Radial Piston Motors
with fixed displacement
Series RM...X
Vg = 1047 cm³/U - 5000 cm³/U

Repair manual

Doc.-No. HM3-006 UK
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1. General
Great attention is to be paid to cleanliness when dismantling or assembling. Do not use fraying cleaning cloths or cleaning wool. Do not assemble in workshops where cutting or grinding is carried out or where dust occurs.

A hoist is required to handle and transport the motors.
The weight of the motors is as follows:

<table>
<thead>
<tr>
<th>Type</th>
<th>RM 1000</th>
<th>RM 1250</th>
<th>RM 1400</th>
<th>RM 1600</th>
<th>RM 1800</th>
<th>RM 2000</th>
<th>RM 2500</th>
<th>RM 3150</th>
<th>RM 4000</th>
<th>RM 4500</th>
<th>RM 5000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gewicht</td>
<td>154 kg</td>
<td>154 kg</td>
<td>255 kg</td>
<td>255 kg</td>
<td>255 kg</td>
<td>255 kg</td>
<td>320 kg</td>
<td>320 kg</td>
<td>500 kg</td>
<td>500 kg</td>
<td>500 kg</td>
</tr>
</tbody>
</table>

Suitable jacking-up of the motor eases dismantling.

If the motor is disconnected from its connecting pipes or opened, then the oil flowing out is to be caught in a suitable container and disposed of according to regulations.

Attention is to be paid that the dismantled parts, particularly sliding surfaces and seals, are not dirtied or damaged.

It is recommended that the dismantled parts be laid in a table covered with clean oiled paper.

The following spare parts list explains the individual parts of the motors:

RM 1250X - RM 1250X: RM 59.63
RM 1400X - RM 2000X: RM 59.67
RM 2500X - RM 3150X: RM 59.71
RM 4000X - RM 5000X: RM 59.75

2. Dismantling the distributor unit
The motor is jacked up vertically with the take-off shaft downwards.

The five hexagonal socket head screws (45) are screwed out of the distributor unit casing (60).

The distributor unit casing can be pushed back and then removed using the two screws M8 x 30 which are screwed into threads provided in the distributor unit casing.

Lift off the distributor eccentric (43.1) together with thrust piece (43.2), roller cage (43.5), the 6 cylindrical rollers (43.6) as well as the distributor rings from the distributor contact surface. In doing so, do not try to lift the distributor rings from the distributor contact surface with metal tools, since this will damage the parts.

Caution! The distributor inner rings have sharp edges. There is the danger of injury.

Once the assembled distributor parts have been wetted with oil, they adhere to the distributor contact surface through adhesive force. If the distributor parts cannot be lifted off easily in one piece, then they can be removed one after another. In order to do so, the thrust piece / cam is lifted out of the distributor rings first.

Caution! The cylindrical rollers (43.6) are only loosely laid in the cage and must be removed carefully at the same time so that they do not fall into the distributor ducts in the contact surface.

The two distributor rings (41.1 and 42) including seals (55.1/55.2 and 56.1/56.2) and spring discs (44) can be removed in one piece. In doing so, the distributor rings are shifted eccentrically on the contact surface until you can grip under the inner ring with one hand and carefully tip it away from the contact surface and then lift it up.

3. Dismantling the drive unit
The motor is jacked-up with the take-off shaft upwards. The oil flowing out is to be caught in a suitable container and disposed of according to regulations. In the case of motors with cylindrical feather key(s), then the feather key(s) (11) are to be removed from the crankshaft takeoff peg.

Changes reserved!
Loosen and remove the bearing cover screws (27). (The screws are glued in and may be very tight, warming may ease unscrewing).

Press the bearing cover (21) evenly out of the motor casing (20) by screwing in two cheese head screws (27) in the two opposite taps and remove the o-rings (52) as well as the alignment disc (24). Carefully store the alignment disc for possible use later. If components necessary for bearing settings, e.g. motor casing, taper roller bearings, bearing cover or crankshaft, are not replaced; then the alignment disc (24) may be re-used and the bearings do not have to be re-set in this case.

The crankshaft (10) can now be pulled out vertically. In order to do so, a lifting screw is to be screwed into the frontal thread of the crankshaft and the crankshaft carefully pulled out using this screw. The bearing inner disc (26) is to be pushed off the crankshaft when removing the crankshaft. If the bearing ring sticks, hitting the accessible part of the shoulder may facilitate removal.

