

Miniature plain guidance systems

maintenance-free



Miniature plain guidance systems

Miniature plain guidance systems are ready-to-fit, maintenance-free guidance systems for stroke lengths of up to 3 metres. They have good sliding characteristics, are suitable for dry running, have adjustable clearance and are highly resistant to chemical influences.

In terms of design space, miniature plain guidance systems have the same mounting dimensions as miniature linear recirculating ball bearing and guideway assemblies.

The units are produced in various carriage sizes and guideway lengths, giving cost-effective designs.

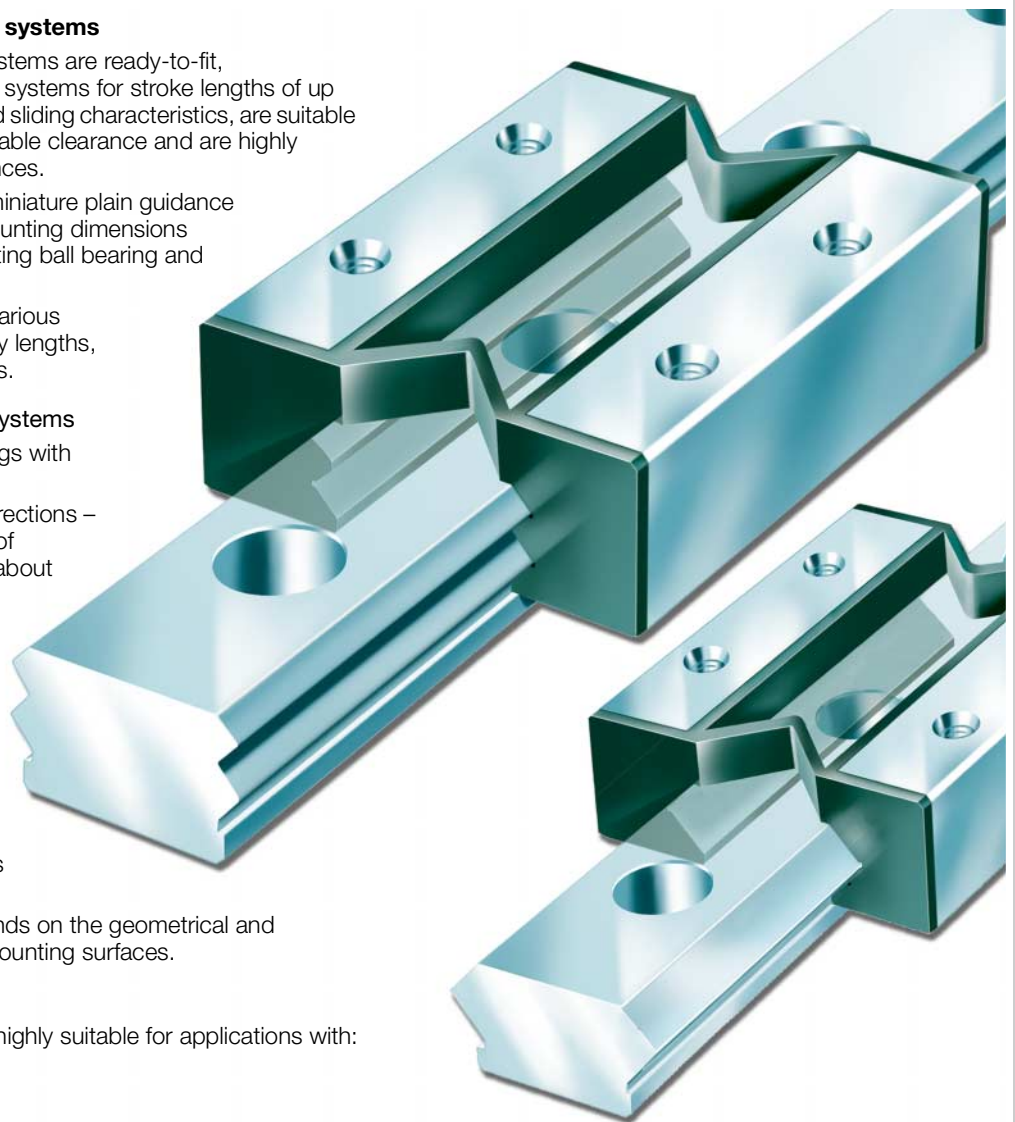
Miniature plain guidance systems

- are linear locating bearings with at least one carriage
- support loads from all directions – apart from the direction of motion – and moments about all axes
- operate substantially free from stick-slip
- are wear-resistant
- are insensitive to contamination
- are highly suitable, due to their aluminium design, for use in lightweight constructions made from aluminium
- do not place high demands on the geometrical and positional accuracy of mounting surfaces.

