

Assembly Instructions

RFL 60 – RFL 100

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1. Disassembling the compressor vacuum pump

- 1.1 **Replacing vanes**
- 1.1.1 **Disassembling the old vanes**
- 1.1.2 **Assembling the new vanes**
- 1.2 **Disassembling the compressor vacuum pump completely**



You need not disassemble the machine completely to replace the vanes. Further, the clearance of moving parts need not be re-adjusted after replacement.

If the machine is being disassembled completely, checking the clearance of moving parts is an absolute must during re-assembling.

If rotor, casing cover or casing of the machine are re-finished, the clearance of moving parts must be re-adjusted.

We recommend to have the clearance re-adjusted by one of our service technicians.

No warranty can be claimed against Gardner Denver Wittig if damages can be attributed to unqualified assembling of the compressor vacuum pump.

- Now the rotor is accessible, and you can pull out the vanes (5) one after the other. Turn the rotor to pull out the vanes located below.
- Remove deposits and contaminants inside the compressor vacuum pump, if any.

1.1 Replacing vanes



As soon as the vanes have worn-out (vanes height less than 49 mm), they have to be replaced.

1.1.1 Disassembling the old vanes



Drain lubrication oil from the screw plug (62) - the maximum is 4.5 litres. If the oil is contaminated or mixed with condensate, dispose in an environmentally friendly manner, else use it again.

- Pull the oil tank (11) off its intermediate flange (12) after loosening the two hexagonal head screws (40/56).
- Disassemble four lubrication lines loosening the fastening elements at the fittings (77) and the intermediate flange (12) of the oil tank.
- Loosen the two hexagonal head screws (39/56) to remove the intermediate flange (12) of the oil tank together with the oil pump.
- For disassemble the fan shell loosen the four cheesehead screws (39).
- Loosen the cheesehead screws (35), pull off the fan wheel (13), disassemble the oil line (76/95).
- Loosen the four screws (34), pull off the cover plate (10).
- Remove the spacer (36) and mark it (e.g. "B" for side B of machine).
The spacer must be re-assembled at the same side of the machine, otherwise the axial clearance will be de-adjusted.
- Mark the front side of the cylindrical roller bearing facing you with a felt tip pen.
The bearing must not be re-assembled reversed, since this may alter the axial clearance.
- Loosen the four cheesehead screw (38) and pull the pins (63/64) before.
- Remove the casing cover (9); make sure that the outer ring of the cylindrical roller bearing does not drop.

