STERN TUBE SEAL

STERN KEEPER C-TYPE

MANUAL

SKC STERN KEEPER CO.,LTD.

C O N T E N T S

CHAPTER 5 MAINTENANCE

CHAPTER 1 DESCRIPTION OF SAFETY

1 LIST OF WARNING

The WARNING items in this manual are shown in TABLE 1-1.

The "WARNING" means the operation or the maintenance which would cause an accident resulting injury or death in case they are not kept.

TABLE 1-1 LIST OF WARNING

WARNING STATEMENT			OUTLINE OF WORK AND OPERATION	MEANING OF WARNING
PAGE	NO	ITEM		
9	2.1	Operation during run	Check temperature by hand touch outside of SEAL RING②.	Not to touch rotating shaft.
10	2.2	Note during run	Check temperature of SEAL RING② to be normal.	Not to touch rotating shaft.
11	1	Maintenance List	Check temperature by hand touch outside of SEAL RING②. Once a week.	
			Check ANTICORROSING PLUG㉘ every 3 months after operate CONTRACTIBLE SEAL⑤ and close water supply valve.	To perform the work during shaft-stop.
12	1	Maintenance List	Check ball valve, pressure gauge on VALVE UNIT㉗ once a year.	
			Re-grind SEAL RING② once a year, replace ROTATING SEAL RING①, BAND ⑨ and O-RING⑥ in case of large water leakage .	
			Re-grind SEAL RING②, replace ROTATING SEAL RING①,BAND⑨ and O-RING⑥ every 2 or 3 years.	
			Clean VACUUM EJECTOR ⓕ of VALVE UNIT㉗ every 2 or 3 years.	
			Check the SEAL DEVICE including bolts, nuts etc at periodical inspection	To perform the work during shaft stop and dry dock stay.
			Replace CONTRACTIBLE SEAL⑤, and O-RING㉙ at periodic inspection.	

TABLE 1-1 LIST OF WARNING (Continued)

WARNING STATEMENT			OUTLINE OF WORK AND OPERATION	MEANING OF WARNING
PAGE	NO	ITEM		
13	1	Maintenance List	On removing the SHAFT, peel off old paint and apply ANTICORROSING PAINT .	To perform the work during shaft-run stop and dry dock stay.
			When the SLEEVE is re-grinded on the SHAFT removing, replace ROTATING SEAL① and BAND⑨ as well.	
			When dismantling the SEAL DEVICE SHEET PACKING⑦ is replaced as well.	
15	3	Dismantle, assemble, inspection and adjustment	Replace ROTATING SEAL RING①.	To stop shaft-rotation.
			Remove SEAL RING②.	Not to drop Split SEAL RING② when removing it.

2. LIST OF CAUTION

The CAUTION items in this manual are shown in TABLE 1-2.

The "CAUTION" means the operation or the maintenance which would cause an accident resulting device damage in case they are not kept.

TABLE 1-2 LIST OF CAUTION

WARNING STATEMENT			OUTLINE OF WORK AND OPERATION	MEANING OF WARNING
PAGE	NO	ITEM		
9	1	Preparation before run	Check BALL VALVE⑧1 for air release on VALVE UNIT㉗ is opened fully and PRESSURE GAUGE shows 0 MPa.	Not to operate CONTRACTIBLE SEAL⑤ during shaft run.
	2.1	Operation during run	Check that CONTRACTIBLE SEAL⑤ is not working.	
10	2.2	Note during run	Check that pressure gauge of VALVE UNIT㉗ is 0 MPa.	
16	3	Dismantle, assemble, inspection and adjustment	After dismantle, assembly, inspection and adjustment in the sea, cancel CONTRACTIBLE SEAL⑤ operation.	
			After dismantle, assembly, inspection & adjustment in the sea, release PLUG㉓ and discharge air in the SEAL DEVICE.	Heat would be generated on SEAL RING①,②.

CHAPTER 2 OUTLINE

1. INTRODUCTION

This SEAL DEVICE (STERN KEEPER TYPE SKC) is a kind of END FACE SEAL DEVICE lubricated with sea water.

The structure is simple with applying rubber elasticity and meets complex vibration from shaft system completely.

The synthetic rubber (NBR) and stainless steel (SUS316) or bronze (CAC403) are applied to the sealing face (contacting face of ROTATING SEAL RING① and SEAL RING②).

The characteristic of the SEAL DEVICE is as follows.

(1) The shaft abrasion, which is caused in case of conventional grand packing, is not happened as there is not the sealing face on the SLEEVE.

(2) The ROTATING SEAL RING① is made of elastic rubber and thrust pad on both front and rear of ROTATING SEAL RING① and has a good performance of followability to axial and radial deflection.

(3) The installation work is easy.

(4) The corrosion-proof countermeasures are introduced in the SEAL DEVICE.

(5) As the CONTRACTIBLE SEAL⑤ for emergency is installed, it is available to stop water leakage and replace ROTATING SEAL RING① by supplying air in the sea.

(6) As both end faces of SEAL RING② are available to use, the action is easy to take in case of emergency. Furthermore it is available to re-use SEAL RING② by re-grinding the sealing face.

2. SPECIFICATION

2.1 SEAL TYPE END FACE SEAL DEVICE BY SEA WATER LUBRICATION

2.2 PLANNED CONDITION

(1) Cooling water : Sea water

(2) Sleeve material : CAC402+0.5%Ni

(3) Cooling water pressure (normal): draught pressure + 0.01～0.04 MPa

(4) Cooling water pressure (Max) : Max. 0.15 MPa

(5) Water volume of cooling water : Min. 10L/min

In case of water supply to RUBBER BEARING.

Water volume = $\{\text{SLEEVE Dia. (cm)}\}^2 \times 5.9 \div 1000 \text{m}^3/\text{h}$

Please contact specified bearing supplier when not rubber bearing.

(6) Air pressure to work CONTRACTIBLE SEAL⑤ : 0.2～1.0 MPa

3. PERFORMANCE

The performance of the SEAL DEVICE is shown in TABLE 2-1.

