NTN-SNR:
LINEAR AXIS NEWS

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With You

A bearing manufacturer known across the world

NTN-SNR as part of the NTN Corporation has been one of the most innovative companies in this sector for decades. The NTN Group is the third-largest roller bearing manufacturer in the world.
This position allows us to provide our customers with a high level of added value regarding service, quality and product range. As a result, we have been able to build a strong image as a competent partner for our customers. Our companies are characterized by global presence and a consistent quality system.
NTN-SNR has been established in the linear technology market since 1985 and strives to offer a complete and competitive product range.

NTN-SNR linear axis are universally applicable modules that accommodate the steadily growing requirements for the automation of installation and manufacturing processes.
They are suitable for the most diverse applications in various industries: room automation, machine tools, electrical engineering/electronic hardware, automobile industry, printing industry, special-purpose machines, clean-room applications in the semiconductor industry, food industry.

The variants are built according to a modular design and depending on the problem, offer not only flexible drive and guiding concepts but also allow adequate freedom for customized solutions.

This means lower building costs and expenses for the user.

NTN-SNR linear axis can be quickly combined with each other and integrated into existing systems. They bring additional advantages through their reliability and durability.

NTN-SNR Engineering provides one-stop support for the design of individual linear axis and the development of system solutions. Through the optimal interaction of mechanics and electronics we offer short design times with optimized system configurations.

Table of contents

1. News Overview

AXC

The proven linear axis range AXC has been expanded to size 40 by the drive variant AXC40A. The new developed size 100 closes the gap between the sizes 80 and 120. It is available with tooth belt and screw drive.

AXF

The NTN-SNR linear axis AXF100 is the first size of the AXF series based on the AXC series. The design and options have been specifically optimized for applications in the fields of food, pharmaceutical and semiconductor industries. The flat surfaces allow an optimal cleaning and prevent the deposit of residues at the profile. Linear axes of the AXF series are available with tooth belt and screw drive.

AXDL

The linear axes series AXDL has been added to the drive variant AXDL_A in sizes 160 and 240.

AXBG

The compact linear modules AXBG provide a completely new series in the NTN-SNR product range. The bodies of the compact linear axes AXBG are based on a U – shaped steel profile with integrated precision guiding and drive system. The carriages with integrated ball circulation are guided inside of the grinded steel profile. The four – point ball contact provides a high level of tilting resistance between carriages and rail. The drive is performed by a precision ball screw. Due to the extremely compact design and the use of a solid steel profile, the compact linear axes AXBG are very rigid and can reach high positioning accuracy, even under heavy loads. Thanks to the high bending stiffness of the U – shaped steel profile and the very rigid guiding system, the compact linear axes are also suitable for applications in which clamped on one side.

AXS

There are for a variety of applications limited space. In order to take account of these applications, the system program of the NTN-SNR linear axes are added to telescopic axes in different sizes. The telescopic axes are characterized by an optimal stroke - length ratio, high load capacity and high dynamics.

Another variant of the gantry axes is the AXS280Y. This linear axes has been specially designed for applications with a tilted assembly position.

AXLM

The linear motor axes AXLM are based on the profiles of the NTN-SNR linear tables AXLT and thus provide applications with high loads, especially torque loads for an excellent solution.

The drive system uses a linear motor, which is characterized by its high dynamics.

The table is guided by two parallel assembled linear guides with ball chain.

General

The various extensions and additions to the linear axes program require an adjustment and addition to the existing type code. Chapter 2 and 9 show the corresponding supplements.

2 . Type code

BAXC	80	S	G	2005	-	B	–	1000	-	1380	-	A	2	-	00	00	A	0	0	N	0
1	2	3	4	5		6		7		8		9	10		11	12	13	14	15	16	17

1	AXC	Series
2	80	Size
3	S	**Drive type** **Z** ..... Tooth belt drive **M** .... Rack and pinion drive **T** ..... Trapezoidal screw drive **E** ..... Linear motor **TH**... Telescopic axis, horizontal **Y** ..... Tooth belt drive on the side **V** ..... Ball screw with reinforced supports **S**..... Ball screw drive **A** .... driven slider **O** .... no drive **Y** .... Tooth belt drive on the side **TV** .. Telescopic axis, vertical
4	G	**Drive design for tooth belt drive** **HL (HR)** .....Mounting surface machined on left side (right) and drive for hollow shaft **HW** .....Hollow shaft **WL (WR)**.....Free end of the shaft left (right) **WD** .....Free ends of the shaft on both sides **KL (KR**.....Integrated coupling for main drive pinion side, left (right) **KLK (KRK)** ....Integrated drive coupling, left side (right) + integrated coupling for connecting shaft right (left) **PL (PR)**.....integrated planetary gear box left (right) **PLK (PRK)**.....Integrated planetary gear box left (right) + integrated coupling for connecting shaft right (left) **GL (GR)** .....Coupling and coupling cone left (right) **GLK (GRK)** ....Coupling and coupling cone left (right) + integrated coupling for connecting shaft right (left) **FL (FR)** .....Drive adapter flange (direct connection between drive shaft and hollow shaft of unit), left side (right)
		Drive design for screw drive **G**..... Coupling cone + coupling (not for AXBG) **F** ..... integrated drive adaption including coupling (not for AXBG) **K**..... Coupling cone **O**… free drive shaft **U**… Deflection belt drive
		Drive design for linear motor drive **A**..... Motor with air cooling **W**… Motor with water cooling

5	2005	**Size ID for drive design with tooth belt drive** **HW, WL, WR, WD, FL, FR**… Shaft or hollow shaft diameter **KL, KR, GL, GR**… Coupling internal diameter main drive pinion side **PL, PR**…Reduction ratio (for PLK or PRK design, only the reduction ratio is indicated)
		Size ID for drive design with screw drive Spindle diameter and pitch [mm]
		Size ID for drive design with rack and pinion drive Gear ratio
		Size ID for drive design with linear motor drive Maximum force of the linear motor [N]
6	B	**without guidance system (feed axis), standard carriages (not for AXBG)** **B** .... Profile rail guide, standard carriage **D** .... Two parallel profile rail guide, standard carriage **L** .... Track roller guide, standard carriage **P** .... Polymer track roller guide, standard carriage **C** .... Profile rail guide, long carriage **M** ... Track roller guide, long carriage **F** .... without guiding system (feed axis), standard carriage
		Guiding system AXBG **A** ..... one carriage, long **B**.... two carriages, long **C** ..... one carriage, short **D** ... two carriages, short
7	1000	**Travel range [mm]**
8	1380	**Total length [mm]** Travel range + additional length according catalogue (Profile length for AXBG)
9	A	**Version / Protection against pollution** See chapter 9.1.
10	2	**Additional options** **0**..... without additional options **1…4** Number of shaft support unit sets (for AXC_S/V and AXDL_S/V possible) **C**..... Balance cylinder (for AXC_A, AXDL_A and AXS_TV possible
11	00	**Switch combination left** See catalogue NTN-SNR Linear axes page 99
12	00	**Switch combination right** See catalogue NTN-SNR Linear axes page 99
13	0	**Drive adaption** **0**..... without drive adaption _..... ID according catalogue NTN-SNR Linear axes pages 82, 85 and 87
14	0	**Lubricants**
15	0	**Safety options** See chapter 9.4.
16	0	**P** .... P - Precision (only for AXC_S, AXDL_S, AXLT_S and AXBG possible)
17	0	(case of order)

3. AXC

3.1. AXC40A

3.1.1. Structure

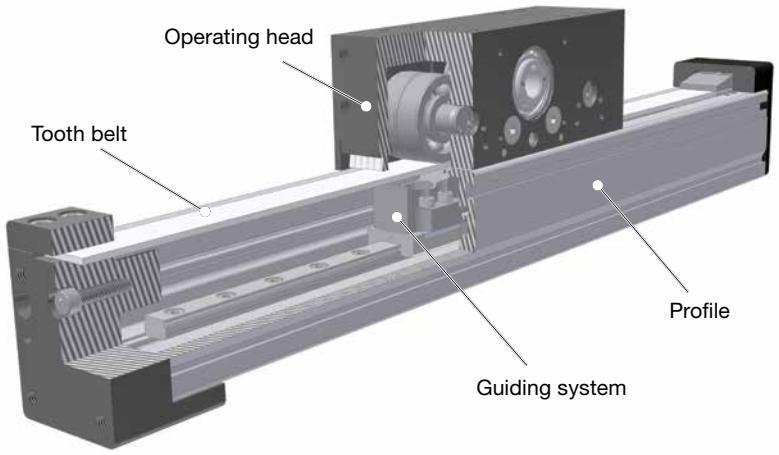
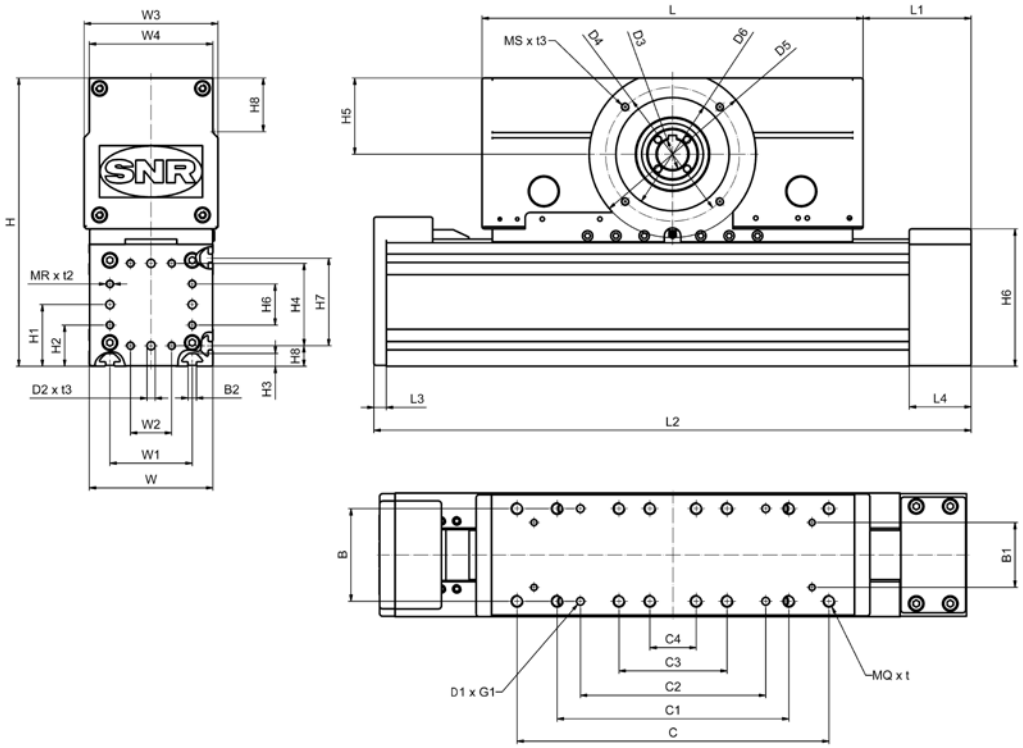


Figure 3.1 Structure

3.1.2. Dimension



	L	W	H	L1	L2	L3	L4	B	C	B1	B2
AXC40A	120	80	170	min. 30	Travel range + 180	5	20	28	80	--	--

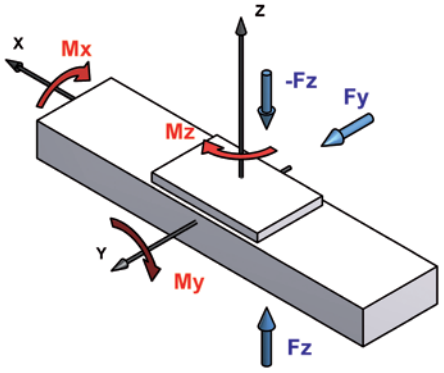
	C1	C2	C3	C4	H1	H2	H3	H4	H5	H6	H7	H8	W1	W2	W3	W4
AXC40A	--	--	--	30	40	20	9,75	44	20,5	55,8	36	--	24	30	39	--

	D1 x t1	D2 x t3	D3	D4	D5	D6	MQ x t	MR x t2
AXC40A	--	4H7 x 8	10H7	--	--	--	M5 x 9	M5 x 10

3.1.3. Technical data

Dynamic loads and moments

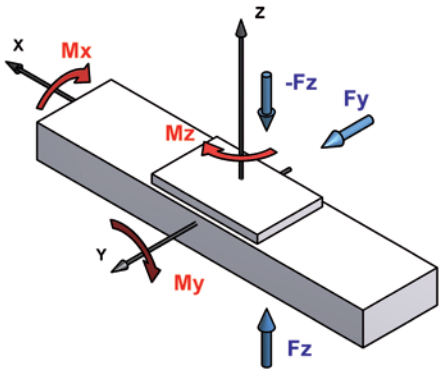
	AXC40A
	Profile rail guide B
Loads [N]	
Fy	500
Fz	500
Load torque [Nm]	
Mx	2,4
My	20
Mz	20



The dynamic load rating of the guiding system based on a nominal service life of 54,000 km.

Static loads and moments

	AXC40A
	Profile rail guide B
Loads [N]	
Fy	900
Fz	900
Load torque [Nm]	
Mx	4,2
My	36
Mz	36



Parameter

	AXC40A
Maximal velocity with profile rail guide B [m/min]	300
Drive element	Tooth belt 16AT3
Allowable dynamic operating load [N]	210
Stroke per revolution [mm]	75
Idling speed torque [Nm]	0,2
Moment of inertia [kgcm^2]	0,16
Geometrical moment of inertia Iy [cm^4]	9,521
Geometrical moment of inertia Iz [cm^4]	12,14
Maximal total length [m]	6

Mass

	AXC40A
	Profile rail guide B
Base mass [kg]	1,4
Mass per 100 mm stroke [kg]	0,3
Operating head mass [kg]	0,9

3.2. AXC100Z

3.2.1. Structure

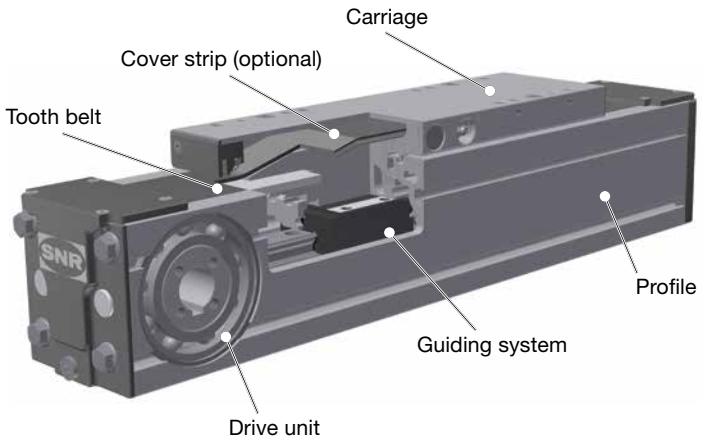
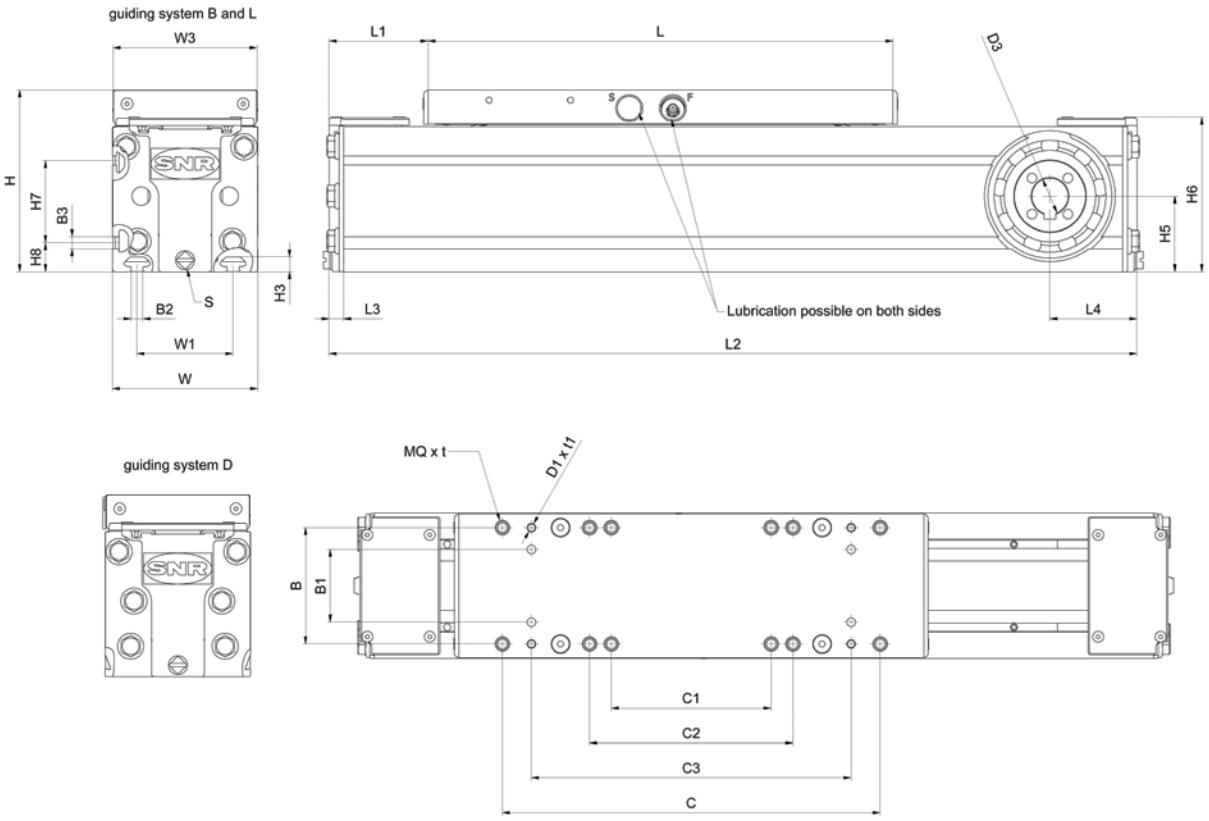


Figure 3.2 Structure

3.2.2. Dimension



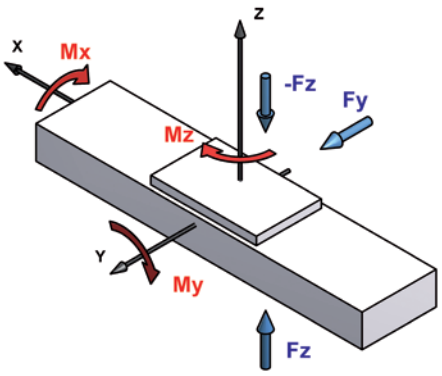
	L	W	H	L1	L2	B	C	L3	L4	B1	B2	B3	D3
AXC100Z	320	100	125	68	Travel range + 460	80	260	12	62	--	8,2	8,2	Ø25H7

	C1	C2	C3	H3	H5	H6	H7	H8	W1	W3	S	MQ x t	D1 x G1
AXC100Z	110	140	220	10,2	52	106	56,5	20	66	99	G 1/8"	M6 x 12	Ø5H7 x 3,5

3.2.3. Technical data

Dynamic loads and moments

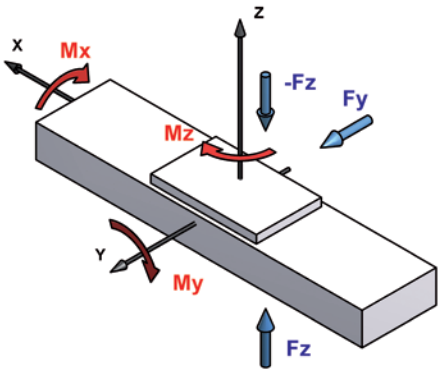
	AXC100Z	AXC100Z	AXC100Z
	Track roller guide L	Profile rail guide B	Profile rail guide D
	Loads [N]		
Fy	3 400	4 800	6 700
Fz	2 300	4 800	6 700
	Load torque [Nm]		
Mx	87	50	195
My	120	265	310
Mz	180	265	310



The dynamic load rating of the guiding system based on a nominal service life of 54,000 km.

