TECHNICAL MANUAL

FOR

TYPE EK SEAL

ManeBar EK Outboard Seal

for Oil Lubrication Systems

Based on Tabulated G.A. Drawings:

H 70001
H 70008
H 70010
H 70028
H 70061

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CONTENTS

1. SPECIFICATION/DATA SHEET.

WORKS ORDER NO. :
OWNER :
VESSLE NAME :
YARD :
YARD No. :

STERNTUBE/SHAFT SEALS

Aft/Outboard Seal	**Forward/Inboard Seal(s)**
Type:	Type:
Size:#	Size:#
Drawing No.:	Drawing No.:

STERNTUBE BEARINGS

Aft STB	Mid STB	Fwd STB
Size:#	Size:#	Size:#
Drawing No.:	Drawing No.:	Drawing No.:

INTERMEDIATE/LINE SHAFT BEARINGS

Type:	Type:
Size:#	Size:#
Drawing No.:	Drawing No.:

LUBRICATION SYSTEM

Drawing No.:

System Components

Fwd seal Tank	**Aft seal Tank**
Drawing No.:	Drawing No.:
Header Tank	**Drain/Observation Tank**
Drawing No.:	Drawing No.:
Air control unit	
Drawing No.:	
Lub Oil Pump set	**Filter/Strainer Unit**
Drawing No.:	Drawing No.:
Oil Flow Meter	**Water Flow Meter**
Drawing No.:	Drawing No.:
Pressure Gauge/Panel Units	**Valves**
Drawing No.:	Drawing No.:

BULKHEAD SEALS

Type:	Type:
Size:#	Size:#
Drawing No.:	Drawing No.:

ACCESSORIES

#
#

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2. INTRODUCTION.

2.1. The equipment described in this manual and the materials selected are the result of many years of research and experience in this field.

2.2. 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.

2.3. Thus, 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 recommend that one of our Service Engineers is present to oversee any Installation or Maintenance.

2.4. **When using this manual refer to the general arrangement drawing(s) in Section 16,** which give the dimensions and data for the correct assembly and operation of the equipment.

Where Grease lubrication is to be used, please refer to TDS 3/008 in Section 16.

2.5. 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).

2.6. For further assistance please contact one of the companies listed below:

UNITED KINGDOM

Deep Sea Seals Limited
4 Marples Way
Havant
Hants PO9 1NX

Tel: 44 (0) 2392 492123
Fax: 44 (0) 2392 492470

USA

Wärtsilä Lips Inc.
3617 Koppens Way
Chesapeake
VA 23323

Tel: 1 757 485 5275
Fax: 1 757 487 3658

NETHERLANDS
Wärtsilä Propulsion Netherlands BV
Lipsstraat 52
5151 RP Drunen

Tel: 31 416 388299
Fax: 31 416 374853

JAPAN
Japan Marine Technologies Ltd.
Sigma Bldg, 3-7-12 Shibaura
Minato-ku
Tokyo, 108-0023
Tel: 81 (0) 35442 2211
Fax: 81 (0) 35442 2260
Telex: 232-4593

3. DESCRIPTION OF THE EQUIPMENT

3.1. ManeBar "EK" seals are members of the "E" series family of Rubber Bodied Radial Face Type seals.

3.2. The "EK" seal described in this Technical Manual is a non-split Outboard unit for use with either Oil, Grease or Closed Water lubrication systems in Fixed or Controllable Pitch Propeller - Thruster or Stabiliser applications.

3.3. The resilient rubber body of the "EK" seal has an integral "face" which rotates with the shaft and propeller against a static (solid or sealing strip mounted) "seat" assembly fixed to the sterntube or thruster housing.

3.4. This combination provides a simple but very effective sealing arrangement capable of accommodating both radial and axial shaft movements.

4. STORAGE AND HANDLING

4.1. All assemblies and components have been carefully inspected before shipment.

4.2. Each component is suitably packed and protected to prevent damage or deterioration during shipment, transit or storage. Any specific storage or handling requirements will be clearly identified on the package label(s).

4.3. Goods should be examined on receipt to verify the contents and their condition.

4.4. Deep Sea Seals should be immediately advised of any damage or discrepancy in the scope of supply. Damage clearly due to handling in transit should be notified to the carrier along with a claim for damages (copy to us).

4.5. Keep goods in their original packing until just prior to installation in order to best protect them.

4.6. 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 ensure a satisfactory life expectancy for any rubber components, exposure to sunlight, ultraviolet light and ozone should be prevented.

4.7. 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 face and seat.

5. PREPARATION

5.1. Remove all burrs and sharp edges over which the seal must pass. The surface of the shaft, local to the seal, should be clean and to the specified diameter and tolerance.

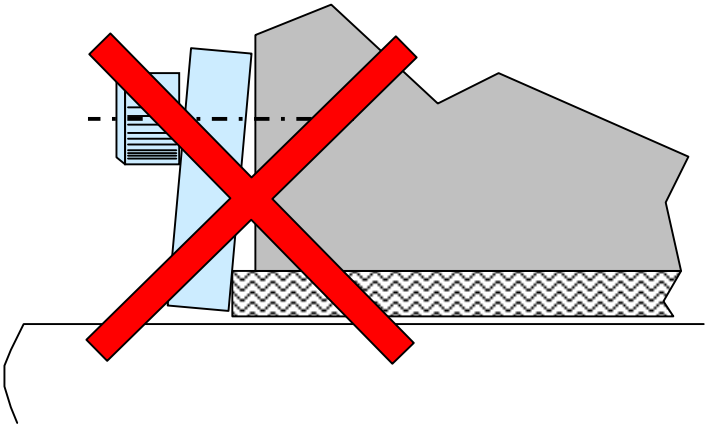
5.2. Ensure that all mating faces with the seal, i.e. the end face of the sterntube/housing and the forward face of propeller boss are machined to the following parameters:

#	Surface finish		- 3·2 µm Ra or finer (Propeller Boss) - 6.3 µm Ra or finer (Sterntube/Housing)	
#	Flatness		- 0·08 mm.	
#	Perpendicularity		Seal Size: 50 - 110 120 - 250 260 - 320	FIM (Measured outside the bolting P.C.D.) 0·2 mm 0·35 mm 0·5 mm

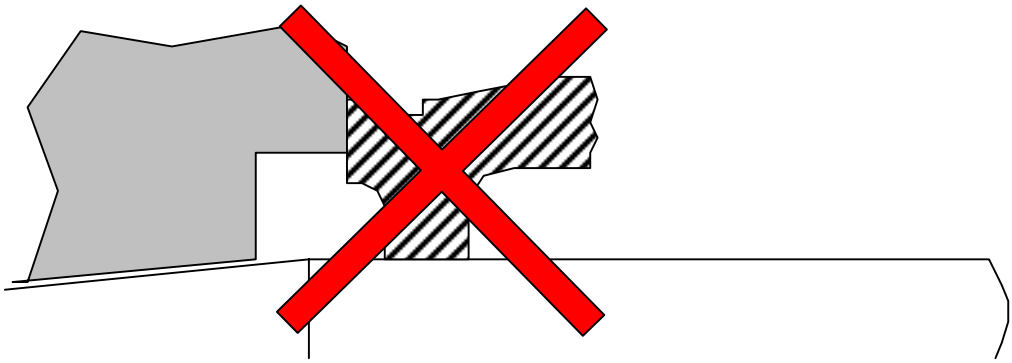
5.3. Where a sealing strip mounted seat is to be used ensure that the sterntube or housing has been machined in accordance with the General Arrangement drawing to accept the sealing strip and seat.

5.4. All mating surfaces should be clean with no debris or old joint material, etc. present.

5.5. Make sure that the end of the bearing does not stand proud of the sterntube or housing, as this will distort the seat.



5.6. Ensure that the forward face of the propeller boss/flange is not stepped where it contacts the aft end of the seal body. See 8.6 & 8.7.

