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EWELLIX

A Schaeffler Company

Profile rail guides - LLT catalogue



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Contents

1 Introduction 4
1.1 Product description 5
1.2 Design 6
1.2.1 Components and material specifications 7
1.2.2 Standard carriage components 8
1.3 Features and benefits 9
1.4 Product range 10
1.4.1. Product overview 10
1.4.2 Preferred range 11

2 Selection guide 14
2.1 Technical data 15
2.1.1 Load rating 15
2.1.2 Preload classes 16
2.1.3 Accuracy 17
2.1.4 Rigidity 18
2.1.5 Permissible operating conditions 19
2.1.6 Friction 20
2.1.7 Applications in corrosive environments 22
2.1.8 Jointed rail tracks 23
2.2 Calculation of bearing loads 24
2.2.1 Calculation bases 24
2.2.2 Constant mean load 26
2.2.3 Factors of influence 30
2.2.4 Load conditions 31
2.2.5 Modified basic rating life 32
2.2.6 Linear guide calculation tools 33
2.2.7 Legend 34

3 Product range 36
3.1 Carriage data 37
3.1.1 Carriage LLTHC … SA 38
3.1.2 Carriage LLTHC … A 40
3.1.3 Carriage LLTHC … LA 42
3.1.4 Carriage LLTHC … SU 44
3.1.5 Carriage LLTHC … U 46
3.1.6 Carriage LLTHC … LU 48
3.1.7 Carriage LLTHC … R 50
3.1.8 Carriage LLTHC … LR 52
3.2 Rail data 55
3.2.1 LLTHR rails 56
3.2.2 LLTHR rails ... D4 rails 58
3.2.3 LLTHR ... D6 rails 60
3.3 Accessories 62
3.3.1 Scraper plate (S1) 64
3.3.2 Additional front seal (S7) 65
3.3.3 Seal kit (S3) 66
3.3.4 Low friction shield (S0) 67
3.3.5 Lube element (S6) 68
3.3.6 Adapter plate (PL) 69
3.3.7 Lubrication connectors 70
3.3.8 Bellows 72

4 Mounting instruction and maintenance 74
4.1 Design rules 75
4.1.1 Typical mounting examples 75
4.1.2 Interface design, screw sizes and tightening torques 76
4.1.3 Position tolerances for attachment holes 77
4.1.4 Permissible height deviation 78
4.1.5 Parallelism 79
4.2 Mounting profile rail guides 80
4.2.1 Packaging (Shipment) 80
4.2.2 Mounting the carriages 80
4.2.3 Preparation 80
4.2.4 Mounting the master rail 81
4.2.5 Parallel alignment of subsidiary rail 82
4.2.6 Mounting a retaining strip 84
4.2.7 Mounting jointed rails 84
4.2.8 Installing plastic caps 85
4.2.9 Installing metal plugs 85
4.3 Mounting accessories 86
4.3.1 Mounting the scraper plate (S1) 86
4.3.2 Mounting an additional front seal (S7) 86
4.3.3 Mounting the seal kit (S3) 87
4.3.4 Mounting the low friction shield (S0) 87
4.3.5 Mounting the LLT Lube element (S6) 88
4.3.6 Mounting an adapter plate (PL) 89
4.3.7 Mounting the grease nipple and lubrication connector (VN UA) 89
4.3.8 Mounting the bellows 90
4.4 Maintenance and repairs 91
4.4.1 Preventative maintenance 91
4.4.2 Lubrication 91
4.4.3 Replacement 94
4.5 Typical application areas 95
4.6 Customized solution 96
4.7 FAQ 97
4.8 Ordering key 102
4.8.1 Ordering key system 102
4.8.2 Ordering key carriages 103
4.8.3 Ordering key rails 104
4.8.4 Ordering key accessories (delivered separately) 104
4.8.5 Ordering key bellows 105

5 Customer specification sheet 106

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The heritage of innovation

Ewellix is a global innovator and manufacturer of linear motion and actuation solutions. Our state-of-the-art linear solutions are designed to increase machine performance, maximise uptime, reduce maintenance, improve safety and save energy. We engineer solutions for assembly automation, medical equipment, mobile machinery, distribution and a wide range of other industrial applications.

Technology leadership

We earned our reputation through decades of engineering excellence. Our journey began over 50 years ago as part of the SKF Group, a leading global technology provider. Our history provided us with the expertise to continuously develop new technologies and use them to create cutting edge products that offer our customers a competitive advantage.

In 2019, we became independent and changed our name to Ewellix. We are proud of our heritage. This gives us a unique foundation on which to build an agile business with engineering excellence and innovation as our core strengths.

Global presence and local support

With our global presence, we are uniquely positioned to deliver standard components and custom-engineered solutions, with full technical and applications support around the world. Our skilled engineers provide total life-cycle support, helping to optimise the design, operation and maintenance of equipment thus improving productivity and reliability while reducing costs. At Ewellix, we don't just provide products; we engineer integrated solutions that help customers realise their ambitions.



Schaeffler Group – We pioneer motion

Ewellix is since 2023 owned by the Schaeffler Group.

As a leading global supplier to the automotive and industrial sectors, the Schaeffler Group has been driving forward groundbreaking inventions and developments in the fields of motion and mobility for over 75 years.

With innovative technologies, products, and services for electric mobility, CO_2-efficient drives, Industry 4.0, digitalization, and renewable energies, the company is a reliable partner for making motion and mobility more efficient, intelligent, and sustainable.

Schaeffler manufactures high-precision components and systems for powertrain and chassis applications as well as rolling and plain bearing solutions for a large number of industrial applications.



1.1 Product description

The productivity and economic success of a given application depends, to a large extent, on the quality of the selected linear components. Often these components determine market acceptance and thus help to obtain a competitive edge for the manufacturer. To do this, the linear components have to be as adaptable as possible to precisely meet the application's requirements, ideally with standard components.

The Ewellix profile rail guide series LLT satisfies these market demands: available in a wide range of sizes, carriages and accessories as well as in various preload and precision classes, LLT profile rail guides facilitate adaptation to individual application demands. In combination with their ability to operate at virtually unlimited stroke, this opens up almost any design option.

The range of possible applications include material handling, plastic injection moulding, woodworking, printing, packaging and medical devices, to name only a few. In these types of applications, the design of the LLT reveals its full capabilities.

Ewellix manufactures LLT profile rail guides in an X-arrangement with a 45° contact angle between the rolling elements and raceways. This design promotes equal load sharing in all four main load directions to provide greater design flexibility. Moreover, deviations in parallelism and height, which usually occur in multi-axis systems, can be compensated for more efficiently, resulting in reliable and smooth operation under a variety of operating conditions.

In addition, Ewellix offers a miniature profile rail guide series and a series of ready assembled and driven profile rail guide slides. Contact your Ewellix representative for additional information.



1.2 Design

Just as with rotary bearings, the raceways of profile rail guides can be arranged in an X- or O-configuration. The technical characteristics of these two arrangements are essentially the same. Therefore, there are no basic differences in behaviour in the vast majority of load situations, except when they are subjected to moment loads around the x-axis.

The Profile rail guides from Ewellix feature an X-arrangement, based on the contact angle of the rolling elements (↳ **fig. 1**).

The advantage of this arrangement is that deviations in parallelism and height, which usually appear in multi-axes systems, can be accommodated more effectively (↳ **fig. 2**).

Due to the design-related smaller lever arm, the X-arrangement provides better self-aligning capability.

In combination with a two-point contact of the rolling elements, running friction is kept to a minimum.

This results in a smooth and stick-slip-free operation of the guidance system.

Fig. 1

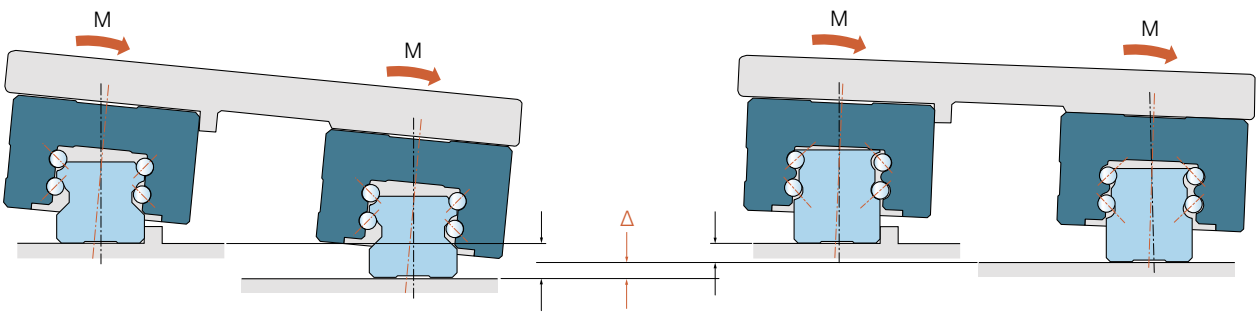
Schematic illustration of the different ball-arrangements



X-arrangement O-arrangement

Fig. 2

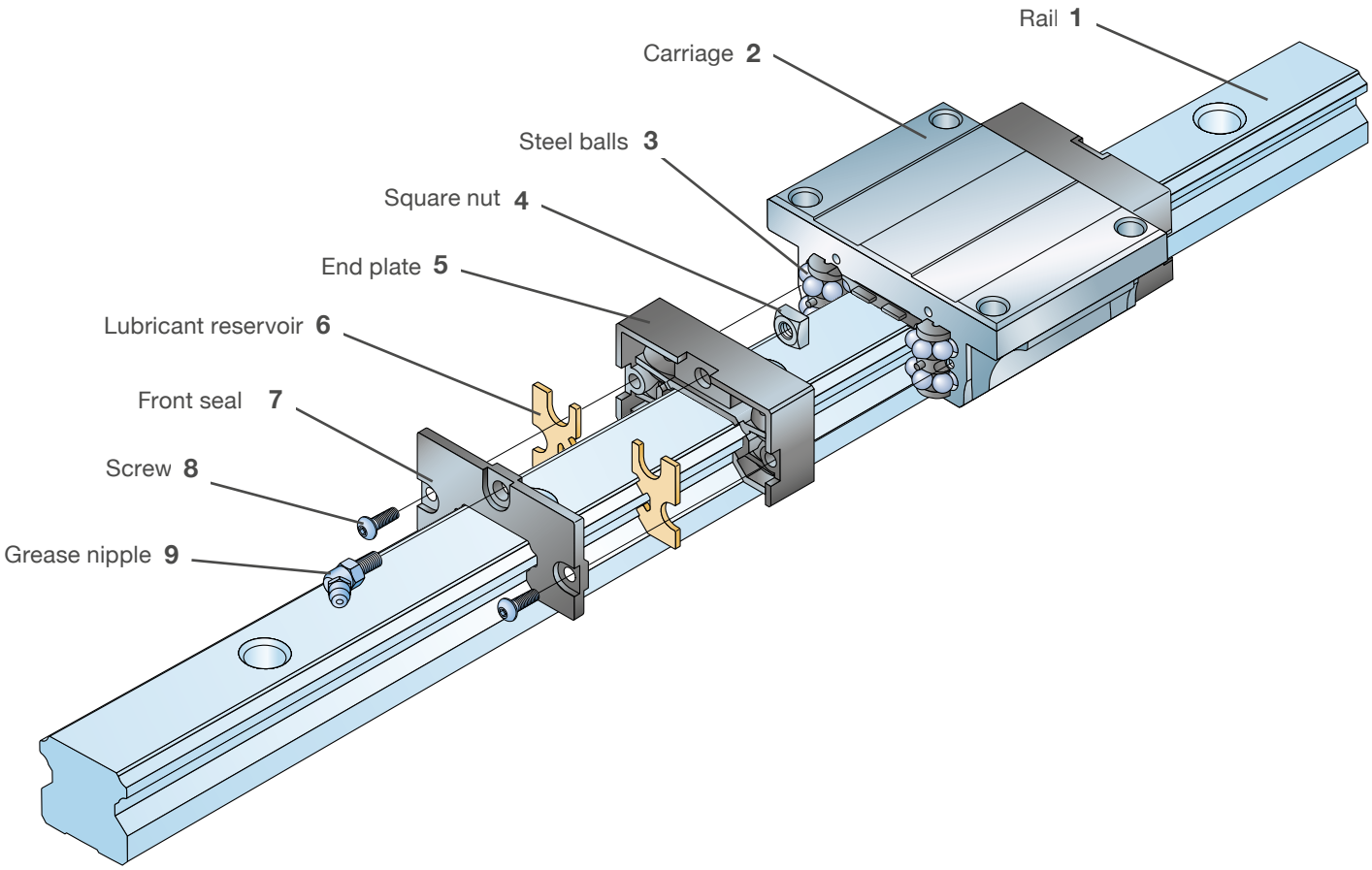
Self-aligning capability in comparison



X-arrangement O-arrangement

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1.2.1 Components and material specifications



Material specifications

1. Steel, inductive hardened
2. Steel, case hardened
3. Bearing steel
4. Steel, zinc coated
5. POM, reinforced
6. EPU foam
7. PA 6.6 and Elastomer; alternative low friction S0 shield made from PA 6.6
8. Steel
9. Steel, nickel coated

1.2.2 Standard carriage components

Seals

The ingress of dirt, swarf and liquids, as well as lubricant leakage can significantly reduce the service life of a profile rail guide system. Ewellix LLT profile rail guide carriages are therefore supplied with front, side and inner seals as standard, which can significantly extend service life.

Front seal

Front seals are especially important since they provide protection for the carriage in the direction of movement.
They are designed as double-lip seals in order to provide improved wiping properties (↳ **fig. 3**).

Side seal

Side seals effectively prevent contaminants from working environment into the system from below. Seal design can deviate based on size (↳ **fig. 4**).

Inner seal

Inner seals are an additional means of protection against lubricant leakage. Seal design can deviate based on size (↳ **fig. 5**).

Grease nipple

Two lube ports with metal thread are located on both front sides of each carriage. As standard, one grease nipple for manual relubrication is supplied along with the carriage, while the opposite side is secured by a set screw. The metal thread also enables the easy and reliable mounting of automatic lubricators.

Grease nipples are according to standard JIS 1575:2000 (↳ **page 70**).

If some accessories require longer grease nipples, they will be provided.

Fig. 3

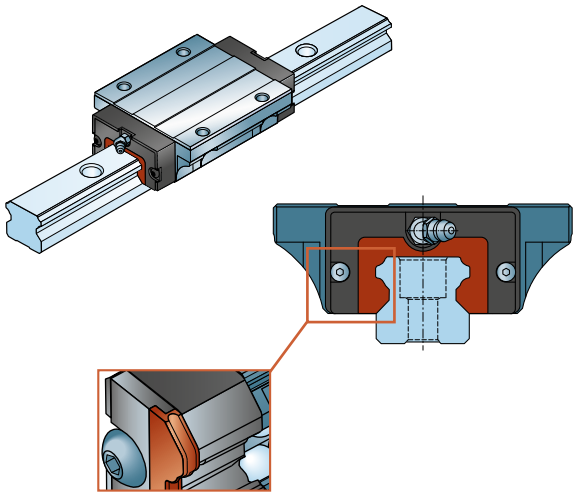


Fig.4

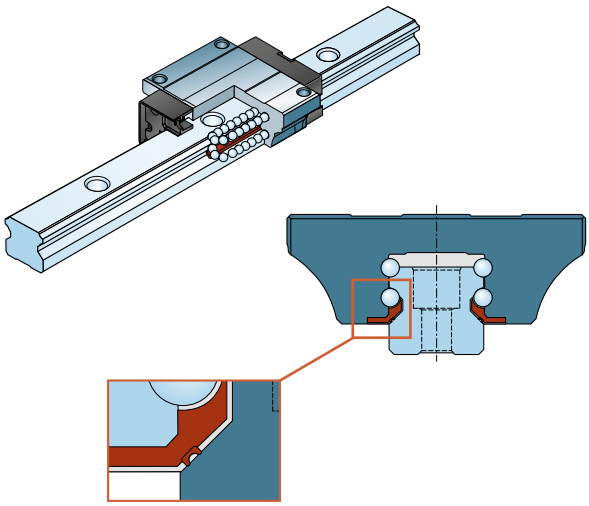
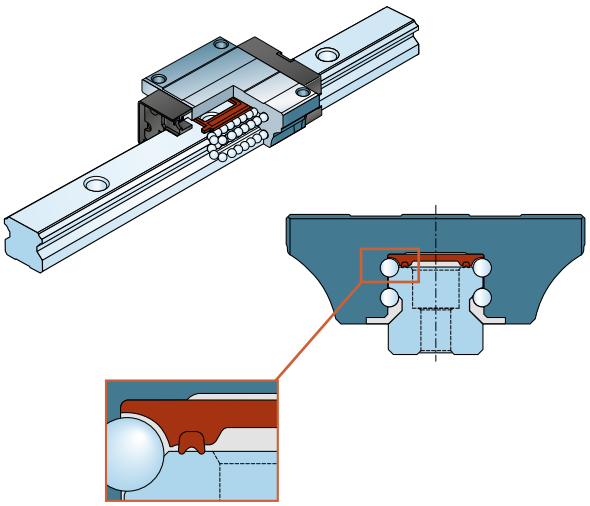
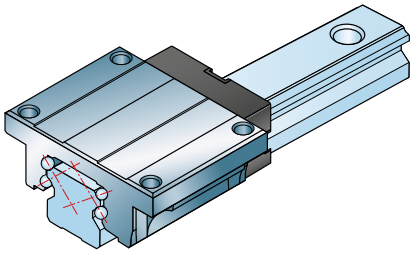


Fig. 5



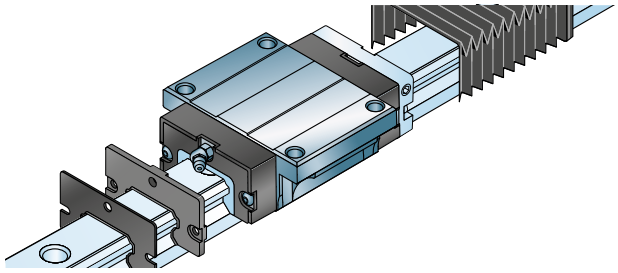
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1.3 Features and benefits



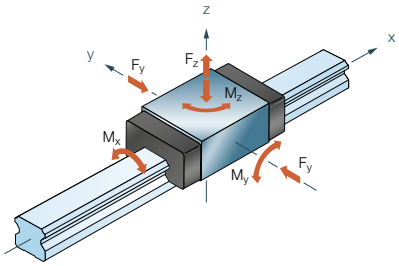
Improved running performance

The LLT profile rail guide has four rows of balls with a 45° contact angle between the rolling elements and raceways. This X-arrangement improves the system's self-aligning capability. Mounting deviations can be accommodated even under preload, resulting in smooth running performance. Friction is kept to a minimum due to two-point ball contact. This enables reliable, stick-slip-free operation for the life of the rail guide.



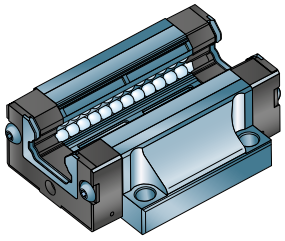
Modular concept for customized solutions

Applications have different speed, precision and environmental requirements. As a result, Ewellix LLT rail guides use modular components so that cost-effective solutions can be built based on the needs of the application. Various precision and preload classes are available to meet different precision and rigidity requirements. Furthermore, a wide range of accessories supports its adaptation to specific environmental needs.



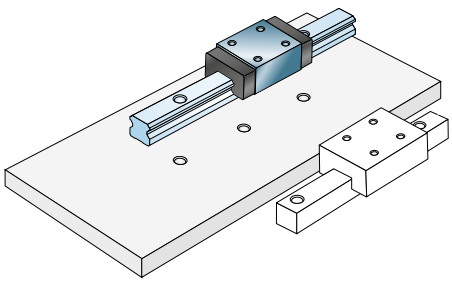
Rigidity, strength and precision for improved production processes

The four-row arrangement of balls at a 45° angle optimizes load sharing in all four main load directions and is in accordance with ISO 14728. This feature provides a high degree of design flexibility. The ability to accommodate high loads and moment loads makes these rail guides ideal even for single carriage systems.



Longer service life and reduced maintenance

Ewellix profile rail guide carriages are pre-lubricated at the factory. The integrated lubricant reservoirs, located in the end plates, constantly relubricate the circulating balls. Both ends of the carriage have threaded metal lubrication ports to accommodate an automatic re-lubrication system. One grease nipple is provided as standard with each carriage. These fully sealed carriages have double lip seals on both ends as well as side and inner seals. The low-friction seals are highly effective against the ingress of contaminants.



Interchangeability and global availability

The main dimensions of Ewellix profile rail guides are in accordance with ISO 12090-1. This enables dimensional interchangeability with all ISO-compliant brands. Ewellix's global sales and distribution network results in availability of replacement parts and serviceability for all systems worldwide.

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1.4 Product range

1.4.1. Product overview

LLTHC ... SA
Flanged carriage, short length, standard height
Further information on **page 38**

LLTHC ... A
Flanged carriage, standard length, standard height.
Further information on **page 40**

LLTHC ... LA
Flanged carriage, extended length, standard height
Further information on **page 42**



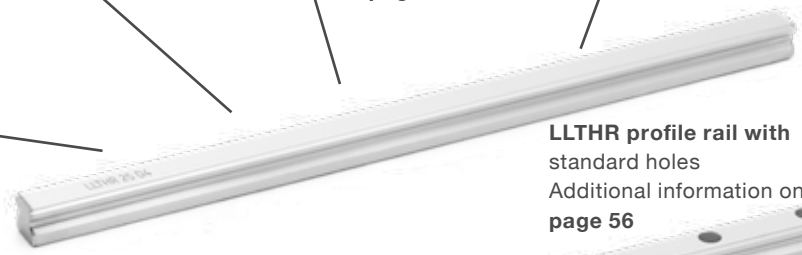




LLTHC ... R
Slim-line carriage, standard length, extended height
Further information on **page 50**

LLTHR profile rail with blind holes
Additional information on **page 58**





LLTHR profile rail with standard holes
Additional information on **page 56**





LLTHR profile rail with protective metal plugs
Additional information on **page 60**

LLTHC ... LR
Slim-line carriage, extended length, extended height
Further information on **page 52**









LLTHC ... SU
Slim-line carriage, short length, standard height
Further information on **page 44**

LLTHC ... U
Slim-line carriage, standard length, standard height
Further information on **page 46**

LLTHC ... LU
Slim-line carriage, extended length, standard height
Further information on **page 48**

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1.4.2 Preferred range

Carriages

Table 1

Size	Precision class	Designation		
		Preload class		
		T0	T1	T2
15	P5	LLTHC 15 SA T0 P5	LLTHC 15 SA T1 P5	–
		LLTHC 15 A T0 P5	LLTHC 15 A T1 P5	LLTHC 15 A T2 P5
		LLTHC 15 SU T0 P5	LLTHC 15 SU T1 P5	–
		LLTHC 15 U T0 P5	LLTHC 15 U T1 P5	LLTHC 15 U T2 P5
		LLTHC 15 R T0 P5	LLTHC 15 R T1 P5	LLTHC 15 R T2 P5
	P3	LLTHC 15 SA T0 P3	LLTHC 15 SA T1 P3	–
		LLTHC 15 A T0 P3	LLTHC 15 A T1 P3	–
		LLTHC 15 SU T0 P3	LLTHC 15 SU T1 P3	–
		LLTHC 15 U T0 P3	LLTHC 15 U T1 P3	–
		LLTHC 15 R T0 P3	LLTHC 15 R T1 P3	–
20	P5	LLTHC 20 SA T0 P5	LLTHC 20 SA T1 P5	–
		LLTHC 20 A T0 P5	LLTHC 20 A T1 P5	LLTHC 20 A T2 P5
		LLTHC 20 LA T0 P5	LLTHC 20 LA T1 P5	LLTHC 20 LA T2 P5
		LLTHC 20 SU T0 P5	LLTHC 20 SU T1 P5	–
		LLTHC 20 U T0 P5	LLTHC 20 U T1 P5	LLTHC 20 U T2 P5
		LLTHC 20 LR T0 P5	LLTHC 20 LR T1 P5	LLTHC 20 LR T2 P5
	P3	LLTHC 20 SA T0 P3	LLTHC 20 SA T1 P3	–
		LLTHC 20 A T0 P3	LLTHC 20 A T1 P3	–
		LLTHC 20 LA T0 P3	LLTHC 20 LA T1 P3	–
		LLTHC 20 SU T0 P3	LLTHC 20 SU T1 P3	–
		LLTHC 20 U T0 P3	LLTHC 20 U T1 P3	–
		LLTHC 20 LR T0 P3	LLTHC 20 LR T1 P3	–
25	P5	LLTHC 25 SA T0 P5	LLTHC 25 SA T1 P5	–
		LLTHC 25 A T0 P5	LLTHC 25 A T1 P5	LLTHC 25 A T2 P5
		LLTHC 25 LA T0 P5	LLTHC 25 LA T1 P5	LLTHC 25 LA T2 P5
		LLTHC 25 SU T0 P5	LLTHC 25 SU T1 P5	–
		LLTHC 25 U T0 P5	LLTHC 25 U T1 P5	LLTHC 25 U T2 P5
		LLTHC 25 LU T0 P5	LLTHC 25 LU T1 P5	LLTHC 25 LU T2 P5
		LLTHC 25 R T0 P5	LLTHC 25 R T1 P5	LLTHC 25 R T2 P5
		LLTHC 25 LR T0 P5	LLTHC 25 LR T1 P5	LLTHC 25 LR T2 P5
	P3	LLTHC 25 SA T0 P3	LLTHC 25 SA T1 P3	–
		LLTHC 25 A T0 P3	LLTHC 25 A T1 P3	–
		LLTHC 25 LA T0 P3	LLTHC 25 LA T1 P3	–
		LLTHC 25 SU T0 P3	LLTHC 25 SU T1 P3	–
		LLTHC 25 U T0 P3	LLTHC 25 U T1 P3	–
		LLTHC 25 LU T0 P3	LLTHC 25 LU T1 P3	–
		LLTHC 25 R T0 P3	LLTHC 25 R T1 P3	–
		LLTHC 25 LR T0 P3	LLTHC 25 LR T1 P3	–