1. Disassembling the compressor vacuum pump

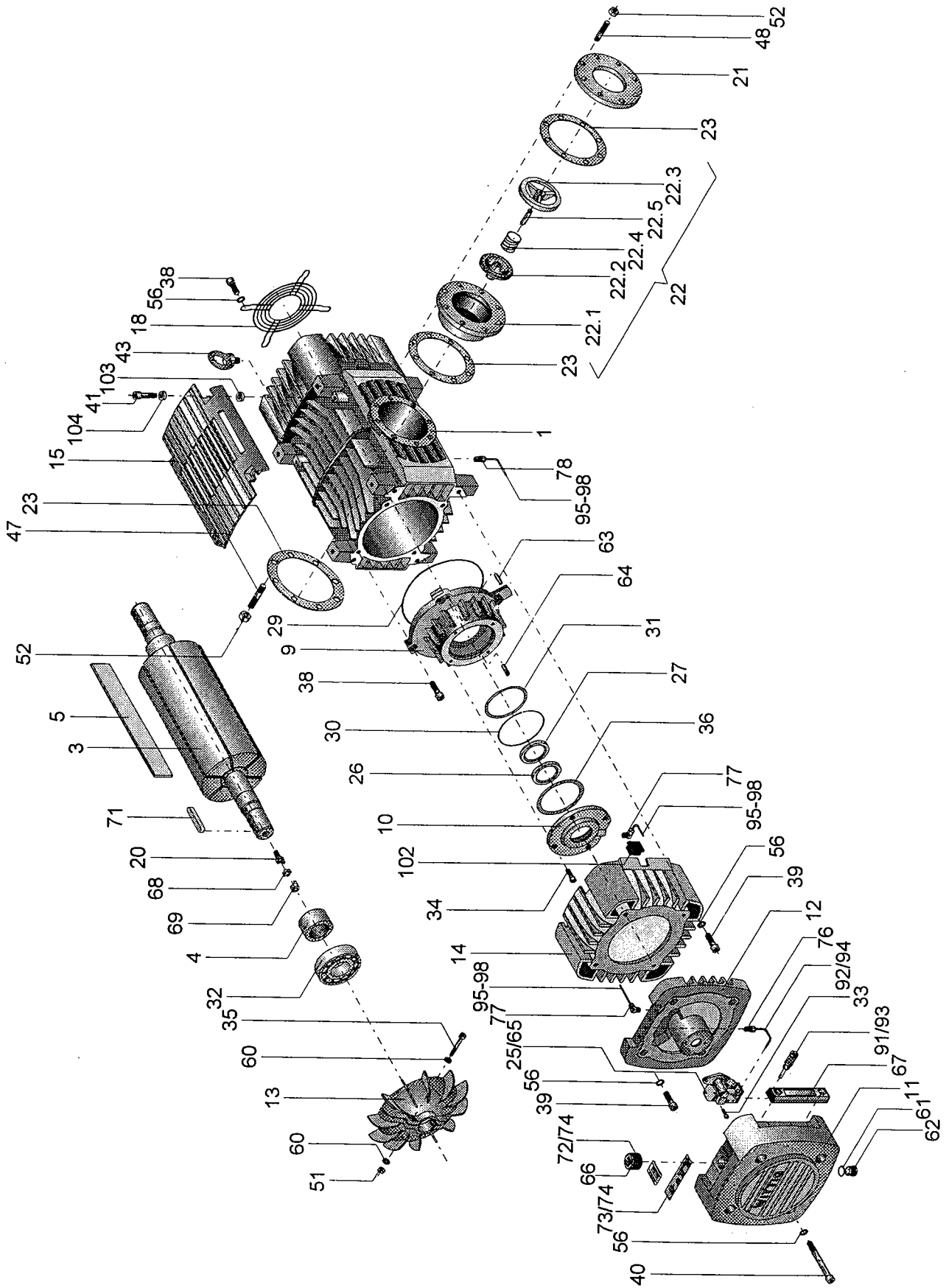


Fig. 1 Disassembling RFL 60 - 100

1. Disassembling the compressor vacuum pump

1.1.2 Assembling the new vanes



Vanes and rotor are perfectly adjusted in their length. Before you assemble new vanes, it is therefore necessary to check the differences in length of rotor and vane. Depending on the model, vanes are slightly shorter or longer than the rotor. The respective under-sizes or oversizes are printed on the packing of the vanes (see Fig. 3).

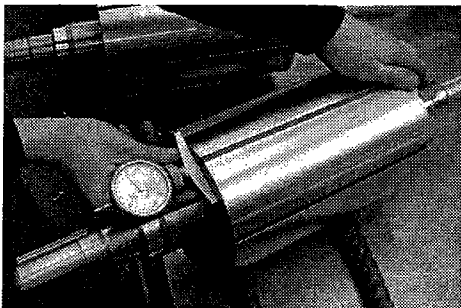


Fig. 3 Determination of the slide dugout

To check to correct length of the vane, you insert it in the rotor slot until it contacts the stop. Then measure the difference in length between rotor and vane.

You must not assemble the vane if the length tolerances are beyond the values printed on the packing of the vanes. If the vane is too long, you may shorten it by hand using oilmoistened abrasive cloth in accordance with the respective safety regulations (e.g. use aspirator protection mask to be saved against grinding dust).

One outer edge of the vane is slightly chamfered. The vane must be assembled such that this chamfer faces the opposite direction of rotation at the outer diameter (see Fig. 2).

