

## AP100 series

pH/redox (ORP) cartridge sensors with water-wash option



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—  
AP100 series  
pH/redox (ORP)  
cartridge sensors

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AP100  
pH/Redox (ORP) cartridge sensors  
with water-wash option

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[DS/AP100-EN](#)







## Electrical safety

This equipment complies with the requirements of CEI/IEC 61010-1:2001-2 'Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use'. If the equipment is used in a manner NOT specified by the Company, the protection provided by the equipment may be impaired.

## Symbols

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

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	Warning – refer to the manual for instructions
	Caution – risk of electric shock
	Protective earth (ground) terminal
	Earth (ground) terminal
	Direct current supply only
	Alternating current supply
	Both direct and alternating current supply
	The equipment is protected through double insulation

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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.

## 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.
- Chemicals must be stored away from heat, protected from temperature extremes and powders kept dry. Normal safe handling procedures must be used.
- 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.

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# 1 INTRODUCTION

## 1.1 Purpose – Figs. 1.1 and 1.2

This instruction manual describes the installation and maintenance of the AP100 Series Industrial pH and Redox (ORP) Electrode Cartridge Systems.

## 1.2 Cartridges and Cartridge Systems

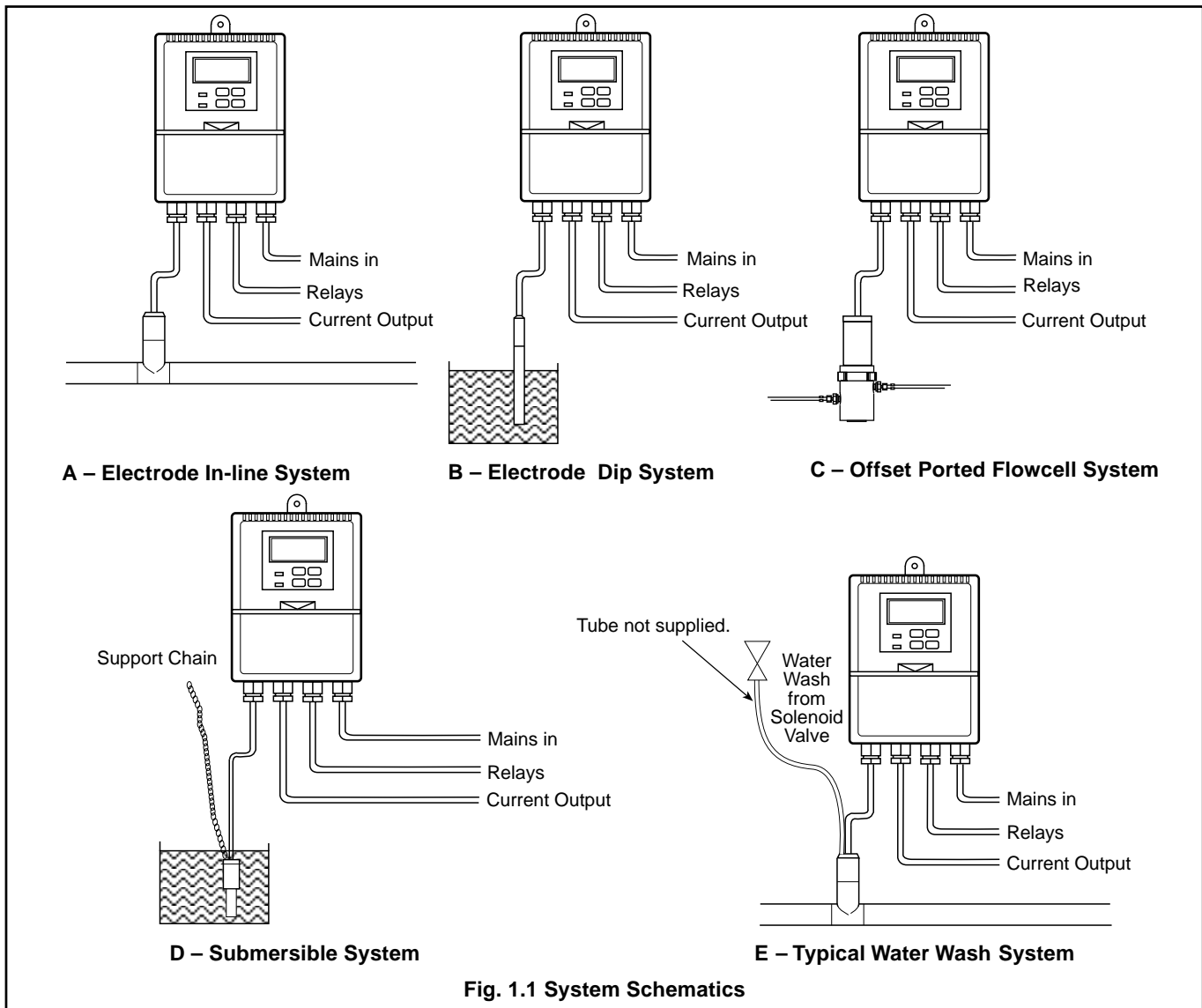
Fig. 1.1 shows schematic layouts for in-line and dip systems. Fig. 1.2 shows unit dimensions and identifies cartridge system installations.

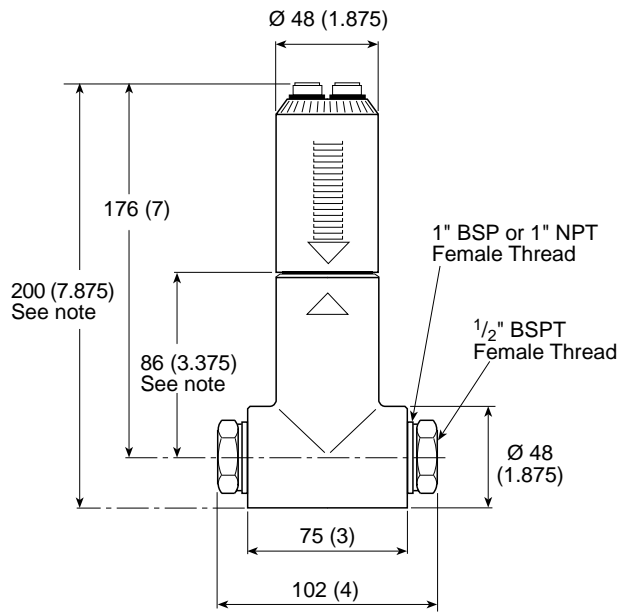
### Cartridge Type

AP101	Bayonet, Cable detached
AP102	Bayonet, Cable attached
AP103	Screw-in, cable detached
AP104	Submersible

