ABB MEASUREMENT & ANALYTICS | INSTRUCTION MANUAL | IM/9408 REV. K

9408 series
Dissolved oxygen systems

Measurement made easy

—
9408 series
Dissolved oxygen systems

Introduction

The 9408 Series dissolved oxygen system comprises a flat-ended sensor mounted into a relatively large diameter spherical flotation collar. This form of construction presents to the sample a surface on which it is difficult for rags and other large solids to lodge. For more demanding applications, on-line cleaning is available using the water wash option.

For more information

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9408 series Dissolved oxygen systems Data Sheet	DS/9408-EN

CONTENTS

1 INTRODUCTION 1

2 SYSTEM TYPES 2
2.1 Unpacking 2
2.2 Floating Ball System 2
2.2.1 Assembled Version 2
2.2.2 Kit Version 2
2.3 Dip Systems 3
2.3.1 Assembled Version 3
2.3.2 Kit Version 3
2.4 Submersible System 3

3 MECHANICAL INSTALLATION 4
3.1 Assembling Kit Systems 4
3.1.1 Floating Ball 4
3.1.2 Dip 5
3.2 Installation 6
3.2.1 Floating Ball System 6
3.2.2 Dip Systems 7
3.2.3 Submersible Systems 7
3.3 Water Supply for Water Wash Systems 8

4 ELECTRICAL INSTALLATION 9
4.1 Connection to the Dissolved Oxygen Transmitter 9
4.2 Calibrating the Sensor 9

5 MAINTENANCE 10
5.1 Replacing the Oxygen Sensor Capsule 10
5.1.1 Floating Ball System 10
5.1.2 Dip Systems 11
5.1.3 Submersible Systems 11
5.2 Replacing the Oxygen Sensor Block 11
5.2.1 Floating Ball System 11
5.2.2 Dip Systems 11
5.2.3 Submersible Systems 12
5.3 Changing the Temperature Compensator 12
5.3.1 Floating Ball and Dip Systems 12
5.3.2 Submersible System 12

6 SPECIFICATION 12

7 SPARE PARTS LIST 13
7.1 Floating Ball System 13
7.2 Dip System 13
7.3 Submersible System 13

APPENDIX A – SUPPORT BRACKET CONVERSION 14
A1 Kit Parts List 14
A2 Conversion Procedure 14

Note. This dissolved oxygen sensor is an electrochemical cell using lead based Chemistry. This ABB product in alignment with the industry of medical devices and monitoring and control instruments for dissolved oxygen measurement under ROHS (Directive 2011/65/eu) are exempted under Annex IV, part 1b for lead anodes in electrochemical sensors. Under normal use, both lead and its oxidised form, lead oxide, exist within the cell but pose no risk in operation or when disposed in conjunction with the disposal requirements of WEEE.
In alignment with the REACH Regulation, (EC 1907/2006) both lead (CAS 7439-92-1) and lead oxide (CAS 1317-36-8) are identified on the candidate list.

1 INTRODUCTION

The ABB Model 9408 Floating Ball is a dissolved oxygen measuring system primarily for use in sewage treatment works where fouling of the dissolved oxygen sensor by rags or other large solids is a common occurrence. To prevent this contamination, a flat ended sensor is mounted inside a relatively large diameter flotation collar, and therefore presents a surface to the contaminant upon which it is almost impossible for the contaminant to collect.
Two other systems are available:

- dip
- submersible

which are for use in open tanks and where access is difficult. See below for a list of variations.
All measuring systems are compatible with the 4640 and 4645 dissolved oxygen transmitters.
A water wash option is available on all dissolved oxygen systems described in this manual. Optional items are shown in illustrations as dotted lines.

Information. To enable easy access to the floating ball sensor a conversion kit is available which converts the standard bracket into a swivel bracket – see appendix for ordering and conversion information.

The following systems are currently available:

Floating Ball
Assembled
Standard 9408 700
With water wash 9408 702
Metric kit
Standard 9408 750
With water wash 9408 752
Imperial kit
Standard 9408 760
With water wash 9408 762

Dip
Assembled
Standard ..... 9408 710 (1 m)
9408 720 (2 m)
9408 730 (3 m)
With water wash ..... 9408 712 (1 m)
9408 722 (2 m)
9408 732 (3 m)
Imperial kit
Standard 9408 771
With water wash 9408 773

Submersible
Standard 9408 600
With water wash 9408 602

2 SYSTEM TYPES

2.1 Unpacking

After carefully removing the 9408 system from its packing, check that the following systems include the associated items and that they are in good condition.

