

Electromechanical Cylinder EMC-HD



Identification system for short product names

Short product name		Example:	EMC	-	085	-	HD	-	1
System	=	E lectro M echanical C ylinder							
Size		085 / 105 / 125 / 150 / 180							
Version	=	H eavy D uty							
Generation	=	Product generation 1							

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Product description

Positioning loads weighing tons to the micrometer, pressing, joining or closing powerfully while varying the motion sequence as required: the new Electromechanical Cylinders EMC Heavy Duty (EMC-HD) from Rexroth exploit the advantages of modern control technology even at high forces.

The high rigidity of the units allows precise positioning in addition to high performance and dynamics. Users can seamlessly integrate the cylinders into intelligent energy management and in this way reduce power consumption and carbon emissions. Parameters for force, position and travel speed can be set as required and flexibly adapted to new tasks at any time via the drive system. The Electromechanical Cylinders EMC-HD for heavy loads transmit the motor movement via ball or planetary screw assemblies depending on the requirements on dynamics and force. Available in various sizes and leads, the highly precise Rexroth screw drives cover a wide range of needs cost-effectively. Rexroth offers the EMC-HD as ready-to-install, purely mechanical axes and as a complete system with a choice of precisely matched gear units, servo motors and drive controllers from the IndraDrive series.

Structural Design

The mechanical system in the Electromechanical Cylinders EMC-HD Heavy Duty is based on proven planetary or ball screw assemblies in a wide range of diameter and lead combinations. A screw drive converts torque into linear motion with high mechanical efficiency. During this process the piston rod fastened to the screw drive nut is extended and retracted. Both the nut and the piston rod are guided in the housing.

The piston rod-to-housing interface is optimally sealed to prevent dirt from working its way in. The entire cylinder fulfills the requirements for protection class IP 65.

The EMC-HD is available with a round piston rod or with an integrated anti rotation feature. The integrated anti rotation feature is realized by four flat surfaces on the piston rod and a square sliding guide in the housing.

Integrated end position buffers protect the mechanical system during start-up. Switches are available as an option.

Limit switches prevent damage to the cylinder in operation. A reference point switch is available for the use of incremental encoder systems. A load measuring pin is available for the exact measurement of forces.

Electromechanical Cylinders EMC-HD require only minimal maintenance effort. The advantage of grease lubrication is that the screw drive can run long distances on one supply of grease.

Advantages

- ▶ High energy efficiency and little pollution (no risk of leaks)
- ▶ Compact and robust design for space-saving integration in machine concepts and usage even in harsh environmental conditions
- ▶ Select from multiple options for high flexibility to serve a broad range of applications
- ▶ Precise positioning, high dynamics, powerful drive and long service life due to the use of highly precise Rexroth planetary and ball screw assemblies
- ▶ Smart, freely programmable drive system allows the realization of complex motion profiles (parameters for force, position and velocity can be set as required over the complete working travel range)



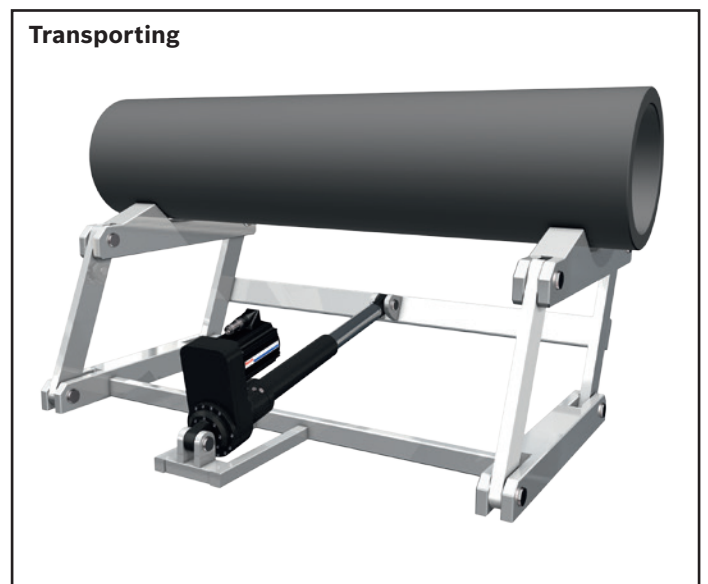
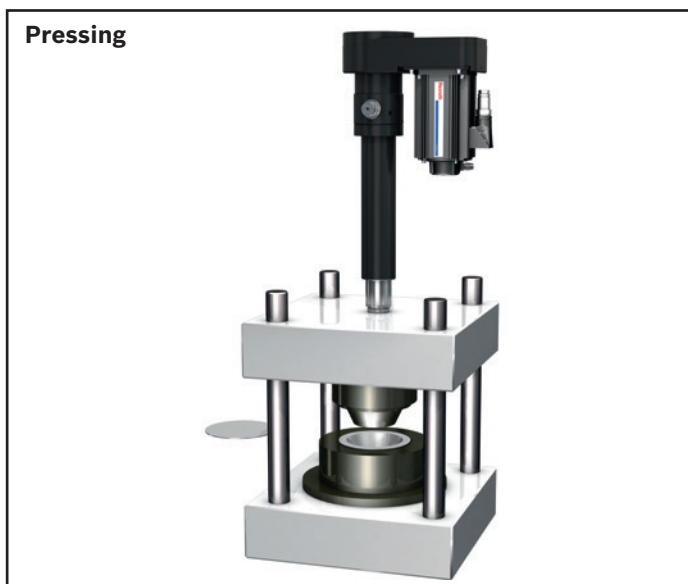
Application areas

Electromechanical Cylinders EMC-HD can be used in many application areas. Due to their specific characteristics, they offer advantages in terms of accuracy, dynamics and controllability, and can therefore not only help to shorten cycle times but also to increase flexibility and quality in the manufacturing process. Their compact design makes them ideal for use in tightly confined spaces.

Possible application areas are:

- ▶ Servo presses and forming technology
- ▶ Joining technology
- ▶ Thermoforming
- ▶ Injection molding and blow molding machines
- ▶ Woodworking machines
- ▶ Machine tools
- ▶ Assembly and handling technology
- ▶ Packaging machines and conveyor systems
- ▶ Testing equipment and laboratory applications
- ▶ Simulators
- ▶ Special-purpose machines

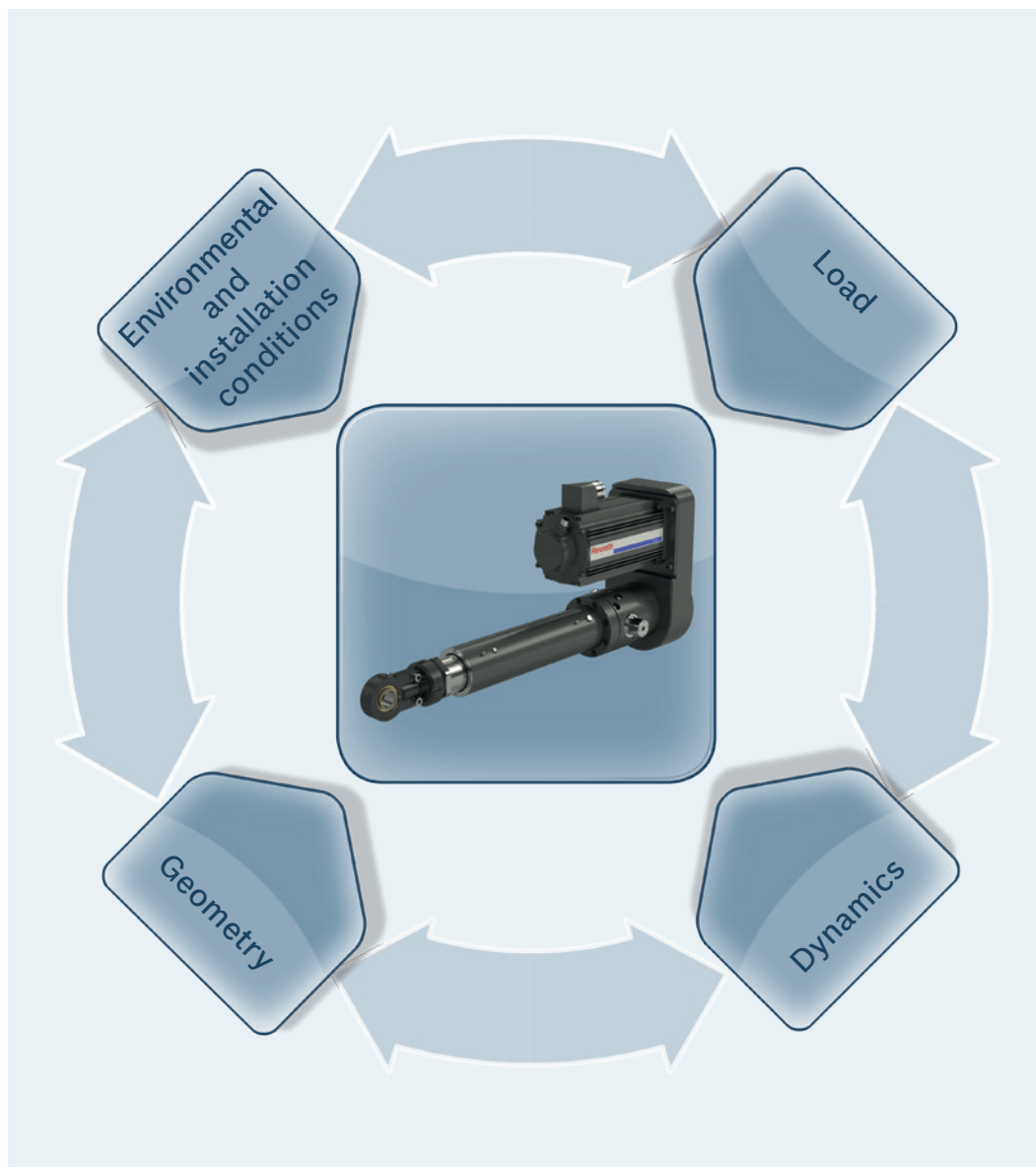
Application examples



Product selection guide

To make sure your electromechanical solution delivers optimal performance, both technically and economically, the right decisions have to be made as early as the planning phase. The following key parameters have a decisive influence on the choice of system and its structural design:

- ▶ Load
- ▶ Dynamics
- ▶ Geometry
- ▶ Environmental and installation conditions



Load

- ▶ Process force
- ▶ Masses
- ▶ Duty cycle
- ▶ Service life requirement
- ▶ etc.

Dynamics

- ▶ Acceleration
- ▶ Linear speed
- ▶ Cycle time
- ▶ etc.

Geometry

- ▶ Work space
- ▶ Installation space
- ▶ Stroke length
- ▶ Interference contours
- ▶ etc.

Environmental and installation conditions

- ▶ Mounting orientation
- ▶ Mounting options
- ▶ Degrees of freedom
- ▶ Temperature
- ▶ Humidity
- ▶ Contamination
- ▶ Vibration and shocks
- ▶ etc.

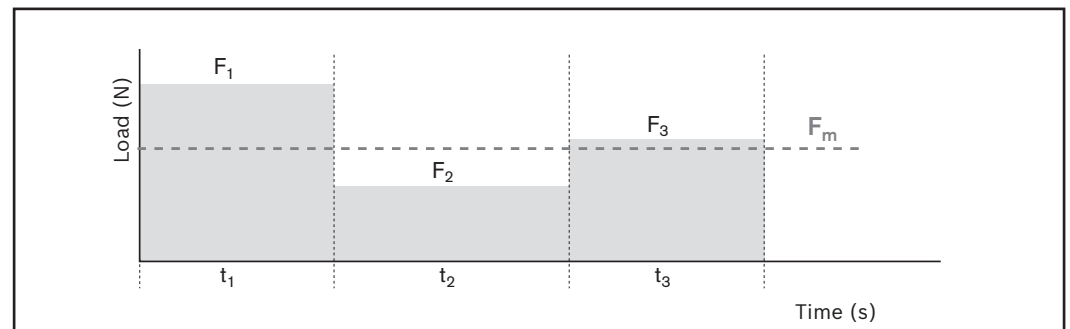
An Electromechanical Cylinder EMC-HD that matches your needs in just six steps

Electromechanical Cylinders EMC-HD offer higher dynamics and precision, better controllability and greater mechanical efficiency than the majority of fluid-power drives. Because of to their special characteristics in comparison with fluid-driven technology, it is particularly important to completely define the requirements of the application in advance. To find the most cost-efficient solution for your application, the following input parameters should be known:

1. Loads

An EMC-HD solution that is both economical and reliable can be found when the loads (process forces and masses) are known as accurately as possible. Along with the maximum force in the application, it is important to also state changing forces over the stroke so that the average load over the entire cycle can be determined. This average load forms the basis for the nominal service life calculation.

