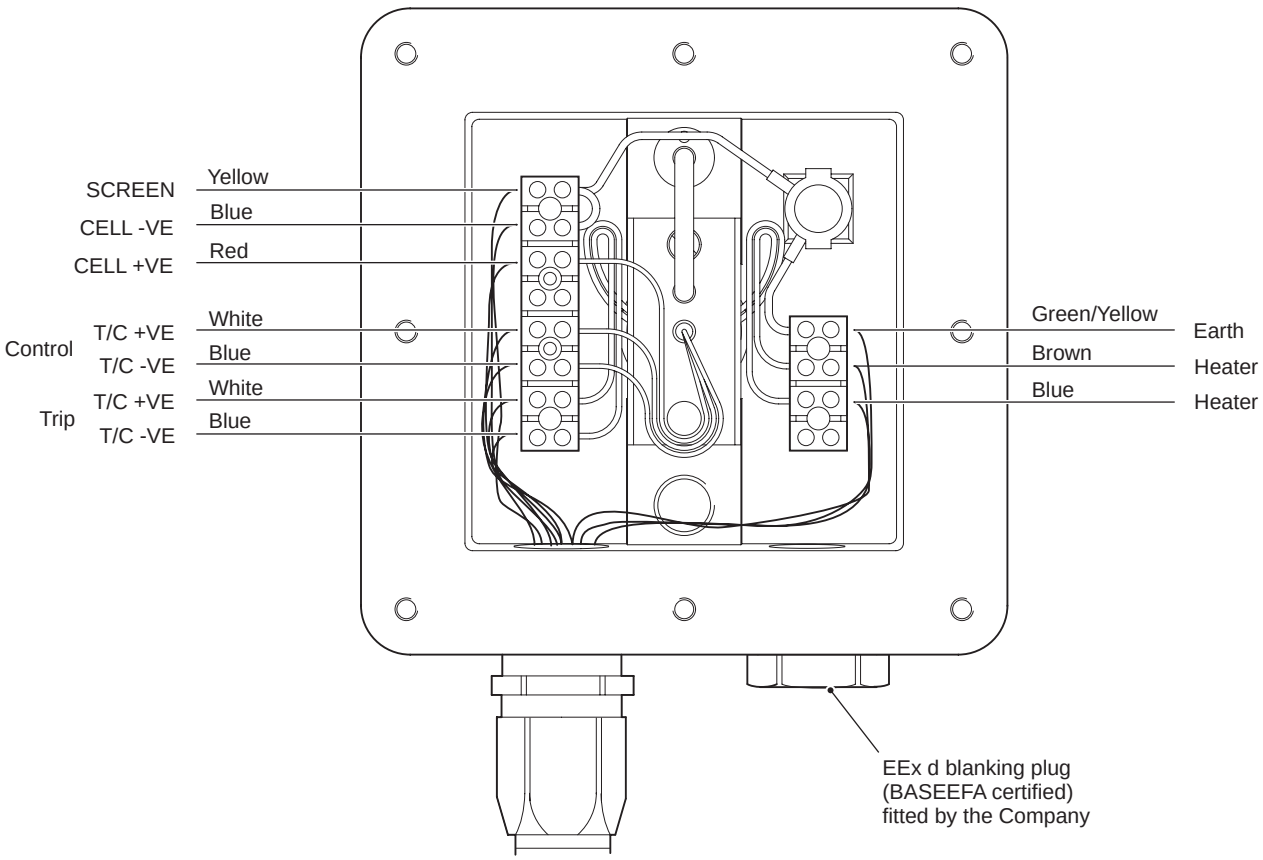


Fig. 4.2 Single Conduit Probe Connections

4.2.3 Dual Conduit Probe Connections – Fig. 4.3

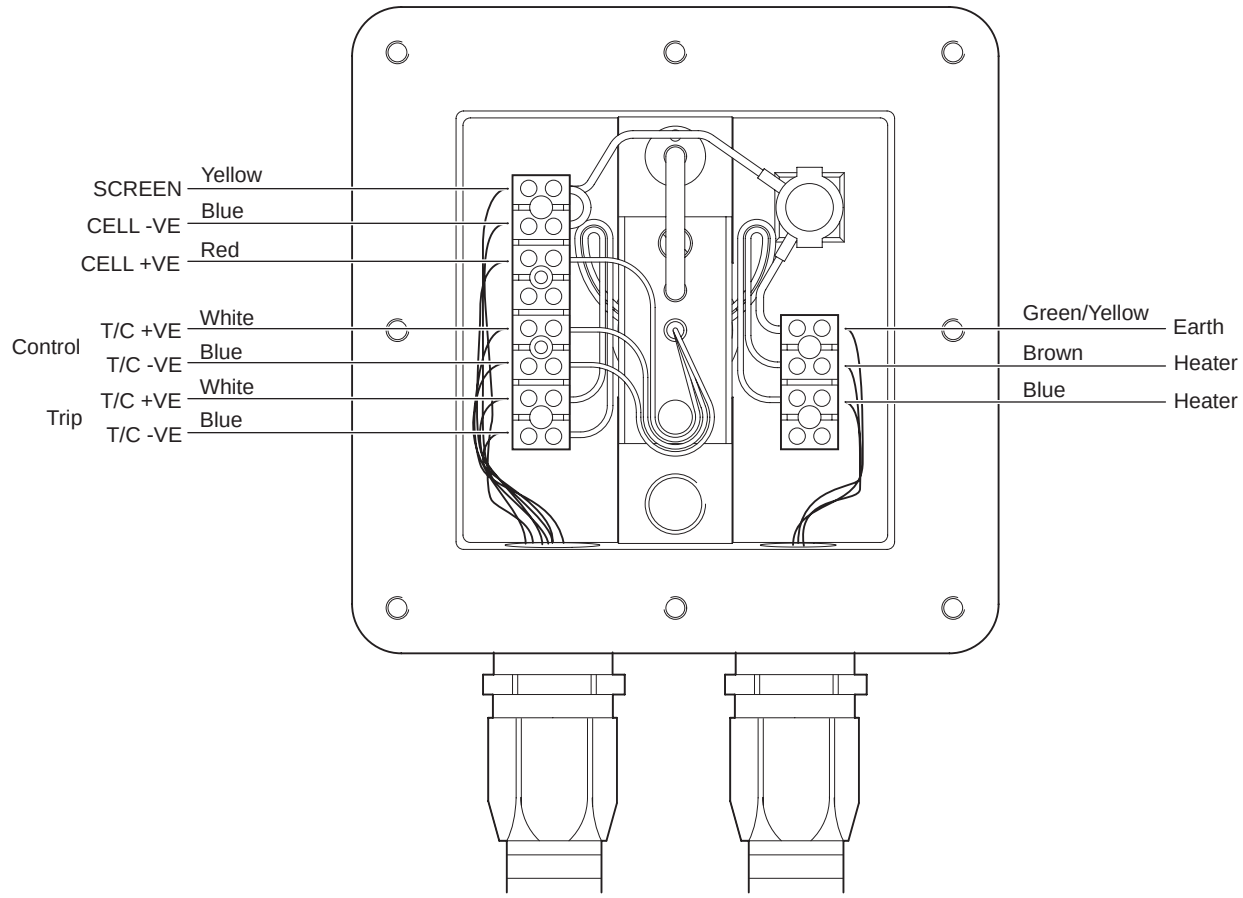


Fig. 4.3 Dual Conduit Probe Connections

4.2.4 Dual Cable Probe Connections – Fig. 4.4

Warning. When fitting barrier glands to special signal and power cable end, the gland manufacturer's instructions must be followed. Screens must be isolated from the gland metalwork when fitting the glands.

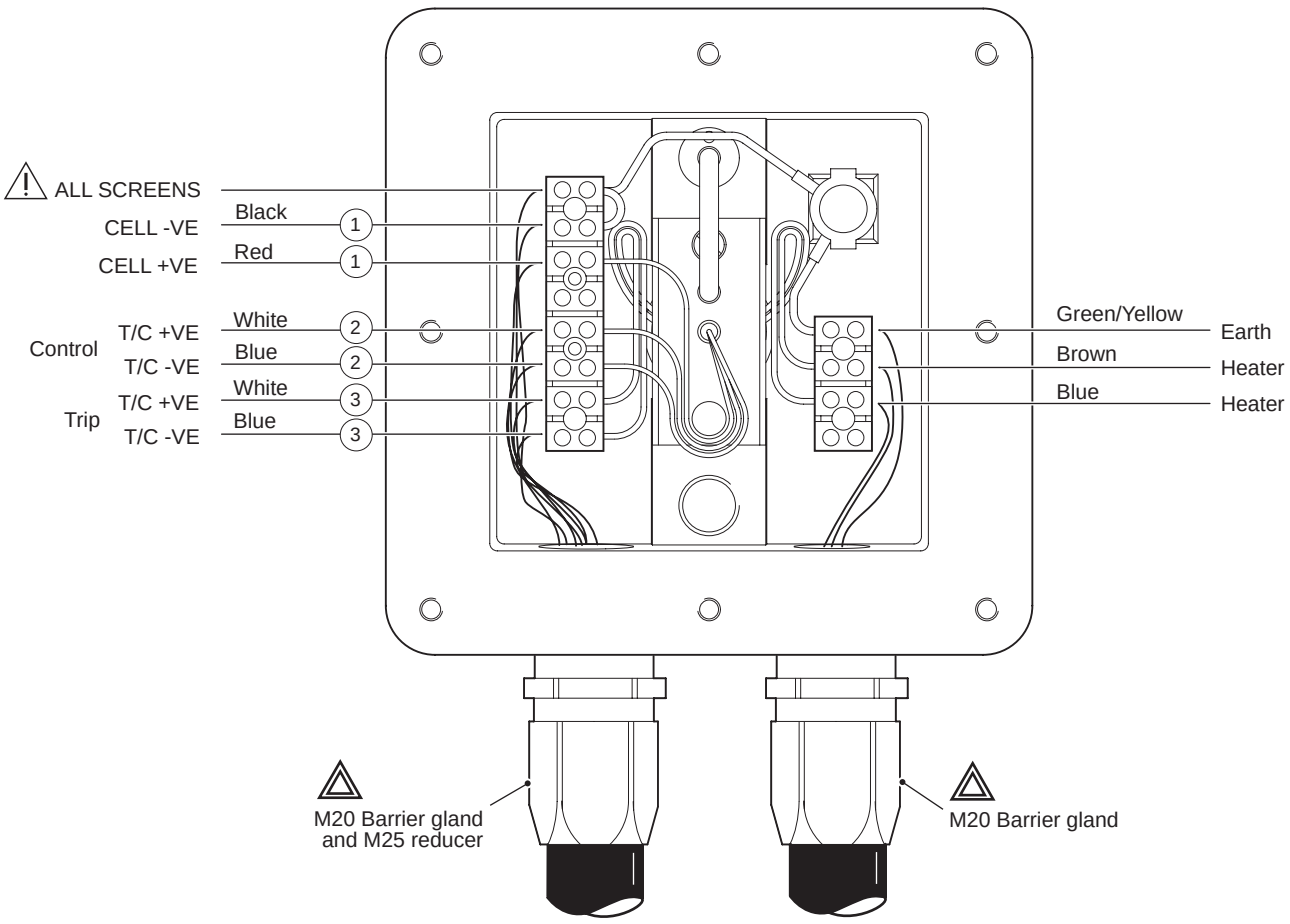


Fig. 4.4 Dual Cable Probe Connections

4.3 Pipe Connections – Fig. 4.5

The compression fittings on the back of the probe head have a 1/4in olive as standard. Spare 6mm olives are also supplied in the accessory kit as an alternative size – see Section 2.2.

4.3.1 External Reference Air Connection – Fig. 4.5

Warning. The maximum reference air pressure is 1.1 bar absolute.

A clean, dry, oil-free regulated air supply is required at a pressure between 20 and 100 millibars (8 to 40 in. W.G.), e.g. from a regulator unit (Model 003000241) available from the Manufacturer. Connect the reference air tubing as shown in Fig. 4.5. Refer to Table 4.2 for reference air and vent outlet tubing specifications.

4.3.2 Vent Connection – Fig. 4.5

The vent outlet allows the reference air to escape to atmosphere via built in flame arrestors. If the outlet is likely to be exposed to moisture, a suitable vent tube must be connected to the outlet and routed to a dry area – see Fig. 4.5. Ensure that the vent outlet, or the vent tube, does not become blocked during probe use.

4.3.3 Test Gas Connection – Fig. 4.5

A test gas inlet is provided for in situ probe testing using a test gas – see Section 2.2.1. A test gas connector kit is supplied in the accessory kit. Refer to the *Interface Electronics Unit Guide* for test gas use.

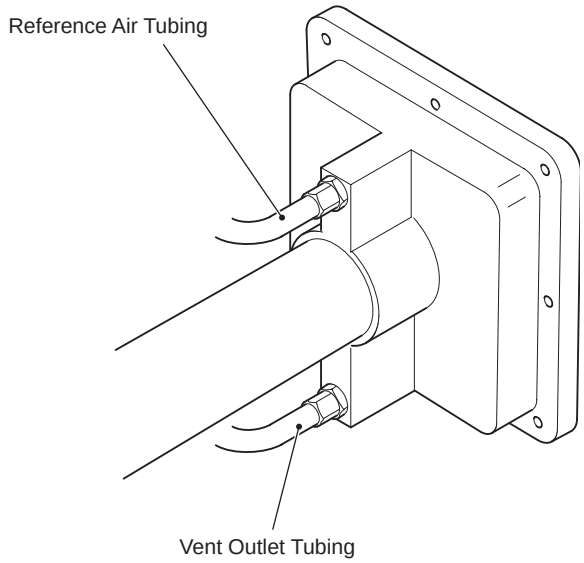


Fig. 4.5 Air Connections

4.4 Resealing the Probe Head – Fig. 4.6

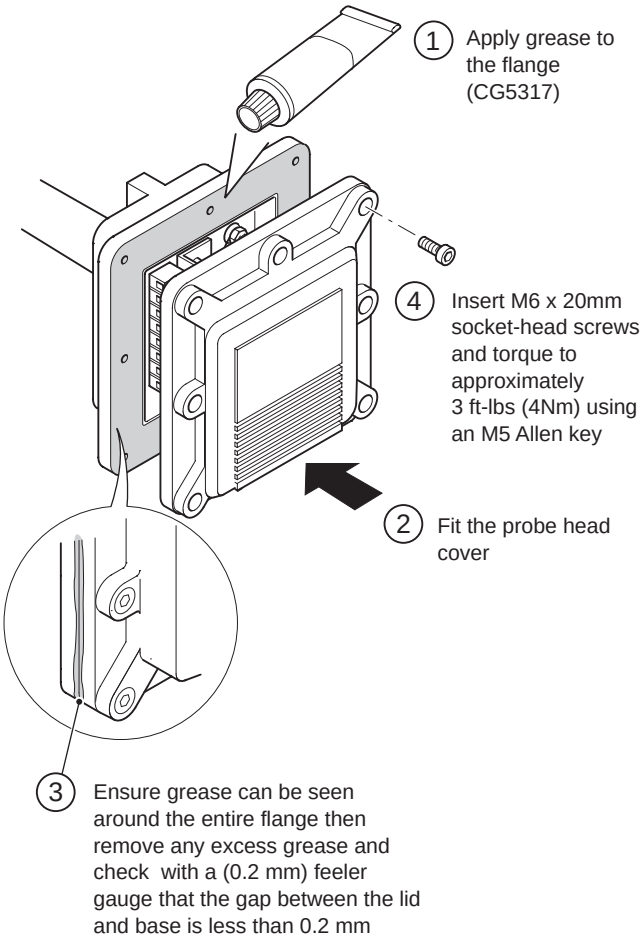


Fig. 4.6 Resealing the Probe Head

Tubing	Tubing Specification
Reference Air Tubing	1/4in o.d. x 1/8in i.d. stainless steel, nylon or p.v.c. tube (100°C ambient max.)
Vent Outlet Tubing	1/4in o.d. x 1/8in i.d. stainless steel, nylon or p.v.c. tube (100°C ambient max.)

