B-2-9 Lubrication of Ball Screw

Lithium soap-based grease at viscosity 30 to 140 mm^2/s (40°C) is used for grease lubrication. Oil with ISO VG 32 to 100 is used for oil lubrication.

In general, lubricants with low base oil viscosity are recommended when the ball screw is used for high speed, and it is important to reduce thermal elongation of the screw shaft. On the other hand, lubricants with high base oil viscosity are recommended when the ball screw is used for low speed, high temperature, with vibration, or under high load.

Please consult NSK about greases for high-load drive and high-temperature applications.

NSK Grease Unit for ball screw lubrication includes:

1) Various types of grease in the bellows-tube which can be instantly attached to the grease pump;

2) Hand grease pump which is compact and easy to use;

3) Nozzles.

Table 9.1 shows NSK greases, and names of other ball screw greases.

Table 9.2 explains checking points in lubrication and standard intervals between replenishments.

It is important to wipe off old grease from the screw shaft prior to applying new grease. Page D16 also explains in detail concerning the replenishing methods.

Table 9.1 Grease for ball screw

Product name	Thickener	Base oil	Base oil viscosity mm^2/s (40°C)	Range of temperature for use (°C)	Application
NSK Grease AS2	Lithium base	Mineral oil	130	–10 – 110	General heavy load
NSK Grease PS2	Lithium base	Synthetic oil combined with mineral oil	15	–50 – 110	Light load
NSK Grease LR3	Lithium base	Synthetic oil	30	–30 – 130	High-speed medium load
NSK Grease NF2	Urea composite type	Synthetic oil combined with mineral oil	27	–40 – 130	Fretting resistant

*Refer to Page D13 for the nature of NSK greases.

Table 9.2 Checking lubricant and intervals of replenishment

Lubricating method	Checking intervals	Check points	Replenish/replacing interval
Intermittent automatic oil supply	Once a week	Remaining volume, contamination	Supply oil when checking (depending on the tank volume)
Grease	2 – 3 months after start of use	Clean, foreign matters	Generally once a year (replenish when necessary)
Oil bath	Every day, when start to work	Oil level	Specify according to oil consumption

B-2-10 Dust Prevention for Ball Screw

If foreign matters enter inside the ball nut, all screw may wear rapidly, or it may malfunction due to damage of groove or ball recirculation system. Use bellows and telescopic pipe (Fig. 10.1) to keep foreign matters from entering into the feed screw system. Install these items so as to shut foreign matters completely from the ball screw.

Also it is even more effective to add seal on the ball nut as shown in Fig. 10.2 to10.6. We provide seals in Table 10.2.

Table 10.1 Seal

	Sealing capability	Torque	Heat	Application
Thin plastic seal	○	○	○	End deflector type, HMD type, BSL type
Plastic seal	×	◎	◎	Tube type, Defiector type (Seal is not put on the lead of 1mm or smaller.)
Wiper seal	△	×	×	
High performance seal	◎	○	○	VSS type
Brush-seal	△	○	○	For R Series (Seal for those with the shaft diameter of 14 mm or less is plastic seal.)