Static loads and moments

	AXC100Z	AXC100Z	AXC100Z
	Track roller guide L	Profile rail guide B	Profile rail guide D
	Loads [N]		
Fy	3 400	16 000	23 500
Fz	2 300	16 000	23 500
	Load torque [Nm]		
Mx	87	175	680
My	120	900	1 100
Mz	180	900	1 100



Parameter

	AXC100Z	AXC100Z	AXC100Z
Maximal velocity	600	300	300
Drive element	Tooth belt 40STD8		
Allowable dynamic operating load [N]	2 900		
Stroke per revolution [mm]	264		
Idling speed torque [Nm]	3,1		
Moment of inertia [kgcm²]	14,3		
Geometrical moment of inertia Iy [cm⁴]	366,7		338,7
Geometrical moment of inertia Iz [cm⁴]	482,8		411,8
Maximal total length [m]	8		6

Mass

	AXC100Z	AXC100Z	AXC100Z
	Track roller guide L	Profile rail guide B	Profile rail guide D
Base mass [kg]	11,9	11,1	11,7
Mass per 100 mm stroke [kg]	1,1	1,2	1,1
Carriage mass [kg]	2,6	2,6	3,2

3.3. AXC100S

3.2.1. Structure

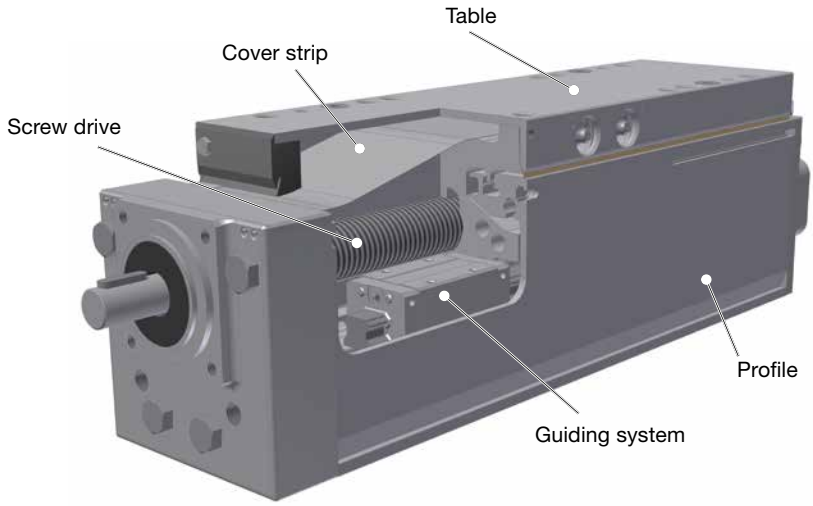
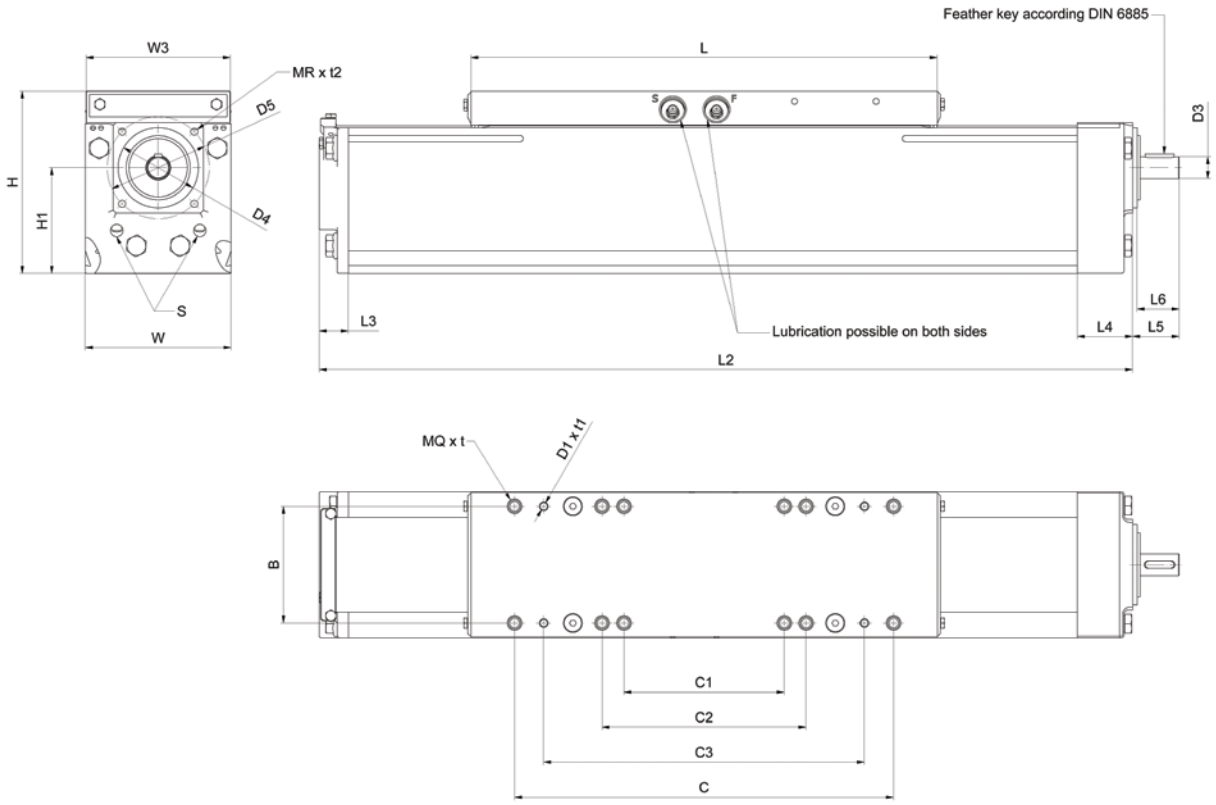


Figure 3.3 Structure

3.3.2. Dimension



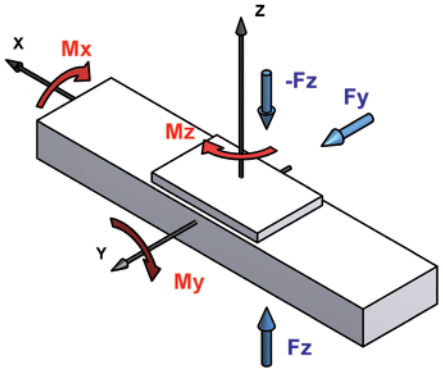
	L	W	H	L2	B	C	L3	L4	L5	L6	H1	W3
AXC100S	320	100	125	Travel range + 400	80	260	20	38	32	29	72,5	99

	C1	C2	C3	MQ x t	MR x 2	D1 x t1	D3	D4	D5	S	S
AXC100S	110	140	220	M6 x 12	M6 x 12	Ø5H7 x 3,5	Ø15H7	Ø55h6	Ø70	G1/8"	G 1/8"

3.3.3. Technical data

Dynamic loads and moments

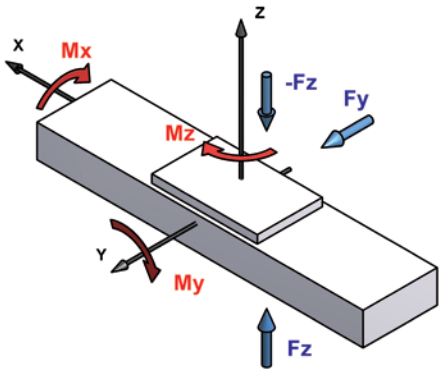
	AXC100S
	Profile rail guide D
Loads [N]	
Fy	6 700
Fz	6 700
Load torque [Nm]	
Mx	195
My	310
Mz	310



The dynamic load rating of the guiding system based on a nominal service life of 54,000 km.

Static loads and moments

	AXC100S
	Profile rail guide D
Loads [N]	
Fy	23 500
Fz	23 500
Load torque [Nm]	
Mx	680
My	1 100
Mz	1 100



Parameter

	AXC100				
	S2505	S2510	S2525	T2405	T2410
Pitch [mm]	5RH	10RH	25RH	5RH/LH	10RH/LH
Maximal velocity [m/min]	24	48	120	4,4	8,9
Dynamic load rating screw drive [N]	19 800	16 100	12 100	--	--
Inertia [kgcm²/m]	2,62	2,82	2,62	1,50	1,50
Idling speed torque [Nm]	0,3…2,0				
Geometrical moment of inertia Iy [cm⁴]	338,7				
Geometrical moment of inertia Iz [cm⁴]	411,8				
Maximum total length [m]	5,8		5,5		
Profile bearing length ratio (nut) [mm²]	--			1040	
Efficiency	0,93	0,98	0,98	0,41	0,58

Mass

	AXC100S
	Profile rail guide D
Base mass [kg]	12,0
Mass per 100 mm stroke [kg]	1,6
Carriage mass [kg]	2,7

4. AXF

4.1. AXF100Z

4.1.1. Structure

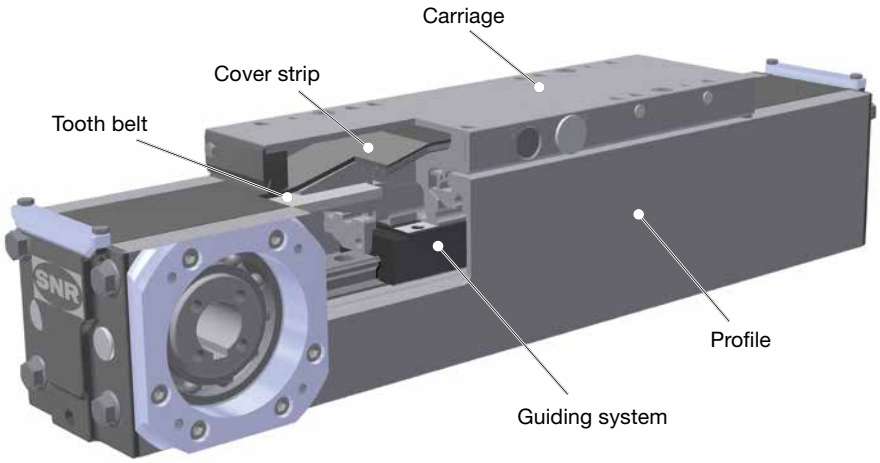
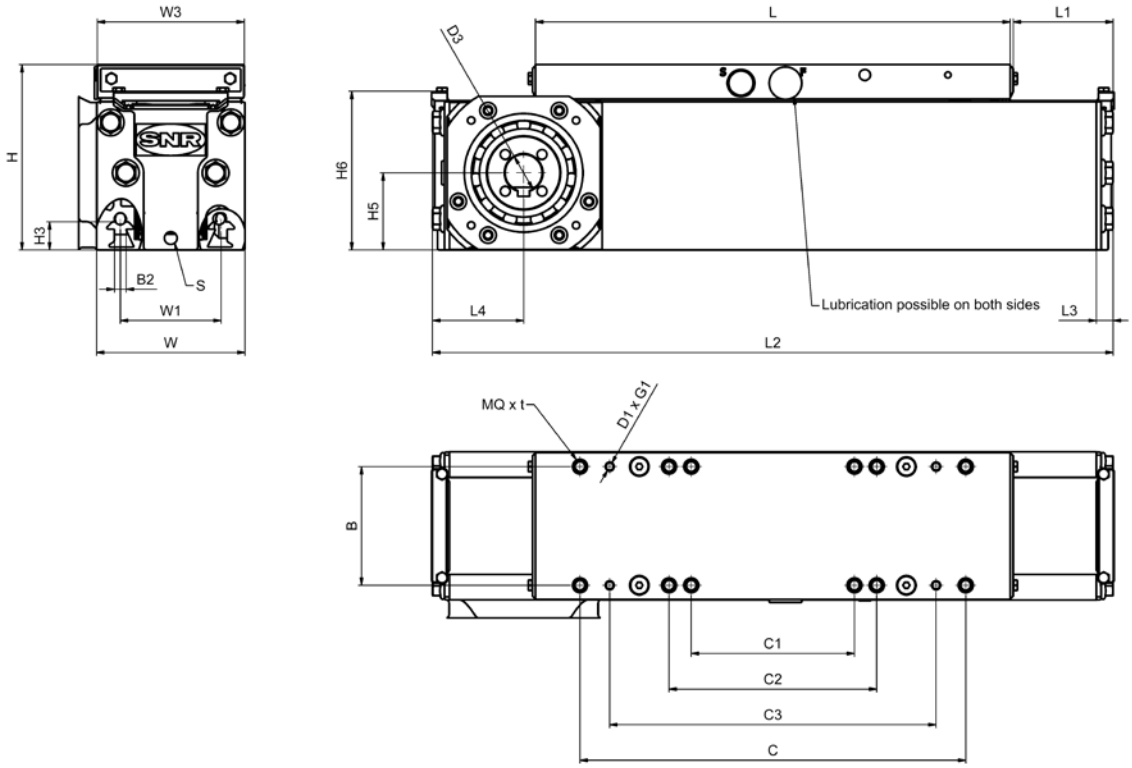


Figure 4.1 Structure

4.1.2. Dimension



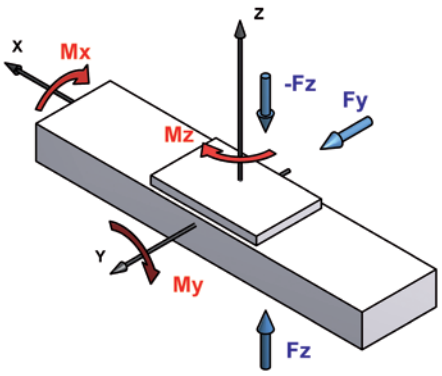
	L	W	H	L1	L2	B	C	L3	L4	B2	D3
AXF100Z	320	100	125	68	Verfahr weg + 460	80	260	12	62	8,0	Ø25H7

	C1	C2	C3	H3	H5	H6	W1	W3	S	MQ x t	D1 x G1
AXF100Z	110	140	220	19	52	110	66	99	G 1/8"	M6 x 12	Ø5H7 x 3,5

4.1.3. Technical data

Dynamic loads and moments

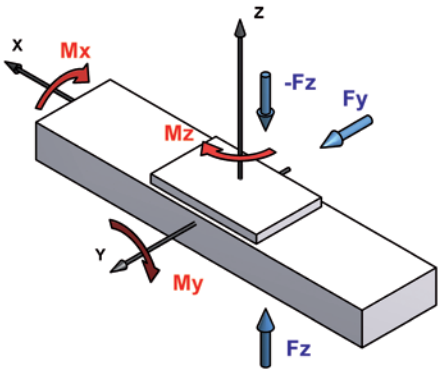
	AXF100Z	AXF100Z	AXF100Z
	Polymer track roller guide P	Profile rail guide B	Profile rail guide D
Loads [N]			
Fy	in preparation	4 800	6 700
Fz	in preparation	4 800	6 700
Load torque [Nm]			
Mx	in preparation	50	195
My	in preparation	265	310
Mz	in preparation	265	310



The dynamic load rating of the guiding system based on a nominal service life of 54,000 km.

Static loads and moments

	AXF100Z	AXF100Z	AXF100Z
	Polymer track roller guide P	Profile rail guide B	Profile rail guide D
Loads [N]			
Fy	in preparation	16 000	23 500
Fz	in preparation	16 000	23 500
Load torque [Nm]			
Mx	in preparation	175	680
My	in preparation	900	1 100
Mz	in preparation	900	1 100



Parameter

	AXF100Z	AXF100Z	AXF100Z
	Polymer track roller guide P	Profile rail guide B	Profile rail guide D
Maximal velocity	600	300	300
Drive element	Tooth belt 40STD8		
Allowable dynamic operating load [N]	2 900		
Stroke per revolution [mm]	264		
Idling speed torque [Nm]	3,1		
Moment of inertia [kgcm^2]	14,3		
Geometrical moment of inertia Iy [cm^4]	366,7		338,7
Geometrical moment of inertia Iz [cm^4]	482,8		411,8
Maximal total length [m]	6		

Mass

	AXC100Z	AXC100Z	AXC100Z
	Polymer track roller guide P	Profile rail guide B	Profile rail guide D
Base mass [kg]	in preparation	11,1	11,7
Mass per 100 mm stroke [kg]	in preparation	1,2	1,1
Carriage mass [kg]	in preparation	2,6	3,2

4.2. AXF100S

4.2.1. Structure

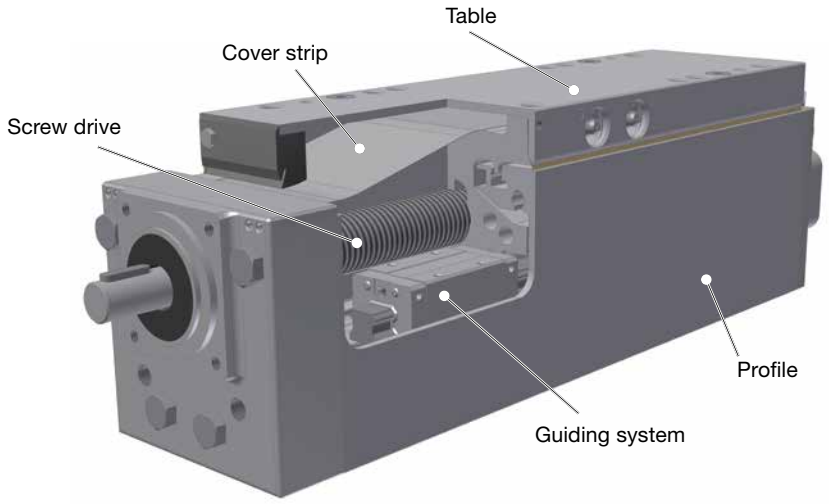
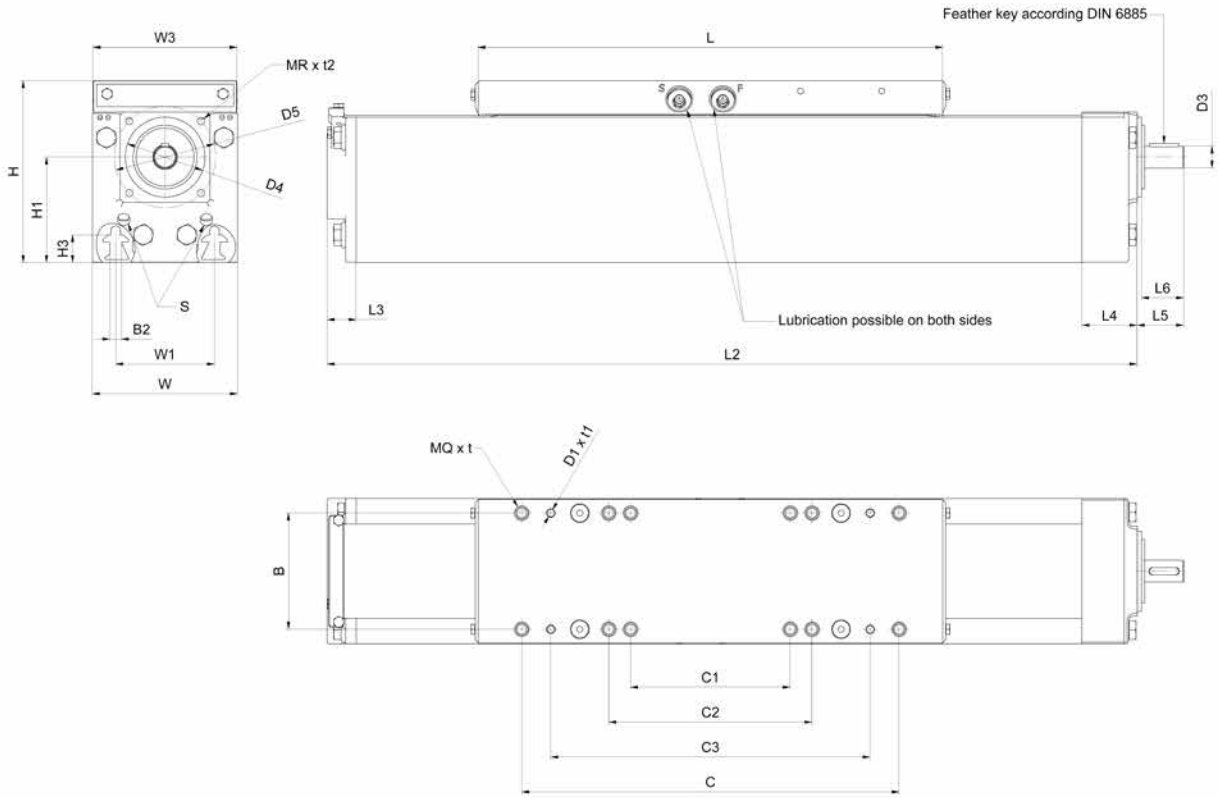


