

B-2-14.4 Shaft End Machining

Shaft end is machined in the following three occasions.

- * Precision ball screws with blank shaft end.
- * Ball screws in R Series with blank shaft end.
- * Additional machining of a completed ball screw

The following are summaries of machining of these shaft ends. For details, please contact NSK.

(1) Additional machining of precision ball screw with blank shaft

① Cutting screw shaft

Use a cutting whetstone, etc. to cut the shaft, leaving stock for turning. Keep the nut in the assembled state to the screw shaft, and open only one side of the plastic wrapping bag, expose only the shaft end section to be machined, then cut the screw shaft. This prevents foreign matters from entering to the ball screw section. Do the same for other machining.

② Precautions in cutting shaft end

Outside of the screw shaft is ground with precision. There is a center hole in the ends. Use them for centering. Do not rotate the shaft quickly or stop it suddenly, or the nut might move along the shaft. We recommend securing the nut with tape. To machine a very long shaft, apply work rests to the screw shaft surface to suppress vibration (especially caused by critical speed).

③ Turning by lathe

Cut to the length, turn shaft end steps, turn thread screw, and provide the center hole. Refer to JIS B1192 which sets standards for shaft end accuracy.

④ Processing by grinding

Apply the same precautions as for cutting for centering, securing nut, and work rest. Grind sections where the bearings and a "Spann ring" are installed.

⑤ Milling processing

Process key way and lockwasher tooth seat.

⑥ Deburring, washing, rust prevention

Wash with clean white kerosene after processing. Apply lubricant for immediate use. For later use, apply rust preventive agent.

[Note]

Contact NSK if nut is accidentally removed.

(2) Additional machining of R Series ball screw shaft end

① Cutting screw shaft

Carry out the same process as for Precision ball screw with blank shaft above.

② Annealing the shaft end (Heat the section of the shaft end to be machined with an acetylene torch. Then gradually cool it in ambient atmosphere.)

* The area not machined loses hardness if exposed to heat. This shortens ball screw life. Cool with water the areas where should not be heated to avoid heat conduction.

③ The following process is the same as Precision ball screw with blank shaft above.

B-2-15 Precautions for Designing Ball Screw

B-2-15.1 Safety System

As shown in the illustration on Page B80, a stopper is installed in some cases to prevent the nut from overrunning due to malfunction of the safety system of the machine itself, or human error during operation.

The travel stopper should be installed at a place where it will not come into contact with the nut when the nut reaches the designed stroke end.

An impact absorbing travel stopper (NSK patent, refer to Page B456) is available at NSK.

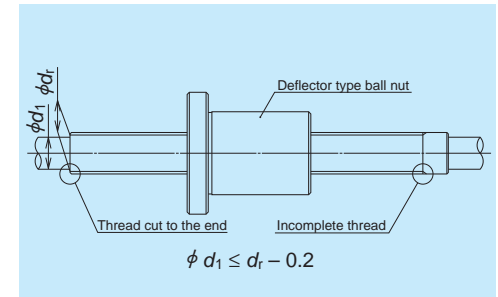


Fig. 15.1 Shaft end of a deflector recirculation system ball screw

B-2-15.2 Design Cautious to Assembling Ball Screw

(1) Cutting through the thread screw to the end

For the deflector, end cap and a part of end deflector ball recirculation system ball screws, one end of the thread screw should be cut through. This is for convenience of assembly for ball nut to the screw shaft (Fig. 15.1).

In this case, the shaft end diameter, where this thread cut through is made, should be 0.2 mm or smaller than the ball groove root diameter " d_r " (See the dimension table). A similar precaution is required when it is absolutely necessary to remove the nut from the screw shaft in order to install the ball screw to the machine. Also, in case using the cut-through end as the shoulder of the support bearing, make certain that a sufficient amount of the effective flat surface is left from the root diameter. If it is insufficient, the bearing cannot be installed in perpendicular to the bearing seat. (Fig. 15.2)

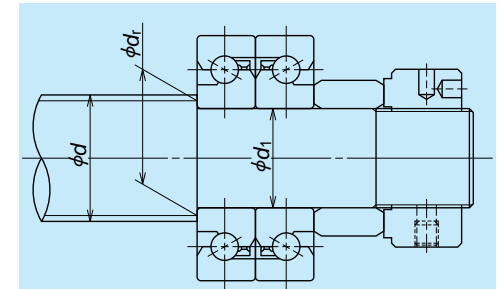


Fig. 15.2 Support bearing and end face (shoulder) for installation

(2) Designing screw shaft end and the nut area

When installing a ball screw to the machine, avoid a design which makes it necessary to separate the nut from the screw shaft as shown in Fig. 15.3. If separated, the balls may fall out. Separation may also deteriorate the ball screw accuracy, or may damage the ball screw. If separating them is unavoidable, please furnish NSK with the component which is to be installed between the nut and screw shaft. NSK will install the component prior to delivery.

