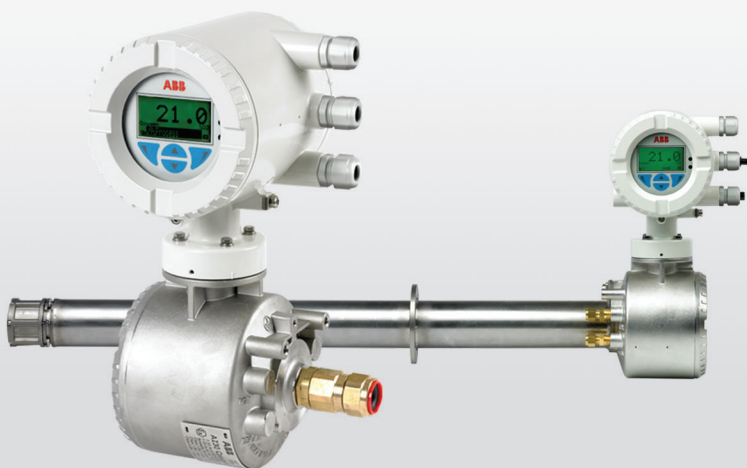


Endura AZ30 series probe and transmitter

Combustion oxygen monitor



Measurement made easy

—
Proven technology for
use in hazardous area
gases and dusts

Introduction

This Maintenance Guide provides the following information:

- site-serviceable maintenance procedures for AZ30 probes (remote and integral versions)
- lists of the spare parts required for the maintenance procedures in this manual.

After completing maintenance procedures, refer to the relevant user guides below to install, connect and configure the system:

- Probe User Guide ([OI/AZ30P-EN](#))
- Programming Guide ([COI/AZ30E-EN](#))

Warning

The AZ30 combustion oxygen monitor is a certified product suitable for use in hazardous area locations. Before using this product refer to the product labeling for details of hazardous area certification.

Maintenance and installation must be carried out only by the manufacturer, authorized agents or persons conversant with the construction standards for hazardous area certified equipment.

For more information

Further publications for the Endura AZ30 probe are available
for free download from:

www.abb.com/analytical

or by scanning this code:



Search for or click on

Data Sheet Endura AZ30 combustion oxygen monitor	DS/AZ30-EN
Programming Guide Endura AZ30 series integral probe and remote transmitter Combustion oxygen monitor	COI/AZ30E-EN
User Guide Endura AZ30 series probe Combustion oxygen monitor	OI/AZ30P-EN
Addendum RoHS Directive 2011/65/EU (RoHS II)	ADD/MEASUREMENT/001-EN

Contents

1	Safety	2		
1.1	Health & Safety	2		
1.2	Electrical Safety – CEI / IEC 61010-1:2001-2	2		
1.3	Symbols – CEI / IEC 61010-1:2001-2	3		
1.4	Product Recycling Information	4		
1.5	Product Disposal	4		
1.6	Restriction of Hazardous Substances (RoHS)	4		
1.7	Safety Precautions	4		
1.8	Safety Conventions	5		
1.9	Safety Recommendations	5		
1.10	Service and Repairs	5		
1.11	Potential Safety Hazards	5		
2	Key Product Safety Areas	6		
2.1	Internal Structure Retaining Screws	6		
2.2	Earth to Probe Chassis	7		
2.3	Flamepath Dimensional Requirements	7		
2.4	Flamepath Locations	8		
3	Troubleshooting – Quick Checks	9		
3.1	Equipment Required	9		
3.2	Pre-check Requirements	9		
3.3	Checking the Heater Resistance	10		
3.4	Checking the Thermocouple / Electrode Assembly Resistance	10		
3.5	Checking the Cell Isolation	11		
3.6	Checking the ACJC Resistance	11		
4	Troubleshooting – Functional Checks	12		
4.1	Equipment Required	12		
4.2	Thermocouple / Electrode Assembly Functional Checks	12		
4.3	Checking Cell Output Voltage	13		
4.3.1	Cell Function Check	14		
4.3.2	Detailed Cell Accuracy Check	14		
4.4	System Functional Check	15		
5	Dismantling and Reassembly – Probe	16		
5.1	Before Removing / Replacing the Probe	16		
5.2	Before Dismantling a Probe	16		
5.3	Flamepath Locations and Maintenance Limitations	17		
5.4	Preparation	17		
5.4.1	Tools Required	17		
5.4.2	Replacement Kits and Spares	17		
5.5	Removing / Refitting an Integral Probe	17		
5.6	Removing / Refitting a Remote Probe	18		
5.7	Replacing the Probe Lid and Seal	19		
5.7.1	Removing the Probe Lid	19		
5.7.2	Fitting a New Probe Lid	19		
5.8	Replacing the Diffuser Flame Arrestor and / or Cell	20		
5.8.1	Removing the Diffuser Flame Arrestor	20		
5.8.2	Removing the Cell and C-ring	20		
5.8.3	Fitting a New C-ring and Cell	22		
5.8.4	Fitting the Diffuser Flame Arrestor	22		
5.9	Replacing the Thermocouple / Electrode Assembly	24		
5.9.1	Removing the Thermocouple / Electrode Assembly	24		
5.9.2	Fitting a New Thermocouple / Electrode Assembly	26		
5.10	Replacing Restrictors	28		
5.11	Replacing the PT1000 Temperature Sensor	29		
6	Dismantling and Reassembly – Transmitter	30		
6.1	Flamepath Locations and Maintenance Limitations	30		
6.2	Replacing the Transmitter Cartridge	30		
6.3	Replacing the Transmitter Backplane	31		
6.3.1	Removing the Backplane	31		
6.3.2	Fitting a New Backplane	31		
6.4	Replacing the Remote Transmitter Lid	32		
6.4.1	Removing the Remote Transmitter Lid	32		
6.4.2	Fitting a New Remote Transmitter Lid	32		
7	Illustrated Parts List – Probe	33		
7.1	Diffuser Flame Arrestor	34		
7.2	Cell Assembly	34		
7.3	C-ring Kit	34		
7.4	AZ30 Probe Lid Replacement Kit	34		
7.5	Thermocouple / Electrode Assembly	34		
7.6	Restrictor Kit	34		
7.7	PT1000 Temperature Sensor	34		
8	Illustrated Parts List – Transmitter	35		
8.1	Cartridge	36		
8.2	AZ30 Probe Backplane	36		
8.3	AZ30 Remote Terminal Housing Lid	36		
	Appendix A – Electrical Connection Details	37		
A.1	Internal Wire Numbers and Terminal Colors	37		
A.2	AZ30 Integral Probe	38		
A.3	AZ30 Remote Probe	39		
	Appendix B – Probe Electrical Connections	40		
B.1	AZ30 Probe Transmitter Cable Connections	40		
B.2	AutoCal Connections at AZ30 Probe	40		
B.3	AutoCal Pressure Switch Connections	41		
B.4	AutoCal Solenoid Valve Terminal Connections	41		
	Appendix C – EC Declaration of Conformity	42		

1 Safety

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 the Technical Publications Department.

Warning.

- It is **not** permitted to perform any maintenance procedure that requires removal of the probe's internal structure – see Section 2.1, Fig. 1.1.
- Before commencing maintenance procedures familiarize yourself with flamepath locations (see Section 2, page 6) and the earth to probe chassis connection conditions (see Section 2.2, page 7).
- Install and use associated equipment in accordance with the relevant national and local standards.
- Maintenance and installation must be carried out **only** by the manufacturer, authorized agents or persons conversant with the construction standards for hazardous area certified equipment.
- Before undertaking maintenance procedures, identify and obtain the required spares / replacement items.
- When in operation, the cell end of the probe reaches temperatures up to 100 °C (212 °F). Allow the cell to reach ambient temperature before starting maintenance procedures.

1.1 Health & Safety

Health and Safety

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

- The relevant sections of these instructions must be read carefully before proceeding.
- Warning labels on containers and packages must be observed.
- Installation, operation, maintenance and servicing must only be carried out by suitably trained personnel and in accordance with the information given.
- Normal safety precautions must be taken to avoid the possibility of an accident occurring when operating in conditions of high pressure and / or temperature.

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














1.2 Electrical Safety – CEI / IEC 61010-1:2001-2

This equipment complies with the requirements of CEI / IEC 61010-1:2001-2 'Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use' and complies with US NEC 500, NIST and OSHA.


If the equipment is used in a manner NOT specified by the Company, the protection provided by the equipment may be impaired.

1.3 Symbols – CEI / IEC 61010-1:2001-2

One or more of the following symbols may appear on the equipment labelling:

	Protective earth (ground) terminal.
	Functional earth (ground) terminal.
	Direct current supply only.
	Alternating current supply only.
	Both direct and alternating current supply.
	The equipment is protected through double insulation.
	This symbol, when noted on a product, indicates a potential hazard which could cause serious personal injury and / or death. The user should reference this instruction manual for operation and / or safety information.
	This symbol, when noted on a product enclosure or barrier, indicates that a risk of electrical shock and / or electrocution exists and indicates that only individuals qualified to work with hazardous voltages should open the enclosure or remove the barrier.
	This symbol indicates that the marked item can be hot and should not be touched without care.
	This symbol indicates the presence of devices sensitive to electrostatic discharge and indicates that care must be taken to prevent damage to them.
	This symbol identifies a risk of chemical harm and indicates that only individuals qualified and trained to work with chemicals should handle chemicals or perform maintenance on chemical delivery systems associated with the equipment.
	This symbol indicates the need for protective eye wear.
	This symbol indicates the need for protective hand wear.
	Electrical equipment marked with this symbol may not be disposed of in European public disposal systems. In conformity with European local and national regulations, European electrical equipment users must now return old or end-of-life equipment to the manufacturer for disposal at no charge to the user.
	Products marked with this symbol indicates that the product contains toxic or hazardous substances or elements. The number inside the symbol indicates the environmental protection use period in years.


1.4 Product Recycling Information

	Electrical equipment marked with this symbol may not be disposed of in European public disposal systems after 12 August 2005. In conformity with European local and national regulations (EU Directive 2002 / 96 / EC), European electrical equipment users must now return old or end-of-life equipment to the manufacturer for disposal at no charge to the user.
--	---


Note. For return for recycling, please contact the equipment manufacturer or supplier for instructions on how to return end-of-life equipment for proper disposal.

1.5 Product Disposal

Note. The following only applies to European customers.

	<p>ABB is committed to ensuring that the risk of any environmental damage or pollution caused by any of its products is minimized as far as possible. The European Waste Electrical and Electronic Equipment (WEEE) Directive (2002 / 96 / EC) that came into force on August 13 2005 aims to reduce the waste arising from electrical and electronic equipment; and improve the environmental performance of all those involved in the life cycle of electrical and electronic equipment.</p> <p>In conformity with European local and national regulations (EU Directive 2002 / 96 / EC stated above), electrical equipment marked with the above symbol may not be disposed of in European public disposal systems after 12 August 2005.</p>
--	---

1.6 Restriction of Hazardous Substances (RoHS)

	The European Union RoHS Directive and subsequent regulations introduced in member states and other countries limits the use of six hazardous substances used in the manufacturing of electrical and electronic equipment. Currently, monitoring and control instruments do not fall within the scope of the RoHS Directive, however ABB has taken the decision to adopt the recommendations in the Directive as the target for all future product design and component purchasing. .
--	--

1.7 Safety Precautions

Please read the entire manual before unpacking, setting up, or operating this instrument.

Pay particular attention to all warning and caution statements. Failure to do so could result in serious injury to the operator or damage to the equipment.

To ensure the protection provided by this equipment is not impaired, do not use or install this equipment in any manner other than that which is specified in this manual.

1.8 Safety Conventions

Warning. Indicates a condition which, if not met, could cause serious personal injury and / or death. Do not move beyond a warning until all conditions have been met.

If a warning sign appears on the instrument itself, refer to Precautionary Labels – UL Certification and Electrical Safety – CEI / IEC 61010-1:2001-2 for an explanation.

Caution. Indicates a condition which, if not met, could cause minor or moderate personal injury and / or damage to the equipment. Do not move beyond a caution until all conditions have been met.

Note. Indicates important information or instructions that should be considered before operating the equipment.

1.9 Safety Recommendations

For safe operation, it is imperative that these service instructions be read before use and that the safety recommendations mentioned herein be scrupulously respected. If danger warnings are not heeded to, serious material or bodily injury could occur.

1.10 Service and Repairs

Other than the serviceable items listed in Appendix B, page 40, none of the instrument's components can be serviced by the user. Only personnel from ABB or its approved representative(s) is (are) authorized to attempt repairs to the system and only components formally approved by the manufacturer should be used. Any attempt at repairing the instrument in contravention of these principles could cause damage to the instrument and corporal injury to the person carrying out the repair. It renders the warranty null and void and could compromise the hazardous area certification, correct working of the instrument, electrical integrity and the CE compliance of the instrument.

If you have any problems with installation, starting, or using the instrument please contact the company that sold it to you. If this is not possible, or if the results of this approach are not satisfactory, please contact the manufacturer's Customer Service

1.11 Potential Safety Hazards

The following potential safety hazards are associated with operating the system:

- Electrical (line voltage) – see page 6
- Hot surfaces – see page 6
- Probe weight – see Probe User Guide (OI/AZ30P-EN)
- Battery backup

The probe-mounted (integral) transmitter employs an IEC 60086-1 Type C battery Varta type CR 2025 Li-Manganese-dioxide / Organic Electrolyte cell, 3V 165mAh or equivalent.

The battery cell is used as backup for a real-time clock with a minimum life expectancy of 10 years in normal use.

The battery is one of the components covered by the hazardous area certification of this product and must be replaced **only** with the same specification cell (or direct equivalent) and must be fitted correctly.

If the battery needs replacing please contact ABB.

- Use in oxygen-enriched atmospheres

The Endura AZ30 oxygen systems must be used **only** for measuring non-oxygen enriched gasses (not more than 21 % oxygen [air]) at pressure no greater than 1.1 bar absolute (44 in. WG).

2 Key Product Safety Areas

Warning. All procedures listed in this manual invalidate the system's explosion-proof integrity. Consequently, before removing any covers or lids, ensure there are no hazardous gases present or alternatively, remove the probe from the hazardous area.

Warning. Before installation and / or maintenance refer to Table 2.1 and Fig.2.3, page 8 to familiarize yourself with:

- Mains power
- Hot surfaces
- Flamepath types and locations (surface finishes, thread lengths, threadforms and fits on all flamepaths must remain undamaged to maintain system integrity and Hazardous Area certification)
- Locking screw locations (locking screws must be in the **locked** position at all times the system is operational. Use the 3 mm A/F hex. wrench [supplied]).

2.1 Internal Structure Retaining Screws

Warning. The 3 internal structure retaining screws (A) must **not** be disturbed. Any maintenance procedures that require removal of the 3 internal structure retaining screws (A) must be performed by qualified ABB personnel only.

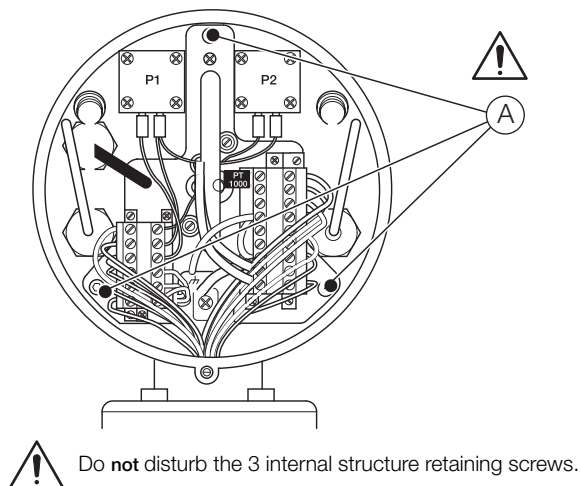


Fig. 2.1 Internal Structure Retaining Screws

2.2 Earth to Probe Chassis

Warning. If the earth to chassis wire (A) in the probe head is disconnected for maintenance or component replacement purposes, it must be reconnected before testing or using the probe.

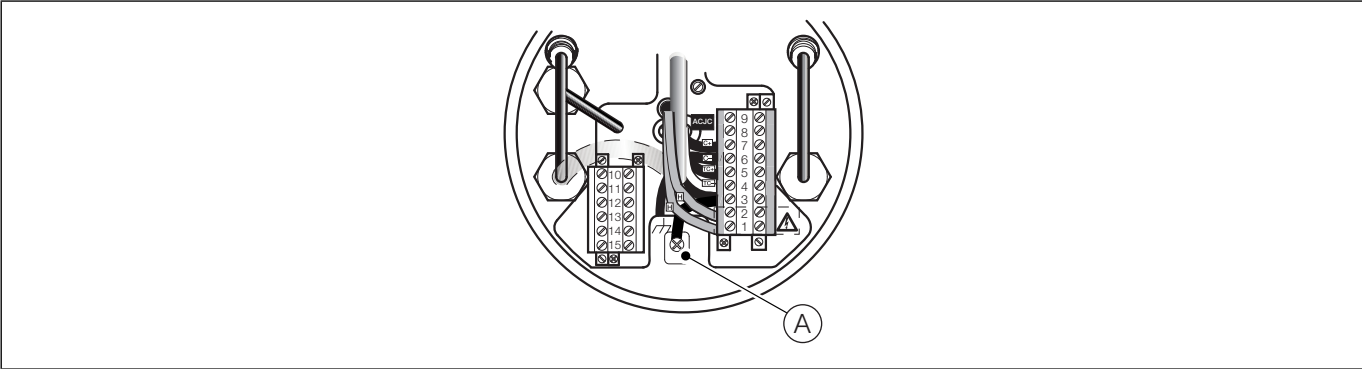


Fig. 2.2 Earth to Probe Chassis

2.3 Flamepath Dimensional Requirements

For dimensional checking purposes, Table 2.1 gives the values and tolerance of the spigot-type joints found in the probe's construction – refer to Fig. 2.3, page 8 for flamepath FP²A and FP²B locations.

