ABS Dry Installed Waste Water Pumps Series FR

Shaft Seal

Close-coupled and Bearing Assemblies 3R, 4R, 5R, 5F and 6F

Observe for hazardous liquids that there can be liquid left in the shaft seal.

3.1 Seal Description

3.1.1 Mechanical Seals

A mechanical seal contains two rings with a high quality surface finish, one of which is stationary whilst the other rotates with the pump shaft. Spring force and liquid pressure hold the faces of the rings in contact with each other, see Fig. 1. The rings are sealed by an elastic component.

The mechanical seal, although not absolutely leak free, should normally pass only a few cubic centimetres per hour. This small leakage will evaporate or be carried away by quench liquid.

ATTENTION

A mechanical seal must never run dry without lubrication and when the friction heat is not dissipated, the rapid temperature rise will quickly lead to overheating and seal failure.

Such factors as pressure, temperature, speed of rotation and the liquid´s chemical properties, all influence the seal design. This variety of influencing factors has led to a multiplicity of designs and materials for mechanical seals.

3.1.2 Packed Glands

Packed glands contain rings of soft packing and a lantern ring inside a cartridge, with a gland compressing the rings together, see Fig. 2.

The shaft is sealed by compressing the packing rings until liquid leakage is just sufficient to dissipate the friction heat. Sealing liquid is introduced in the lantern ring between the soft packing rings.

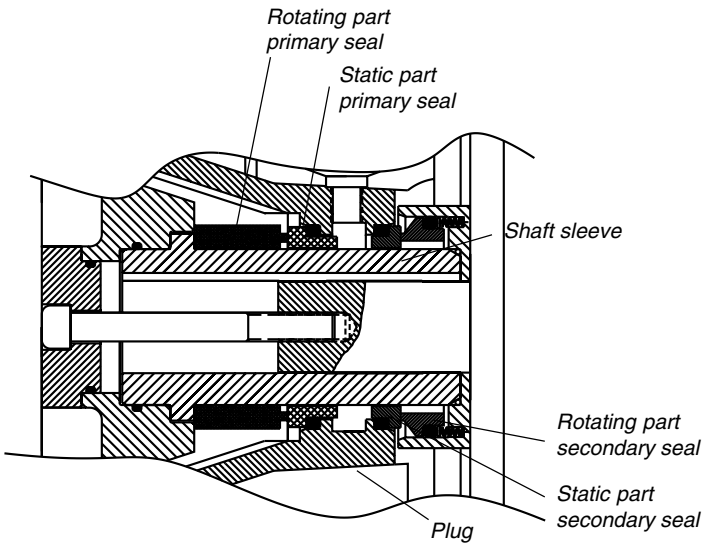

Fig. 1
The double mechanical seal in FR series consists of a primary part and a secondary part.

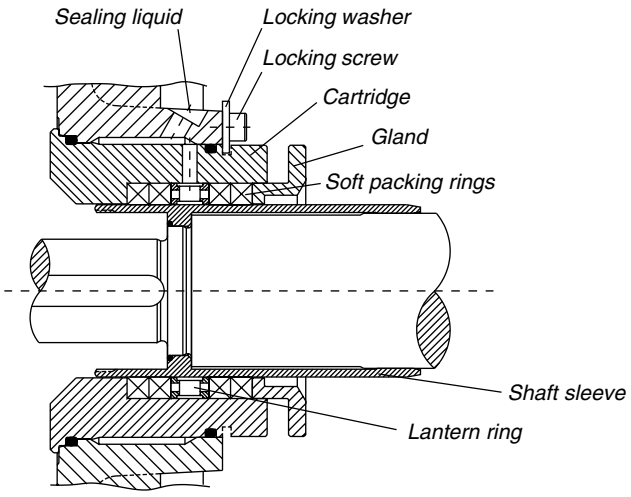

Fig. 2
Gland packing with sealing liquid for bearing assemblies 5R, 5F and 6F

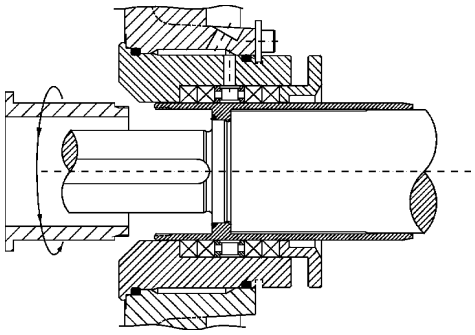

Fig. 3
The special tool (5R) is screwed onto the sleeve and then use a standard puller.

