

NEW

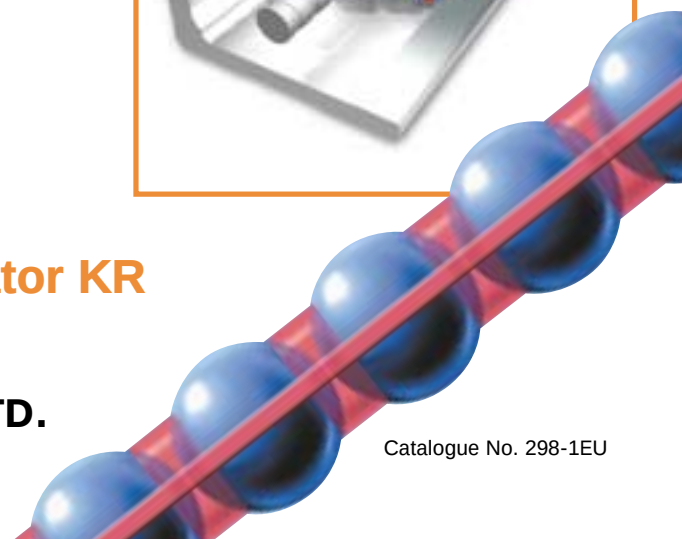
SKR

LM Guide Actuator with
*Caged Ball*TM

**High-Rigidity and High-Precision
LM Guide Actuator of the
New Generation**



- Low noise
- Long-term maintenance free
- Smooth motion
- Compatible to LM Guide Actuator KR



LM Guide Actuator SKR with Caged Ball™

LM Guide with Caged Ball™
+
Precision ballscrew with Caged Ball™
=
Compact LM Guide Actuator with Caged Ball™

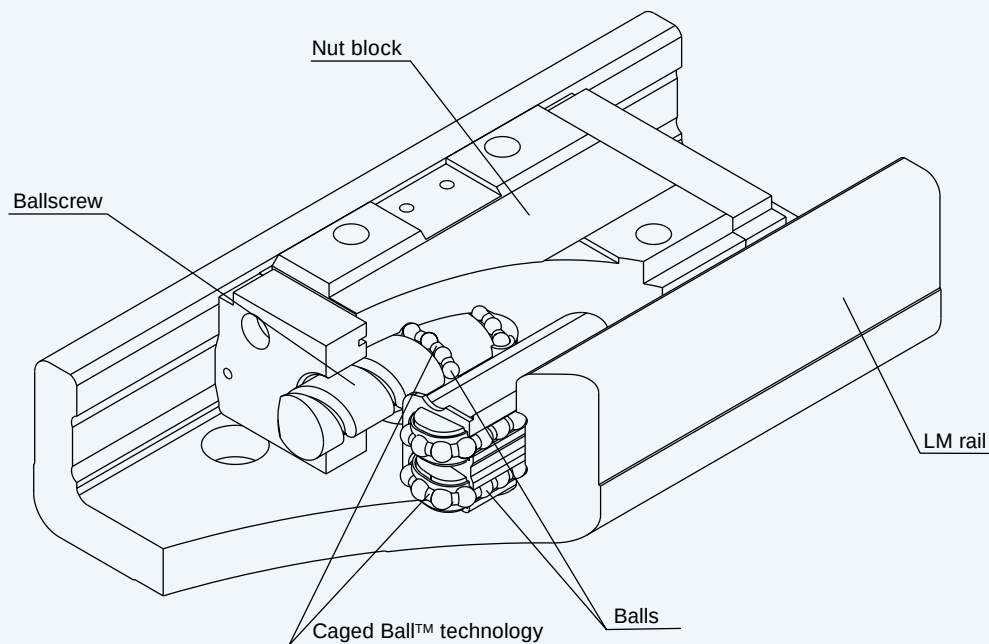


Figure 1 Construction of LM Guide Actuator with Caged Ball™

A highly rigid LM rail having a U-shaped cross section and a one-piece nut block structure with LM guides on both sides and a ball screw at the center enables the actuator to provide highly rigid and accurate functioning at a minimum size.

Based on the Caged Ball™ technology the balls are separated and therefore they do not rub against each other and produce friction. As a result, the balls are not subject to wear and tear. In addition, the grease retention has been enhanced, providing long service life and long-term maintenance-free operation.

Construction and Features

Four-way equal load

Two load-bearing ball trains are arranged on each side, thus constituting a double-row angular-contact design. As this design can bear an equal rated load in the four directions, upward and downward and to the right and left, the mounting direction of the unit is not limited. The LM Guide Actuator SKR is therefore most suitable where the loading direction is not fixed, as in the motion of a Cartesian-coordinate robot arm.

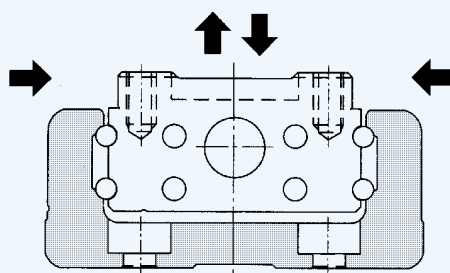


Figure 2 Load bearing capacity of SKR

High rigidity

Unlike conventional LM Guide models, the LM Guide Actuator features an outer-rail structure, which provides far greater rigidity when subjected to overhang loads. The wide U-shaped cross section of the rails contributes to weight reduction and minimizes deflection. Thus a load can be adequately supported even on one end of the LM Guide Actuator.

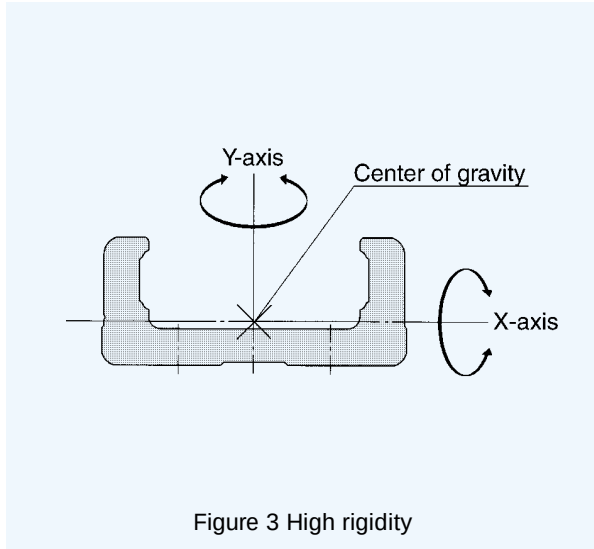


Table 1 Outer rail cross section data

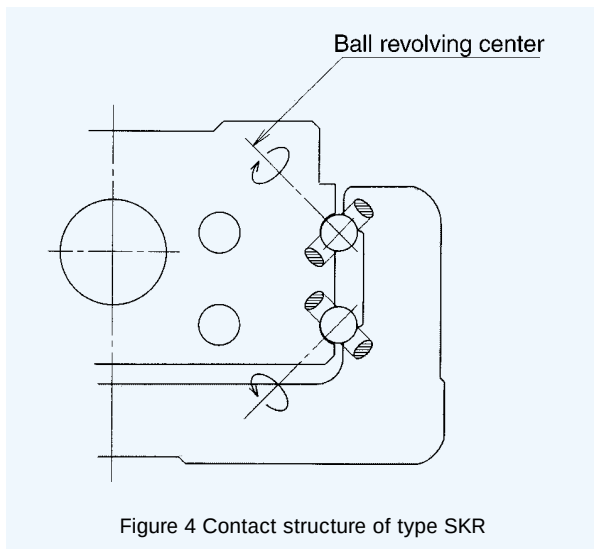
Model No.	I_x (mm ⁴)	I_y (mm ⁴)	Mass m (kg/100mm)
SKR33	5.35×10^4	3.52×10^5	0.61
SKR46	2.05×10^5	1.45×10^6	1.26

I_x = Geometrical moment of inertia of the cross section around the X-axis (mm⁴)

I_y = Geometrical moment of inertia of the cross section around the Y-axis (mm⁴)

High Accuracy

The raceways for the four loaded ball trains are formed into circular arc grooves which allow balls to roll freely even under a preload. This enables a preload to be freely selected and provides a highly rigid guide without clearance. In addition, variation in frictional resistance due to load fluctuation is minimized and high feeding at sub-micron accuracy is realized.

