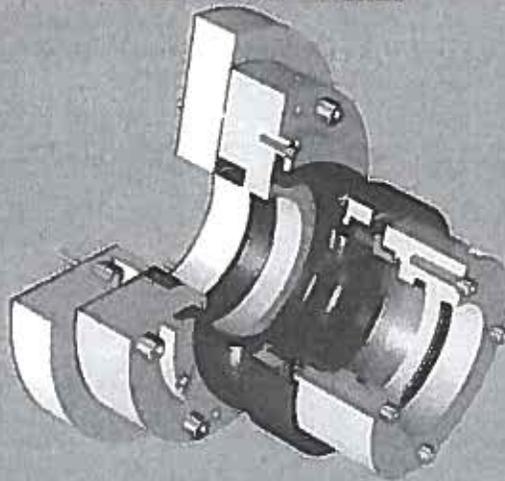


TECHNICAL MANUAL

FOR

TYPE PSE SEAL

IMPERIAL



ManeGuard PSE Inboard Seal

for Water Lubrication Systems

Based on Tabulated G.A. Drawing:

H78214

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1. INTRODUCTION.

- 1.1. The equipment described in this manual and the materials selected are the result of many years of research and experience in this field.
- 1.2. However, the care and attention paid during installation, testing, operations and maintenance, do to a large extent determine the long-term operational reliability of the equipment.
- 1.3. Whilst it is our policy to allow the Installation and Maintenance of this equipment to be carried out by 3rd parties (in accordance with the guidance contained within this Technical Manual) we would always strongly recommend that one of our service engineers is present to oversee any installation or maintenance.
- 1.4. When using this manual refer to the general arrangement drawing(s) in Section 9, which give the dimensions and data for the correct assembly and operation of the equipment.
- 1.5. There is no automatic provision to up-date this manual. However, the supply of a complete new assembly will be accompanied by the latest revision / issue manual and drawing(s).
- 1.6. For further assistance please contact one of the companies listed below:

UNITED KINGDOM		USA	
Wärtsilä UK Limited 4 Marples Way Havant Hants PO9 1NX		Wärtsilä Lips Inc. 3617 Koppens Way Chesapeake VA 23323	
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Tel:	31 416 388115	Tel:	81 (0) 3 5159 8700
Fax:	31 416 374853	Fax:	81 (0) 3 5159 8710

2. DESCRIPTION OF THE EQUIPMENT.

- 2.1.** ManeGuard PSE seals are high performance radial face type seals.
- 2.2.** The PSE seal described in this Technical Manual is a partially-split Inboard unit for use with Water lubrication systems.
- 2.3.** The original supply seal will have a non-split Silicon Carbide Face and Seat.



3. STORAGE AND HANDLING.

- 3.1.** All assemblies and components have been carefully inspected before shipment.
- 3.2.** Each component is suitably packed and protected to prevent damage or deterioration. Specific storage or handling requirements will be clearly identified on the package label(s).
- 3.3.** Goods should be examined on receipt to verify the contents and their condition.
- 3.4.** Wärtsilä UK limited shall be immediately advised of any damage or discrepancy in the scope of supply.
- 3.5.** Keep goods in their original packing until just prior to installation.
- 3.6.** If goods have to be stored for long periods, they should be kept in their original packing, stored flat and unobstructed in a dry, cool and dark environment. To maximise life expectancy for rubber components, do not expose to direct sunlight or sources of Ultra Violet (UV) light or high concentrations of Ozone.
- 3.7.** Care must be taken during handling to prevent any mechanical damage occurring due to dropping, crushing etc. Particular care and attention should be paid to the running / sealing surfaces of the silicon carbide face and seat.

