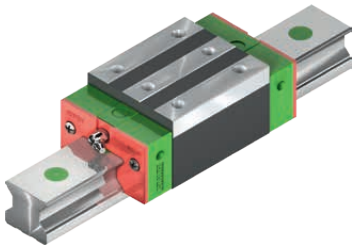
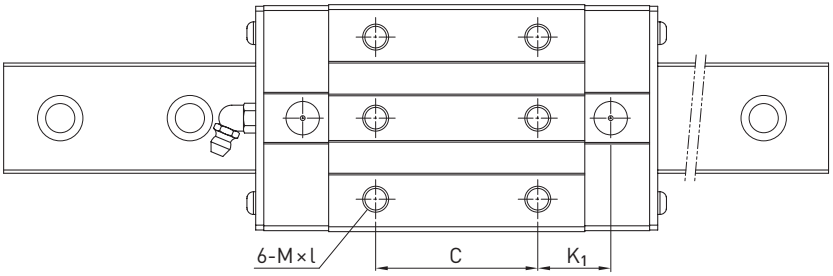


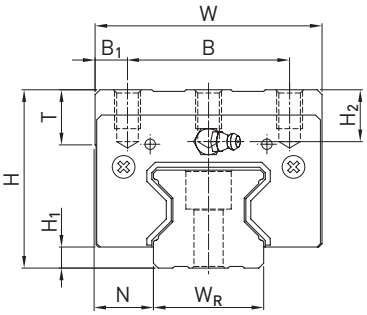
Linear guideway of RG and QR series

- Roller guides for heavy-duty applications
- With maximum requirements on load ratings and torque capacity
- Block with SynchMotion™ technology (QR series)

3.6.9 Dimensions of the RG/QR blocks

3.6.9.1 RGH/QRH





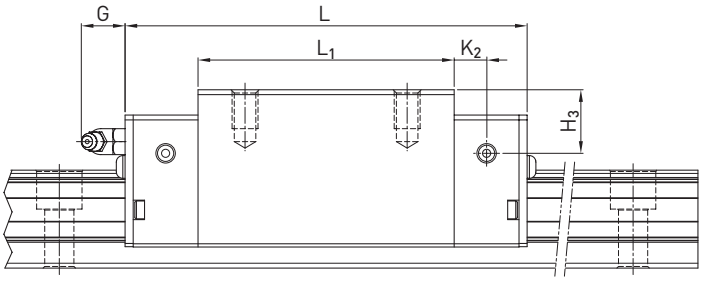
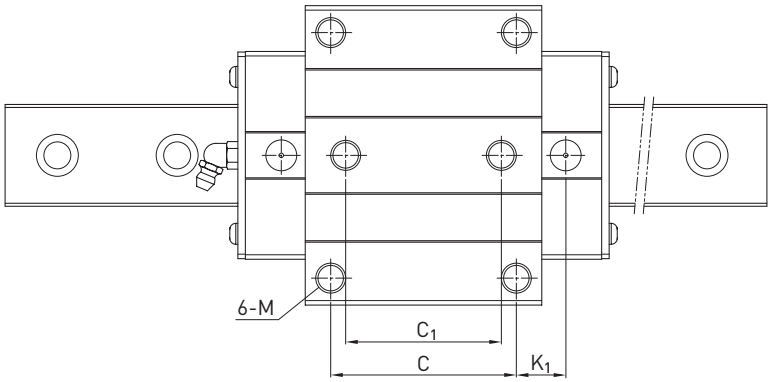


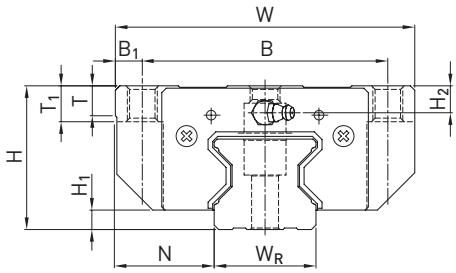
Table 3.97 **Dimensions of the block**

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	K_1	K_2	G	M × l	T	H_2	H_3	C_{dyn}	C_0	
RGH15CA	28	4.0	9.5	34	26	4.0	26	45.0	68.0	13.40	4.70	5.3	M4 × 8	6.0	7.6	10.1	11,300	24,000	0.20
RGH20CA	34	5.0	12.0	44	32	6.0	36	57.5	86.0	15.80	6.00	5.3	M5 × 8	8.0	8.3	8.3	21,300	46,700	0.40
RGH20HA							50	77.5	106.0	18.80							26,900	63,000	0.53
RGH25CA	40	5.5	12.5	48	35	6.5	35	64.5	97.9	20.75	7.25	12.0	M6 × 8	9.5	10.2	10.0	27,700	57,100	0.61
RGH25HA							50	81.0	114.4	21.50							33,900	73,400	0.75
QRH25CA	40	5.5	12.5	48	35	6.5	35	66.0	97.9	20.75	7.25	12.0	M6 × 8	9.5	10.2	10.0	38,500	54,400	0.60
QRH25HA							50	81.0	112.9	21.50							44,700	65,300	0.74
RGH30CA	45	6.0	16.0	60	40	10.0	40	71.0	109.8	23.50	8.00	12.0	M8 × 10	9.5	9.5	10.3	39,100	82,100	0.90
RGH30HA							60	93.0	131.8	24.50							48,100	105,000	1.16
QRH30CA	45	6.0	16.0	60	40	10.0	40	71.0	109.8	23.50	8.00	12.0	M8 × 10	9.5	9.5	10.3	51,500	73,000	0.89
QRH30HA							60	93.0	131.8	24.50							64,700	95,800	1.15
RGH35CA	55	6.5	18.0	70	50	10.0	50	79.0	124.0	22.50	10.00	12.0	M8 × 12	12.0	16.0	19.6	57,900	105,200	1.57
RGH35HA							72	106.5	151.5	25.25							73,100	142,000	2.06
QRH35CA	55	6.5	18.0	70	50	10.0	50	79.0	124.0	22.50	10.00	12.0	M8 × 12	12.0	16.0	19.6	77,000	94,700	1.56
QRH35HA							72	106.5	151.5	25.25							95,700	126,300	2.04
RGH45CA	70	8.0	20.5	86	60	13.0	60	106.0	153.2	31.00	10.00	12.9	M10 × 17	16.0	20.0	24.0	92,600	178,800	3.18
RGH45HA							80	139.8	187.0	37.90							116,000	230,900	4.13
QRH45CA	70	8.0	20.5	86	60	13.0	60	106.0	153.2	31.00	10.00	12.9	M10 × 17	16.0	20.0	24.0	123,200	156,400	3.16
QRH45HA							80	139.8	187.0	37.90							150,800	208,600	4.10
RGH55CA	80	10.0	23.5	100	75	12.5	75	125.5	183.7	37.75	12.50	12.9	M12 × 18	17.5	22.0	27.5	130,500	252,000	4.89
RGH55HA							95	173.8	232.0	51.90							167,800	348,000	6.68
RGH65CA	90	12.0	31.5	126	76	25.0	70	160.0	232.0	60.80	15.80	12.9	M16 × 20	25.0	15.0	15.0	213,000	411,600	8.89
RGH65HA							120	223.0	295.0	67.30							275,300	572,700	12.13

For dimensions of the rail, see Page 114, for standard as well as optional lubrication adapter, see Page 148.

3.6.9.2 RGW/QRW





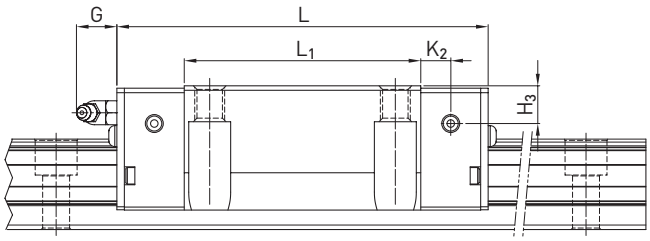


Table 3.98 **Dimensions of the block**

Series/size	Installation dimensions [mm]			Dimensions of the block [mm]															Load ratings [N]		Weight [kg]
	H	H_1	N	W	B	B_1	C	C_1	L_1	L	K_1	K_2	G	M	T	T_1	H_2	H_3	C_{dyn}	C_0	
RGW15CC	24	4.0	16.0	47	38	4.5	30	26	45.0	68.0	11.40	4.70	5.3	M5	6.0	7	3.6	6.1	11,300	24,000	0.22
RGW20CC	30	5.0	21.5	63	53	5.0	40	35	57.5	86.0	13.80	6.00	5.3	M6	8.0	10	4.3	4.3	21,300	46,700	0.47
RGW20HC									77.5	106.0	23.80								26,900	63,000	0.63
RGW25CC	36	5.5	23.5	70	57	6.5	45	40	64.5	97.9	15.75	7.25	12.0	M8	9.5	10	6.2	6.0	27,700	57,100	0.72
RGW25HC									81.0	114.4	24.00								33,900	73,400	0.91
QRW25CC	36	5.5	23.5	70	57	6.5	45	40	66.0	97.9	15.75	7.25	12.0	M8	9.5	10	6.2	6.0	38,500	54,400	0.71
QRW25HC									81.0	112.9	24.00								44,700	65,300	0.90
RGW30CC	42	6.0	31.0	90	72	9.0	52	44	71.0	109.8	17.50	8.00	12.0	M10	9.5	10	6.5	7.3	39,100	82,100	1.16
RGW30HC									93.0	131.8	28.50								48,100	105,000	1.52
QRW30CC	42	6.0	31.0	90	72	9.0	52	44	71.0	109.8	17.50	8.00	12.0	M10	9.5	10	6.5	7.3	51,500	73,000	1.15
QRW30HC									93.0	131.8	28.50								64,700	95,800	1.51
RGW35CC	48	6.5	33.0	100	82	9.0	62	52	79.0	124.0	16.50	10.00	12.0	M10	12.0	13	9.0	12.6	57,900	105,200	1.75
RGW35HC									106.5	151.5	30.25								73,100	142,000	2.40
QRW35CC	48	6.5	33.0	100	82	9.0	62	52	79.0	124.0	16.50	10.00	12.0	M10	12.0	13	9.0	12.6	77,000	94,700	1.74
QRW35HC									106.5	151.5	30.25								95,700	126,300	2.38
RGW45CC	60	8.0	37.5	120	100	10.0	80	60	106.0	153.2	21.00	10.00	12.9	M12	14.0	15	10.0	14.0	92,600	178,800	3.43
RGW45HC									139.8	187.0	37.90								116,000	230,900	4.57
QRW45CC	60	8.0	37.5	120	100	10.0	80	60	106.0	153.2	21.00	10.00	12.9	M12	14.0	15	10.0	14.0	123,200	156,400	3.41
QRW45HC									139.8	187.0	37.90								150,800	208,600	4.54
RGW55CC	70	10.0	43.5	140	116	12.0	95	70	125.5	183.7	27.75	12.50	12.9	M14	16.0	17	12.0	17.5	130,500	252,000	5.43
RGW55HC									173.8	232.0	51.90								167,800	348,000	7.61
RGW65CC	90	12.0	53.5	170	142	14.0	110	82	160.0	232.0	40.80	15.80	12.9	M16	22.0	23	15.0	15.0	213,000	411,600	11.63
RGW65HC									223.0	295.0	72.30								275,300	572,700	16.58