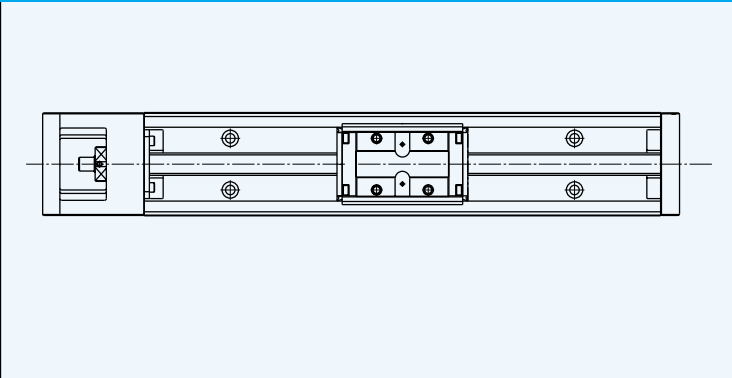


Compact Design

The one-piece structure of the LM Guide actuator, with rails arranged on both sides and the Ball Screw arranged at the center, forms an actuator that is minimal in size yet provides high rigidity and accuracy.

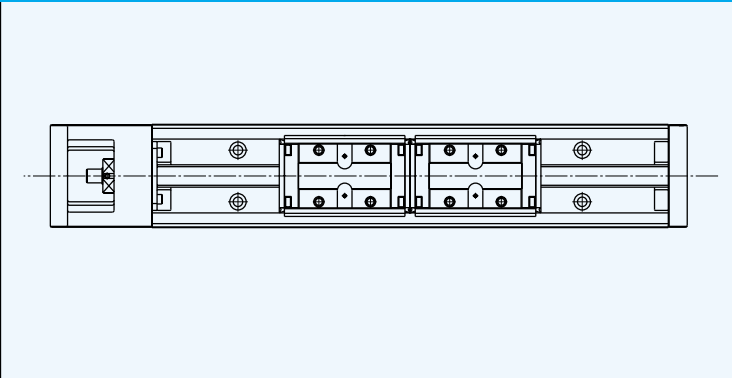
Types and Features

SKR-A



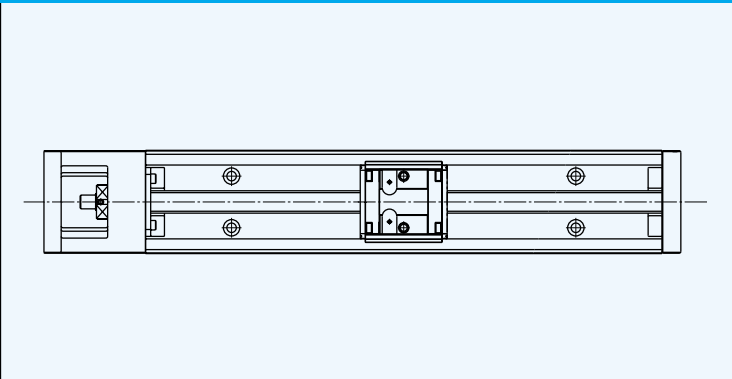
Standard model with one long block.

SKR-B



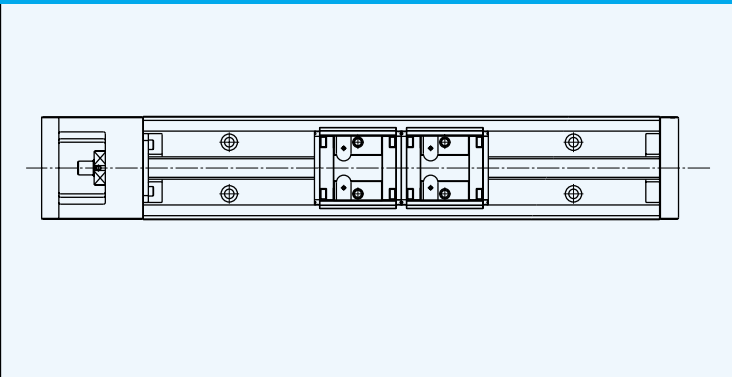
Actuator with two long blocks for enhanced rigidity, load capacity and accuracy.

SKR-C



Standard model but with one short block.
The model size SKR3320 is not applicable.

SKR-D

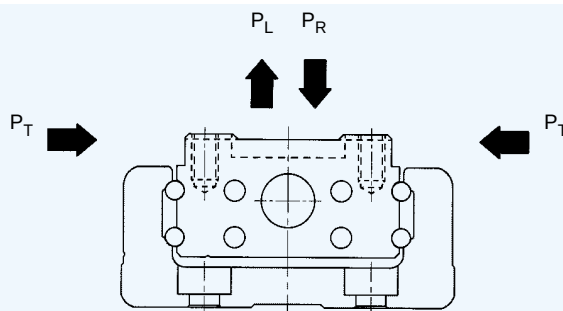


This is a version of SKR-C but with two short blocks. Since it can accommodate a span suitable for different types of equipment, high rigidity can be obtained.

The model size SKR3320 is not applicable.

Technical Datas

The LM Guide Actuator SKR consists of the integrated components LM Guide and ballscrew with support units. For the corresponding load ratings see table 2.



LM Guide

The LM Guide of the SKR can bear loads in all of the radial, reverse-radial, and lateral directions. The basic load rating is equal in these four directions (radial, reverse-radial, and two lateral directions). These values are listed in Table 2.

Ballscrew

The ballscrew can bear axial loads because the ball screw is incorporated in the nut block. The basic load rating is listed in Table 2.

Support Units

The support bearing can bear axial loads because the angular bearings are incorporated in housing A. The basic load rating is listed in Table 2.

Equivalent Load (LM Guide)

The equivalent load in cases where loads in each direction are simultaneously applied to the KR type LM Guide is determined using the following equation:

$$P_E = P_R (P_L) + P_T$$

P_E : Equivalent load (N)
 • radial
 • reverse-radial
 • lateral
 P_R : Radial load (N)
 P_L : Reverse-radial load (N)
 P_T : Lateral load (N)

Table 2 Load ratings

Model No.			SKR33			SKR46	
LM Guide	Basic dynamic load rating C [N]	Type SKR-A(B) ¹⁾	17000			39500	
		Type SKR-C(D) ¹⁾	11300			28400	
	Basic static load rating C ₀ [N]	Type SKR-A(B) ¹⁾	20400			45900	
		Type SKR-C(D) ¹⁾	11500			28700	
Ballscrew	Screw-shaft diameter [mm]		13			15	
	Lead [mm]		6	10	20	10	20
	Screw-shaft root diameter [mm]		10.8			12.3	
	Ball center diameter [mm]		13.5			15.75	
	Basic dynamic load rating C _a [N]		4400	2270	2620	4350	4240
	Basic static load rating C _{0a} [N]		6290	3780	3770	6990	7040
Support Unit	Basic dynamic load rating C _a [N]		6250			6660	
	Permissible load P _{0a} [N]		2300			2750	

¹⁾ Load rating for LM Guide shows the load rating per nut block.

²⁾ For the type SKR3320 no short block is available.

Static Permissible Moment

Static Permissible Moment (LM Guide)

The LM Guide Actuator SKR can bear moments in all directions with only one nut block. Table 3 shows static permissible moments M_A , M_B , and M_C in each direction.