### Sensor Types

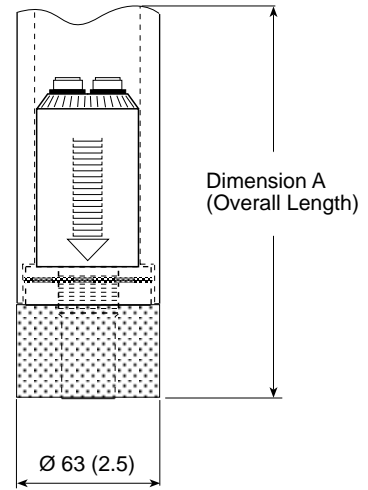
AP10X/1	Standard glass , 0 to 100°C, 0 to 14 pH
AP10X/2	Standard glass , 0 to 100°C, 0 to 14 pH plus Water Wash
AP10X/3	Low resistance glass, 0 to 70°C, 0 to 11 pH
AP10X/4	Low resistance glass, 0 to 70°C, 0 to 11 pH plus Water Wash
AP10X/5	Redox (ORP)
AP10X/6	Redox (ORP) plus Water Wash





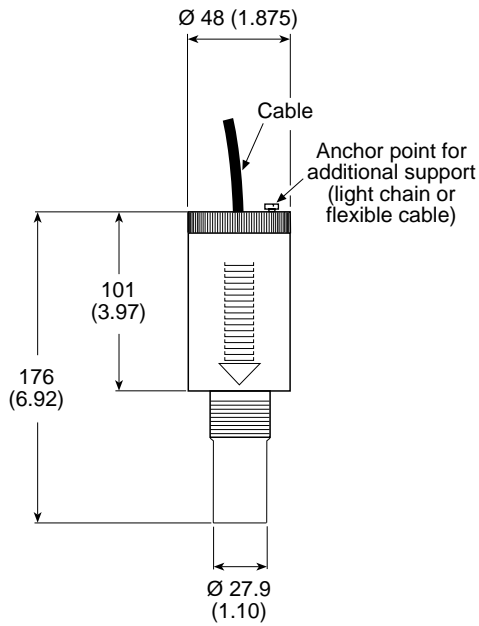
**Note.** Allow an additional 130 (5.125) for connectors and cartridge removal.

