



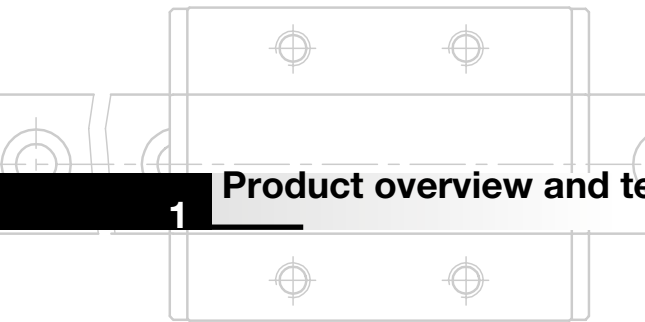
## **MINIRAIL**

Profiled miniature guideway



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# 1 Product overview and technical informations

## MINIRAIL - a range of high-precision guideways

MINIRAIL represents the latest generation of miniature guideways for sophisticated applications. They are extremely robust, and their smooth running, precision, and reliability are demonstrated in every application.

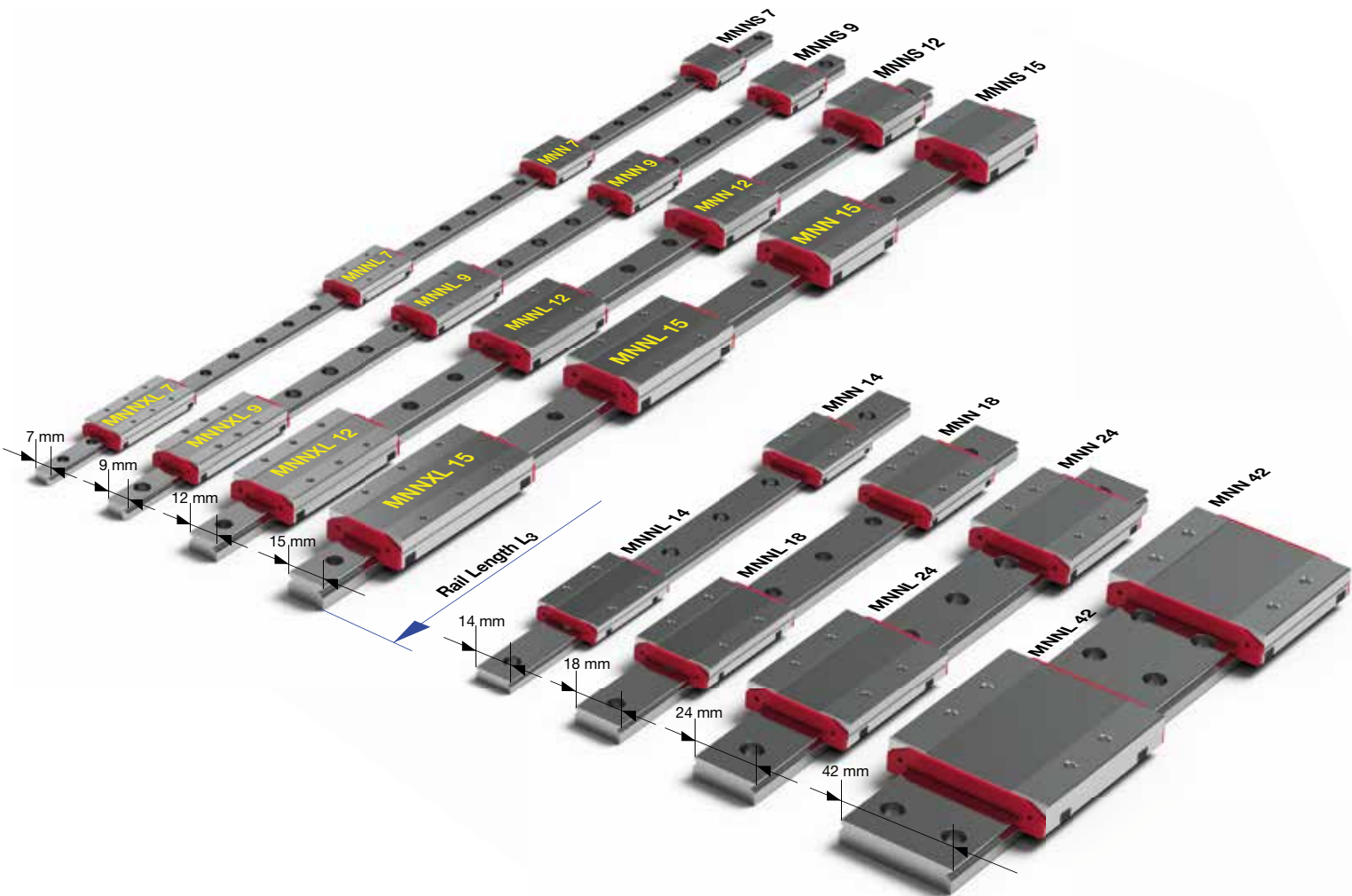
The design, material selection, and surface finish of the recirculation element and ball entry zone guarantee low pulsation and therefore a smooth ride.

### Rail Length L<sub>3</sub>

Our manufacturing know-how supports high-precision manufacturing of rails up to 1000 mm in length, which can be offered in graded lengths.

