Mounting of rolling bearings
Thermal 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.

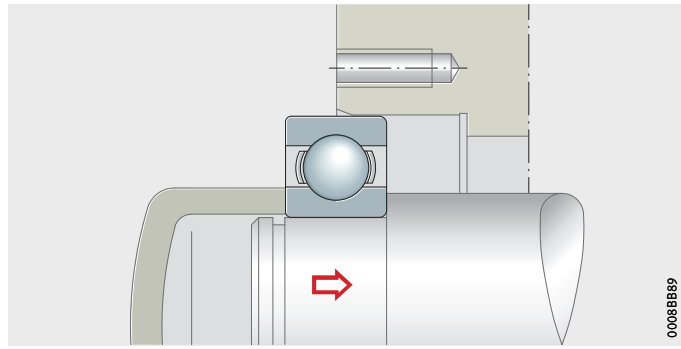


Figure 1
Mounting
of a non-separable bearing

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.

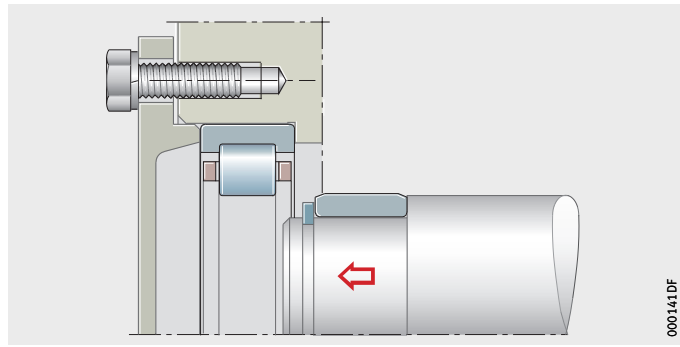
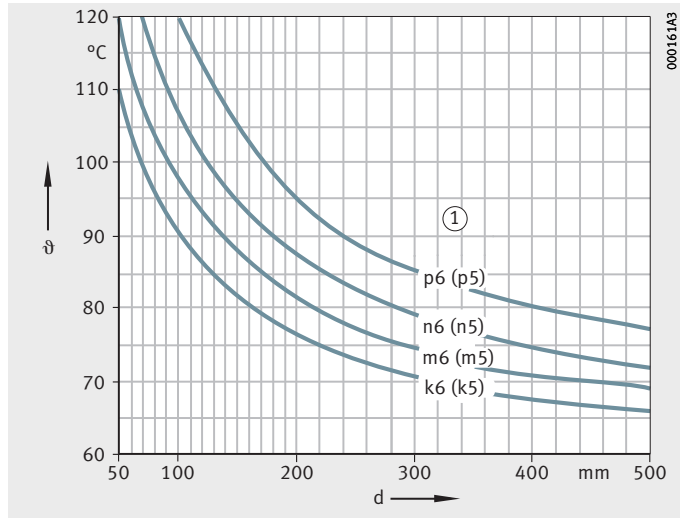


Figure 2
Mounting
of a separable bearing

Thermal mounting

Bearings with a cylindrical bore should be heated before mounting if a tight fit on the shaft is intended and the effort required for pressing into place by mechanical means is too great. The temperature required for mounting is shown in *Figure 3*. The data are valid for maximum fit interference, a room temperature of +20 °C and an excess temperature safety margin of 30 K.



ϑ = heating temperature
d = bearing diameter

① Shaft tolerance

Figure 3
Temperature

When heating the bearings, the temperature must be precisely monitored. An excessive temperature differential between the individual components can lead to distortion with the bearing and thus to damage. In addition, the heating temperature must not normally exceed +120 °C, in order to prevent changes to the structure and hardness of the bearing.

Bearings with cages made from glass fibre reinforced polyamide and bearings that are sealed or have already been greased can be heated to max. +80 °C but not, however, in an oil bath.

After heating, the parts are slid in a single movement, rapidly and without tilting, up to the stop on the seat. While sliding onto the shaft, slight rotation to give a screwdriver effect helps to achieve prompt mounting. Protective gloves should be worn when mounting the heated parts, *Figure 4*, page 4.

Figure 4
Sliding into place
of heated bearing parts

Once the inner ring has been slid in place, it must immediately be secured against its axial abutment point and held under tension until it has cooled, so that it then remains in full contact. There must not be any gap between two rings positioned adjacent to each other.

Induction heating device

Rolling bearings can be brought to mounting temperature quickly, safely and above all cleanly by the use of induction heating devices operating by the transformer principle. The devices are used mainly in batch mounting work.

The heating devices can be used to heat rolling bearings of all types, including greased and sealed bearings. The smallest heating device is used for bearings with a bore of 10 mm or larger, *Figure 5*.
The maximum bearing mass for the heating device shown here, for example, is 40 kg.

