

**HIWIN®**



## Linear Guideways

Linear Guideways  
Accessories



## Linear guideways

### Linear guideways & accessories

A linear guideway makes it possible to move in a linear motion with rolling elements. The use of balls and rollers between the rail and block in a linear guideway makes precise linear movements possible. Compared with a standard sliding guide, the friction coefficient here is just one fiftieth. The high efficiency and zero backlash mean that the linear guideway can be used in various ways.



### Assembly instructions and catalogue for download

Here you can download the corresponding assembly instructions and the current catalogue as PDF files.

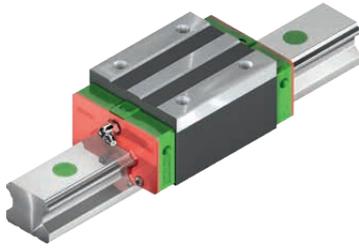
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# Linear guideways

## Product overview

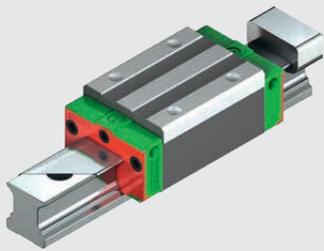
### 1. Product overview



Linear guideway of HG and QH series

Page 30

- Standard series in X arrangement
- Block with SynchMotion™ technology (QH series)



Linear guideway CG series

Page 48

- Standard series in O arrangement
- Optional: Rail with cover strip



Linear guideway of EG and QE series

Page 66

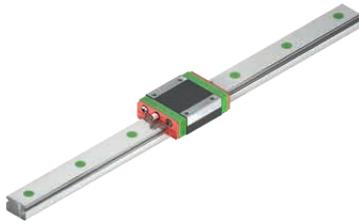
- Flat type
- Especially for applications with limited installation space
- Block with SynchMotion™ technology (QE series)



Linear guideway of WE and QW series

Page 80

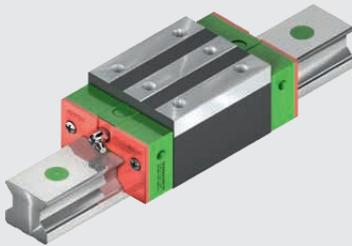
- Wide type
- For maximum torque loads
- Block with SynchMotion™ technology (QW series)



## Linear guideway MG series

Page 92

- Thin and wide design
- Miniature type for the most compact applications
- Dual-row linear guideways



## Linear guideway of RG and QR series

Page 106

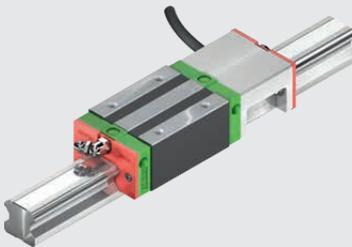
- Roller guides for heavy-duty applications
- With maximum requirements on load ratings and torque capacity
- Block with SynchMotion™ technology (QR series)



## Linear guideway CRG series

Page 124

- Roller guides for heavy-duty applications
- With maximum requirements on load ratings and torque capacity
- Rail with cover strip



## Linear guideway PG series

Page 140

- HG, QH, CG series with integrated positioning measuring system
- Contactless positioning measurement
- Signal output in real time

## Accessories

Page 148

- Lubricating nipple
- Lubrication adapter
- Push-in fittings

# Linear guideways

## General information

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### 2. General information

#### 2.1 Properties and advantages

##### 1. High positioning accuracy

A carriage supported by a linear guideway only has to overcome rolling friction. The difference between static and dynamic rolling friction is very small, which means that the breakaway force is only slightly higher than the moving force. No stick-slip effects occur.

##### 2. Long service life with particularly precise movement

With a sliding guide, errors in accuracy can occur due to different lubricant film thicknesses. Due to the sliding friction and frequent lack of lubrication, high wear and thus decreasing accuracy occurs. In contrast, the linear guideway has the advantage of very low rolling friction, combined with extremely low wear. The guideway accuracy remains almost constant over the entire service life.

##### 3. High velocity with low drive force

Due to the low friction coefficient, only low drive forces are required. The required drive power remains low even with reversing movements.

##### 4. Equal load capacity in all directions

Due to the design-related forced guidance, a linear guideway can absorb forces in vertical and horizontal directions.

##### 5. Simple installation and interchangeability

Installing a linear guideway is simple. With a milled or ground mounting surface, high accuracy is achieved when assembly instructions are followed. Conventional sliding guides require considerably more assembly work due to scraping of the sliding surfaces. Replacing individual components is not possible without scraping. However, linear guideways can be replaced without further effort.

##### 6. Simple lubrication

With sliding guides, insufficient lubrication leads to destruction of the sliding surfaces. The lubricant must be supplied to the sliding surfaces at many points. The linear guideway requires only minimum lubrication, which is produced by a simple supply line to the block. As a variant, HIWIN also supplies blocks with an integrated and replaceable long-term lubrication unit, which ensures long-term lubrication.

##### 7. Corrosion protection

Blocks and profile rails can be supplied with various coatings to achieve optimum corrosion protection. The individual processes are selected depending on the application. For optimal selection of the coating, data on the environmental conditions and the corrosive substances is needed. The MG miniature linear guideway is manufactured in stainless steel.

## 2.2 Selection principles

### Determine the selection conditions

- Machine base
- Maximum installation space
- Desired accuracy
- Required rigidity
- Load type
- Travel path
- Travel speed, acceleration
- Frequency of use
- Service life
- Environmental conditions



### Select the series

- HG and CG series – grinding, milling, drilling machines, lathes, machining centres, woodworking
- EG series – automation technology, high-speed transport, semiconductor assembly, precision measuring equipment
- WE series – single axes with high torque loads  $M_x$
- MG series – miniature technology, semiconductor assembly, medical technology
- RG series – machining centres, injection moulding machines, machines and systems with high rigidity



### Select the accuracy class

- Classes: C, H, P, SP, UP, depending on the required accuracy



### Determine the size and number of blocks

- Depending on empirical values
- Depending on type of load
- If a ballscrew is used, the nominal size of the linear guideways and the ballscrew should be similar, e.g. 32 mm ballscrew and 35 mm profile rail.



### Calculate the maximum block load

- Calculate the maximum block load using the example calculations (see section 2.5). Make sure that the static support stability factor of the selected linear guideway is higher than the corresponding value in the static support stability factor table.



### Determine the preload

- The preload depends on the stiffness requirements and the accuracy of the mounting surface.



### Determine the rigidity

- Calculate the deformation ( $\delta$ ) using the stiffness table in the respective chapter; the stiffness increases with higher preload and with larger guideway dimensions.



### Calculation of service life

- Determine the required service life taking into account the travel speed and frequency; use the example calculations as a guide (see section 2.4).



### Select the type of lubrication

- Grease lubrication via lubricating nipple
- Oil lubrication via connection line



### Selection finished



# Linear guideways

## General information

### 2.3 Load ratings

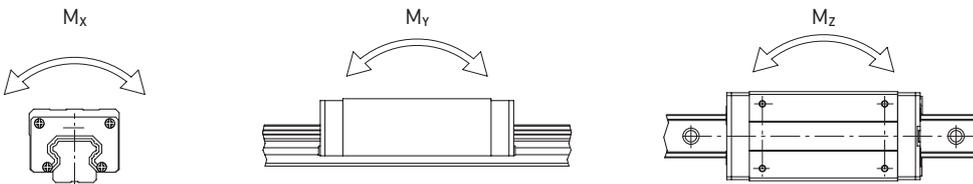
#### 2.3.1 Static load rating $C_0$

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  $0.0001 \times$  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

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

$f_{SL}$	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.

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<sup>1)</sup> (HG, QH, EG, QE, CG, WE, QW, MG) or 100 km<sup>1)</sup> (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.

<sup>1)</sup> 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:  $C_{dyn} 50 \text{ km} = 1.26 \times C_{dyn} 100 \text{ km}$  (HG, QH, EG, QE, CG, WE, QW, MG series)  
 $C_{dyn} 50 \text{ km} = 1.23 \times C_{dyn} 100 \text{ km}$  (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:

$$F 2.2 \quad L = \left( \frac{C_{dyn}}{P} \right)^3 \times 50 \text{ km}$$

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

RG, QR series:

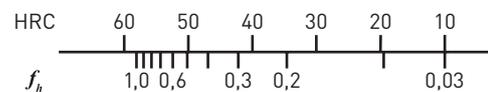
$$F 2.3 \quad L = \left( \frac{C_{dyn}}{P} \right)^{10/3} \times 100 \text{ km}$$

#### 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.

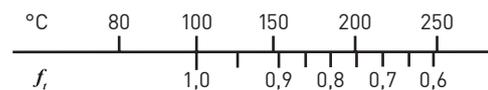
##### Hardness factor ( $f_h$ )

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.

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:

$$F 2.4 \quad L = \left( \frac{f_h \times f_t \times C_{dyn}}{f_w \times P} \right)^3 \times 50 \text{ km}$$

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

RG, QR series:

$$F 2.5 \quad L = \left( \frac{f_h \times f_t \times C_{dyn}}{f_w \times P} \right)^{10/3} \times 100 \text{ km}$$

### 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:

$$F 2.6 \quad L_h = \frac{L}{v \times 60} = \frac{\left( \frac{C_{dyn}}{P} \right)^3 \times 50.000}{v \times 60}$$

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

RG, QR series:

$$F 2.7 \quad L_h = \frac{L}{v \times 60} = \frac{\left( \frac{C_{dyn}}{P} \right)^{10/3} \times 100.000}{v \times 60}$$

## 2.5 Operating load

### 2.5.1 Calculation of load

When calculating the loads acting on a linear guideway, various factors must be taken into account, e.g. the centre of gravity of the load, the approach of the movement force and the mass inertia at the beginning and end of the movement. To obtain a correct value, each parameter must be taken into account.

#### Load on a block

Table 2.3 Examples of the calculation of the load on a block		
Typical examples	Load distribution	Load on a block
		$P_1 = \frac{W}{4} + \frac{F}{4} + \frac{F \times a}{2c} + \frac{F \times b}{2d}$ $P_2 = \frac{W}{4} + \frac{F}{4} + \frac{F \times a}{2c} - \frac{F \times b}{2d}$ $P_3 = \frac{W}{4} + \frac{F}{4} - \frac{F \times a}{2c} + \frac{F \times b}{2d}$ $P_4 = \frac{W}{4} + \frac{F}{4} - \frac{F \times a}{2c} - \frac{F \times b}{2d}$
		$P_1 = P_3 = \frac{F \times l}{2d}$ $P_2 = P_4 = \frac{W}{4} + \frac{F \times l}{2d}$
		$P_1 = P_2 = P_3 = P_4 = -\frac{W \times h}{2d} + \frac{F \times l}{2d}$
		$P_1 = P_2 = -\frac{W \times h}{2c} - \frac{F \times l}{2c}$ $P_3 = P_4 = \frac{W \times h}{2c} + \frac{F \times l}{2c}$ $P_{t1} = P_{t3} = \frac{W}{4} + \frac{F}{4} + \frac{F \times k}{2d}$ $P_{t2} = P_{t4} = \frac{W}{4} + \frac{F}{4} - \frac{F \times k}{2d}$

$P_1 \dots P_4$  Load on a single block

W Weight of load

F Movement force; additionally occurring force

l Lever arm F

c Rail distance

d Block distance

a, b, k Distance to centre of gravity

h Lever arm centre of gravity W

# Linear guideways

## General information

### Load and mass inertia

Table 2.4 Examples of the calculation of load and mass inertia	
<p><b>Consideration of acceleration and braking</b></p>	<p><b>Load on a block</b></p> <ul style="list-style-type: none"> <li>○ Constant velocity           <math display="block">P_1 \dots P_4 = \frac{W}{4}</math> </li> <li>○ Acceleration           <math display="block">P_1 = P_3 = \frac{W}{4} + \frac{1}{2} \times \frac{W}{g} \times \frac{v_c}{t_1} \times \frac{l}{d}</math> <math display="block">P_2 = P_4 = \frac{W}{4} - \frac{1}{2} \times \frac{W}{g} \times \frac{v_c}{t_1} \times \frac{l}{d}</math> </li> <li>○ Braking           <math display="block">P_1 = P_3 = \frac{W}{4} - \frac{1}{2} \times \frac{W}{g} \times \frac{v_c}{t_3} \times \frac{l}{d}</math> <math display="block">P_2 = P_4 = \frac{W}{4} + \frac{1}{2} \times \frac{W}{g} \times \frac{v_c}{t_3} \times \frac{l}{d}</math> </li> </ul>

$P_1 \dots P_4$  Load on a single block [N]

W Weight of load [N]

F Movement force

$F_A$  Reaction force

g Gravitational acceleration [ $m/s^2$ ]

$v_c$  Velocity [m/s]

$t_1$  Acceleration time [s]

$t_2$  Constant travel time [s]

$t_3$  Braking time [s]

c Rail distance [m]

d Block distance [m]

l Distance to underside of rail – travel block centre of gravity [m]

### 2.5.2 Calculation of the equivalent load for variable loads

If the load on a linear guideway varies greatly, an equivalent load must be included in the calculation of the service life. The equivalent load is defined as the load that causes the same wear on the bearings as the variable loads. It can be calculated according to Table 2.5.

