PUPUK KALTIM

Bearing Maintenance

Working Efficiently and Accurately

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Thrust and Journal bearing Maintenance

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Thrust and Journal bearing Maintenance

Do step bearing Maintenance :

- Operating condition data
- Disassembly Bearing
- Inspection parts/ component, Measurement

  (Repair, change parts/ component or Reused)
- Reassembly
- Report/ Records

Thrust and Journal bearing Maintenance

Operating Condition Data

Before to dismantle bearings , knowing data during the operation. they include : temperature and viberasi Bearing.

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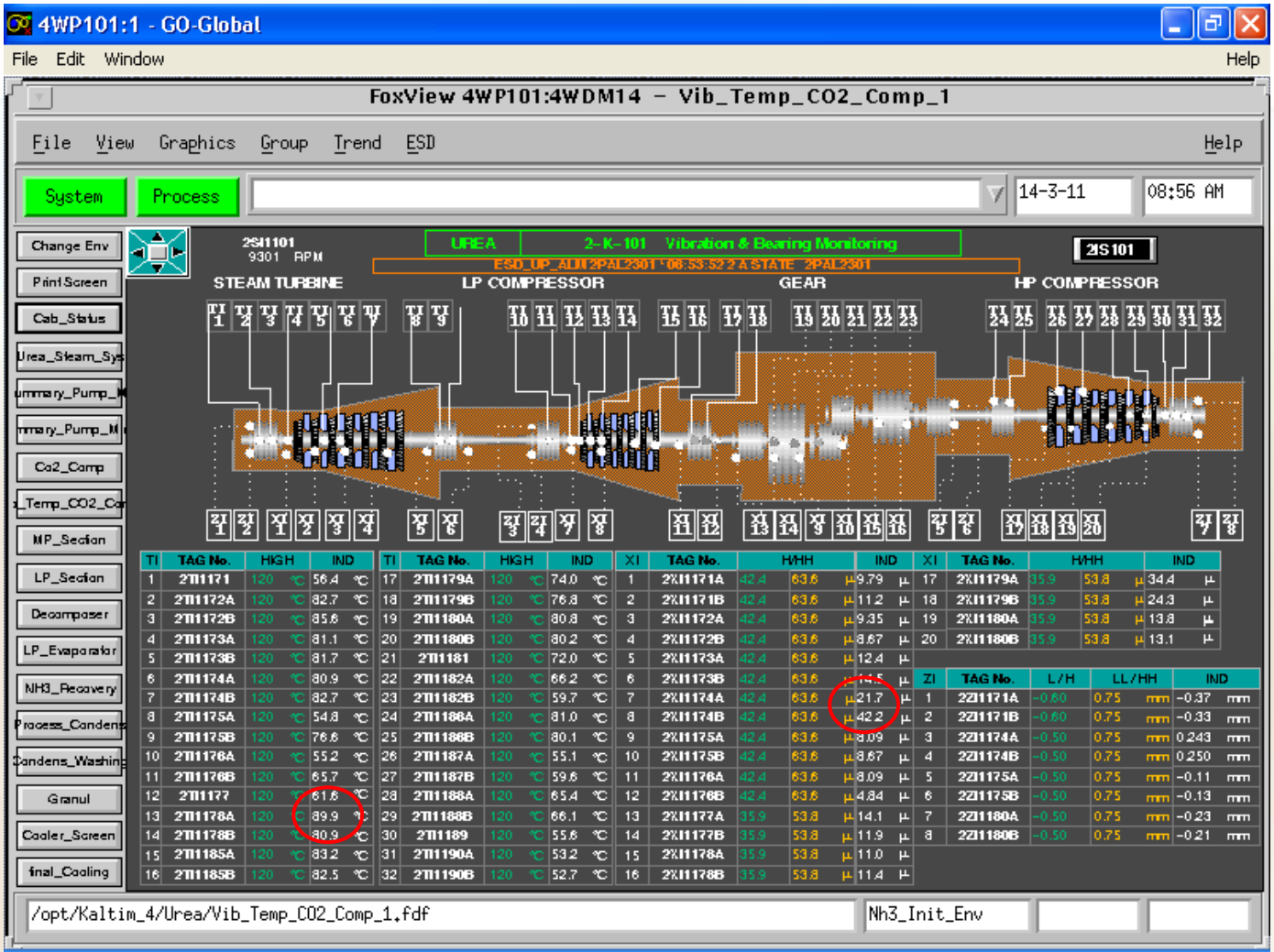
Thrust and Journal bearing Maintenance

Operating Condition Data



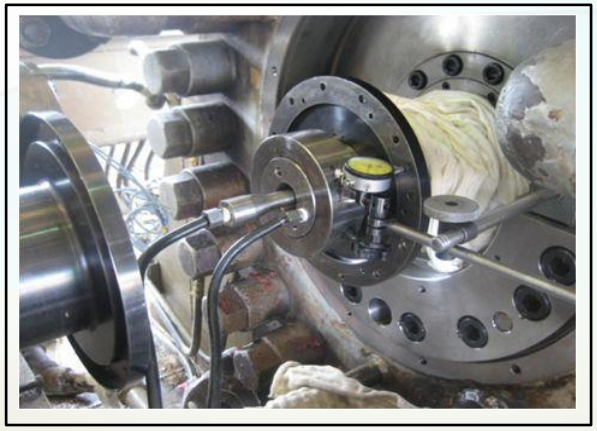
Thrust and Journal bearing Maintenance

Disassembly Bearing

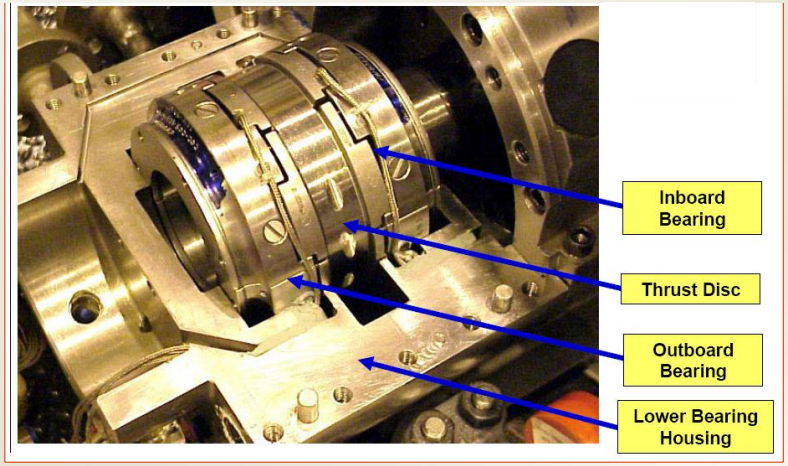
- Remove cable bearing and probe viberasi (instrumentation)