Figure 4.2 Structure

4.2.2. Dimension



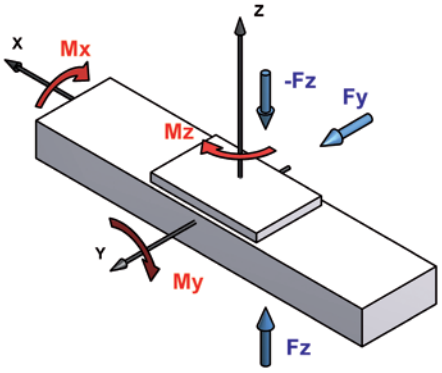
	L	W	H	L2	B	C	L3	L4	L5	L6	H1	H3	B2
AXF100S	320	100	125	Travel range + 400	80	260	20	38	32	29	72,5	19	8

	C1	C2	C3	W1	W3	MQ x t	MR x 2	D1 x t1	D3	D4	D5	S
AXF100S	110	140	220	68	99	M6 x 12	M6 x 12	5H7 x 3,5	Ø15H7	Ø55h6	Ø70	G1/8"

4.2.3. Technical data

Dynamic loads and moments

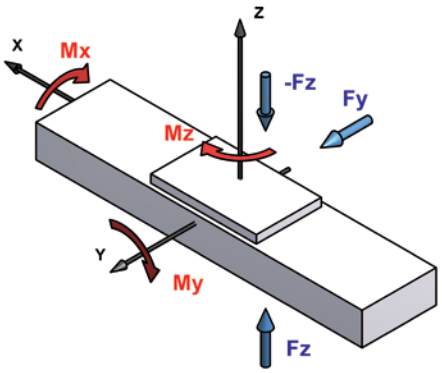
	AXF100S Polymer track roller guide P	AXF100S Profile rail guide D
Loads [N]		
Fy	in preparation	6 700
Fz	in preparation	6 700
Load torque [Nm]		
Mx	in preparation	195
My	in preparation	310
Mz	in preparation	310



The dynamic load rating of the guiding system based on a nominal service life of 54,000 km.

Static loads and moments

	AXF100S Polymer track roller guide P	AXF100S Profile rail guide D
Loads [N]		
Fy	in preparation	23 500
Fz	in preparation	23 500
Load torque [Nm]		
Mx	in preparation	680
My	in preparation	1 100
Mz	in preparation	1 100



Parameter

AXC100 ? ? ?

	AXC100				
	S2505	S2510	S2525	T2405	T2410
Pitch [mm]	5RH	10RH	25RH	5RH/LH	10RH/LH
Maximal velocity [m/min]	24	48	120	4,4	8,9
Dynamic load rating screw drive [N]	19 800	16 100	12 100	--	--
Inertia [kgcm²/m]	2,62	2,82	2,62	1,50	1,50
Idling speed torque [Nm]	0,3…2,0				
Geometrical moment of inertia Iy [cm⁴]	338,7				
Geometrical moment of inertia Iz [cm⁴]	411,8				
Maximum total length [m]	5,8		5,5		
Profile bearing length ratio (nut) [mm²]	--		1040		
Efficiency	0,93	0,98	0,98	0,41	0,58

Mass

AXC100S ? ? ?

	AXC100S Polymer track roller guide P	AXC100S Profile rail guide D
Base mass [kg]	in preparation	12,0
Mass per 100 mm stroke [kg]	in preparation	1,6
Carriage mass [kg]	in preparation	2,7

5. AXDL_A

5.1. Structure

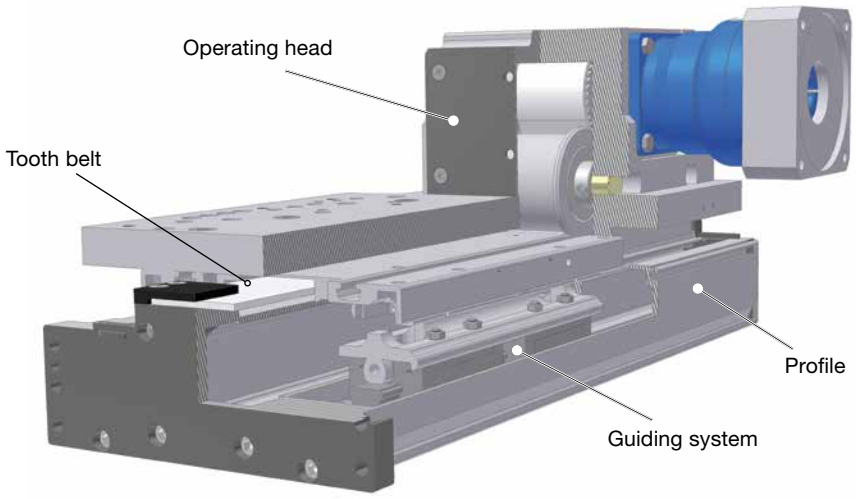
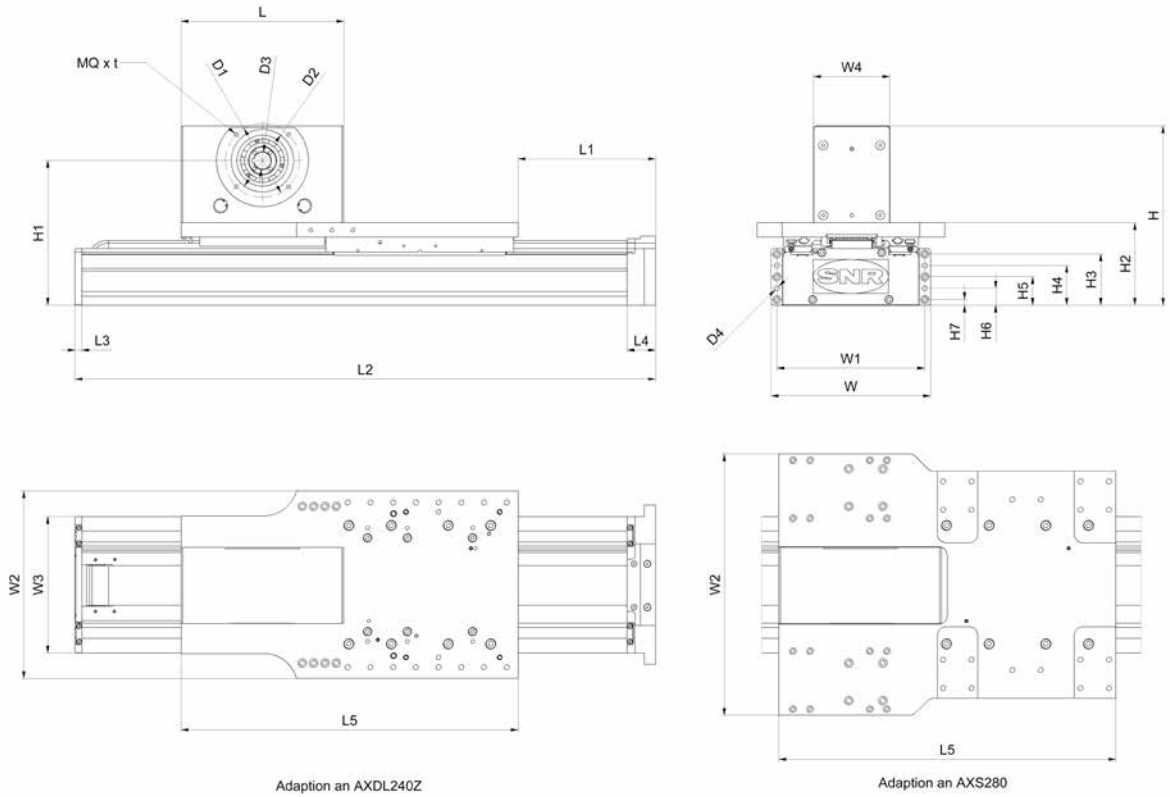


Figure 5.1 Structure

5.2. Dimension



	L	W	H	L1	L2	L3	L4	L5	W1	W2	W3	W4
AXDL160A	174	196	205	32	Travel range + 496(1) Travel range + 516(2)	12	32	429	182	240	160	130
AXDL240A	286	280	315,5	min. 40	Travel range + 620	12	50	593	260	330(3) 460(4)	240	134

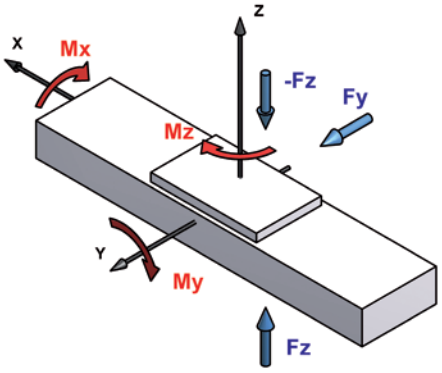
	H1	H2	H3	H4	H5	H6	H7	D1	D2	D3	D4	MQ x t
AXDL160A	164	103	50	40	30	--	10	100	80H8	25H7	6H7	M6 x 12
AXDL240A	254,5	145	90	70	50	30	10	130	110H8	30H7	9H7	M8 x 15,5

(1) Guiding system B (2) Guiding system L (3) for adaption to AXDL240Z (4) for adaption to AXS280

5.3. Technical data

Dynamic loads and moments

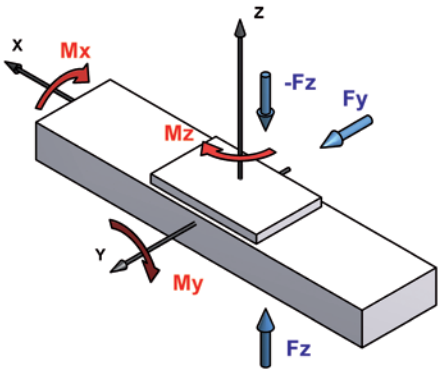
	AXDL160A	AXDL240A	AXDL160A	AXDL240A
	Track roller guide L		Profile rail guide B	
Loads [N]				
Fy	1200	2600	8700	12300
Fz	1200	2600	8700	12300
Load torque [Nm]				
Mx	62	220	430	950
My	84	210	430	1050
Mz	84	210	430	1050



The dynamic load rating of the guiding system based on a nominal service life of 54,000 km.

Static loads and moments

	AXDL160A	AXDL240A	AXDL160A	AXDL240A
	Track roller guide L		Profile rail guide B	
Loads [N]				
Fy	1200	2600	30000	42000
Fz	1200	2600	30000	42000
Load torque [Nm]				
Mx	62	220	1500	3200
My	84	210	1500	3550
Mz	84	210	1500	3550



Parameter

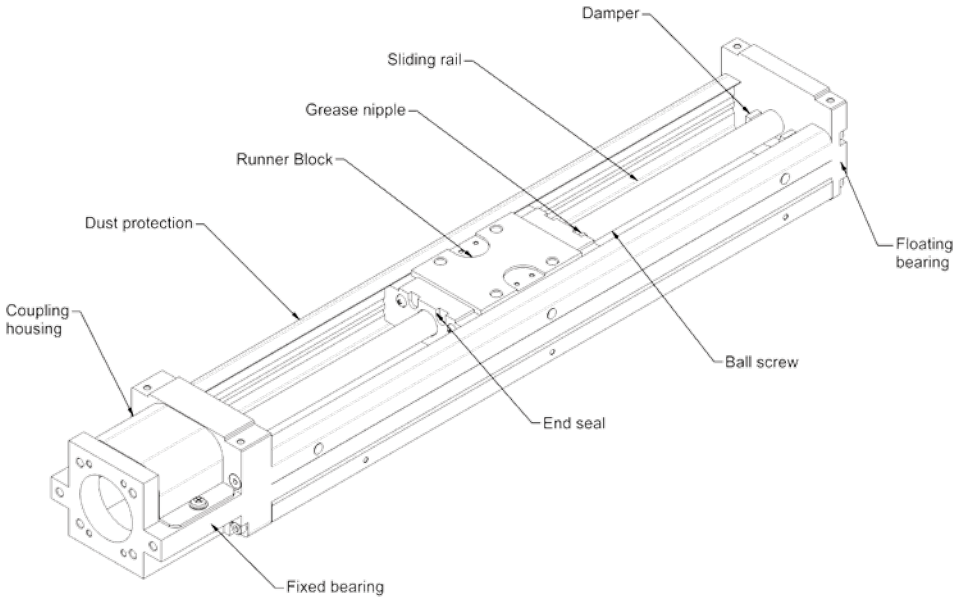
	AXDL160A	AXDL240A
Maximal velocity with track roller guide L [m/min]	600	600
Maximal velocity with profile rail guide B [m/min]	300	300
Drive element	Tooth belt 50STD5	Tooth belt 70STD8
Allowable dynamic operating load [N]	1960	5000
Stroke per revolution [mm]	210	272
Idling speed torque [Nm]	3,6	6,5
Moment of inertia [kgcm2]	11,6	34,8
Geometrical moment of inertia Iy [cm^4]	140,29	751,7
Geometrical moment of inertia Iz [cm^4]	666,8	3956,0
Maximal total length [m]	6,14	6,28

Mass

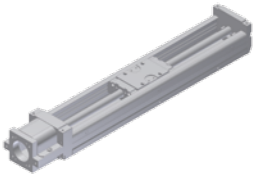
	AXDL160A		AXDL240A	
	Track roller guide L	Profile rail guide B	Track roller guide L	Profile rail guide B
Base mass [kg]	18,1	19,2	53,9	54,1
Mass per 100 mm stroke [kg]	0,9	1,3	2,2	2,7
Operating head mass [kg]	12,3	12,3	37,9	36,3

6. AXBG

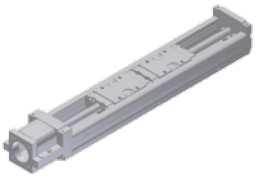
6.1. Structure



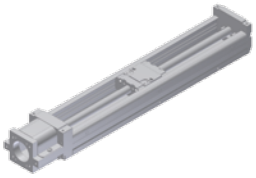
Carriage arrangement



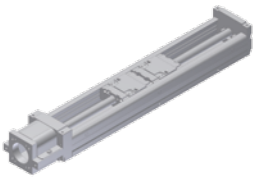
A. one carriage, long



B. two carriages, long



C. one carriage, short



D. two carriages, short

Advantages

• Minimum space requirements

Through the integration of the carriages and ball screw in a U – shaped profile, the design is compared to conventional solutions with separate components extremely space - saving.

• High stiffness

The U – shaped steel profile which serves as a guide rail, enables very rigid structures, with minimum dimensions. The carriage has four ball circuits with four – point – contact, which also contribute to a high level of rigidity.

• High precision

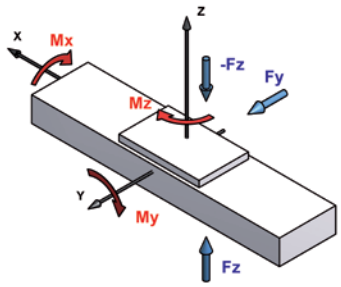
The combination of an extremely accurate grinded profile rail, the carriage and precision ball screw guarantee very high positioning accuracy and repeatability.

