Electric Drives and Controls | Hydraulics | Linear Motion and Assembly Technologies | Pneumatics | Service

Rexroth
Bosch Group

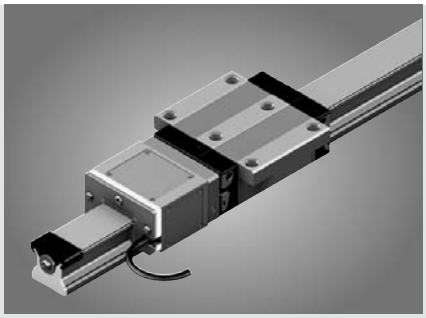
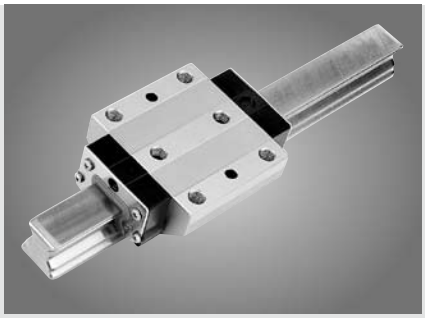
eLINE
Ball Rail Systems

R310EN 2211 (2006.04)

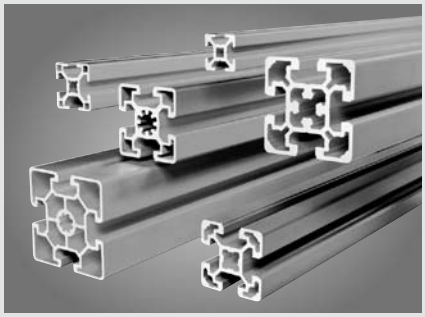
The Drive & Control Company

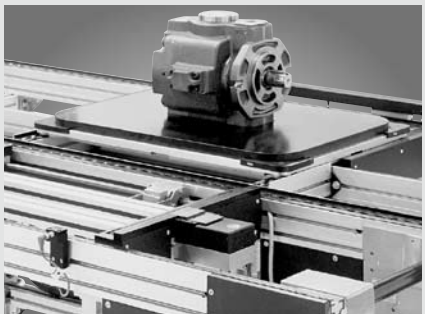
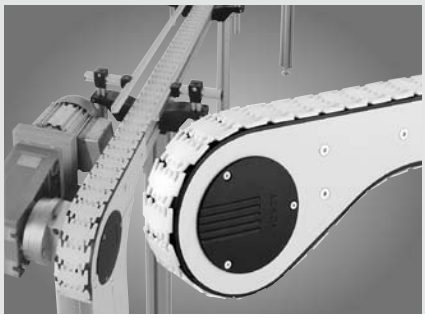
Linear Motion and Assembly Technologies

Ball Rail Systems
Roller Rail Systems
Linear Bushings and Shafts
Ball Screw Drives
Linear Motion Systems
Basic Mechanical Elements
Manual Production Systems
Transfer Systems





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eLINE Ball Rail Systems

Product Overview

Product background

Profiled rail systems have firmly established themselves as standard linear motion solutions. They were developed for precision applications calling for high accuracy and rigidity of guidance, e.g. in machine tools. In the meantime, a great variety of other applications for rail systems have emerged where high rigidity and accuracy are frequently not the most important considerations.

Rexroth's eLINE range of ball rail systems was developed for applications of this kind, especially for light machinery and for handling and positioning movements where the main emphasis is on economy and durability.

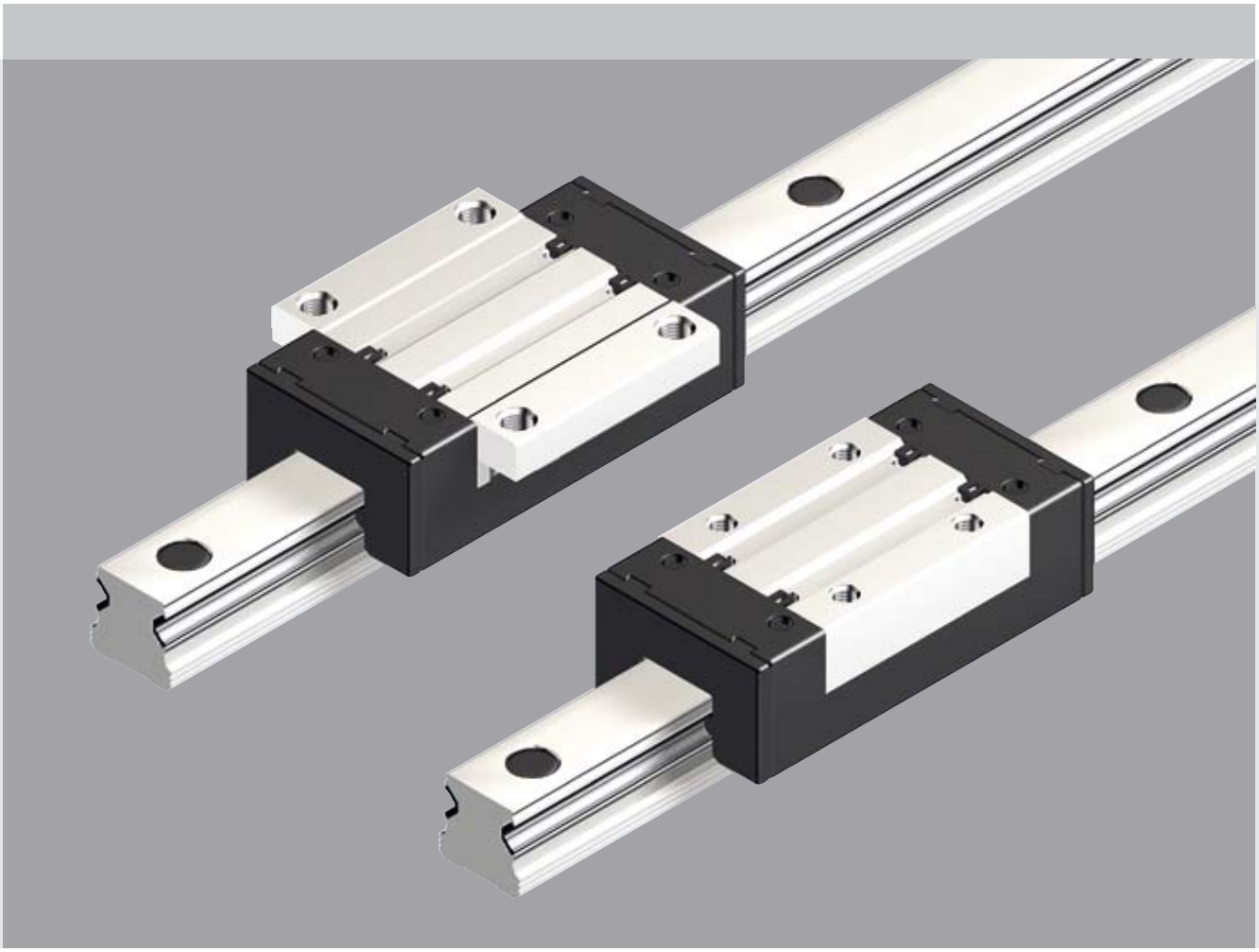
Made of wrought aluminum alloy with ball tracks of hardened antifriction bearing steel, the runner blocks and guide rails are characterized by their low weight. compact design, and equal load bearing capacity in all four main directions of loading.