Thrust and Journal bearing Maintenance

Disassembly Bearing

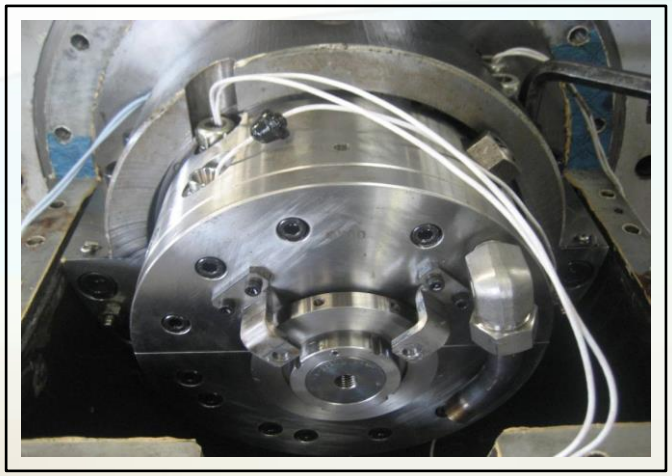


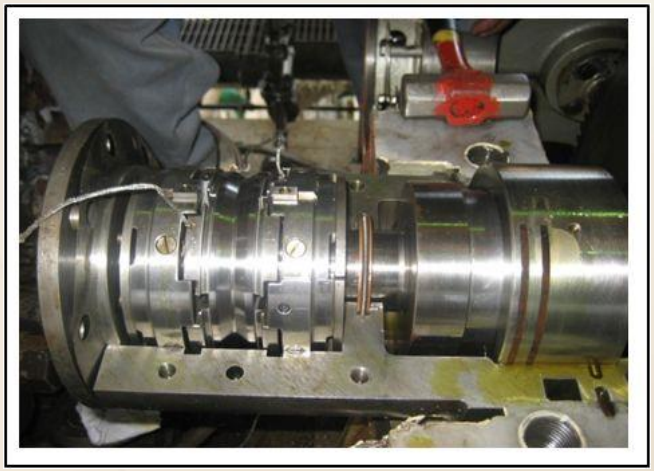
- Remove hub coupling and chek axial floating clearance
- Remove cover / housing bearing



Thrust and Journal bearing Maintenance

Disassembly Bearing

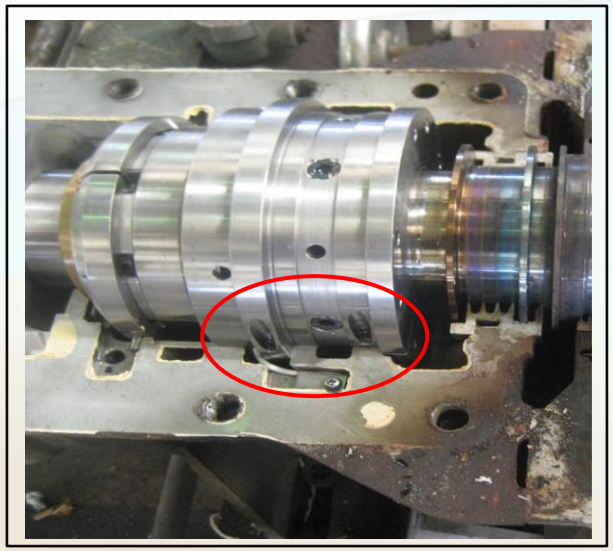


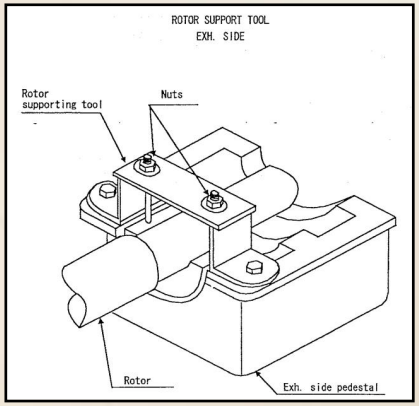


- Remove cable pad journal and thrust bearing

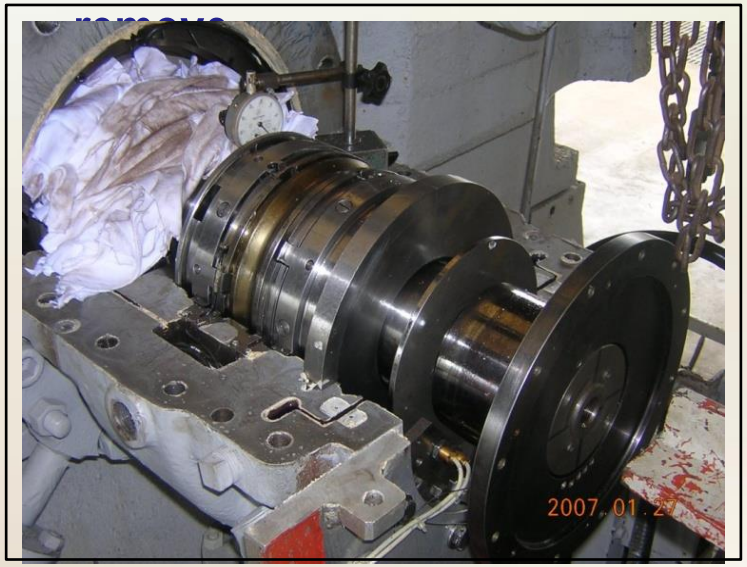
Contact roller bearing Maintenance

Disassembly Bearing



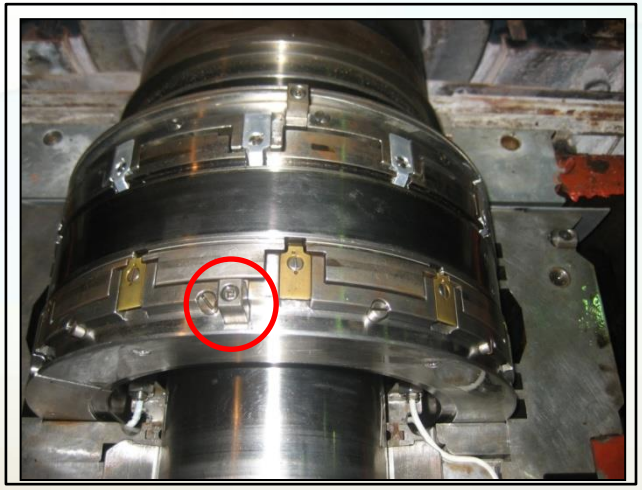


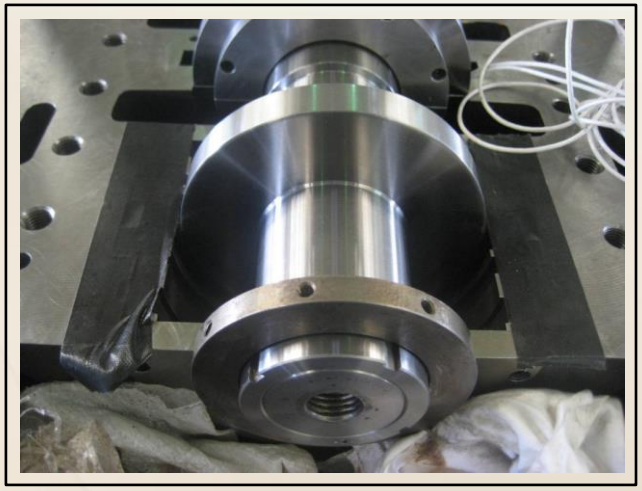
- Remove half journal bearing unit
  - > Lift rotor about 0.20 mm by special tool
  - > Turn bearing half position (until ellen bolt can be)



