Mounting of rolling bearings
Mechanical mounting

Mounting methods

Mounting

Due to the different types and sizes of rolling bearings, they cannot all be mounted using the same method. A distinction is made between mechanical, hydraulic and thermal methods.

In the mounting of non-separable bearings, *Figure 1*, the mounting forces must always be applied to the ring with a tight fit. Any forces applied to the ring with a loose fit would be transmitted by the rolling elements, which could cause damage to the raceways and rolling elements. Heating of the housing causes expansion of the bearing seat and thus makes the mounting process considerably easier.

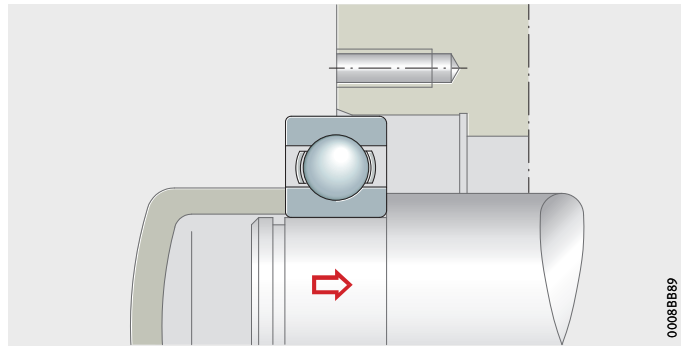


Figure 1
Mounting
of a non-separable bearing

In the case of separable bearings, *Figure 2*, mounting is simpler; both rings can be mounted individually. Rotating the ring during mounting gives a screwdriver effect that will help to avoid scraping marks.

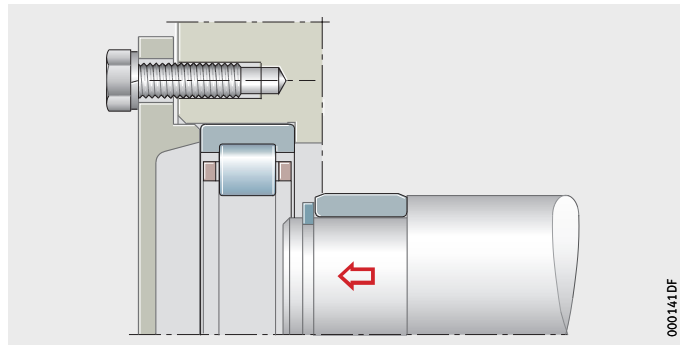


Figure 2
Mounting
of a separable bearing

Mechanical mounting

Smaller rolling bearings can often be mounted by purely mechanical means if the bearing seat is not too tight. It must be ensured, however, that the forces applied in this case do not cause damage to the bearings or their seating surfaces. The use of suitable tools and compliance with certain specifications is helpful in avoiding this.

Mounting of cylindrical seats

Bearings up to a bore diameter of approx. 80 mm can be pressed onto the shaft where a cylindrical seat is present. It is recommended that a mechanical or hydraulic press is used in this case, *Figure 3*.

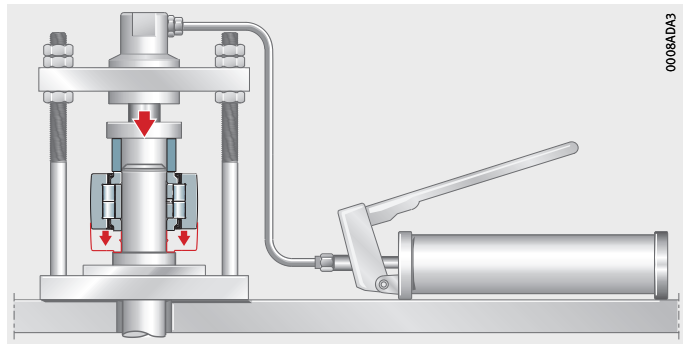


Figure 3
Mounting
by means of a hydraulic press

If a press is not available, bearings with a bore diameter up to 50 mm can also be driven onto the shaft by means of light hammer blows if the fits are not too tight. Since the hardened bearing rings are sensitive to impact load, it is recommended that aluminium mounting sleeves and plastic mounting rings are used, in which case the mounting forces are transmitted by means of form fit. This method can also be used for the mounting of sleeves, intermediate rings, seals and similar parts, *Figure 4*.