Caution! Be careful not to damage the lower areas of the connecting rod.

Then gently pull all the piston and connecting rod units (30) towards the motor casing middle axis, until both connecting rod retaining rings (23) can be removed and take out the upper ring. Then push the piston and connecting rod units (30) outwards until the rear ring can be removed. If necessary, the piston and connecting rod units can be pulled inwards, out of the cylinder ducts.

4. Dismantling the cylinder cover
Loosen and remove the cylinder cover screws (28) and lift off the cylinder cover (22). (The screws are glued in and may be very tight, warming may ease unscrewing).

5. Dismantling a piston / connecting-rod subassembly:
Clamp the piston firmly (but avoiding damage using a vice with soft jaws). Unscrew the set-screw with hole (35) with a screw driver. This set-screw is glued in and also caulked and thus difficult to loosen!
Carefully bore open the pipe (36) with a drill bit size 4.2 mm and cut an M5 thread. Remove the pipe (36) using an M5 screw. Press the bolt (34) out of the piston side.

When assembling the bolt (34) in the piston (32), whereby the bolt must also be inserted through the connecting rod eye (31), be careful that the bolt is turned so that the duct in the bolt is fitted in the direction of the connecting rod longitudinal axis. Drive in the pipe (36) through the piston and the duct in the bolt (34) from the head of the piston (32). Degrease the thread in the piston, glue the set-screw with hole (35) with Loctite 324 or a comparable adhesive and secure additionally by caulking.

6. Condition of the parts
Thoroughly clean all parts after dismantling and then examine them to establish whether they can be re-used or not. Particular attention should be paid to the following components: connecting rod eyes and lower areas, connecting rod running surface on the crankshaft (large eccentric diameter), shaft seal slide ways and edges, taper roller bearing slide ways, cylinder duct surfaces and piston surfaces as well as orings and their supporting rings.

The fronts of the distributor body (inner), the thrust pieces, the eccentric, the distributor inner ring and outer ring and the distributor contact surface are all sealing surfaces and should not have any furrows, such damaged parts are to be replaced.

If the taper roller bearing slide ways show any pitting, eruptions or other signs of wear then both bearings are to be completely replaced.

If the measuring-shaft (64) is damaged then a new unit is to be ordered, since the measuring-shaft (64) is shrunk into the cog (61) and additionally secured with a straight pin (67).

The dirt stripper (51.1) as well as all o-rings in the distributor including their supporting rings should always be replaced.

The order designations and numbers for the parts to be replaced can be seen in the respective spare parts lists.
7. Setting the taper roller bearings

Setting the taper roller bearings is always necessary when parts which influence the bearing settings have been replaced, e.g. motor casing, bearing cover, crankshaft or taper roller bearings, or if the original alignment discs are no longer usable or have been lost.

Setting the axial initial tension is carried out during assembly using alignment discs. To this end, the crankshaft with the bearings is placed in the motor casing and axially braced by screwing on the bearing cover.

The appropriate initial tension is reached by removing or adding individual alignment disc films between the bearing cover and the casing. The moment of friction of the bearing under initial tension serves as the measure for the correct setting.

No parts which may influence the result may be fitted in the motor. These include the piston and connecting rod units, the distributor as well as the shaft seals in the bearing cover, that is the radial packing ring cover (only for motors with measuring-shaft).

The moment of friction is checked by turning the journal using a dynamometric key. In doing so, it is imperative that the bearing is fitted with the lubrication originally applied by the manufacturer and the shaft is manually turned at least two complete rotations. The correct torque setting can be seen in the table on page 7.

The crankshaft is to be dismantled again after bearing setting.

8. Assembling the drive unit

Thoroughly clean all parts before assembling and thoroughly degrease the taps in the motor casing for the cylinder cover and bearing cover screws.

With regard to sub-assembly of the piston/rod - units see point 5 (above).

To assemble the cylinder cover (22), firstly place the supporting rings (54.2) in the space provided and above that the o-ring (54.1) that is towards the inside of the motor. Then place the cylinder cover with its centering shoulder in the motor casing cylinder duct and secure with the 4 cheese head screws (28). These screws are to be grease-free, phosphatised and wetted below the thread with Loctite 324 or a comparable adhesive. The screw torque can be seen in the table on page 7. Repeat this procedure for all other dismantled cylinder covers.