Table 2.5 Examples of the calculation of the equivalent load ( $P_m$ )		
<p><b>Step-wise change</b></p>	<p><b>Uniform change</b></p>	<p><b>Sinusoidal change</b></p>
$P_m = \sqrt[3]{\frac{1}{L} (P_1^3 \times L_1 + P_2^3 \times L_2 + \dots + P_n^3 \times L_n)}$	$P_m = \frac{1}{3} (P_{min} + 2 \times P_{max})$	$P_m = 0,65 \times P_{max}$

$P_m$  Equivalent load

$P_n$  Variable load

$P_{min}$  Smallest load

$P_{max}$  Largest load

L Total travel path

$L_n$  Travel path with load  $P_n$

## 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

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

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	Frictional force [N]
S	Frictional resistance [N]
$\mu$	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](http://www.hiwin.de).

### 2.6.3 Long-term lubrication unit

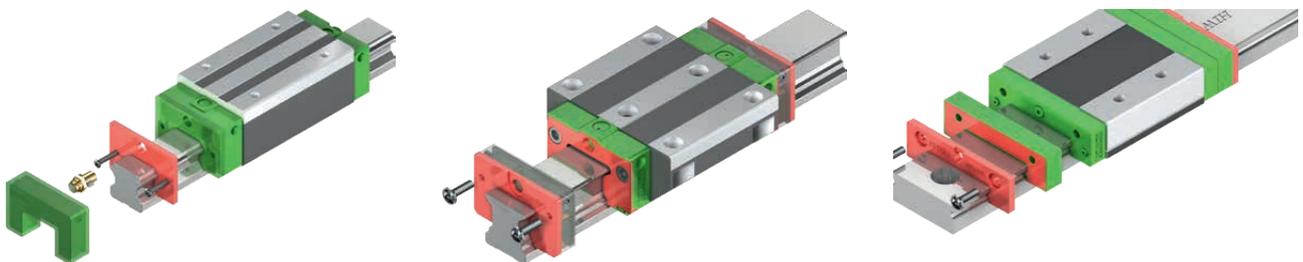
The long-time lubrication unit considerably increases lubrication intervals. Depending on the application and ambient conditions, it can achieve lifetime lubrication.

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  $-10\text{ }^{\circ}\text{C}$  to  $+60\text{ }^{\circ}\text{C}$ .

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

### 2.7 Installation position

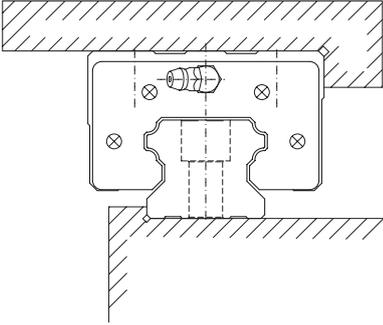
#### 2.7.1 Examples of typical installation positions

A linear guideway can take loads up/down and to the right/left. The installation position depends on the requirements of the machine and the load direction. The accuracy of the profile rail is determined by how straight and level the contact surfaces are because the profile rail is pressed against them when the screws are tightened. Profile

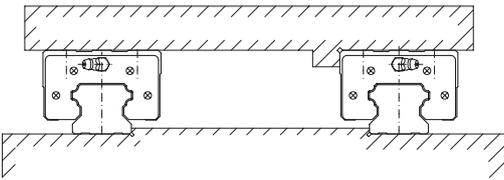
rails that are not pressed against a contact surface may have greater tolerances in terms of straightness. The typical installation positions are shown below: Information on mounting tolerances is given in the chapters of the individual series.

#### A profile edge at a reference edge:

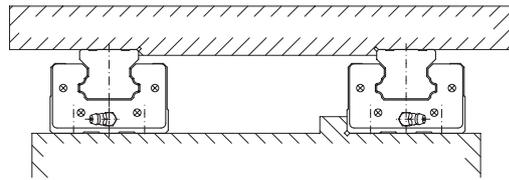
The reference edge is marked by arrows on the top of the rail. For very short rail sections, the marking is on the front side of the rail.



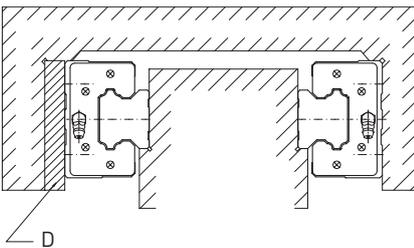
#### Two profile rails with moving block:



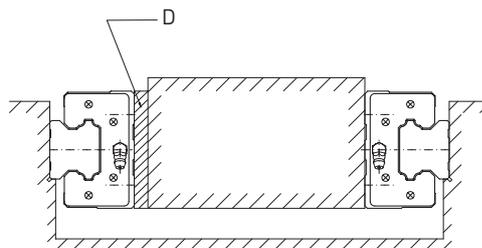
#### Two profile rails with fixed block:



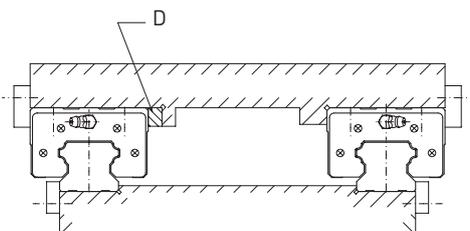
#### Two external blocks:



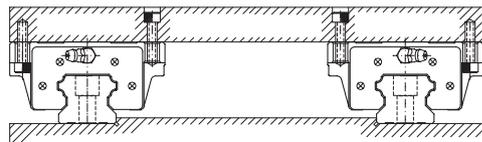
#### Two internal blocks:



#### Structure with assembled surface:



#### Block model HGW\_C with different mounting directions:



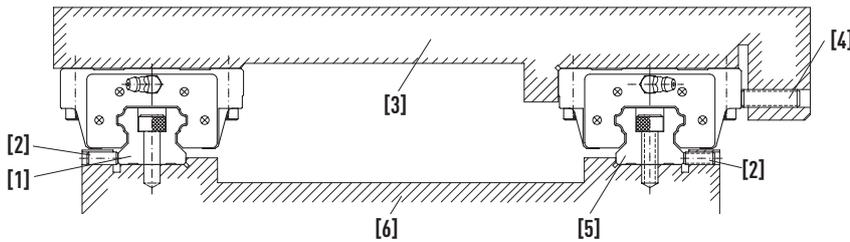
D Spacer

## 2.8 Assembly

Depending on the required accuracy as well as the load on the linear guideway caused by jolting and vibrations, the following three mounting methods are recommended.

### 2.8.1 Mounting the profile rails with reference edge and clamps

If the machine is subjected to strong vibrations, jolting or lateral forces, guideways and blocks may shift. To avoid this problem and to achieve high rigidity and guiding accuracy, mounting the linear guideway with reference edges and clamps on both sides is recommended.

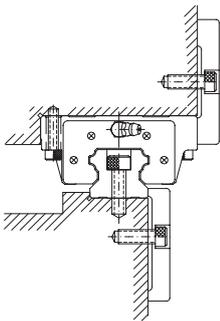


- [1] Follow-on side
- [2] Guide clamping screw
- [3] Carriage
- [4] Block clamping screw
- [5] Reference side
- [6] Machine bed

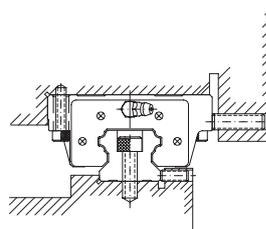
#### 2.8.1.1 Mounting types

The following four mounting types are recommended.

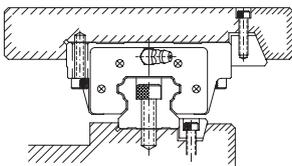
##### Mounting with a clamping plate:



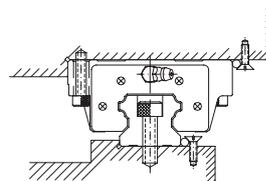
##### Mounting with clamping screws:



##### Mounting with terminal blocks:



##### Mounting with needle rollers:

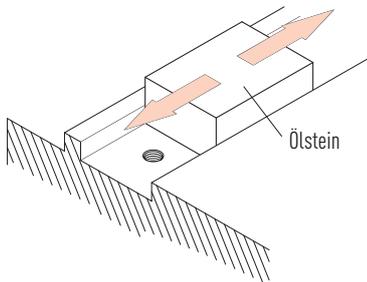


# Linear guideways

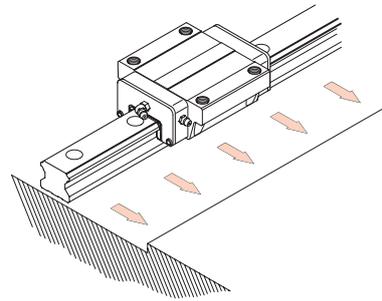
## General information

### 2.8.1.2 Assembly of the profile rails

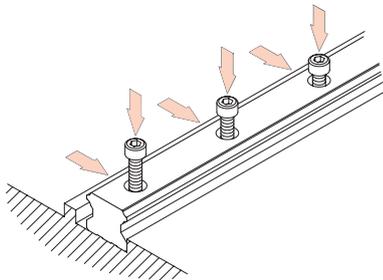
1) Before starting, remove all dirt from the surface of the machine



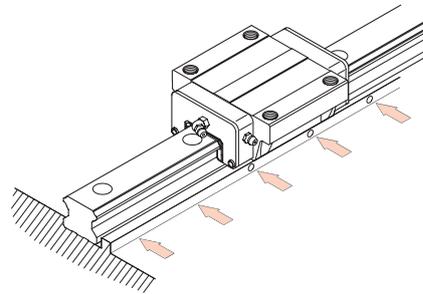
2) Carefully place the profile rail on the bed and hold it firmly against the reference edge



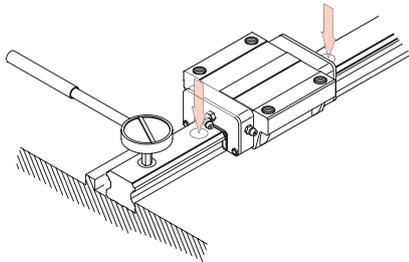
3) When aligning the profile rail on the bed, check whether the threads of the inserted screws engage



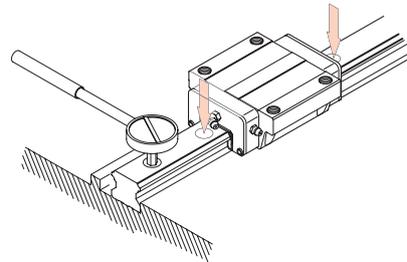
4) Tighten clamping screws one after the other to ensure good contact between the profile rail and the reference edge



5) Working in three steps, tighten all rail fixing screws to the specified tightening torque using a torque spanner

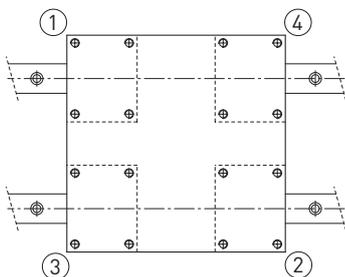


6) Mount the second profile rail in the same way



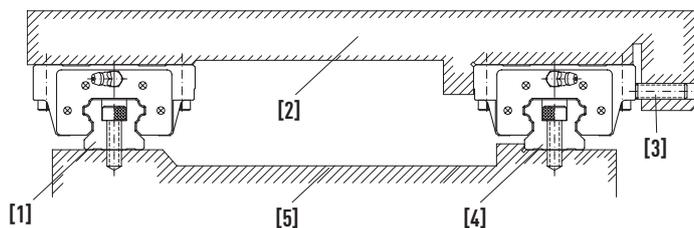
### 2.8.1.3 Mounting the block

- Carefully place carriage on the block. Then temporarily tighten the carriage fixing screws.
- Press the block against the reference edge of the carriage and align the carriage by tightening the clamping screws.
- To mount the carriage evenly, tighten the fixing screws on the reference side and the follow-on side in four passes.