Thrust and Journal bearing Maintenance

Disassembly Bearing

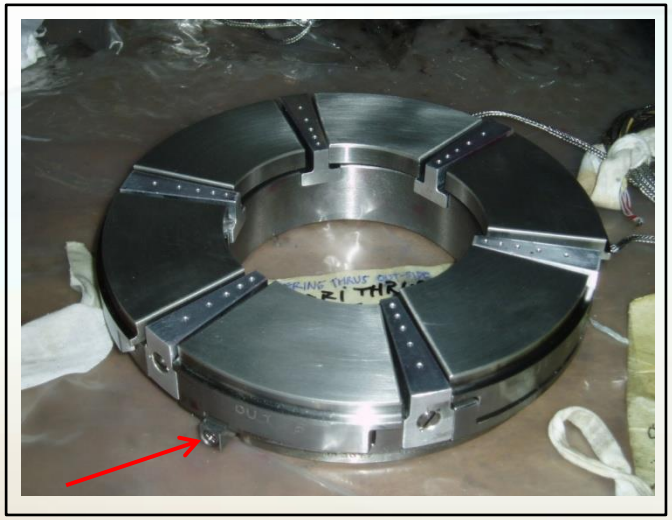


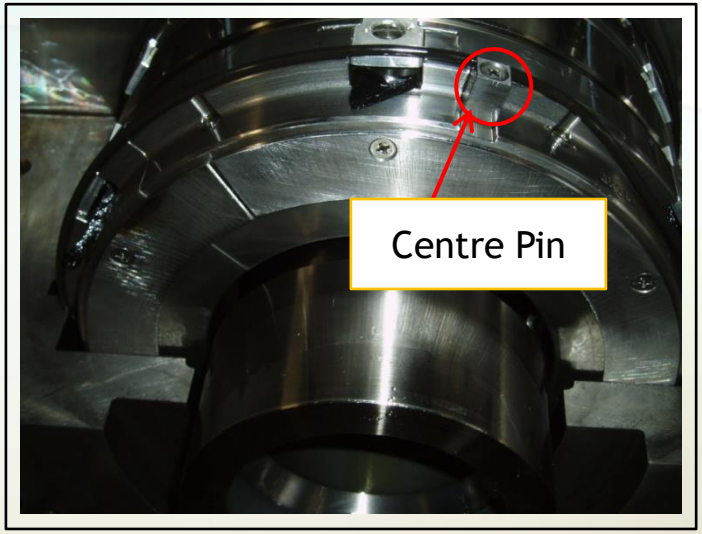


- Remove half thrust pad bearing unit and make sure centre pin in into position.

Thrust and Journal bearing Maintenance

Disassembly Bearing





- Take out pad thrust bearing.

  > be sure position Active and Inactive pad

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Thrust and Journal bearing Maintenance

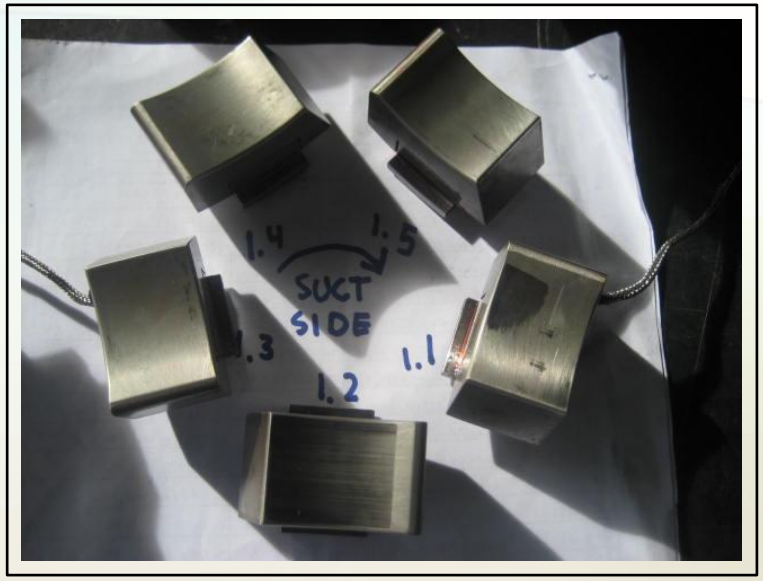
Disassembly Bearing

- Take out pad journal bearing.

  > don't mistake position of pad journal bearing

Thrust and Journal bearing Maintenance

Inspection and measurement



- Clean pads journal and thrust bearing

  > take mark every pads

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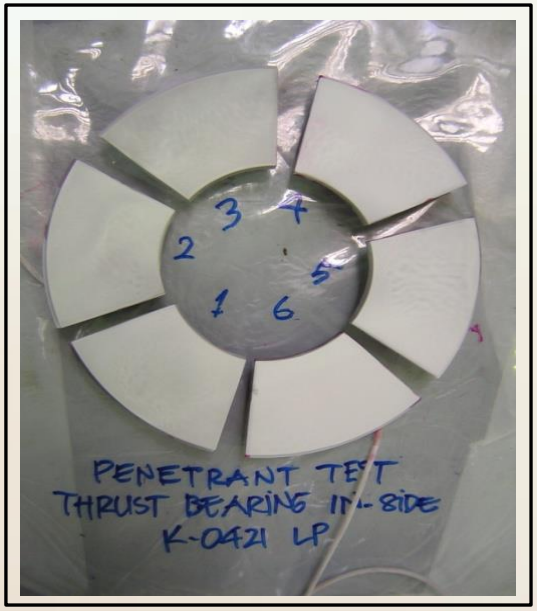
Thrust and Journal bearing Maintenance