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Table 1

Size	Precision class	Designation Preload class T0	T1	T2
30	P5	LLTHC 30 SA T0 P5	LLTHC 30 SA T1 P5	–
		LLTHC 30 A T0 P5	LLTHC 30 A T1 P5	LLTHC 30 A T2 P5
		LLTHC 30 LA T0 P5	LLTHC 30 LA T1 P5	LLTHC 30 LA T2 P5
		LLTHC 30 SU T0 P5	LLTHC 30 SU T1 P5	–
		LLTHC 30 U T0 P5	LLTHC 30 U T1 P5	LLTHC 30 U T2 P5
		LLTHC 30 LU T0 P5	LLTHC 30 LU T1 P5	LLTHC 30 LU T2 P5
		LLTHC 30 R T0 P5	LLTHC 30 R T1 P5	LLTHC 30 R T2 P5
		LLTHC 30 LR T0 P5	LLTHC 30 LR T1 P5	LLTHC 30 LR T2 P5
	P3	LLTHC 30 SA T0 P3	LLTHC 30 SA T1 P3	–
		LLTHC 30 A T0 P3	LLTHC 30 A T1 P3	–
		LLTHC 30 LA T0 P3	LLTHC 30 LA T1 P3	–
		LLTHC 30 SU T0 P3	LLTHC 30 SU T1 P3	–
		LLTHC 30 U T0 P3	LLTHC 30 U T1 P3	–
		LLTHC 30 LU T0 P3	LLTHC 30 LU T1 P3	–
		LLTHC 30 R T0 P3	LLTHC 30 R T1 P3	–
		LLTHC 30 LR T0 P3	LLTHC 30 LR T1 P3	–
35	P5	LLTHC 35 SA T0 P5	LLTHC 35 SA T1 P5	–
		LLTHC 35 A T0 P5	LLTHC 35 A T1 P5	LLTHC 35 A T2 P5
		LLTHC 35 LA T0 P5	LLTHC 35 LA T1 P5	LLTHC 35 LA T2 P5
		LLTHC 35 SU T0 P5	LLTHC 35 SU T1 P5	–
		LLTHC 35 U T0 P5	LLTHC 35 U T1 P5	LLTHC 35 U T2 P5
		LLTHC 35 LU T0 P5	LLTHC 35 LU T1 P5	LLTHC 35 LU T2 P5
		LLTHC 35 R T0 P5	LLTHC 35 R T1 P5	LLTHC 35 R T2 P5
		LLTHC 35 LR T0 P5	LLTHC 35 LR T1 P5	LLTHC 35 LR T2 P5
	P3	LLTHC 35 SA T0 P3		–
		LLTHC 35 A T0 P3		–
		LLTHC 35 LA T0 P3		–
		LLTHC 35 SU T0 P3		–
		LLTHC 35 U T0 P3		–
		LLTHC 35 LU T0 P3		–
		LLTHC 35 R T0 P3		–
		LLTHC 35 LR T0 P3		–
45	P5	LLTHC 45 A T0 P5	LLTHC 45 A T1 P5	LLTHC 45 A T2 P5
		LLTHC 45 LA T0 P5	LLTHC 45 LA T1 P5	LLTHC 45 LA T2 P5
		LLTHC 45 U T0 P5	LLTHC 45 U T1 P5	LLTHC 45 U T2 P5
		LLTHC 45 LU T0 P5	LLTHC 45 LU T1 P5	LLTHC 45 LU T2 P5
		LLTHC 45 R T0 P5	LLTHC 45 R T1 P5	LLTHC 45 R T2 P5
		LLTHC 45 LR T0 P5	LLTHC 45 LR T1 P5	LLTHC 45 LR T2 P5
	P3	LLTHC 45 A T0 P3	LLTHC 45 A T1 P3	–
		LLTHC 45 LA T0 P3	LLTHC 45 LA T1 P3	–
		LLTHC 45 U T0 P3	LLTHC 45 U T1 P3	–
		LLTHC 45 LU T0 P3	LLTHC 45 LU T1 P3	–
		LLTHC 45 R T0 P3	LLTHC 45 R T1 P3	–
		LLTHC 45 LR T0 P3	LLTHC 45 LR T1 P3	–

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Rails

Table 2

Size	Precision class	Designation	
		One-piece-rail	Multi-piece-rail
15	P5	LLTHR 15-…P5	LLTHR 15-…P5 A
		LLTHR 15-…P5 D4	LLTHR 15-…P5 A D4
	P3	LLTHR 15-…P3	LLTHR 15-…P3 A
		LLTHR 15-…P3 D4	LLTHR 15-…P3 A D4
20	P5	LLTHR 20-…P5	LLTHR 20-…P5 A
		LLTHR 20-…P5 D4	LLTHR 20-…P5 A D4
	P3	LLTHR 20-…P3	LLTHR 20-…P3 A
		LLTHR 20-…P3 D4	LLTHR 20-…P3 A D4
25	P5	LLTHR 25-…P5	LLTHR 25-…P5 A
		LLTHR 25-…P5 D4	LLTHR 25-…P5 A D4
		LLTHR 25-…P5 D6	LLTHR 25-…P5 A D6
	P3	LLTHR 25-…P3	LLTHR 25-…P3 A
		LLTHR 25-…P3 D4	LLTHR 25-…P3 A D4
		LLTHR 25-…P3 D6	LLTHR 25-…P3 A D6
30	P5	LLTHR 30-…P5	LLTHR 30-…P5 A
		LLTHR 30-…P5 D4	LLTHR 30-…P5 A D4
		LLTHR 30-…P5 D6	LLTHR 30-…P5 A D6
	P3	LLTHR 30-…P3	LLTHR 30-…P3 A
		LLTHR 30-…P3 D4	LLTHR 30-…P3 A D4
		LLTHR 30-…P3 D6	LLTHR 30-…P3 A D6
35	P5	LLTHR 35-…P5	LLTHR 35-…P5 A
		LLTHR 35-…P5 D4	LLTHR 35-…P5 A D4
		LLTHR 35-…P5 D6	LLTHR 35-…P5 A D6
	P3	LLTHR 35-…P3	LLTHR 35-…P3 A
		LLTHR 35-…P3 D4	LLTHR 35-…P3 A D4
		LLTHR 35-…P3 D6	LLTHR 35-…P3 A D6
45	P5	LLTHR 45-…P5	LLTHR 45-…P5 A
		LLTHR 45-…P5 D4	LLTHR 45-…P5 A D4
		LLTHR 45-…P5 D6	LLTHR 45-…P5 A D6
	P3	LLTHR 45-…P3	LLTHR 45-…P3 A
		LLTHR 45-…P3 D4	LLTHR 45-…P3 A D4
		LLTHR 45-…P3 D6	LLTHR 45-…P3 A D6

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2.1 Technical data

2.1.1 Load rating

Definition of the basic dynamic load rating C

The basic dynamic load rating C is the radial load, constant in magnitude and direction, which a linear rolling bearing can theoretically accommodate for a basic rating life represented by a travelled distance of 100 km (according to ISO 14728 Part 1).

NOTE: As per ISO 14728 Part 1, it is also permissible to state a reference distance of 50 km travelled. In this case, a conversion factor of 1,26 should be applied in order to enable proper comparison of the two load rating values (↳ **formula 1**).

(1) $$C_{100} = \frac{C_{50}}{1{,}26}$$

Definition of the basic static load rating C_0

The basic static load rating C_0 is the static load in the direction of loading which corresponds to a calculated stress at the centre of the most heavily loaded contact point between the rolling element and each of the raceways of carriage and rail.

NOTE: This stress produces a permanent total deformation of the rolling element and the raceway which corresponds to about 0,0001 times the rolling element diameter (according to ISO 14728 Part 2).

Verification and validation

The load ratings stated in this catalogue have been calculated for all product types based on the standards cited.

The calculation model prescribed in the standards has been complemented and verified by Ewellix through internal simulations.

Since it is not economically feasible to test the load ratings of all catalogue types in practice, Ewellix carries out standardized durability examinations at regular intervals by means of selected reference sizes. These tests provide statistical evidence and documentation that the theoretically ascertained load ratings are valid under standardized practical test conditions.

In many cases, this Ewellix internal validation process saves the customer intensive field tests and offers high reliability for LLT profile rail guide designs.

Only in cases where the operating conditions are not known, as well as in cases where these conditions are more exacting than usual, customers are advised to conduct further field tests.

In practice, it is a common approach to integrate results and experiences of existing and proven designs in new designs and apply them to new applications. When using LLT profile rail guides, it also makes sense for customers to build on previous application experience in the continuous development of their applications.

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2.1.2 Preload classes

To adjust a profile rail guide to the specific requirements of a given application, it is advisable to choose an appropriate preload. Preload can enhance the performance of an entire linear guidance system and increase the rigidity of the carriage under load .

Preload is determined by oversizing between steel balls and raceways on carriage and rail track. This is ensured by state-of-the-art, high-precision grinding processes carefully matched with rolling elements.

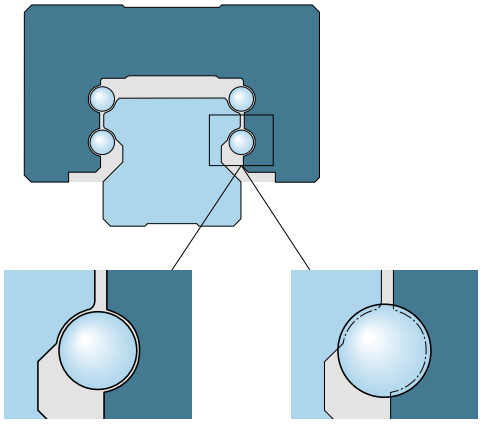
LLT ball profile rail guides are available in three different preload classes, as shown in **table 1**.

NOTE: The principle of the preload generation is shown in **fig. 1**.

For information about what preload classes are typically applied to different applications, see chapter **4.5 Typical application areas** (↳ **page 95**).

Fig. 1

Generation of preload



System without preload

Preloaded system with oversized balls

Table 1

Determining preload values according to preload class	
Preload class	Preload force F_{Pr}
T0	**Zero to light preload**
	For extremely smooth-running profile rail guide systems requiring low friction. This preload class is only available in P5 and P3 precision classes.
T1	**F_{Pr} = 2 % of C**
	For precise profile rail guide systems with low and medium external loads and a high degree of rigidity.
T2	**F_{Pr} = 8 % of C**
	For precise profile rail guide systems with high external load and high requirements for overall rigidity. Also recommended for single-rail systems. Additional common moment loads are absorbed without any significant elastic deformation.

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2.1.3 Accuracy

Precision classes

Ewellix manufactures its LLT ball profile rail guides in three precision classes. These precision classes define the maximum tolerance range of a profile rail system in terms of height, width and parallelism. This choice determines the running accuracy of the system within the application (↳ **table 2** and chapter ↳ **4.5 Typical application areas, page 95**, for further information).

Width and height precision

The tolerance of width N determines the maximum deviation of the distance from the carriage to the rail in lateral direction. Both sides of the rail and the ground side of the carriage can be used as the reference side.

The tolerance of height H is measured between the mounting surface of the carriage and the ground bottom face of the rail. H and N are arithmetic mean values.

The deviations ΔH and ΔN result, when different carriages are measured on the same rail position.

Running parallelism

This refers to the running parallelism tolerance between the two reference planes of the rail and carriage when the carriage is moved along the entire rail length, the rail being screwed to the reference plane. Please refer to **diagram 1** for detailed information.

Combination of rails and carriages

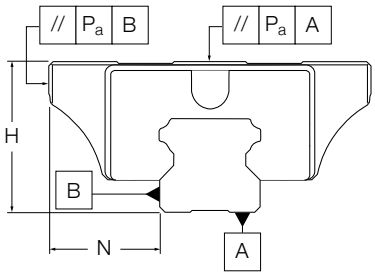
All carriages and rails of the same size and precision class (P5/P3) can be combined with each other while maintaining the initial precision class. They are fully interchangeable. Mixed precision classes are possible.

NOTE: The lower accuracy can be guaranteed when system item assembled by rail and carriage with different accuracy.

NOTE: Precision class P1 can only be delivered as a complete system.

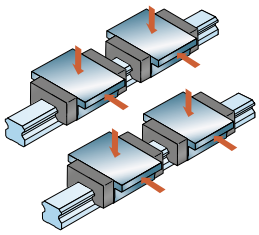
NOTE: Preload/Precision class T2 P3 can only be delivered as a complete system.

Table 2

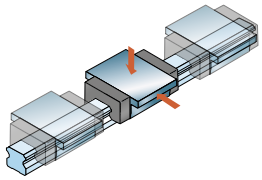


Precision class	Tolerances		Differences in dimension H and N on one rail	
	H [1]	N	ΔH [1] max.	ΔN max.
–	µm		µm	
P5	±100	±40	30	30
P3	±40	±20	15	15
P1	±20	±10	7	7

[1] Measured at the centre of the carriage



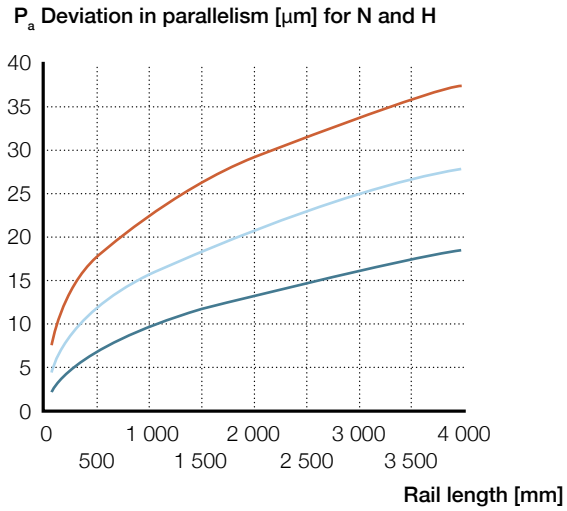
For any combination of carriages and rails



For different carriages on the same rail position

Diagram 1

Running parallelism



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2.1.4 Rigidity

The rigidity of LLT profile rail guides, in addition to their load carrying capacity, is one of the most important criteria in product selection.

Rigidity can be defined as the deformation characteristics of a guidance system under external load. The rigidity of a system depends on the magnitude and direction of the external load, the type of guidance system (size, carriage type, preload) and the mechanical properties of the adjacent support structure. Usually, this load is indicated, including magnitude and direction, on the point of load application of the mounted guidance system.

Rigidity values, which only take deflection of the rolling elements into consideration, can deviate considerably under realistic conditions due to the elasticity of the support structure, the screw connections and the joints between components. Therefore, the overall rigidity at the bearing point is, as a rule, lower than that of the actual guidance system.

The different sizes and types of LLT profile rail guides feature significant differences in their deformation behaviour.

The diagrams represent only the deformation values for a single reference size. These values are measured on properly mounted LLTHS 25 rail guides bolted to well-prepared support surfaces. The loads were applied symmetrically between the load carrying raceways.

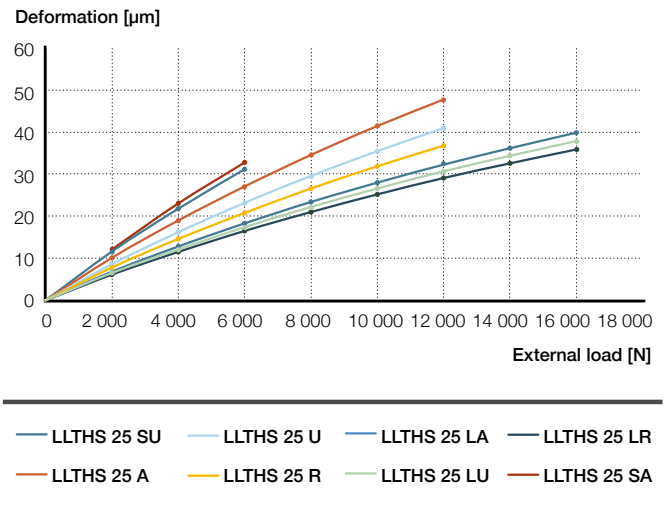
Rigidity values for other types of LLT profile rail guides are available on request.

Furthermore, the type and size of the carriage has an impact on rigidity due to the geometrical differences.

Diagram 2 shows the deformation behaviour of an LLT profile rail guide based on the selected carriage type in one load direction. It represents the behaviour of eight different size 25 carriage types under vertical pushing load in an identical mounting situation.

Diagram 2

Deformation behaviour of size 25 under vertical pushing load, with 8 type different carriages



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2.1.5 Permissible operating conditions

The function of LLT profile rail guides can be realized only if there are no deviations from the specified operating conditions. The formulae and life values stated in the chapter **2.2 Calculation of bearing loads** (↳ **page 24**) are valid only if the operating conditions described in the following are met.

1.1.1 Permissible speed and acceleration

LLT profile rail guides can reach a maximum speed of
v_{max} = 5 m/s.
The maximum acceleration is
a_{max} = 75 m/s² (for preloaded systems).

Permissible maximum load

When selecting an LLT profile rail guide, the dynamic and static load ratings are key factors in this process.

For example, the equivalent dynamic mean load during operation must not exceed 50 % of the dynamic load rating. To calculate the dynamic bearing load, see **page 26**.

Exceeding the dynamic load ratings in operation results in a deviation of the usual load distribution, and can significantly reduce bearing service life. A statistical evaluation according to Weibull is not reliable in these cases.

As stated in ISO 14728 Part 2, the maximum load should not exceed 50 % of the static load rating.

Required minimum load

To prevent the balls from sliding in the load zone during operation at higher speed, the carriage must be under a minimum load at all times. A value of about 2 % of the dynamic load rating can be used as a guideline. This is particularly important for applications that are characterized by highly dynamic cycles. LLT profile rail guides in the T1 preload class are typically able to satisfy minimum load requirements.

Permissible operating temperatures

The permissible temperature range for LLT profile rail guides is:

Continuous operation: –20 to +80 °C

Short-term: max. 100 °C

This temperature range is determined by the synthetic materials used for the ball retainers, recirculation devices and seals.

The time limit for the permissible maximum temperature is dependent on the actual operating conditions.
Low speed (< 0,2 m/s), slightly loaded (P < 15 % C) or stationary applications can be exposed to an ambient temperature < 100 °C for up to one hour.
Design measures like heat shielding can extend this period.

Be sure to check that the temperature limits of the lubricant can withstand elevated temperatures prior to use.

Standstill operation

When external forces create vibrations in a stationary LLT profile rail guide, surface damage due to micro-movements between the balls and raceways may occur. This can increase noise levels during dynamic operation and reduce system service life.

To avoid this type of damage, the guides should be isolated from external vibration and mechanically unloaded for transport purposes.

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2.1.6 Friction

In addition to the external operating load, the friction in a guidance system is determined by a number of other factors. For example, the preload class, external loads, speed of travel and viscosity of the lubricant should be taken into consideration.

The displacement resistance is determined by the proportions of rolling and sliding friction generated by the rolling elements in the contact zone. Also, the recirculation geometry as well as the lubricant have an influence.

The effect of the lubricant depends on its characteristics, quantity and condition.

A running-in phase provides a better distribution of the lubricant in the carriage, and therefore reduces friction.

The operating temperature of the guidance system also influences friction. Higher temperatures reduce the viscosity of the lubricant.

Another factor is the sliding friction of the front and longitudinal seals in contact with the profile rail guide. The friction generated by the seals will, however, decrease after the running-in phase.

The friction can be reduced to a minimum when carriages with low friction shields S0 from size 15 to 30 are used. Due to the reduced sealing ability of these shields, these carriages should only be considered for applications in clean environments.

Moreover, the mounting precision of the rails relative to each other plays an important part, just like the flatness of the saddle plates as well as attachment structure for rail tracks connected to the guides.

The coefficient of friction for lubricated profile rail guides is typically between μ = 0,003 and 0,005. Lower values should be selected for higher loads, and higher values for lower loads. The friction values of the seals must be added to these values.

Table 3

Standard seal					
Test condition			Greased (Grease type LGEP2)		
			Standard seal + side seal + inner seal		
Designation			LLTHS XX TX PX		
–	Size	Carriage length	Running friction force standard (N) Max.		
			T0	T1	T2
Friction Force	15	Short	≤ 4,5	≤ 5,5	–
		Normal	≤ 5,5	≤ 6,5	≤ 8,5
	20	Short	≤ 9,5	≤ 10,5	–
		Normal	≤ 10,5	≤ 11,5	≤ 14,0
		Long	≤ 11,5	≤ 12,5	≤ 15,0
	25	Short	≤ 12,5	≤ 13,5	–
		Normal	≤ 13,5	≤ 14,5	≤ 17,0
		Long	≤ 14,5	≤ 15,5	≤ 18,0
	30	Short	≤ 14,5	≤ 15,5	–
		Normal	≤ 16,0	≤ 17,5	≤ 22,5
		Long	≤ 16,5	≤ 18,0	≤ 23,0
	35	Short	≤ 17,5	≤ 19,0	–
		Normal	≤ 19,0	≤ 20,5	≤ 26,5
		Long	≤ 20,0	≤ 21,5	≤ 27,5
	45	Normal	≤ 22,0	≤ 23,5	≤ 30,5
		Long	≤ 26,0	≤ 28,0	≤ 35,5

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Table 4

Low friction shields S0

Test condition			**Without greasing** Low friction shields S0 + Side seal + inner seal LLTHS XX TX PX Running friction force standard (N) Max.		
Designation –	Size	Carriage length	T0	T1	T2
Friction Force	15	Short	≤ 1,2	≤ 1,5	–
		Normal	≤ 1,5	≤ 1,8	≤ 2,3
	20	Short	≤ 1,7	≤ 2,0	–
		Normal	≤ 2,0	≤ 2,3	≤ 3,1
		Long	≤ 2,5	≤ 2,8	≤ 3,6
	25	Short	≤ 2,0	≤ 2,4	–
		Normal	≤ 2,4	≤ 2,8	≤ 3,8
		Long	≤ 3,0	≤ 3,4	≤ 4,4
	30	Short	≤ 2,5	≤ 3,0	–
		Normal	≤ 3,0	≤ 3,5	≤ 4,8
		Long	≤ 3,5	≤ 4,0	≤ 5,3

Table 5

Additional friction force

Test condition			**Without greasing** Side seal + inner seal	
Size	Additional friction force base on standard seal (N)			
	S1 S1 kit on one side	S7 S7 kit on one side	S6 S6 kit on one side	S3 S3 kit on one side
15	0	1	1,02	4
20	0	1,25	1,02	4
25	0	1,5	2,04	4
30	0	1,75	3,06	4
35	0	2	4,08	4
45	0	2,25	-	4

NOTE:

1. Calculation example: LLTH 15 U T0 carriage standard push and pull force specification is less than or equal to 5.5N, S7 single-plate friction force will increased 1N, so after the S7 single-plate is installed on one side, the push and pull force specification will be less than or equal to 6.5N (5.5N + 1N); after the S7 single-plate is installed on both sides, the push and pull force specification is less than or equal to 7.5N (5.5N+1N*2)

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2.1.7 Applications in corrosive environments

To ensure that LLT profile rail guides operate reliably in corrosive environments, the carriages and rails must be protected with special coatings. These coatings bring about substantial improvements in corrosion resistance and thus increase the wear resistance under critical operating conditions.

Ewellix protects components with the following coatings:

LLTHR rails: TDC (Thin Dense Chrome) coating
Trivalent Chrome coating
LLTHC carriages: Nickel layer

Rail: The rail features a very thin TDC and Trivalent Chrome layer that provides effective corrosion protection, but does not affect the load rating of the system. The TDC has an excellent corrosion protection and withstands 72 hours salt spray test. The cost competitive Trivalent Chrome coating has a proven 24 hours salt spray test protection which is also sufficient to a wide range of applications that requires corrosion protection. For technical data regarding both types of coatings, please refer to **table 6**.

This product range enables two combinations. The coated rail can be combined with both nickel-plated and standard carriages. A combination of coated rail and standard carriage can be used where the rails are exposed to slightly corrosive media only and the carriages are sufficiently shielded through the adjacent structure or other measures (e.g. machines during transport, installations in contact with weak cleaning solutions).

When used in combination with standard carriages, the catalogue load ratings can be used for the life calculation without change. For this design variant, users should bear in mind that preload increases slightly due to the layer thickness.

When using coated rails in combination with nickel-plated carriages, the load ratings for dynamic loads and moments will be reduced by 30 % and for static loads and moments by 20 %. The preload classes T0 and T1 are available as standard. Systems with coated rails can have a slightly higher preload and friction. This will be partly eliminated after a short running time.

Availability

- Rail sizes: 15–45
- Coated rails: maximum length of about 4 000 mm
- Cut-to-length rail: standard – cut edges not coated
- Cut-to-length rail: possible – cut edges coated

Table 6

Technical data and ordering designations of coated components

Properties	Rail		Carriage
Designation	LLTHR ... HD (Europe)	LLTHR ... HT	LLTHC ... A HN
	LLTHR ... HA (USA/CAN)		LLTHC ... R HN
			LLTHC ... U HN
Coating	TDC	Trivalent Chrome	Nickel
Colour	matt grey	glossy silver	glossy silver
Layer hardness	900 HV – 1300 HV	700 HV - 800 HV	550 HV - 800 HV
Corrosion protection	72 h [1]	24 h [2]	72 h [2]
RoHS compliant	yes	yes	yes
Stainless steel ball			Material no. 1.4125 (X105CrMo17)

[1] DIN EN ISO 9227
[2] ASTM B-117 (equivalent to DIN EN ISO 9227)

Table 7

Available coated carriages

Size	Type [1]							
	A	R	U	SA	SU	LA	LR	LU
15	O	O	O	–	O	–	–	–
20	O	–	O	–	–	O	–	–
25	O	O	O	O	O	O	–	O
30	O	O	O	–	O	O	O	–
35	O	O	O	–	O	O	–	–
45	O	O	O	–	–	O	–	–

[1] Other type are available on request.

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NOTE: Where coated LLT rails are used, glossy areas may appear on the raceways after running-in. The corrosion protection properties are not compromised. Coated rails are not completely covered with a complete layer of TDC and Trivalent chromee at the non-machined bottom rail area and inside the mounting holes. Due to the coating process, the coating color might appear in different shades at the rail bottom side.

All components are delivered with preservative ex works. The nickel-plated carriages are delivered unlubricated and must be greased by the customer prior to use and re-lubricated at regular intervals.

Please refer to **4.4.2 for lubrication information**.

NOTE: The carriages of sizes 15 and 20, in combination with TDC coated rails, are supplied with a low friction S0 shield as standard. Optionally, they can also be combined with an additional S7 front seal. In these cases, a slight increase in carriage length must be taken into account (↳ **page 65**).

NOTE: The availability of coated carriages in different sizes and types is shown in **table 7.**

2.1.8 Jointed rail tracks

If the requested rail length exceeds the available delivery length of LLT rails, specially paired and jointed rails can be supplied as ready-to-mount sets consisting of two or more rails (per rail track). In this case, the rails are marked in order to avoid mix-up during mounting. For specific dimensions of the joint(s), please add a drawing. The maximum length for a deliverable rail track is 50 m. Please contact Ewellix to inquire about longer individual rail tracks. If replacement is required, the complete set should be exchanged to provide full functionality.

For designation, refer to Ordering key rails (↳ **page 104**).

For joint rail availability, see **table 8**.

Parallel use of jointed rails.

When the jointed rails are use by parallelly, we suggest to avoid the joint points which are between in the same position (↳ **fig. 3**).

Table 8

Availability of joint rails

Rail	Carriage	P5	P3	P1
Standard rail	Standard carriage	O	O	–
Coated rail	Standard carriage	O	O	–
Standard rail	Coated carriage	O	–	–
Coated rail	Coated carriage	O	–	–

Fig. 2

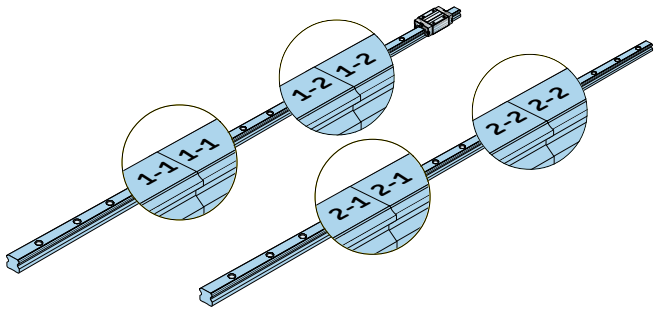
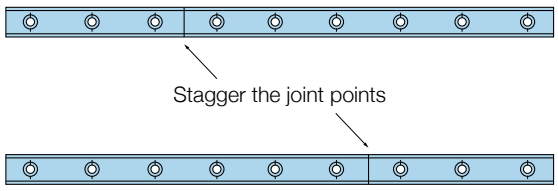


Fig. 3



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2.2 Calculation of bearing loads

2.2.1 Calculation bases

The calculation methods described in this chapter must take into account all actual loads and forces acting on the individual bearings.

Static safety factor

The static safety factor is expressed as the relationship between the static load rating and the maximum static bearing load including preload (↳ **page 27**). The load conditions (↳ **page 31**) acting on the guiding system during operation must also be taken into account. The static safety factor indicates the level of safety against permanent plastic deformation of the rolling elements and raceways and is calculated according to **formula 2**.

(2)
$$s_0 = \frac{C_0}{P_0} = \frac{C_0}{f_d F_{res\ max}}$$

where

C_0 = static load rating [N]
f_d = factor for load conditions
$F_{res\ max}$ = maximum resulting load [N]
P_0 = maximum static load [N]
s_0 = static safety factor

Based on practical experience, guideline values have been specified for the static safety factor, which depend on the operating mode and other external factors. (↳ **table 9**).

If, for example, the guiding system is exposed to vibrations from the machining process, higher safety factors should be applied. Moreover, the load transfer paths between a profile rail guide and its support structure should be taken into account. In particular, the bolted connections must be examined for sufficient safety. See also the chapter 4 **Mounting instruction and maintenance** (↳ **page 74**).
For overhead installations of LLT ball profile rail guides, higher safety factors should be applied. In any case, all provided attachment holes in carriage and rail are to be used in the application to make sure that loads applied on the linear guide will safely be taken and transferred.