## 2.8.2 Mounting the profile rails with reference edge and without clamps

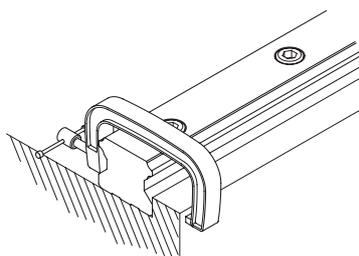
To ensure parallelism between the reference and follow-on rail without clamping screws, the following methods are recommended for mounting. The installation of the block remains as previously described.



- [1] Follow-on rail
- [2] Carriage
- [3] Block clamping screw
- [4] Reference rail
- [5] Machine bed

### 2.8.2.1 Mounting the profile rail on the reference side

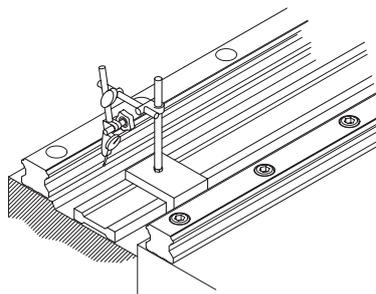
Place the guideway on the mounting surface of the machine bed. Lightly tighten the fixing screws and then press the guideway against the reference edge of the machine bed using a screw clamp. Then tighten the fixing screws one after the other to the specified torque.



### 2.8.2.2 Mounting the profile rail on the follow-on side

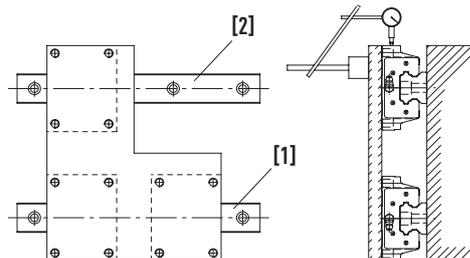
#### Align to a ruler:

Place the ruler between the guideways and align it parallel to the reference edge on the reference side using a dial gauge. When the guideway on the follow-on side is aligned parallel to the reference side, tighten the fixing screws one after the other, working from one end of the guideway to the other.



#### With the help of a plate:

Mount a plate on two blocks on the reference rail. Loosely attach a block to the plate to the follow-on rail. Then attach a dial gauge to the plate and place the sensor on the side of the block of the follow-on rail. Then move the plate from one end to the other and align the follow-on rail parallel to the reference rail. Then tighten the fixing screws one after the other.



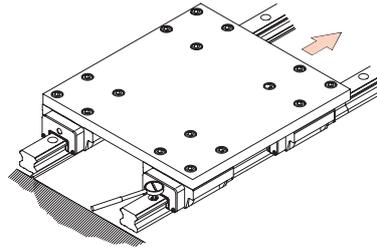
- [1] Reference rail
- [2] Follow-on rail

# Linear guideways

## General information

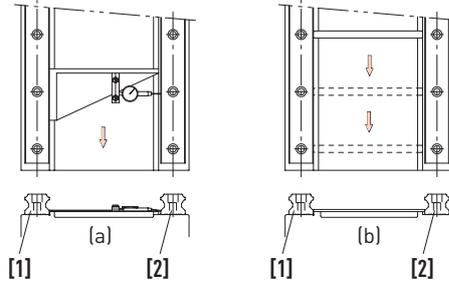
### Alignment on the reference rail:

When the reference rail is correctly installed, mount one plate firmly on two blocks on the reference rail and one of the two blocks on the follow-on rail. Then move the plate from one end of the rails to the other, tightening the fixing screws of the follow-on rail.



### With the help of a gauge:

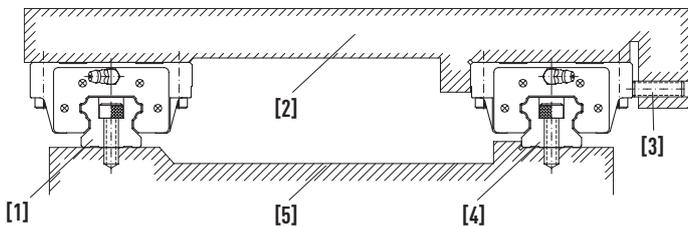
Determine the position of the follow-on rail using a special gauge and tighten the fixing screws with the specified torque.



- [1] Reference rail
- [2] Follow-on rail

### 2.8.3 Mounting the profile rails without reference edge and without clamps

To ensure parallelism of the reference and follow-on rail even without a reference edge on the reference side, the following type of mounting is recommended. Mounting of the block remains as previously described.

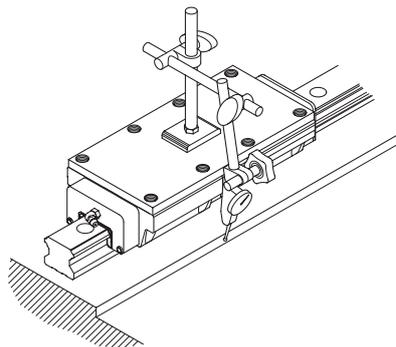


- [1] Follow-on rail
- [2] Carriage
- [3] Block clamping screw
- [4] Reference rail
- [5] Machine bed

#### 2.8.3.1 Mounting the profile rail on the reference side

##### Alignment at a provisional reference edge:

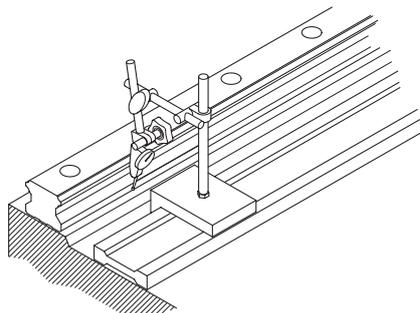
Connect two blocks close together with a plate. Use an edge on the machine bed to align the rail from one end to the other. Move the block to test and then tighten the fixing screws one after the other to the specified torque.



##### Align to a ruler:

Align the rail from end to end using a dial gauge on a ruler. Make sure to tighten the fixing screws firmly one after the other.

The assembly of the follow-on rail corresponds to the procedure of section 2.8.2.2, "Mounting the profile rail on the follow-on side".

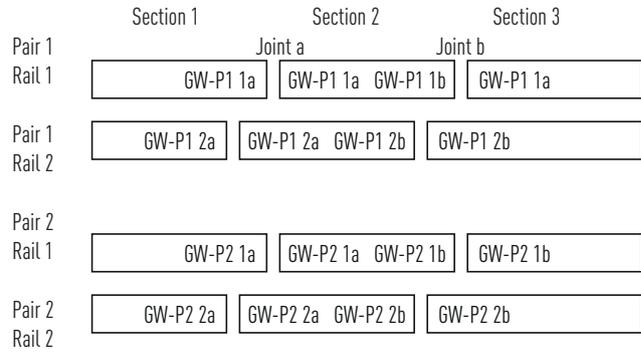
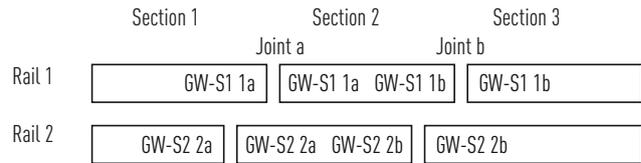


## 2.8.4 Attached profile rails

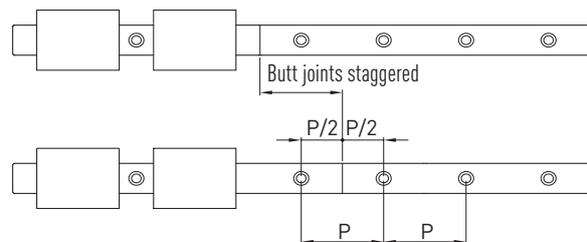
Attached (multi-part) rails must be mounted according to the applied markings. The joints on each section are marked consecutively in alphabetical order and with the rail or pair number so that each rail section can be clearly assigned.

Each joint is labelled on the top of the rail. The label serves as an aid for initial assembly and can be removed at any time without leaving any residue.

Note: After initial assembly of the profile rails, the labels must be removed.



With paired multi-part rails, it is recommended that the butt joints be mounted with an offset.



## 2.8.5 Tightening torques of the fixing screws

Insufficient tightening of the fixing screws severely affects the accuracy of the linear guideway; the tightening torques of the fastening screws according to ISO 4762-12.9 can be taken from the assembly instructions.

# Linear guideways

## General information

### 2.9 Sealing systems

On the one hand, the HIWIN end seals prevent the ingress of foreign substances such as dust particles, chips or liquid into the ball tracks of the block; on the other hand, they reduce lubricant loss. HIWIN offers various sealing systems for the different environmental conditions of your application. The effectiveness of the end seal has a direct influence on the service life of the linear guideway and should therefore be taken into account at the design stage and selected to suit the environmental conditions of your application.

Table 2.6 Overview of sealing systems

	Smooth running seal Good sealing effect, minimum displacement resistance	Standard end seal Very good sealing effect, minor displacement resistance	Double standard end seal Improved sealing effect, average displacement resistance	Optimised end seal Optimal protection against finest dusts and liquids, increased displacement resistance
<b>Scrapper</b> (Air gap 0.1 – 0.2 mm)	ZZX	KKX	ZWX	
<b>Scrapper</b> (Air gap 0.4 – 0.5 mm)	ZZ	KK	ZW	
<b>Without scrapper</b>	SSL	SS <sup>1)</sup>	DD	SW

Sealing effect and displacement resistance higher

<sup>1)</sup> Standard

Note: The sealing systems available in each case can be found in the chapter of the series in the Sealing systems section.

Table 2.7 Selection guide for sealing systems

	<p><b>ZZX</b> See SS, additionally sharp-edged particles, possibly also hot particles or particles adhering to the rail <math>\geq 0.2</math> mm, e.g. chips, welding beads</p> <p>Typical applications:</p> <ul style="list-style-type: none"> <li>○ Turning, milling, drilling</li> <li>○ Welding applications</li> </ul>	<p><b>KKX</b> See DD, additionally sharp-edged particles, possibly also hot particles or particles adhering to the rail <math>\geq 0.2</math> mm, e.g. chips, welding beads</p> <p>Typical applications:</p> <ul style="list-style-type: none"> <li>○ See ZWX</li> </ul>	<p><b>ZWX</b> See SW, additionally sharp-edged particles, possibly also hot particles or particles adhering to the rail <math>\geq 0.2</math> mm, e.g. chips, welding beads</p> <p>Typical applications:</p> <ul style="list-style-type: none"> <li>○ CNC machining centre</li> <li>○ Woodworking (e.g. MDF)</li> </ul>
	<p><b>ZZ</b> See SS, additionally sharp-edged particles, possibly also hot particles or particles adhering to the rail <math>\geq 0.4</math> mm, e.g. chips, welding beads</p> <p>Typical applications:</p> <ul style="list-style-type: none"> <li>○ Turning, milling, drilling</li> <li>○ Welding applications</li> </ul>	<p><b>KK</b> See DD, additionally sharp-edged particles, possibly also hot particles or particles adhering to the rail <math>\geq 0.4</math> mm, e.g. chips, welding beads</p> <p>Typical applications:</p> <ul style="list-style-type: none"> <li>○ See ZW</li> </ul>	<p><b>ZW</b> See SW, additionally sharp-edged particles, possibly also hot particles or particles adhering to the rail <math>\geq 0.4</math> mm, e.g. chips, welding beads</p> <p>Typical applications:</p> <ul style="list-style-type: none"> <li>○ Turning, milling, drilling (with cooling lubricants)</li> <li>○ Solid wood processing with coarse chips</li> </ul>
<p><b>SSL</b> For applications with very low dirt and dust exposure</p> <p>Typical applications:</p> <ul style="list-style-type: none"> <li>○ Measuring technology</li> <li>○ Testing technology</li> </ul>	<p><b>SS (standard variants)</b> For applications with low dirt and dust exposure</p> <p>Typical applications:</p> <ul style="list-style-type: none"> <li>○ Automation technology</li> <li>○ Pick &amp; place</li> <li>○ Handling</li> </ul>	<p><b>DD</b> For applications with heavy dirt and dust exposure (alternatively if SW is not available)</p> <p>Typical applications:</p> <ul style="list-style-type: none"> <li>○ See SW</li> </ul>	<p><b>SW</b> For applications with heavy dirt and dust exposure, especially very fine dust and cooling lubricants</p> <p>Typical applications:</p> <ul style="list-style-type: none"> <li>○ Wood, stone, glass processing</li> <li>○ Grinding machines</li> </ul>