Applications





The guidance systems are highly suitable for applications with:

- low loads
- moment loads
- dry running
- severe contamination.



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Features

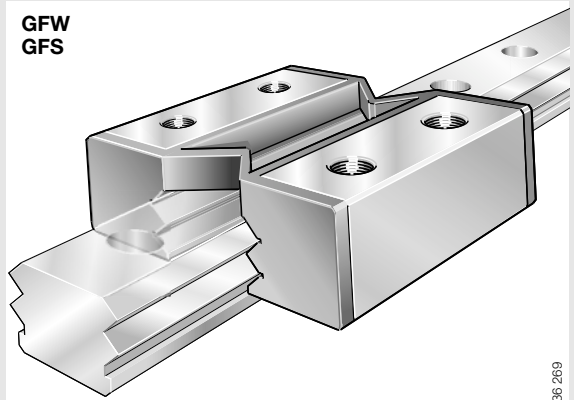
Miniature plain guidance systems

- of these series are ready-to-fit units comprising:
 - at least one carriage with a sliding layer and spring crosspieces
 - one guideway
- are not preassembled
 - Guideways and carriages are supplied separately. Carriages and guideways can be used in any combination
- have a sliding material layer with very low water absorption capability
- are supplied with guideways up to 3 000 mm in length
- can be lubricated with oil or grease.

Miniature plain guidance systems



**GFW
GFS**

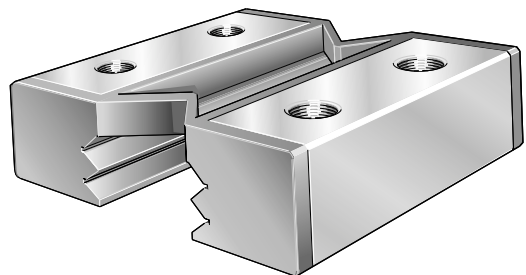


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- basic design comprising:
 - carriage with a sliding layer, end faces and spring crosspieces
 - guideway
- suitable for operating temperatures from $-40\text{ }^{\circ}\text{C}$ to $+80\text{ }^{\circ}\text{C}$

Carriage

GFW

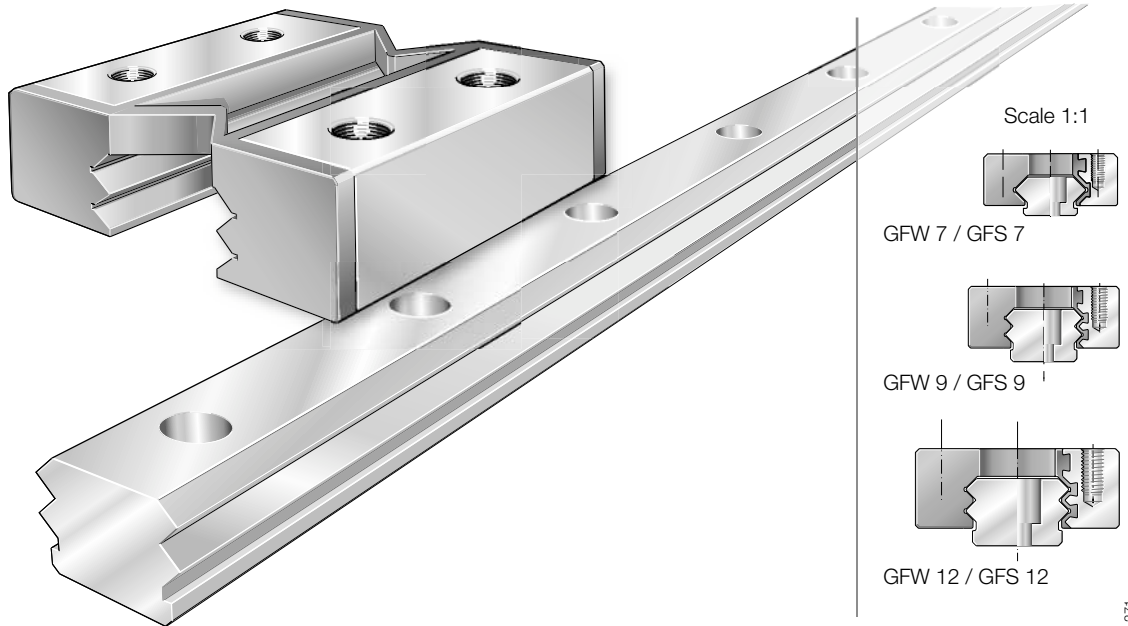


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- saddle plate made from extruded aluminium, anodized
 - end faces and holes not anodized
- sliding layer, end faces and spring crosspieces made as a single component from plain bearing material and rigidly fixed to the two saddle plate elements

