15. Bearing handling

15.1 General information

Bearings are precision parts and in order to preserve their accuracy and reliability, care must be exercised in their handling. In particular, bearing cleanliness must be maintained, sharp impacts avoided, and rust prevented.

Bearings are vulnerable to impact. Do not hit them with a hammer directly or drop them on the floor. (Fig. 15.1)

In addition, bearings are sensitive to foreign particle contamination. When foreign particles enter the bearing during rotation, denting and/or scratches may occur, resulting in objectionable noise and vibration levels and rough bearing rotation (Fig. 15.2). Therefore, when handling bearings, it is necessary to keep the periphery clean.

15.2 Bearing storage

Most rolling bearings are coated with a rust preventive oil before being packed and shipped. Please observe the following guidelines when storing bearings.

1. Ideally, bearings should be stored indoors at room temperature with a relative humidity of less than 60%. Avoid places in direct sunlight or in contact with outer walls because excessive temperature fluctuation or humidity rise may cause condensation.

2. Bearings should not be stored directly on the ground. Instead, they should be placed on a shelf or pallet at least 20 cm above the ground. The maximum number of shipping boxes to be stacked for storage should limited to four whenever possible (Fig. 15.3).

3. Precision rolling bearings, large rolling bearings and thin ring or race rolling bearings must be laid down horizontally for storage (Fig. 15.4). Storing them standing vertically may cause raceway deformation.

For optimal bearing performance, proper bearing handling methods must be used. The handling methods described herein are general guidelines. Depending on the type and size of bearing needed, special handling "methods" may be necessary. For more detailed information, please consult NTN Engineering.

Using proper protective equipment and tools are also essential when installing or removing bearings, to avoid damage to the machinery and ensure the safety of the technician. Further information on proper installation and removal procedures is detailed in the following sections.
15.3 Bearing installation

A jig, a measuring instrument, a lubricant, and a clean and dry workshop will be needed for bearing installation. Further, if possible, it is desirable to install miniature/small ball bearings and precision rolling bearings in a clean room because intrusion of dirt and foreign matter significantly affects bearing performance. Improper installation of bearings may cause marks from the rolling elements on the raceways, adversely affecting the bearing life. For the recommendations on machining accuracy and mounting accuracy of bearings, shafts, and housings, see section "14. Design of shafts and housings."

15.3.1 Installation preparations
(1) Fitting surface of shafts and housings
When a bearing is installed on a shaft or in a housing with surfaces containing burrs or dents, the bearing may not seat properly, causing vibration and noise during operation (see Figs. 15.7 and 15.8).

Therefore, before mounting bearings, remove any burrs, raised material near dents, rust, or dirt on the shaft, housing, or accessories. (Fig. 15.9)

The shaft and housing fitting surfaces should also be checked for roughness, dimensional and design accuracy, and to ensure that they are within allowable tolerance limits. Further, when the bearing is to be press-fitted, using an anti-fretting agent on the fitting surface improves the ease of assembly.

(2) Mounting jig
The jig to be used for mounting must have a size suitable for the bearing and be free of dirt or damage.

(3) Opening of bearing
Bearing should be unpackaged directly before use to avoid introducing foreign particle contaminates or condensation which would lead to rust. Gloves should also be worn when handling bearings to avoid rust generation.

(4) Removal of rust preventative oil
In general, bearings with grease lubrication may be installed without cleaning the rust preventative oil. However, for bearings using oil lubricant, or when lubrication efficiency would be compromised by mixing the grease and rust preventative oil, the rust preventative oil should be removed by washing with a cleaning solvent and dried before installation. The shield type bearings and the seal type bearings filled with grease must not be cleaned.

15.3.2 Installing cylindrical bore bearings
15.3.2.1 Press-fitting
Press-fitting is the most common mounting method and is widely used for small bearings.

When press-fitting a bearing by applying impact with a hammer, use a resin or copper hammer rather than an iron one. To uniformly press the bearing onto the shaft or into the housing, use a sleeve. (Use of a mounting tool kit as shown in Fig. 15.40, A-168 is recommended.) Do not directly apply impact to bearing rings or press-fit them by using a punch because the bearings will not be press-fitted uniformly, causing bearing damage (Fig. 15.10).