**AP101/2/3 – In-Line Flow System**

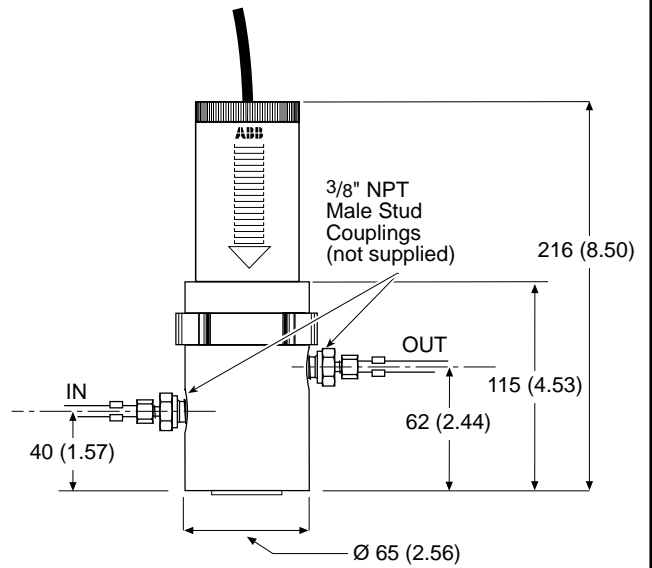


**Dimension A**  
 7674 – 1060 (41.75)  
 7675 – 2060 (81.10)  
 7676 – 3060 (120.50)

**AP103 – Dip System**



**AP104 – Submersible System**



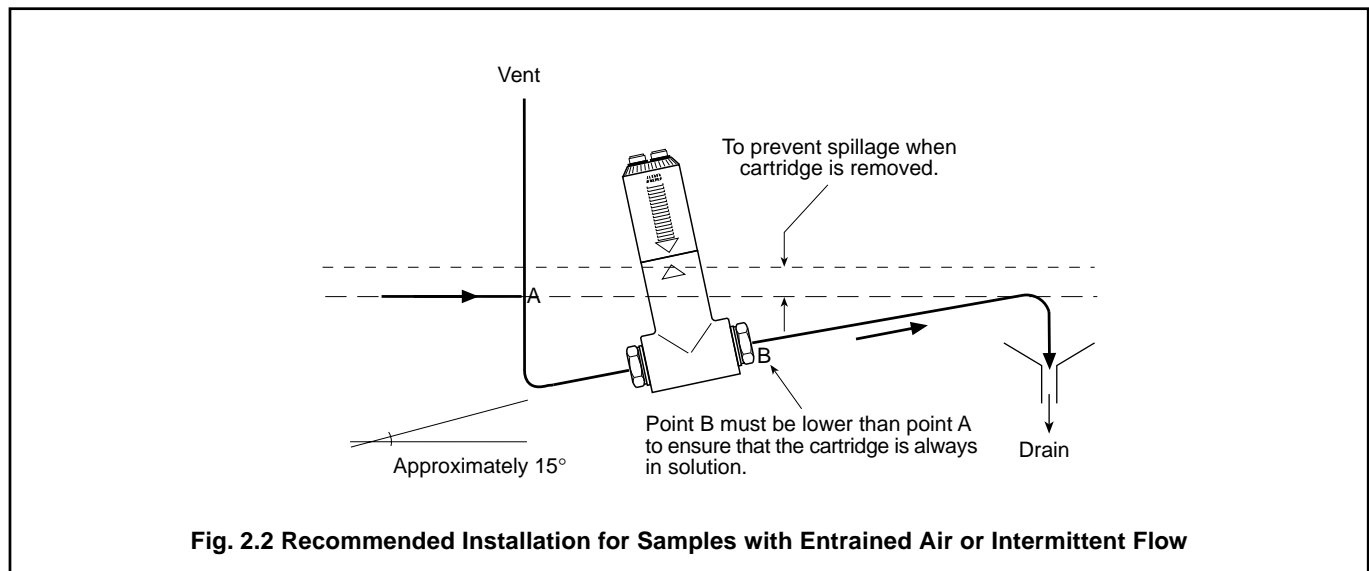
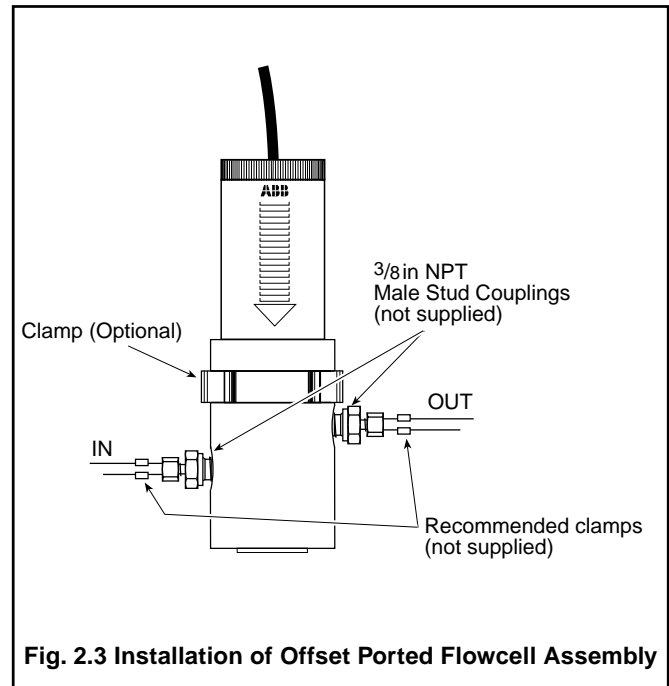
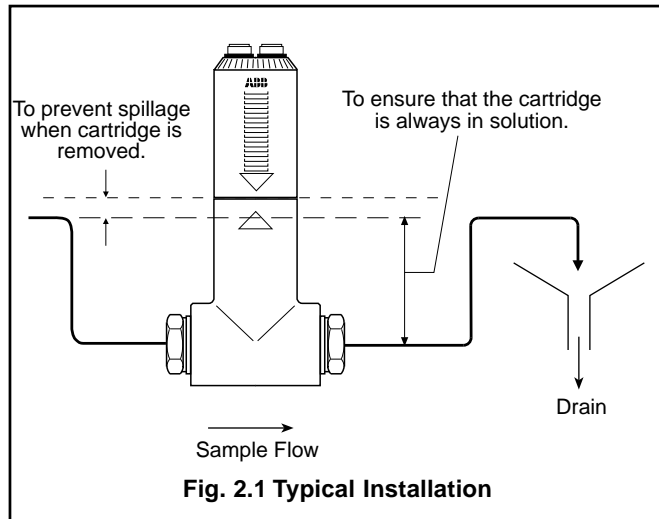
**AP101/2 – Offset Port In-Line System**

**Fig. 1.2 Overall Dimension in mm (in)**

## 2 INSTALLATION

### 2.1 Typical Installation

A typical installation is shown in Fig. 2.1, with offset ported flowcell arrangements illustrated in Fig. 2.3. A recommended installation for samples which may have entrained air or are subject to intermittent flow is shown in Fig. 2.2.



2.2 Water Supply for Water Wash Systems – Fig. 2.4 and 2.5

**Important Note.** Installation must only be carried out in accordance with the local water authority and council bylaws.

**Caution.** The maximum water pressure at the electrode should not exceed 4 bar. At NO time should the sample pressure be allowed to exceed that of the water wash water supply. Fit a non return valve if this possibility exists.

**Information.** As all quick-fit connectors used in Water Wash systems incorporate cutoff valves, tubes may subsequently be disconnected on operational equipment without sample loss or water wash discharge.

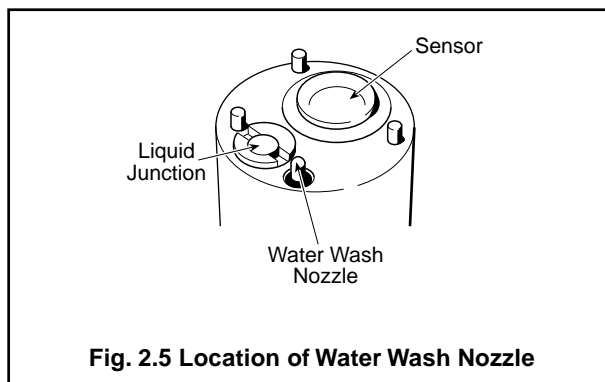
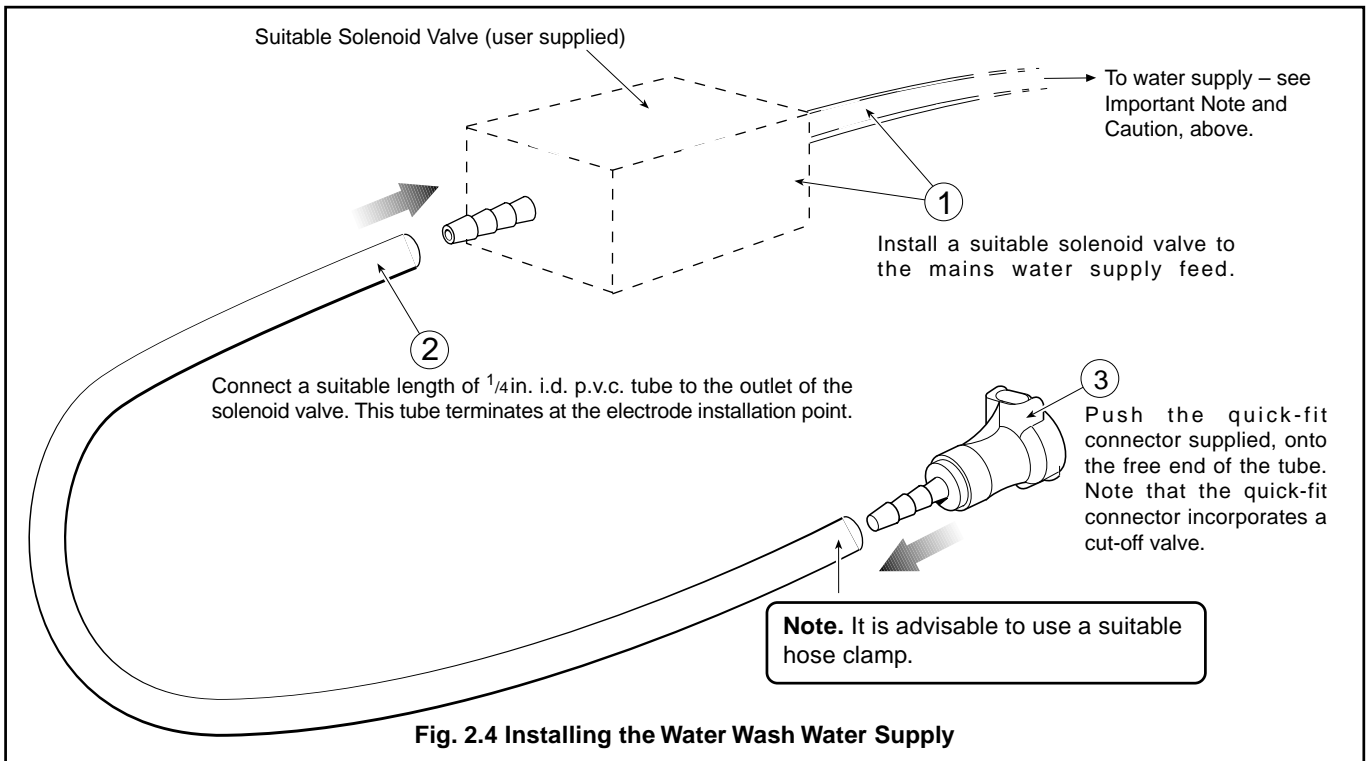
**Note.** For optimum performance of the Water Wash function in flow systems, the sample pressure should be at least 2 bars lower than that of the water wash water supply.

