SKF

Linear Motion

SKF Miniature Profile Rail Guides

www.bergab.ru Берг АБ bergab@ya.ru Тел. (495)-228-06-21, факс (495) 223-3071

The SKF Group

The SKF Group is an international industrial corporation of AB SKF Sweden, founded in 1907, operating in 130 countries. The company has some 45000 employees and more than 80 manufacturing facilities throughout the world.
Its international network is supported up by nearly 20000 distributors and retailers. SKF is the world leader in the rolling bearing business.
Bearings, seals and special steels are SKF's main product areas. In addition, they also manufacture and sell, other industrial precision components and products.

SKF Linear Motion

One of these industrial precision products assortment is manufactured and sold by the SKF Linear Motion Division.
This unit has some 700 employees, 6 manufacturing facilities, 3 product lines. One of the division's strengths is its ability to serve the market through its organization based on 11 specialized Sales Companies located in Europe and North America; however product availability and product application support is provided word-wide by the SKF international network.

The Linear Motion product range covers:
- High Efficiency Screws
- Linear Guiding Systems
- Electromechanical Actuators

CD-ROM "Designer"

All linear Motion products are available in this CD, in DWG and DXF files.
Thanks to "Designer", you can easily copy the drawing of the product you need into your own design drawing. If you are interested, please do not hesitate to contact your local SKF sales organization. It is free of charge.

Catalogue n° 4753 E / VII
3000 · 2002-03

Printed in Germany
by Weppert GmbH & Co. KG

Earlier catalogues the data in which deviate from those given here, are rendered invalid.
The right is reserved to make changes necessitated by technological developments.

www.bergab.ru Берг АБ bergab@ya.ru Тел. (495)-228-06-21, факс (495) 223-3071

www.bergab.ru Берг АБ bergab@ya.ru Тел. (495)-228-06-21, факс (495) 223-3071

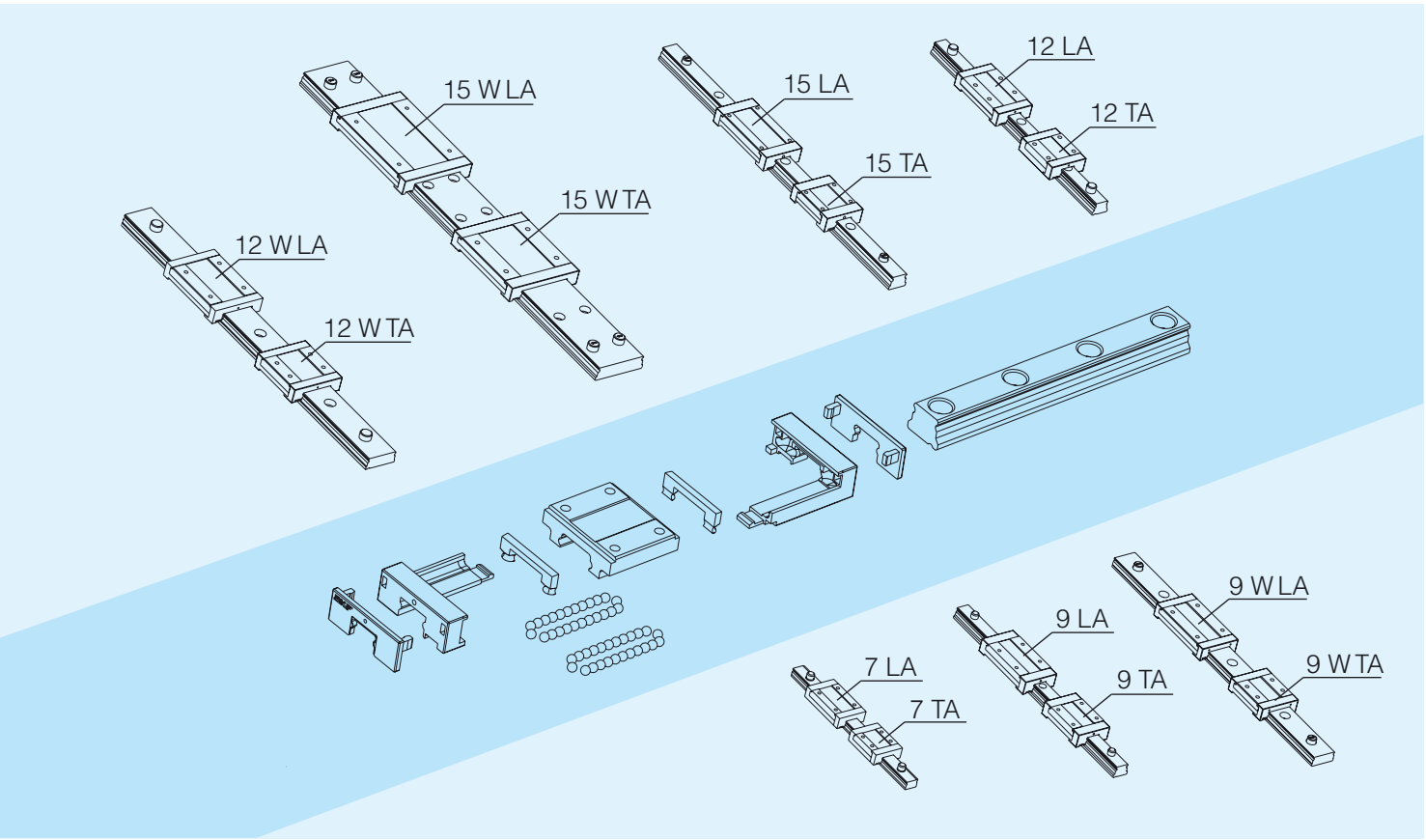
In response to the market trend for increased performance with a minimum of mounting space, SKF has extended its product range by a miniature profile rail guide.