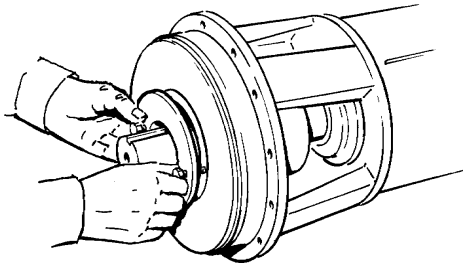

Fig. 4
The cartridge tool is screwed onto the sleeve and fixed to the seal cartridge.

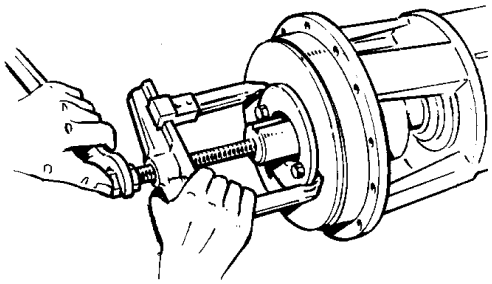

Fig. 5
A standard puller is used to withdraw the cartridge. Remember to remove the locking screw and washer.

3.2 Seal Cartridges

This section 3.2 is not valid for close-coupled version, bearing assembly 3R and 4R.

Always refer to the seal assembly drawing for the pump before removing and installing the cartridge.

3.2.1 Removal

1. Remove the rotor assembly from the pump casing and withdraw the impeller off the shaft. (See instruction No. 4 ”Dismantling and Assembly” Para 4.1).
2. Remove the cartridge locking screw and washer. All connections, plugs and nipples should also be removed.

3.2.1.1 Gland Packing Bearing Assemblies 5R, 5F and 6F

3. NB! It is rarely necessary to dismantle the cartridge for gland packings. Always consider changing the packing rings without dismantling the cartridge. See Para 3.3.2.4 for re-packing.
4. ***5R:*** For extracting the shaft sleeve and then the cartridge for bearing 5R a special tool is required. Screw the special tool onto the shaft sleeve (see Fig. 3) pull out the sleeve with a standard puller.
5. ***5R, 5F and 6F:*** Use the cartridge locating tool (same for bearing assemblies 5R and 5F). Attach it to the cartridge using two screws, see Fig. 4.
6. Pull the cartridge from the casing cover using a puller, see Fig. 5. Take care that the threads in the shaft end are not damaged.

3.2.1.2 Single Mechanical Seal in ABS PSI Cartridge Bearing Assemblies 5R, 5F and 6F

3. Screw the cartridge tool onto the shaft sleeve and attach it to the seal housing using two screws, see Fig 4. Depending on the seal type, it may be necessary to remove a spring or spacer before attaching the tool.
4. Pull the cartridge from the casing cover using a puller, see Fig. 5.

3.2.1.3 Double Mechanical Seal in Seal Cartridge Bearing Assemblies 5R, 5F and 6F

3. Screw the cartridge tool onto the shaft sleeve and attach it to the seal housing using two screws, see Fig. 4.

   ATTENTION

   This instruction must be followed to ensure that equal forces are applied to both the shaft sleeve and the seal cartridge to prevent damage to the seals.
4. Pull the cartridge from the casing cover using a puller, see Fig. 5. Take care that the threads in the shaft end are not damaged.

3.2.2 Installing

1. Check that the O-rings are properly seated in their respective grooves and that drain plug has been fitted. Lubricate the O-rings with soft soap. (Do not use oil or grease.)

