



**FAG**



# Repair and Reconditioning of Rolling Bearings

**SCHAEFFLER**



# Foreword

Reconditioning of rolling bearings can achieve a significant extension in their operating life.

## Cost-effectiveness

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. In many cases, reconditioning of rolling bearings is more cost-effective than using new bearings.

## Quality

Schaeffler performs reconditioning of rolling bearings to uniform standards throughout the world. All sites apply identical processes and guidelines. Schaeffler rolling bearings are processed in accordance with the original drawings. In the case of all bearings, work is carried out using only original components and original replacement parts. High quality reconditioning is achieved as a result of our comprehensive knowledge of rolling bearings.



*Figure 1*  
Uniform standard of reconditioning  
quality worldwide according to  
the zero defects principle

# Foreword

## Global Technology Network

In the reconditioning of rolling bearings, Schaeffler combines its local competence in the regions with the knowledge and innovative strength of its experts worldwide under a single philosophy in the form of its Global Technology Network (GTN). With our local centres of competence (Schaeffler Technology Centers), we bring our portfolio of services and our engineering and service expertise directly to your area. Through this combination, you will experience optimum support anywhere in the world and, thanks to our bundled knowledge, innovative and customised solutions of the highest quality. In this way, you can achieve sustainable reductions in the overall costs of your machinery and plant and thus improvements in efficiency and competitiveness.

## What does the GTN offer?

The performance capability of the GTN provides versatile rolling bearing solutions on the basis of our detailed product knowledge.



*Figure 2*  
Global Technology Network (GTN)

Further information

■ [www.schaeffler.de/gtn](http://www.schaeffler.de/gtn)

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## Target group

In addition to the manufacture of new bearings, the reconditioning of rolling bearings and rolling bearing units is a core competence of Schaeffler, *Figure 1*.



*Figure 1*  
Fitting of rolling elements during reconditioning of a rolling bearing for a tunnel boring machine

### Locations

Reconditioning has been carried out worldwide since 1954 at several certified locations, see page 23.

### Market sectors

Reconditioning is carried out irrespective of manufacturer and is thus not restricted to Schaeffler products. Before reconditioning, the condition of the bearings can be assessed on site in consultation with experts from the Global Technology Network.

Reconditioning is of particular interest in the case of rolling bearings that are used in machinery or vehicles in the following market sectors:

- raw material extraction and processing
- metal extraction and processing
- pulp and paper
- railways.









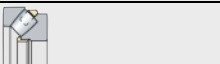

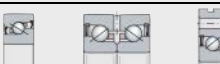



### Dimensions

Reconditioning and modification can be carried out on all rolling bearings with an outside diameter  $D$  from 100 mm to 4 500 mm. In the case of rolling bearings with an outside diameter larger than 4 500 mm, please contact us. The team of experts at Schaeffler can offer comprehensive advice.

## Total Cost of Ownership (TCO)

Once total costs are taken into consideration (TCO = Total Cost of Ownership), reconditioning is only feasible in technical terms at or above a certain outside diameter, see table.

### Minimum outside diameter

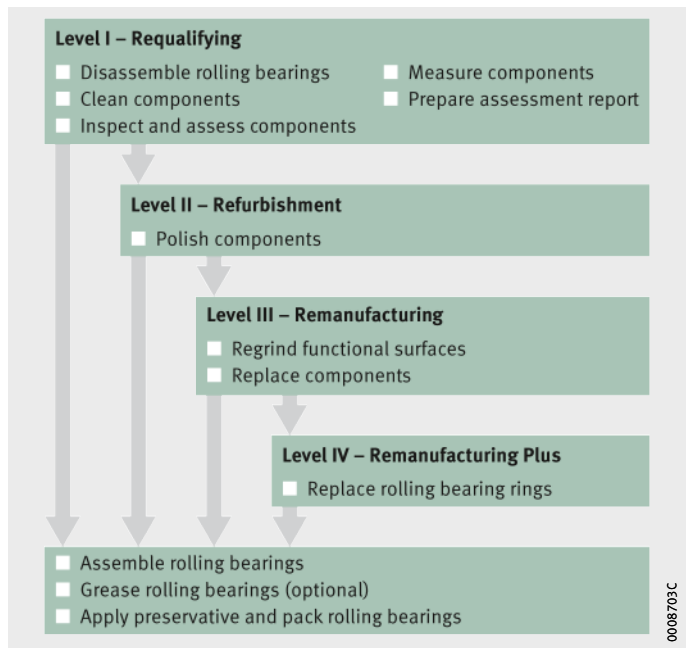
Design	Outside diameter min. mm	Figure
Deep groove ball bearings	620	
Angular contact ball bearings	620	
Four point contact bearings	620	
Cylindrical roller bearings, single row	140	
Cylindrical roller bearings, multiple row	180	
Tapered roller bearings	180	
Spherical roller bearings	120	
Axial deep groove ball bearings	620	
Axial spherical roller bearings	500	
Crossed roller bearings	620	
Bearings for screw drives	620	
Slewing rings	220	
TAROL bearings	150	
Plain bearings	160	

