



Linear and Motion Solutions

Linear guide systems

NEW
circular rails,
adjustment plates



EP 2408 E

Linear guide systems



NADELLA

Summary

GU System	Guide rails GU..M, GU..MT
	Guide Rollers RKU
	Guide Wheels FKU
	Lubricator LUBU
	Guide pins SAG
ROLBLOC System	Guide rails GU..M, GU..MT
	Carriages ROLBLOC MBL
	Carriages ROLBLOC BL
	Adjustment plates PR
FS System	Sand blasted guide railse FS..MT
	Ground guide rails FS..M
	Sand blasted guide rails FSH..MT, FSX..MT
	Ground guide rails FSH..M, FSX..M
	Sand blasted socket guide rails FSB..MT
	Guide Rollers FR..EI
	Guide Rollers FRN..EI
	Floating Guide Rollers FRLK.., FRLR..
	Guide Rollers RKY, RKX
	Guide Rollers FKY, FKX
	Lubricator LUBY - LUBX
FSR System	Circular rails FSR..M
	Oval circuit FSRO
	Ring circuit FSRQ
	Steering carriages T4R...
	Bend rails FSRV..MT

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

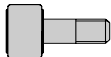















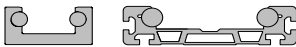
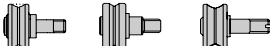






NEW

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	27	For medium-heavy loads Dirty environment
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	34	For all applications
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	51	For all applications
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Summary

GP System	Guide rails GP..MC
	Ground guide rails GP..M
	Guide Rollers PK
	Guide Wheel FK
	Guide Rollers GC
	Lubricator LUBP
DC, C Systems	Guide rails DC
	Guide rails C
	Guide Rollers PFV
	Guide Rollers RKO
	Carriages T4PFV
	Wipers NAID
	Lubricator LUBC
FWS, FWH Systems	Guide rails FWS
	Guide rails FWH
	Guide Rollers FR..EI
	Guide Rollers FR
	Guide Rollers FR..AS
	Guide Rollers FR..AZ
	Carriages T4FR
FWN Systems	Guide rails FWN
LM Systems	Guide rails LM
	Guide Rollers RCL, RCP, PFV
	Floating Guide Rollers RAL
	Guide Wheels GLA
	Carriages C3RCL, C3RAL, C3RYL
	Carriages C4RCL, C4RAL, C4RYL
	Carriages T4RCL, T4RCP, T4PFV, T4RAL, T4RYL
	Lubricator LUBM

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	69	For medium loads Aggressive environment
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	80	For light-medium loads
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	90	For light-medium loads
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Nadella Linear System

With this line of products, NADELLA confirms the aim to provide manufacturing solutions tailored to the user's needs in order to achieve simple automation at a low cost.

The process under way of transferring production automation and relevant handling onto increasingly heavier and cumbersome units has prompted us to seek original and flexible components for the different commodity sectors.

We have accumulated sound working experience in the following sectors:

- marble-working machinery
- foundry machinery
- metal sheet working machinery
- special lifting machines
- pick up
- automatic warehouses
- textile machines
- machine tool protections and utilities
- oxygen cutting machines

Our Technical Department works with Customers and recommends the best component choice by making the calculations needed to determine the best life.

Guides

Length

The maximum length of each single guide component is shown on the dimensional tables.

The standard lengths of the rails are determined by adding the product of the fixing hole centre distance and the number of holes to twice the end dimension (see dimensional tables).

The following table provides the standard length tolerance.

Length	≥ 150 < 420	≥ 420 < 1.050	≥ 1.050 < 2.040	≥ 2.040 < 4.020	≥ 4.020 < 5.280
Length tolerance	±0,5	±0,8	±1,2	±2	±2,5

Joints

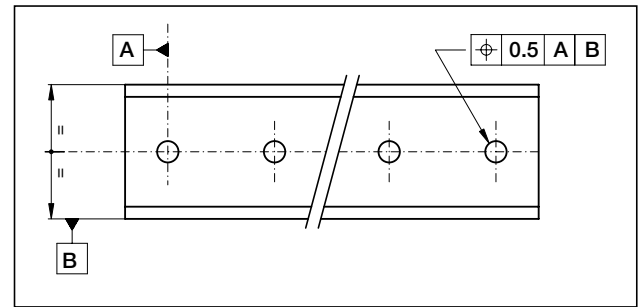
For strokes of greater length, the guide components can be joined after grinding the end faces (suffix R or RR). To maintain the hole centre distance tolerance, when ordering always specify the number of individual rails making one continuous length.

Please specify in the order when rails have to be matched.

Fixing holes

The guides are available with standard holes, as shown in dimensional tables, with special hole layout or without holes (see order code referencing)

Standard tolerance for hole position is $\pm 0,25$ mm



The standard boring layout is designed to fit most common application requirements, but connection strength has to be evaluated on the application case.

Steel guides

General

Steel rails are made of bearing steel to give best stability and durability. Raceways are induction hardened to achieve 58 HRC hardness minimum. The rail core remains soft to allow easy machining. Rails can be provided with different finishes to meet specific application requirements.

Guide rails MT type. Profile is produced by cold drawing process, raceways are induction hardened and sandblasted to improve surface strength and finish.

Guide rails M type. Profile is usually produced by cold drawing process, induction hardened on raceways and ground to improve surface finish and profile geometry and **to remove the partially decarburised surface** (0.1 mm max on cold drawn rails ..MT). Ground rails have to be used when there are high loads, heavy-duty cycles or when there is a high accuracy requirement.

Guide rails MC type (flat rail GP..MC only). MC rails are induction-hardened on every side and finish by-a-rough grinding.

Options

Corrosion protection

For use in oxidising environments or in the presence of corrosive agents, the guides are available with chemical nickel-plating protective anticorrosion treatment (suffix NW.).

This treatment features substantial mechanical characteristics together with a resistance to salty mist corrosion superior to that of hard chrome.

Circular rail

On request circular rails can be provided. Circular rails can be used as an alternative to rotating devices or as junction between straight rails.

Technical features

Standard rail straightness (for non-mounted rails) is 0.5 mm/m max. Higher accuracy can be supplied on request.

Temperature

Standard operating temperature range is -20°C up to 150°C . In lower or higher temperature applications please contact Nadella Technical Service. Special care is required if guide rollers are operating at maximum temperature.

Aluminium guides

General

Made by joining an aluminium alloy support element and hardened steel rods that form the sliding surfaces.

The best features of the two materials and relevant working technologies are combined to give the lightness of the alloy and the hardness and surface finish of the rods.

Guides of this type can be used for structural functions; they have a high moment of inertia that enables them to be used in many applications as carrying structures.

Aluminium extruded profiles are stabilised and anodised.

Sliding rods are induction hardened and ground.

Options

Corrosion protection

For use in oxidising environments or in the presence of corrosive agents, the guides of this series can feature stainless-steel bars (suffix NX).

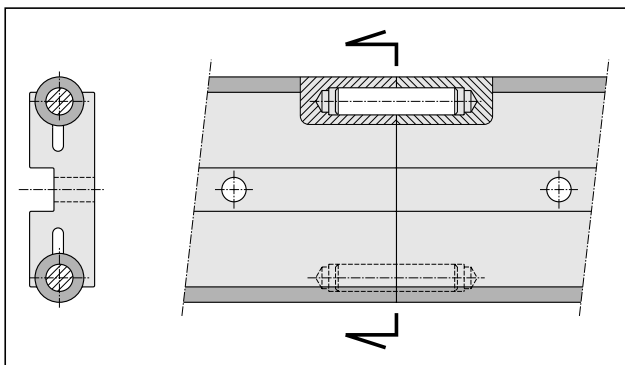
Chromium-plated rods

Optional chromium-plated rods are available (suffix CH); the thickness of the chromium plating is $10 \pm 5 \mu\text{m}$ with hardness $\geq 800 \text{ HV}$.

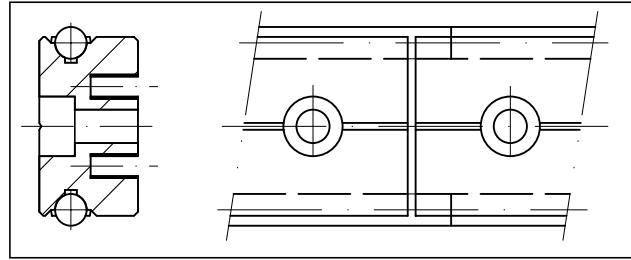
Please check option availability in dimensional tables.

Joints

In case rail made by multiple C-DC or LM rails the most efficient joint can be realized with the insertion of a dowel pin inside the rods. This solution allows for simple assembly at the site and maintains alignment under load.



For rails FWS the joint can be realised by protruding the rods of one rail in order to engage them in the profile of the next rail. In the final configuration there will be a small gap between the aluminium profiles (see next drawing).



Technical features

Standard rails straightness (for non mounted rails) is 0.5 mm/m maximum. Higher accuracy can be supplied on request.

Temperature

Standard operating temperature range is -20°C up to 70°C . Applications with frequent temperature variation should be avoided. For operating conditions outside the given range please contact Nadella Technical Service

Guide rollers

General

Nadella provide a wide range of guide rollers to be able to meet different technical and economic requirements.

All guide rollers are produced in concentric and eccentric versions to allow backlash adjustment during assembly on final equipment. Eccentric rollers are identified by additional R in the code.

The sides of the races of the guide roller, except guide rollers FR,FR..AS,FR..AZ, are slightly convex. Besides reducing rolling friction, this also permits offsetting slight guide flexing or small assembly alignment errors.

Guide rollers are fitted with seals for bearing protection and lubricant retention as described in dimensional tables.

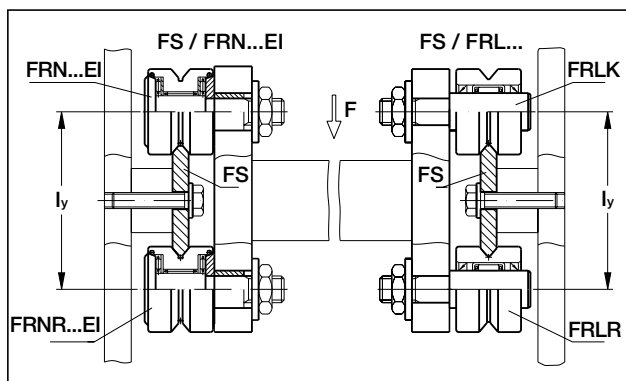
Guide rollers based on **needle or tapered roller bearings** (FRN..EI,RK..,PK..) are recommended for critical applications with heavy axial loads and/or shock loading. Guide rollers based on **ball bearings** (FR..FR..EI,RCL) are more suitable for lighter loads or high dynamic systems.

The carriages based on Rolbloc's system are recommended for applications with heavy loads, high frequency of work and aggressive environment (dust, abrasive).

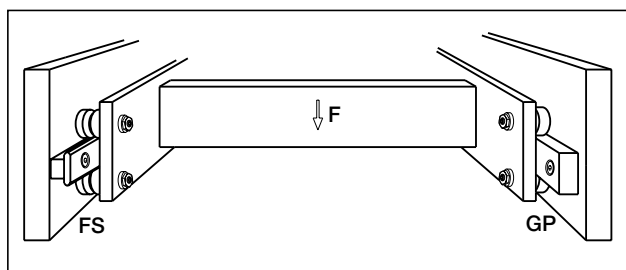
When mounting guide rails opposite to each other with connected carriages, as shown in the sketch, a high level of parallelism between the guide rails is required when axially rigid rollers are used.

To avoid operating problems it is recommended to use axial rigid fixed rollers on one carriage e.g.

FRN/FRNR...EI and axial movable rollers on the other carriage e.g. FRLK/FRLR. Movable rollers allow a little misalignment between the opposite mounted guide rails.



Another solution is to use one profiled guide rail e.g. FS and on the opposite side a flat rail e.g. GP in connection with rollers GC or PK.



Technical features

Lubrication

Guide roller FRN..EI permits bearing relubrication. All other guide rollers are long life lubricated.

Temperature

Guide roller should not operate at constant temperature above 80°C. For short durations 100°C can be accepted. For higher temperature please see the “option section”.

Speed limit

Max velocity has to be determined for each application relevant to the guide roller type, size and load conditions. As general value, in normal conditions maximum speed is 4 m/sec. Contact Nadella Technical service in case of specific request.

Options

Corrosion protection

For uses in oxidising environments or in the presence of corrosive agents, the guide rollers are available in stainless steel (suffix NX). Check in the dimensional table component availability.

Stainless steel used in stainless steel guide rollers belongs to families AISI 440 and AISI 420. Guide rollers equipped with ball bearings (FR..EI, GLA, RCL, RCP..NX) are completely manufactured in stainless steel. Guide rollers equipped with needle

bearings (FRN..EI NX) and tapered bearings (RK.., FK.., PK.. NX) are internally equipped with standard bearing steel bearings.

High temperature

On request guide rollers can be equipped with Viton seals to operate at temperature up to 120° (suffix V). Check in the dimensional table component availability.

Accessories

Tables and carriages

Standard table and carriages for C-DC and LM systems incorporate a black anodised aluminium plate fitted with guide rollers.

Wipers

Standard wipers NAID for C-DC rails are made from NBR compound moulded on a steel plate.

Lubricators

Are composed by two main parts: a plastic box with the same shape profile of the rail, and a lubricated felt; the felt is slightly pressed on the raceways by a spring. The plastic box, that drags the raceways, works as a wiper, and remove dust and shavings.

The plastic box can be mounted directly on the guide rollers plate by the appropriate aluminium plate included in the kit.

In the lubricators for guide rollers size 52 or higher, the grease nipple allows an easy connection with a re-lubrication system.

For the simply lubrication of the rails you can use one lubricator only on each raceway; in order to wipe the raceways it is better to mount two lubricators, before and after the carriage.

The lubricators are supplied with the felt already lubricated.

Lubrication

Bearing lubrication

All the guide rollers, except for the FRN..EI, based on needle bearings, are equipped with long life lubricated bearings. This means that the grease inside the bearing is enough for the entire life of the roller guide. The roller guide type FRN..EI, with needle bearings, accommodates the re-lubrication of the bearings.

Rail lubrication

Rails must be lubricated. This allows reducing the friction, to reach the calculated lifetime of the system and to work at high speed.

No or insufficient lubrication will cause rapid deterioration. The typical signal of tribocorrosion is the presence of a red/dark oxide and rapid wearing of the rail and guide rollers.

The lubrication of the rail, the working environment and the load must be considered all together for a correct estimation of the lifetime of the guide system.

Generally speaking, for application with low duty frequency, a periodic relubrication with a grease or with a viscous oil will sufficiently maintain the lubrication film. The re-lubrication interval depends on the application and must always be tested in the real working conditions. In a system with ground rails and short stroke without lubricators, you can consider a re-lubrication interval every 100,000 cycles. Increasing the load, speed or stroke, or using an under sized bearing will increase lubrication demand and result in a shorter lubrication interval. For a constant lubrication we suggest the use of felt lubricators to ensure a constant layer of lubricant between guide rollers and raceways.

The recommended lubricants are greases and oil for bearings, linear rails or chains, with a high viscosity of the basic oil and with EP additives, in order to separate the metallic surfaces even with low speed.

Assembly instructions

Guide rollers

The eccentric guide rollers allows the preload or clearance of the carriage to be adjusted independently of the guide roller mounting hole positioning tolerance or the distance between the rails.

Recommended mounting hole tolerance is H7.

When adjusting the eccentric guide roller care has to be taken to avoid excessive preload. Excessive preload can reduce the life of the linear system.

Set the preload turning the guide roller counterclockwise so that any movement caused by vibration will cause the nut to be tightened. Ensure the preload is not increased when tightening the nut.

A simple way of setting a roller preload is as follows:

- 1 move the slider on the guide, holding the roller being adjusted with two fingers to prevent it from rotating
- 2 increase the preload by means of the wrench
- 3 repeat step 1 making sure the roller slides without rolling
- 4 when it is no longer possible to prevent roller rolling, slightly decrease the preload and fully tighten the lock nut, thereby setting the position of the eccentric.

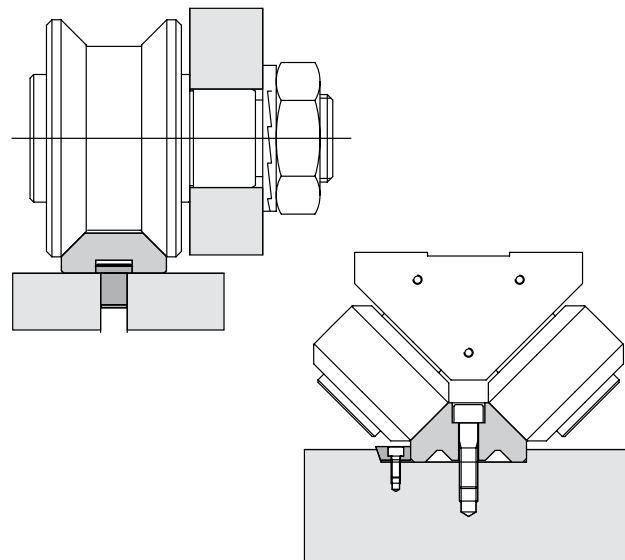
When correctly adjusted it is just possible to cause the guide roller to slip on the guide rail when a torque is applied to the roller.

Guides

For single guide rail type FS, FWS, DC and LM no special assembly instructions are necessary. For multiple parallel rails parallelism has to be checked to avoid guide rollers overload or excessive carriage play. When constant preload is required parallelism error has to be lower than 0.050 mm.

Connection between the rail and the mounting surface has to be designed accordingly with the operating condition to ensure proper product positioning and functionality.

The direction and intensity of the load, the number and strength of the screws, the geometry of mounting surfaces, use of pins or wedges have to be evaluated to fully utilize the linear guide load capacity.



Carriages

Carriages are supplied with concentric guide rollers nut tighten already. Eccentric guide rollers have to be set and tighten during final assembly operation by customer.

Calculation procedure

Calculation is carried out in two steps, first defining the forces on the most heavily loaded roller and then estimating the safety factors and life.

Calculating the loads on the guide rollers

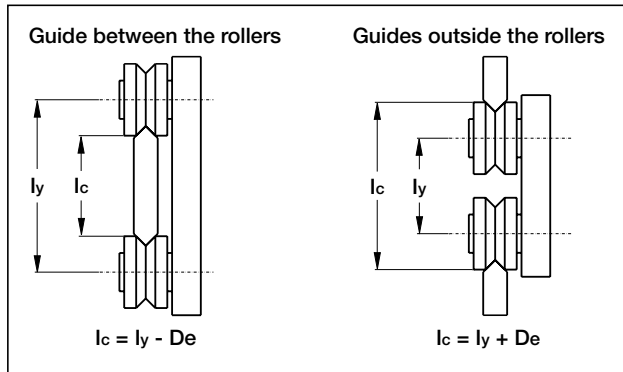
In the case of complex load situations, with forces acting in different directions, calculating the reactions on the rollers is difficult and hard to simplify.

In the event of the applied load having a direction parallel to one of the co-ordinate axes, the radial P_r and axial P_a components of the reactions on the most loaded roller can be obtained using elementary formulas.

With reference to the diagrams shown, we obtain the load components on the rollers relevant for checking and calculating the life, applying the following methods.

Angle α in the formulas is half the groove angle. Look in the dimensional table notes for the correct value.

Distance l_c is the effective contact distance. With the exception of ROLBLOC system the correct value is calculated as the guide rollers centre distance across the rail plus or minus the outer guide roller diameter, depending if the guide is outside or between the rollers.



In case of ROLBLOC the distance l_c is the distance between the rails basis.

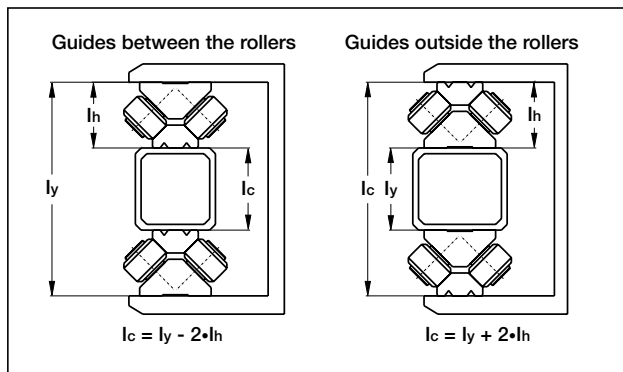
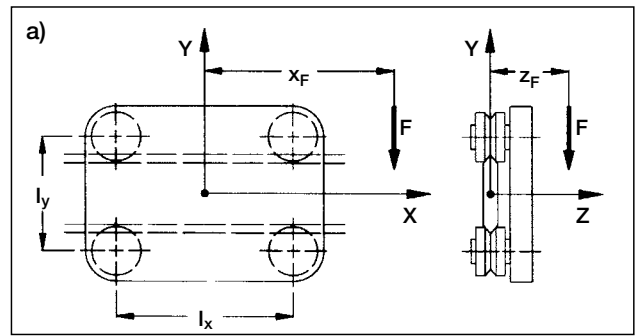


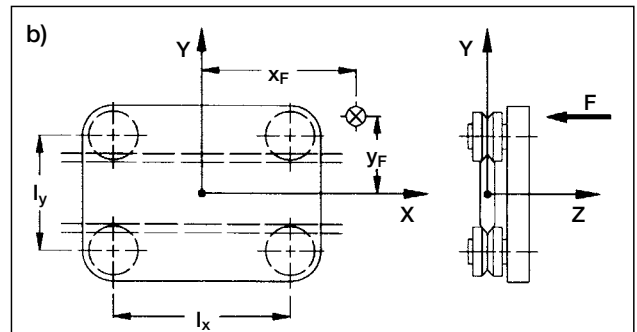
Diagram a) load F applied parallel to axis Y



$$P_a = \frac{F \cdot z_F}{2 \cdot l_c}$$

$$P_r = \frac{F \cdot (l_x + 2 \cdot x_F)}{2 \cdot l_x} + \frac{F \cdot z_F \cdot \tan \alpha}{2 \cdot l_c}$$

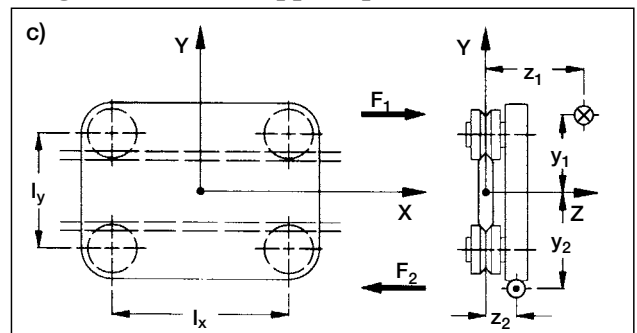
Diagram b) load F applied parallel to axis Z



$$P_a = \frac{F}{4} + \frac{F \cdot x_F}{2 \cdot l_x} + \frac{F \cdot y_F}{2 \cdot l_c}$$

$$P_r = P_a \cdot \tan \alpha$$

Diagram c) load F applied parallel to axis X



In this case the external load F_1 , applied at the point of co-ordinate $y_1 z_1$, should be considered together with reaction $F_2 = -F_1$, applied at the point of co-ordinate $y_2 z_2$. Calling Δy the absolute value of $y_2 - y_1$ and Δz the absolute value of $z_2 - z_1$, the following formula is used:

$$P_a = \frac{F_1 \cdot \Delta z}{2 \cdot l_x}$$

$$P_r = \frac{F_1}{l_x} \cdot \left(\frac{\Delta z \cdot \tan \alpha}{2} + \Delta y \right)$$

Guide roller calculation

In the table for each roller the following data is specified:

C_w basic dynamic load, it is the radial load [N] that applied to the guide roller gives 100 km nominal life*.

C_{or} bearing radial static load, it is the maximum radial load [N] that can be applied on the guide roller, limited by bearing contact stress.

C_{oa} bearing axial static load, it is the maximum axial load [N] that can be applied on the guide roller, limited by bearing contact stress.

F_r limit radial load, it is the maximum radial load [N] that can be applied on the guide roller due to the stud strength; for the guide wheels is the limit radial load of the wheel.

F_a limit axial load, it is the maximum axial load [N] that can be applied on the guide roller due to the stud strength; for the guide wheels is the limit axial load of the wheel.

X and Y coefficients to define the equivalent load for bearing life.

α is the contact angle dependent on the guide roller type.

Rollers FRN..EI work as combined bearings, the basic dynamic load is defined as:

C_{wr} basic radial dynamic load, it is the radial load [N] that applied to the guide roller gives 100 km nominal life*.

C_{wa} basic axial dynamic load, it is the axial load [N] that applied to the guide roller gives 100 km nominal life*.

Note*: ISO 281 states 'the nominal life will be exceeded by 90% of bearings before the first sign of material fatigue'.

Nominal life calculation

System life is the minimum life of either the bearings in the guide roller or the rail/roller contact surfaces.

For the rail/roller surface see the lubrication paragraph. For the bearings life proceed as follows.

The loads P_r and P_a are calculated for ideal condition. However, in practice, because of the structure and operating conditions a better calculation and life estimation is performed using overload factor f_w as follows:

- 1.0 – 1.2 smooth operation at low speed at constant load without shocks
- 1.2 – 1.5 smooth operation with load variation
- 1.5 – 2.0 operation with small shocks and vibrations
- 2.0 ~ 4.0 high acceleration, shocks and vibrations

Once P_a and P_r has been defined we can proceed to calculate the equivalent load P_{eq} (not for FRN..EI).

$$P_{eq} = X P_r + Y P_a \quad [N]$$

Coefficients X and Y can be obtained from guide rollers tables (in case of tapered bearings accordingly with ratio between P_a and P_r).

In case of pure radial guide roller as PK and GC or floating bearings FRL, RAL.

$$P_{eq} = P_r \quad [N]$$

Nominal bearing life:

$$L_{10} = 100 \left(\frac{C_w}{P_{eq} \cdot f_w} \right)^p \quad [km]$$

Where coefficient P is:

$P = 3$ for ball bearing guide rollers (FR,FR..EI, , RCL..., PFV., RAL)

$P = 10/3$ for roller bearing guide rollers (PK...,RKY,RKX,ROLBLOC,GC,FRL..)

In case of guide rollers based on needle bearings type FRN..EI

nominal bearing life is calculated as the minimum between:

$$L_{10} = 100 \left(\frac{C_{wr}}{P_r \cdot f_w} \right)^{10/3} \quad [km]$$

and

$$L_{10} = 100 \left(\frac{C_{wa}}{P_a \cdot f_w} \right)^{10/3} \quad [km]$$

Checking the roller stud

The values of the radial limit loads F_r and axial limit loads F_a shown in the catalogue refer to extreme operating conditions, meaning:

$P_a = 0$ (pure radial load)

$P_r = P_a \tan \alpha$ (maximum axial load)

In intermediate cases, when the ratio is included between the extreme values, the equivalent limit load F_k to be considered must be calculated according to ratio $k = P_a/P_r$.

$$F_k = \frac{F_r \cdot F_a}{K \cdot F_r + (1 - K \tan \alpha) \cdot F_a} \quad [N]$$

To check the strength of the stud, in relation to the limit load, the safety factor has to be greater than 1

$$F_k/P_r > 1$$

Note: in the following common cases it is not necessary to calculate F_k and stud safety evaluation can be completed easily.

In case of floating bearings type FRL and guide rollers PK and GC there isn't any axial load. In case of loads acting in the guide roller plane (F_x or F_y

acting with $Z=0$ the axial load is also zero (0) (see calculation example n° 3).

In these cases it has to be

$$\text{Safety stud check} \quad F_r/P_r > 1$$

In case of load F_z acting perpendicular at guide roller plane the axial load is maximum (load case c, example n° 4).

$$\text{Safety stud check} \quad F_a/P_a > 1$$

Checking the bearing max load

In case of guide rollers based on tapered roller bearings (PK..C, RKU..., RKY..., RKX..) or ball bearings (FR..EI RCL.. PFV..)

We proceed as for the stud

$$\text{ratio } k = P_a/P_r.$$

$$C_{ok} = \frac{C_{or} C_{oa}}{K C_{or} + (1 - K \tan \alpha) C_{oa}} \quad [N]$$

To check the bearing static safety factor it has to be:

$$C_{ok}/P_r > 1$$

As explained for stud calculation in case of pure radial load or max axial load, calculations can be made using values directly from the tables (see calculation example 3 and 4).

In case of guide rollers based on needle bearings type FRN..EI

To check the bearing static safety factor it has to be:

$$C_{or}/P_r > 1$$

$$C_{oa}/P_a > 1$$

In case of guide rollers have two outer rings and ball bearings FR..,

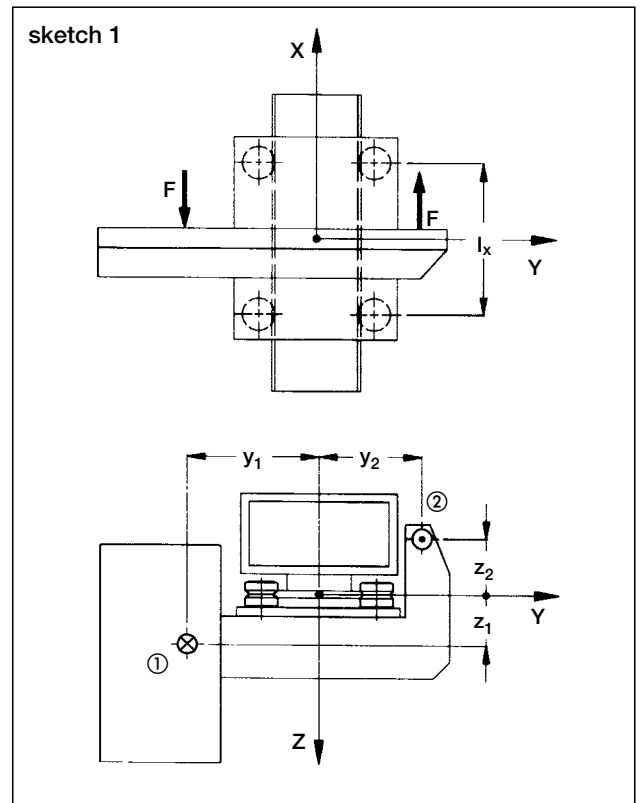
To check the bearing static safety factor it has to be:

$$P_r + P_a \cdot \tan \alpha < C_{or}$$

Examples of calculation

1) A fork-lift truck featuring vertical movement (sketch 1).

The resulting magnitude of the weight passes through point 1, while the vertical force that balances this, for instance the traction of a timing belt, passes through point 2.



Guide rollers type RKY 52 are used with guide rail type FS 62 MT

overload factor $f_w = 1,0$

center distance $l_x = 300 \text{ mm}$ $l_y = 144,3$

$F = 2000 \text{ N}$ $z_1 = 100 \text{ mm}$ $y_1 = -150 \text{ mm}$

$z_2 = -250 \text{ mm}$ $y_2 = 350 \text{ mm}$

$\Delta_z = 350 \text{ mm}$ $\Delta_y = 500 \text{ mm}$

Load on rollers

$$P_a = \frac{2000 \cdot 350}{2 \cdot 300} = 1.167 \text{ N}$$

$$P_r = \frac{2000}{300} \cdot \left(\frac{350 \tan 40}{2} + 500 \right) = 4312 \text{ N}$$

Nominal life

$$k = P_a/P_r = 0.27 \rightarrow X = 0.77 \quad Y = 6.98$$

Equivalent dynamic load

$$P_{eq} = 0.77 \cdot 4312 + 6.98 \cdot 1167 = 11464 \text{ N}$$

$$L_{10} = 100 \left(\frac{40800}{11464 \cdot 1} \right)^{10/3} = 6880 \text{ km}$$

Stud safety coefficient

Equivalent limit load F_k

$$F_k = \frac{11900 \cdot 4250}{0.27 \cdot 11900 + (1 - 0.27 \tan 40) \cdot 4250} = 7780 \text{ N}$$

Stud safety coefficient

$$F_k/P_r = 7780 / 4312 = 1.8$$

Bearing safety coefficient

Equivalent limit load C_{ok}

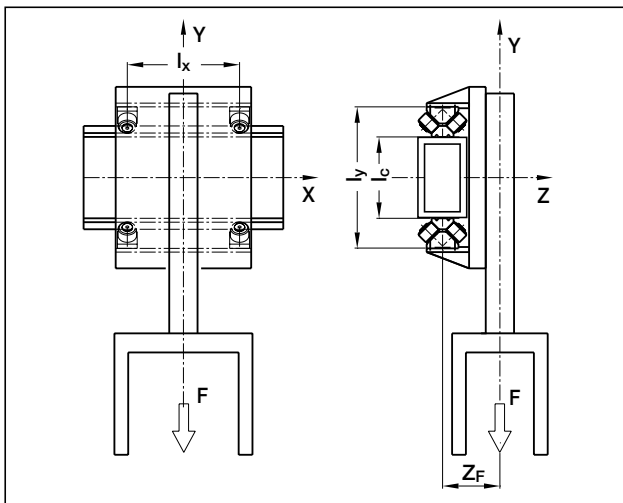
$$C_{ok} = \frac{44000 \cdot 12400}{0.27 \cdot 44000 + (1 - 0.27 \tan 40) \cdot 12400} = 25380 \text{ N}$$

Bearing static safety coefficient

$$C_{ok}/P_r = 25380 / 4312 = 5,9$$

2) The horizontal axis of a manipulator in steel industry

The centre of gravity of the vertical axis and load is placed in the middle of the horizontal centre-axis l_x and 160 mm distance from the guide axis. The dirty environment and the possibility of shocks lead to the choice to ROLBLOC system.



Guide rollers BL252 are used with guide GU62M
 Overload factor $f_w = 1,4$
 Centre distance $l_x = 350 \text{ mm}$ $l_y = 400 \text{ mm}$
 $F = 6000 \text{ N}$ $x = 0$ $y = -1000$ $z = 160 \text{ mm}$

Load on rollers

The effective centeraxis l_c is $400 - 85 - 85 = 230 \text{ mm}$

$$P_a = \frac{6000 \cdot 160}{2 \cdot 230} = 2087 \text{ N}$$

$$P_r = \frac{6000}{2} + \frac{6000 \cdot 160 \tan 45}{2 \cdot 230} = 5087 \text{ N}$$

Nominal life

From the ROLBLOC table $X=1, Y=1$

$$P_{eq} = 1 \cdot 2087 + 1 \cdot 5087 = 7174 \text{ N}$$

$$L_{10} = 100 \left(\frac{59000}{7174 \cdot 1.4} \right)^{10/3} = 36577 \text{ km}$$

Stud safety coefficient

$$K = P_a/P_r = 2087/5087 = 0,41$$

$$F_k = \frac{16800 \cdot 8400}{0.41 \cdot 16800 + (1 - 0.41 \tan 45) \cdot 8400} = 11915 \text{ N}$$

$$F_k/P_r = 11915 / 5087 = 2.3$$

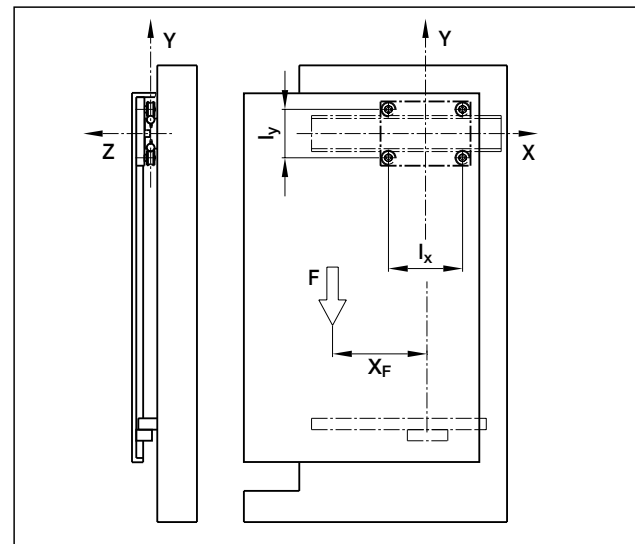
Bearing safety coefficient

$$C_{ok} = \frac{62000 \cdot 31000}{0.41 \cdot 62000 + (1 - 0.41 \tan 45) \cdot 31000} = 43972 \text{ N}$$

$$F_k/P_r = 43972 / 5087 = 8.6$$

3) The sliding door of a machine tool (rail on top)

The door is supported by the rail DC type on the upper edge and driven on bottom side by an auto-aligning carriage C3RAL on LM guide rail type. Because of the effect of the bottom rail there isn't any torque applied at the DC rail. The door weight acts in a plane coincident with the roller/rail vertical axis and as such there is no over turning moment. In this case, limit load calculation can be easily carried out from basic data F_a and C_{oa} without F_k and C_{ok} calculation. Of course the calculation is always the same.



Guide rail DC18.65 is used with carriage
T4 PFV 3518 250
Overload factor $f_w = 1,1$
Centre distance $l_x = 213 \text{ mm}$ $l_y = 113 \text{ mm}$
 $F=450 \text{ N}$ $x=-300$ $y=-500$ $z=0$
(because of LM rail) mm

Load on rollers

The effective centeraxis l_c is $113 - 35 = 78 \text{ mm}$

$$P_a = \frac{450 \cdot 0}{2 \cdot 78} = 0 \text{ N}$$

$$P_r = \frac{450 \cdot (213 + 2 \cdot 300)}{2 \cdot 213} + \frac{450 \cdot 0 \cdot \tan(40)}{2 \cdot 213} = 859 \text{ N}$$

Nominal life

$$L_{10} = 100 \left(\frac{4570}{859 \cdot 1,1} \right)^3 = 11300 \text{ km}$$

Stud safety coefficient

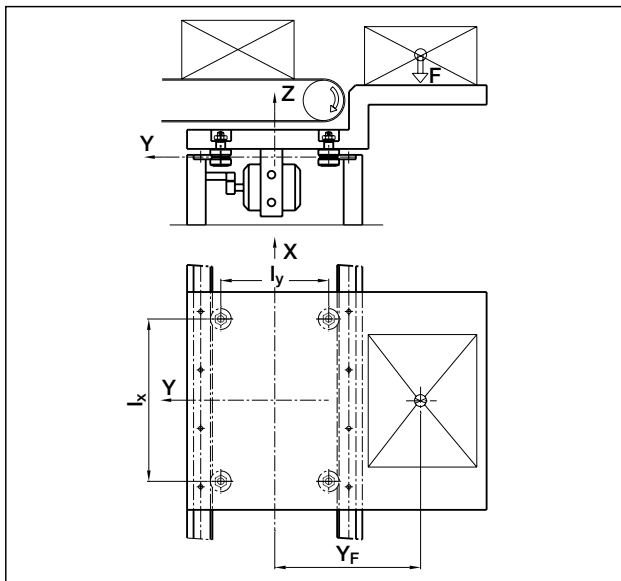
$$F_r/P_r = 2120 / 859 = 2,4$$

Bearing safety coefficient

$$C_{or}/P_r = 2320 / 859 = 2,7$$

4) Transfer unit

The box weight loads the carriage with max axial load. In this load configuration the safety stud check calculation can be easily done directly by the F_a and Co_a value without F_k calculation.



Guide rollers FRN(R)32EI with rails FSH32M
Overload factor $f_w = 1,2$
Centre distance $l_x = 670 \text{ mm}$ $l_y = 450 \text{ mm}$
 $F=400 \text{ N}$ $x=0$ $y=650$ $z=50 \text{ mm}$

Load on rollers

The effective centeraxis l_c is $450 + 32 = 482 \text{ mm}$

$$P_a = \frac{400}{4} + \frac{400 \cdot 650}{2 \cdot 482} = 370 \text{ N}$$

$$P_r = 370 \tan 40 = 310 \text{ N}$$

Nominal life

$$L_{10r} = 100 \left(\frac{5600}{310 \cdot 1,2} \right)^{10/3} = 840000 \text{ km}$$

$$L_{10a} = 100 \left(\frac{2100}{370 \cdot 1,2} \right)^{10/3} = 17760 \text{ km}$$

$$L_{10} = 17760 \text{ km}$$

Stud safety coefficient

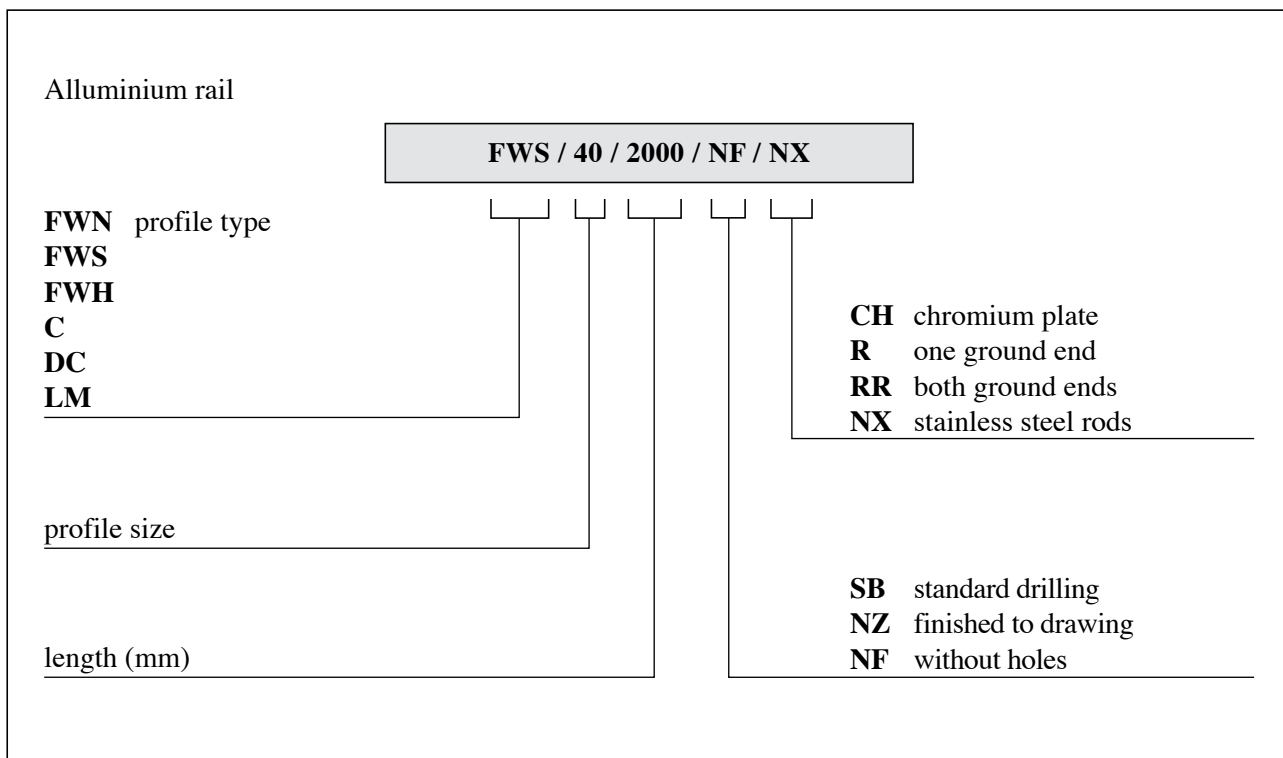
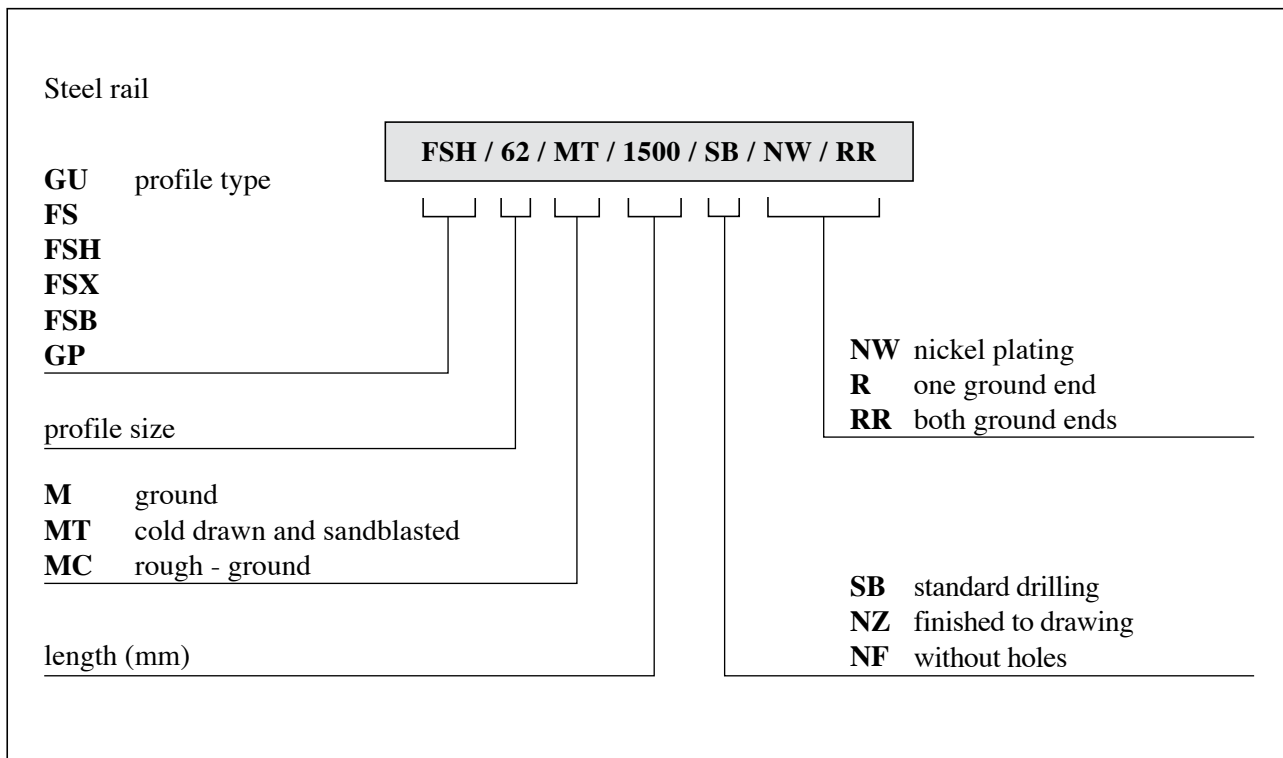
$$F_a/P_a = 950 / 370 = 2.5$$

Bearing safety coefficient

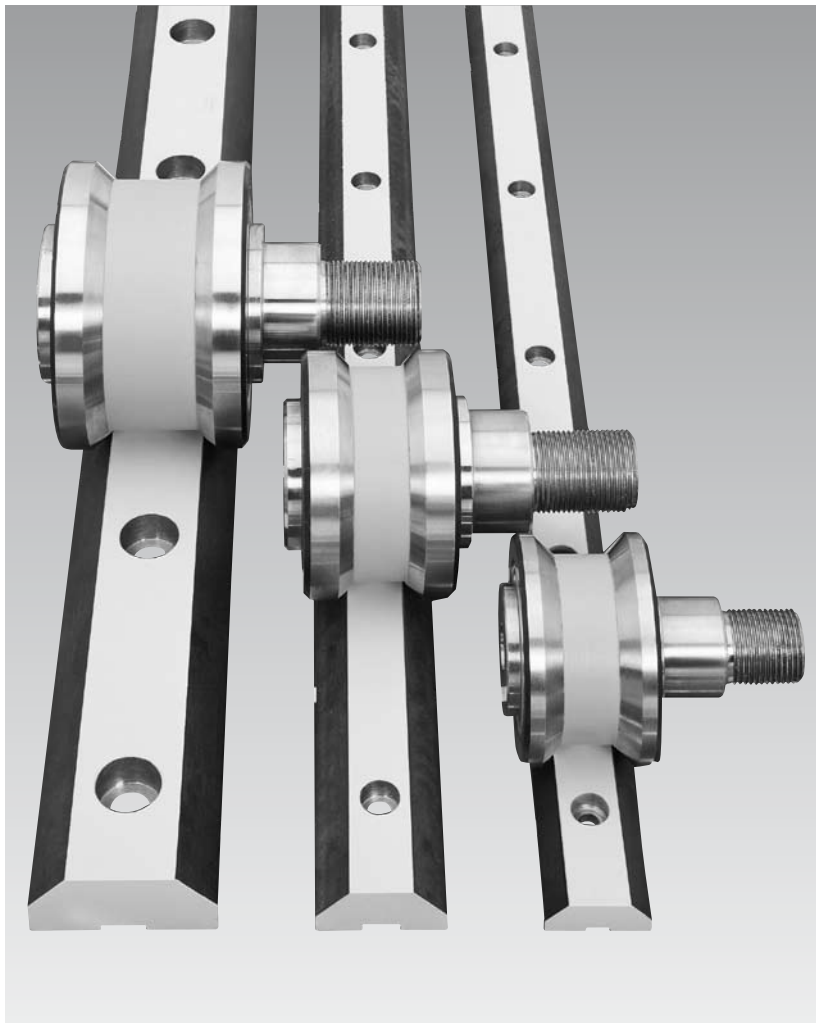
$$C_{or}/P_r = 5100 / 370 = 13,7$$

For further details, contact the NADELLA Technical Service.

