Micro Control Systems

HANBELL

RE Series

MAINTENANCE MANUAL

Next generation of innovative design Screw compressor dedicated to:
R134a, R513A, R1234ze
R450A, R1234yf

High COP & IPLV Model

RE Series

Screw Compressor

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PREFACE

“RE Series Screw Compressor Maintenance Manual” serves as a guide for technicians to do maintenance or overhaul of HANBELL RE series compressor.

Before maintenance or overhaul of compressor, preparation of components, spare parts, tools, measuring instruments and facilities as well as clean surroundings are must.

Although proper procedures of maintenance are described in this manual, the person who performs maintenance of compressor should be well trained and authorized by HANBELL or HANBELL distributors.

I. HOW TO REPLACE CAPACITY SOLENOID VALVE

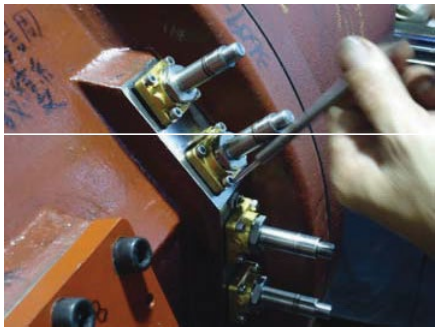
NOTE: If the compressor is still connected in the chiller system, please make sure to pump down first, release pressure inside the compressor and shut down the system to prevent any accident at job site.

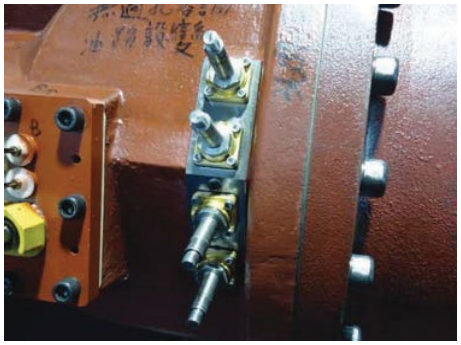
I-1. ASSEMBLE SOLENOID VALVE

Step 1. Put gasket on solenoid valve.
Two holes of gasket must be aligned with those on solenoid valve.

Step 2. Install solenoid valve on compressor casing and make sure that two holes of solenoid valve must be aligned with oil-line holes of compressor casing.

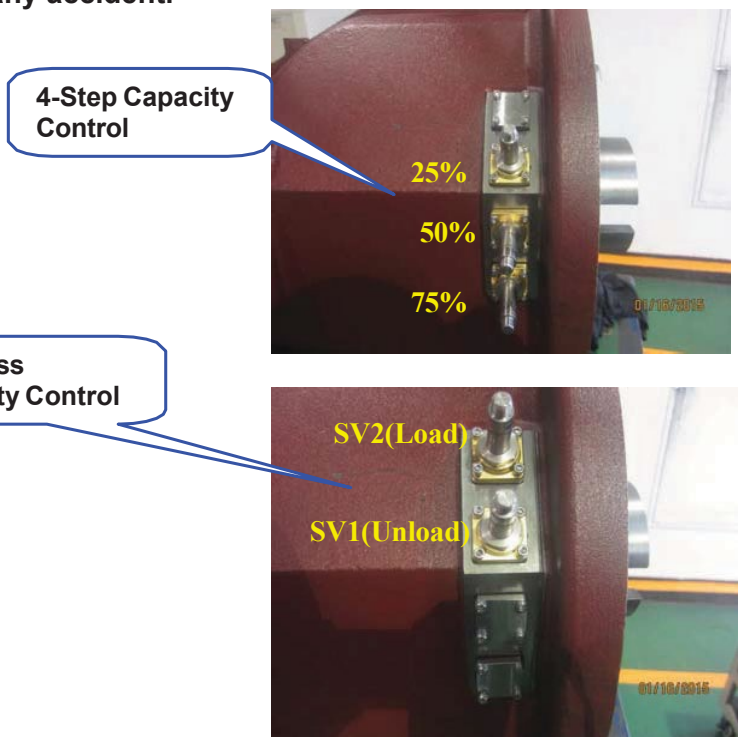
Step 3. Install all solenoid valves on compressor casing, put all bolts on and tighten them.





II. HOW TO CHANGE 4-STEP TO STEP-LESS CAPACITY CONTROL

NOTE: Make sure to release pressure inside the compressor before replacement of each compressor part to prevent any accident.



II-1. DISMANTLE SOLENOID VALVE

Step 1. Loosen all bolts on 75% and 50% solenoid valves and remove them.

Step 2. Loosen bolts on cover plate and remove it.

II-2. ASSEMBLE COVER PLATE

Step 1. Put cover plate with gasket on 50% and 75% solenoid positions.

Step 2. Tighten all bolts.

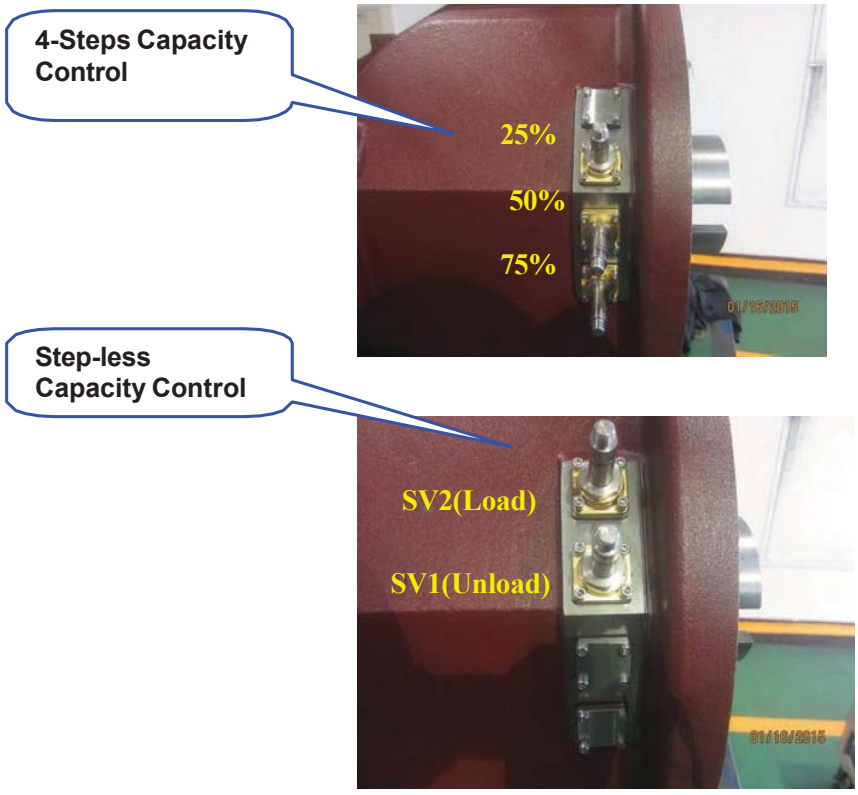
II-3. ASSEMBLE LOAD SOLENOID VALVE (SV2, N.C. as Standard)

Step 1. Put gasket on solenoid valve, two holes of gasket must be aligned with those on casing.

Step 2. Put solenoid valve on casing.

Step 3. Tighten bolts.

III. HOW TO CHANGE STEP-LESS TO 4-STEP CAPACITY CONTROL



III-1. DISMANTLE SOLENOID VALVE AND COVER PLATE

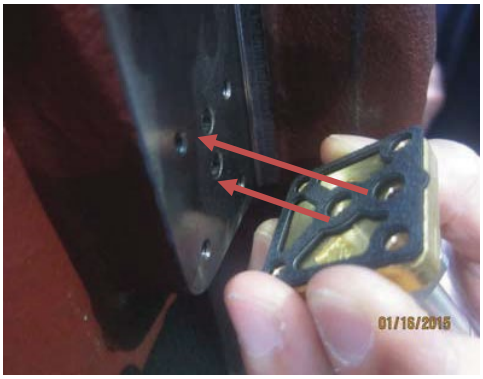
Step 1. Except SV1(25%), loosen all bolts of another solenoid valve and remove them.

III-2. ASSEMBLE 50% and 75% SOLENOID VALVE (N.C) AND COVER PLATE

Step1. Assemble cover plate for step control.
The hole of gasket and cover plate must be aligned with two holes on casing.

Step 2. Tighten all bolts

Step 3 Install 50% and 75% solenoid valve (N.C) with gasket on casing. Two holes of gasket and solenoid valve must be aligned with those on casing.