# Reconditioning levels

## Overview

The operations necessary in reconditioning are dependent on the condition of the rolling bearing. In order to allow a reliable statement of the work required, the rolling bearing must be disassembled, cleaned and then carefully examined.

Beyond this requalifying process (Level I), which is always necessary, further reconditioning steps may be appropriate, *Figure 1*.



*Figure 1*  
Level I to Level IV

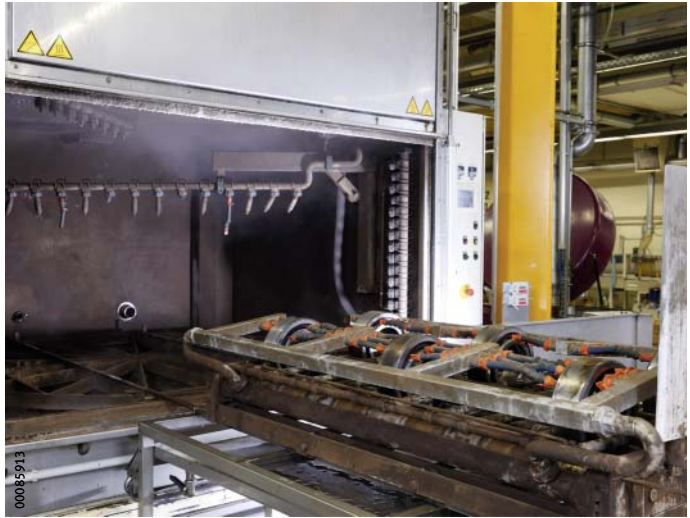


### **Level I – Requalifying**

Each rolling bearing considered for reconditioning must first be subjected to a requalifying process. The purpose of this process is to determine the condition of the bearing.

### **Cleaning**

After disassembly, all the components are thoroughly cleaned. Lubricants and contaminants are removed in order to allow skilled examination. Schaeffler has special washing plant for TAROL units, back-up rollers and large individual bearings, *Figure 2*.



*Figure 2*  
Washing plant

### **Examination**

All components are examined by means of high precision measuring and inspection equipment. Thanks to their many years of experience, the Schaeffler reconditioning experts are extremely well versed in damage characteristics, *Figure 3*.



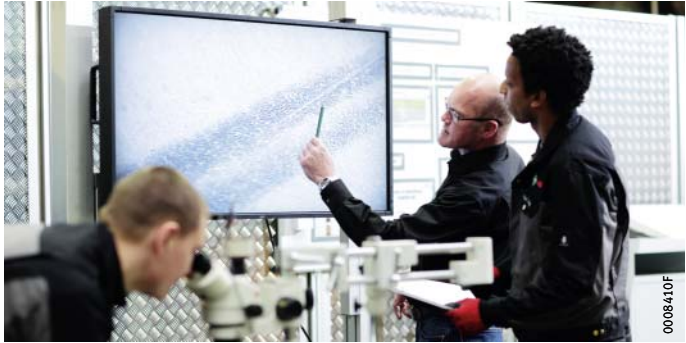
*Figure 3*  
Inspection, assessment and  
measurement

## Reconditioning levels

### Assessment report

The condition of the rolling bearing is documented in an assessment report, *Figure 4*. This contains detailed information as appropriate on the damage present, the methods used in examination and the measurement results.