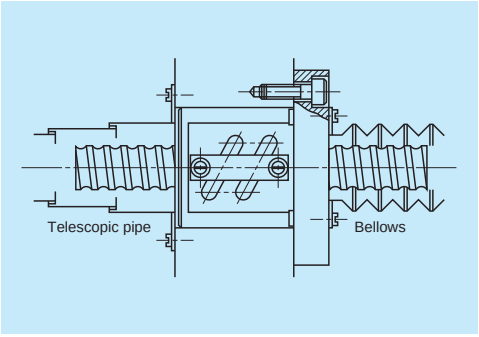

Fig. 10.1 Dust prevention by telescopic pipe and bellows

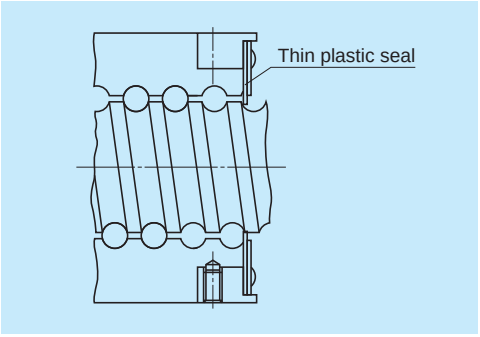

Fig. 10.2 Thin plastic seal

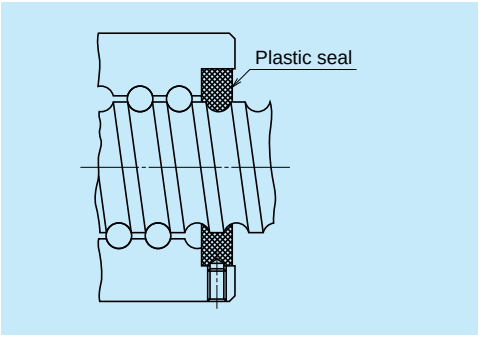

Fig. 10.3 Plastic seal

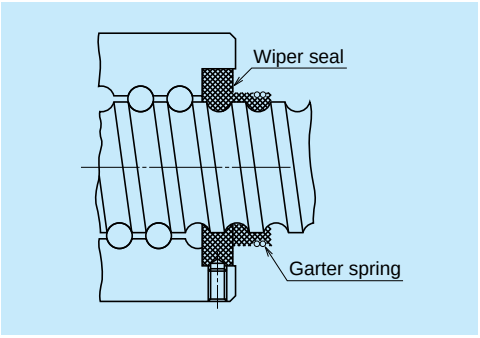

Fig. 10.4 Wiper seal

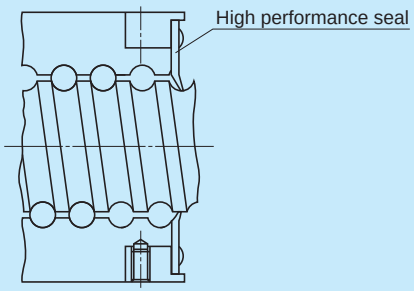

Fig. 10.5 High performance seal

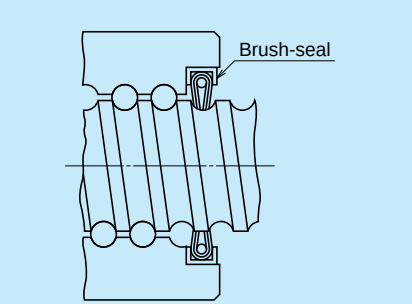

Fig. 10.6 Brush-seal for R Series

B-2-11 Rust Prevention and Surface Treatment of Ball Screws

(1) Stainless steel ball screw

Stainless products KA is standard ball screw and available in stock. Please consult NSK if you require custom made stainless steel ball screw.

(2) Types of surface treatment

The following are common types of treatment.

○Low temperature chrome plating
- Used to prevent corrosion and light reflection, and for cosmetic purpose.

○Fluoride low temperature chrome plating
- Fluoroplastic coating is provided following the low temperature chrome plating.
- Resistance to corrosion is higher than low temperature chrome plating.

○Hard chrome plating
- Has high hardness. Increases resistance to both wear and corrosion.

○Electroless nickel plating
- Creates a film of consistent thickness on complex shaped items.
- For corrosion prevention.

(3) Recommended surface treatment

Among the surface treatments mentioned above, we recommend "Low temperature chrome plating" and "fluoride low temperature chrome plating" for rust prevention because of the result of humidity chamber test for antirust characteristics.

However, never apply any organic solvent for degreasing because it has adverse effect on antirust characteristics.

Table 11.1 Surface treatment length

	Applicable length
Low temperature chrome plating	5 m or less
Fluoride low temperature chrome plating	4 m or less

Refer to 1.3 "Rust Prevention and Surface Treatment" (Page D5) for the results of humidity chamber test.

B-2-12 Ball Screw Specifications for Special Environment

B-2-12.1 Clean Environment

NSK manufactures NSK Clean Grease "LG2 and LGU" for NSK linear guides, ball screws, and Monocarriers which are used under normal temperature and pressure in a clean room.

LG2 and LGU grease are far more superior in stable torque characteristics than the vacuum grease which has been used as a countermeasure against dust generation. LG2 and LGU also have a sufficient durability and dust prevention capability.

Features of "LG2 and LGU"

① Generates less dust than vacuum grease and other general greases. Cleanliness is enhanced by simply switching the grease to LG2 or LGU.

② Has extremely low and stable torque characteristics. It is ideal for high speeds.

③ Unlike vacuum grease, LG2 and LGU have a nature similar to general grease. Its effect is long-lasting, and sufficiently durable. They greatly contribute to minimize the frequency of maintenance.

④ They have an equal capability in rust prevention as general grease, and also is reliable.

When using NSK linear guides, ball screws, or Monocarriers in a clean environment, request LG2 or LGU as a packed lubricant prior to delivery. NSK also makes bellows-tubes which contain 80 grams of LG2 or LGU. The tube is easy to use, and is ideal for maintenance. (Refer to Pages B455 and D20). Wash to remove adipose substances prior to use.

Refer to Page D8 for detailed nature, functions and characteristics of LG2 and LGU.

B-2-12.2 Measures for Use under Vacuum

NSK developed MoS_2 / WS_2 spattering and dry-filmed ball screws for equipment to be used in space. NSK also makes soft-metal film (gold and silver) ball screws to be used in a vacuum environment for semiconductor and liquid crystal display processing equipment.

Lubricants widely used for ball screws in a high vacuum are:
- Vacuum grease which uses base oil of low vapor pressure.
- Solid lubricants such as MoS_2, WS_2 used mainly for equipment in space.
- Solid lubricants by soft-metal such as gold, silver, or lead film.

When used for semiconductor and liquid crystal display making equipment, the oil of the vacuum grease evaporates and causes environmental contamination. Also, it hinders creation of a super high vacuum. MoS_2 in the state of solid lubricant generates a large volume of dust, and Mo is unsuitable for semiconductors and reformed surface. Therefore, it is not suitable for the processing machines for semiconductor and liquid crystal display.

NSK recommends solid lubricant ball screws with a long life. These ball screws are treated with special silver film by NSK's unique processing technology, and can be used in a super-high vacuum. However, because of a solid lubricant, the film may peal off and stick to surface of ball grooves repeatedly, causing the torque to rise momentarily on some occasions. The drive motor should be of large capacity to handle this drastic variation of torque.

Refer to Page D7 for test data of ball screws for vacuum.

For ball screw specifications for special environment, refer to Page D2.