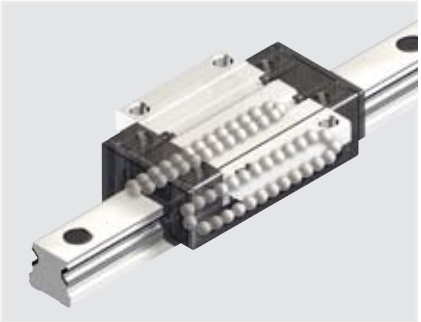
Application areas:

Light machinery, handling technology, jigs and fixtures, assembly technology, positioning units, manual displacement systems, machine enclosures, door and window construction, building services technology, trade show and shop construction, woodworking machinery, DIY equipment, and many more.

Special features of the new eLINE Ball Rail Systems:

- Available in the three most common sizes to DIN 645-1
- Structural design allows for much greater parallelism and height offsets of the mounting bases
- Can be mounted even on unmachined mounting surfaces, depending on the application
- Especially compact, lightweight design; 60% weight saving versus steel versions
- Much higher corrosion resistance than steel versions
- Two rows of especially large-diameter balls make this guide less sensitive to dirt while offering higher torsional stiffness
- Runner blocks initially greased in-factory, therefore provided with long-term lubrication
- Available in two accuracy classes and two preload classes
- Ball retainers in the runner blocks allow them to be removed from the rail without any loss of balls
- All eLINE runner blocks are delivered with ready-mounted seal units
- Optional lube units can be mounted at each end to prolong lubrication intervals still further, often reaching lube-for-life, and provide end sealing action
- Guide rails with reference edge on both sides
- All accuracy classes can be combined with one anotherr
- Interchangeability allows individual stocking of runner blocks and guide rails – top logistics unequalled anywhere in the world
- Same connection dimensions as steel ball rail systems





eLINE flanged runner block

eLINE slimline runner block

Lube unit with sealing function for eLINE Ball Rail Systems (accessories)

For additional information on the Ball Rail Systems range, see main catalog “Rexroth Ball Rail Systems”.

Technical Data, Design Notes, Mounting Instructions

General Technical Data and Calculations

Speed

v_{max} = 2 m/s

Acceleration

a_{max} = 30 m/s^2

Temperature resistance

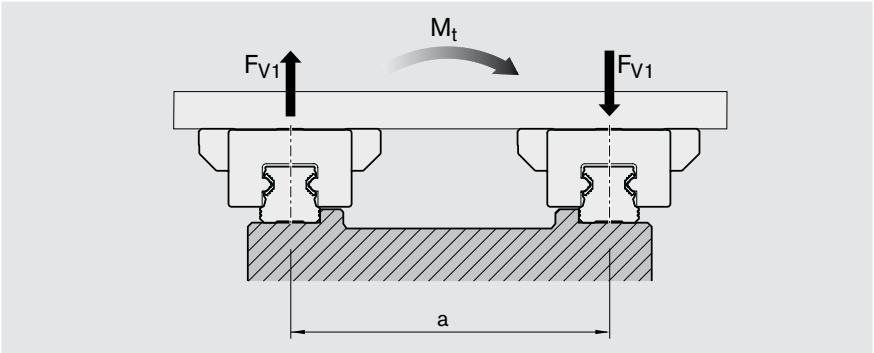
t = 0 - 60 °C

Sealing

All eLINE runner blocks are delivered with ready-mounted seal units

Information on moment load calculation

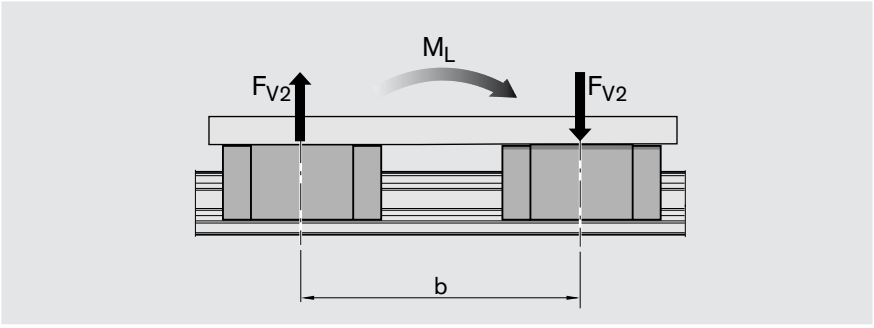
Conversion of a torsional moment acting on a table



$$F_{V1} = \frac{M_t}{a}$$

F_{V1} = external dynamic load (N)
M_t = external torsional moment (Nmm)
a = distance between guide rails (mm)

Conversion of a longitudinal moment acting on a table



$$F_{V2} = \frac{M_L}{b}$$

F_{V2} = external dynamic load (N)
M_L = external longitudinal moment (Nmm)
b = distance between runner blocks (mm)

Load-dependent size selection

$$P_{act.} \leq P_{max}$$

Example:
For $P_{act.}$ = 1500 N, use at least size 20.

Maximum permissible load

Size	P_{max} (N)
15	750
20	1700
25	2500

Service life

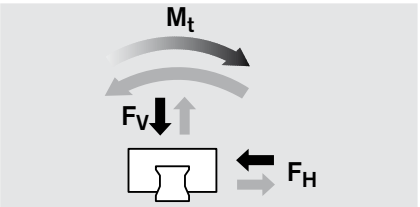
When the condition $P_{act.} \leq P_{max}$ is observed, the minimum service life given in the table will apply.
These values were determined at:
P = 0.15 x C

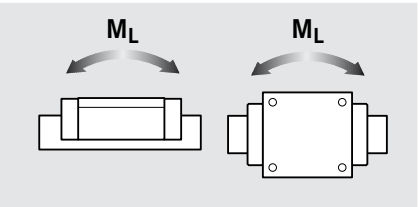
Service life	Condition
4000 km	Use of standard runner block with initial greasing
12500 km	Additional use of two lube units with sealing function
25000 km	Relubrication of the lube units after 12500 km

⚠ **Do not exceed the maximum loading of the screw connections!**

⚠ **Take account of the general service life of lubricants!**

Calculation of bearing load for a runner block





Coefficients k_t and k_L

Size	k_t	k_L
15	139	173
20	109	121
25	97	109

$$P_{act.} = k_f \cdot (|F_V| + |F_H| + k_t \cdot |M_t| + k_L \cdot |M_L|)$$

$P_{act.}$	=	equivalent load	(N)
F_V, F_H	=	external dynamic loads	(N)
M_t	=	external torsional moment[1)]	(Nm)
M_L	=	external longitudinal moment[2)]	(Nm)
k_t	=	torsional moment coefficient	(m^{-1})
k_L	=	longitudinal moment coefficient	(m^{-1})
k_f	=	operating factor (see table for values)	

1) The moment Mt will only be fully effective in an application with only one guide rail. For all other cases, see “Information on moment load calculation”.
2) The moment ML will only be effective when only one runner block is mounted on a guide rail. For all other cases, see “Information on moment load calculation”.

