



Recirculating Bearings

PM - BEARINGS



Introduction

PM - BEARINGS (PM) is specialized in designing and manufacturing linear bearings of the highest quality. PM provides a complete range of linear bearings, frictionless slides, positioning tables and stages, which guarantees the highest level of performance at competitive prices. Thanks to a long history of experience, new findings in research, combined with innovating linear technology, PM products meet the highest accuracy and quality demands of today's industry and are successful in use worldwide.

Since the foundation in 1966, PM has become an **innovator in linear technology** with specialization in the production of high- and very high precision linear bearings and frictionless slides.

Starting with the specialization in precision linear bearings PM has expanded and developed the linear-program through the years. Today, PM offers the widest range of models and sizes to provide the designer maximum flexibility to achieve the best operating results in linear and rotary motion.

One primary goal is **customer-satisfaction** with additional increase of productivity and reliability whit lower production costs. The PM organization is **dedicated to quality** and is focused to provide quick and accurate information to customer request.

The main PM-products are published in:

- Linear Bearings
- Precision Slides
- Positioning Tables and Stages
- Recirculating Bearings

Subassemblies

The growing market for complete subassemblies is fully supported by PM and is a major part of our Total Customer Care strategy. PM is offering not only extensive assembly-facilities, skilled workers and knowledge, but also a time- and cost saving solution with increased flexibility in today's rapidly changing markets.

Representation Worldwide

Made by PM means the same high quality, technical support and follow-ups whether in Asia, the U.S.A. or Europe. Our worldwide representatives are selected to serve you with the best technical advice and service guaranteeing fast and reliable deliveries in all local markets. Please, contact PM for the authorized representative in your area.

The specifications and data in this catalogue are believed to be accurate and reliable. However, in the interest of technical development, PM reserves the right to modify without prior notice.





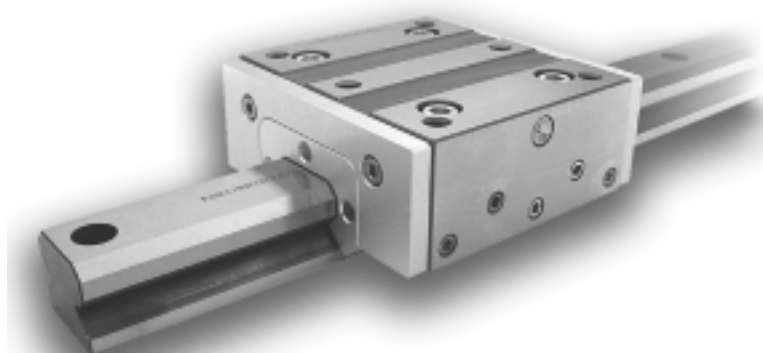
Table of Contents

| Page | |
|------|---|
| 1 | Introduction |
| 4 | Product Overview |
| 6 | Types and Features at a Glance |
| 7 | Selection Flowchart |
| 8 | 1. Technical Data <ul style="list-style-type: none">1.1 General1.2 Friction1.3 Maximum Velocity and Acceleration1.4 Lubrication |
| 10 | 2. Design Considerations <ul style="list-style-type: none">2.1 Fitting Edges & Reference Shoulder2.2 Designing Supporting Surfaces2.3 Attaching Recirculating Units UK/UR2.4 Multi-section Rails2.5 Matched Pairs for Recirculating Units2.6 Distance between two Axis2.7 Emergency Hard Stops |
| 12 | 3. Load and Estimated Lifespan <ul style="list-style-type: none">3.1 Life Span<ul style="list-style-type: none">3.1.1 Nominal Life3.1.2 Basic Static Load Rating C3.1.3 Static Load Safety Factor F_s3.1.4 Basic Dynamic Load Rating C_{dyn}3.1.5 Applied Load (P) Calculation3.2 Expected Nominal Life Factors<ul style="list-style-type: none">3.2.1 Hardness Factor F_h3.2.2 Effect of Elevated Temperatures3.2.3 Load Factor F_w3.2.4 Nominal Operational Calculation Life |
| 15 | 4. Tolerances & Accuracy <ul style="list-style-type: none">4.1 Tolerances4.2 Running Parallelism Accuracy4.3 Vertical Offset Installed Rails4.4 Parallelism of the Installed Rails4.5 Preload Classes4.6 Tolerances on Length and Mounting Holes |



Page

| | |
|-----------|--|
| 17 | 5. Installation Procedure <ul style="list-style-type: none">5.1 Notes on Assembly5.2 Required Mounting Tools5.3 Recommended Tightening Torque5.4 Installation Procedure No.15.5 Installation Procedure No.25.6 Installation Procedure No.35.7 Installation Procedure No.4 Recirculating Units |
| 23 | 6. Linear Miniguide DSU + DSU 30.15F - Flange Type |
| 29 | 7. Recirculating System DS |
| 41 | 8. Heavy-Duty Guideway PNUA |
| 47 | 9. Heavy-Duty Trackrail PSD |
| 50 | 10. Special Customer Design |





Product Overview

As the specialist in precision linear bearings PM offers a broad range of ball, cylindrical roller, and needle roller recirculating guidance systems for every application.

Recirculating bearings are used in longer travel, higher speed, heavier load applications as non-recirculating bearings. The only travel limit is actually given by the guideway length.

Depending on space, load, accuracy, smooth running and environment requirements various products are produced to offer the designers the best system to match their application.

The performance of PM recirculating guides are known as the best available in the market and are the global standard for machines requiring precise smooth linear motion, com-

act size, long distance travel and durable precision.

Most components can be ordered separately in case replacement components are needed.

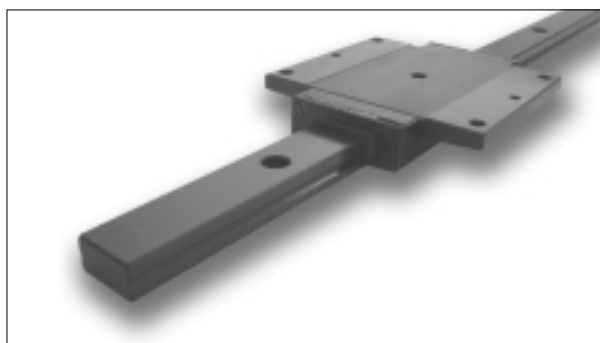
A wide range of special models are available or can be made to customer specifications to meet the most special requirements.



Miniguide DSU

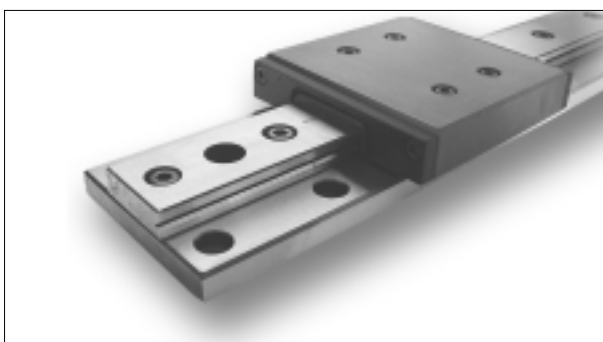
- All metal construction
- Corrosion resistance
- Very compact and light weight
- Narrow and wide models
- Superior running quality
- Max. Cdyn. 7980 N

modified load ratings



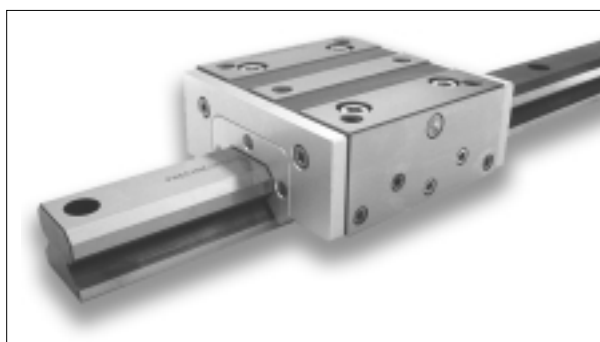
Miniguide DSU-F

- Two-row ball type
- High-quality carbon steel
- Flange type for greater stability
- Extreme smooth running
- Excellent contaminant protection
- Max. Cdyn. 5250 N



Precision Recirculating System DS

- Ball and crossed roller units
- For low up to high loads
- Preloaded by setscrews
- Ease of replacement
- Sizes 2, 3, 6, 9, 12 and 15 mm
- Max. Cdyn. 76.6 kN



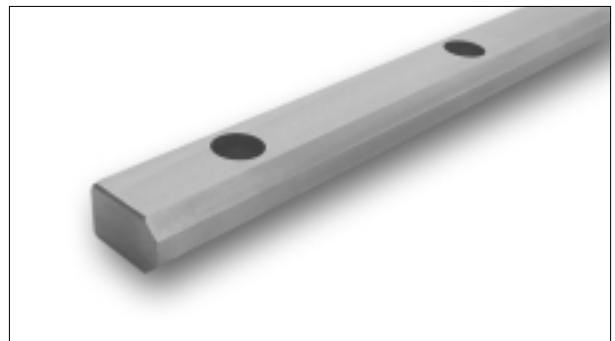
Heavy-duty Needle Guide PNUA

- 4-row needle roller units
- For ultra heavy load applications
- Extremely smooth recirculation
- Highest rigidity
- Sizes 25, 40 and 70
- Max. Cdyn. 175.5 kN



Needle Recirculating Units PNE

- For extreme stiffness
- Low mass - high velocity
- All metal design, no plastics
- Full complement of needles
- Max. Cdyn 157 kN

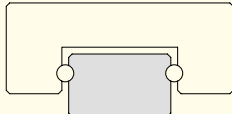
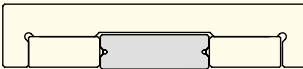
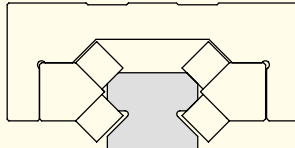


Single guiderail PSD

- Compact, low profile design
- Heavy duty design
- High accurate linear motion
- To combine with PNE needle units
- Max. one piece length 1400 mm



Types and Features at a Glance

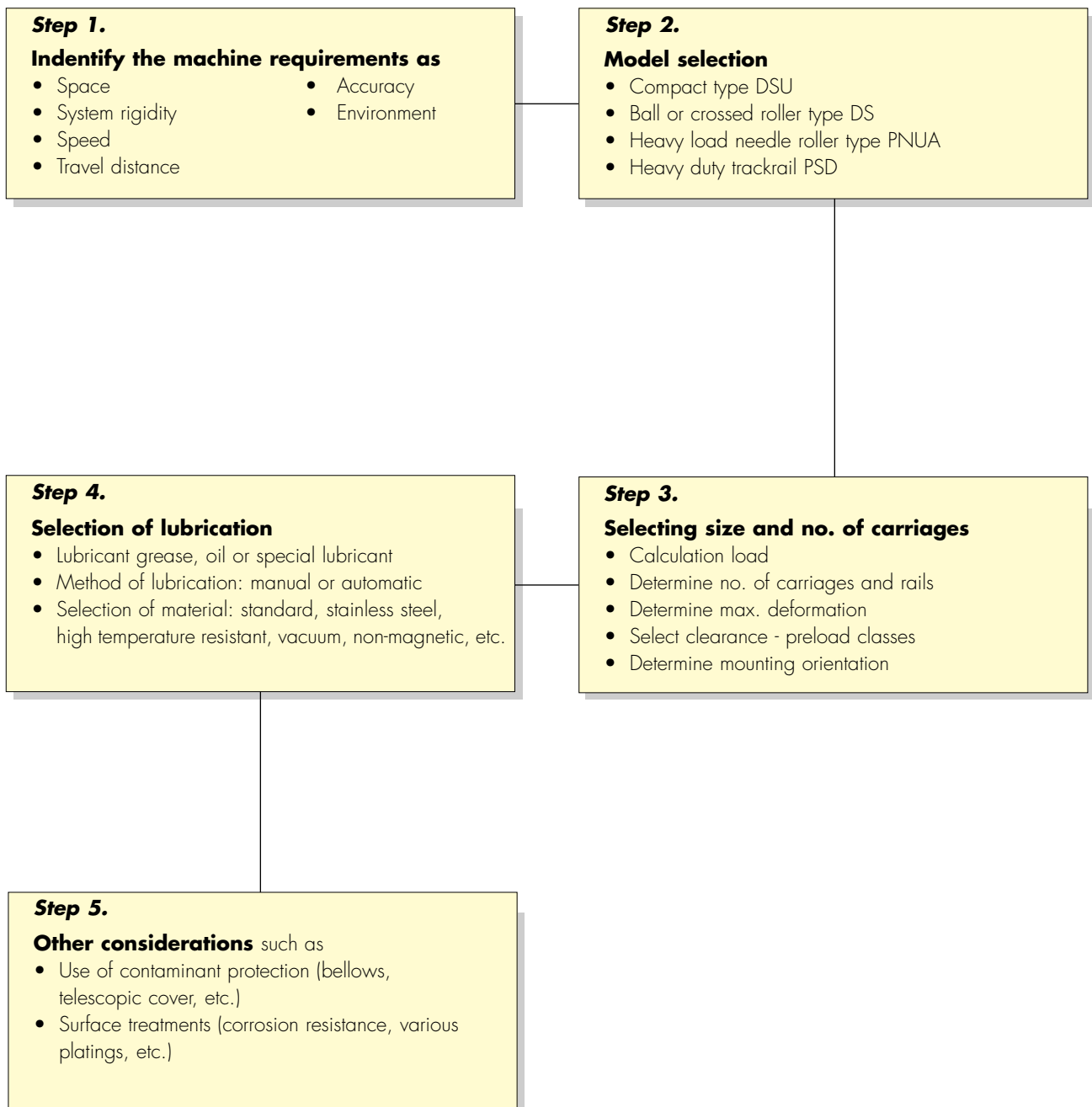
| Type | Recirculating Bearings | | |
|--------------------------------|--|---|---|
| Model | DSU | DS | PNUA |
| Cross Section |  |  |  |
| Characteristics | | | |
| Operating loads | low – medium | medium – high | ultra-heavy |
| Rolling element | ball | ball and crossed roller | 4-row needle roller |
| Material | stainless steel | high-carbon steel | high-carbon steel |
| Preload setting | selected balls | adjustable recirculators | adjustable recirculators |
| Design | miniature & lightweight | thin & wide | heavy load & rigidity |
| Groove geometry | ghotic arc | V-groove | line under 45 angle |
| Replaceable components | no | yes | yes |
| Velocity V _{max} | 180 m/min | 120 m/min | 120 m/min |
| Accelerations a _{max} | 300 m/s ² | 50 m/s ² | 60 m/s ² |
| Accuracy Classes | Q14, Q8 | Q10, Q5 | Q10, Q5 |
| Max. Load capacity (N) | 7980 | 76.500 | 175.500 |
| Rigidity | medium | medium – high | high – ultra high |
| Ease of mounting | yes | yes | yes |
| Typical applications | micro-electronics, laboratory automation, medical equipment, optical machines, textil machines, robotics, PCB assembly, wafer inspection machines | wood working machines, semiconductor lithography machines, measuring instruments | machining centers, stamping presses, measuring instruments, paper manufacturing plants, grinding machines, milling machines, wafer production, flat panel |



Selection Flowchart

Selection of the Recirculating System

Each linear bearing system offers his own unique characteristics. To select a linear guide which match your requirements the following diagram can be used:





1. Technical Data

1.1 General

The PM range of linear guides for unlimited travel are available in various sections with matching ball, and roller, and needle roller diameter in a wide range of standard lengths.



The choice of sizes (cross-sections) and lengths caters for almost all load capacities, enabling the designer to solve most linear motion problems with virtual frictionfree movements, free from play, with adjustable pre-load. Due to these features PM linear guides are almost complete free from wear, needing only minimum lubrication and maintenance, and are used successfully in a wide range of industries, e.g.:

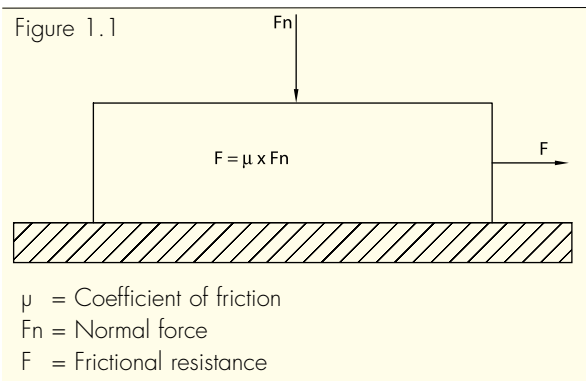
- Packing machinery
- Machine tools + other metal working machinery
- Automation applications
- Special purpose machines + special purpose tooling

Due to the high linear accuracy, which PM linear bearings offer, they are also used widely for:

- Measuring instruments
- Tool setting equipment
- Robotic devices
- Space applications
- Research projects
- Semiconductor equipment

1.2 Friction

Friction is the force necessary to move the carriage along a horizontal plane or track (Figure 1.1) The coefficient of friction (μ) is mostly depending on the ratio C/P^{11} . For recirculating systems with a ratio between 4 and 20 the coefficient of friction is 0.002 to 0.004. (measured without endseals) Other important factors which affect the friction are the quality of running surface, quality of rolling element, amount of preload and type of grease.



¹¹C:dynamic loadrating, P: applied load.

1.3 Maximum Velocity and Acceleration

Linear motion recirculating bearings are suitable to operate at below mentioned speeds and accelerations under standard operating conditions.

- Miniguide **DSU** and **DSU 30.15F**:
 Max. recommended speed $v=180\text{m}/\text{min}$
 Incidental speeds up to $300\text{m}/\text{min}$ are possible.
 Max. acceleration $a=300\text{m}/\text{sec}^2$
- Linear recirculating bearing **DS** equipped with recirculating units UK or UR:
 Max. recommended speed $v=120\text{m}/\text{min}$
 Max. acceleration $a=50\text{m}/\text{sec}^2$
- Linear recirculating bearing **PNUA**:
 Max. recommended speed $v=120\text{m}/\text{min}$
 Max. acceleration $a=60\text{m}/\text{sec}^2$

1.4 Lubrication

PM precision guides are a main part in the construction of machines. The standardized high quality has to be secured during the calculated lifetime. Nevertheless dust and moisture are the main enemies of the precision bearings. Lubrication creates a film between the rolling surfaces and gives a sufficient protection against corrosion. Other benefits are for example:

- Friction reduction
- Reduction of wear
- Prolongation of lifetime
- Cooling

We prefer lubrication by oil CLP (DIN 51517) or HLP (DIN 51524). During operation the temperature has to be between -30°C till $+120^\circ\text{C}$ while the viscosity is between ISO-VG32 and ISO-VG150 in accordance with DIN 51519. In case of grease, lubrication on lithium soap base is recommended like KP2K or KP1K in accordance with DIN 51825.

Recirculating units type UK and UR are standard supplied with lubrication holes to add lubrication easily to the units. PNUA guide bearings are supplied with an oil lubrication port. Proper lubrication helps the bearings to reach their projected operational lifetime.

PM recirculating bearings are supplied ex factory with a sufficient amount of oil lube, and can be used as delivered. This initial lubrication can reach a maximum of 3000 km or 1 year of travel, whichever comes first, under normal operating conditions in which the load ration $C/P=10$ and velocity $V=1\text{m}/\text{s}$.



Table 1.1 Grease volume miniguïdes DSU Units:cm³

| Type | Total amount L+R | Amount per side L/R |
|--------|------------------|---------------------|
| 10.7 | 0.05 | 0.025 |
| 15.9 | 0.10 | 0.05 |
| 20.12 | 0.15 | 0.075 |
| 30.15* | 0.25 | 0.125 |
| 30.20 | 0.30 | 0.15 |
| 10.14 | 0.05 | 0.025 |
| 15.18 | 0.12 | 0.06 |
| 20.24 | 0.20 | 0.10 |
| 30.42 | 0.34 | 0.17 |

L: left side of carriage
R: right side of carriage

* this amount can be used for miniguide type DSU 30.15F as listed on page 27.

Ball – and crossed roller recirculating units UK and UR can operate with a minimum of lubricant. They need to be greased very lightly. The amount of the grease is depending on the operating conditions and contact length of the rolling elements.

Table 1.2 Grease volume needle guide PNUA Units:cm³

| Relubrication | Recirculating bearing PNUA | | |
|-----------------------|----------------------------|------|----|
| | 25 | 40 | 70 |
| Total amount (L+R) | 3.5 | 8.5 | 24 |
| Amount per side (L/R) | 1.75 | 4.25 | 12 |

L: left side of carriage
R: right side of carriage

For further information, please contact PM - BEARINGS.

