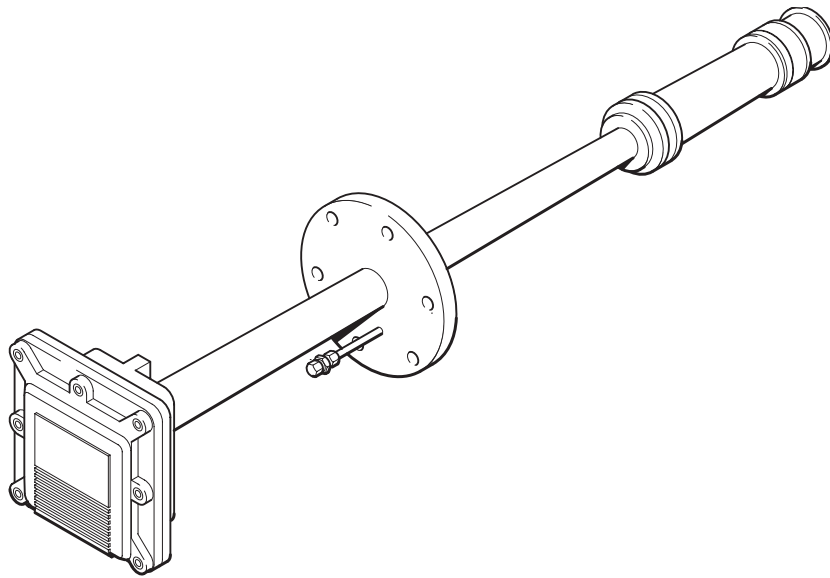


EXFG Probe for use with  
Z-MT Oxygen Analyzer  
System

## Installation Guide

Specific to order number:  
EXP/N/17371/TJA

& for use with ZMT Electronics  
Unit code number:  
ZMT/301/000000/4002CE



# ABB KENT-TAYLOR

## The Company

ABB Kent-Taylor is an established world force in the design and manufacture of instrumentation for industrial process control, flow measurement, gas and liquid analysis and environmental applications.

As a part of ABB, a world leader in process automation technology, we offer customers application expertise, service and support worldwide.

We are committed to teamwork, high quality manufacturing, advanced technology and unrivalled service and support.

The quality, accuracy and performance of the Company's products result from over 100 years experience, combined with a continuous program of innovative design and development to incorporate the latest technology.

The NAMAS Calibration Laboratory No. 0255(B) is just one of the ten flow calibration plants operated by the Company, and is indicative of ABB Kent-Taylor's dedication to quality and accuracy.

BS EN ISO 9001



St Neots, U.K. – Cert. No. Q5907  
Stonehouse, U.K. – Cert. No. FM 21106

EN 29001 (ISO 9001)



Lenno, Italy – Cert. No. 9/90A



Stonehouse, U.K. – Cert. No. 0255

## Use of Instructions



### Warning.

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



### Caution.

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



### Note.

Clarification of an instruction or additional information.



### 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.

Information in this manual is intended only to assist our customers in the efficient operation of our equipment. Use of this manual for any other purpose is specifically prohibited and its contents are not to be reproduced in full or part without prior approval of Technical Communications Department, ABB Kent-Taylor.

### 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

Section	Page	Section	Page
<b>1 INTRODUCTION .....</b>	<b>2</b>	<b>9 DISMANTLING AND RE-ASSEMBLY .....</b>	<b>18</b>
1.1 Documentation .....	2	9.1 Replacing the Ceramic Filter .....	19
1.2 Certification .....	2	9.1.1 Removing the Ceramic Filter .....	19
1.3 System Overview .....	3	9.1.2 Fitting the Ceramic Filter .....	19
1.4 Principle of Operation .....	4	9.2 Replacing the Zirconia Cell .....	20
<b>2 PREPARATION .....</b>	<b>5</b>	9.2.1 Removing the Zirconia Cell .....	20
2.1 Checking the Code Number .....	5	9.2.2 Fitting the Zirconia Cell .....	21
2.2 Accessories Check .....	6	9.3 Replacing the Thermocouple/Electrode Lead Assembly .....	22
2.2.1 Test Gas Connector Kit .....	6	9.3.1 Removing the Thermocouple/ Electrode Lead Assembly .....	22
2.2.2 Probe Flange .....	6	9.3.2 Fitting Ceramic Insulators .....	23
2.2.3 Mounting Plates .....	6	9.3.3 Fitting the Thermocouple/Electrode Lead Assembly .....	24
<b>3 INSTALLATION .....</b>	<b>7</b>	9.4 Removing the Probe Body .....	25
3.1 Siting .....	7	9.5 Replacing the Heater Assembly .....	26
3.2 Mounting .....	8	9.5.1 Removing the Heater Assembly .....	26
<b>4 ELECTRICAL CONNECTIONS .....</b>	<b>9</b>	9.5.2 Fitting the Heater Assembly .....	27
4.1 Conduit, Cable and Gland Specifications .....	9	9.5.3 Aligning the Heater Assembly .....	28
4.2 Conduit and Cable Options .....	10	9.6 Replacing the Trip Thermocouple Assembly ..	31
4.2.1 Access to Probe Terminals .....	10	9.6.1 Removing the Trip Thermocouple Assembly .....	31
4.2.2 Single Conduit Probe Connections ..	10	9.6.2 Fitting the Trip Thermocouple Assembly .....	32
4.2.3 Dual Conduit Probe Connections .....	11	9.7 Removing Seized Screws .....	33
4.2.4 Dual Cable Probe Connections .....	12		
<b>5 PIPE CONNECTIONS .....</b>	<b>13</b>	<b>10 REPLACEMENT PARTS... ..</b>	<b>34</b>
5.1 Pipe Connections .....	13	10.1 Illustrated Parts List .....	34
5.1.1 External Reference Air Connection ..	13	10.2 Mounting Plate .....	38
5.1.2 Vent Connection .....	13	10.3 Conduit Assemblies and Special Dual Cable ..	38
5.2 Resealing the Probe Head .....	13	10.3.1 Single Conduit Assembly (combined power/signal) .....	38
<b>6 OPERATION .....</b>	<b>14</b>	10.3.2 Dual Conduit Assembly (separate power/signal) .....	38
<b>7 CALIBRATION .....</b>	<b>14</b>	10.3.3 Special Dual Cable (separate power and signal cable) ...	38
7.1 Test Gas Connection .....	14	10.4 Spares Kits and Replacement Items .....	38
<b>8 FAULT FINDING .....</b>	<b>15</b>	10.4.1 Electrode/Thermocouple Lead Assembly .....	38
8.1 Checking the Zirconia Cell .....	15	10.4.2 Zirconia Cell .....	38
8.1.1 Checking the Control Thermocouple	15	10.4.3 Ceramic Filter .....	38
8.1.2 Checking the Heater Resistance .....	16	10.4.4 Heater .....	38
8.2 Checking the Trip Thermocouple .....	17	10.4.5 Fasteners .....	38
		10.5 Sealants .....	38
		10.6 Accessory Kits .....	38
		<b>APPENDIX .....</b>	<b>39</b>
		A1 Displayed Value (mV) v. Percentage Oxygen ...	39

# 1 INTRODUCTION

## 1.1 Documentation

Documentation for the ZMT 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.

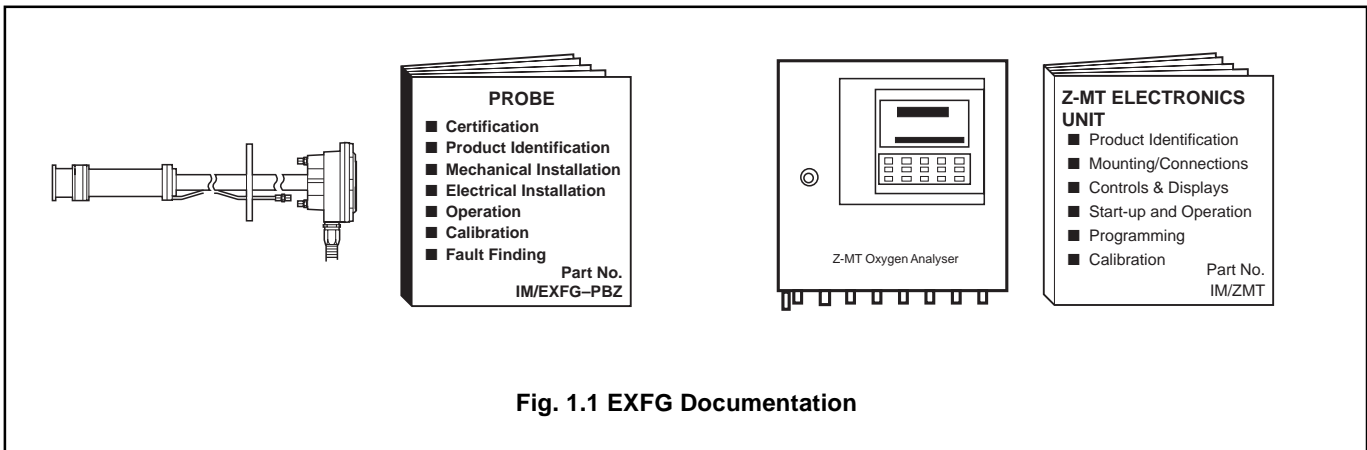
## 1.2 Certification

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

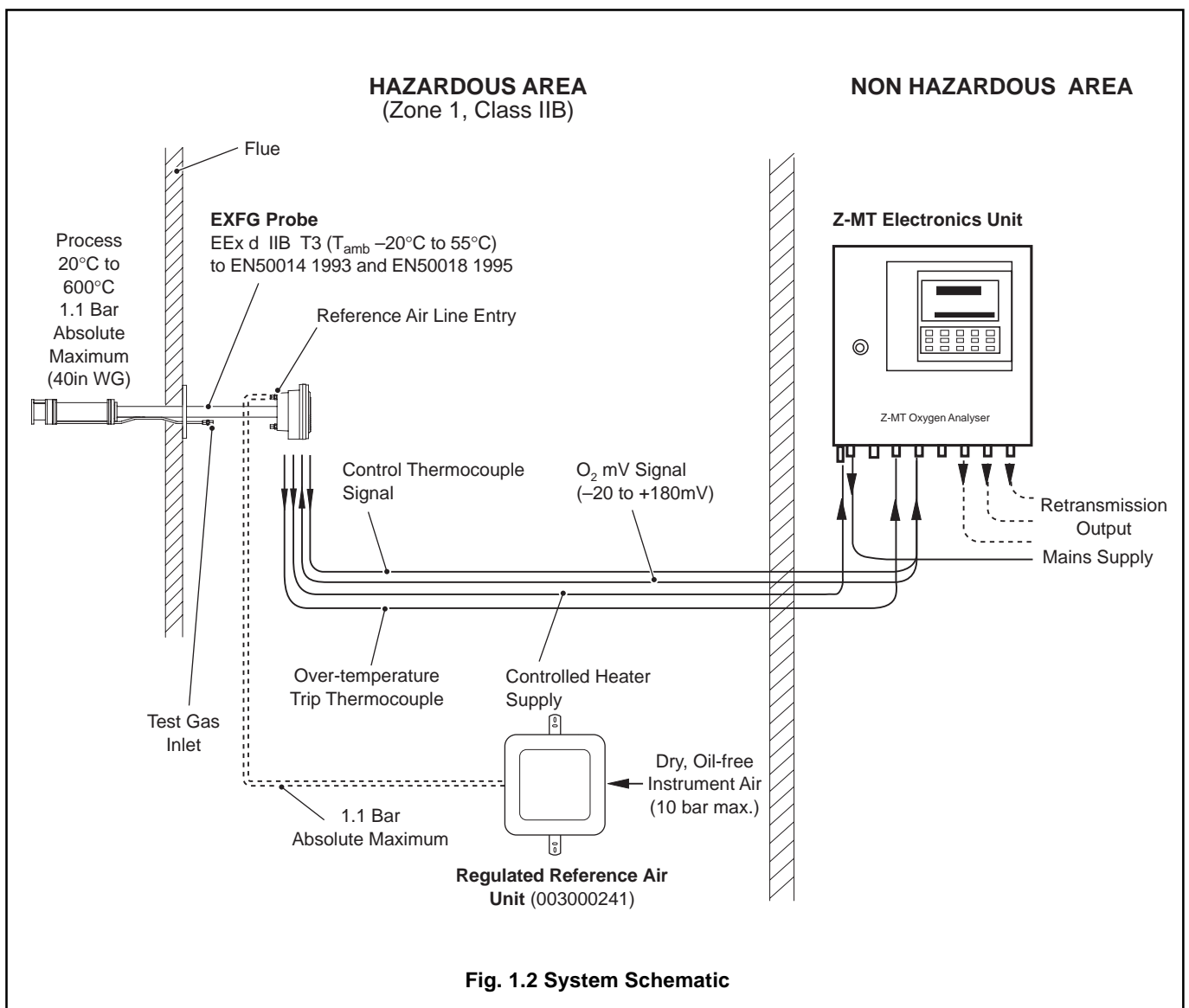
The EXFG Oxygen Probe measures oxygen concentration in flue gas using an in situ ('wet analysis') method. The 'wet analysis' method avoids measurement error (typically 20% of reading higher than the actual value) which would be introduced by a sampling system using the 'dry analysis' method.

System equipment comprises the EXFG Oxygen Probe (flue-mounted) and a ZMT Zirconia Oxygen Analyzer.

During operation, a zirconia cell within the EXFG Probe is controlled by the ZMT Oxygen Analyzer 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 only be connected to a ZMT Oxygen Analyzer, otherwise probe certification may be invalidated. Only ZMT codes **ZMT/301/000000/4002CE** are permissible.

An output generated at the zirconia cell is processed in the ZMT Oxygen Analyzer into a 4 to 20mA retransmission signal representing 25% to 0.25% O<sub>2</sub>.



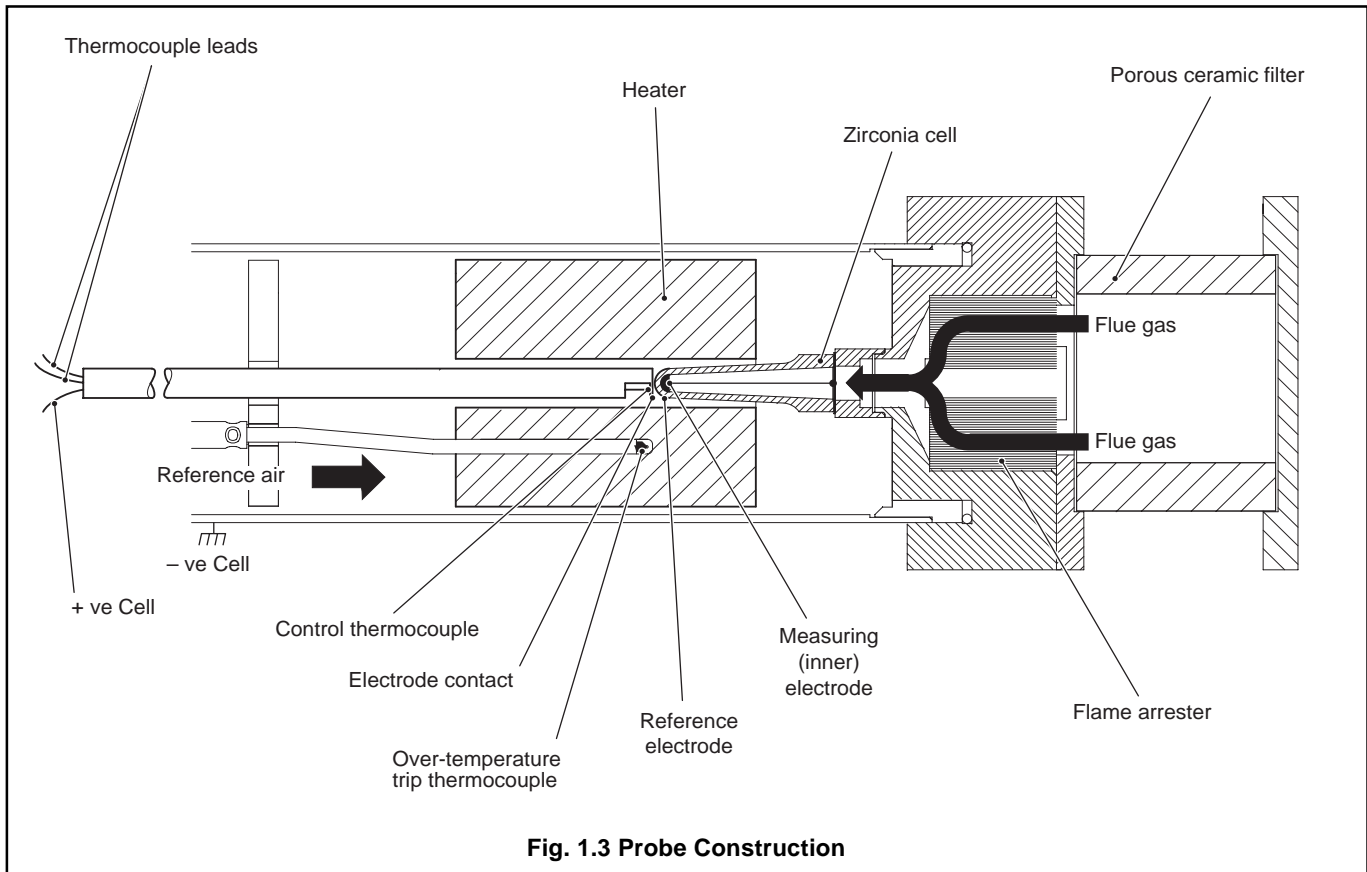
## ...1 INTRODUCTION

### 1.4 Principle of Operation – Fig. 1.3

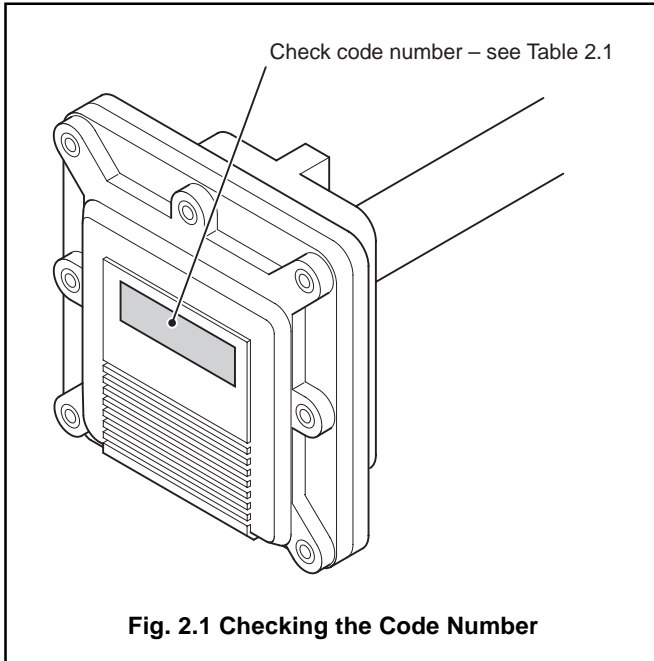
The probe's zirconia cell is a thimble-shaped sensing element fitted with inner and outer electrodes at its closed end. The inner electrode is exposed to the flue gas entering the open end of the cell; the outer electrode is supplied with reference air from a regulator and is therefore exposed to a constant 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.