Inspection and measurement

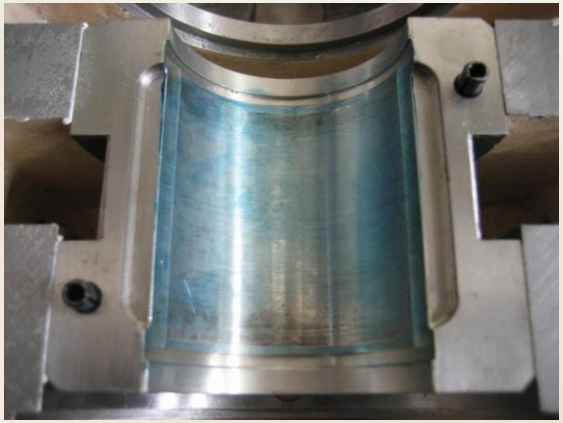
- Penetrant test

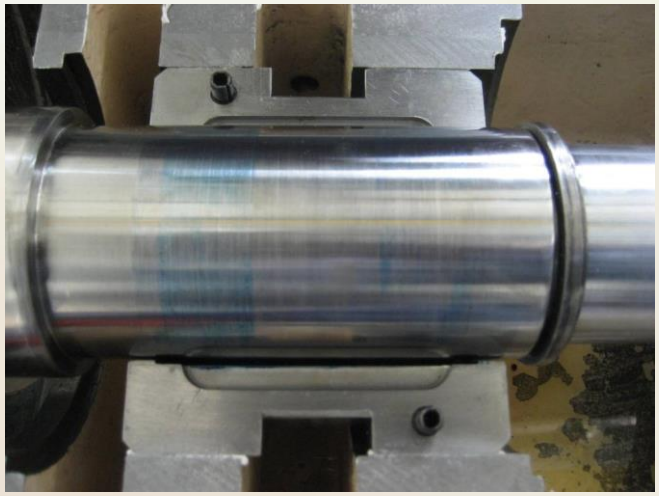


Thrust and Journal bearing Maintenance

Inspection and measurement

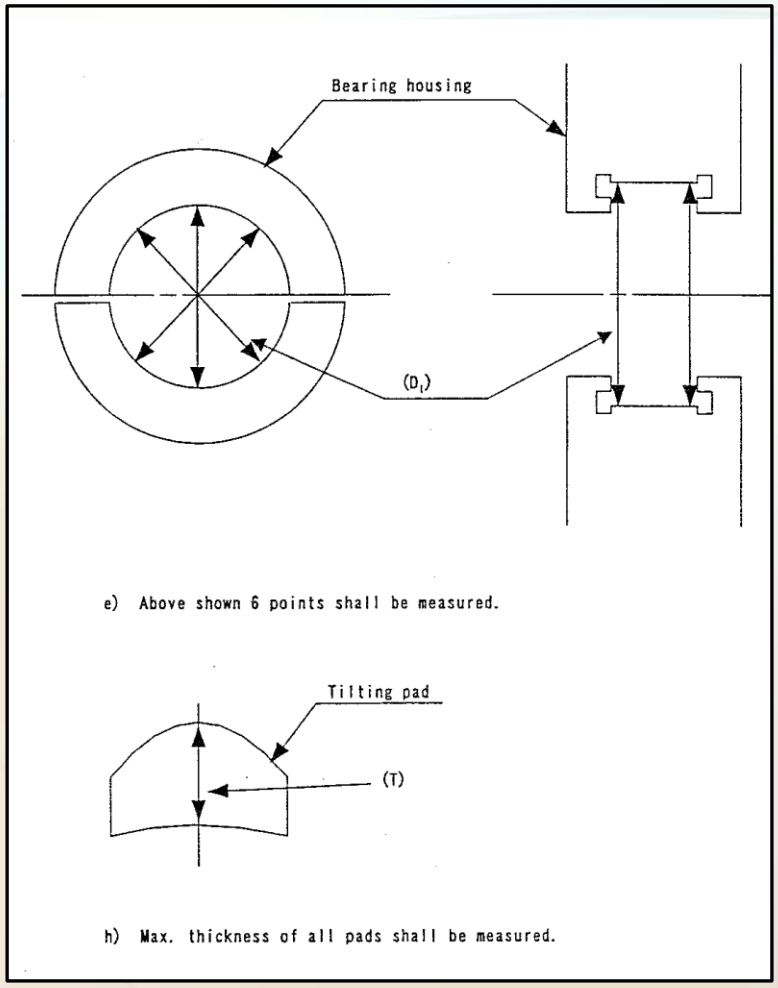
- Penetrant test and blue contact surface





Thrust and Journal bearing Maintenance

Inspection and measurement



- Measurement Radial clearance:
  - Housing
  - Pads
  - Shaft diameter

Thrust and Journal bearing Maintenance

Inspection and measurement

2. Journal bearing

(1) Measurement procedure (please refer to Fig. "B")

a. Remove top half of bearing housing and then remove the rotor in accordance with the rotor lifting procedure.

b. Remove the pads from bearing housing.

c. Clean the surface of the pads and rotor journal and inner surface of bearing housing.

d. Assemble the top and bottom bearing housing and tigthen the fixing bolts.

e. Six(6) points of the inner diameter of bearing housing shall be measured. (DI1, DI2.....,DI6) (see Fig. "B")

f. Confirm above DI1,.....,DI6 are within allowable value.

g. Adopt mean value of above DI1,...,DI6 as inner diameter of bearing housing.

DI=(DI1+DI2+.....+DI6)/6

h. Measure the maximum thickness of all 5 pads (T1,....,T5).
Confirm all of them are within allowable value. (see Fig. "B")

j. Adopt mean value of T1,.....,T5 as a thickness of pads (T).

T=(T1+T2+.....+T5)/5

k. Measure the outer diameter of rotor journal (D).

l. Total clearance of bearing is determined by using the following formula.

Total clearance C=(DI-2T)-D

CLEARANCE TABLE OF BEARINGS (UNIT = mm)

Bearing	Housing inner diameter (DI)	Thickness of pads (T)	Total clearance (C)
Gov. side Design	φ180 +0.07 +0.05	30 -0.01 -0.03	0.22 ~0.29
Max. allow.	-	-	0.435
Exh. side Design	φ180 +0.07 +0.05	30 -0.01 -0.03	0.22 ~0.29
Max. allow.	-	-	0.435

- **Measurement Radial clearance:**

ID Bearing housing - { (2 X AVG Pad thickness) + OD shaft

2. Journal bearing

(1) Measurement procedure (please refer to Fig. "B")

a. Remove top half of bearing housing and then remove the rotor in accordance with the rotor lifting procedure.

b. Remove the pads from bearing housing.

c. Clean the surface of the pads and rotor journal and inner surface of bearing housing.

d. Assemble the top and bottom bearing housing and tigthen the fixing bolts.

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g. Adopt mean value of above DI1,....,DI6 as inner diameter of bearing housing.

$DI=(DI1+DI2+.....+DI6)/6$

h. Measure the maximum thickness of all 5 pads (T1,.....,T5). Confirm all of them are within allowable value. (see Fig. "B")

j. Adopt mean value of T1,.....,T5 as a thickness of pads (T).

$T=(T1+T2+.....+T5)/5$

k. Measure the outer diameter of rotor journal (D).

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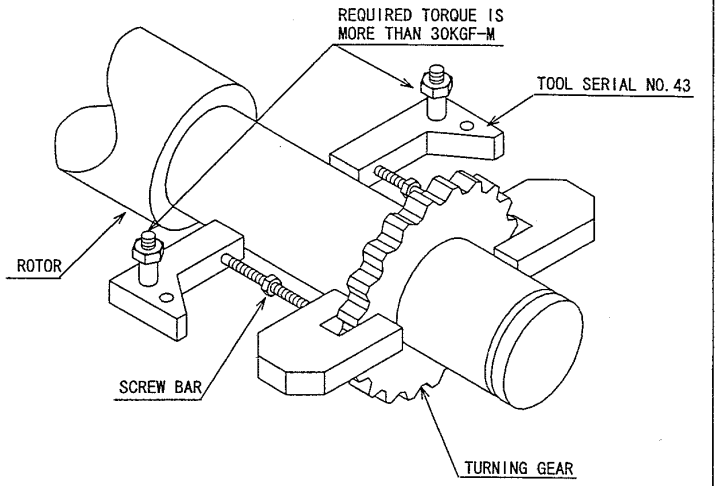
Bearing	Housing inner diameter (DI)	Thickness of pads (T)	Total clearance (C)
Gov. side Design	ϕ180 $^{+0.07}_{+0.05}$	30 $^{-0.01}_{-0.03}$	0.22 –0.29
Max. allow.	–	–	0.435
Exh. side Design	ϕ180 $^{+0.07}_{+0.05}$	30 $^{-0.01}_{-0.03}$	0.22 –0.29
Max. allow.	–	–	0.435

Thrust and Journal bearing Maintenance

Inspection and measurement

ROTOR AXIAL LOCATION ADJUSTING TOOL

NO.
FIG. 12



CAUTION : REMOVE THE COUPLING SPACER, BEFORE ADJUSTMENT OF ROTOR WITH EQUIPMENT.

Remarks

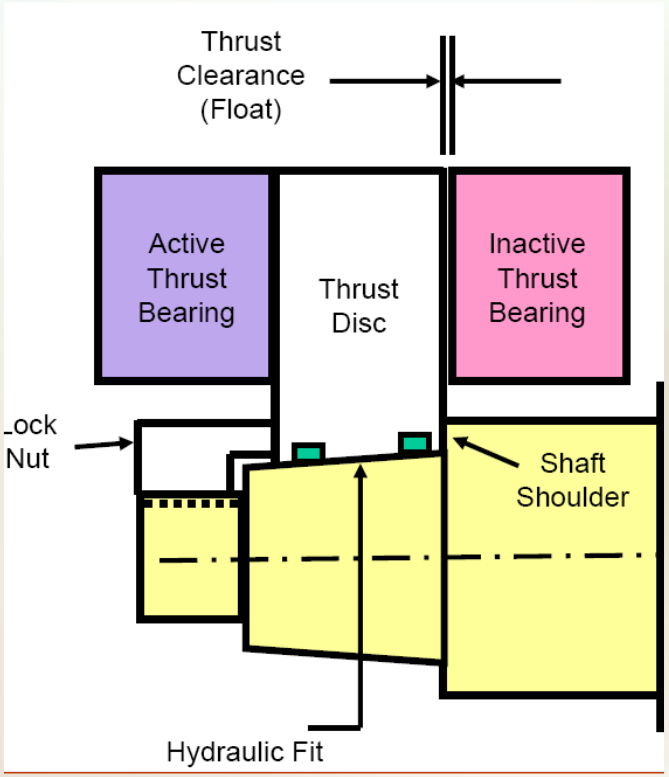
1. Purpose of the tool

   It is used for measuring axial clearance of thrust bearing by moving the rotor to axial direction.