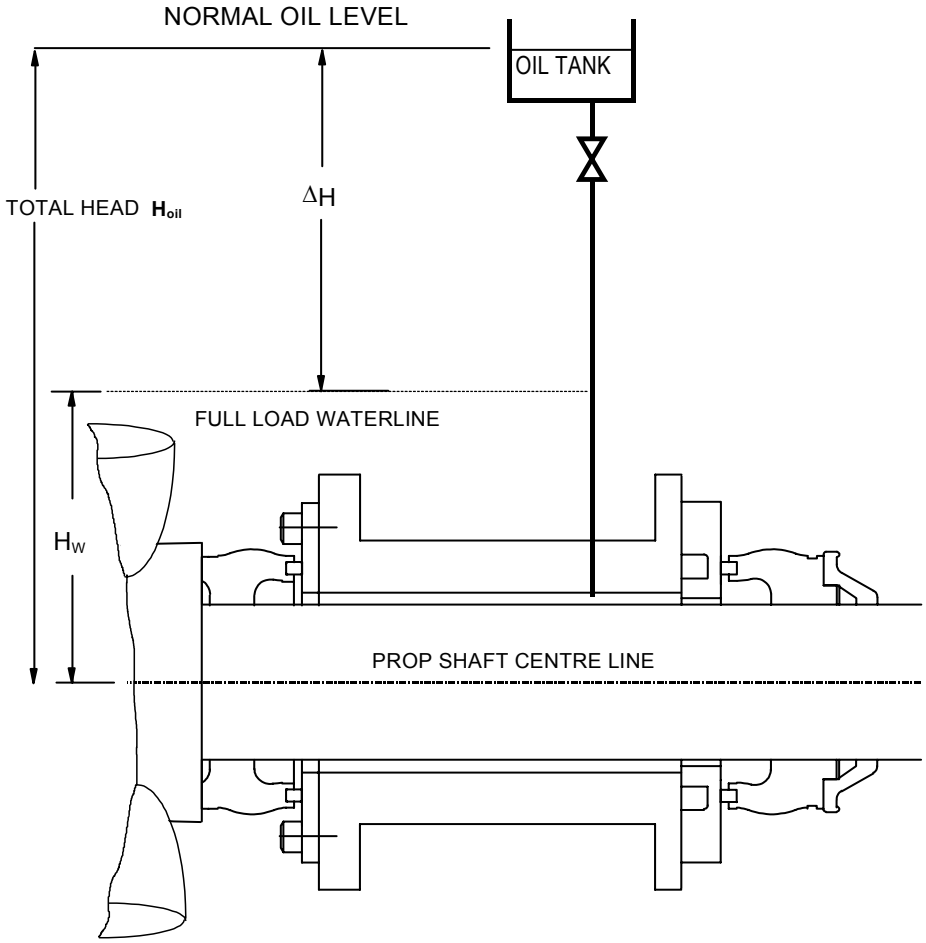


5.7. It is **essential** that the running surfaces of the face and seat are protected at all times during storage, transit and installation to promote correct operation of the assembled unit. Even minor damage to these surfaces can promote leakage.

6. HEAD TANK LOCATION

6.1. Stern Tube Applications

6.1.1. For oil lubricated systems, the head tank must be positioned at such a height above the full load water line as to obtain a minimum differential pressure on the outboard seal of 0.3 bar. See example table below and TDS 1/007 for details. This requirement shall override any information supplied in respect of an inboard seal.

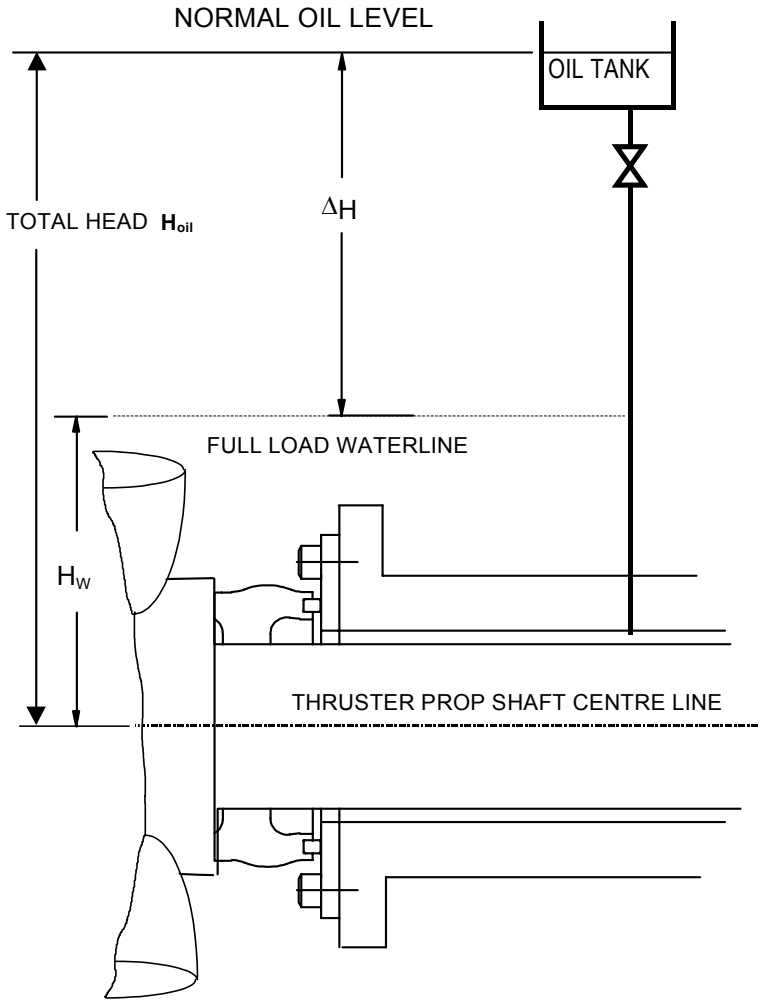


Vessel	H_W	metres	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
Required	ΔH	metres	3.4	3.5	3.6	3.6	3.7	3.7	3.8	3.8	3.9
Required	H_{oil}	metres	4.4	5.0	5.6	6.1	6.7	7.2	7.8	8.3	8.9

6.1.2. Where grease is used as the lubricant, there will not be a 'head tank' but rather a system for pressurising and injecting grease into the sterntube bearing. The system must comply with the general requirements stated in TDS 3/008.

6.2. Thruster Applications

6.2.1. The head tank must be positioned at such a height above the full load water line as to obtain a minimum differential pressure on the EK seal of 0.3 bar. See example table below.



Vessel	H_W	metres	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
Required	ΔH	metres	3.4	3.5	3.6	3.6	3.7	3.7	3.8	3.8	3.9
Required	H_{oil}	metres	4.4	5.0	5.6	6.1	6.7	7.2	7.8	8.3	8.9

Vessel	H_W	metres	5.5	6.0	6.5	7.0	7.5	FOR GREATER DRAFTS CONSULT DEEP SEA SEALS LTD.
Required	ΔH	metres	3.9	4.0	4.1	4.1	4.2	
Required	H_{oil}	metres	9.4	10	10.6	11.1	11.7	

6.2.2. The tank heights given in the table for "thruster" applications are applicable where the propeller is located behind the gearpod ("pusher" propeller). If the propeller is located in front of the gearpod ("tractor" propeller) the water pressure local to the seal will be increased. In these cases the oil head tank may need to be raised to maintain the correct pressure differential, otherwise water contamination of the oil may result.

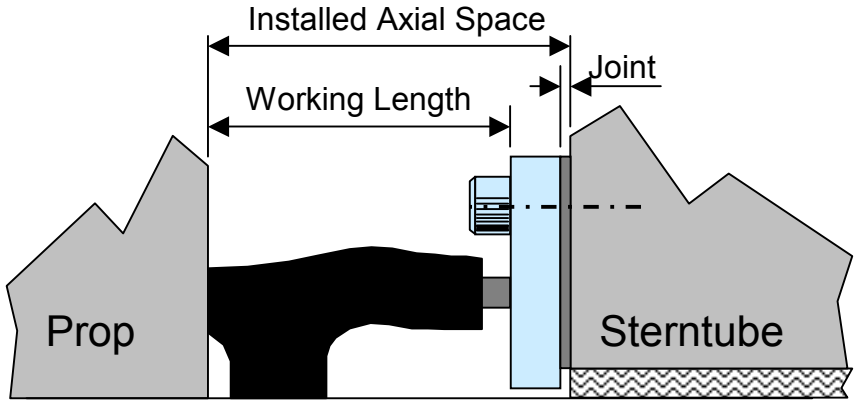
6.2.3. Similarly a tunnel thruster which operates for a significant proportion of time in "tractor" mode may also require a raised head tank.

6.2.4. If a pumped oil circulatory system is used, the maximum oil pressure at the seal must not exceed 1·4 bar with the maximum differential pressure (oil above water) not exceeding 0·8 bar, during operation. This is because an internally predominant differential pressure accentuates the ‘Bulge" of the seal body and reduces the load at the sealing interface.

7. SPECIAL INTERFACING REQUIREMENTS

7.1. Interfacing Requirements - (Solid & Resilient Mounted Seats)

The "EK" seal is designed to fit into a specific axial space so that when assembled with the seat, shaft and propeller in their final positions, the seal is compressed by the correct amount.



Three areas of interfacing are relevant.

7.1.1. The Bore/I.D. of the rubber body to the shaft -
The seal will be supplied with the bore of the body sized to suit the stated shaft diameter.