2. Design Considerations

2.1 Fitting Edges & Reference Shoulder

Proper installation of recirculating bearings requires pushing the reference surface of the carriage and rail against a fitting edge. To guarantee that these references are in precise contact with the mounting surfaces, the design of the corners and the height* of the fitting edge must be machined according below listed specifications. (Table 2.1)

Figure 2.1 Fitting edges and reference shoulder

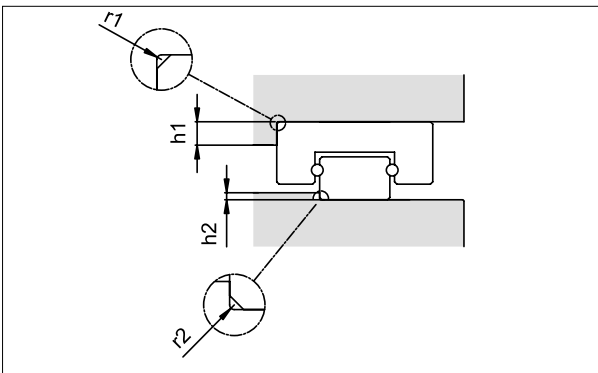


Table 2.1

Unit:mm

| Type & Size | r1 max. | r2 max. | h1 | h2 |
|-------------|------------|------------|------|-------|
| DSU 10.7 | 0.3 | 0.2 | 2.0 | 1.0 |
| DSU 15.9 | 0.4 | 0.3 | 4.0 | 1.5 |
| DSU 20.12 | 0.4 | 0.4 | 4.0 | 2.5 |
| DSU 30.15 | 0.5 | 0.5 | 4.0 | 3.5 |
| DSU 30.20 | 0.5 | 0.5 | 4.0 | 7.0 |
| DSU 10.14 | 0.4 | 0.2 | 2.0 | 2.0 |
| DSU 15.18 | 0.5 | 0.3 | 3.0 | 3.0 |
| DSU 20.24 | 0.5 | 0.4 | 4.0 | 4.0 |
| DSU 30.42 | 0.6 | 0.5 | 5.0 | 5.0 |
| DS 2 | 0.5 | 0.5 | 3.0 | 0.5** |
| DS 3 | 0.8 | 0.8 | 6.0 | 0.5 |
| DS 6 | 1.0 | 1.0 | 8.0 | 1.0 |
| DS 9 | 1.2 | 1.2 | 10.0 | 1.0 |
| DS 12 | 1.2 | 1.2 | 12.0 | 1.0 |
| DS 15 | 1.5 | 1.5 | 12.0 | 1.0 |
| PNUA 25 | 1.0 | 1.0 | 8.0 | 2.5 |
| PNUA 40 | 1.0 | 1.0 | 10.0 | 4.0 |
| PNUA 70 | 1.0 | 1.0 | 12.0 | 4.0 |

* When the shoulder is too high it may interfere with the carriages or other elements. In a situation that the shoulder is too low it does not come in precise contact with the corner radii and the carriage.

Also the thickness of the shoulder should be determined carefully so that it will produce enough rigidity and that it can support lateral loads or forces.

** Rail mounting without the use of a baseplate

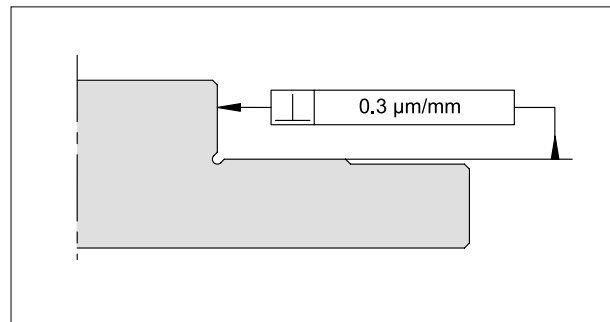
2.2 Designing Supporting Surfaces

Ball recirculators UK: the **angular error** of the supporting surfaces should not exceed $3\mu\text{m}/\text{mm}$.

Roller recirculators UR: the **angular error** of the supporting surfaces should not exceed $0.3\mu\text{m}/\text{mm}$.

Needle roller recirculators PNUA: the **angular error** of the supporting surfaces should not exceed $0.1\mu\text{m}/\text{mm}$.

Figure 2.2 Angular error



The parallelism tolerance of the mounting surface and fitting edges should match the required recirculating bearing motion accuracy.

2.3 Attaching Recirculating Units UK/UR

UK and UR units can be attached in two ways:

1. using the countersunk through holes (figure 2.3)
2. using the threaded holes (figure 2.4)

PM recommended method 1 cause it is a stronger fitting and can handle easier some small hole pitch deviations. In case of preload setting method 1 has to be used, after setting the preload the linear bearing can be attached. In case were method 1 and 2 cannot be used we can supply special attachment screws GD to composite pitch differences between the mounting holes.

Figure 2.3 Countersunk through holes

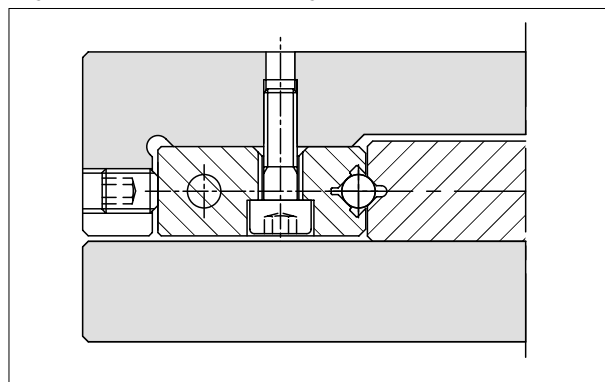
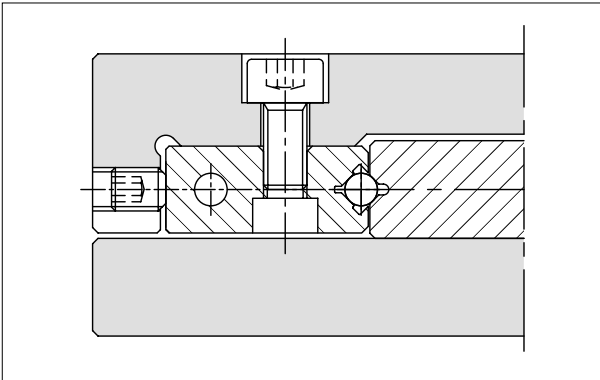


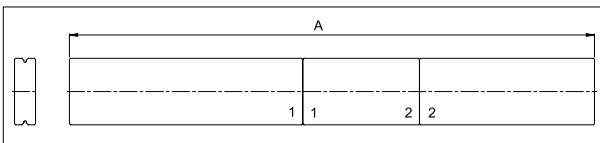
Figure 2.4 Threaded holes



2.4 Multi-section Rails

1. By ordered lengths which exceed the max. length Amax multi-section or butt-jointed rails are needed. In this situation the rails are precision ground within 2 microns and the dimensions are matching.
2. The rails have indication marks on the rail face ends and cannot be mixed. The rails must be aligned so that these marks are corresponding.
3. By installation the rail-ends must touch each other.
The tolerance on length A is +/- 2mm.

Figure 2.5 Multi-section rails



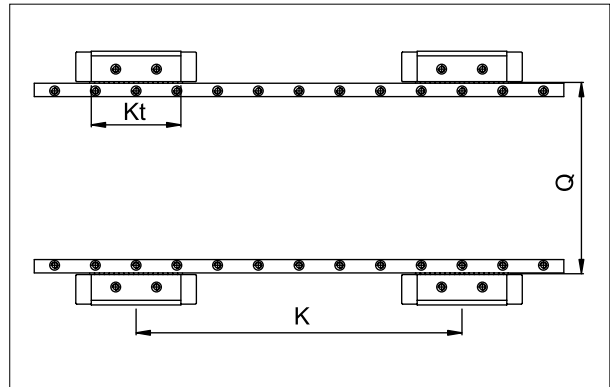
2.5 Matched Pairs for Recirculating Units

In case of two or more recirculating units type are used in arrangements one behind another in the application, they have to be ordered as **matched pairs** (suffix **MP**). In this case the carriages are selected on height tolerance $C \pm 0.01\text{mm}$ and marked accordingly.

2.6 Distance between two Axis

In the case where two or more recirculating units are used one behind another (as possible with RSD-crossed roller ways) the following relationship is recommended with regard to spacing K:

Figure 2.6 Recirculating bearings distance K



- When more than two recirculating units are used:
Middle/middle of recirculating units K to guideway spacing Q, $K / Q \geq 1$
- When a total of two recirculating units are used:
Load carrying length Kt (mentioned in the dimension tables) to guideway spacing Q, $Kt / Q \geq 1$

2.7 Emergency Hard Stops

PM advises to design the emergency hard stops in the symmetry axis of the linear bearing unit to prevent external forces acting on the recirculating units which could effect the accuracy and the operation life.



3. Load and Estimated Lifespan

3.1 Life Span

As a common rule suppliers and designers use the international ISO standards which are split in two procedures

- Nominal lifespan calculation for under dynamic conditions
- Static load safety calculation for under static conditions

The lifespan of a linear motion system is defined as the total distance of travel reached by the time the first fatigue flaking occurs either from a rolling element or raceway.

The rolling elements (balls and needle rollers) and raceways of a linear motion recirculating system that support a load are always subjected to repeated loads and stress as a reaction from rolling contacts. Eventually, fragments of the raceway may come off in flakes due to failure.

3.1.1 Nominal Life

The nominal life is the total distance of travel reached without flaking by 90% of a group identical linear motion systems which are operating under constant stroke and frequency under the same conditions. When the basic dynamic load is applied to a recirculating bearing system, the nominal life is 100 km.

3.1.2 Basic Static Load Rating C

When a rolling element is in contact with the raceway at a maximum Hertzian Pressure of 4.200MPa, the basic static load rating is defined as the load of constant magnitude acting in one direction under which the sum of the permanent deformations of the rolling element and raceway contact point represents approximately 0.0001 times diameter of the rolling element. Often there are also moment loads present, acting at the center of the contact area. These moments are defined as M_d , M_l and M_r and are depending on the direction of the moment.

The basic static load rating and permissible static moment load define the maximum allowable static load in all major directions and is defined in accordance with ISO 281 and indicated in the tables for each recirculating system.

3.1.3 Static Load Safety Factor F_s

To determine the bearing size the designer must consider a certain relationship between the basic static load rating C_0 and the applied load P in order to obtain the static load rating of the bearing. This relationship is expressed in the Safety factor F_s . Experience shows that the size of the Safety factor F_s depends on operating and environment conditions like vibration, shocking loads and others.

The safety factor should be taken into consideration when designing a recirculating bearing system.

Table 3.1 F_s reference values

| Using Condition | Load conditions | F_s |
|-----------------|---|-----------|
| Static | Normal and low impact loads | 1.0 ~ 1.3 |
| | Medium and high shock or twisting loads are often present | 2.0 ~ 3.0 |
| Low Speed | Normal loads | 1.0 ~ 1.5 |
| | Medium and high shock or twisting loads are often present | 2.5 ~ 5.0 |

The Static Load Safety factor F_s can be determined by using the following calculation:

$$F_s = C_0 / P \quad \text{or} \quad F_s = M_0 / M$$

- F_s : Basic static safety factor
- C_0 : Basic static load rating
- P : Applied load
- M_0 : Static permissible moment (N.mm)
- M : Calculated applied moment (N.mm)

3.1.4 Basic Dynamic Load Rating C_{dyn}

The basic dynamic load ratings are based on the fundamentals established by ISO and DIN for the calculation of rolling-contact bearings. (ISO standard 281) They are calculated for a nominal bearing life of 100 km of travel under the same conditions.

The load capacity C , defined in ISO76-1987, is the maximum downward load of force located in the center of the upper-part in horizontal zero-position.

Some suppliers from the Far East often indicate their loading capacities for a translation distance of 50 km. This results in apparently higher load ratings. These values according to JIS standard are above the values according to DIN standard. The recalculation of the loading capacities is done as follows:

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



3.1.5 Applied Load (P) Calculation

The load acting on a recirculating bearing vary in each mounting orientation. Common calculations are based on constant operation speed. In each orientation the load vary because of location of center of gravity, moments direction, changes in speed due to de- acceleration during motion start and stop. For each application these conditions should be carefully taken into consideration by the selection of a recirculating system. For calculation assistance consult PM. Calculation examples are mentioned in our Engineering Guide.

3.2 Expected Nominal Life Factors

3.2.1 Hardness Factor F_h

The guideways are manufactured of bearing steel 1.2842 or 1.3505 and are through-hardened to 58-62 Hrc. The cylindrical rollers and balls are made of bearing steel 1.3505 and have a hardness value of 58-66 Hrc, they are used in the highest grade quality. DSU miniguide are made from stainless steel no. 1.4034.

In cases where the hardness is less then 58 Hrc, the rated loads have to be reduced in accordance with the hardness factor f_h , listed in table 3.2.

Table 3.2 Hardness factor F_h

| Hardness Rockwell Hrc. | Vickers HV | Brinell HB | Hardness factor f_h |
|---------------------------|------------|------------|--------------------------|
| 60 | 697 | - | 1 |
| 59 | 674 | - | 1 |
| 58 | 653 | - | 1 |
| 57 | 633 | - | 0.96 |
| 56 | 613 | - | 0.89 |
| 55 | 595 | - | 0.81 |
| 54 | 577 | - | 0.75 |
| 53 | 560 | - | 0.71 |
| 52 | 544 | 500 | 0.67 |
| 51 | 528 | 487 | 0.63 |
| 50 | 513 | 475 | 0.60 |

Load ratings, which are quoted in this catalogue, actually refer to a Rockwell hardness of 58 Hrc.

3.2.2 Effect of Elevated Temperatures

PM recirculating bearings can be used by temperatures between -40°C up to $+80^{\circ}\text{C}$ during operation. In case of doubt or questions by the use of motors, ball screws, measuring systems etc. please consult PM - BEARINGS.

When PM recirculating bearings are used at temperatures in excess of 150°C , the track-rail hardness begins to fall off and the load ratings must be reduced in accordance with factor f_t , listed in table 3.3. If different elements of a linear bearing assembly, which have been pre-loaded, suffers differential temperatures, then this could have harmful effects. In the worst case, the preload can become excessive and causes Brinell-type indentations in the bearing ways. Accordingly, if high demands are placed on running accuracy, then such temperature differentials must be avoided.

The effect of thermal expansion becomes more important as the travel increases. As the table or environment temperature increases the parts undergo expansion, at a specific rate for any material. The amount of change is depending on the size of the component, the difference in temperature, and the material used. The thermal expansion (ΔA_t) can be defined as follows:

$$\Delta A_t = \alpha A \times \Delta t$$

αA = Coefficient of thermal expansion ($11.5 \times 10^{-6}/^{\circ}\text{C}$)
 Δt = Temperature gradient ($^{\circ}\text{C}$)

Through the years we have developed and designed thousands of positioning tables and stages for various applications. By selecting special materials, linear encoders, linear motors and other driving systems which are not in this catalog, our PM application engineers can assist you in making systems for extreme environments.

Table 3.3 Temperature factor F_t

| Temperature in $^{\circ}\text{C}$ | Temperature factor f_t |
|-----------------------------------|--------------------------|
| 125 | 1 |
| 150 | 1 |
| 175 | 0.95 |
| 200 | 0.90 |
| 225 | 0.82 |
| 250 | 0.76 |
| 275 | 0.68 |
| 300 | 0.61 |



3.2.3 Load Factor F_w

Machines generate vibrations due to inertia loads (start / stop) or impacts due to other loads like moment loads and mechanical vibrations. The impact of these loads are especially difficult to calculate precisely. The correct factor can easily be selected with table 3.4.

Table 3.4 Load factor F_w

| Art of vibrations | Velocity | F_w |
|-----------------------------|--|----------------|
| No vibrations and impacts | Low $V \leq 15\text{m/min}$ | ~ 1.5 |
| Normal loads | Medium $15 < V \leq 60\text{m/min}$ | $1.5 \sim 2.0$ |
| With vibrations and impacts | High $V > 60\text{m/min}$ | $2.0 \sim 3.5$ |

3.2.4 Nominal Operational Calculation Life

To estimate the nominal life for recirculating bearings the following calculation can be employed, providing that the recommended installation conditions, lubrication, and protection from dust and dirt are maintained.

$$L = \frac{F_h + F_t}{F_w} \times C / P^e \times 1.15 \times 10^5 \text{ metres}$$

- L = Expected life in metres
- C = Effective dynamic load rating (N)
- P = Applied load (N)
- e = 10/3 for rollers and needles, and 3 for balls
- 1.15 = An empirical factor applicable to our materials
- F_h = Correction factor for hardness grades
(i.e. below 58HRc)
- F_t = Correction factor for temperature effects
- F_w = Load factor

4. Tolerances & Accuracy

4.1 Tolerances

PM recirculating bearings are offered in different accuracy grades:

DSU + DSU 30.15F: grades Q14 and Q8 (figure 4.1)

DS and PNUA: grades Q10 and Q5 (figure 4.2 and figure 4.3)

To guarantee these accuracy grades the machine construction must be finely machined and free of deformation. The linear bearing systems must be carefully mounted according to the assembly manual.

Figure 4.1 Tolerances miniguide DSU

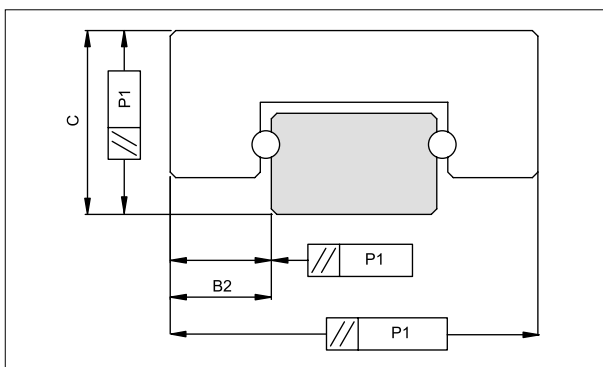


Figure 4.2 Tolerances DS recirculating assemblies

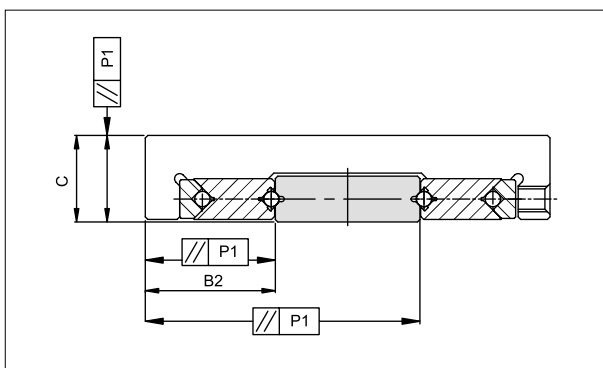


Figure 4.3 Tolerances PNUA recirculating assemblies

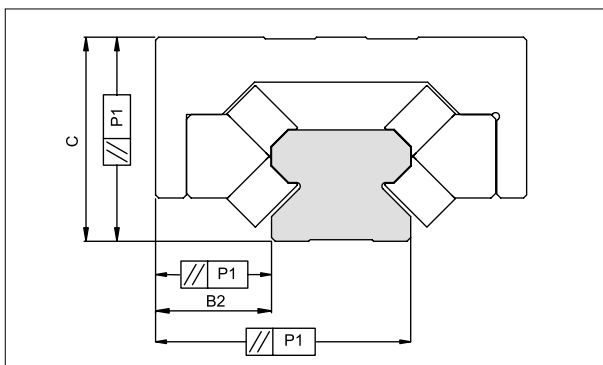


Table 4.1 Accuracy

Unit: microns

| Type +size | Accuracy Grade | Tolerances | |
|------------|----------------|----------------------|--------------------------------------|
| | | C + B2 ¹⁾ | $\Delta C + \Delta B2$ ²⁾ |
| DSU | Q14 | ± 20 | 15 |
| | Q8 | ± 10 | 7 |
| DS | Q10 | ± 15 | 10 |
| | Q5 | ± 10 | 5 |
| PNUA | Q10 | ± 15 | 10 |
| | Q5 | ± 10 | 5 |

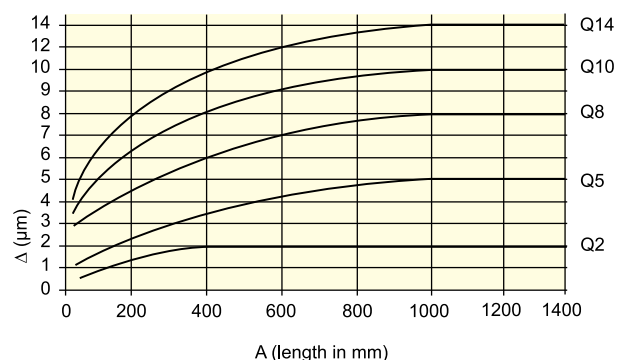
¹⁾ Tolerance C + B2 are measured at the center of the carriage.

