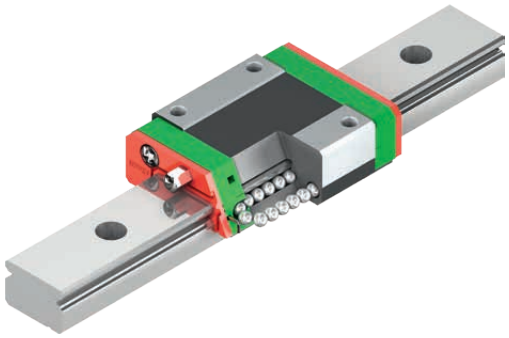
3.5 MG series

3.5.1 Properties of the linear guideway, series MGN

The HIWIN linear guideway of the MGN series is based on proven HIWIN technology. The Gothic arch contact design absorbs loads in all directions and is particularly rigid and precise. Given its compact and lightweight design, it is particularly suited to use in small devices.

3.5.2 Design of the MGN series

- 2-row recirculation ball bearing guide
- Gothic arch contact design
- Stainless steel block and balls
- Rails made from standard or stainless steel
- Compact and lightweight design
- Balls are secured in the block by retaining wire
- Grease nipple available for MGN15
- End seal
- Interchangeable models are available in defined accuracy classes



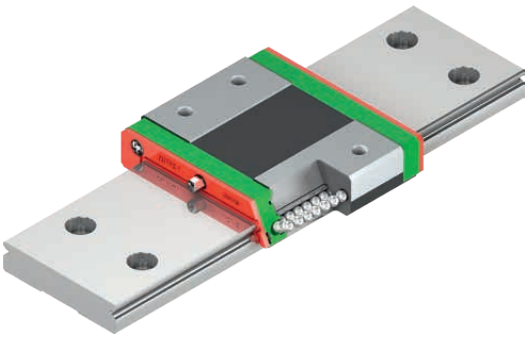
Design of the MGN series

3.5.3 Properties of the linear guideway, series MGW

The HIWIN linear guideway of the MGW series is based on proven HIWIN technology. The Gothic arch contact design absorbs loads in all directions and is particularly rigid and precise. The MGW series has a wider rail than the MGN series so can absorb considerably higher load torques.

3.5.4 Design of the MGW series

- 2-row recirculation ball bearing guide
- Gothic arch contact design
- Stainless steel block and balls
- Rails made from standard or stainless steel
- Compact and lightweight design
- Balls are secured in the block by retaining wire
- Grease nipple available for MGW15
- End seal
- Interchangeable models are available in defined accuracy classes



Design of the MGW series

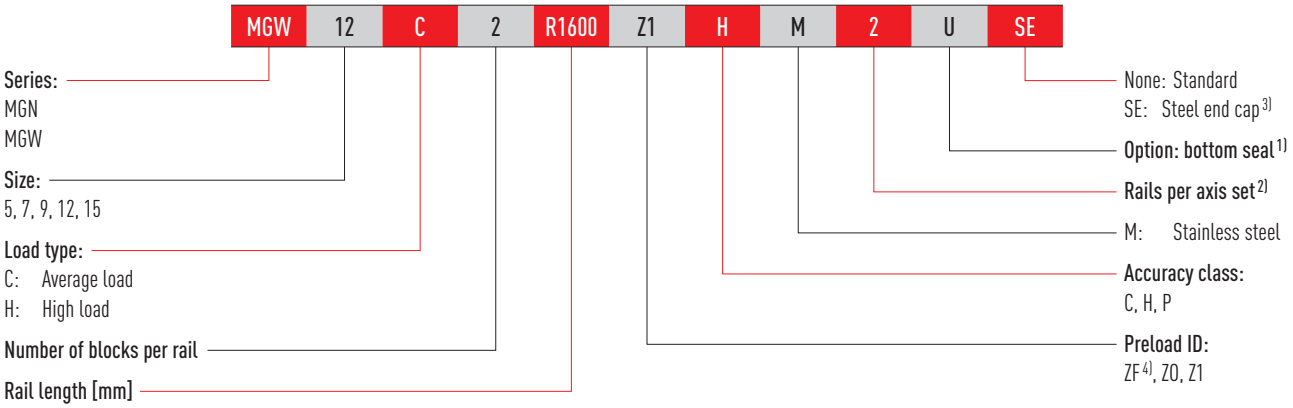
3.5.5 Applications of the MG series

The MGN and MGW series can be used in many sectors, e.g. in the semiconductor industry, PCB population, medical technology, robot applications, measurement devices, office automation and other sectors needing miniature guides.

