

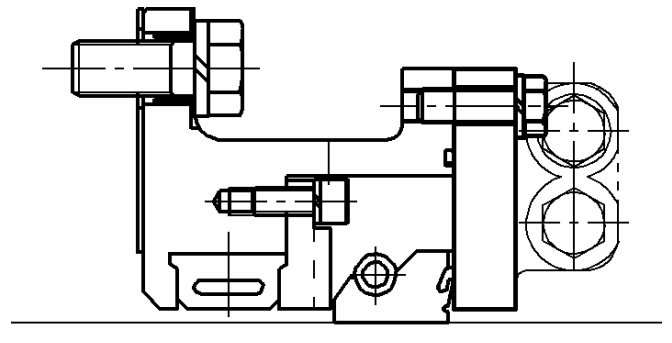
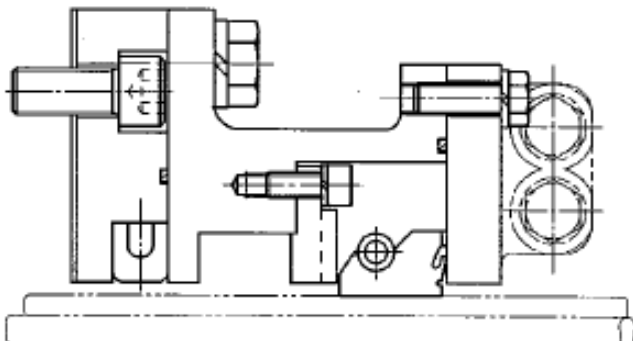
# INSTRUCTION MANUAL

## Kobelco Eagle Marine

### Water Lubricated

### Stern Tube Seals

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**\*\*\*Read this manual before disassembly or removing the shaft . Some steps should be done before shaft removal.**

## A. Description of Seal Assembly

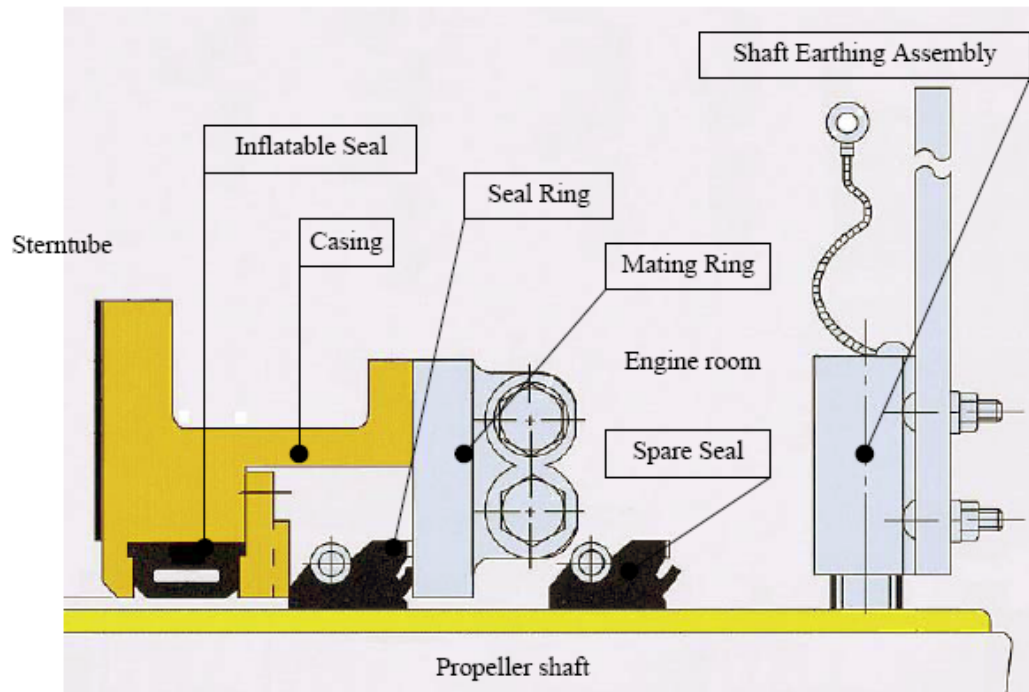


Figure 1

The seal comprises the following principal components, refer to figure 1.