The water supply for the water wash system must come from a suitable supply via a solenoid valve. The general specification for the solenoid valve is:

- Brass body: 2/2, NC
- Orifice size: 3.0 / 4.0 mm
- Port size: 1/8" – 1/4" BSP
- Pressure: 0 to 6 bar
- Coil: 110/115 V a.c. or 230/240 V a.c. 50/60 Hz

Before fitting the electrode cartridge system, install the water supply as shown in Fig. 2.3.

**Note.** See Fig. 2.4 for recommended tubing.

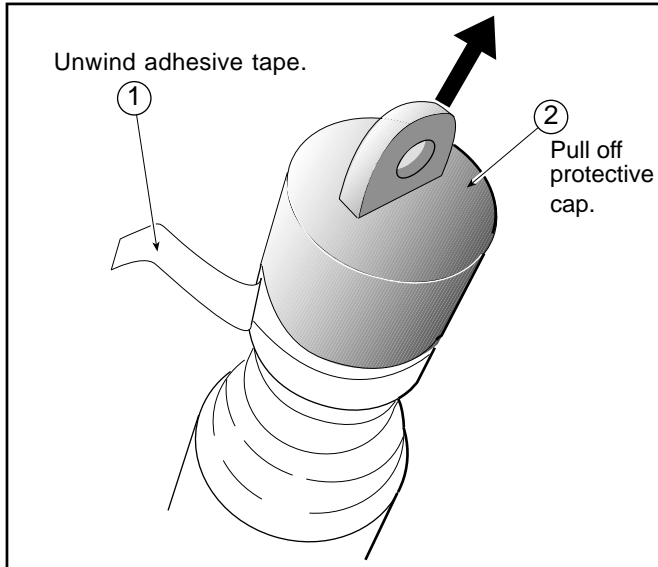


## ...2 INSTALLATION

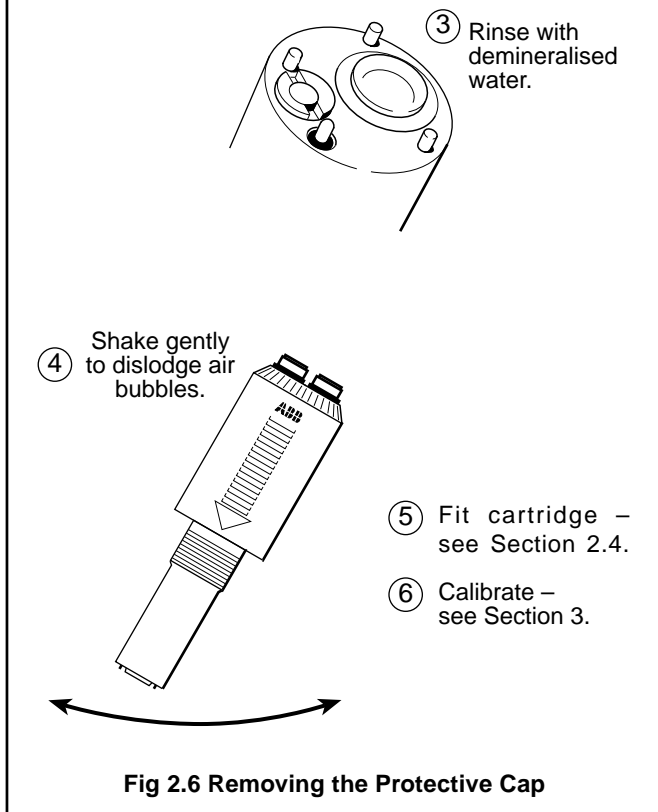
### 2.3 Preparing the Electrode Cartridge – Fig. 2.6

**Important Note.** Before preparing the electrode cartridge, read through Section 2.4 to become familiar with the appropriate installation procedure.

The procedure in Fig. 2.6A is appropriate for both pH and redox (ORP) electrode cartridges. The cartridge is supplied with a protective cap filled with a 7 pH buffer solution and should not require pre-conditioning; it is ready for immediate use.



**Note.** Retain protective cap and tape for future use.



### 2.4 Installing the Electrode Cartridge – Fig. 2.6

#### Caution

- Ensure an 'O' ring is fitted to seal each cable connector.
- Tighten each plug to ensure a good seal. It is vital that the terminations are kept dry at all times.
- Ensure the cable is fed through the dip system tube before the cable is connected. To avoid the risk of damp/corrosive air damaging the cable plugs, connect to the electrodes as soon as possible.