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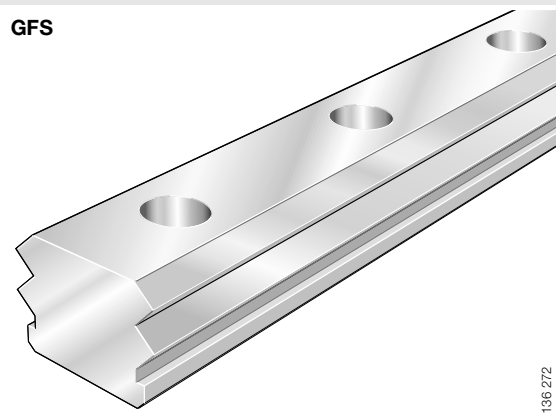
**GFW
GFS**



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Guideway

GFS



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- extruded aluminium, anodized
– end faces and holes not anodized
- slideways on both sides for the carriage
- counterbored through holes for the fixing screws

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Design and safety guidelines

Permissible operating data



Do not exceed the values in Table 1!

Table 1 · Technical data

| Features | Symbol | Value |
|------------------------------------------------------|--------------|-----------------------------|
| Maximum pv value for dry running | $p_{v \max}$ | 0,2 N/mm ² · m/s |
| Permissible specific load carrying capacity (static) | p_{\max} | 4 N/mm ² |
| Permissible sliding speed for dry running | v_{\max} | 1 m/s |

Location of guideways and carriages

Standard location method for miniature plain guidance systems (Figure 1). For special operating conditions or special applications, please consult INA.

In order to avoid location defects, the holes must be carefully deburred.

Hole patterns

The guideways have a symmetrical hole pattern.

In this case:

- $C_5 = C_6$ where $C_{5 \min} \leq C_5 \leq C_{5 \max}$ and $C_{6 \min} \leq C_6 \leq C_{6 \max}$ (Figure 2a).

In the case of an asymmetrical hole pattern:

- $C_5 \neq C_6$ (Figure 2b).

For guideways with a symmetrical hole pattern:

$$C_5 = C_6 = \frac{1}{2} (L - n \cdot C_4)$$

C_5, C_6 mm
Distance between start or end of guideway and nearest hole

L mm
Length of guideway

n -
Maximum number of pitches between holes

C_4 mm
Hole spacing (*Dimension table*).



The minimum and maximum values for C_5 and C_6 must be observed (*dimension table*)! If they are not adhered to, the cut end of the guideway may intersect the counterbore of a hole!