Step 4 Tighten bolts

IV. HOW TO REPLACE OIL FILTER, OIL LEVEL SWITCH

NOTE: If the compressor is still in the chiller system, please pump down the system first, then close the stop valves and release high pressure inside the compressor before removing or replacing any parts for servicing to prevent any accident at job site.

IV-1. DISMANTLE OIL FILTER FLANGE

Step 1. Drain and recover lubricant inside the compressor by loosening the nut of angle valve on service flange or oil filter flange. Another way is loosening all bolts of oil filter flange and removing this flange to drain oil.

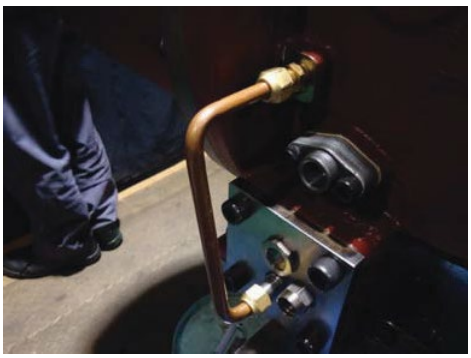
Step 2. After draining lubricant, loosen all bolts of oil filter flange and pull out flange and oil filter.

IV-3. ASSEMBLE OIL FILTER ON COMPRESSION CASING

Step 1. Assemble oil filter and oil filter flange.

Step 2. Install oil filter assembly on compressor casing.

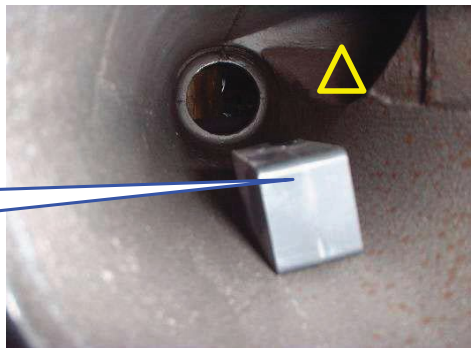
Step 3. Install all hexagonal screw bolts and tighten it using a hexagonal wrench or a torque wrench with torque, **1000 kg-cm.**



IV-4. DISMANTLE OIL LEVEL SWITCH FLANGE

Step 1. Use a torque wrench or hexagonal wrench to loosen bolts of oil level switch cover.

Step 2. If user finds magnet as shown in the photo, take it out and clean it using pressurized air or a piece of cloth then put it back at the position which we mark a triangle sign.



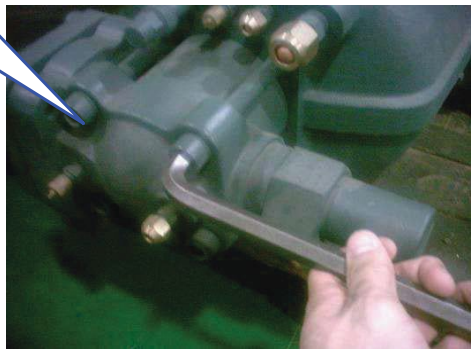
V. HOW TO REPLACE SUCTION FILTER

NOTE: If the compressor is still connected in the chiller system, please make sure to pump down the system and release pressure inside the compressor before replacing any parts of the compressor to prevent any accident at job site.

V-1. DISMANTLE SUCTION FLANGE

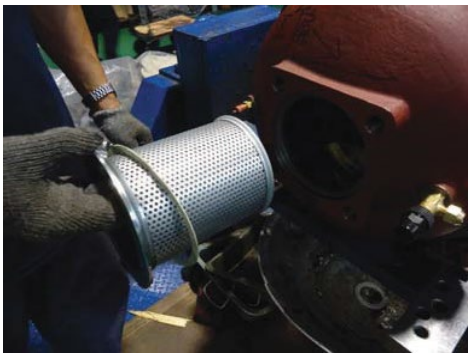
Step 1. Loosen all hexagonal screw bolts of suction flange with a wrench.

NOTE: If the stop valve is connected directly to the suction flange, loosen all screw bolts and remove the stop valve.



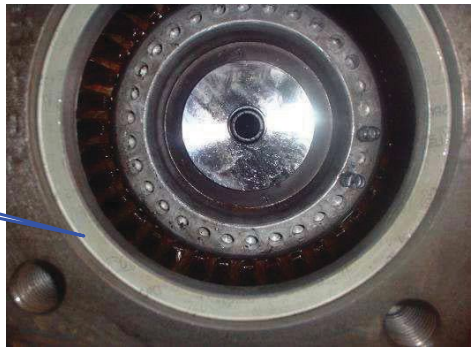
Step 2. Disconnect suction piping from the compressor.

Step 3. Remove gaskets and suction filter from the compressor.

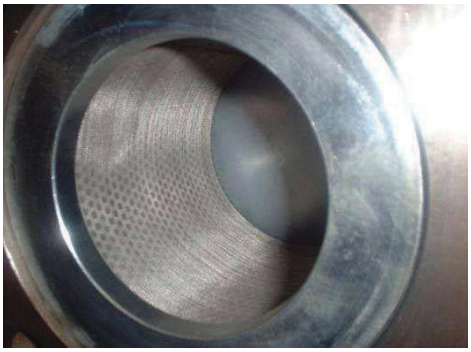


V-2. ASSEMBLE SUCTION FILTER

Step 1. Put suction filter inner gasket on motor casing suction flange before installing suction filter.



Step 2. Install suction filter in compressor casing.



Step 3. Put suction filter outer gasket on motor casing suction flange.

Step 4. Install suction flange with bolts and tighten it using a hexagonal wrench or torque wrench.

NOTE: Please refer to Table 5 in Appendix for torque value setting to tighten compressor accessories.

VI. HOW TO REPLACE CHECK VALVE AND OIL SEPARATOR

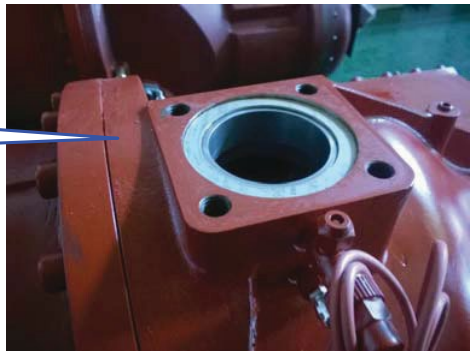
VI-1. DISMANTLE CHECK VALVE

Step 1. Disconnect first discharge piping of the chiller system from check valve.

NOTE: If the service/stop valve is connected directly to compressor discharge piping, loosen first all screw bolts and remove the stop valve.

Step 2. Loosen all bolts of check valve and remove check valve from casing.

Step 4. Replace old gasket with new gasket.



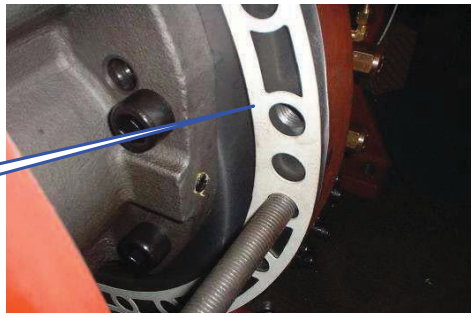
VI-2. DISMANTLE OIL SEPARATOR

Step 1. Install eyebolts on oil separator, lift it using an overhead crane and then loosen all bolts of oil separator.

Step 2. Pull out oil separator from compressor casing.

VI-3. ASSEMBLE OIL SEPARATOR ON COMPRESSOR

Step 1. Put oil separator gasket on compressor casing. Use screw bars on both sides of casing to secure gasket and also hold oil separator during installing.



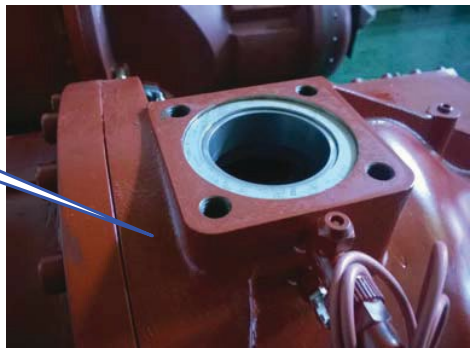
Step 2. Install oil separator on compressor and put all screw bolts and tighten them with a wrench or torque wrench.

NOTE:
For M20 bolt, torque should be 3800 kg-cm.
For M16 bolt, torque should be 2000 kg-cm.

Please also refer to index for torque setting to tighten other bolts.

VI-4. ASSEMBLE CHECK VALVE

Step 1. Put new gasket on discharge port of casing.



Step 2. Install check valve on discharge port of oil separator and put all screw bolts and tighten them using a wrench with torque, **1600 kg-cm**.