#### 2.4.1 In-line pH Systems

- a) Fit the flow cell into the pipeline observing all safety precautions. Fit isolating valves where necessary to enable safe access to the sensor for maintenance purposes.
- b) Ensure that all connections are tight.
- c) Connect the tagged end of the cable to the 4600 Series pH/Redox meter – see Fig. 2.7 and Table 2.1.

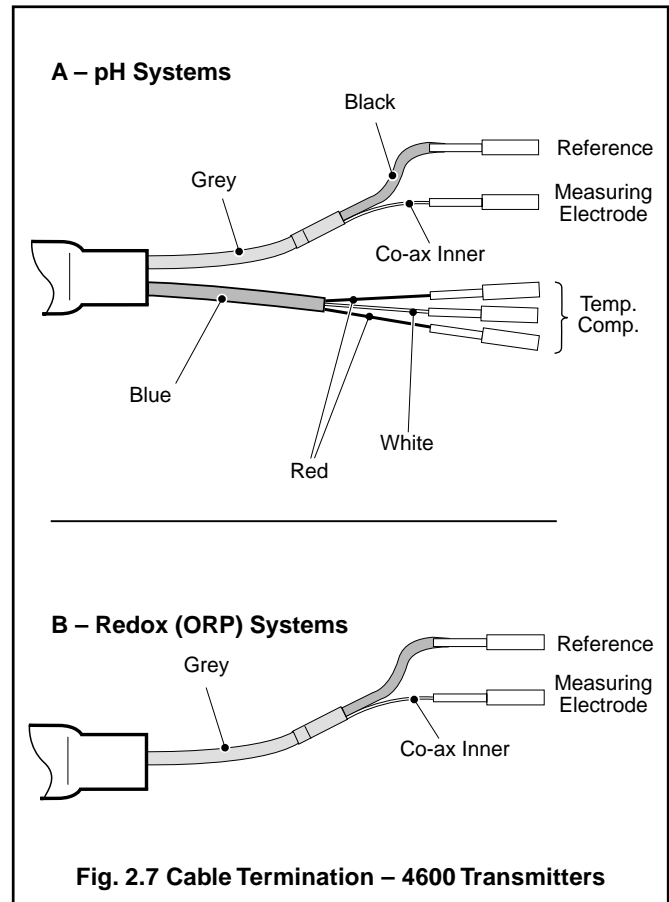




Table 2.1 Series 4600 Connection Equivalents

System Cable	4630	4635
Measuring Electrode (inner of coax)	2	11
Reference (black)	4	9
Temp. Comp. (red)	6	7
Temp. Comp. (white)	5	8
Temp. Comp. (red)	7	6

- d) **For cable detached versions**  
Fit the cable connector plugs to the matching colour sockets – blue to blue, red to red, as appropriate. See Fig. 2.8 inset for tightening and releasing the connector plug.
- e) Calibrate (pH only) – see Section 3.
- f) **For water wash versions**  
Snap on the water feed pipe from the solenoid valve – see Fig. 2.9, and visually check water cleaning action by switching on the water wash option on the 4600 transmitter. There should be a vigorous jet of water sprayed across the glass membrane (pH), or platinum (redox).
- g) Ensure that all pipeline connections are securely fitted. Apply PTFE tape to the threads of the 1" NPT cartridges to effect a water tight seal, and check that the 'O' ring and sealing area are clean on bayonet cartridge versions.
- h) Fit the electrode cartridge to the flow cell (screw or bayonet action) – see Fig. 1.2. Avoid excessive twisting of the cable on screw-type cartridges by disconnecting the cable from the electrode before screwing it into the flow cell. Fit connector plug on completion.

**2.4.2 Submersible Systems (pH and Redox)**

- a) Connect the tagged end of the cable to the 4600 Series pH transmitter – see Fig. 2.8 and Table 2.1.

**Note.** It is strongly recommended that a supporting chain is attached to the anchor point to remove any strain on the signal cable.

- b) Calibrate (pH only)– see Section 3.
- c) Immerse electrode into the solution to be measured.