Flamepath ID	Spigot OD mm (in.)	Bore ID mm (in.)
FP ² A	44.0 (1.732) +0.03 (+0.00118) −0.015 (−0.00059)	44.0 (1.732) +0.05 (+0.00196) −0.35 (−0.01377)
FP ² B	31.96 (1.258) +0.03 (+0.00118) −0.015 (−0.00059)	32.0 (1.259) +0.04 (+0.00157) −0.00 (−0.0)

Table 2.1 Flamepath Dimensions Outside of the Requirements of IEC60079–1 for Inspection and Maintenance

2.4 Flamepath Locations

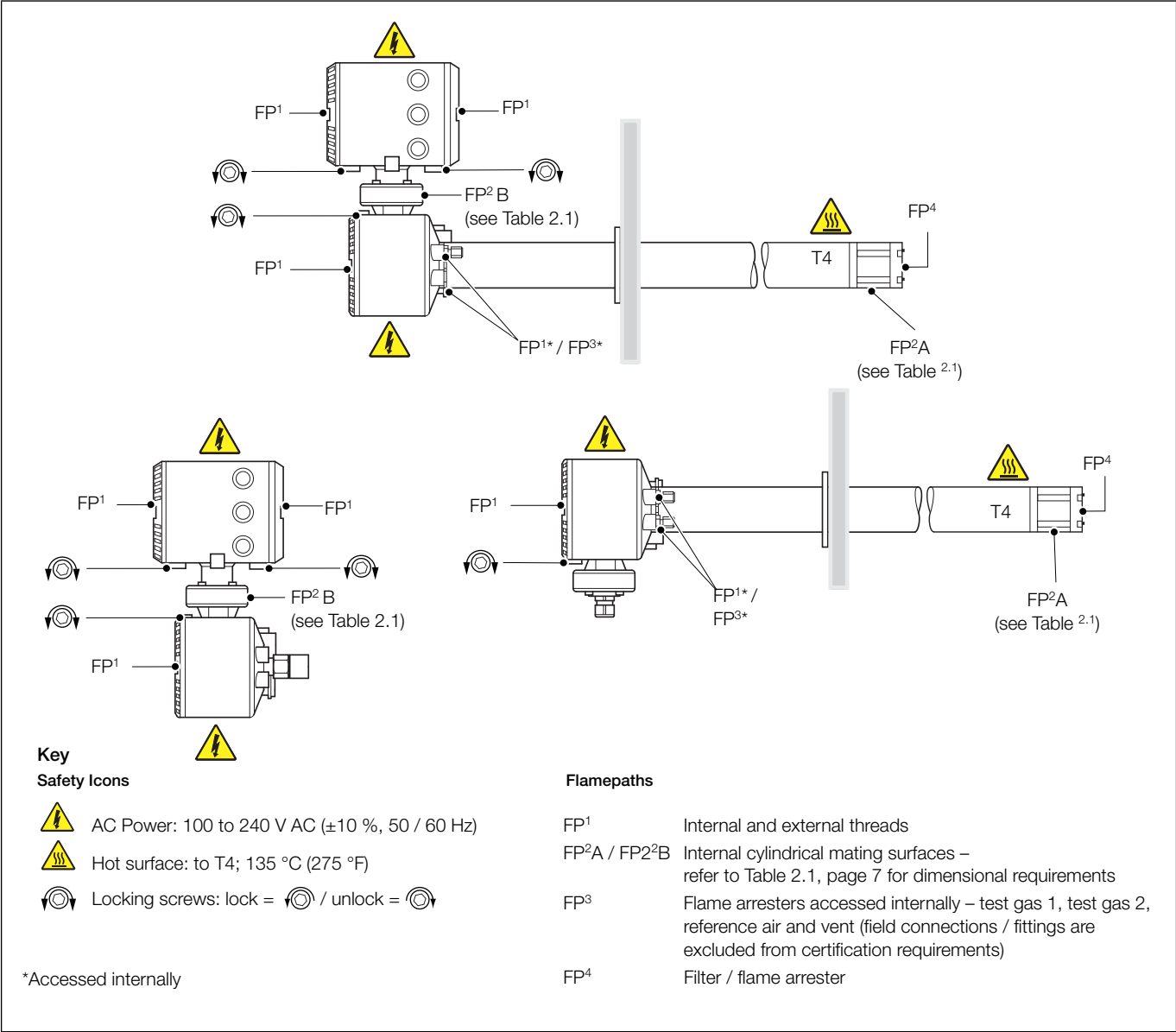


Fig. 2.3 Flamepath Locations and Key Product Safety Areas

3 Troubleshooting – Quick Checks

Warning. All procedures listed in this manual invalidate the system's explosion-proof integrity. Consequently, before removing any covers or lids, ensure there are no hazardous gases present or alternatively, remove the probe from the hazardous area.

Troubleshooting diagnostics are displayed on the transmitter – refer to the transmitter Programming Guide (COI/AZ30E-EN). Where a diagnostic fault is traced to the probe, it may be possible to identify and rectify the fault. After any rectification, the system must be recalibrated.

The following checks can be used to troubleshoot the cause of probe failure quickly:

- checking heater resistance – refer to Section 3.3, page 10
- checking thermocouple / electrode assembly resistance – refer to Section 3.4, page 10
- checking cell isolation – refer to Section 3.5, page 11

3.1 Equipment Required

Digital multimeter ($\geq 10 \text{ M}\Omega$ input impedance on mV ranges).

3.2 Pre-check Requirements

1. The probe does not function properly unless the correct reference air is applied – refer to the probe User Guide (OI/AZ30P-EN).
2. Isolate the probe / transmitter system from mains power before performing checks.



Warning.

Dangerous voltages are present in the probe head across the heater terminals (A) (brown and blue) – refer to Fig. 3.1.

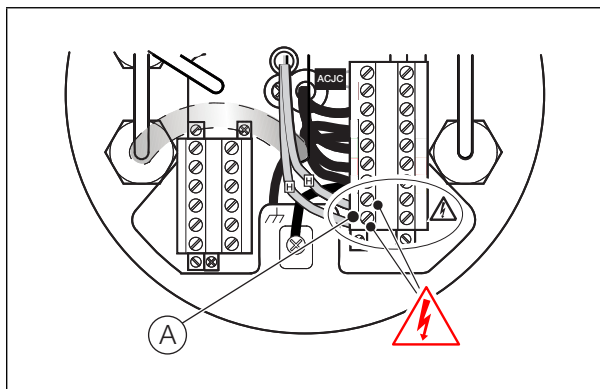


Fig. 3.1 Heater Terminals in Probe Head

Referring to Fig.3.2:

3. At the probe, unscrew and remove the probe lid (A) and unplug the 9-way terminal plug (B) from the 9-way terminal block (C) by unscrewing the 2 x M3 plug retaining screws (D).

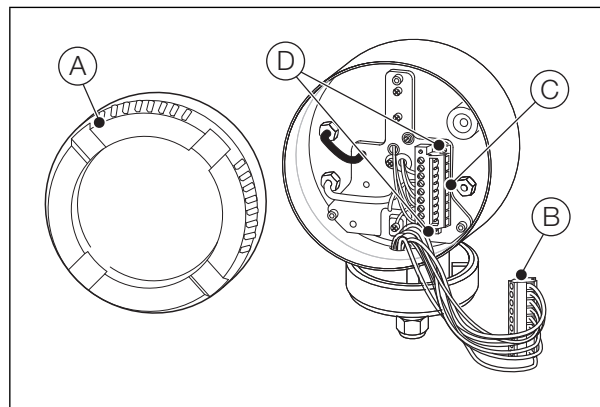


Fig. 3.2 Disconnecting the 9-way Terminal Plug

Note. If the probe has AutoCal, a 6-way terminal block / plug (not shown) is fitted to the terminal plate. It is not necessary to unplug the 6-way terminal plug to perform initial checks.

4. Proceed to Section 3.3, page 10.

3.3 Checking the Heater Resistance

Referring to Fig. 3.3:

- 1. At the 9-way terminal block (A), measure the resistance across the heater leads (B) (brown and blue).

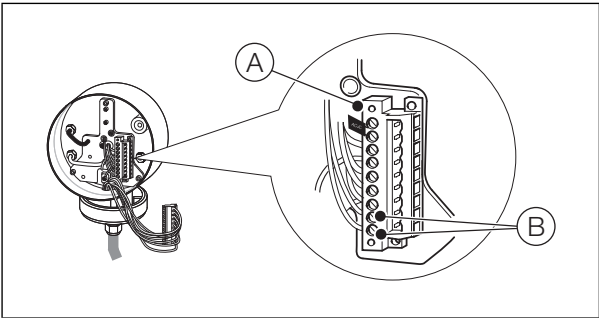


Fig. 3.3 Heater Connections

- 2. The measured resistance should be within the ranges shown in Table 3.1:

Probe Type	Resistance
AZ30Standard Probes 0.5 to 4.0 m (1.64 to 13.12 ft)	185 to 220 Ω

Table 3.1 Heater Resistance by Probe Type

- 3. If the measured resistance is out of range, check the heater wiring and, if necessary, replace the heater assembly – contact ABB Service.

If the measured resistance is within range, proceed to Section 3.4.

3.4 Checking the Thermocouple / Electrode Assembly Resistance

Referring to Fig. 3.4:

- 1. Ensure the probe is at ambient temperature (–20 to 70 °C [–4 to 158 F]).
- 2. At the 9-way terminal block (A), check the thermocouple / electrode assembly terminals (B) (TC+ green and TC– white) for open- or short-circuit.

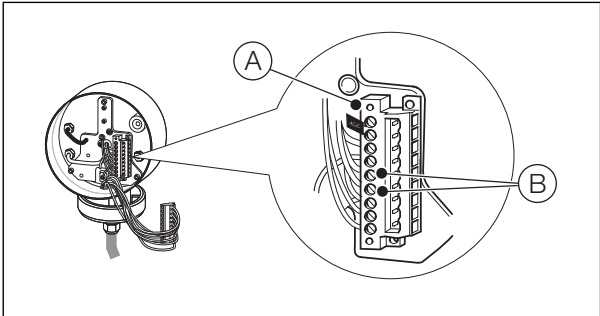


Fig. 3.4 Thermocouple / Electrode Assembly Connections

- 3. Check that the thermocouple / electrode assembly is isolated from the probe body earth. If it is not isolated, check for short-circuits to earth in the probe's internal wiring.
- 4. The resistance measured should be within the following range:

Probe Length	Resistance
0.5 to 2.0 m (1.64 to 6.6 ft)	10 to 17 Ω
2.5 to 4.0 m (8.2 to 13.1 ft)	17 to 23 Ω

Table 3.2 Thermocouple / Electrode Assembly Resistance by Probe Length

- 5. If the measured resistance is out of range, replace the thermocouple / electrode assembly – refer to Section 5.9, page 24.

If the measured resistance is within range, proceed to Section 3.5.

3.5 Checking the Cell Isolation

Referring to Fig. 3.5:

1. At the 9-way terminal block (A), check the resistance from the probe's red (Cell +) connection (B) to the probe body (C).

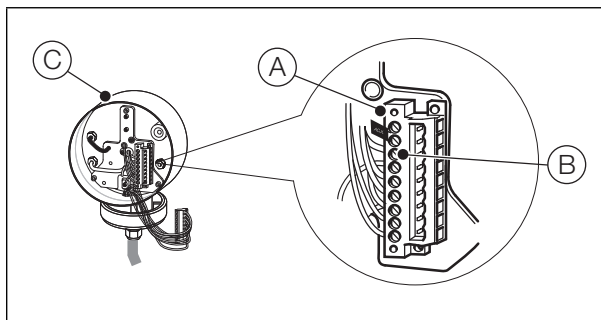


Fig. 3.5 Cell Isolation

2. Check that the cell + connection is isolated from the probe body earth. If it is not isolated, check for short-circuits to earth in the probe's internal wiring.
3. With the cell at ambient temperature, the measured resistance should be > 20 kΩ.

If the measured resistance is within range, proceed to Section 3.6.

If the measured resistance is out of range, replace the cell assembly – refer to Section 5.8, page 20.

3.6 Checking the ACJC Resistance

Referring to Fig. 3.6:

1. At the 9-way terminal block (A), check the resistance (related to ambient temperature) at the probe's ACJC (PT1000 temperature sensor) (B) across terminals (C).

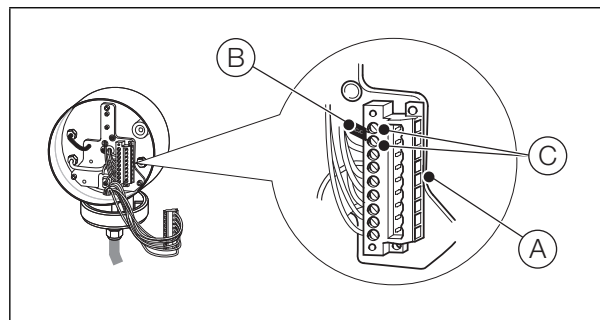


Fig. 3.6 Checking the ACJC Resistance

2. The measured resistance should be within the ranges shown in Table 3.3.
3. If the measured resistance is out of range, replace the PT1000 temperature sensor – refer to Section 5.11, page 29.

If the measured resistance is within range, proceed to Section 4.

°C	0.0	-1.0	-2.0	-0	-4.0	-5.0	-6.0	-7.0	-8.0	-9.0
-20	921.6									
-10	960.9	956.9	953.0	949.1	945.2	941.2	937.3	933.4	929.5	925.5
0	1000.0	996.1	992.2	988.3	984.4	980.4	976.5	972.6	968.7	964.8
°C	+0.0	+1.0	+2.0	+3.0	+4.0	+5.0	+6.0	+7.0	+8.0	+9.0
0	1000.0	1003.9	1007.8	1011.7	1015.6	1019.5	1023.4	1027.3	1031.2	1035.1
10	1039.0	1042.9	1046.8	1050.7	1054.6	1058.5	1062.4	1066.3	1070.2	1074.0
20	1077.9	1081.8	1085.7	1089.6	1093.5	1097.3	1101.2	1105.1	1109.0	1112.8
30	1116.7	1120.6	1124.5	1128.3	1132.2	1136.1	1139.9	1143.8	1147.7	1151.5
40	1155.4	1159.3	1163.1	1167.0	1170.8	1174.7	1178.5	1182.4	1186.2	1190.1
50	1194.0	1197.8	1201.6	1205.5	1209.3	1213.2	1217.0	1220.9	1224.7	1228.6
60	1232.4	1236.2	1240.1	1243.9	1247.7	1251.6	1255.4	1259.2	1263.1	1266.9
70	1270.7									

Table 3.3 Resistance Values for PT1000 Element at Ambient Temperature (-20 to 70 °C [-4 to 158 °F])

4 Troubleshooting – Functional Checks

Warning. All procedures listed in this manual invalidate the system's explosion-proof integrity. Consequently, before removing any covers or lids, ensure there are no hazardous gases present or alternatively, remove the probe from the hazardous area.

Warning. Due to the presence of high voltage heater terminals / wires (85 to 265 V) in the probe head the probe's functional checks, must be carried out by suitably trained personnel only – refer to (A) in Fig. 4.1.

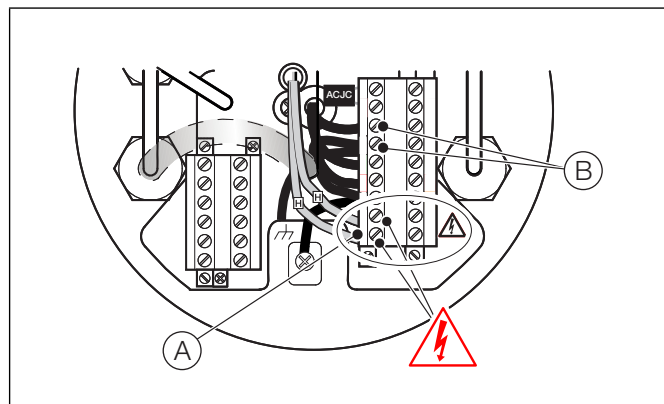


Fig. 4.1 Live Heater Terminals in Probe Head

Caution.

- Functional probe checks are made with the probe / transmitter system powered up.
- Before performing functional checks:
 - ensure the process temperature is within the limits 20 to 800 °C (68 to 1472 °F) and allow a minimum 30-minute warm-up period for the probe cell to stabilize at operating temperature
 - ensure reference air and test gases are applied as detailed in the probe User Guide (OI/AZ30P-EN).
- If precision accuracies are required, allow a 1-hour stabilization period.

4.1 Equipment Required

- AZ30 manuals (transmitter Programming Guide COI/AZ30E-EN and Probe User Guide OI/AZ30P-EN)
- digital multimeter ($\geq 10 \text{ M}\Omega$ input impedance on mV ranges)
- earth continuity tester
- test gas 1 (typically within the range 10 to 21% O₂ in N₂)
- test gas 2 (not < 1 % O₂ in N₂)
- reference air supply (refer to the Probe User Guide OI/AZ30P-EN)

4.2 Thermocouple / Electrode Assembly Functional Checks

Referring to Fig. 4.2:

1. Using either a mercury or digital thermometer, measure the ambient temperature at the thermocouple terminals (A) (TC+ green and TC- white).
2. Measure the voltage across the transmitter's thermocouple terminals (A) (TC+ green and TC- white).

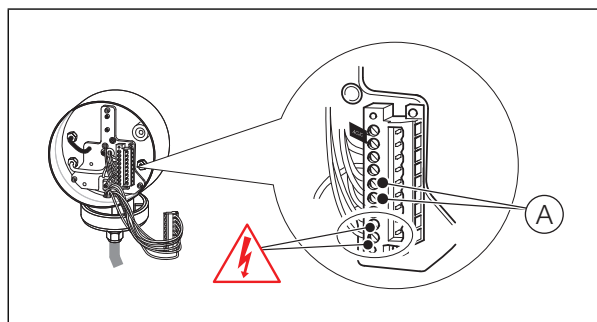


Fig. 4.2 Checking the Thermocouple / Electrode Assembly

Refer to Table 4.1 for the voltages that should be present at the thermocouple terminals, according to the temperature measured at step 1 when the probe temperature has stabilized.

Note.

- For flue temperatures up to 700 °C (1292 °F) the probe thermocouple is heater-maintained at 700 °C (1292 °F).
- For flue temperatures over 700 °C (1292 °F) the probe thermocouple and heater are the same as the flue temperature.
- For process temperatures between 700 and 800 °C, (1292 to 1472 °F) refer to K-type thermocouple tables for millivolt values.