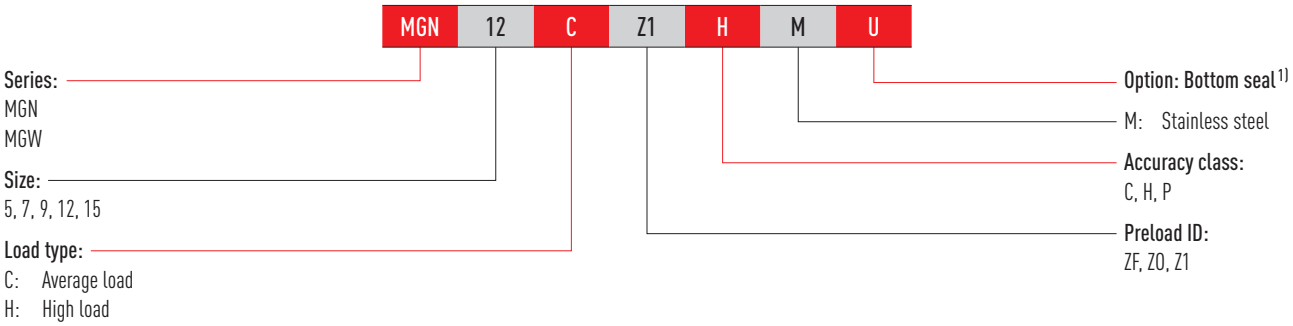
3.5.6 Order codes for the MG series

For MGN and MGW linear guideways, a distinction is made between fully assembled and unmounted models. The dimensions of both models are the same. The main difference is that the block and rail in the unmounted models can be freely interchanged. Block and rail can therefore be ordered separately and fitted by the customer.

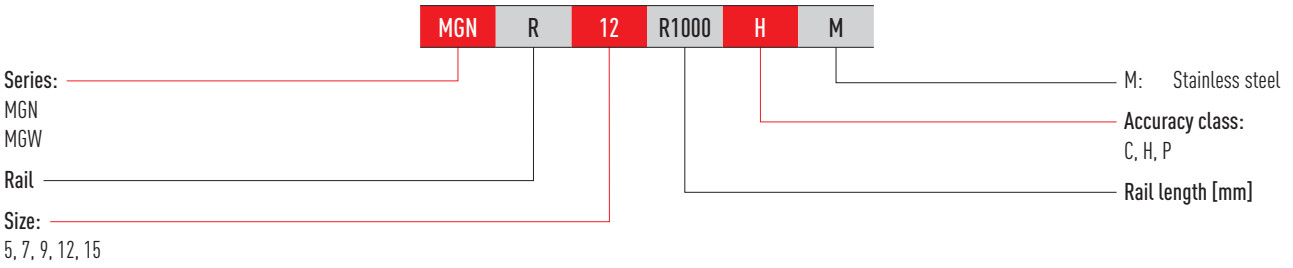
Order code for linear guideway (fully assembled)



Order code for block (unmounted)



Order code for rail (unmounted)



Note:

1) Available for MGN and MGW series in sizes 12 and 15.

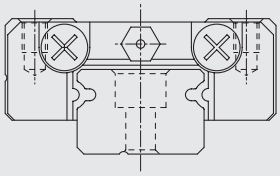
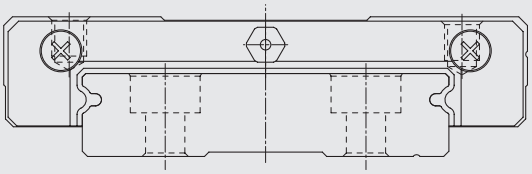
2) The figure 2 is also a quantity, i.e. one item of the above-mentioned article consists of a pair of rails. No number is specified for individual rails. By default multi-part rails are delivered with staggered butt joints.

3) Available for MGN07, 09, 12, 15 and MGW12, 15.

4) Not available for paired rails and for MG05.

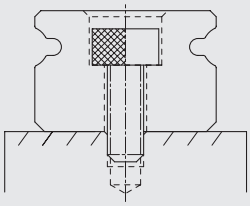
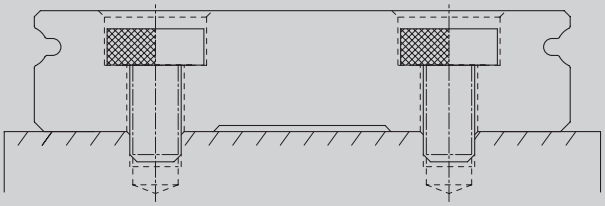
3.5.7 Block types

Table 3.78 **Block types**

Type	Series/size	Structure	Height [mm]	Typical application
Narrow type	MGN-C MGN-H		8 – 16	○ Printers ○ Robotics ○ Precision measuring equipment ○ Semiconductor industry
Wide type	MGW-C MGW-H		9 – 16	

3.5.8 Rail types

Table 3.79 **Rail types**

Fastening from above	
	
MGN_R	MGW_R

3.5.9 Preload

The MGN/MGW series offers three preload classes for various applications.