# 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

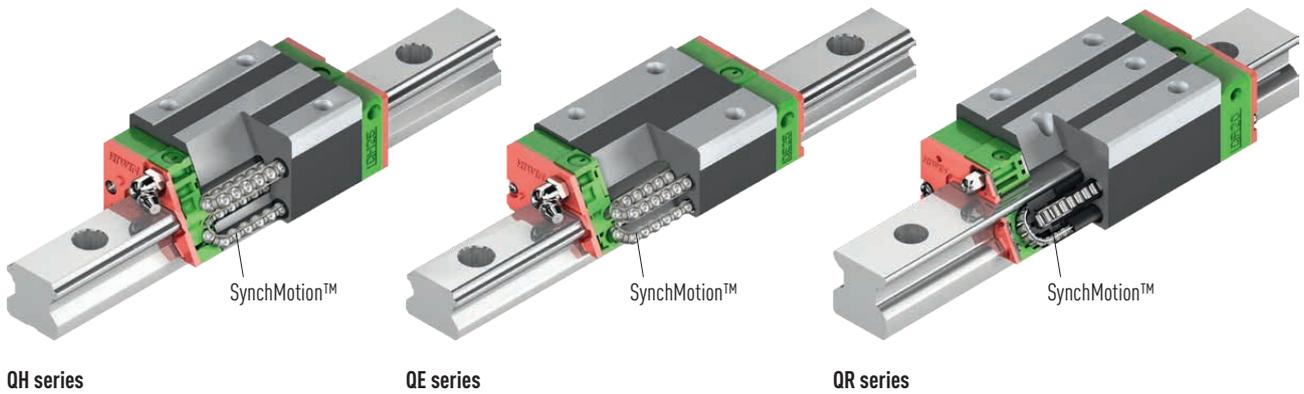


Table 2.8 Availability of SynchMotion™ technology for HIWIN linear guideways

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.

## 2.11 Heat-resistant linear guideways

For continuous operation at temperatures above 80 °C, "solid steel" blocks with steel deflection systems are used. The standard end seals are replaced by heat-resistant end seals and the plastic cover caps of the profile rail by brass cover caps.

### Special properties:

- Good temperature resistance
- Operating temperature up to 150 °C
- Temperature peaks of up to 180 °C.

### Application areas:

- Devices for heat treatment
- Welding devices
- Devices for glass production
- Devices for use in a vacuum.



Table 2.9 Series with available steel deflection system option

Series	Size
HG	15, 20, 25, 30, 35, 45, 55, 65
EG	20, 25
MGN	7, 9, 12, 15
MGW	12, 15

**Article number:** For the steel deflection system option, add identifier "/SE" to the order code. See the structure of the order code in the chapter on the individual series.  
 HG: from Page 30, EG: from Page 66, MG: from Page 93

Order example:

HG
W
25
C
C
ZA
H
ZZ
SE

Note: Heat-resistant linear guideways with steel deflector generally have poorer running properties than comparable standard linear guideways with plastic deflector and are always supplied assembled as linear guideways.

# 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.

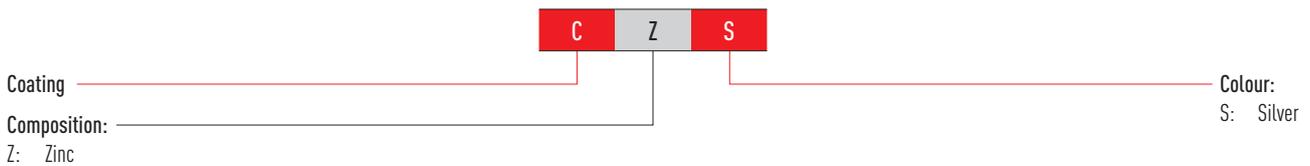
##### Specific features:

- 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.

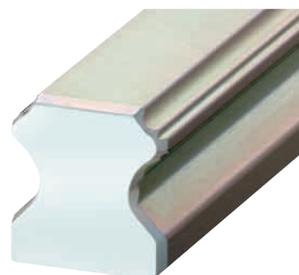


Fig. 2.1 Rail end preserved with zinc spray



Fig. 2.2 Joint uncoated spray

## 2.12.2 HIWIN coating HICOAT CTS

### 2.12.2.1 Features and properties

HICOAT CTS is a thin film chromium plating that provides good corrosion protection and very good wear protection. The high wear resistance results from the very high hardness of the coating. The CTS coating is Cr(VI)-free and food safe. It is available for the HG, EG, CG and WE series.

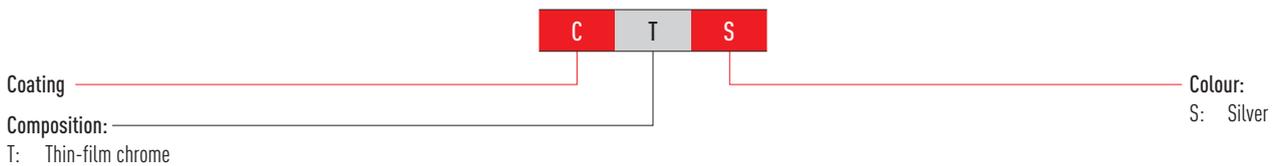
#### Specific features:

- Very good wear protection
- Good corrosion protection
- Cr(VI)-free
- One-piece rails available from stock (end preservation with zinc spray, see below)
- Multi-piece rails are delivered including coated ends (longer delivery time)
- Food safe

#### Technical data:

- Salt spray test according to DIN EN ISO 9227 (with unloaded rail): 96 hours
- Salt spray test according to DIN EN ISO 9227 (with loaded rail): 22 hours
- Maximum rail length (one-piece): 4.0 meters

### 2.12.2.2 Order code for CTS coatings



### 2.12.2.3 Corrosion test

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



New rail in CTS coating



Rail with CTS coating - after 1 month of outdoor storage



Rail (unloaded) with CTS coating - after 22 hours of salt spray test (according to DIN EN ISO 9227)



Uncoated rail – after 4 hours of salt spray test

### 2.12.2.4 Rail end

For one-piece rails, the rail ends are preserved with zinc spray as shown in the adjacent figure. In order to achieve reliable corrosion protection at the uncoated rail ends as well, a high-quality, food-safe zinc spray (zinc content 99%) is used. Multi-piece rails are delivered with coated rail ends (longer delivery time).

**Note:** The mounting holes may have lower coating thicknesses or isolated bare spots. The inner side of the block is generally not coated.



# Linear guideways

## General information

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### 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.

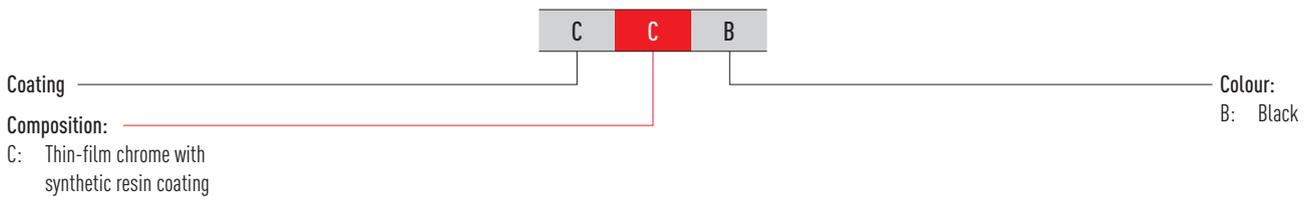
#### Specific features:

- 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



#### 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

## CG series

### 3.2 CG series

#### 3.2.1 Properties of the CG series linear guideway

Standard series in O arrangement. The HIWIN linear guideways of the CG series with O-arrangement of the ball tracks guarantee high torque capacity, especially in the  $M_x$  direction. The modified track geometry ensures high load ratings. The new flexible end seal automatically adapts to the rail contour and ensures strong, durable dust protection. To protect against mechanical damage to the end seal, the blocks of the CG series are already equipped with a scraper in front of the end seal in the standard version.

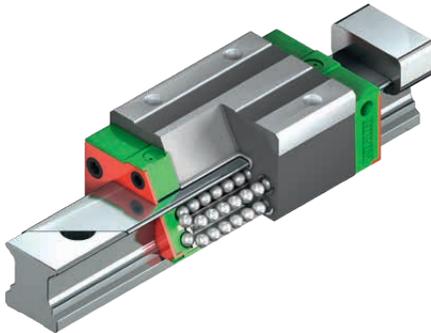
A cover strip is available as an option – dirt ingress and wear of the sealing lip are thus permanently reduced to a minimum. Thanks to the mounting aid, the cover strip can be installed in just a few steps.

For optimum lubricant distribution, the block has an additional channel that introduces the lubricant into the centre of the load-bearing zone. This ensures long relubrication intervals and offers a clear advantage, especially in short-stroke applications.

#### 3.2.2 Layout of CG series

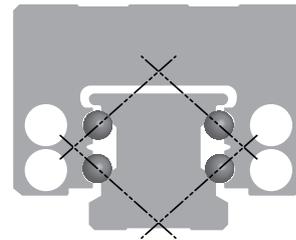
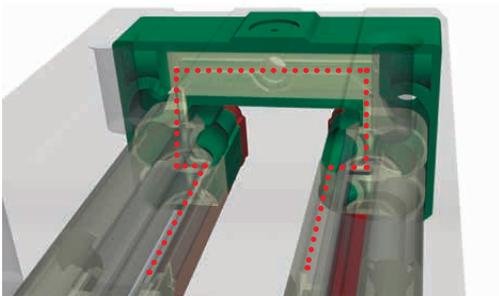
Backlash-free, four-row recirculating ball bearing guide with optimum dust protection even in the standard version.

Easy installation, better protection against dirt ingress and wear of the end seals with cover strip.



Optimised lubrication concept for long relubrication intervals and short-stroke applications.

O-arrangement with changed track geometry for high torque load and load ratings.



#### Advantages:

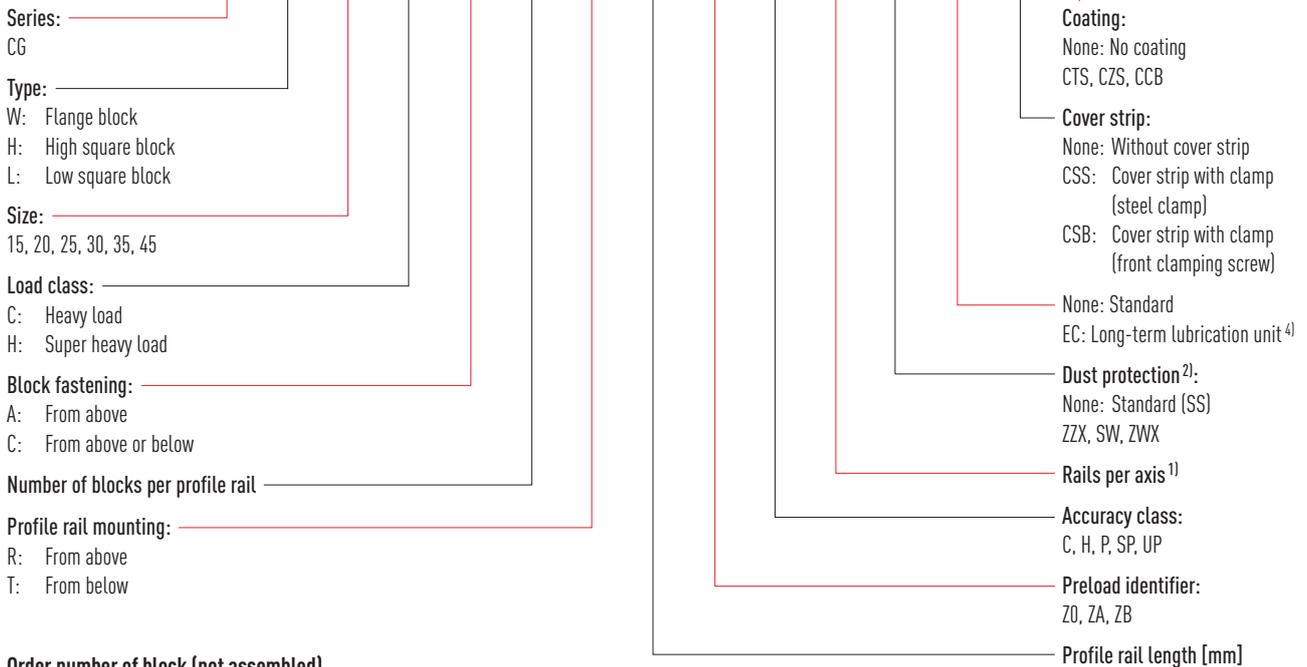
- Backlash-free
- Exchangeable
- High accuracy
- High torque capacity, special roll torque  $M_x$
- Optionally with cover strip

#### 3.2.3 Order codes of CG series

For CG 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. Block and profile rail can be ordered separately and mounted by the customer. Their accuracy reaches class P.

