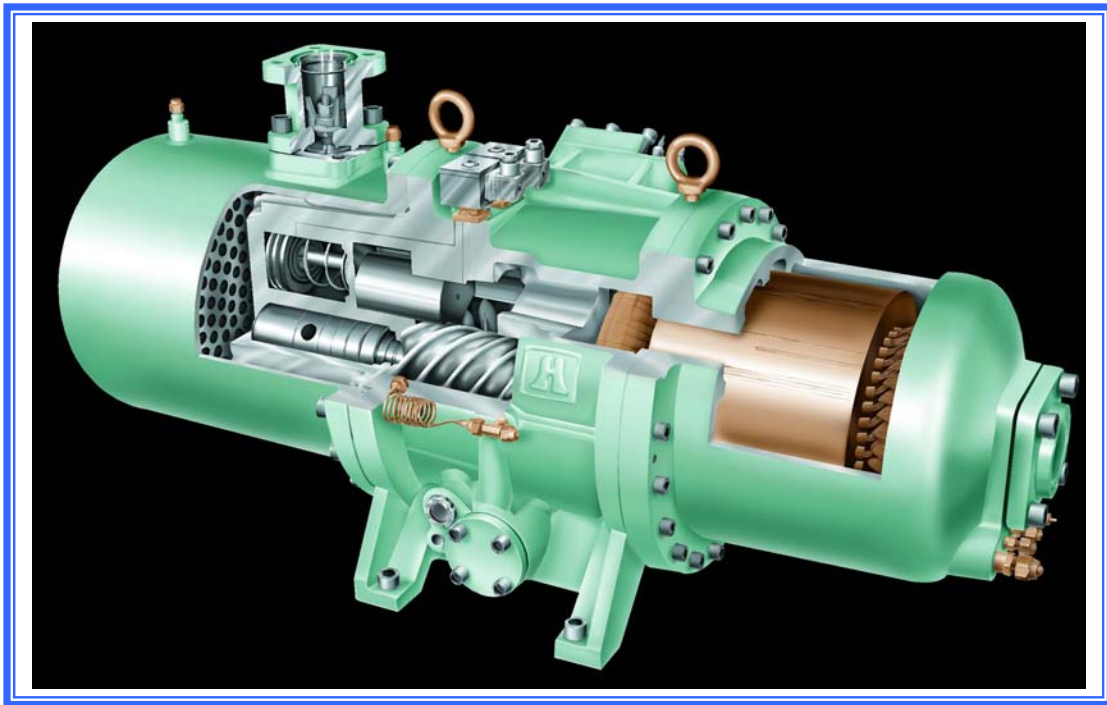




HANBELL SCREW COMPRESSORS

Service Manual



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INTRODUCTION

The HANBELL semi-hermetic twin-screw compressor is developed especially for applications in air-conditioning and refrigeration. With a built-in high operating load design, each compressor is high efficiency and reliability in all working conditions such as thermal storage, and heat pump system. Each compressor has the latest and advanced 5 to 6 Patented Profile design.

This service manual has been prepared for better maintenance performance by HANBELL semi-hermetic twin-screw refrigeration compressors. This service manual provides maintenance policies and gives full details regarding the proper handling and maintenance of the screw compressors to the person in-charge.

HANBELL semi-hermetic twin-screw refrigeration compressors have been developed by HANBELL's own technology and high precision-made machines as compared to ordinary reciprocating compressors. Therefore, before starting the maintenance and overhaul of the compressor we suggest that proper preparation and handling of each components, parts, tools, equipment, and full knowledge of this manual are required.

Although proper maintenance procedures are described in this service manual, maintenance work of the screw compressors should be performed by the persons with full understanding of such work.

1. SCOPE

This HANBELL semi-hermetic twin-screw compressors service manual is applicable to RC series, which is inclusive of RC10~RC11, RC12~RC21, RC22~RC24.

2. DESCRIPTION OF DESIGN

The HANBELL semi-hermetic twin-screw compressors have been developed by HANBELL's own technology, including the basic research and development activities, production engineering, and system engineering. HANBELL screw compressors used the simple and more reliable oil separator and unique types of bearing for axial and radial loads. It also used the high precision CNC MACHINING CENTER, THREAD GRINDING MACHINE to machine the compressor casing and screw rotors, and it is tested in a 3-D MEASURING MACHINE to ensure its high quality performance.

2-1. COMPRESSOR SPECIFICATIONS

Compressor	Displacement	m^3 / hr	RC10	RC11	RC12	RC13	RC14	RC15	RC15L	RC16	RC17
			118/98	165/137	207/172	233/193	309/257	352/293	384/320	490/407	567/471
	Rated Speed	rpm	3550/2950								
	Volume Ratio	V_i	2.2 - 2.6 - 3.0 - 3.5 - 4.8								
	Capacity Control	%	3-steps, or 33%~100% continuous		4-steps, or 25%~100% continuous capacity control system						
Lubrication		Differential pressure feed lubricant									
Motor	Type		3 Phase, 2 Pole, Squirrel-Cage, Induction Motor								
	Starting -up		Y- Δ Starting								
	Frequency	Hz	60/50								
	Voltage	V	220, 380, 440, 460, 480 / 380, 400, 415								
	Insulation		Class F								
	Protection		PTC PROTECTION								
Lubricant Charge	Liter	7	7	7	8	14	16	16	15	18	
Oil Heater	W	150									
Hydrostatic Pressure Test	kg / cm^2G	42									
Weight	kg	260	270	390	435	540	620	620	760	830	

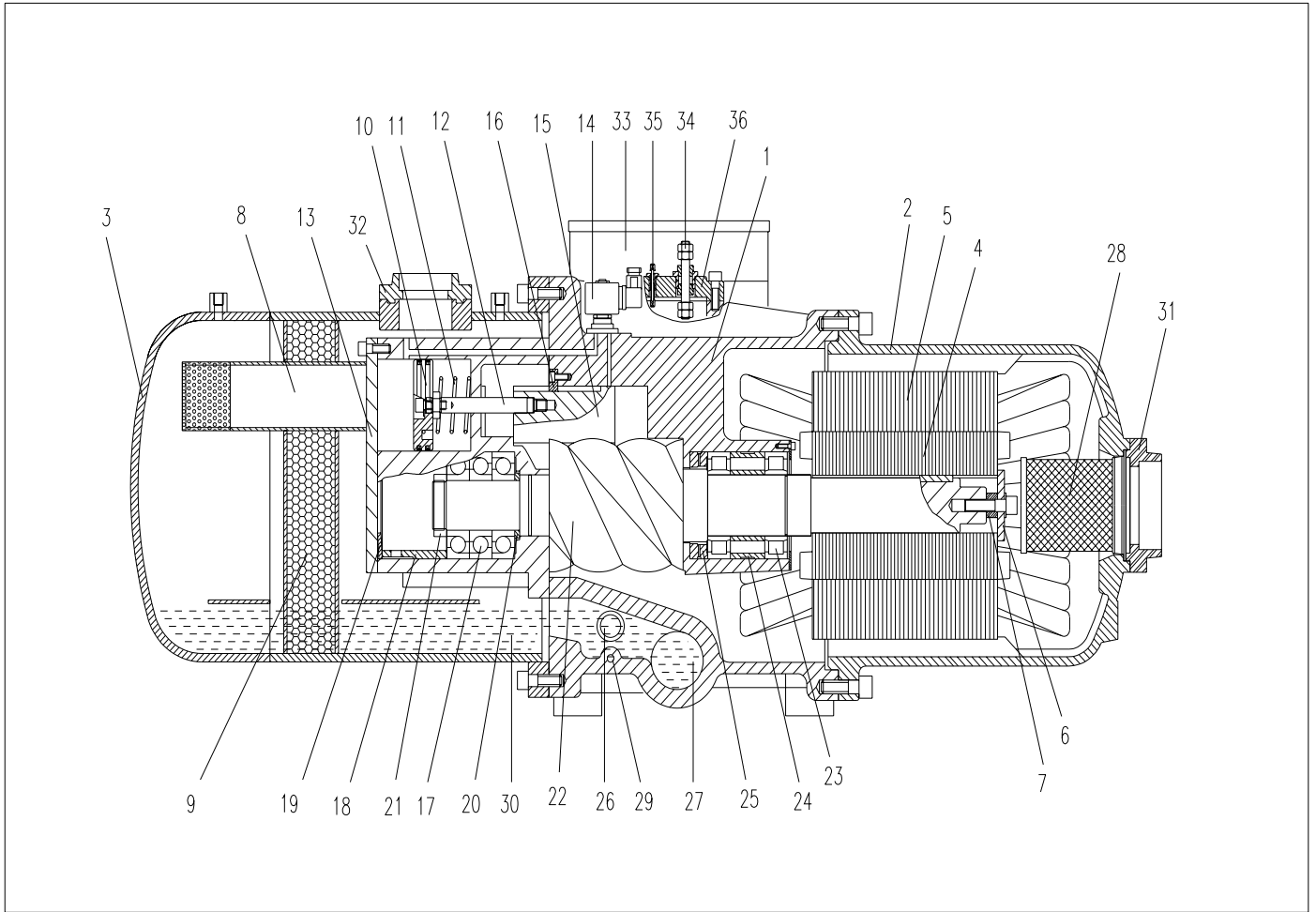
Compressor	Displacement	m^3 / hr	RC18	RC19	RC20	RC21	RC22	RC23	RC24	-	-
			670/545	735/598	952/774	1024/832	1310/1089	1536/1277	1832/1522	-	-
	Rated Speed	rpm	3550/2950								
	Volume Ratio	Vi	2.2 - 2.6 - 3.0 - 3.5 - 4.8								
	Capacity Control	%	4-steps, or 25%~100% continuous capacity control system								
Lubrication		Differential pressure feed lubricant									
Motor	Type		3 Phase, 2 Pole, Squirrel-Cage, Induction Motor								
	Starting -up		Y- Δ Starting (For RC22~24, Direct starting/ cross on-line or reactance starting)								
	Frequency	Hz	60/50								
	Voltage	V	380, 440, 460, 480 / 380, 400, 415								
	Insulation		Class F								
	Protection		PTC PROTECTION								
Lubricant Charge	Liter	23	23	28	28	-	-	-	-	-	
Oil Heater	W	150									
Hydrostatic Pressure Test	kg / cm ² G	42									
Weight	kg	880	990	1220	1240	1490	1580	1630	-	-	

2-2. CONSTRUCTION

HANBELL semi-hermetic twin-screw compressors are constructed with the following three major components; the compressor compartment, the hermetic motor compartment and the oil separator compartment.

- (A) The compressor compartment includes twin-screw helical rotors, bearings and components for capacity control system.
- (B) The hermetic motor compartment includes the motor stator, motor rotor, six terminal plugs for electric power connections, an internal thermostat inserted into the stator coil to protect the motor from burning out, two terminal plugs for the thermostat, and a suction gas strainer.
- (C) The oil separator compartment consists of demister and chambers to serve as an oil separator and an oil reservoir. The rotor of the hermetic motor is connected directly at the suction end of the male rotor shaft and drives the rotor shaft at rated speed of 2,950 rpm at 50 Hz and 3,550 rpm at 60 Hz respectively.

Fig. 1 Construction of screw compressor



- | | |
|-------------------------------|--|
| 1. Compressor casing | 19. Disc spring |
| 2. Motor casing | 20. α Balance piston |
| 3. Oil separator | 21. Bearing slot nut |
| 4. Motor rotor assembly | 22. Male rotor |
| 5. Motor stator assembly | 23. Suction bearing |
| 6. Motor rotor washer | 24. Suction bearings inner/outer spacer ring |
| 7. Motor rotor spacer ring | 25. Oil guiding ring |
| 8. Oil separator baffle | 26. Oil level sight glass |
| 9. Oil separator cartridge | 27. Oil filter cartridge |
| 10. Piston | 28. Suction filter |
| 11. Piston spring | 29. Oil heater |
| 12. Piston rod | 30. Refrigeration lubricant |
| 13. Bearing seat's | 31. Suction flange |
| 14. Modulation solenoid valve | 32. Discharge flange |
| 15. Modulation slide valve | 33. Cable box |
| 16. Slide valve key | 34. Power bolt |
| 17. Discharge bearings | 35. Thermostat terminals |
| 18. Discharge fixed ring | 36. Motor cable cover plate |

3. OPERATIONS AND MAINTENANCE

Before attempting to do some maintenance and troubleshooting, the person in-charge must have full knowledge and understanding of maintenance work of compressor or it should be an authorized technician from HANBELL.

3-1. IMPORTANT INSTRUCTION

A. Before commencing any maintenance work, the screw compressor unit must be put out of operation according to the operating instructions. All refrigerant should be removed and the unit must be depressurized.

B. Preparations for maintenance work on the compressor are to be undertaken in such a manner that it is only necessary for the machine to be open for a short period.

C. Utmost cleanliness during assembly is absolutely essential for continued trouble-free operation.

D. After maintenance and repair work has been completed, the parts must be cleaned with an organically degreasing agent and treated with the refrigerating machinery lube oil of the same brand used in the plant.

3-2. PRE-START CHECKLIST

Table 1

Items	Things to be checked	States or standard values
1. Accessories	<ol style="list-style-type: none"> 1. Oil level 2. Time for heating the oil 3. System valves status 4. Solenoid valves 5. Capillary 	<ol style="list-style-type: none"> 1. Higher than the middle line of oil level sight glass 2. Turn on the oil heater at least 8 hrs. before starting 3. Opened 4. Fixed 5. No serious distortion or damaged
2. Electrical system	<ol style="list-style-type: none"> 1. Voltage of main power. 2. Voltage of control circuit. 3. Insulation resistance value of the motor: between phase to phase and phase to ground. 4. Power terminals and wire cables terminal connections. 5. Grounded. 6. Capacity of electrical accessories. 7. Setting of switches, sensors and controllers. 	<ol style="list-style-type: none"> 1. Electricity voltage should be kept within 5% to the rated voltage, instant maximum voltage drop while starting should be less than 10% to the rated voltage. 2. Standard voltage is 220V. Maximum voltage is 230V. 3. Insulation resistance value should be above 5 MΩ. 4. Power terminals are firmly fixed on terminal block and well insulated. Keep wire cables away from heat source and sharpened metal. Terminal screw and block are both required. 5. Ruled by the local Electricity Regulations. 6. Properly selected (or inquired by the system designer.) 7. Properly set (or inquired by the system designer.)
3. Piping system	<ol style="list-style-type: none"> 1. Outer system piping 2. Leakage test 3. Bolts to fix the compressor. 	<ol style="list-style-type: none"> 1. Fixed firmly. 2. No leakage. 3. Fix the compressor tightly.
4. Safety devices	<ol style="list-style-type: none"> 1. Motor coil sensor (thermister) 2. Discharge sensor (thermister) 3. Controller 	<ol style="list-style-type: none"> 1. Connected in series with discharge sensor to controller. 2. Connected in series with motor sensor to controller. 3. Closed circuit with N.C. & N.O.

NOTE:

A. In addition to the checklist mentioned in table 1, it is necessary to pay more attention to the auxiliary facilities while the chiller commissioned at the job site and the periodic maintenance after the initial start-up.

B. In order to keep the capacity control smoothly under the low ambient temperature with normal oil viscosity, it is required to heat first the oil for at least 8 hours before the next starting. The lower the ambient temperature is, the longer the heating time of oil. The oil temperature should be over **23°C** before starting the compressor. Keep the oil heater energizing after the compressor shut down, for preparation for the next start-up.

C. Check all the settings on each pressure switch, timer relay.

D. Check if all the stop valves have been opened.

E. The running conditions of compressor after commissioning at the factory or job site should be adjusted. The discharge temperature should be 20K above the saturated condensing temperature, the superheat of suction vapor should be within 10K to the saturated evaporating temperature.

3-3. COMPRESSOR START-UP

Compressor motor designed for Y-Δ connection, refer to figure 2 shown below for the wiring connections.

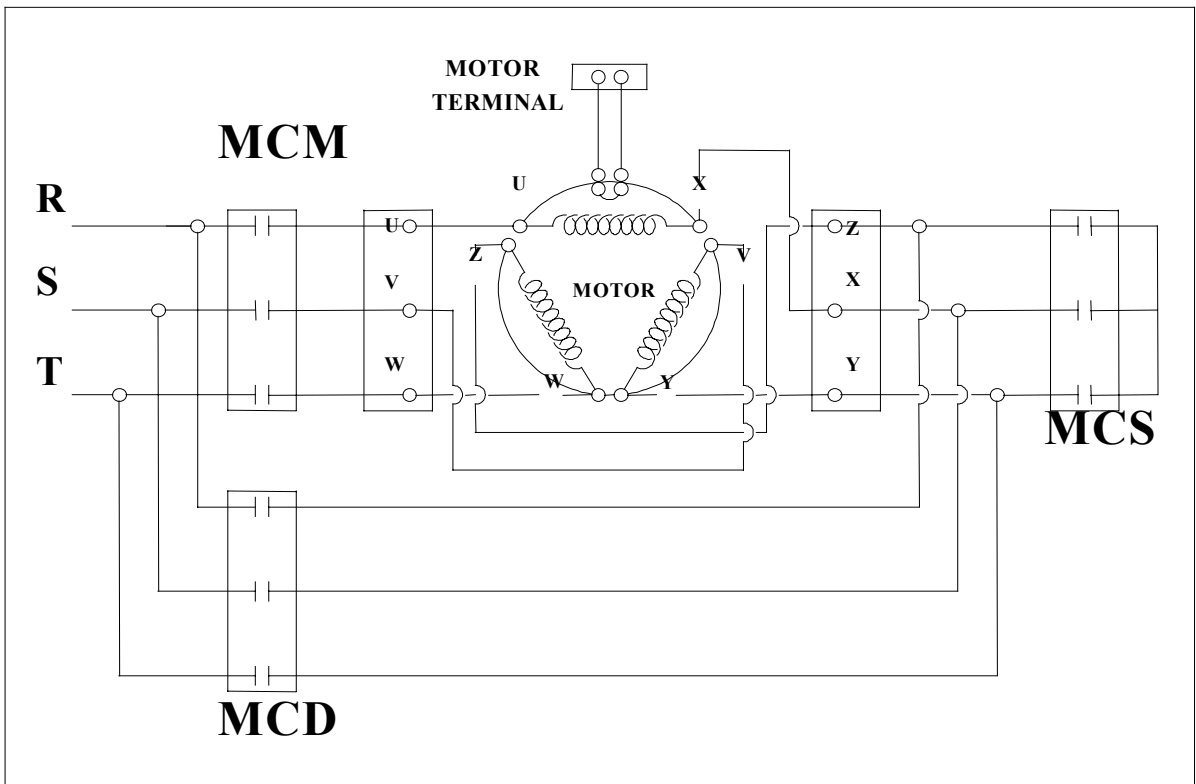


Fig. 2

3-3.1 Start-up limitations

A. Lowest starting voltage: The power voltage cannot be lower than 10% of the rated voltage during the starting-up period of the compressor.