Table 3.80 **Preload ID**

ID	Preload	Accuracy class
ZF	Slight play: 4 – 10 µm	C, H
Z0	Zero-play, very slight preload	C – P
Z1	Slight preload: 0 – 0.02 C_{dyn}	C – P

[1] Not available for size 5

3.5.10 Load ratings and torques

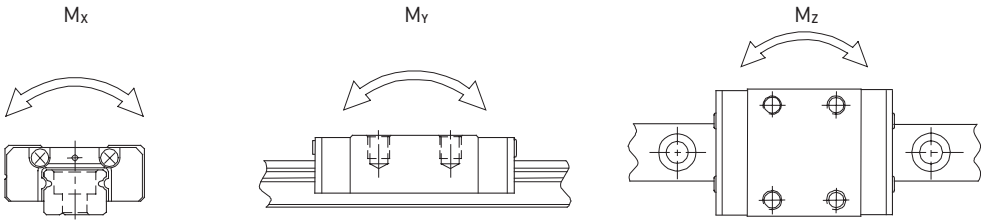


Table 3.81 **Load ratings and torques for MG series**

Series/size	Dynamic load rating C_{dyn} [N] [1]	Static load rating C_0 [N]	Dynamic moment [Nm]			Static moment [Nm]		
			M_X	M_Y	M_Z	M_{0X}	M_{0Y}	M_{0Z}
MGN05C	540	840	1.3	0.8	0.8	2.0	1.3	1.3
MGN05H	670	1,080	1.6	1.4	1.4	2.6	2.3	2.3
MGN07C	980	1,245	3.0	2.0	2.0	4.7	2.8	2.8
MGN07H	1,370	1,960	5.0	3.0	3.0	7.6	4.8	4.8
MGN09C	1,860	2,550	8.0	5.0	5.0	11.8	7.4	7.4
MGN09H	2,550	4,020	12.4	11.8	11.8	19.6	18.6	18.6
MGN12C	2,840	3,920	18.0	10.0	10.0	25.5	13.7	13.7
MGN12H	3,720	5,880	24.0	23.0	23.0	38.2	36.3	36.3
MGN15C	4,610	5,590	37.0	18.0	18.0	45.1	21.6	21.6
MGN15H	6,370	9,110	52.0	41.0	41.0	73.5	57.8	57.8
MGW05C	680	1,180	3.2	1.6	1.6	5.5	2.7	2.7
MGW07C	1,370	2,060	10.0	4.0	4.0	15.7	7.1	7.1
MGW07H	1,770	3,140	13.0	8.0	8.0	23.5	15.5	15.5
MGW09C	2,750	4,120	27.0	12.0	12.0	40.1	18.0	18.0
MGW09H	3,430	5,890	32.0	20.0	20.0	54.5	34.0	34.0
MGW12C	3,920	5,590	50.0	19.0	19.0	70.3	27.8	27.8
MGW12H	5,100	8,240	64.0	36.0	36.0	102.7	57.4	57.4
MGW15C	6,770	9,220	149.0	42.0	42.0	199.3	56.7	56.7
MGW15H	8,930	13,380	196.0	80.0	80.0	299.0	122.6	122.6

[1] Dynamic load rating for travel distance of 50,000 m

3.5.11 Rigidity

Rigidity depends on preload. Formula F 3.15 can be used to determine deformation depending on rigidity.

F 3.15

$$\delta = \frac{P}{k}$$

δ Deformation [µm]
P Operating load [N]
k Rigidity [N/µm]

Table 3.82 **Radial rigidity for series MGN**

Load Class	Series/ size	Preload	
		Z0	**Z1**
Average load	**MGN07C**	26	33
	MGN09C	37	48
	MGN12C	44	56
	MGN15C	57	74
High load	**MGN07H**	39	51
	MGN09H	56	73
	MGN12H	63	81
	MGN15H	87	113

Unit: N/µm

Table 3.83 **Radial rigidity for series MGW**

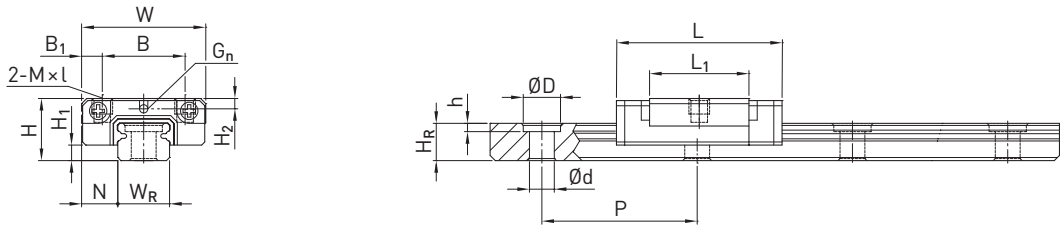
Load Class	Series/ size	Preload	
		Z0	**Z1**
Average load	**MGW07C**	38	49
	MGW09C	55	71
	MGW12C	63	81
	MGW15C	78	101
High load	**MGW07H**	54	70
	MGW09H	74	95
	MGW12H	89	114
	MGW15H	113	145