Large safety factors for the force required, as are common in some fluid-power applications, should be avoided so that the axis is not over-sized. A differentiation also needs to be made between static load (cylinder at standstill) and dynamic load (during feed motion).



2. Duty cycle

The duty cycle is the ratio of the operating time to the total cycle time expressed in percent. The duty cycle is an important input parameter for both the estimation of the total service life of the cylinder and for the thermal assessment of cylinder and motor. Pause times should always be stated in the calculation.

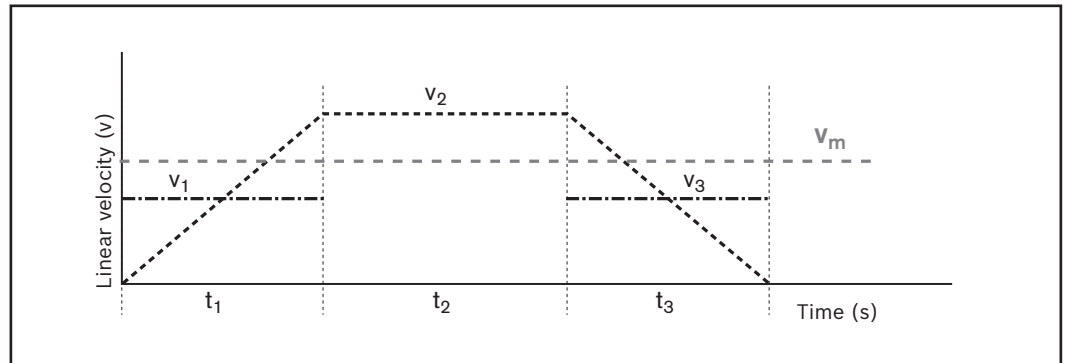
$$DC = \frac{t_B}{t_B + t_P} \cdot 100\%$$

DC	= duty cycle	(%)
t_B	= operating time	(s)
t_P	= pause time	(s)

Product selection guide

3. Total cycle

By stating the acceleration and linear speeds or the necessary cycle time and the travel range as accurately as possible, it is possible to adapt the complete drive train to maximize results for the application. The type of screw drive, lead, gear reductions and drive can be selected such that the requirements are met precisely and efficiently.



4. Integration in the machine

Lateral forces on the piston rod and alignment errors during installation can shorten the service life of the Electromechanical Cylinder EMC-HD.

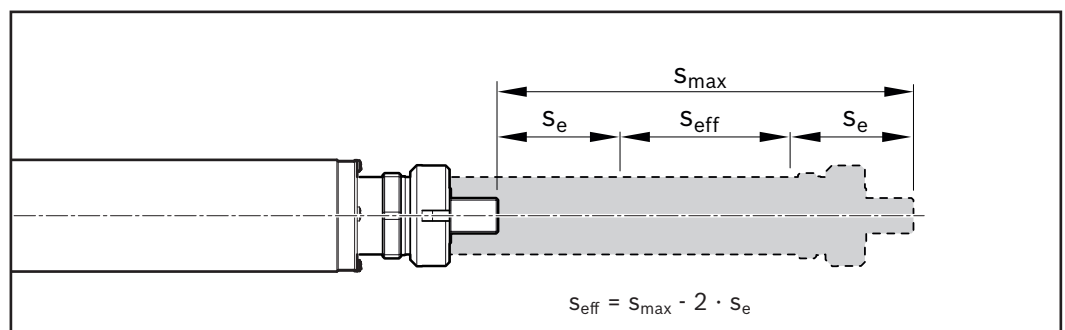
During mounting it must be ensured the cylinder is installed free of distortive stresses and any transverse loads are absorbed by an external guideway.

Especially long cylinder housings in horizontal position should be supported through the foot mounting element at the front end (this reduces the load on the piston rod caused by the weight of the cylinder). Depending on whether the drive torque is to be absorbed in the cylinder or via an external guideway, the cylinder can be ordered with or without an integrated anti rotation feature. (For further information on the anti rotation feature see the “Structural design” section).

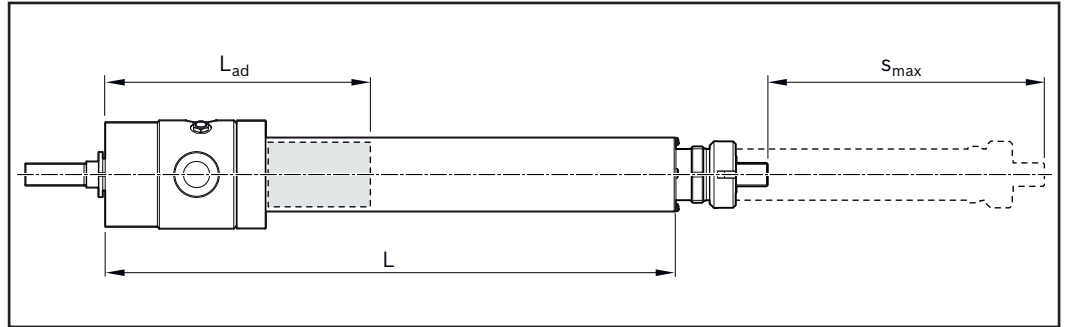
5. Travel range and overall dimensions

Determine the necessary operating stroke in your application. As Electromechanical Cylinders EMC HD must not be allowed to travel right up to the mechanical end stop, it is important to add excess travel (s_e) to both ends of the effective operating stroke (s_{eff}). This maximum travel range (s_{max}) is the parameter to be stated when ordering the cylinder.

Please note information on the short stroke in the “Operating conditions and application” section



For structural design reasons the overall length of the cylinder is greater than the maximum travel (s_{max}), as it includes the length of components such as the screw drive nut or the bearings, in addition to the travel.



The cylinder can be adapted to the available installation space by mounting the motor as an extension to the axis (motor mount and coupling) or parallel to the axis (timing belt side drive). The type of motor attachment chosen also has an effect on the technical performance data and the selectable mounting methods.



6. Environmental conditions

The environment in which a cylinder is operated can have a significant effect on its service life. Both very high and very low temperatures can affect seals, lubrication and the performance of the motor. Abrasive dirt and chemicals can damage the seals and ultimately cause the screw drive to fail over the long term.

Please ask if your application involves special environmental conditions.

Motor-controller combination

Several motor-controller combinations are available in order to provide the most cost-effective solution for every customer application. When sizing the drive, always consider the motor-controller combination.

Notes on motors and controllers

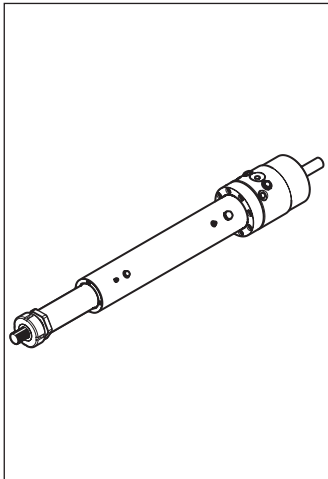
- ▶ The motors can be supplied complete with controllers and control systems
- ▶ For recommended motor-controller combinations, see the “Servo motors” section

Catalogs and information

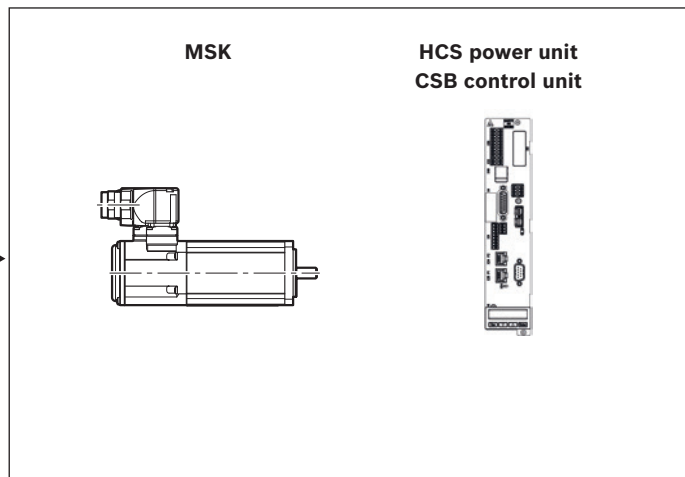
- ▶ Drive System Rexroth IndraDrive, R999000018
- ▶ Rexroth IndraDyn S Synchronous Motors MSK, R911296288
- ▶ Rexroth IndraDrive C Drive Controllers with HCS02 and HCS03, R911314904

Drive-based positioning

EMC-HD

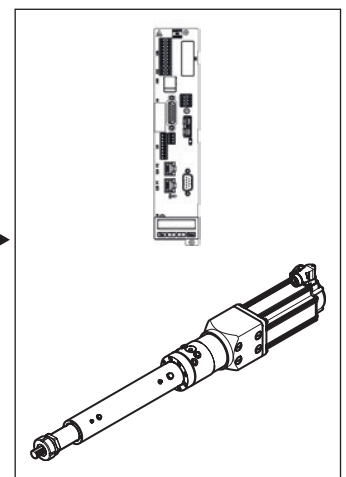


Servo motor



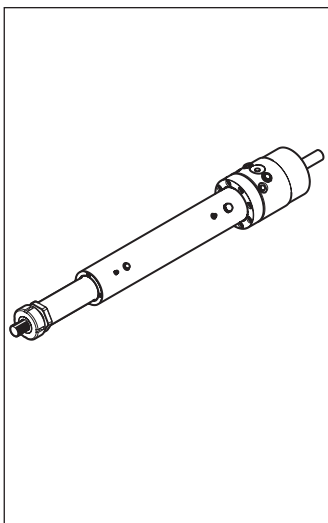
Digital controller

Complete system

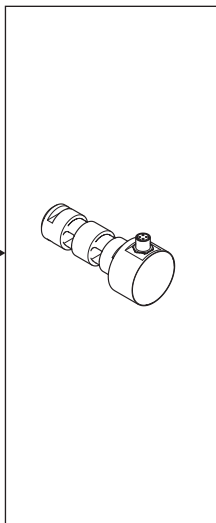


Force control

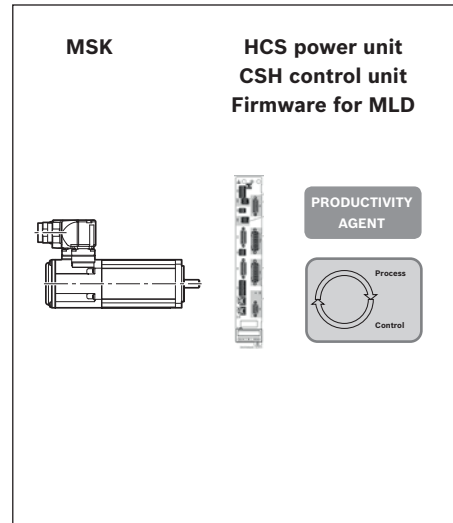
EMC-HD



Load measuring pin

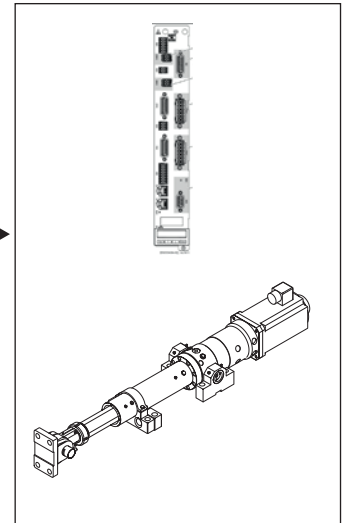


Servo motor



Digital controller with control unit

Complete system

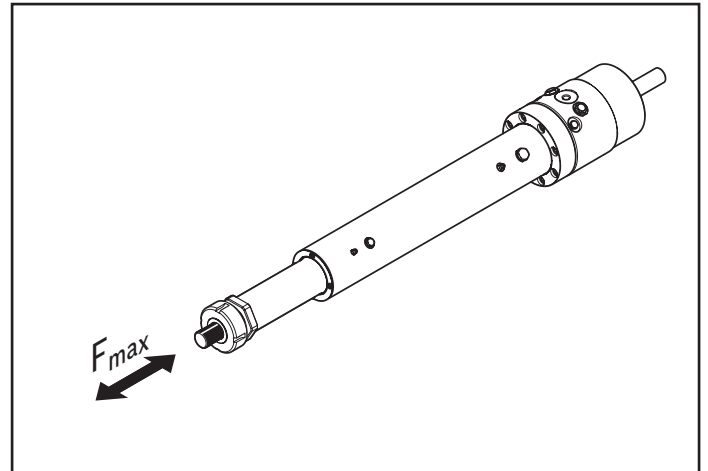


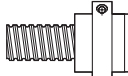

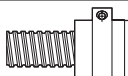

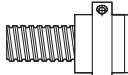

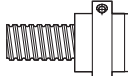

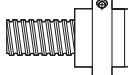
Load ratings and sizes

Note on dynamic load ratings

In relation to the desired service life, generally speaking an equivalent dynamic axial load of up to about 20% of the dynamic load rating (C) has proven effective. (see also service life graphs in the “Technical Data” section).