TABLE 2-1 PERFORMANCE LIST

	FACTOR	SPECIFICATION
Leak water volume	0～50L/day	500 L/day
Shaft surface speed limit	Max. 8m/s	Max. 10m/s
Pressure of cooling water	Min. 0.035MPa	Max. 0.15MPa
Temperature of cooling water	0～35℃	Max 40℃
Temperature of SEAL RING	0～40℃	Max 50℃
＊Pressure of CONTRACTIBLE SEAL	0.2～1.0 MPa	1.0 MPa

＊ : During shaft-run, it is not available to use.

4. ASSEMBLY SPECIFICATION

The clearance tolerance between CASING③ and the SLEEVE is shown in TABLE 2-2.

The squareness tolerance between the seal installation face and the SLEEVE is shown TABLE 2-3.

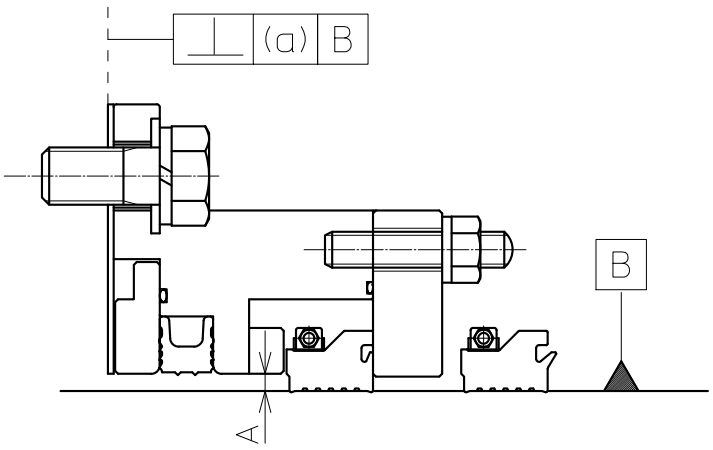


TABLE 2-2 CLEARANCE TOLERANCE

SHAFT DIAMETER	DIMENSION A
φ 70～φ149	3±0.5
φ150～φ209	4± 1
φ210～φ699	6± 1

(mm)

TABLE 2-3 SQUARENESS TOLERANCE

SHAFT DIAMETER	SQUARENESS (a)
φ 70～φ149	0.2
φ150～φ209	0.3
φ210～φ399	0.5
φ400～	0.8

(mm)

CHAPTER 3 STRUCTURE AND OPERATION

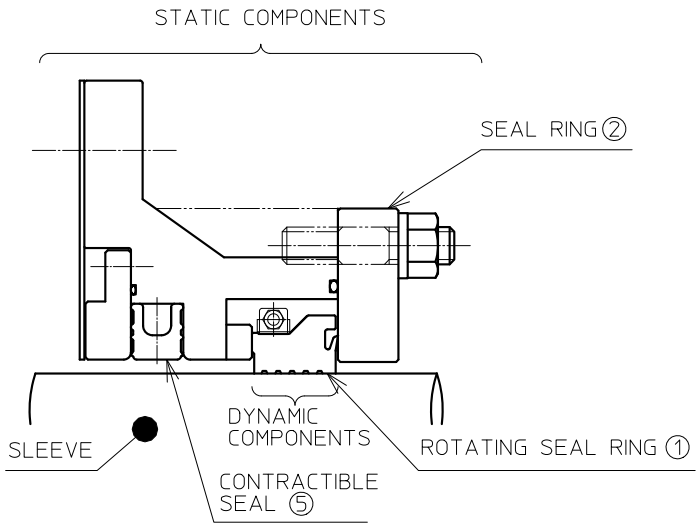
1. FUNDERMENTAL STRUCTURE (DRAWING 3－1, 3－2)

The SEAL DEVICE consists of dynamic components which is installed on the SLEEVE and static components which is installed on the end face of the STERN TUBE.

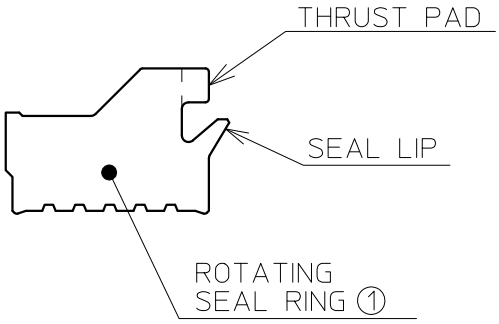
Both the impact resilience of seal lip and the water pressure applied to the back face of ROTATING SEAL RING① provides with sealing pressure.

Some grooves are prepared on the thrust pad on lip side of ROTATING SEAL RING① and can replace cooling water to seal lip.

The CONTRACTIBLE SEAL⑤ is U-shaped, rubber made ring. The air is applied to the inside of it and shrink it to prevent the water leakage.



DRAWING 3-1
CROSS SECTION
OF SEAL DEVICE



DRAWING 3-2
CROSS SECTION OF
ROTATING SEAL RING

2. DETAILED STRUCTURE

2.1 CASING

The CASING③ with CONTRACTIBLE SEAL⑤ is installed on the face of the STERN TUBE and the SEAL RING② is fixed on the bow side of CASING③.

To prevent corrosion between the SHAFT and CASING③, the end face of the STERN TUBE is insulated with SHEET PACKING⑦ and BUSH⑧. To prevent corrosion, between hull and compressed air system of CONTRACTIBLE SEAL⑤ is insulated with TUBE㉛.

The piping system for cooling water is insulated with RUBBER HOSE㉑.

2.2 ROTATING SEAL RING

The ROTATING SEAL RING① is installed between CASING③ and SEAL RING② and then fixed with BAND⑨.

It is made of synthetic rubber(NBR) with excellent performance of water proof, abrasion-proof and sealing. The spare ROTATING SEAL RING① is set on bow side and the replacement of it is very easy in the sea.

The ROTATING SEAL RING① plays important role to seal the water with SEAL RING②.

2.3 SEAL RING

The SEAL RING②, which is fixed on CASING③, is made of stainless steel(SUS316) or bronze(CAC403). It is split into two pieces.

Both end faces of it are available to use as the sealing faces and one of them is prepared as another sealing face.

The sealing face must be kept not give any flaw.

The sealing face, where is contacting with ROTATING SEAL RING①, is the most important portion. After it is finished finely with a lathe machine, it is polished with sand paper(No.240) neatly.

When the sealing face is re-grinded with a lathe machine, chuck the outside of the SEAL RING② not to open the split of it.