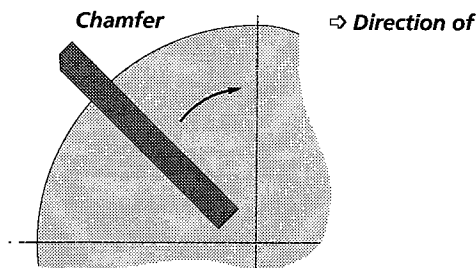


Fig. 2 Correct assembling position of the vane

- Before inserting the rotor slide entoriccate with the stated oil .
- Turn the rotor to insert the vanes.
- Insert a new o-ring (29) in the cover groove.
- Put the casing cover (9) and cylindrical roller bearing (32) together on the shaft end. The o-ring (29) must stay in the recess of the casing cover.
Attention: tighten the four cheesehead screws (38) by hand and insert the pins.
- Check again whether the face of the bearing you marked on disassembling is indeed facing to you.
- Tighten the hexagonal muff (38) in crosswise pattern (tightening torque 80 Nm).
- Insert the spacer (36).

- Insert the O-ring (30) into the groove at the rear side of cover plates (10). Pull on the Cover screws (34)
- Assemble the fan wheel (13) again, consider the rotation direction, assemble the fan shell .

Checking radial tolerance "S" with a steel strip (see chapter 3.3).

- Assemble the intermediate flange (12) together with the oil pump. Check that the cam on the rotor shaft end meshes in the coupling of the oil pump's.
- Insert the two hexagonal head screws (39) and tighten.
- Assemble the oil lines with fittings (77) at the intermediate flange.
- Insert the O-ring (26) into the groove at the rear side of the oil tank. If the O-ring is damaged, replace it.
- Assemble the oil tank and tighten with two hexagonal head screws (40/56).
- Make sure that the screw plug is tightened.



The data for the oil quantity required, the oil specification and the commissioning procedure can be found in the operating manual.

1. Disassembling the compressor vacuum pump

1.2 Complete disassembling of the compressor vacuum pump.



To disassemble the compressor vacuum pump completely, first disassemble the side B (side of the oil pump) as specified in section 1.1.1.

- Disassemble the fan protection (18) by loosening the four cheesehead screws (38).
- Disassemble the fan shell by loosening the four cheesehead screws (39).
- Loosen the cheesehead screws (35) and pull off the fan wheels.
- Disassemble the oil line.
- Loosen the four screws (34). Pull off the cover plate (10).
- Remove the washer (36) and mark with a felt tip pen (e.g. "A" for side A of machine).
The bearing must not be assembled reversed, since this may alter the axial clearance.
- Front side of the now visible cylindrical roller bearing likewise with a felt pen.
The bearing clearance will be possible different.
- Loosen the four screws (38), pull off the pins (63/64) and
- remove the casing cover (9); make sure that the outer ring of the cylindrical roller bearing does not drop.
- Now you can pull the rotor from the casing.

- 2.1 *Vanes*
 - 2.2 *Cylindrical bearings*
 - 2.3 *O-rings and radial shaft seals (WDR)*
 - 2.4 *Casing*
 - 2.5 *Casing covers*
 - 2.6 *Oil lines and oil tank*
-



Check the wear of wearing parts after disassembly of the compressor vacuum pump.

2.1 Vanes (5)

The dimensions of new vanes can be found in table 4.1. The width must not be lower than the rate of admissible wear, otherwise the vane must be replaced. The same applies if chipping at the working edge or delamination fracture is found.

2.2 Cylindrical bearing (32)

Check the bearing surfaces. If the surfaces show strong signs of wearing-in or chipping, they must be replaced. To do so, heat the inner rings of the bearing at the flange shaft and pull them off. Pull the outer rings of the bearing off the casing cover using the puller device.

2.3 O-rings (29, 30) and radial shaft seals (26/27)

Replace damaged O-rings (29, 30) and radial shaft seals (26/27) with new ones, if they are damaged.

2.4 Casing (1)

Check the Casing bore conditions. The bore diameter of a new casing can be found in table 4.1.

If the casing bore is strongly undulated or marked, it must be re-worked (Maximum R_z 8). Smaller marks may be removed with emery fabric or grindstones of low grain size. Turn and hone the surfaces of the bore; after that, re-adjustment of the rotor according to section 3.1 is required.

2.5 Housing end-plate (9)

Check the inner surface of the casing covers on marks caused by the rotor (3). Smaller marks may be removed with emery fabric or grindstones of low grain size. If there are stronger jamming marks, turn along the plane surface of the casing cover (R_z 16, final finishing) at the lathe.