6.2. Technical data

Load rating ball screw and fixed bearing

	Ball screw						Fixed bearing	
			Load rating				Load rating	
	Shaft- Ø mm	Pitch mm	Normal - precision kN		P - precision kN		kN	
	D	p	Ca	C0a	Ca	C0a	Cb	Cb0
AXBG 1501	6	1	0.39	0.77	0.39	0.77	1.21	1.08
AXBG 1502	6	2	0.54	0.75	0.54	0.75	1.21	1.08
AXBG 2001	6	1	0.63	1.34	0.63	1.34	1.31	1.25
AXBG 2005	6	5	0.65	0.92	0.65	0.92	1.31	1.25
AXBG 2602	8	2	2.60	3.64	2.60	3.64	1.79	1.76
AXBG 2605	8	5	2.35	3.30	2.35	3.30	1.79	1.76
AXBG 3305	10	5	3.35	5.90	2.11	2.95	4.4	4.36
AXBG 3310	10	10	2.20	3.50	1.39	1.75	4.4	4.36
AXBG 3320	12	20	2.32	4.05	1.46	2.02	4.4	4.36
AXBG 4610	15	10	4.40	7.90	2.77	3.95	6.77	7.45
AXBG 4620	15	20	4.40	7.90	3.36	5.27	6.77	7.45
AXBG 5520	20	20	5.40	10.50	4.12	7.00	7.74	9.5

Load rating carriage



	Carriage						
	Radial clearance		Load rating		Static moments		
	Normal precision µm	P - precision µm	kN		kNm		
			C	C0	MX	MY	MZ
AXBG 1501 A	-2…0	-4…-2	2.42	4.76	0.051	0.017	0.020
AXBG 1501 B			4.84	9.52	0.102	0.092	0.110
AXBG 1502 A	-2…0	-4…-2	2.42	4.76	0.051	0.017	0.020
AXBG 1502 B			4.84	9.52	0.102	0.092	0.110
AXBG 2001 A	-3…0	-6…-3	4.27	7.89	0.101	0.035	0.042
AXBG 2001 B			8.54	15.78	0.201	0.199	0.237
AXBG 2005 A	-3…0	-6…-3	4.27	7.89	0.101	0.035	0.042
AXBG 2005 B			8.54	15.78	0.201	0.199	0.237
AXBG 2602 A	-4…0	-8…-4	7.87	14.98	0.255	0.099	0.118
AXBG 2602 B			15.74	29.96	0.509	0.550	0.656
AXBG 2605 A	-4…0	-8…-4	7.87	14.98	0.255	0.099	0.118
AXBG 2605 B			15.74	29.96	0.509	0.550	0.656
AXBG 3305 A	-3…0	-7…-3	12.60	22.70	0.500	0.181	0.215
AXBG 3305 B			25.20	45.40	1.000	1.035	1.233
AXBG 3305 C	-3…0	-7…-3	7.80	11.40	0.250	0.049	0.059
AXBG 3305 D			15.60	22.80	0.500	0.368	0.439
AXBG 3310 A	-3…0	-7…-3	12.60	22.70	0.500	0.181	0.215
AXBG 3310 B			25.20	45.40	1.000	1.035	1.233
AXBG 3310 C	-3…0	-7…-3	7.80	11.40	0.250	0.049	0.059
AXBG 3310 D			15.60	22.80	0.500	0.368	0.439
AXBG 3320 A	-3…0	-7…-3	12.60	22.70	0.500	0.181	0.215
AXBG 3320 B			25.20	45.40	1.000	1.035	1.233
AXBG 4610 A	-5…0	-11…-5	29.80	51.20	1.612	0.610	0.727
AXBG 4610 B			59.60	102.40	3.224	3.285	3.914
AXBG 4610 C	-5…0	-11…-5	19.90	28.80	0.907	0.207	0.246
AXBG 4610 D			39.80	57.60	1.814	1.336	1.593
AXBG 4620 A	-5…0	-11…-5	29.80	51.20	1.612	0.610	0.727
AXBG 4620 B			59.60	102.40	3.224	3.285	3.914
AXBG 4620 C	-5…0	-11…-5	19.90	28.80	0.907	0.207	0.246
AXBG 4620 D			39.80	57.60	1.814	1.336	1.593
AXBG 5520 A	-6…0	-18…-6	43.20	74.00	2.701	1.088	1.297
AXBG 5520 B			86.40	148.00	5.402	5.465	6.513

Masses

	mm	Without top cover Version kg				With top cover Version kg			
	L1	A	B	C	D	A	B	C	D
AXBG 15	75	0.21	--	--	--	0.24	--	--	--
	100	0.25	--	--	--	0.28	--	--	--
	125	0.28	0.32	--	--	0.31	0.37	--	--
	150	0.32	0.35	--	--	0.35	0.40	--	--
	175	0.35	0.39	--	--	0.39	0.44	--	--
	200	0.39	0.42	--	--	0.42	0.48	--	--
AXBG 20	100	0.45	--	--	--	0.50	--	--	--
	150	0.58	0.65	--	--	0.63	0.74	--	--
	200	0.71	0.78	--	--	0.77	0.88	--	--
AXBG 26	150	0.93	--	--	--	1.07	--	--	--
	200	1.14	1.31	--	--	1	1.54	--	--
	250	1.36	1.53	--	--	1.653	1.78	--	--
	300	1.57	1.74	--	--	1.76	2.01	--	--
AXBG 33	150	1.60	--	1.50	1.70	1.80	--	1.60	1.90
	200	2.00	--	1.80	2.00	2.10	--	2.00	2.20
	300	2.60	2.90	2.50	2.70	2.80	3.20	2.60	2.90
	400	3.20	3.60	3.10	3.30	3.50	3.90	3.30	3.50
	500	3.90	4.20	3.80	3.90	4.20	4.60	4.00	4.20
	600	4.60	4.90	4.40	4.60	4.90	5.30	4.70	4.90
AXBG 46	340	6.50	7.50	6.00	6.50	7.00	8.00	6.50	7.00
	440	8.00	8.50	7.50	8.00	8.50	9.50	8.00	8.50
	540	9.00	10.00	8.50	9.50	10.00	11.00	9.50	10.00
	640	10.50	11.50	10.00	10.50	11.00	12.50	10.50	11.50
	740	12.00	13.00	11.50	12.00	12.50	14.00	12.00	13.00
	840	13.00	14.00	13.00	13.50	14.00	15.50	13.50	14.00
	940	14.50	15.50	14.00	14.50	15.50	16.50	15.00	15.50
	1 040	16.00	17.00	15.50	16.00	17.00	18.00	16.50	17.00
	1 140	17.50	18.00	17.00	17.50	18.50	19.50	18.00	18.50
	1 240	18.50	19.50	18.50	19.00	19.50	21.00	19.00	20.00
AXBG 55	980	20.00	22.00	--	--	21.00	24.00	--	--
	1 080	22.00	24.00	--	--	23.00	26.00	--	--
	1 180	23.00	25.00	--	--	25.00	27.00	--	--
	1 280	25.00	27.00	--	--	27.00	29.00	--	--
	1 380	27.00	29.00	--	--	29.00	31.00	--	--

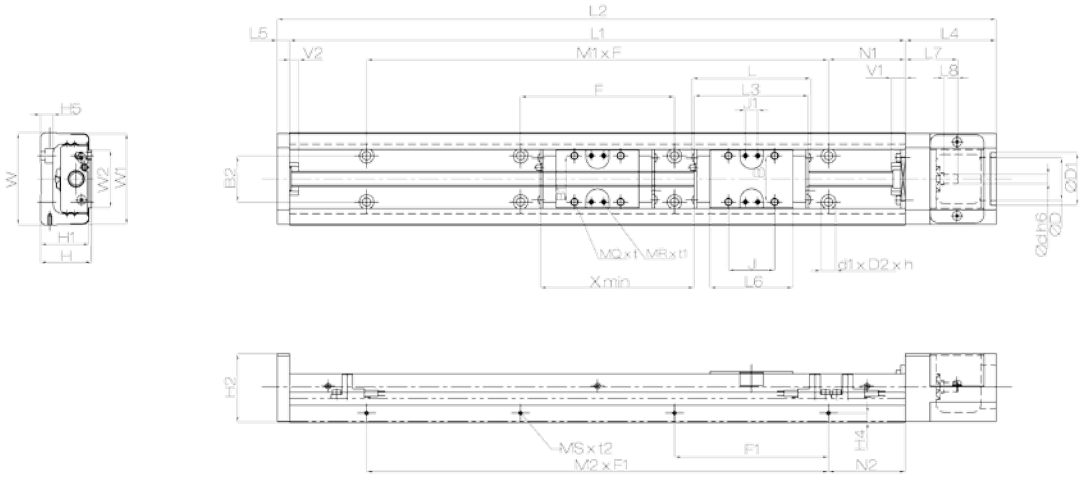
Geometrical moment of inertia of rail

	Geometrical moment of inertia mm^4		Mass kg / m
	I_Y	I_Z	
AXBG 15	1.22×10^3	1.56×10^4	0.12
AXBG 20	6.5×10^3	6.0×10^4	0.25
AXBG 26	1.69×10^4	1.47×10^5	0.38
AXBG 33	5.11×10^4	3.42×10^5	0.60
AXBG 46	2.42×10^5	1.49×10^6	1.24
AXBG 55	2.29×10^5	2.28×10^6	1.50

6.3. Dimension

Data sheets

AXBG without top cover

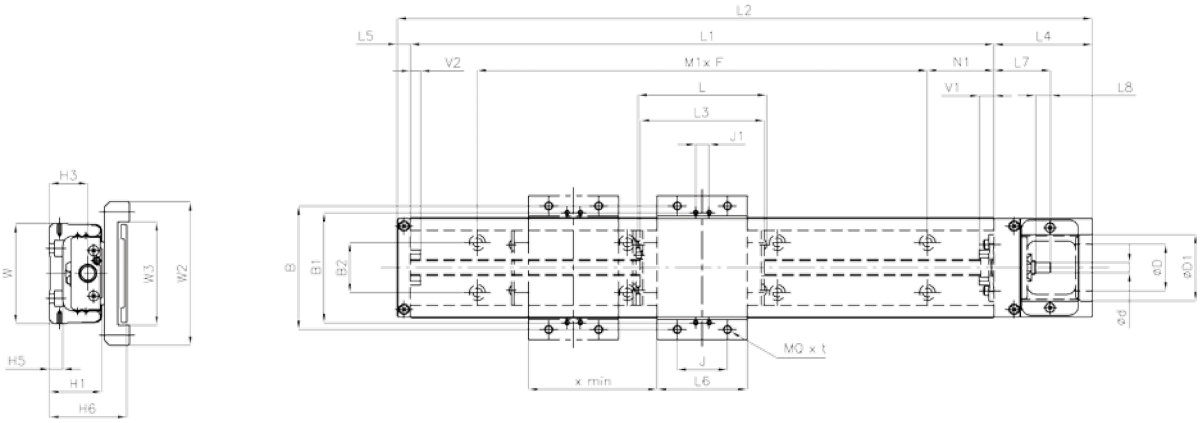


Size and carriage version	System mm											
	H	W	H2	H3	W1	Ød h6	ØD	ØD1	L1	L2	L7	L8
AXBG 15__ A/B	15	30	22.0	9.5	29.2	3.0	28.0 +0,05 0	--	see table stroke length		24.5	7.0
AXBG 20__ A/B	20	40	29.0	12.5	39.6	4.0	20.0 +0,05 0	--			26.0	8.0
AXBG 26__ A/B	26	50	37.0	16.0	49.6	5.0	24.0 +0,05 0	--			30.5	10.0
AXBG 33__ A/B AXBG 33__ C/D	33	60	44.5	23.0	59.0	6.0	28.0 H8	--			34.0	9.0
AXBG 46__ A/B AXBG 46__ C/D	46	86	63.5	32.0	85.0	8.0	50.0 H8	46			51.0	18.0
AXBG 55__ A/B	55	100	74.5	32.0	99.0	12.0	50.0 H8	46.0			59.0	22.0

Size and carriage version	Carriage mm												
	L	B	J	L3	L6	MQ	t	MR	t1	B3	X min	J1	W2
AXBG 15__ A/B	32.9	14	12	--	23.7	M 3	4.0	2 x M 2	3.0	12.0	32.9	--	19.0
AXBG 20__ A/B	40.2	18	20	--	29.0	M 3	4.5	4 x M 2	4.0	18.0	41.8	5.0	23.0
AXBG 26__ A/B	60.0	25	30	--	44.0	M 4	7.0	4 x M 2	4.0	25.0	61.8	8.5	31.0
AXBG 33__ A/B	77.2	30	30	74.4	53.8	M 5	8.0	4 x M 2	5.0	30.0	77.2	8	37.4
AXBG 33__ C/D	51.9		--	49.1	28.5						51.9		
AXBG 46__ A/B	109.2	46	46	106.6	80.0	M 6	12.0	4 x M 2	5.0	46.0	109.2	8.0	54.4
AXBG 46__ C/D	73.2		--	70.6							73.2		
AXBG 55__ A/B	123	50	50	121	95	M 8	15.0	4 x M 3	6.0	50.0	123.0	8.0	65.0

Size and carriage version	Rail mm												
	B1	H1	H5	F	Ød	ØD	h	L5	V1	V2	F1	MS	t2	H4
AXBG 15__ A/B	14	11.5	3.5	50	3.4	6.0	2.0	7.0	6.0	6.0	50	M 2	2	2.5
AXBG 20__ A/B	18	17.0	4.5	60	3.4	6.5	3.0	8.0	10.5	6.0	60	M 2,5	5.0	3.0
AXBG 26__ A/B	25	22.0	6.0	80	4.5	8.0	4.5	10.0	11.0	6.0	80	M 2,5	5.0	4.0
AXBG 33__ A/B AXBG 33__ C/D	30	31.5	8.0	100	5.5	9.5	5.0	8.0	9.0	6.0	100	M 2,5	6.0	6.0
AXBG 46__ A/B AXBG 46__ C/D	46	44.5	11.0	100	6.6	11.0	6.5	13.0	15.0	9.0	100	M 2,5	6.0	7.5
AXBG 55__ A/B	50	42.0	13.0	150	9.0	14.0	8.6	15.0	16.0	9.0	200	M 3	6.0	10.0

AXBG with top cover



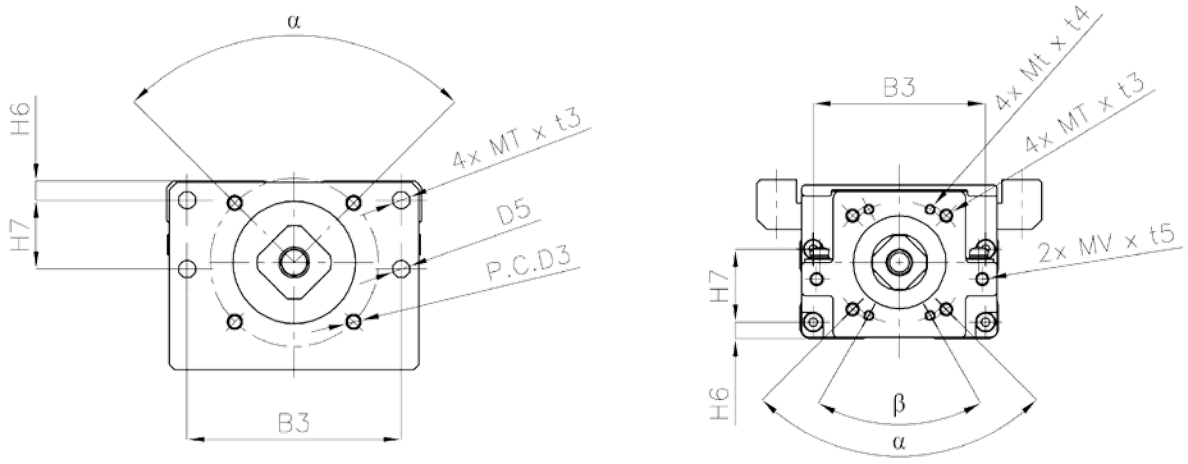
Size and carriage version			System mm									
			H	W	H3	Ød h6	ØD		ØD1	L1	L2	L7	L8
AXBG	15__	A/B	25	30	9.5	3.0	28.0	+0,05 0	--	see table stroke length		24.5	7.0
AXBG	20__	A/B	32	40	12.5	4.0	20.0	+0,05 0	--			26.0	8.0
AXBG	26__	A/B	40	50	16.0	5.0	24.0	+0,05 0	--			30.5	10.0
AXBG	33__	A/B	48	60	23.0	6.0	28.0	H8	--			34.0	9.0
AXBG	33__	C/D											
AXBG	46__	A/B	68	86	32.0	8.0	50.0	H8	46			51.0	18.0
AXBG	46__	C/D											
AXBG	55__	A/B	80	100	32.0	12.0	50.0	H8	46.0			59.0	22.0

Size and carriage version			Carriage mm											
			L	B	J	L3	MQ	t	MR	t1	B3	X min	J1	W2
AXBG	15__	A/B	32.9	38	12	--	M 3	6.0	2 x M 2 (1)	3.0	--	32.9	--	44.0
AXBG	20__	A/B	40.2	45	20	--	M 4	14.0	2 x M 2 (2)	5.0	--	41.8	5.0	52.0
AXBG	26__	A/B	60.0	55	30	--	M 4	17.0	2 x M 2 (3)	5.0	--	61.8	8.5	62.0
AXBG	33__	A/B	77.2	74	30	74.4	M 5	15.0	4 x M 3	6.0	66.0	77.2	8	86.0
AXBG	33__	C/D	51.9		--	49.1						51.9		
AXBG	46__	A/B	109.2	100	46	106.6	M 6	22.0	4 x M 3	6.0	93.0	109.2	8.0	112.0
AXBG	46__	C/D	73.2		--	70.6						73.2		
AXBG	55__	A/B	123	110	50	121	M 8	36.0	4 x M 3	6.0	106.0	123.0	8.0	124.0

Size and carriage version			Rail mm											
			B1	H5	F	Ød	ØD	h	L5	V1	V2	F1	MS	t2	H4
AXBG	15__	A/B	14	3.5	50	3.4	6.0	2.0	7.0	6.0	6.0	50	M 2	2	2.5
AXBG	20__	A/B	18	4.5	60	3.4	6.5	3.0	8.0	10.5	6.0	60	M 2,5	5.0	3.0
AXBG	26__	A/B	25	6.0	80	4.5	8.0	4.5	10.0	11.0	6.0	80	M 2,5	5.0	4.0
AXBG	33__	A/B	30	8.0	100	5.5	9.5	5.0	8.0	9.0	6.0	100	M 2,5	6.0	6.0
AXBG	33__	C/D													
AXBG	46__	A/B	46	11.0	100	6.6	11.0	6.5	13.0	15.0	9.0	100	M 2,5	6.0	7.5
AXBG	46__	C/D													
AXBG	55__	A/B	50	13.0	150	9.0	14.0	8.6	15.0	16.0	9.0	200	M 3	6.0	10.0

(1) lateral 3 mm upper the top edge arranged on both sides
(2) lateral 8,5 mm upper the top edge arranged on both sides
(3) lateral 12 mm upper the top edge arranged on both sides

AXBG Standard coupling housing A



Size and carriage version	Coupling housing A mm											°
	Ød h6	ØD	ØD1	L4	MT	t3	D5	B2	H6	H7	P.C.D3	α
AXBG 15__ A/B	3.0	28.0 +0,05 0	--	42.0	--	--	2.4	25.0	5.5	8.0	--	--
AXBG 20__ A/B	4.0	20.0 +0,05 0	--	49.0	M 3	6.0	3.4	32.4	4.0	9.5	29.0	120
AXBG 26__ A/B	5.0	24.0 +0,05 0	--	52.0	M 3	6.0	3.4	42.0	3.8	13.5	33.0	90

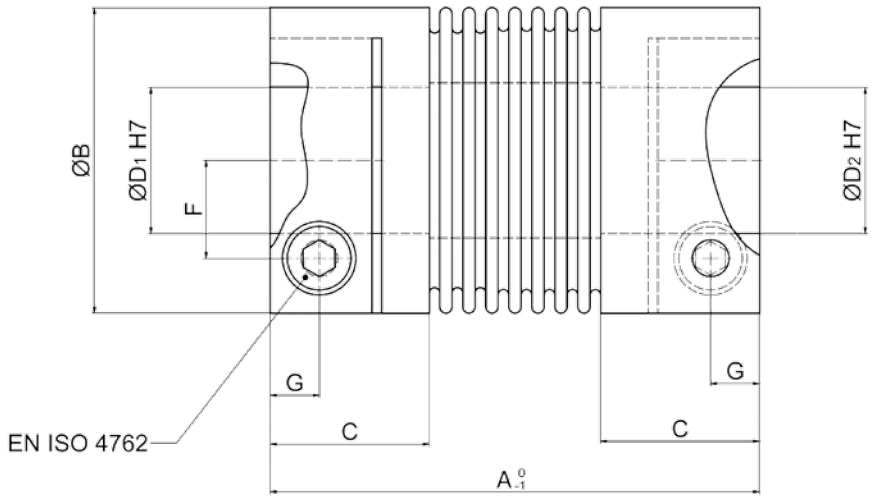
Size and carriage version	Coupling housing A mm												°	
	Ød h6	ØD	ØD1	L4	MT	t3	Mt	t4	MV	t5	P.C.D3	P.C.D4	α	β
AXBG 33__ A/B	6.0	28.0 H8	--	59.0	M 4	8.0	M 3	8.0	M 4	8.0	40.0	37.0	90	60
AXBG 33__ C/D														
AXBG 46__ A/B	8.0	50.0 H8	46.0	85.5	M 4	8.0	M 4	8.0	--	--	60.0	60.0	90	60
AXBG 46__ C/D														
AXBG 55__ A/B	12.0	50.0 H8	46.0	94.0	M 5	10.0	--	--	--	--	70.0	--	90	--