B. Maximum discharge pressure: 18kg/cm² G

C. Minimum suction pressure: 6~8kg/cm² G

D. Maximum designed discharge pressure: 28kg/cm² G

E. Maximum designed discharge temperature: 110°C

3-3.2 Starting current, continuous current of compressor (LRA, MCC)

The current of motor coil (stator) energized with rated frequency and voltage during the motor rotor locked, so the starting current is the same as the locked rotor ampere (LRA).

Starting current of RC compressor (LRA) for R22, R404A, R407C, R507A

Model	380V, 60Hz	380V, 50Hz	Model	380V, 60Hz	380V, 50Hz
RC10	300	250	RC17	1120	1030
RC11	330	275	RC18	1350	1195
RC12	410	340	RC19	1805	1385
RC13	540	445	RC20	2365	1650
RC14	600	510	RC21	2365	2100
RC15	815	710	RC22	2345	2255
RC15L	815	710	RC23	2945	2830
RC16	885	765	RC24	3065	2945

Starting current of RC compressor (LRA) for R134a

Model	380V, 60Hz	380V, 50Hz	Model	380V, 60Hz	380V, 50Hz
RC10	220	180	RC17	840	710
RC11	240	210	RC18	970	785
RC12	295	255	RC19	1200	980
RC13	390	315	RC20	1440	1330
RC14	435	365	RC21	1815	1330
RC15	600	500	RC22	1790	1350
RC15L	600	500	RC23	1790	1350
RC16	885	765	RC24	1790	1350

Maximum continuous current of RC compressor (MCC) for R22, R404A, R407C, R507A

Model	380V, 60Hz	380V, 50Hz	Model	380V, 60Hz	380V, 50Hz
RC10	87	72	RC17	354	290
RC11	107	91	RC18	416	352
RC12	139	116	RC19	472	395
RC13	147	122	RC20	590	493
RC14	199	165	RC21	635	528
RC15	257	215	RC22	628	522
RC15L	257	215	RC23	736	612
RC16	324	275	RC24	843	701

Maximum continuous current of RC compressor (MCC) for R134a

Model	380V, 60Hz	380V, 50Hz	Model	380V, 60Hz	380V, 50Hz
RC10	71	58	RC17	285	236
RC11	86	72	RC18	335	277
RC12	105	87	RC19	367	305
RC13	118	97	RC20	474	395
RC14	156	129	RC21	510	425
RC15	202	169	RC22	510	425
RC15L	202	169	RC23	510	425
RC16	324	275	RC24	510	425

NOTE: Please refer to the latest HANBELL SELECTION PROGRAM for more information regarding the Electrical data. Contact sales department, e-mail address: sales@hanbell.com,

3-3.3 Running restraint of compressor

A. The starting for the Y start is usually set at 4 ± 1 second, and the maximum allowable shift time from Y to Δ be 40 milliseconds. It is advisable to change the Y starting time prior to different working condition in the job site in accordance with the current variation of Y starting. It is recommended that the duration of Y starting is not over 15 seconds at the step of 25% capacity.

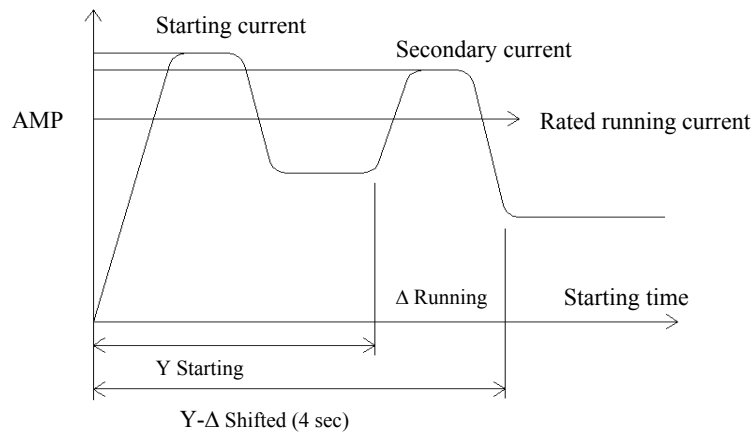


Fig. 3

B. Power supply:

1. Voltage: Long-term running – Rated voltage $\pm 5\%$
2. Instant running – Rated voltage $\pm 10\%$
3. Frequency: Rated frequency $\pm 2\%$
4. Phase current unbalance: The difference between biggest phase current differential and smallest phase current differential is advised to be less than 3%. If the phase current unbalance happens, change the supply power of any of the two phases to avoid the trouble caused by motor or

primary power supply. If the problem occurs then shut down the chiller immediately and do the troubleshooting and then restart the chiller.

C. Phase voltage unbalance: $\pm 2.25\%$

D. Control voltage: Standard sub-control voltage is 220V on HANBELL screw compressor.

3-4. PROTECTIVE DEVICES

Table 2, shows some of the protective devices which are very essential to protect the compressor and operate safely and smoothly.

Table 2 Compressor protective devices (for different application)

Protection switch	Set point
Motor wiring temperature protector	Cutout 120°C, Cut in 75°C
High discharge temperature protector	Cutout 110°C, Cut in 60°C
Phase reversal protector	Phase reversal when power on
Hi-Low pressure protector	Highest pressure 25Kg/cm ² G
Phase failure protector	Phase failure when comp starting or running
Motor overload relay	Set by a related application value, any setting should be tripped in 15 sec.
Hi-Low Voltage protector	Rated Voltage $\pm 10\%$
Oil level switch	Oil level lower than the floating ball
Oil pressure differential switch	Cutout 2.5Kg/cm ² g

3-5. TROUBLESHOOTING AND MAINTENANCE SCHEDULE

For the replacements or status of some compressor accessories refer to the maintenance schedule table 3. Table 4 shows some problem that may encounter when the screw compressor are not running well.

Table 3. Maintenance schedule

CHECK POINTS	TIME PERIOD							
	1000 hrs	2500 hrs	5000 hrs	10000 hrs	15000 hrs	20000 hrs	25000 hrs	30000 hrs
Electrical insulations				✓		✓		✓
Oil filter cartridge				✓		✓		✓
Suction filter								✓
Piston rings								△
Oil level	✓	✓	✓	✓	✓	✓	✓	✓
Motor thermal protector			✓	✓	✓	✓	✓	✓
Bearings				✓		✓		✓/□

Legend: ✓ check or clean □ replaced

Table 4. Problems and probable causes

PROBLEMS	PROBABLE CAUSES
<p>1. Sudden trip of motor thermal protector/thermister</p>	<ol style="list-style-type: none"> 1. Low suction pressure or high suction temperature (lack of refrigerant, clogged suction filter) or high suction superheat. 2. Motor overload, no liquid injection system or liquid injection system failure. 3. Motor wiring protector failure. 4. Electrical system failure, or unstable. 5. Bad motor coil winding causing temperature rise rapidly.
<p>2. Compressor unable to load</p>	<ol style="list-style-type: none"> 1. Low ambient temperature or high oil viscosity. 2. Capillary tube clogged. 3. Modulation solenoid valves clogged. 4. Internal built-in oil lines clogged. 5. Piston stucked-up. 6. Oil filter cartridge clogged.
<p>3. Compressor unable to unload</p>	<ol style="list-style-type: none"> 1. Modulation solenoid valves clogged. 2. Piston ring worn out. 3. Insufficient lubricant. 4. Leakage on discharge cover plate. 5. Solenoid valves voltage misused. 6. Piston stucked-up. 7. Capacity control circuit unsuitable.

PROBLEMS	PROBABLE CAUSES
4. Compressor starting failure or Y-Δ switching failure.	<ol style="list-style-type: none"> 1. Slide valve unable to go back to its 25% capacity position. 2. Magnetic contactor failure. 3. Motor broken down. 4. Phase failure or phase reversal. 5. Motor terminal protector trip. 6. Incorrect power supply connections. 7. Y-Δ timer failure. 8. Discharge stop valve closed. 9. Improper connections between mode terminals of Y-Δ wiring.
5. Abnormal vibration and noise of compressor.	<ol style="list-style-type: none"> 1. Broken bearings. 2. Phenomenon of liquid compression. 3. Friction between rotors or between rotors and compression chamber. 4. Insufficient lubricant oil. 5. Loosen internal parts. 6. Electromagnetic sounds of the solenoid valves. 7. System harmonic vibration caused by improper piping system. 8. External debris into the compressor.
6. High discharge temperature.	<ol style="list-style-type: none"> 1. Insufficient refrigerant. 2. Condenser problem. 3. System overcharged of refrigerant. 4. Air in refrigeration system. 5. Insufficient lubricant oil. 6. Damaged bearings. Mutual friction of rotors. 7. High compression ratio.

3-6. TIGHTENING TORQUE WRENCH AND TOLERANCE

Below are the list of tables showing different setting value of torque wrench for different screw bolts, torque wrench setting for different compressor accessories and torque wrench setting for discharge bearings (male and female). It also shows some of the tolerance.

Table 5. Compressor accessories and torque setting

Accessories	Torque setting (Kg-cm)
1 ½ " Flange and check valves	1,000
2 ½ " Flange and check valves	1,000
3" Flange	2,000
5" Flange	2,000
Cleaning flange	850
Oil filter joint	850
Power bolt	900

Table 6. Compressor screw bolts torque setting

Standard screw bolt Nominal spec.	Torque value (Kg-cm)	
	Range of reference	Setting value
M6	90 ~ 120	100
M8	220 ~ 290	250
M10	430 ~ 580	500
M12	750 ~ 1700	1,000
M16	1,100 ~ 3,400	2,000
M20	1,800 ~ 4,200	3,800

Table 7. Torque setting for male and female bearings (discharge side)

MODEL	Torque Value (Kg-m)	
	Male	Female
RC-12~13	24	16
RC-14~15L	39	21
RC-16~17	51	28
RC-18~21	45	47

Table 8. Discharge clearance of male and female rotor

Item \ Model	RC12~RC13	RC14~RC15	RC16~RC18	RC19~RC21
Standard (mm)	0.04~0.08	0.04~0.09	0.04~0.1	0.04~0.1

Table 9. Tolerance between slide valve and slide valve housing

Model	RC12~RC13	RC14~RC15	RC16~RC18	RC19~RC21
Tolerance (mm)	0.025~0.055	0.03~0.06	0.04~0.07	0.04~0.07

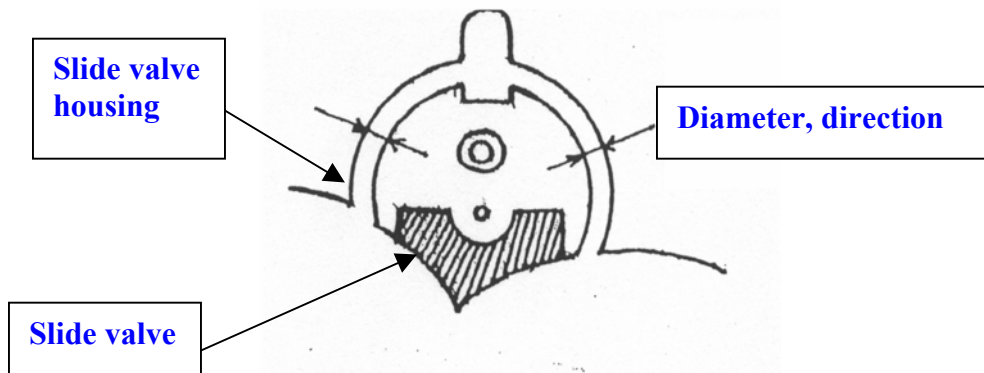


Table 10. Motor insulation standard

To the ground				Phase to phase			Phase to wiring temperature protector		
U	V	W	Wiring temperature protector	U-Z	V-X	W-Y	U	V	W

Should be more than **100** MΩ

2000 MΩ & 1000VDC

Table 11. Vibration standard

Unit: mm/s

Model Item	RC12~RC13	RC14~RC15	RC16~RC18	RC19~RC21
Between Rotors (Around 300 Hz)	<1.4	<2.1	<2.5	<3.0
Motor Rotor (Around 60 Hz)	<2.0	<2.5	<3.0	<3.5

Table 12. Allowable deflection of male rotor and motor rotor

Unit: mm

	Max allowed
For male rotor	0.02
For male rotor combined with motor rotor	0.15

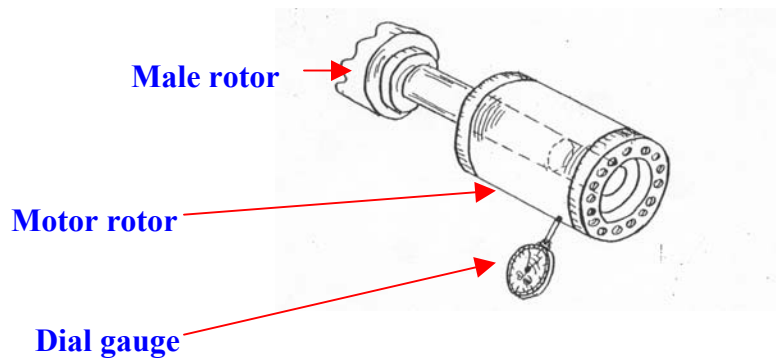


Table 13. Standard sound level

Unit: dbm

Model Frequency	RC10~RC13	RC14~RC15	RC16~RC18	RC19~RC21
50Hz	<82	<84	<87	<89
60Hz	<83	<85	<88	<90

Test standard:

1. Horizontal: 1 m
2. Height: 1.2m~1.5m

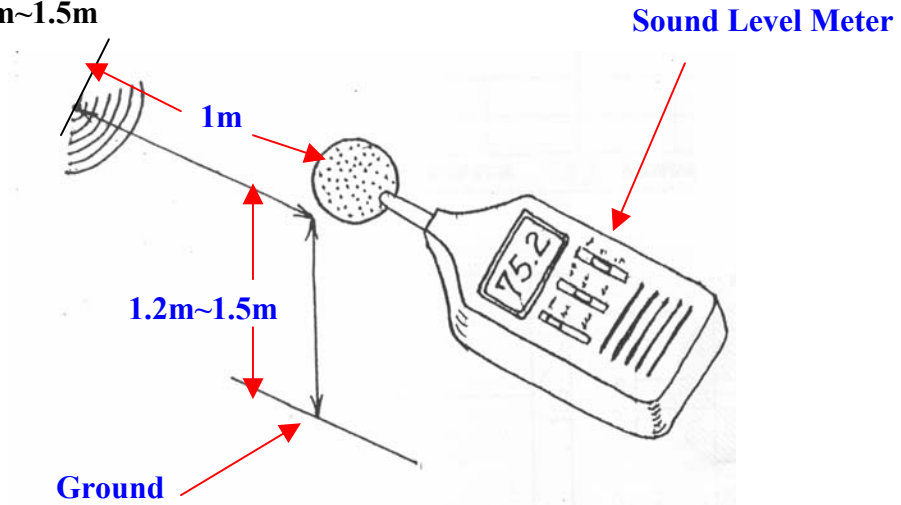


Table 14. Compressor accessories and torque setting

Standard screw bolt Nominal spec.	Torque value (Kg-cm)	
	Range of reference	Setting value
Motor terminal plate screw bolt M12	300 ~ 1,500	900
Oil filter joint flange M12	250 ~ 1,500	850
Oil drop / service / cleaning flange M12	260 ~ 1,500	850
1 ½" flange M16	200 ~ 1,000	1,000
2 ½" flange M16	400 ~ 2,000	1,000
3" flange M20	550 ~ 2,500	2,000
4" flange M20	800 ~ 3,000	2,000
Oil sight glass P1, P3 plug		200

3-7. LUBRICANT

The main functions of the lubrication oil in screw compressor are lubrication, internal sealing, cooling and capacity control. The positive oil pressure in the cylinder pushes the piston and the slide valve, which is connected by a piston rod to move forward and backward in compression chamber. The design with positive pressure differential lubrication system in RC series is available to omit an extra oil pump in the compressor.

The bearings used in RC compressor required a small but steady quantity of oil for lubrication. The oil injection in the compression chamber creates an oil sealing film in the compression housing for increasing the efficiency and absorbed a part of heat of compression.

In order to separate the oil from the mixed refrigerant gas, an oil separator is required to ensure the least amount of oil carried into the system. Pay more attention to the oil temperature, which has a significant factor to the compressor bearings' life. High oil temperature will reduce the oil viscosity and caused poor lubrication and heat absorption in compressor as well. The oil viscosity is recommended to keep over $15 \text{ mm}^2 / \text{s}$ at any temperature. If the compressor operated under the critical condition, then extra oil cooler is required. Some high viscosity oil is recommended to apply to the high working condition. It happens more often that the return oil from evaporator is insufficient due to the high viscosity of oil, which is difficult to be carried back, that causes the loss of oil in the compressor. If the system encounters the oil return problem then an extra 2nd oil separator is recommended to installed between the compressor discharge tube and condenser.

3-7.1 Precautions

A. Use only HANBELL's recommended oil brand, and do not mixed together oil with a different brand. Different kinds of refrigerant have different kind of oil required, note that some synthetic oil are not compatible with mineral oil. The screw compressor should be fill with clean oil before and after initial operation.

B. For the chiller system that uses synthetic oil, be sure that the oil is not exposed to atmosphere for a long time. It is necessary to vacuum the system when installing the compressor.

C. It is suggested to heat first the system in order to vaporized any moisture and then vacuum the system. It is essential for the changing of new oil in the system especially after the motor burned out, the acidity debris are still remain inside the piping so follow the procedure mention above. It is

necessary to check the oil acidity after 72 hours operation and changes it until the value is in the standard level. Table 15 shows oil replacement standard.

Table 15. Oil replacement standards

Item	Value	Item	Value
Color, ASTM	Above 6.0	Total acid number mgKOH/g	Above 0.5
Particle matters mg/100 ml	Above 5.0	Copper strip 100°C/3hrs	Above 2.0
Viscosity, 40° C	Variation± 10% or more	Moisture ppm.	Above 100

3-7.2 Changing oil

Lubrication is one of the most important factors in the compression system, in order to maintain the good running condition of the compressor. It used to lubricate the rotating element of the compressor and it also cools and seal the system, it is the driving force of the piston to move back and forth. Following is the problem that may exist in the system:

1. Clogged oil filter caused by contaminated oil i.e. debris, or swarf.
2. Corroded motor caused by moisture (acid) inside.
3. Spoiled oil due to the compressor running at long duration of high discharge temperature causing the bearing life to shorten.

Following is the time period for changing the oil.

1. Change oil periodically: Check oil for every 10,000 hrs. running period. Change the oil and clean the oil filter after 20,000 hrs. running period. It is recommended to check the oil after 2,500 hrs. running period or 1 year because of the piping debris and swarf that can accumulate inside the system.
2. To prevent the debris and swarf to clog in the oil filter, an oil pressure differential switch can be installed. The switch will trip when the oil pressure differential reaches the critical point and the compressor will automatically shut down. This will protect the bearings from getting any damaged due to lack of lubricating oil.
3. If the compressor discharge temperature often gets higher, then the oil will spoil gradually in a short time. Check the oil level, or follow the recommended time period for changing the oil.
4. Check the acidity of lubricating oil periodically. If the acidity of the oil measured is lower than PH6, then changing of oil is required.
5. Refer to oil replacement standard table to check the characteristic of oil.