Recommended operating factors k_f

k_f	Application
0.8	Linear motion guide with manual drive
1.0	Door guides, seat adjustment, slide units for lamps, guidance of protective wire meshes, general laboratory applications, slide units for measuring devices
1.2	Application in a linear motion axis with ball screw drive
1.3	Application in a linear motion axis with rack and pinion drive
1.5	Application in a linear motion axis with toothed belt drive
2.0	Auxiliary axis of machine tool not subject to dirt
7.0	Application in a linear motion axis with linear motor drive
8.0	Application in a linear motion axis with pneumatic drive
9.0	Application in very dirty environments
Not for use in applications like	Main axis of a machine tool Aggressive wood dust environment Oscillating conveyors Temperatures > 60°C, v > 2 m/s, a > 30 m/s^2 Danger to life and limb (e.g. unsecured overhead installation)

Technical Data, Design Notes, Mounting Instructions

General Technical Data and Calculations

Definition of dynamic load capacity C

The radial loading of constant magnitude and direction which a linear rolling bearing can theoretically endure for a nominal life of 100 km distance traveled (to ISO 14728 Part 1).

Note on maximum load F_{max}

Because of the weight-optimized design of eLINE Ball Rail Systems, the maximum permissible forces for static and dynamic loads must not be exceeded.

Definition and calculation of the nominal life

The calculated service life which an individual linear rolling bearing, or a group of apparently identical rolling element bearings operating under the same conditions, can attain with a 90% probability, with contemporary, commonly used materials and manufacturing quality under conventional operating conditions (to ISO 14728 Part 1) and optimal installation conditions.

Nominal life at constant speed

Calculate the nominal life L or L_h according to formula (1) or (2):

$$(1)\quad L = \left(\frac{C}{F}\right)^3 \cdot 100$$

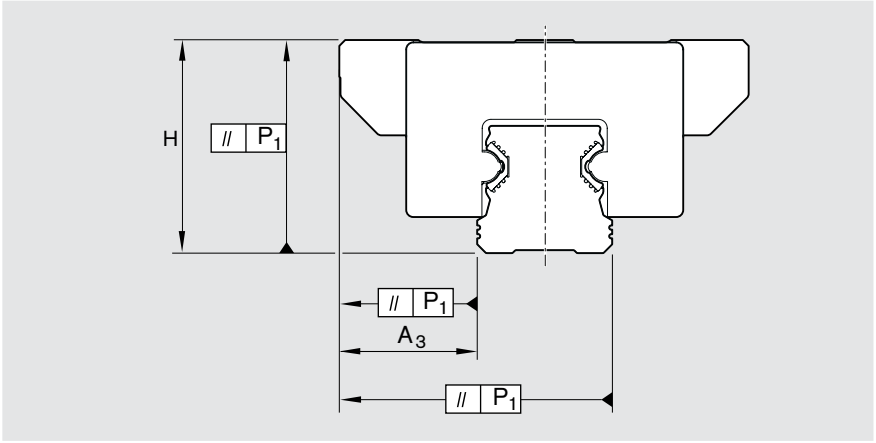
$$(2)\quad L_h = \frac{L}{2 \cdot s \cdot n \cdot 60}$$

L	= nominal life	(km)
L_h	= nominal life	(h)
C	= dynamic load capacity	(N)
F	= equivalent load	(N)
s	= length of stroke*	(m)
n	= stroke repetition rate (complete cycles/min)	(min^{-1})

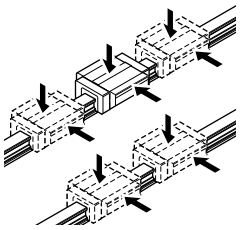
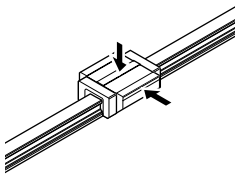
* For a stroke length < 2 x runner block length, the load capacities will be reduced. Please consult us.

Selection of Accuracy Classes

Accuracy classes and their tolerances
eLINE-ball rail systems are offered in two different accuracy classes.

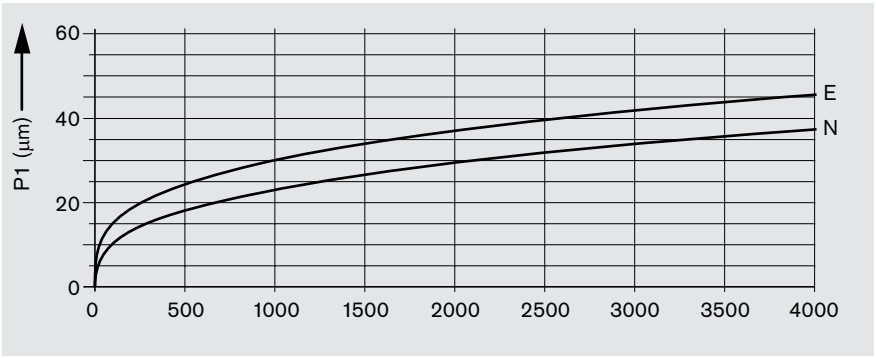


Built-in interchangeability through precision machining
Rexroth manufactures its guide rails and runner blocks with such high precision, especially in the ball track zone, that each individual component element can be replaced by another at any time.
For example, different runner blocks can be used without problems on one and the same guide rail of the same size.

Accuracy class	Tolerances dimension H and A_3 (µm)		Max. difference in dimension H and A_3 on one guide rail ΔH, ΔA_3 (µm)
	H	A_3	
N	±100	±40	30
E	±120	±70	60
Measured at middle of runner block	 For any runner block/rail combination at any position on rail		 For different runner blocks at same position on rail

Parallelism offset P1 of the ball rail system in service

Measured at middle of runner block



Key to graph
P_1 = parallelism offset
L = rail length

Technical Data, Design Notes, Mounting Instructions

Combination of Accuracy Classes

Runner block		Rails N (µm)	Rails E (µm)
N	Tolerance dimension H	+/– 100	+/– 110
	Tolerance dimension A3	+/– 40	+/– 60
	Max. diff. in dimens. H and A3 on one rail	30	30
E	Tolerance dimension H	+/– 115	+/– 120
	Tolerance dimension A3	+/– 50	+/– 70
	Max. diff. in dimens. H and A3 on one rail	60	60

Recommendations for combining accuracy classes

Recommended for short strokes and close spacing of runner blocks:
Runner blocks in higher accuracy class than guide rail.

Recommended for long strokes and larger runner block spacing:
Guide rail in higher accuracy class than runner blocks.