7.1.2. The Propeller Boss surface to the back of the rubber body -
This interface provides the primary drive and pressure boundary for the seal. As well as the Boss surface being flat (see sections 4·2 and 4·6) to fully support the back surface of the EK rubber body, any holes should be suitably filled.

7.1.3. The Stationary Seat interface is very important -
It is normally by varying the thickness of the seat/seat housing that the correct compression on the seal body is achieved.

7.2. Solid Seat Interfacing

7.2.1. The Stationary Seat comprises a one piece ring/plate bolted to the end of the sterntube or equivalent (e.g. thruster housing).

7.2.2. The Seat will normally be supplied to a thickness already determined (at the time of ordering) by the axial space into which the seal assembly will fit.

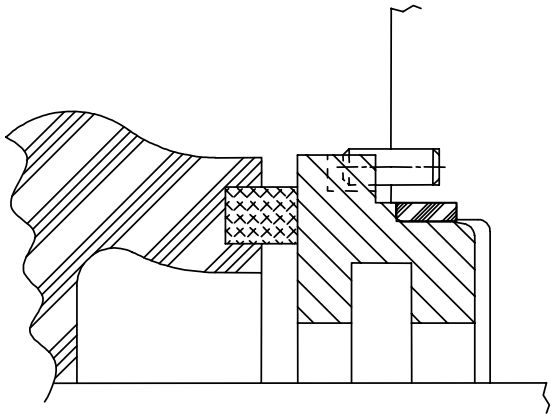
7.2.3. A surface finish of 1·6 µm Ra is achieved by a fine machining process. The seat is then polished to between 1·6 µm and 1·2 µm during manufacture. The running surface flatness tolerance is 0·04 mm and it is emphasised that this is a fine machined surface - not a "ground" one, as a ground surface can prolong the running in period.

7.2.4. The Seat should never be less than 15 mm thick. A seat of less than 15 mm thick would be more susceptible to bolt induced distortion (and hence leakage).

7.2.5. The surface of the sterntube should conform to the requirements of Section 5.

7.3. Sealing Strip Mounted Seat Interfacing.

7.3.1. Where a rubber sealing strip mounted seat is supplied, the Sterntube/Housing must be machined to accept the seat and sealing strip in accordance with Section 5.3 and the applicable G.A. Drawing. This must include the provision of Anti-Rotation pins as shown in Section 8 (Installation) and detailed in the applicable G.A. Drawing.



7.3.2. The rubber sealing strip mounted seat is a specifically designed component. The compression of the body being accounted for during design. Under no circumstances must this component be modified by the customer.

8. INSTALLATION

(Refer to relevant Drawing(s) - see Attachments - Section 16)

8.1. Axial Space

Before fitting the EK seal, the distance between the end face of the sterntube (or Thruster Housing) and the forward face of the propeller boss must be measured. This distance should then be used to re-confirm that the seat assembly is of the correct size to achieve the compressed "working length" on the seal body as shown on the General Arrangement drawing.

8.2. Solid mounted seat arrangement.

As stated earlier (in Section 7), by prior arrangement the seat will be provided of a necessary thickness to give the correct "working length" of the seal. If adjustment is required, modifications may be carried out as follows:

8.2.1. If the measured axial space is larger than originally advised, this would cause the 'EK' seal to be *under-compressed* if fitted into this increased space. Compensation can be made by use of a thicker joint (see below for limitations) or a spacer, to re-establish the correct working length of the seal.

8.2.2. Where the axial space is *less* than originally advised, this would cause the 'EK' seal to be *over-compressed* if fitted into this reduced space. Compensation can be made (to a degree) by removing material from the *back* surface of the seat. Note (as per Section 7.2.4) the *minimum* acceptable thickness of the seat is 15 mm, therefore material can only be removed from the seat, *if* it was supplied *thicker* than the 15 mm minimum. By determining the amount that the *actual* axial space is less than that originally advised, then removal of the same amount of material from the *back* surface of the seat will establish the correct compression on the seal.

8.2.3. Before installing the solid seat, a compressed fibre joint must be fitted to the mounting surface. A thickness of 1 mm is recommended to minimise bolt-induced distortion. On no account should a joint of more than 2 mm be used.

A rubber gasket must not be used.

8.2.4. Once the correct seat thickness has been obtained, remove the propeller and secure the seat and joint in position ensuring an oil tight joint is made. The seat mounting bolts/screws must be tightened progressively, diagonally and evenly to the torque specified on the General Arrangement drawing.

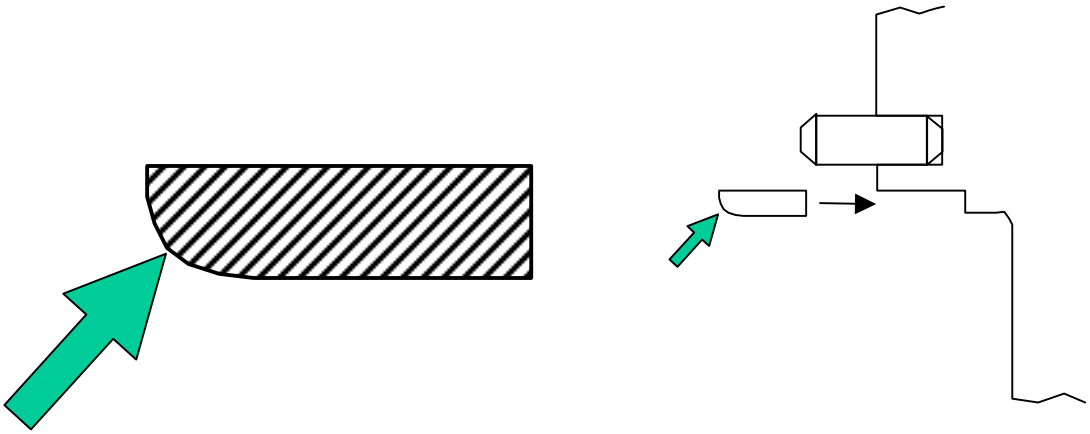
Do not exceed this torque!

8.3. Sealing Strip Mounted seat arrangement.

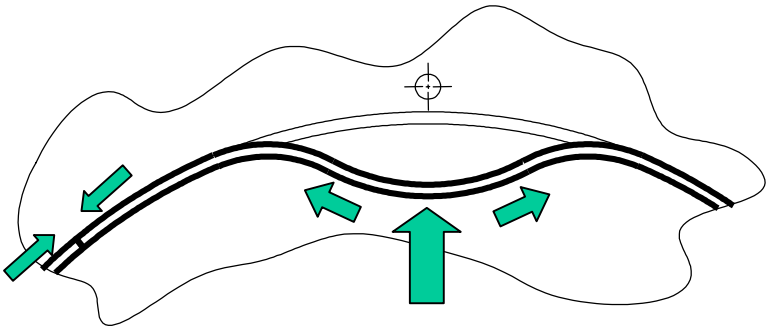
Having confirmed that axial distances and seat interfacing dimensions are as per the General Arrangement Drawing, proceed as follows:

8.3.1. Clean and grease the recess in the Sterntube/Housing.

8.3.2. Insert the Sealing Strip into the recess ensuring that the radiused edge of the strip is outboard and on the inner diameter.

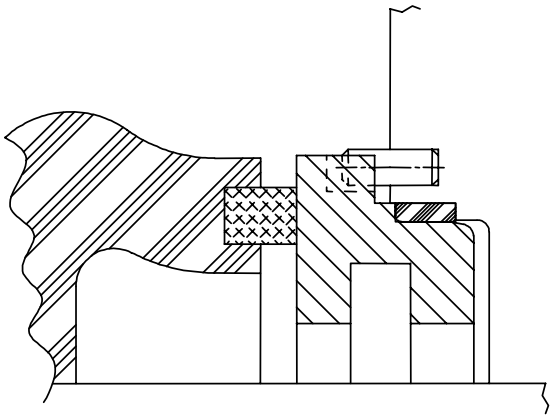


8.3.3. The Sealing Strip is provided overlength (see below). To overcome the "apparent" excess length, the strip ends should be butted together in the recess **(not glued or bonded)** and the excess rubber slowly worked round whilst exerting slight pressure on the loop.



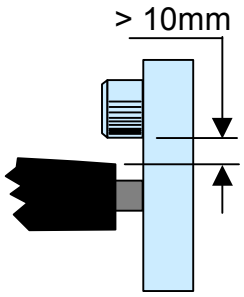
✳✳**NOTE**✳✳ As above, the Sealing Strip is supplied overlength to ensure that the ends butt hard together and that the strip fully supports the seat. **The Sealing Strip must not be cut or shortened.**

8.3.4. Fit the seat into the sealing strip, taking care to engage the anti-rotation pins in the holes in the back of the seat. The seat may require "gentle" tapping with a rubber mallet to fully engage it in the sealing strip.