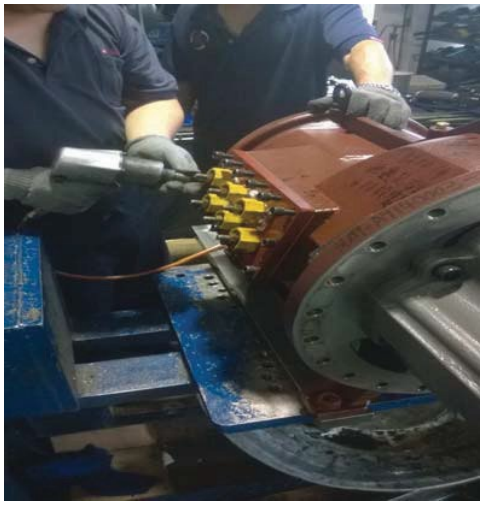
Step 3. Put new gasket on check valve.

Step 4. Install discharge piping or stop valve on check valve and put all screw bolts and tighten them using a wrench with torque, **1600 kg-cm**.

VII. HOW TO REPLACE MOTOR ASSEMBLY AND MOTOR STATOR

VII-1. DISMANTLE TERMINAL COVER PLATE

Step 1. Loosen all screw bolts of terminal cover plate using a wrench or pneumatic wrench.

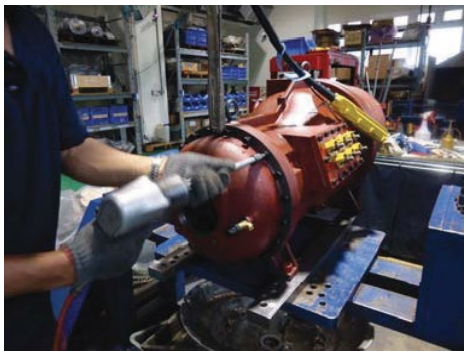


Step 2. Use screw rods to hold terminal cover plate and loosen copper nuts from terminals.

Step 3. Take out terminal cover plate and gasket.

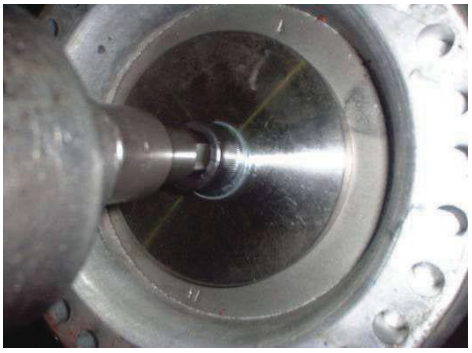
VII-2. DISMANTLE MOTOR COVER AND MOTOR STATOR

Step 1. Remove all screw bolts and pull out motor cover slowly.



Step 2. Use a rope to hold motor cover, hang it with an overhead crane, and then loosen all screw bolts with a pneumatic wrench or hexagonal wrench.

Step 3. Loosen the bolt of motor rotor using a wrench or pneumatic wrench.



Step 4. Pull out motor rotor and remove rotor key with 2 screw rods.
NOTE: **Use a rope to take out motor rotor inside big model of compressor.**

VII-3. DISMANTLE MOTOR STATOR

Step 1. Remove stoppers from the casing.

Step 2. Take out the motor stator with supporting of rope hanging.

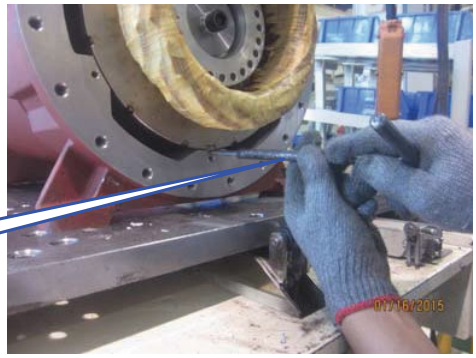
Step 3.Remove the key from bottom of the motor casing.

VII-4. ASSEMBLE MOTOR STATOR

Step 1. Lift the motor stator by rope with an overhead crane.

Step 2. Put motor stator slowly into motor casing horizontally.

Step 3. Simply put in the fixing key in.



Step 4. Lock those stoppers to make it stable.

VII-5. ASSEMBLE MOTOR ROTOR

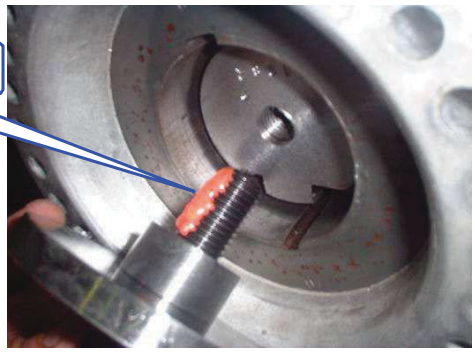
Step 1. Put motor rotor key on male screw rotor.

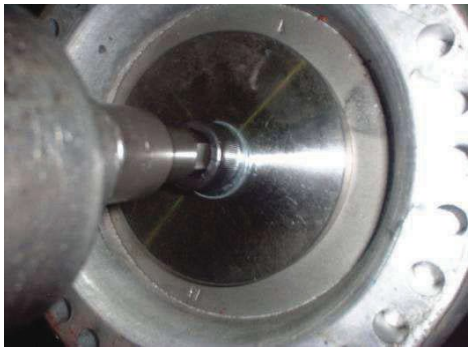
Step 2. Install motor rotor on male screw rotor shaft.

NOTE: Use a rope for installation in bigger models.

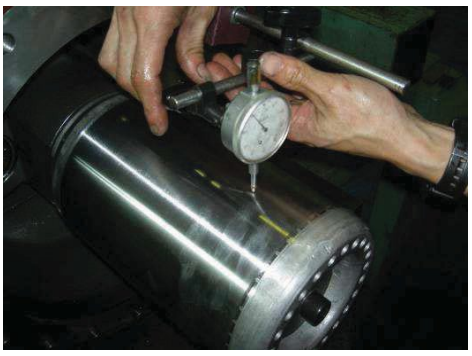
S/N on rotor should be close to suction bearing

Step 3. Apply Loctite sealant on M16 screw bolt and install it with washer.



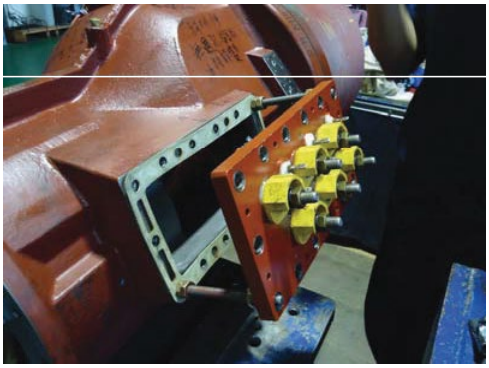


Step 4. Check alignment of motor rotor using a dial gauge. Rotate rotor in counterclockwise direction; reading should not exceed **0.15 mm**.

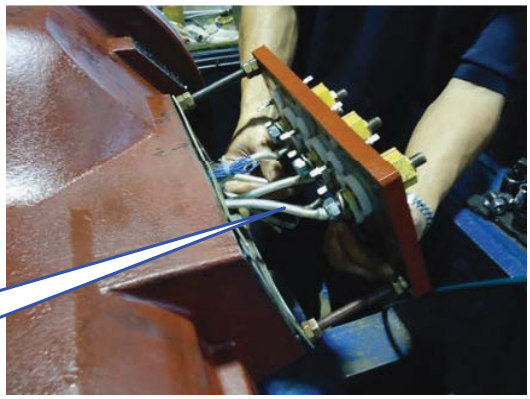


VII-6. ASSEMBLE TERMINAL COVER PLATE

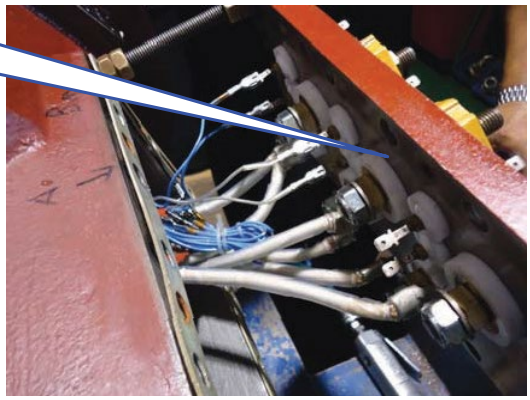
Step 1. Install screw rods first on the compressor casing and then put on terminal plate.



