

Installing seals

General	142
What to remember	142
SKF Bearing fitting tool kit	146
Preparations prior to installation.	146
Installing a radial shaft seal into a housing	146
Installing seals that have an auxiliary lip	149
Installing a solid all-rubber seal	149
Installing a radial shaft seal over a shaft.	150
Replacing a radial shaft seal.	151
Repairing a worn shaft with an SKF wear sleeve	152
Installing an SKF SPEEDI-SLEEVE.	152
Installing a large diameter wear sleeve .	152
Installing a large, split all-rubber seal. . .	154
Installing sealing washers.	156
Installing a V-ring seal	157

General

To perform as intended, seals must be installed properly. This can most easily be done if you have installation experience and a clean work environment and also use suitable tools. The seal counterface, the area where the seal lips contact the shaft, should meet the specifications for surface roughness and roundness, and should be clean. If the counterface shows any signs of wear, repair it. This can be done easily with an SKF SPEEDI-SLEEVE or a large diameter wear sleeve (LDSLV). If it can't be easily repaired, replace the shaft.

Because radial shaft seals are so common, and play such an important role in protecting the bearings, lubricant and other critical components from contaminants, this chapter is limited to such seals unless specified otherwise.

What to remember

SKF seals are available in many types, designs and variants. The most common radial shaft seals are listed below:

- metal-cased radial shaft seals with a garter spring
- metal-cased radial shaft seals without a garter spring
- radial shaft seals with a rubber outside diameter and a garter spring
- radial shaft seals with a rubber outside diameter, without a garter spring

When replacing a seal, be sure that the replacement seal matches the original with regard to the following:

- seal type and design (→ **tables 1a** and **1b**)
- material of the seal lip (→ **table 2, page 145**)

CAUTION: A simple ordering error can result in sudden seal failure, e.g. a nitrile rubber seal might be installed instead of a much more temperature-resistant fluoro rubber seal, although the design is otherwise identical.

For additional information about SKF mounting and installation tools, visit www.mapro.skf.com.

The SKF Reliability Maintenance Institute (RMI) offers a comprehensive range of training courses (→ *Training*, starting on **page 326**). Contact your local SKF representative for additional information, or visit www.skf.com/services.

The SKF program SKF Sealfinder, available online at www.skf.com, contains seal data from approximately 80 different seal manufacturers or distributors, for a quick cross reference.

WARNING:

At temperatures above 300 °C (570 °F) all fluoro elastomers and PTFE compounds give off dangerous fumes. If there is contact with your skin or if the vapours are inhaled, seek medical advice immediately.

Table 1a

Radial shaft seals for general industrial applications


















Seal type without an auxiliary lip		with an auxiliary lip		Description
CRS1		CRSA1		Metal-cased seal with a garter spring
CRSH1		CRSHA1		Reinforced metal-cased seal with a garter spring
CRW1		CRWA1		Metal-cased seal with an SKF WAVE seal lip and a garter spring
CRWH1		CRWAH1		Reinforced metal-cased seal with an SKF WAVE seal lip and a garter spring
CRW5		CRWA5		Metal-cased seal with a pressure profile SKF WAVE seal lip and a garter spring
HMS5		HMSA10		Rubber outside diameter seal with a garter spring
HMS4		HMSA7		Rubber outside diameter seal with a garter spring
SL SLX SLS DL		SLA DLA		Metal-cased seal with a PTFE seal lip(s)
YSL YNSLE YSL				All-PTFE seal with an O-ring(s)