3-7.3 Oil level

Aside from lubricating the bearings and compression chamber, the lubrication oil also controls the capacity control system of the compressor. It is necessary to monitor the oil level of the compressor periodically. It has oil sight glass connected to the side of the compressor to check if the oil level is still enough (above the bottom of the sight glass). For bigger models (RC14~21)), there are two sight glasses connected on both sides to monitor the oil level. All of HANBELL screw compressor have an additional 3 liters of lubrication added to the standard amount. When the compressors are running, the oil level could be higher or lower in the sight glasses, so the technician can check the lowest level of the oil while the chiller is running or check the oil level while the chiller shutdown besides the standard oil level.

NOTE: In case a very long piping of the chiller system, it is necessary to calculate the additional oil amount needed to keep the compressor running smoothly.

Table 16. Specification of applicable oil types (R-22)

		UNITS	TOTAL LUNARIA		SUN SUNISO		CPI CP-4214			MOBIL SHC		
			56	68	4GS	5GS	100	150	320	68	120	220
COLOR, ASTM			1.5	L2.0	L1.0	L1.0	-	-	-	L0.5	L0.5	L0.5
SPECIFIC GRAVITY			0.883	0.883	0.914	0.925	0.96	1.01	1.05	0.834	0.838	0.846
VISCOSITY	40°C	mm^2 / s	56	68	54.5	96.5	123	168	298	68	95	209
	100°C	(cSt)	7.0	7.8	6.07	8.12	14.2	20.2	32	10.0	13.7	25.0
FLASH POINT		°C	220	230	188	198	292	290	271	250	255	260
POUR POINT		°C	-40	-35	-35	-25	-35	-43	-35	-45	-45	-39
T.A.N		Mg KOH/g	0.01	0.01	0.00	0.01	-	-	-	-	-	-
COPPER STRIP 3hr.@ 100°C			1a	1a	1a	1a	-	-	-	-	-	-
MOISTURE		ppm	15	15	20	20	-	-	-	-	-	-
FLOC POINT		°C	-75	-75	-45	-35	-	-	-	-	-	-
DIELECTRIC STRENGTH 2.5mm		KV	75	70	50	50	-	-	-	-	-	-

Table 17. Specification of applicable oil types (R134a, R404a, R407c)

		UNITS	CPI SOLEST				MOBIL EAL		ICI EMKARATE		
			68	120	220	370	68	100	RL411	RL375	RL421
COLOR, ASTM			-	-	-	-	0.5	0.5	1.5	L2.0	L1.0
SPECIFIC GRAVITY			0.945	0.94	0.95	0.955	0.971	0.966	0.9723	0.9783	0.9759
VISCOSITY	40°C	mm^2 / s (cSt)	64	131	215.9	385.96	62.5	95.8	48.0	74.1	134
	100°C		8.9	14.53	20.8	29.23	8.3	10.5	7.3	10.1	15.0
FLASH POINT		°C	266	254	271	302	254	260	273	246	265
POUR POINT		°C	-43	-36.5	-25	-21	-43	-37	-40	-35	-37
T.A.N		mg KOH/g	-	-	-		-	-	<0.05	<0.05	<0.05
COPPER STRIP 3hr@ 100°C			-	-	-		-	-	-	-	-
MOISTURE		ppm	-	-	-		<100	<100	-	-	-
FLOC POINT		°C	-	-	-		-	-	-	-	-
DIELECTRIC STRENGTH 2.5mm		KV	-	-	-		-	-	-	-	-

3-8. MAINTENANCE SPACE

It is necessary to reserve enough space for the connection and installation of electrical box, service valve and solenoid valve. Fig. 5 shows the recommended compressor installation space for future maintenance work in the job site.

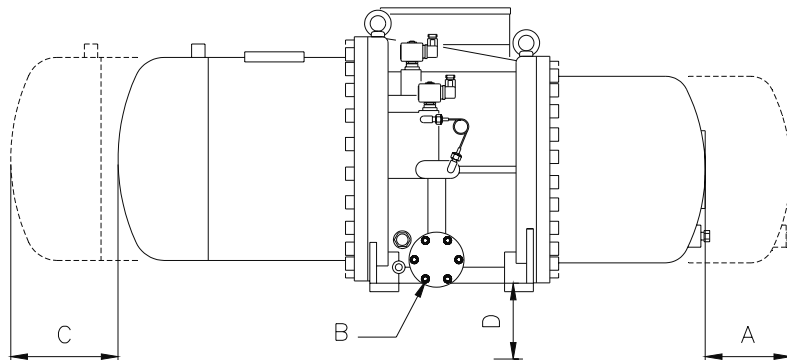


Fig. 4

RC compressor series

	RC10/ RC11	RC12	RC13	RC14	RC15/ RC15L	RC16	RC17	RC18	RC19	RC20	RC21	
A (cm)	41	41	46	47	51	54	59	60	60	65	65	
B. Outwards (cm)	28	28	28	28	28	28	28	35	35	35	35	
C (cm)	26	26	30	28	33	30	35	37	37	45	45	
D (cm)	15	15	15	15	15	15	15	---	---	---	---	
E(Suction filter) (mm)	103		143		153		210					
F(Oil filter)(mm)	200							232				

4. DISASSEMBLY PROCEDURES

This service manual is described regarding the maintenance work of HANBELL semi-hermetic twin-screw compressor. The compressor has been brought into the workshop under the following conditions:

1. The compressor's discharge and suction side are still closed with sealed flanges, and the compressor are free of refrigerant gas.
2. Refrigerant oil still remain inside the compressor.
3. The modulation solenoid valves, and some of the accessories are still connected to the compressor.

4-1. WORK PREPARATION

Before performing the disassembly work of the compressor, be sure to prepare first the washing area, the rotation table, and the facility should be kept clean and in order so that any parts of the compressor can be put in proper place. Refer to fig. 5, and fig. 5-1



Fig. 5



Fig. 5-1

4-2. REFRIGERANT OIL PURGES (Refer to Fig. 6~6-1)

1.Lift the compressor using an overhead crane and put it on the adjustable table and use two hexagonal screw bolts to fix it. (Fig. 6)

2. Put an oil pan or basin under the adjustable table to drain the oil. (Fig. 6-1)

3. Loosen the M12 screw bolts of the oil filter cartridge using an air drive spanner or hexagonal wrench so that the oil can flows out. Do not totally remove the oil filter cartridge until all the oil has flowed out in order to prevent excessive flowing and spillage on the floor. (Fig. 6-1)



Fig. 6



Fig.6-1

4-3. SUCTION SEALED FLANGE, FILTER (Refer to Fig. 7~ 7-2)

1.Loosen the screw bolts of the suction flange using air drive spanner or hexagonal wrench. (Fig.7)



Fig. 7

2. Pull out the suction flange, and gas filter. (Fig. 7-1~7-2)

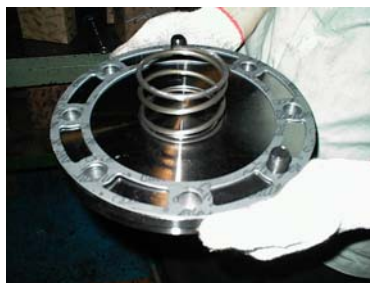


Fig. 7-1



Fig. 7-2

TOOLS: Air drive spanner, hexagonal wrench

4-4. ELECTRICAL COVER PLATE (Fig.8~8-2)

1. Loosen the screw bolts of electrical cover plate and remove all the screws. (Fig.8)



Fig.8

2. Use a screw gauge to hold the cover plate. (Fig.8-1)



Fig.8-1

3. Loosen all the screw nuts of each electrical cover terminal and removed the cover plate. (Fig.8-2)



Fig.8-2

TOOLS: Air drive spanner, hexagonal wrench, cover plate holder

4-5. MOTOR CASING, MOTOR ROTOR (Refer to Fig.9~ 9-5)

1. Use a rope to support the motor casing before loosening all the screw bolts. (Fig.9~9-1)



Fig.9



Fig.9-1

2. Pull out the motor casing slowly and carefully. (Fig.9-2)



Fig.9-2

3. Loosen the bolt of motor rotor. (Fig.9-3)

4. Remove the screw bolt, washer, and spacer. (Fig.9-3)



Fig.9-3

5. Pull out the motor rotor, and the rotor shaft key. (Fig.9-4~9-5)



Fig. 9-4



Fig.9-5

NOTE: For bigger model use a rope and pull out motor rotor using overhead crane.

TOOLS: Rope, overhead crane, air drive spanner or hexagonal wrench

4-6. OIL FILTER, OIL LEVEL SWITCH COVER

(Refer to Fig.10~ 10-2)

1. Loosen the screw bolts of oil filter cartridge, and oil switch cover (Fig.10)



Fig.10

2. Remove all the screws and pull out the oil filter cartridge and oil level switch cover. (Fig.10-1)



Fig.10-1

3. Remove the magnet and clean it. (Fig.10-2)



Fig.10-2

TOOLS: Air drive spanner or hexagonal wrench

4-7. OIL SEPARATOR (Refer to Fig.11~11-1)

1. Use two eyebolts on top of the oil separator and hang it using an overhead crane to hold the oil separator. (Fig.11)



Fig.11

2. Loosen and remove all the screws of oil separator. (Fig.11)

3. Pull out the oil separator from the compressor. (Fig.11-1)



Fig.11-1

TOOLS: Eyebolts, overhead crane, air drive spanner or hexagonal wrench

4-8. DISCHARGE COVER PLATE, PISTON, SPRING, ROD (Refer to Fig.12~12-6)

1. Loosen all the screws of discharge cover plate, then remove the cover plate and gasket. (Fig.12~12-1)



Fig.12



Fig.12-1

2. Remove the disc spring and the discharge fixed ring. (Fig.12-2)



Fig.12-2

3. Loosen the screw bolt of the piston then remove the spacer ring, washer, and the piston. (Fig.12-3~12-4)



Fig. 12-3



Fig.12-4

4. Loosen the connecting rod and remove it. (Fig.12-5~12-6)



Fig.12-5

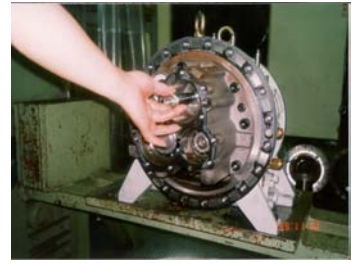


Fig.12-6

TOOLS: Air drive spanner or hexagonal wrench

4-9. BEARING SEAT, BEARING SLOT NUT (Ref to Fig.13~13-6)

1. Rotate the adjustable table with the discharge side on top. (Fig. 13)
2. Loosen all the screws of the bearing seat. (Fig.13)



Fig.13

3. Remove the two guide pin from the bearing seat. (Fig.13-1)

Refer to page 56, item no. 17 for the tool.



Fig.13-1

4. Install the rotor assembly fixed gauge on the male rotor shaft suction side. (Fig.13-2) Refer to page 51 item no. 6 for the tool.



Fig.13-2

5. Loosen the bearing slot nut of the male rotor and then the female rotor. Then remove the rotor assembly fixed gauge. (Fig.13-3~13-4)



Fig.13-3



Fig.13-4

6. Use an M12 screw bolt to separate the bearing seat from the compressor casing. (Fig.13-5)



Fig.13-5

7. Put two eyebolt on top of the bearing seat, then lift it slowly using an overhead crane. (Fig.13-6)



Fig.13-6

TOOLS: Hexagonal wrench, spanner, rotor assembly
Fixed gauge, overhead crane, slot nut tightening gauge

4-10. MALE AND FEMALE SUCTION BEARINGS (Refer to fig.14~14-3)

1. Loosen the suction bearing fix ring of the male rotor. (Fig.14)



Fig.14

2. Take out the suction bearing outer ring of male rotor by using the tool in page 51 item 7. (Fig.14-1)



Fig.14-1

3. Loosen the suction bearing fix bolt of the female rotor. (Fig.14-2)



Fig.14-2

4. Take out the suction bearing outer ring of the female rotor.
(Fig.14-3)



Fig.14-3

TOOLS: Hammer, allen wrench, trumpet shape tool

4-11. SLIDE VALVE, SOLENOID VALVE (Refer to Fig.15~15-2)

1. Rotate the table with the discharge side in front. (Fig.15)
2. Loosen the screw of slide valve key. (Fig.15)



Fig.15

3. Pull out the slide valve. (Fig.15-1)

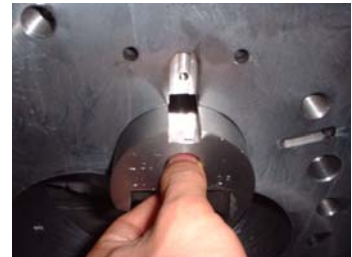


Fig.15-1

4. Loosen the solenoid screw then remove the solenoid valve and the two O-rings in the solenoid valve. (Fig.15-2)



Fig.15-2

NOTE: Replace all the O-rings and gaskets after every dismantling or maintenance of the compressor.

4-12. SCREW ROTORS, BEARINGS (Refer to Fig.16~16-7)

1. Use a cylindrical drum and put it on the base surface of the hydraulic press machine, put some rags inside the cylinder.
2. Lift the bearing seat and put it in the cylindrical drum. Get a piece of steel bar and put it inside the bearing seat so that it will push the rotor when the press machine moves downward. (Fig.16)



Fig.16

3. Press the downward button of the press machine, and if the rotors have already been taken out press the upward button. (Fig.16-1)



Fig.16-1

4. Lift the bearing seat and put it on the pallet, also put the rotors on the pallet. (Fig.16-2~16-3)



Fig.16-2



Fig.16-3

5. Remove all the bearings, spacer ring, and balance piston of the bearing seat by hammering it. (Fig.16-4~16-5)



Fig.16-4



Fig.16-5

6. Remove the inner ring, spacer ring of the male and female suction bearings by: (1) cutting first the inner ring with grinder and used a chisel and hammer it, or (2) heating it to expand and can take out easily. (Fig.16-6~16-7)



Fig.16-6



Fig.16-7

TOOLS: Press machine, cylindrical drum, overhead crane, hammer, chisel,

4-13. MOTOR STATOR (Refer to Fig.17~17-2)

1. Remove first the motor stator guide vane by loosening all the screws. (Fig.17)

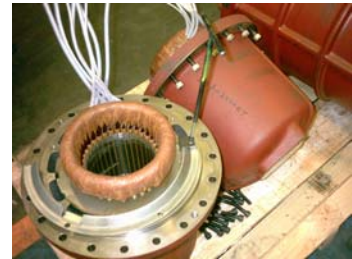


Fig.17

2. Install the motor stator puller. (Fig.17-1)



Fig.17-1

3. Install the hydraulic hose for the puller machine. (Fig.17-2)

4. Operate it until the stator is being remove from the motor casing. (Fig.17-2)



Fig.17-2

TOOLS: Hexagonal wrench, hydraulic puller

4-14. CLEANING OF COMPONENTS (Refer to Fig.18~18-2)

1. Lift the compressor casing and clean it by washing it with oil and use air to dry it. (Fig.18)



Fig.18

2. Do the same procedure in cleaning the male and female rotors, and the motor rotor. (Fig.18-1~18-2)



Fig.18-1



Fig.18-2

5. REASSEMBLY PROCEDURES

5-1. BEARING SEAT, ROTORS, BEARINGS (Refer to Fig.19~19-30)

1. Lift the compressor casing using an overhead crane and put it on the adjustable table with the suction side in front and screw the two base to fixed it temporarily. Rotate the table to about 90° with the discharge side on top and clean the compression chamber using air. (Fig.19)
2. Check the dimension of the male rotor neck and bearing seat neck to get the correct balanced piston size. (Fig.19-1)
3. Check the dimension of the female rotor neck and bearing seat neck to get the correct inner and outer spacer ring. (Fig. 19-2)

CALCULATIONS ON HOW TO GET A BALANCE PISTON AND SPACER RING

EQUATION: $D1 - D2 = C2 - T2 + 0.12\text{mm}$.
 $D\alpha \text{ balance} = C1 - T1 + 0.12\text{mm}$.
 $T2 + D1 = C2 + D2 + 0.12\text{mm}$.

WHERE:

D is for α balance piston
D1 is for inner spacer ring
D2 is for outer spacer ring

FOR BEARING SEAT:

C1 is for male hole
C2 is for female hole

FOR SCREW ROTORS:

T1 is for male rotor
T2 is for female rotor



Fig.19



Fig.19-1

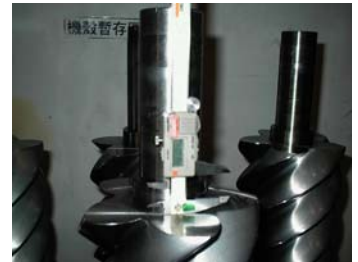


Fig.19-2

4. Clean the male and female rotors using oilstone and wipe it with clean paper. (Fig.19-3~19-4)



Fig.19-3

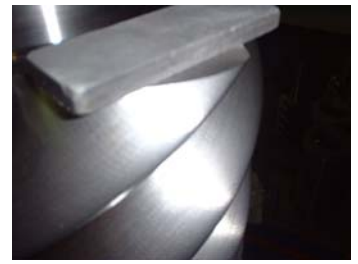


Fig.19-4

5. Lift the male rotor first and put it on the compressor casing and check the clearance of the rotor to the casing. (Fig.19-5)



Fig.19-5

6. Put the female rotor in the compressor casing and check the clearance. (Fig.19-6)



Fig.19-6

7. Heat the discharge radial bearing inner ring up to 80°C. (Fig.19-7)



Fig.19-7

8. Insert the radial bearing inner ring and inner spacer ring on female rotor shaft . (Fig.19-8)



Fig.19-8

9. Lift the bearing seat and put it on the table then clean it using oilstone and clean paper. Also, check and clean the oilhole using air. (Fig.19-9)



Fig.19-9

10. Insert the radial bearing outer ring on the bearing seat.
(Fig.19-10)



Fig.19-10

11. Insert the outer spacer ring on the bearing seat. (Fig.19-11)



Fig.19-11

12. Lift the bearing seat and slowly put it in the compressor casing. (Fig.19-12)



Fig.19-12

13. Used two guide pin and hammer it. (Fig.19-13)



Fig.19-13

14. Put the α balance piston on the male rotor and hammer it up to the bottom (flat surface is at the bottom). (Fig.19-14)



Fig.19-14

15. Put the radial bearing outer ring on the male rotor and hammer it. (Fig.19-15, ~19-16)



Fig.19-15



Fig.19-16

16. Insert the radial bearing inner ring on the male rotor and hammer it. (Fig.19-17, ~19-18)



Fig.19-17



Fig.19-18

17. Heat the male and female axial bearing up to 80°C. (Fig.19-19)



Fig.19-19

18. Insert the axial bearing on the male rotor shaft first, then the female rotor. Wait a few seconds to cool. (Fig.19-20)

NOTE: The bearing position should be: the two bearing face with the series number at the bottom side and the third bearing with series number on top. Do it on both the male and female.