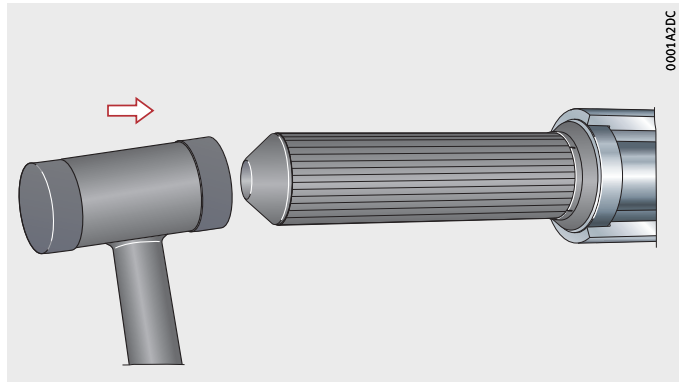
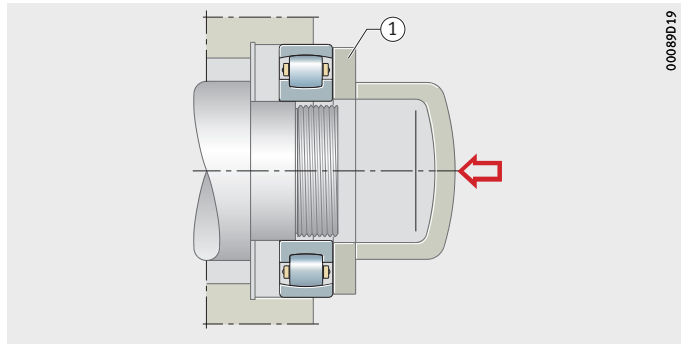


Figure 4
Mounting
using mounting sleeve

Mounting methods

When selecting the dimensions of the mounting sleeve or mounting ring, it must be ensured that the mounting forces are applied over the largest possible circumference but without creating any risk that the cage or rolling elements will be damaged.

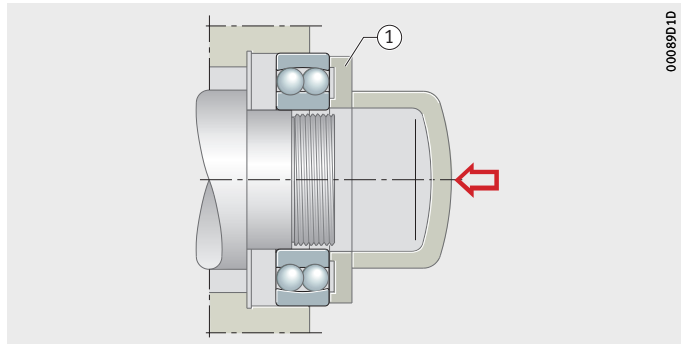
If a bearing is to be simultaneously pressed onto the shaft and into the housing, a disc must be used that is in contact with both bearing rings; this prevents tilting of the outer ring in the housing, *Figure 5*.



① Mounting disc

Figure 5
Simultaneous pressing into place using mounting disc

In some bearings, the rolling elements or bearing cage project at the sides. In this case, a recess must be produced in the disc by means of turning, *Figure 6*.



① Mounting disc

Figure 6
Pressing into place of self-aligning ball bearings with adapted mounting disc

If very tight fits are specified, even small bearings should be mounted after heating.

In the case of housings made from light metal or with a press fit, the seating surfaces can be damaged if the outer ring is pressed into the housing bore. In this case, the housing must be heated.

Mounting of tapered seats

Bearings with a tapered bore are mounted either directly on the tapered shaft or journal or by means of an adapter sleeve or withdrawal sleeve on the cylindrical shaft.

Before mounting, the bearing bore and the seating surfaces on the shaft and sleeve must be cleaned. No mounting paste or similar lubricant should be used. A layer of lubricant would reduce the friction and thus facilitate mounting; in operation, however, the lubricant is gradually squeezed out of the fit joint. As a result, the tight fit is lost and the ring or sleeve begins to creep, causing fretting of the surfaces.

When the bearing is slid onto the taper, the inner ring is expanded and the radial internal clearance is thus reduced. The reduction in radial internal clearance is therefore valid as a measure of the seating of the inner ring.

The reduction in radial internal clearance is determined by the difference in the radial internal clearance before and after mounting of the bearing. The radial internal clearance must first be measured before mounting; during pressing onto the taper, the radial internal clearance must be checked continuously until the required reduction in internal clearance and thus the necessary tight fit is achieved, *Figure 7*.