NOTE: The maximum resulting load $F_{res\ max}$ should be calculated based on the combined static bearing load $F_{comb\ stat}$ determined according to the chapter **Combined static bearing load**, on **page 27**.

NOTE: The general technical rules and standards in the respective industrial sector must also be observed.

Table 9

Static safety factor depending on operating conditions	
Operating conditions	s_0
Normal conditions	min. 2
Smooth, vibration-free operation	> 2–4
Medium vibrations or impact loads	3–5
High vibrations or impact loads	> 5
Overhead installations	The general technical rules and standards in the respective industrial sector must be observed. And if the application poses a risk of serious injury, the user must take appropriate design and safety measures that will prevent the carriage from becoming detached from the rail (e.g. due to loss of rolling elements or failure of screw connections).

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Basic rating life L_{10}

Under controlled laboratory conditions, seemingly identical bearings operating under identical conditions have different individual endurance lives. A clearer definition of the term “bearing life” is therefore essential to calculate bearing size.

Important: All information presented by Ewellix with regard to load ratings is based on the life that 90 % of a sufficiently large group of apparently identical bearings can be expected to attain or exceed.

Basic rating life at constant speed

If the speed is constant, the basic rating life, L_s or L_h, can be calculated using formulae 3 and 5:

(3) $$L_{10s} = \left(\frac{C}{P}\right)^3 100$$

(4) $$P = \frac{f_d}{f_i \sqrt[3]{f_s}} F_{res}$$

(5) $$L_{10h} = \frac{5 \times 10^7}{l_s \; n \; 60} \left(\frac{C}{P}\right)^3$$

where

C = dynamic load rating [N]
f_d = factor for load conditions
f_i = factor for number of carriages per rail
F_{res} = resulting load [N]
f_s = factor for stroke length
L_{10h} = basic rating life [h]
L_{10s} = basic rating life [km]
n = stroke frequency [double strokes/min]
P = equivalent dynamic load [N]
l_s = single stroke length [mm]

Applying a preload

Depending on the combined bearing load and preload class, the resulting load has to be calculated according to the following methodology to get the impact on the life of LLT ball profile rail guides.

Load case 1

$F_{comb} \leq 2{,}8 \; F_{Pr}$ (F_{Pr} ↳ **table 10**)

(6) $$F_{res} = \left(\frac{F_{comb}}{2{,}8 \; F_{pr}} + 1\right)^{1{,}5} F_{pr}$$

Load case 2

$F_{comb} > 2{,}8 \; F_{Pr}$ (F_{Pr} ↳ **table 9**)

(7) $$F_{res} = F_{comb}$$

where

F_{comb} = combined, static or dynamic bearing load [N]
F_{Pr} = preload force [N]
F_{res} = resulting load [N]

Table 10

Determining preload values according to preload class

Preload class	Preload force F_{Pr}
T0	**Zero to light preload**
	For extremely smooth-running profile rail guide systems requiring low friction. This preload class is only available in P5 and P3 precision classes.
T1	**F_{Pr} = 2 % of C**
	For precise profile rail guide systems with low and medium external loads and a high degree of rigidity.
T2	**F_{Pr} = 8 % of C**
	For precise profile rail guide systems with high external load and high requirements for overall rigidity. Also recommended for single-rail systems. Additional common moment loads are absorbed without any significant elastic deformation.

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2.2.2 Constant mean load

General calculation formulae

Equivalent dynamic mean load

The rating life calculation formulae are based on the assumption that the load and the speed are constant. In reality the external loads, positions and speeds are changing in most cases and the workflow has to be separated into load phases with constant or approximately constant conditions along their individual strokes (**diagram 3**). All single load phases are summarized to the equivalent dynamic mean load P_m depending on their individual stroke length (**formulae 8 and 9**).

(8)

$$P_m = \sqrt[3]{\frac{\sum_{j=1}^{v} |P_j^3|\, s_i}{s_{tot}}}$$

(9)

$$s_{tot} = s_1 + s_2 + \ldots + s_n$$

where

P_m = equivalent dynamic mean load [N]
P = equivalent dynamic load[N]
j = counter for load phases
V = amount of load phases
s_i = individual stroke length [mm]
s_{tot} = total stroke length [mm]

Maximum resulting load

The maximum value of F_{res} is required for calculating the static safety factor s . To this end, all loads must be calculated for the individual stroke lengths. With these figures, the maximum resulting load $F_{res\ max}$ can be calculated and then inserted in the equation for s_0 (**formula 2**).

(10)

$$F_{res\ max} = \underset{j=1}{\overset{v}{MAX}} |F_{res,j}|$$

where

$F_{res\ max}$ = maximum resulting load [N]
$F_{res,j}$ = resulting load for load phase [N]
j = counter for load phase
V = amount of load phases

Combined bearing loads

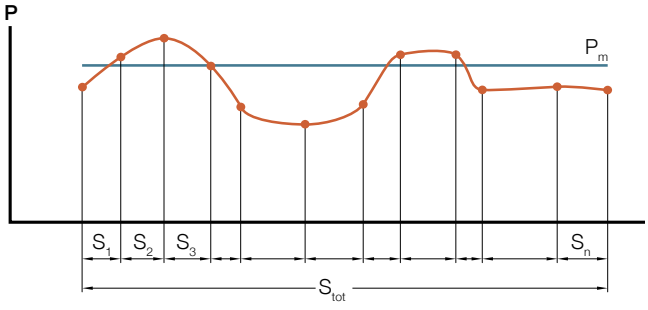
The following chapter describes the method to calculate the combined bearing load with possible combinations of forces and moments. All load components must be constant in magnitude to enable their calculation as one load phase.

If one of the load proportions varies significantly in magnitude over the length of the stroke, a separate load phase must be calculated according to the same method.

NOTE: For the following four calculations, a load, acting on the carriage at any angle, must be broken down into the proportions F_y and F_z. These proportions are then inserted into the respective formula.

Diagram 3

Variable load acting on a carriage



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Combined static bearing load

For static vertical and horizontal loads, the combined static bearing load $F_{comb,stat}$ can be calculated using **formula 11** (↳ **fig. 4**).

Formula 11 applies to a system with two rails and four carriages (no torque loads can occur).

(11) $$F_{comb,stat} = |F_y| + |F_z|$$

where

$F_{comb,stat}$ = combined static bearing load [N]

F_y, F_z = external bearing loads in y- and z-direction [N]

For combined static bearing loads – both vertical and horizontal – in combination with static moments, the combined static bearing load $F_{comb,stat}$ can be calculated using **formula 12** (↳ **fig. 5**).

(12) $$F_{comb,\,stat} = |F_y| + |F_z| + C_0 \left(\left| \frac{M_x}{M_{xC_0}} \right| + \left| \frac{M_y}{M_{yC_0}} \right| + \left| \frac{M_z}{M_{zC_0}} \right| \right)$$

where

C_0 = static load rating [N]

$F_{comb,stat}$ = combined static bearing load [N]

F_y, F_z = external bearing loads in y- and z-direction [N]

M_x, M_y, M_z = bearing moment loads at respective coordinates [Nm]

M_{xC_0}, M_{yC_0}, M_{zC_0} = permissible static moment loads [Nm]

Formula 12 can be used for the following systems:

- One rail with one carriage (all types of moment loads can occur)
- Two rails with one carriage each (M_x cannot occur)
- One rail with two carriages (M_y, M_z cannot occur)

NOTE: The maximum value of $F_{comb,stat}$ is required for calculating the static safety factor s_0. To this end, all loads must be calculated for the individual stroke lengths. With these figures, the maximum resulting load $F_{res\,max}$ can be calculated and then inserted in the equation for s_0 (**formula 2**).

Combined dynamic bearing load

For loads – both vertical and horizontal (↳ **fig. 4**) – the combined dynamic bearing load $F_{comb,dyn}$ is calculated by means of **formula 13.**

Formula 13 applies to a system with two rails and four carriages.

(13) $$F_{comb,dyn} = |F_y| + |F_z|$$

where

$F_{comb,dyn}$ = combined dynamic bearing load [N]

F_y, F_z = external bearing loads in y- and z-direction [N]

NOTE: The design of the profile rail guide permits this simplified calculation. If different load stages exist for F_y and F_z, then F_y and F_z must be considered individually in **formula 8**.

When combined dynamic bearing loads and dynamic moments are present, the combined dynamic bearing load $F_{comb,dyn}$ can be calculated using **formula 14** (↳ **fig. 5**).

(14) $$F_{comb,\,dyn} = |F_y| + |F_z| + C \left(\left| \frac{M_x}{M_{xC}} \right| + \left| \frac{M_y}{M_{yC}} \right| + \left| \frac{M_z}{M_{zC}} \right| \right)$$

where

C = dynamic load rating [N]

$F_{comb,dyn}$ = combined dynamic bearing load [N]

F_y, F_z = external bearing loads in y- and z-direction [N]

M_x, M_y, M_z = bearing moment loads at respective coordinates [Nm]

M_{xC}, M_{yC}, M_{zC} = permissible dynamic moment loads [Nm]

Formula 14 can be used for the following systems:

- One rail with one carriage (all types of moment loads can occur)
- Two rails with one carriage each (M_x cannot occur)
- One rail with two carriages (M_y, M_z cannot occur)

Fig. 4

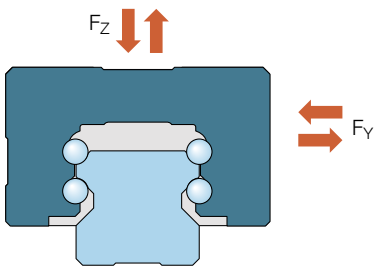
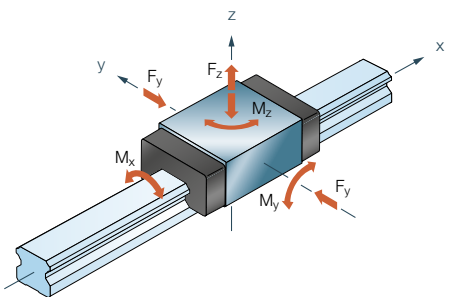


Fig. 5



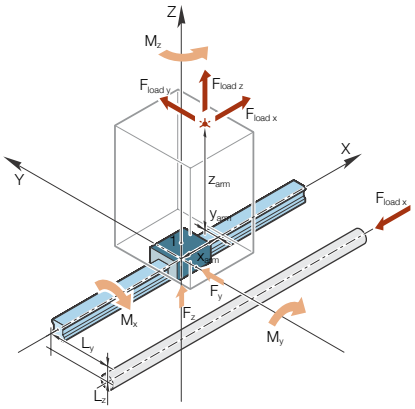
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Calculation examples for typical profile rail guide systems

The calculation formulas for determining the loads of carriages are shown on the following tables.

Fig. 6

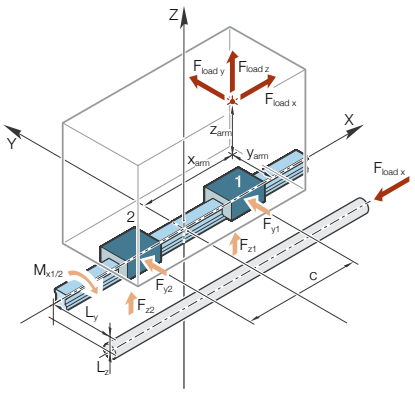
Loads on a system with 1 guide rail and 1 carriage



Carriage	Formula
1	Load: Force in z-direction $F_z = \sum_{j=1}^{k} F_{load\ z,\ j}$
1	Load: Force in y-direction $F_y = \sum_{j=1}^{k} F_{load\ y,\ j}$
1	Load: Moment about X-axis $M_x = \sum_{j=1}^{k} (F_{load\ y,\ j} \cdot z_{arm,\ j}) - \sum_{j=1}^{k} (F_{load\ z,\ j} \cdot y_{arm,\ j})$
1	Load: Moment about Y-axis $M_y = \sum_{j=1}^{k} (F_{load\ x,\ j} \cdot (z_{arm,\ j} - L_z)) - \sum_{j=1}^{k} (F_{load\ z,\ j} \cdot x_{arm,\ j})$
1	Load: Moment about Z-axis $M_z = -\sum_{j=1}^{k} (F_{load\ x,\ j} \cdot (y_{arm,\ j} - L_y)) + \sum_{j=1}^{k} (F_{load\ y,\ j} \cdot x_{arm,\ j})$

Fig. 7

Loads on a system with 1 guide rail and 2 carriages

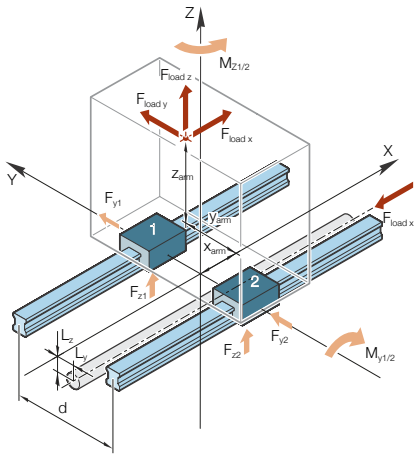


Carriage	Formula
1	Load: Force in z-direction $F_{z1} = \frac{\sum_{j=1}^{k} F_{load\ z,\ j}}{2} - \frac{\sum_{j=1}^{k} (F_{load\ x,\ j} \cdot (z_{arm,\ j} - L_z)) - \sum_{j=1}^{k} (F_{load\ z,\ j} \cdot x_{arm,\ j})}{c}$
2	Load: Force in z-direction $F_{z2} = \frac{\sum_{j=1}^{k} F_{load\ z,\ j}}{2} + \frac{\sum_{j=1}^{k} (F_{load\ x,\ j} \cdot (z_{arm,\ j} - L_z)) - \sum_{j=1}^{k} (F_{load\ z,\ j} \cdot x_{arm,\ j})}{c}$
1	Load: Force in y-direction $F_{y1} = \frac{\sum_{j=1}^{k} F_{load\ y,\ j}}{2} - \frac{\sum_{j=1}^{k} (F_{load\ x,\ j} \cdot (y_{arm,\ j} - L_y)) - \sum_{j=1}^{k} (F_{load\ y,\ j} \cdot x_{arm,\ j})}{c}$
2	Load: Force in y-direction $F_{y2} = \frac{\sum_{j=1}^{k} F_{load\ y,\ j}}{2} + \frac{\sum_{j=1}^{k} (F_{load\ x,\ j} \cdot (y_{arm,\ j} - L_y)) - \sum_{j=1}^{k} (F_{load\ y,\ j} \cdot x_{arm,\ j})}{c}$
1/2	Load: Moment about X-axis $M_{x1} = M_{x2} = \frac{\sum_{j=1}^{k} (F_{load\ y,\ j} \cdot z_{arm,\ j}) - \sum_{j=1}^{k} (F_{load\ z,\ j} \cdot y_{arm,\ j})}{2}$

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Fig. 8

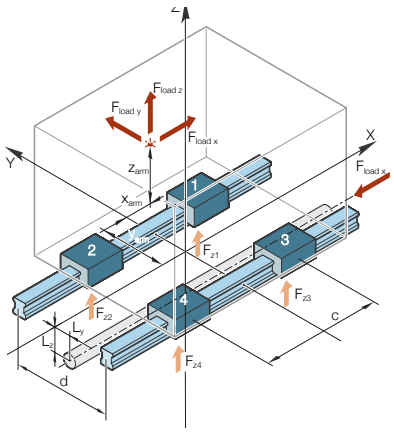
Loads on a system with 2 guide rails and 2 carriages



Carriage	Formula
1	Load: Force in z-direction $F_{z1}=\frac{\sum_{j=1}^{k} F_{load\ z,\ j}}{2}-\frac{\sum_{j=1}^{k}(F_{load\ y,\ j}\cdot z_{arm,\ j})-\sum_{j=1}^{k}(F_{load\ z,\ j}\cdot y_{arm,\ j})}{d}$
2	Load: Force in z-direction $F_{z2}=\frac{\sum_{j=1}^{k} F_{load\ z,\ j}}{2}+\frac{\sum_{j=1}^{k}(F_{load\ y,\ j}\cdot z_{arm,\ j})-\sum_{j=1}^{k}(F_{load\ z,\ j}\cdot y_{arm,\ j})}{d}$
1/2	Load: Force in y-direction $F_{y1}=F_{y2}=\frac{\sum_{j=1}^{k} F_{load\ y,\ j}}{2}$
1/2	Load: Moment about Y-axis $M_{y1}=M_{y2}=\frac{\sum_{j=1}^{k}(F_{load\ x,\ j}\cdot(z_{arm,\ j}-L_z))-\sum_{j=1}^{k}(F_{load\ z,\ j}\cdot x_{arm,\ j})}{2}$
1/2	Load:Moment about Z-axis $M_{z1}=M_{z2}=\frac{-\sum_{j=1}^{k}(F_{load\ x,\ j}\cdot(y_{arm,\ j}-L_y))+\sum_{j=1}^{k}(F_{load\ y,\ j}\cdot y_{arm,\ j})}{2}$

Fig. 9

Loads on a system with 2 guide rails and 4 carriages



Carriage	Formula
1	Load: Force in z-direction $F_{z1}=\frac{\sum_{j=1}^{k} F_{load\ z,\ j}}{4}+\frac{\sum_{j=1}^{k}(F_{load\ x,\ j}\cdot y_{arm,\ j})-\sum_{j=1}^{k}(F_{load\ y,\ j}\cdot z_{arm,\ j})}{2\cdot d}+\frac{\sum_{j=1}^{k}(F_{load\ z,\ j}\cdot x_{arm,\ j})-\sum_{j=1}^{k}(F_{load\ x,\ j}\cdot(z_{arm,\ j}-L_z))}{2\cdot c}$
2	Load: Force in z-direction $F_{z2}=\frac{\sum_{j=1}^{k} F_{load\ z,\ j}}{4}+\frac{\sum_{j=1}^{k}(F_{load\ z,\ j}\cdot y_{arm,\ j})-\sum_{j=1}^{k}(F_{load\ y,\ j}\cdot z_{arm,\ j})}{2\cdot d}+\frac{\sum_{j=1}^{k}(F_{load\ x,\ j}\cdot(z_{arm,\ j}-L_z))-\sum_{j=1}^{k}(F_{load\ z,\ j}\cdot X_{arm,\ j})}{2\cdot c}$
3	Load: Force in z-direction $F_{z3}=\frac{\sum_{j=1}^{k} F_{load\ z,\ j}}{4}+\frac{\sum_{j=1}^{k}(F_{load\ y,\ j}\cdot z_{arm,\ j})-\sum_{j=1}^{k}(F_{load\ z,\ j}\cdot y_{arm,\ j})}{2\cdot d}+\frac{\sum_{j=1}^{k}(F_{load\ z,\ j}\cdot x_{arm,\ j})-\sum_{j=1}^{k}(F_{load\ x,\ j}\cdot(z_{arm,\ j}-L_z))}{2\cdot c}$
4	Load: Force in z-direction $F_{z4}=\frac{\sum_{j=1}^{k} F_{load\ z,\ j}}{4}+\frac{\sum_{j=1}^{k}(F_{load\ y,\ j}\cdot z_{arm,\ j})-\sum_{j=1}^{k}(F_{load\ z,\ j}\cdot y_{arm,\ j})}{2\cdot d}+\frac{\sum_{j=1}^{k}(F_{load\ x,\ j}\cdot(z_{arm,\ j}-L_z))-\sum_{j=1}^{k}(F_{load\ z,\ j}\cdot x_{arm,\ j})}{2\cdot c}$

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2.2.3 Factors of influence

Requisite reliability

Factor c_1 is used for lifetime calculations where a reliability higher than 90 % is needed. The corresponding values can be found in (↳ **table 11**).

Operating conditions

The lubrication effectiveness is strongly dependent on the degree of separation between the rolling elements and raceway surfaces in the contact zones. A specific minimum viscosity is required for the formation of an effectively separating lubricating film at operating temperature, taking into account the kinematic conditions. Assuming a normal level of cleanliness of the profile rail guide as well as effective sealing, factor c_2 depends on the viscosity ratio κ exclusively. κ designates the ratio between the actual kinematic viscosity and the requisite minimum viscosity (↳ **formula 15**).

(15) $$\kappa = \frac{v}{v1}$$

where

κ = viscosity ratio

v = actual kinematic viscosity [mm²/s]

v_1 = requisite minimum viscosity [mm²/s]

The requisite minimum viscosity v_1 for LLT guides depends on the mean speed (↳ **diagram 4**).

The value for v_1 can be related to the actual viscosity v according to formula 15 in order to obtain κ. Now c_2 can be taken from (↳ **diagram 5**). If the viscosity ratio κ is less than 1, a lubricant with EP additives is recommended. If lubricant with EP additives are used, the higher value for c_2 can be used for calculation.

Table 11

Factor c_1 for reliability

Reliability %	L_{ns}	c_1
90	L_{10s}	1
95	L_{5s}	0,62
96	L_{4s}	0,53
97	L_{3s}	0,44
98	L_{2s}	0,33
99	L_{1s}	0,21

Diagram 4

Determining the requisite minimum viscosity v_1

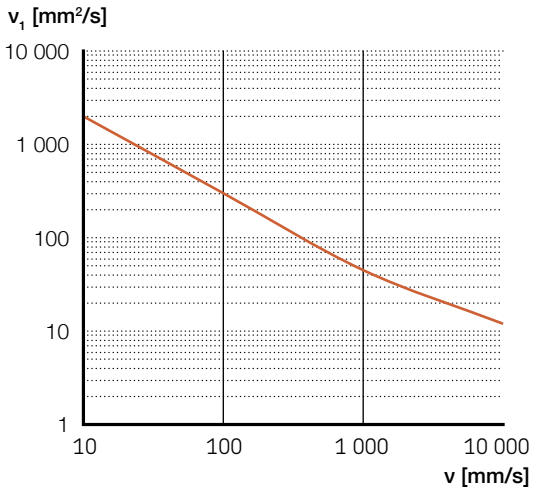
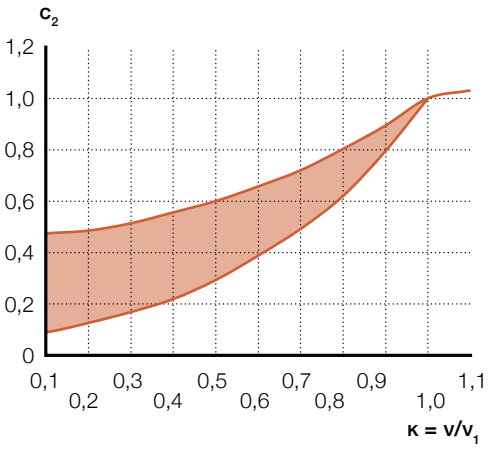


Diagram 5

Determining factor c_2 for operating conditions



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2.2.4 Load conditions

The load acting on an LLT ball profile rail guide is resulting from acceleration, impact loads and vibration. It is extremely difficult to quantify these additional dynamic forces. To approximate the impact these indeterminate loads will have on the life of the system, the load must be multiplied by factor f_d. Depending on the mean speed and strength of the impact load, values listed in **table 12** can be selected for f_d.

Number of carriages per rail

Most profile rail guide configurations feature two or more carriages mounted on one rail. The load distribution on these various carriages is strongly influenced by the mounting precision, the manufacturing quality of the adjacent components, and particularly, the distance between the carriages. Factor f_i takes these influences on carriage loading into account based on the number of carriages per rail and their distance relative to each other (↳ **table 13** and **fig. 10**).

Impact of stroke length

Strokes that are shorter than the metal body of the carriage (dimension L_2) have a negative influence on the achievable life of a guiding system. If the stroke is longer than the carriage metal body length, the factor is $f_s = 1$. Sequenced load phases with identical moving direction deliver a sub stroke length (S_s) according to **formula 16** to determine f_s. Based on the ratio of the sub stroke lengths (S_s) to the metal body of the carriage L_2, the factor f_s is determined according to **table 14**.

(16)

$$S_s = \sum_{j=A}^{B} S_j$$

where

S_s = sub stroke length [mm]
S_j = individual stroke length [mm]
j = counter for load phases
A = starting point of movement in one direction
B = next reversal point

Table 12

Factor f_d for load conditions

Load conditions	f_d from	up to
Smooth operation, no or light impact loads Speed ≤ 2 m/s	1,0	1,5
High impact loads Speed > 2 m/s	1,5	3,0

Table 13

Factor f_i for number of carriages per rail

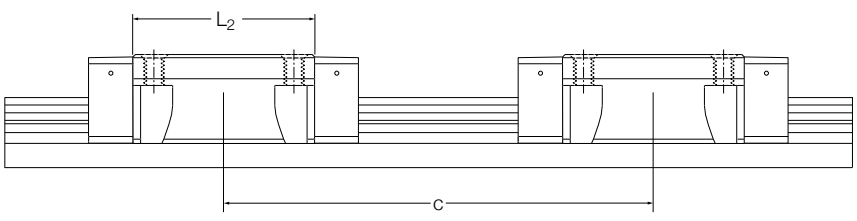
Number of carriages	If c ≥ 1,5*L_2 f_i	If c < 1,5*L_2 f_i
1	1	1
2	1	0,81
3	1	0,72

Table 14

Factor f_s depending on the ratio S_s/L_2

S_s/L_2	f_S
1,0	1,0
0,9	0,91
0,8	0,82
0,7	0,73
0,6	0,63
0,5	0,54
0,4	0,44
0,3	0,34
0,2	0,23

Fig. 10

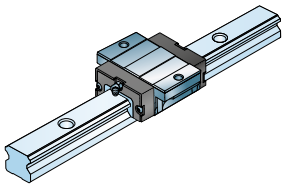


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3.1 Carriage data

LLTHC ... SA

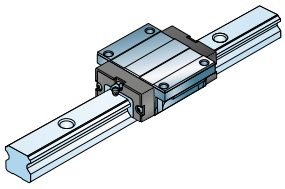
Flanged carriage, short length, standard height



Size [1]	Load ratings	
	C	C_0
–	N	
15	5 800	9 000
20	9 240	14 400
25	13 500	19 600
30	19 200	26 600
35	25 500	34 800
45	–	–

LLTHC ... A

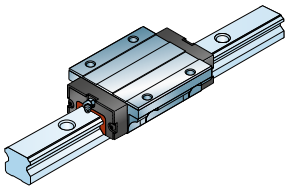
Flanged carriage, standard length, standard height



Size [1]	Load ratings	
	C	C_0
–	N	
15	8 400	15 400
20	12 400	24 550
25	18 800	30 700
30	26 100	41 900
35	34 700	54 650
45	59 200	91 100

LLTHC ... LA

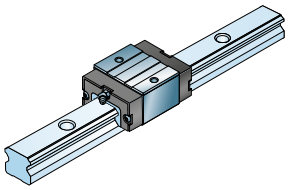
Flanged carriage, extended length, standard height



Size [1]	Load ratings	
	C	C_0
–	N	
15	–	–
20	15 200	32 700
25	24 400	44 600
30	33 900	60 800
35	45 000	79 400
45	72 400	121 400

LLTHC ... SU

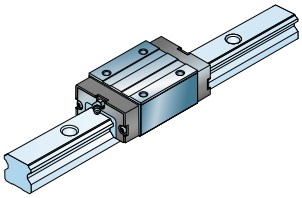
Slim-line carriage, short length, standard height



Size [1]	Load ratings	
	C	C_0
–	N	
15	5 800	9 000
20	9 240	14 400
25	13 500	19 600
30	19 200	26 600
35	25 500	34 800
45	–	–

LLTHC ... U

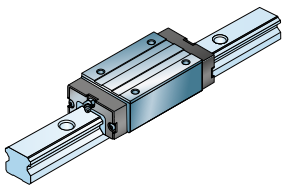
Slim-line carriage, standard length, standard height



Size [1]	Load ratings	
	C	C_0
–	N	
15	8 400	15 400
20	12 400	24 550
25	18 800	30 700
30	26 100	41 900
35	34 700	54 650
45	59 200	91 100

LLTHC ... LU

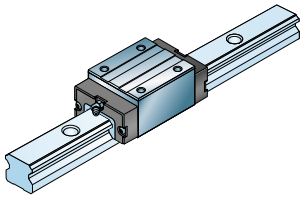
Slim-line carriage, extended length, standard height



Size [1]	Load ratings	
	C	C_0
–	N	
15	–	–
20[2]	15 200	32 700
25	24 000	44 600
30	33 900	60 800
35	45 000	79 400
45	72 400	121 400

LLTHC ... R

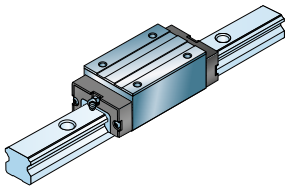
Slim-line carriage, standard length, extended height



Size [1]	Load ratings	
	C	C_0
–	N	
15	8 400	15 400
20	–	–
25	18 800	30 700
30	26 100	41 900
35	34 700	54 650
45	59 200	91 100

LLTHC ... LR

Slim-line carriage, extended length, extended height



Size [1]	Load ratings	
	C	C_0
–	N	
15	–	–
20[2]	15 200	32 700
25	24 400	44 600
30	33 900	60 800
35	45 000	79 400
45	72 400	121 400

[1] Front seal appearance can slightly deviate by size.
[2] LLLTHC 20 LU and LLTHC 20 LR is the same product

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3.1.1 Carriage LLTHC ... SA

Flanged carriage, short length, standard height.