Table 4.2 Reference Air and Vent Tubing Specifications

5 OPERATION

a) Check that a blanking plug is securely fitted to the test gas connector on the probe – see Fig. 3.3.

> **Note.** If the blanking plug is not fitted, air leaking into the probe via the connector may cause measurement errors. In a pressurized flue, gases venting to atmosphere through the connector could cause corrosion of the test gas tube. In a negative pressure flue, air leakage may cause high O_2 reading errors.

b) Check connections on both the Probe and the Interface Electronics Unit (refer also to the *EXFG Interface Electronics Unit Guide*).

c) Switch on the mains power supply and reference air flow.

d) Check and, if necessary, adjust the reference air flow to a stable flow rate between 50 and 1,000cc/min.

e) Check the l.e.d.s on the EXFG Interface Electronics Unit – see Fig. 5.1.

Refer to the *EXFG Interface Electronics Unit Guide, Fig. 6.1* for other l.e.d. indications.

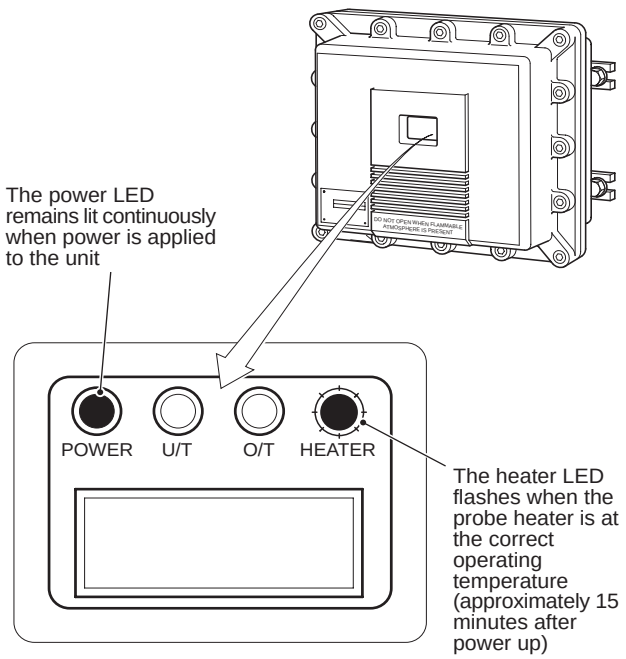


Fig. 5.1 LED Indication Showing Probe Heater at Normal Operating Temperature

6 CALIBRATION

Full gas calibration procedures for the system are described in *Section 5* of the *EXFG Interface Electronics Unit Guide*.

> **Note**. Test gas flows for all probes **must be set to 3,000cc/min.** (±10%) or measurement errors may occur.

System fault finding procedures are given in Section 7. Where a fault is traced to the probe, it may be possible to identify and rectify the fault.

After any rectification, the system must be re-calibrated as described in *Section 5* of the *EXFG Interface Electronics Unit Guide* to maintain the stated accuracies.

7.1 Checking the Zirconia Cell

Note. The zirconia cell can be tested without affecting the explosion-proof integrity of either the EXFG Probe or the EXFG Interface Unit.

a) Carry out a system calibration check as described in *Section 5* of the *Interface Electronics Unit Guide*.

If the analyzer response is correct when measuring test gas but sluggish and insensitive when measuring flue gas, replace the ceramic filter as described Section 8.1.

If a correct test gas response cannot be obtained, check the control thermocouple operation as described in Section 7.1.1.

7.1.1 Checking the Control Thermocouple – Fig. 7.1

Warning. To check the control thermocouple operation it is necessary to remove the probe's connection cover, thus invalidating the explosion proof integrity. Consequently, before removing the connection cover ensure that their are no hazardous gases present or, alternatively, remove the probe from the hazardous area.

a) Remove the probe connection cover as described in Section 4.2.1.

Warning. The probe heater terminals are at high voltage (55V a.c.). Take all necessary precautions against electric shock when measuring voltages inside the probe head.

b) Check the control thermocouple voltage as shown in Fig. 7.1. The measured voltage must be within ±0.1mV of the voltages listed in Table 7.1.

If the measured voltage is **correct**, replace the zirconia cell as described in Section 8.2.

If the measured voltage is **high**, relocate the probe to a position in the flue where the temperature does not exceed 600°C.

If the measured voltage is **low**, check the heater operation as described in section 7.1.2.

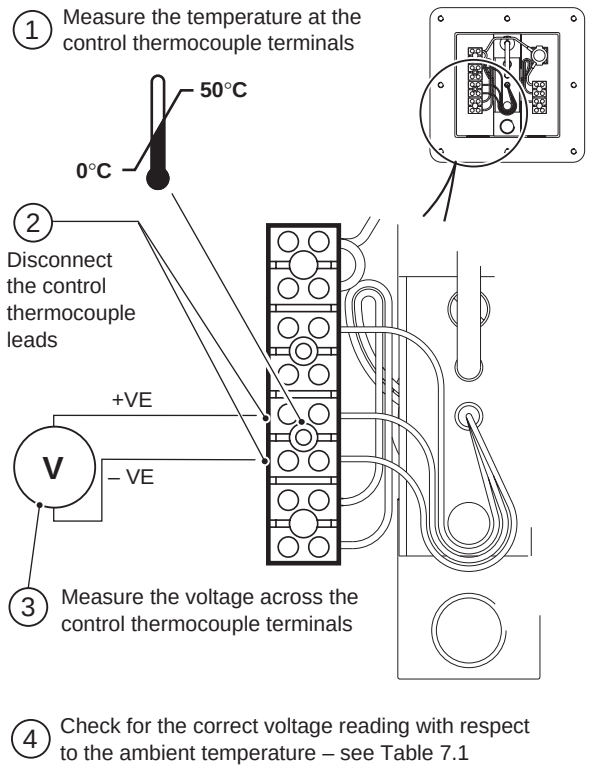


Fig. 7.1 Checking the Control Thermocouple

Ambient Temp. (°C)	Thermocouple mV	Ambient Temp. (°C)	Thermocouple mV
50	26.266	24	27.328
49	26.307	23	27.369
48	26.348	22	27.409
47	26.389	21	27.450
46	26.430	20	27.490
45	26.471	19	27.530
44	26.512	18	27.570
43	26.554	17	27.611
42	26.595	16	27.651
41	26.636	15	27.691
40	26.677	14	27.731
39	26.718	13	27.771
38	26.759	12	27.811
37	26.799	11	27.851
36	26.840	10	27.891
35	26.881	9	27.931
34	26.922	8	27.971
33	26.963	7	28.011
32	27.003	6	28.050
31	27.044	5	28.090
30	27.085	4	28.130
29	27.126	3	28.169
28	27.166	2	28.209
27	27.207	1	28.249
26	27.247	0	28.288
25	27.288		

Table 7.1 – Control Thermocouple v. Ambient Temperature (680°C)

7.1.2 Checking the Heater Resistance – Fig. 7.2

Warning. To check the heater resistance it is necessary to remove the probe's connection cover, thus invalidating the explosion proof integrity. Consequently, before removing the connection cover ensure that their are no hazardous gases present or, alternatively, remove the probe from the hazardous area.

a) Switch off the mains power supply to the Interface Electronics Unit.

b) Check the resistance of the probe heater as described in Fig. 7.2.

If the heater resistance is **correct**, check the loop resistance of the heater circuit at the Interface Electronics Unit.

If the loop impedance is **correct**, replace the zirconia cell as described in Section 8.2.

If the heater resistance is **incorrect** replace the heater assembly as described in Section 8.5.

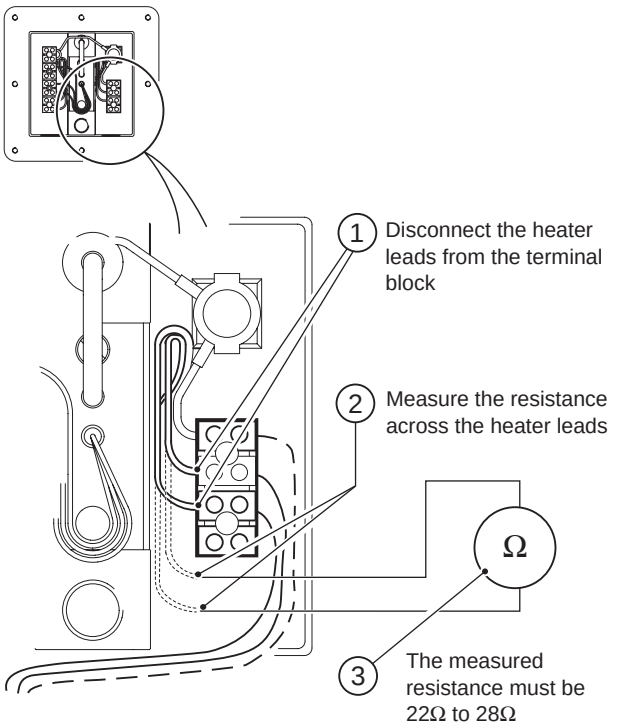


Fig. 7.2 Checking the Heater Resistance

7.2 Checking the Trip Thermocouple – Fig. 7.3

Warning. To check operation of the trip thermocouple, the probe's connection cover must be removed, thus invalidating the explosion proof integrity. Consequently, before removing the connection cover ensure that their are no hazardous gases present or, alternatively, remove the probe from the hazardous area.

a) Remove the connection cover as described in Section 4.2.1.

Warning. The probe heater terminals are at high voltage (55V a.c.). Take all necessary precautions against electric shock when measuring voltages inside the probe head.

b) Check the trip thermocouple voltage as shown in Fig. 7.3.

Caution. The trip thermocouple voltage must be within ±0.2mV of the voltages listed in Table 7.2, or the probe's certification is invalidated.

c) Ensure the measured voltage is **correct**.

d) If the measured voltage is **incorrect**, check the position of the trip thermocouple inside the heater then check the trip thermocouple voltage again. If the voltage is still incorrect, replace the trip thermocouple assembly as described in Section 8.6.

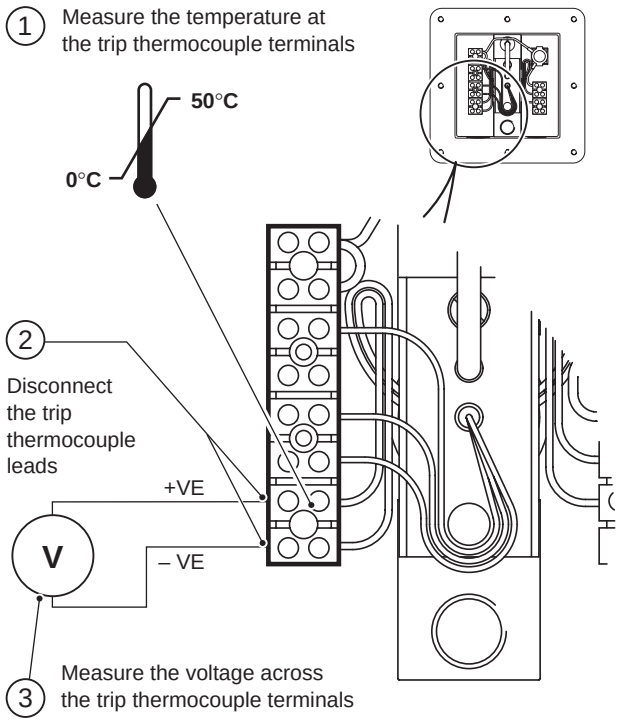


Fig. 7.3 Checking the Trip Thermocouple

Ambient Temp. (°C)	Thermocouple mV	Ambient Temp. (°C)	Thermocouple mV
50	21.815	24	22.877
49	21.856	23	22.918
48	21.897	22	22.958
47	21.938	21	22.999
46	21.979	20	23.039
45	22.020	19	23.079
44	22.061	18	23.119
43	22.103	17	23.160
42	22.144	16	23.200
41	22.185	15	23.240
40	22.226	14	23.280
39	22.267	13	23.320
38	22.308	12	23.360
37	22.348	11	23.400
36	22.389	10	23.440
35	22.430	9	23.480
34	22.471	8	23.520
33	22.512	7	23.560
32	22.552	6	23.599
31	22.593	5	23.639
30	22.634	4	23.679
29	22.675	3	23.718
28	22.715	2	23.758
27	22.756	1	23.798
26	22.796	0	23.837
25	22.837		

Table 7.2 – Trip Thermocouple v. Ambient Temperature (575°C)

8 DISMANTLING AND RE-ASSEMBLY

Warning. Repairs and refurbishing of apparatus with type of protection 'd' should be performed only by the original manufacturer, authorized agents or a repairer who is conversant with the construction standards for flameproof equipment and demonstrates the ability to understand certification restraints. (*Extract from BS5345.*)

Caution.

- The probe is a certified flameproof enclosure. Therefore, clearances and surface finishes between mating parts and lengths of spigot type joints **MUST NOT** be damaged during Dismantling and Re-assembly or any other maintenance procedures.
- If this condition is not observed, the certification of the equipment is invalidated. In the event of any damage to the equipment, refer to the Company.
- EEx d glands used on the Probe must be of the EEx d 'Barrier Gland' type with BASEEFA certification.
- All cables must conform to BS5345 for flameproof 'd' type enclosures for mechanical construction.
- Before removing the probe, thoroughly clean the outer surfaces with non-abrasive materials to prevent contamination of the inner assemblies.
- Only use replacement parts and components approved by the Company, this applies to nuts and bolts as well as component parts. Never refit damaged items.
- We recommend that a special fasteners spares kit (see Section 9.4.5) is obtained prior to work on any of the dismantling and re-assembly procedures described in this section.