Selection of System Preload

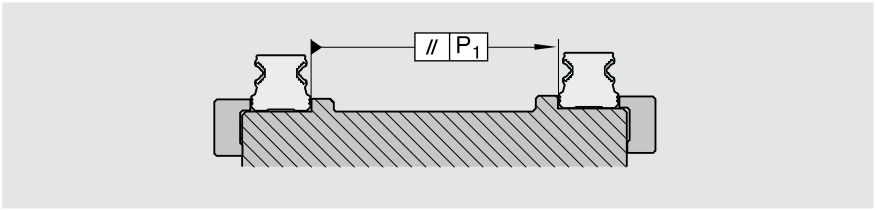
Selection of the preload class
In versions without preload there will be a slight clearance between the runner block and the rail. With two rails and use of more than one runner block per rail, this clearance is usually equalized by parallelism tolerances.

Code	Version	Areas of application
C0	without preload	For particularly smooth running guide systems with the lowest possible friction and a minimum of external influences, and for mounting bases with low accuracy.
C1	with preload	For more accurate guide systems with low external loads.

General Mounting Instructions

Parallelism of the installed rails measured at the guide rails and at the runner blocks

The parallelism offset P1 causes a slight increase in preload on one side of the assembly.
If the tolerances given in the table are not exceeded, the reduction in travel life will as a rule be negligible.

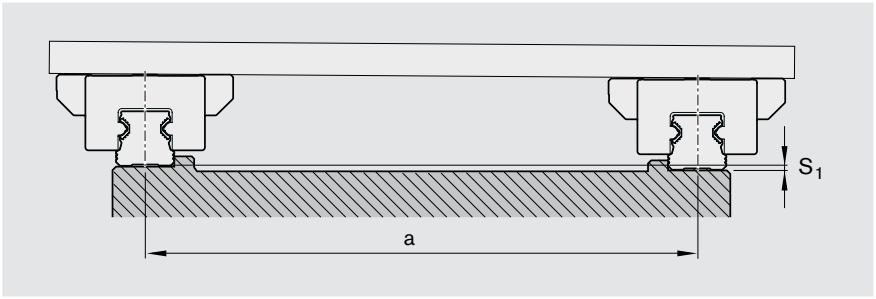


Size	Parallelism offset P_1 (mm) for preload class	
	C0	C1
15	0.027	0.018
20	0.031	0.021
25	0.034	0.022

⚠ **LINE ball rail systems allow substantially higher installation tolerances compared to steel rail systems.**

Vertical offset

If the permissible vertical offset S_1 and S_2 is not exceeded, the reduction in travel life will as a rule be negligible.
The tolerance for dimension H, as given the table with accuracy classes in the "Technical Data" section, must be deducted from the permissible vertical offset S_1.



Permissible vertical offset in the transverse direction S_1

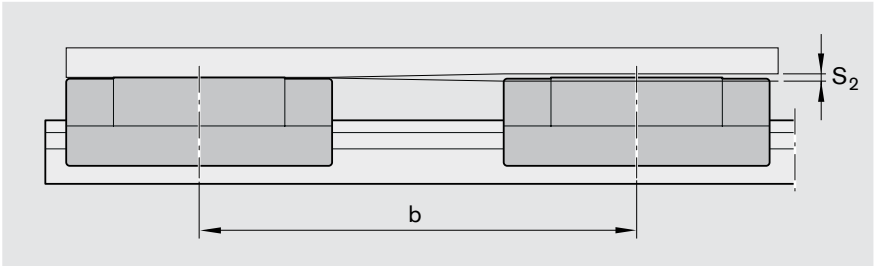
$$S_1 = a \cdot Y_1$$

S_1 = permissible vertical offset (mm)
a = distance between guide rails (mm)
Y_1 = calculation factor

Calculation factor	for preload class	
	C0	C1
Y_1	$1.2 \cdot 10^{-3}$	$7.5 \cdot 10^{-4}$

Permissible vertical offset in the longitudinal direction S_2

The tolerance “max. difference in dimensions H on the same rail”, as given the table with accuracy classes in the "Technical Data” section, must be deducted from the permissible vertical offset S_2.



$$S_2 = b \cdot Y_2$$

S_2 = permissible vertical offset (mm)
b = distance between runner blocks (mm)
Y_2 = calculation factor

Calculation factor	for preload class	
	C0	C1
Y_2	$6 \cdot 10^{-4}$	$2.1 \cdot 10^{-4}$

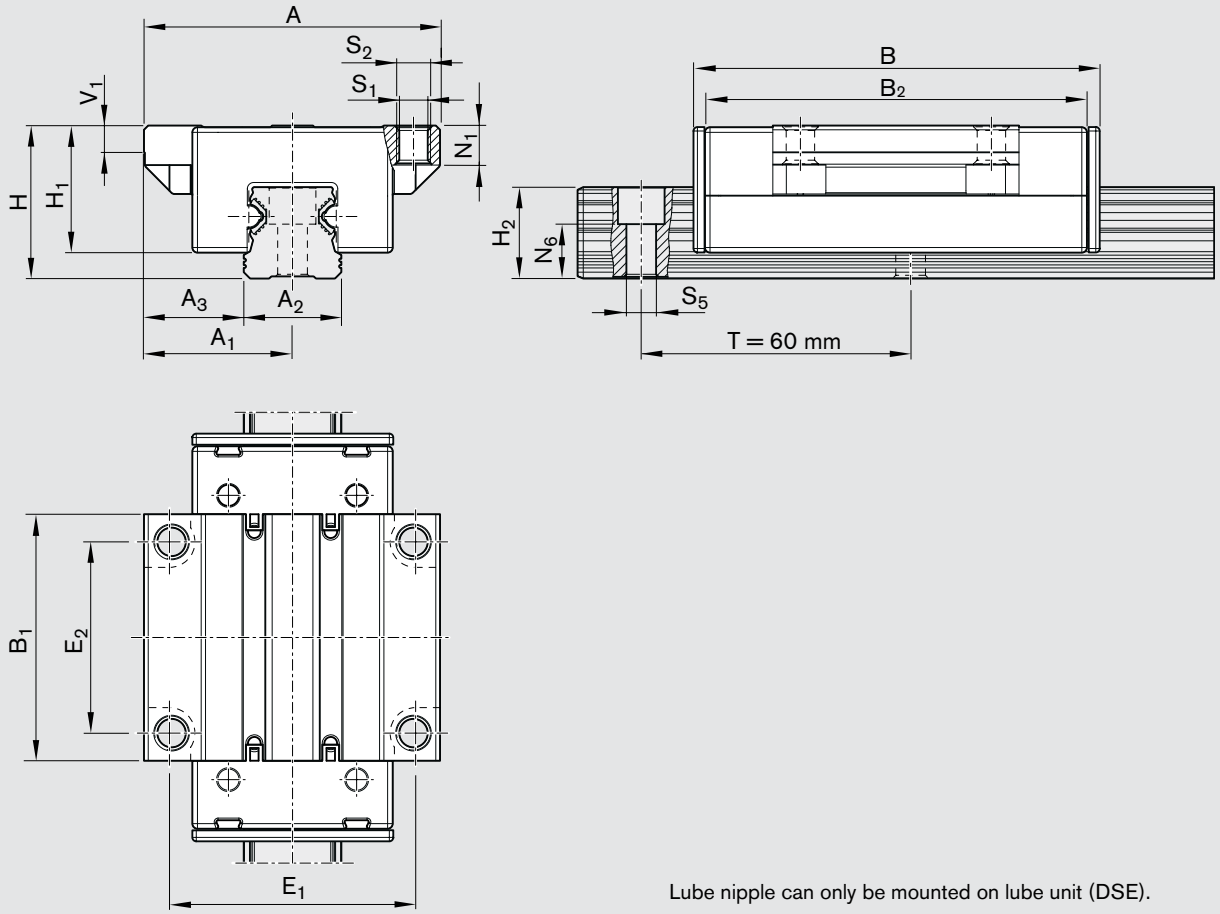
Preload classes
C0 = without preload
C1 = with preload