Guide rail order code

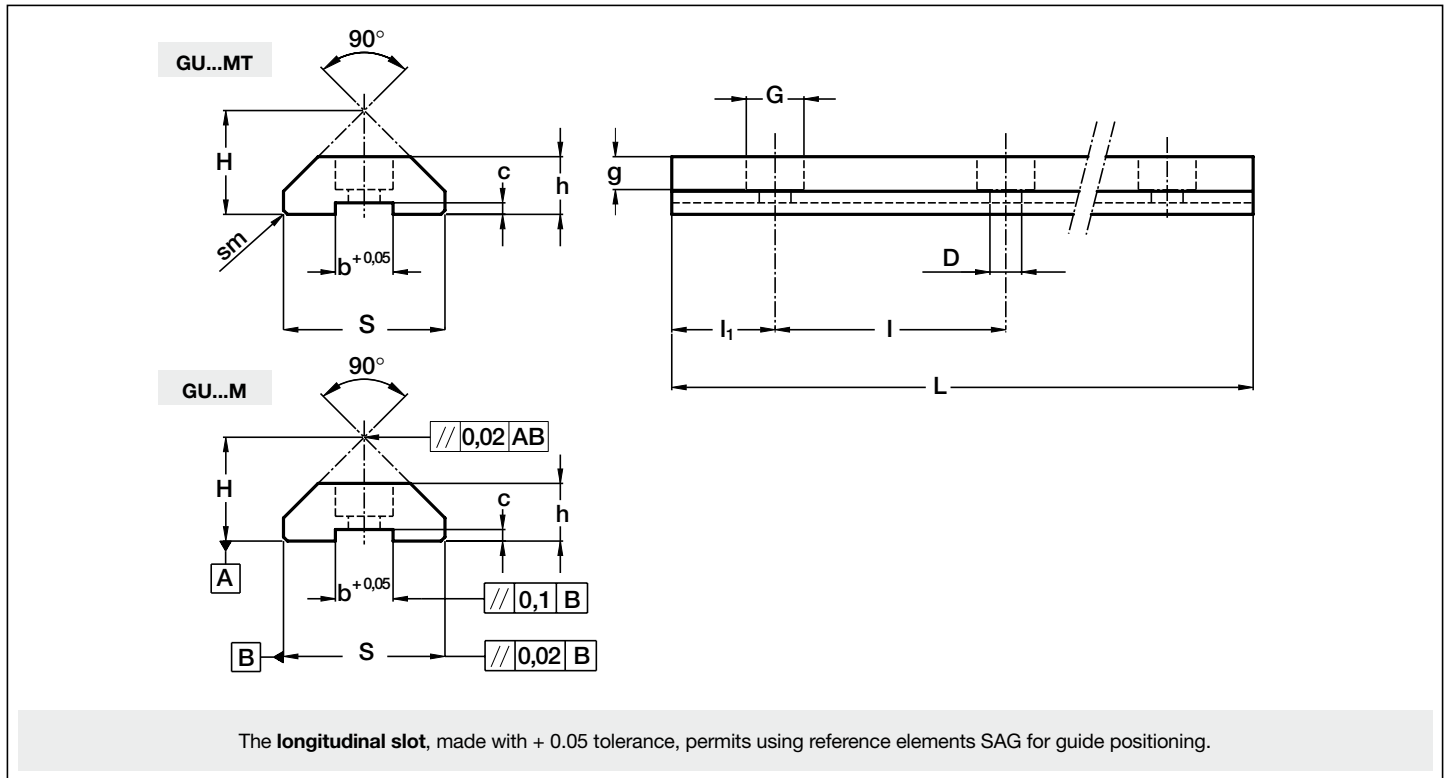


GU System



NADELLA

Guide Rails GU..M, GU..MT



Type	Dimensions (mm)											Weight (kg/m) ⁽²⁾
	H ± 0.05	h ± 0.05	S ± 0.05	D + 0.1	G	g	b + 0.05	c ± 0.05	sm	l	l ₁	
GU 28 MT	19	11	28.8	5.5	10	5.7	10	2.5	0.7x45°	90	30	1.97
GU 35 MT	23.9	15.7	35.5	6.6	11	6.8	10	3.8	1x45°	90	30	3.35
GU 50 MT	35.5	21	50.8	11	18	11	16	4.3	1x45°	90	30	6.89

max length in single element L=6 000 mm (1)

Type	Dimensions (mm)											Weight (kg/m) ⁽²⁾
	H ± 0.05	h ± 0.05	S ± 0.05	D + 0.1	G	g	b + 0.05	c ± 0.05	l	l ₁		
GU 28 M	18	10	28	5.5	10	5.7	10	2	90	30	1.8	
GU 35 M	23	15	35	6.6	11	6.8	10	3.3	90	30	3.2	
GU 50 M	34.5	20	50	11	18	11	16	3.8	90	30	6.8	

max length in single element L=4 020 mm (1)

(1) Longer rails are supplied in sections with ground butt joints - (2) Weight without holes

Rails finishing

- drawn, induction hardened and sandblasted tracks (**MT**);
- drawn, induction hardened and ground (**M**)
- Induction hardening on raceways only

Hole layout

- holes according to catalogue (**SB**)
- finishes to drawing (**NZ**)
- without holes (**NF**)

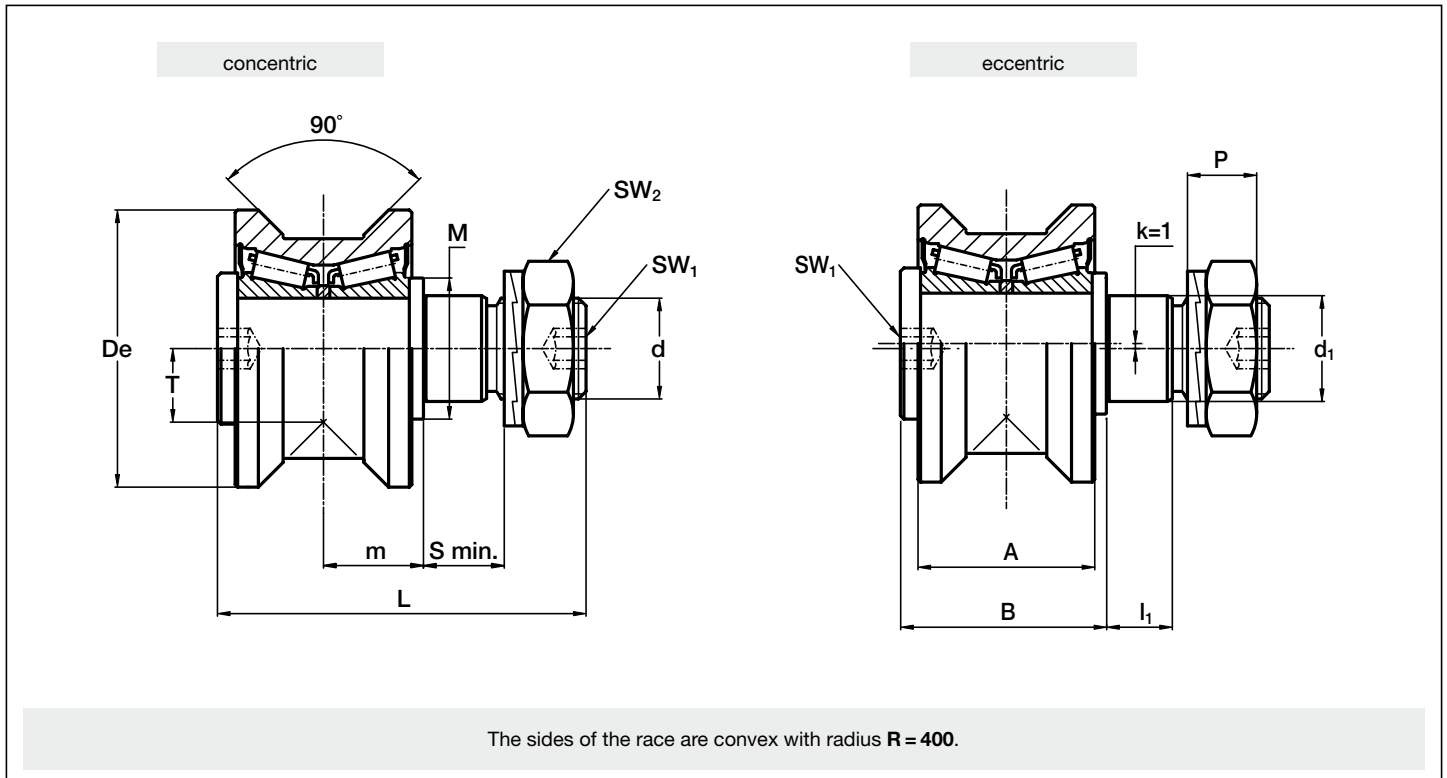
Optional features

- ground one end (**R**)
- ground both ends (**RR**)
- chemical Nickel-plating (**NW**)

Example of standard designation: **GU 35 MT/4300/SB**

See page 15 for standard codification

Guide Rollers **RKU**

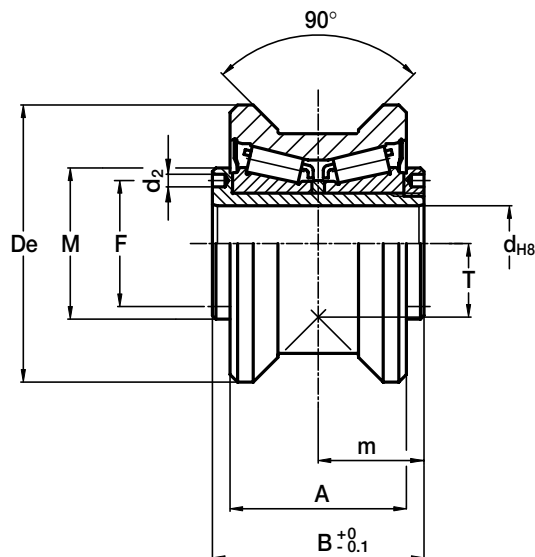


Type		Dimensions (mm)														
concentric	eccentric	De	d ₁ ⁽¹⁾	d	T	m	S min.	P	L	A	B	l ₁	M	SW ₁	SW ₂	k
RKU 55	RKUR 55	55	21	M 20 x 1.5	14.6	19.8	15	13.4	73	35	41	14	28	8	ch. 30	1
RKU 65	RKUR 65	65	27	M 24 x 1.5	18	20.8	19	15.4	83	37	44	18	35	10	ch. 36	1
RKU 75	RKUR 75	75	36	M 30 x 1.5	23.7	27	19	21.6	100	45	55	18	44	12	ch. 46	1
RKU 95	RKUR 95	95	38	M 36 x 1.5	25.5	30	24	24.6	115	53	62	23	50	14	ch. 55	1
RKU 115	RKUR 115	115	42	M 36 x 1.5	33.5	34	33	24.6	135	53	70	32	56	14	ch. 55	1

Type		Dynamic load (N)	Limit loads of the bearing (N)		Limit loads of the stud (N)		Life coefficients				Torque wrench settings ⁽²⁾ (Nm)	Weight (kg)
			radial C _{or}	axial C _{oa}	radial F _r	axial F _a	P _a /P _r ≤ 0.1		P _a /P _r > 0.1			
		C _w ⁽⁶⁾					X	Y	X	Y		
RKU 55	RKUR 55	41 650	44 000	12 400	11 900	4 250	1	4.67	0.77	6.98	80	0.6
RKU 65	RKUR 65	46 800	50 400	12 750	22 100	6 800	1	3.93	0.74	6.55	160	0.9
RKU 75	RKUR 75	66 700	72 000	18 900	31 300	10 100	1	4.67	0.77	6.98	300	1.6
RKU 95	RKUR 95	116 800	136 000	37 800	43 700	12 600	1	3	0.8	4.96	450	2.8
RKU 115	RKUR 115	182 450	195 000	50 000	55 600	17 900	1	4.26	0.72	7.1	450	4.9

- Housing bore tolerance: H7
- The torque wrench settings are given for non-lubricated threads; for lubricated threads, multiply figure by 0.8
- Standard seals: material NBR, RS type
- On request, the guide rollers can be supplied in stainless steel (suffix **NX**) and with Viton seals for operating temperatures up to 120°C (suffix **V**, not available for RKU 115)
- Dimensions relating to the stainless-steel rollers (suffix **NX**)
- C_w basic load for 100 km
- The guide rollers include self-locking washers and hexagonal nut (DIN 439B) for fitting
- Pressure angle α for load calculation: 45°

Guide wheels **FKU**



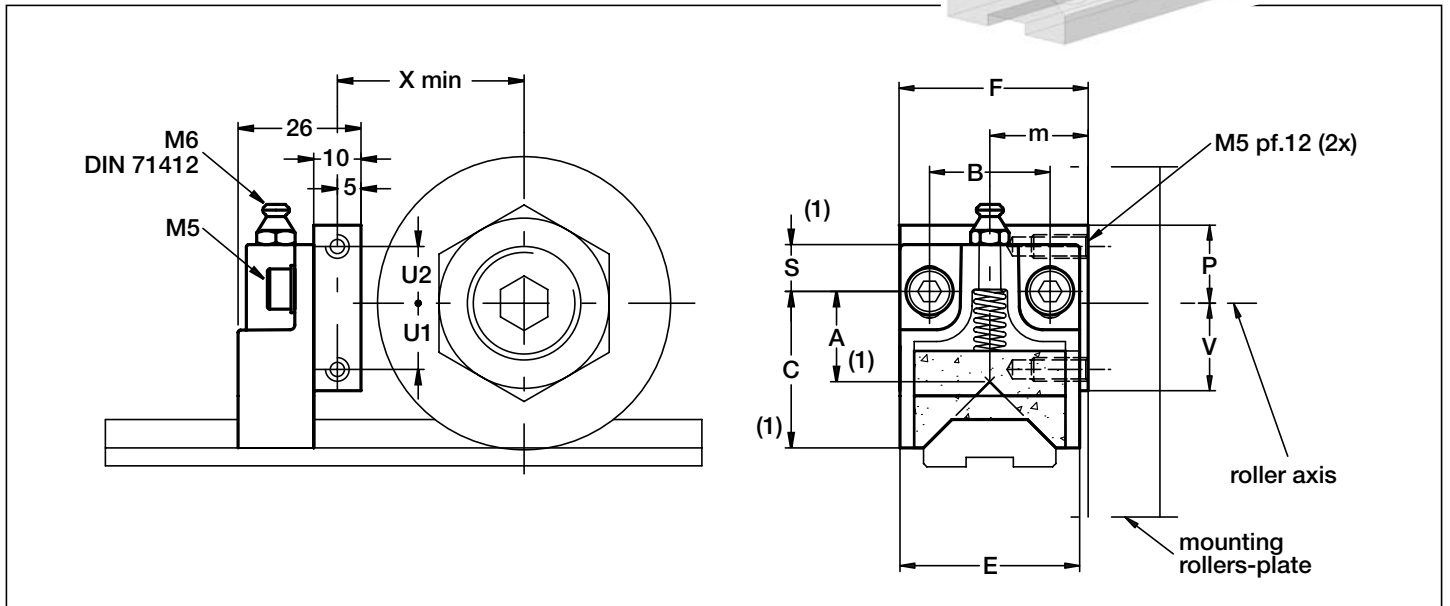
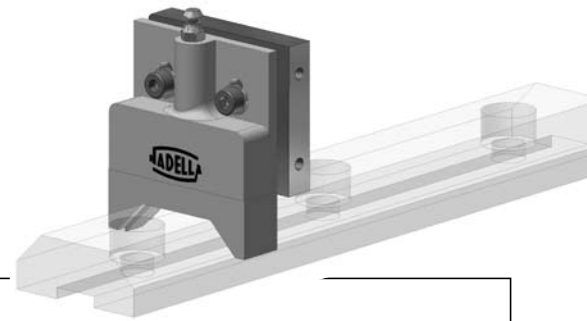
The sides of the race are convex with radius $R = 400$.

Type	Dimensions (mm)								
	De	d	T	m	A	B	F	d ₂	M
FKU 55	55	15	14.6	21	35	42	25	2.5	30
FKU 65	65	20	18	22.5	37	45	29	3	35
FKU 75	75	25	23.7	28	45	56	37	4	44
FKU 95	95	28	25.5	32	53	56 ⁽²⁾	42	4	49
FKU 115	115	35	33.5	36	60	63 ⁽²⁾	52	4	59

Type	Dynamic load (N) C _w ⁽³⁾	Limit loads of the bearing (N) radial C _{or} axial C _{oa}		Limit loads of the wheel (N) radial F _r axial F _a		Life coefficients				Weight (kg)
						P _a /P _r ≤ 0.1		P _a /P _r > 0.1		
						X	Y	X	Y	
FKU 55	41 650	44 000	12 400	11 900	4 250	1	4.67	0.77	6.98	0.5
FKU 65	46 800	50 400	12 750	22 100	6 800	1	3.93	0.74	6.55	0.6
FKU 75	66 700	72 000	18 900	31 300	10 100	1	4.67	0.77	6.98	1.2
FKU 95	116 800	136 000	37 800	43 700	12 600	1	3	0.8	4.96	2.3
FKU 115	182 450	195 000	50 000	55 600	17 900	1	4.26	0.72	7.1	3.9

- 1) On request, the guide rollers can be supplied in stainless steel (suffix **NX**) and with Viton seals for operating temperatures up to 120°C (suffix **V** not available for FKU 115)
- 2) Dimensions relating to the stainless-steel rollers (suffix **NX**)
- 3) C_w basic load for 100 km
- 4) To prevent rotation between roller and shaft a pin can be fitted in one of the holes "d₂" positioned in the side flange
- 5) Pressure angle α for load calculation: 45°
- 6) Standard seals: material NBR, RS type

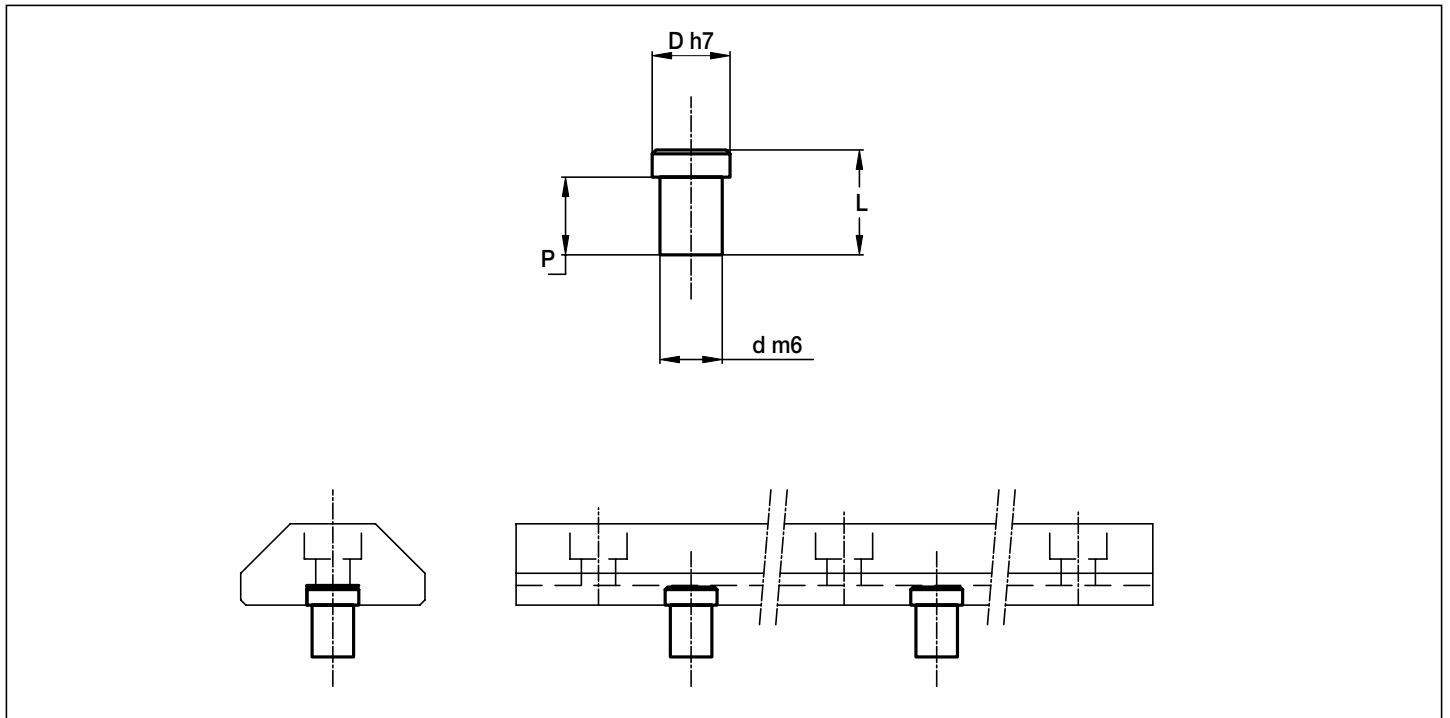
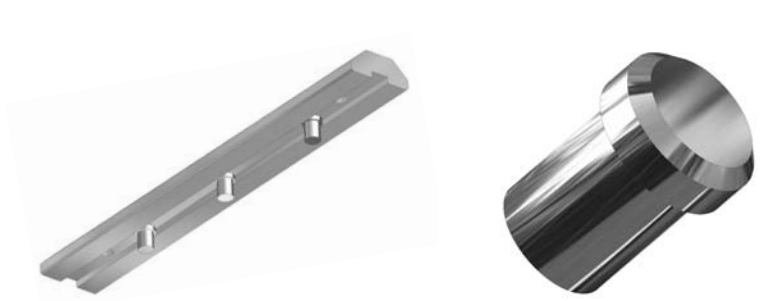
Lubricator LUBU



Type	Dimensions (mm)												Weicht (g)	Suggested combinations
	X	U1	U2	F	m	B	S	C	A	E	V	P		
LUBU 55	35	12	14	40	19.8	25.5	10	34	20	38	16.5	18.5	65	RKU 55 RKUR 55 FKU 55
LUBU 65	40	14	12	40	20.8	25.5	10	34	20	38	18.5	16.5	65	RKU 65 RKUR 65 FKU 65
LUBU 75	45	19	11	50	27	25.5	10	43	25.4	44	24	16	85	RKU 75 RKUR 75 FKU 75
LUBU 95	55	21	9	60	30	30	16.5	50	24.9	58	31	19	140	RKU 95 RKUR 95 FKU 95
LUBU 115	65	30	0	63	34	30	16.5	50	24.9	58	40	10	140	RKU 115 RKUR 115 FKU 115

- 1) The dimension of the plastic part refers to the centre of the regulation-slot. Allows a translation of +/- 3 mm.
- 2) The lubricator is supplied with the felt already lubricated. The lubricant has a mineral oil base.
- 3) During the mounting fix the aluminium support to the rollers plate, adjust the height of the plastic part in order to put it in contact with the raceways and than block it in that position with the M5 screws.

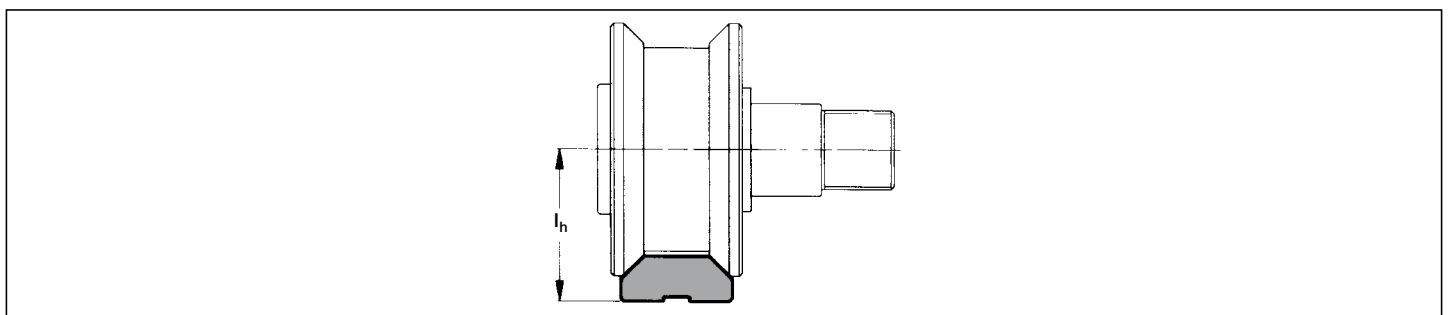
Guide pins **SAG**



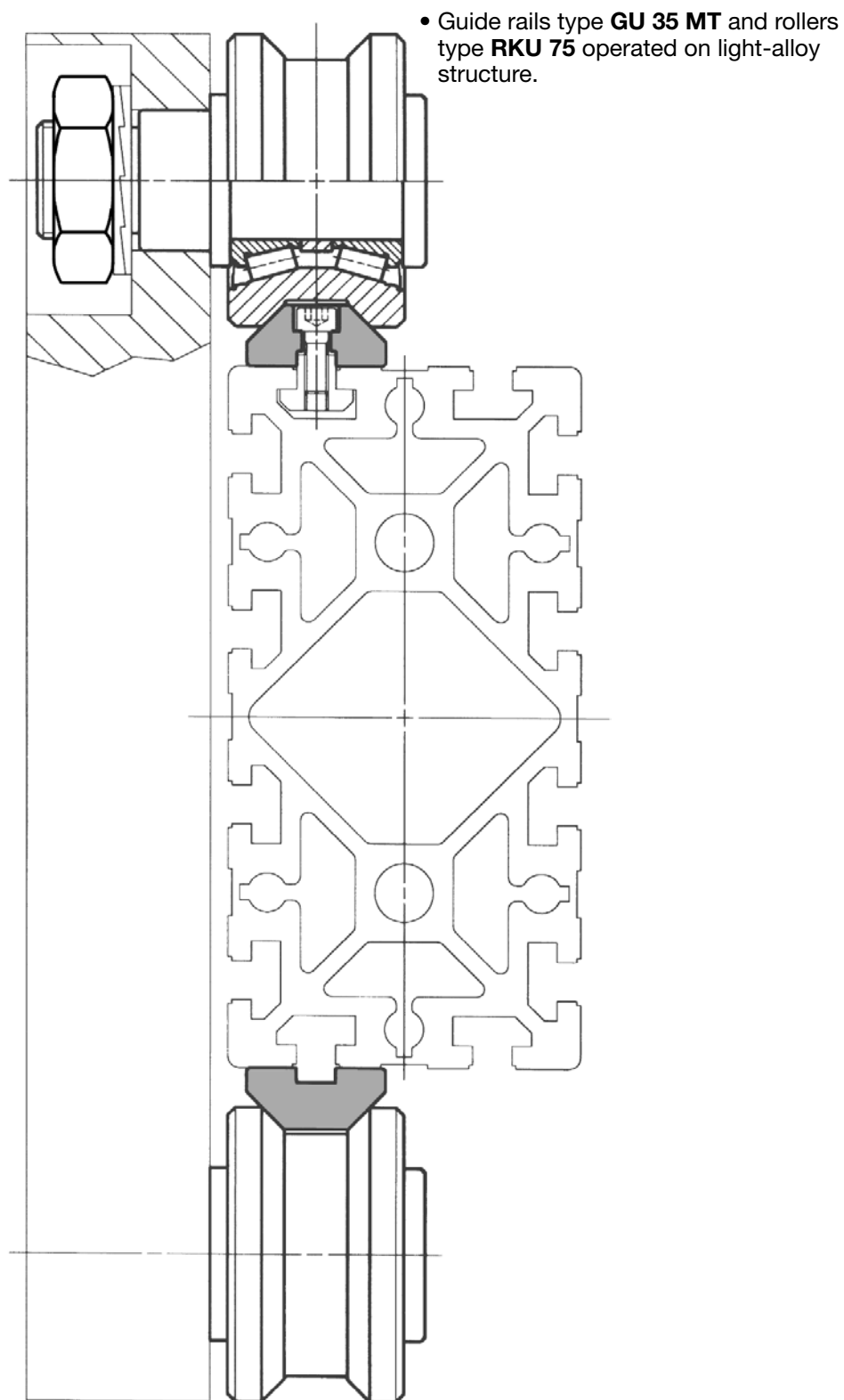
Pin type	Guide type	Dimensions (mm)			
		D	d ⁽¹⁾	P	L
SAG 28	GU 28 MT	10	8	10.0	12.3
SAG 35	GU 35 MT	10	8	10.0	13.5
SAG 50	GU 50 MT	16	10	11.2	15.0

1) Housing bore tolerance: H7

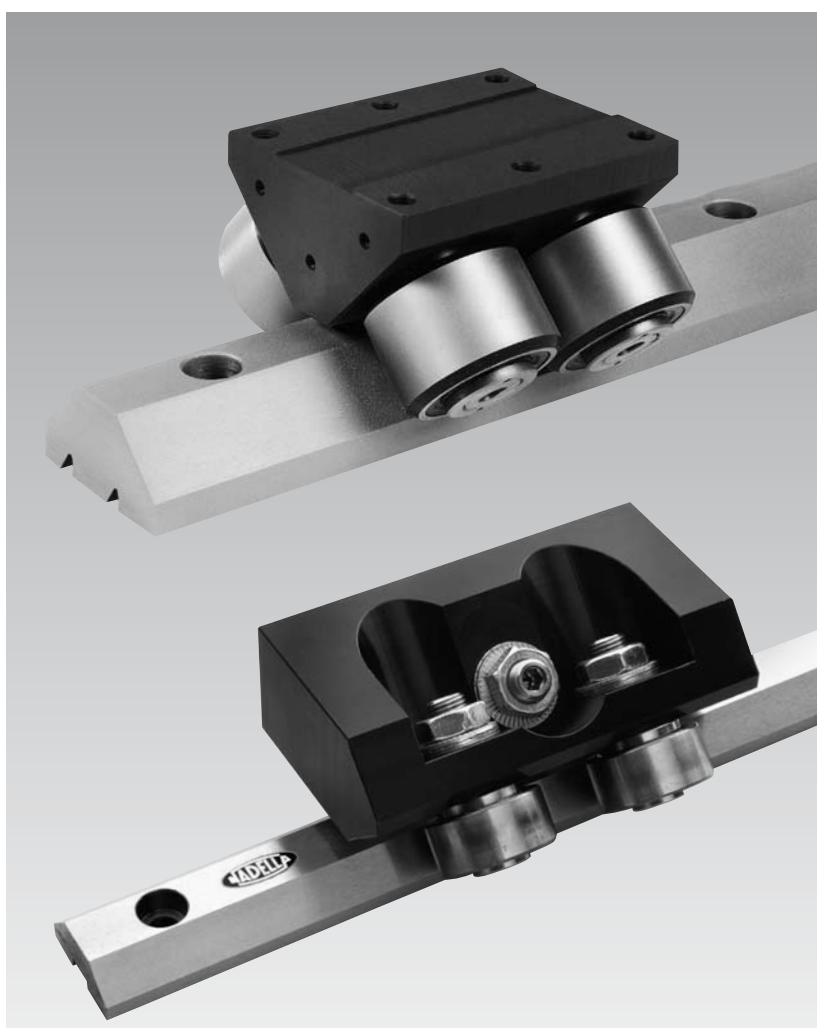
Guide roller combinations



Guide \ Roller	I_h (mm)				
	RKU 55	RKU 65	RKU 75	RKU 95	RKU 115
GU 28 MT	33.6	37	–	–	–
GU 28 M	32.6	36	–	–	–
GU 35 MT	–	41.9	47.6	–	–
GU 35 M	–	41	46.7	–	–
GU 50 MT	–	–	–	61	69
GU 50 M	–	–	–	60	68



ROLBLOC System



NADELLA

ROLBLOC system

The carriages based on Rolbloc's system are recommended for applications with heavy loads, high frequency of work and aggressive environment (dust, abrasive).

For the profiled guide rollers, the contact between the rollers and the rail takes place on the ground raceways, which are inclined respect the rotation axis of the guide roller. Due to this inclination angle in the contact area there is a dragging proportional to the dimension of the contact area and to the value of the inclination angle. In the ROLBLOC system the rotation axes of the roller guides are parallel to the raceways of the rail, with the following pure rolling. The pure rolling recedes the superficial stress and the effects of the dust between the surfaces.

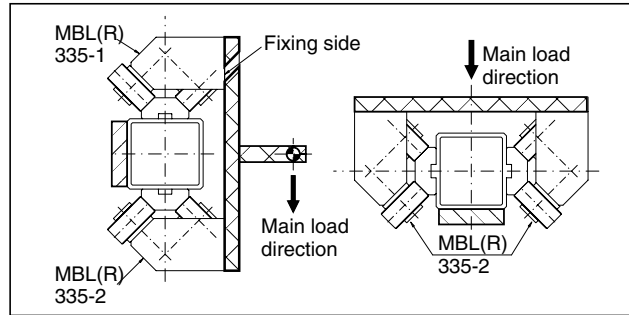
Technical features

ROLBLOC carriages **BL2..** and **BL4..** are composed by a body in burnished steel on which are mounted two or four roller guides equipped with tapered rollers (similar to flat roller guides type PK..C). The final part of the code (that can be 52, 75 or 115) shows the external diameter of the roller guides.

MBL carriages are composed by an alluminium body provided, on one side, with four threaded screws that allow the direct mounting on the fixing plate. Besides, in order to facilitate the aligning, there are also two pin screws. The body is equipped with guide rollers with a double row angular contact ball bearing. On the body are mounted three guide rollers according to the following combinations:

- **MBL 335-1:** three concentric guide rollers, of which one on the fixing side;
- **MBL 335-2:** three concentric guide rollers, of which two on the fixing side;
- **MBLR 335-1:** three concentric guide rollers, of which one on the fixing side;
- **MBLR 335-2:** three concentric guide rollers, of which two on the fixing side.

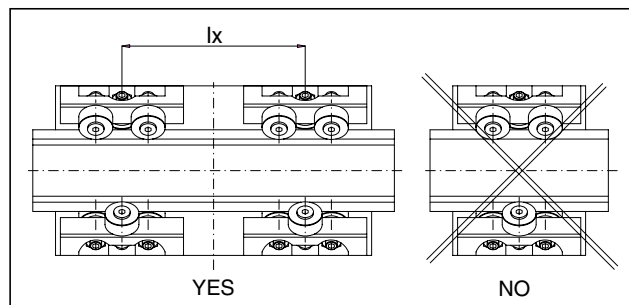
MBL 335-.. carriages are dissymmetrical components. In order to fully utilize the load capacity of the carriages it is necessary to consider the main load direction and than put the two coupled guide rollers in that direction.



MBL components are checked with the same method used for ROLBLOC BL, but it is very important to consider the exact bearing ratings that must be correct for the load direction. When the axial load (perpendicular to the fixing side of the carriage, or parallel to the fixing side of the rail) is in the direction of the two coupled guide rollers, as for the sketch above, you must use the coefficient with the number 2 (C_{oa2} , F_{a2} , Y_2), otherwise with the number 1 (C_{oa1} , F_{a1} , Y_1).

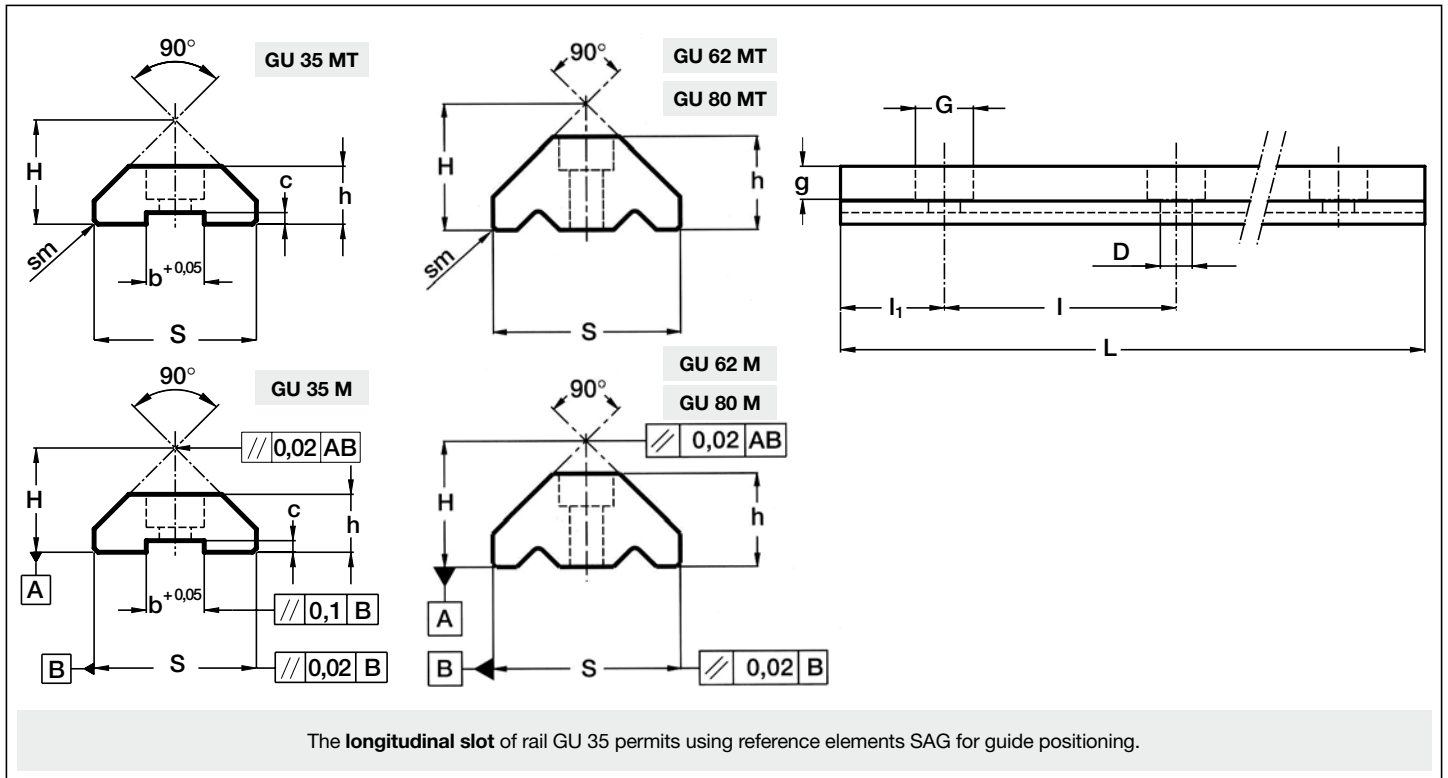
Mounting instructions

For the mounting of the carriages BL or MBL, with two, three and four guide rollers, are necessary at least two carriages on every rail. A slider realised with only two carriages for rail is not steady (see sketch below).



Pay the maximum attention during the setting of the eccentricity of the eccentric guide rollers in order to avoid excessive preloads that can reduce the lifetime of the system. Setting the eccentric guide rollers by rotating the stud anticlockwise (respect the head side of the guide roller).

Guide Rails **GU..M,** **GU..MT**



Type	Dimensions (mm)											Weight (kg/m) ⁽²⁾
	H ± 0.05	h ± 0.05	S ± 0.05	D + 0.1	G	g	b + 0.05	c ± 0.05	sm	I	I ₁	
GU 35 MT	23.9	15.7	35.5	6.6	11	6.8	10	3.8	1x45°	90	30	3.35
GU 62 MT	43.5	32.5	63.5	11	18	11	-	-	2x45°	120	30	11.80
GU 80 MT	56.7	41.5	81.5	13.5	20	13	-	-	2x45°	120	30	20.30

max length in single element L = 6 000 mm (1)

Type	Dimensions (mm)											Weight (kg/m) ⁽²⁾
	H ± 0.05	h ± 0.05	S ± 0.05	D + 0.1	G	g	b + 0.05	c ± 0.05	I	I ₁		
GU 35 M	23	15	35	6.6	11	6.8	10	3.3	90	30	3.2	
GU 62 M	42	31	62	11	18	11	-	-	120	30	10.9	
GU 80 M	55.2	40	80	13.5	20	13	-	-	120	30	20	

max length in single element L = 4 020 mm (1)

(1) Longer rails are supplied in sections with ground butt joints - (2) Weight without holes

Rails finishing

- drawn, induction hardened and sandblasted tracks (**MT**);
- drawn, induction hardened and ground (**M**)
- Induction hardening on raceways only

Hole layout

- holes according to catalogue (**SB**)
- finishes to drawing (**NZ**)
- without holes (**NF**)

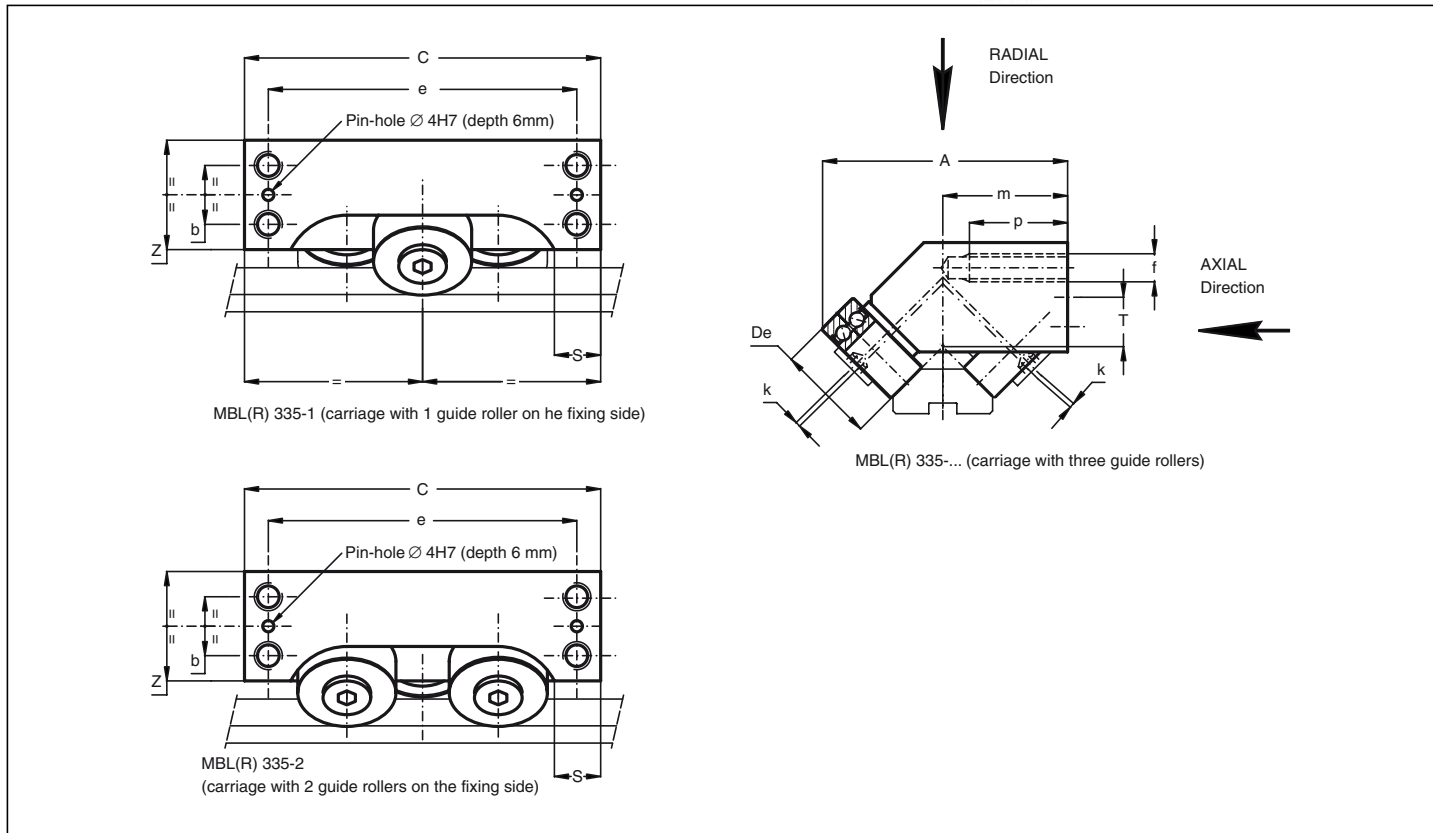
Optional features

- ground one end (**R**)
- ground both ends (**RR**)
- chemical Nickel-plating (**NW**)

Example of standard designation: **GU 62 MT/4300/SB**

See page 15 for standard codification

Carriages MBL

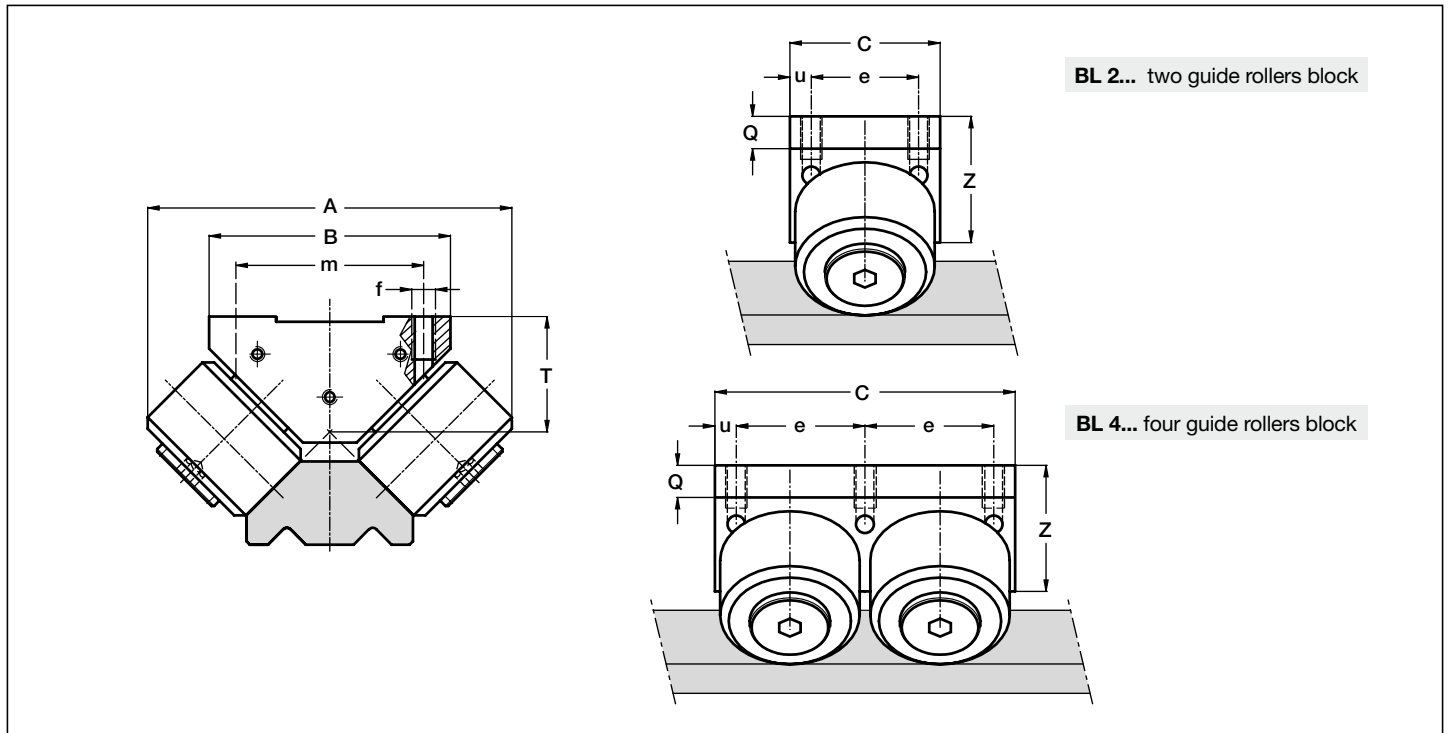


Type		Dimensions (mm)											Weight (kg)	
concentric	eccentric	A	C	S	m	e	b	p	f	k ⁽²⁾	T	Z		De
MBL 335-1	MBLR 335-1	87.5	127	16.5	44.5	110	21	35	M10	0.75	17.6	39	35	0.94
MBL 335-2	MBLR 335-2													

Type		Dynamic load (N)	Limit loads of the bearing (N)			Limit loads of the stud (N)			Life coefficients		
			radial C _{or}	axial C _{oa}		radial F _r	axial F _a		X	Y	
		C _w ⁽³⁾		C _{oa1} ⁽⁵⁾	C _{oa2} ⁽⁶⁾		F _{a1} ⁽⁵⁾	F _{a2} ⁽⁶⁾		Y ₁ ⁽⁵⁾	Y ₂ ⁽⁶⁾
MBL 335-1	MBLR 335-1	14 500	7 000	3 500	7 000	8 400	4 200	8 400	1	1	0
MBL 335-2	MBLR 335-2										

- 1) Standard seals metallic ZZ
- 2) Maximum value of eccentricity for carriages MBLR, where all the guide rollers are eccentric
- 3) C_w basic load for 100 km, radial load
- 4) Pressure angle α for load calculation: 45°
- 5) Bearing ratings you must use when the axial load is in the direction of the side with one guide roller only
- 6) Bearing ratings you must use when the axial load is in the direction of the side with two guide rollers

Carriages BL



BL 2... two guide rollers block

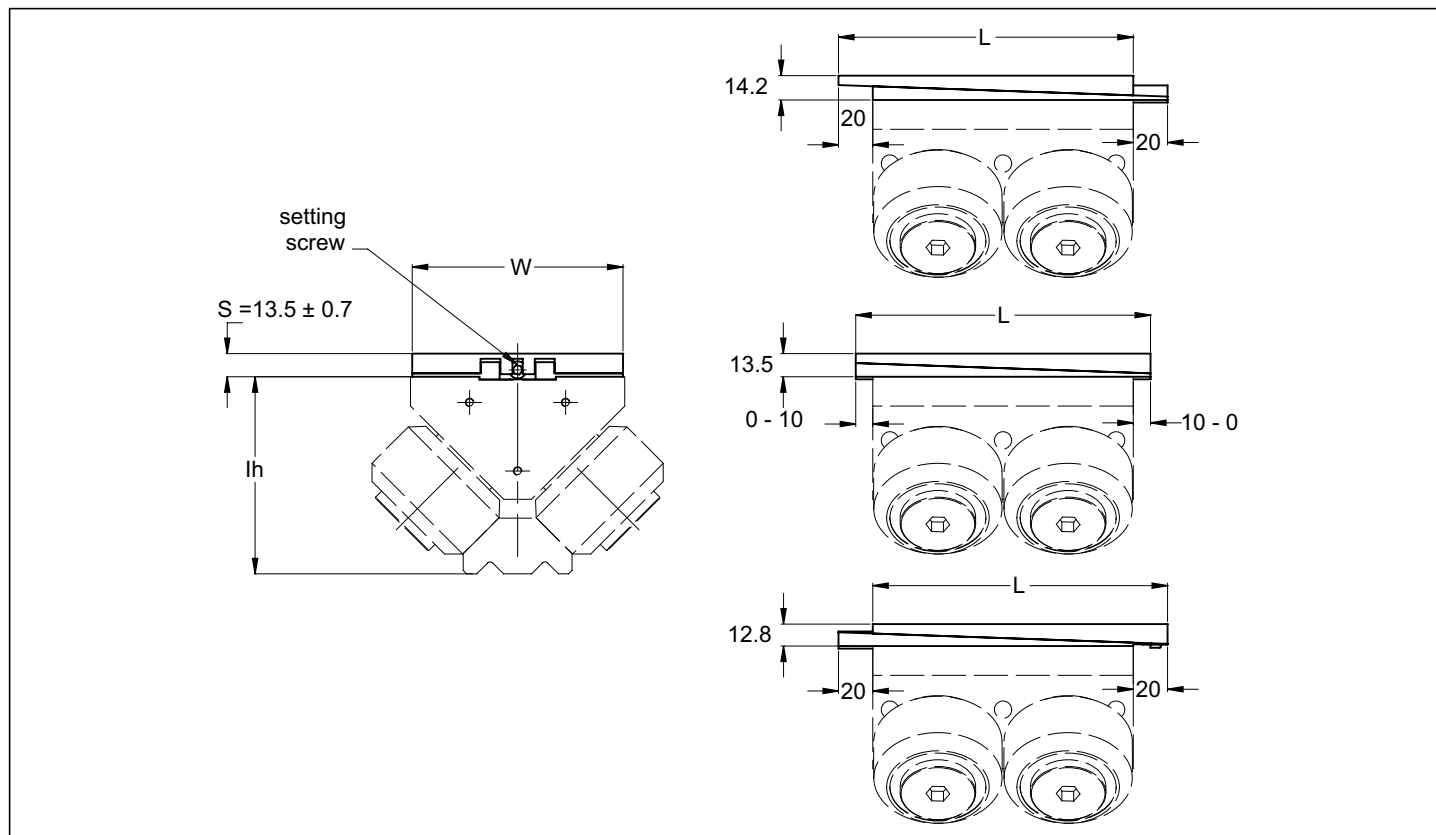
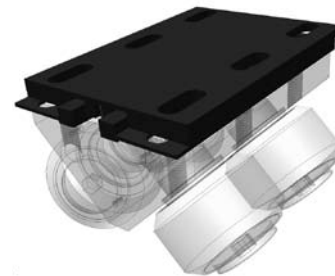
BL 4... four guide rollers block

Type	Dimensions (mm)										Weight (kg)
	A	B	C	m	e	u	f	Q	T	Z	
BL 2 52	136	90	56	70	40	8	M 8	12	43	47	2.4
BL 4 52	136	90	112	70	48	8	M 8	12	43	47	4.8
BL 2 75	170	125	76	85	56	10	M 12	17.1	71.5	70	6.5
BL 4 75	170	125	152	85	66	10	M 12	17.1	71.5	70	13
BL 2 115	243	170	125	120	95	15	M 14	22	99.8	93	21.6
BL 4 115	243	170	250	120	110	15	M 14	22	99.8	93	43.2

Type	Dynamic load (N)	Limit loads of the bearing (N)		Limit loads of the stud (N)		Life coefficients	
	$C_w^{(3)}$	radial $C_{or}^{(4)}$	axial $C_{oa}^{(5)}$	Radial $F_r^{(4)}$	Axial $F_a^{(5)}$	X	Y
BL 2 52	59 000	62 200	31 100	16 800	8 400	1	1
BL 4 52	118 000	124 400	62 200	33 600	16 800	1	1
BL 2 75	96 300	101 800	50 900	44 200	22 100	1	1
BL 4 75	192 600	203 600	101 800	88 400	44 200	1	1
BL 2 115	264 500	276 000	138 000	78 600	39 300	1	1
BL 4 115	529 000	552 000	276 000	157 200	78 600	1	1

- 1) Standard seals: material NBR, RS type
- 2) On request, the guide rollers can be supplied in stainless steel (suffix **NX**) and with Viton seals for operating temperatures up to 120°C (suffix **V**, up to dimension BL.... 75 included)
- 3) C_w basic load for 100 km, load perpendicular to the roller side fixing surface
- 4) Loads perpendicular to the roller side fixing surface
- 5) Loads parallel to the roller side fixing surface
- 6) Pressure angle α for loads checking calculation: 45°

Adjustment plates **PR** **NEW**



Type	Dimensions (mm)		Weight (kg)	Combination with ROLBLOC carriages
	L	W		
PR 252	76	88	0.5	BL 252
PR 452	132	88	1.0	BL 452
PR 275	96	123	1.0	BL 275
PR 475	172	123	1.9	BL 475

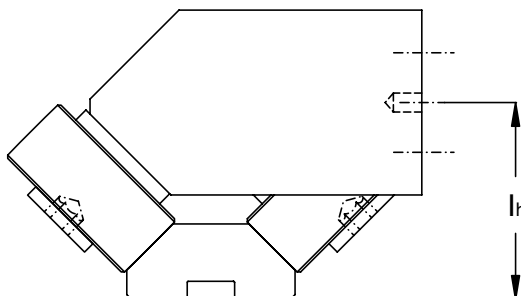
The adjusting plates allows to easily set the proper component preload during the mounting on the machine.