For dimensions of the rail, see Page 114, for standard as well as optional lubrication adapter, see Page 148.

3.6.10 Dimensions of the RG rail

The RG profile rail is used for both the RG and QR blocks.

3.6.10.1 Dimensions RGR_R

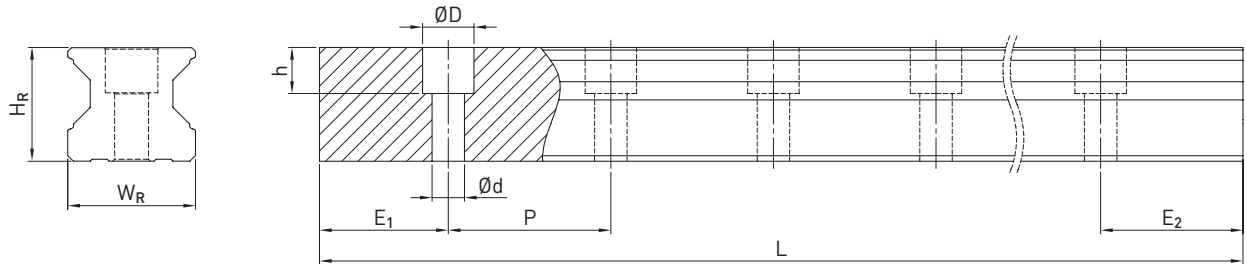


Table 3.99 **Dimensions of profile rail RGR_R**

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	D	h	d	P						
RGR15R	M4 × 20	15	16.5	7.5	5.7	4.5	30.0	4,000	3,960.0	42	6	24.0	1.70
RGR20R	M5 × 25	20	21.0	9.5	8.5	6.0	30.0	4,000	3,960.0	44	7	23.0	2.66
RGR25R	M6 × 30	23	23.6	11.0	9.0	7.0	30.0	4,000	3,960.0	46	8	22.0	3.08
RGR30R	M8 × 35	28	28.0	14.0	12.0	9.0	40.0	4,000	3,920.0	58	9	31.0	4.41
RGR35R	M8 × 35	34	30.2	14.0	12.0	9.0	40.0	4,000/5,600 [1)]	3,920.0/5,520 [1)]	58	9	31.0	6.06
RGR45R	M12 × 45	45	38.0	20.0	17.0	14.0	52.5	4,000/5,600 [1)]	3,937.5/5,437.5 [1)]	76.5	12	40.5	9.97
RGR55R	M14 × 55	53	44.0	23.0	20.0	16.0	60.0	4,000/5,600 [1)]	3,900.0/5,500 [1)]	88	14	46.0	13.98
RGR65R	M16 × 65	63	53.0	26.0	22.0	18.0	75.0	4,000/5,600 [1)]	3,900.0/5,500 [1)]	105	15	60.0	20.22

[1)] Optional type on request

3.6.10.2 Dimensions RGR_T

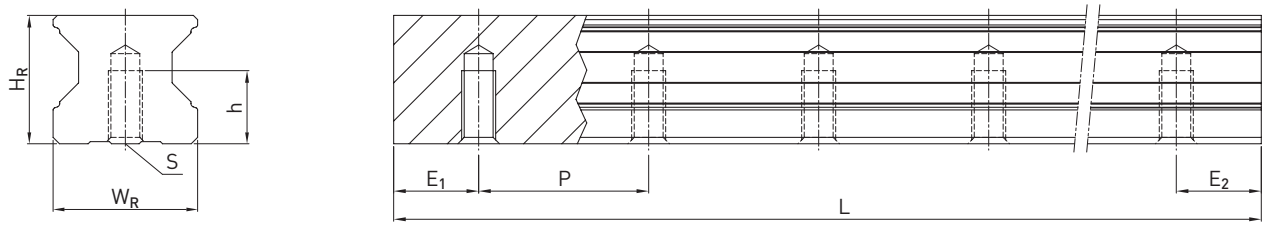


Table 3.100 **Dimensions of profile rail RGR_T**

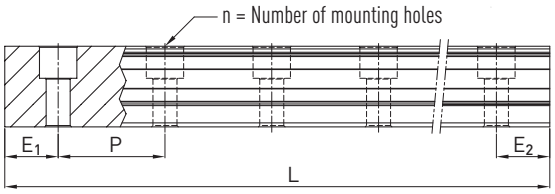
Series/size	Dimensions of the rail [mm]					Max. length [mm]	Max. length $E_1 = E_2$ [mm]	Min. length [mm]	$E_{1/2}$ min [mm]	$E_{1/2}$ max [mm]	Weight [kg/m]
	W_R	H_R	S	h	P						
RGR15T	15	16.5	M5	8.0	30.0	4,000	3,960.0	42	6	24.0	1.86
RGR20T	20	21.0	M6	10.0	30.0	4,000	3,960.0	44	7	23.0	2.76
RGR25T	23	23.6	M6	12.0	30.0	4,000	3,960.0	46	8	22.0	3.36
RGR30T	28	28.0	M8	15.0	40.0	4,000	3,920.0	58	9	31.0	4.82
RGR35T	34	30.2	M8	17.0	40.0	4,000	3,920.0	58	9	31.0	6.48
RGR45T	45	38.0	M12	24.0	52.5	4,000	3,937.5	76.5	12	40.5	10.83
RGR55T	53	44.0	M14	24.0	60.0	4,000	3,900.0	88	14	46.0	15.15
RGR65T	63	53.0	M20 [1)]	30.0	75.0	4,000	3,900.0	105	15	60.0	21.24

[1)] Deviates from DIN 645

Note:
1. The tolerance for E is +0,5 to −1 mm for standard, for joint connections 0 to −0.3 mm.
2. If no information is provided on the $E_{1/2}$ dimensions, the maximum number of mounting holes is determined taking into account $E_{1/2}$ min.
3. The rails are shortened to the desired length. If no information on the $E_{1/2}$ dimensions is provided, then the rails are manufactured symmetrically.

3.6.10.3 Calculation of the length of profile rails

HIWIN offers profile rains in customised lengths. To make sure the end of the profile rail does not become unstable, the value E should not exceed half 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 break out.



F 3.19

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

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

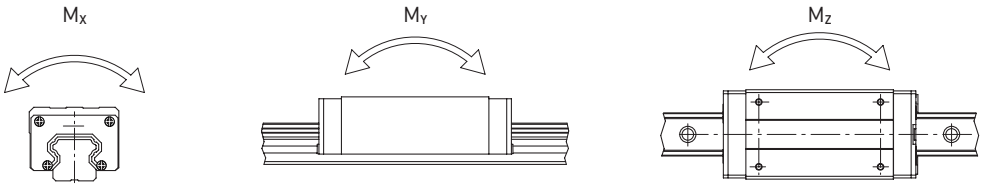
2.3 Load ratings

2.3.1 Static load rating C_0

If a linear guideway system is subjected to excessive loads or impacts during movement or at a standstill, localised permanent deformation occurs between the track and balls. As soon as this permanent deformation exceeds a certain level, it affects smooth operation of the guideway. According to its basic definition, the static load rating corresponds to a static load that causes permanent deformation of 0.0001 × ball diameter at the contact point that is loaded the most. The values are given in the tables for each linear guideway system. Using these tables, the designer can select a suitable linear guideway system. The maximum static load to which a linear guideway system is subjected must not exceed the static load rating.

2.3.2 Permissible static moment M_0

The permissible static moment is the moment which, in a defined direction and size, corresponds to the maximum possible load on the moving parts by the basic static load rating. The permissible static moment is defined for linear motion systems for three directions: M_X, M_Y and M_Z.



2.3.3 Static support stability

For profile rail systems at rest and slow motion, the static support stability must be taken into account, which depends on the environmental and operating conditions. Increased support stability is particularly important for guideways that are subjected to impact loads, see Table 2.1. The static support stability can be calculated according to F 2.1.

F 2.1

$$f_{SL} = \frac{C_0}{P} \; ; \quad f_{SM} = \frac{M_0}{M}$$

f_{SL}	Static support stability
f_{SM}	Static support stability for torque load
C_0	Static load rating [N]
M_0	Permissible static moment [Nm]
P	Static equivalent load [N]
M	Static equivalent moment [Nm]

Note: The linear guideway's load-bearing capacity is often restricted – not by its load-bearing strength, but by the screw connection. We therefore recommend checking the screw connection's maximum permissible load-bearing capacity in accordance with VDI 2230.