2. How to use the tool

   1) Dismantle the cover of governor side pedestal and set the tool on the governor side pedestal and coupling flange.
   2) Turn the both side screw bar uniformly and pull the rotor toward governer end until thrust disc contacts with thrust pad surface.
   3) Apply dial indicator on the end of shaft and read the indication. Record it as "R1".
   4) Turn the both side screw bar to push the rotor toward exhaust end until thrust disc contacts with thrust pads. Take reading again and record it as "R2".
   5) Then the total axial clearance of thrust bearing is R=R2 - R1.

- **Measurement Thrust clearance:**



Remarks

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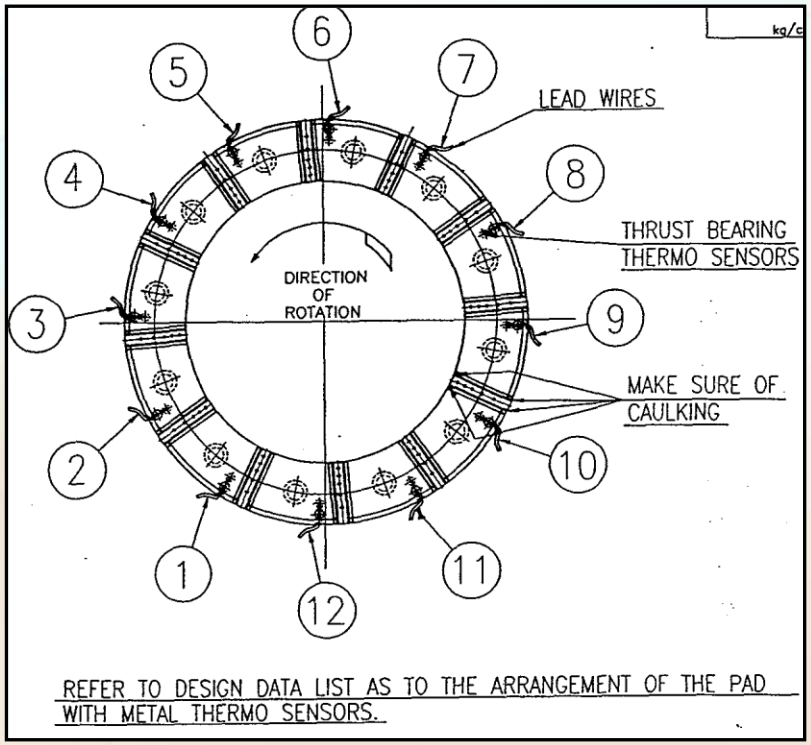
2. How to use the tool

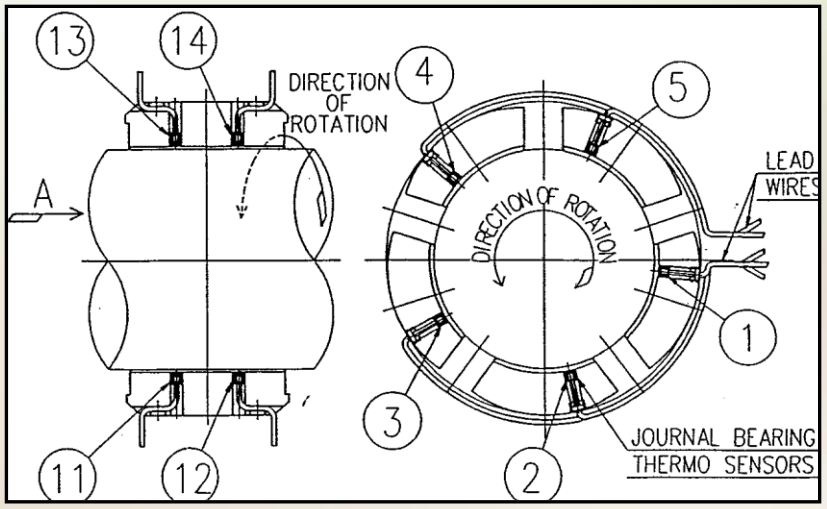
1) Dismantle the cover of governor side pedestal and set the tool on the governor side pedestal and coupling flange.
2) Turn the both side screw bar uniformly and pull the rotor toward governer end until thrust disc contacts with thrust pad surface.
3) Apply dial indicator on the end of shaft and read the indication. Record it as "R1".
4) Turn the both side screw bar to push the rotor toward exhaust end until thrust disc contacts with thrust pads. Take reading again and record it as "R2".
5) Then the total axial clearance of thrust bearing is R=R2 - R1.

Thrust and Journal bearing Maintenance

Inspection and measurement



- **Measurement Thermo sensor**



Thrust and Journal bearing Maintenance

Reassembly

Reassembly Journal Bearing

- Clean all part of Journal bearing and shaft area.
- On both suction and discharge assemble Journal bearing. Place housing lower half and upper half on a flat area and insert pads into housing and secure them by set bolt.
- Fit in lower half bearing assembly on shaft , apply clean oil on the surface and lift shaft about 0.20 mm than push in lower half bearing assembly be carefully cable pad bearing damage.
- Apply clean oil on the shaft and Fit in upper half bearing assembly , instal pin and ellen bolt between lower and upper half bearing assembly , then lightly tighten them.
- Lift shaft about 0.20 mm then turn of unit bearing assembly confirm that mark between Pin and Cover bearing.
- After Journal bearing completely assembled make sure that Rotor turn smoothly and chek cable thermo sensor good condition.

Thrust and Journal bearing Maintenance

Assembly

Reassembly Thrust Bearing

- Clean all part of Thrust bearing , shaft area and Thrust dish.
- On both Actve and Inactive assemble Thrust bearing. Place housing lower half and upper half on a flat area and insert pads into housing and secure them by set bolt.
- Fit in lower Actve and Inactive half bearing assembly on shaft , apply clean on the surface pads and Thrust disc then push the rotor to beside until bearing assembly fit in shaft , be carefully cable pad bearing damage.
- Fit in upper Actve and Inactive half bearing assembled on shaft and insert ellen bolt / set bolt then lightly tighten them.
- Turn thrust bearing assembled and confirm mark , make sure Pin stay in that position (centre with cover bearing)
- Install cover bearing and chek floating axial clearance .