The close cooperation with numerous customers combined with SKF's experience has resulted in a miniature rail guide design that sets new standards.

SKF offers its customers an excellent technical advisory service on the spot as well as a vast modular range for the performance increase of machines and installations.

In total SKF offers seven rail sizes and fourteen different types of carriages (see Illustration 1).

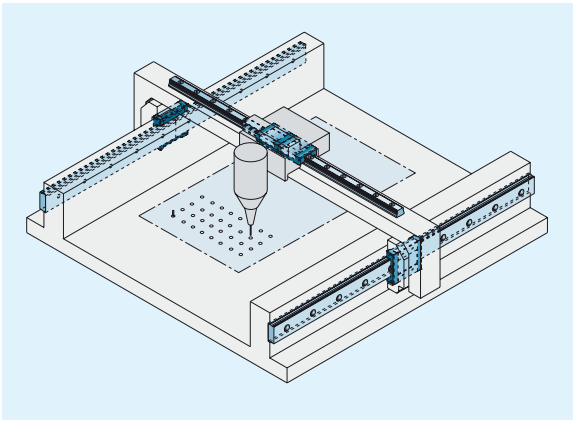
Miniature profile rails are universally applicable and preferably used in automation technology, electronics production, medical engineering and precision mechanics (see Application examples, page 3).



Technical data

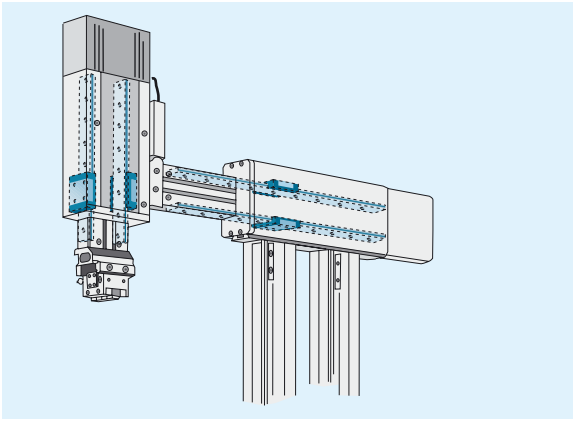
Structure:	Four-point contact ball recirculation system with identical load angles and 2 ball recirculation paths per carriage for unlimited stroke
Range:	Four different types (7, 9, 12, 15) comprising different widths and carriage lengths
Rail material:	Stainless steel 1.4037
Carriage material:	Stainless steel 1.4037 with return zones of POM
Ball material:	Stainless steel 1.4037
Sealing material:	Desmopan
Temperature range:	from –20 °C up to +80 °C
Speed:	up to 3 m/s max.
Acceleration:	up to 80 m/s^2 max.
Accuracy:	2 accuracy classes (P5, P1)
Stiffness:	3 standard preload classes (T_0, T_1, T_2)

Applications examples



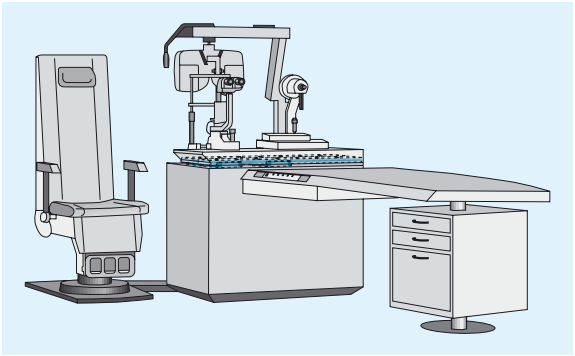
Electronics
PCB drilling and routing machine

A flat-format and weight-saving design enables small machine dimensions. High power density results in shorter processing times.



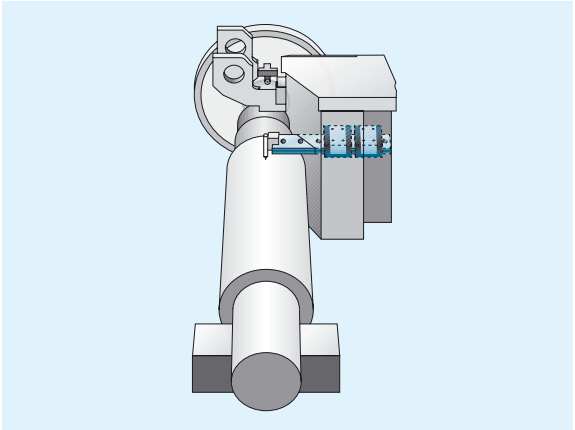
Automation technology
Pick-and-place manipulators

A low-mass guidance system coupled with aluminium profiles permits faster sequences of motion and higher cycle rates.