4. PREPARATION.

- 4.1. Remove all burrs and sharp edges from the shaft. The surface of the shaft, should be clean and to the diameter and tolerance on the G.A. drawing.
- 4.2. Ensure that all mating faces with the seal, i.e. the end face of the sterntube/housing/adaptor and the shaft are machined to the following parameters:

Surface finish		- 250 μ in Ra or finer (Stern tube / Housing) - 32 μ in Ra or finer (Shaft in area of O-cord and Drive Clamp Ring)
Flatness		0.003".
Perpendicularity		0.014" FIM (Measured outside the bolting P.C.D.)
Concentricity		0.020"

The forward end of the Stern tube / housing shall be machined to accept the adaptor ring / mounting ring securing screws as detailed on the G.A. Drawing.

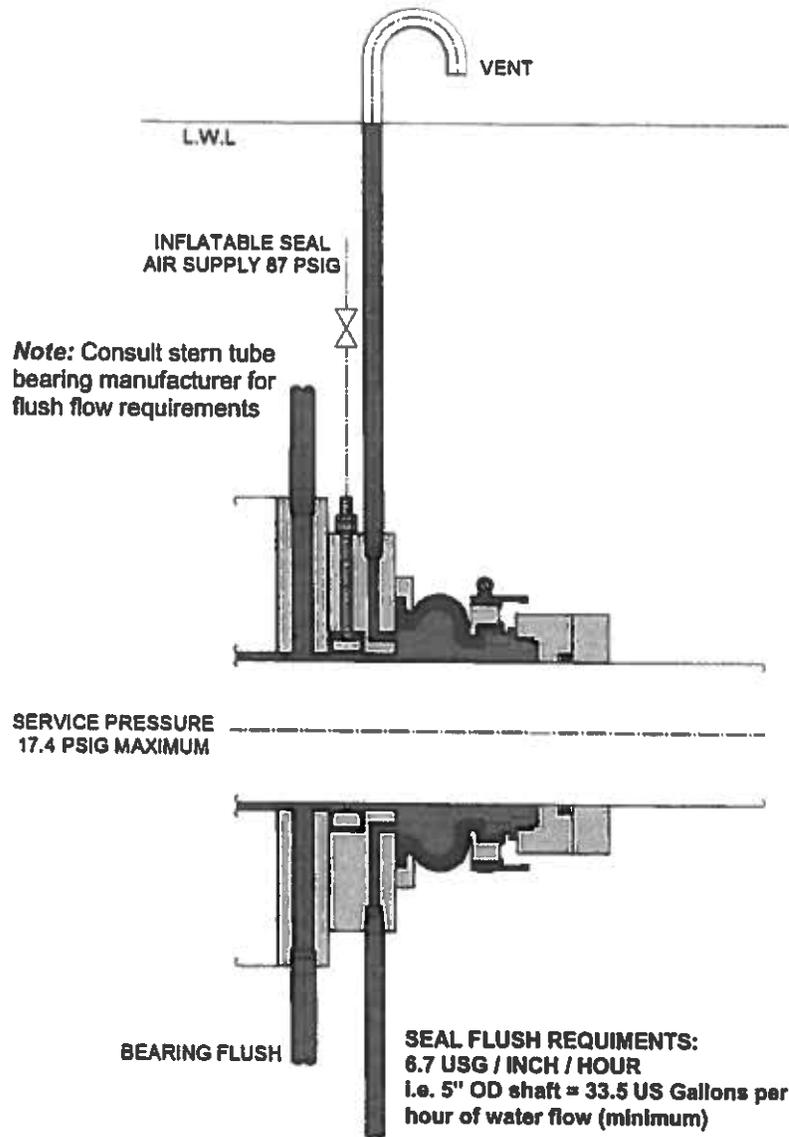
- 4.3. Mating surfaces should be clean with no debris or joint material, etc. present.

5. HEAD TANK LOCATION.

In a normal open water lubrication application, there will not be a "header tank" as such.

The flush water for the bearing/seal will normally be provided from a pumped system.

Details shall be as per the following figure:



Note: Flush / cooling water to the seal shall be filtered to at least 200 micron (μm).

