

# Toughcarrier™

High-rigidity and high-load-capacity single-axis actuator  
with rollers installed as rolling elements

Patent Pending



# 1 Toughcarrier™

## 1.1 Features

Greatly improved load capacity due to switching of rolling elements to rollers. Mounting dimensions are compatible with those of the MCH Series, allowing substitution.

### ● Light weight and compact design

Taking into account part composition and rigidity, the cross sections of the rail and slider are the same as MCH series.

### ● Superb rust-preventive ability

Low-temperature chrome plating comes standard.

### ● All-in-one structure

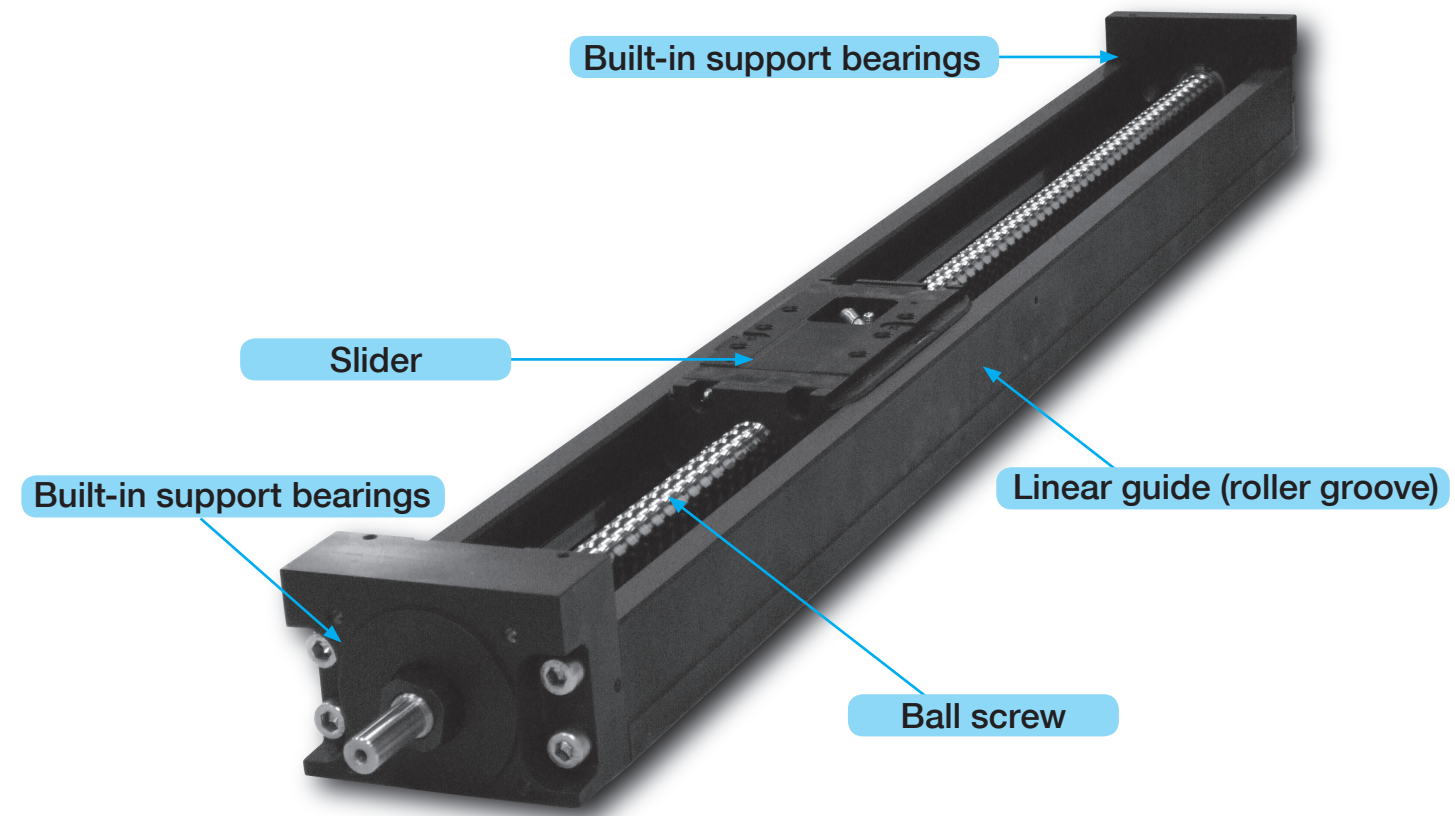
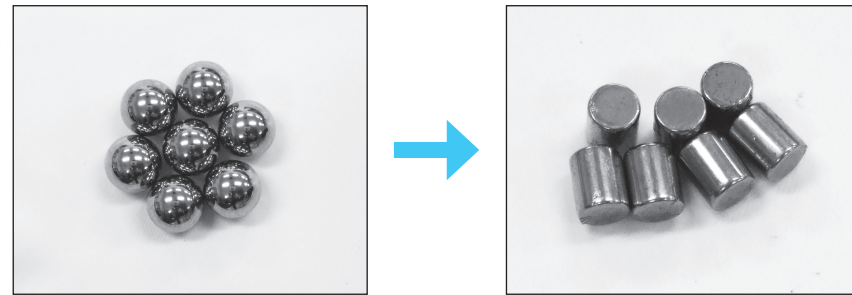
- 1) The all-in-one structure integrates a ball screw, a linear guide and a support unit into a single structure to significantly reduce design time.
- 2) The bottom and one side of the rail are datum surfaces to facilitate highly accurate installation. Models with pin holes are also available as standard.
- 3) Immediate operation after installation and run-in is possible due to pre-packed grease.
- 4) A wide selection of ball screw leads are available.

### ● Long-term maintenance-free operation

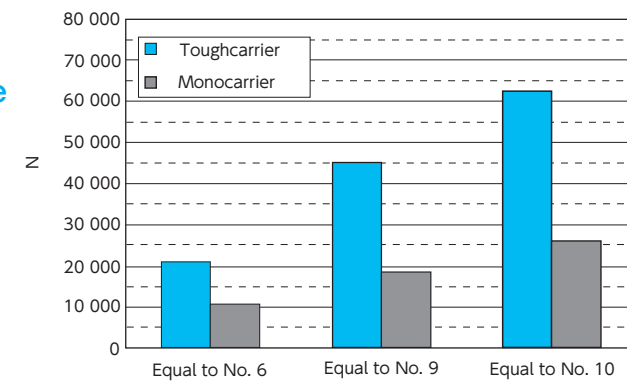
Use of NSK K1 lubrication unit and grease maintains smooth lubricating performance for long periods.

### ● Updated rolling elements

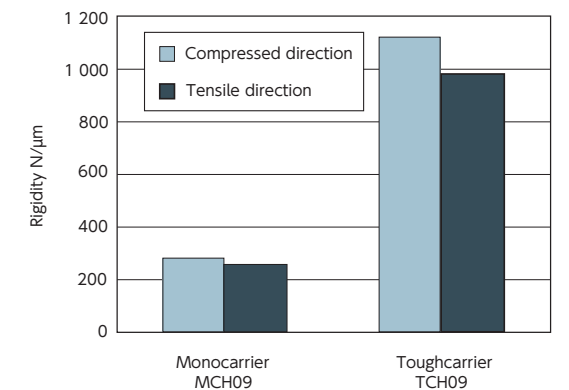
Rollers are installed as rolling elements for the first time anywhere.



### ● High rigidity, long life



Twice the dynamic load rating and nine-times longer life compared to Monocarrier



Four-times higher rigidity than Monocarrier

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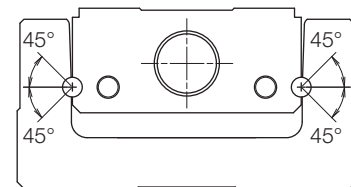
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## 1.2 Classification and Series

### Structure

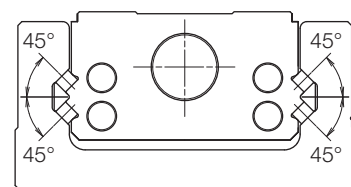
#### Rolling elements: Balls

MCH Series

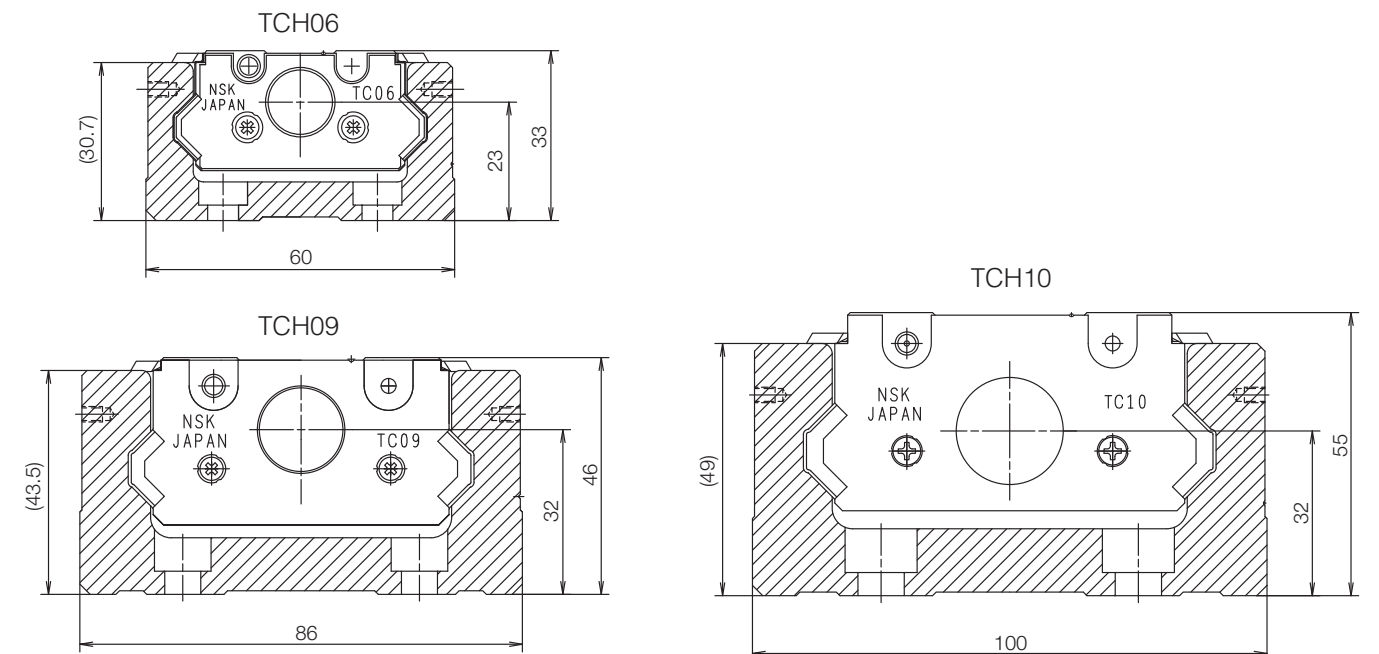


#### Rolling elements: Rollers

TCH Series



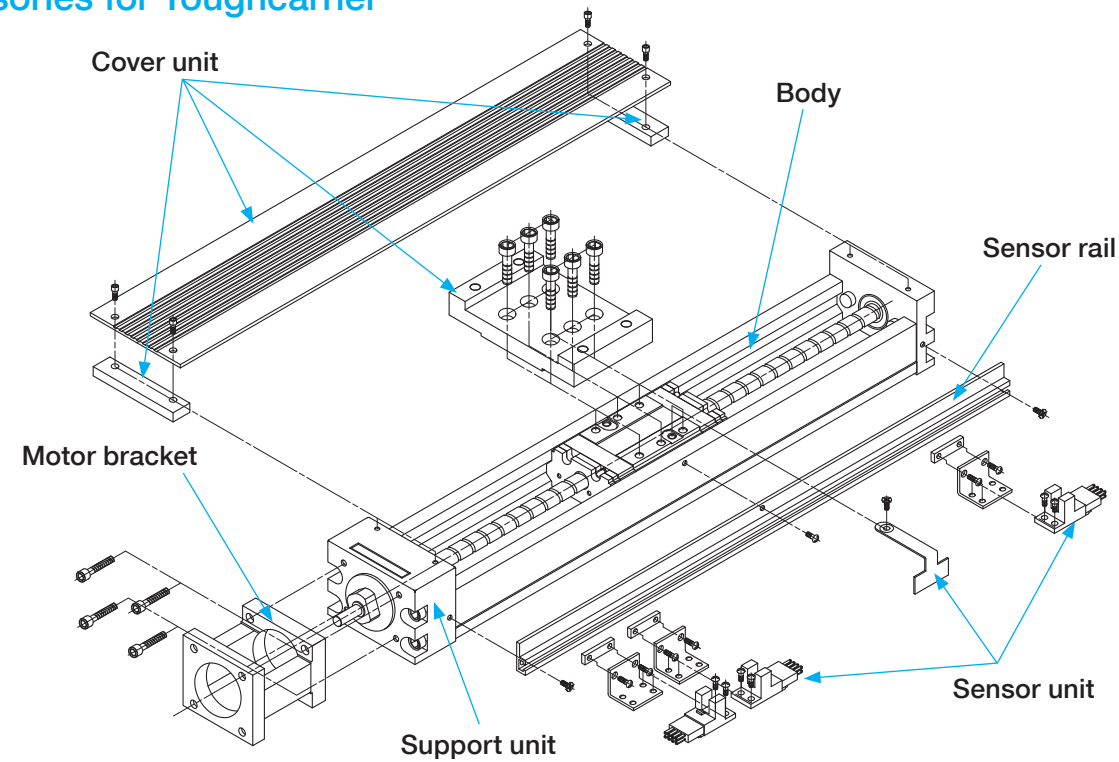
### Cross-sections of TCH Series





## 1.3 Accessories

### Accessories for Toughcarrier



Assembly Example of accessories

Sensor unit, cover unit, motor bracket and sensor rail are available as options for Toughcarrier. Contact NSK for other specifications other than those of NSK standard accessories.

#### 1. Sensor unit

- Photo sensor...Use of both OMRON EE-SX674 and EE-1001
  - Proximity switch...Use of OMRON E2S-W13, E2S-W14
- Available in a unit including sensor fitting clamps.

#### 2. Sensor rail

This rail holds the sensor. Please order the appropriate rail according to the stroke.

#### 3. Cover unit

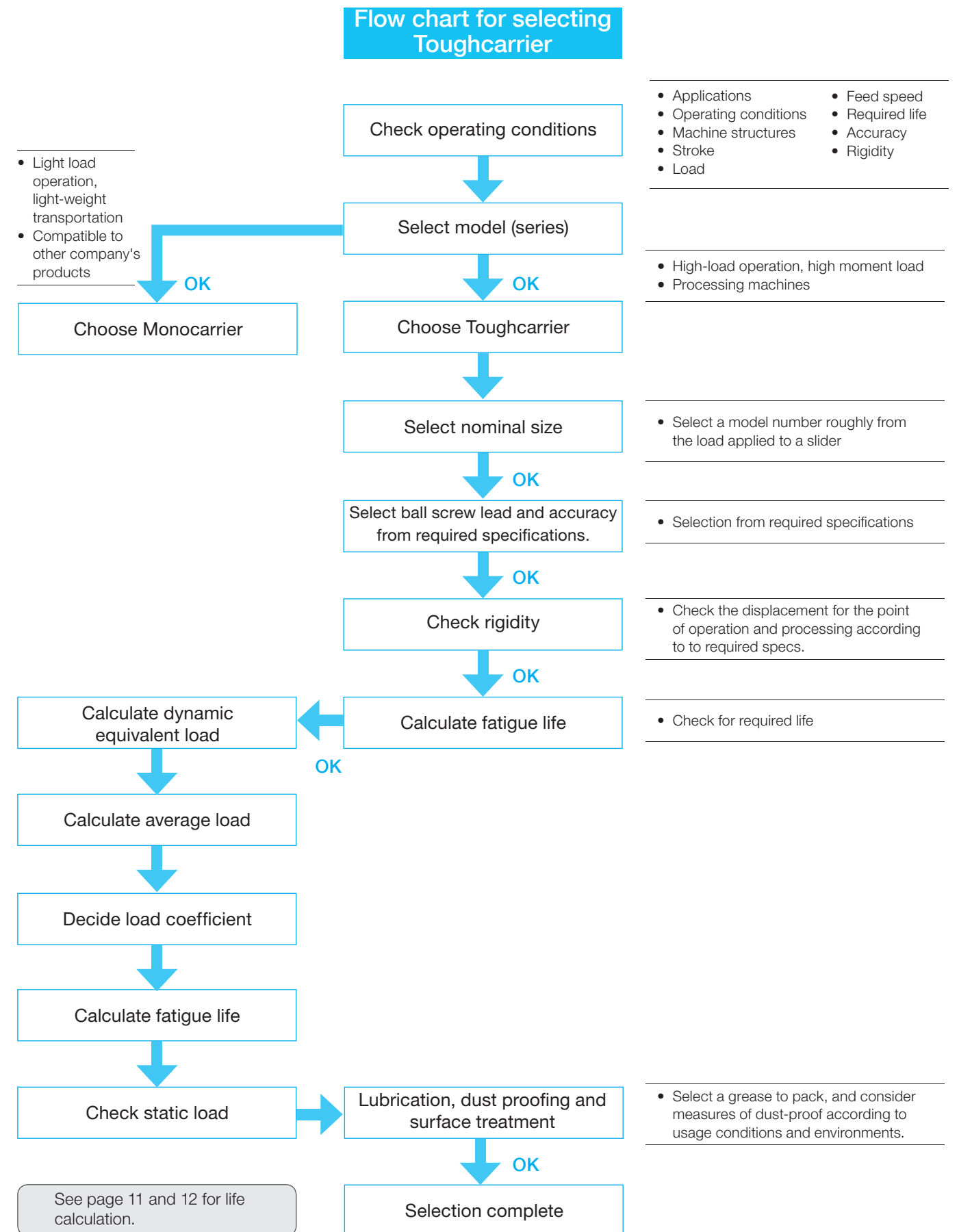
This unit consists of a top cover and spacer plate.

#### 4. Motor bracket

Brackets are available for a variety of models from different motor manufacturers. Please consult NSK when the mounting dimensions differ from your order.

## 1.4 Selection of Toughcarrier

### 1.4.1 Selection Procedures



### 1.4.2 Rail Length and Lead

#### ◆ Combinations of rail length and lead

##### ● TCH06

Slider type Lead (mm) Rail length (mm)	Standard slider						Short slider					
	Single slider			Double slider			Single slider			Double slider		
	5	10	20	5	10	20	5	10	20	5	10	20
150	✓	✓	✓				✓	✓				
200	✓	✓	✓				✓	✓				
300	✓	✓	✓	✓	✓		✓	✓		✓	✓	
400	✓	✓	✓	✓	✓		✓	✓		✓	✓	
500	✓	✓	✓	✓	✓		✓	✓		✓	✓	
600	✓	✓	✓		✓	✓	✓	✓			✓	

\* 20 mm lead for short sliders not available.

##### ● TCH09

Slider type Lead (mm) Rail length (mm)	Standard slider						Short slider					
	Single slider			Double slider			Single slider			Double slider		
	5	10	20	5	10	20	5	10	20	5	10	20
240	✓	✓	✓				✓	✓	✓			
340	✓	✓	✓				✓	✓	✓			
440	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	
540	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	
640	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	
740	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓
840	✓	✓	✓				✓	✓	✓			
940	✓	✓	✓		✓	✓	✓	✓	✓		✓	✓

##### ● TCH10

Slider type Lead (mm) Rail length (mm)	Standard slider				Short slider			
	Single slider		Double slider		Single slider		Double slider	
	10	20	10	20	10	20	10	20
280	✓	✓			✓	✓		
380	✓	✓			✓	✓		
480	✓	✓			✓	✓		
580	✓	✓	✓	✓	✓	✓	✓	✓
680	✓	✓	✓	✓	✓	✓	✓	✓
780	✓	✓	✓	✓	✓	✓	✓	✓
880	✓	✓	✓	✓	✓	✓	✓	✓
980	✓	✓	✓	✓	✓	✓	✓	✓
1 080	✓	✓		✓	✓	✓		✓
1 180	✓	✓		✓	✓	✓		✓
1 280	✓	✓		✓	✓	✓		✓
1 380	✓	✓		✓	✓	✓		✓

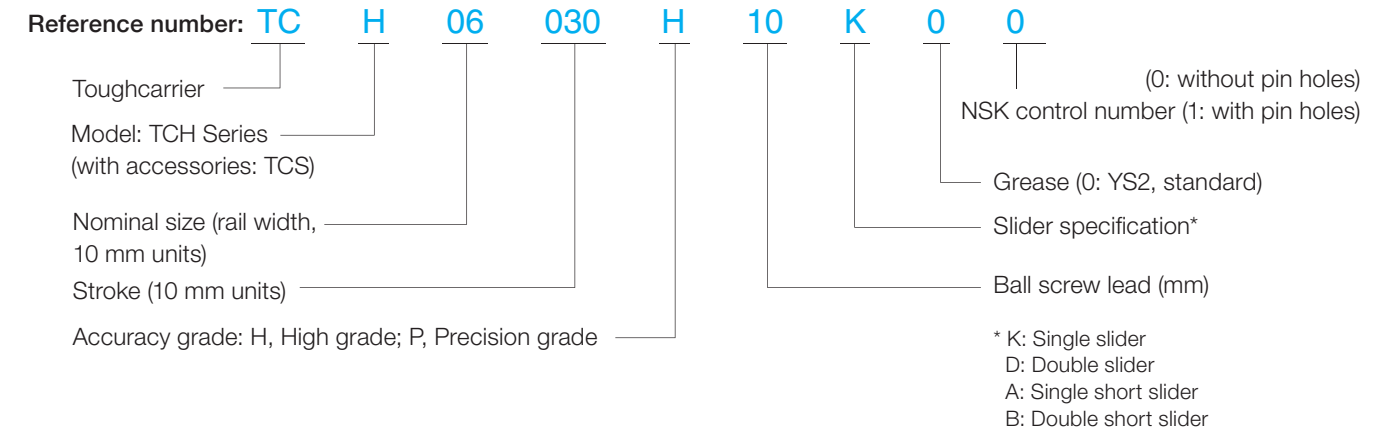
#### ◆ Availability

Model No.	Lead (mm)	Slider	Rail length (mm)
TCH06	5, 10, 20	Single	600
		Double	
TCH09	5, 10, 20	Single	940
		Double	
TCH10	10, 20	Single	1 380
		Double	

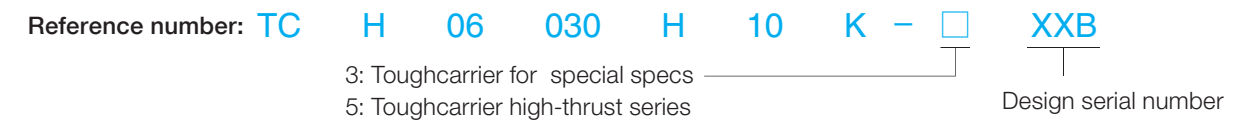
### 1.4.3 Reference Number Coding and Accuracy Grade

#### ● Reference number coding for TCH Series

##### Body

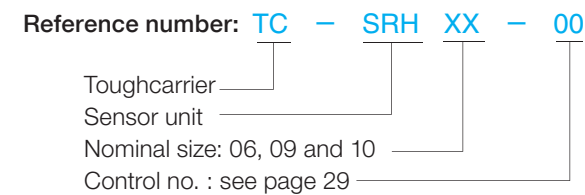


##### Special specifications

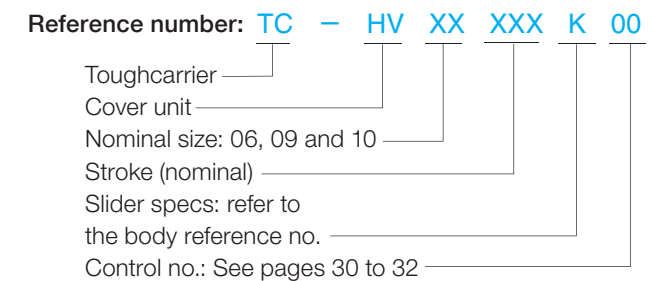


#### ● Reference number for accessories

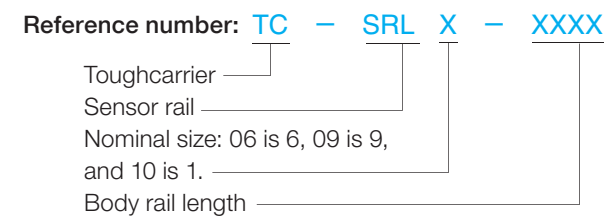
##### 1. Sensor unit



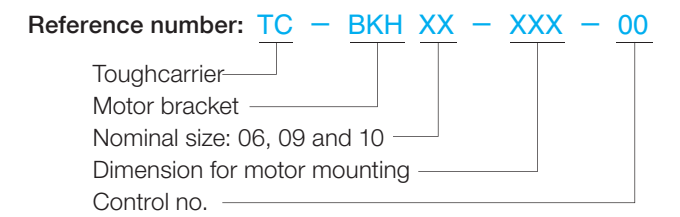
##### 3. Cover unit



##### 2. Sensor rail



##### 4. Motor bracket



#### ◆ Accuracy grade

Unit: μm

Grade	High grade (H grade)			Precision grade (P grade)			
	Stroke (mm)	Repeatability	Running parallelism (vertical)	Backlash	Repeatability	Positioning accuracy	Running parallelism (vertical)
~ 200	±10	20 or less	±3	3 or less	20	8	3 or less
~ 400					25	10	
~ 600					30	12	
~ 700					35	15	
~ 1 000					40	20	

High and precision grades are available for accuracy grade. Consult NSK for your requirements.



### 1.4.4 Maximum Speed

#### ● Maximum speed (standard slider)

Maximum speed of the Toughcarrier is determined by the critical speed of the ball screw shaft and the d · n value. Do not exceed the maximum speed in the table below.

	Stroke (nominal)	Ball screw lead (mm)	Body rail length L <sub>2</sub> (mm)	Maximum speed (mm/s)
TCH06 Single slider	50	5	150	250
	100		200	
	200		300	
	300		400	
	400		500	
	500		600	
	50	10	150	500
	100		200	
	200		300	
	300		400	
400	500			
500	600			
TCH06 Double slider	50	5	150	250
	100		200	
	230		400	
	330		500	
	130	10	300	500
	230		400	
	330		500	
	430		600	
TCH09 Single slider	100	5	240	250
	200		340	
	300		440	
	400		540	
	500		640	
	600		740	
	700		840	
	800		940	
	100	10	240	500
	200		340	
	300		440	
	400		540	
	500		640	
	600		740	
	700		840	
	800		940	
TCH09 Double slider	100	5	240	250
	200		340	
	300		440	
	400		540	
	500		640	
	600		740	
	700		840	
	800		940	
	100	10	240	500
	200		340	
	300		440	
	400		540	
	500		640	
	600		740	
	700		840	
	800		940	
TCH10 Single slider	100	20	280	1 000
	200		380	
	300		480	
	400		580	
	500		680	
	600		780	
	700		880	
	800		980	
	100	10	280	500
	200		380	
	300		480	
	400		580	
	500		680	
	600		780	
	700		880	
	800		980	
TCH10 Double slider	100	20	280	1 000
	200		380	
	300		480	
	400		580	
	500		680	
	600		780	
	700		880	
	800		980	
	100	10	280	500
	200		380	
	300		480	
	400		580	
	500		680	
	600		780	
	700		880	
	800		980	
TCH10 Single slider	100	5	240	250
	200		340	
	300		440	
	400		540	
	500		640	
	600		740	
	700		840	
	800		940	
	100	10	240	500
	200		340	
	300		440	
	400		540	
	500		640	
	600		740	
	700		840	
	800		940	
TCH10 Double slider	100	5	240	250
	200		340	
	300		440	
	400		540	
	500		640	
	600		740	
	700		840	
	800		940	
	100	10	240	500
	200		340	
	300		440	
	400		540	
	500		640	
	600		740	
	700		840	
	800		940	
TCH10 Single slider	160	10	280	500
	260		380	
	360		480	
	460		580	
	560		680	
	660		780	
	760		880	
	860		980	
	160	20	280	1 000
	260		380	
	360		480	
	460		580	
	560		680	
	660		780	
	760		880	
	860		980	
TCH10 Double slider	160	10	280	500
	260		380	
	360		480	
	460		580	
	560		680	
	660		780	
	760		880	
	860		980	
	160	20	280	1 000
	260		380	
	360		480	
	460		580	
	560		680	
	660		780	
	760		880	
	860		980	
TCH10 Single slider	160	5	240	250
	240		340	
	340		440	
	440		540	
	540		640	
	640		740	
	740		840	
	840		940	
	160	10	240	500
	240		340	
	340		440	
	440		540	
	540		640	
	640		740	
	740		840	
	840		940	
TCH10 Double slider	160	5	240	250
	240		340	
	340		440	
	440		540	
	540		640	
	640		740	
	740		840	
	840		940	
	160	10	240	500
	240		340	
	340		440	
	440		540	
	540		640	
	640		740	
	740		840	
	840		940	
TCH10 Single slider	160	10	280	500
	260		380	
	360		480	
	460		580	
	560		680	
	660		780	
	760		880	
	860		980	
	160	20	280	1 000
	260		380	
	360		480	
	460		580	
	560		680	
	660		780	
	760		880	
	860		980	
TCH10 Double slider	160	10	280	500
	260		380	
	360		480	
	460		580	
	560		680	
	660		780	
	760		880	
	860		980	
	160	20	280	1 000
	260		380	
	360		480	
	460		580	
	560		680	
	660		780	
	760		880	
	860		980	
TCH10 Single slider	160	5	240	250
	240		340	
	340		440	
	440		540	
	540		640	
	640		740	
	740		840	
	840		940	
	160	10	240	500
	240		340	
	340		440	
	440		540	
	540		640	
	640		740	
	740		840	
	840		940	
TCH10 Double slider	160	5	240	250
	240		340	
	340		440	
	440		540	
	540		640	
	640		740	
	740		840	
	840		940	
	160	10	240	500
	240		340	
	340		440	
	440		540	
	540		640	
	640		740	
	740		840	
	840		940	
TCH10 Single slider	160	10	280	500
	260		380	
	360		480	
	460		580	
	560		680	
	660		780	
	760		880	
	860		980	
	160	20	280	1 000
	260		380	
	360		480	
	460		580	
	560		680	
	660		780	
	760		880	
	860		980	
TCH10 Double slider	160	10	280	500
	260		380	
	360		480	
	460		580	
	560		680	
	660		780	
	760		880	
	860		980	
	160	20	280	1 000
	260		380	
	360		480	
	460		580	
	560		680	
	660		780	
	760		880	
	860		980	

Note: If you need to operate the Toughcarrier near the critical speed or in excess of the maximum speed in the table, please consult NSK.

#### ● Maximum speed (short slider)

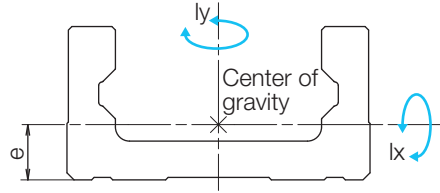
Maximum speed of the Toughcarrier is determined by the critical speed of the ball screw shaft and the d · n value. Do not exceed the maximum speed in the table below.

	Stroke (nominal)	Ball screw lead (mm)	Body rail length L <sub>2</sub> (mm)	Maximum speed (mm/s)
TCH06 Single slider	70	5	150	250
	120		200	
	220		300	
	320		400	
	420		500	
	520		600	
	70	10	150	500
	120		200	
	220		300	
	320		400	
420	500			
520	600			
TCH06 Double slider	70	5	150	250
	120		200	
	220		300	
	320		400	
	420		500	
	70	10	150	500
	120		200	
	220		300	
	320		400	
	420		500	
TCH09 Single slider	140	5	240	250
	240		340	
	340		440	
	440		540	
	540		640	
	640		740	
	740		840	
	840		940	
	140	10	240	500
	240		340	
	340		440	
	440		540	
	540		640	
	640		740	
	740		840	
	840		940	
TCH09 Double slider	140	5	240	250
	240		340	
	340		440	
	440		540	
	540		640	
	640		740	
	740		840	
	840		940	
	140	10	240	500
	240		340	
	340		440	
	440		540	
	540		640	
	640		740	
	740		840	
	840		940	
TCH10 Single slider	140	10	240	500
	240		340	
	340		440	
	440		540	
	540		640	
	640		740	
	740		840	
	840		940	
	140	20	240	1 000
	240		340	
	340		440	
	440		540	
	540		640	
	640		740	
	740		840	
	840		940	
TCH10 Double slider	140	10	240	500
	240		340	
	340		440	
	440		540	
	540		640	
	640		740	
	740		840	
	840		940	
	140	20	240	1 000
	240		340	
	340		440	
	440		540	
	540		640	
	640		740	
	740		840	
	840		940	

Note: If you need to operate the Toughcarrier near the critical speed or in excess of the maximum speed in the table, please consult NSK.

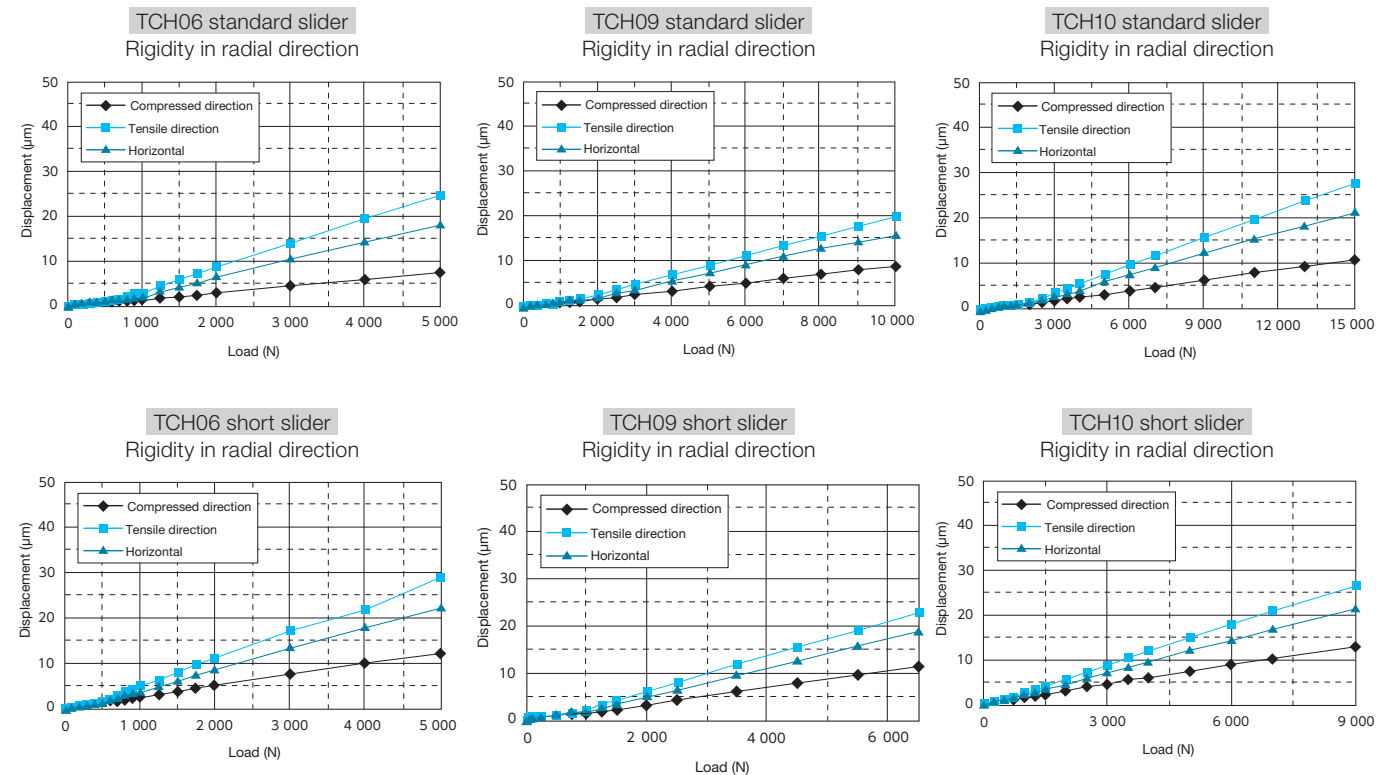
### 1.4.5 Rigidity

#### Rigidity of rail

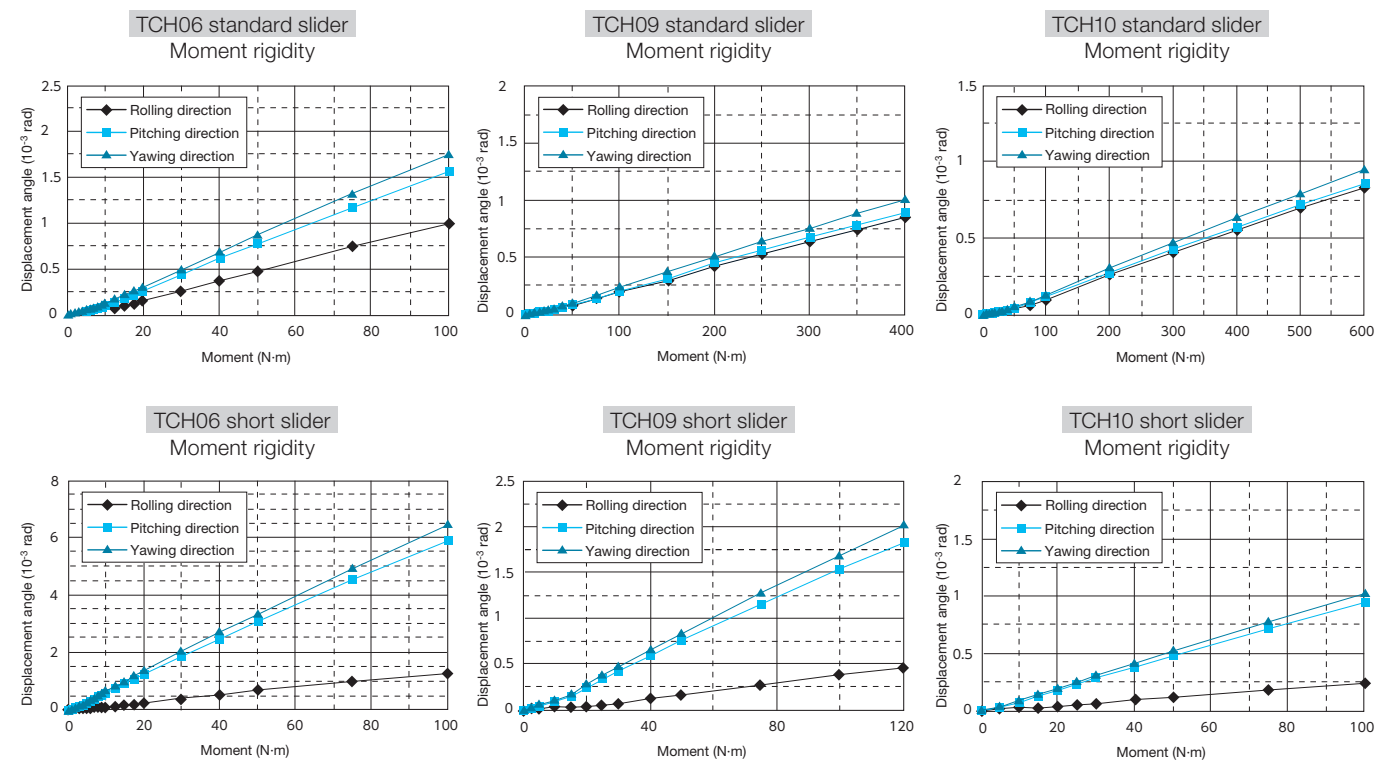


Model no.	Geometrical moment of inertia × 10 <sup>4</sup> (mm <sup>4</sup> )		Center of gravity (mm)	Mass (kg/100mm)
	lx	ly	e	w
TCH06	6.47	36.2	10.6	0.60
TCH09	28.4	162	15.7	1.32
TCH10	46.0	283	17.2	1.73

#### Rigidity in radial direction



#### Moment in radial direction



### 1.4.6 Load Rating

#### Road rating for TCH series Standard slider

Model no.	Lead ℓ (mm)	Shaft dia. d (mm)	Basic dynamic load rating (N)			Basic static load rating (N)		Support bearing limit load (N)
			Ball screw Ca	Linear guide C	Support bearings Ca	Ball screw Coa	Linear guide Co	
TCH06	5	φ12	3 760	20 900	6 600	6 310	45 000	2 700
	10		2 260			3 780		
	20		2 260			3 780		
TCH09	5	φ15	7 100	44 900	8 800	13 000	96 900	5 090
	10		7 060			12 700		
	20		4 560			7 750		
TCH10	10	φ20	10 900	62 400	9 600	21 700	132 000	5 670
	20		7 060			12 700		

#### Short slider

Model no.	Lead ℓ (mm)	Shaft dia. d (mm)	Basic dynamic load rating (N)			Basic static load rating (N)		Support bearing limit load (N)
			Ball screw Ca	Linear guide C	Support bearings Ca	Ball screw Coa	Linear guide Co	
TCH06	5	φ12	3 760	12 200	6 600	6 310	22 500	2 700
	10		2 260			3 780		
TCH09	5	φ15	7 100	27 900	8 800	13 000	52 500	5 090
	10		7 060			12 700		
	20		4 560			7 750		
TCH10	10	φ20	10 900	38 700	9 600	21 700	71 500	5 670
	20		7 060			12 700		

- Basic dynamic and static load ratings indicate values for one slider.
- Basic dynamic load rating of linear guide is a load that allows for a 50-km rating fatigue life and is a vertical and constant load on the ball mounting surface.
- Basic dynamic load rating of ball screw is load in the axial direction that allows 90% of ball screws of a group of the same Toughcarriers to rotate 1 million revolutions under the same condition without causing flaking by rolling contact fatigue.
- Basic dynamic load rating of support bearings is load that allows 1 million revolutions under the same condition.
- Basic static load rating is load that results in combined permanent deformations at contact points of rolling elements and rolling surfaces of respective parts at a diameter of 0.01%.

#### Basic static moment load of linear guide

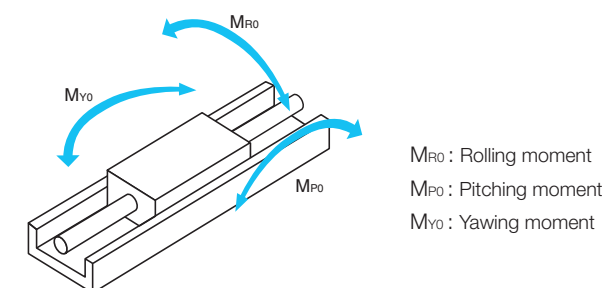
##### Standard slider

Model no.	Slider	Basic static moment load (N·m)		
		Rolling M <sub>RO</sub>	Pitching M <sub>PO</sub>	Yawing M <sub>YO</sub>
TCH06	Single	800	340	340
TCH09	Single	2 510	1 340	1 340
TCH10	Single	3 980	2 150	2 150

##### Short slider

Model no.	Slider	Basic static moment load (N·m)		
		Rolling M <sub>RO</sub>	Pitching M <sub>PO</sub>	Yawing M <sub>YO</sub>
TCH06	Single	400	85	85
TCH09	Single	1 350	390	390
TCH10	Single	2 150	630	630

- The basic static moment is the value when rolling contact pressure of balls exceeds 4 000 N/mm<sup>2</sup>.
- If you plan to apply extremely heavy loads, please consult NSK for estimation of fatigue life.



## 1.4.7 Estimation of Life Expectancy

### (1) Life of linear guide for Toughcarrier

Study the load to be applied to the linear guide of Toughcarrier (Fig. 1). The equivalent load (Fe) is determined by substituting the load for equation 1 (Eq. 2 or 2' for tightly coupled double slider type).

- For single slider
 
$$Fe = Y_H F_H + Y_V F_V + Y_R \mathcal{E}_R M_R + Y_P \mathcal{E}_P M_P + Y_Y \mathcal{E}_Y M_Y \dots 1)$$

- For double slider  
For double sliders, calculation of the load applied to each slider is required. Dynamic equivalent load is only for rolling moment. This is the same procedure as for linear guide selection where two sliders are installed in a rail. Check the mean load for each slider, and calculate shortest life becomes the life of linear guide.

When lateral direction (FH) and vertical direction (FV) loads are applied to the center of the coordinate in Fig. 1,

$$F_{HA} = \frac{F_H}{2} + \frac{M_Y}{\ell}, F_{VA} = \frac{F_V}{2} + \frac{M_P}{\ell}$$

$$F_{HB} = \frac{F_H}{2} - \frac{M_Y}{\ell}, F_{VB} = \frac{F_V}{2} - \frac{M_P}{\ell}$$

[Slider A]

$$Fe_A = Y_H \cdot F_{HA} + Y_V \cdot F_{VA} + Y_R \mathcal{E}_R \frac{M_R}{2} \dots 2)$$

$$= Y_H \left( \frac{F_H}{2} + \frac{M_Y}{\ell} \right) + Y_V \left( \frac{F_V}{2} + \frac{M_P}{\ell} \right) + Y_R \mathcal{E}_R \frac{M_R}{2}$$

[Slider B]

$$Fe_B = Y_H \cdot F_{HB} + Y_V \cdot F_{VB} + Y_R \mathcal{E}_R \frac{M_R}{2} \dots 2')$$

$$= Y_H \left( \frac{F_H}{2} - \frac{M_Y}{\ell} \right) + Y_V \left( \frac{F_V}{2} - \frac{M_P}{\ell} \right) + Y_R \mathcal{E}_R \frac{M_R}{2}$$

F<sub>H</sub>: Lateral direction load acting on the slider (N)  
F<sub>V</sub>: Vertical direction load acting on the slider (N)  
M<sub>R</sub>: Rolling moment acting on the slider  
M<sub>P</sub>: Pitching moment acting on the slider  
M<sub>Y</sub>: Yawing moment acting on the slider  
E<sub>R</sub>: Dynamic equivalent coefficient to rolling moment  
E<sub>P</sub>: Dynamic equivalent coefficient to pitching moment  
E<sub>Y</sub>: Dynamic equivalent coefficient to yawing moment  
ℓ: Sliders span

\*For dynamic equivalent coefficient, see table 1.  
Y<sub>H</sub>, Y<sub>V</sub>, Y<sub>R</sub>, Y<sub>P</sub>, Y<sub>Y</sub>: 1.0 or 0.5

At equations 1, 2 and 2' for obtaining equivalent load Fe, the maximum value of Y in the values for each equation is assumed to be 1.0. For others it is assumed to be 0.5.

Fig.1 Direction of load

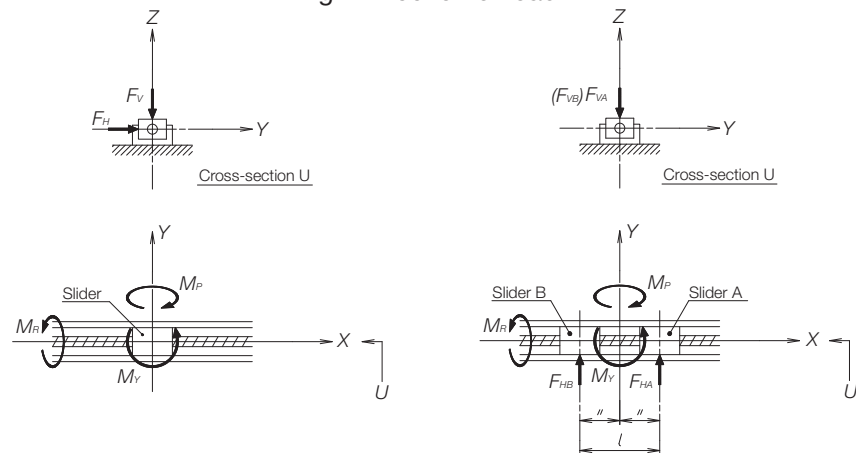
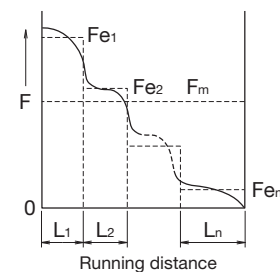


Fig.2 Stepped fluctuating load



If the loads acting on the slider fluctuate (in general, M<sub>P</sub> and M<sub>Y</sub> may fluctuate with the acceleration/deceleration of slider), the mean effective load is determined by Eq. 3.

Travelling distance under equivalent load Fe<sub>1</sub>: L<sub>1</sub>  
Travelling distance under equivalent load Fe<sub>2</sub>: L<sub>2</sub>  
.....  
Travelling distance under equivalent load Fe<sub>n</sub>: L<sub>n</sub>

Mean effective load Fm is calculated by the following equation.

$$Fm = \sqrt[10]{\frac{1}{L} (Fe_1^{10} \cdot L_1 + Fe_2^{10} \cdot L_2 + \dots + Fe_n^{10} \cdot L_n)} \dots 3)$$

F<sub>m</sub>: Mean effective load of fluctuating loads (N)  
L: Total travelling distance (mm)

The life of linear guide for Toughcarrier is determined by Eq. 4.

$$L = 50 \times \left( \frac{C}{f_w \cdot Fm} \right)^{\frac{10}{3}} \dots 4)$$

L: Life of linear guide (km)  
C: Basic dynamic load rating of linear guide (N)  
F<sub>m</sub>: Mean effective load acting on linear guide (N)  
f<sub>w</sub>: Load coefficient (see table 2)

When the estimated life does not meet the required life, the life of the linear guide is calculated again after following measures are taken,

- 1: Change from single slider type to double slider type.
- 2: Use a larger Toughcarrier.

### (2) Life of Ball Screw (Support Bearing)

The mean effective load is determined from the axial load. Axial direction mean effective load Fm

$$Fm = \sqrt[3]{\frac{1}{L} (Fe_1^3 \cdot L_1 + Fe_2^3 \cdot L_2 + \dots + Fe_n^3 \cdot L_n)} \dots 5)$$

ℓ: Ball screw lead (mm)  
L: Life of ball screw (km)  
Ca: Basic dynamic load rating of ball screw (N)  
F<sub>m</sub>: Mean effective load acting on ball screw (N)  
f<sub>w</sub>: Load factor (see table 2)

The life of ball screw is determined by eq. 6.

$$L = \ell \times \left( \frac{Ca}{f_w \cdot Fm} \right)^3 \times 10^6 \dots 6)$$

The life of a support bearing is calculated by Eq. 6.

If the life of ball screw/support bearing does not meet the required life, use a larger size Toughcarrier. After applying the calculations mentioned above, selection of the Toughcarrier is completed.

Table 1 Dynamic equivalent coefficient

	TCH06			TCH09			TCH10		
	Rolling	Pitching	Yawing	Rolling	Pitching	Yawing	Rolling	Pitching	Yawing
Standard slider	56	93	93	39	51	51	33	44	44
Short slider	56	186	186	39	95	95	33	80	80

Table 2 Value of load factor

Operating conditions	Load factor f <sub>w</sub>
At smooth operation with no mechanical shock	1.0 ~ 1.2
At normal operation	1.2 ~ 1.5
At operation with mechanical shock and vibration	1.5 ~ 3.0

\*When the bottom of rail is not fastened, the load factor is 1.5 or greater.

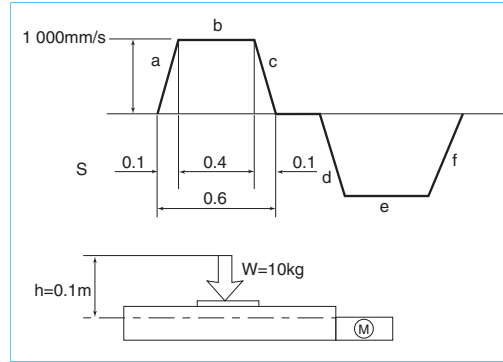


### 1.4.8 Example of Life Estimation

#### Example of life estimation for Toughcarrier Example 1

##### 1. Use condition

Stroke	500 mm
Maximum speed	1 000 mm/s
Load mass	W=10 kg
Acceleration	9.80 m/s <sup>2</sup>
Setting position	Horizontal
Operating profile	See figure to right



##### 2. Selection of model number (interim selection)

First, select a greater ball screw lead as the maximum speed is 1,000 mm/s. The interim selection is TCH06050H20K00, a single slider specification TCH06 that has 500 mm stroke, as the stroke is 500 mm.

##### 3. Calculation

###### 3-1 Linear guide

3-1-1 Fatigue life: Multiply the result of Eq. 1 by the dynamic equivalent coefficient (Table 1 single slider) to convert the load volume. From operation profile in the above figure, the acceleration is 10 m/s<sup>2</sup>.

i) Constant speed

$$Fe_1 = Y_V F_V = Y_V W_g = 1 \cdot 10 \cdot 9.8 = 98 \text{ N}$$

ii) Accelerating

$$Fe_2 = Y_V F_V + Y_P \varepsilon_P M_P = Y_V W_g + Y_P \varepsilon_P h W \alpha$$

$$= 0.5 \cdot 10 \cdot 9.8 + 1 \cdot 93 \cdot 0.1 \cdot 10 \cdot 10$$

$$= 979 \text{ N}$$

iii) Decelerating

$$Fe_3 = Y_V F_V + Y_P \varepsilon_P M_P = 0.5 \cdot 10 \cdot 9.8 + 1 \cdot 93 \cdot 0.1 \cdot 10 \cdot 10$$

$$= 979 \text{ N}$$

Mean effective load Fm

$$F_m = \sqrt[10]{\frac{1}{L} (Fe_1^{10} \cdot L_1 + Fe_2^{10} \cdot L_2 + Fe_3^{10} \cdot L_3)}$$

$$= \sqrt[10]{\frac{1}{500} (98^{10} \cdot 400 + 979^{10} \cdot 50 + 979^{10} \cdot 50)}$$

$$= 605 \text{ N}$$

$$L = 50 \times \left( \frac{C}{f_w \cdot F_m} \right)^{\frac{10}{3}}$$

$$= 50 \times \left( \frac{20\,900}{1.2 \cdot 605} \right)^{\frac{10}{3}}$$

$$= 3.65 \times 10^6 \text{ km}$$

3-1-2 Static safety factor: Divide the basic static load rating by the maximum load.

$$F_s = \frac{C_0}{F_e} = \frac{C_0}{F_{e2}} = \frac{45\,000}{979} = 45.9$$

##### 3-2 Ball screw

3-2-1 Fatigue life: Obtain the axial load of each stage of operation referring to the operation profile, and then calculate the mean load.

i) Constant load

$$Fe_1 = \mu \cdot W \cdot g = 0.01 \cdot 10 \cdot 9.8 = 0.98 \text{ N}$$

ii) Accelerating

$$Fe_2 = Fe_1 + W \cdot \alpha = 0.98 + 10 \cdot 10 = 101 \text{ N}$$

iii) Decelerating

$$Fe_3 = Fe_1 + W \cdot \alpha = 0.98 - 10 \cdot 10 = 99 \text{ N}$$

Axial mean effective load

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

$$= \sqrt[3]{\frac{1}{500} (0.98^3 \cdot 400 + 101^3 \cdot 50 + 99^3 \cdot 50)}$$

$$= 59 \text{ N}$$

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

$$= 20 \times \left( \frac{2\,260}{1.2 \cdot 59} \right)^3 \times 10^6$$

$$= 6.50 \times 10^6 \text{ km}$$

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

$$F_s = \frac{C_{0a}}{F_e} = \frac{C_{0a}}{F_{e2}} = \frac{3\,780}{101} = 37.4$$

##### 3-3 Support bearings

3-3-1 Fatigue life: Use the axial load Fm = 59 N that is the result of the calculation in 3-2-1, above.

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

$$= 20 \times \left( \frac{6\,600}{1.2 \cdot 59} \right)^3 \times 10^6$$

$$= 1.62 \times 10^7 \text{ km}$$

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

$$F_s = \frac{C_{0a}}{F_e} = \frac{C_{0a}}{F_{e2}} = \frac{2\,700}{101} = 26.7$$

##### 3-4 Result

TCH06050H20K00	Linear guide	Ball screw	Support bearings
Fatigue life	3.65×10 <sup>6</sup> km	6.50×10 <sup>6</sup> km	1.62×10 <sup>7</sup> km
Static safety factor	45.9	37.4	26.7

Example of life estimation

Example-2

1. Use condition

Stroke	600 mm
Maximum speed	500 mm/s
Load mass	W=20 kg
Acceleration	9.80 m/s <sup>2</sup>
Setting position	Vertical
Operating profile	See figure to right

2. Selection of model number (interim selection)

Select a 10 mm lead ball screw as the maximum speed is 500 mm/s. The interim selection is TCH09067H10D00 (double slider specification) from the stroke and the vertical setting position.

3. Calculation

3-1 Linear guide

3-1-1 Fatigue life: Multiply the result of Eq. 2 and 2' by the dynamic equivalent coefficient (Table 1 double slider) to convert the load volume. From operation profile in the above figure, the acceleration is 1 m/s<sup>2</sup>. The interim slider span is 0.13.

Under this condition,

$$F_H = 0, F_V = 0, M_R = 0$$

in Eq., and both sliders have the same load with different direction.

i) Constant speed

$$F_{e1} = Y_H \cdot \frac{M_Y}{\ell} + Y_V \cdot \frac{M_P}{\ell}$$

$$= 0.5 \cdot \frac{0.1 \cdot 20 \cdot 9.8}{0.13} + 1.0 \cdot \frac{0.15 \cdot 20 \cdot 9.8}{0.13}$$

$$= 302 \text{ N}$$

ii) Accelerating

$$F_{e2} = Y_H \cdot \frac{M_Y}{\ell} + Y_V \cdot \frac{M_P}{\ell}$$

$$= 0.5 \cdot \frac{0.1 \cdot 20 \cdot (9.8 + 1.0)}{0.13} + 1.0 \cdot \frac{0.15 \cdot 20 \cdot (9.8 + 1.0)}{0.13}$$

$$= 333 \text{ N}$$

iii) Decelerating

$$F_{e3} = Y_H \cdot \frac{M_Y}{\ell} + Y_V \cdot \frac{M_P}{\ell}$$

$$= 0.5 \cdot \frac{0.1 \cdot 20 \cdot (9.8 - 1.0)}{0.13} + 1.0 \cdot \frac{0.15 \cdot 20 \cdot (9.8 - 1.0)}{0.13}$$

$$= 271 \text{ N}$$

Mean effective load Fm

$$F_m = \sqrt[10]{\frac{1}{L} (F_{e1}^{10} \cdot L_1 + F_{e2}^{10} \cdot L_2 + F_{e3}^{10} \cdot L_3)}$$

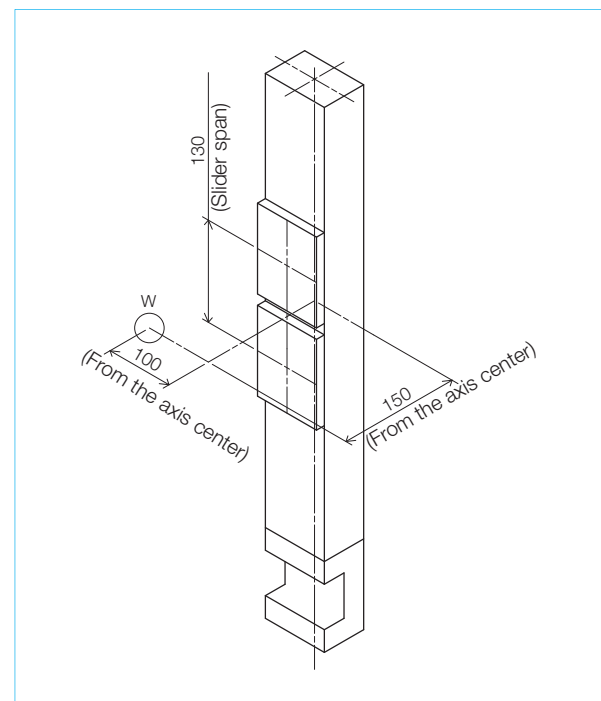
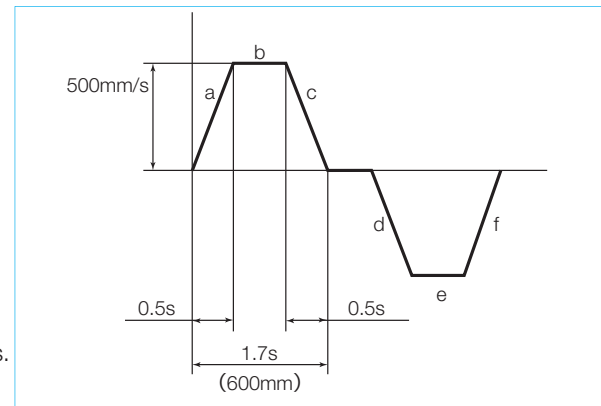
$$= \sqrt[10]{\frac{1}{600} (302^{10} \cdot 350 + 333^{10} \cdot 125 + 271^{10} \cdot 125)}$$

$$= 304 \text{ N}$$

$$L = 50 \times \left( \frac{C}{f_w \cdot F_m} \right)^3$$

$$= 50 \times \left( \frac{44\,900}{1.2 \cdot 304} \right)^3$$

$$= 4.63 \times 10^8 \text{ km}$$



3-1-2 Static safety factor: Divide the basic static load rating by the maximum load.

$$F_s = \frac{C_0}{F_e} = \frac{C_0}{F_{e2}} = \frac{96\,900}{333} = 290$$

3-2 Ball screw

3-2-1 Fatigue life: Obtain the axial load of each stage of operation referring to the operation profile, and then calculate the mean load.

i) Constant speed

$$F_{e1} = W \cdot g = 20 \cdot 9.8 = 196 \text{ N}$$

ii) Accelerating

$$F_{e2} = F_{e1} + W \cdot \alpha = 196 + 20 \cdot 1.0 = 216 \text{ N}$$

iii) Decelerating

$$F_{e3} = F_{e1} - W \cdot \alpha = 196 - 20 \cdot 1.0 = 176 \text{ N}$$

Axial mean effective load Fm

$$F_m = \sqrt[3]{\frac{1}{L} (F_{e1}^3 \cdot L_1 + F_{e2}^3 \cdot L_2 + F_{e3}^3 \cdot L_3)}$$

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

$$= 197 \text{ N}$$

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

$$= 10 \times \left( \frac{7\,060}{1.2 \cdot 197} \right)^3 \times 10^6$$

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

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

$$F_s = \frac{C_{0a}}{F_e} = \frac{C_{0a}}{F_{e2}} = \frac{12\,700}{216} = 58.7$$

3-3 Support bearings

3-3-1 Fatigue life: Use the axial load Fm = 197 N that is the result of the calculation in 3-2-1, above.

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

$$= 10 \times \left( \frac{8\,800}{1.2 \cdot 197} \right)^3 \times 10^6$$

$$= 5.15 \times 10^5 \text{ km}$$

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

$$F_s = \frac{C_{0a}}{F_e} = \frac{C_{0a}}{F_{e2}} = \frac{5\,090}{216} = 23.5$$

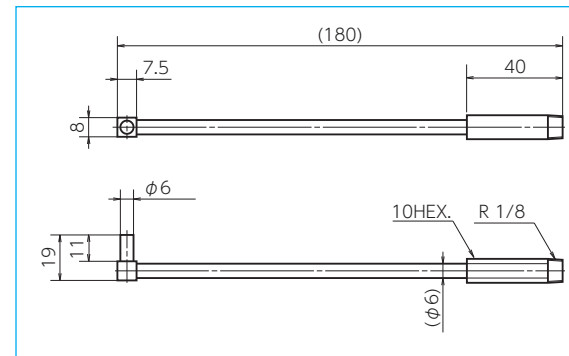
3-4 Result

TCH09067H10D00	Linear guide	Ball screw	Support bearings
Fatigue life	4.63×10 <sup>8</sup> km	2.66×10 <sup>5</sup> km	5.15×10 <sup>5</sup> km
Static safety factor	290	58.7	23.5

## 1.5 Maintenance

### 1.5.1 Maintenance Method

1. With standard Toughcarrier, grease is packed in the linear guides, ball screw and support bearings.
2. Toughcarriers are equipped with NSK K1 Lubrication Unit as a standard feature, allowing maintenance-free use for 5 years or 10,000 km depending on the application, whichever comes first. Replenishing the preceded grease may extend the product life even further.
3. The NSK K1 Lubrication Unit is ideal in dusty environments. However, the life may be shorter than described in 2, above, in such environments. In such a case, the frequency of replenishment must be increased.
4. A Nozzle for the NSK grease pump for MCH Monocarriers, which is also usable with the TCH series, is available as an option.



Dedicated nozzle for MCH

#### Precautions for handling

1. Please consult with NSK when the motor is coupled to a ball screw using a pulley because there is a restriction on allowable load to the end of ball screw shaft.
  2. To extend high performance of NSK K1 Lubrication Unit, please observe the following.
    1. Temperature range: Ambient temperature: 50 °C (Max. instantaneous temperature: 80 °C)
    2. 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.

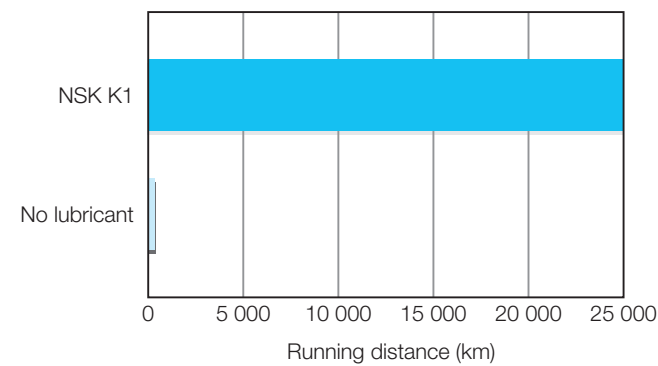
### 1.5.2 NSK K1 Lubrication Unit

NSK K1 Lubrication Unit exhibits outstanding features, confirmed by abundant experimental data as well as the proven performance of linear guides and ball screws 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 the figure below. While the linear guide cannot be operated without lubricant for even short periods without damage, installation of the NSK K1 permits the linear guide to run over 25 000 km without problem.

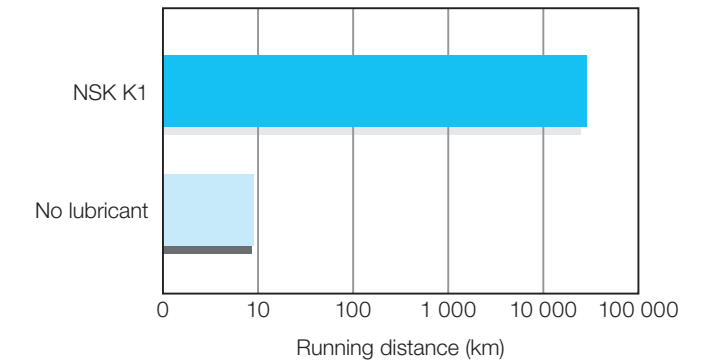
Conditions	Test piece: LH30AN (preload Z1)
	Speed: 3.3 m/s Stroke: 1 800 mm
No lubricant	All grease removed
NSK K1	All grease removed + NSK K1



#### (2) High-speed durability test of ball screws without lubricant

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

Conditions	Test piece: BS2020 (Ball screw)
	Shaft dia. : 20 mm
	Lead : 20 mm
	Load : none
	Speed: 1.3 m/s(4 000 min <sup>-1</sup> ) Stroke: 600 mm
No lubricant	All grease removed
NSK K1	All grease removed + NSK K1



#### ● NSK K1 Lubrication Unit for Food Processing and Medical Devices also available.

For safe use of equipment for food processing and medical care, NSK provides a Toughcarrier 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.

## 1.6 NSK Clean Grease LG2 Specifications

#### ◆ 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 commonly used in clean rooms, LG2 has several advantages such as higher 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, rather 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 environments at normal pressure in normal temperatures. It cannot be used in a vacuum environment.

#### ◆ Aspects

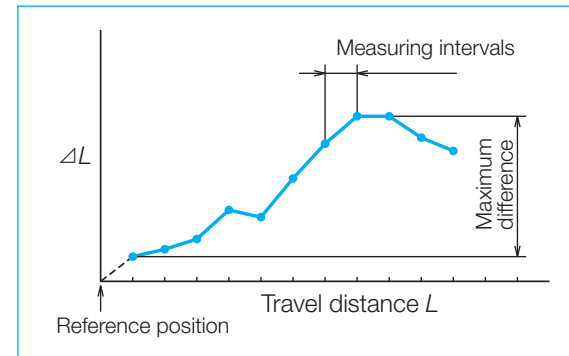
Thickener	Lithium soap base
Lithium soap base	Mineral oil + Synthetic hydrocarbon oil
Consistency	199
Dropping point	201 °C
Volume of evaporation	1.40% (99 °C, 22hr)
Copper plate corrosion test	Satisfactory (Method B, 100 °C, 24hr)
Oil separation	0.8% (100 °C, 24hr)
Base oil kinematic viscosity	32 mm <sup>2</sup> /s (40 °C)



## 1.7 Characteristics and Evaluation Method

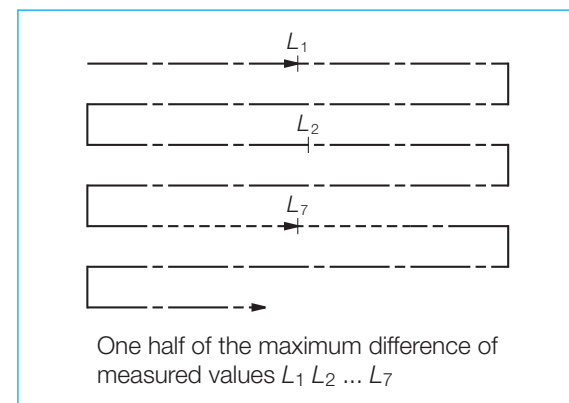
### 1.7.1 Positioning Accuracy

Successive positioning is performed from the reference position in a specific direction. The difference between the actual and desired travel distances from the reference position is measured for each point. This measurement is repeated seven times to determine the average value. Such average value measurements are made over the entire travel distance at the intervals specified for each model, and the maximum difference of the average values determined at the respective positions is taken as the measured value.



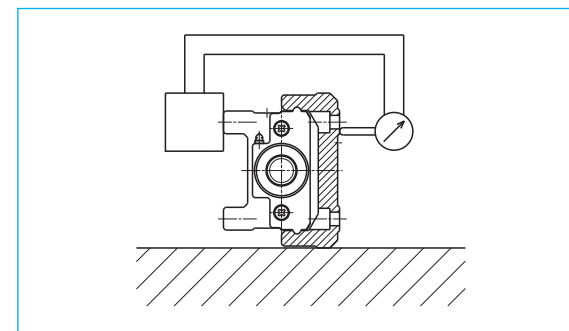
### 1.7.2 Repeatability

Positioning is repeated seven times at any point from the same direction to measure the stopping position and determine one half of the maximum difference of readings. These measurement are made over the entire travel distance at the intervals specified for each model. The maximum difference of the determined values is taken as the measured value. One half of the maximum difference is expressed with a plus or minus ( $\pm$ ) sign.



### 1.7.3 Running Parallelism (Vertical direction)

Running parallelism is expressed as parallelism of the slider to the bottom surface of the rail. An indicator is fixed to the axial slider, with its stylus slightly touching the rail bottom surface. The slider is moved in the axial direction for checking. The total indicator reading is defined as the running parallelism. During the checking, the rail is not fixed to the table base. Please be aware that, in general applications, the rail is fixed to the machine base. Wobbly rolling error will thus be added to the running parallelism.



Setting of indicator

## 1.8 Reliability

### Results of yawing load resistance test

Conditions	Specimen	: TCH09 High grade
	Speed	: 500 mm/sec(3 000 min <sup>-1</sup> )
	Stroke	: 190 mm
No lubricant	Yawing load	: 320 N·m 25% of static moment ratings
	Calculated life	: 1 Lh or longer
	Running distance	: 1 575 km
	No problems on rolling surfaces	

### Views of slider rolling surfaces

Datum top surface	
Datum bottom surface	
Opposite to datum top surface	
Opposite to datum bottom surface	

## 1.9 Special Specifications

### Special specifications for Toughcarrier

Special specifications are also available. For details of the following specifications, consult NSK.

#### (1) Surface treatment

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

#### (2) Special Machining (Processing)

- Shaft end processing
    - Key way processing
    - One flat or two flats processing
  - Pin hole processing
- NSK Standard specification is available. If requiring other specifications, consult NSK.

#### (3) Motor Bracket

- For motor brackets that are not listed in the catalog, please consult NSK.
  - We assemble motor upon request if the motor is provided in advance.
- Note: Operation check of the motor is unavailable.

#### (4) Reversed Motor Mount

A reversed motor mount is available. Please consult NSK.  
Note: Operation check of the motor is unavailable.

For other specifications not listed above, please consult NSK.

## 1.10 Sensor Specifications

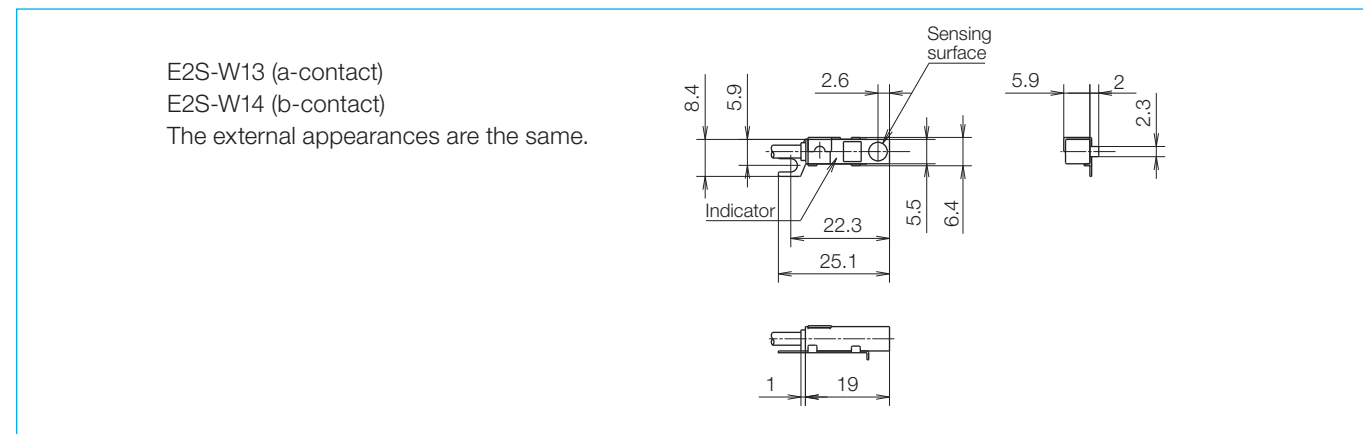
### 1.10.1 Proximity Switch

◆ OMRON E2S-W13 and E2S-W14 used

	E2S-W13 type	E2S-W14 type
Sensing surface	Top surface	
Sensing distance	1.6 mm ± 15%	
Differential travel	0 ~ 1.2 mm	
Differential travel	Up to 10% of sensing distance	
Detectable object type	Ferrous metal	
Standard sensed object	Iron, 12×12×1 mm	
Response frequency	1 kHz min	
Power supply voltage (operating voltage range)	12 to 24 VDC; ripple (p-p), 10% max. (10 to 30 VDC)	
Current consumption	13 mA max. at 24 VDC with no load	
Control output switching capacity	NPN open collector output, 50mA max. (30 VDC max.)	
Residual voltage	1.0 V max. at a load current of 50 mA and a cable length of 1 m	
Indicator	Operation indicator (orange)	
Operating status (at sensed object approach)	Normally open (a-contact)	Normally-closed (b-contact)
Wire lead length	1 000 mm	

Note 1) Be sure to connect sensors correctly.  
2) Please contact NSK for PNP output type.

Operation mode	Output type	Type	Time chart	Output circuit
NO	NPN	E2S-W13 type	Target object: Yes (ON), No (OFF) Output transistor (load): ON (ON), OFF (OFF) Output transistor (orange): ON (ON), OFF (OFF)	<p>*Maximum load current: 50 mA</p>
		E2S-W14 type	Target object: Yes (ON), No (OFF) Output transistor (load): OFF (ON), OFF (OFF) Output transistor (orange): ON (ON), OFF (OFF)	



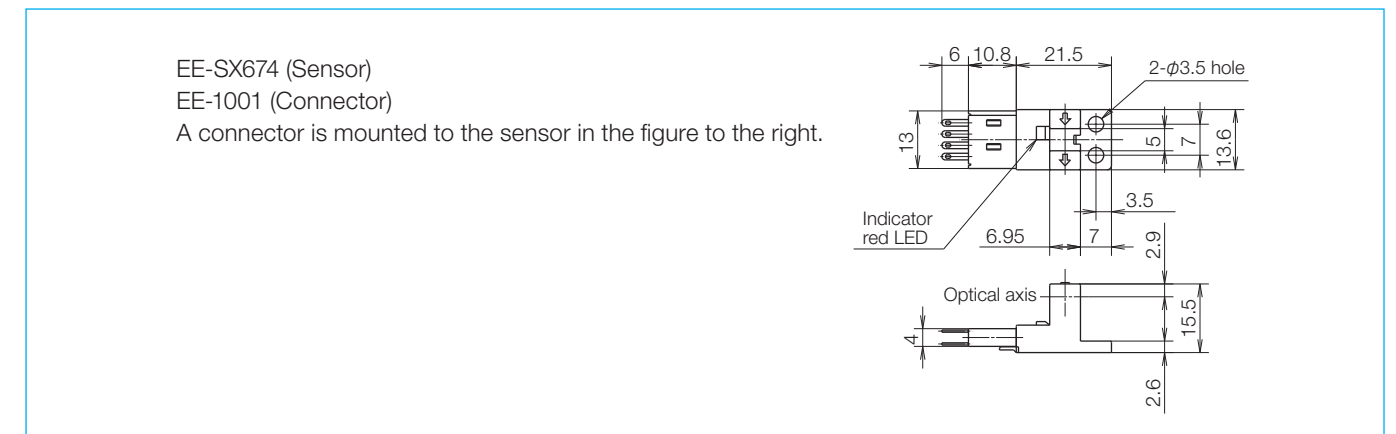
### 1.10.2 Photo Sensor

◆ Use of OMRON EE-SX674

	EE-SX674 type
Sensing distance	5 mm (groove width)
Standard sensed object	opaque 2×0.8 mm min.
Differential travel	0.025 mm
Light source	GaAs infrared LED with a peak wavelength of 940 nm
Indicator	On when light enters (red LED)
Supply voltage	5 to 24 VDC ±10%; ripple (p-p), 10% max.
Current consumption	35 mA max.
Control output	NPN open collector output models, at 5 to 24 VDC, 100 mA load current max.
Response frequency	1 kHz max. (3 kHz typ.)
Ambient illumination	Fluorescent light, 1,000 lx max.
Ambient temperature	-25 to 55 °C (-13 to 131 °F) when operating, -30 to 80 °C (-22 to 176 °F) for storage.
Ambient humidity	5 to 85% RH when operating, 5 to 95% RH when stored
Connecting method	EE-1001/1006 connectors, soldering terminals

Note 1) Be sure to connect sensors correctly.  
2) Please contact NSK for PNP output type.

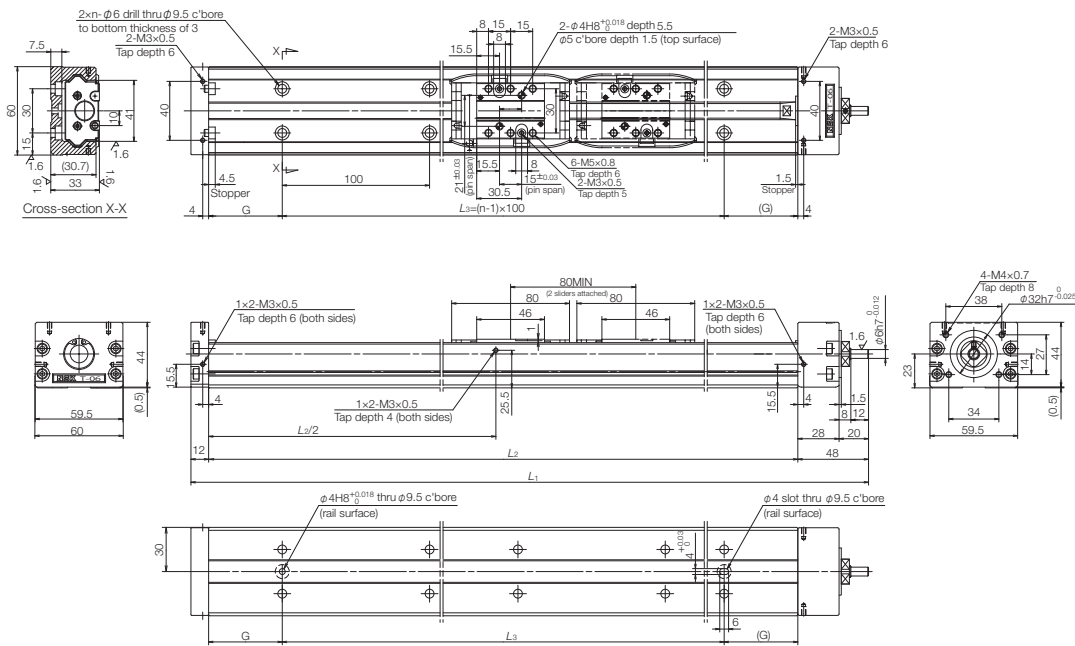
Type	Operation mode	Time chart	Connection terminal	Output circuit
EE-SX674 type	On when light enters	Light enters: ON Light interrupted: OFF Indicator (red): ON Output transistor: ON Load 1 (relay): Operates Load 2: H	When terminals between L and + are short circuited	<p>DC 5 to 24 V (Control output) 100 mA max.</p>
	On when light interrupted	Light enters: ON Light interrupted: OFF Indicator (red): OFF Output transistor: ON Load 1 (relay): Operates Load 2: H	When terminals between L and + are open circuited	



# 1.11 Dimensions

## 1.11.1 Dimension table for standard products

### ◆ TCH06 Standard Slider Specifications (with pin holes)

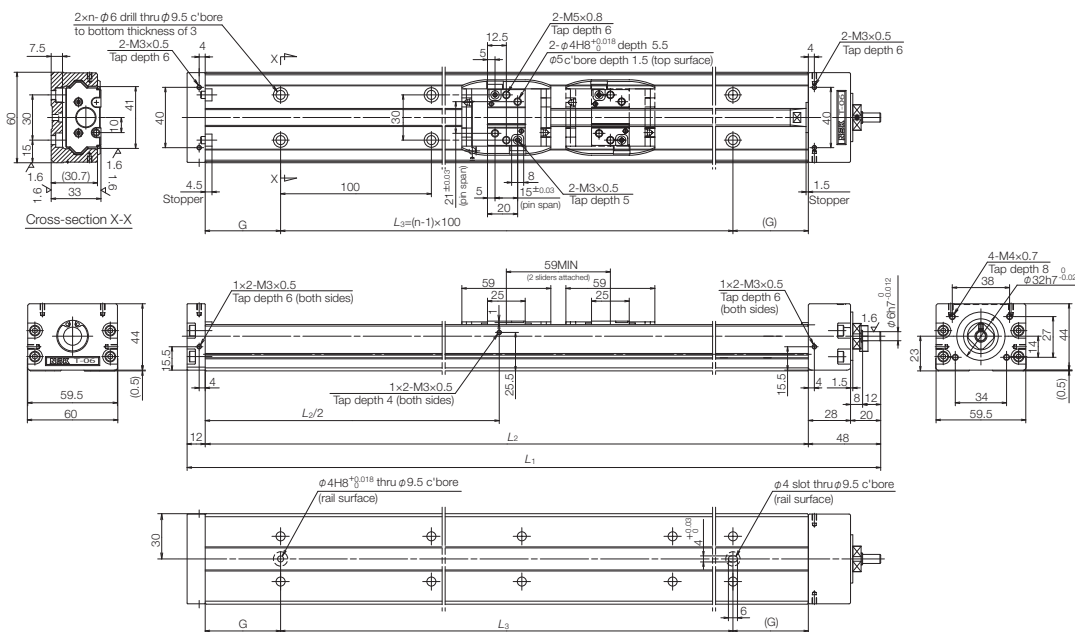


Toughcarrier dynamic torque specifications

Unit: N·cm

Model no.	Slider specifications	Ball screw lead (mm)	Accuracy grade	
			High grade	Precision grade
TCH06	Single standard slider	5	1.0 ~ 6.0	1.8 ~ 9.0
		10	1.1 ~ 7.2	2.0 ~ 10.6
		20	1.6 ~ 9.5	2.2 ~ 12.9
	Double standard sliders	5	1.0 ~ 7.2	2.0 ~ 10.1
		10	1.2 ~ 9.5	2.2 ~ 12.9
		20	1.8 ~ 14.1	2.8 ~ 17.5

### ◆ TCH06 Short Slider Specifications (with pin holes)



Toughcarrier dynamic torque specifications

Unit: N·cm

Model no.	Slider specifications	Ball screw lead (mm)	Accuracy grade	
			High grade	Precision grade
TCH06	Single short slider	5	0.8 ~ 5.9	1.8 ~ 8.9
		10	1.0 ~ 7.0	2.0 ~ 10.4
	Double short slider	5	1.0 ~ 7.0	2.0 ~ 10.0
		10	1.2 ~ 9.2	2.2 ~ 12.6

### TCH06 Standard Slider Specifications (Single)

Reference number	Nominal stroke (mm)	Stroke limit (mm)	Ball screw lead (mm)	Body length (mm)				No. of mounting holes n	Inertia $\times 10^{-6}$ (kg · m <sup>2</sup> )	Mass (kg)
				L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	G			
*TCH06005H05K00 (01)	50	64	5	210	150	100	25	2	2.94	2.2
*TCH06005H10K00 (01)			10							
*TCH06005H20K00 (01)			20							
*TCH06010H05K00 (01)	100	114	5	260	200	100	50	2	3.74	2.5
*TCH06010H10K00 (01)			10							
*TCH06010H20K00 (01)			20							
TCH06020H05K00 (01)	200	214	5	360	300	200	50	3	5.34	3.3
TCH06020H10K00 (01)			10							
TCH06020H20K00 (01)			20							
TCH06030H05K00 (01)	300	314	5	460	400	300	50	4	6.84	3.9
TCH06030H10K00 (01)			10							
TCH06030H20K00 (01)			20							
TCH06040H05K00 (01)	400	414	5	560	500	400	50	5	8.44	4.6
TCH06040H10K00 (01)			10							
TCH06040H20K00 (01)			20							
TCH06050H05K00 (01)	500	514	5	660	600	500	50	6	10.1	5.3
TCH06050H10K00 (01)			10							
TCH06050H20K00 (01)			20							

Items marked with \* are unavailable for upside-down operation.

### TCH06 Standard Slider Specifications (Double)

Reference number	Nominal stroke (mm)	Stroke limit (mm)	Ball screw lead (mm)	Body length (mm)				No. of mounting holes n	Inertia $\times 10^{-6}$ (kg · m <sup>2</sup> )	Mass (kg)
				L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	G			
TCH06013H05D00 (01)	130	134	5	360	300	200	50	3	5.47	3.6
TCH06013H10D00 (01)			10							
TCH06023H05D00 (01)	230	234	5	460	400	300	50	4	7.06	4.2
TCH06023H10D00 (01)			10							
TCH06033H05D00 (01)	330	334	5	560	500	400	50	5	8.64	4.9
TCH06033H10D00 (01)			10							
TCH06043H10D00 (01)	430	434	10	660	600	500	50	6	11.08	5.6
TCH06043H20D00 (01)			20							

### TCH06 Short Slider Specifications (Single)

Reference number	Nominal stroke (mm)	Stroke limit (mm)	Ball screw lead (mm)	Body length (mm)				No. of mounting holes n	Inertia $\times 10^{-6}$ (kg · m <sup>2</sup> )	Mass (kg)
				L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	G			
*TCH06007H05A00 (01)	70	85	5	210	150	100	25	2	2.87	2.1
*TCH06007H10A00 (01)			10							
*TCH06012H05A00 (01)	120	135	5	260	200	100	50	2	3.67	2.4
*TCH06012H10A00 (01)			10							
TCH06022H05A00 (01)	220	235	5	360	300	200	50	3	5.27	3.2
TCH06022H10A00 (01)			10							
TCH06032H05A00 (01)	320	335	5	460	400	300	50	4	6.77	3.8
TCH06032H10A00 (01)			10							
TCH06042H05A00 (01)	420	435	5	560	500	400	50	5	8.37	4.5
TCH06042H10A00 (01)			10							
TCH06052H05A00 (01)	520	535	5	660	600	500	50	6	9.97	5.2
TCH06052H10A00 (01)			10							

Items marked with \* are unavailable for upside-down operation.

### TCH06 Short Slider Specifications (Double)

Reference number	Nominal stroke (mm)	Stroke limit (mm)	Ball screw lead (mm)	Body length (mm)				No. of mounting holes n	Inertia $\times 10^{-6}$ (kg · m <sup>2</sup> )	Mass (kg)
				L <sub>1</sub>	L <sub>2</sub>	L <sub>3</sub>	G			
TCH06017H05B00 (01)	170	176	5	360	300	200	50	3	5.34	3.4
TCH06017H10B00 (01)			10							
TCH06027H05B00 (01)	270	276	5	460	400	300	50	4	6.93	4.0
TCH06027H10B00 (01)			10							
TCH06037H05B00 (01)	370	376	5	560	500	400	50	5	8.51	4.7
TCH06037H10B00 (01)			10							
TCH06047H10B00 (01)	470	476	10	660	600	500	50	6	10.57	5.4





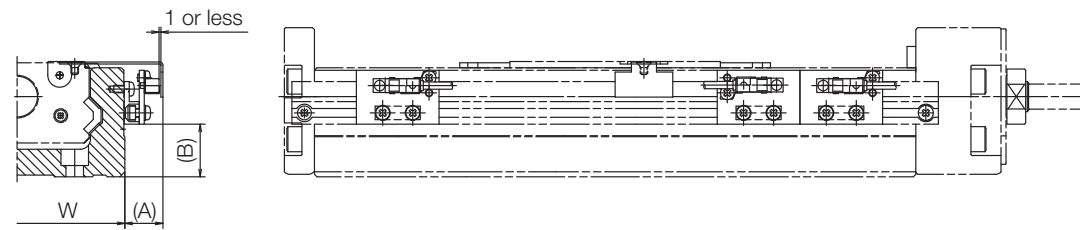


### 1.11.2 Accessories: Sensor Unit

Reference number TC – SRH □□ – 1□  
 Nominal size      Coding for model no.

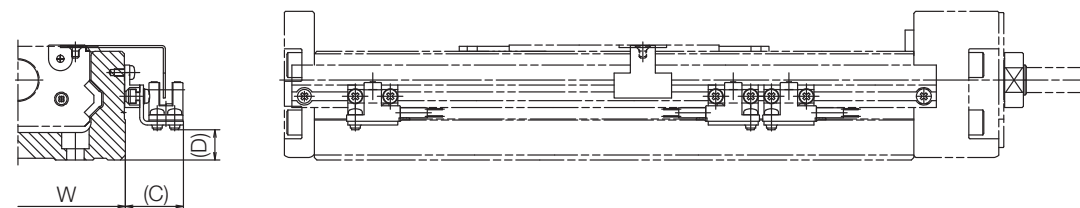
- 0: Proximity switch (3 b-contacts)
- 1: Proximity switch (3 a-contacts)
- 2: Proximity switch (1 a-contact, 2 b-contacts)
- 3: Photo sensor (3 sensors)

#### ◆ Proximity switch



Model no.	Reference number			Dimensions		
	A (mm)	B (mm)	Body width W (mm)			
TCH06	TC-SRH06-10	TC-SRH06-11	TC-SRH06-12	17	10	60
TCH09	TC-SRH09-10	TC-SRH09-11	TC-SRH09-12	16	21	86
TCH10	TC-SRH10-10	TC-SRH10-11	TC-SRH10-12	16	25	100
Quantity	Proximity switch (a-contact)	—	3	1	E2S-W13 (OMRON Corp.)	
	Proximity switch (b-contact)	3	—	2	E2S-W14 (OMRON Corp.)	

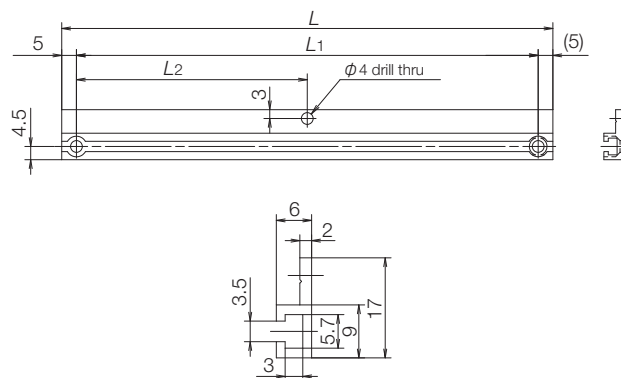
#### ◆ Photo sensor



Model no.	Reference number	Dimensions			Note
		C (mm)	D (mm)	Body width W (mm)	
TCH06	TC-SRH06-13	24	2	60	EE-SX674 (OMRON Corp.) 3 sets (EE-1001 connector included)
TCH09	TC-SRH09-13	24	12	86	
TCH10	TC-SRH10-13	24	16	100	

### 1.11.3 Accessories: Sensor Rail

Reference number TC – SRL □ – □□□□  
 Body rail length  
 Model no. 06→6  
 09→9  
 10→1

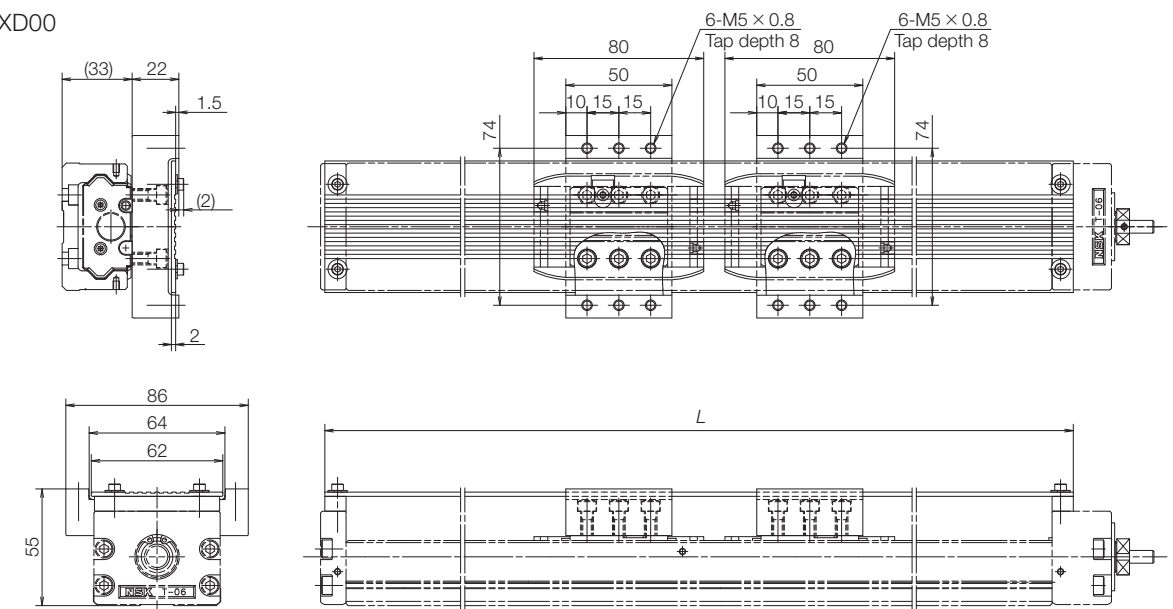


Model no.	Body rail length	Dimensions		
		L	L <sub>1</sub>	L <sub>2</sub>
TCH06	150	168	158	079
	200	218	208	104
	300	318	308	154
	400	418	408	204
	500	518	508	254
	600	618	608	304
TCH09	240	258	248	124
	340	358	348	174
	440	458	448	224
	540	558	548	274
	640	658	648	324
	740	758	748	374
TCH10	840	858	848	424
	940	958	948	474
	280	298	288	144
	380	398	388	194
	480	498	488	244
	580	598	588	294
	680	698	688	344
	780	798	788	394
	880	898	888	444
	980	998	988	494
	1 080	1 098	1 088	544
	1 180	1 198	1 188	594
1 280	1 298	1 288	644	
1 380	1 398	1 388	694	

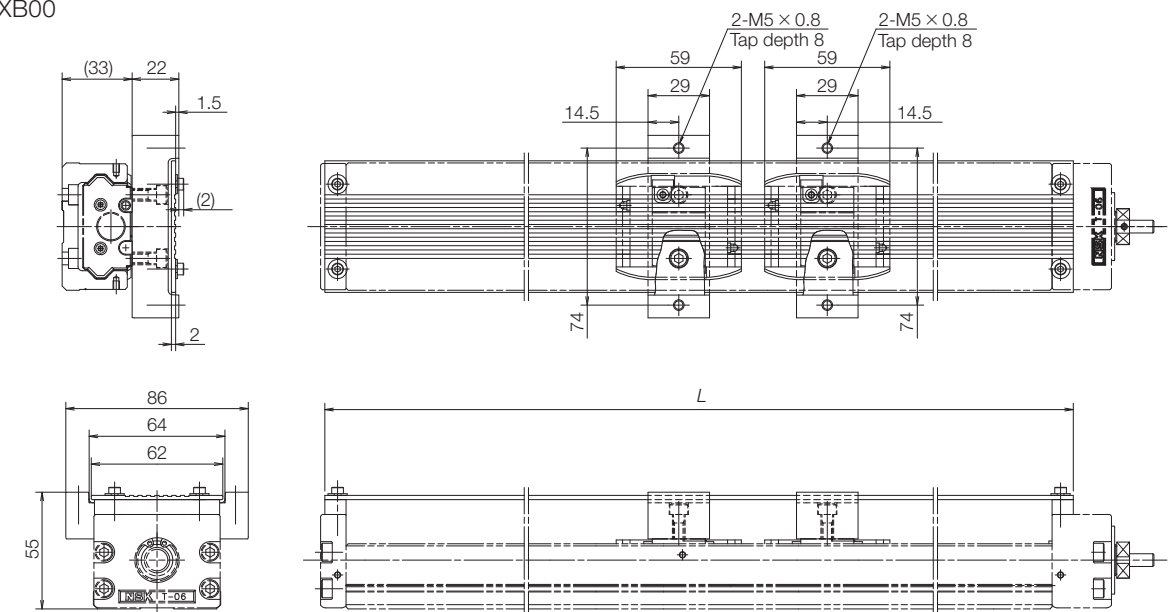
### 1.11.4 Accessories: Cover Unit

#### ◆ Cover Unit

- TC-HV06XXXK00
- TC-HV06XXXD00



- TC-HV06XXXA00
- TC-HV06XXXB00

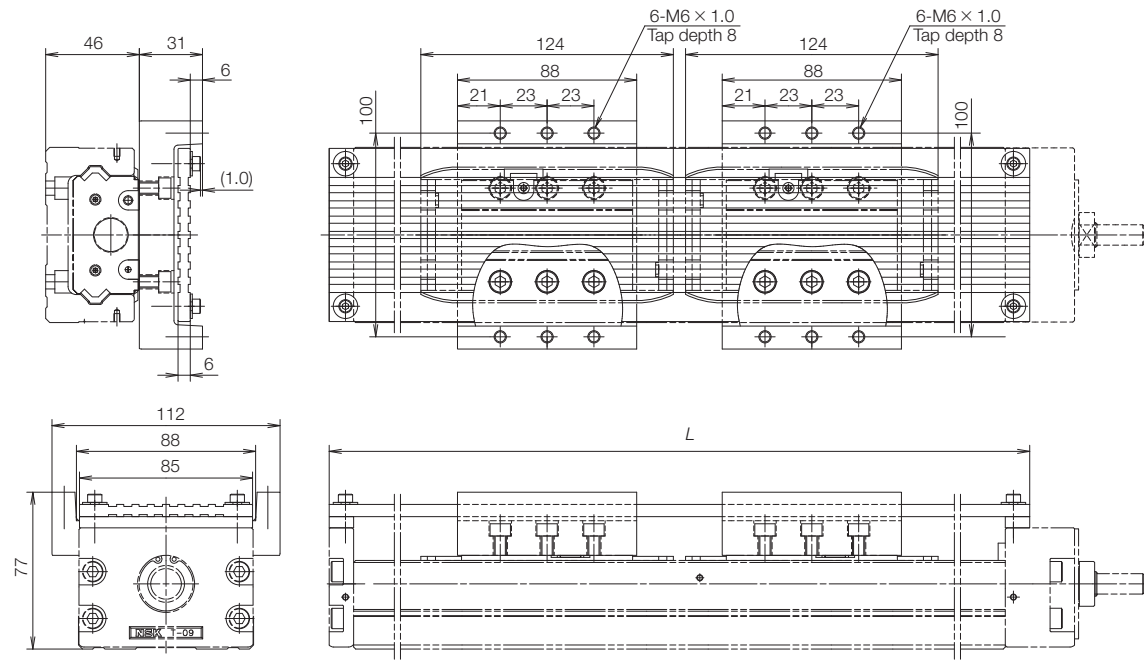


#### TCH06

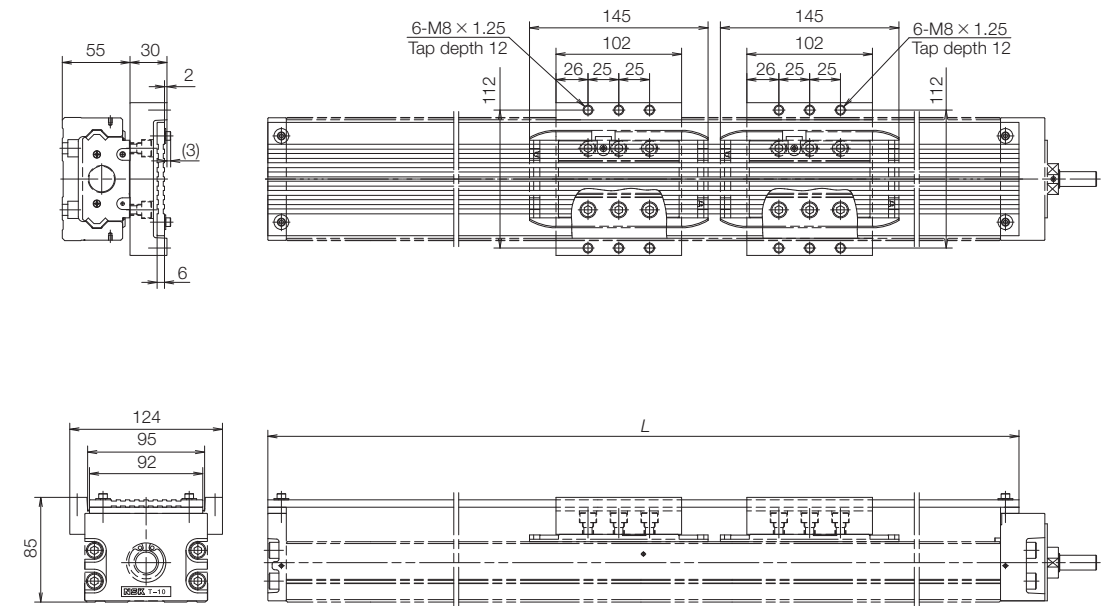
Body rail length	Dimensions L	Slider specifications			
		Standard		Short	
		Single	Double	Single	Double
150	170	TC-HV06005K00	—	TC-HV06007A00	—
200	220	TC-HV06010K00	—	TC-HV06012A00	—
300	320	TC-HV06020K00	TC-HV06013D00	TC-HV06022A00	TC-HV06017B00
400	420	TC-HV06030K00	TC-HV06023D00	TC-HV06032A00	TC-HV06027B00
500	520	TC-HV06040K00	TC-HV06033D00	TC-HV06042A00	TC-HV06037B00
600	620	TC-HV06050K00	TC-HV06043D00	TC-HV06052A00	TC-HV06047B00



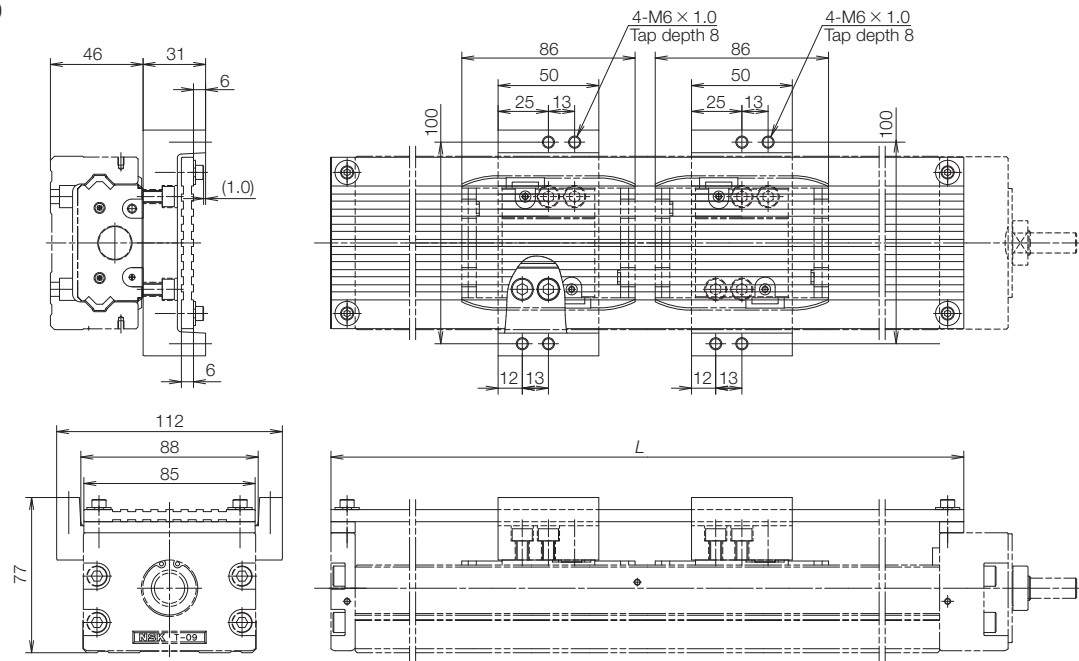
TC-HV09XXXK00  
TC-HV09XXXD00



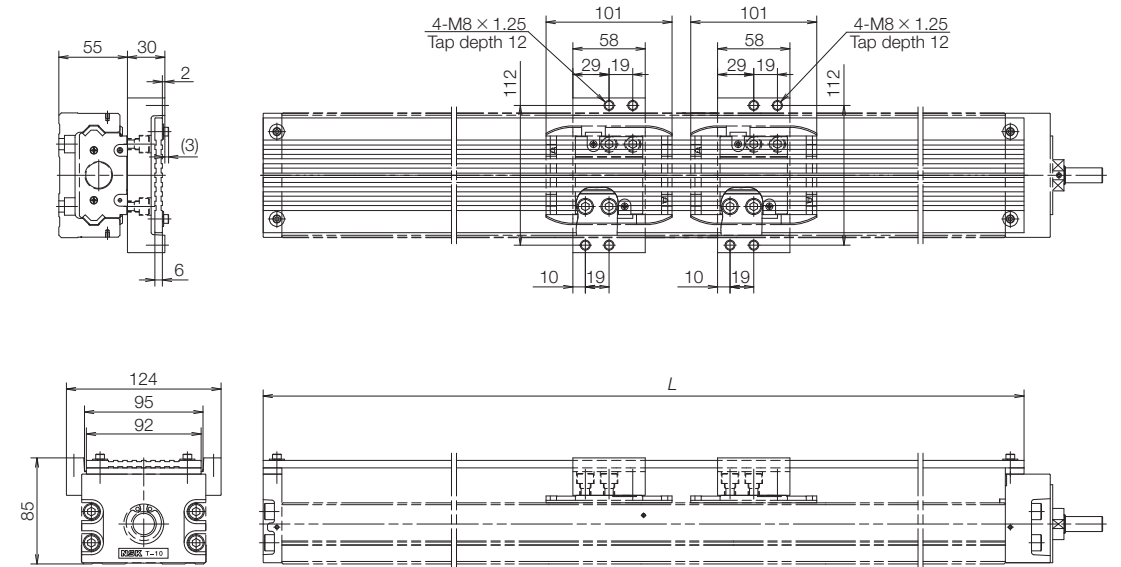
TC-HV10XXXK00  
TC-HV10XXXD00



TC-HV09XXXA00  
TC-HV09XXXB00



TC-HV10XXXA00  
TC-HV10XXXB00



TCH09

Body rail length	Dimensions L	Slider specifications			
		Standard		Short	
		Single	Double	Single	Double
240	264	TC-HV09010K00	—	TC-HV09014A00	—
340	364	TC-HV09020K00	—	TC-HV09024A00	—
440	464	TC-HV09030K00	TC-HV09017D00	TC-HV09034A00	TC-HV09025B00
540	564	TC-HV09040K00	TC-HV09027D00	TC-HV09044A00	TC-HV09035B00
640	664	TC-HV09050K00	TC-HV09037D00	TC-HV09054A00	TC-HV09045B00
740	764	TC-HV09060K00	TC-HV09047D00	TC-HV09064A00	TC-HV09055B00
840	864	TC-HV09070K00	—	TC-HV09074A00	—
940	964	TC-HV09080K00	TC-HV09067D00	TC-HV09084A00	TC-HV09075B00

TCH10

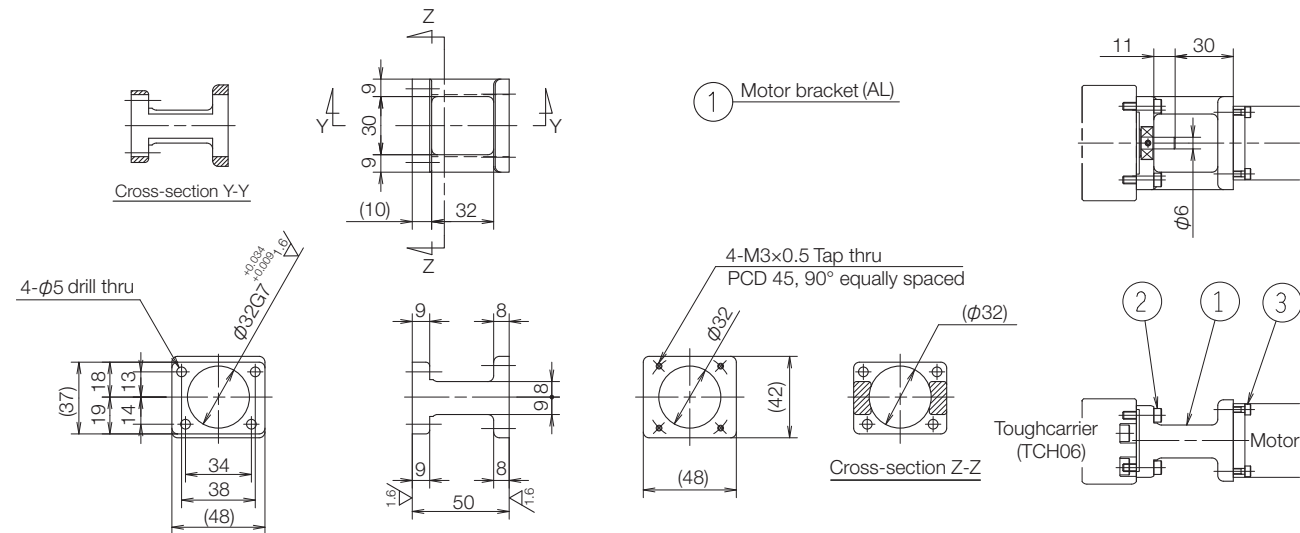
Body rail length	Dimensions L	Slider specifications			
		Standard		Short	
		Single	Double	Single	Double
280	310	TC-HV10010K00	—	TC-HV10016A00	—
380	410	TC-HV10020K00	—	TC-HV10026A00	—
480	510	TC-HV10030K00	—	TC-HV10036A00	—
580	610	TC-HV10040K00	TC-HV10027D00	TC-HV10046A00	TC-HV10036B00
680	710	TC-HV10050K00	TC-HV10037D00	TC-HV10056A00	TC-HV10046B00
780	810	TC-HV10060K00	TC-HV10047D00	TC-HV10066A00	TC-HV10056B00
880	910	TC-HV10070K00	TC-HV10057D00	TC-HV10076A00	TC-HV10066B00
980	1 010	TC-HV10080K00	TC-HV10067D00	TC-HV10086A00	TC-HV10076B00
1 080	1 110	TC-HV10090K00	TC-HV10077D00	TC-HV10096A00	TC-HV10086B00
1 180	1 210	TC-HV10100K00	TC-HV10087D00	TC-HV10106A00	TC-HV10096B00
1 280	1 310	TC-HV10110K00	TC-HV10097D00	TC-HV10116A00	TC-HV10106B00
1 380	1 410	TC-HV10120K00	TC-HV10107D00	TC-HV10126A00	TC-HV10116B00

## 1.11.5 Accessories: Motor Bracket

### ◆ Motor bracket

Motor models are subject to change at the motor manufacturers. For details, please contact the manufacturer. For motors other than applicable motors shown below, please contact NSK.

#### Reference number : TC-BKH06-145-00



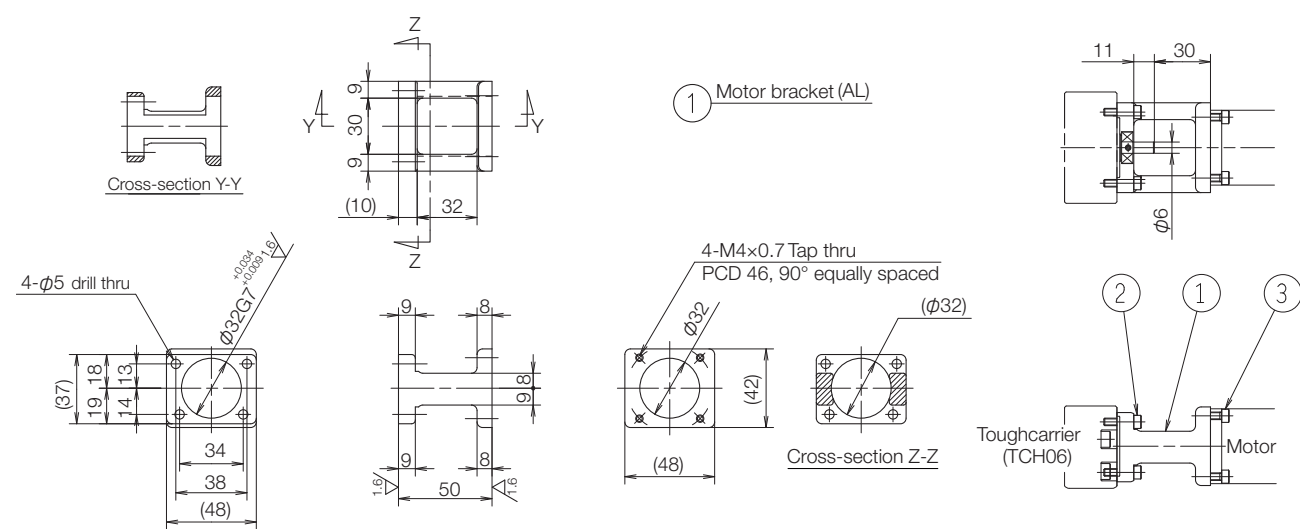
- Notes
1. Be sure to align the center lines when installing the motor.
  2. Be careful of the assembly orientation of the bracket.
  3. As the bracket is made by sand casting, the external dimensions are for reference only.

#### Applicable motors

Manufacturer	Motor model
Panasonic Co., Ltd.	MSMD5A (50W), MSMD10 (100W)

- ② Hexagon socket head cap screw (M4, length 16)
- ③ Hexagon socket head cap screw (M3, length 12)

#### Reference number : TC-BKH06-146-00



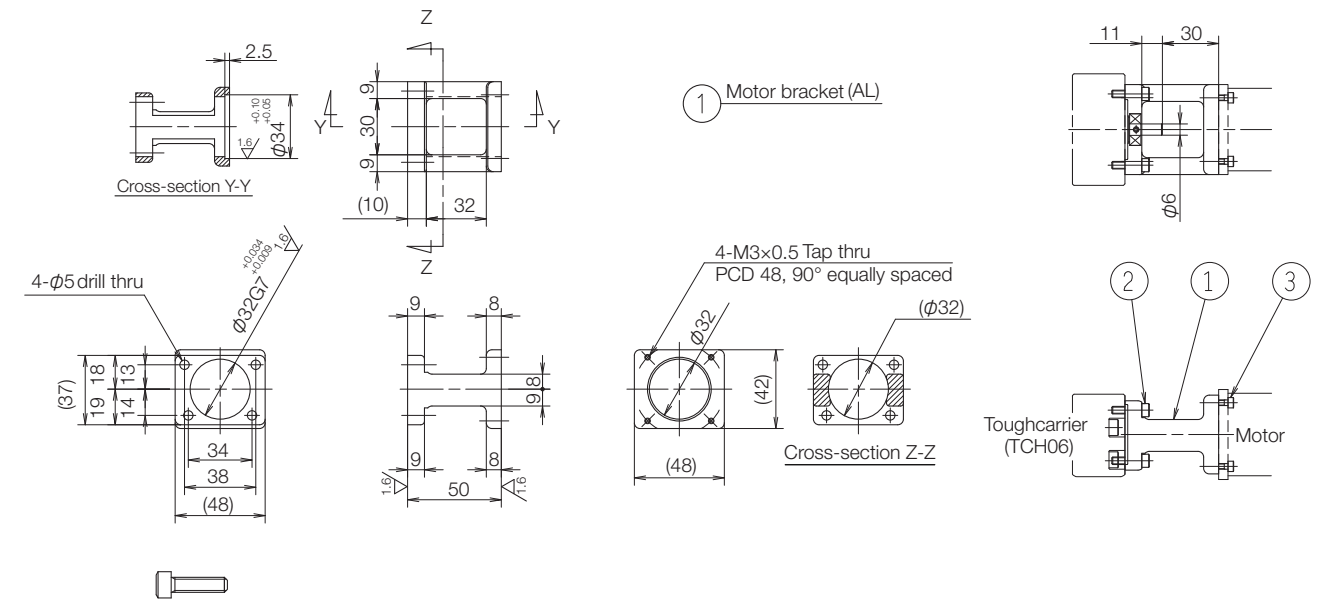
- Notes
1. Be sure to align the center lines when installing the motor.
  2. Be careful of the assembly orientation of the bracket.
  3. As the bracket is made by sand casting, the external dimensions are for reference only.

#### Applicable motors

Manufacturer	Motor model
YASKAWA Electric Corp.	SGMJV-A5A(50W), SGMJV-A5A(50W), SGMJV-01A(100W), SGMJV-01A(100W), SGMJV-C2A(150W), SGMJV-C2A(150W)
Mitsubishi Electric Corp.	HF-KP053(50W), HF-MP053(50W), HC-KFS053(50W), HC-MFS053(50W), HF-KP13(100W), HF-MP13(100W), HC-KFS13(100W), HC-MFS13(100W)
OMRON Corp.	R88M-W03(30W), R88M-W05(50W), R88M-W10(100W)
SANYO DENKI Co., Ltd.	P30B04003(30W), P30B04005(50W), P30B04010(100W), R2AA04005(50W), R2AA04010(100W)

- ② Hexagon socket head cap screw (M4, length 16)
- ③ Hexagon socket head cap screw (M4, length 14)

#### Reference number : TC-BKH06-148-00



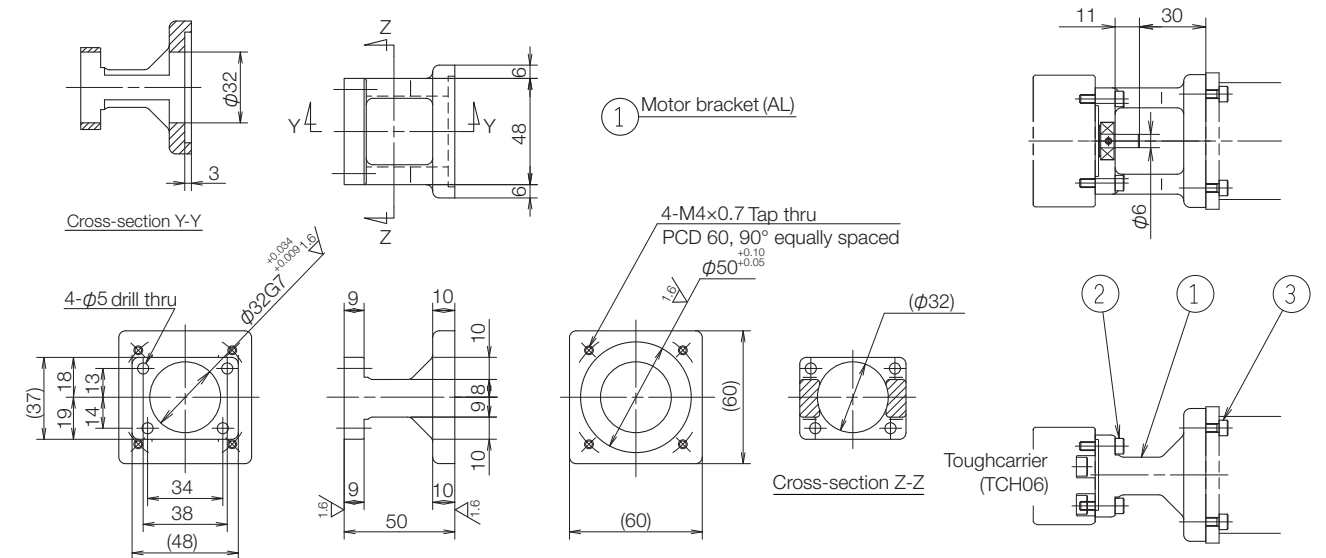
- ② Hexagon socket head cap screw (M4, length 16)
- ③ Hexagon socket head cap screw (M3, length 12)

- Notes
1. Be sure to align the center lines when installing the motor.
  2. Be careful of the assembly orientation of the bracket.
  3. As the bracket is made by sand casting, the external dimensions are for reference only.

#### Applicable motors

Manufacturer	Motor model
Panasonic Co., Ltd.	MAMA01(100W)
SANYO DENKI Co., Ltd.	P50B04006(60W), P50B04010(100W)

#### Reference number : TC-BKH06-160-00



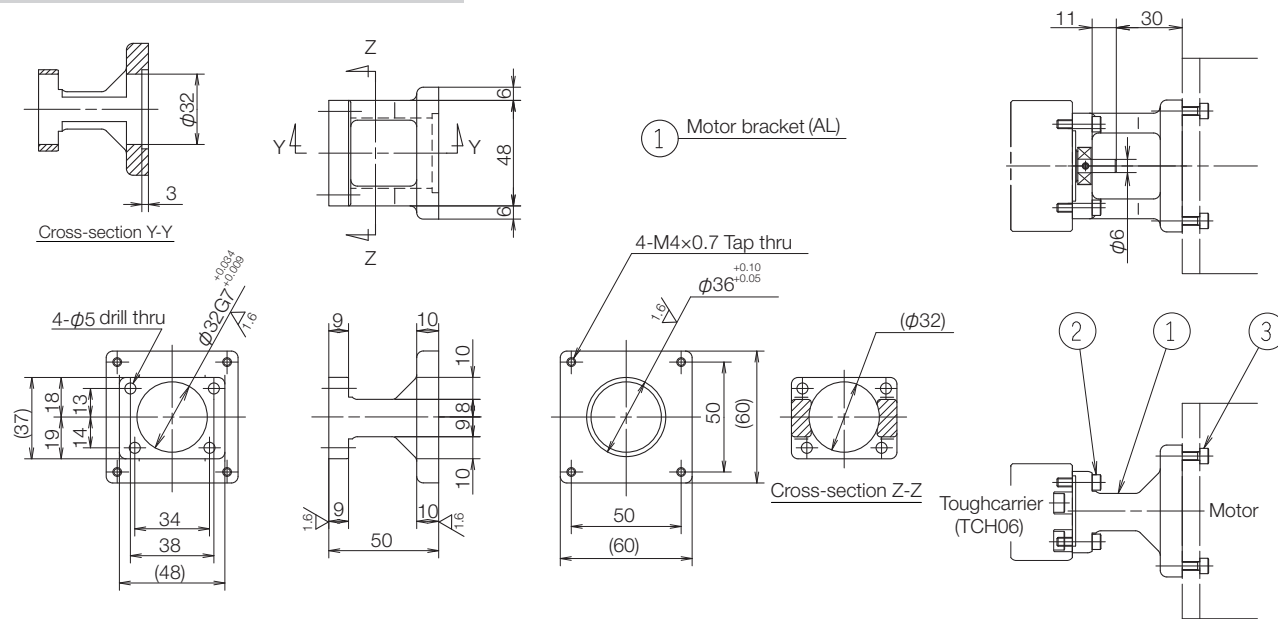
- ② Hexagon socket head cap screw (M4, length 16)
- ③ Hexagon socket head cap screw (M4, length 14)

- Notes
1. Be sure to align the center lines when installing the motor.
  2. Be careful of the assembly orientation of the bracket.
  3. As the bracket is made by sand casting, the external dimensions are for reference only.

#### Applicable motors

Manufacturer	Motor model
SANYO DENKI Co., Ltd.	P50B05005(50W), P50B05010(100W), P50B05020(200W)

Reference number : TC-BKH06-250-00



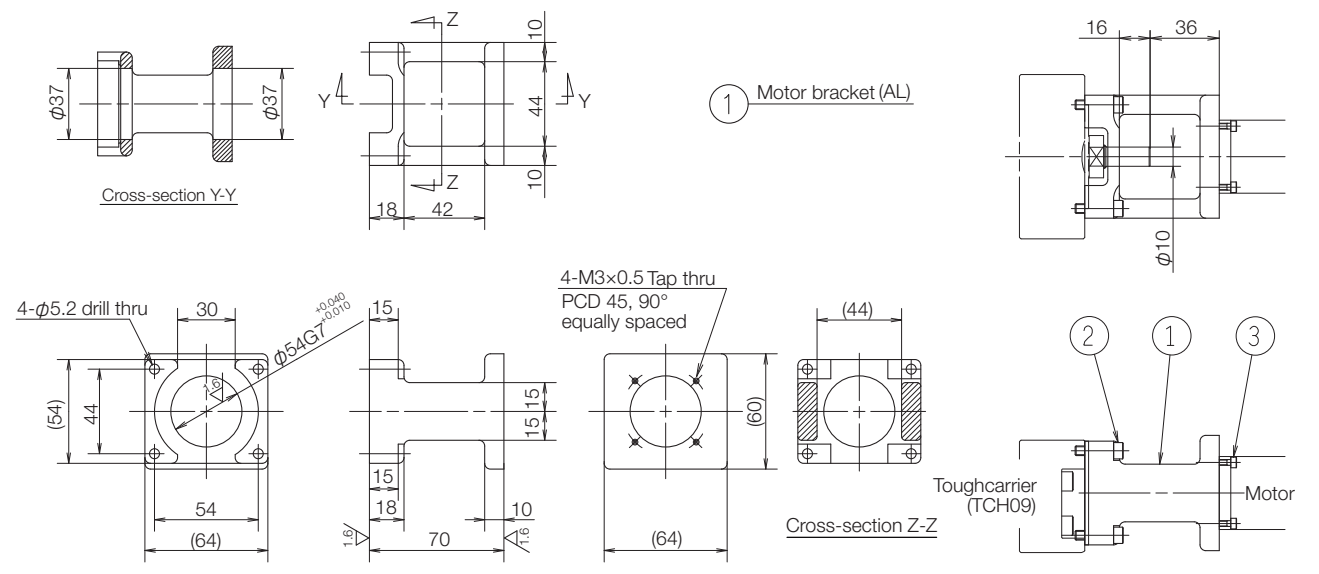
- ② Hexagon socket head cap screw (M4, length 16)
- ③ Hexagon socket head cap screw (M4, length 14)

Notes 1. Be sure to align the center lines when installing the motor.  
 2. Be careful of the assembly orientation of the bracket.  
 3. As the bracket is made by sand casting, the external dimensions are for reference only.

Applicable motors

Manufacturer	Motor model
SANYO DENKI Co., Ltd.	PBM603XXX, PBM604XXX, 103F78XX
ORIENTAL MOTOR Co., Ltd.	AS66, ASC66, UPK56X, PK56X, CSK56X, CFK56X, UFK56X

Reference number : TC-BKH09-145-00



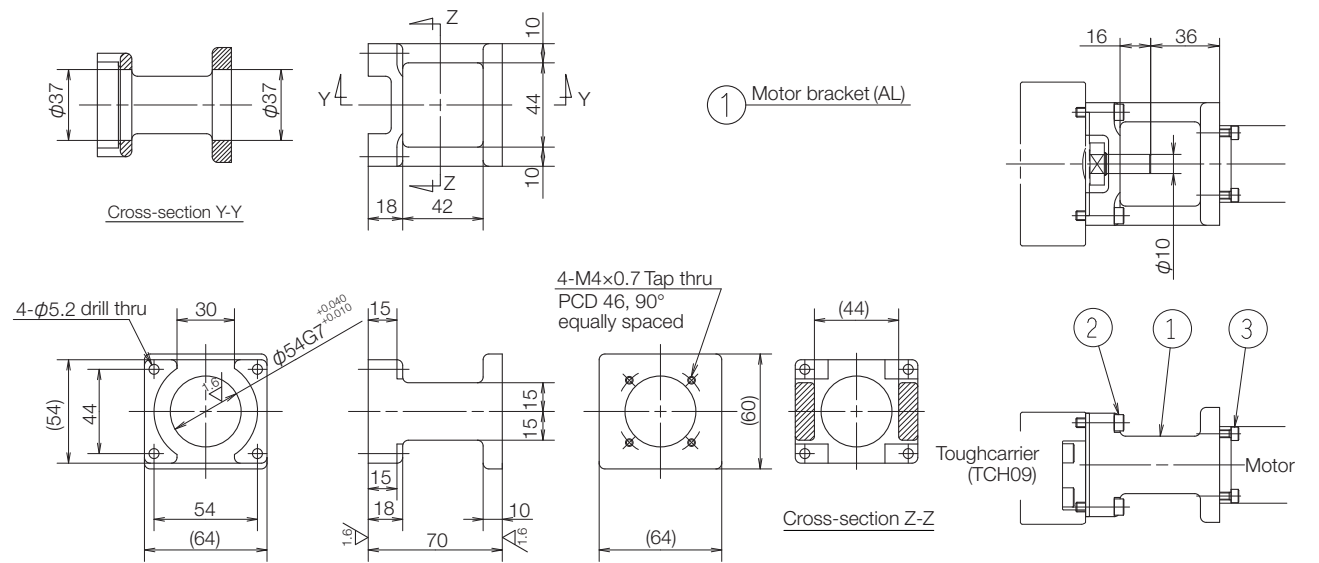
- ② Hexagon socket head cap screw (M5, length 20)
- ③ Hexagon socket head cap screw (M3, length 12)

Notes 1. Be sure to align the center lines when installing the motor.  
 2. Be careful of the assembly orientation of the bracket.  
 3. As the bracket is made by sand casting, the external dimensions are for reference only.

Applicable motors

Manufacturer	Motor model
Panasonic Co., Ltd.	MSMD01 (100W)

Reference number : TC-BKH09-146-00



- ② Hexagon socket head cap screw (M5, length 20)
- ③ Hexagon socket head cap screw (M4, length 14)

Notes 1. Be sure to align the center lines when installing the motor.  
 2. Be careful of the assembly orientation of the bracket.  
 3. As the bracket is made by sand casting, the external dimensions are for reference only.

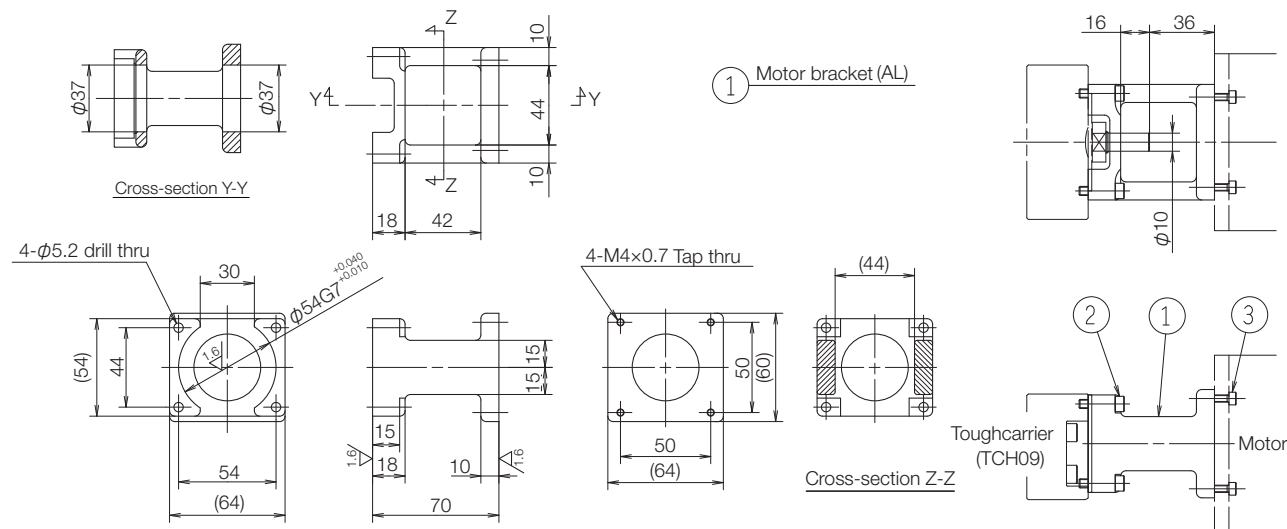
Applicable motors

Manufacturer	Motor model
YASKAWA Electric Corp.	SGMJV-01A (100W), SGMJV-01A (100W), SGMJV-C2A (150W), SGMJV-C2A (150W)
Mitsubishi Electric Corp.	HF-KP13 (100W), HF-MP13 (100W), HC-KFS13 (100W), HC-MFS13 (100W)
OMRON Corp.	P30B04005 (50W), P30B04010 (100W), R2AA04010 (100W)





Reference number : TC-BKH09-250-00



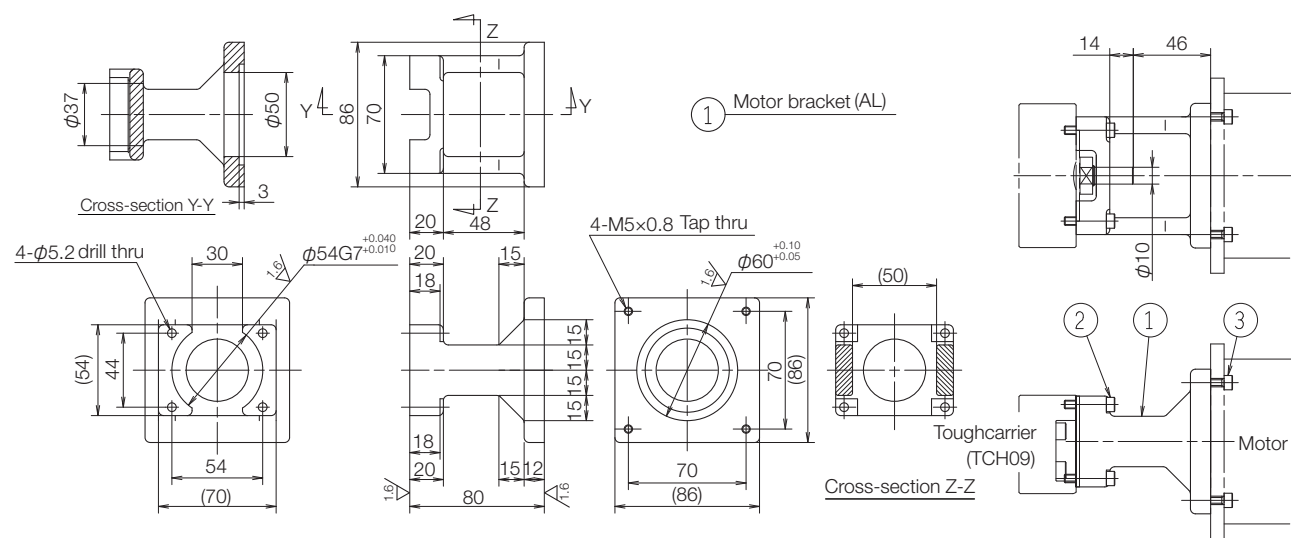
- ② Hexagon socket head cap screw (M5, length 20)
- ③ Hexagon socket head cap screw (M4, length 14)

Notes 1. Be sure to align the center lines when installing the motor.  
 2. Be careful of the assembly orientation of the bracket.  
 3. As the bracket is made by sand casting, the external dimensions are for reference only.

Applicable motors

Manufacturer	Motor model
SANYO DENKI Co., Ltd.	PBM603XXX, PBM604XXX, 103F78XX
ORIENTAL MOTOR Co., Ltd.	AS66, ASC66, UPK56XX, PK56XX, CSK56X, CFK56X, UFK56X

Reference number : TC-BKH09-270-00



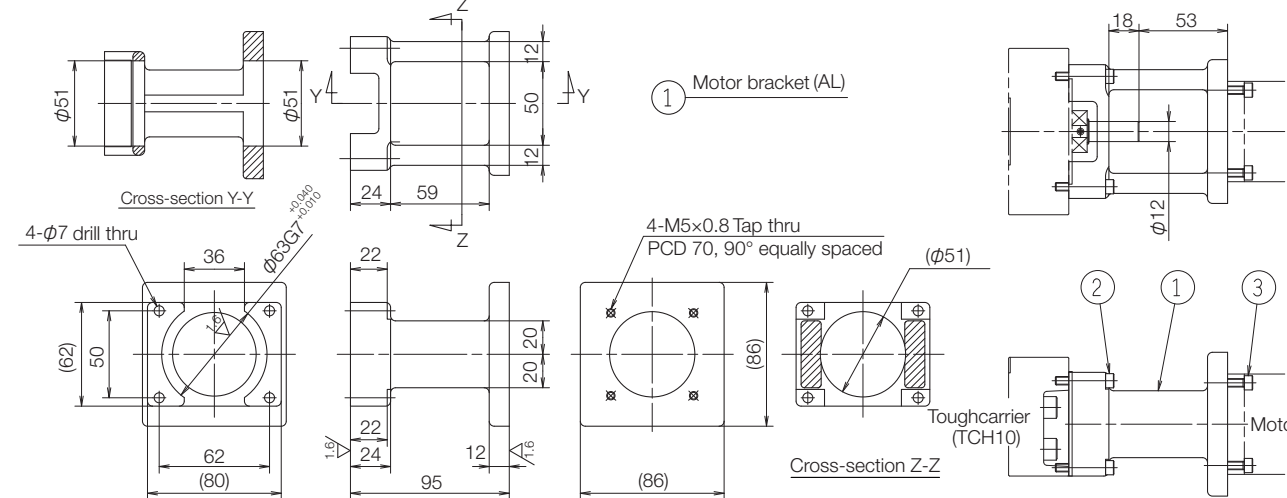
- ② Hexagon socket head cap screw (M5, length 25)
- ③ Hexagon socket head cap screw (M5, length 16)

Notes 1. Be sure to align the center lines when installing the motor.  
 2. Be careful of the assembly orientation of the bracket.  
 3. As the bracket is made by sand casting, the external dimensions are for reference only.

Applicable motors

Manufacturer	Motor model
SANYO DENKI Co., Ltd.	103F85XX
ORIENTAL MOTOR Co., Ltd.	AS98, UPK59X, PK59X, CSK56X, CFK59X, UFK59X

Reference number : TC-BKH10-170-00



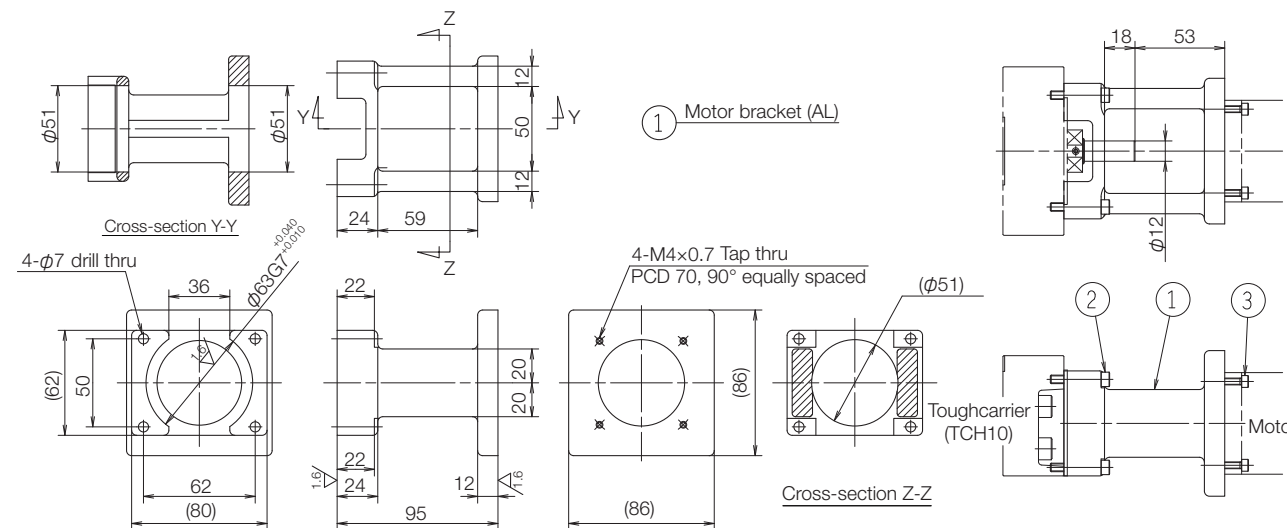
- ② Hexagon socket head cap screw (M6, length 30)
- ③ Hexagon socket head cap screw (M5, length 20)

Notes 1. Be sure to align the center lines when installing the motor.  
 2. Be careful of the assembly orientation of the bracket.  
 3. As the bracket is made by sand casting, the external dimensions are for reference only.