Carriages from size 15 to 30 are also available with low friction S0 shield. Dimensions are the same as standard version. For designation, refer to **Ordering key carriages** (↳ **page 103**).



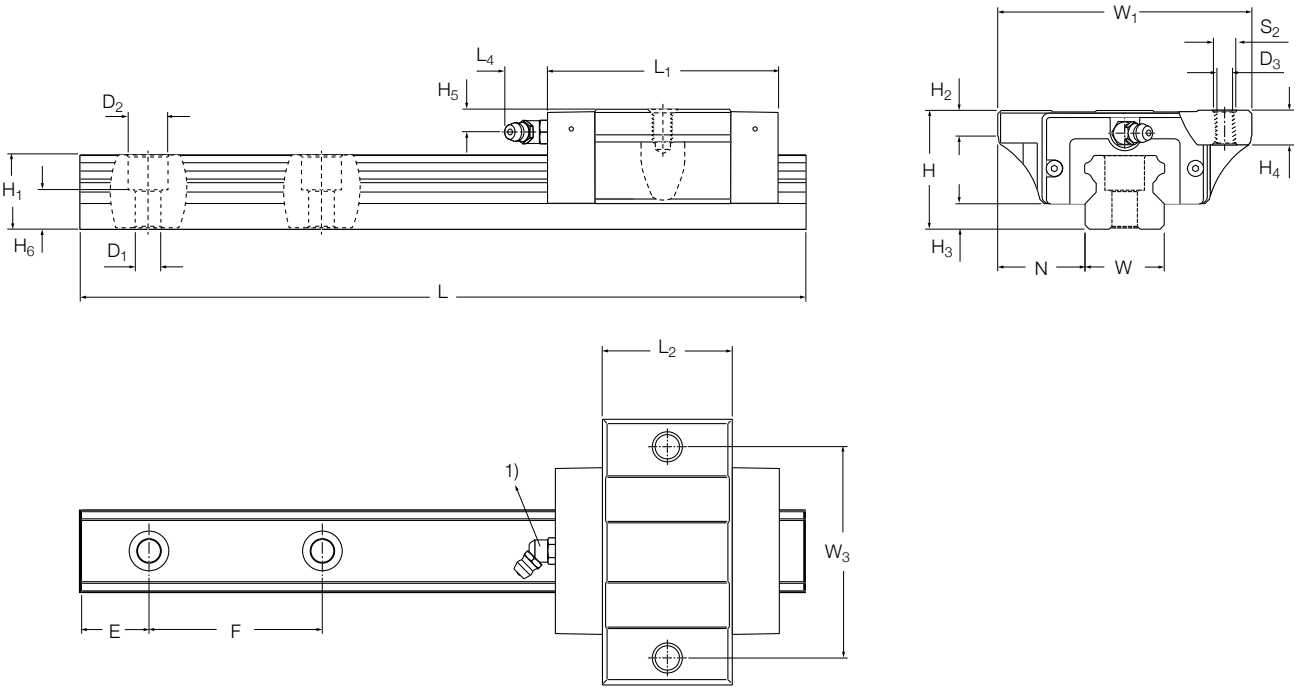
Technical data

Size	Precision class	Designation [1] Preload class T0	T1
–		–	
15	P5	**LLTHC 15 SA T0 P5**	**LLTHC 15 SA T1 P5**
	P3	**LLTHC 15 SA T0 P3**	**LLTHC 15 SA T1 P3**
	P1		**LLTHC 15 SA T1 P1**
20	P5	**LLTHC 20 SA T0 P5**	**LLTHC 20 SA T1 P5**
	P3	**LLTHC 20 SA T0 P3**	**LLTHC 20 SA T1 P3**
	P1		**LLTHC 20 SA T1 P1**
25	P5	**LLTHC 25 SA T0 P5**	**LLTHC 25 SA T1 P5**
	P3	**LLTHC 25 SA T0 P3**	**LLTHC 25 SA T1 P3**
	P1		**LLTHC 25 SA T1 P1**
30	P5	**LLTHC 30 SA T0 P5**	**LLTHC 30 SA T1 P5**
	P3	**LLTHC 30 SA T0 P3**	**LLTHC 30 SA T1 P3**
	P1		**LLTHC 30 SA T1 P1**
35	P5	**LLTHC 35 SA T0 P5**	**LLTHC 35 SA T1 P5**
	P3	**LLTHC 35 SA T0 P3**	**LLTHC 35 SA T1 P3**
	P1		**LLTHC 35 SA T1 P1**

[1] • **Preferred range**.
• Only available as system.
For designation, please refer to designation system.

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Dimensional drawing



Size	Assembly dimensions					Carriage dimensions							
	W_1	N	H	H_2	H_3	L_1	L_2	L_4	W_3	H_4	H_5	D_3	S_2
–	mm												
15	47	16	24	5,7	4,6	48,9	25,6	4,3	38	8	4,3	4,3	M5×0,8
20	63	21,5	30	6,7	5	55,4	32,1	15	53	9	5,7	5,2	M6×1,0
25	70	23,5	36	10,8	7	66,2	38,8	16,6	57	12	6,5	6,7	M8×1,25
30	90	31	42	8,8	9	78	45	14,6	72	11,5	8	8,5	M10×1,5
35	100	33	48	12,1	9,5	88,8	51,4	14,6	82	13	8	8,5	M10×1,5

Size	Rail dimensions									Weight		Load ratings [2]		Moments [2]			
										carriage	rail	dynamic	static	dynamic	static	dynamic	static
	W	H_1	H_6	F	D_1	D_2	E_{min} ±0,75	E_{max} ±0,75	L_{max} ±1,5			C	C_0	M_{xC}	M_{xC_0}	M_{yC}=M_{zC}	M_{yC_0}=M_{zC_0}
–	mm									kg	kg/m	N		Nm			
15	15	14	8,5	60	4,5	7,5	10	50	3 920	0,12	1,4	5 800	9 000	39	60	21	32
20	20	18	9,3	60	6	9,5	10	50	3 920	0,25	2,3	9 240	14 400	83	130	41	64
25	23	22	12,3	60	7	11	10	50	3 920	0,38	3,3	13 500	19 600	139	202	73	106
30	28	26	13,8	80	9	14	12	70	3 944	0,56	4,8	19 200	26 600	242	335	120	166
35	34	29	17	80	9	14	12	70	3 944	0.83	6,6	25 500	34 800	393	536	182	248

[1] For detailed information on grease nipples, please refer to **page 70** .

[2] Dynamic load capacities and moments are based on a travel life of 100 km. Please refer to **page 15** for further details.

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3.1.2 Carriage LLTHC ... A

Flanged carriage, standard length, standard height.

Carriages from size 15 to 30 are also available with low friction S0 shield. Dimensions are the same as standard version. For designation, refer to **Ordering key carriages** (↳ **page 103**).



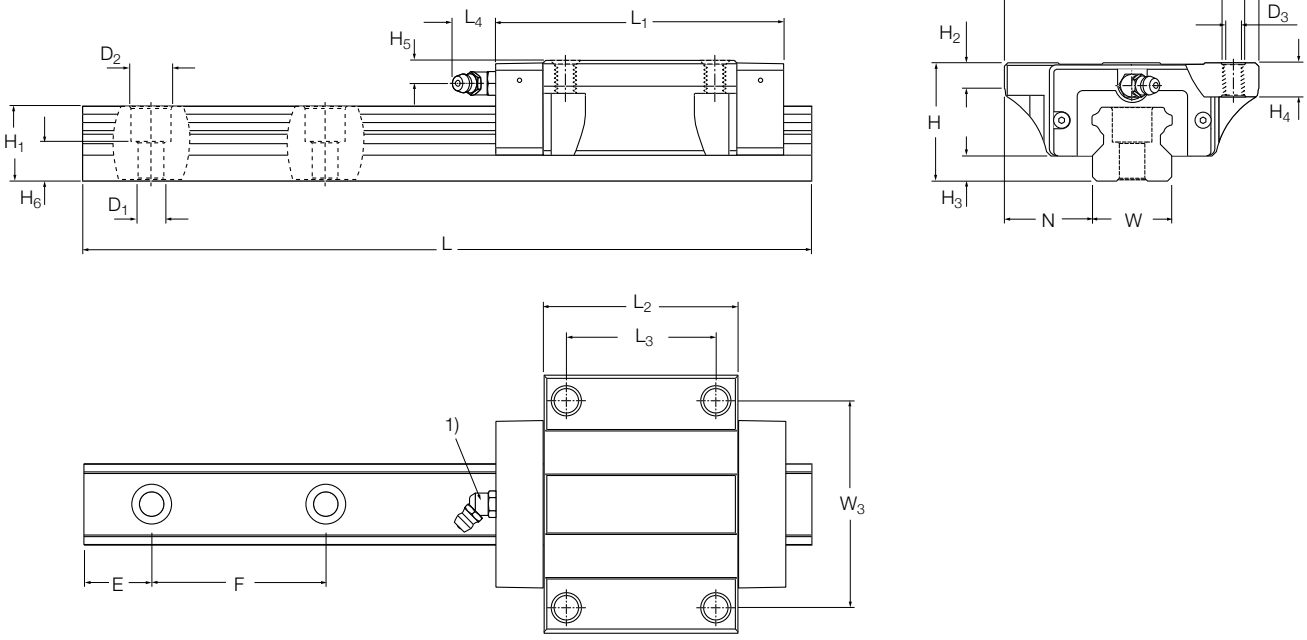
Technical data

Size	Precision class	Designation [1] Preload class T0	T1	T2
–		–		
15	P5	**LLTHC 15 A T0 P5**	**LLTHC 15 A T1 P5**	**LLTHC 15 A T2 P5**
	P3	**LLTHC 15 A T0 P3**	**LLTHC 15 A T1 P3**	LLTHC 15 A T2 P3
	P1		LLTHC 15 A T1 P1	LLTHC 15 A T2 P1
20	P5	**LLTHC 20 A T0 P5**	**LLTHC 20 A T1 P5**	**LLTHC 20 A T2 P5**
	P3	**LLTHC 20 A T0 P3**	**LLTHC 20 A T1 P3**	LLTHC 20 A T2 P3
	P1		LLTHC 20 A T1 P1	LLTHC 20 A T2 P1
25	P5	**LLTHC 25 A T0 P5**	**LLTHC 25 A T1 P5**	**LLTHC 25 A T2 P5**
	P3	**LLTHC 25 A T0 P3**	**LLTHC 25 A T1 P3**	LLTHC 25 A T2 P3
	P1		LLTHC 25 A T1 P1	LLTHC 25 A T2 P1
30	P5	**LLTHC 30 A T0 P5**	**LLTHC 30 A T1 P5**	**LLTHC 30 A T2 P5**
	P3	**LLTHC 30 A T0 P3**	**LLTHC 30 A T1 P3**	LLTHC 30 A T2 P3
	P1		LLTHC 30 A T1 P1	LLTHC 30 A T2 P1
35	P5	**LLTHC 35 A T0 P5**	**LLTHC 35 A T1 P5**	**LLTHC 35 A T2 P5**
	P3	**LLTHC 35 A T0 P3**	**LLTHC 35 A T1 P3**	LLTHC 35 A T2 P3
	P1		LLTHC 35 A T1 P1	LLTHC 35 A T2 P1
45	P5	**LLTHC 45 A T0 P5**	**LLTHC 45 A T1 P5**	**LLTHC 45 A T2 P5**
	P3	**LLTHC 45 A T0 P3**	**LLTHC 45 A T1 P3**	LLTHC 45 A T2 P3
	P1		LLTHC 45 A T1 P1	LLTHC 45 A T2 P1

[1] • **Preferred range**.
• **Only available as system**.
For designation, please refer to designation system.

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Dimensional drawing



Size	Assembly dimensions					Carriage dimensions								
	W_1	N	H	H_2	H_3	L_1	L_2	L_3	L_4	W_3	H_4	H_5	D_3	S_2
–	mm													
15	47	16	24	5,7	4,6	63,3	40	30	4,3	38	8	4,3	4,3	M5×0,8
20	63	21,5	30	6,7	5	73,3	50	40	15	53	9	5,7	5,2	M6×1,0
25	70	23,5	36	10,8	7	84,4	57	45	16,6	57	12	6,5	6,7	M8×1,25
30	90	31	42	8,8	9	100,4	67,4	52	14,6	72	11,5	8	8,5	M10×1,5
35	100	33	48	12,1	9,5	114,4	77	62	14,6	82	13	8	8,5	M10×1,5
45	120	37,5	60	12,1	14	136,5	96	80	14,6	100	15	8,5	10,4	M12×1,75

Size	Rail dimensions									Weight		Load ratings [2]		Moments [2]			
										carriage	rail	dynamic	static	dynamic	static	dynamic	static
	W	H_1	H_6	F	D_1	D_2	E_{min} ±0,75	E_{max} ±0,75	L_{max} ±1,5			C	C_0	M_{xC}	M_{xC_0}	$M_{yC}=M_{zC}$	$M_{yC_0}=M_{zC_0}$
–	mm									kg	kg/m	N		Nm			
15	15	14	8,5	60	4,5	7,5	10	50	3 920	0,21	1,4	8 400	15 400	56	103	49	90
20	20	18	9,3	60	6	9,5	10	50	3 920	0,4	2,3	12 400	24 550	112	221	90	179
25	23	22	12,3	60	7	11	10	50	3 920	0,57	3,3	18 800	30 700	194	316	155	254
30	28	26	13,8	80	9	14	12	70	3 944	1,1	4,8	26 100	41 900	329	528	256	410
35	34	29	17	80	9	14	12	70	3 944	1,6	6,6	34 700	54 650	535	842	388	611
45	45	38	20,8	105	14	20	16	90	3 917	2,7	11,3	59 200	91 100	1215	1869	825	1 270

[1] For detailed information on grease nipples, please refer to **page 70**.

[2] Dynamic load capacities and moments are based on a travel life of 100 km. Please refer to **page 15** for further details.

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3.1.3 Carriage LLTHC ... LA

Flanged carriage, extended length, standard height.

Carriages from size 20 to 30 are also available with low friction S0 shield. Dimensions are the same as standard version. For designation, refer to **Ordering key carriages** (↳ **page 103**).



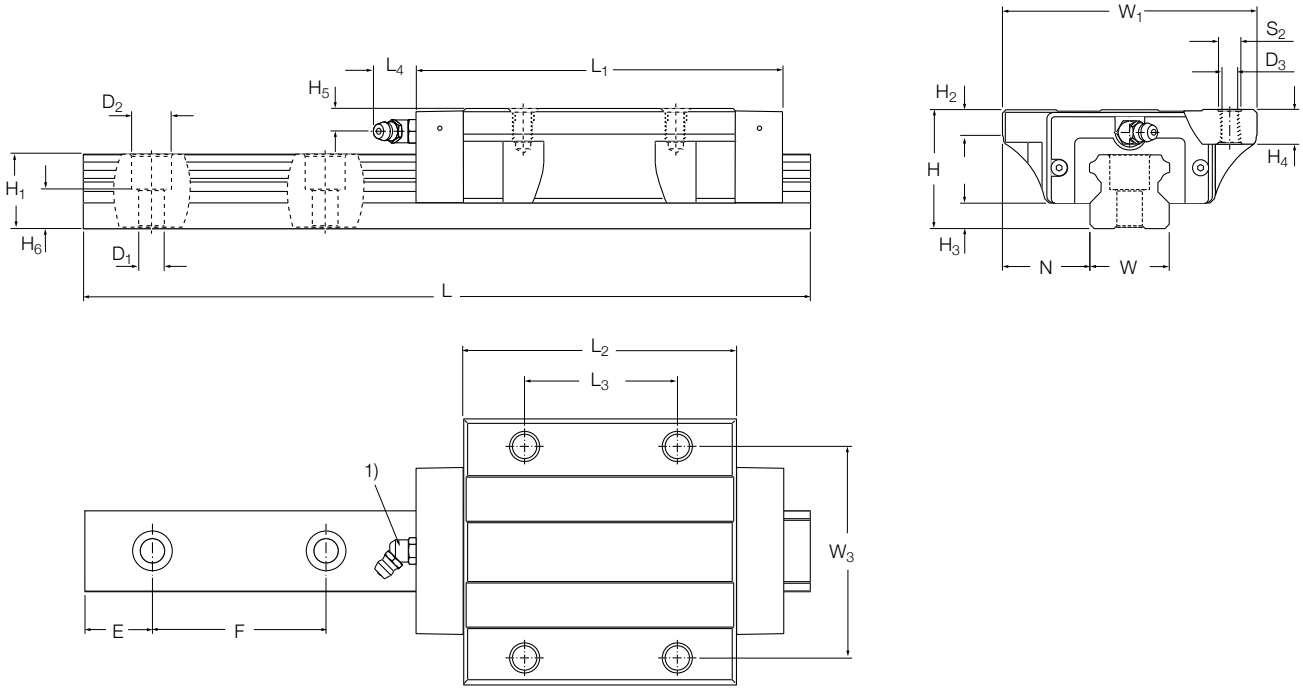
Technical data

Size	Precision class	Designation [1] Preload class T0	T1	T2
–		–		
20	P5	**LLTHC 20 LA T0 P5**	**LLTHC 20 LA T1 P5**	**LLTHC 20 LA T2 P5**
	P3	**LLTHC 20 LA T0 P3**	**LLTHC 20 LA T1 P3**	LLTHC 20 LA T2 P3
	P1		LLTHC 20 LA T1 P1	LLTHC 20 LA T2 P1
25	P5	**LLTHC 25 LA T0 P5**	**LLTHC 25 LA T1 P5**	**LLTHC 25 LA T2 P5**
	P3	**LLTHC 25 LA T0 P3**	**LLTHC 25 LA T1 P3**	LLTHC 25 LA T2 P3
	P1		LLTHC 25 LA T1 P1	LLTHC 25 LA T2 P1
30	P5	**LLTHC 30 LA T0 P5**	**LLTHC 30 LA T1 P5**	**LLTHC 30 LA T2 P5**
	P3	**LLTHC 30 LA T0 P3**	**LLTHC 30 LA T1 P3**	LLTHC 30 LA T2 P3
	P1		LLTHC 30 LA T1 P1	LLTHC 30 LA T2 P1
35	P5	**LLTHC 35 LA T0 P5**	**LLTHC 35 LA T1 P5**	**LLTHC 35 LA T2 P5**
	P3	**LLTHC 35 LA T0 P3**	**LLTHC 35 LA T1 P3**	LLTHC 35 LA T2 P3
	P1		LLTHC 35 LA T1 P1	LLTHC 35 LA T2 P1
45	P5	**LLTHC 45 LA T0 P5**	**LLTHC 45 LA T1 P5**	**LLTHC 45 LA T2 P5**
	P3	**LLTHC 45 LA T0 P3**	**LLTHC 45 LA T1 P3**	LLTHC 45 LA T2 P3
	P1		LLTHC 45 LA T1 P1	LLTHC 45 LA T2 P1

[1] • **Preferred range**.
• **Only available as system**.
For designation, please refer to designation system.

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Dimensional drawing



Size	Assembly dimensions					Carriage dimensions								
–	W_1 mm	N	H	H_2	H_3	L_1	L_2	L_3	L_4	W_3	H_4	H_5	D_3	S_2
20	63	21,5	30	6,7	5	89,5	66,2	40	15	53	9	5,7	5,2	M6×1,0
25	70	23,5	36	10,8	7	106,5	79,1	45	16,6	57	12	6,5	6,7	M8×1,25
30	90	31	42	8,8	9	125,4	92,4	52	14,6	72	11,5	8	8,5	M10×1,5
35	100	33	48	12,1	9,5	142,9	105,5	62	14,6	82	13	8	8,5	M10×1,5
45	120	37,5	60	12,1	14	168,5	128	80	14,6	100	15	8,5	10,4	M12×1,75

Size	Rail dimensions									Weight		Load ratings 2)		Moments 2)			
	W	H_1	H_6	F	D_1	D_2	E_{min} ±0,75	E_{max} ±0,75	L_{max} ±1,5	carriage	rail	dynamic C	static C_0	dynamic M_{xC}	static M_{xC_0}	dynamic $M_{yC}=M_{zC}$	static $M_{yC_0}=M_{zC_0}$
–	mm									kg	kg/m	N		Nm			
20	20	18	9,3	60	6	9,5	10	50	3 920	0,52	2,3	15 200	32 700	137	295	150	322
25	23	22	12,3	60	7	11	10	50	3 920	0,72	3,3	24 400	44 600	252	460	287	525
30	28	26	13,8	80	9	14	12	70	3 944	1,4	4,8	33 900	60 800	428	767	466	836
35	34	29	17	80	9	14	12	70	3 944	2	6,6	45 000	79 400	694	1 224	706	1 246
45	45	38	20,8	105	14	20	16	90	3 917	3,6	11,3	72 400	121 400	1 485	2 491	1 376	2 308

[1] For detailed information on grease nipples, please refer to **page 70**.

[2] Dynamic load capacities and moments are based on a travel life of 100 km. Please refer to **page 15** for further details.

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3.1.4 Carriage LLTHC ... SU

Slim-line carriage, short length, standard height.

Carriages from size 15 to 30 are also available with low friction S0 shield. Dimensions are the same as standard version. For designation, refer to **Ordering key carriages** (↳ **page 103**).



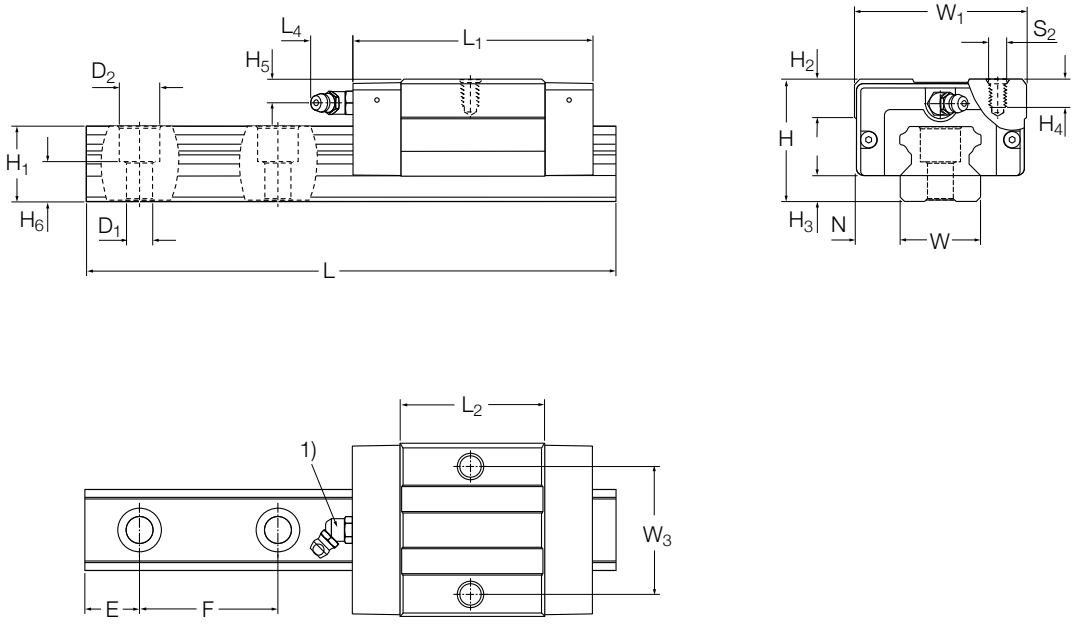
Technical data

Size	Precision class	Designation [1] Preload class T0	T1
–		–	
15	P5	**LLTHC 15 SU T0 P5**	**LLTHC 15 SU T1 P5**
	P3	**LLTHC 15 SU T0 P3**	**LLTHC 15 SU T1 P3**
	P1		**LLTHC 15 SU T1 P1**
20	P5	**LLTHC 20 SU T0 P5**	**LLTHC 20 SU T1 P5**
	P3	**LLTHC 20 SU T0 P3**	**LLTHC 20 SU T1 P3**
	P1		**LLTHC 20 SU T1 P1**
25	P5	**LLTHC 25 SU T0 P5**	**LLTHC 25 SU T1 P5**
	P3	**LLTHC 25 SU T0 P3**	**LLTHC 25 SU T1 P3**
	P1		**LLTHC 25 SU T1 P1**
30	P5	**LLTHC 30 SU T0 P5**	**LLTHC 30 SU T1 P5**
	P3	**LLTHC 30 SU T0 P3**	**LLTHC 30 SU T1 P3**
	P1		**LLTHC 30 SU T1 P1**
35	P5	**LLTHC 35 SU T0 P5**	**LLTHC 35 SU T1 P5**
	P3	**LLTHC 35 SU T0 P3**	**LLTHC 35 SU T1 P3**
	P1		**LLTHC 35 SU T1 P1**

[1] • **Preferred range**.
• **Only available as system**.
For designation, please refer to designation system.

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Dimensional drawing



Size	Assembly dimensions					Carriage dimensions						
	W_1	N	H	H_2	H_3	L_1	L_2	L_4	W_3	H_4	H_5	S_2
–	mm											
15	34	9,5	24	4,8	4,6	48,9	25,6	4,3	26	4	4,3	M4×0,7
20	44	12	30	9,3	5	55,4	32,1	15	32	6,5	5,7	M5×0,8
25	48	12,5	36	9,6	7	66,2	38,8	16,6	35	6,5	6,5	M6×1,0
30	60	16	42	12,6	9	78	45	14,6	40	8,5	8	M8×1,25
35	70	18	48	12,3	9,5	88,8	51,4	14,6	50	10	8	M8×1,25

Size	Rail dimensions									Weight		Load ratings [2]		Moments [2]			
										carriage	rail	dynamic	static	dynamic	static	dynamic	static
	W	H_1	H_6	F	D_1	D_2	E_{min} ±0,75	E_{max} ±0,75	L_{max} ±1,5			C	C_0	M_{xC}	M_{xC_0}	M_{yC}=M_{zC}	M_{yC_0}=M_{zC_0}
–	mm									kg	kg/m	N		Nm			
15	15	14	4,5	60	7,5	8,5	10	50	3 920	0,1	1,4	5 800	9 000	39	60	21	32
20	20	18	6	60	9,5	9,3	10	50	3 920	0,17	2,3	9 240	14 400	83	130	41	64
25	23	22	7	60	11	12,3	10	50	3 920	0,21	3,3	13 500	19 600	139	202	73	106
30	28	26	9	80	14	13,8	12	70	3 944	0,48	4,8	19 200	26 600	242	335	120	166
35	34	29	9	80	14	17	12	70	3 944	0,8	6,6	25 500	34 800	393	536	182	248

[1] For detailed information on grease nipples, please refer to **page 70**.

[2] Dynamic load capacities and moments are based on a travel life of 100 km. Please refer to **page 15** for further details.

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3.1.5 Carriage LLTHC ... U

Slim-line carriage, standard length, standard height.

Carriages from size 15 to 30 are also available with low friction S0 shield. Dimensions are the same as standard version. For designation, refer to **Ordering key carriages** (↳ **page 103**).