- ▶ Here the following must not be exceeded:
 - The maximum permissible drive torque
 - The maximum permissible load
 - The maximum permissible linear speed
 - The maximum permissible acceleration



EMC-HD	Drive unit	$d_0 \times P$ (mm)	C (N)	F_{max} (N)	$s_{max perm}$ (mm)	v_{max} (m/s)
085	PLSA 	30x5	87 000	44 000	700	0.42
		30x10	98 000	44 000		0.83
	BASA 	40x10	72 000	44 000		0.63
		40x20	95 000	38 000		1.00
105	PLSA 	39x5	122 000	65 000	1 000	0.32
		39x10	140 000	76 000		0.64
	BASA 	50x10	79 000	65 000		0.50
		50x20	111 000	56 000		1.00
125	PLSA 	48x5	188 000	95 000	1 200	0.26
		48x10	211 000	110 000		0.52
	BASA 	63x10	88 000	88 000		0.40
		63x20	130 000	85 000		0.80
150	PLSA ¹⁾ 	60x10	In preparation		1 500	
		60x20				
	BASA 	80x20	262 700	115 000		0.50
180	PLSA 	75x10	470 000	250 000	1 700	0.33
		75x20	470 000	290 000		0.67

¹⁾ In preparation

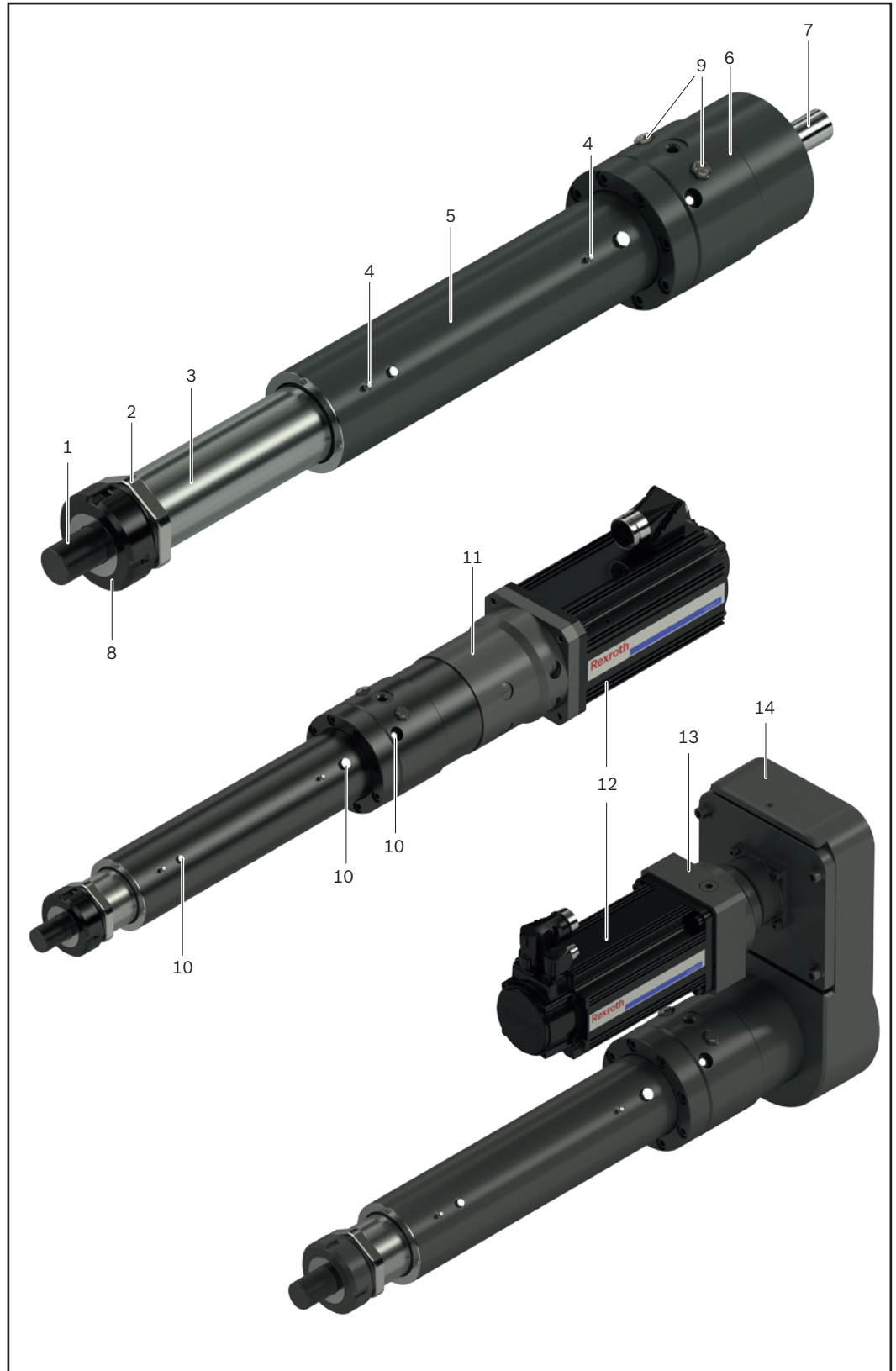
- C = dynamic load rating
- d_0 = diameter of screw drive
- F_{max} = maximum permissible axial force
- BASA = Ball Screw Assembly
- PLSA = Planetary Screw Assembly
- P = screw drive lead
- $s_{max perm}$ = maximum permissible linear travel
- v_{max} = maximum speed

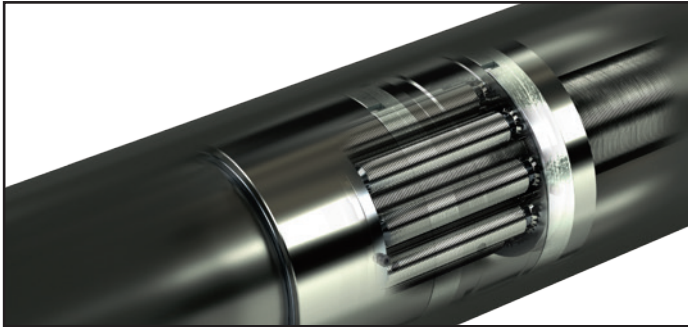
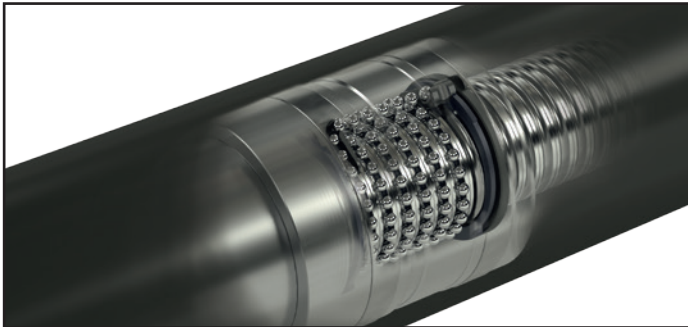
Structural design

- 1** Threaded bolt
(steel, burnished)
- 2** Wrench flats, only for
version "round piston
rod" (steel, galvanized)
- 3** Piston rod
(steel, chrome-plated)
- 4** Lube nipple
(steel, galvanized)
- 5** Housing
(steel, black painted)
- 6** Bearing housing
(steel, black painted or
galvanized)
- 7** Drive journal (steel)
- 8** Lock nut
(steel, black galvanized)
- 9** Air compensation
(bronze)
- 10** Mounting thread for
switch (with locking
screw steel, galvanized)

Attachment parts

- 11** Motor mount and coupling
- 12** Motor
- 13** Gear
- 14** Timing belt side drive



Version with Planetary Screw Assembly PLSA**Version with Ball Screw Assembly BASA****Guide with round piston rod****Guide with integrated anti rotation feature****Screw drive**

The EMC-HD is available with a planetary or ball screw assembly.

- ▶ In the case of planetary screw assemblies, several planets are positioned in a rotationally symmetric manner inside a nut. They rotate parallel to the axis of a screw and generate linear motion. The numerous contact areas inherent in this system design result in high axial rigidity and load-bearing capacity and thus provide for a long service life. Planetary screw assemblies achieve very high positioning accuracy and repeatability even in case of minimal traversing movements.
- ▶ In ball screw assemblies, balls provide the rolling contact. The high leads allow for highly dynamic applications while assuring high mechanical efficiency so that little heat is generated. The low lubricant consumption ensures service intervals are long. The use of multi-start screws and a large number of ball track turns in the nut of the ball screw results in high load ratings and therefore a long service life.

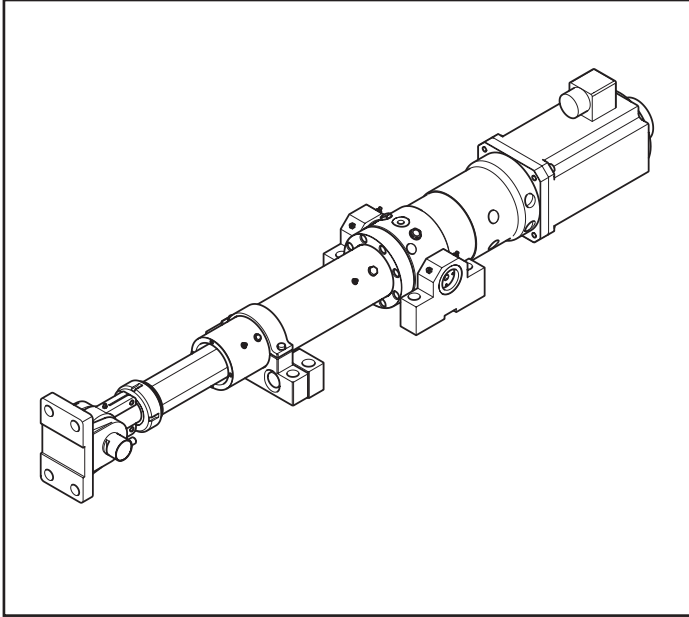
Anti rotation feature

The EMC-HD is available with or without a piston rod anti rotation feature.

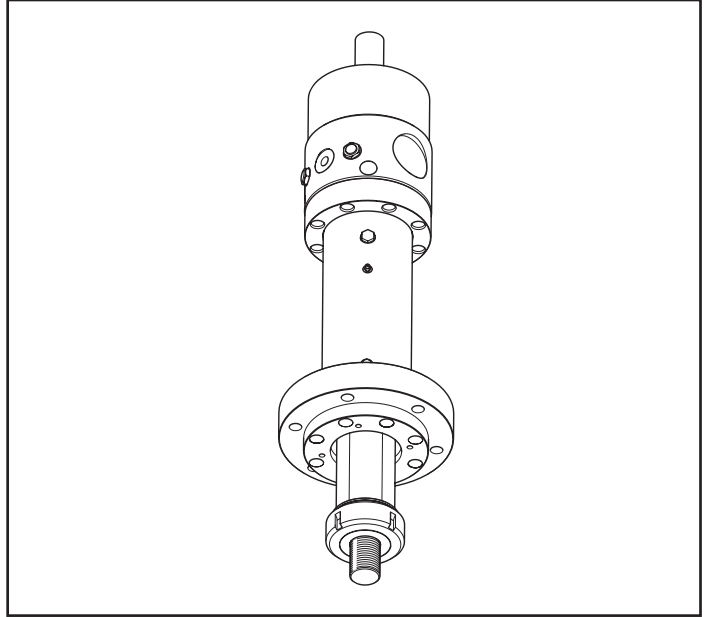
- ▶ On the cost-optimized basic version with round piston rod, the piston rod can still rotate during installation and as a result easily extended and retracted manually. To ensure correct linear motion in operation, the piston rod must be secured externally against rotation (e.g. by fastening it to a linear guide). The torque to be absorbed corresponds to the drive torque at the drive journal of the screw drive (see the “Design calculations” section).
- ▶ The integrated anti rotation feature is used if external absorption of the torque is not possible (e.g. when space is limited or if the piston rod extends freely into the working zone). The anti rotation feature is realized by means of four guide surfaces on the piston rod and a sliding guide at the head end of the housing.