In the case of sealed bearings, the radial internal clearance is not measured.

Instead of the reduction in radial internal clearance, the axial drive-up distance on the taper can be measured. In the case of the normal taper 1:12 of the inner ring bore, the drive-up distance corresponds to approximately fifteen times the reduction in radial internal clearance. The factor 15 takes into consideration that the interference of the fit surfaces acts only to the extent of 75% to 80% as expansion of the inner ring raceway.

If neither the reduction in radial internal clearance nor the drive-up distance can be reliably determined, the bearing should if possible be mounted outside the housing. The bearing may only be pressed into place so far that it can still be rotated easily and the outer ring can easily be swivelled by hand. The fitter must be able to sense when the located bearing still runs freely.

If a dismounted bearing is mounted again, it is not sufficient to move the retaining nut to its earlier position. After longer periods of operation, the fit loosens again since the thread undergoes settling and the seating surfaces become smoothed. The reduction in radial internal clearance, the drive-up distance or the expansion must therefore also be measured in this case.

Figure 7
Measurement of radial internal clearance using feeler gauges

In order to press the bearing onto the tapered seat or press in a withdrawal sleeve, mechanical or hydraulic presses are used. The type of mounting to be selected in the individual case is dependent on the mounting conditions.

Hook wrenches

Hook wrenches can be used to tighten and loosen locknuts (precision locknuts) on shafts, adapter sleeves or withdrawal sleeves, *Figure 8*. Hook wrenches can be used to mount small and medium-sized rolling bearings on tapered shaft seats, adapter sleeves or withdrawal sleeves. If no torque value is specified, jointed hook wrenches, jointed pin wrenches and jointed face wrenches can be used for locknuts and precision locknuts.

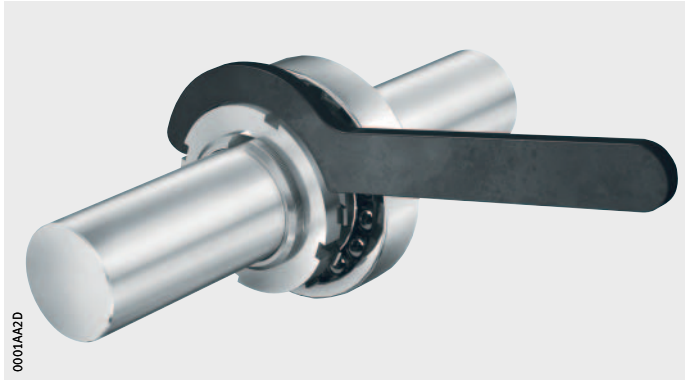


Figure 8
Hook wrench

Small bearings with an adapter sleeve are slid onto the tapered seat of the sleeve by means of the adapter sleeve nut and a hook wrench, *Figure 9*.

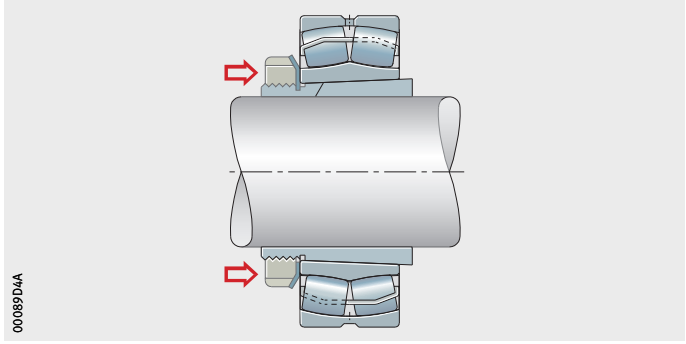


Figure 9
Pressing a spherical roller bearing onto an adapter sleeve using the adapter sleeve nut

Small withdrawal sleeves are pressed into the gap between the shaft and inner ring bore using a locknut, *Figure 10*.