3. If the thermocouple voltage is correct, remove the probe from the flue and replace the cell (refer to Section 5.8, page 20) and / or the thermocouple / electrode assembly (refer to Section 5.9, page 24).

Ambient Temp. °C (°F)	Millivolts	Ambient Temp. °C (°F)	Millivolts
50 (122)	27.106	24 (75.2)	28.168
49 (120.2)	27.147	23 (73.4)	28.209
48 (118.4)	27.188	22 (71.6)	28.249
47 (116.6)	27.229	21 (69.8)	28.29
46 (114.8)	27.27	20 (68)	28.33
45 (113)	27.311	19 (66.2)	28.37
44 (111.2)	27.352	18 (64.4)	28.41
43 (109.4)	27.394	17 (62.6)	28.451
42 (107.6)	27.435	16 (60.8)	28.491
41 (105.8)	27.476	15 (59)	28.531
40 (104)	27.527	14 (57.2)	28.571
39 (102.2)	27.558	13 (55.4)	28.611
38 (100.4)	27.599	12 (53.6)	28.651

Ambient Temp. °C (°F)	Millivolts	Ambient Temp. °C (°F)	Millivolts
37 (98.6)	27.639	11 (51.8)	28.691
36 (96.8)	27.68	10 (50)	28.731
35 (95)	27.721	9 (48.2)	28.771
34 (93.2)	27.762	8 (46.4)	28.811
33 (91.4)	28.803	7 (44.6)	28.851
32 (89.6)	28.843	6 (42.8)	28.89
31 (87.8)	28.884	5 (41)	28.93
30 (86)	27.925	4 (39.2)	28.97
29 (84.2)	27.966	3 (37.4)	29.009
28 (82.4)	28.006	2 (35.6)	29.049
27 (80.6)	28.047	1 (33.8)	29.089
26 (78.8)	28.087	0 (32)	29.128
25 (77)	28.128		

Table 4.1 Thermocouple v Ambient Temperature for Flue Temperatures up to 700 °C (1292 °F)

4.3 Checking Cell Output Voltage

In the following checks, test gas is applied to the probe and the cell output is measured to check if the cell is functioning to theoretical values in isolation from any associated transmitter.

The check can be performed using 1 test gas (for a functional check) or 2 test gases (for a detailed cell accuracy check). Using 2 test gases provides the most accurate result – both checks refer to the graph in Fig. 4.3:

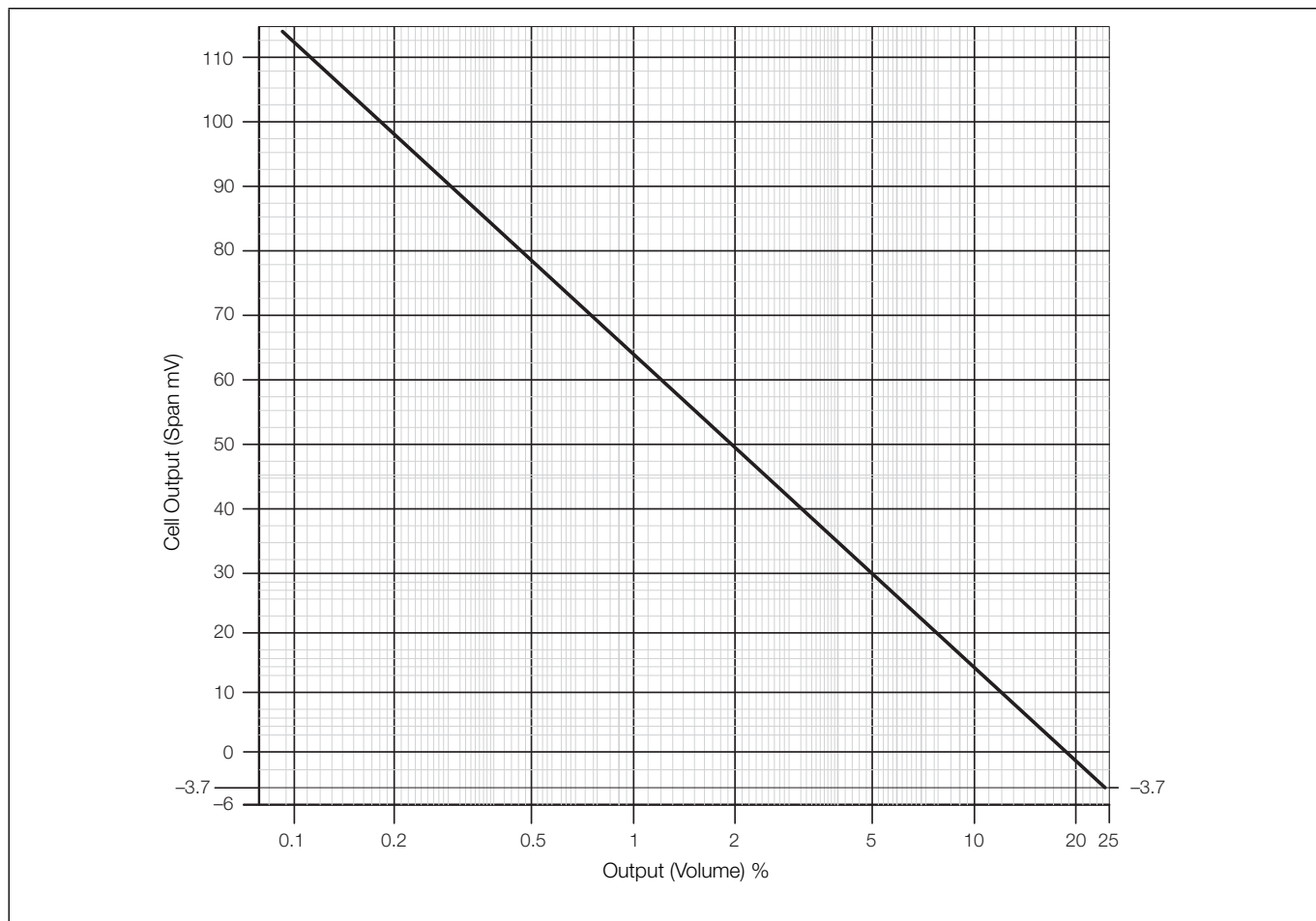


Fig. 4.3 Cell Output v Percentage Oxygen

4.3.1 Cell Function Check

Note. This check uses 1 test gas.

Referring to Fig. 4.1:

1. Remove the leads to the cell terminals (B) (Cell+ red; Cell– black) and connect the digital multimeter (0 to 200 mV range) directly across the leads.
2. If AutoCal is fitted, open the test gas valve manually. If AutoCal is not fitted, apply the test gas directly to the test gas inlet and control it externally – refer to the probe User Guide (OI/AZ30P–EN).
3. Leave the test gas to run for a minimum of 3 minutes and record the reading on the digital multimeter.
4. Switch the test gas off.
5. The measured voltage should correspond to the oxygen volume percentage for the test gas used – refer to Fig. 4.3, page 13.
6. If this check has resulted in:
 - a. **satisfactory readings:**
the cell, heater and thermocouple are functioning correctly – incorrect readings at the transmitter may be due to transmitter calibration faults – refer to the transmitter Programming Guide (COI/AZ30E–EN)
 - b. **unsatisfactory readings:**
there is a difference of more than ± 5 mV between the measured cell output voltage and the graph – refer to Fig. 4.3, page 13

the thermocouple / electrode assembly may be faulty (check this first – refer to Section 4.2, page 12) or the cell may be faulty – see section 5.8, page 20.

4.3.2 Detailed Cell Accuracy Check

Note. This detailed check uses 2 test gases – checking the isolated cell output voltage using 2 test gases provides the most accurate result.

The 2 test gases are:

- air (20.95 % O₂) to give a zero reading
- a second test gas not less than 1 % O₂

To perform this check, calculate the span mV value first then calculate the % O₂ value from the span mV value.

1. For millivolt readings and test gas management, refer to steps 1 to 4 from Section 4.3.1.
2. To calculate the span mV value:
 - a. allow the probe to settle in air, or with test gas air for 5 minutes minimum to stabilize – note the millivolt reading which should be $\leq \pm 2$ mV (if the cell is less than 1 year old), but may be up to ± 5 mV on older cells
 - b. calculate the span mV value as the **sum** of zero and test gas mV, for example:
 $-1 \text{ mV zero} + 62.77 \text{ test gas mV} = 63.77 \text{ mV span}$
 $+1 \text{ mV zero} + 62.77 \text{ mV test gas mV} = 61.77 \text{ mV span}$
3. Use the following formula to calculate the % O₂ from the span mV value:

$$\text{Cell mV} = 0.0496 T (\log_{10} P_0 / P_1) + C \text{ mV},$$
 where:
 T = cell temperature °K =
 $(700 \text{ °C} + 273.16)$ for process temperatures $< 700 \text{ °C}$
 or
 $(\text{process temperature} + 273.16)$ for process temperatures $> 700 \text{ °C}$
 P_0 = partial pressure ref. gas (20.95 % O₂)
 P_1 = partial pressure measured gas
 C = cell constant

The following examples show calculations for process temperatures <700 °C and >700 °C:

Example 1 – Process Temp. <700 °C

For test gas of 20.95 % O₂ (air):

$$\text{EmV} = 0.0496 \times (700 + 273.16) (\log_{10} 20.95 / 20.95) \pm \text{CmV}$$

$$\text{EmV} = 48.2608 (\log_{10} 1)$$

$$\text{EmV} = \text{CmV (cell constant)}$$

Example 2 – Process Temp. <700 °C

For a certified test gas of 1 % O₂:

$$\text{EmV} = 0.0496 \times (700 + 273.16) (\log_{10} 20.95/1) \pm \text{CmV}$$

$$\text{EmV} = 48.2608 (\log_{10} 20.95) \pm \text{CmV}$$

$$\text{EmV} = 63.76 \text{ mV} \pm \text{CmV}$$

Example 3 – Process Temp. of 800 °C

For a certified test gas of 1 % O₂:

$$\text{EmV} = 0.0496 \times (800 + 273.16) (\log_{10} 20.95/1) \pm \text{CmV}$$

$$\text{EmV} = 48.2608 (\log_{10} 20.95/1) \pm \text{CmV}$$

$$\text{EmV} = 63.76 \text{ mV} \pm \text{CmV}$$

Note. Pure N₂ or any other inert gas cannot be used to calibrate a zirconia system 'gas zero' as this equates to an infinite cell output voltage. A gas with a known value close to zero (for example 1 % O₂ in N₂) must be used for this purpose.

4.4 System Functional Check

This section checks the AZ30probe and associated transmitter for system functionality and accuracy.

1. Perform a manual 2-point calibration using the 2 test gases selected – refer to the probe User Guide (OI/AZ30P-EN).
2. If this fails, check the transmitter calibration – refer to the transmitter Programming Guide (COI/AZ30E-EN).

5 Dismantling and Reassembly – Probe

Warning. All procedures listed in this manual invalidate the system's explosion-proof integrity. Consequently, before removing any covers or lids, ensure there are no hazardous gases present or alternatively, remove the probe from the hazardous area.

5.1 Before Removing / Replacing the Probe

Warning.

- When in operation, the cell end of the probe reaches temperatures up to 100 °C (212 °F). Allow the cell to reach ambient temperature before starting maintenance procedures.
- Do not attempt to remove a probe unless the system it is used in has been shut down and isolated.
- Do not attempt to remove a probe without approval from authorized personnel.
- Before removing a probe from the flue, prepare the flue for probe removal in accordance with relevant safety and site regulations.
- Fit a blanking flange to the process if necessary.
- Use lifting equipment with a lifting capacity in excess of the total probe weight – refer to the probe User Guide (OI/AZ30P-EN) for probe weights.

Caution. Probe internal components are fragile – for ease of handling, ensure a minimum of 2 personnel are used when handling 2 (6.6 ft.) probes and ensure support is provided along the complete length of the inner assembly.

5.2 Before Dismantling a Probe

Warning.

- Clean the outer surfaces of the probe thoroughly to prevent contamination of inner assemblies.
- If the probe has been in service, the parts exposed to the process gases may be contaminated with corrosive or hazardous substances. Check with the process operators for possible contaminants or request a CoSH sheet.
- Oil, grease, hand cream and even oily skin can contaminate the probe's internal structure causing poor stability and drifting readings. When handling any probe parts, beware of introducing contaminants.
- Do not bend the internal structure – the thermocouple / electrode insulators are fragile and will be damaged or break if bent.
- Handle internal components carefully, keep them clean and ensure mating surfaces are not damaged during maintenance procedures.
- Do not subject the probe to blows from hammers or sharp objects.
- Do not reuse damaged parts, use new replacement parts only.

5.3 Flamepath Locations and Maintenance Limitations

Warning.

- Before commencing maintenance procedures familiarize yourself with flamepath locations and flamepath requirements – see Section 2, page 6.
- It is **not** permitted to perform any maintenance procedure that requires removal of the probe's internal structure – see Section 2.1, page 6.

5.4 Preparation

The following equipment and working conditions are recommended to ensure the probe is maintained in a suitable environment:

- a clean, dry, moisture- and dust-free atmosphere
- a workbench of at least twice the probe length – for example, to maintain a 2.0 m (6.5 ft) probe, a workbench of at least 4.0 m (13.12 ft) is recommended
- support along the complete length of the internal assembly – a length of plastic guttering can be used to protect the ceramics and other components during removal / refitting, or extra personnel can be used

5.4.1 Tools Required

- M4 open-ended spanner (supplied with probe)
- 3 mm A/F Hex wrench (supplied with probe and restrictor kit)
- 2.5 mm A/F Hex wrench (supplied with restrictor kit)
- 9/16 in. socket or ring spanner
- 14 mm socket or ring spanner
- 12 mm AF Hex wrench
- small hacksaw
- scalpel or similar small sharp blade
- small flat-bladed (terminal) screwdriver
- small pozi-drive (crosshead) screwdriver
- medium flat-bladed screwdriver
- small magnet
- A torque driver set to 2 Nm, fitted with a 3 mm hexagon wrench (or a 3 mm A/F hexagon wrench)

5.4.2 Replacement Kits and Spares

Refer to Section 7, page 33 and Section 8, page 35 for replacement kits.

5.5 Removing / Refitting an Integral Probe

Referring to Fig. 5.1:

1. Isolate the transmitter from mains power supplies and label the isolator to prevent power being reconnected accidentally.
2. Isolate, identify and disconnect gas supplies.
3. Remove the transmitter terminal chamber cap (A).
4. Before disconnecting any of the field terminations, use the blank terminal block (B) in Fig. 5.1 to note the existing transmitter connections.
5. Disconnect the field terminations.
6. Loosen cable glands (C) (as required) and separate and insulate individual mains and signal cable terminations as a safety precaution.
7. Remove the probe from its mounting by reversing the installation procedure (refer to the probe User Guide [OI/AZ30P-EN] for original installation instructions), ensuring the probe is supported along the length of the body.
8. Move the probe to the maintenance area.
9. Proceed with the required maintenance procedure(s).
10. To refit the probe refer to the probe User Guide [OI/AZ30P-EN].

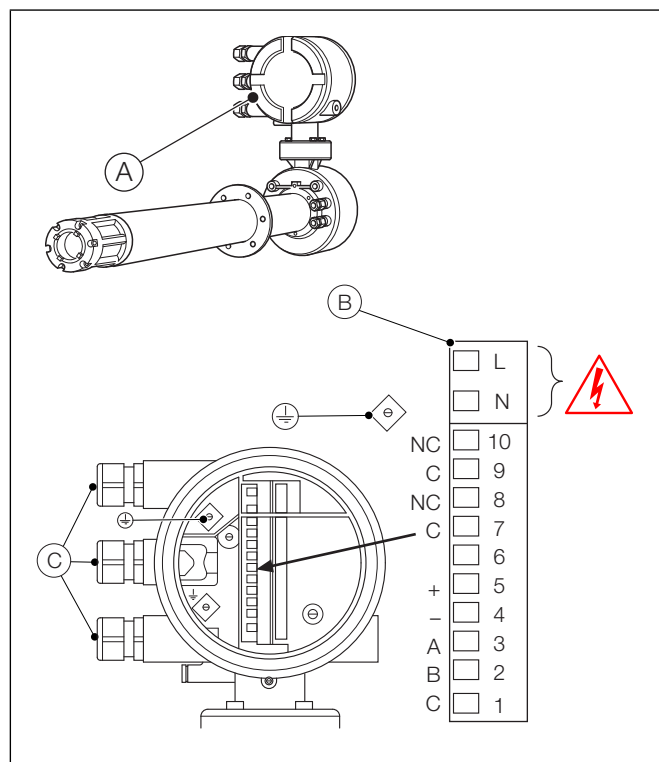


Fig. 5.1 Disconnecting an Integral Probe

5.6 Removing / Refitting a Remote Probe

1. Isolate the remote transmitter from mains power supplies and label the isolator to prevent power being reconnected accidentally.
2. Isolate, identify and disconnect gas supplies.

Referring to Fig. 5.2:

3. Unscrew and remove probe lid (A).
4. Disconnect all wires to terminal block (B).
5. If AutoCal is fitted, disconnect all wires to terminal block (C).
6. Loosen cable gland (D) and carefully withdraw the cable from the probe.
7. Separate and insulate the individual heater and signal cable terminations as a safety precaution.
8. Remove the probe from its mounting by reversing the installation procedure (refer to the probe User Guide (OI/AZ30P-EN) for original installation instructions), ensure the probe is supported along the length of the body as it is withdrawn from the flue.
9. Move the probe to the maintenance area.
10. Proceed with the required maintenance procedure(s).
11. To refit the probe refer to the probe User Guide (OI/AZ30P-EN).