Tools Required

Maintenance Procedure	Tools Required
Replacing the Ceramic Filter	1 Torque driver 0 to 5Nm (with right-angle adaptor) fitted with an M3 hexagon wrench or M3 Allen key 2 Small/medium hacksaw
Replacing the Zirconia Cell	1 Torque driver 0 to 5Nm (with right-angle adaptor) fitted with an M3 hexagon wrench or M3 Allen key 2 Small/medium hacksaw 3 Scalpel 4 M4 open-ended spanner
Replacing the Thermocouple/Electrode Lead Assembly	1 Torque driver 0 to 5Nm (with right-angle adaptor) fitted with an M3 hexagon wrench or M3 Allen key 2 Small/medium hacksaw 3 Scalpel 4 M4 open-ended spanner 5 Two slot-head screwdrivers, one small, one medium
Removing the Probe Body	1 Torque driver 0 to 5Nm (with right-angle adaptor) fitted with an M3 hexagon wrench or M3 Allen key 2 Small/medium hacksaw 3 Scalpel 4 M4 open-ended spanner 5 Two slot-head screwdrivers, one small, one medium
Replacing the Heater Assembly	1 Torque driver 0 to 5Nm (with right-angle adaptor) fitted with an M3 hexagon wrench or M3 Allen key 2 Small/medium hacksaw 3 Scalpel 4 M4 open-ended spanners (x 2) 5 Two slot-head screwdrivers, one small, one medium 6 5.5mm Open-ended spanner 7 Long nosed pliers (x 1 pair)
Replacing the Trip/Thermocouple Assembly	1 Torque driver 0 to 5Nm (with right-angle adaptor) fitted with an M3 hexagon wrench or M3 Allen key 2 Small/medium hacksaw 3 Scalpel 4 M4 open-ended spanners (x 2) 5 Two slot-head screwdrivers, one small, one medium 6 5.5mm Open-ended spanner 7 Long nosed pliers (x 1 pair)

Table 8 – Identification of Tools

8.1 Replacing the Ceramic Filter – Fig. 8.1

A ceramic filter kit is required when replacing the ceramic filter – see Section 9.4.3.

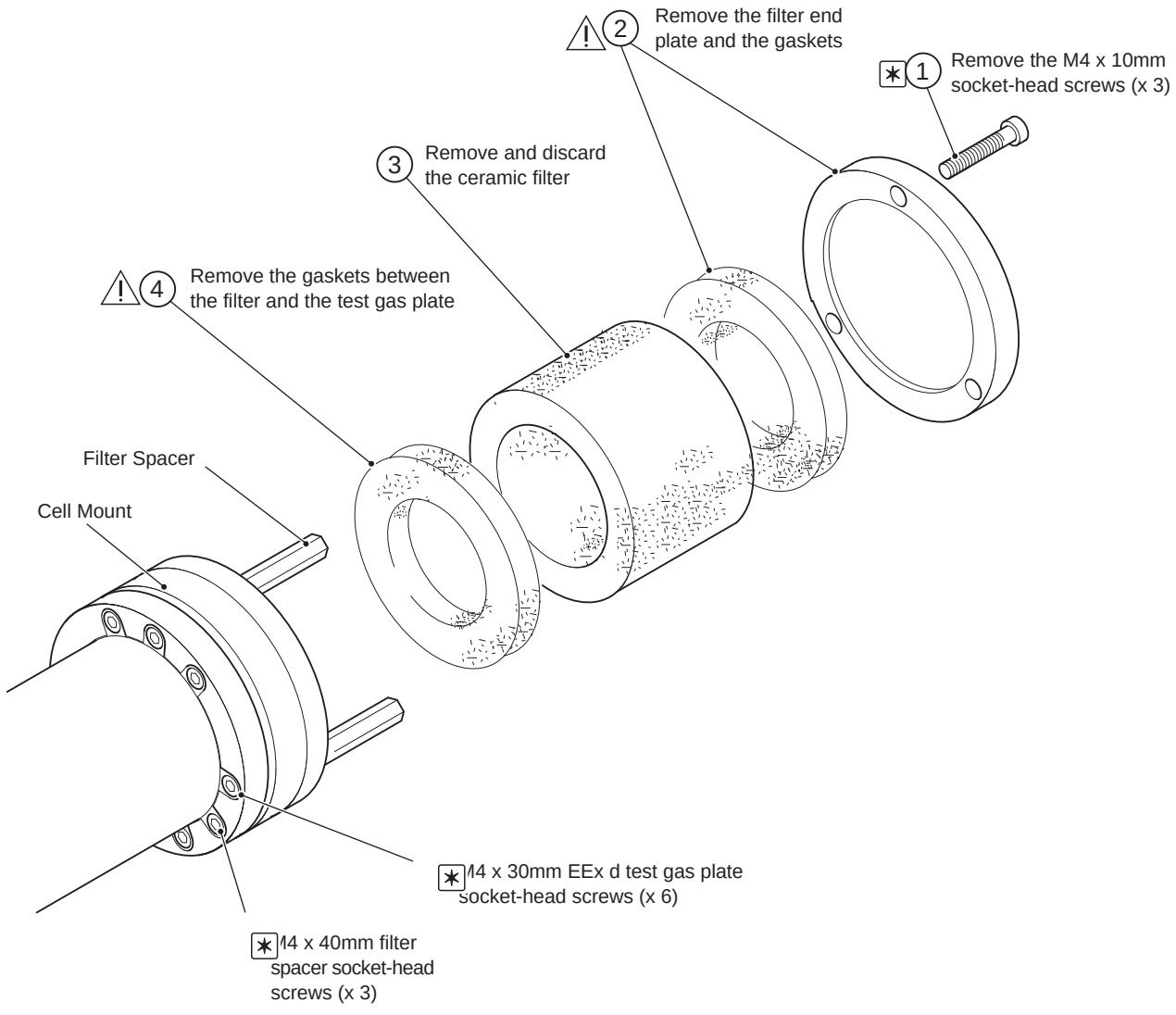
8.1.1 Removing the Ceramic Filter – Fig. 8.1

Remove the ceramic filter as described in Fig. 8.1.

8.1.2 Fitting the Ceramic Filter – Fig. 8.1

Fit a replacement filter by reversing the procedure described in Fig. 8.1.

When refitting, insert a sufficient number of gaskets to allow the securing screws to hold the filter firmly in position.



Caution. There must be at least two gaskets on the cell side of the filter and at least one on the end plate side. The central hole in the filter gaskets is enlarged to allow free flow of test gas past the gaskets. Ensure that the gaskets are positioned concentric with the filter to prevent any test gas flow restriction. Torque the screws evenly to 3ft-lbs (4Nm). Do not overtighten.

Note. If screws have seized, refer to Fig. 8.15 on page 33 and cut at points A and B.

Fig. 8.1 Replacing the Ceramic Filter

8.2 Replacing the Zirconia Cell

A zirconia cell assembly is required when replacing the zirconia cell – see Section 9.4.2.

8.2.1 Removing the Zirconia Cell – Fig. 8.2

a) Remove the ceramic filter as described in Section 8.1.1.

b) Remove the zirconia cell as described in Fig. 8.2.

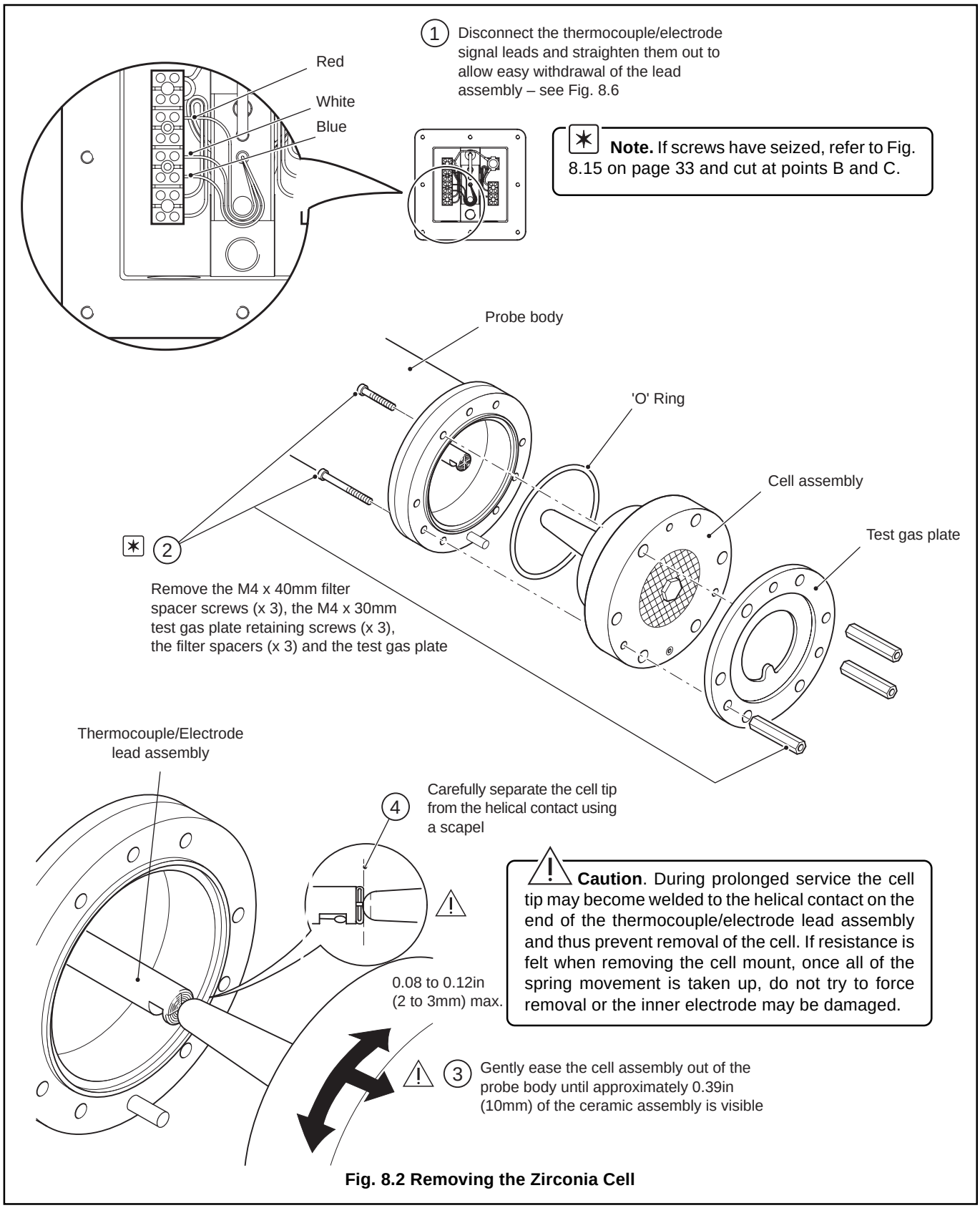


Fig. 8.2 Removing the Zirconia Cell

8.2.2 Fitting the Zirconia Cell – Fig. 8.3

a) Carry out the procedures described in Fig. 8.3.

b) Refit the ceramic filter as described in Section 8.1.2.

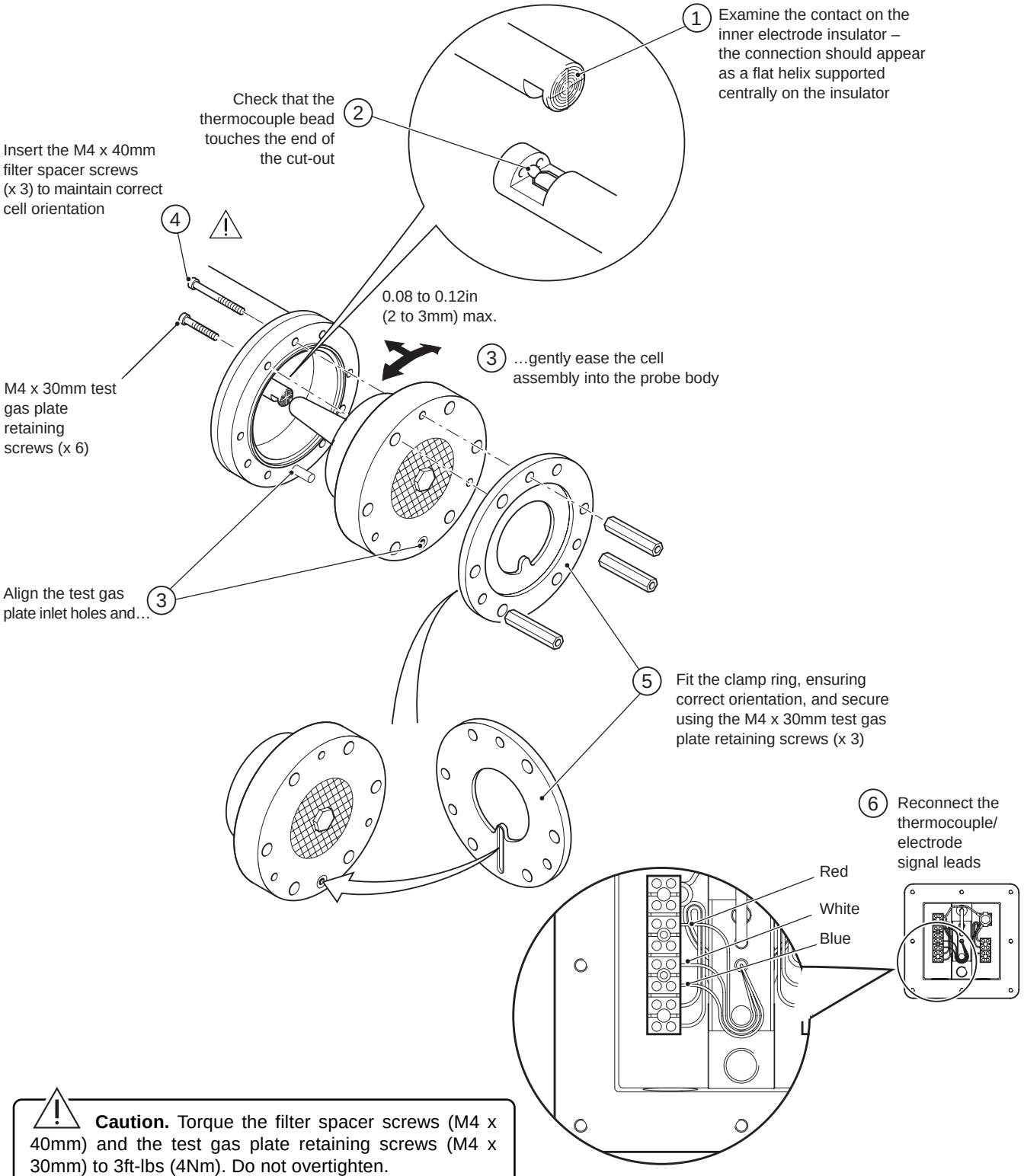


Fig. 8.3 Fitting the Zirconia Cell

8.3 Replacing the Thermocouple/Electrode Lead Assembly

An electrode/thermocouple assembly is required when replacing the electrode/thermocouple lead assembly – see Section 9.4.1

8.3.1 Removing the Thermocouple/Electrode Lead Assembly – Fig. 8.4

a) Remove the ceramic filter as described in Section 8.1.1.

b) Remove the zirconia cell as described in Section 8.2.1.

c) Remove the thermocouple/electrode lead assembly as described in Fig. 8.4.