2.6 Oil lines (79) and oil tank (11)

Put the oil lines (79) between the intermediate flange (12) of the oil tank, the oil pump (65) and the fittings (77) in pure benzine and clean with compressed air. Make sure that all oil lines are free. Also clean the strainer (17) at the end of the oil intake line and the oil tank (11) with pure benzine.

3. Assembling the compressor-vacuum pump

- 3.1 **Assembly of the A- and B-side**
- 3.2 **Checking axial clearance "Z" and the oil clearance "Ö"**
- 3.2.1 **Check the axial clearance (total clearance)**
- 3.2.2 **Check the oil clearance**
- 3.3 **Checking radial clearance "S" with a steel strip**
- 3.4 **Assembling of the rest to the machine**



Re-assembly is done in inverted order as disassembly described in section 1, this means, first you assemble the drive side, then the side of the oil pump.

As long as no components were machined or components replaced, it is sufficient to check the tolerances of moving parts after re-assembly.

However, if certain components have been machined (e.g. in order to remove marks of wear) or have been replaced, the tolerances adjusted at the works are lost and you have to re-adjust the tolerances of the moving parts according to the instructions in section 4.

After assembly, it must be possible to turn the rotor by hand without resistance. The rotor must not jam at any position.

3.1 Assembly of the A- and B-side

Installation of the casing as described in fig. 5.

- Insert the rotor (3) into the machine.
- Make sure that you insert the rotor vane (5) as described in section 1.1.2.
- Beat in the cheesehead screw (63) and the conical pin (64) into the bearing cover. The pin must stick out for 2 - 3 mm over the surface.
- Guide the casing cover (9) over the rotor shaft against the casing (1). Consider the perfect sit of the o-rings (29).
- Fit the out sticking cylinder- and conical pin in the borehole of the casing.
- Attach the casing cover (9) with four washer (56) and screws (38) on the casing. Tighten the screws first by hand (see fig. 7).
- Fix the cylinder pin (63) and the conical pin (64) with a hammer (see fig. 8).
- Tighten the screws (38) in crosswise pattern (tightening torque 50 Nm).
- Insert the corrugated lock washer (30) into the cover.
- Fix the outer rings of the cylindrical roller bearing careful in bearing seat of the casing cover. Use a rubber hammer. Don't tilt! The outer rings of the bearing must to be movable easily in the axial direction.
- Consider the marking by assampling. If you exchange the bearings of the A- or B-side, then the clearance-adjustment will be different. The same will happen, if you assemble the bearings conversely.
- Lay the washers (36) into the bearing covers. Attach bearing covers (10) with shaft seal. Consider the marks on the washer. Turn in the screws (34) only so far, that the head of the screen has a distance to the cover of 3 mm.

3.2 Checking axial clearance "Z" and the oil clearance "Ö"

3.2.1 Check the axial clearance (total clearance)

- For this attach on one shaft side, a dial gauge with magnet stands and steel plate and fix it with winding M12 in the winding M12 of the fan shell.
- Set the dial gauge on the front side of the shaft. Squeeze the rotor (3) into the casing of the end up to the limitation.
- Put the dial gauge to "0"
- Pull off the rotor (3) from the casing up to the limitation.
- Read the total clearance from the dial gauge. For the necessary value look at table 4.1.



If the measured values have a deviation to the demanded values, ask our service.

3.2.2 Check the oil clearance

- Tighten the cover crews (34) in crosswise pattern to check the oil clearance (tightening torque 15 Nm). The adjust dial gauge has to remain in the assembled position.
- Afterwards squeeze the rotor (3) into the casing up to the limitation again. The dial gauge must indicate the dictated oil clearance (see chap. 4.1).
- After that pull out the rotor (3) from the casing up to the limitation. The indication of the dial gauge have to indicate the value of the total clearance minus the oil clearance.
- In the case of deviations from the stated values, insert a washer (36) to correct the oil clearance.
- Ultimately, check the residual clearance again. (Values from tab. 4.1).

3.3 Checking radial clearance "S" with a steel strip

For checking the radial clearance insert a steel strip (thickness 0,05 ... 0,08 mm) between inner surface of the bore and rotor through the inlet port (see Fig. 6).



By a careful turning of the rotor, the steel strip on the A- and B-side must have an easy tension. It may not jam.