Unit: N/µm

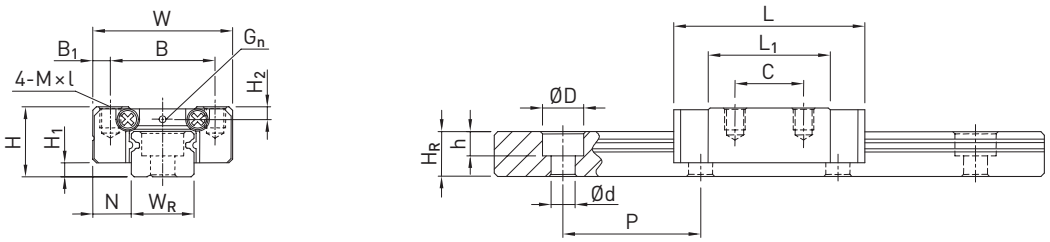
3.5.12 Dimensions of the MG block

3.5.12.1 MGN

MGN05



MGN07, MGN09, MGN12



MGN15

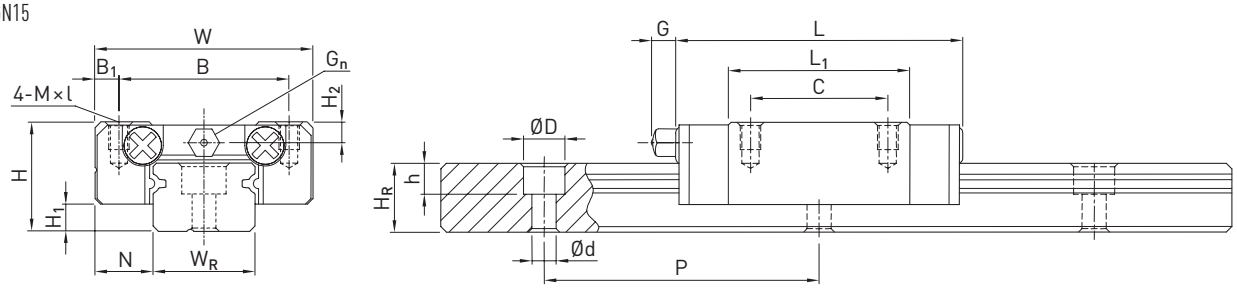


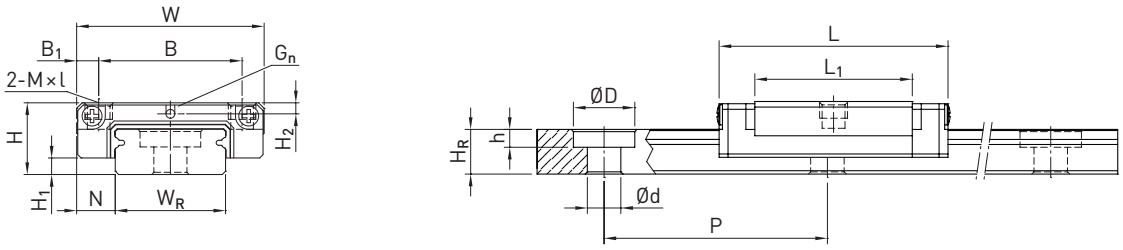
Table 3.84 **Dimensions of the block**

Series/ size	Installation dimensions [mm]			Dimensions of the block [mm]										Load ratings [N]		Weight [kg]
	H	H_1	N	W	B	B_1	C	L_1	L	G	G_n	M × l	H_2	C_{dyn}	C_0	
MGN05C	6	1.5	3.5	12	8	2.0	—	9.6	16.0	—	Ø0.8	M2 × 1.5	1.0	540	840	0.008
MGN05H							—	12.6	19.0					670	1,080	0.010
MGN07C	8	1.5	5.0	17	12	2.5	8	13.5	22.5	—	Ø1.2	M2 × 2.5	1.5	980	1,245	0.010
MGN07H							13	21.8	30.8					1,372	1,960	0.020
MGN09C	10	2.0	5.5	20	15	2.5	10	18.9	28.9	—	Ø1.4	M3 × 3	1.8	1,860	2,550	0.020
MGN09H							16	29.9	39.9					2,550	4,020	0.030
MGN12C	13	3.0	7.5	27	20	3.5	15	21.7	34.7	—	Ø2	M3 × 3.5	2.5	2,840	3,920	0.030
MGN12H							20	32.4	45.4					3,720	5,880	0.050
MGN15C	16	4.0	8.5	32	25	3.5	20	26.7	42.1	4.5	M3	M3 × 4	3.0	4,610	5,590	0.060
MGN15H							25	43.4	58.8					6,370	9,110	0.090