Stroke length

Size	Dimension mm				Stroke mm Version			
	L1	L2	N	N1	A	B	C	D
AXBG 15__	75	124	12.5	12.5	30	--	--	--
	100	149	25	25	55	--	--	--
	125	174	12.5	12.5	80	46	--	--
	150	199	25	25	105	71	--	--
	175	224	12.5	12.5	130	96	--	--
	200	249	25	25	155	121	--	--
AXBG 20__	100	157	20	20	43	--	--	--
	150	207	15	15	93	51	--	--
	200	257	40	40	143	101	--	--
AXBG 26__	150	212	35	35	73	--	--	--
	200	262	20	20	123	61	--	--
	250	312	45	45	173	111	--	--
	300	362	30	30	223	161	--	--
AXBG 33__	150	217	25	25	60	--	85	34
	200	267	50	50	110	--	135	84
	300	367	50	50	210	133	235	184
	400	467	50	50	310	233	335	284
	500	567	50	50	410	333	435	384
	600	667	50	50	510	433	535	484
AXBG 46__	340	438.5	70	20	209	100	245	172
	440	538.5	70	20	309	200	345	272
	540	638.5	70	20	409	300	445	372
	640	738.5	70	20	509	400	545	472
	740	838,5	70	20	609	500	645	572
	840	938.5	70	20	709	600	745	672
	940	1 038.5	70	20	809	700	845	772
	1040	1 138.5	70	20	909	800	945	872
	1140	1 238.5	70	20	1 009	900	1 045	972
	1240	1 338.5	70	20	1 109	1 000	1 145	1 072
AXBG 55__	980	1 089	40	90	834	711	--	--
	1 080	1 189	15	40	934	811	--	--
	1 180	1 289	65	90	1 034	911	--	--
	1 280	1 389	40	40	1 134	1 011	--	--
	1 380	1 489	15	90	1 234	1 111	--	--

6.4. Accessories

Couplings



	Dimension mm								
	A	B	C	D_1	D_{2min}	D_{2max}	F	G	H
AXBG 15 AX - MK2 / 5 / 25 / 3 / ...	25	15	9	3.0	3.0	7.0	4.5	3.0	12.0
AXBG 20 AX - MK2 / 10 / 30 / 4 /...	30	15	9	4.0	3.0	7.0	4.5	3.0	17.0
AXBG 26 AX - MK2 / 15 / 30 / 5 /...	30	19	11	5.0	3.0	8.0	6.0	3.5	14.5
AXBG 33 AX - MK2 / 15 / 30 / 6 /...	30	19	11	6.0	3.0	8.0	6.0	3.5	14.5
AXBG 46 AX - MK2 / 100 / 50 / 8 / ...	50	40	16	8.0	5.0	24.0	15.0	5.0	27.5
AXBG 55 AX - MK2 / 100 / 50 / 12 / ...	50	40	16	12.0	5.0	24.0	15.0	5.0	27.5

	Screw Fastening torque		Tosional rigidity	Moment of inertia	Nominal torque	Weight
	E	Nm	Nm / rad	gcm²	Nm	g
AXBG 15 AX - MK2 / 5 / 25 / 3 / ...	M 2	0.43	280	2.6	0.5	9.0
AXBG 20 AX - MK2 / 10 / 30 / 4 /...	M 2	0.43	380	3.4	1.0	10.0
AXBG 26 AX - MK2 / 15 / 30 / 5 /...	M 2.5	0.85	380	3.4	1.5	10.0
AXBG 33 AX - MK2 / 15 / 30 / 6 /...	M 2.5	0.85	750	8.5	1.5	22.0
AXBG 46 AX - MK2 / 100 / 50 / 8 /...	M 4	4.50	9050	160.0	10.0	120.0
AXBG 55 AX - MK2 / 100 / 50 / 12 /...	M 4	4.50	9050	160.0	10.0	120.0

7. AXS

7.1. AXS110TH

7.1.1. Structure

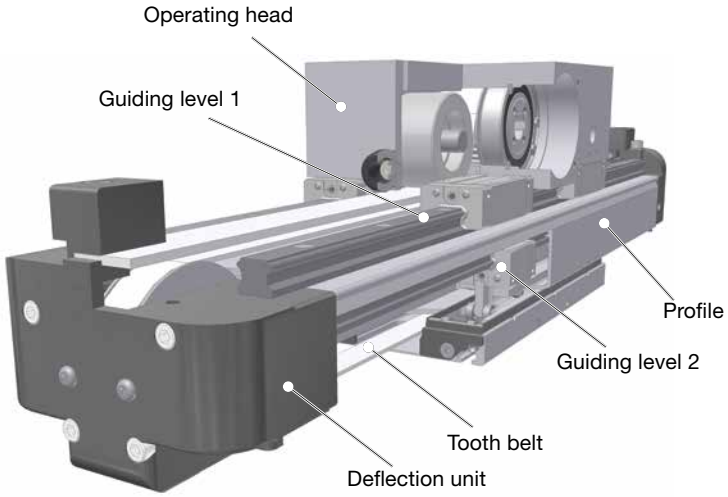
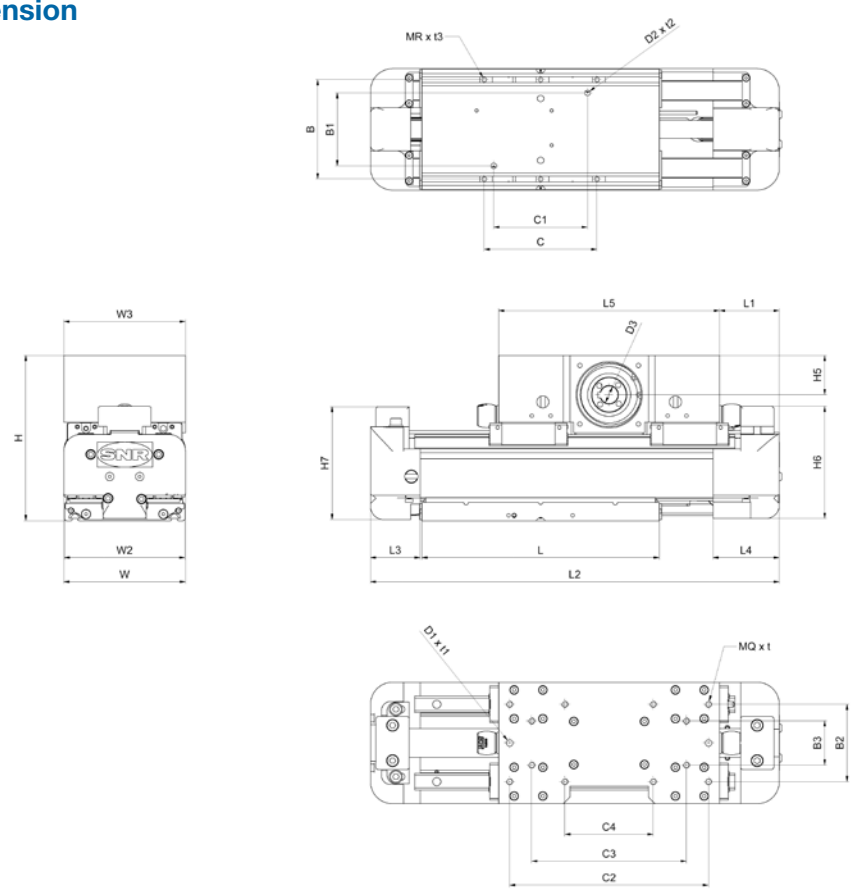


Figure 7.1 Structure

7.1.2. Dimension



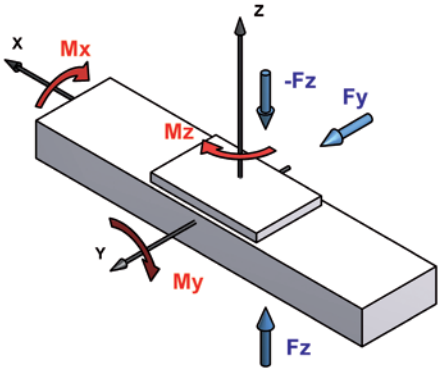
	L	W	H	L1	L2	L3	L4	L5	B	C	B1	B2	B3
AXS110TH	215	110	150	min. 54	+ 310	45	60	200	90	max. 200	66	70	40

	C1	C2	C3	C4	H5	H6	H7	D3	MQ x t	MR x t3	D1 x t1	D2 x t2
AXS110TH	85	180	140	80	35,5	102	103	Ø16H7	M6 x 12	M5 x 8	Ø6H7 x 15	Ø5H7 x 4

7.1.3. Technical data

Dynamic loads and moments

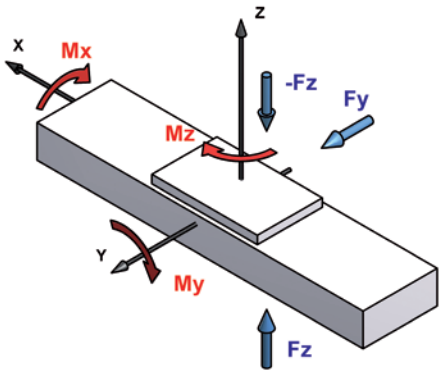
	AXS110TH Profile rail guide B	
	1. level	2. level
	Loads [N]	
Fy	6 800	2 800
Fz	6 800	2 800
	Load torque [Nm]	
Mx	240	100
My	500	135
Mz	500	135



The dynamic load rating of the guiding system based on a nominal service life of 54,000 km.

Static loads and moments

	AXS110TH Profile rail guide B	
	1. level	2. level
	Loads [N]	
Fy	19 000	7 800
Fz	19 000	7 800
	Load torque [Nm]	
Mx	660	270
My	1 400	380
Mz	1 400	380



Parameter

	AXS110TH Profile rail guide B	
	1. level	2. level
Maximal velocity [m/min]	600	
Drive element	Tooth belt 25STD5	Tooth belt 16AT3
Allowable dynamic operating load [N]	980	210
Max. energy absorption of the shock absorber [Nm]	21	
Stroke per revolution [mm]	350	
Idling speed torque [Nm]	3,2	
Moment of inertia [kgcm²]	2,83	
Geometrical moment of inertia Iy [cm⁴]	79,67	
Geometrical moment of inertia Iz [cm⁴]	384,6	
Maximal total length [m]	6	

Mass

	AXS110TH Profile rail guide B	
		1. level
Base mass [kg]	9,0	5,5
Mass per 100 mm stroke [kg]	0,4	
Carriage mass [kg]	0,9	

7.2. AXS240TH

7.2.1. Structure

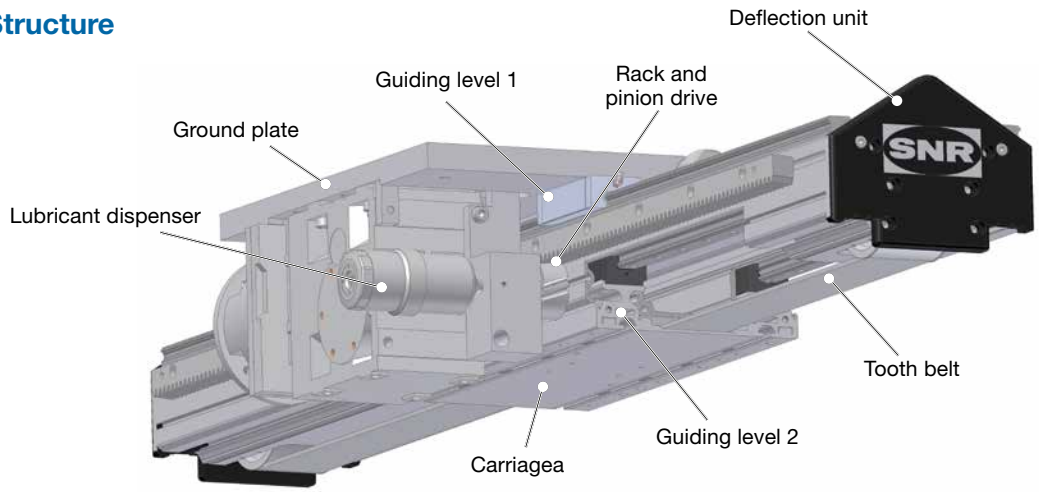
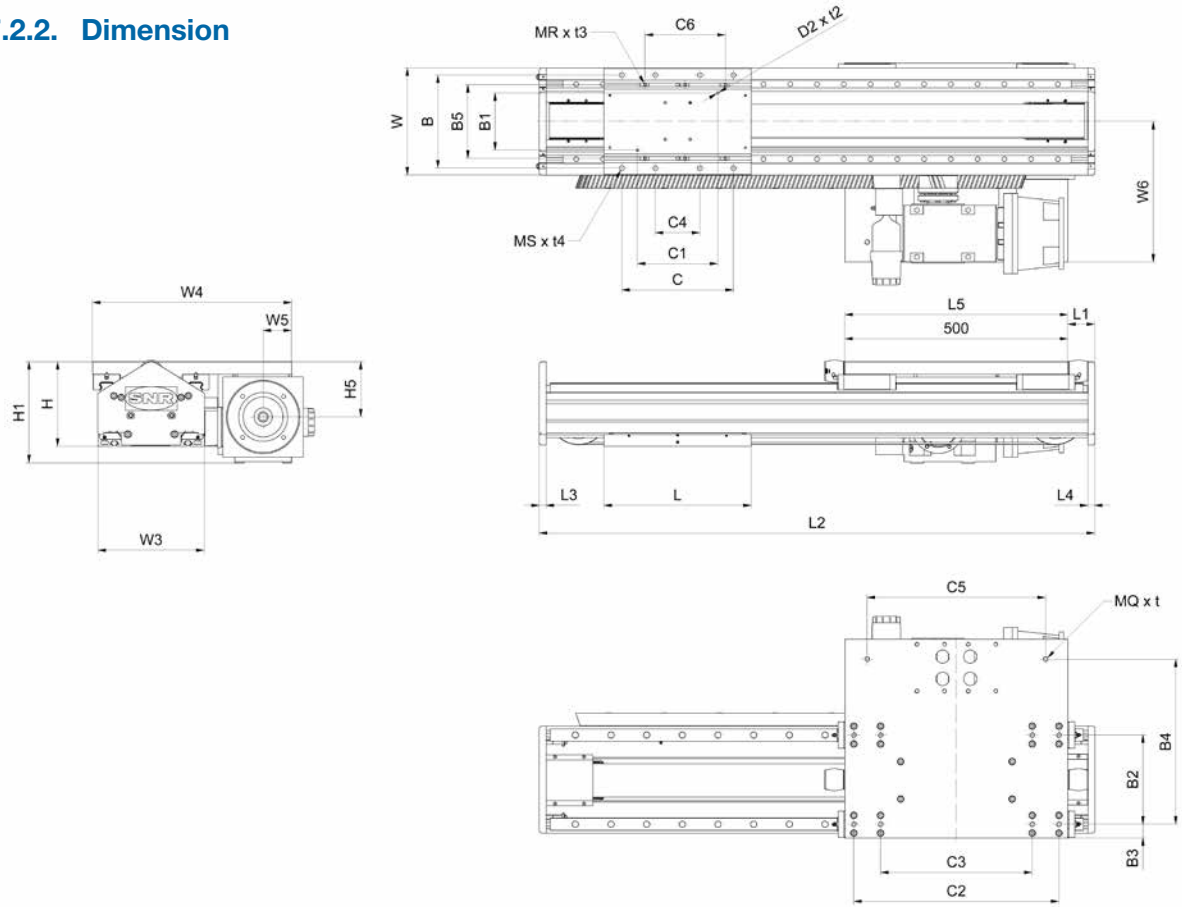


Figure 7.2 Structure

7.2.2. Dimension



	L	W	H	L1	L2	L3	L4	L5	B	C
AXS240TH_B	330	240	190	min. 60	Travel range/2 + 490	15	15	370	208,5	250
AXS240TH_C	500	240	190	min. 60	Travel range/2 + 620	15	15	500	208,5	430

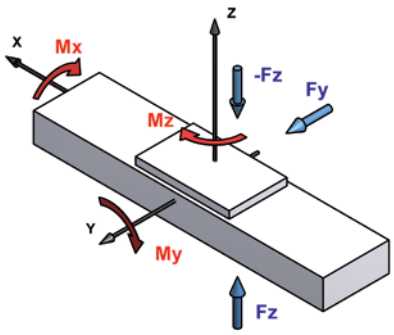
	B1	B2	B3	B4	B5	C1	C2	C3	C4	C5	C6
AXS240TH_B	128	--	17	326	165	180	--	--	100	320	max. 310
AXS240TH_C	128	200	31	370	165	280	460	340	100	400	max. 480

	H1	H5	W3	W4	W5	W6	MQ x t	MR x t3	MS x t4	D2 x t2
AXS240TH_B	227	123,8	238	446	64	315	Ø17	M8 x 12	M10 x 16	Ø6H7 x 10
AXS240TH_C	227	123,8	238	495	64	315	M12 x 28	M8 x 12	M10 x 16	Ø6H7 x 10

7.2.3. Technical data

Dynamic loads and moments

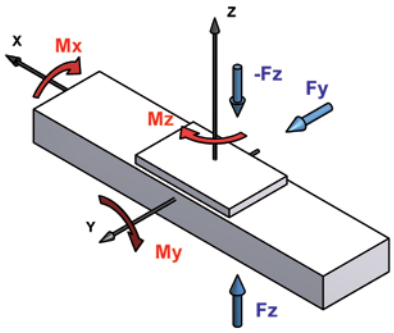
	AXS240TH Profile rail guide B		AXS240TH Profile rail guide C	
	1. Ebene	2. Ebene	1. Ebene	2. Ebene
	Loads [N]			
Fy	23 000	15 000	26 000	15 000
Fz	23 000	15 000	26 000	15 000
	Load torque [Nm]			
Mx	2 800	1 300	3 100	1 300
My	3 400	1 450	5 200	1 450
Mz	3 400	1 450	5 200	1 450



The dynamic load rating of the guiding system based on a nominal service life of 54,000 km.