3.2.2.1 Gland Packing
Bearing Assemblies 5R, 5F and 6F

2. Place the shaft sleeve, the gland and the lantern ring onto the shaft and fit the O-ring between the shaft sleeve and the shaft.
3. Use a pen and mark the line of the locking washer recess to aid alignment with the screw hole in the casing cover. Push the cartridge by hand into the casing cover, until it is stopped by the O-rings.
4. Attach the cartridge tool to the cartridge using the two screws.
5. Press home the cartridge using a special mounting yoke (not the same for 5R and 5F) and impeller screws, see Fig. 6. It may be necessary to restrain the pump shaft to prevent it rotating.
6. Remove the tool screws from the cartridge.
7. Place two packing rings on each side of the lantern ring into the cartridge. For tightening the gland, see Para. 3.3.2.4 for re-packing.
8. Replace the cartridge locking screw and washer. For further assembly see Instruction No. 4 ”Dismantling and Assembly” Para. 4.3.

3.2.2.2 Single Mechanical Seal in ABS PSI Cartridge
Bearing Assemblies 5R, 5F and 6F

2. Attach the cartridge tool to the seal housing with the two screws.
3. Use a pen and mark the line of the locking washer recess to aid alignment with the screw hole in the casing cover. Push the cartridge by hand into the casing cover, until it is stopped by the O-rings. Press home the cartridge using the mounting yoke and impeller screws, see Fig. 6. It may be necessary to restrain the pump shaft to prevent it rotating.
4. Replace the cartridge locking screw and washer. For further assembly see Instruction No. 4 ”Dismantling and Assembly” Para. 4.3.

3.2.2.3 Double Mechanical seal in Seal Cartridge
Bearing Assemblies 5R, 5F and 6F

ATTENTION

2. Attach the cartridge locating tool to the seal housing and the shaft sleeve with equal pressure, in order to prevent damage to the seal faces.
3. Use a pen and mark the line of the locking washer recess to aid alignment with the screw hole in the casing cover. Push the cartridge by hand into the casing cover, until it is stopped by the O-rings. Press home the cartridge using a special mounting yoke and impeller screws, see Fig. 6. It may be necessary to restrain the pump shaft to prevent it rotating.
4. Lock the cartridge by tightening the locking screw and washer. For further assembly see Instruction No. 4 ”Dismantling and Assembly” Para. 4.3.

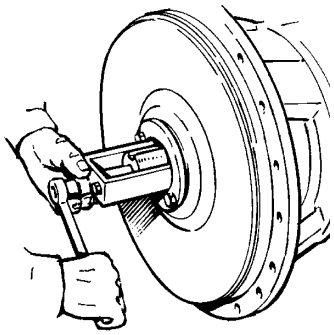

Fig. 6
For pumps built on bearing assembly sizes 5 and 6, a mounting yoke is used with the impeller screws.

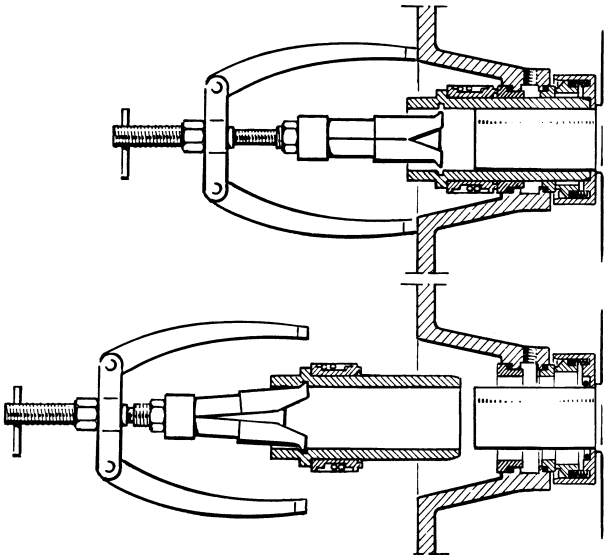

Fig. 7
Use a standard puller with a special extension to extract the shaft extension.