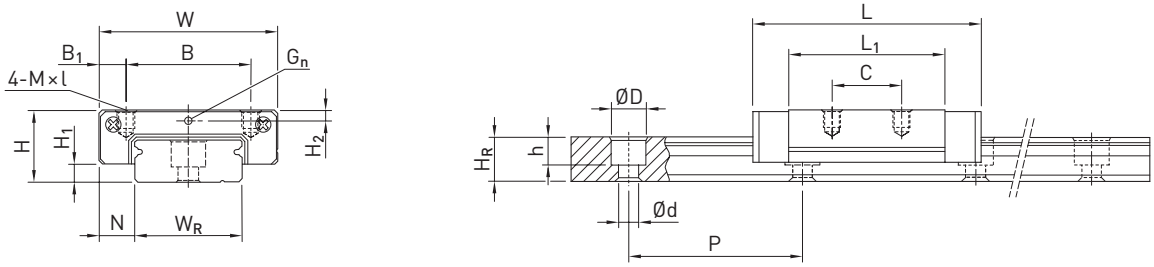
For dimensions of rail, see Page 97, for standard and optional lubrication adapter, see Page 128.

3.5.12.2 MGW

MGW05



MGW07, MGW09, MGW12



MGW15

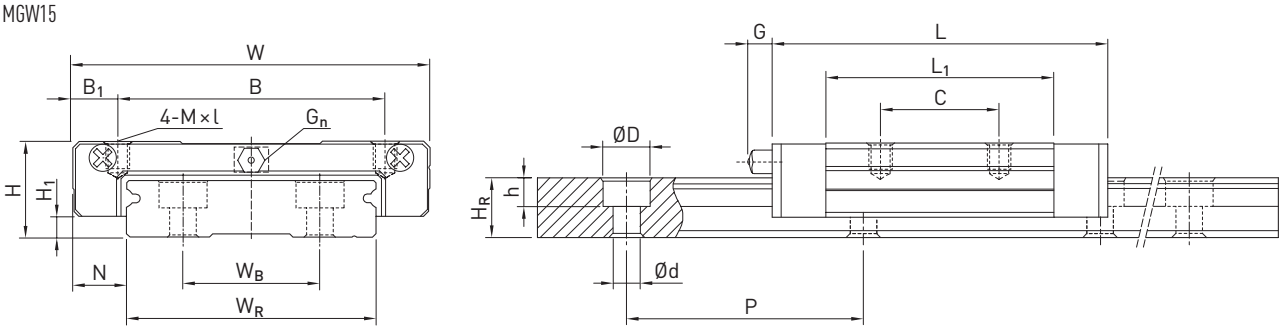


Table 3.85 **Dimensions of the block**

Series/ size	Installation dimensions [mm]			Dimensions of the block [mm]										Load ratings [N]		Weight [kg]
	H	H_1	N	W	B	B_1	C	L_1	L	G	G_n	M × l	H_2	C_{dyn}	C_0	
MGW05C	6.5	1.5	3.5	17	13	2.0	–	14.1	20.5	–	Ø1.2	M2.5 × 1.5	1.00	680	1,180	0.02
MGW07C	9.0	1.9	5.5	25	19	3.0	10	21.0	31.2	–	Ø1.2	M3 × 3	1.85	1,370	2,060	0.02
MGW07H							19	30.8	41.0					1,770	3,140	0.03
MGW09C	12.0	2.9	6.0	30	21	4.5	12	27.5	39.3	–	Ø1.4	M3 × 3	2.40	2,750	4,120	0.04
MGW09H					23	3.5	24	38.5	50.7					3,430	5,890	0.06
MGW12C	14.0	3.4	8.0	40	28	6.0	15	31.3	46.1	–	Ø2	M3 × 3.6	2.80	3,920	5,590	0.07
MGW12H							28	45.6	60.4					5,100	8,240	0.10
MGW15C	16.0	3.4	9.0	60	45	7.5	20	38.0	54.8	5.2	M3	M4 × 4.2	3.20	6,770	9,220	0.14
MGW15H							35	57.0	73.8					8,930	13,380	0.22

For dimensions of rail, see Page 97, for standard and optional lubrication adapter, see Page 128.