8.4. Seal Mounting

Clean the shaft, seat and face using a non chlorinated solvent cleaner. If necessary lightly soap the shaft over which the seal must pass. Carefully slide the seal complete with the shroud ring into position, against the seat, ensuring that there is at least 10 mm radial clearance for the seal to rotate without fouling the seat securing bolts/screws



8.5. Face Lubrication

For normal F.P.P. and C.P.P. applications the face and seat should not be lubricated on assembly, but for thruster applications oiling is recommended (same oil as to be used for the thruster). Petroleum jelly is acceptable but grease must not be applied as it can interfere with the running-in process and may cause overheating with the potential for reduced life expectancy and performance. Solid lubricants such as molybdenum disulphide, graphite or p.t.f.e. must not be used.

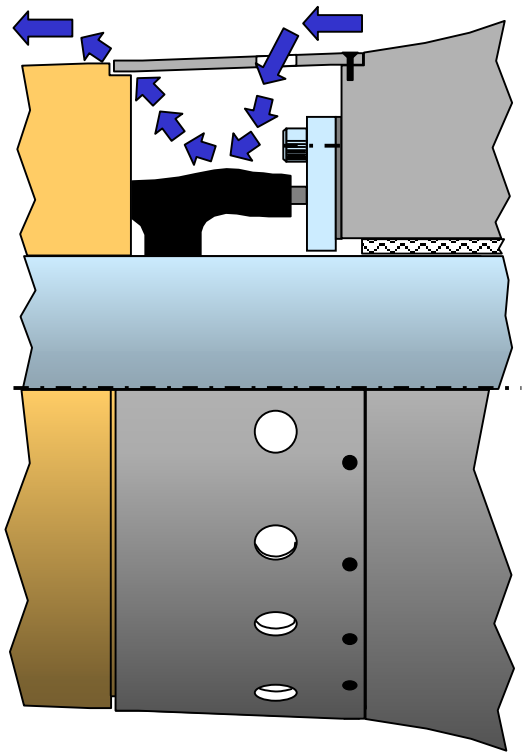
8.6. Propeller Fitting

8.6.1. Fit the propeller, ensuring that any traces of oil or grease are removed from the aft end of the seal body and the face of the propeller boss. Re-confirm that the distance between the forward face of the propeller boss and the running face of the seat, is as stated on the general arrangement drawing. Also check that the end of the seal body is fully supported by the propeller boss.

8.6.2. The aft end of the seal body is the primary drive and pressure boundary. Bore sealing cannot be guaranteed and if a keyed propeller is used it is important to ensure that the propeller cone is watertight.

8.7. Fitting the Ropeguard

After a successful test (Section 9), fit the rope guard, ensuring that it has holes at the forward end equivalent in area to two 50 mm diameter holes, to allow water flow over the seal.



9. TESTING

9.1. Static Test

Pressure test the seal and sterntube/thruster gear housing.

9.1.1. For Oil Lubrication - the seal will withstand a test pressure of 1.0 bar. An oil pressure of more than 1.2 bar may preclude a satisfactory test where there is no water outside the seal. Leakage should be zero during the static test although a slight weep from the face is permissible (this is often referred to as a bead of oil at the interface). Provided that the leak rate does not exceed 1 drop every 60 seconds this should reduce when the seal has been ‘run-in’.

9.1.2. For Grease Lubrication - the same pressures and parameters are applicable as for oil. Leakage should be zero during the static test although a slight bead of grease from the face is permissible (the 'flow' of grease will be almost imperceptible). This 'flow' will cease when the seal has run in.

9.2. Dynamic Test (Thruster Units Only)

Sometimes thruster units are tested dynamically before launch. If the seal is to be tested dynamically once installed, the following criteria should be followed.

9.2.1. Option 1

If possible the seal should be fully immersed in a suitably sized test tank containing sufficient water to cool the seal interface.

9.2.2. Option 2

If no test tank is available a suitable test rig/chamber which surrounds the complete seal interface on the thruster unit should be fitted. A cooling water flush of 1 litre/hour/mm of shaft diameter can then be pumped through the test chamber. The inlet to the test chamber should be positioned at the bottom, with the return outlet at the top. This will ensure that sufficient cooling water flow is supplied to the seal interface also ensuring that the test chamber is flooded at all times. The maximum oil/water pressure differential should not exceed 0.8 bar.

9.2.3. Option 3

If no test tank or chamber is available the seal can be operated in air, provided that a thermocouple is attached to the seat near the seal interface and the interface temperature monitored. The maximum interface temperature is 80°C. A higher temperature will cause damage to the seal resulting in operational failure when in future service.

It is recommended that cooling jets of water are used to spray the seal assembly. The sprays being positioned around the circumference of the sealing interface.

Option 3 should only be used when Options 1 and 2 are not possible. Deep Sea Seals Ltd. cannot accept any liability for failure of the seal during this type of test due to operation of the assembly outside of its design parameters.

10. NORMAL OPERATION

During Normal Operation with the "EK" seal functioning within parameters, all conditions should be stable.

10.1. Stable Operating Conditions

10.1.1. Header Tank Level steady. No change in the level should be seen.

10.1.2. Lubricant conditions good. All analysis figures should be within acceptable range according to the Lubricant Manufacturers data.

10.1.3. Bearing temperature normal.

10.2. Routine checks that should be conducted

10.2.1. Check and record Header tank level daily, refilling as necessary.

10.2.2. Check and record bearing/sterntube lubricant temperature daily.

10.2.3. Visually inspect water around Outboard seal area for leakage whenever possible.

10.2.4. Check Header Tank alarm(s) weekly for correct operation.

10.2.5. Check stern tube/bearing for water ingress using the sampling cock.

10.2.6. Test the lubricant in accordance with the manufacturers recommendations.

11. LUBRICATION SYSTEM

For an "EK" Outboard seal used in an "Oil" lubricated system, refer to Technical Data Sheet (T.D.S.) 1/007. Sheet 1. See Section 16.

This defines the requirements of the Oil system with respect to Header Tank heights, Pressures and required differential pressures.

Sheet 2 relates to the cooling requirements for an "Inboard" "E"-series seal and is not relevant to the Outboard "EK" seal.

Where grease is used as the lubricant, there is no 'recommended' system however it must comply with the general requirements stated in TDS 3/008 See Section 16.

Comment - unlike oil systems, the pressure in a grease system can vary throughout, therefore the pressure measured at the grease injection point may not be the same as the pressure at the outboard seal.

12. RECOMMENDED LUBRICANT LIST

For an "EK" Outboard seal used in an "Oil" lubricated system, refer to Technical Data Sheet (T.D.S.) 9/001 Sheet 4 of 4 See Section 16 which lists recommended and acceptable oils for use with "E" series seals.

For Grease lubricated systems, no approved list currently exists. Where acceptance is required, please refer to Deep Sea Seals Ltd. (see addresses, Section 2).
The grease should be suitable for the bearing system.
The grease should not be a Silicon, Synthetic or High Temperature grease.

Refer to TDS 9/001 Sheet 4 of 4 See Section 16.

13. PROBLEM SOLVING - Level 'a'

13.1. Any problems with the “EK” Outboard seal will normally show themselves in one of two ways:

(A) The loss of lubricant from the system.

(B) Water ingress into the lubricating system.

(Refer to the associated causes and corrective actions in Section 13.4 and 13.5).

13.2. Evidence that either of the above has occurred will be demonstrated in one of the following ways. (Also refer to the associated problem solving flow charts in Section 13.3 as indicated below).

(i) Water or an Emulsification found during routine testing of the bearing lubricant. (Flow chart 13.3.2).

(ii) A low level alarm warning from the bearing Header Tank. (Flow chart 13.3.3).

(iii) A visible leak/discharge outboard into the water. (Flow chart 13.3.4).

(iv) An increase in the level or overflow of the bearing Header Tank activating the high level alarm if one is fitted. (Flow chart 13.3.5).

(v) A high bearing-lubricant temperature alarm. (Flow chart 13.3.6).

