ROBUST Series was developed using NSK’s material, evaluation, and analysis technologies to improve the performance of machine tools.

## ROBUST Series

### ROBUST Series Features
- **High-Speed Precision Bearings**
- **NEEDLE ROLLER BEARINGS STRATEGIC**
- **INDUSTRIAL MACHINERY BEARINGS DIVISION-HEADQUARTER**
- **ASIA BUSINESS STRATEGIC DIVISION-HEADQUARTER**
- **EUROPE DIVISION-HEADQUARTER**
- **WORLDWIDE HEADQUARTERS**

### Applications
- Precision machine tools
- Aircraft engines
- Railway equipment
- Industrial machinery

### Benefits
- Increased efficiency
- Enhanced performance
- Longer maintenance intervals

### NSK’s Commitment
- NSK is dedicated to providing high-quality bearing solutions for a wide range of industries.
- NSK offers a comprehensive range of precision bearings to meet the needs of diverse applications.

### Contact Information
For more information about NSK products, please contact:

**NSK North America, Inc.**

**NSK Limited**

**NSK Americas, Inc.** (American Headquarters)

**NSK Corporation** (Japanese Headquarters)

**NSK Europe, Ltd.** (European Headquarters)

**NSK Australia Pty. Ltd.** (Australian Headquarters)

**NSK Canada Inc.** (Canadian Headquarters)

**Packaging**

- NSK has a basic policy not to export any products or technology designated as controlled items by export-related laws. When exporting the products in this brochure, the laws of the exporting country must be observed.
Building on the new technologies of today to meet the requirements of tomorrow

NSK continually develops and provides new products and solutions for customers. In 1998, the ROBUST Series was developed. During the last JIMTOF 2002, NSK emphasized the themes of “Environmentally Sound,” “Easy Handling,” and “Economy.” Now the themes for the future are “Fast,” “Friendly,” “Firm,” and “Fine.”

NSK contributes to the machine tool industry by providing new and continuously improved products.

2003 — Ball Screw Support Angular Contact Thrust Ball Bearings with Seal
   Angular Contact Ball Bearings with Seal
2002 — Grease Replenishing System High-Rigidity,
   Double-Row Cylindrical Roller Bearings with TB Cage
2001 — High Accuracy Cylindrical Roller Bearings
2000 — ROBUST Ultra High-Speed Cylindrical Roller Bearings with PEEK Cage
1999 — ROBUST High Accuracy Angular Contact Ball Bearings
1998 — ROBUST Ultra High-Speed Angular Contact Ball Bearings
1997 — SHX material
The ROBUST Series was developed using NSK’s material, evaluation, and analysis technologies. These technologies and the ROBUST Series are being continuously improved to deliver the highest quality and performance.

**Angular Contact Ball Bearings**

- **Rolling elements**: Ceramics
  - SUJ2
- **Rings**: SHX, SUJ2
- **Cage**: Polyamide, Phenolic, PEEK

<table>
<thead>
<tr>
<th>Type</th>
<th>Rings</th>
<th>Rolling elements</th>
<th>Cage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SUJ2</td>
<td>SUJ2</td>
<td>Polyamide 46 (TYN) Phenolic (T) PEEK (T42)</td>
</tr>
<tr>
<td>2</td>
<td>SUJ2</td>
<td>Ceramics</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>SHX</td>
<td>Ceramics</td>
<td></td>
</tr>
</tbody>
</table>

**Cylindrical Roller Bearings**

- **Rolling elements**: Ceramics
  - SUJ2
- **Rings**: SHX, SUJ2
- **Cage**: PEEK (Single row), PPS (Double row)

<table>
<thead>
<tr>
<th>Type</th>
<th>Rings</th>
<th>Rolling elements</th>
<th>Cage</th>
</tr>
</thead>
<tbody>
<tr>
<td>5b</td>
<td>SUJ2</td>
<td>SUJ2</td>
<td></td>
</tr>
<tr>
<td>6b</td>
<td>SHX</td>
<td>SHX</td>
<td></td>
</tr>
<tr>
<td>6t</td>
<td>SHX</td>
<td>Ceramics</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>SUJ2</td>
<td>SUJ2</td>
<td>PPS (TB)</td>
</tr>
</tbody>
</table>