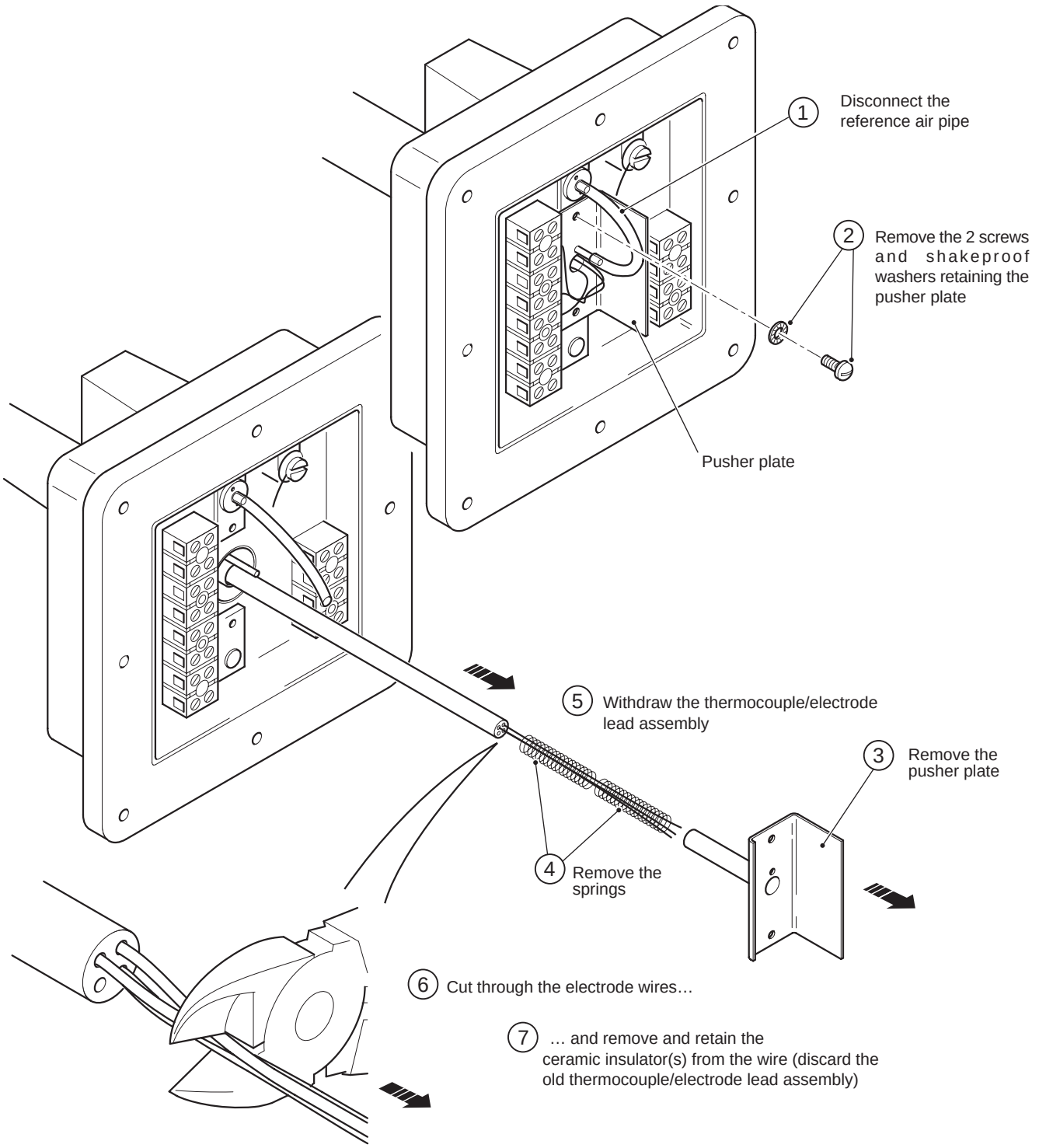


Fig. 8.4 Removing the Thermocouple/Electrode Lead Assembly

8.3.2 Fitting Ceramic Insulators – Fig. 8.5

a) Lay the new thermocouple/electrode lead assembly at the end of a long work surface and carefully uncoil the extension wires, one at a time.

Note. To retain the uncoiled lead ends during fitting, use a clamping block constructed from a wooden board and three bulldog clips – see Fig. 8.5.

Caution. Do not to kink the wires during fitting to avoid damage to the finished assembly.

b) Refit the ceramic insulators as described in Fig. 8.5.

c) Refit the zirconia cell as described in Section 8.2.2.

d) Refit the ceramic filter as described in Section 8.1.2.

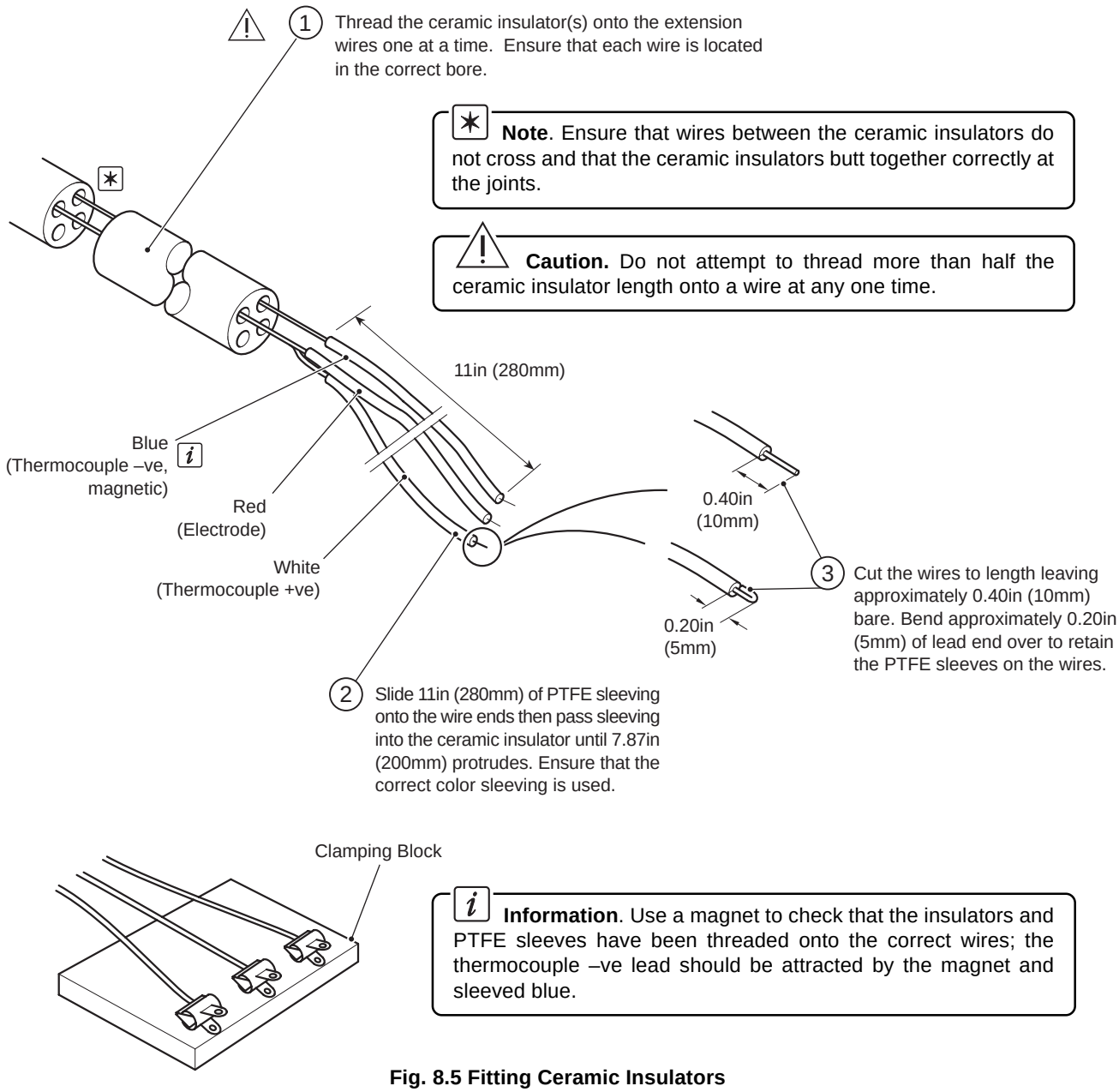


Fig. 8.5 Fitting Ceramic Insulators

8.3.3 Fitting the Thermocouple/Electrode Lead Assembly – Fig. 8.6

a) Refit the thermocouple/electrode lead assembly as described in Fig. 8.6.

b) Refit the zirconia cell as described in Section 8.2.2.

c) Refit the ceramic filter as described in Section 8.1.2.