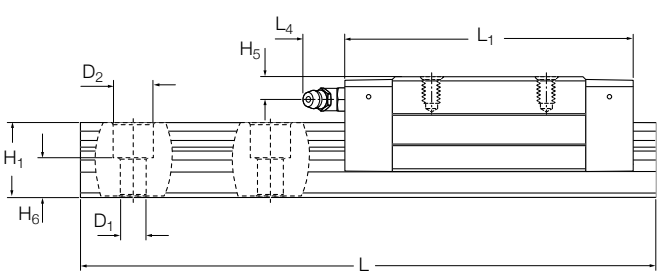
Technical data

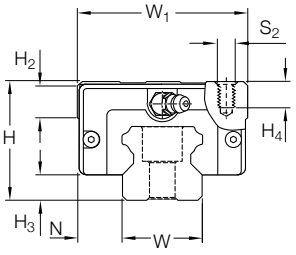
Size	Precision class	Designation [1] Preload class T0	T1	T2
–		–		
15	P5	**LLTHC 15 U T0 P5**	**LLTHC 15 U T1 P5**	**LLTHC 15 U T2 P5**
	P3	**LLTHC 15 U T0 P3**	**LLTHC 15 U T1 P3**	LLTHC 15 U T2 P3
	P1		LLTHC 15 U T1 P1	LLTHC 15 U T2 P1
20	P5	**LLTHC 20 U T0 P5**	**LLTHC 20 U T1 P5**	**LLTHC 20 U T2 P5**
	P3	**LLTHC 20 U T0 P3**	**LLTHC 20 U T1 P3**	LLTHC 20 U T2 P3
	P1		LLTHC 20 U T1 P1	LLTHC 20 U T2 P1
25	P5	**LLTHC 25 U T0 P5**	**LLTHC 25 U T1 P5**	**LLTHC 25 U T2 P5**
	P3	**LLTHC 25 U T0 P3**	**LLTHC 25 U T1 P3**	LLTHC 25 U T2 P3
	P1		LLTHC 25 U T1 P1	LLTHC 25 U T2 P1
30	P5	**LLTHC 30 U T0 P5**	**LLTHC 30 U T1 P5**	**LLTHC 30 U T2 P5**
	P3	**LLTHC 30 U T0 P3**	**LLTHC 30 U T1 P3**	LLTHC 30 U T2 P3
	P1		LLTHC 30 U T1 P1	LLTHC 30 U T2 P1
35	P5	**LLTHC 35 U T0 P5**	**LLTHC 35 U T1 P5**	**LLTHC 35 U T2 P5**
	P3	**LLTHC 35 U T0 P3**	**LLTHC 35 U T1 P3**	LLTHC 35 U T2 P3
	P1		LLTHC 35 U T1 P1	LLTHC 35 U T2 P1
45	P5	**LLTHC 45 U T0 P5**	**LLTHC 45 U T1 P5**	**LLTHC 45 U T2 P5**
	P3	**LLTHC 45 U T0 P3**	**LLTHC 45 U T1 P3**	LLTHC 45 U T2 P3
	P1		LLTHC 45 U T1 P1	LLTHC 45 U T2 P1

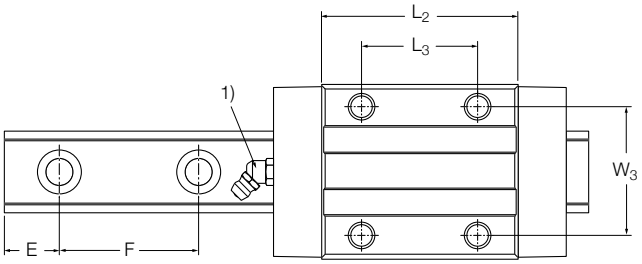
[1] • **Preferred range**.
• **Only available as system**.
For designation, please refer to designation system.

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Dimensional drawing







3

Size	Assembly dimensions					Carriage dimensions							
	W_1	N	H	H_2	H_3	L_1	L_2	L_3	L_4	W_3	H_4	H_5	S_2
–	mm												
15	34	9,5	24	4,8	4,6	63,3	40	26	4,3	26	4	4,3	M4×0,7
20	44	12	30	9,3	5	73,3	50	36	15	32	6,5	5,7	M5×0,8
25	48	12,5	36	9,6	7	84,4	57	35	16,6	35	6,5	6,5	M6×1,0
30	60	16	42	12,6	9	100,4	67,4	40	14,6	40	8,5	8	M8×1,25
35	70	18	48	12,3	9,5	114,4	77	50	14,6	50	10	8	M8×1,25
45	86	20,5	60	12,7	14	136,5	96	60	14,6	60	12	8,5	M10×1,5

Size	Rail dimensions									Weight		Load ratings [2]		Moments [2]			
	W	H_1	H_6	F	D_1	D_2	E_{min} ±0,75	E_{max} ±0,75	L_{max} ±1,5	carriage	static	dynamic C	static C_0	dynamic M_{xC}	static M_{xC_0}	dynamic $M_{yC}=M_{zC}$	static $M_{yC_0}=M_{zC_0}$
–	mm						mm			kg	kg/m	N		Nm			
15	15	14	8,5	60	4,5	7,5	10	50	3 920	0,17	1,4	8 400	15 400	56	103	49	90
20	20	18	9,3	60	6	9,5	10	50	3 920	0,26	2,3	12 400	24 550	112	221	90	179
25	23	22	12,3	60	7	11	10	50	3 920	0,38	3,3	18 800	30 700	194	316	155	254
30	28	26	13,8	80	9	14	12	70	3 944	0,81	4,8	26 100	41 900	329	528	256	410
35	34	29	17	80	9	14	12	70	3 944	1,2	6,6	34 700	54 650	535	842	388	611
45	45	38	20,8	105	14	20	16	90	3 917	2,1	11,3	59 200	91 100	1 215	1 869	825	1 270

[1] For detailed information on grease nipples, please refer to **page 70**.

[2] Dynamic load capacities and moments are based on a travel life of 100 km. Please refer to **page 15** for further details.

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3.1.6 Carriage LLTHC ... LU

Slim-line carriage, extended length, standard height.

Carriages from size 25 to 30 are also available with low friction S0 shield. Dimensions are the same as standard version. For designation, refer to **Ordering key carriages** (↳ **page 105**).



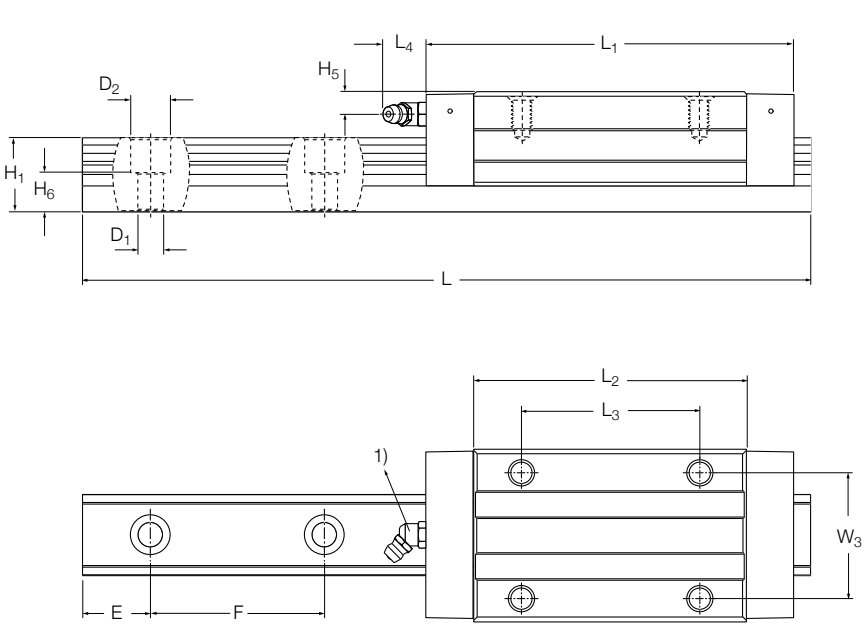
Technical data

Size	Precision class	Designation [1] Preload class T0	T1	T2
–		–		
25	P5	**LLTHC 25 LU T0 P5**	**LLTHC 25 LU T1 P5**	**LLTHC 25 LU T2 P5**
	P3	**LLTHC 25 LU T0 P3**	**LLTHC 25 LU T1 P3**	LLTHC 25 LU T2 P3
	P1		LLTHC 25 LU T1 P1	LLTHC 25 LU T2 P1
30	P5	**LLTHC 30 LU T0 P5**	**LLTHC 30 LU T1 P5**	**LLTHC 30 LU T2 P5**
	P3	**LLTHC 30 LU T0 P3**	**LLTHC 30 LU T1 P3**	LLTHC 30 LU T2 P3
	P1		LLTHC 30 LU T1 P1	LLTHC 30 LU T2 P1
35	P5	**LLTHC 35 LU T0 P5**	**LLTHC 35 LU T1 P5**	**LLTHC 35 LU T2 P5**
	P3	**LLTHC 35 LU T0 P3**	**LLTHC 35 LU T1 P3**	LLTHC 35 LU T2 P3
	P1		LLTHC 35 LU T1 P1	LLTHC 35 LU T2 P1
45	P5	**LLTHC 45 LU T0 P5**	**LLTHC 45 LU T1 P5**	**LLTHC 45 LU T2 P5**
	P3	**LLTHC 45 LU T0 P3**	**LLTHC 45 LU T1 P3**	LLTHC 45 LU T2 P3
	P1		LLTHC 45 LU T1 P1	LLTHC 45 LU T2 P1

[1] • **Preferred range**.
• **Only available as system**.
For designation, please refer to designation system.

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Dimensional drawing



Size	Assembly dimensions					Carriage dimensions							
	W_1	N	H	H_2	H_3	L_1	L_2	L_3	L_4	W_3	H_4	H_5	S_2
–	mm												
25	48	12,5	36	9,6	7	106,5	79,1	50	16,6	35	6,5	6,5	M6×1,0
30	60	16	42	12,6	9	125,4	92,4	60	14,6	40	8,5	8	M8×1,25
35	70	18	48	12,3	9,5	142,9	105,5	72	14,6	50	10	8	M8×1,25
45	86	20,5	60	12,7	14	168,5	128	80	14,6	60	12	8,5	M10×1,5

Size	Rail dimensions									Weight		Load ratings [2]		Moments [2]			
										carriage	rail	dynamic	static	dynamic	static	dynamic	static
	W	H_1	H_6	F	D_1	D_2	E_{min} ±0,75	E_{max} ±0,75	L_{max} ±1,5			C	C_0	M_{xC}	M_{xC_0}	$M_{yC}=M_{zC}$	$M_{yC_0}=M_{zC_0}$
–	mm						mm			kg	kg/m	N		Nm			
25	23	22	12,3	60	7	11	10	50	3 920	0,47	3,3	24 400	44 600	252	460	287	525
30	28	26	13,8	80	9	14	12	70	3 944	0,82	4,8	33 900	60 800	428	767	466	836
35	34	29	17	80	9	14	12	70	3 944	1,26	6,6	45 000	79 400	694	1 224	706	1 246
45	45	38	20,8	105	14	20	16	90	3 917	2,11	11,3	72 400	121 400	1 485	2 491	1 376	2 308

[1] For detailed information on grease nipples, please refer to **page 70**.

[2] Dynamic load capacities and moments are based on a travel life of 100 km. Please refer to **page 15** for further details.

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3.1.7 Carriage LLTHC ... R

Slim-line carriage, standard length, extended height.

Carriages from size 15 to 30 are also available with low friction S0 shield. Dimensions are the same as standard version. For designation, refer to **Ordering key carriages** (↳ **page 103**).



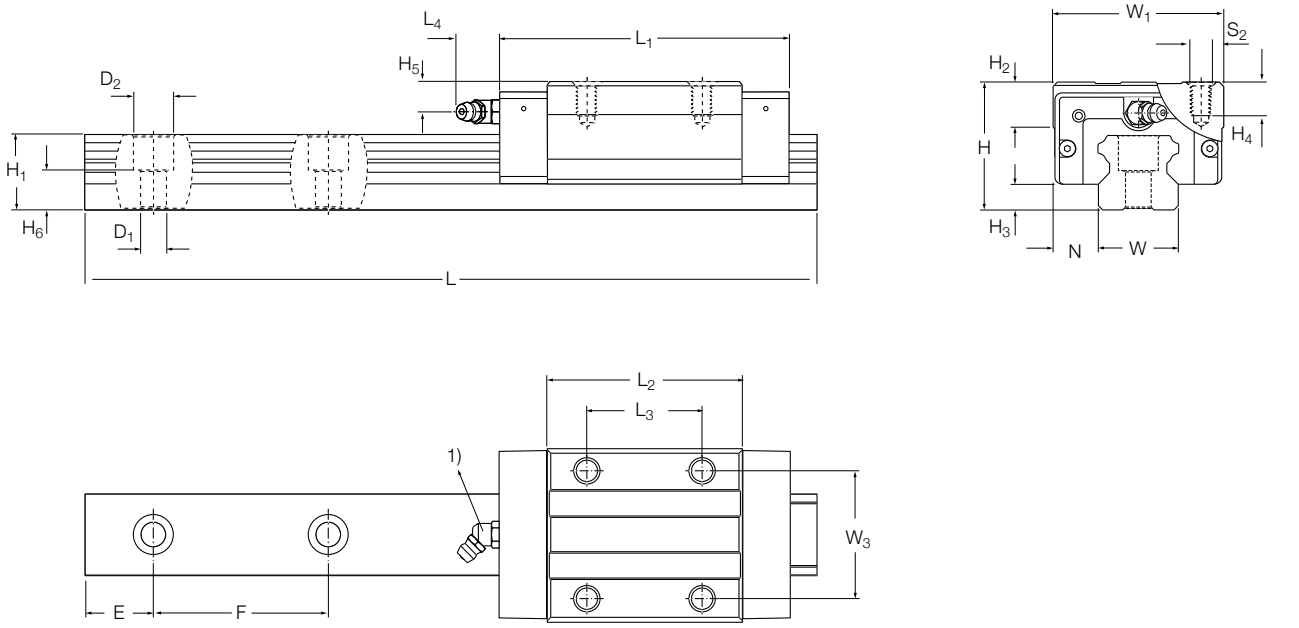
Technical data

Size	Precision class	Designation [1] Preload class T0	T1	T2
–		–		
15	P5	LLTHC 15 R T0 P5	LLTHC 15 R T1 P5	LLTHC 15 R T2 P5
	P3	LLTHC 15 R T0 P3	LLTHC 15 R T1 P3	LLTHC 15 R T2 P3
	P1		LLTHC 15 R T1 P1	LLTHC 15 R T2 P1
25	P5	LLTHC 25 R T0 P5	LLTHC 25 R T1 P5	LLTHC 25 R T2 P5
	P3	LLTHC 25 R T0 P3	LLTHC 25 R T1 P3	LLTHC 25 R T2 P3
	P1		LLTHC 25 R T1 P1	LLTHC 25 R T2 P1
30	P5	LLTHC 30 R T0 P5	LLTHC 30 R T1 P5	LLTHC 30 R T2 P5
	P3	LLTHC 30 R T0 P3	LLTHC 30 R T1 P3	LLTHC 30 R T2 P3
	P1		LLTHC 30 R T1 P1	LLTHC 30 R T2 P1
35	P5	LLTHC 35 R T0 P5	LLTHC 35 R T1 P5	LLTHC 35 R T2 P5
	P3	LLTHC 35 R T0 P3	LLTHC 35 R T1 P3	LLTHC 35 R T2 P3
	P1		LLTHC 35 R T1 P1	LLTHC 35 R T2 P1
45	P5	LLTHC 45 R T0 P5	LLTHC 45 R T1 P5	LLTHC 45 R T2 P5
	P3	LLTHC 45 R T0 P3	LLTHC 45 R T1 P3	LLTHC 45 R T2 P3
	P1		LLTHC 45 R T1 P1	LLTHC 45 R T2 P1

[1] • **Preferred range**.
• **Only available as system**.
For designation, please refer to designation system.

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Dimensional drawing



Size	Assembly dimensions					Carriage dimensions							
	W1	N	H	H2	H3	L1	L2	L3	L4	W3	H4	H5	S2
–	mm												
15	34	9,5	28	8,8	4,6	63,3	40	26	15	26	7,5	8,3	M4×0,7
25	48	12,5	40	13,6	7	84,4	57	35	16,6	35	10	10,5	M6×1,0
30	60	16	45	15,6	9	100,4	67,4	40	14,6	40	11,2	11	M8×1,25
35	70	18	55	19,3	9,5	114,4	77	50	14,6	50	17	15	M8×1,25
45	86	20,5	70	22,7	14	136,5	96	60	14,6	60	20,5	18,5	M10×1,5

Size	Rail dimensions									Weight		Load ratings [2]		Moments [2]			
										carriage	rail	dynamic	static	dynamic	static	dynamic	static
	W	H_1	H_6	F	D_1	D_2	E_{min} ±0,75	E_{max} ±0,75	L_{max} ±1,5			C	C_0	M_xC	M_{xC_0}	$M_{yC}=M_{zC}$	$M_{yC_0}=M_{zC_0}$
–	mm				Ø		mm			kg	kg/m	N		Nm			
15	15	14	8,5	60	4,5	7,5	10	50	3 920	0,19	1,4	8 400	15 400	56	103	49	90
25	23	22	12,3	60	7	11	10	50	3 920	0,45	3,3	18 800	30 700	194	316	155	254
30	28	26	13,8	80	9	14	12	70	3 944	0,91	4,8	26 100	41 900	329	528	256	410
35	34	29	17	80	9	14	12	70	3 944	1,5	6,6	34 700	54 650	535	842	388	611
45	45	38	20,8	105	14	20	16	90	3 917	2,3	11,3	59 200	91 100	1 215	1 869	825	1 270

[1] For detailed information on grease nipples, please refer to **page 70**.

[2] Dynamic load capacities and moments are based on a travel life of 100 km. Please refer to **page 15** for further details.

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3.1.8 Carriage LLTHC ... LR

Slim-line carriage, extended length, extended height.

Carriages from size 20 to 30 are also available with low friction S0 shield. Dimensions are the same as standard version. For designation, refer to **Ordering key carriages** (↳ **page 103**).



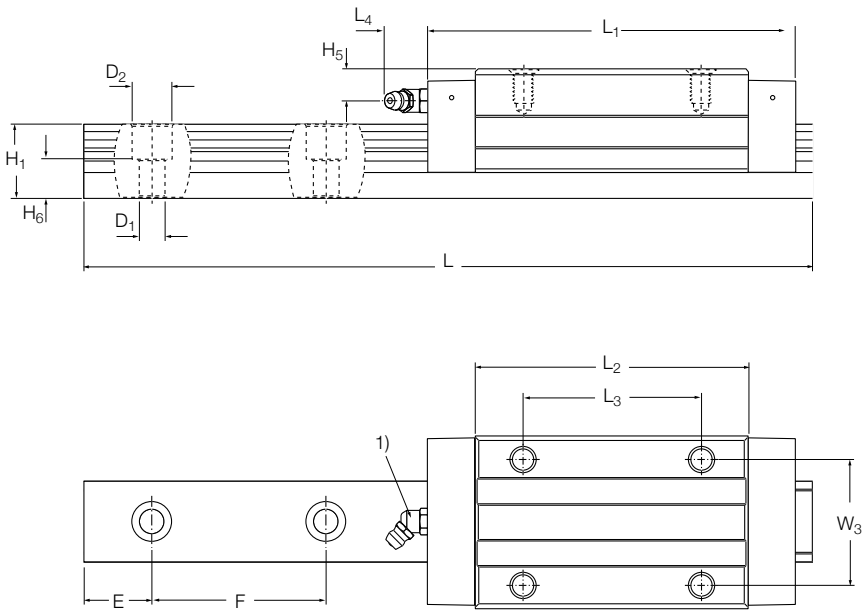
Technical data

Size	Precision class	Designation [1]		
		Preload class		
		T0	T1	T2
–		–		
20	P5	**LLTHC 20 LR T0 P5**	**LLTHC 20 LR T1 P5**	**LLTHC 20 LR T2 P5**
	P3	**LLTHC 20 LR T0 P3**	**LLTHC 20 LR T1 P3**	**LLTHC 20 LR T2 P3**
	P1		**LLTHC 20 LR T1 P1**	**LLTHC 20 LR T2 P1**
25	P5	**LLTHC 25 LR T0 P5**	**LLTHC 25 LR T1 P5**	**LLTHC 25 LR T2 P5**
	P3	**LLTHC 25 LR T0 P3**	**LLTHC 25 LR T1 P3**	**LLTHC 25 LR T2 P3**
	P1		**LLTHC 25 LR T1 P1**	**LLTHC 25 LR T2 P1**
30	P5	**LLTHC 30 LR T0 P5**	**LLTHC 30 LR T1 P5**	**LLTHC 30 LR T2 P5**
	P3	**LLTHC 30 LR T0 P3**	**LLTHC 30 LR T1 P3**	**LLTHC 30 LR T2 P3**
	P1		**LLTHC 30 LR T1 P1**	**LLTHC 30 LR T2 P1**
35	P5	**LLTHC 35 LR T0 P5**	**LLTHC 35 LR T1 P5**	**LLTHC 35 LR T2 P5**
	P3	**LLTHC 35 LR T0 P3**	**LLTHC 35 LR T1 P3**	**LLTHC 35 LR T2 P3**
	P1		**LLTHC 35 LR T1 P1**	**LLTHC 35 LR T2 P1**
45	P5	**LLTHC 45 LR T0 P5**	**LLTHC 45 LR T1 P5**	**LLTHC 45 LR T2 P5**
	P3	**LLTHC 45 LR T0 P3**	**LLTHC 45 LR T1 P3**	**LLTHC 45 LR T2 P3**
	P1		**LLTHC 45 LR T1 P1**	**LLTHC 45 LR T2 P1**

[1] • **Preferred range,**
• Only available as system.
For designation, please refer to designation system.

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Dimensional drawing



Size	Assembly dimensions					Carriage dimensions							
	W_1	N	H	H_2	H_3	L_1	L_2	L_3	L_4	W_3	H_4	H_5	S_2
–	mm												
20	44	12	30	9,3	5	89,5	66,2	50	15	32	6,5	5,7	M5×0,8
25	48	12,5	40	13,6	7	106,5	79,1	50	16,6	35	10	10,5	M6×1,0
30	60	16	45	15,6	9	125,4	92,4	60	14,6	40	11,2	11	M8×1,25
35	70	18	55	19,3	9,5	142,9	105,5	72	14,6	50	17	15	M8×1,25
45	86	20,5	70	22,7	14	168,5	128	80	14,6	60	20,5	18,5	M10×1,5

Size	Rail dimensions									Weight		Load ratings[2]		Moments[2]			
										carriage	rail	dynamic	static	dynamic	static	dynamic	static
	W	H_1	H_6	F	D_1	D_2	E_{min} ±0,75	E_{max} ±0,75	L_{max} ±1,5			C	C_0	M_{xC}	M_{xC_0}	M_{yC}=M_{zC}	M_{yC_0}=M_{zC_0}
–	mm				Ø		mm			kg	kg/m	N		Nm			
20	20	18	9,3	60	6	9,5	10	50	3 920	0,47	2,3	15 200	32 700	137	295	150	322
25	23	22	12,3	60	7	11	10	50	3 920	0,56	3,3	24 400	44 600	252	460	287	525
30	28	26	13,8	80	9	14	12	70	3 944	1,2	4,8	33 900	60 800	428	767	466	836
35	34	29	17	80	9	14	12	70	3 944	1,9	6,6	45 000	79 400	694	1 224	706	1 246
45	45	38	20,8	105	14	20	16	90	3 917	2,8	11,3	72 400	121 400	1 485	2 491	1 376	2 308

[1] For detailed information on grease nipples, please refer to **page 70**.

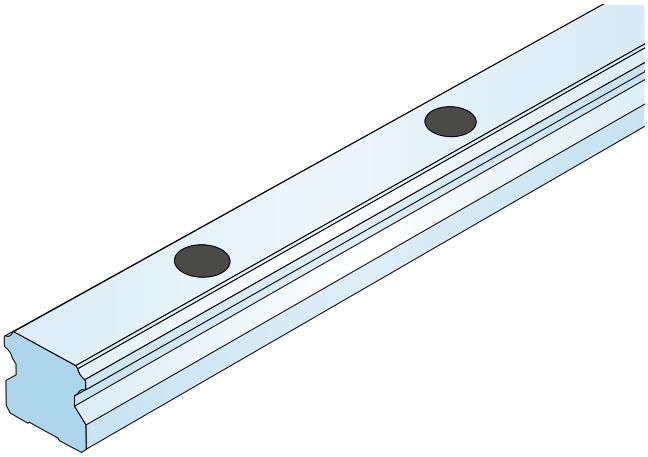
[2] Dynamic load capacities and moments are based on a travel life of 100 km. Please refer to **page 15** for further details.

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3.2 Rail data

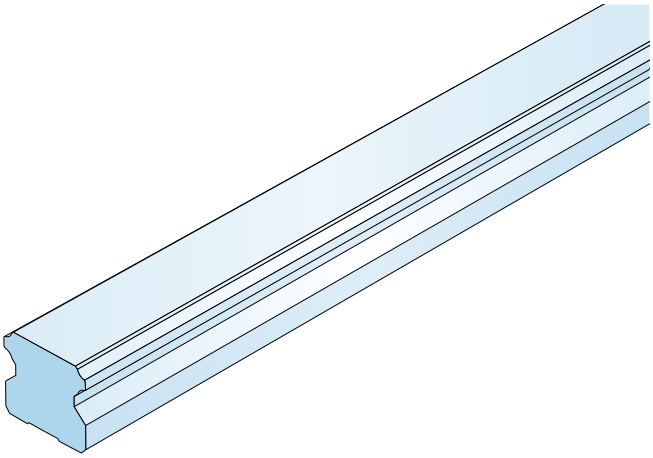
LLTHR rails

Supplied with protective plastic caps for mounting from above.



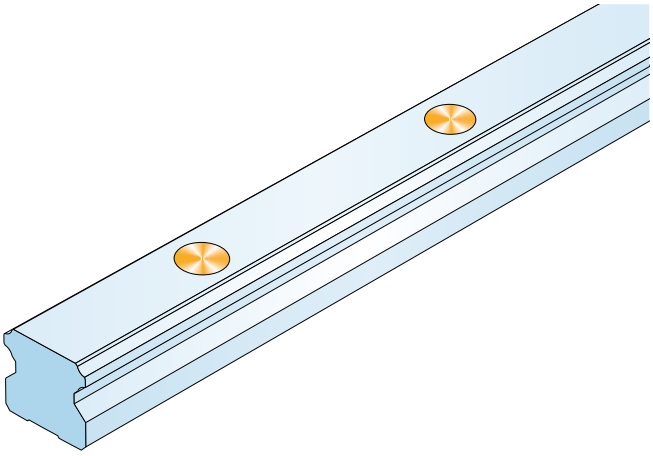
LLTHR ... D4 rails

With blind holes for mounting from below.



LLTHR ... D6 rails

Supplied with protective metal plugs for mounting from above.



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3.2.1 LLTHR rails

Rails are supplied with protective plastic caps for mounting from above. For designation, refer to **Ordering key rails** (↳ **page 104**).

NOTE: If a rail length is required that exceeds the maximum length available, jointed rails can be ordered. These rails are manufactured so they match seamlessly to each other.



