Cenovus Energy
Foster Creek West Pads SAP

FINAL DATABOOK

Mayekawa

Refrigerant Compressor

MYCOM P400

K-9700

PO: P482176

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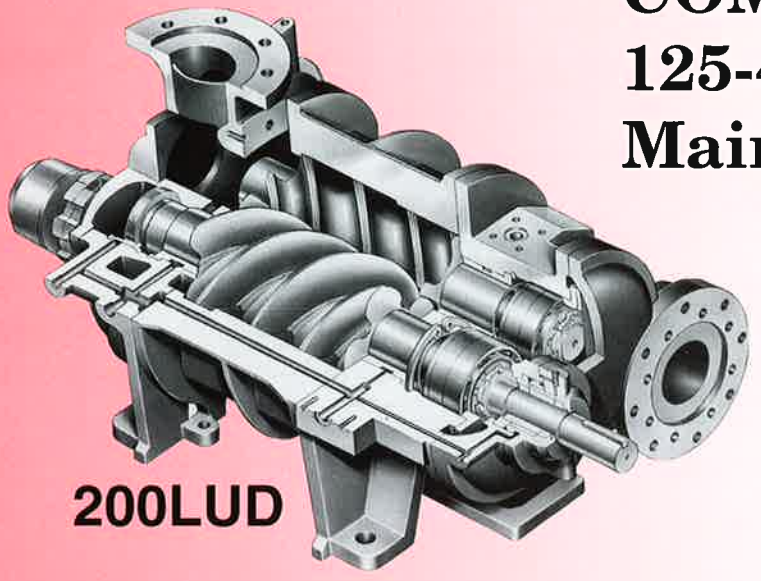
SCREW COMPRESSOR 125-400UD Maintenance Manual



200LUD

MYCOM

400MUD

MAYEKAWA MFG. CO., LTD.

Tokyo,Japan

I n d e x

INTORODUCTION

Read this manual carefully and familiarize yourself with the structure and the operating principles and procedures before disassembling and reassembling this compressor.

Failure to follow the instructions given in this manual may result in possible personal injury and/or serious compressor damage.

⚠ DENGER

* Be sure disconnect the power to the motor and control system before disconnecting drive connection and control connection.
* If the drive connection and control connection are disconnected with out cutting the power supply, electric shock or compressor rotation may occur, endangering life.
* If power source turned on during inspection or maintenance service, compressor and oil pump start operation, resulting in occurrence of unforeseen accident such as physical injury, exposure of the pressure vessel, shock, etc.

⚠ WARNING

- Should this product be operated carelessly and in disregard of the instructions given in this manual, death or serious injury may result. Read this manual carefully before disassembly or reassembly of this equipment. This manual must be kept in a convenient, easily-accessible location near the system and should be studied periodically by those working with system.
- Maintenance work on this product should not be undertaken without a thorough understanding of the instructions given in this manual.
- Prior to commencing any inspection or maintenance work on the product, read the safety warnings provided the beginning of this manual.
- Keep this manual in a convenient, easily-accessible location near the system and study it frequently.
- If this manual is lost or damaged, a replacement should be obtained immediately from Mayekawa Mfg. Co,, Ltd.. or the nearest representative in your area.
- If ownership of this product passes to another party, this instruction manual should always accompany the compressor.
- Mayekawa Mfg. Co,, Ltd. reserves the right to make changes or improvements to its products without notice. It is possible, therefore, that some explanations given in this manual may not apply to a particular machine. If any uncertainty exists on the part of the compressor operator, contact Mayekawa Mfg. Co,, Ltd or the nearest representative in your area.
- Any questions regarding this manual or the product should be addressed to Mayekawa Mfg. Co,, Ltd or the nearest representative in your area.
- Safety and warning labels are attached to the product. Do not remove these labels or allow them to become dirty and unreadable.

Tool

- Hand tools should not be modified.
  Unreasonable modification of a tool may result in damage to the compressor or parts when the tool is used.
- Deformed or worn-out tool or modified tool may have a risk of serious injury.

Refrigerant

- Confirm that the internal pressure of the compressor is the same as ambient air pressure before disconnecting.
- Should high pressure refrigerant gas or lubricating oil remained inside the compressor crankcase, physical injury may occur due to below out on disassembly such as suffocation, faint, etc.

Removing compressor

- Compressor lifting and moving work should be carried out only by qualified personnel.
- If the compressor is not stabilized horizontally on the work bench, it may fall when being worked on.
- Disassembly and assembly work should never be carried out at the status of lifting, otherwise serious injury may result by drop of main body of compressor or component parts on laborer.

I. GENERAL EXPLANATION OF THE SCREW COMPRESSOR

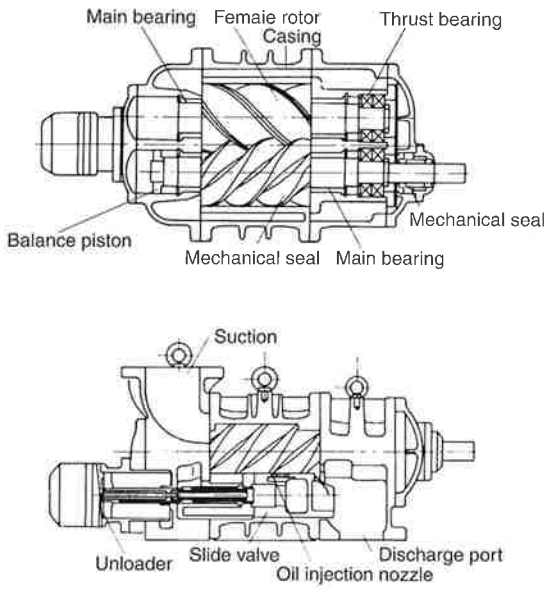
Several type of compressor are used for refrigeration purposes. Among them the screw compressor is classified as a positive displacement rotary type. This type of compressor employs a rotating action to compress and eject the gas. The effect is the same as that of the common reciprocating compressor.

As shown in Fig 1, the main part of the compressor consists of two mating helically grooved rotors set in bearings at either end of the compressor casing. The rotor having convex lobes is called the male rotor and the one having six concave lobes is called the female rotor.

A 2 pole motor is generally used, driving the male rotor. It rotates at 3000 rpm at 50 Hz and 3600 rpm at 60 Hz, and the female rotor follows at 2000 rpm (50HZ) and 2400 rpm (60Hz).

The rotor lobe profiles are our latest design, having an asymmetric profile which gives high compression efficiency. Wear on the rotors is negligible as they are well lubricated and the leading edges do not come in contact with the casing.

Fig.1 Compresser structure



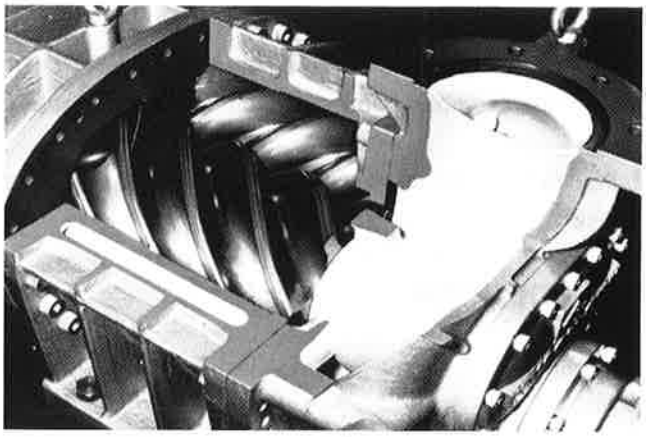
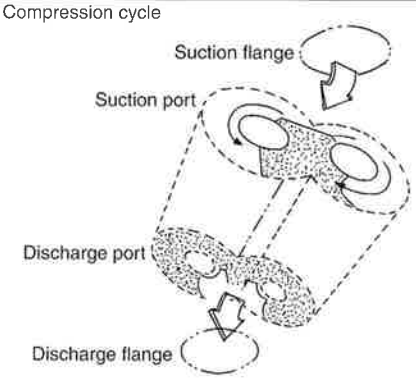


Fig.2 Rotation and compression by rotor

Fig.3 Compression cycle



Suction phase:

A pair of lobes an mesh on the suction port side. Gas flows in the increasing volume formed between the lobes and the casing until the lobes are completely unmeshed.

Transfer phase:

The trapped pocket isolated from the inlet and outlet is moved circumferentially at constant suction pressure.

Fig.4 Suction phase

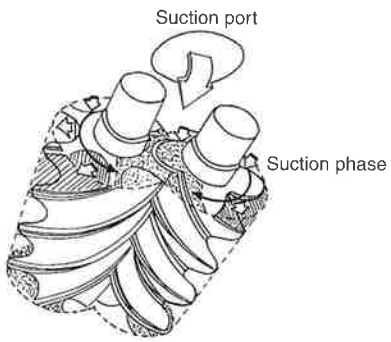
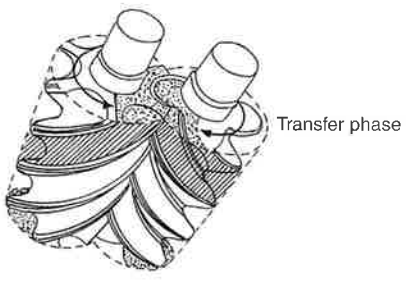


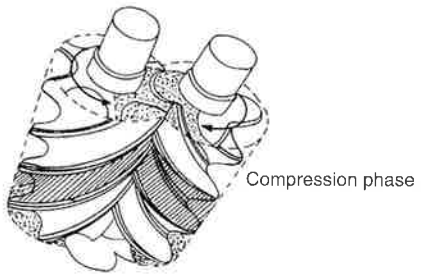
Fig.5 Suction side sealed



Compression phase:

When remeshing starts at the inlet end, the trapped volume is reduced, and the charge is gradually moved helically, while simultaneously being compressed, toward the discharge end as the lobes' mesh point moves along axially.

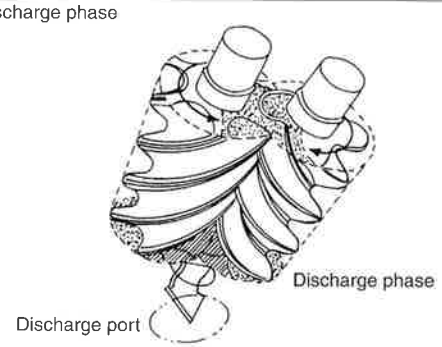
Fig.6 Compression phase



Discharge phase:

Discharge starts when the compressed volume has been moved to the axial port on the discharge end of the machine and continues until all the trapped gas is completely purged.

Fig.7 Discharge phase



As described in the proceeding passages, the screw compressor repeats suction, transfer, compression and discharge continuously at each lobe interface. This compressor has no valve mechanism as found in reciprocating compressors so no vibration or abrasion occurs. Moreover, stable, surge free running is performed under all operating conditions as this is a positive displacement type compressor.

Note: The built-in volume ratio is Vi as shown in the capacity charts, catalogue and other materials.

Volume ratio L=2.6
M=3.6
H=5.8

$$Vi = \frac{\text{Volume of trapped gas when Compression begins}}{\text{Volume of the same amount of gas when Discharge begins}}$$

The relationship of Vi and the compression ratio in general.

$(Vi)^k \pi i = Pd/ps$ Where k=Cp/Cv of refrigeration gas
Vi=Designed volume ratio
πi=Designed compression ratio

L.M.H should be chosen in accordance with operating conditions. The use of a compressor the volume ratio of which has not been matched with operating conditions is a waste of power and does not provide efficient operation.

Fig.8 Interrnal volume ratio

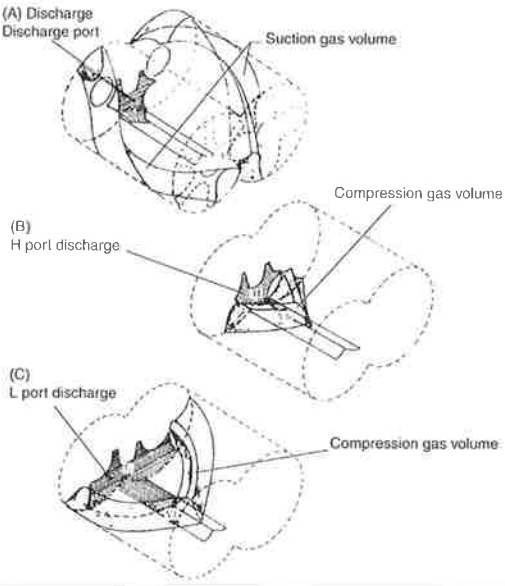


Fig.9-1

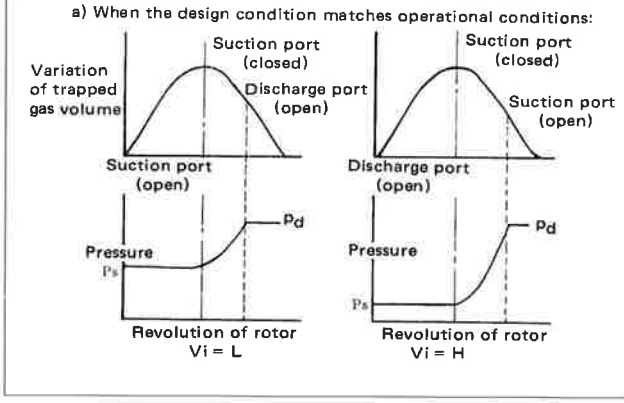
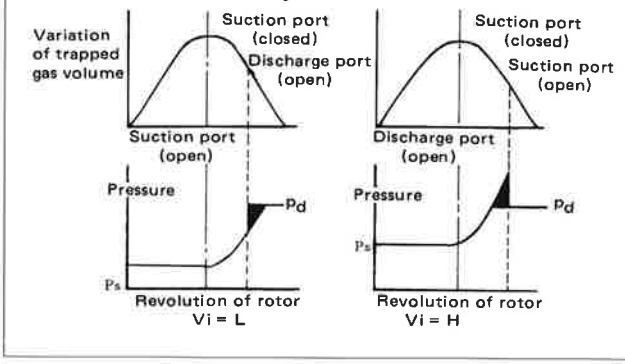


Fig.9-2



(1) In case of high compression ratio operation using a compressor with a small volume ratio.
The compressed gas arriving at the discharge port is not compressed sufficiently. The resulting difference in gas pressure on either side of the port produces a counter flow of the gas towards the suction side.

(2) In case of low compression ratio operation using a compressor with a high volume ratio.
The gas is excessively compressed and expands to occupy the available volume at the discharge side.
This results in inefficient operation due to the excess work performed by the compressor.

The main structural entities other than the rotors are the main, side and thrust bearings, and the oil & gas seals, the slide valve for capacity control, the oil pressure mechanics and the casing.

a) Bearings:

A sleeve type bearing lined with white metal is used for the main and side bearings. These bearings receive radial loads only. The thrust bearings employed are the angular contact ball bearing type, (125-320) and receive of axial loads on the male and female rotor which result from the pressure of gas and the interaction of the drive load and the helical configuration of the rotors. In addition, the oil pressure piston on the discharge side of the mail rotor balances the uneven loads on the rotors. (400 thrust bearings employed tilting pad thrust bearings)

Fig.10 Capacity Control

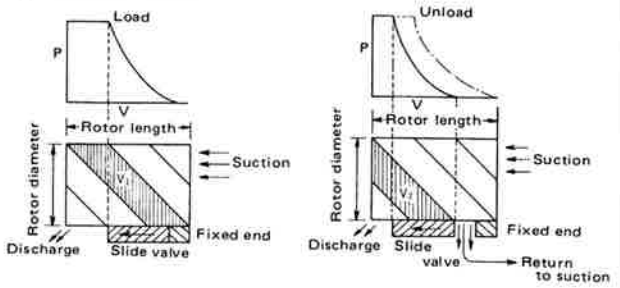
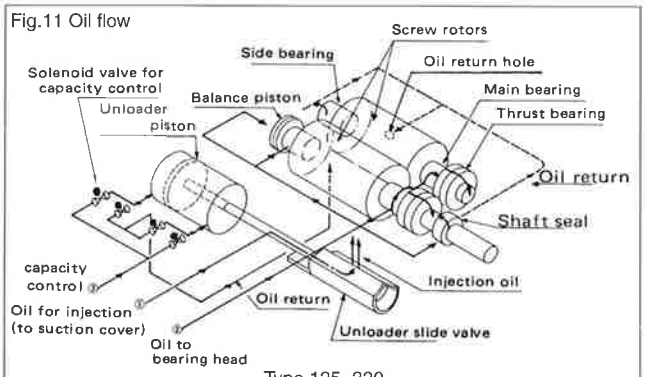
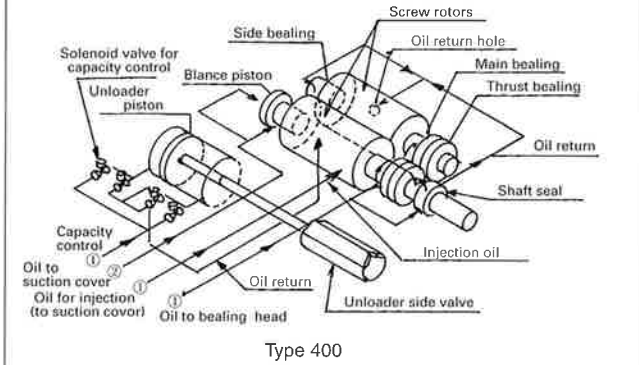


Fig.11 Oil flow



Type 125~320



Type 400

b) Mechanical shaft seal:

Sealing throughout is accomplished by the use of "O" rings (suitable for all types of refrigerant currently in use.) These rings are highly reliable and we can guarantee their excellent sealing qualities for all oils and refrigerants.

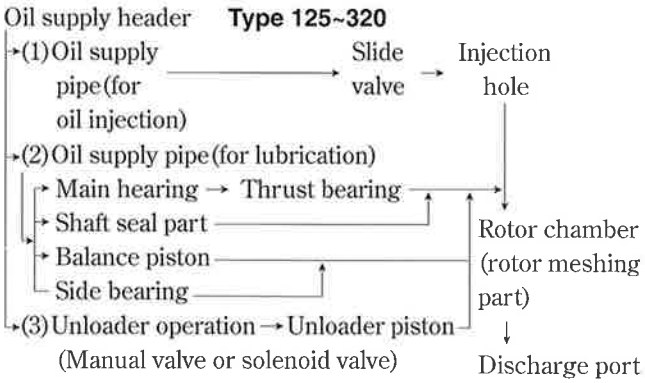
c) Capacity control mechanics:

Capacity control is accomplished by an unloader slide valve which moves parallel to the rotor axis and changes the area of the opening in the bottom of the rotor casing. This, in effect, lengthens or shortens the region of compression of the rotor and further acts to return gas to the suction side, while bypassing compressed gas.

Optional Capacity Control:

The pressure or temperature of the suction gas can be converted to an electrical pulse to operate an oil pressure actuator, which controls in the back and forth movement of the slide valve.

Lubrication oil flow of the standard type compressor
Lubricating oil follows three paths through the compressor finished and is discharged with the gas.



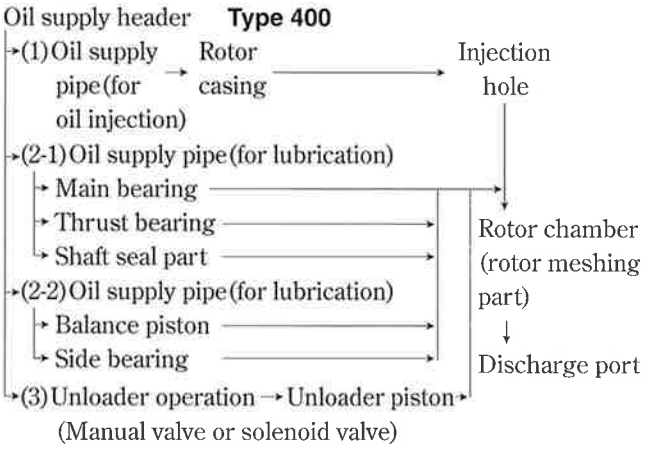
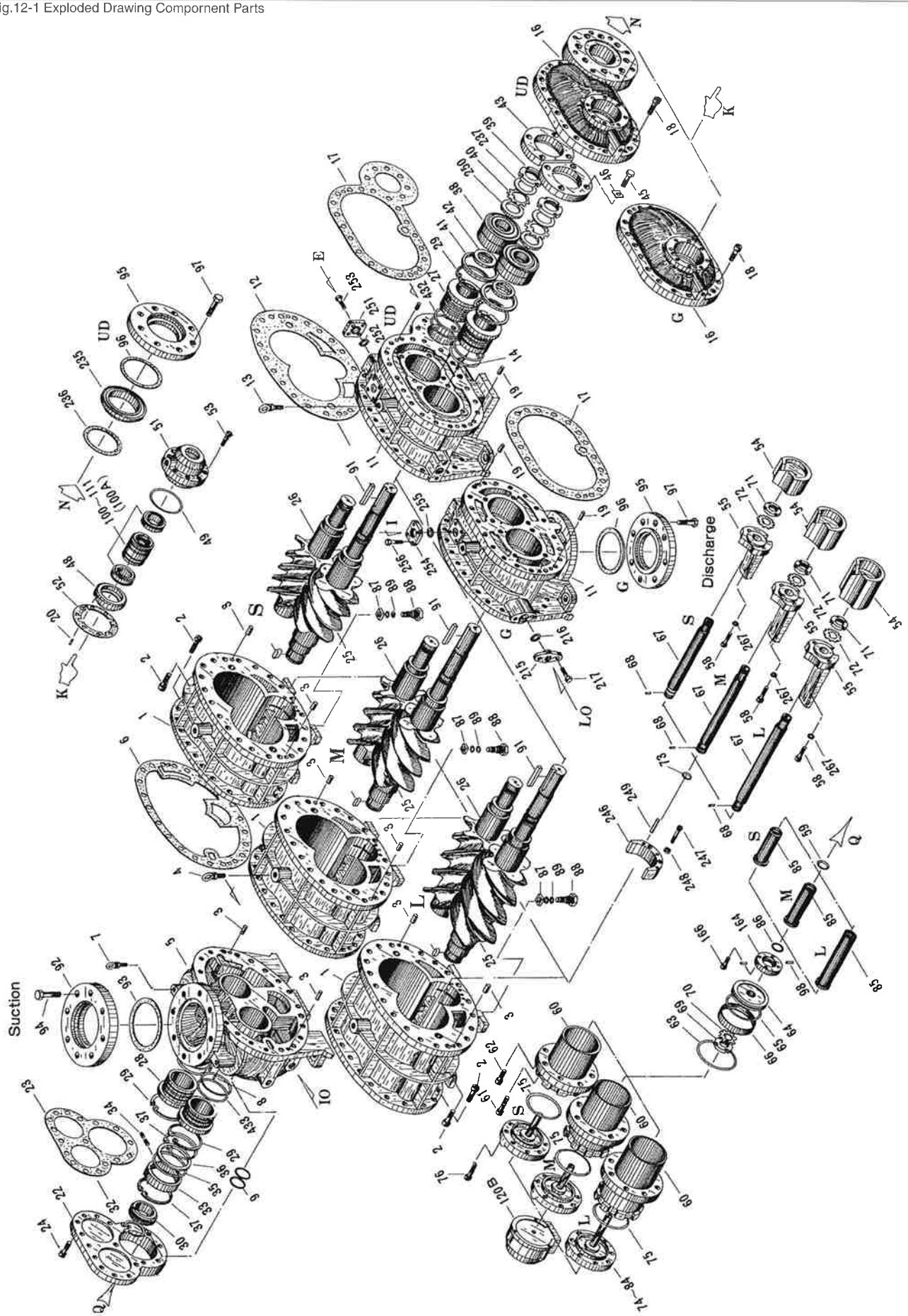
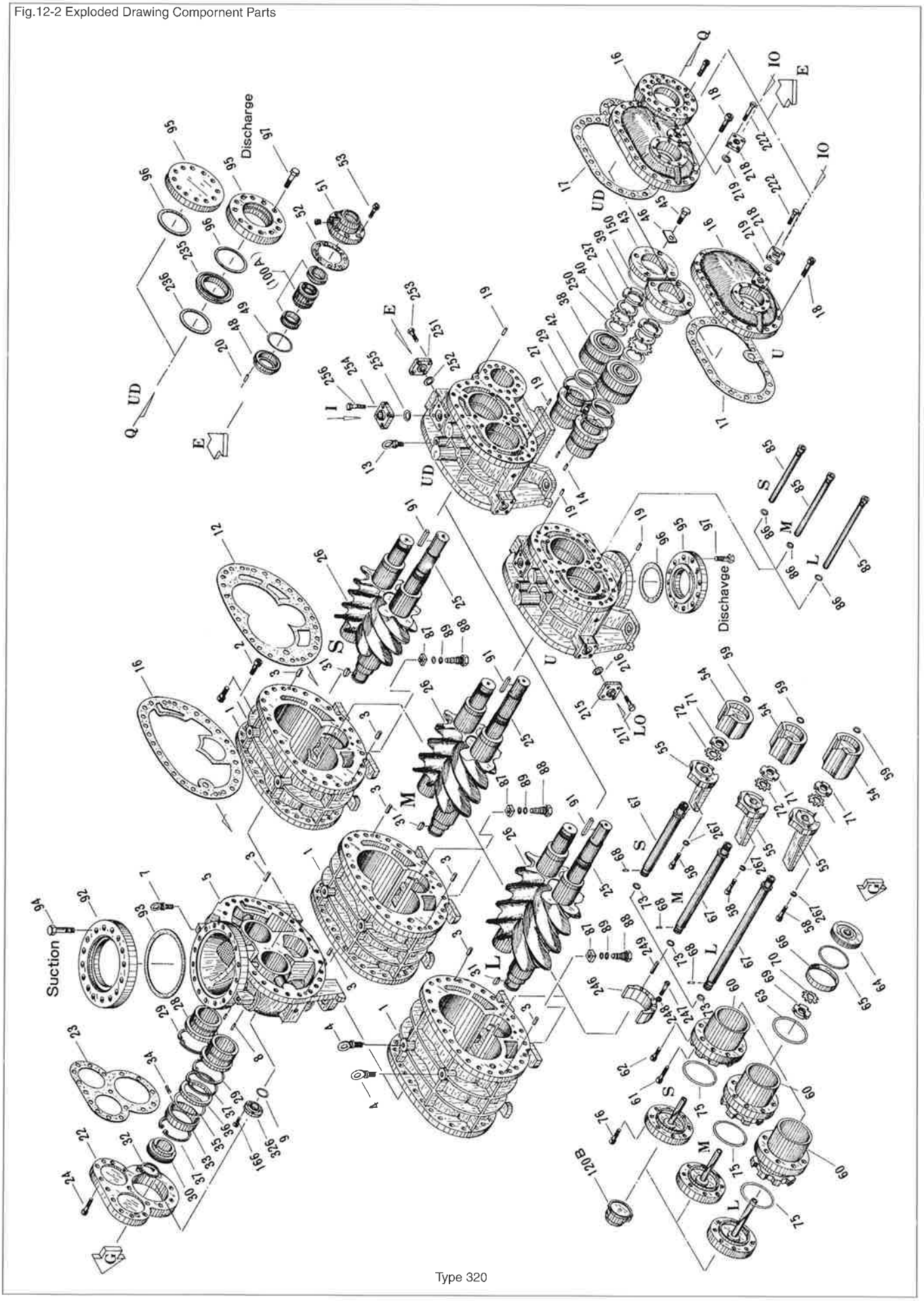


Fig.12-1 Exploded Drawing Compornent Parts



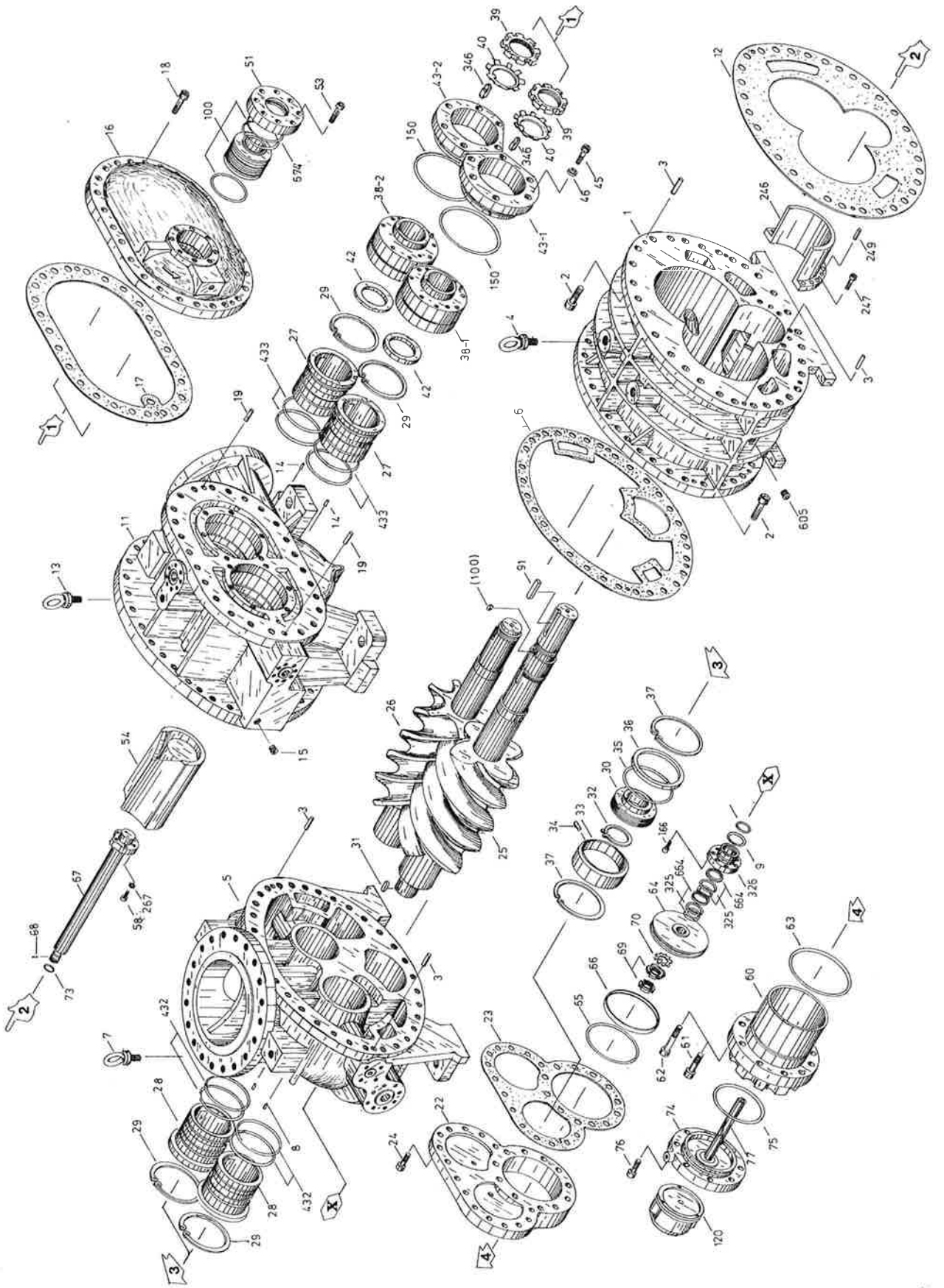
Type 125~250

Fig.12-2 Exploded Drawing Compornent Parts



Type 320

Fig.12-3 Exploded Drawing Compornent Parts



Type 400

1) 125** Parts List

No.	EX	Parts Name	Code No	Remarks	SUD	LUD	SG	LG
1		Main Rotor Casing	CS0010-CS	125S**	1		1	
1		Main Rotor Casing	CS0010-CL	125L**		1		1
2		Hexagon Socket Head Cap Screw	NB3514-040	M14×40	36	36	36	36
3		Alignment Pin	NE2016-040	ϕ16×40	4	4	4	4
4		Hanger Bolt	NB6000-016	M16	1	1	1	1
5		Suction Cover	CS0050-CLD	125***	1	1	1	1
6		Gasket, Suction Cover	CS0061-C	125***	1	1	1	1
7		Hanger Bolt	NB6000-012	M12	2	2	2	2
8		Spring Pin	NE3204-010	ϕ4×10	2	2	2	2
9		"O"ring	PA2401-042	JISB2401 1A P42	2	2	2	2
10	A	Plug	NF0600-08	R1/4	1	1	1	1
10	B	Plug	NF0600-08	R1/4	1	1	1	1
10	C	Plug	NF0600-10	R3/8	1	1	1	1
10	D	Plug	NF0600-10	R3/8	1	1	1	1
11	H	Bearing Head	CS0110-CDH	125***	1	1		
11	H	Bearing Head	CS0110-CGH	125*G*			1	1
11	M	Bearing Head	CS0110-CDM	125***	1	1		
11	M	Bearing Head	CS0110-CGM	125*G*			1	1
11	L	Bearing Head	CS0110-CDL	125***	1	1		
11	L	Bearing Head	CS0110-CGL	125*G*			1	1
12		Gasket, Bearing Head	CS0121-C	125***	1	1	1	1
13		Hanger Bolt	NB6000-012	M12	1	1	1	1
14		Spring Pin	NE3204-010	ϕ4×10	2	2	2	2
16		Bearing Cover	CS0160-CD	125***	1	1		
16		Bearing Cover	CS0160-CG	125*G*			1	1
17		Gasket, Bearing Cover	CS0171-CD	125***	1	1		
17		Gasket, Bearing Cover	CS0171-CG	125*G*			1	1
18	1	Hexagon Socket Head Cap Screw	NB3512-030	M12×30	13	13	16	16
18	2	Hexagon Socket Head Cap Screw	NB3512-075	M12×75	8	8		
18		Alignment Pin	NE2013-032	ϕ13×32	2	2	2	2
20		Spring Pin	NE3203-008	ϕ3×8	1	1	1	1
22		Balance Piston Cover	CS0220-C	125***	1	1	1	1
23		Gasket, Balance Piston Cover	CS0231-C	125***	1	1	1	1
24		Hexagon Socket Head Cap Screw	NB3508-025	M8×25	11	11	11	11
25		Male Rotor	CS0252-CS	125S**	1		1	
26		Female Rotor		125S**	1		1	
25		Male Rotor	CS0252-C	125L**		1		1
26		Female Rotor		125L**		1		1
27		Main Bearing	CS0270-C	125***	2	2	2	2
28		Side Bearing	CS0280-C	125***	2	2	2	2
29		Stop Ring	NG1100-080	H80	4	4	4	4
30		Balance Piston	CS0300-C	125***	1	1	1	1
31		Key, Balance Piston	CS0310-C	125***	1	1	1	1
32		Stop Ring	NG1200-040	S40	1	1	1	1

No.	EX	Parts Name	Code No	Remarks	SUD	LUD	SG	LG
38		Thrust Bearing	CS0380-C	7209AFADFC7P5a	2	2	2	2
39		Lock Nut	NG3100-09	AN09	2	2	2	2
40		Lock Washer	NG3200-09	AW09	2	2	2	2
41		Spacer,Thrust Bearing Outer Race	CS0410-C	125***	2	2	2	2
42		Spacer,Thrust Bearing Alignment	CS0420-C	125***	2	2	2	2
43		Thrust Bearing Gland	CS0430-CD	125***	2	2	2	2
45		Hexagon Head Bolt	NB1508-025	M8×25	8	8	8	8
46		Lock Washer	ND3200-08	125***	8	8	8	8
48		Retainer,Oil Seal	CS0480-C	125***	1	1	1	1
49		"O"ring	PA2402-085	JISB2401 1A G85	1	1	1	1
50		Oil Seal	CS0501-CV		1	1	1	1
51		Seal Cover	CS0510-CB	125***	1	1	1	1
51	HE	Seal Cover	CS0510-CHE	125*** (HE)	1	1	1	1
52		Gasket, Seal Cover	CS0521-C	125***	1	1	1	1
53		Hexagn Socket Head Cap Screw	NB3506-020	M6×20	8	8	8	8
54	L	Unloader Slide Valve (L Port)	CS0541-CSL	125S**	1		1	
54	M	Unloader Slide Valve (M Port)	CS0541-CSM	125S**	1		1	
54	H	Unloader Slide Valve (H Port)	CS0541-CSH	125S**	1		1	
54	L	Unloader Slide Valve (L Port)	CS0541-CLL	125L**		1		1
54	M	Unloader Slide Valve (M Port)	CS0541-CLM	125L**		1		1
54	H	Unloader Slide Valve (H Port)	CS0541-CLH	125L**		1		1
58		Hexagon Socket Head Cap Screw	NB3506-025	M6×25	4	4	4	4
59		"O"ring	PA2401-030	JISB2401 1A P30	2	2	2	2
60		Unloader Cylinder	CS0600-CL	125***	1	1	1	1
61		Hexagon Socket Head Cap Screw	NB3508-025	M8×25	2	2	2	2
62		Hexagon Socket Head Cap Screw	NB3508-065	M8×65	6	6	6	6
63		"O"ring	PA2402-095	JISB2401 1A G95	1	1	1	1
64		Unloader Piston	CS0641-C	125***	1	1	1	1
65		"O"ring	PA2401-075	JISB2401 1A P75	1	1	1	1
66		Cap Seal	CS0660-C	CAP-3BE75	1	1	1	1
67		Push Rod,Unloader Slide Valve	CS0671-CS	125S**	1		1	
67		Push Rod,Unloader Slide Valve	CS0671-CL	125L**		1		1
68		Guide Pin	CS0680-03	ϕ3×8	1	1	1	1
69		Lock Nut	NG3100-05	AN05	2	2	2	2
70		Lock Washer	NG3200-05	AW05	2	2	2	2
73		"O"ring	PA2401-021	JISB2401 1A P21	1	1	1	1
74		Unloader Cylinder Cover	CS0740-C	125***	1	1	1	1
75		"O"ring	PA2402-085	JISB2401 1A G85	1	1	1	1
76		Hexagon Socket Head Cap Screw	NB3506-030	M6×30	8	8	8	8
77		Indicator CAM	CS0770-CS	125S**	1		1	
77		Indicator CAM	CS0770-CL	125L**		1		1
78		Ball Bearing	CS0780-E	#6000	1	1	1	1
79		Stop Ring	NG1200-010	S10	1	1	1	1
80		Bearing Gland	CS0800-E	200***	1	1	1	1

1) 125** Parts List

No.	EX	Parts Name	Code No	Remarks	SUD	LUD	SG	LG
81		Hexagon Socket Head Cap Screw	NB3506-015	M6×15	3	3	3	3
82		"V"ring	CS0820-EB	20×10×12	1	1	1	1
83		Spring	CS0830-E	200***	1	1	1	1
84		Retainer,Indicator Cam Spring	CS0840-E	200***	1	1	1	1
85		Oil Injection Pipe	CS0851-CS	125S**	1		1	
85		Oil Injection Pipe	CS0851-DS	125L&160S		1		1
87		Guide Block	CS0870-C	125***	1	1	1	1
88		Stem, Guide Block		125***	1	1	1	1
89		"O"ring	PA2401-012	JISB2401 1A P12	2	2	2	2
91		Shaft Key	CS0910-C	125***	1	1	1	1
92		Suction Flange	CS7140-100	MYK100A(4")	1	1	1	1
63		Gasket,Suction Flange	CR7201-100		1	1	1	1
94		Hexagon Head Bolt	NB1222-055	M22×55	4	4	4	4
95		Discharge Flange	CS7140-066	MYK65A(2"1/2)	1	1		
95		Discharge Flange	CS7140-090	MYK90A(3"1/2)			1	1
96		Gasket,Discharge Flange	CS2361-C		1	1		
96		Gasket,Discharge Flange	CS7201-090				1	1
97		Hexagon Head Bolt	NB1516-045	M16×45	4	4	4	4
98		Spring Pin	NE3203-012	ϕ3×14	2	2	2	2
100		Mechanical Seal Assembly	CS1000-CV	BOS-T1	1	1	1	1
120		Unloader Indicator Assembly	CS1209-0CF		1	1	1	1
164		Pipe Gland, Oil Injection	CS1640-D	160***	1	1	1	1
166		Hexagon Socket Head Cap Screw	NB3505-012	M5×12	2	2	2	2
235		Spacer,Discharge Flange	FX1010-125		1	1	1	1
236		Gasket,Discharge Flange Spacer	CS2361-C		1	1	1	1
237		Torsional Slip Washer	CS2370-C	125***	2	2	2	2
246		Guide, Unloader Slide Valve	CS2460-C	125***	1	1	1	1
247		Hexagon Socket Head Cap Screw	NB3506-045	M6×45	3	3	3	3
248		Spring Washer	ND3200-06	M6	3	3	3	3
249		Alignment Pin	NE2006-035	ϕ6×35	2	2	2	2
250		Thrust Washer	CS2500-C	125***	2	2	2	2
251		Flange (for Electromizer)	CR7400-015	MYK15A(1/2")	1	1	1	1
253		Gasket, Flange (for Electromizer)	CR7201-015		1	1	1	1
253		Hexagon Head Bolt	NB1512-030	M12×30	2	2	2	2
254		Flange (for Aquamizer)	CR7400-010	MYK10A(3/8")	1	1	1	1
255		Gasket, Flange (for Aquamizer)	CR7201-010		1	1	1	1
256		Hexagon Head Bolt	NB1512-030	M12×30	2	2	2	2
267		Special Spring Washer		M6	4	4	4	4
605		Plug	NF0600-15	R1/2	1	1	1	1
607		Plug	NF0600-04	R1/8	1	1	1	1

2) 160** Parts List

No.	EX	Parts Name	Code No	Remarks	SUD	MUD	LID	SG	MG	LG
1		Main Rotor Casing	CS0010-DS	160S**	1			1		
1		Main Rotor Casing	CS0010-DM	160M**		1			1	
1		Main Rotor Casing	CS0010-DL	160L**			1			1
2		Hexagon Socket Head Cap Screw	NB3512-040	M12×40	52	52	52	52	52	52
3		Alignment Pin	NE2013-040	ϕ13×40	4	4	4	4	4	4
4		Hanger Bolt	NB6000-016	M16	1	1	1	1	1	1
5		Suction Cover	CS0050-DD	160***	1	1	1	1	1	1
6		Gasket, Suction Cover	CS0061-D	160***	1	1	1	1	1	1
7		Hanger Bolt	NB6000-012	M12	2	2	2	2	2	2
8		Spring Pin	NE3204-010	ϕ4×10	2	2	2	2	2	2
9		"O"ring	PA2401-042	JISB2401 1A P42	2	2	2	2	2	2
10	A	Plug	NF0600-04	R1/8	1	1	1	1	1	1
10	B	Plug	NF0600-08	R1/4	1	1	1	1	1	1
10	C	Plug	NF0600-08	R1/4	1	1	1	1	1	1
11	H	Bearing Head	CS0114-DDH	160***	1	1	1			
11	H	Bearing Head	CS0114-DGH	160*G*				1	1	1
11	M	Bearing Head	CS0114-DDM	160***	1	1	1			
11	M	Bearing Head	CS0114-DGM	160*G*				1	1	1
11	L	Bearing Head	CS0114-DDL	160***	1	1	1			
11	L	Bearing Head	CS0114-DGL	160*G*			1	1		1
12		Gasket, Bearing Head	CS0121-D	160***	1	1	1	1	1	1
13		Hanger Bolt	NB6000-012	M12	1	1	1	1	1	1
14		Spring Pin	NE3204-010	ϕ4×10	2	2	2	2	2	2
15		Plug	NF0600-08	R1/4	1	1	1	1	1	1
16		Bearing Cover	CS0160-DD	160***	1	1	1			
16		Bearing Cover	CS0160-DG	160*G*				1	1	1
17		Gasket, Bearing Cover	CS0171-DD	160***	1	1	1			
17		Gasket, Bearing Cover	CS0171-DD	160*G*				1	1	1
18	2	Hexagon Socket Head Cap Screw	NB35412-080	M12×80	8	8	8			
19		Alignment Pin	NE2010-040	ϕ10×40	2	2	2	2	2	2
20		Spring Pin	NE3203-010	ϕ3×10	1	1	1	1	1	1
22		Balance Piston Cover	CS0220-D	160S/L	1	1	1	1	1	1
23		Gasket, Balance Piston Cover	CS0231-D	160L**	1	1	1	1	1	1
24		Hexagon Socket Head Cap Screw	NB3510-025	M10×25	11	11	11	11	11	11
25		Male Rotor	CS0252-DS	160S*	1			1		
26		Female Rotor		160S*	1			1		
25		Male Rotor	CS0252-DM	160M*		1			1	
26		Female Rotor		160M*		1			1	
25		Male Rotor	CS0252-DL	160L*			1			1
26		Female Rotor		160L*			1			1
27		Main Bearing	CS0270-DRT	160***	2	2	2	2	2	2
28		Side Bearing	CS0280-DRT	160***	2	2	2	2	2	2
29		Stop Ring	NG1100-102	H102	4	4	4	4	4	4
30		Balance Piston	CS0300-D	160***	1	1	1	1	1	1
31		Key, Balance Piston	CS0310-D	160***	1	1	1	1	1	1
32		Stop Ring	NG1200-050	S50	1	1	1	1	1	1
33		Sleeve, Balance Piston	CS0330-D	160***	1	1	1	1	1	1
34		Set Screw	NA8606-015	M6×15	2	2	2	2	2	2
35		"O"ring	PA2402-095	JISB2401 1A G95	1	1	1	1	1	1

2) 160** Parts List

No.	EX	Parts Name	Code No	Remarks	SUD	MUD	LID	SG	MG	LG
36		Spacer	CS0360-D	160***	1	1	1	1	1	1
37		Stop Ring	NG1100-102	H102	2	2	2	2	2	2
38		Thrust Bearing	CS0380-D	7212AFADFC7P5a	2	2	2	2	2	2
39		Lock Nut	NG3100-12	AN12	2	2	2	2	2	2
40		Lock Washer	NG3200-12	AW12	2	2	2	2	2	2
41		Spacer,Thrust Bearing Outer Race	CS0410-D	160***	2	2	2	2	2	2
42		Spacer,Thrust Bearing Alignment	CS0420-D	160***	2	2	2	2	2	2
43		Thrust Bearing Gland	CS0430-D	160***	2	2	2	2	2	2
45		Hexagon Head Bolt	NB1510-030	M10×30	8	8	8	8	8	8
46		Lock Washer	CS0460-D	160***	8	8	8	8	8	8
48		Retainer,Oil Seal	CS0480-D	160***	1	1	1	1	1	1
49		"O"ring	PA2402-090	JISB2401 1A G90	1	1	1	1	1	1
50		Oil Seal	CS0501-DV	SA1J55	1	1	1	1	1	1
51		Seal Cover	CS0510-DB	160***BBS	1	1	1	1	1	1
51	HE	Seal Cover	CS0510-DHE	160*** (HE)	1	1	1	1	1	1
52		Gasket, Seal Cover	CS0521-D	160***	1	1	1	1	1	1
53		Hexagn Socket Head Cap Screw	NB3508-025	M8×25	8	8	8	8	8	8
54	L	Unloader Slide Valve (L Port)	CS0541-DSL	160S**	1			1		
54	M	Unloader Slide Valve (M Port)	CS0541-DSM	160S**	1			1		
54	H	Unloader Slide Valve (H Port)	CS0541-DSH	160S**	1			1		
54	L	Unloader Slide Valve (L Port)	CS0541-DML	160M**		1			1	
54	M	Unloader Slide Valve (M Port)	CS0541-DMM	160M**		1			1	
54	H	Unloader Slide Valve (H Port)	CS0541-DMH	160M**		1			1	
54	L	Unloader Slide Valve (L Port)	CS0541-DLL	160L**			1			1
54	M	Unloader Slide Valve (M Port)	CS0541-DLM	160L**			1			1
54	H	Unloader Slide Valve (H Port)	CS0541-DLH	160L**			1			1
55		Unloader Slide Valve	-	160S**	1			1		
55		Unloader Slide Valve	-	160M**		1			1	
55		Unloader Slide Valve	-	160L**			1			1
58		Hexagon Socket Head Cap Screw	NB3508-025	M8×25	4	4	4	4	4	4
59		"O"ring	PA2401-030	JISB2401 1A P30	2	2	2	2	2	2
60		Unloader Cylinder	CS0600-DS	160S**	1			1		
60		Unloader Cylinder	CS0600-DM	160M**		1			1	
60		Unloader Cylinder	CS0600-DL	160L**			1			1
61		Hexagon Socket Head Cap Screw	NB3510-025	M10×25	2	2	2	2	2	2
62		Hexagon Socket Head Cap Screw	NB3510-065	M10×65	6	6	6	6	6	6
63		"O"ring	PA2402-125	JISB2401 1A G125	1	1	1	1	1	1
64		Unloader Piston	CS0641-D	160***	1	1	1	1	1	1
65		"O"ring	PA2401-100	JISB2401 1A P100	1	1	1	1	1	1
66		Cap Seal	CS0660-D	CAP-3BE100	1	1	1	1	1	1
67		Push Rod,Unloader Slide Valve	CS0671-DS	160S**	1			1		
67		Push Rod,Unloader Slide Valve	CS0671-DM	160M**		1			1	
67		Push Rod,Unloader Slide Valve	CS0671-DL	160L**			1			1
68		Guide Pin	CS0680-03	ϕ3×8	1	1	1	1	1	1
69		Lock Nut	NG3100-05	AN05	2	2	2	2	2	2
70		Lock Washer	NG3200-05	AW05	2	2	2	2	2	2
73		"O"ring	PA2401-021	JISB2401 1A P21	1	1	1	1	1	1
74		Unloader Cylinder Cover	CS0740-D	160***	1	1	1	1	1	1
75		"O"ring	PA2402-110	JISB2401 1A G110	1	1	1	1	1	1