When a large number of bearings are to be installed at one time, a dedicated jig or a hydraulic press may be used.
(3) Simultaneous press-fitting

When press-fitting a non-separable bearing such as a deep groove ball bearing onto the shaft and into the housing at the same time, use a ring-shaped block and uniformly apply force to inner and outer rings simultaneously. Do not apply force on either the inner or outer ring individually because it may cause dents or scratches on the raceway surface (Fig. 15.13).

[Caution]
- Excessive interference during installation may cause cracks and excessively small bearing internal clearance, resulting in seizure. For further detail, see section “7. Bearing fits.”
- Excessive impact at the time of installation may cause dents and damage.
- No foreign matter should enter the fitting surface during installation.
- For large interference fits and medium/large size bearings, consider other installation methods besides press-fitting at room temperature.

15.3.2.2 Heat fitting (shrink fitting)

When the inner ring interference is large or the bearing is large, press-fitting the inner ring onto the shaft at room temperature requires significant force. Heating the bearing and expanding the inner ring before installation makes the installation onto the shaft easier.

The inner ring expansion amount necessary for heat fitting can be obtained from the interference of the fitting surface between the inner ring and the shaft and the temperature difference before and after the bearing is heated (Fig. 15.14).

The main methods used to heat bearings uniformly are (1) oil bath, (2) constant temperature oven, and (3) fast therm induction heater.

(1) Heating bearings in oil bath

One bearing heating method is immersing a bearing in a heated clean oil (Fig. 15.16). Foreign particles are often found on the bottom of the oil bath; therefore, do not directly place bearings on the bottom of the oil bath. Instead, place the bearings on a wire rack or suspend it in the oil and then heat it. Shielded bearings and sealed bearings filled with grease must not be heated in the oil bath (Fig. 15.17).

(2) Heating bearings in constant temperature oven

With a constant temperature oven, bearings can be heated in a dry state (Fig. 15.18).

For heat fitting, any bearing that did not undergo dimension stabilization treatment must not be heated above 120°C to avoid permanent bearing damaged and shortened operating life. For sealed bearings, the seal temperature rating must not be exceeded.

In addition, heat torches and heat guns should not be used for heating bearings because the bearings may be heated non-uniformly and temperature control is difficult (Fig. 15.15).
(3) Heating bearings with fast therm induction heater

With a fast therm induction heater, bearings can be heated safely, cleanly, and quickly in a dry state. Heating bearings by induction heating makes the bearings magnetic; therefore, it is necessary to demagnetize bearings after heating. The NTN fast therm induction heater (Fig. 15.42, A-168) has an automatic demagnetization function.

[Caution]
- Use heat-resistant gloves for safety when handling a heated bearing. NTN heat-resistant gloves optimal for bearing handling are available (Fig. 15.43, A-168).
- It is important to complete heat fitting quickly. If the bearing cannot be inserted onto the shaft during heat fitting, stop the process and consider removing the bearing.
- When heat fitting is performed, the inner ring contracts in the axial direction during cooling, creating a clearance between the bearing and the shaft shoulder (Fig. 15.19). Therefore, it is necessary to tighten the bearing with a nut until it is completely cooled or apply a force in the axial direction while the bearing cools, to bring the bearing into close contact with the shoulder of the shaft.

15.3.3 Installation of tapered bore bearing

Small tapered bore bearings are installed by inserting a bearing a predetermined amount with locknuts and by using a tapered bore or an adapter sleeve/withdrawal sleeve. Locknuts are tightened by a hook spanner wrench (Fig. 15.20).

Large size bearings require considerable fitting force and must be installed hydraulically.

In Fig. 15.21 the fitting surface friction and nut tightening torque needed to install bearings with tapered bores directly onto tapered shafts are decreased by injecting high pressure oil between the fitting surfaces.

Fig. 15.19 Bearing contraction after heating

Fig. 15.20 Installation methods using locknuts

Fig. 15.21 Bearing installation using oil pressure

Fig. 15.22 (a) shows a method of installation where a hydraulic nut is used to drive the bearing onto a tapered shaft. Fig. 15.19 (b) and (c) show installation methods using a hydraulic nut with adapter sleeves and withdrawal sleeves.