eLINE Runner Blocks

Runner block
FNS R2031
Flanged, normal, standard height

- Runner block body made from wrought aluminum alloy
- Hardened steel running tracks
- Steel balls to DIN 5401
- With seal unit (DE)
- Initial greasing with Dynalub 510
- For $P_{act.} \leq P_{max,}$ no relubrication necessary throughout the stated minimum service life

Size	Accuracy class	Part numbers	
		Clearance	Preload
15	N	R2031 194 10	R2031 114 10
	E	R2031 195 10	–
20	N	R2031 894 10	R2031 814 10
	E	R2031 895 10	–
25	N	R2031 294 10	R2031 214 10
	E	R2031 295 10	–



Lube nipple can only be mounted on lube unit (DSE).

Size	Dimensions (mm)																		Weight[1]
	A	A_1	A_2	A_3	B	B_1	B_2	H	H_1	H_2	V_1	E_1	E_2	N_1	$N_6^{\pm 0.5}$	S_1	S_2	S_5	(kg)
15	47	23.5	15	16.0	64.0	37.8	59.0	24	19.8	14.3	4.1	38	30	6.0	8.1	4.3	M5	4.4	0.08
20	63	31.5	20	21.5	85.9	51.5	80.3	30	24.7	19.3	5.5	53	40	8.0	11.6	5.3	M6	6.0	0.18
25	70	35.0	23	23.5	96.0	58.0	90.0	36	29.9	21.8	6.4	57	45	9.3	12.9	6.7	M8	7.0	0.26

Load capacities[2] (N)			Moments (Nm)			
Size	C dyn.	F_{max}	M_t dyn.	M_{tmax} stat.	M_L dyn.	M_{Lmax} stat.
15	5000	2000	36	14	29	12
20	11000	4400	101	40	89	35
25	16000	6400	165	66	147	59

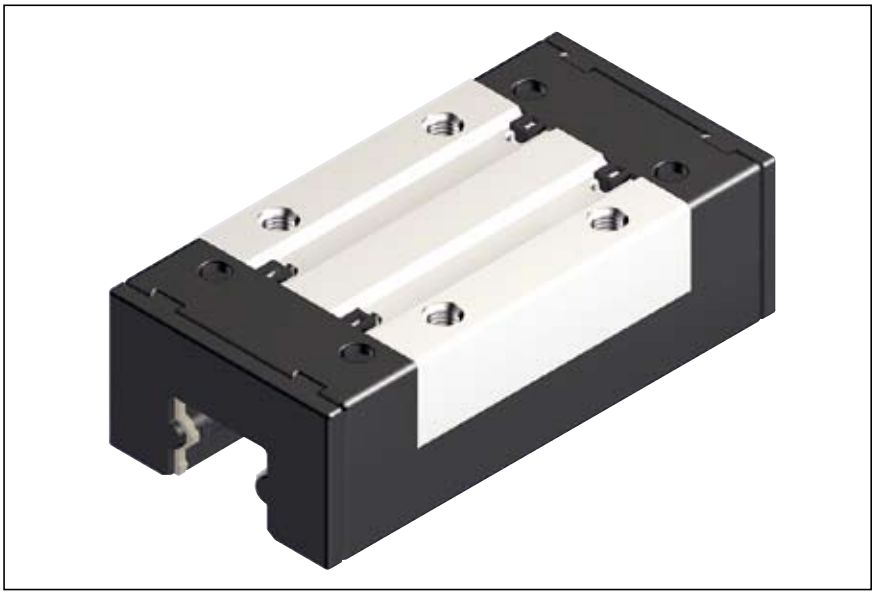
1) Please note the low weight of the runner block.

2) Determination of dynamic load capacities and moments is based on a travel life of 100 000 m. However, frequently this is determined on the basis of only 50 000 m. In this case, for comparison: Multiply values C, M_t and M_L from the table by 1.26.