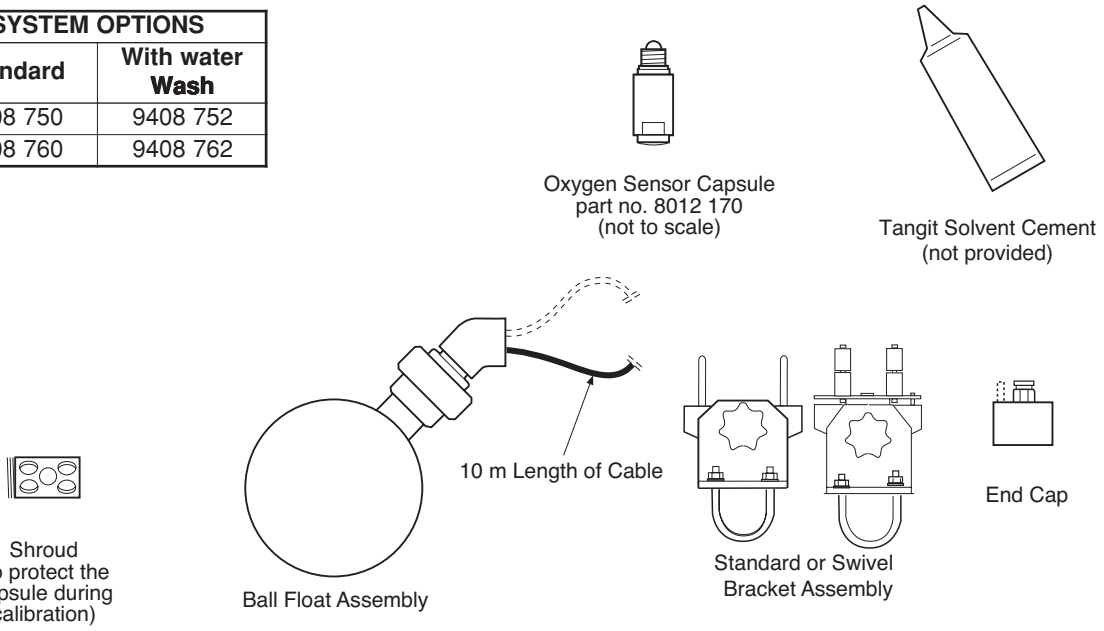
2.2 Floating Ball System

2.2.1 Assembled Version

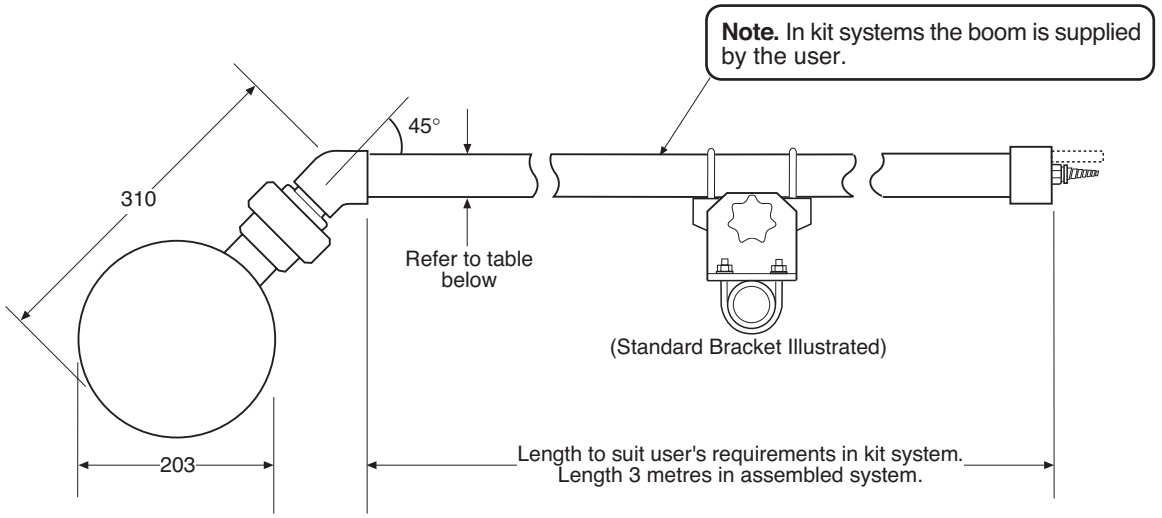
The system (9408 700 and 702) is fully assembled with a 3 metre boom except for the oxygen sensor capsule (8012 170). Dimensions are as shown in Fig. 2.1b.

2.2.2 Kit Version – Fig. 2.1

	SYSTEM OPTIONS	
	Standard	**With water Wash**
Metric	9408 750	9408 752
Imperial	9408 760	9408 762



a) Contents of the System Supplied in Kit Form



	Pipe Dimensions
Metric	ABS pipe o.d. 50 mm x 3.3 w.t. (PN10)
Imperial	ABS pipe 11/2" N.B. x 4.5 w.t. Class E

Dimensions in mm unless otherwise indicated.

b) Dimensions of Kit and Assembled Systems

Fig. 2.1 Floating Ball System

2.3 Dip Systems

2.3.1 Assembled Version – Fig. 2.2

Pipe Length (metres)	SYSTEM OPTIONS	
	Standard	With Water Wash
1	9408 710	9408 712
2	9408 720	9408 722
3	9408 730	9408 732

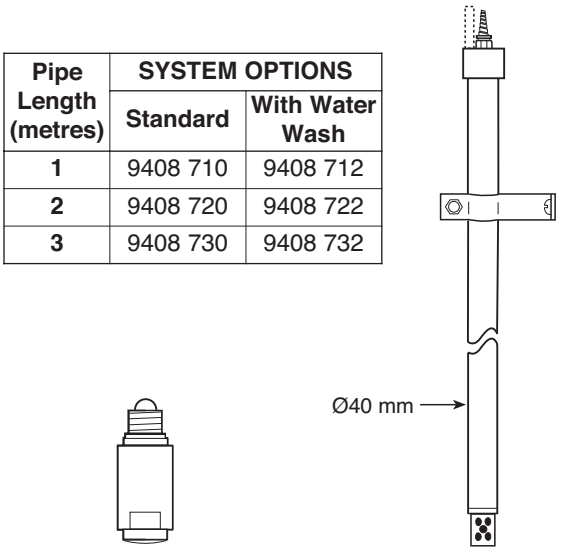


Fig. 2.2 Assembled Dip System

2.4 Submersible System – Fig. 2.4

SYSTEM OPTIONS	
Standard	With Water Wash
9408 600	9408 602

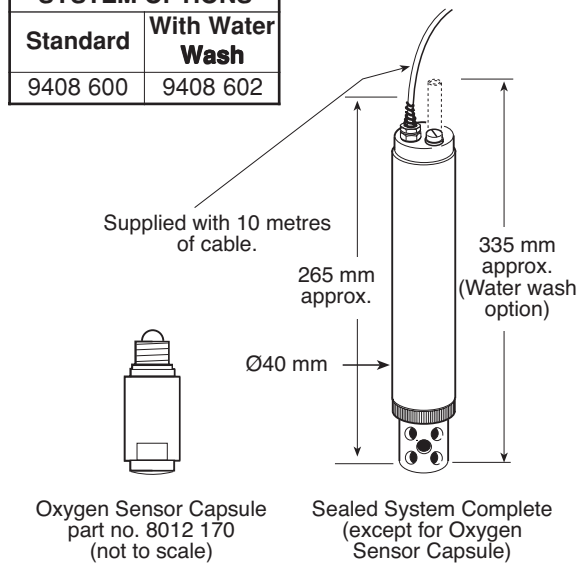


Fig. 2.4 Submersible System

2.3.2 Kit Version – Fig. 2.3

Standard System (9408 771)

Contents
1 Top cap (with fixing screw)
2 Adaptor
3 Shroud
4 Sensor block (with cable attached and dummy sensor fitted)
5 Dissovled oxygen sensor capsule
6 Tangit Solvent Cement (not provided)

System with Water Wash (9408 773)

Contents
1 Top cap (with fixing screw)
2 Adaptor
3 Shroud
4 Sensor block (with cable and water wash tube attached and dummy sensor fitted)
5 Dissovled oxygen sensor capsule
6 Tangit Solvent Cement (not provided)
7 Tube connector

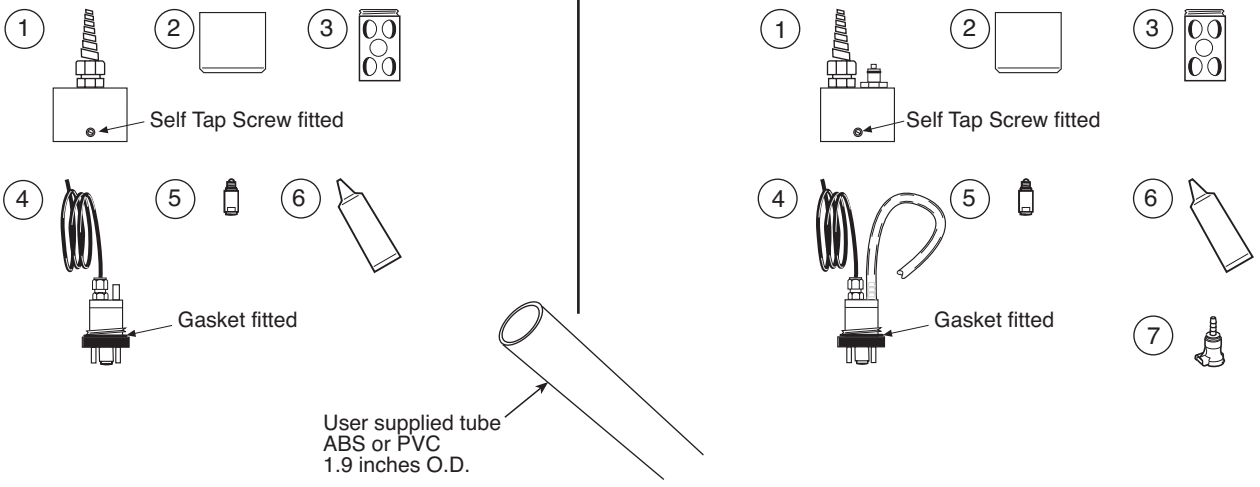


Fig. 2.3 Dip System Kits

3 MECHANICAL INSTALLATION

3.1 Assembling Kit Systems

3.1.1 Floating Ball – Fig. 3.1

For installation of the assembled unit see Section **3.2.1 Floating Ball System.**