*Figure 4*  
Preparation  
of the assessment report



If no damage to the bearing is found during inspection and assessment, preservation, greasing and repacking is carried out immediately. Where bearings are damaged, a higher level of reconditioning required is documented in the assessment report.

If requested by the customer, this assessment report is archived by Schaeffler. This means that, if reconditioning is carried out on multiple occasions, a comprehensive life history of the part can be created.

### Proposal

If damage is found, the customer will receive the detailed assessment report. On this basis, a proposal will be prepared stating the scope and price of the reconditioning recommended, *Figure 5*. The delivery time of the reconditioned bearing is also indicated.

If the customer decides in favour of the reconditioning in the proposal, the assessment costs are included as part of the reconditioning costs.

*Figure 5*  
Preparation of proposal



**Level II –  
Refurbishment**

This reconditioning is carried out where there is minimal damage to functional surfaces such as raceways. The rolling bearing rings, rolling elements and cages are polished. In this case, surfaces not relevant to function are simply cleaned.

**Polishing**

In the polishing operation, any stubborn contaminants, running marks, fretting corrosion or corrosion of functional surfaces is removed, *Figure 6*. The components are then cleaned. After this reconditioning, the dimensions and tolerances correspond to those of a new rolling bearing.



*Figure 6*  
Polishing

## Reconditioning levels

### Level III – Remanufacturing

If significant damage is present, the functional surfaces are reground. In this case, new rolling elements are also used.

### Regrinding of functional surfaces

Damage to the functional surfaces must be removed by means of regrinding, *Figure 7*.

Following this operation, the functional surfaces must have the same profile as a new rolling bearing. It is only then that the full performance capacity can be achieved.



*Figure 7*  
Regrinding  
of large size bearing ring

Regrinding is normally carried out using the same machines and tools that are used in the manufacture of new rolling bearings.

Production engineers reach these decisions in consultation with the relevant experts from the design and application engineering departments. In this way, it can be ensured that design features such as the hardening depth can be taken into consideration in machining.

## 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 8*.

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



*Figure 8*  
Rollers and raceway

## Reconditioning levels

### Level IV – Remanufacturing Plus

Where there is extreme material damage such as eruptions or cracks due to material fatigue, it is not possible to reuse damaged parts. Rolling elements, cages or rolling bearing rings that are too severely damaged must therefore be replaced by new parts, *Figure 9*.

The costs involved in this level of reconditioning are approximately equivalent to the manufacture of a new rolling bearing. This level of reconditioning is often only of interest for special bearing types or in situations of extreme time pressure. With this level of reconditioning, it is possible to reengineer the rolling bearing in accordance with a specific application. This is always carried out in close consultation with experienced colleagues from the relevant design department and employees with technical responsibility for the application.

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 9*  
Mounting  
of a new rolling bearing ring

### Replacement of rings

Rings are only replaced if the damage present cannot be repaired. In this case, the new rings are manufactured by Schaeffler in accordance with the company's internal standards and then mounted.

# Special bearing types

## TAROL units

TAROL units are predominantly used as wheelset bearings in rail vehicles. The aggressive operating conditions lead to corrosion, deposits and wear. After reconditioning, their functional capability is fully restored, *Figure 1*.

- ① Before reconditioning
- ② After reconditioning

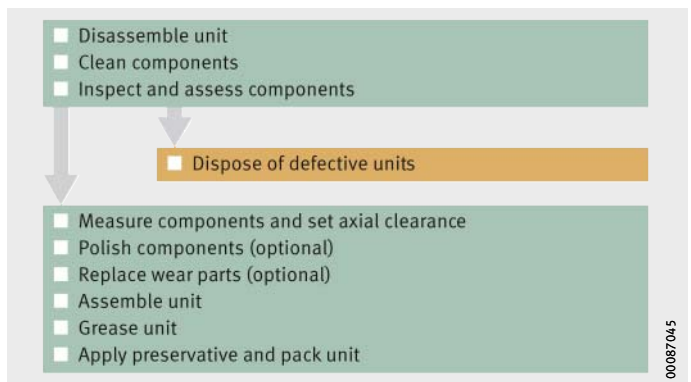
*Figure 1*  
TAROL units



TAROL units and similar bearing units are reconditioned without further consultation with the customer and according to predetermined cost rates. This reconditioning differs in certain respects from standard reconditioning, *Figure 2*.