No.	EX	Parts Name	Code No	Remarks	SUD	MUD	LID	SG	MG	LG
76		Hexagon Socket Head Cap Screw	NB3508-025	M8×25	8	8	8	8	8	8
77		Indicator CAM	CS0770-DS	160S**	1			1		
77		Indicator CAM	CS0770-DM	160M**		1			1	
77		Indicator CAM	CS0770-DL	160L**			1			1
78		Ball Bearing	CS0780-E	#6000	1	1	1	1	1	1
79		Stop Ring	NG1200-010	S10	1	1	1	1	1	1
80		Bearing Gland	CS0800-E	200***	1	1	1	1	1	1
81		Hexagon Socket Head Cap Screw	NB3506-015	M6×15	3	3	3	3	3	3
82		"V"ring	CS0820-EB	20×10×12	1	1	1	1	1	1
83		Spring	CS0830-E	200***	1	1	1	1	1	1
84		Retainer,Indicator Cam Spring	CS0840-E	200***	1	1	1	1	1	1
85		Oil Injection Pipe	CS0851-DS	160S**	1			1		
85		Oil Injection Pipe	CS0851-DM	160M**		1			1	
85		Oil Injection Pipe	CS0851-DL	160L**			1			1
87		Guide Block	CS0870-D	160***	1	1	1	1	1	1
88		Stem, Guide Block	-	160***	1	1	1	1	1	1
89		"O"ring	PA2401-016	JISB2401 1A P16	2	2	2	2	2	2
91		Shaft Key	CS0910-D	160***	1	1	1	1	1	1
92		Suction Flange	CS7140-125	MYK125A	1	1	1	1	1	1
93		Gasket,Suction Flange	CR7201-125		1	1	1	1	1	1
94		Hexagon Head Bolt	NB1220-055	M20×55	8	8	8	8	8	8
95		Discharge Flange	CS7140-101	MYK100CD	1	1	1	1	1	1
96		Gasket,Discharge Flange	CS2361-D		1	1	1	1	1	1
97		Hexagon Head Bolt	NB1222-055	M22×55	4	4	4	4	4	4
98		Spring Pin	NE3203-014	ϕ3×14	2	2	2	2	2	2
100		Mechanical Seal Assembly	CS1001-DV	160V** BOS Type	1	1	1	1	1	1
120		Unloader Indicator Assembly	CS1209-0EH		1	1	1	1	1	1
164		Pipe Gland, Oil Injection	CS1640-D	160***	1	1	1	1	1	1
166		Hexagon Socket Head Cap Screw	NB3505-012	M5×12	2	2	2	2	2	2
235		Spacer,Discharge Flange	-		1	1	1	1	1	1
236		Gasket,Discharge Flange Spacer	CS2361-D		1	1	1	1	1	1
237		Torsional Slip Washer	CS2370-D	160***	2	2	2	2	2	2
247		Hexagon Socket Head Cap Screw	NB3506-060	M6×60	4	4	4	4	4	4
248		Spring Washer	ND3300-06	M6	4	4	4	4	4	4
249		Alignment Pin	NE2006-050	ϕ6×50	2	2	2	2	2	2
250		Thrust Washer	CS2500-D	160***	2	2	2	2	2	2
251		Flange (for Electromizer)	CR7400-025	MYK25A	1	1	1	1	1	1
252		Gasket, Flange (for Electromizer)	CR7201-025		1	1	1	1	1	1
253		Hexagon Head Bolt	NB1512-040	M12×35	4	4	4	4	4	4
254		Flange (for Aquamizer)	CR7400-020	MYK20A	1	1	1	1	1	1
255		Gasket, Flange (for Aquamizer)	CR7201-020		1	1	1	1	1	1
256		Hexagon Head Bolt	NB1512-035	M12×35	2	2	2	2	2	2
267		Special Spring Washer	ND3300-08	M8	4	4	4	4	4	4
432		"O"ring	PA2402-085	JISB2401 1A G85	4	4	4	4	4	4
433		"O"ring	PA2402-085	JISB2401 1A G85	4	4	4	4	4	4
605		Plug	NF0600-15	R1/2	1	1	1	1	1	1
607		Plug	NF0600-04	R1/8	1	1	1	1	1	1

3) 200** Parts List

No.	EX	Parts Name	Code No	Remarks	SUD	MUD	LUD	SG	MG	LG
1		Main Rotor Casing	CS0010-ES	200S**	1			1		
1		Main Rotor Casing	CS0010-EM	200M**		1			1	
1		Main Rotor Casing	CS0010-EL	200L**			1			1
2		Hexagon Socket Head Cap Screw	NB3516-050	M16×50	50	50	50	50	50	50
3		Alignment Pin	NE2016-055	φ16×55	4	4	4	4	4	4
4		Hanger Bolt	NB6000-020	M20	1	1	1	1	1	1
5		Suction Cover	CS0050-ED	200***	1	1	1	1	1	1
6		Gasket, Suction Cover	CS0061-E	200***	1	1	1	1	1	1
7		Hanger Bolt	NB6000-012	M12	2	2	2	2	2	2
8		Spring Pin	NE3206-012	φ6×12	2	2	2	2	2	2
9		"O"ring	PA2402-055	JISB2401 1A G55	2	2	2	2	2	2
10	A	Plug	NF0600-10	R3/8	1	1	1	1	1	1
10	B	Plug	NF0600-08	R1/4	1	1	1	1	1	1
10	C	Plug	NF0600-15	R1/2	1	1	1	1	1	1
10	D	Plug	NF0600-15	R1/2	1	1	1	1	1	1
11	H	Bearing Head	CS0114-EDH	200***	1	1	1			
11	H	Bearing Head	CS0114-EGH	200*G*				1	1	1
11	M	Bearing Head	CS0114-EDM	200***	1	1	1			
11	M	Bearing Head	CS0114-EGM	200*G*				1	1	1
11	L	Bearing Head	CS0114-EDL	200***	1	1	1			
11	L	Bearing Head	CS0114-EGL	200*G*			1	1		1
12		Gasket, Bearing Head	CS0121-E	200***	1	1	1	1	1	1
13		Hanger Bolt	NB6000-012	M12	1	1	1	1	1	1
14		Spring Pin	NE3206-012	φ6×12	2	2	2	2	2	2
16		Bearing Cover	CS0160-ED	200***	1	1	1			
16		Bearing Cover	CS0160-EG	200*G*				1	1	1
17		Gasket, Bearing Cover	CS0171-ED	200***	1	1	1			
17		Gasket, Bearing Cover	CS0171-EG	200*G*				1	1	1
18	1	Hexagon Socket Head Cap Screw	NB3516-050	M16×50	17	17	17	20	20	20
18	2	Hexagon Socket Head Cap Screw	NB3516-075	M16×75	8	8	8			
19		Alignment Pin	NE2010-050	φ10×50	2	2	2	2	2	2
20		Spring Pin	NE3203-010	φ3×10	1	1	1	1	1	1
21		Plug	NF0600-10	R3/8	1	1	1	1	1	1
22		Balance Piston Cover	CS0220-EVD	200***	1	1	1	1	1	1
23		Gasket, Balance Piston Cover	CS0231-E	200***	1	1	1	1	1	1
24		Hexagon Socket Head Cap Screw	NB3512-030	M12×30	11	11	11	11	11	11
25		Male Rotor	CS0252-ES	200S*	1			1		
26		Female Rotor		200S*	1			1		
25		Male Rotor	CS0252-EM	200M*		1			1	
26		Female Rotor		200M*		1			1	
25		Male Rotor	CS0252-EL	200L*			1			1
26		Female Rotor		200L*			1			1
27		Main Bearing	CS0270-ER	200***	2	2	2	2	2	2
28		Side Bearing	CS0280-ER	200***	2	2	2	2	2	2
29		Stop Ring	NG1100-130	H130	4	4	4	4	4	4
30		Balance Piston	CS0300-E	200***	1	1	1	1	1	1
31		Key, Balance Piston	CS0310-E	200***	1	1	1	1	1	1
32		Stop Ring	NG1200-065	S65	1	1	1	1	1	1
33		Sleeve, Balance Piston	CS0330-E	200***	1	1	1	1	1	1
34		Set Screw	NA8608-015	M8×15	2	2	2	2	2	2
35		"O"ring	PA2401-120	JISB2401 1A P120	1	1	1	1	1	1
36		Spacer	CS0360-E	200***	1	1	1	1	1	1

No.	EX	Parts Name	Code No	Remarks	SUD	MUD	LUD	SG	MG	LG
37		Stop Ring	NG1100-130	H130	2	2	2	2	2	2
37		Thrust Bearing	CS0380-E	7313AFADFC7P5a	2	2	2	2	2	2
38		Lock Nut	NG3100-13	AN13	2	2	2	2	2	2
40		Lock Washer	NG3200-13	AW13	2	2	2	2	2	2
41		Spacer,Thrust Bearing Outer Race	CS0410-E	200***	2	2	2	2	2	2
42		Spacer,Thrust Bearing Alignment	CS0420-E	200***	2	2	2	2	2	2
43		Thrust Bearing Gland	CS0430-E	200***	2	2	2	2	2	2
45		Hexagon Head Bolt	NB1512-035	M12×35	8	8	8	8	8	8
46		Lock Washer	CS0460-E		8	8	8	8	8	8
48		Retainer,Oil Seal	CS0480-EV	TYPE	1	1	1	1	1	1
49		"O"ring	PA2402-115	JISB2401 1A G115	1	1	1	1	1	1
50		Oil Seal	CS0501-EV	SA1J 65×85×12	1	1	1	1	1	1
51		Seal Cover	CS0510-E	200***	1	1	1	1	1	1
51	HE	Seal Cover	CS0510-EHE	200*** (HE)	1	1	1	1	1	1
52		Gasket, Seal Cover	CS0521-E	200***	1	1	1	1	1	1
53		Hexagn Socket Head Cap Screw	NB3510-025	M10×25	8	8	8	8	8	8
54	L	Unloader Slide Valve (L Port)	CS0541-ESL	200S**	1			1		
54	M	Unloader Slide Valve (M Port)	CS0541-ESM	200S**	1			1		
54	H	Unloader Slide Valve (H Port)	CS0541-ESH	200S**	1			1		
54	L	Unloader Slide Valve (L Port)	CS0541-EML	200M**		1			1	
54	M	Unloader Slide Valve (M Port)	CS0541-EMM	200M**		1			1	
54	H	Unloader Slide Valve (H Port)	CS0541-EMH	200M**		1			1	
54	L	Unloader Slide Valve (L Port)	CS0541-ELL	200L**			1			1
54	M	Unloader Slide Valve (M Port)	CS0541-ELM	200L**			1			1
54	H	Unloader Slide Valve (H Port)	CS0541-ELH	200L**			1			1
55		Unloader Slide Valve	-	200S**	1			1		
55		Unloader Slide Valve	-	200M**		1			1	
55		Unloader Slide Valve	-	200L**			1			1
58		Hexagon Socket Head Cap Screw	NB3510-030	M10×30	4	4	4	4	4	4
59		"O"ring	PA2401-040	JISB2401 1A P40	2	2	2	2	2	2
60		Unloader Cylinder	CS0600-ES	200S**	1			1		
60		Unloader Cylinder	CS0600-EM	200M**		1			1	
60		Unloader Cylinder	CS0600-EL	200L**			1			1
61		Hexagon Socket Head Cap Screw	NB3512-030	M12×30	2	2	2	2	2	2
62		Hexagon Socket Head Cap Screw	NB3512-075	M12×75	6	6	6	6	6	6
63		"O"ring	PA2402-150	JISB2401 1A G150	1	1	1	1	1	1
64		Unloader Piston	CS0641-E	200***	1	1	1	1	1	1
65		"O"ring	PA2401-125	JISB2401 1A P125	1	1	1	1	1	1
66		Cap Seal	CS0660-E	CAP-3BE125	1	1	1	1	1	1
67		Push Rod,Unloader Slide Valve	CS0671-ES	200S**	1			1		
67		Push Rod,Unloader Slide Valve	CS0671-EM	200M**		1			1	
67		Push Rod,Unloader Slide Valve	CS0671-EL	200L**			1			1
68		Guide Pin	CS0680-05	ϕ5×12	1	1	1	1	1	1
69		Lock Nut	NG3100-07	AN07	2	2	2	2	2	2
70		Lock Washer	NG3200-07	AW07	2	2	2	2	2	2
73		"O"ring	PA2402-030	JISB2401 1A G30	1	1	1	1	1	1
74		Unloader Cylinder Cover	CS0740-E	200***	1	1	1	1	1	1
75		"O"ring	PA2402-135	JISB2401 1A G135	1	1	1	1	1	1
76		Hexagon Socket Head Cap Screw	NB3510-025	M10×25	8	8	8	8	8	8
77		Indicator CAM	CS0770-ES	200S**	1			1		
77		Indicator CAM	CS0770-EM	200M**		1			1	
77		Indicator CAM	CS0770-EL	200L**			1			1

3) 200** Parts List

No.	EX	Parts Name	Code No	Remarks	SUD	MUD	LUD	SG	MG	LG
78		Ball Bearing	CS0780-E	#6000	1	1	1	1	1	1
79		Stop Ring	NG1200-010	S10	1	1	1	1	1	1
80		Bearing Gland	CS0800-E	200***	1	1	1	1	1	1
81		Hexagon Socket Head Cap Screw	NB3506-015	M6×15	3	3	3	3	3	3
82		"V"ring	CS0820-EB	20×10×12	1	1	1	1	1	1
83		Spring	CS0830-E	200***	1	1	1	1	1	1
84		Retainer,Indicator Cam Spring	CS0840-E	200***	1	1	1	1	1	1
85		Oil Injection Pipe	CS0851-ES	200S**	1			1		
85		Oil Injection Pipe	CS0851-EM	200M**		1			1	
85		Oil Injection Pipe	CS0851-EL	200L**			1			1
87		Guide Block	CS0870-E	200***	1	1	1	1	1	1
88		Stem, Guide Block	-	200***	1	1	1	1	1	1
89		"O"ring	PA2401-020	JISB2401 1A P20	2	2	2	2	2	2
91		Shaft Key	CS0910-E	200***	1	1	1	1	1	1
92		Suction Flange	CS7140-150	MYK150A(6")	1	1	1	1	1	1
93		Gasket,Suction Flange	CR7201-150	MYK150A	1	1	1	1	1	1
94		Hexagon Head Bolt	NB1222-055	M22×55	8	8	8	8	8	8
95		Discharge Flange	CS7140-126	MYK125A(5")	1	1	1	1	1	1
96		Gasket,Discharge Flange	CS2361-E	MYK125A	1	1	1	1	1	1
97		Hexagon Head Bolt	NB1220-055	M20×55	8	8	8	8	8	8
98		Spring Pin	NE3203-015	ϕ3×16	2	2	2	2	2	2
100		Mechanical Seal Assembly	CS1000-EV	BOS-E1	1	1	1	1	1	1
120		Unloader Indicator Assembly	CS1209-0EF		1	1	1	1	1	1
164		Retainer,Oil Injection Pipe	CS1640-E		1	1	1	1	1	1
166		Hexagon Socket Head Cap Screw	NB3505-012	M5×12	2	2	2	2	2	2
167		Plug	NF0600-15	R1/2	1	1	1	1	1	1
215		Flange,Lubrication Oil Supply	CR7400-020	MYK20A(3/4")	1	1	1	1	1	1
216		Flange	CR7201-020	MYK20A	1	1	1	1	1	1
217		Hexagon Head Bolt	NB1512-035	M12×35	4	4	4	4	4	4
235		Spacer,Discharge Flange	-		1	1	1	1	1	1
236		Gasket,Discharge Flange Spacer	CS2361-E		1	1	1	1	1	1
237		Torsional Slip Washer	CS2370-E	200***	2	2	2	2	2	2
246		Guide, Unloader Slide Valve	CS2460-E	200***	1	1	1	1	1	1
247		Hexagon Socket Head Cap Screw	NB3508-070	M8×70	3	3	3	3	3	3
248		Spring Washer	ND3300-08	M8	3	3	3	3	3	3
249		Alignment Pin	NE2006-060	ϕ8×60	2	2	2	2	2	2
250		Thrust Washer	CS2500-E	200***	2	2	2	2	2	2
251		Flange (for Electromizer)	CR7400-032	MYK32A(1"1/4)	1	1	1	1	1	1
252		Gasket, Flange (for Electromizer)	CR7201-032	MYK32A	1	1	1	1	1	1
253		Hexagon Head Bolt	NB1512-040	M12×40	4	4	4	4	4	4
254		Flange (for Aquamizer)	CR7400-025	MYK25A(1")	1	1	1	1	1	1
255		Gasket, Flange (for Aquamizer)	CR7201-025	MYK25A	1	1	1	1	1	1
256		Hexagon Head Bolt	NB1512-040	M12×40	4	4	4	4	4	4
267		Special Spring Washer	ND3300-10	M10	4	4	4	4	4	4
432		"O"ring	PA1517-022	JIS W1516 1A G22	4	4	4	4	4	4
433		"O"ring	PA1517-022	JIS W1516 1A G22	4	4	4	4	4	4
528		Sleeve,Oil Seal	CS5280-EV	200V**	1	1	1	1	1	1
529		Set Screw	NA8606-005	M6×5	2	2	2	2	2	2
605		Plug	NF0600-20	R3/4	1	1	1	1	1	1
607		Plug	NF0600-04	R1/8	1	1	1	1	1	1

4) 250** Parts List

No.	EX	Parts Name	Code No	Remarks	SUD	MUD	LUD	SG	MG	LG
1		Main Rotor Casing	CS0010-FS	250S**	1			1		
1		Main Rotor Casing	CS0010-FM	250M**		1			1	
1		Main Rotor Casing	CS0010-FL	250L**			1			1
2		Hexagon Socket Head Cap Screw	NB3520-060	M20×60	44	44	44	44	44	44
3		Alignment Pin	NE2016-070	φ16×70	4	4	4	4	4	4
4		Hanger Bolt	NB6000-024	M24	1	1	1	1	1	1
5		Suction Cover	CS0050-FD	250***	1	1	1	1	1	1
6		Gasket, Suction Cover	CS0061-F	250***	1	1	1	1	1	1
7		Hanger Bolt	NB6000-012	M12	2	2	2	2	2	2
8		Spring Pin	NE3206-012	φ6×12	2	2	2	2	2	2
9		"O"ring	PA2402-060	JISB2401 1A G60	2	2	2	2	2	2
10	A	Plug	NF0600-10	R3/8	1	1	1	1	1	1
10	B	Plug	NF0600-08	R1/4	1	1	1	1	1	1
10	C	Plug	NF0600-20	R3/4	1	1	1	1	1	1
10	D	Plug	NF0600-15	R1/2	1	1	1	1	1	1
11	H	Bearing Head	CS0114-FDH	250***	1	1	1			
11	H	Bearing Head	CS0114-FGH	250*G*				1	1	1
11	M	Bearing Head	CS0114-FDM	250***	1	1	1			
11	M	Bearing Head	CS0114-FGM	250*G*				1	1	1
11	L	Bearing Head	CS0114-FDL	250***	1	1	1			
11	L	Bearing Head	CS0114-FGL	250*G*				1	1	1
12		Gasket, Bearing Head	CS0121-F	250***	1	1	1	1	1	1
13		Hanger Bolt	NB6000-012	M12	1	1	1	1	1	1
14		Spring Pin	NE3206-012	φ6×12	2	2	2	2	2	2
16		Bearing Cover	CS0160-FD	250***	1	1	1			
16		Bearing Cover	CS0160-FG	250*G*				1	1	1
17		Gasket, Bearing Cover	CS0171-FD	250***	1	1	1			
17		Gasket, Bearing Cover	CS0171-FG	250*G*				1	1	1
18	1	Hexagon Socket Head Cap Screw	NB3516-050	M16×50	20	20	20	24	24	24
18	2	Hexagon Socket Head Cap Screw	NB3516-090	M16×90	8	8	8			
19		Alignment Pin	NE2010-050	φ10×50	2	2	2	2	2	2
20		Spring Pin	NE3203-010	φ3×10	1	1	1	1	1	1
21		Plug	NF0600-10	R3/8	1	1	1	1	1	1
22		Balance Piston Cover	CS0220-FVD	250V**	1	1	1	1	1	1
23		Gasket, Balance Piston Cover	CS0231-F	250***	1	1	1	1	1	1
24		Hexagon Socket Head Cap Screw	NB3512-030	M12×30	11	11	11	11	11	11
25		Male Rotor	CS0252-FS	250S	1			1		
26		Female Rotor		250S	1			1		
25		Male Rotor	CS0252-FM	250M		1			1	
26		Female Rotor		250M		1			1	
25		Male Rotor	CS0252-FL	250L			1			1
26		Female Rotor		250L			1			1
27		Main Bearing	CS0270-FRT	250***	2	2	2	2	2	2
28		Side Bearing	CS0280-FRT	250***	2	2	2	2	2	2
29		Stop Ring	NG1100-160	H160	4	4	4	4	4	4
30		Balance Piston	CS0300-F	250***	1	1	1	1	1	1
31		Key, Balance Piston	CS0310-F	250***	1	1	1	1	1	1
32		Stop Ring	NG1200-080	S80	1	1	1	1	1	1
33		Sleeve, Balance Piston	CS0330-F	250***	1	1	1	1	1	1
34		Set Screw	NA8608-020	M8×20	2	2	2	2	2	2

4) 250** Parts List

No.	EX	Parts Name	Code No	Remarks	SUD	MUD	LUD	SG	MG	LG
35		"O"ring	PA2401-150	JISB2401 1A G150	1	1	1	1	1	1
36		Spacer	CS0360-F	250***	1	1	1	1	1	1
37		Stop Ring	NG1100-160	H160	2	2	2	2	2	2
38		Thrust Bearing	CS0380-F	7317AFADFC7P5a	2	2	2	2	2	2
39		Lock Nut	NG3100-17	AN17	2	2	2	2	2	2
40		Lock Washer	NG3200-17	AW17	2	2	2	2	2	2
42		Spacer,Thrust Bearing Alignment	CS0420-F	250***	2	2	2	2	2	2
43		Thrust Bearing Gland	CS0430-F	250***	2	2	2	2	2	2
45		Hexagon Head Bolt	NB1516-045	M16×45	8	8	8	8	8	8
46		Lock Washer	CS0460-F		8	8	8	8	8	8
48		Retainer,Oil Seal	CS0480-F	250***	1	1	1	1	1	1
49		"O"ring	PA2402-135	JISB2401 1A G135	1	1	1	1	1	1
50		Oil Seal	CS0501-FV	SA1J 75×100×13	1	1	1	1	1	1
51		Seal Cover	CS0510-FB	250***	1	1	1	1	1	1
51	HE	Seal Cover	CS0510-FHE	250*** (HE)	1	1	1	1	1	1
52		Gasket, Seal Cover	CS0521-F	250***	1	1	1	1	1	1
53		Hexagn Socket Head Cap Screw	NB3512-030	M12×30	8	8	8	8	8	8
54	L	Unloader Slide Valve (L Port)	CS0541-FSL	250S**	1			1		
54	M	Unloader Slide Valve (M Port)	CS0541-FSM	250S**	1			1		
54	H	Unloader Slide Valve (H Port)	CS0541-FSH	250S**	1			1		
54	L	Unloader Slide Valve (L Port)	CS0541-FML	250M**		1			1	
54	M	Unloader Slide Valve (M Port)	CS0541-FMM	250M**		1			1	
54	H	Unloader Slide Valve (H Port)	CS0541-FMH	250M**		1			1	
54	L	Unloader Slide Valve (L Port)	CS0541-FLL	250L**			1			1
54	M	Unloader Slide Valve (M Port)	CS0541-FLM	250L**			1			1
54	H	Unloader Slide Valve (H Port)	CS0541-FLH	250L**			1			1
55		Unloader Slide Valve	-	250S**	1			1		
55		Unloader Slide Valve	-	250M**		1			1	
55		Unloader Slide Valve	-	250L**			1			1
58		Hexagon Socket Head Cap Screw	NB3512-040	M12×40	4	4	4	4	4	4
59		"O"ring	PA2401-046	JISB2401 1A P46	2	2	2	2	2	2
60		Unloader Cylinder	CS0600-FS	250S**	1			1		
60		Unloader Cylinder	CS0600-FM	250M**		1			1	
60		Unloader Cylinder	CS0600-FL	250L**			1			1
61		Hexagon Socket Head Cap Screw	NB3516-040	M16×40	2	2	2	2	2	2
62		Hexagon Socket Head Cap Screw	NB3516-090	M16×90	6	6	6	6	6	6
63		"O"ring	PA2402-190	JISB2401 1A G190	1	1	1	1	1	1
64		Unloader Piston	CS0641-F	250***	1	1	1	1	1	1
65		"O"ring	PA2401-155	JISB2401 1A P155	1	1	1	1	1	1
66		Cap Seal	CS0660-F		1	1	1	1	1	1
67		Push Rod,Unloader Slide Valve	CS0671-FS	250S**	1			1		
67		Push Rod,Unloader Slide Valve	CS0671-FM	250M**		1			1	
67		Push Rod,Unloader Slide Valve	CS0671-FL	250L**			1			1
68		Guide Pin	CS0680-05	ϕ5×12	1	1	1	1	1	1
69		Lock Nut	NG3100-08	AN08	2	2	2	2	2	2
70		Lock Washer	NG3200-08	AW08	2	2	2	2	2	2
73		Oring	PA2402-035	JISB2401 1A G35	1	1	1	1	1	1
74		Unloader Cylinder Cover	CS0740-F	250***	1	1	1	1	1	1
75		"O"ring	PA2402-170	JISB2401 1A G170	1	1	1	1	1	1
76		Hexagon Socket Head Cap Screw	NB3512-030	M12×30	8	8	8	8	8	8

No.	EX	Parts Name	Code No	Remarks	SUD	MUD	LUD	SG	MG	LG
77		Indicator CAM	CS0770-FS	250S**	1			1		
77		Indicator CAM	CS0770-FM	250M**		1			1	
77		Indicator CAM	CS0770-FL	250L**			1			1
78		Ball Bearing	CS0780-E	#6000	1	1	1	1	1	1
79		Stop Ring	NG1200-010	S10	1	1	1	1	1	1
80		Bearing Gland	CS0800-E	200***	1	1	1	1	1	1
81		Hexagon Socket Head Cap Screw	NB3506-015	M6×15	3	3	3	3	3	3
82		"V"ring	CS0820-EB	20×10×12	1	1	1	1	1	1
83		Spring	CS0830-E	200***	1	1	1	1	1	1
84		Retainer,Indicator Cam Spring	CS0840-E	200***	1	1	1	1	1	1
85		Oil Injection Pipe	CS0851-FS	250S**	1			1		
85		Oil Injection Pipe	CS0851-FM	250M**		1			1	
85		Oil Injection Pipe	CS0851-FL	250L**			1			1
87		Guide Block	CS0870-F	250***	1	1	1	1	1	1
88		Stem, Guide Block	-	200***	1	1	1	1	1	1
89		"O"ring	PA2401-020	JISB2401 1A P20	2	2	2	2	2	2
91		Shaft Key	CS0910-F	250***	1	1	1	1	1	1
92		Suction Flange	CS7140-250	MYK250A(10")	1	1	1	1	1	1
93		Gasket,Suction Flange	CS0931-F	MYK250A	1	1	1	1	1	1
94		Hexagon Head Bolt	NB1224-065	M24×65	12	12	12	12	12	12
95		Discharge Flange	CS7140-151	MYK150A(6")	1	1	1	1	1	1
96		Gasket,Discharge Flange	CR7201-150	MYK150A	1	1	1	1	1	1
97		Hexagon Head Bolt	NB1222-055	M22×55	8	8	8	8	8	8
98		Spring Pin	NE3203-012	ϕ3×12	2	2	2	2	2	2
100		Mechanical Seal Assembly	CS1001-FV	BOS-E1	1	1	1	1	1	1
120		Unloader Indicator Assembly	CS1209-0EF		1	1	1	1	1	1
164		Retainer,Oil Injection Pipe	CS1640-F		1	1	1	1	1	1
166		Hexagon Socket Head Cap Screw	NB3505-012	M5×12	2	2	2	2	2	2
235		Spacer,Discharge Flange	-	250***	1	1	1	1	1	1
236		Gasket,Discharge Flange Spacer	CS2361-F	250***	1	1	1	1	1	1
237		Torsional Slip Washer	CS2370-F	250***	2	2	2	2	2	2
246		Guide, Unloader Slide Valve	CS2460-F	250***	1	1	1	1	1	1
247		Hexagon Socket Head Cap Screw	NB3508-090	M8×90	4	4	4	4	4	4
248		Spring Washer	ND3300-08	M8	4	4	4	4	4	4
249		Alignment Pin	NE2006-080	ϕ8×80	2	2	2	2	2	2
250		Thrust Washer	CS2500-F	250***	2	2	2	2	2	2
251		Flange (for Electromizer)	CS7140-050	MYK50A(2")	1	1	1	1	1	1
252		Gasket, Flange (for Electromizer)	CR7201-050	MYK50A	1	1	1	1	1	1
253		Hexagon Head Bolt	NB1516-045	M16×45	4	4	4	4	4	4
254		Flange (for Aquamizer)	CR7400-032	MYK32A(1"1/4)	1	1	1	1	1	1
255		Gasket, Flange (for Aquamizer)	CR7201-032	MYK32A	1	1	1	1	1	1
256		Hexagon Head Bolt	NB1512-040	M12×40	4	4	4	4	4	4
267		Special Spring Washer	ND3300-12	M12	4	4	4	4	4	4
432		"O"ring	PA2402-135	JISB2401 1A G135	4	4	4	4	4	4
433		"O"ring	PA2402-135	JISB2401 1A G135	4	4	4	4	4	4
528		Sleeve,Oil Seal	CS5280-FV	250V**	1	1	1	1	1	1
529		Set Screw	NA8606-010	M6×10	2	2	2	2	2	2
605		Plug	NF0600-25	R 1"	1	1	1	1	1	1
607		Plug	NF0600-04	R1/8	1	1	1	1	1	1

5) 320** Parts List

No.	EX	Parts Name	Code No	Remarks	SUD	MUD	LUD	LLUD	SU	MU	LU
1		Main Rotor Casing	CS0010-GS	320S**	1				1		
1		Main Rotor Casing	CS0010-GM	320M**		1				1	
1		Main Rotor Casing	CS0010-GL	320L**			1				1
1		Main Rotor Casing	CS0010-GLL	320LL**				1			
2		Hexagon Socket Head Cap Screw	NB3522-080	M24×80	52	52	52	52	52	52	52
3		Alignment Pin	NE2025-080	ϕ25×80	4	4	4	4	4	4	4
4		Hanger Bolt	NB6000-030	M30	2	2	2	2	2	2	2
5		Suction Cover	CS0050-GU	320***	1	1	1		1	1	1
5		Suction Cover	CS0050-GLL	320LL**				1			
6		Gasket, Suction Cover	CS0061-G	320***	1	1	1	1	1	1	1
7		Hanger Bolt	NB6000-016	M16	2	2	2	2	2	2	2
8		Spring Pin	NE3206-018	ϕ6×18	2	2	2	2	2	2	2
9		"O"ring	PA2401-058	JISB2401 1A P58	1	1	1	1	1	1	1
10	A	Plug	NF0600-15	R1/2	1	1	1	1	1	1	1
10	B	Plug	NF0600-20	R3/4	1	1	1	1	1	1	1
11	H	Bearing Head	CS0114-GDH	320***	1	1	1	1			
11	H	Bearing Head	CS0110-GUH	320*U					1	1	1
11	M	Bearing Head	CS0114-GDM	320***	1	1	1	1			
11	M	Bearing Head	CS0110-GUM	320*U					1	1	1
11	L	Bearing Head	CS0114-GDL	320***	1	1	1	1			
11	L	Bearing Head	CS0110-GUL	320*U					1	1	1
12		Gasket, Bearing Head	CS0121-G	320***	1	1	1	1	1	1	1
13		Hanger Bolt	NB6000-016	M16	1	1	1	1	1	1	1
14		Spring Pin	NE3206-018	ϕ6×18	2	2	2	2	2	2	2
15		Plug	NF0600-08	R1/4	3	3	3	3	3	3	3
16		Bearing Cover	CS0160-GD	320***	1	1	1	1			
16		Bearing Cover	CS0160-GU	320*U					1	1	1
17		Gasket, Bearing Cover	CS0171-GD	320***	1	1	1	1			
17		Gasket, Bearing Cover	CS0171-GU	320*U					1	1	1
18	1	Hexagon Socket Head Cap Screw	NB3520-070	M20×70	20	20	20	20	20	20	20
18	2	Hexagon Socket Head Cap Screw	NB3520-120	M20×120	14	14	14	14			
19		Alignment Pin	NE2016-070	ϕ16×70	2	2	2	2	2	2	2
20		Spring Pin	NE3203-015	ϕ3×15	1	1	1	1	1	1	1
21		Plug	NF0600-10	R3/8	1	1	1	1	1	1	1
22		Balance Piston Cover	CS0220-G	320***	1	1	1	1	1	1	1
23		Gasket, Balance Piston Cover	CS0231-G	320***	1	1	1	1	1	1	1
24		Hexagon Socket Head Cap Screw	NB3516-045	M16×45	11	11	11	11	11	11	11
25		Male Rotor	CS0252-GS	320S**	1				1		
26		Female Rotor		320S**	1				1		
25		Male Rotor	CS0252-GM	320M**		1				1	
26		Female Rotor		320M**		1				1	
25		Male Rotor	CS0252-GL	320L**			1				1
26		Female Rotor		320L**			1				1
25		Male Rotor	CS0252-GLL	320LL**				1			
26		Female Rotor		320LL**				1			
27		Main Bearing	CS0270-GRT	320***	2	2	2	4	2	2	2
28		Side Bearing	CS0280-GRT	320***	2	2	2		2	2	2
29		Stop Ring	NG1100-200	H200	4	4	4	4	4	4	4
30		Balance Piston	CS0300-G	320***	1	1	1	1	1	1	1
31		Key, Balance Piston	CS0310-G	320***	1	1	1	1	1	1	1

No.	EX	Parts Name	Code No	Remarks	SUD	MUD	LUD	LLUD	SU	MU	LU
32		Stop Ring	NG1200-100	S100	1	1	1	1	1	1	1
33		Sleeve, Balance Piston	CS0330-G	320***	1	1	1	1	1	1	1
34		Spring Pin	NE3206-014	ϕ6×14	1	1	1	1	1	1	1
35		"O"ring	PA2402-190	JISB2401 1A G190	1	1	1	1	1	1	1
36		Spacer	CS0360-G	320***	1	1	1	1	1	1	1
37		Stop Ring	NG1100-200	H200	2	2	2	2	2	2	2
38		Thrust Bearing	CS0380-G	7321ADFP5a+KL16BC2	2	2	2	2	2	2	2
39		Lock Nut	NG3100-21	AN21	2	2	2	2	2	2	2
40		Lock Washer	NG3200-21	AW21	2	2	2	2	2	2	2
42		Spacer,Thrust Bearing Alignment	CS0420-G	320***	2	2	2	2	2	2	2
43		Thrust Bearing Gland	CS0430-G	320***	2	2	2	2	2	2	2
45		Hexagon Head Bolt	NB1520-055	M20×55	8	8	8	8	8	8	8
46		Lock Washer	CS0460-G	320***	8	8	8	8	8	8	8
48		Retainer,Oil Seal	CS0480-G	320***	1	1	1	1	1	1	1
49		"O"ring	PA2402-160	JISB2401 1A G160	1	1	1	1	1	1	1
50		Oil Seal	CS0501-GV	SA1J95×120×13	1	1	1	1	1	1	1
51		Seal Cover	CS0510-GB	320***	1	1	1	1	1	1	1
51	HE	Seal Cover	CS0510-GHE	320*** (HE)	1	1	1	1	1	1	1
52		Gasket, Seal Cover	CS0521-G	320***	1	1	1	1	1	1	1
53		Hexagon Socket Head Cap Screw	NB3516-040	M16×40	8	8	8	8	8	8	8
58		Hexagon Socket Head Cap Screw	NB3516-050	M16×50	4	4	4	4	4	4	4
59		"O"ring	PA2401-032	JISB2401 1A P32	1	1	1	1	1	1	1
60		Unloader Cylinder	CS0600-GS	320S**	1				1		
60		Unloader Cylinder	CS0600-GM	320M**		1				1	
60		Unloader Cylinder	CS0600-GL	320L**			1				1
60		Unloader Cylinder	CS0600-GLL	320LL**				1			
61		Hexagon Socket Head Cap Screw	NB3520-050	M20×50	2	2	2	2	2	2	2
62		Hexagon Socket Head Cap Screw	NB3520-110	M20×110	6	6	6	6	6	6	6
63		"O"ring	PA2402-240	JISB2401 1A G240	1	1	1	1	1	1	1
64		Unloader Piston	CS0640-G	320***	1	1	1	1	1	1	1
65		"O"ring	PA2401-200	JISB2401 1A P200	1	1	1	1	1	1	1
66		Cap Seal	CS0660-G	CAP-3BE200	1	1	1	1	1	1	1
67		Push Rod,Unloader Slide Valve	CS0670-GS	320S**	1				1		
67		Push Rod,Unloader Slide Valve	CS0670-GM	320M**		1				1	
67		Push Rod,Unloader Slide Valve	CS0670-GL	320L**			1				1
67		Push Rod,Unloader Slide Valve	CS0670-GLL	320LL**				1			
68		Guide Pin	CS0680-06	ϕ6×16	1	1	1	1	1	1	1
69		Lock Nut	NG3100-10	AN10	1	1	1	1	1	1	1
70		Lock Washer	NG3200-10	AW10	1	1	1	1	1	1	1
71		Lock Nut	NG3100-12	AN12	1	1	1	1	1	1	1
72		Lock Washer	NG3200-12	AW12	1	1	1	1	1	1	1
73		"O"ring	PA2401-044	JISB2401 1A P44	1	1	1	1	1	1	1
74		Unloader Cylinder Cover	CS0740-G	320***	1	1	1	1	1	1	1
75		"O"ring	PA2402-210	JISB2401 1A G210	1	1	1	1	1	1	1
76		Hexagon Socket Head Cap Screw	NB3516-040	M16×40	8	8	8	8	8	8	8
77		Indicator CAM	CS0770-GS	320S**	1				1		
77		Indicator CAM	CS0770-GM	320M**		1				1	
77		Indicator CAM	CS0770-GL	320L**			1				1
77		Indicator CAM	CS0770-GLL	320LL**				1			
78		Ball Bearing	CS0780-E	#6000	1	1	1	1	1	1	1

5) 320** Parts List

No.	EX	Parts Name	Code No	Remarks	SUD	MUD	LUD	LLUD	SU	MU	LU
79		Stop Ring	NG1200-010	S10	1	1	1	1	1	1	1
80		Bearing Gland	CS0800-E	200L**	1	1	1	1	1	1	1
81		Hexagon Socket Head Cap Screw	NB3506-015	M6×15	3	3	3	3	3	3	3
82		"V"ring	CS0820-EB	20×10×12	1	1	1	1	1	1	1
83		Spring	CS0830-E	200L**	1	1	1	1	1	1	1
84		Retainer,Indicator Cam Spring	CS0840-E	200L**	1	1	1	1	1	1	1
85		Oil Injection Pipe	CS0850-GS	320S**	1				1		
85		Oil Injection Pipe	CS0850-GM	320M**		1				1	
85		Oil Injection Pipe	CS0850-GL	320L**			1	1			1
86		"O"ring	PA2402-030	JISB2401 1A G30	1	1	1	1	1	1	1
87		Guide Block	CS0870-G	320***	1	1	1	1	1	1	1
89		"O"ring	PA2401-024	JISB2401 1A P24	2	2	2	2	2	2	2
91		Shaft Key	CS0910-G	320***	1	1	1	1	1	1	1
92		Suction Flange	CS7140-350	MYK350A(14")	1	1	1	1	1	1	1
93		Gasket,Suction Flange	CS0931-G	MYK350A	1	1	1	1	1	1	1
94		Hexagon Head Bolt	NB1224-075	M24×75	16	16	16	16	16	16	16
95		Discharge Flange	CS7140-201	MYK200A(8")	1	1	1	1	1	1	1
96		Gasket,Discharge Flange	CR7201-200	MYK200A	1	1	1	1	1	1	1
97		Hexagon Head Bolt	NB1220-055	M20×55	12	12	12	12	12	12	12
100		Mechanical Seal Assembly	CS1000-GV	BOS-E1	1	1	1	1	1	1	1
120		Unloader Indicator Assembly	CS1209-0EF		1	1	1	1	1	1	1
150		"O"ring	PA2402-220	JISB2401 1A G220	2	2	2	2	2	2	2
166		Hexagon Socket Head Cap Screw	NB3505-010	M5×10	4	4	4	4	4	4	4
167		Plug	NF0600-15	R1/2	1	1	1	1	1	1	1
215		Flange,Lubrication Oil Supply	CS7140-040	MYK40A(1 1/2")	1	1	1	1	1	1	1
216		Flange	CR7201-040	MYK40A	1	1	1	1	1	1	1
217		Hexagon Head Bolt	NB1512-040	M12×40	4	4	4	4	4	4	4
218		Flange,Injection Oil Supply	CR7400-025	MYK25A(1")	1	1	1	1	1	1	1
219		Gasket,Injection Oil Supply Flange	CR7201-025	MYK25A	1	1	1	1	1	1	1
220		Hexagon Head Bolt	NB1512-040	M12×40	4	4	4	4	4	4	4
230		Plug	NF0600-20	R3/4	1	1	1	1	1	1	1
237		Torsional Slip Washer	CS2370-G	320***	2	2	2	2	2	2	2
246		Guide, Unloader Slide Valve	CS2460-G	320***	1	1	1	1	1	1	1
247		Hexagon Socket Head Cap Screw	NB3510-110	M10×110	4	4	4	4	4	4	4
248		Spring Washer	ND3300-10	M10	4	4	4	4	4	4	4
249		Alignment Pin	NE2013-100	ϕ13×100	2	2	2	2	2	2	2
250		Thrust Washer	CS2500-G	320***	2	2	2	2	2	2	2
251		Flange (for Electromizer)	CS7140-080	MYK80A(3")	1	1	1	1	1	1	1
252		Gasket, Flange (for Electromizer)	CR7201-080	MYK80A	1	1	1	1	1	1	1
253		Hexagon Head Bolt	NB1220-050	M20×55	4	4	4	4	4	4	4
254		Flange (for Aquamizer)	CS7140-050	MYK50A(2")	1	1	1	1	1	1	1
255		Gasket, Flange (for Aquamizer)	CR7201-050	MYK50A	1	1	1	1	1	1	1
256		Hexagon Head Bolt	NB1516-045	M16×45	4	4	4	4	4	4	4
267		Special Spring Washer	ND3300-16	M16	4	4	4	4	4	4	4
326		Gland,"O"ring	CS3260-G		1	1	1	1	1	1	1
528		Sleeve,Oil Seal	CS5280-GV		1	1	1	1	1	1	1

6) 400** Parts List

No.	EX	Parts Name	Code No	Remarks	SUD	MUD	LUD	LLUD
1		Main Rotor Casing		400S**	1			
1		Main Rotor Casing		400M**		1		
1		Main Rotor Casing		400L**			1	
1		Main Rotor Casing		400LL**				1
2		Hexagon Socket Head Cap Screw		M30×110	60	60	60	60
3		Alignment Pin		30×100	4	4	4	4
4		Hanger Bolt		M42	2	2	2	2
5		Suction Cover	CS0050-QV	400***	1	1	1	1
6		Gasket, Suction Cover	CS0061-S1	4032**	1	1	1	1
7		Hanger Bolt	NB6000-024	M24	2	2	2	2
8		Spring Pin		ϕ8×25	2	2	2	2
9		"O"ring	PA2402-095	JISB2401 1A G95	1	1	1	1
11		Bearing Head	CS0110-QV	400*UD	1	1	1	1
12		Gasket, Bearing Head	CS0120-QV	400V**	1	1	1	1
13		Hanger Bolt		M42	1	1	1	1
14		Spring Pin		ϕ8×25	2	2	2	2
15		Plug	NF0600-25	NPT 1"	1	1	1	1
16		Bearing Cover	CS0160-QV	400*UD	1	1	1	1
17		Gasket, Bearing Cover	CS0170-QV	400***	1	1	1	1
18		Hexagon Socket Head Cap Screw		M30×100	26	26	26	26
19		Alignment Pin		20×100	2	2	2	2
20		Spring Pin		ϕ3×16	1	1	1	1
22		Balance Piston Cover	CS0220-QV	400***	1	1	1	1
23		Gasket, Balance Piston Cover	CS0230-QV	400***	1	1	1	1
24		Hexagon Socket Head Cap Screw		M24×70	15	15	15	15
25		Male Rotor	CS0250-QS	400S**	1			
26		Female Rotor		400S**	1			
25		Male Rotor	CS0250-QM	400M**		1		
26		Female Rotor		400M**		1		
25		Male Rotor		400L**			1	
26		Female Rotor		400L**			1	
25		Male Rotor		400LL**				1
26		Female Rotor		400LL**				1
27		Main Bearing	CS0270-Q	400***	2	2	2	2
28		Side Bearing	CS0280-Q	400***	2	2	2	2
29		Stop Ring	NG1100-250	H250	4	4	4	4
30		Balance Piston	CS0300-QV	400V**	1	1	1	1
31		Key, Balance Piston		400V**	1	1	1	1
32		Stop Ring	NG1200-120	S120	1	1	1	1
33		Sleeve, Balance Piston	CS0330-QV	400V**	1	1	1	1
34		Spring Pin		ϕ10×25	1	1	1	1
35		"O"ring	PA2402-240	JISB2401 1A G240	1	1	1	1
36		Spaser	CS0360-QV	400V**	1	1	1	1
37		Stop Ring	NG1100-250	H250	2	2	2	2
38	1	Thrust Bearing	CS0380-QM1	400*** M	1	1	1	1
38	2	Thrust Bearing	CS0380-QF2	400*** F	1	1	1	1
39		Lock Nut	NG3100-28	AN28	2	2	2	2
40		Lock Washer	NG3200-28X	AW28X	2	2	2	2

6) 400** Parts List

No.	EX	Parts Name	Code No	Remarks	SUD	MUD	LUD	LLUD
42		Spacer,Thrust Bearing Alignment	CS0420-QV	400***	2	2	2	2
43	1	Thrust Bearing Gland	CS0430-QVM	400***	1	1	1	1
43	2	Thrust Bearing Gland	CS0430-QVF	400***	1	1	1	1
45		Hexagn Socket Head Cap Screw		M20×75	12	12	12	12
46		Conical Spring Washer	ND3200-20	M20	12	12	12	12
51		Seal Cover	CS0510-QV	400***	1	1	1	1
53		Hexagn Socket Head Cap Screw	NB3516-040	M16×40	8	8	8	8
54	L	Unloader Slide Valve (L Port)		400S**	1			
54	M	Unloader Slide Valve (M Port)		400S**	1			
54	L	Unloader Slide Valve (L Port)		400M**		1		
54	M	Unloader Slide Valve (M Port)		400M**		1		
54	L	Unloader Slide Valve (L Port)		400L**			1	
54	M	Unloader Slide Valve (M Port)		400L**			1	
54	L	Unloader Slide Valve (L Port)		400LL**				1
54	M	Unloader Slide Valve (M Port)		400LL**				1
58		Hexagon Socket Head Cap Screw	NB3516-055	M16×55	7	7	7	7
60		Unloader Cylinder		400S**	1			
60		Unloader Cylinder		400M**		1		
60		Unloader Cylinder		400L**			1	
60		Unloader Cylinder		400LL**				1
61		Hexagon Socket Head Cap Screw		M24×85	2	2	2	2
62		Hexagon Socket Head Cap Screw		M24×180	9	9	9	9
63		"O"ring	PA2402-300	JISB2401 1A G300	1	1	1	1
64		Unloader Piston		400***	1	1	1	1
65		"O"ring"		JISB2401 1A P265	1	1	1	1
66		Cap Seal	CS0660-QD	CAP-3BE265	1	1	1	1
67		Push Rod,Unloader Slide Valve		400S***	1			
67		Push Rod,Unloader Slide Valve		400M***		1		
67		Push Rod,Unloader Slide Valve		400L***			1	
67		Push Rod,Unloader Slide Valve		400LL**				1
68		Guide Pin	CS0680-06	ϕ6×16	1	1	1	1
69		Lock Nut	NG3100-10	AN10	2	2	2	2
70		Lock Washer	NG3200-10	AW10	1	1	1	1
73		"O"ring	PA2402-045	JISB2401 1A G45	1	1	1	1
74		Unloader Cylinder Cover		400***	1	1	1	1
75		"O"ring	PA2402-270	JISB2401 1A G270	1	1	1	1
76		Hexagon Socket Head Cap Screw	NB3522-080	M24×80	11	11	11	11
77		Indicator CAM		400S**	1			
77		Indicator CAM		400M**		1		
77		Indicator CAM		400L**			1	
77		Indicator CAM		400LL**				1
78		Ball Bearing	CS0780-QV	#6302	1	1	1	1
79		Stop Ring	NG1200-015	S15	1	1	1	1
80		Bearing Gland	CS0800-QV	400V**	1	1	1	1
81		Hexagon Socket Head Cap Screw	NB3506-015	M6×15	3	3	3	3
82		"V"ring		20×10×12	1	1	1	1
83		Spring	CS0830-E	200L**	1	1	1	1
84		Retainer,Indicator Cam Spring	CS0840-QV	400V**	1	1	1	1

No.	EX	Parts Name	Code No	Remarks	SUD	MUD	LUD	LLUD
91		Shaft Key		400***	1	1	1	1
92		Suction Flange		ANSI#300 16"	1	1	1	1
93		Gasket,Suction Flange		ANSI#300 16"	1	1	1	1
94		Stud Bolt & Nut		1 1/4" -7UNC ×165mm	20	20	20	20
95		Discharge Flange		ANSI#300 12"	1	1	1	1
96		Gasket,Discharge Flange		ANSI#300 12"	1	1	1	1
97		Stud Bolt & Nut		1 1/8" -7UNC ×150mm	16	16	16	16
100		Mechanical Seal Assembly		400*** BOD	1	1	1	1
100	B	Mechanical Seal Assembly		400*** BBD	1	1	1	1
120		Unloader Indicator Assembly			1	1	1	1
150		"O"ring	PA2402-290	JISB2401 1A G290	2	2	2	2
166		Hexagon Socket Head Cap Screw	NB3512-025	M12×25	4	4	4	4
215	1	Flange,Lubrication Oil Supply for Main Journal		ANSI#300 2"	1	1	1	1
215	2	Flange,Lubrication Oil Supply for Side Journal		ANSI#300 2"	1	1	1	1
215	3	Flange,Lubrication Oil Supply for TPTB		ANSI#300 2"	1	1	1	1
216	1	Gasket,Lubrication Oil Supply for Main Journal		ANSI#300 2"	1	1	1	1
216	2	Gasket, Lubrication Oil Supply for Side Journal		ANSI#300 2"	1	1	1	1
216	3	Gasket, Lubrication Oil Supply for TPTB		ANSI#300 2"	1	1	1	1
217	1	Stud Bolt & Nut		75mm	8	8	8	8
217	2	Stud Bolt & Nut		75mm	8	8	8	8
217	3	Stud Bolt & Nut		75mm	8	8	8	8
218		Flange,Injection Oil Supply		ANSI#300 2"	1	1	1	1
219		Gasket,Injection Oil Supply		ANSI#300 2"	1	1	1	1
220		Stud Bolt & Nut		75mm	4	4	4	4
221		Flange,Loading oil conection for hydoraulic cylinder		ANSI#300 1"	1	1	1	1
222		Gasket,Loading oil conection for hydoraulic cylinder		ANSI#300 1"	1	1	8	8
223		Stud Bolt & Nut		75mm	4	4	4	4
246		Guide, Unloader Slide Valve	CS2380-QV	400***	1	1	1	1
247		Hexagon Socket Head Cap Screw	NB3516-075	M16×75	8	8	8	8
249		Alignment Pin	NE2016-055	55	2	2	2	2
267		Special Spring Washer	ND3300-16	M16	7	7	7	7
325		"O"ring	PA2401-070	JISB2401 1A P70	2	2	2	2
326		Gland,"O"ring	CS3260-QV	400V**	1	1	1	1
432		"O"ring	PA2402-210	JISB2401 1A G210	4	4	4	4
433		"O"ring	PA2402-210	JISB2401 1A G210	4	4	4	4
597		Spring Washer	ND3200-06	M6	3	3	3	3
605		Plug	NF0600-10	NPT3/8	3	3	3	3
664		Backup Ring		SUN-2BP-70-T2	4	4	4	4
674		"O"ring		JISW1516 1A G39	4	4	4	4
999		Drain Flange		ANSI#300 1"	1	1	1	1
999		Gasket,Drain Flange		ANSI#300 1"	1	1	1	1
999		Stud Bolt & Nut		75mm	4	4	4	4

Ⅱ. PREPARATIONS FOR DISMANTLING

The following are the detailed instructions for dismantling, inspecting and assembling the MYCOM screw compressor for routine servicing.
Partial dismantlement and inspection may be carried out without raising the compressor, but it must be removed from the base for a complete inspection.
The technique used when dismantling and the handing of parts mentioned in this manual should be followed closely, otherwise damage or trouble may occur after starting up.