2.1 Checking the Code Number – Fig. 2.1



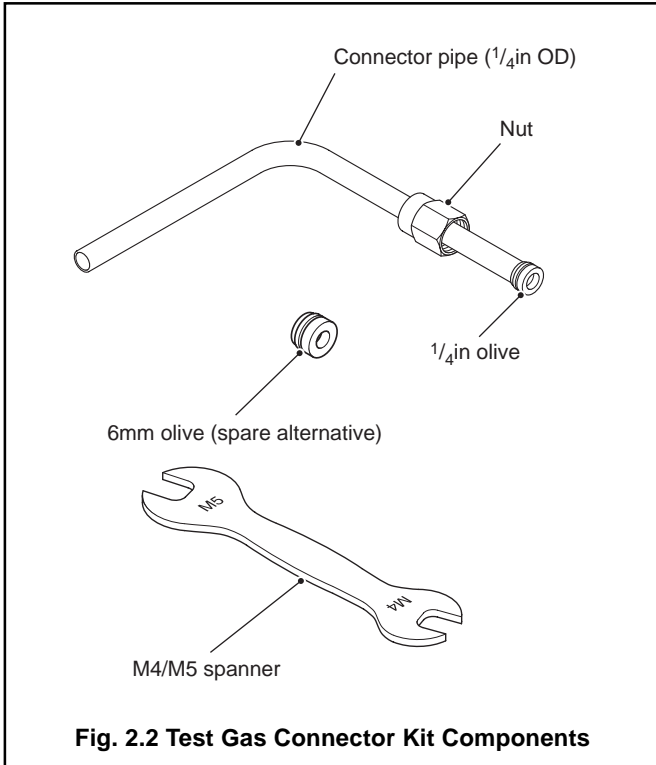
EXFG Oxygen Analyzer System		EXFG/	X	X	X	000
<b>EXFG Probe</b>	Not supplied		0			
	1.64ft (0.5m) insertion length – with standard flange		1			
	3.281ft (1.0m) insertion length – with standard flange		2			
	6.562 (2.0m) insertion length – with standard flange		3			
	1.64ft (0.5m) insertion length – with ANSI flange		4			
	3.281ft (1.0m) (insertion length) – with ANSI flange		5			
	6.562 (2.0m) insertion length – with ANSI flange		6			
<b>Flexible Conduits</b>	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		
<b>or</b>						
<b>Dual Special Cables</b>		(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.)					
<i>and</i>						
SWA power cable – EXFG/0195 (per metre, 100 metre max.)						
20mm barrier gland – B11275 (qty. 2 rqd.)						
<b>Mounting Plate</b>	Not supplied				0	
	Mounting plate assembly – standard flange only				1	

Table 2.1 Code Number Interpretation

## ...2 PREPARATION

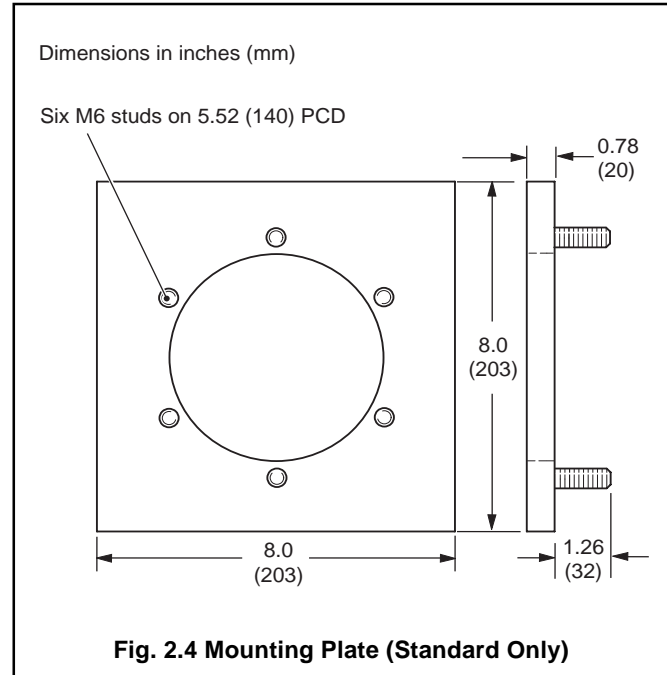
### 2.2 Accessories Check

#### 2.2.1 Test Gas Connector Kit – Fig. 2.2

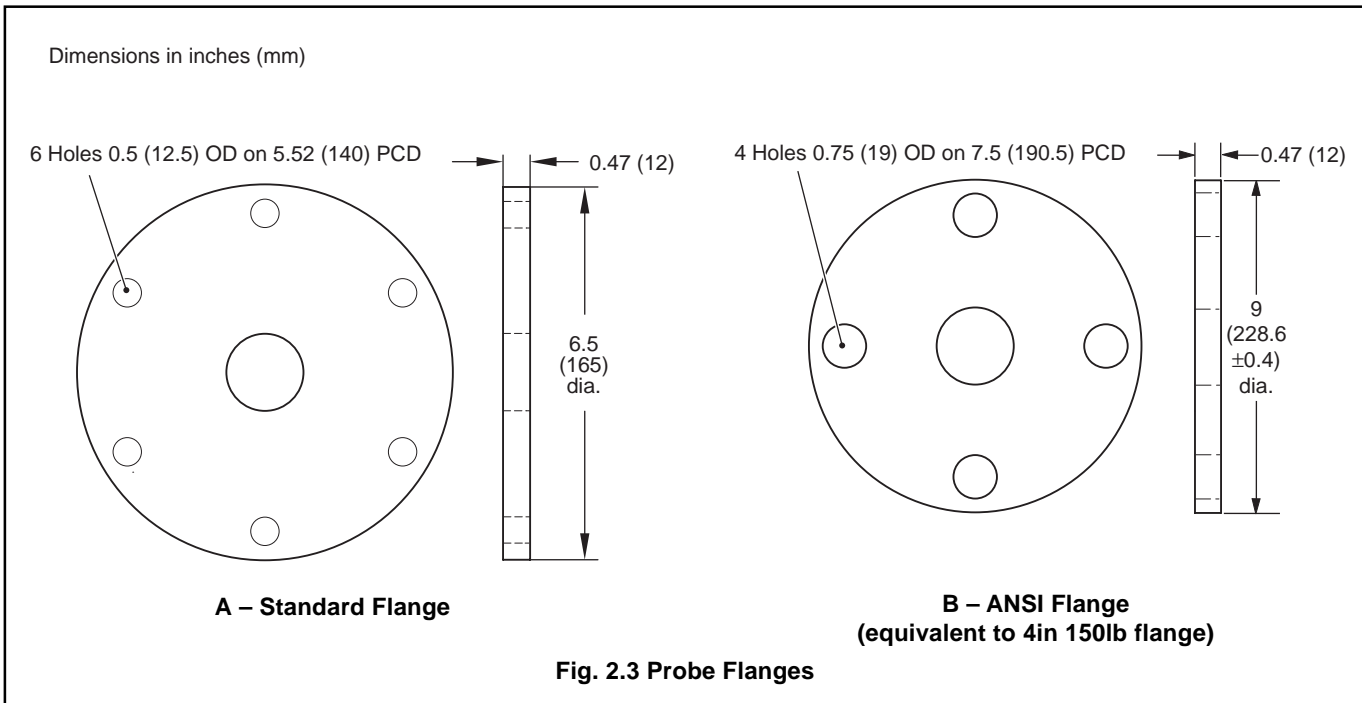


#### 2.2.3 Mounting Plates – Fig. 2.4

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.



#### 2.2.2 Probe Flange – Fig. 2.3







**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.

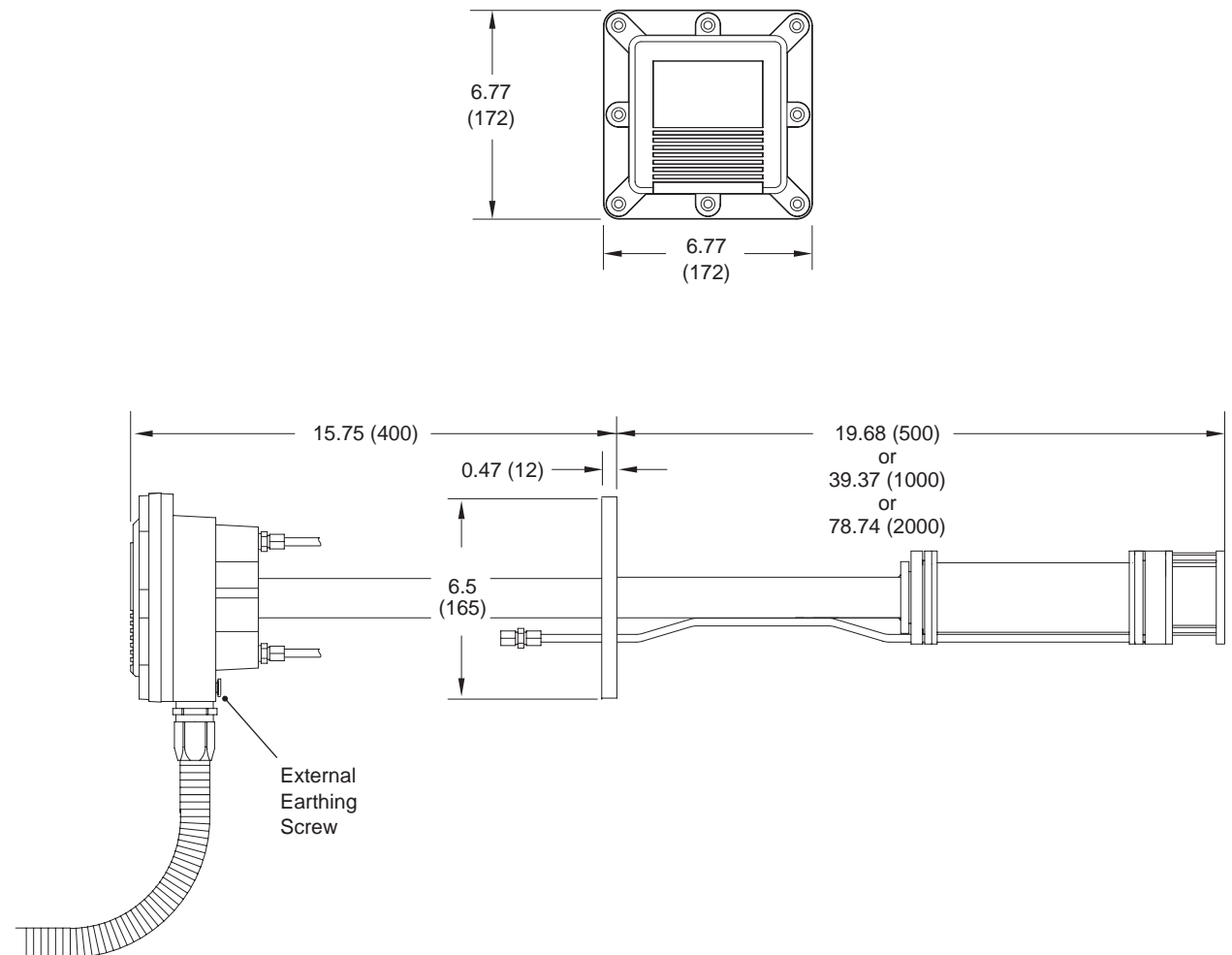
Probe dimensions are shown in Fig 3.1. A clearance of at least 1 inch (25mm) in excess of the overall probe length is necessary for installation or removal procedures.

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 ZMT Oxygen Analyzer. 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.

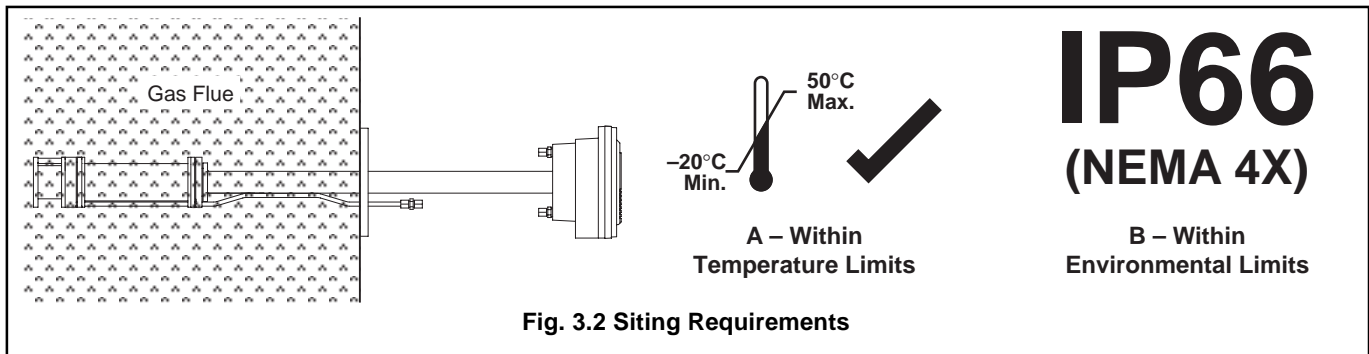
Dimensions in inches (mm)



**Fig. 3.1 Overall Dimensions**

## ...3 INSTALLATION

### ...3.1 Siting – Figs. 3.1 and 3.2

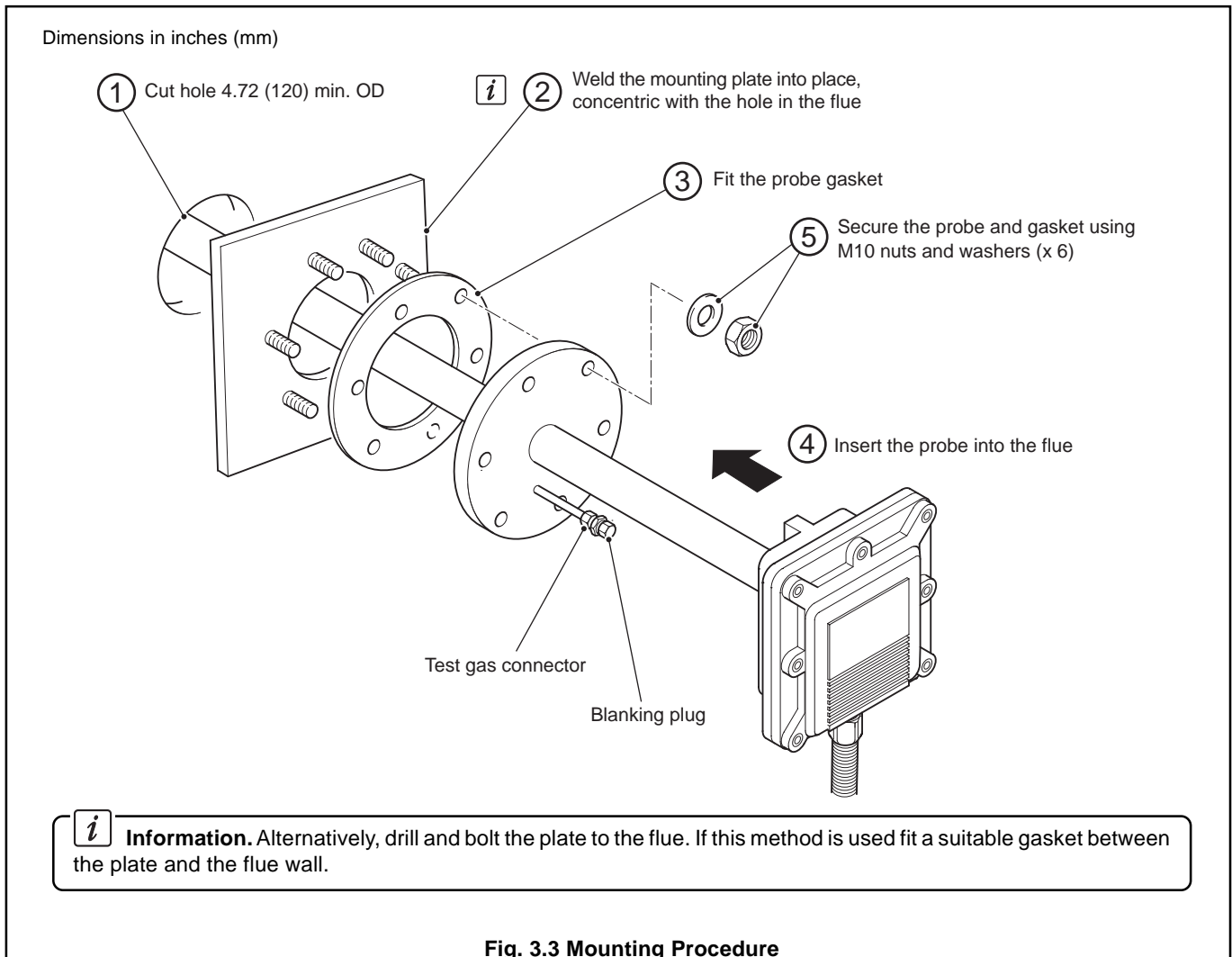


### 3.2 Mounting – Fig. 3.3



#### 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.





## ...4 ELECTRICAL CONNECTIONS

### 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:

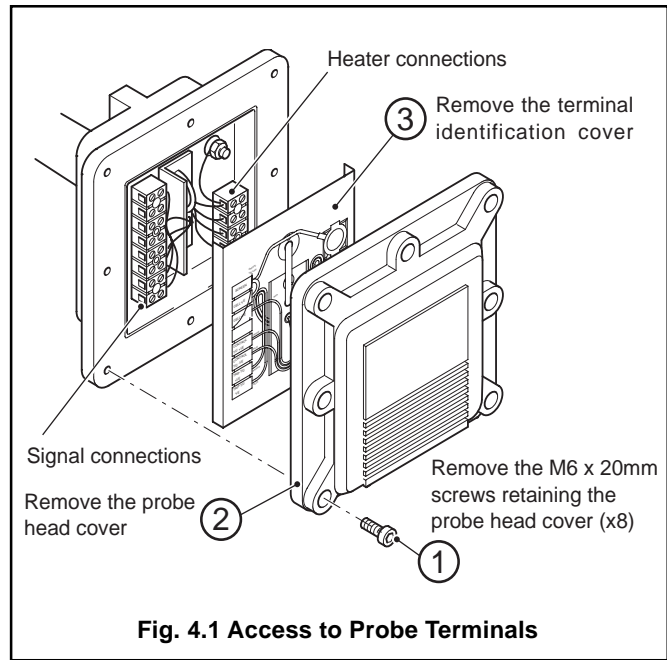
- Single conduit – 19.68ft (6.0m) or 32.81ft (10.0m) lengths, comprising; one conduit for signal and heater power leads,
- Dual conduits – 19.68ft (6.0m) or 32.81ft (10.0m) lengths, comprising; one conduit for signal leads, one conduit for the heater power lead,
- Dual special cables – for lengths up 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.