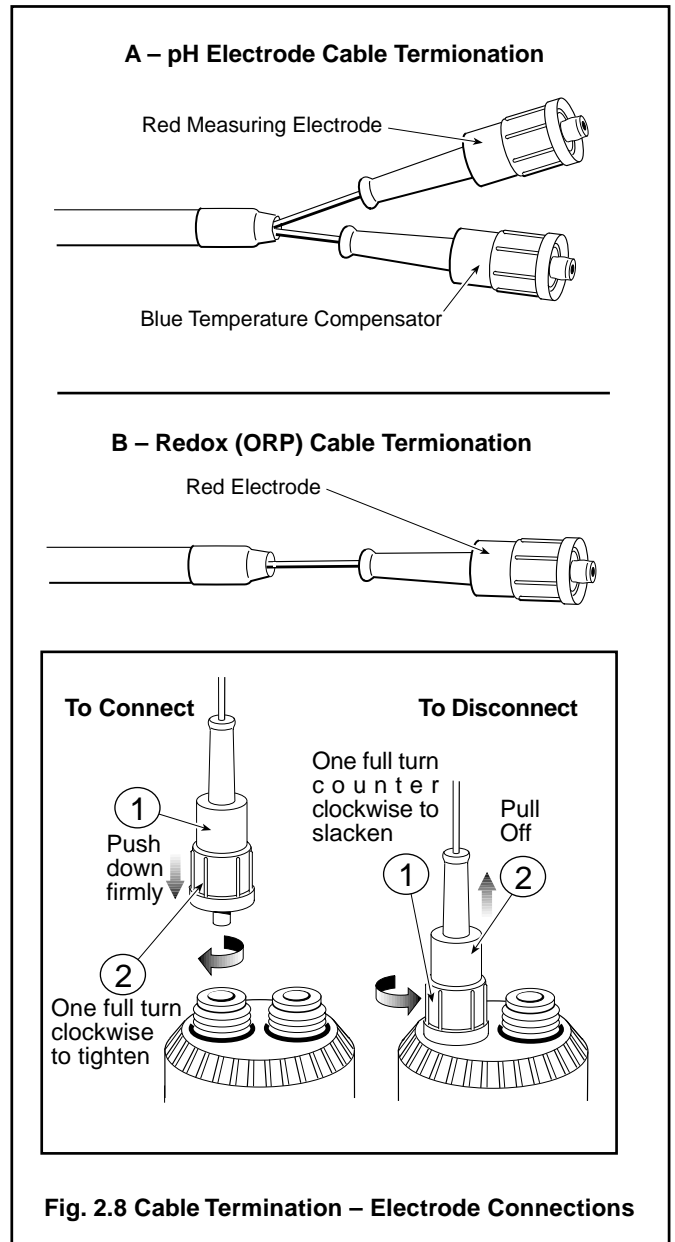


Fig. 2.8 Cable Termination – Electrode Connections

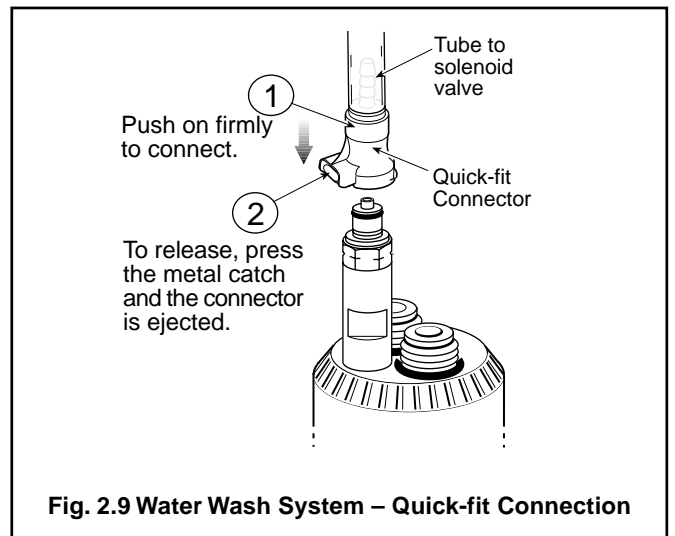


Fig. 2.9 Water Wash System – Quick-fit Connection

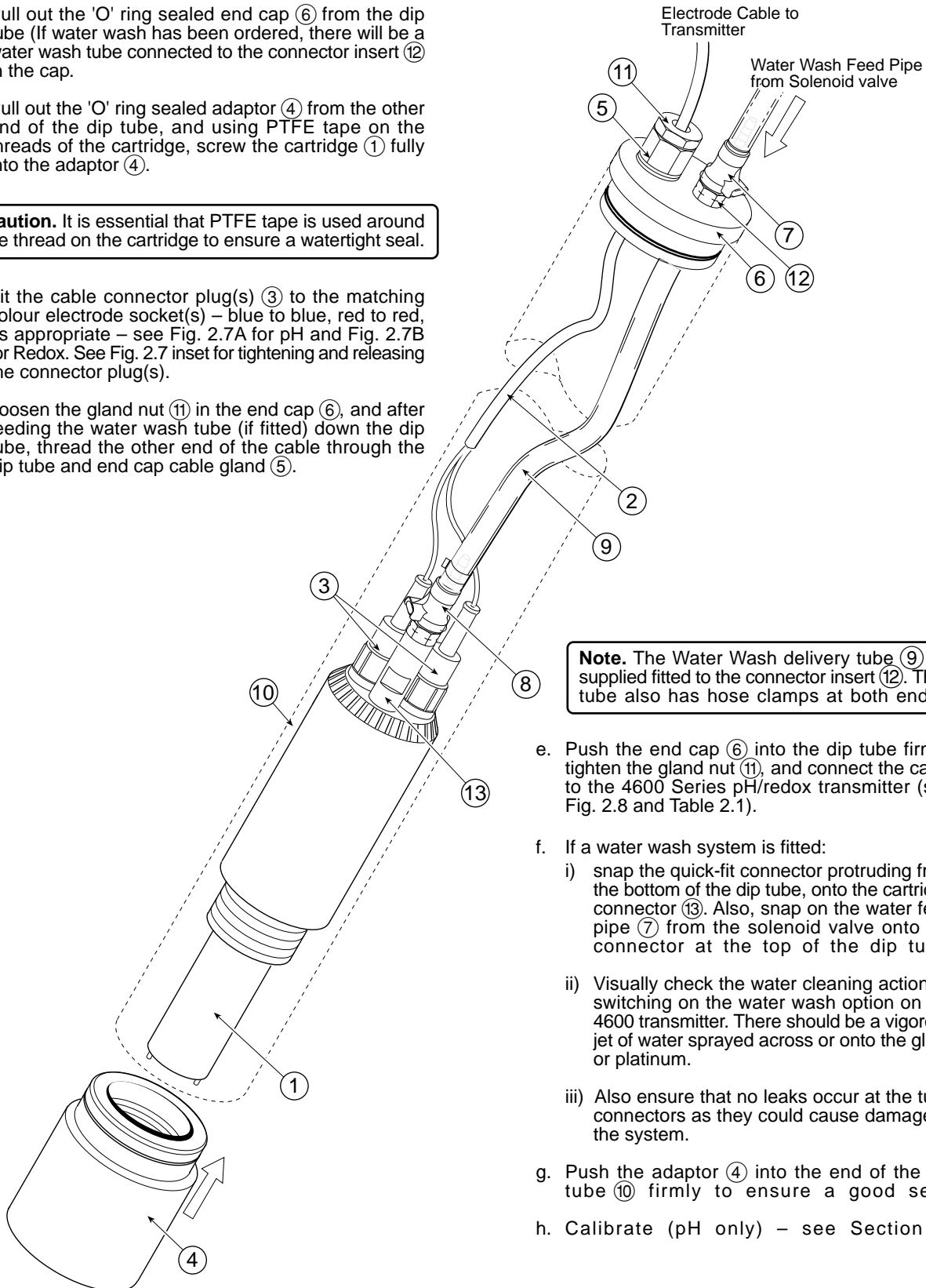
## ...2 INSTALLATION

### 2.4.3 Dip Systems (pH and Redox) – Fig. 2.10

- a. Pull out the 'O' ring sealed end cap (6) from the dip tube (If water wash has been ordered, there will be a water wash tube connected to the connector insert (12) in the cap).
- b. Pull out the 'O' ring sealed adaptor (4) from the other end of the dip tube, and using PTFE tape on the threads of the cartridge, screw the cartridge (1) fully into the adaptor (4).