Table 2.1 **Static support stability**

Load	f_{SL}; f_{SM} [min.]
Normal load	1.25 – 3.00
With jolting and vibration	3.00 – 5.00

2.3.4 Dynamic load rating C_{dyn}

The dynamic load rating is the load, defined in terms of direction and size, at which a linear guideway achieves a nominal service life of a 50 km [1] (HG, QH, EG, QE, CG, WE, QW, MG) or 100 km [1] (RG, QR) travel path. The dynamic load rating is specified for each guideway in the dimension tables. It can be used to calculate the service life of a particular guideway.

[1] The dynamic load rating of linear guideways is specified for a service life of a 50 or 100 km travel path, depending on the manufacturer. The following factors can be used to convert the basic dynamic load rating: C_{dyn} 50 km = 1.26 × C_{dyn} 100 km (HG, QH, EG, QE, CG, WE, QW, MG series)
C_{dyn} 50 km = 1.23 × C_{dyn} 100 km (RG, QR series)

2.4 Service life calculation

2.4.1 Definition of service life

The constant and repeated loading of tracks and balls of a linear guideway causes fatigue on the track surface. In the end, so-called pitting formation occurs.
The service life of a linear guideway is defined as the total travel distance covered until pitting occurs on the surface of the track or balls.

2.4.2 Nominal service life (L)

The service life can be very different even if linear guideways are manufactured in the same way and used under the same movement conditions. Therefore, the nominal service life is taken as a reference value for estimating the service life of a linear guideway.
The nominal service life corresponds to the total travel path achieved without failure by 90% of a group of identical linear guideways used under the same conditions.

2.4.2.1 Calculation of the nominal service life

The actual load influences the nominal service life of a linear guideway. Using the selected dynamic load rating and the equivalent dynamic load, the nominal service life can be calculated using the formulas F 2.2 and F 2.3.

Formulas for calculation of the nominal service life

HG, QH, EG, QE, CG, WE, QW, MG series:

F 2.2

$$L = \left(\frac{C_{dyn}}{P}\right)^3 \times 50\,km$$

RG, QR series:

F 2.3

$$L = \left(\frac{C_{dyn}}{P}\right)^{10/3} \times 100\,km$$

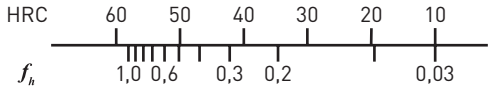
L	Nominal service life [km]
C_{dyn}	Dynamic load rating [N]
P	Dynamic equivalent load [N]

2.4.2.2 Factors of nominal service life

The type of load, the hardness of the track and the temperature of the guideway have a considerable influence on the nominal service life. The relationship between these factors are shown by formulas F 2.4 and F 2.5.

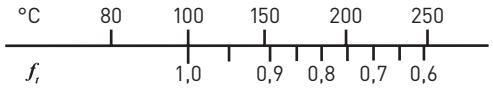
Hardness factor (f_h)

The tracks of the linear guideways have a hardness of 58 HRC. A hardness factor of 1.0 therefore applies. If the hardness differs, the hardness factor according to the adjacent figure must be taken into account. If the specified hardness is not achieved, the permissible load is reduced. In this case, the dynamic load rating and the static load rating must be multiplied by the hardness factor.



Temperature factor (f_t)

The application range of the standard profile rails is between –10 and 80 °C ambient temperature. For ambient temperatures up to 150 °C, the use of linear guideways with steel deflection system is required (marked with the suffix "SE" in the order code). Short-term ambient temperatures of up to 180 °C are possible. However, we recommend consulting our technical support for this. If the temperature of a linear guideway exceeds 100 °C, the permissible load and the service life are reduced. That is why the dynamic load rating and the static load rating must be multiplied by the temperature factor.



Linear guideways

General information

Load factor (f_w)

To take into account external influences on the service life of the profile rails which are not directly included in the calculation (e.g. vibrations, jolting and high speed), the dynamic equivalent load is multiplied by the load factor according to Table 2.2. For short-stroke applications (stroke < 2 × block lengths), the calculated load factor must be doubled.

Table 2.2 **Load factor**

Type of load	Travel speed	f_w
No jolting and vibration	At 15 m/min	1.0 – 1.2
Normal load	15 m/min – 60 m/min	1.2 – 1.5
Minor jolting	60 m/min – 120 m/min	1.5 – 2.0
With jolting and vibration	Greater than 120 m/min	2.0 – 3.5

Formulas for calculation of the nominal service life (considering all factors)

HG, QH, EG, QE, CG, WE, QW, MG series:

F 2.4

$$L = \left(\frac{f_h \times f_t \times C_{dyn}}{f_w \times P} \right)^3 \times 50\,km$$

RG, QR series:

F 2.5

$$L = \left(\frac{f_h \times f_t \times C_{dyn}}{f_w \times P} \right)^{10/3} \times 100\,km$$

L Nominal service life [km]
f_h Hardness factor
C_{dyn} Dynamic load rating [N]
f_t Temperature factor
P Dynamic equivalent load [N]
f_w Load factor

2.4.3 Service life (L_h)

The service life in hours is calculated from the nominal service life with the aid of the travel speed and movement frequency.

Formulas for calculation of the service life (L_h)

HG, QH, EG, QE, CG, WE, QW, MG series:

F 2.6

$$L_h = \frac{L}{v \times 60} = \frac{\left(\frac{C_{dyn}}{P} \right)^3 \times 50.000}{v \times 60}$$

RG, QR series:

F 2.7

$$L_h = \frac{L}{v \times 60} = \frac{\left(\frac{C_{dyn}}{P} \right)^{10/3} \times 100.000}{v \times 60}$$

L_h Service life [h]
L Nominal service life [m]
v Velocity [m/min]
C_{dyn}/P Load rating/Load ratio

2.6 Friction and lubrication

2.6.1 Frictional resistance

The use of rolling elements in the linear guideway essentially reduces the friction to the rolling friction of the rolling elements. The friction coefficient of linear guideways is thus very small, up to one fiftieth of the value of traditional sliding guides. In general, the friction coefficient is about 0.004, depending on the series. If the load is only 10% or less of the basic dynamic load rating, most of the frictional resistance is generated by the wipers and by the grease and friction between the rolling elements. If the operating load becomes greater than 10% of the dynamic load rating, the load provides most of the frictional resistance.

F 2.8

$$F = \mu \times W + S$$

F	Frictional force [N]
S	Frictional resistance [N]
μ	Friction coefficient
W	Load [N]

2.6.2 Lubrication

The linear guideways, like all rolling bearings, require adequate lubrication. Both grease and oil may be used in general. The lubricant is a constructional element and should be taken into consideration when designing a machine. The lubricants reduce wear, protect against dirt, reduce corrosion and lengthen service life. Dirt can settle and solidify on unprotected profile rails. This dirt must be removed on a regular basis.

For wall mounting, we generally recommend grease or low-viscosity lubricant; for oil lubrication, we generally ask that you consult us, as insufficient lubrication may occur depending on the installation position.

HIWIN offers greases for different requirements:

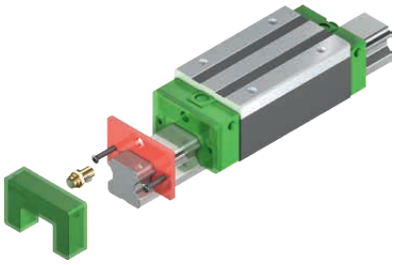
- HIWIN G01: Heavy-duty applications
- HIWIN G02: Clean room and vacuum applications
- HIWIN G03 Clean room and vacuum applications with high velocities
- HIWIN G04: Applications with high speeds
- HIWIN G05: Standard applications
- HIWIN G06: Short stroke and high frequency applications
- HIWIN G07: Applications at low temperatures

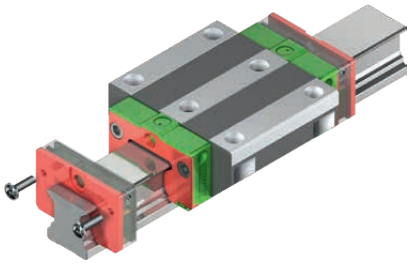
Information on HIWIN lubricants can be found in the Accessories chapter on Page 149. Detailed information on HIWIN lubricants and lubrication of the linear guideways can be found in the **"Linear guideways"** assembly instructions at www.hiwin.de.

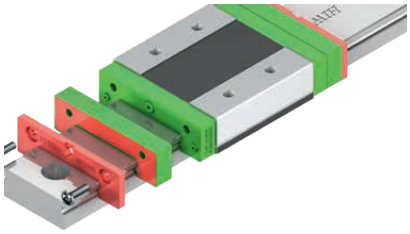
2.6.3 Long-term lubrication unit

The long-time lubrication unit considerably increases lubrication intervals. Depending on the application and ambient conditions, it can achieve lifetime lubrication.
It also considerably reduces lubricant consumption, as only the required quantity of lubricant is applied.
The compact construction and special design allows the block to be fitted in any position without impairing the lubrication function.

The long-time lubrication unit can be used at ambient temperatures of –10 °C to +60 °C.
The long-time lubrication units are available for the HG/QH, CG, EG/QE, MG and RG series. The corresponding dimensions and the running performance can be found in the chapter of the corresponding series. HG/QH series: Page 30, CG series: Page 48, EG/QE series: Page 66, MG series: Page 92, RG series: Page 106.