Medical equipment
Optical instruments

Ease of movement and corrosion-resistant materials ensure reliability in everyday use.



Precision mechanics
Measuring systems

Accuracy, with a minimum of mounting space, increases the capacity and capabilities of measuring machines.

Product features

Maximum utilisation of mounting space:
The compact design of the SKF miniature profile rail guides permits maximum performance on a minimum of mounting space. Dimensions and weights of machines and installations can be further reduced.

Performance:
For improved machinery performance, maximum speeds and accelerations under loads acting in all directions are possible. This permits more efficient processes and the reduction of cycle times.

Reliability:
More than 90 years of SKF experience with rolling bearing geometry guarantee long product life. Maintenance intervals are extended and the service life of machines and installations is increased.

Resistance:
The use of stainless steel in combination with plastic components makes these guides universally applicable. The reliability in application engineering is increased and risks are eliminated.

Rails

The rails are ground on all faces. The maximum rail lengths by the piece are shown in the table opposite. SKF supplies the rails in lengths according to customer requirements. The distance measurement E (see Illustration page 10) is manufactured symmetrically, depending on the rail length.
Upon request, SKF can also supply special rails to customer drawings.

Rail designation	Maximum rail lenght by the piece
LLMHR 7	1000 mm
LLMHR 9 / LLMWR 9	1000 mm
LLMHR 12 / LLMWR 12	1000 mm
LLMHR 15 / LLMWR 15	1000 mm

Carriages

A wide range of 14 different types of carriages, each available in three preload classes and with a choice between sealed and open types, permits optimum system designs tailored to the respective requirement profile.

Preload and stiffness

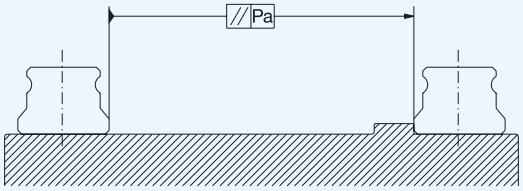
The determination of an appropriate preload renders the miniature profile rail guide suitable for widely varying operating conditions and changes the stiffness of the overall system. SKF recommends clearance-free systems (T_0) for applications with constant load and low friction. For applications characterised by shock loads, vibration and alternating loads or torques, it is advisable to select a preloaded system (T_1) and a T_2 system should be chosen for high torques and high stiffness.

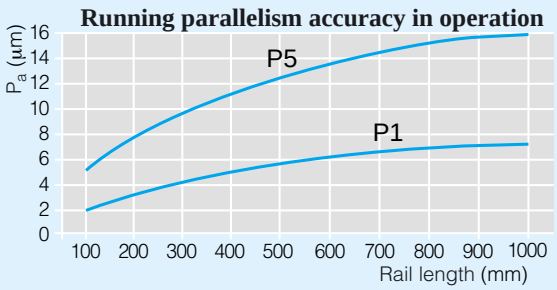
Preload class	Characteristics
T_0	absolutely smooth running, light clearance
T_1	smooth running, slight clearance up to light preload
T_2	full running, preload

further preload classes upon request

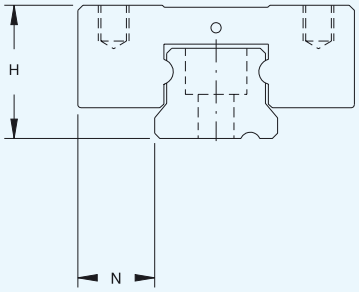
Accuracy

Running parallelism accuracy
of paired systems





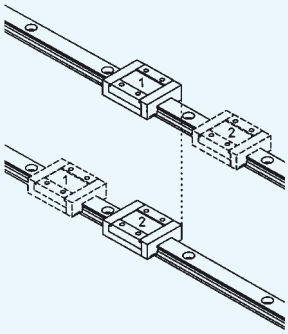
System accuracy
of different guidance systems



Dimension tolerances		
	H (mm)	N (mm)
P1	±0,010	±0,015
P5	±0,020	±0,025

The tolerances apply over the entire guide length for any combination of carriage and rail.

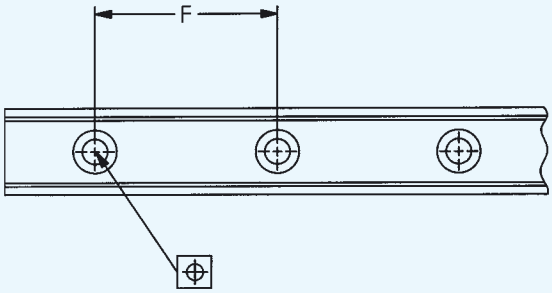
System tolerance



Maximum tolerance for paired systems or carriages at identical rail position		
	ΔH_1) (mm)	ΔN (mm)
P1	0,007	0,007
P5	0,015	0,015

The dimensions ΔH and ΔN relate to the ideal centre of the carriage. Each dimension is derived from the mean value of two measured points with identical centre distance.

Distance tolerance



Position tolerance of rail attachment holes	
⊕	∅ 0,3

Load carrying capacity

Static load rating C_0
The static load rating C_0 is the load which corresponds to an arithmetical Hertzian Pressure of 4,200 MPa between raceway and balls. This pressure produces a permanent deformation of approximately 0.0001 of the ball diameter.