#### 4.2.1 Access to Probe Terminals – Fig. 4.1



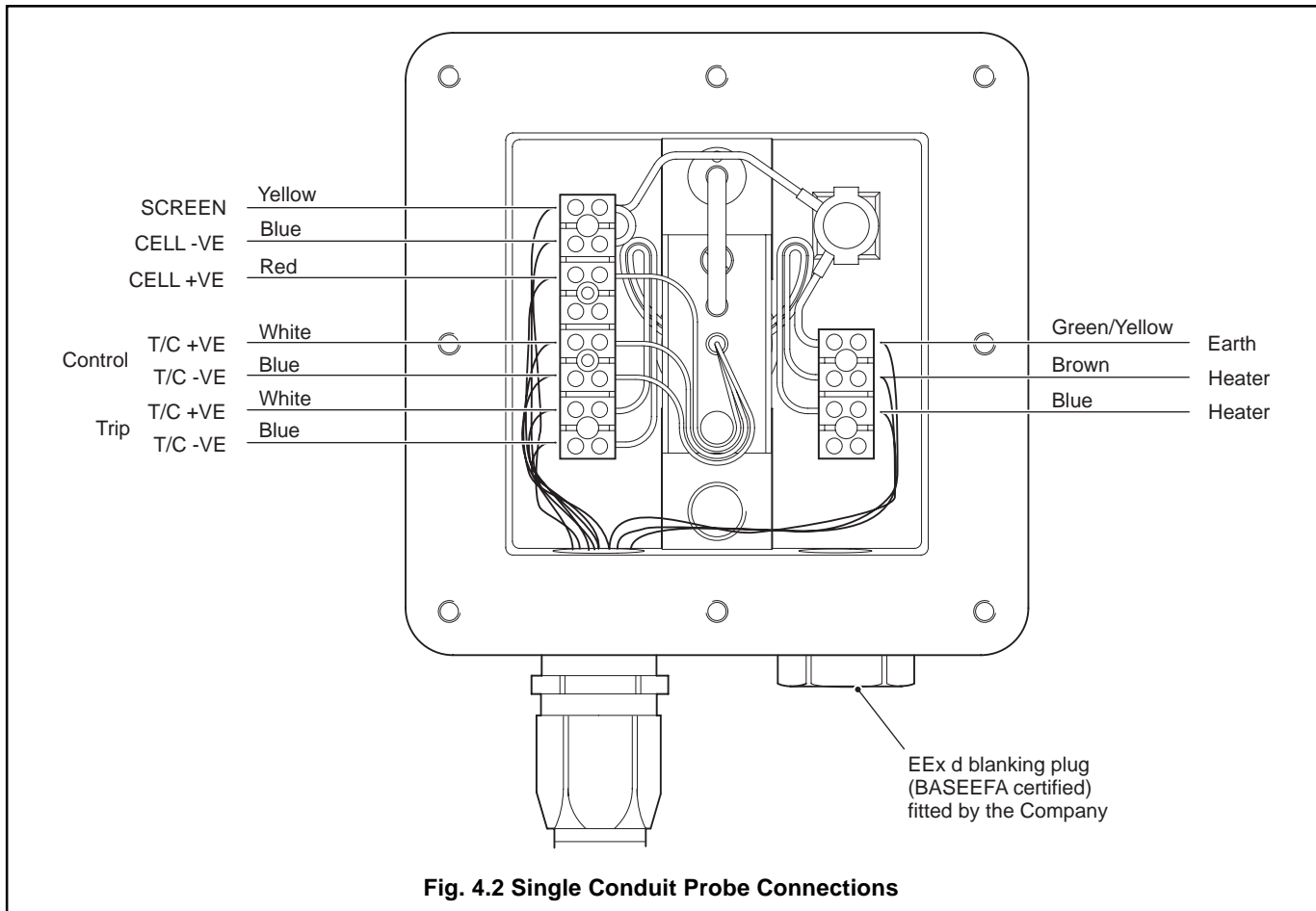
**Warning.** Once commissioned, the enclosure must not be opened when a flammable atmosphere is present.



**Fig. 4.1 Access to Probe Terminals**

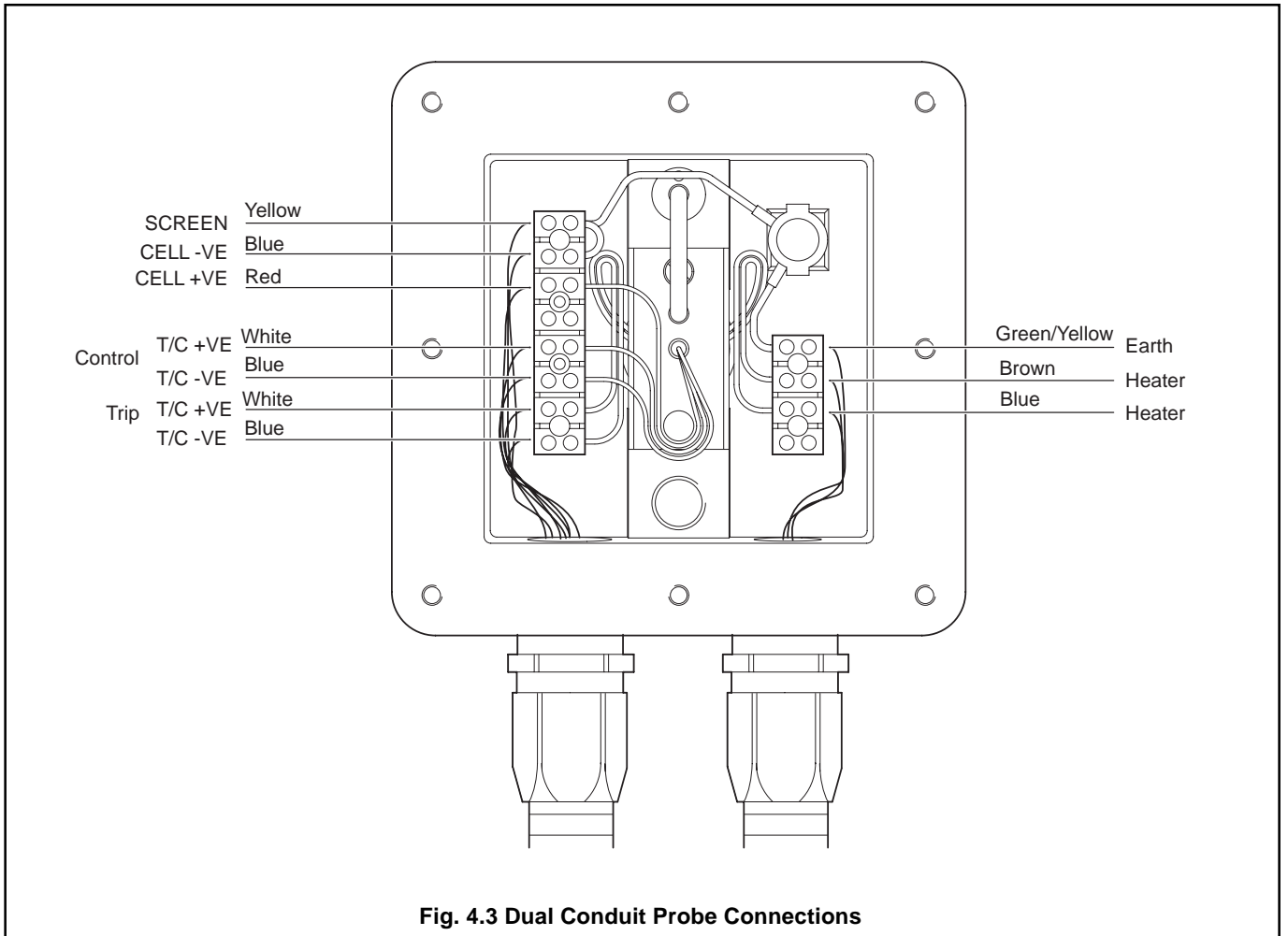
#### 4.2.2 Single Conduit Probe Connections – Fig. 4.2

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



## ...4 ELECTRICAL CONNECTIONS

### 4.2.4 Dual Cable Probe Connections – Fig. 4.4

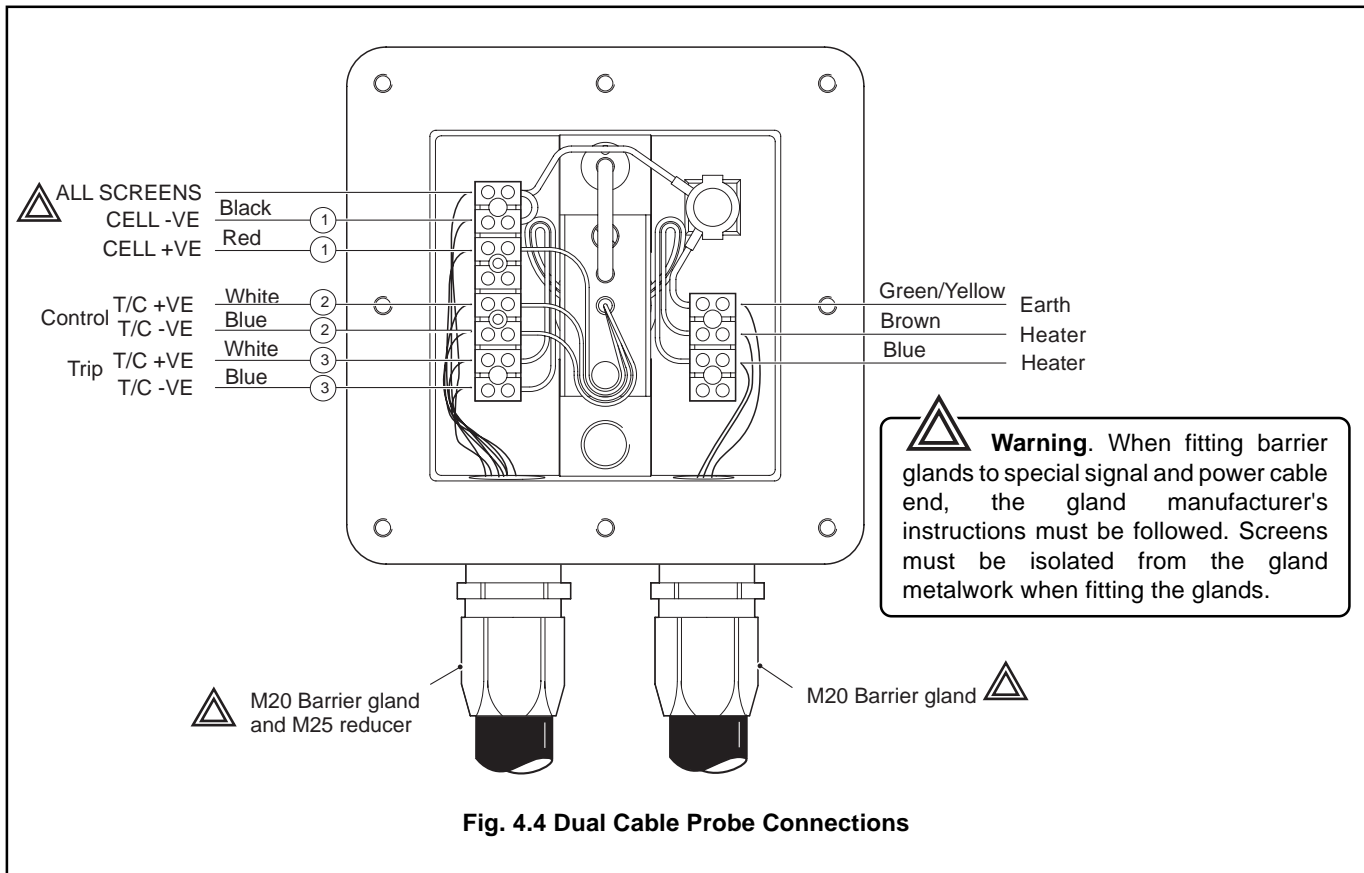


Fig. 4.4 Dual Cable Probe Connections

**5.1 Pipe Connections – Fig. 5.1**

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.

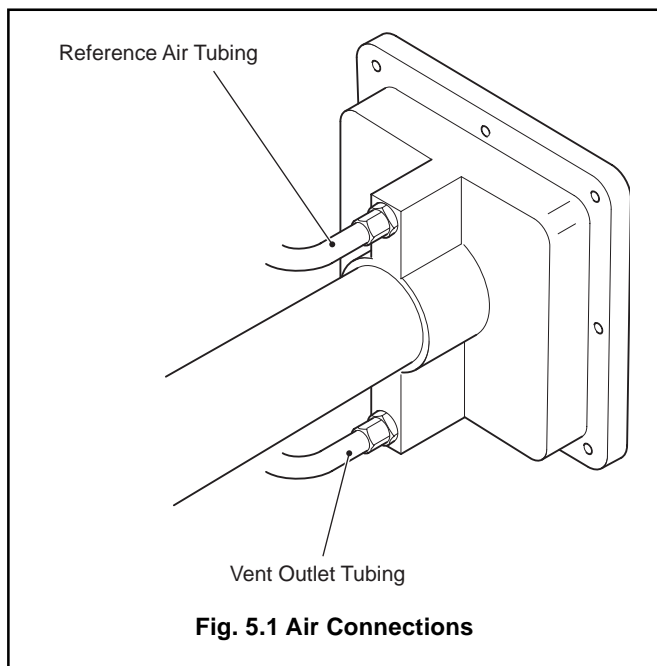
**5.1.1 External Reference Air Connection – Fig. 5.1**

**Warning.** The maximum reference air pressure is 1.1 bar absolute – certification may be invalidated if exceeded.

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. 5.1. Refer to Table 5.1 for reference air and vent outlet tubing specifications.

**5.1.2 Vent Connection – Fig. 5.1**

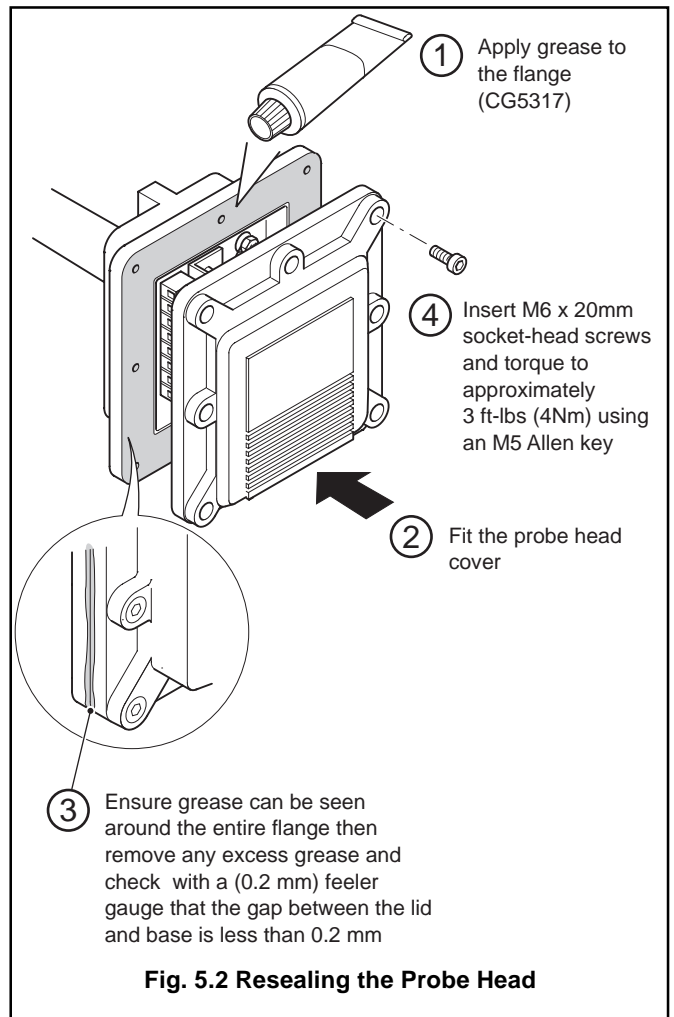
The vent outlet allows the reference air to escape to atmosphere via built in flame arrestors. If the outlet is likely to be exposed to moisture, a suitable vent tube must be connected to the outlet and routed to a dry area – see Fig. 4.5. Ensure that the vent outlet, or the vent tube, does not become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



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 5.1 Reference Air and Vent Tubing Specifications**

**5.2 Resealing the Probe Head – Fig. 5.2**



## 6 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<sub>2</sub> reading errors.

- b) Check connections on both the Probe and the ZMT Oxygen Analyzer (refer also to the *ZMT Oxygen Analyzer Manual IM/ZMTEXFG Issue 1*).
- 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.

## 7 CALIBRATION

Full gas calibration procedures for the system are described in the *ZMT Oxygen Analyzer Manual IM/ZMTEXFG Issue 1*.