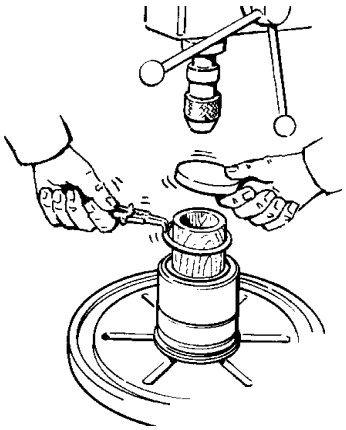

Fig. 8
The locating rings for a double mechanical seal assembly are easily removed and inserted with a pedestal drill. Use a piece of wood as protection.

3.3 Seal Overhaul

Refer to the seal assembly. Generally apply soft soap to all O-rings and rubber parts before assembling. All chamfers should be smooth.

3.3.1 Mechanical seals

The seal lubricant chamber is filled with lubricant (60% water, 40% glycol (Dowcal20)). Approximate lubricant quantities for seal chamber and lubricant container are 0,1-0,3 litre, depending on bearing assembly size (close-coupled, 3R, 4R and 5R).

1. Remove the rotor assembly and motor from the pump casing and withdraw the impeller off the shaft. (See instruction No. 4 ”Dismantling and Assembly” Para. 4.1). Unscrew drain plug to empty seal chamber (only for close coupled, 3R, 4R and 5R).

3.3.1.1 Dismantling; Double mechanical Seal Close-coupled, Bearing Assemblies 3R and 4R

Primary and secondary seal

2. Insert a standard puller with special extension into shaft extension (See Fig. 7).
3. Pull out the shaft extension.

Primary seal

4. Remove the primary seal from the shaft extension.
5. Remove the primary seat from the lantern.

Secondary seal

6. Remove the lantern by unscrewing the screws secured to the motor.
7. Remove the static part of the secondary seal from the lantern.
8. Remove the key and the rotating part (including its collar) of the secondary seal from the shaft.

3.3.1.2 Dismantling; Single Mechanical Seal Bearing Assemblies 5R, 5F and 6F

2. Lift out the shaft sleeve with the rotating part of the seal.
3. Remove the rotating part of the seal.
4. Press out the stationary seat.

3.3.1.3 Dismantling; Double mechanical Seal Bearing Assemblies 5R, 5F and 6F

2. Depress seat retainer and remove the locating rings (circlip). It may not be possible to do this manually so a pedestal drill may be used for instance, with a piece of wood to avoid damaging the seat retainer. (See Fig. 8).
3. Seat retainer can now be removed. If it sticks, force it out using water. Compressed air is not recommended, due to the danger of the retainer coming free too fast.
4. Remove the shaft sleeve with the seal rotating parts and lift out the front seat retainer.
5. Remove the rotating part of the seal.

3.3.1.4 Assembly; Double Mechanical Seal Close-coupled, Bearing Assemblies 3R and 4R

See Fig. 9 for assembly (Fig. shows close-coupled version).

1. Insert the primary seal seat in the lantern from the pump side.
2. Fit the rotating part of the primary seal on the shaft extension.
3. Insert the secondary seal seat from the motor side.
4. Assemble the rotating part of the seal in its drive collar. Fit it on the motor shaft. Place the key on the shaft and insert the o-ring in the drive collar.
5. Fit the lantern onto the motor (or the bearing assembly).
6. Put the shaft extension on the motor shaft.
7. For fitting the impeller, see Instruction No. 4 ”Dismantling and Assembly” Para. 4.3.5.

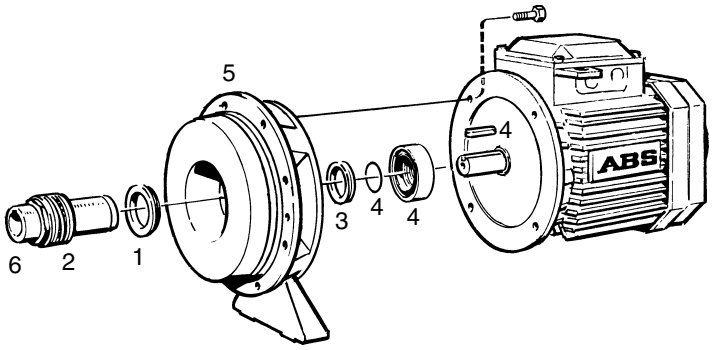

Fig. 9
Assembly sequence for close coupled version, bearing assemblies 3R, and 4R.
The figure shows the close-coupled version.