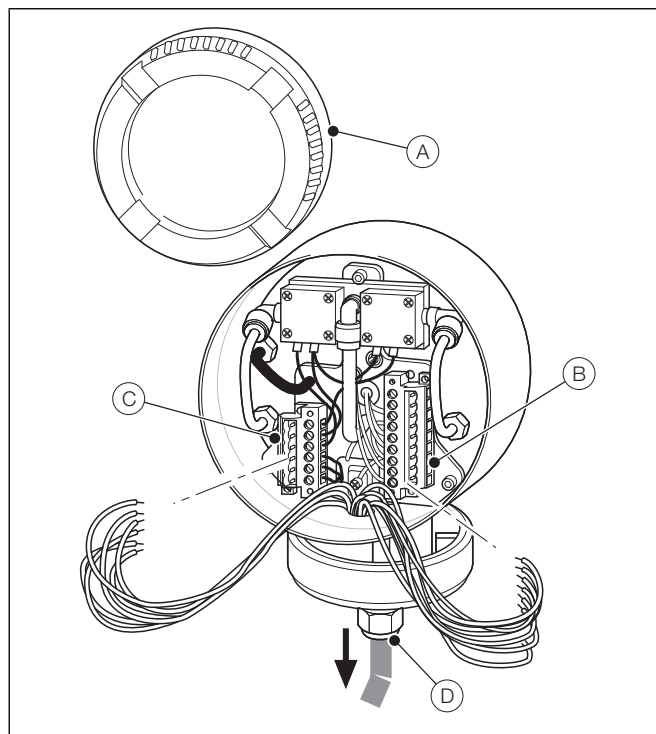


Fig. 5.2 Disconnecting a Remote Probe

5.7 Replacing the Probe Lid and Seal

Warning. If the probe lid is replaced with the probe in situ, ensure the system it is used in has been shut down and isolated to prevent the risk of electrical shocks.

Before replacing the end cap:

1. If fitting a new probe lid, ensure the wiring label is available.
2. If necessary, remove the probe from its mounting as detailed in Section 5.5, page 17 (integral probe) or Section 5.6, page 18 (remote probe).

5.7.1 Removing the Probe Lid

Referring to Fig. 5.3:

1. Unscrew and remove probe lid (A).
2. Remove seal and discard O-ring (B).

5.7.2 Fitting a New Probe Lid

Referring to Fig. 5.3:

1. Fix the new wiring label (C) to the inside of the probe lid.
2. Fit the new O-ring onto the probe lid ensuring it is seated correctly.
3. Screw the new probe lid onto the probe body until hand-tight.

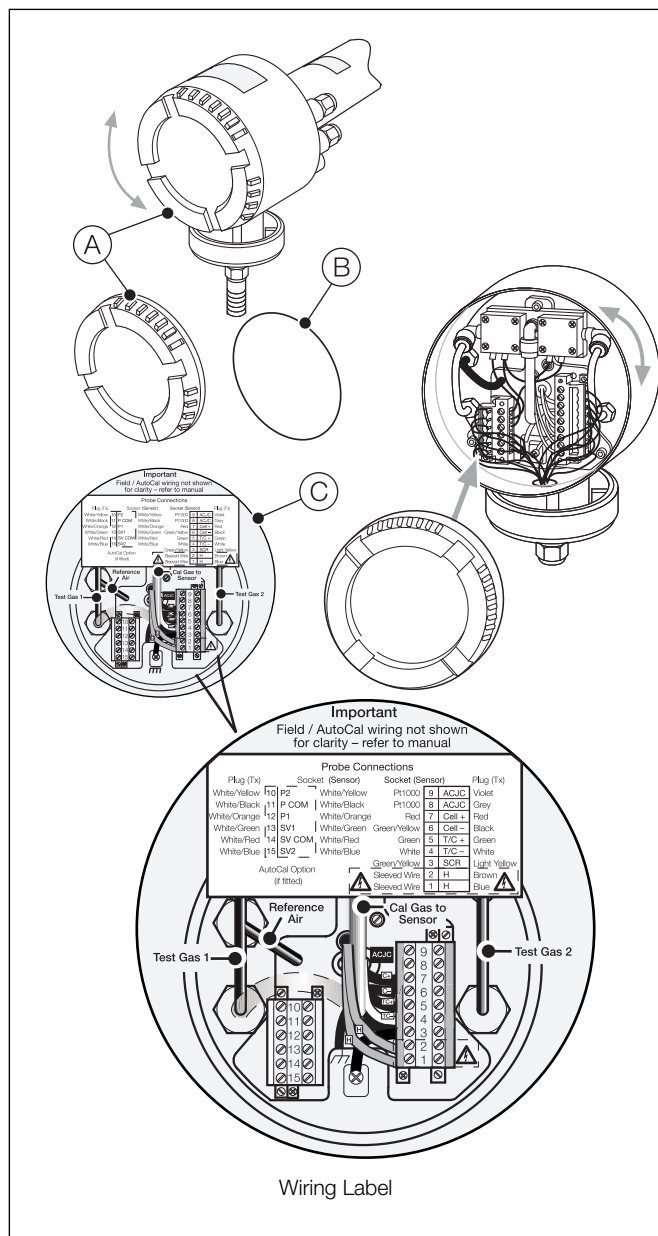


Fig. 5.3 Replacing the Probe Lid and Seal

5.8 Replacing the Diffuser Flame Arrestor and / or Cell

Warning. When in operation, the cell end of the probe reaches temperatures up to 100 °C (212 °F). Allow the cell to reach ambient temperature before starting maintenance procedures.

Note. Check all items for damage as they are removed. Do not re-use the nuts or bolts, always replace damaged items with new parts.

Before replacing the cell:

1. Ensure a replacement cell kit is available – see section 7.2, page 34.

Note. It is recommended that a replacement thermocouple / electrode assembly (refer to Section 7.5, page 34) is also available in case the existing assembly is damaged during cell replacement.

2. Remove the probe from its mounting as detailed in Section 5.5, page 17 (integral probe) or Section 5.6, page 18 (remote probe).
3. Record the cell data printed on the existing cell label – refer to the probe User Guide (OI/AZ30P-EN) for label details.
4. Remove the probe lid as detailed in Section 5.7.1, page 19.

5.8.1 Removing the Diffuser Flame Arrestor

Referring to Fig. 5.4:

1. At the probe head, disconnect the red (Cell +), green (TC+) and white (TC-) wires (A) from the inner terminal block connections and straighten the wires.

Note. AutoCal versions only – if necessary, disconnect the test gas to sensor tube to enable access to the green (TC+), white (TC-) and red (Cell+) terminals.

2. Unscrew and remove M4 screw (C) to release the spring loading on the thermocouple / electrode assembly.
3. At the probe cell end, loosen the 6 M4 x 50 bolts (D) using an M4 spanner and 3 mm A/F hexagon wrench (supplied).
If the bolts are seized, use a small hacksaw to cut the through the bolts at the recess between the diffuser flame arrestor and the probe end plate (E).
4. Remove the 6 M4 x 50 bolts.

5. Carefully withdraw the diffuser flame arrestor (F) while supporting the cell (G). If necessary, use a solvent, for example lighter fluid (petroleum ether) or alcohol (surgical spirits) to lubricate the joint between the diffuser flame arrestor and probe end.

Caution. Do not use oil or release agents – these will damage the components.

6. Proceed to Section 5.8.2, to fit a new cell.

5.8.2 Removing the Cell and C-ring

Referring to Fig. 5.4:

1. Remove the test gas injection pipe (H) from the cell housing and retain for re-assembly.
2. Carefully attempt to withdraw the cell (I) from the cell housing using minimal force.
 - If the cell can be withdrawn freely, proceed to step 4.
 - If the cell does not move (is stuck in the probe body), use a spanner on the 2 flats to rock it sideways gently until loose – **do not rotate more than 2 to 3 mm (0.08 to 0.12 in.)**. If this action frees the cell proceed to step 4.
 - If the cell cannot be withdrawn freely and is welded to the thermocouple / electrode contact assembly, proceed to step 3.
3. If the cell is welded to the helical contact at the end of the thermocouple / electrode assembly, carefully withdraw the cell and thermocouple / electrode contact assembly until the cell tip (J) is visible.

Use a sharp blade to cut between the wire nest and cell tip and separate the 2 items (K). Take extreme care not to damage either item.

4. Remove and discard 'C-ring (L).

If the C-ring is stuck, insert a small screwdriver blade in the hollow of the C-ring (M) and gently prise it in several places until free.

Caution. Do not touch the sealing face or ID of the probe recess with the screwdriver blade. The surface finish must be undamaged to maintain the C-ring's sealing properties.

5. Proceed to Section 5.8.3, page 22 to fit a new cell.

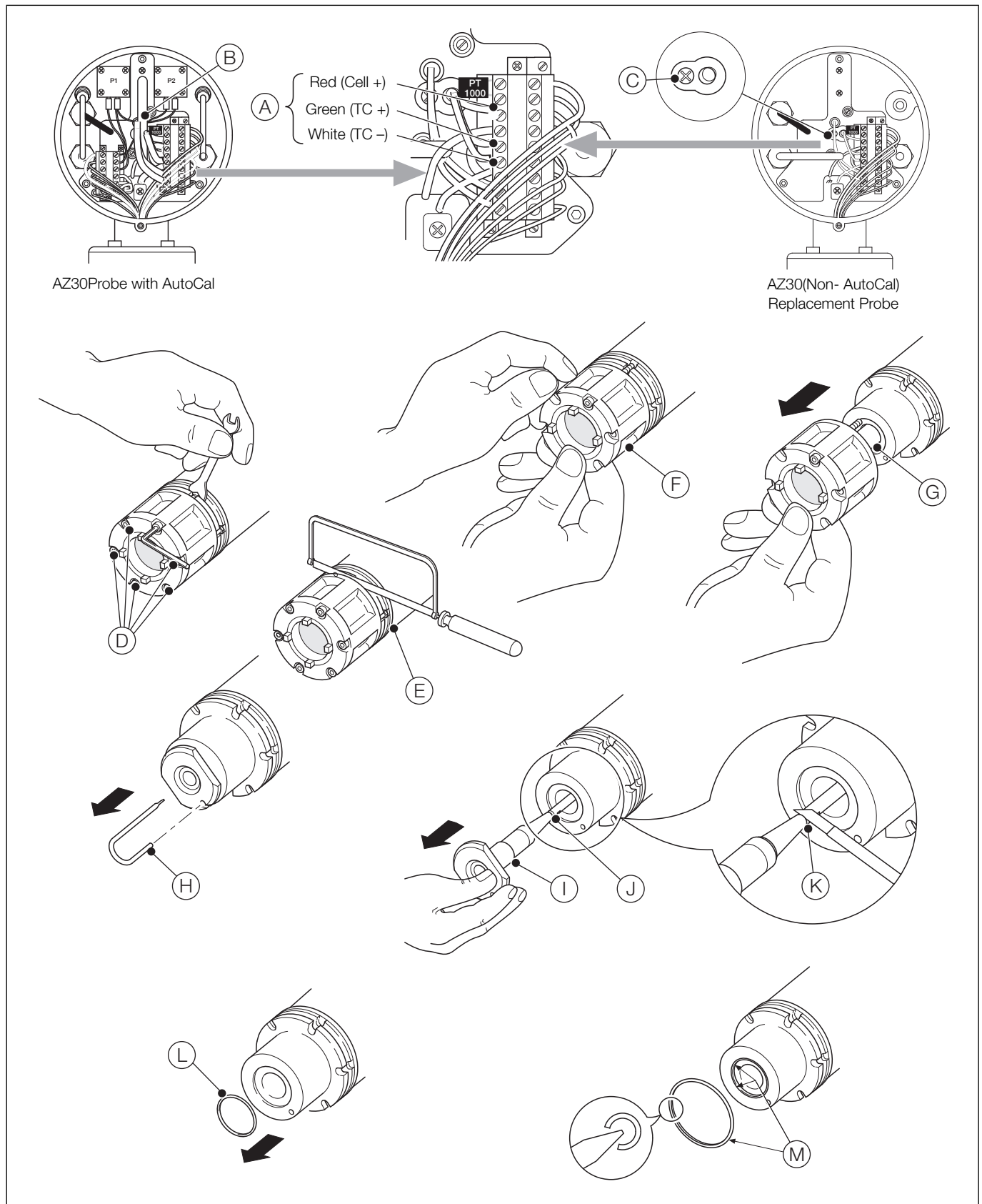


Fig. 5.4 Removing the Cell and C-ring

5.8.3 Fitting a New C-ring and Cell

Referring to Fig. 5.5:

1. Transfer the alteration details onto the new Commissioning Label (A) supplied with the new cell and fix the new Commissioning Label to the probe body.

Caution. To comply with certification, probes must be fitted and operated with flow restrictors. Do not use the probe unless restrictors are fitted.

If a new Commissioning Label is attached to the probe (required if the cell is replaced), the 'Restrictors Fitted' / 'Yes' box must be ticked by the customer – see Fig. 5.5.

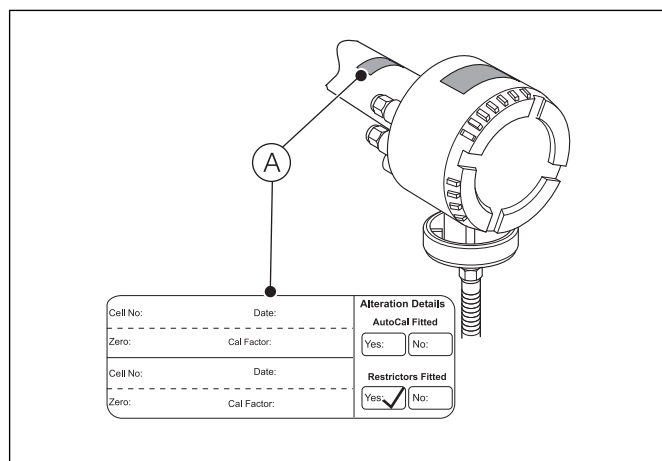


Fig. 5.5 Commissioning Label Details and Location on Probe

Referring to Fig. 5.6:

2. Check the cell mounting area for damage and ensure it is clean and dry. Clean by hand only using a non-metallic pan scourer – do not use any other abrasives.
3. Position a new 'C-ring (A) into recess (B).
4. Locate the cell (C) and use a small screwdriver to align it with the test gas injection pipe hole (D) in the probe body end plate.
5. Carefully slide the cell into the probe body end plate. Do not rotate the cell once it has engaged with the helical contact at the end of the thermocouple / electrode assembly.
6. Refit the test gas injection pipe (E) ensuring the short end is fitted into the test gas injection pipe hole (D).
7. Proceed to Section 5.8.4 to fit the diffuser flame arrestor.

5.8.4 Fitting the Diffuser Flame Arrestor

Referring to Fig. 5.6:

1. Locate the diffuser flame arrestor (F) by aligning the internal notch (G) with the test gas pipe.
2. Locate the 6 M4 x 50 bolts (H) and fit nuts (I).
3. Tighten the 6 M4 x 50 nuts and bolts using an M4 spanner and 3 mm A/F hexagon wrench (supplied), Tighten opposing bolts evenly to a torque of 2 Nm (1.47 ft/lb).

Note. A small amount of anti-seize grease or oil can be used on these nuts only to assist assembly. Do not use anti-seize grease or oil on any other probe fixings.

4. At the probe head, press the thermocouple / electrode assembly spring locator (J) in and refit and tighten the M4 retaining screw (K).
5. Re-connect the red (Cell+), green (TC+) and white (TC-) wires (L) to the inner terminal block connections.

Note. AutoCal versions only – if the test gas to sensor tube (M) was disconnected at step 1, Section 5.8.1, page 20, reconnect it.

6. Refit the probe lid – see section 5.7.2, page 19.
7. Re-install the probe as detailed in the probe User Guide (OI/AZ30P-EN).
8. Make gas supplies to the probe and electrical supplies to the transmitter – refer to the probe User Guide (OI/AZ30P-EN) and transmitter Programming Guide (COI/AZ30E-EN).
9. Use the new cell's Zero and Cal. Factor data on the Commissioning Label to commission and calibrate the probe – refer to the transmitter Programming Guide (COI/AZ30E-EN) for calibration details.

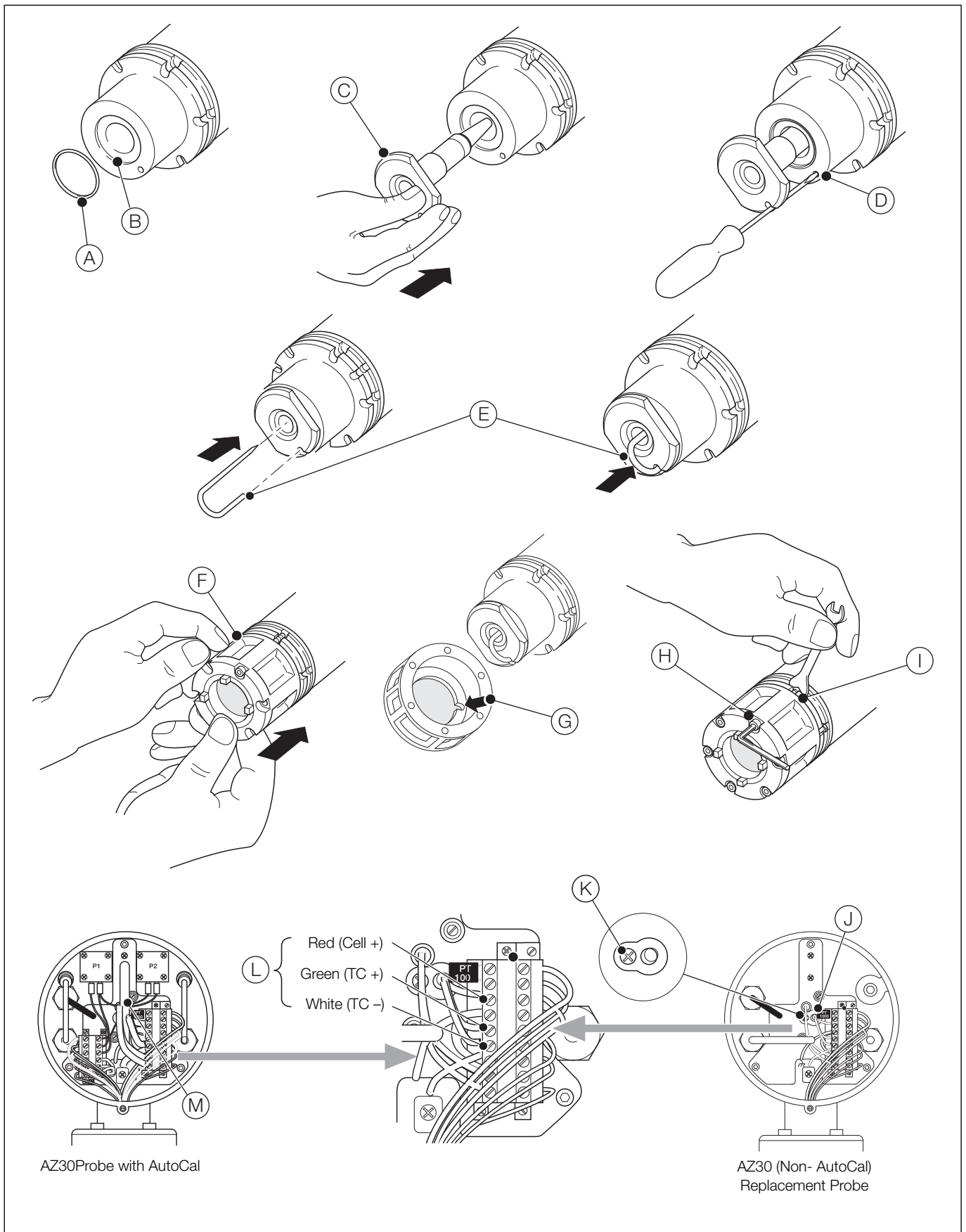


Fig. 5.6 Fitting a New C-ring and Cell

5.9 Replacing the Thermocouple / Electrode Assembly

Note. Check all items including the extension insulators for damage as they are removed. Keep items for reuse in a clean safe place. Replace any damaged items with new replacements. Never reuse damaged insulators.