²⁾ Tolerances $\Delta C + \Delta B2$ are maximum dimension differences measured at the center of two or more carriages mounted on the same rail.

4.2 Running Parallelism Accuracy

Figure 4.4 shows the running parallelism accuracy P1 of the recirculating systems.

Figure 4.4 Running parallelism accuracy



4.3 Vertical Offset Installed Rails

By the design of the supporting structure of the recirculating-bearing trackrails one of the following calculations to determine the tolerance for the vertical offset (S) between two parallel axis can be used:

$$S1 = 0.00015Q$$

$$S2 = 0.00008Q$$

$$S3 = 0.00004Q$$

S1= permissible vertical offset (μm) for DSU size 10.7, 15.9, 20.12, 30.15, 30.20

S2= permissible vertical offset (μm) for DSU size 10.14, 15.18, 20.24, 30.42

S3= permissible vertical offset (μm) for DS and PNUA

Q= distance between two axis (mm)

note: to minimize the effect of the roll moment across the axis, the deviation between the two axis from one another must be kept within the tolerance.



4.4 Parallelism of the Installed Rails

Figure 4.5

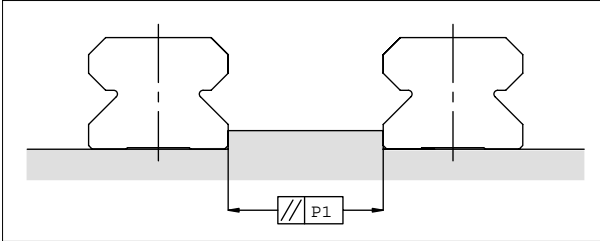


Table 4.2 Max. parallelism accuracy Unit: μm

| Type & size | Max. Parallelism offset P1 Preload classes | | |
|-------------|---|----|----|
| | V1 | V2 | V3 |
| DSU 10.7 | ± 2 | 2 | - |
| DSU 15.9 | ± 2 | 4 | - |
| DSU 20.12 | ± 2 | 4 | - |
| DSU 30.15 | ± 4 | 6 | - |
| DSU 30.20 | ± 7 | 8 | - |
| DSU 10.14 | ± 2 | 2 | - |
| DSU 15.18 | ± 2 | 4 | - |
| DSU 20.24 | ± 2 | 4 | - |
| DSU 30.42 | ± 4 | 6 | - |
| DS 2 | 2 | 4 | 5 |
| DS 3 | 4 | 6 | 7 |
| DS 6 | 4 | 8 | 10 |
| DS 9 | 4 | 8 | 10 |
| DS 12 | 5 | 8 | 10 |
| DS 15 | 5 | 8 | 10 |
| PNUA 25 | 2 | 4 | 5 |
| PNUA 40 | 3 | 4 | 6 |
| PNUA 70 | 3 | 4 | 6 |

Values are measured over 1000mm rail length

Values for DS type are based upon assembly with crossed roller recirculating systems UR type, except DS-2 which is with ball type UK.

4.5 Preload Classes

Recirculating assemblies are factory preloaded. Depending on the operation characteristics and the model we supply in two or three different classes. Miniguides DSU are preloaded by ball selection and are standard supplied in preload class V1 ($\sim 0.02 \cdot \text{Cdyn.}$), preload class V2 is to be requested. In operation where clearance is required we can supply in class V0 (clearance max. 5 microns). DS and PNUA recirculating systems are offered in three preload classes V1, V2 and V3 and are preloaded by using setscrews.

Note: a high amount of preload increases the rigidity and friction resistance of a recirculating bearing but can also reducing the operating life.

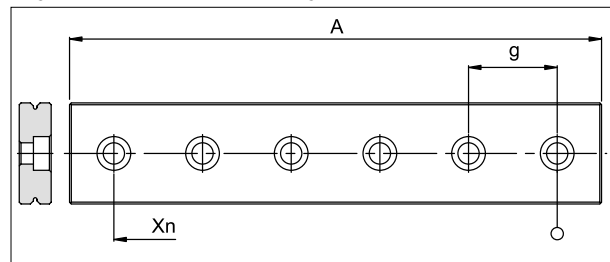
Table 4.3 Preload classes

| Preload classes | Suffix | Preload setting |
|------------------|--------|-------------------------------------|
| Standard preload | V1 | $\sim 0.02 \cdot \text{Cdyn.}$ |
| Medium preload | V2 | $0.05 \sim 0.07 \cdot \text{Cdyn.}$ |
| Heavy preload | V3 | $0.10 \sim 0.15 \cdot \text{Cdyn.}$ |

| Preload classes | Suitable applications |
|------------------|---|
| Standard preload | Smooth and accurate motion, evenly balanced load. |
| Medium preload | Medium load and medium overhang loads. |
| Heavy preload | High moment loads, vibrations. |

4.6 Tolerances on Length and Mounting Holes

Figure 4.6 Tolerances on length and holes



| | |
|-----------------------|-----------------------------|
| Length $A \leq 300$: | $\pm 0.3\text{mm}$ |
| Length $A > 300$: | $\pm 1 \text{‰}$ of A |
| Pitch g: | $\pm 0.3\text{mm}$ |
| $X_n \leq 350$: | $\pm 0.3\text{mm}$ |
| $X_n > 350$: | $\pm 0.8 \text{‰}$ of X_n |

i For rail lengths longer than A_{max} . factory-made mating sections are joined end-to-end.



5. Installation Procedure

5.1 Notes on assembly

Before Starting Assembly

Tap holes in the bed to mount the guide rails.
Check corner radii $r1$, heights of fitting edges and reference surface. (chapter 2.1)
Holes in the table must be premachined to customer print.

Before installation always check

- The components for completeness and condition.
- Strength factor of the screws in the case of high lift-off loads.
- Deburr all holes with a oilstone after drilling.
- Before and during assembly all components must be the same room temperature.
- Keep out of any foreign material when mounting the systems or components.
- Conditions of the screws and bolts; they have to be cleaned and in good condition.

Important information during installation

- Always clamp the rails with their locating side against the locating side of the machine bed.
- For an uniform tightening of the bolts the use of a torque screw driver is recommended.
- Tighten the attachment screws alternately from the rail center.

After installation always check

- When assembly is finished, the linear guides must be inspected for running performance.
- Lubricant is distributed over the entire travel distance.

Different assembly procedures are recommended depending on accuracy and rigidity requirements of the system. In this catalog we describe 3 typical mounting procedures. Example 1 describes the general procedure for Miniguide DSU and flange type DSU-F. The mounting procedures for recirculating systems DS and PNUA are mentioned in procedure 2 and 3. In procedure 4 we describe the installation of separate recirculating units.

5.2 Required Mounting Tools

For the assembly of recirculating bearing the following tools are required:

- Oil stone
- Lubricant
- Lint free cloth for cleaning
- C-clamp (only for assembly procedure 1)
- Jig (only for assembly procedure 1)
- Straight-edge (only for assembly procedure 3)
- Torque wrench
- Attachment screws for the rail systems
- Pushing screws

5.3 Recommended Tightening Torque

By the design of a recirculating system into the machine the strength factor of the screws must be checked. Especially in case of high lift-off loads and forces. For the tightening of the screws the use of a torque wrench is recommended.

Table 5.1 Recommended tightening torque Units: N.m

| Screw size | Strenghtclass | |
|------------|---------------|------|
| | 8.8 | 12.9 |
| M2 | 0.35 | 0.6 |
| M3 | 1.3 | 2.1 |
| M4 | 2.9 | 5.0 |
| M5 | 5.7 | 9.5 |
| M6 | 9.5 | 16.0 |
| M8 | 23 | 39 |
| M10 | 46 | 77 |
| M12 | 80 | 135 |
| M14 | 125 | 215 |
| M16 | 195 | 330 |



5.4 Installation Procedure No.1 for Miniguide DSU and DSU-F

Operating condition: general purpose

- Use of one reference side on both table and bed.
- Table is screwed on to the carriage from above.
- Miniguides are supplied with installed carriages, do not move the carriages from the rails, balls are not retained.

Assembly Reference Rail

1. The recirculating bearings are coated with anti-corrosion oil. Before starting assembly, clean the locating and support sides of the rails, carriages, bed and table with a clean cloth. After this slightly oil these surfaces with a light oil or grease per PM specs.
2. Carefully place the reference rail of the first system on the mounting surface of the bed.
3. Use a C-clamp or similar device to press the rail against the fitting edge at the bed. Figure 5.1.
4. Check the bolt engagements when inserting the bolts into the mounting holes. Tighten the attachment bolt of the rail lightly at the positioning of the clamp. Repeat these processes in other bolt positions in sequence.
5. Tighten the attachment bolts with a torque wrench to the specified torque starting alternately from the rail center. See table 5.1 for specified torque. Page 17.
For multi-section rails, ensure flush rail surfaces at joints

Assembly Second Rail

6. Lightly fix the second rail parallel to the reference rail on to the bed by using of a jig, as shown in figure 5.2. When the rail is parallel to the reference rail, tighten the attachment bolts in sequence from one end to the other to the specified torque.

Assembly Carriages on to the Table

7. Check the location of the attachment holes in the table for the carriages. Move all carriages in positioning and place the table carefully on them. Figure 5.3.
8. Temporarily tighten the table to the carriages on the reference rail while pushing the fitting edge of the carriages to the fitting edge of the table.

9. Fix one of the carriages of the second rail correctly to the table and leave other carriages temporarily tightened with the attachment bolts.

10. Move the carriage slowly manually forward and backward and fix all attachment bolts of the carriages uniformly which are temporarily tightened to the table in a diagonal sequence.

Figure 5.1 Use of C-clamp

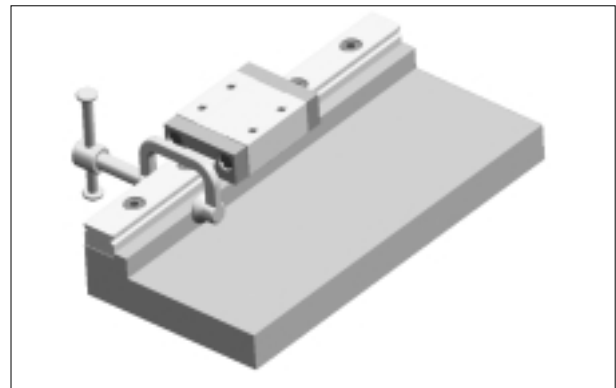


Figure 5.2 Use of a Jig

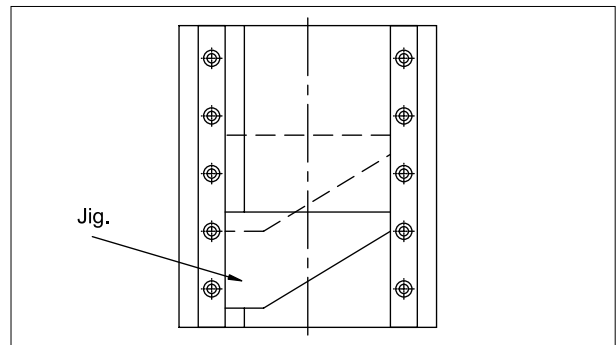
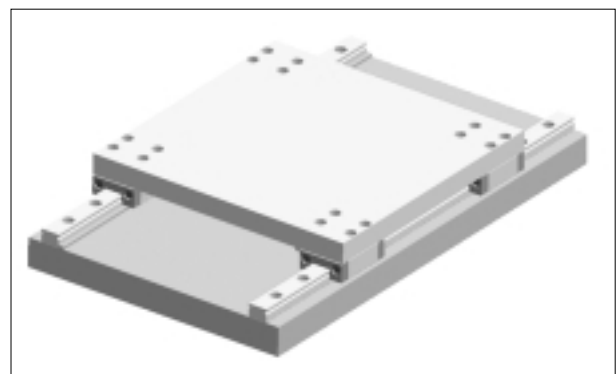


Figure 5.3 Placement of the table



5.5 Installation Procedure No. 2 for DS and PNUA type

Operating condition: high accuracy and rigid motion when subjected to vibrations and impact loads.

- Use on two sides fitting edges and setpush screws between bed and rail.
- The reference rail carriages using one fitting edge of table, carriages using push setscrews.
- Table is screwed onto the carriage from above.

Assembly Reference Rail

1. The recirculating bearings are coated with anti-corrosion oil. Before assembly, clean the locating and support sides of the rails, carriages, bed and table with a clean cloth. After this slightly oil these surfaces with a spindle oil.
2. Carefully place the rail on the mounting surface. Check the bolt engagements when inserting the bolts into the mounting holes. Carefully press the rail against the fitting edge using the push setscrews as shown in figure 5.4.
3. Tighten the attachment bolts with a torque wrench to the specified torque starting alternately from the rail centers. See table for specified torque. For multi-section rails, ensure flush rail surfaces at joints.

In case of components are used for replacements see assembly procedure nr. 4 at page 21. Otherways go to step 4.

Assembly Second Rail

4. Lightly fix the second rail parallel to the reference rail on to the bed in the same way as in step 2. When the rail is parallel to the reference rail, tighten the attachment bolts in sequence from one end to the other to the specified torque.

Assembly Carriages on to the Table

5. Check the location of the attachment holes in the table for the carriages. Move all carriages in positioning and place the table carefully on them. Figure 5.5.
6. Tighten the lateral push setscrews on the table to press the fitting edge of the carriages to the fitting edge of the table. Figure 5.6.

7. Tighten the table to the carriages on the reference rail using the torque wrench to the specified torque.
8. Fix one of the carriages of the second rail correctly to the table and leave other carriages temporarily tightened with the attachment bolts.
9. Move the carriage slowly manually forward and backward.
10. Tighten all attachment bolts of the carriages uniformly which are temporarily tightened to the table.

Figure 5.4 Use of push setscrews

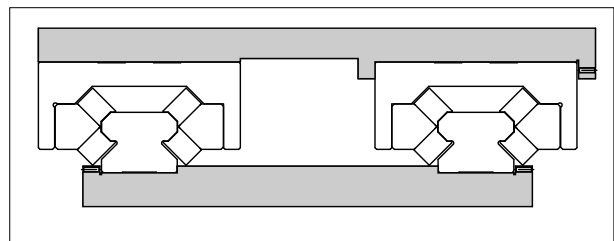


Figure 5.5 Placement of the table

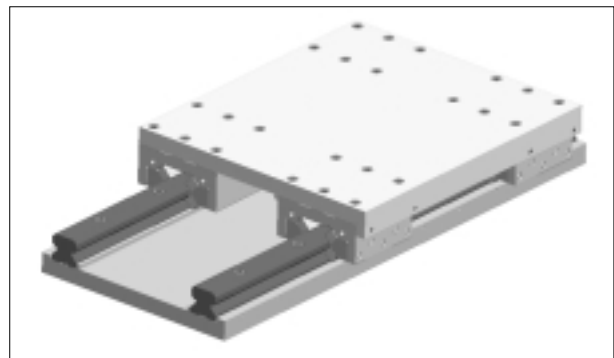
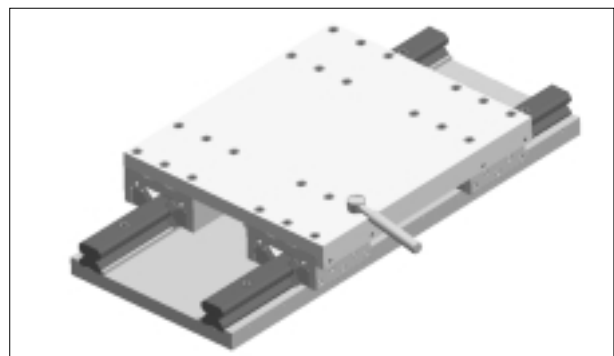


Figure 5.6 Tightening of the table



5.6 Installation Procedure No. 3 for DS and PNUA type

Operating condition: where no fitting edge is provided on the bed for the reference rail.

- Medium loads with moderate velocity.
- Use of one reference side on table with push screws.
- Table is screwed on to the carriage from above.

Assembly Reference Rail

1. The recirculating bearings are coated with anti-corrosion oil. Before starting assembly clean the locating and support sides of the rails, carriages, bed and table with a clean cloth. After this slightly oil these surfaces with a spindle oil.
2. Carefully place the reference rail of the first system on the mounting surface of the bed.
3. Installation of the reference rail.
 - 3.1 *Using a provisional datum plane (Figure 5.7)*
 - 3.1.1 Two carriages are fixed to the measuring plate with a dial gauge on the top. A temporary reference plane provided near on the bed is used for checking the straight alignment of the rail from one end to the other. Move the carriages slowly forward and backward and lightly tighten the mounting bolts in sequence.
 - 3.1.2. Tighten the attachment bolts to the specified torque starting alternately from the rail center. Check the bolt engagements when inserting the bolts into the mounting holes.
 - 3.2 *Using a straightedge (Figure 5.8)*
 - 3.2.1 Tighten the attachment bolts of the rail lightly. Slowly move the dial gauge forward and check the straightness of the reference side of the rail from one end to the other.
 - 3.2.2 Tighten the attachment bolts to the specified torque starting alternately from the rail center.
 - 3.3 For multi-section rails, ensure flush rail surfaces at joints.

Assembly Second Rail

4. Lightly fix the second rail parallel to the reference rail on to the bed by using of a jig, as shown in figure 5.9. When the rail is parallel to the reference rail, tighten the attachment bolts in sequence from one end to the other to the specified torque.
5. Check the location of the attachment holes in the table for the carriages. Move all carriages in positioning and place the table carefully on them.

6. Temporarily tightening the table to the carriages on the reference rail while pushing the reference mounting surface of the carriages to the shoulder reference surface of the table while using the lateral pushing screws.
7. Fix one of the carriages of the second rail correctly to the table and leave other carriages temporarily tightened with the attachment bolts.
8. Move the carriage slowly manually forward and backward and fix the second rail finally to the bed using a torque wrench. During this process tighten the rail attachment bolt immediately behind the fixed carriage of the second rail.
9. Tighten all attachment bolts of the carriages uniformly which are temporarily tightened to the table.

Figure 5.7 Provisional datum plane

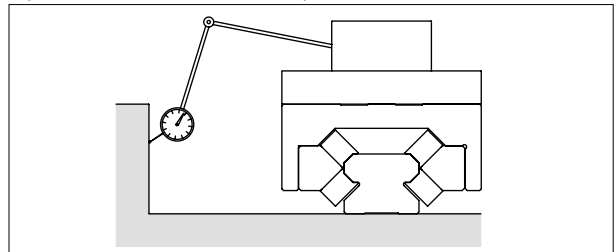


Figure 5.8 Use of straight edge

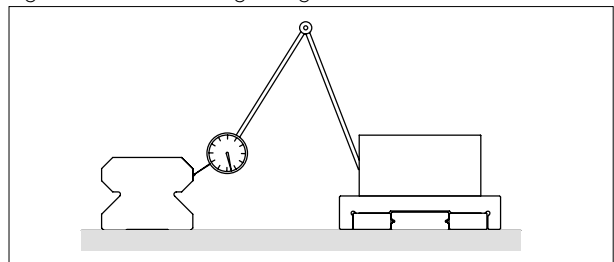
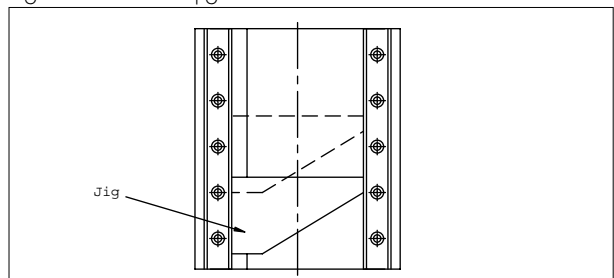


Figure 5.9 Use of jig





5.7 Installation Procedure No. 4 for Recirculating Units UK, UR, PNE

Preloading Recirculating Units type UK, UR, PNE

The function of the preload is to increase the rigidity and accuracy of a linear bearing system and achieve a playfree guideway.

Sometimes the preload is factory installed by selection on ball diameter as for miniguide DSU and flange type DSU 30.15F. In other cases the preload is adjusted with setscrews which are uniformly tighten to the specified torque with a torque wrench. Similar to the installation procedure of crossed rollerway sets.