Fig.19-20

19. Use a rotor assembly fixed gauge to the suction side of the male rotor so that it will not move when tightening the bearings. (Fig.19-21)



Fig.19-21

20. Put loctite sealant on both the male and female end side screw. (Fig.19-22)



Fig.19-22

21. Put the bearing slot nut on both the male and female rotor. (Fig.19-23)



Fig.19-23

22. Tighten the male rotor first using a torque wrench (refer to [Table 7](#) for the torque), then the female rotor. (Fig.19-24)



Fig.19-24

23. Remove the rotor assembly fixed gauge and the two pin from the compressor casing. (Fig.19-25~19-26)



Fig.19-25



Fig.19-26

24. Lift the bearing assembly and check the clearance of the rotor to the bearing seat, refer to [Table 8](#) for the tolerance. (Fig.19-27)



Fig.19-27

25. Heat the suction radial bearing inner ring and inner spacer ring of the male and female rotor. (Fig.19-28)



Fig.19-28

26. Insert the inner ring and inner spacer ring on the male and female rotor. (Fig.19-29)

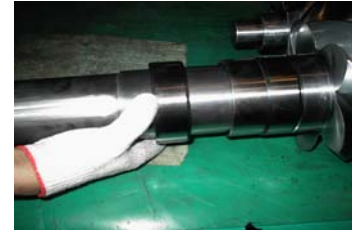


Fig.19-29

27. Use a chisel and hammer it to prevent the ring from moving or falling. (Fig.19-30)



Fig.19-30

5-2. SUCTION BEARING (Refer to Fig.20~ 20-7)

1. Install the oil guiding ring on the male and female hole. Be sure that the oil hole in the ring is in the same side as the oil hole in the casing. (Fig.20)



Fig.20

2. Install the radial bearing (male, female) outer ring on the casing and hammer. (Fig.20-1~20-2)



Fig.20-1



Fig.20-2

3. Put the outer spacer ring on the casing (male). (Fig.20-3)



Fig.20-3

4. Install the radial bearing outer ring on the casing (male). (Fig.20-4)



Fig.20-4

5. Put loctite sealant on the screw hole. (Fig.20-5)



Fig.20-5

6. Install the suction bearing fix ring and fix bolt. (Fig.20-6~20-7)



Fig.20-6



Fig.20-7

TOOLS: Hammer, trumpet shape tool, loctite sealant

5-3. SLIDE VALVE, SOLENOID VALVE (Refer to Fig.21~21-3)

1. Clean the oil hole of the compressor casing using air. (Fig.21)



Fig.21

2. Screw the modulation solenoid valve using air drive spanner or hexagonal wrench. (Fig.21-1)



Fig.21-1

3. Use a pile or oilstone to eliminate any burrs on the surface of the slide valve. (Fig.21-2)



Fig.21-2

4. Install the slide valve in the compressor casing. Check the clearance, refer to [Table 9](#) for the clearance. (Fig.21-3)



Fig.21-3

TOOLS: Pile, oilstone, hexagonal wrench, spanner

5-4. COMPRESSOR CASING (Refer to Fig.22~22-4)

1. Clean the compressor casing using spatula and wipe it with clean paper. (Fig.22)



Fig.22

2. Rotate the table with the discharge side on top and put loctite sealant on the surface of the compression chamber. (Fig.22-1)



Fig.22-1

3. Lift the bearing assembly and put it slowly in the compressor casing. (Fig.22-2)

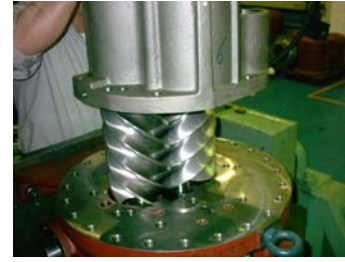


Fig.22-2

4. Put two guide pin on the bearing seat and hammer it. (Fig.22-3)



Fig.22-3

5. Put all the hexagonal screw bolts and tighten it. (Fig.22-4)



Fig.22-4

TOOLS: Spatula, clean paper, loctite sealant, overhead crane, spanner or hexagonal wrench, hammer

5-5. PISTON,PISTON ROD,SPRING, COVER PLATE (Refer to Fig. 23~23-8)

1. Rotate the table with the discharge side in front.

2. Put loctite sealant in the piston rod and install it to the slide valve. (Fig.23~23-1)



Fig. 5



Fig. 5-1

3. Fixed the piston to the piston gauge. (Fig.5-2)



Fig. 5-2

4. Put a copper washer on the piston rod and put some oil in the piston cylinder. (Fig.5-3)



copper washer

Fig. 5-3

5. Put the piston and piston spring on the cylinder. (Fig.5-4)



Fig. 5-4

6. Use hexagonal screw and tighten it, then check the piston by pushing it forward and backward. (Fig.5-5)



Fig. 5-5

7. Put the bearing fix ring, and disc spring. (Fig.5-6)



Fig. 5-6

8. Put the gasket, cover plate and put all the screws and tighten it. (Fig.5-7~5-8)



Fig. 5-7



Fig.5-8

TOOLS: Spanner or hexagonal wrench, oil, loctite sealant, piston gauge, socket wrench

5-6. MOTOR ROTOR (Refer to Fig. 6~6-6)

1. Put the shaft key on the male rotor shaft suction side. (Fig.6)



Fig. 6

2. Lift the motor rotor and install it to the compressor. (Fig.6-1~6-3)

rotor number mark in inside position



Fig. 6-1



Fig. 6-2



Fig. 6-3

3. Put washer and spacer ring on the hexagonal screw and put loctite sealant then install it to the motor rotor and tighten it . (Fig.6-4~6-5)



Fig. 6-4



Fig. 6-5

4. Check the motor rotors' alignment using a dial gauge on top.
The reading should not exceed 0.15mm. (Fig.6-6)



Fig. 6-6

TOOLS: Overhead crane, spanner or wrench, loctite sealant, dial gauge

5-7. MOTOR (Refer to Fig. 7~7-10)

1. Put the motor stator on stator fixed jig. (Fig 7)



Fig. 7

2. Lift the motor stator and put it on the base surface of the hydraulic press machine. (Fig. 7-1)



Fig. 7-1

3. Insert the motor stator key and hammer it. (Fig. 7-2)



Fig. 7-2

4. Lift the motor casing and put it on top of the motor stator with the key on the stator in the same position as the keyway on the motor casing. (Fig. 7-3)



Fig. 7-3

5. Press the advance button of the machine and then the downward button to press the motor casing to the motor stator. (Fig. 7-4)



Fig. 7-4

6. Press the upward button of the machine and remove the motor assembly by lifting it and put it on the pallet. (Fig. 7-5~7-6)



Fig. 7-5



Fig. 7-6

TOOLS: Stator fix jig, overhead crane, press machine, hammer

7. Install the motor stator guide vane and use hexagonal screw bolts and tighten it. (Fig. 7-7)



Fig. 7-7

8. Lift the motor assembly and put gasket on it and install it to the compressor. (Fig. 7-8)



Fig. 7-8

9. Pull out the wiring terminal. (Fig. 7-9)



Fig. 7-9

10. Put all the screws on the motor and tighten it. (Fig. 7-10)



Fig. 7-10

TOOLS: Spanner or wrench, overhead crane, motor cable cover plate lifter, press machine

5-8. TERMINAL COVER (Refer to Fig. 8~8-3)

1. Pull out the motor wiring terminal and install it to the cover plate (Fig. 8)



Fig. 8

2. Put all the screw nuts and tighten it, install the motor thermostat wiring terminal. (Fig. 8-1)



Fig. 8-1

3. Put all the hexagonal screws on the terminal cover plate and tighten it. (Fig. 8-2)



Fig. 8-2

4. Check each terminal using a tester. Refer to [Table 10](#) for the test standard (Fig. 8-3)



Fig. 8-3

TOOLS: Motor cover plate lifter, tester, spanner, hexagonal wrench

5-9. OIL SEPARATOR (Refer to Fig. 9~9-4)

1. Lift the oil separator and put it on the adjustable push cart.
(Fig. 9)



Fig. 9

2. Clean the oil separator then wipe it with a piece of rag.
(Fig. 9-1)



Fig.9-1

3. Put Teflon on the discharge side of the bearing seat and put gasket on the compressor casing.(Fig. 9-2)

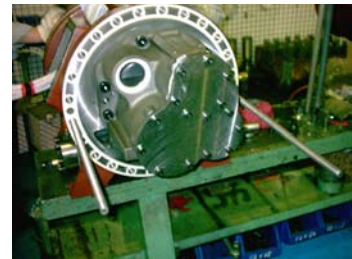


Fig.9-2

5. Install the oil separator to the compressor casing and put all the hexagonal screw bolts and tighten it using an air drive spanner or hexagonal wrench. (Fig. 9-3~9-4)



Fig. 9-3



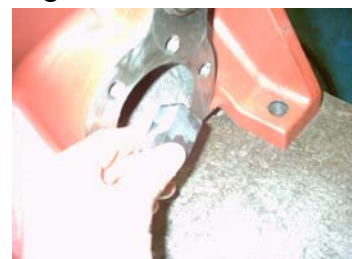
Fig.9-4

TOOLS: Overhead crane, adjustable push cart, oilstone, spanner or wrench

5-10. OIL FILTER, OIL SWITCH (Refer to Fig. 10~10-4)

1. Put two magnet inside the compressor crankcase. (Fig. 10)

Fig. 10



2. Put teflon and gasket on the oil filter cartridge. (Fig. 10-1)



Fig. 10-1

3. Install the oil filter cartridge to the compressor and put all the screws and tighten it. (Fig. 10-2)



Fig. 10-2

4. Put gasket on the oil switch cover. (Fig. 10-3)



Fig. 10-3

5. Install the oil switch to the compressor. (Fig. 10-4)



Fig. 10-4

TOOLS: Spanner or hexagonal wrench

5-11. SUCTION SEALED FLANGE, FILTER (Refer to Fig. 11~11-3)

1. Put Teflon inside the suction port of the compressor and the suction filter. (Fig. 11)

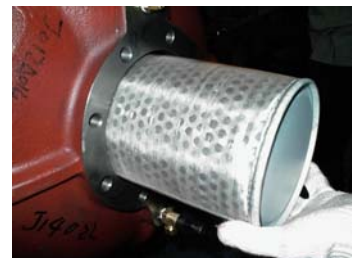


Fig. 11

2. Put spring and gasket on the suction sealed flange. (Fig. 11-1)



Fig. 11-1

3. Install the suction sealed flange to the compressor. (Fig. 11-2)



Fig. 11-2

4. Put all the hexagonal screw bolts and tighten it. (Fig. 11-3)



Fig. 11-3

TOOLS: Spanner or hexagonal wrench

5-12. OIL CHARGE

Before charging the compressor with refrigeration oil, be sure to vacuum it first then filled it with dry nitrogen (0.3~0.5 Kg/cm² G).

RC SERIES

Model	RC10	RC11	RC12	RC13	RC14	RC15	RC15L	RC16	RC17	RC18	RC19	RC20	RC21
Lubricant charge, Lit.	7	7	7	8	14	16	16	15	18	23	23	28	28

6. LIST OF TOOLS, BEARINGS

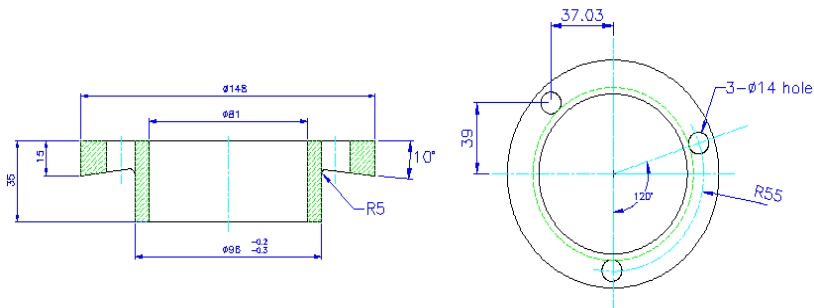
6-1. LIST OF TOOLS

RC SERIES COMPRESSOR

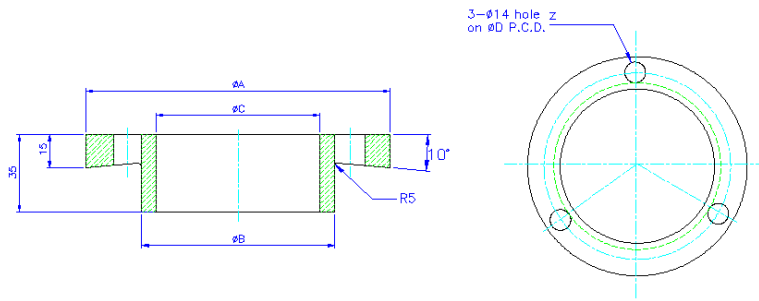
Item	Drawing number	Tools Name
1	CRAAAB41	Circle Tool for loosening the bearings (1)
2	CRAAAB42	Circle Tool for loosening the bearings (2)
3	CRAAAB43	Circle Tool for loosening the bearings (3)
4	CRAAAB44	Circle Tool for loosening the bearings (4)
5	CRAAAB1A	Tool for Bearing assembly (2)
6	CRAAAA10	Male Rotor Assembly Fixed Gauge
7	CRAAAB20	Plate Tool for loosening the bearings
8	CRAAAB30	Trumpet Shape tool for tightening Suction bearings
9	CRAAAB31	B-TYPE NU tool for loosening NU Bearings
10	CRAAAB90	Tool for tightening NU bearing inner ring
11	CRAAAB91	Tool for tightening NU bearing inner ring
12	CRAAAB60	Slot Nut Tightening Gauge-for Male Rotor
13	CRAAAB61	Slot Nut Tightening Gauge-for Female Rotor
14	CRAAAB70	Press Tool for Piston Assembly
15	CRAXAE11	Motor Cable Cover Plate Lifter
16		Slide Pull Rod Lifter
17		Tool for Pin

1. Circle Tool for loosening the bearing (1)(CRAAAB41)

(RC14~15F)

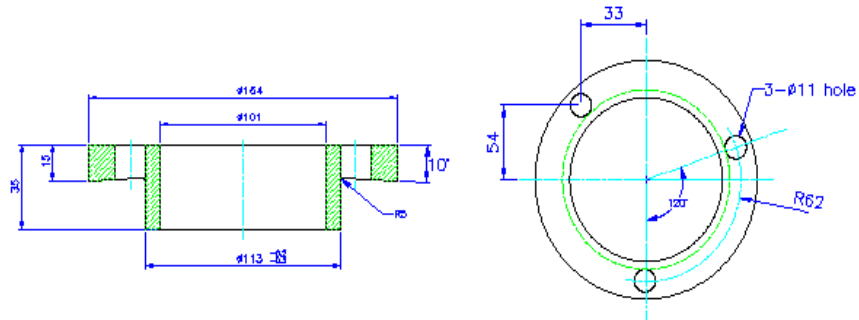


2. Circle Tool for loosening the bearings (2) (CRAAAB42)

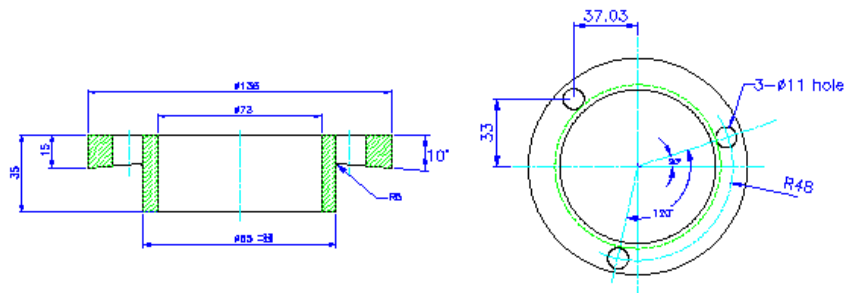


Model	ΦA	ΦB	ΦC	ΦD (P.C.D)
RC14~15L Male	188	136	122	150
RC16~17 Male	202	150	141	164
RC16~17 Female	162	110	101	124
RC19~21 Male	192	140	132	154
RC19~21 Female	182	130	122	144

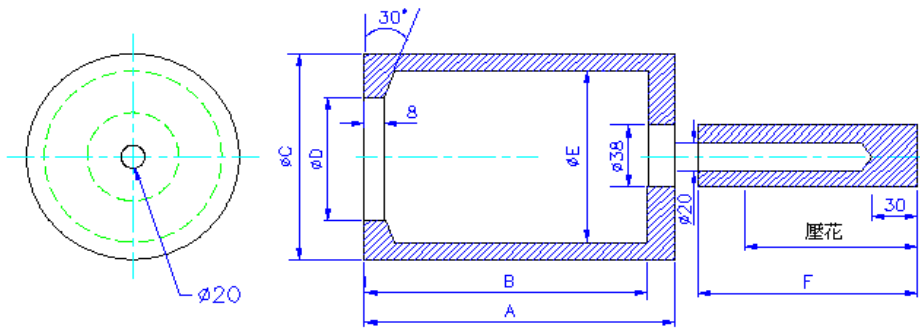
3. Circle Tool for loosening the bearings (3)(CRAAAB43)
(RC12~13M)



4. Circle Tool for loosening the bearings (4)(CRAAAB44)
(RC12~13F)

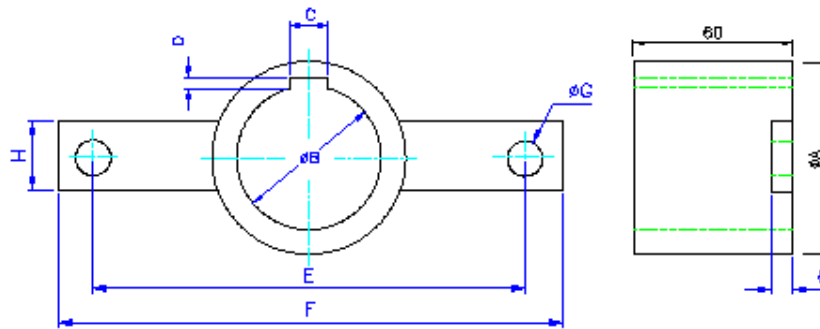


5. Tool for Bearing assembly (2) (CRAAAB1A)



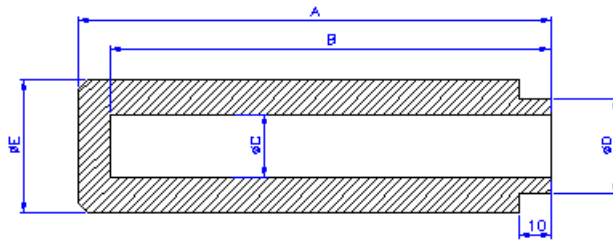
Model	RC12~RC13		RC14~15		RC16~17		RC19~21	
	Male	Female	Male	Female	Male	Female	Male	Female
A	170	155	195	215	196	165	225	220
B	155	140	180	200	181	150	210	205
ΦC	100	72	120	140	100	80	130	120
ΦD	45.5	30.5	55.5	65.5	45.5	35.5	60.5	55.5
ΦE	88	60	108	128	88	68	119	109
F	150	165	155	155	174	185	250	255