Before replacing the thermocouple and electrode assembly:

1. Ensure replacement thermocouple and electrode assembly and C-ring kits are available – see section 7.5, page 34.
2. Remove the probe from its mounting – see section 5.5, page 17 (integral probe) or Section 5.6, page 18 (remote probe).
3. Remove the probe lid as detailed in Section 5.7.1, page 19.

5.9.1 Removing the Thermocouple / Electrode Assembly

Referring to Fig. 5.7:

1. At the probe head, disconnect the red (Cell +), green (TC+) and white (TC–) sleeved wires (A) from the inner terminal block connections.

Caution. AutoCal versions only – if necessary, disconnect the test gas to sensor tube (B) to allow access to the terminal connectors.

2. Unscrew and remove M4 screw (C).
3. Check if the cell is welded to the electrode tip by gently pulling the white and green sleeved wires (D).

Caution. Do not pull the Cell + (red sleeve) wire (E) to check for thermocouple / electrode assembly play.

4. If resistance is felt, check if cell is welded to the helical contact at the end of the thermocouple / electrode assembly – see section 5.8.2, page 20 (step 3). When the cell has been released / removed, proceed to step 5.
5. The thermocouple / electrode assembly is very fragile, so withdraw the thermocouple / electrode assembly (F) from the probe body carefully, providing support (G) along the length of the assembly and keeping it straight.
6. Lay the thermocouple / electrode assembly on a long **clean** flat surface.
7. Proceed to Section 5.9.2, page 26 to fit a new thermocouple / electrode assembly.

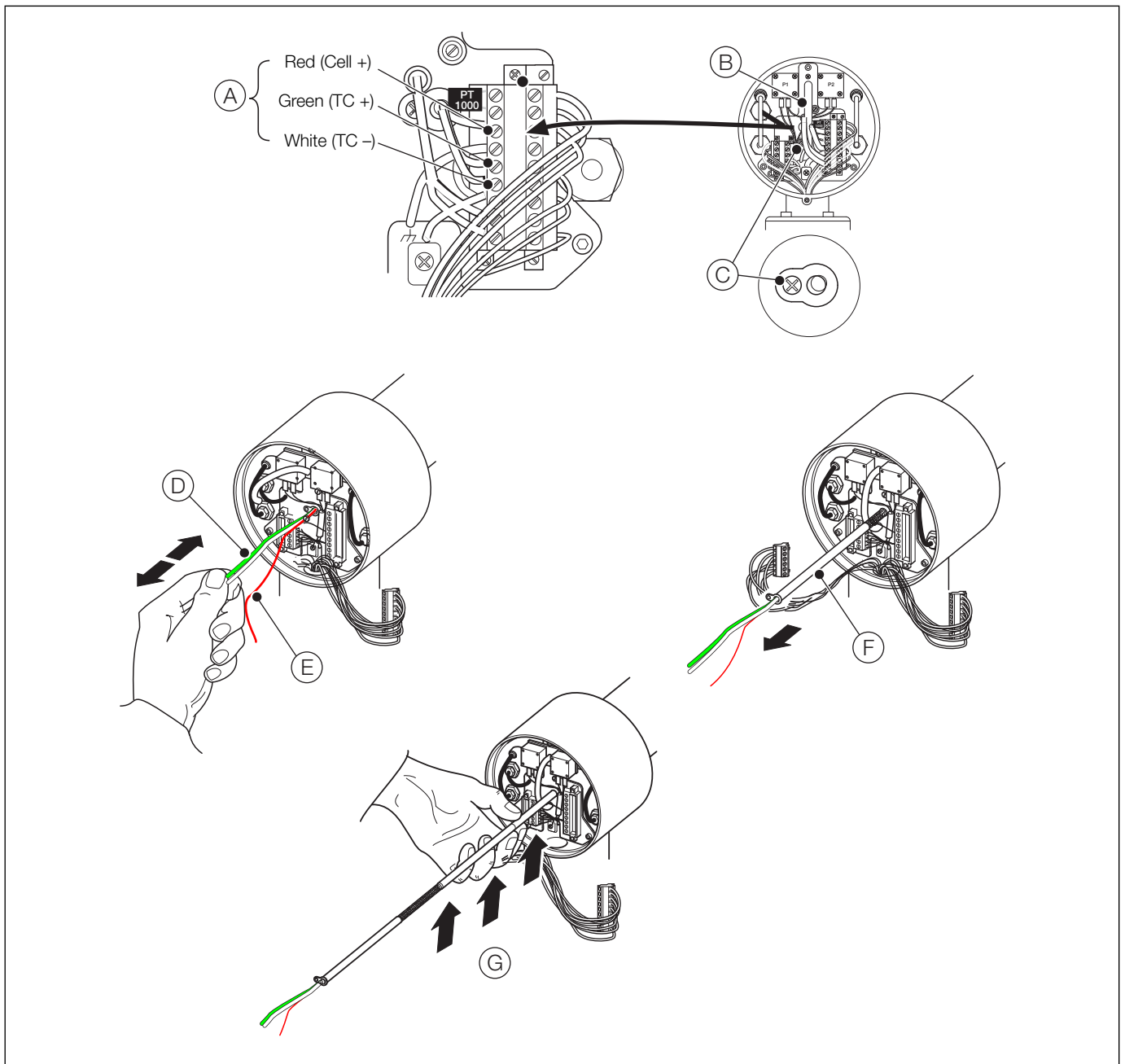


Fig. 5.7 Removing the Thermocouple / Electrode Assembly

5.9.2 Fitting a New Thermocouple / Electrode Assembly

Referring to Fig. 5.8:

1. Remove the existing spring locator (A) from the old assembly.
2. Lay the new assembly (B) out at the end of a long work surface and carefully uncoil the electrode wires, one at a time.

Note. To retain the uncoiled lead ends during fitting, use a clamping block (C) constructed from a wooden board and 3 bulldog clips or use 3 weights.

Caution. Do not kink the wires during fitting as they will not feed through the insulators if kinked.

3. Fit the 500 mm (19.7 in.) long insulator(s) (D) supplied – refer to Table 5.1 for insulator quantities for each probe length.

Thread each insulator onto the extension wires one by one. Ensure wires are not crossed in the insulator channels. Do not attempt to thread more than half the insulator length onto a wire at one time and ensure insulators butt together correctly at the joints.

Insertion Length m (ft.)	No. of Insulators
0.5 (1.7)	0
1.0 (3.3)	1
1.5 (5.0)	2
2.0 (6.6)	3

Table 5.1 500 mm (19.7in.) Insulator Quantities by Probe Length

4. Next fit the (short) 148 mm (5.8 in.) insulator (E).
5. Identify the thermocouple negative wire (TC-) (F) (magnetically attractive). The thermocouple positive (TC+) (G) is the same wire diameter as the thermocouple negative (TC-) (F). The thinnest wire is the cell positive (Cell+) (H).
6. Using the correct PTFE colored sleeving (supplied), slide each sleeve onto the wire ends (I):
 - Green (TC+), thick wire, non-magnetic (G)
 - White (TC-), thick wire, magnetic (F)
 - Red (Cell+), thin wire (H)
7. Pass 100 mm (4 in.) of sleeving into the last (short) insulator (E).

Caution Do not trim the sleeves – they must pass into the last insulator by 100 mm (4 in.) to ensure that the wires cannot short out when operating at very high process temperatures due to thermal expansion differences.

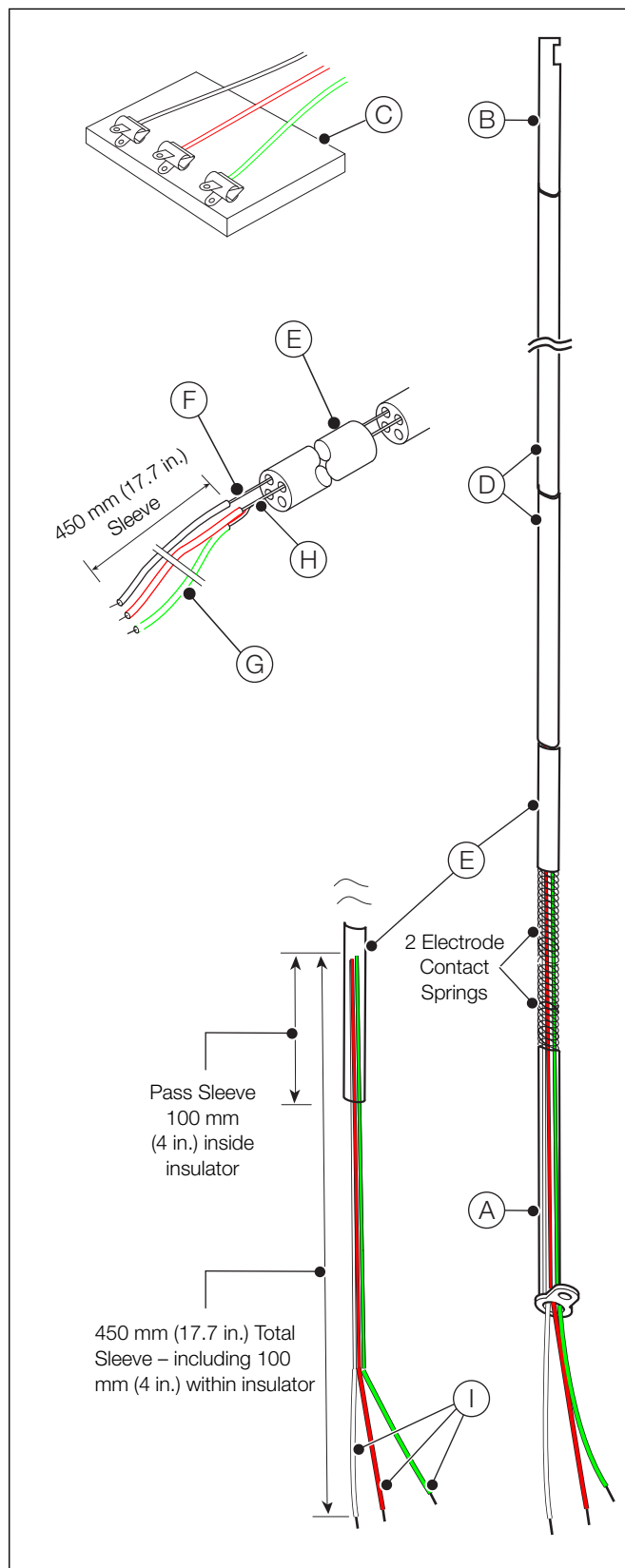


Fig. 5.8 Disassembling the Thermocouple / Electrode Assembly and Fitting New Insulators

Referring to Fig. 5.9:

8. Slide the 2 electrode contact springs (J) and the new spring locator (K) over the sleeved wires and slide them along until the springs butt up to the insulator.

9. Cut the sleeved wires from the end of the short insulator (L) to leave a length of 340 mm (13.4 in.).

DO NOT cut the sleeves.

10. Position the sleeves to leave 10 mm (0.4 in.) of bare wire, (M) then bend the wire over by approximately 5 mm (0.2 in.) to retain the PTFE sleeves.

11. Refit the cell assembly as described in Section 5.8, page 20.

12. Carefully slide the assembled thermocouple / electrode assembly (N) into position in the probe body, supporting the insulators to prevent damage.

13. Locate the M4 spring locator retaining screw (O) to secure the assembly.

14. Reconnect the red (Cell +), green (TC+) and white (TC-) sleeved wires (P) to the inner terminal block connections.

The 3 PTFE sleeved wires (TC+, TC- and Cell+) must be free to slide within the spring locator by up to 30 mm (1.2 in.) to allow for thermal expansion of the probe body during probe operation.

15. **AutoCal versions only** – if the Test Gas to Sensor tube (Q) was disconnected at step 1, in Section 5.9.1, page 24, reconnect it.

16. Refit the probe lid – refer to Section 5.7.2, page 19.

17. Re-install the probe – refer to the probe User Guide (OI/AZ30P-EN).

18. Make gas supplies to the probe and electrical supplies to the transmitter.

19. If a new cell has been fitted, re-calibrate the probe – refer to the transmitter Programming Guide (COI/AZ30E-EN).

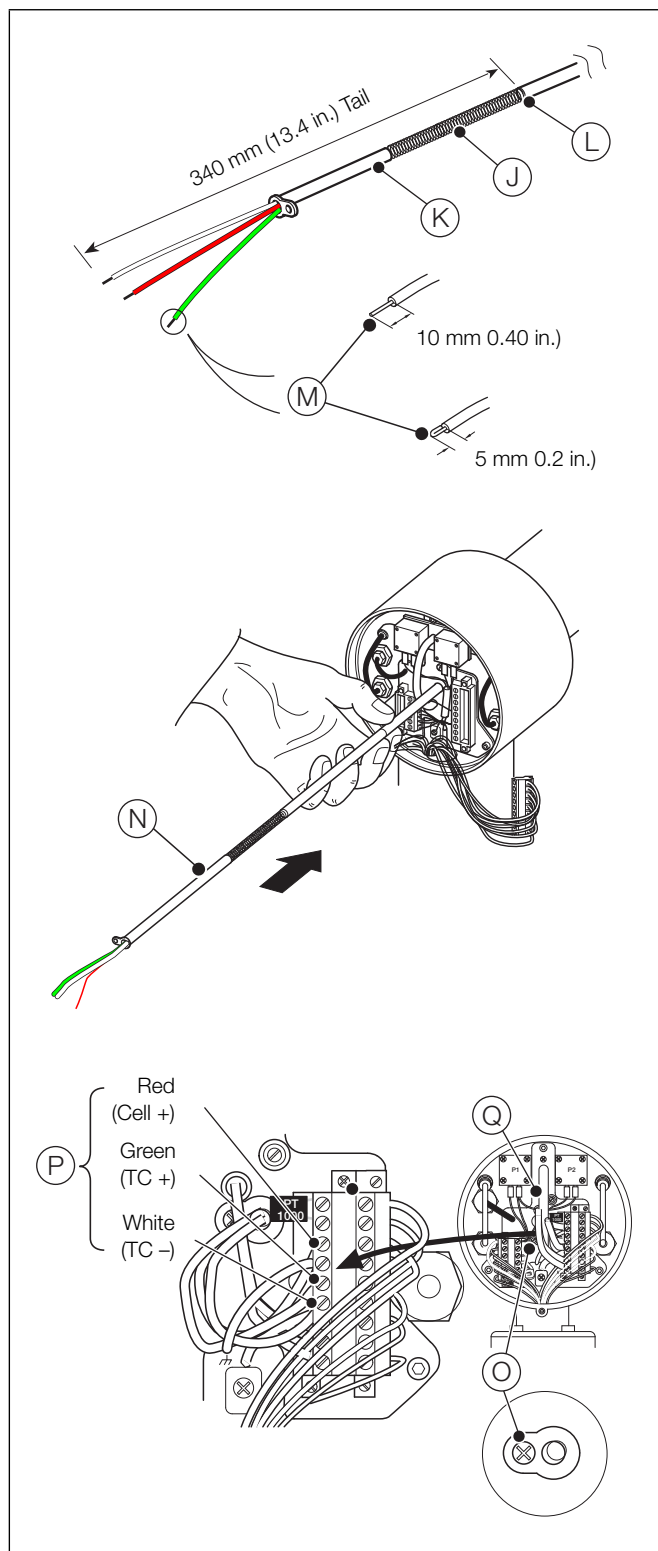


Fig. 5.9 Fitting a New Thermocouple / Electrode Assembly

5.10 Replacing Restrictors

Caution. To comply with certification, probes must be fitted and operated with flow restrictors. Do not use the probe unless restrictors are fitted.

If a new Commissioning Label is attached to the probe (required if the cell is replaced), the 'Restrictors Fitted' / 'Yes' box must be ticked by the customer – see item (J), Fig. 5.10.

Before proceeding:

- Ensure a restrictor kit is available – see section 7.6, page 34.
- Remove the probe from its mounting as detailed in Section 5.5, page 17 (integral probe) or Section 5.6, page 18 (remote probe).

Referring to Fig. 5.10:

Note. The restrictors have extremely small orifices so ensure the following procedure is performed in a clean area.

1. Remove the reference air (Ref. Air) fitting (A) and external test gas (TG1, TG2) fittings (B) from the probe body inlets (C) using the correct spanner (not supplied).

Caution. Use only the following tools for test gas and vent fittings:

- NPT fittings: $\frac{9}{16}$ in. socket or ring spanner.
- BSP fittings: 14 mm socket or ring spanner.

Torque setting for both NPT and BSP is 25 Nm (18.44 ft/lb) – **maximum**.

Where a screwed blanking plug is fitted (NPT or BSP), a 12 mm AF hexagon wrench is required.