Table 1b

Radial shaft seals for heavy industrial applications














Seal type without an auxiliary lip		with an auxiliary lip		Description
HDL		HDLA		Metal-cased seal with a garter spring
HDS1 HDS2		HDSA1 HDSA2		Metal-cased seal with a garter spring in an SKF Springlock groove (HDS2 and HDSA2 also have an SKF Springcover)
		HDSB1 HDSB2		Metal-cased seal with a garter spring in an SKF Springlock groove (HDSB2 also has an SKF Springcover)
		HDSC1 HDSC2		Metal-cased seal with a garter spring in an SKF Springlock groove (HDSC2 also has an SKF Springcover)
HDS3				Metal-cased seal with a garter spring in an SKF Springlock groove with an SKF Springcover and adjustable spacer lugs
HDS4				Rubber outside diameter seal with a garter spring and spacer lugs moulded into the seal body
HDS6				Rubber outside diameter seal without a garter spring, with spacer lugs moulded into the seal body
HDS7				Metal-cased seal without a garter spring
HDSD1 HDSD2				Metal-cased seal with two seal lips facing opposite directions, with garter springs
HDSE1 HDSE2				Metal-cased seal with two seal lips facing the same direction, with garter springs
HS4 HS5				Solid all-rubber seal with a garter spring in an SKF Springlock groove (HS5 also has an SKF Springcover)

Table 1b cont.

Radial shaft seals for heavy industrial applications

Seal type				Description
without an auxiliary lip		with an auxiliary lip		
HS6 HS7 HS8				Split all-rubber seal with a garter spring in an SKF Springlock groove (HS7 and HS8 also have an SKF Springcover)
HSF1 HSF2 HSF3		HSF4		Split fabric-reinforced seal with a garter spring
HSF5 HSF6 HSF7 HSF9		HSF8		Solid fabric-reinforced seal with a garter spring
SBF				Metal-inserted seal with a garter spring
R01-P R01-R		R02-P R02-R		Rubber outside diameter seal with a garter spring
R01-AF R01-AS				Rubber outside diameter seal with a garter spring

5

Table 2

SKF seal lip material variants

Designation suffix	Seal lip material	Designation example
R, RG H	Acrylonitrile-butadiene rubber (NBR) Hydrogenated acrylonitrile-butadiene rubber (HNBR)	CR 15X35X7 CRW1 R CR 420X470X20 HDS3 H
D V T	Carboxylic-acrylonitrile-butadiene rubber (XNBR) (SKF Duralip) Fluoro rubber (FKM) (SKF Duralife) ¹⁾ Polytetrafluoroethylene (PTFE)	CR 240X280X16 HDS2 D CR 640X680X20 HDL V CR 70X90X10 RD10 T

¹⁾ Important safety information about fluoro elastomers is supplied on [page 142](#).

SKF Bearing fitting tool kit

The SKF Bearing fitting tool kit can be used to install radial shaft seals with an outside diameter up to 120 mm. The kit consists of:

- 3 impact sleeves, for even force distribution, marked with the letters A, B or C
- 36 impact rings, marked with the letter for the corresponding impact sleeve and the inside and outside diameter of the ring, e.g. B 25/52
- 1 double-sided dead-blow hammer

Preparations prior to installation

To obtain a reliable seal and achieve the best results, do the following:

- Make sure that the dimensions of the selected seal match those of the shaft diameter and housing bore.
- Make sure that the selected seal can withstand the media as well as the operating temperature and speed.
- Check the seal for any damage, e.g. dents, scores or cuts. Never use a damaged seal.
- Carefully clean the seal if it has become dirty. Use warm soapy water (not above 30 °C (85 °F)) and allow the seal to dry at room temperature.
- Chamfer and blend the housing bore corner to prevent damage to the outside surface of the seal.
- The housing bore and counterface on the shaft should meet the requirements given by SKF with regard to dimensional and form accuracy, roughness and hardness.
- All shaft edges over which the seal lip must pass should be chamfered or rounded.
- Lightly coat the seal with the lubricant that will be used for the application. PTFE seal lips should not be pre-lubricated unless they are used in applications that run dry.

Installing a radial shaft seal into a housing

When installing a seal into a housing bore, the installation force should be applied as close as possible to the outside diameter of the seal. Therefore, SKF recommends using a mandrel in

conjunction with a mechanical or hydraulic press (or hammer).

CAUTION: During installation, make sure the orientation of the seal lip is correct (→ **fig. 1**). When the primary function of the seal is to prevent contamination, the seal lip should face outward toward the contaminants. When the primary function is to retain lubricant, the seal lip should face inward toward the lubricant.