Installation examples

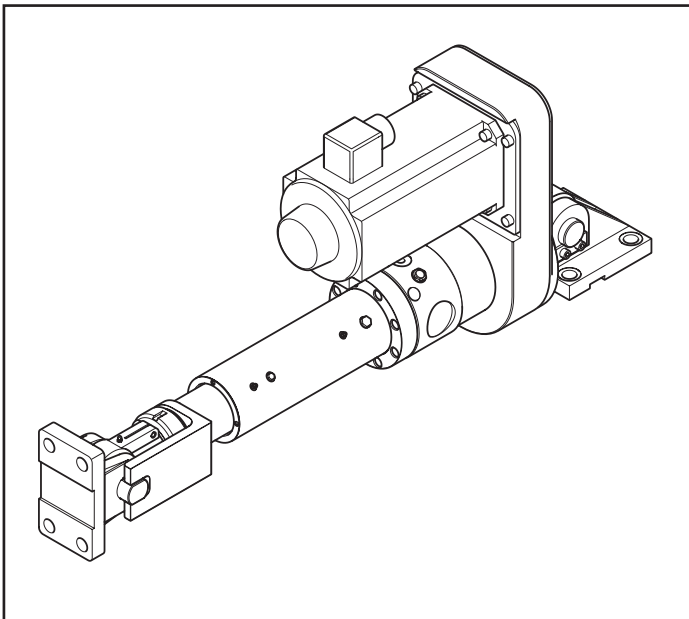
Installation with trunnion bearing blocks and foot mounting, non-swiveling



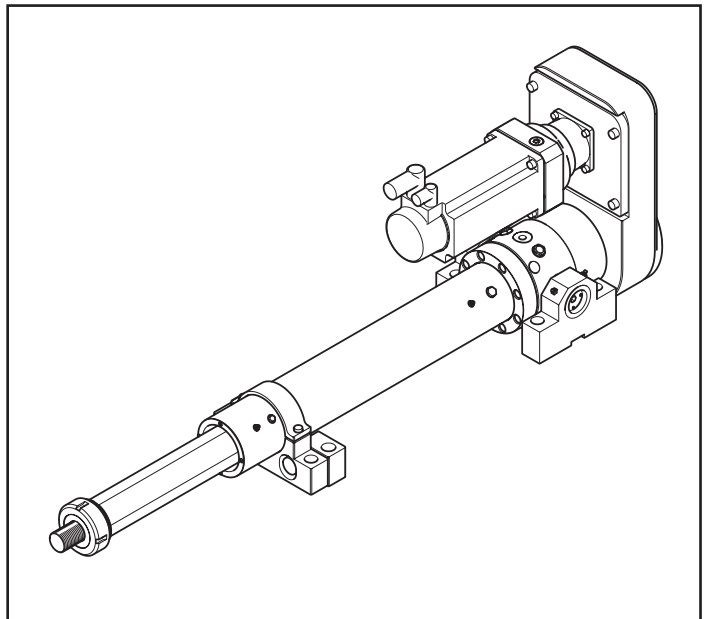
Installation with round flange only possible vertically, non-swiveling



Installation with bearing block form A and B, swiveling



Installation with trunnion bearing blocks, Piston rod not guided, foot mounting required, non-swiveling



Technical data

Dimensions, load capacities, maximum forces and masses

EMC-HD	PLSA		BASA		C (N)	F _{max} (N)	S _{min} (mm)	S _{max perm} ¹⁾ (mm)	L _{ad} (mm)	m _s		m _{ca}	
	d ₀ xP (mm)	d ₀ xP (mm)	k _{g fix} (kg)	k _{g var} (kg/mm)						m _{ca fix} (kg)	m _{ca var} (kg/mm)		
085	30x5	–	87 000	44 000	85	700	352	30	0.030	6.2	0.011		
	30x10	–	98 000	44 000	85	700	352	30	0.030	6.2	0.011		
	–	40x10	72 000	44 000	110	700	352	30	0.033	6.2	0.011		
	–	40x20	95 000	38 000	230	700	370	30	0.033	6.2	0.011		
105	39x5	–	123000	65 000	110	1 000	404	44	0.030	11.0	0.015		
	39x10	–	140000	76 000	110	1 000	404	44	0.030	11.0	0.015		
	–	50x10	79000	65 000	110	1 000	394	44	0.047	11.0	0.015		
	–	50x20	111000	56 000	115	1 000	416	44	0.047	11.0	0.015		
125	48x5	–	188 000	95 000	130	1 200	442	70	0.060	16.5	0.025		
	48x10	–	211 000	110 000	130	1 200	442	70	0.060	16.5	0.025		
	–	63x10	88 000	88 000	170	1 200	405	70	0.068	16.5	0.025		
	–	63x20	130 000	85 000	230	1 200	427	70	0.068	16.5	0.025		
150	60x10 ²⁾	–											
	60x20 ²⁾	–											
	–	80x20	262 000	115 000	170	1 500	586	115	0.103	32.0	0.036		
180	75x10	–	470 000	250 000	190	1 700	677	206	0.135	53.0	0.058		
	75x20	–	470 000	290 000	190	1 700	677	206	0.135	53.0	0.058		

¹⁾ For non-standard strokes, please contact Bosch Rexroth.

²⁾ In preparation

Mass of the EMC-HD

Weight calculation without motor and without motor attachment*)

$$m_s = k_{g \text{ fix}} + k_{g \text{ var}} \cdot s_{\text{max}}$$

Weight calculation without motor with timing belt side drive including gear unit (optional)*)

$$m_s = k_{g \text{ fix}} + k_{g \text{ var}} \cdot s_{\text{max}} + m_{\text{sd}}$$

Weight calculation without motor with motor mount and coupling including gear unit (optional)*)

$$m_s = k_{g \text{ fix}} + k_{g \text{ var}} \cdot s_{\text{max}} + m_c$$

Moved mass of system*)

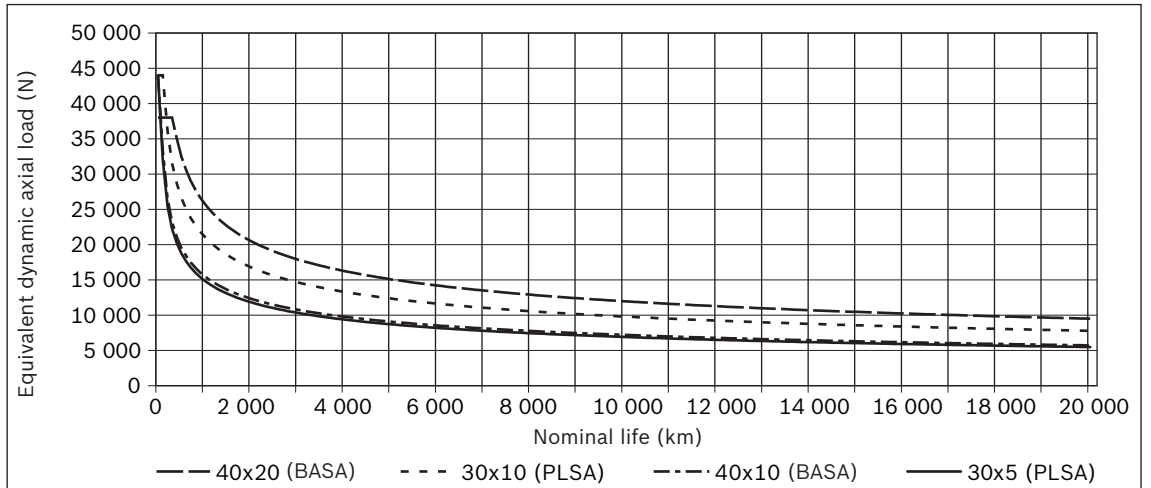
$$m_{\text{ca}} = m_{\text{ca fix}} + m_{\text{ca var}} \cdot s_{\text{max}}$$

*) When calculating the mass of the entire system, additionally the masses of the attachments/mounting elements must also be taken into account.

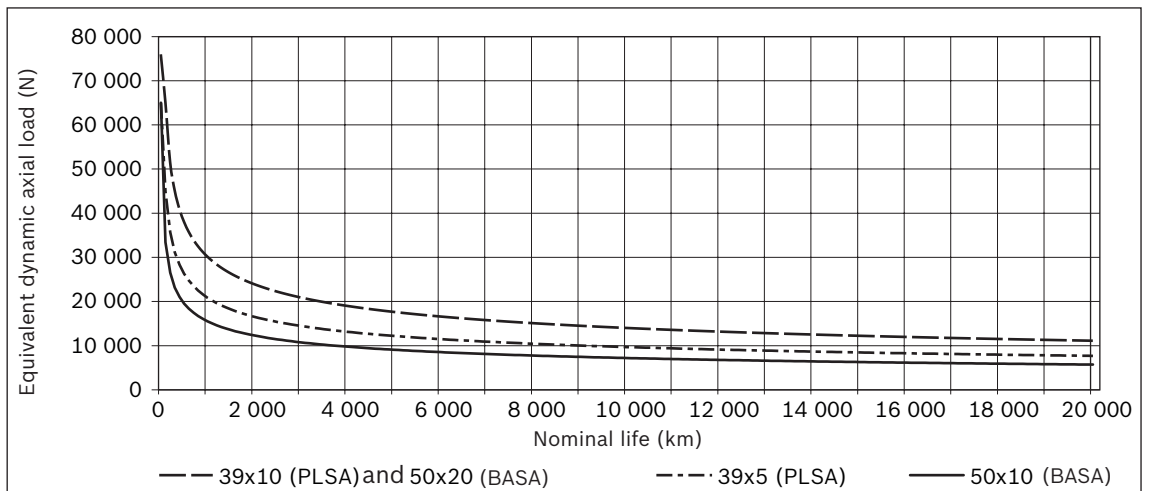
C	= dynamic load rating	(N)	m _{ca var}	= constant of the variable-length portion of the moved mass of system	(kg/mm)
d ₀	= diameter of the screw drive	(mm)	m _s	= mass of EMC-HD	(kg)
F _{max}	= maximum permissible axial force	(N)	m _{sd}	= mass of timing belt side drive	(kg)
BASA	= Ball Screw Assembly		P	= screw drive lead	(mm)
k _{g fix}	= constant for the fixed-length portion of the mass	(kg)	PLSA	= Planetary Screw Assembly	
k _{g var}	= constant for the variable-length portion of the mass	(kg/mm)	S _e	= excess travel	(mm)
L	= overall length (without piston rod)	(mm)	S _{eff}	= effective stroke	(mm)
L _{ad}	= additional length	(mm)	S _{min}	= minimum travel range	(mm)
m _c	= mass of motor mount and coupling	(kg)	S _{max}	= maximum travel range	(mm)
m _{ca}	= moved mass of system	(kg)	S _{max perm}	= maximum permissible travel	(mm)
m _{ca fix}	= constant for the fixed-length portion of the moved mass of system	(kg)			