2. If fitted, remove existing filter pads (D) from the probe body TG1, TG2 and Ref. Air inlets.
3. If fitted, remove existing test gas restrictors (E) from the probe body TG1 and TG2 inlets using the 3 mm A/F hexagon key supplied in the toolkit with the probe.
4. If fitted, remove the reference air restrictor (F) from the probe body (Ref. Air) inlet using the 2.5 mm A/F hexagon key supplied with the restrictor kit.
5. Remove any O-rings from the new restrictors and discard (the seal between the restrictors and probe body inlets is made by the metal-to-metal faces of the restrictors / inlets).
6. Fit the 2 new (larger) test gas restrictors (G) into the TG1 and TG2 inlets on the casting and tighten fully using the 3 mm A/F hexagon key.

Do not use thread sealant (the metal to metal seal is sufficient).

7. Fit the new (smaller) reference air restrictor (H) into the Ref. Air inlet and tighten fully using the 2.5 mm A/F wrench supplied. Do not use thread sealant (the metal to metal seal is sufficient).
 8. Fit new filter pads (I) in front of each restrictor.
 9. Refit the reference air (Ref. Air) fitting (A) and external test gas (TG1, TG2) fittings (B) fitting using the correct spanner – see step 1 (left).
- Ensure fittings are leak-tight, use PTFE tape on the threads if necessary.
10. Mark the Commissioning label (J) on the probe to show that restrictors are fitted.
 11. Re-install the probe as detailed in the probe User Guide (OI/AZ30P-EN).
 12. Make gas supplies to the probe and electrical supplies to the transmitter – refer to the transmitter Programming Guide (COI/AZ30E-EN) for electrical supplies and the probe User Guide (OI/AZ30P-EN) for gas and reference air supplies.

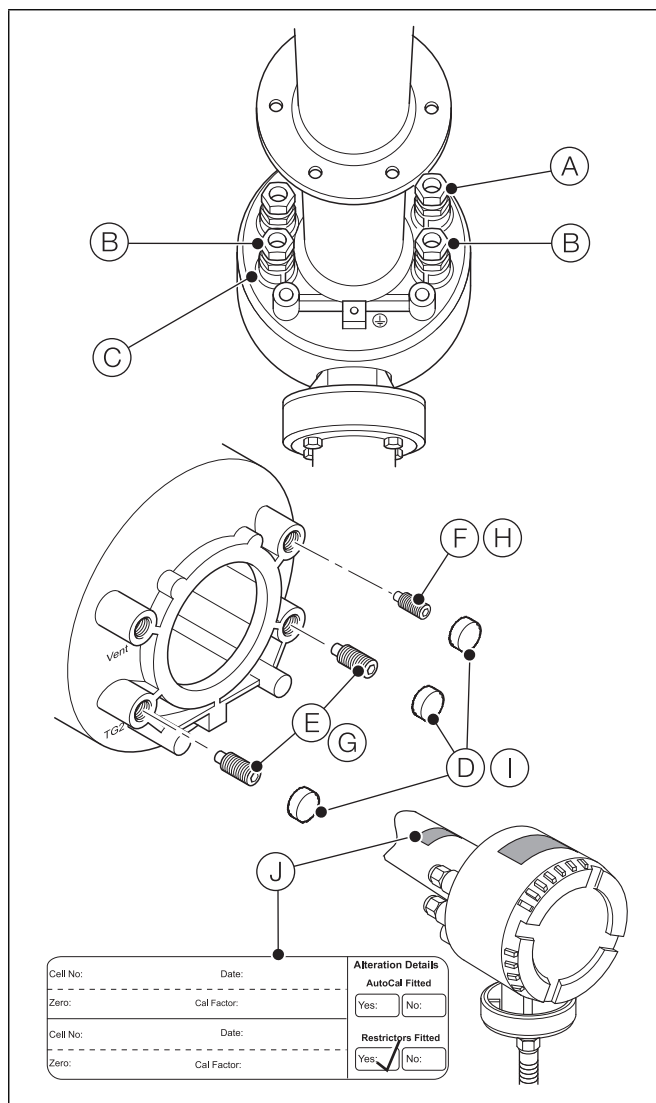


Fig. 5.10 Replacing / Fitting Restrictors

5.11 Replacing the PT1000 Temperature Sensor

Before fitting the PT1000 sensor:

- Ensure a PT1000 sensor is available – see section 7.6, page 34.
- Remove the probe from its mounting as detailed in Section 5.5, page 17 (integral probe) or Section 5.6, page 18 (remote probe).
- Remove the probe lid as detailed in Section 5.7.1, page 19.

Referring to Fig. 5.11:

1. Loosen the 2 ACJC connection terminal block screws (A) (violet and grey terminal label) and remove existing PT1000 sensor (B).
2. Connect the new PT1000 to the terminal block and tighten the 2 ACJC terminal block screws (A).
3. Refit the probe lid – see section 5.7.2, page 19.
4. Re-install the probe as detailed in the probe User Guide (OI/AZ30P-EN).

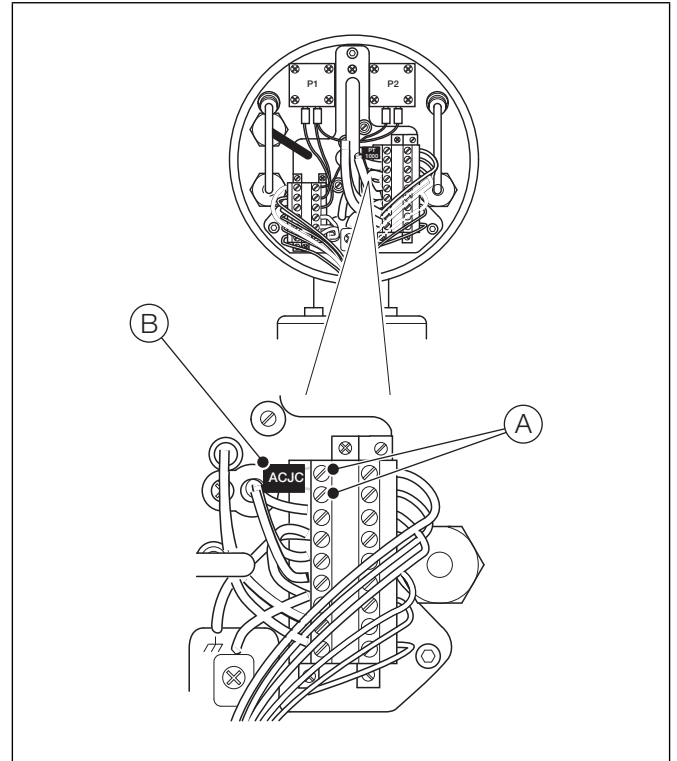


Fig. 5.11 Removing / Replacing the PT1000 Sensor

6 Dismantling and Reassembly – Transmitter

Warning. All procedures listed in this manual invalidate the system's explosion-proof integrity. Consequently, before removing any covers or lids, ensure there are no hazardous gases present or alternatively, remove the probe from the hazardous area.

Warning.

- Before dismantling the transmitter, clean the outer surfaces of the transmitter thoroughly.
- Handle internal components carefully, keep them clean and ensure mating surfaces are not damaged during maintenance procedures.
- Do not subject the transmitter to blows from hammers or sharp objects.
- Do not reuse damaged parts, use new replacement parts only.

6.1 Flamepath Locations and Maintenance Limitations

Warning.

- Before commencing maintenance procedures familiarize yourself with flamepath locations and flamepath requirements – see Section 2, page 6.
- It is **not** permitted to perform any maintenance procedure that requires removal of the probe's internal structure – see Section 2.1, page 16.

6.2 Replacing the Transmitter Cartridge

Warning. Isolate the transmitter from power supplies before removing the cover and label the isolator to prevent accidental switch on.

1. Ensure a replacement cartridge of the correct type is available – see section 8.1, page 36 for cartridge options.

Referring to Fig. 6.1:

2. Screw security pin (A) in (clockwise) to enable the cover to be removed.
3. Unscrew the transmitter cover (B) by twisting it anti-clockwise.
4. Slacken the 3 cartridge retaining screws (C), lift the cartridge (D) away from the housing and discard the cartridge – refer to the probe User Guide (COI/AZ30E-EN) for recommended disposal procedures.
5. Position a new cartridge over the backplane (E), align the cartridge retaining screws (C) with the 3 backplane screw access holes (F) and push the cartridge in gently to engage the connectors.
6. Tighten the 3 cartridge retaining screws (C) to secure the cartridge (D) to the backplane (E).
7. Refit the transmitter cover (B) by screwing it in place and unscrew security pin (A) to lock the cover.
8. Refer to the transmitter Programming Guide (COI/AZ30E-EN) to re-configure the transmitter

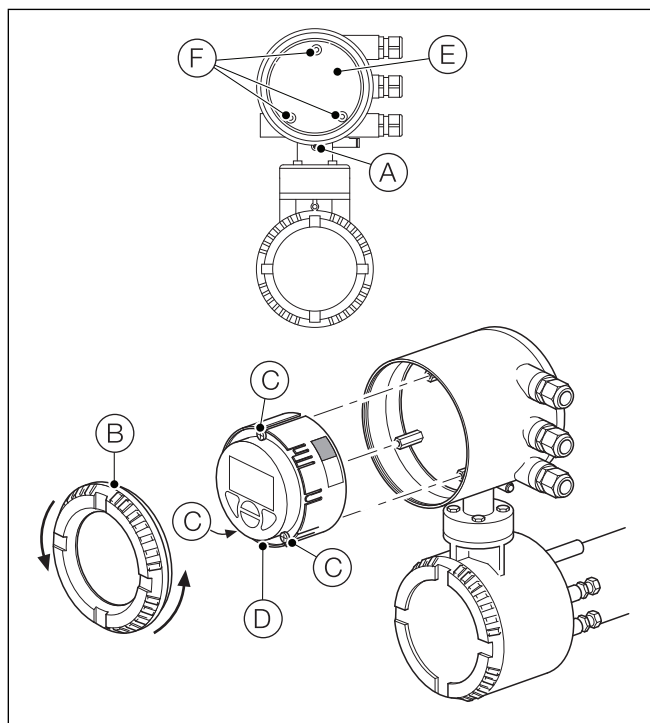


Fig. 6.1 Replacing the Transmitter Cartridge

6.3 Replacing the Transmitter Backplane

6.3.1 Removing the Backplane

Warning. Isolate the transmitter from power supplies before removing the cover and label the isolator to prevent accidental switch on.

1. Remove the transmitter cover and cartridge as detailed in Section 6.2, page 30, steps 2 to 4.

Referring to Fig. 6.2:

2. Unplug the probe signal connectors (A).
3. Unscrew and remove the 3 backplane retaining screws (B).
4. Lift the backboard (C) out of the probe transmitter housing (D) and discard the backboard – refer to the transmitter Programming Guide (COI/AZ30E-EN) for disposal recommendations.
5. Proceed to Section 6.3.2, page 31 to fit a new backplane.

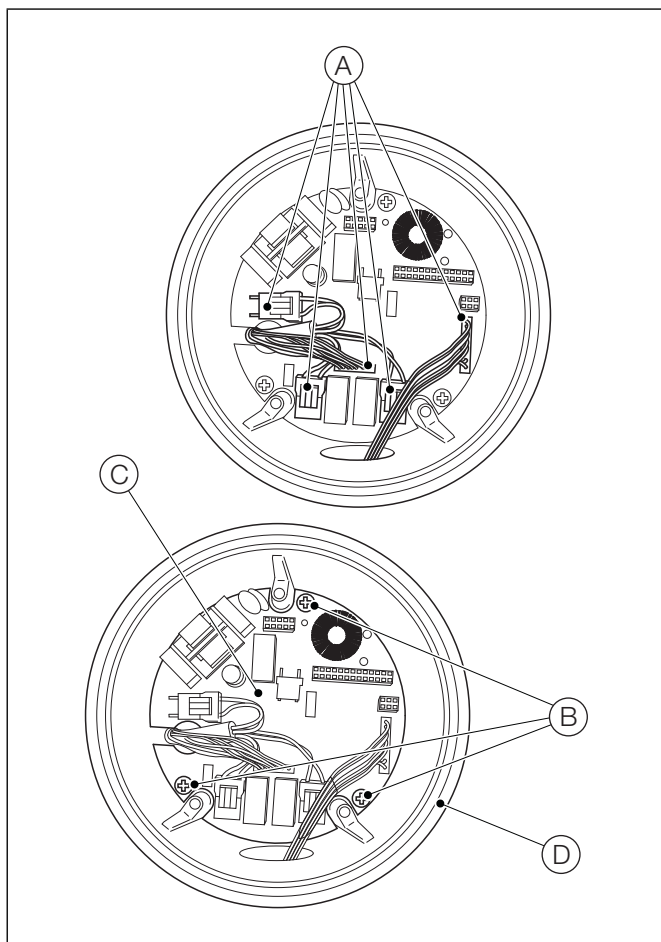


Fig. 6.2 Removing the Transmitter Backplane

6.3.2 Fitting a New Backplane

Referring to Fig. 6.3:

1. Position the new backboard (A) in the probe's transmitter housing (B).
2. Tighten the 3 backplane retaining screws (C) to secure the backplane (A) to the probe's transmitter housing (B).
3. Reconnect the probe's signal connectors (D), ensuring they are plugged into the correct terminations.
4. Proceed to Section 6.2, page 30, steps 5 to 8 to refit the cartridge (the refitting procedure is the same for both existing and new cartridges).

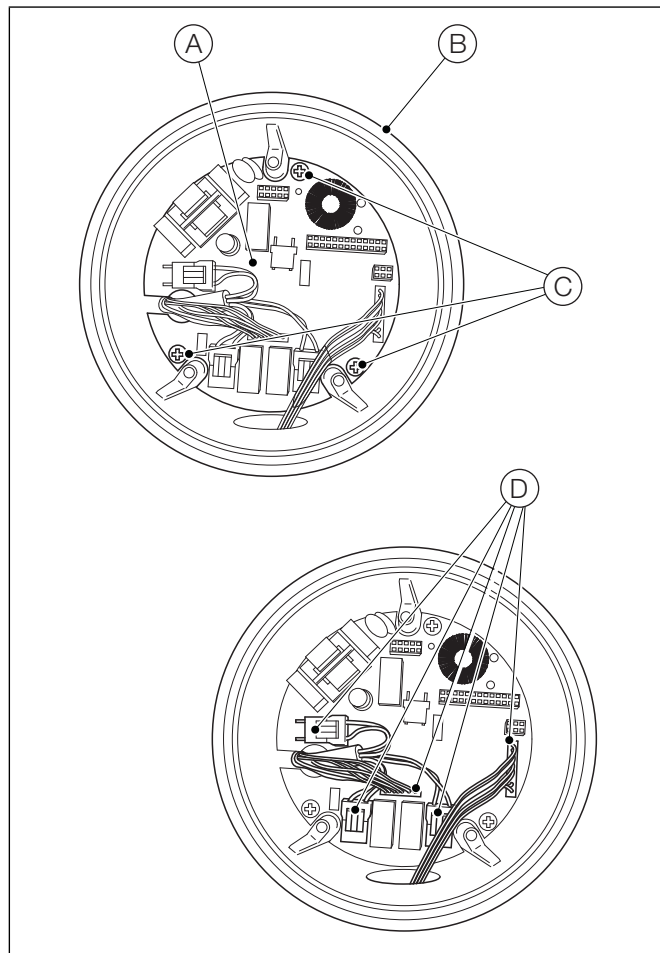


Fig. 6.3 Fitting a New Transmitter Backplane

6.4 Replacing the Remote Transmitter Lid

Warning. If the remote transmitter lid is replaced with the probe in situ, ensure the system it is used in has been shut down and isolated to prevent the risk of electrical shocks.

Before replacing the remote transmitter lid:

1. Ensure the wiring label is available.
2. If necessary, remove the probe from its mounting as detailed in Section 5.6, page 18.

6.4.1 Removing the Remote Transmitter Lid

Referring to Fig. 5.3:

1. Unscrew, remove and discard remote transmitter lid (A).

6.4.2 Fitting a New Remote Transmitter Lid

Referring to Fig. 5.3:

1. Fix the new wiring label (B) to the inside of the new remote transmitter lid (C).
2. Screw the new remote transmitter lid onto the housing (D) until hand-tight.