Mark the distributor shaft cog (61) in the middle of one of the half-moon front surfaces as well as on the opposite side (180° transferred) in the rear transition radius of the distributor square with a prick punch if not already thus marked. This is necessary to provide an optical impression of the fitting position relative to the rotational angle of the crankshaft.

Place the swivel-joint roller bearing (63) in the casing duct up to the shoulder. Fit the carrier (62) in the cog (61) and then press the cog into the fitted swivel-joint roller bearing (63) up to the axial shoulder of the bearing receiver.

Now place the taper roller bearing inner ring (26) in the bearing outer ring in the motor casing and loosely place the rear connecting rod retaining ring in the casing with the smaller inner diameter upwards.

Insert the piston and connecting rod units (30) into the cylinder ducts using a special piston ring collet chuck or appropriate piston ring clamp (see Special Tools table on page 7).

Place the connecting rod retaining rings (23) in the connecting-rod guide channel and press the connecting rod out completely so that the connecting rod lower areas lie in the rings. Move the rings and connecting rod lower areas into a position externally centered around the crankshaft eccentric.

The crankshaft (10) can now be pushed with its rear bearing journal in the taper roller bearing (26) and with the large eccentric diameter in the connecting rod shoes held by the rings (23).

Be careful that the rear end of the crankshaft goes over the carrier (62) and onto the cog (61) when inserting into the rear taper bearings (26). In addition, the crankshaft is to be turned so that its maximum eccentricity is where the prick punch mark is on one of the two half-moon front surfaces of the cog (26). (This serves to provide an optical impression of the fitting of the crankshaft from the reverse of the casing).

Changes reserved!
Now place the alignment discs (24) required for the taper roller bearing setting in Point 6, on the inner flange of the bearing cover so that the ducts are covered. Then graze the o-ring (52) over the bearing cover casing-side centering diameter so that the o-ring comes against the corner with the alignment ring.

Then lay a new dirt stripper (51.1) and the spacer ring (51.2) in the bearing cover (21). Now press the shaft seal (51.3) with its dust lip downwards and the seal edge upwards evenly at the circumference of the outer ring into the bearing cover.

An appropriate tool is to be used for assembly (see Special Tools table on page 7).

The completely assembled bearing cover is to be pushed onto the crankshaft (7) using a conical assembly sleeve on the crankshaft take-off peg (see Special Tools table on page 10), so that the cover screw holes and the motor casing taps are on top of one another. Then remove the assembly sleeve from the shaft.

When screwing in the hexagonal socket head screws (27) these screws are to be grease-free, phosphatised and wetted below the thread with Loctite 324 or a comparable adhesive.

Tighten the screws evenly crosswise with a dynamometric key. The torque setting can be seen in the table on page 7.

For motors with cylindrical take-off shafts with feather key(s) the feather key(s) are now replaced in the take-off shaft pegs.

9. Assembling the distributor
Firstly jack up the motor with the take-off shaft downwards.
Carefully slide the distributor rings (41.1) and (42), completely assembled with shuttle valve (41.2 and 41.3), spring discs (44) and seals (55.1, 55.2 and 56.1, 56.2) over the square of the distributor peg on the distributor contact surface (20.2) so that the front surface of the distributor ring (41.1) lies on the distributor contact surface.

Caution! Attention is to be paid that the distributor contact surface is not damaged.

Place the supporting ring (53.2) and the o-ring (53.1) in the thrust piece so that the supporting ring lies on the thrust piece with its even front on the metal surface of the thrust piece. Wet the o-ring and supporting ring with oil to ease assembly.

Then place the alignment pin (43.7) in the duct on the front of the distributor eccentric (43.1). Then push the shim (43.3) and then the ball bearing compensating disc (43.4) over the cylindrical shaft of the eccentric (on the side of the straight pin). Now align the thrust piece with its front channel on the straight pin in the eccentric and push it over this.

To ease fitting the distributor eccentric (43.1) with the 6 cylindrical roller bearings (43.6) they are coated with bearing grease and set into the roller cage (43.4) pushed over the distributor eccentric. The entire unit is carefully placed over the square of the cog (61) in the distributor rings (61) with the thrust piece upwards.

Caution! Attention is to be paid that the distributor eccentric with its highest point at 90° right of the crankshaft eccentric highest point, is pushed onto the crankshaft square. The position of the crankshaft highest point is marked by a prick punch in the rear transition radius of the cog distributor square as well as on the front of the take-off shaft.