Note:

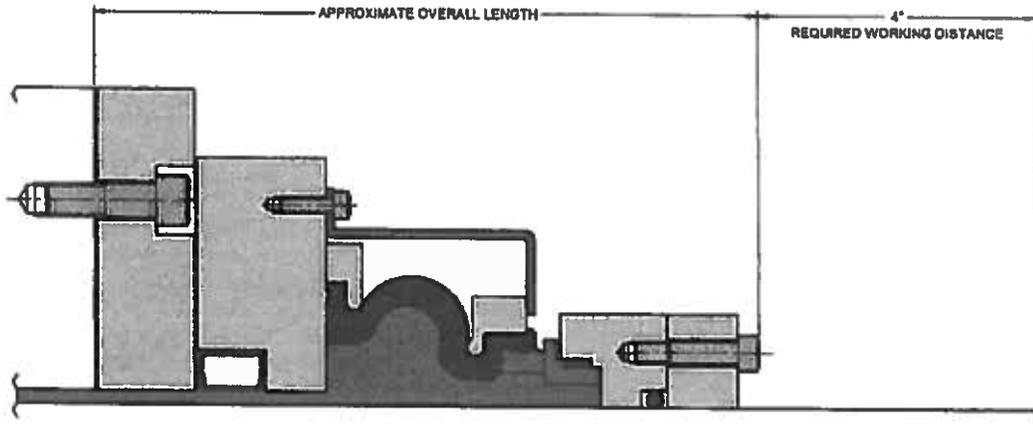
Seal flush: 6.7 USG / inch / hour refers to flow per inch of shaft diameter. Thus a seal fitted to a 5 inch shaft would require a minimum cooling water flow rate of 33.5 USG per hour.

Flush/cooling water to the seal shall be filtered to 200 micron or better.

Bearing flush: Whilst the stern tube bearing cooling / lubricating water supply provision is made within the adaptor plate, the actual water flow and pressure requirements shall be specified by the bearing manufacturer. WPUK are not responsible for the adequate supply of bearing water requirements. Any rates quoted are indicative only.

6. SPECIAL INTERFACING REQUIREMENTS.

Four areas of interfacing are relevant.



6.1. The Bore of the seat and drive clamp ring assemblies to the shaft.

The seal is supplied to suit the stated shaft diameter.

6.2. The Mounting ring interface.

The surface of the Stem tube to which the adaptor plate (or Mounting Ring) is to be fitted must comply with the requirements of Section 4 (preparation).

6.3. Axial Space.

This space shall include the maintenance distance as per the G.A. drawing.

6.4. Service connections.

All connections and services (usually bearing flush, seal flush water, vent and air supply) as detailed on the G.A. drawing shall be provided.

(Section Error! Reference source not found. and Section 7.9 also make reference to the service connections).

7. INSTALLATION.

(Refer to relevant Drawing(s) - see Attachments – Section 9)

(Part number references are based on G.A. Drawing H76214 positions).

7.1. General Advice

- * The PSE seal shall be installed with the propeller shaft removed, withdrawn or de-coupled. The installation procedure is based upon fitting the seal in cartridge / main assembly form, over an exposed / withdrawn shaft.

7.2. Warning.

- * The silicon carbide face and seat must be handled with great care.

7.3. Order of Component Assembly.

1. Adaptor plate assembly (If fitted). (9)
2. Mounting ring and bellows assemblies (3 + 2) – fitted as a cartridge unit (with the compression tooling assembly (CT) in place).
3. Seat housing assembly - minus O-cord. (1)
4. Seat housing – O-cord. (1-4)
5. Drive clamp ring assembly. (4)
6. Splashguard and clamp (2-5/2-6)
7. Service connections.

7.4. Adaptor.

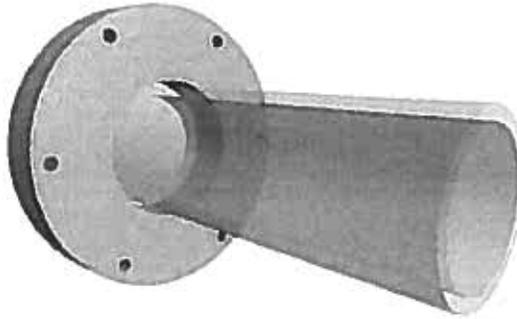
An Adaptor Plate (9-1) is supplied as standard and can be fitted between the Sterntube/Bulkhead and the PSE seal Mounting Ring (3-1). The adaptor ring is provided for the following reasons.