Applications

- Machine tools
- Production machines: Injection moulding machines, paper industry, textile machines, food industry, woodworking machines
- Electronics industry: Semiconductor industry, robotics, cross tables, measuring and testing machines
- Other areas: Medical equipment, automation, handling technology

Linear guideways

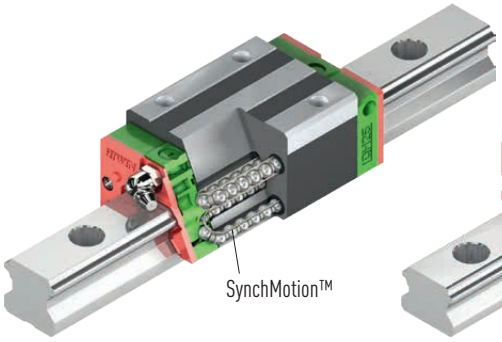
General information

2.10 SynchMotion™ technology

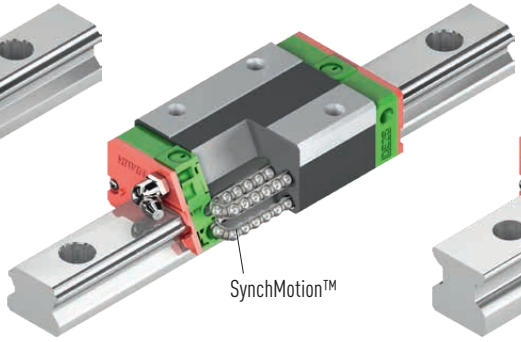
The innovative SynchMotion™ technology reduces contact between the rolling elements and the block. Similar to the ball cage of a standard ball bearing, the rolling elements are kept at a defined distance from each other by SynchMotion™ technology. Counter-rotating friction, as occurs in conventional linear guideways, is thus prevented and synchronisation fluctuations are significantly reduced. Even at high speeds, no uncontrolled ball movements occur. SynchMotion™ technology also improves lubricant transport within the block and lubricant storage.

Advantages:

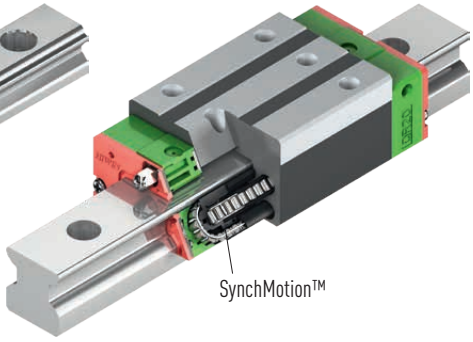
- Improved synchronous performance
- Optimised for high travel speeds
- Improved lubrication properties
- Reduced running noise
- Higher dynamic load rating



QH series



QE series



QR series

Table 2.8 **Availability of SynchMotion™ technology for HIWIN linear guideways**

Series	Sizes									
	15	20	21	25	27	30	35	45	55	65
QH	●	●	–	●	–	●	●	●	–	–
QE	●	●	–	●	–	●	●	–	–	–
QW	–	–	●	–	●	–	●	–	–	–
QR	–	–	–	●	–	●	●	●	–	–

Dimensionally identical and compatible with the HG, EG, WE and RG blocks, the blocks with SynchMotion™ technology are mounted on the standard rail and are therefore very easy to exchange.

Linear guideways

General information

2.12 HIWIN coating for linear guideways

2.12.1 HIWIN coating HICOAT CZS

2.12.1.1 Features and properties

HICOAT CZS is a very thin zinc coating that provides very good corrosion protection, even in radii and chamfers. Smaller bare spots remain protected against corrosion by the cathodic protection effect. This results in a significantly longer service life compared to uncoated parts. CZS coating available for the HG, EG, CG and WE series. Note: Not for series RG, MG, PG, QH, QE, QR and QW.

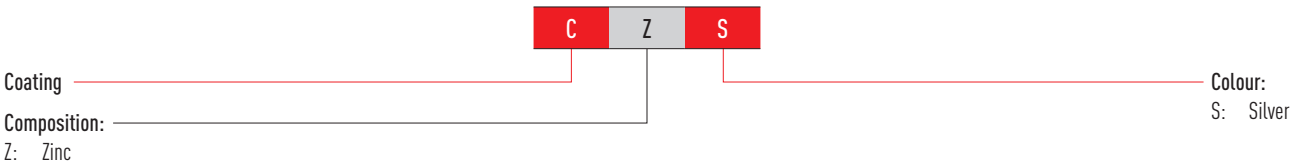
Specific features:

- Very good corrosion protection
- Cr(VI)-free
- One-piece and multi-piece rails available from stock
- End preservation with zinc spray (see below)
- Possible interaction between coating, ambient medium and lubricant should be checked on a case-by-case basis

Technical data:

- Salt spray test according to DIN EN ISO 9227 (with unloaded rail): 300 hours
- Salt spray test according to DIN EN ISO 9227 (with loaded rail): 99 hours
- Maximum rail length (one-piece): 4.0 meters

2.12.1.2 Order code for CZS coatings



2.12.1.3 Corrosion test

CZS-coated profile rails were tested in comparison with an uncoated profile rail.

New rail in CZS coating

Rail with CZS coating – after 6 months of outdoor storage

Rail (unloaded) with CZS coating – after 99 hours of salt spray test (according to DIN EN ISO 9227)

Uncoated rail – after 4 hours of salt spray test

2.12.1.4 Rail end

The rail ends are preserved with zinc spray. In order to achieve reliable corrosion protection at the uncoated rail ends as well, a high-quality zinc spray (zinc content 99%) is used. The rail ends of single-piece rails and the outer ends of multi-piece rails are preserved with zinc spray approx. 2 mm beyond the cut edge as shown in Fig. 2.1. Rail ends at joints are supplied with a greased, uncoated cut edge (see Fig. 2.2).
Note: The mounting holes and the process-related contact points on the underside of the rail may have lower coating thicknesses or isolated bare spots. The inner side of the block is generally not coated.

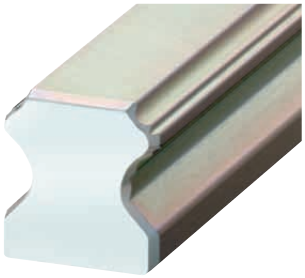


Fig. 2.1 **Rail end preserved with zinc spray**

Fig. 2.2 **Joint uncoated**

Linear guideways

General information

2.12.3 HIWIN coating HICOAT CCB

2.12.3.1 Features and properties

HICOAT CCB is a very thin chromium oxide layer with a cured synthetic resin coating. It is characterised by good corrosion protection combined with very good running properties. The very thin layer thickness enables use with all HIWIN linear guideways, especially with the MG and RG series.

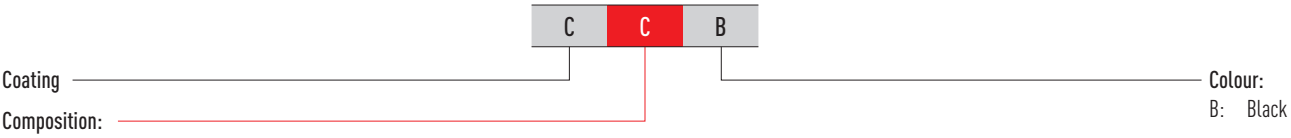
Specific features:

- Very thin layer thickness
- Very good running properties
- Good corrosion protection
- Cr(VI)-free
- Including coated rail end
- Available from Taiwan stock

Technical data:

- Salt spray test according to DIN EN ISO 9227 (with unloaded rail): 24 hours
- Maximum rail length (one-piece): 4.0 meters

2.12.3.2 Order code for CCB coatings



C: Thin-film chrome with synthetic resin coating

2.12.3.3 Corrosion test

CCB-coated profile rails were tested in comparison with an uncoated profile rail.

New rail in CCB coating

Rail (unloaded) with CCB coating - after 24 hours of salt spray test (according to DIN EN ISO 9227)

Uncoated rail – after 4 hours of salt spray test

Linear guideways

RG/QR series

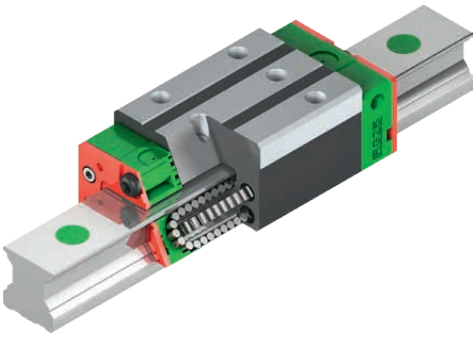
3.6 RG/QR series

3.6.1 Properties of the RG and QR series linear guideways

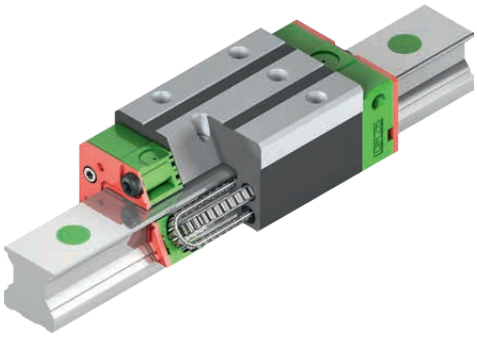
The HIWIN linear guideways of the RG series use rollers rather than balls as rolling elements. The RG series offers extremely high rigidity and a very high load capacity. It is designed with a 45° contact angle. The linear contact surface dramatically reduces deformation caused by loading, thereby achieving extremely high rigidity and load capacity in all 4 load directions. The linear guideways of the RG series are thus ideally suited for use in high-precision manufacturing.
The models of the QR series with SynchMotion™ technology offer all the advantages of the standard RG series. Controlled movement of the rollers at a defined distance also results in improved synchronous performance, higher reliable travel speeds, extended lubrication intervals and less running noise. Since the installation dimensions of the QR blocks are identical to those of the RG blocks, they are also mounted on the RGR standard rail and can thus be easily interchanged. For further information, see Page 24.