The following are suggested installation methods that depend on the application and the location of the seal:

- seal back face to seat against a shoulder or a retaining ring – use a mandrel (→ **fig. 2**).
- at a certain distance within an opening – use a mandrel with a stop to position the seal properly (→ **fig. 3**).
- flush with the wall of the housing bore – use the SKF Bearing fitting tool kit (→ **fig. 4**). Otherwise, cover the seal with a wood or plastic board and tap the seal into place with a hammer (→ **fig. 5**).

If a suitable installation tool is not available for large seals, SKF recommends using a wooden block (→ **fig. 6**) or a metal fitting disc. When using alternative tools, work evenly around the circumference of the seal to prevent the seal from tilting or skewing. If the seal is to be recessed behind the housing wall, a piece of wood should be used (→ **fig. 7**).

Fig. 1

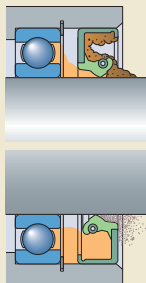


Fig. 2

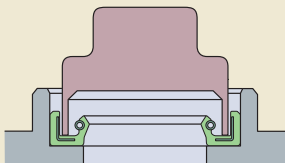


Fig. 5

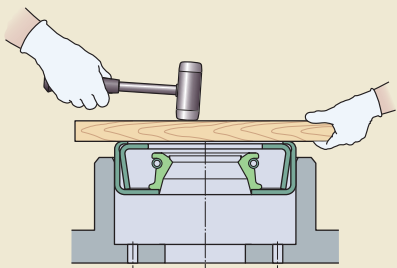


Fig. 3

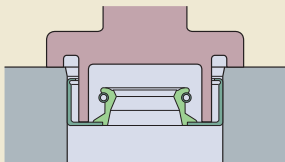


Fig. 6

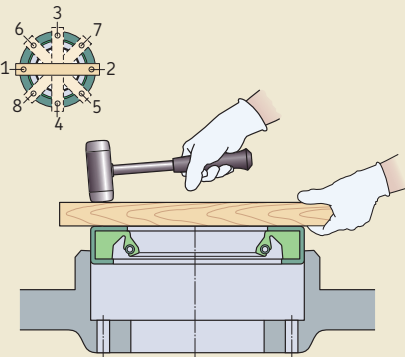


Fig. 4

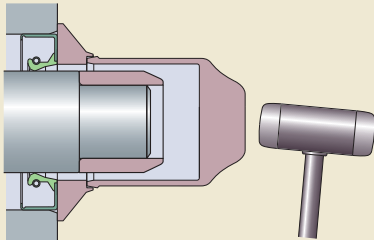


Fig. 7

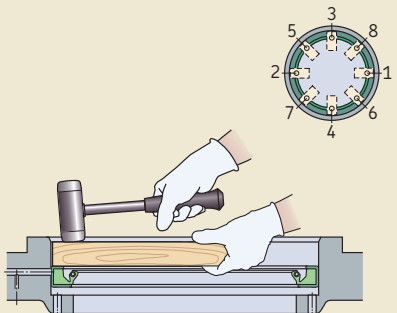
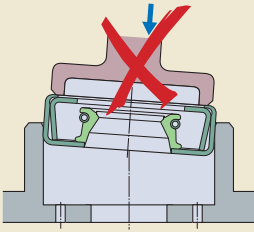


Fig. 8



When installing a seal into a housing bore:

- Make sure that the seal and installation tool are not in an inclined position (→ **fig. 8**). They should be perpendicular to the housing.
- Make sure that the outside diameter of the tool extends to the outside diameter of the seal, or there is a risk that the seal will bend or distort (→ **fig. 9**).
- Never use a drift punch (→ **fig. 10**).
- Always tap the installation tool gently with a hammer.
- Never hit the seal directly with any type of hammer (→ **fig. 11**).

CAUTION: Use sealants sparingly (to prevent contact with the seal lip, counterface and bearing).