3.5.13 Dimensions of the MG rail

3.5.13.1 Dimensions of MGN_R

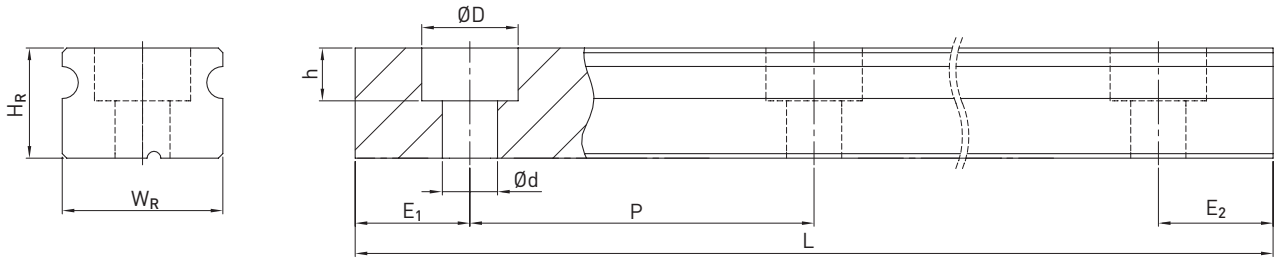


Table 3.86 **Dimensions of rail MGN_R**

Series/ size	Assembly screw for rail [mm]	Dimensions of rail [mm]						Max. length [mm]	Max. length $E_1 = E_2$ [mm]	Min. length [mm]	$E_{1/2}$ min [mm]	$E_{1/2}$ max [mm]	Weight [kg/m]
		W_R	H_R	D	h	d	P						
MGNR05R	M2 × 8	5	3.6	3.6	0.8	2.4	15	250	225	38	4	11	0.15
MGNR07R	M2 × 8	7	4.8	4.2	2.3	2.4	15	600	585	40	5	12	0.22
MGNR09R	M3 × 10	9	6.5	6.0	3.5	3.5	20	1,200	1,180	50	5	15	0.38
MGNR12R	M3 × 10	12	8.0	6.0	4.5	3.5	25	2,000	1,975	60	5	20	0.65
MGNR15R	M3 × 12	15	10.0	6.0	4.5	3.5	40	2,000	1,960	92	6	34	1.06

3.5.13.2 Dimensions of MGW_R

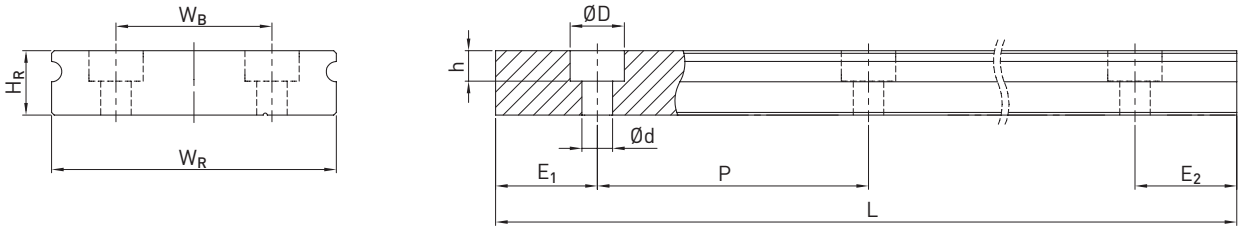


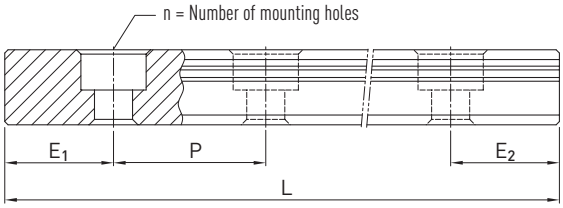
Table 3.87 **Dimensions of rail MGW_R**

Series/ size	Assembly screw for rail [mm]	Dimensions of the rail [mm]							Max. length [mm]	Max. length $E_1 = E_2$ [mm]	Min. length [mm]	$E_{1/2}$ min [mm]	$E_{1/2}$ max [mm]	Weight [kg/m]
		W_R	H_R	W_B	D	h	d	P						
MGWR05R	M2.5 × 8	10	4.0	—	5.5	1.6	3.0	20	250	220	48	4	11	0.34
MGWR07R	M3 × 8	14	5.2	—	6.0	3.2	3.5	30	600	570	72	6	24	0.51
MGWR09R	M3 × 10	18	7.0	—	6.0	4.5	3.5	30	2,000	1,170	72	6	24	0.91
MGWR12R	M4 × 12	24	8.5	—	8.0	4.5	4.5	40	2,000	1,960	96	8	32	1.49
MGWR15R	M4 × 16	42	9.5	23	8.0	4.5	4.5	40	2,000	1,960	96	8	32	2.86

Note:
1. The tolerance for E is +0.5 to – 1 mm for standard rails and 0 to –0.3 mm for joints.
2. If the $E_{1/2}$ dimensions are not indicated, the maximum possible number of mounting holes will be determined under consideration of $E_{1/2}$ min.
3. The rails are shortened to the required length. If the $E_{1/2}$ dimensions are not indicated, these will be carried out symmetrically

3.5.13.3 Calculating the length of rails

HIWIN offers rails in customized lengths. To prevent the risk of the end of the rail becoming unstable, the value E must not exceed half of the distance between the mounting holes (P). At the same time, the value $E_{1/2}$ should be between $E_{1/2}$ min and $E_{1/2}$ max so that the mounting hole does not rupture.