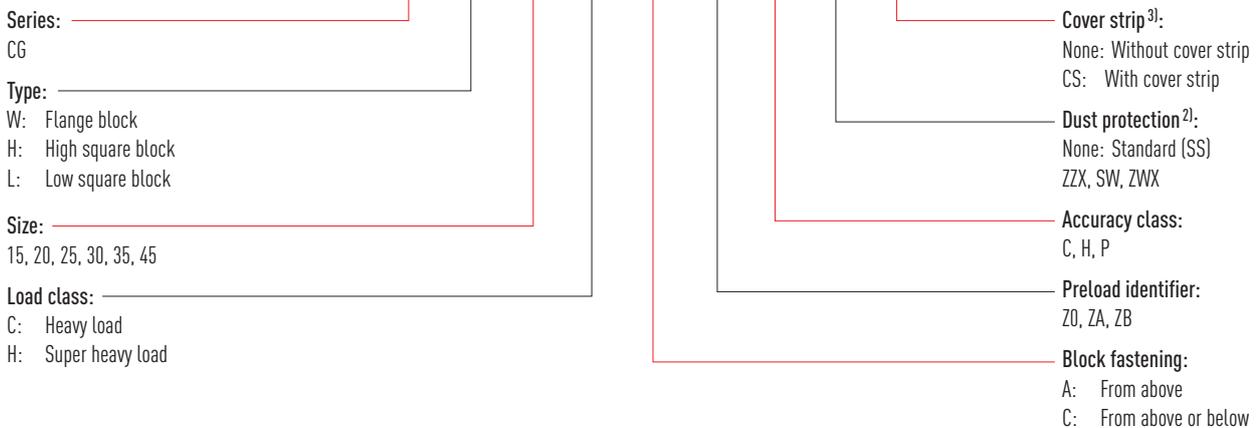
## Order code for linear guideway (assembled)

**CG W 25 C C 2 R 1600 Z0 H 2 SW EC CSS CTS**



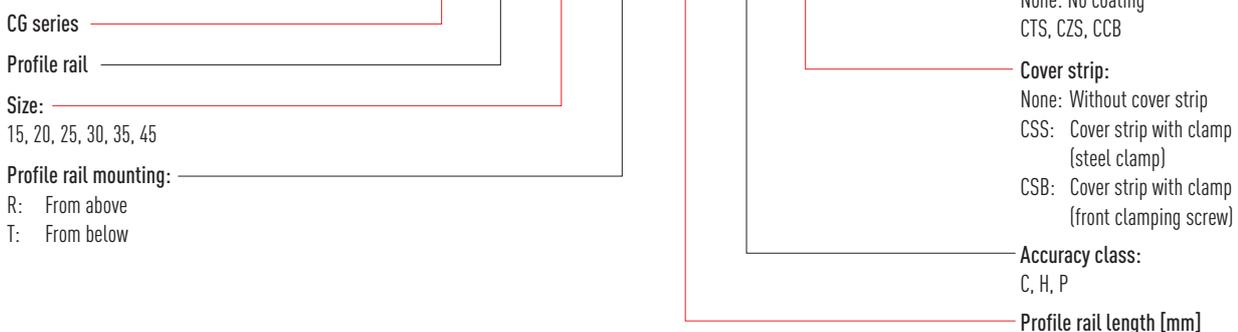
## Order number of block (not assembled)

**CG W 25 C C Z0 H SW CS**



## Order number of profile rail (not assembled)

**CG R 25 R 1200 H CSS CTS**



### Note:

<sup>1)</sup> 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.

<sup>2)</sup> An overview of the individual sealing systems can be found on Page 22

<sup>3)</sup> The standard dust protection (SS) can be used for profile rails with and without cover strip.

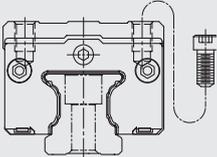
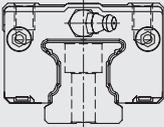
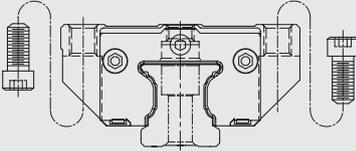
<sup>4)</sup> Only available for sizes 15, 20 and 25.

# Linear guideways

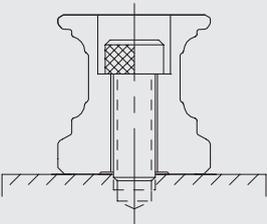
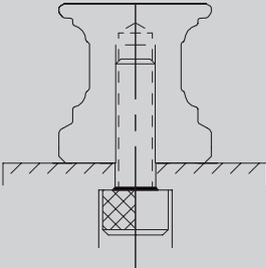
## CG series

### 3.2.4 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.

Type	Series/size	Layout	Height [mm]	Typical applications
High square type	CGH-CA CGH-HA		28 – 70	<ul style="list-style-type: none"> <li>○ Woodworking</li> <li>○ Machining centres</li> <li>○ NC lathes</li> <li>○ Grinding machines</li> <li>○ Precision milling machines</li> <li>○ High performance cutting machines</li> <li>○ Automation technology</li> <li>○ Transport technology</li> <li>○ Measuring technology</li> <li>○ Machines and devices with high required positioning accuracy</li> </ul>
Low square type	CGL-CA CGL-HA		25 – 60	
Flange type	CGW-CA CGW-HA		24 – 60	

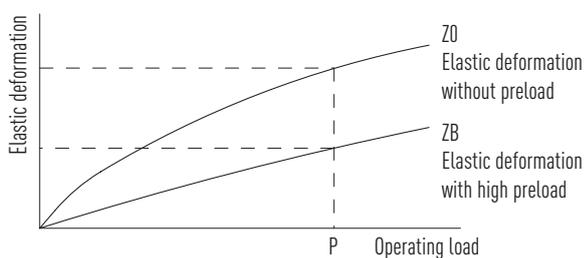
### 3.2.5 Profile rail types

Fastening from above	Fastening from below
	
CGR_R	CGR_T

### 3.2.6 Preload

#### Definition

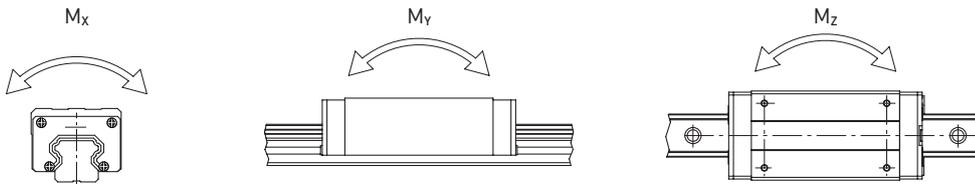
Each linear guideway can be preloaded via the ball size. The curve shows that the rigidity doubles at high preload. The CG series of linear guideways offers three standard preloads for different applications and conditions.



## Preload identifier

Identifier	Preload		Application	Example applications
Z0	Slight preload	$0 - 0.02 C_{dyn}$	Constant load direction, little vibration, less accuracy required	<ul style="list-style-type: none"> <li>○ Transport technology</li> <li>○ Automatic packaging machines</li> <li>○ X-Y axis in industrial machines</li> <li>○ Welding machines</li> </ul>
ZA	Medium preload	$0.05 - 0.07 C_{dyn}$	High accuracy required	<ul style="list-style-type: none"> <li>○ Machining centres</li> <li>○ Z axes in industrial machines</li> <li>○ Eroding machines</li> <li>○ NC lathes</li> <li>○ Precision X-Y table</li> <li>○ Measuring technology</li> </ul>
ZB	High preload	Over $0.1 C_{dyn}$	High rigidity required, vibration and jolting	<ul style="list-style-type: none"> <li>○ Machining centres</li> <li>○ Grinding machines</li> <li>○ NC lathes</li> <li>○ Horizontal and vertical milling machines</li> <li>○ Z-axis of machine tools</li> <li>○ High performance cutting machines</li> </ul>

### 3.2.7 Load ratings and torques



Series/Size	Dynamic load rating $C_{dyn}$ [N] <sup>1)</sup>	Static load rating $C_0$ [N]	Static moment [Nm]		
			$M_{0x}$	$M_{0y}$	$M_{0z}$
CG_15C	14,700	19,520	190	140	140
CG_20C	23,700	30,510	370	280	280
CG_20H	28,600	39,900	480	480	480
CG_25C	34,960	43,940	600	490	490
CG_25H	40,500	54,080	740	730	730
CG_30C	46,000	55,190	950	700	700
CG_30H	58,590	78,180	1,350	1,230	1,230
CG_35C	61,170	79,300	1,730	1,090	1,090
CG_35H	77,900	112,340	2,460	2,020	2,020
CG_45C	98,430	112,660	3,560	2,350	2,350
CG_45H	125,580	159,600	5,050	4,450	4,450

<sup>1)</sup> Dynamic load rating for 50,000 m travel path

# Linear guideways

## CG series

### 3.2.8 Rigidity

The rigidity depends on the preload. With the formula F 3.4, the deformation can be calculated depending on the rigidity.

F 3.4

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

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

Table 3.23 Radial rigidity of CG series

Load type	Series/ Size	Rigidity depending on the preload		
		Z0	ZA	ZB
Heavy load	CG_15C	240	290	330
	CG_20C	270	420	480
	CG_25C	340	440	570
	CG_30C	440	550	760
	CG_35C	470	610	800
	CG_45C	550	720	820
Super heavy load	CG_20H	360	470	530
	CG_25H	410	540	620
	CG_30H	490	640	730
	CG_35H	570	730	840
	CG_45H	740	960	1,100