1. The mating ring provides the sealing surface against which the seal ring makes face contact. For ease of maintenance the mating ring is split so that it can be removed from the shaft when a seal ring requires changing. It can be reused by machining on the worn end face.
2. The seal ring is constructed from Nitrile rubber. The seal ring is fixed to the shaft by a Stainless Steel garter spring. As the seal ring rotates with the shaft, its face makes contact with the mating ring. Therefore, it does not wear the shaft, as does the conventional gland packing.
3. The inflatable seal is positively located on 2 sides within the seal casing. When filled with compressed air the inflatable seal inflates and makes contact with the shaft preventing any seawater from entering the ship once the mating ring is removed. The inflatable seal is used when a seal ring requires changing. The inflatable seal should never be inflated while the shaft is turning. The seal can be fitted with two different types of inflatable rings. The figure above shows the standard style inflatable ring. A "U" shaped inflatable ring can also be fitted.

## B. Installation

**Before starting installation, the shaft sleeve and bulkhead or stern tube where the seal will be installed should be inspected to check for damage. If there is any damage or a question about the condition of the shaft sleeve or mounting flange, please contact your Kobelco Eagle representative.**

The installation of the Kobelco Eagle water lubricated seal is a simple procedure. The following steps will ensure that the installation is a success and will help to provide many years of trouble free operation.

The steps for installation of the water lubricated seal are as follows:

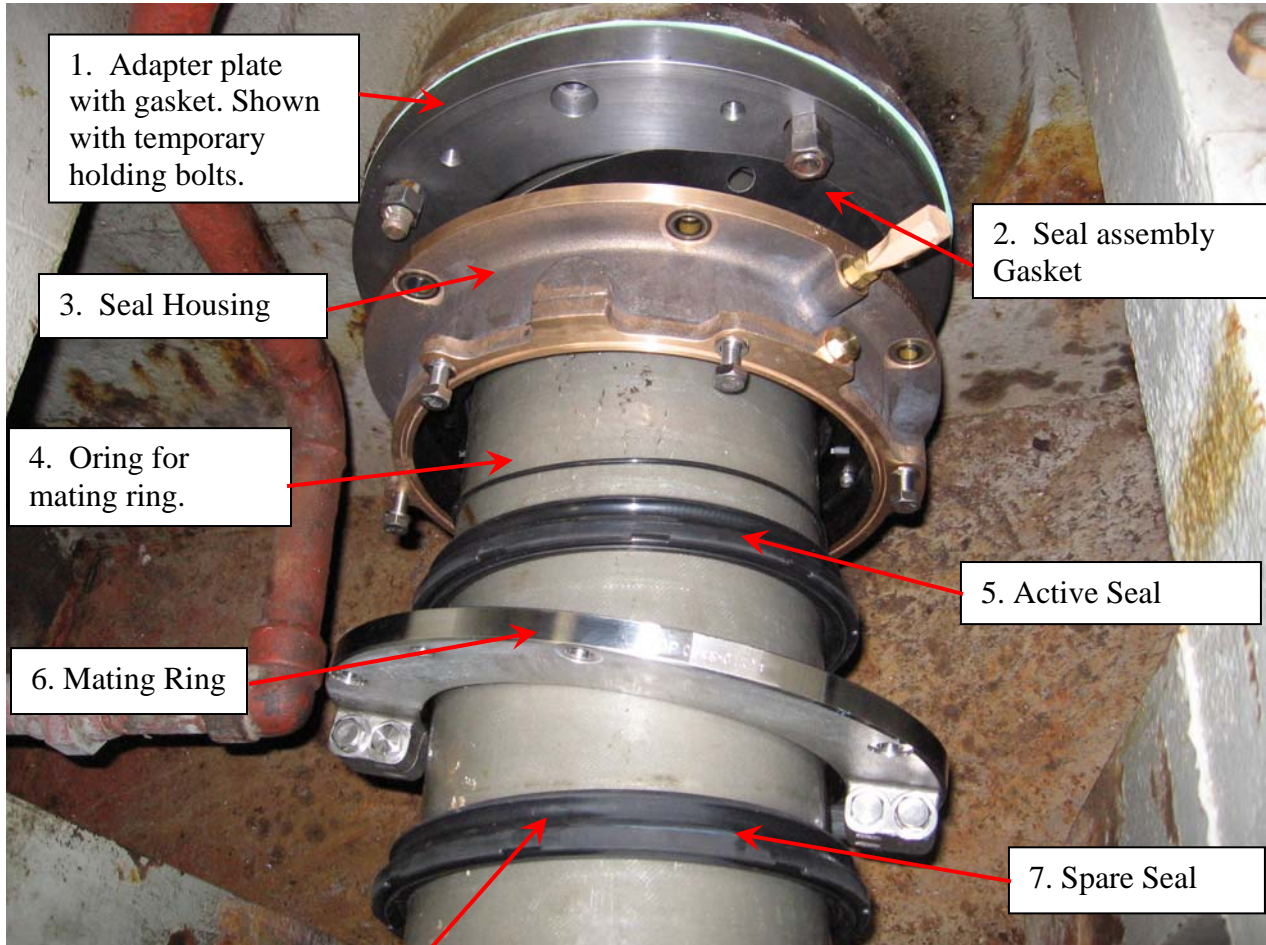
- (1) Before removal of the tailshaft for an existing installation, the following steps should be taken.
  - (a) Unbolt the stuffing box or packing gland from the stern tube.
  - (b) Fix a dial indicator to the tailshaft close to the mounting location of the seal assembly.
  - (c) Place the pointer of the dial on the mounting flange or location where the seal will mount.
  - (d) Check the run out or squareness of the face of the mounting flange. Readings should be taken at eight equally spaced locations around the flange.