The amount of preload depends on the diameter of rolling elements, pitch of the setscrews and size of the setscrews. For an optimal preload setting, which achieves the smallest possible deviation in the preload zone, it is necessary that the setscrews are located at the same place as the attachment screws of the units to the table. This location must be within load carrying zone K_t as shown in figure 5.10.

Otherwise during movement, angular errors will increase a high amount of pressure on the balls/rollers or needle rollers which increase the displacement resistance and which in worst cases can damage the running surface and rolling elements and shorten the operating life.

The setting of the preload with the setscrews should be executed starting alternately from the center of the carriage setscrews.

Complete linear guide assemblies are factory preloaded supplied and do not need re-adjustment.

The **amount of preload** is depending on the rigidity of the base construction and the application and is normally between 2 and 20% of the permissible load C . Next placed tables can be used as a guideline.

i Preload has the same effect on a linear bearing life as a working load and should be kept to a minimum.

Minimum requirement:

- Carriage table part US or PNUA or custom made
- Recirculating units ball type UK, crossed roller type UR or needle roller type PNE.

Figure 5.10 Load carrying section K_t

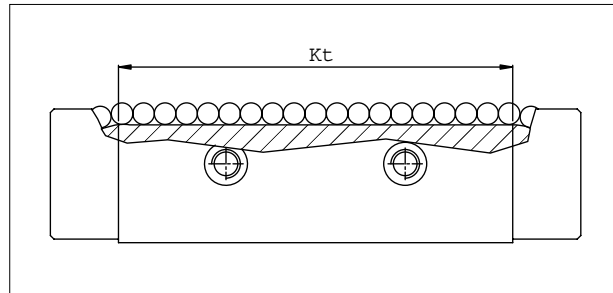


Table 5.2 Recommended preload settings for units UK

| Recirculating unit Part no. | Table Part no. | Setscrew | Preload setting (N.cm) |
|-----------------------------|----------------|----------|------------------------|
| UK-2040 | US-2040 | M3 | 0.36 |
| UK-2060 | US-2060 | M3 | 0.36 |
| UK-3075 | US-3075 | M5 | 1.50 |
| UK-3100 | US-3100 | M5 | 1.50 |
| UK-6100 | US-6100 | M6 | 4.00 |
| UK-6175 | US-6175 | M6 | 4.00 |
| UK-9150 | US-9200 | M8 | 6.00 |
| UK-9250 | US-9250 | M8 | 9.00 |
| UK-12200 | US-12200 | M10 | 12.00 |
| UK-12300 | US-12300 | M10 | 19.00 |
| UK-15250 | UK-15250 | M12 | 20.00 |
| UK-15350 | UK-15350 | M12 | 27.00 |

Table 5.3 Recommended preload settings for units UR

| Recirculating unit Part no. | Table Part no. | Setscrew | Preload setting (N.cm) |
|-----------------------------|----------------|----------|------------------------|
| UR-3075 | US-3075 | M5 | 5.00 |
| UR-3100 | US-3100 | M5 | 6.00 |
| UR-6100 | US-6100 | M6 | 22.00 |
| UR-6175 | US-6175 | M6 | 28.00 |
| UR-9200 | US-9200 | M8 | 68.00 |
| UR-9250 | US-9250 | M8 | 93.00 |
| UR-12200 | US-12200 | M10 | 116.00 |
| UR-12300 | US-12300 | M10 | 181.00 |
| UR-15250 | UK-15250 | M12 | 255.00 |
| UR-15350 | UK-15350 | M12 | 347.00 |

Table 5.4 Recommended preload settings for units PNE

| Recirculating unit Part no. | Table Part no. | Setscrew | Preload setting (N.m) |
|-----------------------------|----------------|----------|-----------------------|
| PNE-25 | PMT-25 | M8 | 1.30 |
| PNE-40 | PMT-40 | M8 | 2.90 |
| PNE-70 | PMT-70 | M10 | 5.70 |

Important Information in case of unit replacement.

Before starting replacement of components carefully ensure that:

1. the rail surfaces are free from brinell marks, lost of rail fragments etc...
2. component mounting surface in the carriage on flatness and accuracy.

Assembly Recirculating Units

1. Press the first recirculator against the reference surface of the carriage and tighten the attaching screws with a torque wrench. Figure 5.11
2. Place the second recirculator against the adjusting side and lightly tighten the attaching screws. Figure 5.12
3. Slide the carriage carefully on the rail
4. During adjustment with the preload setscrews, move the carriage over the full rail length until desired preload is achieved and assembly is playfree. Figure 5.13. Adjustment of the screws is starting alternately from the centre.
5. Secure the attaching screws on the adjusting recirculating unit with the required torque. (table 5.1, 5.2, 5.3 listed page 21)
6. Repeat steps 1- 5 for the other carriages.

Figure 5.11

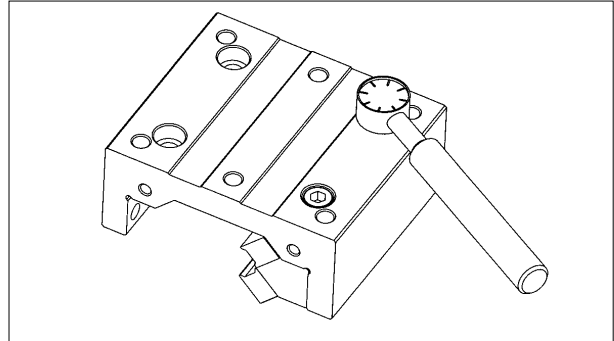


Figure 5.12

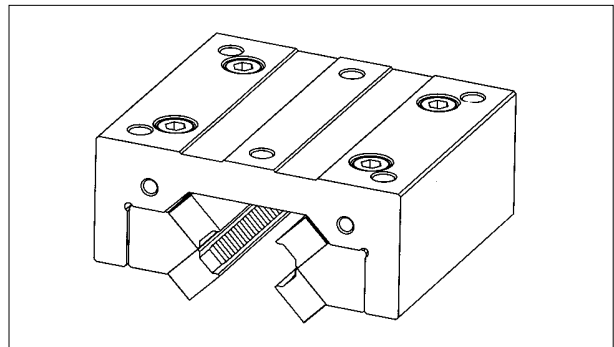
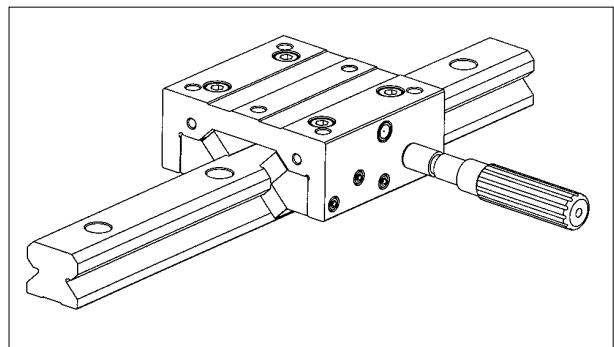


Figure 5.13





6. Linear Miniguide

DSU



DSU Miniguides in both standard and wide models are made from corrosion resistant stainless steel. They offer an extremely low friction resistance, accurate linear motion and long term trouble free operation.

The ball grooves in the rail and the carriage are ground very precisely which result in an unexcelled high running accuracy and smoothness. DSU miniguides are supplied with a light amount of preload ~ 0.02 Cdyn (V1) which increases the stiffness and offers a long operation lifetime.

Material

Rail, body and balls are made from stainless steel No. 1.4034, through hardened 54-57HRC.
Endcaps light metal, surface treatment.
(All metal construction)

Options (consult PM)

- Complete stainless steel version.
- Models for special environments such as UHV, high temperatures and low temperatures (cryogen).
- Special greases.

Structure and Features

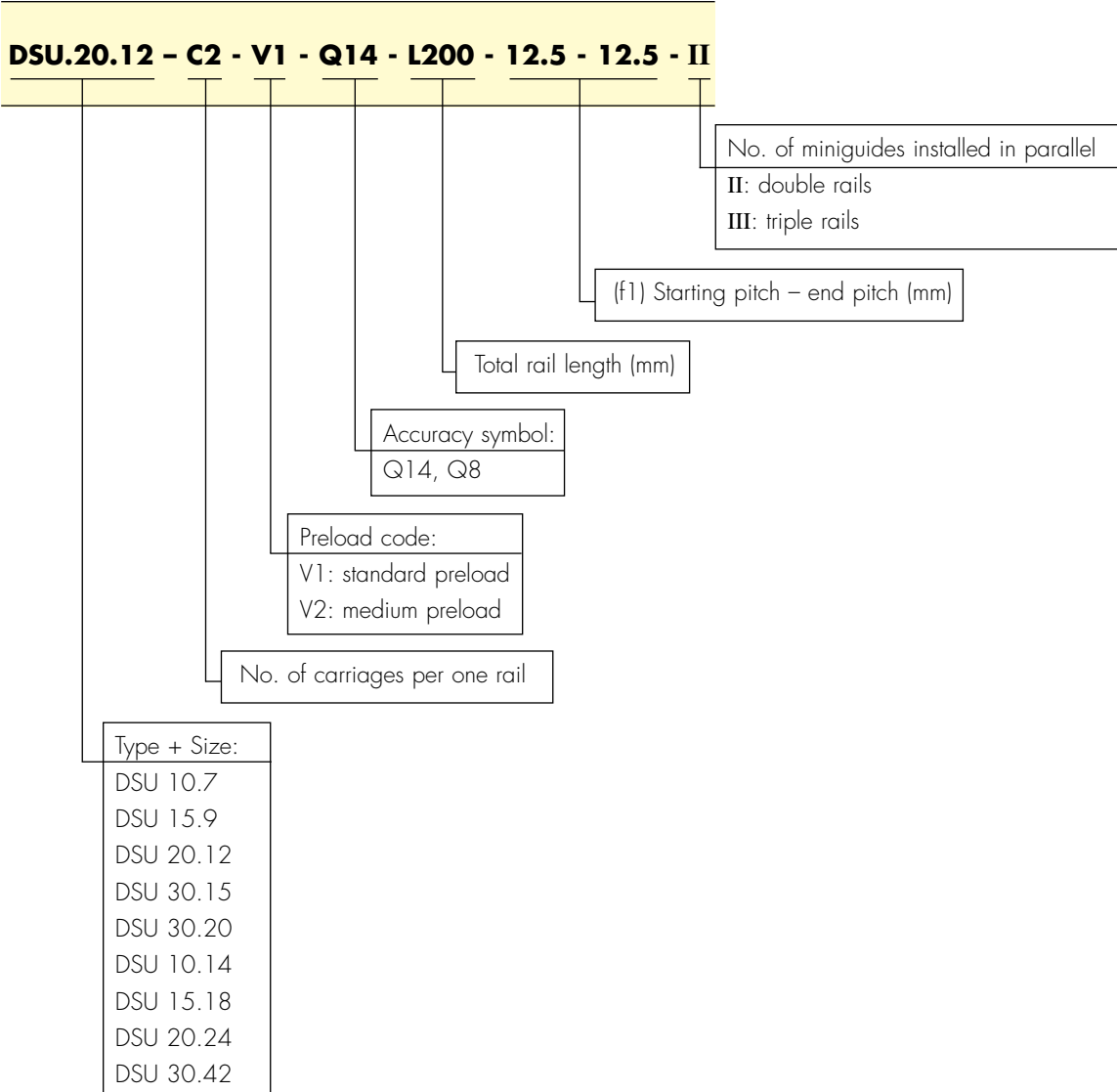
- **Two-ball rows in compact design**
Miniguides are supplied with two rows of balls which are running in a gothic-arch groove. This design enable the carriage to take up the load and moments in all directions and reduce the size.
- **All metal construction**
No plastic components are used. This allows the DSU-series to be used in areas where most commercially available guides will fail and allow a higher speed capability.
- **Smooth operation**
A better ball recirculation to the fact that the precision grind rail and recirculating caps geometry are fitting perfectly together.
- **Cleanroom capability**
No seals or plastic components to rub, eliminating particulate.
- **Ease of installation**
Rails and carriages are mounted together and factory lubricated for quick, simple assembly.
- **Drop in replacements**
DSU miniguides are matching dimensions with the industry standard sizes.

Special

PM is able to modify the design to customer requirements.



Ordering Information DSU Miniguide System

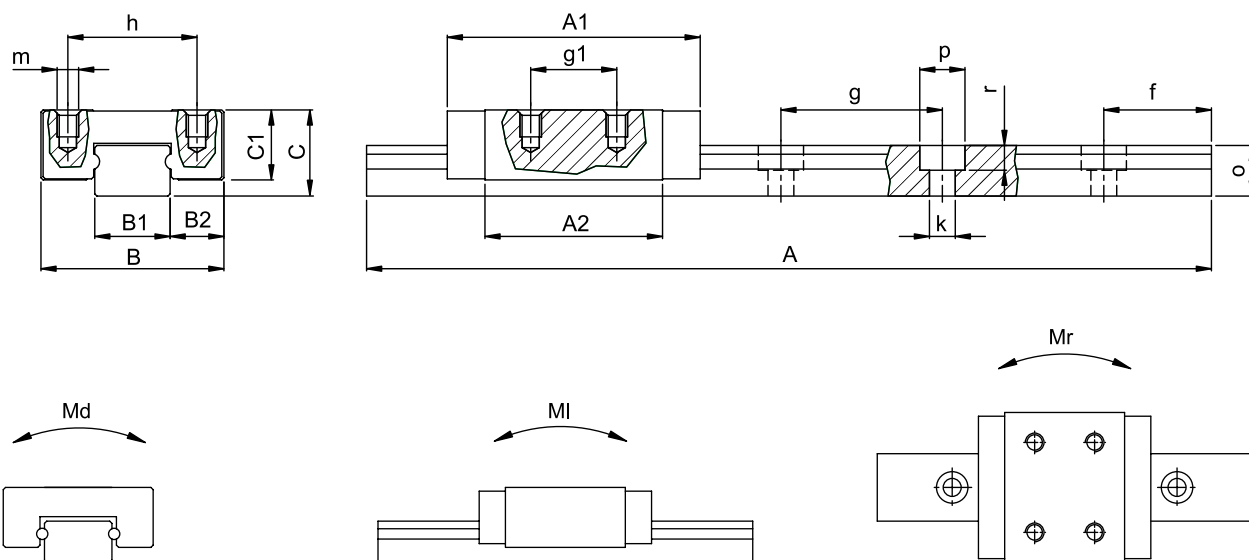


Ordering example: 2 pcs. Partnumber DSU20.12-C2-V1-Q14-L200-12.5-12.5 - II



Linear Miniguide narrow type

DSU
sizes 7, 9, 12, 15, 20



Units: mm

| Type + size | A1 | A2 | B | C | B1 | B2 | C1 | f | g | g1 | h | k | m | o | p | r |
|-------------|------|----|----|----|----|-----|------|------|----|----|----|-----|--------|-----|-----|-----|
| DSU 10.7 | 23.5 | 16 | 17 | 8 | 7 | 5 | 6.5 | 10 | 15 | 8 | 12 | 2.4 | M2x2.5 | 4.7 | 4.2 | 2.3 |
| DSU 15.9 | 26 | 19 | 20 | 10 | 9 | 5.5 | 7.8 | 10 | 20 | 13 | 15 | 3 | M2x2.5 | 5.5 | 5 | 3 |
| DSU 20.12 | 34 | 24 | 27 | 13 | 12 | 7.5 | 10 | 12.5 | 25 | 15 | 20 | 3.5 | M3x3.5 | 7.5 | 6 | 4.5 |
| DSU 30.15 | 42 | 30 | 32 | 16 | 15 | 8.5 | 12 | 25 | 40 | 20 | 25 | 3.5 | M3x4 | 9.5 | 6 | 4.5 |
| DSU 30.20 | 62 | 50 | 46 | 25 | 20 | 13 | 17.5 | 25 | 60 | 38 | 38 | 6 | M4x6 | 15 | 9.5 | 5.5 |

| Type + size | Standard length A | A max. |
|-------------|--|--------|
| DSU 10.7 | 50, 80, 110, 170, 230, 290, 350, 410 | 410 |
| DSU 15.9 | 60, 100, 200, 300, 400, 500, 600, 700 | 700 |
| DSU 20.12 | 75, 100, 200, 300, 400, 500, 600, 700,... | 1200 |
| DSU 30.15 | 90, 170, 250, 330, 410, 530, 650, 770,... | 1200 |
| DSU 30.20 | 110, 230, 350, 470, 590, 710, 830, 950,... | 1200 |
| | Other lengths on request | |

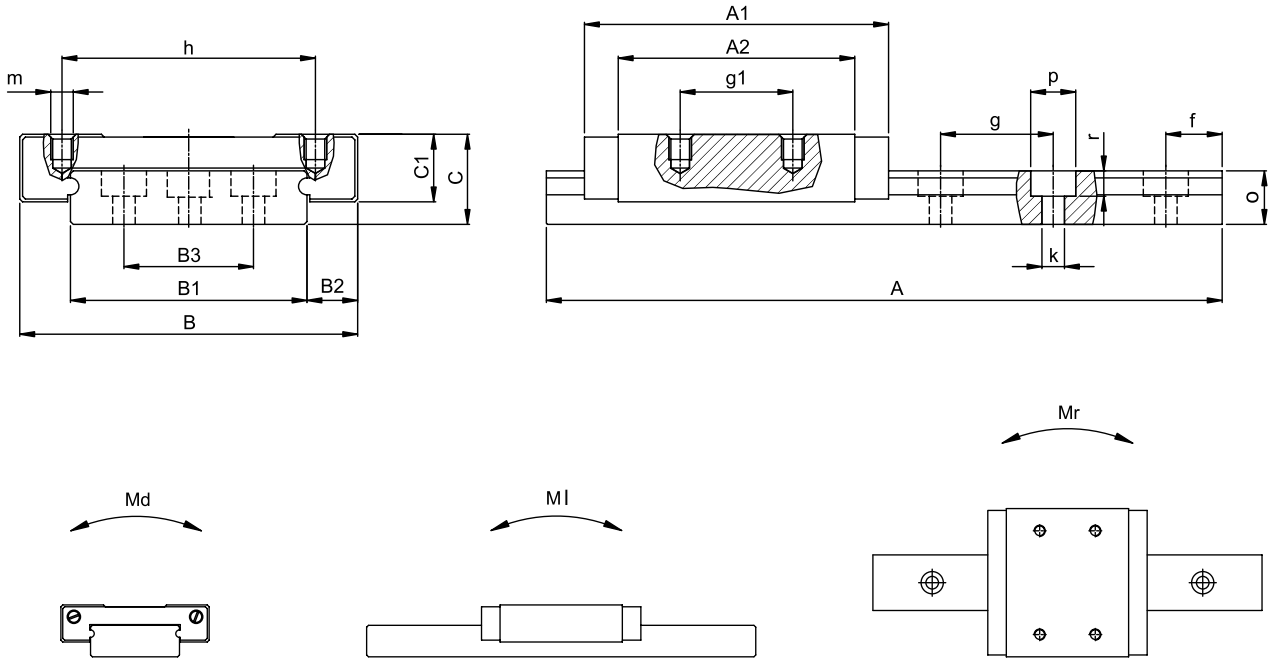
| Type + size | Load capacity (N) | | Static moments (N.m) | | | Weights | | |
|-------------|-------------------|-------|----------------------|------|------|---------------------|--|--------------|
| | C | Co | Md | MI | Mr | Standard return cap | Carriage (g) Stainless steel return cap | Rail g/100mm |
| DSU 10.7 | 910 | 1650 | 7.5 | 4.4 | 4.4 | 10 | 13 | 22 |
| DSU 15.9 | 1760 | 2850 | 12.8 | 10.5 | 10.5 | 25 | 28 | 31 |
| DSU 20.12 | 2540 | 3945 | 23.2 | 16.4 | 16.4 | 50 | 60 | 59 |
| DSU 30.15 | 4425 | 5590 | 43.0 | 29.0 | 29.0 | 75 | 95 | 100 |
| DSU 30.20 | 7980 | 12100 | 52.5 | 33.0 | 33.0 | 220 | 260 | 213 |