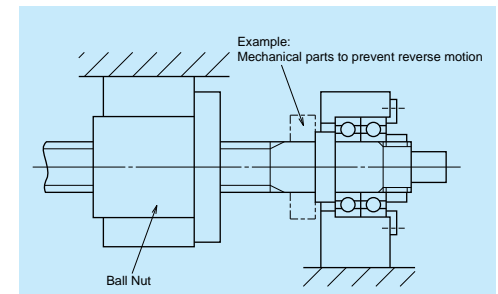


Fig. 15.3 Nut and ball screw are required to be separated when installing in this structure.

(3) Removing nut from the shaft at time of assembly

If it is unavoidable, use an arbor (Fig. 15.4), keeping the balls in the nut. In this case, the outside diameter of the arbor should be approximately 0.2 to 0.4 mm smaller than the ball groove root diameter "d."

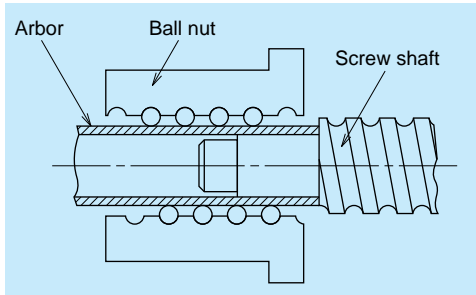


Fig. 15.4 Arbor to install and remove nut

(4) Centering of the ball nut when installing

When installing the nut as shown in Fig. 15.5, provide a space between the housing and the nut body diameter, allowing the centering to be performed.

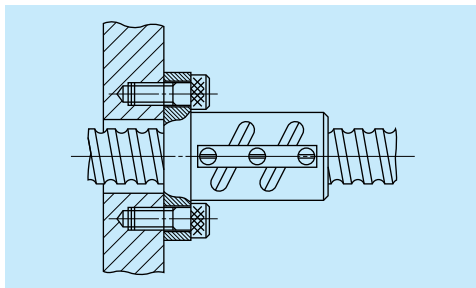
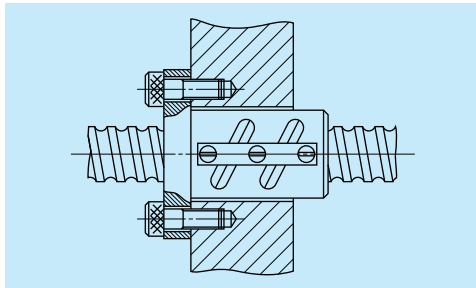


Fig. 15.5 Fixing a ball nut by flange

(5) Preventing the thread screw of nut from loosening

When installing and securing the nut to the housing at the thread screw section, as in the case for RNCT Series of R Series ball screw, apply an agent which prevents the nut from loosening.

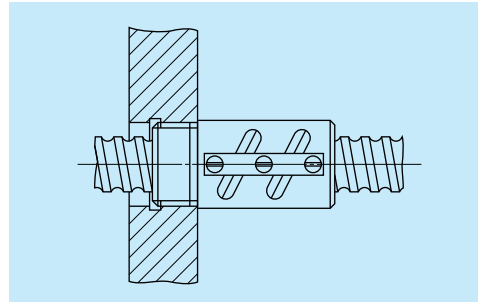


Fig. 15.6 Fixing a ball nut with thread screw

(6) Installation of brush-seal to the nut

If the brush-seal is installed at the thread screw side of the nut which comes with a thread screw, the brush-seal should be designed to be secured as shown in Fig. 15.7.

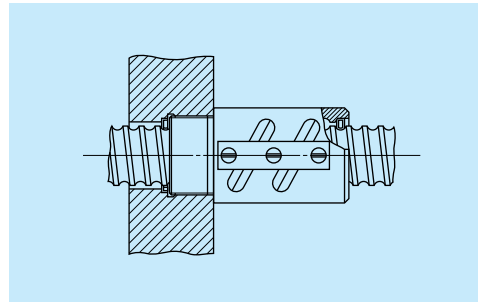


Fig. 15.7 Installation of brush-seal to a ball nut with thread screw

B-2-15.3 Effective Stroke of Ball Screw

Rigidity of a ball screw which is hardened by the induction hardening may be slightly low at both ends of the screw section. Consider this low hardness prior to determining the length of effective stroke. Please consult NSK for details.

B-2-15.4 Matching after Delivery

Please inform NSK on the position and size if it is necessary to machine the screw shaft end, or if a knock pin at the nut installation section is needed after delivery.

NSK takes a measure and protects designated spots from heat treatment prior to delivery to make subsequent machining easy.

B-2-15.5 NSK K1™ Lubrication Unit

When using NSK K1 lubrication unit, be aware of the operating temperature and chemicals that come to contact for keeping the best performance of K1.

Temperature range for use:

Maximum temperature for use; 50°C

Momentary maximum temperature in use; 80°C

Chemicals that should not come to contact:

Do not leave K1 Seal in organic solvent, white kerosene such as hexane, thinner which removes oil, and rust preventive oil which contains white kerosene.

Water-type cutting oil, oil-type cutting oil, grease such as mineral-type AS2 and ester-type PS2 do not damage K1 Seal.