With tapered bore bearings, as the inner ring is driven axially onto the shaft, adapter or withdrawal sleeve, the interference increases so that the bearing radial internal clearance will decrease. Interference can be estimated by measuring the decrease in radial internal clearance. As shown in Fig. 15.24, the radial internal clearance between the rollers and outer ring of spherical roller bearings should be measured with a thickness gauge under no load while the rollers are held in the correct position. Measure the radial internal clearance on both rows, and check that the values are equivalent. Instead of using the decrease in amount of radial internal clearance to estimate the interference, it is possible to estimate the mounted radial internal clearance by measuring the distance the bearing has been driven onto the shaft.

Fig. 15.22 Installation using hydraulic nut

Fig. 15.23 Installation using hydraulic withdrawal sleeve

Fig. 15.24 Internal clearance measurement method for spherical roller bearings
Commentary

The fitting. After installation, check that the predetermined interference can be obtained.

For conditions such as heavy loads, high speeds, or when there is a large temperature differential between inner and outer rings, etc., which require large interference fits, bearings with a minimum radial internal clearance of C3 or greater should be used. Table 15.1 and Table 15.2 list the maximum values for radial internal clearance and axial displacement. The remaining clearance in mounted bearings with tapered bores must be greater than the minimum allowable residual clearance listed in Table 15.1 or Table 15.2.

For self-aligning ball bearings, a predetermined interference can be obtained by tightening the nut until the radial internal clearance becomes about half the size before the fitting. After installation, check that the bearing lightly and smoothly rotates.

### Table 15.1 Tapered bore spherical roller bearings (ULTAGE series installation)

<table>
<thead>
<tr>
<th>Bearing handling</th>
<th>Bearing Handling</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Minimum residual internal clearance</th>
<th>Unit: mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN C3 C4</td>
<td></td>
</tr>
<tr>
<td>0.010</td>
<td>0.025</td>
</tr>
<tr>
<td>0.015</td>
<td>0.030</td>
</tr>
<tr>
<td>0.020</td>
<td>0.035</td>
</tr>
<tr>
<td>0.025</td>
<td>0.040</td>
</tr>
<tr>
<td>0.030</td>
<td>0.040</td>
</tr>
<tr>
<td>0.035</td>
<td>0.050</td>
</tr>
<tr>
<td>0.040</td>
<td>0.060</td>
</tr>
</tbody>
</table>

### Table 15.2 Tapered bore spherical roller bearings (installation of other series besides ULTAGE)

<table>
<thead>
<tr>
<th>Bearing handling</th>
<th>Bearing Handling</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Minimum residual internal clearance</th>
<th>Unit: mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN C3 C4</td>
<td></td>
</tr>
<tr>
<td>0.010</td>
<td>0.025</td>
</tr>
<tr>
<td>0.015</td>
<td>0.030</td>
</tr>
<tr>
<td>0.020</td>
<td>0.035</td>
</tr>
<tr>
<td>0.025</td>
<td>0.040</td>
</tr>
<tr>
<td>0.030</td>
<td>0.040</td>
</tr>
<tr>
<td>0.035</td>
<td>0.050</td>
</tr>
<tr>
<td>0.040</td>
<td>0.060</td>
</tr>
</tbody>
</table>

Note: The nut rotation angle may only be applied when a nut having the same inner diameter code as the bearing is used.
15.3.4 Installation of outer ring
With tight interference fits, the outer rings of small type bearings can be installed with a hydraulic press at room temperature. Alternately, the housing can be heated and expanded before installing the outer ring, or the outer ring can be cooled with a freezer, etc. before installing. If a freezer or another cooling agent is used, moisture will condense on bearing surfaces. Therefore appropriate rust preventative measures are necessary before cooling the bearing.

15.3.5 Internal clearance adjustment
As shown in Fig. 15.25, for angular contact ball bearings and tapered roller bearings the required amount of axial internal clearance can be set at the time of installation by tightening or loosening the adjustment nut.