Please read this manual carefully and be sure that you understand the procedures completely before starting.

Ⅱ-1 Hand tools

A landing plate or metal work bench should be available in addition to the necessary hand tools. The landing plate does not need a machined surface; only a smooth clean surface, with a thickness of at least 1.5mm. For models up to 160LUD the landing plate should be 800mm wide & 1,000mm by 1,500mm for the 200SUD & larger models. The working area must be spacious, clean, and free from dust.

Fig.13-1 Longitudinal section (Type125~250)

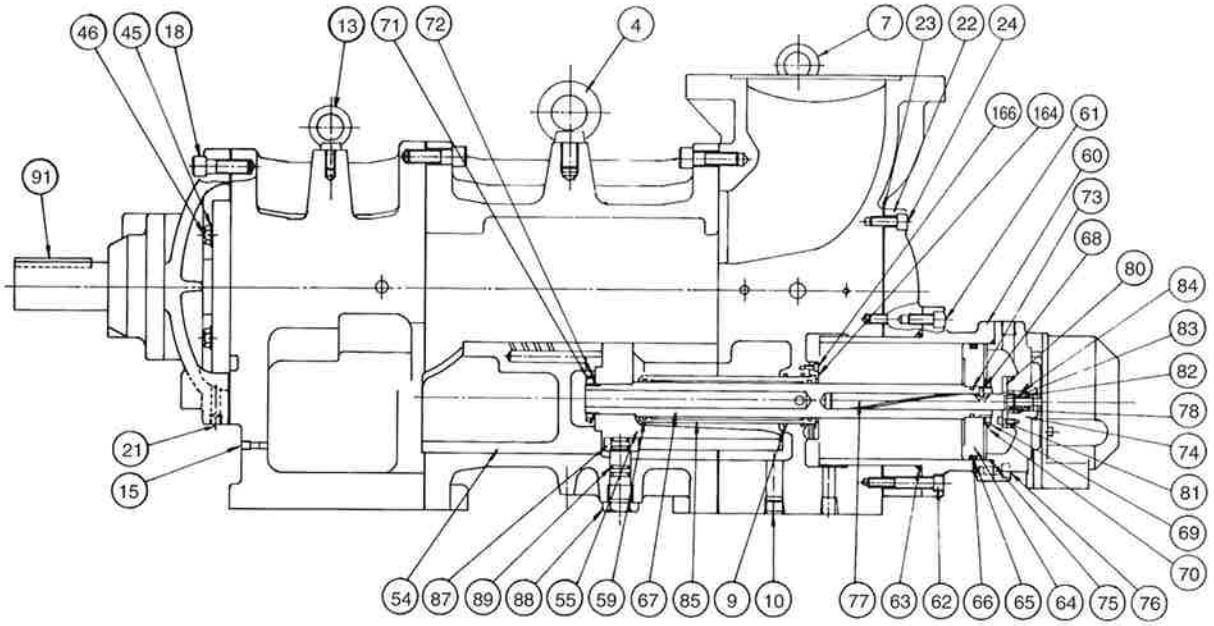


Fig.13-2 Cross section (Type125~250)

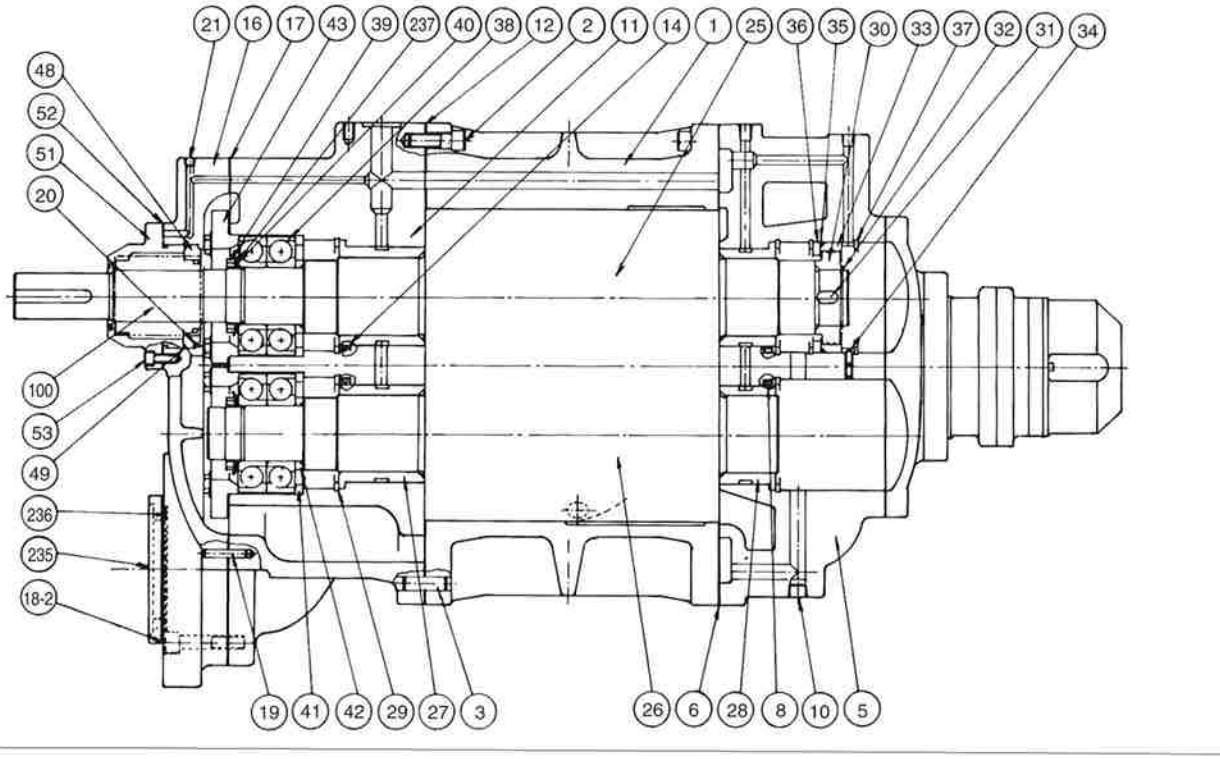


Fig.13-3 Longitudinal section (Type 320)

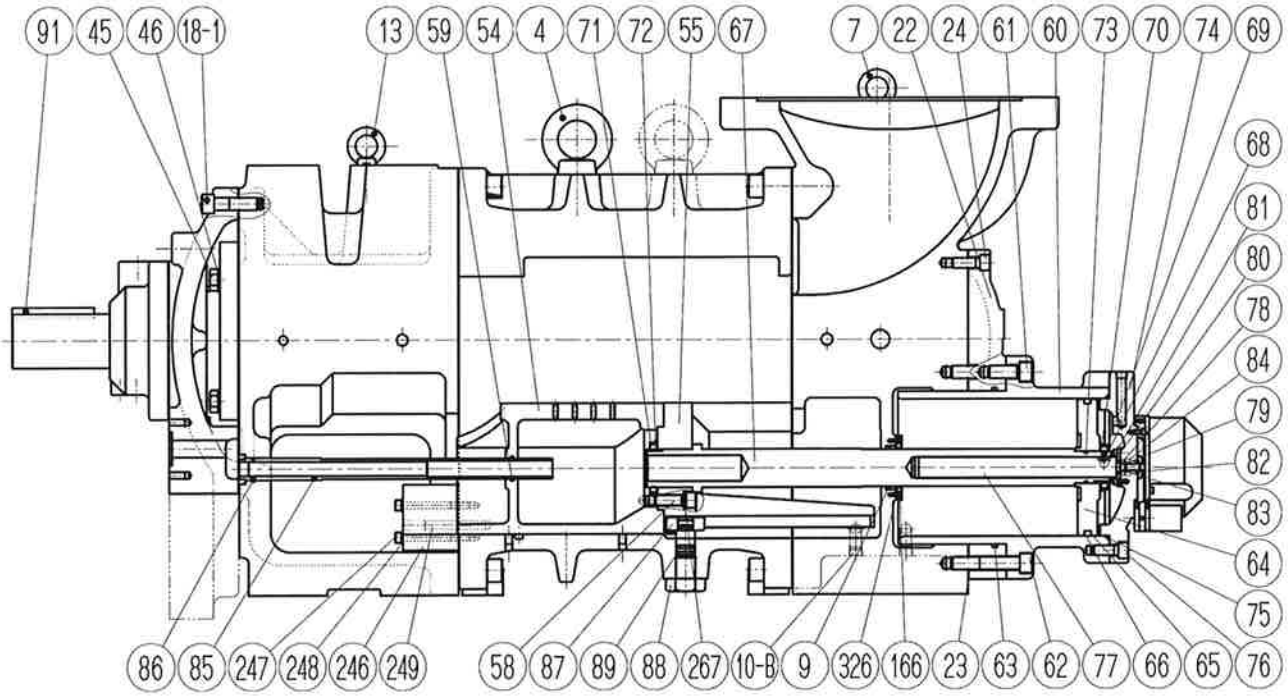
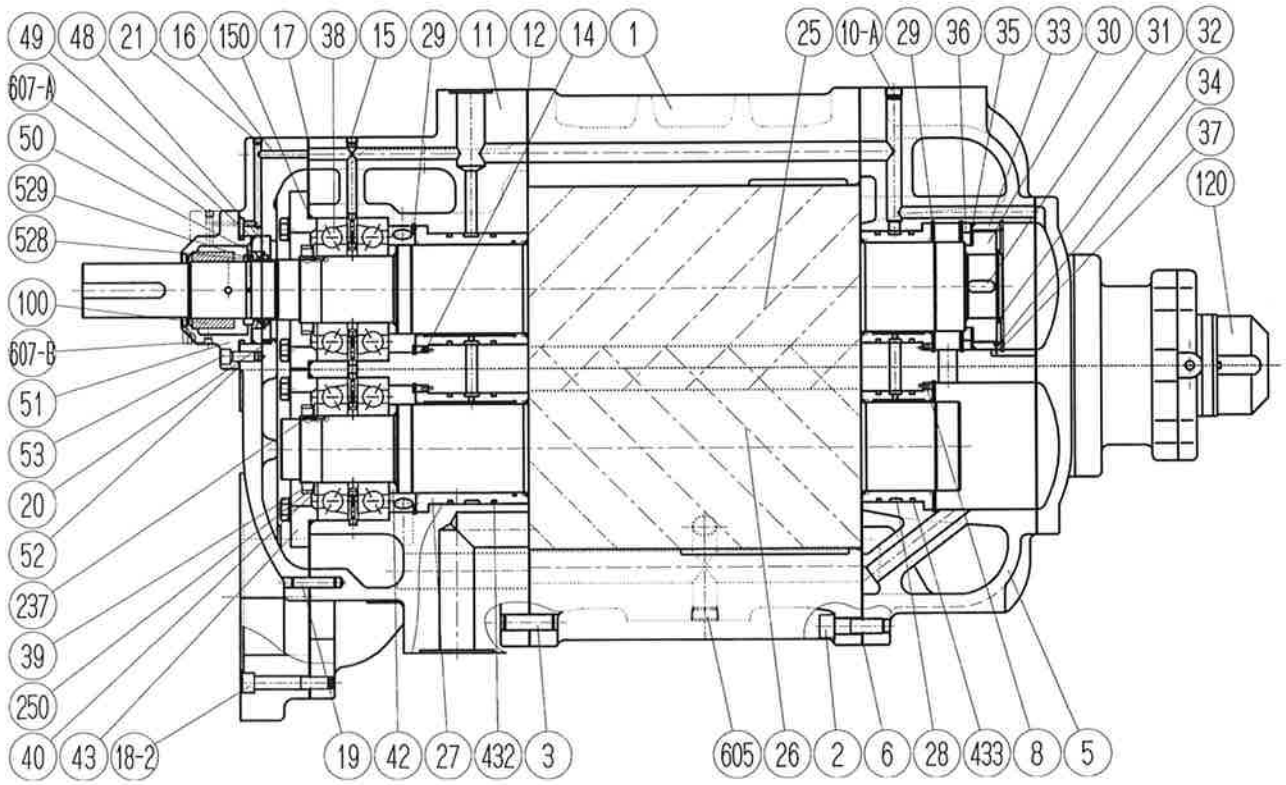


Fig.13-4 Cross section (Type 320)



Ⅱ-2 Releasing of Refrigerant

Before dismantling release the gas in the compressor. Purge gas in the compressor using a by-pass or by drawing the gas out with another compressor. If the former ways is impossible, release the gas directly into the atmosphere.

Halocarbon gases may be released into a well ventilated room. Special caution should be paid releasing gas if the machine room is located is the basement of the building as of the gas is heavier than air and will remain over floor or produce hazardous gas if comes it contact with fire.

Ammonia gas must be discharged into water. In this case, should be taken to ensure that the water is not sucked into the machine.

Ⅱ-3 Disconnecting of Auxiliary Equipment

Remove the following parts which are coupled with or attached to the compressor.

(1) The coupling which connects the compressor to the motor.

(2) The flanges connecting the compressor at the suction and discharge sides.

(3) The lubrication pipes connected to the compressor. (Oil remaining in the pipe may flow out, so loosen the connections slowly using a tin of some sort to catch the draining oil.)

(4) The connections to the unloader. (Refer to IV-2 Dismantling of unloader indicator.) Care should be taken

Fig.13-5 Longitudinal section (Type 400)

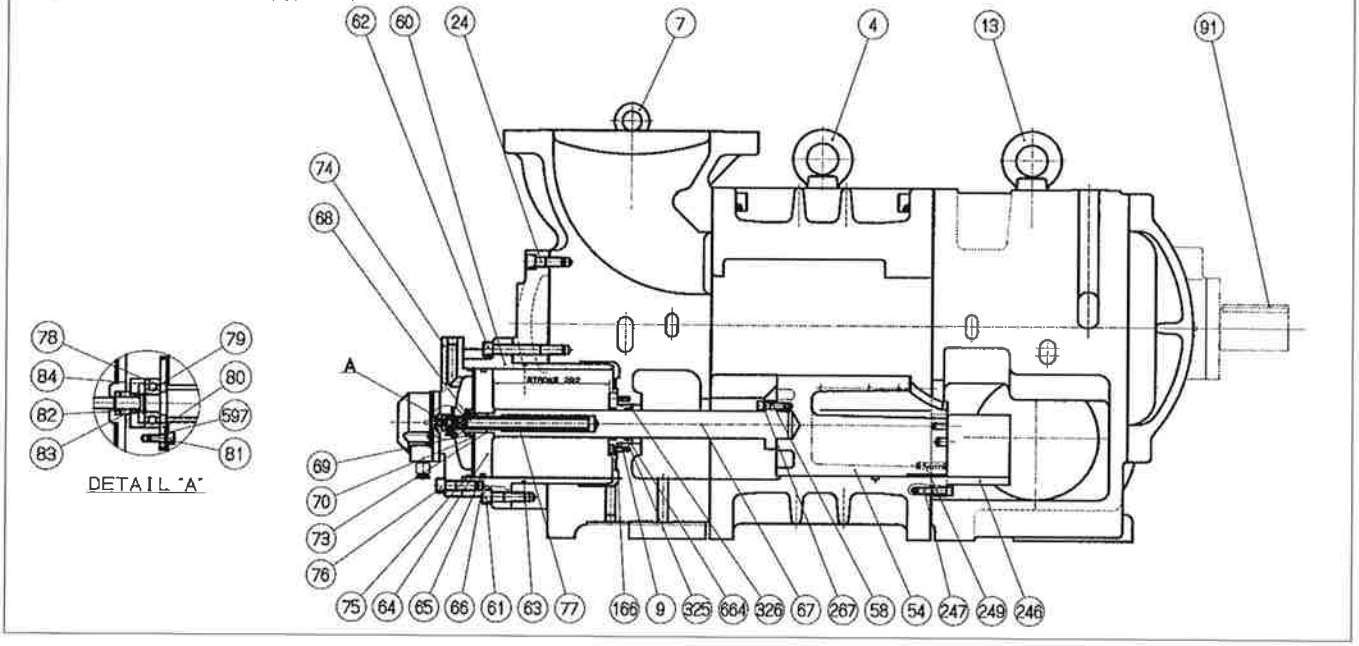
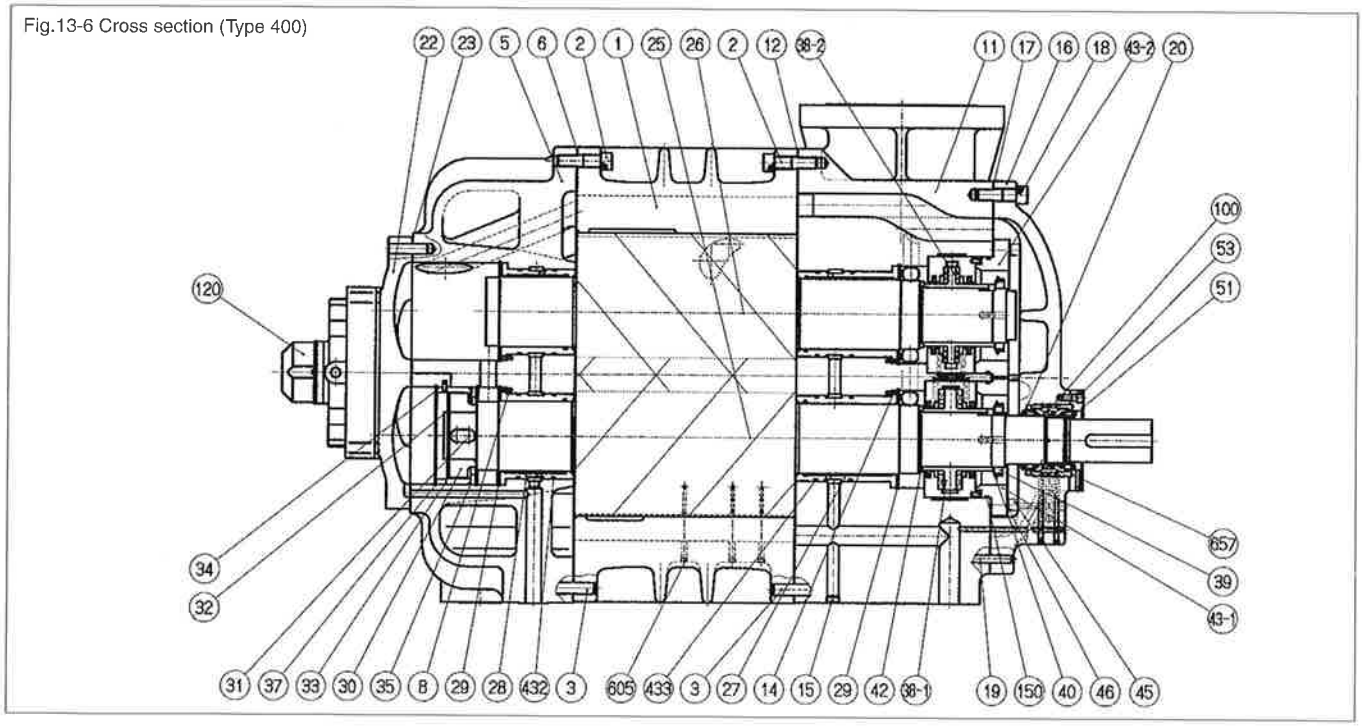


Fig.13-6 Cross section (Type 400)



not to tangle the wires, arrange them neatly for reconnection.

(5) Liquid injection type - Liquid line piping electromizer (economizer) type - gas suction line from the liquid cooler.

Ⅱ-4 Removing Compressor

The hanger eye bolt in the middle of the compressor should be used for lifting the compressor, there are 6 to 8 Allen screws located on the lower part of the casing which are inaccessible after the compressor is placed on the landing plate and they should be removed after the compressor has been hoisted clear.

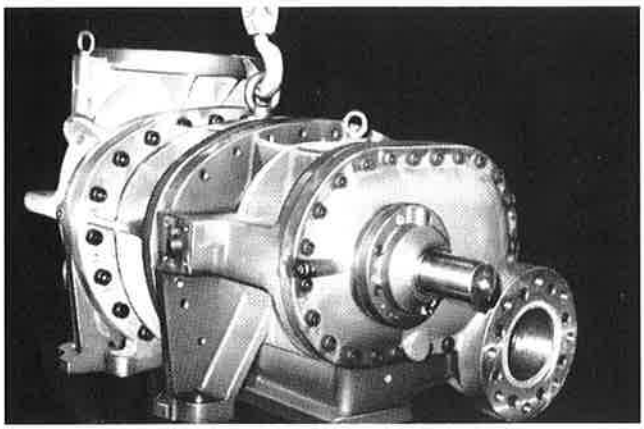


Fig.14 Lifting of the compressor

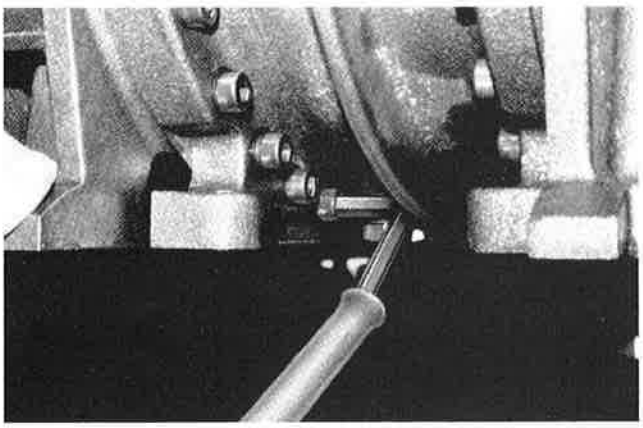


Fig.15 Lower Allen screws securing the suction cover

Precautions when loosening rotor casing bolts Model 250 and Larger Screw Compressors

The lower portion of the rotor casing of Model 250 and Larger screw compressors is secured to the bearing head and suction cover with bolts. Do not loosen these bolts while the casing is suspended. Loosen only after the feet of the suction cover and the bearing head are firmly down on the workbench or table. The best method is to position two tables of equal height at a proper distance under the casing. Unless the casing is properly set, there is a risk of it dropping during the loosening work.

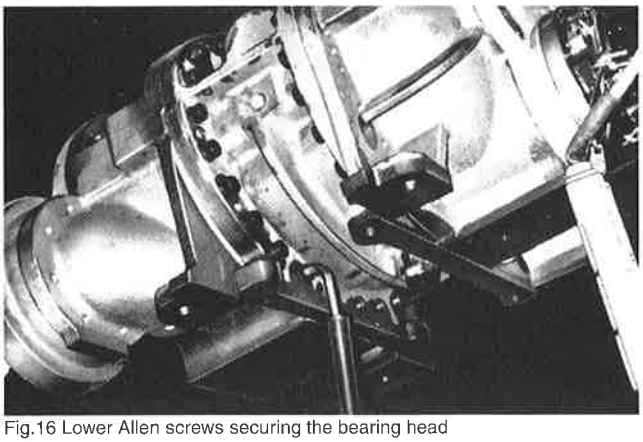
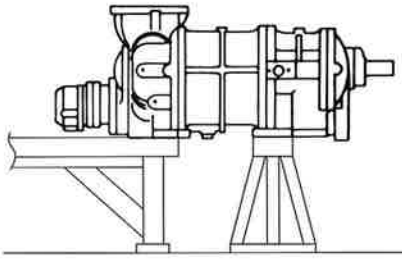


Fig.16 Lower Allen screws securing the bearing head

Fig. 17 Workbench & table



Ⅱ-5 Draining Oil

Most of the oil can be drained while the compressor is suspended by removing the drain plugs (10&21) on the bottom of the suction cover (5) and the bearing cover (6). Oil remaining in the unloader cylinder, blind cover and seal cover may be drained when dismantling these parts on the landing plate.

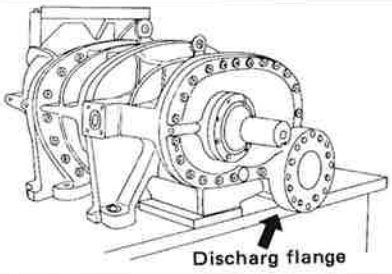
Ⅲ.PROCEDURES FOR DISMANTLING

The dismantling and checking the screw compressor should be follows.

Following our procedure will minimize the work, even for partial dismantlement.

Types 125~320 have the discharge flange on the bearing cover. Theis projects below the bottom of the compressor, so when placing the compressor on the loading plate it should project over the end of the plate.

Fig.18

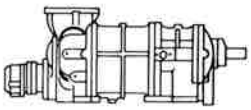


When the work is done on the floor, position a timber block under the compressor discharge side after the bearing cover has been removed.

Parts to be disassembled	Sequence of disassembly
(1) Mechanical seal	(1)
(2) Unlodaer indicator	(2)
(3) Unlodaer cover	(2) → (3)
(4) Unlodaer piston & unloader cylinder	(2) → (3) → (4)
(5) Bearing cover	(1) → (5)
(6) Thrust bearing	(1) → (5) → (6)
(7) Blind cover	(2) → (3) → (4) → (7)
(8) Balance piston	(2) → (3) → (4) → (7) → (8)
(9) Suction cover & side bearing	(2) → (3) → (4) → (7) → (8) → (9)
(10) Rotor	(1) ~ (10)
(11) Bearing head & main bearing	(1) ~ (11)
(12) Unlodaer slide valve & guide block	(1) ~ (12)

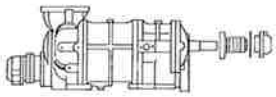
Sequence up to (8) can be done on the base, but (9) to (12) must be done on the landing plate. The details of each step are as follows.

Ⅳ.DISMANTLEMENT AND INSPECTION



Care must be taken during each phase. The slightest mistake may necessitate rotor replacement and/or trouble and capacity failure after start up. Be sure to read each section carefully and to understand the procedures thoroughly before starting.

Ⅳ-1 Mechanical Seal



Construction:125-320UD

A new balance type single seal (100) is used for UD type compressor. A combination of tungsten carbide and carbon graphite is used for the frictional surface of the seal and an 'O' ring is provided for packing. As shown Fig.19, balance type mechanical seal function well under a wide range of conditions. An oil seal to the inside of the seal to act as an oil retainer. Because the frictional portion of the seal is subject to wear due to the rapid rotation of the shaft, a sleeve (528) is provided for the frictional portion on model 200~320 so that the friction portion can be replaced.

Fig. 19 Mechanical seal, Exploded drawing

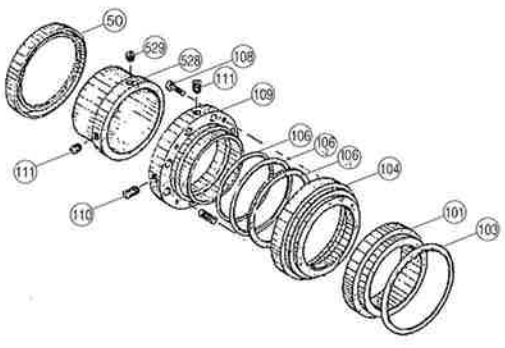
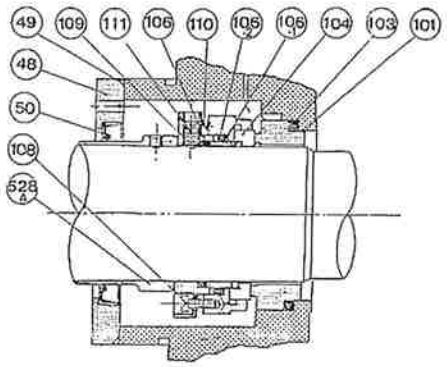
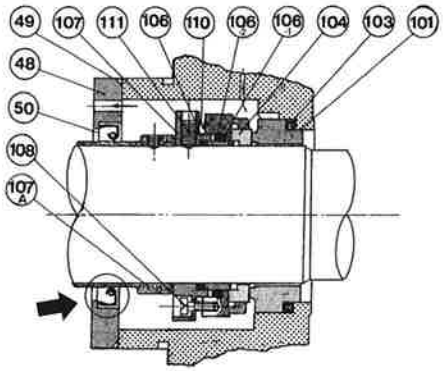


Fig. 20 Mechanical seal



Cross sectional view of single seal (Before 2003/May)



Cross sectional view of single seal (After 2003/May)
"Chek the seal direction"

Ⅳ-1. 1

a) Remove the seal cover by unscrewing the Allen screws from the cover (51).

b) A carbon insert (101) is set in the seal cover and a turn-stop pin (102) is set into the outer rim of the insert. The carbon insert is very fragile, so care must be taken when removing the seal cover.

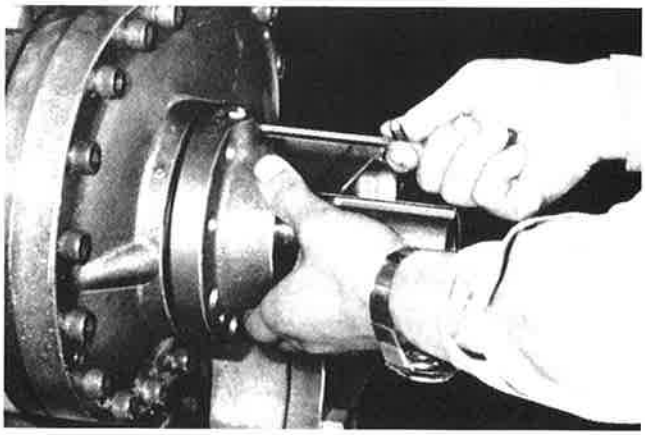


Fig 21 Removing Allen bolts securing seal cover

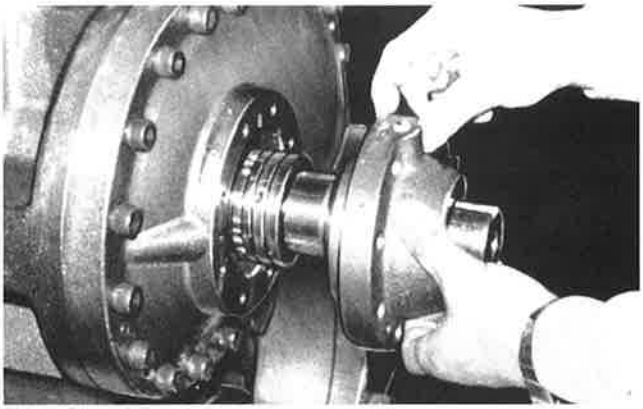


Fig. 22 Removing seal cover

c) After removing the seal cover, check the axial surface for scratches, dust or paint residue, and clean the area thoroughly to avoid damage to the "O" ring (106)of the shaft packing. From type 160, remove the plugs on the bearing cover, and loosen the setscrews (111) of the seal collar.

For type 400 after removing the seal cover, pulling out the shower flushing ring (611). See IV-1' Mechanical Seal 400 (next page)

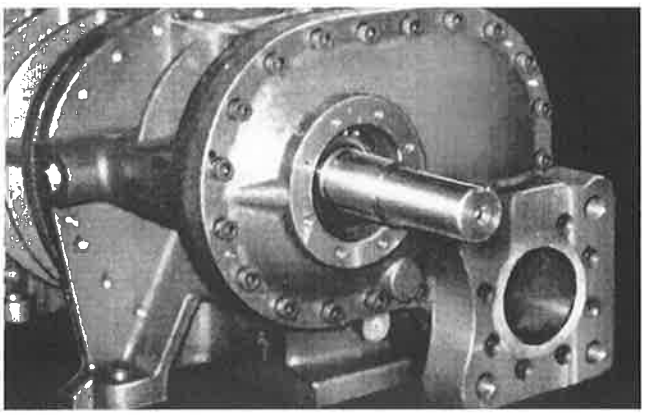


Fig.23 Mechanical seal

d) Loosen the set screw (111) of the seal collar (109) about four turns, and remove the seal unit (104 to 111).
It is not necessary to remove the set screws completely from the seal collar, but the seal ring should be turned to confirm that the set screws are free of the shaft. After confirmation, the seal unit can be removed.

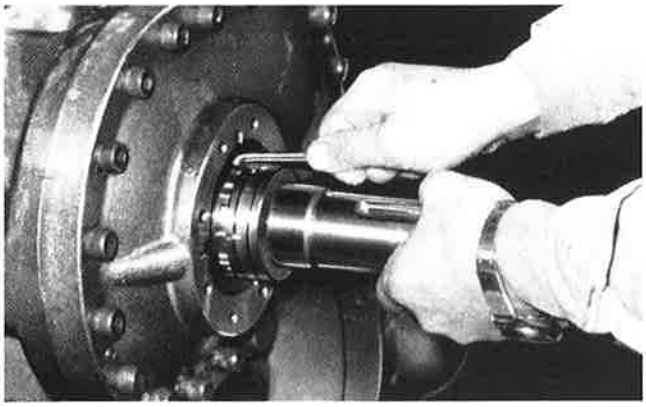


Fig.24 Loosening set screw

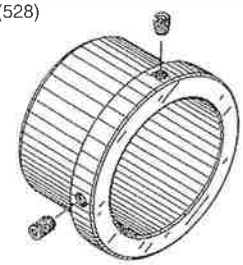
e) Furthermore, inside the mechanical seal can be found a seal gland (48) .This gland contains an oil seal (50).

Fig. 25 Seal gland

f) The "O" ring (49) between the seal cover and the seal gland should be removed before removing the seal gland. The seal gland can be pulled out easily using two eye-bolts.

g) Remove the sleeve of the oil seal (528) after loosening the two setscrews (529)

Fig. 26 Oil seal sleeve (528)



h) All dismantled parts should be washed thoroughly and placed in proper order in a clean dust free place. The carbon insert and seal ring should be cleaned and set aside.

Ⅳ-1.2 Inspection:

a) Check the contact surfaces of the carbon insert (101) and the seal ring (104). They may be reused if they do not show undue wear, and no leakage has occurred prior to dismantlement.

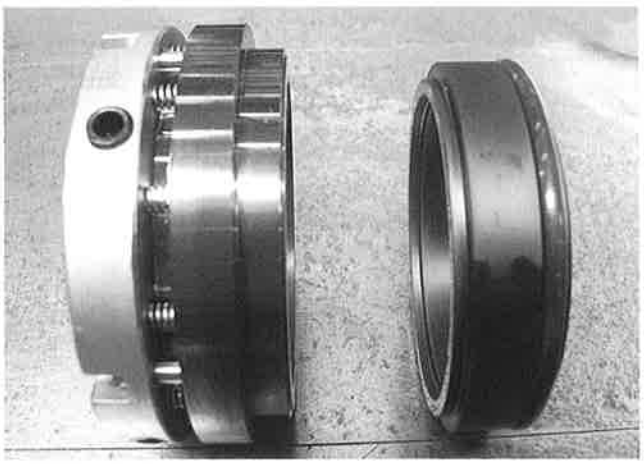


Fig.27 Single seal

b) Inspect the "O" rings. For Freon refrigerant systems, the "O" ring may suffer from swelling or deformation. If any abnormality is observed in an "O" ring, replace it. A total of four "O" rings are used for the seal cover, seal carbon and seal collar Inspect the frictional surface of the oil seal sleeve (528).
If any wear is found, replace the oil seal and the sleeve with new parts. Since the oil seal is specially designed for the compressor, only genuine parts should be used.

c) It is not necessary to remove the carbon insert from the seal cover or seal gland, other than for checking for leakage of the seal parts.

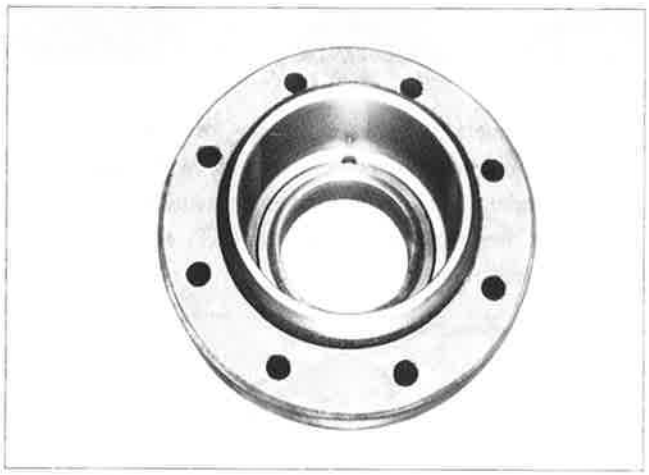


Fig. 28 Seal cover and carbon insert

Fig. 29 Bellows type single seal

Ⅳ-1' Mechanical Seal (400UD)

1. Remove the hexagon socket cap screws on the seal cover and remove the cover.

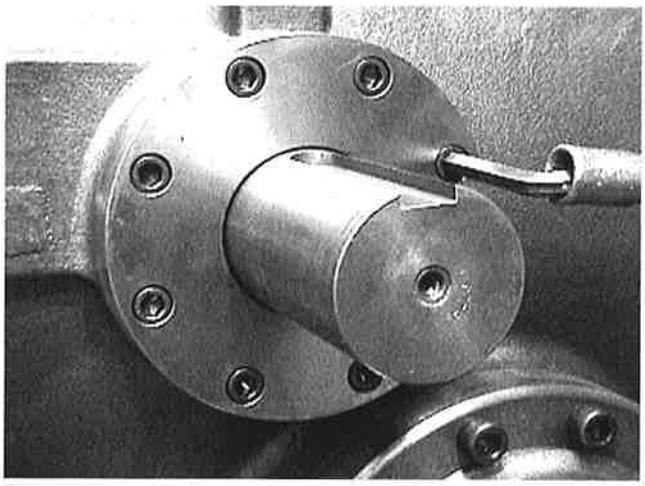


Fig. 400-1 Removing seal cover (1)

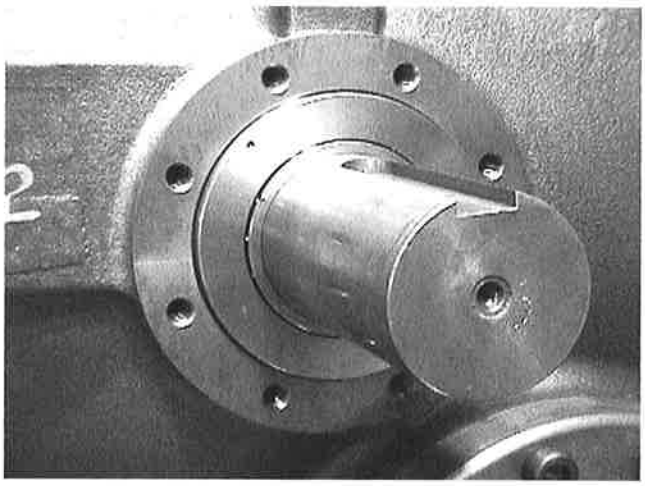
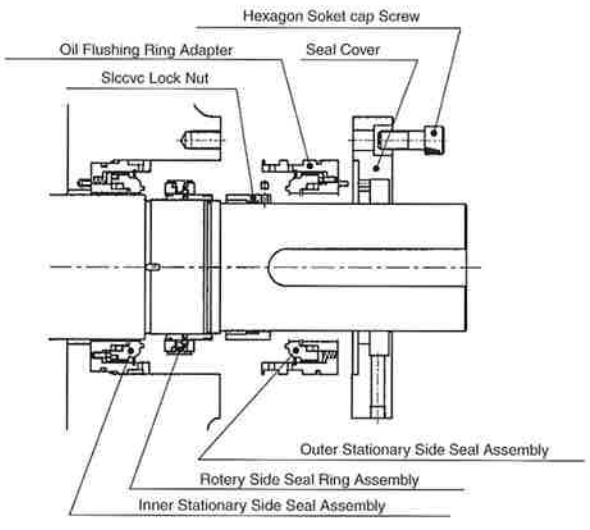


Fig. 400-2 Removeing seal cover (2)

Fig. 400-3 Cross sectional view of mechanical shaft seal



2. Install two eyebolts into the bolt holes on the outer stationary side seal assembly and pull out the outer stationary side seal assembly carefully.

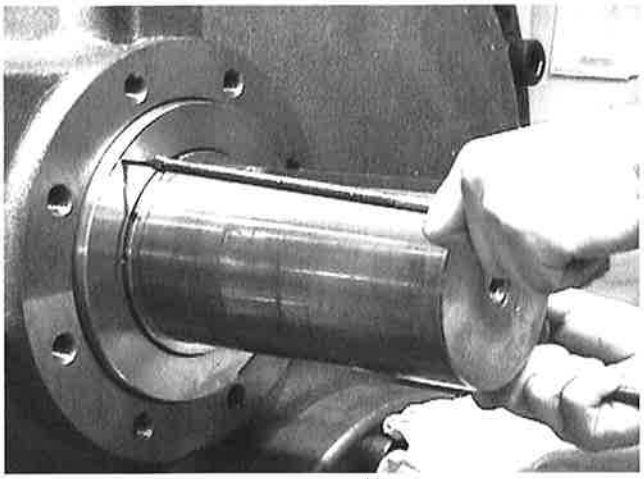


Fig.400-4 Outer stationary side seal assembly

3. Loosen the set screws on the sleeve lock nut and turn the nut using a the wrench. Remove the sleeve lock nut from the shaft.

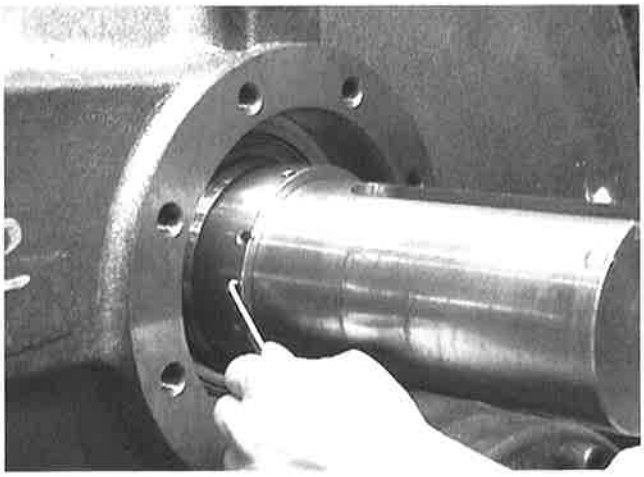


Fig. 400-5 Set screws

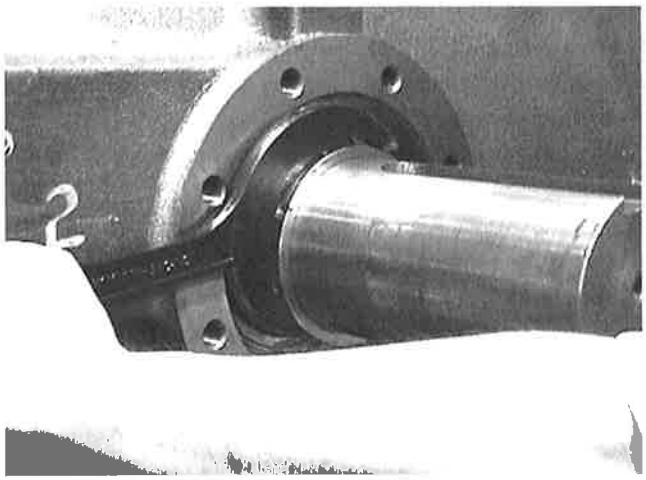


Fig.400-6 Lock nut sleeve (1)

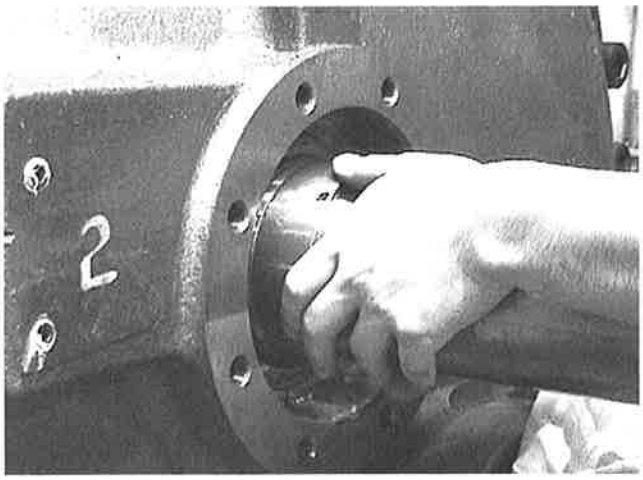


Fig.400-6 Lock nut sleeve (2)

4. Attach the threaded ring jig to the rotary side seal ring assembly and pull out the rotary side seal ring assembly from the stuffing box with the threaded ring jig.

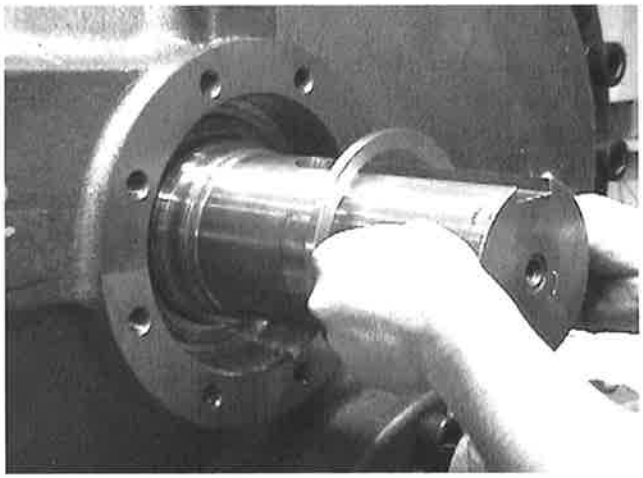


Fig. 400-7 Threaded ring ji for retainer

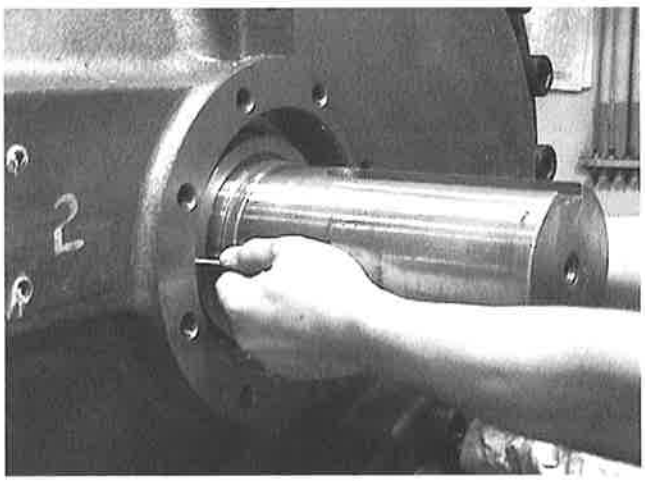


Fig. 400-8 Rotary side seal ring assembly

5. Remove the oil flushing ring adapter from the stuffing box.

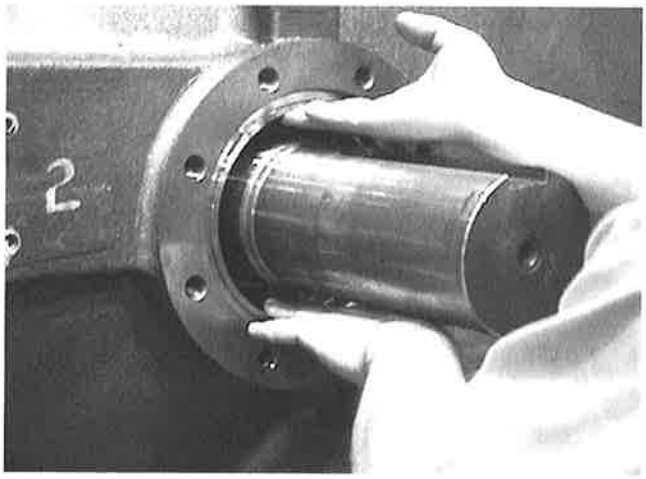


Fig. 400-9 Oil flushing ring adapter

6. Remove the small key on the top of the male rotor. Put the key in the safe place so as not to lose it.

7. Install two eyebolts in the bolt holes on the inner stationary side seal assembly and pull it out horizontally from the stuffing box.