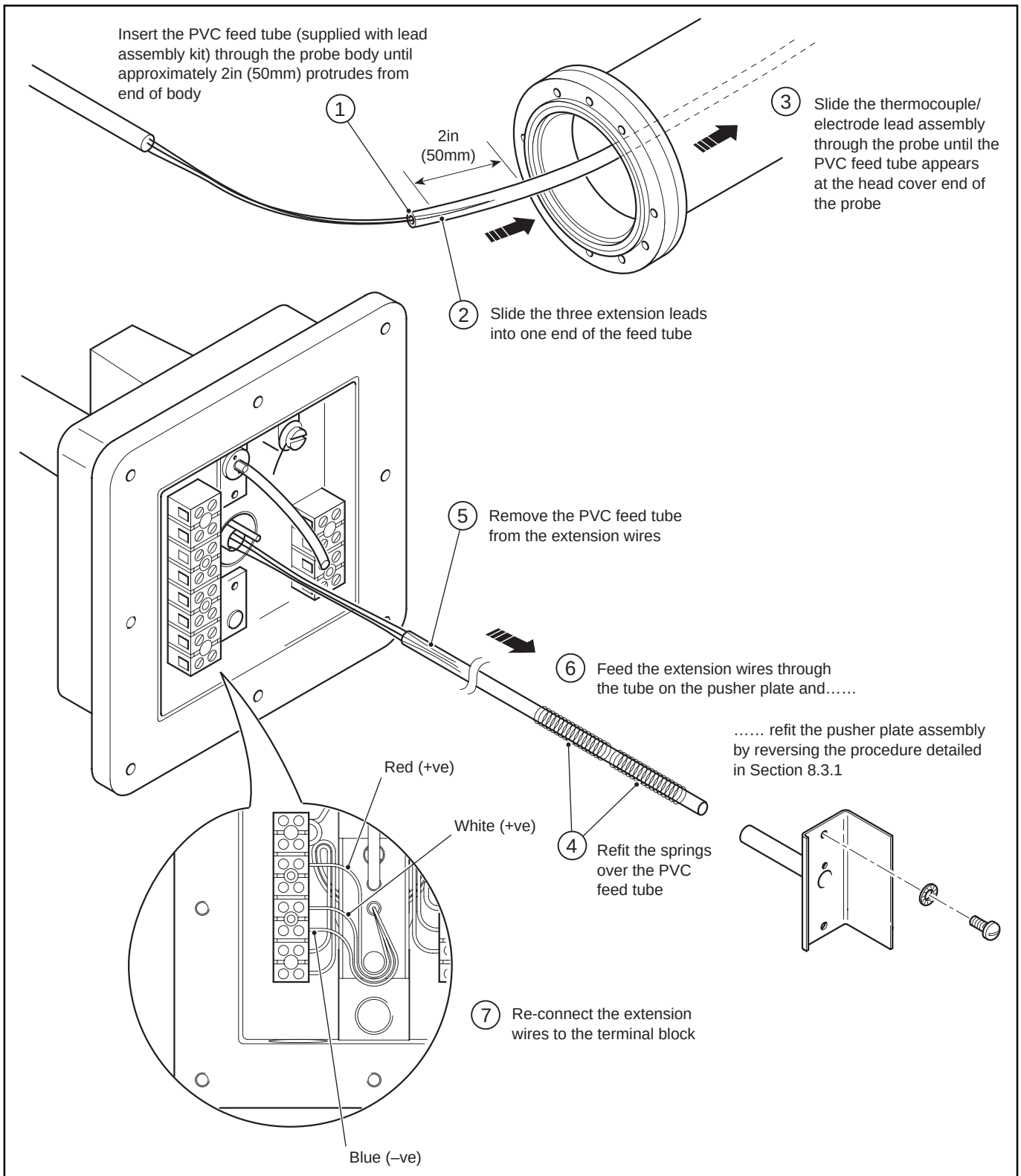


Fig. 8.6 Fitting the Thermocouple/Electrode Assembly

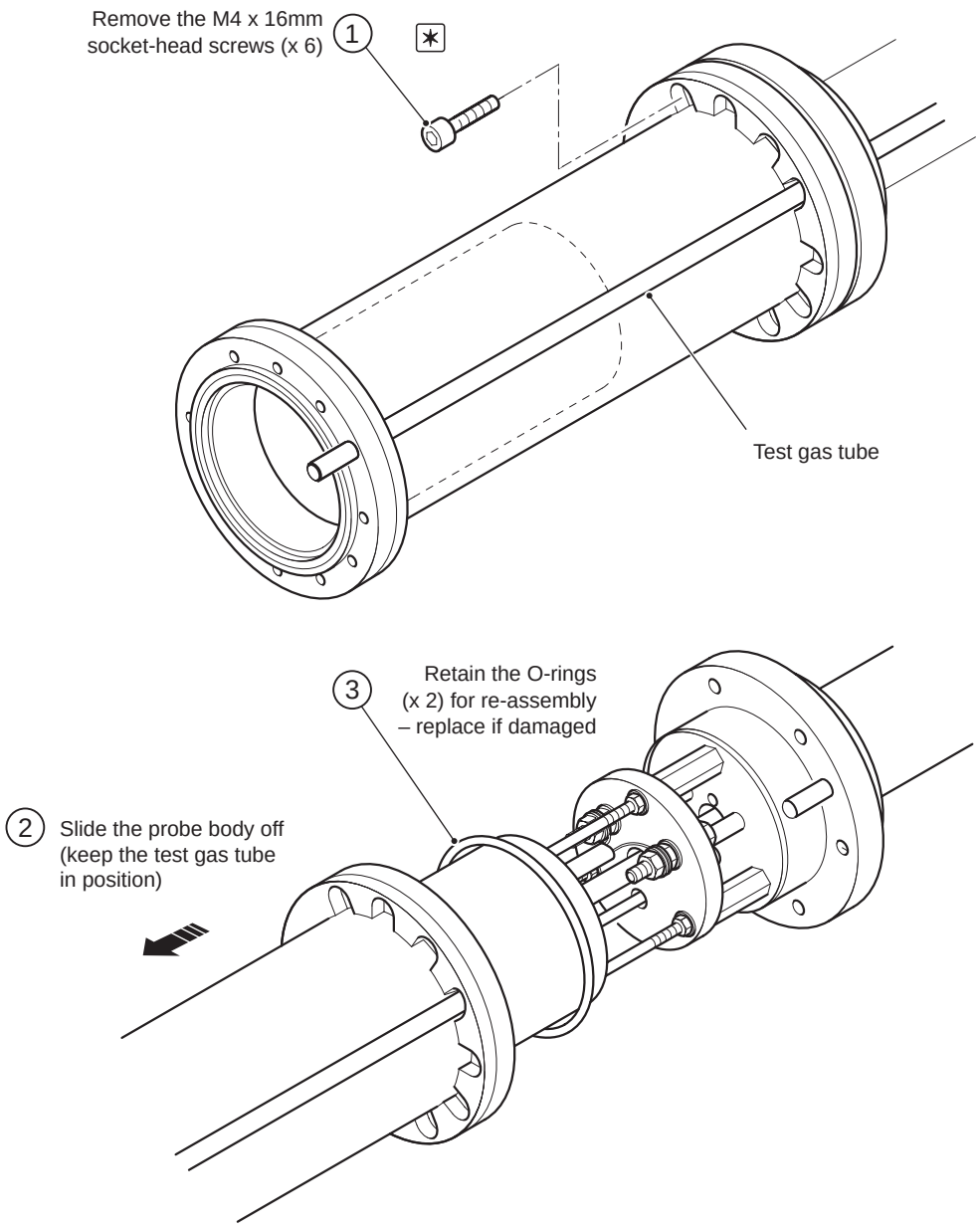
8.4 Removing the Probe Body – Fig. 8.7

A special fasteners kit is required when refitting the probe body – see Section 9.4.5.

a) Remove the ceramic filter as described in Section 8.1.1.

b) Remove the zirconia cell as described in Section 8.2.1.

c) Remove the probe body described in Fig. 8.7.



Note. If screws have seized refer to Fig. 8.15, page 33 and cut at point C.

Fig. 8.7 Removing the Probe Body

8.5 Replacing the Heater Assembly

A new heater assembly is required when replacing the heater assembly – see Section 9.4.4.

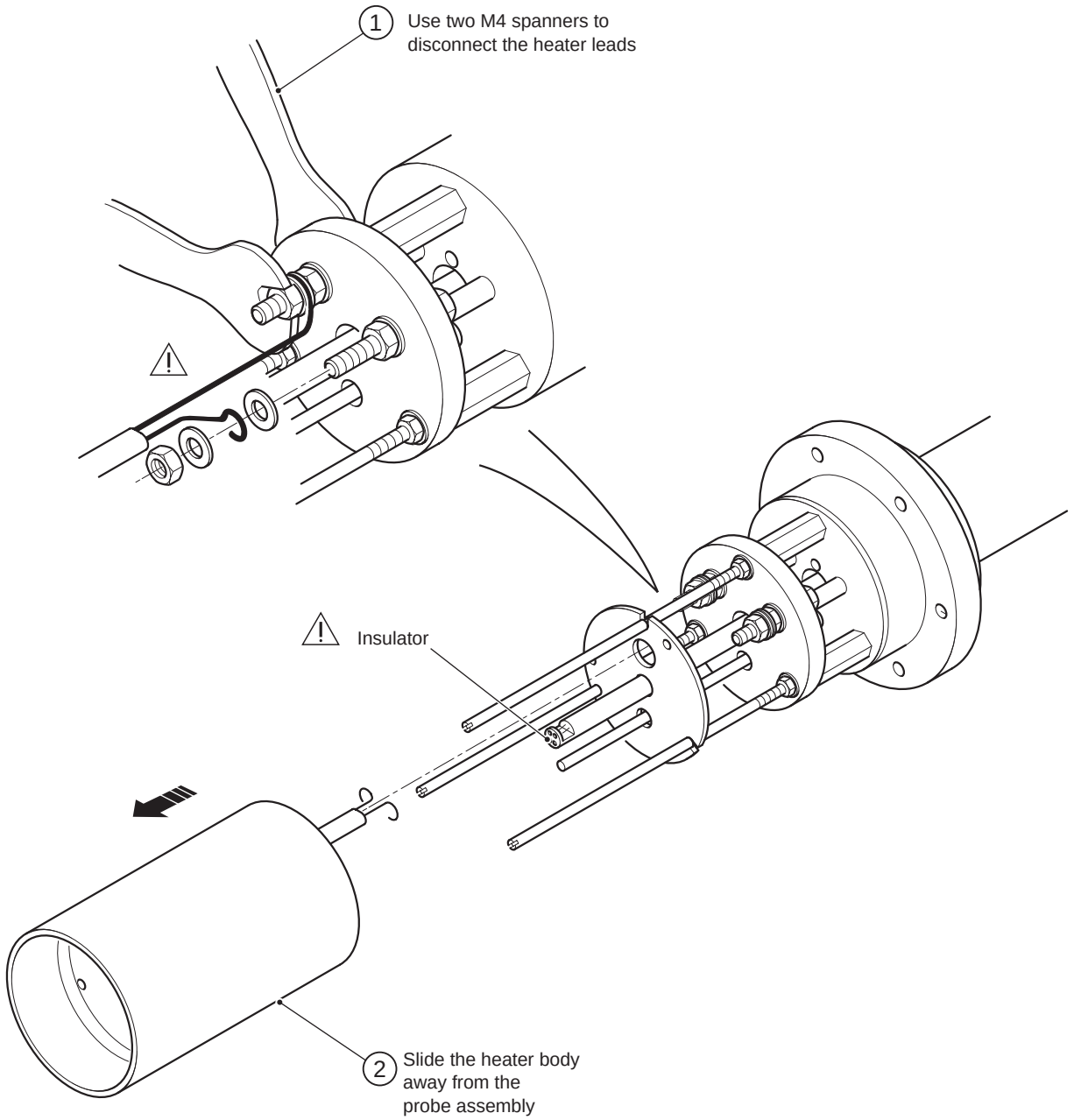
8.5.1 Removing the Heater Assembly – Fig. 8.8

a) Remove the ceramic filter as described in Section 8.1.1

b) Remove the zirconia cell as described in Section 8.2.1.

c) Remove the probe body described in Section 8.4.

d) Remove the heater assembly as described in Fig. 8.8.



Caution. Do not damage the insulator or stress the heater wires when removing the heater body.

Fig. 8.8 Removing the Heater Assembly

8.5.2 Fitting the Heater Assembly – Fig. 8.9

a) Refit the heater assembly as described in Fig. 8.9

b) Align the heater assembly as described in Fig. 8.10.

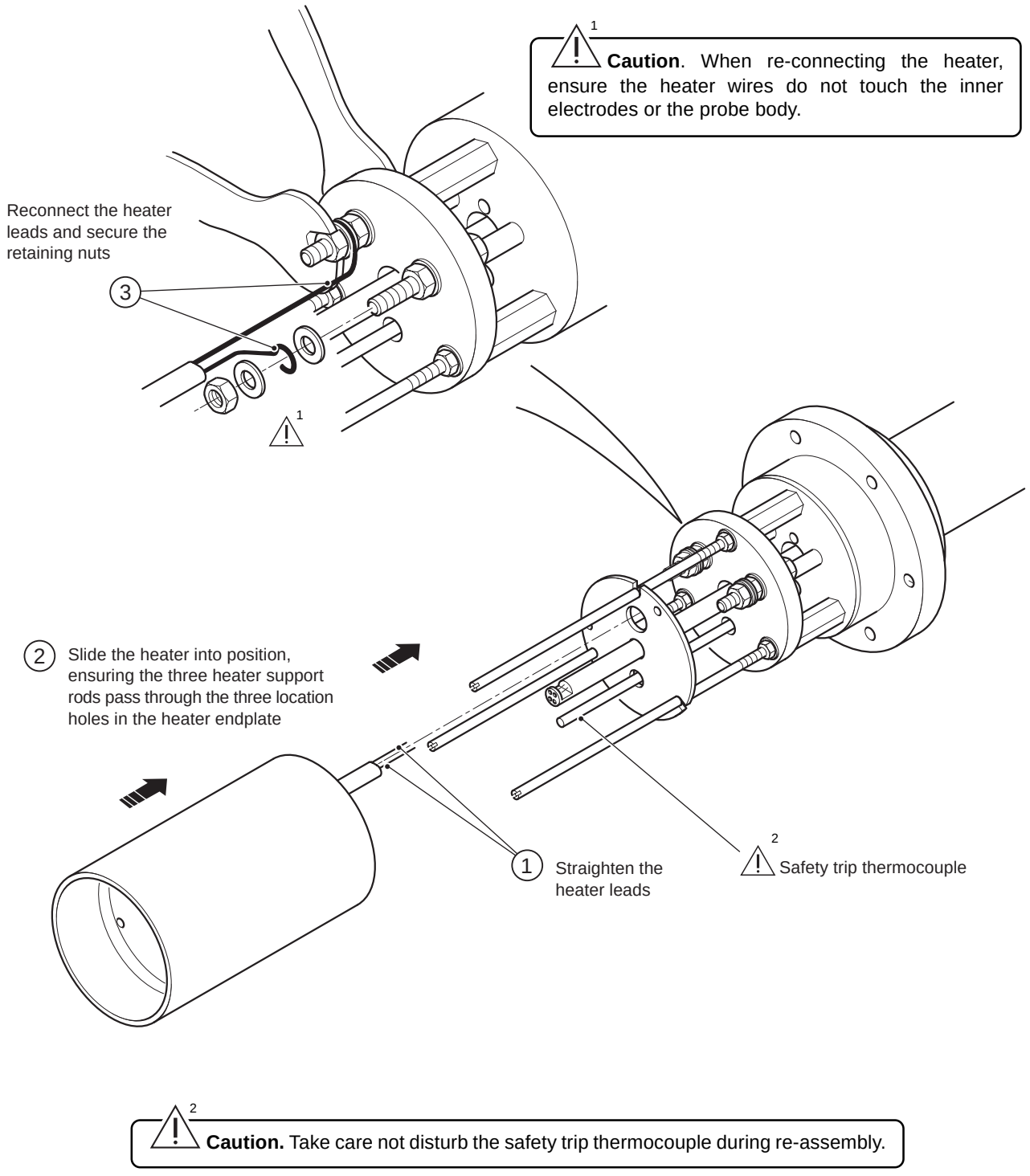


Fig. 8.9 Fitting the Heater Assembly

8.5.3 Aligning the Heater Assembly – Figs. 8.10, 8.11 and 8.12

a) Align the heater assembly as described Figs. 8.10, 8.11 and 8.12.

b) Refit the probe body by reversing the steps described in Fig. 8.7.

c) Refit the zirconia cell as described in Section 8.2.2.

d) Refit the ceramic filter as described in Section 8.1.2.