The **range** includes eight rail widths. The following carriage sizes are available to select from:

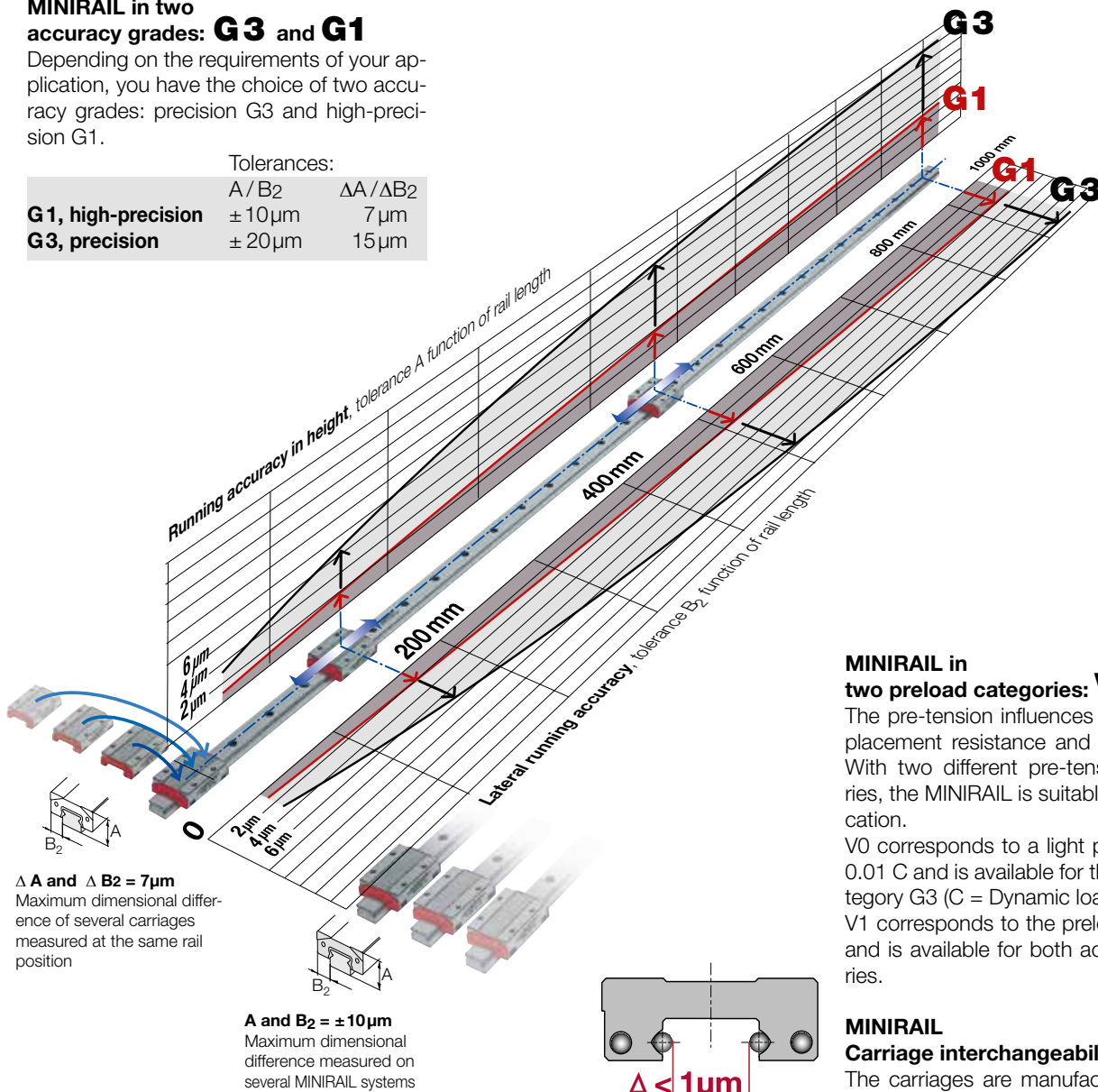
<b>Standard, short</b>	MNNS 7	MNNS 9	MNNS 12	MNNS 15
<b>Standard</b>	MNN 7	MNN 9	MNN 12	MNN 15
<b>Standard, long</b>	MNNL 7	MNNL 9	MNNL 12	MNNL 15
<b>Standard, x-long</b>	MNNXL 7	MNNXL 9	MNNXL 12	MNNXL 15
<b>Wide</b>	MNN 14	MNN 18	MNN 24	MNN 42
<b>Wide, long</b>	MNNL 14	MNNL 18	MNNL 24	MNNL 42



## MINIRAIL in two accuracy grades: **G3** and **G1**

Depending on the requirements of your application, you have the choice of two accuracy grades: precision G3 and high-precision G1.

	Tolerances:	
	A / B <sub>2</sub>	$\Delta A / \Delta B_2$
<b>G1, high-precision</b>	$\pm 10 \mu\text{m}$	$7 \mu\text{m}$
<b>G3, precision</b>	$\pm 20 \mu\text{m}$	$15 \mu\text{m}$



## MINIRAIL in two preload categories: **V0** and **V1**

The pre-tension influences the rigidity, displacement resistance and service lifetime. With two different pre-tensioning categories, the MINIRAIL is suitable for your application.

V0 corresponds to a light preload of up to 0.01 C and is available for the accuracy category G3 (C = Dynamic load).

V1 corresponds to the preload 0 to 0.03 C and is available for both accuracy categories.