To adjust the suitable axial internal clearance or amount of bearing preload, the internal clearance can be measured while tightening the adjusting nut as shown in Fig. 15.26. Another method is to check rotational torque by rotating the shaft or housing while adjusting the nut.

15.4 Lubricant enclosure
An appropriate amount of lubricant that is suitable for the use condition of the bearing should be applied if the bearings are not pre-filled with grease. For details, see section “11. Lubrication.”

15.5 Post installation running test
To check that the bearing has been properly installed, a running test is performed after installation is completed. The shaft or housing is first rotated by hand and if no problems are observed at low speed, a no-load power test should then be performed. If no abnormalities are observed, the load and speed are gradually increased to operating conditions. During the test if any unusual noise, vibration, or temperature rise is observed, the test should be stopped and the equipment should be examined. If necessary, the bearing should be disassembled for inspection.

15.6 Bearing disassembly
Bearings are often removed as part of periodic inspection procedures or during the replacement of other parts. However, the shaft and housing are almost always reinstalled, and in more than a few cases the bearings themselves are reused. These bearings, shafts, housings, and other related parts must be designed to prevent damage during disassembly procedures, and the proper disassembly tools must be employed. When removing bearing rings with interference, pulling force should be applied to the press fit bearing ring only. Do not remove the raceway through the rolling elements.

[Caution]
Bearings and jigs used for disassembly may fall off when the bearing is removed from the shaft or the housing.
To facilitate disassembly procedures, attention should be given to planning the designs of shafts and housings, such as providing extraction grooves on the shaft and housing for puller claws as shown in Figs. 15.30 and 15.31. Threaded bolt holes could also be provided in housings to facilitate the pressing out of outer rings as shown in Fig. 15.32.

Large bearings, installed with tight fits, that have been in service for a long period of time, will likely have developed fretting on fitting surfaces and will require considerable dismounting force. In such instances, dismounting friction can be reduced by injecting oil under high pressure between the shaft and inner ring surfaces as shown in Fig. 15.33.

Induction heating can be used for removing the inner ring of cylindrical roller bearings having no flange on the inner ring such as NU type and NJ type bearings. With this method, the inner ring is heated until it expands, and can be removed (Fig. 15.34). The bearing becomes magnetized by induction heating; therefore, it is necessary to demagnetize the bearing after heating.

15.6.2 Disassembly of bearings with tapered bores
Small bearings installed using an adapter are removed by loosening the locknut, placing a block on the edge of the inner ring as shown in Fig. 15.35 (a) or the edge of the lock nut as shown in Fig. 15.35 (b), and tapping it with a hammer. In such a case, use a resin or copper hammer instead of an iron one. Bearings which have been installed with withdrawal sleeves can be disassembled by tightening down the lock nut as shown in Fig. 15.36.

For large type bearings on tapered shafts, adapters, or withdrawal sleeves, disassembly is greatly facilitated by hydraulic methods. Fig. 15.37 shows the case where the bearing is removed by applying hydraulic pressure on the fitting surface of a bearing installed on a tapered shaft.
15.7 Bearing maintenance and inspection

Managing the condition of the machine during operation is important for preventing bearing failure. The following items are the general maintenance management methods.

(1) Inspection of machine while running
The interval for replenishing and replacing lubricant is determined by a study of lubricant properties and checking the bearing temperature, noise and vibration.

(2) Observation of bearing after use
Take note of any problem that may appear after the bearing is used or when performing routine inspections, and take measures for preventing reoccurrence of any damage discovered.

Maintenance management requires that the frequency for performing routine inspections be determined according to the importance of the device or machine.

15.7.1 Inspection of machine while running

### 15.7.1.1 Bearing temperature
In general, the bearing temperature increases after the start of operation and becomes steady at a slightly lower temperature after a certain time elapses (usually 10 to 40°C higher than the room temperature). The time until the temperature becomes steady differs depending on the bearing size, type, rotational speed, lubrication method, and heat dissipation condition of the bearing surroundings. It varies from 20 minutes to several hours.

When the bearing temperature does not become steady and rises excessively, the following may be the cause. Stop the operation and take measures.