Units with damaged components are disposed of. Superficial operating marks are removed by means of polishing. Wear parts such as seals are replaced on the basis of an agreement with the customer. The units are greased using a specified lubricant and assembled, after which preservation and packing is carried out in accordance with customer requirements.

*Figure 2*  
Reconditioning of TAROL units



## Special bearing types

### Special bearings

Reconditioning is suitable not only for rolling bearings from the standard product range. Reconditioning is often particularly cost-effective for special bearings.

### Tandem bearings for extruder screws

Tandem bearings consist of several axial cylindrical roller bearings arranged in series and are normally designed and manufactured for a specific project. As a result, new tandem bearings are not normally available at short notice and the reconditioning of used bearings is the most rapid and most cost-effective alternative.

In reconditioning, the tolerances are observed precisely and the original manufacturing parameters are taken into consideration. It is also ensured that the elastic system of rings and washers precisely matched to each other is also achieved, *Figure 3*.

The reuse of tandem bearings is only advisable if this type of skilled reconditioning operation is carried out.



*Figure 3*  
Measurement  
of a tandem bearing



### **Axial/radial bearings YRTM**

Axial/radial bearings YRTM are high precision bearings for combined loads and have an integral measuring system. The dimensional scale is applied to the outside diameter of the shaft locating washer. The magnetically hard coating has magnetic poles at a pitch of 250  $\mu\text{m}$  that serve as angle references. Mechanical damage to this layer must be prevented. However, magnetic damage can be repaired by a recoding operation.

In order to give reliable protection against mechanical damage during transport, a protective strip must be applied to the dimensional scale and the high precision bearing must be sent in a special packaging unit. Great care must be taken during disassembly. We therefore offer disassembly and transport as an optional element of reconditioning. If the shaft locating washer must be ground, the dimensional scale is then recoded.

### **Complete units**

Schaeffler offers the reconditioning of complex complete units. The complete units are first disassembled. Depending on the customer's requirements, the rolling bearings are then reconditioned and reassembled or new rolling bearings are used.

Reconditioning of all components is also possible. In the case of back-up rollers for multi-roll stands, Schaeffler can for example take the completely mounted rolls from the customer and return these in reconditioned, ready-to-fit form within a very short space of time.

## Other services

### **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 very 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.

### **Coating**

Schaeffler has developed a large number of coatings and can thus improve the characteristics of components. A coating can prevent corrosion, reduce wear or contribute to energy efficiency by decreasing friction. Depending on the area of use and the application, the customer can select the most suitable coating.

### **Defect analysis following bearing failure**

If damage is discovered during examination of the rolling bearing, a request can be submitted for examination and assessment of this damage. The results of the examinations are recorded in the assessment report and can if necessary be summarised in a separate report. As a result, a statistical evaluation of possible defect sources can be carried out.

### **Material testing**

Rolling bearings are inspected by means of specially developed procedures and using state of the art techniques either on site or at a reconditioning location. Depending on the given situation, crack and hardness testing or ultrasonic inspections are applied.

## Measurement

Depending on the customer's request, dimensions such as mounting dimensions are measured precisely, *Figure 1*. The values determined are documented in a detailed measurement record.

Schaeffler can also perform measurements of torque, inertia and slippage.



*Figure 1*  
Measurement

## Long term packaging

Unless specified otherwise, Schaeffler uses standard packaging for reconditioned rolling bearings.

Upon customer request, long term packaging is used. Special preservatives and desiccants matched to the particular climate zone allow storage for up to several years. The condition of the desiccant is checked via a flap in the crate. An indicator shows whether the packaging is undamaged.