2.4 CONTRACTIBLE SEAL

The CONTRACTIBLE SEAL⑤ is made of rubber (NBR) and put into CASING③ and held with STOP RING④.

The CONTRACTIBLE SEAL⑤ is used when the SEAL RING② or ANTICORROSING-PLUG㉘ is replaced in the sea.

By supplying air (0.2～1.0 MPa), the CONTRACTIBLE SEAL⑤ is shrink inside and tighten the SHAFT and stop water leakage.

Accordingly, it is not used except the above case.

When the CONTRACTIBLE SEAL⑤ is operated for a long time, not to enclose a compressed air for a long time from BALL VALVE of VALVE UNIT㉗ but always keep to supply compressed air.

As the CONTRACTIBLE SEAL⑤ is not use during shaft running, discharge air after it is used.

CHAPTER 4　HANDLING PROCEDURE

1 PREPARATION BEFORE RUN

1.1 NORMAL RUN

(1) To confirm that the BALL VALVE⑷1 for air release on VALVE UNIT㉗ is opened fully and the pressure gauge shows 0 MPa.

> CAUTION
> NOT TO OPERATE THE CONTRACTIBLE SEAL⑤ DURING RUN.

(2) To confirm that the pressure of cooling water is 0.035MPa＜P＜0.15 MPa with pressure gauge on pipe.

(3) To confirm that the cooling water is running with pressure gauge and touching cooled water pipe.

(4) To confirm that the water is not leaking anywhere except sealing face.

1.2 AFTER LONG STOPPAGE OR DISMANTLE MAINTENANCE

(1) After leave dock, to confirm that the air is discharged after PLUG㉓ on CASING③ is released and the water is supplied to the SEAL DEVICE.

(2) To confirm the note in accordance with previous item 1.1(NORMAL RUN)

2. OPERATION PROCEDURE

2.1 OPERATION DURING RUN

(1) To confirm that the cooling water is running with pressure gauge.

(2) To confirm that the water is not leaking and check the volume of it if any.

(3) To touch the outside of SEAL RING② and confirm the temperature of it.

> WARNING
> NOT TO TOUCH THE ROTATING SHAFT TO CHECK
> THE TEMPERATURE.

(4) To confirm that the pressure gauge on VALVE UNIT㉗ is 0MPa.

> CAUTION
> NOT TO OPERATE CONTRACTIBLE SEAL⑤ DURING RUN.

2.2 NOTE DURING RUN

(1) To confirm that the pressure of cooling water is normal.

(2) To confirm that the volume of leaked water is normal.

(3) To confirm that the temperature of SEAL RING② is normal.

> WARNING
> NOT TO TOUCH THE ROTATING SHAFT

(4) To confirm that the pressure gauge on VALVE UNIT㉗ is 0 MPa.

> CAUTION
> NOT TO OPERATE CONTRACTIBLE SEAL⑤ DURING RUN

3. ACTION AFTER RUN

3.1 NORMAL RUN

(1) To confirm the water leakage during shaft-stop.

(2) To stop the supply of cooling water to the BEARING.

3.2 LONG STOPPAGE

(1) In case of stop over one week, to supply the water to the SEAL DEVICE once a week.

(2) To confirm the note in accordance with previous item 3.1 (NORMAL RUN)

4. CONTRACTIBLE SEAL OPERATION PROCEDURE

4.1 PREPARATION

To open BALL VALVE ⓐ2 of VALVE UNIT㉗ and discharge drain of VACUUM EJECTORⓕ.

To confirm that the air is discharged by putting hand on air discharge side of BALL VALVE ⓐ1 of VALVE UNIT㉗. Clean VACUUM EJECTORⓕ if the air-discharge is too weak.

4.2 OPERATION

To close BALL VALVE ⓐ1 for air release of VALVE UNIT㉗ and supply compressed air (0.2～1.0 MPa) to CONTRACTIBLE SEAL⑤ by opening BALL VALVE ⓐ2.

Accordingly, the CONTRACTIBLE SEAL⑤ is shrunk to tighten the SLEEVE for sealing.

But the CONTRACTIBLE SEAL⑤ is not available to use during shaft-run.

4.3 CANCELLATION

To close BALL VALVE ⓐ2 of VALVE UNIT㉗. Open BALL VALVE ⓐ2 after opening BALL VALVE ⓐ1, sucks out air enough through the copper pipe for 10 to 20 sec.

After that, close the BALL VALVE ⓐ2.

CHAPTER 5 MAINTENANCE

The MAITENANCE LIST of SEAL DEVICE is shown in TABLE 5-1.

As the maintenance frequency below is standard term, please implement it per actual condition

TABLE 5-1 MAINTENANCE LIST

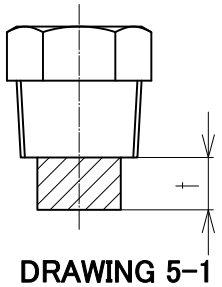
FREQUENCY	MAINTENANCE ITEM	ACTION FOR SAFETY	IMPLEMENT PROCEDURE	NOTE
Every day	Check cooling Water supply to the BEARING		1.Check pressure gauge 2.Check cooled pipe with hand touch. 3.Clean filter of cooling water system. (Draught pressure + 0.01～0.04 MPa)	
	Check leaked water volume		Optimum volume is 0～50L/day. In case of larger volume, Refer to 5-2. (Trouble and Action)	
Once a week	Check temperature of the SEAL RING	WARNING Not to touch the SHAFT	Below 50℃ is normal. In case the shaft temperature is too high to touch, refer To 5-2. (Trouble and Action)	
Long stoppage in the sea. (Over a week)	Cooling water Supply to the BEARING		In case of long stoppage in the sea, supply water to the STERN TUBE and replace water in the STERN TUBE once a week.	
Once every three months	ANTICORROSING PLUG㉘ check	WARNING To check during shaft-stop	In case dimension (t) is below 1 mm, replace it .(dimension(t) of new one:10mm) Note) In case of shaft-diameter below Φ99, the dimension (t) is 5 mm.  **DRAWING 5-1** Dimension (t) of ANTICORROSING PLUG	Operate CONTRACTIB-LE SEAL⑤ and close water supply valve and start to work.