- The adaptor plate is supplied to ensure the bore of the sterntube/ bulkhead is equal to the mounting ring bore.
- The adaptor plate can be used for retrofits where the existing mounting holes are not compatible with the supplied seal.
- The adaptor plate has a provision of 2 bearing flush connections (NPT female threads)

7.4.1 If the adaptor plate is to be used then it must be installed over the shaft at this stage. When using the adaptor plate for retrofits the adaptor plate shall be drilled to suit the existing mounting positions ensuring the butt bolt positions and bearing flush provisions are considered **before** drilling, i.e. the pitch circle diameter of the holes added shall not break through the bearing flush provisions provided. Wärtsilä UK Ltd are not

responsible for the drilling of the supplied adaptor plate by third parties, or any rework required in terms of paint finish rectification etc.

- 7.4.2 The adaptor plate (9-1) shall be orientated to position its top dead centre (stamped / marked 'TDC'). Refer to the G.A. drawing for the positions of connections, fasteners etc.
- 7.4.3 Fit the gasket (9-3), to the Stem tube / bulkhead. Then position the adaptor plate (correctly orientated for TDC) onto the Stem tube using the main securing Screws (9-2), having applied threadlock to them.



- 7.4.4 Centralise the adaptor plate to the shaft to within 0.020" concentricity.
- 7.4.5 Tighten the Screws (9-2) in an even, progressive and diametrically opposite sequence. Finally, tighten the fasteners to the torque value shown in the G.A. Drawing

7.5. Static part of the Seal Assembly.

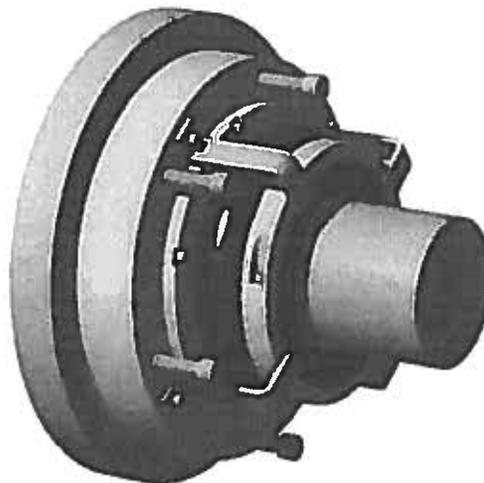
The mounting ring, bellows and face assemblies are supplied as an assembled (cartridge) unit, with the compression tooling fitted.



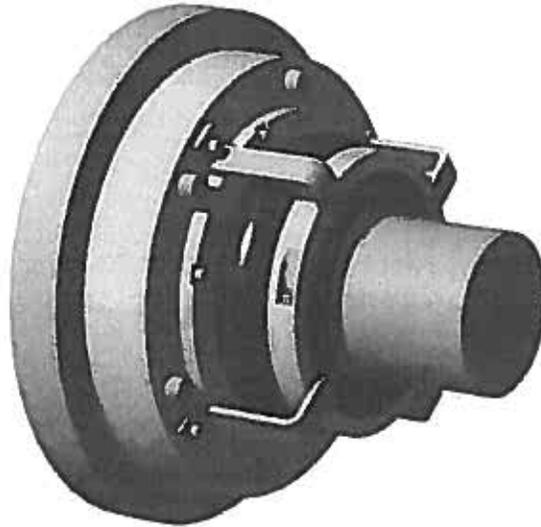
Ensure that the shaft is perfectly clean before proceeding.

7.5.1. Orientate the cartridge to TDC. The mounting ring is stamped TDC. Note the resultant positions of the flush connections.