# Customer benefits

The reconditioning of rolling bearings and rolling bearing units is cost-effective in many cases and allows greater flexibility.

The advantages of reconditioning are as follows:

- reductions in life cycle costs (LCC)
- increases in operating life
- savings in material and energy costs
- reductions in inventory costs
- high flexibility through short lead times
- feedback on the characteristics and frequencies of damage.

## Quality

Schaeffler offers products of very high quality for all industrial market sectors. This is the result of many years of experience in the development and manufacture of rolling bearings. The products and services provided have been tested in practical use and are certified in accordance with ISO 9001.

The most important quality criteria are:

- reconditioning in accordance with Schaeffler drawings
- skilled personnel with comprehensive know-how in rolling bearings
- reconditioning in accordance with Schaeffler internal processes and guidelines
- the use of original Schaeffler components and original Schaeffler replacement parts
- comprehensive documentation of reconditioning and the examinations carried out
- customer-specific marking of the bearing and labelling of the packaging.

## Costs

The costs of reconditioning are dependent on the level of reconditioning necessary, the inspections carried out and the quantity and size of the rolling bearings. The higher the quantity and the larger the rolling bearings, the greater the cost-effectiveness of reconditioning.

## Delivery time

Delivery times for reconditioned rolling bearings are dependent on the level of reconditioning required.

In urgent cases, reconditioning in accordance with Level I to Level III can be carried out at short notice. In some cases, even reconditioning in accordance with Level IV can be carried out at short notice. An appropriate proposal will be prepared after inspection by the Schaeffler expert team.

# 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 1*.

Since it is only at Level III and above that steel is required for the manufacture of rolling elements, reconditioning up to Level II gives savings in material and energy. In the case of defective components, Schaeffler ensures correct separation of materials according to grade.



*Figure 1*  
Nature reserve

## Active environmental protection

In product development, purchasing, in manufacturing or disposal – active environmental protection is firmly anchored within all business divisions of Schaeffler. Successful environmental management is founded on the basis of a uniform worldwide environmental policy.

All Schaeffler manufacturing facilities and Schaeffler reconditioning locations are certified in accordance with the relevant environmental standards. Every plant is also validated in accordance with the stringent European environmental guideline EMAS, even in those cases where this is not required by the relevant laws.

## References

The advantages available through reconditioning are shown by examples from practice.

### Railway bearings

In order to fulfil the safety regulations relating to rail traffic while also reducing costs, a Finnish rail operator decided to commission reconditioning of wheelsets, *Figure 1*.

After disassembly at the operator, the wheel discs were reconditioned by the manufacturer. All the wheelset bearings – including those railway bearings not manufactured by Schaeffler – were reconditioned by experienced Schaeffler experts. After just a short period, they were ready for operation again.

Railway bearings are designed in such a way that they can generally be reconditioned several times.

The advantages for the Finnish company were as follows:

- rapid availability of wheelset bearings
- reduced costs
- lower logistical outlay due to reconditioning irrespective of manufacturer.



*Figure 1*  
Rail traffic

### Further information

- Examples from practice:  
Global Technology Solution GTS 0074.