TABLE 5-1 MAINTENANCE LIST (Continued)

FREQUENCY	MAINTENANCE ITEM	ACTION FOR SAFETY	IMPLEMENT PROCEDURE		NOTE
Once a year	Check ball valve and pressure gauge of VALVE UNIT㉗	WARNING To implement during shaft-stop	In case trouble or damage is found , replace it.		
	Replacement of ROTATING SEAL RING①		Only when the leaked water is over 100L/day, replace it.		
	Replacement of BAND⑨		Only when the ROTATING SEAL RING① is replaced, the BAND⑨ is replaced as well.		
	Re-grind of SEAL RING②		Only when the leaked water is over 100L/day, re-grind it.		
	Replacement of O-RING⑥		Only when the SEAL RING② is replaced , the O-RING is replaced as well.		
Once every two or three years	Replacement of ROTATING SEAL RING①	WARNING To implement during shaft-stop	Replace to new one. (Spare ROTATING SEAL RING① is set on the SHAFT and then bonded .)		
	Replacement of BAND⑨		It is replaced with ROTATING SEAL RING① replacement.		
	Re-grinding of SEAL RING②		Re-grind it.		
	Replacement of O-RING⑥		Replace to new one	If replaced to new one and passed over 3 months, replace to new one again.	
	Cleaning of VACUUM EJECTORⓕ		Remove it from VALVE UNIT㉗ and clean it.		
Periodic inspection	Check the SEAL DEVICE, bolt, nut etc	WARNING To implement during dry-dock stay and shaft-stop	Remove from hull and clean each components. If corrosion, damage and degrading are found, replace to new one or repair it.		
	Replacement of CONTRACTIBLE SEAL⑤		Replacement to new one.		
	Replacement of O-RING㉙.		Replacement to new one.	If replaced to new one and passed over 3 months, replace to new one again.	

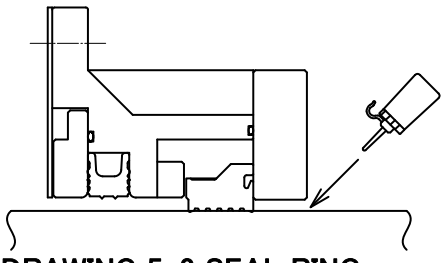
TABLE 5-1 MAINTENANCE LIST (Continued)

FREQUENCY	MAINTENANCE ITEM	ACTION FOR SAFETY	IMPLEMENT PROCEDURE	NOTE
Periodic inspection	Application of ANTICORROSING PAINT	WARNING To implement during shaft-stop	Peel off old paint on the SLEEVE and apply ANTICORROSING PAINT. Refer to assembly drawing for paint area.	In case a rough surface is found, make it smooth with sand paper.
	In case the SLEEVE is re-grinded, items below are implemented in addition.			
	Replacement of ROTATING SEAL RING①	WARNING To implement during shaft-stop	Replacement to new one. (NEW SIZE)	
	Replacement of BAND⑨		Replacement to new one. (NEW SIZE)	
Each dismantle work	Replacement of SHEET PACKING⑦	WARNING To implement during shaft-stop	Replacement to new one. when it is removed at dismantle work.	Apply a liquid packing to set.

2 TROUBLE AND ACTION

The TROUBLE AND ACTION is shown in the TABLE 5-2

TABLE 5-2 TROUBLE AND ACTION

TROUBLE	CAUSE	ACTION
Large water leakage	・Abrasion of ROTATING SEAL RING① ・Abrasion of SEAL RING② ・Bite of dusts on sealing face ・Step on sealing face of split portion	Optimum volume of leaked water is about 0～50L/day Even if the water is increased over 500L/day, adjustment is not necessary. As the water level is changed periodically, check it for four or five days. And in case the water level is not decreased, take the actions below. (1) Remove SEAL RING② and repair rough surface to make smooth with sand paper etc. (2) In case the water level is not decreased after the action (1), replace ROTATING SEAL RING① to spare one and reverse SEAL RING②. In case the SEAL RING② is re-grinded, the ROTATING SEAL RING② must be replaced to new one. (3) The step on split portion is smoothed with sand paper.
Temperature of SEAL RING is very high.	The air is held in the SEAL DEVICE	Release PLUG㉓ of CASING③ and discharge air in the SEAL DEVICE and water supply system.
	Cooling water is not supplied.	Check valve operation. Check pump and pipe system.
	CONTRACTIBLE SEAL is working	Open BALL VALVE ⓐ1 for air discharge of VALVE UNIT㉗ and close BALL VALVE ⓐ2 and release CONTRACTIBLE SEAL⑤ operation.
	Sealing face is not fitting.	In case the ROTATING SEAL RING① is replaced, the heat is generated until the sealing face is fitted. Release PLUG㉓ of CASING③ and discharge sea water to cool and wait the sealing face is fitting. (20～30 hr) In case the temperature is increased, supply water to location (mark ↓) on DRAWING 5-2 and cool it.  **DRAWING 5-2 SEAL RING**
Pressure of cooling water is too low.	Water supply is disturbed.	Check valve operation. Check pump, piping system and filter etc.

3 DISMANTLE, ASSEMBLY, INSPECTION AND ADJUSTMENT

3.1 DISMANTLE, ASSEMBLY AND MAINTENANCE

3.1.1 REPLACEMENT OF ROTATING SEAL RING

Below is procedure to replace ROTATING SEAL RING① in the sea.

Refer to (6)～(14) to replacement in dry dock.

WARNING TO STOP SHAFT-ROTATION

(1) Stop water supply to the BEARING.

(2) Preparation before CONTRACTIBLE SEAL⑤ operation.

(Note: To stop shaft-rotation. Refer to CHAPTER 4. HANDLING PROCEDURE)

(3) Close BALL VALVE ⓐ1 for air release of VALVE UNIT㉗ to supply the air to CONTRACTIBLE SEAL⑤.

(4) Open BALL VALVE ⓐ2 of VALVE UNIT㉗ and increase air pressure slowly to reach 0.2～1.0MPa.

(5) Release PULG㉓ to discharge the air and confirm that CONTRACTIBLE SEAL⑤ is working.

(6) Remove NUT⑰ and BOLT⑫ and then remove SEAL RING②.

As there are GUIDE PIN⑲ is in SEAL RING②, open it both side equally.