Technical data

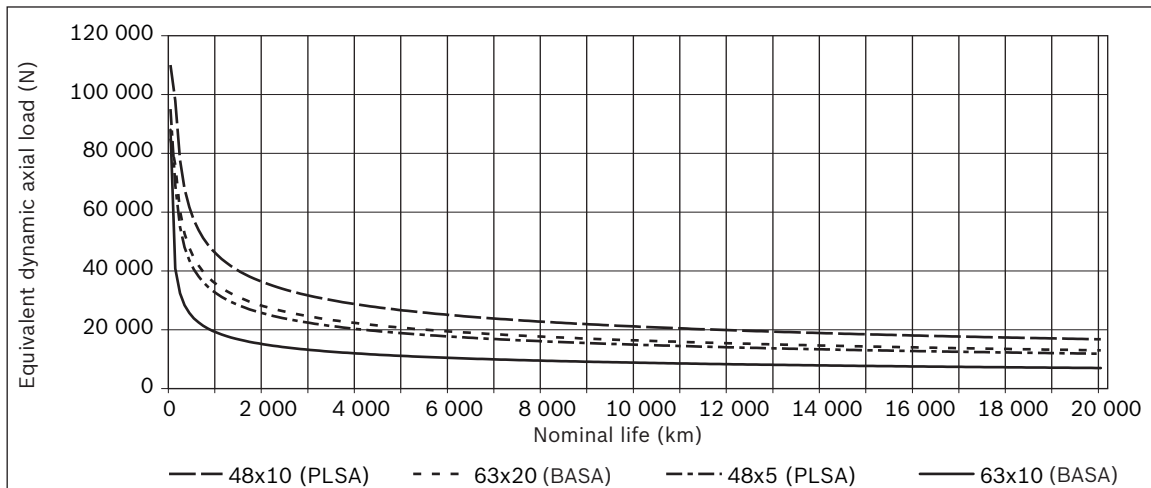
Service life EMC-085-HD



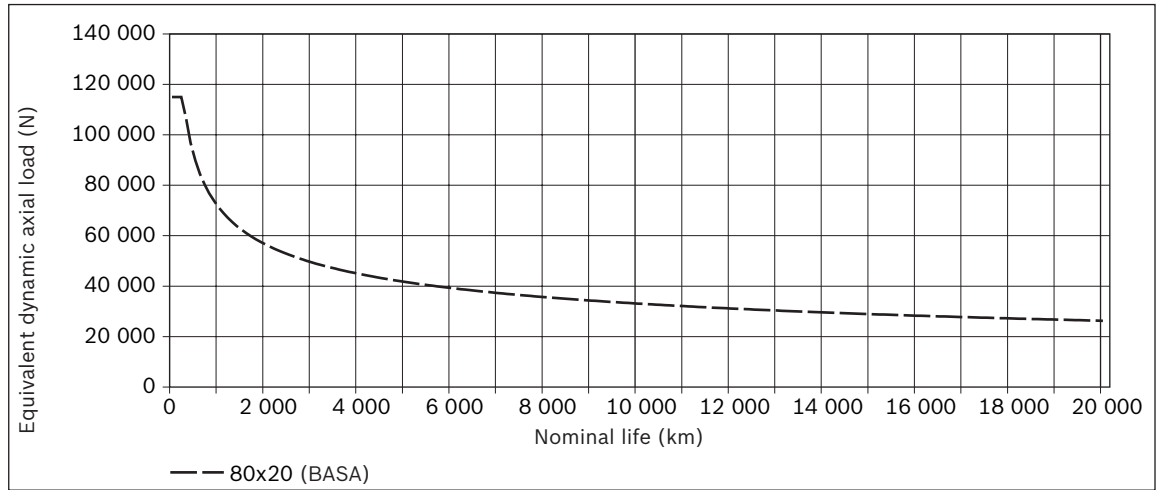
EMC-105-HD



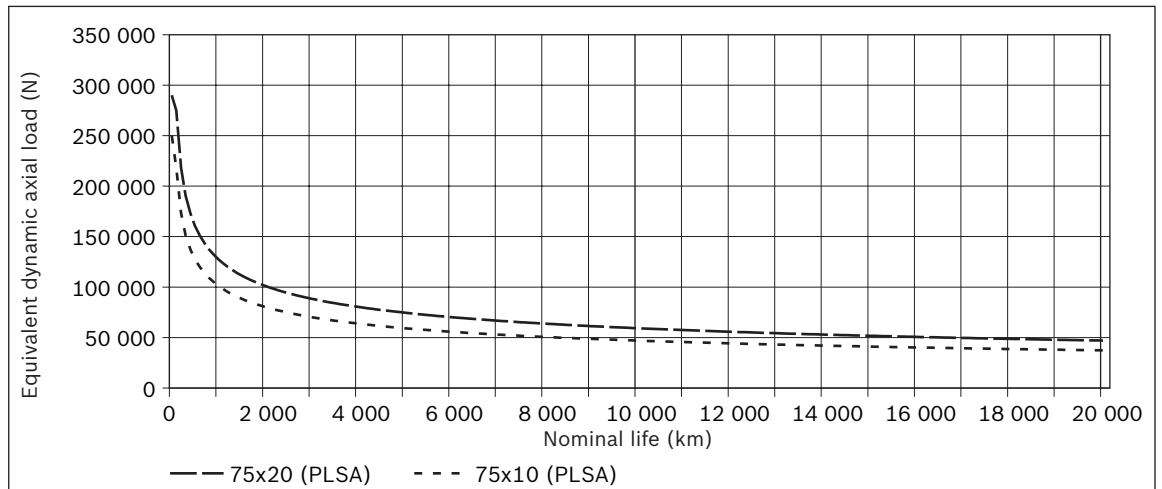
EMC-125-HD



EMC-150-HD



EMC-180-HD



The stated values apply on compliance with the specified relubrication intervals and for standard operation
 For short stroke operation (stroke < s_{min}) reduction factors must be considered.
 (see the “Operating conditions and application” section).
 For calculation of the equivalent dynamic axial load F_m see the “Calculation principles” section.

Technical data

Drive data

EMC-HD	PLSA $d_0 \times P$ (mm)	BASA $d_0 \times P$ (mm)	F_{max} (N)	M_p (Nm)	v_{max} (m/s)	n_p (rpm)	a_{max} (m/s ²)	M_{Rs} (Nm)	
085	30x5	–	44 000	44	0.42	5 040	30	3.5	
	30x10	–	44 000	88	0.83	4 980	30	4.0	
	–	40x10	44 000	78	0.63	3 780	16	4.0	
	–	40x20	38 000	134	1.00	3 000	33	4.5	
105	39x5	–	65 000	65	0.32	3 850	30	9.0	
	39x10	–	76 000	151	0.64	3 850	30	9.0	
	–	50x10	65 000	115	0.50	3 000	12	7.5	
	–	50x20	56 000	198	1.00	3 000	22	7.5	
125	48x5	–	95 000	94	0.26	3 120	30	8.0	
	48x10	–	110 000	219	0.52	3 120	30	8.0	
	–	63x10	88 000	156	0.40	2 400	8.5	8.0	
	–	63x20	85 000 ¹⁾	301	0.80	2 400	15	9.0	
150	60x10 ⁴⁾	–	In preparation						
	60x20 ⁴⁾	–	In preparation						
	–	80x20	115 000	407	0.50	1 875	6.9	12.5	
180	75x10	–	250 000	497	0.33	2 000	30	17.0	
	75x20	–	290 000	1 154	0.67	2 000	30	19.0	

¹⁾ When using timing belt side drives only possible up to 62 000 N

²⁾ For version with anti rotation feature

³⁾ Calculated for 25 °C ambient temperature

⁴⁾ In preparation

a_{max} = maximum permissible acceleration

d_0 = diameter of screw drive

F_{max} = maximum permissible axial force

$k_{J \text{ fix}}$ = constant for fixed-length portion of mass moment of inertia

$k_{J \text{ var}}$ = constant for length-variable portion of mass moment of inertia

$k_{J \text{ m}}$ = constant for mass-specific portion of mass moment of inertia

i = gear ratio

m_c = mass of motor mount and coupling including gear unit

M_p = maximum permissible drive torque

M_{Rs} = frictional torque of EMC-HD

n_p = maximum permissible rotary speed of EMC-HD

P = screw drive lead

v_{max} = maximum permissible speed

η = mechanical efficiency

	$k_{J \text{ fix}}$	$k_{J \text{ var}}$	$k_{J \text{ m}}$	Backlash of screw drive (μm)	Max. perm. piston rod twist angle ²⁾ ($^{\circ}$)	Perm. transmitted power ³⁾ (W)	η
	206	0.628	0.633	30	± 1.5	430	0.8
	216	0.643	2.533	30	± 1.5	430	0.8
	456	1.383	2.533	0	± 1.5	1 100	0.9
	527	1.463	10.132	0	± 1.5	2 000	0.9
	712	1.775	0.633	30	± 1.5	440	0.8
	733	1.810	2.533	30	± 1.5	480	0.8
	1 456	3.616	2.533	0	± 1.5	1 100	0.9
	1 491	3.632	10.132	0	± 1.5	2 000	0.9
	2 046	4.104	0.633	30	± 1.5	460	0.8
	2 065	4.125	2.533	30	± 1.5	540	0.8
	4 459	9.645	2.533	0	± 1.5	1 100	0.9
	4 704	9.645	10.132	0	± 1.5	2 000	0.9
	12 843	21.475	10.132	0	± 1.5	2 000	0.9
	16 529	24.436	2.533	30	± 1.5	970	0.8
	16 550	24.527	10.132	30	± 1.5	1 240	0.8

Technical data

Drive data for motor attachment via flange and coupling

EMC-HD	d _{0xP} (mm)	Attachment for motor (optionally with gear unit)	Motor attachment option	i	Motor mount and coupling incl. gear unit											
					F _{max} (N)	M _p ¹⁾ (Nm)	v _{max} (m/s)	n _p ²⁾ (min ⁻¹)	η	M _{Rs} (Nm)	k _J fix	k _J var	k _J m	m _c (kg)	a _{max} (m/s ²)	
085	30x5	MSK071	01	1	44 000	44.0	0.42	5 000	0.80	6.00	1 106.0	0.628	0.633	5.0	30	
		MSK100/101	02/03	1	44 000	44.0	0.42	5 000	0.80	6.00	1 106.0	0.628	0.633	6.6		
		MSK071/101	06/07	3	44 000	15.4	0.13	4 500	0.76	5.50	1 232.9	0.070	0.070	14.3		
		MSK071	16	5	44 000	9.3	0.08	4 500	0.76	3.60	1 012.2	0.025	0.025	12.7		
	30x10	MSK071	01	1	44 000	88.0	0.83	5 000	0.80	6.00	1 116.0	0.643	2.533	5.0		
		MSK100/101	02/03	1	44 000	88.0	0.83	5 000	0.80	6.00	1 116.0	0.643	2.533	6.6		
		MSK071/101	06/07	3	44 000	30.9	0.25	4 500	0.76	5.50	1 234.0	0.071	0.281	14.3		
		MSK071	16	5	44 000	18.5	0.15	4 500	0.76	3.60	1 012.6	0.026	0.101	12.7		
	40x10	MSK071	01	1	44 000	78.0	0.63	3 750	0.90	5.00	1 356.0	1.383	2.533	5.0		16
		MSK100/101	02/03	1	44 000	78.0	0.63	3 750	0.90	5.00	1 356.0	1.383	2.533	6.6		
		MSK071/101	06/07	3	44 000	27.4	0.25	4 500	0.86	5.17	1 260.7	0.154	0.281	14.3		
		MSK071	16	5	44 000	16.4	0.15	4 500	0.86	3.40	1 022.2	0.055	0.101	12.7		
	40x20	MSK071	01	1	38 000	134.0	1.00	3 000	0.90	5.00	1 427.0	1.463	10.132	5.0		33
		MSK100/101	02/03	1	38 000	134.0	1.00	3 000	0.90	5.00	1 427.0	1.463	10.132	6.6		
		MSK071/101	06/07	3	38 000	47.0	0.50	4 500	0.86	5.17	1 268.6	0.163	1.126	14.3		
		MSK 071	16	5	38 000	28.2	0.30	4 500	0.86	3.40	1 025.1	0.059	0.405	12.7		
105	39x5	MSK071	01	1	65 000	64.7	0.32	3 846	0.80	9.00	2 632.6	1.7754	0.633	6.1	30	
		MSK100/101	02/03	1	65 000	64.7	0.32	3 846	0.80	9.00	2 632.6	1.7754	0.633	7.9		
		MSK071	06	3	65 000	22.7	0.13	4 500	0.76	6.50	1 402.5	0.1973	0.070	13.8		
		MSK101	12	4	65 000	17.0	0.09	4 500	0.76	4.95	1 174.5	0.1110	0.040	15.6		
		MSK071	16	5	65 000	13.6	0.08	4 500	0.76	4.20	1 073.3	0.0710	0.025	13.8		
		MSK071	26	7	65 000	9.7	0.05	4 500	0.76	2.89	989.7	0.0362	0.013	13.8		
	39x10	MSK071	01	1	76 000	151.2	0.64	3 846	0.80	9.00	2 653.5	1.8096	2.533	6.1		
		MSK100/101	02/03	1	76 000	151.2	0.64	3 846	0.80	9.00	2 653.5	1.8096	2.533	7.9		
		MSK071	06	3	76 000	53.1	0.25	4 500	0.76	6.50	1 404.8	0.2011	0.281	13.8		
		MSK101	12	4	76 000	39.8	0.19	4 500	0.76	4.95	1 175.8	0.1131	0.158	15.6		
		MSK071	16	5	76 000	31.8	0.15	4 500	0.76	4.20	1 074.1	0.0724	0.101	13.8		
		MSK071	26	7	76 000	22.7	0.11	4 500	0.76	2.89	990.2	0.0369	0.052	13.8		
	50x10	MSK071	01	1	65 000	114.9	0.50	3 000	0.90	7.50	3 376.3	3.6166	2.533	6.1		12
		MSK100/101	02/03	1	65 000	114.9	0.50	3 000	0.90	7.50	3 376.3	3.6166	2.533	7.9		
		MSK071	06	3	65 000	40.3	0.25	4 500	0.86	6.00	1 485.1	0.4018	0.281	13.8		
		MSK101	12	4	65 000	30.2	0.19	4 500	0.86	4.58	1 221.0	0.2260	0.158	15.6		
		MSK071	16	5	65 000	24.2	0.15	4 500	0.86	3.90	1 103.1	0.1447	0.101	13.8		
		MSK071	26	7	65 000	17.3	0.11	4 500	0.86	2.67	1 004.9	0.0738	0.052	13.8		
	50x20	MSK071	01	1	56 000	198.1	1.00	3 000	0.90	7.50	3 411.5	3.6324	10.132	6.1		22
		MSK100/101	02/03	1	56 000	198.1	1.00	3 000	0.90	7.50	3 411.5	3.6324	10.132	7.9		
		MSK071	06	3	56 000	69.5	0.50	4 500	0.86	6.00	1 489.1	0.4036	1.126	13.8		
		MSK101	12	4	56 000	52.1	0.38	4 500	0.86	4.58	1 223.2	0.2270	0.633	15.6		
		MSK071	16	5	56 000	41.7	0.30	4 500	0.86	3.90	1 104.5	0.1453	0.405	13.8		
		MSK071	26	7	56 000	29.8	0.21	4 500	0.86	2.67	1 005.6	0.0741	0.207	13.8		

Note:

All data is given for the complete mechanical drive chain (EMC-HD with motor mount and coupling) at the reference point motor shaft. Actual results depend on the selected motor-controller combination. The engine torque might need to be limited.

