

Axial mean effective load F_m

$$F_m = \sqrt[3]{\frac{1}{L} (Fe_1^3 \cdot L_1 + Fe_2^3 \cdot L_2 + Fe_3^3 \cdot L_3)}$$

$$= \sqrt[3]{\frac{1}{600} (196^3 \cdot 350 + 216^3 \cdot 125 + 176^3 \cdot 125)}$$

$$= 197 \text{ N}$$

$$L = \ell \times \left(\frac{C_a}{f_w \cdot F_m}\right)^3 \times 10^6$$

$$= 10 \times \left(\frac{7060}{1.2 \cdot 197}\right)^3 \times 10^6$$

$$= 2.66 \times 10^5 \text{ km}$$

3-2-2. Static safety factor; Divide the basic static load rating by the maximum axial load.

$$F_s = \frac{C_{0a}}{F_e} = \frac{C_{0a}}{F_{e2}} = \frac{12700}{216} = 58.7$$

C-1-5 Maintenance

C-1-5.1 Maintenance Method

- For standard Monocarrier, we pack grease in the slider, linear guides and ball screw.
- Monocarriers are equipped with NSK K1 Lubrication Unit as a standard feature, therefore, you may use it for 5 years or 10 000 km depending on your application, whichever comes first, without maintenance. However replenishment of preceded grease may extend its life substantially.
- The NSK K1 Lubrication Unit is ideal in environments where oily dust exists. However, the life may be shorter than described in Clause 2 above. In such a case, it requires increasing the frequency of replenishment.

3-3. Support unit

3-3-1. Fatigue life; Use the axial load $F_m = 197 \text{ N}$, that is the result of above calculation 3-2-1.

$$L = \ell \times \left(\frac{C_a}{f_w \cdot F_m}\right)^3 \times 10^6 = 10 \times \left(\frac{7100}{1.2 \times 197}\right)^3 \times 10^6$$

$$= 2.70 \times 10^5 \text{ km}$$

3-3-2. Static safety factor; Divide the limit load by the maximum axial load.

$$F_s = \frac{C_{0a}}{F_e} = \frac{C_{0a}}{F_{e2}} = \frac{3040}{216} = 14.0$$

3-4. Result

MCM08068H10D00	Linear guide	Ball screw	Support unit
Fatigue life	3.11 × 10 ⁶ km	2.66 × 10 ⁶ km	2.70 × 10 ⁶ km
Static safety factor	69.3	58.7	14.0

- A Nozzle for the NSK grease gun for MCH Monocarriers is available as an option. NSK reference number: NSK HGP NZ8

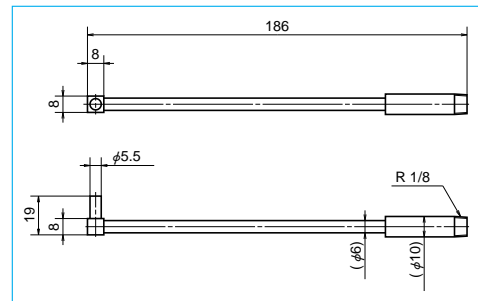


Fig. 5.1 NSK HGP NZ8

Precautions for handling

- Please consult with NSK when the motor is coupled to the ball screw using a pulley because there is a restriction on allowable load to the end of ball screw shaft.
- To extend high performance of NSK K1 lubrication unit, please observe the following.

- Temperature range Ambient temperature: 50°C
Max. instantaneous temperature: 80°C
- Use of chemicals Never leave a Monocarrier in close proximity of grease removing organic solvents such as hexane or thinner. Never immerse it in an antirust solvent that contains kerosene.

Note: Other oils, such as water-based and oil based cutting oil, and grease do not cause any problems.

C-1-5. 2 NSK K1™ Lubricant Unit

NSK K1 lubrication unit exhibits outstanding features, confirmed by abundant experimental data, along with proven performance of linear guides and ball screws that are equipped with NSK K1.