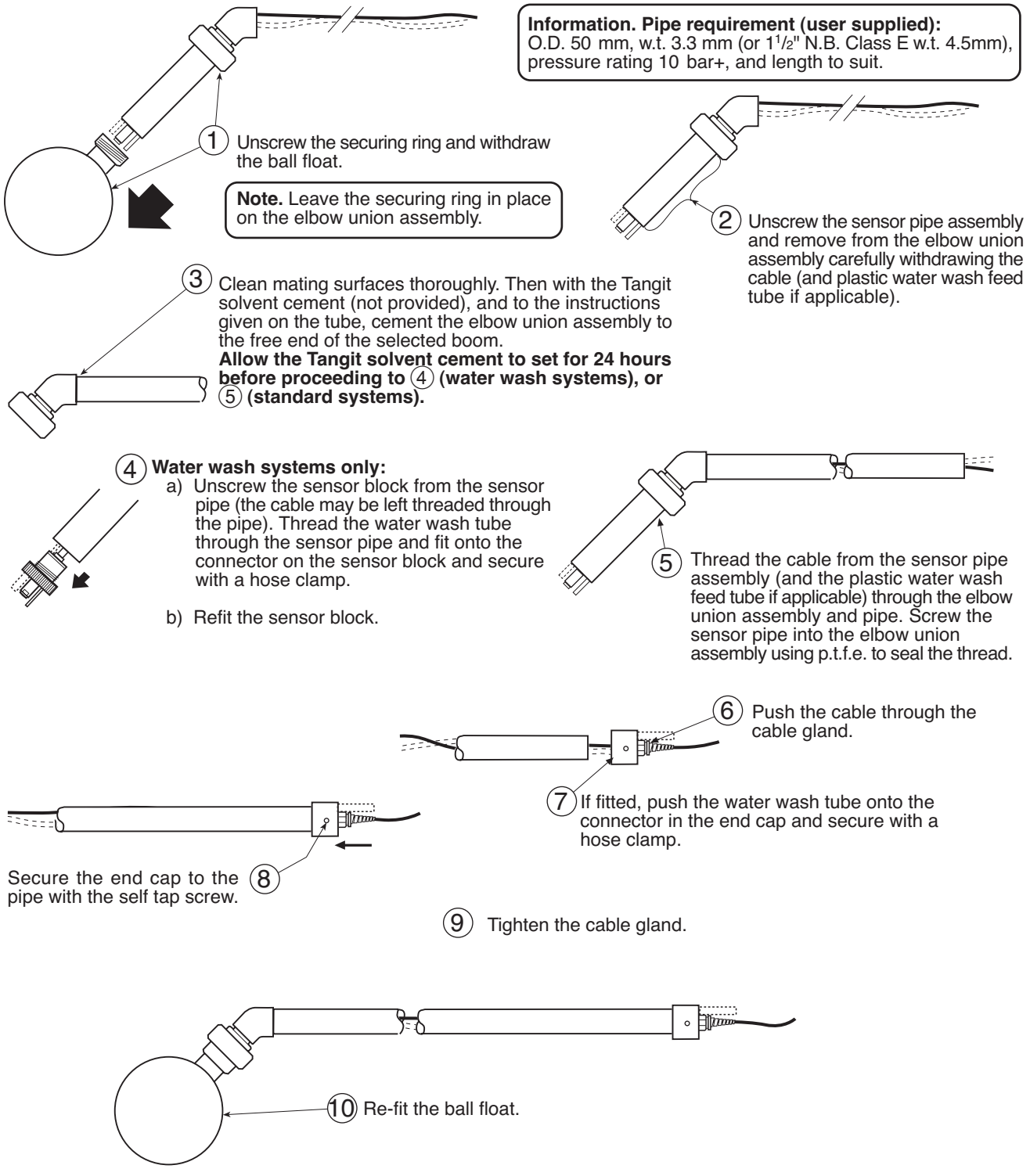


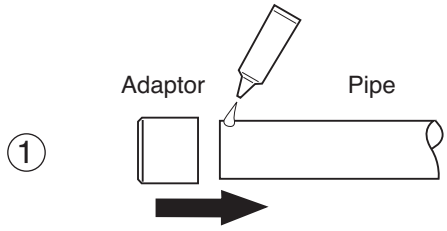
Fig. 3.1 Floating Ball Kit Assembly

3.1.2 Dip – Fig. 3.2

For installation of the assembled unit see Section 3.2.2 Dip Systems.

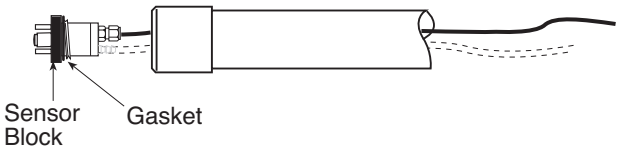
Information. Pipe requirement (user supplied): O.D. 1.9", 1½" N.B., pressure rating 10 bar+, and cut length to suit.

Note. There is no bracket supplied with this kit.

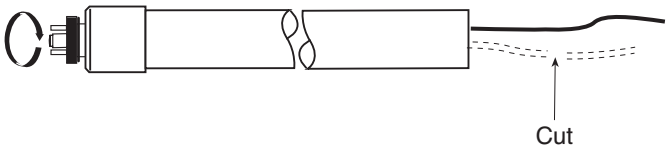


① Clean mating surfaces thoroughly. Then with the Tangit solvent cement (not provided) and to the instructions given on the tube, cement the **adaptor** to the **pipe**.

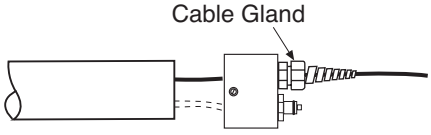
Allow the Tangit solvent cement to set for 24 hours before proceeding.



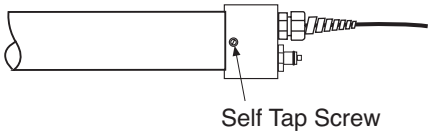
② Ensure that the **gasket** is in place on the **sensor block**. Feed the cable attached to the **sensor block** (and water wash tube if fitted) through the **adaptor** and **pipe**.



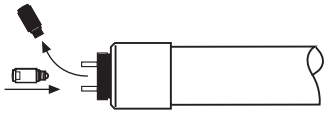
③ Screw the **sensor block** into the **adaptor** firmly and cut the water wash tube, if fitted, allowing sufficient to fit to the connector in the **end cap** and a little slack for manoervering.



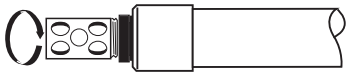
④ Feed the cable through the **cable gland** in the **end cap.** Push the water wash tube (if fitted) onto the connector in the **end cap** and secure with a hose clamp.



⑤ Secure the end cap to the pipe with the **self tap screw**. Tighten the cable gland.



⑥ Remove the dummy sensor capsule and fit the dissolved oxygen sensor capsule. A suitable procedure (and cautions) is included in Fig. 5.1.



⑦ Screw the shroud onto the sensor block.

⑧ Proceed to Section 3.2.2 for installation procedure.

Fig. 3.2 Dip Kit Assembly

3.2 Installation

Caution. The system is supplied with the temperature probe and a dummy oxygen capsule fitted into the oxygen sensor body which is in the ball assembly. Before securing the boom to the handrail bracket, unscrew the dummy capsule from the end of the oxygen sensor body and fit the oxygen sensor capsule to the sensor body – see Section **5.1 Replacing the Oxygen Sensor Capsule.**

The floating ball system is provided with pipe clamp fittings for handrail fixing. The installation should be arranged to ensure that when the boom is anchored to the rail, the sensor in the ball is fully covered by the liquid to be monitored.