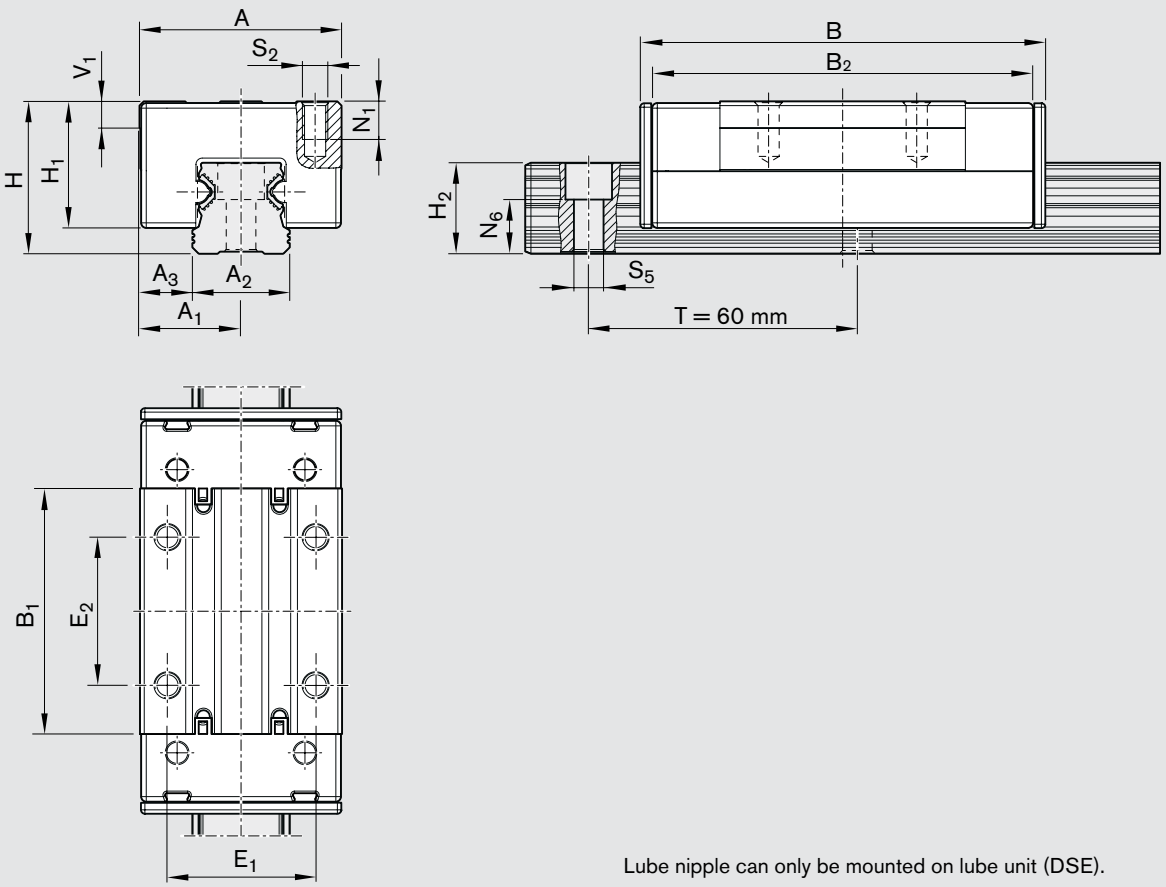
eLINE Runner Blocks

Runner block
SNS R2032
Slimline, normal, standard height

- Runner block body made from wrought aluminum alloy
- Hardened steel running tracks
- Steel balls to DIN 5401
- With seal unit (DE)
- Initial greasing with Dynalub 510
- For $P_{act.} \leq P_{max,}$ no relubrication necessary throughout the stated minimum service life



Size	Accuracy class	Part numbers	
		Clearance	Preload
15	N	R2032 194 10	R2032 114 10
	E	R2032 195 10	–
20	N	R2032 894 10	R2032 814 10
	E	R2032 895 10	–
25	N	R2032 294 10	R2032 214 10
	E	R2032 295 10	–



Lube nipple can only be mounted on lube unit (DSE).

Size	Dimensions (mm)																	Weight[1]
	A	A_1	A_2	A_3	B	B_1	B_2	H	H_1	H_2	V_1	E_1	E_2	N_1	$N_6^{\pm 0.5}$	S_2	S_5	(kg)
15	34	17	15	9.5	64.0	37.8	59.0	24	19.8	14.3	4.1	26	26	6.0	8.1	M4	4.4	0.07
20	44	22	20	12.0	85.9	51.5	80.3	30	24.7	19.3	5.5	32	36	7.5	11.6	M5	6.0	0.15
25	48	24	23	12.5	96.0	58.0	90.0	36	29.9	21.8	6.4	35	35	9.0	12.9	M6	7.0	0.22

Load capacities[2] (N)			Moments (Nm)			
Size	C dyn.	F_{max}	M_t dyn.	M_{tmax} stat.	M_L dyn.	M_{Lmax} stat.
15	5000	2000	36	14	29	12
20	11000	4400	101	40	89	35
25	16000	6400	165	66	147	59

1) Please note the low weight of the runner block.

2) Determination of dynamic load capacities and moments is based on a travel life of 100 000 m. However, frequently this is determined on the basis of only 50 000 m. In this case, for comparison: Multiply values C, M_t and M_L from the table by 1.26.

eLINE Guide Rails

Guide rails for mounting from above R2035

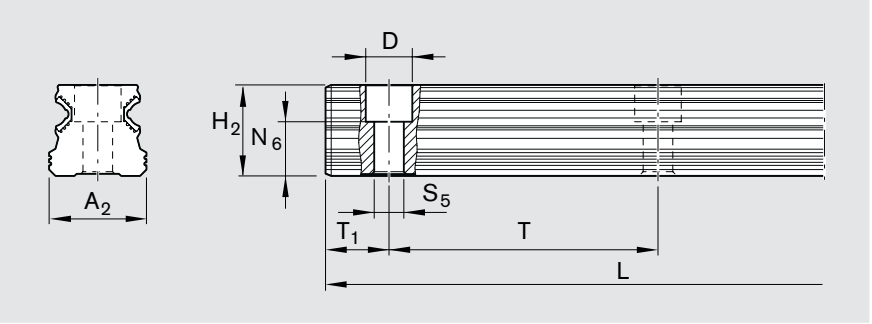
with plastic mounting hole plugs (supplied)

- Rail body made from wrought aluminum alloy, anodized
- Ball running tracks made from hardened antifriction bearing steel

Part numbers and rail lengths

Size	Accuracy class	Part number One-piece Rail length L (mm)	Composite Number of sections, Rail length L (mm)	Recommended rail length, one-piece Spacing T (mm)	Number of holes n_B / Rail length L (mm)					
15	N	R2035 104 31.....	R2035 104 3.....	60	2/80	2/90	2/100	2/116	3/176	4/236
	E	R2035 105 31.....			5/296	6/356	7/416	8/476	9/536	10/596
20	N	R2035 804 31.....	R2035 804 3.....		11/656	12/716	13/776	14/836	15/896	16/956
	E	R2035 805 31.....			17/1016	18/1076	19/1136	20/1196	21/1256	22/1316
25	N	R2035 204 31.....	R2035 204 3.....		23/1376	24/1436	25/1496	26/1556	27/1616	28/1676
	E	R2035 205 31.....			29/1736	30/1796	31/1856	32/1916	33/1976	34/2036
					35/2096	36/2156	37/2216	38/2276	39/2336	40/2396
					41/2456	42/2516	43/2576	44/2636	45/2696	46/2756
					47/2816	48/2876	49/2936	50/2996	51/3056	52/3116
					53/3176	54/3236	55/3296	56/3356	57/3416	58/3476
					59/3536	60/3596	61/3656	62/3716	63/3776	64/3836
					65/3896	66/3956	67/4016			

Dimensions and weights



Size	Dimensions (mm)									Weight[2]
	A_2	H_2	$N_6^{\pm 0.5}$	D	S_5	$T_{1S}^{\pm 0.5}$	T_{1min}	T	L_{max}[1]	(kg/m)
15	15	14.3	8.1	7.4	4.4	28.0	10	60	4016	0.57
20	20	19.3	11.6	9.4	6.0	28.0	10	60	4016	0.98
25	23	21.8	12.9	11.0	7.0	28.0	10	60	4016	1.25