(1) High-Speed Durability Test of Linear Guides without Lubricant

Results of high-speed durability testing of a linear guide without lubricant are shown in Fig. 5.2. While the linear guide cannot be operated without lubricant for even short periods without damage, the installation of the NSK K1 permits the linear guide to run over 25 000 km without any problem.

Conditions	Test piece: LH30AN (Preload Z1)
	Speed: 3.3 m/s
	Stroke: 1800 mm
No lubricant	All grease removed
NSK K1	All grease removed + NSK K1

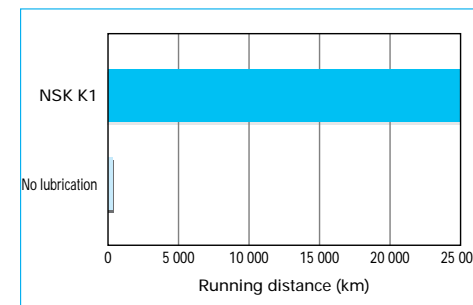


Fig. 5.2 Results of high-speed durability test of linear guides without lubricant

(2) High-Speed Durability Test of Ball Screws without Lubricant

Results of high-speed durability testing of ball screw without lubrication are shown in Fig. 5.3. While the ball screw cannot be operated without a lubricant at 8.5 km without damage, the installation of the NSK K1 permits the ball screw to run over 21 000 km without any problem.

Conditions	Test piece: BS2020 (ball screw)
	Shaft diameter: 20 mm
	Lead: 20 mm
	Load: none
	Speed: 1.3 m/s (4 000 min ⁻¹)
No lubricant	All grease removed
	NSK K1
	All grease removed + NSK K1

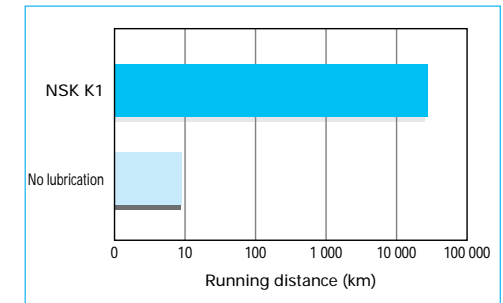


Fig. 5.3 Results of high-speed durability test of ball screws without lubricant

●NSK K1 Lubrication Units for food processing and medical devices are available.

For safety equipment of food processing and medical care, NSK provides the Monocarrier equipped with special NSK K1 Lubrication Unit that is made of materials approved by the FDA. Dimensions are the same as the standard NSK K1 Lubrication Unit, and special handling care is not required.

C-1-6 NSK Clean Grease LG2 Specification

● Features

This grease was developed by NSK to be exclusively used for linear guides and ball screws in clean rooms. Compared to the fluoride grease which are commonly used in clean rooms, LG2 has several advantages such as: higher in lubrication function, longer lubrication life, more stable torque (resistant to wear), and higher rust prevention.

In dust generation, LG2 is more than equal to fluoride grease in keeping dust volume low. Since the base oil is not a special oil but a mineral oil, LG2 can be handled in the same manner as general grease.

● Applications

LG2 is lubrication grease for rolling contact machine components such as linear guides and ball screws for processing equipment for semiconductors and LCD which require highly clean environment at normal pressure in normal temperatures. It cannot be used in a vacuum environment.

● Nature

Thickener	Lithium soap base
Base oil	Mineral oil + Synthetic hydrocarbon oil
Consistency	207
Dropping point	200°C
Volume of evaporation	1.40% (99°C, 22 hr)
Copper plate corrosion test	Satisfactory (Method B, 100°C, 24 hr)
Oil separation	0.8% (100°C, 24 hr)
Base oil kinematic Viscosity	30 mm ² /s (40°C)

C-1-7 Characteristics and Evaluation Method

C-1-7. 1 Positioning Accuracy

Perform successive positioning from the reference position in a specific direction. Measure the difference between the actual and desired travel distances for each point from the reference position. Repeat this measurement seven times to determine the average value. Measure such average value over the entire travel distance at the intervals specified for each model and take the maximum difference of the average values determined at respective positions as the measured value.