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

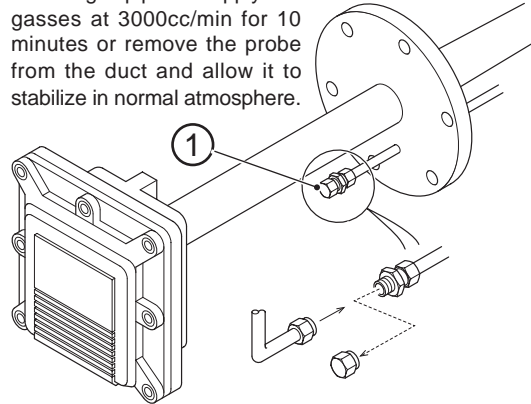
System fault finding procedures are given in Section 8. Where a fault is traced to the probe, it may be possible to identify and rectify the fault.

After any rectification, the system must be re-calibrated as described in the *ZMT Oxygen Analyzer Manual IM/ZMTEXFG Issue 1*, to maintain the stated accuracies.

### 7.1 Test Gas Connection – Fig. 7.1

A test gas inlet is provided for in situ probe testing using a test gas. A test gas connector kit is supplied in the accessory kit – see Section 2.2.1.

Remove the dust cap, attach the test gas pipe and apply test gasses at 3000cc/min for 10 minutes or remove the probe from the duct and allow it to stabilize in normal atmosphere.



**Fig. 7.1 Test Gas Inlet Connections**



8.1 Checking the Zirconia Cell

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

a) Carry out a system calibration check as described in the *ZMT Oxygen Analyzer Guide, IM/ZMTEXFG Issue 1*.

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 8.1.1.

8.1.1 Checking the Control Thermocouple – Fig. 8.1

**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 there 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. 8.1. The measured voltage must be within  $\pm 0.1\text{mV}$  of the voltages listed in Table 8.1.

If the measured voltage is **correct**, replace the zirconia cell as described in Section 9.2.

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 8.1.2.

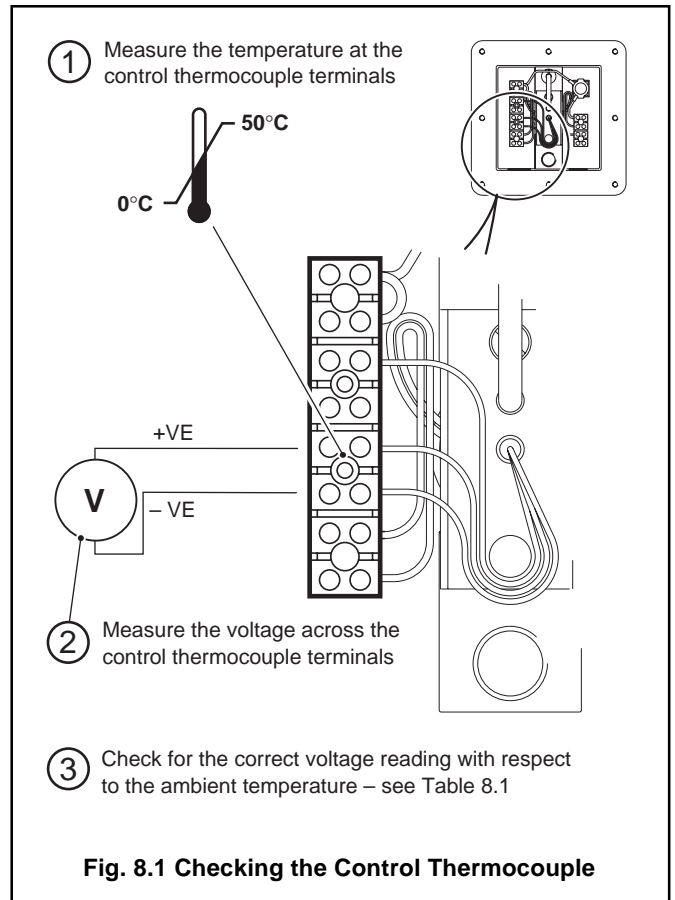


Fig. 8.1 Checking the Control Thermocouple

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

## ...8 FAULT FINDING

### 8.1.2 Checking the Heater Resistance – Fig. 8.2



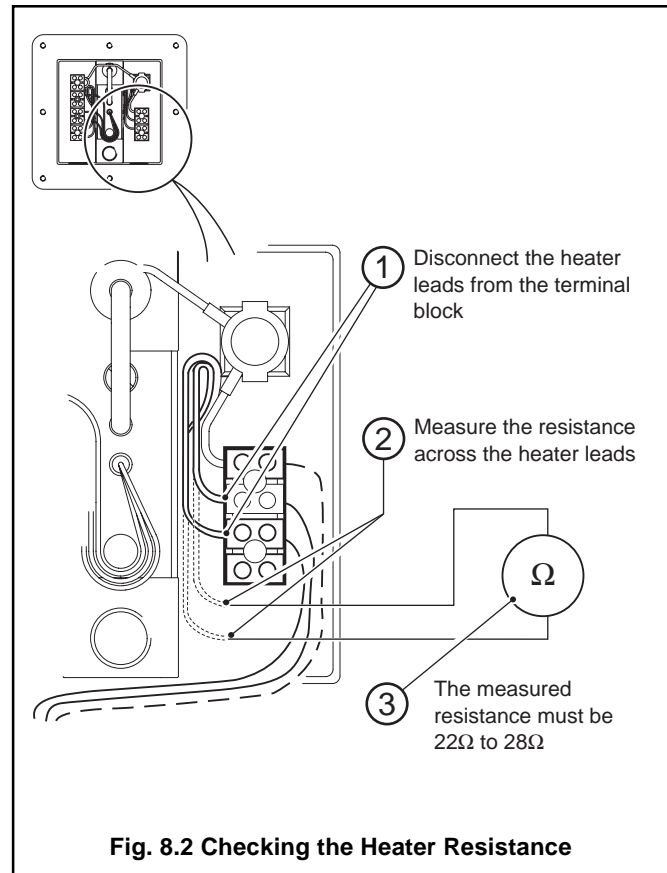
**Warning.** To check the heater resistance it is necessary to remove the probe's connection cover, thus invalidating the explosion proof integrity. Consequently, before removing the connection cover ensure that there are no hazardous gases present or, alternatively, remove the probe from the hazardous 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. 8.2.

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 9.2.

If the heater resistance is **incorrect** replace the heater assembly as described in Section 9.5.



**Fig. 8.2 Checking the Heater Resistance**

8.2 Checking the Trip Thermocouple – Fig. 8.3



**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 there 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. 8.3.



**Caution.** The trip thermocouple voltage must be greater than or equal to the voltages listed in Table 8.2, 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 9.6.

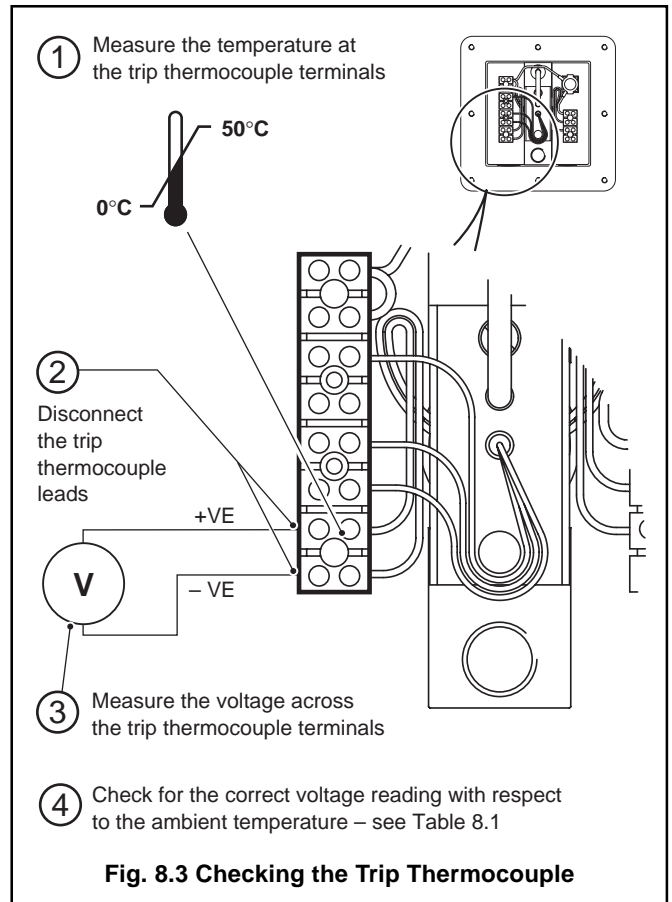


Fig. 8.3 Checking the Trip Thermocouple

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 8.2 – Trip Thermocouple v. Ambient Temperature (575°C Minimum)

## 9 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 10.4.5) 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	<ol style="list-style-type: none"> <li>1 Torque driver 0 to 5Nm (with right-angle adaptor) fitted with an M3 hexagon wrench or M3 Allen key</li> <li>2 Small/medium hacksaw</li> </ol>
Replacing the Zirconia Cell	<ol style="list-style-type: none"> <li>1 Torque driver 0 to 5Nm (with right-angle adaptor) fitted with an M3 hexagon wrench or M3 Allen key</li> <li>2 Small/medium hacksaw</li> <li>3 Scalpel</li> <li>4 M4 open-ended spanner</li> </ol>
Replacing the Thermocouple/Electrode Lead Assembly	<ol style="list-style-type: none"> <li>1 Torque driver 0 to 5Nm (with right-angle adaptor) fitted with an M3 hexagon wrench or M3 Allen key</li> <li>2 Small/medium hacksaw</li> <li>3 Scalpel</li> <li>4 M4 open-ended spanner</li> <li>5 Two slot-head screwdrivers, one small, one medium</li> </ol>
Removing the Probe Body	<ol style="list-style-type: none"> <li>1 Torque driver 0 to 5Nm (with right-angle adaptor) fitted with an M3 hexagon wrench or M3 Allen key</li> <li>2 Small/medium hacksaw</li> <li>3 Scalpel</li> <li>4 M4 open-ended spanner</li> <li>5 Two slot-head screwdrivers, one small, one medium</li> </ol>
Replacing the Heater Assembly	<ol style="list-style-type: none"> <li>1 Torque driver 0 to 5Nm (with right-angle adaptor) fitted with an M3 hexagon wrench or M3 Allen key</li> <li>2 Small/medium hacksaw</li> <li>3 Scalpel</li> <li>4 M4 open-ended spanners (x 2)</li> <li>5 Two slot-head screwdrivers, one small, one medium</li> <li>6 5.5mm Open-ended spanner</li> <li>7 Long nosed pliers (x 1 pair)</li> </ol>
Replacing the Trip/Thermocouple Assembly	<ol style="list-style-type: none"> <li>1 Torque driver 0 to 5Nm (with right-angle adaptor) fitted with an M3 hexagon wrench or M3 Allen key</li> <li>2 Small/medium hacksaw</li> <li>3 Scalpel</li> <li>4 M4 open-ended spanners (x 2)</li> <li>5 Two slot-head screwdrivers, one small, one medium</li> <li>6 5.5mm Open-ended spanner</li> <li>7 Long nosed pliers (x 1 pair)</li> </ol>

**Table 9.1 – Identification of Tools**

**9.1 Replacing the Ceramic Filter – Fig. 9.1**

A ceramic filter kit is required when replacing the ceramic filter – see Section 10.4.3.

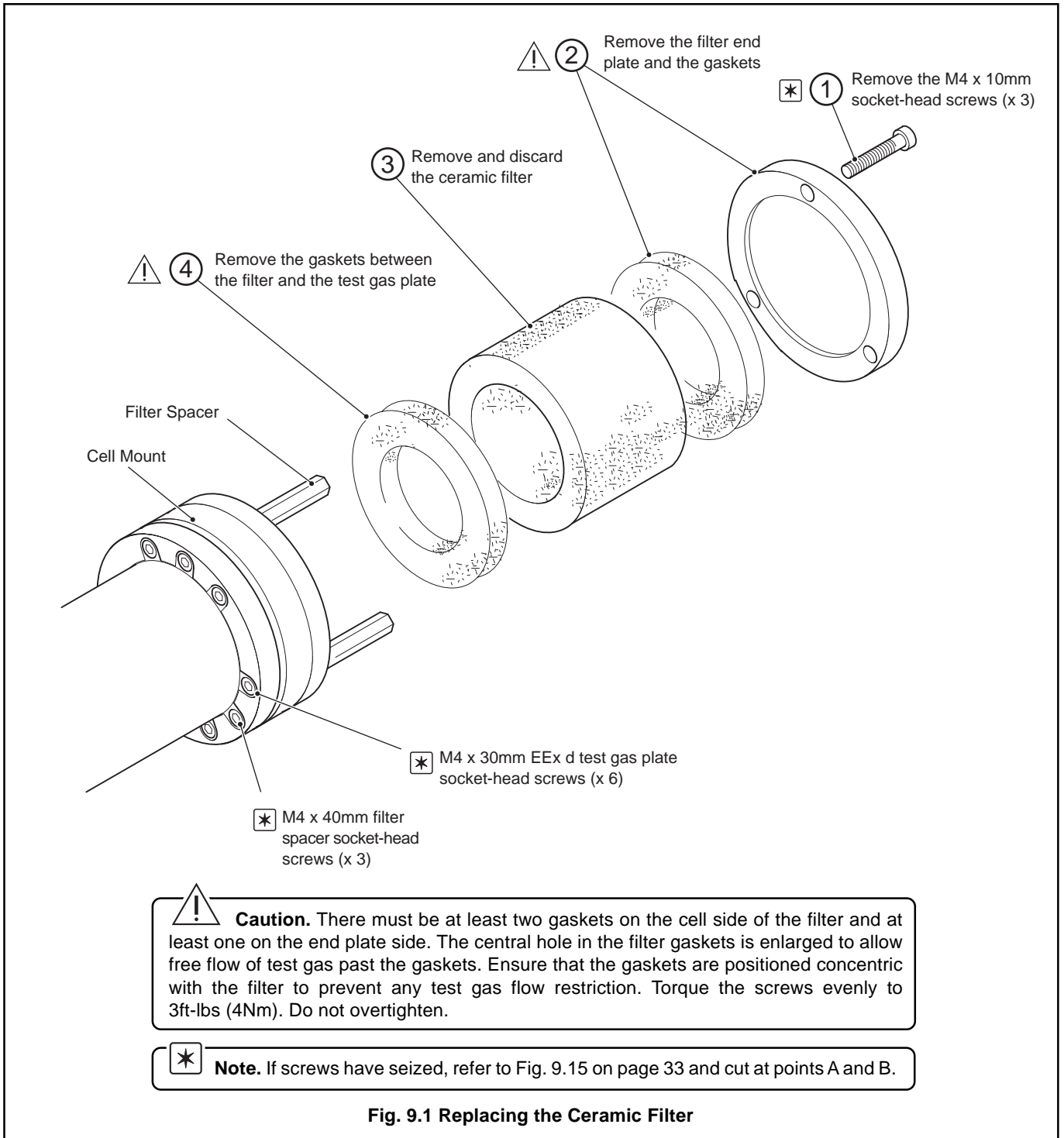
**9.1.1 Removing the Ceramic Filter – Fig. 9.1**

Remove the ceramic filter as described in Fig. 9.1.

**9.1.2 Fitting the Ceramic Filter – Fig. 9.1**

Fit a replacement filter by reversing the procedure described in Fig. 9.1.

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



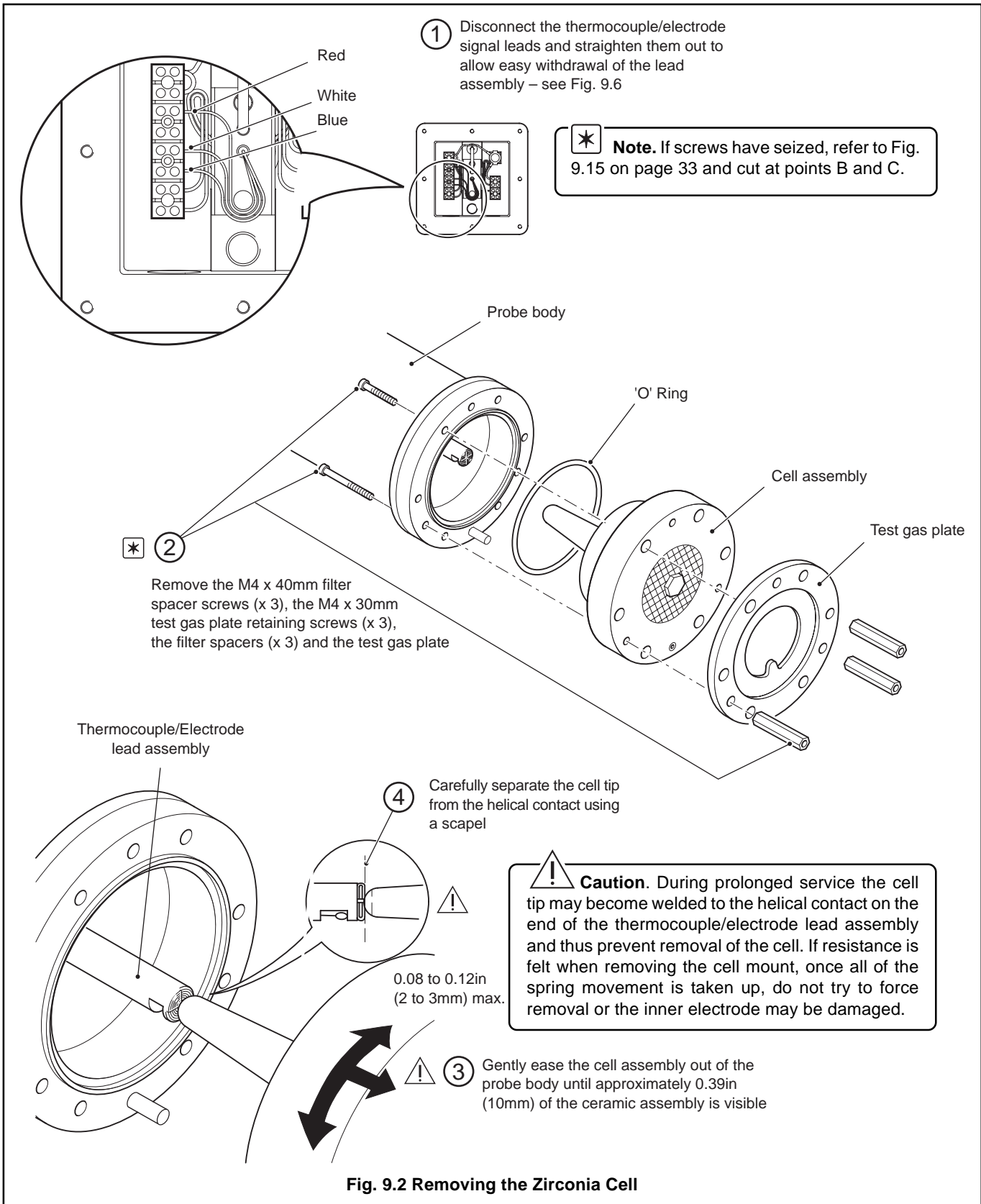
## ...9 DISMANTLING AND RE-ASSEMBLY

### 9.2 Replacing the Zirconia Cell

A zirconia cell assembly is required when replacing the zirconia cell – see Section 10.4.2.