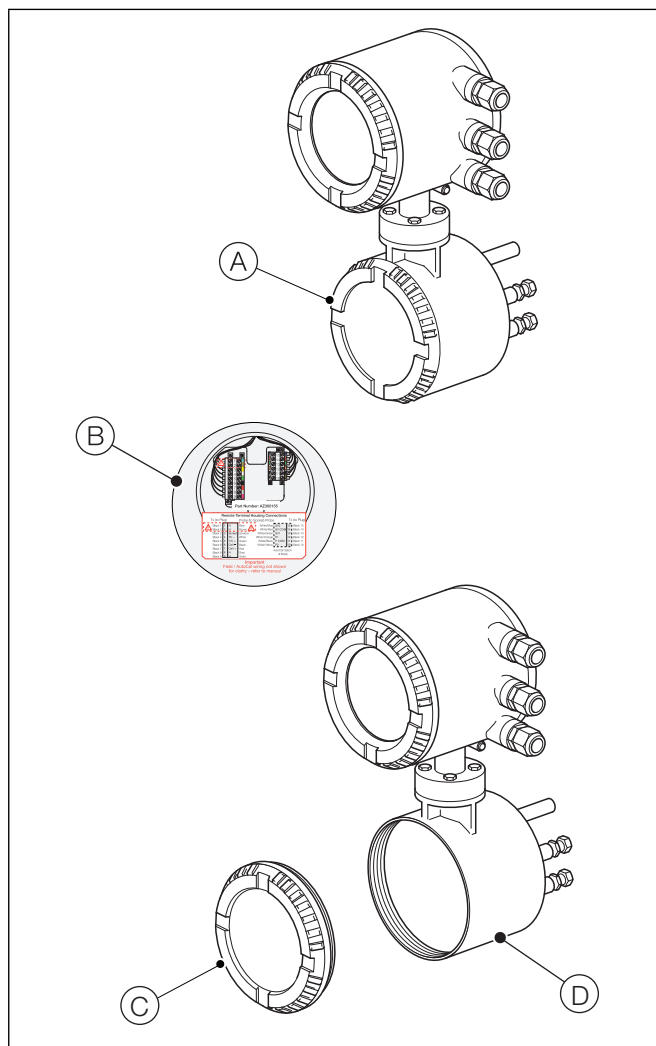
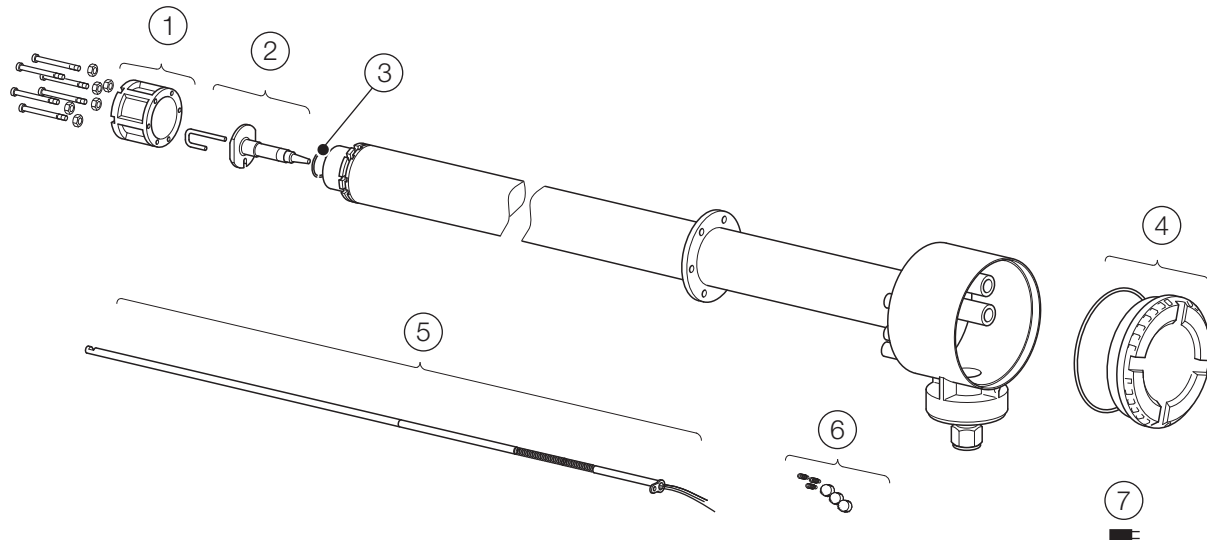


Fig. 6.4 Replacing the Remote Transmitter Lid

7 Illustrated Parts List – Probe



The diagram shows an exploded view of the AZ30 probe assembly. Callout 1 points to a set of diffuser flame arrestor components. Callout 2 points to the cell assembly. Callout 3 points to a C-ring. Callout 4 points to the AZ30 probe lid. Callout 5 points to the thermocouple / electrode assembly, which includes insulators. Callout 6 points to a restrictor kit. Callout 7 points to the PT1000 temperature sensor.

Item	Description	Kit Components	Replacement Procedure
①	Diffuser flame arrestor	Table 7.1, page 34	Refer to Section 5.8.4, page 22
②	Cell assembly	Table 7.2, page 34	Refer to Section 5.8, page 20
③	C-ring	Table 7.3, page 34	Refer to Section 5.8.3, page 22
④	AZ30 probe lid	Table 7.4, page 34	Refer to Section 5.7, page 19
⑤	Thermocouple / electrode assembly (includes insulators)	Table 7.5, page 34	Refer to Section 5.9, page 24
⑥	Restrictor kit	Table 7.6, page 34	Refer to Section 5.10, page 28
⑦	PT1000 temperature sensor	Table 7.7, page 34	Refer to Section 5.11, page 29

Fig. 7.1 AZ30 Probe Replacement Kits

7.1 Diffuser Flame Arrestor

Item	Quantity
Diffuser Flame Arrestor	1
M4 x 60 cap head bolts	6
M4 nuts	6
C-ring	1

Table 7.1 Diffuser Flame Arrestor Replacement Kit – Part No. AZ300 746

7.2 Cell Assembly

Item	Quantity
Cell	1
M4 x 60 cap head screws	6
M4 nuts	6
C-ring	1
Commissioning label	1

Table 7.2 Cell Replacement Kit – Part No. AZ300 745

7.3 C-ring Kit

Item	Quantity
C-ring	1
M4 x 60 cap head bolts	6
M4 nuts	6

Table 7.3 C-ring Replacement Kit – Part No. AZ300 744

7.4 AZ30 Probe Lid Replacement Kit

Item	Quantity
Probe lid	1
Probe lid seal	1
AZ30 Wiring label	1

Table 7.4 AZ30 Probe Lid Replacement Kit – Part No. AZ200 728

7.5 Thermocouple / Electrode Assembly

Item	Quantity
Thermocouple / electrode assembly kit comprises: cell contact sub-assembly – as probe insertion length (1 per kit) springs (2 per kit) 500 mm (19.7 in.) long insulators (refer to Table 5.1, page 26 for quantities by insertion length) 148 mm (5.8 in.) long T/C and electrode insulator (1 per kit) red, white and green color-coded 0.45 m (17.7 in.) sleeves for wires (1 sleeve for each wire, 3 sleeves per kit) Thermocouple / electrode kit part numbers comprise: 0.5 m (1.64 ft.) – kit part no. AZ200 701 1.0 m (3.28 ft.) – kit part no. AZ200 702 1.5 m (4.92 ft.) – kit part no. AZ200 703 2.0 m (6.56 ft.) – kit part no. AZ200 704	1

Table 7.5 Thermocouple / Electrode Assembly Replacement Kit

7.6 Restrictor Kit

Item	Quantity
Restrictor (large) M6	2
Restrictor (small) M5	1
Filter	3
Commissioning label	1
Hex wrench – 3.0 mm A/F	1
Hex wrench – 2.5 mm A/F	1

Table 7.6 Restrictor Kit – Part No. AZ200 727

7.7 PT1000 Temperature Sensor

Item	Quantity
PT1000 temperature sensor	1

Table 7.7 PT1000 Temperature Sensor – Part No. AZ200 725

8 Illustrated Parts List – Transmitter

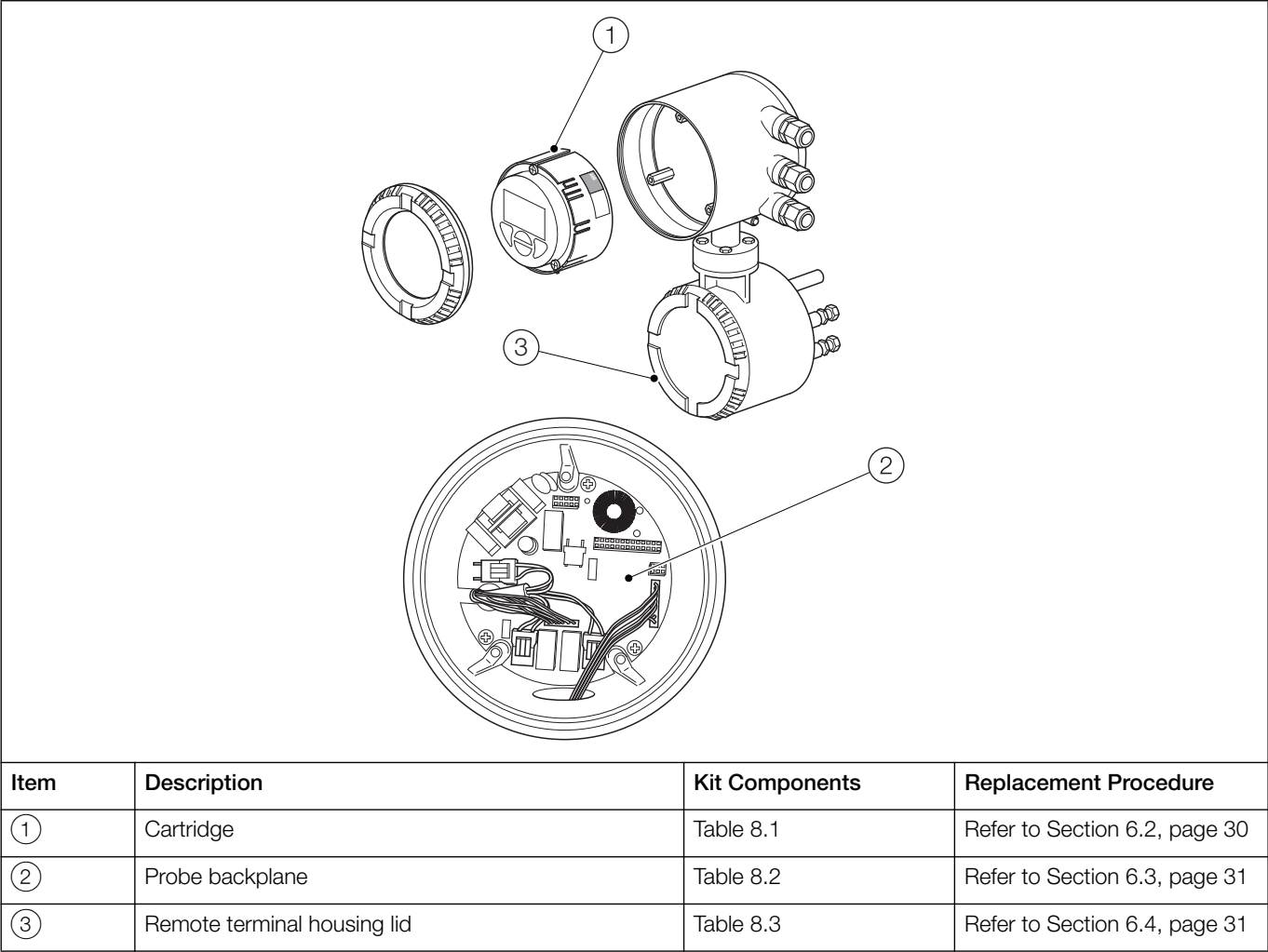


Fig. 8.1 AZ30 Transmitter Replacement Kits

8.1 Cartridge

Item	Quantity
Replacement cartridge. Replacement cartridge options comprise: Standard cartridge (kit part no. AZ200 750) Standard cartridge, plus analog outputs (kit part no. AZ200 751) Standard cartridge, plus digital input / output (kit part no. AZ200 752)	1

Table 8.1 Cartridge Replacement Kit

8.2 AZ30 Probe Backplane

Item	Quantity
AZ30 probe backplane	1

Table 8.2 AZ30 Probe Backplane Replacement Kit –
Part No. AZ200 757

8.3 AZ30 Remote Terminal Housing Lid

Item	Quantity
AZ30 remote transmitter lid	1

Table 8.3 AZ30 Remote Terminal Housing Lid Replacement Kit
– Part No. AZ300 757

Appendix A – Electrical Connection Details

A.1 Internal Wire Numbers and Terminal Colors

Internal connections between the electronics unit and the remote or integral terminal blocks are made using black sheathed individually numbered wires. These wires are connected to the (inner) terminal block terminals.

Probe cable wires are color-coded and colors correspond to the color-coded terminal plugs fitted to the terminal blocks.

Refer to the following table to match internal wire numbers with colored probe wires.

Internal Wire Number	Terminal / Probe Cable Color	Tag ID	Connection Type
----------------------	------------------------------	--------	-----------------

Standard connections to 9-way terminal block

1	Blue	H	Heater
2	Brown	H	Heater
3	Screen	SCN	Screen
4	White	TC –	Thermocouple (–ve)
5	Green	TC+	Thermocouple (+ve)
6	Black	CELL –	Oxygen Input (–ve)
7	Red	CELL +	Oxygen Input (+ve)
8	Grey	ACJC	PT1000 Cold Junction Compensation
9	Violet	ACJC	PT1000 Cold Junction Compensation

AutoCal connections to 6-way terminal block

10	White / Yellow	PS2	Pressure Switch – Gas 2
11	White / Black	P COM	Pressure Switch – Common
12	White / Orange	PS1	Pressure Switch – Gas 1
13	White / Green	SV1	Solenoid Valve – Gas 1
14	White / Red	SV COM	Solenoid Valve – Common
15	White / Blue	SV2	Solenoid Valve – Gas 2

Table A.1 Probe Cable Connections at Remote Transmitter

A.2 AZ30 Integral Probe

Note. Refer to Table A.1, page 37 for connection details.

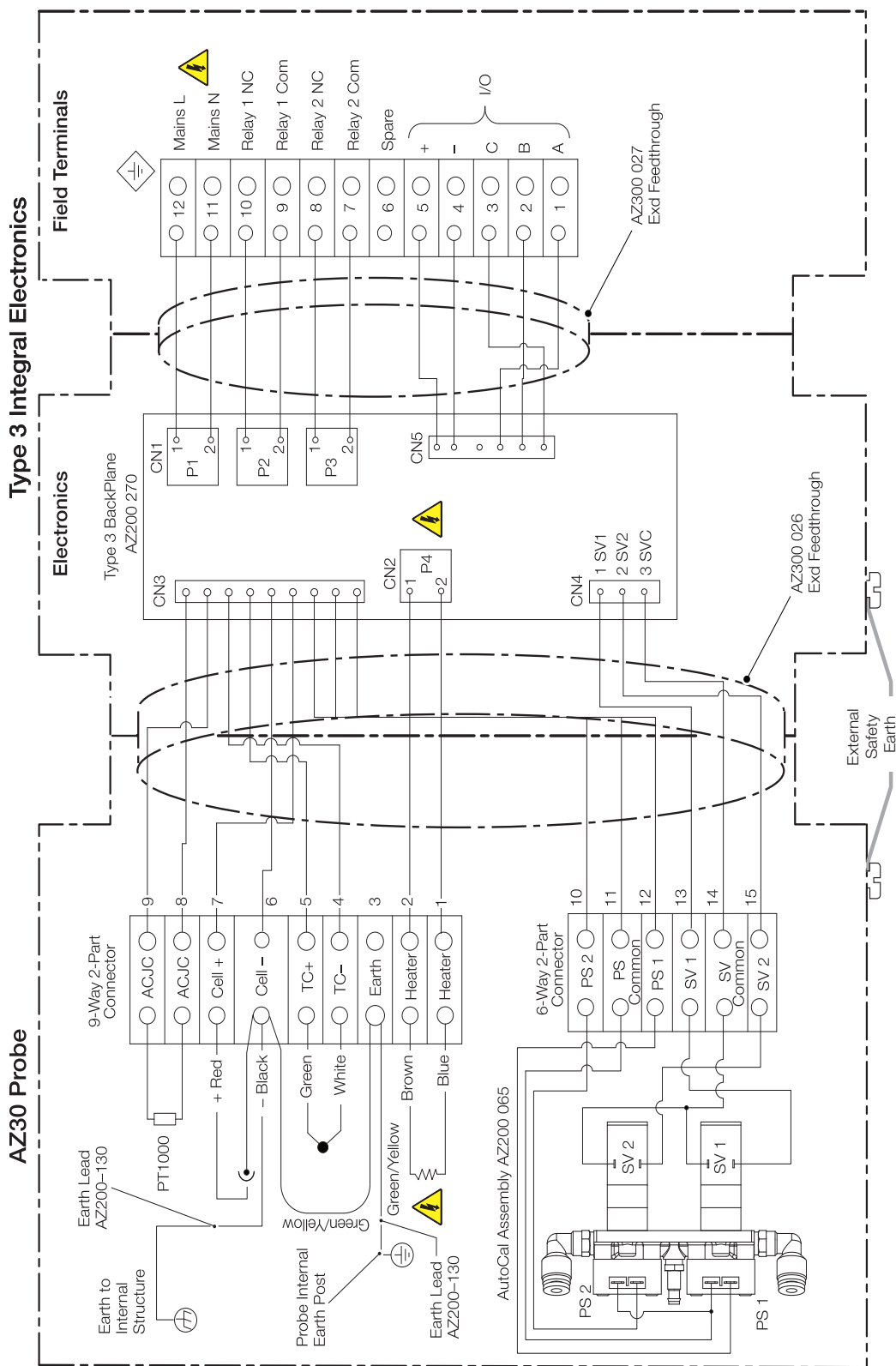


Fig. A.1 AZ30 Integral Probe – Connection Diagram

A.3 AZ30 Remote Probe

Note. Refer to Table A.1, page 47 for connection details.

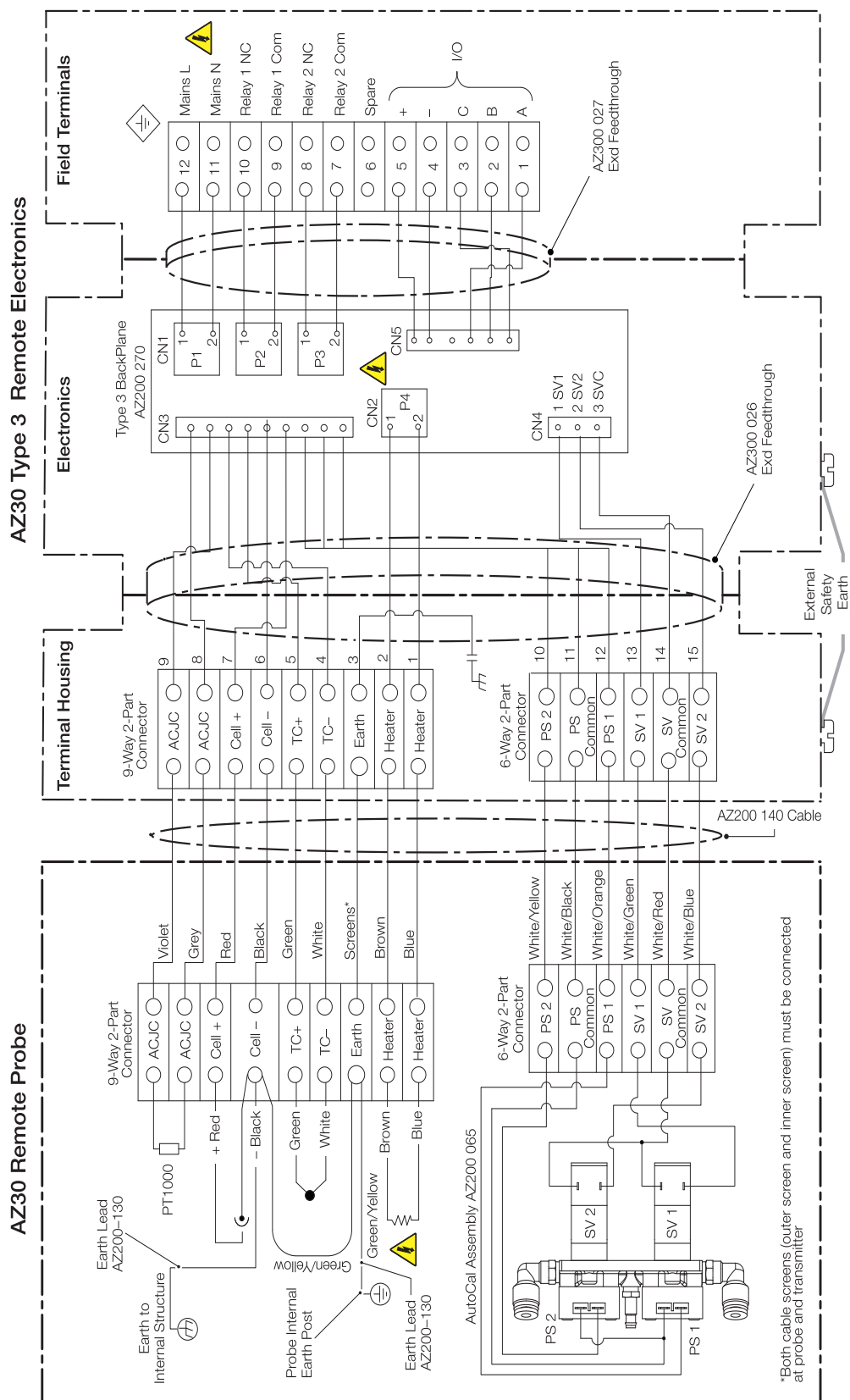


Fig. A.2 AZ30 Remote Probe – Connection Diagram

Appendix B – Probe Electrical Connections

B.1 AZ30 Probe Transmitter Cable Connections

Note. Non-AutoCal probes are not fitted with the 6-way AutoCal terminal block or pressure switch / solenoid valve option.