## MINIRAIL

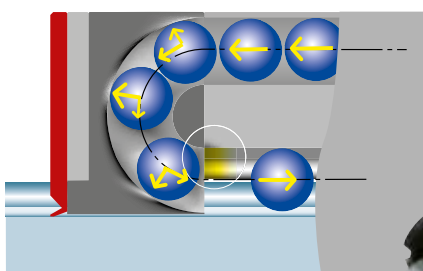
### Carriage interchangeability guarantee

The carriages are manufactured with high precision and are completely interchangeable. This makes a high degree of flexibility with respect to operations planning, stocking and assembly. As a result of the interchangeability, additional carriages can be installed onto an existing rail.

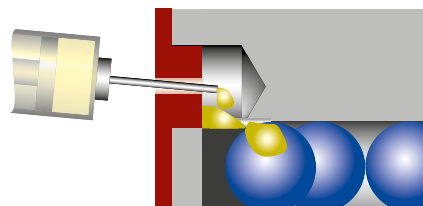
**µm - accuracy**  
Our manufacturing control of this precise dimension is decisive for the complete interchangeability of the carriages.

**High accelerations of up to 300 m/s<sup>2</sup>**

The recirculation element plays a crucial role in withstanding the constantly increasing acceleration values. For this reason, SCHNEEBERGER uses a plastic material that is capable of enduring very high loads. The ingenious shape and the smooth surfaces of the recirculation element are designed with high levels of centrifugal force in mind.

**Direct lubrication**

Two lubrication bores in each front plate allow the direct lubrication on the ball recirculation system.



### Ball retention device for easy handling

If a carriage is removed from the rail or is being prepared for installation, the balls are always retained in the carriage by a special ball retaining device. This makes handling significantly easier and is prerequisite for quickly changing the carriages.



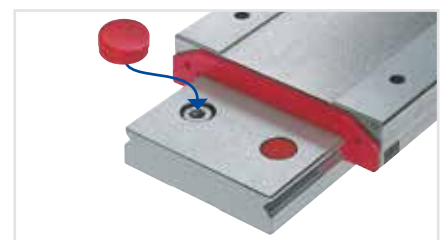
### Protection against dirt

To obtain quietness and extended life, rail and carriage assemblies require clean running surfaces - even under unfavorable conditions. Therefore our MINIRAIL carriages are equipped with rail-wiping, contoured front plates.

Should the protective - and wiping function of the front plates not be required, the front plates can be removed easily. As a result, the displacement resistance is reduced significantly.



Plastic plugs in the rail mounting holes prevent the accumulation of any dirt.



Tight clearances between the carriage and rail prevent dirt penetration.



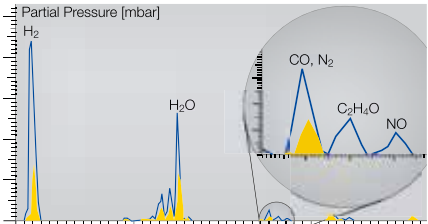
**High-grade materials**

All rails and carriages are manufactured from corrosion-resistant, through-hardened steel and are suitable for utilization in the most diverse applications.



**Vacuum capacity**

MINIRAIL can be operated in high vacuum without any wiper (max.  $10^{-7}$  mbar).



**Protective packaging**

Carriages and rails are packed carefully and ready for installation. In the process MINIRAIL carriages are shipped on a protective rail, in order to prevent any impairment by dirt or debris.





**High smoothness and low displacement force**

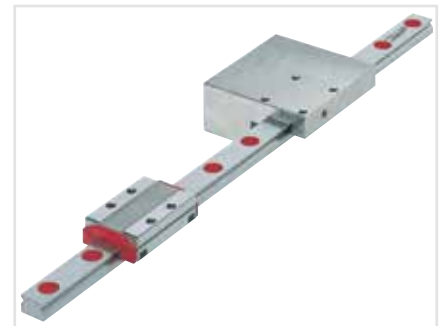
The precise fine grinding of the ball entry position on the running track is crucial to the operational quietness and service life, especially in the case of carriages with preload. Here we have indeed produced our best work.



**Clamping element for safety purposes**

The clamping element has been developed especially for MINIRAIL. In normal operation, the clamping element is maintained in an open position by compressed air, and in the case of an electric power failure, the spring-force blocks all movement for operational safety.

[www.zimmer-gmbh.de](http://www.zimmer-gmbh.de)