Unit: N/μm

## 3.2.9 Dimensions of the CG blocks

### 3.2.9.1 CGH

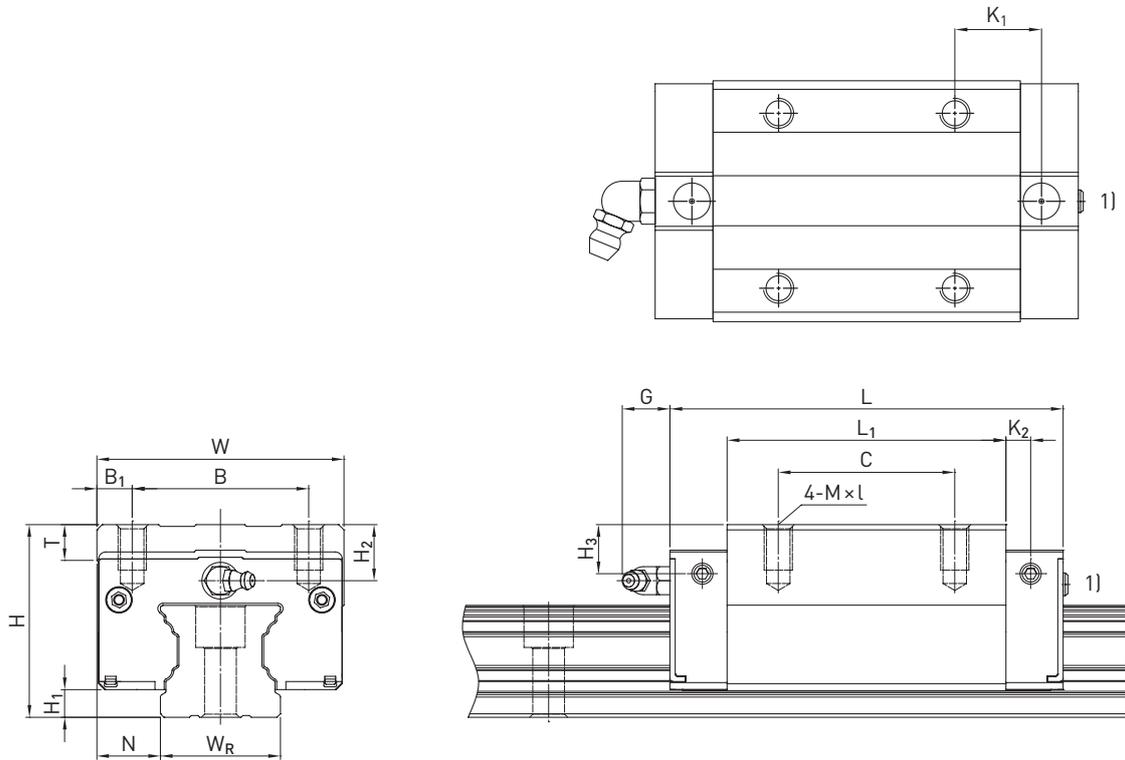


Table 3.24 Dimensions of the block

Series/size	Installation dimensions [mm]			Dimensions of the block [mm]													Load ratings [N]		Weight [kg]
	H	H <sub>1</sub>	N	W	B	B <sub>1</sub>	C	L <sub>1</sub>	L	K <sub>1</sub>	K <sub>2</sub>	G	M × l	T	H <sub>2</sub>	H <sub>3</sub>	C <sub>dyn</sub>	C <sub>0</sub>	
CGH15CA	28	4.1	9.5	34	26	4.0	26	39.6	58.2	10.8	4.25	6.0	M4 × 6	6.0	7.8	7.8	14,700	19,520	0.15
CGH20CA	30	4.6	12.0	44	32	6.0	36	52.5	74.9	12.45	5.50	6.0	M5 × 6	8.0	3.7	3.5	23,700	30,510	0.25
CGH20HA							50	68.5	90.9	13.45	28,600						39,900	0.33	
CGH25CA	40	6.1	12.5	48	35	6.5	35	61.0	84.0	17.4	5.00	12.0	M6 × 8	8.0	10.0	9.5	34,960	43,940	0.46
CGH25HA							50	78.4	101.4	18.6	40,500						54,080	0.59	
CGH30CA	45	7.0	16.0	60	40	10.0	40	69.0	97.4	19.75	8.70	12.0	M8 × 10	9.5	9.7	10.0	46,000	55,190	0.71
CGH30HA							60	91.5	119.9	21	58,590						78,180	0.94	
CGH35CA	55	7.6	18.0	70	50	10.0	50	79.0	111.4	22.6	7.00	12.0	M8 × 13	10.2	16.0	14.0	61,170	79,300	1.24
CGH35HA							72	103.4	135.8	23.8	77,900						112,340	1.62	
CGH45CA	70	9.7	20.5	86	60	13.0	60	97.2	137.6	23	8.70	12.9	M10 × 17	16.0	18.5	18.2	98,430	112,660	2.38
CGH45HA							80	133.6	174.0	31.2	125,580						159,600	3.01	

For dimensions of the rail, see Page 56, for standard as well as optional lubrication adapter, see Page 148.

<sup>1)</sup> Flat head screw protrudes 1 mm in all sizes.

# Linear guideways

## CG series

### 3.2.9.2 CGL

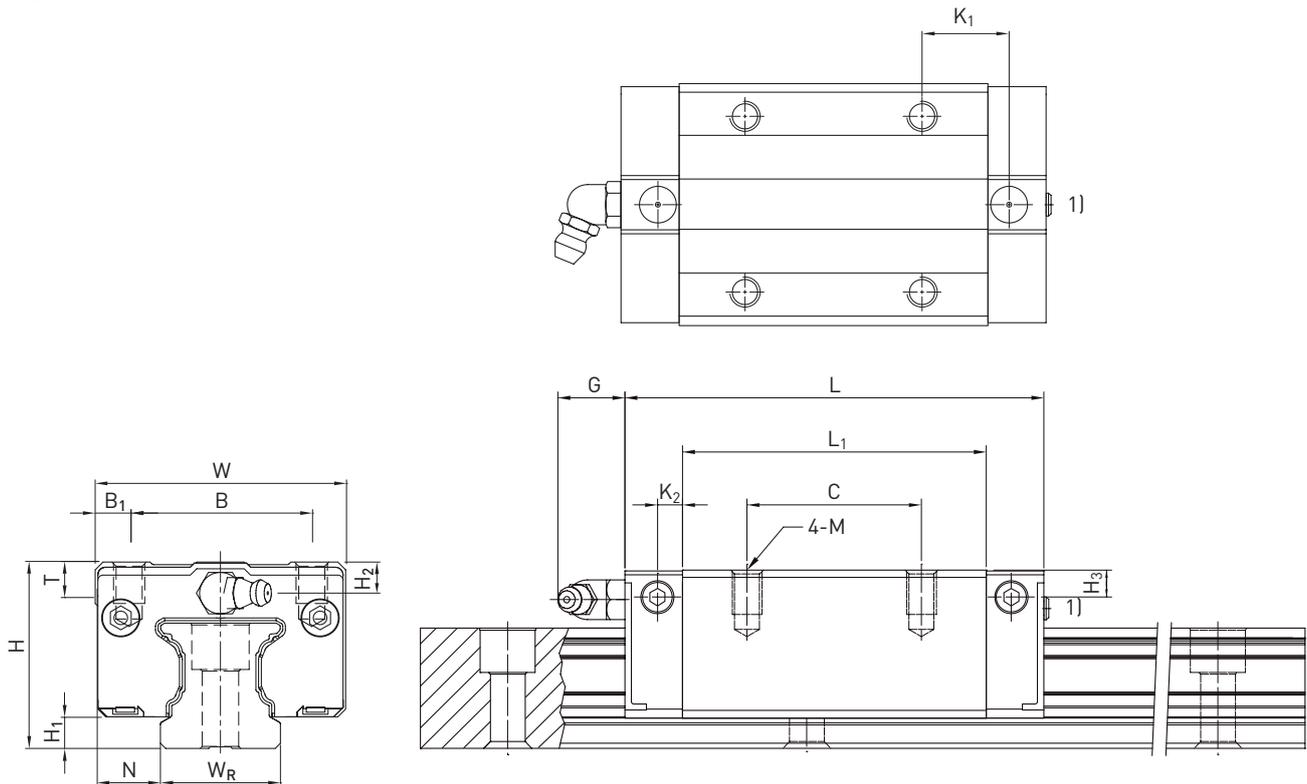


Table 3.25 Dimensions of the block

Series/size	Installation dimensions [mm]			Dimensions of the block [mm]													Load ratings [N]		Weight [kg]
	H	H <sub>1</sub>	N	W	B	B <sub>1</sub>	C	L <sub>1</sub>	L	K <sub>1</sub>	K <sub>2</sub>	G	M × l	T	H <sub>2</sub>	H <sub>3</sub>	C <sub>dyn</sub>	C <sub>0</sub>	
CGL15CA	24	4.1	9.5	34	26	4.0	26	39.6	58.2	10.8	4.25	6.0	M4 × 6	6.0	3.8	3.8	14,700	19,520	0.11
CGL25CA	36	6.1	12.5	48	35	6.5	35	61.0	84.0	17.4	5.00	12.0	M6 × 8	8.0	6.0	5.5	34,960	43,940	0.37
CGL25HA							50	78.4	101.4	18.6							40,500	54,080	0.47
CGL30CA	42	7.0	16.0	60	40	10.0	40	69.0	97.4	19.75	8.70	12.0	M8 × 10	9.5	6.7	7.0	46,000	55,190	0.61
CGL30HA							60	91.5	119.9	21.0							58,590	78,180	0.82
CGL35CA	48	7.6	18.0	70	50	10.0	50	79.0	111.4	22.6	7.00	12.0	M8 × 13	10.2	9.0	7.0	61,170	79,300	0.93
CGL35HA							72	103.4	135.8	23.8							77,900	112,340	1.22
CGL45CA	60	9.7	20.5	86	60	13.0	60	97.2	137.6	23.0	8.70	12.9	M10 × 17	16.0	8.5	8.1	98,430	112,660	1.72
CGL45HA							80	133.6	174.0	31.2							125,580	159,600	2.39

For dimensions of the rail, see Page 56, for standard as well as optional lubrication adapter, see Page 148.

<sup>1)</sup> Flat head screw protrudes 1 mm in all sizes.

## 3.2.9.3 CGW

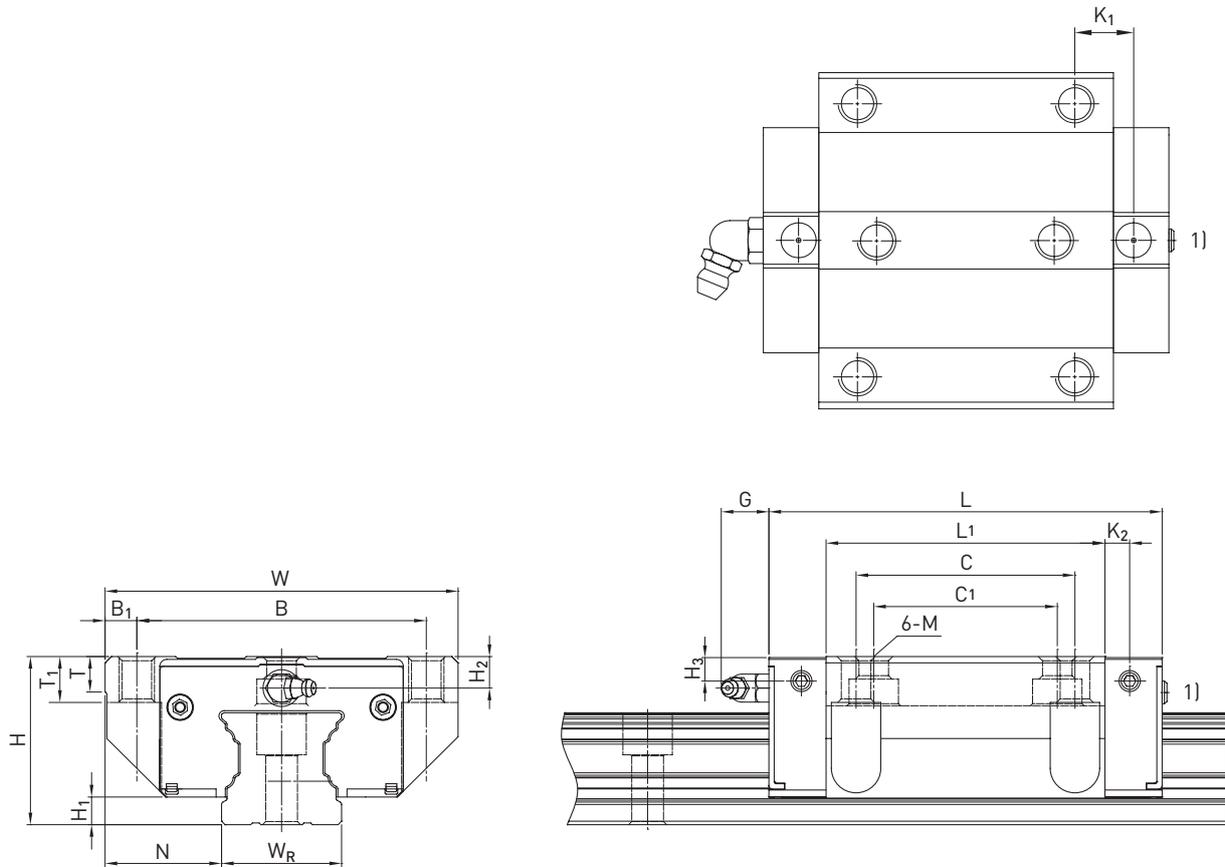


Table 3.26 Dimensions of the block

Series/size	Installation dimensions [mm]			Dimensions of the block [mm]													Load ratings [N]		Weight [kg]		
	H	H <sub>1</sub>	N	W	B	B <sub>1</sub>	C	C <sub>1</sub>	L <sub>1</sub>	L	K <sub>1</sub>	K <sub>2</sub>	G	M	T	T <sub>1</sub>	H <sub>2</sub>	H <sub>3</sub>		C <sub>dyn</sub>	C <sub>0</sub>
CGW15CC	24	4.1	16.0	47	38	4.5	30	26	39.6	58.2	8.8	4.25	6.0	M5	6.0	6.5	3.8	3.8	14,700	19,520	0.14
CGW20CC	30	4.6	21.5	63	53	5.0	40	35	52.5	74.9	10.45	5.50	6.0	M6	6.5	7.7	3.7	3.5	23,700	30,510	0.36
CGW20HC									68.5	90.9	18.45	28,600							39,900	0.47	
CGW25CC	36	6.1	23.5	70	57	6.5	45	40	61.0	84.0	12.4	5.00	12.0	M8	7.0	9.3	6.0	5.5	34,960	43,940	0.53
CGW25HC									78.4	101.4	21.1	40,500							54,080	0.68	
CGW30CC	42	7.0	31.0	90	72	9.0	52	44	69.0	97.4	13.75	8.70	12.0	M10	10.5	12.0	6.7	7.0	46,000	55,190	0.90
CGW30HC									91.5	119.9	25.0	58,590							78,180	1.19	
CGW35CC	48	7.6	33.0	100	82	9.0	62	52	79.0	111.4	16.6	7.00	12.0	M10	10.1	13.1	9.0	7.0	61,170	79,300	1.37
CGW35HC									103.4	135.8	28.8	77,900							112,340	1.79	
CGW45CC	60	9.7	37.5	120	100	10.0	80	60	97.2	137.6	13.0	8.70	12.9	M12	15.1	15.0	8.5	8.1	98,430	112,660	2.45
CGW45HC									133.6	174.0	31.2	125,580							159,600	3.00	

For dimensions of the rail, see Page 56, for standard as well as optional lubrication adapter, see Page 148.