Static moments "M_A, M_B, M_C"
The permissible static moments correspond to a moment load that produces the same permanent deformation as in the static load rating C_0.

Load direction
SKF miniature profile rail guides are designed to accommodate loads in all directions.

Dynamic load rating C
The dynamic load rating C is the constant load which gives a theoretical system life of 100,000 m of travel with a certainty of 90%.

Life calculation

The life of a profile rail guide is defined as the total linear distance travelled before the appearance of the first signs of material fatigue on the raceways or rolling elements. Both in laboratory trials and in practice it is found that the life of apparently similar rail guides under completely identical operating conditions can differ. Calculation of the requisite bearing size therefore requires a clear statistic definition of the term bearing life. All references to dynamic load rating of profile rail guides apply to the basic rating life as covered by the ISO definition, in which life is understood as that operating period reached or exceeded by 90 % of a large group of identical bearings. The SKF life calculation is based on 100,000 metres of travel. Other calculation models assume merely 50,000 metres of travel. In such cases, the dynamic load ratings must be divided by a factor of 1.26 to ensure comparability with the SKF values. For further details please refer to the SKF Linear guide handbook (Catalogue 4185 E).

$$L_{10} = \left(\frac{C}{P}\right)^3$$

L_{10} = basic rating life, 10^5 m
C = dynamic load rating, N
P = equivalent dynamic bearing load, N

Where the stroke length and frequency are constant it is often easier to calculate the basic rating life in hours of operation using the equation:

$$L_{10h} = \frac{50\,000\,000}{s \cdot n \cdot 60}\left(\frac{C}{P}\right)^3$$

L_{10h} = basic rating life, hours of operation
s = stroke travel, mm
n = frequency of stroke, min^{-1} (number of movements from one end position to the other end and back again)

Permissible operating conditions

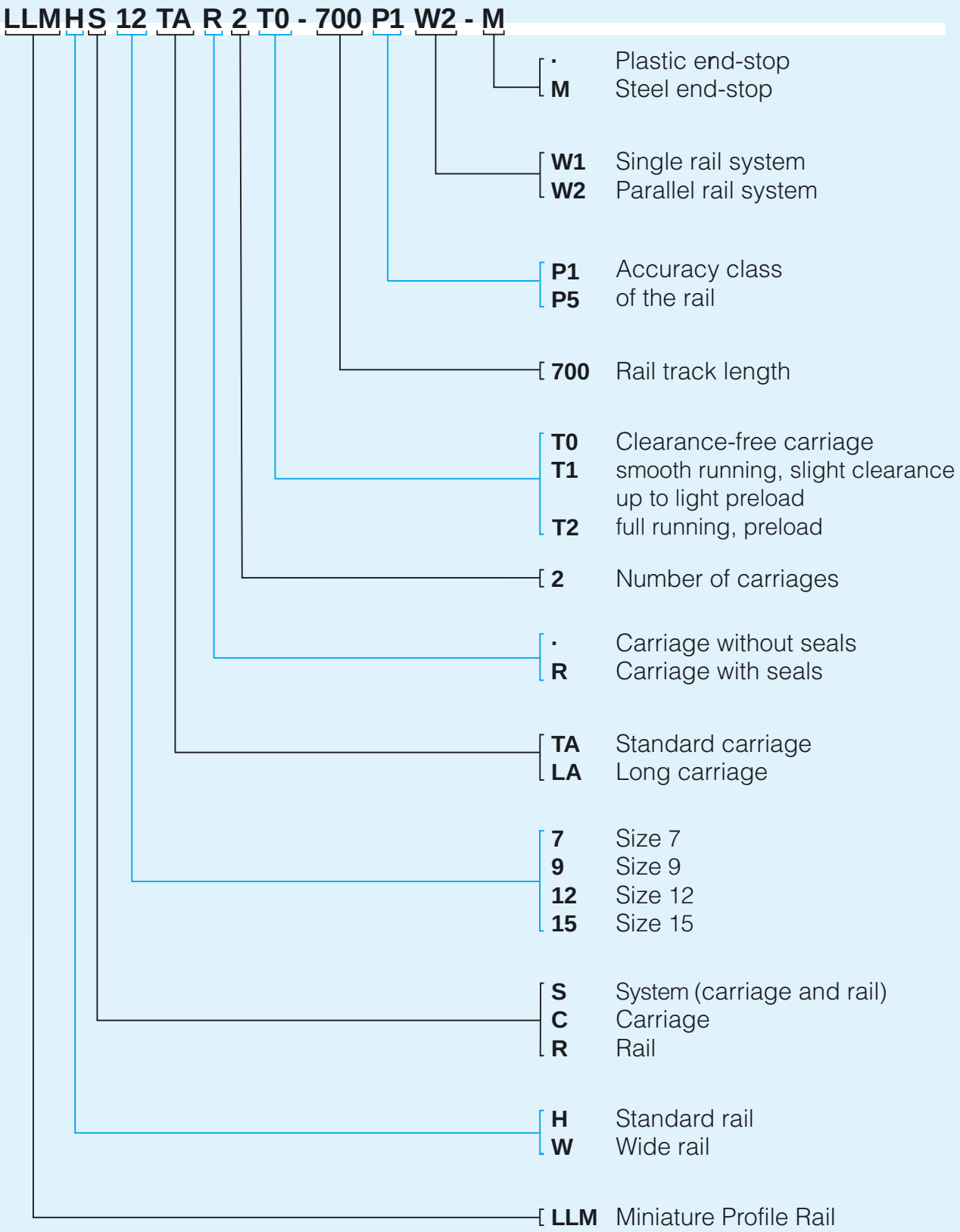
Permissible maximum load
DIN 636, Part 2, stipulates that the calculation of bearing life is valid only when the equivalent dynamic loading of a profile rail guide does not exceed 0.5 C. Any higher loading leads to an imbalance of stress distribution which can have a negative effect on bearing life. Where such conditions prevail, the user should turn to SKF for recommendations and advice on bearing life calculation.