3.4 Assembling of the rest to the machine

If the in table 4.1 described clearance where reached, than complete the machine in the reverse order as in chap. 1.1.2.

4. Adjustment of tolerances

- 4.1 Tolerances, tolerance-determining dimensions and acceptable wear dimensions
 4.2 Adjusting the radial clearance "S" and the end plates
 4.3 Changing the direction or rotation



Efficiency, operation performance and service life of the compressor vacuum pump depend upon the careful adjustment of the radial and axial clearance. Thus, keep care not to alter the adjusted clearances after disassembling the compressor vacuum pump and do not damage machine components which influence clearance.

4.1 Tolerances, tolerance-determining dimensions and acceptable wear dimensions

Abbreviation	Description	Dimensions (mm)		
		RFL 60	RFL 80	RFL 100
Z	Longitudinal tolerance (Overall tolerance): The length tolerance of the rotor embedded between the two casing covers.	0,428 ... 0,500	0,624 ... 0,720	0,624 ... 0,720
Ö	Oil clearance: Minimum distance between rotor and casing cover when compressor is cold.	0,05 ... 0,08	0,05 ... 0,08	0,05 ... 0,08
$R_K = Z - 2\ddot{O}$	Remaining clearance: Difference between overall tolerance and oil clearance with cold compressor	0,268 ... 0,400	0,464 ... 0,620	0,464 ... 0,620
$L_G - L_S$	Axial clearance of the vanes between the casing covers	1,318 ... 1,431	1,264 ... 1,389	1,264 ... 1,389
$L_R - L_S$ ^①	Vane underlap of the vanes to the rotor body	0,850 ... 0,971	0,580 ... 0,729	0,580 ... 0,729

^① When measuring the vane underlap with mounted rotor, the oil clearance on the A-side has to be taken into account, i.e. the measured value has to be reduced by 0,05 ... 0,08 mm.

Dimensions determining tolerance

D_G	Internal diameter of casing	198 ^{+0,115}	198 ^{+0,115}	200 ^{+0,115}
L_G	Length of casing	280,25 ^{-0,032}	379,90 ^{-0,036}	379,90 ^{-0,036}
L_R	Length of rotor	279,79 ^{-0,04}	379,23 ^{-0,050} ^{+0,01}	379,23 ^{-0,050} ^{+0,01}
L_S	Length of vanes	278,9 ^{-0,081}	378,6 ^{-0,089}	378,6 ^{-0,089}
h	Height of vanes	53,5 ^{-0,3}	53,5 ^{-0,3}	53,5 ^{-0,3}
S	Radial clearance between rotor and casing at its minimum point	0,05 ... 0,06	0,05 ... 0,06	0,05 ... 0,06
E	Thickness of adjusting steel strip for side A and side B	0,08 ... 0,10	0,08 ... 0,10	0,08 ... 0,10
A	Radial clearance of cylindrical roller bearings	0,030 ... 0,045	0,030 ... 0,045	0,030 ... 0,045