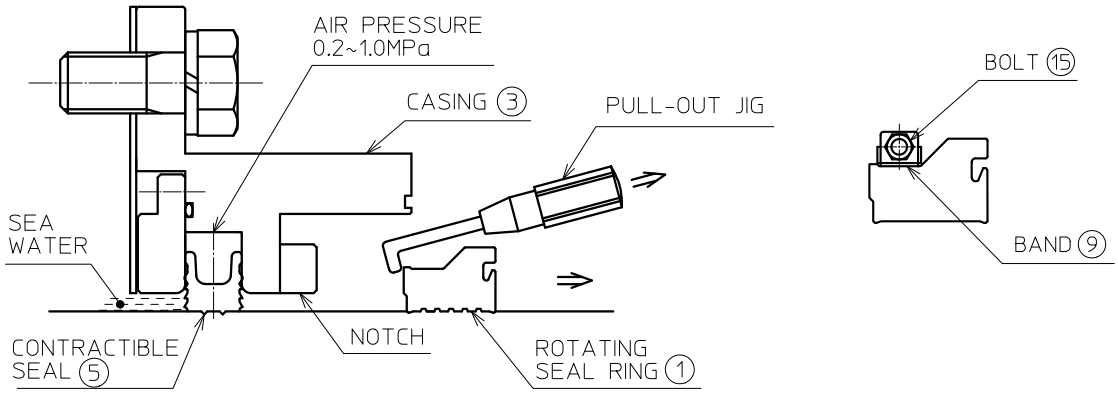
In case GUIDE PIN⑲ is bent, it must be replaced.

WARNING NOT TO DROP SPLIT SEAL RING② WHEN REMOVING IT

(7) Clean spare sealing face of SEAL RING②.

(8) Take out ROTATING SEAL RING① with PULL-OUT JIG from notch as DRAWING 5-3.

On this occasion, pull out ROTATING SEAL RING① as its circumference comes out evenly.

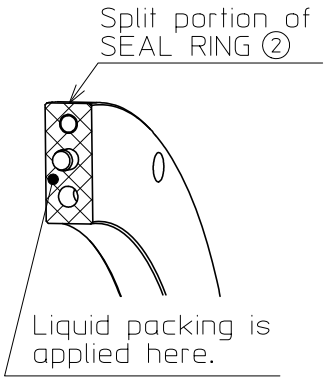


DRAWING 5-3 PULLING-OUT PROCEDURE OF SEAL RING

(9) Remove BAND⑨ after release BOLT⑮. Cut ROTATING SEAL RING① with a knife and remove it from the SLEEVE.

(10) Clean thrust pad of CASING③ and surface of the SLEEVE and apply grease on them and inside diameter area of ROTATING SEAL RING① as well.

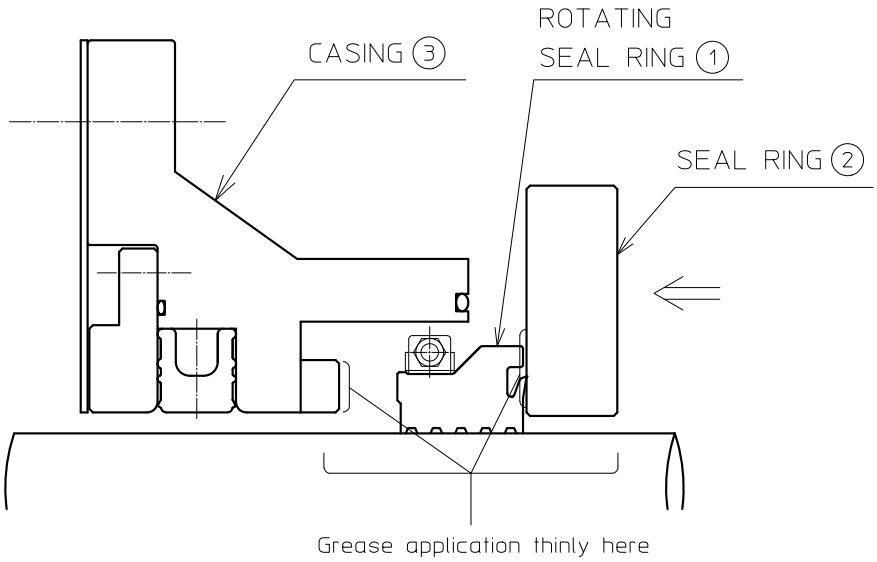
(11) Clean and degrease split portion of SEAL RING②. And connect split portion with BOLT⑫ after liquid packing is applied on it.
(The connection location is beyond ROTATING SEAL RING② of bow side) On this occasion, the step on sealing face is not acceptable. The step is finished to be smooth with sand paper.
(Refer to DRAWING5-4)



DRAWING5-4
LIQUID PACKING
APPLICATION ON
SEAL RING②

(12) Clean the sealing face of ROTATING SEAL RING① and SEAL RING② And apply grease on them.

(13) Pushing spare ROTATING SEAL RING① with SEAL RING②, move spare ROTATING SEAL RING① into CASING③.



DRAWING 5-5 INSTALLATION PROCEDURE OF SEAL RING

(14) Fix SEAL RING② with NUT⑰.

(15) Release CONTRACTIBLE SEAL⑤ operation.

(Refer to CHAPTER 4. HANDLING PROCEDURE)

CAUTION NOT TO OPERATE CONTRACTIBLE SEAL DURING RUN.

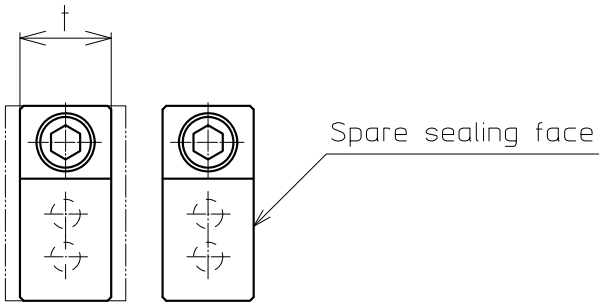
(16) Release PLUG㉓ and discharge air inside of the SEAL DEVICE.

CAUTION THE HEAT GENERATION WOULD BE CAUSED IN ROTATING SEAL RING①, ②.