7.5.2. Fit the gasket (3-6), to the stern tube / adaptor plate. Position the mounting ring onto the stern tube / adaptor plate using the main securing screws (3-3), having previously applied threadlock to them. Take care to prevent SIC face from contacting the shaft during installation.



- 7.5.3. If the adaptor plate is not fitted then centralise the Mounting Ring (3-1) to the Shaft to ≤ 0.020 " concentricity.
- 7.5.4. Tighten the screws (3-3) in an even, progressive and diametrically opposite sequence to the torque value shown in the G.A. drawing.



Note: Test the inflatable seal at this stage. Connect a suitable foot / hand pump (or other means of inflation, i.e. governed compressed air supply) to the air supply connection on the mounting ring and pressurise to a pressure of 87 psl(g) (maximum).

The inflatable should blow down evenly to contact the shaft all round.

This test only proves that the inflatable seal activates. Now conduct a pressure test on the inflatable as described in Testing, Section 8.1

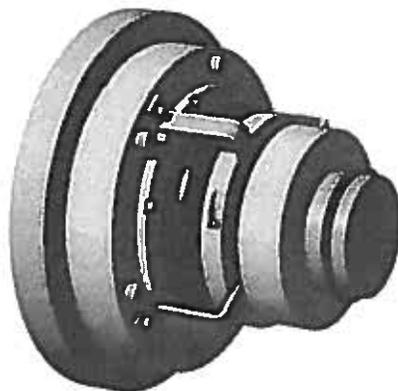
After a successful test, remove the pressure and/or the pump and confirm that the inflatable seal retracts into the mounting ring recess.

7.6. Seat Housing Assembly.

- 7.6.1. Check that the seat (1-1) is fitted in its sealing strip (1-3) in the seat housing (1-2). Carefully fit the seat housing (1-2) over the shaft.
- 7.6.2. Clean the face and seat with a non-chlorinated solvent cleaner. Check and re-confirm that both face and seat are undamaged.
- 7.6.3. Carefully push the seat housing (1-2) up to the face (2-2) so that the seat (1-1) and face (2-2) are lightly contacting each other.



- 7.6.4. Fit the O-cord (1-4) around the shaft, and with the butts pressed together, fit it into its recess in the seat housing (1-2). There is no need to "join" the O-cord, as the supplied length of the cord ensures that the butts will be in compression when fitted. However, if desired in order to aid the fitting of the O-cord, it may be joined using the adhesive supplied. Ensure the bond is good and that there is no step at the bonded butts. Any dried glue can be carefully removed using a fine grade abrasive paper.



Do not cut or shorten the O-Cord!

7.7. Drive Clamp Ring Assembly (DCR).

- 7.7.1. Orientate the drive clamp ring (4-1) and fit it over the shaft (the side that contacts the seat housing (1-2), has a better finish i.w.o. the seat O-cord). Slide the DCR along the shaft to contact the seat housing.

Note: A wedge may be inserted at the butt to ease installation if necessary.



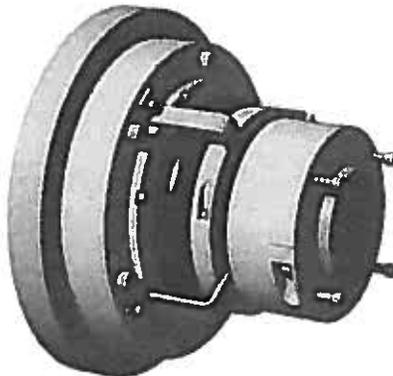
Ensure that the O-cord (1-4) is not trapped by the DCR.

- 7.7.2. Apply liquid threadlock (supplied) to the DCR butt screw (4-2). Fit and lightly tighten it so that the DCR just grips the shaft.