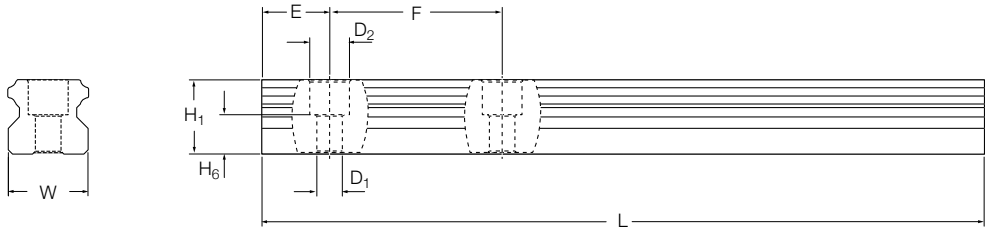
Technical data

Size	Precision class	Designation [1]		Pitch
		One-piece rail	Multi–piece rail	
–	–	–		F mm
15	P5	LLTHR 15 - ... P5	LLTHR 15 - ... P5 A	60
	P3	LLTHR 15 - ... P3	LLTHR 15 - ... P3 A	
	P1	LLTHR 15 - ... P1	LLTHR 15 - ... P1 A	
20	P5	LLTHR 20 - ... P5	LLTHR 20 - ... P5 A	60
	P3	LLTHR 20 - ... P3	LLTHR 20 - ... P3 A	
	P1	LLTHR 20 - ... P1	LLTHR 20 - ... P1 A	
25	P5	LLTHR 25 - ... P5	LLTHR 25 - ... P5 A	60
	P3	LLTHR 25 - ... P3	LLTHR 25 - ... P3 A	
	P1	LLTHR 25 - ... P1	LLTHR 25 - ... P1 A	
30	P5	LLTHR 30 - ... P5	LLTHR 30 - ... P5 A	80
	P3	LLTHR 30 - ... P3	LLTHR 30 - ... P3 A	
	P1	LLTHR 30 - ... P1	LLTHR 30 - ... P1 A	
35	P5	LLTHR 35 - ... P5	LLTHR 35 - ... P5 A	80
	P3	LLTHR 35 - ... P3	LLTHR 35 - ... P3 A	
	P1	LLTHR 35 - ... P1	LLTHR 35 - ... P1 A	
45	P5	LLTHR 45 - ... P5	LLTHR 45 - ... P5 A	105
	P3	LLTHR 45 - ... P3	LLTHR 45 - ... P3 A	
	P1	LLTHR 45 - ... P1	LLTHR 45 - ... P1 A	

[1] • **Preferred range,**
• Only available as system.
By rail length in mm, e.g. LLTHR 15 -1000 P5

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Dimensional drawing



Size	Dimensions									Weight
	W	H_1	H_6	D_1	D_2	E_{min} ±0,75	E_{max} ±0,75	F	L_{max} ±1,5	
–	mm									kg/m
15	15	14	8,5	4,5	7,5	10	50	60	3 920	1,4
20	20	18	9,3	6	9,5	10	50	60	3 920	2,3
25	23	22	12,3	7	11	10	50	60	3 920	3,3
30	28	26	13,8	9	14	12	70	80	3 944	4,8
35	34	29	17	9	14	12	70	80	3 944	6,6
45	45	38	20,8	14	20	16	90	105	3 917	11,3

The “E” dimension designates the distance from the rail end to centre of the first attachment hole. If no specific “E” dimension is provided by the customer with the order, the rails are produced according to the following formulae:

Calculation of number of attachment holes in rail guide

(1) $$n_{real} = \frac{L}{F}$$

(2) Round down of n_{real} to n

(3) n + 1 = z

F = Distance of attachment holes

L = Rail length

n_{real} = Real calculation value number of hole distances

z = Number of attachment holes in rail

Determination of E dimension based on z

(4) $$E_{real} = \frac{L - F\,(z - 1)}{2}$$

E_{real} = Real calculation value for E-dimension

E_{min} = Minimum E-dimension according to catalogue

Comparison with catalogue value of E_{min}

(4.1) If $E_{real} \geq E_{min}$

Usage of E_{real} from **formula 4**

(4.2) If $E_{real} < E_{min}$

Calculation of E_{real} according to **formula 5**

(5) $$E_{real} = \frac{L - F\,(z - 2)}{2}$$

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3.2.2 LLTHR rails ... D4 rails

For mounting from below. For designation, refer to **Ordering key rails** (↳ **page 104**).

NOTE: If a rail length is required that exceeds the maximum length available, jointed rails can be ordered. These rails are manufactured so they match seamlessly to each other.



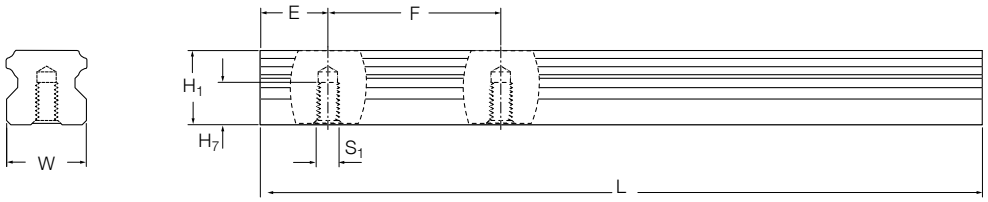
Technical data

Standard rail size	Precision class	Designation [1]		Pitch
		One-piece rail	Multi–piece rail	
–	–	–		F mm
15	P5	**LLTHR 15 - ... P5 D4**	**LLTHR 15 - ... P5 A D4**	60
	P3	**LLTHR 15 - ... P3 D4**	**LLTHR 15 - ... P3 A D4**	
	P1	**LLTHR 15 - ... P1 D4**	**LLTHR 15 - ... P1 A D4**	
20	P5	**LLTHR 20 - ... P5 D4**	**LLTHR 20 - ... P5 A D4**	60
	P3	**LLTHR 20 - ... P3 D4**	**LLTHR 20 - ... P3 A D4**	
	P1	**LLTHR 20 - ... P1 D4**	**LLTHR 20 - ... P1 A D4**	
25	P5	**LLTHR 25 - ... P5 D4**	**LLTHR 25 - ... P5 A D4**	60
	P3	**LLTHR 25 - ... P3 D4**	**LLTHR 25 - ... P3 A D4**	
	P1	**LLTHR 25 - ... P1 D4**	**LLTHR 25 - ... P1 A D4**	
30	P5	**LLTHR 30 - ... P5 D4**	**LLTHR 30 - ... P5 A D4**	80
	P3	**LLTHR 30 - ... P3 D4**	**LLTHR 30 - ... P3 A D4**	
	P1	**LLTHR 30 - ... P1 D4**	**LLTHR 30 - ... P1 A D4**	
35	P5	**LLTHR 35 - ... P5 D4**	**LLTHR 35 - ... P5 A D4**	80
	P3	**LLTHR 35 - ... P3 D4**	**LLTHR 35 - ... P3 A D4**	
	P1	**LLTHR 35 - ... P1 D4**	**LLTHR 35 - ... P1 A D4**	
45	P5	**LLTHR 45 - ... P5 D4**	**LLTHR 45 - ... P5 A D4**	105
	P3	**LLTHR 45 - ... P3 D4**	**LLTHR 45 - ... P3 A D4**	
	P1	**LLTHR 45 - ... P1 D4**	**LLTHR 45 - ... P1 A D4**	

[1] • **Preferred range,**
• Only available as system.
replace "..." by rail length in mm, e. g. LLTHR 15 - 1000 P5 D4

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Dimensional drawing



Size	Dimensions								Weight
	W	H_1	H_7	S_1	E_{min} ±0,75	E_{max} ±0,75	F	L_{max} ±1,5	
–	mm								kg/m
15	15	14	8	M5	10	50	60	3 920	1,4
20	20	18	10	M6	10	50	60	3 920	2,4
25	23	22	12	M6	10	50	60	3 920	3,4
30	28	26	15	M8	12	70	80	3 944	5,0
35	34	29	17	M8	12	70	80	3 944	6,8
45	45	38	24	M12	16	90	105	3 917	11,8

The “E” dimension designates the distance from the rail end to centre of the first attachment hole. If no specific “E” dimension is provided by the customer with the order, the rails are produced according to the following formulae:

Calculation of number of attachment holes in rail guide

(1) $n_{real} = \frac{L}{F}$

(2) Round down of n_{real} to n

(3) n + 1 = z

F = Distance of attachment holes

L = Rail length

n_{real} = Real calculation value for number of hole distances

z = Number of attachment holes in rail

Determination of E dimension based on z

(4) $E_{real} = \frac{L - F\,(z - 1)}{2}$

E_{real} = Real calculation value for E-dimension

E_{min} = Minimum E-dimension according to catalogue

Comparison with catalogue value of E_{min}

(4.1) If $E_{real} \geq E_{min}$
Usage of E_{real} from **formula 4**

(4.2) If $E_{real} < E_{min}$
Calculation of E_{real} according to **formula 5**

(5) $E_{real} = \frac{L - F\,(z - 2)}{2}$

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3.2.3 LLTHR ... D6 rails

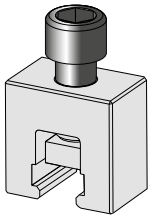
Rails are supplied with protective metal caps for mounting from above. For designation, refer to **Ordering key rails** (↳ **page 104**).

Protective metal plugs ensure that no residues of dirt, swarf, cooling water and other contaminants remain in the area of the attachment holes. After insertion, these plugs align flush with the surface of the profile rail guide to provide effective wiping. The use of additional scraper plates in combination with these protective metal plugs is an option which will further enhance protection (↳ **page 62**).

NOTE: If a rail length is required that exceeds the maximum length available, jointed rails can be ordered. These rails are manufactured so they match seamlessly to each other.



Size-specific mounting tools from Ewellix are needed for installing the protective metal plugs. Please refer to **page 104** for ordering the mounting tool.



Mounting tool for installing protective metal plugs

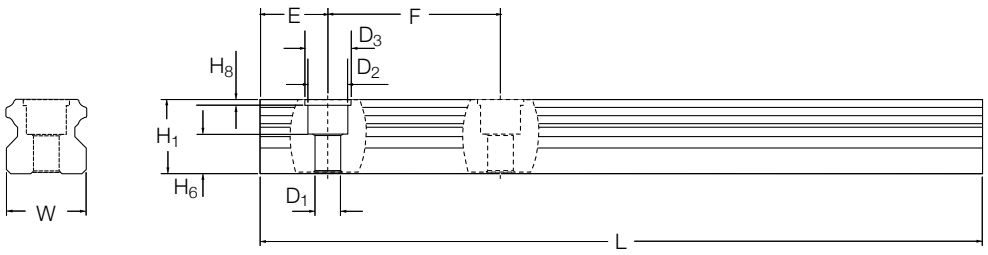
Technical data

Standard rail size	Precision class	Designation [1]		Pitch
		One-piece rail	Multi–piece rail	
–	–	–		F mm
25	P5	**LLTHR 25 - ... P5 D6**	**LLTHR 25 - ... P5 A D6**	60
	P3	**LLTHR 25 - ... P3 D6**	**LLTHR 25 - ... P3 A D6**	
	P1	**LLTHR 25 - ... P1 D6**	**LLTHR 25 - ... P1 A D6**	
30	P5	**LLTHR 30 - ... P5 D6**	**LLTHR 30 - ... P5 A D6**	80
	P3	**LLTHR 30 - ... P3 D6**	**LLTHR 30 - ... P3 A D6**	
	P1	**LLTHR 30 - ... P1 D6**	**LLTHR 30 - ... P1 A D6**	
35	P5	**LLTHR 35 - ... P5 D6**	**LLTHR 35 - ... P5 A D6**	80
	P3	**LLTHR 35 - ... P3 D6**	**LLTHR 35 - ... P3 A D6**	
	P1	**LLTHR 35 - ... P1 D6**	**LLTHR 35 - ... P1 A D6**	
45	P5	**LLTHR 45 - ... P5 D6**	**LLTHR 45 - ... P5 A D6**	105
	P3	**LLTHR 45 - ... P3 D6**	**LLTHR 45 - ... P3 A D6**	
	P1	**LLTHR 45 - ... P1 D6**	**LLTHR 45 - ... P1 A D6**	

[1] • **Preferred range,**
• Only available as system.
replace "..." by rail length in mm, e. g. LLTHR 15 - 1000 P5 D4

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Dimensional drawing



Size	Dimensions											Weight
	W	H_1	H_6	H_8	D_1	D_2	D_3	E_{min} ±0,75	E_{max} ±0,75	F	L_{max} ±1,5	
–	mm											kg/m
25	23	22	12,3	2,2	7	11	13	10	50	60	3 920	3,3
30	28	26	13,8	2,2	9	14	16	12	70	80	3 944	4,8
35	34	29	17	2,2	9	14	16	12	70	80	3 944	6,6
45	45	38	20,8	2,2	14	20	25	16	90	105	3 917	11,3

The "E" dimension designates the distance from the rail end to centre of the first attachment hole. If no specific "E" dimension is provided by the customer with the order, the rails are produced according to the following formulae:

Calculation of number of attachment holes in rail guide

(1) $n_{real} = \frac{L}{F}$

(2) Round down of n_{real} to n

(3) n + 1 = z

F = Distance of attachment holes

L = Rail length

n_{real} = Real calculation value for number of hole distances

z = Number of attachment holes in rail

Determination of E dimension based on z

(4) $E_{real} = \frac{L - F\,(z - 1)}{2}$

E_{real} = Real calculation value for E-dimension

E_{min} = Minimum E-dimension according to catalogue

Comparison with catalogue value of E_{min}

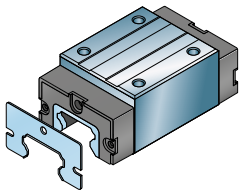
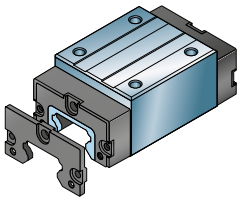
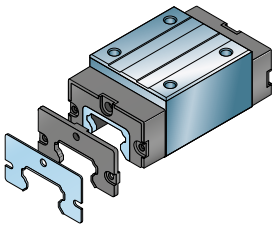
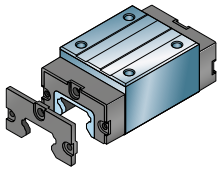
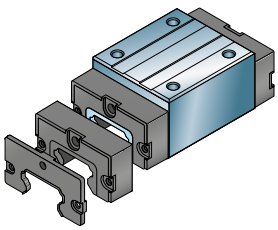
(4.1) If $E_{real} \geq E_{min}$
Usage of E_{real} from **formula 4**

(4.2) If $E_{real} < E_{min}$
Calculation of E_{real}
according to **formula 5**

(5) $E_{real} = \frac{L - F\,(z - 2)}{2}$

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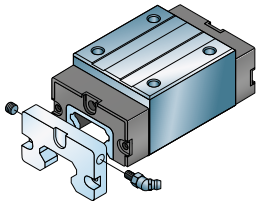
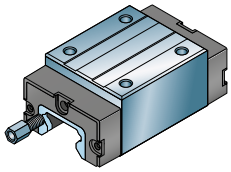
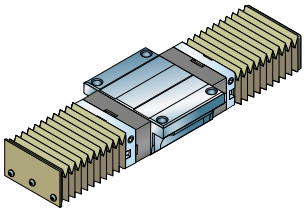
3.3 Accessories

Accessories Item name	Illustration [1]	Purpose
Scraper plate LLTHZ ... S1		Scraper plates are spring-steel, non-contact components. They protect the front seal from coarse contaminants or hot metal chips.
Additional front seal LLTHZ ... S7		Additional front seals are contact seals that can be attached to the carriage end faces. They are single-lip seals consisting of special heavy-duty material and offer additional protection against liquids and smaller contaminants. An additional front seal, in combination with carriages equipped with a low friction S0 shield, result in a sealed system with lower friction.
Seal kit LLTHZ ... S3		The seal kit consists of a metal scraper and an additional front seal. It is intended for applications involving exposure to coarse and fine dirt as well as liquids.
Low friction shield LLTHZ ... S0		The low friction shield has no contact with the rail. It replaces the standard front seal and results in a reduced friction force. Since the sealing function is not in place at the front ends of the carriage, the lubrication interval is reduced. The low friction shield is available for carriages from size 15 to 30.
Lube element LLTHZ ... S6		The lube element is designed to enhance the service life of a profile rail guide system. It provides an additional lubrication reservoir which consists of foam filled with oil in permanent contact with the raceways at the rail. By capillary attraction of the foam, the oil is constantly dosed in the correct amount. The ball elements roll through the applied oil film, whereby the optimal tribological conditions are maintained. The lube element is mounted on the end plate. The use of the originally delivered front seal keeps the dirt outside and the lubricant inside the carriage.

[1] Appearance can vary slightly depending on the size

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Accessories

Item name	Illustration [1]	Purpose
Adapter plate LLTHZ ... PL		Adapter plates provide a side lubrication point, either for a grease nipple or for central lubrication systems. The interface of the adapter plate is the same on both sides. The adapter plate can be mounted on both end sides of the carriage. Usually only one adapter plate is used per carriage. Please note that this accessory is also part of the bellow sets.
Lubrication connector LLTHZ ... VN UA		The lubrication connector is used to provide an interface for central lubrication systems. The lubrication connector can be mounted on both end sides of the carriage. Usually only one lubrication connector is used per carriage. Please note that the lubrication connector cannot be used in combination with additional seals (scraper plate, additional front seal, seal kit and adapter plate).
Bellows LLTHZ ... B		Bellows protect the entire system against solid and liquid contaminants from above. They are suitable for highly contaminated environments like machining centres in the woodworking and metals industries.

[1] Appearance can vary slightly depending on the size

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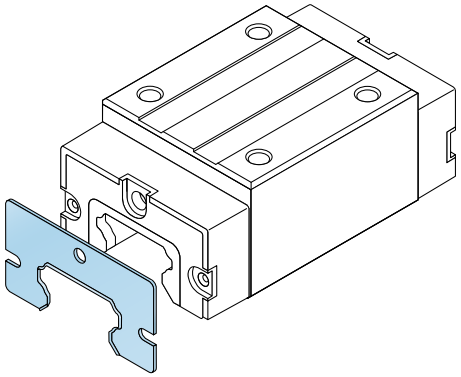
3.3.1 Scraper plate (S1)

- Material: spring steel according to DIN EN 10088
- Appearance: black
- Designed with a specified maximum gap of 0,2 to 0,3 mm

Mounting

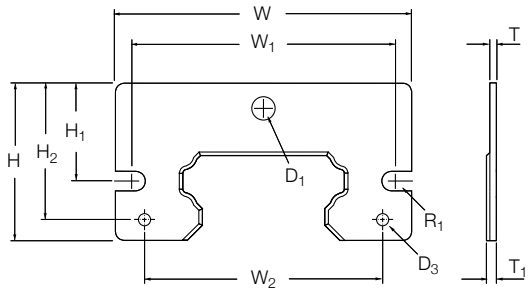
Mounting screws and grease nipple are included. When mounting, be sure there is an even space between the rail and scraper plate.

NOTE: Can be ordered in combination with an additional front seal as a kit. For designation, refer to **Ordering key accessories (↳ page 104).**



Appearance can vary slightly depending on the size.

Dimensional drawing



Size	Part designation	Dimensions										
–	–	D_1 mm	D_3	R_1	W	W_1	W_2	H	H_1	H_2	T	T_1
15	**LLTHZ 15 S1**	3,6	–	1,75	31,6	25,8	–	18,5	12	–	1,5	2,3
20	**LLTHZ 20 S1**	5,5	–	1,75	42,6	35	–	24,2	14,8	–	1,5	2,3
25	**LLTHZ 25 S1**	5,5	–	2,25	46,6	39,6	–	27,7	16,8	–	1,5	2,3
30	**LLTHZ 30 S1**	6,5	–	1,75	57	50	–	30,4	19,3	–	1,5	2,3
35	**LLTHZ 35 S1**	6,5	3,4	2,25	67,3	59,2	52	36,3	22,1	30,1	1,5	2,3
45	**LLTHZ 45 S1**	6,5	3,4	2,75	83,3	72	67	44,2	27,5	38,3	1,5	2,3

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3.3.2 Additional front seal (S7)

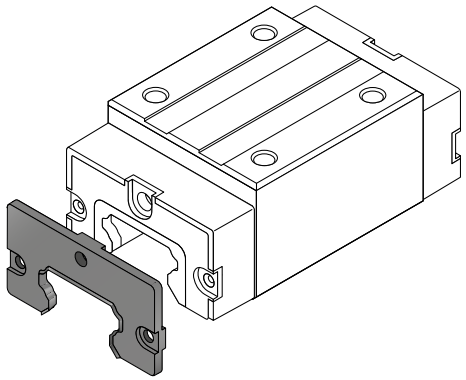
- Material: Elastomer
- Design: single-lip seal

Mounting

Mounting screws and grease nipple are included.

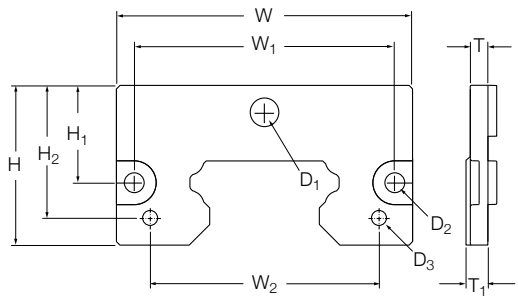
NOTE: Can be ordered in combination with a scraper plate as a kit. For designation, refer to
Ordering key accessories (↳ page 104).

An additional front seal in combination with carriages equipped with low friction S0 shield results in a sealed system with lower friction.



Appearance can vary slightly depending on the size.

Dimensional drawing



Size	Part designation	Dimensions										
–	–	D_1 mm	D_2	D_3	W	W_1	W_2	H	H_1	H_2	T	T_1
15	**LLTHZ 15 S7**	3,6	3,4	–	31,6	25,8	–	18,5	12	–	3	4
20	**LLTHZ 20 S7**	5,5	3,4	–	42,6	35	–	24,2	14,8	–	3	4
25	**LLTHZ 25 S7**	5,5	4,5	–	46,6	39,6	–	27,7	16,8	–	3	4
30	**LLTHZ 30 S7**	6,5	3,4	–	57,9	50	–	31,5	19.3	–	4	5
35	**LLTHZ 35 S7**	6,5	4,5	3,4	67,3	59,2	52	36,3	22,1	30,1	4	5
45	**LLTHZ 45 S7**	6,5	5,5	3,4	83,3	72	67	44,2	27,5	38,3	4	5

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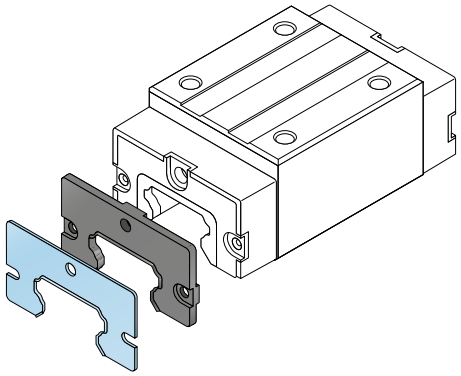
3.3.3 Seal kit (S3)

The seal kit consists of the following components:

- Scraper plate
- Additional front seal

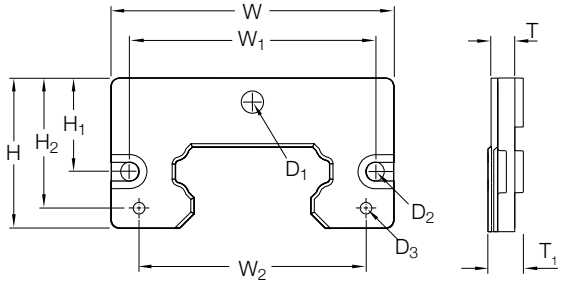
Mounting

Mounting screws and grease nipple are included. For designation, refer to **Ordering key accessories (↳ page 104).**



Appearance can vary slightly depending on the size.

Dimensional drawing



Size	Part designation	Dimensions										
–	–	D_1 mm	D_2	D_3	W	W_1	W_2	H	H_1	H_2	T	T_1
15	**LLTHZ 15 S3**	3,6	3,4	–	31,6	25,8	–	18,5	12	–	4,5	5,3
20	**LLTHZ 20 S3**	5,5	3,4	–	42,6	35	–	24,2	14,8	–	4,5	5,3
25	**LLTHZ 25 S3**	5,5	4,5	–	46,6	39,6	–	27,7	16,8	–	4,5	5,3
30	**LLTHZ 30 S3**	6,5	3,4	–	57,9	50	–	31,5	19,3	–	5,5	6,3
35	**LLTHZ 35 S3**	6,5	4,5	3,4	67,3	59,2	52	36,3	22,1	30,1	5,5	6,3
45	**LLTHZ 45 S3**	6,5	5,5	3,4	83,3	72	67	44,2	27,5	38,3	5,5	6,3

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3.3.4 Low friction shield (S0)

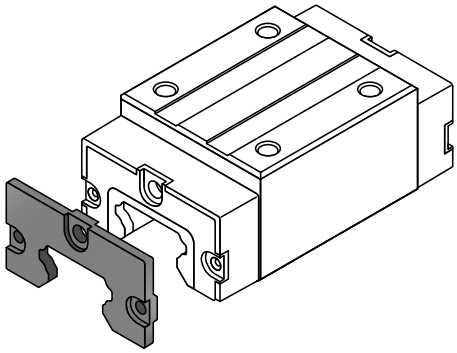
- Material: PA6.6
- Size: 15 to 30
- Non-contact component

Mounting

The low friction shield (S0) replaces the standard front seal.

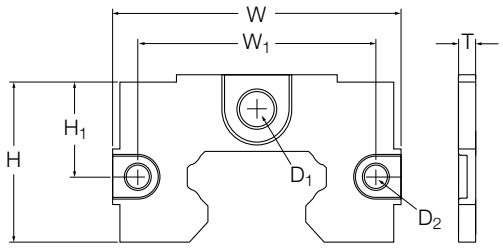
The dimensions for the mounting screws and the grease nipple remain unchanged.

NOTE: A low friction shield (S0) combined with the additional front seal (S7) results in a sealed system with lower friction.



Appearance can vary slightly depending on the size.

Dimensional drawing



Size	Part designation	Dimensions						
–	–	D_1 mm	D_2	W	W_1	H	H_1	T
15	**LLTHZ 15 S0**	3,4	3,4	31,3	25,8	18,3	11,2	2
20	**LLTHZ 20 S0**	5,4	3,4	42,4	35	24,1	13,8	2
25	**LLTHZ 25 S0**	5,4	4,4	46,4	39,6	27,1	15,7	2,5
30	**LLTHZ 30 S0**	6,3	3,4	57,2	50	31,3	18,1	4

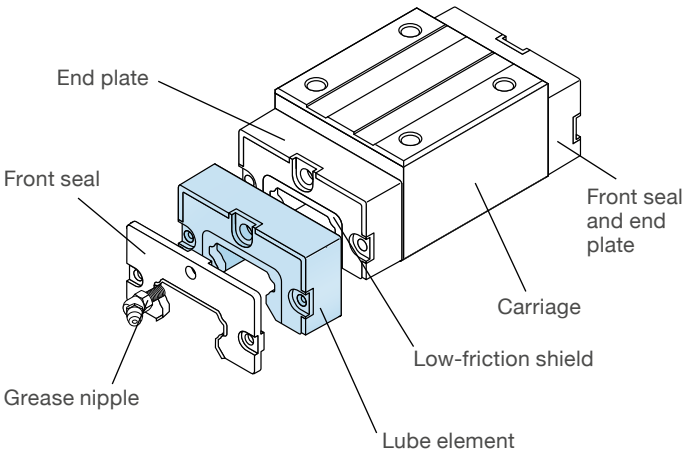
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3.3.5 Lube element (S6)

Benefits

- Longer relubrication intervals
- Less maintenance costs
- Easy mounting and replacement by clicking onto/over the rail
- Applicable for horizontal and vertical mounting
- Can be combined and ordered with standard LLT accessories, such as seal kit
- Suitable for all carriage types of size 15 to 35
- Delivered ready to mount with all needed parts and filled with oil



Technical data

The relubrication interval of 5 000 km with lube element is valid for all sizes and under following pre-conditions:

Load ratio:	$F_m \leq 0{,}3C$
Speed:	≤ 1 m/s
Temperature:	+10 up to +50 °C
Mounting:	One lube element per lubricated carriage

The lube element is filled with high quality oil which has the right viscosity and is compatible with the grease of the carriage. Other oil types can be validated by Ewellix on request. The lube element housing is made of POM. By mounting a grease nipple to the lube element, the carriage can be regularly greased. It is not possible to refill the lube element. For ideal function the lube element should be replaced after 5 000 km of travel distance, unless regular greasing is given through the grease nipple.

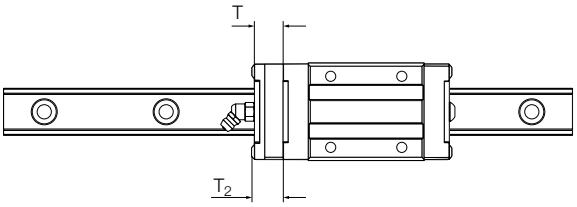
Because of the contact of the foam to the raceways of the rail, a slight increase of friction can occur.