3.6.2 Layout of RG/QR series

- Four-row recirculating roller guide
- 45° contact angle
- Different sealing variants, depending on application area
- 6 connection options for lubricating nipples and lubrication adapters
- SynchMotion™ technology (QR series)



Layout of RG series



Layout of QR series

Advantages:

- Backlash-free
- Exchangeable
- Very high load ratings
- Very high rigidity
- Low displacement forces even with high preload

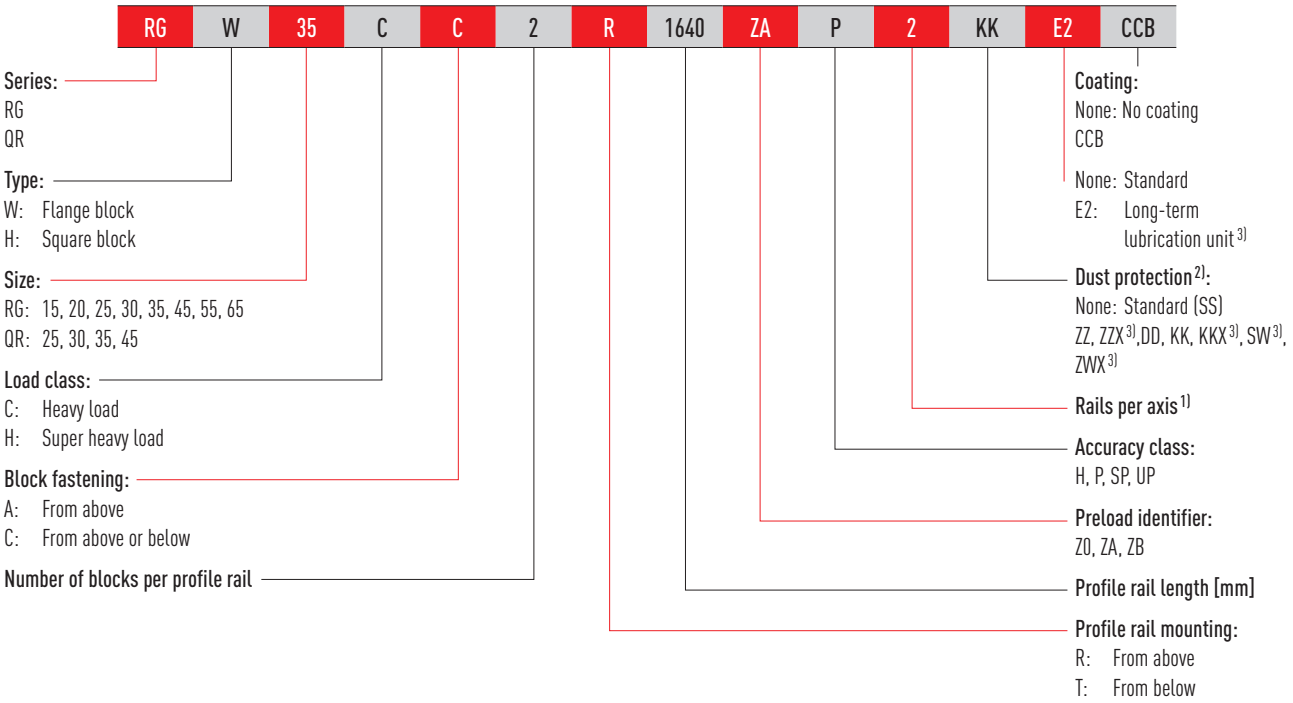
Additional advantages of QR series:

- Improved synchronous performance
- Optimised for higher travel speeds
- Extended relubrication intervals
- Reduced running noise
- Higher dynamic load rating

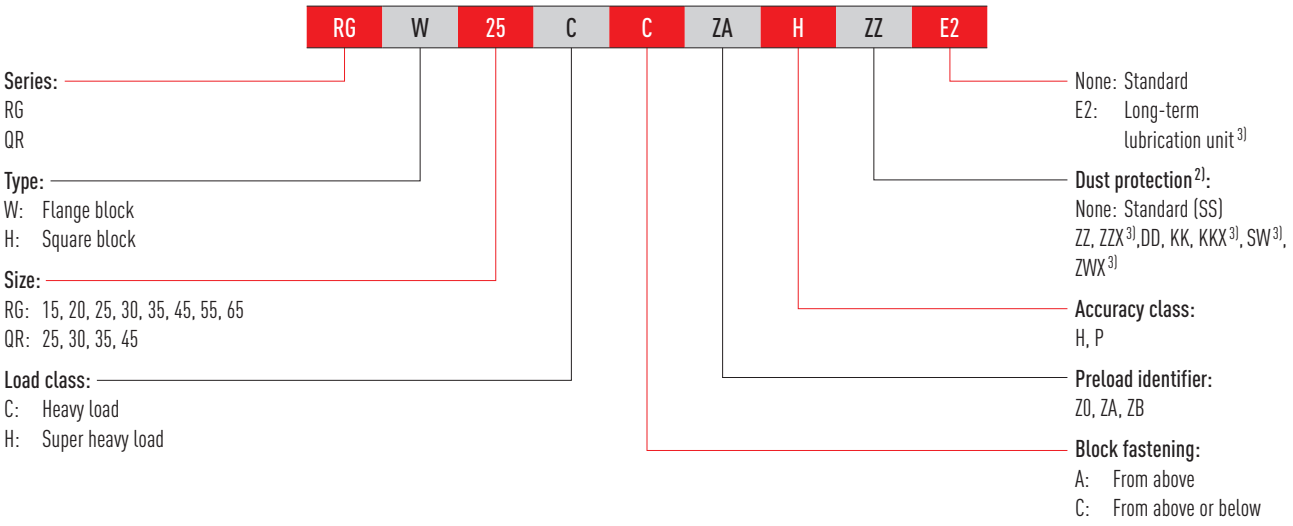
3.6.3 Order codes of RG/QR series

For RG/QR linear guideways , there is a distinction made between assembled and non-assembled models. The dimensions of both models are the same. The main difference is that, in the unassembled models, blocks and profile rails can be freely interchanged. The article numbers of the series contain the dimensions, the model, the accuracy class, the preload, etc.

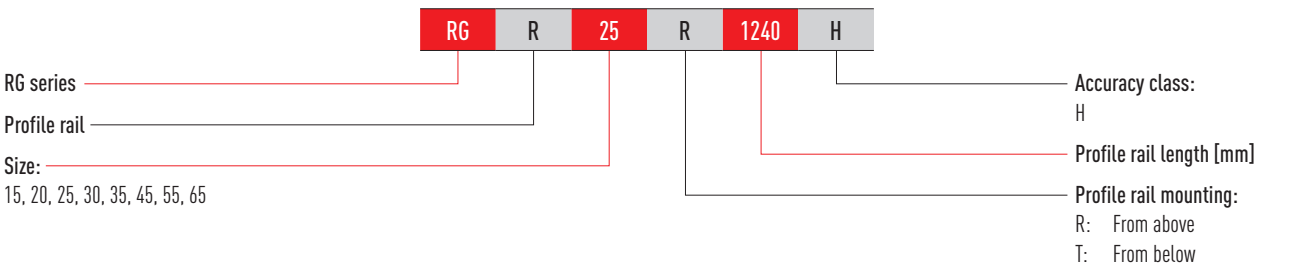
Order code for linear guideway (assembled)



Order number of block (not assembled)



Order number of profile rail (not assembled)



Note:

1) The number 2 is also a quantity indication, i.e. one piece of the article described above consists of one pair of rails. No number is given for single profile rails. In the case of multi-part rails, the joint is offset as standard.

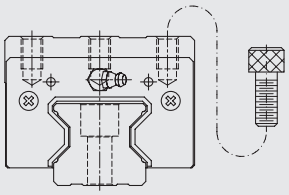
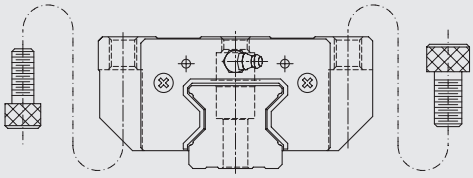
2) An overview of the individual sealing systems can be found on Page 22

3) Only available for RG

3.6.4 Block types

HIWIN offers block and flange blocks for its linear guideways. Due to the low installation height and the larger mounting surface, flange blocks are better suited for large loads.

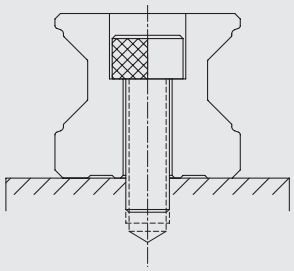
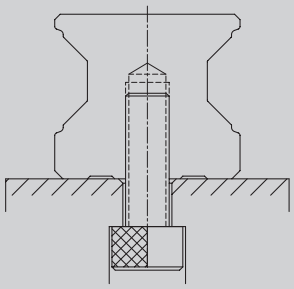
Table 3.92 **Block types**

Type	Series/size	Layout	Height [mm]	Typical applications
Square type	RGH-CA RGH-HA		28 – 90	○ Automation technology ○ Transport technology ○ CNC machining centres ○ High performance cutting machines ○ CNC grinding machines ○ Injection moulding machines ○ Portal milling machines ○ Machines and systems with high required rigidity ○ Machines and systems with high required load ratings ○ Spark erosion machines
Flange type	RGW-CC RGW-HC		24 – 90	

3.6.5 Profile rail types

In addition to profile rails with standard fastening from above, HIWIN also offers rails for fastening from below.

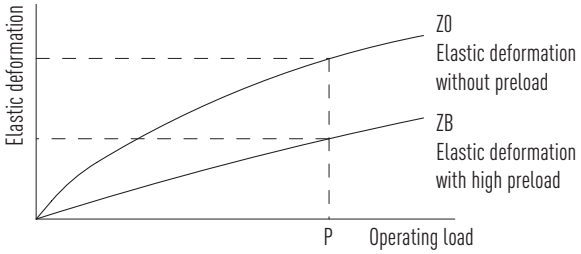
Table 3.93 **Profile rail types**

Fastening from above	Fastening from below
	
RGR_R	RGR_T

3.6.6 Preload

Definition

Each linear guideway can be preloaded via the ball size. The curve shows that the rigidity doubles at high preload. The RG/QR series of linear guideways offers three standard preloads for different applications and conditions.