**Core Technology**

- **Material Technology**
  - Ceramic rolling element
    - Taking advantage of ceramics material properties to improve the performance and the reliability of bearings
  - SHX Steel
    - Suitable for ultra high-speed operation, and extends fatigue life

- **Evaluation Technology**
  - Cages for Angular Contact Ball Bearings
    - TYN Cage: Optimum performance with grease lubrication, with silent operation
    - T Cage: Optimum bearing performance and reliability at high-speed operation

- **Analysis Technology**
  - High-strength cages for Cylindrical Roller Bearings
    - By adopting an engineered polymer and utilizing FEM analysis in design, NSK has developed an extremely high strength cage.

**ROBUST Series Continuous Improvement**
Fast
Ultra High-Speed with Silent Operation

Acknowledging increased demand for silent operation during high-speed, NSK provides the solution with oil-air lubrication.

Typical spindle structure with oil-air lubrication for ultra high-speed machining centers

Typical application
Molding die machining
Aerospace components machining

Bearing Selection Guide

Bearing type based on preload method and rotational speed

Achieved 3.0M $d_m n$
ROBUST Cylindrical Roller Bearings simplify the structure of the spindle and also achieve 3.0M $d_m n$: twice the current speed.

Low temperature rise designed for higher speed operation
ROBUST Angular Contact Ball Bearings have achieved low temperature rise during high-speed operation through optimised design.

Higher speed with silent operation
Spin-Shot II provides spindles with the capability of both silent operation and higher speed under optimised lubrication conditions. Spin-Shot II can maintain excellent performance even when the conventional air supply is reduced by 1/3.

Typical spindle structure with oil-air lubrication for ultra high-speed machining centers

Molding die machining
Aerospace components machining

Angular Contact Ball Bearings

Ultra High-Speed Angular Contact Ball Bearings Spin-Shot II

Spin-Shot II

Ultra High-Speed Angular Contact Ball Bearings

Ultra High-Speed Cylindrical Roller Bearings

Ultra High-Speed Angular Contact Ball Bearings

Ultra High-Speed Cylindrical Roller Bearings

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Spin-Shot II

Ultra High-Speed Angular Contact Ball Bearings

Ultra High-Speed Cylindrical Roller Bearings

Ultra High-Speed Angular Contact Ball Bearings

Ultra High-Speed Cylindrical Roller Bearings

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**Bearings for high-speed machining centers with grease lubrication**

**Grease Replenishing System**

Higher speed with silent operation

This system feeds a small amount of grease to the bearing at regular intervals, enabling speeds up to 1.8M \( \omega_n \) with position preload. The Grease Replenishing System enables longer grease life, consumes less air, and is quieter relative to an oil-air system. MTE grease developed by NSK is used in the system. MTS and MTE grease provide the best performance for normal grease lubrication.

**Angular Contact Ball Bearings**

AngULAR CONTACT BALL BEARINGS WITH TYN

CAGE, SUITED FOR GREASE LUBRICATION; SEAL ENABLES LONGER GREASE LIFE.

TYN CAGE (BALL GUIDED, ENGINEERED POLYMER) SUITABLE FOR GREASE LUBRICATION; SEAL ENABLES LONGER GREASE LIFE.

Bore dia: 30 mm – 100 mm

**High-Speed Angular Contact Ball Bearings**

(Photo: Angular Contact Ball Bearings with Seal)

**High-Speed Cylindrical Roller Bearings**

(Photo: Z specification)

**From NSK—“Low Heat Generation Cylindrical Roller Bearings”**

By reducing the number of rollers by half (Z spec.), this specification of Cylindrical Roller Bearings is well-suited for the rear side of a spindle with a built-in motor. This new idea provides longer grease life.