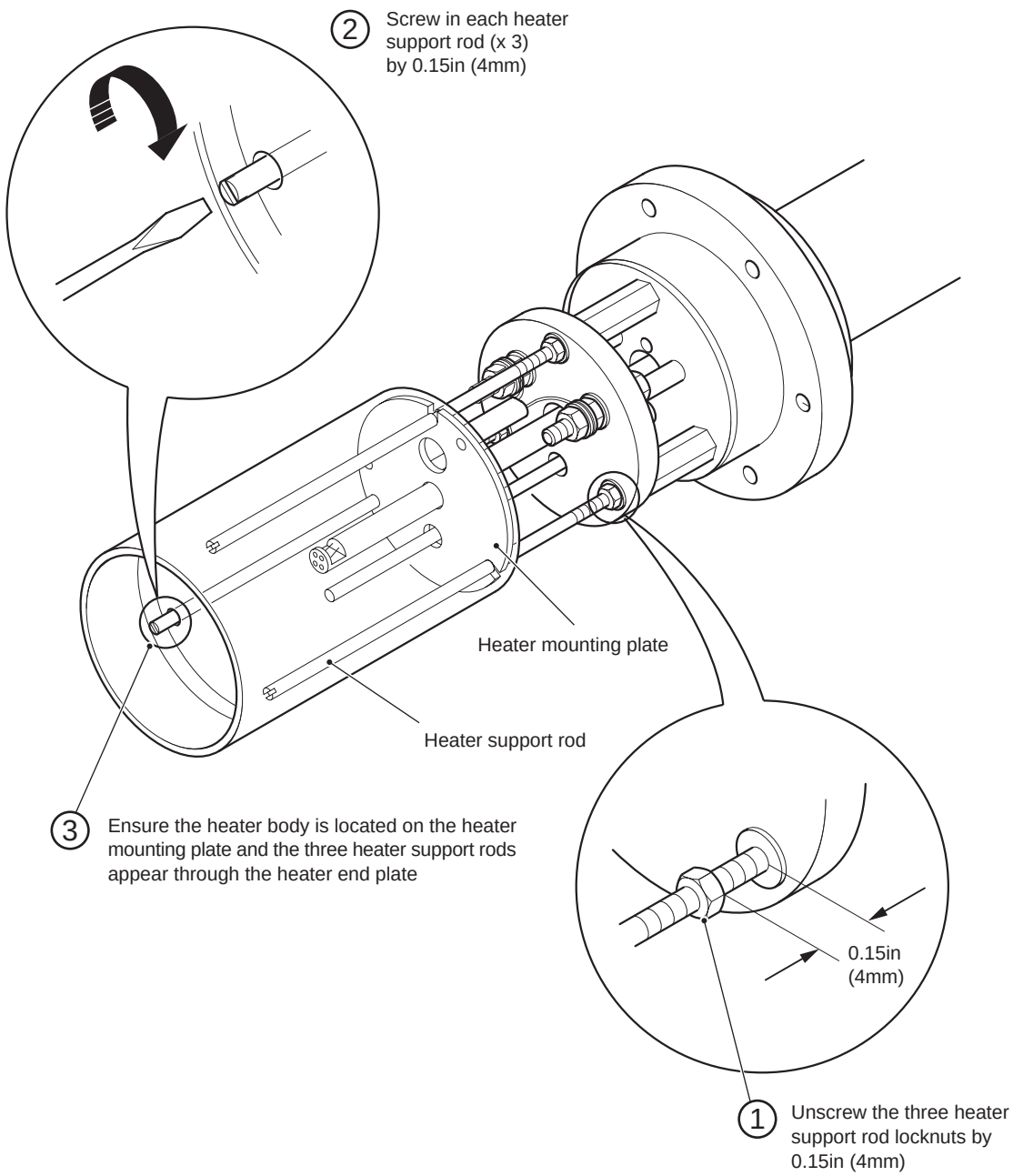
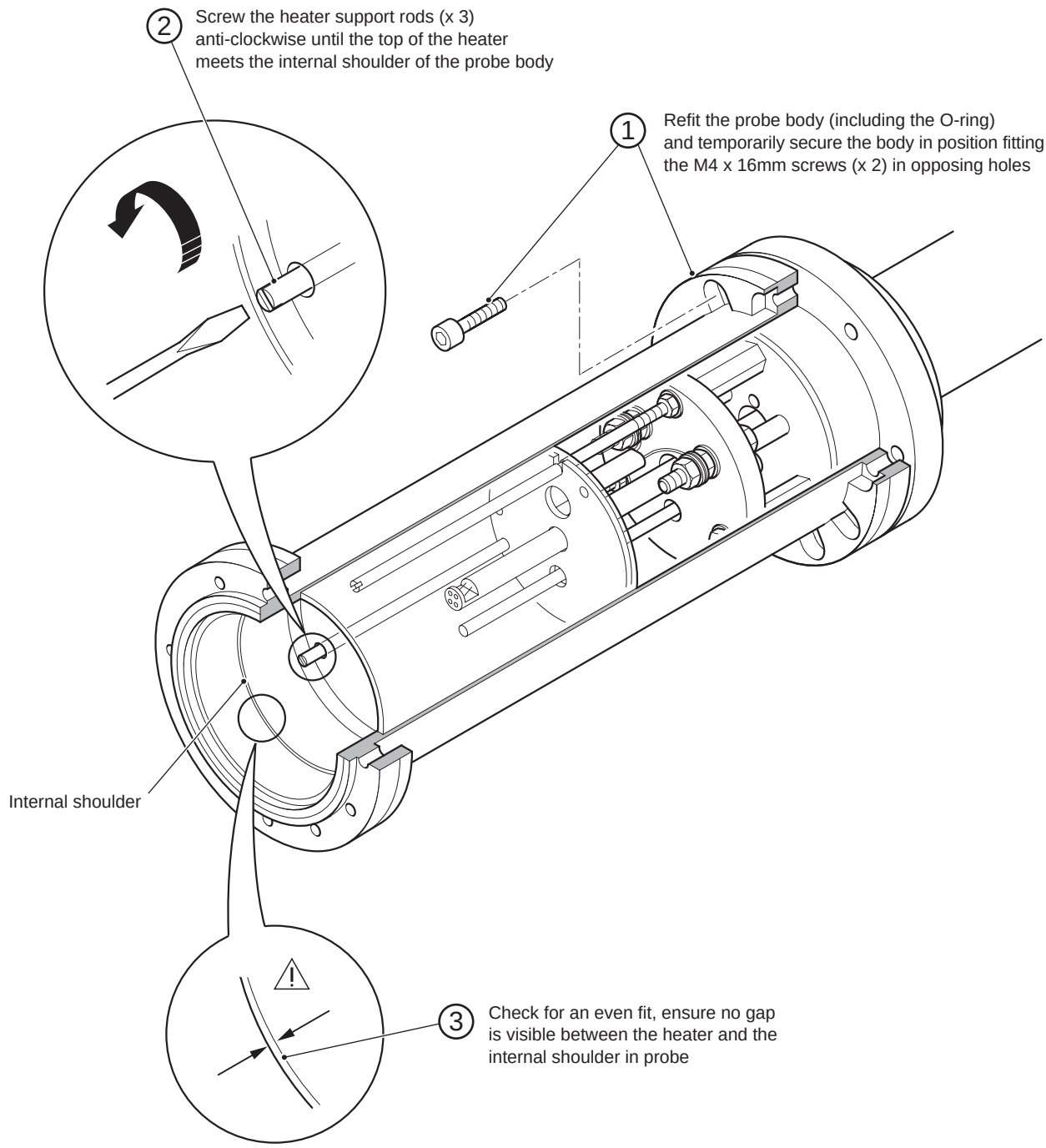


Fig. 8.10 Aligning the Heater Assembly – Preparation

…8.5.3 Aligning the Heater Assembly



Caution. Do not force the heater into the probe shoulder by overtightening the heater support rods.

Fig. 8.11 Aligning the Heater Assembly – Checking Heater Alignment

…8.5.3 Aligning the Heater Assembly

Caution. After refitting the heater, check the trip thermocouple voltage (see Section 7.2), or the probe's certification is invalidated.

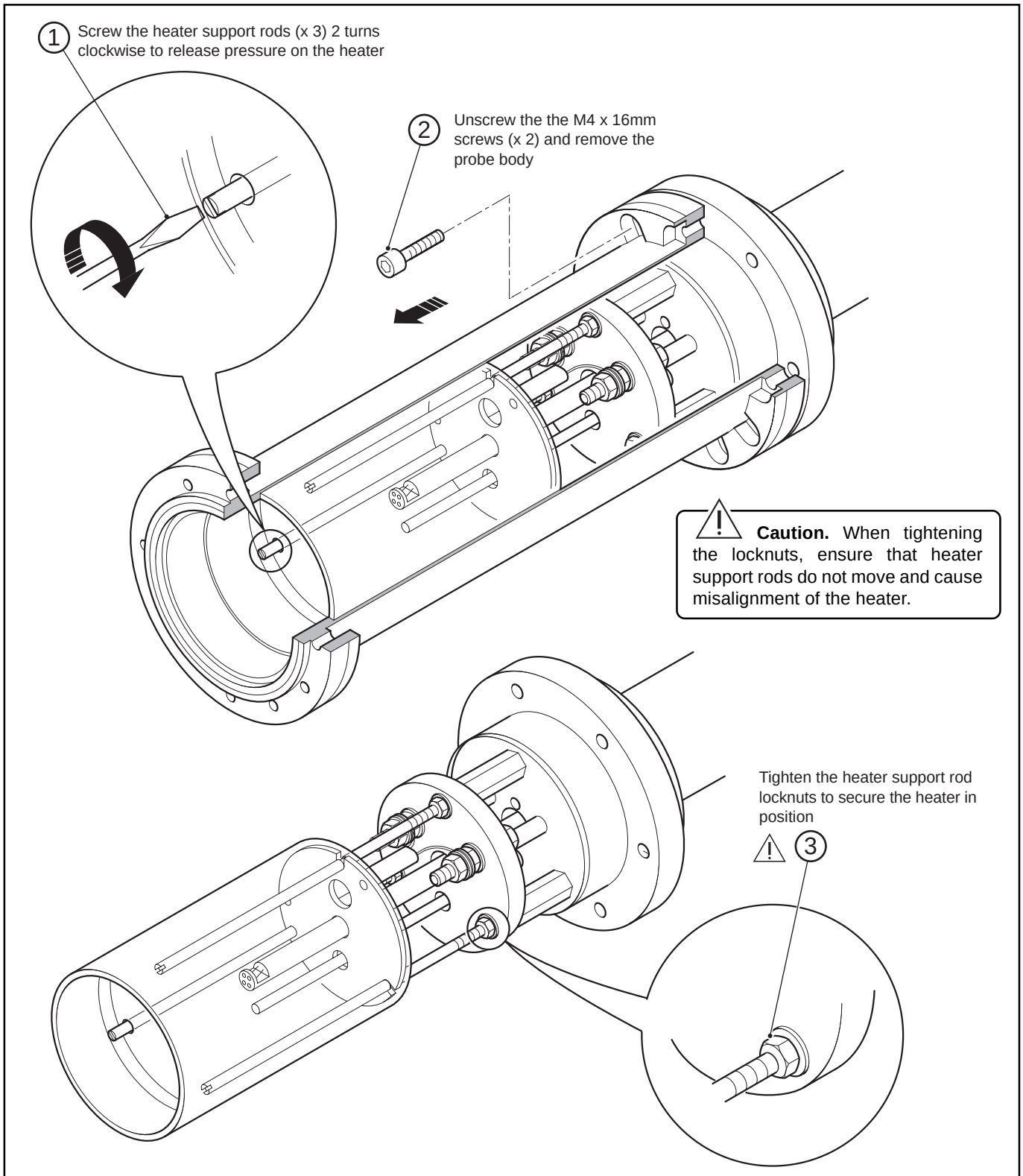


Fig. 8.12 Aligning the Heater Assembly – Locking Heater into Position

8.6 Replacing the Trip Thermocouple Assembly

A replacement trip thermocouple assembly is required for this procedure – see Section 9, Fig. 9.1b, item 35.

8.6.1 Removing the Trip Thermocouple Assembly – Fig. 8.13

a) Remove the ceramic filter as described in Section 8.1.1.

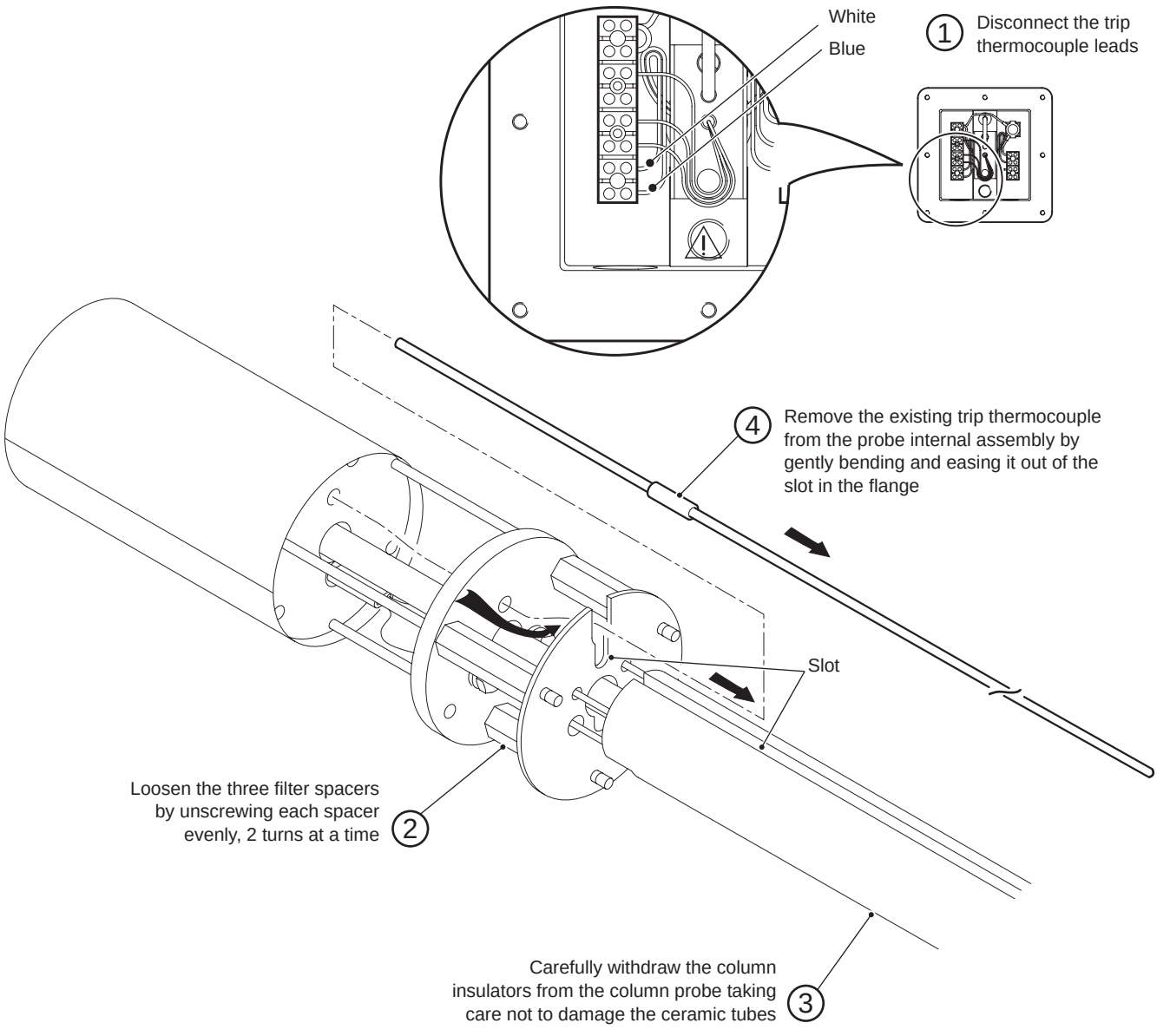
b) Remove the zirconia cell as described in Section 8.2.1.

c) Remove the probe body described in Section. 8.4.

d) Disconnect the thermocouple/electrode lead assembly as described in Section 8.3.1.

e) Disconnect the trip thermocouple leads in the terminal head – see Section 4.

f) Remove the trip thermocouple assembly as described in Fig. 8.13.



Caution. When withdrawing the trip thermocouple, do not apply stress on supporting components.

Fig. 8.13 Removing the Trip Thermocouple Assembly

8.6.2 Fitting the Trip Thermocouple Assembly – Fig. 8.14

a) Re-assemble the trip thermocouple assembly as described Fig. 8.14.

b) Re-connect the trip thermocouple leads in the terminal head – see Section 4.

c) Refit the thermocouple/electrode lead assembly as described in Sections 8.3.2 and 8.3.3.

d) Refit the probe body by reversing the steps described in Section 8.4.

e) Refit the zirconia cell as described in Section 8.2.2.

f) Refit the ceramic filter as described in Section 8.1.2.