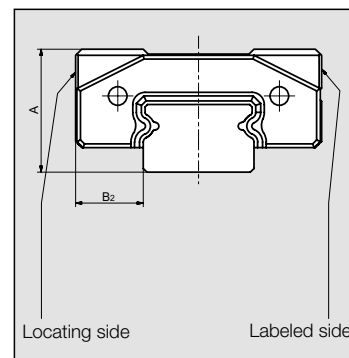


### Accuracy classes

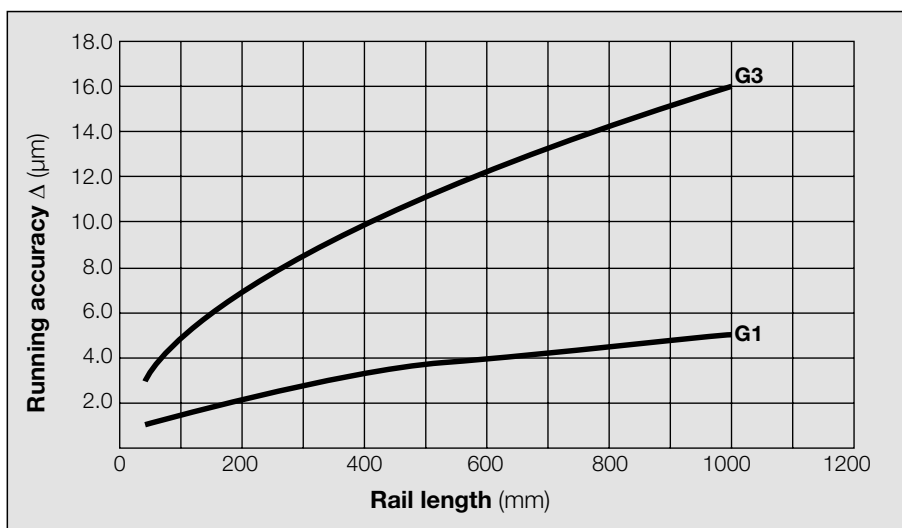
The MINIRAIL guideways are available in two accuracy classes.

Accuracy class	Tolerances <sup>1</sup> A and B <sub>2</sub>	<sup>2</sup> Δ A and ΔB <sub>2</sub>
<b>G1</b>	± 10 μm	7 μm
<b>G3</b>	± 20 μm	15 μm

<sup>1</sup> Measuring referring to the center of the carriage  
<sup>2</sup> Dimension differences between two or more carriages measured at the middle of each carriage (mean value of both supports) and at the same rail position



### Running accuracy



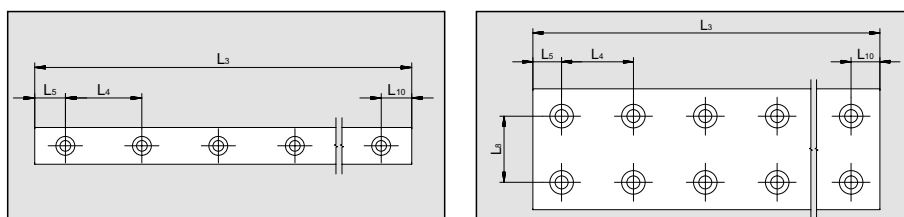
### Preload classes V0 and V1

Preloading increases the rigidity of the guideway but also affects operational life and increases translation resistance. The MINIRAIL system is available in two preload classes to address specific application requirements. The rail up to determines the preload classes.

Preload class	Preload	Accuracy class
<b>V0</b>	near clearance to 0.01 · C	G3
<b>V1</b>	0 to 0.03 · C	G1, G3

C = Dynamic loading capacity (see page 13)

## Rail lengths



Standard rail lengths $L_3$ (length in mm)					
Size	$L_4$	$L_5, L_{10}$	$L_8$	$L_3$	Max $L_3$
7	15	5	–	40, 55, 70, 85, ...	1000
9	20	7.5	–	55, 75, 95, 115, ...	995
12	25	10	–	70, 95, 120, 145, ...	995
15	40	15	–	70, 110, 150, 190, ...	990
14	30	10	–	80, 110, 140, 170, ...	980
18	30	10	–	80, 110, 140, 170, ...	980
24	40	15	–	110, 150, 190, 230, ...	990
42	40	15	23	110, 150, 190, 230, ...	990

### Custom rail lengths

Other rail lengths are available up to the maximum rail lengths above and are calculated according to the following formula:

$$L_3 = (n-1) \cdot L_4 + L_5 + L_{10} \quad n = \text{number of fixing holes}$$

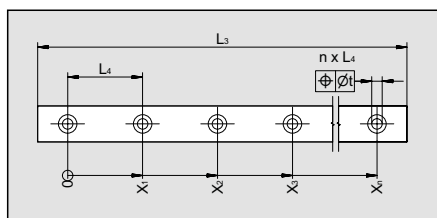
The following minimum and maximum values should be maintained for the starting hole pitch  $L_5$  and the end hole pitch  $L_{10}$ .

Minimum and maximum starting and end hole pitch $L_5, L_{10}$ (lengths in mm)								
Size	7	9	12	15	14	18	24	42
$L_5, L_{10}$ minimum	4	5	5	5	5	5	6	6
$L_5, L_{10}$ maximum	11	15	20	35	25	25	34	34

## Tolerances for rail lengths and fixing holes

The position tolerance of the attaching holes and the length tolerance is:

Rail	$L_3, X_n \leq 300 \text{ mm}$	$L_3, X_n > 300 \text{ mm}$
$t$ (mm)	0.3	$0.001 \cdot X_n$
$L_3$	$\pm 0.3$	$\pm 0.001 \cdot L_3$



**Lubrication**

The front plates include two lubrication holes to allow independent lubrication for the right and left side of the carriage. This ensures that all tracks of the carriage are provided with lubricant, in all installation orientations.

At delivery the carriages are slightly oiled. Prior to operation the carriages must be lubricated! Subsequent lubrication depends upon environmental conditions as well as the nature and type of the load. Guarantees regarding subsequent lubrication intervals can only be provided through the user's own tests and experience. In all cases, the recommendations provided by the lubricant manufacturer must be followed.

For lubrication with oil, SCHNEEBERGER recommends mineral oil CLP (DIN 51517) or HLP (DIN 51524) in the viscosity range of ISO VG32 to ISO VG150 in accordance with DIN 51519.