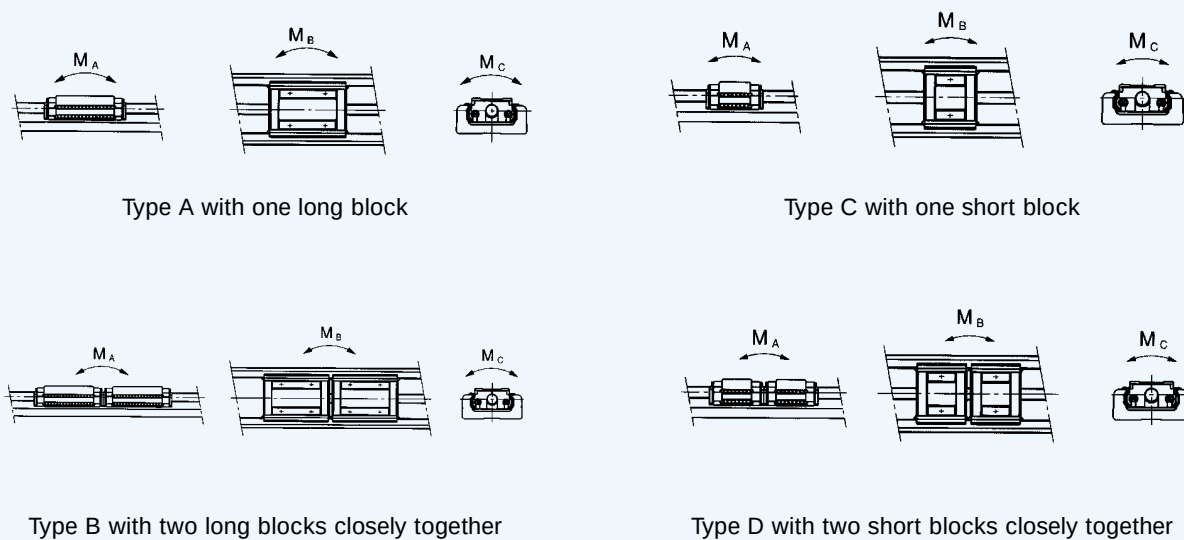


Figure 5

Table 3 Static permissible moment

Unit: Nm

Model No.	Static permissible moment		
	M_A	M_B	M_C
SKR33-A	173	173	340
SKR33-B	990	990	680
SKR33-C	58	58	190
SKR33-D	390	390	380
SKR46-A	579	579	1110
SKR46-B	3240	3240	2220
SKR46-C	236	236	690
SKR46-D	1460	1460	1390

Note: The values for the types SKR-B and SKR-D show those of two closely linked nut blocks.

Service Life

The LM Guide Actuator SKR consists of an LM Guide, a ballscrew and support bearings. The service lives of these components can be calculated using the values of the basic dynamic load rating presented in table 2 “Load rating”.

Nominal Life

The nominal life refers to the total running distance that 90% of identical units of the LM Guide in a group, when operated independently under the same conditions, can achieve without developing flaking. The nominal life is calculated as follows:

$$L = \left(\frac{f_c \cdot C}{f_w \cdot P_c} \right)^3 \cdot 50 \text{ [km]}$$

L	: Nominal Life	(km)
C	: Basic dynamic load rating	(N)
P _c	: Calculated load applied	(N)
f _w	: Load factor	(see table 5)
f _c	: Contact factor	(see table 4)

When SKR-A and SKR-C as well as SKR-B and SKR-D are used with close-linked double inner blocks, and subjected to a moment, calculate the equivalent load by multiplying the moment exerted by one of the equivalent factors in Table 6.

$$P_m = K \cdot M$$

P _m	: Equivalent load (per block)	(N)
K	: Moment-equivalent factor	(mm ⁻¹)
M	: Operating moment	(Nmm)

(If three or more blocks are used in a system, or if two blocks are used separated from each other, contact us.)

Particularly when moment M_C is exerted on SKR-B(-D):

$$P_m = \frac{K_c \cdot M_c}{2}$$

When a radial load (P) and moment are exerted on type KR simultaneously:

$$P_E = P_m + P$$

P _E	: Total equivalent radial load	(N)
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Service Life in Hours

Once the nominal life (L) is obtained from this calculation, the service life in hours can be calculated using the following equation if the stroke length and the number of reciprocal operations are constant:

$$L_h = \frac{L \cdot 10^6}{2 \cdot \ell_s \cdot n_1 \cdot 60}$$

L _h	: Service life in hours	(h)
ℓ _s	: Stroke length	(mm)
n ₁	: Reciprocal operations per minute	(min ⁻¹)

Ballscrew and Support Bearing

The nominal life refers to the total number of revolutions that 90% of identical units of the ballscrew (support bearing) in a group, when operated independently under the same conditions, can achieve without developing flaking. The nominal life for ballscrews and support bearings is calculated as follows:

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

L	: Nominal life in revolutions per minute	(min ⁻¹)
C _a	: Basic dynamic load rating	(N)
F _a	: Axial load	(N)
f _w	: Load factor	(see table 5)

Service Life in Hours

Once the nominal life (L) is obtained from this calculation, the service life in hours can be calculated using the following equation if the stroke length and the number of reciprocal operations are constant:

$$L_h = \frac{L \cdot \ell}{2 \cdot \ell_s \cdot n_1 \cdot 60}$$

L _h	: Service life in hours	(h)
ℓ _s	: Stroke length	(mm)
n ₁	: Reciprocal operations per minute	(min ⁻¹)
ℓ	: Lead	(mm)

f_c : Contact factor

When the SKR-B and SKR-D are used with close-linked double inner blocks, multiply the basic load rating by a contact factor chosen from the table below.

Table 4 Contact factor (f_c)

Type of block	f_c
Type A/C	1.0
Type B/D	0.81

f_w : Load factor

Table 5 Load factor f_w

Impact and vibration	Velocity V	f_w
Very slight	Very low $V \leq 0.25$ m/s	1.0~1.2
Slight	Low $0.25 < V \leq 1.0$ m/s	1.2~1.5
Intermediate	Intermediate $1.0 < V \leq 2.0$ m/s	1.5~2.0
Strong	High $V > 2.0$ m/s	2.0~3.5

K : Moment-equivalent factor (LM Guide)

In an LM Guide operating while subjected to a moment, the load distribution is not uniform. This results in an excessive load at localized areas. In this case, calculate the load by multiplying the moment value by a moment-equivalent factor chosen from Table 6.

Table 6 Moment-equivalent factor (K)

Unit: mm^{-1}

Model No.	K_A	K_B	K_C
SKR33-A	1.42×10^{-1}	1.42×10^{-1}	4.96×10^{-2}
SKR33-B	2.47×10^{-2}	2.47×10^{-2}	4.96×10^{-2}
SKR33-C	2.39×10^{-1}	2.39×10^{-1}	4.96×10^{-2}
SKR33-D	3.54×10^{-2}	3.54×10^{-2}	4.96×10^{-2}
SKR46-A	9.51×10^{-2}	9.51×10^{-2}	3.39×10^{-2}
SKR46-B	1.70×10^{-2}	1.70×10^{-2}	3.39×10^{-2}
SKR46-C	1.46×10^{-1}	1.46×10^{-1}	3.39×10^{-2}
SKR46-D	2.36×10^{-2}	2.36×10^{-2}	3.39×10^{-2}

K_A : Moment-equivalent factor in direction M_A

K_B : Moment-equivalent factor in direction M_B

K_C : Moment-equivalent factor in direction M_C

Note: For types SKR-B and SKR-D, the values show those of two closely related nut blocks.

Accuracy Standards

The accuracy standard for the LM Guide Actuator SKR is specified below.

Table 7 Accuracy standard

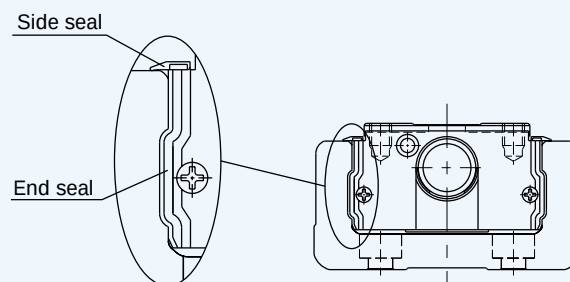
Unit: mm

Model No.	Rail length	Positioning accuracy reproducibility	Positioning accuracy	Running parallelism	Backlash	Starting torque [Ncm]	
SKR33	150	±0.003	0.020	0.010	0.003	15	
	200						
	300						
	400		0.025	0.015			
	500						
	600						
	700		0.030	0.020			
SKR46	340	±0.003	0.025	0.015	0.003	15	
	440						
	540						
	640		0.030	0.020		17	
	740						

- Notes: 1. The evaluation methods for the accuracy grades must conform to **THK** standard.
 2. The starting torque must be measured with lithium-soap-based grease No. 2 sealed in.
 For Types KR20 and 26, however, AFA Grease must be sealed in.
 3. When high-viscosity grease such as vacuum grease or clean-room grease is used, measurements may exceed the standards presented here. Therefore, the motor to be used must be chosen carefully.

Seals

End seals as well as side seals are standard for the type SKR.