Step 2. Connect rings of lead wires to terminal bolts on terminal cover plate. Marks on ring terminals of lead wires should correspond to those of terminal bolts on terminal cover plate. Install screw nuts and washers on each terminal bolts, tighten all screw nuts using a wrench or pneumatic wrench and also connect cable sockets of PTC thermistor and those of motor temperature sensor if any to sensor terminals.



The same marks U-U, V-V, W-W, Z-Z, X-X, and Y-Y correspond in terminal bolts and ring terminals of lead wires.



Step 3. Install all bolts and tighten them using a torque wrench or hexagonal wrench with torque, **1000 kg-cm.**

VIII. HOW TO REPLACE PISTON, PISTON ROD, AND SLIDE VALVE

VIII-1. DISMANTLE OIL SEPARATOR

Step 1. Lift the compressor, put it on workbench and fix the base using two screw bolts diagonally at least.

Note: In case there is no workbench at job site, use a table that could bear the load of compressor instead.

Step 2. Dismantle check valve, use a wrench to loosen bolts, and then remove check valve.

Step 3. Install two eyebolts on oil separator and hang them using an overhead crane, and then loosen all bolts of oil separator.

Step 4. Take out oil separator from compressor.

VIII-2. DISMANTLE PISTON AND PISTON ROD

Step1. Loosen three screws on the oil separator.

Sep2. Take out the oil separator carefully.

Step3. Loosen three screw bars.

Step4. Screw out two exhaust tubes.

Step 5. Loosen all screw bolts of discharge two cover plates and then remove it.

Step 6. Take out disc springs and discharge bearing fixed rings.

Step 7. Loosen the bolt of piston and remove it.

Step 8. Pull out piston, modulation spring, and copper washer.

Step 9. Use a torque wrench to take out piston rod.

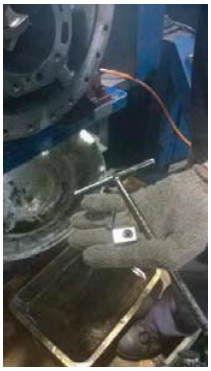
VIII-3. DISMANTLE BEARING SEAT AND SLIDE VALVE

Step 1.Loosen bolts of bearing seat using a wrench.


Step 2. Remove two position pins from bearing seat.


Step 3. Install two eyebolts on bearing seat and lift it slowly using an overhead crane.

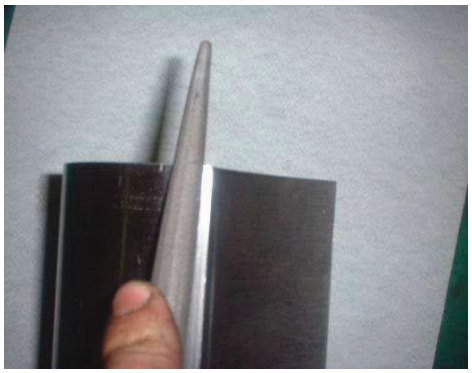
Step 4. Loosen the bolt of slide valve key using a hexagonal wrench and take out slide valve key.

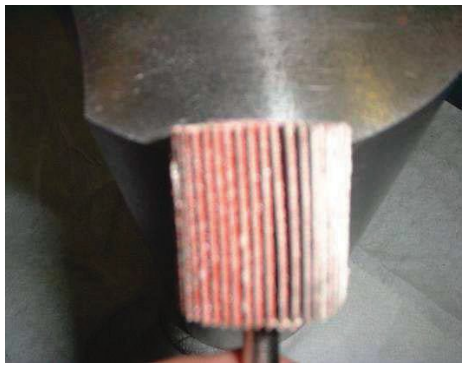



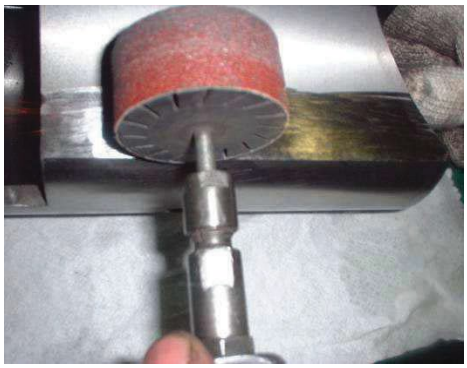
Step 5. Take out slide valve.

VIII-4. ASSEMBLE SLIDE VALVE

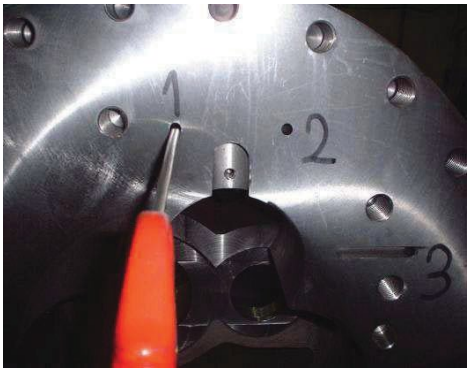
Step 1. Use a file or grinding wheel to slightly clean the sharp edge of slide valve.







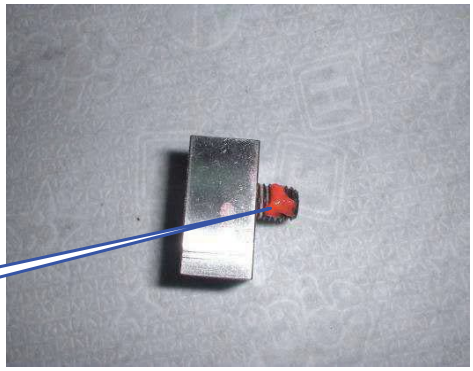
Step 2. Clean oil passages in compressor casing with pressurized air.



Step 3. Install slide valve in compressor casing. Make sure that slide valve can be moved smoothly.

NOTE:Please refer to Table 6 in Appendix for clearance.

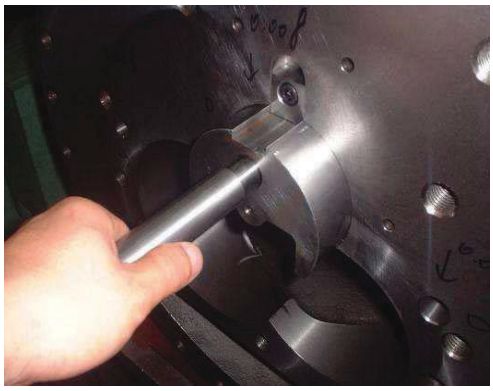
Step 4. Apply Loctite sealant on the bolt of slide valve key.



Step 5. Install slide valve key and tighten it with a hexagonal wrench.

NOTE:Please also refer to Appendix for torque setting to tighten bolts.

Step 6. Check if slide valve can be moved smoothly again.



VIII-5. ASSEMBLE BEARING SEAT

Step 1. Apply Loctite sealant in the surface of the compressor casing.
Be careful not to drop any sealant inside the chamber.

Step 2. Lift bearing seat and install it carefully on the compressor casing.

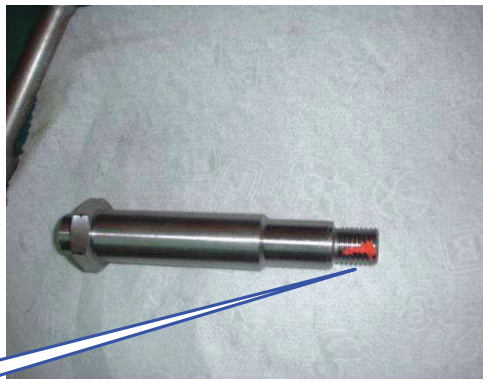
Step 3. Fix position pins in original positions at two ends of bearing seat by hammering it.

Step 4. Install all hexagonal screw bolts and tighten them with a torque wrench or hexagonal wrench. Please also refer to Appendix for torque setting to tighten bolts.

PS: There is one screw has to be tighten located insight at one of the exhaust tube hole.

VIII-6. ASSEMBLE PISTON ROD AND PISTON

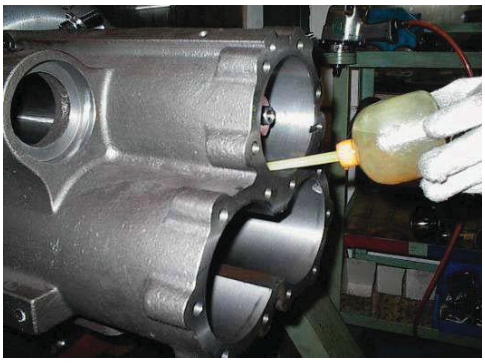
Step 1. Apply Loctite sealant on piston rod's screw and install it on the slide valve using a torque wrench with torque, **1000 kg-cm**. Check again if motion of slide valve is smooth by moving piston rod forward and backward.