For lubrication with grease, SCHNEEBERGER recommends grease KP2K or KP1K in accordance with DIN 51825.

A re-lubrication set with an appropriate oil can be ordered at SCHNEEBERGER with the ordering code MNW.



**Lubrication with grease**

During the lubrication the carriages have to be moved on the rail in order to distribute the lubricant.

Quantity of grease in cm³							
MNNS 7	MNNS 9	MNNS 12	MNNS 15				
0.03	0.05	0.09	0.16				
MNN 7	MNN 9	MNN 12	MNN 15	MNN 14	MNN 18	MNN 24	MNN 42
0.04	0.09	0.15	0.25	0.05	0.11	0.20	0.33
MNNL 7	MNNL 9	MNNL 12	MNNL 15	MNNL 14	MNNL 18	MNNL 24	MNNL 42
0.05	0.11	0.20	0.35	0.07	0.14	0.26	0.45
MNNXL 7	MNNXL 9	MNNXL 12	MNNXL 15				
0.07	0.14	0.26	0.45				

**Lubrication with oil**

During the lubrication the carriages have to be moved on the rail in order to distribute the lubricant.

**Re-lubrication**

**Guideline values based on the following assumption:**

- Load ratio C/P\* = 10
- Speed of 1 m/s
- Stroke of 150 mm
- Re-lubrication interval = 3000 km

\*C = dynamic loading capacity / P = equivalent force

**Permissible speeds  
and accelerations**

General applications under normal operating conditions:

Speeds up to	5 m/s
Accelerations up to	300 m/s <sup>2</sup>

**Permissible operating  
temperatures**

MINIRAIL guideways can be used at operating temperatures between -40°C and +80°C. Short term temperatures up to +120°C are permissible.

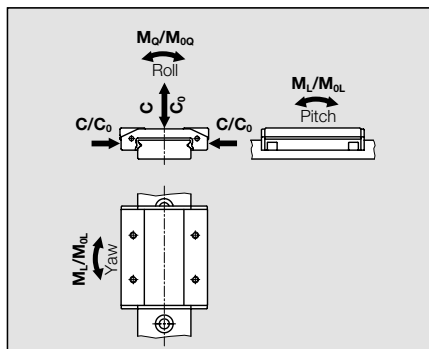
**Materials**

All steel parts are made from through hardened stainless steel. Plastic components are injection-molded using POM and TPE.

The drawing illustrates a shaft-hub assembly with the following dimensions and features:

- Top View (Left):** Shows a cross-section of the hub with dimensions  $B$  (total width),  $N$  (inner width),  $e$  (offset),  $g$  (gap),  $A$  (height),  $B_1$  (inner radius),  $B_2$  (outer radius), and  $X$  (keyway position).
- Bottom View (Left):** Shows a cross-section of the shaft with dimensions  $m1$  (key width),  $a$  (key height), and  $X$  (keyway position).
- Side View (Right):** Shows the shaft-hub assembly with dimensions  $L$  (total length),  $L_6$  (hub length),  $L_1$  (key length),  $L_2$  (key length),  $L_3$  (total length),  $L_4$  (hub length),  $L_5$  (key length),  $L_{10}$  (key length),  $f_1$  (key fit),  $f_2$  (key fit),  $MNN$  (key fit),  $MNNL$  (key fit),  $MNNXL$  (key fit), and  $L_{10}$  (key length).

Type		Dimensions (mm)																					
Rail	Carriage	A	B	B <sub>1</sub>	B <sub>2</sub>	J	J <sub>1</sub>	L	L <sub>1</sub>	L <sub>2</sub>	L <sub>4</sub>	L <sub>5</sub> /L <sub>10</sub>	L <sub>6</sub>	L <sub>8</sub>	N	e	f <sub>1</sub>	f <sub>2</sub>	g	g <sub>2</sub>	m <sub>1</sub>	o	
MN 7	MNNS 7	8	17	7	5	6.5	4.5	18.6	-	-	15	5	16.1	-	12	M2	2.4	4.2	2.5	2.2	3.1	2.5	
	MNN 7							24.6	8	-			22.1										
	MNNL 7							32.1	13	-			29.6										
	MNNXL 7							41.1	20	10			38.6										
MN 9	MNNS 9	10	20	9	5.5	8	5.5	22	-	-	20	7.5	19	-	15	M3	3.5	6	3	2	3.8	3.1	
	MNN 9							32	10	-			29										
	MNNL 9							40	16	-			37										
	MNNXL 9							50	26	13			47										
MN 12	MNNS 12	13	27	12	7.5	10	7.5	23.9	-	-	25	10	20.9	-	20	M3	3.5	6	3.5	3	4.75	3.9	
	MNN 12							36.4	15	-			33.4										
	MNNL 12							46.4	20	-			43.4										
	MNNXL 12							58.9	30	15			55.9										
MN 15	MNNS 15	16	32	15	8.5	12	9.5	31.7	-	-	40	15	28.7	-	25	M3	3.5	6	4	5	5.55	4.9	
	MNN 15							43.7	20	-			40.7										
	MNNL 15							58.7	25	-			55.7										
	MNNXL 15							73.7	40	20			70.7										
MN 14	MNN 14	9	25	14	5.5	6.8	5.2	32.1	10	-	30	10	29.6	-	19	M3	3.5	6	2.8	2	3.3	2.2	
	MNNL 14							41.1	19	-			38.6										
MN 18	MNN 18	12	30	18	6	8.5	7	40	12	-	30	10	37	-	21	M3	3.5	6	3	2.5	4.3	3.1	
	MNNL 18							50	24	-			47										
MN 24	MNN 24	14	40	24	8	10	8.5	46.4	15	-	40	15	43.4	-	28	M3	4.5	8	3.5	4	4.75	3.9	
	MNNL 24							58.9	28	-			55.9										
MN 42	MNN 42	16	60	42	9	12	9.5	55.7	20	-	40	15	52.7	23	45	M4	4.5	8	4.5	5	5.5	4.9	
	MNNL 42							73.7	35	-			70.7										