A lube set LLTHZ S6 consists of one low-friction shield (S0), one lube element and two screws. The permissible storage temperature is –15 up to +50 °C. The maximum storage duration in a warehouse is two years under the above mentioned conditions.

In case of different pre-conditions in the application, the performance may differ. Please contact Ewellix for further information.

Dimensional drawing

The carriage length increases by value T_2, when a lube element is used



Size	T	T_2 (including screw head)	Tightening torque of mounting screws
–	mm	mm	Nm
15	10,5	11,0	0,20
20	12,5	13,0	0,20
25	14,5	15,0	0,20
30	14,5	15,0	0,38
35	17,5	18,0	0,38

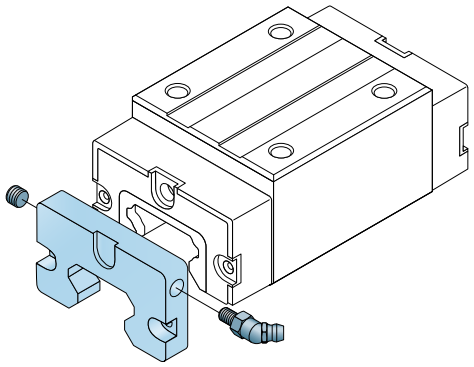
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3.3.6 Adapter plate (PL)

- Material: Aluminium
- Appearance: Natural aluminium, non-anodized

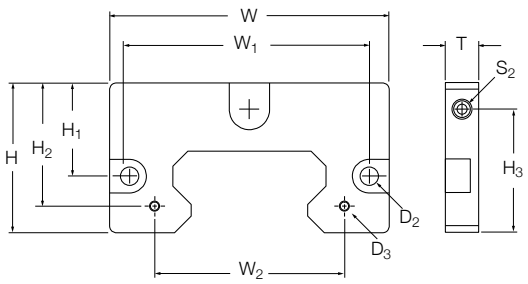
Mounting

Mounting screws, sealing ring and grease nipple are included. For designation, refer to **Ordering key accessories (↳ page 104).**



Appearance can vary slightly depending on the size.

Dimensional drawing



Size	Part designation	Dimensions										
–	–	S_2 mm	D_2	D_3	W	W_1	W_2	H	H_1	H_2	H_3	T
15	**LLTHZ 15 PL**	M5×0,8	3,4	M2×0,4	32	25,8	20	18,9	12,2	16,4	13,7	10
20	**LLTHZ 20 PL**	M5×0,8	3,4	M3×0,5	43	35	28	24,5	15	20	17,5	10
25	**LLTHZ 25 PL**	M5×0,8	4,5	M3×0,5	47	39,6	32	28	17	23	22,5	10
30	**LLTHZ 30 PL**	M6×1,0	3,5	M3×0,5	58,5	50	38	32	19,5	26	25	10
35	**LLTHZ 35 PL**	M6×1,0	4,5	M3×0,5	68	59,2	45	37	22,5	29,5	30	10
45	**LLTHZ 45 PL**	M6×1,0	5,5	M3×0,5	84	72	57	45	28	37	37	10

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4.1 Design rules

The following mounting instructions are applicable to all carriage types.

To maintain the high precision of Ewellix LLT profile rail guides, the carriages must be handled carefully during transport and mounting.

To provide protection during transport, storage and assembly, LLT rails and carriages are coated with a corrosion inhibiting compound. This compound does not need to be removed if the recommended lubricants are used.

4.1.1 Typical mounting examples

Rails

Each rail has ground reference edges on both sides.

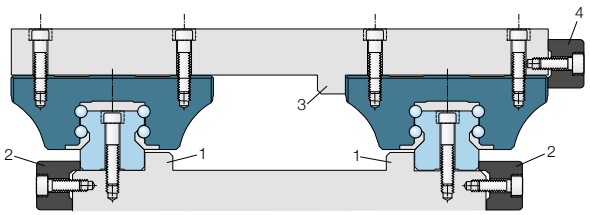
Options for securing the rails laterally (↳ fig. 1)

1. Stop edges
2. Retaining strips

Rails that are not laterally fixed must be installed straight and parallel. Ewellix recommends using a support strip to maintain the rail's position during installation.

Fig. 1

Mounting with laterally fixed rails and carriages



NOTE: Rail ends must be chamfered to prevent seal damage during installation. If two rails are to be joined, do not chamfer either of the mating ends.

Guideline values for the permissible lateral loads for unsupported rails are listed on **page 77, table 3.**

Carriage

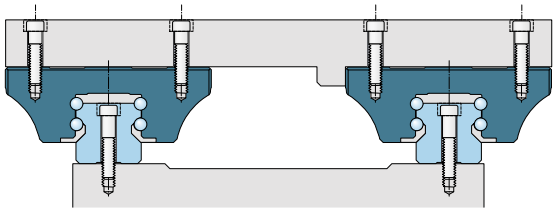
Each carriage has one ground reference side (please refer to dimension H2 in the drawings of the carriages) (↳ **page 39**).

Options for securing the carriages laterally (↳ fig. 1)

3. Stop edges
4. Retaining strips

Fig. 2

Mounting without lateral rail support



NOTE: If mounted correctly, the carriage should move easily on the rail when pushed.

During assembly, secure the carriage to prevent it from falling. Guideline values for the permissible lateral loads for unsupported carriages are shown in **page 77, table 3.**

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4.1.2 Interface design, screw sizes and tightening torques

- Flange-type carriages can be fastened from above (↳ **fig. 3**) or below (↳ **fig. 4**)
- Slim-type carriages can be fastened from above (↳ **fig. 5**)
- Rails can be fastened from above (↳ **fig. 4** and **5**) or below (↳ **fig. 3,** rail type **LLTHR … D4**).

Fig. 3

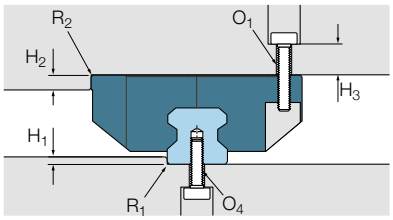


Fig. 4

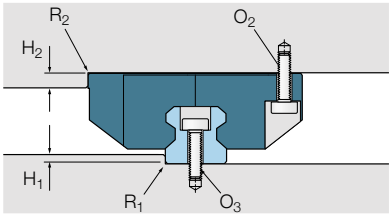


Fig.5

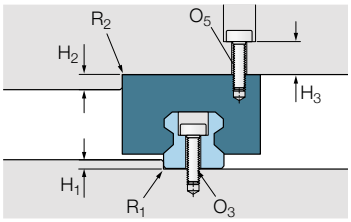


Table 1

Stop edges, corner radii and screw sizes

Size	Dimensions						Screw				
	H_1 min	H_1 max	R_1 max	H_2	R_2 max	H_3 [1]	O_1 ISO 4762	O_2	O_3 [1]	O_4 [1]	O_5 [2]
–	mm						4 Piece		Rail		
15	**2,5**	3,5	0,4	4	0,6	6	M5 x 12	M4 × 12	M4 × 20	M5 × 12	M4 × 12
20	**2,5**	4,0	0,6	5	0,6	9	M6 x 16	M5 × 16	M5 × 25	M6 × 16	M5 × 16
25	**3,0**	5,0	0,8	5	0,8	10	M8 x 20	M6 × 18	M6 × 30	M6 × 20	M6 × 18
30	**3,0**	5,0	0,8	6	0,8	10	M10 x 20	M8 × 20	M8 × 30	M8 × 20	M8 × 20
35	**3,5**	6,0	0,8	6	0,8	13	M10 x 25	M8 × 25	M8 × 35	M8 × 25	M8 × 25
45	**4,5**	8,0	0,8	8	0,8	14	M12 x 30	M10 ×30	M12 × 45	M12 × 30	M10 × 30

[1] The stated values are only recommendations

[2] For carriage type SU + SA, two screws are sufficient to withstand the maximum load .

Table 2

Tightening torques for mounting screws

	Screw strength class	Screw					
		M4	M5	M6	M8	M10	M12
	–	Nm					
for counterparts made out of steel or cast iron	8,8	2,9	5,75	9,9	24	48	83
	12,9	4,95	9,7	16,5	40	81	140
for counterparts made out of aluminium	8,8	1,93	3,83	6,6	16	32	55
	12,9	3,3	6,47	11	27	54	93

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Table 3

Dimensions and guide values for permissible lateral forces without additional lateral support (↳ fig. 2)

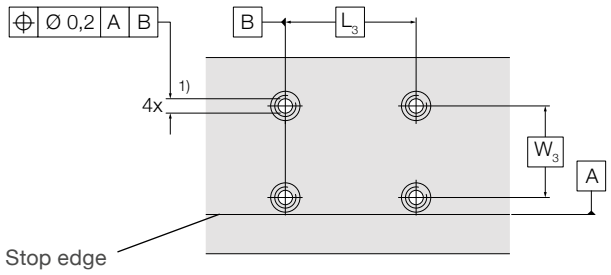
Carriages	Screw strength class	Carriages				
		O_1	O_2	O_5	O_3	O_4
A, U, R	8,8	23 % C	11 % C	11 % C	6 % C	6 % C
	12,9	35 % C	18 % C	18 % C	10 % C	10 % C
LA, LU, LR	8,8	18 % C	8 % C	8 % C	4 % C	4 % C
	12,9	26 % C	14 % C	14 % C	7 % C	7 % C
SA, SU	8,8	12 % C	8 % C	8 % C	9 % C	9 % C
	12,9	21 % C	13 % C	13 % C	15 % C	15 % C

4.1.3 Position tolerances for attachment holes

The attachment holes of all surrounding parts have to match the tolerances shown in **figure 6** and **7.**

Fig. 6

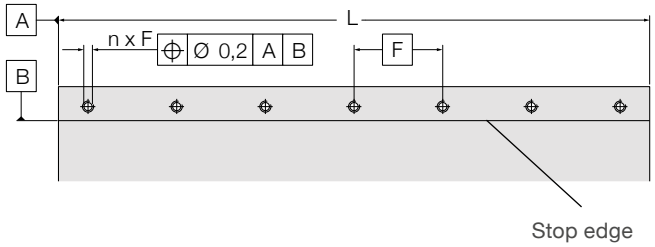
Attachment structure for carriages



1) in case of carriage types SA, SU: 2x

Fig. 7

Attachment structure for profile rail guides



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4.1.4 Permissible height deviation

The values for height deviation are applicable for all carriage types.

If the values for height deviation S_1 (↳ **table 4**) and S_2 (↳ **table 5**) are within the specified range, the service life of the rail guide system will not be influenced.

For permissible height deviation in the lateral direction (↳ table 4)

S_1 = d Y

where

S_1 = Permissible height deviation [mm]

d = Distance between the rails [mm]

Y = Calculation factor lateral direction

NOTE: The height tolerance of H for the carriages has to be taken into account. For additional information on height tolerance, see **pages 17, table 2.** If the difference S_1–2 x tolerance H < 0, a new product selection is necessary (other preload, precision).

For permissible height deviation in the longitudinal direction (↳ table 5)

S_2 = c X

where

S_2 = Permissible height deviation [mm]

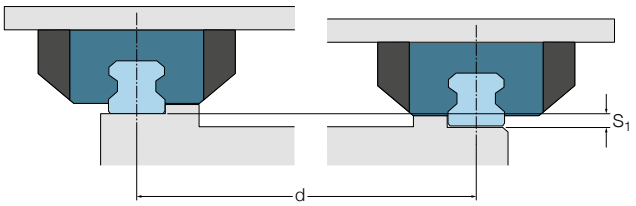
c = Distance between the carriages [mm]

X = Calculation factor longitudinal direction

NOTE: The maximum difference ΔH for the carriages has to be taken into account. For additional information, **pages 17, table 2**. If the difference S_2 – ΔH < 0, a new product selection is necessary (other preload, precision).

Table 4

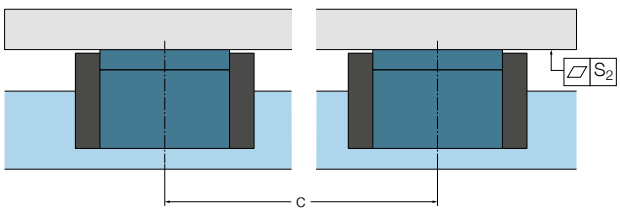
Permissible height deviation in lateral direction



Calculation factor	Preload		
	T0	T1 Preload (2 % C)	T2 Preload (8 % C)
Y	5,2 × 10^{-4}	3,4 × 10^{-4}	2,0 × 10^{-4}
Y (SA and SU carriage types)	6,2 × 10^{-4}	4,1 × 10^{-4}	–

Table 5

Permissible height deviation in longitudinal direction



Calculation factor	Carriage length		
	short	normal	long
X	6,6 × 10^{-5}	4,7 × 10^{-5}	3,3 × 10^{-5}

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4.1.5 Parallelism

The parallelism of mounted rails is measured on the rails and the carriages. The values for the deviation in parallelism P_a are applicable to all carriage types.

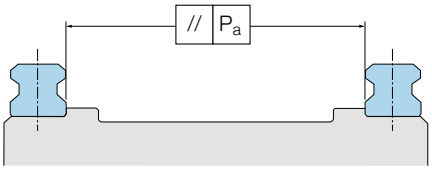
Deviation in parallelism P_a increases the internal load. If the values are within the specified range in **table 6**, the service life of the profile rail guide system will not be influenced.

For typical applications, the mounting surface can be slightly resilient.

However, for high-precision applications, the mounting surface must be rigid and the values in the table have to be cut in half.

Table 6

Deviation in parallelism P_a



Size	Preload class		
–	T0	T1 (2 % C)	T2 (8 % C)
15	0,030	0,018	0,010
20	0,036	0,022	0,012
25	0,038	0,024	0,014
30	0,042	0,028	0,018
35	0,046	0,030	0,020
45	0,056	0,038	0,024
Carriage type SA + SU			
15	0,036	0,022	–
20	0,044	0,026	–
25	0,046	0,028	–
30	0,050	0,034	–
35	0,056	0,036	–

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4.2 Mounting profile rail guides

4.2.1 Packaging (Shipment)

Profile rails and carriages are delivered in their own packaging. Unwrap these components carefully and remove the foam from the carriage. Do not recycle the packaging until the installation is complete. The packaging can be used to protect the components from damage during the mounting process.

4.2.2 Mounting the carriages

Screw in the grease nipple on the desired end plate and adjust the direction with the right washer (different thickness). Be sure that the ends of the rail are chamfered and deburred to avoid damaging the front seals or internal components. Apply a small amount of oil or grease to chamfers and the front seal of the carriage. Slide the carriage straight and carefully onto the profile rail, avoiding any misalignment.

4.2.3 Preparation

The threaded holes on the base plate must be first prepared according to the rail size.

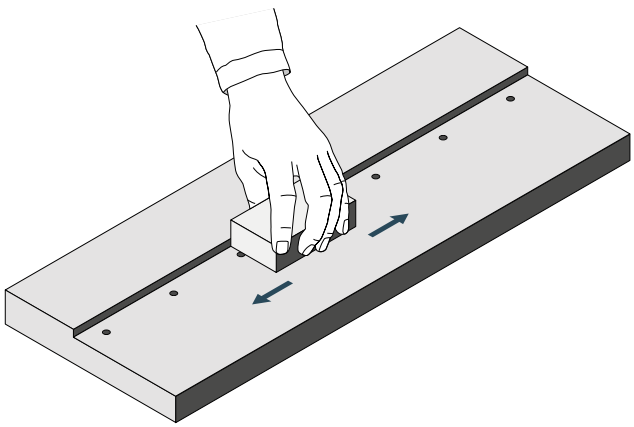
Make sure that the contact surfaces are flat and free of any damage or burrs. Use an oil stone to smooth them if necessary (↳ **fig. 8**). Check the stop edges for dimensional and position precision and inspect the corner radii (↳ **page 76, table 1**).

Clean the contact surfaces thoroughly. Coat them with a thin coat of light oil to prevent corrosion.

Make sure that the rails, carriages, base plate, mounting plate and fastening screws all have the same temperature during installation.

Remove the corrosion inhibiting compound from the rail or carriage surfaces that are in contact with other parts. Then apply a thin coat of light oil to these surfaces. Be sure that all drilled and tapped holes are clean and free of debris prior to mounting.

Fig. 8



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4.2.4 Mounting the master rail

1. Place the profile rail gently onto the base plate.
2. Insert the screws, making sure that they are unobstructed, e.g. the mounting holes are properly aligned.
3. Partially tighten the screws so that the rail is still loose.
4. Push the rail against the stop edge (↳ **fig. 9**). The stop edge can be directly machined in the mounting surface or an external/mobile support strip that is only there for mounting. If necessary, hold the rail in place with a retaining strip (↳ **4.2.6 Mounting a retaining strip, page 84**). In cases where no lateral support is provided, use an external reference surface **(↳ fig. 10)** or a straight edge for alignment.
5. Using a torque wrench, tighten the centre mounting screw. Then, tighten the remaining screws using an alternating pattern **(↳ fig. 11)**. Torque values are listed in **table 2, page 76.**
6. Check the parallelism of the fastened master rail to the specific reference. Result should be better than values in **table 6, page 79**.

Fig. 9

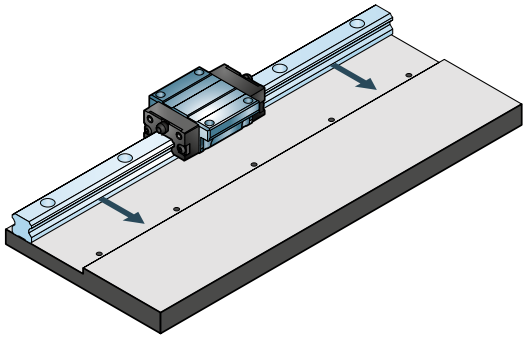


Fig. 10

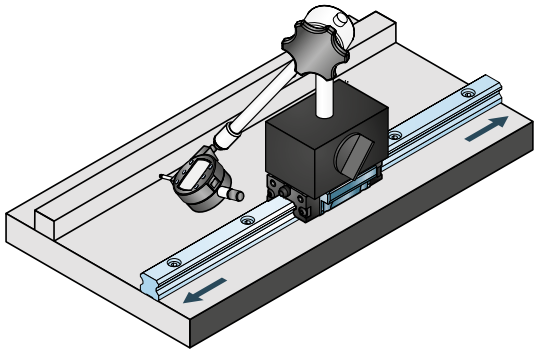
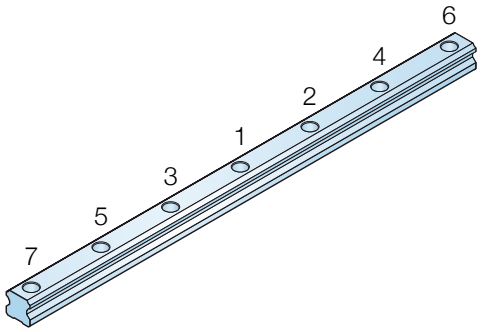


Fig. 11



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4.2.5 Parallel alignment of subsidiary rail

The already aligned and fastened rail is defined as the master rail. Depending on the base plate design, there are several options for mounting subsidiary rails. Please choose the suitable option listed below.

Option I

Mounting with two stop edges on the base plate

If stop edges are provided on both sides of the base plate (↳ **fig. 12**), please proceed as described above in **3.4 Mounting the master rail.**

Option II

Mounting with two stop edges on the mounting plate

If there is no stop edge for the subsidiary rail on the base plate, the second rail can be aligned using a mounting plate with two stop edges.

1. Push in the carriage against the stop edge of the mounting plate (↳ **fig. 13**).
2. Using a torque wrench, tighten the mounting screws to the designated value (↳ **table 2, page 76**).
3. Place the subsidiary rail into position on the base plate.
4. Insert the screws, making sure that they are unobstructed, e.g. the mounting holes are properly aligned. (↳ **fig. 14**).
5. Partially tighten the screws so that the rail is still loose.
6. Slide the mounting plate with the already fastened carriages onto the rails and move it over the full stroke (↳ **fig. 15**).
7. Starting at one end of the rail, pre-tighten the rail screws to approximately 1/3 of their torque value. To maintain parallelism, be sure that the carriage is very close to the screws being tightened. (↳ **fig. 16**).

Double-check for parallelism by running the carriages along their full stroke. Then, using a torque wrench, tighten the centre mounting screw. Tighten the remaining screws using the alternating pattern (↳ **fig.11, page 81**). Torque values are listed in **table 2, page 76.**

NOTE: The resulting parallelism has to be according the values in **table 6, page 79**.

Fig. 12

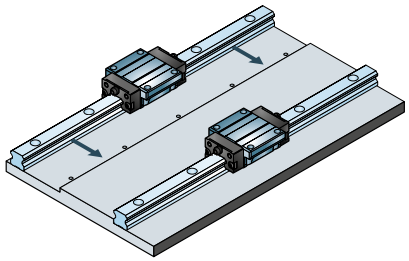


Fig.13

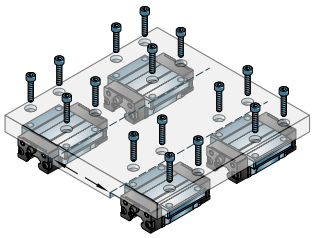


Fig.14

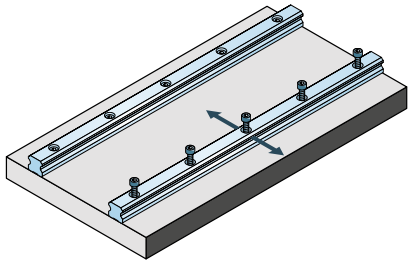


Fig. 15

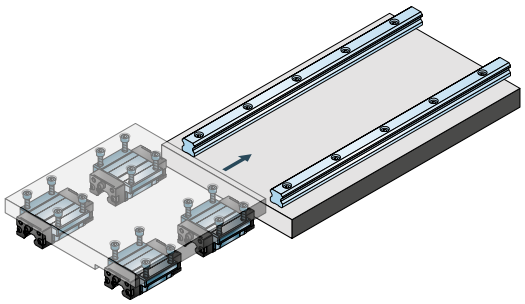
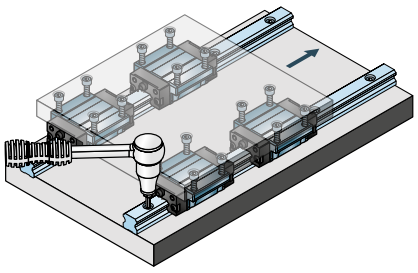


Fig. 16



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Option III

Mounting with no stop edges

If there are no stop edges for the subsidiary rail on the base plate and no stop edges for the carriages on the mounting plate, then proceed as follows:

1. Place the subsidiary rail onto the base plate.
2. Insert the screws, making sure that they are unobstructed, e.g. the mounting holes are properly aligned (↳ **fig. 17**).
3. Partially tighten the screws so that the rail is still loose.
4. Slide a carriage onto the mounted master rail and affix a dial indicator to the top of the carriage. Place the tip of the indicator at the center of the ground reference edge of the subsidiary rail (↳ **fig. 18**).

Do the alignment and pre-fasten the screws with $^1/_3$ torque (↳ **fig. 19**).

5. Tighten all rail screws, beginning from the center, alternating to the ends (↳ **fig. 11 page 81**), with designated torque (↳ **table 2, page 76**) by using a torque wrench. Double check the parallelism along the full stroke.

NOTE: The resulting parallelism has to be according the values in **table 6, page 79**.

Fig.17

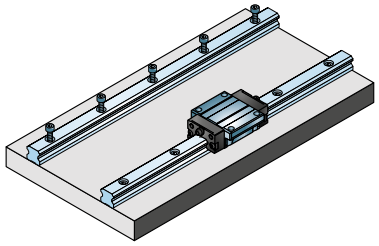


Fig.18

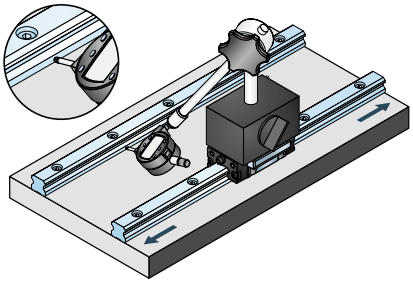
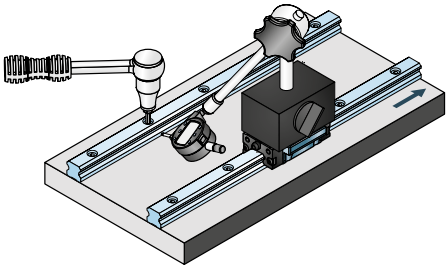
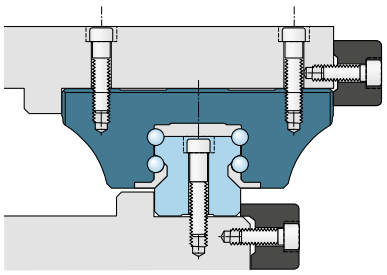


Fig. 19



4.2.6 Mounting a retaining strip

Fig. 20



Profile rail guides can also be mounted without a retaining strip. However, guides are recommended because they absorb lateral forces and reduce the effort to straighten the rails. By using a retaining strip, the load capacity does not have to be reduced as shown on **page 77, table 3**. For details, refer to **pages 75** to **79.**

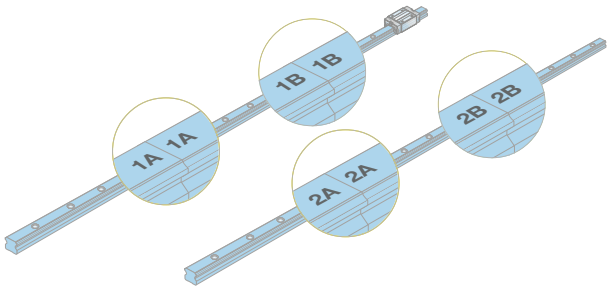
Before the retaining strips can be mounted, be sure that all screws are in place and slightly tightened.

1. Tighten the retaining strip screws(↳ **fig. 20**) with a torque wrench.
2. Then, tighten the rail/carriage screws with a torque wrench. For permitted torque values, see **page 76**, **table 2.** Dimensions of the retaining strip, screws and distance between the screw holes depend on each specific customer case.

Check the straightness of the rail with a dial indicator by using a straight edge or an external reference edge (↳ **page 81, fig. 10).**

4.2.7 Mounting jointed rails

Fig. 21



Jointed rails are generally used when the longest rail length available (approximately 4 000 mm) is insufficient. When joining rails, Ewellix recommends grinding the base plate and stop edge which will significantly improve raceway alignment. As always, the bottom-side and the reference-edge of the rail are used for alignment. Do not use the top of the rail as a reference surface.

If the base plate does not have a stop edge, use clamps and a straight-edge during the entire installation process so that the rail being installed does not move out of position.

Make sure that the joined rails are well aligned. The gap between two jointed rails should not exceed 20 µm. All rail sections are numbered continuously and close to the joint to avoid mounting errors (↳ **fig. 21**).

Before using the system, move the carriage over the rail joints. There should be no perceptible difference in terms of noise or resistance. If there is a difference, please repeat the mounting process.

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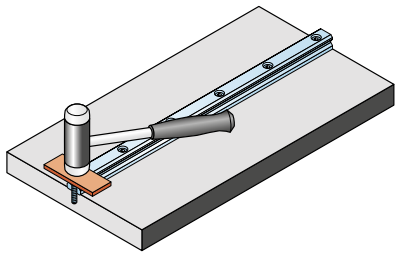
4.2.8 Installing plastic caps

The plastic caps supplied with each rail guide must be installed flush with the rail surface.

NOTE: Caps sticking above the rail surface can damage the seal, generate debris and reduce the service life of the rail guide system. Caps that are sunk below the surface of the rail can collect dirt.

To install the caps, use a rubber mallet and a soft, e.g. plastic or aluminium , flat transition piece. Avoid sharp edges that could damage the rail (↳ **fig. 22**).