Dial reading to this face.



- (e) Record these readings. The maximum dial reading is 0.020 inches. If a reading is greater than this, contact your Kobelco Eagle representative to discuss the solution.
    - (f) Inspect shaft liner in area where new seal will be installed. Any grooves or problems should be repaired.
    - (g) Complete any machining required to mount the adapter plate. Discuss this step with your Kobelco Eagle representative.

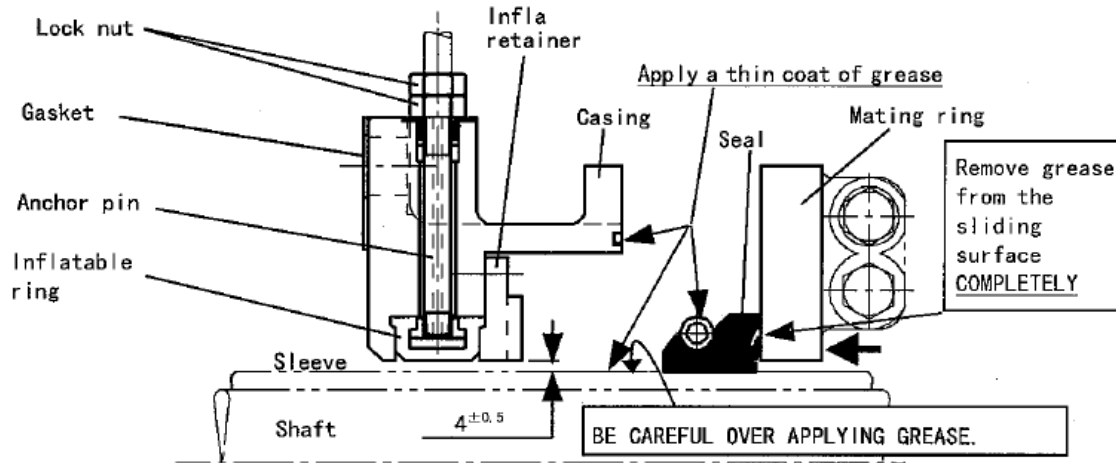
- (2) Uncouple shaft and drift back or remove, depending on situation.
- (3) After the shaft is ready to go back in, the adapter plate and seal assembly should be stacked on the shaft. The following picture shows the assembly stacked in the correct orientation. Particular attention should be paid to the direction the seals are mounted on the shaft. The groove for the spring should be towards the propeller side.
- (4) Please note that the inflatable sealing ring should be installed in the housing. If it is not installed, see the steps for installation in the overhaul section of this manual before stacking parts on shaft.**



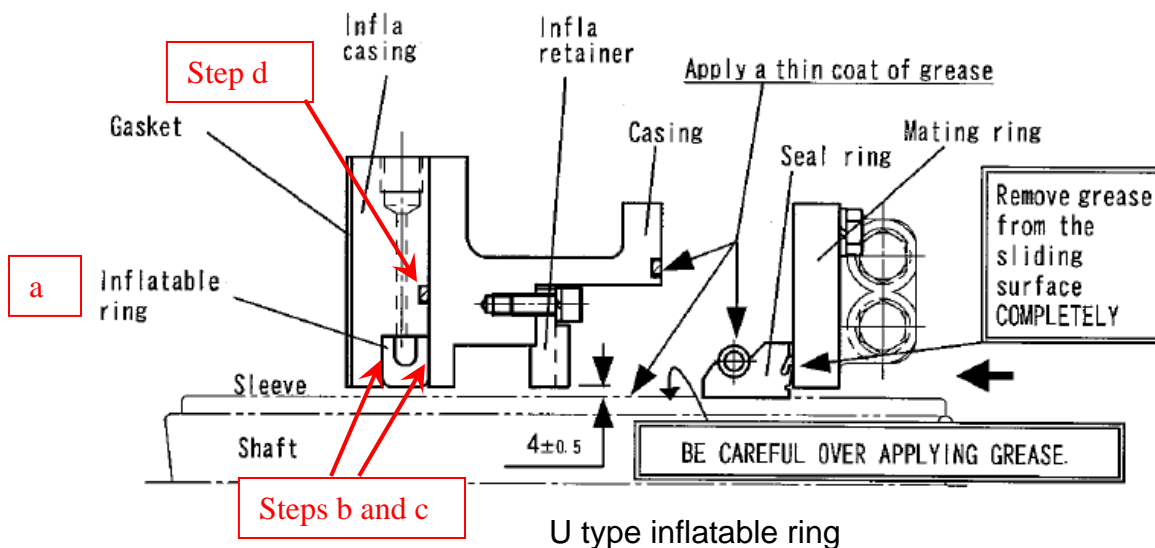
Note the location and orientation of the seal, the groove for the spring is towards the propeller side.