Loading capacities are calculated values, based on DIN 636-2

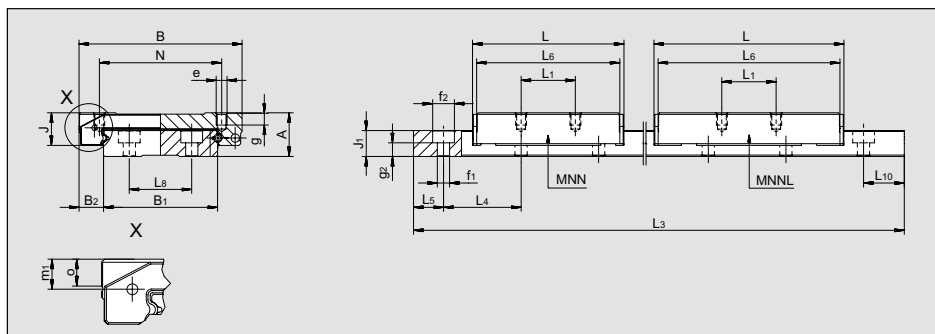
$C_0$  = static loading capacity

$C$  = dynamic loading capacity (100 km)

$M_0$  = static moment

$M$  = dynamic moment (100 km)

#### Type: 42

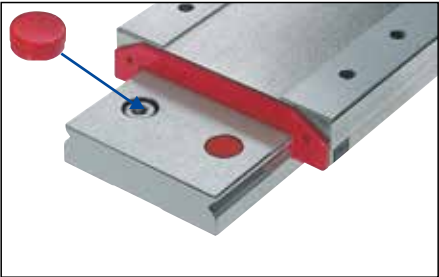


	Loading capacities		Moments				Weights	
							Carriage	Rail
	$C_0$ (N)	$C$ (N)	$M_{0Q}$ (Nm)	$M_{0L}$ (Nm)	$M_Q$ (Nm)	$M_L$ (Nm)	(g)	(g/m)
	935	645	3.4	1.6	2.3	1.1	9	216
	1560	925	5.6	4.3	3.3	2.5	13	
	2340	1230	8.4	9.3	4.4	4.9	18	
	3275	1550	11.8	17.4	5.6	8.2	23	
	1385	1040	6.5	2.8	2.8	4.8	16	309
	2770	1690	12.9	10.2	7.9	6.2	24	
	3880	2140	18.1	19.4	9.9	10.7	31	
	5270	2645	24.5	34.5	12.3	17.3	40	
	1735	1420	10.6	3.6	8.7	3	29	598
	3900	2510	23.8	16.3	15.3	10.4	47	
	5630	3240	34.4	32.9	19.8	18.9	63	
	7800	4070	47.6	61.1	24.8	31.9	81	
	3120	2435	23.7	9.4	18.5	7.3	56	996
	5620	3680	42.7	28.1	27.9	18.4	81	
	8740	5000	66.4	65.5	38.1	37.6	114	
	11855	6200	90.1	116.5	47.1	60.9	146	
	2340	1230	16.6	9.3	8.7	4.9	25	518
	3275	1550	23.3	17.4	11	8.2	33	
	3880	2140	35.5	19.4	19.6	10.7	47	915
	5270	2645	48.2	34.5	24.2	17.3	60	
	5630	3240	68.2	32.9	39.2	18.9	84	1473
	7800	4070	94.4	61.1	49.3	31.9	109	
	8110	4750	171.2	56.8	100.3	33.3	169	2828
	11855	6200	250.2	116.5	130.8	60.9	231	

Accessories and options

Plastic plugs

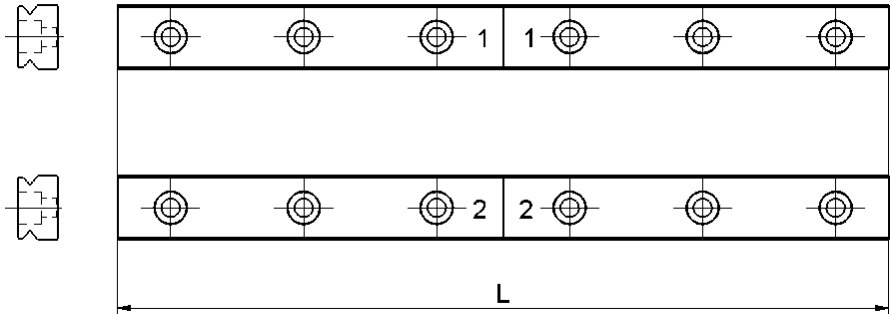
Plastic plugs can be used to close the rail attachment holes.