Fig. 22



4.2.9 Installing metal plugs

1. Slide the mounting tool (↳ **fig. 23**) onto the rail (↳ **fig. 24**). Slide the mounting tool onto the rail, but remove all brass chips from the press block in advance.
2. Match the center of the mounting tool with the center of the metal plug, then use a hexagonal wrench to tighten the bolt (↳ **fig. 25**). Stop tightening the bolt when the plug is flush with the rail surface.
   Do not overtighten the bolt. 5–10 Nm is sufficient. Repeat this step for the remaining metal plugs.
   Important: Before pressing in the plug and during plug alignment, make sure the top surface of the plug is parallel to the top surface of the rail.
   After pressing the plugs into the rail, check that they are all flush with the rail surface. Then clean the rail to remove any debris.
   With fastened rails the plugs have to be destroyed for removal.

Fig. 23

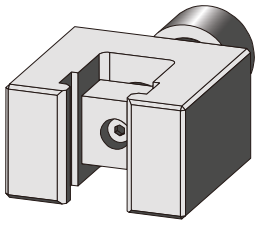


Fig. 24

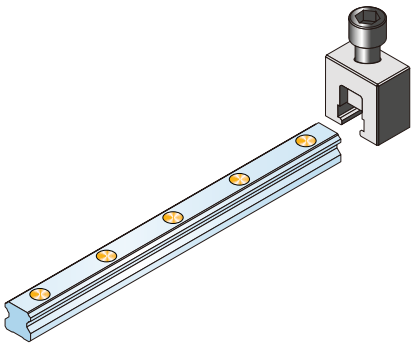
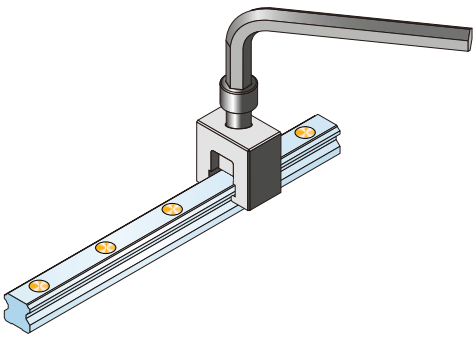


Fig. 25

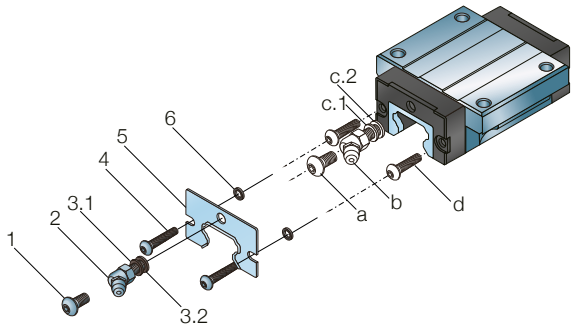


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4.3 Mounting accessories

4.3.1 Mounting the scraper plate (S1)

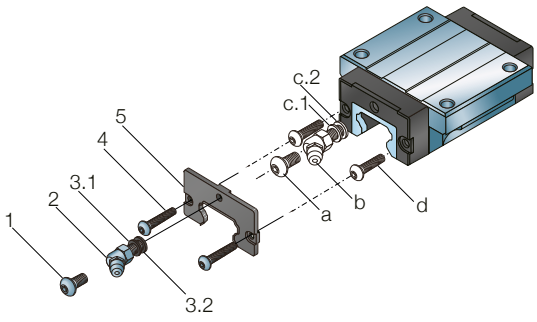
Fig. 26



1. Remove the grease nipple (**b**) and washers (**c.1 and c.2**), or the set screw (**a**) (↳ **fig. 26**).
2. Remove the mounting screws (**d**)
3. Put the washers for mounting screws (**6**) into the fixation hole on each side.
4. Attach the metal scraper plate (**5**) onto the end plate, and position it accurately against the latter.
5. Install the mounting screws (**4**)
6. Install the grease nipple (**2**) and washers (**3.1 and 3.2**) if necessary.
7. If a grease nipple is not required, install a set screw (**1**) instead.

4.3.2 Mounting an additional front seal (S7)

Fig. 27

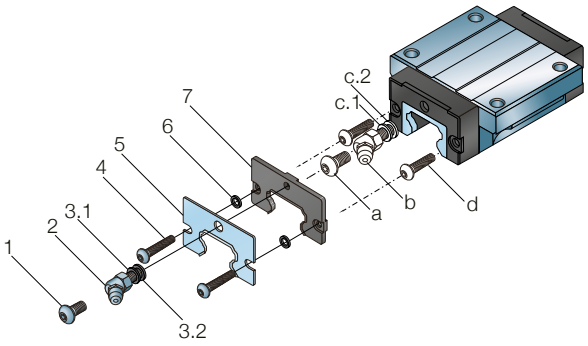


1. Remove the grease nipple (**b**) and washers (**c.1 and c.2**), or the set screw (**a**) (↳ **fig. 27)**
2. Remove the mounting screws (**d)**
3. Attach the additional front seal (**5**) onto the end plate, and position it accurately against the latter.
4. Install the mounting screws (**4**)
5. Install the grease nipple (**2**) and washers (**3.1 and 3.2**) if necessary.
6. If a grease nipple is not required, install a set screw (**1**) instead.

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4.3.3 Mounting the seal kit (S3)

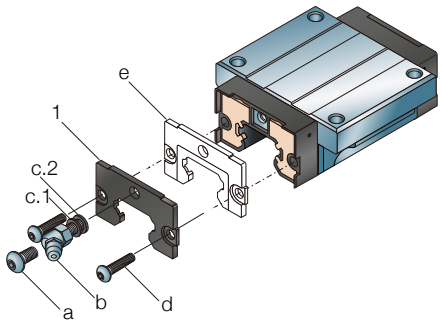
Fig. 28



1. Remove the grease nipple (**b**) and washers (**c.1 and c.2**), or the set screw (**a**) (↳ **fig. 28**)
2. Remove the mounting screws (**d**)
3. Attach the additional front seal (**7**) onto the end plate, and position it accurately against the latter.
4. Put the washers for mounting screws (**6**) on both sides. The washers are put between the metal scraper (**5**) and the additional front seal (**7**)
5. Attach the metal scraper plate (**5**) on the additional front seal (**7**), and align them with each other.
6. Install the mounting screws (**4**)
7. Install the grease nipple (**2**) and washers (**3.1 and 3.2**) if necessary.
8. If a grease nipple is not required, install a set screw (**1**) instead.

4.3.4 Mounting the low friction shield (S0)

Fig. 29



1. Remove the grease nipple (**b**) and washer (**c.1 and c.2**), or the set screw (**a**) (↳ **fig. 29**)
2. Remove the mounting screws (**d**)
3. Remove the front seal (**e**) and replace it with the low friction shield (**1**).
   NOTE: Make sure that the foam remains in its correct place.
4. Re-install the mounting screws (**d**)
5. Install back the grease nipple (**b**) and washers (**c.1** and **c.2**) if necessary.
6. If a grease nipple is not required, install a set screw (**a**) instead.

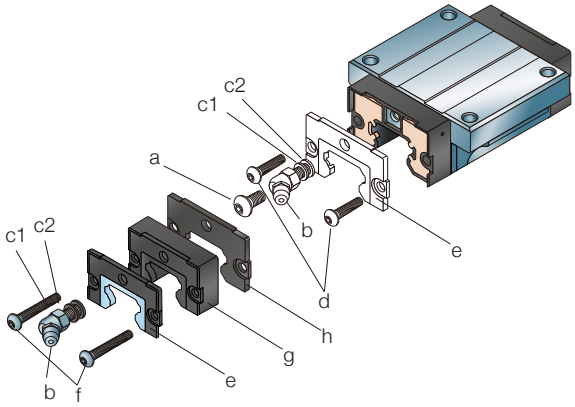
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4.3.5 Mounting the LLT Lube element (S6)

Mounting

1. Remove grease nipple (**b**) and washers (**c1, c2**) or the set screw (**a**) (↳ **fig. 30**)
2. Remove the mounting screws (**d**) Remove the front seal (**e**) and replace it with the low-friction shield (**h**)
3. Position the lube element (**g**) in front of the low-friction shield (**h**)
4. Add the front seal (**e**) to the lube element (**g**)
5. Install the new mounting screws (**f**) and tighten them with the given torque
6. Move the carriage with the mounted lube element on the rail and check the sealing function (if bad, adjust the seal)
7. Install the grease nipple (**b**) and washers (**c1, c2**) if necessary
8. If the grease nipple (**b**) is not required, install the set screw (**a**) instead

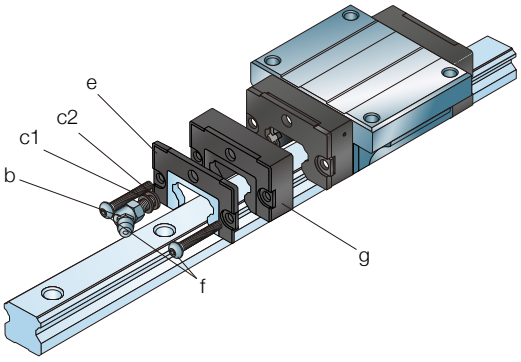
Fig. 30



Replacement

1. Remove grease nipple (**b**) and washers (**c1, c2**) or the set screw (↳ **fig. 31**)
2. Remove the mounting screws (**f**)
3. Pull the front seal (**e**) away from the old lube element
4. Pull the old lube element away from the carriage and remove from the rail
5. Position the new lube element (**g**) onto the rail as shown
6. Push the front seal (**e**) together with the new lube element to the carriage
7. Install the mounting screws (**f**) and tighten them with the given torque
8. Move the carriage with the mounted lube element on the rail and check the sealing function (if bad, adjust the seal)
9. Install the grease nipple (**b**) and washers (**c1, c2**) if necessary
10. Re-grease the carriage as described on **page 93**
11. If grease nipple (**b**) is not required, install a set screw after re-greasing instead

Fig. 31

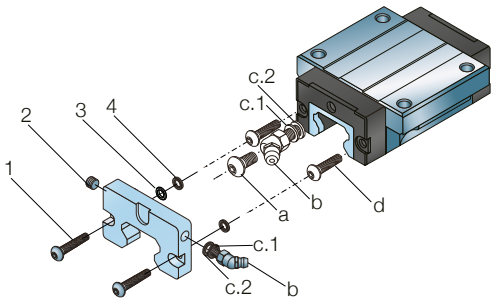


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4.3.6 Mounting an adapter plate (PL)

1. Remove the grease nipple (**b**) and washers (**c.1 and c.2**), or the set screw (**a**) (↳ **fig. 32**)
2. Remove the mounting screws (**d**)
3. Attach the adapter plate with sealing ring (**3**) onto the end plate, and position it accurately against the latter.
4. Put the washers (**4**) for mounting screws on both sides.
5. Install the mounting screws (**1**)
6. Install the original grease nipple (**b**) and washers (**c.1 and c.2**) on the lateral side of the adapter plate.
7. Install the set screw (**2**) on the other side of the adapter plate.

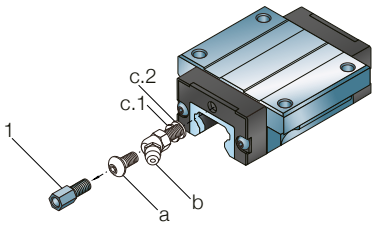
Fig. 32



4.3.7 Mounting the grease nipple and lubrication connector (VN UA)

1. Remove the grease nipple (**b**) and washers (**c.1 and c.2**), or the set screw (**a**) (↳ **fig. 33**)
2. Install the lubrication connector (**1**) onto the lube port.

Fig. 33



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4.4 Maintenance and repairs

4.4.1 Preventative maintenance

To avoid dirt from adhering to and embedding into the rails, the rails should be cleaned regularly with a cleaning stroke. Ewellix recommends a cleaning stroke over the entire length of the rails twice a day or at least after eight hours of operation.

Perform a cleaning stroke each time when switching the machine on or off.

4.4.2 Lubrication

The appropriate type and amount of lubricant is required for rolling bearings to function reliably. To reduce wear, the lubricant prevents direct metal-to-metal contact between the rolling elements and the raceways. In addition, the lubricant protects the rail and carriage from corrosion.

The guidance system can only realize its optimum operating temperature when a minimum amount of lubricant to reliably lubricate the profile rail guide is applied.

Grease lubrication

Under normal operating conditions, LLT profile rail guides should be lubricated with grease. The advantage of grease is that it is more easily retained in the bearing, which is particularly important when the axis of travel is inclined or vertical. Moreover, it contributes to sealing the bearing against the ingress of liquid contaminants or humidity.

Base oil viscosity

The viscosity of a lubricating oil is key to the formation of the hydrodynamic film that separates the rolling elements from the raceways.

In general, the viscosity of lubricating oils is based on the flow rate at 40 °C. These values also apply to the mineral base oils contained in lubricating greases.

The base oils of commercially available rolling bearing greases have viscosity values between 15 and 500 mm^2/s (at 40 °C). Greases with higher base oil viscosities often release too slowly to sufficiently lubricate bearings.

Consistency class

Lubricating greases are divided into various consistency classes according to a scale by the National Institute of Grease Lubrication (NLGI). These are also reflected in DIN 51 818 and DIN 51 825.

4

Table 7

A selection of SKF rolling bearing greases

Properties	Lubricant (designation)			
	LGEP 2	LGMT 2	LGLT 2	LGFP 2
Thickener	Li	Li	Li	Al complex soap
Base oil	Mineral oil	Mineral oil	Di-ester oil	Medical white oil
Operating temperature, °C (steady state)	–20 up to +110	–30 up to +120	–55 up to +110	–20 up to +110
Kinematic viscosity of base oil mm^2/s	200	110	15	130
Consistency class (acc. to NLGI)	2	2	2	2
Temperature range / Application range	Grease with extreme pressure (EP) additives > best grease for standard environment	normal temperature	low temperature	food compatible

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Greases with a metallic soap thickener with a consistency of 2 or 3 on the NLGI scale are particularly suitable for use with Ewellix profile rail guides. The grease consistency should not vary too much with changing operating temperatures or stress levels. Greases that soften at higher temperatures can leak from the bearing position, while greases that get stiffer at lower temperatures can impede the operation of the linear guidance system.

Specific requirements are placed on the lubricating grease's purity, composition and compatibility if the grease is to be used in special applications, for instance in the food sector, medical engineering, etc. In such cases, criteria should be further specified for the lubricant in addition to viscosity and consistency class.

Temperature range

The temperature range over which a lubricant can be used depends largely on the type of base oil and thickener as well as the additives.

The low temperature limit, the lowest temperature at which the grease enables the bearing to be started up without difficulty, is largely determined by the type of base oil and its viscosity. The high temperature limit is determined by the type of thickener and its dropping point. The dropping point is the temperature at which a grease changes its consistency and becomes a fluid.

NOTE: Grease will age with increasing rapidity at higher operating temperatures. The resulting by-products have a detrimental effect on the grease's lubrication properties and conditions in the rolling contact zone.

Lubricating greases with synthetic base oils can be used both at higher and lower temperatures than lubricants with a mineral oil base.

Corrosion inhibiting additives in lubricants

Lubricants typically contain additives to inhibit corrosion. In addition, the type of thickener is crucially important in this regard.

Lithium-base and calcium-soap greases provide excellent corrosion protection properties. They are also resistant to water wash-out.

In applications where corrosion protection is a key operational parameter, Ewellix recommends coated LLT profile rail guides and a grease with a good rust preservative (↳ **page 22**).

SKF bearing greases

The assortment of SKF greases has been developed based on the latest information about rolling bearing lubrication and has undergone extensive testing both in the laboratory and under field conditions.

Table 7 page 91 lists those SKF greases that are particularly well-suited for LLT profile rail guides. Additional information and special lubricant recommendations are available from Ewellix upon request.

NOTE: Tests have shown that SKF LGEP 2 grease will perform satisfactorily in the majority of applications.

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Factory pre-lubrication

LLT carriages are normally supplied pre-lubricated with SKF LGEP 2 grease. The technical data for this grease can be found in **page 91, table 7**. A preservative is applied to the LLT rails and carriages to protect them during transport, storage and mounting. When using the recommended lubricants, it is not necessary to remove this preservative.

NOTE: The nickel-plated carriages are delivered unlubricated and must be greased by the customer prior to use and re-lubricated at regular intervals.

NOTE: In addition, there are unlubricated carriages available on request that are completely protected with a preservative. These carriages must be greased by the customer.

Initial lubrication

Initial lubrication is not required since Ewellix profile rail guides are delivered pre-greased and ready to install unless specified otherwise. In cases where a different type of grease is required, the carriages should be thoroughly cleaned and regreased prior to mounting. Alternatively, the carriages can be ordered without grease. Please refer to **table 8** for appropriate grease quantity.

This initial grease fill should be applied three times according to the steps below:

1. Grease each carriage according to the quantities listed (↳ **table 8**).
2. Move the carriage three times backwards and forwards with stroke longer than carriage length.
3. Repeat steps **1** and **2**, twice more.
4. Check if a lubricating film is visible on the rail.

Relubrication

The lubrication intervals for profile rail guides depend primarily on the average running speed, operating temperature and grease quality.

The intervals recommended for fixed operating conditions are listed in **table 9**. For appropriate grease quantity refer to **table 8**. Where contamination, use of coolants, vibration, shock loads etc. form part of the environmental conditions, it is advisable to reduce relubrication intervals accordingly.

NOTE: For P_m determination, please use **formula 8** to calculate constant mean load described on **page 26**. Also, consider recommended lubrication intervals in **table 9**.

Table 8

Size	Grease quantity		
	Carriage type		
	A, U, R	LA, LU, LR	SA, SU
–	cm^3		
15	0,4	–	0,3
20	0,7	0,9	0,6
25	1,4	1,8	1,1
30	2,2	2,9	1,8
35	2,2	2,9	1,8
45	4,7	6,1	–

Table 9

Size	Lubrication intervals [1]	
	Under normal operating conditions, v ≤ 1 m/s	
	Travel under load	
	$P_m \leq 0{,}15\ C$	$P_m \leq 0{,}3\ C$
–	km	
15	5 000	1 200
20	5 000	1 200
25	10 000	2 400
30	10 000	2 400
35	10 000	2 400
45	10 000	2 400

[1] NLGI 00 grease reduces the relubrication intervals to 75 % of the stated values

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Short stroke applications

If the stroke is less than twice the carriage length, both lube ports must be used, each filled equally with the grease quantity stated for initial lubrication or relubrication.

Example

- Short stroke application
- Carriage type A
- Size 25

Apply 3 × 1,4 cm^3 into the left and 3 × 1,4 cm^3 into the right grease nipple.

Important: To avoid serious damage to the rail guides, it is important to consider the miscibility of greases when changing from one lubricant to another.

Moreover, you must also consider the possibility of reduced relubrication intervals when performing at a short stroke operation and reduced load carrying capacity as well as the possibility of chemical interaction with synthetic materials, lubricants and preservatives.

Please refer to the grease manufacturer's instructions. In case of incompatibility between lubricants employed, the carriages should be thoroughly cleaned before re-greasing.

Central lubrication systems

If the application features a central lubrication system using greases with a consistency of 2 or higher on the NLGI scale, contact Ewellix.

Initial lubrication with adapter plate or bellow

During the first relubrication of a carriage with adapter plate, it is important to increase the amount of lubricant according to **table 10**.

4.4.3 Replacement

If the LLT profile rail guide system has reached the end of its service life and has to be replaced, Ewellix recommends replacing the whole system.

Please locate the name of the ordering key written on the carriage and measure the rail length and the E-dimension (the distance from the rail end to the first hole) for re-ordering.

Table 10

Size	Additional grease quantity
–	cm^3
15	0,2
20	0,4
25	0,4
30	0,5
35	0,6
45	0,7

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4.5 Typical application areas

Typical application areas

Applications	Precision classes			Preload classes			Special requirements on	
	P5	P3	P1	T0	T1	T2	Speed	Sealing
Handling								
Linear robotics	•	•		•	•		•	
Linear tables	•	•	•	•	•	•	•	
Modules and axis	•	•		•	•			
Pneumatic automation	•	•		•	•		•	
Plastic injection moulding								
Clamping / injecting	•	•		•	•		•	
Machine hood	•			•				
Woodworking								
Portal and gantry	•	•	•	•	•	•	•	•
Machine hood	•			•				
Printing								
Cutting and transport systems	•			•	•			•
Packaging								
Labelling	•	•		•				
Stacking/palletizing	•	•		•	•		•	
Medical								
X-ray	•	•		•	•			
Patient tables	•	•		•	•			•
Laboratory automation	•	•		•	•			•
Machine tool								
Cutting	•	•	•	•	•	•	•	•
Sawing	•	•		•	•	•	•	

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4.8 Ordering key

4.8.1 Ordering key system

LLTH	S	25	A	2	T2	1000	P5	HD	S0	A	B0	D4	E0	M	S1	C	M

Size
15, 20, 25, 30, 35, 45

Carriage type [1)]
SA Flanged carriage, short length, standard height
A Flanged carriage, standard length, standard height
LA Flanged carriage, extended length, standard height
SU Slim-line carriage, short length, standard height
U Slim-line carriage, standard length, standard height
LU Slim-line carriage, extended length, standard height
R Slim-line carriage, standard length, extended height
LR Slim-line carriage, extended length, extended height

Number of carriages per rail
1, 2, 4, 6, …

Preload class
T0 Zero preload
T1 Light preload, 2 % C
T2 Medium preload, 8 % C

Rail length
80 mm up to maximum rail length (1 mm steps)

Precision class
P5 Standard
P3 Medium
P1 High

Coating [2) 3) 4) 5) 11)] (no code for standard: non coated rails and carriages)
HD Thin dense chrome rail with non coated carriage, available in Europe
HA Thin dense chrome rail with non coated carriage, available in USA/CAN
HT Trivalent chrome rail with non coated carriage.
HDN Thin dense chrome rail with nickel plated carriage, available in Europe
HAN Thin dense chrome rail with nickel plated carriage, available in USA/CAN
HTN Trivalent chrome rail with nickel plated carriage

Sealing [9) 10)] (no code for standard sealing)
S0 Low friction shield

Jointed rail track [6)] (if not selected – no code)
A Yes

Prepared for bellows (if not selected – no code)
B0 Rails prepared for bellows (for ordering the bellow see ordering key bellows), available in Europe

Rail
D Rail, if customized according to drawing number
D4 Rail with blind holes
D6 [7)] Rail with metal plugs

Distance between end face and the center of the first mounting hole of the rail
E0 If no “E” specified, the holes at both rail ends will be positioned equidistantly from either end of the rail (shortest possible “E” dimension)
Exx “E” dimension to be specified, for calculation and minimum “E” dimension (↳ **page 57**)

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LLTH	S	25	A	2	T2	1000	P5	HD	S0	A	B0	D4	E0	M	S1	C	M

Carriage mounted on rail (if not selected – no code)
M Yes

Additional seals, when part of a system (other and separate available parts see ordering key accessories)
S1 Scraper plate
S3 Seal kit, additional front seal with scraper plate
S7 Additional front seal
S6 Lube element
61 Lube element + Scraper plate
63 Lube element + Seal kit, additional front seal with scraper plate
67 Lube element + Additional front seal

Quantity of additional seals
C (2) seals per carriage
S (2) seals per system, outer surface of carriages to have seal mounted

Additional seals mounted on carriage [8] (if not selected – no code)
M Yes

[1] Not all combinations of preload / precision class available for each carriage type. Please refer to **pages 38 to 53**.
[2] Available coated carriage types refer to **page 22** (**table7**).
[3] Only available in preload classes T1 and precision class P5.
[4] Please note: a system with coated rail can have a slightly higher preload and friction. This will be partly eliminated after a short running time. Be aware, that the end of the rail is not normally coated.
[5] For size 15 and 20, only carriages with low friction S0 shield shall be used. If seal function is needed, a combination with additional front seal S7 is recommended.
[6] Jointed rail code should be selected if the ordered rail length exceeds the maximum standard rail length (defined in dimension tables, **pages 38 to 53**). Availability defined in **table 8, page 23**.
[7] Available for size 25–45. Mounting tool needs to be ordered separately (↳ **ordering key accessories**).
[8] Additional seals can only be mounted on carriage if full system is ordered (Carriage mounted on rail = Yes).
[9] Not for size 35 and 45.
[10] LLTH 15 and 20 HN are always equipped with S0 as STANDARD.
[11] Without lubricant, corrosion protected only.

4.8.2 Ordering key carriages

LLTH	C	25	A	T2	P5	HN	S0

Size
15, 20, 25, 30, 35, 45

Carriage type [1]
SA Flanged carriage, short length, standard height
A Flanged carriage, standard length, standard height
LA Flanged carriage, extended length, standard height
SU Slim-line carriage, short length, standard height
U Slim-line carriage, standard length, standard height
LU Slim-line carriage, extended length, standard height
R Slim-line carriage, standard length, extended height
LR Slim-line carriage, extended length, extended height

Preload class
T0 Zero preload
T1 Light preload, 2 % C
T2 Medium preload, 8 % C

Precision class
P5 Standard
P3 Medium
P1 High

Coating [2] [3] [4] [7] (no code for standard: non coated carriage)
HN Nickel plated carriage

Sealing [5] [6] (no code for standard sealing)
S0 Low friction shield

[1] Not all combinations of preload / precision class available for each carriage type. Please refer to **pages 38 to 53**.
[2] Only available for preload class T1, precision class P5. For an overview of the available carriages with coating, please refer to **page 22**, **table 7**.
[3] Please note: a system with coated rails can have a slightly higher preload and friction. This will be partly eliminated after a short running time.
[4] For size 15 and 20, only carriages with low friction S0 shield shall be used. If seal function is needed, a combination with additional front seal S7 is recommended.
[5] Not for size 35 and 45.
[6] LLTH 15 and 20 HN are always equipped with S0 as STANDARD.
[7] Without lubricant, corrosion protected only.

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4.8.3 Ordering key rails

LLTH	R	25	1000	P5	HD	A	B0	D4	E0

Size
15, 20, 25, 30, 35, 45

Rail length
80 mm up to maximum rail length (1 mm steps)

Precision class
P5 Standard
P3 Medium
P1 High

Coating [1) 2)] (no code for standard: non coated rail)
HD Thin dense chrome rail, available in Europe
HA Thin dense chrome rail, available in USA/CAN
HT Trivalent chrome rail, available world wide

Jointed rail track [3)]
A Yes

Prepared for Bellows
B0 Rails prepared for bellows. To order, see “ordering key bellows.”, available in Europe

Rail [4)]
D Rail, if customized according to drawing number
D4 Rail with blind holes
D6 [5)] Rail with metal plugs

Distance between end face and the center of the first mounting hole of the rail
E0 If no “E” specified, the holes at both rail ends will be positioned equidistantly from either end of the rail (shortest possible “E” dimension)
Exx “E” dimension to be specified, for calculation and minimum “E” dimension, (↳ **page 57**)

[1)] Only available in precision class P5.
[2)] Please note: a system with coated rail can have a slightly higher preload and friction. This will be partly eliminated after a short running time. Be aware that, as standard, the end of the rail is not coated.
[3)] Jointed rail code should be selected if the ordered rail length exceeds the maximum standard rail length (defined in dimension tables, **pages 38 to 53**). Availability defined in **table 8, page 23**.
[4)] Plastic and metal plugs available as spare parts. Please contact Ewellix for further information.
[5)] Available for sizes 25–45. Mounting tool needs to be ordered separately (see ↳ **ordering key accessories**).

4.8.4 Ordering key accessories (delivered separately)

LLTH	Z	25	S1

Size
15, 20, 25, 30, 35, 45

Accessories (will be delivered as single units)
S0 [1)] Low friction shield
S1 Scraper plate
S3 Seal kit, additional front seal with scraper plate
S7 Additional front seal
PL Adapter plate, used for side lubrication
VN UA [2)] Lubrication connector
D6 [3)] Mounting tool for metal plugs
S6 Lube element
61 Lube element + Scraper plate
63 Lube element + Seal kit, additional front seal with scraper plate
67 Lube element + Additional front seal

[1)] Available for sizes 15–30 to replace standard front seal.
[2)] Fits for all types of carriages (↳ **page 37**), but not in combination with additional seals (S1/S3/S7).
[3)] Available for sizes 25–45.

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