Load ratings are based on DIN 636-2



DSU
sizes 14, 18, 24, 42

Linear Miniguide
wide type



Units: mm

| Type + size | A1 | A2 | B | C | B1 | B2 | B3 | C1 | f | g | g1 | h | k | m | o | p | r |
|-------------|------|----|----|----|----|-----|----|-----|----|----|----|----|-----|--------|-----|---|-----|
| DSU 10.14 | 31.4 | 21 | 25 | 9 | 14 | 5.5 | - | 6.5 | 10 | 30 | 10 | 19 | 3.5 | M3x2.8 | 5.2 | 6 | 3.2 |
| DSU 15.18 | 38 | 29 | 30 | 12 | 18 | 6 | - | 7.8 | 10 | 30 | 12 | 21 | 3.5 | M3x3 | 7.5 | 8 | 4.5 |
| DSU 20.24 | 44 | 33 | 40 | 14 | 24 | 8 | - | 10 | 15 | 40 | 15 | 28 | 4.5 | M3x3.5 | 8.5 | 8 | 4.5 |
| DSU 30.42 | 55 | 42 | 60 | 16 | 42 | 9 | 23 | 12 | 15 | 40 | 20 | 45 | 4.5 | M4x4.5 | 9.5 | 8 | 4.5 |

| Type + size | Standard length A | A max. |
|-------------|---|--------|
| DSU 10.14 | 50, 80, 110, 140, 170, 200, 230, 260, 290, 320, 350, 380 | 410 |
| DSU 15.18 | 50, 80, 110, 140, 170, 200, 260, 320, 380, 440, 500, 560 | 700 |
| DSU 20.24 | 70, 110, 150, 190, 230, 270, 310, 390, 470, 550, 630, 710, 790, 870, 950 | 1200 |
| DSU 30.42 | 110, 150, 190, 230, 270, 310, 430, 550, 670, 790, 910, 1030, 1150 Other lengths on request | 1200 |

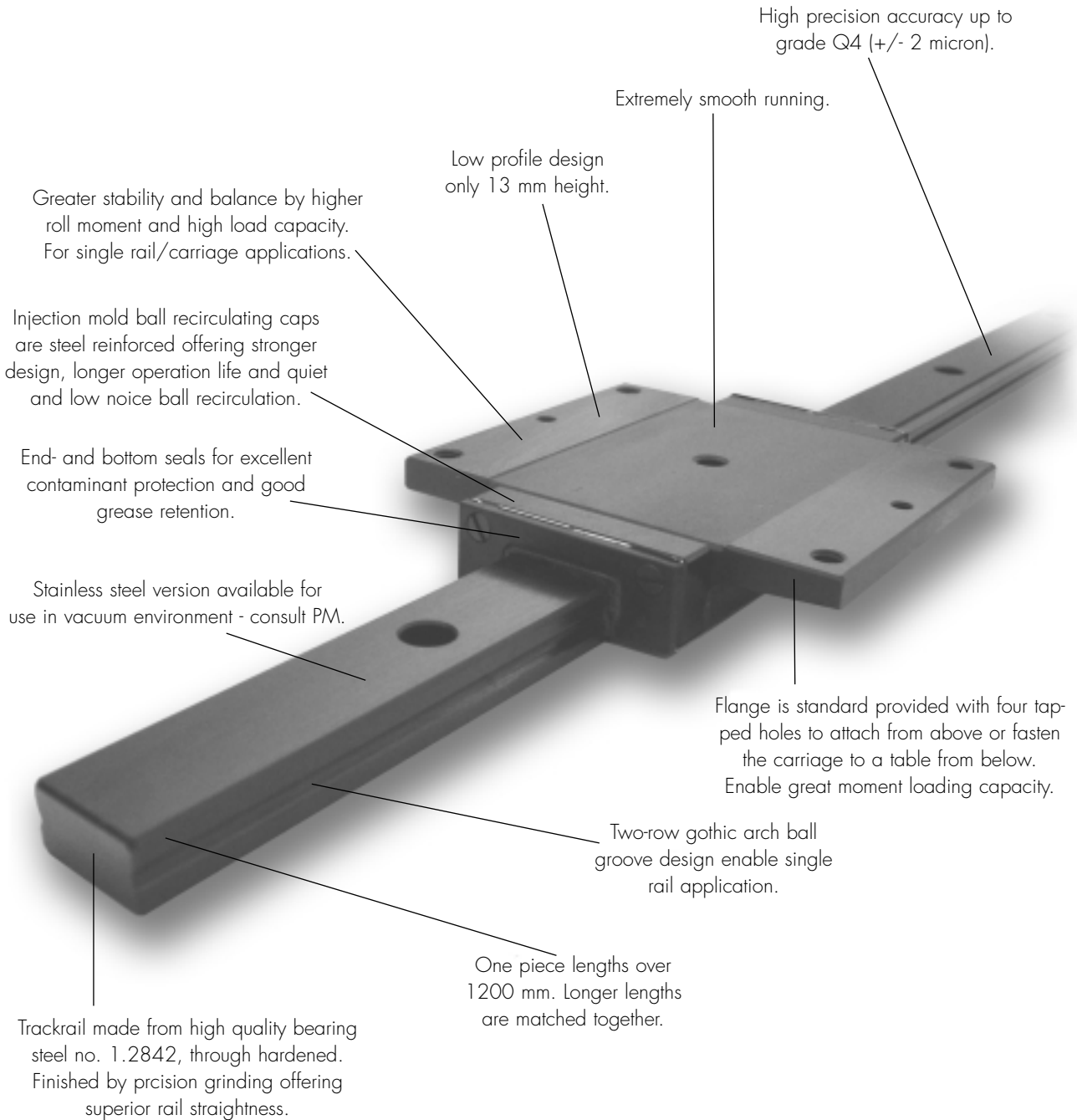
| Type + size | Load capacity (N) | | Static moments (N.m) | | | Weights | | |
|-------------|-------------------|------|----------------------|------|------|-------------------------------------|--|----------------|
| | C | Co | Md | Ml | Mr | Carriage (g) Standard return cap | Carriage (g) Stainless steel return cap | Rail (g/100mm) |
| DSU 10.14 | 1590 | 2560 | 18.1 | 8.9 | 8.9 | 20 | 25 | 49 |
| DSU 15.18 | 2310 | 3830 | 35.4 | 16.8 | 16.8 | 45 | 57 | 91 |
| DSU 20.24 | 3220 | 5560 | 61.5 | 24.5 | 24.5 | 85 | 103 | 145 |
| DSU 30.42 | 5250 | 8950 | 188.6 | 57.0 | 57.0 | 165 | 197 | 280 |

Loadratings are based on DIN 636-2



DSU 30.15F

Flange type



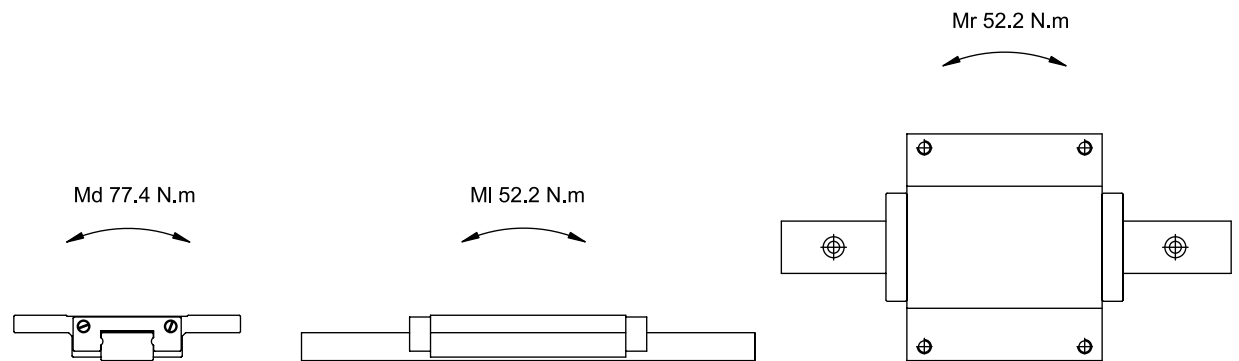
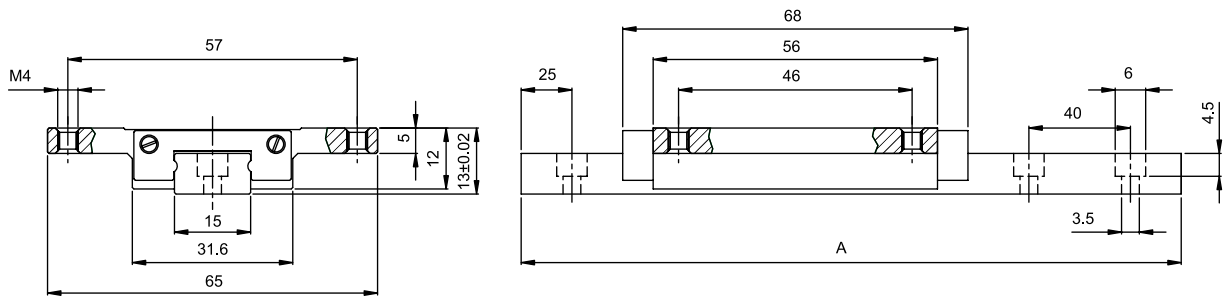
Standard dimensions are listed on page 28

Custom lengths and configurations available



Flange type

DSU 30.15F



Units: mm

| Standard length A | A max | Load capacity (N) | | Weights | |
|---|-------|-------------------|------|------------|--------------|
| | | C | Co | Carriage g | Rail g/100mm |
| 70, 110, 150, 190, 230, 270, 310, 350, 390, 430, 470, 550, 670, 870,... | 1200 | 4000 | 4500 | 175 | 100 |

Load ratings are based on DIN 636-2



7. Recirculating Systems

Ball & roller type

DS



DS guides are compact designed linear motion systems for unlimited travel in every orientation. The parts can also be ordered as single components in case of replacements or for use in combination with single rails type RSD (catalog Linear Bearings). The DS guides are designed so that they can carry low up to high load and moment loadings in all major directions depending on the recirculating unit system.

Material Table Bodies

Specifications are listed at page 30 for the components.

Structure and Features

- **Low profile design;** DS linear guides are designed for compact design in high accuracy applications.
- **Field maintenance/components separate to order;** Individual components such as recirculating units, track rails and wipers can be replaced in the field. They can be ordered separately.
- **Full complement of balls/rollers;** DS ball or roller guides are designed and with full complement of balls or rollers which combines a maximum loading capacity for these sizes. Some sizes are available with damping spacers for smoother operation in reduced load applications.
- **Adjustability;** The use of individual bearings permits tuning of the bearing preload in the field for different operation conditions and machine applications.
- **Ultra high precision accuracy upto +/-0.002mm;** DS linear guides are available in two high precision accuracy classes Q8 and Q4. Q8 is used general machine purpose as machine centers, milling machines and stamping presses as Q4 accuracy is ideal for ultra-high precision devices as inspection scanning equipment and semiconductor equipment.

Options

- Ultra High Precision Class Q4
- Matched pairs
- Multi-section guides
- Preload classes V2, V3
- Clamping Device KDS
- Endwipers U
- Damping spacers
- Corrosion resistant
- Dry run

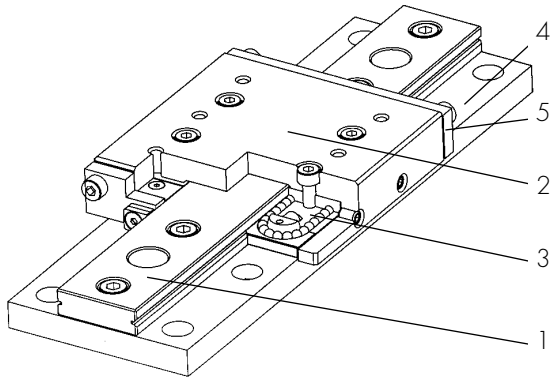
Notes for ordering

For ordering please check that quantity and partnumber is correctly mentioned.



Recirculating Systems

DS-UT



DS-UT linear tables are compact linear motion systems for unlimited travel in every orientation. The wide range of sizes and lengths offers a economical and space saving solution. The parts can also be ordered as components for replacements.

The DS-UT bearings are designed so that they can carry load and moment loadings in all directions.

In cases of $A > 1400\text{mm}$ we supply multi section lengths which are ground together within 2 micron.

A complete set DS-UT consist of one double prism rail type DS, one table model US, two recirculating units UK or UR and depending on the operation conditions one baseplate type UT and two endseals type U.

No 1. DS Double Prism Rail (page 32)

DS rails are 2-row precision guides providing space-saving solutions. They are manufactured from high quality bearing steel 1.2842, through hardenend $60 \pm 2\text{Hrc}$. DS guides can be mounted either directly or by using the precision ground base plate. The rails come with two dowel pin holes for precise mounting without reference shoulders.

DS rails can also be used with PM type RSD crossed roller ways and cages as in catalog "Linear Bearings".

No.2 US Table (page 33)

US tables are used to attach and preload the recirculating units to the DS rails. They are made of unhardened steel which allow the user to add custom holes easily. The tables include standard countersunk attachment holes for the recirculating units. Tables are precision ground and they come with a black oxide finishing. The lateral threaded holes are to install the preload.

No.3 UK/UR- Recirculating Units (page 34/35)

UK recirculating units are single row ball bearings for low to medium loads. For greater load ratings and stiffness we offer crossed roller recirculating units UR. The units can be used in every orientation. The main body in made of high quality bearing steel 1.2842 and through hardened at $60 \pm 2\text{Hrc}$ and precision ground. The special designed return offers extremely smooth running characteristics. UK and UR type have the same mounting dimensions and are therefore interchangeable. The designs offers retained rolling element.

From size 2 and on the units are offered in two lengths. Longer lengths offer higher load and moment ratings with the same low height.

In situations where dirt can enter the inside of the bearings the use of UK ball units is recommended since they are less sensitive to dirt than rollers.

UK and UR recirculators can also be used with PM type RSD crossed roller ways listed in catalog "Linear Bearings".

No. 4 UT Baseplate (page 36)

These base units (ground but not hadened) increase the stability of the DS bearing track and facilitate especially the installation of long track-rails. They come with threaded holes to bolt down the double-sided rails solidly to their UT-base, possible lateral distortion of the track-rails is thus inhibited.

No. 5 U Endseals (page 38)

U- endseals are a simply, effective and economical solution for protecting the DS-guides in operations where dust, dirt and other contamination are present. They are installed on both the front- and backside of the US table and during travel they clean the V- grooves and the rail upper surfaces.

KDS Clamping Device (page 39)

KDS clamping devices (optional) allows the roller table to be locked in any position and is factory mounted onto the US table.

Order Example:

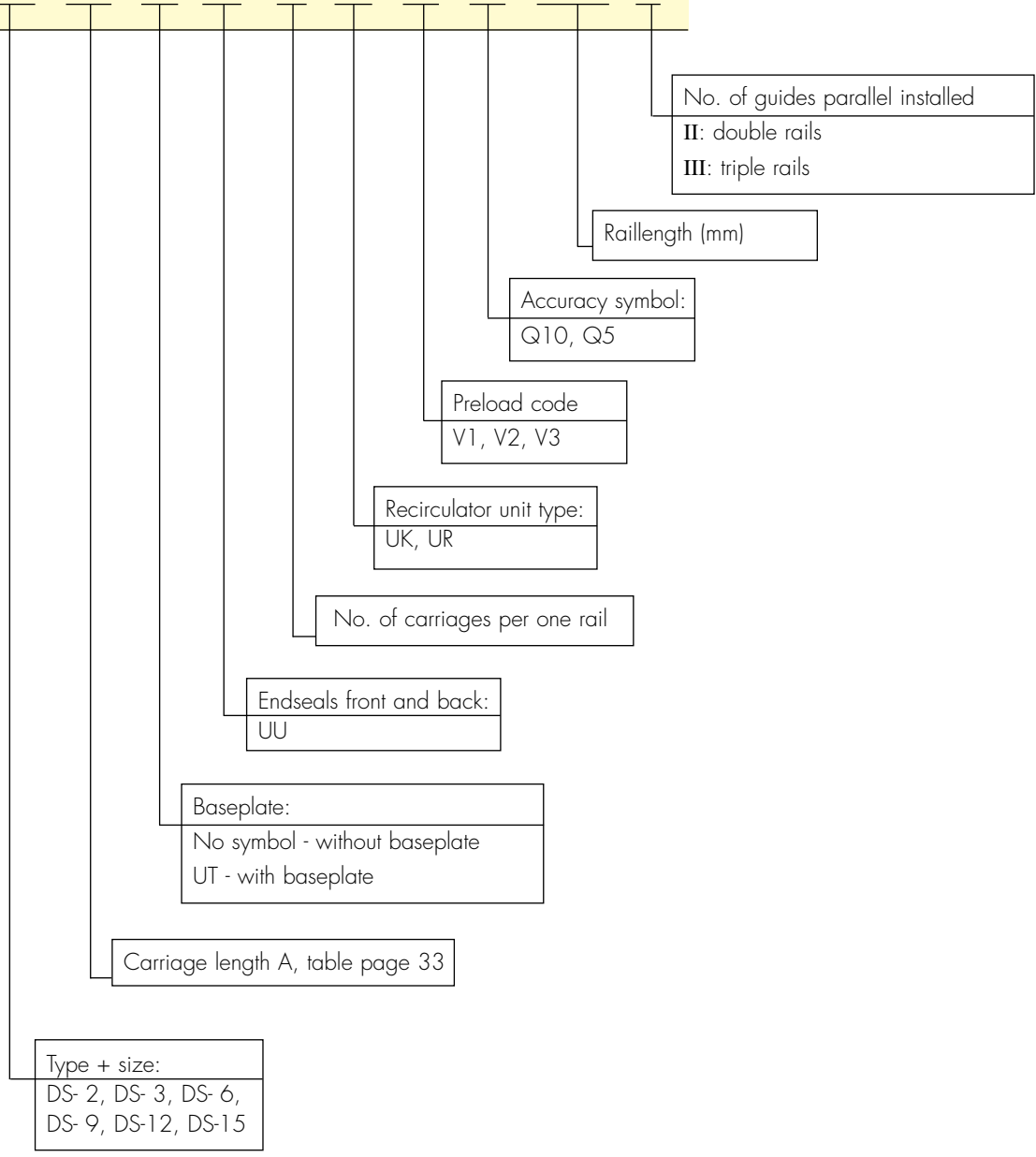
- 1 Rail DS-3400 (ball size 3, length 400mm)
- 2 Recirculating Units UK-3075
- 1 Table Unit US-3075
- 2 Endseals U-3
- * mounted and adjusted together*



**Ordering DS Linear Guide System
"Ready-to-Install"**

Modelnumber of DS series

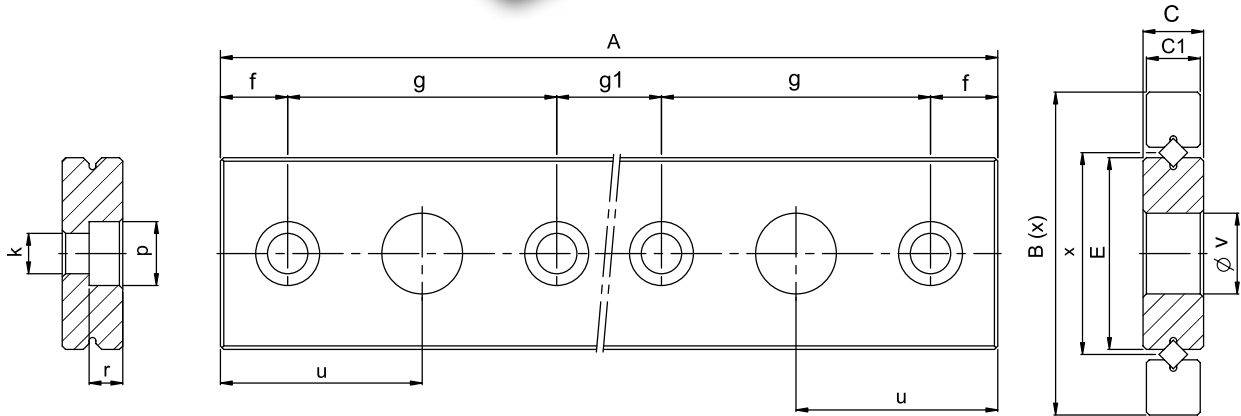
DS 3 - 075 - UT - UU - C2 - UK - V1 - Q5 - L 400 - II