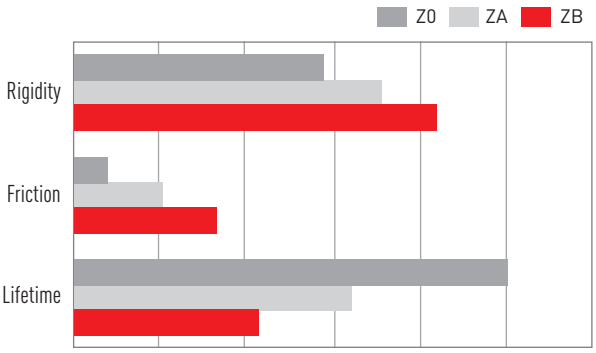


Preload identifier

Table 3.94 **Preload identifier**

Identifier	Preload		Application
Z0	Slight preload	0.02 – 0.04 C_{dyn}	Constant load direction, low jolting and low required accuracy
ZA	Medium preload	0.07 – 0.09 C_{dyn}	High precision required
ZB	High preload	0.12 – 0.14 C_{dyn}	Very high rigidity and precision required, vibration and jolting

The figure shows the relationship between rigidity, frictional resistance and nominal service life. For smaller size models, preload is not recommended above ZA to avoid preload-related reductions in service life.



3.6.7 Load ratings and torques

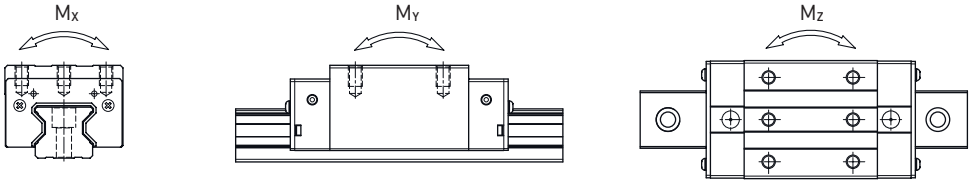


Table 3.95 **Load ratings and torques for RG/QR series**

Series/Size	Dynamic load rating C_{dyn} [N] [1]	Static load rating C_0 [N]	Static moment [Nm]		
			M_{0X}	M_{0Y}	M_{0Z}
RG_15C	11,300	24,000	311	173	173
RG_20C	21,300	46,700	647	460	460
RG_20H	26,900	63,000	872	837	837
RG_25C	27,700	57,100	758	605	605
QR_25C	38,500	54,400	722	627	627
RG_25H	33,900	73,400	975	991	991
QR_25H	44,700	65,300	867	907	907
RG_30C	39,100	82,100	1,445	1,060	1,060
QR_30C	51,500	73,000	1,284	945	945
RG_30H	48,100	105,000	1,846	1,712	1,712
QR_30H	64,700	95,800	1,685	1,630	1,630
RG_35C	57,900	105,200	2,170	1,440	1,440
QR_35C	77,000	94,700	1,955	1,331	1,331
RG_35H	73,100	142,000	2,930	2,600	2,600
QR_35H	95,700	126,300	2,606	2,335	2,335
RG_45C	92,600	178,800	4,520	3,050	3,050
QR_45C	123,200	156,400	3,959	2,666	2,666
RG_45H	116,000	230,900	6,330	5,470	5,470
QR_45H	150,800	208,600	5,278	4,694	4,694
RG_55C	130,500	252,000	8,010	5,400	5,400
RG_55H	167,800	348,000	11,150	10,250	10,250
RG_65C	213,000	411,600	16,200	11,590	11,590
RG_65H	275,300	572,700	22,550	22,170	22,170

[1] Dynamic load rating for 100,000 m travel path

3.6.8 Rigidity

The rigidity depends on the preload. With the formula F 3.18, the deformation can be calculated depending on the rigidity.

F 3.18

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

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

Table 3.96 **Radial rigidity of RG/QR series**

Load type	Series/ Size	Rigidity depending on the preload		
		Z0	ZA	ZB
Heavy load	RG_15C	482	504	520
	RG_20C	586	614	633
	RG_25C	682	717	740
	QR_25C	616	645	665
	RG_30C	809	849	876
	QR_30C	694	726	748
	RG_35C	954	1,002	1,035
	QR_35C	817	856	882
	RG_45C	1,433	1,505	1,554
	QR_45C	1,250	1,310	1,350
	RG_55C	1,515	1,591	1,643
	RG_65C	2,120	2,227	2,300
Super heavy load	RG_20H	786	823	848
	RG_25H	873	917	947
	QR_25H	730	770	790
	RG_30H	1,083	1,136	1,173
	QR_30H	910	950	980
	RG_35H	1,280	1,344	1,388
	QR_35H	1,090	1,140	1,170
	RG_45H	1,845	1,938	2,002
	QR_45H	1,590	1,660	1,720
	RG_55H	2,079	2,182	2,254
	RG_65H	2,931	3,077	3,178

Unit: N/μm

3.6.10.4 Cover caps for mounting holes of profile rails

The cover caps are used to keep the mounting holes free of chips and dirt. The standard plastic cover caps accompany each profile rail. Optional cover caps have to be ordered separately.

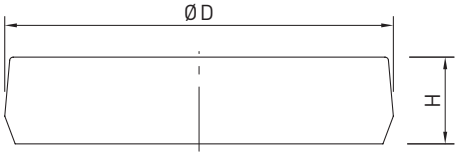


Table 3.101 **Cover caps for mounting holes of profile rails**

Rail	Screw	Article number			Ø D [mm]	Height H [mm]
		Plastic (200 units)	Brass [1]	Steel [1]		
RGR15R	M4	5-002218	5-001344	–	7.5	1.2
RGR20R	M5	5-002220	5-001350	5-001352	9.5	2.5
RGR25R	M6	5-002221	5-001355	5-001357	11.0	2.8
RGR30R	M8	5-002222	5-001360	5-001362	14.0	3.5
RGR35R	M8	5-002222	5-001360	5-001362	14.0	3.5
RGR45R	M12	5-002223	5-001324	5-001327	20.0	4.0
RGR55R	M14	5-002224	5-001330	5-001332	23.0	4.0
RGR65R	M16	5-002225	5-001335	5-001337	26.0	4.0

[1] Not recommended for coated rails.

3.6.11 Sealing systems

Different sealing systems are available for HIWIN blocks. You can find an overview on Page 22. The following table shows the total length of the blocks with different sealing systems. Appropriate sealing systems are available for these sizes.

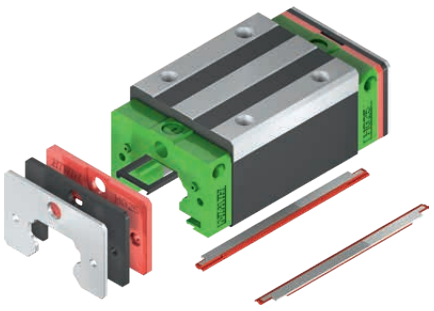


Table 3.102 **Total length of block with different sealing systems**

Series/size	Total length L (including screws)							
	SS	ZZ	ZZX	DD	KK	KKX	SW	ZWX
RG_15C	68.0	70.0	–	72.4	74.4	–	–	–
RG_20C	86.0	88.0	–	90.4	92.4	–	–	–
RG_20H	106.0	108.0	–	110.4	112.4	116.4	–	–
RG_25C	97.9	99.9	103.9	102.3	104.3	108.3	–	–
QR_25C	97.7	99.9	–	102.3	104.3	–	–	–
RG_25H	114.4	116.4	120.4	118.8	120.8	124.8	–	–
QR_25H	112.9	114.9	–	117.3	119.3	–	–	–
RG_30C	109.8	112.8	115.8	114.6	117.6	120.6	–	–
QR_30C	109.8	112.8	–	114.6	117.6	–	–	–
RG_30H	131.8	134.8	137.8	136.6	139.6	142.6	–	–
QR_30H	131.8	134.8	–	136.6	139.6	–	–	–
RG_35C	124.0	127.0	130.0	129.0	132.0	135	–	–
QR_35C	124.0	127.0	–	129.0	132.0	–	–	–
RG_35H	151.5	154.5	157.5	156.5	159.5	163.5	–	–
QR_35H	151.5	154.5	–	156.5	159.5	–	–	–
RG_45C	153.2	156.2	159.2	160.4	163.4	166.4	156.5	166.2
QR_45C	153.2	156.2	–	160.4	163.4	–	–	–
RG_45H	187.0	190.0	193.0	194.2	197.2	200.2	190.3	200.0
QR_45H	187.0	190.0	–	194.2	197.2	–	–	–
RG_55C	183.7	186.7	189.7	190.9	193.9	196.9	186.9	198.3
RG_55H	232.0	235.0	238.0	239.2	242.2	245.2	235.2	246.6
RG_65C	232.0	235.0	238.0	240.8	243.8	246.8	235.2	245.3
RG_65H	295.0	298.0	301.0	303.8	306.8	309.8	298.2	308.3

Unit: mm

3.6.11.1 Designation of the seal sets

The seal sets are always shipped complete with the installation materials and include the supplemental parts for the standard seal.

RG 25 SS

Series:
RG
QR

Size:
RG: 15, 20, 25, 30, 35, 45, 55, 65
QR: 25, 30, 35, 45

Dust cover ID:
SS: Standard seal
ZZ: End seal with scraper
ZZX: End seal with optimised scraper
DD: Double end seal
KK: Double end seal with scraper
KKX: Double end seals with plate
SW: End seal with double sealing lip
ZWX: End seal with double sealing lip and scraper

3.6.12 Lubrication unit

Further information on the lubrication unit can be found in the general information In section "2.6.3 Long-term lubrication unit" on Page 15.
The following drawing shows the dimension (L) for a single-sided lubrication unit. The dimension for a double-sided lubrication unit results from the dimension L + V + T. The E2 long-term lubrication unit is available with the sealing systems named in the table.