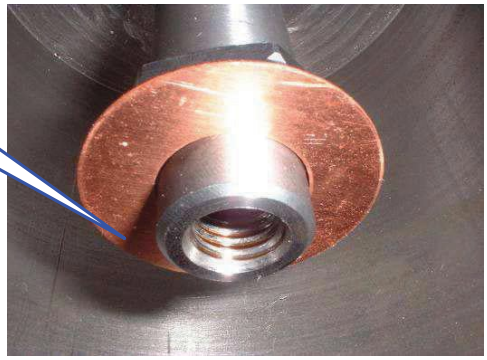
Loctite Sealant

Push and pull piston rod to check if motion of slide valve is smooth.

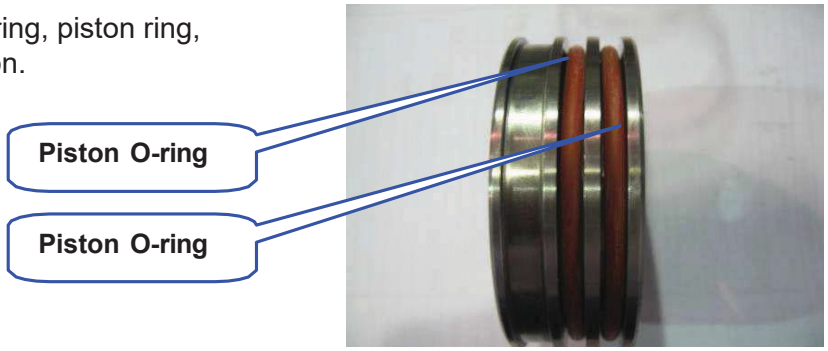
Step 2. Apply some lubricant in cylinder and put on copper washer.

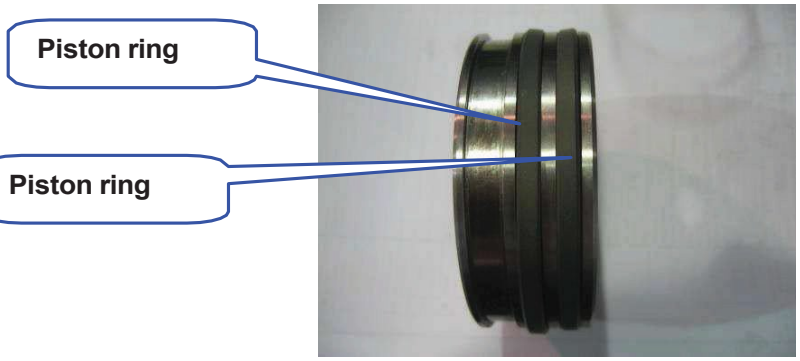


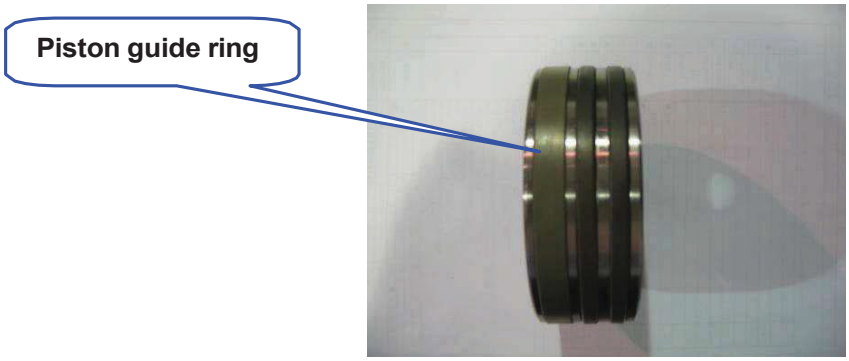
Copper Washer



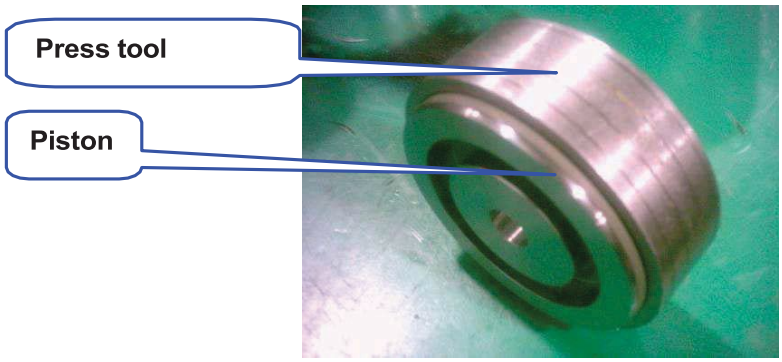
Step 3. Install first the piston O-ring, piston ring, and piston guide ring in the piston.



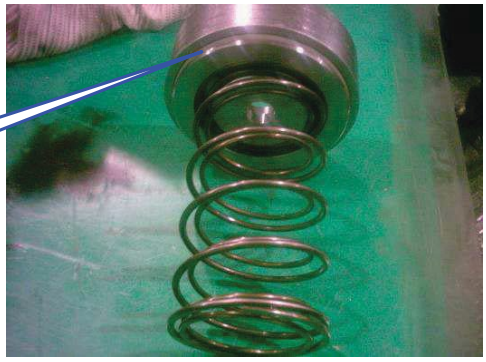


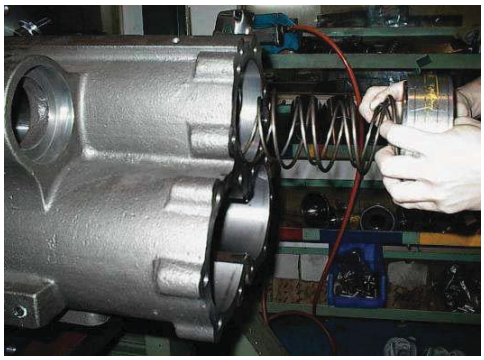


Step 4. Fix the piston to piston press tool

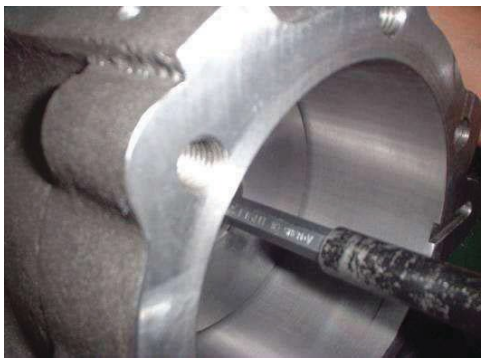


Step 5. Install piston with modulation spring on the piston rod. Be careful not to drop copper washer inside cylinder.





Step 6. Install the bolt with washer and spring washer on piston. Check motion of piston by pushing it to the end and release it. It should rebound at least 75% of its travel.



VIII-7. ASSEMBLE DISCHARGE COVER PLATE

Step 1. Apply some lubricant in discharge bearing.

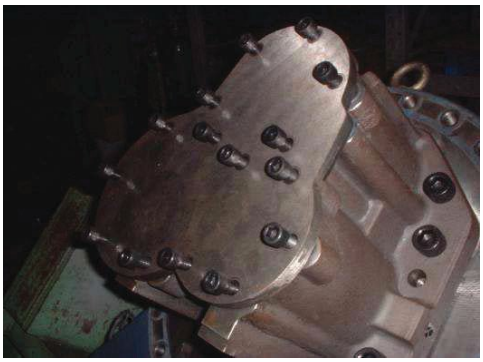
Step 2. Install discharge bearing fixed rings (male and female).

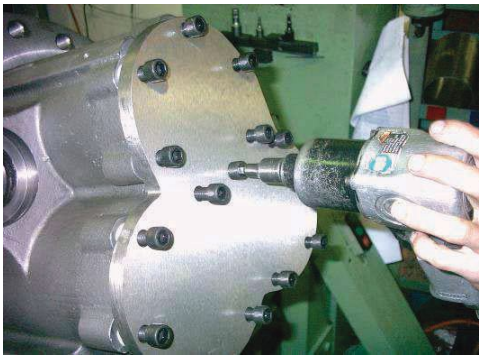
Step 3. Install disc springs (male and female).

Step 4. Install discharge cover plate with new gasket.

Step 5. Put all hexagonal bolts and tighten them using a hexagonal wrench or torque wrench with torque, **1000 kg-cm**.

NOTE:Please also refer to Appendix for torque setting to tighten bolts.