Requisite minimum load
In order to assure slip-free running of profile rail guides, they must be subjected to a certain minimum load. The general guideline is a minimum value of P = 0.001 C. The minimum load is of special importance in profile rail guides which operate at high speed or with high acceleration. In such cases, the inertia forces of the balls as well as the rolling friction in the lubricant can have an adverse effect on the rolling conditions in the guide and can lead to damaging slip conditions between the balls and raceways.

www.bergab.ru Берг АБ bergab@ya.ru Тел. (495)-228-06-21, факс (495) 223-3071

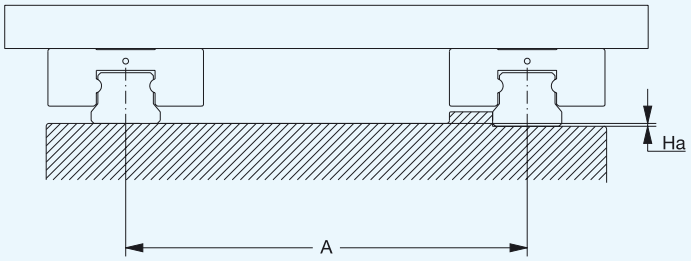
Order designation

The following designation system should be used for inquiries and orders.



Mounting details

Permissible height deviation in transverse direction H_a

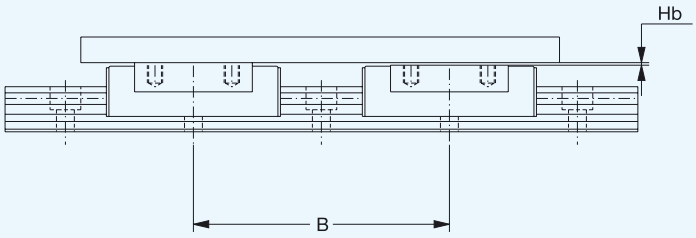


$$H_a = A \cdot Z$$

H_a = permissible height deviation (mm)
A = distance of rails (mm)
Z = calculation factor

T_0	$3{,}0 \cdot 10^{-4}$
T_1/T_2	$1{,}5 \cdot 10^{-4}$

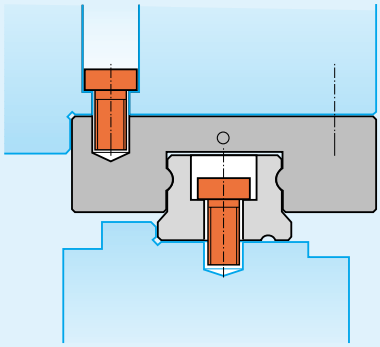
Permissible height deviation in longitudinal direction H_b



$$H_b = B \cdot 7 \cdot 10^{-5}$$

H_b = permissible height deviation (mm)
B = distance of carriages (mm)

Ideal mounting arrangement



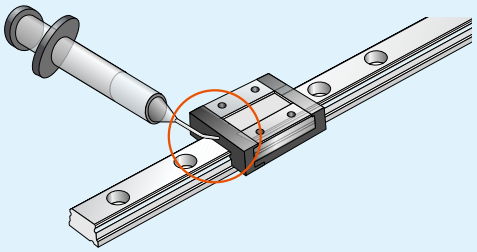
The illustration opposite shows the ideal mounting arrangement for miniature profile rail guides. Carriage and rail can be mounted at both sides, but their datum planes should be on the same side of the system. To ensure a neat abutment to the adjacent edges, these should feature a relief fillet.

Tightening torque of fixing bolts

Thread size	Maximum tightening torque (Ncm)
M 2	32
M 3	110
M 4	260
M 5	510

The opposite table shows the maximum tightening torques for fixing bolts depending on the thread size.