DS
sizes 2, 3, 6, 9, 12, 15

2-row trackrail



*DS in combination with RSD crossed rollerways

Units: mm

| Type + size | B | C | C1 | E | D ³⁾ | f | g | g1 | k | p | r | u | v | x | Weight g/mm |
|-------------|-----|-----|----|------|-----------------|----|------------------|-----|-----|-----|------|------------------|------|-----|-------------|
| DS - 2 | 30 | 6.5 | 6 | 17 | 2 | 10 | 40 ¹⁾ | 50 | 4.8 | 7.8 | 4.1 | 30 ²⁾ | 8H7 | 18 | 1.80 |
| DS - 3 | 48 | 9 | 8 | 28.4 | 3 | 10 | 40 | 50 | 6 | 9.5 | 5.1 | 30 | 12H7 | 30 | 3.67 |
| DS - 6 | 77 | 16 | 15 | 43 | 6 | 15 | 85 | 100 | 9 | 14 | 8.3 | 50 | 15H7 | 46 | 5.02 |
| DS - 9 | 122 | 24 | 22 | 73.6 | 9 | 25 | 75 | 100 | 13 | 19 | 12.5 | 60 | 15H7 | 78 | 16.83 |
| DS - 12 | 141 | 30 | 28 | 77 | 12 | 25 | 75 | 100 | 13 | 19 | 12.5 | 60 | 15H7 | 83 | 20.62 |
| DS - 15 | 174 | 38 | 36 | 96 | 15 | 25 | 75 | 100 | 13 | 19 | 12.5 | 60 | 15H7 | 103 | 31.40 |

¹⁾ for length 100 mm: g = 80

²⁾ for length 100 mm: u = 50

³⁾ diameter rolling elements

| Type + size | Standard length A |
|-------------|--|
| DS - 2 | 100, 150, 200, 300, 400, 500 |
| DS - 3 | 200, 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200 |
| DS - 6 | 300, 400, 500, 600, 700, 800, 900, 1000, 1100, 1200 |
| DS - 9 | 400, 500, 600, 700, 800, 900, 1000, 1100, 1200 |
| DS - 12 | 500, 600, 700, 800, 900, 1000, 1100, 1200 |
| DS - 15 | 600, 700, 800, 900, 1000, 1100, 1200 |
| | Other lengths on request |

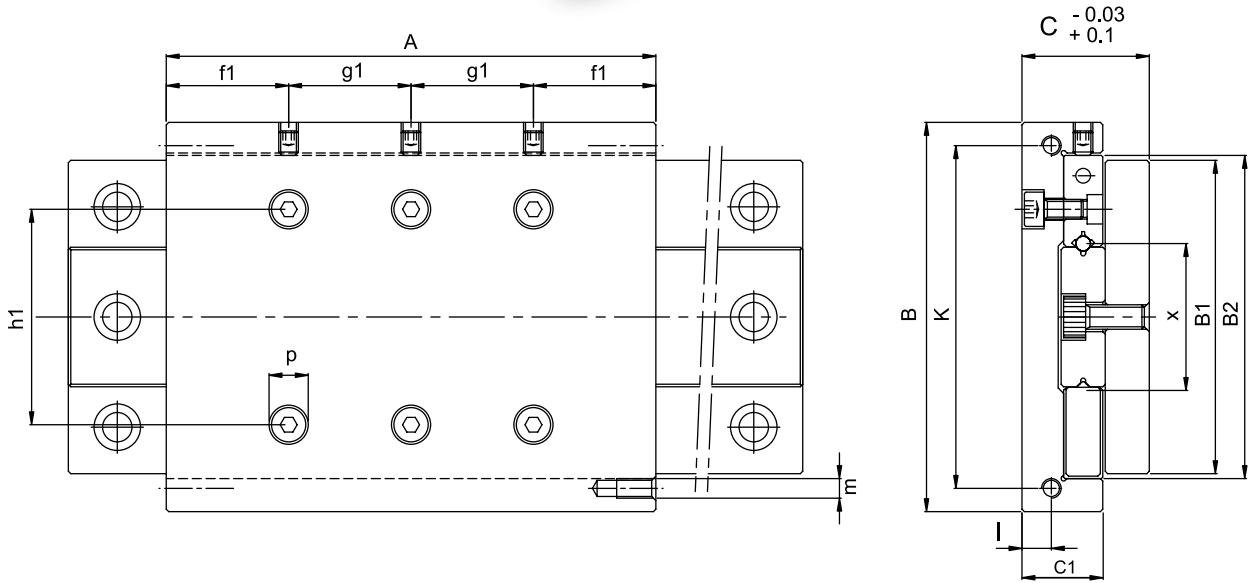
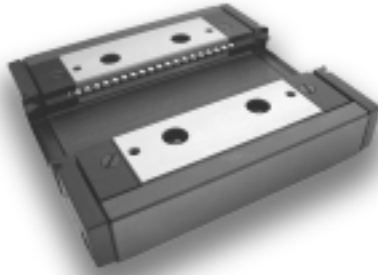
Ordering example: Type Size x Length - Accuracy grade

DS 3 x 600 - Q5



Rollertable

US



i US tables are supplied without recirculating units.

Units: mm

| Type + size | A | B | B1 | B2 | C* | C1 | f1 | g1 | h1 | K | l | m | p | x | Weight kg |
|-------------|-----|-------|------|-----|----|-------|------|-------|-----|------|-----|------|-----|-----|-----------|
| US - 2040 | 40 | 49.5 | 39 | 40 | 18 | 11.25 | 12.5 | 1x15 | 26 | 43.5 | 3.8 | M2.5 | 6.3 | 18 | 0.12 |
| US - 2060 | 60 | | | | | | 15 | 2x15 | | | | | | | 0.18 |
| US - 3075 | 75 | 79.5 | 64 | 66 | 26 | 16.5 | 25 | 1x25 | 44 | 70 | 6 | M4 | 7.8 | 30 | 0.42 |
| US - 3100 | 100 | | | | | | | 2x25 | | | | | | | 0.56 |
| US - 6100 | 100 | 129.5 | 99.5 | 106 | 42 | 27.5 | 32.5 | 1x 35 | 68 | 116 | 8.5 | M5 | 11 | 46 | 1.47 |
| US - 6175 | 175 | | | | | | 37.5 | 2x50 | | | | | | | 2.58 |
| US - 9150 | 150 | 199 | 159 | 166 | 60 | 39 | 45 | 1x60 | 110 | 177 | 11 | M6 | 14 | 78 | 4.74 |
| US - 9250 | 250 | | | | | | | 2x75 | | | | | | | 7.90 |
| US - 12200 | 200 | 249 | 159 | 203 | 69 | 49 | 60 | 1x80 | 127 | 223 | 14 | M8 | 17 | 83 | 9.68 |
| US - 12300 | 300 | | | | | | | 2x90 | | | | | | | 14.53 |
| US - 15250 | 250 | 299 | 159 | 253 | 86 | 66 | 75 | 1x100 | 157 | 273 | 18 | M10 | 19 | 103 | 19.88 |
| US - 15350 | 350 | | | | | | | 2x100 | | | | | | | 27.83 |

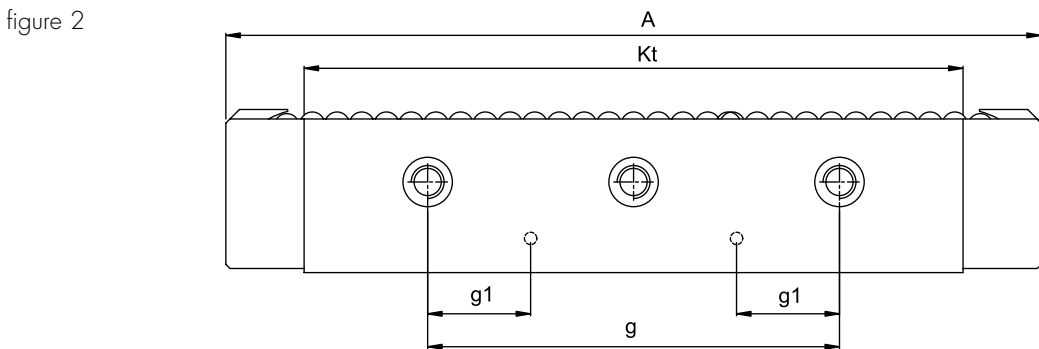
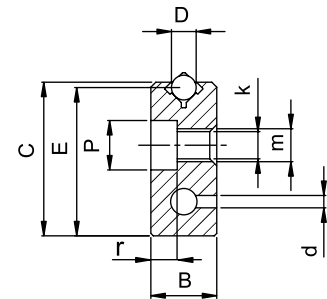
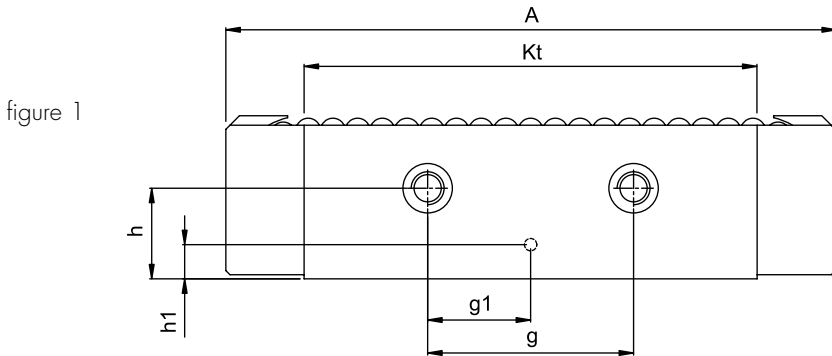
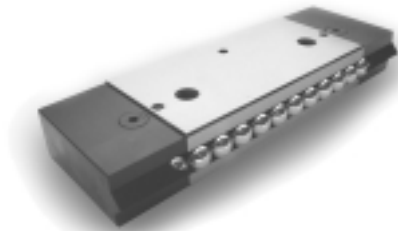
* in combination with baseplate UT

| | | | | |
|-------------------|-----------|-------------|---|----------------------------|
| Ordering example: | Type | Size | x | Options MP (matched pairs) |
| | US | 3075 | - | - |



Recirculating Units
Sizes 2-15

UK
Ball type



Units: mm

| Type + size | A | B | C | D | E | Kt | d | g | g1 | h | h1 | k | m | p | r | Cdyn (N) | Weight in g |
|-------------|-------|----|-------|----|----|-----|-----|--------|--------------------|----|------|------|-----|------|------|----------|-------------|
| UK- 2040 | 39 | 6 | 11.42 | 2 | 11 | 26 | 1 | 1x 15 | 7.5 | 7 | 3 | 2.5 | M3 | 4.3 | 2.2 | 294 | 15 |
| UK- 2060 | 59 | | | | | 46 | | 2x 15 | 7.5 ¹⁾ | | | | | | | 504 | 25 |
| UK- 3075 | 73 | 8 | 18.65 | 3 | 18 | 53 | 1.5 | 1x 25 | 12.5 | 11 | 4 | 3.3 | M4 | 6 | 3.2 | 540 | 60 |
| UK- 3100 | 99 | | | | | 78 | | 2x 25 | 12.5 ¹⁾ | | | | | | | 810 | 85 |
| UK- 6100 | 98.5 | 15 | 31.25 | 6 | 30 | 60 | 2 | 1x 35 | 17.5 | 19 | 8.25 | 5.2 | M6 | 9.5 | 5.2 | 858 | 220 |
| UK- 6175 | 172 | | | | | 138 | | 2x 50 | 25 ¹⁾ | | | | | | | 1872 | 490 |
| UK- 9150 | 149.5 | 22 | 45.80 | 9 | 44 | 99 | 3 | 1x 60 | 30 | 28 | 12 | 6.8 | M8 | 11 | 6.8 | 1800 | 730 |
| UK- 9250 | 248.5 | | | | | 198 | | 2x 75 | 37.5 ¹⁾ | | | | | | | 3450 | 1520 |
| UK- 12200 | 199 | 28 | 62.50 | 12 | 60 | 120 | 3 | 1x 85 | 42.5 | 38 | 16 | 8.5 | M10 | 13.5 | 8.5 | 2860 | 1570 |
| UK- 12300 | 299 | | | | | 216 | | 2x 90 | 45 ¹⁾ | | | | | | | 4940 | 2930 |
| UK- 15250 | 249 | 36 | 77.80 | 15 | 75 | 147 | 3 | 1x 100 | 50 | 48 | 20 | 10.3 | M12 | 16.5 | 10.3 | 4200 | 3190 |
| UK- 15350 | 349 | | | | | 247 | | 2x 100 | 50 ¹⁾ | | | | | | | 7140 | 5390 |

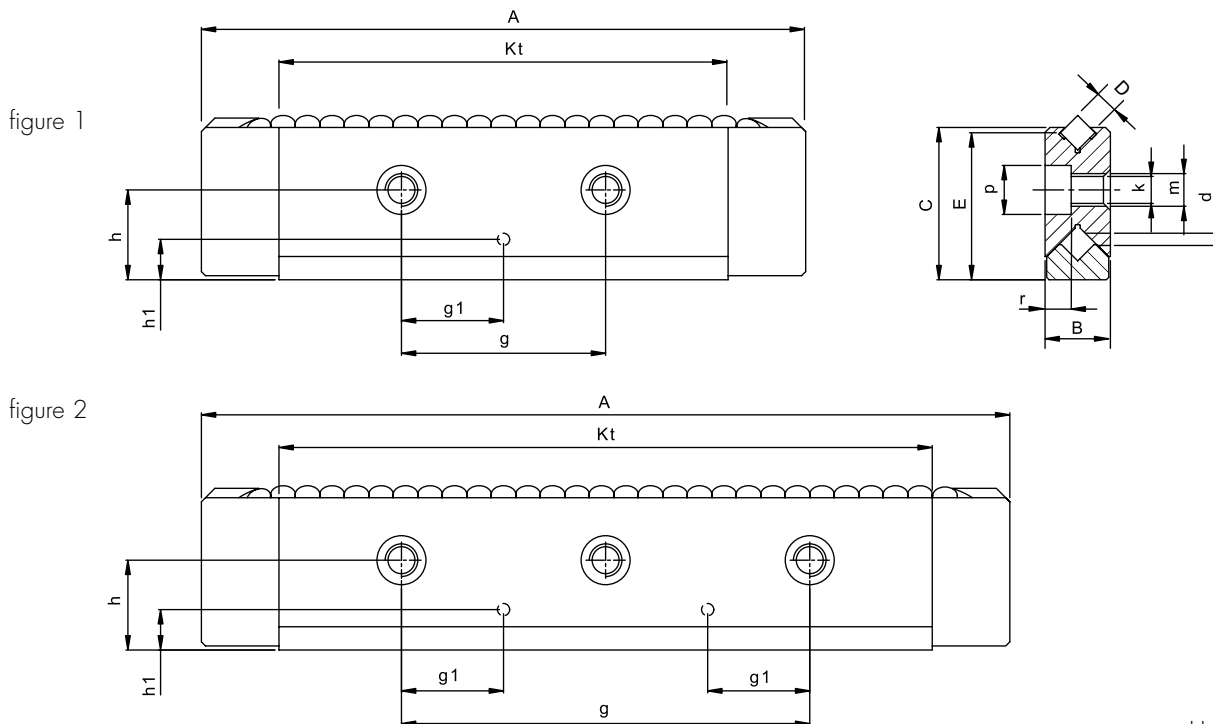
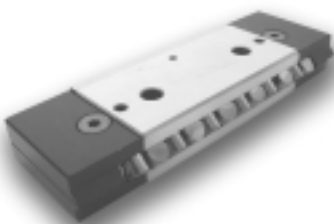
¹⁾ figure 2: UK-2060, UK-3100, UK-6175, UK-9250, UK-12300, UK-15350

| | | | | |
|-------------------|-----------|-------------|---|----------------------------|
| Ordering example: | Type | Size | x | Options MP (matched pairs) |
| | UK | 3075 | - | - |



UR
Crossed Roller type

Recirculating Units
Sizes 3-15



Units: mm

| Type + size | A | B | C | D | E | Kt | d | g | g1 | h | h1 | k | m | p | r | Cdyn (kN) | Weight in g |
|-------------|-------|----|-------|----|----|-----|-----|--------|--------------------|----|------|------|-----|------|------|-----------|-------------|
| UR- 3075 | 74 | 8 | 18.65 | 3 | 18 | 53 | 1.5 | 1x 25 | 12.5 | 11 | 4 | 3.3 | M4 | 6 | 3.2 | 1.2 | 53 |
| UR- 3100 | 98 | | | | | 78 | | 2x 25 | 12.5 ¹⁾ | | | | | | | 1.8 | 83 |
| UR- 6100 | 98.5 | 15 | 31.25 | 6 | 30 | 61 | 2 | 1x 35 | 17.5 | 19 | 8.15 | 5.2 | M6 | 9.5 | 5.2 | 5.7 | 235 |
| UR- 6175 | 172 | | | | | 133 | | 2x 50 | 25 ¹⁾ | | | | | | | 6.2 | 511 |
| UR- 9150 | 150 | 22 | 45.80 | 9 | 44 | 90 | 3 | 1x 60 | 30 | 28 | 12 | 6.8 | M8 | 11 | 6.8 | 7.4 | 756 |
| UR- 9250 | 249.9 | | | | | 189 | | 2x 75 | 37.5 ¹⁾ | | | | | | | 14.9 | 1.550 |
| UR- 12200 | 200 | 28 | 62.50 | 12 | 60 | 110 | 3 | 1x 85 | 42.5 | 38 | 16 | 8.5 | M10 | 13.5 | 8.5 | 12.8 | 1.720 |
| UR- 12300 | 296 | | | | | 206 | | 2x 90 | 45 ¹⁾ | | | | | | | 23 | 3.100 |
| UR- 15250 | 244 | 36 | 77.80 | 15 | 75 | 140 | 3 | 1x 100 | 50 | 48 | 20 | 10.3 | M12 | 16.5 | 10.3 | 22.5 | 3.680 |
| UR- 15350 | 349 | | | | | 245 | | 2x 100 | 50 ¹⁾ | | | | | | | 38.3 | 5.600 |

¹⁾ figure 2: UR-3100, UR-6175, UR-9250, UR-12300, UR-15350

Ordering example: Type Size x Options MP (matched pairs)
UR 3075 - -

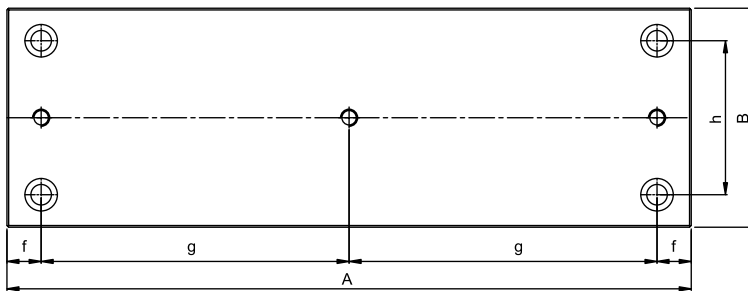


Baseplate

UT
Sizes 2, 3, 6, 9, 12, 15



figure 1



Units: mm

| Type + size | B | C | D | f | g | g1 | h | k | m | p | r | Weight per g/mm |
|-------------|------|-----|----|----|----|-----|------|-----|-----|-----|------|-----------------|
| UT - 2 | 39 | 6.5 | 2 | 10 | 40 | 50 | 28 | 4.8 | M4 | 7.8 | 4.1 | 2.6 |
| UT - 3 | 64 | 9 | 3 | 10 | 40 | 50 | 45 | 6 | M5 | 9.5 | 5.1 | 4.4 |
| UT - 6 | 99.5 | 14 | 6 | 15 | 35 | 50 | 70.5 | 9 | M8 | 14 | 8.3 | 10.5 |
| UT - 9 | 159 | 19 | 9 | 25 | 75 | 100 | 110 | 13 | M12 | 19 | 12.5 | 23.1 |
| UT - 12 | 159 | 19 | 12 | 25 | 75 | 100 | 110 | 13 | M12 | 19 | 12.5 | 23.1 |
| UT - 15 | 159 | 19 | 15 | 25 | 75 | 100 | 134 | 13 | M12 | 19 | 12.5 | 23.1 |

| Type + size | Standaard length A (figure) |
|-------------|--|
| UT - 2 | 100 (1), 150 (2), 200 (3), 300 (3), 400 (3), 500 (3) |
| UT - 3 | 200 (3), 300 (3), 400 (3), 500 (3), 600 (3), 700 (3), 800 (3), 900 (3), 1000 (3), 1100 (3), 1200 (3) |
| UT - 6 | 300 (4), 400 (4), 500 (4), 600 (4), 700 (4), 800 (4), 900 (4), 1000 (4), 1100 (4), 1200 (4) |
| UT - 9 | 400 (3), 500 (2), 600 (3), 700 (2), 800 (3), 900 (2), 1000 (3), 1100 (2), 1200 (3) |
| UT - 12 | 500 (2), 600 (3), 700 (2), 800 (3), 900 (2), 1000 (3), 1100 (2), 1200 (3) |
| UT - 15 | 600 (3), 700 (2), 800 (3), 900 (2), 1000 (3), 1100 (2), 1200 (3) |
| | Other lengths on request |