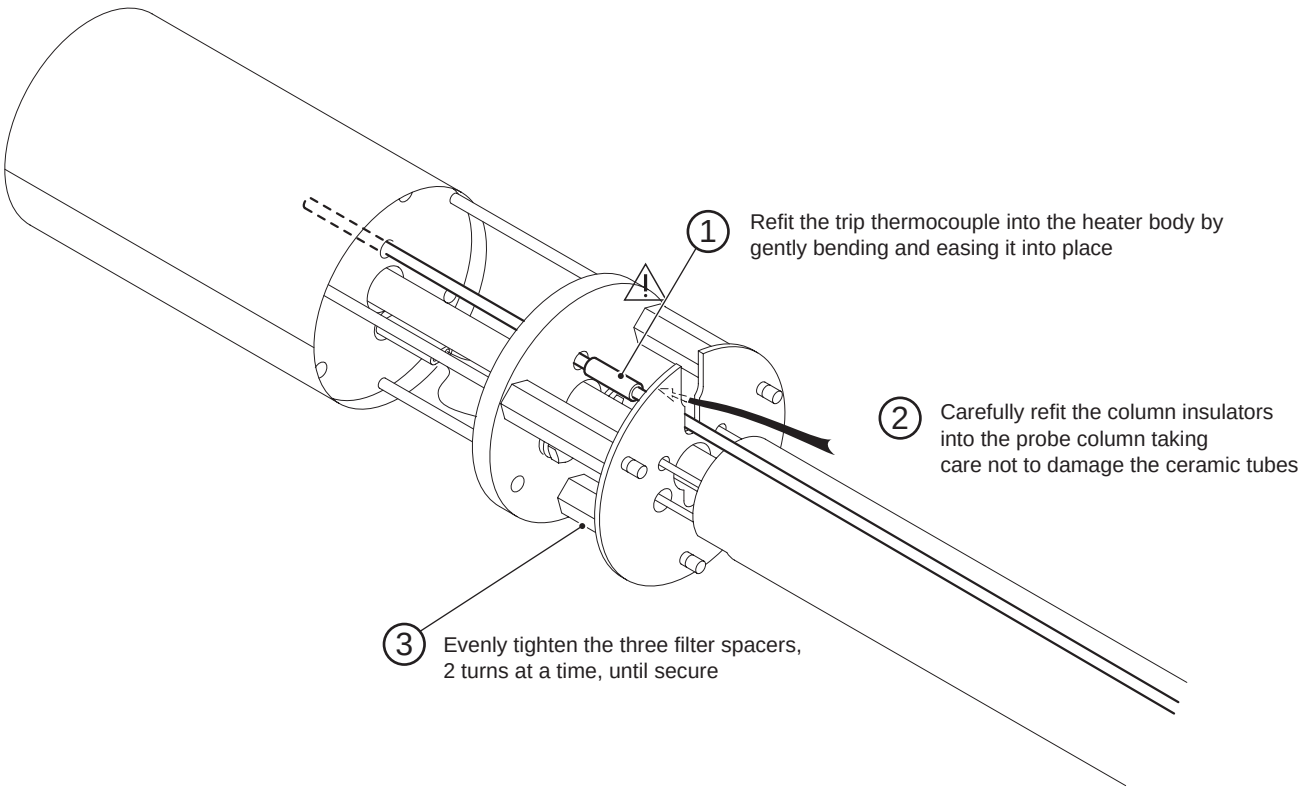
g) When the probe is fully assembled:

i) Switch on the EXFG Interface Electronics Unit.

ii) When heater operating temperature is reached (after approximately 15 minutes) leave for a further 1 hour to stabilize.

iii) Check the trip thermocouple voltage as described in Section 7.2.

Caution. The trip thermocouple voltage must be within the limits stated in Section 7.2, or the probe's certification is invalidated.



Caution.

- When refitting the trip thermocouple, do not stress supporting or adjacent components.
- The trip thermocouple must be positioned accurately inside the heater element to ensure accurate voltage readings when checking the trip thermocouple voltage – see Section 8.6.2, step g).

Fig. 8.14 Fitting the Trip Thermocouple Assembly

8.7 Removing Seized Screws – Fig. 8.15

During prolonged service in a high temperature screws may become seized. Seized screws must be cut (using a suitable hacksaw) and removed to allow sub-assemblies to be dismantled or removed.

Authorized replacement screws (for all external fastenings) can be obtained by ordering a special fasteners spares kit – see Section 9.4.5.

Warning.

- Only cut seized screws at the cutting points identified below.
- Only fit new screws supplied by the Company – see Section 9.4.5.
- During cutting, take care not to cut or damage adjacent parts.

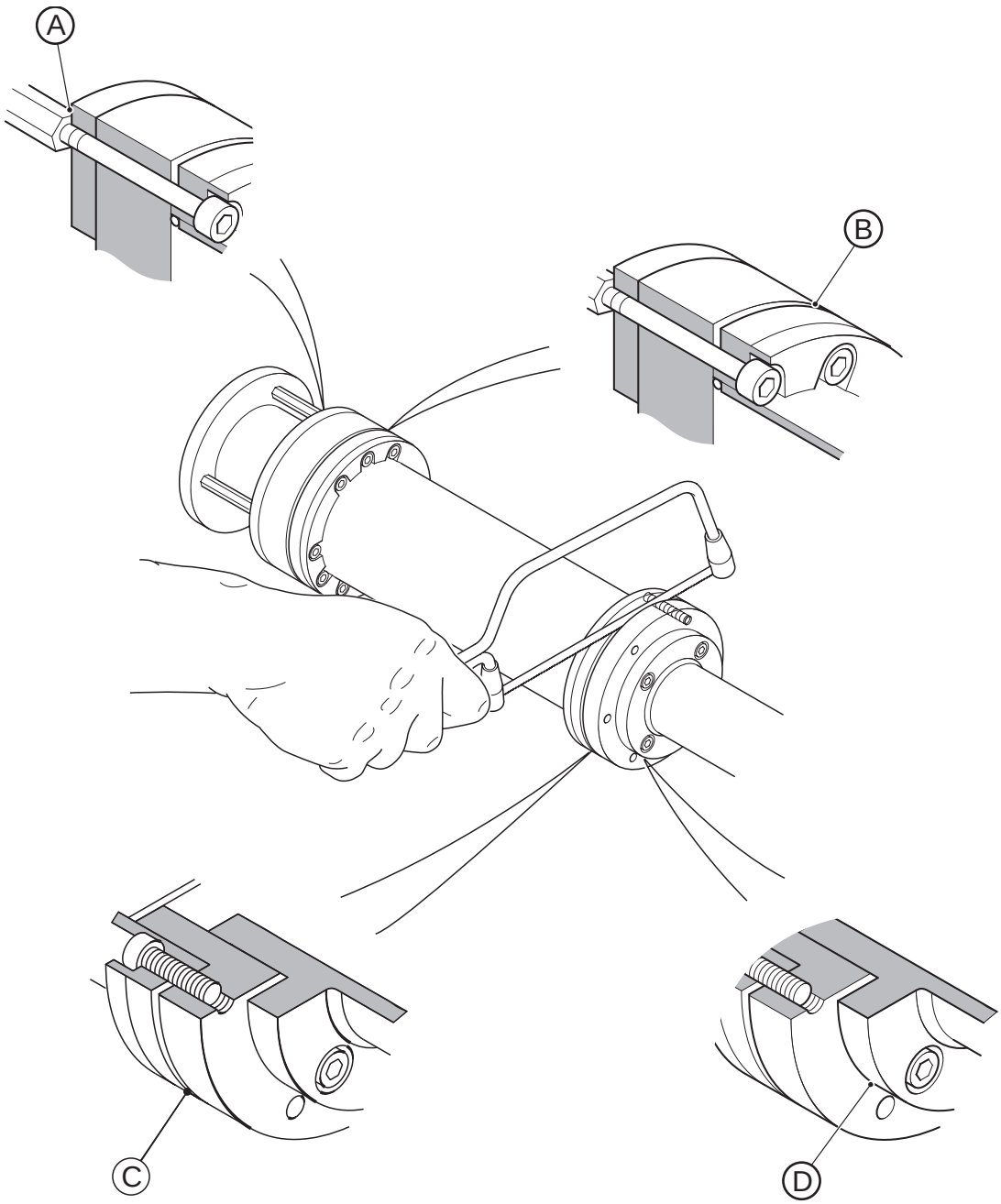


Fig. 8.15 Cutting and Removing Seized Screws

9 REPLACEMENT PARTS…

9.1 Illustrated Parts List – Fig. 9.1a and 9.1b

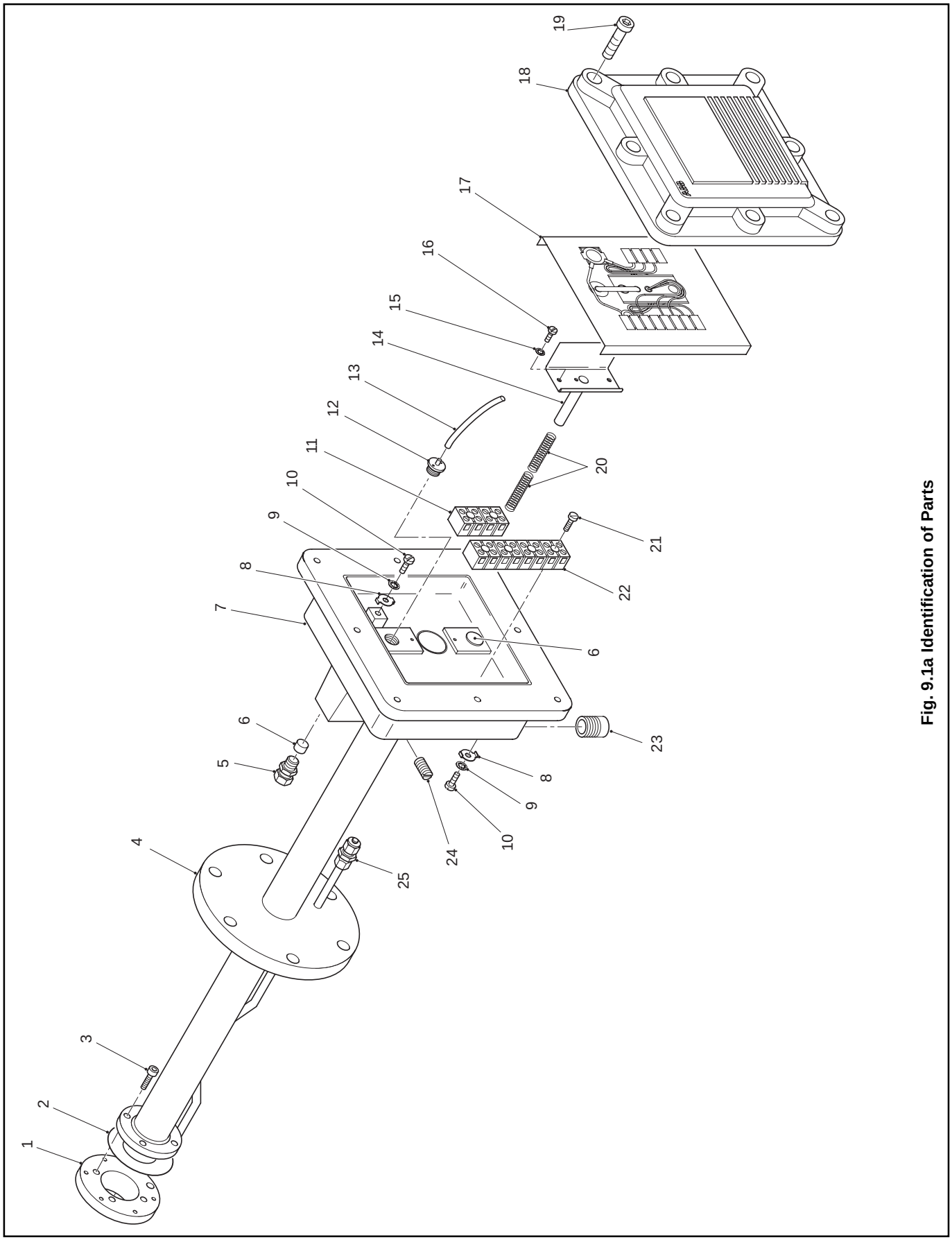


Fig. 9.1a Identification of Parts

Item	Description	Part No.	Qty.
1	EEx d column flange	EXFG/0131I	1
2	Column gasket	EXFG/0101	2
3	M4 x 10mm socket-head screw	B9760	7
4	Column assembly		
	1.64ft (0.5m) Probe body		
	Standard	EXFG/0070I	1
	ANSI	EXFG/0076I	1
	3.281ft (1.0m) Probe body		
	Standard	EXFG/007I1	
	ANSI	EXFG/0077I	1
	6.56ft (2.0m) Probe body		
	Standard	EXFG/0072I	1
	ANSI	EXFG/0078I	1
5	Union-adaptor (test gas)	B11119	2
6	Felt filter	B11117	2
7	Probe head base	EXFG/0113I	1
8	Earthing washer	EXFG/0154	2
9	M6 locking washer	B10389	2
10	M6 x 12 socket-head screw	B11130	2
	Signal earth lead*	EXFG/0050	1
	Body earth lead*	EXFG/0059	1
11	Terminal block (4-way)	B9254	1
12	Air inlet adaptor	EXFG/0119	1
13	Air inlet tube	2336Bx201006	As rqd.
14	Pusher plate assembly	EXFG/0074	1

Item	Description	Part No.	Qty.
15	M4 locking washer	J/0225/670	2
16	M4 x 10mm plain screw	J/0227/586	2
17	Connection cover	EXFG/0138	1
18	Probe head lid	EXFG/0111I	1
19	M6 x 20mm socket-head screw	B11115	8
20	Spring	B11186	2
21	M3 x 16 screw	B6417	4
22	Terminal block (8-way)	B6184	1
23	M20 x 1.5 conduit plug (EEx d) (single conduit option only)	B11116	1
24	M6 x 10mm grub screw	B11114	2
25	Coupling (test gas)	002320044	1
	or		
	Blanking plug*	003000348	1