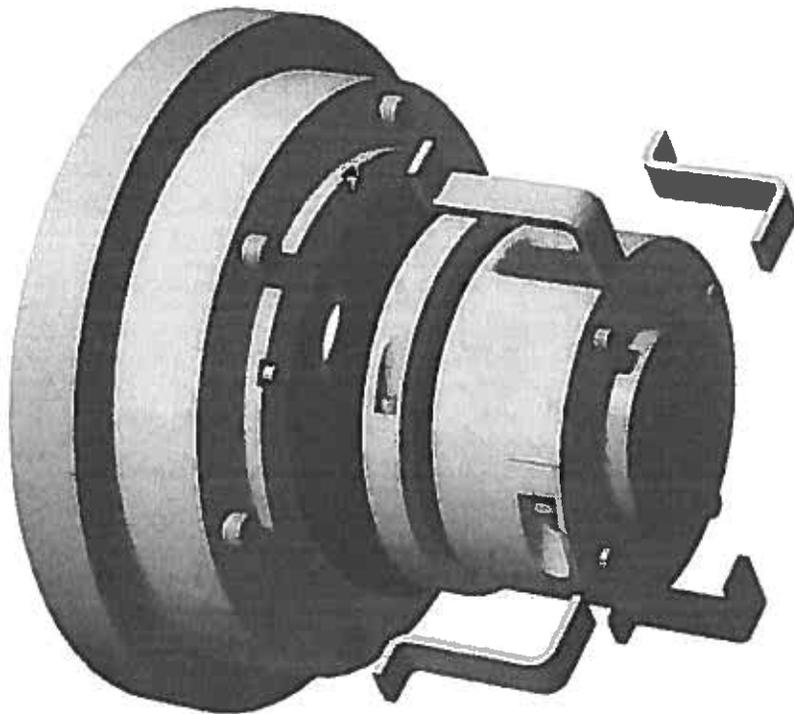
Note: Remove the wedge (if used) referenced above before tightening the butt screw.

- 7.7.3. Turn the DCR so that the through holes in it for the drive screws (1-5) are aligned with the tapped holes in the seat housing (1-2).

- 7.7.4. Fit the drive screws (1-5), (having applied threadlock) so that they fit through the DCR and into the tapped holes in the seat housing (1-2). Evenly and diagonally tighten the drive screws (1-5) to the torque shown on the G.A. drawing until they are securely holding the DCR (4-1) to the seat housing (1-2).

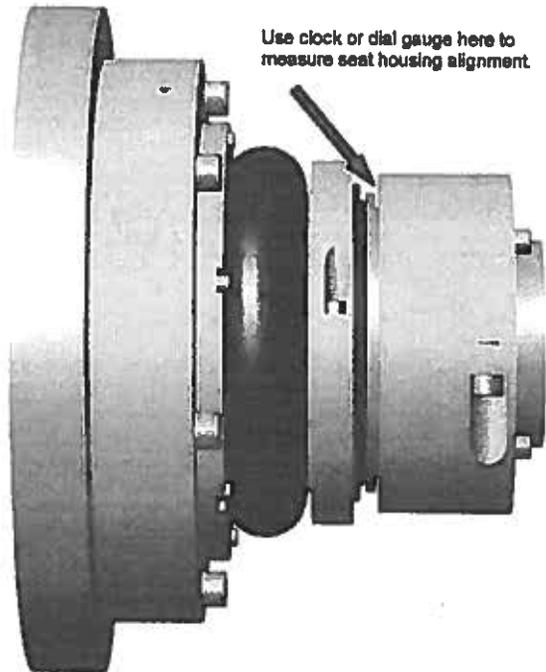


- 7.7.5.** Carefully fully tighten the DCR butt screw (4-2) to the torque shown on the G.A. drawing.
- 7.7.6.** Undo and remove the compression tooling assembly (CT). Disassemble, clean and store for re-use in the toolbox.



7.8. Seat Alignment.

- 7.8.1. Use a clock gauge on the seat housing (1-2) aft vertical surface. Use the turning gear to slowly rotate the shaft to check the swash/alignment of the seat housing. It must be within 0.008" T.I.R. (Total Indicator Reading).



If it is not, carefully loosen the DCR butt screw (4-2) and adjust the DCR until the seat housing is correctly aligned. When within tolerance, re-torque the DCR butt screw (4-2) to the torque shown on the G.A. drawing, and re-check the swash / alignment reading (adjust again if necessary).