Model Number Coding

SKR33
10
A
+
300L
P
0
-
0
0
0
0

1
2
3
4
5
6
7
8
9
10

- 1 Model No.
- 2 Lead (mm)
- 3 Type of inner block
- 4 Outer rail length (mm)
- 5 Accuracy standard (see table 7)
- 6 Motor type (see table 8)
- 7 Provision of cover (see table 8)
- 8 Sensor (see table 8)
- 9 Housing A
- 10 Flange form

Table 8

Accuracy grade		Motor		Provision of cover		Provision of sensor	
Symbol	Comment	Symbol	Comment	Symbol	Comment	Symbol	Comment
P	Precision grade	0	without	0	without	0	without
						1	Sensor rail provided
						2	Photosensor EE-SX671 (Omron)
						4	Proximity sensor GL-12F (Omron)
		1	Motor provided	1	Cover provided	5	Proximity sensor GXL-N12F (Omron)
						6	Photosensor EE-SX674 (Omron)
						7	Proximity sensor APM-D3 (Omron)
						X ⁽¹⁾	Proximity sensor TL-W3M__ (Omron)

(1)

Type	Version
TL-W3MC1	NPN-Normally open
TL-W3MC2	NPN-Normally Closed
TL-W3MB1	PNP-Normally open
TL-W3MB2	PNP-Normally Closed

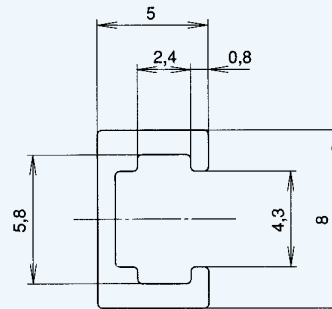
X = Standard Sensor Europe

Please mention the number and the type when ordering.
Example: 2 x TL-W3MB2 and 1 x TL-W3MB1

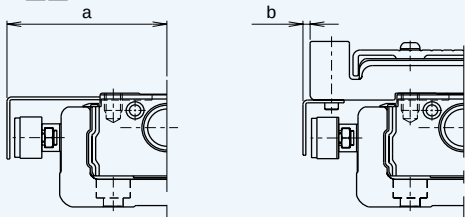
Sensor

Sensor rail

A sensor rail with the following dimensions can be fixed at the SKR:



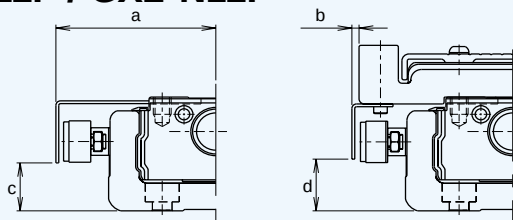
TL-W3M



Unit: mm

Model No.	a	b
SKR33	43.95	1.2
SKR46	57	0.6

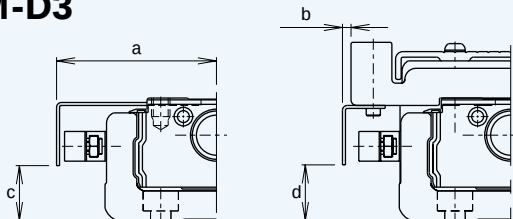
GL-12F / GXL-N12F



Unit: mm

Model No.	a	b	c	d
SKR33	44.75	2	13.8	14
SKR46	57.7	1.8	25.4	22

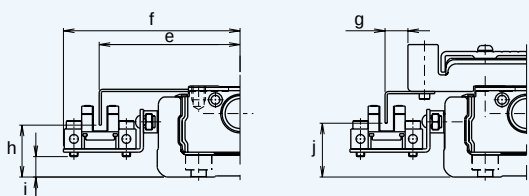
APM-D3



Unit: mm

Model No.	a	b	c	d
SKR33	43.05	0.3	14.8	15
SKR46	56.2	0.2	25.4	22

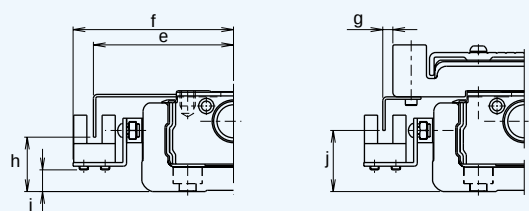
EE-SX671



Unit: mm

Model No.	e	f	g	h	i	j
SKR33	51.05	64	8.3	18.8	7.4	19.5
SKR46	64.1	77	8.3	28.4	16.4	26.5

EE-SX674

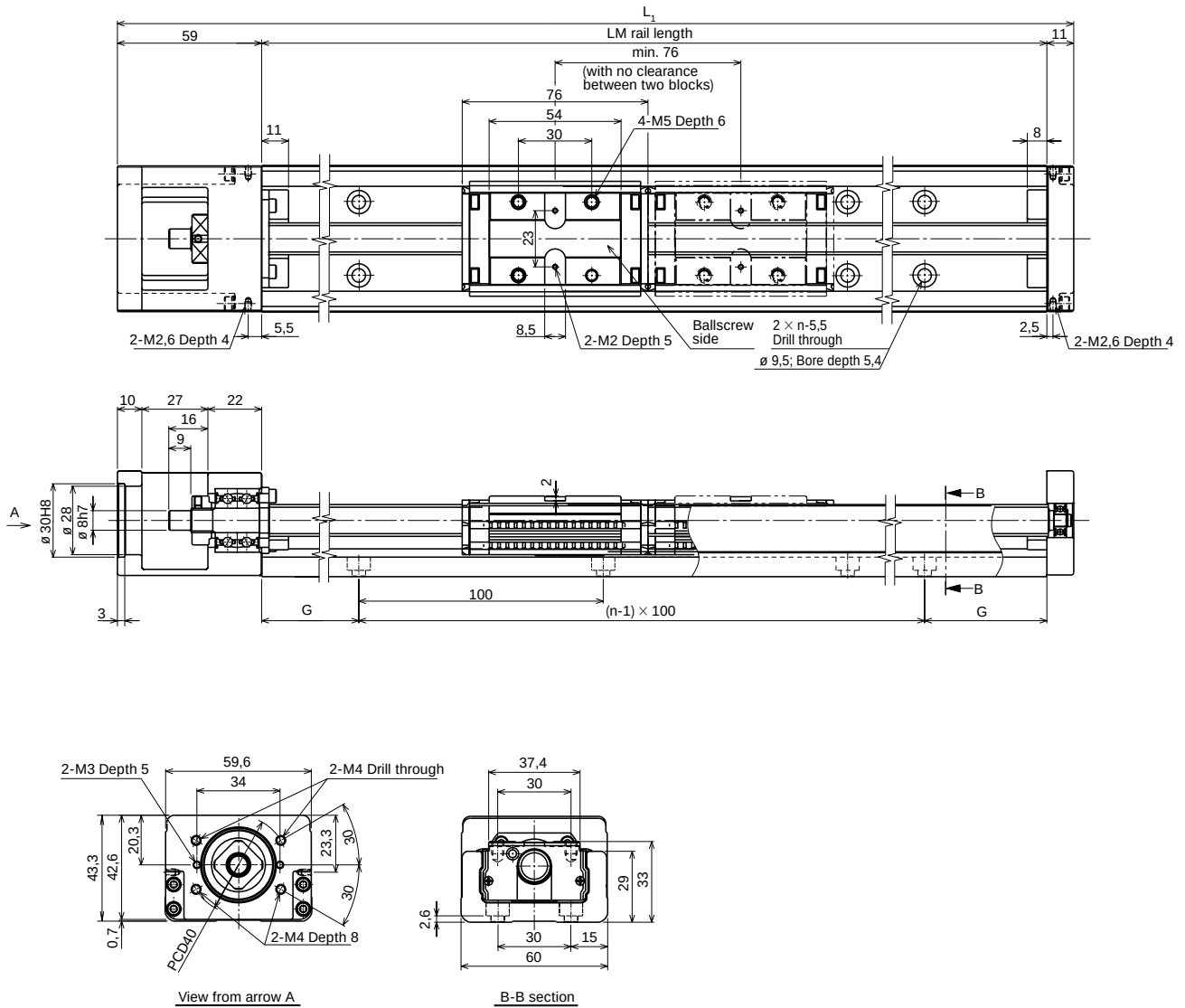


Unit: mm

Model No.	e	f	g	h	i	j
SKR33	45.85	52.5	3.3	17.8	7.1	20
SKR46	58.9	65.5	3.2	27.4	16.1	27

SKR33 Standard Type

SKR33-A (with one long block) SKR33-B (with two long blocks)