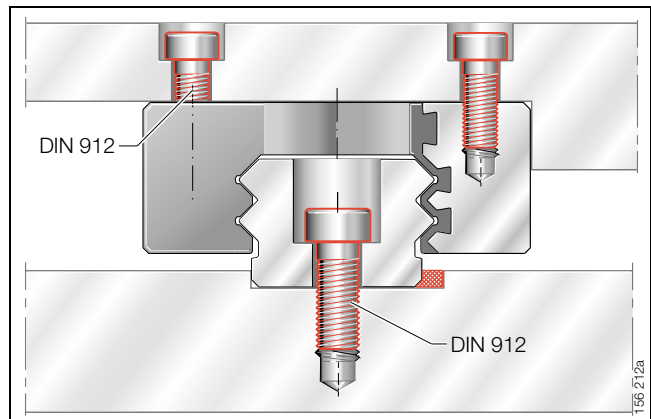


Figure 1 · Location of guideways and carriages

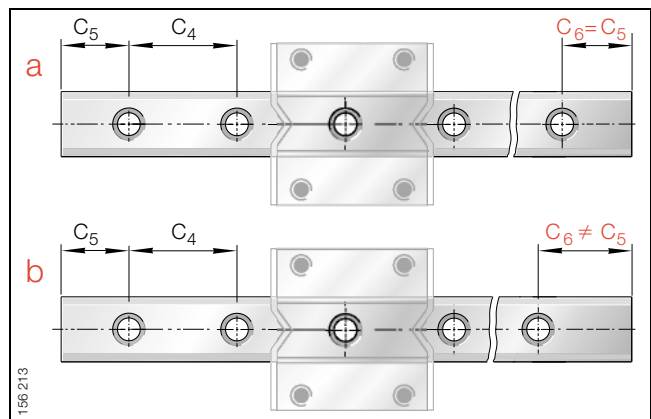


Figure 2 · Symmetrical (a) and asymmetrical (b) hole pattern

Bearing clearance

Before the carriage and guideway are fitted, they have clearance in relation to each other.

The permissible bearing clearance is dependent on:

- the load
- the sliding speed
- the temperature
- the cycle time
- any lubrication used.

Set the bearing clearance to 0,1 mm in the following cases:

- maximum load
- maximum travel velocity
- 100% operating duration
- dry running.

Setting the bearing clearance

The bearing clearance can be set:

- by means of a screw in the adjacent construction (Figure 3) or
- by pressing the carriage onto the guideway by hand and tightening the screws in the carriage in this position (Figure 4).

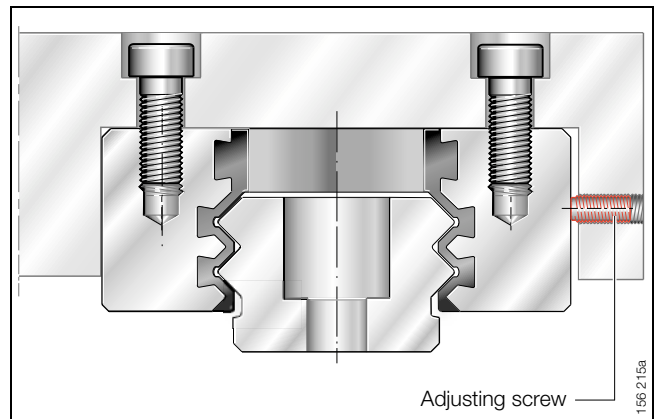


Figure 3 · Setting the bearing clearance – using an adjustment screw

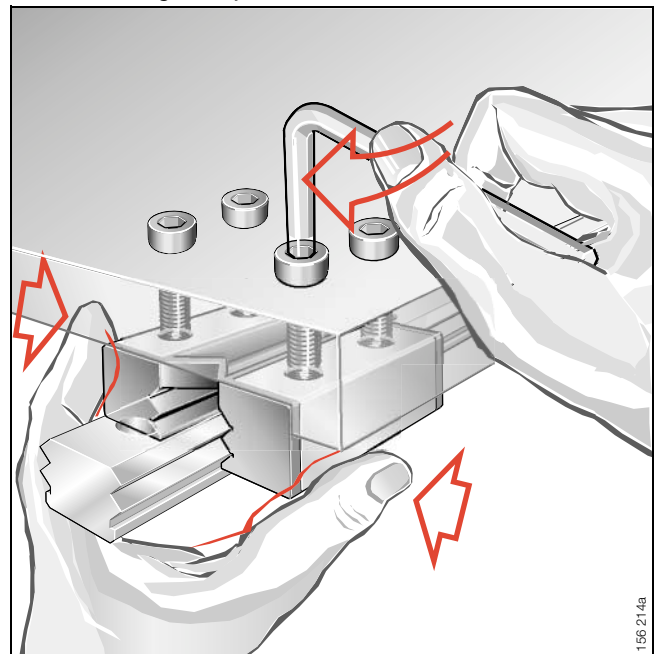


Figure 4 · Setting the bearing clearance – by hand

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Design of bearing arrangements

The design of a bearing arrangement with miniature linear plain guidance systems is essentially determined by the requirements for:

- accuracy
- smoothness of running
- load carrying capacity.

This has a direct influence on the adjacent construction and primarily concerns:

- the geometrical and positional accuracy of the mounting surfaces
- the location of the guidance elements.

! Ensure that the adjacent construction has adequate strength – VDI guideline 2 230!

Geometrical and positional accuracy of the mounting surfaces

The higher the requirements for accuracy and smooth running of the guidance system, the more attention must be paid to the geometrical and positional accuracy.