### 15.7.1.2 Bearing noise
To check bearing running noise, the sound can be checked and the type of noise can be ascertained with a listening instrument placed against the housing. A clear, smooth and continuous running sound is normal; however, determining the exact noise requires significant experience. Although it is difficult to express noise with words and it is different depending on the person, Table 15.3 shows the characteristics and cause of the typical abnormal noises of bearings.

<table>
<thead>
<tr>
<th>Noise</th>
<th>Characteristics</th>
<th>Cause (probable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buzzing noise</td>
<td>—</td>
<td>Entrance of foreign matter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Roughness of the surfaces of raceway, ball, roller</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Scratches on the surfaces of raceway, ball, roller</td>
</tr>
<tr>
<td>Whooosh (small size bearings)</td>
<td>—</td>
<td>Roughness of the surfaces of raceway, ball, roller</td>
</tr>
<tr>
<td>Short whoosh noise</td>
<td>The noise is generated intermittently and regularly.</td>
<td>Contact with labyrinth part</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sympathetic vibration, fitting failure (shaft shape failure)</td>
</tr>
<tr>
<td>Rubbing noise/rumbling noise</td>
<td>The noise magnitude and pitch change when the rotational speed is changed. The noise becomes loud at a certain rotational speed. The noise becomes loud and quiet. The noise sometimes resembles the sound of sirens and whistles (howling noise).</td>
<td>Deformation of raceway</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chattering noise of raceway, ball, roller (a little noise for large size bearings is normal)</td>
</tr>
<tr>
<td>Screeching noise/crunchy noise</td>
<td>Roughness felt when the bearing is rotated by hand</td>
<td>Scratches on the raceway surface (regular)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Scratches on the ball or roller (irregular)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dirt, deformation of raceway (partial negative clearance)</td>
</tr>
<tr>
<td>Grumbling noise</td>
<td>Continuous noise in high speed rotation</td>
<td>Scratches on the surfaces of raceway, ball, roller</td>
</tr>
<tr>
<td>Whirring noise</td>
<td>The noise stops the moment the power is turned off.</td>
<td>Electromagnetic sound of motor</td>
</tr>
<tr>
<td>Clinking noise (mainly with small size bearings)</td>
<td>Irregular</td>
<td>Entrance of foreign matter</td>
</tr>
<tr>
<td></td>
<td></td>
<td>The noise does not change when the rotational speed is changed.</td>
</tr>
<tr>
<td>Jingling noise (tapered roller bearings)</td>
<td>The noise is regular and becomes continuous in high speed rotation.</td>
<td>Unsuitable lubricant (use soft grease for low temperature)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cage pocket abrasion, insufficient lubricant, insufficient bearing load operation</td>
</tr>
<tr>
<td>Flapping noise (large size bearings)</td>
<td>Clear cage sound is normal.</td>
<td></td>
</tr>
<tr>
<td>Ticking noise/clacking noise/clattering noise</td>
<td>Continuous in low speed rotation.</td>
<td>Collision noise from cage pocket, insufficient lubrication. The noise stops by preloading or by making the internal clearance smaller.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Collision noise of rollers for the full component type</td>
</tr>
<tr>
<td>Clanging noise</td>
<td>Loud metallic collision noise</td>
<td>Deformation of raceway</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Low-speed thin large size bearings</td>
</tr>
<tr>
<td>Sliding noise/squeaking noise/spalling sound</td>
<td>Mainly with cylindrical roller bearings, the noise changes when the rotational speed is changed. Large noise sounds like metallic sound. The noise temporarily stops when grease is supplied.</td>
<td>Lubricant (grease) consistency too high</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Radial internal clearance too large</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Insufficient lubricant</td>
</tr>
<tr>
<td>Squealing noise/creaking noise/whining noise</td>
<td>Metal biting sound</td>
<td>Bitting between roller and flange surface of roller bearing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Internal clearance too small</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Insufficient lubricant</td>
</tr>
<tr>
<td>Splashing noise</td>
<td>Occurs irregularly with small size bearings</td>
<td>Sound generated when bubbles in the grease are broken</td>
</tr>
<tr>
<td>Groaning noise/</td>
<td>Irregular squeaky noise</td>
<td>Slippage of fitting part</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Squeaking of mounting surface</td>
</tr>
<tr>
<td>Indistinguishable loud noise during operation.</td>
<td>Roughness of the surfaces of raceway, ball, roller</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Deformation of raceway surface, ball, and roller caused by abrasion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Too large internal clearance caused by abrasion</td>
</tr>
</tbody>
</table>
15.7.1.3 Bearing vibration
Measuring the machine vibration during operation with a vibration measuring instrument can reveal bearing damage at an early stage. The bearing damage degree can be estimated by quantitatively measuring and analyzing the vibration amplitude and frequency. However, measurement values differ depending on the measurement positions and bearing use conditions. Therefore, it is desirable to accumulate measurement data and set criteria for each machine.