Acceptable wear dimensions

D_G	Internal diameter of casing	200	200	201
h	Height of vanes	49	49	49

4. Adjustment of tolerances

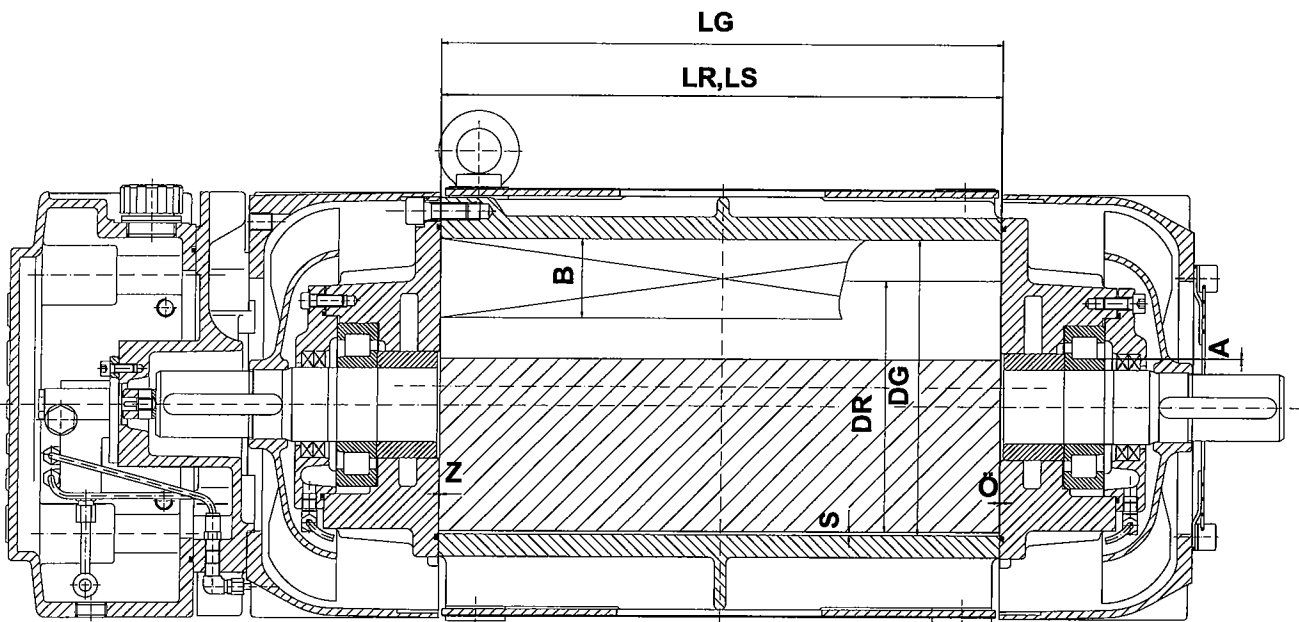


Fig. 4 Clearance and clearance determine dimensions

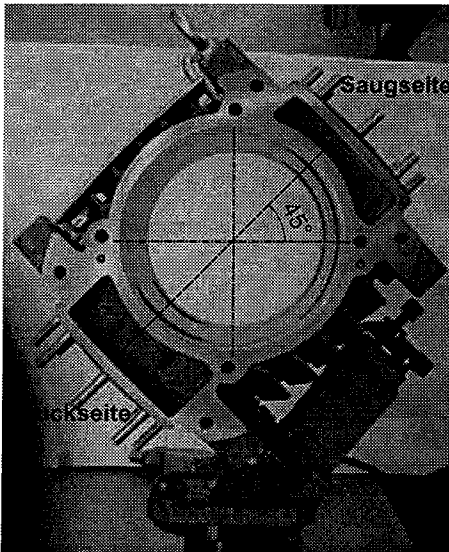


Fig. 5 Assembling position of the casing (see chap. 3.1)

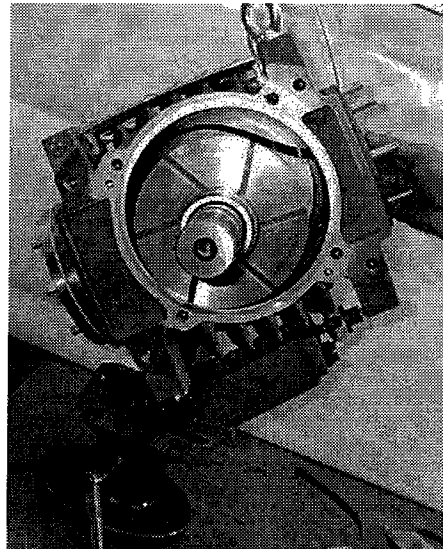


Fig. 6 Check the radial clearance "S" (see chap. 3.3)

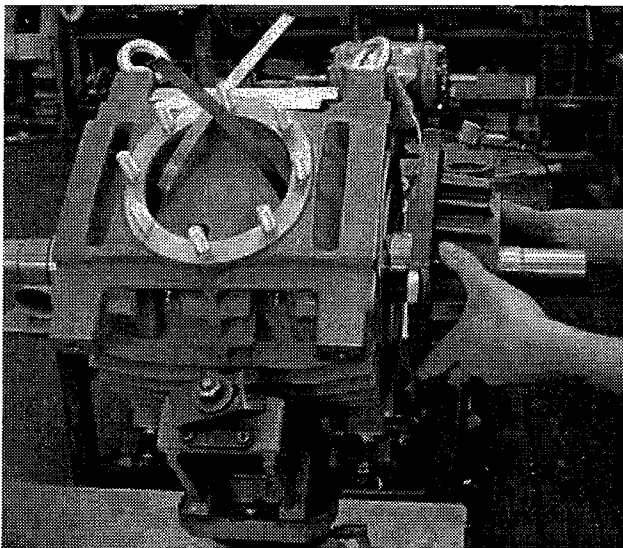


Fig. 7 Assembling of the casing cover (see chap. 3.1)