3.2.1 Floating Ball System – Fig. 3.3

Select the position for the floating ball system on the handrail.

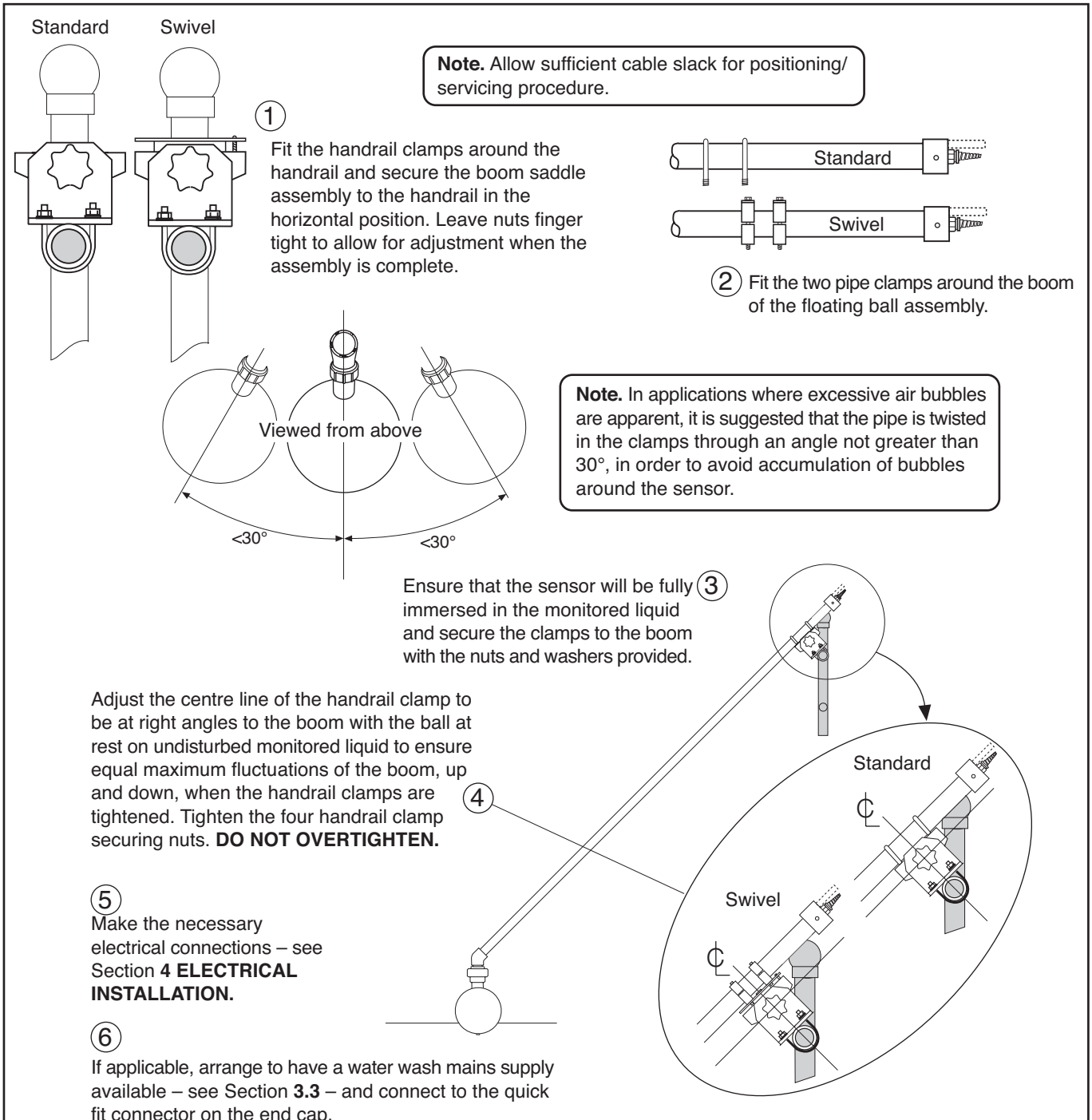


Fig. 3.3 Installing the Floating Ball System

3.2.2 Dip Systems – Fig. 3.4

Note.

- The standard dip system is supplied with the temperature probe and oxygen sensor body fitted. Before fitting the dip tube to any bracket or fixing, remove the protective shroud, unscrew the dummy capsule from the end of the oxygen sensor body and fit the oxygen sensor capsule to the sensor body (see Section **5.1 Replacing the Oxygen Sensor Capsule**) and replace the shroud. See section 3.1.2 for assembling dip kit systems.
- If the final mounting position of the dip system is inconvenient for wiring when fitted, wire the system prior to fixing – see Section **4 ELECTRICAL INSTALLATION**.