3.1.2 RE-GRINDING OF SEAL RING

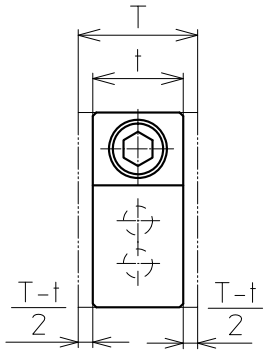
After remove NUT⑰ and BOLT⑫, take off SEAL RING② from CASING③. Then re-grind the sealing face till the abrasion is disappeared. The surface roughness of sealing surface must be below 1.5 μm Ry. The trace out of a lathe machine must be cleaned with sandpaper (No.120～240) The chuck of a lathe machine is tightened from outside. The split portion is opened if the chucking is done inside. In case the split portion is opened even if they are tightened with bolts, re-grind the split portion.

When thickness [t] changes to low-limit, replace to new one (DRAWING 5-6)



DRAWING 5-6 THICKNESS [t] of SEAL RING

3.1.3 STANDARD SIZE & REPLACEMENT BASE SIZE OF SEAL RING (mm)

SEAL RING②	SHAFT DIAMETER	ORIGINAL THIKNESS	LIMIT TOTAL THICKNESS TO RE-GRIND	LIMIT TOTAL THICKNESS TO RE-GRIND ONE SIZE
	ϕ 70～ϕ 99	12	8	2
	ϕ100～ϕ149	16	10	3
	ϕ150～ϕ209	20	13	3.5
	ϕ210～ϕ399	24	16	4
	ϕ400～ϕ699	26	18	4

3.1.4 SLEEVE RE-GRINDING LIMIT

The SLEEVE is re-grinded because of abrasion and corrosion. The applicable re-grinding dimension per SLEEVE SIZE is as follows.

DIAMETER OF SLEEVE(mm)	MAX RE-GRINDING MARGIN (mm)
Φ 70～Φ149	2 IN DIAMETER
Φ150～Φ209	3 IN DIAMETER
Φ210～Φ399	5 IN DIAMETER
Φ400～Φ699	7 IN DIAMETER

In case the SLEEVE is re-grinded over the dimension above, replace to new SEAL DEVICE with new dimension.

3.1.5 REPLACEMENT OF CONTRACTIBLE SEAL (per each shaft removal)

(1) Remove both SEAL RING② and ROTATING SEAL RING①.

(2) Remove CASING③ from the STERN TUBE.

(3) Take off BOLT⑭ and remove STOP RING④ from CASING③.

(4) Remove both CONTRACTIBLE SEAL⑤ and O-RING㉙.

(5) Re-assembly is implemented in accordance with 3.1.7 (ASSEMBLY AND INSTALLATION)

3.1.6 REPLACEMENT OF ANTICORROSING PLUG

In case the replacement in the sea is implemented, it is done after implementation of 3.1.1 (REPLACEMENT OF ROTAION SEAL RING (1)～(5)).

3.1.7 ASSEMBLY AND INSTALLATION (REFER TO DRAWING5-7～5-9)

(1) Clean CASING③ and STOP RING④ and check there is not any flaw on the contacting face with CONTRACTIBLE SEAL⑤. (In case there is any sludge etc. on the contacting face of CONTRACTIBLE SEAL⑤ with CASING③ and STOP RING④, clean it with a sandpaper etc. and finish it to become smoothly.)

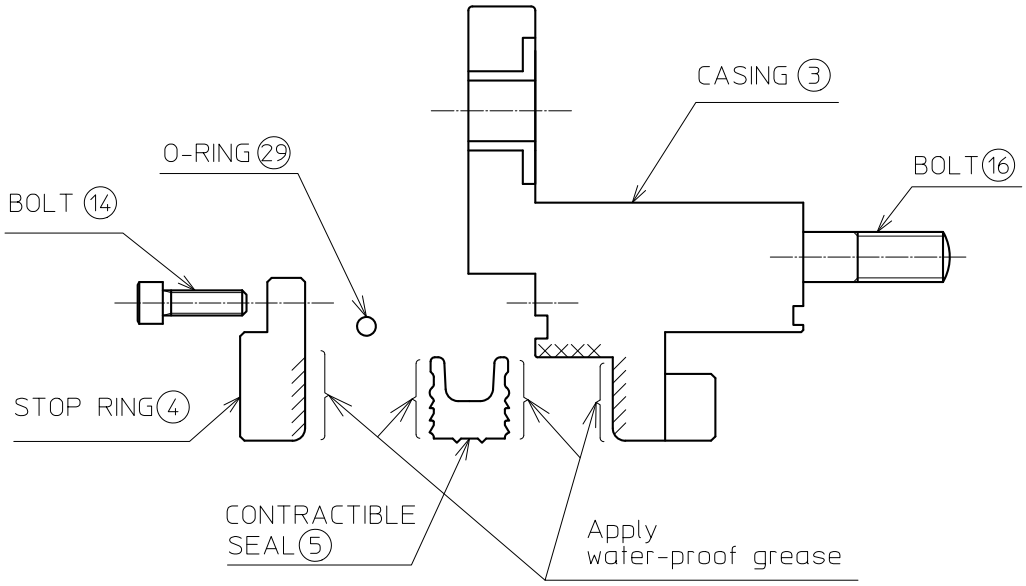
(2) Apply water-proof grease thinly on the location marked ////on CASING③.

(3) Apply water-proof grease thinly on one side (CASING③ side) of CONTRACTIBLE SEAL⑤ and push it into CASING③. As the outside diameter of CONTRACTIBLE SEAL⑤ is larger than the inside diameter of CASING③, push one part of it in first and the other part in order.

(4) Apply water-proof grease thinly on one side(STOP RING④ side) of CONTRACTIBLE SEAL⑤ which is set in CASING③.

(5) Install O-ring㉙ into the groove of CASING③.

(6) Apply water-proof grease thinly on the location marked ////on STOP RING④ and fix it on CASING③ with BOLT⑭. (BOLT⑭ must be tightened in order diagonally.)