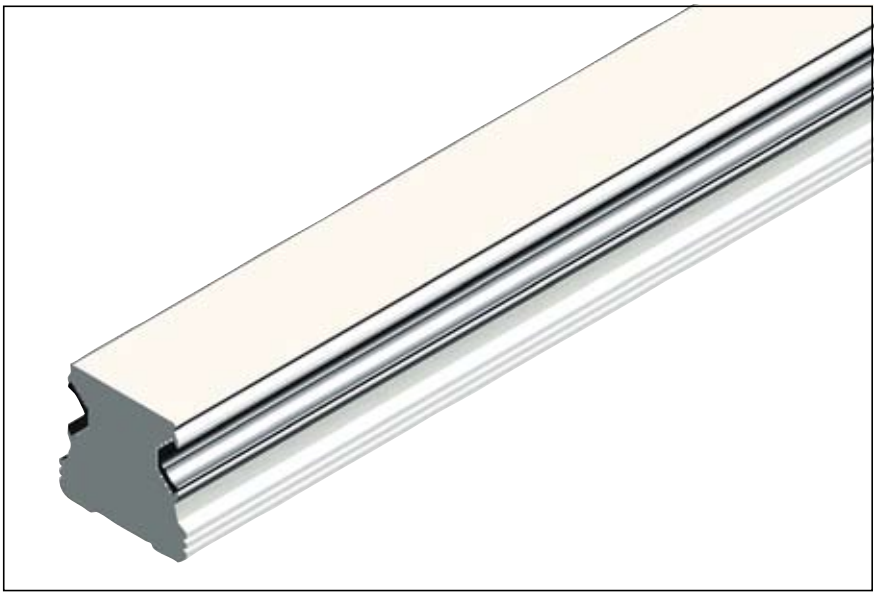
1) One-piece guide rails

2) Please note the low weight per meter of the guide rail.

eLINE Guide Rails

Guide rails for mounting from below R2037

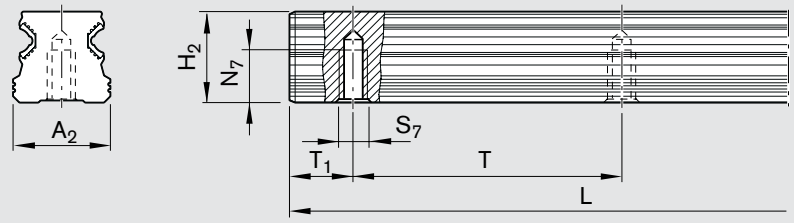
- Rail body made from wrought aluminum alloy, anodized
- Ball running tracks made from hardened antifriction bearing steel
- Especially suitable for mounting on e.g. metal plates, plastics, or wood with through-holes



Part numbers and rail lengths

Size	Accuracy class	Part number One-piece Rail length L (mm)	Part number Composite Number of sections, Rail length L (mm)	Recommended rail length, one-piece Spacing T (mm)	Number of holes n_B / Rail length L (mm)					
15	N	R2037 104 31.....	R2037 104 3.....	60	2/80	2/90	2/100	2/116	3/176	4/236
	E	R2037 105 31.....			5/296	6/356	7/416	8/476	9/536	10/596
20	N	R2037 804 31.....	R2037 804 3.....		11/656	12/716	13/776	14/836	15/896	16/956
	E	R2037 805 31.....			17/1016	18/1076	19/1136	20/1196	21/1256	22/1316
25	N	R2037 204 31.....	R2037 204 3.....		23/1376	24/1436	25/1496	26/1556	27/1616	28/1676
	E	R2037 205 31.....			29/1736	30/1796	31/1856	32/1916	33/1976	34/2036
					35/2096	36/2156	37/2216	38/2276	39/2336	40/2396
					41/2456	42/2516	43/2576	44/2636	45/2696	46/2756
					47/2816	48/2876	49/2936	50/2996	51/3056	52/3116
					53/3176	54/3236	55/3296	56/3356	57/3416	58/3476
					59/3536	60/3596	61/3656	62/3716	63/3776	64/3836
					65/3896	66/3956	67/4016			

Dimensions and weights



Size	Dimensions (mm)								Weight[2]
	A_2	H_2	N_7	S_7	$T_{1S}^{\pm 0.5}$	T_{1min}	T	L_{max}[1]	(kg/m)
15	15	14.3	7.5	M5	28.0	10	60	4016	0.57
20	20	19.3	9.0	M6	28.0	10	60	4016	0.98
25	23	21.8	12.0	M6	28.0	10	60	4016	1.25

1) One-piece guide rails

2) Please note the low weight per meter of the guide rail.

Accessories

Lube unit with sealing function DSE

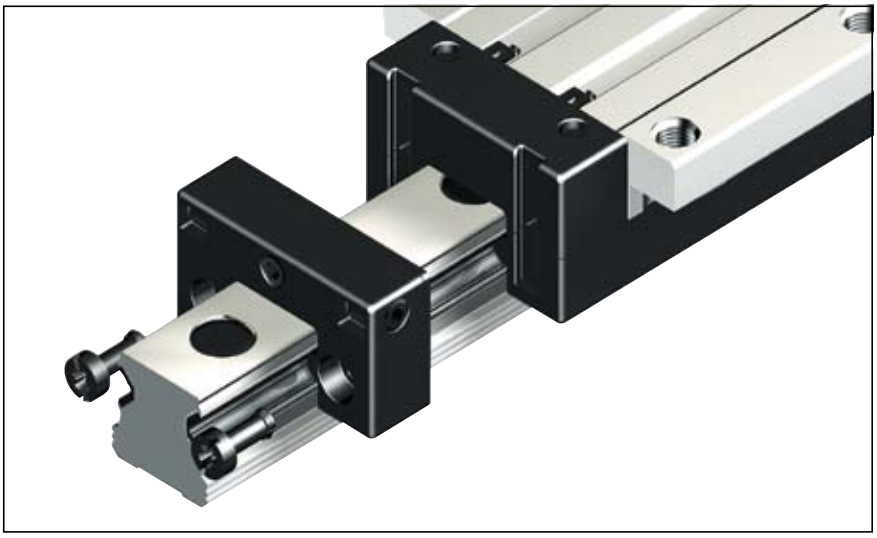
- Material: special plastic
- Acts as an end seal
- Relubricatable