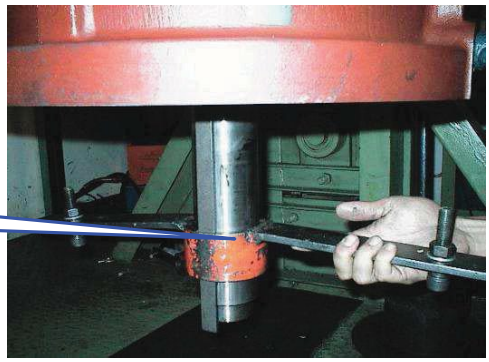


IX. HOW TO REPLACE MALE AND FEMALE ROTORS AS WELL AS BEARINGS

NOTE: Please follow procedures in VII (VII-1~VII-2), VIII (VIII-1~VIII-3) and IX(IX-1~IX-6) first and then below steps.

IX-1. DISMANTLE BEARING LOCK NUT

Step 1. Install male rotor fixing jig in the suction side of male rotor.



Step 2. Loosen bearing lock nut using lock nut tightening jig for male and female rotors.

Step 3. Remove male rotor fixing jig and lift bearing seat slowly using an overhead crane.

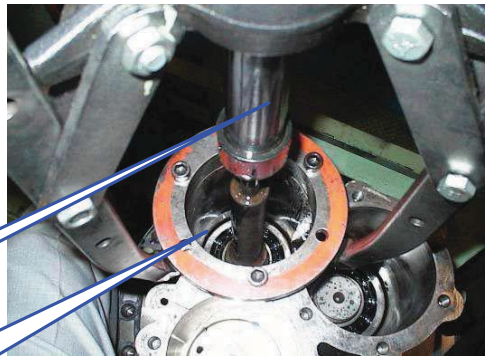
IX-2. DISMANTLE MALE AND FEMALE ROTORS

Step 1. Put a cylinder in hydraulic press machine and then put bearing seat assembly inside cylinder to take out male and female rotors.

Use steel bar to press down rotor.

NOTE: ANOTHER WAY TO TAKE OUT MALE AND FEMALE ROTORS

Step 2. Use circular jig for loosening bearing (Please also refer to Appendix for jig list) and puller instead. First, install circular jig for loosening bearing on male or female bearing housing. Put a steel bar on the top of rotor shaft and install puller. Use steel bar to press down rotor shaft gradually when tightening puller.

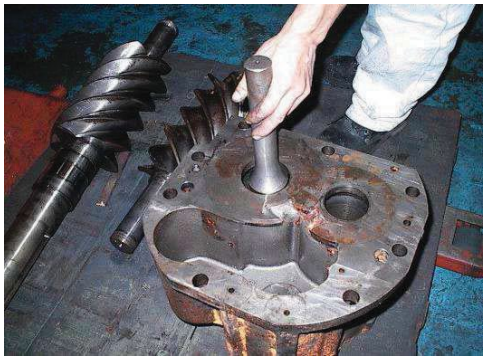


Puller

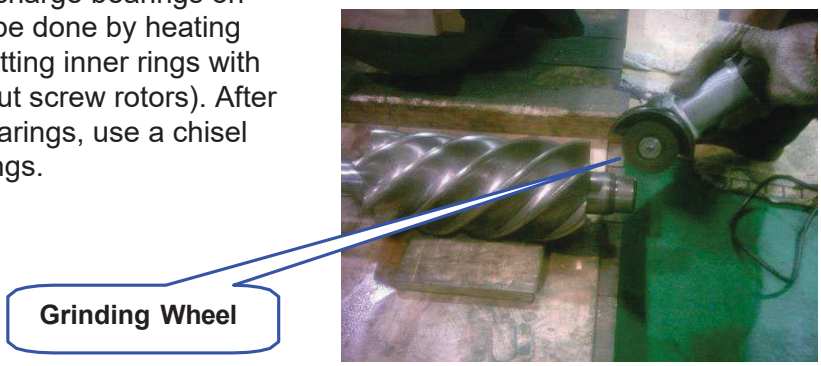
Circular Jig for Loosening Bearing

IX-3. DISMANTLE DISCHARGE AND SUCTION BEARINGS

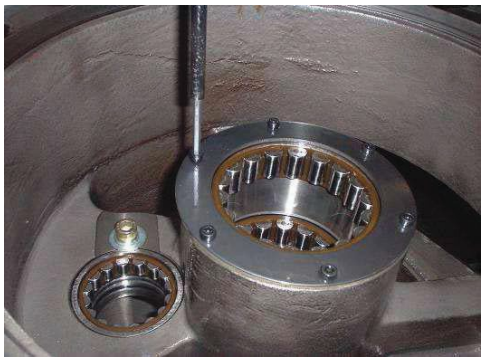
Step 1. Remove outer rings of discharge bearings from the bearing seat first with hammer and jig.



Step 2. Remove inner rings of discharge bearings on male and female rotors. This can be done by heating inner rings with acetylene or by cutting inner rings with grinding wheel (be careful not to cut screw rotors). After cutting inner rings of discharge bearings, use a chisel and a hammer to take out inner rings.



Step 3. Loosen bolts of suction bearing fixed ring (male) suction and take out bearings by hammering.



Step 4. Loosen the bolt over female suction bearing and take out female suction bearing by hammering.

IX-4. ASSEMBLE MALE AND FEMALE ROTORS AS WELL AS DISCHARGE BEARINGS

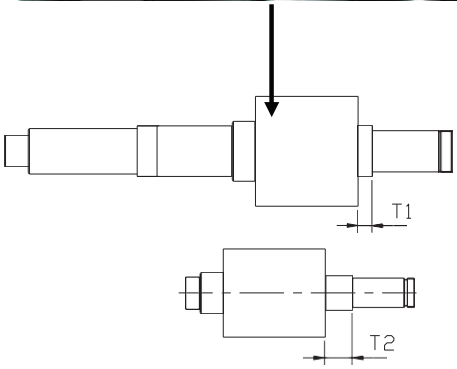
Step 1. Calculate necessary thickness of a balance piston and difference between inner& outer spacer and grind them to obtain adequate discharge clearance.

NOTE:

EQUATIONS: **D1-D2=C2-T2+0.12mm**
Da balance=C1-T1+0.12mm

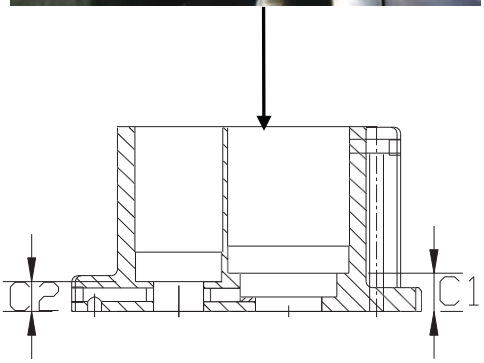
MALE AND FEMALE ROTORS

T1 height of male rotor neck
T2 height of female rotor neck



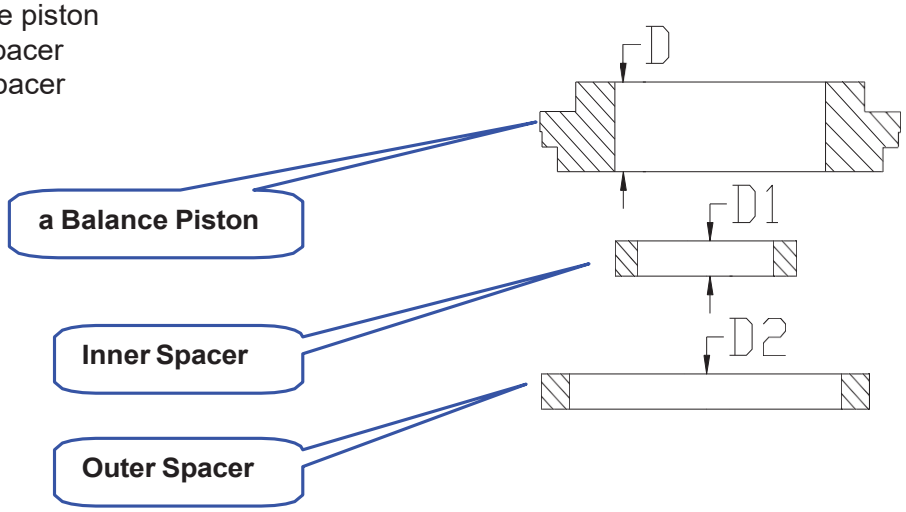
BEARING SEAT

C1 thickness of flange in male-rotor hole of bearing seat
C2 thickness of flange in female-rotor hole of bearing seat



SPACER RING AND a BALANCE PISTON

D thickness of a balance piston
D1 thickness of inner spacer
D2 thickness of outer spacer



Steps as below

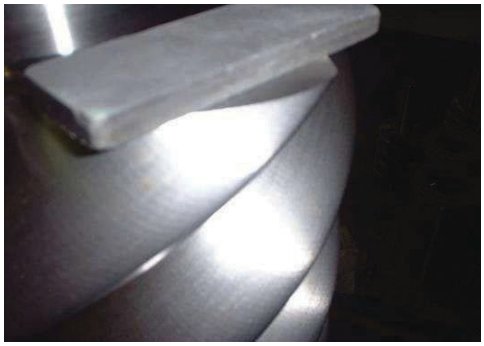
Inner& outer spacer and balancing piston are used to adjust discharge clearance of rotors.
Measure C1 & C2 by Vernier micrometer and T1 & T2 by Vernier caliper.
Calculate necessary thickness of a balance piston and difference between inner& outer spacer by the following formulae.