Ordering example: Type Size x Length
UT 3 x 600



UT
Sizes 2, 3, 6, 9, 12, 15

Baseplate

figure 2

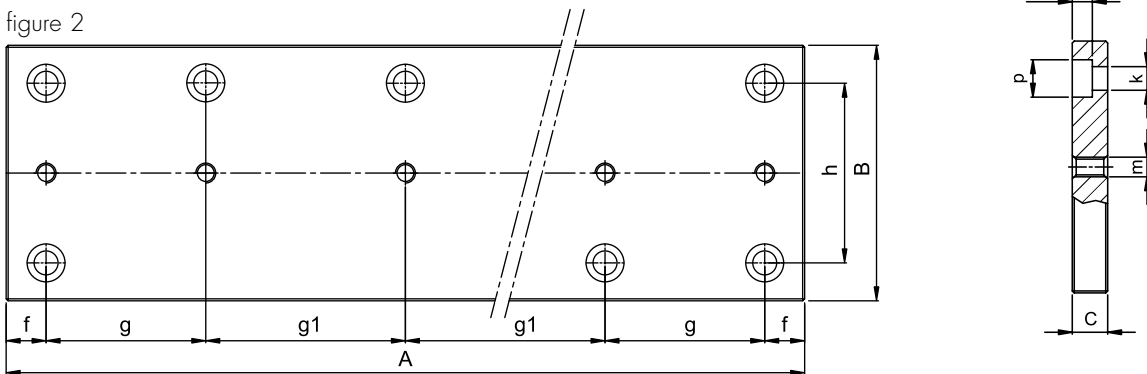


figure 3

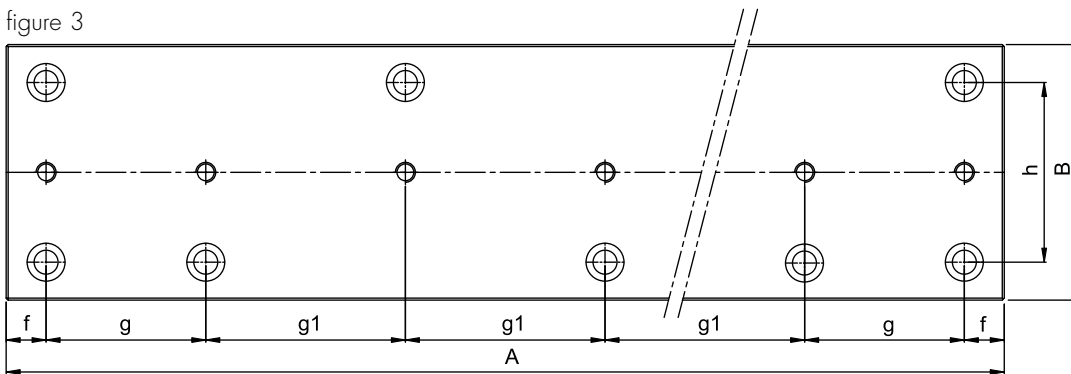
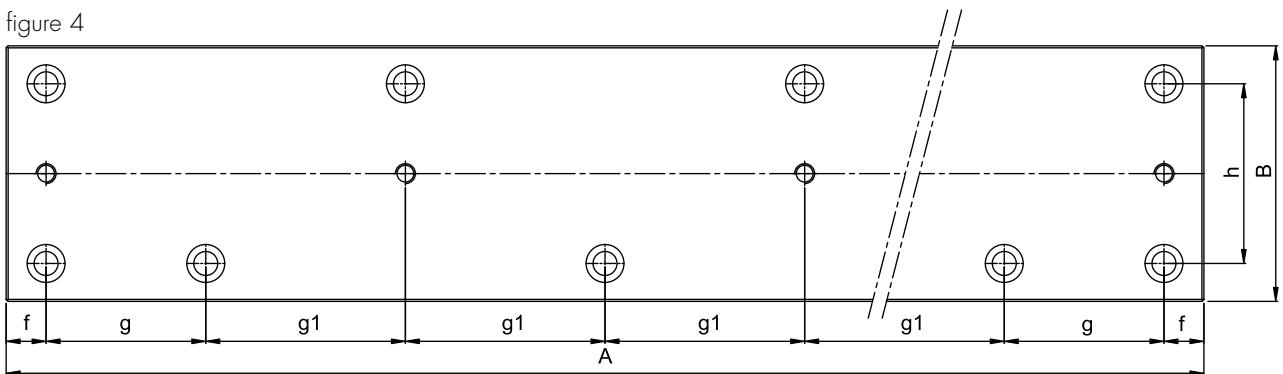


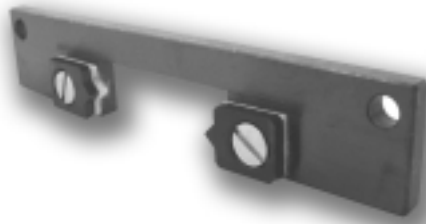
figure 4



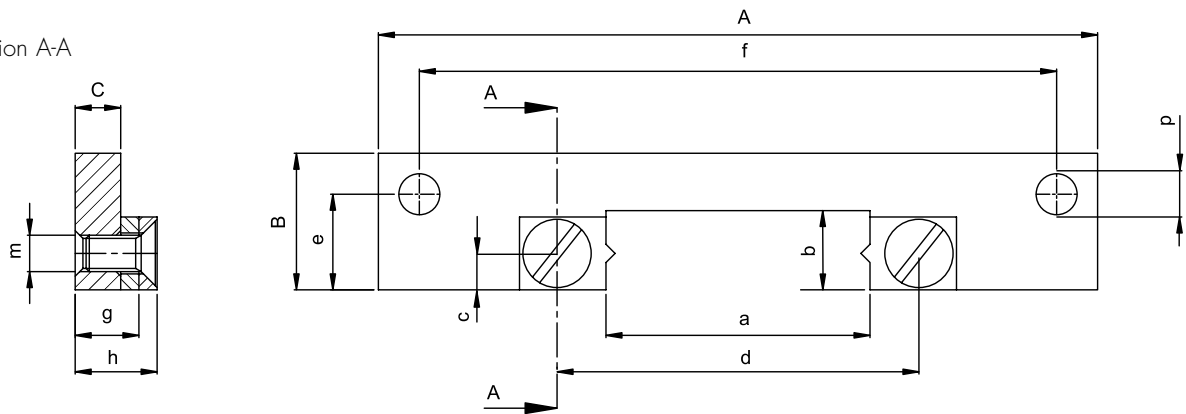


Endseals

U-type
sizes 3, 6, 9, 12, 15



Section A-A



Units: mm

| Type + size | A | B | C | a | b | c | d | e | f | g | h | m | p | Weight in g |
|-------------|-----|----|----|------|------|------|-------|------|-----|---|------|-----|-----|-------------|
| U - 3 | 79 | 15 | 5 | 29 | 9 | 4 | 39.75 | 10.5 | 70 | 3 | 10.2 | M3 | 4.5 | 40 |
| U - 6 | 128 | 25 | 6 | 43.5 | 15.7 | 7.5 | 63 | 19 | 116 | 3 | 12.2 | M5 | 5.7 | 130 |
| U - 9 | 197 | 37 | 8 | 74 | 23.3 | 10.5 | 102.2 | 28 | 177 | 3 | 15.2 | M6 | 7 | 365 |
| U - 12 | 247 | 47 | 10 | 77.6 | 29.3 | 14 | 115 | 35 | 223 | 3 | 18.2 | M8 | 9 | 860 |
| U - 15 | 297 | 64 | 12 | 96.6 | 37.3 | 18 | 142 | 48 | 273 | 3 | 21.3 | M10 | 11 | 1680 |

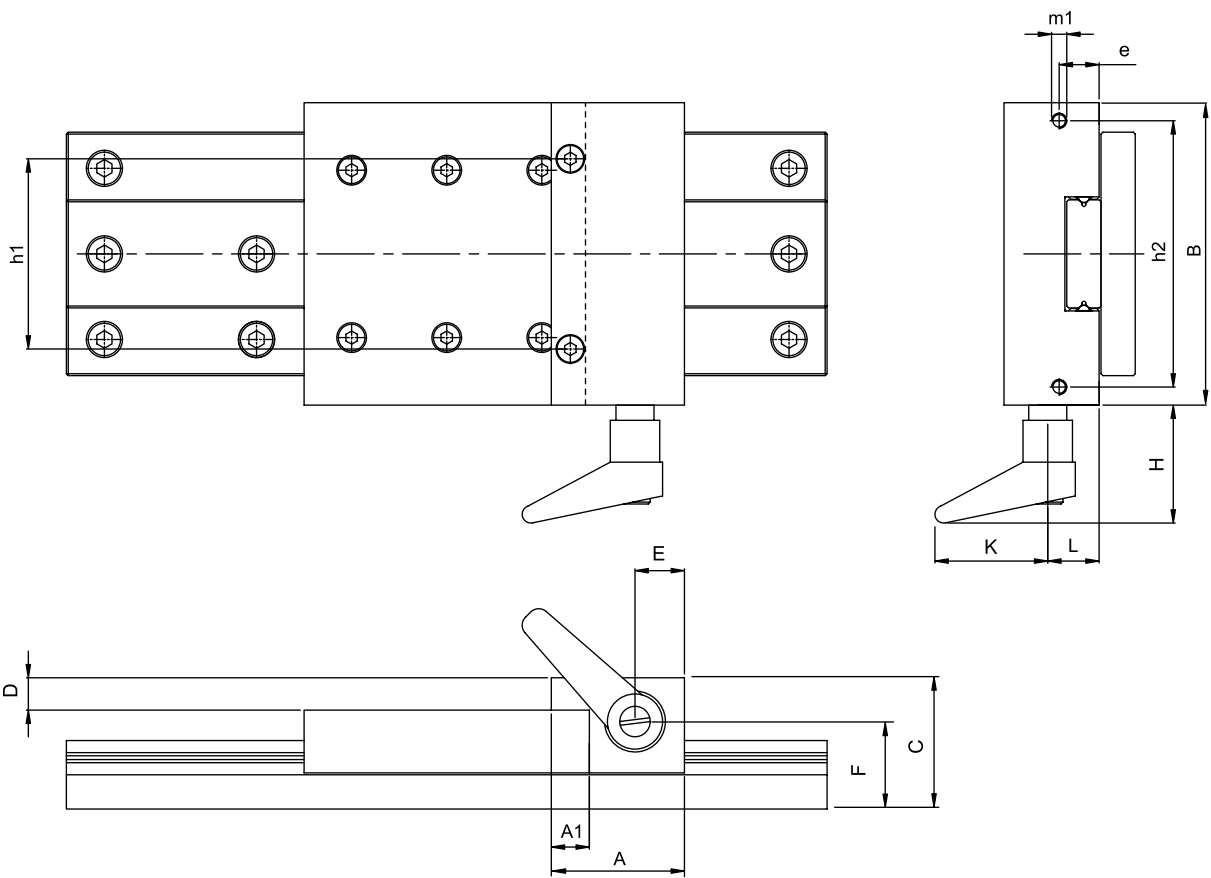
Ordering example: Type - Size

U - 3



KDS
sizes 3, 6, 9

Clamping Device



Units: mm

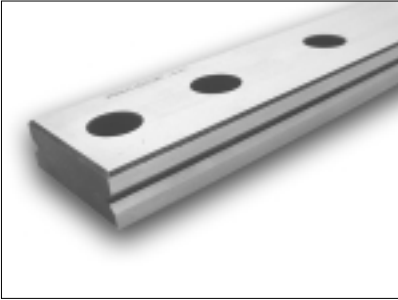
| Type + Size | A | B | C | A1 | D | E | F | H | h1 | h2 | K | L | e | m1 | Weight in g |
|-------------|----|-------|------|----|------|----|------|----|-----|-----|----|------|------|----|-------------|
| KDS - 3 | 35 | 79.5 | 34.5 | 10 | 8.5 | 13 | 22.5 | 31 | 50 | 70 | 40 | 13.5 | 10.5 | M4 | 265 |
| KDS - 6 | 45 | 129.5 | 52.5 | 12 | 10.5 | 18 | 36 | 47 | 90 | 116 | 65 | 21.5 | 19 | M5 | 830 |
| KDS - 9 | 55 | 199 | 72 | 15 | 12 | 21 | 51 | 59 | 180 | 177 | 80 | 30 | 28 | M6 | 1210 |

Ordering example: Type - Size
KDS - 3

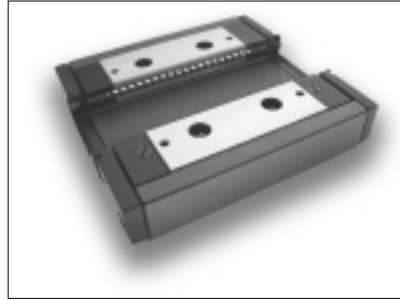
Overview Accessoires

DS-UT

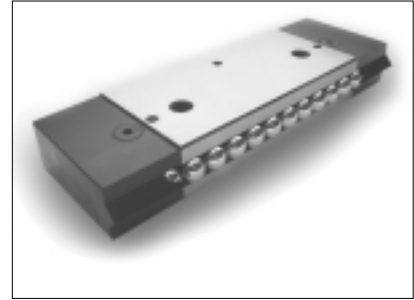
Trackrail DS



Rollertable US



Recirculating unit UK/UR



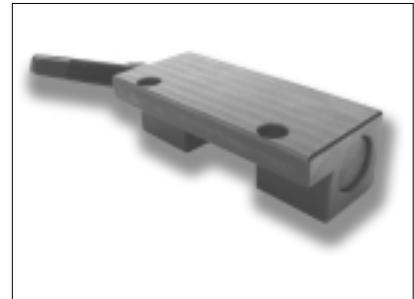
Baseplate UT



Endseals U



Clamping device KDS



| Rail DS Page 32 | Table US Page 33 | Recirculating units UK/UR Page 34/35 | Baseplate UT Page 36 | End seal U Page 38 | Clamping device KDS Page 39 |
|--------------------|----------------------|--|-------------------------|-----------------------|--------------------------------|
| DS-2 | US-2040 US-2060 | UK-2040 UK-2060 | n.a. | n.a. | n.a. |
| DS-3 | US-3075 US-3100 | UK-3075 / UR-3075 UK-3100 / UR-3100 | UT-3 | U-3 | KDS-3 |
| DS-6 | US-6100 US-6150 | UK-6100 / UR-6100 UK-6150 / UR-6150 | UT-6 | U-6 | KDS-6 |
| DS-9 | US-9150 US-9250 | UK-9150 / UR-9150 UK-9250 / UR-9250 | UT-9 | U-9 | KDS-9 |
| DS-12 | US-12200 US-12300 | UK-12200 / UR-12200 UK-12300 / UR-12300 | UT-12 | U-12 | n.a. |
| DS-15 | US-15250 US-15350 | UK-15250 / UR-15250 UK-15350 / UR-15350 | UT-15 | U-15 | n.a. |

n.a.: not available



8. Heavy-Duty Guideway Needle roller type

PNUA



PNUA linear guides are designed to support extremely heavy loads, while ensuring a great rigidity and high degree of precision travel in linear direction. PNUA guides are originally created for the machine tool industry but also successful in many other applications as grinding machines, electro-discharge machines and stamping presses. In applications where roller guides are pushed to their limits or in places where space is limited PNUA compact needle roller guides have proven their superior performance.

Material

Specifications are listed at page 42 for the components.

Structure and Features

- **Greater permissible load ratings**
Due to a **longer effective line contact** and the **X-arrangement** of the needle roller units they can carry extremely high loads and moment loadings in all directions.
- **Field maintenance / components separate to order**
Individual components such as recirculating units, track rails and wipers can be replaced in the field. They can be ordered separately.
- **Full complement of needles/highest rigidity**
PNUA needle roller guides are robust designed and only available with full complement of needle rollers which combines a maximum loading capacity with maximum rigidity.
- **Adjustability**
The use of individual bearings permits tuning of the bearing preload in the field for different operation conditions and machine application.
- **Ultra high precision accuracy upto $\pm 0.0025\text{mm}$**
PNUA linear guides are available in two high precision accuracy classes Q10 and Q5. Q10 is used in general machine purpose as machine centers, milling machines and stamping presses as Q5 accuracy is ideal for ultra-high precision devices as inspection scanning equipment and semiconductor equipment.

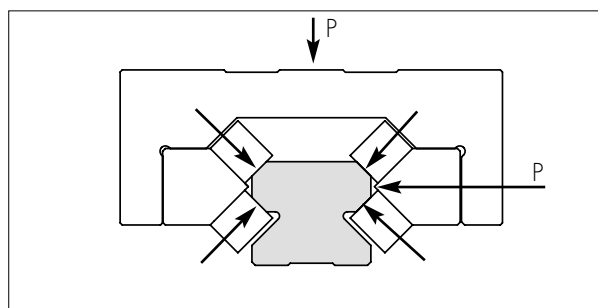
Options

- Ultra High Precision Class Q5
- Matched pairs
- Multi-section guides (length $A > 1400\text{ mm}$)
- Preload classes V2, V3
- Endwipers PMA

Notes by Ordering

By ordering please check that quantity and partnumber (page 43) is correctly mentioned.

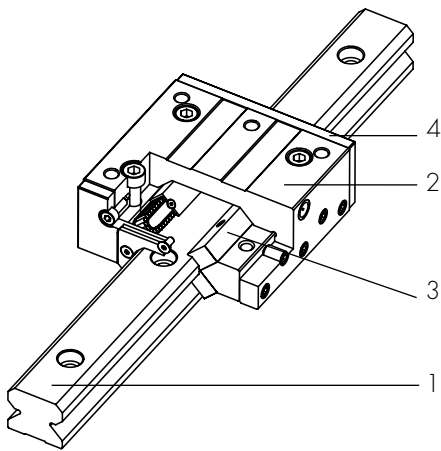
X-arrangement of needle rollers



P: applied load



Recirculating Systems PNUA needle roller type



PNUA linear guides are designed to support extremely high loads, while ensuring maximum rigidity and high degree of precision in every orientation. PNUA guides are originally created for the machine tool industry but also used in many other applications as grinding machines and stamping presses.

PNUA needle roller bearings are designed so that they can carry extremely high loads and moment loadings in all directions due to the **X-arrangement** of the needle rollers.

In cases of $A > 1400\text{mm}$ we supply multi section lengths which are matched together and marked accordingly.

PNUA tables consisting of one 4-row rail, one table, two recirculating cassettes (per cassette two recirculating units) and depending on the operation conditions two endseals.

No. 1. PMR 4-row Trackrail (page 44)

PMR rails are 4-row precision guides providing space-saving solutions. They are manufactured from high quality bearing steel 1.2842, through hardened $60 \pm 2\text{Hrc}$. PMR rails can be bolted down into the application. They are available in 3 sizes and several standard lengths.

No.2 PMT Table (page 45)

PMT tables are used to attach and preload the recirculating units to the PMR rails. They are made cast iron offering excellent damping characteristics. The tables include standard countersunk attachment holes for the recirculating units and 6 threaded holes. Tables are precision ground and provide space-saving solutions. The lateral adjustment holes are to install the preload screws.

For higher loads we can supply longer carriages so that two units can mount the one behind another. Tables are equipped with lubrication ports for relubrication from the side.

No. 3 PNE – Recirculating Units (page 48)

PNE recirculating units are double row needle roller bearings for high to extremely high loads.

They can be used in every orientation. The main body in made of high quality bearing steel 1.2842 and through hardened at $60 \pm 2\text{Hrc}$ and precision ground. The special designed return offers extremely smooth running characteristics without skewing. All needles are retained to prevent them from dropping out.