Observe the tolerances for the support and locating surfaces in accordance with Figure 5 and Figure 6

- surfaces should be precision milled. A mean roughness value of $R_a3,2$ should be achieved.

! If these tolerances are not met,
 – this will impair the overall accuracy of the guidance system
 – the clearance will be affected
 – the operating life of the guidance system will be reduced!

The parallelism deviation and the height difference ΔH (Figure 5) should never in total exceed the clearance set (ΔH in μm is the maximum permissible deviation from the theoretically precise position)

- Setting the bearing clearance: see page 5.

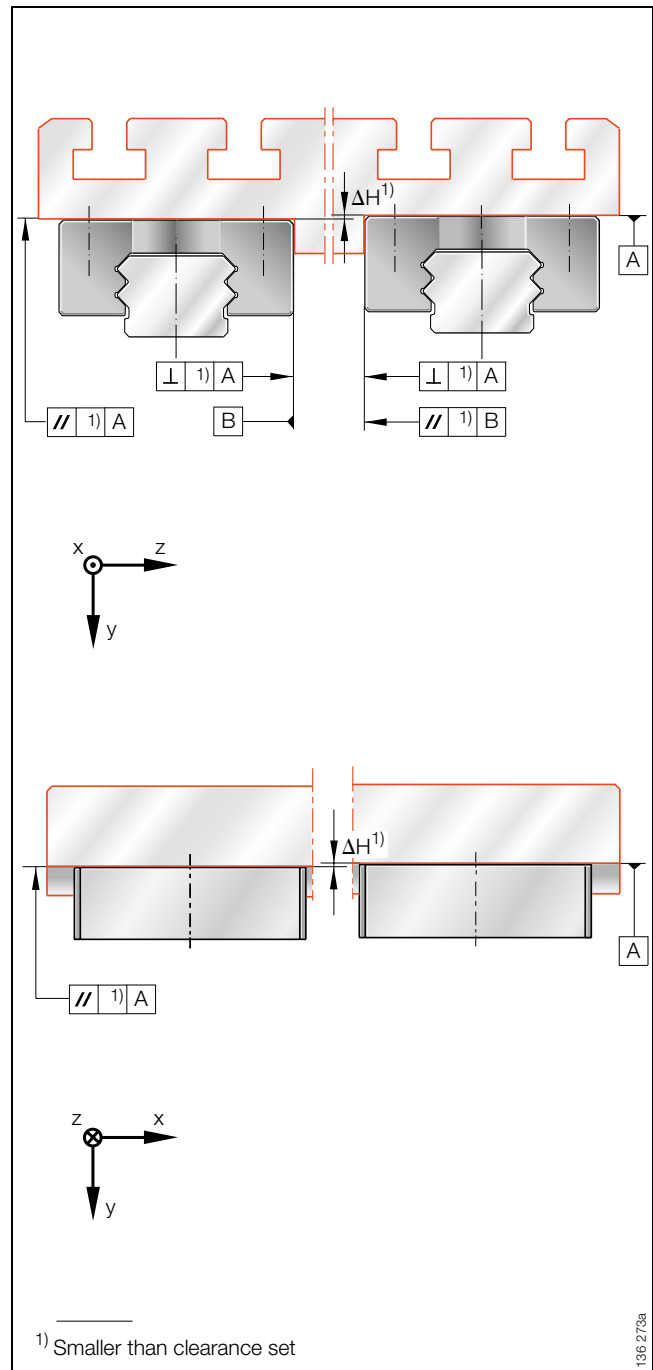


Figure 5 · Tolerances for mounting surfaces

Parallelism of mounted guideways

For guideways arranged parallel to each other, the parallelism value t given in Figure 6 and Table 2 should be adhered to

- if the maximum values are exceeded, a larger clearance must be set.

Table 2 · Parallelism of mounted guideways

| Miniature plain guidance system | Guideway | Parallelism ¹⁾ t |
|---------------------------------|-------------|-------------------------------|
| Designation | Designation | μm |
| GFW 7/GFS 7 | GFS 7 | 20 |
| GFW 9/GFS 9 | GFS 9 | 25 |
| GFW 12/GFS 12 | GFS 12 | 30 |

¹⁾ Dependent on clearance.

Locating heights and corner radii

Locating heights and corner radii should be in accordance with Figure 7 and Table 3.