Da balance=C1-T1+0.12mm

D1-D2=C2-T2+0.12mm

Grind a balance piston to necessary thickness calculated.
Grind inner& outer spacer to make sure they are of the same thickness before further grinding.
When D1-D2 is positive, further grind thicknessID1-D2Ifrom outer spacer.
When D1-D2 is negative, further grind thicknessID1-D2Ifrom inner spacer.

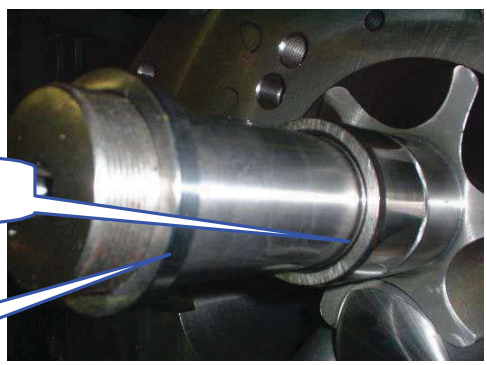
Step 2. Clean suction and discharge surfaces of male and female rotors with oilstone and grinding wheel.



Step 3. Install male rotor in the special frame, and then female rotor.

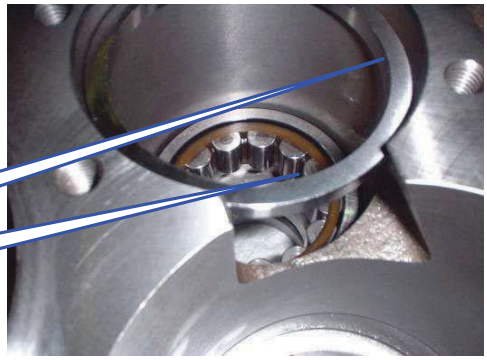
Step 4. Heat bearing inner rings (male and female) to **80 deg C** before their installation.

Step 5. Install bearing inner rings and inner spacer on discharge end of female rotor.

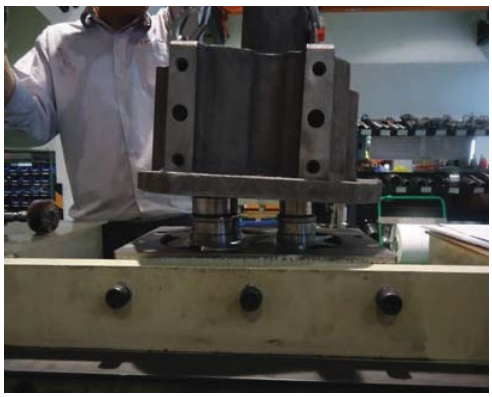


Step 6. Clean bearing seat with oilstone and grinding wheel to remove sharp edges.

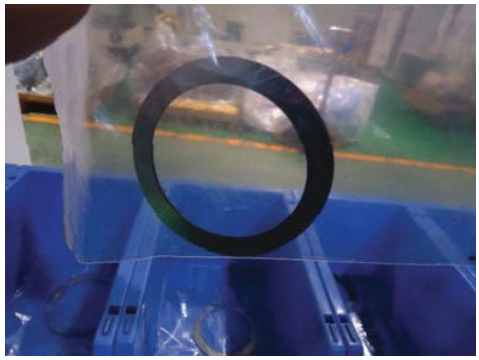
Step 7. Install bearing outer rings and then outer spacer in female-rotor hole of bearing seat and hammer them to the end.

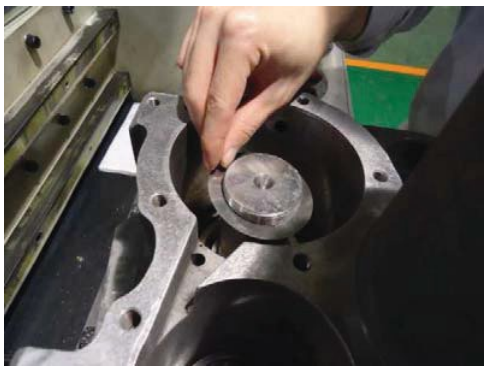


Step 8. Lift bearing seat with an overhead crane and put it on compressor casing.

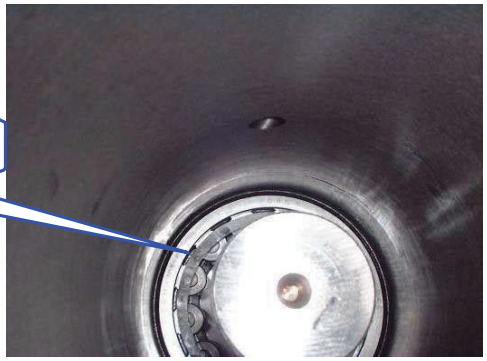


Step 9. Install a balance piston on male rotor.

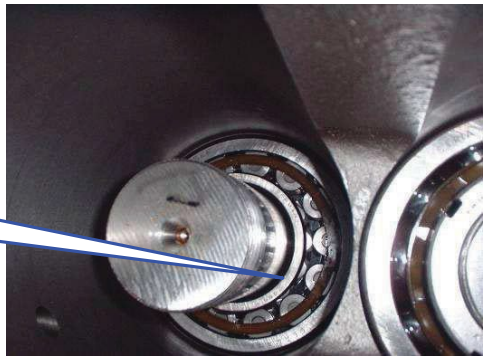




Step 11. Install discharge bearing outer rings on male rotor and hammer them to the end.

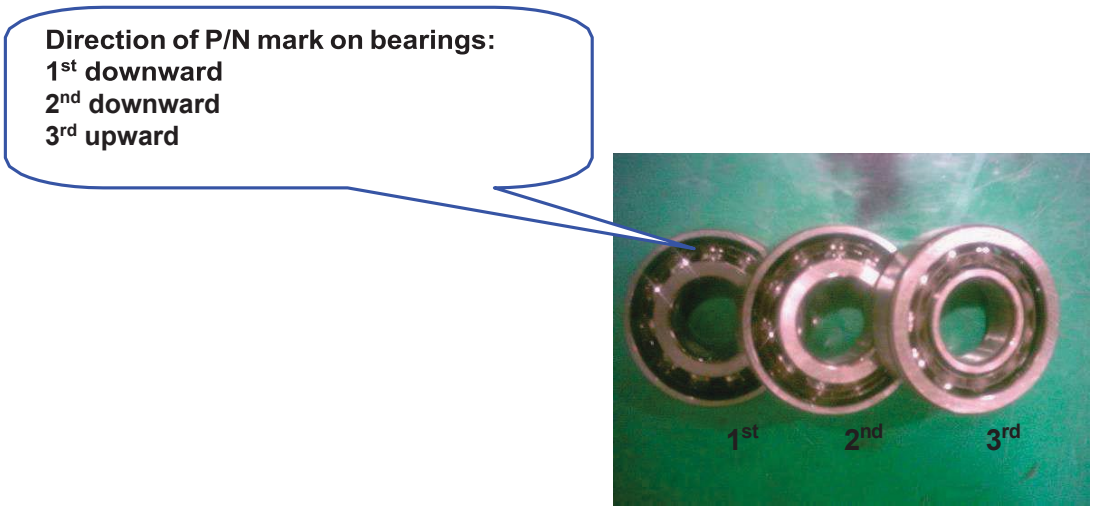


Step 12. Install discharge bearing inner rings on male rotor. Wait for a few seconds for their cooling and hammer them to the end.