The two steel plates are placed in between the standard ROLBLOC and the mounting surface. Setting is done by the setting screw before the final tightening of the screws used to mount the ROLBLOC.

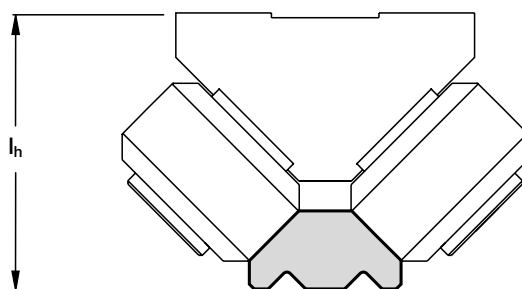
Dimension W of plates is 2 mm lower than the block of ROLBLOC. Use the ROLBLOC side as reference for the block position.

When the plates are set in the mid position (thickness 13.5 mm) they can be shifted 10 mm from the block centreline. The possible shift is reduced with the regulation since it become null at the end of allowed setting, minimum or maximum height. Consider 10 mm of space over the plate length on each side (20 mm over the block length) to use the full thickness setting capability +/- 0,7 mm

Guide Rollers combination

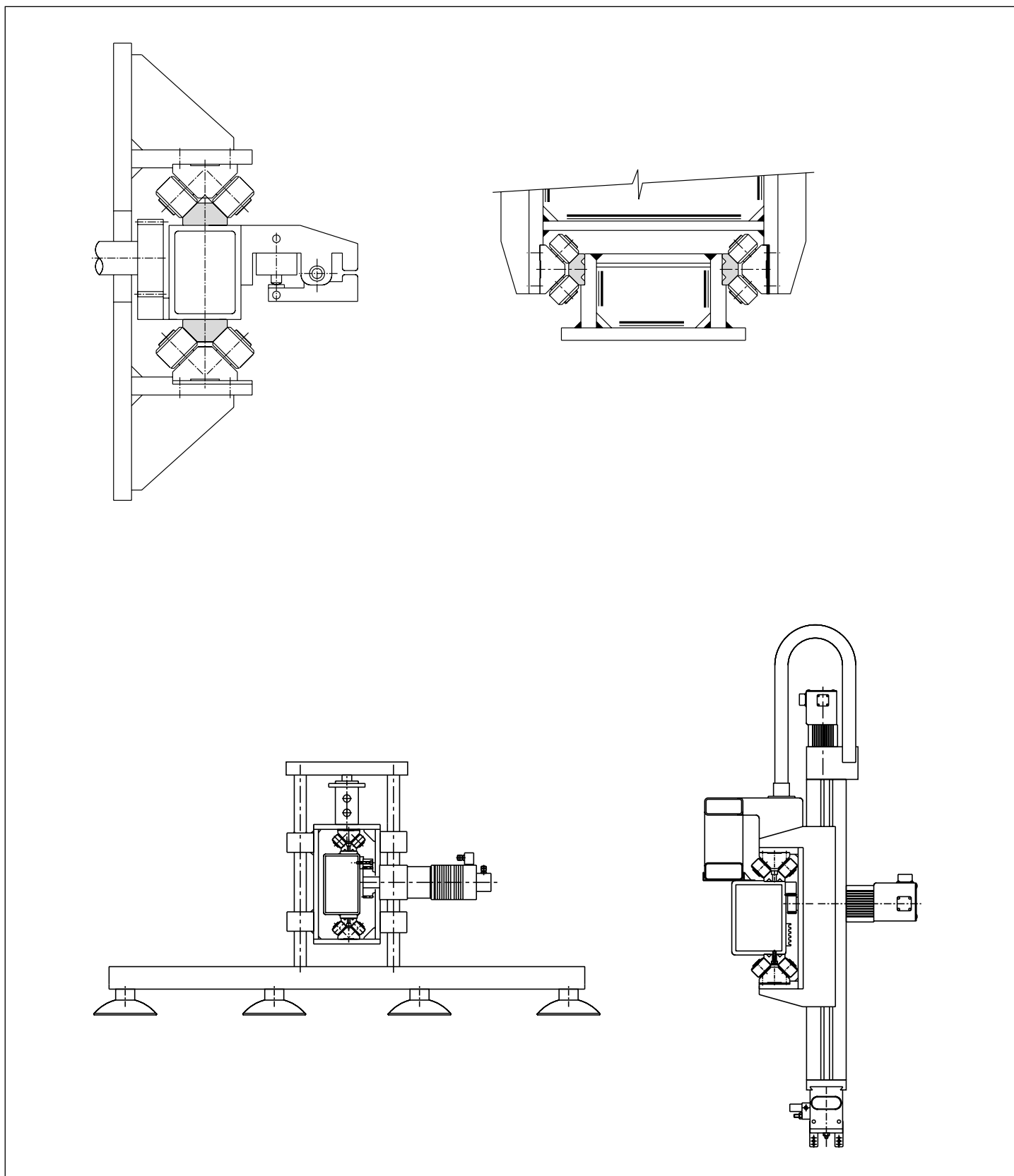


Guide \ Roller	l_h (mm)
	MBL / MBLR
GU 35 MT	41.5
GU 35 M	40.6



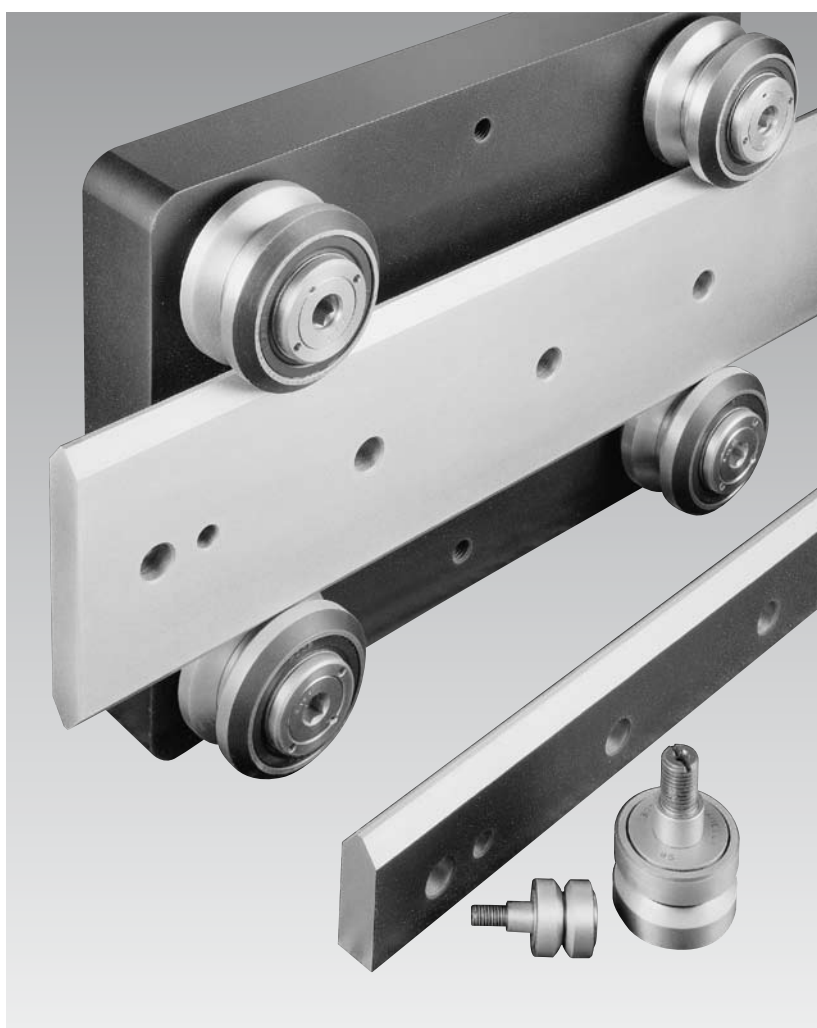
Guide \ Roller	l_h (mm)					
	BL 2 52	BL 4 52	BL 2 75	BL 4 75	BL 2 115	BL 4 115
GU 62 MT	86.5	86.5	115	115	-	-
GU 62 M	85	85	113.5	113.5	-	-
GU 80 MT	-	-	-	-	156.5	156.5
GU 80 M	-	-	-	-	155	155

Mounting Example



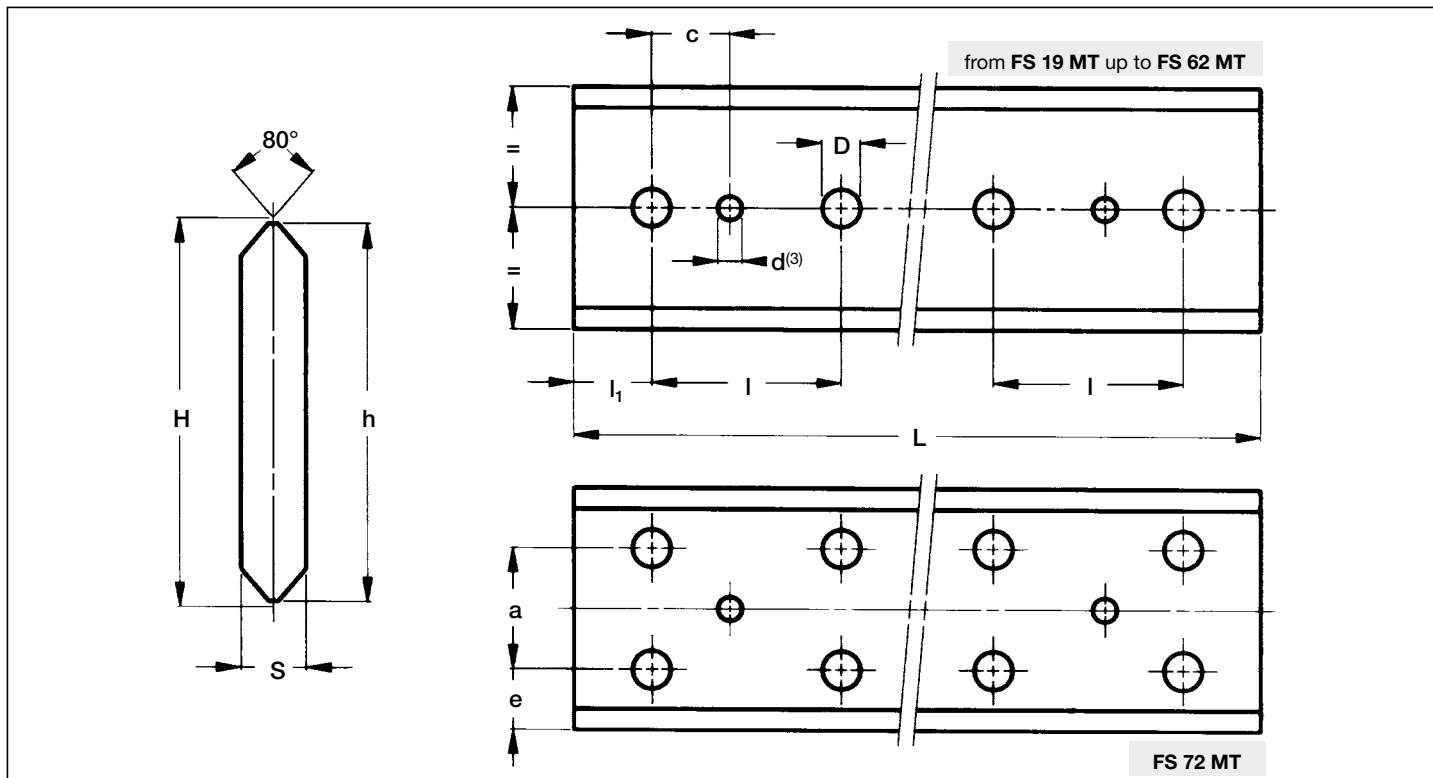
For further details, contact the NADELLA Technical Service.

FS System



NADELLA

Guide Rails FS..MT



Type	Dimensions (mm)										Weight ⁽²⁾ (kg/m)
	H ± 0.1	h ± 0.1	S ± 0.1	d ⁽³⁾ + 0.05	D	c ⁽²⁾	e	a	l	l ₁	
FS 19 MT	22.2	21	5.3	4	6.5	15	–	–	90	30	0.8
FS 22 MT	28.8	27	5.8	5	6.5	15	–	–	90	30	1.1
FS 32 MT	43.8	42	6.8	6	6.5	15	–	–	90	30	2.1
FS 35 MT	48.8	47	8.8	6	9	20	–	–	90	30	3.0
FS 40 MT	64.5	62	8.8	6	9	20	–	–	90	30	4.1
FS 47 MT	80.15	77.2	11	6	11.5	20	–	–	90	30	6.3
FS 52 MT	91.35	88.2	13	8	13.5	20	–	–	90	30	8.5
FS 62 MT	106	103	15.7	8	13.5	20	–	–	90	30	11.7
FS 72 MT	124.6	121	19	10	17.5	30	30.5	60	90	30	16.9

Maximum length of single guide element L = 6 000 mm (1)

1) Longer rails are supplied in sections with ground butt joints - 2) Weight without holes

3) Standard layout without pin holes

Rails finishing

- drawn, induction hardened and sandblasted tracks (**MT**);
- Induction hardening on raceways only

Hole layout

- holes according to catalogue (**SB**)
- finishes to drawing (**NZ**)
- without holes (**NF**)

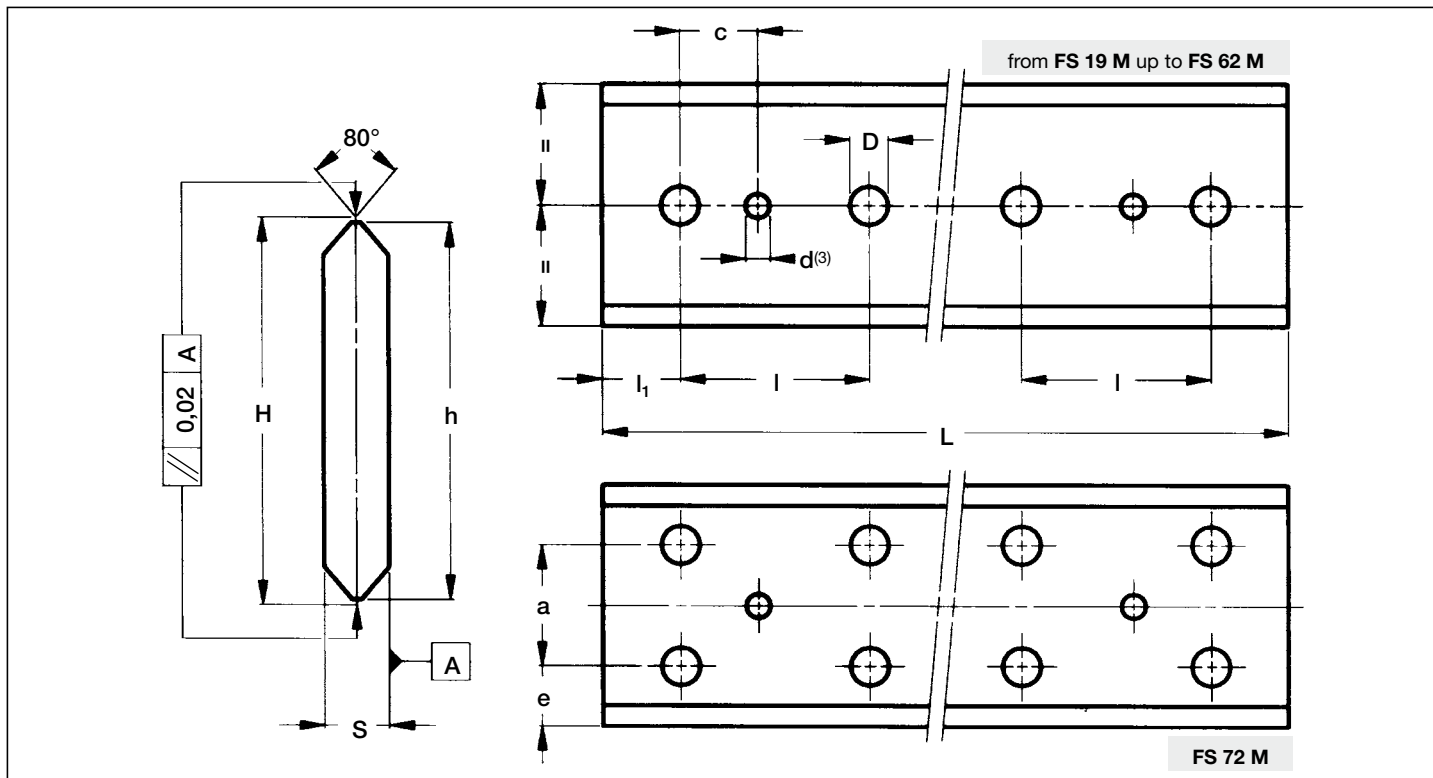
Optional features

- ground one end (**R**)
- ground both ends (**RR**)
- chemical Nickel-plating (**NW**)
- pin holes

Example of standard designation: **FS 52 MT/5280/SB**

See page 15 for standard codification

Guide Rails FS..M



Type	Dimensions (mm)										Weight ⁽²⁾ (kg/m)
	H ± 0.05	h ± 0.1	S ± 0.05	d ⁽³⁾ + 0.05	D	c	e	a	l	l ₁	
FS 19 M	20.95	20	4.5	4	6.5	15	–	–	90	30	0.6
FS 22 M	27.86	26	5	5	6.5	15	–	–	90	30	0.9
FS 32 M	42.86	41	6	6	6.5	15	–	–	90	30	1.8
FS 35 M	47.86	46	8	6	9	20	–	–	90	30	2.6
FS 40 M	63.58	61	8	6	9	20	–	–	90	30	3.7
FS 47 M	78.58	76	10	6	11.5	20	–	–	90	30	5.6
FS 52 M	89.78	87	12	8	13.5	20	–	–	90	30	7.7
FS 62 M	104.76	102	15	8	13.5	20	–	–	90	30	11.2
FS 72 M	122.98	120	18	10	17.5	30	30	60	90	30	15.8

Maximum length of single guide element L = 4,020 mm (1)

1) Longer rails are supplied in sections with ground butt joints

2) Weight without holes

3) Standard layout without pin holes

Rails finishing

- drawn, induction hardened and ground profile (M);
- Induction hardening on raceways only

Hole layout

- holes according to catalogue (SB)
- finishes to drawing (NZ)
- without holes (NF)

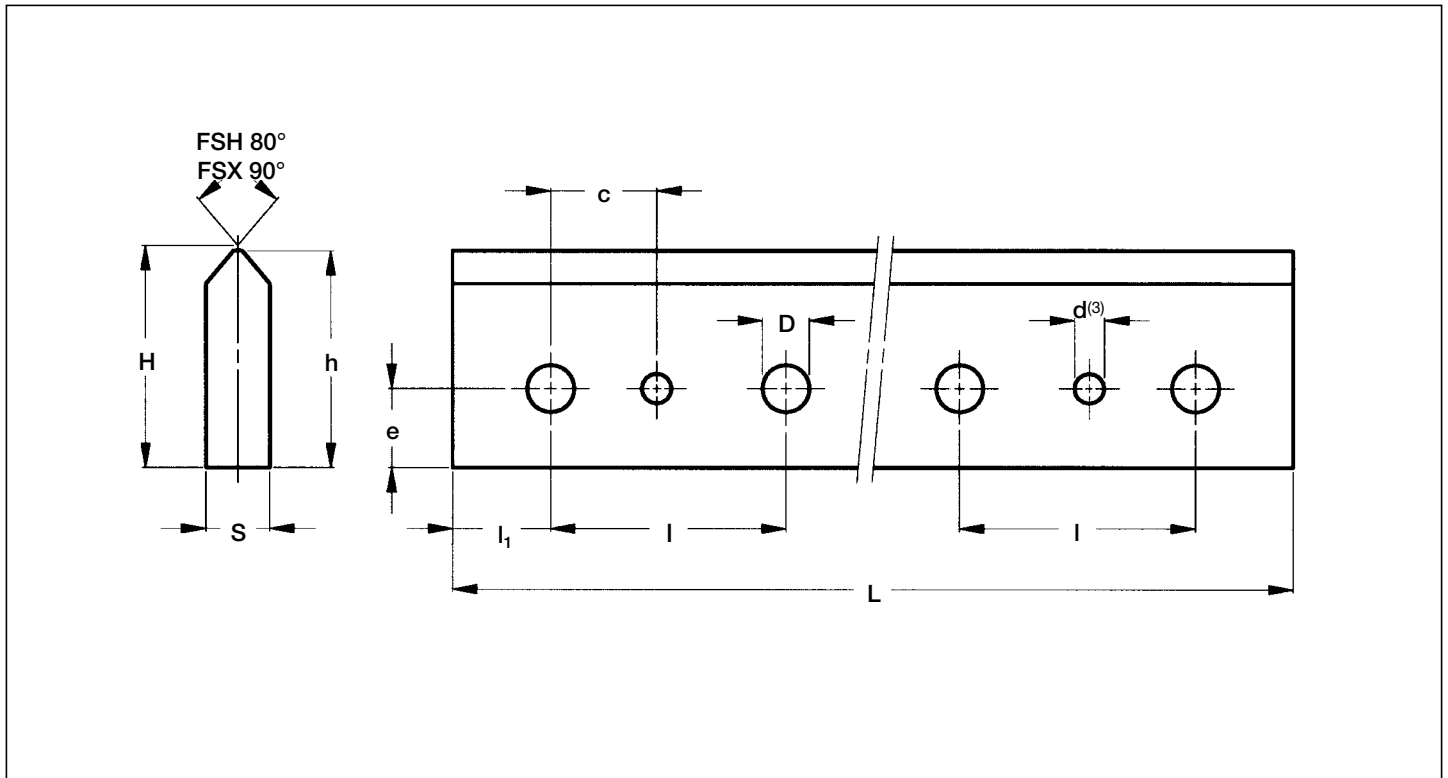
Optional features

- ground one end (R)
- ground both ends (RR)
- chemical Nickel-plating (NW)
- pin holes

Example of standard designation: **FS 40 M/2760/SB**

See page 15 for standard codification

Guide Rails **FSH..MT, FSX..MT**



Type	Dimensions (mm)									Weight ⁽²⁾ (kg/m)
	H ± 0.1	h ± 0.1	S ± 0.1	d ⁽³⁾ + 0.05	D	c	e	l	l ₁	
FSH 22 MT	23.9	23	5.8	5	6.5	15	9	90	30	1.0
FSH 32 MT	29.9	29	6.8	6	6.5	15	11	90	30	1.5
FSH 40 MT	37.2	36	8.8	6	9	20	16	90	30	2.4
FSH 52 MT	40.75	39.2	13	8	13.5	20	17	90	30	3.7
FSH 62 MT	50.75	49.2	16	8	13.5	20	17	90	30	5.7
FSH 72 MT	60.85	59.2	19	10	17.5	30	20	90	30	8.2
FSX 90 MT	62.85	61	26.5	10	13.5	30	22	90	30	11.6

Maximum length of single guide element L = 6 000 mm⁽¹⁾

1) Longer rails are supplied in sections with ground butt joints

2) Weight without holes

3) Standard layout without pin holes

Rails finishing

- drawn, induction hardened and sandblasted tracks (**MT**);
- Induction hardening on raceways and base only

Hole layout

- holes according to catalogue (**SB**)
- finishes to drawing (**NZ**)
- without holes (**NF**)

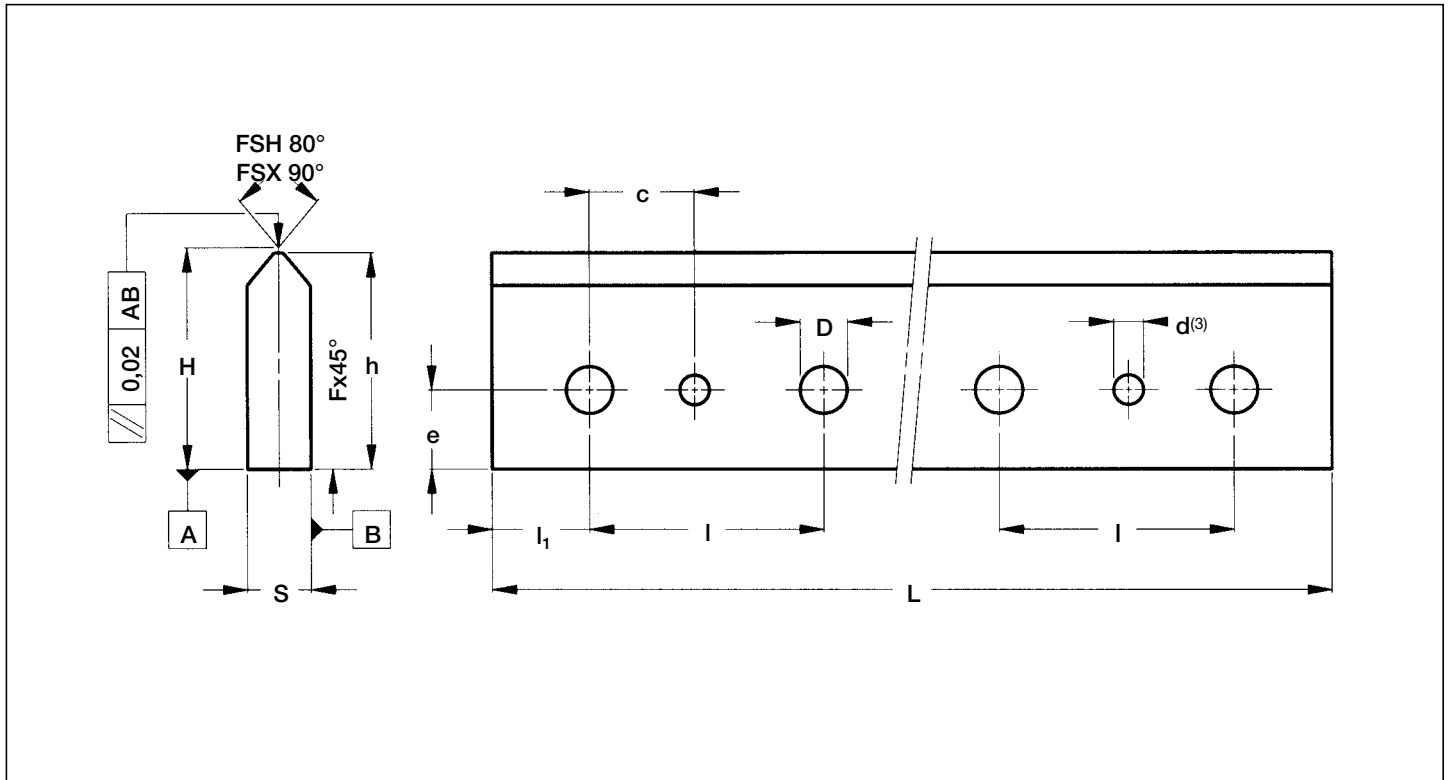
Optional features

- ground one end (**R**)
- ground both ends (**RR**)
- chemical Nickel-plating (**NW**)
- pin holes

Example of standard designation: **FSH 52 MT/5280/SB**

See page 15 for standard codification

Guide Rails **FSH...M, FSX...M**



Type	Dimensions (mm)									Weight ⁽²⁾ (kg/m)
	H ± 0.05	h ± 0.1	S ± 0.05	d ⁽³⁾ + 0.05	D	c	e	l	l ₁	
FSH 19 M	18.98	18.5	4.5	4	6.5	15	8	90	30	0.6
FSH 22 M	22.93	22	5	5	6.5	15	9	90	30	0.8
FSH 32 M	28.93	28	6	6	6.5	15	11	90	30	1.2
FSH 40 M	36.29	35	8	6	9	20	16	90	30	2.1
FSH 52 M	39.39	38	12	8	13.5	20	17	90	30	3.4
FSH 62 M	49.38	48	15	8	13.5	20	17	90	30	5.2
FSH 72 M	59.49	58	18	10	17.5	30	20	90	30	7.6
FSX 90 M	61.79	60	26	10	13.5	30	22	90	30	11.0

Maximum length of single guide element L = 4 020 mm⁽¹⁾

1) Longer rails are supplied in sections with ground butt joints

2) Weight without holes

3) Standard layout without pin holes

Rails finishing

- drawn, induction hardened and ground profile (**M**);
- Induction hardening on raceways and base only

Hole layout

- holes according to catalogue (**SB**)
- finishes to drawing (**NZ**)
- without holes (**NF**)

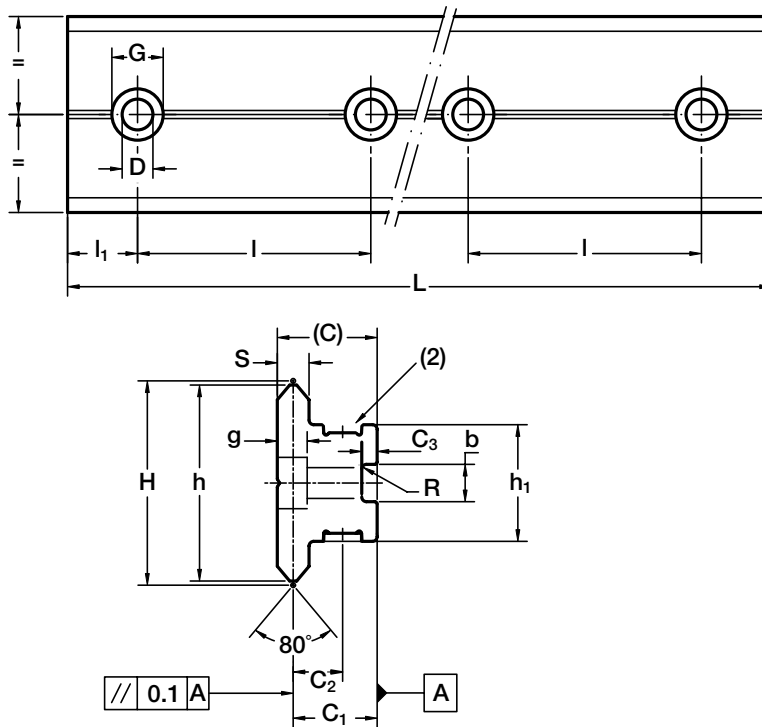
Optional features

- ground one end (**R**)
- ground both ends (**RR**)
- chemical Nickel-plating (**NW**)
- pin holes

Example of standard designation: **FSH 40 M/2760/SB**

See page 15 for standard codification

Guide Rails **FSB..MT**



Type	Dimensions (mm)															Weight ⁽³⁾ (kg/m)
	D	G	g	l	l ₁	H ± 0.1	h ± 0.1	S ± 0.1	(C)	C ₁ ± 0.1	C ₂	C ₃	b + 0.05	h ₁	R	
FSB 32 MT	6.6	11	6.8	90	30	43.8	42	6.8	21.4	18	10.6	3.3	8	25	1	4.5
Maximum length of single guide element L = 6 000 mm ⁽¹⁾																

- 1) Longer rails are supplied in sections with ground butt joints
- 2) Option measuring tape, for more information contact technical department
- 3) Weight without holes

Rails finishing

- drawn, induction hardened and sandblasted tracks (**MT**);
- Induction hardening on raceways only

Hole layout

- holes according to catalogue (**SB**)
- finishes to drawing (**NZ**)
- without holes (**NF**)

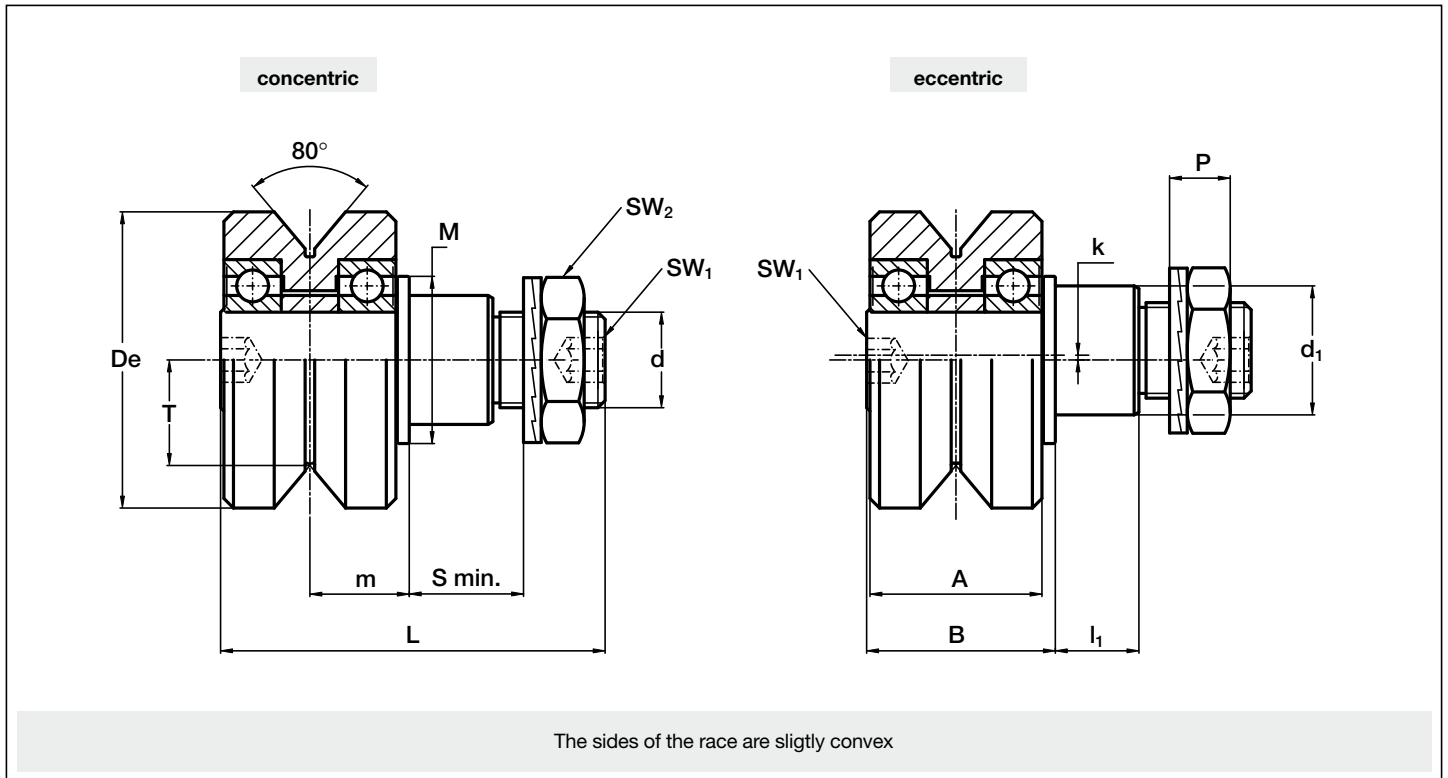
Optional features

- ground one end (**R**)
- ground both ends (**RR**)
- chemical Nickel-plating (**NW**)

Example of standard designation: **FSB 32 MT/2040/SB**

See page 15 for standard codification

Guide Rollers **FR..EI**



Type		Dimensions (mm)														
concentric	eccentric	De	d ₁ ⁽¹⁾	d	T	m	S min.	P	L	A	B	l ₁	M	SW ₁	SW ₂	k
FR 22 EI	FRR 22 EI	22	9	M 6 x 1	7.7	9.4	9	6.5	37	15	18.2	8	14	4 ⁽⁶⁾	ch. 10	0.5
FR 32 EI	FRR 32 EI	32	14	M 10 x 1.25	11.8	12.6	12	8.5	50.5	21	24.5	11	20	4	ch. 16	1
FR 40 EI	FRR 40 EI	40	16	M 12 x 1.5	14.6	15.5	12	10.4	59.5	28	30.5	11	22	5	ch. 18	1
FR 52 EI	FRR 52 EI	52	21	M 16 x 1.5	19.1	19.8	15	11.4	69.5	32	36.5	14	28	6	ch. 24	1,5
FR 62 EI	FRR 62 EI	62	27	M 20 x 1.5	22.1	20.8	18.5	12.4	80.5	36	39.5	17.5	35	8	ch. 30	2

Type		Dynamic load (N)	Limit loads of the bearing (N)		Limit loads of the stud (N)		Life coefficients		Torque wrench settings ⁽²⁾ (Nm)	Weight (g)
			radial C _{or}	axial C _{oa}	radial F _r	axial F _a	X	Y		
FR 22 EI	FRR 22 EI	1 800	1 080	350	1 700	720	1	2.20	3	45
FR 32 EI	FRR 32 EI	4 400	2 330	750	1 200	500	1	2.92	20	130
FR 40 EI	FRR 40 EI	7 350	4 000	1 300	3 000	1 300	1	2.75	26	260
FR 52 EI	FRR 52 EI	9 500	5 500	1 750	7 500	3 000	1	2.96	64	510
FR 62 EI	FRR 62 EI	15 500	8 500	2 750	10 900	4 200	1	3.07	120	820

1) Housing bore tolerance: H7

2) The torque wrench settings are given for non-lubricated threads; for lubricated threads, multiply figure by 0.8

3) On request, the guide rollers can be supplied in stainless steel (suffix **NX**)

4) C_w basic load for 100 km

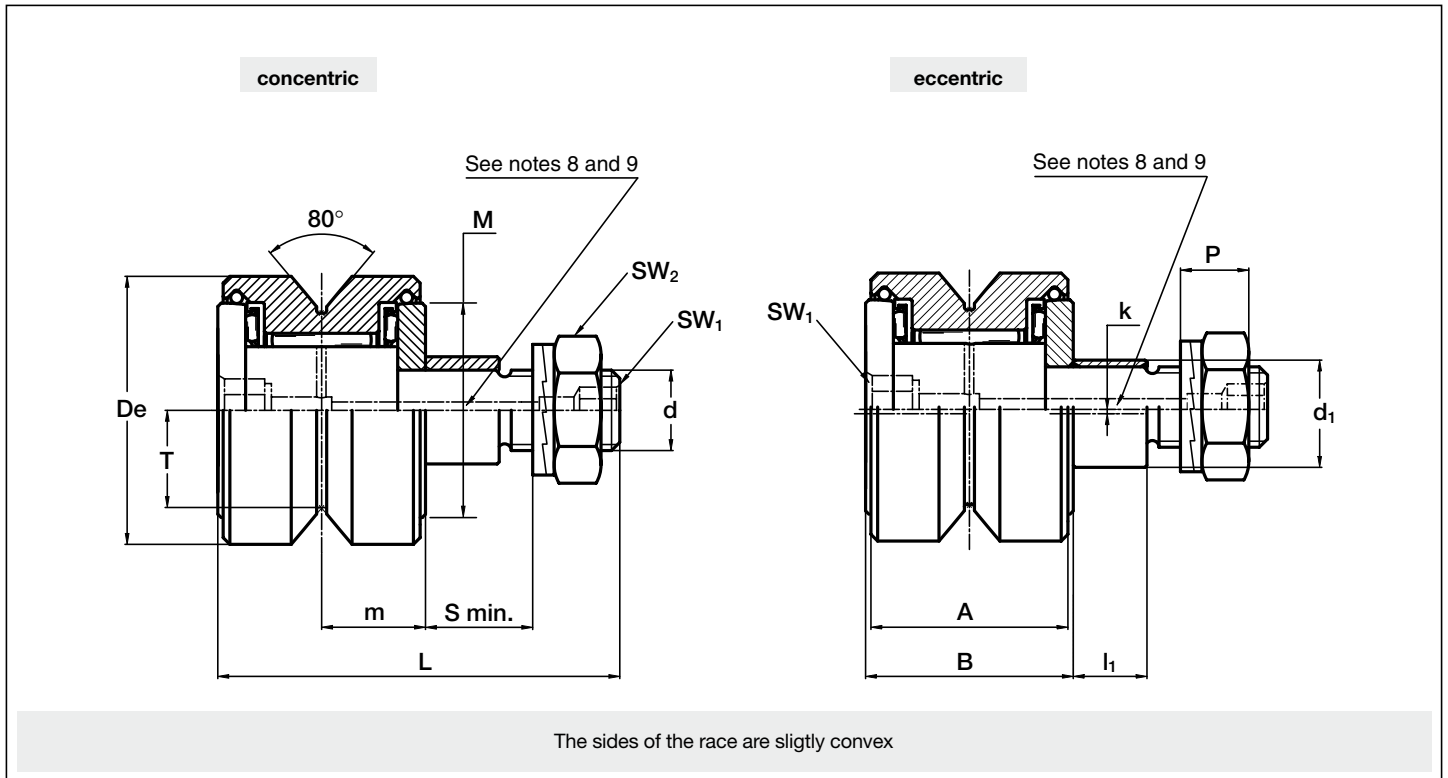
5) The guide rollers are complete with self-locking washers and hexagonal nut (DIN 439B) for fitting

6) Pressure angle α for load calculation: 40°

7) NBR seals RS type

8) Screw driver slot on the stud side

Guide Rollers **FRN..EI**



Type		Dimensions (mm)														
concentric	eccentric	De	d ₁ ⁽¹⁾	d	T	m	S min.	P	L	A	B	l ₁	M	SW ₁	SW ₂	k
FRN 19 EI ⁽⁸⁾	FRNR 19 EI ⁽⁸⁾	19	7	M 5 x 0.8	7	8.8	6.5	4.2	34	17	18	5.5	14	*	ch. 8	0.5
FRN 22 EI ⁽⁸⁾	FRNR 22 EI ⁽⁸⁾	22	9	M 6 x 1	7.7	9.4	9	6.5	39	18.2	20	8	16.5	*	ch. 10	0.5
FRN 32 EI ⁽⁸⁾	FRNR 32 EI ⁽⁸⁾	32	14	M 10 x 1.25	11.8	12.6	12	10.4	52	24.2	26	11	25	4	ch. 16	1
FRN 40 EI ⁽⁹⁾	FRNR 40 EI ⁽⁹⁾	40	16	M 12 x 1.5	14.6	15.5	12	11.4	60	29.4	31	11	32	8	ch. 18	1

*) screwdriver slot

Type		Dynamic loads (N)		Limit loads of the bearing (N)		Limit loads of the stud (N)		Torque wrench ⁽²⁾ settings (Nm)	Weight (g)
		C _{wr} ⁽⁴⁾	C _{wa} ⁽⁴⁾	radial C _{or}	axial C _{oa}	radial F _r	axial F _a		
FRN 19 EI	FRNR 19 EI	1 800	600	1 720	1 300	490	270	1.8	35
FRN 22 EI	FRNR 22 EI	3 280	800	3 750	1 670	590	290	3	53
FRN 32 EI	FRNR 32 EI	5 600	2 100	7 200	5 100	2 030	950	20	160
FRN 40 EI	FRNR 40 EI	12 300	2 600	17 000	6 700	2 800	1 350	26	290

1) Housing bore tolerance: H7

2) The torque wrench settings are given for non-lubricated threads; for lubricated threads, multiply figure by 0.8

3) On request, the guide rollers can be supplied in stainless steel (suffix **NX**)

4) C_w basic load for 100 km

5) The guide rollers are complete with self-locking washers and hexagonal nut (DIN 439B) for fitting

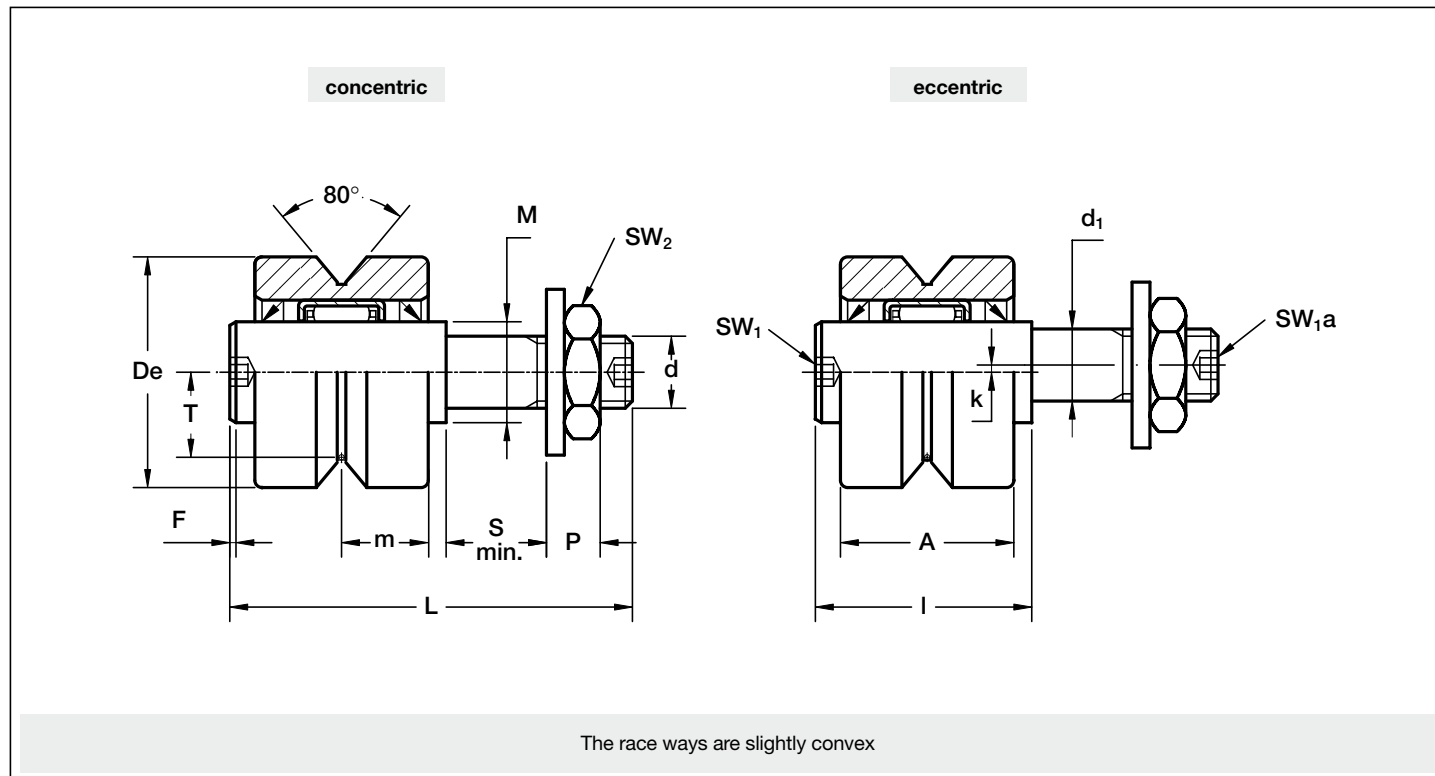
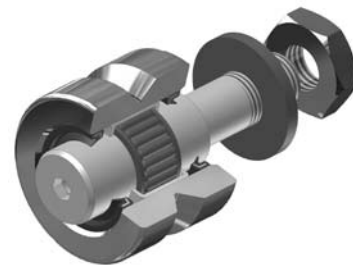
6) Pressure angle α for load calculation: 40°