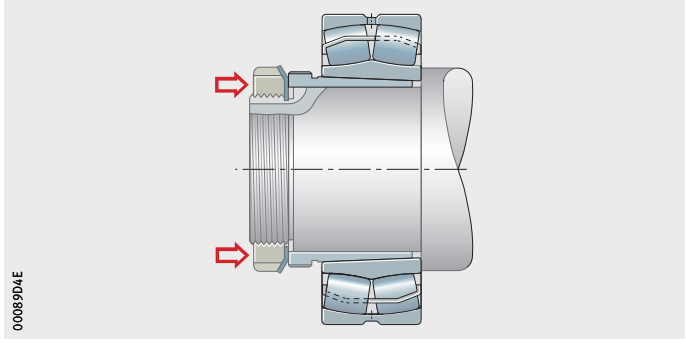


Figure 10
Pressing into place a withdrawal sleeve using the shaft nut

Double hook wrenches

Double hook wrenches are intended for the mounting of smaller self-aligning ball bearings and spherical roller bearings on adapter sleeves. They contain torque wrenches for precisely determining the initial mounting position before the bearing is pushed into place.

Each double hook wrench is engraved with torsion angles so that the drive-up distance and reduction in radial internal clearance can be precisely set, *Figure 11*.

Measurement of the radial internal clearance is difficult especially in the case of smaller self-aligning ball bearings and spherical roller bearings. If the bearing is mounted in a housing, it is not possible to measure the radial internal clearance in some cases.

As a result, measurement is often dispensed with and the radial internal clearance is estimated in approximate terms by means of the method normally used in the past. In this case, the rolling bearing is pressed onto the adapter sleeve until the outer ring can still be freely rotated and slight resistance is felt under swivelling.

With the method we recommend, the radial internal clearance can be set very accurately. The radial internal clearance is reduced in two stages. First, the locknut is lightly tightened to a specified tightening torque. This gives a precisely defined initial position and the radial internal clearance is then set very accurately in the second stage.

The locknut is then tightened by a defined angle. The radial internal clearance has now been reduced by the recommended 60% to 70%.

Figure 11
Mounting
by means of double hook wrench

Shaft nuts with pressure screws

In the case of larger bearings, considerable forces are required in order to tighten the nuts. In such cases, mounting is made easier by means of the shaft nut with pressure screws shown in *Figure 12*. A spacer ring should be inserted between the nut and sleeve in order to prevent damage to the sleeve.

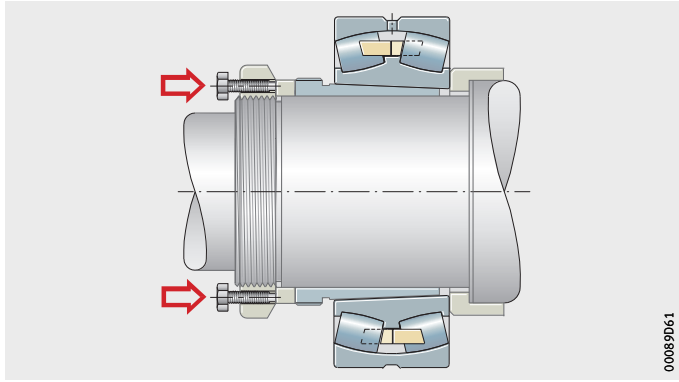


Figure 12
Mounting by means of shaft nut with pressure screws

In order to prevent tilting of the bearing or sleeve, the nut is first tightened only to the point where the nut and mounting ring are fully in contact. The pressure screws are made from quenched and tempered steel and uniformly distributed over the circumference – their quantity is based on the forces required – and are tightened uniformly in a circular sequence until the necessary reduction in radial internal clearance is achieved. Since the taper connection is self-locking, the device can then be removed and the bearing secured by means of its own retaining nut. The principle can also be applied to bearings that are located on an adapter sleeve or directly on a tapered journal.

For the mounting of large bearings, it is advisable to use hydraulic methods in order to slide the bearing into place or press in the sleeve.

Further information

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Schaeffler Technologies AG & Co. KG

Industriestraße 1–3
91074 Herzogenaurach
Germany
Internet www.schaeffler.de/en
E-mail info.de@schaeffler.com

In Germany:
Phone 0180 5003872
Fax 0180 5003873

From other countries:
Phone +49 9132 82-0
Fax +49 9132 82-4950

Schaeffler Technologies AG & Co. KG

Georg-Schäfer-Straße 30
97421 Schweinfurt
Germany
Internet www.schaeffler.de/en
E-mail faginfo@schaeffler.com

In Germany:
Phone 0180 5003872
Fax 0180 5003873

From other countries:
Phone +49 9721 91-0
Fax +49 9721 91-3435

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