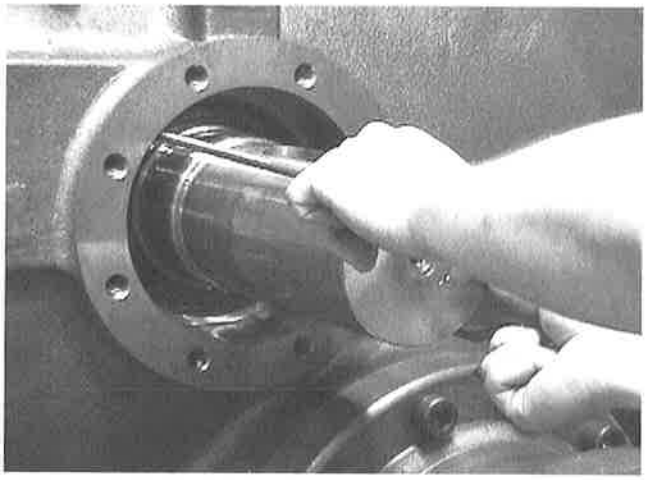


Fig.400-10 Pulling out inner stationary side seal pulling out

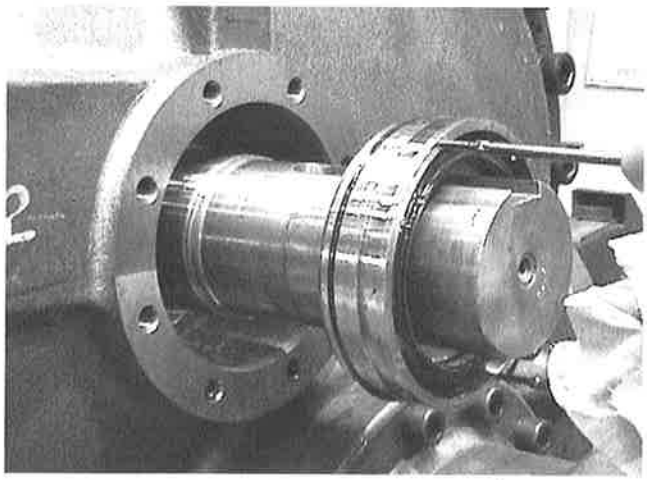
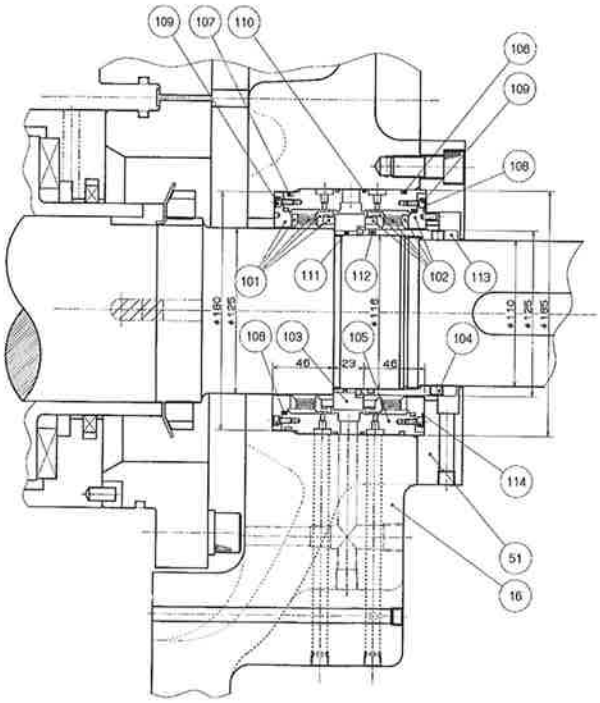
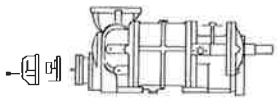


Fig.400-11 Pulling out inner stationary side seal pulling out

Fig. 400-12 Optional bellows type seal (Reference)





Ⅳ-2. Unloader Indicator

Two types of unloader indicator control, automatic and manual, are available. This description is for the automatic control indicator only.

Ⅳ-2.1.Dismantlement:

It is not necessary to dismantle the unloader indicator itself when dismantling of the compressor. The dismantlement, assembly and adjustment of the unloader indicator are described in chapter Ⅵ.

Two methods of removing the compressor from the frame can be used;

1. After a) below, remove the wiring and separate from the connector support (144) or
2. After e) below, leave all indicator parts on the frame side. Either method is OK but when removing the wiring only, install the indicator cover to protect the indicator itself before removing the compressor.

a) Remove the 3 Allen screws (147) which holding the indicator cover (146), and remove.

b) The indicator cover together with the glass and glass spacer can be removed. Take care not to drop the glass because it is only glued to the spacer.

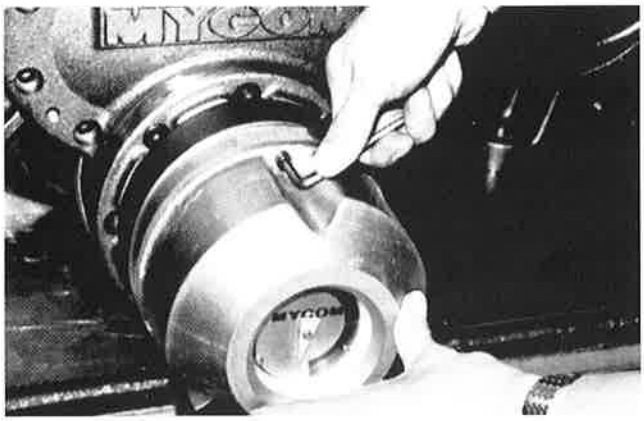


Fig.30 Allen screw holding the indicator cover

c) The manual type has an extension shaft with an indicator needle. The automatic type has a micro-switch cam which connects the potentiometer shaft and the unloader cylinder cam shaft.
Loosen the set screw (128) inside of the micro-switch cam to free the potentiometer shaft and micro-switch cam.

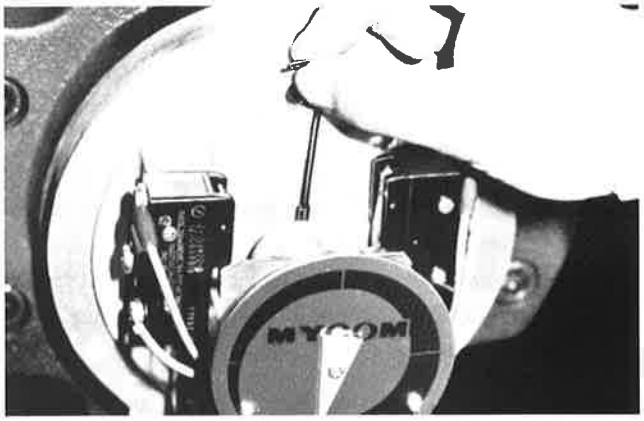


Fig.31 Loosening Allen screws holding cam shaft and micro-switch cam.

d) Loosen the Allen screw (122) holding the base plate (121), and remove the micro-switch base plate.

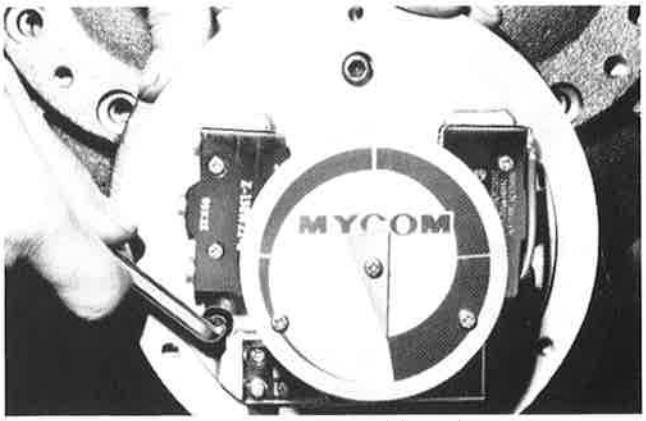


Fig. 32 Loosening Allen screws of micro-switch base plate

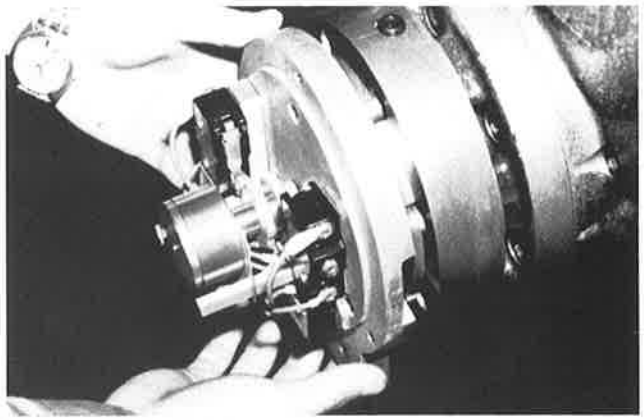


Fig. 33 Removing indicator

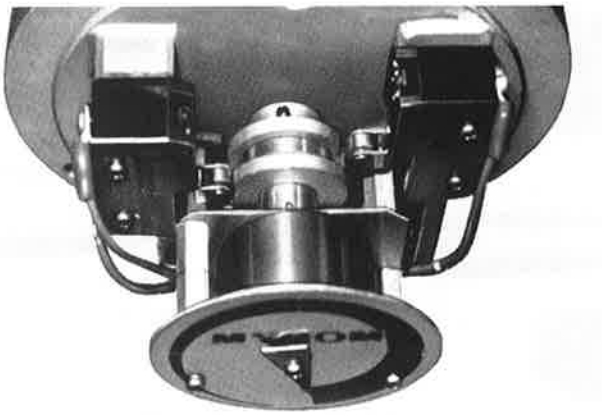


Fig. 34 160UD~320UD of Indicator

Fig. 35 Standard Indicator of 125UD

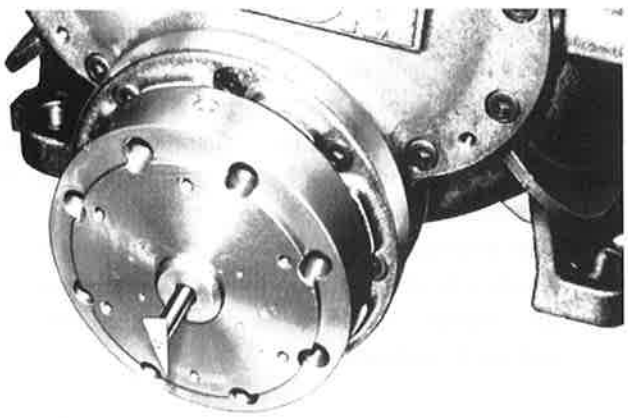


Fig. 36 Unloader cover

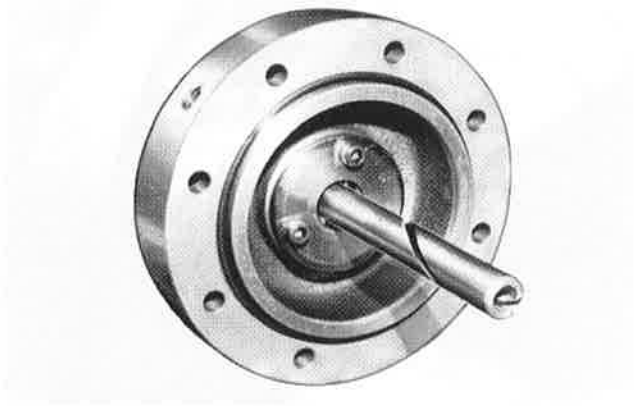


Fig. 37 Unloader cover assembly

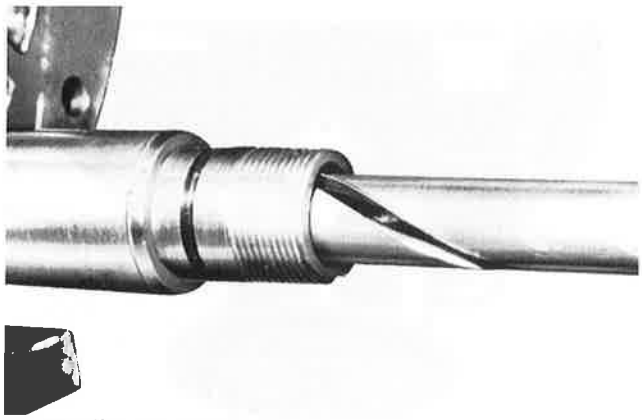
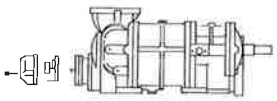


Fig. 38 Setting cam and push rod



Ⅳ-3 Unloader Cover

The indicator cam (77) which shows the position of an unloader slide valve is set in the unloader cover (74).
It is not necessary. To disassemble unless there are abnormalities such as leakage of the packing or indicator malfunction.

Ⅳ-3.1 Disassembly:

a) After removing the unloader indicator, remove the Allen screws (76) which hold the unloader cover.
b) The indicator cam is fixed to the cover and will come out as the cover is withdrawn. This mated with the unloader push rod by a guide pin is fixed in the push rod.
Care should be taken not to incline the unloader cover is the shaft of the indicator cam may be bent.
c) If the indicator does not work normally, the indicator cam (77) and guide pin (68) should be inspected. The packing should be disassembled if leakage around the cam/unloader cover seal occurs.
(1) The bearing gland (80) holding the indicator cam is attached by three Allen screws (81) to the inside of the unloader cover. Remove these Allen screws and pull out the indicator cam.

Fig. 39 Body of unloader cover

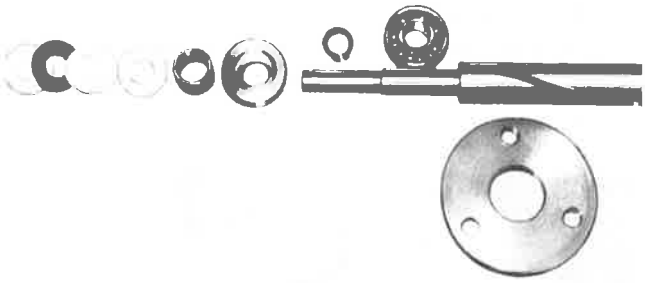


Fig. 40 Shaft seal parts of indicator cam

(2) The ball bearing (78) and snap ring (79) set on the shaft need not be disassembled.
(3) Disassemble the spring retainer (84), spring (83) and the Teflon V ring (82) in this order. The Teflon V ring must be renewed if once removed.

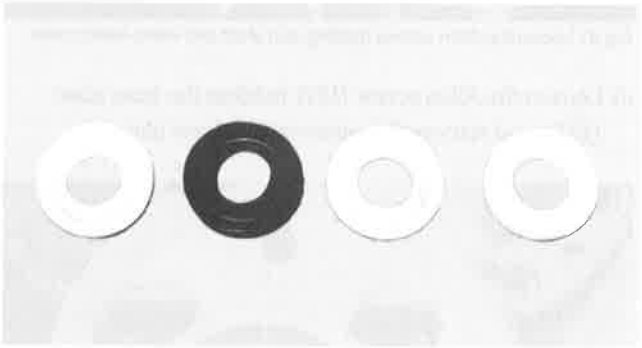


Fig. 41 "V" ring

Ⅳ-3.2 Inspection:

a) Check the shaft packing of the indicator cam. If leakage occurs, replace the V ring and insert the contact surface of the shaft.
b) The indicator cam must be removed if it is damaged or defective.

Ⅳ-4 Unloader Piston and Unloader Cylinder

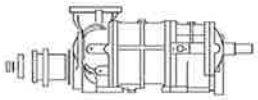
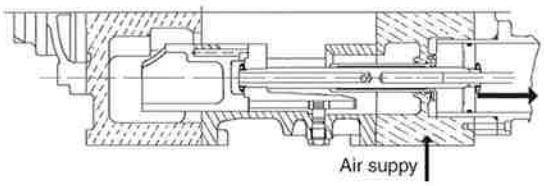


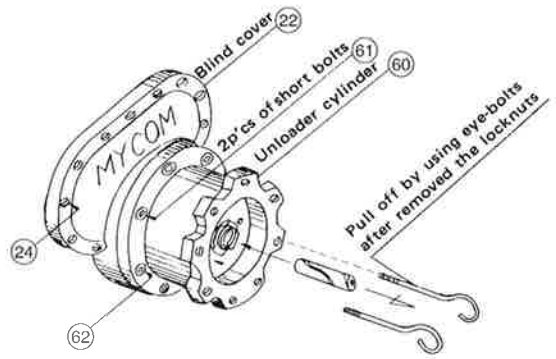
Fig. 42 Morving unloader piston



a) For thorough inspection of the unloader, the unloader piston (64) and unloader cylinder (60) must be removed. Before disassembly of these parts, Connect the compressed air pipe to the connecting port of oil pressure piping, which is prepared at the downward of the suction cover for unloader activation, then inject compressed air into the oil piping line to move the unloader piston to the full load position.

b) The unloader piston is fixed to the unloader push rod (67) by a bolt. Straighten the lock washer claws (72), and remove locknut (69).Pull out the unloader piston.
If the piston is removed from the cylinder it is necessary to remove the cylinder, attached by 8 Allen screws (61&-62) as well, in order to reassemble the unit correctly.

Fig. 43 Unloader piston removal



c) The unloader cylinder which is fixed to the Balance piston cover by two short bolts is fastened to the suction cover withsix long bolts with the blind cover between them.
If do not disassemble cylinder section and proceed the disassembly of other sections, leave to short bolts and remove a unit with the blind cover only loosing Allen screw (24), but at that time, take care for not spoil by the spilling out of oil which is kept between the balance piston and side bearing.

Ⅳ-4.1 Inspections:

a) Remove and check the Teflon cap and the "O" ring (65) on the unloader piston. It is recommended that these to used at least two years.

b) Check the unloader cylinder carefully as there is a possibility that the surface may be coated with oil residue or is scored. Finish the surface with fine emery paper.

c) Check the seating of the 'O' ring (73) on the piston.

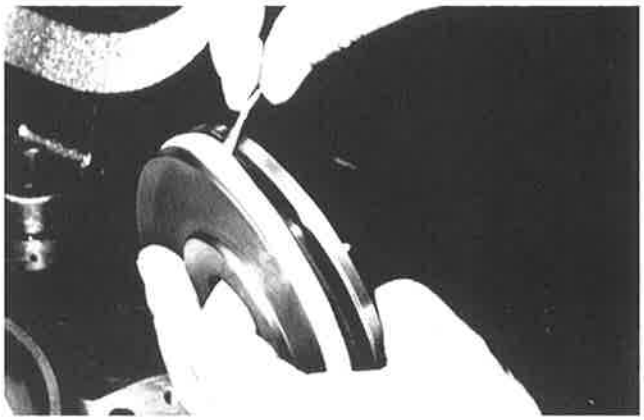
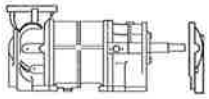


Fig. 44 Checking 'O' ring and cap seal of unloader piston

Ⅳ-5 Bearing cover



There are some differences between types UD and G. The UD type has a discharge flange and weight is therefore unbalanced so care should be taken when handling. Removal of the bearing cover (16) is necessary when checking the thrust bearing and/or pulling out rotors.

Ⅳ-5.1 Disassembly:

a) Remove all Allen screws (18) or (18-1). The bearing cover is still held to the bearing head by the guide pin (19).

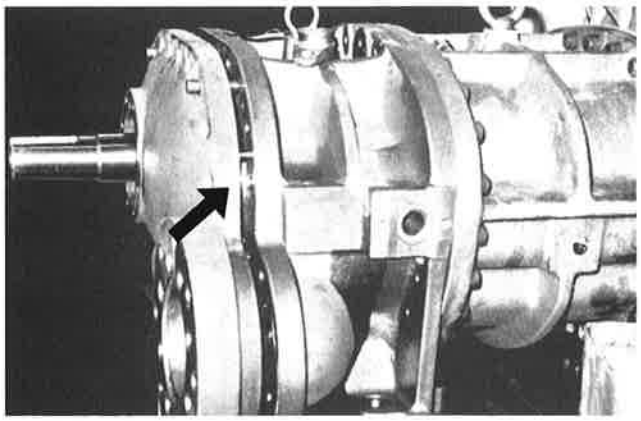


Fig. 45 Removing bearing cover

b) Insert two eye-bolts in the holes provided in the cover and press off the cover evenly.

c) Before pressing off the bearing cover the shaft should be covered with rags to protect it should the cover fall after the guide pin (19) come free. Screw a headless bolt in to the top hole to prevent the cover falling.
The bearing covers of 250SUD, MUD, LUD and larger types are provided with a hanging bolt on the top of the cover, which should be used during disassembly and reassembly.

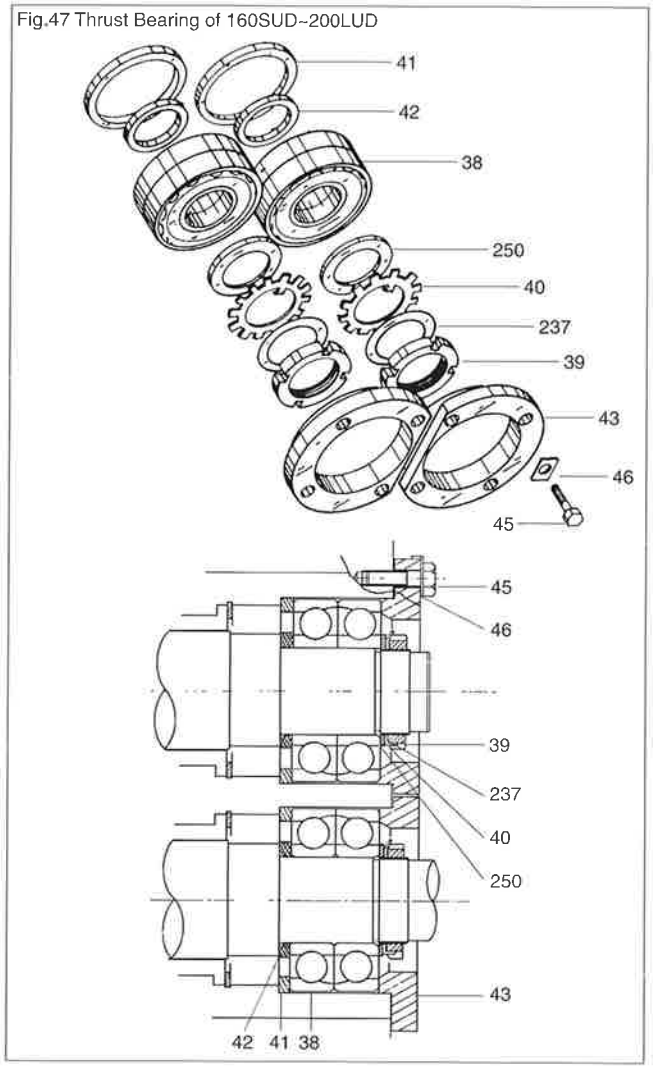
Ⅳ-6 Thrust Bearing 125-320
400UD refer to Ⅳ.- 6' thrust bearing (400UD)

The thrust bearing is the most important of all component parts of the screw compressor. Special care should be taken with assembly and adjustment; otherwise it may cause trouble and/or poor capacity performance.

Fig. 46 A pair of thrust bearings (Left side lies upon the right side)

The thrust bearing (38) employed is a face assembled angular contact type ball bearing which is specially designed for accuracy and long life. The construction of this bearing is such that it receives the thrust load completely and does not receive any radial load. (Clearance is kept between the outer race of the thrust bearing and the bearing head.)

Fig.47 Thrust Bearing of 160SUD~200LUD



No.	Description	Q'ty
38	Thrust bearing	2 sets
39	Lock nut	2 p'cs
40	Lock washer	2 p'cs
41	Bearing spacer	2 p'cs
42	Washer	2 p'cs
43	Thrust bearing gland	2 p'cs
45	Gland bolt	8 p'cs
46	Lock washer	8 p'cs
237	Tortional slip washer	2 p'cs
250	Thrust bearing washer, w/o type 400	2 p'cs

The above is important in deciding the gap of the rotors and bearing head at the discharge side. This gap has a significant influence on the capacity of compressor.

There are two types fastening for the thrust bearings, refer to Fig.47 and 49

Ⅳ-6.1 Disassembry: thrust bearing gland

a) Bend back the claws of washers (46) and (47) which lock the gland bolts (45). Unscrew the gland bolts and remove the thrust bearing glands (43) and thrust bearing gland guides (44) as units. When pulling out the last bolt, care should be taken so as not to allow the part to fall.
Sometimes spring washers are employed instead of common lock washers

Fig.48

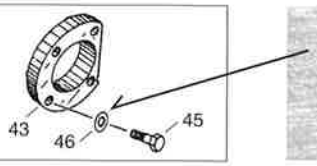
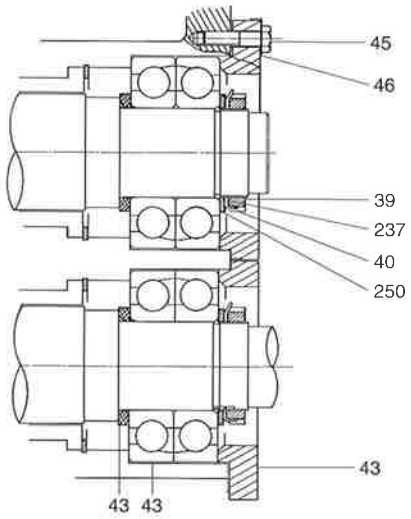


Fig.49 Thrust Bearing of 250SUD~320LUD



No.	Description	Q'ty
38	Thrust bearing	2 sets
39	Lock nut	2 p'cs
40	Lock washer	2 p'cs
41	Bearing spacer	2 p'cs
42	Washer	2 p'cs
43	Thrust bearing gland	2 p'cs
45	Gland bolt	8 p'cs
46	Lock washer	8 p'cs
237	Tortional slip washer	2 p'cs
250	Thrust bearing washer, w/o type 400	2 p'cs

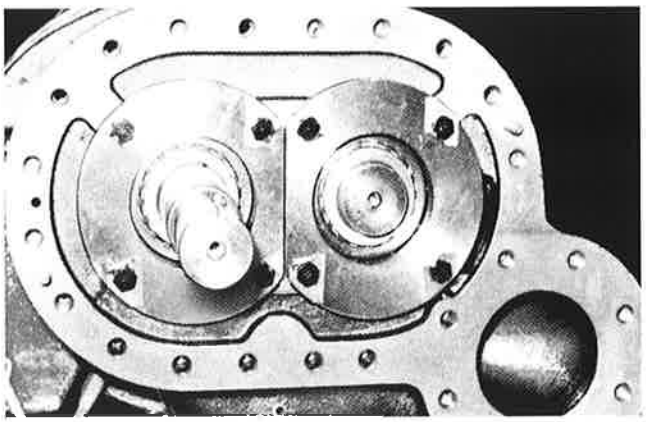


Fig. 50 Parts of thrust bearing gland (160UD)

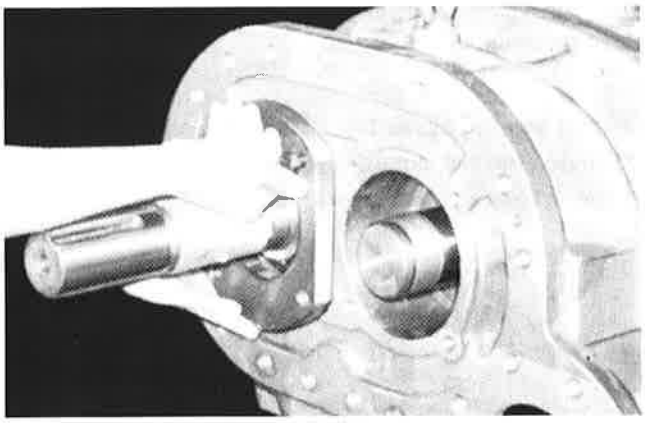


Fig. 51 Removing of thrust bearing gland

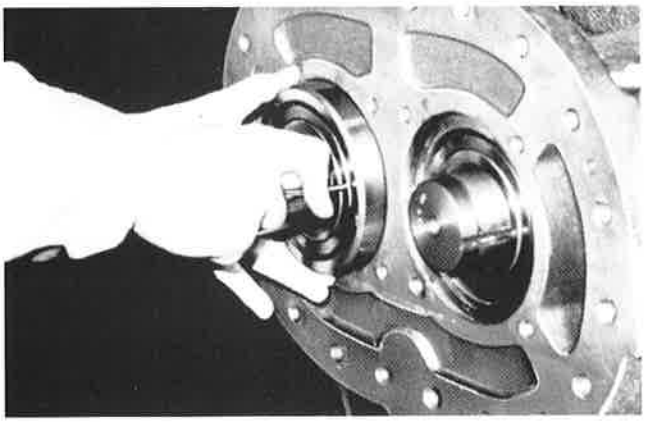


Fig. 52 Pulling out the bearing

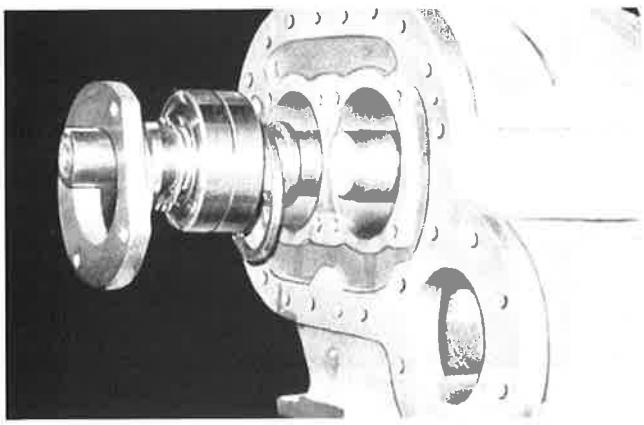


Fig. 53 Setting parts

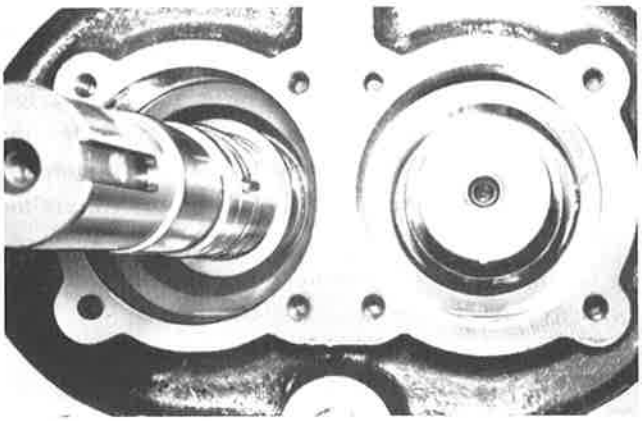


Fig. 54 Bearing spacer & washer after removed bearing

Fig. 55 Marks on the spacer and washer Disassembly of thrust bearing

b) Bend back the claws of the lock washers (40) on the axial side. Loosen the locknuts (39), and remove. A torsional slip washer is inserted between the locknut and the lock washers, care should be taken not to bend or loose.

c) There is a gap between the outer race of the thrust bearing and the bearing head. The inner race of the bearing is easily removed using a wire about 2 to 3 mm diameter. with a bent point. Insert this wire between the outer race and the ball retainer and pull out.

d) Bearing spacer (41) and washers (42) are found behind the thrust bearings. These parts have been marked M and F, to indicate the male and female rotor sides. All parts should be separated into two groups and during reassembly should not be mixed.

e) 250UD&320UD models do not employ a thrust bearing spacer.

Ⅳ-6.2 Inspection of thrust bearing

a) It is normal if the ball bearings have a lustrous quality after washing. Check the gap between the retainer and balls. It is abnormal if the inside of the retainer is burred or the gap is too big.

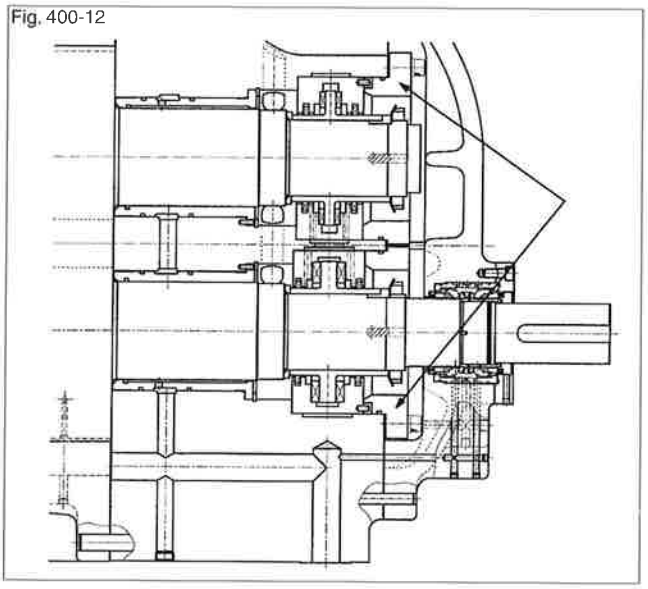
b) Hold the inner race firmly and revolve the outer race, if abnormal vibration is felt, it may indicate an abnormality of the orbital surface of both races and/or bearings. Check thoroughly and if defects are found, renew the bearing. It may however, only be dirty and a thorough washing and blasting by high pressure air correct the vibration.

c) The bearing must be renewed when the compressor has been operated more than 30,000 hors.

Ⅳ-6' Thrust bearing disassembly(400UD)

Thrust Bearing Gland

Fig. 400-12



1. Loosen the hexagon cap screws and install the lifting eyebolt into the bolt hole at the top of the thrust bearing gland.
2. Lift up the thrust bearing gland and, remove the bolts and insert a safety bolt at the top of the thrust bearing gland. Pull out the thrust bearing gland by using minus drivers. Remove the thrust bearing gland and another side thrust bearing gland as same.

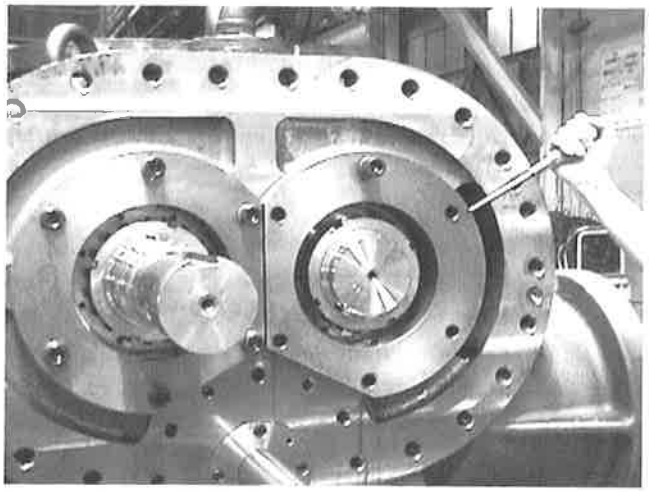


Fig. 400-13 Thrust bearing gland (1)
(Photo Used 400VMD) There are different points between VMD and MUD.

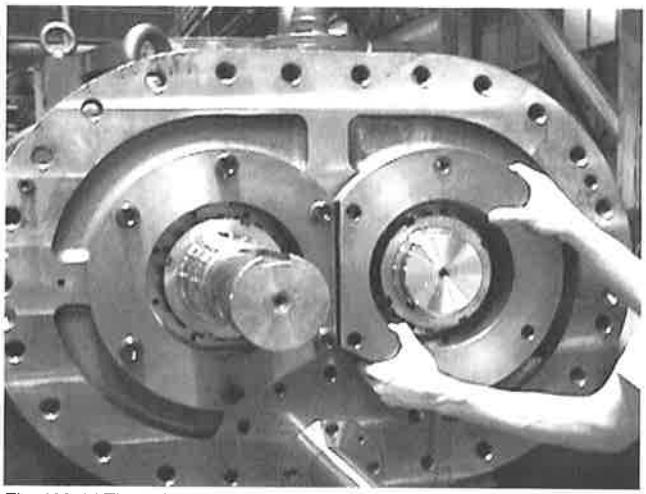
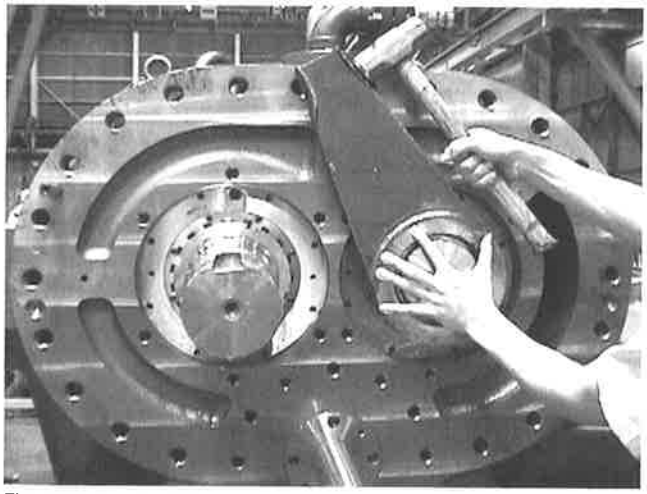


Fig. 400-14 Thrust bearing gland (2)

Thrust bearing assembly

1. Loosen the lock nut using a lock nut wrench and remove the lock nut and lock nut washer.



Fig, 400-15 Lock nut(1)

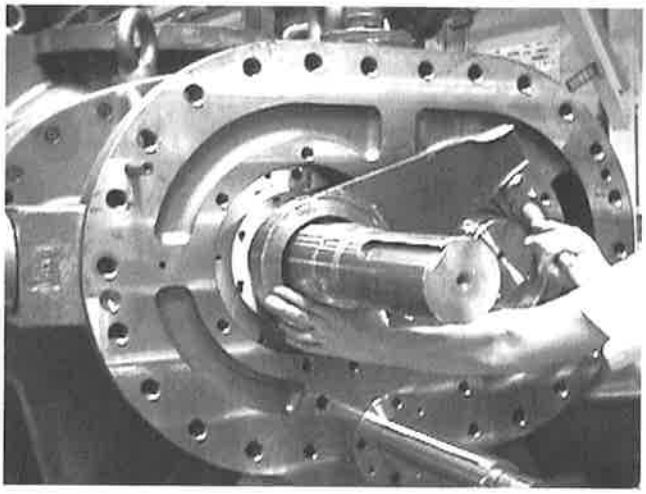
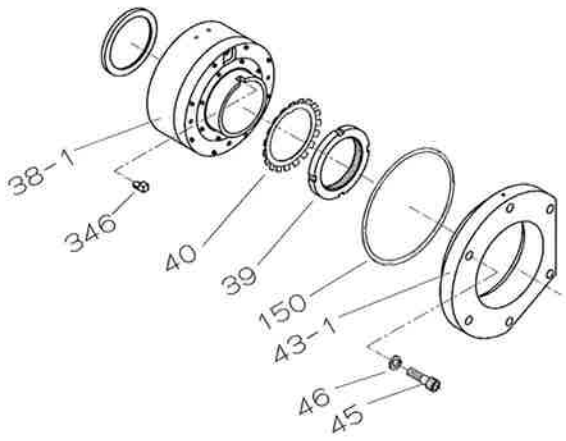


Fig.400-16 Lock nut (2)

Fig. 400-17 Exploded view of thrust bearing



2. Remove the key on the shaft. Store the in a safe place.
3. Install two eyebolts into bolt holes on the tilting pad thrust bearing and pull it out until a bolt hole on the top of the bearing shows up towards axial direction.
4. Install the lifting eyebolt into the hole on the top of the tilting pad thrust bearing and lift it up. Pull out the tilting pad thrust bearing from the bearing box.

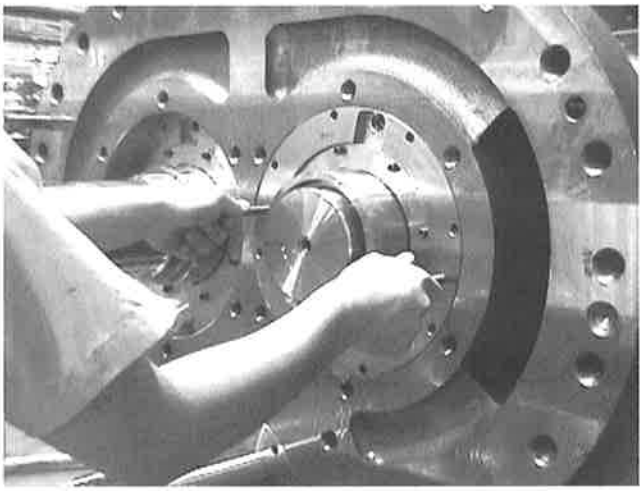


Fig.400-18 Thrust bearing (1)

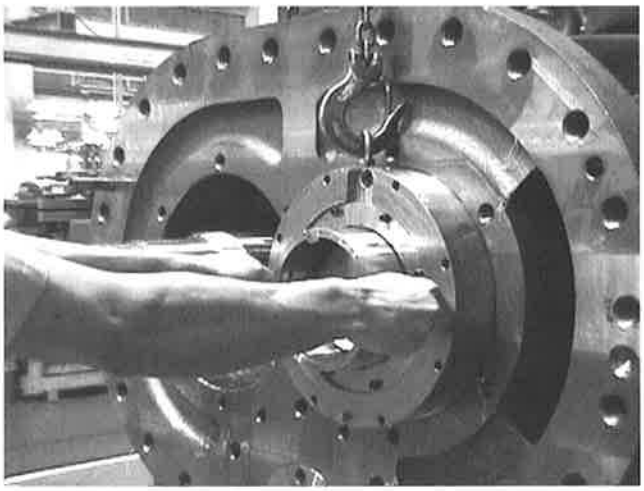


Fig.400-19 Thrust bearing (2)

5. Removing thrust bearing alignment spacer frim the shaft.

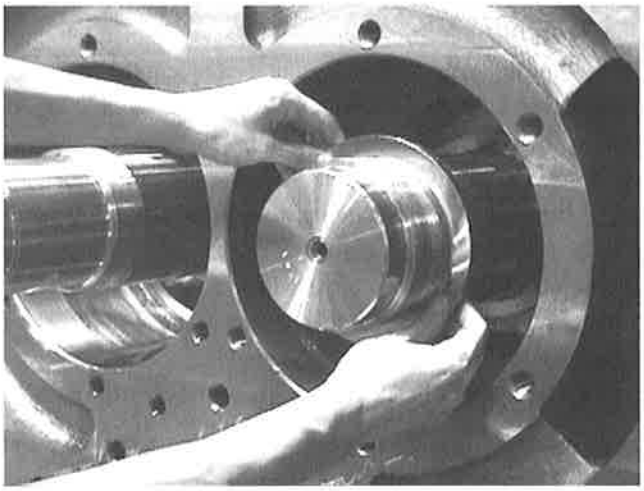


Fig. 400-20 Alignment spacer (1)

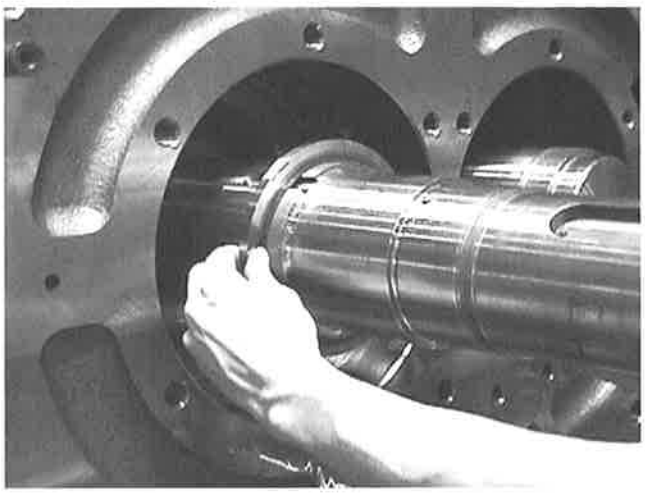


Fig. 400-21 Alignment spacer (2)

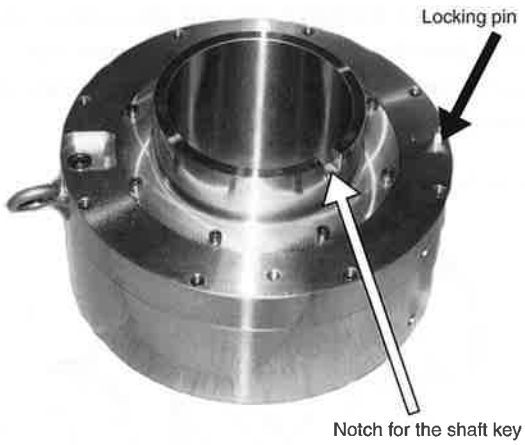
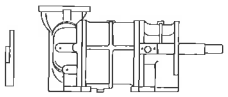


Fig. 400-22 Tilting pad thrust bearing

Ⅳ-7 Balance Piston Cover



The blind cover(22) can be removed along with the unloader cylinder for easier dismantlement. The following instructions are for removing the balance piston cover only. Balance piston cover of 320UD and loger typs provided with a hanger eye bolt hole.

a) Loosen all the retaining bolts (24) slightly (3 to 4 turns). Tap the side of the balance piston cover with a hammer to loosen the cover gasket (23).

b) The oil (approx. one quart) which will spill should be caught in a can. Remove all bolts except the top one. Remove the remaining bolt while holding the balance piston cover with one hand. Take care not to damage the gasket

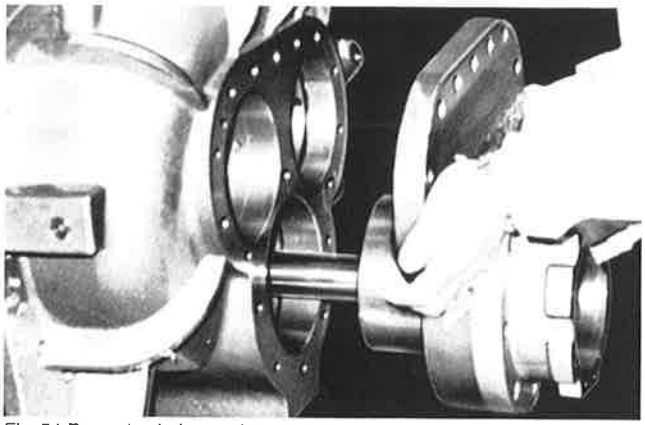
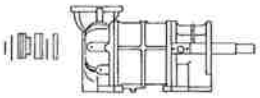


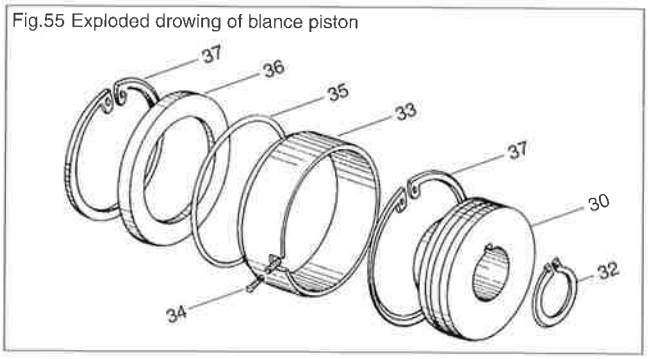
Fig. 54 Removing balance piston cover



Ⅳ-8 Balance Piston

During operation of the compressor, the male rotor runs at much higher speed than the female rotor, so that load on the thrust bearing of the male side is lager. With screw compressors the male rotor is subjected to strong thrust load from the discharge side and also rotates considerably faster than the female rotor. If the same type of thrust bearing were used for both the male and female rotors, the male side bearing life would be much shorter.

Fig.55 Exploded drowing of blance piston



The balance piston (30) provides relief on the thrust bearing and the male rotor. For model 125LUD, the balance piston is positioned directly in the suction cover, while for the 160SUD model and lager there is a balance piston sleve. The balance piston is crenulated (grooved) and forced fed by oil to apply a counter force on the bearing sleeve due to labyrinth effect of the piston.

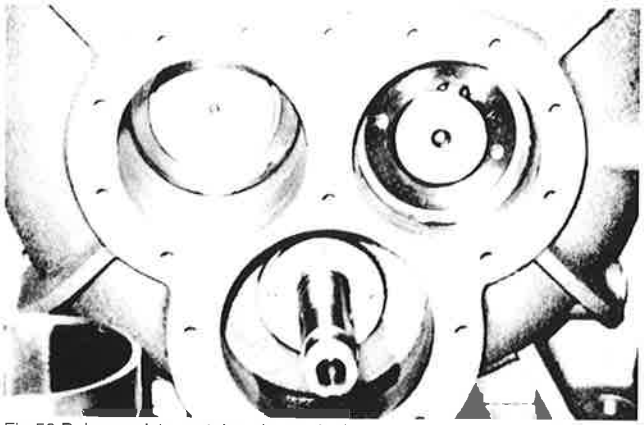


Fig.56 Balance piston retainer (snap ring)

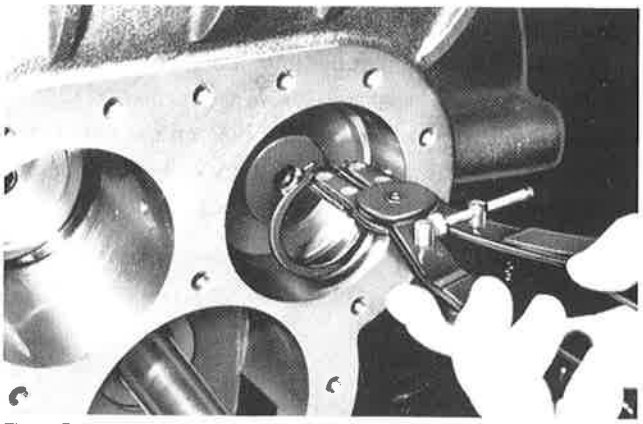


Fig.57 Removing snap ring holdings balance piston

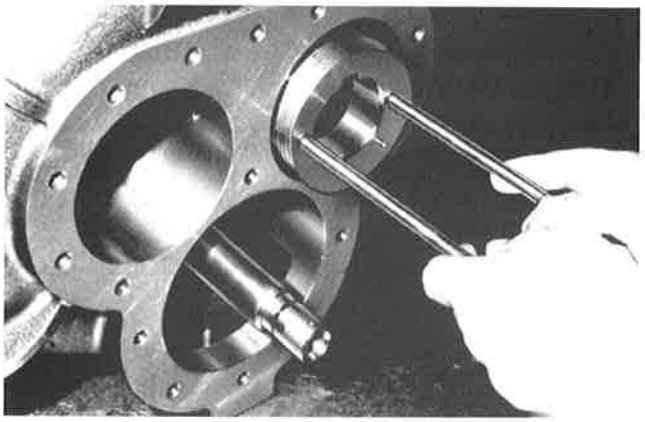


Fig.58 Remove balance piston

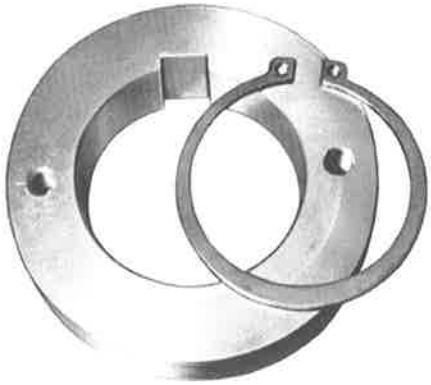


Fig.59 Balance piston

a) Remove the snap ring (32) which holds the balance piston (30) using a pair of snap-ring pliers. Screw eye bolts into the balance piston and withdraw. It is not necessary to remove the balance piston key (31). At this point removal of the 125UD balance piston is complete, but for the 160UD and larger models, the sleeve will have to be removed.

b) A grub screw (34) located just inside the sleeve (33) holds it in place. This grub screw is locked in place by a similar screw inserted from the female rotor side.