6. Male Rotor Assembly Fixed Gauge (CRAAAA10)



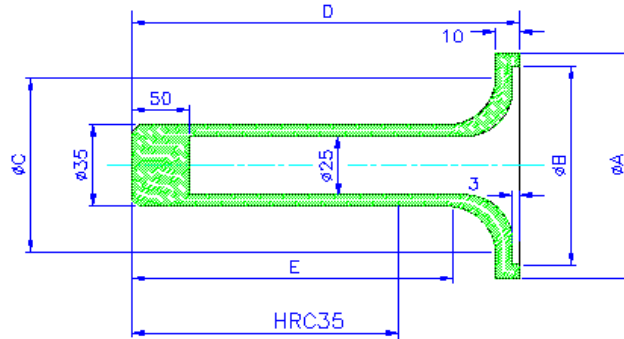
Model	A	B	C	D	E	F	G	H
RC12~13	70	50	12.3	4	380	420	14	30
RC14~15L	80	60	12.3	4	436	470	18	40
RC16~17	94	74	12.3	4	475	520	18	50
RC19~21	105	83	22.3	6	516	550	18	55

7. Plate Tool for loosening the bearings (CRAAAB20)



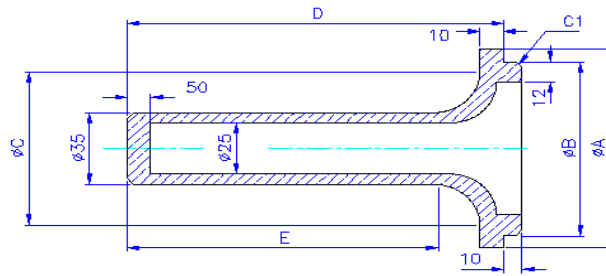
Model (NU)	A	B	ΦC	ΦD	E
7306	210	200	20	30	42.1
7307	210	200	25	35	51.9
7309	210	200	35	45	55.1
7311	210	200	45	55	65.9
7312	210	200	50	60	74.9
7313	210	200	55	65	89.9

8. Trumpet Shape tool for Tightening Suction bearings (CRAAAB30)



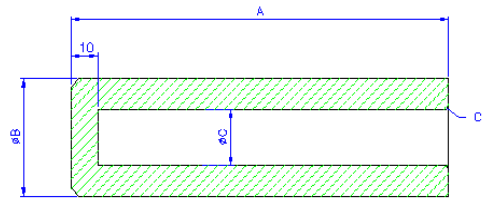
Model	RC12~13 PRESS		RC14~15L PRESS		RC16~17 PRESS		RC19~21 PRESS	
ΦA	99	30	119	71	139	89	149	89
ΦB	85	47	105	57	125	75	135	78
ΦC	60	45	65	51	90	72	100	60
D	160	160	160	160	160	160	160	160
E	130	130	130	130	130	130	130	130
Model	RC12~13 LOOSEN		RC14~15L LOOSEN		RC16~17 LOOSEN		RC19~21 LOOSEN	
ΦA	72	43	85.5	51.5	97.5	65.5	104.5	69.5
ΦB	52	33	65.5	36.5	77.5	50.5	84.5	54.5
ΦC	60	30	50	35	60	50	80	50
D	260	205	335	240	360	230	460	380
E	210	155	285	190	310	180	410	330

9. B –TYPE NU tool for loosening NU Bearings (CRAAAB31)



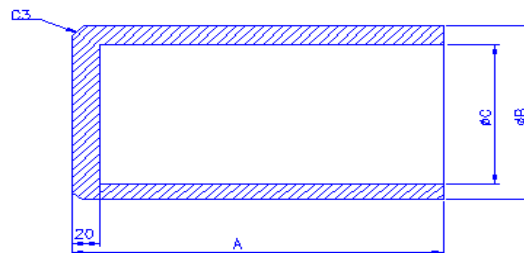
機 型	RC12~13 LOOSEN	RC14~15L LOOSEN	RC16~17 LOOSEN
	Female	Female	Female
ΦA	42.2	52	62
ΦB	40.5	46.2	58.5
ΦC	35	35	50
D	205	240	230
E	155	190	180

10. Tool for tightening NU bearing inner ring (CRAAAB90)



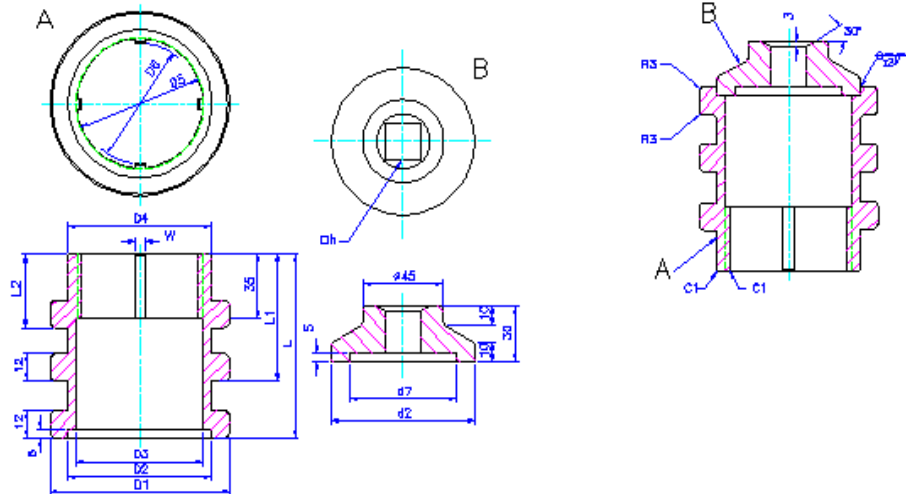
Model	A	ΦB	ΦC	Note
RC12~13	210	58.5	45	NU309
RC14~15L	229	70.5	55	NU311
RC16~17	260	82.5	65	NU313
RC19~21 Male	330	70	60	NU312
RC19~21 Female	330	65	55	NU2311

11. Tool for tightening NU bearing inner ring (CRAAAB91)



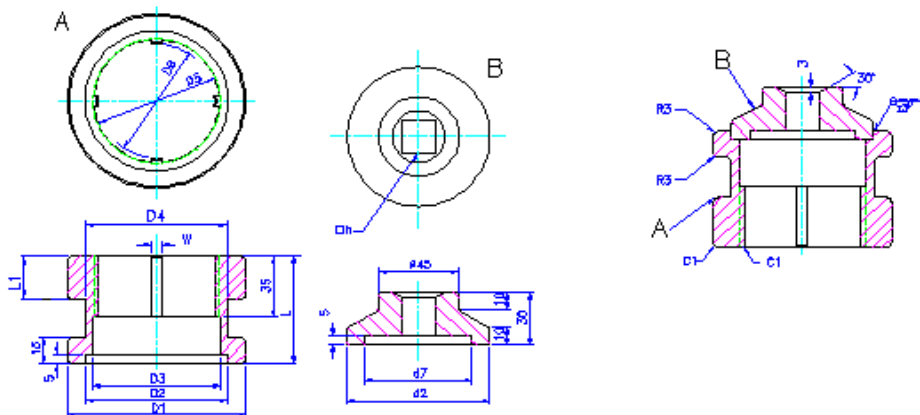
Model	A	B	C	Note
RC12~13	200	100	84	NU309
RC14~15L	300	120	110	NU311
RC16~17	230	140	132	NU313
RC19~21	300	128	120	NU312

12. Slot Nut Tightening Gauge-for Male Rotor (CRAAAB60)



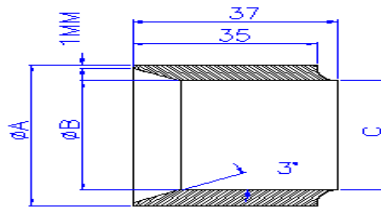
	A										B		
	D1	D2	D3	D4	D5	D6	W	L1	L	L2	D2	D7	□h
	-0 -0.05	+0.05 +0		±0.05	±0.05		-0 -0.05				-0.02 -0.05		+0.1 -0
M30*1.5KM06 -1,2F	71.5	62	46	54	45.3	41.3	4.7	43	80	0	62	45	19.2
M35*1.5KM07 -3,4F	79.5	63	53	62	52.3	48.3	4.7	46	95	0	63	45	19.2
M45*1.5KM09 -5,6F	99.5	90	66	75	65.3	60.3	5.7	75	93	40	90	60	19.2
M55*2KM11 -7,8F	120.5	110	76	84	75.3	69.3	6.7	90	180	45	110	70	19.2
M60*2KM12 -7,8M	130.5	110	86	90	80.3	75.3	6.7	100	190	45	110	70	19.2

13. Slot Nut Tightening Gauge-for Female Rotor (CRAAAB61)



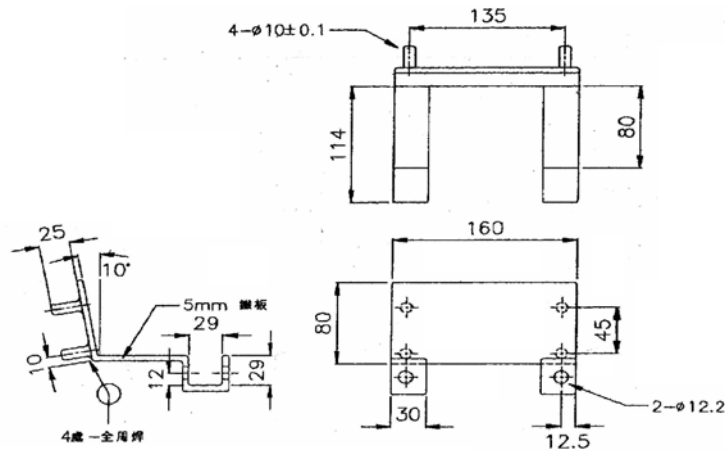
	A									B		
	D1	D2	D3	D4	D5	D6	W	L	L1	D2	D7	□h
	-0 -0.05	+0.05 +0		±0.05	±0.05		-0 -0.05			-0.02 -0.05		+0.1 -0
M45*1.5KM09 -1,2F	99.5	90	66	75	65.3	60.3	5.7	65	28	90	60	19.2
M55*2KM11 -3,4F	120.5	110	76	84	75.3	69.3	6.7	73	26	110	70	19.2
M65*2KM13 -5,6F	139.5	100	86	95	85.3	79.3	6.7	75	24	100	70	19.2

14. Press Tool for Piston Assembly (CRAAAB70)

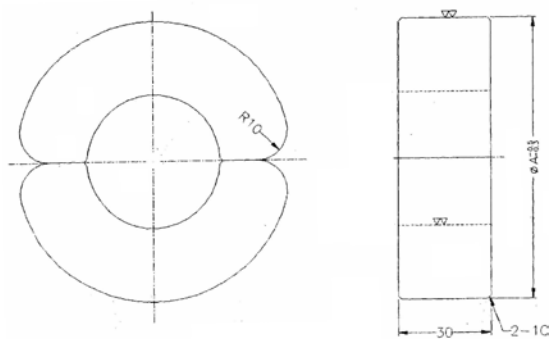


Model	A	B	C
RC12~13	100	89.5	90
RC14~15	110	99.5	100
RC16~17	130	119.5	120

15. Motor Cable Cover Plate Lifter (CRAXAE11)

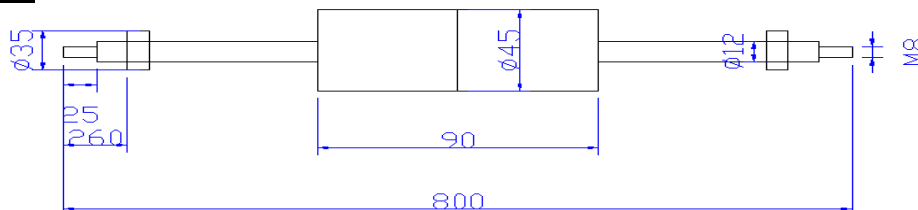


16. Slide Pull Rod Lifter



Model	ΦA
RC12~13	90
RC14~15L	100

17. Tool For Pin



6-2. LIST OF BEARINGS (RC SERIES)

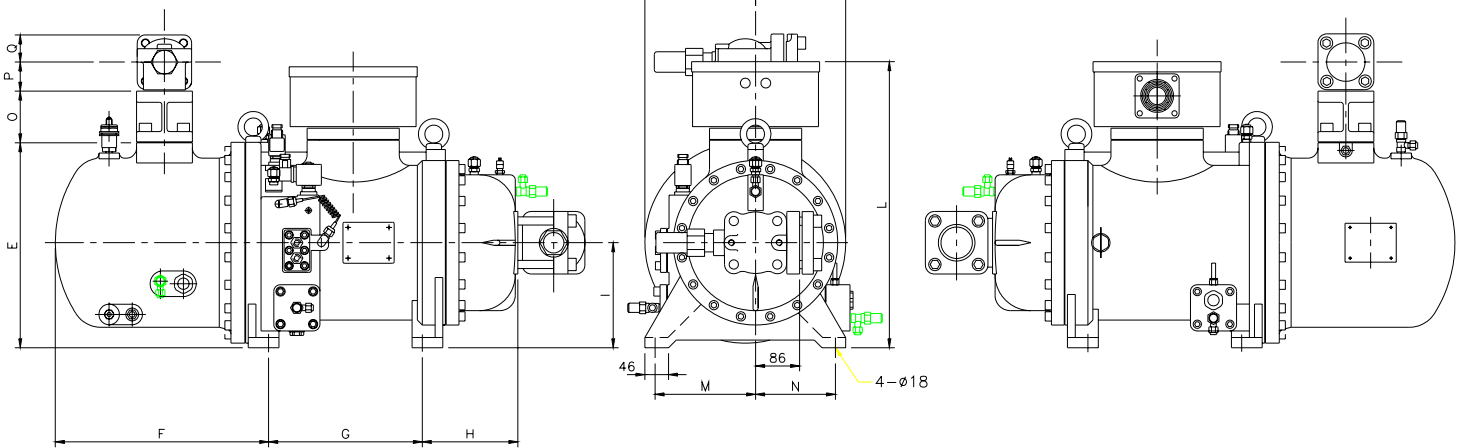
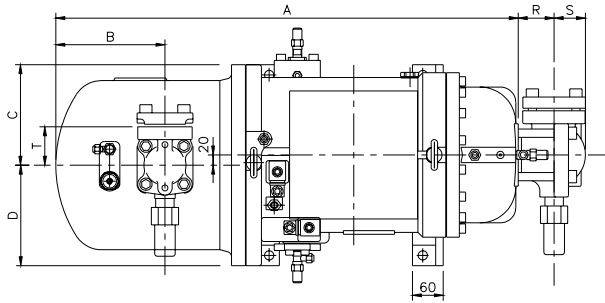
Table below shows the list of bearings for male and female (suction and discharge side) rotor shaft.

MODEL	BEARING TYPE (DISCHARGE)				BEARING TYPE (SUCTION)			
	MALE	QTY.	FEMALE	QTY.	MALE	QTY.	FEMALE	QTY.
RC10~11	7307BUO	3	7306BUO	3	NKI55/35	1	NKI30/30	1
	NU307E	1	NU2306E	1				
RC12~13	7309BUO	3	7306BUO	3	NU2211E	2	NJ2206E	1
	NU309E	1	NU2306E	1				
RC14~15L	7311BUO	3	7307BUO	3	NU2213E	2	NJ2207E	1
	NU311E	1	NU2307E	1				
RC16~17	7313BUO	3	7309BUO	3	NU2216E	2	NJ2210E	1
	NU313E	1	NU2309E	1				
RC18	7313BUO	3	7310BUO	3	NU2216E	1	NJ2210E	1
	NU313E	1	NU2310E	1				
RC19~21	7312BUO	3	7311BUO	3	NU2217	2	NJ2308	1
	NU312E	1	NU2311E	1				
RC22~24	7313BUO	3	7315BUO	3	NJ2310E	1	NU2318E	1
	NU2313E	1	NU315E	1				