Table 3 · Locating heights and corner radii

| Miniature plain guidance system | Locating heights and corner radii | | | |
|---------------------------------|-----------------------------------|------------|------------|------------|
| | h_1 | h_2 max. | r_1 max. | r_2 max. |
| GFW 7/GFS 7 | 3 | 1 | 0,4 | 0,2 |
| GFW 9/GFS 9 | 4 | 1,5 | 0,4 | 0,4 |
| GFW 12/GFS 12 | 5 | 2 | 0,4 | 0,4 |

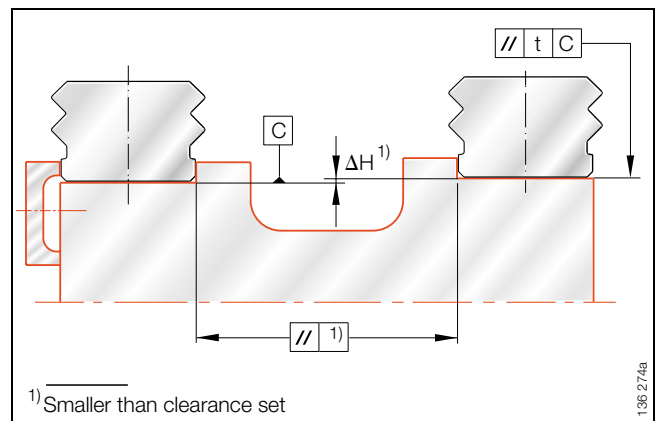


Figure 6 · Parallelism of mounted guideways

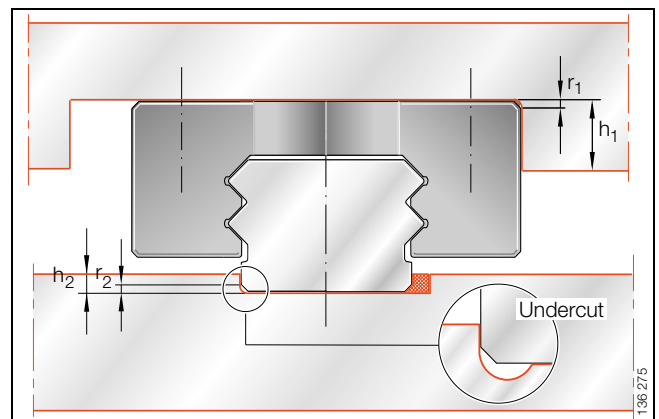


Figure 7 · Locating heights and corner radii

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Accuracy

Accuracy classes available: see Figure 8 and Table 4.

Table 4 · Accuracy class

| Miniature plain guidance system Guideway Designation | Accuracy class ¹⁾ |
|------------------------------------------------------------|------------------------------|
| GFS | G4 |

¹⁾ The accuracy class is stated in relation to the parallelism of the guideway. The values in Table 5 are dependent on the clearance set and are therefore only valid under certain conditions.

Parallelism of raceways to locating surfaces

Parallelism tolerances of guideways: see Figure 8.

Tolerances of reference dimensions for locating surfaces

The tolerances are arithmetic mean values (Figure 9 and Table 5). They relate to the centre point of the screw mounting or locating surfaces of the carriage. The dimensions H and A₁ should always remain within the tolerance irrespective of the position of the carriage on the guideway.

Table 5 · Accuracy class and tolerances

| Tolerance | Accuracy class |
|----------------------------|---------------------|
| | G4 μm |
| for height ¹⁾ | H ±150 |
| for distance ¹⁾ | A ₁ ±200 |

¹⁾ When set free from clearance.