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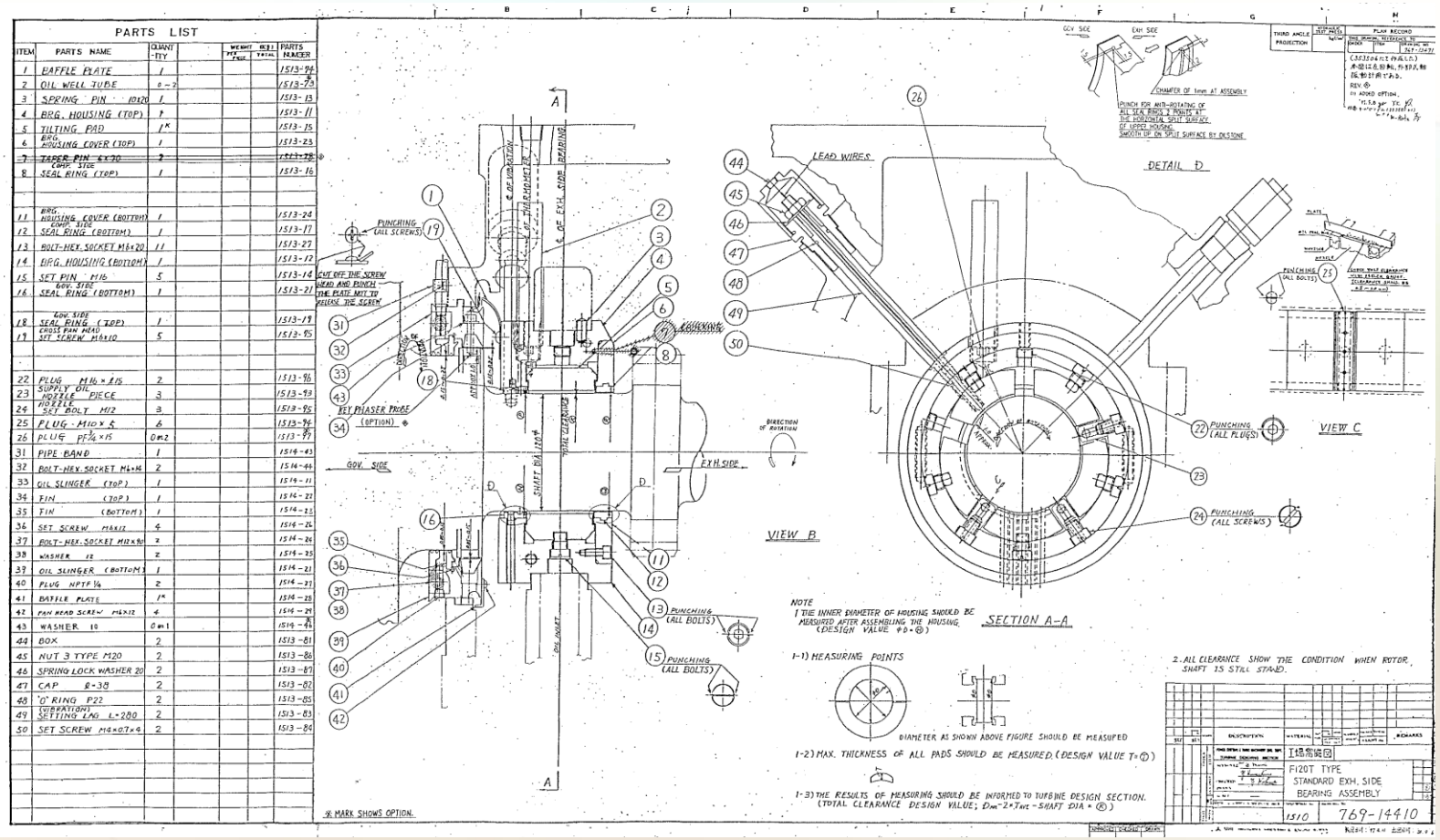
Thrust and Journal bearing Maintenance

Reassembly



PARTS LIST

ITEM	PARTS NAME	QUANTITY	WEIGHT PER PCS	WEIGHT TOTAL	PARTS NUMBER
1	BAFFLE PLATE	1			1513-96
2	OIL WELL TUBE	6 ~ 7			1513-73
3	SPRING PIN ø8X20	1			1513-13
4	BRG. HOUSING (TOP)	1			1513-11
5	TILTING PAD	1K			1513-15
6	BRG. HOUSING COVER (TOP)	1			1513-23
7	TAPER PIN 6X30 COMP. SIDE	2			1513-78
8	SEAL RING (TOP)	1			1513-16
11	BRG. HOUSING COVER (BOTTOM) COMP. SIDE	1			1513-24
12	SEAL RING (BOTTOM)	1			1513-17
13	BOLT-HEX. SOCKET M8x20	11			1513-27
14	BRG. HOUSING (BOTTOM)	1			1513-12
15	SET PIN M16	5			1513-14
16	GOV. SIDE SEAL RING (BOTTOM)	1			1513-21
18	GOV. SIDE SEAL RING (TOP)	1			1513-19
19	CROSS PAN HEAD SET SCREW M6X10	5			1513-95
22	PLUG M16 x P1.5	2			1513-96
23	SUPPLY OIL NOZZLE PIECE	3			1513-93
24	NOZZLE SET BOLT M12	3			1513-95
25	PLUG M10 x L	6			1513-94
26	PLUG PF3/4 x 15	0 or 2			1513-97
31	PIPE BAND	1			1514-43
32	BOLT-HEX. SOCKET M6x14	2			1514-44
33	OIL SLINGER (TOP)	1			1514-11
34	PIN (TOP)	1			1514-22
35	PIN (BOTTOM)	1			1514-23
36	SET SCREW M6X12	4			1514-24
37	BOLT-HEX. SOCKET M12x30	2			1514-26
38	WASHER 12	2			1514-25
39	OIL SLINGER (BOTTOM)	1			1514-21
40	PLUG NPTF 1/4	2			1514-27
41	BAFFLE PLATE	1K			1514-28
42	PAN HEAD SCREW M4X12	4			1514-29
43	WASHER 10	0 or 1			1514-45
44	BOX	2			1513-81
45	NUT 3 TYPE M20	2			1513-86
46	SPRING LOCK WASHER 20	2			1513-87
47	CAP ø-38	2			1513-82
48	"O" RING P22	2			1513-85
49	(VIBRATION) SETTING ENG L=200	2			1513-83
50	SET SCREW M14x0.7x4	2			1513-84

* MARK SHOWS OPTION.

NOTE
1 THE INNER DIAMETER OF HOUSING SHOULD BE MEASURED AFTER ASSEMBLING THE HOUSING. (DESIGN VALUE ø D ø)

1-1) MEASURING POINTS

1-2) MAX. THICKNESS OF ALL PADS SHOULD BE MEASURED. (DESIGN VALUE T=Ⓕ)

1-3) THE RESULTS OF MEASURING SHOULD BE INFORMED TO TURBINE DESIGN SECTION. (TOTAL CLEARANCE DESIGN VALUE; Dm-2*Tm-SHAFT DIA=Ⓔ)

2. ALL CLEARANCE SHOW THE CONDITION WHEN ROTOR SHAFT IS STILL STAND.

F12OT TYPE
STANDARD EXH. SIDE
BEARING ASSEMBLY

1510 769-14410

PUPUK KALTIM

Thrust and Journal bearing Maintenance

Report / Record

PARTS NAME	INSPECTION ITEMS	INSPECTION METHOD	RESULT		REMARKS
			ACCEPTED	REPLACED	
Thrust bearing (Active side)	Clearance	○Measure ○Record	○	○	
	Surface contact(Scratch, Trace, Seizing, Melting etc.)	○Visual ○Record	○	○	
	Abration, Crack	○Visual○P/T○Record	○	○	
	Fretting corrosion on back surface	○Visual ○Record	○	○	
	Rust, Corrosion	○Visual ○Record	○	○	
	Thickness of shoe	○Measure ○Record	○	○	
(Inactive side)	Surface contact(Scratch, Trace, Seizing, Melting etc.)	○Visual ○Record	○	○	
	Abration, Crack	○Visual○P/T○Record	○	○	
	Fretting corrosion on back surface	○Visual ○Record	○	○	
	Rust, Corrosion	○Visual ○Record	○	○	
	Thickness of shoe	○Measure ○Record	○	○	
Journal bearing	Surface contact(Scratch, Trace, Seizing, Melting etc.)	○Visual ○Record	○	○	
	Abration, Crack	○Visual○P/T○Record	○	○	
	Fretting corrosion on back surface	○Visual ○Record	○	○	
	Rust, Corrosion	○Visual ○Record	○	○	
	Pad thickness	○Measure ○Record	○	○	Pad type only
	Crush amount	○Measure ○Record	○	○	Sleeve type only
	Clearance	○Measure ○Record	○	○	
Bearing housing	Deformation and defect on surface	○Visual	○	○	
	Fitness of housing (To casing)	○Visual ○Measure ○Record	○	○	
	Rust, Corrosion	○Visual ○Record	○	○	
Bearing temperature detector	Short circuit, Insulation fault	○Visual ○Ormmeter	○	○	