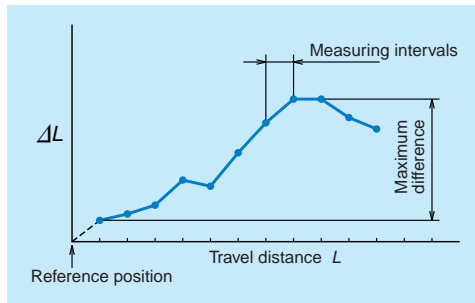


Fig. 7.1

C-1-7. 2 Repeatability

Repeat positioning at any point seven times from the same direction to measure the stopping position and determine one half of the maximum difference of readings. Repeat this measurement over the entire travel distance at the intervals specified for each model. Take the maximum difference of the determined values as the measured value. Express one half of the maximum difference with a plus-or-minus (±) sign.

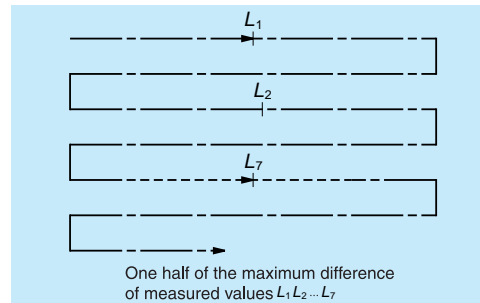


Fig. 7.2

C-1-7. 3 Running Parallelism (Vertical direction)

We specify the parallelism of slider to the datum bottom face of rail. An indicator is fixed on the slider making its stylus slightly touching on the rail bottom surface. The slider is moved in the axial direction for the checking. We define the total indicator reading as the running parallelism. During the checking, the rail is not fixed to the table base. Please be aware that, in general application, the rail is fixed to the machine base, and thus the wobbly rolling error will be added to the running parallelism.

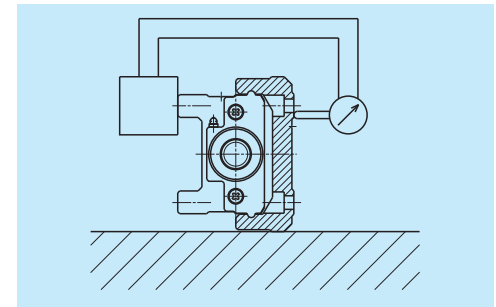


Fig. 7.3 Setting of indicator

C-1-8 Special Specifications

Please consult NSK if your requirement is not in the standard products.

(1) Surface Treatment

- Fluoride low temperature chrome plating

Note: Ball screw parts (including low temperature chrome plating.)

(2) Special Machining (Processing)

- ① Shaft end processing
 - Key way processing
 - One flat or two flats processing
- ② Pin hole processing
 - Slider
 - Rail

Note: Due to interference with the internal construction, the position of pin hole is limited. Please consult NSK for the pin position.

(3) Motor Bracket and Intermediate Plate for Motor Mounting

- We provide motor mounting brackets and intermediate plates that are not listed in the catalog.
- We assemble motor upon request, if the motor is provided in advance.

Note: Motion check of the motor is unavailable.

(4) Reversed Motor Mount

The reversed motor mount is available. Please consult NSK.

Notes: 1) We don't check motor running condition.

- 2) Please refer to the bottom of page C77 to 79 for the configuration of reversed motor mounting of the MCH series.

(5) Right and Left Turn Thread

Right and left turn ball screw is available. Please consult NSK for available leads.

(6) Ball-Screw-Less Specification (Only Linear Guide Part)

A ball-screw-less rail part with the same cross section of standard Monocarriers is available for a driven linear guide. It will lessen a height adjustment work compared with a construction with two standard Monocarriers.

Note: Height grinding adjustment of the two axes assembly is not available.