Fig. 9

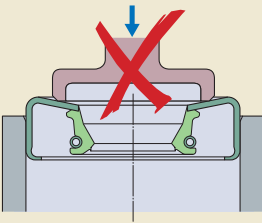


Fig. 10

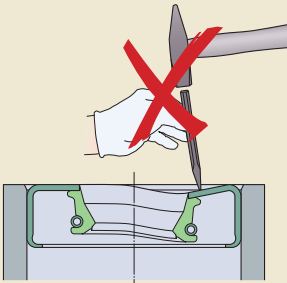
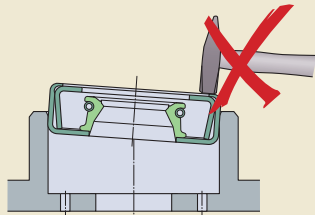


Fig. 11



Installing seals that have an auxiliary lip

When installing double-lip seals or seals that have a contacting auxiliary lip, fill the gap between the primary and auxiliary lip with an appropriate grease (→ **fig. 12**). This does not apply to silicone rubber seals or seals with hydrodynamic aids.

Installing a solid all-rubber seal

All-rubber seals can be installed by hand; no special installation tools are required. However, after installation, the seal must be axially clamped in the housing bore by a retaining cover (→ **fig. 13**).

Fig. 12

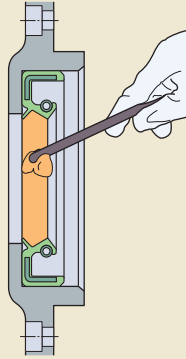
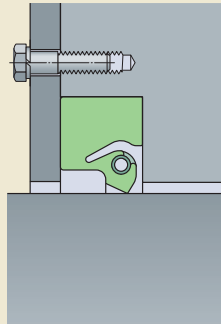


Fig. 13



Installing a radial shaft seal over a shaft

When installing a seal over a shaft, SKF recommends the following:

- Cover all grooves, keyways, cross holes, splines, threads, and any other sharp edges with a thin-walled ($< 0,5 \text{ mm}$) protective cap (\rightarrow **fig. 14**).
- Use a sleeve when the shoulder of a stepped shaft is not chamfered or rounded (\rightarrow **fig. 15**).

The outside surface of protective caps and sleeves should be coated with the same lubricant as the seal and counterface. The outside surface and lead-in chamfer of the installation tool should be free of any burrs or sharp edges.

Radial shaft seals made of PTFE should always be installed using a protective cap or sleeve.

If, after the seals have been installed, the housing or machine is to be painted, the seals must be protected from the paint. Discs cut from cardboard (\rightarrow **fig. 16**) can be used.

Fig. 14

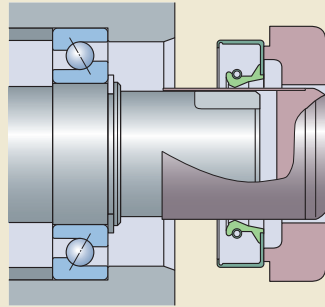


Fig. 15

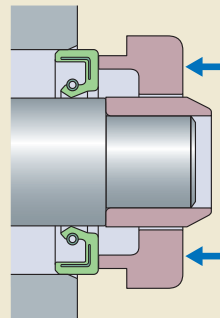


Fig. 16

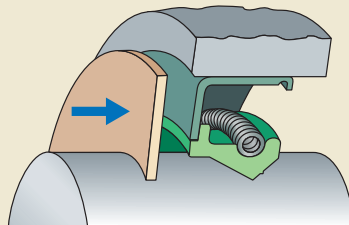
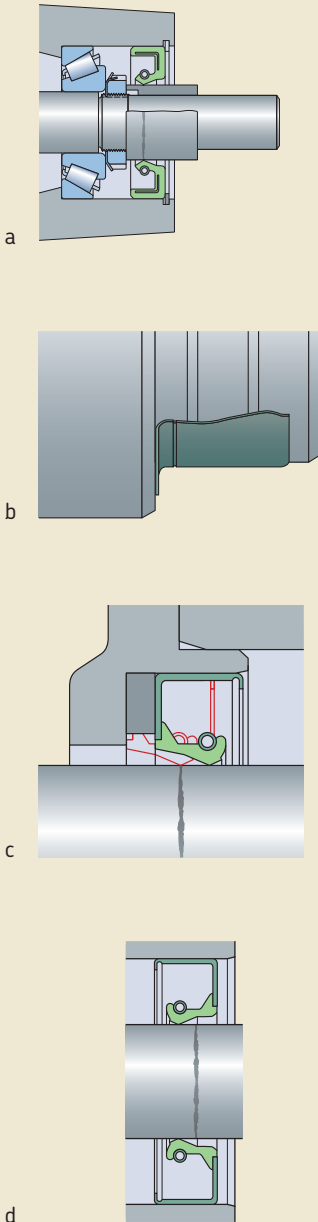


Fig. 17



Replacing a radial shaft seal

CAUTION: Once a radial shaft seal has been removed from an application, it should never be reused.