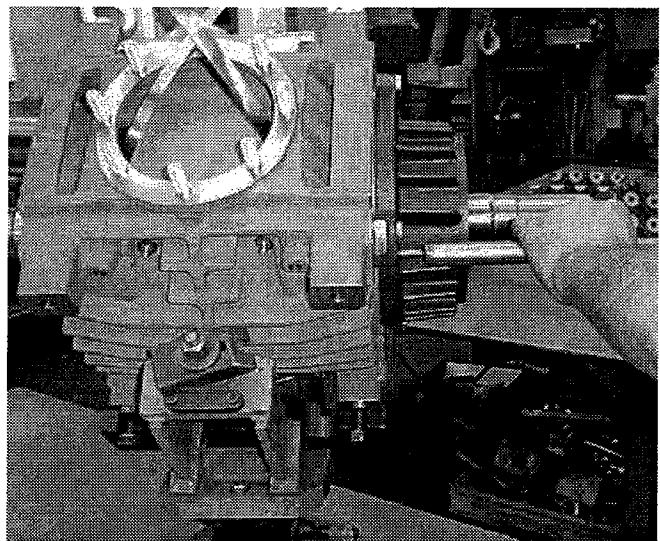


Fig. 8 Drive of the cylinder- and conical pins (see chap. 3.1)

4.2 Adjusting the radial clearance "S" and the casing covers



The radial clearance "S" of the compressor vacuum pump must be re-adjusted again if the rotor, the casing or casing covers were replaced, if the rotor outer diameter was grounded or if the bore of the casing was machined.

- In addition, measure the radial clearance "A" of the cylindrical roller bearings (32). Before you do so, clean the bearings from oil and grease with benzine or fuel oil. The tolerances "A" have to correspond to the dimensions detailed in table 4.1.
- Pull the bearing inner ring (32) over the roller.
- Put two steel strips (E) under the rotor (3) inserted in the casing (1) and the casing covers such that their ends protrude through the inlet ports (Fig. 8). Put casing cover (9) at the drive side together with o-ring (29), the assembled outer ring and the rollers of the bearing (32) onto the shaft and the inner ring of the cylindrical roller bearing. Put a steel plate in front of the end plate and a steel tube of suitable diameter over the shaft. Mount and tighten a hexagonal head screw and a big washer into the thread at the shaft as to press the face of the rotor (3) tightly against the casing cover (9). Attach the casing cover (9) with the screws (38) at the casing (1).
- The opposite side of the compressor vacuum pump is still open. Measure the gap between rotor (3) and casing (1) with a gauge at the flange shaft and check whether the rotor is centered in the casing bore.
- If required, correct the centre position by loosening the nuts of the casing cover (9) and adjusting the casing cover accordingly. Re-tighten the nuts at the casing cover (tightening torque 80 Nm). Put the opposite casing cover onto the inner ring of the cylindrical bearing (32) and tighten the screws. Remove the clamping device from the drive side. Fasten a lathe dog to the free end of the shaft and use it to turn the rotor until the steel strips (E) slip off from below the rotor. Then pull the steel strips out through the inlet ports.
- Go on turning the rotor and check whether it can be turned without jamming. Then drill and fix the casing cover and casing at the marked points.
- Use a taper reamer to ream the holes. Blow out the drilled and reamed holes, hammer in the tapered and cylindrical pins.

Checking the passage strip as described in item 3.

4.3 Changing the direction or rotation



If the direction of rotation of the compressor vacuum pump is to be changed, e.g. from clockwise to counter-clockwise or back, then the oil tank, the oil tank adapter flange, the oil pump and the oil line must be disassembled from the as far B-side and assembled on the as far the A-side. Exchange the fan barrier guard as well.

4. Adjustment of tolerances