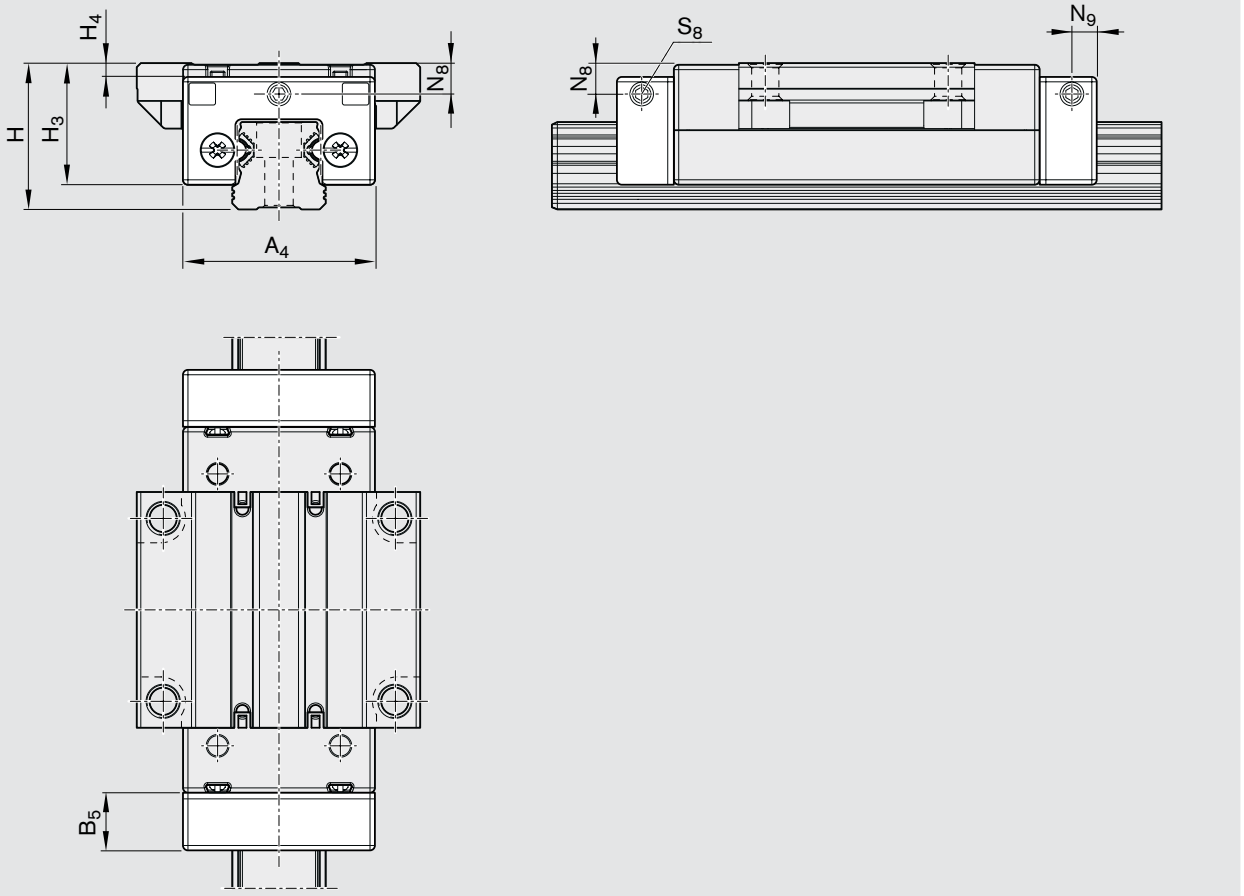
Mounting instructions:

⚠ **Before mounting the DSE, remove the seal unit by pulling it upward.**

The required fastening elements are supplied along with the unit.
Please order the lube nipple separately.
Lube units are prefilled with ISO VG 1000 oil and therefore ready for mounting.

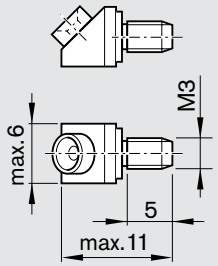
- Push the lube unit onto the guide rail and fasten it to the runner block.



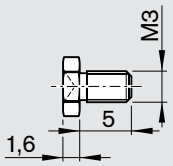


Size	Part number	Dimensions (mm)								Oil
		A_4	B_5	H	H_3	H_4	N_8	N_9	S_8	(cm^3)
15	R2030 125 00	31.7	11.5	24	19.4	0.4	4.5	5.0	M3	0.65
20	R2030 825 00	43.2	13.0	30	24.3	0.4	5.0	5.0	M6	1.35
25	R2030 226 00	47.2	14.0	36	30.0	3.4	7.6	6.1	M6	1.7

Funnel-type lube nipple for size 15

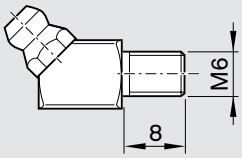


Part number
R3417 004 09

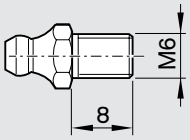


Part number
R3417 029 09

Hydraulic-type lube nipple for size 20 and 25



Part number
R3417 007 02



Part number
R3417 008 02

Mounting instructions:
The lube nipples can only be mounted on the lube unit DSE.

Accessories

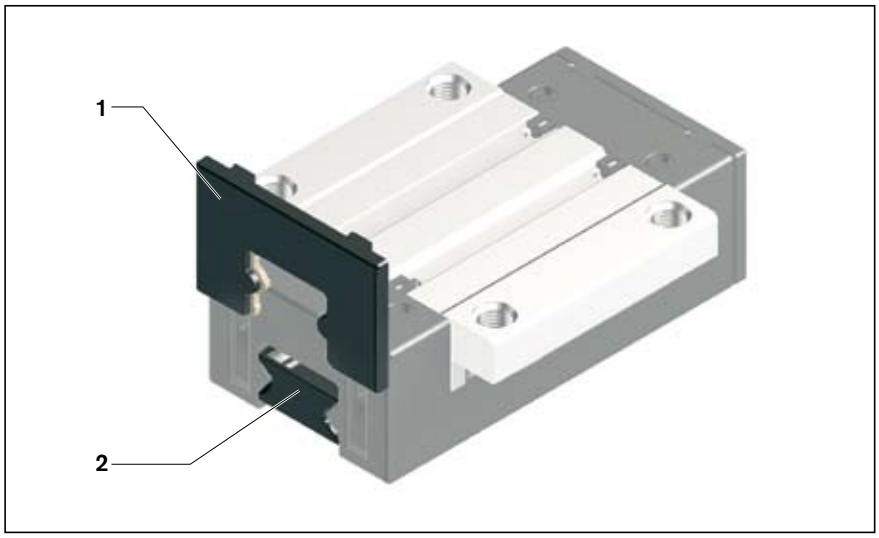
Seal unit DE

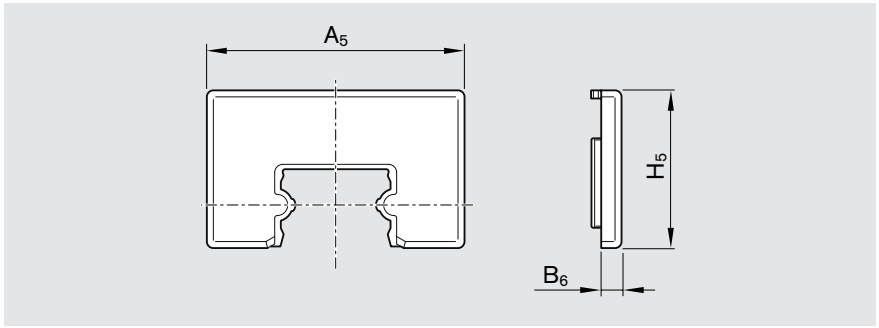
Material: POM

Mounting instructions:

⚠ **The seal unit cannot be mounted when the runner block is on the guide rail.**

- Slide the seal unit (1) from above into the grooves on the end face of the runner block.
- Mount the runner block, pushing it off the mounting arbor (2) and onto the guide rail. The seal unit will align itself vertically relative to the guide rail.





Size	Part numbers	Dimensions (mm)			Quantity per pack
		A_5	B_6	H_5	
15	R2030 110 00	31.7	2.5	19.4	
20	R2030 810 00	43.2	2.8	24.3	20
25	R2030 211 00	47.2	3.0	26.5	

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