7) Standard Viton seals to fit temperature up to 120°C

8) Lubrication hole only on the head side

9) Lubrication hole also on the stud side

Guide Rollers **FRLK.., FRLR..**



Type		Dimensions (mm)														
concentric	eccentric	De	d ₁ ⁽¹⁾	d	T	m	S min.	P	L	A	I	F	M	SW ₁	SW ₂	k
FRLK 19	FRLR 19	19	5	M 5 x 0.8	7	8.3	6.5	3.9	38.6	16.6	22.6	1	7	2.5	8	0.5
FRLK 22	FRLR 22	22	6	M 6 x 1	7.7	8.9	9	4.7	42.8	17.8	23.8	1	10	3	10	0.5
FRLK 32	FRLR 32	32	10	M 10 x 1.25	11.8	12.1	12	7.5	56.2	24.2	30.2	1	14	4	17	1
FRLK 40	FRLR 40	40	12	M 12 x 1.5	14.6	14.7	12	9	64.7	29.4	35.7	2	20	4	19	1
FRLK 52	FRLR 52	52	16	M 16 x 1.5	19.1	18.8	15	12	77.6	37.6	44.6	2	25	5	24	1.5
FRLK 62	FRLR 62	62	20	M 20 x 1.5	22.1	19.8	19	15	87.6	39.6	46.6	2	30	8	30	2
FRLK 72	FRLR 72	72	24	M 24 x 1.5	25.5	26	22	18	109	52	59	2	35	10	36	3

Type		Dynamic load (N)	Limit load of the bearing (N)	Limit load of the stud (N)	Torque ⁽²⁾ wrench setting (Nm)	Weight (g) ⁽³⁾
		C _w ⁽⁴⁾	radial C _{or}	radial F _r		
FRLK 19	FRLR 19	1 910	930	240	1.8	42
FRLK 22	FRLR 22	2 860	1 500	410	3	60
FRLK 32	FRLR 32	5 620	2 900	1 720	20	160
FRLK 40	FRLR 40	10 600	6 400	2 610	26	300
FRLK 52	FRLR 52	17 700	10 500	5 150	64	627
FRLK 62	FRLR 62	20 500	12 400	9 610	120	967
FRLK 72	FRLR 72	35 400	22 000	13 500	220	1 714

1) Housing bore tolerance: H7

2) The torque wrench settings are given for non-lubricated threads; for lubricated threads, multiply figure by 0.8

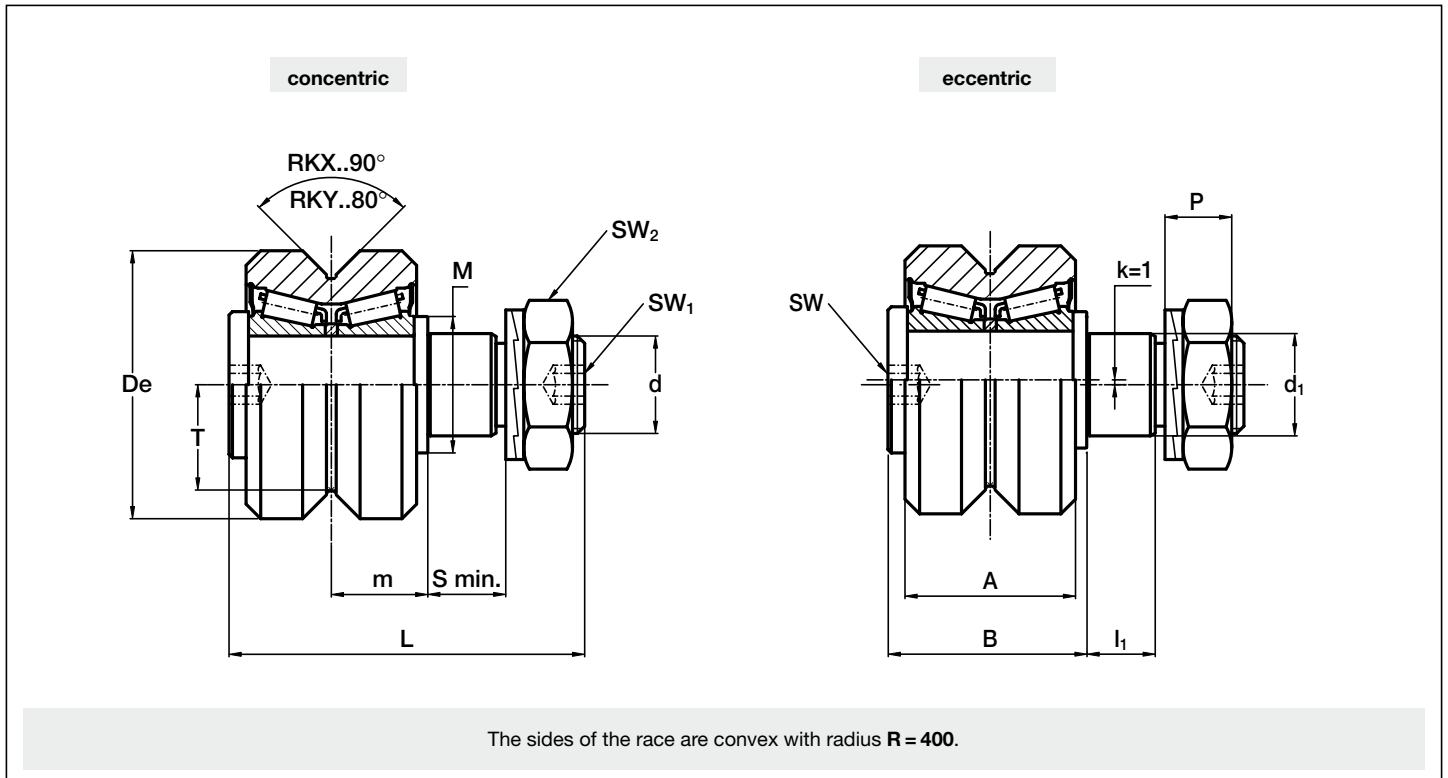
3) Weight without fittings

4) C_w basic load for 100 km

5) The guide rollers are completed with conical spring washer and nut (DIN 439B)

6) The guide rollers are sealed on both sides

Guide Rollers **RKY.., RKX..**

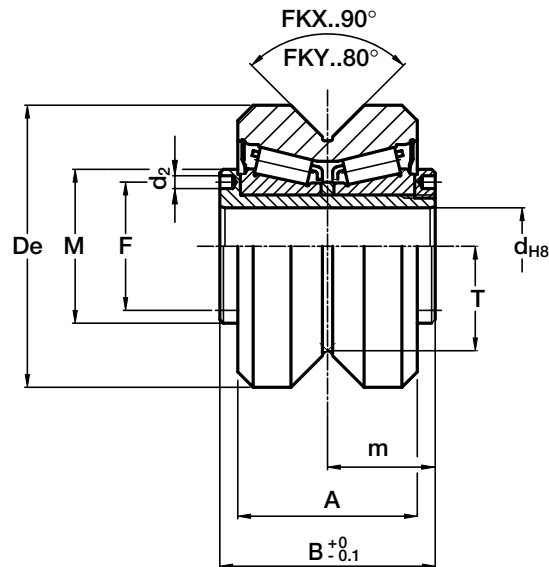


Type		Dimensions (mm)															
concentric	eccentric	De	d ₁ ⁽¹⁾	d	T	m	S min.	P	L	A	B	I ₁	M	SW ₁	SW ₂	k	
RKY 52	RKYR 52	52	21	M 20 x 1.5	19.1	19.8	15	13.4	73	35	41	14	28	8	ch. 30	1	
RKY 62	RKYR 62	62	27	M 24 x 1.5	22.1	20.8	19	15.4	83	37	44	18	35	10	ch. 36	1	
RKY 72	RKYR 72	72	36	M 30 x 1.5	25.5	27	19	21.6	100	45	55	18	44	12	ch. 46	1	
RKX 90C	RKXR 90C	90	38	M 36 x 1.5	32.5	30	24	24.6	115	53	56 ⁽⁶⁾	62	23	50	14	ch. 55	1
RKX 110C	RKXR 110C	110	42	M 36 x 1.5	39.5	34	33	24.6	135	60	63 ⁽⁶⁾	70	32	56	14	ch. 55	1

Type		Dynamic load (N)	Limit loads of the bearing (N)		Limit loads of the stud (N)		Life coefficients				Torque wrench settings ⁽²⁾ (Nm)	Weight (kg)
			radial C _{or}	axial C _{oa}	radial F _r	axial F _a	Pa/Pr ≤ 0.1		Pa/Pr > 0.1			
		C _w ⁽⁵⁾					X	Y	X	Y		
RKY 52	RKYR 52	40 750	44 000	12 400	11 900	4 250	1	4.67	0.77	6.98	80	0.6
RKY 62	RKYR 62	46 000	50 400	12 750	22 100	6 800	1	3.93	0.74	6.55	160	0.9
RKY 72	RKYR 72	64 850	72 000	18 900	31 300	10 100	1	4.67	0.77	6.98	300	1.6
RKX 90C	RKXR 90C	113 400	136 000	37 800	43 700	12 600	1	3	0.8	4.96	450	2.8
RKX 110C	RKXR 110C	177 500	195 000	50 000	55 600	17 900	1	4.26	0.72	7.1	450	4.9

- Housing bore tolerance: H7
- The torque wrench settings are given for non-lubricated threads; for lubricated threads, multiply figure by 0.8
- Standard seals: material NBR, RS type
- On request, the guide rollers can be supplied in stainless steel (suffix **NX**) and with Viton seals for operating temperatures up to 120°C (suffix **V**, up to dimension RKX 90 C included)
- C_w basic load for 100 km
- Dimensions relating to the stainless-steel rollers (suffix **NX**)
- The guide rollers are complete with self-locking washers and hexagonal nut (DIN 439B) for fitting
- Pressure angle α for load calculation: guide rollers RKY 40° - guide rollers RKX 45°

Guide Wheels **FKY.., FKX..**



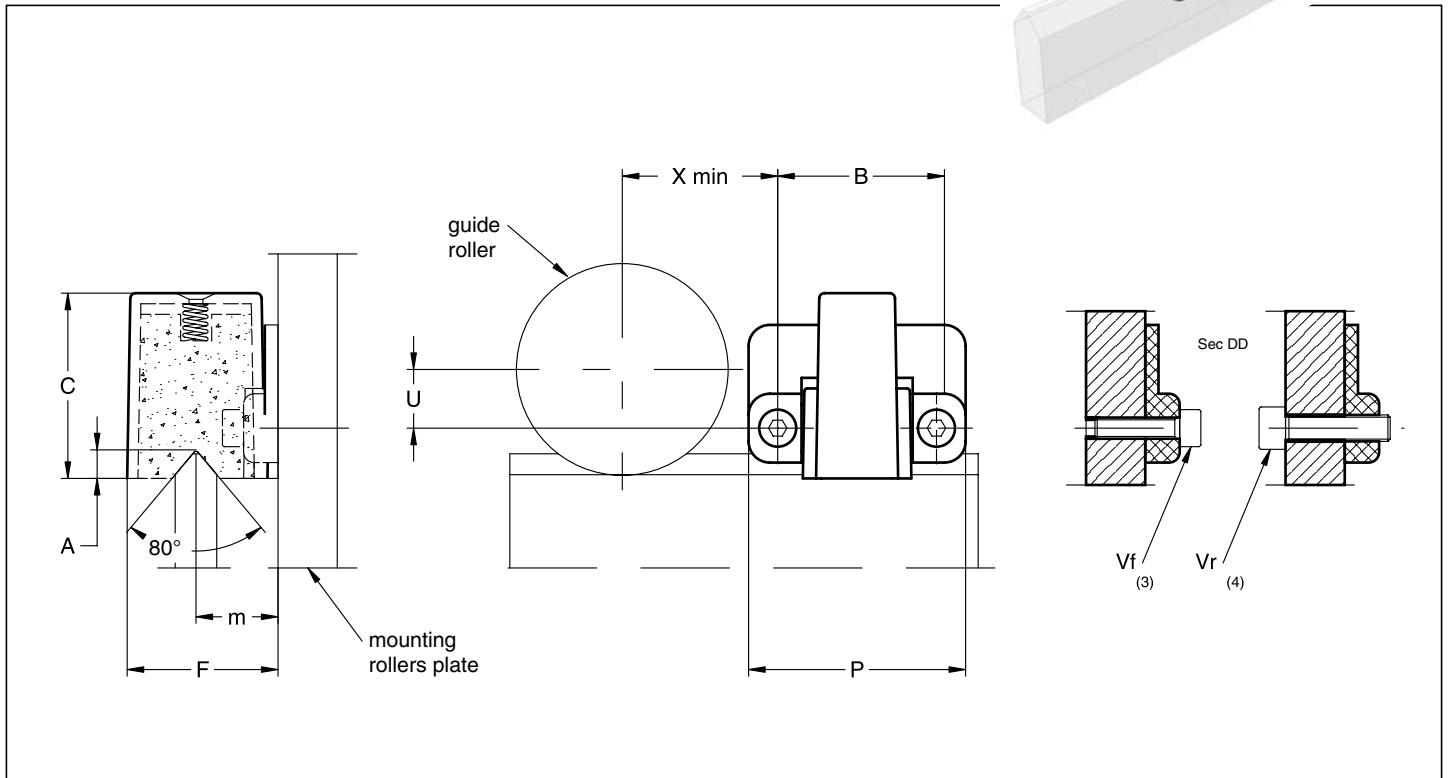
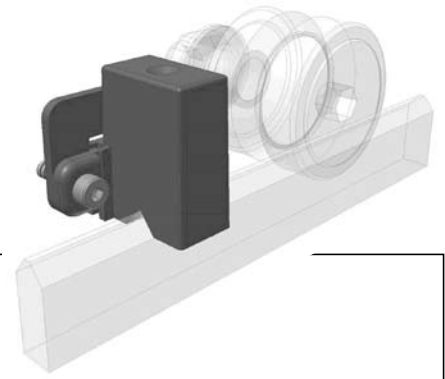
The sides of the race are convex.

Type	Dimensions (mm)									Weight (kg)
	De	d	T	m	A	B	F	d ₂	M	
FKY 52C	52	15	19.1	21	35	42	25	2.5	30	0.5
FKY 62C	62	20	22.1	22.5	37	45	29	3	35	0.6
FKY 72C	72	25	25.5	28	45	56	37	4	44	1.2
FKX 90C	90	28	32.5	32	53	56 ⁽²⁾⁻⁻⁻	64	4	49	2.3
FKX 110C	110	35	39.5	36	60	63 ⁽²⁾⁻⁻⁻	72	4	59	3.9

Type	Dynamic load (N)	Limit loads of the bearing (N)		Limit loads of the wheel (N)		Life coefficients			
		radial C _{or}	axial C _{oa}	radial F _r	axial F _a	Pa/Pr ≤ 0.1		Pa/Pr > 0.1	
	C _w ⁽³⁾					X	Y	X	Y
FKY 52C	40 750	44 000	12 400	11 900	4 250	1	4.67	0.77	6.98
FKY 62C	46 000	50 400	12 750	22 100	6 800	1	3.93	0.74	6.55
FKY 72C	64 850	72 000	18 900	31 300	10 100	1	4.67	0.77	6.98
FKX 90C	113 400	136 000	37 800	43 700	12 600	1	3	0.8	4.96
FKX 110C	177 550	195 000	50 000	55 600	17 900	1	4.26	0.72	7.1

- 1) On request, the guide rollers can be supplied in stainless steel (suffix **NX**) and with Viton seals for operating temperatures up to 120°C (suffix **V**, up to dimension FKX 90 C included)
- 2) Dimensions relating to the stainless-steel rollers (suffix **NX**)
- 3) C_w basic load for 100 km
- 4) To prevent rotation between roller and shaft a pin can be fitted in one of the holes "d₂" positioned in the side flange
- 5) Pressure angle α for load calculation: guide rollers FKY 40° - guide rollers FKX 45°
- 6) Standard seals: material NBR, RS type

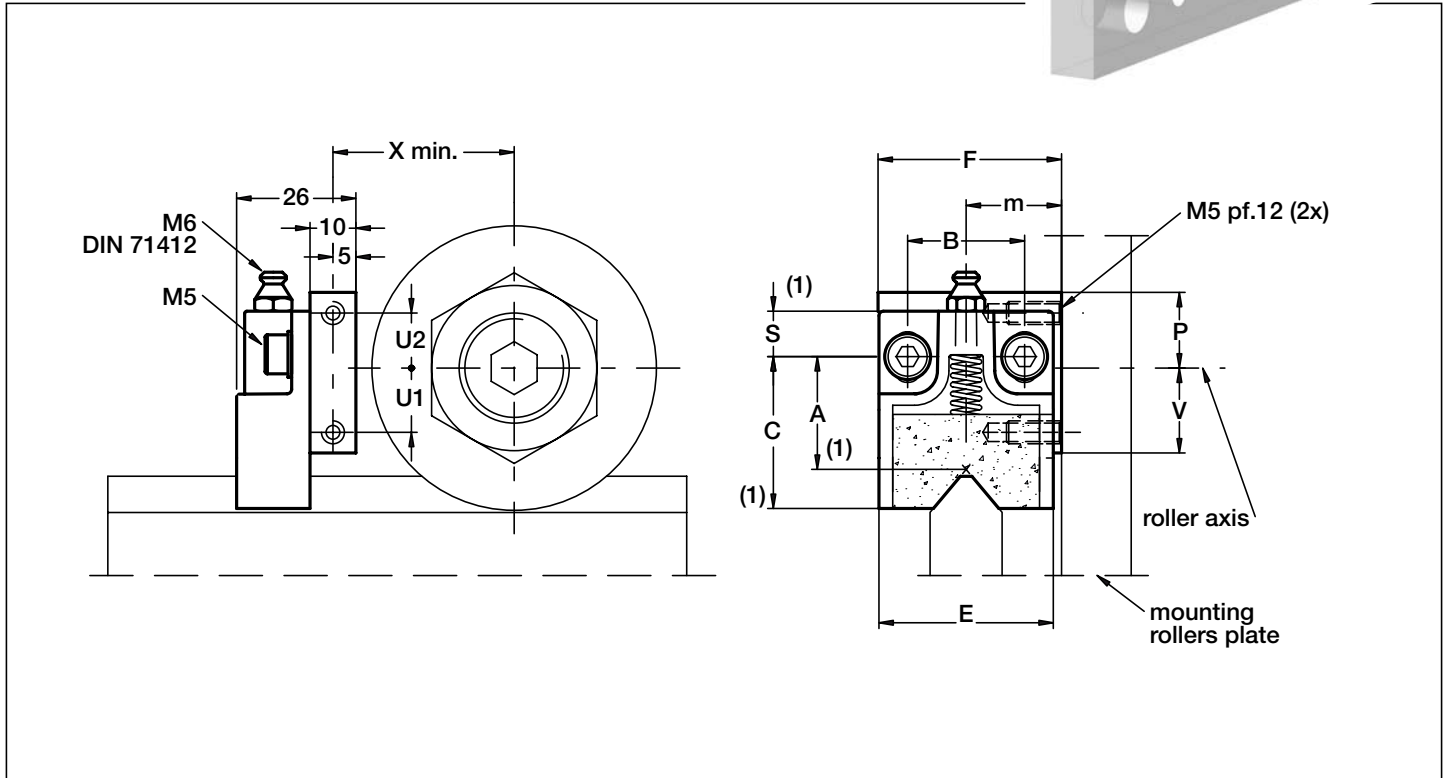
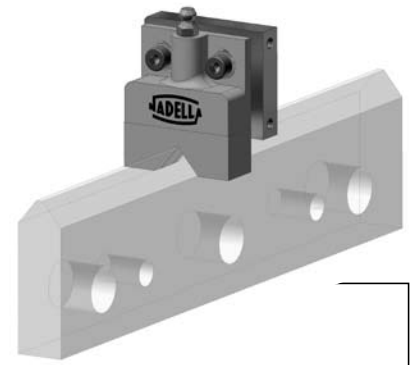
Lubricator **LUBY** for FS guide rollers up to size 40



Type	Dimensions (mm)										Weight (g)	Suggested combinations
	X	U	B	F	m	A	C	P	Vf	Vr		
LUBY 19	15	1.5	25	15.6	8.8	2.5	19	32.5	M3x12	M4	10	FR... 19...
LUBY 22	16.5	3	25	16.8	9.4	3.3	22	32.5	M3x12	M4	10	FR... 22...
LUBY 32	21.5	8	25	23.2	12.6	4.2	30	32.5	M3x12	M4	15	FR... 32...
LUBY 40	27.5	10.5	30	28.5	15.5	5.4	35	41	M4x12	M5	30	FR... 40...

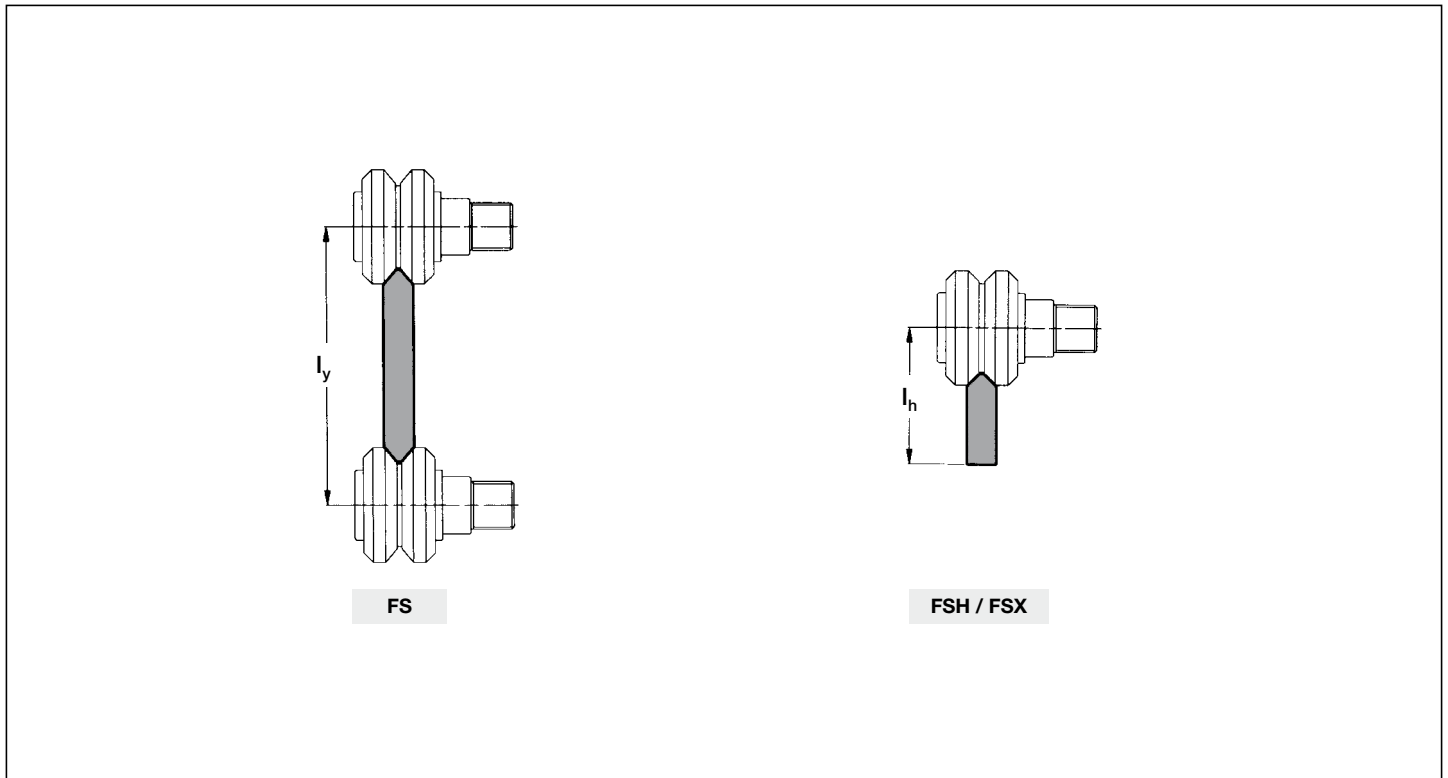
- 1) The lubricator is supplied with the felt already lubricated. The lubricant has a mineral oil base
- 2) At the mounting, insert the screws inside the rollers plate, without tighten them, adjust the height of the plastic part in order to put it in contact with the raceways and then block it
- 3) The screws Vf for the frontal mounting are included in the packaging. Arrange two thread holes for dimension Vf in the mounting rollers plate
- 4) The screws for the mounting on the nut side of the roller are not included in the packaging. Arrange on the mounting rollers plate the holes in order to insert te screws Vr

Lubricator **LUBY, LUBX** for FS guide rollers size 52 and higher



Type	Dimensions (mm)												Weight (g)	Suggested combinations
	X	U1	U2	F	m	B	S	C	A	E	V	P		
LUBY 52	33.5	12	14	40	19.8	25.5	10	34	24.5	38	16.5	18.5	65	RKY 52 RKYR 52 FKY 52 FR 52 EI FRR 52 EI
LUBY 62	38.5	14	12	40	20.8	25.5	10	34	24.5	38	18.5	16.5	65	RKY 62 RKYR 62 FKY 62 FR 62 EI FRR 62 EI
LUBY 72	43.5	19	11	50	27	25.5	10	40	29	44	24	16	85	RKY 72 RKYR 72 FKY 72
LUBX 90	52.5	21	9	60	30	30	16.5	45.5	33.5	58	31	19	140	RKX 90C RKXR 90C FKX 90C
LUBX 110	62.5	30	0	63	34	30	16.5	45.5	33.5	58	40	10	140	RKX 110C RKXR 110C FKX 110C

- 1) The dimension of the plastic part refers to the centre of the regulation slot. The regulation slot allows a translation of +/- 3 mm
- 2) The lubricator is supplied with the felt already lubricated. The lubricant has a mineral oil base
- 3) During the mounting fix the aluminium support to the rollers plate, adjust the height of the plastic part in order to put it in contact with the raceways and than block it in that position with the M5 screws



Guide Rollers FR...EI, FRN...EI, RKY, RKX, FKY, FRL, FRLK

	ly (mm)	Guide roller size						
		19...	22...	32...	40...	52...	62...	72...
FS..M	FS 19 M	35	36.4					
	FS 22 M	41.9	43.3					
	FS 32 M			66.5				
	FS 35 M			71.5	*77			
	FS 40 M				92.8			
	FS 47 M				*107.8	116.8		
	FS 52 M					128	*134	
	FS 62 M					143	149	
	FS 72 M						*167.2	174

	lh (mm)	Guide roller size									
		19...	22...	32...	40...	52...	62...	72...	90...	110...	
FSH..M, FSX..M	FSH 19 M	26	26.7								
	FSH 22 M	*29.9	30.6								
	FSH 32 M			40.7							
	FSH 40 M			*48	50.9						
	FSH 52 M				*54	58.5					
	FSH 62 M					*68.5	71.5				
	FSH 72 M						*81.6	85			
	FSX 90 M								94.3	101.3	

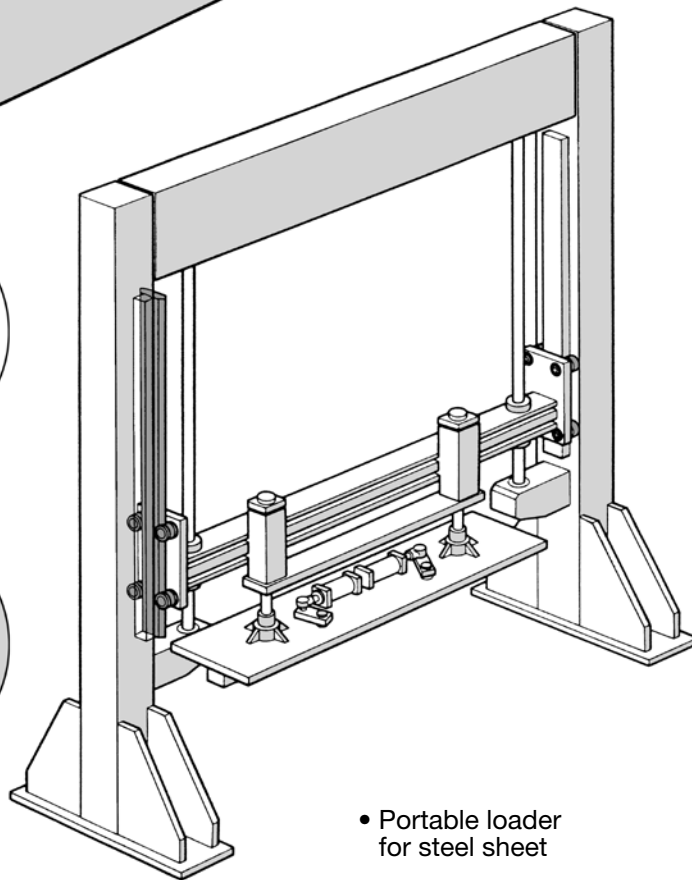
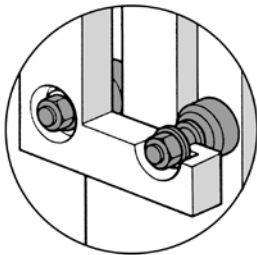
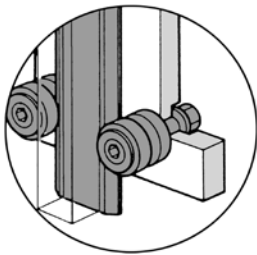
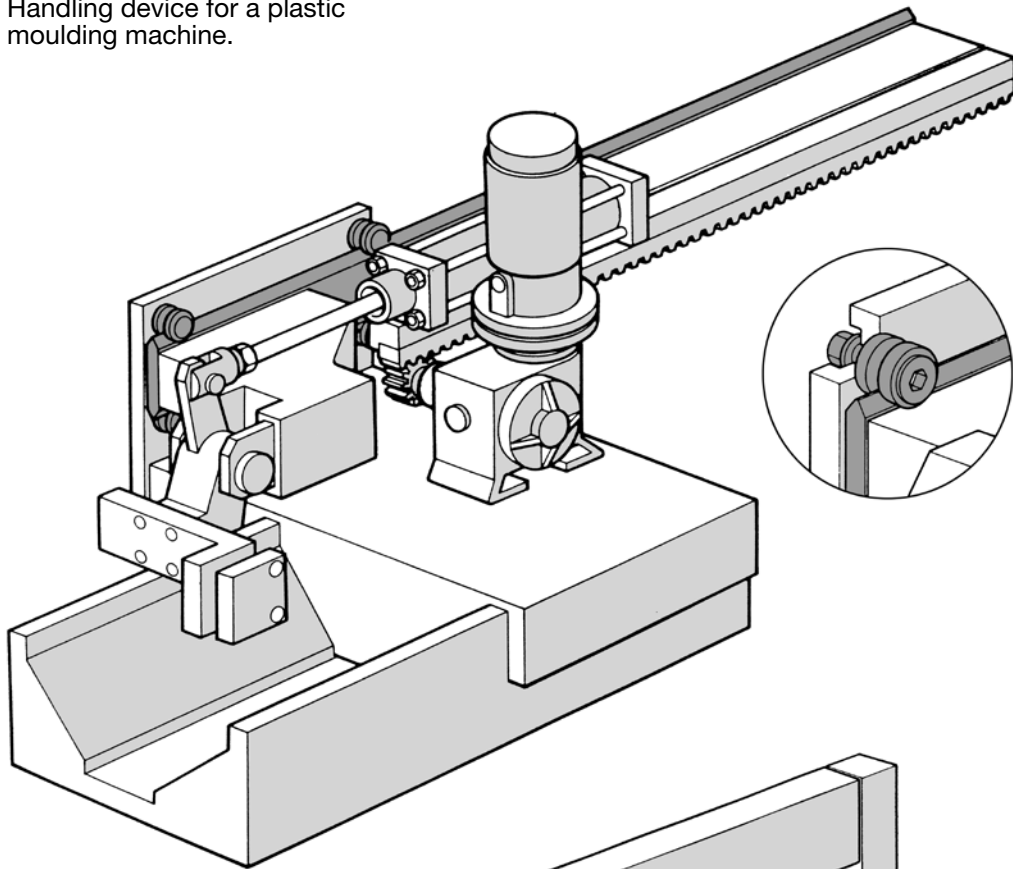
	ly (mm)	Guide roller size						
		19...	22...	32...	40...	52...	62...	72...
FS..MT	FS 19 MT	36.2	37.6					
	FS 22 MT		44.2					
	FS 32 MT			67.4				
	FS 35 MT			72.4	*78			
	FS 40 MT				93.7			
	FS 47 MT				*109.3	118.3		
	FS 52 MT					129.5	*135.5	
	FS 62 MT					144.2	150.2	
	FS 72 MT						*168.8	175.6

	lh (mm)	Guide roller size									
		19...	22...	32...	40...	52...	62...	72...	90...	110...	
FSH..MT, FSX..MT	FSH 22 MT	30.9	31.6								
	FSH 32 MT			41.7							
	FSH 40 MT			*49	51.8						
	FSH 52 MT				*55.4	59.9					
	FSH 62 MT					*69.9	72.9				
	FSH 72 MT						*83	86.4			
	FSX 90 MT								95.3	102.3	

* possible combination

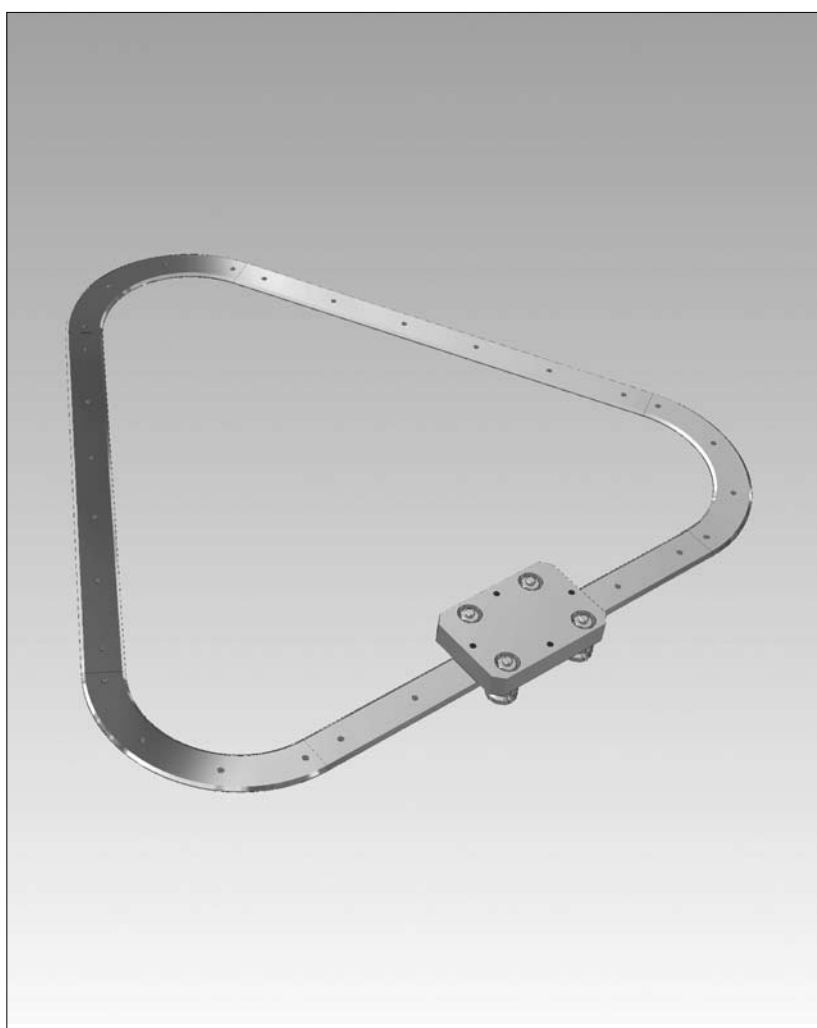
Mounting Examples

- Handling device for a plastic moulding machine.



- Portable loader for steel sheet

FSR System NEW

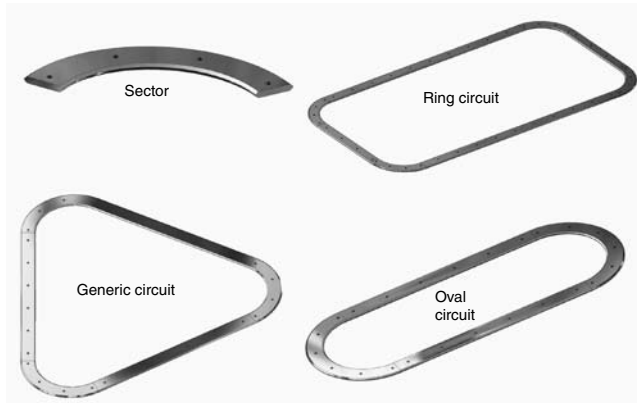


NADELLA

Circular systems

Nadella proposes several circular rails based on the FS family of profiles. The rails can be used as an entire circumference, or single sectors, or joined together with straight pieces of rail in order to obtain oval or ring circuits.

Guide



The rails are steel, induction hardened on the raceways, with the same section dimensions as straight FS..M rails. In the circuits the rails are joined together with alignment blocks that allow easy precise mounting.

All the pieces of the circuit are supplied appropriately marked in order to avoid mistakes during joining.

For protection against corrosion Nadella proposes nickel plating (option NW) for both straight and circular pieces.

In addition to the standard dimensions in the table it is possible to realize rings with different sections or radii in order to satisfy specific demands.

Guide rollers

Any guide rollers of the FS family of products can be used in combination with the circular rails.

Carriage

Carriages for circular rails can be realized with guide rollers in fixed position or mounted on steering arms.

Carriages with guide rollers in fixed positions

You can set up the distance between the centres of the guide rollers of a carriage with fixed guide rollers in order to obtain clearance-free running both on the straight and on the circular stretch of a circuit. The resulting carriage, normally a simple table with four holes for the housing of the guide rollers, will be simple and compact; there are, however, some contraindications:

- In the passage from the straight stretch to the circular one (and vice versa), when two guide rollers are engaged on the straight portion and two on the circular one, there will be clearance between the carriage and the rail. The extent of the clearance depends on the

dimensions of the rail, of the roller guides and of the carriage. Because of this clearance it is not possible to have an accurate positioning of the carriage during the passage between straight and circular stretch and therefore, in fast application, there will be vibration, noise and overload of the roller guides.

- This kind of carriages, with fixed guide rollers, can be used only for a single specific radius throughout the circuit. To use a carriage with fixed guide roller positions you can't have circular stretches with different radii.

Steering Carriages

The contraindications for the carriage with guide rollers in fixed positions can be resolved by using the steering carriage. Guide rollers are mounted in pairs on steering arms that are free to rotate in order to always be transversal to the rail in every point of the circuit. The carriage won't have clearance at any point in the circuit improving transition area accuracy and reduce running noise.

The studs of the steering carriage are fitted with needle bearings and seals for lubricant retention and protection. The tightening of the stud is obtained by the full tightening of the nut, and guarantees the best locking.



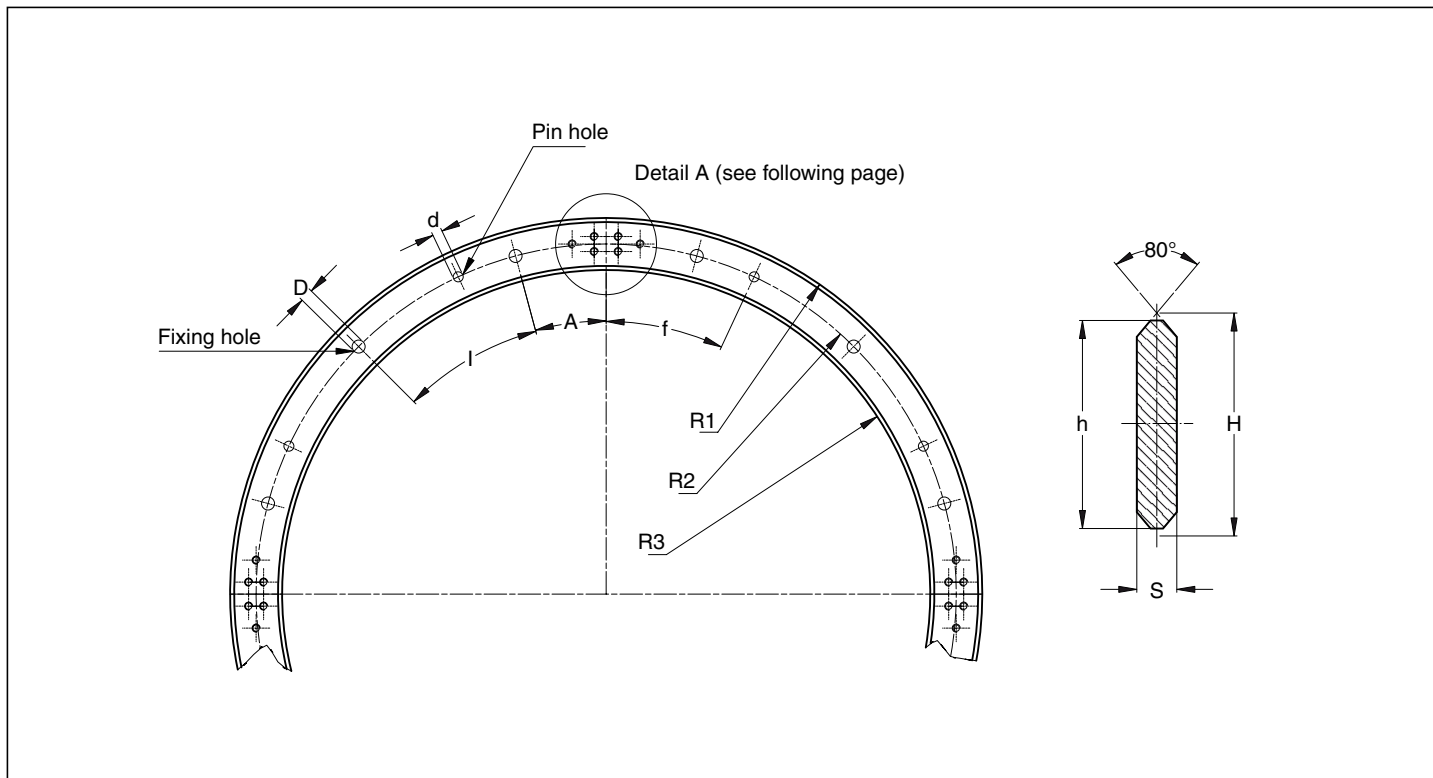
Bend rails

The bend rails FSRV..MT can be produced with any radius of curvature.

Are available in a single piece for length up 2700 mm; for longer lengths more pieces can be joined together (with proper connecting plates).



Circular rails **FSR..M**



Type	A	l	f	d H7	D	R1*	R2*	R3*	n° fixing holes/360°	n° pin holes/360°	h	H	S
FSR22M-075	22.5°	45°	45°	5	6.5	88	75	62	8	4	26	27.86	5
FSR22M-125	15°	30°	25°	5	6.5	138	125	112	12	8	26	27.86	5
FSR22M-175	15°	30°	25°	5	6.5	188	175	162	12	8	26	27.86	5
FSR35M-225	11.25°	22.5°	7.5°	8	9	248	225	202	16	8	46	47.86	8
FSR35M-300	11.25°	22.5°	7.5°	8	9	323	300	277	16	8	46	47.86	8
FSR47M-400	9°	18°	18°	10	11.5	438	400	362	20	8	76	78.58	10
FSR47M-500	9°	18°	18°	10	11.5	538	500	462	20	8	76	78.58	10

* R1, R2, R3 are radius

Rails finishing

- steel
- induction hardened on the raceways

Hole layout

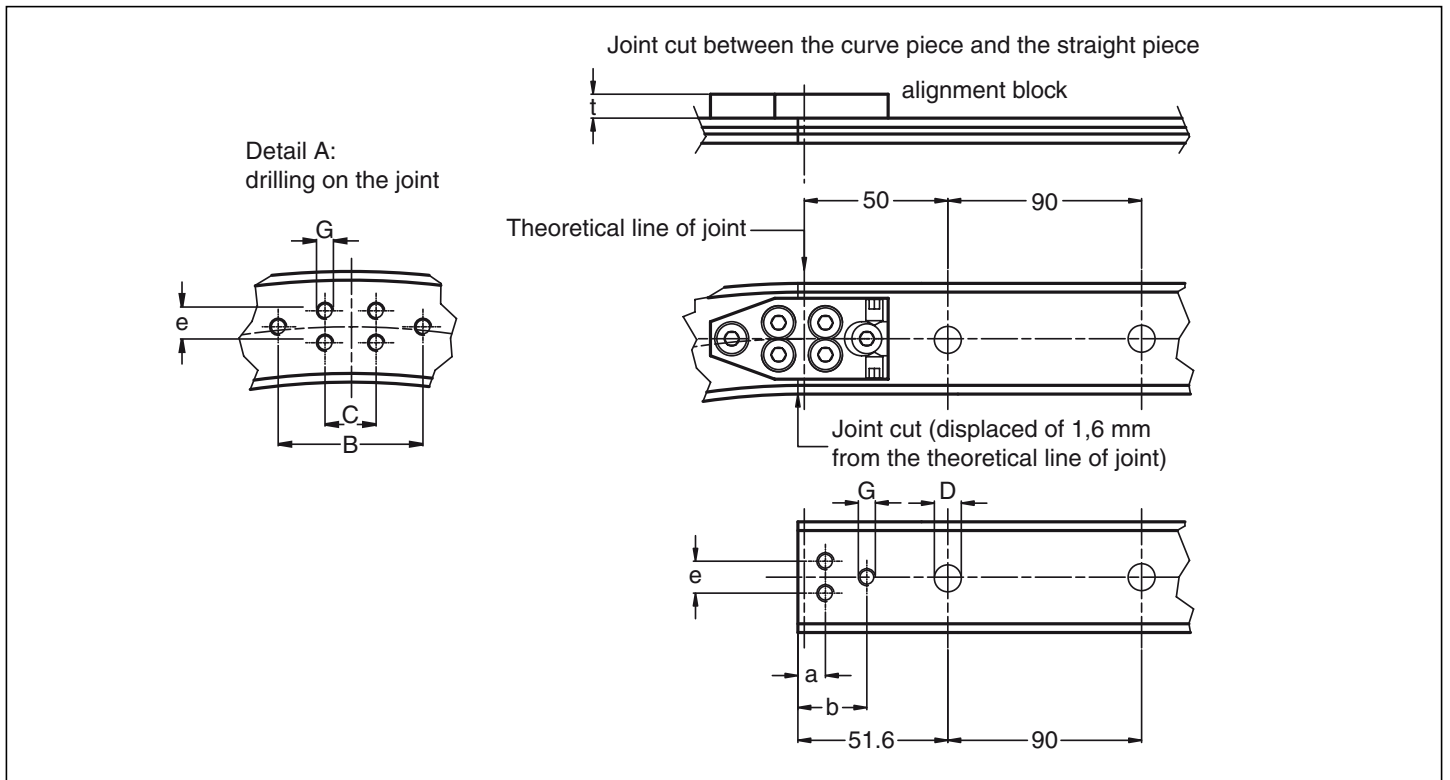
- holes according to catalogue (**SB**)
- finishes to drawing (**NZ**)

Optional features

nickel plating (**NW**)

Example of standard designation: **FSR35M-225-180**

Circular rail sector FSR35M ray 225 mm,
sector angle 180°

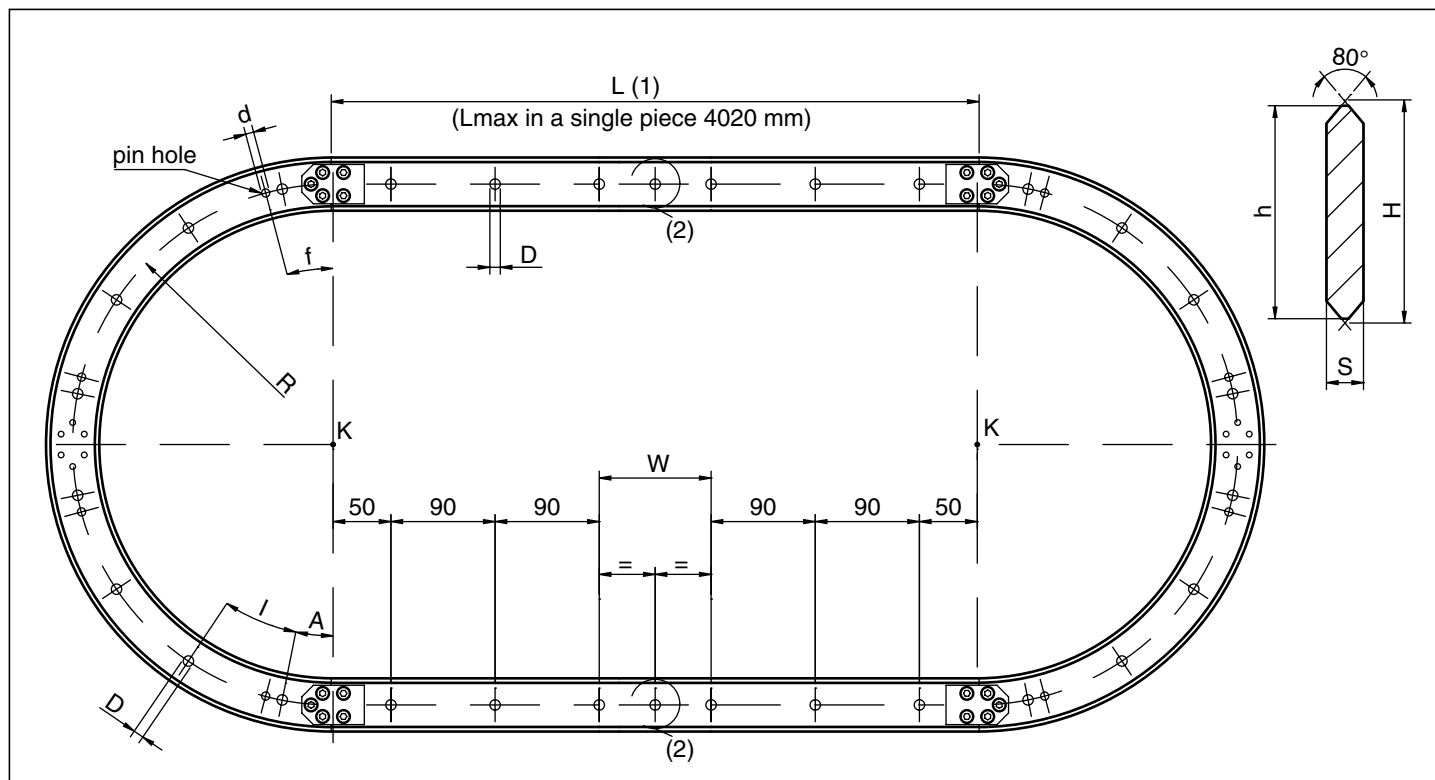


Type	Dimensions (mm)								Suggested combination
	C	B	e	G	D	a	b	t	
FSR22M-075	12	34	7.5	M4	6.5	7.6	18.6	5.8	FR22EI FRN22EI
FSR22M-125	12	34	7.5	M4	6.5	7.6	18.6	5.8	FR22EI FRN22EI
FSR22M-175	12	34	7.5	M4	6.5	7.6	18.6	5.8	FR22EI FRN22EI
FSR35M-225	18	38	20	M6	9	10.6	19.6	6	FR32EI FRN32EI FR40EI FRN40EI
FSR35M-300	18	38	20	M6	9	10.6	19.6	6	FR32EI FRN32EI FR40EI FRN40EI
FSR47M-400	18	58	43	M6	11.5	8.6	18.1	9	FR40EI FRN40EI FR52EI RKY52
FSR47M-500	18	58	43	M6	11.5	8.6	18.1	9	FR40EI FRN40EI FR52EI RKY52

The joint cut is displaced of 1.6 mm from the theoretical line of joint.
The alignment block allows an easy mounting of the joint.