3.3.1.5 Assembly; Single Mechanical Seal Bearing Assemblies 5R, 5F and 6F

1. Press the seat into the seat retainer.
2. Fit the rotating parts on the shaft sleeve from the chamfered end of the sleeve (not the threaded end which might destroy the O-ring), according to the dimension given on the seal assembly drawing.
3. Insert the rotating parts into the cartridge. For rubber bellow seals always check that the seal is fastened to the sleeve before mounting it into the cartridge.
4. Attach the cartridge tool to the cartridge to keep the sleeve in position.

3.3.1.6 Assembly; Double Mechanical Seal Bearing Assemblies 5R, 5F and 6F

1. Insert the front seat retainer and seat.
2. Fit the rotating parts on the shaft sleeve from the chamfered end of the sleeve (not the threaded end which might destroy the O-ring), according to the dimension given on the seal assembly drawing.
3. Insert the rotating parts into the cartridge.
4. Insert the rear seat and seat retainer.
5. Press down the rear seat retainer so that it is possible just to insert the locating rings (circlip) vertically. (Use a pedestal drill or similar, see Fig. 8).
6. Fit drain plug.

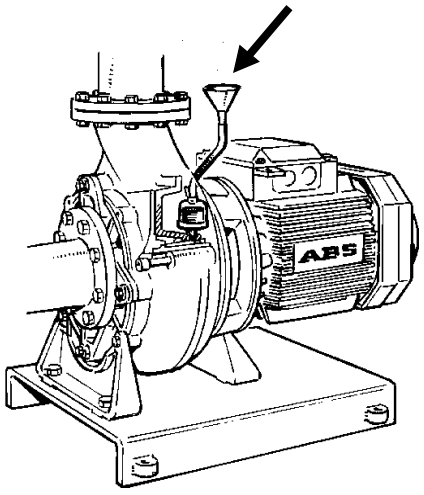

Fig. 10
The seal lubricant chamber is filled with lubricant (60% water, 40% glycol (Dowcal20)). Approximate lubricant quantities for seal chamber and lubricant container are 0,1-0,3 litre, depending on bearing assembly size.

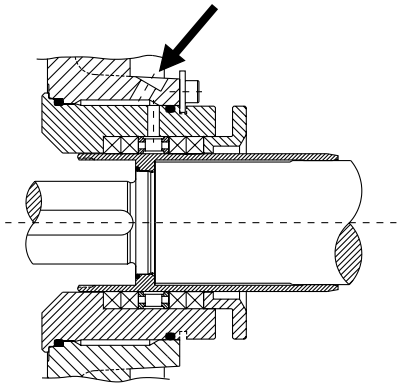

Fig. 11
Gland packing: the sealing liquid is introduced from above.

**) Sealing liquid pressure = pump inlet pressure + 0,6 of generated pressure + 1 bar. (Max. pressure 5 bar).*

3.3.2 Gland Packing

The sectional drawing for the current seal arrangement should always be at hand.

The shaft is sealed by compressing the packing until liquid leakage is just sufficient to dissipate the frictional heat.

3.3.2.1 Gland Packing without Sealing Liquid

With comparatively clean pumped media containing no solids, and with pressures behind the impeller above atmospheric, there is no need for sealing liquid. Consequently, no lantern ring is required in the stuffing box.

3.3.2.2 Gland Packing with Sealing Liquid

When the pumped medium is not clean or if there is a partial vacuum behind the impeller, sealing liquid must be supplied to prevent solid particles entering the stuffing box or air ingress at the gland. Two packing rings are fitted inboard of the lantern ring to minimise dilution of the pumped liquid see Fig. 11.

