

Tapered Roller Bearings



Single row tapered roller bearings

Tapered roller bearings are designed such that their conical rollers and raceways are arranged so that all elements of the roller and raceway cones meet at a common apex on the bearing axis (refer to Fig. 1). The rollers are guided by the contact between the large end of the roller and the rib on the inner ring (cone).

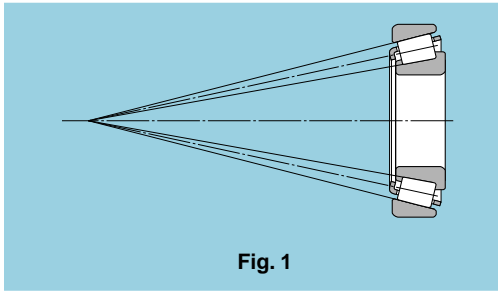


Fig. 1

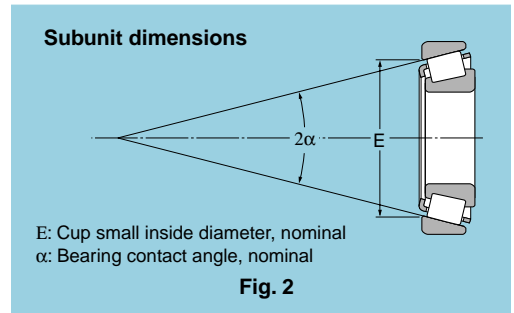
This construction provides a high capacity for radial loads, axial loads, and combined loads. The larger the contact angle, the greater the loading capacity becomes. When a pure radial load is placed on the bearing, an induced load in the axial direction is also generated. So, these bearings are generally used in pairs opposing each other. Proper running clearance or preload can be obtained by adjusting the distance of the two bearings against one another. Since the inner (cone) and outer (cup) rings are separable, each ring can be mounted individually, allowing both rings to use tight fitting practices, if desired.

Both metric and inch systems are standardized by bearing series and both systems are widely used. The metric system is specified in ISO (ISO 355) and JIS 1512, and the inch system (including J-series) is standardized in AFBMA standard.

Press steel cages are generally used in these bearings, however, large-sized bearings use machined or pin type cages. Smaller sizes sometimes use plastic cages depending on the application.

Subunits

Tapered roller bearings can be disassembled into subunits, that is, the inner ring with rollers (cone) and the outer ring (cup). The subunit dimensions are standardized in ISO or AFBMA standards. The unified subunits provide interchangeability within each dimensional standard, Classes 0 and 6X of JIS for the metric system standards (ISO or JIS); with Classes K, N, and C for the J-series (AFBMA); and with Classes 4, 2, and 3 for the inch system (AFBMA). Furthermore, since high precision grade bearings are not interchangeable these bearings should be used by assembling subunits with the identical manufacturing number.



E: Cup small inside diameter, nominal
 α : Bearing contact angle, nominal

Fig. 2

Regarding the single row tapered roller bearings described in the dimensional table, the dimensions for these subunits are standardized for both metric and inch systems (including J-series) unless otherwise noted.

Allowable misalignment

By suitably setting the contact condition of the rollers with the raceway ring, not only is edge loading prevented, a certain misalignment between the inner and outer rings caused by mounting error can be permitted. The allowable misalignment for tapered roller bearing is about 0.0005 radian (0°, 1.5') for single row or back-to-back arrangement and 0.001 radian (0°, 3.5') for face-to-face arrangement. When a larger misalignment is required by the bearing, please consult with NTN.

Types ET and 4T tapered roller bearings

Types ET and 4T tapered roller bearings are made of case hardened steel having high purity, low oxygen content, and strictly controlled chemical composition. Moreover, the steel is manufactured through a special heat treatment developed by NTN to reduce crack sensitivity. The dimension and quantity of rollers are designed to maximize the bearing's load rating. As a result, the fatigue life and reliability of the bearing have been improved to where a life compensation coefficient, a_2 , of formula 5.7 (according to the materials and manufacturing method described on page A-42) can be applied:

$$a_2 = 1.9 \text{ (for Type ET and } a_2 = 1.4 \text{ (for Type 4T)}$$

Improvements in material composition and heat treatment method effectively prolong the life of Type ET tapered roller bearings under extreme usage conditions such as under excessive loads and/or in lubrication oil contaminated by particulates such as dirt or metal chips. These bearing types are relatively small size bearings.

Types ET and 4T tapered roller bearings are classified by attaching the symbol "ET" or "4T" in front of the basic bearing number.