

Tapered Roller Bearings as a Fastener Problem

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About Tapered Roller Bearings

Tapered roller bearings (Fig. 1) have tapered bearing tracks on the inner and outer rings like rolling elements use the cones. They are suitable for carrying combined loads i.e. simultaneously acting radial and axial loads. They are used mostly in cars as automotive wheel bearings and are commonly used for moderate speed, heavy duty applications where durability is required. Common real world applications are agriculture, construction and mining equipment, sports robot combat, axle systems, gear boxes, engine motors and reducers, propeller shafts, railroad axle-boxes, differential, wind turbines, etc.

Single row tapered roller bearings are usually set against the second taper. By setting the preload, it is possible to achieve a tight fit (ISO 355).

Unlike others, the tapered roller bearings are detachable and must therefore be held together by the so-called KM-nut 1 and secured by the cage 2 (Fig. 2). **By turning (tightening) the KM nut, the necessary preload of the tapered roller bearing 3 is created at the same time.**

At first glance (Fig. 2), this is a complicated system that does not guarantee a constant bearing preload. Even from a logistics and assembly point of view, it is not advantageous. **And this is an opportunity to optimize the KM nut and thus the entire structural unit.**

Design Option

As can be seen from Fig. 3, **one of the possible solutions is to provide KM nut with an IL locking system, well known locking classical nuts.** This system makes it possible to eliminate the unreliable and redundant security cage (see Fig. 2). The main advantage of this system - exact assembly and solid resistance of nuts against vibrations - is also supported by simplified logistics because the retaining ring is firmly integrated with the nut. In addition, the retaining ring can be easily replaced with a new one if required.

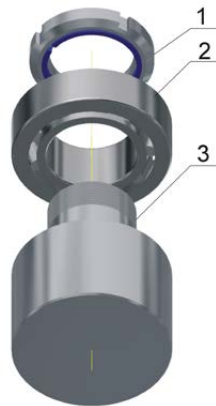


Fig. 3
(1 - KM nut with locking system IL, 2 - Tapered roller bearing, 3 - Spindle)

Tightening Tools

Of course, tightening tools are also important. As shown in the pictures 4a (classic system SKF) and 4b (an innovative form), **the classic tightening of the original KM nut can be replaced by a so-called double-spanner**, relying on the constant hardened material and on the length of the arms. In this way, nearly constant preload values are achieved, which is an important factor in their service life.

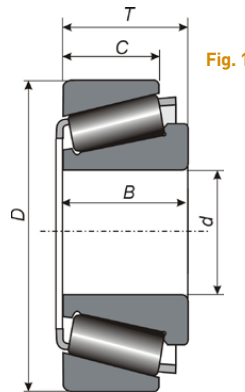
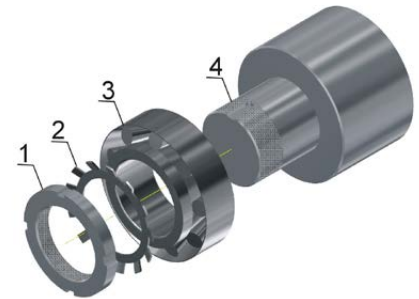


Fig. 1

Fig. 2 (1 - KM nut, 2 - Cage, 3 - Tapered roller bearing, 4 - Spindle)



Manual tightening cannot guarantee this condition. As shown in Fig. 5, relying on manual dexterity seldom hits the right values. In addition, it shows a relatively large variance of values.

Conclusion

The presented article confirms that even rolling bearings cannot do without threaded joints. KM nuts are not the only case in this regard. Not by chance the world-famous bearing company SKF has published elsewhere, for example, the results of its own study on the most common causes of failure of screw spokes. The question is why was this bearing manufacturer so interested in screws to such detail? The answer is because in many cases, screws are an indispensable piece of equipment for mounting rotating components. ■

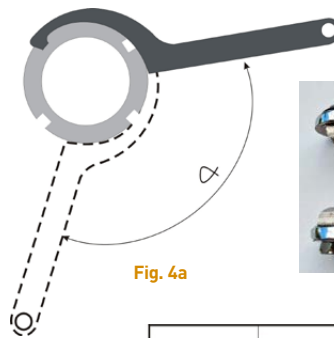


Fig. 4a



Fig. 4b

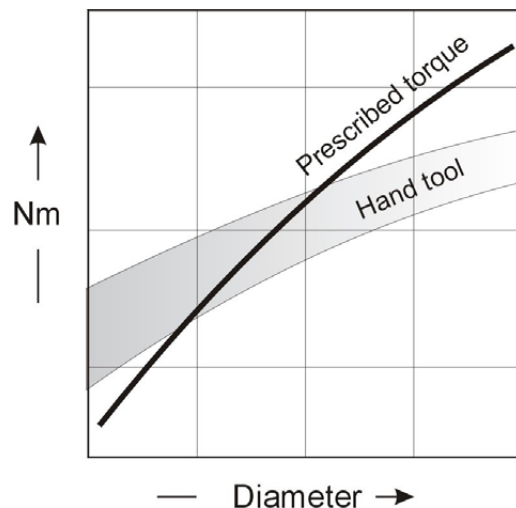


Fig. 5