- (4) At this point in time, the coupling can be reinstalled on the shaft and the shaft slide back into position and coupled back to the gear box.

- (5) The adapter plate can now be installed. Apply a liquid gasket material to both sides of the adapter plate gasket. Suitable liquid gasket materials include: 3-Bond, Permatex #2, or 5200. The adapter plate should then be bolted to the stern tube mounting flange. Check that the adapter plate is centered to the shaft within 0.020" of center, using feeler gauges. Adjust the adapter plate as needed.
- (6) Clean the shaft sleeve using a light solvent, WD 40 etc.
- (7) If you have the D shaped inflatable seal, skip to step 8, follow the steps below for the U shaped inflatable (refer to the two pictures to identify which inflatable sealing ring you have, if necessary.)



D type inflatable ring

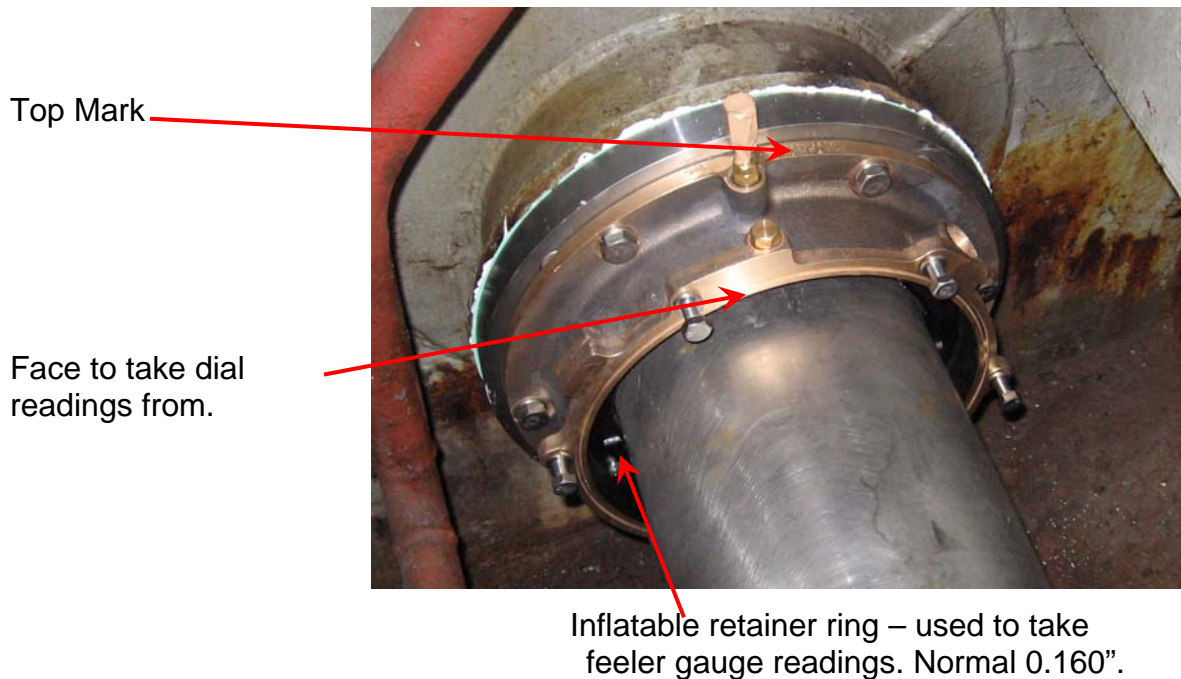


U type inflatable ring

- (a) The U shaped inflatable seal fits in the adapter plate or infla casing supplied by Kobelco Eagle.
- (b) Apply a thin coating of grease to both sides of the inflatable sealing ring.
- (c) Insert the inflatable sealing ring into the adapter plate groove.
- (d) Place the oring in the groove of the adapter plate.