F 3.16

$$L = (n - 1) \times P + E_1 + E_2$$

L Total length of the rail [mm]
n Number of mounting holes
P Distance between two mounting holes [mm]
$E_{1/2}$ Distance from the middle of the last mounting hole to the end of the rail [mm]

3.5.13.4 Tightening torques for mounting bolts

Insufficient tightening of the mounting bolts strongly compromises the precision of the linear guideway; the following tightening torques are therefore recommended for the relevant screw sizes.

Table 3.88 **Tightening torques of the mounting bolts according to ISO 4762-12.9**

Series/size	Screw size	Torque [Nm]	Series/size	Screw size	Torque [Nm]
MGN05	M2 × 6	0.6	**MGW05**	M2.5 × 7	1.2
MGN07	M2 × 6	0.6	**MGW07**	M3 × 6	2.0
MGN09	M3 × 8	2.0	**MGW09**	M3 × 8	2.0
MGN12	M3 × 8	2.0	**MGW12**	M4 × 8	4.0
MGN15	M3 × 10	2.0	**MGW15**	M4 × 10	4.0

3.5.13.5 Cover caps for mounting holes of rails

The cover caps are used to keep the mounting holes free of chips and dirt. The standard plastic caps are provided with each rail.

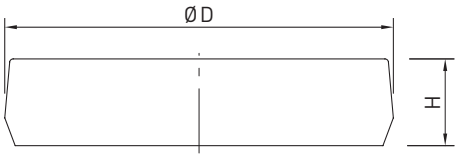


Table 3.89 **Cover caps for mounting holes of rails**

Rail	Screw	Article number		Ø D [mm]	Height H [mm]
		Plastic (200pcs.)	**Brass**		
MGNR09R	M3	5-002217 [1)]	5-001340 [1)]	6	1.2
MGNR12R	M3	5-002217	5-001340	6	1.2
MGNR15R	M3	5-002217	5-001340	6	1.2
MGWR09R	M3	5-002217	5-001340	6	1.2
MGWR12R	M4	5-002219	–	8	1.2
MGWR15R	M4	5-002219	–	8	1.2

[1)] Standard: without cover caps, state in order if required. Only possible with cylinder head screws with a low head according to DIN 7984

3.5.14 Dust protection

The blocks of the MG series are equipped on both sides with an end seal to protect against dirt as standard. In addition seals for the bottom of the block can be ordered using the "+U" identifier in the order code. They are available as options for sizes 12 and 15. They cannot be fitted for sizes 5, 7 and 9 due to the limited installation space H_1. When fitting a bottom seal, the side mounting surface of the rail must not exceed H_1.

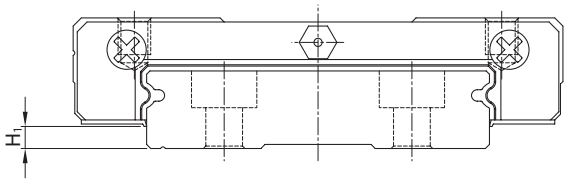
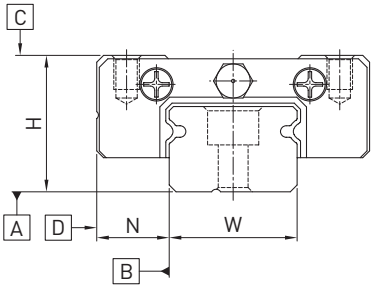


Table 3.90 **Installation space H_1**

Series/size	Bottom seal	H_1	Series/size	Bottom seal	H_1
MGN05	–	–	**MGW05**	–	–
MGN07	–	–	**MGW07**	–	–
MGN09	–	–	**MGW09**	–	–
MGN12	●	2.0	**MGW12**	●	2.6
MGN15	●	3.0	**MGW15**	●	2.6

3.5.15 Tolerances depending on accuracy class

The MG series are available in three accuracy classes depending on parallelism between block and rail, height accuracy H and accuracy of width N. The choice of accuracy class is determined by the machine requirements.



3.5.15.1 Parallelism

Parallelism of stop surfaces D and B of block and rail and parallelism of top of block C to mounting surface A of rail. Ideal linear guideway installation is required, as is a measurement in the centre of the block.