7. APPENDIX

7-1. RC SERIES OUTLINE DRAWINGS

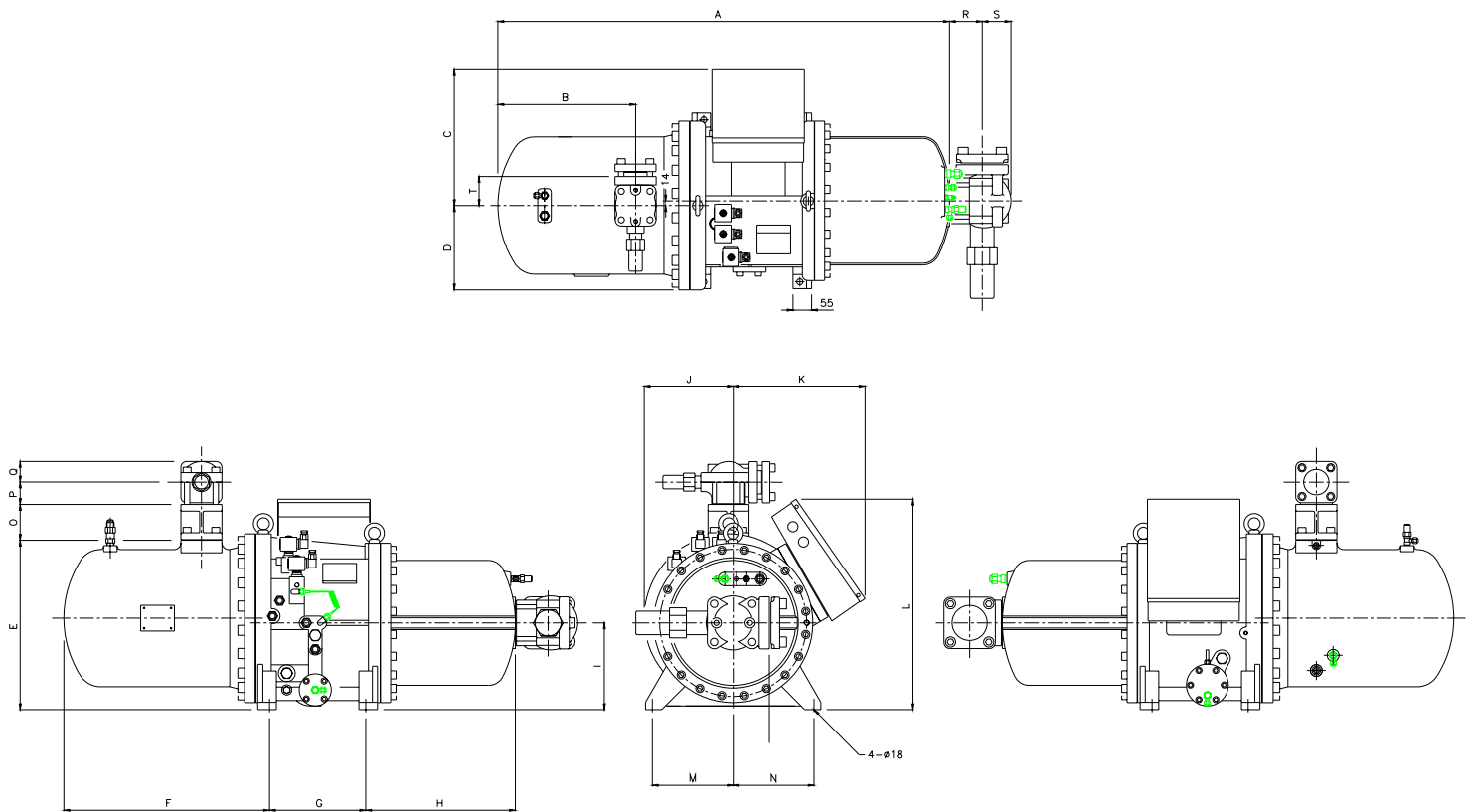
RC10~RC11 Outline Drawings



DIMENSION										UNIT: mm
Model	A	B	C	D	E	F	G	H	I	J
RC10-RC11	903	213	196	196	400	416.5	300	186.5	205	216

DIMENSION										UNIT: mm
Model	K	L	M	N	O	P	Q	R	S	T
RC10-RC11	176	558.5	196	156	101	56.6	53	70	61	75

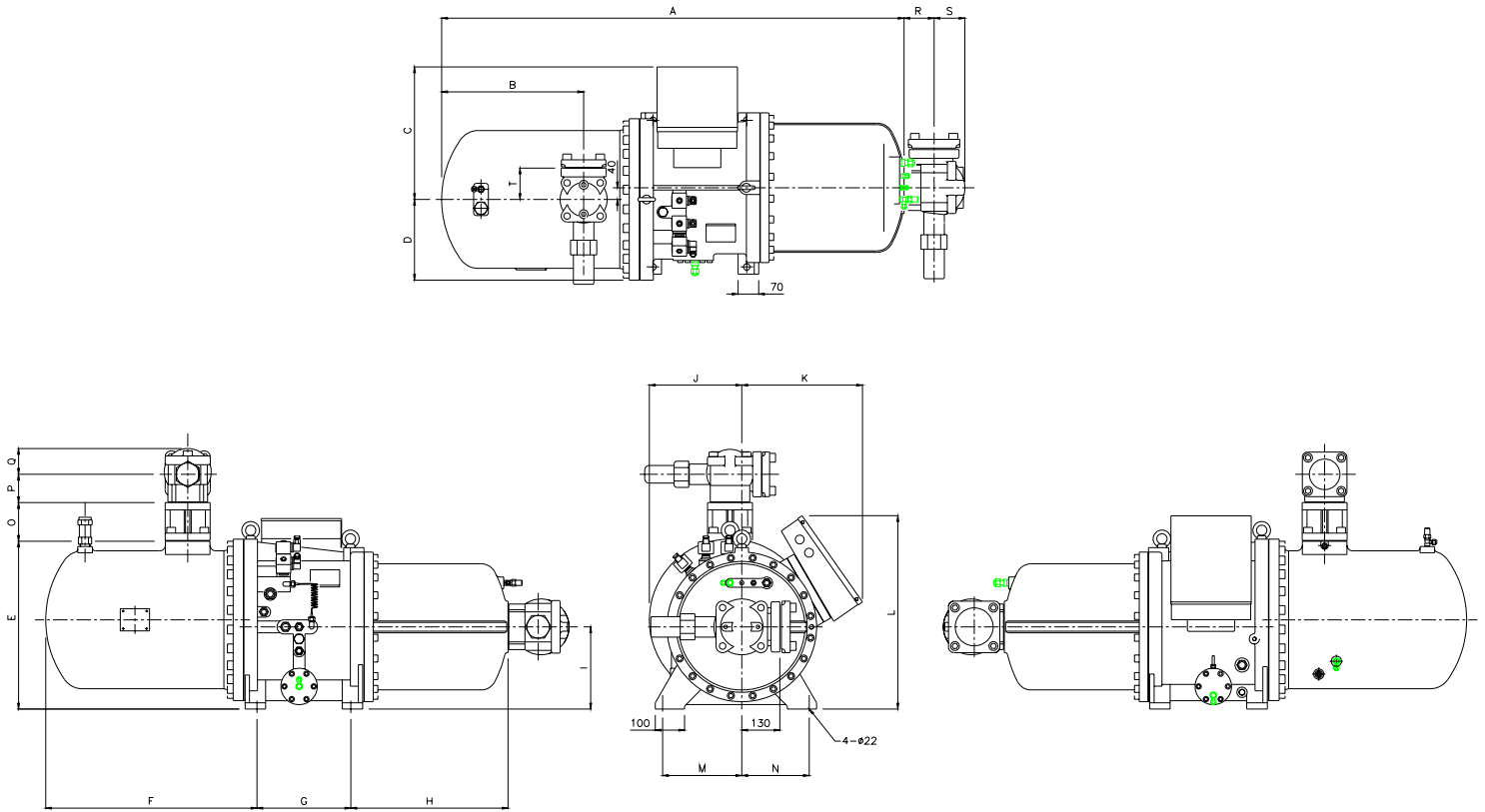
RC12~RC17 Outline Drawings



DIMENSION										UNIT: mm
Model	A	B	C	D	E	F	G	H	I	J
RC12	1042	310	378	229	447	501	200	341	225	245
RC13	1150	345	378	229	447	536	228	386	225	245
RC14	1217	365	405	250	502	567	251	399	257	264
RC15/15L	1339	408	405	250	502	610	285	444	257	264
RC16	1334	392	453	275	553	613	288	433	275	315
RC17	1459	440	453	275	553	661	320	478	275	315

DIMENSION										UNIT: mm
Model	K	L	M	N	O	P	Q	R	S	T
RC12	362	592	225	225	101	57	53	82	69	75
RC13	362	592	225	225	101	57	53	82	69	75
RC14	391	624	240	240	106	67	61	97	85	86
RC15/15L	391	624	240	240	106	67	61	97	85	86
RC16	413	655	270	230	120	82	68	103	105	95
RC17	413	655	270	230	120	82	68	103	105	95

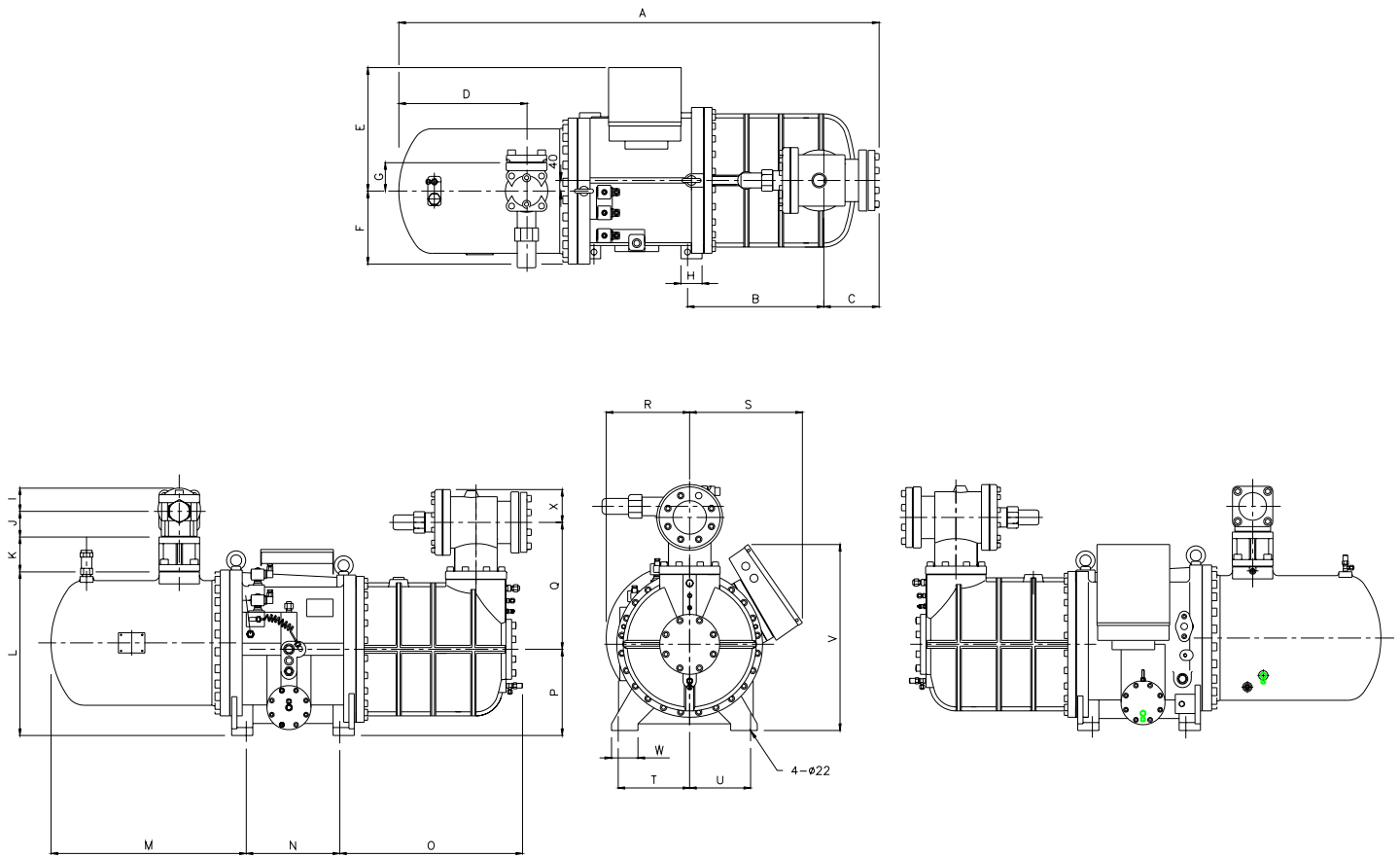
RC-18 Outline Drawings



DIMENSION											UNIT: mm	
Model	A	B	C	D	E	F	G	H	I	J	K	L
RC18	1576	484	451.5	275	572	720	320	536	280	315	411.5	659

DIMENSION									UNIT: mm
Model	M	N	O	P	Q	R	S	T	
RC18	270	230	131.5	96.5	88	103	105	107	

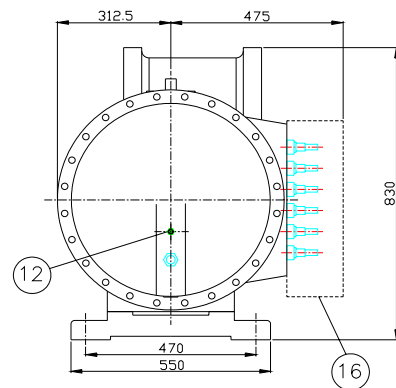
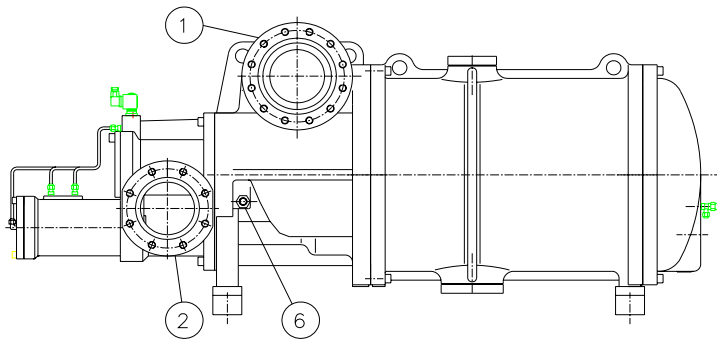
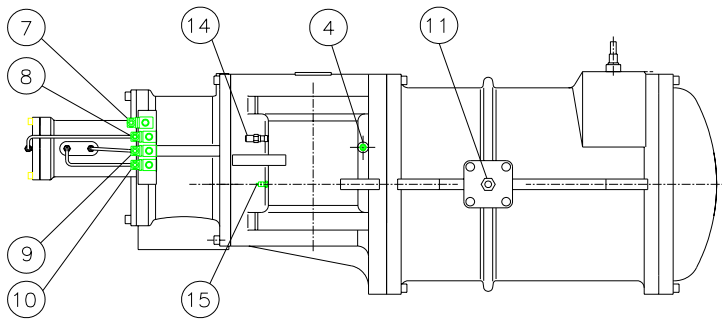
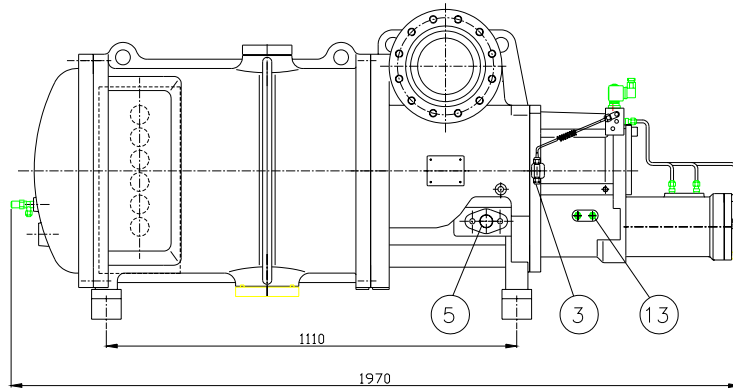
RC19~RC21 Outline Drawings



DIMENSION												UNIT: mm
Model	A	B	C	D	E	F	G	H	I	J	K	L
RC19	1812.5	514.5	208.5	484	466	275	107	80	88	96.5	131.5	617
RC20~21	2033.5	584.5	208.5	560	466	275	130	80	105	103	131.5	617

DIMENSION												UNIT: mm
Model	M	N	O	P	Q	R	S	T	U	V	W	X
RC19	736.5	353	690	325	478.5	315	426	270	230	701	100	124
RC20~21	822.5	418	760	325	478.5	315	426	270	230	701	100	124

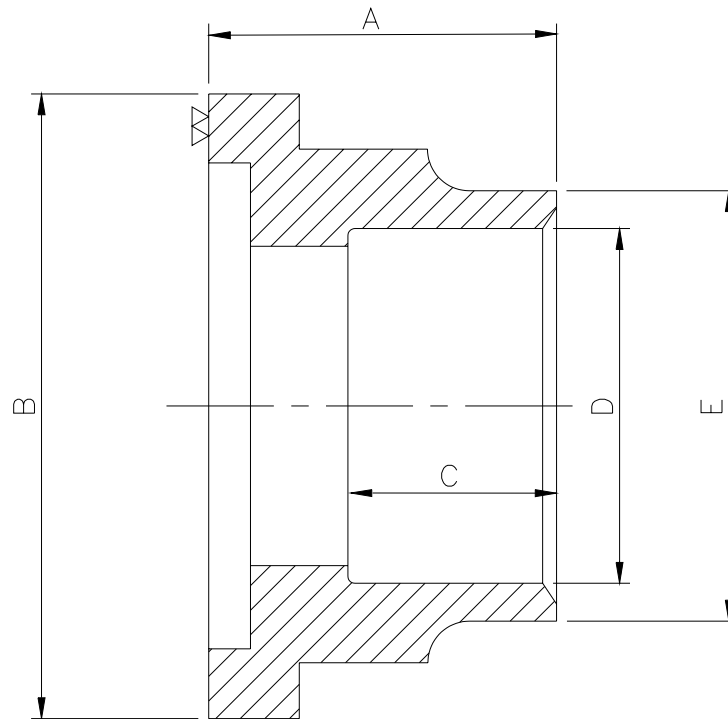
RC-22 Outline Drawing



- 1. Suction Flange
- 2. Discharge Flange
- 3. Oil Inlet Connector
- 4. Oil Inlet Connector
- 5. Economizer Connector
- 6. Liquid Injection Connector
- 7. Modulation S.V. (Continuous Control)
- 8. Modulation S.V. (25%)

- 9. Modulation S.V. (50%)
- 10. Modulation S.V. (75%)
- 11. Liquid Injection Connector
- 12. Stop Valve-Middle pressure side
- 13. Stop Valve-High pressure side
- 14. Stop Valve-Low pressure side
- 15. Refrigerant Charge Connector
- 16. Cable Box

7-2. OUTLINE DIMENSION OF DISCHARGE AND SUCTION FLANGE COUPLING



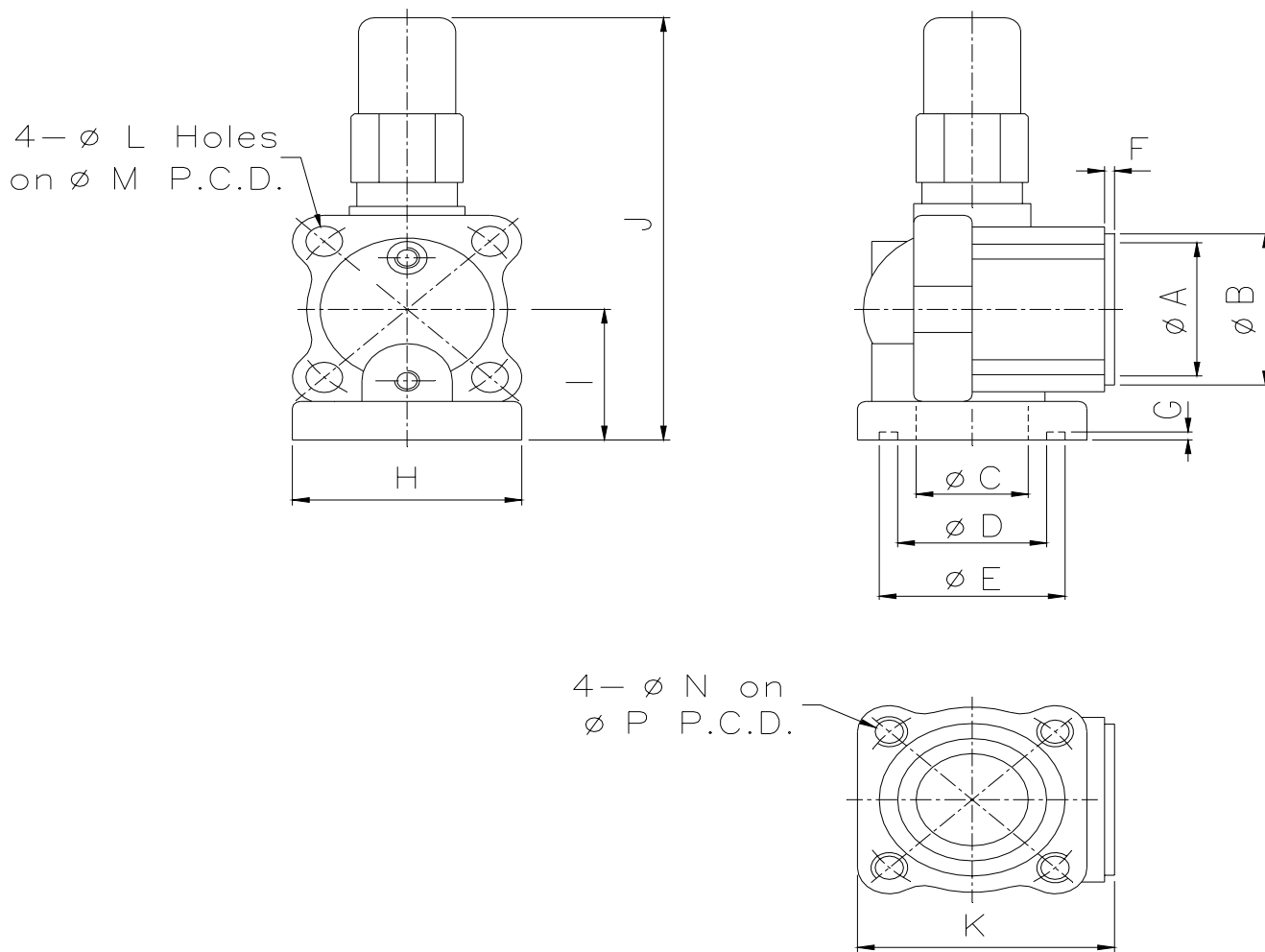
Specification and dimension of standard flanges coupling