No. 4 PMA Endseals

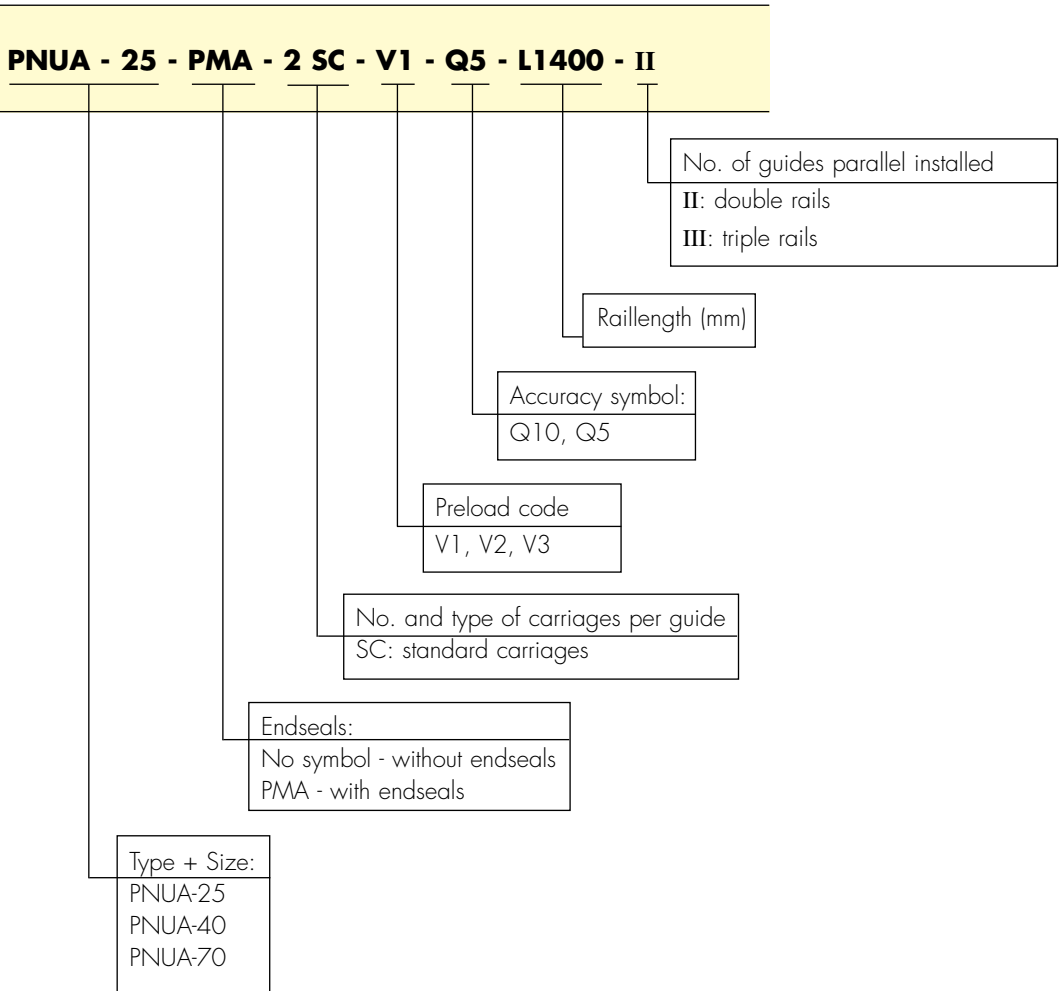
PMA endseals are an effective and economical solution to protect the PNUA-guides in operations where dust, dirt and other contamination are present. They are installed on both the front- and backside of the PMT table and during travel they are cleaning the running surfaces grooves and the rail uppersurface. PMA endseals increase the operational reliability even under the most strenghthen conditions.

For other sealing requirements please consult PM.



Ordering PNUA Linear Guide System "Ready-to-Install"

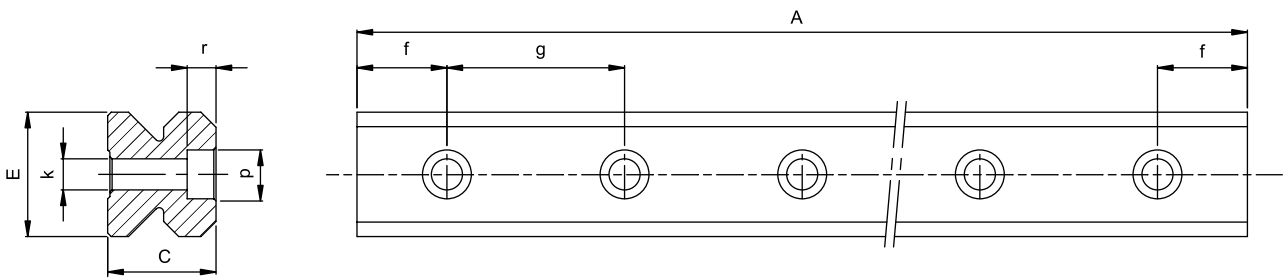
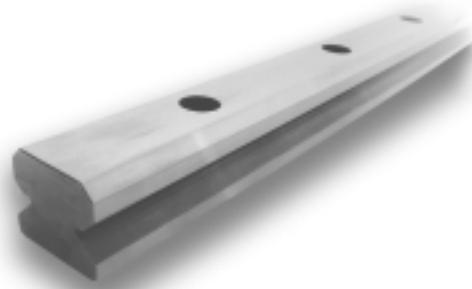
Modelnumber of **PNUA** series





4 Row - Trackrail

PMR
sizes 25, 40, 70



Units: mm

| Type + size | C | E | g | k | p | r | weight g/100mm |
|-------------|------|----|-----|-----|----|-----|----------------|
| PMR - 25 | 24.4 | 28 | 80 | 6.8 | 11 | 6.5 | 450 |
| PMR - 40 | 36 | 45 | 105 | 9 | 14 | 8.5 | 1090 |
| PMR - 70 | 50 | 63 | 150 | 14 | 20 | 14 | 1530 |

| Type + size | Standard rail length A (starting- and endhole pitch f) |
|-------------|---|
| PMR - 25 | 300 (30), 400 (40), 500 (50), 600 (20), 700 (30), 800 (40), 900 (50), 1000 (20), 1100 (30), 1200 (40) |
| PMR - 40 | 300 (45), 400 (42.5), 500 (40), 600 (37.5), 700 (35), 800 (32.5), 900 (30), 1000 (27.5), 1100 (25), 1200 (22.5) |
| PMR - 70 | 300 (75), 400 (50), 500 (25), 600 (75), 700 (50), 800 (25), 900 (75), 1000 (50), 1100 (25), 1200 (75) Other lengths on request |

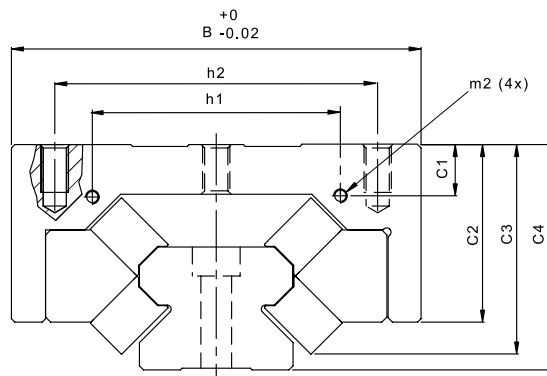
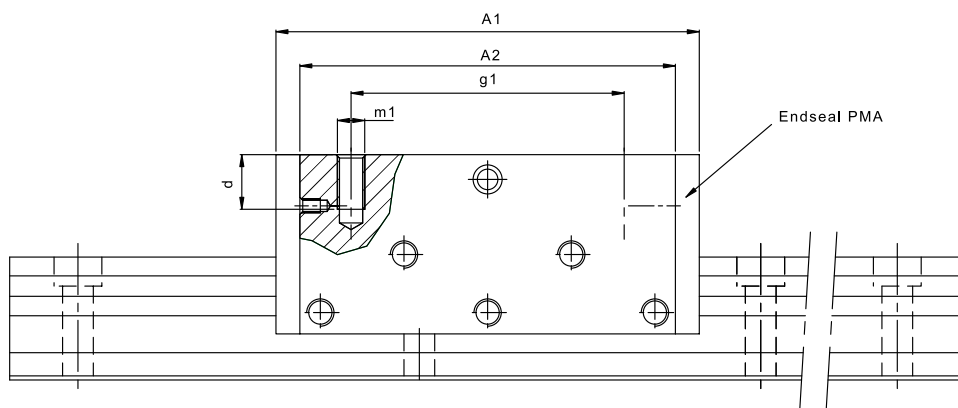
Ordering example: Type - Size x Length - Accuracy grade

PMR - 25 x 800 - Q5



PMT
sizes 25, 40, 70

Carriage Table



Units: mm

| Type + size | A1 | B | C4 | A2 | C1 | C2 | C3 | g1 | h1 | h2 | m1xd | m2 | Weight in g |
|-------------|-----|-----|----|-----|----|------|------|-----|-----|-----|--------|----|-------------|
| PMT-25 | 92 | 90 | 46 | 78 | 12 | 36.5 | 43 | 60 | 58 | 72 | M6x12 | M4 | 890 |
| PMT-40 | 124 | 120 | 66 | 110 | 15 | 52 | 61.5 | 80 | 90 | 100 | M8x15 | M4 | 2045 |
| PMT-70 | 164 | 175 | 90 | 150 | 20 | 71.5 | 85 | 110 | 120 | 150 | M12x20 | M6 | 2860 |

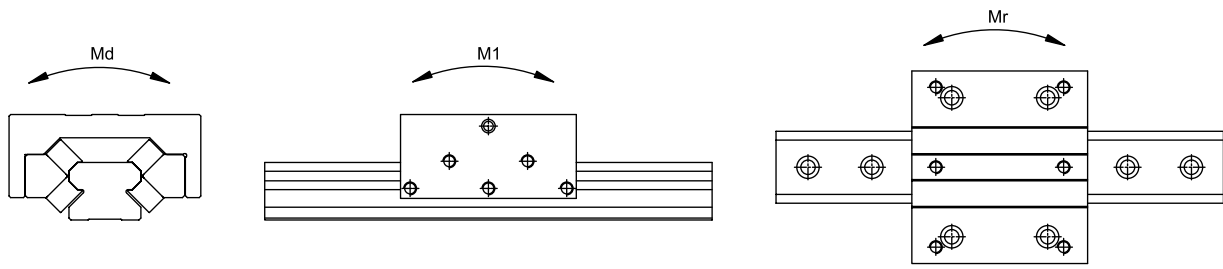
Ordering example: Type - Size x Options MP (matched pairs)

PMT - 25 - -



Carriage Table

PMT
sizes 25, 40, 70



Units: mm

| Type + size | Load capacity (kN) | | Static moments (N.m) | | | Weights (kg) | |
|-------------|--------------------|-----|----------------------|------|------|--------------|----------|
| | C | Co | Md | Ml | Mr | Carriage | PNE unit |
| PMT- 25 | 30 | 100 | 180 | 450 | 180 | 890 | 260 |
| PMT- 40 | 88 | 291 | 370 | 1500 | 370 | 2045 | 745 |
| PMT- 70 | 175.5 | 580 | 1200 | 3450 | 1200 | 2860 | 1245 |

Overview Accessoires

Trackrail PMR

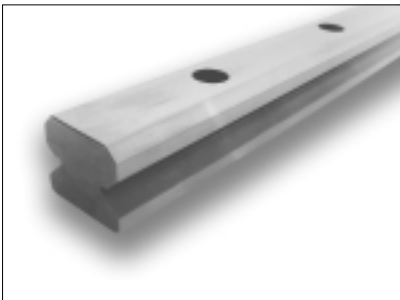


Table PNUA



Recirculating unit PNE



Ordering information:

Per PMT carriages are two needle cassetes PNE needed.
One cassette include 2 needle recirculating units.

The size of the cassetes are direct related to the size of the carriage table and rail guide.

| Type + size | Carriage table type + size | Suitable for Rail guide type + size | Endseal type + size |
|-------------|----------------------------|-------------------------------------|---------------------|
| PNE-25 | PMT-25 | PMR-25 | PMA-25 |
| PNE-40 | PMT-40 | PMR-40 | PMA-40 |
| PNE-70 | PMT-70 | PMR-70 | PMA-70 |



9. Heavy Duty Trackrail

PSD



The new PSD trackrails from PM in combination with needle roller recirculating units are used in applications to replace the standard configuration of two linear guideways with carriages which are used in a parallel configuration. The two-row needle roller recirculating units model PNE is a standard taken from the PNUA guide carriage for ultra-high loadings. With this new configuration of needle roller unit and trackrail PSD, PM is providing a technologically pioneering solution for compact and high load applications.

Material

Bearing steel No. 1.2842, through hardened 60 +/-2Hrc.

Structure and Features

■ Ultra Compact designed

The compact trackrail in combination with the needle roller unit is developed for limited space applications where high load and moment loads are often present. The needle unit, as a standard taken from the PNUA needle roller assembly, can be directly attached into the machine table and eliminate so the use of a standard carriage. This mounting saves money and improves the stiffness.

■ In every mounting orientation

Since PSD trackrails can be used with PNE needle units they can be used in every orientation, eliminating the risk of cage creep.

■ Improved load ratings

In comparison to the commonly used roller guides, needle roller recirculating units can offer about 50% more stiffness. Through the innovating design of the two-row needle units, arranged at a 45° angle, it can support loads equally in all directions.

■ Ultra high precision accuracy upto +/-0.002mm

PSD trackrails are available in three high precision accuracy classes Q10, Q5 and Q2. Q10 is used general machine purpose as machine centers, milling machines and stamping presses as Q5 accuracy is ideal for ultra-high precision devices as inspection scanning equipment and semiconductor equipment.

Options

- Ultra High Precision Class Q2
- Matched pairs
- Multi-section guides (length A>1400mm)

Special

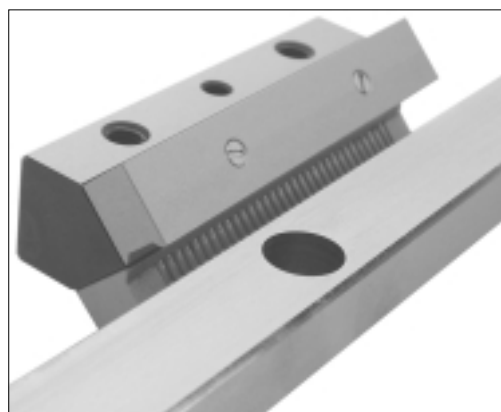
The trackguides can be custom made.

Notes by ordering

By ordering please specify the following:

1. Quantity and type of trackrail.

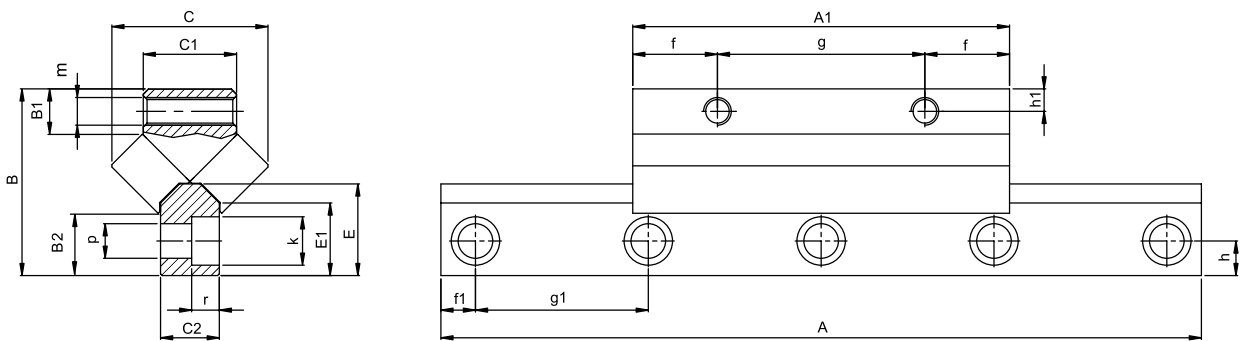
Trackrail PSD with needle units PNE.





Heavy Duty Trackrail

PSD
size 25, 40, 70



Units: mm

| Type + size | A1 | B | B1 | B2 | C | C1 | C2 | E | E1 | f | g | g1 | m | h | h1 | k | p | r |
|-------------|-----|----|----|------|------|----|----|------|------|------|-----|-----|-----|----|-----|-----|----|----|
| PSD- 25 | 77 | 40 | 11 | 13 | 30.5 | 18 | 12 | 19 | 15.5 | 16 | 45 | 80 | M6 | 8 | 6 | 6.8 | 11 | 8 |
| PSD- 40 | 109 | 54 | 13 | 18 | 45.5 | 27 | 17 | 26.5 | 21 | 24.5 | 60 | 105 | M8 | 10 | 6.5 | 9 | 14 | 10 |
| PSD- 70 | 149 | 80 | 24 | 23.7 | 65.5 | 39 | 24 | 38.5 | 31 | 24.5 | 100 | 150 | M12 | 15 | 12 | 14 | 20 | 14 |

| Type + size | Standard rail length A (starting- and endhole pitch f) |
|-------------|---|
| PSD - 25 | 300 (30), 400 (40), 500 (50), 600 (20), 700 (30), 800 (40), 900 (50), 1000 (20), 1100 (30), 1200 (40) |
| PSD - 40 | 300 (45), 400 (42.5), 500 (40), 600 (37.5), 700 (35), 800 (32.5), 900 (30), 1000 (27.5), 1100 (25), 1200 (22.5) |
| PSD - 70 | 300 (75), 400 (50), 500 (25), 600 (75), 700 (50), 800 (25), 900 (75), 1000 (50), 1100 (25), 1200 (75) Other lengths on request |

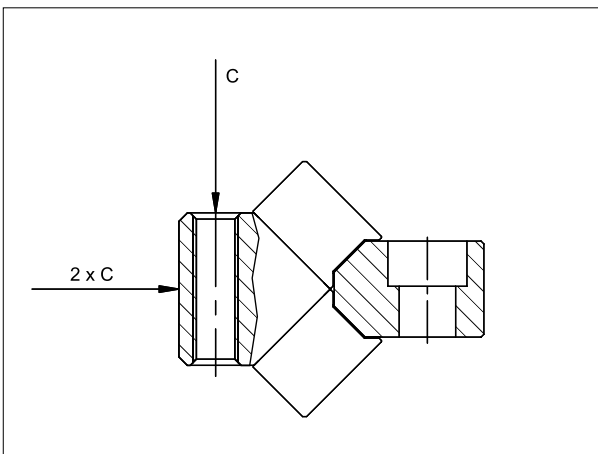
Ordering example: Type - Size x Length - Accuracy grade
PSD - 25 x 800 - Q8



Heavy Duty Trackrail

PSD
size 25, 40, 70

Load ratings



| Recirculator type | Load capacity (kN) | | Weight g | To be used with trackrail size |
|-------------------|---------------------------------|-------------------------------|-------------|--------------------------------------|
| | C _{dyn} ⁽¹⁾ | C _o ⁽¹⁾ | | |
| PNE-25 | 35 | 118 | 260 | PSD- 25 |
| PNE-40 | 80 | 264 | 745 | PSD- 40 |
| PNE-70 | 157 | 519 | 1245 | PSD- 70 |

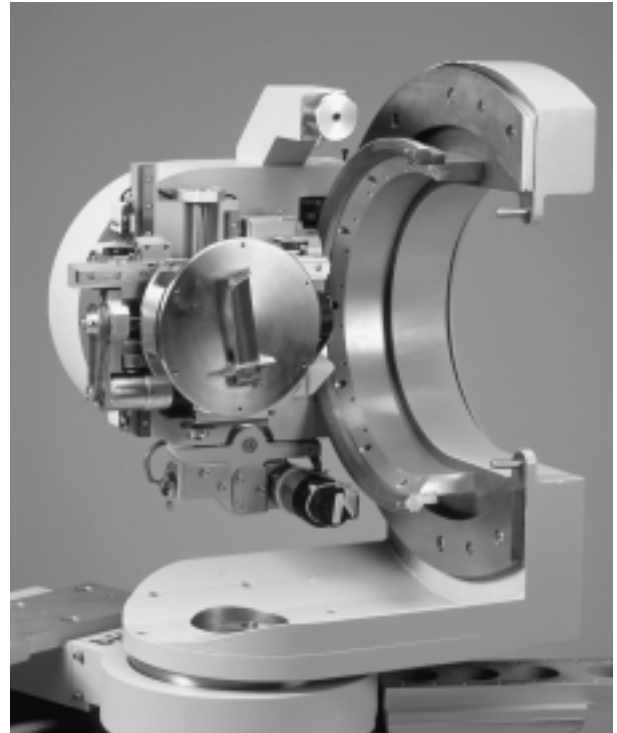
- 1) Load rating for one unit
Ratings are defined by the screwed connection
Ratings refer to the rolling elements



10. Special Customer Design

At PM, we are able to supply linear bearings, frictionless slides and positioning tables to your specific application requirements. Relying on long history experience, know-how and manufacturing capabilities, our product engineers are able to design the most technical and economical solutions according to your demands, even when they're extreme. Special customer designed slides can be delivered within 6 weeks after approval.

Please, feel free to contact one of our product specialists for more information.



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