Table 3.91 **Tolerance of parallelism between block and rail**

Rail length [mm]	Accuracy class		
	C	H	P
– 50	12	6	2.0
50 – 80	13	7	3.0
80 – 125	14	8	3.5
125 – 200	15	9	4.0
200 – 250	16	10	5.0
250 – 315	17	11	5.0
315 – 400	18	11	6.0
400 – 500	19	12	6.0
500 – 630	20	13	7.0
630 – 800	22	14	8.0
800 – 1000	23	16	9.0
1000 – 1200	25	18	11.0
1200 – 1300	25	18	11.0
1300 – 1400	26	19	12.0
1400 – 1500	27	19	12.0
1500 – 1600	28	20	13.0
1600 – 1700	29	20	14.0
1700 – 1800	30	21	14.0
1800 – 1900	30	21	15.0
1900 – 2000	31	22	15.0

Unit: µm

3.5.15.2 Accuracy – height and width

Height tolerance of H
Permissible absolute dimension variance of height H, measured between centre of screw-on surface C and underside of rail A, with block in any position on the rail.

Height variance of H
Permissible variance of height H between several blocks on a rail, measured in the same rail position

Width tolerance of N
Permissible absolute dimension variance of width N, measured between centre of screw-on surfaces D and B, with block in any position on the rail.

Width variance of N
Permissible variance of width N between several blocks on a rail, measured in the same rail position.

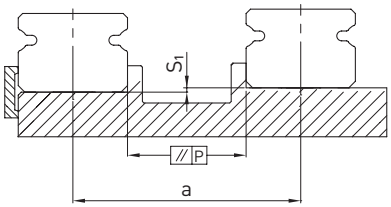
Table 3.92 **Height and width tolerances**

Series/size	Accuracy class	Height tolerance of H	Width tolerance of N	Height variance of H	Width variance of N
MG_05 – MG_15	C (Normal)	± 0.04	± 0.04	0.03	0.3
	H (High)	± 0.02	± 0.025	0.015	0.02
	P (Precision)	± 0.01	± 0.015	0.007	0.01

Unit: mm

3.5.15.3 Permissible mounting surface tolerances

Once the requirements relating to the accuracy of the mounting surfaces are met, the good accuracy, rigidity and lifetime of the MG series linear guideways are achieved.



Tolerance for the parallelism of the reference surface (P):

Table 3.93 **Maximum tolerance for parallelism (P)**

Series/size	Preload class		
	ZF	Z0	Z1
MG_05	2	2	2
MG_07	3	3	3
MG_09	4	4	3
MG_12	9	9	5
MG_15	10	10	6

Unit: μm

Tolerance for the height of the reference surface (S_1):

F 3.17 $S_1 = a \times K$

S_1 Max. height tolerance [mm]
a Distance between rails [mm]
K Coefficient of the height tolerance

Table 3.94 **Maximum tolerance for height of reference surface (S_1)**

Series/size	Preload class		
	ZF	Z0	Z1
MG_05	0.4×10^{-4}	0.4×10^{-4}	0.04×10^{-4}
MG_07	0.5×10^{-4}	0.5×10^{-4}	0.06×10^{-4}
MG_09	0.7×10^{-4}	0.7×10^{-4}	0.12×10^{-4}
MG_12	1.0×10^{-4}	1.0×10^{-4}	0.24×10^{-4}
MG_15	1.2×10^{-4}	1.2×10^{-4}	0.40×10^{-4}

Table 3.95 **Requirements for the mounting surface**

Series/size	Required evenness of the mounting surface
MG_05	0.015/200
MG_07	0.025/200
MG_09	0.035/200
MG_12	0.050/200
MG_15	0.060/200

Note: The values in the table are applicable to the preload classes ZF and Z0. For Z1 or if more than one rail is to be mounted on the same surface, the table values must be at least halved.

3.5.16 Shoulder heights and fillets

Imprecise shoulder heights and fillets of mounting surfaces compromise precision and may lead to conflicts with the block or rail profiles. The following shoulder heights and edge profiles must be observed in order to avoid assembly problems.

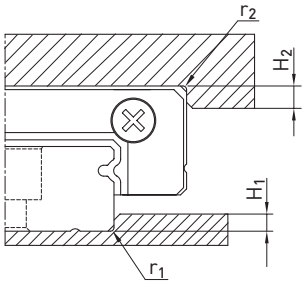


Table 3.96 **Shoulder heights and fillets**

Series/size	Max. edge radius r_1	Max. edge radius r_2	Shoulder height of H_1	Shoulder height of H_2
MGN05	0.1	0.2	1.2	2
MGN07	0.2	0.2	1.2	3
MGN09	0.2	0.3	1.7	3
MGN12	0.3	0.4	1.7	4
MGN15	0.5	0.5	2.5	5
MGW05	0.1	0.2	1.2	2
MGW07	0.2	0.2	1.7	3
MGW09	0.3	0.3	2.5	3
MGW12	0.4	0.4	3.0	4
MGW15	0.4	0.8	3.0	5

Unit: mm