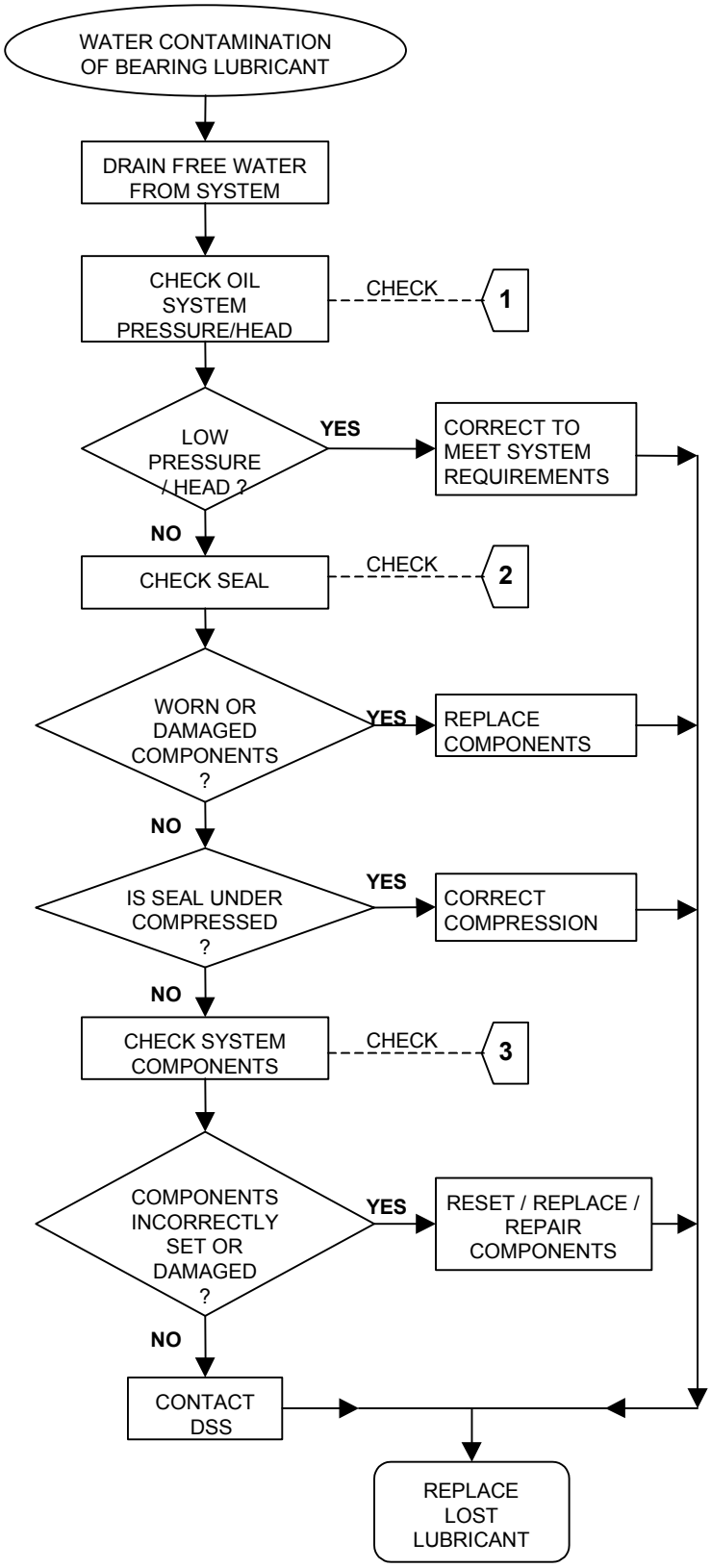
13.3. "Flow Charts"

Explanations of the above, including cause, effect and corrective actions now follow:

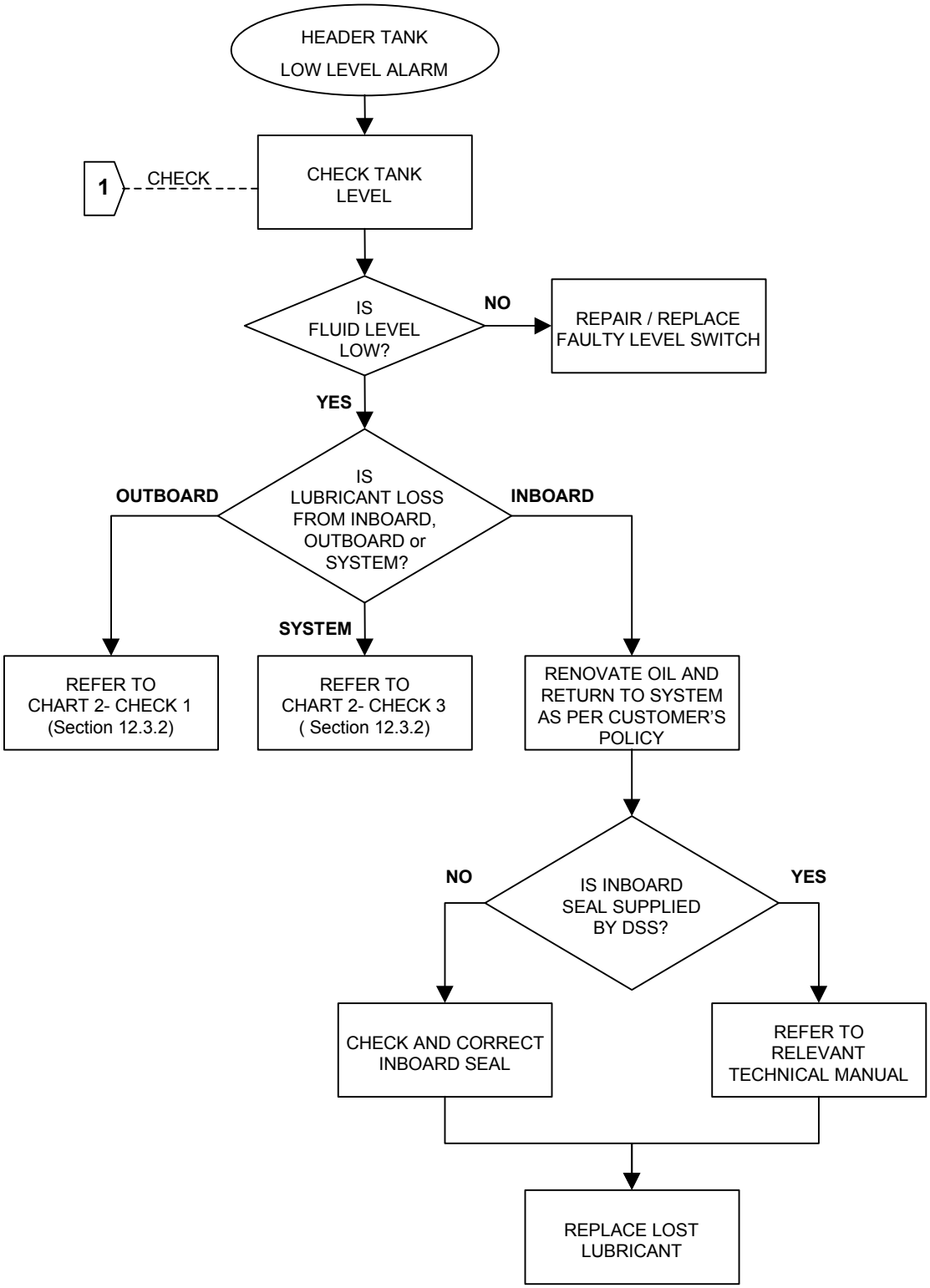
13.3.1. Normal Operation

For Normal Operating Conditions, refer to Section 10 (in conjunction with Head Tank locations shown in Section 6).

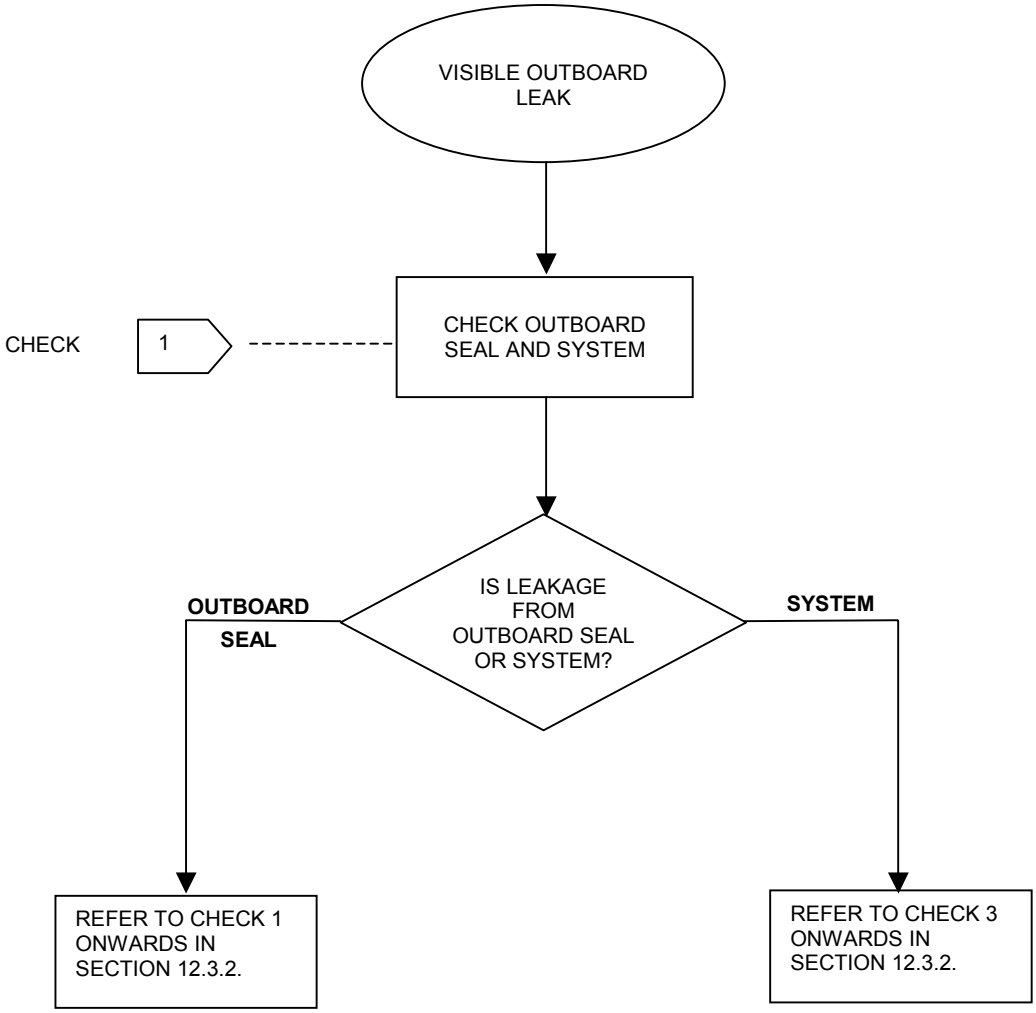
13.3.2. WATER/EMULSIFICATION DISCHARGE FROM BEARING TEST VALVE OR COCK.