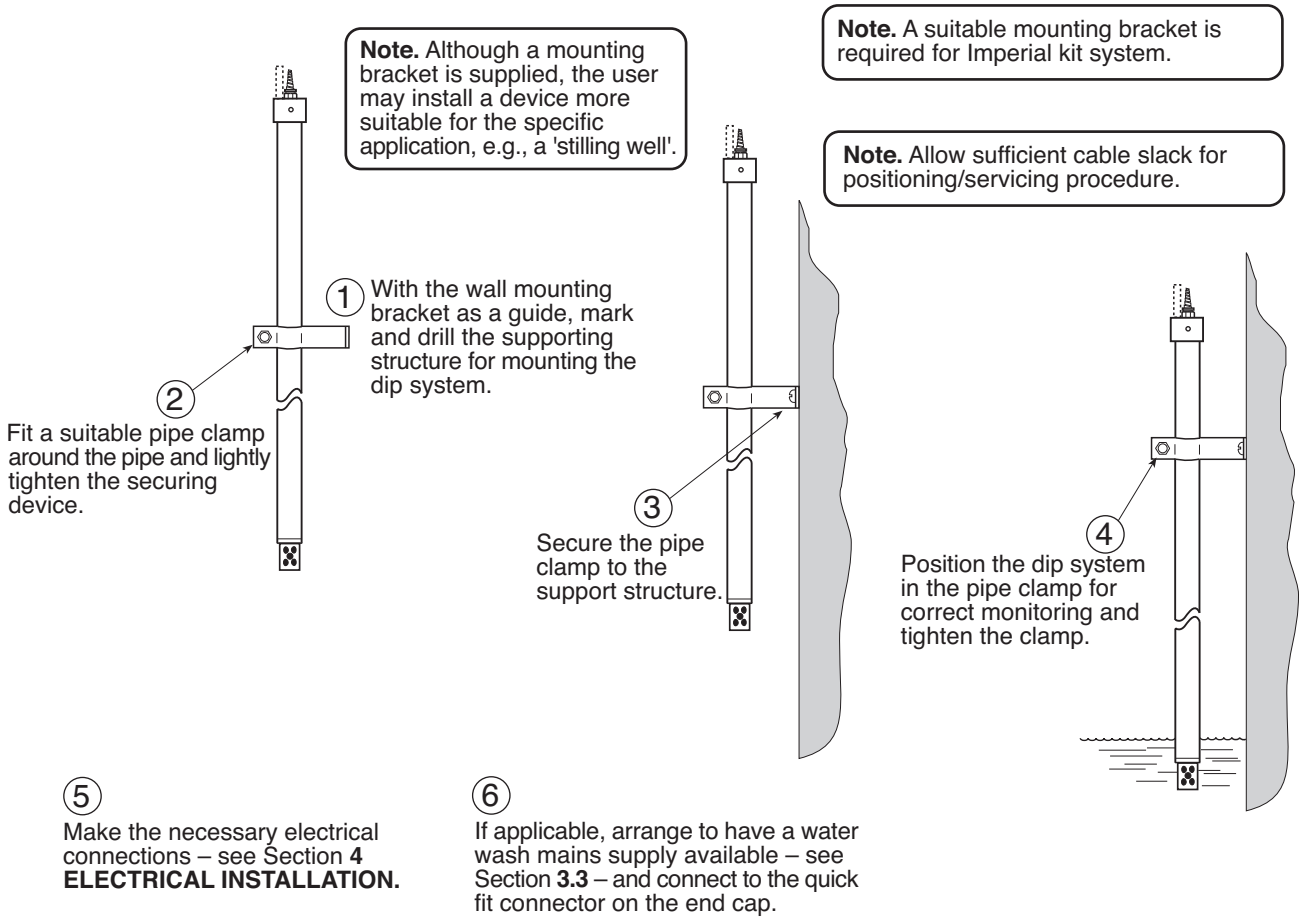


Fig. 3.4 Installing the Dip Systems

3.2.3 Submersible Systems – Fig. 3.5

Note. The submersible system is supplied with the temperature probe and oxygen sensor body fitted. Remove the protective shroud, unscrew the dummy capsule from the end of the oxygen sensor body and fit the oxygen sensor capsule to the sensor body (see Section **5.1 Replacing the Oxygen Sensor Capsule**) and replace the shroud.

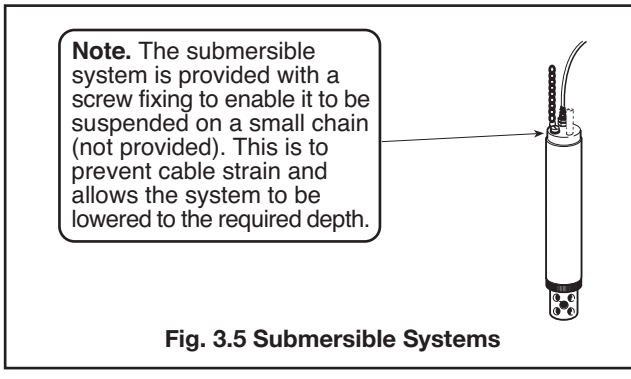


Fig. 3.5 Submersible Systems

3.3 Water Supply for Water Wash Systems – Fig. 3.6

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 50 psi (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. A general specification for the solenoid valve is:

Brass body:.....2/2, NC
Orifice size: .....3.0 / 4.0 mm
Port size:.....$^1/_4$ in – $^1/_2$ in BSP or NPT
Pressure:.....0 to 6 bar
Coil:.....24 V a.c., 110/115 V a.c. or
230/240 V a.c. 50/60 Hz

Note. See Fig. 3.6 for recommended tubing.

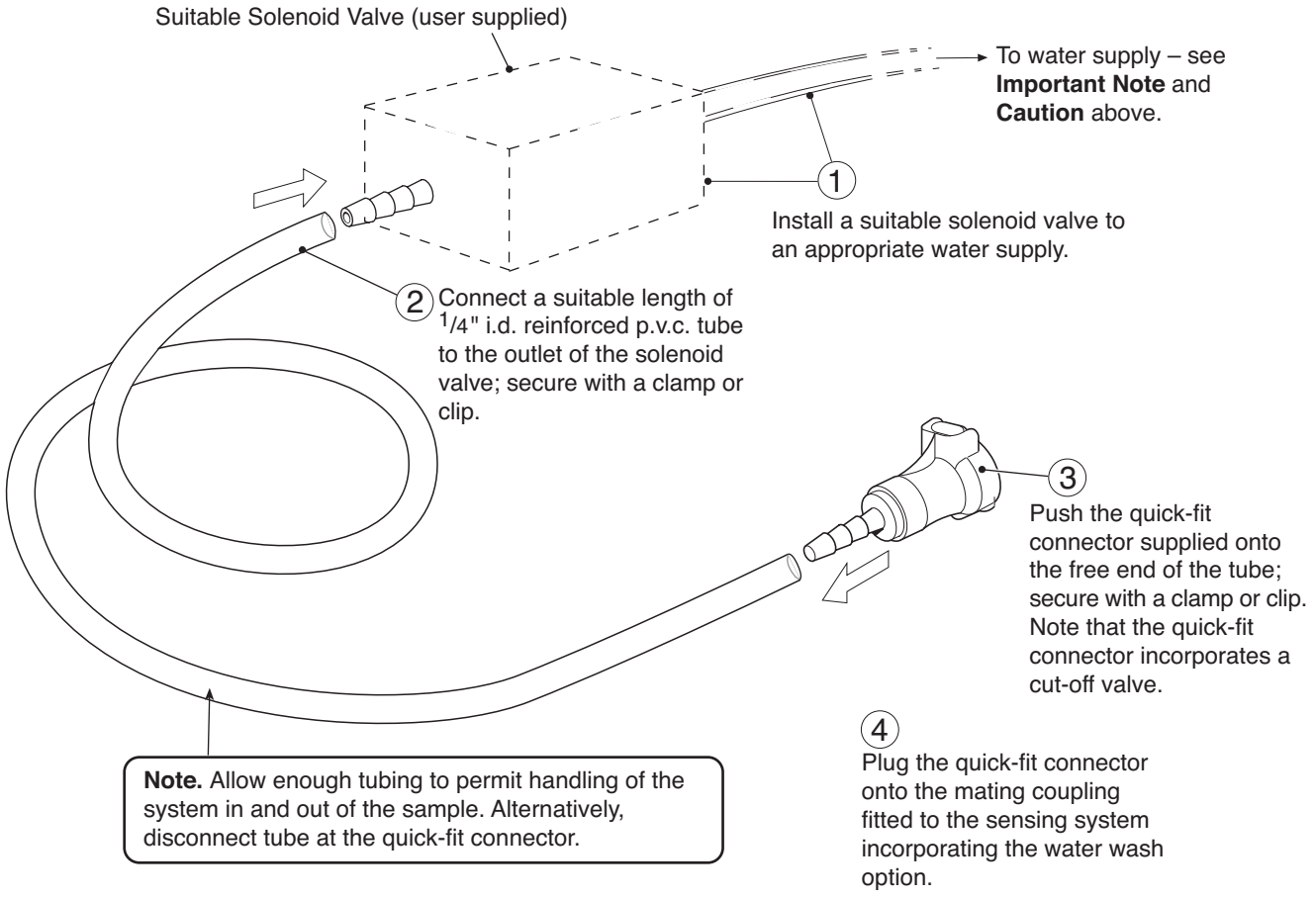


Fig. 3.6 Installing the Water Wash Water Supply

4 ELECTRICAL INSTALLATION

Caution. Cable should be of circular cross-section and of sufficient diameter to effect a seal inside the cable glands.

4.1 Connection to the Dissolved Oxygen Transmitter

Note. With floating ball and dip systems sufficient spare cable should be provided for manipulating the floating ball system if space is restricted when installing the interconnection cable between the floating ball and the transmitter.

Connect the cable (supplied permanently attached to the system) to the transmitter unit as detailed in the associated transmitter operating instructions, using the **terminal sleeve colors** to correspond with those in the operating instructions. For convenience, Tables 4.1 and 4.2 detail the connections to transmitters 4640 and 4645 respectively.

4640		
	Terminal No.	Wire
Sensor	1	+ve (Red)
	2	
	3	– ve (Blue)
	4	Screen
Remperature Compensator	5	Black
	6	Green
	7	Yellow

Table 4.1 Connections to the 4640 Dissolved Oxygen Transmitter

4645		
TBB		
	Terminal No.	Wire
Temperature Compensator	6	Yellow
	7	Green
	8	Black
Sensor	10	– ve (Blue)
	11	
	12	+ve (Red)
Connect the screen to the earth stud on the case.		