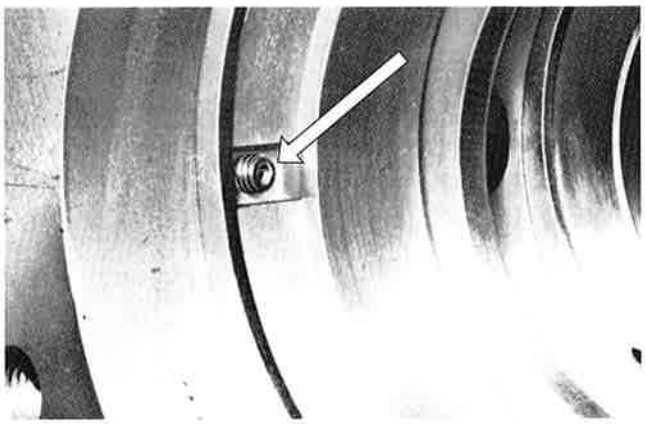


Fig.60 Loosing grab screw of balance piston sleeve (125~250UD type)

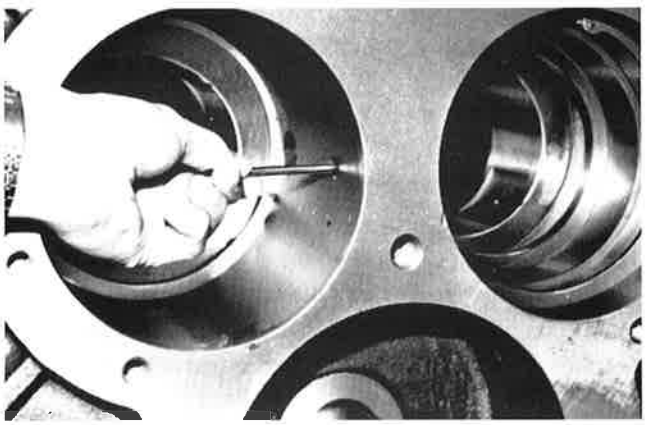


Fig.61 Loosing of locking screw

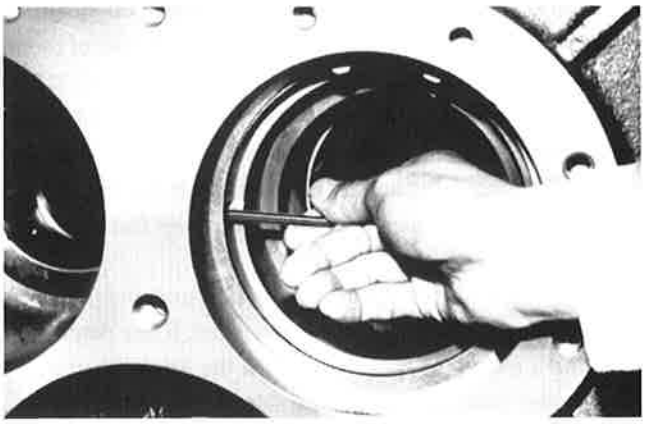


Fig.62 Removal grub screw

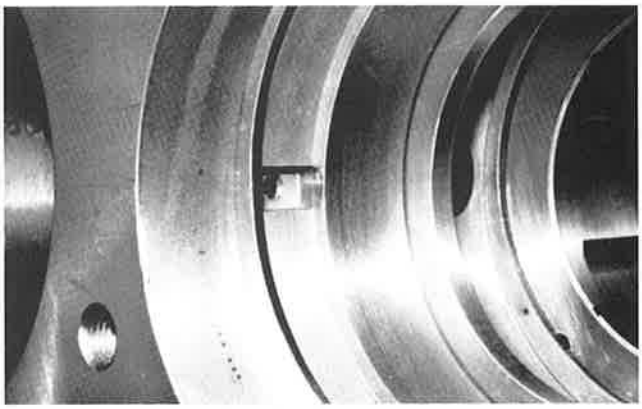


Fig.63 A view after screw removed (up to 250UD)

c) To release the sleeve, unscrew the locking screw (81) a few turns from the rotor side and then drive the grub screw in the sleeve into the suction cover body, until it is clear of the sleeve.

d) Remove the snap ring (37) retaining the sleeve, and withdraw the sleeve. Also remove the 'O' ring (45) between the sleeve and the spacer (36).

e) It is not necessary to remove the snap ring (29) behind the spacer (36), except when checking the side bearing (28).

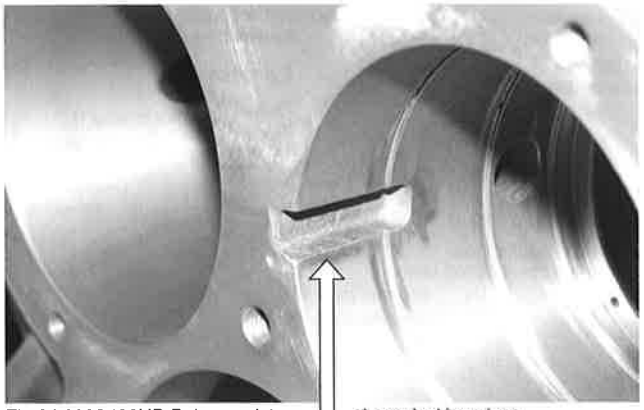


Fig.64 320&400UD Balance piston sleeve locking glove

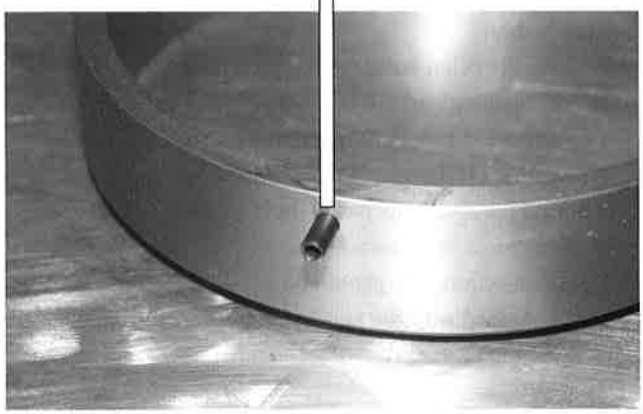
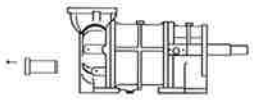


Fig.65 320&400UD Balance piston sleeve locking pin

The balance piston cannot be damaged while in operation. The 'O' ring however, should be renewed if damaged. The sleeve may be scored by the piston, but this is normal and it does not retard performance of the piston and sleeve due to labyrinth effect of the piston

Ⅳ-9 Oil injection pipe for 125to 250



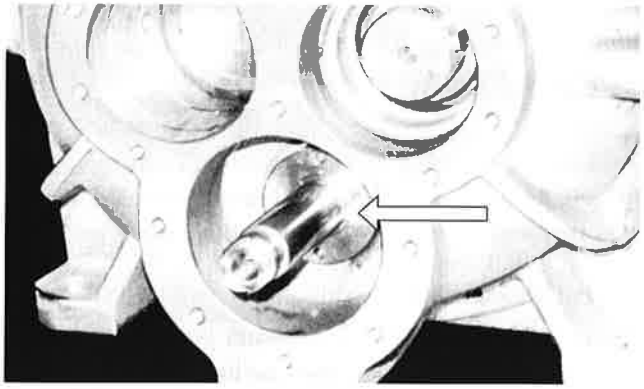
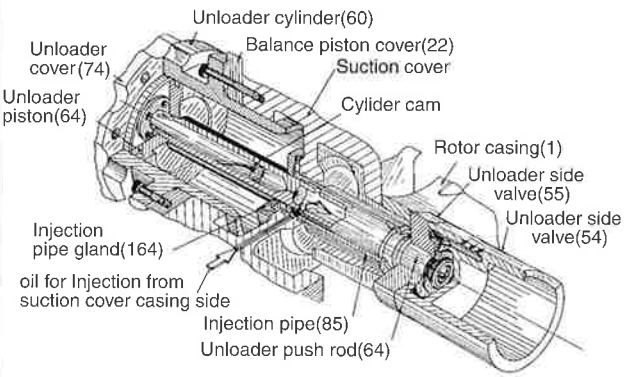


Fig. 66 Oil injection pipe insert part

The unloader push rod projects from the suction cover after removing of the unloader cylinder. The injection pipe surrounds the push rod. This pipe relays injection oil to the unloader push rod and slide valve through the suction cover.

Fig. 67 Oil injection pipe, Exploded Drawing



Disassembly:

a) Remove the Allen bolts (166) which fasten the oil injection pipe gland (164).

b) Two threaded holes are machined on the oil injection pipe gland. Fit the eye blots and draw out the unloader pushrod parallel. This part is held by four 'O' rings so some force is required.

c) The oil injection pipe gland and the oil injection pipe (85) are connected with the spring pin and, so are pulled out at the same time.

Checking

Check the "O" ring, if necessary renew them.

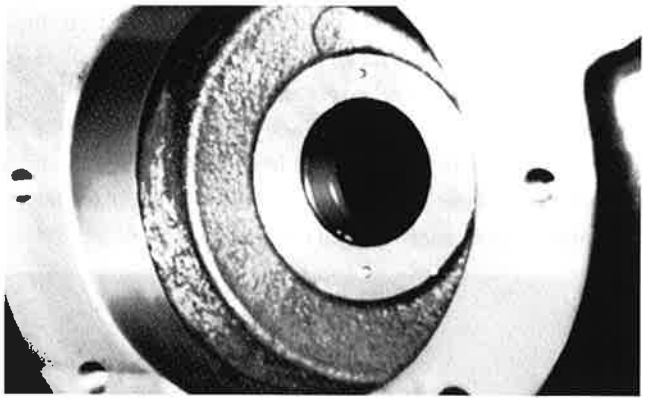


Fig. 68 Oil injection pipe gland

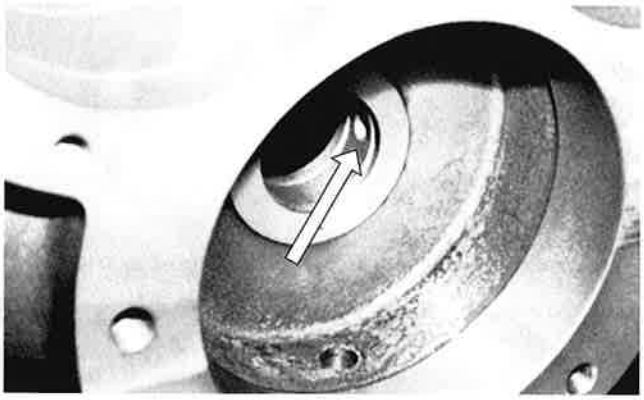
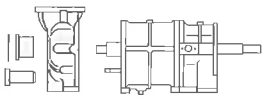


Fig. 69 Oil hole for injection

Ⅳ-10 Suction Cover and Side Bearing



The suction cover (5) is one of the most important parts of the compressor, forming as it does the gas suction port and connection port for the injection oil, housing the side bearings of the rotors and forming one end of the casing.

Ⅳ-10. 1. Dismantling:

a) Remove all Allen screw (2) connecting the suction cover and the casing. Drive the alignment pin (3) clear of the suction cover flange.

b) Tap the base or the suction cover to break the seal. Push the unloader push rod to the discharge side and slide the suction cover away and off the rotor shaft. Do not use a screw-driver or chisel to separate the cover from the casing.

c) The suction cover itself cannot be damaged, but the side bearing in the cover should be checked. If any damage is found it should be renewed. Check the 'O' ring in the unloader push rod bore. If the side bearing must be renewed, remove with a bearing puller. Replace using a mallet and a wooden drive block. At this time the rotors come out because the trust bearing was removed, but leave the rotors in the rotor casing and remove only the suction cover.

d) Remove snap ring (29) and push out the bearing in the direction of blind cover from the rotor side. It should be tapped out, because it is lightly pressed in.

It is not necessary to disassemble this section except when renewing .Some models is have screw holes for pulling out the cover. Use eye-bolts to pull out. The bearing will not be damaged with this method.

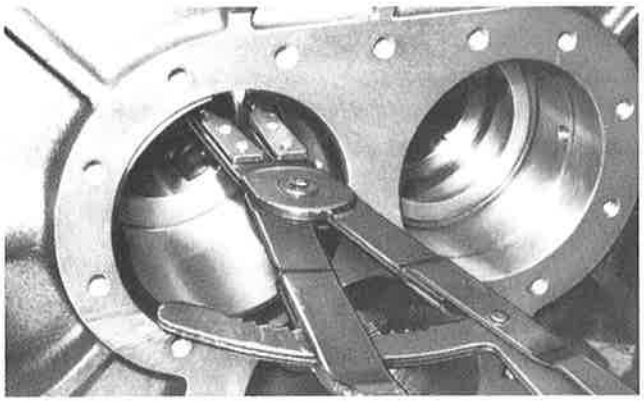
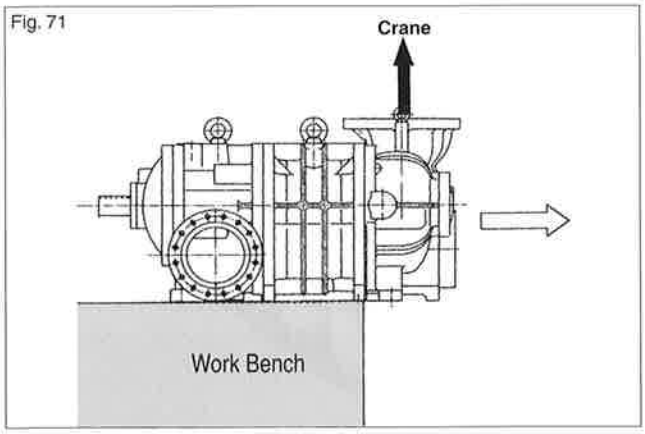


Fig. 70 Removing snapping of side bearing

Ⅳ-10.2 Inspection:

a) The suction cover itself cannot be damaged. The side bearing located inside of the suction cover is a wearing part so check the surface of the metal.

b) Check the 'O' ring (9) is in the oil injection pipe hole at the center of the suction cover.



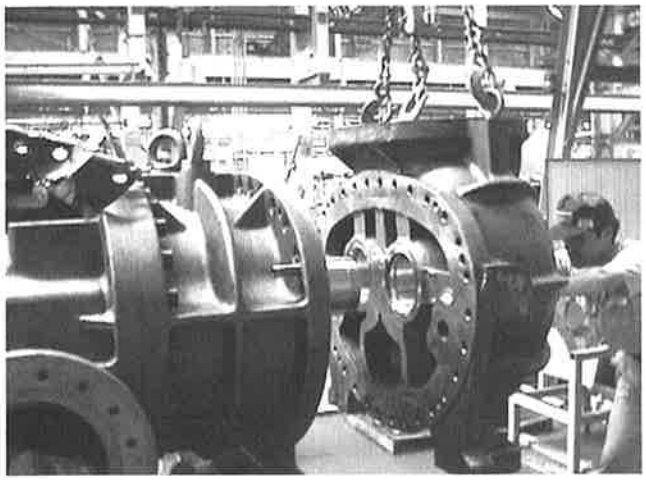
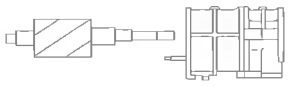


Fig. 72 Dismantling (400UD) Suction cover

Ⅳ-11 Rotor and Rotor casing



For compressors up to type 160LUD, the rotor can be lifted out by hand, however for larger types from 200SUD a sling and pulley block must be used.(Rotor weight Refer table end of page)

Ⅳ-11.1 Dismantling:

a) Twist the rotor out approx. 2/3s. of its length, attach the sling around the center and lift clear. Either rotor may be taken out first, but it is easier to pull out the male rotor first because it has a longer shaft than the female rotor.

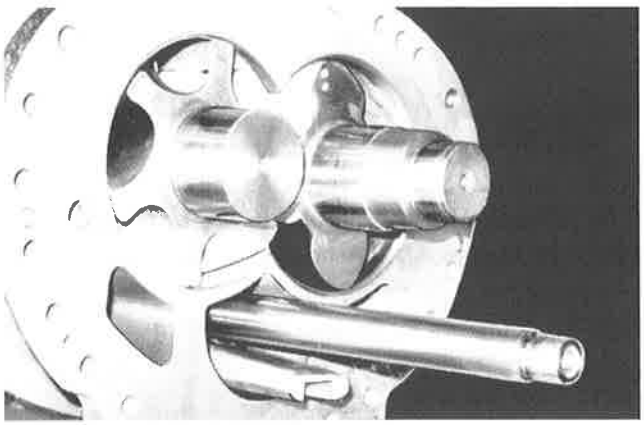


Fig. 73 After suction cover removed

b) It is easy to remove by screwing to the right. In this condition hang the rotor at the center and pull out slowly.

c) Don't put the rotor on a concrete or steel floor, as damage to the seal edges may result.

d) Pull out the female rotor in the same manner the male rotor, taking specially care not to damage the surface of the main bearing.

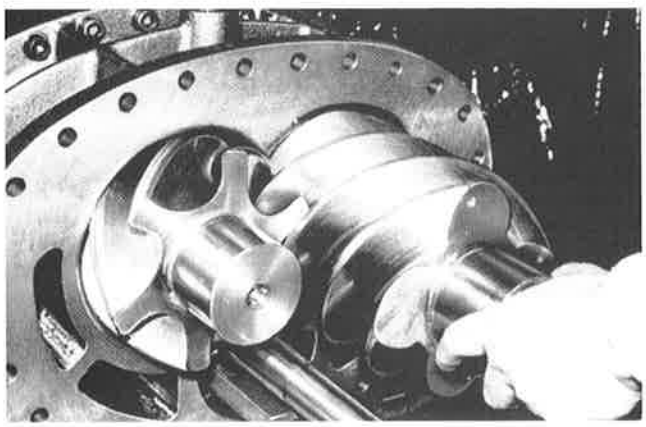


Fig.74 Removing female rotor

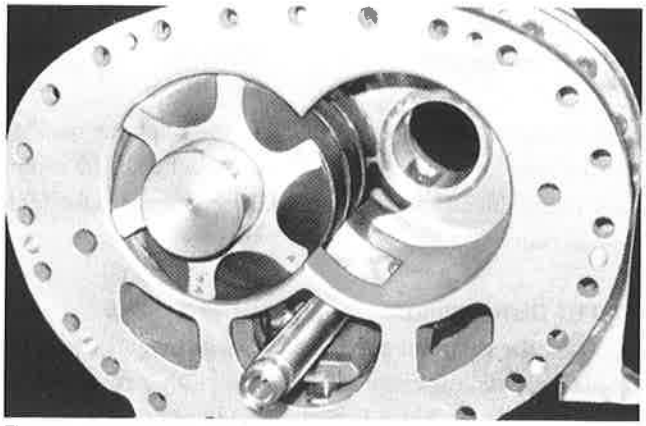
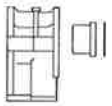


Fig.75 Removing male rotor

Ⅳ-12 Bearing Head and Main Bearing



The bearing head (11) is an important part of the casing as it forms the gas discharge port, houses the main bearings and rotors, and forms one end of the body.

The difference between the UD type and G types is the shape of these parts. Measurements are the same but the discharge gas outlet flange is parallel to the axis for the UD type but downward for the G type.

Ⅳ-12.1 Dismantling:

It is not necessary to disassemble the rotor casing and bearing head if disassembly of the unloader slide valve is not required.

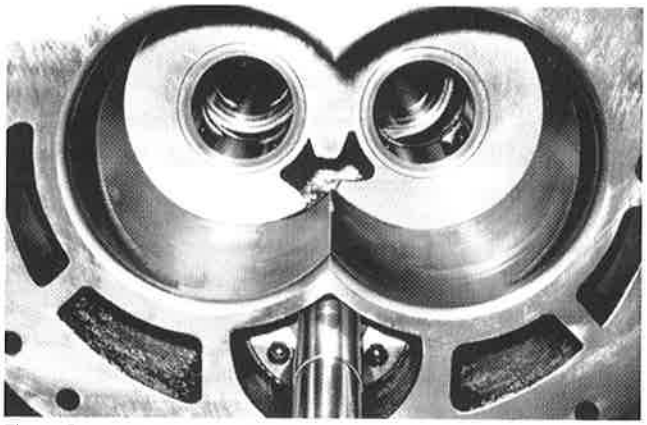


Fig. 76 Rotor casing and bearing head

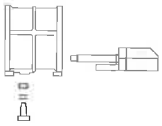
a) Remove all Allen bolts '1) which fasten the casing and bearing head. Drive the alignment pin (3) through.
b) Break the seal by tapping the base until separation is achieved. If the gasket sticks tightly, screw an Allen bolt(2) into the blind hole on the casing side.
c) The main bearing is lightly pressed into the bearing head. Remove the stop ring and tap out from the rotor side to remove.

Ⅳ-12. 2 Inspection

These parts are very rarely damaged but it is wise to check the following.

a) Check the bearing surface of the main bearing (27) set in the bearing head. If dust is imbedded inside the bearing, it must be renewed.
b) Check the bearing surface at the discharge port on the rotor side. If it is badly scratched, incorrect adjustment of the end clearance may result. Sometimes dust in the gas causes such scratches.
c) Check the contact surface of the casing and slide valve. If abrasion is found grind and polish.

Ⅳ-13 Unloader Slide Valve and Guide Block



A guide block, mounted at the bottom of the rotor casing, controls the movement of the slide valve. The guide block consists of a threaded guide block bolt (88), a guide block (87) and two 'O' rings (89).

The guide block engages a slot in the bottom of the slide valve. This slide valve body assembly varies in length according to the compressor type.

The slide valve assembly is comprised of the valve body having three components, part Nos. 54-1, 55-2, two Allen screw (58), and the unloader push rod (67). The push rod is secured to the valve with a locknut (69) and a washer (70).

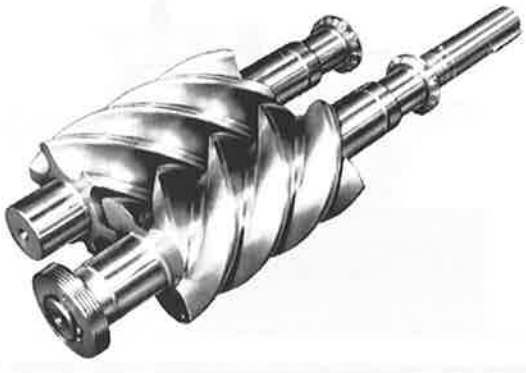


Fig. 77 Rotors

Ⅳ-13. 1 Dismantling

a) Remove the unloader slide valve assembly from the casing. It is not necessary to take the valve assembly apart except when renewing the unloader push rod.
b) To replace this rod, remove the Allen bolts (58) and separate the slide valve (2) body parts (55).
c) Unscrew the locknut, slide off the lock washer, and then withdraw the push rod from the valve body .
d) Removal of the guide block is done by removing the guide block bolt (88) from the underside of the casing. Removal of the guide block stem is not necessary except if refrigerant leakage is found around the bolt hole.

Ⅳ-13. 2 Inspection

These parts are very rarely damaged but it is wise to check the following.

a) Check the wearing surface and gap between the guide and the slide valve.

b) Check the pin mating the indicator cylinder cam and unloader push pipe.

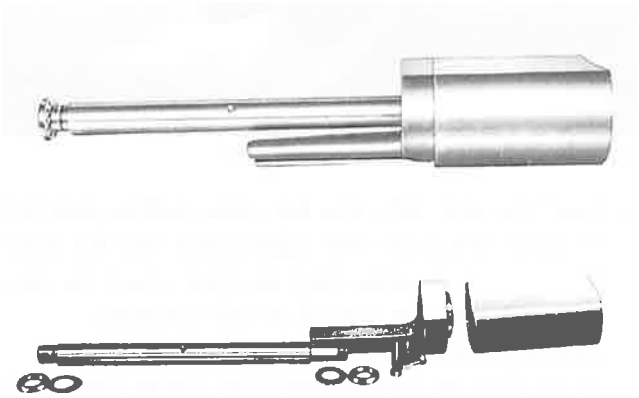


Fig. 78 Unloader slide valve assemblies (upper)
Disassembled parts (lower)

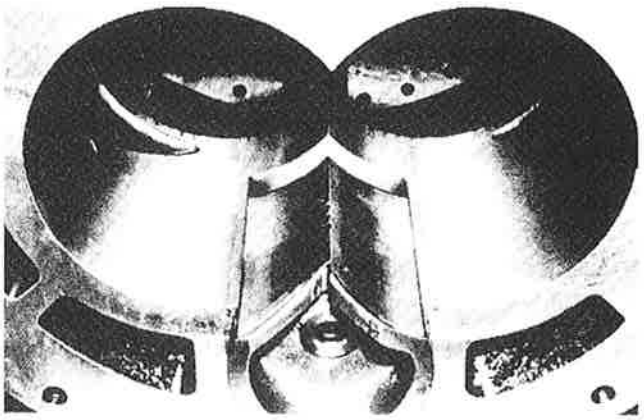


Fig. 79 Rotor casing and unloader slide valve

Bolt fastening torque Hex Socket cap screw fastening torque

Bolt size ISO standard	Kgf-cm	N·m
M4	28	2.8
M5	60	6
M6	100	10
M8	250	25
M10	500	50
M12	900	90
M14	1400	140
M16	2400	240
M20	4500	450
M24	7500	750
M30	16000	1600

"O" ring list (W,ID,OD)Unit:mm.

No.	Mounting position	125S/L,UD,G	160L/M/S,UD,G	200L/M/S,UD,G	250L/M/S,UD,G	320L/M/S,UD,U	400L/M/S,UD,G
9	Suction cover	P42 3.5 41.7 48.7	P42 3.5 41.7 48.7	G55 3.1 54.4 60.6	G60 3.1 59.4 65.6	P58 5.7 57.6 69	G95 3.1 94.4 100.6
35	Balance piston sleeve	-	G95 3.1 94.4 100.6	P120 5.7 119.6 131	P150 5.7 149.6 161	G190 5.7 189.3 200.7	G240 5.7 239.3 250.7
49	Seal retainer	G85 3.1 84.4 90.6	G90 3.1 89.4 95.6	G115 3.1 114.4 120.6	G135 3.1 134.4 140.6	G160 5.7 159.3 170.7	-
59	Oil injection pipe	P30 3.5 29.7 36.7	P30 3.5 29.7 36.7	P40 3.5 39.7 46.7	P46 3.5 45.7 52.7	P32 3.5 31.7 38.7	-
63	Unloader cylinder	G95 3.1 94.4 100.6	G125 3.1 124.4 130.6	G150 5.7 149.3 160.7	G190 5.7 189.3 200.7	G240 5.7 239.3 250.7	G300 5.7 299.3 310.7
65	Unloader piston	P75 5.7 74.6 86	P100 5.7 99.6 111	P125 5.7 124.6 136	P155 8.4 154.5 171.3	P200 8.4 219.5 236.3	P265 8.4 264.5 281.3
73	Unloader push rod	P21 2.4 20.8 25.6	P21 2.4 20.8 25.6	G30 3.1 29.4 35.6	G35 3.1 34.4 40.6	P44 3.5 43.7 50.7	G45 3.1 44.4 50.6
75	Unloader caver	G85 3.1 84.4 90.6	G110 3.1 109.4 115.6	G135 3.1 134.4 140.6	G170 5.7 169.3 180.7	G210 5.7 209.3 220.7	G270 5.7 269.3 280.7
86	Oil injection	-	-	-	-	G30 3.1 29.4 35.6	-
89	Guide block	P12 2.4 11.8 16.6	P16 2.4 15.8 20.6	P20 2.4 19.8 24.6	P20 2.4 19.8 24.6	P24 3.5 23.7 30.7	-
150	Thrust bearing gland	-	-	-	-	G220 5.7 219.3 230.7	G290 5.7 289.3 300.7
325	Gland 'O' ring	-	-	-	-	-	P70 5.7 69.6 81
432	Main bearing	-	G85 3.1 84.4 90.6	WG22 3.53 107.5 114.6	G135 3.1 134.4 140.6	G165 5.7 164.3 175.7	G210 5.7 209.3 220.7
433	Side bearing	-	G85 3.1 84.4 90.6	WG22 3.53 107.5 114.6	G135 3.1 134.4 140.6	G165 5.7 164.3 175.7	G210 5.7 209.3 220.7
657	Seal cover	-	-	-	-	-	G135 3.1 134.4 140.6

Standard : JIS B2401
Item marked ☆ are JIS W1516

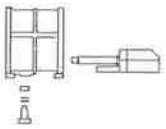
V REASSEMBLY

Before reassembly, confirm which the parts are to be renewed. Reassembly is done in the reverse order of dismantlement. Be sure to clean the working table and tools first. Pats should be washed in washing fluid cleaned and dried by blowing with compressed air if possible. Apply compressor oil just before assembly.

Do not wash the "O" rings in washing fluid as the rubber will deform. It is enough to wipe then with soft clean cloth.

Apply oil to both side of gasket, and paste graphite powder mixed with oil no one side if possible. This makes it easy to remove these parts during subsequent disassembly. Using liquid gasket is also effective.

V-1 Unloader Slide Valve and Guide Block for type 125 to 320



a) Reset the guide block in the casing, replacing and tightening the guide block bolt. Make sure that the block is locked into place with the "D" stamped on it facing you.

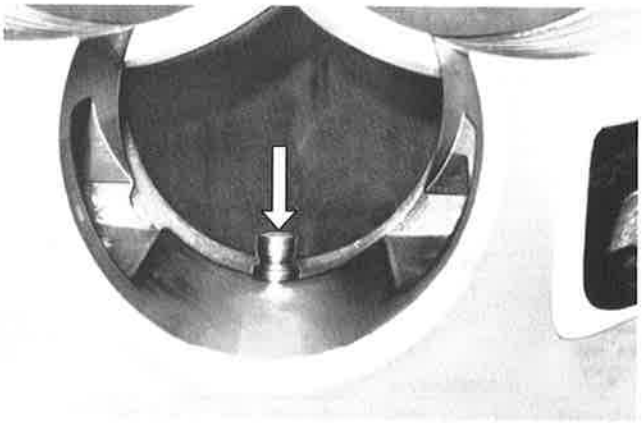


Fig. 80 Guide block stem inside of casing

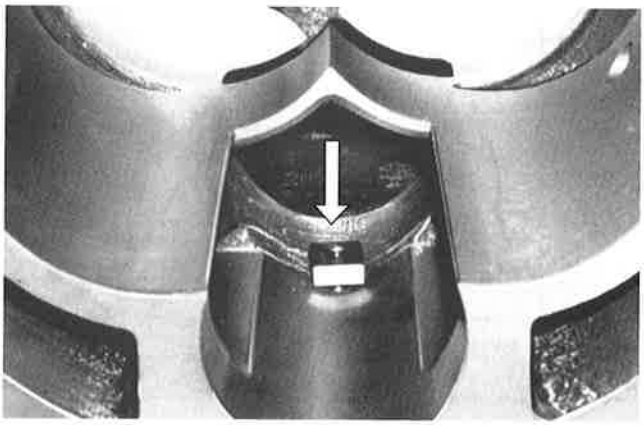


Fig.81 Guide block in the rotor casing

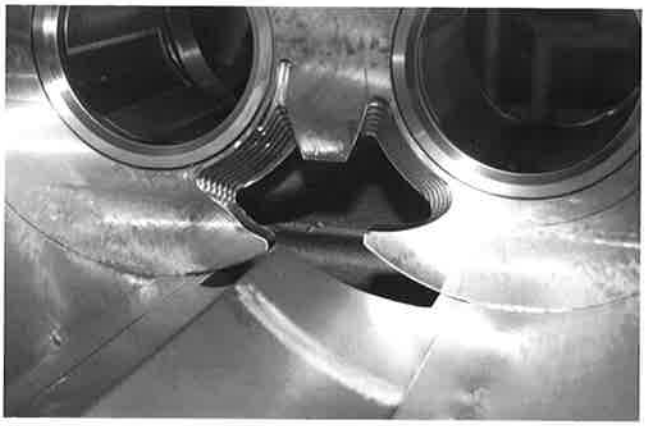


Fig. 82 400UD side valve and bearing head guide

b) Insert the slide valve into the casing making sure that the guide slot in the slide valve passes over the guide block without snagging. After insertion, propel the slide valve back and forth to check overall movement.

c) Confirm positioning C status.
Do not allow the value to twist in the casing' Drawing A: This will occur when the guide block is incorrectly installed.
Drawing (B): check the rotor casing and the slide valve thoroughly. This will occur due to wearing of the casing and/or the upper side of the slide valve after frequent operation. File or grind bottom slide valve to obtain (C).

d) It is important to maintain (C) otherwise undesirable abrasion will occur.

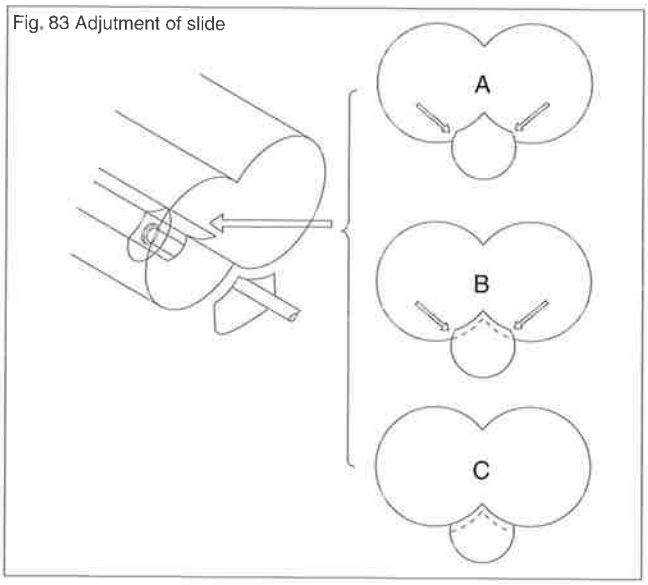


Fig. 83 Adjutment of slide

V-2 Bearing Head and Main Bearing

a) The main bearing is lightly pressed fitted. Place the notch of the main bearing to match with the alignment pin (14) in the bearing head, apply a piece of wood and strike in. If it slips. and cannot be set in the correct position, remove and try again. Use a jig such as on oil pressure jack, if necessary.

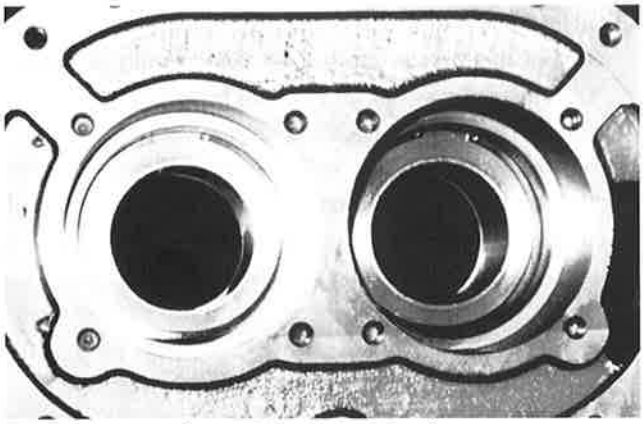


Fig. 84 Appearance of correctly installed main bearing

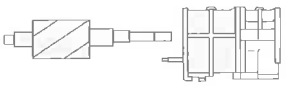
Fig. 85 Notch in bearing

Be sure to fit the "O" ring (433) provided on the outer diameter.

b) The cover gasket should be trimmed on the inside edge. (Important for thrust gap adjustment). Ascertain that it is correctly positioned as it is nonsymmetrical.

c) Before tightening the Allen bolts (2), drive the alignment pin (3) through the flange.

V-3. Rotor



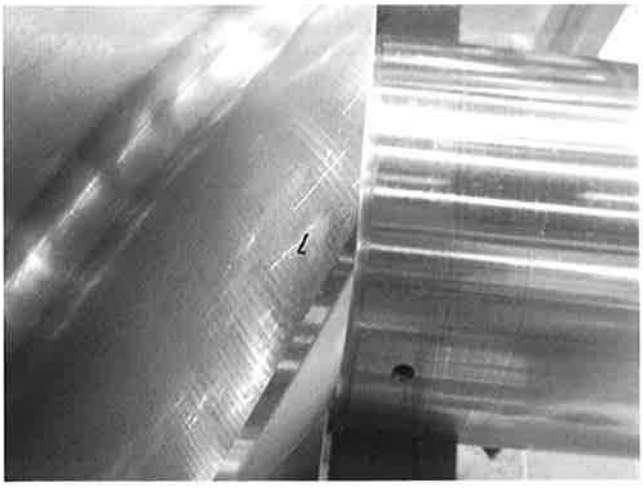


Fig. 86 Set marks of male rotor (400M)

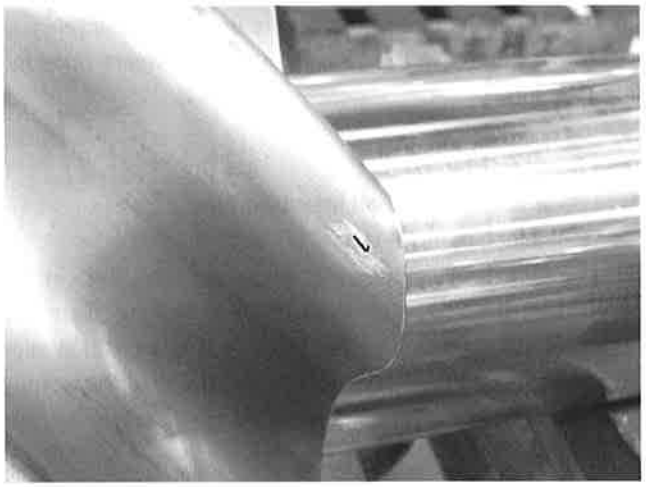


Fig. 87 Setting marks of female Rotor (400M)

a) The lobes of each rotor are numbered. These numbers are stamped on the discharge end of the male rotor and on the suction end of the female rotor.

b) Set the female rotor into the casing and position lobes 1 and 2 towards the male rotor side.

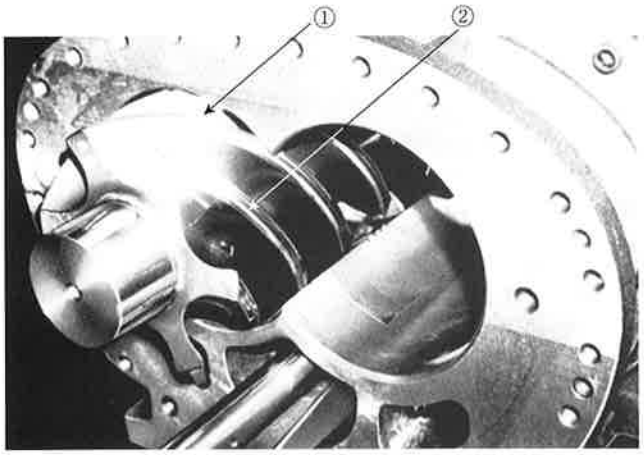


Fig. 88 Setting female rotor (200S)

c) Insert the male rotor so that lobe 1 fits between lobes 1 and 2 of the female rotor. The above procedure is essential for meshing and balancing, so it must be followed exactly.

d) After setting the rotors into the casing, apply compressor oil to the surface of the lobes/

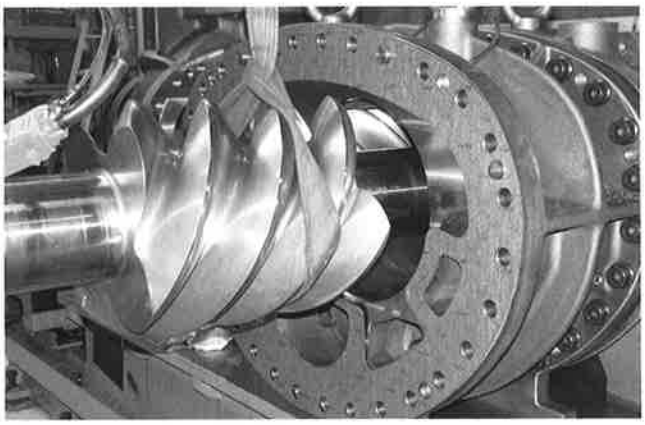
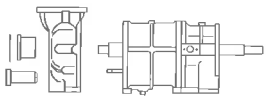


Fig. 89 Setting male rotor (400M)

e) Do not revolve the rotors, as the outer circumference of the rotor touches the casing, and it may wears the edge of the lobes.



V-4 Suction cover,
Side bearing and oil injection pipe
(Oil injection pipe for type 125 to 250)

a) The side bearing is lightly pressed in the hole in the suction cover. Be sure to fit the side bearing alignment pin (8) in the notch of the bearing. If this position slips while pressing in, try again. Confirm that the setting position is in correct, and then fix the bearing with the snap ring.

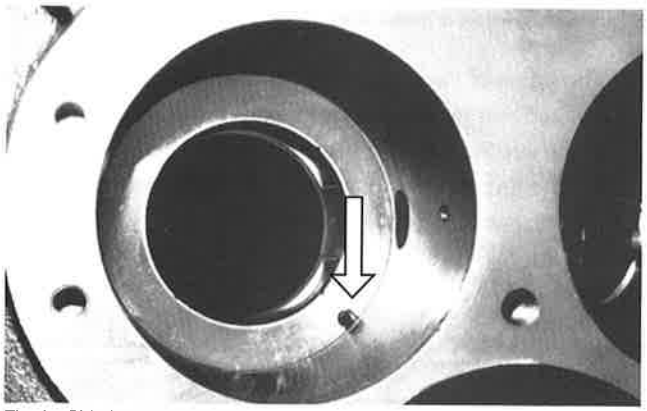


Fig. 90 Side bearing stopper

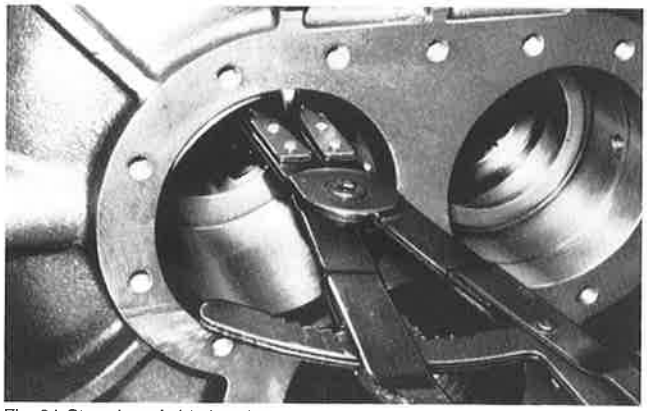


Fig. 91 Stop ring of side bearing

b) Fit the "O" ring spacer (36) and "O" ring (35) after setting the stop ring (37) on the male rotor side of the suction cover.

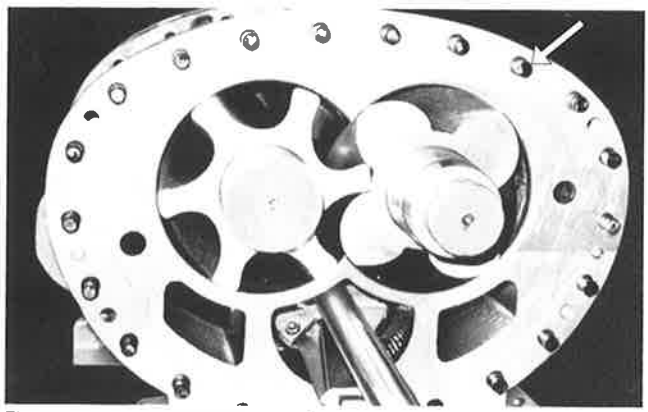


Fig. 92 Setting bolts of suction cover

c) Oil injection pipe and pipe gland are fitted together with a pin. Set this part in the suction cover. Apply oil on the "O" , ring and press in, and fix with bolts.
Notice: The oil hole positions on the when viewed right side from the unloader cylinder side. Orient the "O" mark on the pipe gland on the right side. Apply enough oil on the "O" ring of the injection pipe.

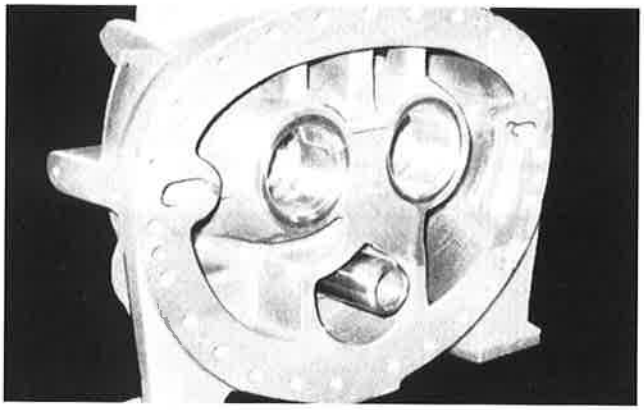


Fig. 93 Inside of suction cover

d) Ascertain that the cover gasket is correctly placed as it is non-symmetrical. Apply sufficient oil to the side bearing.

e) The suction cover is positioned by sliding it onto the rotor shaft; first, position the unloader slide valve at the full load position. Set the slide valve push rod end into the oil injection pipe of the suction cover and fit the push rod into the injection pipe. Take care not to damage the "O" ring of the injection pipe by the push rod.

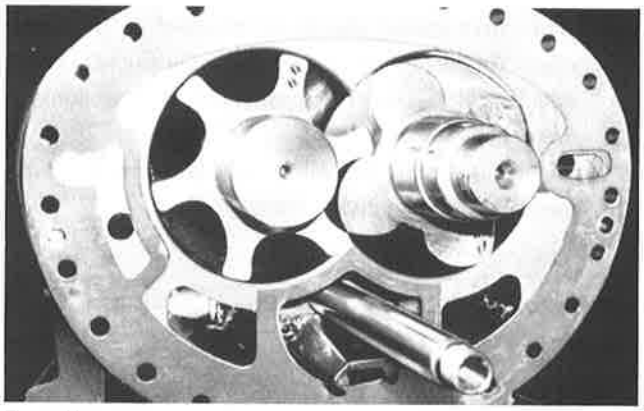


Fig. 94 Unsymmetrice gasket of suction cover

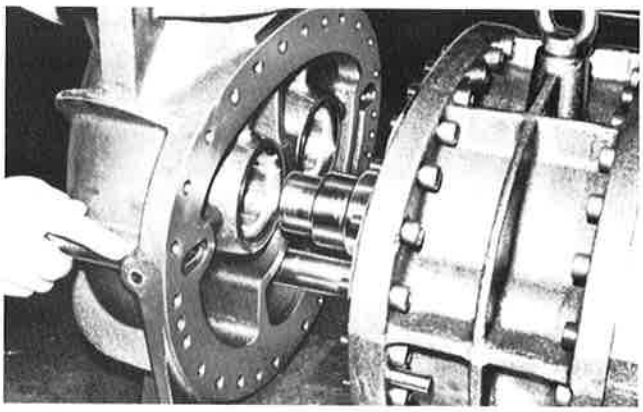


Fig. 95 Setting of suction cover (125-320)

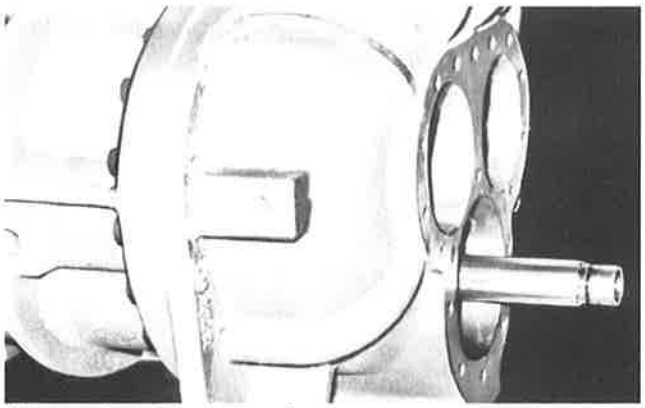
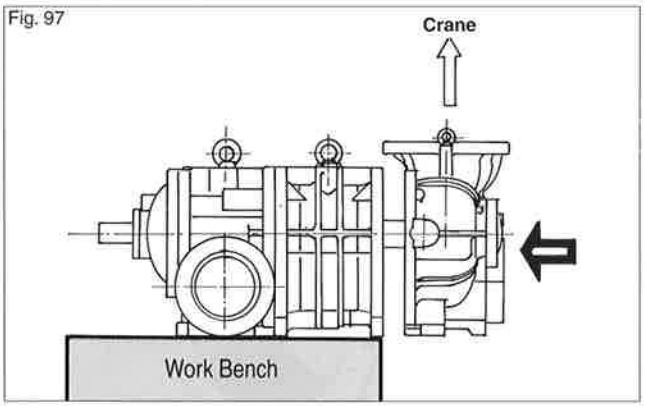


Fig. 96 Setting of unloader push pipe

f) When setting the bearing part of the rotor into the side bearing, care should be taken not to damage the white metal is inside the side bearing, with the end of the rotor shaft.

g) When the top of the shaft aligns with the bearing, slide in parallel to the rotor shaft and set



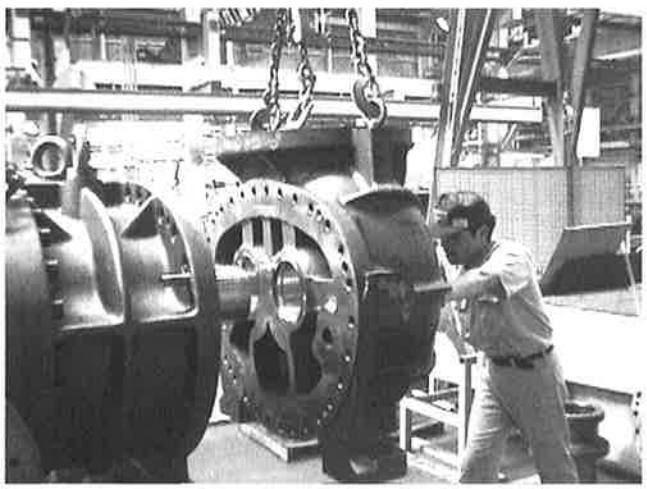
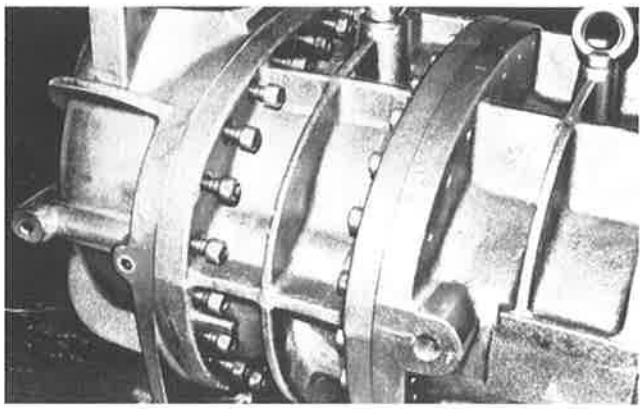


Fig. 98 (400UD).Setting of suction cover

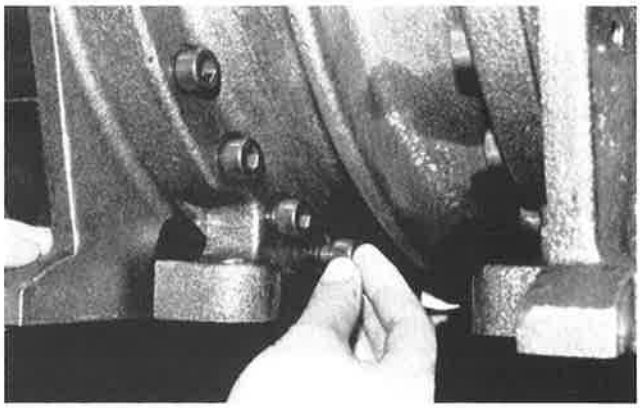


Figs. 99 Completion of suction cover setting

h) Before tightening the Allen bolts, drive the alignment pin back through the casing flange. The lower 6-8 pieces of bolt must be fastened after the compressor is lifted. (125-250)

Precautions when tightening rotor casing bolts
Model 250 and Larger Screw Compressors

The lower portion of the rotor casing of Model 250 and larger screw compressors is secured to the bearing head and suction cover with bolts. Do not tighten these bolts while the casing is suspended. Tighten only after the feet of the suction cover and the bearing head are firmly down on the workbench or table. The best method is to position two tables of equal height at a proper distance under the casing. Unless the casing is properly setted, there is a risk of it dropping during the tightening work.