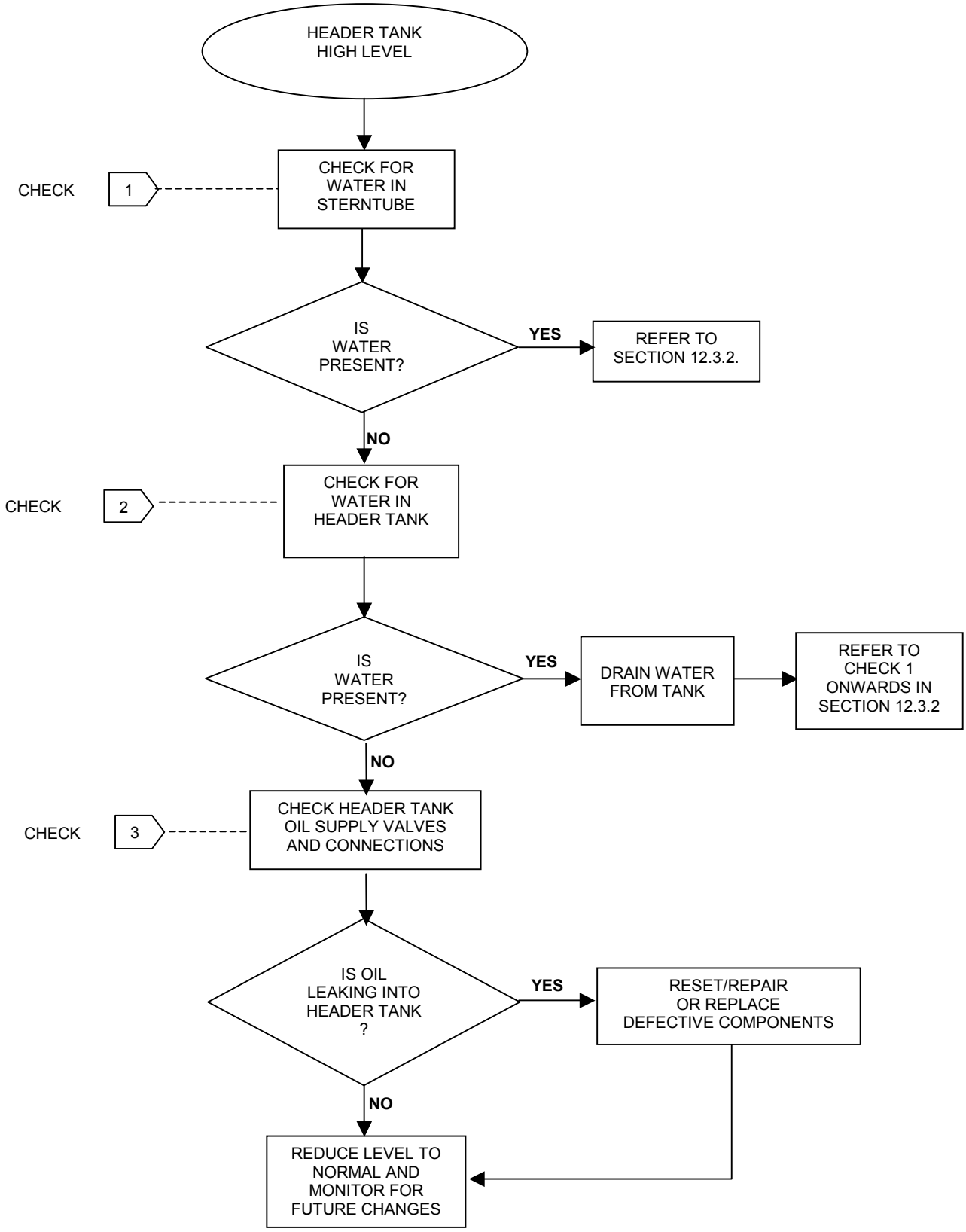
13.3.3. HEADER TANK LOW LEVEL ALARM.



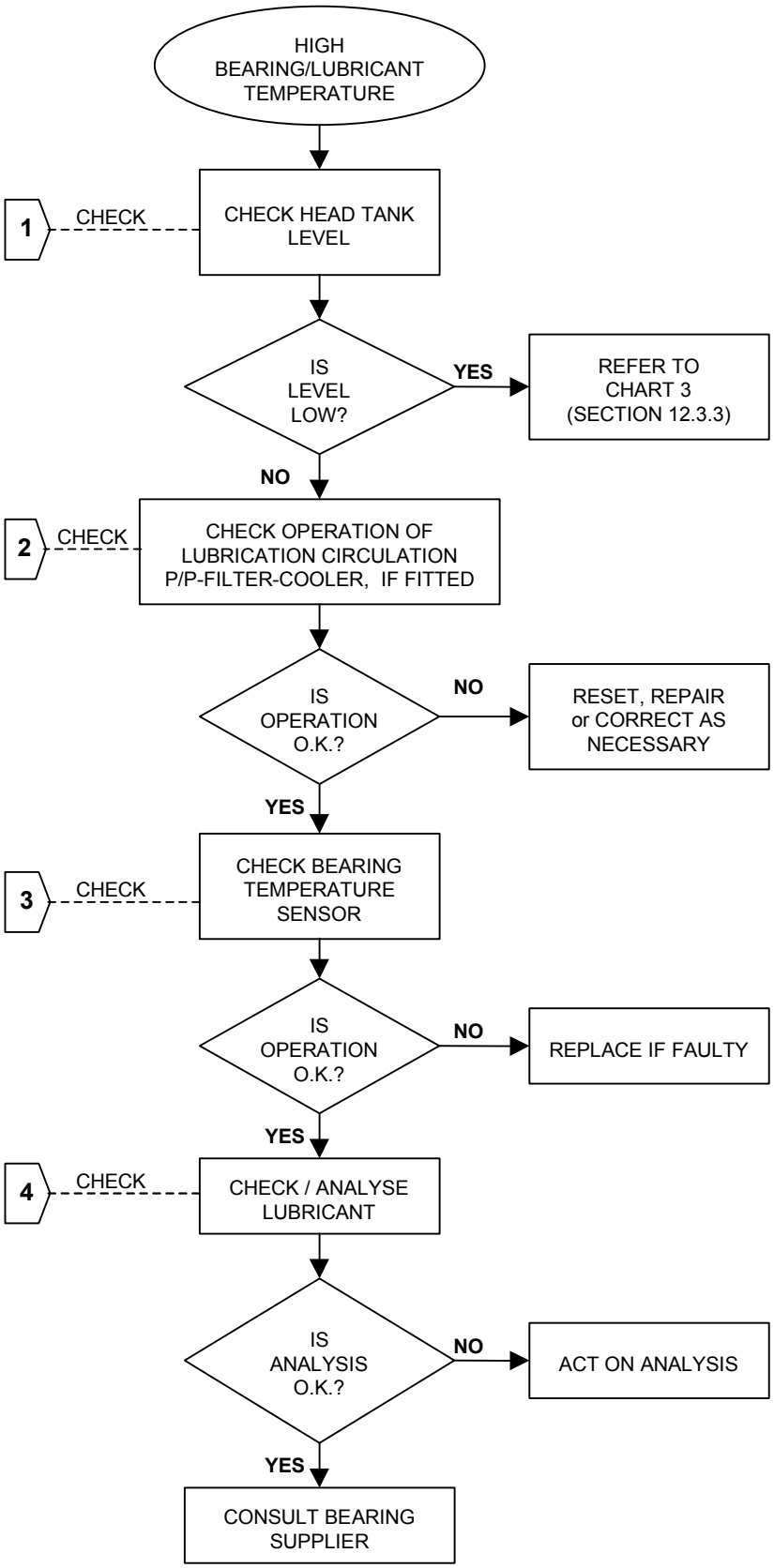
13.3.4. VISIBLE LUBRICANT LEAK OUTBOARD



13.3.5. HEADER TANK OVERFLOW OR INCREASE IN LEVEL



13.3.6. HIGH BEARING - LUBRICANT TEMPERATURE



13.4. Section “A” - The loss of lubricant from the system!

Lubricant loss via the Outboard seal may be due to one or more causes. For each, a suggested course of corrective actions follow:

