



FAG



Reconditioning and Repair of Rolling Bearings

SCHAEFFLER GROUP
INDUSTRIAL AFTERMARKET

Foreword

The characteristics and condition of rolling bearings have a significant influence on the production process. Preventive and condition-based maintenance measures are intended to maintain a consistently high level of plant availability. It is often the case that new rolling bearings are fitted although the existing bearings could be restored to as-new condition by means of appropriate reconditioning.

It is much more cost-effective to recondition large rolling bearings rather than use new bearings and, in many cases, the delivery times are shorter too.

Maintenance measures are carried out in the normal way. The reconditioned bearing is used instead of a new bearing. This allows reductions in inventory costs relating to maintenance.

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Reconditioning

The reconditioning of rolling bearings and rolling bearing units is one of the core competences in the service sector of Schaeffler Group Industrial. It is carried out at several certified locations worldwide, see page 16.

Industrial sectors

Reconditioning is carried out irrespective of manufacturer and is not restricted to products of the Schaeffler Group. The service sector is thus an expert partner for customers from a very wide range of industrial sectors such as general and special machine building, steelmaking, pulp and paper production, wind energy, shipbuilding, railway and mining, *Figure 1*.



Figure 1
Assembly
of a reconditioned rolling bearing
for a tunnel boring machine

Dimensions

Reconditioning and modification can be carried out on rolling bearings with an outside diameter D of up to 4 250 mm.

Bearings and bearing units are divided into three diameter groups:

- $D < 425$ mm
- $425 \text{ mm} < D < 1250$ mm
- $1250 \text{ mm} < D < 4250$ mm.

If reconditioning or modification of other bearings is required, please contact us.

Assessment

Before reconditioning, the bearing is disassembled, cleaned and examined. The processing steps required are established and a proposal is prepared. This process is designated as assessment.

Cleaning

First, all the components are thoroughly cleaned. The Schaeffler Group has special washing equipment for TAROL units, back-up rollers and large individual bearings. Any contamination is rinsed out in order to allow expert examination.

Examination

All components are examined closely. Thanks to their many years of experience, the reconditioning experts of the Schaeffler Group are extremely well versed in damage characteristics, *Figure 1*. Examination work is supported by the use of high precision measuring and inspection equipment, *Figure 2*, page 6.



Figure 1
Examination
of the raceways on a bearing
for a tunnel boring machine

Assessment



Figure 2
Measurement

Assessment report

Any defects are recorded in an assessment report and transferred, if requested, into a database. In this way, a life story is created for each rolling bearing. Based on the assessment report, the necessary processing steps and thus the reconditioning level are defined.

Proposal on large rolling bearings

Based on the assessment, a proposal is prepared stating the scope of the reconditioning required and the resulting prices and delivery times. Cost-effectiveness is always assessed in comparison with the costs for a new bearing.

If the customer decides in favour of the reconditioning recommended, the assessment costs are included as part of the reconditioning costs. If no significant damage is found, the only costs charged are those incurred for the assessment itself.

Proposal on smaller rolling bearings

The procedure differs in the case of TAROL units and back-up rollers for cold and hot strip mills. The proposal is prepared on the basis of the design drawing. Reconditioning is then documented piece by piece. Only the units actually reconditioned are charged for.

Reconditioning levels

There are four reconditioning levels, from Level I to Level IV, see table.

Level I to Level IV

Processing steps	Level			
	I	II	III	IV
Removal of fretting corrosion	■	■	■	■
Polishing of raceways	–	■	–	–
Regrinding of raceways	–	–	■	■
Manufacture of rolling elements	–	–	■	■
Replacement of cage	–	–	■	■
Replacement or rework of rolling bearing rings	–	–	–	■
Assembly	■	■	■	■
Preservation or greasing	■	■	■	■
Packing	■	■	■	■
Despatch	■	■	■	■

Level I – Requalifying

In the most favourable case, no machining is required. In Level I, fretting corrosion is removed and the bearing is reassembled. We then preserve or grease the bearing, *Figure 1*. Finally, the bearing is carefully packed and returned.



Figure 1
Greasing of TAROL units

Reconditioning levels

Level II – Refurbishment

This reconditioning is carried out where there is minimal damage to the raceways. Fretting corrosion is removed and the inner and outer rings are polished. All further processing steps are in accordance with Level I.