Oval circuit **FSRO**

NEW



Type	Dimensions (mm)								
	Radius R	D	A	I	d H7	f	S	h	H
FSRO22M-075-...	75	6.5	22.5°	45°	5	45°	5	26	27.86
FSRO22M-125-...	125	6.5	15°	30°	5	25°	5	26	27.86
FSRO22M-175-...	175	6.5	15°	30°	5	25°	5	26	27.86
FSRO35M-225-...	225	9	11.25°	22.5°	8	7.5°	8	46	47.86
FSRO35M-300-...	300	9	11.25°	22.5°	8	7.5°	8	46	47.86
FSRO47M-400-...	400	11.5	9°	18°	10	18°	10	76	78.58
FSRO47M-500-...	500	11.5	9°	18°	10	18°	10	76	78.58

The oval circuit is composed by: two sectors of circular rails (180° with center in K) and two straight pieces of rails. The circuit is supplied complete of alignment blocks (with the proper screws), and all the pieces are marked in order to obtain the correct sequence during the mounting.

(1) The length of the straight pieces is higher than the distance between the centers K (1.6 mm x 2) in order to cover the thickness of rail lost during the cutting of the circular sectors (for more details about joints see page 52).

Standard hole layout (SB) for the straight rails:

- first and last hole of 50 mm, starting from the centers K;
- hole pitch 90 mm;
- central hole (2) only if the last hole pitch W is higher than 120 mm;
- W can't be less than 60 mm.

Rails finishing

- for the circular rail see page 51
- for the straight rail see page 35

Hole layout

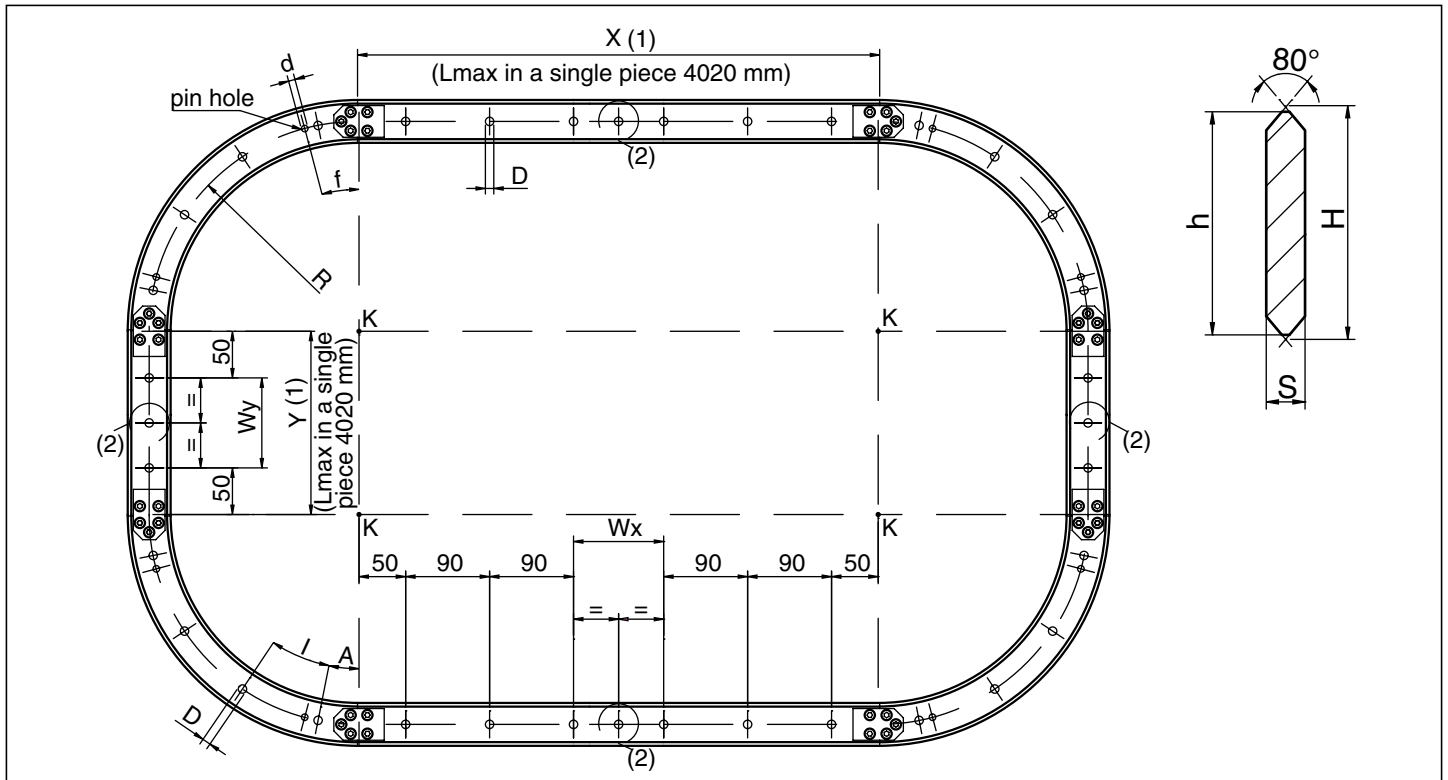
- standard holes according to catalogue (SB)
- finishes to drawing (NZ)

Optional features

- nickel plating (NW)

Example of standard designation: **FSRO35M-225-2000/SB**
Oval circuit, size 35, ray 225 mm, distance between the centers K equal to 2000 mm (1), standard holes.

Ring circuit **FSRQ** **NEW**



Type	Dimensions (mm)								
	Radius R	D	A	I	d H7	f	S	h	H
FSRQ22M-075-...	75	6.5	22.5°	45°	5	45°	5	26	27.86
FSRQ22M-125-...	125	6.5	15°	30°	5	25°	5	26	27.86
FSRQ22M-175-...	175	6.5	15°	30°	5	25°	5	26	27.86
FSRQ35M-225-...	225	9	11.25°	22.5°	8	7.5°	8	46	47.86
FSRQ35M-300-...	300	9	11.25°	22.5°	8	7.5°	8	46	47.86
FSRQ47M-400-...	400	11.5	9°	18°	10	18°	10	76	78.58
FSRQ47M-500-...	500	11.5	9°	18°	10	18°	10	76	78.58

The ring circuit is composed by: four sectors of circular rails (90° with center in K) and four straight pieces of rails. The circuit is supplied complete of alignment blocks (with the proper screws), and all the pieces are marked in order to obtain the correct sequence during the mounting.

(1) The length of the straight pieces is higher than the distance between the centers K (1,6 mm x 2) in order to cover the thickness of rail lost during the cutting of the circular sectors (for more details about joints see page 52).

Standard hole layout (SB) for the straight rails:

- first and last hole at 50 mm, starting from the centers K;
- hole pitch 90 mm;
- central hole (2) only if the last hole pitch (Wx in horizontal and Wy in vertical) is higher than 120 mm;
- Wx and Wy can't be less than 60 mm.

Rails finishing

- for the circular rail see page 51
- for the straight rail see page 35

Hole layout

- standard holes according to catalogue (SB)
- finishes to drawing (NZ)

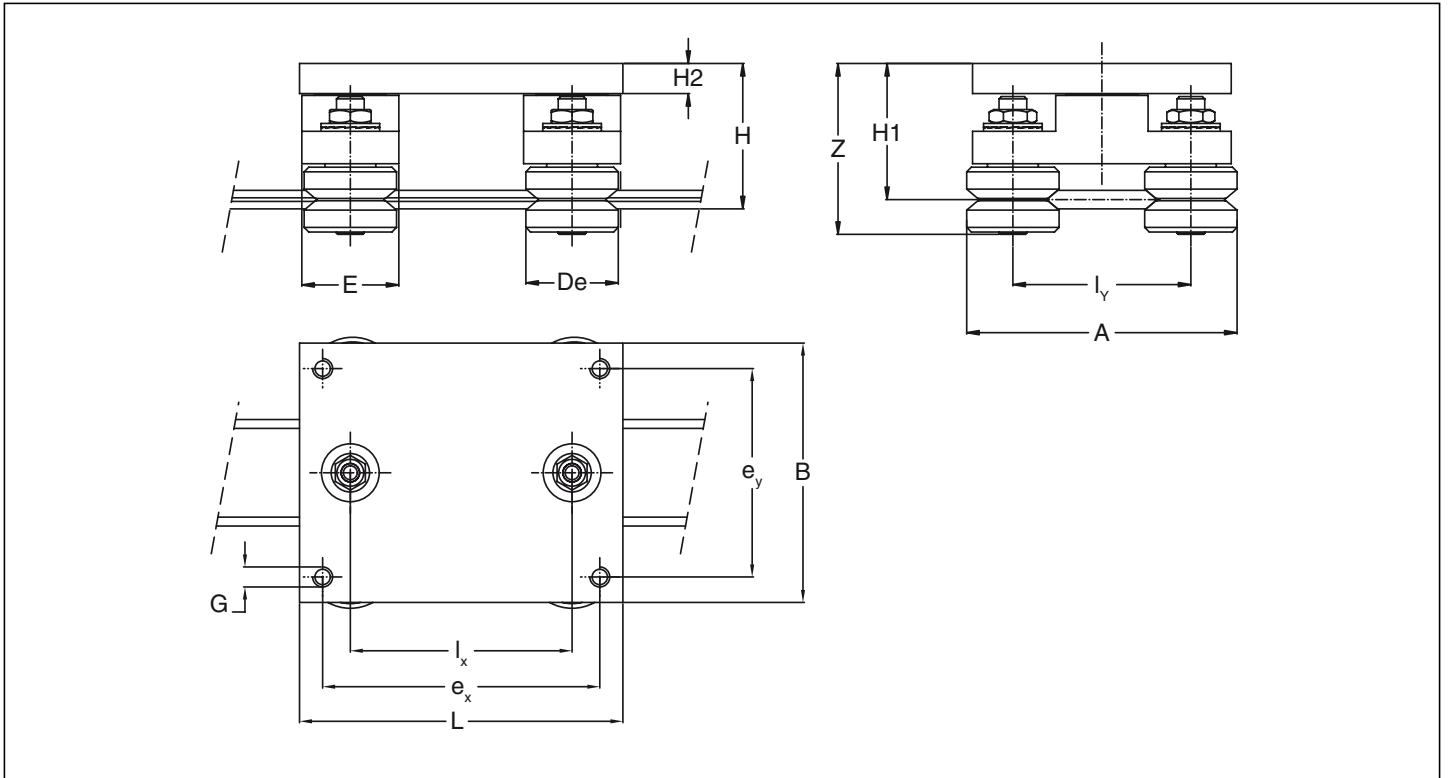
Optional features

- nickel plating (NW)

Example of standard designation: **FSRQ35M-225-2000-1000/SB**
 Ring circuit, size 35, ray 225 mm, horizontal distance between the centers K equal to 2000 mm (1), vertical distance between the centers K equal to 1000 mm (1), standard holes.

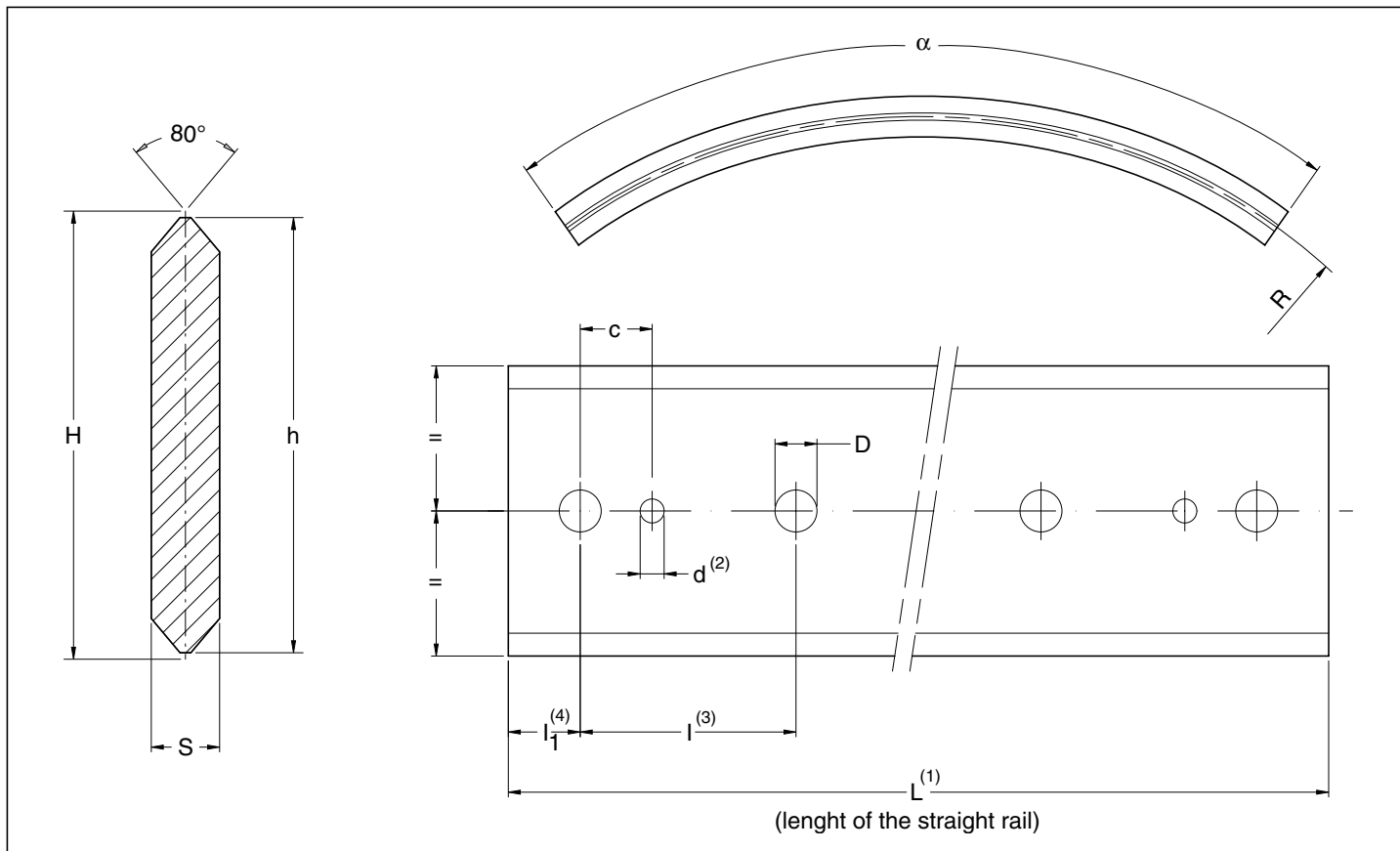
Steering carriage T4R...

NEW



Type	Dimensions (mm)													Weight (kg)	Suggested combination
	De	L	B	e _x	e _y	l _x	l _y	H	H1	H2	G	A	Z		
T4R22 FR22EI 80 T4R22 FRN22EI 80	22	80	62	68	50	50	43.3	45.5	43	12	M5	65.3	53.6	0.5	FSR 22 M FS 22 M
T4R35 FR32EI 140 T4R35 FRN32EI 140	32	140	112	120	90	96	71.5	59.9	55.9	13	M8	103.5	69.3	1.1	FSR 35 M FS 35 M
T4R35 FR40EI 140 T4R35 FRN40EI 140	40	140	112	120	90	96	77	62.8	58.8	13	M8	117	74.3	1.6	FSR 35 M FS 35 M
T4R47 FR40EI 180 T4R47 FRN40EI 180	40	180	160	150	130	120	107.8	74.3	69.3	19	M10	147.8	84.8	2.4	FSR 47 M FS 47 M
T4R47 FR52EI 180 T4R47 RKY52 180	52	180	160	150	130	120	116.8	78.6	73.6	19	M10	168.8	94.8	3.3	FSR 47 M FS 47 M

Bend rails **FSRV..MT** **NEW**



Type	Dimensions (mm)									Weight ⁽⁵⁾ (kg/m)
	H ± 0.1	h ± 0.1	S ± 0.1	d ⁽²⁾ ± 0.05	D	c ⁽²⁾	R _{min.}	l ⁽³⁾	l ₁	
FSRV 22 MT	28.80	27.0	5.8	5	6.6	15	500	90	(4)	1.1
FSRV 32 MT	43.80	42.0	6.8	6	6.6	15	600	90	(4)	2.1
FSRV 40 MT	64.50	62.0	8.8	6	9.0	20	700	90	(4)	4.1
FSRV 52 MT	91.35	88.2	13.0	8	13.5	20	900	90	(4)	8.5

Maximum length in a single piece L=2 700 mm (1)

- 1) Higher lengths can be obtained by joining more pieces
- 2) Standard layout without pin holes
- 3) Center to center distance of the straight rail
- 4) Dimension that change with R and α
- 5) Rail without holes

After the assembling there will be the correct radius of curvature

Rail finishing

- drawn, sand blaster, nitriding hardening

Hole layout

- standard holes according to catalogue (**SB**)
- finishes to drawing (**NZ**)

Optional features

- nickel plating (**NW**)
- pin holes

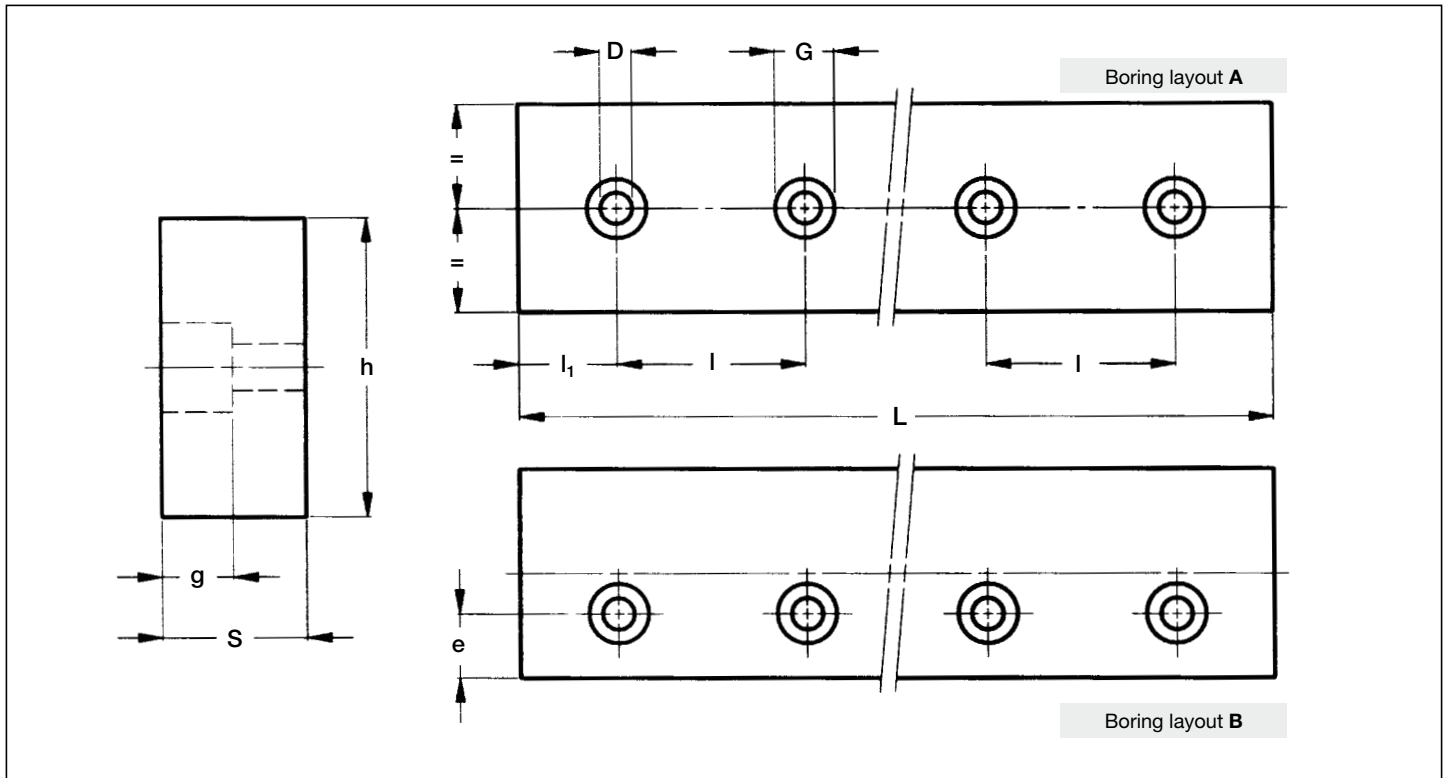
Example of standard designation: **FSRV 32 MT - 1500 - 60°/NZ**
Bend rail sector, size 32, ray R=1500 mm,
 $\alpha=60^\circ$, standard holes

GP System



NADELLA

Guide rails GP..MC



Type	Dimensions (mm)								Weight ⁽²⁾ (kg/m)
	h ± 0.05	S ± 0.05	D	G	g	e	l	l ₁	
GP 2626 MC	26	26	9	15	9	(3)	120	50	5.3
GP 3232 MC	32	32	9	15	9	(3)	150	60	8.1
GP 3617 MC	36	17	6.5	11	6.8	12.5	120	50	4.8
GP 4321 MC	43	21	9	15	9	11.5	150	60	7
GP 6222 MC	62	22	9	15	9	21	150	60	10.7
GP 7232 MC	72	32	13.5	20	13	24	180	70	18.1
GP 8222 MC	82	22	13.5	20	13	20	180	70	14.2

Max length of single guide element L = 5 800 mm ⁽¹⁾

- 1) Longer rails are supplied in sections with ground butt joints
- 2) Weight without holes
- 3) For boring layout A only

Rails finishing

- material: C60 or CK45
- induction hardened on every side
- surface finished by a rough grinding (MC)

Hole layout

- holes according to catalogue (A or B)
- finishes to drawing (NZ)
- without holes (NF)

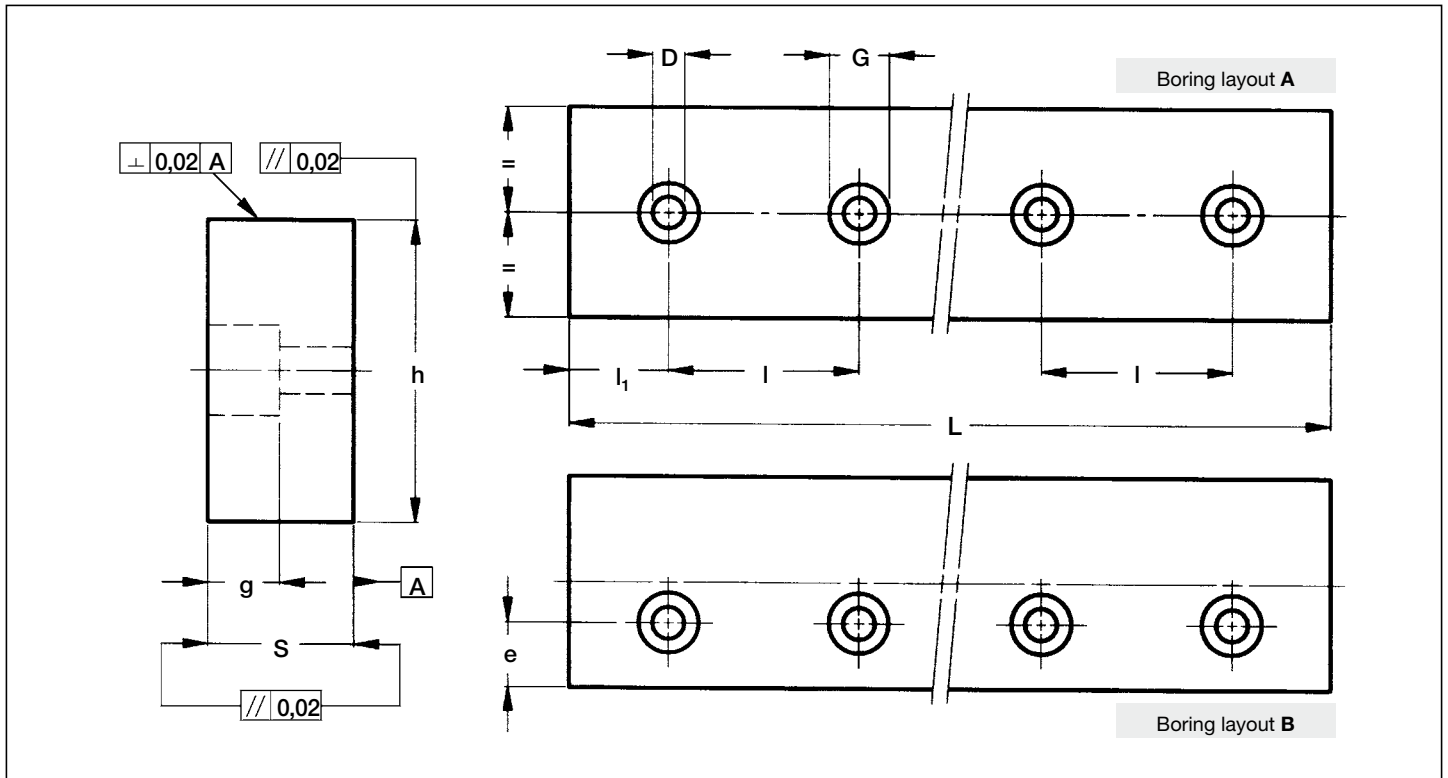
Optional features

- ground one end (R)
- ground both ends (RR)
- chemical nickel plating (NW)

Example of standard designation: **GP 6222 MC/4300/B**

See page 15 for standard codification

Guide Rails GP..M



Type	Dimensions (mm)								Weight ⁽²⁾ (kg/m)
	h ± 0.05	S ± 0.05	D	G	g	e	l	l ₁	
GP 2525 M	25	25	9	15	8.5	⁽³⁾	120	50	4.9
GP 3131 M	31	31	9	15	8.5	⁽³⁾	150	60	7.5
GP 3516 M	35	16	6.5	11	6.8	12	120	50	4.4
GP 4220 M	42	20	9	15	9	11	150	60	6.5
GP 6121 M	61	21	9	15	9	20.5	150	60	10
GP 7131 M	71	31	13.5	20	12.5	23.5	180	70	17.3
GP 8121 M	81	21	13.5	20	13	19.5	180	70	13.4

max length of single guide element L = 4 020 mm ⁽¹⁾

1) Longer rails are supplied in sections with ground butt joints (max. length with treatment NW on request)

2) Weight without holes

3) Only available according to figure A

Rails finishing

- material: C60 or CK45
- induction hardened and ground tracks on every side (**M**);

Hole layout

- holes according to catalogue (**A** or **B**)
- finishes to drawing (**NZ**)
- without holes (**NF**)

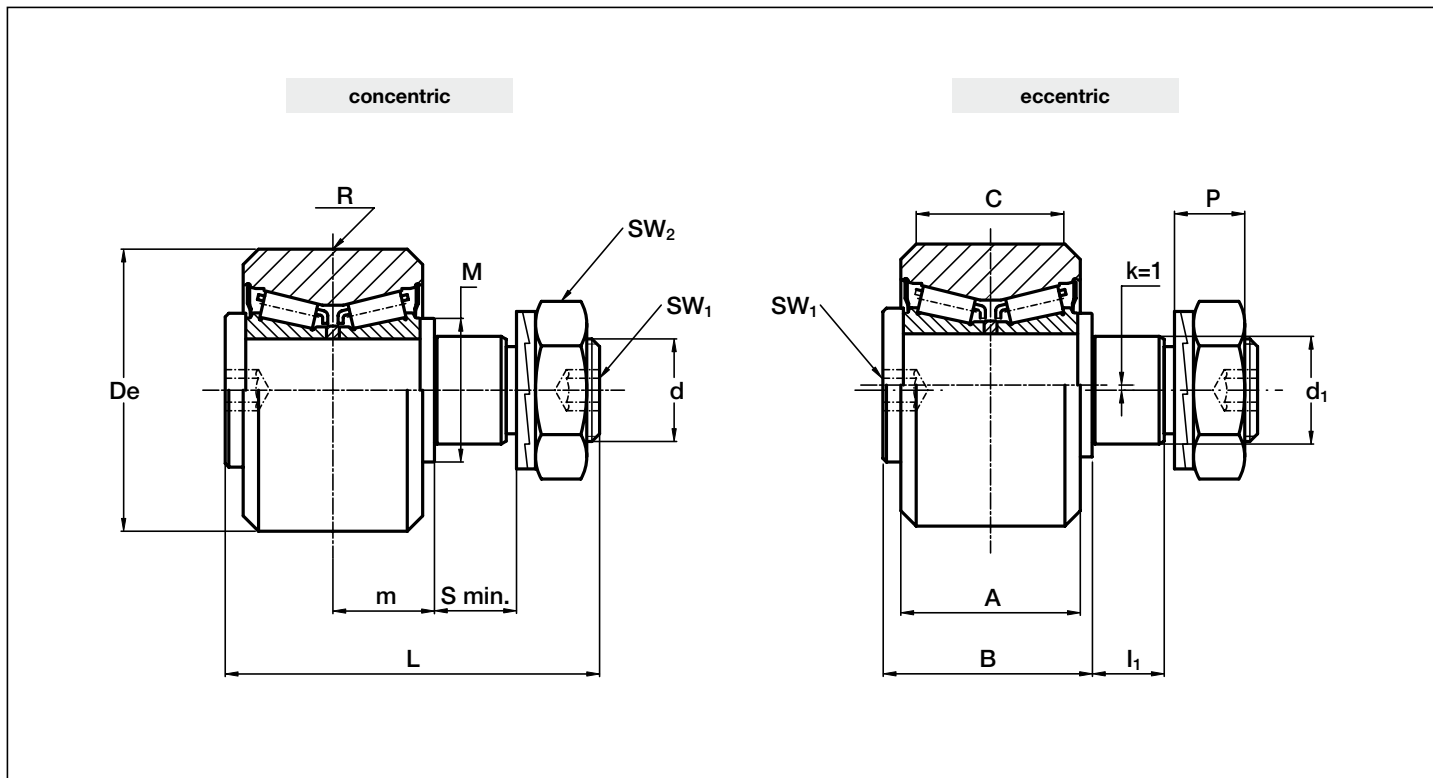
Optional features

- ground one end (**R**)
- ground both ends (**RR**)
- chemical Nickel-plating (**NW**)

Example of standard designation: **GP 6121 M/2070/B**

See page 15 for standard codification

Guide Rollers **PK**



Type		Dimensions (mm)															
concentric	eccentric	De	d ₁ ⁽¹⁾	d	m	S min.	P	L	A	B	C	R	I ₁	M	SW ₁	SW ₂	k
PK 52C	PKR 52C	52	21	M 20 x 1.5	19.8	15	13.4	73	35	41	29	800	14	28	8	ch. 30	1
PK 62C	PKR 62C	62	27	M 24 x 1.5	20.8	19	15.4	83	37	44	29	800	18	35	10	ch. 36	1
PK 72C	PKR 72C	72	36	M 30 x 1.5	27	19	21.6	100	45	55	33	1 200	18	44	12	ch. 46	1
PK 90C	PKR 90C	90	38	M 36 x 1.5	30	24	24.6	115	53	62	45	1 200	23	50	14	ch. 55	1
PK 110C	PKR 110C	110	42	M 36 x 1.5	34	33	24.6	135	56 ⁽⁵⁾ 60	70	48	1 200	32	56	14	ch. 55	1

Type		Dynamic load (N)	Limit load of the bearing (N)	Limit load of the stud (N)	Torque ⁽²⁾ wrench setting (Nm)	Weight (Kg)
		C _w ⁽⁶⁾	radial C _{or}	radial F _r		
PK 52C	PKR 52C	42 100	44 000	11 900	80	0.6
PK 62C	PKR 62C	47 750	50 400	22 100	160	0.9
PK 72C	PKR 72C	67 450	72 000	31 300	300	1.6
PK 90C	PKR 90C	118 000	136 000	43 700	450	2.8
PK 110C	PKR 110C	185 000	195 000	55 600	450	4.9

1) Housing bore tolerance: H7

2) The torque wrench settings are given for non-lubricated threads; for lubricated threads, multiply figure by 0.8

3) Standard seals: material NBR, RS type

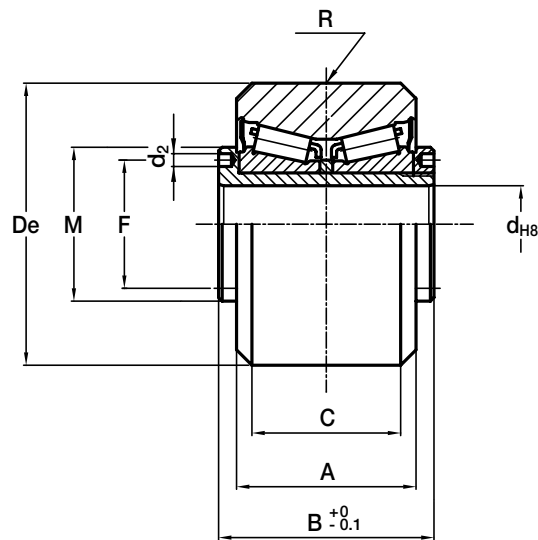
4) On request, the guide rollers can be supplied in stainless steel (suffix **NX**) and with Viton seals for operating temperatures up to 120°C (suffix **V**, up to dimension PK 90 C included)

5) Dimensions relating to the stainless-steel rollers (suffix **NX**)

6) C_w basic load for 100 km

7) The guide rollers are complete with self-locking washers and hexagonal nut for fitting

Guide Wheels **FK**

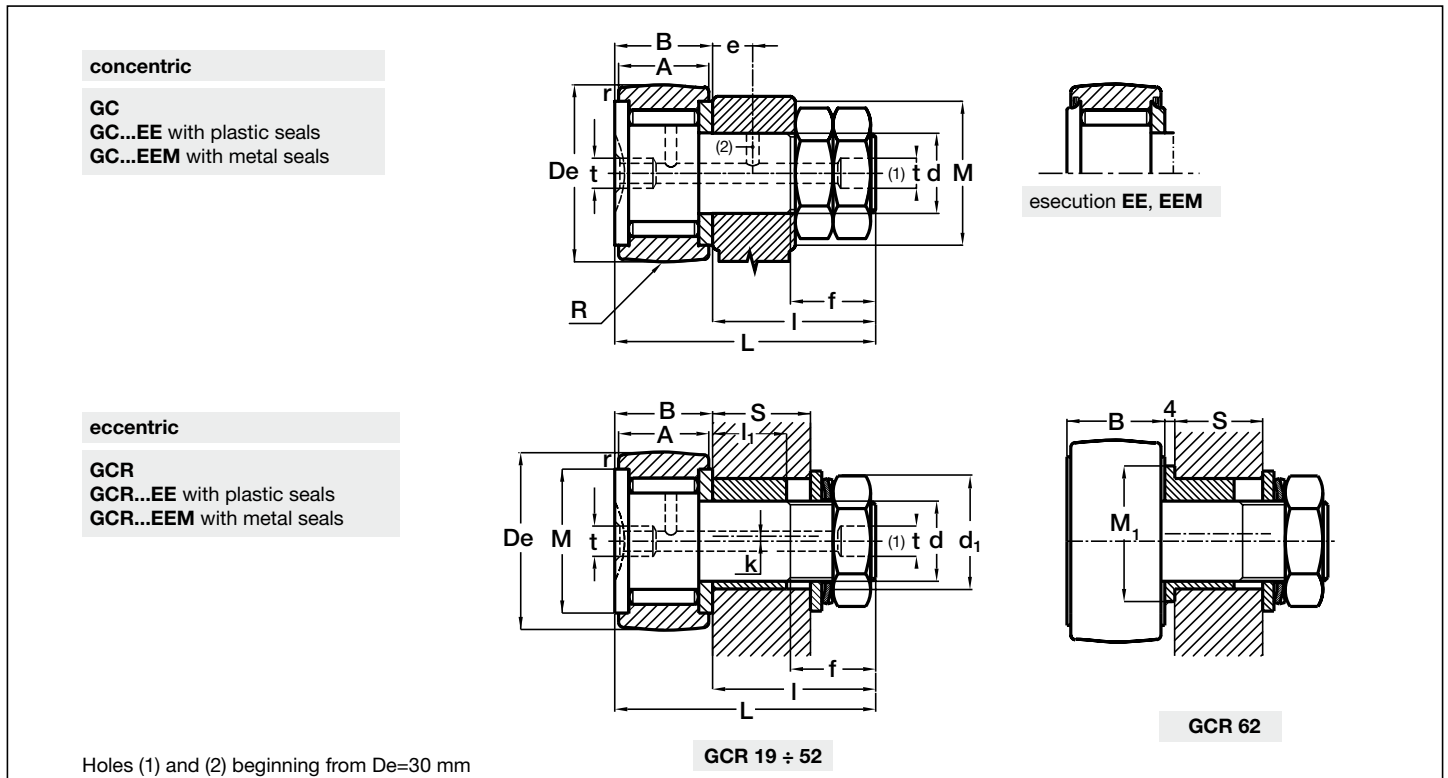


Type	Dimensions (mm)								
	De	d	A	B	C	R	F	d ₂	M
FK 52C	52	15	35	42	29	800	25	2.5	30
FK 62C	62	20	37	45	29	800	29	3	35
FK 72C	72	25	45	56	33	1 200	37	4	44
FK 90C	90	28	53	56 ⁽³⁾ 64	45	1 200	42	4	49
FK 110C	110	35	60	63 ⁽³⁾ 72	48	1 200	52	4	59

Type	Dynamic load (N)	Limit load of the bearing (N)	Limit load of the wheel (N)	Weight (kg)
	C _w ⁽⁴⁾	radial C _{or}	radial F _r	
FK 52C	42 100	44 000	11 900	0.5
FK 62C	47 750	50 400	22 100	0.6
FK 72C	67 450	72 000	31 300	1.2
FK 90C	118 000	136 000	43 700	2.3
FK 110C	185 000	195 200	55 600	3.9

- 1) Standard seals: material NBR, RS type
- 2) On request, the guide rollers can be supplied in stainless steel (suffix **NX**) and with Viton seals for operating temperatures up to 120°C (suffix **V**, up to dimension FK 90 C included)
- 3) Dimensions relating to the stainless-steel rollers (suffix **NX**)
- 4) C_w basic load for 100 km
- 5) To prevent rotation between roller and shaft a pin can be fitted in one of the holes “d₂” positioned in the side flange

Guide Rollers GC



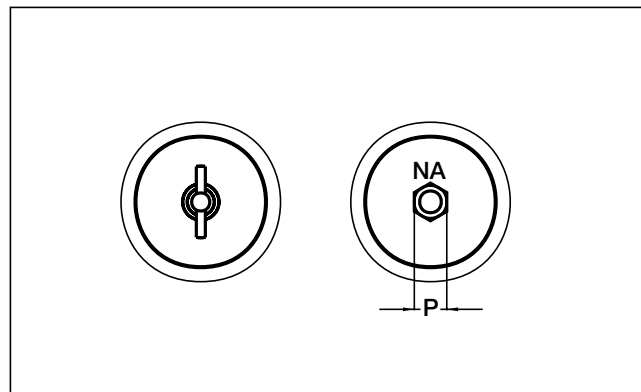
Type (1)		Dimensions (mm)																
		De	A	B max	d	d ₁ (7)	k	L max	l max	f	pitch	r min	t	e	M (6)	M ₁	P (2)	l ₁
GC 19	GCR 19	19	11	12.2	8	11	0.5	32.7	20.5	10	1.25	0.3	4	-	15.3	-	-	10
GC 22	GCR 22	22	12	13.2	10	14	1	36.7	23.5	12	1.25*	0.3	4	-	18.2	-	-	11
GC 24	GCR 24	24	12	13.2	10	14	1	36.7	23.5	12	1.25*	0.3	4	-	18.2	-	-	11
GC 26	GCR 26	26	12	13.2	10	14	1	36.7	23.5	12	1.25*	0.3	4	-	20.8	-	-	11
GC 28	GCR 28	28	12	13.2	10	14	1	36.7	23.5	12	1.25*	0.3	4	-	20.8	-	-	11
GC 30	GCR 30	30	14	15.2	12	16	1	40.7	25.5	13	1.5	0.6	4	6	24.8	-	8	11
GC 32	GCR 32	32	14	15.2	12	16	1	40.7	25.5	13	1.5	0.6	4	6	24.8	-	8	11
GC 35	GCR 35	35	18	19.6	16	21	1.5	52.6	33	17	1.5	0.6	6	8	28.8	-	10	14
GC 40	GCR 40	40	20	21.6	18	24	1.5	58.6	37	19	1.5	1	6	8	33.8	-	12	16
GC 47	GCR 47	47	24	25.6	20	27	2	66.6	41	21	1.5	1	6	9	38.7	-	14	17.5
GC 52	GCR 52	52	24	25.6	20	27	2	66.6	41	21	1.5	1	6	9	38.7	-	14	17.5
GC 62	GCR 62	62	29	30.6	24	36	3	80.6	50	25	1.5	1	6	11	52	44	12	18

* These threads may be supplied with pitch of 1 mm (clamping torque 13 Nm)

- Housing bore tolerance: H7

- The guide rollers are complete with washers and hexagonal nut for fitting

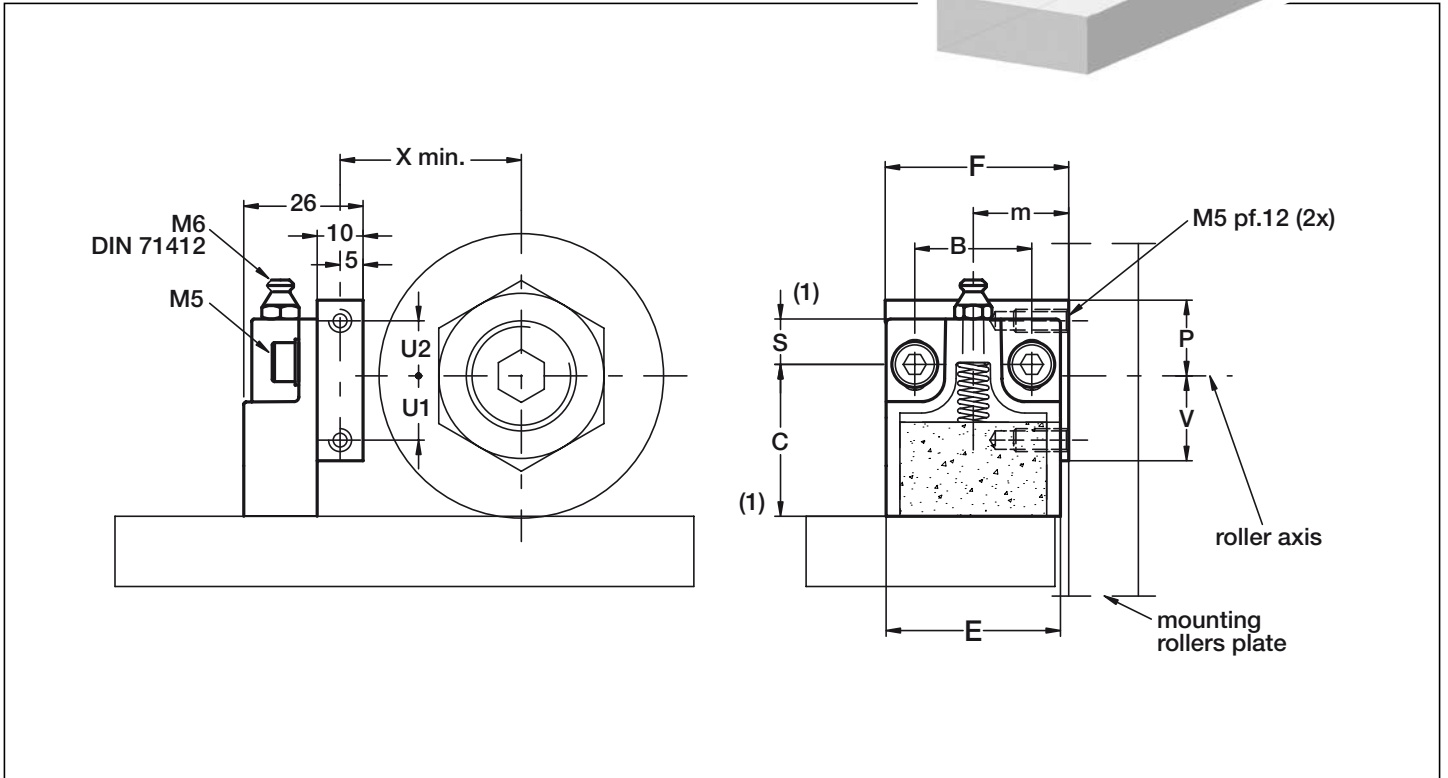
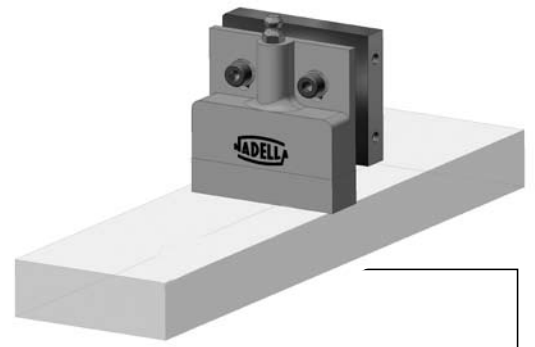
- 1) Specification for followers with cylindrical outer ring: GCL, GCRL, GCL...EE, GCL...EEM, GCRL...EEM. On request the followers can be supplied possessing a screw driver slot at the threaded end of the stud (suffix **AK**).
- 2) Followers with outer diameter up to 28 mm included possess a screw driver slot on the head. Followers with outer diameter from 30 to 52 mm included can possess the screw driver slot or the hexagonal socket. For outer diameter above 52 mm the followers possess the hexagonal socket.
- 3) The load shown is limited by the strengths of the stud and outer ring.
- 4) With oil lubrication of followers without seals GC, GCR, GCL e GCRL, these speeds can be increased by 30% for continuous rotation or up to 50% momentarily.
- 5) These torques are shown for dry threads. For lubricated threads, take 0,8 of these values.
- 6) Minimum recommended abutment diameter in case of high axial load or in the presence vibrations.
- 7) The eccentric collar is tightly fitted on the follower stud.
- 8) C_w basic load for 100 Km



S		R	Dynamic load (N)	Limit load of the bearing (N)	Limit load of the stud (3) (N)				Speed limit grease lubrication r.p.m. (4)	Torque wrench setting (Nm) (5)	
					GC...		GCR...			GC...	GCR...
min	max		C_w (8)	radial C_{or}	Din. F_r	Stat. F_{or}	Din. F_r	Stat. F_{or}			
10.5	13	160	4 900	7 800	2 830	5 200	2 830	4 500	7 600	8	5
11.5	14	200	5 600	9 700	4 900	8 100	4 900	5 600	6 300	20	16
11.5	14	200	6 300	9 700	5 200	9 200	5 200	5 600	6 300	20	16
11.5	14	200	8 400	12 500	5 200	9 600	5 200	6 100	5 500	20	16
11.5	14	200	9 200	12 500	5 200	9 600	5 200	6 100	5 500	20	16
11.5	14.5	250	12 700	17 900	7 700	14 300	7 700	10 400	4 800	26	22
11.5	14.5	250	13 800	17 900	7 700	14 300	7 700	10 400	4 800	26	22
14.5	19	320	19 800	33 000	11 400	24 000	11 000	11 000	3 850	64	55
16.5	22	400	21 400	41 000	14 200	27 000	12 300	12 300	3 150	90	75
18	25	500	31 800	65 000	21 400	40 000	21 400	23 700	2 700	120	100
18	25	500	39 400	65 000	21 400	40 000	21 400	23 700	2 700	120	100
18.5	25.5	640	51 300	85 000	31 000	57 500	28 800	28 800	2 330	220	180

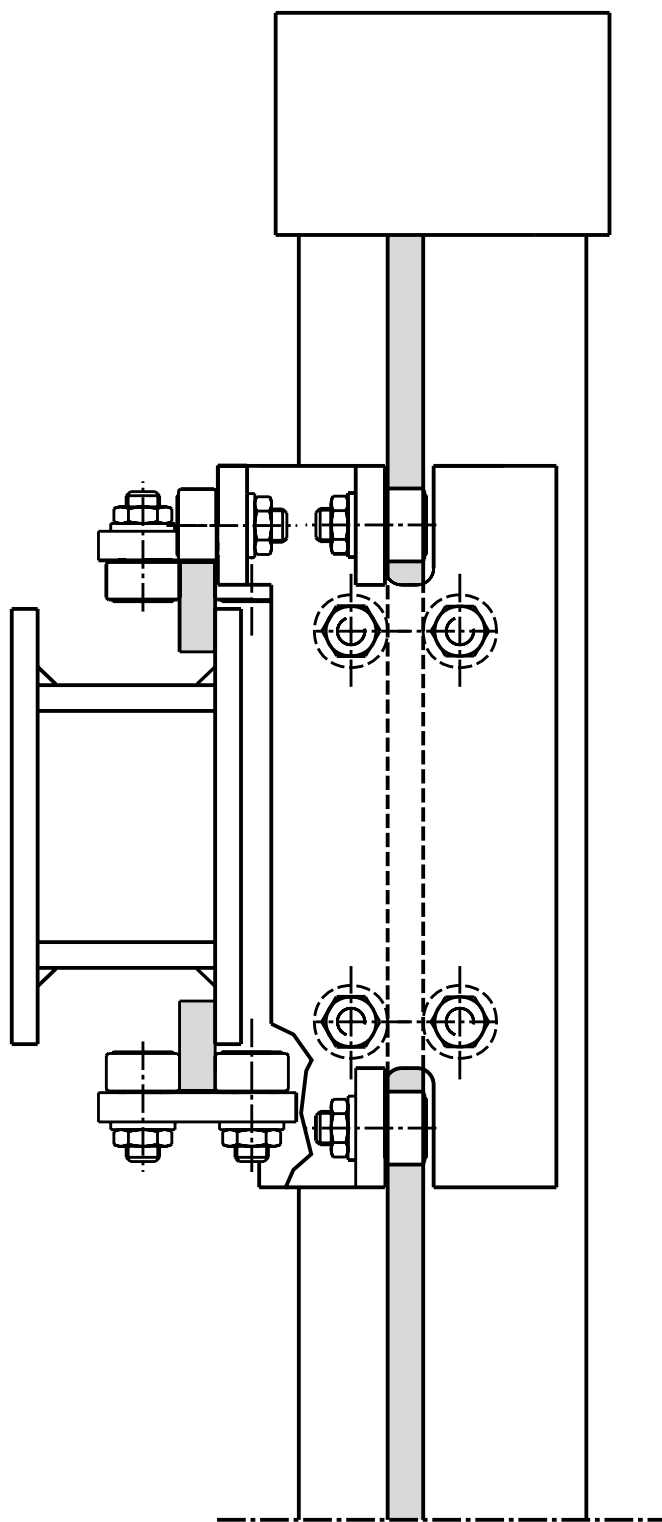
On request track rollers can be supplied in stainless steel (suffix **NX**)

Lubricator LUBP



Type	Dimensions (mm)											Weight (g)	Suggested combinations
	X	U1	U2	F	m	B	S	C	E	V	P		
LUBP 52	33.5	12	14	40	19.8	25.5	10	32.5	38	16.5	18.5	65	PK 52 C PKR 52 C FK 52 C
LUBP 62	38.5	14	12	40	20.8	25.5	10	32.5	38	18.5	16.5	65	PK 62 C PKR 62 C FK 62 C
LUBP 72	43.5	19	11	50	27	25.5	10	40	44	24	16	85	PK 72 C PKR 72 C FK 72C
LUBP 90	52.5	21	9	60	30	30	16.5	43.5	58	31	19	140	PK 90 C PKR 90 C FK 90 C
LUBP 110	62.5	30	0	63	34	30	16.5	43.5	58	40	10	140	PK 110 C PKR 110 C FK 110 C

- 1) The dimension of the plastic part refers to the centre of the regulation slot. The regulation slot allows a translation of +/- 3 mm
- 2) The lubricator is supplied with the felt already lubricated. The lubricant has a mineral oil base
- 3) During the mounting fix the aluminium support to the rollers plate, adjust the height of the plastic part in order to put it in contact with the raceways and than block it in that position with the M5 screws.