- (8) Mount the seal casing to the adapter plate, making sure the rubber gasket is in position. **\*\*Make sure the top mark on the seal casing is at the top.** The seal casing should then be centered to the shaft using feeler gauges. The maximum allowable deviation from center is 0.020". The feeler gauge will slip under the inflatable seal retaining ring a slight amount, then bump against the inflatable ring in the case of the D type inflatable seal ring. **The normal clearance is 0.160"**. Take care that the retainer ring is used for centering, not the inflatable ring. Tighten all seal assembly mounting bolts. If there is a problem centering the housing, discuss this with your Kobelco Eagle representative. Record these readings on the sheet provided.



- (9) Again mount a dial indicator on the shaft just forward of the seal assembly. Take another set of face readings from the seal assembly casing.
- (10) Record all of the readings on the sheet shown on the next page. Submit a copy of the sheet to your Kobelco Eagle representative for record keeping and warranty purposes. Completely fill out the sheet and save with the manual for future reference.



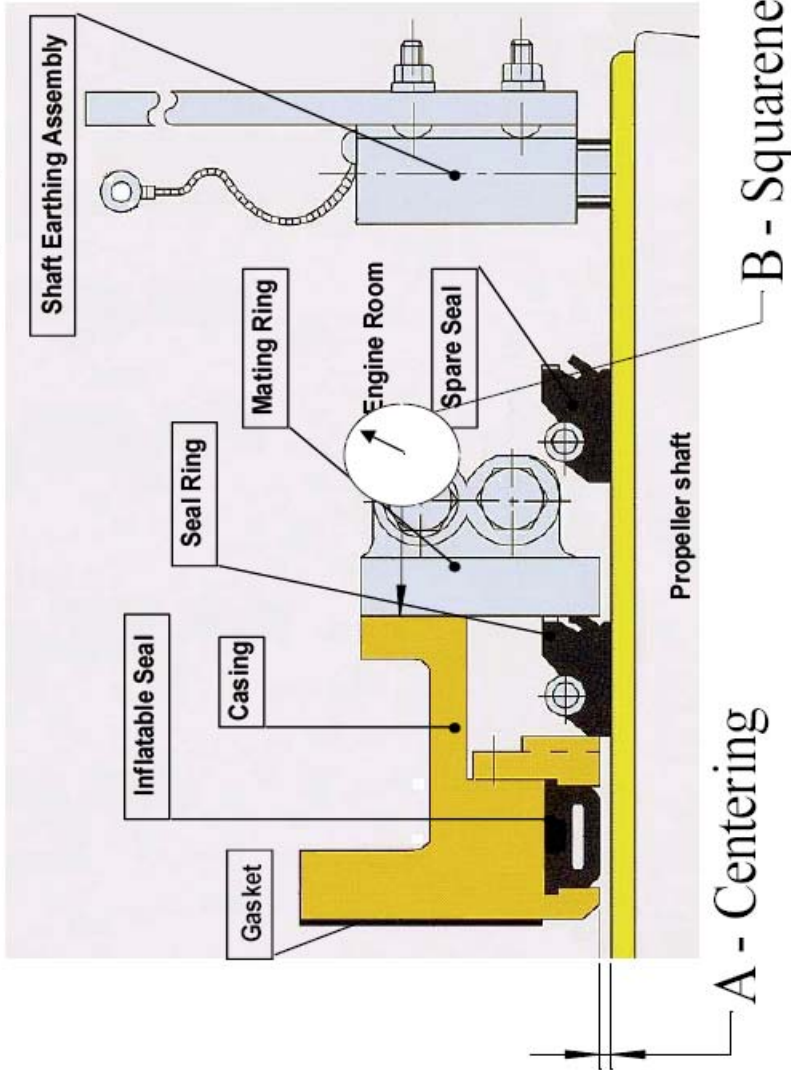
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Kobelco Marine Stern Tube seal installation

Vessel	
Owner	
Location of Repair	
Shipyard	

Service Engineer		
Service Period		to
Seal Size		
Serial Number		



Position	A - Centering	B - Squaresness
Top		
1:30		
Stbd		
4:30		
Bottom		
7:30		
Port		
10:30		
Top		
1:30		
Stbd		
4:30		
Bottom		
7:30		
Port		
10:30		

Notes / Comments:

- (11) Clean the shaft again using a light solvent such as WD 40.



- (12) Install the oring for the mating ring. Use a light grease or oring grease on the oring.