Table 4.2 Connections to the 4645 Dissolved Oxygen Transmitter

4.2 Calibrating the Sensor – Fig. 4.1

The procedures for zero and span calibration are fully described in the 4600 Series Transmitter Unit Operating Instructions, to which reference should be made.

Note. It is advisable to switch off the water wash before starting the calibration procedure. This can be done either by turning off at the 4600 transmitter unit, or by disconnecting the quick-fit connector.

1) Remove the system from its mounting bracket.

2) If the system is a floating ball type, unscrew the securing collar and remove the ball – Fig. 4.1.

3) Carefully wash the exposed sensor capsule with clean water.

4) If the system is a floating ball type, fit the shroud, provided with the system, to protect the sensor capsule – Fig. 4.1.

5) Calibrate as instructed in the 4600 Series Operating Instructions.

6) If the system is a floating ball type, remove the protective shroud after calibration and replace the ball – Fig. 4.1.

7) Re-enable the water wash if applicable.

Regular maintenance is limited to periodic cleaning and calibration.

The sensor capsule is replaced whenever the existing one becomes exhausted – see Section **5.1 Replacing the Oxygen Sensor Capsule**. Typical sensor life is approximately 12 months.

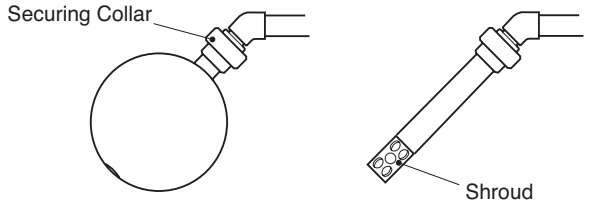


Fig. 4.1 Floating Ball Shroud for Calibration

5 MAINTENANCE

5.1 Replacing the Oxygen Sensor Capsule

Storage

DO:

— use sensors in date rotation to prevent them being stored longer than necessary.
— at all times, store sensors in a dry and cool environment.
— store sensors in a refrigerator to extend their life, but DO NOT allow them to freeze.

DO NOT:

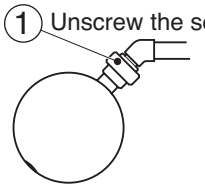
— allow sensors to dry out, either in storage or in use.
— leave sensors in vehicles where they are likely to freeze or be exposed to high temperatures.
— leave sensors on-site without protection from direct sun or high temperatures.
— use the sensor if it's sealed environment has dried out.

5.1.1 Floating Ball System – Fig. 5.1

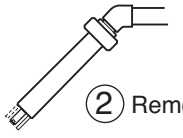
Refer to Fig. 3.2 for information about accessing the floating ball. Use the necessary procedure steps in reverse order.

Notes.

- For systems fitted with the standard bracket the boom will have to be freed from the bracket clamp to access the floating ball.
- For systems fitted with a swivel bracket, when the boom is in the horizontal position, unscrew the swivel plate locking bolt sufficiently to release the swivel plate. Swing the boom so that the floating ball is accessible.



1 Unscrew the securing ring whilst restraining the ball from turning.



2 Remove the ball from the sensor pipe.

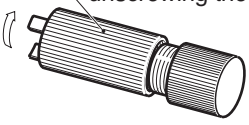
Caution. Clean and dry the area around the sensor capsule before removal, as indicated below.

3 Use the capsule housing as a tool to unscrew the old capsule from the sensor block (see O for method); discard the old capsule in accordance with local regulations.

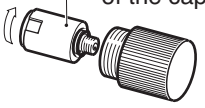
4 Dry the sensor block with a paper tissue; ensure that the gold electrical contacts, and the recess into which the capsule screws, are clean and completely dry.

Caution.

- Do not leave the new capsule exposed to air for more than 30 minutes as the membrane will dry out.
- Ensure the following steps are done carefully to avoid damaging the membrane covering the silver cathode.



5 Access the new capsule by unscrewing the capsule housing

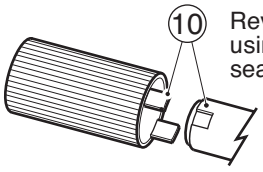


6 Unscrew the capsule from the shorting cap using the reverse end of the capsule housing as a tool.

7 Remove and discard the rubber sealing ring from the new capsule.

8 Dry the capsule with a paper tissue taking care not to damage the delicate, transparent membrane covering the silver cathode. Ensure that the gold contacts, and the threaded portion of the capsule are clean and completely dry.

9 Fit the new sealing ring supplied – see 7 above and screw the capsule into the sensor block by hand, firmly.



10 Reverse the capsule housing and locate the lugs into the keyways on top of the capsule.Then using the capsule housing as a tool, tighten the the sensor firmly by hand to ensure a good seal.

11 Calibrate the sensor - see Section 4.2 Calibrating the Sensor.

12 Align the holes in the end of the ball with the protruding sensor capsule and temperature compensator and replace the ball assembly over the sensor pipe. Ensure that an 'O' ring is in place in the union half.

13 Tighten the securing ring whilst restraining the ball from turning; rotation of the ball may damage the sensing end of the system.

Fig. 5.1 Replacing the Oxygen Sensor Capsule

5.1.2 Dip Systems

The procedure is identical to that for the Floating Ball System except that, in this case, it is only necessary to remove and replace the protective shroud instead of the ball. The shroud is removed from the end of the sensor block by unscrewing it.

5.1.3 Submersible Systems

The procedure is identical to that for the Dip System – see Section 5.1.2 **Dip Systems**.

5.2 Replacing the Oxygen Sensor Block

5.2.1 Floating Ball System – Fig. 5.2

1) To avoid damaging the sensor capsule dry around it then carefully remove it from the end of the sensor block and store safely. DO NOT touch the membrane.

> **Caution.** Do not leave the capsule exposed to air for more than 30 minutes as the membrane will dry out.

2) Disconnect the cable from the dissolved oxygen transmitter (or junction box if applicable) and attach a draw wire of suitable length.

3) Slacken the cable gland on the end of the boom.

4) Remove the self tap screw and pull off the end cap.

5) Draw the cable through the gland.

6) Unscrew the securing ring of the ball float (whilst restraining the ball from turning) and withdraw the ball from the elbow union.

7) Carefully unscrew the sensor block from the end of the sensor pipe.

8) If fitted, disconnect the water wash feed tube from the sensor block.

9) Pull the cable through the boom, leaving sufficient draw wire at the end cap end to enable the replacement to be pulled through.

10) Disconnect the sensor block cable from the draw wire.

11) Attach the draw wire to the replacement sensor block cable and re-assemble in the reverse order of the previous steps.

12) Remove the dummy capsule from the replacement sensor block and carefully replace the sensor capsule into the sensor block.

5.2.2 Dip Systems

The procedure is identical to that for the floating ball system except that it is only necessary to remove and replace the protective shroud instead of the ball. Remove the shroud by unscrewing it.