If the seal counterface shows any signs of wear or damage, it must be repaired. There are several ways to do this (→ **fig. 17**):

- Rework the shaft counterface; this requires shaft removal.
- Replace the ring that served as a counterface (**a**).
- Install an SKF SPEEDI-SLEEVE (for shaft diameters ≤ 203 mm) (**b**), or a large diameter wear sleeve (LDSL) (for shaft diameters > 203 mm).
- Install a spacer ring in the housing bore between the housing shoulder and the seal (**c**).
- Press the new seal to a different depth in the housing bore (**d**).

When applicable, the seal lip should always be displaced toward the side of the medium to be sealed (**c**).

When choosing a replacement seal, the design and material should correspond to the original. In case of doubt, a higher quality seal should be used to make sure it can withstand the operating conditions.

If a seal of the same design is not available in the same width as the original, a somewhat narrower seal could be used. Or, if the depth of the housing bore allows, a somewhat wider seal could be chosen as a replacement.

Repairing a worn shaft with an SKF wear sleeve

Installing an SKF SPEEDI-SLEEVE

SKF SPEEDI-SLEEVE wear sleeves provide a quick, easy and inexpensive way to repair the seal wear track on a shaft. These sleeves, which eliminate the need to disassemble a machine so that the shaft can be sent out for repair, can significantly reduce repair and downtime costs. Another advantage of SKF SPEEDI-SLEEVE wear sleeves is that the material is only 0,28 mm thick.

Although installation is simple, it should be done carefully to achieve the best results (→ fig. 18).

- 1 Clean the seal counterface on the shaft. Remove any burrs or rough spots (a) and make sure that the sleeve will not be installed over keyways, cross holes, splines or similar.
- 2 Measure the diameter where the sleeve will be positioned on an unworn portion of the shaft. Measure in three positions and average the readings (to make sure the shaft is within recommended specifications). If the mean diameter is within the range for a given sleeve size, there is sufficient press fit built into the sleeve to keep it from sliding or spinning without using an adhesive.
- 3 Determine where the sleeve must be positioned to cover the seal wear track. Measure to the exact point, or mark directly on the surface. The sleeve must be placed over the worn area, not just bottomed or left flush with the end of the shaft.
- 4 Shallow wear grooves do not require filling. Optionally, a light layer of a non-hardening sealant can be applied to the inside diameter surface of the sleeve. Clean away sealant that migrates to the shaft or sleeve outside diameter surface.
- 5 If the shaft is deeply scored, fill the groove with a powdered metal epoxy type filler. Install the sleeve before the filler hardens, allowing the sleeve to wipe off any excess filler. Clean away any remaining filler from the sleeve outside diameter surface.

CAUTION: Never use heat to install an SKF SPEEDI-SLEEVE!

- 6 The flange can most often be left intact, but in applications where the flange will interfere with other components, it should be removed. If it needs to be removed, cut it perpendicular to the outside diameter in one location. The flange end of the sleeve goes on the shaft first. Then, place the installation tool over the sleeve (b).
- 7 Gently tap the centre of the installation tool until the sleeve covers the worn surface. If the installation tool is too short, a length of pipe or tubing with a squared-off, burr-free end (c) can be used. Be sure that the inside diameter of the pipe is the same as that of the installation tool. Take care not to scratch the precision-ground sleeve outside diameter.
- 8 An SKF SPEEDI-SLEEVE should always be installed so that the outside edge of the sleeve is seated on the full shaft diameter to prevent the sharp edge damaging the seal during installation.
- 9 If the flange was cut for removal, use a pair of long-nose pliers to grasp the flange away from the seal surface (d) and twist it into a coil, being careful not to lift the end of the sleeve off the shaft or it will leave a jagged edge. Flange removal must be done with care to avoid damage to the sleeve outside diameter.
- 10 After the sleeve is installed, check again for burrs that could damage the seal.
- 11 Lubricate the sleeve with the system media before installing the seal.
- 12 Proceed with the seal installation.
- 13 Start mounting the new seal following the instructions mentioned above or re-mount the end cover provided with a new seal (e).