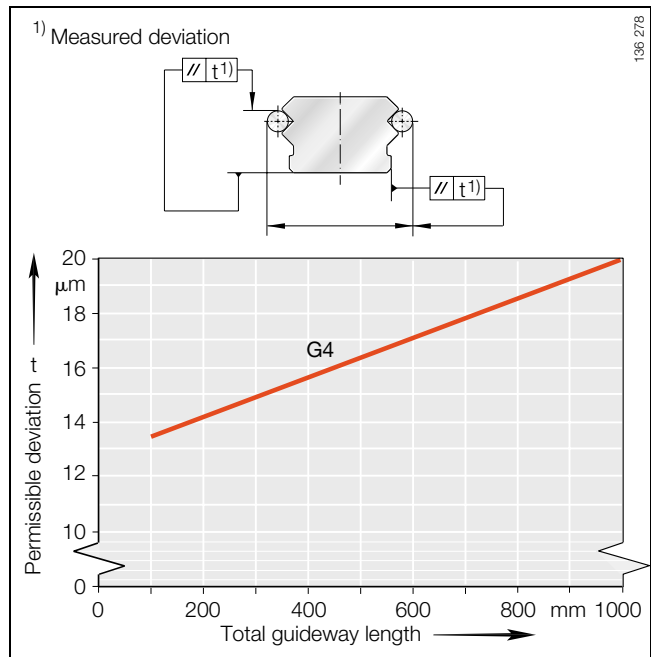


Figure 8 · Accuracy class and parallelism tolerances of guideways

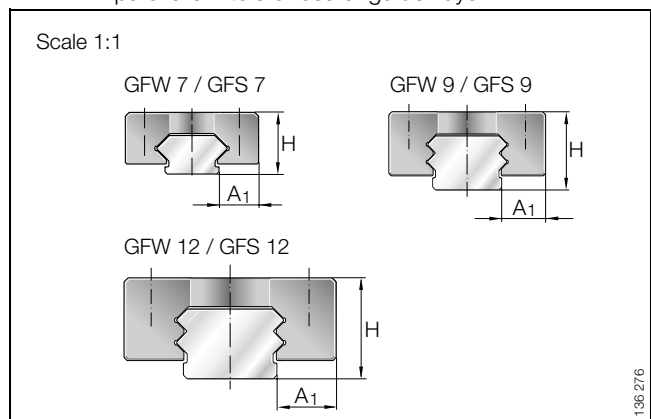


Figure 9 · Reference dimensions for accuracy

Length tolerances for guideways

Tolerances: see Figure 10 and Table 6.

Table 6 · Length tolerances

| Miniature plain guidance system Guideway | Tolerances | |
|---------------------------------------------|---------------------|------------------------------|
| | Guideways/carriages | |
| Designation | L ≤ 300 mm | L > 300 mm |
| GFS | ±0,05 mm | ±0,15% of guideway length |

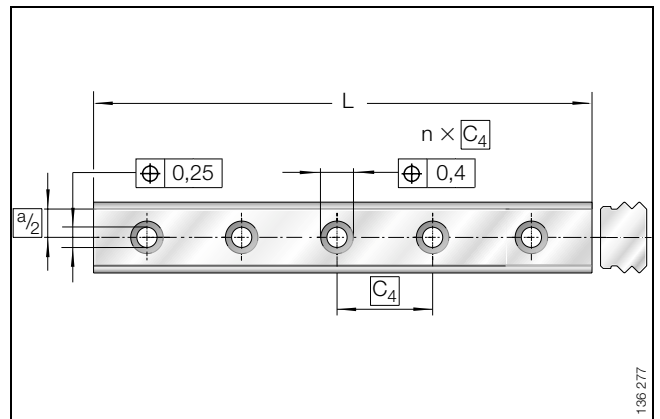


Figure 10 · Length tolerances



Ordering example and ordering designation

Guideways and carriages must be ordered separately.

Miniature plain guidance system with

two carriages GFW 9

one guideway GFS 9

Guideway length 1 000 mm

Hole pattern symmetrical

Ordering designation:

2 off GFW 9 (Figure 11)

1 off GFS 9/1 000 (Figure 11).