Smaller bearings

Level II is cost-effective not only for large bearings but also for smaller bearings supplied in larger quantities. Examples include TAROL units and spherical roller bearings from continuous casting lines. In addition, wear parts such as seals are replaced.

TAROL units

TAROL units are mainly used in railway applications. Correct axial clearance is decisive for achieving maximum bearing life and quietness of running in travel. When these bearing units are processed according to Level II, the axial clearance is set and then checked using special gauges, *Figure 2*.



Figure 2
Measurement of TAROL components

Level III – Remanufacturing

In many cases, the raceways are so heavily damaged that they must be reground, *Figure 3*.

After grinding, the running surfaces must show the original profile again. Full performance capacity can only be achieved with this profile. The profile is only known to rolling bearing manufacturers.

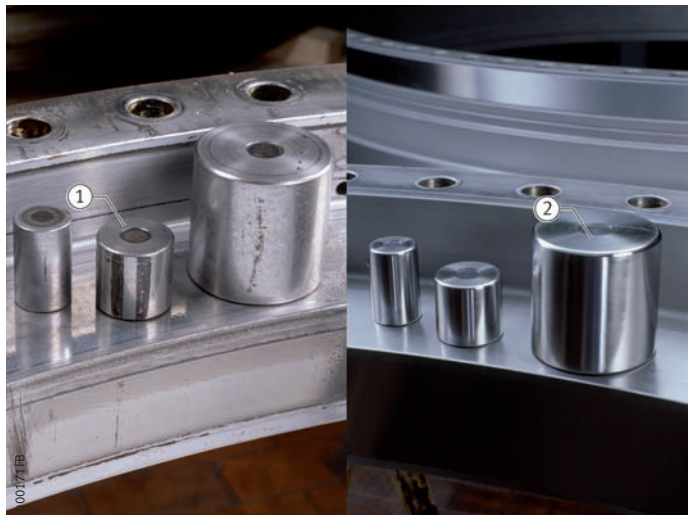


Figure 3
Regrinding of large size bearing ring

New rolling elements

If raceways are reground, new rolling elements must be used in order to achieve the original internal clearance.

The new rolling elements are produced to an oversize that corresponds to the amount of material removed during regrinding, *Figure 4*.



- ① Before:
Rollers and raceway
with corrosion marks and
foreign body indentations
- ② After:
Reground raceway,
new rollers with matched oversize

Figure 4
Rollers and raceway

Reconditioning levels

Level IV – Remanufacturing Plus

Where extreme material damage such as pittings or cracks due to material fatigue is present, it is not possible to use these parts again. The heavily damaged rolling elements, cages or rolling bearing rings must therefore be replaced by new parts, *Figure 5*.

It is not possible to make general statements about delivery times and costs. These must be agreed on an individual basis with the customer.



Figure 5
Mounting of new rolling bearing ring

Further services

Special bearings

Reconditioning is suitable not only for rolling bearings from the standard product range. Special bearings are often particularly expensive and reconditioning is extremely cost-effective in such cases. Examples include high precision bearings for combined loads in machine tools or tandem bearings for extruder screws, *Figure 1*.



Figure 1
Tandem bearing

Availability

Very high precision and an extremely restricted area of application have the effect of reducing the user's freedom in terms of interchangeability and availability. Furthermore, reconditioning is often a rapid solution.

Modification of rolling bearings

In addition to reconditioning, rolling bearings can also be modified. Examples include the provision of threaded holes, adjustment of bearing clearance or changes to bore diameter. Reconditioning experts and application engineers work closely together in order to ensure the full functional capability and rating life of the modified bearings.

New area of application

A rolling bearing from replacement parts stock that is no longer needed can be adapted to a different purpose. This saves time, material and cost, while still providing the customer with a rolling bearing that is of new quality.