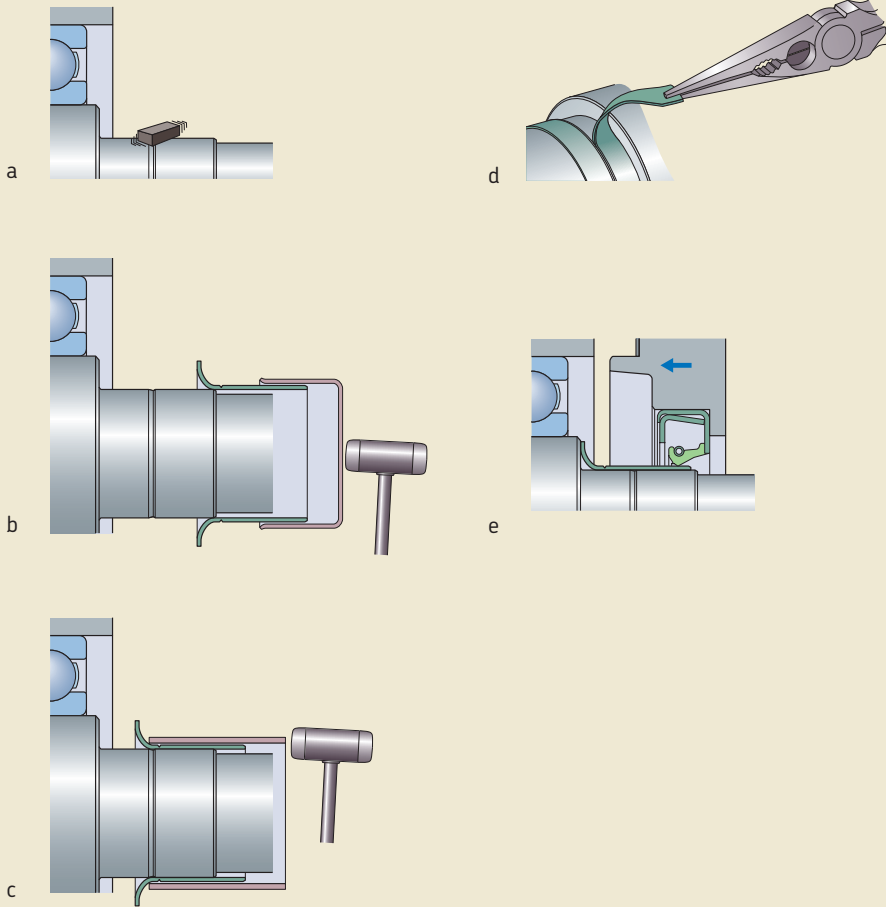
Installing a large diameter wear sleeve

SKF large diameter wear sleeves (LDSL) are designed for a heated slip-fit installation. The sleeve must be heated uniformly to approximately 180 °C (355 °F) prior to installation on the shaft, using suitable equipment such as an SKF induction heater.

CAUTION: Do not heat the sleeve to temperatures above 200 °C (390 °F).

The sleeve should be installed immediately after heating since it cools rapidly and could seize on

Fig. 18



5

the shaft before the correct position is achieved. If the sleeve requires repositioning, be careful not to damage the outside diameter or lead-in chamfer.