- (13) Place a light coating of grease on the shaft. Wipe the grease coating with your hand to remove any heavy concentrations of grease.





- (14) Slide the sealing ring onto the liner and push towards the seal housing. Place the garter spring around the shaft and hook together. Roll the garter spring into the groove on the sealing ring. Wipe the sealing ring clean with a soft cloth. **Make sure that there is no grease on the sealing ring lip or mating ring, since grease on the lip will damage the sealing ring. If there is any grease, remove using a solvent such as Methyl Ethyl Ketone (MEK) or equivalent.**



- (15) Push the sealing ring towards the housing, but not into the housing. Make sure the seal is extending past the housing at least 1/2" all the way around. Align top mark on mating ring with top mark on housing. Push the mating ring towards the housing and use the mating ring to push the seal into the housing. Once bolts can be started, install all of the mating ring mounting bolts and using opposite bolt pairs, tighten bolts to pull mating ring and seal into housing. Make sure oring for the mating ring stays in location and tighten all mating ring bolts in a star pattern.



- (16) Slide the spare seal up onto the liner and install the garter spring. The spare seal should then be protected using either a grease tape or a light layer of grease with plastic wrap and duct tape over the seal. The sealing ring should be positioned about 2 to 3 “ from the seal assembly, depending on the length of the liner. In no case should the spare seal touch the seal assembly.
- (17) Install the shaft grounding assembly in a convenient location near the seal assembly. Make sure the assembly is properly bonded to the ships structure. There is a small set screw in the side of the shaft ground which will allow the ground to be pressed against the shaft by spring force.

## C. Piping

- (1) Each vessel has different requirements for piping. The following is for guidance only. If you are unsure of what should be done, contact your Kobelco Eagle representative.
- (2) Piping for water supply
  - i) The seal housing is fitted with one or two 1” NPT connections, depending on seal size, for water supply. If water supply is needed in your installation, the 1” fitting or fittings should be used.
  - ii) The seal assembly does not require any water supply, the connections are in place for water supply to the bearings. Your bearing manufacturer should be able to provide a required water flow for the type of bearing installed.
  - iii) Some vessels are fitted with scoop type water supply, in this case, install a 1” stainless plug or plugs in the seal housing.
  - iv) For vessels which operate in muddy or dirty water, a flushing connection is recommended. A 1” pipe nipple with a valve and garden hose connection should be installed. This will allow flushing of the seal on a weekly to monthly interval, depending on the situation. Talk with your Kobelco Eagle representative if you have any questions.
- (3) Piping for Air supply
  - i) The seal assembly inflatable bladder should be fitted with some way of pressurizing the air bladder with compressed air. The air pressure supplied to the air bladder should not exceed 80 psi. An air regulator should be used to control the air pressure.
  - ii) A typical method of introducing air the inflatable bladder is by either installing a quick connect fitting and plugging the ships service air into an air regulator and then into the seal assembly or if there is no ships service air, using a Schrader valve and a bicycle pump.
  - iii) The D type inflatable sealing ring is shown in the pictures above. The U type inflatable sealing ring is in the adapter ring, so the air fitting is screwed in to the top of the adapter ring.

## D. Installation testing

(1) Before or during undocking, the seal assembly should be tested for proper operation. The two methods are described below:

i) Testing while in drydock:

- (1) Make a temporary connection to the 1" fitting in the seal housing to a garden hose with a pressure gauge in the line.
- (2) Make a connection to the inflatable seal with an air line, pressure regulator and gauge. There should be a valve to shut off the air supply, but still maintain pressure on the inflatable seal and pressure gauge.
- (3) Inflate the inflatable seal with air to 40 psi. Close the valve to the inflatable seal. Make sure that the pressure in the inflatable seal does not drop at a rate higher than 10% of the air pressure per hour.
- (4) Supply water to the seal casing at 2 times the standard draft pressure. For example, a 10 foot draft should supply about 10 psi water pressure.
- (5) Maintain this water pressure for 15 minutes, check for leaks from the sealing ring.

ii) Testing during undocking

- (1) Testing of the seal can be done during undocking.
- (2) During undocking, open the vent plug on top of the housing to vent any air from the stern tube.
- (3) Once a good flow of water is observed, close the vent plug.
- (4) Once the dock is most of the way down, but before coming off the blocks, open the vent and watch for a good flow of water. Inflate the inflatable seal to about 40 psi.
- (5) There should be no water flowing from the vent during this time.
- (6) After maintaining pressure for a few minutes on the inflatable seal, deflate the inflatable seal and watch the vent. There should then be a good flow of water again. Close vent plug.
- (7) Check the seal assembly and mounting flanges for leaks.