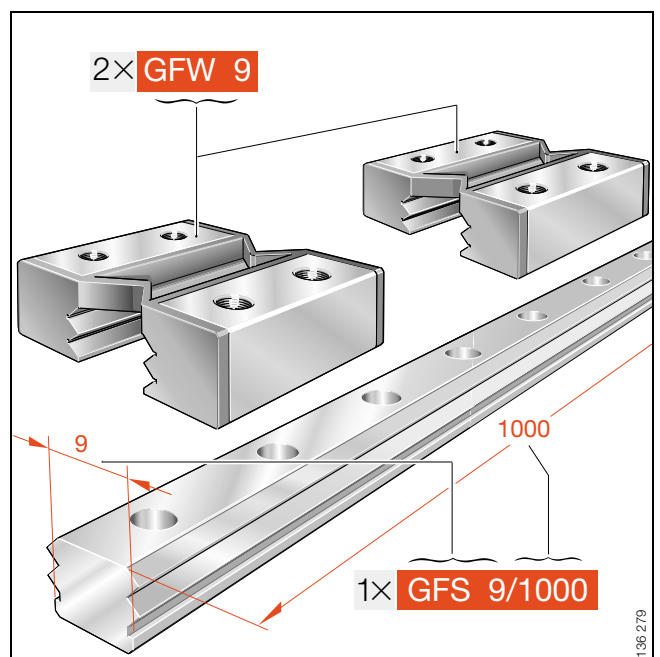


Figure 11 · Ordering example, ordering designation

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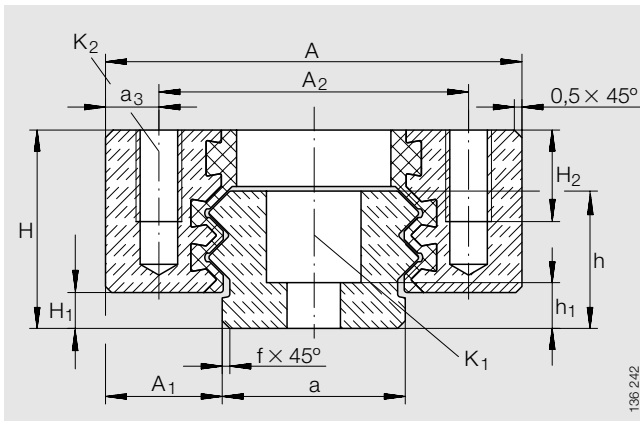
Series GFW/GFS

| Dimension table · Dimensions in mm | | | | | | | | | | | | |
|------------------------------------|------------|---------------|--------------|------------|----|------|------|----|-----------------|---------------------|----------------|----------------|
| Carriage | | Guideway | | Dimensions | | | | | | Mounting dimensions | | |
| Designation | Mass ≈g | Designation | Mass ≈g/m | H | A | C | h | a | L ¹⁾ | A ₁ | A ₂ | a ₃ |
| GFW 7 | 4 | GFS 7 | 100 | 8 | 17 | 23,5 | 5 | 7 | 3 000 | 5 | 12 | 2,5 |
| GFW 9 | 7 | GFS 9 | 160 | 10 | 20 | 30 | 6,75 | 9 | 3 000 | 5,5 | 15 | 2,5 |
| GFW 12 | 13 | GFS 12 | 290 | 13 | 27 | 34 | 9 | 12 | 3 000 | 7,5 | 20 | 3,5 |

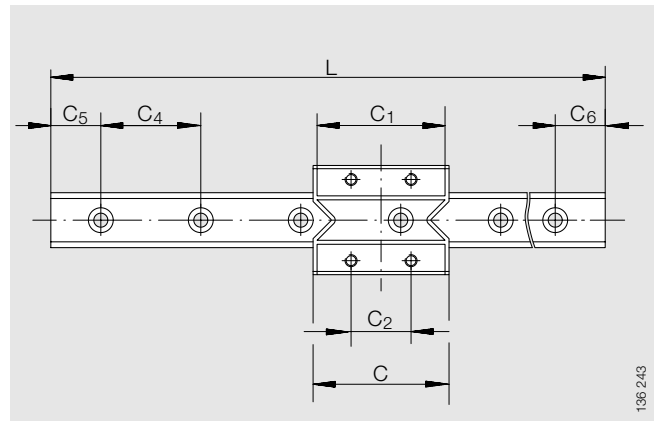
1) Maximum guideway length L.

2) The dimensions C₅ and C₆ are dependent on the guideway length.

3) For a carriage at a sliding speed of 0,5 m/s.



GFW, GFS



GFW with GFS · top view

| | | | | | | | | | | | | | Basic load ratings | |
|----------------|----------------|----------------|------------------------------|------|------------------------------|------|-----|----------------|----------------|----------------|----------------|----------------|---------------------|----------------------|
| C ₁ | C ₂ | C ₄ | C ₅ ²⁾ | | C ₆ ²⁾ | | f | H ₁ | H ₂ | h ₁ | K ₁ | K ₂ | C ₀ N | C ³⁾ N |
| | | | min. | max. | min. | max. | | | | | | | | |
| 21,5 | 8 | 15 | 5 | 12 | 5 | 12 | 0,3 | 1,3 | 3 | 1,4 | M2 | M2 | 213 | 21,3 |
| 28 | 13 | 20 | 5 | 17 | 5 | 17 | 0,5 | 1,7 | 4 | 2,5 | M2 | M2 | 397 | 39,7 |
| 32 | 15 | 25 | 5 | 21 | 5 | 21 | 0,5 | 2,35 | 6 | 3 | M3 | M3 | 481 | 48,1 |



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