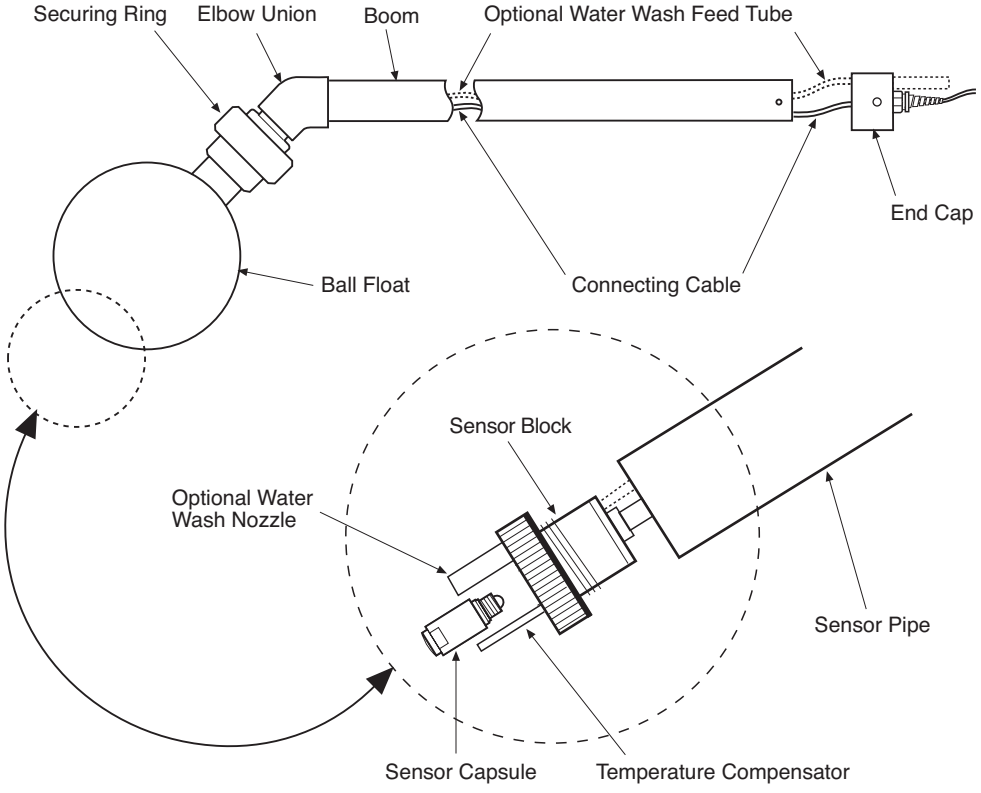


Fig. 5.2 Replacing the Oxygen Sensor Body

5.2.3 Submersible Systems

Submersibles are sealed systems and apart from sensor capsule replacement, no other maintenance is possible.

5.3 Changing the Temperature Compensator

5.3.1 Floating Ball and Dip Systems

This item is an integral part of the sensor body and is, therefore, not maintainable. Change the complete sensor body as described in Section 5.2.

5.3.2 Submersible System

The submersible system includes a sealed unit housing the combined temperature compensator/oxygen sensor body and is not accessible for maintenance purposes except for the replacement of the sensor capsule – see Section **5.1.3 Dip Systems.**

6 SPECIFICATION

Sensor Type:..... 8012-170 sensor capsule.

Response:

Typically 20 seconds for 90% of a step change of oxygen concentration at 20°C.

Temperature Compensation:

Automatic correction by means of integral Pt 100 resistance thermometer.

Accuracy:

±0.2 mg l^{-1} or ±2% saturation within ±10°C of the calibration temperature in the range 0 to 35°C.

Operating Temperature Range: 0 to 40°C

Operating Pressure: ..... Atmospheric

Dimensions:

Floating Ball

Ball diameter:..... 203 mm
Boom, outside diameter: ..... Metric - 50 mm
Imperial - $1^{7}/_{8}$ in (48 mm approximately)

Boom length
Assembled..... 3 metres
Kit..... 3 metres, user supplied

Dip

Dip Tubes:
Assembled (metric)..... 1,2 or 3 metre options
40 mm outside diameter
Kit (Imperial)..... user supplied
1.9 in outside diameter

Submersible

Diameter..... 40 mm
Length Approximately 265 mm
(335 mm with water wash)
Cable length ..... 10 m

Materials of Construction:

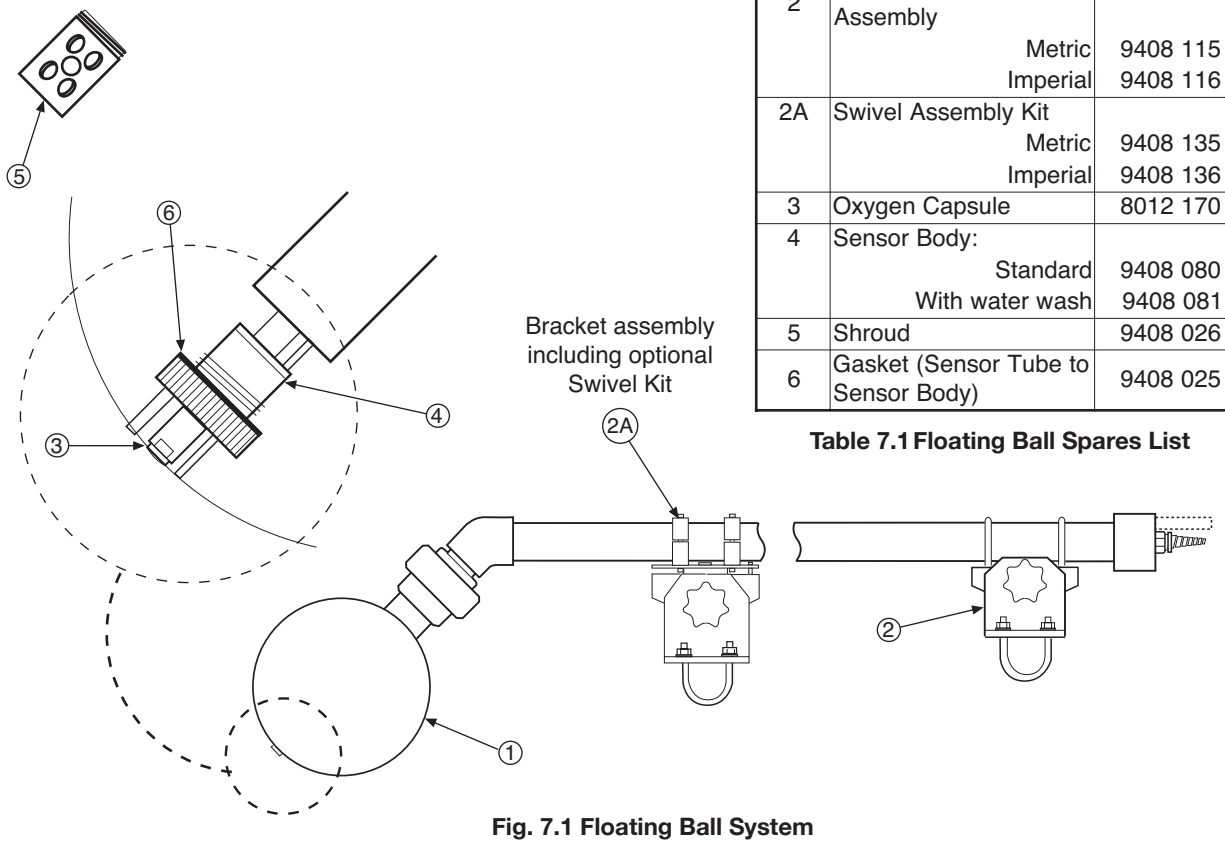
Boom:..... ABS
Sensor body: ..... ABS
Flotation ball:..... Polypropylene
Tube on dip system ..... Polypropylene
Body of submersible system..... Polypropylene
Bracket metalwork ..... Stainless steel

Extra Connection Cable:

Part No.: 0233-828
Maximum distance: ..... 100 metres (328 feet)