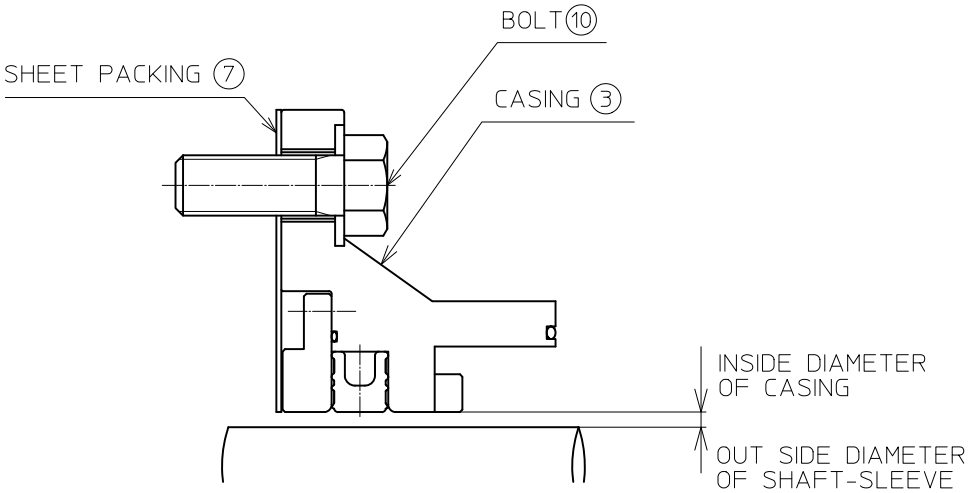
DRAWING 5-7 INSTALLATION PROCEDURE OF CONTRACTIBLE SEAL

(7) Put SHEET PACKING⑦ on the back of CASING③ with rubber adhesive.

(8) Clean the end face of the STERN TUBE.

(9) Put CASING③ on the end face of the STERN TUBE with BOLT⑩.

(10) Check the arrangement of CASING③ with marking TOP. The clearance between top/bottom and right/left must be arranged equally. (Refer to P.6 TABLE 2-2)



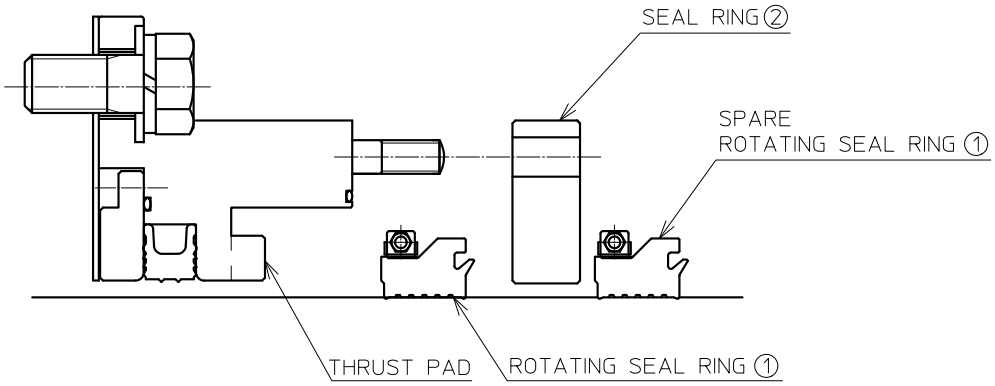
DRAWING 5-8 CLEARANCE ADJUSTMENT BETWEEN SHAFT SLEEVE AND CASING

(11) Before the SHAFT is installed in the STERN TUBE, apply ANTICORROSING PAINT on the location where the SEAL DEVICE is installed widely.

(Refer to attachment drawing-1)

(12) Installation onto the SHAFT

When the SHAFT is installed into the BEARING of the STERN TUBE from stern side, an watchman, who stays inboard, checks if the SHAFT is inserted correctly.



DRAWING 5-9 INSTALLATION ORDER OF SEAL RING

(13) Put BAND⑨ on the outside of ROTATING SEAL RING① and tighten it with BOLT⑮.

(14) Clean the sealing face of ROTATING SEAL RING① and SEAL RING②, the surface of thrust pad of CASING③ and the surface of the SLEEVE. Then apply a grease on them thinly.

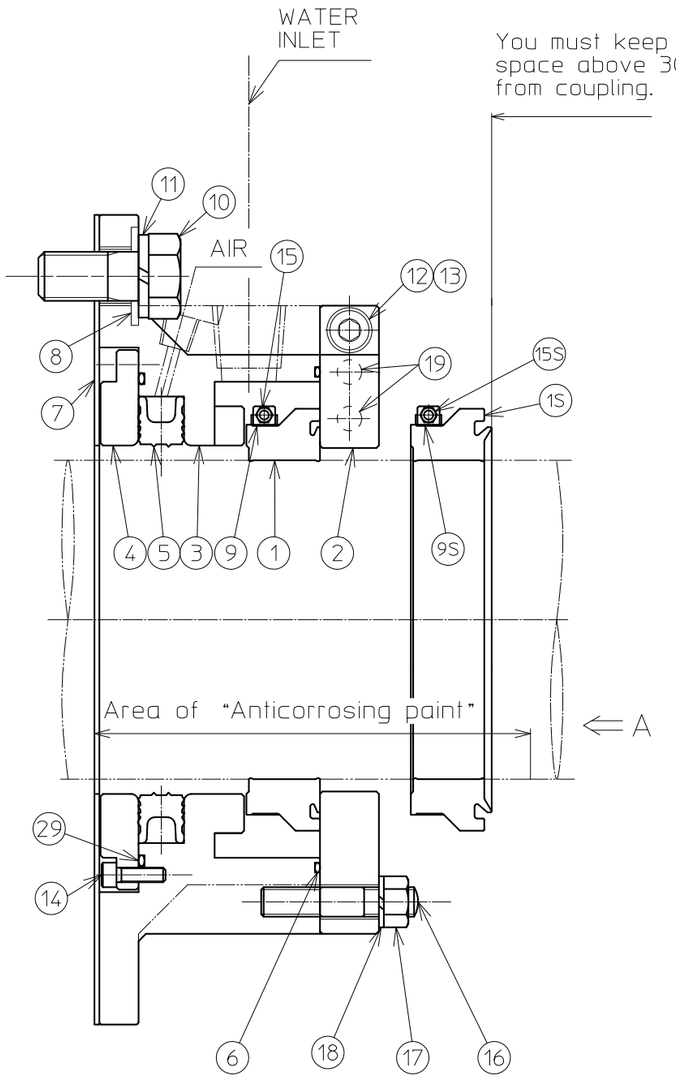
(15) Pushing forward ROTATING SEAL RING① with SEAL RING②, move ROTATING SEAL RING① into CASING③.