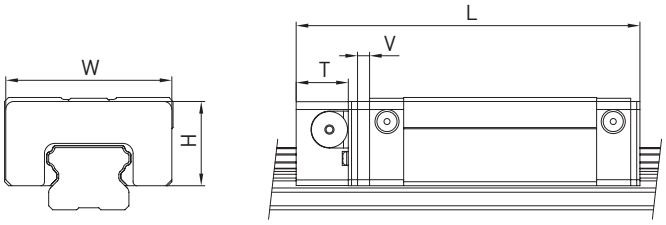


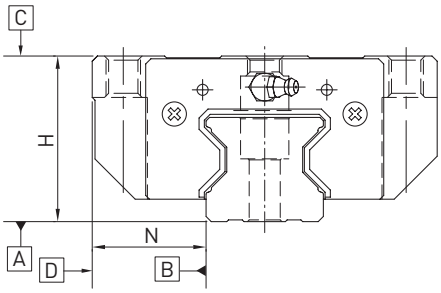
Table 3.103 **Dimensions of the block with lubrication unit E2**

Model	Dimensions of the block [mm]								Max. running performance[2] [km] E2 single-sided	Max. running performance[2] [km] E2 double-sided
	W	H	T	V	L_{SS}[1]	L_{ZZ}[1]	L_{DD}[1]	L_{KK}[1]		
RG_15C	33	19,2	12,5	3,5	84,0	86,0	88,4	90,4	4.000	8.000
RG_20C	43,4	24,2	12,5	3,5	102	104,0	106,4	108,4	4.000	8.000
RG_20H	43,4	24,2	12,5	3,5	122	124,0	126,4	128,4	4.000	8.000
RG_25C	46.8	29.2	13.5	3.5	114.9	116.9	119.3	121.3	4,000	8,000
RG_25H	46.8	29.2	13.5	3.5	131.4	133.4	135.8	137.8	4,000	8,000
RG_30C	58.8	34.9	13.5	3.5	126.8	129.8	131.6	134.6	4,000	8,000
RG_30H	58.8	34.9	13.5	3.5	148.8	151.8	153.6	156.6	4,000	8,000
RG_35C	68.8	40.3	13.5	3.5	141.0	144.0	146.0	149.0	4,000	8,000
RG_35H	68.8	40.3	13.5	3.5	168.5	171.5	173.5	176.5	4,000	8,000
RG_45C	83.8	50.2	16.0	4.5	173.7	176.7	180.9	183.9	4,000	8,000
RG_45H	83.8	50.2	16.0	4.5	207.5	210.5	214.7	217.7	4,000	8,000
RG_55C	97.6	58.4	16.0	4.5	204.2	207.2	211.4	214.4	4,000	8,000
RG_55H	97.6	58.4	16.0	4.5	252.5	255.5	259.7	262.7	4,000	8,000
RG_65C	121.7	76.1	16.0	4.5	252.5	255.5	261.3	264.3	4,000	8,000
RG_65H	121.7	76.1	16.0	4.5	315.5	318.5	324.3	327.3	4,000	8,000

[1] Total length depending on the selected dust protection. SS = Standard dust protection
[2] Further details can be found in the assembly instructions in the "Lubrication" chapter

3.6.13 Tolerances depending on the accuracy class

The RG and QR series are available in four accuracy classes according to the parallelism between block and rail, height accuracy H and width accuracy N. The selection of the accuracy class is determined by the requirements of the machine.



3.6.13.1 Parallelism

Parallelism of locating surfaces D and B of the block and rail and of top block surface C to mounting surface A of the rail. Ideal installation of the linear guideway and the measurement in the centre of the block are prerequisites.

Table 3.104 **Tolerance of parallelism between block and profile rail**

Rail length [mm]	Accuracy class			
	H	**P**	**SP**	**UP**
– 100	7	3	2	2
100 – 200	9	4	2	2
200 – 300	10	5	3	2
300 – 500	12	6	3	2
500 – 700	13	7	4	2
700 – 900	15	8	5	3
900 – 1100	16	9	6	3
1100 – 1500	18	11	7	4
1500 – 1900	20	13	8	4
1900 – 2500	22	15	10	5
2500 – 3100	25	18	11	6
3100 – 3600	27	20	14	7
3600 – 4000	28	21	15	7

Unit: µm

3.6.13.2 Accuracy – height and width

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

Height variance of H
Permissible deviation of height H between several blocks on one rail, measured at the same position of the rail.

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

Width variance of N
Permissible deviation of width N between several blocks on one rail, measured at the same position of the rail.

Table 3.105 **Tolerances of width and height**

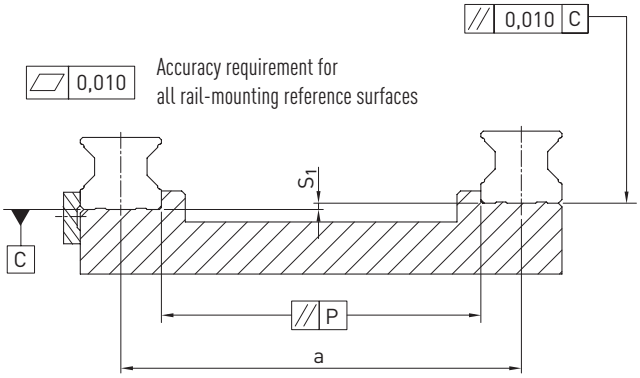
Series/size	Accuracy class	Height tolerance of H	Width tolerance of N	Height variance of H	Width variance of N
RG_15, 20	H (high)	± 0.03	± 0.03	0.01	0.01
	P (precision)	0/– 0.03 [1)] ± 0.015 [2)]	0/– 0.03 [1)] ± 0.015 [2)]	0.006	0.006
	SP (super precision)	0/– 0.015	0/– 0.015	0.004	0.004
	UP (ultra precision)	0/– 0.008	0/– 0.008	0.003	0.003
RG_25, 30, 35 **QR_25, 30, 35**	H (high)	± 0.04	± 0.04	0.015	0.015
	P (precision)	0/– 0.04 [1)] ± 0.02 [2)]	0/– 0.04 [1)] ± 0.02 [2)]	0.007	0.007
	SP (super precision)	0/– 0.02	0/– 0.02	0.005	0.005
	UP (ultra precision)	0/– 0.01	0/– 0.01	0.003	0.003
RG_45, 55 **QR_45**	H (high)	± 0.05	± 0.05	0.015	0.02
	P (precision)	0/– 0.05 [1)] ± 0.025 [2)]	0/– 0.05 [1)] ± 0.025 [2)]	0.007	0.01
	SP (super precision)	0/– 0.03	0/– 0.03	0.005	0.007
	UP (ultra precision)	0/– 0.02	0/– 0.02	0.003	0.005
RG_65	H (high)	± 0.07	± 0.07	0.02	0.025
	P (precision)	0/– 0.07 [1)] ± 0.035 [2)]	0/– 0.07 [1)] ± 0.035 [2)]	0.01	0.015
	SP (super precision)	0/– 0.05	0/– 0.05	0.007	0.01
	UP (ultra precision)	0/– 0.03	0/– 0.03	0.005	0.007

Unit: mm

[1)] Assembled linear guideway
[2)] Unassembled linear guideway

3.6.13.3 Permissible tolerances of the mounting surface

Once the requirements for the accuracy of the mounting surfaces are met, the high accuracy, rigidity and service life of the RG/QR series linear guideways are achieved.



Tolerance of parallelism of reference surface (P)

Table 3.106 **Maximum tolerance for parallelism (P)**

Series/Size	Preload class		
	Z0	**ZA**	**ZB**
RG_15	5	3	3
RG_20	8	6	4
RG/QR_25	9	7	5
RG/QR_30	11	8	6
RG/QR_35	14	10	7
RG/QR_45	17	13	9
RG_55	21	14	11
RG_65	27	18	14

Unit: μm

Tolerance of height of reference surface (S_1)

F 3.20 $$S_1 = a \times K - T_H$$

S_1 Maximum height tolerance [mm]
a Distance between rails [mm]
K Coefficient of height tolerance
T_H Tolerance of height according to Table 3.105

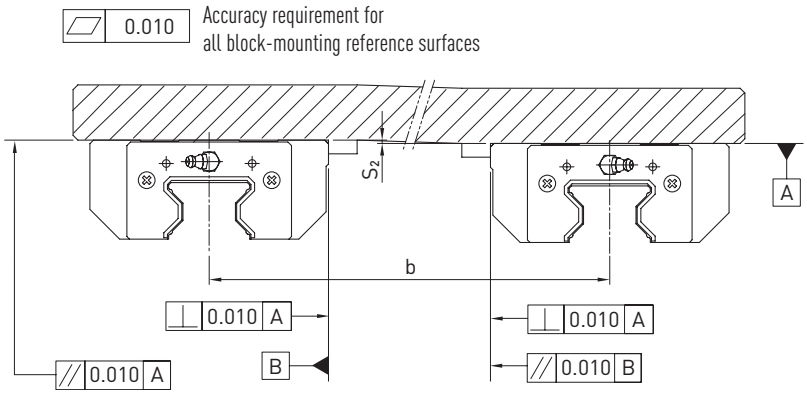
Table 3.107 **Coefficient of height tolerance (K)**

Series/Size	Preload class		
	Z0	**ZA**	**ZB**
RG_15 – 65/QR_25 – 45	2.2×10^{-4}	1.7×10^{-4}	1.2×10^{-4}

Note: If $S_1 < 0$, select another tolerance class!