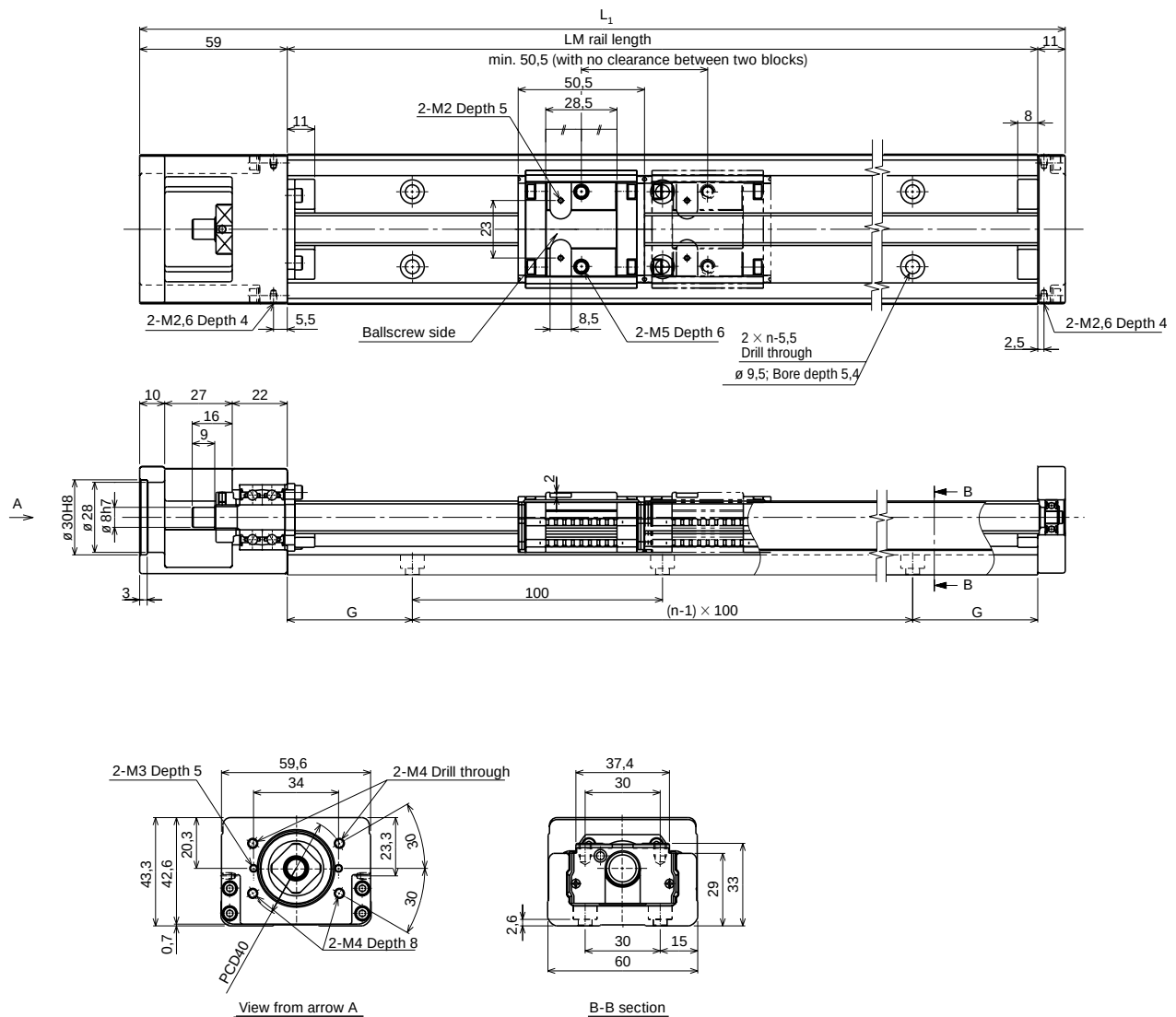


Unit: mm

Lm rail length L_1	Overall length L_2	Possible stroke range		G	n	Total mass [kg]	
		A-Typ	B-Typ ¹⁾			A-Typ	B-Typ
150	220	55	—	25	2	1.7	2.01
200	270	105	—	50	2	2.1	2.41
300	370	205	129	50	3	2.8	3.11
400	470	305	229	50	4	3.5	3.81
500	570	405	329	50	5	4.2	4.51
600	670	505	429	50	6	4.9	5.21
700	770	605	529	50	7	5.6	5.91

¹⁾ The possible stroke range for the type SKR-B is represented by those for closely-linked double blocks.

SKR33-C (with one short block)
SKR33-D (with two short blocks)



Unit: mm

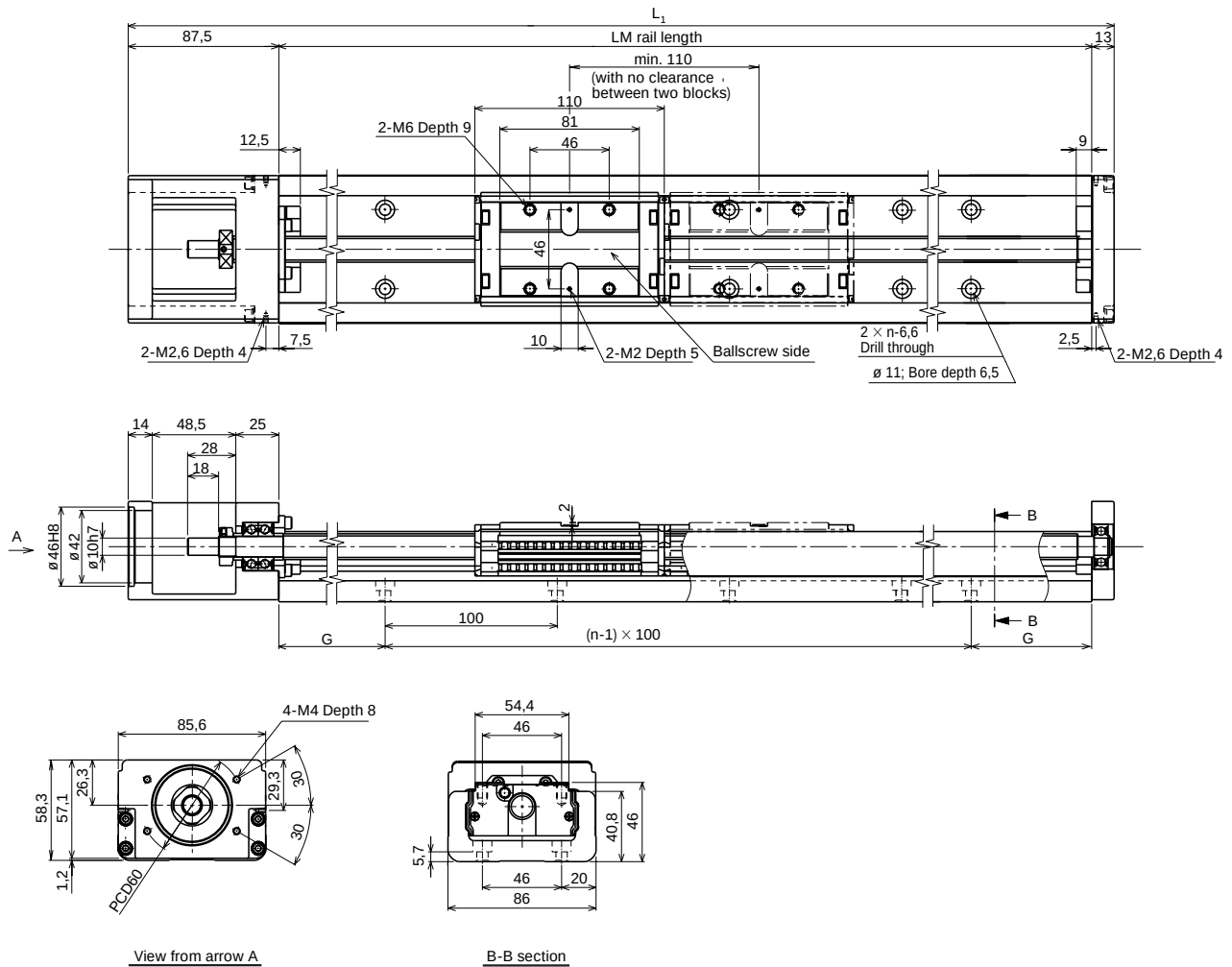
Schienenlänge L_1	Gesamtlänge L_2	Possible stroke range		G	n	Total mass [kg]	
		C-Typ	D-Typ ¹⁾			C-Typ	D-Typ
150	220	80.5	30	25	2	1.6	1.77
200	270	130.5	80	50	2	1.9	2.07
300	370	230.5	180	50	3	2.6	2.77
400	470	330.5	280	50	4	3.3	3.47
500	570	430.5	380	50	5	4.0	4.17
600	670	530.5	480	50	6	4.8	4.97
700	770	630.5	580	50	7	5.5	5.67

¹⁾ The possible stroke range for the type SKR-D is represented by those for closely-linked double blocks.