DC, C System



NADELLA

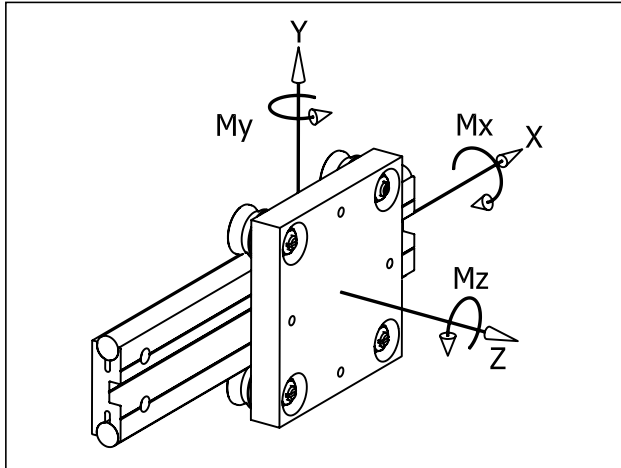
DC system

DC system is based on rails, guide rollers and carriages that provide a complete guiding system.

Rails and rollers can be used as single elements.

In most cases the application is based on standard carriages.

The load capacities are tabulated with reference to the axis system showed in the sketch below:



MAXIMUM LOADS ON SINGLE CARRIAGE

The following table shows the maximum loads that can be applied on a single carriage.

Rails	Carriages	F _y N	F _z N	M _x Nm	M _y Nm	M _z Nm
DC 10.54	T4 PFV 25 10 80	1590	800	22	18	35
	T4 PFV 25 10 120	1590	800	22	33	67
DC 16.80	T4 PFV 35 16 165	3570	1800	70	110	225
	T4 PFV 35 16 250	3570	1800	70	190	370
DC 18.65	T4 PFV 35 18 150	3940	1810	55	100	220
	T4 PFV 35 18 250	3940	1810	55	190	420
DC 25.95	T4 PFV 50 25 220	7890	3900	180	320	640
	T4 PFV 50 25 300	7890	3900	180	480	950

The maximum loads are based on the stud and bearing strengths and on a maximum contact pressure, between rail and roller, of 1250 N/mm². The load in the table are considered as acting singularly. For applications with many loads acting at the same time the loads must be reduced.

BASIC DYNAMIC LOADS OF SINGLE CARRIAGE

The following table shows the nominal loads that correspond to a nominal life of the bearing at 100 km.

The nominal lifetime of the carriage can be estimated from the standard bearing formula

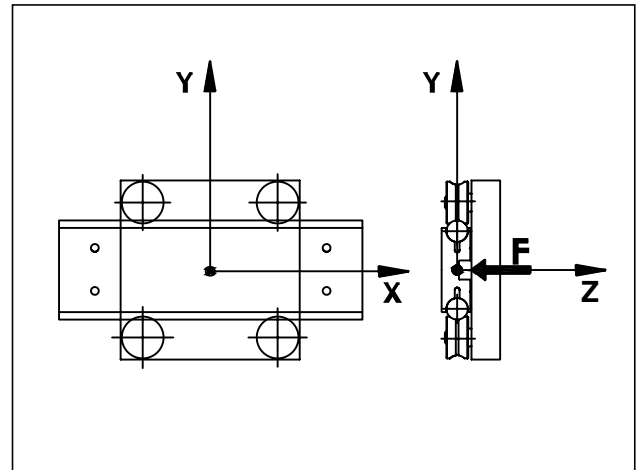
$$L_{10} = (C_i/P_i)^3 \times 100 \text{ km}$$

C_i is the basic dynamic load capacity in a specific direction i and P_i is the external load applied in the same specific direction.

Rails	Carriage	C _y N	C _z N	CM _x Nm	CM _y Nm	CM _z Nm
DC 10.54	T4 PFV 25 10 80	3700	1200	32	27	84
	T4 PFV 25 10 120	3700	1200	32	51	158
DC 16.80	T4 PFV 35 16 165	9000	2950	115	185	570
	T4 PFV 35 16 250	9000	2950	115	310	950
DC 18.65	T4 PFV 35 18 150	9000	2950	95	165	510
	T4 PFV 35 18 250	9000	2950	95	315	970
DC 25.95	T4 PFV 50 25 220	17500	6100	290	500	1400
	T4 PFV 50 25 300	17500	6100	290	750	2150

Calculation example: carriage loaded with an external load F

Carriage T4 PFV 50 25 220; F = 2000 N.



The external load F acts in the z-axis direction:

$$P_z = F = 2000 \text{ N}$$

In the table of the “maximum loads” you find that the load capacity F_z for carriage T4 PFV 50 25 220 is equal to 3900 N, so the system is validated against breakage.

To estimate the system lifetime we proceed as follows: from the table of the “basic dynamic loads” we see that C_z, for the carriage T4 PFV 50 25 220, is equal to 6100 N.

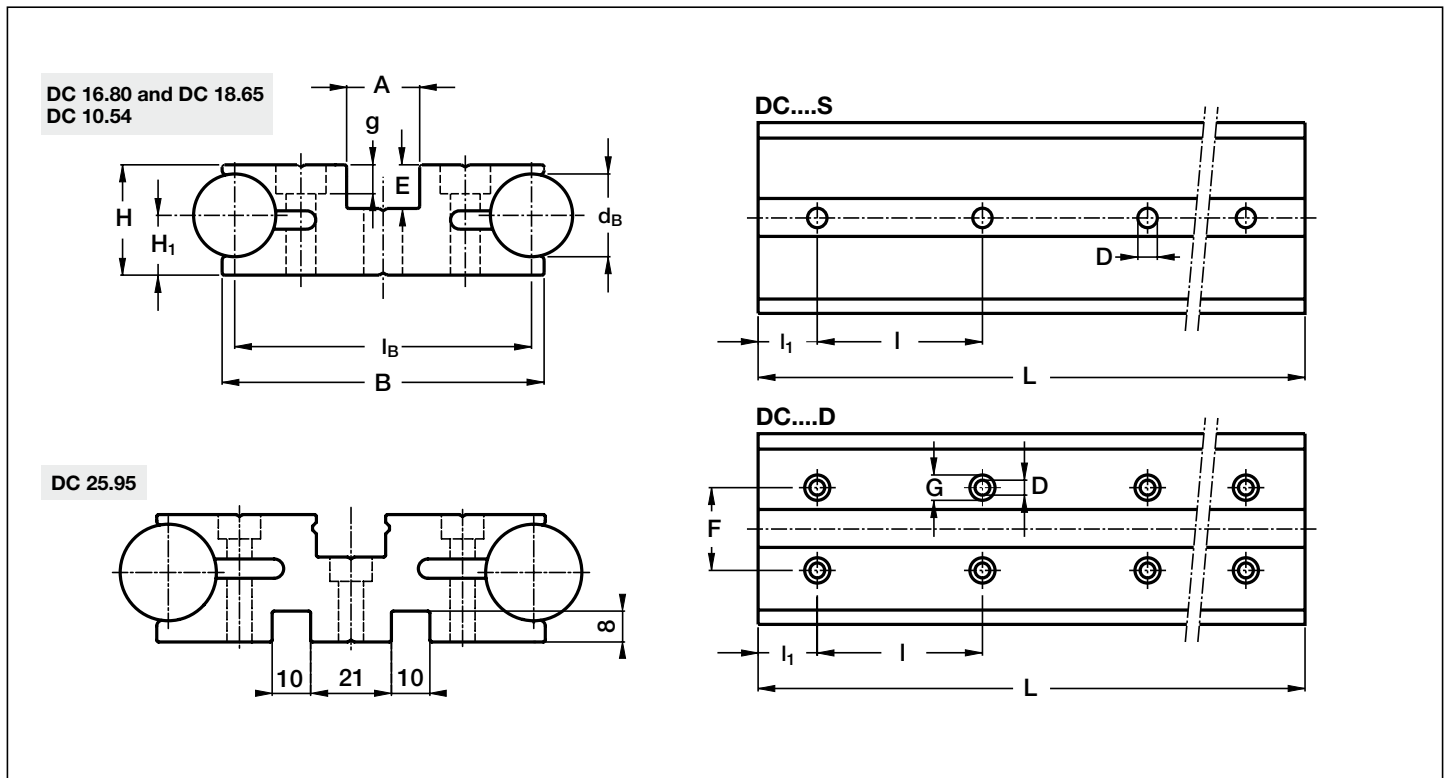
The nominal lifetime will be:

$$L_{10} = (6100/2000)^3 \times 100 = 2837 \text{ km}$$

Important notes:

- in order to reach the calculated lifetime it is important to lubricate the rails;
- for load configurations with many loads and moments acting at the same time in different directions, please refer to the calculation examples you can find at the beginning of the catalogue or contact our Technical department.

Guide Rails DC



Type	Dimensions (mm)													Moments of inertia ⁽²⁾ (cm ⁴)		Weight (kg/m)
	d _B	l _B	B	H	H ₁	A	E	D	G	g	F	l	l ₁	J _x	J _y	
DC 10.54 S ⁽³⁾	10	54	57	19.5	13	25	10.5	6.5	-	-	-	150	30	2.16	20.5	3.15
DC 10.54 D ⁽³⁾	10	54	57	19.5	13	25	10.5	4.4	8	4.2	36	150	30	2.16	20.5	3.15
DC 16.80 S ⁽³⁾	16	80	86	25.5	14.5	18	9.5	8.5	-	-	-	150	30	9.6	85	7.1
DC 16.80 D ⁽³⁾	16	80	86	25.5	14.5	18	9.5	6.5	11	6.3	54	150	30	9.6	85	7.1
DC 18.65 S	18	65	70.5	24	13	16	9.5	8.5	-	-	-	150	30	6.1	34.7	7
DC 18.65 D	18	65	70.5	24	13	16	9.5	6.5	11	6.3	36	150	30	6.1	34.7	7
DC 25.95 S ^{(4) (3)}	25	95	101	33	18	19	13	10.5	-	-	-	150	30	21.8	142.2	13.5
DC 25.95 D ^{(4) (3)}	25	95	101	33	18	19	13	6.5	11	6.3	58	150	30	21.8	142.2	13.5

max length in single element L=6000 ⁽¹⁾

1) Longer rails are supplied in sections with ground butt joints and, on request, with pin connection

2) Inertia value based on equivalent aluminium yield 70000 N/mm²

3) Available with stainless steel shafts - 4) Available with hollow shafts

Hole layout

- holes according to catalogue (**S** or **D**)
- finishes to drawing (**NZ**)
- without holes (**NF**)

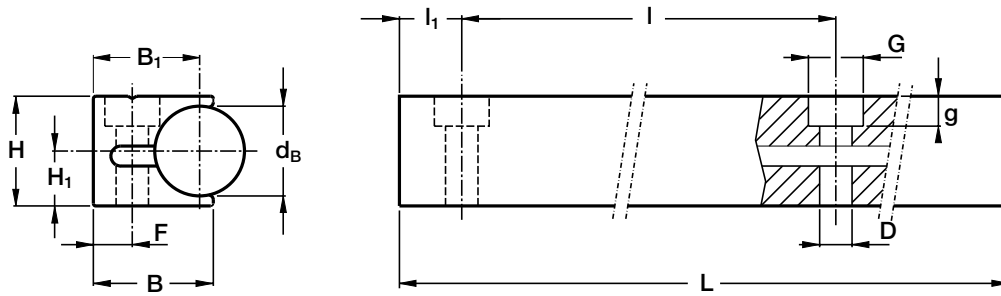
Optional features

- ground one end (**R**)
- ground both ends (**RR**)
- Stainless steel shafts (**NX**)
- Chromium plated shafts (**CH**)
- Hollow shafts (**AC**) only for note (4)

Example of standard designation: **DC2595 S/2010/S/NX**

See page 15 for standard codification

Guide Rails C



Type	Dimensions (mm)											Moments of inertia ⁽²⁾ (cm ⁴)		Weight (kg/m)
	d _B	B	B ₁	H	H ₁	D	G	g	F	l	l ₁	J _x	J _y	
C 10 ⁽³⁾	10	16.9	15.4	14.5	8	4.4	8	4.2	6.5	100	30	0.4	0.3	1.1
C 18	18	24	21.3	22	11	6.5	11	6.3	7.8	150	50	1.7	1.1	2.8
C 22	22	28	25	26.5	13.5	6.5	11	6.3	9	160	50	3.5	2.0	4.1
C 30 ^{(3) (4)}	30	36	32.5	36	19	9	15	8.3	11.5	180	60	11.1	5.6	7.6

max length in single element L=6000 ⁽¹⁾

1) Longer rails are supplied in sections with ground butt joints and, on request, with pin connection

2) Inertia value based on equivalent aluminium yield 70000 N/mm²

3) Available with stainless steel shafts

4) Available with hollow shafts

Hole layout

- holes according to catalogue (**SB**)
- finishes to drawing (**NZ**)
- without holes (**NF**)

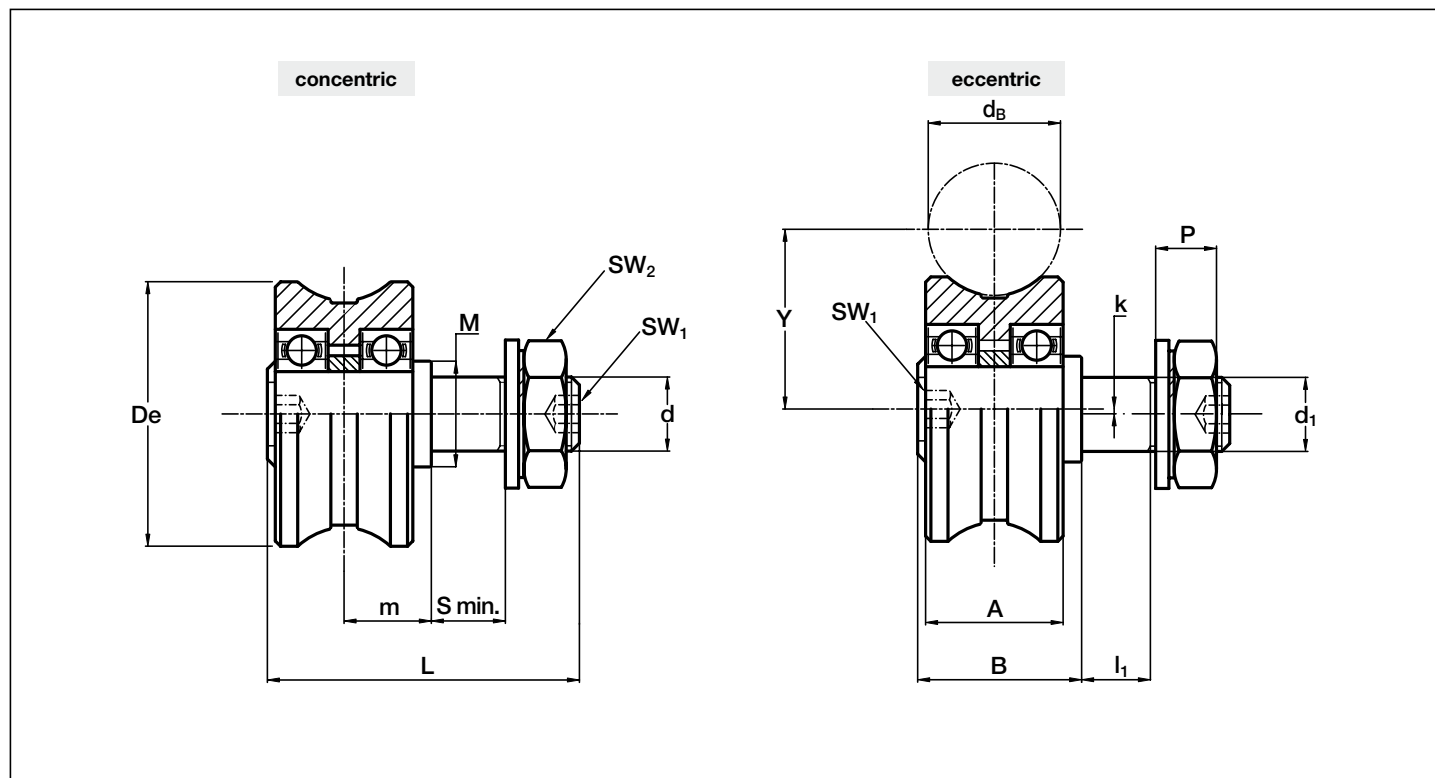
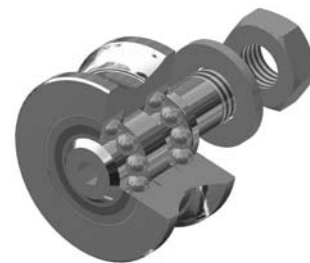
Optional features

- ground one end (**R**)
- ground both ends (**RR**)
- Stainless steel shafts (**NX**)
- Chromium plated shafts (**CH**)

Example of standard designation: **C10/2060/SB**

See page 15 for standard codification

Guide rollers **PFV** with “gothic arch” profile



Type		Dimensions (mm)														Recommended pairings		
concentric	eccentric	De	dB	d ₁ ⁽¹⁾	d	Y	m	S min.	P	L	A	B	I ₁	M	SW ₁		SW ₂	k
PFV 25.10 ⁽³⁾	PFVR 25.10 ⁽³⁾	25	10	8	M8x1.25	15.5	7.5	11	9	34.8	12	14.8	10	12	4	ch.13	0.75	C 10/DC 10.5
PFV 35.16 ⁽³⁾	PFVR 35.16 ⁽³⁾	35	16	10	M10x1.25	23	12	12	10.7	45.3	18	22.3	11	15	4	ch.17	0.75	DC 16.80
PFV 35.18 ⁽³⁾	PFVR 35.18 ⁽³⁾	35	18	10	M10x1.25	24	12	12	10.7	45.3	18	22.3	11	15	4	ch.17	0.75	C 18/DC 18.65
PFV 43.22 ⁽³⁾	PFVR 43.22 ⁽³⁾	43	22	12	M12x1.5	29	14	13	12.5	52	23	27	12	18	5	ch.19	1	C 22
PFV 50.25 ⁽³⁾	PFVR 50.25 ⁽³⁾	50	25	14	M14x1.5	34	16.5	14	13.5	59	26	31	13	20	6	ch.22	1	C 25.95
PFV 60.30	PFVR 60.30	60	30	16	M16x1.5	41	19.5	17	14	69.5	31	36.5	16	30	8	ch.24	1	C 30

Type		Dynamic load (N)	Limit loads of the bearing (N)		Limit loads of the stud (N)		Life coefficients		Torque wrench ⁽²⁾ settings (Nm)	Weight (g)
		C _w ⁽⁴⁾	radial C _{or}	axial C _{oa}	radial F _r	axial F _a	X	Y		
PFV 25.10	PFVR 25.10	1 850	1 080	200	1 740	450	1	4.4	8	42
PFV 35.16	PFVR 35.16	4 550	2 320	430	2 120	570	1	4.4	20	115
PFV 35.18	PFVR 35.18	4 570	2 320	430	2 120	570	1	4.4	20	113
PFV 43.22	PFVR 43.22	7 600	4 000	780	3 150	820	1	4	26	210
PFV 50.25	PFVR 50.25	8 800	4 800	940	4 240	1 100	1	4	44	335
PFV 60.30	PFVR 60.30	15 700	8 500	1 560	5 360	1 350	1	4.3	64	570

1) Housing bore tolerance: H7

2) The torque wrench settings are given for non-lubricated threads; for lubricated threads, multiply figure by 0.8

3) Available in stainless steel (suffix **NX**)

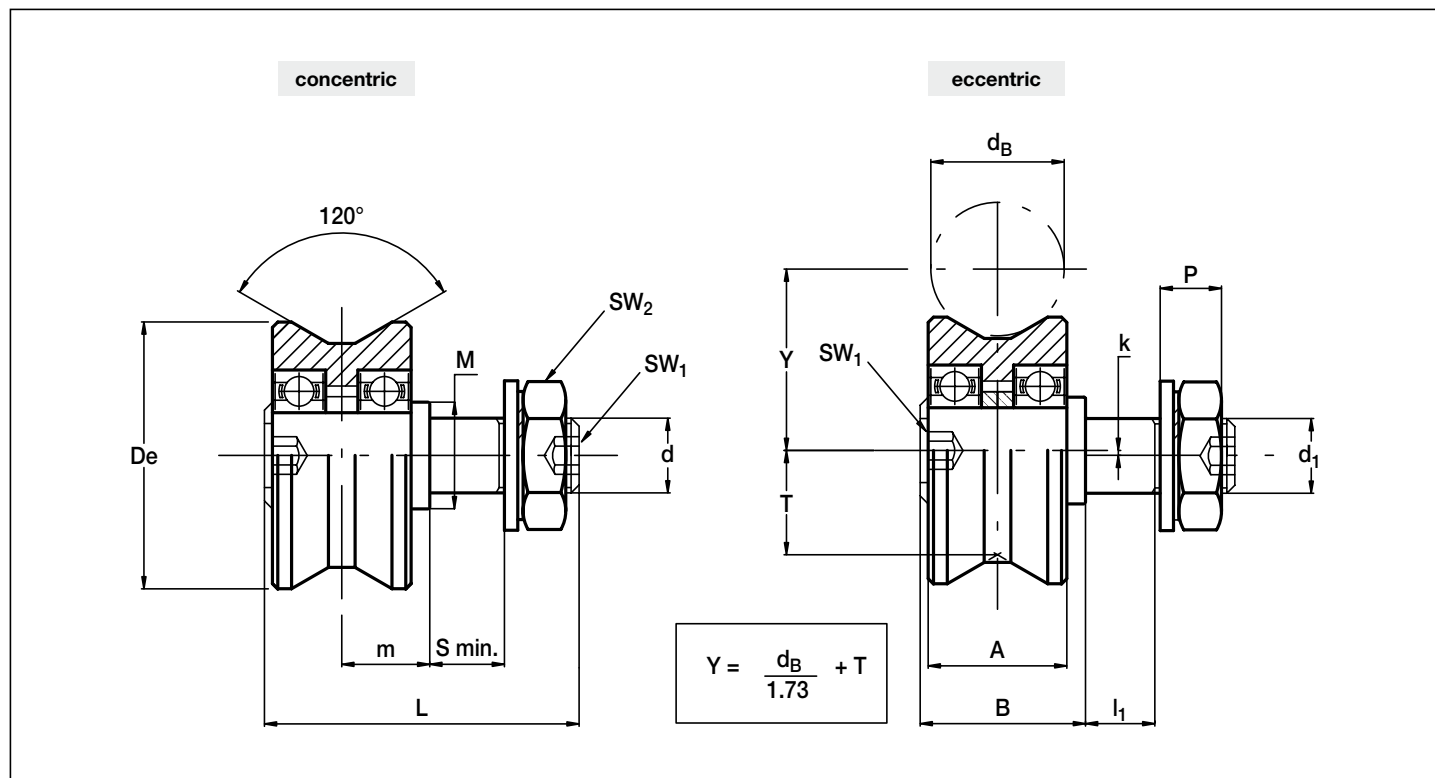
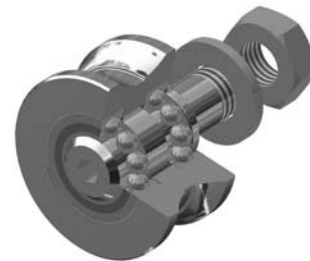
4) C_w basic load for 100 km

5) The guide rollers are complete with self-locking washers and hexagonal nut for fitting

6) Pressure angle α for load calculation: 60°

7) NBR seals, RS type

Guide rollers **PFV** straight profile



Type		Dimensions (mm)															
concentric	eccentric	De	dB	d ₁ ⁽¹⁾	d	T	m	S min.	P	L	A	B	l ₁	M	SW ₁	SW ₂	k
PFV 25	PFVR 25	25	from 6 to 18	8	M 8x1.25	9.7	7.5	11	9	34.8	12	14.8	10	12	4	ch. 13	0.75
PFV 35	PFVR 35	35	from 14 to 25	10	M10x1.25	13.6	12	12	10.7	45.3	18	22.3	11	15	4	ch. 17	0.75
PFV 43	PFVR 43	43	from 18 to 30	12	M12x1.5	16.3	14	13	12.5	52	23	27	12	18	5	ch. 19	1
PFV 50	PFVR 50	50	from 20 to 35	14	M14x1.5	19.6	16.5	14	13.5	59	26	31	13	20	6	ch. 22	1
PFV 60	PFVR 60	60	from 22 to 40	16	M16x1.5	23.7	19.5	17	14	69.5	31	36.5	16	30	8	ch. 24	1

Type		Dynamic load (N)	Limit loads of the bearing (N)		Limit loads of the stud (N) ⁽³⁾		Life coefficients		Torque wrench (Nm) ⁽²⁾ settings	Weight (g)
		C _w ⁽⁴⁾	radial C _{or}	axial C _{oa}	radial F _r	axial F _a	X	Y		
PFV 25	PFVR 25	1 850	1 080	200	1 740	450	1	4.4	8	42
PFV 35	PFVR 35	4 550	2 320	430	2 120	570	1	4.4	20	115
PFV 43	PFVR 43	7 600	4 000	780	3 150	820	1	4	26	210
PFV 50	PFVR 50	8 800	4 800	940	4 240	1 100	1	4	44	335
PFV 60	PFVR 60	15 700	8 500	1 560	5 360	1 350	1	4.3	64	570

1) Housing bore tolerance: H7

2) Torque wrench settings are given for non-lubricated threads; for lubricated threads, multiply figure by 0.8

3) In order to avoid the wear of the raceways the applied load must be smaller than 25% of limit load

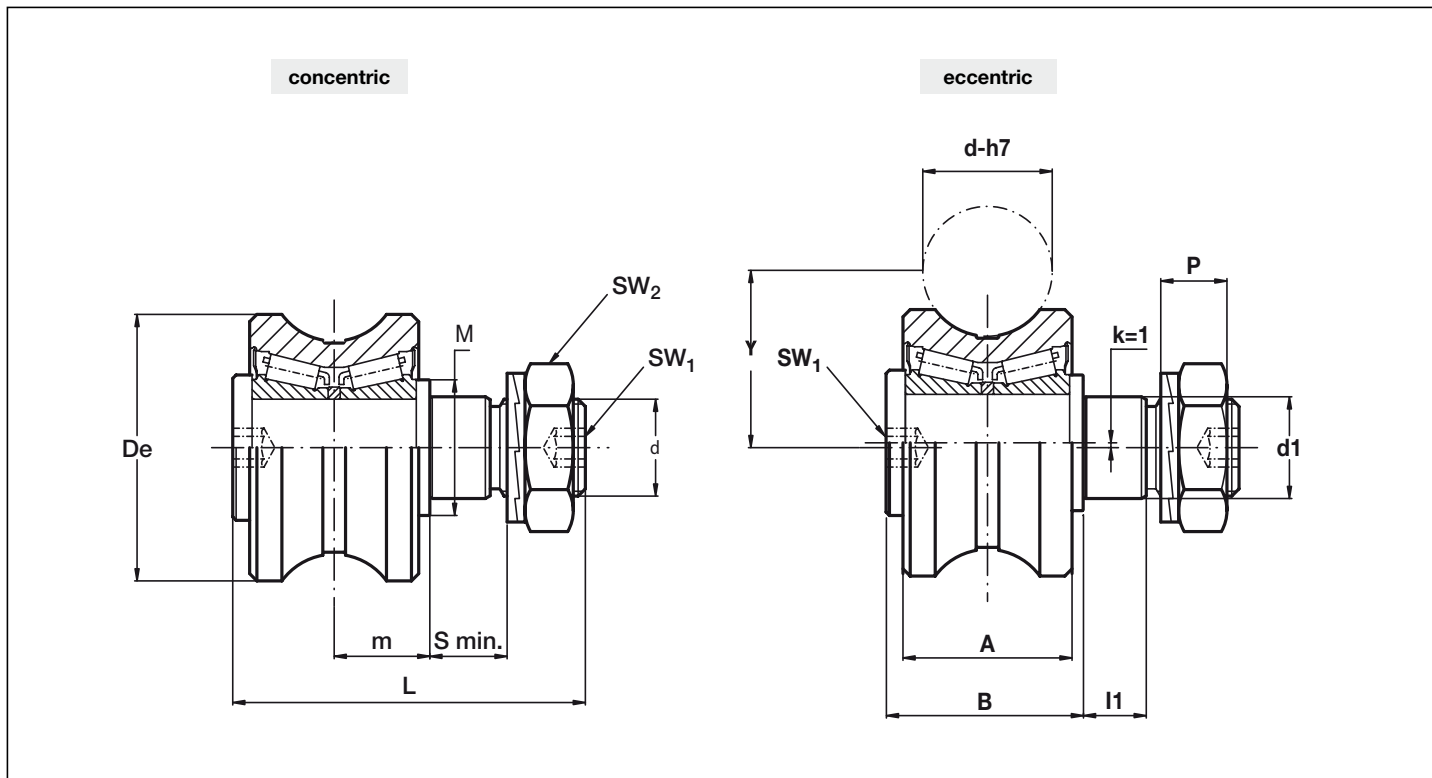
4) C_w basic load for 100 km

5) Guide rollers are complete with self-locking washers and hexagonal nut for fitting

6) Pressure angle α for load calculation: 60°C

7) Standard seals: material NBR, type RS

Guide rollers **RKO**

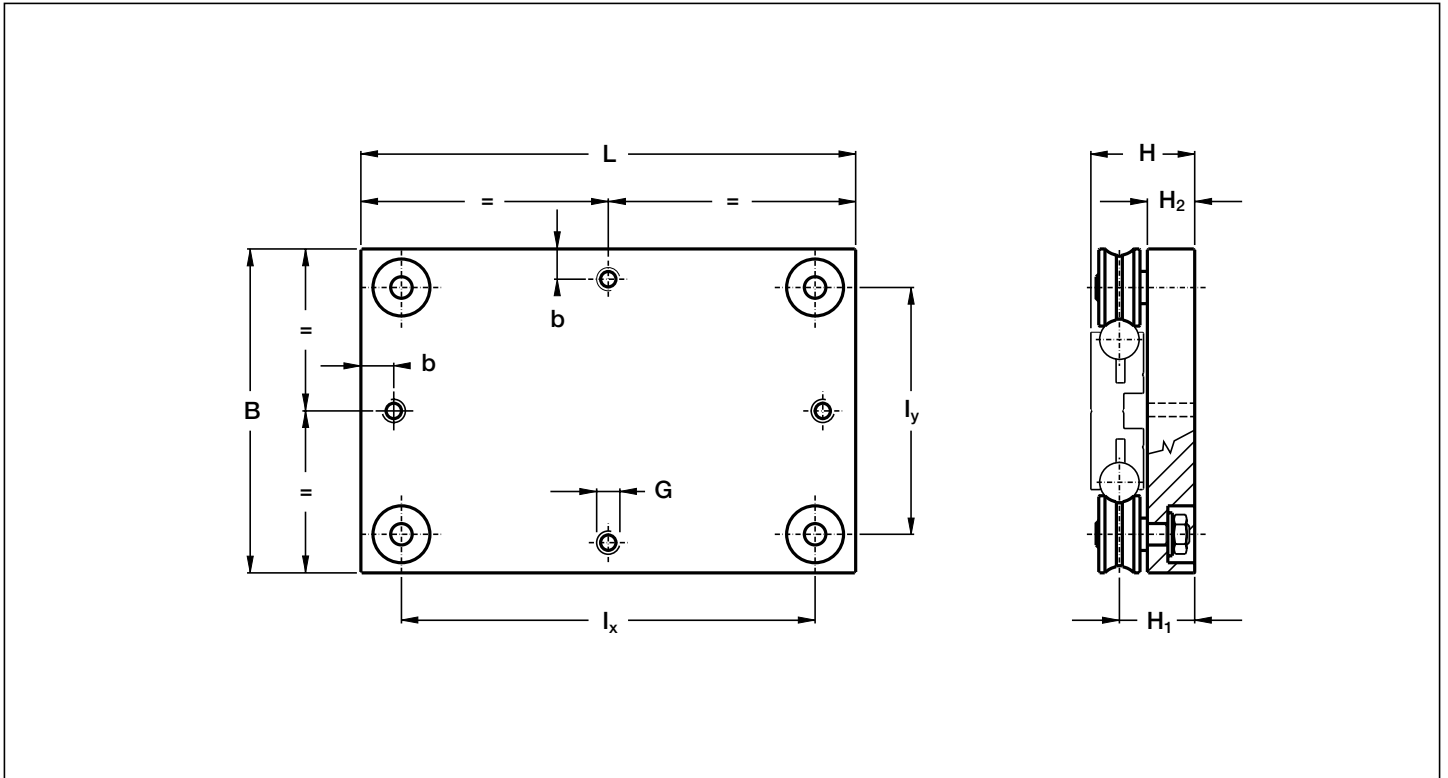
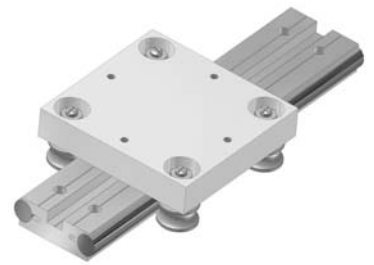


Type		Dimensions (mm)															
concentric	eccentric	De	d-h7	d ₁ ⁽¹⁾	d	Y	m	S min.	P	L	A	B	l ₁	M	SW ₁	SW ₂	k
RKO 55.20	RKOR 55.20	55	20	21	M 20 x 1.5	32.9	19.8	15	13.4	73	35	41	14	28	8	ch. 30	1
RKO 55.25	RKOR 55.25	55	25	21	M 20 x 1.5	34.3	19.8	15	13.4	73	35	41	14	28	8	ch. 30	1
RKO 62.30	RKOR 62.30	62	30	21	M 20 x 1.5	39.6	19.8	15	13.4	73	55	41	14	28	8	ch. 30	1
RKO 80.40	RKOR 80.40	79	40	36	M 30 x 1.5	50.7	27	19	19.6	100	45	55	18	44	12	ch. 46	1

Type		Dynamic load (N)	Limit loads of the bearing (N)		Limit loads of the stud (N)		Life coefficients				Torque wrench (Nm) ⁽²⁾ settings	Weight (kg)
			radial C _{or}	axial C _{oa}	radial F _r	axial F _a	Pa/Pr ≤ 0.1		Pa/Pr > 0.1			
							C _w ⁽⁴⁾	X	Y	X		
RKO 55.20	RKOR 55.20	40 750	44 000	12 400	11 900	3 550	1	4.67	0.77	6.98	80	0.6
RKO 55.25	RKOR 55.25	40 750	44 000	12 400	11 900	3 450	1	4.67	0.77	6.98	80	0.6
RKO 62.30	RKOR 62.30	46 000	44 000	12 400	11 900	3 150	1	4.67	0.77	6.98	80	0.7
RKO 80.40	RKOR 80.40	64 850	72 000	18 900	31 300	10 100	1	4.67	0.77	6.98	300	1.6

- 1) Housing bore tolerance: H7
- 2) Torque wrench settings are given for non-lubricated threads; for lubricated threads, multiply figure by 0.8
- 3) Standard seals: material NBR, type RS
- 4) On request, the guide rollers can be supplied with Viton seals for operating temperatures up to 120°C (suffix **V**)
- 5) C_w basic load for 100 km
- 6) The guide rollers is complete with self-locking washers and hexagonal nut for fitting
- 7) Pressure angle α for load calculation: 60°C

Carriages **T4PFV**

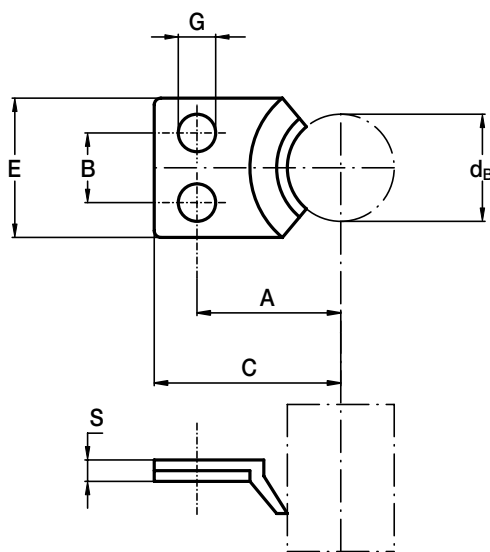
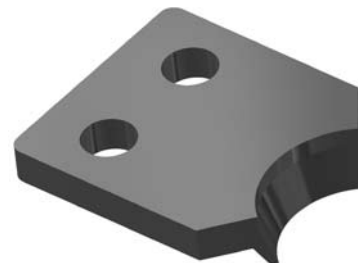


Type	Dimensions (mm)									Weight (kg)	Recommended pairings
	L	B	I _x	I _y	H	H ₁	H ₂	G	b		
T4PFV 25 10 80 ⁽¹⁾	80	120	45	85	41	28	20.5	M8	15	0.69	DC 10.54
T4PFV 25 10 120 ⁽¹⁾	120	120	85	85	41	28	20.5	M8	15	0.96	DC 10.54
T4PFV 35 16 165 ⁽¹⁾	165	165	126	126	50.5	36	24	M8	15	2.1	DC 16.80
T4PFV 35 16 250 ⁽¹⁾	250	165	211	126	50.5	36	24	M8	15	3.1	DC 16.80
T4PFV 35 18 150 ⁽¹⁾	150	150	113	113	49	36	24	M8	15	1.8	DC 18.65
T4PFV 35 18 250 ⁽¹⁾	250	150	213	113	49	36	24	M8	15	2.8	DC 18.65
T4PFV 50 25 220 ⁽¹⁾	220	220	163	163	63.5	45.5	29	M10	20	5	DC 25.95
T4PFV 50 25 300 ⁽¹⁾	300	220	243	163	63.5	45.5	29	M10	20	6.4	DC 25.95

1) Available with stainless steel guide rollers (**NX**)

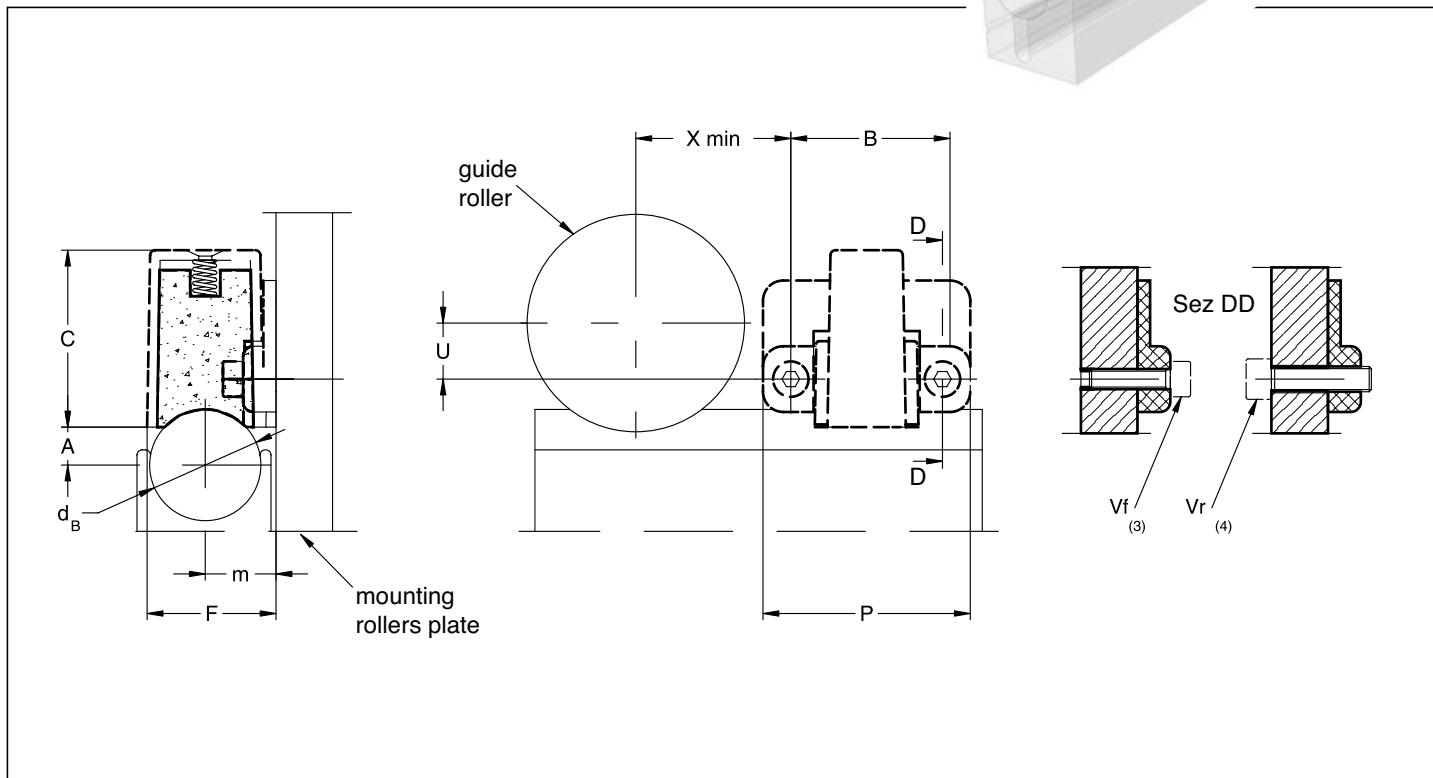
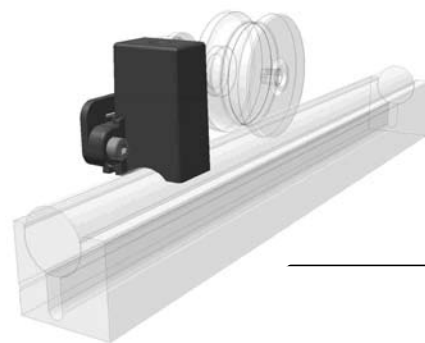
2) Carriages are complete with guide rollers

3) Pressure angle α for load calculation: 60°



Type	Dimensions (mm)								Recommended pairings
	d_B	E	C	A	B	G	A	S	
NAID 010	10	13	17.5	13.5	6.5	3.5	12	3	C 10
NAID 016	16	20	26.5	20.5	10	4.5	18	3	DC 16.80
NAID 018	18	20	26.5	20.5	10	4.5	18	3	C 18/DC 18.65
NAID 022	22	24	30	24	14	4.5	23	3	C 22
NAID 025	25	28	37.5	30.5	18	4.5	26	3	C 25.95
NAID 030	30	32	45.5	37.5	20	5.5	31	3	C 30

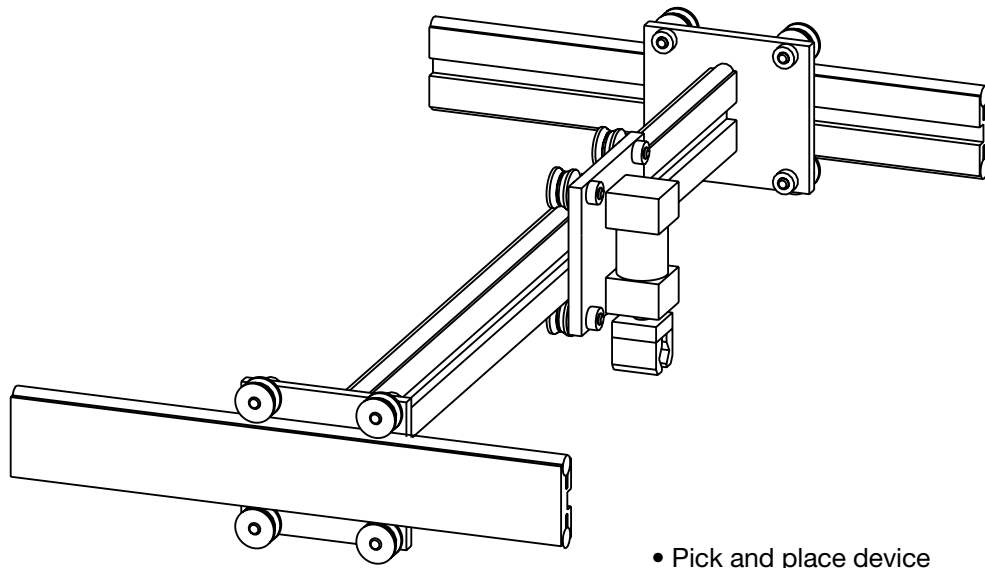
Lubricator LUBC



Type	Dimensions (mm)											Weight (g)	Suggested combinations
	X	U	B	F	m	dB	A	C	P	Vf	Vr		
LUBC 25.10	18	4.5	25	13	7.5	10	3	22	32.5	M3x12	M4	10	PFV 25.10
LUBC 35.16	23	9.5	25	22	12	16	5.5	32	32.5	M3x12	M4	15	PFV 35.16
LUBC 35.18	23	9.5	25	22	12	18	6.5	32	32.5	M3x12	M4	15	PFV 35.18
LUBC 43.22	29	12	30	25.5	14	22	22	35	41	M4x12	M5	30	PFV 43.22
LUBC 50.25	32.5	15.5	30	30.5	16.5	25	9	45	41	M4x12	M5	35	PFV 50.25
LUBC 60.30	37.5	20.5	30	36.5	19.5	30	11	50	41	M4x12	M5	40	PFV 60.30

- 1) The lubricator is supplied with the felt already lubricated. The lubricant has a mineral oil base
- 2) At the mounting, insert the screws inside the rollers plate, without tighten them, adjust the height of the plastic part in order to put it in contact with the raceways and then block it
- 3) The screws Vf for the frontal mounting are included in the packaging. Arrange two thread holes for dimension Vf in the mounting rollers plate
- 4) The screw for the mounting on the nut side of the roller are not included in the packaging. Arrange on the mounting rollers plate the holes in order to insert the screws Vr

Mounting Examples

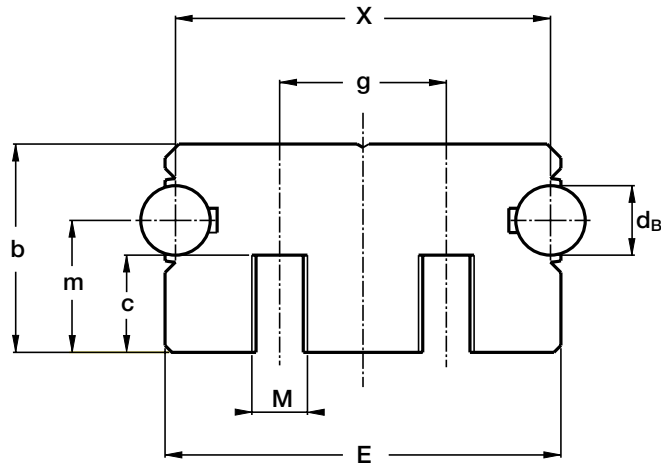


FWS, FWH System



NADELLA

Guide Rails FWS



Type	Dimensions (mm)							
	d_B	X	M	g	E	b	m	c
FWS 22	6	34	M 5	16	36	20	14	10
FWS 32	8	42	M 6	20	45	25	17	12
FWS 40	10	54	M 8	24	57	30	19	14
FWS 52	12	66	M 10	32	69	36	24	18

single guide element L=4500 ⁽¹⁾

Type	Screw distance max.			Momentsof inertia ⁽²⁾ cm ⁴		Weight (kg/m)
	for 2 screw channels		for additional holes (NZ)	J_x	J_y	
	Distance (mm)	Torque wrench settings (Nm)	Distance (mm)			
FWS 22	190	2	220	2.07	6.01	2
FWS 32	210	5	240	5.1	14.56	3.3
FWS 40	250	15	280	11.01	35.26	5
FWS 52	250	23	280	22.85	74.12	7.2

1) Longer rails are supplied in sections with ground butt joints at the rods

2) Inertia value based on equivalent aluminium yield 70000 N/mm² including shafts

Hole layout

- finishes to drawing (**NZ**)
- without holes (**NF**)

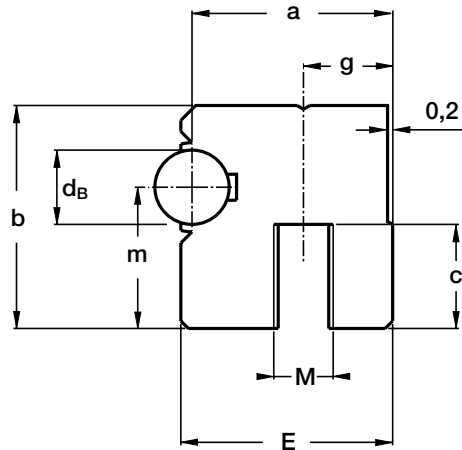
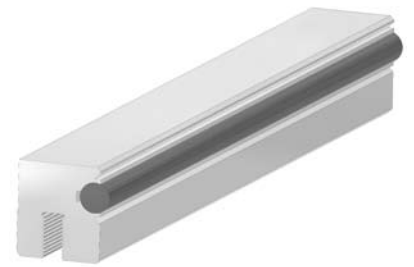
Optional features