CAUSE		CORRECTIVE ACTION	
A1	Lubricant pressure too high.	**a**	Reduce to that stated in the Technical Manual.
A2	Loss of seal compression due to age or wear.	**a**	Reduce the lubricant pressure (a little at a time) to establish a "balance" with the water. This reduces leakage and still protects the bearing.
		b	Temporarily (for "oil") if "a" does not stabilise the situation, the oil can be changed to one designed to operate with a leaking outboard seal (e.g. Vickers Hydrox 550).
		c	Replace the component(s) responsible for the loss of compression.
A3	Insufficient Compression due to installation or axial shaft movement	**a**	As for 2a.
		b	As for 2b.
		c	Establish the correct compression using a thicker joint or spacer behind the seat or housing. Alternatively fit a thicker seat or housing.
		d	Determine and rectify the causes of excessive shaft movement.
A4	Debris (e.g. Line, net or rope).	**a**	As for 2a.
		b	Carefully remove any debris. If no damage has occurred a good seal should be re-established. If damage has occurred - refer to "A5".
		c	As for 2b.
		d	Improve the ropeguard/net cutter arrangements etc. to prevent re-occurrence.
A5	Damage to the outboard seal.	**a**	If the seal is damaged and is leaking then proceed as for 2a. having first checked for and carefully removed any debris.
		b	As for 2b.
		c	Replace damaged components as soon as is possible.
		d	As for 4d.

13.5. Section “B” - Water Ingress into the Lubricating system!

As for lubricant loss, water ingress may be due to one or more causes (basically identical to those responsible for lubricant loss).

For each, a suggested course of corrective actions follow:

CAUSE		CORRECTIVE ACTION	
B1	Lubricant pressure too low.	**a**	Increase to that stated in the Technical Manual.
B2	Loss of seal compression due to age or wear.	**a**	As for "A" 2a - but - "increasing" the pressure to establish a "balance".
		b	As for "A" 2b.
		c	As for "A" 2c.
B3	Insufficient compression due to installation or axial shaft movement.	**a**	As for "B" 2a.
		b	As for "A" 2b.
		c	As for "A" 3c.
		d	As for "A" 3d.
B4	Debris (e.g. line, net or rope).	**a**	As for "B" 2a.
		b	As for "A" 4b - However if damage has occurred, refer to "B" 5.
		c	As for "A" 2b.
		d	As for "A" 4d.
B5	Damage to the Outboard Seal.	**a**	If the seal is damaged and is leaking then proceed as for "B" 2a. having first checked for and carefully removed any debris.
		b	As for "A" 2b.
		c	As for "A" 5c.
		d	As for "A" 4d.

NOTE: Where corrective actions involving material replacement, refurbishment or adjustment have rectified a situation, then any “temporary” measures taken such as changes in lubricant type or pressure should be reverted to normal.

NOTE: If these Problem Solving measures fail to rectify a situation, then assistance and further advice should be sought via one of the contact addresses given in the front of the Technical Manual.

14. MAINTENANCE

(Refer to relevant Drawing(s) - see Attachments - Section 16.)

14.1. The need for "Maintenance" may be determined by several factors which are performance related. Alternatively, though the performance of the equipment may be perfectly satisfactory, maintenance may be carried out as part of a planned/preventative schedule. Overhaul of the equipment may also be carried out because it is part of a system or assembly that is itself needing or due for maintenance!

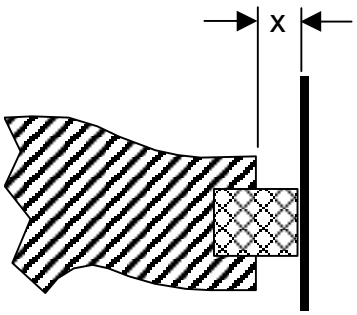
14.2. Factors that normally determine the need for Maintenance are:

14.2.1. Performance :-

Loss of lubricant from the system or water ingress into the system.

14.2.2. Wear :-

Normally associated with the fibre "face" in the "EK" seal, though it does to a lesser degree affect the ni-resist seat.
Wear is important as the loss of material means a loss of compression in the rubber body, which can lead to leakage.
Wear can be determined by measuring the distance between the seat and the rubber body (see below).



Condition for Seal Size:		Status
#50-#60	#70-#320	
X = 5 mm	X = 6 mm	'as new'
X > 3 mm	X > 4 mm	O.K.
X < 3 mm	X < 4 mm	Replace body assembly

Normally an oil lubricated seal experiences low levels of wear, however, operation in abrasive conditions, may lead to higher wear rates than when operating in clean water.

14.2.3. Damage:-

The seal can be damaged due to debris or physical intervention - usually associated with fishing line, nets, rope, wire etc. connected with a poorly designed / fitted or damaged rope guard.

14.2.4. Age:-

The face and seat elements have no limitation with regard to Age. Their "service life" will be governed by "Performance", "Wear" or "Damage".

The life limit for the EK **"rubber"** body is 10 years (elapsed time - not just operation) and renewal must be carried out every 2nd 4/5 year docking. However, it is more likely that for operational reasons (Performance, Wear or Damage) all rubber components will be replaced "every" 4/5 year docking.

Replacement of the EK body at least every 8-10 years is recommended as the body is compressed on fitting and provides the necessary closing force between the face and seat. Rubber loses "elasticity" over a period of time and the body will develop a "permanent set" with a subsequent loss of closing force.

14.3. To replace or carry out maintenance on either the "EK" seal body or seat assembly, the propeller must be removed to allow removal of these non-split items.

Note : Shut off the oil supply to the bearing and drain the oil from the sterntube/housing assembly, before commencing removal procedures.

14.4. Whenever replacing the seal body assembly, the seat should be removed and re-conditioned or replaced as required.

A new seal face should not be run against a previously used seat that exhibits any evidence of wear or grooving. If the seat cannot be restored to an "as new" surface condition by abrading (rotary motion) with a 600 grade grit paper; it must be machined to remove any wear track or pattern.

See section 7.2.3. for the machining finishes and tolerances. If more than 1·0 mm needs to be machined off of a seat which is already at its minimum thickness, then it should be replaced due to the loss of compression as previously referenced. See Section 8.2.3 with reference to maximum joint thickness.

14.5. Fit or refit the seat and body assemblies as per Section 8, Installation.

14.6. Replace the Propeller in accordance with Section 8.6 & 8.7.

14.7. Pressure test the seal as per Section 9 (Testing).

14.8. Refit the Rope Guard - See Section 8.7.

15. SPARE PARTS AND THEIR STORAGE

15.1. For the "EK" seal, as it is basically only a 2 component assembly (Body Assembly and Seat Assembly), the requirement for "Spare Parts" is limited.

15.2. The seat assembly is considered to be a refurbishable item using a simple machining process as described in Section 14 (Maintenance). The only component that might be held as a "spare" is a body assembly. However due consideration must be given to the possibly lengthy storage of a rubber component.

15.3. All parts held as spares should be kept in their original packaging as they will have been inspected and packed prior to despatch as described in Section 4 (Storage and Handling).

15.4. All components must be protected from damage or deterioration by maintaining their original packing and careful storage to prevent physical damage (with special care being taken of any fine machined surfaces or critical components).

All spares should be stored flat and unobstructed in a dry, cool and dark environment, as described in Paragraph 4.6.

16. ATTACHMENTS.

The following attachments should accompany this Technical Manual (TM EK/01).

- Tabulated or Specific General Arrangement Drawing(s) ✳
- TDS 1/007
  TDS 3/008
  TDS 9/001 Sheet 4 of 4 (ManeBar Recommended / Acceptable Oils Listing).