**\*\*\*Special Note: Never rotate the shaft with the inflatable sealing ring inflated. You will damage the sealing ring.**

## E. Installation Check Sheet

The following are the main steps to take during installation:

		Date Completed
(1)	Check squareness of mounting flange with Dial Indicator	
(2)	Mount adapter ring – if required	
(3)	Mount seal casing, check centering and squareness	
(4)	Fill out measurement record and submit to Kobelco Eagle	
(5)	Install Oring for mating ring	
(6)	Install active seal garter spring	
(7)	Install active seal ring, push in place with mating ring	
(8)	Pull in active seal ring with mating ring bolts, tighten in star pattern	
(9)	Install spare sealing ring and garter spring	
(10)	Protect spare sealing ring	
(11)	Make any necessary water connections	
(12)	Make air fitting connections	
(13)	Test seal assembly per testing instructions	



## **F. Operation**

Normal operation of the stern tube seal requires only a few minor steps. Depending on your installation, please make sure you follow these rules:

- (1) Keep all the sea water piping valves wide open.
- (2) Make sure the air piping or fittings for the inflatable seal are vented to atmosphere and not plugged.
- (3) Check the seal assembly daily. Look for leakage and check the housing temperature for abnormalities. A little leakage of water from the seal ring is acceptable, since it allows for lubrication and cooling.
- (4) If any welding or hot work is to be done near the seal assembly, make sure it is adequately protected.

If during normal operation, you find excessive water leakage from the seal assembly, refer to the trouble shooting chart. The chart on the next page will show the normal inspection activities.

## G. Sealing ring replacement

**If seal ring replacement is required, the following steps should be carried out, refer to the installation procedure for detailed descriptions:**

- (1) Unwrap and clean the spare seal, make sure there is no grease on the sealing ring.
- (2) Stop the shaft and prevent it from turning.
- (3) Inflate the inflatable seal to about 40 psi. The seal can be inflated up to 80 psi without danger of damaging the seal. **If the shaft turns with the inflatable under pressure, damage to the inflatable seal will occur and it will require replacement.**
- (4) Open the vent at the top of the seal assembly to make sure there is not water flowing past the inflatable. If you can not stop the water flow with the inflatable, a diver will need to plug the stern tube to determine what is preventing the inflatable from sealing.
- (5) With the water flow stopped, remove the bolts from the mating ring flange. Split the mating ring. Note that there are body fit bolts in the mating ring. Be careful not to damage or loose these bolts.
- (6) Slid the damaged seal out of the housing, disconnect the garter spring and cut the old seal off the shaft.
- (7) Bolt the mating ring halves back together on the forward side of the spare seal. Check the mating parts to make sure there is no sharp edge. If there is, clean with a stone or emory cloth.
- (8) Check the oring between the mating ring and the seal housing, make sure it is in good condition.
- (9) Using the mating ring, slide the spare seal into the housing. **The mating ring must be used to push the seal ring into the housing to correctly position the seal.**
- (10) Bolt the mating ring flange to the casing.
- (11) Deflate the inflatable seal, make sure that there is water flow from the vent and close the vent. Check the seal for leaks.
- (12) **Double check that the inflatable seal has no air pressure.** Once the above steps are complete, the shaft can be rotated again.

## H. Inspection

		Frequency	Inspection / Maintenance	Note
1	Seal Assembly Condition	1 time/day	Check visually or measure if there is any water leakage or an increase or decrease in leakage rate. A little leakage of water from the seal ring is acceptable on account of lubrication and cooling.	
2	Supply water Pressure – if fitted with pump	1 time/day	Check that it is equivalent to shaft center level pressure plus 2 to 6 psi.	Pressure gauge to be positioned in close vicinity to the seal.
3	Sea water filter – if fitted	1 time/wk.	Check filter element.	Adjust frequency of inspection if filter clogs up. Clean as needed.
4	Grounding device	1 time/wk.	Check carbon brush condition. Check and remove dust and oil on sliding surface.	
5	Inflatable ring	1 month before docking	There should be no leakage of water through the vent plug at an air pressure of 30 to 40 psi.	Inspection to be done before docking. All air in the inflatable should be purged. <b>Shaft must be stopped for test.</b>
6	Major Inspection	1 time per year	Inspect sealing ring by normal overhaul procedure for disassembly.	Check for excessive wear or deformation of sealing ring.
			Inspect grooves on seal and spring for sealing ring, inspect behind sealing ring for debris which would prevent water flow.	Debris in grooves can cause excessive heat and wear.
			Check the condition of mating ring.	If the wear on the mating ring is over 0.020", it should be resurfaced on a lathe.
			Check the condition of shaft sleeve surface.	If the sleeve is painted, it should be repaired.