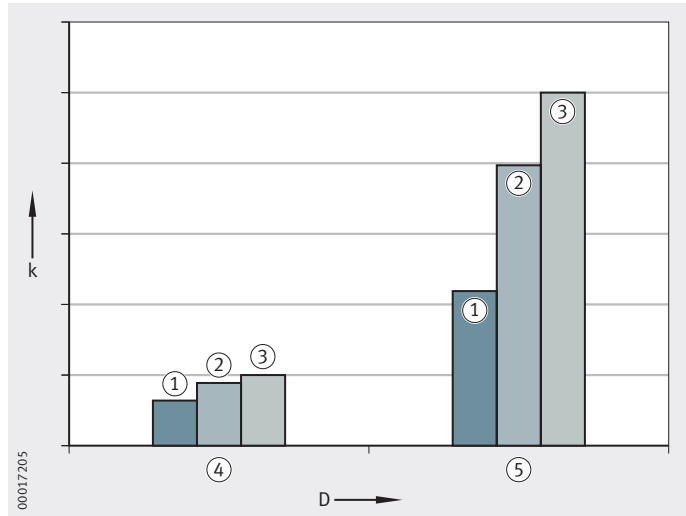
Customer benefits

The reconditioning of rolling bearings is frequently already cost-effective for rolling bearings and rolling bearing units with an outside diameter greater than or equal to 180 mm.

Costs The costs of reconditioning are between 45% and 85% of the new price, *Figure 1* and *Figure 2*. The larger the bearing, the more cost-effective the use of reconditioning.

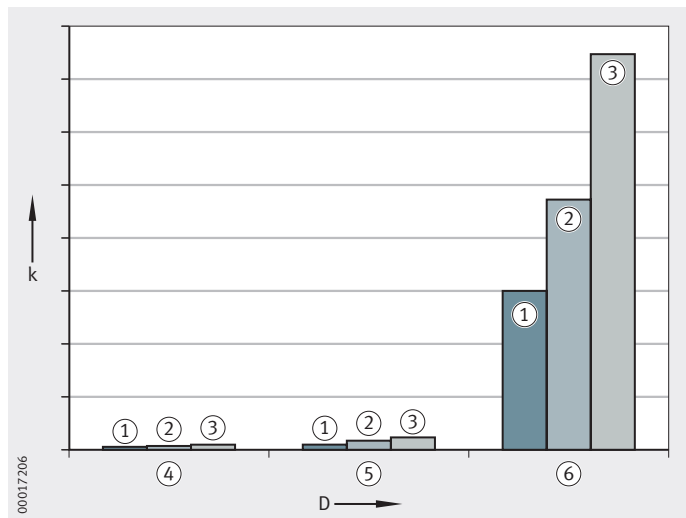
- k = costs
- D = diameter
- ① Level II
- ② Level III
- ③ New bearing
- ④ $D < 425$ mm
- ⑤ $425 \text{ mm} < D < 1250$ mm

Figure 1
Costs,
 $D < 1250$ mm



- k = costs
- D = diameter
- ① Level II
- ② Level III
- ③ New bearing
- ④ $D < 425$ mm
- ⑤ $425 \text{ mm} < D < 1250$ mm
- ⑥ $1250 \text{ mm} < D < 4250$ mm

Figure 2
Costs,
 $D < 4250$ mm



Savings

Since there is no requirement for steel production, the forging process for bearing rings or for brass and plastic production for bearing cages, material and energy can be saved. It is only at Level III and above that steel is required for the manufacture of rolling elements.

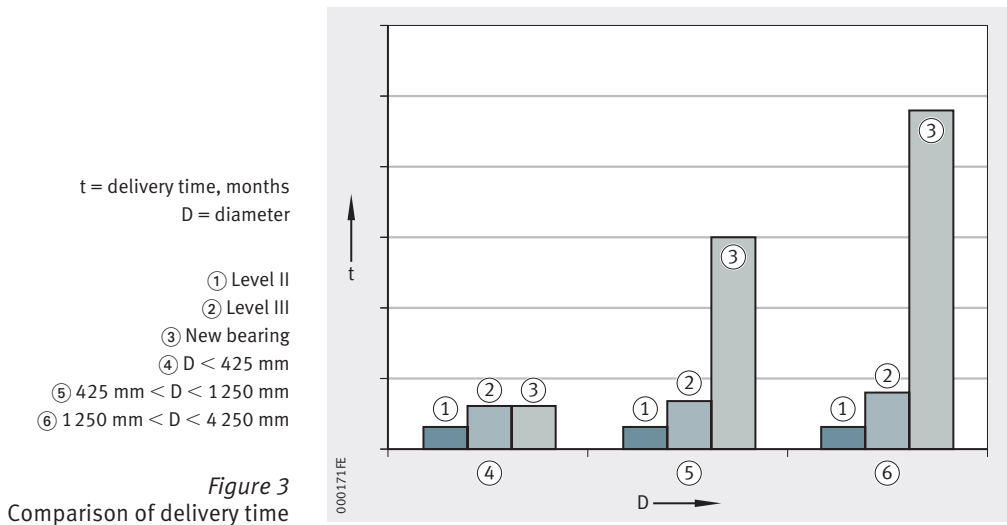
Furthermore, Schaeffler Group ensures that bearing components to be scrapped are sorted and separated according to their material grades. This separation is applied not only to the cleaning agents used but also the residues contained therein.