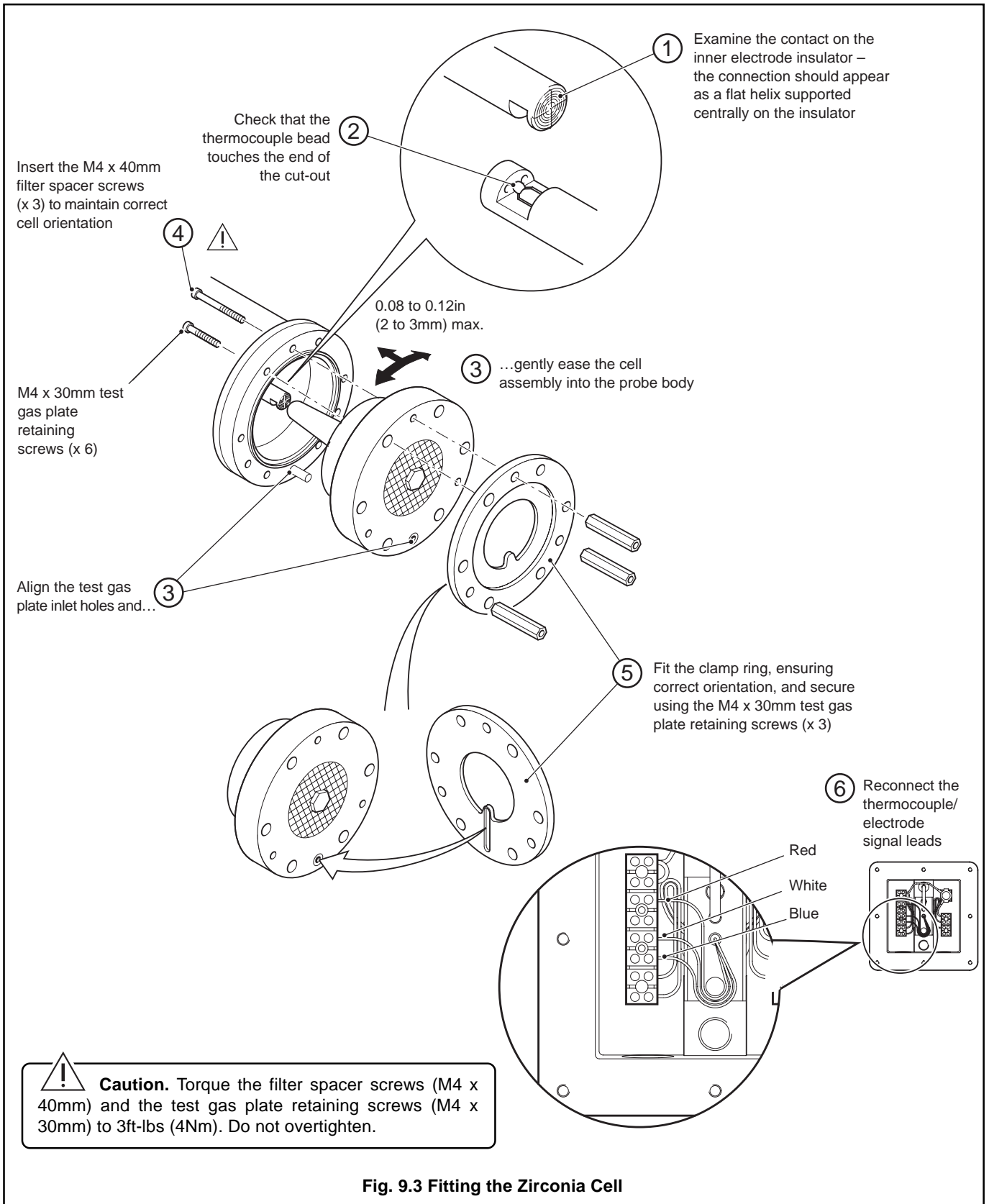
#### 9.2.1 Removing the Zirconia Cell – Fig. 9.2

- Remove the ceramic filter as described in Section 9.1.1.
- Remove the zirconia cell as described in Fig. 9.2.



9.2.2 Fitting the Zirconia Cell – Fig. 9.3

- a) Carry out the procedures described in Fig. 9.3.
- b) Refit the ceramic filter as described in Section 9.1.2.





## ...9 DISMANTLING AND RE-ASSEMBLY

### 9.3 Replacing the Thermocouple/Electrode Lead Assembly

An electrode/thermocouple assembly is required when replacing the electrode/thermocouple lead assembly – see Section 10.4.1

#### 9.3.1 Removing the Thermocouple/Electrode Lead Assembly – Fig. 9.4

- a) Remove the ceramic filter as described in Section 9.1.1.
- b) Remove the zirconia cell as described in Section 9.2.1.
- c) Remove the thermocouple/electrode lead assembly as described in Fig. 9.4.

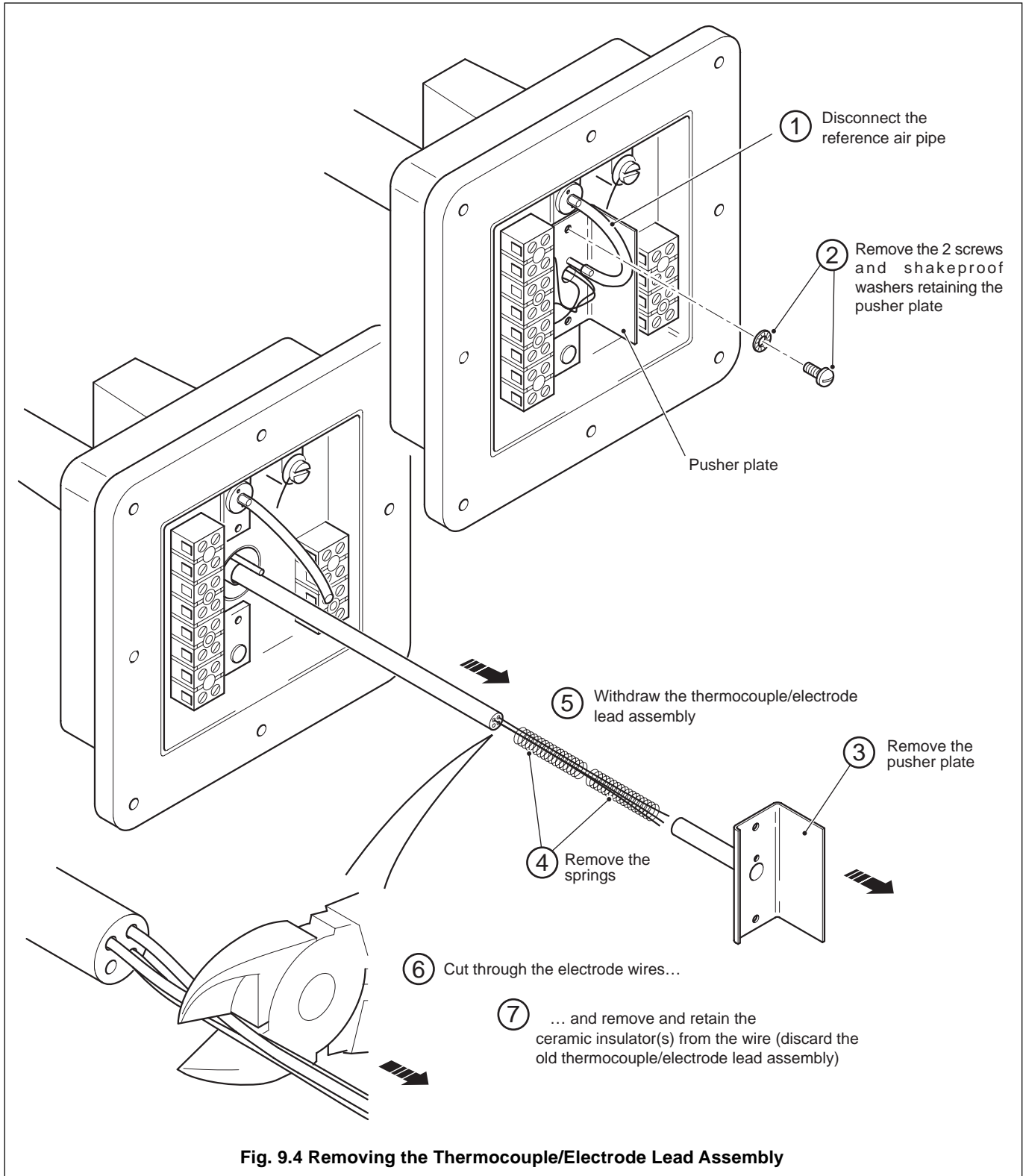


Fig. 9.4 Removing the Thermocouple/Electrode Lead Assembly



9.3.2 Fitting Ceramic Insulators – Fig. 9.5

- 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. 9.5.

**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. 9.5.  
 c) Refit the zirconia cell as described in Section 9.2.2.  
 d) Refit the ceramic filter as described in Section 9.1.2.

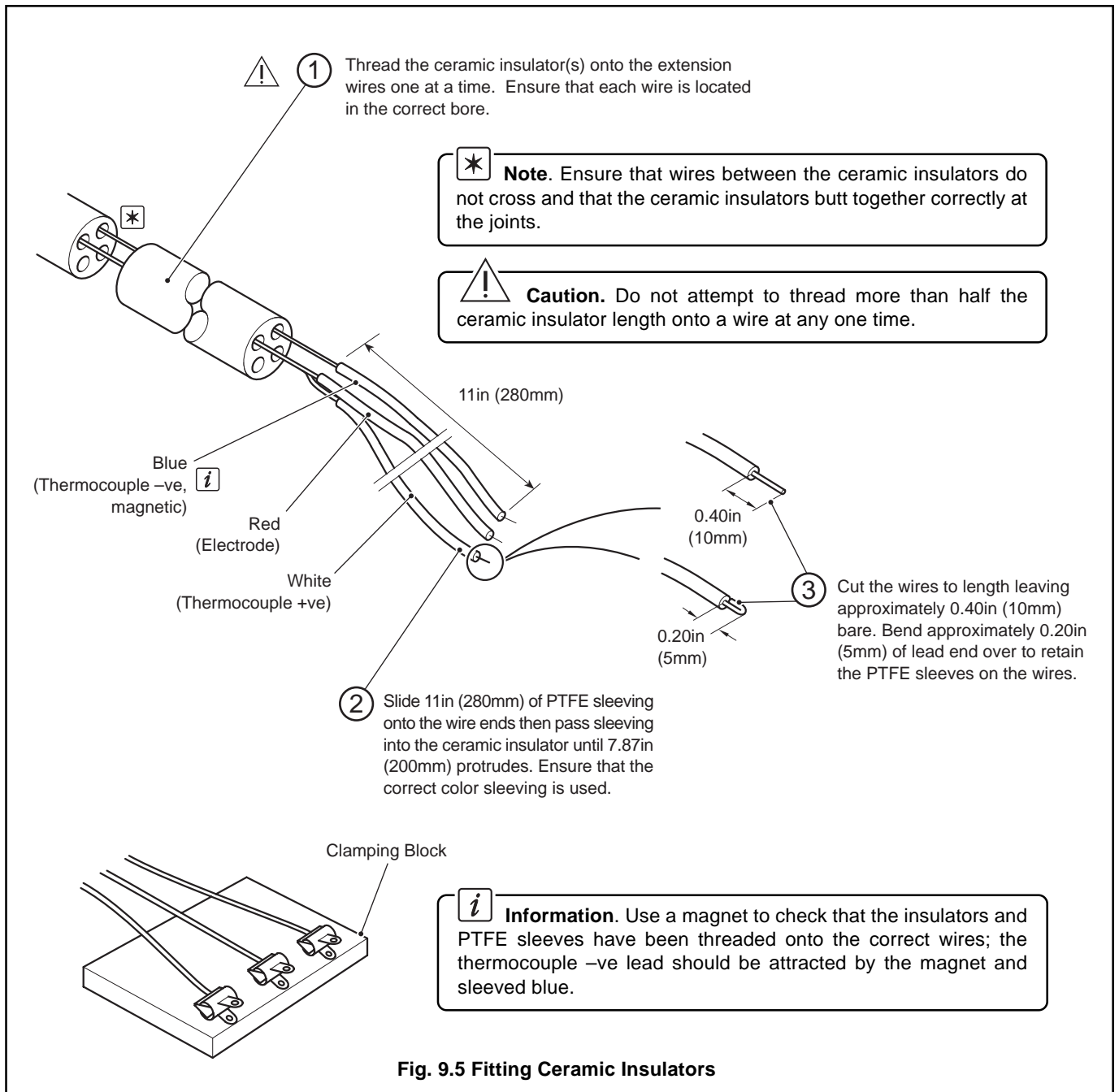
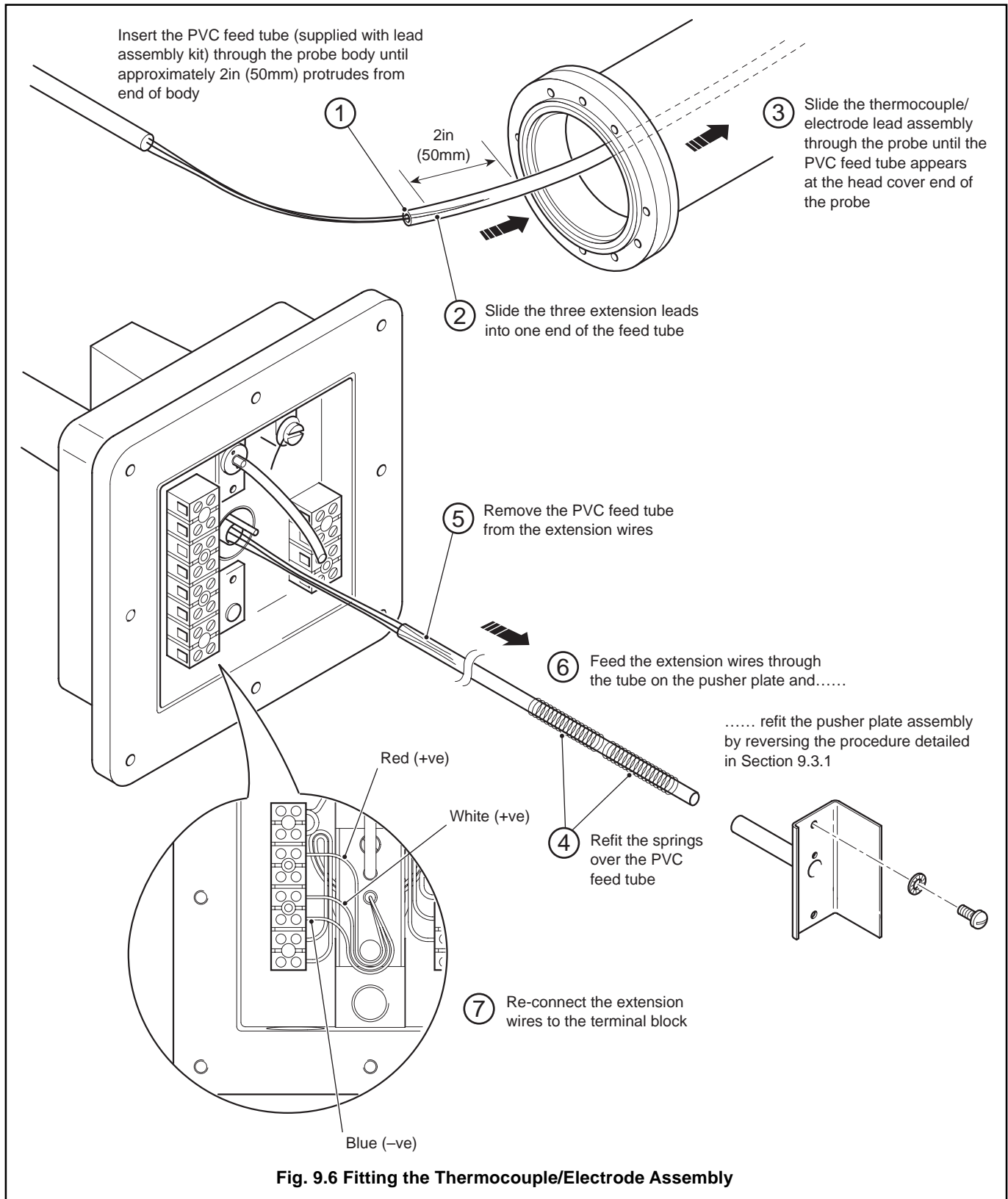