**Caution.** It is essential that PTFE tape is used around the thread on the cartridge to ensure a watertight seal.

- c. Fit the cable connector plug(s) (3) to the matching colour electrode socket(s) – blue to blue, red to red, as appropriate – see Fig. 2.7A for pH and Fig. 2.7B for Redox. See Fig. 2.7 inset for tightening and releasing the connector plug(s).
- d. Loosen the gland nut (11) in the end cap (6), and after feeding the water wash tube (if fitted) down the dip tube, thread the other end of the cable through the dip tube and end cap cable gland (5).



**Note.** The Water Wash delivery tube (9) is supplied fitted to the connector insert (12). The tube also has hose clamps at both ends.

- e. Push the end cap (6) into the dip tube firmly, tighten the gland nut (11), and connect the cable to the 4600 Series pH/redox transmitter (see Fig. 2.8 and Table 2.1).
- f. If a water wash system is fitted:
  - i) snap the quick-fit connector protruding from the bottom of the dip tube, onto the cartridge connector (13). Also, snap on the water feed pipe (7) from the solenoid valve onto the connector at the top of the dip tube.
  - ii) Visually check the water cleaning action by switching on the water wash option on the 4600 transmitter. There should be a vigorous jet of water sprayed across or onto the glass or platinum.
  - iii) Also ensure that no leaks occur at the tube connectors as they could cause damage to the system.
- g. Push the adaptor (4) into the end of the dip tube (10) firmly to ensure a good seal.
- h. Calibrate (pH only) – see Section 3.

Fig. 2.10 Dip System Assembly

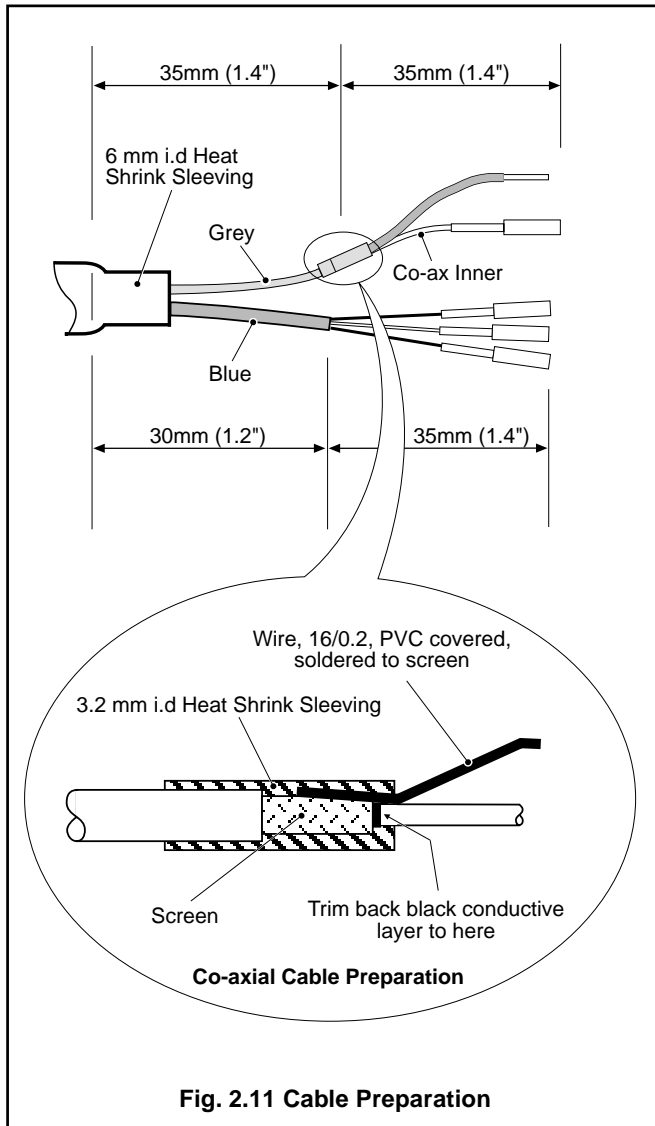
## ...2 INSTALLATION

### 2.4.4 Cable Termination – Fig. 2.11

**Note.** For AP102 Series Cable Attached, and AP104 Series Submersible cartridges, note the cable colours and respective sleeves before proceeding.

If the provided standard length cable requires shortening, the recommended preparation is as shown in Fig. 2.11.

Strip back the overall cable sheath to measurements as shown and fit suitable solder tags and sleeves to the ends of all leads, for connection to the transmitter.



## 3 CALIBRATION

When the electrode system has been correctly connected and all electrical connections made to the associated pH transmitter, the system is ready for calibration by either immersing the electrodes (using suitably sized beakers):

a) in a calibration solution (buffer) of known pH value for a single-point calibration,

or

b) in two separate calibration solutions of known pH values for a two point calibration.

For electrode systems in use:

- 1) Remove the electrode from the process or sample.
- 2) Wash the visible electrode surface with demineralised water.
- 3) Proceed as described in the paragraph above.

Refer to the instruction manual for the pH transmitter for full details of the calibration procedure.

**Warning.** Before removing any electrode from a flow line, ensure that any isolating valves have been closed.

**Caution.** It is important when buffering to ensure that the visible surface of the electrodes has been cleaned using demineralised water. Also ensure when moving from one buffer solution to the next to wash the electrodes and dry them carefully using a soft tissue.

## 4 MAINTENANCE

### 4.1 General Cleaning

**Warning.** Before removing any electrode from a flow line, ensure that any isolating valves have been closed.

To ensure accurate monitoring, keep the electrodes free of contaminants by periodic cleaning, the frequency of which depends on the particular application.