Static loads and moments

	AXS240TH Profile rail guide B		AXS240TH Profile rail guide C	
	1. Ebene	2. Ebene	1. Ebene	2. Ebene
	Loads [N]			
Fy	56 000	42 000	69 000	42 000
Fz	56 000	42 000	69 000	42 000
	Load torque [Nm]			
Mx	6 800	3 500	8 400	3 500
My	8 200	3 900	14 000	3 900
Mz	8 200	3 900	14 000	3 900



Parameter

	AXS240TH Profile rail guide B	
	1. level	2. level
Maximal velocity [m/min]	600	
Drive element	Pinion drive, module 3	Tooth belt 75AT10
Allowable dynamic operating load [N]	4 900	5 000
Max. energy absorption of the shock absorber [Nm]	223	
Stroke per revolution [mm]	500	
Idling speed torque [Nm]	6,0	
Moment of inertia [kgcm^2]	1 439	
Geometrical moment of inertia Iy [cm^4]	9 030	
Geometrical moment of inertia Iz [cm^4]	6	
Maximal total length [m]	6	

Mass

	AXS240TH Table 330 mm		AXS240TH Table 500 mm	
		1. level		1. level
Base mass [kg]	85,4	39,1	91,4	43,7
Mass per 100 mm stroke [kg]	2,5		2,5	
Carriage mass [kg]	6,6		9,7	

7.3. AXS280TH

7.3.1. Structure

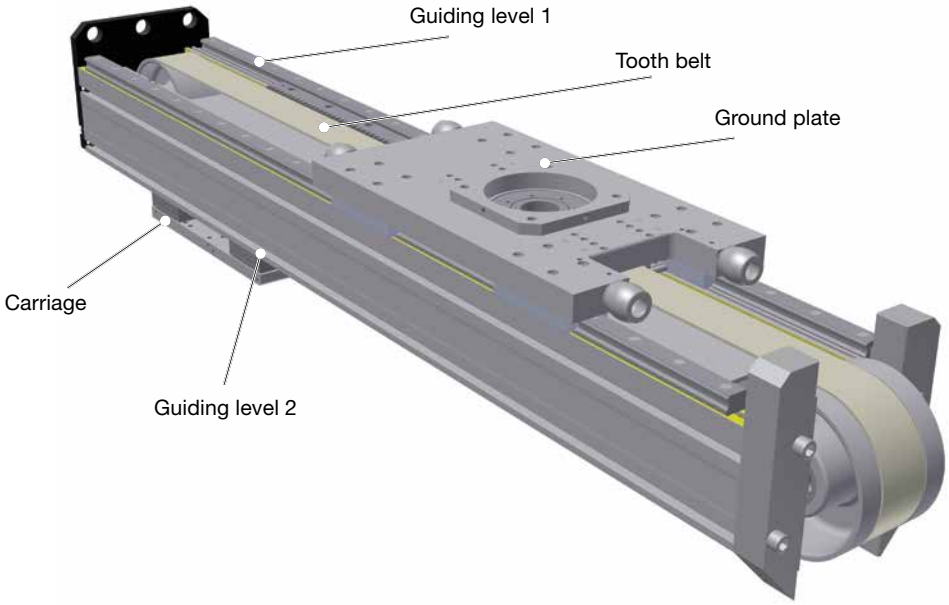
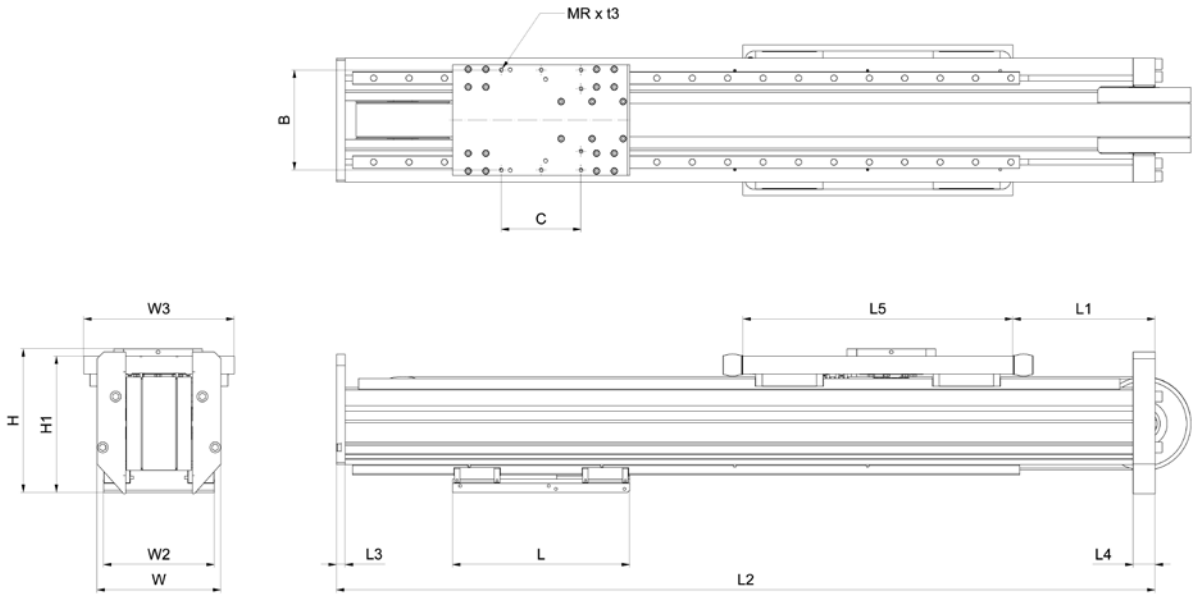


Figure 7.3 Structure

7.3.2. Dimension

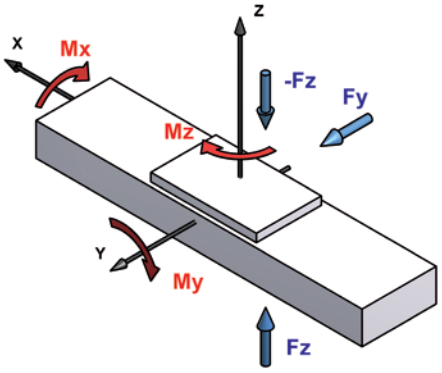


	L	W	H	L1	L2	L3	L4	L5	B	C	H1	W2	W3	MR x t3
AXS280TH	400	280	325	min. 95	+ 770	20	50	610	226	180	308	250	340	M10 x 20

7.3.3. Technical data

Dynamic loads and moments

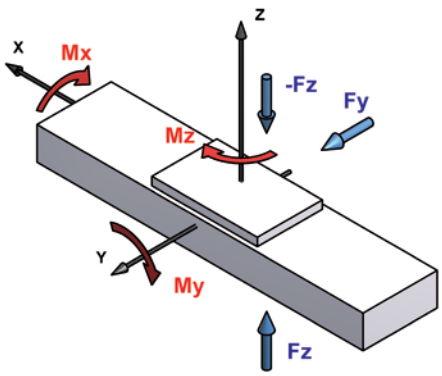
	AXS280TH Profile rail guide B	
	1. level	2. level
Loads [N]		
Fy	35 000	23 000
Fz	35 000	23 000
Load torque [Nm]		
Mx	4 200	2 200
My	7 000	3 400
Mz	7 000	3 400



The dynamic load rating of the guiding system based on a nominal service life of 54,000 km.

Static loads and moments

	AXS280TH Profile rail guide B	
	1. level	2. level
Loads [N]		
Fy	100 000	56 000
Fz	100 000	56 000
Load torque [Nm]		
Mx	12 000	5 300
My	20 000	8 200
Mz	20 000	8 200



Parameter

	AXS280TH Profile rail guide B	
	1. level	2. level
Maximal velocity [m/min]	600	
Drive element	Pinion drive, module 3	Tooth belt 75AT10
Allowable dynamic operating load [N]	15 000	5 000
Max. energy absorption of the shock absorber [Nm]	361 or 446	
Stroke per revolution [mm]	700	
Idling speed torque [Nm]	11	
Moment of inertia [kgcm^2]	11 690	
Geometrical moment of inertia Iy [cm^4]	21 340	
Geometrical moment of inertia Iz [cm^4]	6	
Maximal total length [m]	6	

Mass

	AXS280TH Profile rail guide B	
		1. level
Base mass [kg]	133,8	102,5
Mass per 100 mm stroke [kg]	3,3	
Carriage mass [kg]	12,0	

7.4. XS280TV

7.4.1. Structure

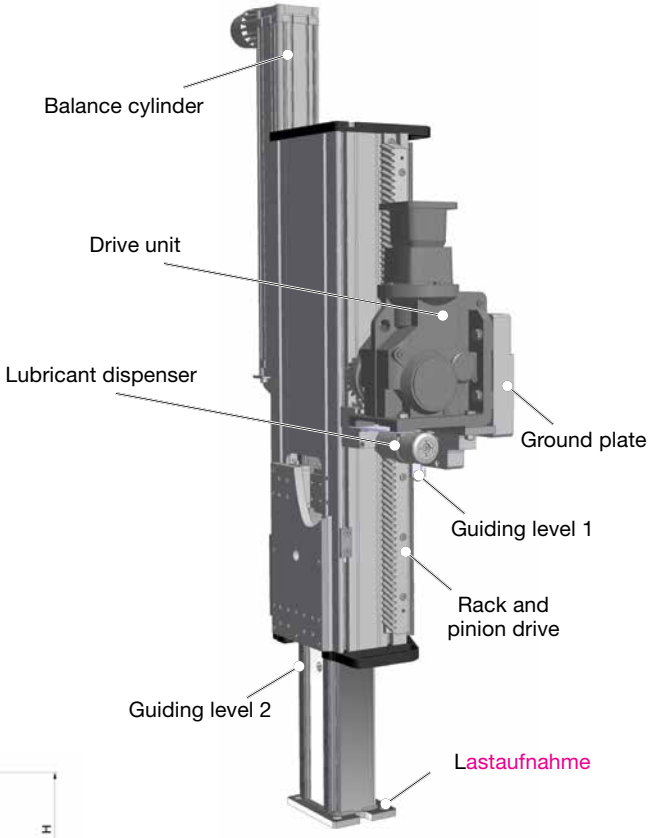
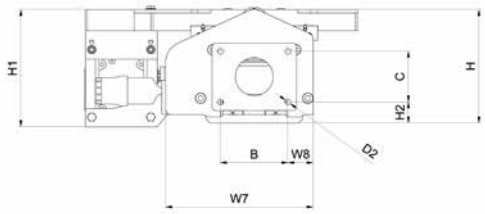
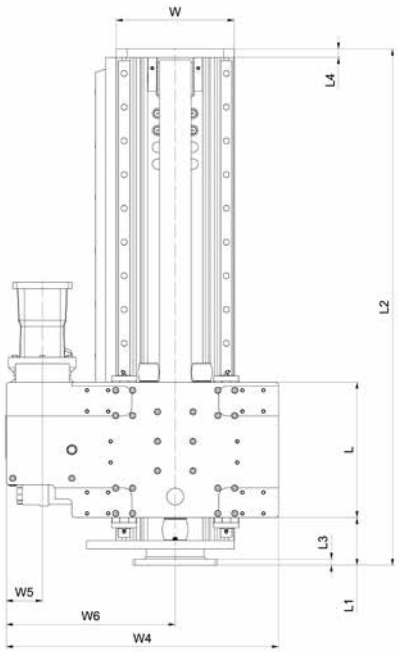


Figure 7.4 Structure

7.4.2. Dimension





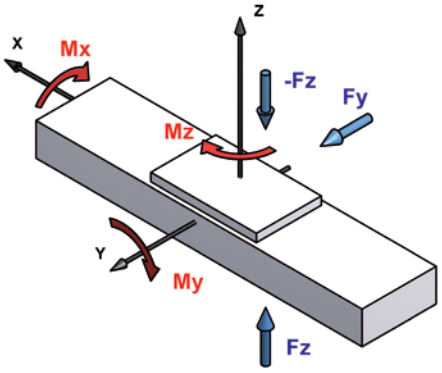
	L	W	H	L1	L2	B	C
AXS280TV	321	280	269,2	min. 113	Travel range/2 + 500	160	120

	L3	L4	H1	H2	W4	W5	W6	W7	W8	D2
AXS280TV	14	20	278	50	645	85	400	350	60	Ø13,5

7.4.3. Technical data

Dynamic loads and moments

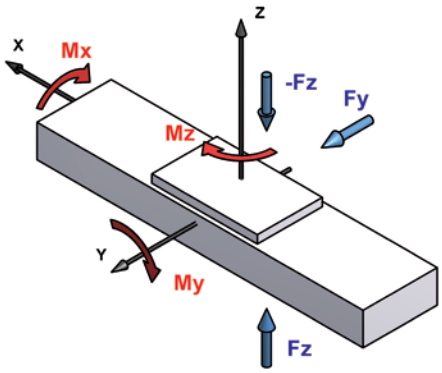
	AXS280TV Profile rail guide B	
	1. level	2. level
Loads [N]		
Fy	26 000	15 000
Fz	26 000	15 000
Load torque [Nm]		
Mx	3 100	800
My	3 000	2 300
Mz	3 000	2 300



The dynamic load rating of the guiding system based on a nominal service life of 54,000 km.

Static loads and moments

	AXS280TV Profile rail guide B	
	1. level	2. level
Loads [N]		
Fy	69 000	42 000
Fz	69 000	42 000
Load torque [Nm]		
Mx	8 000	2 100
My	8 000	6 200
Mz	8 000	6 200



Parameter

	AXS280TV Profile rail guide B	
	1. level	2. level
Maximal velocity [m/min]	600	
Drive element	Pinion drive, module 4	Tooth belt 75AT10
Allowable dynamic operating load [N]	8 940	5 000
Max. energy absorption of the shock absorber [Nm]	446	
Stroke per revolution [mm]	560	
Idling speed torque [Nm]	6	
Moment of inertia [kgcm^2]	7 958(1)	
Geometrical moment of inertia Iy [cm^4]	14 654(1)	
Geometrical moment of inertia Iz [cm^4]	3	
Maximal total length [m]	6	

(1) 1. Guiding level

Mass

	AXS280TV Profile rail guide B	
		1. level
Base mass [kg]	120,1	50,8
Mass per 100 mm stroke [kg]	4,3	
Carriage mass [kg]	14,8 + (Stroke x 0,015)	

7.5. AXS280Y

7.5.1. Structure

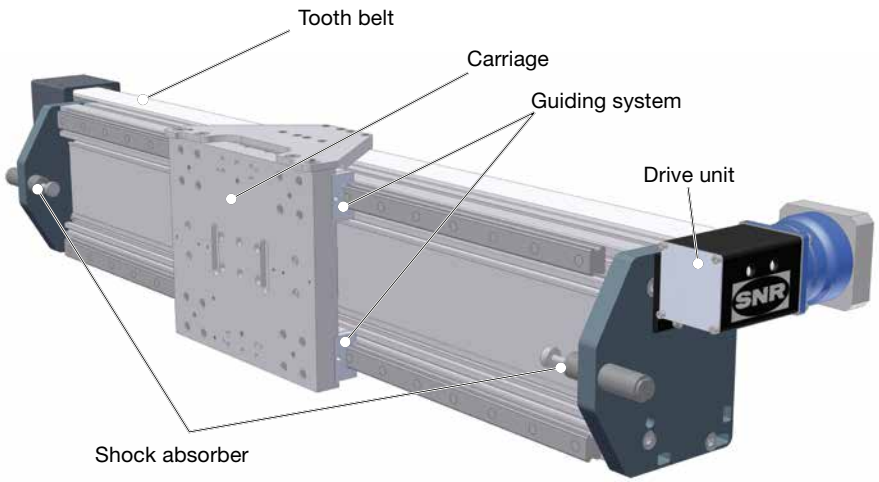
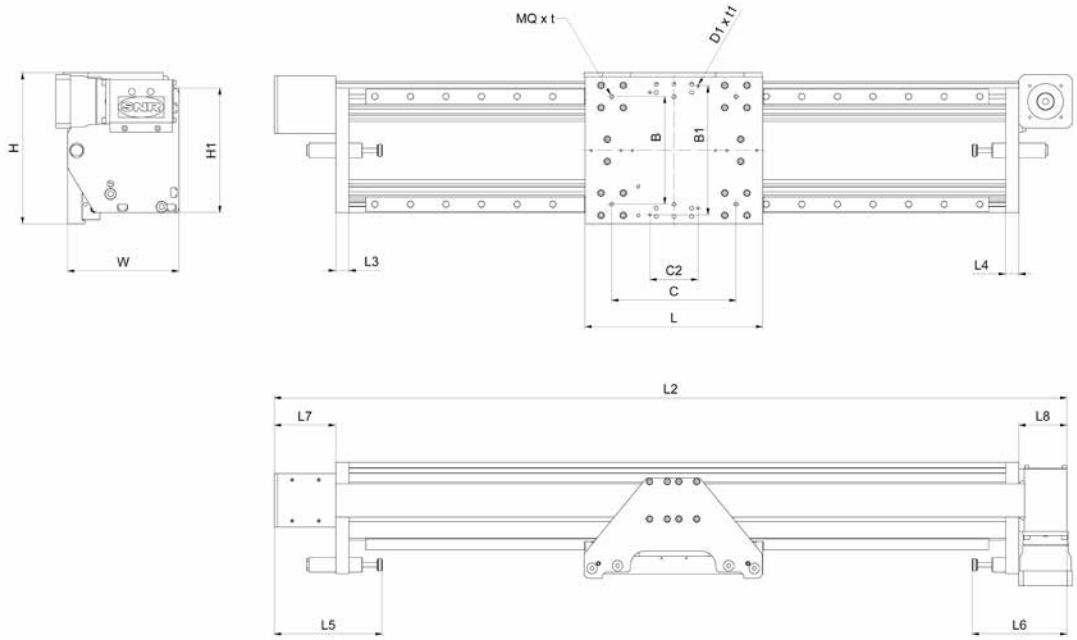


Figure 7.5 Structure

7.5.2. Dimension



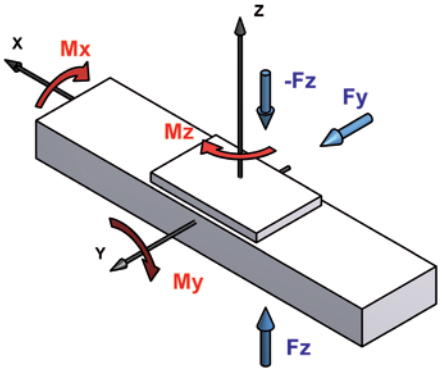
	L	W	H	L2	B	C	B1	C2	H1
AXS280Y	400	250	340	Travel range/2 + 830…990	242	280	290	108	280

	L3	L4	L5	L6	L7	L8	MQ x t	D1 x t1
AXS280TH	30	30	max. 310	max. 280	168	138	M10 x 30	Ø6H7 x 30

7.5.3. Technical data

Dynamic loads and moments

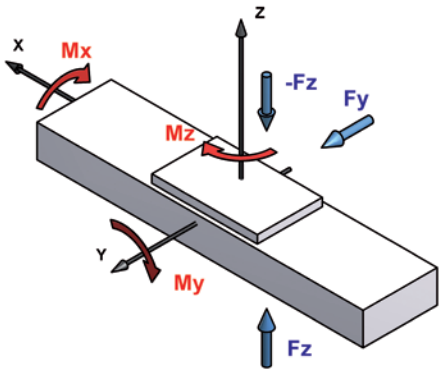
	AXS280Y Profile rail guide B 400 mm carriage length	AXS280Y 600 mm carriage length
Loads [N]		
Fy	25 000	25 000
Fz	25 000	25 000
Load torque [Nm]		
Mx	3 000	3 000
My	3 500	6 000
Mz	3 500	6 000



The dynamic load rating of the guiding system based on a nominal service life of 54,000 km.