- ground one end (**R**)
- ground both ends (**RR**)
- Stainless steel shafts (**NX**)

Example of standard designation: **FWS32 S/1500/NF**

See page 15 for standard codification

Guide Rails FWH



Type	Dimensions (mm)							
	d_B	a	M	g	E	b	m	c
FWH 22	6	17	M5	8	18	20	14	10
FWH 32	8	21	M5	10	22.5	25	17	12
FWH 40	10	27	M8	12	28.5	30	19	14
FWH 52	12	33	M10	16	34.5	36	24	18

Maximum length of single guide element L = 4 500 ⁽¹⁾

Type	Screw distance max.			Moments of inertia ⁽²⁾ cm ⁴		Weight (kg/m)
	for 1 screw channels		for additional holes	J_x	J_y	
	Distance (mm)	Torque wrench settings (Nm)	Distance (mm)			
FWH 22	70	2	120	1.02	0.83	1
FWH 32	60	5	130	2.55	2.05	1.6
FWH 40	97	15	150	5.71	4.75	2.5
FWH 52	120	23	150	10.12	11.85	3.6

1) Longer rails are supplied in sections with ground butt joints

2) Inertia value based on equivalent aluminium yield 70000 N/mm² including shafts

Hole layout

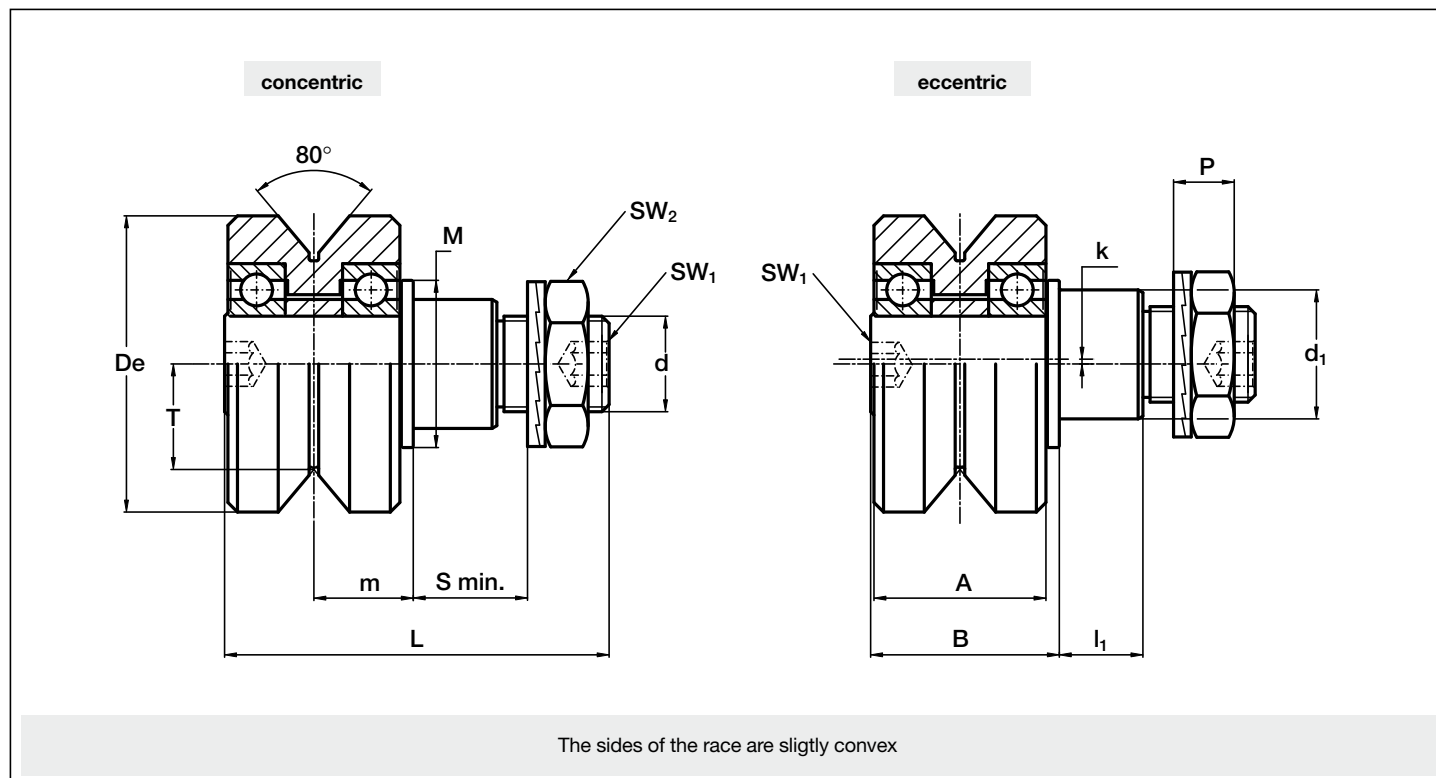
- finishes to drawing (**NZ**)
- without holes (**NF**)

Optional features

- ground one end (**R**)
- ground both ends (**RR**)
- Stainless steel shafts (**NX**)

Example of standard designation: **FWS32 S/1500/NF**
See page 15 for standard codification

Guide Rollers **FR..EI**



Type		Dimensions (mm)														
concentric	eccentric	De	d ₁ ⁽¹⁾	d	T	m	S min.	P	L	A	B	l ₁	M	SW ₁	SW ₂	k
FR 22 EI	FRR 22 EI	22	9	M 6 x 1	7.7	9.4	9	6.5	37	15	18.2	8	14	4	ch. 10	0.5
FR 32 EI	FRR 32 EI	32	14	M 10 x 1.25	11.8	12.6	12	8.5	50.5	21	24.5	11	20	4	ch. 16	1
FR 40 EI	FRR 40 EI	40	16	M 12 x 1.5	14.6	15.5	12	10.4	59.5	28	30.5	11	22	5	ch. 18	1
FR 52 EI	FRR 52 EI	52	21	M 16 x 1.5	19.1	19.8	15	11.4	69.5	32	36.5	14	28	6	ch. 24	1.5
FR 62 EI	FRR 62 EI	62	27	M 20 x 1.5	22.1	20.8	18.5	12.4	80.5	36	39.5	17.5	35	8	ch. 30	2

Type		Dynamic load (N)	Limit loads of the bearing (N)		Limit loads of the stud (N)		Life coefficients		Torque wrench settings ⁽²⁾ (Nm)	Weight (g)
			radial C _{or}	axial C _{oa}	radial F _r	axial F _a	X	Y		
FR 22 EI	FRR 22 EI	1 800	1 080	350	1 700	720	1	2.20	3	45
FR 32 EI	FRR 32 EI	4 400	2 330	750	1 200	500	1	2.92	20	130
FR 40 EI	FRR 40 EI	7 350	4 000	1 300	3 000	1 300	1	2.75	26	260
FR 52 EI	FRR 52 EI	9 500	5 500	1 750	7 500	3 000	1	2.96	64	510
FR 62 EI	FRR 62 EI	15 500	8 500	2 750	10 900	4 200	1	3.07	120	820

1) Housing bore tolerance: H7

2) The torque wrench settings are given for non-lubricated threads; for lubricated threads, multiply figure by 0.8

3) On request, the guide rollers can be supplied in stainless steel (suffix **NX**)

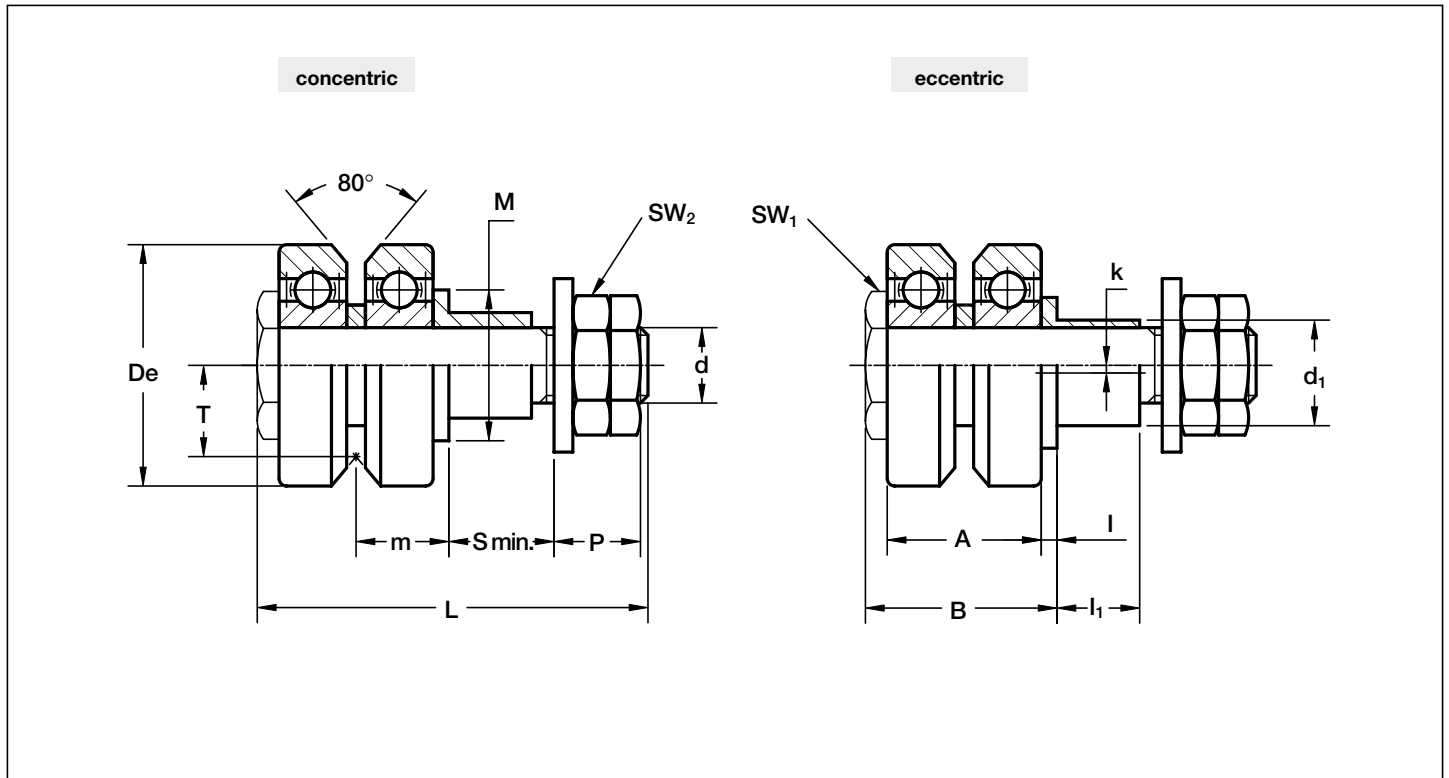
4) C_w basic load for 100 km

5) The guide rollers are complete with self-locking washers and hexagonal nut for fitting

6) Pressure angle α for load calculation: 40°

7) NBR seals RS type

Guide Rollers **FR**



Type		Dimensions (mm)															
concentric	eccentric	De	d ₁ ⁽¹⁾	d	T	m	S min.	P	L	A	B	I ₁	I	M	SW ₁	SW ₂	k
FR 22	FRR 22	22	9	M 6 x 1	8	9.2	9	7.7	39	13.9	19.5	8	2.2	14	10	10	0.5
FR 32	FRR 32	32	14	M 10 x 1.25	12.1	12.4	12	11.5	52	20.5	25.5	11	2.1	20	17	17	1
FR 40	FRR 40	40	16	M 12 x 1.5	14.6	15.5	12	13.5	60	25	31	11	3	22	22	19	1
FR 52	FRR 52	52	21	M 16 x 1.5	19.1	19.8	15	17	73	32	40	14	3.8	28	27	24	1.5

Type		Dynamic load (N)	Limit loads of the bearing (N)		Limit loads of the stud (N)		Life coefficients		Torque wrench settings ⁽²⁾ (Nm)	Weight (g) ⁽³⁾
			C _w ⁽⁴⁾	radial C _{or}	axial C _{oa}	radial F _r	axial F _a	X		
FR 22	FRR 22	700	176	105	800	380	1	0.593	3	43
FR 32	FRR 32	1 480	352	210	2 770	1 240	1	0.593	20	132
FR 40	FRR 40	2 440	545	325	3 830	1 720	1	0.593	26	235
FR 52	FRR 52	4 130	889	530	7 100	3 150	1	0.593	64	490

1) Housing bore tolerance: H7

2) The torque wrench settings are given for non-lubricated threads; for lubricated threads, multiply figure by 0.8

3) Weight without fittings

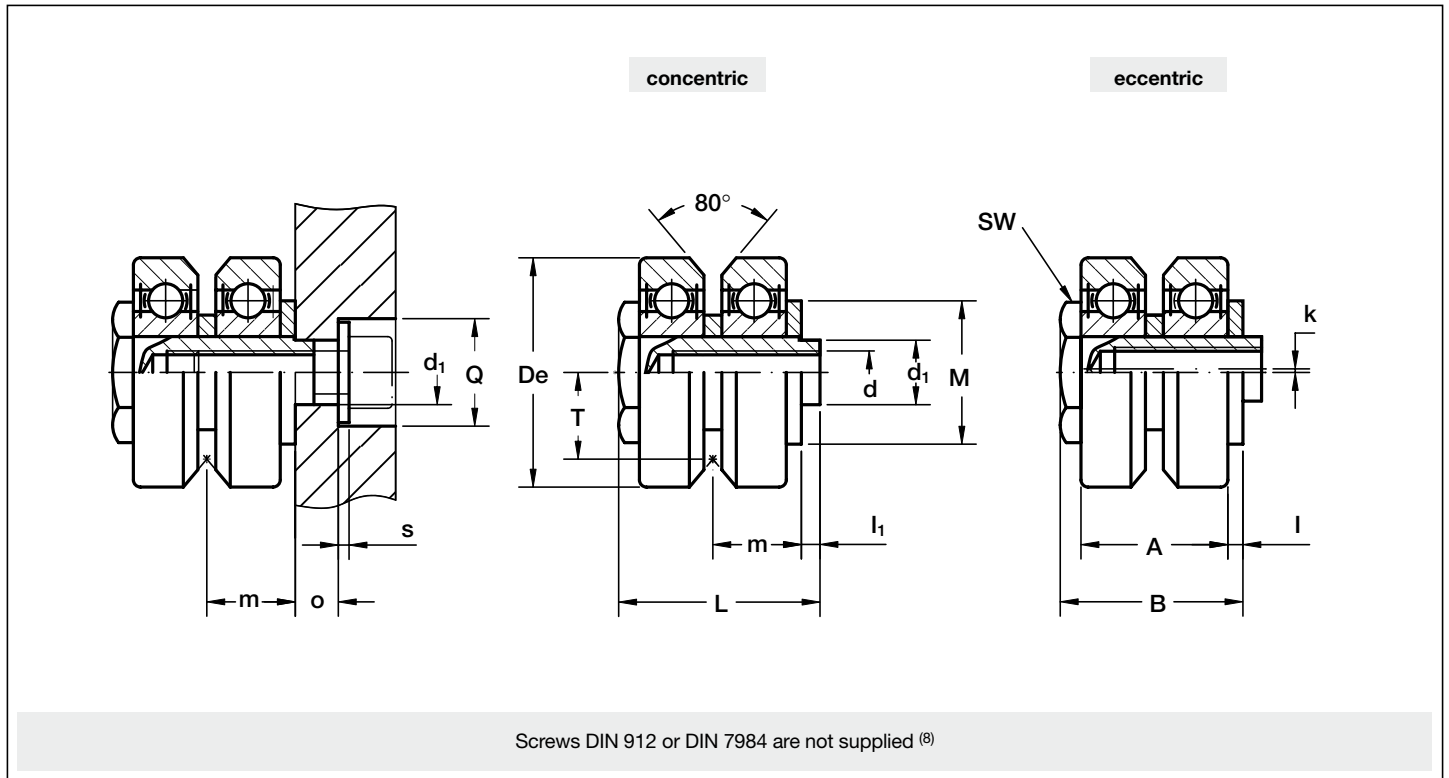
4) C_w basic load for 100 km

5) The guide rollers are completed with conical spring washer, nut and counter nut

6) Pressure angle α for load calculation: 40°

7) NBR seals RS type

Guide Rollers **FR..AS**

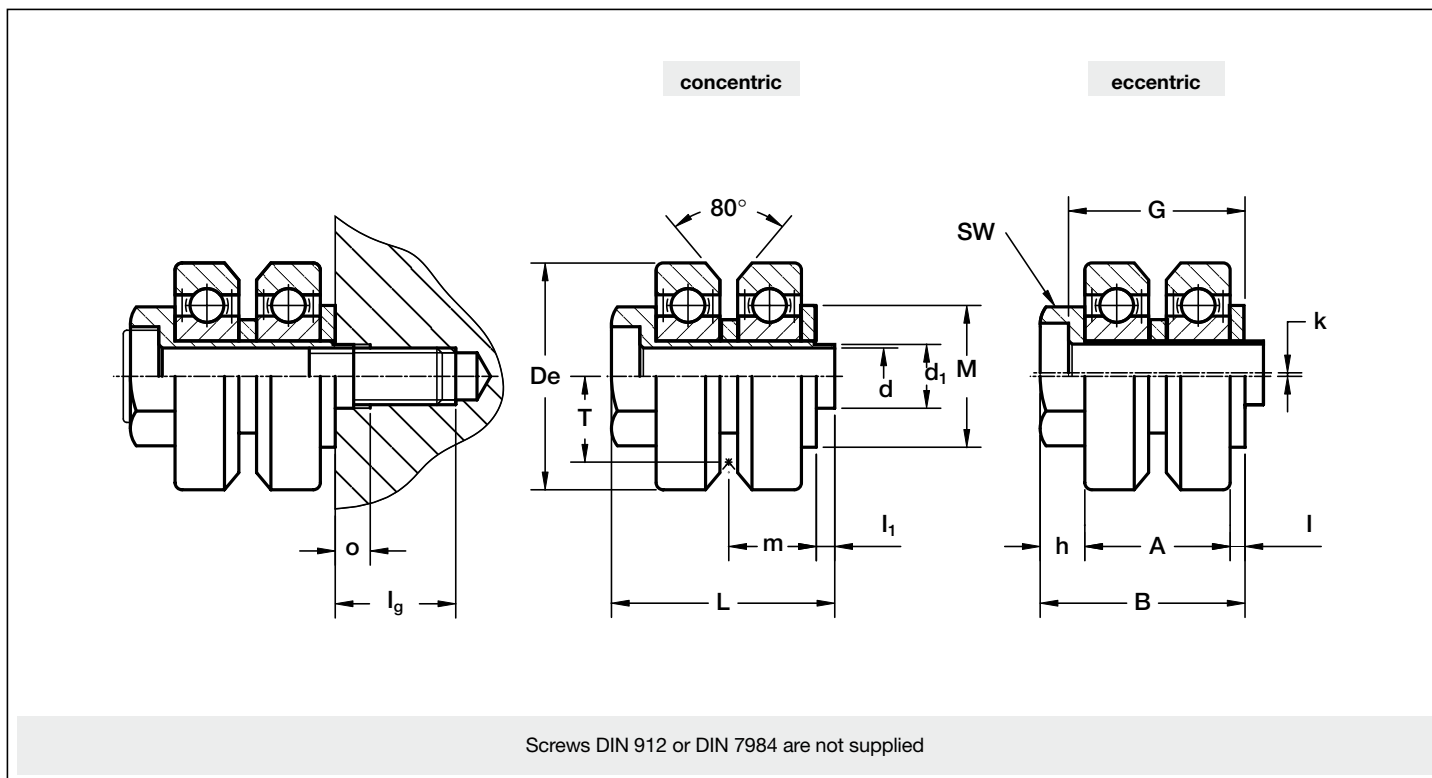


Type		Dimensions (mm)															
concentric	eccentric	De	d ₁ ⁽¹⁾	d ⁽²⁾	T	m	L	A	B	l ₁	I	M	SW	o	Q	s	k
FR 22 AS	FRR 22 AS	22	6	M 5	8	9.2	21.5	13.9	19.5	2	2.2	14	10	4.5	10	0	0.5
FR 32-1 AS	FRR 32-1 AS	32	9	M 6	12.1	12.4	28.1	20.5	25.5	2.6	2.1	20	17	6	15	1.5 ⁽⁵⁾	0.5
FR 40-1 AS	FRR 40-1 AS	40	13	M 8	14.6	15.5	33.5	25	31	2.5	3	25	22	6.5	20	2 ⁽⁵⁾	1
FR 52-1 AS	FRR 52-1 AS	52	16	M 10	19.1	19.8	43.2	32	40	3.2	3.8	32	27	8	24	2.5 ⁽⁵⁾	2

Type		Dynamic load (N)	Limit loads of the bearing (N)		Limit loads of the stud (N)		Life coefficients		Weight (g) ⁽³⁾
			radial C _{or}	axial C _{oa}	radial F _r	axial F _a	X	Y	
FR 22 AS	FRR 22 AS	700	176	105	470	210	1	0.593	32
FR 32-1 AS	FRR 32-1 AS	1 480	352	210	1 590	710	1	0.593	93
FR 40-1 AS	FRR 40-1 AS	2 440	545	325	4 040	1 790	1	0.593	169
FR 52-1 AS	FRR 52-1 AS	4 130	889	530	5 830	2 560	1	0.593	365

- 1) Housing bore tolerance H7
- 2) Safety thread SPIRALOCK
- 3) Weight without fittings
- 4) C_w basic load for 100 km
- 5) The guide rollers are completed with washer DIN 134
- 6) Pressure angle α for load calculation: 40°
- 7) Standard seals: material NBR, type RS
- 8) Length of screws: min = d+o+s; max = m+o+s

Guide Rollers **FR..AZ**



Type		Dimensions (mm)																
concentric	eccentric	De	d ₁ ⁽¹⁾	d	T	m	L	A	B	l ₁	l	h ⁽⁵⁾	M	SW	G	o	l _g ⁽²⁾	k
FR 22 AZ	FRR 22 AZ	22	6	5.1	8	9.2	23.5	13.9	21.5	2	2.2	5.4	14	10	18.5	4	13	0.5
FR 32 AZ	FRR 32 AZ	32	9	8.1	12.1	12.4	31.5	20.5	28.9	2.6	2.1	6.3	20	17	24.9	5	17	0.5
FR 40 AZ	FRR 40 AZ	40	13	12.1	14.6	15.5	39	25	36.5	2.5	3	8.5	25	24	30.5	5	26	1
FR 52 AZ	FRR 52 AZ	52	16	14.1	19.1	19.8	49.5	32	46.3	3.2	3.8	10.5	32	27	39.3	5.5	27	2

Type		Dynamic load (N)	Limit loads of the bearing (N)		Limit loads of the stud (N)		Life coefficients		Weight (g) ⁽³⁾	Required screws e.g. DIN7984
			radial C _{or}	axial C _{oa}	radial F _r	axial F _a	X	Y		
FR 22 AZ	FRR 22 AZ	700	176	105	470	210	1	0.593	30	M 5 x 30
FR 32 AZ	FRR 32 AZ	1 480	352	210	1 590	710	1	0.593	91	M 8 x 40
FR 40 AZ	FRR 40 AZ	2 440	545	325	4 040	1 790	1	0.593	169	M 12 x 50
FR 52 AZ	FRR 52 AZ	4 130	889	530	5 830	2 560	1	0.593	357	M 14 x 60

1) Housing bore tolerance: H7

2) Min. thread length for steel

Recommended screwed depth in steel = 1*d

In cast iron e.g. grey cast iron = 1.25*d

In aluminium = 2*d

3) Weight without screw

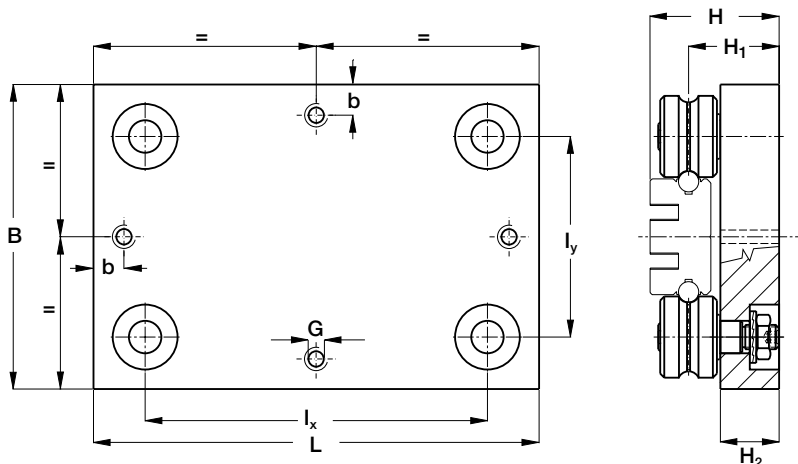
4) C_w basic load for 100 km

5) Dimension h plus screw head must be maintained free when using these guide rollers with FWS or FWH guide rails

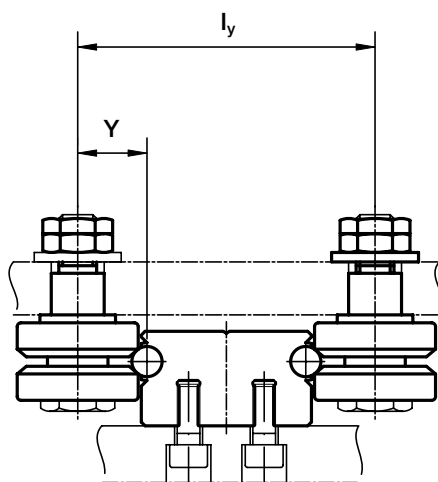
6) Pressure angle α for load calculation: 40°

7) NBR seals RS type

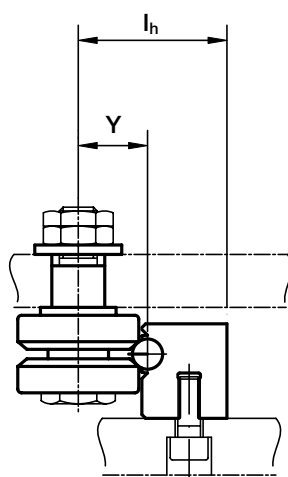
Carriage T4FR



Type	Dimensions (mm)									Weight (kg)	Suggested combinations
	L	B	l_x	l_y	H	H_1	H_2	G	b		
T4FR 22 90	90	90	59	58.7	42.4	28.4	19	M6	15	0.6	FWS 22
T4FR 22 150	150	90	119	58.7	42.4	28.4	19	M6	15	0.9	FWS 22
T4FR 32 120	120	120	78	78	58.6	41.6	29	M8	15	1.5	FWS 32
T4FR 32 180	180	120	138	78	58.6	41.6	29	M8	15	2.1	FWS 32
T4FR 40 150	150	150	99	98.8	63.5	44.5	29	M8	15	2.6	FWS 40
T4FR 40 220	220	150	169	98.8	63.5	44.5	29	M8	15	3.4	FWS 40
T4FR 52 190	190	190	123	123	82.8	58.8	39	M10	20	5.4	FWS 52
T4FR 52 260	260	190	203	123	82.8	58.8	39	M10	20	6.8	FWS 52



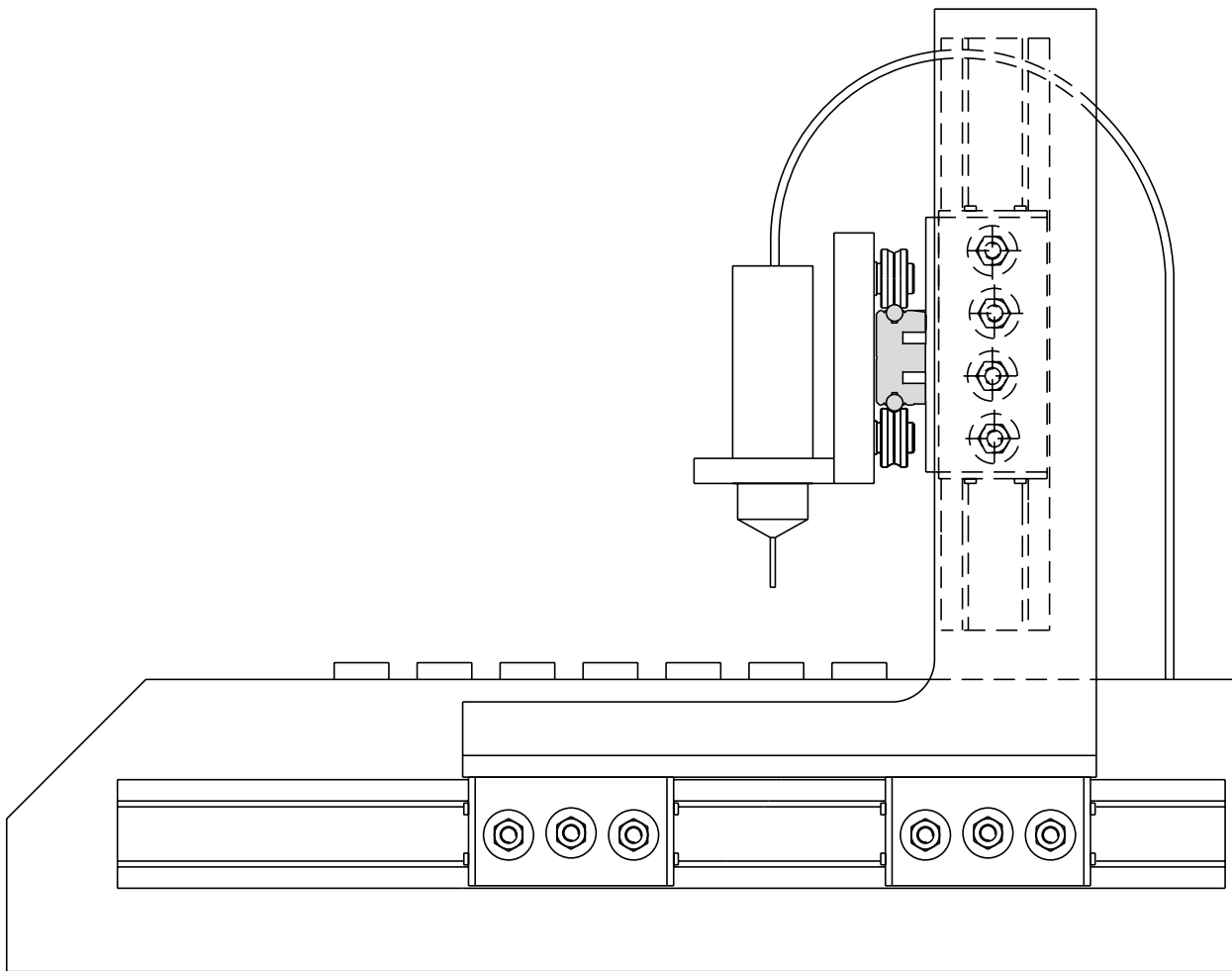
Type	Roller type FR/FRR, FR/FRR..AS/..AZ		Roller type FR/FRR...EI	
	Y	l_y	Y	l_y
FWS 22	12.7	59.4	12.4	58.8
FWS 32	18.3	78.6	18	78
FWS 40	22.4	98.8	22.4	98.8
FWS 52	28.4	122.8	28.4	122.8



Type	Roller type FR/FRR, FR/FRR..AS/..AZ		Roller type FR/FRR...EI	
	Y	l_h	Y	l_h
FWH 22	12.7	29.7	12.4	29.4
FWH 32	18.3	39.3	18	39
FWH 40	22.4	49.4	22.4	49.4
FWH 52	28.4	61.4	28.4	61.4

The guide roller size has to match the rail size: i.e. guide roller FR32 with guide rails FW32

Glue dispensing machine

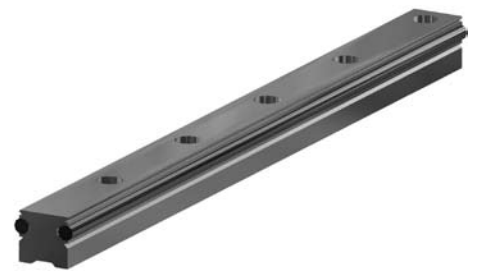


FWN system

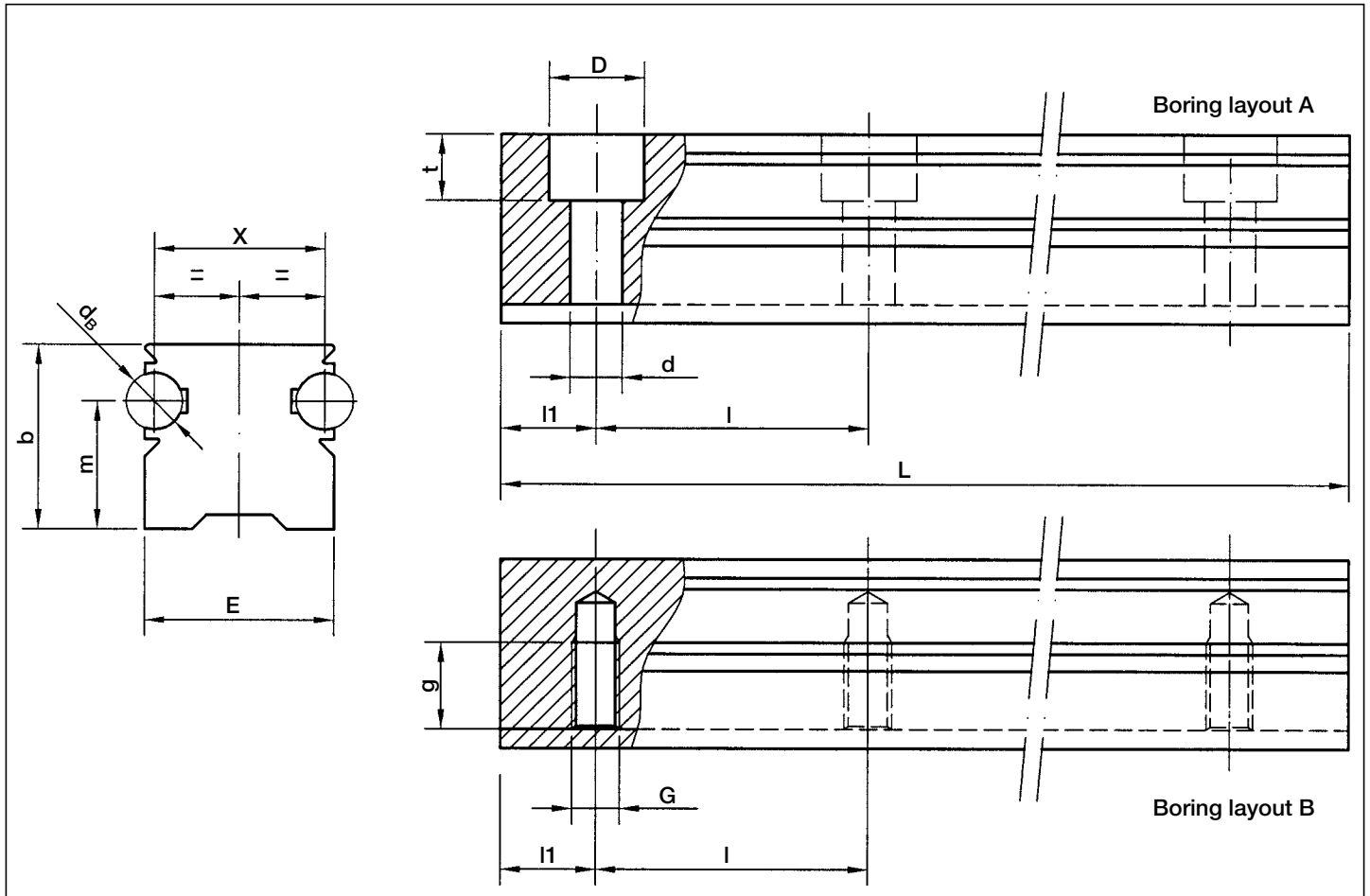


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Guide rails FWN



Dimensions according to DIN 645



Type	Dimensions (mm)												Weight (kg/m)
	d_B	E	X	D	d	G	g	m	t	b	l_1	l	
FWN 20	6	20	18	10	5.5	M6	12	13.5	7	19.5	30	60	1.3
FWN 25	6	23	21	11	6.6	M6	12	18	8.5	25.5	30	60	1.8

Max length of single guide element L=4 500 mm (2)

1) Longer rails are supplied in sections with ground butt-joints

Hole layout

- holes according to DIN (A and B)
- finishes to drawing (NZ)
- without holes (NF)

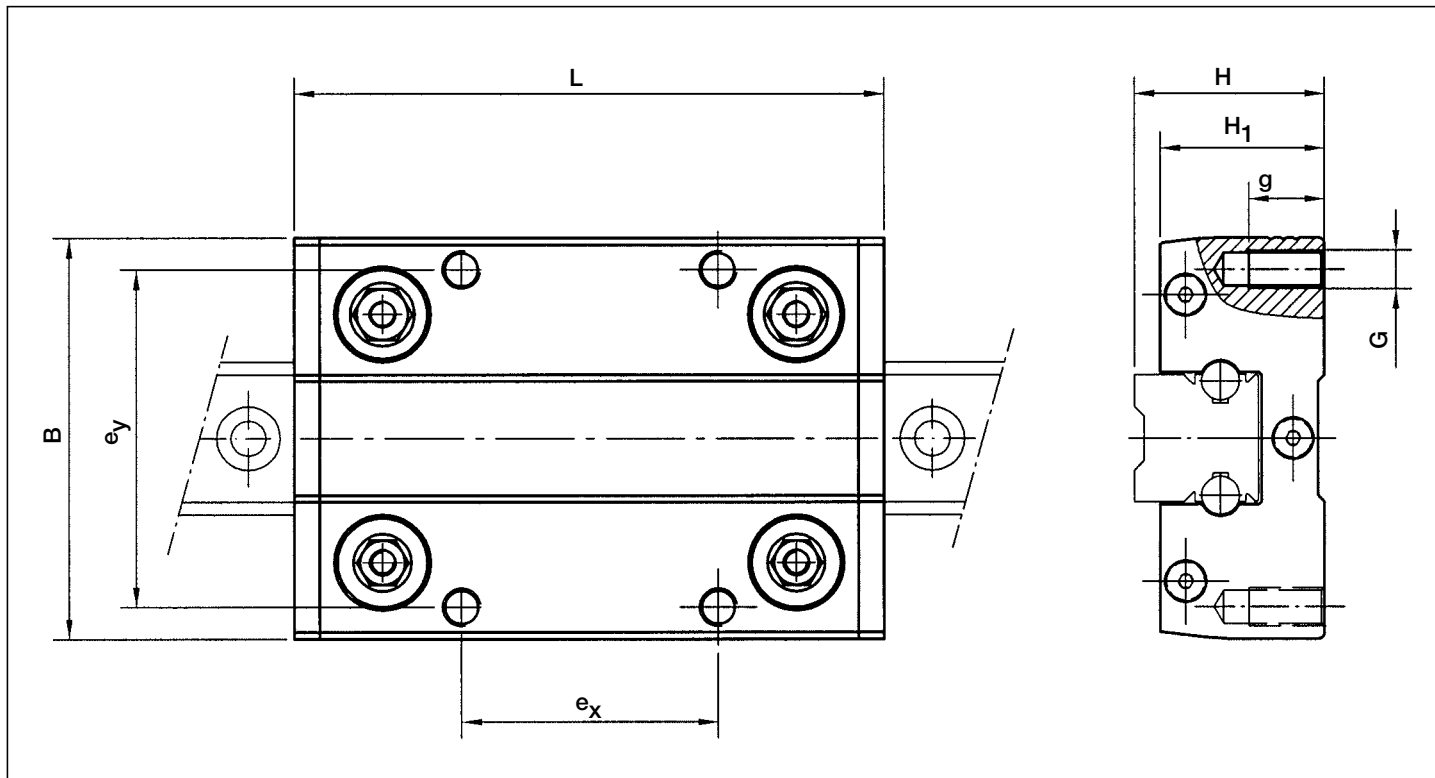
Optional features

- ground one end (R)
- ground both ends (RR)
- stainless steel shafts (NX)

Carriage TA4



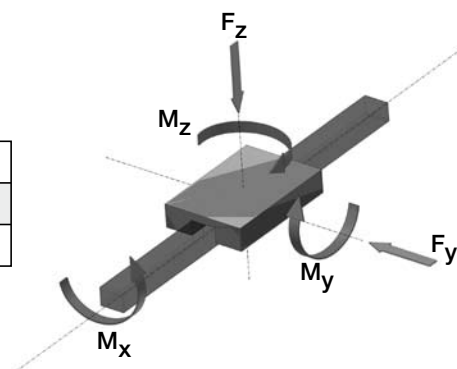
Dimensions according to DIN 645



Type	Dimensions (mm)								Weight (kg)	Suggested combinations
	B	G	H	H ₁	L	e _x	e _y	g		
TA4GLA 17.06	63	M6	30	26	92	40	53	12	0.3	FWN 20
TA4GLA 19.06	70	M8	36	31	104	45	57	16	0.4	FWN 25

Max load on a single carriage

Carriage	F _y (N)	F _z (N)	M _x (Nm)	M _y (Nm)	M _z (Nm)
TA4GLA 17.06	600	400	5	15	20
TA4GLA 19.06	1 700	960	19	33	70



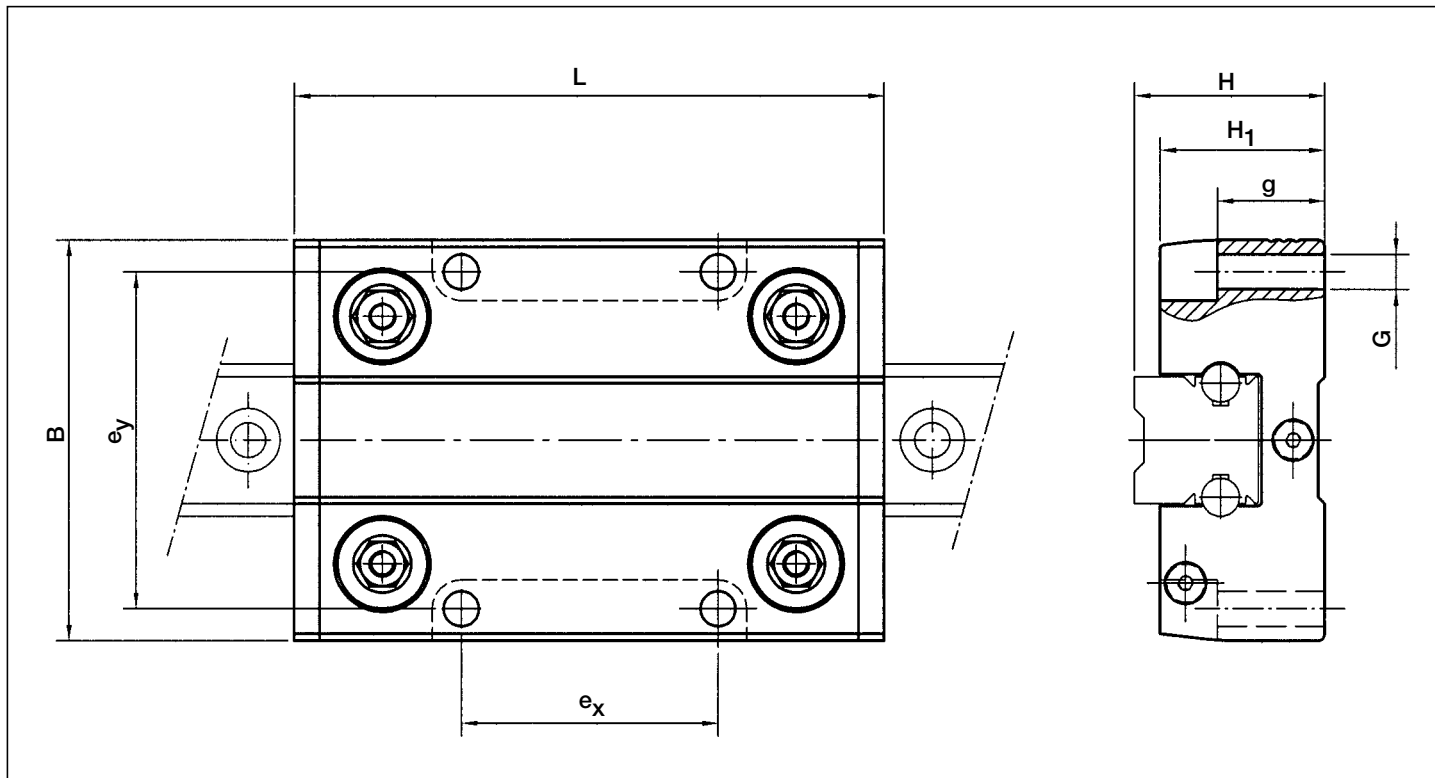
Optional features

- available with stainless steel guide rollers (**NX**)
- available with felts for lubrication (**UU**)

Carriage TB4



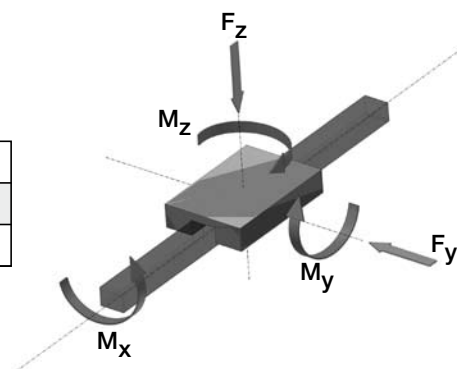
Dimensions according to DIN 645



Type	Dimensions (mm)								Weight (kg)	Suggested combinations
	B	G	H	H ₁	L	e _x	e _y	g		
TB4GLA 17.06	63	5.5	30	26	92	40	53	17	0.25	FWN 20
TB4GLA 19.06	70	6.6	36	31	104	45	57	23.5	0.35	FWN 25

Max load on a single carriage

Carriage	F _y (N)	F _z (N)	M _x (Nm)	M _y (Nm)	M _z (Nm)
TB4GLA 17.06	600	400	5	15	20
TB4GLA 19.06	1 700	960	19	33	70



Optional features

- available with stainless steel guide rollers (**NX**)
- available with felts for lubrication (**UU**)

LM system



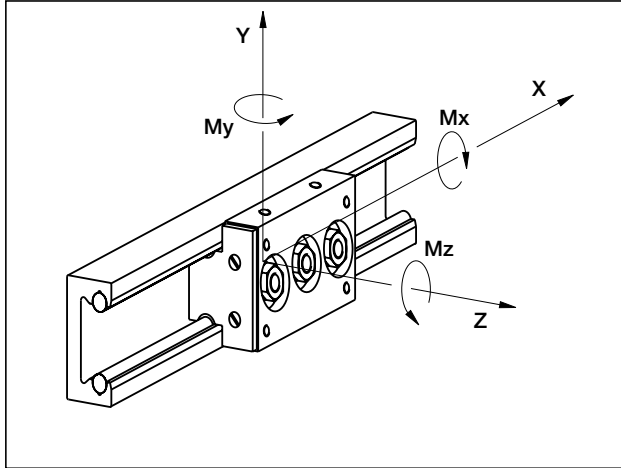
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System

LM system is based on rail, guide rollers and carriages to provide a complete guiding system.

Guide rails and rollers can be used as single elements. In most cases the application is based on standard carriages and cursors.

Referring to the axis system below, the load capacities are tabulated as follows:



MAX LOAD ON SINGLE CARRIAGE

The following table shows the maximum load that can be applied on a single carriage.

Guide	Carriage	F _y N	F _z N	M _x Nm	M _y Nm	M _z Nm
LM 30	C3 RCL 17 06 065	1000*	330	3.5	5.8	10
	C4 RCL 17 06 085	1000	660	7	11	20
LM 40	C3 RCL 24 06 085	1810*	520	7.6	15	26
	C4 RCL 24 06 114	1810	1040	15	25	52
LM 65	C3 RCL 35 10 115	4160*	1200	26	45	78
	C4 RCL 35 10 152	4160	2400	50	75	155
LM 120	T4 RCL 35 10 150	4160	2400	110	120	200
	T4 RCL 35 10 220	4160	2400	110	200	350
	T4 RCP 42 10 150	5250	3030	140	150	260
	T4 RCP 42 10 220	5250	3030	140	250	440
LM 180	T4 PFV 43 22 180	6300	3120	185	200	400
	T4 PFV 43 22 280	6300	3120	185	350	715

* F_y directed to load the two concentric guide rollers

The maximum load is based on the guide roller data (stud and bearing strength) and on maximum contact pressure between rail and roller of 1250 N/mm². Loading is considered to be acting in a single plane or axis only.

BASIC DYNAMIC LOAD OF SINGLE CARRIAGE

The following table shows the nominal load that corresponds to a nominal life of the bearing at 100 km.

The nominal carriage life can be estimated from the standard bearing formula.

$$L_{10} = (C_i/P_i)^3 \times 100 \text{ km}$$

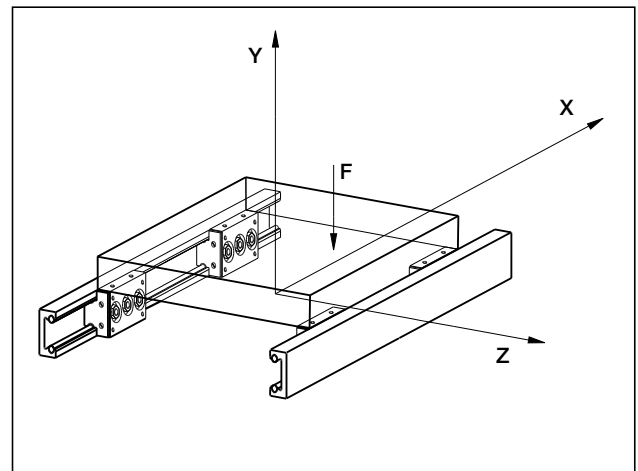
C_i and P_i are the basic capacity and load applied for a specific direction.

Guide	Carriage	C _y N	C _z N	CM _x Nm	CM _y Nm	CM _z Nm
LM 30	C3 RCL 17 06 065	3000*	830	9	16	30
	C4 RCL 17 06 085	3000	1670	18	26	60
LM 40	C3 RCL 24 06 085	8400*	2340	34	67	122
	C4 RCL 24 06 114	8400	4670	68	110	244
LM 65	C3 RCL 35 10 115	15800*	4050	86	152	296
	C4 RCL 35 10 152	15800	8110	172	250	593
LM 120	T4 RCL 35 10 150	15800	8110	370	400	780
	T4 RCL 35 10 220	15800	8110	370	685	1335
	T4 RCP 42 10 150	24000	14130	650	700	1190
	T4 RCP 42 10 220	24000	14130	650	1195	2030
LM 180	T4 PFV 43 22 180	15190	5300	320	335	965
	T4 PFV 43 22 280	15190	5300	320	600	1725

* F_y directed to load the two concentric guide rollers

Calculation example: four carriages C3RCL 35 10 115 platform

The common configuration is shown in the here following sketch:



The platform moves along the two guide rails and has a load of "F" acting at 100 mm and 50 mm from the carriage centre.