Figure 5
Small heating device

The operating range of the largest heating device starts at a bore of 85 mm, *Figure 6*. The heaviest workpiece mass can be up to 1 200 kg.

Figure 6
Large heating device

After the heating process, the bearing is automatically demagnetised. Further details on induction heating devices are given in TPI 200, FAG Heating Devices for Mounting of Rolling Bearings.

Heating plate

Heating plates are used to heat rolling bearings or small machine parts by means of contact heat. It must be ensured, however, that the entire bearing is heated uniformly, *Figure 7*.

A ring or disc is placed between a heating plate without temperature control and the inner ring of a bearing with a polyamide cage.

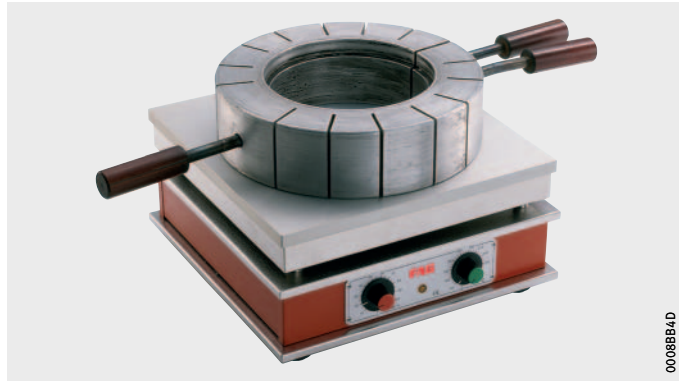


Figure 7
Heating process with a temperature-controlled heating plate

Mounting methods

Oil bath

With the exception of sealed, greased bearings and high precision bearings, rolling bearings of all sizes and types can be heated in an oil bath. For heating, a clean oil with a flash point above +250 °C must be used. A thermostatic controller is advisable (temperature +80 °C to +120 °C). In order that the bearings are heated uniformly and no deposits of contamination occur within them, they should be laid on a grid or suspended in the oil bath. After heating, the oil must be allowed to drain off thoroughly and all fit and locating surfaces must be carefully wiped.

With this method, please note the risk of accidents, environmental pollution by oil vapour and flammability of hot oil.

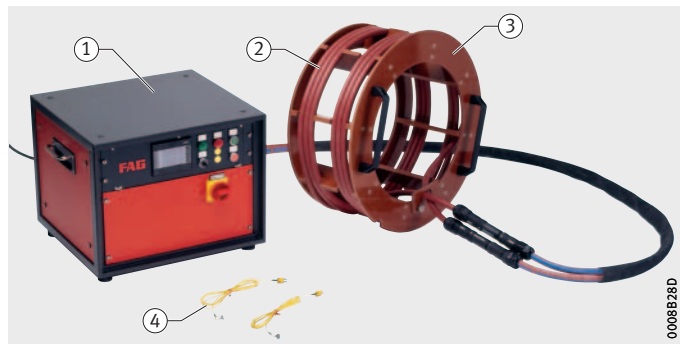
Heating cabinet

Safe, clean heating of rolling bearings can be carried out in a heating cabinet. The temperature is controlled by means of a thermostat and is therefore precisely maintained. There is almost no possibility of bearing contamination. The disadvantage is that heating by means of hot air takes a relatively long time and is comparatively intensive in terms of time and energy.

Medium frequency technology

With the aid of FAG devices using medium frequency technology, it is possible to heat very large and heavy bearings as well as other components of shrink fit connections by inductive means in order to achieve joining and loosening. Due to its compact construction, the device can also be used for mobile operation.

The heating device comprises the medium frequency generator and an inductor, *Figure 8*. Depending on the application, this can be of a flexible or rigid design. The flexible version is similar to a cable that is placed either within the bore or on the outside of the workpiece. Flexible inductors are suitable for workpieces of various sizes and various shapes and can be used for long periods at heating temperatures up to +150 °C.



① Generator
② Flexible inductor
③ Subframe
④ Temperature sensor

Figure 8
FAG medium frequency heating device

In batch production applications, where large quantities of identical components are mounted, flexibility is less important than reduced setup times and increased process reliability. Rigid inductors are suitable for this task. In this design, the coil is fitted in a housing matched to the workpiece and can thus be placed quickly and easily in the heating zone. Rigid inductors are also suitable, in contrast to the flexible variant, for small components.

In the heating of non-separable bearings, the outer ring must be heated first so that the internal clearance is maintained and damage to the bearing is prevented.

The devices are designed for the specific application. Please contact the application experts at Schaeffler.

Advantages

- Versatile application possibilities by means of flexible inductors.
- Ease of transport – usable anywhere.
- Rapid, energy-efficient operation.
- Short heating times and high productivity.

Further information

- TPI 217, FAG Medium Frequency Heating Devices.

Further information

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