<sup>1)</sup> Flat head screw protrudes 1 mm in all sizes.

# Linear guideways

## CG series

### 3.2.10 Dimensions of the CG rail

#### 3.2.10.1 Dimensions CGR\_R

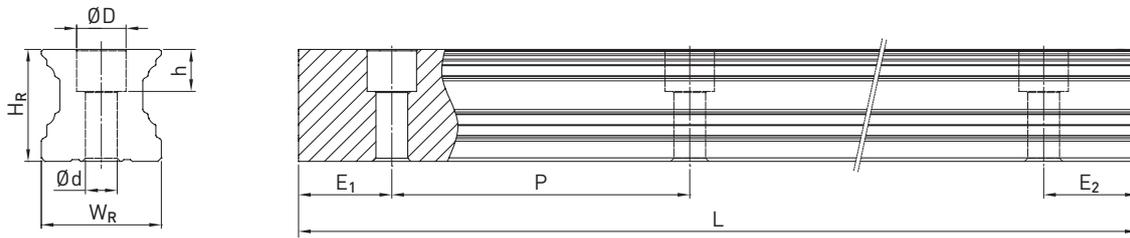


Table 3.27 Dimensions of profile rail CGR\_R

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] <sup>1)</sup>	$E_{1/2}$ min [mm] <sup>2)</sup>	$E_{1/2}$ max [mm]	Weight [kg/m]
		$W_R$	$H_R$	D	h	d	P							
CGR15R	M4 × 20	15	16.20	7.5	5.9	4.5	60	4,000	3,900	72	6	14	54	1.58
CGR20R	M5 × 25	20	20.55	9.5	8.5	6.0	60	4,000	3,900	74	7	16	53	2.48
CGR25R	M6 × 30	23	24.25	11.0	9.0	7.0	60	4,000	3,900	76	8	17	52	3.38
CGR30R	M8 × 35	28	28.35	14.0	12.4	9.0	80	4,000	3,920	98	9	18	71	5.10
CGR35R	M8 × 40	34	31.85	14.0	12.0	9.0	80	4,000	3,920	98	9	24	71	7.14
CGR45R	M12 × 50	45	39.85	20.0	17.0	14.0	105	4,000	3,885	129	12	27	93	11.51

<sup>1)</sup>  $E_{1/2}$  min without cover strip and with cover strip (clamp: steel clamp)

<sup>2)</sup>  $E_{1/2}$  min with cover strip (clamp: front clamping screw)

#### 3.2.10.2 Dimensions CGR\_T

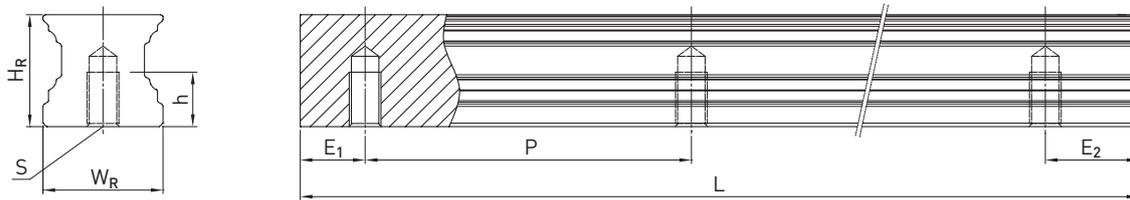


Table 3.28 Dimensions of profile rail CGR\_T

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] <sup>1)</sup>	$E_{1/2}$ min [mm] <sup>2)</sup>	$E_{1/2}$ max [mm]	Weight [kg/m]
	$W_R$	$H_R$	S	h	P							
CGR15T	15	16.20	M5	8	60	4,000	3,900	72	6	14	54	1.58
CGR20T	20	20.55	M6	10	60	4,000	3,900	74	7	15	53	2.48
CGR25T	23	24.25	M6	12	60	4,000	3,900	76	8	15	52	3.38
CGR30T	28	28.35	M8	15	80	4,000	3,920	98	9	16	71	5.10
CGR35T	34	31.85	M8	17	80	4,000	3,920	98	9	22	71	7.14
CGR45T	45	39.85	M12	24	105	4,000	3,885	129	12	24	93	11.51

<sup>1)</sup>  $E_{1/2}$  min without cover strip and with cover strip (clamp: steel clamp)

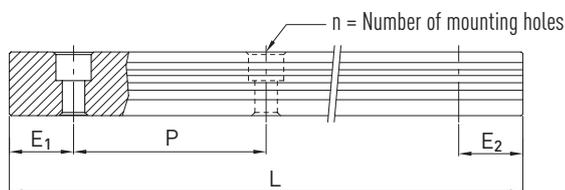
<sup>2)</sup>  $E_{1/2}$  min with cover strip (clamp: front clamping screw)

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.

### 3.2.10.3 Calculation of the length of profile rails

HIWIN offers profile rails 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  $E_{1/2 \text{ min}}$  and  $E_{1/2 \text{ max}}$  so that the mounting hole does not break out.



**F 3.5**

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

- 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].

### 3.2.10.4 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.

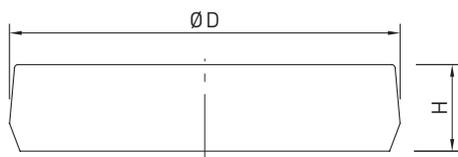


Table 3.29 Cover caps for mounting holes of profile rails

Rail	Screw	Article number			Ø D [mm]	Height H [mm]
		Plastic (200 units)	Brass <sup>1)</sup>	Steel <sup>1)</sup>		
CGR15R	M4	5-002218	5-001344	—	7.5	1.2
CGR20R	M5	5-002220	5-001350	5-001352	9.5	2.5
CGR25R	M6	5-002221	5-001355	5-001357	11.0	2.8
CGR30R	M8	5-002222	5-001360	5-001362	14.0	3.5
CGR35R	M8	5-002222	5-001360	5-001362	14.0	3.5
CGR45R	M12	5-002223	5-001324	5-001327	20.0	4.0

<sup>1)</sup> Not recommended for coated rails.

# Linear guideways

## CG series

### 3.2.10.5 Cover strip clamp

The optional cover strip is supplied with a steel clamp to secure the strip. Alternatively, the clamp can also be secured with a clamping screw on the front side. The stroke is shortened when the clamping screw is used on the front side, see assembly instructions



Fig. 3.1 Clamp: Steel



Fig. 3.2 Clamp: Front-side clamping screw

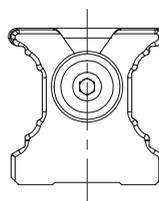
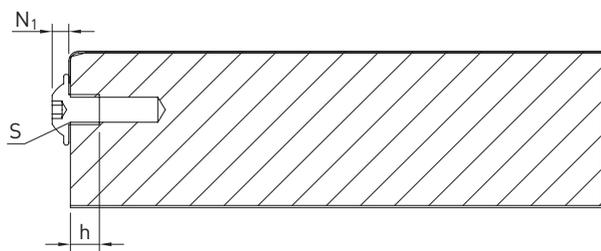


Table 3.30 Dimensions of profile rail with front-side clamping screw

Series/Size	S [mm]	h [mm]	N <sub>1</sub> [mm]
CG_15	M3	5	1.65
CG_20	M4	5	2.20
CG_25	M4	5	2.20
CG_30	M4	5	2.20
CG_35	M6	9	3.30
CG_45	M6	9	3.30

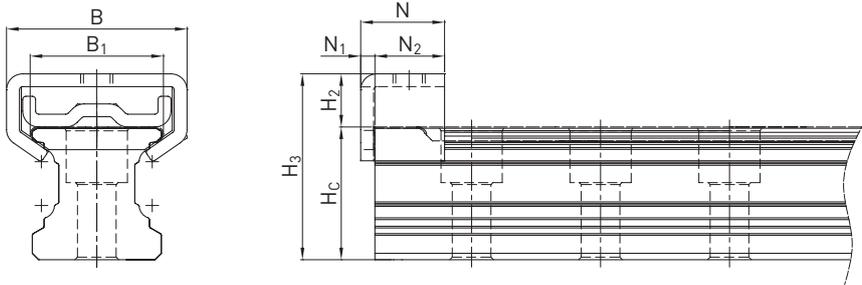


Table 3.32 Dimensions of profile rail with steel clamp

Series/Size	H <sub>3</sub> [mm]	H <sub>c</sub> [mm]	H <sub>2</sub> [mm]	N [mm]	N <sub>1</sub> [mm]	N <sub>2</sub> [mm]	B [mm]	B <sub>1</sub> [mm]
CG_15	20.09	16.70	3.9	15	2.2	12.8	21.0	15.8
CG_20	29.05	20.75	8.3	13	2.2	10.8	28.0	20.7
CG_25	34.42	24.45	10.0	15	2.2	12.8	30.6	23.9
CG_30	37.80	28.55	9.3	12	2.2	9.8	34.0	28.9
CG_35	43.20	30.40	13.0	18	2.2	15.8	35.4	34.8
CG_45	52.66	39.85	13.7	18	2.2	15.8	53.6	45.6

### 3.2.11 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.

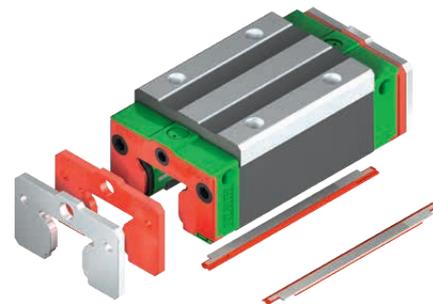


Table 3.31 Total length of block with different sealing systems

Series/size	Total length L (including screws)			
	SS	ZZX	SW	ZWX
CG15C	58.2	61.2	63.2	66.2
CG20C	74.9	77.9	79.9	82.9
CG20H	90.9	93.9	95.9	98.9
CG25C	84.0	90.0	89.0	95.0
CG25H	101.4	107.4	106.4	112.4
CG30C	97.4	103.4	102.8	108.8
CG30H	119.9	125.9	125.3	131.3
CG35C	111.4	117.4	116.8	122.8
CG35H	135.8	141.8	141.2	147.2
CG45C	137.6	143.6	143.0	149.0
CG45H	174.0	180.0	179.4	185.4

Unit: mm

# Linear guideways

## CG series

### 3.2.12 Long-term lubrication unit

Further information on the lubrication unit can be found in the general information in section "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 + T. The EC lubrication unit is available with the sealing systems named in the table.