Model	Standard Discharge Coupling Tube		Standard Suction Coupling Tube	
	Steel pipe	Copper pipe	Steel pipe	Copper pipe
RC10	1 1/2"	1 5/8"	2"	2 1/8"
RC11	1 1/2"	1 5/8"	2"	2 1/8"
RC12	1 1/2"	1 5/8"	2 1/2"	2 5/8"
RC13	1 1/2"	1 5/8"	2 1/2"	2 5/8"
RC14	2 "	2 1/8"	3"	3 1/8"
RC15	2 "	2 1/8"	3"	3 1/8"
RC15L	2 "	2 1/8"	3"	3 1/8"
RC16	2 1/2"	2 5/8"	4"	4 1/8"
RC17	2 1/2"	2 5/8"	4"	4 1/8"
RC18	3"	3 1/8"	4"	4 1/8"
RC19	3"	3 1/8"	5"	5 1/8"
RC20	4"	4 1/8"	5"	5 1/8"
RC21	4"	4 1/8"	5"	5 1/8"
RC22	5"	5 1/8"	6"	---
RC23	5"	5 1/8"	8"	---
RC24	5"	5 1/8"	8"	---

	Materials and Sizes of pipes		Dimension of standard flanges (Coupling Tube)				
			A	B	C	D	E
Suitable for Discharge flange of RC10~RC13	Copper	1 5/8"	52	75	35	41.6	52
		1 3/4"				44.8	55
		2"				51.1	62
		2 1/8"				54.3	65
	Steel	1 1/4"				43.3	58
		1 1/2"				49.3	64
Suitable for Discharge flange of RC14~RC15L And Suitable for Suction flange of R10 ~ RC11	Copper	1 3/4"	50	90	30	44.8	55
		2"				51.1	62
		2 1/8"				54.3	65
		2 1/2"				63.8	74
		2 5/8"				67	77
	Steel	1 1/2"				49.3	64
		2"				61.3	76
Suitable for Discharge flange of RC16~RC17 And Suitable for Suction flange of R12 ~ RC13	Copper	1 5/8"	60	110	35	41.6	52
		1 3/4"				44.8	55
		2"				51.1	62
		2 1/8"				54.3	65
		2 1/2"				63.8	74
		2 5/8"				67	77
	Steel	1 1/2"				49.3	64
		2"				61.3	76
		2 1/2"				77.2	90
Suitable for Discharge flange of RC18~RC19 And Suitable for Suction flange of RC14 ~ RC15L	Copper	2"	66	120	45	51.1	62
		2 1/8"				54.3	65
		2 3/8"				60.7	71
		2 1/2"				63.8	74
		2 5/8"				67	77
		3"				76.6	87
		3 1/8"				79.8	90
	Steel	2"				61.3	76
		2 1/2"				77.2	92
		3"				90.2	103
Suitable for Discharge flange of RC20, RC21 And Suitable for Suction flange of RC16 ~ RC18	Copper	3"	76	145	50	76.6	87
		3 1/8"				79.8	90
		3 5/8"				92.4	103
		4"				102	112
		4 1/8"				105.1	116
	Steel	3"				90.2	105
		3 1/2"				102.8	117
		4"				115.6	128

	Materials and Sizes of pipes		Dimension of standard flanges (Coupling Tube)				
			A	B	C	D	E
Suitable for Discharge flange of RC22~RC24 And Suitable for Suction flange of RC19 ~ R21	Copper	4 1/8"	80	174	35	105.1	121
		5 1/8"				130.5	147
	Steel	4"				115.6	134
		5"				141.3	154
Suitable for suction flange of RC22	Steel	5"	75	215	40	141.3	154
		6"				166.7	196
Suitable for suction flange of RC23~24	Steel	6"	75	215	40	166.7	196
		8"				75	260

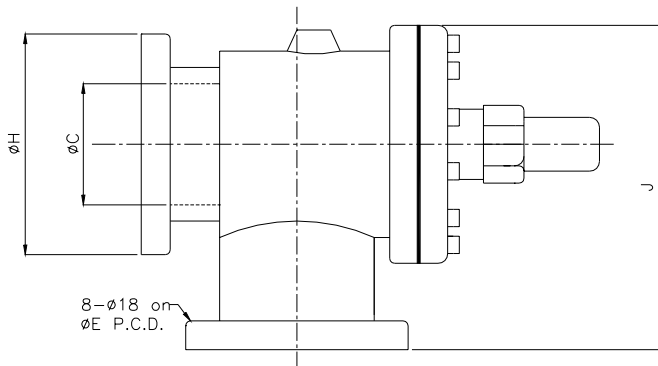
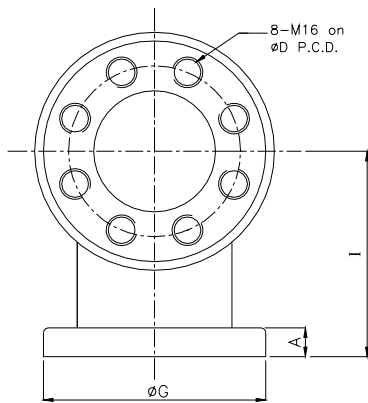
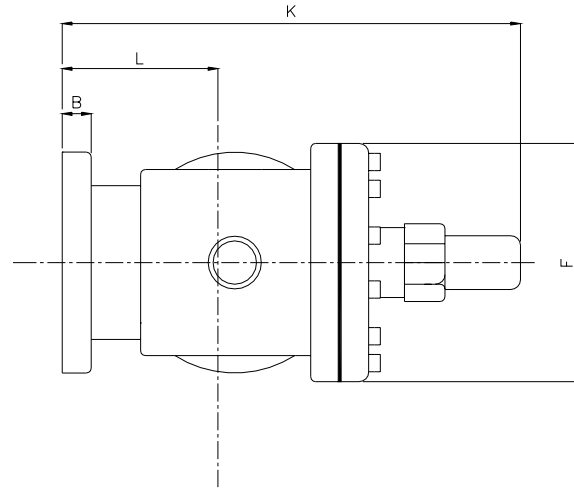
7-3. SPECIFICATION AND DIMENSION OF STOP (SERVICE) VALVES



Models	Dia.	Dimensions unit: mm														
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	P
RV-40	1 1/2"	60	75	36	59	76	6	5	106	75	256	115	18	105	M16x2	105
RV-65	2 1/2"	90	110	67	89	111	6	5	137	95	307	153	18	140	M16x2	140
RV-80	3"	100	120	80	99	121	6	5	154	117	398	177	22	160	M20x2.5	160
RV-100	4"	125	145	105	124	146	6	5	171	130	445	201	22	185	M20x2.5	185

Maximum working pressure	Hydrostatic pressure test	Refrigerant	Temperature range
28 kg / cm ² G	42 kg / cm ² G	HFC, HCFC	-40°C~150°C

Specification and dimension of stop valve (B)

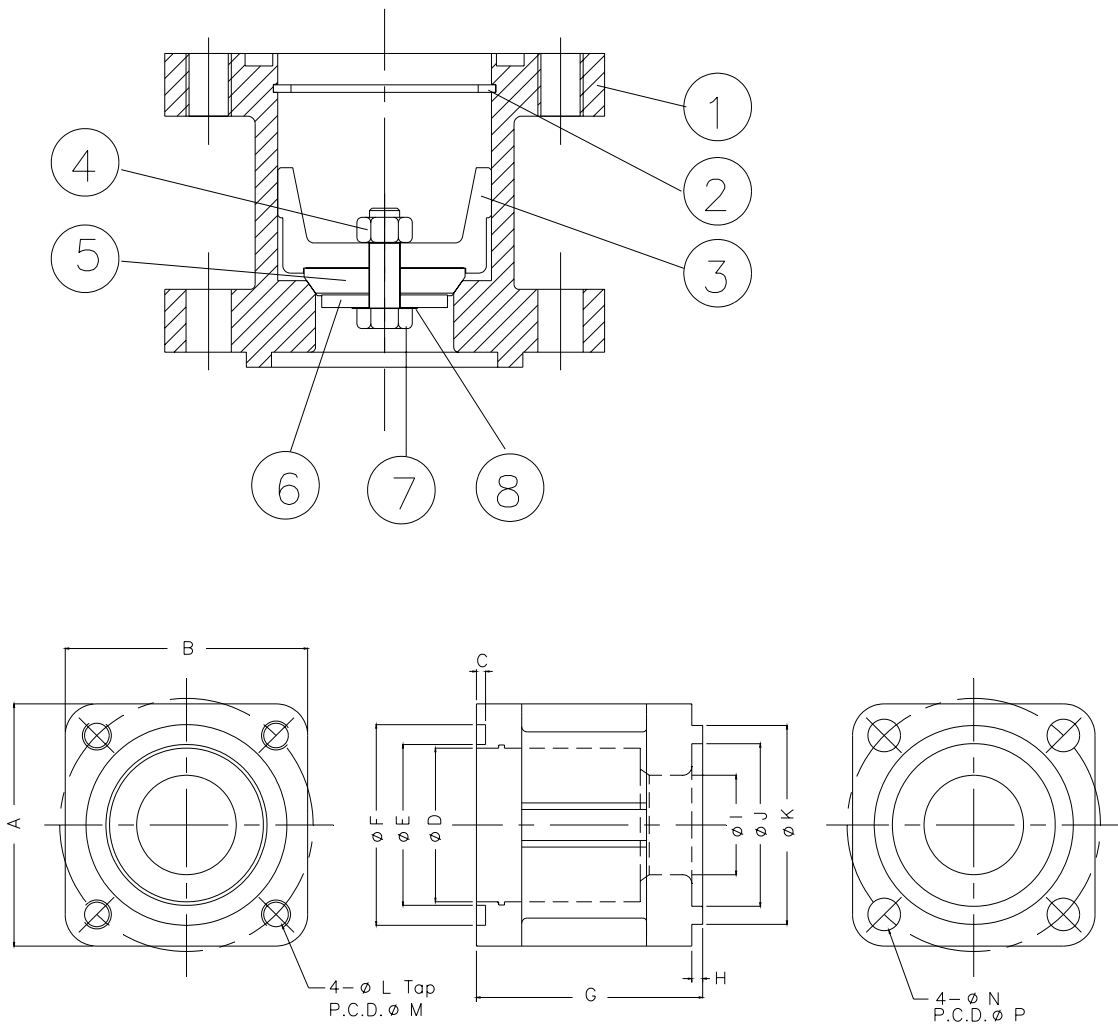


Models	Dia.	Dimensions												unit: mm
		A	B	C	D	E	F	G	H	I	J	K	L	
RV--120	5"	30	30	126	178	194	248	230	230	214	338	474	161	

Maximum working pressure	Hydrostatic pressure test	Refrigerant	Temperature range
28 kg / cm ² G	42 kg / cm ² G	HFC, HCFC	-40°C~150°C

7-4. SPECIFICATION AND DIMENSION OF CHECK VALVES

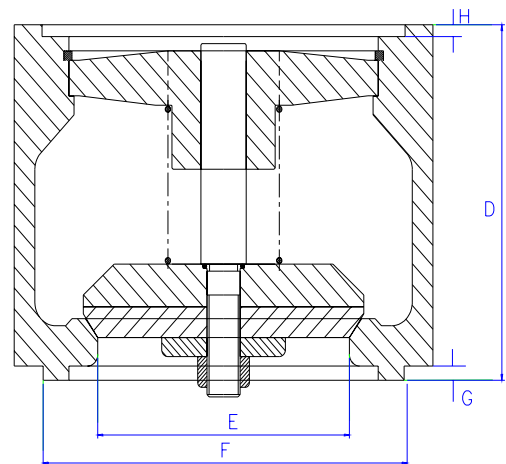
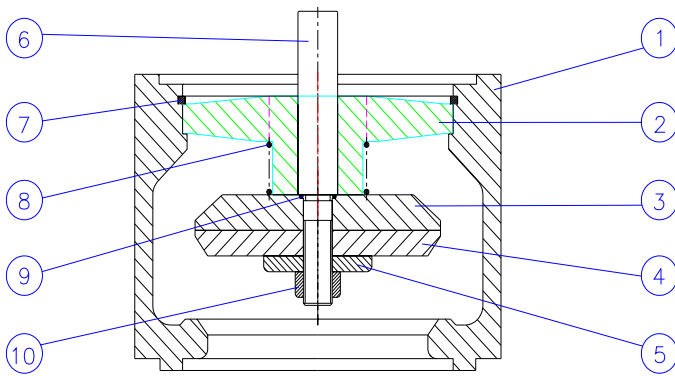
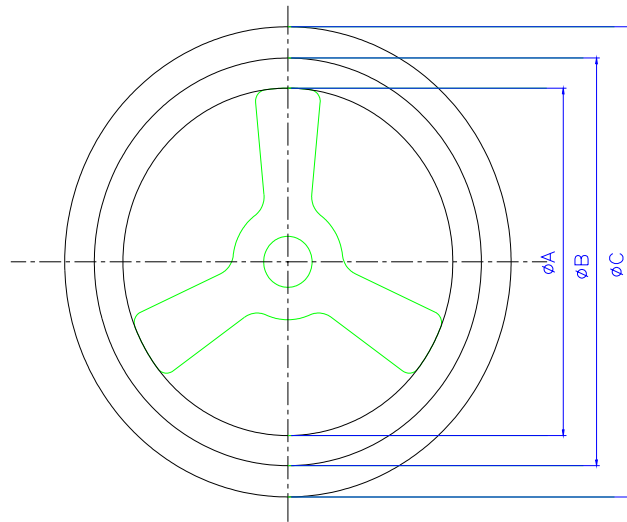
(A)



Diameter	Dimension														unit: mm	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	P	
1 1/2"	109	109	5	55	59	76	105	6	34	60	75	M16x2	105	18	105	
2 1/2"	134	134	5	85	89	111	125	6	55	90	110	M16x2	140	18	140	
3"	153	153	5	95	99	121	135	6	66	100	120	M20x2.5	160	22	160	
4"	171	171	5	120	124	146	135	6	80.5	125	145	M20x2.5	185	22	185	

No.	1	2	3	4	5	6	7	8
Item	Body	C clipper	Guide seat	Nut	Valve plate	Gasket	Bolt	Washer

**Specification and dimension of check valve
(B)**



Diameter	Dimension								Unit: mm
	A	B	C	D	E	F	G	H	
5"	150	176	203	150	122	175	6	5	

No.	1	2	3	4	5	6	7	8	9	10
Item	Body	Guide seat	Valve plate	Gasket	Valve plate	Rod	C clipper	Spring	O-ring	M-16 bolt

7-5. CHECKLIST

MODEL	COMPRESSOR TESTING CHECK LIST	
	1	INSULATION To ground: U, V, W, THERMAL PROTECTOR
		TEST Between Phase: U-Z, V-X, W-Y
		Protector: U, V, W (USED 1000DCV, 2000Mega ohms the reading be greater than 100)
	2	Check if the compressor have sufficient oil before testing.
FOR TESTING	3	When using Generator, be sure that the voltage, frequency are the same as compressor specs.
	4	Be sure the compressor have been vacuum. Inlet, Outlet stop valve had been open.
	5	Check if there is refrigerant in the system.
	6	Check if the motor rotation is correct.The discharge pressure is higher than suction.
	7	Be sure the compressor is in 50 % capacity position after compressor stop.
	8	Be sure to turn OFF the main breaker when compressor stop. (NFB)
	9	Check if there is anything wrong, then fill-up the production check table.
	10	Check the voltage, current of 3 phase while running. OK: NO OK: specified
	11	Vibration frequency analysis to measure the vibration. OK: NO OK: specified
	12	Noise level: dBA, Background noise: dBA
		If there some noise, what kind of noise.(Which of the modulation have problem.)
	13	Check the modulation: loading: 25%~50% 50%~75% 75%~100%
		unloading: 25%~50% 50%~75% 75%~100%
	1	Check if the compressor are clean inside. (no metallic particles)
	2	Be sure that P1 hole had been clean.
LEAK TEST	3	Check all the packing, gasket of compressor.If damage,change with new one.
2nd TEST	4	Check if there is two magnet in the crankcase and clean it first.
	5	Check if the copper flare had been damage and change with new one.
	6	Be sure to change the suction and oil filter with new one after each performance test.
	7	Check if there is any leak by implating it with dry air with pressure of 28 kg/cm2 G for 1min.
	1	Check the specification of oil. Standard:
	2	Be sure that the compressor have been vacuum with a pressure of 0.3~0.5 kg/cm2G
	3	Be sure to put additional nut and washer in the six power bolt terminal.
INSULATION		To ground: U, V, W, Thermal protector
TEST		Between the phase: U-Z, V-X, W-Y
		Protector: U, V, W, (used 1000DCV, 2000Mega ohms, reading should be more than 100)
	1	Check if all the cover in the accessories have been remove after painting.
FINAL	2	Check if there is no oil leakages in all the flanges and connections.
PROCEDURE	3	Check if all the screw of cable box have been screwed and it should be the same model as the
		compressor. Also check if all the accessories and sticker are present.
	4	Check if there is anything wrong and fill up the production check table.
	5	Heater voltage: 220V Solenoid valve coil: 220V
REMARKS		