Fg. 100 Fastening of bolts lower part of rotor casing

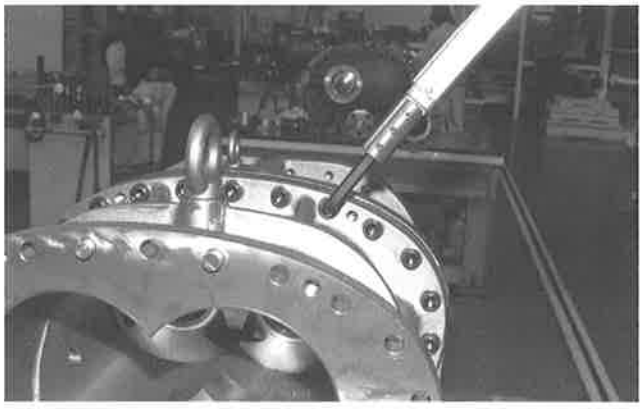
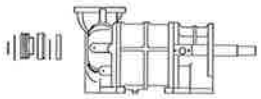


Fig. 101 Fastening of bolts before lower part

Fig. 102 Fastening of bolts by hydraulic wrench (320-400UD)

i) Confirm the mating of the rotors by turning the male rotor by hand.



V-5 Balance Piston

a) Set the balance piston sleeve(33). The beveled end of the sleeve is "O" the ring side and the side with the notch faces out word. The position of the notch must match with the set screw.

b) Set the snap ring (37) while holding the balance piston sleeve.

c) Screw out the set screw out until the head protrudes from the hole. Lock with other screw from female rotor side.

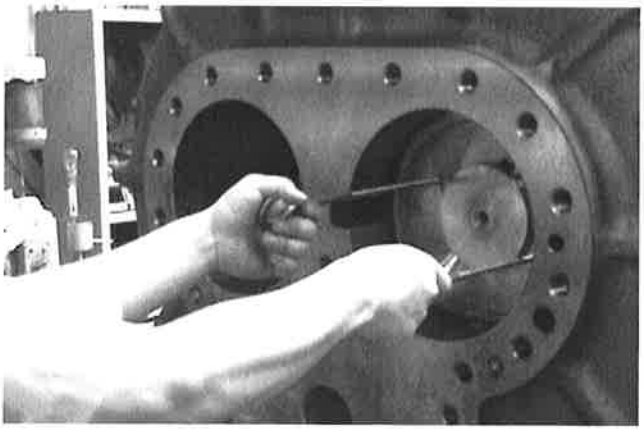


Fig.103-1 Balance piston set

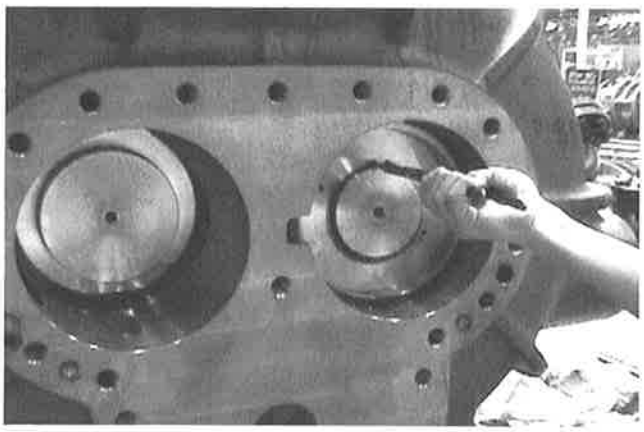


Fig. 103-2 Set the snap ring of the balance piston (400VMD)

d) Screw an eye-bolt into the balance piston, put the key into the keyway and push in.

e) Set the balance piston snap ring (32).

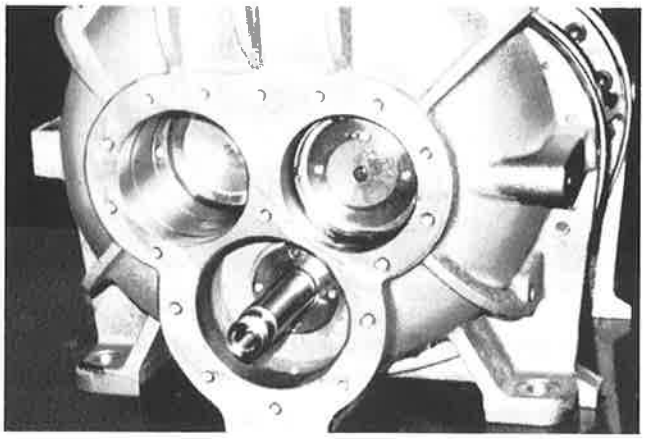


Fig.103-3 Balance piston installed

V-6 Balance Piston Cover

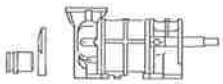
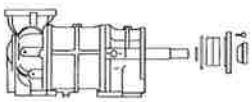


Fig.104 Balance piston cover and unloader cylinder

During reassembly, it is recommended that the balance piston cover and unloader cylinder be connected before hand, and then the unit (with piston) be attached to the suction cover. This will facilitate the alignment of the push rod and piston. Do not forget to position the 'O'ring (63). (refer to instructions on the unloader piston and unloader cylinder). This part is only a cover so it will never be damaged.



V-7 Thrust Bearing

a) Position the bearing spacers (41) and washers (42), making sure that they are on the appropriate male and female sides. This is extremely important for the clearance at the discharge end of the rotors. Refer to Fig 106.

b) Keep the space between the washers and bearing spacers clean. If there is any residue or dust present, it will affect end-clearance.

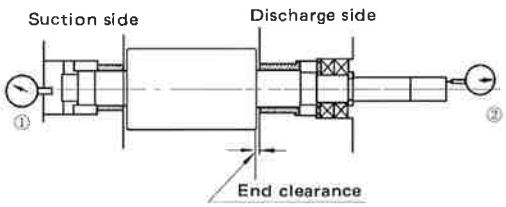
c) The thrust bearing should be positioned so that the apex of the 'V' (ref.FIG.105) inscribed on the bearing is on the rotor side.

d) Next fit the lock washers (40), fasten the locknuts (39) and fix the inner ring the thrust bearing on the shaft. In this case, it is better to renew the lock washer so the same claw in not bent again.

Do not fasten the bearing nut tightly, it will affect the end-clearance of the rotor. Fasten the nut confirming maintenance end-clearance.

Fig.105 "V" mark of thrust bearing setting

Fig.106 Adjustment of thrust bearing



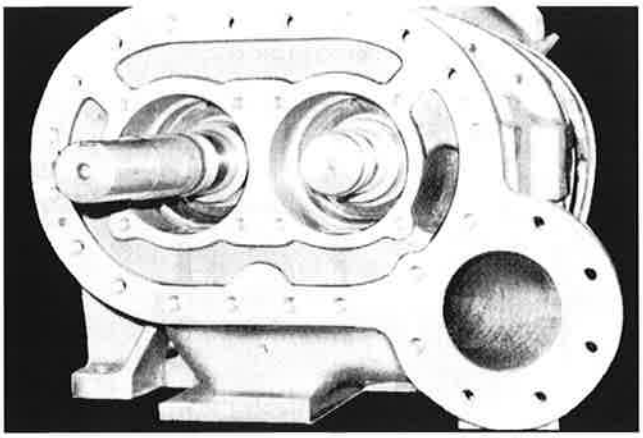


Fig.107 Thrust bearing space

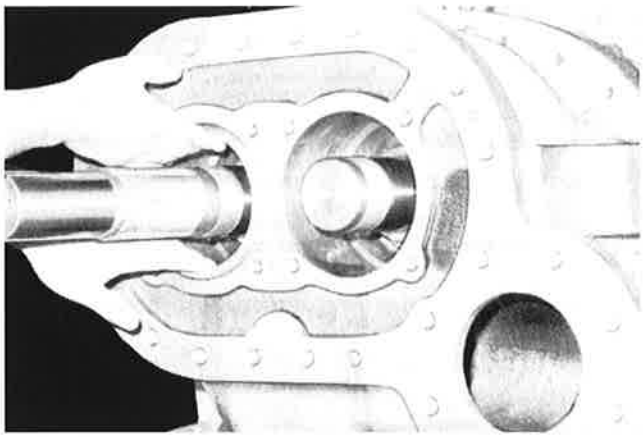


Fig.108 Setting thrust bearing spacer

e) At this point measure and confirm the end-clearance of the rotors. The tolerances must be kept in the following ranges. We recommend the following method to measure end-clearance:

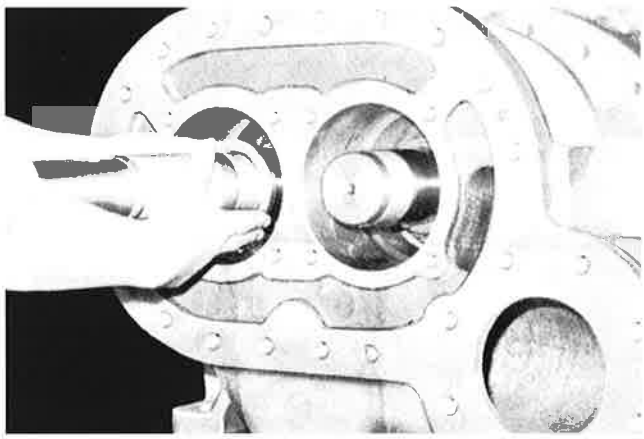


Fig.109 Setting bearing adjusting washer (125~320)

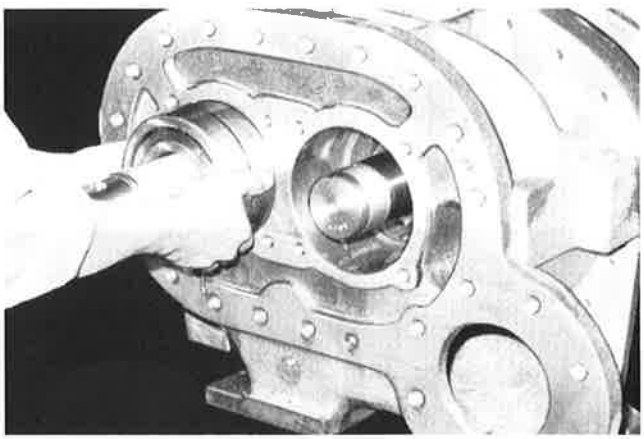


Fig.110 Setting bearing

End clearance

Model	S	M	L	LL	S-B	M-B	L-B	LL-B
125	0.03-0.05	0.03-0.05	0.03-0.05					
160	0.04-0.06	0.04-0.06	0.04-0.06		0.20-0.22	0.22-0.24	0.24-0.26	
200	0.05-0.07	0.05-0.07	0.05-0.07		0.26-0.30	0.28-0.32	0.31-0.35	
250	0.08-0.11	0.08-0.11	0.08-0.11	0.08-0.11	0.40-0.44	0.45-0.49	0.50-0.54	
320	0.17-0.21	0.20-0.24	0.23-0.27	0.26-0.30	0.70-0.76	0.73-0.79	0.77-0.83	0.81-0.87
400	0.24-0.30	0.24-0.30	0.24-0.30	0.24-0.30	0.70-0.80	0.75-0.85	0.80-0.90	0.85-0.95

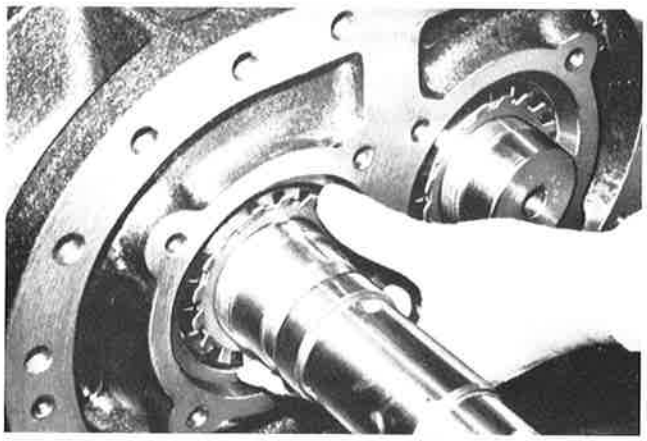


Fig. 111 Setting bearing washer

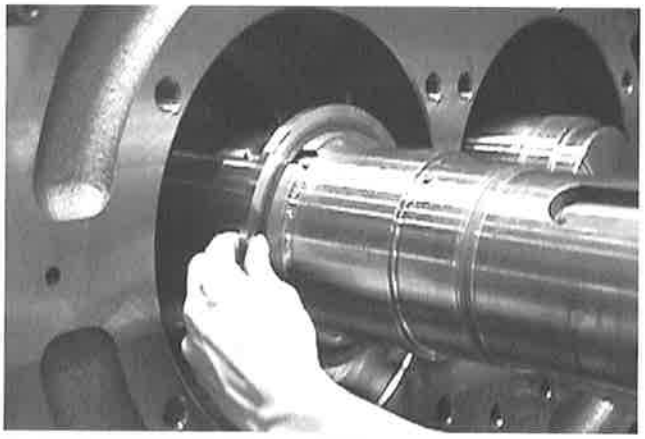


Fig. 114 (400) Setting bearing adjusting washer

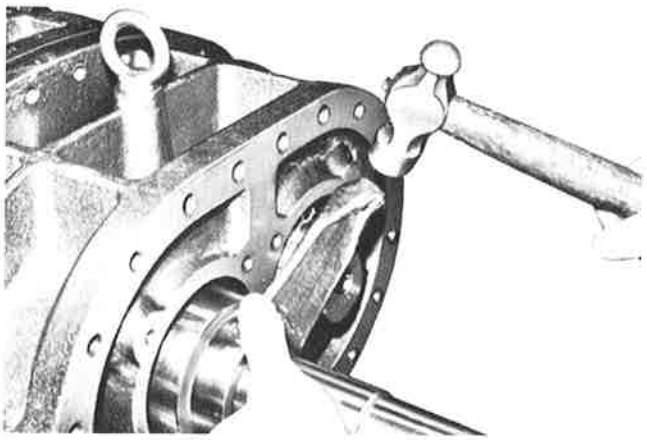


Fig. 112 Fasten locknut

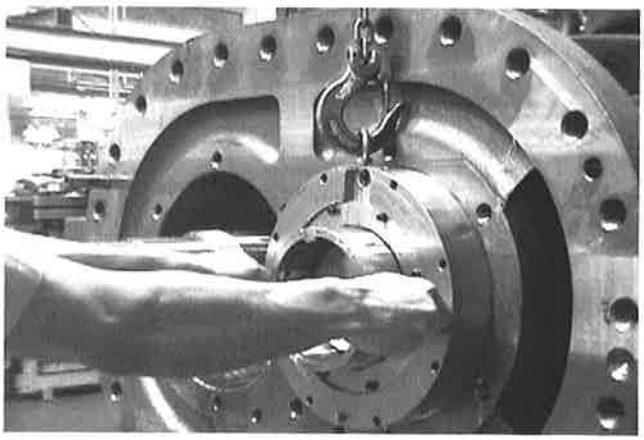


Fig. 115 (400) Setting bearing

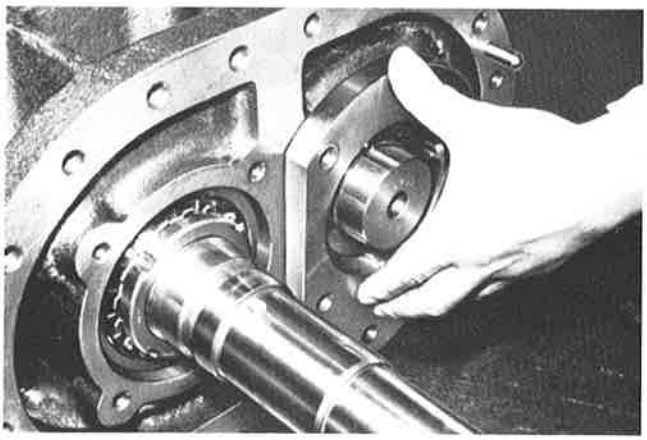


Fig. 113 Setting thrust bearing gland

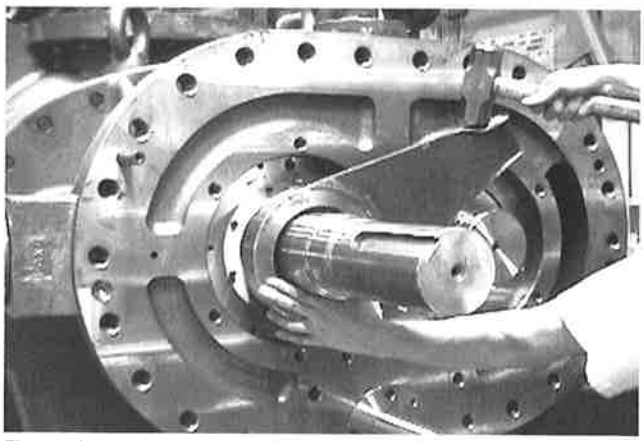
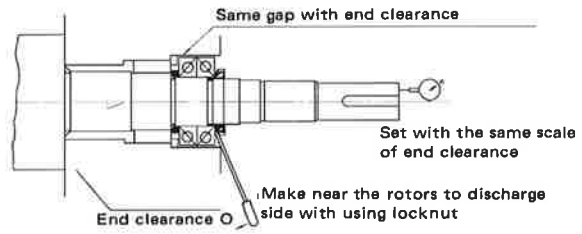


Fig. 116 (400) Fastening locknut
(Photo used 400VD type compressor.)

* For model 400UD the insert thrust bearing key in the shaft key way. Now Install the lock washer and lock nut and tighten the lock nut using lock nut wrench.

f) Under the condition of fixing the inner race of thrust bearing on the shaft, then push the rotor to the discharge side. It is one way that draw the bearing part of lock nut with using a driver (Refer fig. 117).
Position a set gauge on the suction end of the shaft and set the needle at zero.

Fig. 117 Adjustment of thrust (I)



g) The same methods should be used for setting the end clearance of the female rotor. Please note however that in order to position the female rotor at the discharge side a screw driver must be used to shoving the rotor forward as shown in Fig 117.

h) Install the thrust bearing gland and gland bolts. Tighten up the bolts to the torque value given in the table below.

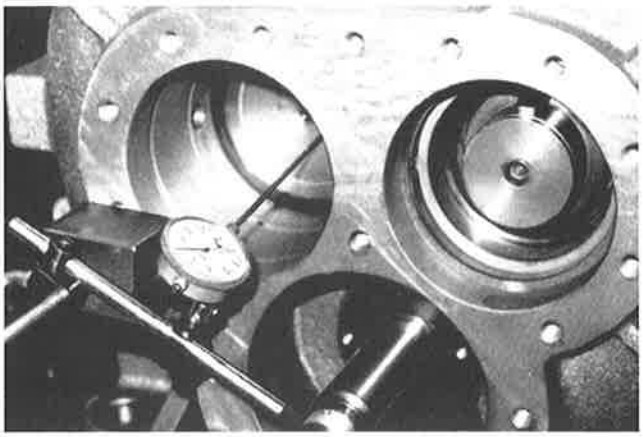
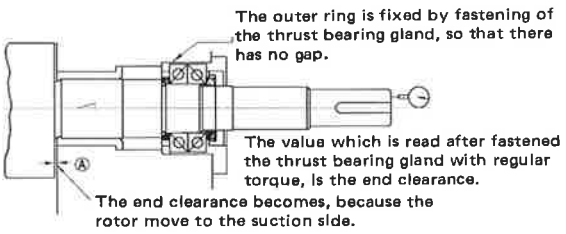


Fig. 118 Adjusting of thrust end-clearance

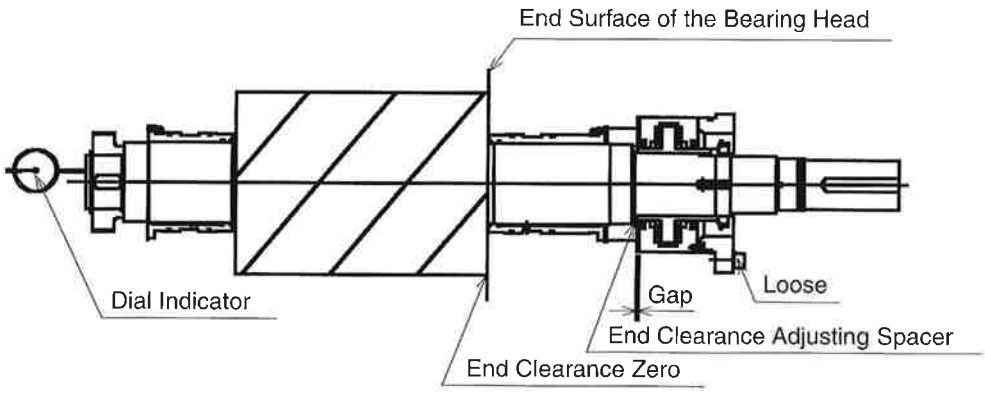
Fig. 119 Adjustment of thrust (II)



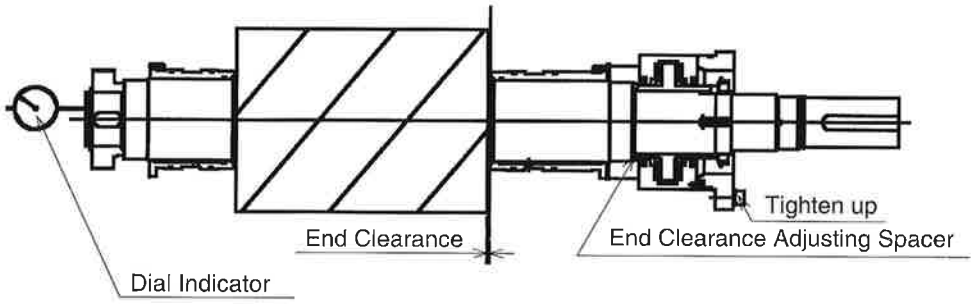
Gland bolt torque values

Model	N . m	Kg . cm	Ft . lb
125	30	300	21.70
160	40	400	28.93
200	50	500	36.17
250	60	600	43.40
320	120	1200	86.78
400	90	900	65.10

Fig. 120



a) End Clearance Zero Condition



b) Completion of the Clearance

i) Correction of out-ranged end-clearance

(1) If end-clearance is grater than the designated value, i.e. the measured clearance of the end of the rotor from the discharge side of the bearing head is too big when the thrust bearing is fastened by the locknut, it must be shortened.

First method:

If (A) is too large, the thrust bearing spacer must be ground to obtain equality of the measured result and the designated value.

For this, a high precision surface grinder must be used to obtain accurate parallel.

The thickness must be measured using a micrometer.

This adjustment is most common and should be used for all models.

Second method:

Insert a shim of proper thickness between the bearing spacer (41) and the outer ring of the bearing. The thickness of the shim is determined by the measured result and the designated value. Do not use brass or copper shims when the refrigerant is ammonia because these materials are easily corroded.

(2) If end clearance is smaller than the designated value, i.e. the rotors will not turn after gland bolts are secure, This is because the washer (42) is not thick enough or the spacer is too thick. To adjust, insert a shim of appropriate thickness between the washer (42) and inner race of the thrust bearing or renew the washer.

If the bearing spacer (41) is too thick, it must be ground.

After adjusting by the above, measure several times and confirm best suitable end-clearance.

j) Turn the male rotor shaft by hand to confirm smooth rotation.

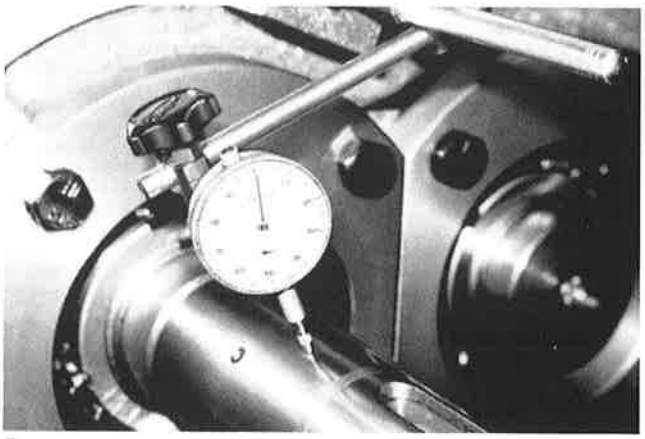


Fig. 121 Measuring axial deflection

k) Next check the radial deflection at the indicated point on the male rotor using a dial indicator. A maximum deflection of 0.03mm (0.05mm for type 400) is acceptable. Deflection may be caused by no uniformity of the washer or spacer surface and it may necessary to check the "V" mark setting again.

Even if end-clearance meets the designated value,

disassembly and adjustment of the bearing spacer (41), is vital to ensure long life and good performance. If dust is present between the parts, the deflection value will increase.

l) After completion of adjustment, finish fastening the thrust bearing.

Notice: (125-320)

(1) Use a new lock washer

(2) Set the torsional slip washer between the lock nut and the lock washer.

(3) Care should be taken not to break the claws of the lock washers.

m) After confirming fastening, finally bending the claws of the loch washer for fastening nut and for bearing gland.

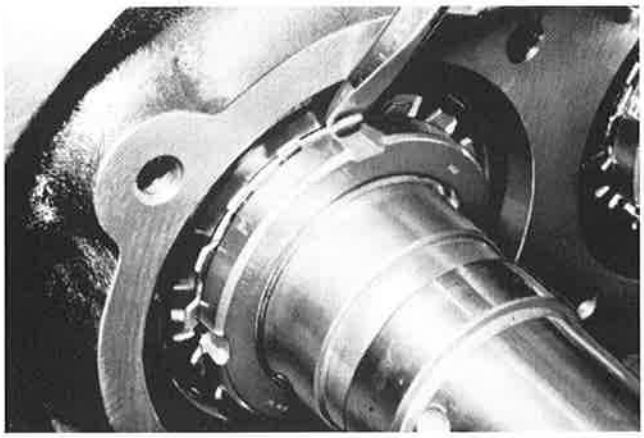


Fig. 122 Bending the claw of washer

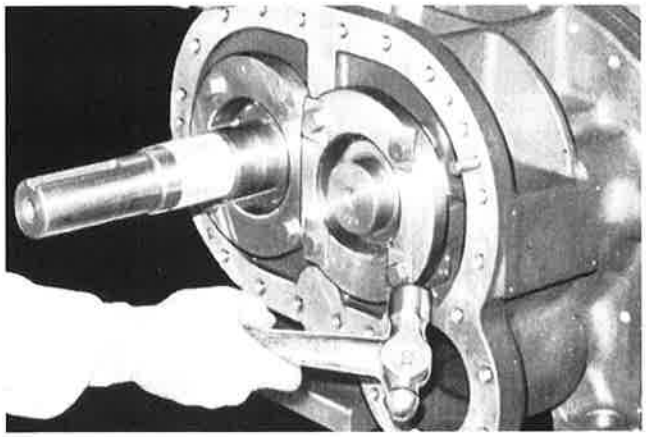


Fig. 123 Bending of out side of claw washer

n) (400UD) The inner race of tilting pad is furnished with a locking key. After inserting the Tilting Pad assembly, fit the key in the key glove if the inner race, then align the bottom stepped side of the key with the Tilting Pad.

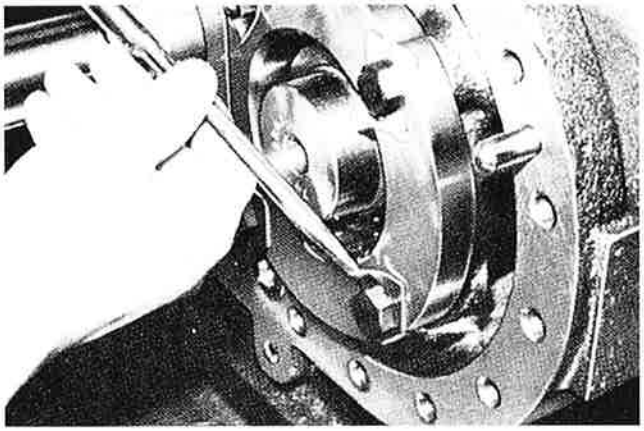


Fig. 124 Bending inside of locknut

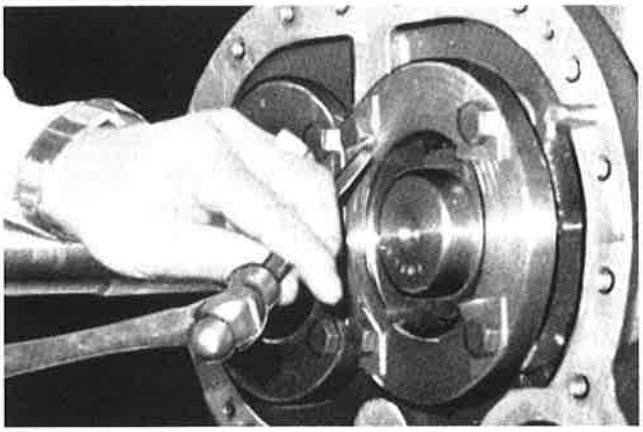


Fig. 125 Bend the claw firmly

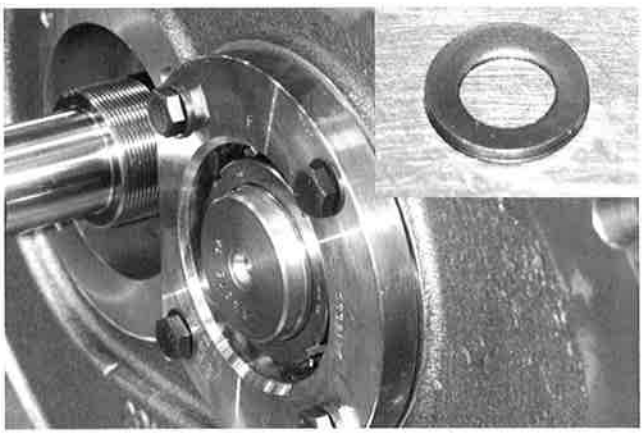


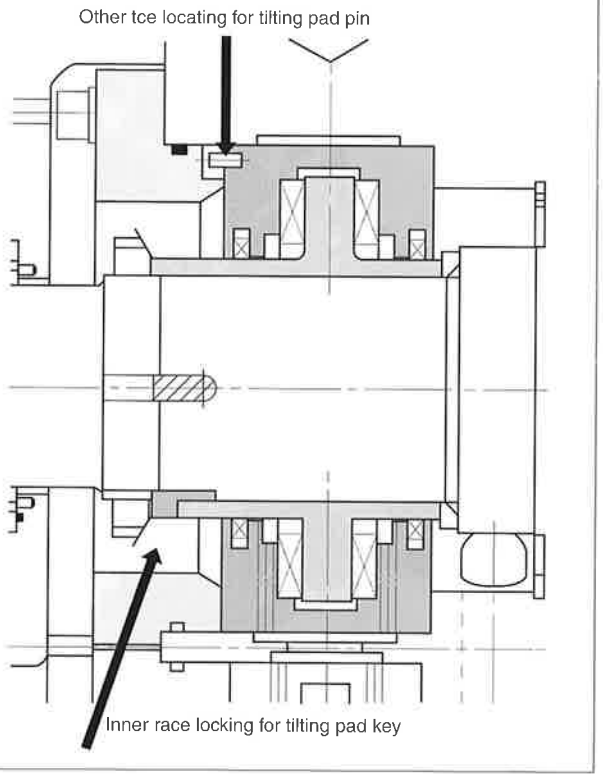
Fig. 126 Employ spring washer

0) After the locking key is mounted on the shaft , fit the lock washer and lock nut, then secure the Tilting Pad inner race to the shaft using the locking key.

p) The outer race of the Tilting Pad is also fitted with a locking pin which face toward the Thrust Bearing Gland is notched to fit with the locking pin. Assemble the Tilting Pad while confirming that the notch of outer race aligns with the locking pin.

q) Fit the spring washers and tighten the Allen Bolts of the Thrust Bearing Gland to the specified torque. Sectional drawing of Tilting pad thrust bearing Outer race locating for tilting pad pin

Fig. 127



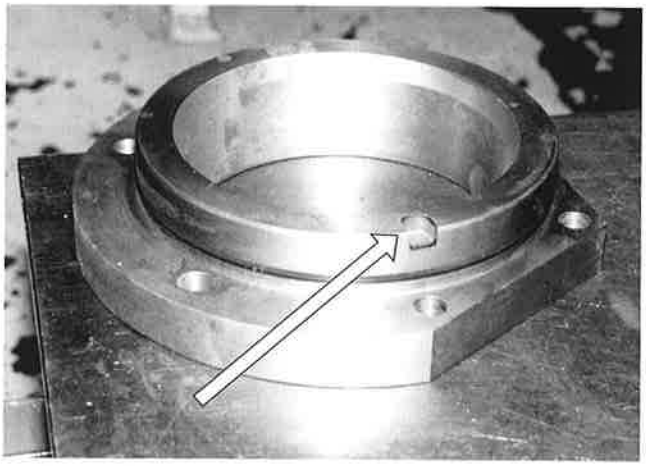


Fig.128 Thrust bearing gland is notched fit with the locking pin

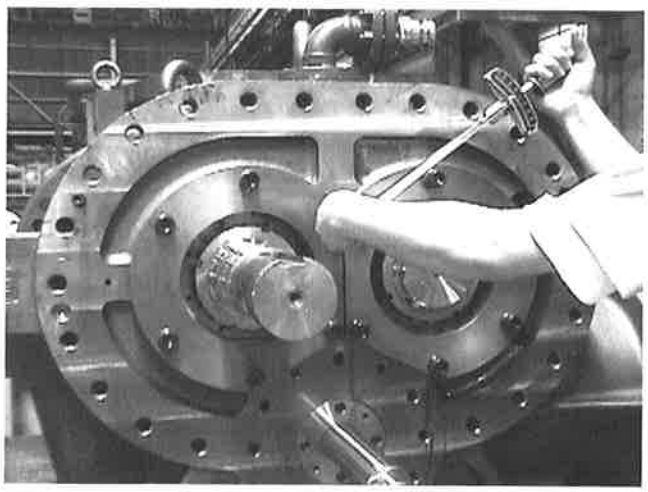
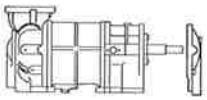


Fig.129 Tighten thrust bearing glands Allen screws



V-8.Bearing cover

Care should be taken not to damage the shaft during reassembly

a) Put a gasket on the bearing head. Put the bearing cover on the body using the alignment pin (19), and fasten two Allen bolts (18) at relative positions. After confirmed all contacting surface touch completely, fasten the remaining bolts.

b) Do not forget to install the oil drain plug at the bottom.

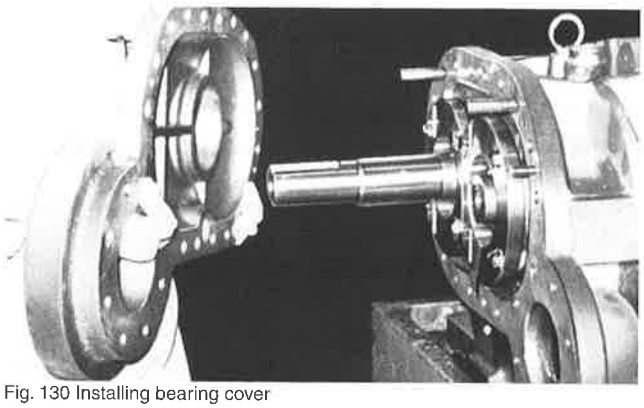


Fig. 130 Installing bearing cover

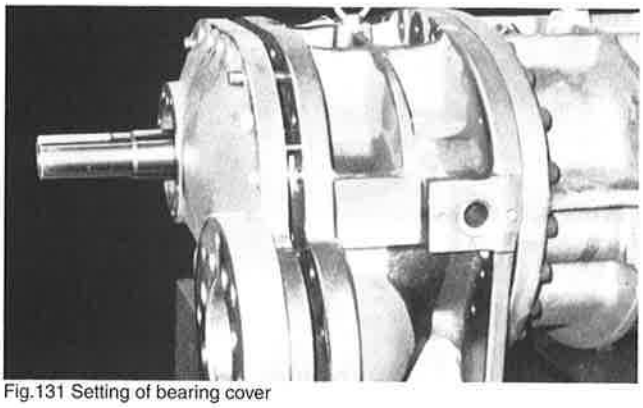


Fig.131 Setting of bearing cover

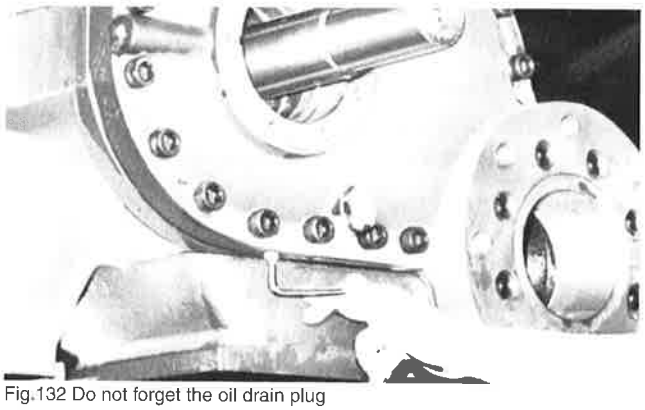
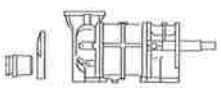


Fig.132 Do not forget the oil drain plug



V-9 Unloader Piston and Unloader Cylinder

a) Care should be taken when mounting the seal cap of the unloader piston and mating the cap seal when fitting the piston into the unloader cylinder. Set the "O" ring and cap on the unloader piston and push the piston into the unloader cylinder from the beveled side. The unloader cylinder and blind cover must be set together before the above work is done (Ref. V-6)

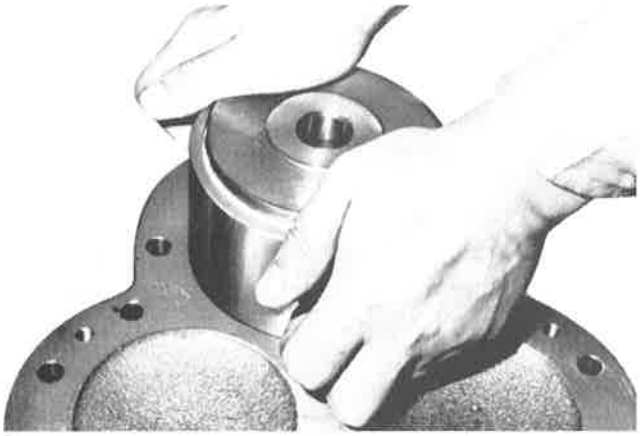


Fig. 133 Pushing piston into unloader cylinder

b) Confirm that the cap seal is in the normal position. Push the unloader push rod into the dead end and put the unloader piston to this side, then set the unloader cylinder and blind cover on the suction cover.

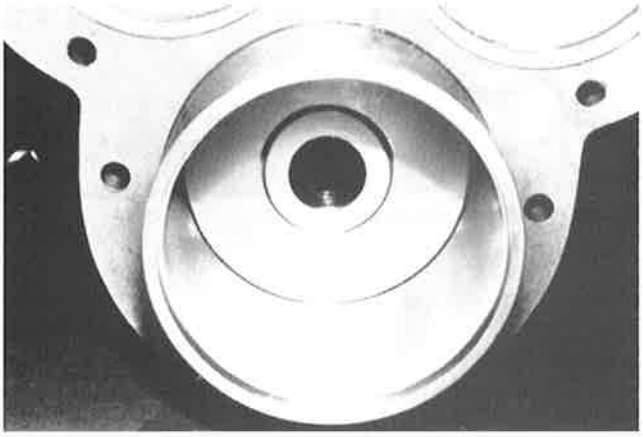


Fig. 134 View of suction cover where unloader cylinder, blind cover, unloader piston are fitted

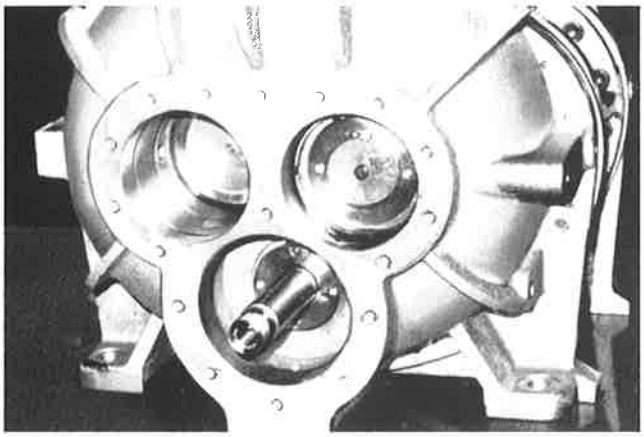


Fig. 135 Positioning unloader push rod on the suction covers side

c) Push the piston onto the push rod and attach the nut temporarily. Draw the piston forward and remove the nut.

d) Attach the lock washer and finally secure the nut.

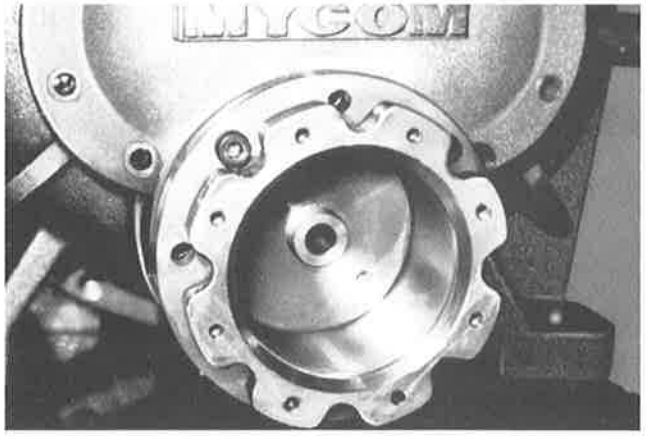


Fig. 136 Fitting of piston and push rod

e) Remove the eye-bolt on the bearing side and replace the plug (85).

f) Confirm normal operation of the piston and slide valve but screwing two eye-bolts into the unloader piston and reciprocating manually.

g) Place the unloader piston on the unload side. This is necessary for the following assembly and adjustment of the unloader cover and indicator.

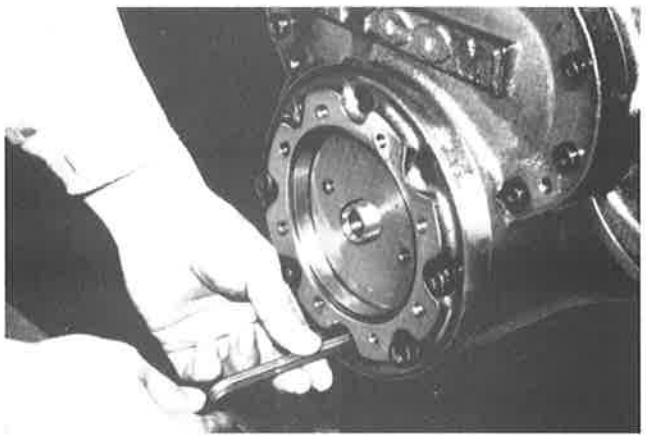


Fig. 137 Fasten cylinder and blind cover

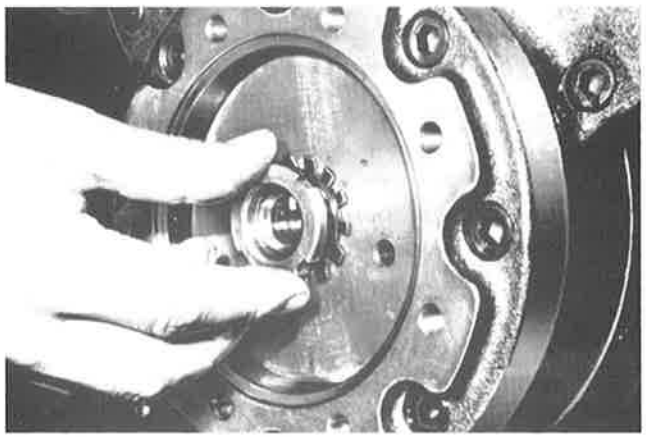


Fig.138 Fitting washer and retaining nut

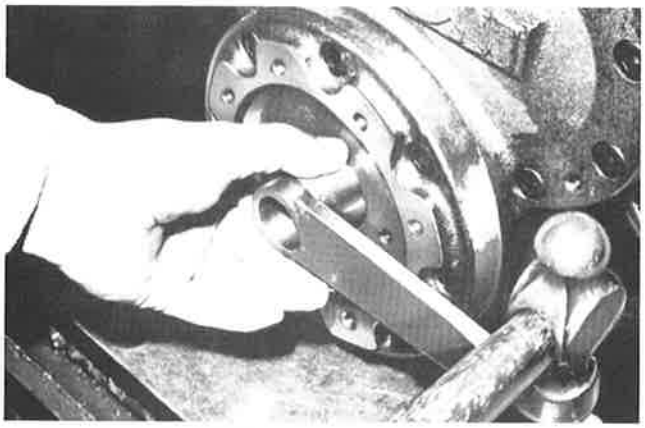


Fig. 139 Fasten the nut tightly

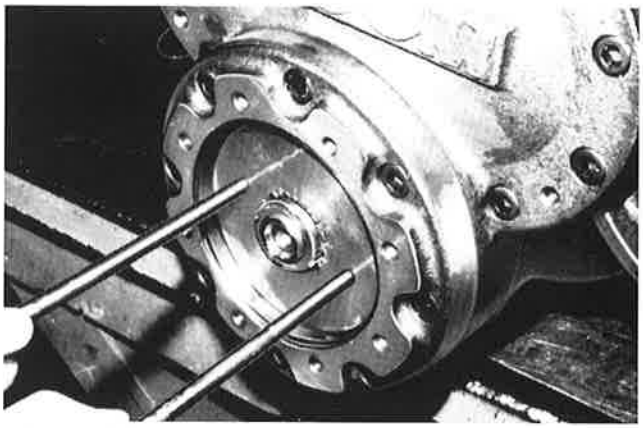


Fig. 141 Confirm operation with eye-bolts

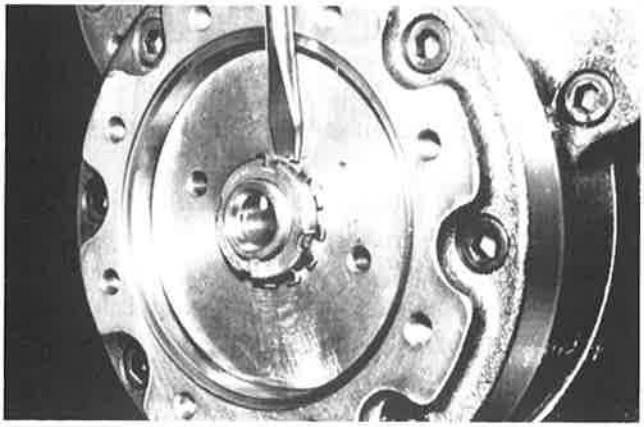


Fig. 140 Bending the claw washer

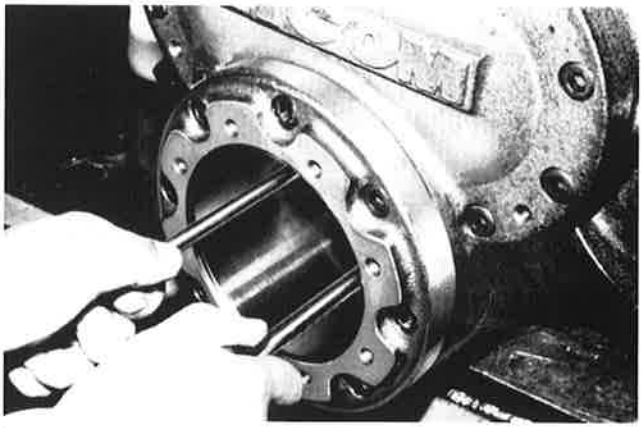
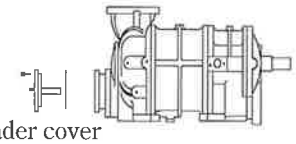


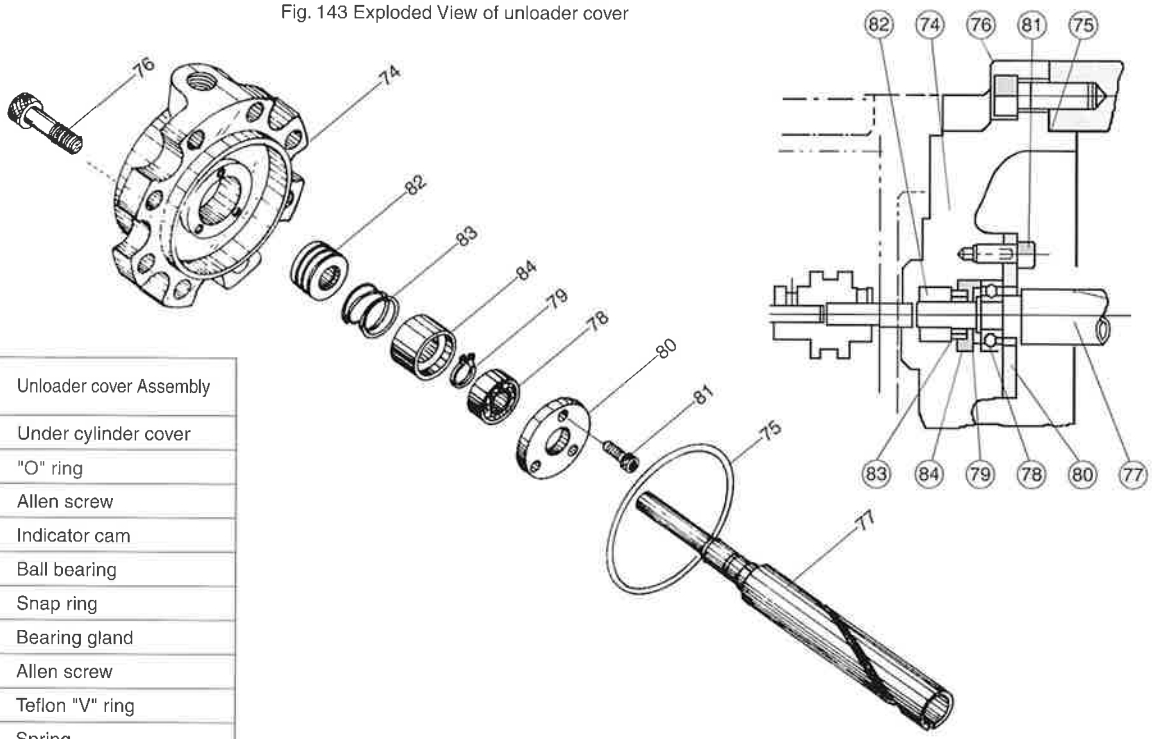
Fig. 142 Full unloader position (push to the end)



V-10 Unloader cover

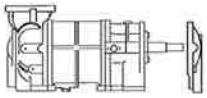
Refer to Fig.143 for assembly of the unloader cover

Fig. 143 Exploded View of unloader cover



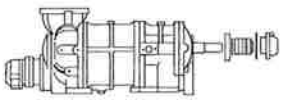
Index No.	Unloader cover Assembly
74	Under cylinder cover
75	"O" ring
76	Allen screw
77	Indicator cam
78	Ball bearing
79	Snap ring
80	Bearing gland
81	Allen screw
82	Teflon "V" ring
83	Spring
84	Spring retainer

a) Fit the bearing on the cylinder cam shaft. Push on the inner race to push in, otherwise the bearing may be damaged. Push in until the step of the cylinder cam, and fix with the stop ring.
b) Apply light oil and fit the "V" ring on the cover side.
c) Set the spring and spring retainer, put "V" ring on the cylinder cam shaft and fasten the bearing with the bearing gland.
d) Confirm smooth turning of the cylinder cam. Fettle "O" ring (75) on the unloader cover.
e) Push the unloader slide valve to the full unloaded position, and mate the groove of the cylinder cam and the push rod pin. Push in the cover and secure. The oil pressure distribution port for action of the unloader piston must be on top.