EMC-HD	d ₀ xP (mm)	Attachment for motor (optionally with gear unit)	Motor attachment option	Motor mount and coupling incl. gear unit												
				i	F _{max} (N)	M _p ¹⁾ (Nm)	v _{max} (m/s)	n _p ²⁾ (min ⁻¹)	η	M _{Rs} (Nm)	k _{J fix}	k _{J var}	k _{J m}	m _c (kg)	a _{max} (m/s ²)	
125	48x5	MSK100	02	1	95 000	94.5	0.26	3 120	0.80	7.50	3 966.0	4.104	0.633	6.8	30	
		MSK101	03	1	95 000	94.5	0.26	3 120	0.80	7.50	4 136.0	4.104	0.633	6.9		
		MSK100	06	3	95 000	33.2	0.13	4 500	0.76	6.00	1 569.6	0.456	0.070	14.5		
		MSK101	07	3	95 000	33.2	0.11	4 000	0.76	10.10	1 949.6	0.456	0.070	24.1		
		MSK071	16	5	95 000	19.9	0.08	4 500	0.76	3.90	1 126.6	0.164	0.025	14.2		
	48x10	MSK100	02	1	110 000	218.8	0.52	3 120	0.80	8.00	3 985.0	4.125	2.533	6.8		
		MSK101	03	1	110 000	218.8	0.52	3 120	0.80	8.00	4 155.0	4.125	2.533	6.9		
		MSK100	06	3	110 000	76.8	0.25	4 500	0.76	6.17	1 571.7	0.458	0.281	14.5		
		MSK101	07	3	110 000	76.8	0.22	4 000	0.76	10.27	1 951.7	0.458	0.281	24.1		
		MSK071	16	5	110 000	46.1	0.15	4 500	0.76	4.00	1 127.4	0.165	0.101	14.2		
	63x10	MSK100	02	1	88 000	155.6	0.40	2 400	0.90	8.00	6 379.0	9.645	2.533	6.8	8.5	
		MSK101	03	1	88 000	155.6	0.40	2 400	0.90	8.00	6 549.0	9.645	2.533	6.9		
		MSK100	06	3	88 000	54.6	0.25	4 500	0.86	6.17	1 837.7	1.072	0.281	14.5		
		MSK101	07	3	88 000	54.6	0.22	4 000	0.86	10.27	2 217.7	1.072	0.281	24.1		
		MSK071	16	5	88 000	32.8	0.15	4 500	0.86	4.00	1 223.2	0.386	0.101	14.2		
	63x20	MSK100	02	1	62 200	220.0	0.80	2 400	0.90	9.00	6 624.0	9.645	10.132	6.8	15	
		MSK101	03	1	85 000	300.6	0.80	2 400	0.90	9.00	6 794.0	9.645	10.132	6.9		
		MSK100	06	3	62 200	77.2	0.50	4 500	0.86	6.50	1 864.9	1.072	1.126	14.5		
		MSK101	07	3	85 000	105.5	0.44	4 000	0.86	10.60	2 244.9	1.072	1.126	24.1		
		MSK071	16	5	62 200	46.3	0.30	4 500	0.86	4.20	1 233.0	0.386	0.405	14.2		
150	60x10 ³⁾															
	60x20 ³⁾															
80x20	MSK101	03	1	96 133	340.0	0.50	1 500	0.90	12.50	17 372.6	21.4752	10.132	17.5	6.9		
	MSK133	04	1	115 000	406.7	0.50	1 500	0.90	12.50	17 982.6	21.4752	10.132	18.7			
	MSK101	12	4	115 000	107.0	0.33	4 000	0.86	8.93	2 308.9	1.3422	0.633	35.4			
	MSK101	17	5	115 000	85.6	0.27	4 000	0.86	7.20	1 803.3	0.8590	0.405	35.4			
	MSK101	13	4	115 000	107.0	0.29	3 500	0.86	14.13	6 880.2	1.3422	0.633	60.4			
	MSK101	18	5	115 000	85.6	0.23	3 500	0.86	11.50	5 023.7	0.8590	0.405	60.4			
	MSK101	27	7	115 000	61.2	0.17	3 500	0.86	8.59	3 359.6	0.4383	0.207	60.4			

1) Torque may be limited by the maximum torque of the motor.
 2) Rotary speed may be limited by the maximum speed of the motor.
 3) In preparation

Technical data

Drive data for motor attachment via flange and coupling

EMC-HD	d ₀ xP (mm)	Attachment for motor (optionally with gear unit)	Motor attachment option	i	Motor mount and coupling incl. gear unit										
					F _{max} (N)	M _p ¹⁾ (Nm)	v _{max} (m/s)	n _p ²⁾ (min ⁻¹)	η	M _{Rs} (Nm)	k _J fix	k _J var	k _J m	m _c (kg)	a _{max} (m/s ²)
180	75x10	MSK101	03	1	250 000	497.4	0.33	2 000	0.80	17.00	59 610.4	24.4358	2.533	27.1	30
		MSK133	04	1	250 000	497.4	0.33	2 000	0.80	17.00	59 610.4	24.4358	2.533	28.3	
		MSK101	07	3	250 000	174.5	0.19	3 500	0.76	19.67	11 703.4	2.7151	0.281	61.1	
		MSK101	17	5	250 000	104.7	0.12	3 500	0.76	12.40	5 174.4	0.9774	0.101	61.1	
		MSK101	27	7	250 000	74.8	0.08	3 500	0.76	9.23	3 436.5	0.4987	0.052	61.1	
		MSK133	08	3	250 000	170.9	0.19	3 500	0.78	23.67	16 445.8	2.7151	0.281	69.1	
		MSK133	18	5	250 000	102.5	0.12	3 500	0.78	12.90	7 346.9	0.9774	0.101	69.1	
	75x20	MSK101	03	1	133 204	530.0	0.67	2 000	0.80	19.00	59 874.4	24.5272	10.132	27.1	
		MSK133	04	1	163 363	650.0	0.67	2 000	0.80	19.00	59 874.4	24.5272	10.132	28.3	
		MSK101	07	3	178 442	249.1	0.39	3 500	0.76	20.33	11 732.7	2.7252	1.126	61.1	
		MSK101	17	5	178 442	149.5	0.23	3 500	0.76	12.80	5 185.0	0.9811	0.405	61.1	
		MSK101	27	7	178 442	106.8	0.17	3 500	0.76	9.51	3 441.9	0.5006	0.207	61.1	
		MSK133	08	3	290 000	396.5	0.39	3 500	0.78	24.33	16 475.1	2.7252	1.126	69.1	
		MSK133	18	5	290 000	237.9	0.23	3 500	0.78	13.30	7 357.5	0.9811	0.405	69.1	

¹⁾ Torque may be limited by the maximum torque of the motor.

²⁾ Rotary speed may be limited by the maximum speed of the motor.

Note:

All data is given for the complete mechanical drive chain (EMC-HD with motor mount and coupling) at the reference point motor shaft. Actual results depend on the selected motor-controller combination.
The engine torque might need to be limited.

Technical data

Drive data for motor attachment via timing belt side drive

EMC-HD	d ₀ xP (mm)	Attachment for motor (optionally with gear unit)	Motor attachment option	i ¹⁾	Timing belt side drive incl. gear unit												
					F _{max} (N)	M _p ²⁾ (Nm)	v _{max} (m/s)	n _p ³⁾ (min ⁻¹)	η	M _{Rs} (Nm)	k _J fix	k _J var	k _J m	m _{sd} (kg)	a _{max} (m/s ²)		
085	30x5	MSK071/100/101	40/41/42	1.5	44 000	30.1	0.42	7 560	0.78	5.33	3 621.6	0.2791	0.281	16.0	30		
			MSK071	50	4.5	44 000	10.6	0.08	4 500	0.74	5.28	1 512.4	0.0310	0.031		23.7	
			MSK071	70	7.5	44 000	6.3	0.05	4 500	0.74	3.47	1 112.9	0.0112	0.011		23.7	
	30x10	MSK071/100/101	40/41/42	1.5	44 000	60.2	0.83	7 470	0.78	5.67	3 626.0	0.2858	1.126	16.0			
			MSK071	50	4.5	44 000	21.1	0.17	4 500	0.74	5.39	1 512.9	0.0318	0.125		23.7	
			MSK071	70	7.5	44 000	12.7	0.10	4 500	0.74	3.53	1 113.0	0.0114	0.045		23.7	
	40x10	MSK071/100/101	40/41/42	1.5	44 000	53.5	0.63	5 670	0.87	5.67	3 732.7	0.6147	1.126	16.0		16	
			MSK071	50	4.5	44 000	18.8	0.17	4 500	0.83	5.39	1 524.7	0.0683	0.125			23.7
			MSK071	70	7.5	44 000	11.3	0.10	4 500	0.83	3.53	1 117.3	0.0246	0.045			23.7
	40x20	MSK071/100/101	40/41/42	1.5	38 000	92.1	1.00	4 500	0.87	6.00	3 764.2	0.6502	4.503	16.0	33		
			MSK071	50	4.5	38 000	32.3	0.33	4 500	0.83	5.50	1 528.2	0.0722	0.500		23.7	
			MSK071	70	7.5	38 000	19.4	0.20	4 500	0.83	3.60	1 118.6	0.0260	0.180		23.7	
105	39x5	MSK071/100/101	40/41/42	1.5	65 000	44.4	0.32	5 769	0.78	9.00	3 846.7	0.7891	0.281	16.0	30		
			MSK071	50	4.5	65 000	15.6	0.08	4 500	0.74	6.50	1 537.4	0.0877	0.031		23.7	
			MSK071	70	7.5	65 000	9.4	0.05	4 500	0.74	4.20	1 121.9	0.0316	0.011		23.7	
	39x10	MSK071/100/101	40/41/42	1.5	76 000	103.9	0.64	5 769	0.78	9.00	3 856.0	0.8043	1.126	16.0	30		
			MSK071	50	4.5	76 000	36.5	0.17	4 500	0.74	6.50	1 538.4	0.0894	0.125		23.7	
			MSK071	70	7.5	76 000	21.9	0.10	4 500	0.74	4.20	1 122.2	0.0322	0.045		23.7	
	50x10	MSK071/100/101	40/41/42	1.5	65 000	79.0	0.50	4 500	0.87	8.00	4 177.2	1.6074	1.126	16.0	12		
			MSK071	50	4.5	65 000	27.7	0.17	4 500	0.83	6.17	1 574.1	0.1786	0.125		23.7	
			MSK071	70	7.5	65 000	16.6	0.10	4 500	0.83	4.00	1 135.1	0.0643	0.045		23.7	
	50x20	MSK071/100/101	40/41/42	1.5	55 983	136.1	1.00	4 500	0.87	8.00	4 192.9	1.6144	4.503	16.0	22		
			MSK071	50	4.5	55 983	47.7	0.33	4 500	0.83	6.17	1 575.9	0.1794	0.500		23.7	
			MSK071	70	7.5	55 983	28.6	0.20	4 500	0.83	4.00	1 135.7	0.0646	0.180		23.7	
125	48x5	MSK100/101	41/42	1.5	95 000	64.9	0.26	4 680	0.78	9.60	11 329.3	1.8240	0.281	27.1	30		
			MSK100/101	51/52	4.5	95 000	22.8	0.08	4 500	0.74	6.70	2 368.8	0.2027	0.031		36.8	
			MSK071	70	7.5	95 000	13.7	0.05	4 500	0.74	4.32	1 421.2	0.0730	0.011		36.8	
	48x10	MSK100/101	41/42	1.5	110 000	150.4	0.52	4 680	0.78	9.93	11 337.8	1.8333	1.126	27.1			
			MSK100/101	51/52	4.5	110 000	52.8	0.17	4 500	0.74	6.81	2 369.8	0.2037	0.125		34.8	
			MSK071	70	7.5	110 000	31.7	0.10	4 500	0.74	4.39	1 421.5	0.0733	0.045		34.8	
	63x10	MSK100/101	41/42	1.5	88 000	107.0	0.84	7 560	0.87	9.93	12 401.8	4.2867	1.126	27.1		8.5	
			MSK100/101	51/52	4.5	88 000	37.5	0.17	4 500	0.83	6.81	2 488.0	0.4763	0.125			34.8
			MSK071	70	7.5	88 000	22.5	0.10	4 500	0.83	4.39	1 464.1	0.1715	0.045			34.8
	63x20	MSK100/101	41/42	1.5	62 000	164.9	0.80	3 600	0.87	10.60	12 510.7	4.2867	4.503	27.1	15		
			MSK100/101	51/52	4.5	62 000	72.5	0.33	4 500	0.83	7.03	2 500.1	0.4763	0.500		34.8	
			MSK071	70	7.5	62 000	43.5	0.20	4 500	0.83	4.52	1 468.4	0.1715	0.180		34.8	