PUPUK KALTIM

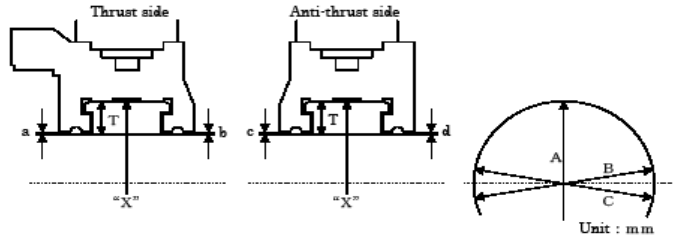
Thrust and Journal bearing Maintenance

Report / Record

JOURNAL BEARING CLEARANCE RECORD

Equip. No. : 103-JHP Date : 20 . 01 . 2009

Model : 4V-7S



Unit : mm

1. Bearing Housing Inside Diameter "X" :

	Position	A	B	C
1) Thrust side	Design : 150.00~150.01mm	118.01	118.00	
2) Anti-thrust side	Design : 150.00~150.01mm	118.00	118.00	

2. Bearing Pad Thickness "T" (Design : 19.00) :

1) Thrust side	① 18.99	② 18.985	③ 18.985	④ 18.985	⑤ 18.985
2) Anti-thrust side	① 18.985	② 19.00	③ 19.00	④ 19.00	⑤ 18.995

*Change new 5 pads on Anti thrust side

3. Rotor Shaft Outside Diameter "Y" :

1) Thrust side	Design : ϕ80 mm	Actual : 79.89 mm
2) Anti-thrust side	Design : ϕ80 mm	Actual : 79.89 mm

4. Bearing Clearance "C" ("C"="X"−2"T"−"Y") :

1) Thrust side	Design : 0.12~0.18 mm	Actual : 0.14 mm
2) Anti-thrust side	Design : 0.12~0.18 mm	Actual : 0.15 mm

5. Clearance "a", "b", "c" & "d" :

1) Thrust side	Design : 0.60~0.71 mm	a : 0.65 mm	b : 0.65 mm
2) Anti-thrust side	Design : 0.60~0.71 mm	c : 0.65 mm	d : 0.60 mm

6. Clearance of dumper ring :

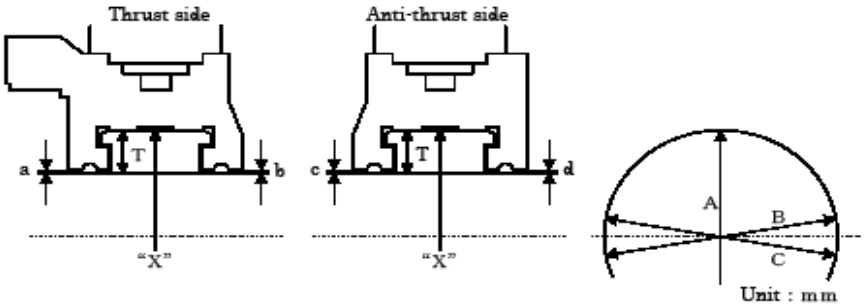
I.D. : 100.11 mm O.D. : 99.99 mm Design : 0.12~0.14 mm Actual : 0.12 mm

Sheet No. (C)

JOURNAL BEARING CLEARANCE RECORD

Equip. No. : 103-JHP Date : 20 . 01 . 2009

Model : 4V-7S



Unit : mm

1. Bearing Housing Inside Diameter "X" :

		Position	A	B	C
1)	Thrust side	Design : 150.00~150.01mm	118.01	118.00	
2)	Anti-thrust side	Design : 150.00~150.01mm	118.00	118.00	

2. Bearing Pad Thickness "T" (Design : 19.00) :

1) Thrust side ① 18.99 ② 18.985 ③ 18.985 ④ 18.985 ⑤ 18.985

2) Anti-thrust side ① 18.985 ② 19.00 ③ 19.00 ④ 19.00 ⑤ 18.995

*Change new 5 pads on Anti thrust side

3. Rotor Shaft Outside Diameter "Y" :

1) Thrust side Design : ϕ80 mm Actual : 79.89 mm

2) Anti-thrust side Design : ϕ80 mm Actual : 79.89 mm

4. Bearing Clearance "C" ("C"="X"－2"T"－"Y") :

1) Thrust side Design : 0.12~0.18 mm Actual : 0.14 mm

2) Anti-thrust side Design : 0.12~0.18 mm Actual : 0.15 mm

5. Clearance "a", "b", "c" & "d" :

1) Thrust side Design : 0.60~0.71 mm a : 0.65 mm b : 0.65 mm

2) Anti-thrust side Design : 0.60~0.71 mm c : 0.65 mm d : 0.60 mm

6. Clearance of dumper ring :

I.D. : 100.11 mm O.D. : 99.99 mm Design : 0.12~0.14 mm Actual : 0.12 mm

Sheet No. (C)

Thrust and Journal bearing Maintenance

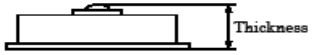
Report / Record

THRUST SHOE THICKNESS RECORD

Equip. No. : 103—JHP
Model : 4V-7S

Date : 21 . 01 . 2009

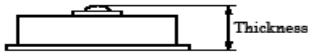
1. Active side thrust bearing shoe:



Unit : mm

No.	Last overhaul 0	This time O/H
1		25.36
2		25.36
3		25.36
4		25.36
5		25.35
6		25.36

2. Inactive side thrust bearing shoe:



Unit : mm

No.	Last overhaul 0	This time O/H
1		25.37
2		25.37
3		25.37
4		25.365
5		25.37
6		25.37

Sheet No. (C)

THRUST SHOE THICKNESS RECORD

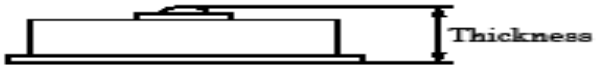
Equip. No. : 103—JHP

Model : 4V-7S

Date : 21 . 01 . 2009

1 . Active side thrust bearing shoe:

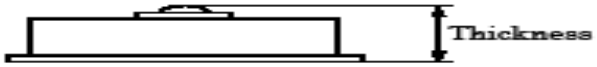
Unit : mm



No.	Last overhaul 0	This time O/H
1		25.36
2		25.36
3		25.36
4		25.36
5		25.35
6		25.36

2. Inactive side thrust bearing shoe:

Unit : mm



No.	Last overhaul 0	This time O/H
1		25.37
2		25.37
3		25.37
4		25.365
5		25.37
6		25.37