Data:

guide LM 65 and cursors C3RCL3510115

$$I_x = 400 \text{ mm} \quad I_z = 300 \text{ mm}$$

$$F = 6.000 \text{ N} \quad X_F = 100 \text{ mm} \quad Z_F = 50 \text{ mm}$$

In this configuration the load on the most heavily loaded carriage is P_y and can be calculated using the following formula:

$$P = \frac{F}{4} + \frac{F \cdot X_F}{2 \cdot I_x} + \frac{F \cdot Z_F}{2 \cdot I_z} = 2750 \text{ N}$$

The load F_y shown in the "max loads" table is 4.160N (carriages mounted with eccentric roller on top), so the system is validated against breakage.

To estimate the system life we proceed as follows: from the nominal life table C_y = 15.800 N

$$L_{10} = (15.800/2.750)^3 \times 100 = 18.900 \text{ km}$$

Important note: to reach this value it is important to lubricate the rail, otherwise fretting corrosion between rail and roller can reduce the expected life.

Auto-aligning

Systems

Auto-aligning systems are assembled with guide rollers RAL type on LM system carriages tables.

The guide rollers RAL type allows axial displacement of the roller on the pin. An “O” ring retains the roller in position during the mounting.

Auto-aligning systems compensate for opposite rail misalignment errors. They are useful for mounting inaccurately aligned structures or those structures subject to flexure.

C3RAL C4RAL T4RAL

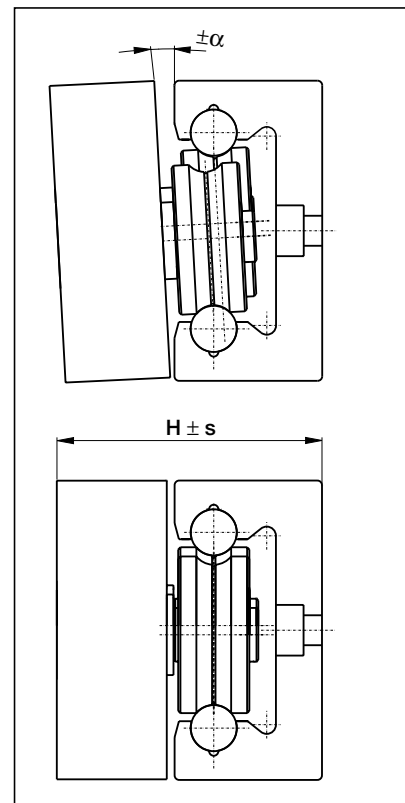
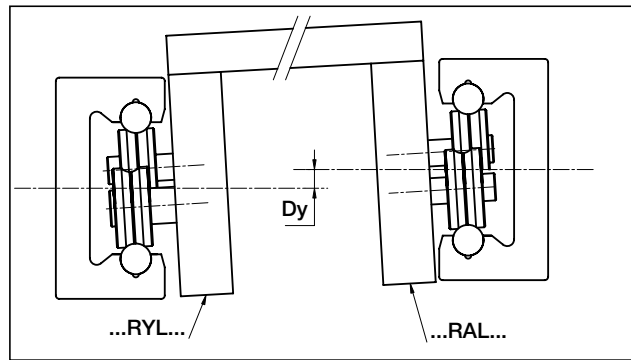
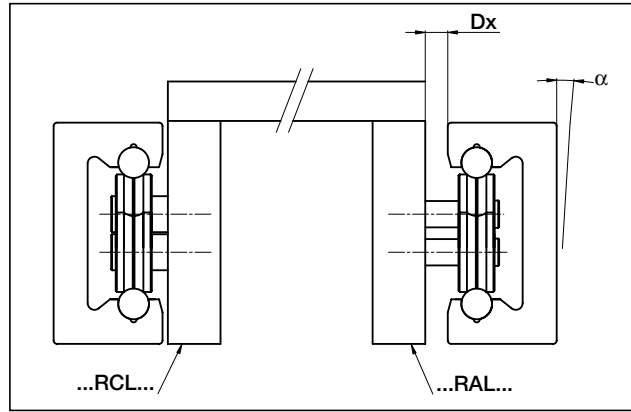
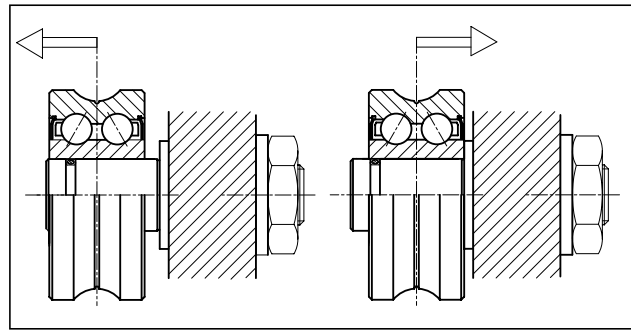
Is used to compensate for D_x misalignment between opposite rails. The table or carriage with all guide rollers RAL/RALR type can move towards or away from the rail. Type RAL provides radial support only. Axial load, transverse to the direction of travel, is reacted by carriage type RCL on the opposite rail.

C3RYL C4RYL T4RYL

Rail misalignment D_y requires the ability for both carriages to rotate. The table or carriage RYL type, with guide rollers RCL/RCP in contact with a steel shaft of the LM rail and guide rollers RALR type in contact with the opposite shaft, allows carriage rotation ensuring at the same time the transverse direction control.

The maximum D_y value is dependent on the distance between the rails and the tabulated maximum angle ‘ α ’ for that carriage.

Note: RYL carriage axial load capability is lower than the same size RCL/RCP carriage.



Max transverse moving allowed by auto-aligning tables and carriages

Carriage code (1)		α max (°)	S max (mm)	H nominal (mm)	Rail
C3RAL 17 06 065	C4RAL 17 06 085	1	0.8	27.5	LM 30
C3RYL 17 06 065	C4RYL 17 06 085	1	-		
C3RAL 24 06 085	C4RAL 24 06 114	1	1	35.7	LM 40
C3RYL 24 06 085	C4RYL 24 06 114	1	-		
C3RAL 35 10 115	C4RAL 35 10 152	1	1	58	LM 65
C3RYL 35 10 115	C4RYL 35 10 152	1	-		
T4RAL 35 10 150	T4RAL 35 10 220	0.3	1	58.5	LM 120
T4RYL 35 10 150	T4RYL 35 10 220	0.3	-		
T4RAL 42 10 150	T4RAL 42 10 220	0.75	1.5	65.5	
T4RYL 42 10 150	T4RYL 42 10 220	0.75	-		

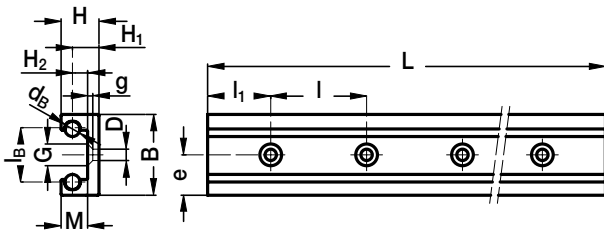
1) See light load systems Nadella catalogue for table and carriage dimensions.

2) Variations of dimension H exceeding $\pm s$ can compromise bearing axial moving and decrease the roller limit load, Fr.

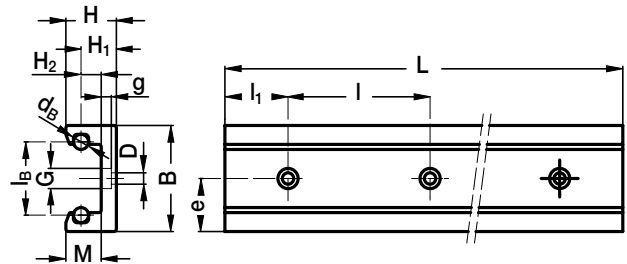
Guide Rails LM



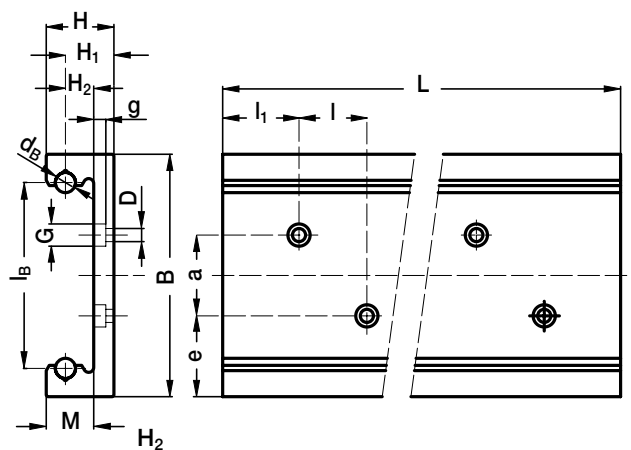
LM 30



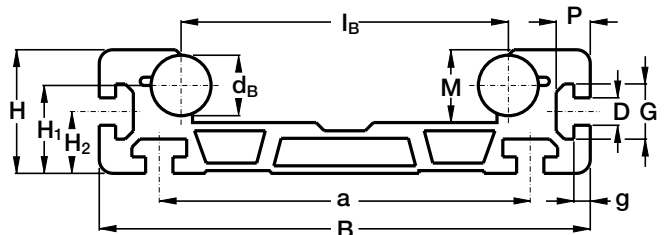
LM 40 LM 65



LM 120



LM 180



Type	Dimensions (mm)															Moments of inertia ⁽²⁾ (cm ⁴)		Weight (kg/m)	L ⁽¹⁾ max (mm)
	d _B	l _B	B	H	H ₁	H ₂	M	D	G	g	a	e	P	l	l ₁	J _x	J _y		
LM 30 ⁽⁴⁾	6	21.5	32	15.5	10.5	6	11	4.5	9.5	2.5	-	16	-	80	40	0.5	3	1.1	6 000
LM 40 ⁽⁴⁾	6	29	42	20	14	8	14	4.5	8	4	-	21	-	100	50	1.2	8.8	1.5	6 000
LM 65 ⁽⁴⁾	10	42.5	65	32	23.5	13.5	22	6.5	11	6	-	32.5	-	100	50	8.8	54.9	4.1	6 000
LM 120 ⁽⁴⁾	10	92	120	33.5	24	14	23.5	6.5	11	6	40	40	-	100	50	14.8	311.6	6	6 000
LM 180 ⁽³⁾	22	120	180	45	32	22.5	26.5	10	20.1	6	136	-	12.5	-	-	53.3	1 096.6	13.1	6 000

1) Longer rails are supplied in sections with ground butt joints and, on request, with pin connection

2) Inertia value based on equivalent aluminium yield 70000 N/mm²

3) Available with hollow shafts (AC) - 4) available with stainless steel shafts (suffix NX)

Hole layout

- holes according to catalogue (SB)
- finishes to drawing (NZ)
- without holes (NF)

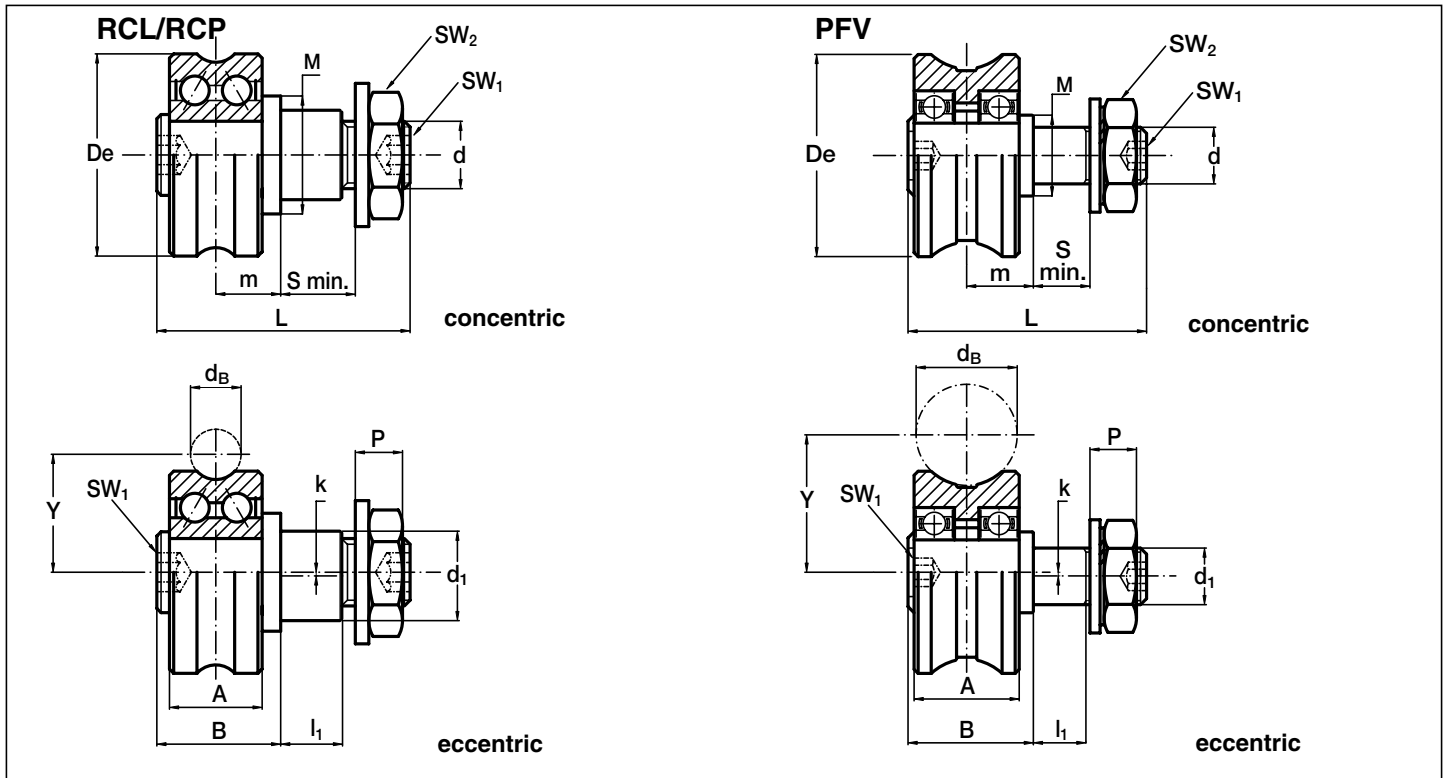
Optional features

- ground one end (R)
- ground both ends (RR)
- Chromium plated shafts (CH)
- Hollow shafts (AC) (3)

Example of standard designation: **LM 40/1720/NF**

See page 15 for standard codification

Guide Rollers **RCL, RCP, PFV**



Type		Dimensions (mm)															Suggested combination		
concentric	eccentric	De	d _B	d ₁ ⁽¹⁾ conc.	d ₁ ⁽¹⁾ ecc.	d	Y	m	S min.	P	L	A	B	l ₁	M	SW ₁		SW ₂	k
RCL 17.06 ⁽³⁾	RCLR 17.06 ⁽³⁾	17	6	5	6.5	M 5x0.8	10.5	6	6	3.7	21	7	11	5.2	9	2.5	ch. 8	0.25	LM 30
RCL 24.06 ⁽³⁾	RCLR 24.06 ⁽³⁾	24	6	8	11	M 8x1.25	14	7.7	7	5.6	28.2	11	14.7	6.5	14	4	ch. 13	0.5	LM 40
RCL 35.10 ⁽³⁾	RCLR 35.10 ⁽³⁾	35	10	10	10	M10x1.25	20.65	10.5	14	7	43	15.9	20.5	13	18	5	ch. 17	0.75	LM 65
RCP 42.10	RCPR 42.10	42	10	17	17	M12x1.25	24	12.5	12	9.5	50	19	24.5	11	25	6	ch. 19	0.75	LM 120
PFV 43.22 ⁽³⁾	PFVR 43.22 ⁽³⁾	43	22	12	12	M12x1.5	29	14	13	12.5	52	23	27	12	18	5	ch. 19	1	LM 180

Type		Dynamic load (N)	Limit loads of the bearing (N)		Limit loads of the stud (N)		Life coefficients				Torque wrench ⁽²⁾ settings (Nm)	Weight (g)
			radial C _{or}	axial C _{oa}	radial F _r	axial F _a	Pa/Pr ≤ 0.37		Pa/Pr > 0.37			
		C _w ⁽⁴⁾					X	Y	X	Y		
RCL 17.06	RCLR 17.06	1 500	840	350	530	260	1	1.37	0.5	2.73	1.8	20
RCL 24.06	RCLR 24.06	4 200	2 300	1 000	1 600	830	1	1.37	0.5	2.73	8	40
RCL 35.10	RCLR 35.10	7 900	5 100	1 500	2 400	1 100	1	1.67	0.5	3.03	20	130
RCP 42.10	RCPR 42.10	12 000	7 100	2 100	4 300	1 160	1	1.17	0.5	2.53	24	185
PFV 43.22	PFVR 43.22	7 600	4 000	780	3 150	820	1	4	1	4	24	205

1) Housing bore tolerance: H7

2) The torque wrench settings are given for non-lubricated threads; for lubricated threads, multiply figure by 0.8

3) Available in stainless steel (suffix **NX**) with RS seals type

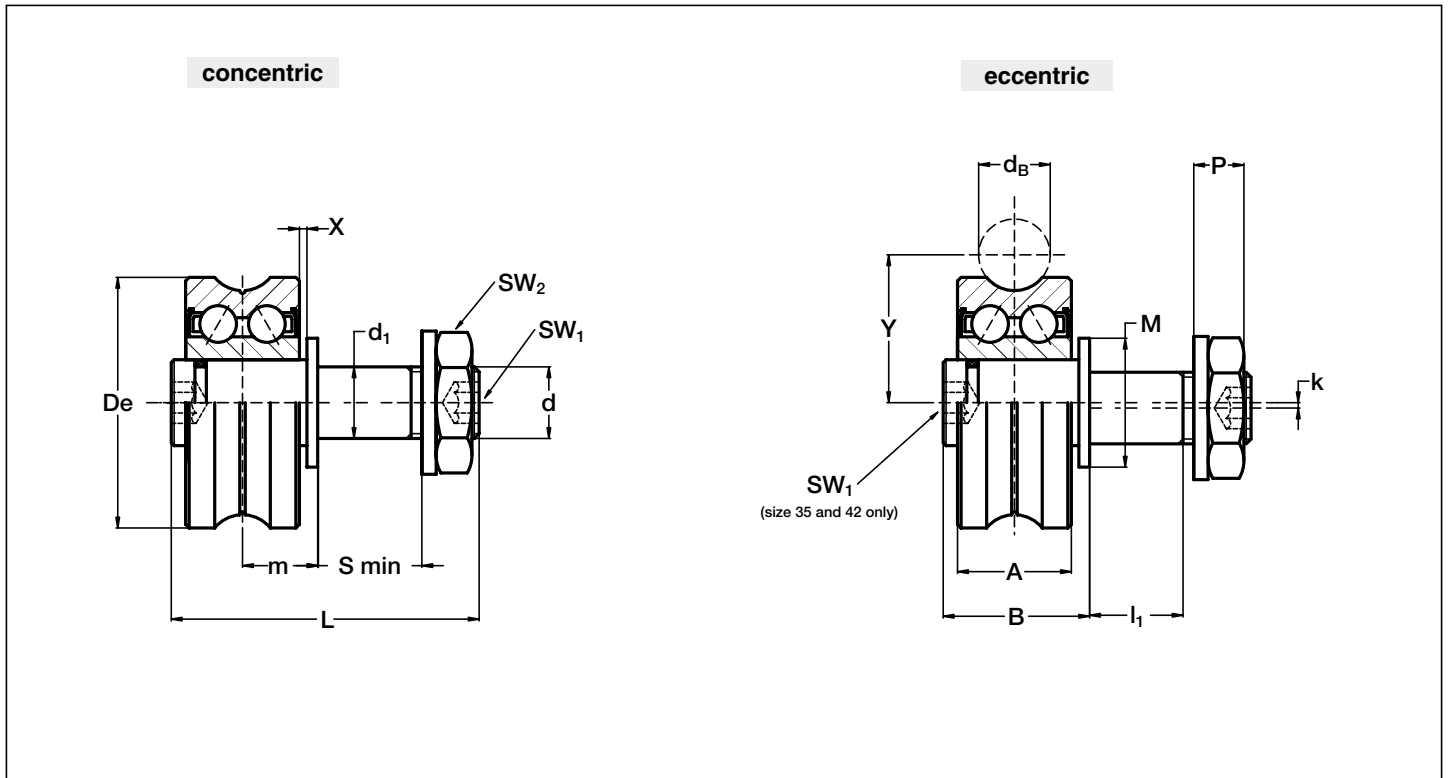
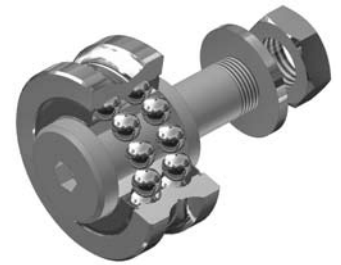
4) C_w basic load for 100 km

5) The guide rollers are complete with self-locking washers and hexagonal nut for fitting

6) Pressure angle α for load calculation: 60°

7) Standard seals ZZ type for RCL and RCP; NBR type RS for PFV

Guide Rollers **RAL**



Type		Dimensions (mm)																		Suggested combination
concentric	eccentric	De	dB	d ₁ ⁽¹⁾ conc.	d ₁ ⁽¹⁾ ecc.	d	Y	m	S min.	P	L	A	B	X ⁽⁵⁾	I ₁	M	SW ₁	SW ₂	k	
RAL 17.06	RALR 17.06	17	6	5	6.5	M 5x0.8	10.5	6	6	3.7	20.5	7	10.5	0.8	5.5	9	2.5	ch. 8	0.25	LM 30
RAL 24.06	RALR 24.06	24	6	8	11	M 8x1.25	14	7.7	7	5.6	27.5	11	14	1	6.5	14	4	ch. 13	0.5	LM 40
RAL 35.10	RALR 35.10	35	10	10	10	M10x1.25	20.65	10.5	14	7	43	15.9	20.5	1	13	18	5	ch. 17	0.75	LM 65
RAL 42.10	RALR 42.10	42	10	17	17	M12x1.25	24	12.5	12	9.5	49	19	23.5	1.5	11	25	6	ch. 19	0.75	LM 120

Type		Dynamic load (N)	Limit load of the bearing (N)	Limit loads of the stud (N) ⁽⁵⁾	Torque wrench ⁽²⁾ settings (Nm)	Weight (g)
		C _w ⁽³⁾	radial C _{or}	radial F _r		
RAL 17.06	RALR 17.06	1 500	840	470	1.8	20
RAL 24.06	RALR 24.06	4 200	2 300	1 500	8	40
RAL 35.10	RALR 35.10	7 900	5 100	3 800	20	130
RAL 42.10	RALR 42.10	12 100	7 100	3 200	24	185

1) Housing bore tolerance: H7

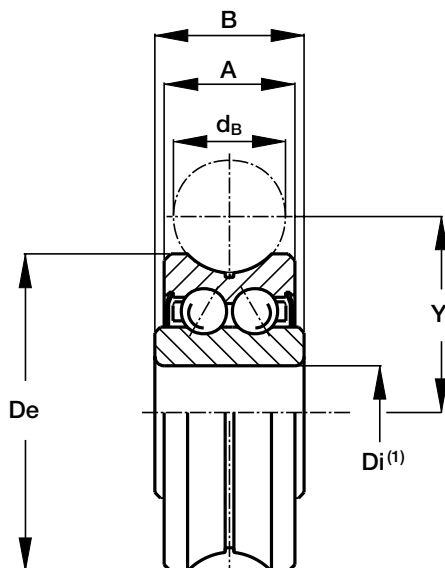
2) The torque wrench settings are given for non-lubricated threads; for lubricated threads, multiply figure by 0.8

3) C_w basic load for 100 km

4) The guide rollers are complete with self-locking washers and hexagonal nut for fitting

5) Dimension ± X is the max displacement from dimension m to ensure proper guide roller function and safety

Guide Wheels **GLA**



Type	Dimensions (mm)					
	De	dB	Di ⁽¹⁾	Y	A	B
GLA 17.06 ⁽⁴⁾	17	6	5	10.5	7	8
GLA 24.06 ⁽⁴⁾	24	6	8	14	11	11
GLA 35.10 ⁽⁴⁾	35	10	12	20.65	15.9	15.9
GLA 35.12	35	12	12	21.75	15.9	15.9
GLA 42.10	42	10	12	24	19	19
GLA 47.10	47	10	15	26.65	19	19
GLA 52.16	52	16	20	31.5	20.6	22.6

Type	Dynamic load (N)	Limit loads of the bearing (N)		Life coefficients				Weight (g)
		radial C _{or}	axial C _{oa}	Pa/Pr ≤ 0.37		Pa/Pr > 0.37		
	C _w ⁽²⁾			X	Y	X	Y	
GLA 17.06	1 500	840	350	1	1.37	0.5	2.73	10
GLA 24.06	4 200	2 300	1 000	1	1.37	0.5	2.73	20
GLA 35.10	7 900	5 100	1 500	1	1.67	0.5	3.03	80
GLA 35.12	7 800	5 000	1 400	1	2.47	0.5	3.83	80
GLA 42.10	12 000	7 100	2 100	1	1.17	0.5	2.53	100
GLA 47.10	15 400	9 200	3 300	1	0.97	0.5	2.33	170
GLA 52.16	19 300	10 500	4 000	1	2.17	0.5	3.53	230

1) Tolerance of Diameter Di: +0 / -0.008 mm

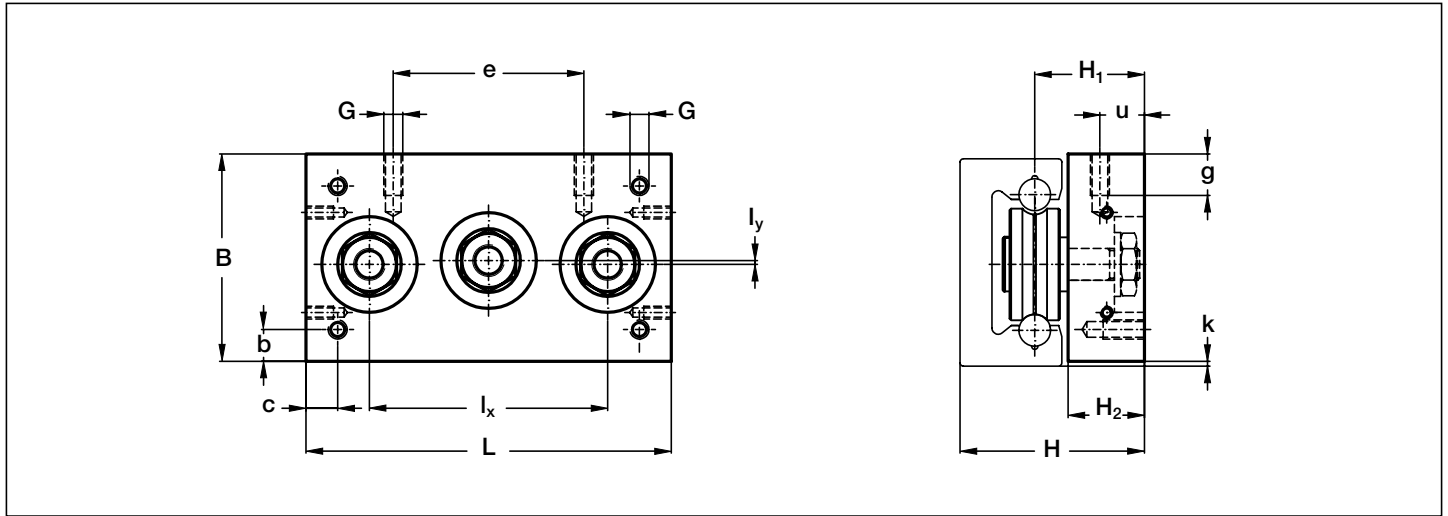
2) C_w basic load for 100 km

3) Pressure angle α for load calculation: 60°

4) Available in stainless steel (suffix NX) with RS seals type

5) Standard seals ZZ type

Carriage C3RCL, C3RAL, C3RYL

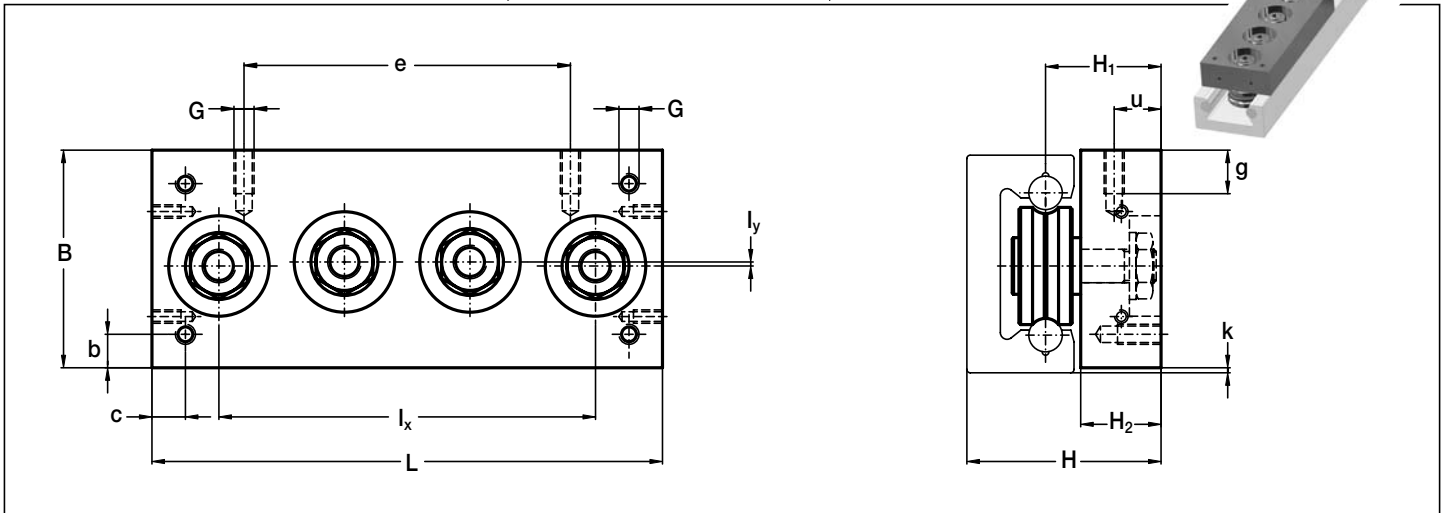


Type	Dimensions (mm)														Weight (kg)	Suggested combinations
	L	B	I _x	I _y	H	H ₁	H ₂	G	g	b	c	u	e	k		
C3RCL 17 06 065	65	32	40	0.5	27.5	17	11	M4	6	4	6	5.5	24	0.5	0.1	LM 30
C3RCL 24 06 085	85	42	58	1	35.7	21.7	14	M5	8	6	6	7	35	1	0.2	LM 40
C3RCL 35 10 115	115	65	75	1.2	58	34.5	24	M6	10	10	10	14	60	1.5	0.8	LM 65

1) Dimensions in the table are correct also for carriages C3 RAL, C3 RYL

2) Available with stainless steel guide rollers

Carriage C4RCL, C4RAL, C4RYL

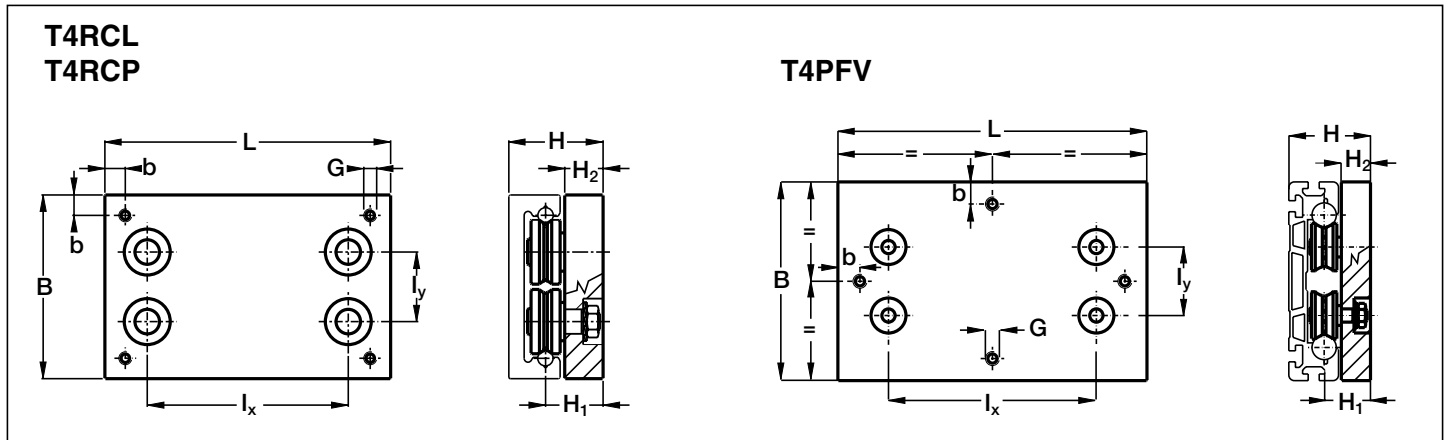


Type	Dimensions (mm)														Weight (kg)	Suggested combinations
	L	B	I _x	I _y	H	H ₁	H ₂	G	g	b	c	u	e	k		
C4RCL 17 06 085	85	32	60	0.5	27.5	17	11	M4	6	4	6	5.5	44	0.5	0.15	LM 30
C4RCL 24 06 114	114	42	87	1	35.7	21.7	14	M5	8	6	6	7	60	1	0.25	LM 40
C4RCL 35 10 152	152	65	112.5	1.2	58	34.5	24	M6	10	10	10	14	90	1.5	1	LM 65

1) Dimensions in the table are correct also for carriages C4 RAL and C4 RYL

2) Available with stainless steel guide rollers

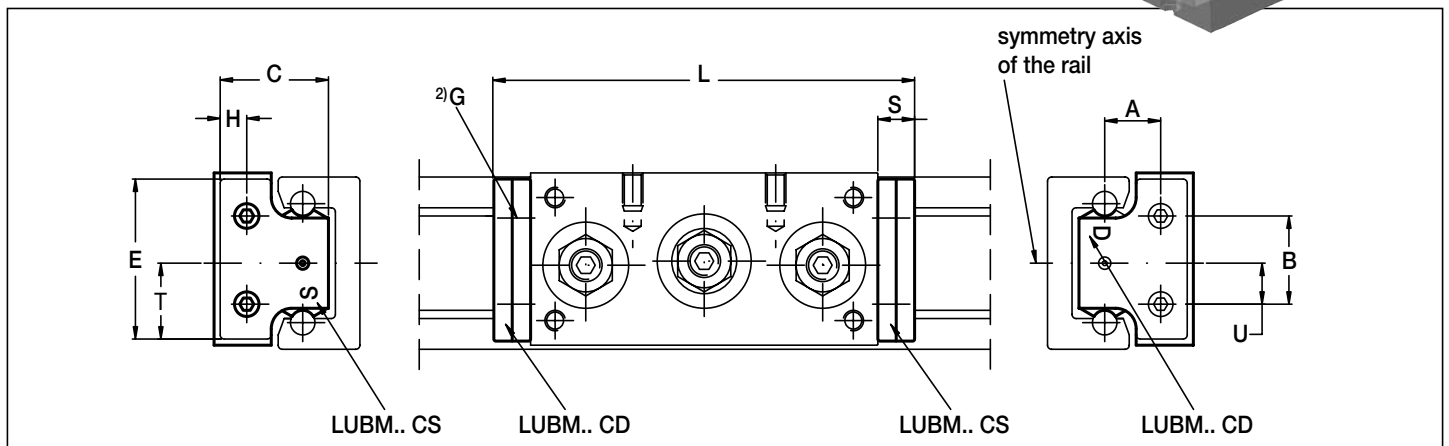
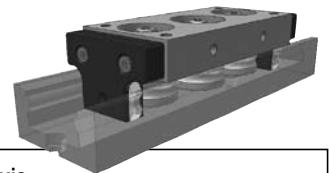
Carriage **T4RCL, T4RCP, T4PFV** **T4RAL, T4RYL**



Type	Dimensions (mm)									Weight (kg)	Recommended pairing
	L	B	I _x	I _y	H	H ₁	H ₂	G	b		
T4RCL 35 10 150	150	120	99	50.7	58.5	34.5	24	M8	10	1.6	LM 120
T4RCL 35 10 220	220	120	169	50.7	58.5	34.5	24	M8	10	2.2	LM 120
T4RCP 42 10 150	150	120	99	44	65.5	41.5	29	M8	15	2	LM 120
T4RCP 42 10 220	220	120	169	44	65.5	41.5	29	M8	15	2.7	LM 120
T4PFV 43 22 180	180	180	127	62	74	42	28	M10	20	3.1	LM 180
T4PFV 43 22 280	280	180	227	62	74	42	28	M10	20	4.5	LM 180

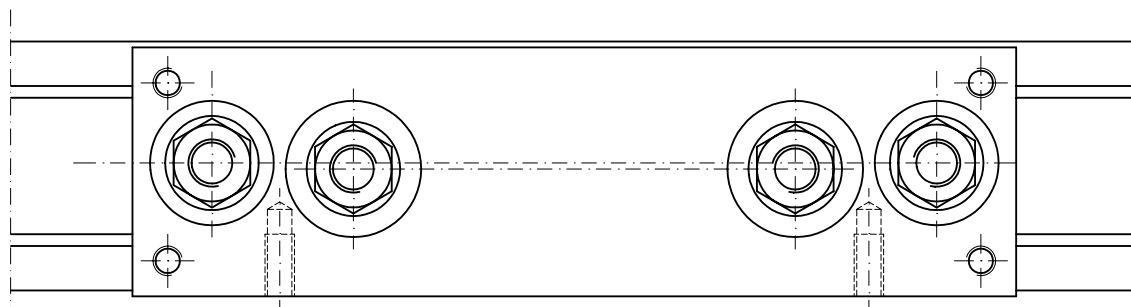
1) Dimensions valid also for T4RAL and T4RYL

Lubricator **LUBM**

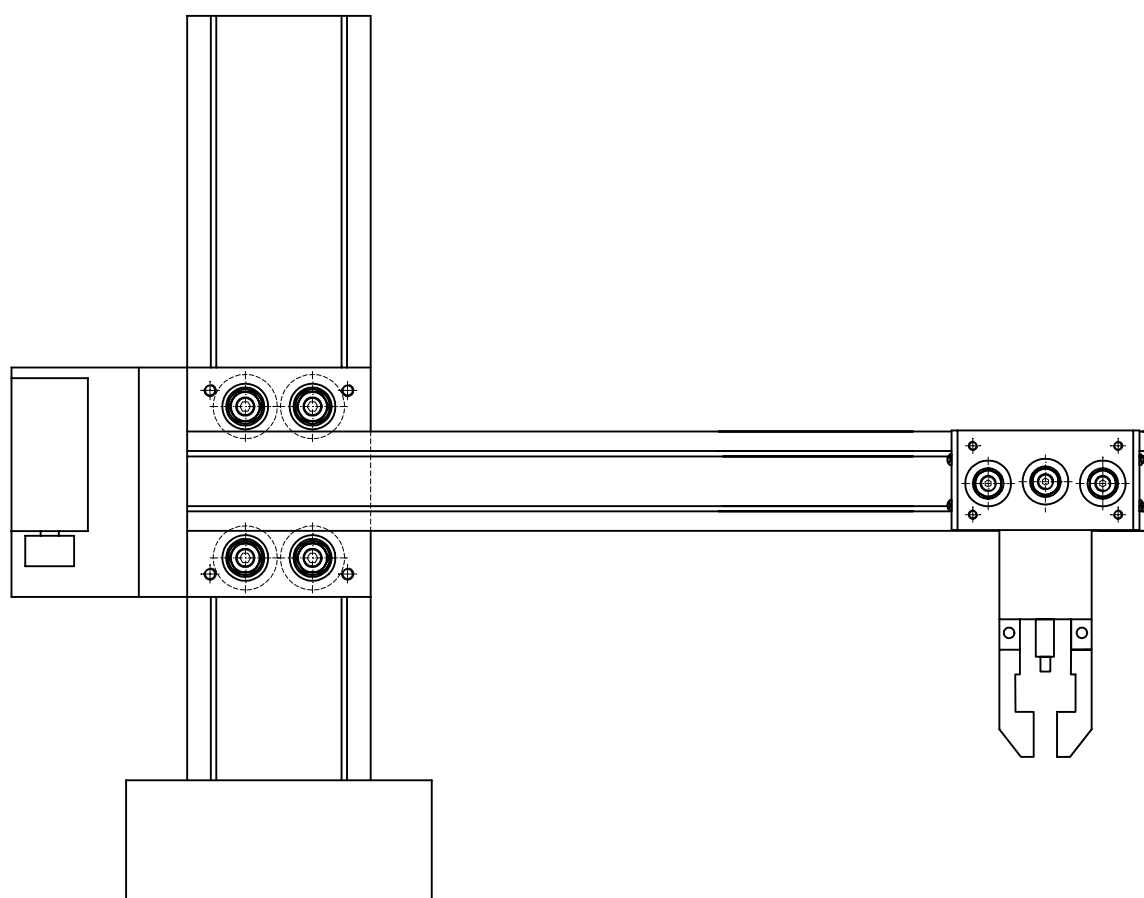


Type	Dimensions (mm)										Suggested combinations with the rails	
	A	B	U	E	T	H	C	G	S	L C3 RCL C4 RCL		
LUBM 030	9.5	16	8	30	15	6.5	20.5	M2.5	9	83	103	LM 30
LUBM 040 CD/CS	13.7	21.5	10	40	19	7	27	M3	9	103	132	LM 40
LUBM 065 CD/CS	20.5	30	15	63	30	13	44.5	M4	9	133	170	LM 65

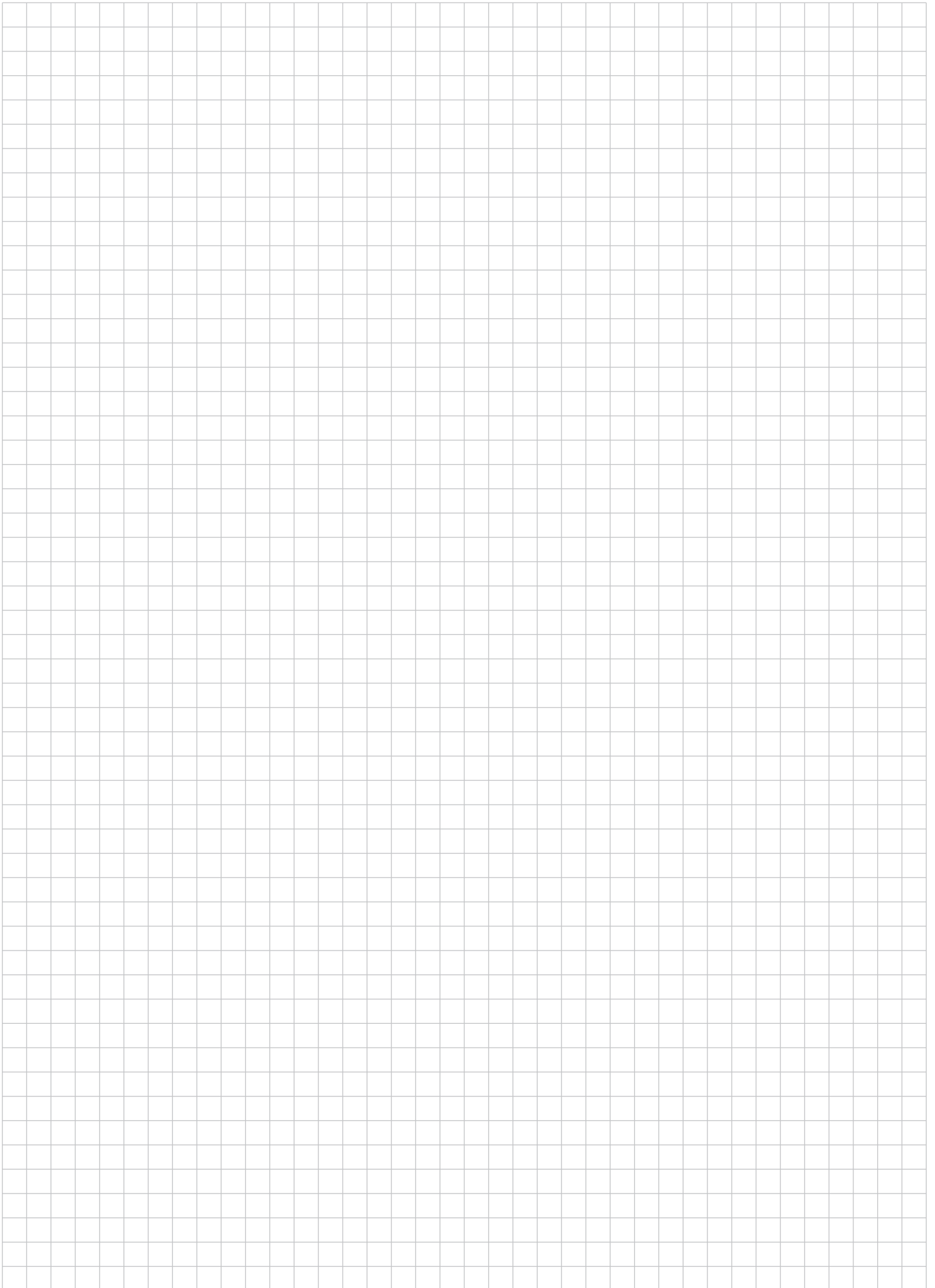
1) The lubricator is supplied with the felt already lubricated. The lubricant has a mineral oil base - 2) Countersunk head screws for the mounting are already in the packaging - 3) The lubricator can be mounted on carriages RCL, RAL and RYL



• Example of special design carriage



• Joystick for handling test samples



Note



3D CAD DRAWINGS

*Our 2D and 3D drawings can be
down loaded from our web site:*

www.nadella.eu

Nadella

Direzione Generale

Via Melette, 16
20128 Milano
<http://www.nadella.it>

Tel. +39 02.27.093.297
Fax +39 02.25.51.768
e-mail: customer.service@nadella.it

Nadella GmbH

Nufringen Rudolf-Diesel-Straße 28 Tel. +49 07032 95 40-0
71154 Nufringen Fax +49 07032 95 40-25
<http://www.nadella.de> e-mail: info@nadella.de

AUSTRIA

TAT Technom Antriebstechnik GmbH
Haidbachstraße 1 - 4061 Pasching
Tel. +43 7229 648 400 - Fax +43 7229 618 17
www.tat.at

CHINA

NADELLA CHINA
14/A Yandang Building, 107 Yandang Road
200020 Shanghai, P.R. of China
Tel. +86 21 6473 4841 - Fax +86 21 6473 3694

WENXIN Machinery

Guang Zhou Roa
Rm2001 20F JUNLIN Int. Plaza
Tel. +86 25 51 86 01 21 - Fax +86 25 51 86 01 26
www.wenxinmachinery.com

CZECH REPUBLIK

TAT Pohonova Technika Spol s.r.o.
Hranicni 53 - 37006 Ceske Budejovice
Tel. +420 387 414 414 - Fax +420 387 414 415
www.tat.at/cz

DENMARK

ACTON A/S
Torbenfeldvej 3 - 2665 Vallensbaek
Tel. +45 43 73 70 43 - Fax +45 86 75 27 00
www.acton.dk

FINLAND

EIE Maskin Oy
Postfach PL 80 - 10601 Tammissaari
Tel. +358 19 223 91 00 - Fax +358 19 223 91 99
www.eie.se

FRANCE

SNR Lyon - Direction Réseau France
Le Florentin - B.P. 8
71, Chemin du Moulin Carron
Tel. +33 478 66 6800 - Fax +33 478 66 6820
www.snr-bearings.com

INDIA

NRB Bearings
Dhannur, 15 Sir P.M. Road, Fort,
Mumbai 400 001
Tel. +91 022 2266 41 60 - Fax +91 022 2266 04 12
www.nrbbearings.com

KOREA

Intech Automation Inc.
Youngdeungpodong 7-GA
13FL, JEIL Bldg., 94-46
Seoul, Korea 150-037
Tel. +822 26 32 770 - Fax +822 34 39 00 80
www.intechautomation.co.kr

NETHERLANDS

LinMotion BV
Kruisboog 2 - 3905 CV TG Veenendaal
Tel. +31 318 694 226 - Fax +31 318 694 225
www.linmotion.nl

NORWAY

Elmeko AS
Postboks 80 - 1346 Gjettem
Tel. +47 675 72 270 - Fax +47 675 77 280
www.eie.se

POLAND

ENITRA Sp.zo.o
ul. 1-go Maja 62 - 58300 Walbrzych
Tel. +48 74887 02 24 - Fax +48 74887 02 23
www.enitra.pl

SPAIN

GAES S.A.
Paseo Ubarburu, 58 Poligono 27
20014 - San Sebastián
Tel. +34 943 445 777 - Fax +34 943 445 350
www.gaessa.com

RODALSA S.L.

Barrachi, 12 - Pab. 21 - 01013 - Vitoria
Tel. +34 945 289 395 - Fax +34 945 289 246
www.rodalsa.net

SNR Rodamientos Iberica S.A.

Madrid C/Barberan, 6 - 28035 Madrid
Tel. +34 916 718 913 - Fax +34 916 736 548
www.snr-bearings.com

SWEDEN

EIE Maskin AB
Harpsundswägen 197 - 12459 Bandhagen
Tel. +46 8 727 88 00 - Fax +46 8 727 88 99
www.eie.se

SWITZERLAND

Uiker Wälzlager AG
Schwerzistrasse 30 - 8807 Freienbach
Tel. +41 554 15 18 68 - Fax +41 554 15 18 60
www.uiker.ch

TURKEY

EKSİM Mühendislik Sistemleri
Perpa Ticaret Merkezi B Blok Kat: 11 No: 1675
Sisli - Istanbul / Turkey
Tel. +90 212 222 81 12 - Fax +90 212 222 81 02
www.eksimmuhendislik.com

USA

Nadella US.
761 West Michigan Ave. - Suite N
Jackson, MI 49201
Tel. +01 517 774 4466 - Fax +01 517 764 0806
www.nadella.us