Fig. 9.5 Fitting Ceramic Insulators

## ...9 DISMANTLING AND RE-ASSEMBLY

### 9.3.3 Fitting the Thermocouple/Electrode Lead Assembly – Fig. 9.6

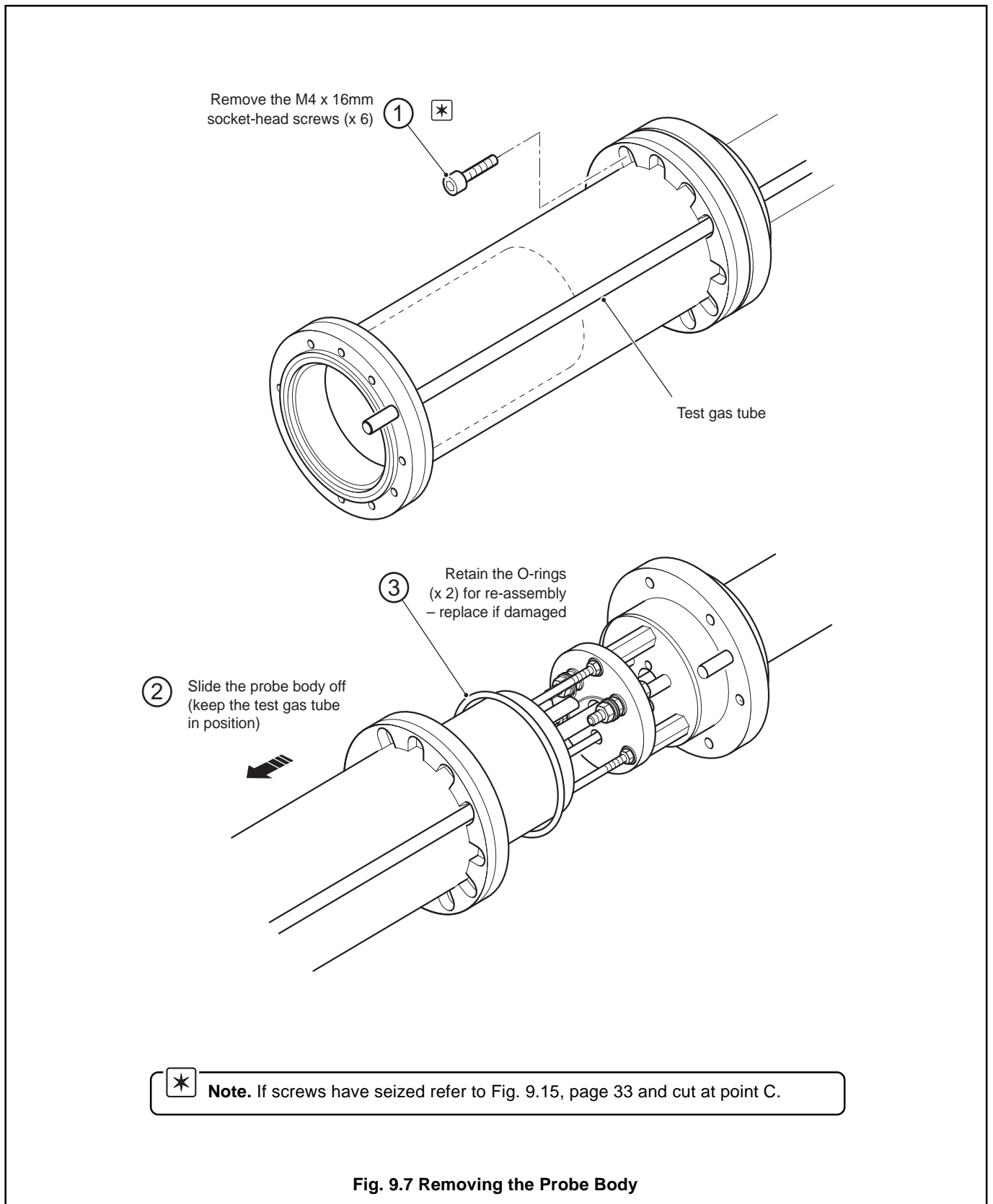
- a) Refit the thermocouple/electrode lead assembly as described in Fig. 9.6.
- b) Refit the zirconia cell as described in Section 9.2.2.
- c) Refit the ceramic filter as described in Section 9.1.2.



### 9.4 Removing the Probe Body – Fig. 9.7

A special fasteners kit is required when refitting the probe body – see Section 10.4.5.

- a) Remove the ceramic filter as described in Section 9.1.1.
- b) Remove the zirconia cell as described in Section 9.2.1.
- c) Remove the probe body described in Fig. 9.7.



## ...9 DISMANTLING AND RE-ASSEMBLY

### 9.5 Replacing the Heater Assembly

A new heater assembly is required when replacing the heater assembly – see Section 10.4.4.

#### 9.5.1 Removing the Heater Assembly – Fig. 9.8

- Remove the ceramic filter as described in Section 9.1.1
- Remove the zirconia cell as described in Section 9.2.1.
- Remove the probe body described in Section 9.4.
- Remove the heater assembly as described in Fig. 9.8.

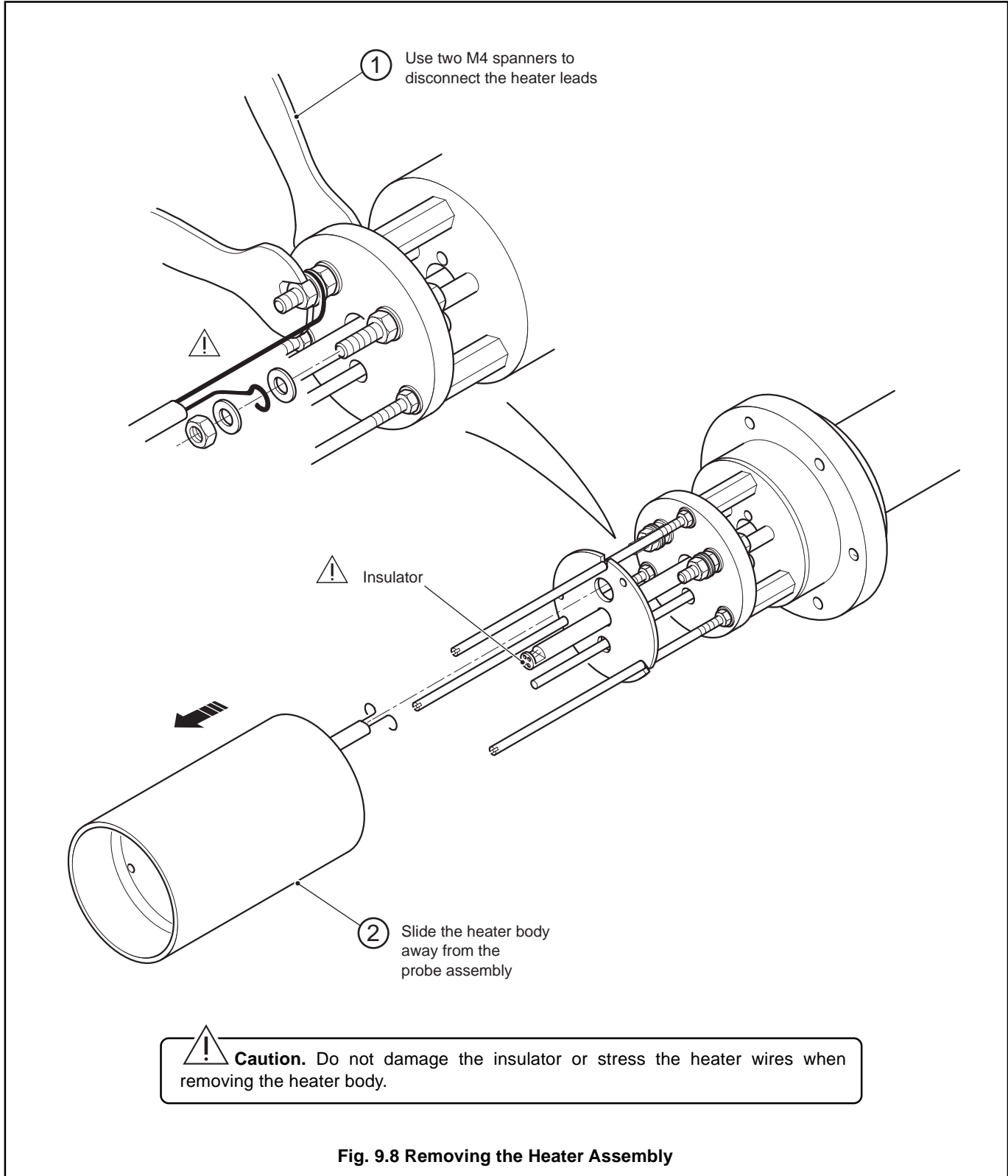
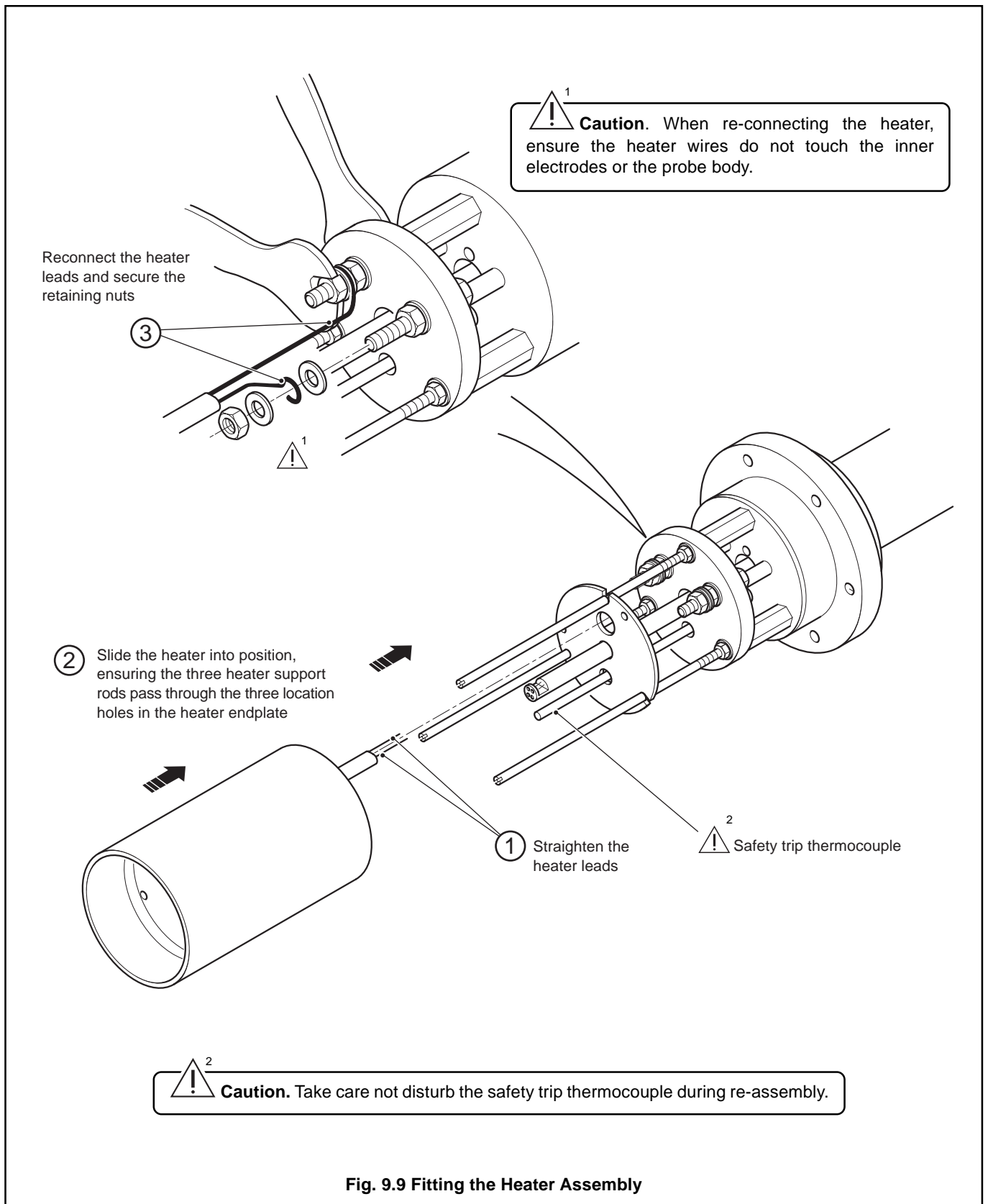


Fig. 9.8 Removing the Heater Assembly

## 9.5.2 Fitting the Heater Assembly – Fig. 9.9

- a) Refit the heater assembly as described in Fig. 9.9
- b) Align the heater assembly as described in Fig. 9.10.



## ...9 DISMANTLING AND RE-ASSEMBLY

### 9.5.3 Aligning the Heater Assembly – Figs. 9.10, 9.11 and 9.12

- a) Align the heater assembly as described Figs. 9.10, 9.11 and 9.12.
- b) Refit the probe body by reversing the steps described in Fig. 9.7.
- c) Refit the zirconia cell as described in Section 9.2.2.
- d) Refit the ceramic filter as described in Section 9.1.2.