Stock costs

Companies are always working to reduce stock costs. Stock costs are not only costs for material and tools but also for spare parts that are often stored for many years. An increasing number of customers are deciding to hold a reconditioned rolling bearing in stock.

Delivery time

In general, delivery times are significantly shorter than those for new bearings, *Figure 3*.



Planned maintenance

The reconditioned rolling bearing can be put into use immediately and the bearing that has been dismantled can be sent for reconditioning. This is a significant step towards planned maintenance, a model that can also be applied to other components.

Customer benefits

Environment One of our most important shared possessions is an intact environment. The decision in favour of reconditioning of rolling bearings allows manufacturing companies to make a considerable and ongoing contribution to the sparing use of resources and the protection of the environment, *Figure 4*.



Figure 4
Nature reserve, Austria

Packaging Not every rolling bearing is put into use immediately after delivery. In some cases, the bearing must be stored at a dusty construction site or in a storage hall in tropical regions. Under such extreme environmental influences, the standard packaging is not sufficient to secure the high quality level achieved in reconditioning.

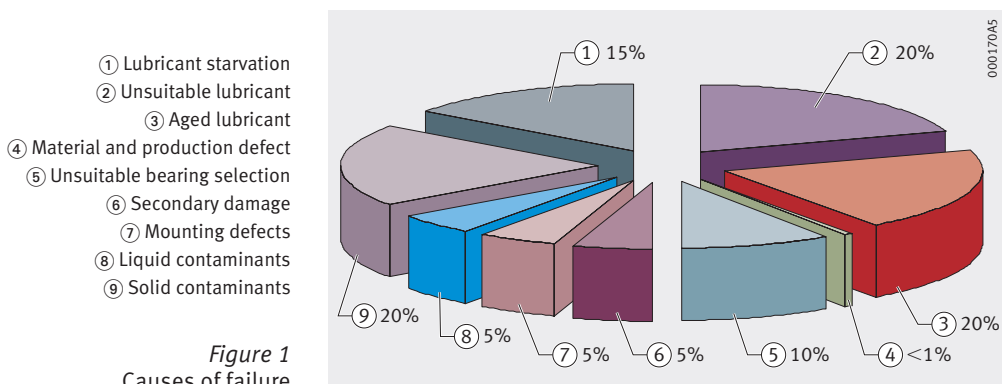
Long term packaging The Schaeffler Group has developed long term packaging suitable for storage up to several years. This involves the use of special preservatives and desiccants. These are matched to the particular climate zone. The air in the packaging is sucked out in order to prevent the formation of condensation.

For protection against mechanical influences, the bearing is packed in a wooden crate. The condition of the desiccant is checked via a flap in the crate. An indicator shows whether the packaging is undamaged.

Failure prevention

Studies have shown that, statistically, less than 1% of bearing failures are due to errors in production. Premature wear of rolling bearings is caused much more often by incorrect lubrication and defective mounting, *Figure 1*.

In order to prevent bearing failure and its consequences, the service sector of the Schaeffler Group Industrial offers appropriate products and services, see also Catalogue IS 1, FAG Equipment and Services for the Mounting and Maintenance of Rolling Bearings.



Mounting, dismounting, alignment

The portfolio encompasses not only mounting of rolling bearings but also the complete spectrum of tools for mounting, dismounting and alignment.

Lubricants

A large selection of Arcanol high performance greases, including appropriate lubricators, is available to the customer.

Condition monitoring

The condition of rolling bearings can be monitored with the aid of condition monitoring systems. The data can be evaluated on site or using remote diagnosis by our experts. Such condition monitoring can identify very small instances of damage and thus allow unplanned downtime to be avoided.

Training

Training is structured according to a modular concept so that the training course appropriate to the specific requirements can be selected from the portfolio. Individual training courses can also be conducted upon request.

Reconditioning locations

The Schaeffler Group offers reconditioning and repair of rolling bearings at several locations worldwide, *Figure 1*.



Figure 1
Reconditioning locations

Addresses

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