Drive data for motor attachment via timing belt side drive

EMC-HD	d ₀ xP (mm)	Attachment for motor (optionally with gear unit)	Motor attachment option	i ¹⁾	Timing belt side drive incl. gear unit												
					F _{max} (N)	M _p ²⁾ (Nm)	v _{max} (m/s)	n _p ³⁾ (min ⁻¹)	η	M _{RS} (Nm)	k _{J fix}	k _{J var}	k _{J m}	m _{sd} (kg)	a _{max} (m/s ²)		
150	60x10 ⁴⁾																
	60x20 ⁴⁾																
	80x20	MSK101	42	1.5	67 858	164.9	0.50	2 250	0.87	16.33	25 877.8	9.5445	4.503	38.0	6.9		
		MSK101	51	4.5	115 000	98.1	0.30	4 000	0.83	13.04	4 365.3	1.0605	0.500	55.7			
		MSK101	71	7.5	115 000	58.9	0.18	4 000	0.83	7.97	2 135.1	0.3818	0.180	55.7			
		MSK101	52	4.5	115 000	98.1	0.26	3 500	0.83	19.44	7 955.3	1.0605	0.500	72.0			
MSK101		72	7.5	115 000	58.9	0.16	3 500	0.83	12.27	3 825.1	0.3818	0.180	72.0				
180	75x10	MSK101/133	42/43	1.5	201 052	274.9	0.33	3 000	0.78	26.33	65 566.4	10.8604	1.126	68.4	30		
		MSK101	51	4.5	250 000	119.9	0.15	4 000	0.74	16.38	8 775.2	1.2067	0.125	86.3			
		MSK101	71	7.5	250 000	72.0	0.09	4 000	0.74	9.97	3 722.7	0.4344	0.045	86.3			
		MSK101	52	4.5	250 000	119.9	0.13	3 500	0.74	22.78	12 365.2	1.2067	0.125	103.0			
		MSK133	53	4.5	250 000	119.9	0.13	3 500	0.74	22.78	13 105.2	1.2067	0.125	103.0			
		MSK101	72	7.5	250 000	72.0	0.08	3 500	0.74	14.27	5 412.7	0.4344	0.045	103.0			
	75x20	MSK101/133	42/43	1.5	100 526	274.9	0.67	3 000	0.78	27.67	65 575.6	10.9010	4.503	68.4			
		MSK101	51	4.5	135 485	130.0	0.30	4 000	0.74	16.82	8 776.2	1.2112	0.500	86.3			
		MSK101	71	7.5	229 282	132.0	0.18	4 000	0.74	10.23	3 723.0	0.4360	0.180	86.3			
		MSK101	52	4.5	290 000	278.3	0.26	3 500	0.74	23.22	12 366.2	1.2112	0.500	103.0			
		MSK133	53	4.5	290 000	278.3	0.26	3 500	0.74	23.22	13 106.2	1.2112	0.500	103.0			
		MSK101	72	7.5	290 000	167.0	0.16	3 500	0.74	14.53	5 413.0	0.4360	0.180	103.0			

¹⁾ Gear ratio of timing belt side drive and gear unit.

²⁾ Torque may be limited by the maximum torque of the motor.

³⁾ Rotary speed may be limited by the maximum speed of the motor.

⁴⁾ In preparation

Note:

All data is given for the complete mechanical drive chain (EMC-HD with timing belt side drive) at the motor shaft reference point.

Actual results depend on the selected motor-controller combination.

The engine torque might need to be limited.

a_{max} = maximum permissible acceleration

d₀ = diameter of screw drive

F_{max} = maximum permissible axial force

k_{J fix} = constant for fixed-length portion of mass moment of inertia

k_{J var} = constant for length-variable portion of mass moment of inertia

k_{J m} = constant for mass-specific portion of mass moment of inertia

i = gear ratio

M_p = maximum permissible drive torque

M_{RS} = frictional torque of EMC-HD

m_{sd} = mass of timing belt side drive including gear unit

n_p = maximum permissible rotary speed of EMC-HD

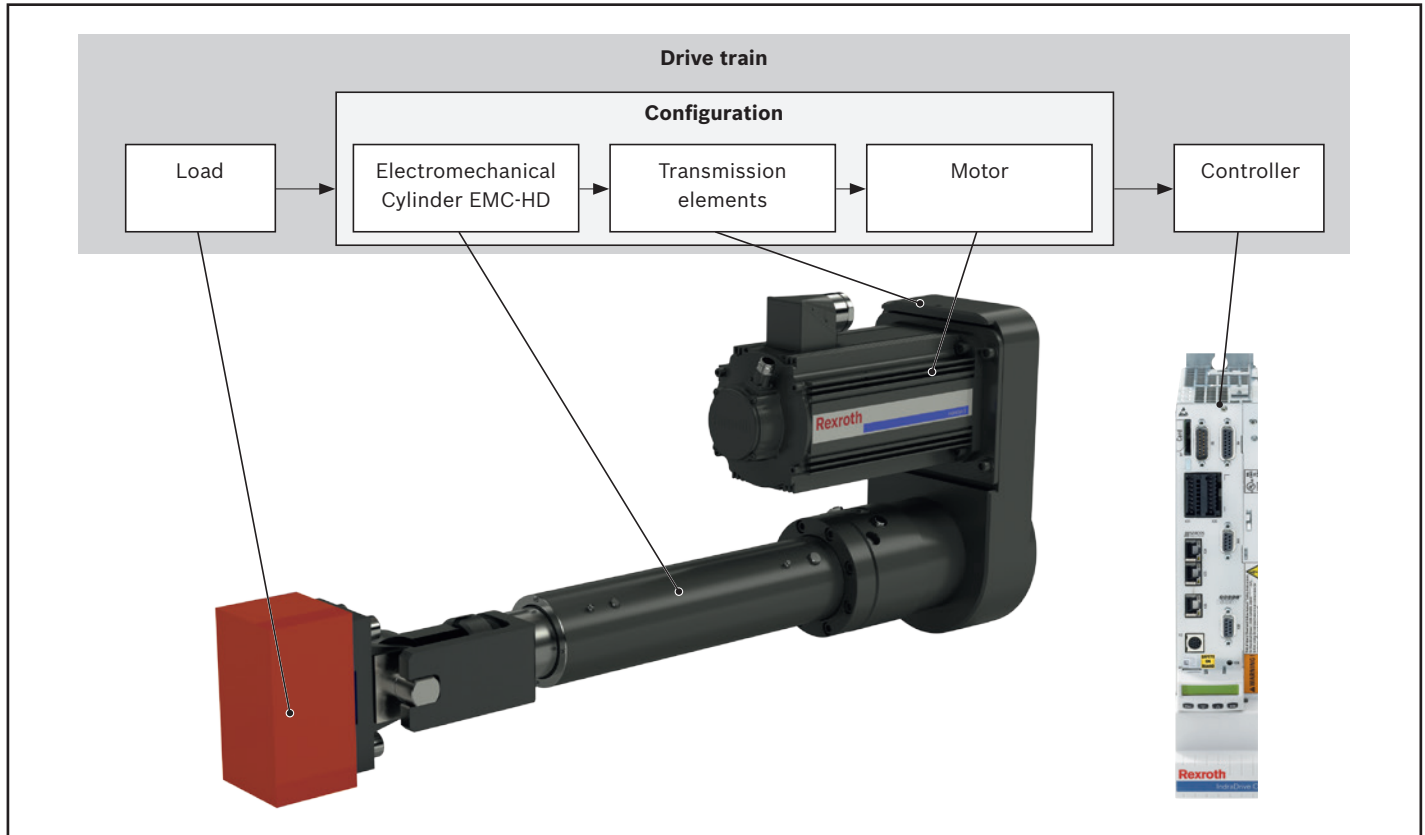
P = screw drive lead

v_{max} = maximum permissible linear speed

η = mechanical efficiency

Calculation principles

Drive train



The correct dimensioning and assessment of an application requires structured consideration of the drive train as a whole. The basic element of the drive train is the configuration – comprising the Electromechanical Cylinder EMC-HD, the transmission element (coupling or timing belt side drive) and the motor which can be ordered in that constellation as per the catalog.

Maximum permissible loads

When selecting of Electromechanical Cylinders EMC-HD, maximum limits for permissible loads and forces must be taken into account. These limits can be found in the “Product Description and Technical Data” section.

The values stated there are system-related. In other words, the upper limits are determined not only by the load ratings of the bearing points but also include structural design and material-related considerations.

Mechanical calculation

Permissible mechanical drive power

To avoid overheating of the cylinder, the permissible mechanical drive power is stated for each screw drive combination (see “Technical Data”). This value applies at an ambient temperature of 25 °C and even distribution of the load over the stroke length. For applications in which the cylinder is permanently loaded over a small section of the total stroke length, please contact Bosch Rexroth.

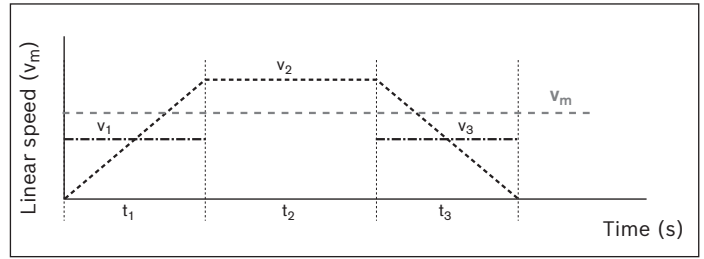
Phases without load must be taken into account when calculating of the sum of the discrete time steps.

$$P_{\text{app}} = \frac{1}{t_{\text{tot}}} \cdot (|F_1| \cdot |v_1| \cdot t_1 + |F_2| \cdot |v_2| \cdot t_2 \dots |F_n| \cdot |v_n| \cdot t_n)$$

$$P_{\text{app}} < \text{perm. transmitted power}$$

Service life of Electromechanical Cylinder EMC-HD

Where the operating conditions vary (fluctuating linear speed and load), the service life must be calculated using the average values for F_m and v_m .

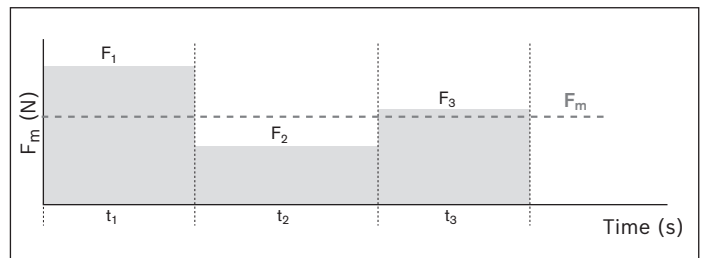


When the linear speed varies, the average speed v_m is calculated as follows:

$$v_m = \frac{1}{t_{tot}} \cdot (|v_1| \cdot t_1 + |v_2| \cdot t_2 + \dots + |v_n| \cdot t_n)$$

$$t_{tot} = t_1 + t_2 + \dots + t_n$$

Where both the load and the rotary speed fluctuate, the average load F_m is calculated as follows:



$$F_m = \sqrt[3]{|F_1|^3 \cdot \frac{|v_1|}{v_m} \cdot \frac{t_1}{t_{tot}} + |F_2|^3 \cdot \frac{|v_2|}{v_m} \cdot \frac{t_2}{t_{tot}} + \dots + |F_n|^3 \cdot \frac{|v_n|}{v_m} \cdot \frac{t_n}{t_{tot}}}$$

Nominal service life

The formula applies on compliance with the specified relubrication intervals and for standard operation. For short stroke (stroke < s_{min}) a reduction must be taken into consideration.