Static loads and moments

	AXS280Y Profile rail guide B 400 mm carriage length	AXS280Y Profile rail guide B 600 mm carriage length
Loads [N]		
Fy	81 000	81 000
Fz	81 000	81 000
Load torque [Nm]		
Mx	9 800	9 800
My	11 000	19 000
Mz	11 000	19 000



Parameter

	AXS280Y
Maximal velocity with profile rail guide B [m/min]	300
Drive element	Tooth belt 75STD8
Max. energy absorption of the shock absorber [Nm]	900
Allowable dynamic operating load [N]	5 000
Stroke per revolution [mm]	272
Idling speed torque [Nm]	7,0
Moment of inertia [kgcm^2]	24,3
Geometrical moment of inertia Iy [cm^4]	7 958
Geometrical moment of inertia Iz [cm^4]	14 650
Maximal total length [m]	10 (one-piece)(1)

Mass

	AXC280Y Profile rail guide B
Base mass [kg]	55,3
Mass per 100 mm stroke [kg]	4,6
Carriage mass 400 mm table [kg]	16,3
Carriage mass 600 mm table [kg]	22,3

8. AXLM

8.1. Structure

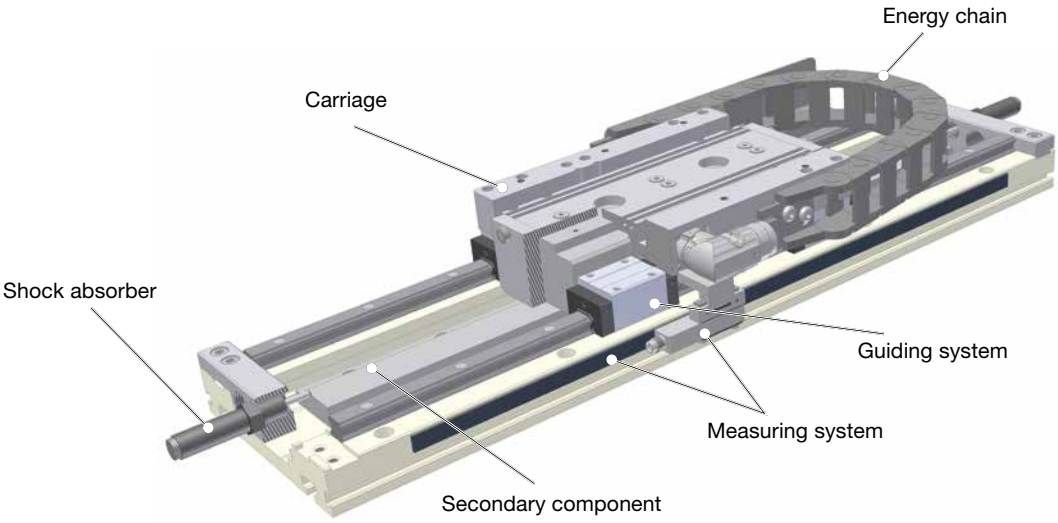
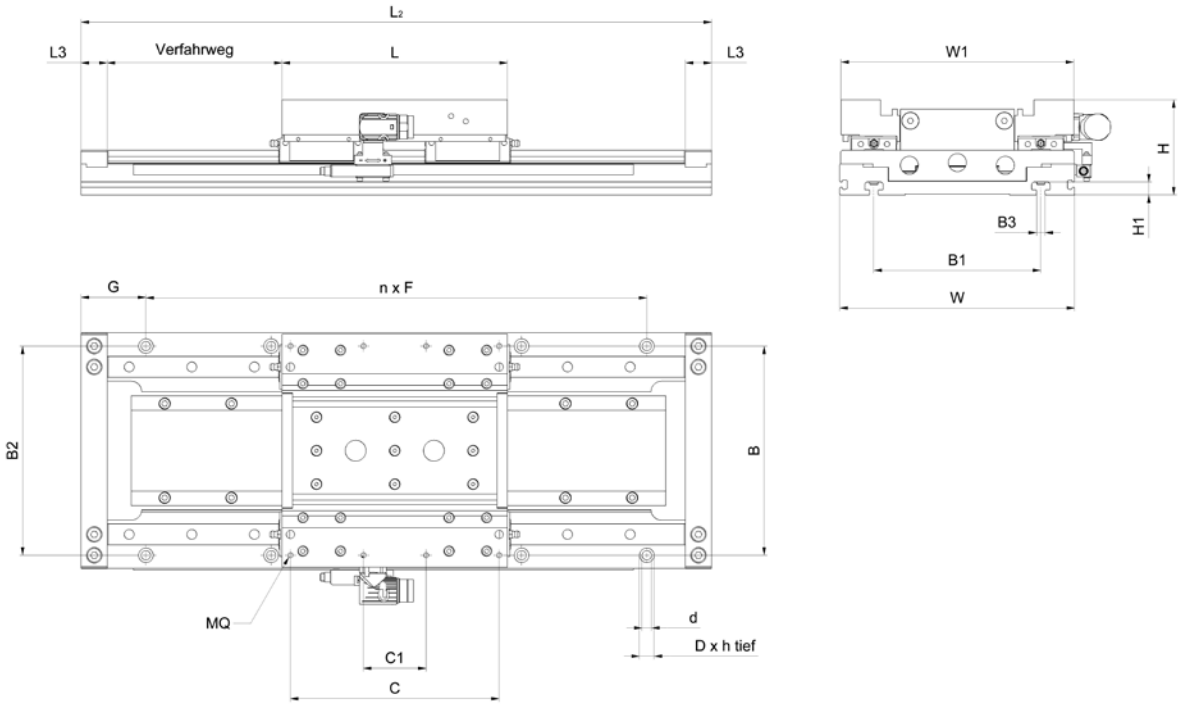


Figure 8.1 Structure

8.2. Dimension



	H	W	L	L2	B	C	C1	MQ	L3
AXLM155-300	81,5	155	215	Travel range + L + 66	120	135	--	M6	20
AXLM155-400									
AXLM155-650			391	Travel range + L + 72		275	135		
AXLM155-800									
AXLM155-980			567			450	180		
AXLM155-1200									
AXLM225-650	90	225	216	Travel range + L + 82	200	200	60	M6	25
AXLM225-1000									
AXLM225-1300			392			300	160		
AXLM225-1950			568			470	250		
AXLM225-2000			392			300	160		
AXLM225-2600			744			650	430		
AXLM225-3000			568			470	250		
AXLM225-4000			744			650	430		
AXLM225-5000			920			830	610		
AXLM325-2650	115	325	394	Travel range + L + 122	270	305	--	M8	35
AXLM325-3970			572			470	305		
AXLM325-5300			748			650	430		
AXLM325-6600			924			830	650		

	B1	B2	B3	G	F	W1	H1	d	D	h
AXLM155	105	135	8,2	41	120	142	12,5	6,5	11	9
AXLM225	160	200	8,2	62	120	223	12,5	9,0	14	12
AXLM325	--	300	--	76	160	323	--	11,0	18	4

8.3. Technical data

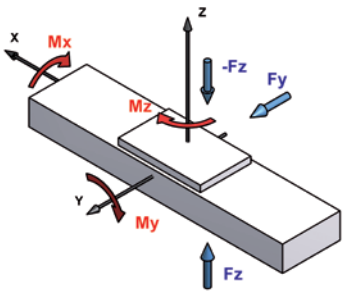
AXLM155

Feeding force

Type	F_{max} Maximum force [N]	F_n Permanent force [N]	Velocity with F_n [m/s]
AXLM155-330A	330	125	6
AXLM155-330W		240	6
AXLM155-400A	400	150	6
AXLM155-400W		300	6
AXLM155-650A	650	240	6
AXLM155-650W		470	6
AXLM155-800A	800	300	6
AXLM155-800W		600	6
AXLM155-980A	980	360	6
AXLM155-980W		700	6
AXLM155-1200A	1 200	450	6
AXLM155-1200W		900	6

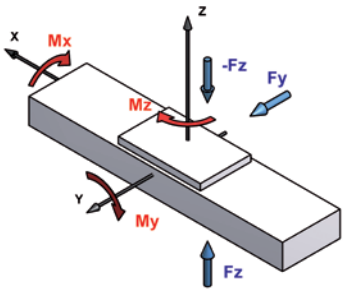
Dynamic loads and moments

	AXLM155-330	AXLM155-400	AXLM155-650	AXLM155-800	AXLM155-980	AXLM155-1200
Loads [N]						
Fx	4 490	4 490	4 490	4 490	6 730	6 730
Fy	5 240	5 390	5 950	6 240	8 480	9 310
Fz	3 740	3 590	3 030	2 740	4 580	4 150
Load torque [Nm]						
Mx	185	175	150	135	225	205
My	280	270	495	445	765	690
Mz	280	270	495	445	765	690



Static loads and moments

	AXLM155-330	AXLM155-400	AXLM155-650	AXLM155-800	AXLM155-980	AXLM155-1200
Loads [N]						
Fx	15 700	15 700	15 700	15 700	23 500	23 500
Fy	16 400	16 600	17 200	17 500	25 700	26 100
Fz	15 000	14 800	14 200	14 000	21 400	21 000
Load torque [Nm]						
Mx	745	735	710	695	1070	1050
My	1 130	1 120	2 330	2 300	3 600	3 520
Mz	1 130	1 120	2 330	2 300	3 600	3 520



AXLM225

Feeding force

Type	F_{max} Maximum force [N]	F_n Permanent force [N]	Velocity with F_n [m/s]
AXLM225-650A	650	280	4,6
AXLM225-650W		500	4,7
AXLM225-1000A	1 000	440	3,7
AXLM225-1000W		750	3,1
AXLM225-1300A	1 300	560	4,6
AXLM225-1300W		1 000	4,7
AXLM225-1950A	1 950	840	4,6
AXLM225-1950W		1 500	4,7
AXLM225-2000A	2 000	880	3,7
AXLM225-2000W		1 500	3,1
AXLM225-2600A	2 600	1 120	4,6
AXLM225-2600W		2 000	4,7
AXLM225-3000A	3 000	1 320	3,7
AXLM225-3000W		2 250	3,1
AXLM225-4000A	4 000	1 760	3,7
AXLM225-4000W		3 000	3,1
AXLM225-5000A	5 000	2 200	3,7
AXLM225-5000W		3 750	3,1

Dynamic loads and moments

	AXLM225-650	AXLM225-1000	AXLM225-1300	AXLM225-1950	AXLM225-2000	AXLM225-2600	AXLM225-3000	AXLM225-4000	AXLM225-5000
Loads [N]									
Fx	6 900	6 900	6 900	13 400	8 950	13 400	13 400	17 900	22 400
Fy	8 380	9 100	9 780	17 700	13 300	19 100	19 900	26 400	33 000
Fz	5 420	4 700	4 020	9 130	4 630	7 730	7 000	9 360	11 700
Load torque [Nm]									
Mx	400	345	295	675	340	570	515	690	860
My	375	325	585	1 420	675	1 650	1 100	1 650	2 400
Mz	375	325	585	1 420	675	1 650	1 100	1 650	2 400

Static loads and moments

	AXLM225-650	AXLM225-1000	AXLM225-1300	AXLM225-1950	AXLM225-2000	AXLM225-2600	AXLM225-3000	AXLM225-4000	AXLM225-5000
Loads [N]									
Fx	24 400	24 400	24 400	47 400	31 600	47 400	47 400	63 200	7 9000
Fy	25 900	26 600	27 300	51 700	36 000	53 100	53 900	71 800	89 700
Fz	22 900	22 200	21 500	43 100	27 300	41 700	41 000	54 700	68 400
Load torque [Nm]									
Mx	1 700	1 650	1 550	3 150	2 000	3 080	3 000	4 050	5 000
My	1 600	1 550	3 100	6 700	3 950	8 950	6 400	9 750	14 000
Mz	1 600	1 550	3 100	6 700	3 950	8 950	6 400	9 750	14 000

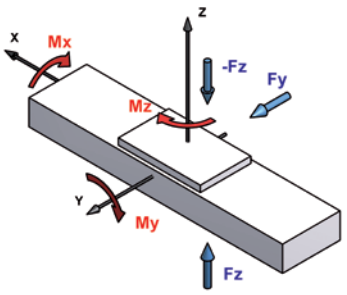
AXLM325

Feeding force

Type	F_{max} Maximum force [N]	F_n Permanent force [N]	Velocity with F_n [m/s]
AXLM325-2650A	2 650	1 200	2,0
AXLM325-2650W		2 000	1,9
AXLM325-3970A	3 970	1 800	2,0
AXLM325-3970W		3 000	1,9
AXLM325-5300A	5 300	2 400	2,0
AXLM325-5300W		4 000	1,9
AXLM325-6600A	6 600	3 000	2,0
AXLM325-6600W		5 000	1,9

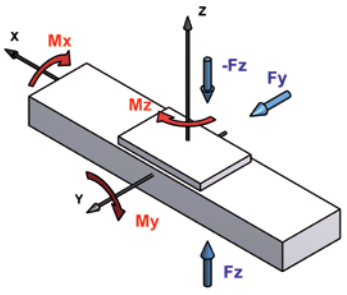
Dynamic loads and moments

	AXLM325-2650	AXLM325-3970	AXLM325-5300	AXLM325-6600
Loads [N]				
Fx	14 300	18 500	27 800	37 100
Fy	20 100	27 100	39 200	51 300
Fz	8 550	9 960	16 400	22 900
Load torque [Nm]				
Mx	880	1 020	1 680	2 350
My	1 320	2 350	3 540	5 220
Mz	1 320	2 350	3 540	5 220

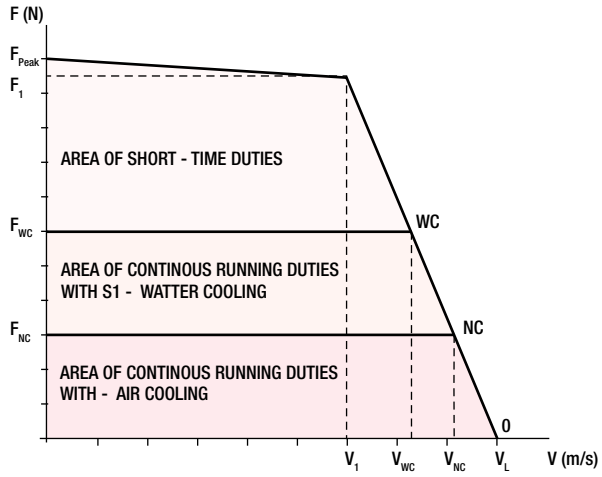


Static loads and moments

	AXLM325-2650	AXLM325-3970	AXLM325-5300	AXLM325-6600
Loads [N]				
Fx	43 700	56 500	84 800	113 000
Fy	49 400	65 100	96 200	127 000
Fz	37 900	48 000	73 400	98 900
Load torque [Nm]				
Mx	3 900	4 950	7 580	10 200
My	5 900	11 300	15 900	22 600
Mz	5 900	11 300	15 900	22 600



Feeding force characteristic



F_{max} Maximum force developed by the linear motor

$F_{nc/wc}$ Continuously developed force of the linear motor for air cooling (Fnc) or for water cooling (Fwc)

Figure 8.2 Feeding force characteristic

In general linear motors, as well as rotative servo motors, can be loaded with substantially higher forces for a short-time period.
The linear motor is able to operate in the area of short-time duties (for example while acceleration) for a maximum time-period of 5s.
The effective force must be in this case in the area of continuous running duty.

Mass

Type	Base mass [kg]	Mass per 100 mm stroke [kg]	Carriage mass [kg]
AXLM155-330	3,8	1,5	3,1
AXLM155-400	4,7	1,5	4,0
AXLM155-650	6,9	1,5	5,9
AXLM155-800	8,5	1,5	7,5
AXLM155-980	9,9	1,5	8,6
AXLM155-1200	12,4	1,5	11,1
AXLM225-650	9,5	2,2	8,4
AXLM225-1000	10,9	2,5	9,8
AXLM225-1300	15,6	2,2	14,1
AXLM225-1950	22,9	2,2	21,0
AXLM225-2000	17,7	2,5	16,1
AXLM225-2600	29,4	2,2	27,1
AXLM225-3000	26,2	2,5	24,2
AXLM225-4000	34,7	2,5	32,2
AXLM225-5000	43,0	2,5	40,1
AXLM325-2650	32,2	4,3	28,9
AXLM325-3970	44,2	4,3	40,1
AXLM325-5300	58,5	4,3	53,7
AXLM325-6600	73,0	4,3	67,4

8.4. Options

Protection against contamination

Bellow (type designation F in the type code)

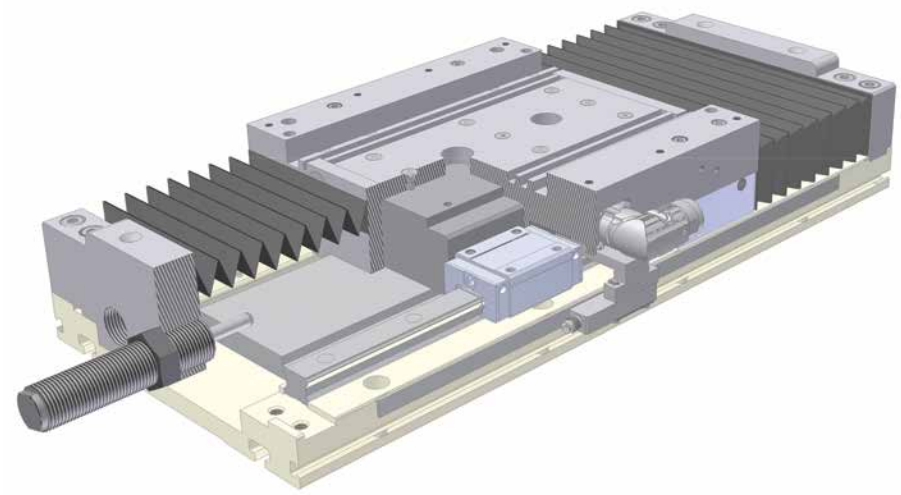


Figure 8.3 AXLM225 with bellow

Top cover (Type designation C in the type code)

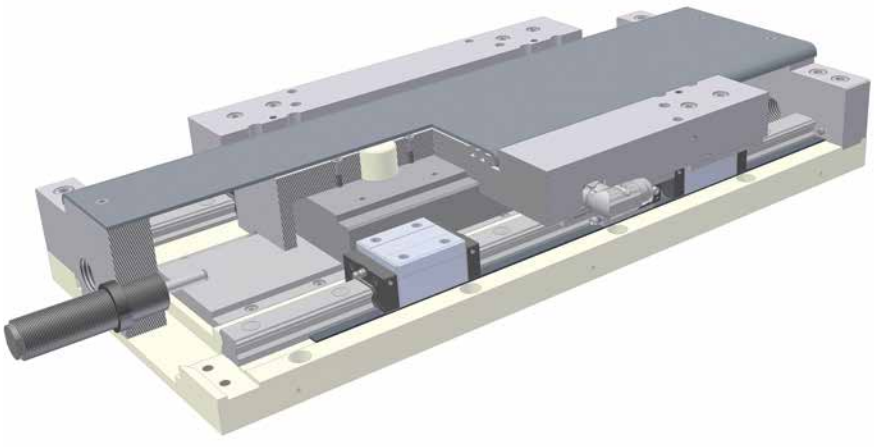


Figure 8.4 AXLM325 with top cover

Switches

Linear motor modules can be optional equipped with two inductive switches in a special design. This version of switches has the type designation 36 in the type code.