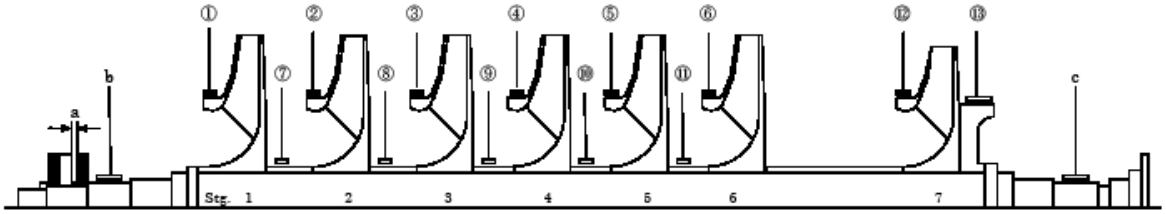
Thrust and Journal bearing Maintenance

Report / Record

CLEARANCE RECORD

Equip. No. : 103–JHP
Model : 4v-7S

Date : 22 . 01 . 2009



Rotor S/N : KU-7883 / 28 S

Unit : mm

No	Description	Design	Actual	No	Description	Design	Actual
a	Thrust bearing	0.46~0.56	0.47	⑧	2~3rd stage shaft labyrinth	0.40~0.60	0.51
b	Journal bearing	0.12~0.18	0.14	⑨	3~4th stage shaft labyrinth	0.40~0.60	0.52
①	1st stage impeller labyrinth	0.40~0.60	0.49	⑩	4~5th stage shaft labyrinth	0.40~0.60	0.55
②	2nd stage impeller labyrinth	0.40~0.60	0.58	⑪	5~6th stage shaft labyrinth	0.40~0.60	0.55
③	3rd stage impeller labyrinth	0.40~0.60	0.54	⑫	7th stage impeller labyrinth	0.50~0.70	0.47
④	4th stage impeller labyrinth	0.40~0.60	0.56	⑬	Balance piston labyrinth	0.40~0.60	0.51
⑤	5th stage impeller labyrinth	0.40~0.60	0.43	c	Journal bearing	0.12~0.18	0.15
⑥	6th stage impeller labyrinth	0.40~0.60	0.54				
⑦	1~2nd stage shaft labyrinth	0.40~0.60	0.57				

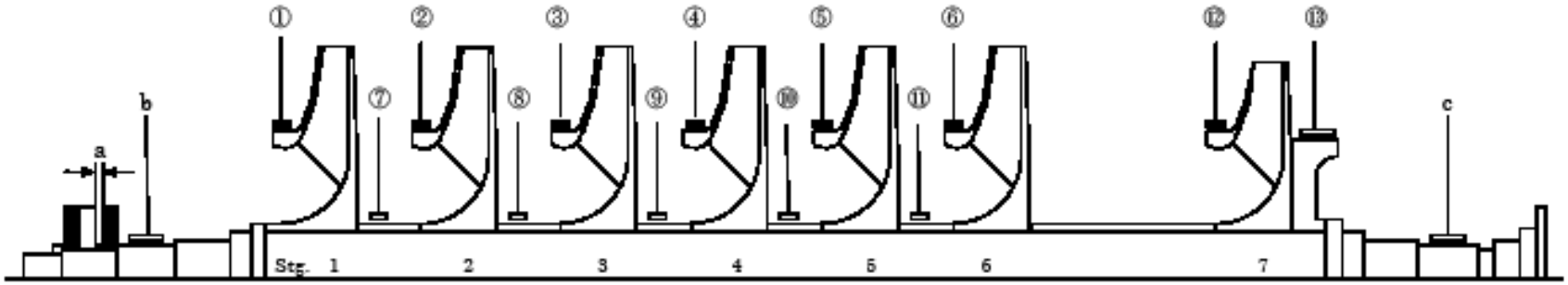
※1 Viewed from thrust end ※2 Labyrinth design clearances are on dia. Note: Max. allowable of all clearances are 150% of max. design clearance.

Stg. 8

CLEARANCE RECORD

Equip. No. : 103−JHP
Model : 4v-7S

Date : 22 . 01 . 2009



Rotor S/N : KU-7883 / 28 S

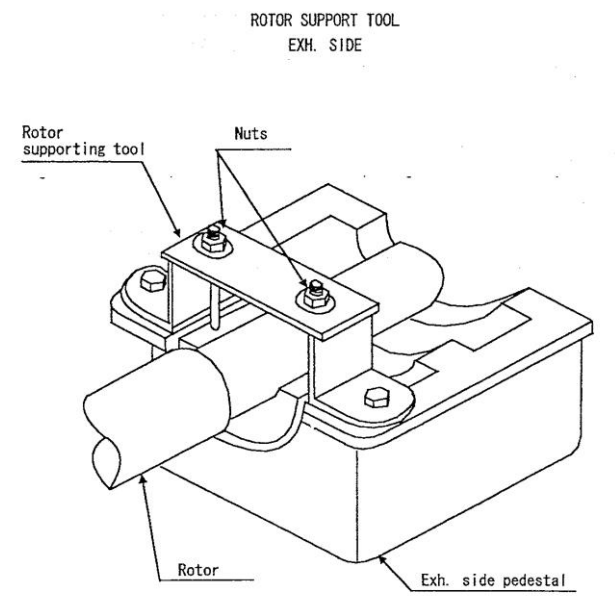
Unit : mm

No	Description	Design	Actual	No	Description	Design	Actual
a	Thrust bearing	0.46～0.56	0.47	⑧	2～3rd stage shaft labyrinth	0.40～0.60	0.51
b	Journal bearing	0.12～0.18	0.14	⑨	3～4th stage shaft labyrinth	0.40～0.60	0.52
①	1st stage impeller labyrinth	0.40～0.60	0.49	⑩	4～5th stage shaft labyrinth	0.40～0.60	0.55
②	2nd stage impeller labyrinth	0.40～0.60	0.58	⑪	5～6th stage shaft labyrinth	0.40～0.60	0.55
③	3rd stage impeller labyrinth	0.40～0.60	0.54	⑫	7th stage impeller labyrinth	0.50～0.70	0.47
④	4th stage impeller labyrinth	0.40～0.60	0.56	⑬	Balance piston labyrinth	0.40～0.60	0.51
⑤	5th stage impeller labyrinth	0.40～0.60	0.43	c	Journal bearing	0.12～0.18	0.15
⑥	6th stage impeller labyrinth	0.40～0.60	0.54				
⑦	1～2nd stage shaft labyrinth	0.40～0.60	0.57				

※1 Viewed from thrust end ※2 Labyrinth design clearances are on dia. Note: Max. allowable of all clearances are 150% of max. design clearance.

Thrust and Journal bearing Maintenance

Inspection and measurement



2. Journal bearing

(1) Measurement procedure (please refer to Fig. "B")

a. Remove top half of bearing housing and then remove the rotor in accordance with the rotor lifting procedure.

b. Remove the pads from bearing housing.

c. Clean the surface of the pads and rotor journal and inner surface of bearing housing.

d. Assemble the top and bottom bearing housing and tigthen the fixing bolts.

e. Six(6) points of the inner diameter of bearing housing shall be measured. (D11, D12.....,D16) (see Fig. "B")

f. Confirm above D11,.....,D16 are within allowable value.

g. Adopt mean value of above D11,...,D16 as inner diameter of bearing housing.

$DI=(D11+D12+.....+D16)/6$

h. Measure the maximum thickness of all 5 pads (T1,....,T5). Confirm all of them are within allowable value. (see Fig. "B")

j. Adopt mean value of T1,.....,T5 as a thickness of pads (T).

$T=(T1+T2+.....+T5)/5$

k. Measure the outer diameter of rotor journal (D).

l. Total clearance of bearing is determined by using the following formula.

Total clearance $C=(DI-2T)-D$

CLEARANCE TABLE OF BEARINGS (UNIT = mm)

Bearing	Housing inner diameter (DI)	Thickness of pads (T)	Total clearance (C)
Gov. side Design	ϕ180 $^{+0.07}_{+0.05}$	30 $^{-0.01}_{-0.03}$	0.22 –0.29
Max. allow.	–	–	0.435
Exh. side Design	ϕ180 $^{+0.07}_{+0.05}$	30 $^{-0.01}_{-0.03}$	0.22 –0.29
Max. allow.	–	–	0.435

PUPUK KALTIM

Thrust and Journal bearing Maintenance

Thank you - Terimakasih