V-11 Bearing Cover

Screw a long stud bolt into the bearing head and fit the gasket and the bearing cover, taking care not to damage the shaft seal portion. Align the parallel pin (3) and push the bearing cover onto the bearing head, being careful to maintain even alignment.
Screw two bolts in at diagonal positions to assure the bearing cover is parallel. Secure the remaining bolts after the full face of the bearing cover contacts the bearing head.



V-12 Mechanical Shaft Seal

Fig. 144 Exploded view of shaft seal (125-320)

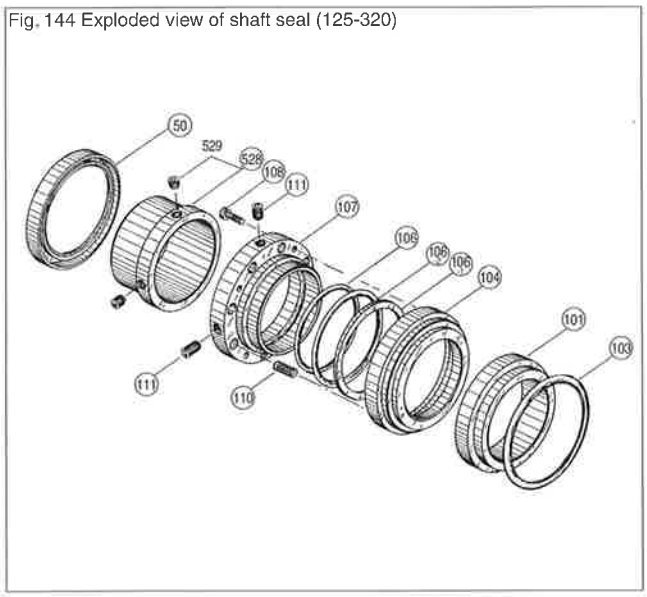


Fig. 145-1 Cross sectional view of component (After May 2003)

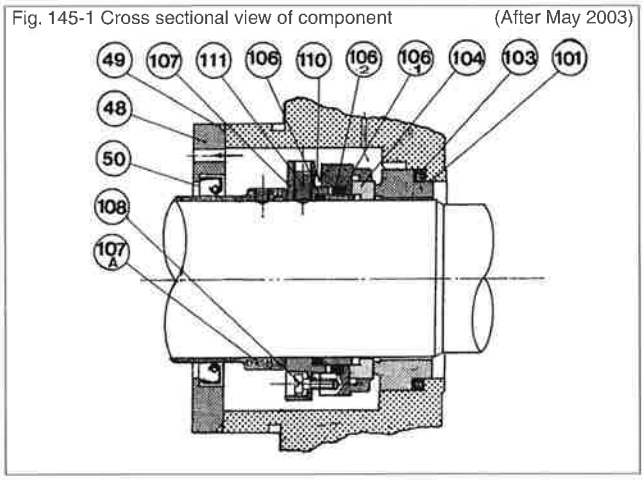
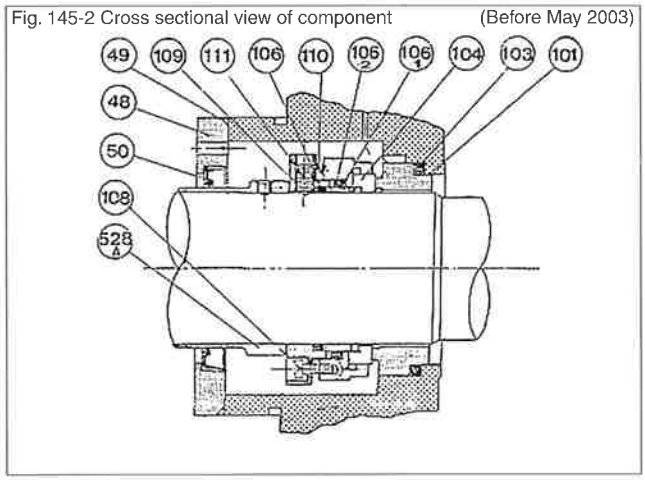


Fig. 145-2 Cross sectional view of component (Before May 2003)



Parts of mechanical seal

48	Seal retainer	106	"O" ring
49	"O" ring	108	Drive pin
50	Oil seal	109	Shaft seal collar
101	Carbon insert	110	Spring
103	"O" ring	111	Set screw
104	Seal ring	528	Sleeve, oil seal
112	"O" ring	529	Socket detent screw
106-1	Back-up ring		
106-2	"O" ring		

a) Clean the contact surface of the shaft seal thoroughly before assembling.
b) Carefully inspect the seal contact surface on the stepped portion of the shaft for flaws and scratches before assembling.
c) When mounting the seal retainer (48), confirm that it is positioned in the correct direction.
Position the seal retainer so that the oil induction hole is located above the shaft. Be sure that the seal retainer detent screw (529) and the notch in the retainer are correctly mated and turn the seal retainer to the left and right using an eye-bolt to confirm that it is securely fixed.

d) Next, insert the seal cover "O" ring (49). Note that this part is sometimes forgotten during assembly.

e) Fit the oil seal sleeve (528) and secure the two set screws(529).

f) Mount the shaft seal assembly (100).
Push the"O"ring(49)in carefully so that it is not damaged. Two screws are provided for the seal collar (109). Secure the screws (111) making sure that they mate with the countersunk holes in the shaft. After mounting, push on the seal ring (104) manually to confirm axial movement.

Fig. 146-1 Seal retainer & oil seal

Fig. 146-2 Seal retainer oil seal and sleeve (2003 May~)

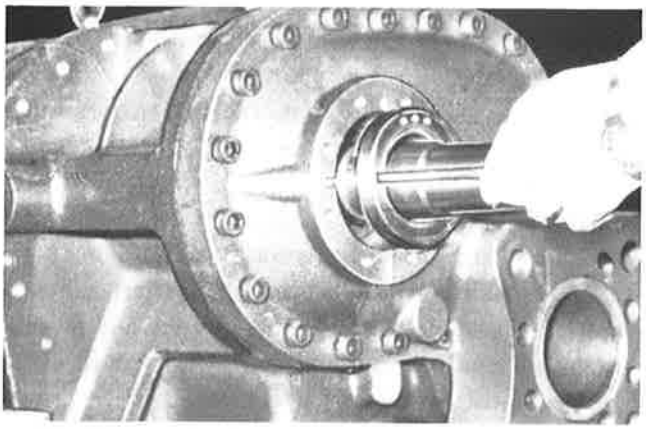


Fig. 147 Fitting seal retainer

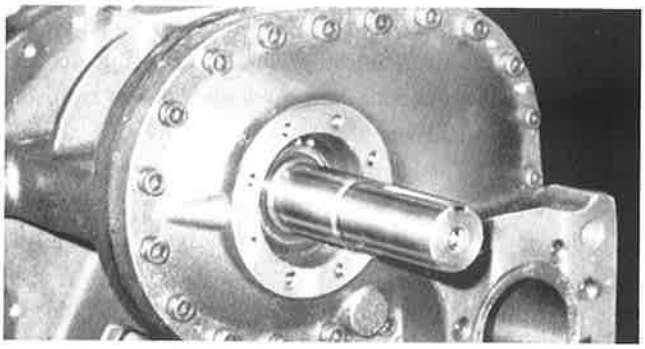


Fig. 148 Setting completed

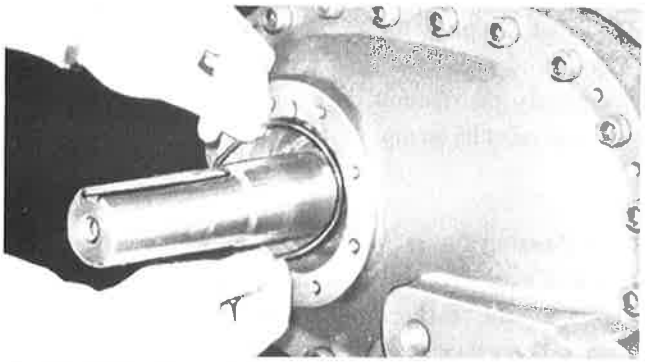


Fig. 149 Positioning "O" ring of seal cover

g) Fit the "O" ring (103) for the carbon and the carbon insert (101) in the seal cover (50).

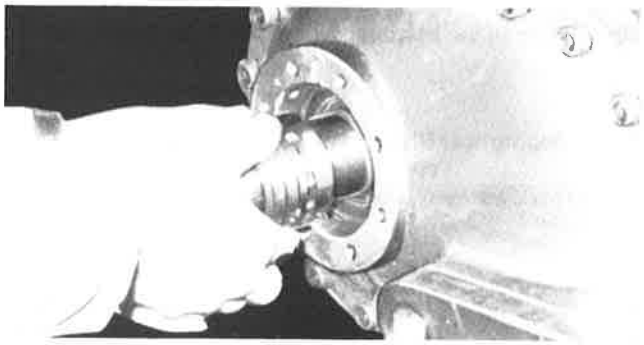


Fig. 150 Fitting seal assembly

Fig. 151 Mounting carbons insert

Fit the gasket (52) on the seal cover (50) and position it correctly to match the oil holes in the bearing cover and, then fit the seal cover by sliding it onto the shaft. When fastening the seal cover, the carbon should first contact the seal ring (104).Hold the seal cover securely against the bearing cover and secure it first with two diagonally positioned bolts (53), then mount and tighten all of the other bolts (53)

h) The bearing covers of types 160SUD and160LUD have holes through which shaft seal collar screws can be tightened. These holes must be plugged after fixing the seal cover.

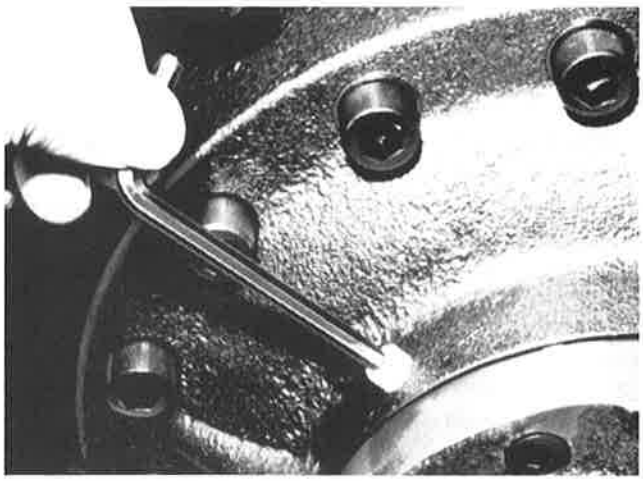


Fig. 152 Blind plug of bearing cover 160UD

V-12' Mechanical Shaft Seal (400UD)

Many seal failures can be caused by installation errors. Careful installation is a major factor in the life of the seal. The installation procedure is shown as follows.

1. Wipe the rotary side retainer cleanly, so that it is free from adhesion, stains and dust, dirt, then apply the lubricant to point S.

2. Assemble the rotary seat with the retainer making sure the pin hole of the rotary seat is aligned with the pin position of the retainer, and, mark the match mark on the end of the seal end outside diameter and on the retainer, using a marking pen.

3. Apply the lubricant to the inside diameter side "O" ring, and fit the "O" ring in the rotary side retainer groove.

4. Wipe the rotary seat clean, so that it is free of foreign matter such as dust or dirt and apply lubricant to point S.

5. Apply the lubricant to the "O" ring, fit it on the out side diameter of the rotary seat, and push the rotary seat evenly into the retainer with the match mark aligned with that of retainer.
   Fit the rotary seat to the atmospheric side and inside the equipment in the similar way.

6. After fitting the rotary seat, wipe the seal end surface, using a soft cloth or a paper soaked in PT cleaning solution, or acetone, check that the seal end surface is free from adhesion of dust or grease.

7. Install two eyebolts into threaded holes on the inner stationary side seal assembly. Insert the inner stationary side seal assembly into the stuffing box while mating the pin hole on the bearing cover with the pin on the carbon assembly.

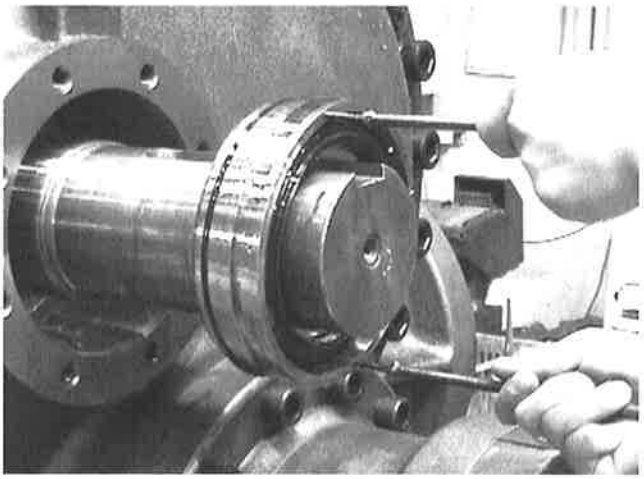


Fig. 400-S1 Inner stationary side seal (1)

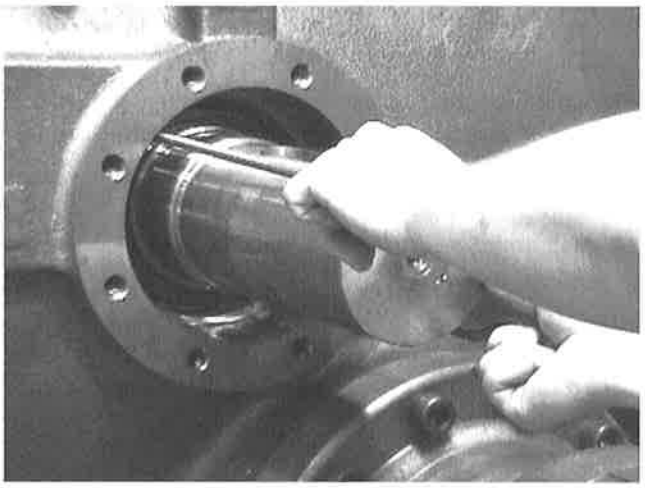


Fig. 400-S2 Inner stationary side seal (2)

8. Wipe the drive collar clean, so that the collar is free of dust or dirt.

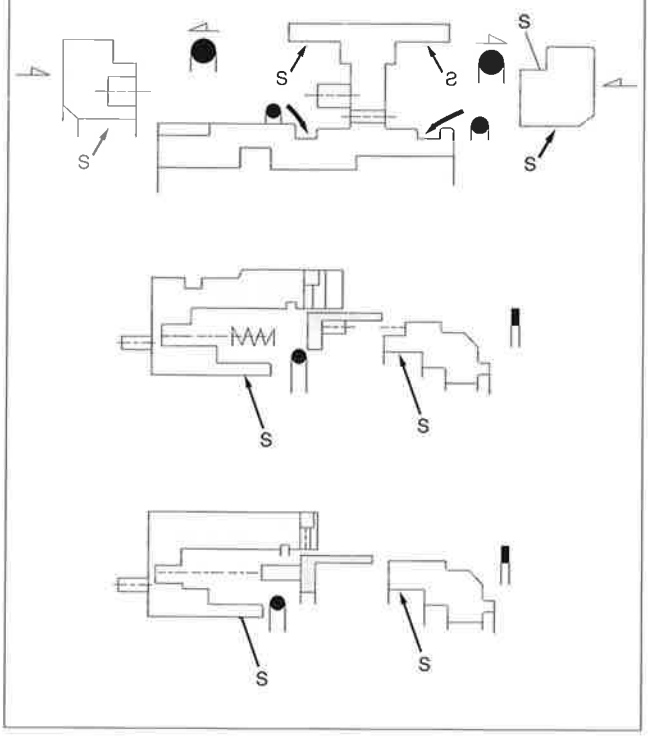
9. Wipe the stationary side seal ring clean, so that it is free of foreign matter such as dust, dirt, etc., and insert the seal ring evenly with the concave part of seal ring aligned with the pin position of the drive collar.

10. Wipe the spring retainer clean, so that it is free of foreign matter such as dust, dirt, etc., and apply lubricant to pint S.

11. Wipe the "O" ring clean, and fit the "O" ring on the retainer.

12. Fit the spring in the spring hole of the retainer.

Fig. 400-S3 Schematic drawing of oil application points



13. Apply lubricant to point S of the seal ring, and push in the ring evenly with the pin hole of the spring retainer aligned with the pin position of the driver collar.

14. Push in the seal ring and fit the snap ring in the spring retainer groove.

15. Push in the seal ring evenly, to check that the seal ring is returns smoothly to the snap ring by side by the force of spring.

16. For final step, wipe the seal end surface, using a soft cloth or a paper soaked in PT cleaning solution or acetone, and check for adhesion of dust.

17. Fit the "O" ring on the outer circumference of the stationary side seal ring assembly, and fit the stationary side seal ring assembly into the seal box with the pin hole of the bearing cover aligned with the pin position of the seal ring assembly.

18. Fit the adapter with the pin positioning aligned with the notch of the spring retainer fitted in advance.

19. Fit the key in the shaft keyway.

20. Fit the rotary side seal ring assembly the with the key groove aligned with the shaft key.

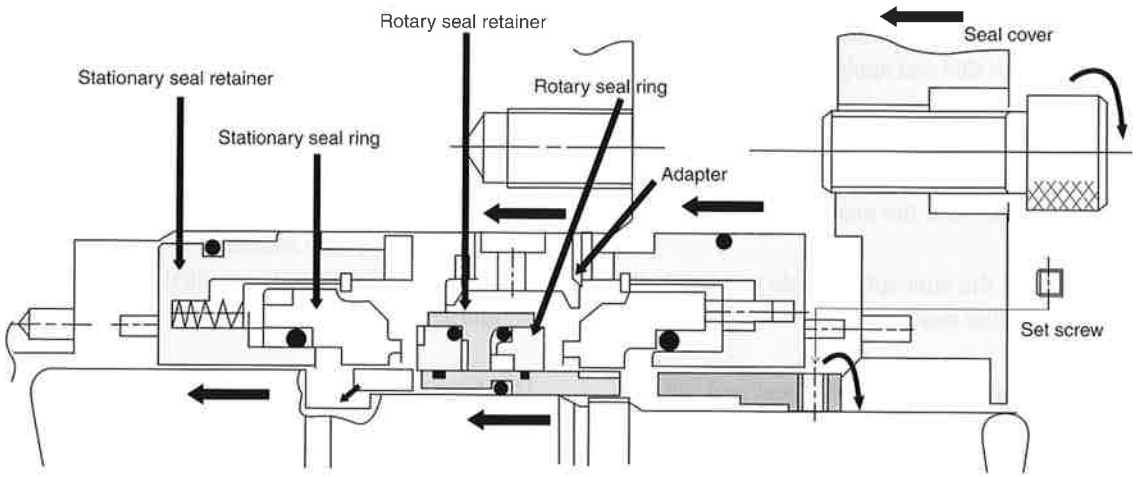
21. Tighten the sleeve nut, and push the rotary side seal ring assembly.

22. Tighten the sleeve loose-prevention set screw.

23. Fit the "O" ring on the outer circumference of the stationary side seal ring assembly, and fit the stationary seal ring assembly into the seal box.

24. Fit the seal cover with the pin of the spring retainer aligned with the pin hole position of the seal cover and tighten it with the hexagon socket head bolts evenly in diagonal sequence.

Fig. 400-S4 Sectional view of 400UD shaft seal



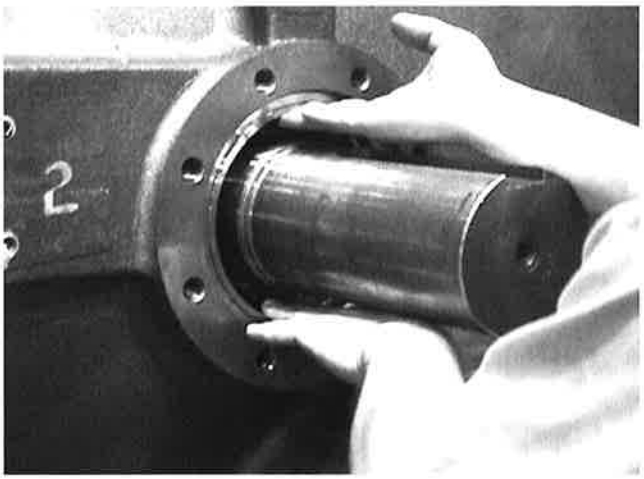


Fig. 400-S5 Oil flushing ring adapter

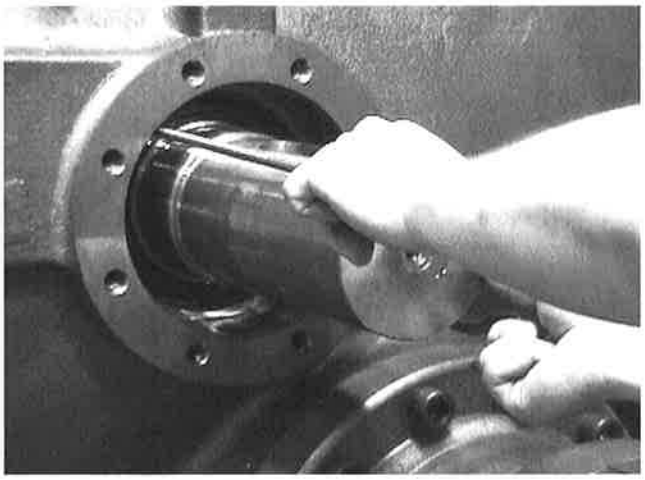
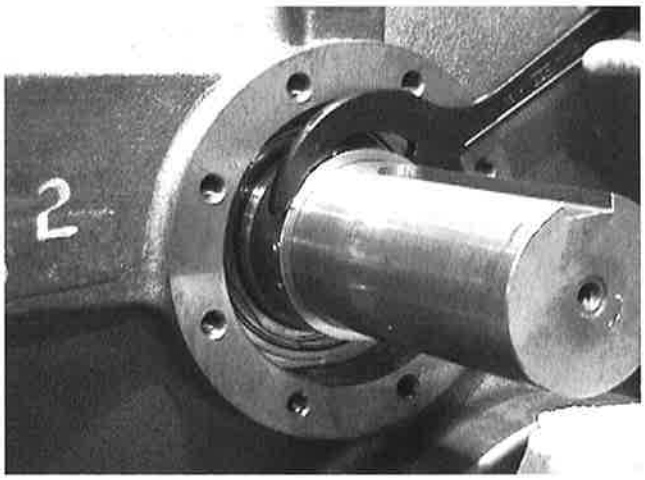


Fig. 400-S6 Rotary side seal ring assembly with threaded jig

* Remove the threaded ring jig from the rotary side seal ring assembly. Mount the sleeve lock nut on the shaft and tighten up the sleeve lock nut. Tighten the two set screws on the sleeve lock nut.



Fig, 400-S7 Sleeve lock nut

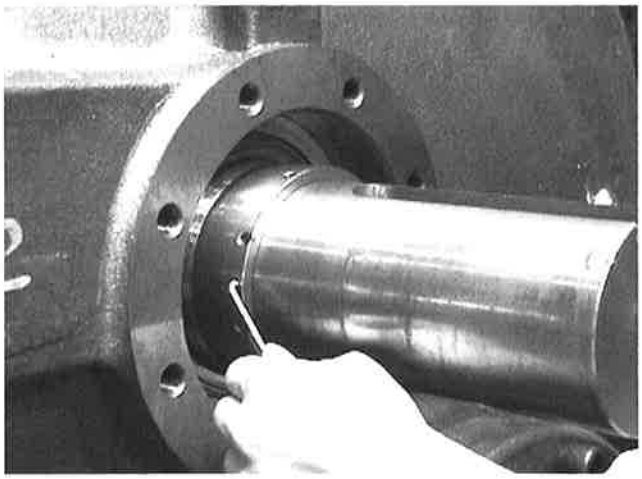


Fig. 400-S8 Set screw

* Install two eyebolts into threaded holes on the outer stationary side seal assembly. Insert outer stationary side seal assembly into the stuffing box.
* Fit the seal cover on the bearing cover while mating the pin hole on the seal cover with the pin on the outer stationary side seal assembly. Tighten the hexagon cap screws evenly in diagonal sequence.

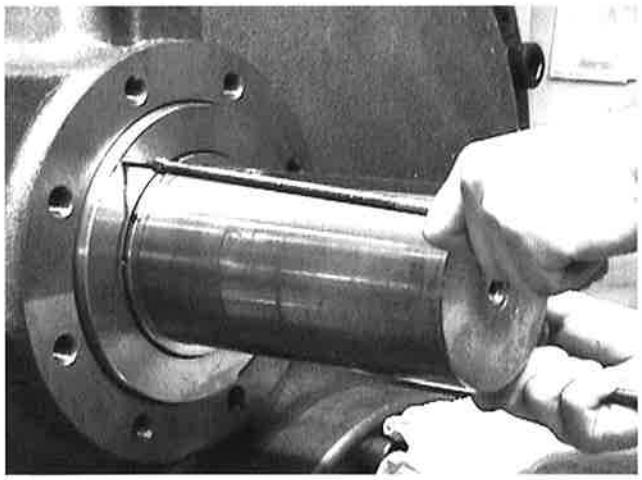


Fig. 400-S9 Outer stationary side seal

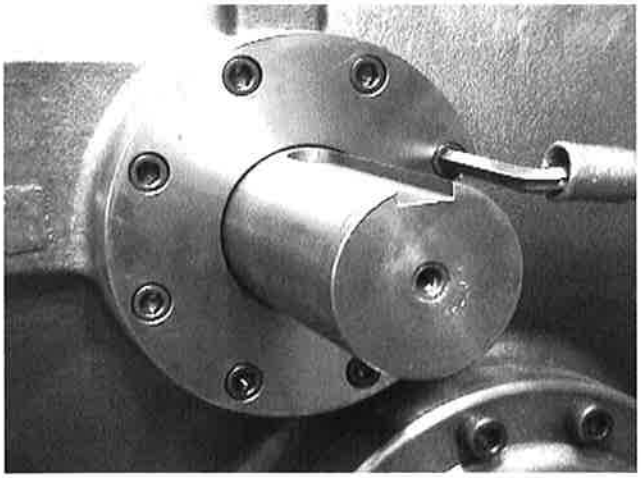
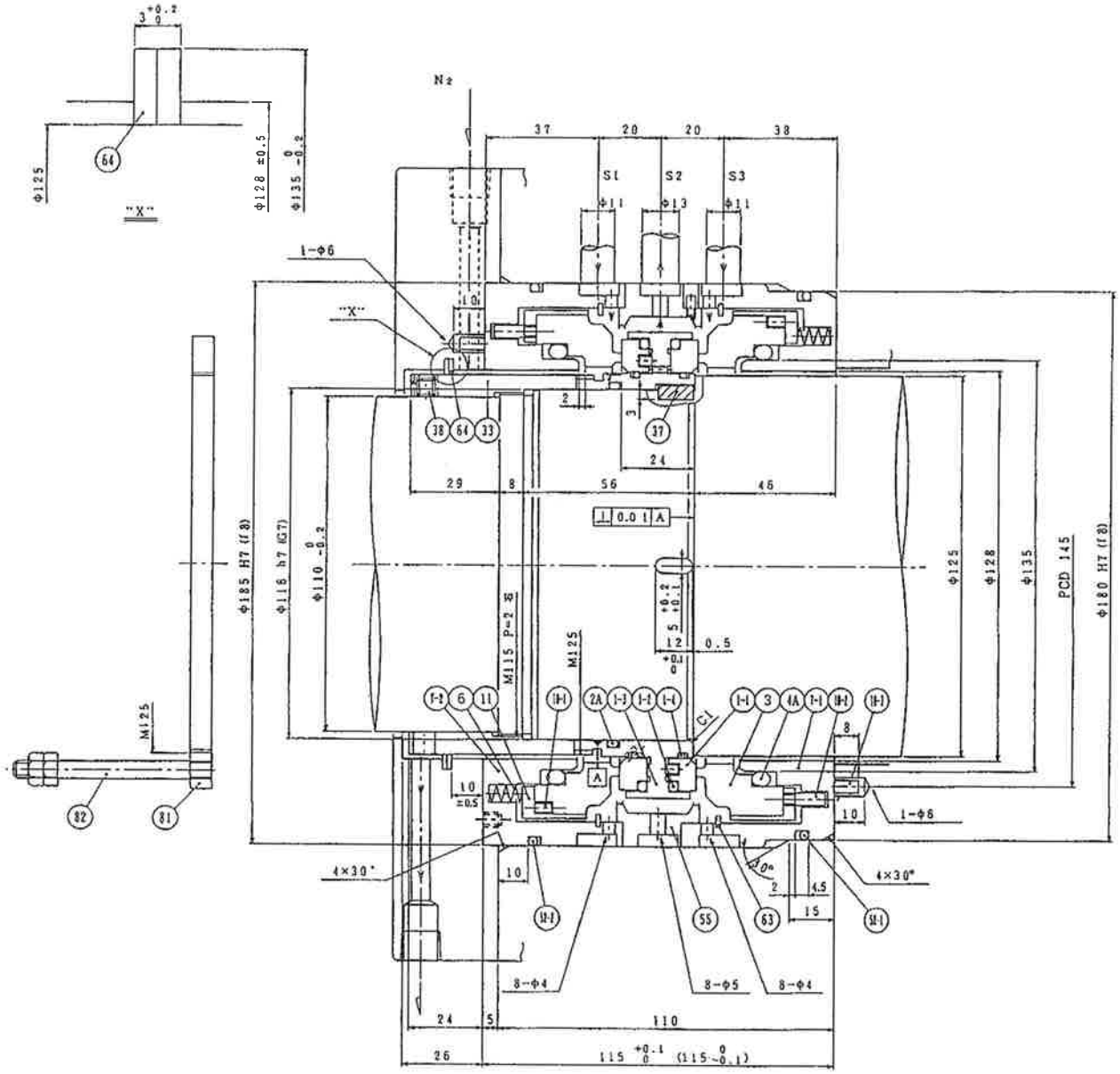
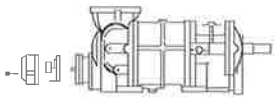


Fig. 400-S10 Seal cover

Fig.400-S11 400UD shaft seal cross sectional view (standard type)





VI DISMANTLMENT AND ADJUSTMENT OF UNLOADER INDICATOR

The indicator of the automatic control system consists of a potentiometer, micro switch and cam. Two types of indicator are a available:

(1) 125	Type 121-600-00 (Ref. Drawing No. 155)
(2) 160 to 400	Type 201-600-00 (Ref. Drawing No. 156)

The components for 125 are as follow: (1 type only)

1 potentiometer	For feed-back of slide valve position
1 micro-switch	For signal of no-load position slide valve
1 micro-switch	For signal of full-load position of slide valve
1 cam	For micro-switch

The components for the 160 and up are as follow; (3 types)

	Automatic Standard	Particular Spec.1	Particular Spec.2
Potentiometer	1	1	1
Micro-switch 1	1	1	-
Micro-switch 2	-	1	-
Micro-switch 3	-	-	2
Cam for control	1	1	-
Cam for special	-	-	1

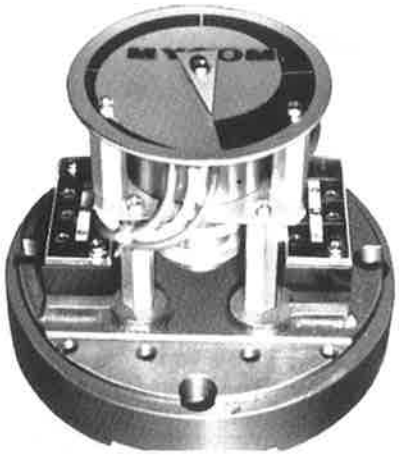


Fig. 153 Unloader indicator for 125UD

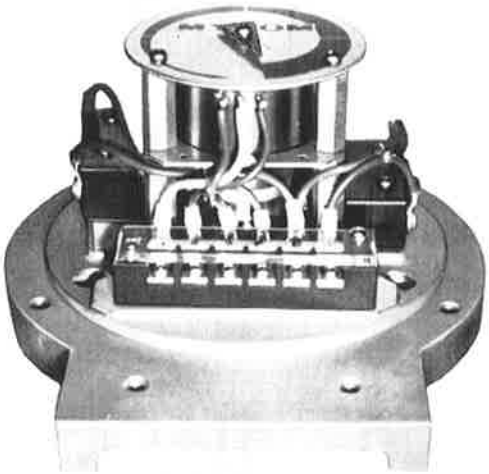


Fig. 154 Unloader indicator for 160-400

Fig. 155 Exploded view of unloader indicator (125LUD)

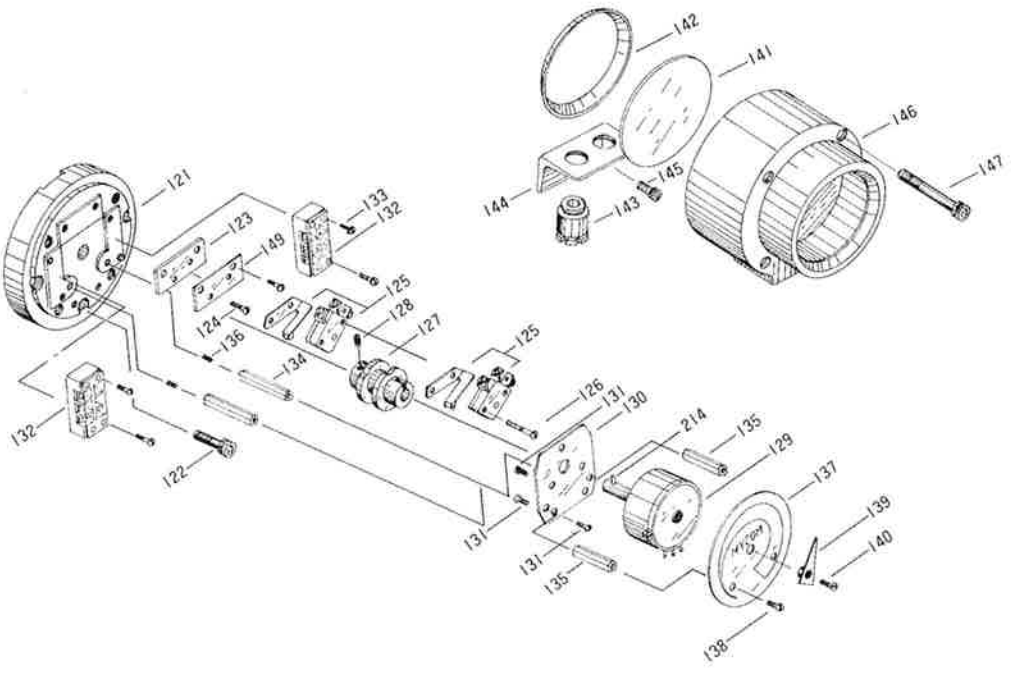


Fig. 156 Exploded view of unloader indicator (160SUD~250LUD)

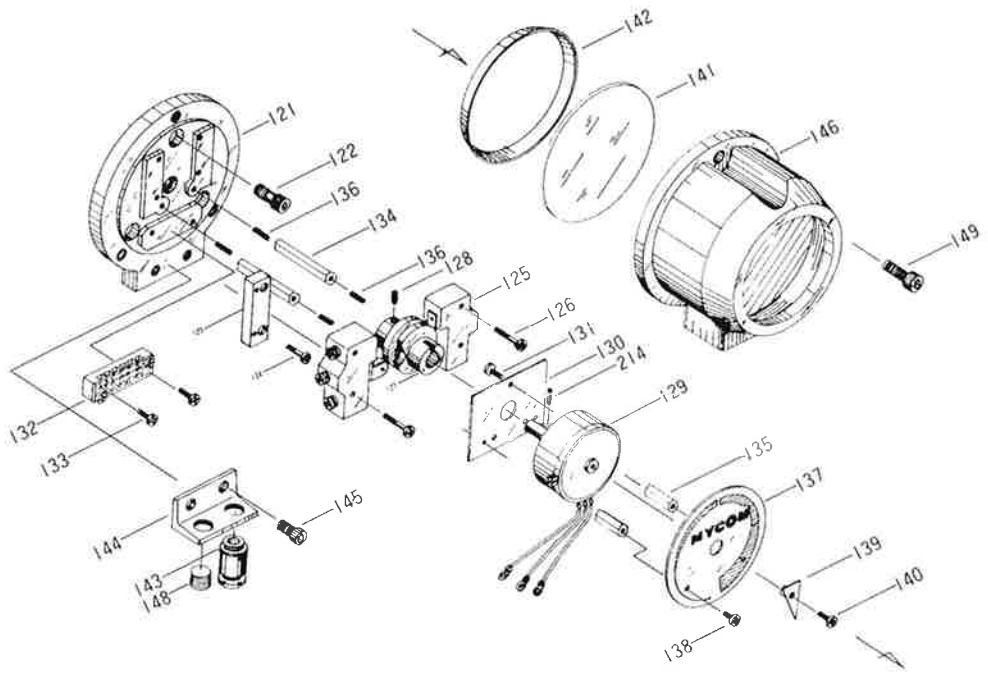


Fig. 157 Unloader indicator for 125LUD

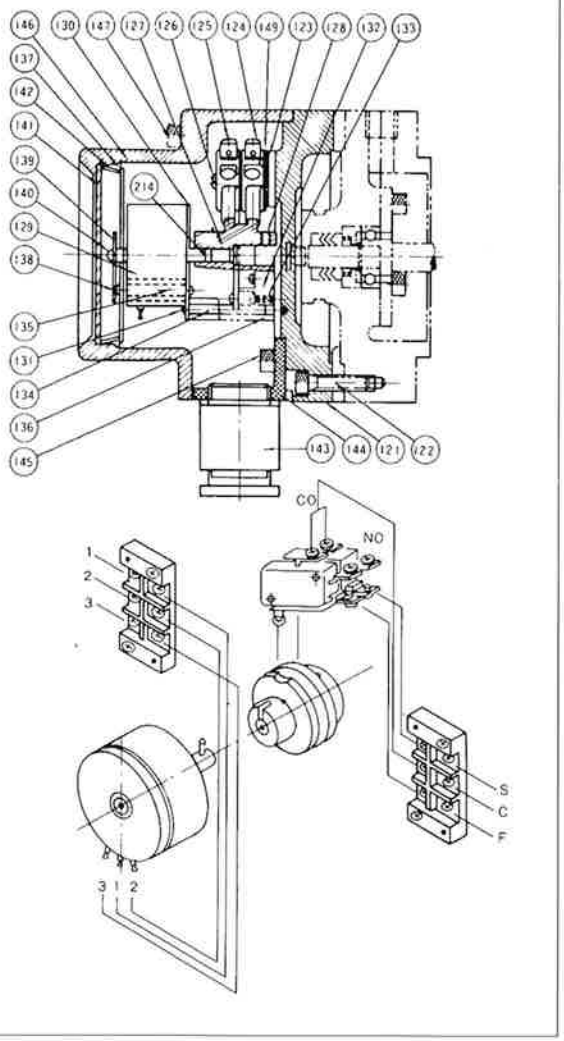
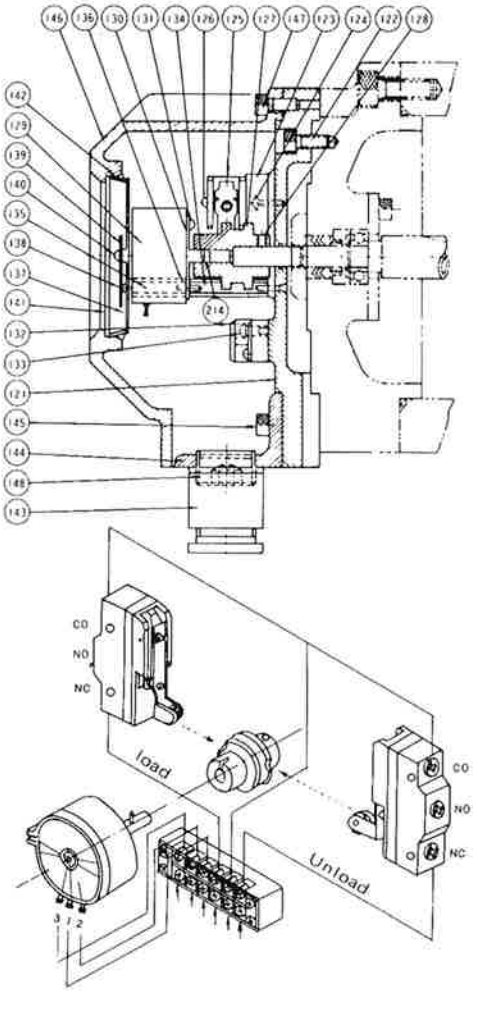


Fig. 158 Unloader indicator for 160SUD to 400LUD



for 125LUD			for 160LUD to 250LUD		
Index No.	Description	Q' ty	Index No.	Description	Q' ty
121	Micro-switch bass plate	1	121	Micro-switch bass plate	1
122	Allen screw	3	122	Allen screw	3
123	Micro-switch set-plate	1	123	Micro-switch set-plate	1
124	Philips screw	2	124	Philips screw	2
125	Micro-switch	2	125	Micro-switch	2
126	Philips screw	2	126	Philips screw	4
127	Cam	1	127	Cam	1
128	Cam set screw	2	128	Cam set screw	2
129	Potentiometer	1	129	Potentiometer	1
130	Potentiometer set-plate	1	130	Potentiometer set-plate	1
131	Philips screw	4	131	Philips screw	3
132	Terminal block	1	132	Terminal block	1
133	Philips screw	2	133	Philips screw	2
134	Potentiometer support arm (1)	2	134	Potentiometer support arm (1)	2
135	Potentiometer support arm (2)	2	135	Potentiometer support arm (2)	2
136	Potentiometer mounting screw	2	136	Potentiometer mounting screw	4
137	Indicater dial	1	137	Indicater dial	1
138	Indicater dial screw	2	138	Indicater dial screw	2
139	Indicater needle	1	139	Indicater needle	1
140	Indicater needle screw	1	140	Indicater needle screw	2
141	Indicater glass	1	141	Indicater glass	1
142	Glass support	1	142	Glass support	1
143	Electric wiring connector	1	143	Electric wiring connector	1
144	Connecter support	1	144	Connecter support	1
145	Indicater allen screw	2	145	Indicater allen screw	2
146	Indicater cover (2)	1	146	Indicater cover (2)	1
147	Indicater cover allen screw	3	147	Indicater cover allen screw	3
149	Indicater, micro-switch	1	149	Puug	1
214	Pin	1	214	Pin	1

Ⅵ-1 Dismantlement of the Type 201-600-00. (Ref. Fig.159 to 164)

a) Unscrew the indicator needle screw (140) and remove the needle (139).

b) Remove the indicator dial screws (138) which hold the indicator dial (137).

c) The potentiometer set-plate is held between two support arms (134) and (135). To remove this set-plate, hold support arms (134) and loosen (135).

d) Take off the two support arms. The potentiometer (129) can be removed with the set-plate (130).

e) The potentiometer is held to the set-plate by two Philips screws.

f) The micro-switch (125) can now be removed by loosing the two Philips screws (126).
The right side is for the signal of no-load position and the left side is for full-load.
The left side has a base plate (123) held by two Philips screw. (124).

g) The terminal block is easily removed by unscrewing the Philips screws (133).
The Micro-switch must be fixed firmly after operation is confirmed. The contact point of this switch may easily slip if a screw is loose.

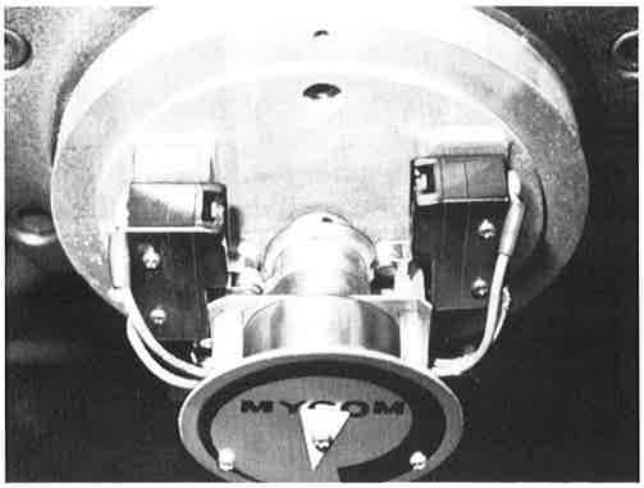


Fig.159 No load positioned cam in case of two micro-switch

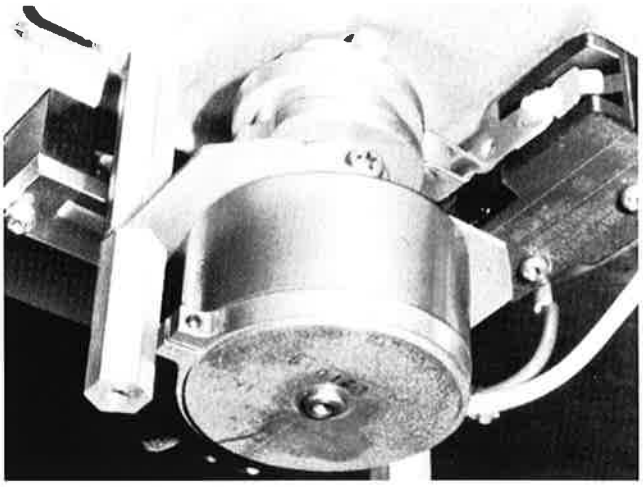


Fig. 160 In case of one micro-switch

Ⅵ -2 Inspection

a) No parts need checking except the electric parts.
Since a full rotary type potentiometer is employed, check smooth variation of resistance during rotation.

b) Check the operation on the micro-switch contacts using a tester.

Ⅵ -3 Assembly and adjustment

Assembly is done in the reverse order of dismantlement.
Adjustment is most important.

- The relation between the position of the slide valve and the cam which works the micro-switch.
- No-load position and the resistance value of the potentiometer.

These adjustments can be done after fixed the micro-switch set-plate is mounted on the unloader cover.

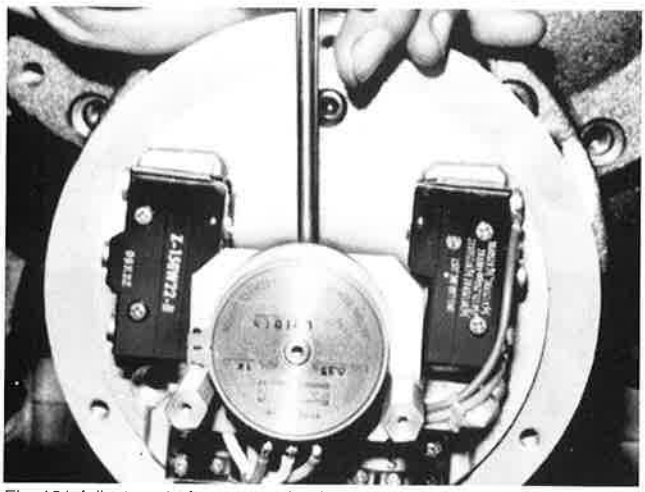


Fig. 161 Adjustment of cam at no-load position

a) The cam shaft of the unloader cylinder is now positioned at no-load. (Ref. V-9 Unloader piston and unloader cylinder.)
Position the micro-switch roller on the depression in the micro-switch cam inside of the unloader cover and tighten cylinder cam set screw.