7 SPARE PARTS LIST

7.1 Floating Ball System

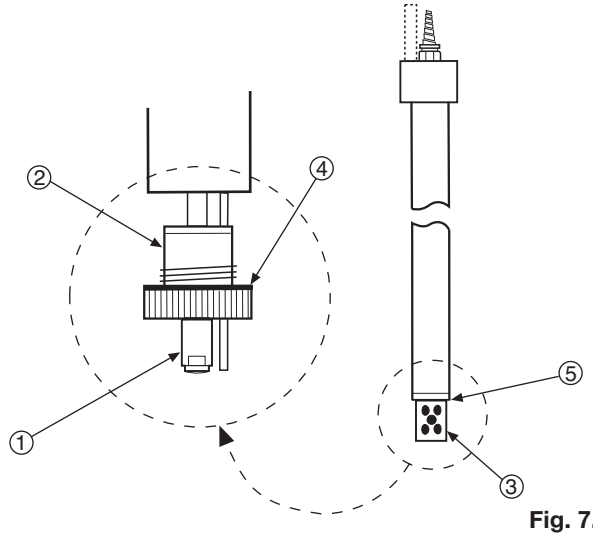


Item No.	Description	Part No.
1	Ball Float Assembly	9408 065
2	Standard Bracket Assembly	
	Metric	9408 115
	Imperial	9408 116
2A	Swivel Assembly Kit	
	Metric	9408 135
	Imperial	9408 136
3	Oxygen Capsule	8012 170
4	Sensor Body:	
	Standard	9408 080
	With water wash	9408 081
5	Shroud	9408 026
6	Gasket (Sensor Tube to Sensor Body)	9408 025

Table 7.1 Floating Ball Spares List

Fig. 7.1 Floating Ball System

7.2 Dip System



Item No.	Description	Part No.
1	Oxygen Capsule	8012 170
2	Sensor Body:	
	Standard	9408 080
	With water wash	9408 081
3	Shroud	9408 026
4	Gasket (Sensor Tube to Sensor Body)	9408 025
5	Gasket (Shroud to Sensor Body)	9404 130

Table 7.2 Dip Spares List

Fig. 7.2 Dip System

7.3 Submersible System

Oxygen Capsule 8012 170
Shroud 9408 026

APPENDIX A – SUPPORT BRACKET CONVERSION

A1 Kit Parts List – Fig. A.1

Table A.1 Contents of Conversion Kit

Item No.	Description	No. Off	Pt Nos
1	Boom clamps	4	Metric Kit 9408 135 Imperial Kit 9408 136
2	Boom clamps ends	2	
3	Boom clamps bolts	4	
4	Shoulder screw	1	
5	Swivel plate	1	
6	Swivel plate locking screw	1	
7	Bearing washer	1	

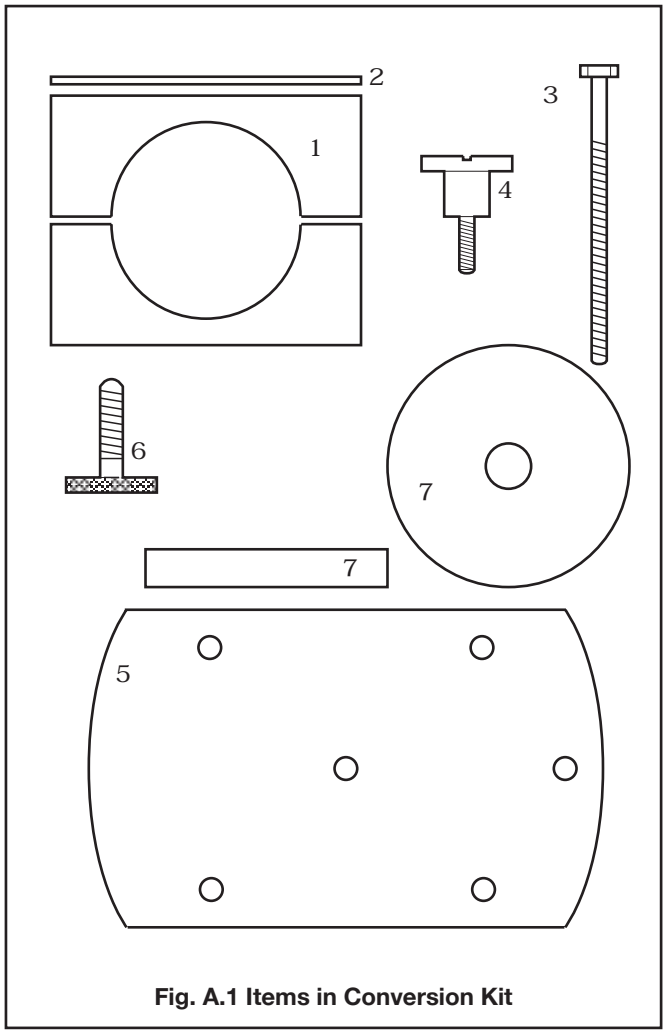


Fig. A.1 Items in Conversion Kit

A2 Conversion Procedure – Fig. A.2

1) Discard the upper 'U' bolts from the standard bracket.

2) Assemble the items from the conversion kit shown in Table A.1 and Fig. A.1 on to the clamp base plate – see Fig. A.2.

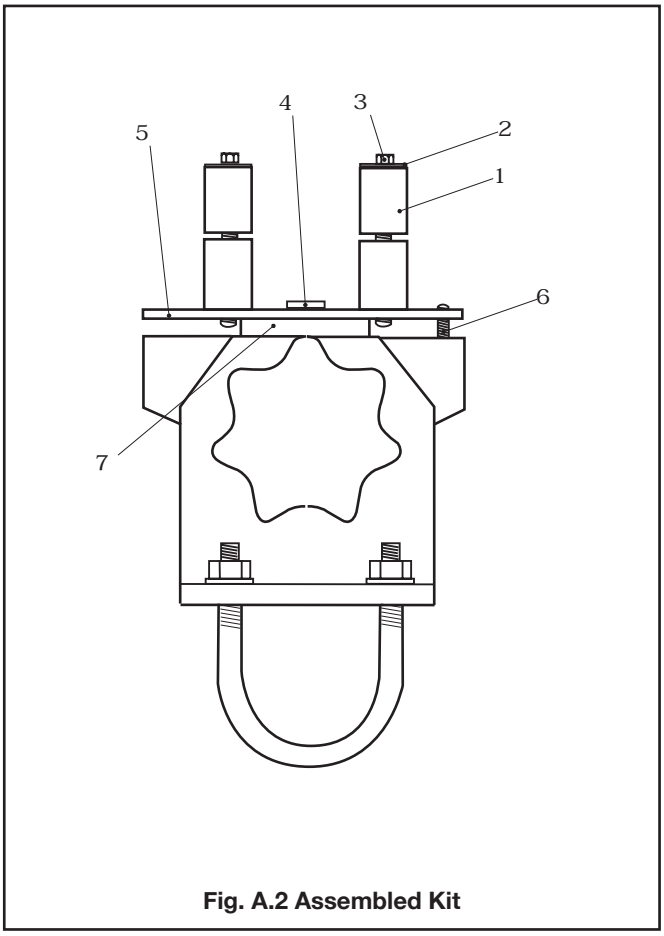


Fig. A.2 Assembled Kit

NOTES

Sales

Service

ABB Limited
Measurement & Analytics
Oldends Lane, Stonehouse
Gloucestershire,
GL10 3TA
UK
Tel: +44 (0)1453 826661
Fax: +44 (0)1453 829671
Email: 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

abb.com/measurement

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