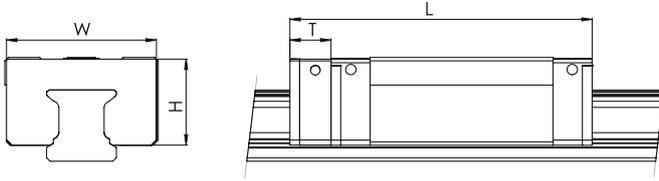


Table 3.33 Dimensions of the block with lubrication unit EC

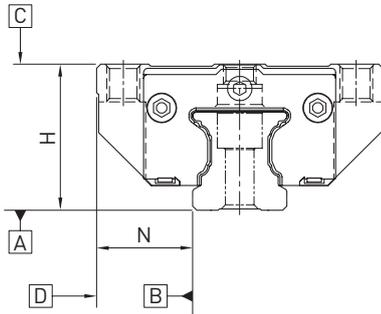
Model	Dimensions of the block [mm]				Max. running performance <sup>2)</sup> [km] EC single-sided	Max. running performance <sup>2)</sup> [km] EC double-sided
	W	H	T	L <sub>SS/sw</sub> <sup>1)</sup>		
CG_15C	33.4	19.35	10.8	69.0	10,000	20,000
CG_20C	43.0	24.85	11.8	86.7	10,000	20,000
CG_20H	43.0	24.85	11.8	102.7	10,000	20,000
CG_25C	47.0	28.90	12.5	96.5	10,000	20,000
CG_25H	47.0	28.90	12.5	113.9	10,000	20,000

<sup>1)</sup> Total length with selected dust protection. SS = Standard dust protection

<sup>2)</sup> Further details can be found in the assembly instructions in the "Lubrication" chapter

### 3.2.13 Tolerances depending on the accuracy class

The CG series are available in five 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.



#### 3.2.12.1 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 3.34 Tolerance of parallelism between block and profile rail

Rail length [mm]	Accuracy class				
	C	H	P	SP	UP
- 100	12	7	3	2	2
100 - 200	14	9	4	2	2
200 - 300	15	10	5	3	2
300 - 500	17	12	6	3	2
500 - 700	20	13	7	4	2
700 - 900	22	15	8	5	3
900 - 1100	24	16	9	6	3
1100 - 1500	26	18	11	7	4
1500 - 1900	28	20	13	8	4
1900 - 2500	31	22	15	10	5
2500 - 3100	33	25	18	11	6
3100 - 3600	36	27	20	14	7
3600 - 4000	37	28	21	15	7

Unit:  $\mu\text{m}$

# Linear guideways

## CG series

### 3.2.13.1 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.

Series/size	Accuracy class	Height tolerance of H (T <sub>H</sub> )	Width tolerance of N	Height variance of H	Width variance of N
CG_15, 20	C (Normal)	± 0.1	± 0.1	0.02	0.02
	H (high)	± 0.03	± 0.03	0.01	0.01
	P (precision)	0/- 0.03 <sup>1)</sup> ± 0.015 <sup>2)</sup>	0/- 0.03 <sup>1)</sup> ± 0.015 <sup>2)</sup>	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
CG_25, 30, 35	C (Normal)	± 0.1	± 0.1	0.02	0.03
	H (high)	± 0.04	± 0.04	0.015	0.015
	P (precision)	0/- 0.04 <sup>1)</sup> ± 0.02 <sup>2)</sup>	0/- 0.04 <sup>1)</sup> ± 0.02 <sup>2)</sup>	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
CG_45	C (Normal)	± 0.1	± 0.1	0.03	0.03
	H (high)	± 0.05	± 0.05	0.015	0.02
	P (precision)	0/- 0.05 <sup>1)</sup> ± 0.025 <sup>2)</sup>	0/- 0.05 <sup>1)</sup> ± 0.025 <sup>2)</sup>	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

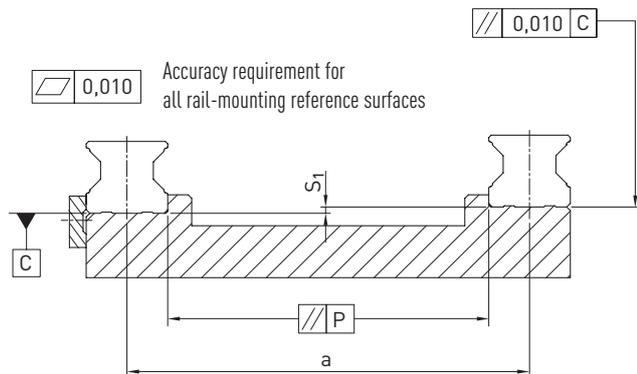
Unit: mm

<sup>1)</sup> Assembled linear guideway

<sup>2)</sup> Unassembled linear guideway

### 3.2.13.2 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 CG series linear guideways are achieved.



#### Tolerance of parallelism of reference surface (P)

Table 3.36 Maximum tolerance for parallelism (P)

Series/Size	Preload class		
	Z0	ZA	ZB
CG_15	9	5	4
CG_20	11	7	5
CG_25	12	8	6
CG_30	14	9	7
CG_35	15	11	8
CG_45	19	12	10

Unit:  $\mu\text{m}$

#### Tolerance of height of reference surface ( $S_1$ )

$$F 3.6 \quad S_1 = a \times K - T_H$$

$S_1$  Maximum height tolerance [mm]  
 $a$  Distance between rails [mm]  
 $K$  Coefficient of height tolerance  
 $T_H$  Tolerance of height according to Table 3.35

Table 3.37 Coefficient of height tolerance (K)

Series/Size	Preload class		
	Z0	ZA	ZB
CG_15 - CG_45	$2.8 \times 10^{-4}$	$1.7 \times 10^{-4}$	$1.2 \times 10^{-4}$

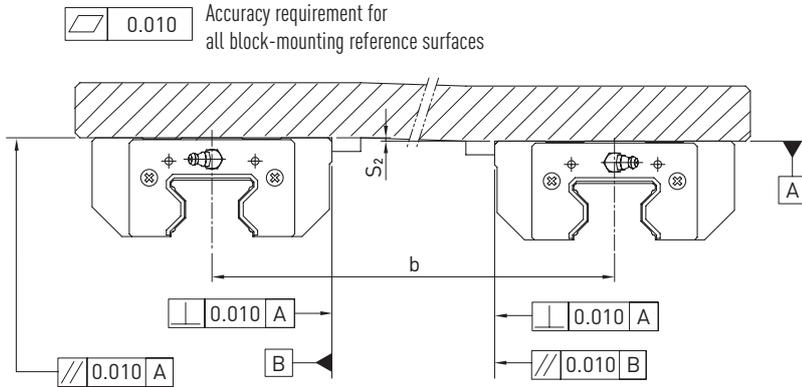
Note: If  $S_1 < 0$ , select another tolerance class!

# Linear guideways

## CG series

### Height tolerance for mounting surface on block

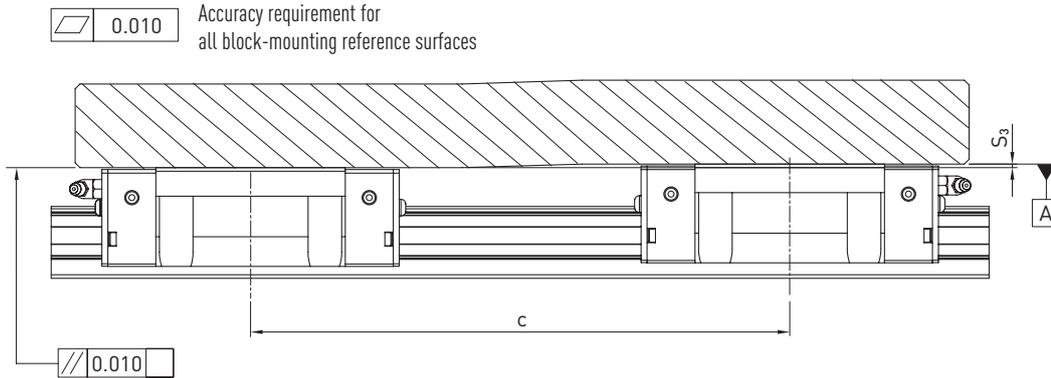
- The height tolerance of the reference surface when two or more blocks are used in parallel ( $S_2$ )



**F 3.7**  $S_2 = b \times K$

- $S_2$  Maximum height tolerance [mm]
- $b$  Distance between blocks [mm]
- $K$  Coefficient of height tolerance

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



**F 3.8**  $S_3 = c \times K$

- $S_3$  Maximum height tolerance [mm]
- $c$  Distance between blocks [mm]
- $K$  Coefficient of height tolerance

Series/Size	Load type	
	CG_C	CG_H
CG_15 - CG_45	$4.2 \times 10^{-5}$	$3.0 \times 10^{-5}$

**3.2.14 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.

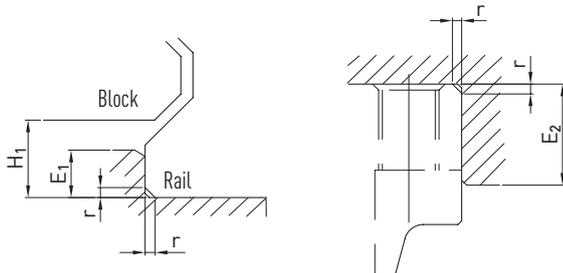


Table 3.39 Shoulder heights and edge roundings

Series/Size	Max. radius of edges r	Shoulder height of the reference edge of rail E <sub>1</sub>	Shoulder height of the reference edge of block E <sub>2</sub>	Clearance height under block H <sub>1</sub>
CG_15	0.5	3.0	4.0	4.3
CG_20	0.5	3.5	5.0	4.6
CG_25	1.0	5.0	5.0	6.1
CG_30	1.0	5.0	5.0	7.0
CG_35	1.0	6.0	6.0	7.6
CG_45	1.0	8.0	8.0	9.5

Unit: mm

# Linear guideways

## EG/QE series

### 3.3 EG/QE series

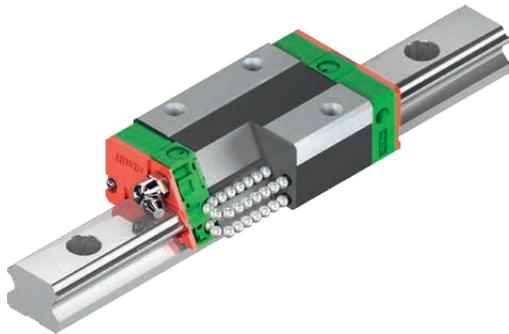
#### 3.3.1 Properties of the EG and QE series linear guideways

Flat type, specially for applications with limited installation space. The HIWIN linear guideways of the EG series with four ball tracks are well-suited for applications with tight installation space due to their low installation height. Nevertheless, the EG series has the same properties as the HG series: high load capacity, low displacement forces and high efficiency. The ball retainers prevent the balls from falling out when pulled from the profile rail during installation of the blocks.

The models of the QE series with SynchMotion™ technology offer all the advantages of the standard EG series. Controlled movement of the balls 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 QE blocks are identical to those of the EG blocks, they are also mounted on the EGR standard rail and can thus be easily interchanged. For further information, see Page 24.

#### 3.3.2 Layout of EG/QE series

- Four-row recirculating ball bearing guide
- 45° contact angle of the ball tracks
- The ball retainers prevent the balls from falling out when the block is removed
- Different sealing variants, depending on application area
- 6 connection options for lubricating nipples or lubrication adapters
- SynchMotion™ technology (QE series)



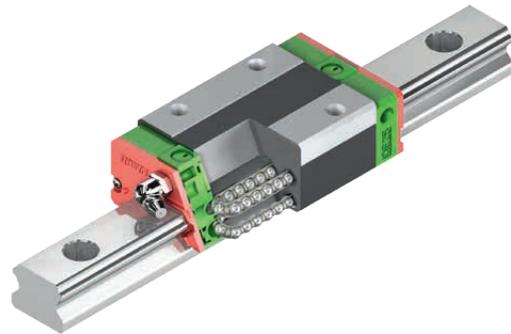
Layout of EG series

#### Advantages:

- Backlash-free
- Exchangeable
- High accuracy
- Highly resilient in all loading directions
- Low friction losses even with preload from optimised ball tracks and 2-point contact

#### 3.3.3 Order codes of EG/QE series

For EG/QE 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. Block and profile rail can be ordered separately and mounted by the customer. Their accuracy reaches class P.



Layout of QE series

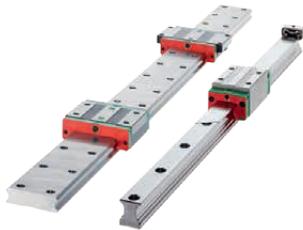
#### Additional advantages of QE series:

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





# We live motion.



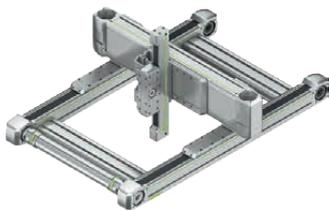
Linear Guideways



Ballscrews



Linear Axes



Linear Axis Systems



Torque Motors



Robots



Linear Motors



Rotary Tables



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