* Items not illustrated

…9 REPLACEMENT PARTS

…9.1 Illustrated Parts List – Figs. 9.1a and 9.1b

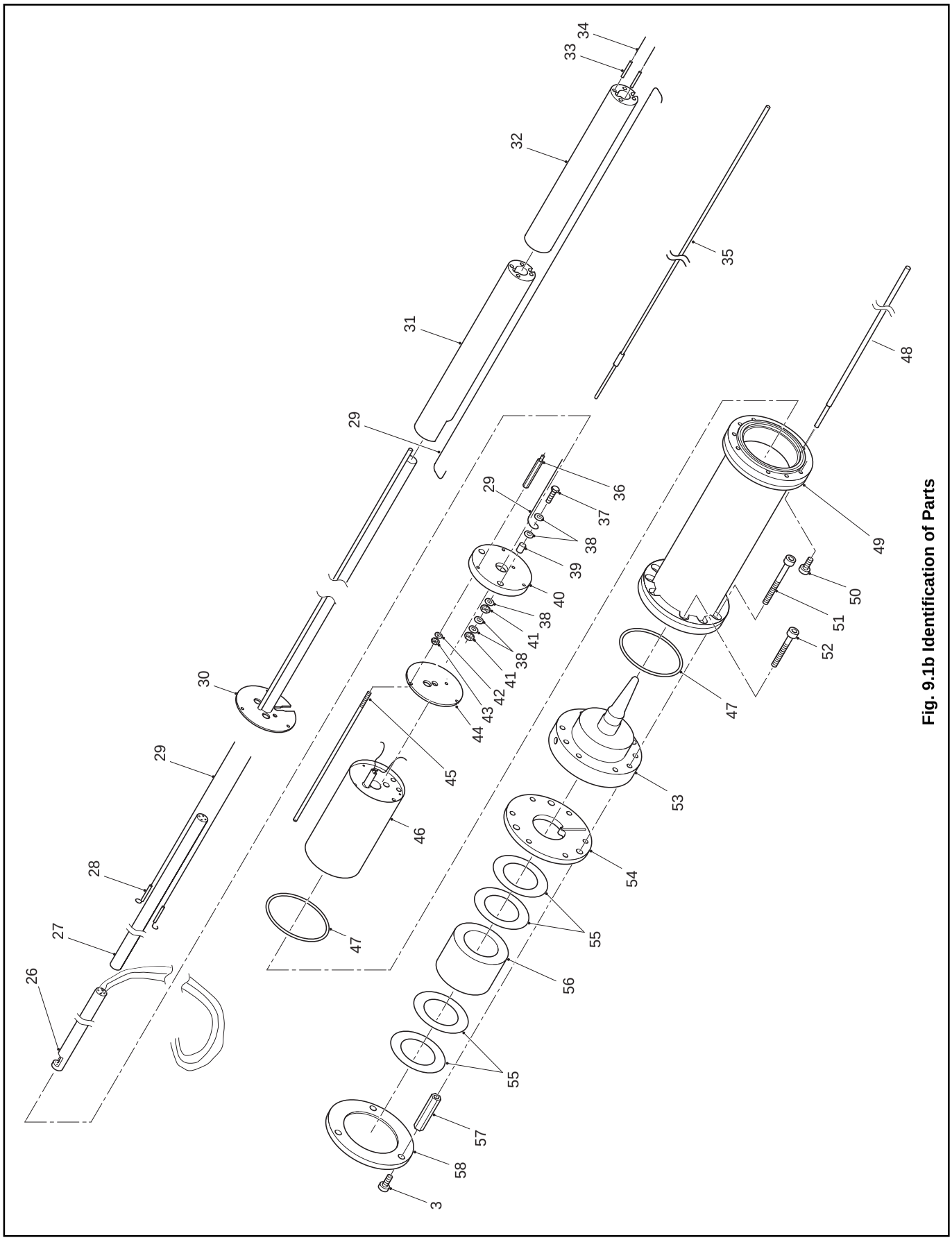


Fig. 9.1b Identification of Parts

Item	Description	Part No.	Qty.
26	Electrode/thermocouple assembly. .... see Section 9.5		
	(full replacement kit, excluding. item 27)		
27	Ceramic tube		
	1.64ft (0.5m) Probe body	RMV313	1
	3.28ft (1.0m) Probe body	RMV313	3
	6.56ft (2.0m) Probe body	RMV313	7
28	Heater lead insulator sleeve	EXFG/0162	2
29	Heater/ceramic insulator wire	001351006	As rqd.
30	Centre tube assembly		
	1.64ft (0.5m) Probe body	EXFG/0080I	1
	3.28ft (1.0m) Probe body	EXFG/0081I	1
	6.56ft (2.0m) Probe body	EXFG/0082I	1
31	Column insulator machined	EXFG/0107	1
32	Column insulator		
	1.64ft (0.5m) Probe body	EXFG/0106	1
	3.28ft (1.0m) Probe body	EXFG/0106	4
	6.56ft (2.0m) Probe body	EXFG/0106	9
	1.64ft (0.5m) Probe body only		
	Short column insulator*	EXFG/0114	1
33	Heater connection wire sleeve	B4204	As rqd.
34	Heater connection wire	B2404	As rqd.
35	Trip thermocouple		
	1.64ft (0.5m) Probe body	EXFG/0170	1
	3.28ft (1.0m) Probe body	EXFG/0171	1
	6.56ft (2.0m) Probe body	EXFG/0172	1
36	Heater mounting spacers	EXFG/0122	3
37	M4 x 25mm hexagon-head screw	B10727	2

Item	Description	Part No.	Qty.
38	M4 plain washer	B7298	10
39	Connection plate spacer	ZFG2/0129	2
40	Ceramic terminal plate	EXFG/0108	1
41	M4 full nut	B8690	4
42	M3 plain washer	B11138	3
43	M3 full nut	B7067	3
44	Heater mounting plate	ZFG2/0158	1
45	Heater support rods	EXFG/0118	3
46	Spares heater assembly	EXFG/0096	1
47	O-ring	002310038	2
48	Test gas tube	EXFG/0126	1
49	EEx d probe body assembly	EXFG/0090I	1
50	M4 x 16mm socket-head screw	B7295	6
51	M4 x 40mm socket-head screw	B10709	3
52	M4 x 30mm socket-head screw	B10714	6
53	Spares cell assembly	EXFG/0088	1
54	EEx d test gas plate	EXFG/0133I	2
55	Filter gasket	003000094	4 (min.)
56	Spares ceramic filter kit	EXFG/0087	1
57	Filter spacer	EXFG/0135	3
58	Filter end plate	EXFG/0134	1

* Items not illustrated

9 REPLACEMENT PARTS

9.2 Mounting Plate

Mounting plate assembly – see Fig. 2.4 003000354

9.3 Conduit Assemblies and Special Dual Cable

9.3.1 Single Conduit Assembly (combined power/signal)

Standard 19.68ft (6m) assembly EXFG/0060
M20 EEx d bung B11116

Standard 32.81ft (10 m) EXFG/0061
M20 EEx d bung B11116

9.3.2 Dual Conduit Assembly (separate power/signal)

Standard 19.68ft (6m) assembly, comprising:
signal conduit (inc. 2 x M25 EEx d glands) .. EXFG/0062
and
power conduit (inc. 2 x M20 EEx d glands) .. EXFG/0063

Standard 32.81ft (10m) assembly, comprising:
signal conduit (inc. 2 x M25 EEx d glands) .. EXFG/0064
and
power conduit (inc. 2 x M20 EEx d glands) .. EXFG/0065

9.3.3 Special Dual Cable (separate power and signal cable)

Cable up to 328.10ft (100m):
signal cable (per meter) EXFG/0194
M20 EEx d glands (x 2) B11275
M25/M20 reducer (x 2) B11274

power cable (per meter) EXFG/0195
M20 EEx d glands (x 2) B11275

9.4 Spares Kits and Replacement Items

9.4.1 Electrode/Thermocouple Lead Assembly

Thermocouple/Electrode lead assembly kit EXFG/0086

Comprising:
Electrode/thermocouple sub-assembly EXFG/0085
Spring (x 2) B11186
Heater sleeve, length 0.98ft (0.3m) B4204
Insulation sleeve – blue,
length 0.82ft (0.25m) 002410034
Insulation sleeve – white,
length 0.82ft (0.25m) 002410033
Insulation sleeve – red,
length 0.82ft (0.25m) 002410032
PVC feed tube,
length 1.64ft (0.5m) YBM0202

9.4.2 Zirconia Cell

Zirconia cell assembly EXFG/0088

9.4.3 Ceramic Filter

Ceramic filter kit EXFG/0087

Comprising:
Ceramic filter EXFG/0136
Filter gaskets (x 7) 003000094

9.4.4 Heater

Heater assembly EXFG/0096

9.4.5 Fasteners

Special fasteners spares kit EXFG/0083

Comprising:
M4 x 10mm socket-head screw (x 7) B9760
M4 x 16mm socket-head screw (x 6) B7295
M4 x 30mm socket-head screw (x 6) B10714
M4 x 40mm socket-head screw (x 3) B10709
M6 x 20mm socket-head screw (x 8) B11115

9.5 Sealants

Grease 0.88lb (400gm) tube (probe head flange) .. CG5317

Thread sealant (vent connections). CG5091

9.6 Accessory Kits

Accessory kit – see Fig. 2.2. ..... EXFG/0067

APPENDIX

A1 Displayed Value (mV) v. Percentage Oxygen – Fig. A1

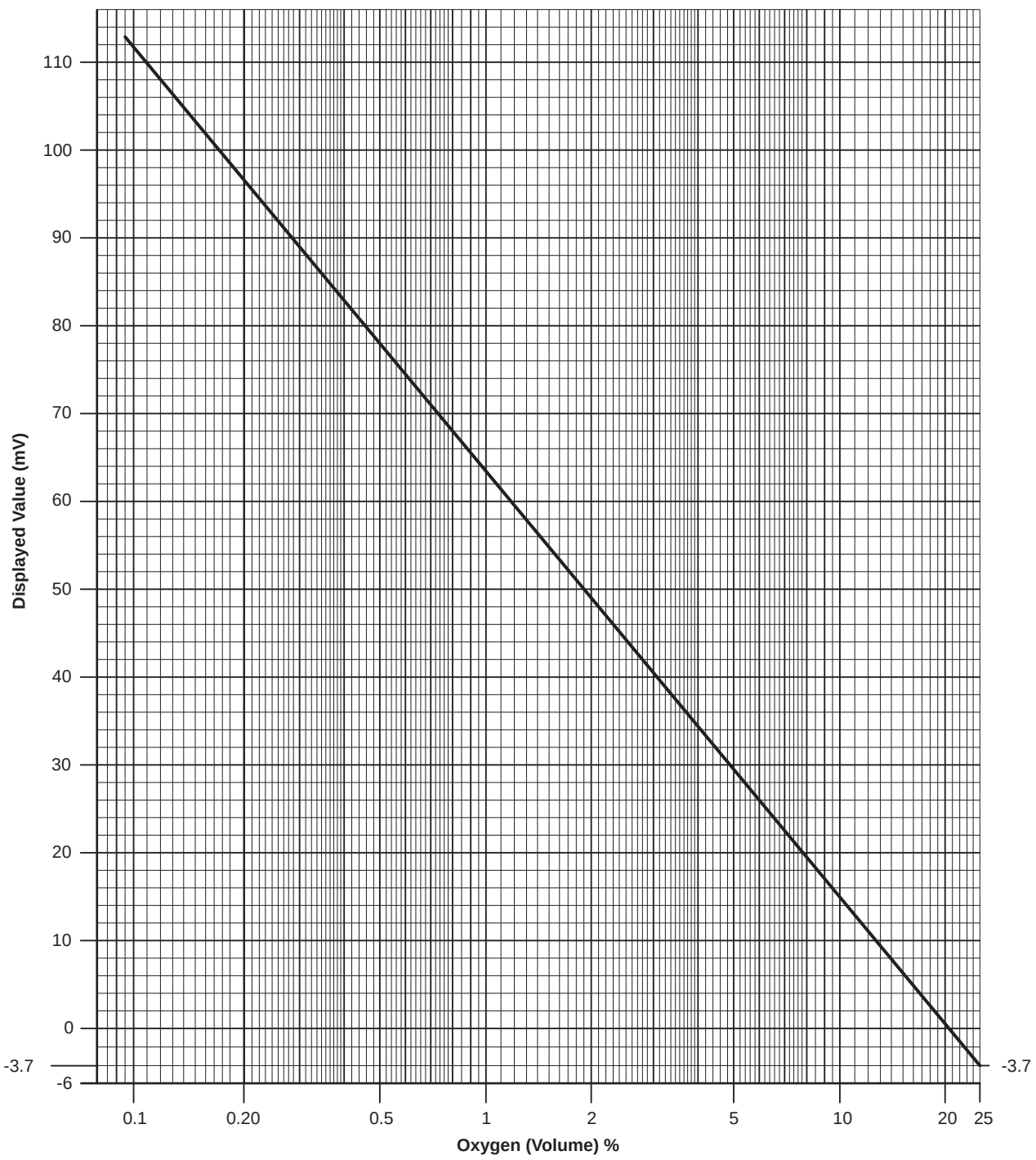


Fig. A1 Displayed Value (mV) v. Percentage Oxygen

NOTES

CUSTOMER SUPPORT

Service, Support and Maintenance

ABB Process Analytics' commitment to quality doesn't end when we deliver our equipment.

We also provide, at the client's request: start-up services, maintenance services, training services, reconditioning, repair and replacement parts services.

Training services are available for virtually every aspect of operating and maintaining ABB Process Analytics analyzers and systems. Training may be arranged on-site or at any of our training centres.

Maintenance services are available on an unscheduled, as needed basis, or by way of long-term, scheduled maintenance agreements.

Facilities

ABB Process Analytics' primary manufacturing and administrative facility is located in Lewisburg, West Virginia. We also operate sales and service centres in Houston, Texas; Baton Rouge, Louisiana; Sarnia, Ontario; UK; France; Italy; The Netherlands and Singapore. Training centres are located in Lewisburg, Houston and Europe.

For complete information and assistance with ABB Process Analytics analyzers, systems and services, contact any of our facilities for details of your nearest Service and Repair Centre.

United States
ABB Process Analytics
843 N. Jefferson Street
Lewisburg, WV 24901
USA
Office: (304)647-4358
FAX: (304)645-4236

Canada
ABB Process Analytics
1362 Lambton Mall Road
Unit#18
Sarnia, Ontario N7S 5R6
CANADA
Office: (519)541-0011
FAX: (519)541-0012

United Kingdom
ABB Process Analytics Ltd
Howard Road
Eaton Socon, St. Neots
Cambs. UK PE19 3EU
Office: 44-1480-404440
FAX: 44-1480-405775

Middle East
ABB ARESCON
PO Box 2774
Manama, Bahrain
Office: 973-725377
FAX: 973-725332

Benelux
ABB Process Analytics BV
Pampuslaan 89
1382 JM Weesp
Netherlands
Office: 31-2944-17291
FAX: 31-2944-13656

France
ABB Instrumentation
Process Analytics Div
6/8 Rue Peupliers
BP 430-92004 Nanterre
Cedex, France
Office: 33-1-4769-7280
FAX: 33-1-4242-3995

Pacific Rim
ABB Industry Pte. Ltd.
No. 2 Ayer Rajah Crescent
Singapore 0513
Office: 65-776-5711
FAX: 65-778-0222

Italy
ABB Kent-Taylor SpA
Process Analytics Division
Valle Edison, 50
20099 Sesto S. Giovanni - MI
Italy
Office: 39-2-262321
FAX: 39-2-26232902

The Company's policy is one of continuous product improvement and the right is reserved to modify the information contained herein without notice.

 ABB Process Analytics Printed in U.K.

IM/EXFGPB–PA Issue 2

ABB Process Analytics
843 N. Jefferson Street
Lewisburg, WV 24901
USA
Office: (304)647-4358
FAX: (304)645-4236