Lubrication



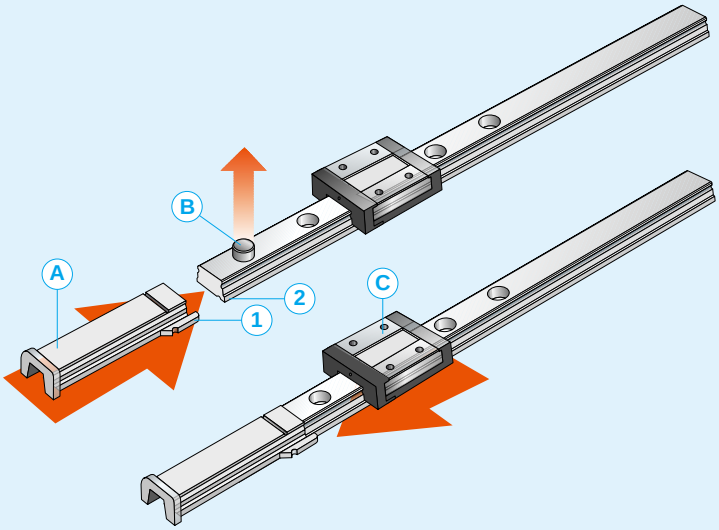
Order designation	Size
VM LLM 12	7, 9, 12, 15, 9 W, 12 W
VM LLM 15	15 W

The relubrication intervals depend on the environmental conditions and the magnitude and type of load!

As the manufacturer is not familiar with the respective individual operating conditions, only tests carried out by the user or close observation can provide certainty about the appropriate relubrication intervals.

SKF miniature profile rails are pre-greased and are thus ready for use when delivered. The individual carriages can be relubricated through lubrication holes at the faces. Here, the relubrication intervals depend on the distance travelled as well as the cycles and environmental conditions.

Carriages
Mounting and dismounting

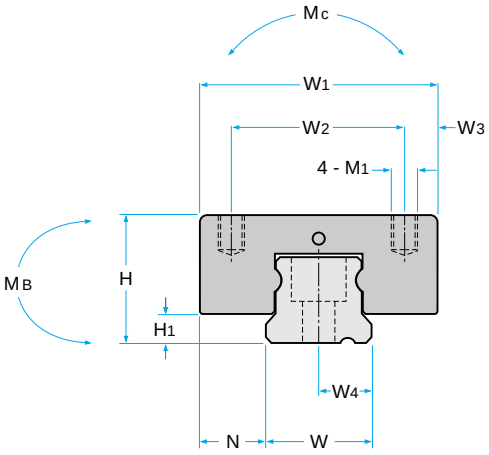


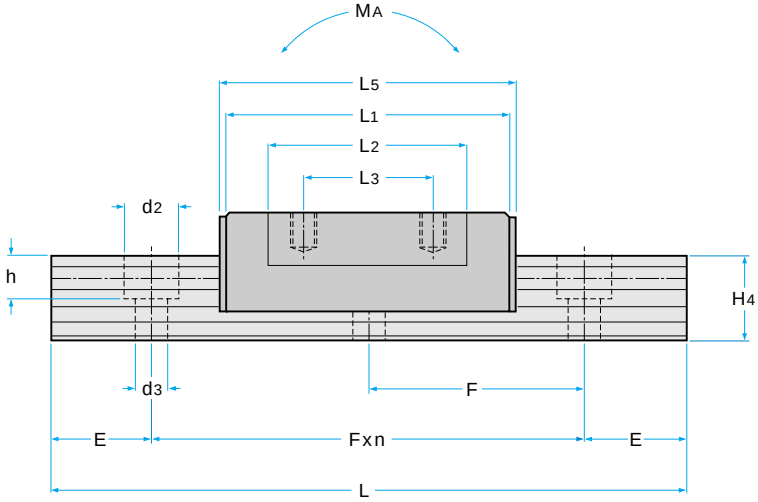
For dismounting the system pre-mounted by SKF, please observe the following instructions:

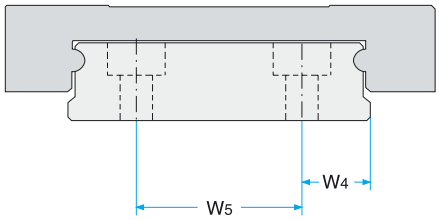
- Remove the end-stop Ⓑ from the rail.
- Position side ① of the mounting rail Ⓐ to the rail ② so that there is no misalignment or gap between rail and mounting rail.
- Slide the carriage Ⓒ from the rail to the mounting rail and keep both rails in position while doing so.

For mounting the carriage onto the rail, please proceed in reverse order.

Attention: Please always use the enclosed mounting rail as the ball retention inside the carriage is not guaranteed otherwise.



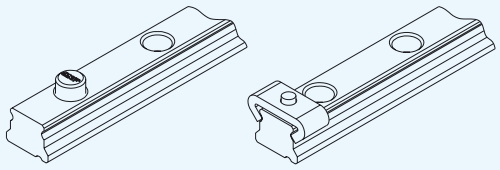




LLMWS 15 design

Designation	Carriage dimensions										
	H (mm)	W_1 (mm)	W_3 (mm)	W_2 (mm)	L_1 (mm)	L_2 (mm)	L_3 (mm)	L_5 (mm)	M_1 (mm)	H_1 (mm)	Weight (kg)
LLMHS 7 TA **LLMHS 7 LA**	8	17	2.5	12	22 29.5	16 23.5	8 12	23.5 31	M 2 x 2.5	1.5	0.01 0.02
LLMHS 9 TA **LLMHS 9 LA**	10	20	2.5	15	30 38.5	21.5 30	10 15	32 40.5	M 3 x 3	2	0.02 0.03
LLMWS 9 TA **LLMWS 9 LA**	12	30	4.5 3.5	21 23	36.5 48.5	28 40	12 24	40 50.5	M 3 x 3	2	0.04 0.06
LLMHS 12 TA **LLMHS 12 LA**	13	27	3.5	20	33 45	23 35	15 20	36 48	M 3 x 3.5	3	0.03 0.06
LLMWS 12 TA **LLMWS 12 LA**	14	40	6	28	42.5 56	32.5 46	15 28	45.5 59	M 3 x 3.5	3	0.08 0.11
LLMHS 15 TA **LLMHS 15 LA**	16	32	3.5	25	41.5 57.5	29.5 45.4	20 25	44.5 61.5	M 3 x 4	4	0.06 0.10
LLMWS 15 TA **LLMWS 15 LA**	16	60	7.5	45	51.2 70.5	42 61.1	20 35	55.5 74.5	M 4 x 4.5	4	0.15 0.22

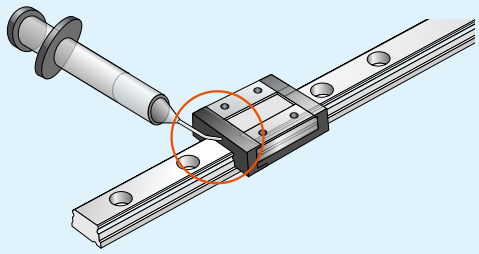
Accessories



Standard Steel end-stop

In addition to the plastic end-stop which is fastened in the first and last rail hole, there is also an option for a steel end-stop that can be mounted in any hole. Order suffix – **M**.

Attention:
This does not serve as a limit stop.



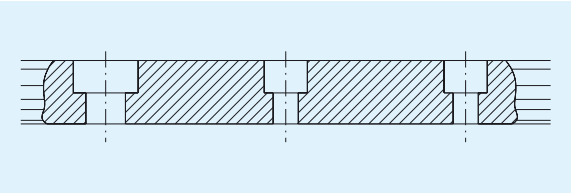
Relubrication unit for well-aimed lubricant dosages. Supplied with rounded needle and filling of special grease.

Order designation	Size
VM LLM 12	7, 9, 12, 15, 9 W, 12 W
VM LLM 15	15 W

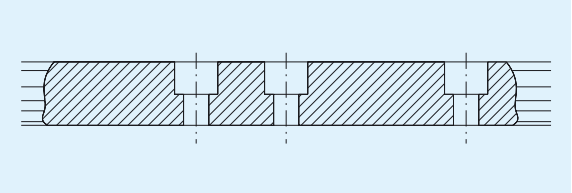
	Rail Dimensions							Basic Load Rating		Static moments		
Designation	H_4 (mm)	W (mm)	W_4 (mm)	W_5 (mm)	d_3 x d_2 x h (mm)	F (mm)	Weight (kg)	C (N)	Co (N)	M_A (Nm)	M_B (Nm)	M_C (Nm)
LLMHS 7 TA **LLMHS 7 LA**	4.8	7	3.5	-	2.5 x 4.5 x 2.5	15	0.19	860 1 400	1 670 2 700	4.9 7	4.9 7	5.2 9
LLMHS 9 TA **LLMHS 9 LA**	6.5	9	4.5	-	3.5 x 6 x 3.5	20	0.31	1 850 2 295	3 130 4 270	11.2 20.1	11.2 20.1	13.2 17.9
LLMWS 9 TA **LLMWS 9 LA**	7.5	18	9	-	3.5 x 6.0 x 4.5	30	0.96	1 785 2 640	3 330 4 900	14.2 30.2	14.2 30.2	30.4 45.1
LLMHS 12 TA **LLMHS 12 LA**	8.8	12	6	-	3.5 x 6 x 4.5	25	0.62	2 550 3 470	4 000 6 225	15 34.5	15 34.5	21.7 33.8
LLMWS 12 TA **LLMWS 12 LA**	8.8	24	12	-	4.5 x 8 x 4.5	40	1.40	3 300 4 150	5 780 8 000	30 55.8	30 55.8	69 95.6
LLMHS 15 TA **LLMHS 15 LA**	10.8	15	7.5	-	3.5 x 6 x 4.5	40	1.02	2 880 4 670	5 390 8 720	21.6 57.8	25.5 68.6	40.2 67.6
LLMWS 15 TA **LLMWS 15 LA**	10.8	42	9.5	23	4.5 x 8 x 4.5	40	2.95	3 890 5 830	7 060 10 600	40.2 94.1	48.0 108	148 225

www.bergab.ru Берг АБ bergab@ya.ru Тел. (495)-228-06-21, факс (495) 223-3071

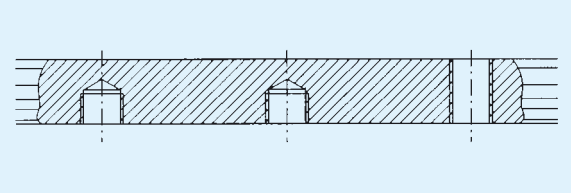
Special designs tailored to customer requirements



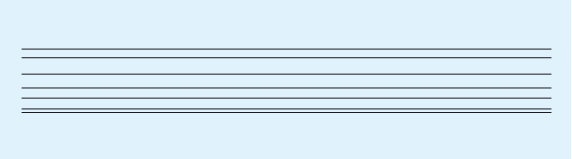
- different fastening holes (stepped holes) in terms of size and depth of holes relative to each other.