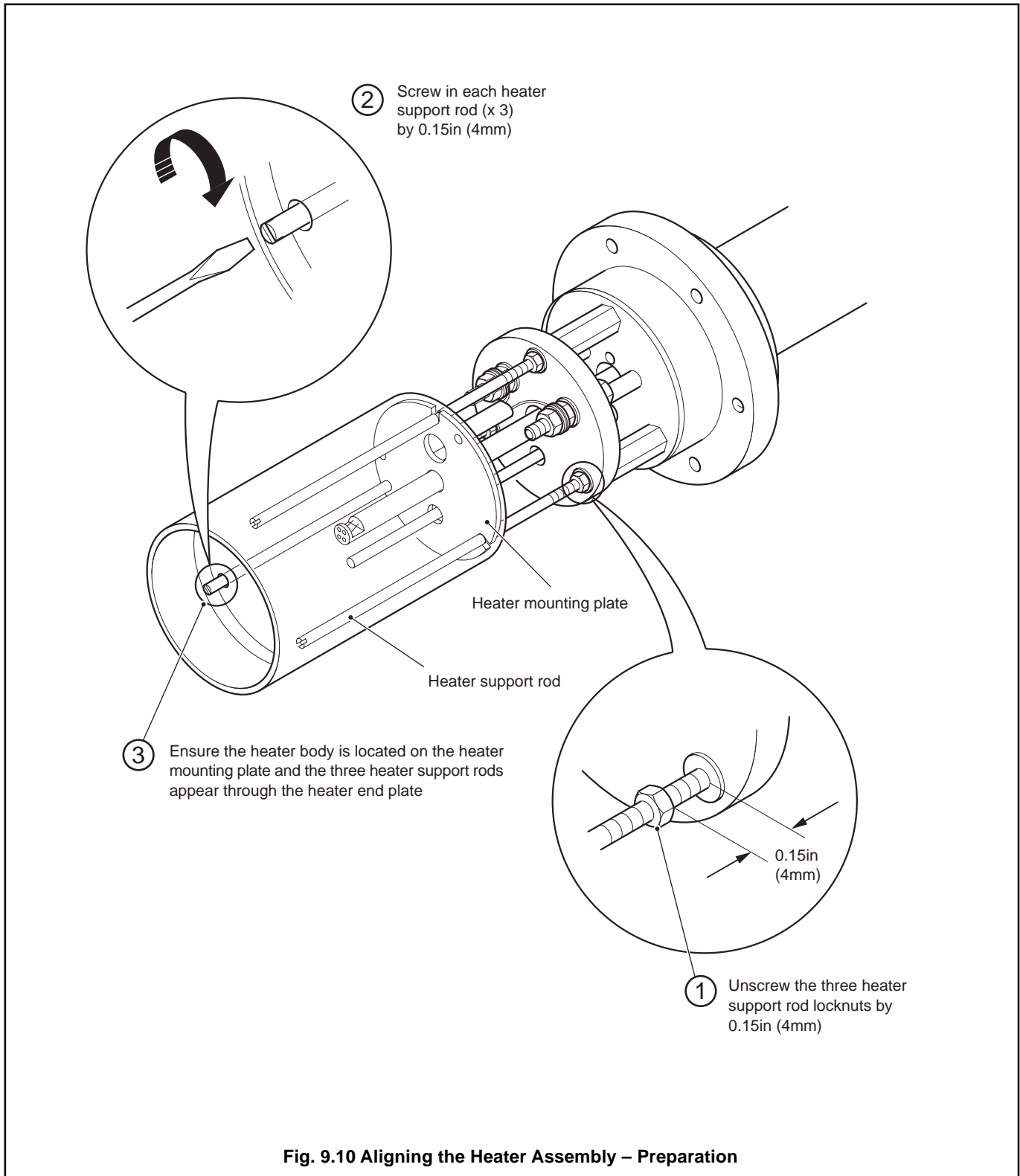


Fig. 9.10 Aligning the Heater Assembly – Preparation

...9.5.3 Aligning the Heater Assembly

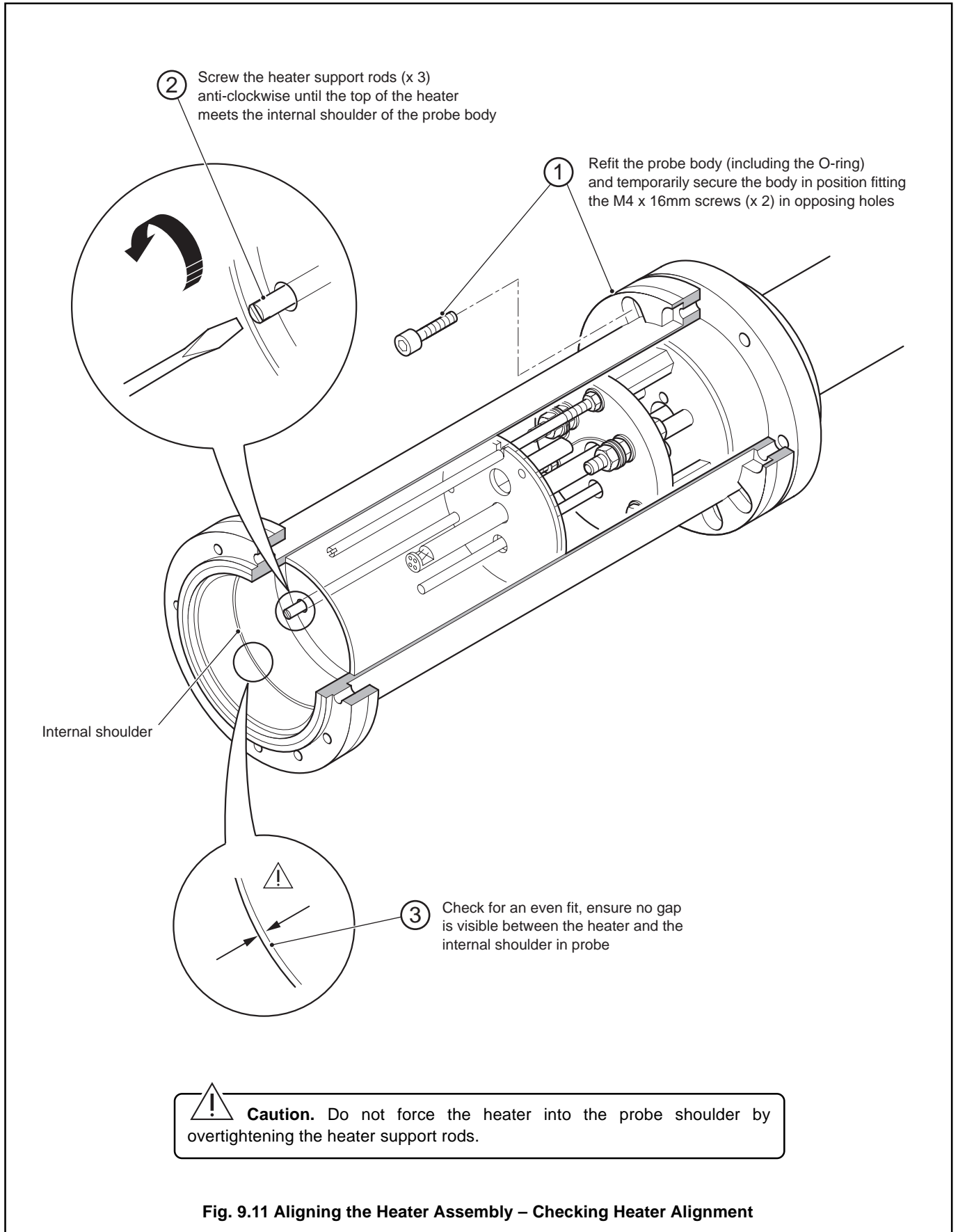


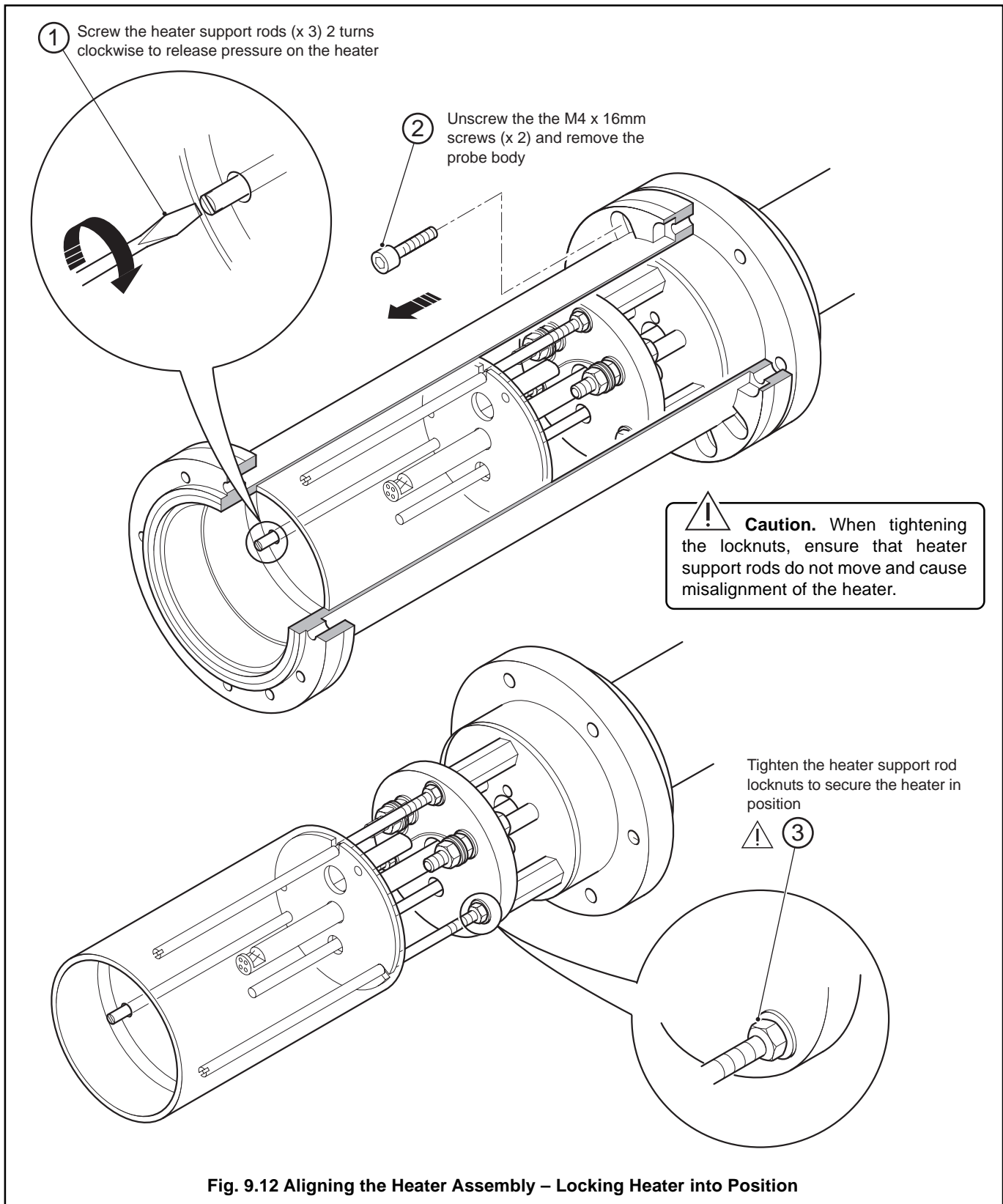
Fig. 9.11 Aligning the Heater Assembly – Checking Heater Alignment

## ...9 DISMANTLING AND RE-ASSEMBLY

### ...9.5.3 Aligning the Heater Assembly



**Caution.** After refitting the heater, check the trip thermocouple voltage (see Section 8.2), or the probe's certification is invalidated.



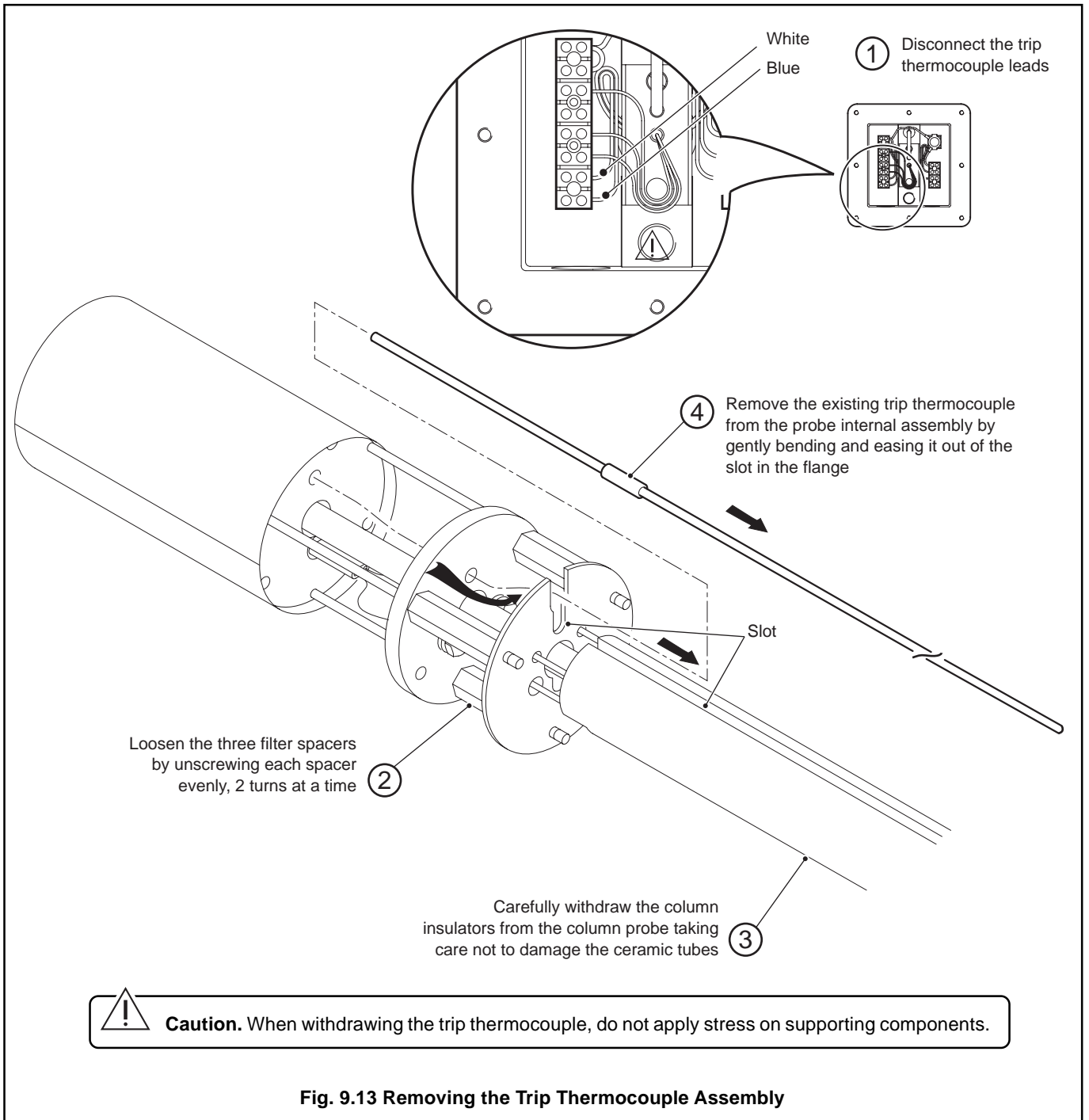


**9.6 Replacing the Trip Thermocouple Assembly**

A replacement trip thermocouple assembly is required for this procedure – see Section 10, Fig. 10.1b, item 35.

**9.6.1 Removing the Trip Thermocouple Assembly – Fig. 9.13**

- a) Remove the ceramic filter as described in Section 9.1.1.
- b) Remove the zirconia cell as described in Section 9.2.1.
- c) Remove the probe body described in Section. 9.4.
- d) Disconnect the thermocouple/electrode lead assembly as described in Section 9.3.1.
- e) Disconnect the trip thermocouple leads in the terminal head – see Section 4.
- f) Remove the trip thermocouple assembly as described in Fig. 9.13.



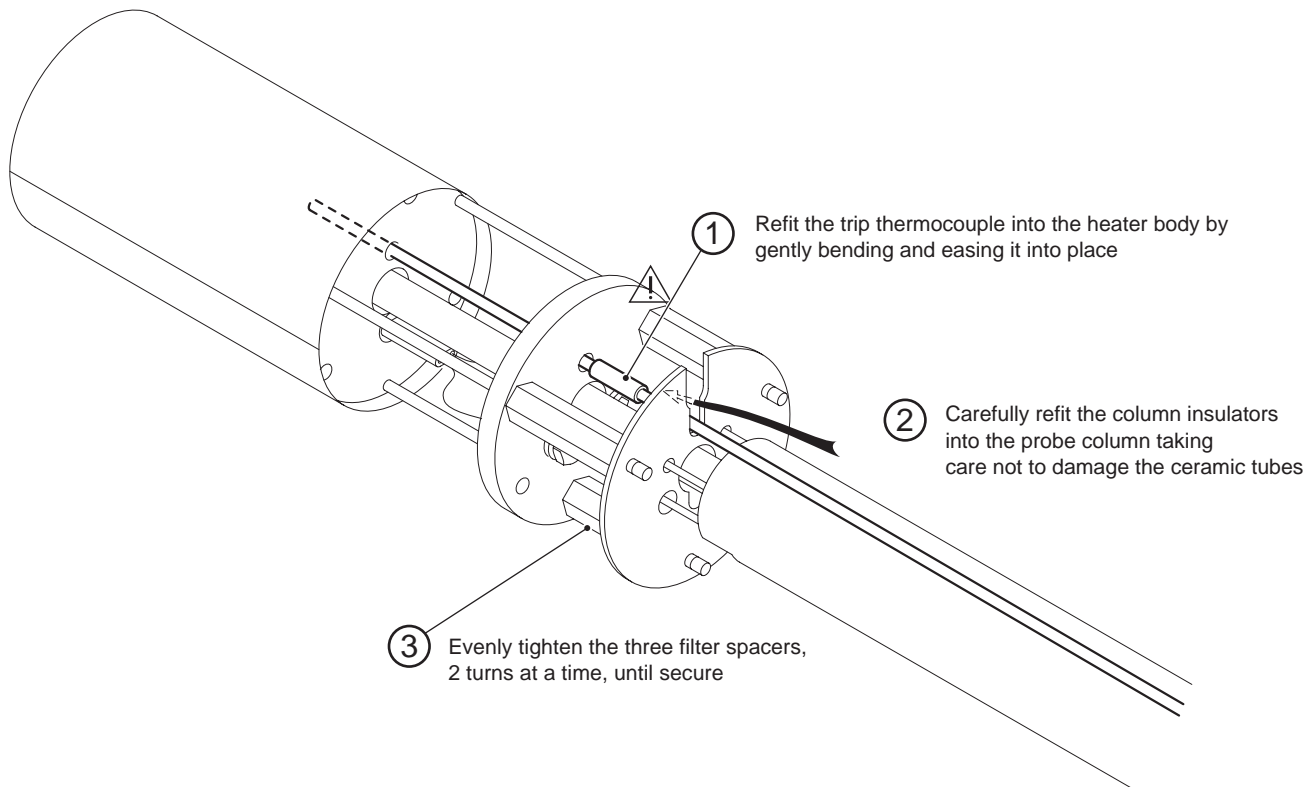
## ...9 DISMANTLING AND RE-ASSEMBLY

### 9.6.2 Fitting the Trip Thermocouple Assembly – Fig. 9.14

- a) Re-assemble the trip thermocouple assembly as described Fig. 9.14.
- 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 9.3.2 and 9.3.3.
- d) Refit the probe body by reversing the steps described in Section 9.4.
- e) Refit the zirconia cell as described in Section 9.2.2.
- f) Refit the ceramic filter as described in Section 9.1.2.
- g) When the probe is fully assembled:
  - i) Switch on the ZMT Oxygen Analyzer .
  - 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 8.2.



**Caution.** The trip thermocouple voltage must be within the limits stated in Section 8.2, or the probe's certification is invalidated.



**Caution.**

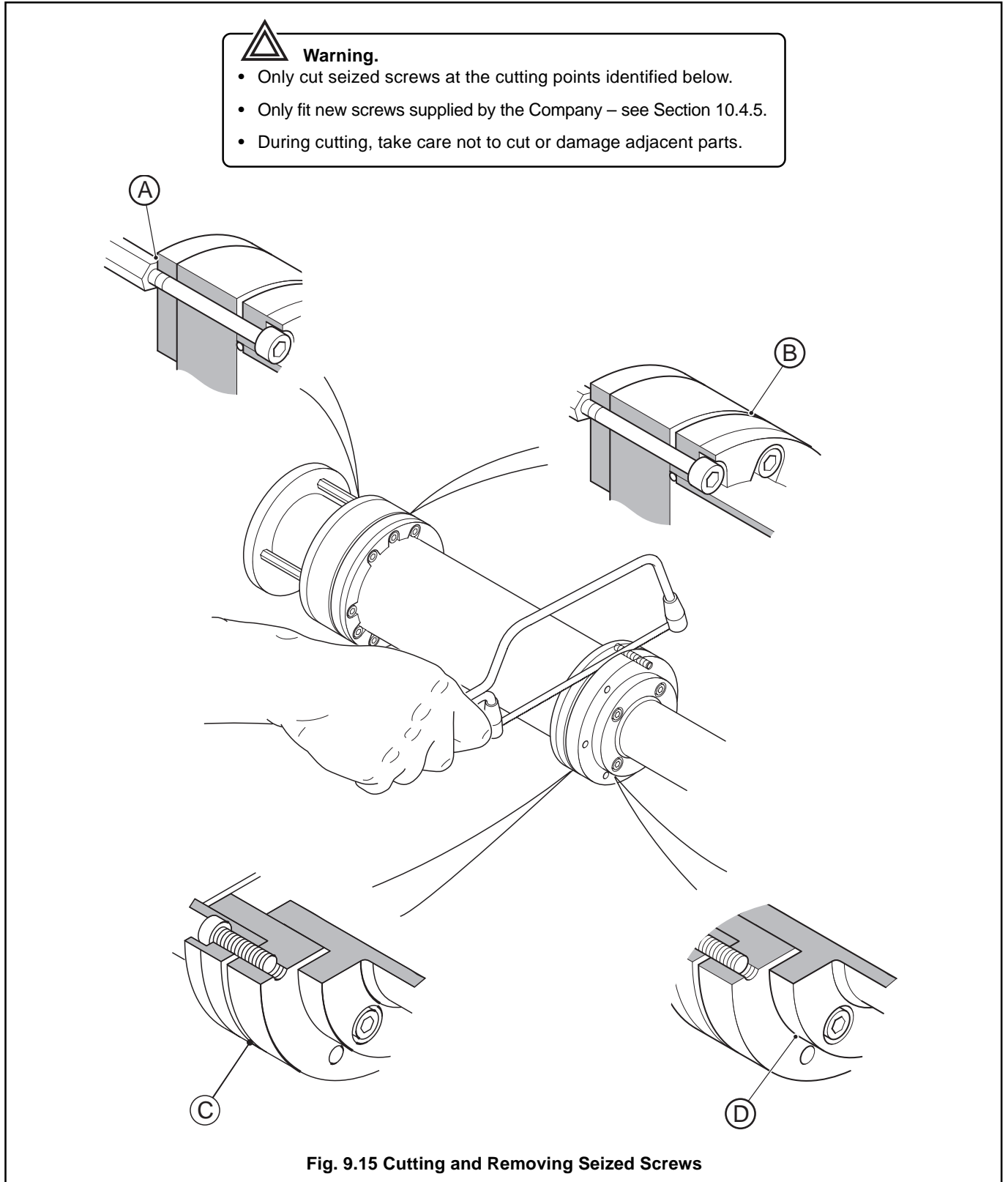
- When refitting the trip thermocouple, do not stress supporting or adjacent components.
- The trip thermocouple must be positioned accurately inside the heater element to ensure accurate voltage readings when checking the trip thermocouple voltage – see Section 9.6.2, step g).

**Fig. 9.14 Fitting the Trip Thermocouple Assembly**

**9.7 Removing Seized Screws – Fig. 9.15**

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 10.4.5.