**Bearing Selection Guide**

Bearing type based on preload method and rotational speed

<table>
<thead>
<tr>
<th>( d \omega_n (10^6) )</th>
<th>BNR</th>
<th>BER</th>
<th>ISO standard 70AS</th>
<th>Grease Replenishing System</th>
<th>N10</th>
<th>NN10</th>
</tr>
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<tbody>
<tr>
<td>2.50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>2.00</td>
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</tr>
<tr>
<td>1.50</td>
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<tr>
<td>1.00</td>
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<tr>
<td>0.50</td>
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<td>0.00</td>
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</tr>
</tbody>
</table>

**Typical application**

Molding die machining
Automotive parts machining
High-Speed, High-Rigidity, and High-Accuracy Bearings for Lathes

High-Speed, High-Rigidity, and High-Accuracy Bearings for Lathes

High-Rigidity, Double-Row Cylindrical Roller Bearings

- **High speed and high rigidity with long grease life**
  - ROBUST Cylindrical Roller Bearings with TB cage, made with the finest materials and optimised design, are suitable for lathes, and provide high-speed and high rigidity.

- **Low heat generation, high rigidity, and high accuracy**
  - Low heat generation and high rigidity increase the reliability of the spindle.

Interchangeability
- BAR and BTR type bearings are special-width designs and therefore can be used to replace the TAC20X type. This enables the customer to use these new-type bearings by simply replacing spacer A with spacer B (see left diagram), without modifying the housing or the shaft.

Bearing Selection Guide

Bearing type based on rotational speed

<table>
<thead>
<tr>
<th>$d_{0}n$ ($\times 10^6$)</th>
<th>BER</th>
<th>BAR</th>
<th>BTR</th>
<th>NN30</th>
</tr>
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<tbody>
<tr>
<td>0.95</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.85</td>
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</tr>
<tr>
<td>0.65</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.00</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Rigidity of the main shaft with position preload

Typical spindle structure for lathes

E44 symbol: standard oil holes and grooves on O.D.
**Ball Screw Support Bearings**

- **Ball Screw Support Angular Contact Thrust Ball Bearings**

  Design optimised to produce high rigidity bearing for special applications
  This bearing design has been improved to meet the requirements of this application. Using long life and high reliability material, fatigue life has been extended, and by increasing the number of the balls, the rigidity of this bearing has been increased.

- **Ball Screw Support Angular Contact Thrust Ball Bearings, with seal**

  Easy handling and increased reliability
  Superior seal design for typical ball screw applications increases the reliability of the bearings and provides for easy handling. Universal combination of this bearing provides extra flexibility.

**Ultra High-Speed Bearings for Internal Grinders**

- **Ultra High-Accuracy Angular Contact Ball Bearings**

  Ultra high-speed and accuracy provided by special design features
  In order to meet the ultra high-speed capability and high running accuracy required in bearings for internal grinders, this series has the following features.
  - Accuracy class: ISO Class 2
  - Inner ring counter-bore allows for more efficient oil delivery to the bearing
  These universal combination bearings can be used in any combination.

---

**Bearing Selection Guide**

Bearing type based on lubrication method and rotational speed

<table>
<thead>
<tr>
<th>$\sigma_{\text{r},n} \times 10^6$</th>
<th>BGR</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.10</td>
<td>☜</td>
</tr>
<tr>
<td>2.80</td>
<td>☜</td>
</tr>
<tr>
<td>2.50</td>
<td>☜</td>
</tr>
<tr>
<td>2.20</td>
<td>☜</td>
</tr>
<tr>
<td>1.90</td>
<td>☜</td>
</tr>
<tr>
<td>1.60</td>
<td>☜</td>
</tr>
<tr>
<td>1.30</td>
<td>☜</td>
</tr>
</tbody>
</table>

- OIL-lub
- AIR-lub
- Grease lub
**Function for each application**

**Special high accuracy class: P2X**

The lowest radial runout

<table>
<thead>
<tr>
<th>NSK accuracy</th>
<th>P5</th>
<th>P4</th>
<th>P3</th>
<th>P2</th>
<th>P2X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensional accuracy</td>
<td>ISO CLASS 5</td>
<td>ISO CLASS 4</td>
<td>ISO CLASS 2</td>
<td>ISO CLASS 2</td>
<td>Higher than ISO CLASS 2</td>
</tr>
<tr>
<td>Running accuracy</td>
<td>ISO CLASS 4</td>
<td>ISO CLASS 2</td>
<td>ISO CLASS 2</td>
<td>ISO CLASS 2</td>
<td></td>
</tr>
</tbody>
</table>

**Function for each application**

**Universal combination: SU (Single Universal)**

Universal combination bearing can be used for any arrangement of DB, DT, DF, DBD, DBB