7.9. Service Connections.

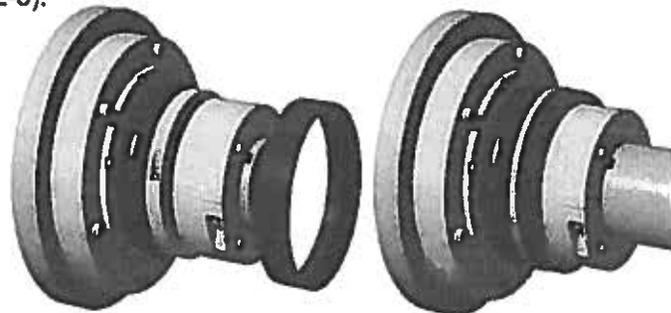
- 7.9.1. Referring to the G.A. Drawing, connect the services to the mounting ring (3-1) and adaptor plate (9.1) (if fitted) as listed below.
- Seal water flush/vent connections in the mounting ring. The flush is on the horizontal at 90° to the vent at TDC.
 - Bearing flush connections in the adaptor plate. The flush connections are at 90° to each other one on the horizontal and the other at TDC.
 - A single air connection to the Inflatable seal in the mounting ring.
- 7.9.2. Before connection, ensure that all pipes are clean and clear of debris.
- 7.9.3. It is important that water and air are provided to the seal and bearing "in the quantities and at the pressures as defined by the G.A. drawing". Further, the water supply to the seal should be filtered to 200 micron or better.
- 7.9.4. If the seal is not being connected to a permanent vent, the TDC vent connection must be plugged using the plug 3-7 supplied, after the seal has been flooded and all trapped air allowed to escape.
- 7.9.5. Where the bearing flush provision in the adaptor plate (9-1) is not being connected to a flush system, the flush connections must be plugged using the plugs (9-4) supplied, before the seal is flooded.

7.10. Splashguard.

- 7.10.1. The splashguard (2-5) supplied should now be fitted using the clamp (2-6)
- 7.10.2. The splashguard is supplied split and must be fitted around the face clamp (2-3). A clamp ring (2-6) holds the guard in place; the rubber section locates around the face clamp as shown on the G.A. drawing.

Fit the splashguard with the split at TDC and the hole at BDC, to route leakage to the bilge.

Fit the clamp (2-6) to the groove in the O.D. of the splashguard, and tighten it so that it secures the splashguard (2-5) in position on the face clamp (2-3).



8. TESTING.

8.1. Emergency Inflatable Seal.

The emergency seal may be operated by air or a suitable liquid.

Refer to Section 7.9 (service connections) regarding pipework connections.

Test the inflatable using pressure to the maximum figure on the G.A. drawing.

Test the inflatable (refer to Section 7.5.3) and check that the seal is hard against the shaft all round.

With the inflatable seal activated, carry out a pressure drop test by closing the supply valve. The pressure may drop very slowly, however if there is a rapid loss of pressure, the connections, and if necessary, the inflatable seal, should be examined.

8.2. Main Seal.

After the Seal had been fitted and compressed, and with the service connections made as per Section 7.9, proceed to test the face seal as follows:

Inflate the inflatable (to the pressure on the G.A. Drawing). Fill the seal with water, filtered to 200µm (micron) or better, then shut the vent and apply pressure via the flush connection (Max. 17.4 p.s.i.g. as per the G.A. drawing). A small leak between the face and seat is acceptable on static test, which should reduce when the seal has 'run-in'.

9. ATTACHMENTS.

The following are covered by this Technical Manual (TM-PSE-04 (I) - INSTALLATION).

- H76214 Tabulated G.A. drawing of PSE type seal – Imperial sizes.
- TDS 1/039 FSE / PSE basic water / air system – Phase I units.

Note: This manual is written based on the General Arrangement drawing listed on the front cover.

In all instances, the drawing(s) specific to the application must be included after this attachment page and referenced in conjunction with this manual.

The attachments identified above, now follow: