

Miniature LM Guide RSR and RSR-W

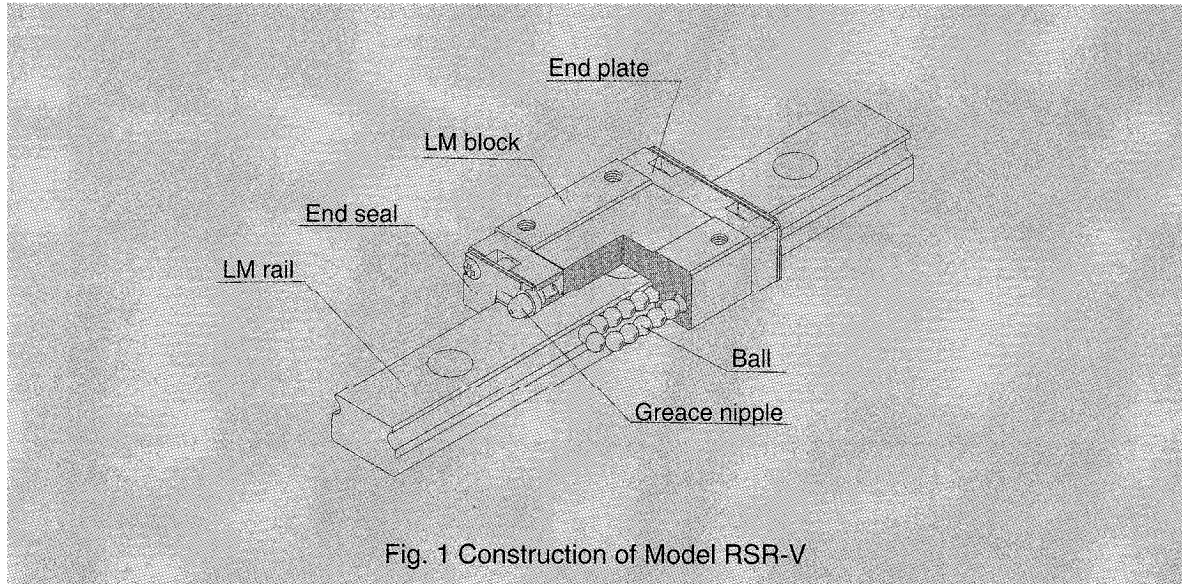


Fig. 1 Construction of Model RSR-V

Construction and Features

Balls roll in two rows of precision-ground raceways on an LM rail and an LM block. The end plates attached to the LM block cause the trains of balls to circulate.

In types RSR and RSR-W, balls circulate in the compact body of the LM block. As a result, linear motion with an unlimited stroke length can be achieved.

The LM block has been designed to be space-saving yet provide the required rigidity. When used in combination with large-diameter balls, the LM block can ensure high rigidity in all directions.

Ultra-compact

Miniature LM Guide types RSR and RSR-W are free from the problems involving dislocation of the cage that are often seen with cross-roller guides, ball slides, and similar finite-stroke-type equipment. These miniature LM Guides can therefore provide highly reliable compact linear systems.

Bears loads in any direction

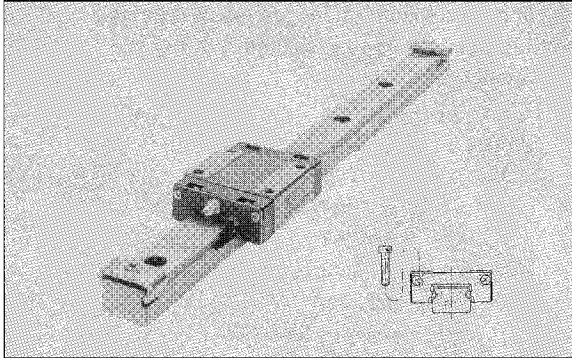
Types RSR and RSR-W can bear loads in any direction perpendicular to the LM-rail longitudinal axis. Light moment loads can be borne by a one-axis configuration. In type RSR-W in particular, the number of effective balls is increased and the LM rail is widened. This design has increased the rigidity against moments. Despite its compact size, even a single unit of this type of LM Guide provides higher durability than two-axis linear bushes installed in parallel.

Stainless-steel type available

Upon request, we can provide stainless-steel LM blocks, rails, and balls.

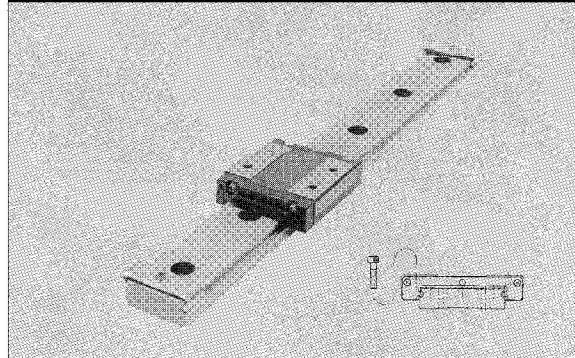
Types and Features

Types RSR and RSR-K/V



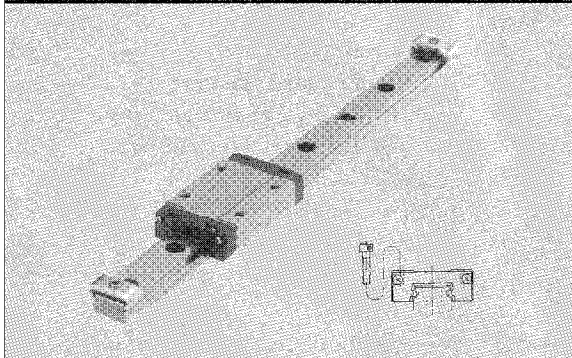
Standard type of Miniature LM Guide.

Type RSR-W/WV



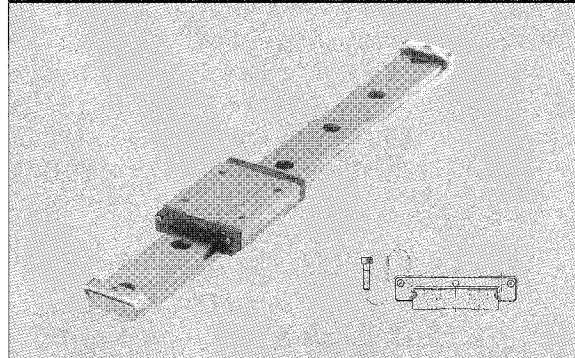
Type RSR-V modified by increasing both the length and width of the LM block in order to achieve greater load ratings and permissible moments.

Type RSR-N



Type RSR-V modified by increasing both the length and width of the LM block in order to achieve greater load ratings and permissible moments.

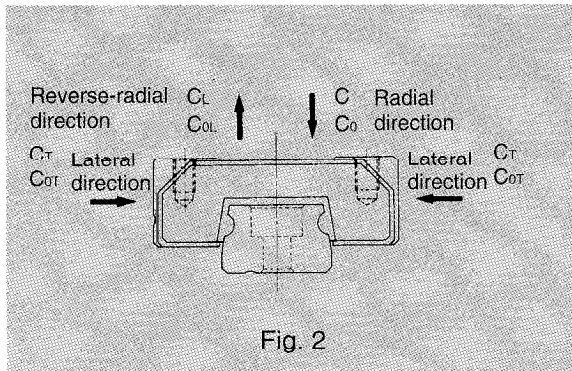
Type RSR-WN



Type RSR-W modified by increasing the LM-block length, number of effective balls, and load rating; features the highest load-carrying capability of any Miniature LM Guide model.

Load Rating and Permissible Moment in Various Directions

Load rating



Type RSR can bear loads in all four directions: radial, reverse-radial, and the two lateral directions. The basic load ratings of types RSR3 through 9 in all four directions (radial, reverse-radial, and the two lateral directions) are equivalent to one another. The values are given in the corresponding dimension tables.

The basic load ratings of types RSR12 through 20 are for the exertion of a load in the radial direction in the diagram shown above. The values are given in the corresponding dimension tables. Values for the reverse-radial and lateral directions are given in Table 1.

Table 1 Load Ratings of Types RSR12 through 20 in Various Directions

Direction	Basic dynamic load rating	Basic static load rating
Radial	C	C_0
Reverse-radial	$C_L = 0.78C$	$C_{OL} = 0.70C_0$
Lateral	$C_T = 0.78C$	$C_{OT} = 0.71C_0$

Equivalent load

The equivalent load for types RSR3 through 9 when loads in various directions are exerted on its LM block simultaneously can be obtained using the following equation:

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

where

P_E : equivalent load (N)

- In the radial direction
- In the reverse-radial direction
- In the lateral direction

P_R : radial load (N)

P_L : reverse-radial load (N)

P_T : lateral load (N)

The equivalent load for types RSR12 through 20 when loads in the radial and lateral, or reverse-radial and lateral directions are exerted on its LM block simultaneously can be obtained using the following equation:

$$P_E = X \cdot P_R (P_L) + Y \cdot P_T$$

where

P_E : equivalent load (N)

- In the radial direction
- In the reverse-radial direction
- In the lateral direction

P_R : radial load (N)

P_L : reverse-radial load (N)

P_T : lateral load (N)

X and Y : equivalent factor (see Tables 2 and 3)

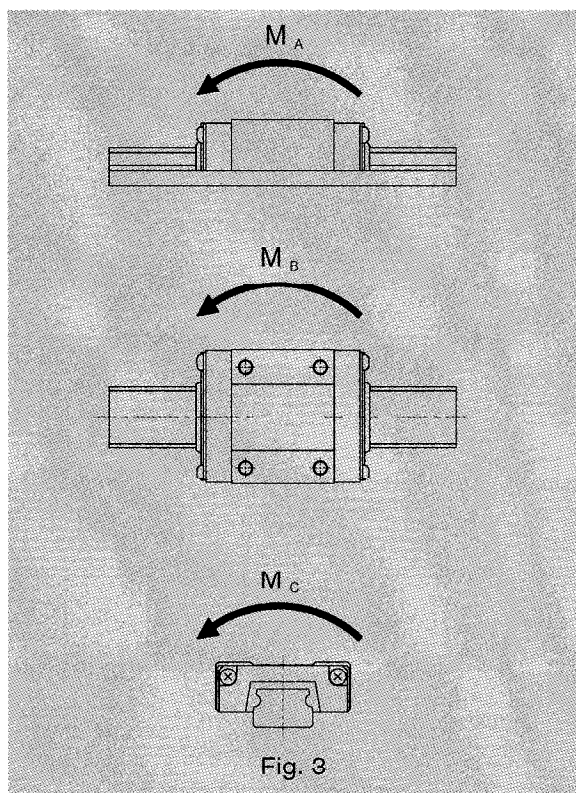
Table 2 Types RSR12 through 20 Equivalent Factor (under radial and lateral loads)

P_E	X	Y
Equivalent load in the radial direction	1	0.83
Equivalent load in the lateral direction	1.20	1

Table 3 Types RSR12 through 20 Equivalent Factor (under reverse-radial and lateral loads)

P_E	X	Y
Equivalent load in the reverse-radial direction	1	0.99
Equivalent load in the lateral direction	1.01	1

Permissible moment



In type RSR, a single LM block can bear moments in all directions. Table 4 gives the permissible moments in directions M_A , M_B , and M_C for a single LM block.

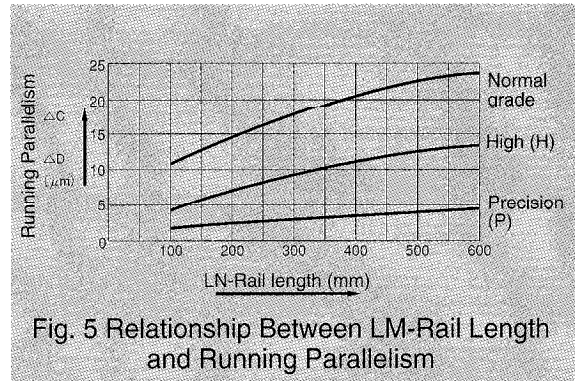
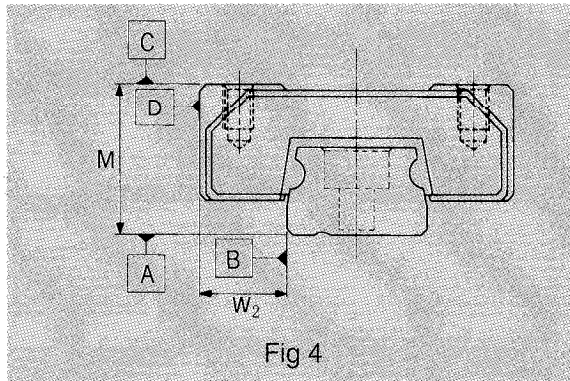
Table 4 Type-RSR Static Permissible Moment

Unit : N·m

Model No.	M_A	M_B	M_C
RSR 5	0.8	0.8	1.47
RSR 5 N	1.85	1.85	2.4
RSR 7	2.55	2.55	5.10
RSR 7 N	7.56	7.56	9.31
RSR 9 K	5.10	5.10	10.4
RSR 9 N	17.6	17.6	18.4
RSR 12 V	8.04	8.72	14.7
RSR 12 N	24.1	26.1	26.7
RSR 15 V	16.5	17.9	30.2
RSR 15 N	49.3	53.6	53.1
RSR 20 V	48.8	52.7	75.7
RSR 20 N	143	156	133
RSR 3 W	0.91	0.91	1.41
RSR 3 WN	1.51	1.51	2.26
RSR 5 W	1.98	1.98	4.78
RSR 5 WN	9.31	9.31	6.98
RSR 7 W	5.39	5.39	15.2
RSR 7 WN	12.4	12.4	22.5
RSR 9 WV	16.3	16.3	36.0
RSR 9 WN	31.5	31.5	49.4
RSR 12 WV	17.2	18.6	47.6
RSR 12 WN	44.9	48.8	75.7
RSR 15 WV	35.2	38.2	137
RSR 15 WN	92.4	100	215

A-IV

Accuracy Standards



The accuracy of type RSR is shown in Table 5 for each model number, classified into the normal, high, and precision grades.

Table 5 Type RSR Accuracy Standard

Unit : mm

Model No.	Accuracy standard	Normal	High	Precision
	Item	No symbol	H	P
RSR 3 RSR 5	Tolerance for height M	± 0.03	—	± 0.015
	Tolerance for the height M difference among LM blocks	0.015	—	0.005
	Tolerance for rail-to-block lateral distance W_2	± 0.03	—	± 0.015
	Tolerance for rail-to-block lateral distance W_2 difference among LM blocks	0.015	—	0.005
	Running Parallelism of surface C with surface A	ΔC (as per Fig. 5)		
	Running parallelism of surface D with surface B	ΔD (as per Fig. 5)		
RSR 7 RSR 9 RSR 12 RSR 15 RSR 20	Tolerance for height M	± 0.04	± 0.02	± 0.01
	Tolerance for the height M difference among LM blocks	0.03	0.015	0.007
	Tolerance for rail-to-block lateral distance W_2	± 0.04	± 0.025	± 0.015
	Tolerance for rail-to-block lateral distance W_2 difference among LM blocks	0.03	0.02	0.01
	Running Parallelism of surface C with surface A	ΔC (as per Fig. 5)		
	Running parallelism of surface D with surface B	ΔD (as per Fig. 5)		

Radial clearance

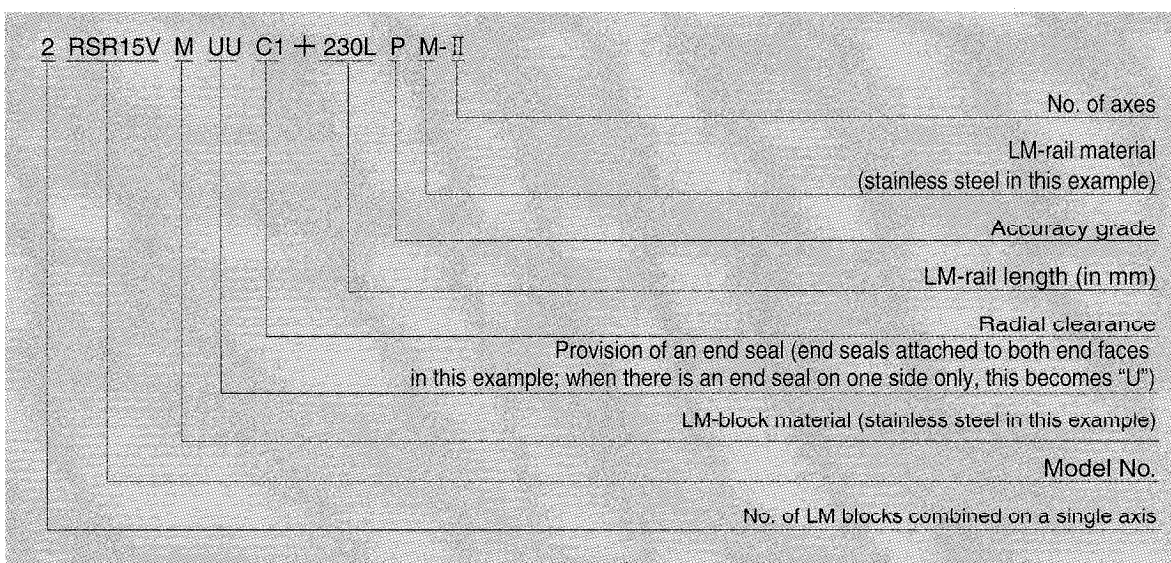
Table 6 presents the radial clearances of types RSR.

Table 6 Type-RSR Radial Clearances

Unit : μm

Model No.	Clearance symbol	Nomal	Under a light preload
		No symbol	C1
RSR 3		$0 \sim +1$	$-0.5 \sim 0$
RSR 5		$0 \sim +1.5$	$-1 \sim 0$
RSR 7		± 2	$-3 \sim 0$
RSR 9		± 2	$-4 \sim 0$
RSR 12		± 3	$-6 \sim 0$
RSR 15		± 5	$-10 \sim 0$
RSR 20		± 7	$-14 \sim 0$

Model-number coding



Note: This coding is based on the assumption of one set of code for a one-axis unit.
(A configuration of two axes installed in parallel is given at least two sets of code.)

Contamination Protection

From our wide array of products for type RSR, you can select the one best suited for your situation. (For details on seals, see “Contamination Protection” for type HSR on page A-223.)

Not all LM Guide models accept all contamination-protection accessories. Please check Table 7.

If your choice is applicable to your system, please note that in some models, attaching a contamination-protection accessory to an LM block changes the block's overall length. Add the increment specified in the corresponding dimension table to dimension L.

Table 7 Applicability of Seals to Type RSR, and the Increment to Be Added to the Block Overall Length

Unit : mm

Model No.	No symbol		UU	
RSR 5	○	-1.4	○	—
RSR 7	○	-1.4	○	—
RSR 9 K	○	-3.0	○	—
RSR 12 V	○	-4.0	○	—
RSR 15 V	○	-4.0	○	—
RSR 20 V	○	-5.0	○	—
RSR 3 W	○	-0.8	○	—
RSR 5 W	○	-1.4	○	—
RSR 7 W	○	-1.0	○	—
RSR 9 WV	○	-3.0	○	—
RSR 12 WV	○	-3.2	○	—
RSR 15 WV	○	-4.0	○	—

Note: ○ = Applicable

- The dimensions of types RSR5, 7, 3W, 5W, and 7W without seals include the head dimension of the end-plate mounting screw.

Seal resistance value

For the maximum value of seal resistance of Seals Type RSR...UU per LM block in which grease is applied, see Table 8.

Table 8 Maximum Resistance Value of seals to Type RSR

Unit : N

Model No.	Seal resistance value
RSR 5	0.06
RSR 7	0.08
RSR 9 K	0.1
RSR 12 V	0.4
RSR 15 V	0.8
RSR 20 V	1.0
RSR 3 W	0.2
RSR 5 W	0.3
RSR 7 W	0.4
RSR 9 W	0.8
RSR 12 W	1.1
RSR 15 W	1.3

Comparison Between Type RSR-W and Other Models

1. Application using two axes of linear bushes

- Whereas linear bushes must be used in a two-axis configuration, type RSR-W can be used in a one-axis configuration. Therefore, a system using this type of LM Guide can be made compact and space-saving.
- Type RSR-W has more balls per train for bearing loads than other models, and both the LM block and rail are wider. High rigidity is thereby ensured against overhang loads.
- Installation accuracy can be established solely by bolting LM rails to the base, thereby reducing installation time.

Example comparison between types RSR12W and LM10

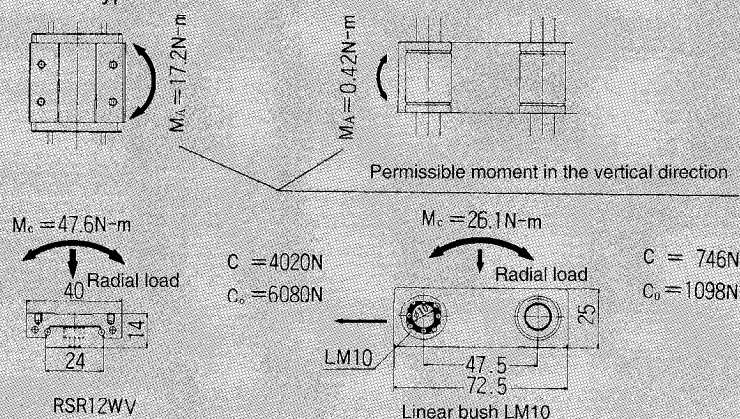


Fig. 6

2. Application using a cross-roller table

- The cage will not dislocate even during vertical installation, and linear motion with no limitation is possible.
- The need to make complicated clearance adjustments has been eliminated; smooth motion free from clearance can be maintained for extended periods.
- The wide LM block can be used as is, as a miniature table.

Comparison example between types RSR9WV and VRM1035

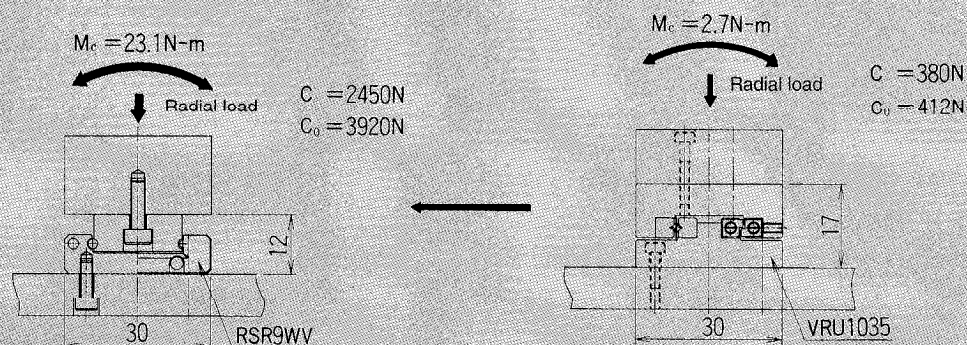


Fig. 7

Precautions on Use

Mounting-surface precision

The standard type RSK employs a raceway shaped like a Gothic-arch groove. When it is used in a configuration in which two units are combined in parallel, errors in mounting-surface precision increase the rolling resistance, which may decrease the smoothness of the resulting motion. For the mounting-surface precision, see Section 3.7, "Mounting-Surface Dimensional Tolerance," on page A-63.

For installation in a location in which the required mounting accuracy cannot be achieved, use of type RSR-A (semi-standard), in which the raceway shape is changed to that of a circular-arc groove, is recommended. (Note, however, that this type should not be used in a one-axis configuration.)

For the mounting-surface precision of type RSR-A, see Section 3.7, "Mounting-Surface Dimensional Tolerance," on page A-63.

Mounting-Surface Height and Corner Profile

Normally, mounting surfaces for LM blocks and rails have lateral reference surfaces to aid in positioning rails and blocks with a high degree of accuracy.

For the reference-surface shoulder height, see Table 9.

Furthermore, provide enough space to the corner profile of a mounting surface so that the corner does not interfere with chamfers made on the LM blocks or rails, or provide the corner with a radius smaller than corner radius r_1 , r_2 specified in Table 9.

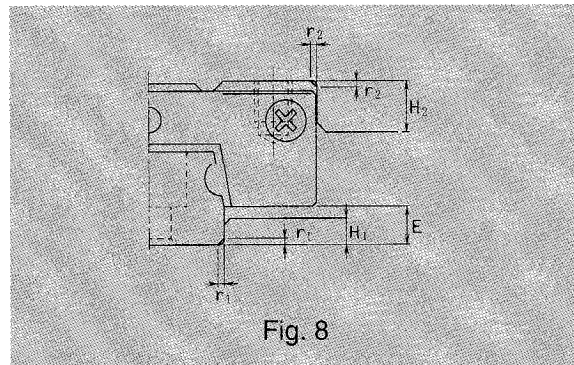


Fig. 8

Table 9 Mounting-Surface Shoulder Height and Corner Radius

Unit : mm

Model No.	LM-rail fillet radius r_1 (Max.)	LM-block fillet radius r_2 (Max.)	LM-rail shoulder height H_1	LM-block shoulder height H_2	E
RSR 5	0.1	0.3	1.2	2	1.5
RSR 7	0.1	0.5	1.2	3	1.5
RSR 9	0.3	0.5	1.9	3	2.2
RSR12	0.3	0.3	1.4	4	3
RSR15	0.3	0.3	2.3	5	4
RSR20	0.5	0.5	5.5	5	7.5
RSR 3 W	0.1	0.3	0.7	2	1
RSR 5 W	0.1	0.3	1.2	2	1.5
RSR 7 W	0.1	0.1	1.7	3	2
RSR 9 W	0.1	0.1	3.9	3	4.2
RSR12 W	0.3	0.3	3.7	4	4
RSR15 W	0.3	0.3	3.7	5	4

Stopper

In miniature LM Guide types RSR and RSR-W, removing the LM block from the rail causes the balls to fall off. To prevent this, the LM block is delivered with stoppers installed. When removing the stopper before the LM Guide is used, be careful not to allow the LM block to overrun.

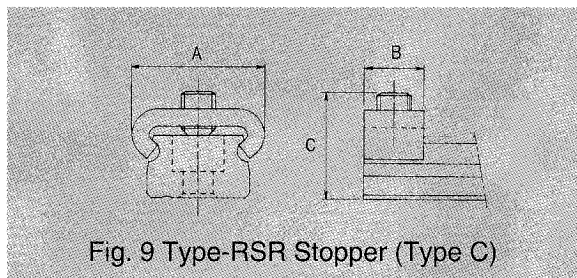


Fig. 9 Type-RSR Stopper (Type C)

Table 10 Dimensions of the Type-RSR Stopper (Type C)

Unit : mm

Model No.	A	B	C
RSR 7	10.5	5	8.7
RSR 9	13	6	9.5
RSR 12	14	7	11.5
RSR 15	17.5	7	13.5
RSR 20	20.5	7	19
RSR 7 W	18	6	9.2
RSR 9 W	20	6	11.5
RSR 12 W	26.5	7	12.5
RSR 15 W	44.5	7	13.5

Note: Types RSR5 and 5W use an O-ring, and type RSR3W uses a silicone tube.

LM-Rail Standard and Maximum Lengths

Table 11 gives the standard and maximum LM-rail lengths for type RSR.

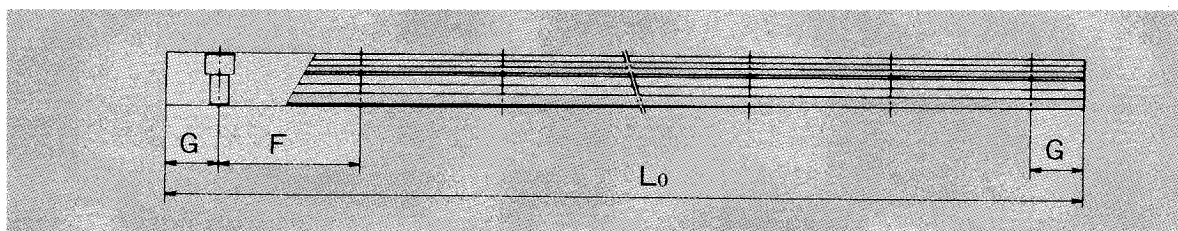


Table 11 Type-RSR/RSR-W LM-Rail Standard and Maximum Lengths

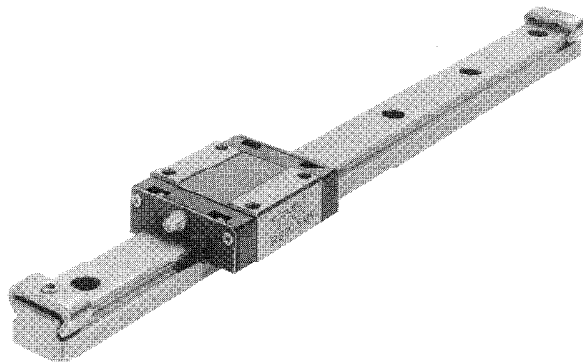
Unit : mm

Model No.	RSR 5	RSR 7	RSR 9	RSR 12	RSR 15	RSR 20	RSR 3W	RSR 5W	RSR 7W	RSR 9W	RSR 12W	RSR 15W
LM-rail standard length (L ₀)	40	40	55	70	70	220	40	50	50	50	70	110
	55	55	75	95	110	280	55	70	80	80	110	150
	70	70	95	120	150	340	70	90	110	110	150	190
	100	85	115	145	190	460		110	140	140	190	230
	130	100	135	170	230	640		130	170	170	230	270
	160	130	155	195	270	880		150	200	200	270	310
			175	220	310	1000		170	260	260	310	430
			195	245	350				290	290	390	550
			275	270	390					320	470	670
			375	320	430						550	790
				370	470							
				470	550							
				570	670							
				870								
Standard pitch	15	15	20	25	40	60	15	20	30	30	40	40
F	5	5	7.5	10	15	20	5	5	10	10	15	15
G	200	300	1000	1340	1430	1800	100	200	400	1000	1430	1800

Note 1: All LM rails are made of stainless steel.

RSR-VM/RSR-M/RSR-N

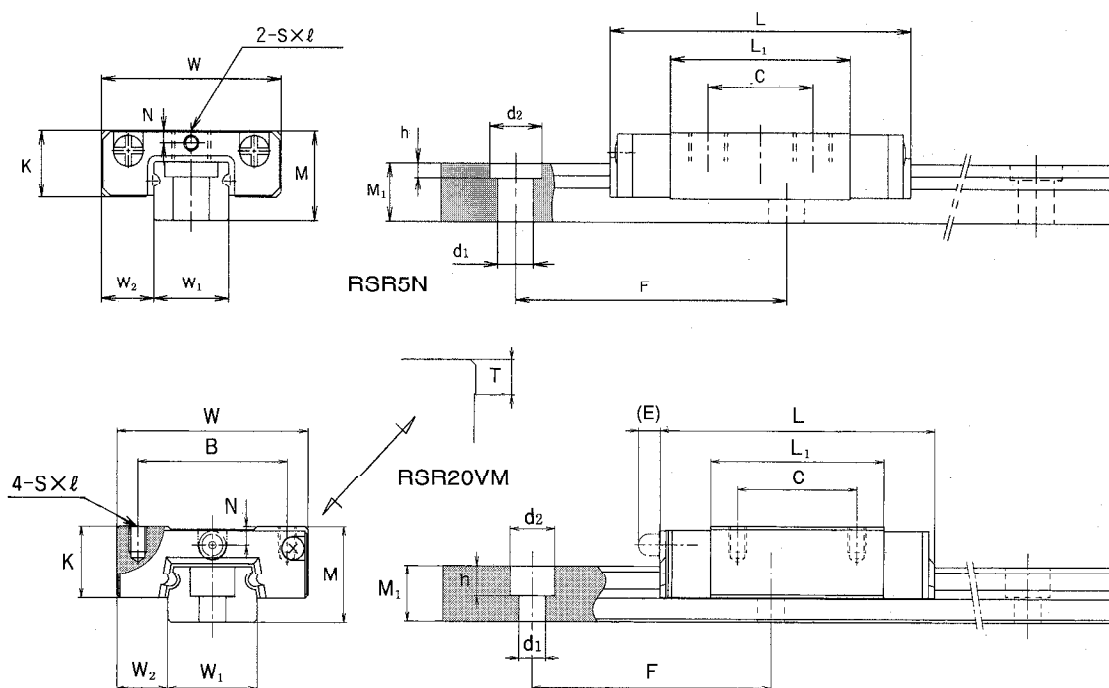
Stainless-Steel Type



Model No.	External dimensions			LM-block dimensions									Grease nipple (oil note)
	Height M	Width W	Length L	B	C	S×ℓ	L ₁	T	K	N	E		
RSR 5 M RSR 5 N	6	12	17 20	8 -	- 7	M2×1.5 M2.6×1.8	8.8 12	-	4.5	0.8	-	φ0.8 drilled hole	
RSR 7 M RSR 7 N	8	17	23.5 33	12	8 13	M2×2.5	13.4 23	-	6.5	1.7	-	-	
RSR 9 KM RSR 9 N	10	20	31 41	15	10 16	M3×3.0	19.8 29.8	-	7.8	-	-	-	
RSR 12 VM RSR 12 N	13	27	35 48	20	15 20	M3×3.5	20.6 33.3	-	10	3	-	φ2 drilled hole	
RSR 15 VM RSR 15 N	16	32	43 61	25	20 25	M3×4	25.7 43.5	-	12	3.5	3.6 3.7	PB 107	
RSR 20 VM RSR 20 N	25	46	66.5 86.5	38	38 38	M4×6	45.2 65	6	17.5	5	6.4	A-M6F	

Notes:

- Models affixed with an "M" feature excellent corrosion and environmental resistance, as their LM blocks, rails, and balls are made of stainless steel.
- We can provide models with stainless-steel end plates. If you require these, contact us.
- For model number coding, see page A-313.
- For load ratings in various directions, see page A-310.



Unit : mm

LM-rail dimensions					Basic load rating		Mass	
W_1	W_2	M_1	F	$d_1 \times d_2 \times h$	C N	C_0 N	LM block kg	LM rail kg/m
$5 \begin{smallmatrix} 0 \\ -0.02 \end{smallmatrix}$	3.5	4	15	$2.4 \times 3.5 \times 1$	320 550	590 960	0.003 0.004	0.14
$7 \begin{smallmatrix} 0 \\ -0.02 \end{smallmatrix}$	5	4.7	15	$2.4 \times 4.2 \times 2.3$	880 1590	1370 2500	0.013 0.018	0.23
$9 \begin{smallmatrix} 0 \\ -0.02 \end{smallmatrix}$	5.5	5.5	20	$3.5 \times 6 \times 3.3$	1470 2600	2250 3960	0.018 0.027	0.32
$12 \begin{smallmatrix} 0 \\ -0.025 \end{smallmatrix}$	7.5	7.5	25	$3.5 \times 6 \times 4.5$	2650 4300	4020 6650	0.037 0.055	0.58
$15 \begin{smallmatrix} 0 \\ -0.025 \end{smallmatrix}$	8.5	9.5	40	$3.5 \times 6 \times 4.5$	4410 7160	6570 10700	0.069 0.093	0.925
$20 \begin{smallmatrix} 0 \\ -0.03 \end{smallmatrix}$	13	15	60	$6 \times 9.5 \times 8.5$	8820 14200	12700 20600	0.245 0.337	1.95

- For permissible moments M_A , M_B , and M_C , see page A-311.
- For LM-rail standard lengths, see page A-317.
- For the screws used to fasten type-RSR5M/5N LM rails in place, use Phillips-head machine screws of M2x0.4 (#0 pan-head machine-screw class 1) for precision equipment.

1 kN \approx 102 kgf