# 10 REPLACEMENT PARTS

## 10.1 Illustrated Parts List – Fig. 10.1a and 10.1b

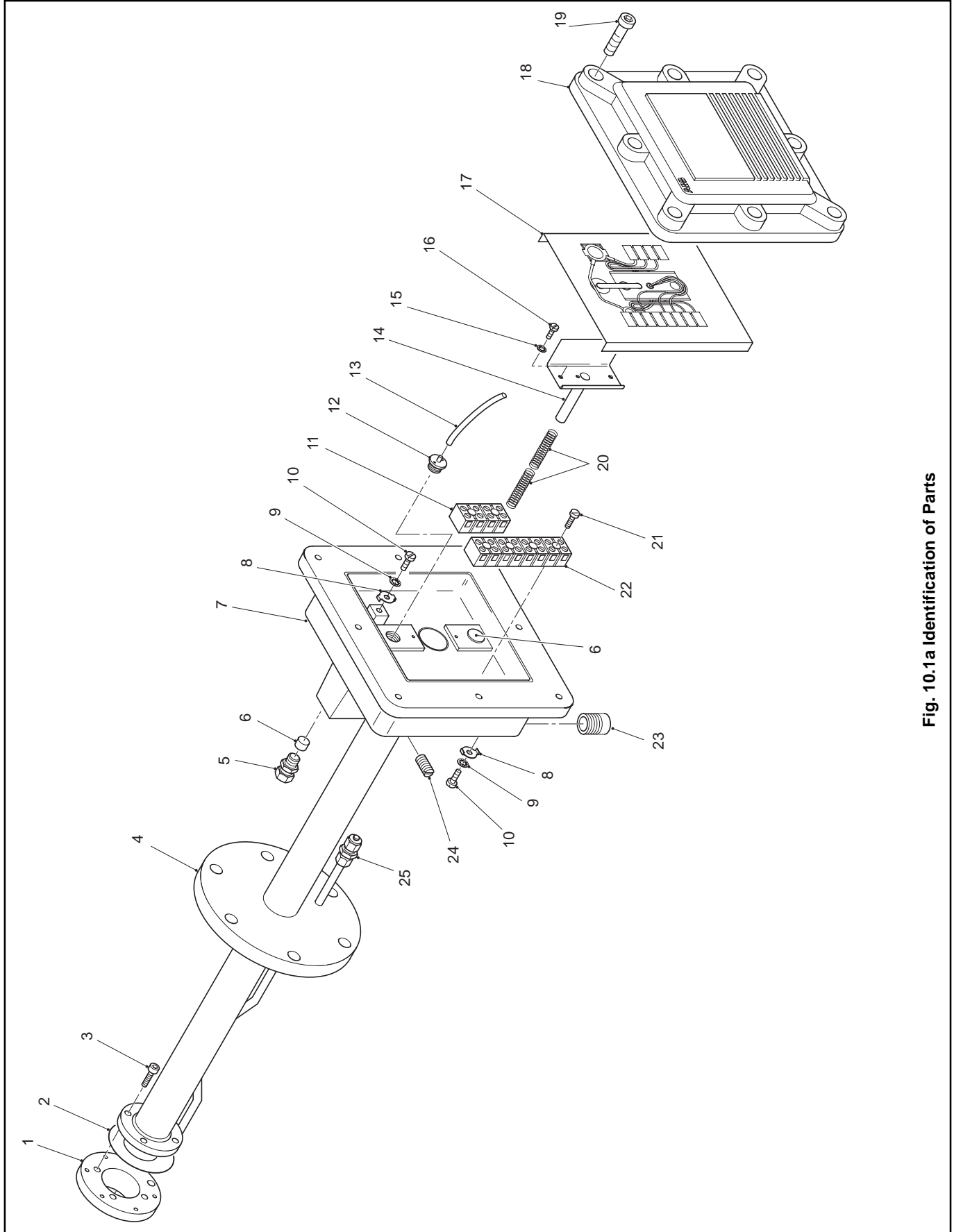


Fig. 10.1a Identification of Parts

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/0111	1
19	M6 x 20mm socket-head screw	B1115	8
20	Spring	B1186	2
21	M3 x 16 screw	B6417	4
22	Terminal block (8-way)	B6184	1
23	M20 x 1.5 conduit plug (EEEx d) (single conduit option only)	B1116	1
24	M6 x 10mm grub screw	B1114	2
25	Coupling (test gas) or Blanking plug*	002320044 003000348	1

\* Items not illustrated

Item	Description	Part No.	Qty.
1	EEEx 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/0071I	1
	ANSI	EXFG/0077I	1
	6.56ft (2.0m) Probe body Standard	EXFG/0072I	1
	ANSI	EXFG/0078I	1
5	Union-adaptor (test gas)	B1119	2
6	Felt filter	B1117	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 Signal earth lead* Body earth lead*	B1130 EXFG/0050 EXFG/0059	2 1 1
11	Terminal block (4-way)	B9254	1
12	Air inlet adaptor	EXFG/0119	1
13	Air inlet tube	2336Bx201006	As reqd.
14	Pusher plate assembly	EXFG/0074	1

...10 REPLACEMENT PARTS

...10.1 Illustrated Parts List – Figs. 10.1a and 10.1b

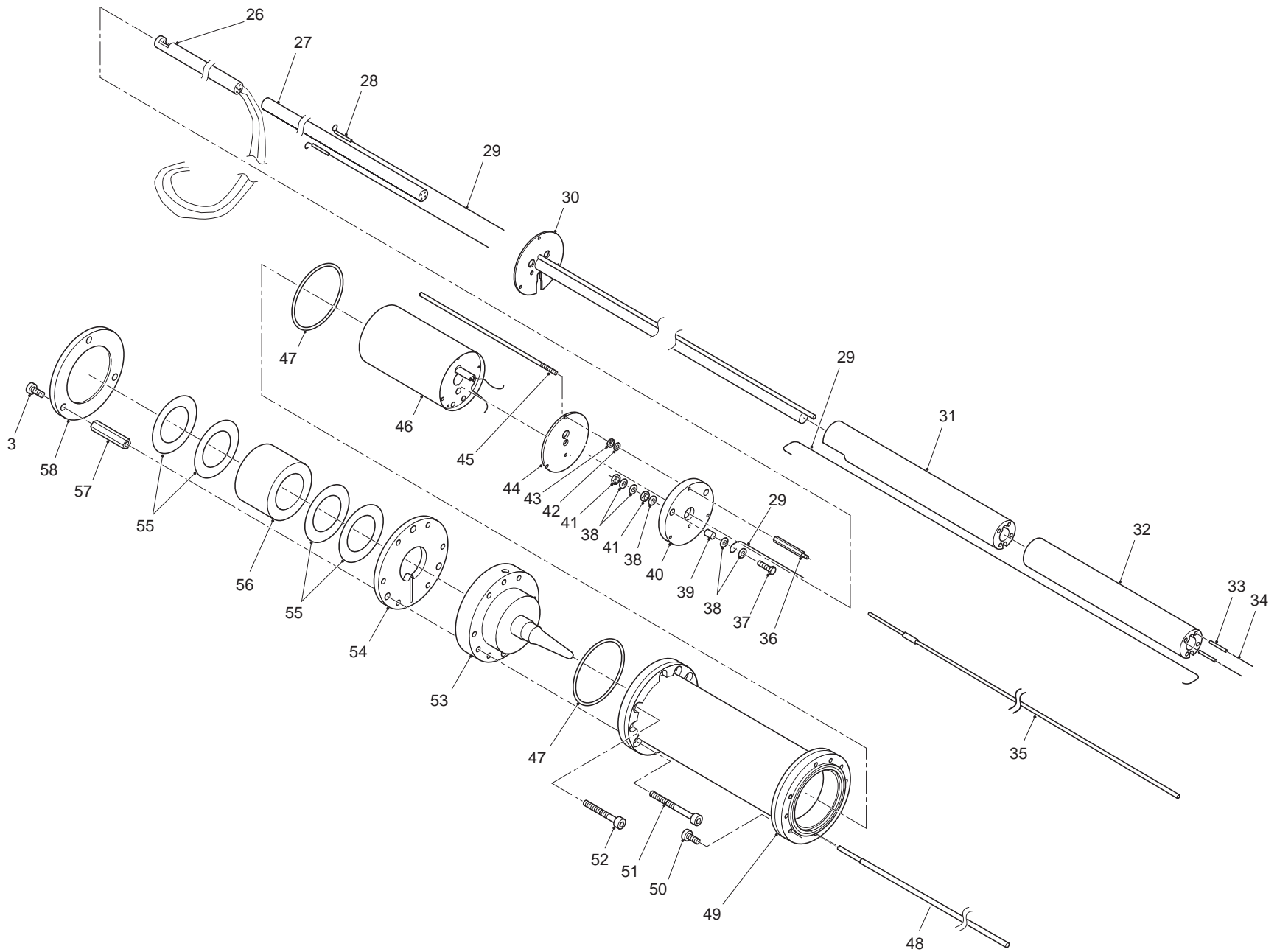


Fig. 10.1b Identification of Parts

Item	Description	Part No.	Qty.	Item	Description	Part No.	Qty.
26	Electrode/thermocouple assembly. .... see Section 9.5 (full replacement kit, excluding item 27)			38	M4 plain washer	B7298	10
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			39	Connection plate spacer	ZFG2/0129	2
28	Heater lead insulator sleeve..... EXFG/0162 ..... 2			40	Ceramic terminal plate	EXFG/0108	1
29	Heater/ceramic insulator wire..... 001351006 ..... As reqd.			41	M4 full nut..... B8690 ..... 4		
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			42	M3 plain washer	B11138	3
31	Column insulator machined..... EXFG/0107 ..... 1			43	M3 full nut..... B7067 ..... 3		
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			44	Heater mounting plate	ZFG2/0158	1
33	1.64ft (0.5m) Probe body only Short column insulator* ..... EXFG/0114 ..... 1			45	Heater support rods	EXFG/0118	3
34	Heater connection wire sleeve ..... B4204 ..... As reqd.			46	Spares heater assembly	EXFG/0096	1
35	Heater connection wire ..... B2404 ..... As reqd.			47	O-ring	002310038	2
36	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			48	Test gas tube..... EXFG/0126 ..... 1		
37	Heater mounting spacers M4 x 25mm hexagon-head screw ..... B10727 ..... 2			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

## 10 REPLACEMENT PARTS

### 10.2 Mounting Plate

Mounting plate assembly – see Fig. 2.4 ..... 003000354

### 10.3 Conduit Assemblies and Special Dual Cable

#### 10.3.1 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

#### 10.3.2 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

#### 10.3.3 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

### 10.4 Spares Kits and Replacement Items

#### 10.4.1 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

#### 10.4.2 Zirconia Cell

Zirconia cell assembly ..... EXFG/0088

#### 10.4.3 Ceramic Filter

Ceramic filter kit ..... EXFG/0087

Comprising:

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

#### 10.4.4 Heater

Heater assembly ..... EXFG/0096

#### 10.4.5 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

### 10.5 Sealants

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

Thread sealant (vent connections) ..... CG5091

### 10.6 Accessory Kits

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



# APPENDIX

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

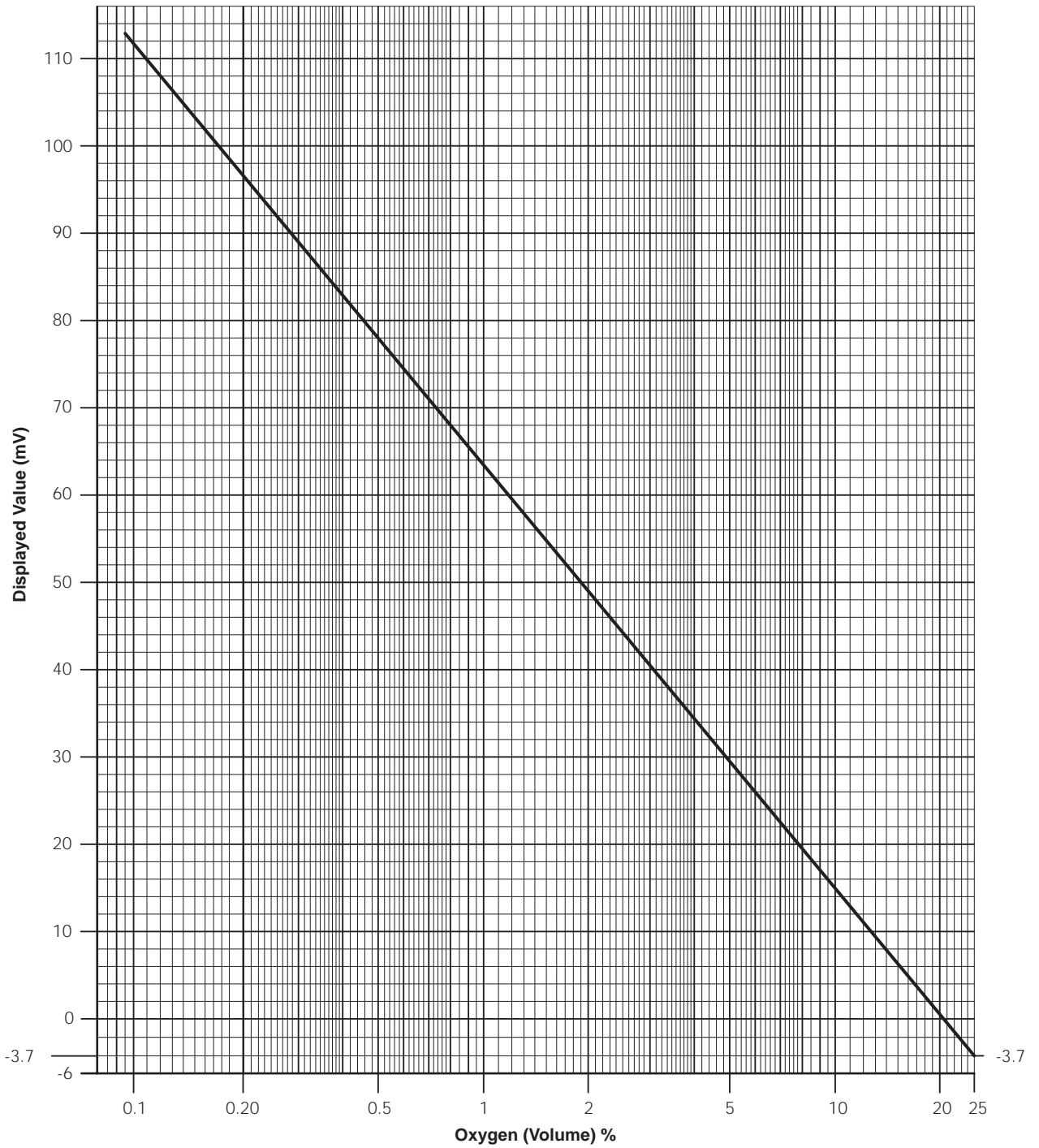


Fig. A1 Displayed Value (mV) v. Percentage Oxygen

---

## NOTES

---

# PRODUCTS & CUSTOMER SUPPORT

## A Comprehensive Instrumentation Range

### Analytical Instrumentation

- **Transmitters**  
On-line pH, conductivity, and dissolved oxygen transmitters and associated sensing systems.
- **Sensors**  
pH, redox, selective ion, conductivity and dissolved oxygen.
- **Laboratory Instrumentation**  
pH and dissolved oxygen meters and associated sensors.
- **Water Analyzers**  
For water quality monitoring in environmental, power generation and general industrial applications including: pH, conductivity, ammonia, nitrate, phosphate, silica, sodium, chloride, fluoride, dissolved oxygen and hydrazine.
- **Gas Analyzers**  
Zirconia, katharometers, hydrogen purity and purge-gas monitors, thermal conductivity.

### Controllers & Recorders

- **Controllers**  
Digital display, electronic, pneumatic. Discrete single-loop and multi-loop controllers which can be linked to a common display station, process computer or personal computer.
- **Recorders**  
Circular and strip-chart types (single and multi-point) for temperature, pressure, flow and many other process measurements.

### Electronic Transmitters

- **Smart & Analog Transmitters**  
For draft, differential, gauge and absolute pressure measurement. Also, liquid level and temperature
- **I to P Converters and Field Indicators**

### Flow Metering

- **Magnetic Flowmeters**  
Electromagnetic, insertion type probes and water meters.
- **Turbine Flowmeters**
- **Wedge Flow Elements**
- **Mass Flow Meters**  
Transmitters, sensors, controllers and batch/display units.

### Level Control

- **Submersible, Capacitance & Conductivity.**

### Pneumatic Instrumentation

- **Transmitters**
- **Indicating Controllers**
- **Recording Controllers**

## Customer Support

ABB Kent-Taylor provides a comprehensive after sales service via a Worldwide Service Organization. Contact one of the following offices for details on your nearest Service and Repair Centre.

### United Kingdom

ABB Kent-Taylor Limited  
Tel: +44 (0)1480 470781  
Fax: +44 (0)1480 470787

### United States of America

ABB Instrumentation Inc.  
Tel: +1 716 2926050  
Fax: +1 716 2736207

### Italy

ABB Kent-Taylor SpA  
Tel: +39 (0) 344 58111  
Fax: +39 (0) 344 56278

### Client Warranty

Prior to installation, the equipment referred to in this manual must be stored in a clean, dry environment, in accordance with the Company's published specification. Periodic checks must be made on the equipment's condition.

In the event of a failure under warranty, the following documentation must be provided as substantiation:

1. A listing evidencing process operation and alarm logs at time of failure.
2. Copies of operating and maintenance records relating to the alleged faulty unit.



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

© 1996 ABB Kent-Taylor Printed in the EC 12.96

**ABB Kent-Taylor Ltd.**  
St. Neots,  
Cambs.  
England, PE19 3EU  
Tel: (01480) 475321  
Fax: (01480) 217948

**ABB Kent-Taylor Ltd.**  
**Analytical & Flow Group**  
Stonehouse, Glos.  
England, GL10 3TA  
Tel: (01453) 826661  
Fax: (01453) 826358

**ABB Instrumentation Inc.**  
PO Box 20550, Rochester  
New York 14602-0550  
USA  
Tel: (716) 292 6050  
Fax: (716) 273 6207

**ABB Kent-Taylor SpA**  
22016 Lenno  
Como  
Italy  
Tel: (0344) 58111  
Fax: (0344) 56278