7-6. SCREW COMPRESSOR PARTS LIST

RC12~15L PARTS LIST		
ITEM	PART NAME	QTY.
1	OIL SEPARATOR	1
	1"1/2 GASKET (2"1/2 FOR RC-14&15)	1
2	ANGLE VALVE	1
3	BOLT	4
4	BOLT	4
5	WASHER	8
6	DISCHARGE FLANGE	1
7	COPPER TUBE	1
8	CHECK VALVE	1
9	OIL SEPARATOR GASKET	1
10	BOLT (OIL SEPARATOR)	20
11	BOLT (END PLATE)	13
12	DISCHARGE COVER PLATE	1
13	GASKET OF DISCHARGE COVER PLATE	1
14	BOLT (FOR SLIDE VALVE FIXED)	1
15	SPRING WASHER	1
16	WASHER	1
17	PISTON	1
18	COPPER WASHER	1
19	PISTON'S O-RING	2
20	PISTON RING	2
21	PISTON ROD	1
22	PISTON SPRING	1
23	DISC SPRING (MALE ROTOR)	1
24	DISCHARGE FIXED RING (MALE ROTOR)	1
25	KM9 BEARING SLOT NUT (MALE ROTOR)	1
26	DISCHARGE BEARING (AXIAL, MALE ROTOR)	3
27	DISCHARGE BEARING (RADIAL, MALE ROTOR)	1
28	BALANCE PISTON	1
29	MALE ROTOR	1
30	MOTOR ROTOR KEY	1
31	OIL GUIDING RING (MALE ROTOR)	1
32	SUCTION BEARING (MALE ROTOR)	1
33	INNER SPACER RING OF SUCTION BEARING (MALE ROTOR)	1
34	OUTER SPACER RING OF SUCTION BEARING (MALE ROTOR)	1
35	SUCTION BEARING (MALE ROTOR)	1
36	MOTOR ROTOR	1
37	MOTOR ROTOR SPACER RING	1
38	MOTOR ROTOR WASHER	1
39	SPRING WASHER	1
40	BOLT (FOR MOTOR ROTOR FIXED)	1
41	DISC SPRING (FEMALE ROTOR)	1
42	DISCHARGE FIXED RING (FEMALE ROTOR)	1
43	KM6 BEARING SLOT NUT (FEMALE ROTOR)	1
44	DISCHARGE BEARING OF FEMALE ROTOR (AXIAL)	3
45	INNER SPACER RING OF FEMALE ROTOR	1
	OUTER SPACER RING OF FEMALE ROTOR	1

RC12~15L PARTS LIST		
ITEM	PART NAME	QTY.
46	DISCHARGE BEARING OF FEMALE ROTOR (RADIAL)	1
47	FEMALE ROTOR	1
48	OIL GUIDING RING (FEMALE ROTOR)	1
49	SUCTION BEARING (FEMALE ROTOR)	1
50	BEARING SEAT	1
51	GASKET OF DISCHARGE EXHAUST TUBE	1
52	BOLT (FOR BEARING SEAT)	8
53	FIX PIN	2
54	PLUG	2
55	BOLT FOR SLIDE VALVE KEY	1
56	SLIDE VALVE KEY	1
57	SLIDE VALVE	1
58	BOLT	6
59	SERVICE FLANGE	1
60	GASKET OF SERVICE FLANGE	1
61	MAGNETICS	2
62	COMPRESSOR CASING	1
63	OIL FILTER	1
64	INNER GASKET OF OIL FILTER FLANGE	1
65	OUTER GASKET OF OIL FILTER FLANGE	1
66	OIL FILTER FLANGE	1
67	BOLT	4
68	OIL HEATER (220V)	1
69	POWER BOLT	6
70	POWER BOLT O-RING	6
71	COPPER NUT (FOR POWER BOLT)	6
72	SPRING WASHER	6
73	COPPER NUT	6
74	SCREW FOR PTC WIRING	2
	PTC WIRING SCREW O-RING	2
75	BOLT (FOR MOTOR CABLE COVER PLATE)	16
76	MOTOR CABLE COVER PLATE	1
77	GASKET (FOR MOTOR CABLE COVER PLATE)	1
78	NUT	3
79	WASHER	3
80	SOLENOID COIL	3
81	SOLENOID VALVE (STEP CONTROL)	3
	SOLENOID VALVE O-RING	6
82	BOLT	12
83	CAPILLARY	1
84	90° ELBOW	2
85	PLUG	1
	PLUG O-RING	1
86	5/8" CONNECTOR	3
87	OIL SIGHT GLASS (O-RING INCLUDED)	1
88	SUCTION FIXED RING (MALE ROTOR)	1
89	BOLT	4
90	WASHER	1
91	SPRING WASHER	1

RC12~15L PARTS LIST		
ITEM	PART NAME	QTY.
92	BOLT	1
93	BOLT (FOR MOTOR STATOR GUIDE VANE)	7
94	M8 SPRING WASHER	8
95	PAD OF GUIDE VANE	1
96	MOTOR STATOR GUIDE VANE	1
97	MOTOR STATOR	1
98	FIXED PIN OF MOTOR STATOR	1
99	GASKET OF MOTOR CASING	1
100	MOTOR CASING	1
101	BOLT (FOR MOTOR CASING)	20
102	2"1/2 GASKET (3" FOR RC-14~15l)	1
103	SUCTION FILTER	1
104	GASKET	1
105	COPPER TUBE	1
106	SUCTION FLANGE	1
107	WASHER	8
108	BOLT (FOR SUCTION FLANGE)	4

RC16~18 PARTS LIST		
ITEM	PART NAME	QTY.
1	OIL SEPARATOR	1
	GASKET	1
2	ANGLE VALVE	1
3	BOLT	4
4	BOLT	4
5	WASHER	8
6	DISCHARGE FLANGE	1
7	COPPER TUBE	1
8	CHECK VALVE	1
9	OIL SEPARATOR GASKET	1
10	BOLT (OIL SEPARATOR)	24
11	BOLT (END PLATE)	15
12	DISCHARGE COVER PLATE	1
13	GASKET OF DISCHARGE COVER PLATE	1
14	BOLT (FOR SLIDE VALVE FIXED)	1
15	SPRING WASHER	1
16	WASHER	1
17	PISTON	1
18	COPPER WASHER	1
19	PISTON'S O-RING	2
20	PISTON RING	2
21	PISTON ROD	1
22	PISTON INNER SPRING	1
	PISTON OUTER SPRING	1
23	DISC SPRING (MALE ROTOR)	1
24	DISCHARGE FIXED RING (MALE ROTOR)	1
25	KM9 BEARING SLOT NUT (MALE ROTOR)	1
26	DISCHARGE BEARING (AXIAL, MALE ROTOR)	3
27	DISCHARGE BEARING (RADIAL, MALE ROTOR)	1

RC16~18 PARTS LIST		
ITEM	PART NAME	QTY.
28	BALANCE PISTON	1
29	MALE ROTOR	1
30	MOTOR ROTOR KEY	1
31	OIL GUIDING RING (MALE ROTOR)	1
32	SUCTION BEARING (MALE ROTOR)	1
33	INNER SPACER RING OF SUCTION BEARING (MALE ROTOR)	1
34	OUTER SPACER RING OF SUCTION BEARING (MALE ROTOR)	1
35	SUCTION BEARING (MALE ROTOR)	1
36	MOTOR ROTOR	1
37	MOTOR ROTOR SPACER RING	1
38	MOTOR ROTOR WASHER	1
39	SPRING WASHER	1
40	BOLT (FOR MOTOR ROTOR FIXED)	1
41	DISC SPRING (FEMALE ROTOR)	1
42	DISCHARGE FIXED RING (FEMALE ROTOR)	1
43	KM6 BEARING SLOT NUT (FEMALE ROTOR)	1
44	DISCHARGE BEARING OF FEMALE ROTOR (AXIAL)	3
45	INNER SPACER RING OF FEMALE ROTOR	1
	OUTER SPACER RING OF FEMALE ROTOR	1
46	DISCHARGE BEARING OF FEMALE ROTOR (RADIAL)	1
47	FEMALE ROTOR	1
48	OIL GUIDING RING (FEMALE ROTOR)	1
49	SUCTION BEARING (FEMALE ROTOR)	1
50	BEARING SEAT	1
51	GASKET OF DISCHARGE EXHAUST TUBE	1
52	BOLT (FOR BEARING SEAT)	8
53	FIX PIN	2
54	PLUG	2
55	BOLT FOR SLIDE VALVE KEY	1
56	SLIDE VALVE KEY	1
57	SLIDE VALVE	1
58	BOLT	6
59	SERVICE FLANGE	1
60	GASKET OF SERVICE FLANGE	1
61	MAGNETICS	2
62	COMPRESSOR CASING	1
63	OIL FILTER	1
64	INNER GASKET OF OIL FILTER FLANGE	1
65	OUTER GASKET OF OIL FILTER FLANGE	1
66	OIL FILTER FLANGE	1
67	BOLT	6
68	OIL HEATER (220V)	1
69	POWER BOLT	6
70	POWER BOLT O-RING	6
71	COPPER NUT (FOR POWER BOLT)	6
72	SPRING WASHER	6
73	COPPER NUT	6
74	SCREW FOR PTC WIRING	2
	PTC WIRING SCREW O-RING	2
75	BOLT (FOR MOTOR CABLE COVER PLATE)	16
76	MOTOR CABLE COVER PLATE	1
77	GASKET (FOR MOTOR CABLE COVER PLATE)	1
78	NUT	3
79	WASHER	3

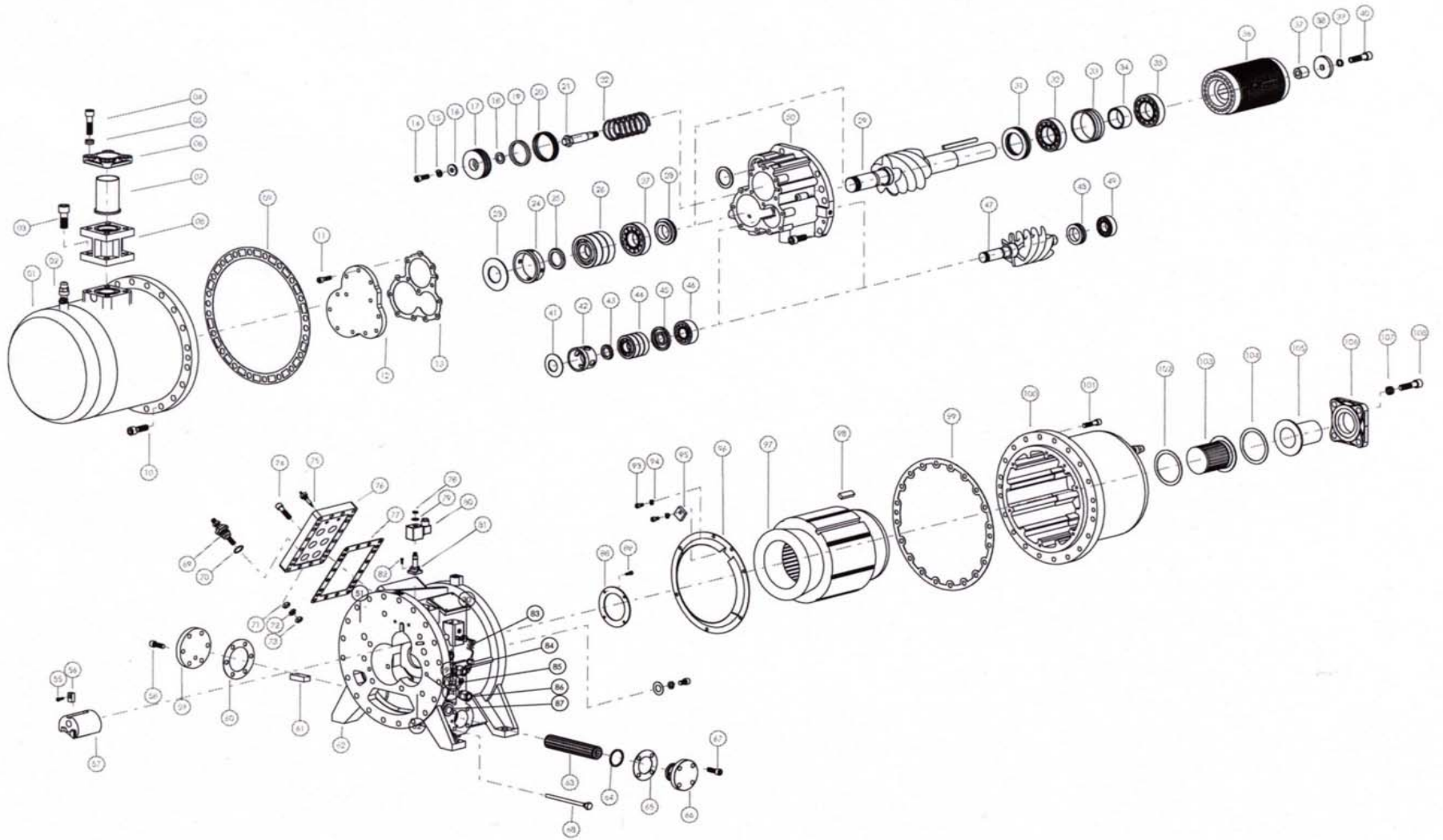
RC16~18 PARTS LIST		
ITEM	PART NAME	QTY.
80	SOLENOID COIL	3
81	SOLENOID VALVE (STEP CONTROL)	3
	SOLENOID VALVE O-RING	6
82	BOLT	12
83	CAPILLARY	1
84	90° ELBOW	2
85	PLUG	1
	PLUG O-RING	1
86	5/8" CONNECTOR	3
87	OIL SIGHT GLASS (O-RING INCLUDED)	1
88	SUCTION FIXED RING (MALE ROTOR)	1
89	BOLT	6
90	WASHER	1
91	SPRING WASHER	1
92	BOLT	1
93	BOLT (FOR MOTOR STATOR GUIDE VANE)	6
94	M8 SPRING WASHER	8
95	PAD OF GUIDE VANE	2
96	MOTOR STATOR GUIDE VANE	1
97	MOTOR STATOR	1
98	FIXED PIN OF MOTOR STATOR	1
99	GASKET OF MOTOR CASING	1
100	MOTOR CASING	1
101	BOLT (FOR MOTOR CASING)	20
102	GASKET	1
103	SUCTION FILTER	1
104	GASKET	1
105	COPPER TUBE	1
106	SUCTION FLANGE	1
107	WASHER	8
108	BOLT (FOR SUCTION FLANGE)	4

RC19~21 PARTS LIST		
ITEM	PART NAME	QTY.
1	OIL SEPARATOR	1
	GASKET	1
2	ANGLE VALVE	1
3	BOLT	4
4	BOLT	4
5	WASHER	8
6	DISCHARGE FLANGE	1
7	COPPER TUBE	1
	GASKET	1
8	CHECK VALVE	1
9	OIL SEPARATOR GASKET	1
10	BOLT (OIL SEPARATOR)	24
11	BOLT (END COVER PLATE)	15
12	DISCHARGE END COVER PLATE	1
13	GASKET OF DISCHARGE COVER PLATE	1
14	BOLT (FOR SLIDE VALVE FIXED)	1
15	SPRING WASHER	1

RC19~21 PARTS LIST		
ITEM	PART NAME	QTY.
16	WASHER	1
17	PISTON	1
18	COPPER WASHER	1
19	PISTON'S O-RING	2
20	PISTON RING	2
21	PISTON ROD	1
22	VALID PISTON SPRING (INNER)	1
23	VALID PISTON SPRING (OUTTER)	1
24	DISC SPRING (MALE ROTOR)	1
25	DISCHARGE FIXED RING (MALE ROTOR)	1
26	KM12 BEARING SLOT NUT (MALE ROTOR)	1
27	DISCHARGE BEARING (AXIAL, MALE ROTOR)	3
28	DISCHARGE BEARING (RADIAL, MALE ROTOR)	1
29	BALANCE PISTON (MALE)	1
30	MALE ROTOR	1
31	KEY OF MOTOR ROTOR	1
32	OIL GUIDING RING (MALE ROTOR)	1
33	SUCTION BEARING (MALE ROTOR)	1
34	OUTER SPACER RING OF SUCTION BEARING (MALE ROTOR)	1
35	INNER SPACER RING OF SUCTION BEARING (MALE ROTOR)	1
36	SUCTION BEARING (MALE ROTOR)	1
37	MOTOR ROTOR	1
38	MOTOR ROTOR SPACER RING	1
39	MOTOR ROTOR WASHER	1
40	SPRING WASHER	1
41	BOLT (FOR MOTOR ROTOR FIXED)	1
42	DISC SPRING (FEMALE ROTOR)	1
43	DISCHARGE FIXED RING (FEMALE ROTOR)	1
44	KM11 BEARING SLOT NUT (FEMALE ROTOR)	1
45	DISCHARGE BEARING OF FEMALE ROTOR (LONGITUDINAL)	3
46	DISCHARGE BEARING (TRANSVERSE, FEMALE ROTOR)	1
47	BALANCE PISTON (FEMALE)	1
48	FEMALE ROTOR	1
49	OIL GUIDING RING (FEMALE ROTOR)	1
50	SUCTION BEARING OF FEMALE ROTOR (TRANSVERSE)	1
51	BEARING SEAT	1
52	GASKET OF DISCHARGE EXHAUST TUBE	1
53	BOLT (FOR BEARING SEAT)	8
54	FIX PIN	2
55	PLUG	2
56	BOLT FOR SLIDE VALVE KEY	1
57	SLIDE VALVE KEY	1
58	SLIDE VALVE	1
59	BOLT	8
60	OIL LEVEL SWITCH SET	1
61	GASKET OF SERVICE FLANGE	1
62	MAGNETICS	2
63	COMPRESSOR CASING	1
64	OIL FILTER	1
65	INNER GASKET OF OIL FILTER FLANGE	1
66	GASKET OF SERVICE FLANGE	1
67	OIL FILTER FLANGE	1
68	BOLT	8
69	POWER BOLT	6
70	POWER BOLT O-RING	6

RC19~21 PARTS LIST		
ITEM	PART NAME	QTY.
71	COPPER NUT (FOR POWER BOLT)	6
72	SPRING WASHER	6
73	COPPER NUT (FOR POWER BOLT)	6
74	SCREW FOR PTC WIRING	2
	PTC WIRING SCREW O-RING	2
75	BOLT (FOR MOTOR CABLE COVER PLATE)	16
76	MOTOR CABLE COVER PLATE	1
77	GASKET (FOR MOTOR CABLE COVER PLATE)	1
78	NUT	3
79	WASHER	3
80	SOLENOID COIL	3
81	SOLENOID VALVE (STEP CONTROL)	3
82	BOLT	12
83	CAPILLARY	1
84	90° ELBOW	2
85	5/8" CONNECTOR	1
86	OIL SIGHT GLASS (O-RING INCLUDED)	2
87	PLUG (O-RING INCLUDED)	1
	POWER BOLT O-RING	1
88	3/4"CONNECTOR	2
89	SUCTION FIXED RING (MALE ROTOR)	1
90	BOLT	6
91	WASHER	1
92	SPRING WASHER	1
93	BOLT (FOR MOTOR STATOR GUIDE VANE)	1
94	MOTOR STATOR	1
95	GASKET OF MOTOR CASING	1
96	MOTOR CASING	1
97	BOLT (FOR MOTOR CASING)	24
98	FIXED BOLT OF MOTOR STATOR	1
	FIXED BOLT O-RING	1
99	WASHER (FOR FIXED BOLT OF MOTOR STATOR)	1
100	BOLT	8
101	M16 SPRING WASHER	24
102	FLANGE	1
103	FLANGE SHELF	1
104	GASKET FOR 5" FLANGE	1
105	GASKET FOR SUCTION FILTER	1
106	SUCTION FILTER	1
107	SPRING	1
108	GASKET FOR SUCTION FILTER FLANGE	1
109	SUCTION FILTER FLANGE	1
110	BOLT (FOR SUCTION FLANGE)	8

RC-12~RC17 EXPLODED DRAWING



RC19~RC21 EXPLODED DRAWING