MINIRAIL Typ	Plastic plugs Typ	Plastic plugs can be combined with attaching screws of type		
		DIN 912	DIN 7984	DIN 7380
MN 7	MNK 4	-	-	X
MN 9	MNK 6	-	X	X
MN 12	MNK 6	X	X	X
MN 15	MNK 6	X	X	X
MN 14	MNK 6	-	X	X
MN 18	MNK 6	X	X	X
MN 24	MNK 8	-	X	X
MN 42	MNK 8	-	X	X

Multi-section rails (ZG)

Should the desired overall length of the rail exceed the maximum length specified in the brochure, some rails can be ground together. The offset between the individual guide rails does not exceed 0.002 mm. When assembling the guideways, the numbering at the junction must be observed.





## Dynamic loading capacity C

The loading capacity values for anti-friction guideways are based on the principles specified by the ISO for calculation of rolling-contact bearings (DIN ISO 281).

Dynamic loading capacity is the loading which results in a nominal operational life corresponding to a translation distance of 100 000 m (100 km) provided that the loading due to mass and direction is unchanged and the line of influence acts vertically on the rolling-contact bearing unit.

Other suppliers often indicate their loading capacities for a translation distance of 50 000 m (50 km). These values according to JIS standard are above the values according to DIN ISO. The recalculation of the loading capacities is done as follows:

$$C_{50} = 1.26 \cdot C_{100}$$

## Operational life calculation

The nominal calculated operational life L for the equivalent force P and a dynamic loading capacity C is:

$$L = (C/P)^3 \cdot 10^5 \text{ m} \quad L = \text{nominal life (m)}$$

## Operational life calculation in hours

$$L_h = \frac{L}{2 \cdot s \cdot n \cdot 60} = \frac{L}{60 \cdot v_m}$$

$L_h$  = nominal life (h)  
 $s$  = stroke length (m)  
 $n$  = stroke frequency (min<sup>-1</sup>)  
 $v_m$  = average traversing speed (m/min)

**Tightening torques for rails  
and carriages**

**Tightening torques for fastening screws DIN 912,  $\mu$  0,125 (12,9)  
and DIN 912,  $\mu$  0,2 (A2-70)**

Strengthclass	max. tightening torques [Nm]		
	M2	M3	M4
12.9	0.6	2.1	5.0
A2—70	0.3	1.1	2.6

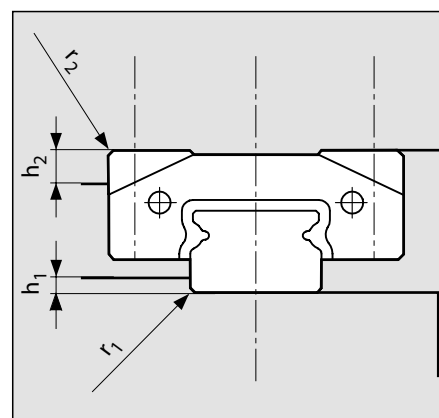
**Notes**

When the screws are greased with grease containing  $\text{MoS}_2$  the friction coefficient  $\mu$  can be reduced by as much as half. As the tightening torques required to reach the maximum permissible tightening force depend on the friction coefficient, they must be reduced accordingly. The values can be obtained from the screw manufacturer's information or from the specialist literature. If necessary, carry out tests to determine the actual friction coefficient.

Refer to the screw manufacturer's information. This is always binding.

### Configuration of the lateral locating sides

The corners between the support and locating surfaces of the surrounding structure are normally provided with a relief groove. However, if no relief groove is provided, then the dimensions tabulated below must be maintained.



Size	$h_1$	$r_1 \text{ max}$	$r_2 \text{ max}$	$h_2$
<b>7</b>	1.2	0.2	0.3	2.5
<b>9</b>	1.5	0.3	0.4	3
<b>12</b>	2.5	0.4	0.4	4
<b>15</b>	3.5	0.5	0.5	5
<b>14</b>	1.8	0.2	0.4	2
<b>18</b>	3	0.3	0.5	3
<b>24</b>	3.5	0.4	0.5	4
<b>42</b>	3.5	0.5	0.6	5

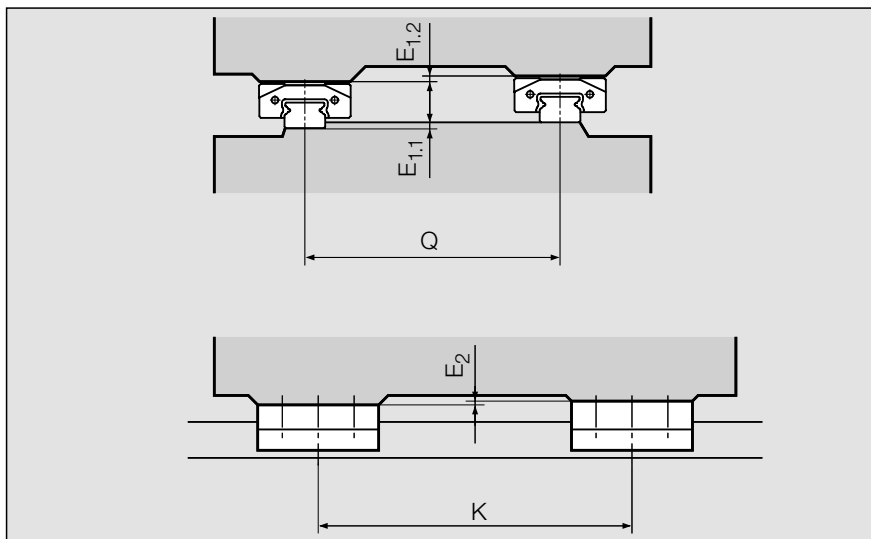
### Configuration of assembly surfaces

MINIRAIL advantages can only be achieved when mounted to a rigid, accurately machined structure.