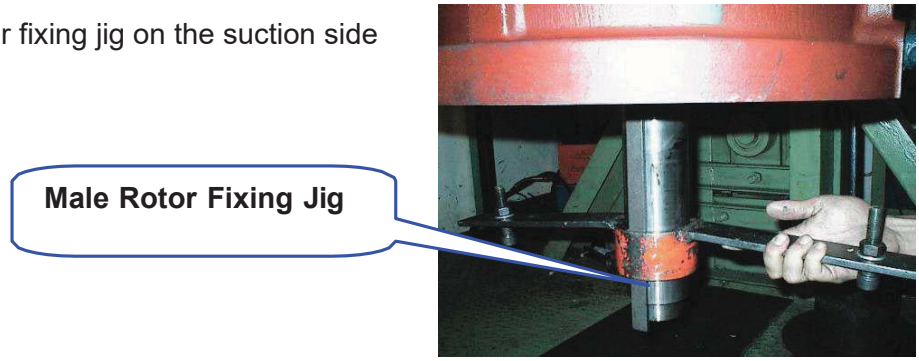


Step 13. Heat male and female axial bearings to **80˚C.**

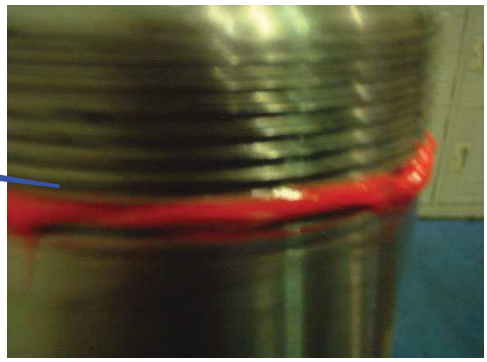
Step 14. Install three axial bearings on male and male rotors respectively.
Direction of bearings: The first and second bearings with mark of part number downward; the third bearing with mark of part number upward.
NOTE: Please refer to Table 2 in Appendix for types of bearings used for all models.



Step 15. Install male rotor fixing jig on the suction side of male rotor.

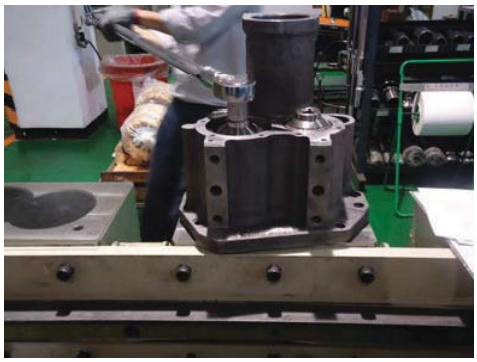


Step 16. Apply Loctite sealant on end screws of male and female rotors and install bearing lock nut.

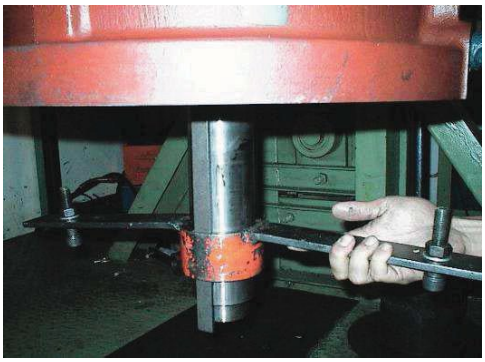


Step 17. Put on lock nut tightening jigs and tighten them with a torque wrench.
Please refer to the table below for torque setting.

Table for Torque Setting to tighten Lock Nut



Step 18. Remove male rotor fixing jig.



Step 19. Lift bearing seat assembly and check discharge clearance of between male/female rotors and bearing seat with a feeler gauge.

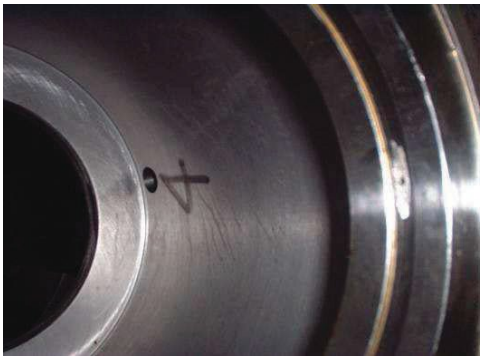
IX-5. ASSEMBLE SUCTION BEARINGS

Step 1. Heat radial bearing inner rings (male and female) and inner spacer (male) to **80 ºC**.

Step 2. Install inner ring and inner spacer ring on male rotor and inner ring on female rotor.

Step 3. Use a chisel to mark on male rotor to prevent inner rings and inner spacer from moving.

Step 5. Install oil-guiding ring in male-rotor hole of compressor casing and hammer it to the end.

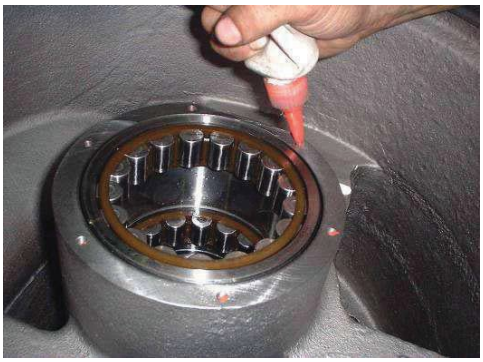


Step 6. Install the first suction radial bearing outer ring.

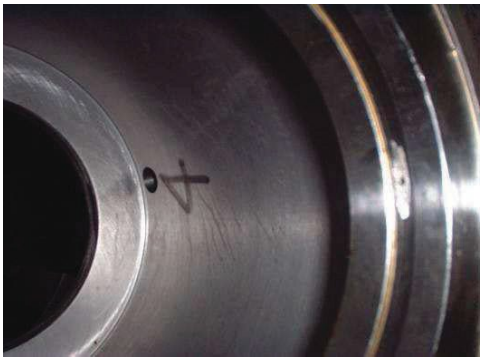
Step 7. Install suction outer spacer and hammer it to the end.

Step 8. Install the second suction radial bearing outer ring.

Step 9. Apply Loctite sealant in holes for screw and install suction bearing fixed ring. Put all screw bolts and tighten them with a torque wrench or hexagonal wrench.
Please refer to Appendix for torque setting to tighten screw bolts.



Step 10. Install oil-guiding ring in female-rotor hole of compressor casing and hammer it to the end.



Step 11. Install radial bearing outer ring.

Step 12. Apply Loctite sealant in hole for screw and tighten screw bolt with washer.

IX-6. ASSEMBLE OIL SEPARATOR

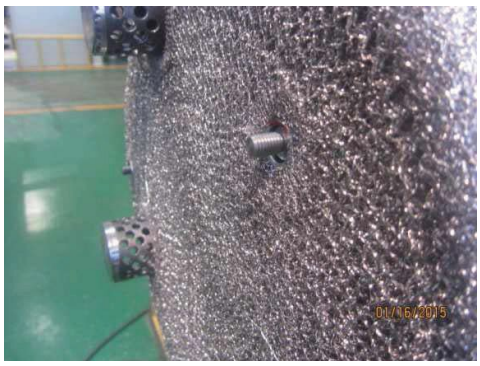
NOTE: Before assembling oil separator, assemble bearing seat first.

Step 1. Clean flange of separator with oilstone and wipe it with a piece of cloth or rag.

Step 2. Screw in two exhaust tubes into the bearing seat.

Step 3. Install three screw bars on the bearing seat.

Step 4. Put on the oil separator and tighten then on it.



Step 4. Install oil separator and put on all screw bolts and tighten them with a torque wrench or hexagonal wrench.
Please refer to Appendix for torque setting to tighten screw bolts.

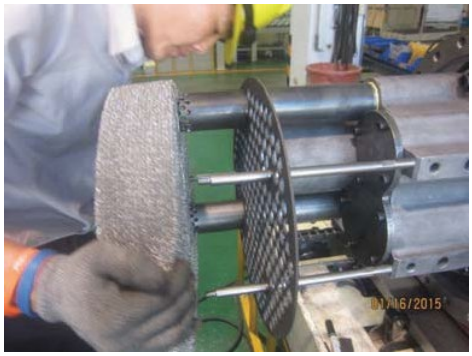
IX-8. ASSEMBLE OIL SEPARATOR

NOTE: Before assembling oil separator, assemble bearing seat first. Please follow procedures in RE technical manual.

Step 1. Clean flange of separator with oilstone and wipe it with a piece of cloth or rag.

Step 2. Install 2 exhaust tubes and 3 bolts onto the bearing seat.

Step 3. Install two screw rods on compressor casing and then install oil separator gasket.



Step 4. Install oil separator and put on all screw bolts and tighten them with a torque wrench or hexagonal wrench.
Please refer to Appendix for torque setting to tighten screw bolts.

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