Installing a large, split all-rubber seal

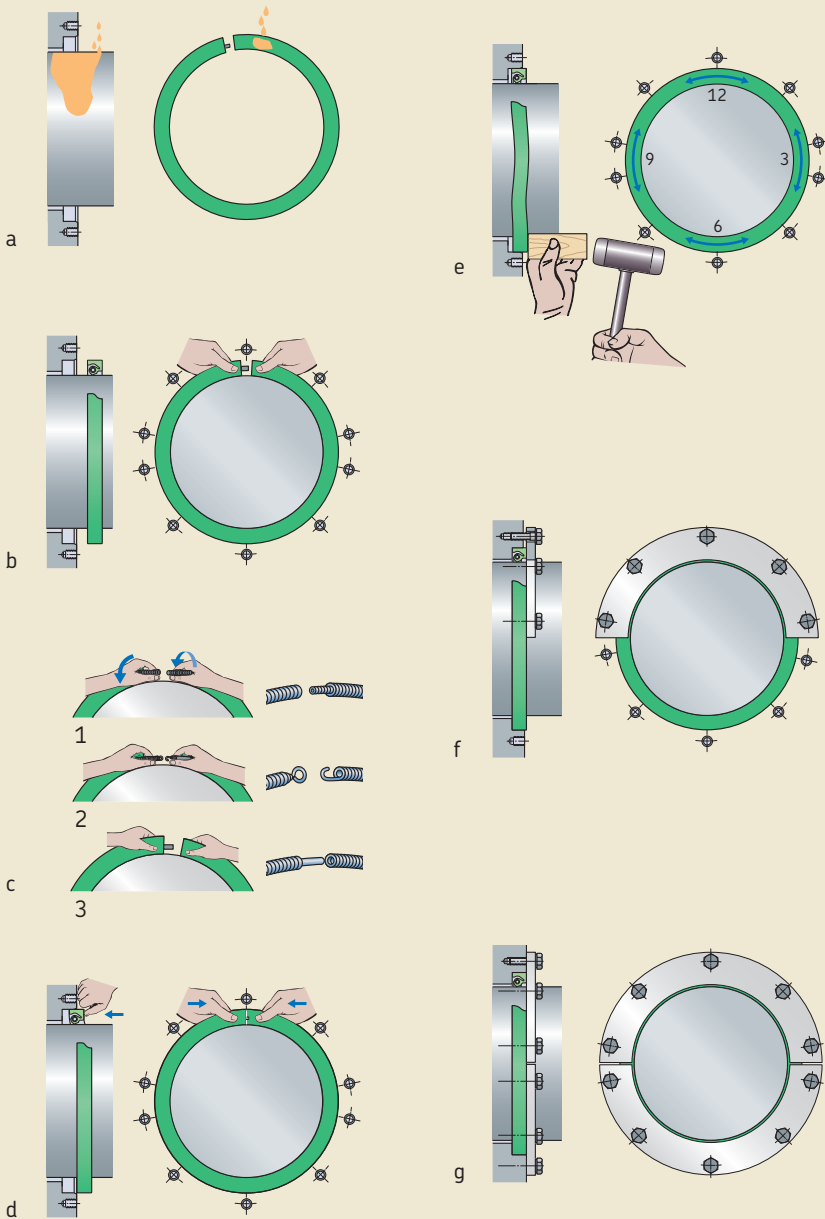
When installing a split all-rubber seal in the HS6, HS7 and HS8 series or a split fabric-reinforced seal in the HSF1, HSF2, HSF3 and HSF4 series, follow these instructions (→ **fig. 19**).

- 1 Where appropriate, insert the spring in the SKF Springlock groove and position the spring connection so that it is displaced with regard to the seal joint.
- 2 Apply a light coat of lubricant to the seal lips and counterface (**a**). Use the same lubricant that will be used to lubricate the application.
- 3 Check that the seal lip is facing the correct direction (**b**).
- 4 Join the ends of the garter spring:
 - For springs with threaded type connectors (**c1**), applicable for seals in the HSF1, HSF2, HSF3 and HSF4 series, wind the spring ends together. Insert one end into the other and screw into position.
 - For springs with hook-and-eye connectors (**c2**), applicable for seals in the HS6 series and most seals in the HS8 series, draw the ends of the spring together and insert the hook into the eye. Do not over-stretch the spring as this might impair seal performance.
 - For springs with control wire connectors (**c3**), applicable for seals in the HS7 series, draw the ends of the seal together. Then, insert the control wire into the other end of the spring. Do not over-stretch the spring as this might impair seal performance.
- 5 Position the seal joint on the shaft so that it is in the 12 o'clock position and push the seal at its joint into the housing bore (**d**).
- 6 Push the rest of the seal into position starting at the 3 and 9 o'clock positions (**e**), finishing simultaneously at the 6 and 12 o'clock positions. For shaft diameters of 1 200 mm and above, it may be preferable to fix the seal in the 12, 3, 6 and 9 o'clock positions before locating the remaining sections of the seal.