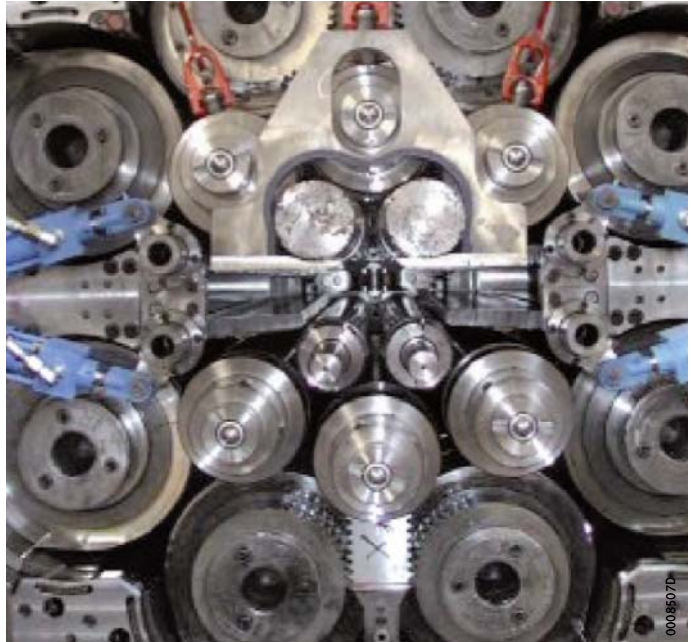
## Steel industry

A French company wanted to extend the operating life of back-up rollers in roll stands, *Figure 2*. The challenge in the reconditioning operation was to achieve the permissible section height tolerance of 5  $\mu\text{m}$  on each back-up roller set and ensure high surface quality.

Due to the high standard of quality at Schaeffler, regrinding did not lead to any loss of quality.

The advantages for the French customer are as follows:

- rapid availability of back-up rollers
- reduced costs
- extended operating life of the back-up rollers.



*Figure 2*  
Multi-roll cold rolling mill

### Further information

- Examples from practice:  
Global Technology Solution GTS 0073.

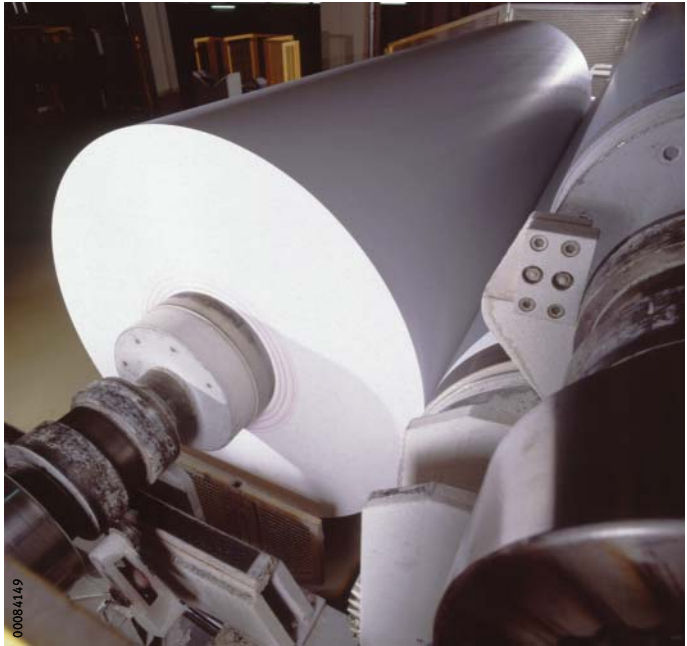
## References

### Pulp and paper

A well-known equipment builder was tasked with modernising a paper machine at short notice, which also required overhaul of the rolling bearings, *Figure 3*. Since the spherical roller bearings fitted were no longer in production, the equipment builder sought the assistance of the Schaeffler expert team. Since there was only a short period of time available for the modernisation, the customer quickly received the spherical roller bearings which had been overhauled in accordance with Level I and a small quantity that had been overhauled in accordance with Level II.

The advantages for the equipment builder are as follows:

- rapid availability of the reconditioned rolling bearings
- reduced costs
- no requirement for redesign of the adjacent construction of the drying cylinder
- short downtime.



*Figure 3*  
Rewinding of paper

### Further information

- Examples from practice:  
Global Technology Solution GTS 0075.



# Reconditioning locations

## Fixed location reconditioning

Schaeffler offers the reconditioning of rolling bearings at several locations worldwide, *Figure 1*.



*Figure 1*  
Reconditioning locations

### Addresses

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<sup>1)</sup> Reconditioning for bearings with  $D \leq 500$  mm.

<sup>2)</sup> Reconditioning for bearings with mit  $D > 500$  mm.

## Mobile reconditioning

Schaeffler reconditioning experts can, for example, carry out reconditioning of rolling bearings on site at the customer. We can offer you comprehensive advice on this subject.

## Further information



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**Global Technology Network (GTN)**  
Many practical examples can be found on the GTN pages  
under Global Technology Solutions  
[www.schaeffler.com/gtn](http://www.schaeffler.com/gtn)

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