Height tolerance for mounting surface on block

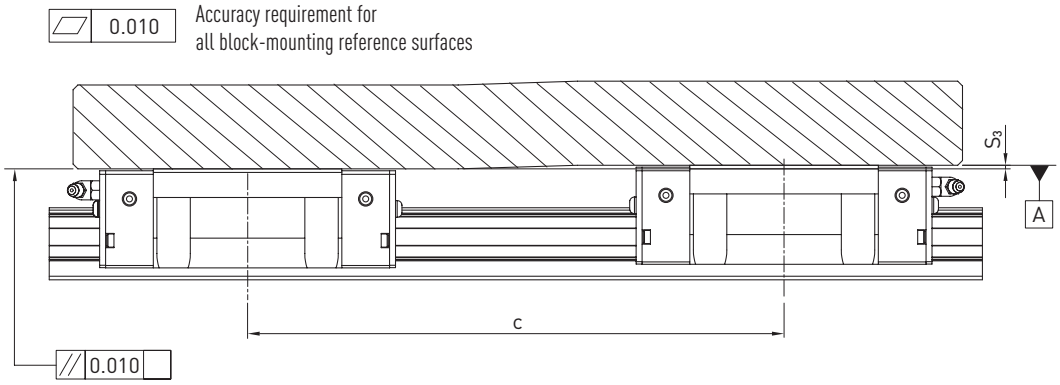
- The height tolerance of the reference surface when two or more blocks are used in parallel (S_2)



F 3.21 $S_2 = b \times 4{,}2 \times 10^{-5}$

S_2 Maximum height tolerance [mm]
b Distance between blocks [mm]

- The height tolerance of the reference surface when two or more blocks are used in parallel (S_3)



F 3.22 $S_3 = c \times 4{,}2 \times 10^{-5}$

S_3 Maximum height tolerance [mm]
c Distance between blocks [mm]

3.6.14 Shoulder heights and edge roundings

Inaccurate shoulder heights and edge roundings of mounting surfaces impair accuracy and may conflict with the block or rail profile. The following shoulder heights and edge profiles must be observed to avoid assembly problems.

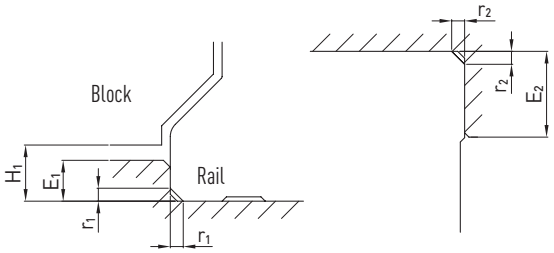


Table 3.108 **Shoulder heights and edge roundings**

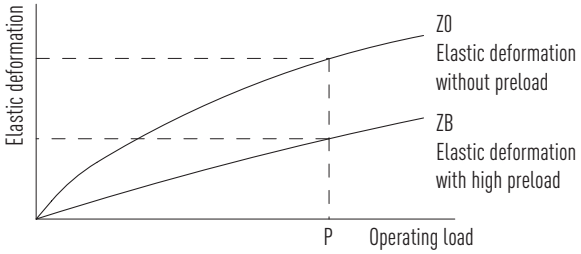
Series/Size	Max. radius of edges r_1	Max. radius of edges r_2	Shoulder height of the reference edge of rail E_1	Shoulder height of the reference edge of block E_2	Clearance height under block H_1
RG_15	0.5	0.5	3.0	4.0	4.0
RG_20	0.5	0.5	3.5	5.0	5.0
RG/QR_25	1.0	1.0	5.0	5.0	5.5
RG/QR_30	1.0	1.0	5.0	5.0	6.0
RG/QR_35	1.0	1.0	6.0	6.0	6.5
RG/QR_45	1.0	1.0	7.0	8.0	8.0
RG_55	1.5	1.5	9.0	10.0	10.0
RG_65	1.5	1.5	10.0	10.0	12.0

Unit: mm

3.7.4 Preload

Definition

Each linear guideway can be preloaded via the ball size. The curve shows that the rigidity doubles at high preload. The RG/QR series of linear guideways offers three standard preloads for different applications and conditions.

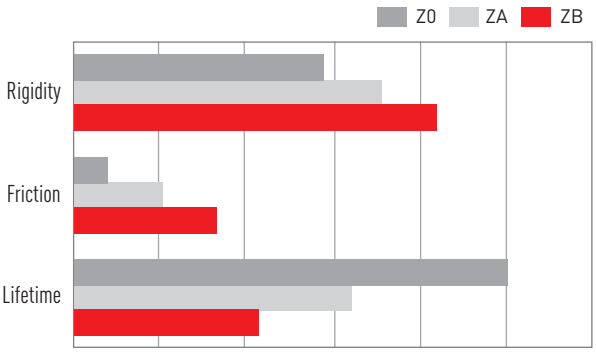


Preload identifier

Table 3.111 **Preload identifier**

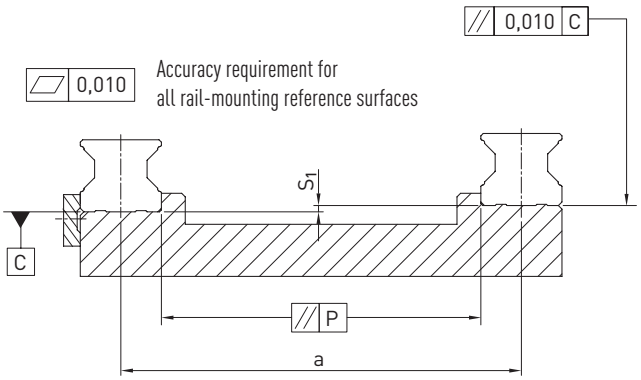
Identifier	Preload		Application
Z0	Slight preload	0.02 – 0.04 C_{dyn}	Constant load direction, low jolting and low required accuracy
ZA	Medium preload	0.07 – 0.09 C_{dyn}	High precision required
ZB	High preload	0.12 – 0.14 C_{dyn}	Very high rigidity and precision required, vibration and jolting

The figure shows the relationship between rigidity, frictional resistance and nominal service life. For smaller size models, preload is not recommended above ZA to avoid preload-related reductions in service life.



3.7.10.3 Permissible tolerances of the mounting surface

Once the requirements for the accuracy of the mounting surfaces are met, the high accuracy, rigidity and service life of the RG/QR series linear guideways are achieved.



Tolerance of parallelism of reference surface (P)

Table 3.122 **Maximum tolerance for parallelism (P)**

Series/Size	Preload class		
	Z0	**ZA**	**ZB**
CRG_15	5	3	3
CRG_20	8	6	4
CRG_25	9	7	5
CRG_30	11	8	6
CRG_35	14	10	7
CRG_45	17	13	9
CRG_55	21	14	11
CRG_65	27	18	14

Unit: μm

Tolerance of height of reference surface (S_1)

F 3.25 $$S_1 = a \times K - T_H$$

S_1 Maximum height tolerance [mm]
a Distance between rails [mm]
K Coefficient of height tolerance
T_H Tolerance of height according to Table 3.121

Table 3.123 **Coefficient of height tolerance (K)**

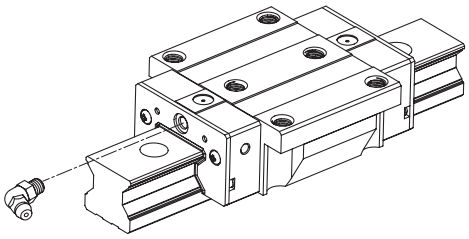
Series/Size	Preload class		
	Z0	**ZA**	**ZB**
CRG_15 – 65	2.2×10^{-4}	1.7×10^{-4}	1.2×10^{-4}

Note: If $S_1 < 0$, select another tolerance class!

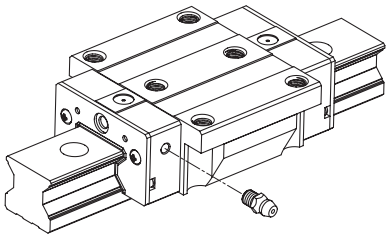
4. Accessories

4.1 Lubrication adapter

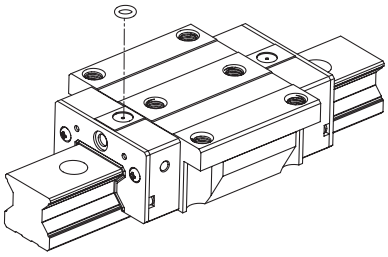
A lubricating nipple is fitted as standard on the end face of one end of the block **(1)**. The opposite side is closed with a plug screw. Alternatively, lubrication can also be supplied via the four holes **(2)** provided in the side of the deflector or from above **(3)**. Lubricating nipples, lubrication adapters or push-in fittings can be used for lubrication.



(1) Front side lubrication



(2) Side lubrication



(3) Lubrication from above

Table 4.1 **Overview of block type/thread size**

Block type	Thread size side/front
HG_15	M4
HG_20, HG_25, HG_30, HG_35	M6 × 0.75
HG_45, HG_55, HG_65	⅛ PT
QH_15	M4
QH_20, QH_25, QH_30, QH_35	M6 × 0.75
QH_45	⅛ PT
EG_15	M4
EG_20, EG_25, EG_30, EG_35	M6 × 0.75
QE_15	M4
QE_20, QE_25, QE_30, QE_35	M6 × 0.75
CG_15, CG_20	M3
CG_25, CG_30, CG_35, CG_45	M6 × 0.75
WE_17	M3
WE_21, WE_27, WE_35, QW_21, QW_27	M6 × 0.75 / M4
WE_35, QW_35	M6 × 0.75
WE_50	⅛ PT
MG_15	M3
RG_15, RG_20, CRG_15, CRG_20	M4
RG_25, RG_30, RG_35, CRG_25, CRG_30, CRG_35	M6 × 0.75
RG_45, RG_55, RG_65, CRG_45, CRG_55, CRG_65	⅛ PT
QR_25, QR_30, QR_35	M6 × 0.75
QR_45	⅛ PT