### 4.2 Liquid Junction and Electrolyte Level

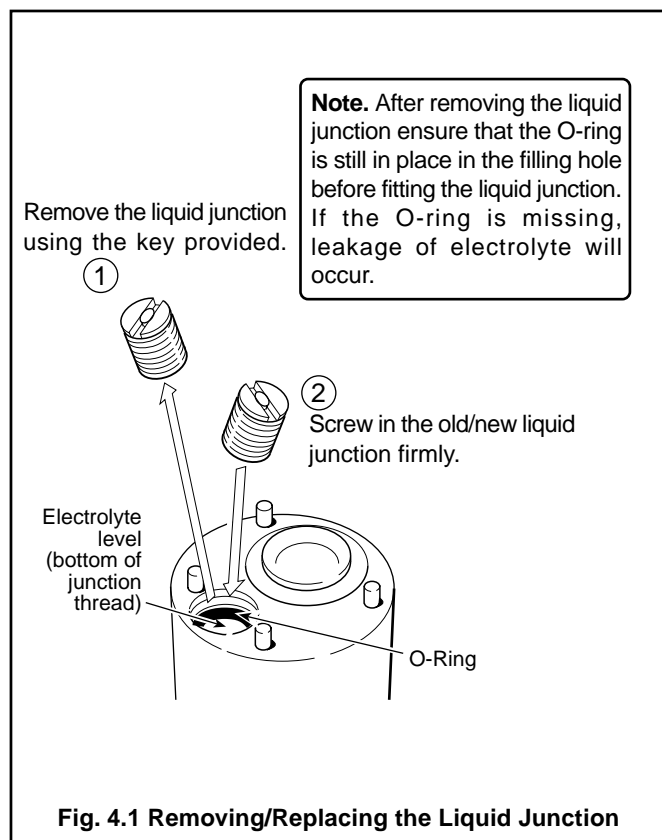
The procedures in this section are appropriate for both pH and redox (ORP) electrode cartridges.

#### 4.2.1 Replacing Liquid Junction – Fig. 4.1

**Caution.** Carry out the following procedure with the cartridge inverted, as shown in Fig. 4.1, to prevent spillage of the electrolyte.

**Note.**

A tool for removing and fitting liquid junctions is provided in the electrolyte replenishing kit (part no. 7670 088).



#### 4.2.2 Checking Electrolyte Level – Fig. 4.1

Periodically check the level of electrolyte (approximately every three months) as follows:

- Remove the electrode cartridge from the system.
- Use the procedure in 4.2.1 to remove the liquid junction observing necessary cautions and notes.
- View the electrolyte level through the liquid junction hole and top up to the bottom of the junction thread, if necessary, using the pipette and electrolyte provided with the replenishment kit.
- Fit the liquid junction, or replace with a new one if necessary, and install the electrode.

### 4.3 Storage of the Electrode

**Caution.** Failure to ensure the glass membrane and reference element do not dry out may irreversibly affect the response of the electrode.

If it is necessary to remove the electrode from the sample line, fill the retained protective cap (see Fig. 2.6) with water and cotton wool, or equivalent, and fit it to the cartridge.

## 5 SPARES

**Table 5.1 Spares List**

Item	Part No.	Old Part No.
<b>Bayonet Cartridges</b>		
pH – standard glass	AP101/100	7670 101
pH – low resistance glass	AP101/300	7670 105
Redox	AP101/500	7670 211
pH – standard glass with water wash	AP101/200	7670 301
pH – low resistance glass with water wash	AP101/400	7670 305
Redox with water wash	AP101/600	7670 311
<b>Screw in Cartridges</b>		
pH – standard glass	AP103/100	7670 102
pH – low resistance glass	AP103/300	7670 106
Redox	AP103/500	7670 212
pH – standard glass with water wash	AP103/200	7670 302
pH – low resistance glass with water wash	AP103/400	7670 306
Redox with water wash	AP103/600	7670 312
<b>Cable Attached Cartridges</b>		
pH – 3 metre	AP102/103	7670 703
pH – 5 metre	AP102/105	7670 705
pH – 10 metre	AP102/110	7670 710
Redox – 3 metre	AP102/503	
Redox – 5 metre	AP102/505	
Redox – 10 metre	AP102/510	
<b>Submersible Cartridges</b>		
pH – 10 metre	AP104/110	7670 600
pH – 30 metre	AP104/130	7670 604
Redox – 10 metre	AP104/510	7670 620
Redox – 30 metre	AP104/530	7670 624
<b>Consumable Spares</b>		
	<b>Part Number</b>	
Refurbishment Kit comprising: 'O' rings, 3.5M KCl electrolyte, pipette, liquid junction & extraction key	7670 088	
<b>System Spares</b>		
Screwed Bayonet Adaptor	7670 063	
Flowcell – Bayonet	7670 041	
Flowcell – Screwed	7670 042	
Electrode 'O' Ring (Bayonet)	0211 080	
Flowcell 'O' Ring	0211 237	
Adaptor 'O' Ring	0211 229	
Plug Connector 'O' Ring	0211 062	
Pipeline Insert 1/2" BSPT	7601 420	
Pipeline Insert 1/2" NPT	7601 430	
Offset Ported Flowcell (acetal)	7670 170	
Offset Ported Flowcell (stainless steel)	7670 180	
Optional Clamp (Offset Ported Flowcell)	0215 165	
<b>Detached Cable Assemblies</b>		
pH – 3 metre	7670 003	
pH – 5 metre	7670 004	
pH – 10 metre	7670 005	
Redox – 3 metre	7670 013	
Redox – 5 metre	7670 014	
Redox – 10 metre	7670 015	

**Table 5.2 Additional Spares for Water Wash Systems Only**

Item (refer to Fig. 2.10 to identify component numbers in brackets)	Part No.
End Cap Quick-fit In-line Connector (7) – 1/4" barb	0216512
End Cap Quick-fit Connector Insert (12) – Panel mount 1/8" hose barb	0216513
Cartridge Quick-fit In-line Connector (8) – 1/8" barb	0216514
Tubing (9) – specify length: 1, 2 or 3 metres	0212141
Hose clamp for tubing (9) above	0215163

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## NOTES

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Sales



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**ABB Limited**  
**Measurement & Analytics**

Oldends Lane  
Stonehouse  
Gloucestershire  
GL10 3TA  
UK  
Tel: +44 (0)1453 826 661  
Fax: +44 (0)1453 829 671  
Email: [instrumentation@gb.abb.com](mailto:instrumentation@gb.abb.com)

**ABB Inc.**  
**Measurement & Analytics**

125 E County Line Road  
Warminster  
PA 18974  
USA  
Tel: +1 215 674 6000  
Fax: +1 215 674 7183

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