The sealing liquid* must always be clean and of a pressure higher than the pressure behind the impeller. The flow should be about 0,1 l/min.

If the pressure behind the impeller is partial vacuum and the pumped liquid is clean ”Internal sealing liquid” may be used as sealing liquid. The liquid is fed from the pump discharge to the lantern ring via an external pipe. The pressure should not however exceed 5 bars.

3.3.2.3 Running Maintenance

See Instruction No. 2 ”Start-up and Running Maintenance” Para. 2.6.2 ”Shaft Seal”.

3.3.2.4 Re-packing

See Para. 3.2.1 for removal of cartridge.

1. Remove the gland and use a packing extractor to remove all old packing. If a lantern ring is fitted ensure the two rings inboard are removed. Remove the lantern ring by using a packing extractor in one of the two holes. Clean the stuffing box thoroughly.
2. Check the shaft sleeve and gland follower. If they are scored or badly worn, replace them.

3. Flush the sealing liquid pipe to check for blockages.
4. Select new packing according to table 1. A slightly larger packing may be used, but never a smaller size.
5. Each ring should be long enough for the ends to be pressed together when inserted in the stuffing box. Cut the ends at right angles using a sharp knife - avoid tearing the ends. If it is difficult to insert the packing, roll it with a pipe on a clean, flat surface. Do not hammer the packing as this will cause the fibres to rupture.
6. Oil the packing rings and shaft sleeve, with e.g. machine oil, before inserting the rings. Inert sealant is used for oxygen and chlorates.
7. The gland follower should move easily into the stuffing box. Push in the rings using the follower and stagger the joints half a turn as in Fig. 12. Do not put in too many rings. The gland follower should have a guiding depth of 3-5 mm into the stuffing box. Ensure that the follower is at right angles to the shaft. An unevenly tightened gland follower may cut into the shaft sleeve.
8. When fitting a lantern ring, ensure it is correctly located. Note it will be slightly displaced when the packing is compressed.
9. The gland nuts should be lightly tightened, until the frictional resistance is noticed when turning the shaft by hand. Then loosen the nuts 1/6 turn.

3.3.2.5 Running-In

After re-packing, careful running-in is important. See Para. 3.2.2 for installing the cartridge.

1. Open suction valve and the sealing and cooling liquid valves, if any.
2. Fill the pump completely. Leakage should be ample, but not so that liquid sprays from the shaft.
3. Start the pump, open the discharge valve and observe the stuffing box. If leakage is excessive, tighten the gland nuts by 1/6 turn at 10 minute intervals. If leakage stops completely, loosen the gland nuts until dripping restarts. Do not let the packing run dry as overheating damage will occur. If the packing overheats, stop the pump and allow the shaft sleeve and gland to cool. When the pump is running it can be cooled by using a hose.

   ATTENTION

   Repeated dry-running will damage the whole seal unit. With very high pump pressures, it may be necessary to stop the pump to make gland adjustments.
4. Check the pump regularly during the initial 1-3 hours of running-in. Leakage should be normal by end of this period, i.e., about 10 drips per minute, or somewhat more for hot liquids. The stuffing box should be regularly observed during the first 24 hours.

Table 1
Dimensions of packing rings.

Bearing Assembly	D	d	b	Length*	No of rings** with Lantern Ring	without Ring
	mm	mm	mm	mm		
5R/5F	124	100	12,7	378	4	5
6F	144	120	12,7	434	4	5

** The length can vary with ring supplier.*
*** Ensure gland follower guiding distance is at least 3-5 mm.*

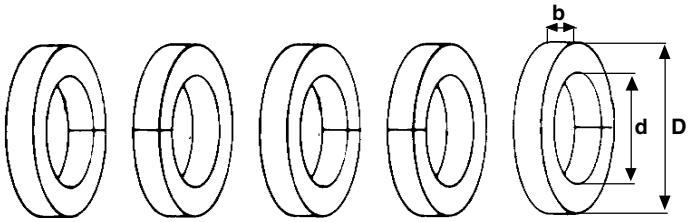

Fig.12
When inserting the packing rings, the joints should be staggered half a turn.

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