CAUTION: Never insert only one end of the seal and wrap the remaining part of the seal around the shaft. The seal will stretch, making installation into the housing bore difficult or even impossible.

- 7 Push the seal into the housing bore using a small block of wood, until it makes contact with the housing shoulder (**e**).
- 8 Check the seal, particularly at the joint.
- 9 Install the cover plate (**f** and **g**). Tighten the attachment bolts evenly, until the end cover abuts the housing face.

Fig. 19



Installing sealing washers

Sealing washers – with or without a flocked washer (→ **fig. 20a**) – should always be arranged as shown in **fig. 21a** so that the pumping effect of the discs is away from the bearing. If spacing washers (→ **fig. 20b**) are intended to facilitate relubrication, one spacing washer must be installed adjacent to the inner ring and the other adjacent to the outer ring (→ **fig. 21b**).

- 1 Fill the free space between the two washers with a water-repellent and rust inhibiting grease, e.g. SKF LGMT 2.
- 2 Lightly coat the bore and outside washer surfaces with grease.
- 3 Place the washer set in the starting position. Be sure that the side face of the housing washer will abut the bearing outer ring (→ **fig. 21b**).
- 4 Press the washer set into the housing bore and onto the shaft simultaneously, using a dolly or similar tool that abuts both washers (→ **fig. 22**). Make sure the washers are not skewed.
- 5 Where several sets of washers are to be installed adjacent to each other, install the first set before installing the next.

Fig. 20

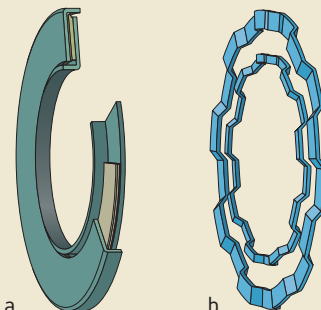


Fig. 22

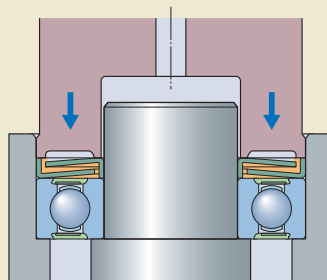
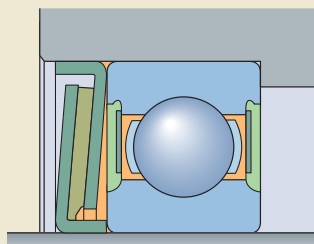
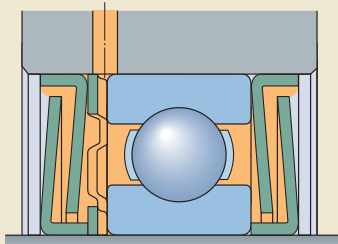


Fig. 21

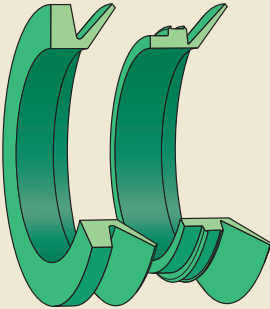


a



b

Fig. 23



Installing a V-ring seal

V-rings seals (→ **fig. 23**) are elastic and can be stretched over other components, making installation simple and easy (→ **fig. 24**). In cases where many V-rings of the same size are to be installed, simple installation tools (→ **fig. 25**) can be made to push the seal to a predetermined depth.

When installing a V-ring seal, make sure it fits uniformly around the shaft and the fitted width, from the counterface to the backside of the V-ring, is within specified tolerances.

Fig. 24

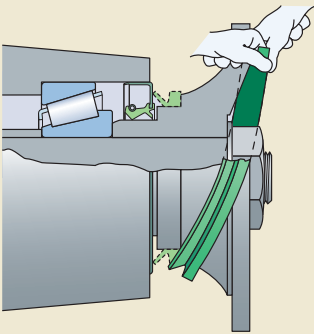


Fig. 25