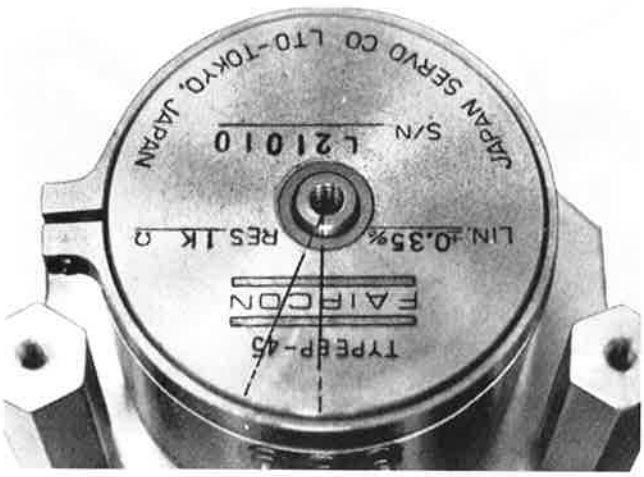


Fig. 162 Adjustment of potentiometer at no-load position

b) Set the line of out side and the line of axial side of ruled lines marked on the dial side of the potentiometer, and tighten the potentiometer shaft and micro-switch cam set screw.

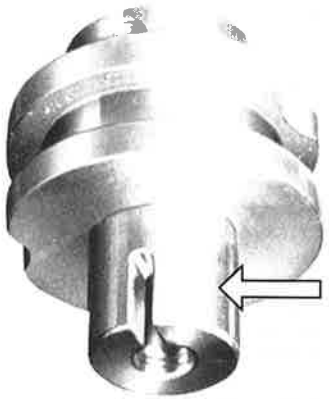


Fig. 163 Ditch of micro-switch cam

c) Since July 1973, the positioning of the potentiometer is achieved automatically because these parts have been improved. A slot in the micro-switch cam and a spring pin on the potentiometer shaft fit together.

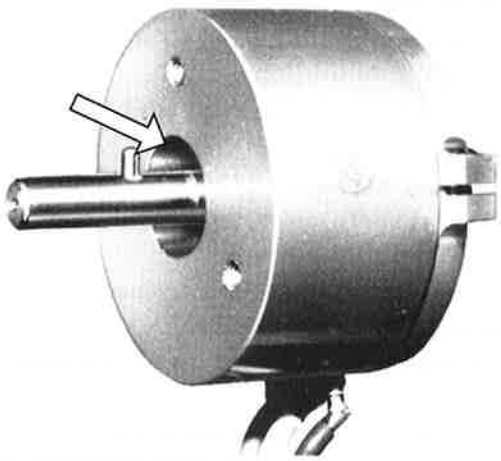


Fig. 164 Shaft of potentiometer

d) Attach the dial and set the needle at the no-load position.
If there is a micro-switch for full load use, adjust the set screw of the micro-switch to work by the cam.
The working of this switch should be confirmed at the full load position. There are several ways to set the full load position:

(1) Move the slide valve to the full load position by the oil pressure using the oil pump pressure.

(2) Push the slide valve to the full load position with a long rod through the plug hole on the discharge side of the bearing head.

(3) Send low pressure air into the B chamber of the unloader piston. The micro-switch must be fixed firmly after proper function is confirmed. The contact point of this switch may easily slip if the screw is loose.

e) After confirming the above, connect the control wiring and attach the unloader indicator cover.

f) Care should be taken not to pinch the wires between the cover and the base.

Notice.

Dismantlement, inspection and reassembly are now complete.

Mate the compressor with the screw package. Before attaching the suction and discharge pipes, centering should be taken between the motor and the compressor.

Reconfirm centering after fastening the pipes.

Needless to say, a leak test, confirmation of all control connections, etc., should be done before starting operation.

Dynamic Blance of Screw Compressor Rotor ◆allowable level of unbalance

Model		Diameter (cm)	Rotor Weight (kg)		◆(g · cm)	◆(N · cm)	Value of unblance	Remark
125	S	12.75	M	14.1	4.7	0.046	0.7	Rev. speed 3600rpm standard material FCD600
			F	10.6	3.5	0.034	0.6	
	L		M	18.3	6.1	0.059	1.0	
			F	14.0	4.6	0.046	0.7	
160	S	16.32	M	28.5	9.5	0.093	1.2	
			F	22.2	7.4	0.072	0.9	
	M		M	33.0	10.9	0.107	1.3	
			F	25.8	8.6	0.084	1.0	
	L		M	37.4	12.4	0.122	1.5	
			F	29.4	9.8	0.096	1.2	
200	S	20.40	M	53.5	17.8	0.174	1.7	
			F	41.7	13.8	0.135	1.4	
	M		M	62.4	20.7	0.203	2.0	
			F	48.8	16.9	0.159	1.6	
	L		M	70.9	23.5	0.230	2.3	
			F	55.7	18.5	0.181	1.8	
250	S	25.50	M	101.5	33.7	0.330	2.6	
			F	79.7	26.4	0.259	2.1	
	M		M	118.9	39.4	0.387	3.1	
			F	93.9	31.1	0.305	2.4	
	L		M	135.4	44.9	0.440	3.5	
			F	107.2	35.6	0.349	2.8	
320	S	32.13	M	205.4	68.1	0.668	4.2	
			F	162.1	53.8	0.527	3.3	
	M		M	239.1	79.3	0.778	4.9	
			F	189.5	62.9	0.616	3.9	
	L		M	272.5	90.4	0.886	5.6	
			F	216.7	71.8	0.705	4.5	
	LL		M	314.7	104.3	1.023	6.5	
			F	254.0	84.2	0.826	5.2	
400	S	40.80	M	439.1	145.6	1.428	7.1	
			F	350.8	116.3	1.141	5.7	
	M		M	510.2	169.2	1.659	8.3	
			F	408.6	135.5	1.329	6.6	
	L		M	576.6	191.2	1.875	9.4	
			F	462.9	153.5	1.505	7.5	
400 Booster	S	40.80	M	373.2	123.8	1.214	6.1	
			F	302.2	100.2	0.983	4.9	
	M		M	444.4	147.4	1.445	7.2	
			F	360.6	119.4	1.171	5.9	
	L		M	511.2	169.5	1.662	8.3	
			F	414.2	137.4	1.347	6.7	

Allowable level based on Jis B0950G Class 2.5
Allowable level = (2.5 9550)/ 3600 Rotor weight / 2 1/10
Allowable level =Value of unbalance × Rotor Radial

Memo

MAYEKAWA MFG. CO., LTD.

2-13-1,Botan,Koto-Ku,Tokyo 135,Japan
Tel:(03)3642-8181 Fax:(03)3643-7094

For any question concerring this manual please contact:

Moriya Factory Compressor Mfg. Co.,Ltd.
Quality Promotion Group
Tel:(0297)48-1590 Fax:(0297)48-0632

Cat.No.2200D11E-KI735C·06.3
Printed in Japan

MYCOM

Report No. 2020249
Order No. MCV37815
Item No. -

INSPECTION & TEST REPORT

Type of Compressor	**Screw Compressor**
Name of Manufacturer	**MAYEKAWA MFG. CO., LTD.**
Compressor Model	**P400SUD-HE**
Compressor Serial No.	**4055122**

(Remarks)

This inspection and test record is complete together with the following test records attached herewith :

1 .Material Identification List

2 .Hydrostatic and Gas Leak Tests Report

3 .Screw Compressor Test Results

4 .Dismantling Inspection Report

Date of Issue : **May 13, 2020**

Checked by : K. Watanabe

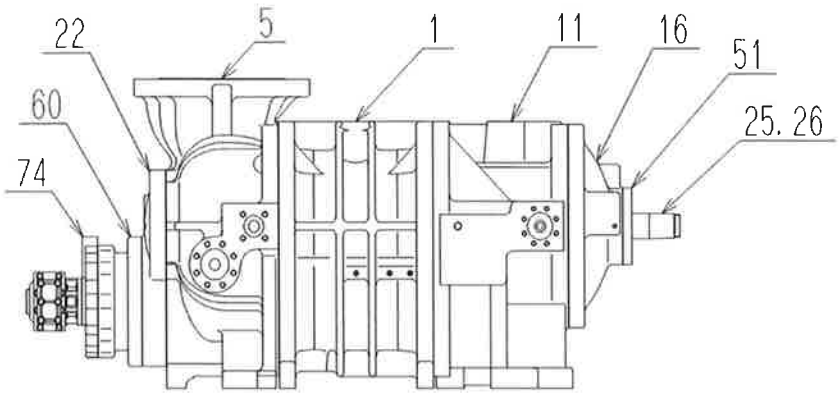
Approved by : A. Koyama

MYCOM

Report No. 2020249

Material Identification List

Item No.	**-**
Type of Compressor	**Screw Compressor**
Compressor Model No.	**P400SUD-HE**
Compressor Serial No.	**4055122**



No.	Name of Part	Material	Identification No.	Page	Remarks
1	Main Rotor Casing	FC300	0121	P 1	
5	Suction Cover	FC300	0111	P 2	
11	Bearing Head	FC300	9823	P 3	
16	Bearing Cover	FC300	0122	P 4	
22	Balance Piston Cover	FC300	8601	P 5	
60	Unloader Cylinder	FC300	9604	P 6	
74	Unloader Cover	FC300	0110	P 7	
25	Male Rotor	FCD600	K84371	P 8	
26	Female Rotor	FCD600	K9069	P 9	

SURVEYOR

Date : May 13, 2020

Checked by : K. Iwatanabe

Approved by : A. Koizumi

2020年4月3日

Date of issue Apr. 3. 2020

材料証明書　Material Certificate

EN 10204　3.1

得意先名　（株）前川製作所　様

To Messers　MAYEKAWA MFG CO., LTD.

新潟県長岡市宮下町436-1

株式会社　キャストアンドー

436-1 Miyashitamati Nagaoka-shi Niigata-ken Japan

CAST ANDOH CO.

材質 Material	1995年改正 JIS. G5501 FC300	試料の形状 Test Piese Size	2011年改正 JIS. Z2241 NO. 8C			試験日 Date of test	2020年2月19日
機名 Machine	400S	図番 DFT. No.		部品名 Name of parts	ローターケーシング Main Rotor Casing		

規格 Standard / 試料記号 T. P. NO.	直径 Diameter mm	引張荷重 Maximum Lord N	引張強さ Tensile Stlength N/mm²	耐力 Yield Stlength N/mm²	伸び Elogation %	直径 Diameter mm	最大荷重 Maximum Lord N	たわみ Deflection mm	硬さ試験 Hardness 1998年改定 JIS. Z2243 硬度数 Brinell HB	化学成分 Chemical Composition TC %	Si %	Mn %	P %	S %	*
	20±0.7	———	≧300	———	———	———	———	———	≦262	———	———	———	———	———	*
0121	20.0	104690	333	———	———	———	———	———	229	3.28	1.66	0.87	0.053	0.056	*
				———	———	———	———	———							*
				———	———	———	———	———							*

備考・Remarks　本製品は、ご指定の規格または仕様によって製造され、その要求事項を満足していることを証明します。
We hereby certify that material described has been manufactured and inspected and inspected satisfactory with requirement of the above specificasion

SI単位換算値
Conversion of Unit
1kgf=9.80665N
1kgf/mm²=9.80665N/mm²
1kgf m=9.80665J

品質管理者

Checked by　　Tested by

Reviewed by: K. Watanabe
MAYEKAWA. MFG, CO.,LTD

2020年4月3日

Date of issue Apr. 3. 2020

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436-1 Miyashitamati Nagaoka-shi Niigata-ken Japan

CAST ANDOH CO.

材質 Material	1995年改正 JIS. G5501 FC300	試料の形状 Test Piese Size	2011年改正 JIS. Z2241 NO. 8C			試験日 Date of test	2020年1月30日
機名 Machine	400UD	図番 DFT. No.		部品名 Name of parts	サクションカバー Suction Cover		

規格 Standard / 試料記号 T. P. NO.	直径 Diameter mm	引張荷重 Maximum Lord N	引張強さ Tensile Stlength N/mm²	耐力 Yield Stlength N/mm²	伸び Elogation %	直径 Diameter mm	最大荷重 Maximum Lord N	たわみ Deflection mm	硬さ試験 Hardness 1998年改定 JIS. Z2243 硬度数 Brinell HB	化学成分 Chemical Composition TC %	Si %	Mn %	P %	S %	*
	20±0.7	———	≧300	———	———	———	———	———	≦262	—	—	—	—	—	*
0111	20.0	104350	332	———	———	———	———	———	221	3.27	1.70	0.86	0.053	0.056	*
				———	———	———	———	———							*
				———	———	———	———	———							*

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SI単位換算値
Conversion of Unit
1kgf=9.80665N
1kgf/mm²=9.80665N/mm²
1kgf m=9.80665J

Reviewed by: K. Watanabe
MAYEKAWA. MFG, CO.,LTD

2020年4月27日

Date of issue Apr. 27. 2020

材料証明書　Material Certificate

EN 10204　3.1

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新潟県長岡市宮下町436-1

株式会社　キャストアンドー

436-1 Miyashitamati Nagaoka-shi Niigata-ken Japan

CAST ANDOH CO.

材質 Material	1995年改正 JIS. G5501 FC300	試料の形状 Test Piese Size	2011年改正 JIS. Z2241 NO. 8C			試験日 Date of test	2019年9月14日
機名 Machine	400UD	図番 DFT. No.		部品名 Name of parts	ベアリングヘッド Bearing Head		

規格 Standard / 試料記号 T. P. NO.	直径 Diameter mm	引張荷重 Maximum Lord N	引張強さ Tensile Stlength N/mm²	耐力 Yield Stlength N/mm²	伸び Elogation %	直径 Diameter mm	最大荷重 Maximum Lord N	たわみ Deflection mm	硬さ試験 Hardness 1998年改定 JIS. Z2243 硬度数 Brinell HB	化学成分 Chemical Composition TC %	Si %	Mn %	P %	S %	*
	20±0.7	———	≧300	———	———	———	———	———	≦262	———	———	———	———	———	*
9823	20.0	104960	334	———	———	———	———	———	233	3.26	1.67	0.89	0.054	0.057	*
				———	———	———	———	———							*
				———	———	———	———	———							*

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Checked by _____　　Tested by _____

SI単位換算値
Conversion of Unit
1kgf=9.80665N
1kgf/mm²=9.80665N/mm²
1kgf m=9.80665J

Reviewed by: K. Watanabe
MAYEKAWA. MFG, CO.,LTD

2020年4月3日

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新潟県長岡市宮下町436-1

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436-1 Miyashitamati Nagaoka-shi Niigata-ken Japan

CAST ANDOH CO.

材質 Material	1995年改正 JIS. G5501 FC300	試料の形状 Test Piese Size	2011年改正 JIS. Z2241 NO. 8C			試験日 Date of test	2020年2月19日
機名 Machine	400UD	図番 DFT. No.		部品名 Name of parts	ベアリングカバー Bearing Cover		

規格 Standard	直径 Diameter mm	引張荷重 Maximum Lord N	引張強さ Tensile Stlength N/mm²	耐力 Yield Stlength N/mm²	伸び Elogation %	直径 Diameter mm	最大荷重 Maximum Lord N	たわみ Deflection mm	硬さ試験 Hardness 1998年改定 JIS. Z2243 硬度数 Brinell HB	化学成分 Chemical Composition TC %	Si %	Mn %	P %	S %	*
試料記号 T. P. NO.	20±0. 7	———	≧300	———	———	———	———	———	≦262	—	—	—	—	—	*
0122	20. 0	103510	330	———	———	———	———	———	212	3. 29	1. 68	0. 85	0. 053	0. 056	*
				———	———	———	———	———							*
				———	———	———	———	———							*

備考・Remarks　本製品は、ご指定の規格または仕様によって製造され、その要求事項を満足していることを証明します。
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SI単位換算値
Conversion of Unit
1kgf=9. 80665N
1kgf/mm²=9. 80665N/mm²
1kgf m=9. 80665J

品質管理者
Checked by _____　Tested by _____

Reviewed by: K. Watanabe
MAYEKAWA. MFG, CO.,LTD

2020年4月3日
Date of issue Apr. 3. 2020

材料証明書　Material Certificate
EN 10204　3.1

得意先名　　(株) 前川製作所　　様
To Messers　MAYEKAWA MFG CO., LTD.

新潟県長岡市宮下町436-1
株式会社　キャストアンドー
436-1 Miyashitamati Nagaoka-shi Niigata-ken Japan
CAST ANDOH CO.

材質 Material	1995年改正 JIS. G5501 FC300	試料の形状 Test Piese Size	2011年改正 JIS. Z2241 NO. 8C			試験日 Date of test	2018年6月20日
機名 Machine	400UD	図番 DFT. No.		部品名 Name of parts	バランスピストンカバー Balance Piston Cover		

規格 Standard / 試料記号 T. P. NO.	直径 Diameter mm	引張荷重 Maximum Lord N	引張強さ Tensile Stlength N/mm²	耐力 Yield Stlength N/mm²	伸び Elogation %	直径 Diameter mm	最大荷重 Maximum Lord N	たわみ Deflection mm	硬さ試験 Hardness 1998年改定 JIS. Z2243 硬度数 Brinell HB	化学成分 Chemical Composition TC %	Si %	Mn %	P %	S %	*
	20±0.7	———	≧300	———	———	———	———	———	≦262	——	——	——	——	——	*
8601	20.0	103300	329	———	———	———	———	———	210	3.29	1.69	0.84	0.055	0.052	*
				———	———	———	———	———							*
				———	———	———	———	———							*

備考・Remarks　本製品は、ご指定の規格または仕様によって製造され、その要求事項を満足していることを証明します。
We hereby certify that material described has been manufactured and inspected and inspected satisfactory with requirement of the above specificasion

品質管理者
Checked by ＿＿＿＿＿＿　Tested by ＿＿＿＿＿＿

SI単位換算値
Conversion of Unit
1kgf=9.80665N
1kgf/mm²=9.80665N/mm²
1kgf m=9.80665J

Reviewed by: K. Iwatanabe
MAYEKAWA. MFG, CO.,LTD

2019年6月25日

Date of issue Jun. 25. 2019

材料証明書　Material Certificate

EN 10204　3.1

得意先名　　(株) 前川製作所　　様

To Messers　MAYEKAWA MFG CO., LTD.

新潟県長岡市宮下町436-1

株式会社　キャストアンドー

436-1 Miyashitamati Nagaoka-shi Niigata-ken Japan

CAST ANDOH CO.

材質 Material	1995年改正 JIS. G5501 FC300	試料の形状 Test Piese Size	2011年改正 JIS. Z2241 NO. 8C			試験日 Date of test	2019年6月18日
機名 Machine	400S	図番 DFT. No.		部品名 Name of parts	アンローダーシリンダー Unloader Cylinder		

規格 Standard	直径 Diameter mm	引張荷重 Maximum Lord N	引張強さ Tensile Stlength N/mm²	耐力 Yield Stlength N/mm²	伸び Elogation %	直径 Diameter mm	最大荷重 Maximum Lord N	たわみ Deflection mm	硬さ試験 Hardness 1998年改定 JIS. Z2243 硬度数 Brinell HB	化学成分 Chemical Composition TC %	Si %	Mn %	P %	S %	*
試料記号 T. P. NO.	20＝0. 7	———	≧300	———	———	———	———	———	≦262	—	—	—	—	—	*
9603	20. 0	103320	329	———	———	———	———	———	210	3. 29	1. 69	0. 85	0. 052	0. 055	*
9604	20. 0	103030	328	———	———	———	———	———	208	3. 31	1. 68	0. 84	0. 056	0. 053	*

備考・Remarks　本製品は、ご指定の規格または仕様によって製造され、その要求事項を満足していることを証明します。
We hereby certify that material described has been manufactured and inspected and inspected satisfactory with requirement of the above specificasion

品質管理者

Checked by　　Tested by

SI単位換算値
Conversion of Unit
1kgf=9. 80665N
1kgf/mm²=9. 80665N/mm²
1kgf m=9. 80665J

Reviewed by: K. Watanabe

MAYEKAWA. MFG, CO.,LTD

2020年4月3日
Date of issue Apr. 3. 2020

材料証明書　Material Certificate
EN 10204　3.1

得意先名　　(株) 前川製作所　　様
To Messers　MAYEKAWA MFG CO., LTD.

新潟県長岡市宮下町436-1
株式会社　キャストアンドー
436-1 Miyashitamati Nagaoka-shi Niigata-ken Japan
CAST ANDOH CO.

材質 Material	1995年改正 JIS. G5501 FC300	試料の形状 Test Piese Size	2011年改正 JIS. Z2241 NO. 8C			試験日 Date of test	2020年1月30日
機名 Machine	400UD	図番 DFT. No.		部品名 Name of parts	アンローダーカバー Unloader Cover		

規格 Standard / 試料記号 T. P. NO.	直径 Diameter mm	引張荷重 Maximum Lord N	引張強さ Tensile Stlength N/mm²	耐力 Yield Stlength N/mm²	伸び Elogation %	直径 Diameter mm	最大荷重 Maximum Lord N	たわみ Deflection mm	硬さ試験 Hardness 1998年改定 JIS. Z2243 硬度数 Brinell HB	化学成分 Chemical Composition TC %	Si %	Mn %	P %	S %	*
	20±0.7	———	≧300	———	———	———	———	———	≦262	—	—	—	—	—	*
0110	20.0	103030	328	———	———	———	———	———	206	3.28	1.71	0.83	0.056	0.053	*
				———	———	———	———	———							*
				———	———	———	———	———							*

備考・Remarks　本製品は、ご指定の規格または仕様によって製造され、その要求事項を満足していることを証明します。
We hereby certify that material described has been manufactured and inspected and inspected satisfactory with requirement of the above specificasion

品質管理者
Checked by ＿＿＿＿＿＿　Tested by ＿＿＿＿＿＿

SI単位換算値
Conversion of Unit
1kgf=9.80665N
1kgf/mm²=9.80665N/mm²
1kgf m=9.80665J

Reviewed by: K. Watanabe
MAYEKAWA. MFG, CO.,LTD

No. 5498

材料試験成績書 Result of Material Test

EN 10204 3.1

発行日 Issue Date: Apr . 18 . 2020 .

得意先名 To Messrs. 株式会社 前川製作所 殿
MAYEKAWA MFG. CO., LTD.

溶解番号 Charge No. A8437

管理番号 Control No. K8437 , K8438 (R95)

株式会社 川口金属工業 品質保証室
KAWAGUCHI METAL INDUSTRIES CO.,LTD. Quality Assurance Sec.
埼玉県川口市宮町18－19
18-19 MIYA-cho KAWAGUCHI-shi SAITAMA-PREF.JAPAN

機種 Type	400Su M Rotor	材質 Material	JIS G 5502 FCD600「2001」	試験片 Test piece	JIS Z 2241 4号縮小 φ=10mm, GL=35mm	個数 Quantity	2

項目 Item		引張試験 Tensile Test JIS Z 2241				硬さ試験 Hardness Test JIS Z 2243	球状化率 Sphero idizing	熱処理 Heat Treatment	化学試験 Chemical Composition				
規格 Spec. / 溶解番号	直径 Diameter mm	荷重試験 Maximum Load N	引張強さ Tensile Strength N/mm²	耐力 Proof Stress N/mm²	伸び Elonga-tion %	硬さ Hardness HBW	%	種類 Condition / 温度 Temp.	C %	Si %	Mn %	P %	S %
Charge No.	10.00	－	≧600	≧370	≧3	170-270	≧80		≧2.5	1.80-2.40	0.20-0.50	≦0.040	≦0.020
A8437	10.05	53,200	671	429	4.0	229	88.3	Norma. 850℃X 4hs	3.61	2.11	0.37	0.019	0.009
		判定 Judgment	外観検査 Visual Inspection			合 格	Good	Temper 600℃X 5hs					
			寸法検査 Dimensional Inspection			合 格	Good						

注記 Notes

It is hereby certified that the above results are true and correct in every details.
(上記の成績は要求事項を満足している事を証明します。)

Reviewed by: K. Watanabe
MAYEKAWA. MFG, CO.,LTD

品質責任者 Chief of Inspection Dept. N. Okada

Tested by K. Murata

No. 5669

材料試験成績書 Result of Material Test

EN 10204 3.1　　発行日 Issue Date: Sep . 7 . 2019 .

得意先名 To Messrs. 株式会社 前川製作所 MAYEKAWA MFG. CO., LTD. 殿

溶解番号 Charge No. B7089

管理番号 Control No. K9068 , K9069 (R96)

株式会社 川口金属工業 品質保証室
KAWAGUCHI METAL INDUSTRIES CO.,LTD. Quality Assurance Sec.
埼玉県川口市宮町18－19
18-19 MIYA-cho KAWAGUCHI-shi SAITAMA-PREF.JAPAN

機種 Type	400Su F Rotor	材質 Material	JIS G 5502 FCD600「2001」	試験片 Test piece	JIS Z 2241 4号縮小 φ=10mm, GL=35mm	個数 Quantity	2

項目 Item		引張試験 Tensile Test JIS Z 2241				硬さ試験 Hardness Test JIS Z 2243	球状化率 Sphero idizing	熱処理 Heat Treatment	化学試験 Chemical Composition				
規格 Spec. / 溶解番号 Charge No.	直径 Diameter mm	荷重試験 Maximum Load N	引張強さ Tensile Strength N/mm²	耐力 Proof Stress N/mm²	伸び Elonga-tion %	硬さ Hardness H B W	%	種類 Condition / 温度 Temp.	C %	Si %	Mn %	P %	S %
										1.80-	0.20-		
Charge No.	10.00	-	≧600	≧370	≧3	170-270	≧80		≧2.5	2.40	0.50	≦0.040	≦0.020
B7089	10.09	63,200	791	471	4.6	241	83.6	Norma. 850℃X 4hs	3.43	1.89	0.38	0.021	0.008
		判定 Judgment	外観検査 Visual Inspection			合 格	Good	Temper 600℃X 5hs					
			寸法検査 Dimensional Inspection			合 格	Good						

注記 Notes

It is hereby certified that the above results are true and correct in every details.
(上記の成績は要求事項を満足している事を証明します。)

Reviewed by: K. Watanabe
MAYEKAWA. MFG, CO.,LTD

品質責任者 Chief of Inspection Dept. N. Okada

Tested by A. Muto

MYCOM

Report No. 2020249

Material Identification List

Item No.	**-**
Type of Compressor	**Screw Compressor**
Compressor Model No.	**P400SUD-HE**
Compressor Serial No.	**4055122**

No.	Name of Part	Material	Identification No.	Page	Remarks
-	Cover Flange ANSI#300-16"	SF440A	6868F	P 1	
-	Cover Flange ANSI#300-12"	SF440A	652899	P 2	
-	Cover Flange ANSI#300-2 1/2"	SF440A	653868	P 3	
-	Cover Flange ANSI#300-2"	SF440A	650135	P 2	
-	Cover Flange ANSI#300-1"	SF440A	650310	P 2	

SURVEYOR

Date : May 13, 2020

Checked by : K. Watanabe

Approved by : A. Kogiso

MAYEKAWA MFG. CO.,LTD Moriya Plant

Document No. : 68580

Ref No. : C4500475282

RESULT OF MATERIAL TEST

K. I IBA IRON WORKS CO. , LTD.
5-141-2,KANNABE-CHO,SAKAIKU,SAKAI
TEL. (072) 232-9761 ～3

Customer				End User	
Name of Article and Equipment	Flange		Material (Steel Maker)	SF440A DAIDO STEEL CO.,LTD.	JIS G3201-2008
Prosess of Manufacture	Electric Furnace Forged Steel				

Charge No.	Drawing No. or Dimension in mm	Qty.	C x 100	Si x 100	Mn x 100	P x1000	S x1000	Cu x 100	Ni x 100	Mo x 100	Cr x 100	V x 100	Nb x 100		Ceq. x 100	Spec. / Remarks
			Chemical Composition (%)													
			Max. 60	15-50	30-120	Max. 30	Max. 35									
6868F	ANSI (Rc3/4B付き) 300LB BL-RF 16″	1	23	20	34	7	16	4	4		7					C450047528 2-00010

Reviewed by: K. Watanabe
MAYEKAWA. MFG, CO.,LTD

Type of Test / Specification / Specimen No.	Dir	Tension Test: Size of Specimen,mm in Dia	Gage Length	Area Sq.	Yield Point N/mm2	Tensile Strength N/mm2	Elog. %	Red. of Area %	Bend Test 180°	Impact Test	Hardness Brinell	Heat Treatment Temperature	Remarks
					Min.225	440-540	Min. 24	Min. 45			Min. 121		
6868F IM-7286		14	70	153.9	284	451	32	52			HB 140	N.900℃ A.C	

It is hereby certified that the above results are true and correct in every details.

Surveyor to

Date of Stamp March 13, 2020

Chief Inspection Section

需要家NO. CUSTOMER'S REF. NO.

契約番号 OUR REF. NO.
SA785041-00 01

INSPECTION CERTIFICATE 検査証明書

1 0 0

Contractor 契約先	伊藤忠丸紅鉄鋼株式会社 井上特殊鋼株式会社 御中	Purchaser 需要家	御中

Chemical Composition 化学成分

Elements 成分	C %X100	Si %X100	Mn %X100	P %X1000	S %X1000	Cu %X100	Ni %X100	Cr %X100	Mo %	Ni+Cr %X100	%	%	%	%	%	%	%
Specification 規格	22 -28	15 -35	30 -60	MAX 30	MAX 35	MAX 30	MAX 20	MAX 20		MAX 35							
Results 成績	23	20	34	7	16	4	4	7		11							

Mechanical Properties 機械的性質

Items 項目	Tension Test 引張試験							Impact Test 衝撃試験		Bending Test 曲げ試験	Heat Treatment 熱処理
	Type of Specimen 試験片	Yield Strength 耐力 %	Yield Point 降伏点	Tensile Strength 引張強さ	Elongation 伸び %	Reduction of Area 絞り %	Hardness かたさ	Type of Specimen 試験片			
Specification 規格											
Results 成績											

Remarks 記事

Items 項目	Grain Size 結晶粒度	Decarburization 脱炭 mm	Streak Flaw 地きず	Body Hardness 製品かたさ	Non Metallic Inclusion 非金属介在物				
Results 成績									
Items 項目	Hardenability 熱処理かたさ								
Results 成績									

Reviewed by: K. Iwatanabe
MAYEKAWA MFG. CO., LTD.

Hardenability (End Quenching Method) 焼入性(一端焼入法)

Results 成績																	

Date 発行日	Certificate No. 証明書番号	Type of Steel 鋼種名	Size & Shape 寸法・形状	Condition 納入状態	Heat No. 溶解番号
17-08-21 N ヤユ -1	78J4256 (8SA110)	S25C	300 D	R	6868F

It is hereby certified that the above results are true and correct in every detail.
上記の成績は要求事項を満足していることを証明します。

P1-2

Chief of Quality Assurance Section
R. Oguni

Quality Assurance Section,
Chita Plant
Daido Steel Co., Ltd.
大同特殊鋼株式会社
知多工場 品質保証室

Document No. : 68581

Ref No. : C4500475282

RESULT OF MATERIAL TEST

K.I IBA IRON WORKS CO. , LTD.
5-141-2,KANNABE-CHO,SAKAIKU,SAKAI
TEL. (072) 232-9761 ～3

Customer				End User																
Name of Article and Equipment	Flange		Material (Steel Maker)	SF440A GODO STEEL, LTD.													JIS G3201-2008			
Prosess of Manufacture	Electric Furnace Forged Steel		Chemical Composition (%)																	Spec.
			C x 100	Si x 100	Mn x 100	P x1000	S x1000	Cu x 100	Ni x 100	Mo x 100	Cr x 100	V x 100	Nb x 100		Ceq. x 100					
Charge No.	Drawing No. or Dimension in mm	Qty.	Max. 60	15-50	30-120	Max. 30	Max. 35													Remarks
650135	ANSI 300LB BL-RF 2″	3	23	20	52	16	16	13	6		12									C450047528 2-00040
650310	ANSI 300LB BL-RF 1″	1	23	19	52	17	19	11	6		8									C450047528 2-00050
652899	ANSI (Rc3/4B付き) 300LB BL-RF 12″	1	23	18	51	16	14	13	5		11									C450047528 2-00020

Reviewed by: K. Watanabe
MAYEKAWA MFG. CO.,LTD.

Type of Test	Dir	Tension Test						Bend Test	Impact Test	Hardness	Heat Treatment Temperature	Remarks
		Size of Specimen,mm in			Yield Point N/mm2	Tensile Strength N/mm2	Elog. %	Red. of Area %	180°		Brinell	
Specification		Dia	Gage Length	Area Sq.								
Specimen No.					Min.225	440-540	Min. 24	Min. 45			Min. 121	
650135 IM-7170		14	70	153.9	304	467	34	55			HB 143	N.900℃ A.C
650310 IM-6715		14	70	153.9	294	471	34	55			HB 143	N.900℃ A.C
652899 IM-7050		14	70	153.9	294	465	33	55			HB 143	N.900℃ A.C

It is hereby certified that the above results are true and correct in every details.

Surveyor to

Date of Stamp March 13, 2020

Chief Inspection Section

INSPECTION CERTIFICATE
鋼材検査証明書

GODO STEEL, LTD. HIMEJI WORKS
合同製鐵株式会社姫路製造所
2946, NAKASHIMA, SHIKAMA-KU, HIMEJI CITY, HYOGO PREF, JAPAN
姫路市飾磨区中島２９４６番地

Contract No. 注文No.: 50610873055
Order's No. 注文組合番号:
Supplier 注文者: 合鐵産業株式会社
Commodity 品名: 機械構造用炭素鋼
Specification 規格: JIS G4051 S25C
Customer 需要家: 森寅鋼業株式会社
Shipper :
Destination 揚港:
工事名称:

JIS No. JIS認証番号 : QA0507027

Ship No. 船番 :

Certificate No. 証明書番号 : 5020181101487
Date 発行日 : 2018/11/14
処理コード : 1114 44370

Size 寸法 φmm	Length 長さ	Quantity 員数	Mass 質量 kg	Charge No. 鋼番	Chemical Composition 化学成分(%) C X100 22 - 28	Si X100 15 - 35	Mn X100 30 - 60	P X1000 Max. 30	S X1000 Max. 35	Cu X100 Max. 30	Ni X100 Max. 20	Cr X100 Max. 20	TE X100 Max. 35
240	6.000m	1	2,130	652899	23	18	51	16	14	13	5	11	16
合計		1	2,130										

Size 寸法 φmm	Charge No. 鋼番	Tensile Test 引張試験 (GL=50mm) Y.P. 降伏点又は0.2%耐力 N/mm2	T.S. 引張強さ N/mm2	EL. 伸び % Min. 27	R.A. 絞り %	Bend Test 曲げ試験	Angle °	Hardness 硬度 HBW	Impact Test 衝撃試験	熱処理
240	652899	351	503	35				141		T.P N

TE:Ni+Cr

Reviewed by: K. Iwatandoe
MAYEKAWA. MFG, CO.,LTD

Leader of Quality Control Group
品質管理グループリーダー
Hiroyasu Yoshikawa
吉川 弘康

Surveyor to

WE HEREBY CERTIFY THAT THE MATERIAL DESCRIBED HEREIN HAS BEEN MADE IN ACCORDANCE WITH THE RULES OF THE CONTRACT
上記注文品は御指定の規格または仕様に従つて製造され、その要求事項を満足していることを証明します。

C015100FR002A01

INSPECTION CERTIFICATE
鋼材検査証明書

GODO STEEL, LTD. HIMEJI WORKS
合同製鐵株式会社姫路製造所
2946, NAKASHIMA, SHIKAMA-KU, HIMEJI CITY, HYOGO PREF, JAPAN
姫路市飾磨区中島２９４６番地

Contract No. 注文No.: 111067A0015
Order's No. 註文書整番号: 017690 441
Supplier 注文者: 日鉄住金物産株式会社
Commodity 品名: 機械構造用炭素鋼
Specification 規格: JIS G4051 S25C
Customer 需要家:
Shipper :
Destination 揚港:
工事名称:

JIS No. JIS認証番号 : QA0507027

Ship No.船番 :

Certificate No. 証明書番号 : 5020180201866
Date 発行日 : 2018/02/20
処理コード : 0220 49821

Size 寸法 φmm	Length 長さ	Quantity 員数	Mass 質量 kg	Charge No. 鋼番	Chemical Composition 化学成分(%) C X100 22 – 28	Si X100 15 – 35	Mn X100 30 – 60	P X1000 Max. 30	S X1000 Max. 35	Cu X100 Max. 30	Ni X100 Max. 20	Cr X100 Max. 20	TE X100 Max. 35
60	6.000m	32	4,256	650073	23	20	52	17	19	16	7	9	16
70	6.000m	12	2,172	650310	23	19	52	17	19	11	6	8	14
110	6.000m	5	2,240	650135	23	20	52	16	16	13	6	12	18
130	6.000m	3	1,872	553629	22	20	51	22	16	9	10	8	18
合計		52	10,540										

Size 寸法 φmm	Charge No. 鋼番	Tensile Test 引張試験 Y.P. 降伏点又は0.2%耐力	T.S. 引張強さ	EL. 伸び %	R.A. 絞り %	Bend Test 曲げ試験 Angle °	Hardness 硬度	Impact Test 衝撃試験	

TE:Ni+Cr

Reviewed by: K. Watanabe
MAYEKAWA. MFG, CO

Leader of Quality Control Group
品質管理グループリーダー
Hiroyasu Yoshikawa
吉川 弘康

Surveyor 10

WE HEREBY CERTIFY THAT THE MATERIAL DESCRIBED HEREIN HAS BEEN MADE IN ACCORDANCE WITH THE RULES OF THE CONTRACT.
上記注文品は御指定の規格または仕様に従って製造され、その要求事項を満足していることを証明します。

Document No. : 68582

Ref No. : C4500475282

RESULT OF MATERIAL TEST

K. I IBA IRON WORKS CO. , LTD.
5-141-2,KANNABE-CHO,SAKAIKU,SAKAI
TEL. (072) 232-9761 ~3

Customer				End User															
Name of Article and Equipment	Flange			Material (Steel Maker)	SF440A GODO STEEL, LTD.													JIS G3201-2008	
Prosess of Manufacture	Electric Furnace Forged Steel			Chemical Composition (%)															Spec.
				C x 100	Si x 100	Mn x 100	P x1000	S x1000	Cu x 100	Ni x 100	Mo x 100	Cr x 100	V x 100	Nb x 100			Ceq. x 100		
Charge No.	Drawing No. or Dimension in mm		Qty.	Max. 60	15-50	30-120	Max. 30	Max. 35											Remarks
653868	ANSI 300LB BL-RF 2-1/2"		2	22	17	52	13	7	12	7		10							C450047528 2-00030

Reviewed by: K. Iwatsuka
MAYEKAWA. MFG, CO.,LTD

Type of Test	Dir	Tension Test						Bend Test	Impact Test	Hardness	Heat Treatment Temperature	Remarks
		Size of Specimen,mm in			Yield Point N/mm2	Tensile Strength N/mm2	Elog. %	Red. of Area %	180°		Brinell	
Specification		Dia	Gage Length	Area Sq.								
Specimen No.					Min.225	440-540	Min. 24	Min. 45			Min. 121	
653868 IM-8205		14	70	153.9	298	459	33	53			HB 140	N.900℃ A.C

It is hereby certified that the above results are true and correct in every details.

Surveyor to

Date of Stamp March 13, 2020

Chief Inspection Section

INSPECTION CERTIFICATE
鋼材検査証明書

GODO STEEL, LTD. HIMEJI WORKS
合同製鐵株式会社姫路製造所
2946, NAKASHIMA, SHIKAMA-KU, HIMEJI CITY, HYOGO PREF, JAPAN
姫路市飾磨区中島２９４６番地

Contract No. 注文No.: 111068C0030
Order's No. 注文書照合番号: 017690 441
Supplier 注文者:
Commodity 品名: 機械構造用炭素鋼
Specification 規格: JIS G4051 S25C
Customer 需要家:
Shipper :
Destination 揚港:
工事名称:

JIS No. JIS認証番号 : QA0507027

Ship No. 船番 :

Certificate No. 証明書番号 : 5020190302208
Date 発行日 : 2019/03/22
処理コード : 0322 41286

Size 寸法 φmm	Length 長さ	Quantity 員数	Mass 質量 kg	Charge No. 鋼番	Chemical Composition 化学成分(%) C X100 22 - 28	Si X100 15 - 35	Mn X100 30 - 60	P X1000 Max. 30	S X1000 Max. 35	Cu X100 Max. 30	Ni X100 Max. 20	Cr X100 Max. 20	TE X100 Max. 35
110	6.000m	5	2,240	750439	23	22	53	23	17	14	8	9	17
130	6.000m	6	3,744	653868	22	17	52	13	7	12	7	10	17
合計		11	5,984										

Size 寸法 φmm	Charge No. 鋼番	Tensile Test 引張試験 Y.P. 降伏点又は0.2%耐力	T.S. 引張強さ	EL. 伸び %	R.A. 絞り %	Bend Test 曲げ試験	Angle °	Hardness 硬度	Impact Test 衝撃試験	

Reviewed by: K. Watanabe
MAYEKAWA. MFG, CO.,LTD

TE:Ni+Cr

Surveyor to

Leader of Quality Control Group
品質管理グループリーダー
Hiroyasu Yoshikawa
吉川 弘康 H. Yoshikawa

WE HEREBY CERTIFY THAT THE MATERIAL DESCRIBED HEREIN HAS BEEN MADE IN ACCORDANCE WITH THE RULES OF THE CONTRACT.
上記注文品は御指定の規格または仕様に従つて製造され、その要求事項を満足していることを証明します。

C015100FR002A01

MYCOM

Report No. 2020249

Hydrostatic & Gas Leak Tests Report

Item No.	-
Type of Compressor	Screw Compressor
Compressor Model No.	P400SUD-HE
Compressor Serial No.	4055122

TEST RECORD

Item	Design Pressure PSIG	Test Pressure PSIG	Used Fluid	Hold Time(Min)	Tested Date	Judgment
Hydrostatic test	377	566	OIL	30	April 13, 2020	Accepted
Gas leak test	377	377	Air	30	April 14, 2020	Accepted

USED PRESSURE GAUGES

Item	Dia × Max. Pres. MPaG	Manufacturer	Class(JIS)	No.
Hydrostatic test	ϕ 100 × 7.0	NAGANO	1.5	1 , 2
Gas leak test	ϕ 100 × 5.0	NAGANO	1.5	3 , 4

Note :

No.	Registration No.	Terms of validity
1	AA-70116	Jul,2020
2	AA-70126	Jul,2020
3	AA-50013	Jul,2020
4	AA-50138	Jul,2020

SURVEYOR

Checked by : K. Watanabe

Approved by : A. Hagiwara

MYCOM

Report No. 2020249

Screw Compressor Test Record

Item No.	:	-
Date	:	April 9, 2020
Model	:	P400SUD-HE
Serial No.	:	4055122
Test fluid	:	AIR
Orifice No.	:	17
Time	:	14:00
Inspection items	:	Internal test

SURVEYOR

Revolution		2994	min^{-1}
Running Torque		2190.0	N·m
Room Temperature		21.0	℃
Atmospheric Pressure		1010	hPa.
Discharge Pressure		0.70	MPa.G
Suction Pressure	L(7.00) kPa R(7.00) kPa	0.00	kPa
Pressure Before Orifice	L(12.72) kPa R(6.92) kPa	5.80	kPa
Pressure Difference at Orifice	L(8.00) kPa R(5.98) kPa	2.02	kPa
Oil Pressure		0.90	MPa.G
Suction Temperature		31.0	℃
Temperature Before Orifice		34.0	℃
Oil Temperature		40.0	℃
Discharge Temperature		68.0	℃

Noise	96.0	dB(A)
Background Noise	71.1	dB(A)

TEST RESULTS;

Temp. of Rotor Casing		57.0	℃
Temp. of Bearing Head		52.0	℃
Temp. of Shaft Seal		54.0	℃
Test of Vibration	V	1	μm
	H	1	μm
	A	2	μm

Approved by : A. Moriyama

Checked by : K. Watanabe

MAYEKAWA MFG.CO.,LTD. Moriya Plant

MYCOM

Report No. 2020249

Screw Compressor Test Results

SURVEYOR

GENERAL INFORMATION;

Item No.	:	-
Model	:	P400SUD-HE
Serial No.	:	4055122
Date of Test	:	April 9, 2020
Tested at	:	MAYEKAWA MFG. CO.,LTD. MORIYA PLANT 2000, Tatsuzawa Moriya-City, Ibaraki-Pref., 302-0118, Japan

PERFORMANCE TEST ;

			STANDARD	ACTUAL		Judgment	CRITERIA
Capacity	(m^3/h)	:	5738.6	5911.8	(103.0 %)	Accepted	95% and more
Brake Kilowatts	(BkW)	:	674.4	686.0	(101.7 %)	Accepted	105% or less

MECHANICAL RUNNING TEST ;

		ALLOWABLE MAXIMUM		ACTUAL		Judgment
Temp. of Rotor Casing	:	75.0	≧	57.0	℃	Accepted
Temp. of Bearing Head	:	75.0	≧	52.0	℃	Accepted
Temp. of Shaft Seal	:	60.0	≧	54.0	℃	Accepted

VIBRATION AND NOISE TESTS ;

			ALLOWABLE MAXIMUM		ACTUAL		Judgment
Noise		:	103	≧	96.0	dB(A)	Accepted
Vibration (Frequency range : 10 - 1000Hz)	V	:	20	≧	1	μm	Accepted
	H	:	20	≧	1	μm	Accepted
	A	:	20	≧	2	μm	Accepted

Approved by : A. Hayama

Checked by : K. Tsutsumibe

MYCOM

Report No. 2020249

Dismantling Inspection Report

Item No.	-
Type of Compressor	**Screw Compressor**
Compressor Model No.	**P400SUD-HE**
Compressor Serial No.	**4055122**
Inspection Date	**April 13, 2020**

Criteria : There shall not be any defects which harm the use of compressor (I.E. irregular abrasions or damages)

No.	Parts Name	Result	Remarks
25	Male Rotor	Accepted	
26	Female Rotor	Accepted	
27 M	Main Bearing for Male Rotor	Accepted	
27 F	Main Bearing for Female Rotor	Accepted	
28 M	Side Bearing for Male Rotor	Accepted	
28 F	Side Bearing for Female Rotor	Accepted	
38 M	Thrust Bearing for Male Rotor	Accepted	
38 F	Thrust Bearing for Female Rotor	Accepted	
60	Unloader Cylinder	Accepted	
100	Mechanical Seal Assembly	Accepted	

SURVEYOR

Checked by : K. Watanabe

Approved by : A. Moriyama

MAYEKAWA MFG.CO.,LTD Moriya Plant

MAYEKAWA

Mycom Compressor Services

Recommended Procedures for Long Term Storage

The following recommendations will help to protect and preserve your compressor. To prevent corrosion of the internal parts and to prevent false brinnelling of the compressor bearings, proper storage is imperative.

A. Compressor Internals

1. Close off all ports and flange openings, leaving the suction inlet open.
2. Fill the suction inlet with NEW compressor oil.
3. Slowly turn compressor over with a spanner wrench until all air is worked out. Top off with oil and repeat until completely full. Close off suction inlet.
4. When possible, vent the air from the seal housing.
5. Some compressors may require that the suction end of the machine be propped up to allow the oil to completely cover the rotors.

B. Compressor External

1. Coat the shaft with oil and wrap with protective material such as a shop towel and duct tape.
2. Cover the machine with plastic or a drop cloth to keep clean.
3. If possible, store the compressor in an area where it is not subjected to vibration from nearby equipment.

C. Periodic Maintenance

1. Rotate the compressor shaft ¼ to ½ turn every 90 days.
2. Oil shaft and re-apply protective coating every three months.
3. Maintain a storage log.

Filling the compressor with oil may not always be possible. If the compressor is installed on a package and can not be filled with oil, maintain a dry nitrogen holding charge on the entire unit. Items "B" and "C" listed above will still apply.

MAYEKAWA USA INC
3395 Farmtrail Road, York PA 17406-5616 Phone: (717) 779-0138 Fax: (717) 779-0109

MYCOM

WARRANTY

MYCOM
CANADA LTD.

STANDARD CONDITION OF SALE

a) Seller warrants the goods against defects of materials and workmanship under normal use and service for a period of 18 months after the date of shipment or 12 months after the date of commencement of operations, which ever occurs first. This warranty does not cover ordinary wear and tear, corrosion, abuse, misuse, overloading, or altered products. This warranty is extended only to the original Buyer and is not transferable.

b) The obligations of Seller under the warranty set out in paragraph (a) will be limited to resupplying f.o.b. Seller's warehouse, unless otherwise specified, any part or parts which may prove to be defective and allowing credit therefor in an amount to be established by the Seller if:

(i) Buyer has fully complied with Terms of Payment

(ii) Buyer gives seller prompt written notice of the defect or defects

(iii) Buyer returns the part alleged to be defective to Seller's warehouse freight prepaid and,

(iv) inspection of Seller confirms the defect or defects.

Buyer agrees that if the procedure is not followed or Seller does not confirm the defect or defects, the Buyer will be required to pay the full price for the part supplied f.o.b. Seller's warehouse. Buyer agrees that this remedy of being allowed credit for the part in an amount to be established by the Seller, is the exclusive remedy under this Contract. Buyer will not be entitled to any claim for labour charges or the installation of the part or parts.

c) No warranties of any kind, whether express or implied, are made by Seller with respect to the Goods unless specifically contained in this Contract. Seller disclaims all other express, statutory, and implied warranties applicable to the Goods, including, without limiting the generality of the foregoing, all implied warranties of merchantability and the fitness for use. In no event will Buyer or User be entitled to recover under the warranty contained in this Contract for incidental or consequential damages including, but not limited to, damages for inconvenience, rental or replacement equipment, loss or profits, or other commercial loss. Seller will not be bound by any representations, agreements, terms, conditions, or warranties made by any employee or agent of Seller relating to this transaction unless they are specifically contained in this Contract, and Buyer specifically represents that he has not relied upon any representations, agreements, terms, conditions, or warranties other than those contained herein.

d) Seller will not be liable to Buyer or Buyer's business for any loss of income therefrom or for damages to goods, wares, merchandise, or other property of Buyer, Buyer's employees, invitees, or any other person, in or about the premises of Buyer or elsewhere, and Buyer hereby assumes all the risks of damaged property or injury to person arising from any cause and thereby waives all claims with respect thereof against Seller.

e) On equipment furnished by Seller, but manufactured by others, Seller extends the same warranty as Seller receives from the manufacturer thereof.