* For the type SKR33 no short block is available.

SKR46 Standard Type

SKR46-A (with one long block) SKR46-B (with two long blocks)

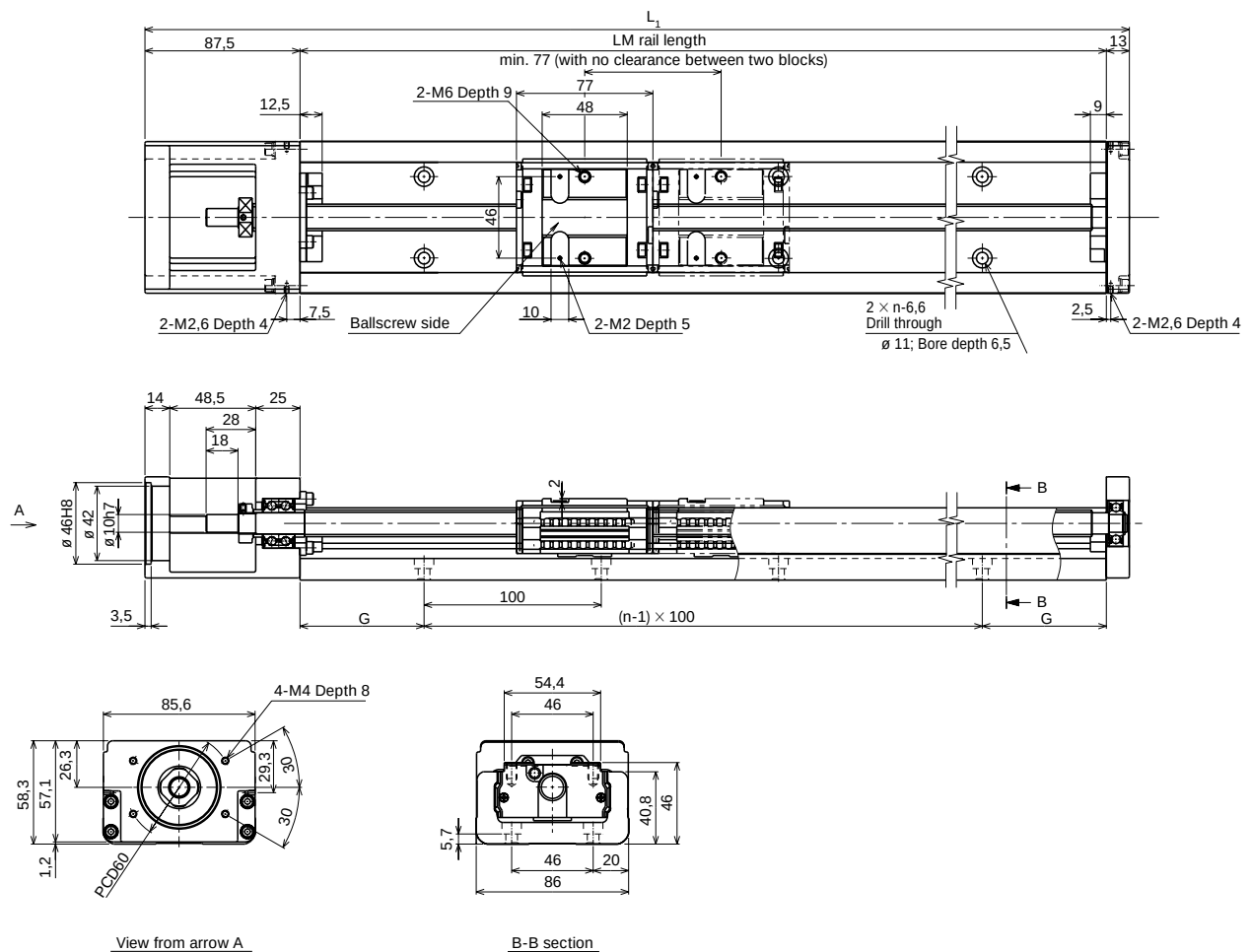


Unit: mm

Lm rail length L_1	Overall length L_2	Possible stroke range		G	n	Total mass [kg]	
		A-Typ	B-Typ ¹⁾			A-Typ	B-Typ
340	440.5	208.5	98.5	70	3	6.4	7.3
440	540.5	308.5	198.5	70	4	7.8	8.7
540	640.5	408.5	298.5	70	5	9.2	10.1
640	740.5	508.5	398.5	70	6	10.6	11.5
740	840.5	608.5	498.5	70	7	12.0	12.9

¹⁾ The possible stroke range for the type SKR-B is represented by those for closely-linked double blocks.

SKR46-C (with one short block)
SKR46-D (with two short blocks)



Unit: mm

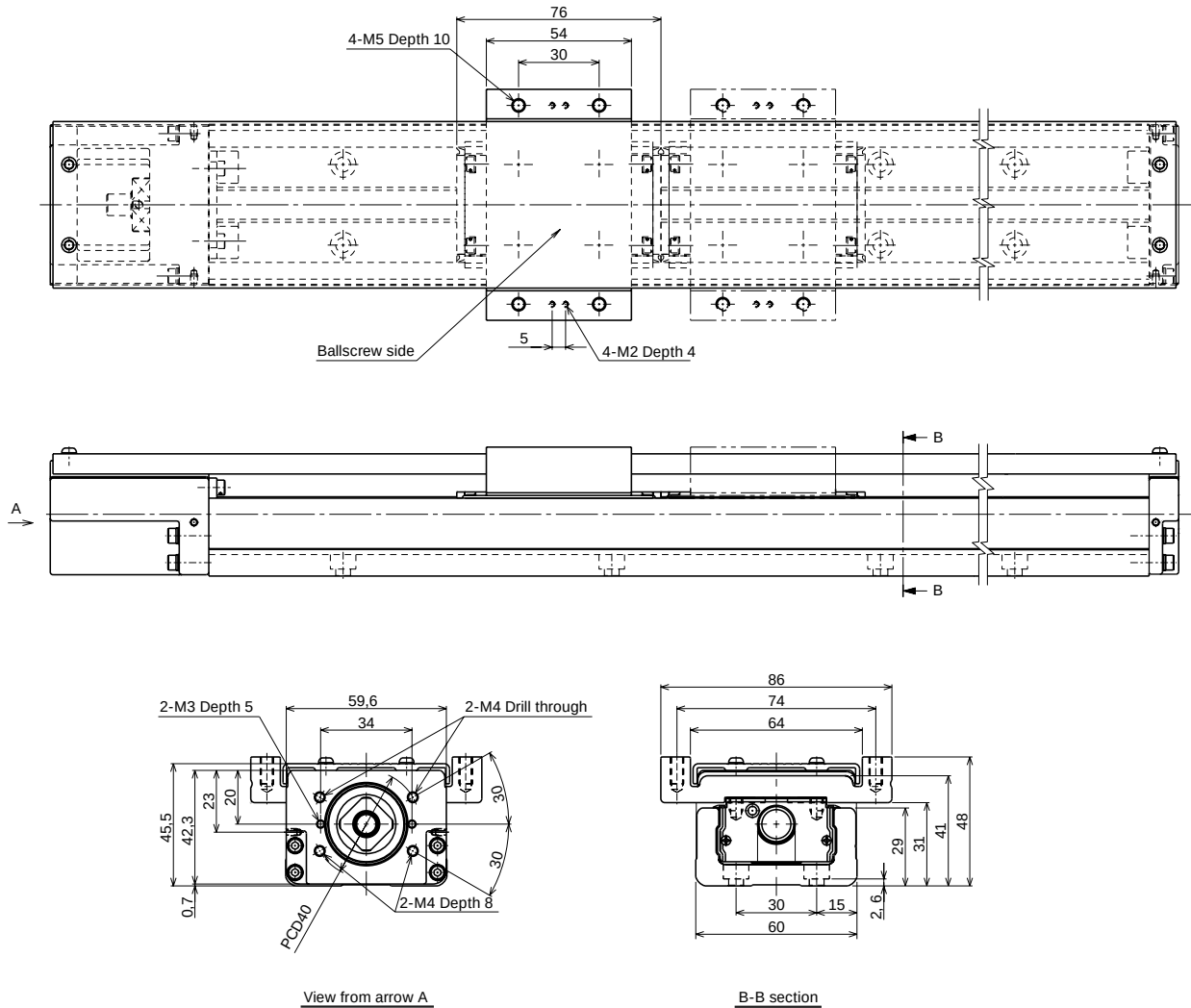
Lm rail length L_1	Overall length L_2	Possible stroke range		G	n	Total mass [kg]	
		C-Typ	D-Typ ¹⁾			C-Typ	D-Typ
340	440.5	241.5	164.5	70	3	6.1	6.67
440	540.5	341.5	264.5	70	4	7.5	8.07
540	640.5	441.5	364.5	70	5	8.9	9.47
640	740.5	541.5	464.5	70	6	10.3	10.87
740	840.5	641.5	564.5	70	7	11.7	12.27

¹⁾ The possible stroke range for the type SKR-D is represented by those for closely-linked double blocks.

SKR33 Standard Type with Cover

SKR33-A (with one long block)

SKR33-B (with two long blocks)

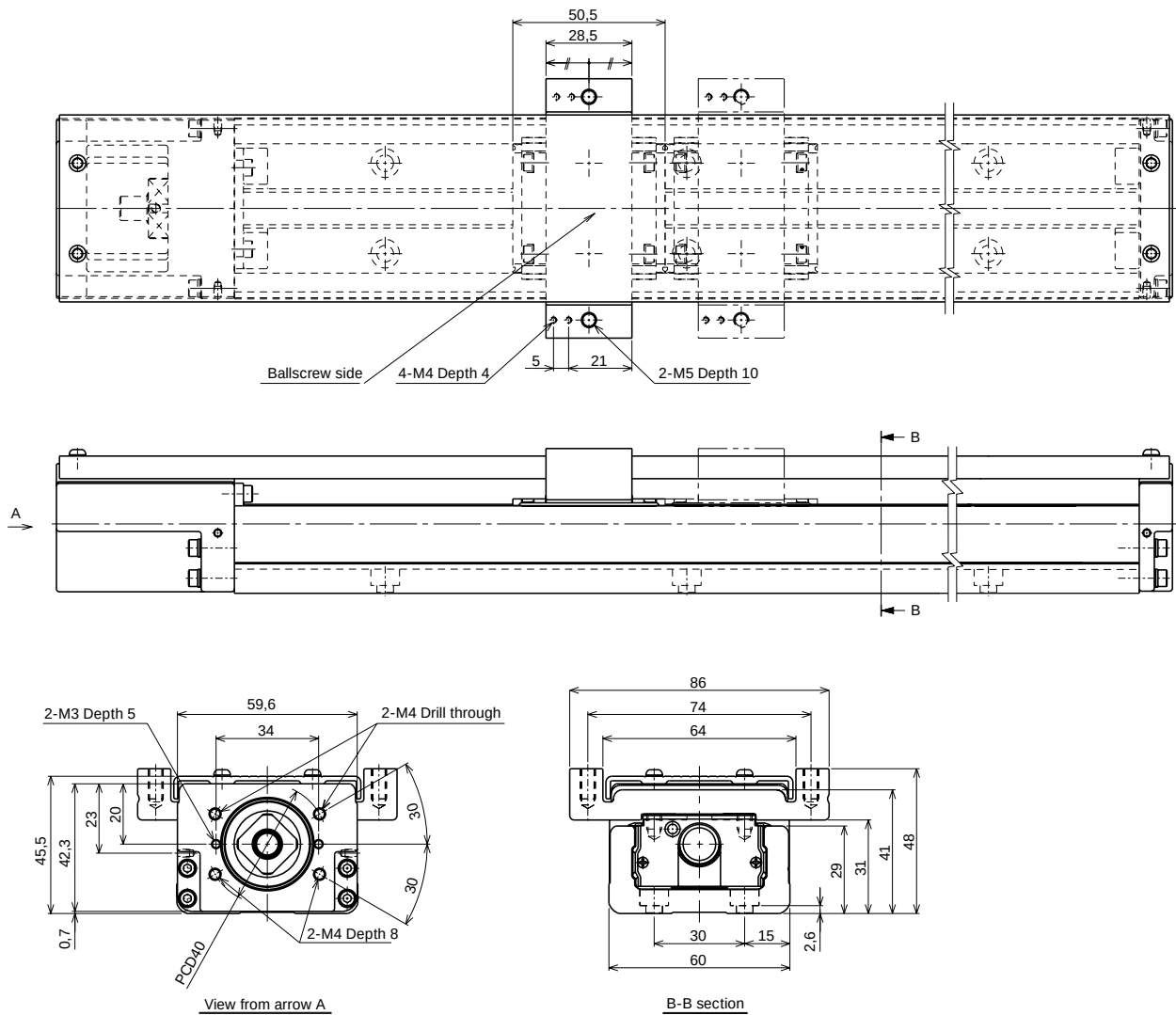


Unit: mm

Lm rail length L_1	Overall length L_2	Possible stroke range		G	n	Total mass [kg]	
		A-Typ	B-Typ ¹⁾			A-Typ	B-Typ
150	220	55	—	25	2	1.9	2.21
200	270	105	—	50	2	2.3	2.61
300	370	205	129	50	3	3.0	3.31
400	470	305	229	50	4	3.8	4.11
500	570	405	329	50	5	4.5	4.81
600	670	505	429	50	6	5.2	5.51
700	770	605	529	50	7	6.0	6.31

¹⁾ The possible stroke range for the type SKR-B is represented by those for closely-linked double blocks.

SKR33-C (with one short block)
SKR33-D (with two short blocks)



Unit: mm

Lm rail length L_1	Overall length L_2	Possible stroke range		G	n	Total mass [kg]	
		C-Typ	D-Typ ¹⁾			C-Typ	D-Typ
150	220	80.5	30	25	2	1.7	2.01
200	270	130.5	80	50	2	2.1	2.41
300	370	230.5	180	50	3	2.8	3.11
400	470	330.5	280	50	4	3.6	3.91
500	570	430.5	380	50	5	4.3	4.61
600	670	530.5	480	50	6	5.1	5.41
700	770	630.5	580	50	7	5.8	6.11

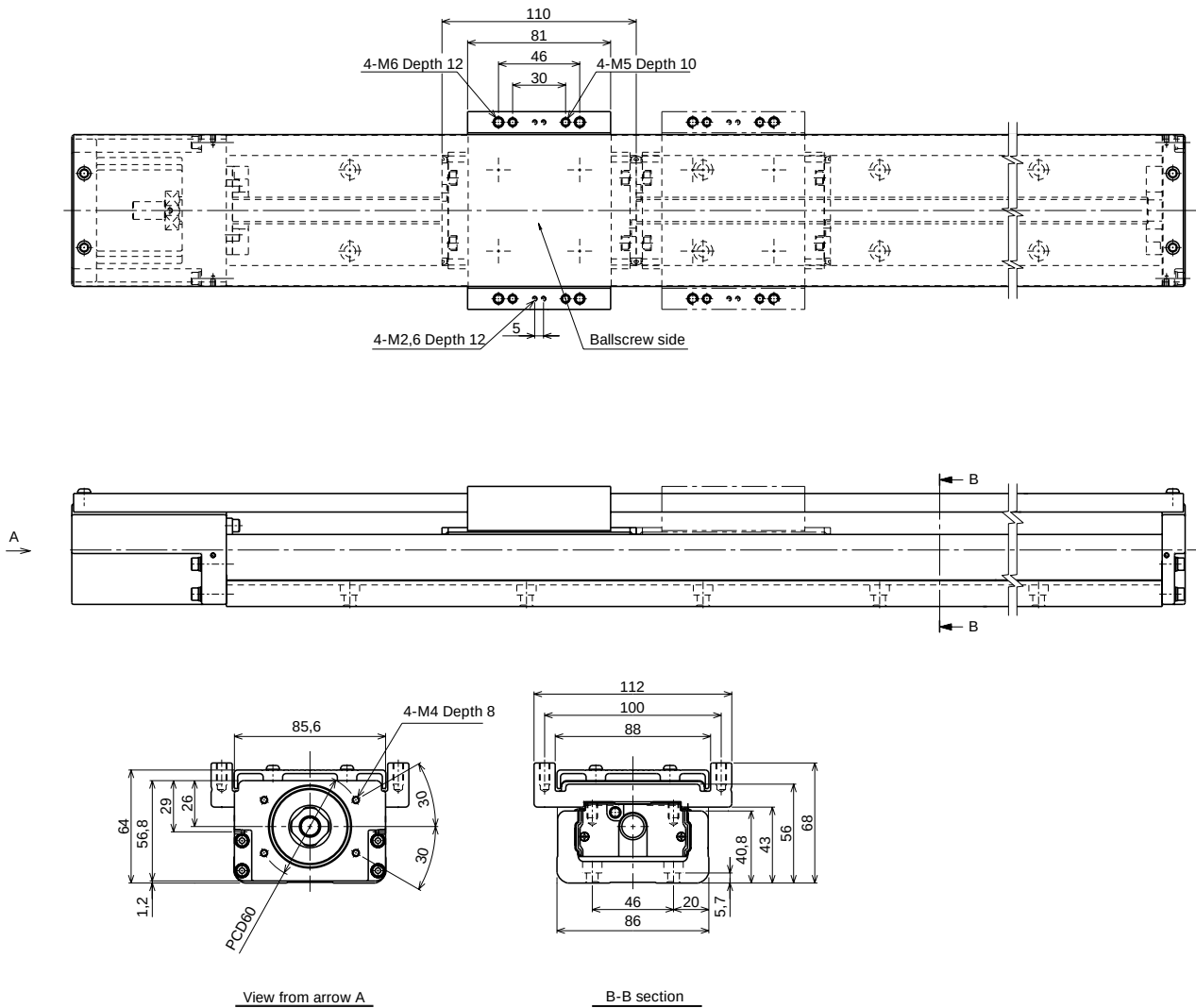
¹⁾ The possible stroke range for the type SKR-D is represented by those for closely-linked double blocks.

* For the type SKR33 no short block is available.

SKR46 Standard Type with Cover

SKR46-A (with one long block)

SKR46-B (with two long blocks)

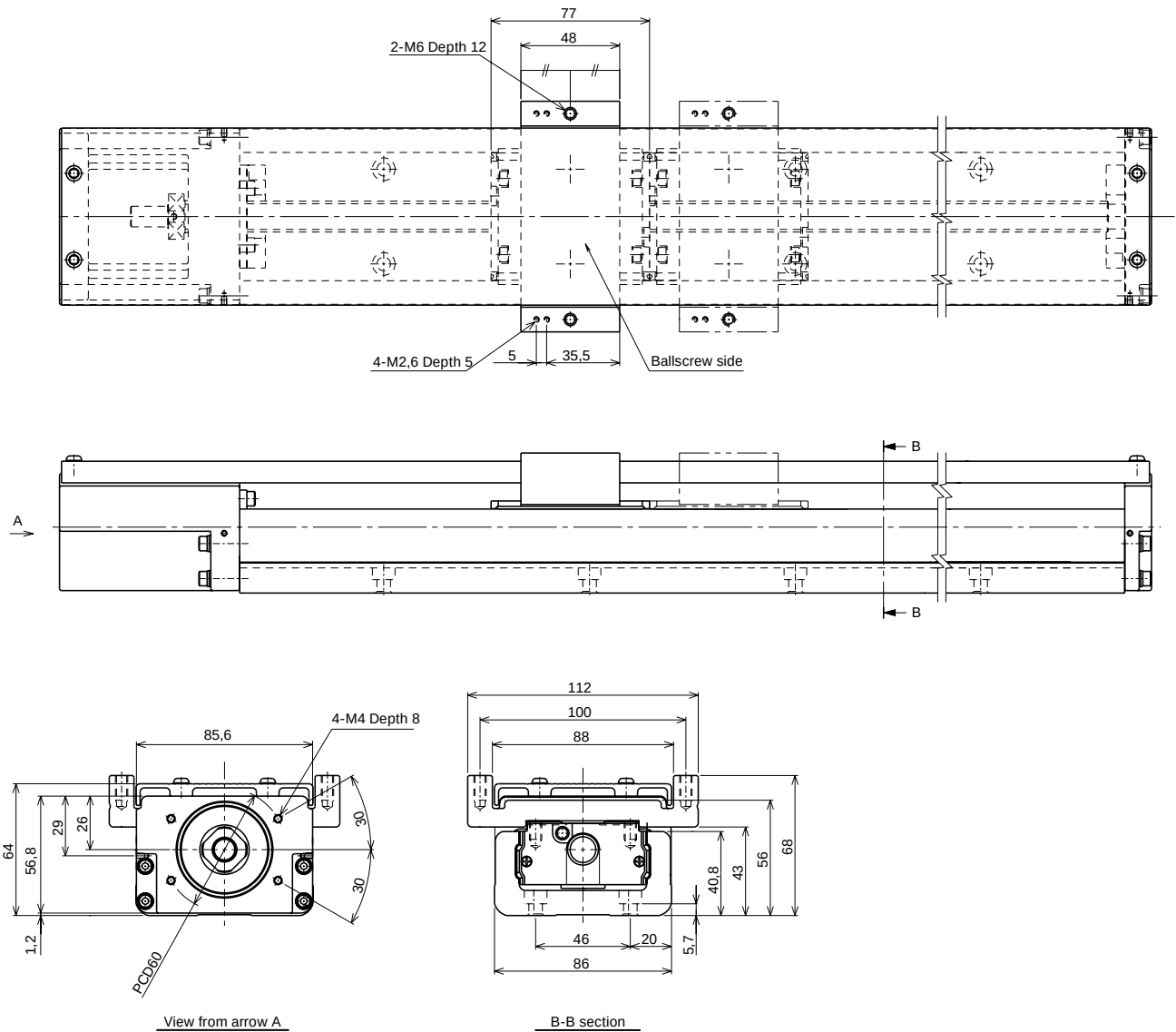


Unit: mm

Lm rail length L_1	Overall length L_2	Possible stroke range		G	n	Total mass [kg]	
		A-Typ	B-Typ ¹⁾			A-Typ	B-Typ
340	440.5	208.5	98.5	70	3	7.1	8
440	540.5	308.5	198.5	70	4	8.6	9.5
540	640.5	408.5	298.5	70	5	10.1	11
640	740.5	508.5	398.5	70	6	11.5	12.4
740	840.5	608.5	498.5	70	7	13.0	13.9

¹⁾ The possible stroke range for the type SKR-B is represented by those for closely-linked double blocks.

SKR46-C (with one short block)
SKR46-D (with two short blocks)



Unit: mm

Lm rail length L_1	Overall length L_2	Possible stroke range		G	n	Total mass [kg]	
		C-Typ	D-Typ ¹⁾			C-Typ	D-Typ
340	440.5	241.5	164.5	70	3	6.7	7.27
440	540.5	341.5	264.5	70	4	8.1	8.67
540	640.5	441.5	364.5	70	5	9.6	10.17
640	740.5	541.5	464.5	70	6	11.1	11.67
740	840.5	641.5	564.5	70	7	12.5	13.07

¹⁾ The possible stroke range for the type SKR-D is represented by those for closely-linked double blocks.



Precautions on Use

• Handling

Do not drop the product or subject it to impact, as doing so may damage it. Therefore, due care should be exercised in its handling.

Unauthorized disassembly of the product could lead to contamination by foreign matter, reducing precision. Therefore, disassembly should not be performed unless absolutely necessary.

At high rotational speeds, the ballscrew causes resonance due to the characteristic frequency of the screw shaft, which may make operation impossible. The shaft speed should be therefore set at a level below the resonant point (critical speed).

Please consult **THK**.

• Operating temperature range

Do not use this product at 80 °C or higher. If your system requires a temperature of 80 °C or higher, contact **THK**.

• Lubrication

A certain lubrication is absolutely necessary for the operation of the LM Guide Actuator SKR. Otherwise, it will be damaged before it reaches its projected service life. Therefore, please take care about the following points:

- Before operation the anti-corrosion oil must be removed and the LM Guide Actuator SKR lubricated.
- The usage of different lubricants must be avoided.
- The lubricant intervals should correspond to the operation necessities and to the environment surroundings.
- When used under special environment, including in locations subject to continual vibration, in a clean room, under a vacuum, and at low or high temperatures, contact **THK**.

Specifications are subject to change without notice

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