Terminal / Cable Color	Tag ID	Tx Connection
Violet	ACJC	Pt1000 Cold Junction Compensation
Grey	ACJC	Pt1000 Cold Junction Compensation
Red	Cell +	Oxygen Input (+ve)
Black	Cell –	Oxygen Input (–ve)
Green	T / C+	Thermocouple (+ve)
White	T / C –	Thermocouple (–ve)
Light Yellow	SCN	Screen
Brown	H	Heater
Blue	H	Heater

Table B.1 Probe Transmitter Cable Connections

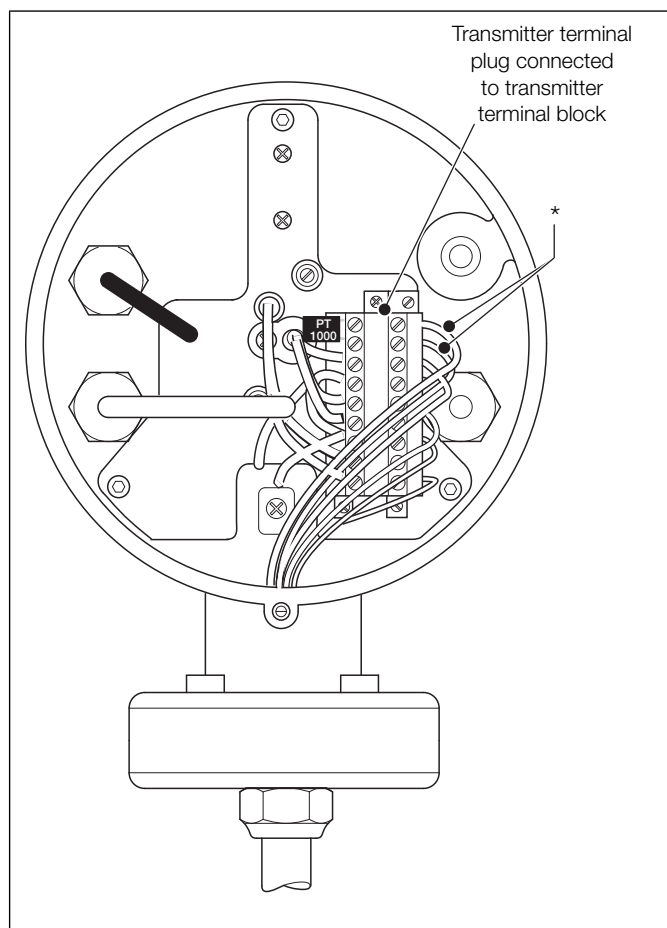


Fig. B.1 Probe Transmitter Cable Connections

B.2 AutoCal Connections at AZ30 Probe

Terminal / Cable Color	Tag ID	AutoCal Connection
White / Yellow	PS2	Pressure Switch Gas 2
White / Black	PS COM	Pressure Switch Common
White / Orange	PS1	Pressure Switch Gas 1
White / Green	SV1	Solenoid Valve Gas 1
White / Red	SV COM	Solenoid Valve Common
White / Blue	SV2	Solenoid Valve Gas 2

Table B.2 AutoCal Connections at Probe

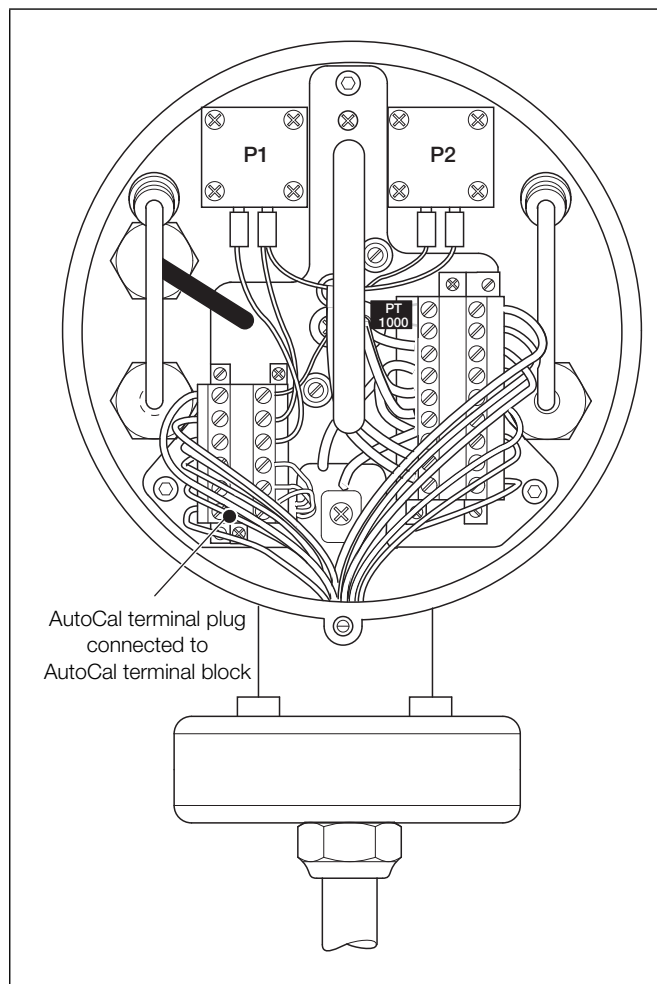


Fig. B.2 AutoCal Connections at AZ30 Probe

B.3 AutoCal Pressure Switch Connections

Note.

- Refer to Table B.2, page 40 for pressure switch terminal connections.
- Pressure switches are voltage-free.

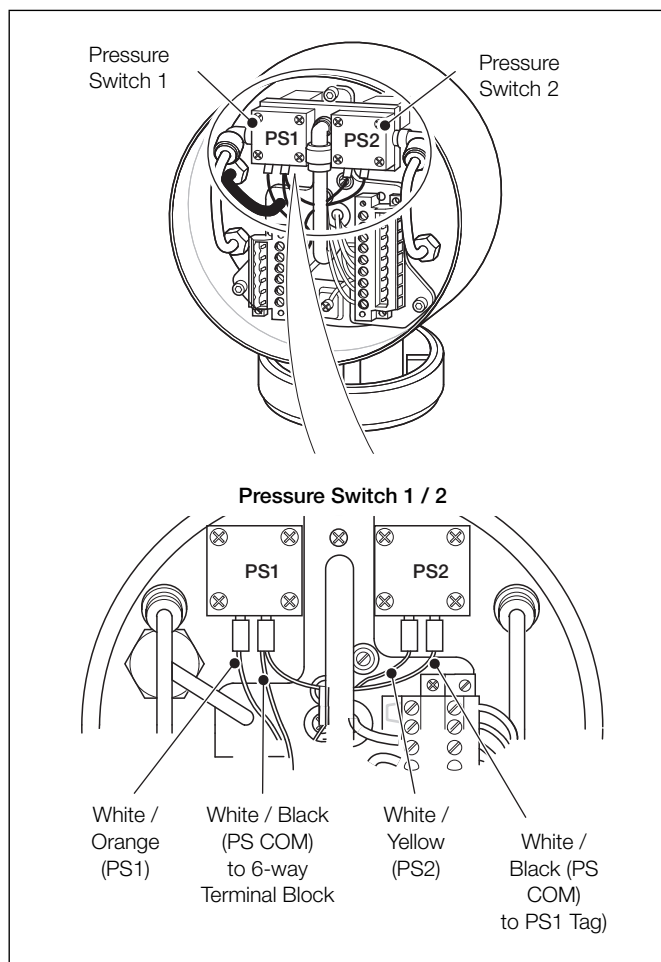


Fig. B.3 AutoCal Pressure Switch Connections

B.4 AutoCal Solenoid Valve Terminal Connections

Note.

- Refer to Table B.2, page 40 for solenoid valve terminal connections.
- Solenoid valves have a maximum output of 100 mA @ 24 V DC (protection and inline fuses are required if using external automatic calibration panels).

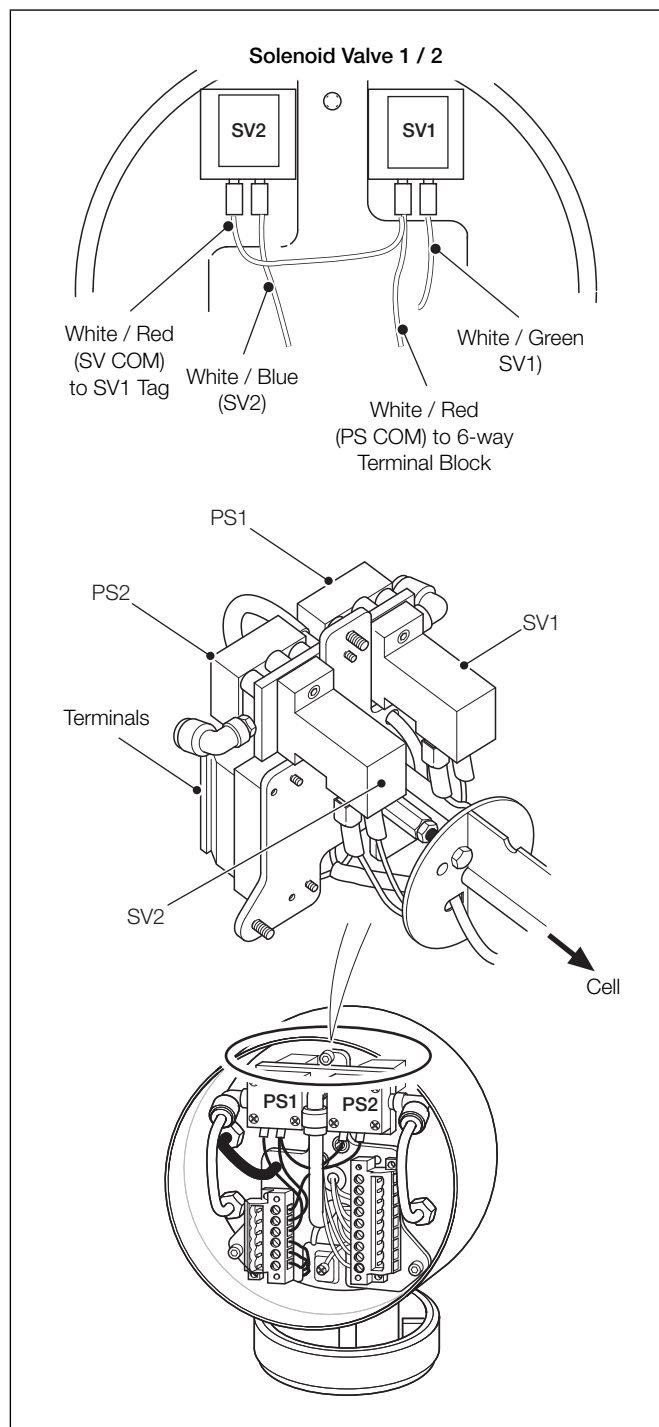


Fig. B.4 AutoCal Solenoid Valve Connections

Appendix C – EC Declaration of Conformity

Power and productivity
for a better world™



EC Declaration of Conformity

We, **ABB Limited**

Of, **Oldends Lane
Stonehouse
Gloucestershire
England
GL10 3TA**

Declare under our own responsibility that the product:

Description of the Equipment:- **AZ30 Oxygen Probe**

to which this declaration relates is in conformity with the following standards:

Directive 2006/95/EC (LVD)

Harmonised Standard used:
EN61010-1:2001

Directive 2004/108/EC (EMC)

Harmonised Standard used:
EN 61326:2006

Directive 94/9/EC (ATEX) and IECEx

Harmonised Standards used:
IEC 60079-0 2011 Ed 6, EN60079-1 2007-04 Ed 6, EN60079-31 2009, EN60079-31 2008 Ed 1

Provisions of the Directive fulfilled by the Equipment.

Equipment Group:-

⊕ II 2GD

Ex d IIB+H₂ T4 Gb (Ta -20°C to +70°C)

Ex tb IIIC T135C Db (Ta -20°C to +70°C) IP66

Name, notified body number and address of the Notified Body:-

Baseefa Ltd, Number 1180, of:- Rockhead Business Park, Staden Lane, Buxton,
Derbyshire SK17 9RZ.

Number of the type examination certificates:-

Baseefa12ATEX0076X - last supplement issued **16 APRIL 2012**

IECEx BAS 12.048X - last supplement issued **23 APRIL 2012**

When installed and operated according to the supplied instructions.

8-JUN-2012

Date of Issue

Signature Brian Hull - General Manager

Fig. C.1 AZ30 Oxygen Probe


<p>Power and productivity for a better world™ ABB</p> <p>EC Declaration of Conformity</p> <p>We, ABB Limited</p> <p>Of, Oldends Lane Stonehouse Gloucestershire England GL10 3TA</p> <p>Declare under our own responsibility that the product:</p> <p>Description of the Equipment:- AZ30 O₂ Transmitter</p> <p>to which this declaration relates is in conformity with the following standards:</p> <p>Directive 2006/95/EC (LVD) Harmonised Standard used: EN61010-1:2001</p> <p>Directive 2004/108/EC (EMC) Harmonised Standard used: EN 61326:2006</p> <p>Directive 94/9/EC (ATEX) and IECEx Harmonised Standards used: IEC 60079-0 2011 Ed 6, EN60079-1 2007-04 Ed 6, EN60079-31 2009, EN60079-31 2008 Ed 6</p> <p>Provisions of the Directive fulfilled by the Equipment. Equipment Group:- Ⓔ II 2GD Ex d IIB+H₂ T6 Gb (Ta -20°C to +55°C) Ex tb IIIC T85°C Db (Ta -20°C to +55°C) IP66</p> <p>Name, notified body number and address of the Notified Body:- Baseefa Ltd, Number 1180, of:- Rockhead Business Park, Staden Lane, Buxton, Derbyshire SK17 9RZ.</p> <p>Number of the type examination certificates:- Baseefa12ATEX0078U - last supplement issued 16 APRIL 2012 IECEx BAS 12.0050U - last supplement issued 09 May 2012</p> <p>When installed and operated according to the supplied instructions.</p> <p>8-JUN-2012</p> <p>Date of Issue</p> <p> Signature Brian Hull - General Manager</p>	
---	--

Fig. C.2 AZ30 O₂ Transmitter



EC Declaration of Conformity

We, **ABB Limited**

Of, **Oldends Lane
Stonehouse
Gloucestershire
England
GL10 3TA**

Declare under our own responsibility that the product:

Description of the Equipment:- **AZ30 Remote Terminal Box**

to which this declaration relates is in conformity with the following standards:

Directive 2006/95/EC (LVD)

Harmonised Standard used:
EN61010-1:2001

Directive 2004/108/EC (EMC)

Harmonised Standard used:
EN 61326:2006

Directive 94/9/EC (ATEX) and IECEx

Harmonised Standards used:
IEC 60079-0 2011 Ed 6, EN60079-1 2007-04 Ed 6, EN60079-31 2009, EN60079-31 2008
Ed 1

Provisions of the Directive fulfilled by the Equipment.

Equipment Group:-

Ⓔ II 2GD

Ex d IIB+H₂ T6 Gb (Ta -20°C to +70°C)

Ex tb IIIC T85°C Db (Ta -20°C to +70°C) IP66

Name, notified body number and address of the Notified Body:-

Baseefa Ltd, Number 1180, of:- Rockhead Business Park, Staden Lane, Buxton, Derbyshire
SK17 9RZ.

Number of the type examination certificates:-

Baseefa12ATEX0077X - last supplement issued **16 APRIL 2012**

IECEx BAS 12.0049X - last supplement issued **23 APRIL 2012**

When installed and operated according to the supplied instructions.

8-JUN-2012

Date of Issue

Signature Brian Hull - General Manager

Fig. C.3 AZ30 Remote Terminal Box

Sales



Service



Software



ABB Measurement & Analytics

For your local ABB contact, visit:
www.abb.com/contacts

For more product information, visit:
www.abb.com/measurement

We reserve the right to make technical changes or modify the contents of this document without prior notice. With regard to purchase orders, the agreed particulars shall prevail. ABB does not accept any responsibility whatsoever for potential errors or possible lack of information in this document.

We reserve all rights in this document and in the subject matter and illustrations contained therein. Any reproduction, disclosure to third parties or utilization of its contents – in whole or in parts – is forbidden without prior written consent of ABB.