9. Options

9.1. Versions - Protection versions

AXC / AXF

Size	Version	AXC														AXC	
		40			60			80			100		120			100	
		A	S	Z	A	S	Z	A	S	Z	S	Z	A	S	Z	S	Z
0	without	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
A	Plastic cover strip		S		x	S	x		S	x	S	x		S	x	S	S
B	Metal cover strip										x	x				x	x
E	Plastic cover strip, Side seals										x	x				x	x
H	Sealing air connection in the end plate	x	x	x	x	x	x	x	x	x	S	S	x	x	x	S	S
I	Plastic cover strip and sealing air connection in the end plate		x		x	x	x		x	x	S	x		x	x	S	S
K	Plastic cover strip, side seals and sealing air connection in the end plate										x	x				x	x
M	Metal cover strip, Side seals										x	x				x	x
N	Metal cover strip, Side seals and sealing air connection in the end plate										x	x				x	x
Q	slight corrosion protection	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
R	Corrosion protected	(x)	x	(x)	x	x	x	x	x	x	x	x	x	x	x	x	x
S	Wet area version																x
U	Clean room version	(x)	(x)		(x)	(x)	x	(x)	(x)	x	(x)	x	(x)	(x)	x	(x)	x
V	Clean room version and vacuum connection in the end plate	(x)	(x)	(x)	(x)	(x)	x	(x)	(x)	x	(x)	x	(x)	(x)	x	(x)	x

S: Standard (additional selection not necessary)
x: Option available
(x): Option conditionally available

AXDL / AXBG

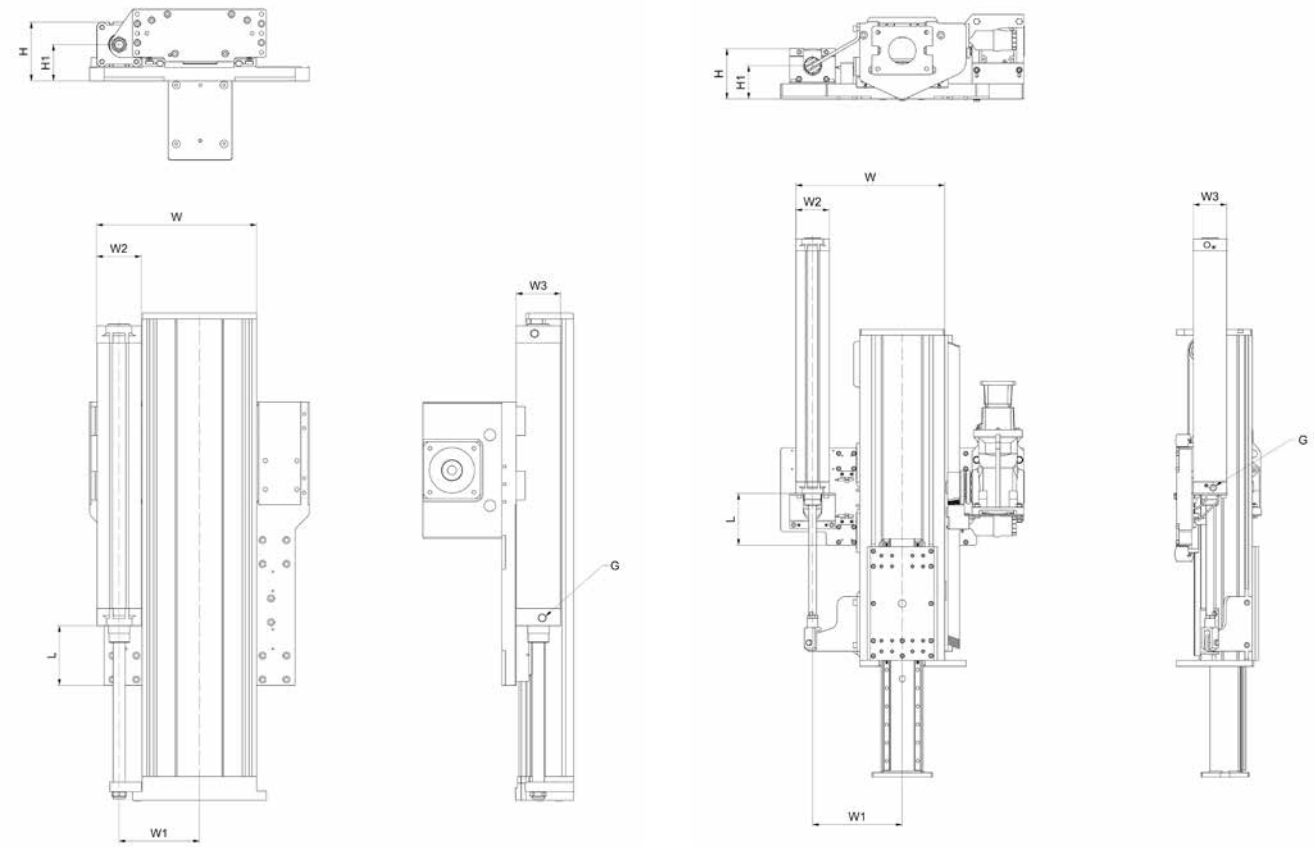
Size	Version	AXC								AXC					
		110		160			240			15	20	26	33	46	55
		S	Z	A	S	Z	A	S	Z	S	S	S	S	S	S
0	without	x	x	x	x	x	x	x	x	x	x	x	x	x	x
A	Plastic cover strip	S	S		S	S		S	S						
C	Top cover									x	x	x	x	x	x
D	Plastic cover strip, felt strip seal and inner seal	x	x	x	x	x	x	x	x						
F	Bellow									x	x	x	x	x	x
H	Sealing air connection in the end plate	x	x	x	x	x	x	x	x						
I	Plastic cover strip and sealing air connection in the end plate	x	x		x	x		x	x						
J	Plastic cover strip, felt strip seal, inner seals and sealing air connection in the end plate	x	x	x	x	x	x	x	x						
Q	slight corrosion protection	x	x	x	x	x	x	x	x	x	x	(x)	(x)	(x)	(x)
R	Corrosion protected	x	x	x	x	x	x	x	x	(x)	(x)	(x)	(x)	(x)	(x)
U	Clean room version	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)
V	Clean room version and vacuum connection in the end plate	(x)	(x)	(x)	(x)	(x)	(x)	(x)	(x)						

AXLT / AXLM / AXS

Size	Version	AXLT				AXLM			AXS										
		155	225	325	455	155	225	325	110	120	200	230	240	280					460
		S	S	S	S	E	E	E	T	T	M	M	T	T	M	Z	Y	M
0	without	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
C	Top cover					x	x	x											
F	Below	x	x	x	x	x	x	x											
Q	slight corrosion protection	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
R	Corrosion protected	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
U	Clean room version					x	x	x											

S: Standard (additional selection not necessary)
x: Option available
(x): Option conditionally available

9.2. Air balance cylinder



AXDL240A

AXS280TV

	Cylinder	Piston-Ø	L	W	H	H1	W1	W2	W3	G
AXC80A			on request							
AXC120A			on request							
AXDL160A			on request							
AXDL240A	DNC80	80	variably adjustable	335	123	76	168	93	93	G3/8"
AXS280TV	DNC100	100	170	490	165	110	295	110	110	G1/2"

9.3. Lubricants

Description	Base oit / Type of soap	NLGI-Class DIN 51818	Worked penetration DIN ISO 2137 at 25°C [0,1mm]	Basic oil viscosity DIN ISO 51562 at 40°C [mm²/s]	Density [mg/cm³]	Temp. range [°C]	Properties	Application area
SNR LUB HEAVY DUTY	Mineral oil / Lithium with EP additives	2	295	ca. 115	890	-25...+140°C	high loads, very high protection against wear and corrosione	General machine building
SNR LUB HIGH SPEED+	Ester, SHC / Lithium, Calcium	2	-	25	900	-45...+120°C	Very good adhesion properties Very good water resistance	High speeds
SNR LUB HIGH TEMP	semi-synthetic / Polyurea	2	265...295	160	900	-40...+160°C	High temperature resistance Good corrosion protection High oxidation resistance	High temperature range
SNR LUB FOOD	Paraffinic mineral, PAO / Aluminium complex	2	265...295	195	920	-30...+120°C	Good corrosion protection Very good adhesion properties High water resistance NSF H1 registered *	Food processing industry
Microlub GL261	Mineral oil / special lithium-calcium soap	1	310...340	280	890	-30...+140°C	Good wearing protection Particularly pressure-resistant Additive against tribo-corrosion	• General machine building • High load • Short-stroke applications • Vibrations
Klübersynth BEM34-32	Synthetic hydrocarbon oil / special calcium soap	2	265...295	ca. 30	890	-30...+140°C	Particularly pressure-resistant Good wearing protection Good ageing resistance Low starting torque	Clean-room applications
Klübersynth UH1 14-151	Synthetic hydrocarbon oil / ester oil Aluminium complex soap	1	310...340	ca.150	920	-45...+120C	Good corrosion protection Good ageing resistance High water resistance NSF H1 registered *	• Pharmaceutical industry • Food- processing industry

** This lubricant has been registered as an H1 product, i.e. it was developed for occasional, technically unavoidable contact with food. Experience has shown that the lubricant can also be used for appropriate applications in the pharmaceutical and cosmetic industry when the conditions in the product information are adhered to. However, no specific test results that might be required for applications in the pharmaceutical industry, e.g. bio-compatibility, are available. The systems manufacturer and operator should therefore perform appropriate risk analyses before applications in this area. Measures to exclude health risks and injuries have to be taken, where required. (Source: Klüber Lubrication)*

Index of lubrication greases

Index	Manufacturer	Grease description (see Chapter 4.2.4)
00	NTN-SNR	SNR LUB Heavy Duty (standard grease)
01	Klüber	Without grease, only with Contrakor Fluid H1 preservation oil
02	NTN-SNR	SNR LUB HIGH SPEED+
03	NTN-SNR	SNR LUB HIGH TEMP
04	NTN-SNR	SNR LUB FOOD
05	Klüber	Microlub GL261
06	Klüber	Klübersynth BEM34-32
07	Klüber	Klübersynth UH1 14-151
99		Special grease according to customer specifications

9.4. Safety options

Size	Version	AXC			AXF		AXDL			AXBG	AXLT	AXLM	AXS			
		A	S	Z	A	S	Z	A	S	Z	S	Z	A	S	Z	S
0	without safety options	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
A	with safety break	x	x	x	x	x	x	x	x		x	x	x	x	x	x
B	with safety nut		x		x			x			x					
C	with collision protection (moved profile)		x		x			x			x					
D	with collision protection (moved carriage)		x		x			x			x					
E	with safety break and safety nut		x		x			x			x					
F	with safety break and collision protection (moved profile)		x		x			x			x					
G	with safety break and collision protection (moved carriage)		x		x			x			x					
H	with safety nut and collision protection (moved profile)		x		x			x			x					
I	with safety nut and collision protection (moved carriage)		x		x			x			x					
J	with safety break, safety nut and collision protection (moved profile)		x		x			x			x					
K	with safety break, safety nut and collision protection (moved carriage)		x		x			x			x					

X: Option available

9.5. Precision classes

AXBG

Type	Profile length	Positioning repeatability N [µm]	Positioning repeatability P [µm]	Positioning accuracy N [µm]	Positioning accuracy P [µm]	Running parallelism N [µm]	Running parallelism P [µm]	Backlash N [µm]	Backlash P [µm]	Starting torque N [µm]	Starting torque P [µm]
AXBG15	75	± 3	± 1	40	20	20	10	5	2	0,010	0,012
	100										
	125										
	150										
	175										
	200										
AXBG20	100	± 3	± 1	50	20	25	10	5	2	0,010	0,012
	150										
	200										
AXBG26	150	± 3	± 1	50	20	25	10	5	2	0,015	0,040
	200										
	250										
	300										
AXBG33	150	± 3	± 1	30	15	25	10	5	2	0,070	0,150
	200										
	300			35	20						
	400										
	500			40	25	35	15				
	600		--	70	--		--		--		--
AXBG46	340	± 3	± 1	35	20	35	15	5	2	0,100	0,150
	440										
	540			40	25						
	640										0,170
	740			50	30	40	20				
	840		--	80	--	50	--		--		--
	940										
	1040										
	1140			100							
	1240										
AXBG55	980	± 3	± 1	80	35	50	25	5	2	0,120	0,120
	1080										
	1180			100	40		30				0,170
	1280		--		--		--		--		--
	1380										

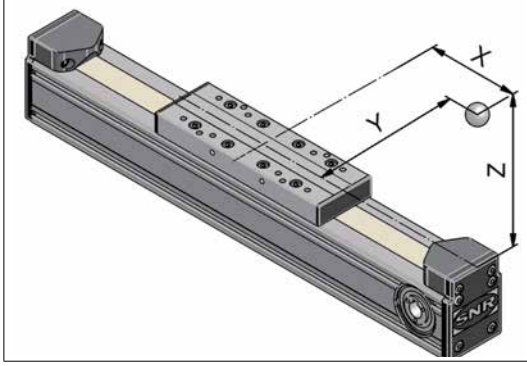
AXC / AXDL / AXLT

Drive version	Size ID screw drive	Travel variation [µm / 300mm] S	Travel variation [µm / 300mm] S
Ball screw drive	alle	52	23
Trapezoidal screw drive	T1203	200	--
	T1604	50	--
	T1608	100	--
	T2004	50	--
	T2008	100	--
	T2405	50	--
	T2410	200	--
	T3606	50	--
	T3612	200	--
		80	--

10. Enquiry guide

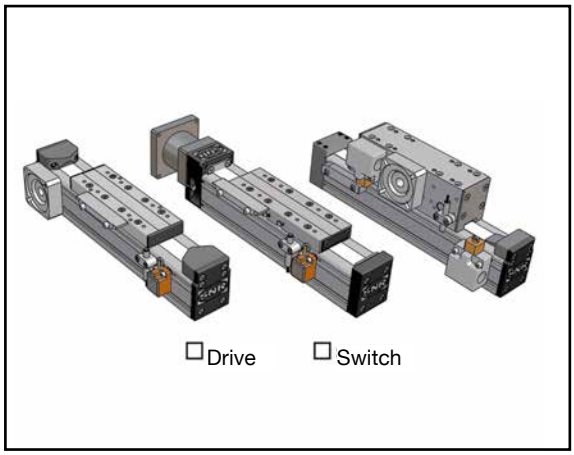
Date								
Bid to								
Company								
Contact person								
Fonction/Service								
Address								
Telephone			Télécopie :					
E-mail								
Project name								
Nature de la demande	☐ Besoin unique		Pièce					
	☐ Besoin série		Pièces/an	☐ Délai souhaité :		Pièces		sem.
	☐ Nouvelle construction			☐ Amélioration technique				
	☐ Réduction des coûts			☐ Prix objectif :				Euro
	☐ Alternative à la concurrence			☐ Concurrence :				

• Application parameters

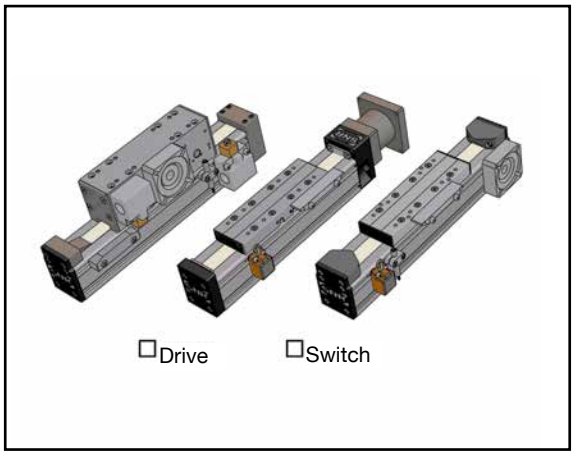
Application parameters	Single axis	Multi-axes system		
		X	Y	Z
Single-axis/multi-axes system (centre-to-centre distance) [mm]				
Mounting position: horizontal/vertical				
Travel distance [mm]				
Traverse rate [m/min]				
Acceleration [m/s2]				
Traverse time, [s]				
Cycle time [s]				
Desired service life, [h]				
Operating conditions (dust, chippings, etc.)				
Useful load [kg]				
Power, [N]				
Co-ordinates of the centre of gravity Load X, [mm]				
Co-ordinates of the centre of gravity Load Y, [mm]				
Co-ordinates of the centre of gravity Load Z, [mm]				
Co-ordinates of the centre of gravity Power X, [mm]				
Co-ordinates of the centre of gravity Power Y, [mm]				
Co-ordinates of the centre of gravity Power Z, [mm]				
	Observations:			

Device to linear axis AX

Please cross out/enter applicable

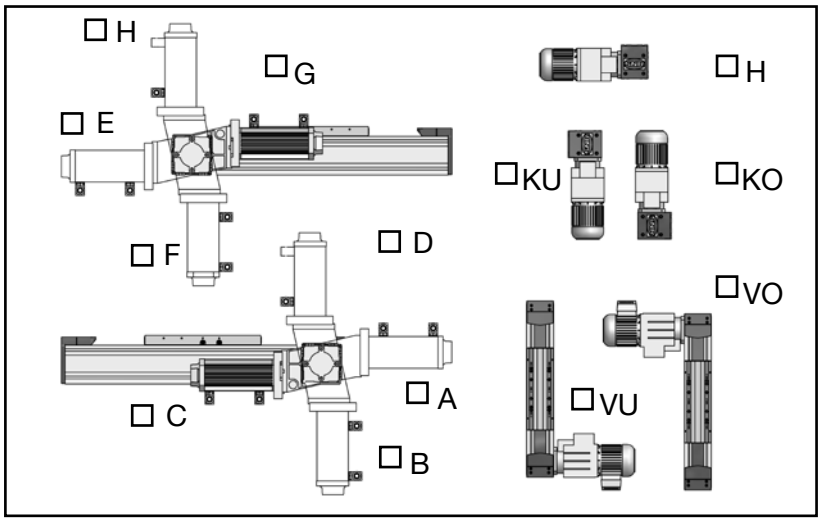


Built-in components left



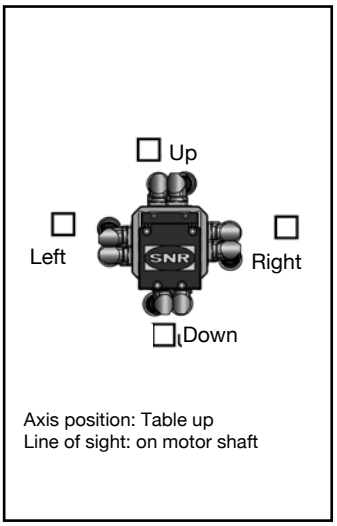
Built-in components right

Type of drive			Guidance system
☐ Ball screw			☐ Ball rail systems
☐ Trapezoidal thread drive			☐ Roller guide
☐ Synchronous belt drive			☐ No guidance
☐ Rack and opinion drive			
☐ Carriage (Omega drive)			
☐ No drive			
Drive model			
In toothed-belt drive			**In ball screw**
☐ Hollow shaft			☐ Coupling cone + coupling
☐ Free shaft end	☐ right	☐ left	☐ Deflection belt drive
☐ Integrated coupling	☐ right	☐ left	☐ Free drive schaft
☐ + integrated coupling for connecting shaft	☐ right	☐ left	
☐ Integrated planetary reduction gearbox	☐ right	☐ left	
☐ + integrated coupling for connecting shaft	☐ right	☐ left	
☐ Coupling and coupling cone	☐ right	☐ left	
☐ + integrated coupling for connecting shaft	☐ right	☐ left	
☐ Drive adapter flange	☐ right	☐ left	
Switch			
☐ Mechanical limit switches	☐ IP 30		☐ IP 67
☐ Inductive proximity switches	☐ Break contact NC (standard)		☐ Make contact NO
☐ Reference switch	☐ PNP (Standard)		☐ NPN



Mounting position angular gear

Mounting position linear axis



Axis position: Table up
Line of sight: on motor shaft

Location motor connection

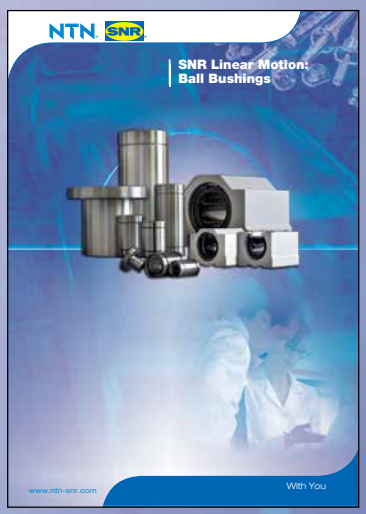
Additional catalogue documentation

More information concerning our NTN-SNR products for linear motion is provided in our catalogues.

NTN-SNR Linear Motion
Linear modules

NTN-SNR Linear Motion
Ball screws

NTN-SNR Linear Motion
Linear guides



NTN-SNR Linear Motion
Ball bushings

NTN-SNR Ball splines