When the bearing is damaged, vibration including specific frequencies that depend on the bearing internal specifications and rotational speed occurs. The bearing vibration frequency can be calculated with the bearing technique calculation tool on the NTN website (https://www.ntnglobal.com).

15.7.1.4 Leakage/abnormal deterioration of lubricant
The main causes of the leakage/abnormal deterioration of lubricant are as follows. It is necessary to take measures depending on the use conditions and environment.

- Too much lubricant
- Unsuitable lubricant
- Improper installation
- Unsuitable sealing mechanism
- Deterioration caused by use
- Unsuitable operating condition
- Abnormal deterioration

15.7.2 Observation of bearing after use
Carefully observe bearings after use and during periodic inspection, and take appropriate recurrence prevention measures if any damage was found. For details, see section “16. Bearing damage and corrective measures.”
15.8 Bearing maintenance tools

**NTN** offers maintenance tools for easily and safely installing/disassembling bearings. **NTN** also offers a portable abnormality detection device, a small vibration measurement device that has excellent portability and usability for measuring the vibration generated from the machine.

### 15.8.1 Maintenance tools

Figs. 15.40 through 15.49 show some of the main maintenance tools that are convenient for installing/disassembling bearings. For details, see the special catalog “Maintenance tools (CAT. No. 6600/J).”

- **Fig. 15.40** Cold mounting case
- **Fig. 15.41** Hook spanners
- **Fig. 15.42** Induction heater
- **Fig. 15.43** Heat-resistant gloves
- **Fig. 15.44** Set of calibrated feeler gauges
- **Fig. 15.45** Bore puller set
- **Fig. 15.46** Back puller
- **Fig. 15.47** Mechanical puller
- **Fig. 15.48** Hydraulic puller
- **Fig. 15.49** Tri Section Pulling Plates

The jig is efficient for easily and safely removing bearings press-fitted into shafts of large size bearings.

The protective gloves allow safe handling of high-temperature bearings up to 350°C.

The kit allows accurate, safe, and quick bearing installation.

The five spanners allow tightening/loosening nuts of 30 different sizes.

The device allows safe and secure heat fitting work and has an automatic demagnetization function, an overheat prevention function, and a temperature maintaining function.

The tool allows simple and high precision measurement of bearing clearance.

The jig allows quick and easy removal of bearings press-fitted into housings by a tight fit.

The raw vibration data and the analysis results can be saved in smart devices for operation and can be downloaded in CSV format as necessary.

The FFT analysis clarifies the detailed operational state of the machine. By registering measurement conditions such as bearing part numbers and rotational speed, it is possible to detect the damage inside the bearing and estimate the damaged parts. In addition, selecting measurement conditions allows detecting abnormalities such as unbalance and misalignment of machines having rotating parts. In OA measurement, the acceleration, speed, and displacement can be displayed independently, and the measurement can be used as a general vibrometer.

The tool allows simple and high precision measurement of bearing clearance.

The protective gloves allow safe handling of high-temperature bearings up to 350°C.

The jig allows accurate, safe, and quick bearing installation.

The five spanners allow tightening/loosening nuts of 30 different sizes.

The device allows safe and secure heat fitting work and has an automatic demagnetization function, an overheat prevention function, and a temperature maintaining function.

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For the product details, please contact **NTN** Engineering.

For details, see the special catalog “**NTN PORTABLE VIBROSCOPE** (CAT. No. 6601/E).”

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**Commentary**