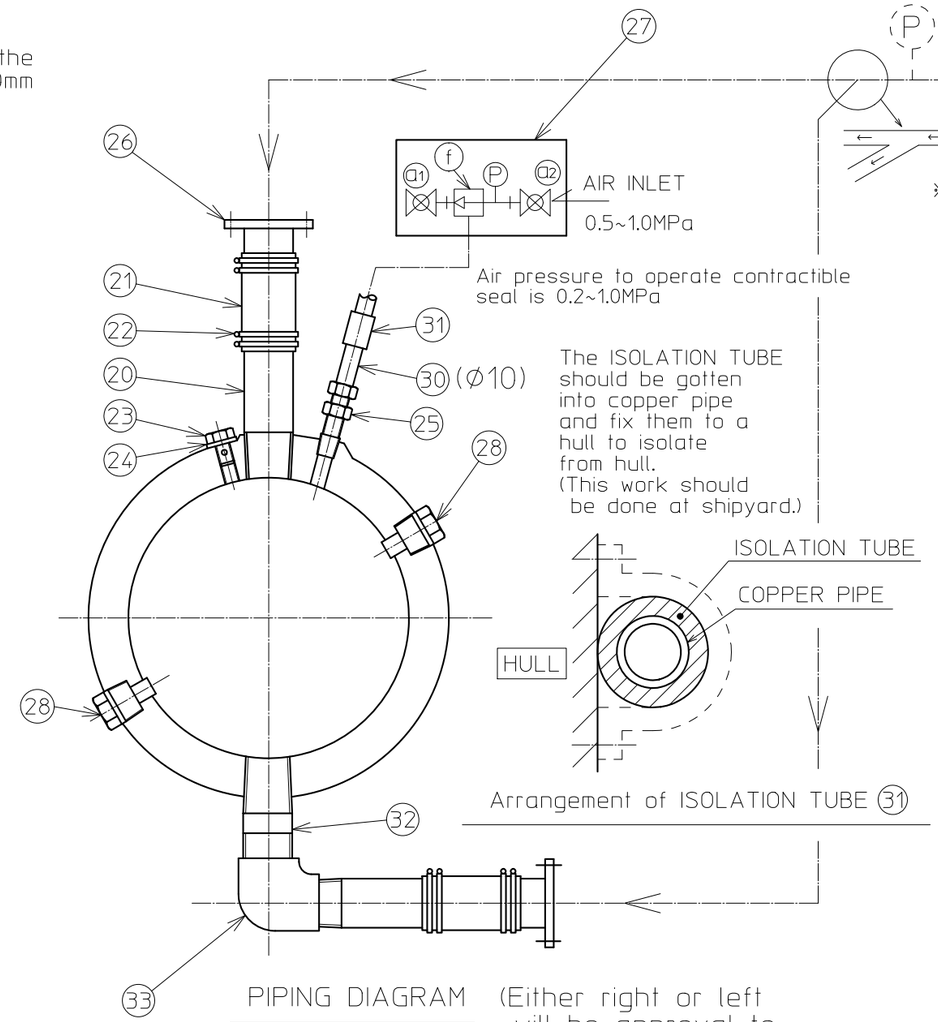
(16) Fix SEAL RING② with NUT⑰.

(17) Put spare BAND⑨ on the band groove of spare ROTATING SEAL RING① and tighten with BOLT⑮. On this occasion , not to make SEAL RING② touch.

(18) Install TUBE FITTING㉕ for piping to supply compressed air to CONTRACTIBLE SEAL⑤. Then connect VALVE UNIT㉗ and the SEAL DEVICE side with Φ10mm COPPER PIPE㉚. On this occasion , fix ISOLATION TUBE㉛ on COPPER PIPE㉚ with hull to prevent corrosion.

(EXAMPLE) Two Water Pipes





PIPING DIAGRAM

A VIEW

(Either right or left will be approval to put the lower part of waterpipe.)

REF No.	NAME OF PART	MATERIAL
33	ELBOW	SUS304
32	PIPE	SUS304
31	ISOLATION TUBE	RUBBER
30	COPPER PIPE	C1020
29	O RING	NBR
28	ANTICORROSING PLUG	Zn,C4622
27	VALVE UNIT	SGP
26	FLANGE	SUS304
25	TUBE FITTING	C3604
24	SEAL WASHER	SUS304
23	PLUG	SUS304
22	HOSE BAND	SUS304
21	WATER HOSE	RUBBER
20	PIPE	SUS304
19	GUIDE PIN	SUS304
18	SPRING WASHER	SUS304
17	NUT	SUS304
16	BOLT	SUS304
15	BOLT	SUS316
14	BOLT	SUS316
13	SPRING WASHER	SUS304
12	BOLT	SUS304
11	SPRING WASHER	SUS304
10	BOLT	SUS304
9	BAND	SUS316
8	BUSH	FRP
7	SHEET PACKING	CR
6	O RING	NBR
5	CONTRACTIBLE SEAL	NBR
4	STOP RING	CAC403
3	CASING	CAC403
2	SEAL RING	SUS316
1	ROTATING SEAL RING	NBR

Table size for (26) FLANGE

Outer diameter of Sleeve	SIZE	Water pipes	Outer diameter of Sleeve	SIZE	Water pipes
ø 70~ø 99	15A JIS 5K	One pipe	ø300~ø399	25A JIS 5K	Two pipes
ø100~ø199	20A JIS 5K	One pipe	ø400~ø499	32A JIS 5K	Two pipes
ø200~ø209	25A JIS 5K	One pipe	ø500~ø599	32A JIS 5K	Three pipes
ø210~ø259	25A JIS 5K	One pipe	ø600~ø699	32A JIS 5K	Four pipes
ø260~ø299	25A JIS 5K	Two pipes			

NOTES.

1)CONTRACTIBLE SEAL should not be activated when shaft is rotating.

2)After coming out of dock or assembling of Seal Unit on board at sea,air must be left out of Seal Unit from PLUG (23) .

3)You must paint "Anticorrosing Paint" on the surface of the SLEEVE where Seal Unit is to be installed.

4)Considerations must be given to secure enough space surrounding the Seal Unit so that the disassembly and replacement works can be made efficiently.

DRAWING-1