Applicable motors

Manufacturer	Motor model
YASKAWA Electric Corp.	SGMJV-02A (200W), SGMAV-02A (200W), SGMJV-04A (400W), SGMAV-04A (400W)
Mitsubishi Electric Corp.	HF-KP23 (200W), HF-MP23 (200W), HF-KP43 (400W), HF-MP43 (400W), HC-KFS23 (200W), HC-MFS23 (200W), HC-KFS43 (400W), HC-MFS43 (400W)
OMRON Corp.	R88M-W20 (200W), R88M-W40 (400W)
SANYO DENKI Co., Ltd.	P30B06020 (200W), P30B06040 (400W), R2AA06020 (200W), R2A06040 (400W)

Reference number : TC-BKH10-170-01



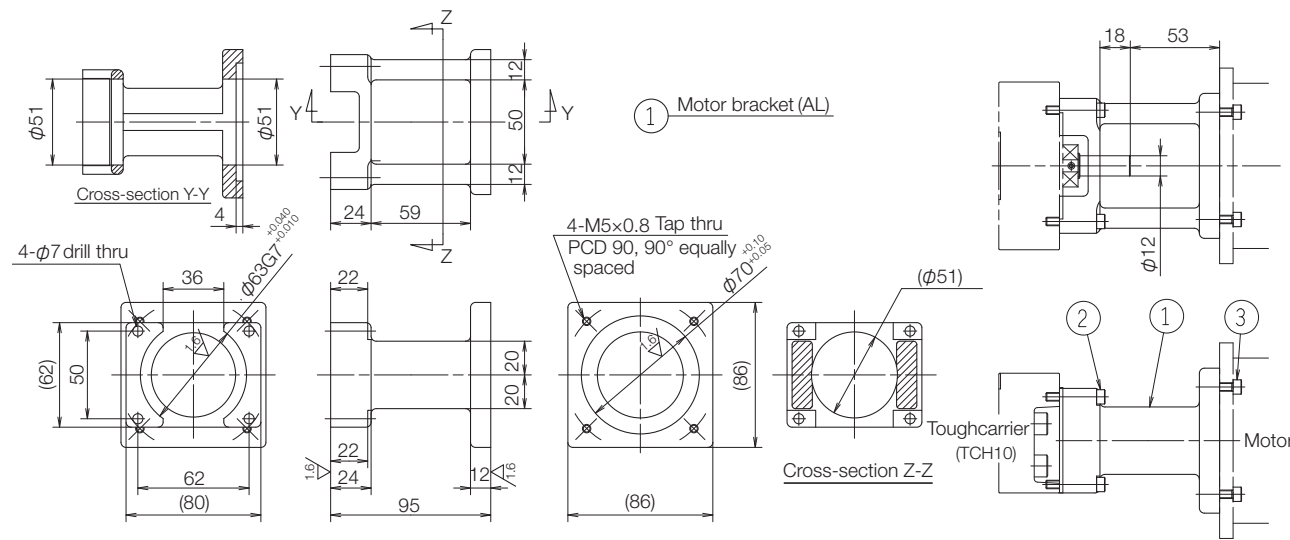
- ② Hexagon socket head cap screw (M6, length 30)
- ③ Hexagon socket head cap screw (M4, length 16)

Notes 1. Be sure to align the center lines when installing the motor.  
 2. Be careful of the assembly orientation of the bracket.  
 3. As the bracket is made by sand casting, the external dimensions are for reference only.

Applicable motors

Manufacturer	Motor model
Panasonic Co., Ltd.	MSMD02 (200W), MAMA02 (200W), MSMD04 (400W), MAMA04 (400W)

Reference number : TC-BKH10-190-00



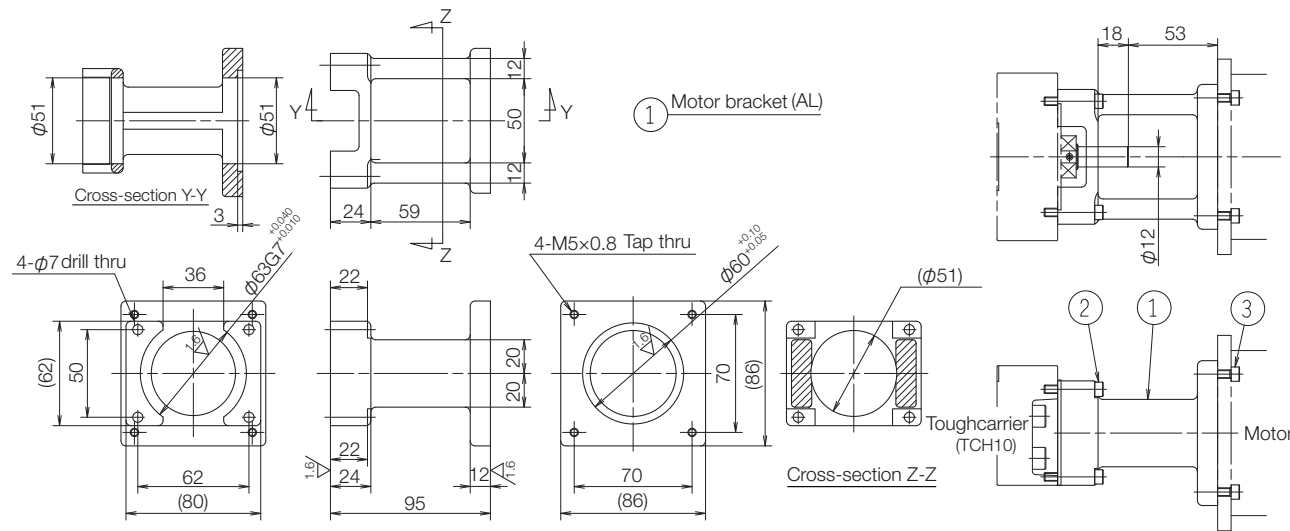
Notes 1. Be sure to align the center lines when installing the motor.  
2. Be careful of the assembly orientation of the bracket.  
3. As the bracket is made by sand casting, the external dimensions are for reference only.

**Applicable motors**

Manufacturer	Motor model
Panasonic Co., Ltd.	MSMD08 (750W), MAMA08 (750W)
SANYO DENKI Co., Ltd.	P50B07020 (200W), P50B07030 (300W), P50B07040 (400W)

- ② Hexagon socket head cap screw (M6, length 30)
- ③ Hexagon socket head cap screw (M5, length 16)

Reference number : TC-BKH10-270-00



Notes 1. Be sure to align the center lines when installing the motor.  
2. Be careful of the assembly orientation of the bracket.  
3. As the bracket is made by sand casting, the external dimensions are for reference only.

**Applicable motors**

Manufacturer	Motor model
SANYO DENKI Co., Ltd.	103FB5XX
ORIENTAL MOTOR Co., Ltd.	AS98, UPK59X, PK59X, CSK59X, CFK59X, UFK59X

- ② Hexagon socket head cap screw (M6, length 30)
- ③ Hexagon socket head cap screw (M5, length 16)

## 1.12 Motor Bracket Compatibility Table

Model No.	Reference number	Motor manufacturer	Stepping motor model no.	Wattage of AC servo motor									
				30 W	50 W	60 W	100 W	150 W	200 W	300 W	400 W	750 W	
TCH06	TC-BKH06-145-00	Panasonic Co., Ltd.			MSMD5A		MSMD10						
		YASKAWA Electric Corp.			SGMJV-A5A		SGMJV-01A		SGMJV-C2A				
					SGMAV-A5A		SGMAV-01A		SGMAV-C2A				
					HF-KP053		HF-KP13						
					HF-MP053		HF-MP13						
	TC-BKH06-146-00	Mitsubishi Electric Corp.				HC-KFS053		HC-KFS13					
						HC-MFS053		HC-MFS13					
		OMRON Corp.		R88M-W03		R88M-W05		R88M-W10					
		SANYO DENKI Co., Ltd.		P30B04003		P30B04005		P30B04010					
							R2AA04005		R2AA04010				
TC-BKH06-148-00	Panasonic Co., Ltd.						MAMA01						
	SANYO DENKI Co., Ltd.					P50B04006	P50B04010						
TC-BKH06-160-00	SANYO DENKI Co., Ltd.					P50B05005	P50B05010		P50B05020				
	SANYO DENKI Co., Ltd.		PBM603XXX PBM604XXX 103F78XX										
TCH09	TC-BKH09-145-00	Panasonic Co., Ltd.					MSMD01						
		YASKAWA Electric Corp.				SGMJV-01A		SGMJV-C2A					
					SGMAV-01A		SGMAV-C2A						
					HF-KP13								
					HF-MP13								
	TC-BKH09-146-00	Mitsubishi Electric Corp.				HC-KFS13		HC-KFS13					
						HC-MFS13							
		SANYO DENKI Co., Ltd.			P30B04005		P30B04010						
							R2AA04010						
TC-BKH09-160-00	SANYO DENKI Co., Ltd.					P50B05005	P50B05010		P50B05020				
	YASKAWA Electric Corp.								SGMJV-02A		SGMJV-04A		
TC-BKH09-170-00									SGMAV-02A		SGMAV-04A		
									HF-KP23		HF-KP43		
									HF-MP23		HF-MP43		
									HC-KFS23		HC-KFS43		
									HC-MFS23		HC-MFS43		
									R88M-W20		R88M-W40		
									P30B06020		P30B06040		
TC-BKH09-170-01	Panasonic Co., Ltd.						R2AA06010		R2AA06020		R2AA06040		
									MSMD02		MSMD04		
									MAMA02		MAMA04		
									P50B07020	P50B07030	P50B07040		
TCH10	TC-BKH09-190-00	SANYO DENKI Co., Ltd.											
		SANYO DENKI Co., Ltd.		PBM603XXX PBM604XXX 103F78XX									
	TC-BKH09-250-00	ORIENTAL MOTOR Co., Ltd.				AS66 ASC66 UPK56X PK56X CSK56X CFK56X UFK56X							
TC-BKH09-270-00	ORIENTAL MOTOR Co., Ltd.				AS98 UPK59X PK59X CSK59X CFK59X UFK59X								
TCH10	TC-BKH10-170-00	YASKAWA Electric Corp.							SGMJV-02A		SGMJV-04A		
									SGMAV-02A		SGMAV-04A		
									HF-KP23		HF-KP43		
									HF-MP23		HF-MP43		
									HC-KFS23		HC-KFS43		
	TC-BKH10-190-00	Mitsubishi Electric Corp.				HC-MFS23		HC-MFS23		HC-MFS43		HC-MFS43	
		OMRON Corp.				R88M-W20		R88M-W40					
		SANYO DENKI Co., Ltd.				P30B06020		P30B06040					
										R2AA06020		R2AA06040	
TC-BKH10-270-00	Panasonic Co., Ltd.								MSMD02		MSMD04		
									MAMA02		MAMA04		
												MSMD08	
												MAMA08	
									P50B07020	P50B07030	P50B07040		

### 1.13 Sensor Rail and Top Cover Unit Combination Table

Model No.	Reference number	Rail length (L <sub>2</sub> )	Sensor rail reference number	Cover unit reference number
TCH06	TCH06005H05K00	150	TC-SRL6-0150	TC-HV06005K00
	TCH06005H10K00			
	TCH06005H20K00			
	TCH06007H05A00			
	TCH06007H10A00	200	TC-SRL6-0200	TC-HV06007A00
	TCH06010H05K00			
	TCH06010H10K00			
	TCH06010H20K00			
	TCH06012H05A00	300	TC-SRL6-0300	TC-HV06010K00
	TCH06012H10A00			
	TCH06012H10A00			
	TCH06020H05K00			
	TCH06020H10K00	400	TC-SRL6-0400	TC-HV06020K00
	TCH06020H20K00			
	TCH06013H05D00			
	TCH06013H10D00			
	TCH06022H05A00			
	TCH06022H10A00			
	TCH06017H05B00			
	TCH06017H10B00			
	TCH06030H05K00	500	TC-SRL6-0500	TC-HV06013D00
	TCH06030H10K00			
	TCH06030H20K00			
	TCH06023H05D00			
	TCH06023H10D00			
	TCH06032H05A00			
	TCH06032H10A00			
	TCH06027H05B00			
	TCH06027H10B00	600	TC-SRL6-0600	TC-HV06022A00
	TCH06040H05K00			
	TCH06040H10K00			
	TCH06040H20K00			
	TCH06033H05D00			
	TCH06033H10D00			
	TCH06042H05A00			
	TCH06042H10A00			
	TCH06037H05B00	TC-SRL6-0600	TC-HV06017B00	TC-HV06030K00
	TCH06037H10B00			
	TCH06050H05K00			
	TCH06050H10K00			
	TCH06050H20K00			
	TCH06043H10D00			
	TCH06043H20D00			
	TCH06052H05A00			
	TCH06052H10A00	TC-HV06023D00		
	TCH06047H10B00		TC-HV06032A00	

- Sensor rail reference numbers are determined according to the rail length. Select a sensor rail appropriate for your requirements.
- Shapes and numbers of spacer plates for cover unit are selected according to slider specifications.

Model No.	Reference number	Rail length (L <sub>2</sub> )	Sensor rail reference number	Cover unit reference number
TCH09	TCH09010H05K00	240	TC-SRL9-0240	TC-HV09010K00
	TCH09010H10K00			
	TCH09010H20K00			
	TCH09014H05A00			
	TCH09014H10A00	340	TC-SRL9-0340	TC-HV09014A00
	TCH09014H20A00			
	TCH09020H05K00			
	TCH09020H10K00			
	TCH09020H20K00	440	TC-SRL9-0440	TC-HV09020K00
	TCH09024H05A00			
	TCH09024H10A00			
	TCH09024H20A00			
	TCH09030H05K00	540	TC-SRL9-0540	TC-HV09024A00
	TCH09030H10K00			
	TCH09030H20K00			
	TCH09017H05D00			
	TCH09017H10D00			
	TCH09034H05A00			
	TCH09034H10A00			
	TCH09034H20A00			
	TCH09025H05B00	640	TC-SRL9-0640	TC-HV09030K00
	TCH09025H10B00			
	TCH09040H05K00			
	TCH09040H10K00			
	TCH09040H20K00			
	TCH09027H05D00			
	TCH09027H10D00			
	TCH09044H05A00			
	TCH09044H10A00	740	TC-SRL9-0740	TC-HV09017D00
	TCH09044H20A00			
	TCH09035H05B00			
	TCH09035H10B00			
	TCH09050H05K00			
	TCH09050H10K00			
	TCH09050H20K00			
	TCH09037H05D00			
	TCH09037H10D00	840	TC-SRL9-0840	TC-HV09034A00
	TCH09054H05A00			
	TCH09054H10A00			
	TCH09054H20A00			
	TCH09045H05B00			
	TCH09045H10B00			
	TCH09060H05K00			
	TCH09060H10K00			
	TCH09060H20K00	940	TC-SRL9-0940	TC-HV09025B00
	TCH09047H10D00			
	TCH09047H20D00			
	TCH09064H05A00			
	TCH09064H10A00			
	TCH09064H20A00			
	TCH09055H10B00			
	TCH09055H20B00			
	TCH09070H05K00	TC-SRL9-0940	TC-HV09040K00	
	TCH09070H10K00			
	TCH09070H20K00			
	TCH09074H05A00			
	TCH09074H10A00	TC-SRL9-0940	TC-HV09044A00	
	TCH09074H20A00			
	TCH09080H05K00			
	TCH09080H10K00			
TCH09080H20K00	TC-SRL9-0940	TC-HV09050K00		
TCH09067H10D00				
TCH09067H20D00				
TCH09084H05A00				
TCH09084H10A00	TC-SRL9-0940	TC-HV09054A00		
TCH09084H20A00				
TCH09075H10B00				
TCH09075H20B00				
TCH09075H10B00	TC-SRL9-0940	TC-HV09054A00		
TCH09075H20B00			TC-HV09045B00	

- Sensor rail reference numbers are determined according to the rail length. Select a sensor rail appropriate for your requirements.
- Shapes and numbers of spacer plates for cover unit are selected according to slider specifications.



# 2 Toughcarrier High-Thrust Series

(Special product)

## 2.1 Specifications

The life of the feeding system is improved by use of higher load capacity ball screw part and support bearings for standard Toughcarrier.

		TCH06		TCH09		TCH10	
Ball screw	Shaft diameter (mm)	12		20		25	
	Lead (mm)	10	20	10	20	20	25
	Basic dynamic load rating Ca (N)	3 760	2 970	11 500	8 790	9 760	9 760
	Basic static load rating Coa (N)	6 310	4 240	25 700	18 500	23 600	23 600
Linear guide	Basic dynamic load rating C (N)	20 900		44 900		62 400	
	Basic static load rating Co (N)	45 000		96 900		132 000	
Support bearings	Basic dynamic load rating (N)	5 900		18 800		21 900	
	Load limit (N)	3 500		11 500		26 600	

- 1) Only compatible with standard slider.
- 2) Applicable strokes are as follows.  
 TCH06: Stroke 500 mm  
 TCH09: Stroke 800 mm  
 TCH10: Stroke 1 200 mm
- 3) High and precision grades are available for accuracy.

## 2.2 Features

- 1) Mounting dimensions are the same as Monocarrier MCH Series and standard Toughcarrier. (Interchangeable)
- 2) Permissible rotational speed is faster than standard Toughcarrier due to different ball recirculation system.

Model No.	Reference number	Rail length (L <sub>2</sub> )	Sensor rail reference number	Cover unit reference number		
TCH10	TCH10010H10K00	280	TC-SRL1-0280	TC-HV10010K00		
	TCH10010H20K00			TC-HV10016A00		
	TCH10016H10A00			TC-HV10020K00		
	TCH10016H20A00			TC-HV10026A00		
	TCH10020H10K00	380	TC-SRL1-0380	TC-HV10030K00		
	TCH10020H20K00			TC-HV10036A00		
	TCH10026H10A00			TC-HV10040K00		
	TCH10026H20A00			TC-HV10046A00		
	TCH10030H10K00	480	TC-SRL1-0480	TC-HV10050K00		
	TCH10030H20K00			TC-HV10056A00		
	TCH10036H10A00			TC-HV10060K00		
	TCH10036H20A00			TC-HV10066A00		
	TCH10040H10K00	580	TC-SRL1-0580	TC-HV10070K00		
	TCH10040H20K00			TC-HV10076A00		
	TCH10027H10D00			TC-HV10080K00		
	TCH10027H20D00			TC-HV10086A00		
	TCH10046H10A00			TC-HV10090K00		
	TCH10046H20A00			TC-HV10096A00		
	TCH10036H10B00			TC-HV10100K00		
	TCH10036H20B00			TC-HV10106A00		
	TCH10050H10K00			680	TC-SRL1-0680	TC-HV10110K00
	TCH10050H20K00					TC-HV10116A00
	TCH10037H10D00	TC-HV10120K00				
	TCH10037H20D00	TC-HV10126A00				
	TCH10056H10A00	TC-HV10130K00				
	TCH10056H20A00	TC-HV10136A00				
	TCH10046H10B00	TC-HV10140K00				
	TCH10046H20B00	TC-HV10146A00				
	TCH10060H10K00	780	TC-SRL1-0780			TC-HV10150K00
	TCH10060H20K00					TC-HV10156A00
	TCH10047H10D00			TC-HV10160K00		
	TCH10047H20D00			TC-HV10166A00		
	TCH10066H10A00			TC-HV10170K00		
	TCH10066H20A00			TC-HV10176A00		
	TCH10056H10B00			TC-HV10180K00		
	TCH10056H20B00			TC-HV10186A00		
	TCH10070H10K00			880	TC-SRL1-0880	TC-HV10190K00
	TCH10070H20K00					TC-HV10196A00
	TCH10057H10D00	TC-HV10200K00				
	TCH10057H20D00	TC-HV10206A00				
	TCH10076H10A00	TC-HV10210K00				
	TCH10076H20A00	TC-HV10216A00				
	TCH10066H10B00	TC-HV10220K00				
	TCH10066H20B00	TC-HV10226A00				
	TCH10080H10K00	980	TC-SRL1-0980			TC-HV10230K00
	TCH10080H20K00					TC-HV10236A00
	TCH10067H10D00			TC-HV10240K00		
	TCH10067H20D00			TC-HV10246A00		
	TCH10086H10A00			TC-HV10250K00		
	TCH10086H20A00			TC-HV10256A00		
	TCH10076H10B00			TC-HV10260K00		
	TCH10076H20B00			TC-HV10266A00		
	TCH10090H10K00			1 080	TC-SRL1-1080	TC-HV10270K00
	TCH10090H20K00					TC-HV10276A00
	TCH10077H20D00	TC-HV10280K00				
	TCH10096H10A00	TC-HV10286A00				
	TCH10096H20A00	TC-HV10290K00				
	TCH10086H20B00	TC-HV10296A00				
	TCH10100H10K00	1 180	TC-SRL1-1180			TC-HV10300K00
	TCH10100H20K00					TC-HV10306A00
	TCH10087H20D00					TC-HV10310K00
	TCH10106H10A00					TC-HV10316A00
	TCH10106H20A00			TC-HV10320K00		
	TCH10096H20B00			TC-HV10326A00		
	TCH10110H10K00			1 280	TC-SRL1-1280	TC-HV10330K00
	TCH10110H20K00					TC-HV10336A00
	TCH10097H20D00					TC-HV10340K00
	TCH10116H10A00					TC-HV10346A00
	TCH10116H20A00	TC-HV10350K00				
	TCH10106H20B00	TC-HV10356A00				
	TCH10120H10K00	1 380	TC-SRL1-1380			TC-HV10360K00
	TCH10120H20K00					TC-HV10366A00
	TCH10107H20D00					TC-HV10370K00
	TCH10126H10A00					TC-HV10376A00
	TCH10126H20A00			TC-HV10380K00		
	TCH10116H20B00			TC-HV10386A00		

- Sensor rail reference numbers are determined according to the rail length. Select a sensor rail appropriate for your requirements.
- Shapes and numbers of spacer plates for cover unit are selected according to slider specifications.

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