A roughness average ratio of  $R_a$  0.4 to 1.6  $\mu\text{m}$  is recommended for support and locating surfaces.

Inaccuracies of the attachment surfaces are partially compensated by the elastic deformation of the MINIRAIL. However, they may affect overall accuracy, running behavior and operational life.

### Geometrical and position accuracy of the support surfaces

Admissible height difference  $E_1$  (use values in mm for the calculation)

	Size	Preload	
	MNNS, MNN, MNNL, MNNXL	VO	V1
<b>E1 = E1.1 + E1.2</b>	7, 9, 12, 15	0.00025 Q	0.00015 Q
<b>E1 = E1.1 + E1.2</b>	14, 18, 24, 42	0.00013 Q	0.00008 Q
	MNNS	VO	V1
<b>E2</b>	7, 9, 12, 15	0.00010 K	0.00010 K
	MNN	VO	V1
<b>E2</b>	7, 9, 12, 15	0.00005 K	0.00005 K
<b>E2</b>	14, 18, 24, 42	0.00004 K	0.00004 K
	MNNL	VO	V1
<b>E2</b>	7, 9, 12, 15	0.00004 K	0.00004 K
<b>E2</b>	14, 18, 24, 42	0.00003 K	0.00003 K
	MNNXL	VO	V1
<b>E2</b>	7, 9, 12, 15	0.00003 K	0.00003 K

### Example of calculation

Nominal:	Type	MNN 12
	Preload class	V1
	Gap Q	120 mm

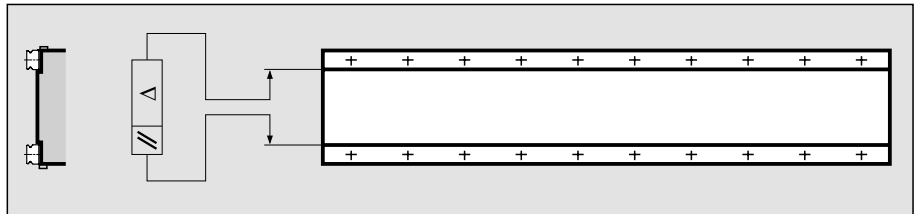
Target: Admissible height difference  $E_1$

Calculation:  $0.00015 \times 120 \text{ mm} = \underline{0.018 \text{ mm}}$

Result: The difference of  $E_{1.1}$  plus  $E_{1.2}$  ( $= E_1$ ) must not exceed 0.0180 mm.

## Parallelism tolerances of the locating surfaces

Permissible tolerances for the parallelism



Tolerances for preload class (mm)				
	7 / 14	9 / 18	12 / 24	15 / 42
<b>V0</b>	0.003	0.005	0.008	0.01
<b>V1</b>	0.002	0.003	0.004	0.005

## Mounting instructions

The installation of the MINIRAIL guideways is described in detail in the separate **Mounting Instructions MINIRAIL** and can be downloaded from [www.schneeberger.com](http://www.schneeberger.com) at menu DOWNLOADS.

## As delivered condition

MINIRAIL are delivered in protective packaging. The carriages are mounted on a plastic rail and slightly oiled for immediate operation.



## Transportation and intermediate storage

MINIRAIL are highly precise components, which have to be treated with care. As a protection against damage, the following instructions should be followed:

- Always store and transport MINIRAIL in their original packaging.
- Protect the guideways against impacts and dampness/humidity.

## Ordering information MINIRAIL

The MINIRAIL carriage and rail must be ordered as separate items.

		Ordering example:	___	MNN	12	-G3
<b>Carriage</b>						
Quantity	___					
Carriage type	MNNS**, MNN, MNNL, MNNXL**					
Size	7, 9, 12, 15, 14, 18, 24, 42					
Accuracy class	G1, G3					

\*\* Not available for sizes 14, 18, 24 and 42

		Ordering example:	___	MN	9	-155	-7.5	-7.5	-G1	-V1	-ZG
<b>Rail</b>											
Quantity	___										
Rail type	MN										
Size	7, 9, 12, 15, 14, 18, 24, 42										
Rail length	L <sub>3</sub> (in mm)										
Starting hole pitch	L <sub>5</sub> (in mm)*										
End hole pitch	L <sub>10</sub> (in mm)*										
Accuracy class	G1, G3										
Preload class	V0, V1										
Multi-part rails	ZG										

\* Indicate only if special pitch

### Accessories

		Ordering example:	___	MNW
<b>Re-lubrication set</b>				
Quantity	___			
Type	MNW			

		Ordering example:	___	MNK	6
<b>Plastic plugs</b>					
Quantity	___				
Type	MNK				
Size	4, 6, 8				

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- MINERAL CASTING SCHNEEBERGER
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- MINISCALE miniature guideway with integrated measuring system
- MINISLIDE micro frictionless tables
- MONORAIL AND AMS profiled linear guideways with integrated measuring system
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- POSITIONING SYSTEMS
- SLIDES



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