This distributor installation guarantees with pressure on connection 2 „clockwise“-rotation looking at the shaft front surface
Now place the supporting ring (57.2) and the o-ring (57.1) in the channels in the distributor contact surface (20.2) so that the even front surface of the supporting ring lies towards the motor casing. Then carefully place the distributor casing on top and secure with the 5 cheese head screws (45). These screws are to be grease-free, phosphatised and wetted below the thread with Loctite 324 or a comparable adhesive. The screw torque can be seen in the table on page 7.
10. Starting-up

The motor must be filled with hydraulic fluid via a leakage fluid connection before starting up. The motor leakage oil connection is to be positioned so that the casing always remains full of hydraulic fluid.

Leakage from the radial piston motor must be returned to the tank separately from runback and from other users, to avoid retained pressure. The leakage pressure measured directly at the leakage fluid connection should not exceed 1 bar.

The entire hydraulic system should be completely vented to ensure faultless operation of the motor.

When starting up the motor, do not operate immediately at maximum pressure and / or maximum speed, but allow newly fitted parts time to settle or run in.

Recommendation for the first hours of operation:

Pressure approx. 100 - 150 bar
Speed approx. 50 - 100 rpm

Optimum running properties only occur after a running-in phase of approx. 20 - 30 hours.

11. Table of torque / setting torque of bearings

<table>
<thead>
<tr>
<th>Torque (Nm)</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Screw (27)</td>
<td>65 Bearing cover</td>
</tr>
<tr>
<td>Screw (28)</td>
<td>210 Cylinder cover</td>
</tr>
<tr>
<td>Screw (27)</td>
<td>85 Bearing cover</td>
</tr>
<tr>
<td>Screw (28)</td>
<td>425 Cylinder cover</td>
</tr>
<tr>
<td>Screw (27)</td>
<td>85 Bearing cover</td>
</tr>
<tr>
<td>Screw (28)</td>
<td>425 Cylinder cover</td>
</tr>
<tr>
<td>Screw (27)</td>
<td>210 Bearing cover</td>
</tr>
<tr>
<td>Screw (28)</td>
<td>730 Cylinder cover</td>
</tr>
<tr>
<td>Screw (45)</td>
<td>525 Distributor cover</td>
</tr>
<tr>
<td>Bearing setting torque</td>
<td>2-10</td>
</tr>
<tr>
<td>Bearing setting torque</td>
<td>5-15</td>
</tr>
</tbody>
</table>

12. Special tools

The use of some special tools is urgently recommended for the optimum quality of the operations described in this repair manual.

These tools may be ordered under the following numbers:

<table>
<thead>
<tr>
<th>Special tool</th>
<th>Order-Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Piston ring collet chuck ø 63</td>
<td>VO-013.842</td>
</tr>
<tr>
<td>Piston ring collet chuck ø 80</td>
<td>VO-013.843</td>
</tr>
<tr>
<td>Piston ring collet chuck ø 100</td>
<td>VO-013.844</td>
</tr>
<tr>
<td>Assembly tool for radial packing ring 90 / 110 x 7.5</td>
<td>VO-013.845</td>
</tr>
<tr>
<td>Assembly tool for radial packing ring 100 / 120 x 7.5</td>
<td>VO-013.846</td>
</tr>
<tr>
<td>Assembly tool for radial packing ring 105 / 120 x 7.5</td>
<td>VO-013.847</td>
</tr>
<tr>
<td>Assembly tool for radial packing ring 120 / 120 x 7.5</td>
<td>VO-013.848</td>
</tr>
<tr>
<td>Assembly tool for radial packing ring 12 / 22 x 6 / 6.5</td>
<td>VO-013.849</td>
</tr>
<tr>
<td>Assembly sleeve for radial packing ring ø 90</td>
<td>VO-013.850</td>
</tr>
<tr>
<td>Assembly sleeve for radial packing ring ø 100</td>
<td>VO-013.851</td>
</tr>
<tr>
<td>Assembly sleeve for radial packing ring ø 105</td>
<td>VO-013.852</td>
</tr>
<tr>
<td>Assembly sleeve for radial packing ring ø 120</td>
<td>VO-013.853</td>
</tr>
<tr>
<td>Assembly sleeve for radial packing ring ø 12</td>
<td>VO-013.854</td>
</tr>
</tbody>
</table>
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- Mining equipment
- Materials handling equipment

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