## I. Parts Replacement Interval

### (1) Seal ring

The seal life is approximately 2 ~ 4 years, but it can be little shorter in vessels with a deep draft. When sealing rings are replaced, the garter spring should be replaced at the same time.

### (2) Inflatable ring

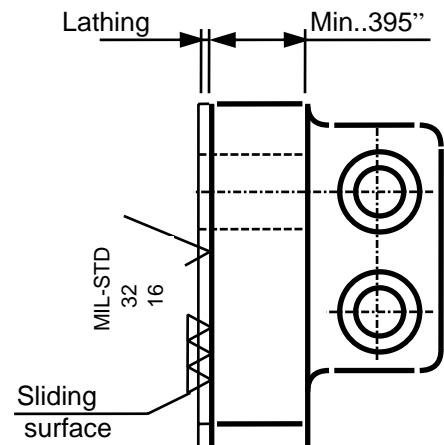
Typically about 5 years, but it is recommended to replace the inflatable at shaft withdrawal. In addition, if the ring is inflated and damaged due to shaft rotation, it should be replaced immediately.

### (3) Mating ring

A worn mating ring can be reused after reconditioning. Reconditioning of the mating ring can be accomplished as follows:

If the amount of wear on the sliding surface is over 0.020" in depth, it should be reconditioned by machining in a lathe.

In case machining is not necessary, finish it as flat as possible using emery paper or equivalent.



### (4) "O" ring

If there are no serious defects or tears in the bonded part, it can be used for about 5 years. But when disassembling the seal or replacing sealing rings, it should be replaced.



## **J. Service Network**

### **Factory:**

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## K. Troubleshooting

Term	Inspection Method	Normal Condition	Abnormality Detected	Cause of Trouble	Corrective Action Recommended
1 Temp. of the Liner	Hand inspection	Warm to the touch. Less than 120 Deg. F. Initial operating temp. of a new seal ring may be higher.	Too hot to touch. Smell of burning rubber noted.	High water pressure due to excessive water supply.	Adjust water pressure. See Term 3.
				Inflated Inflatable Seal Ring	Purge air in the inflatable ring at V2.
				Fishing net or rope caught on the propeller.	Remove net or rope.
				Improperly installed seal ring.	Dissassemble liner, apply grease to shaft in seal ring area, reset seal ring.
2 Amount of Water Leakage	Visual inspection and measurement of water leakage.	With shaft rotating, seal size 110-190 : leakage up to 1 gal./day seal size 210-310 : leakage up to 3 gal./day seal size 330-490 : leakage up to 6 gal.day	Water leakage above 10 to 20 gallons per day.	Something caught between seal ring and liner.	Disassemble liner, clean liner and seal ring, reassemble.
				Warped seal ring.	Pour hot (160-180 Deg. F) water on the seal ring.
				Worn seal ring.	Replace the seal ring with the spare on the shaft.
		With new seal ring and reconditioned liner, water leakage should be minimal (approx. 0-0.5 gal./day).	There should be no water leakage between the seal ring and shaft sleeve.	Worn liner (more than 0.02 inch groove depth).	Machine liner on lathe. Temporary repair using emory cloth or grinder to smooth liner as uniformly as possible.
				Seal ring hardens due to low water temperature.	Pour hot (160-180 Deg. F) water on the seal ring.
				Something caught between seal ring and shaft.	Disassemble liner, slide seal ring out, clean shaft sleeve and inside of seal ring if necessary. Use emory cloth.
Rubber adhesive fails.	Replace the seal ring with the spare on the shaft.				
3 Water Supply Pressure	Check pressure gauge G2. Visual and hand inspections.	Draft pressure + 1.4 to 4.3 PSI	Liner too hot to touch.	See Term 1.	See Term 1. Clean inside of seal assembly box.
			A large amount of water leakage.	Damaged stern tube bearing.	
4 Inflatable Seal Ring	With shaft stationary, inflate seal ring to 40 to 85 psi. Inspect for water leakage.	Should be no immediate air pressure drop. No sea water leakage.	Inflatable seal ring can not be inflated and water leakage from air supply line V2.	Inflatable seal ring inflated while shaft is turning.	Replace inflatable seal ring as soon as possible. Normally this repair done in dry dock. Emergency repair may be done afloat by plugging the stern boss.
			Inflatable seal ring inflates but sea water leaks.	Insufficient air pressure.	Increase air pressure (max. 140 psi).
				Supply water line valve V3 left open.	Close the valve.