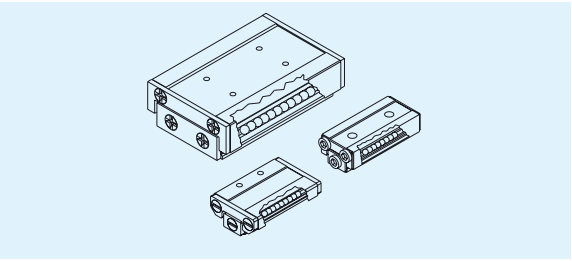
- variable hole distances



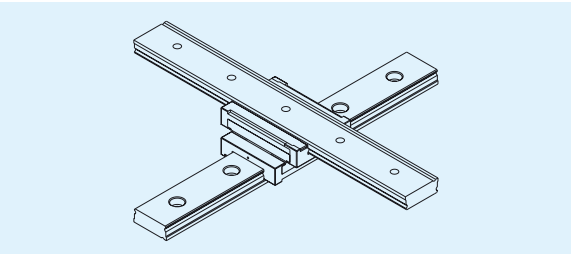
- blind holes and threads
- through holes or through threads



- without fixing bores for gluing of rail



- special design with limited stroke (without ball recirculation) according to customer request

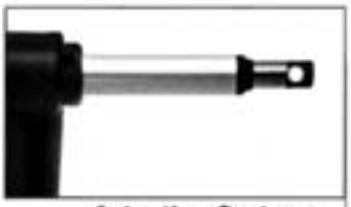


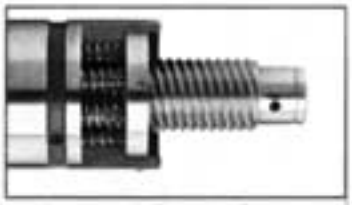
- 90° cross arrangement in different sizes

?

- your requested design / your solution

Services


Actuation Systems


Ball and Roller Screws


High Precision Bearings


Linear Guiding and Positioning Systems


Spindles


Spindle Service

SKF®

Linear Motion

SKF Guiding Systems

SKF Ball & Roller Screws

SKF Actuators

SKF Linear Motion offers a wide range of precision engineered linear motion components, units and systems.
In addition to comprehensive product literature and software, SKF offers assistance from experienced linear motion engineers.

Linear Motion has **3 product lines** and a sales organisation based on **11 specialized sales companies** located in Europe, Japan and in the USA.

However the product availability as well as the product application is **world-wide granted by the SKF Bearing international network**. To get any other SKF address all over the world, please contact one of the companies below.

Austria
Linear Motion
SKF Österreich AG
Phone: +43 22 36 6 7090
Fax: +43 22 36 6 709220
e-mail: multitec.austria@skf.com

Benelux
SKF Multitec Benelux B.V.
Phone: +31 30 6029029
Fax: +31 30 6029028
Sales Office Belgium/Luxembourg:
Phone: +32 2 5024270
Fax: +32 2 5027336
e-mail: multitec_benelux@skf.com

France
SKF Equipements
Phone: +33 1 30 12 73 00
Fax: +33 1 30 12 69 09
e-mail: equipements.france@skf.com

Germany
SKF Linearsysteme GmbH
Phone: +49 9721 657-0
Fax: +49 9721 657-111
e-mail: lin.sales@skf.com

Italy
Multitec
SKF Industrie S.p.A.
Phone: +39 11 57 17 61
Fax: +39 11 5 71 76 33
e-mail: multitec.italy@skf.com

Japan
SKF Japan Ltd.
Phone: +81 3 3436 4129
Fax: +81 3 3578 1014
e-mail: skf.japan@skf.com

Spain
SKF Productos Industriales S.A
Phone: +34 93 377 99 77
+34 93 377 99 07
Fax: +34 93 474 20 39/31 56
e-mail: prod.ind@skf.com

Switzerland
Linear Motion & Precision Technologies
Phone: +41 1 825 81 81
Fax: +41 1 825 82 82
e-mail: skf.schweiz@skf.com

Sweden/Denmark/Finland/Norway
SKF Multitec Sweden
Phone: +46 42 25 35 00
Fax: +46 42 25 35 45/46

Sales Office Denmark
Phone: +45 65 92 77 77
Fax: +45 65 92 74 77

Sales Office Finland
Phone: +358 94 52 97 52
Fax: +358 94 12 77 65

Sales Office Norway
Phone: +47 22 30 71 70
Fax: +47 22 30 28 14
e-mail: multitec.nordic@skf.com

United Kingdom
SKF Engineering Products Ltd.
Phone: +44 1582 490049
Fax: +44 1582 496574
e-mail. skf.epl@skf.com

USA
SKF Motion Technologies
Phone: +1 610 861-4800
Fax: +1 610 861-4811
e-mail: motiontech.usa@skf.com

http://www.linearmotion.skf.com

SKF
Linear Motic

www.bergab.ru Берг АБ bergab@ya.ru Тел. (495)-228-06-21, факс (495) 223-3071