✳ **Note:** This manual is written based on the "Tabulated" General Arrangement Drawings listed on the front cover.

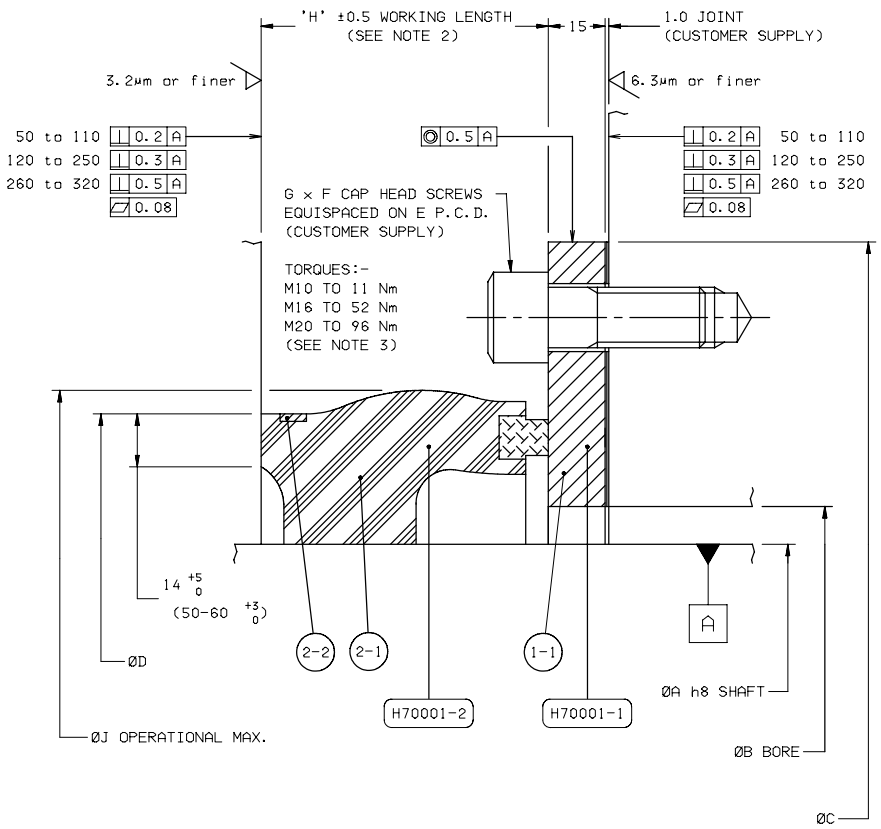
However, EK seals with a **"specific"** General Arrangement Drawing that are derived from one of the listed "Tabulated" Drawings, are also covered by this Technical Manual.

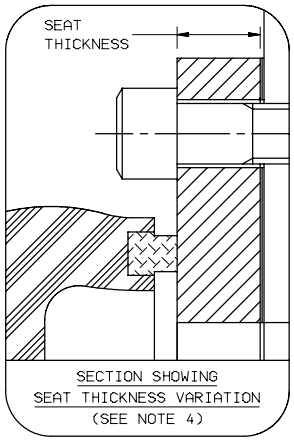
In all instances the Drawing(s) specific to the application must be included after this attachment page and referenced in conjunction with this manual

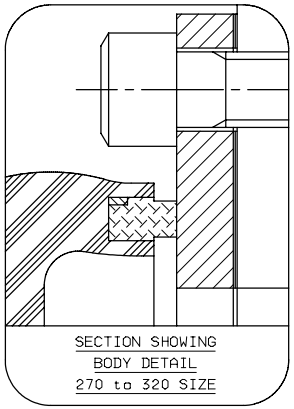
The attachments referenced above, now follow:

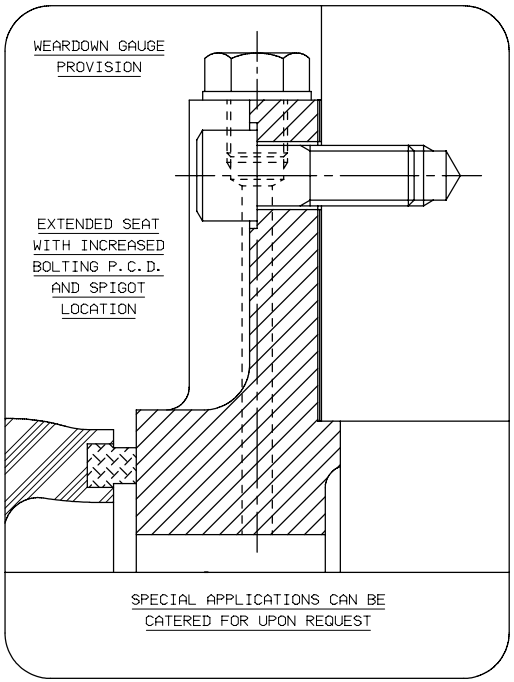
DRG NO: H70001	CODE: DRAWN AS FOR 140 - 230	TDS 16/026	50 MM FULL SIZE	3RD ANGLE PROJ

DRG POSN	DESCRIPTION	MATERIAL	QTY
H70001-1	SEAT ASSY (NON-SPLIT)		1
-1-1	SEAT (NON-SPLIT)	NI-RESIST	1
H70001-2	BODY ASSY (NON-SPLIT)		1
-2-1	BODY (NON-SPLIT)	NEOPRENE	1
-2-2	SHROUD RING	BRONZE	1
H70001-TM	TECHNICAL MANUAL	TM-EK/01	1









NOTES

1. ALL DIMENSIONS IN mm.
2. THRUSTER APPLICATIONS WORKING LENGTH = 'H' + 2.0
3. TIGHTEN SCREWS DIAMETRICALLY OPPOSITE IN EVEN STAGES TO ACHIEVE TORQUE FIGURES STATED.
4. SEAT MINIMUM THICKNESS SUPPLIED IS 15mm BUT A GREATER THICKNESS MAY BE SPECIFIED AS REQUIRED, WITH THE WORKING LENGTH REMAINING AS DIMENSION 'H'.
5. CUSTOMER MUST PROVIDE A SUITABLE ROPEGUARD TO PROTECT THE SEAL.

SERVICE DATA

SERVICE.....: OIL (SEE TDS 9/001)
TEMPERATURE.....: -5 TO 40°C
OIL PRESSURE (MAX).....: 0.8 BAR
SEAWATER PRESSURE (MAX).....: 0.5 BAR
DIFFERENTIAL PRESSURE (MIN).....: 0.3 BAR
SHAFT AXIAL MOVEMENT (MAX).....: +1 -2 (+ MEANS SEAL IS COMPRESSED)
SHAFT RADIAL MOVEMENT (MAX).....: ±5.0
SHAFT LENGTH (MAX).....: 10 METRES

A FROM	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	FROM A
BELOW	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	BELOW
B BORE	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	BORE B
C Ø	164	174	220	230	240	250	260	270	280	300	310	320	330	340	350	360	370	380	390	405	415	425	435	445	455	465	485	495	Ø C
D Ø	112	122	136	146	156	166	176	186	196	209	219	229	239	249	259	269	279	289	299	309	319	329	339	349	359	369	379	389	Ø D
E PCD	142	152	185	195	205	215	230	240	250	260	270	280	290	300	310	320	330	340	350	365	375	385	395	405	415	425	445	455	PCD E
F SCREWS	M10	M10	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M16	M20	M20	M20	M20	M20	M20	M20	M20	M20	SCREWS F
G No OFF	4	4	4	4	4	4	6	6	6	6	6	6	6	6	8	8	8	8	8	8	8	8	8	8	8	8	8	8	No OFF G
H LTH	62	62	62	62	62	62	62	62	62	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	76	LTH H
J Ø MAX	127	139	153	163	179	186	192	206	219	231	241	255	261	272	281	297	307	314	326	333	344	353	359	371	382	389	399	412	Ø MAX J
REV/MIN	1350	1300	1250	1120	1040	975	920	870	825	780	740	700	660	640	605	580	550	530	510	495	475	460	455	440	430	420	410	400	REV/MIN

John Crane-Lips

MARINE PROPULSION SYSTEMS

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CUSTOMER: GENERAL

USED ON: OIL LUBRICATED BEARINGS

CONTRACT: ***

DRN: G.E. BARRETT

CHK: A.C. LANE

REF: DSS

MOD: 6-SEPT-2000

DATE: 10-AUG-1982

John Crane-Lips EMA

SEALS & BEARINGS

4 MARPLES WAY
HAVANT
HAMPSHIRE
PO9 1NX
ENGLAND

CLASS: ABS BV DNV KR NKK

TITLE: TABULATED GA OF TYPE EK OUTBOARD SEAL

SIZE	DRAWING NO	REVISION
A2	H70001	K

SCALE 1:1 SHEET 1 OF 1