- in revolutions L_{10}
- in hours L_{10h}

$$L_{10} = \left(\frac{C}{F_m} \right)^3 \cdot 10^6$$

$$L_{10h} = \frac{L_{10}}{n_m \cdot 60}$$

$$n_m = \frac{v_m \cdot 60\,000}{P}$$

Drive torque M:

$$M = \frac{F \cdot P}{2000 \cdot \pi \cdot \eta \cdot i}$$

C	= dynamic load rating	(N)	n_m	= mean rotary speed	(min^{-1})
F	= load	(N)	P	= screw drive lead	(mm)
F_1, F_2, \dots, F_n	= axial load in phase 1 ... n	(N)	P_{app}	= useful power in the application	(W)
F_m	= equivalent dynamic axial load	(N)	t_1, t_2, \dots, t_n	= discrete time step for phases 1 ... n	(s)
i	= gear ratio of timing belt side drive/gear unit	(-)	t_{tot}	= sum of discrete time step t_1, t_2, \dots, t_n	(s)
L_{10}	= nominal life in revolutions	(-)	v_1, v_2, \dots, v_n	= linear speed in phase 1 ... n	(m/s)
L_{10h}	= nominal life in hours	(h)	v_m	= average linear speed	(m/s)
M	= drive torque	(Nm)	η	= mechanical efficiency	

Sizing the drive

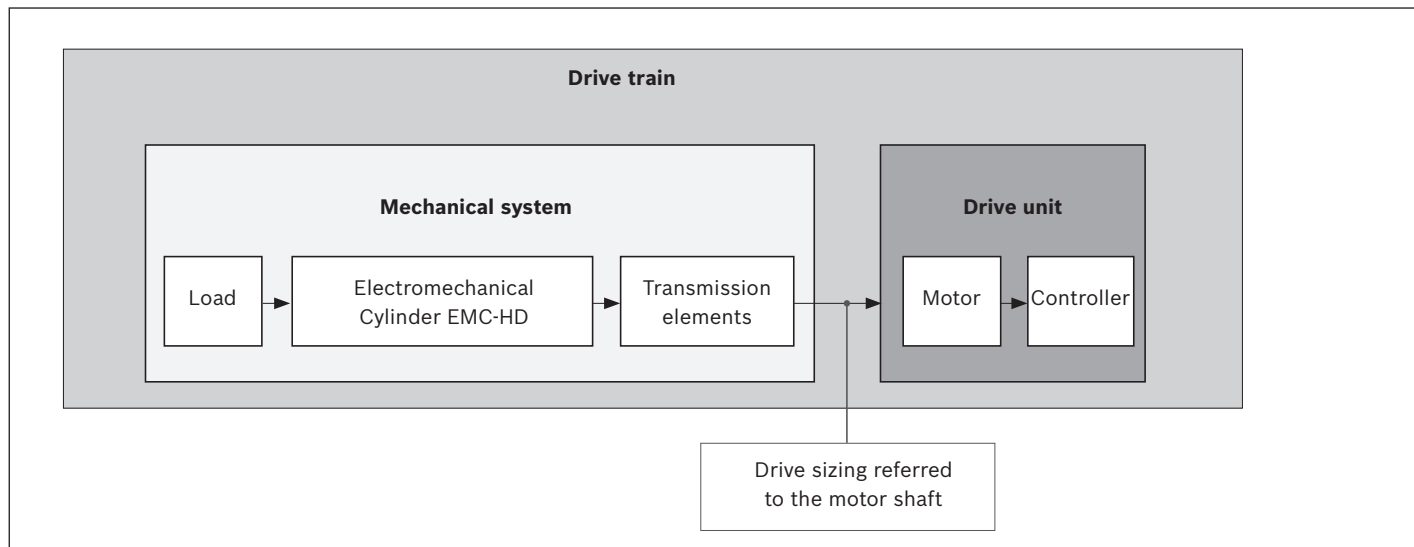
Principles

When calculating the required size of drive, the drive train can be subdivided into the **mechanical system** and the **drive** itself. The **mechanical system** includes the physical components – Electromechanical Cylinder EMC-HD (including gear unit transmission element) – and the load to be carried.

The electric **drive** is a motor-controller combination with the appropriate performance data.

The sizing or dimensioning of the electric drive is done taking the motor shaft as a reference point.

When sizing the drive, limit values must be taken into account as well as basic values. The limit values are to be observed in order to avoid damaging the mechanical components.



Technical data and formula symbols for the mechanical system

The technical data for the Electromechanical Cylinder EMC-HD already include the relevant gear unit data and the gear ratio. This means that the relevant maximum permissible values for drive torque and linear speed as well as the basic values for frictional torque and mass moment of inertia referred to the motor shaft are reduced and can be taken directly from the tables (see “Drive data”).

The following technical data with the associated symbols are used when considering the basic mechanical system requirements in the design calculations for sizing the drive. The data listed in the table below can be found in the “Technical data” section or they are determined using the formulas described on the following pages.

		Load	Mechanical system EMC-HD (incl. gear unit as transmission element)
Weight moment	(Nm)	M_g ⁴⁾	–
Equivalent dynamic torque	(Nm)	M_m ¹⁾	–
Frictional torque	(Nm)	–	M_{Rs} ³⁾
Mass moment of inertia	(kgm ²)	J_t ¹⁾	J_s ²⁾
Max. permissible linear speed	(m/s)	–	v_{max} ³⁾
Max. permissible rotary speed	(rpm)	–	n_p ³⁾
Max. permissible drive torque	(Nm)	–	M_p

1) Determine the value using the appropriate formula

2) Length-dependent value, determined using the appropriate formula

3) Use the value from the table

4) For vertical mounting position: determine the value using the appropriate formula

Drive sizing referred to the motor shaft

When sizing the drive, all the relevant design calculation values for the mechanical components contained in the drive train must be determined – and be expressed in terms of or reduced to – the motor shaft. In other words, for a combination of mechanical components within the drive train, this will result in one value for each of the following:

- Frictional torque M_R
- Mass moment of inertia J_{ex}
- Maximum permissible speed v_{mech} (max. permissible rotary speed n_{mech})
- Max. permissible drive torque M_{mech}

Determining the values for the individual mechanical components in the drive train, based on the motor shaft

Frictional torque M_R

The value for the frictional torque of the EMC-HD already includes the friction for an appropriately configured gear unit and has been reduced with reference to the motor shaft.

For motor attachment via gear unit

$$M_R = M_{Rs}$$

Mass moment of inertia J_{ex}

The constants used in the formulas $k_{J\ fix}$, $k_{J\ var}$ and $k_{J\ m}$ already include the mass moment of inertia and gear ratios of the related transmission elements used and can therefore be taken from the “Drive data” table.

$$J_{ex} = J_s + J_t$$

Determination of the mass moment of inertia of the EMC-HD components (including transmission elements, if used)

$$J_s = (k_{J\ fix} + k_{J\ var} \cdot s_{max}) \cdot 10^{-6}$$

Determination of the translatory mass moment of inertia of the external load (reduced to motor shaft)

$$J_t = m_{ex} \cdot k_{J\ m} \cdot 10^{-6}$$

Maximum permissible linear speed and maximum permissible rotary speed

The value for the maximum permissible linear speed of the EMC-HD already includes the permissible rotary speed for any incorporated transmission elements.

Maximum permissible speed v_{mech}

$$v_{mech} = v_{max}$$

Maximum permissible rotary speed n_{mech}

$$n_{mech} = n_p$$

When considering the complete drive train (mechanical system + motor/controller) the rotary speed of the motor can lie below the maximum value for the mechanical system (M_{mech}) and thus limit the maximum permissible rotary speed of the overall drive train.

J_{ex} = mass moment of inertia of mechanical system	(kgm ²)	s_{max} = maximum travel range	(mm)
J_s = mass moment of inertia of linear system	(kgm ²)	m_{ex} = moved external load	(kg)
J_t = translational mass moment of inertia of external load based on the linear system drive journal	(kgm ²)	M_R = frictional torque at motor journal	(Nm)
$k_{J\ fix}$ = constant for fixed-length proportion of mass moment of inertia	(–)	M_{Rs} = frictional torque of system	(Nm)
$k_{J\ m}$ = constant for mass-specific proportion of mass moment of inertia	(–)	n_{mech} = maximum permissible rotary speed of mechanical system	(min ⁻¹)
$k_{J\ var}$ = constant for variable-length proportion of mass moment of inertia	(–)	n_p = maximum permissible rotary speed of EMC-HD	(min ⁻¹)
		v_{max} = maximum permissible speed of EMC-HD	(m/s)
		v_{mech} = maximum permissible speed of mechanical system	(m/s)

Sizing the drive

Max. permissible drive torque M_{mech}

The lowest (minimum) of all the values for permissible drive torque of all mechanical components contained in the drive train determines the maximum permissible drive torque of the mechanical system which has to be taken into consideration as the upper limit for the drive when sizing the motor. The value for the maximum permissible drive torque of the EMC-HD already includes the maximum permissible drive torque of any incorporated transmission elements.

$$M_{\text{mech}} = M_p$$

When considering the complete drive train (mechanical system + motor/controller), the maximum torque of the motor can lie below the maximum value for the mechanical system (M_{mech}) and thus limit the maximum permissible drive torque of the overall drive train.

If the maximum torque of the motor lies above the upper limit for the mechanical system (M_{mech}), the maximum motor torque must be limited to the permitted value for the mechanical system.

Rough guide for pre-selection of the motor

The following conditions can be used as a rough guide for pre-selecting the motor.

Condition 1:

The speed of the motor must be the same as or higher than the speed required for the mechanical system (but not exceeding the maximum permissible value).

$$n_{\text{max}} \geq n_{\text{mech}}$$

Condition 2:

Consideration of the ratio of mass moments of inertia of the mechanical system and the motor. The ratio of the mass moments of inertia serves as an indicator for the control performance of a motor-controller combination.

The mass moment of inertia of the motor is directly related to the motor size.

Mass moment of inertia ratio

$$v = \frac{J_{\text{ex}}}{J_m + J_{\text{br}}}$$

For preselection, experience has shown that the following ratios will result in high control performance.

These are not rigid limits, but values exceeding them will require closer consideration of the specific application.

Application area	v
Handling	≤ 6.0
Processing	≤ 1.5

Condition 3:

Estimation of the ratio of the static load moment to the continuous torque of the motor. The torque ratio must be smaller than or equal to the empirical value of 0.6. By looking at the required motor torque levels, this estimation roughly covers the dynamic characteristics which still have to be determined by plotting an exact motion profile.

Torque ratio:

$$\frac{M_{\text{stat}}}{M_0} \leq 0.6$$

Static load moment:

$$M_{\text{stat}} = M_R + M_g + M_m$$

Weight moment:

For vertical mounting position only!

For motor attachment via motor mount and coupling: $i = 1$

$$M_g = \frac{P \cdot (m_{\text{ex}} + m_{\text{ca}}) \cdot g}{2000 \cdot \pi \cdot i \cdot \eta}$$

Equivalent dynamic torque

$$M_m = \frac{F_m \cdot P}{2000 \cdot \pi \cdot i \cdot \eta}$$

When considering the torque ratio, the torque demand from the axial loads in the cycle must be included in the static load moment. The equivalent dynamic torque can be calculated approximately via the average load F_m . The value to be used for mechanical efficiency will depend on the drive element, BASA or PLSA.

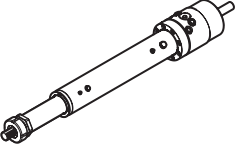
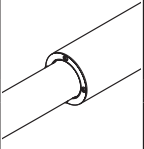
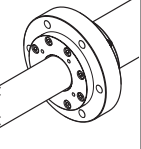
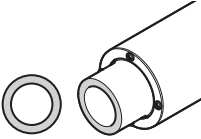
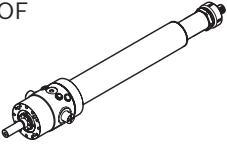
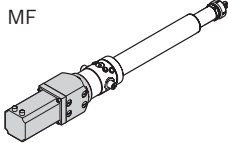
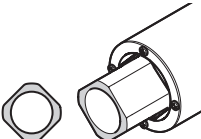
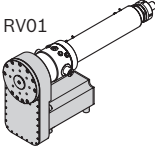
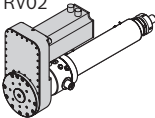
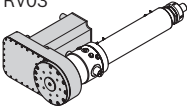
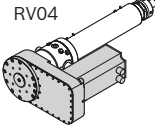
In the “Configuration and Ordering” section, users can put together standard configurations including gear unit and motor, for the various EMC-HD sizes by selecting the appropriate options. By checking the three conditions stated above, it is possible to see whether a standard motor selected in a particular configuration will generally be of a suitable size for the specific application.

Precise sizing of the drive

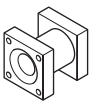
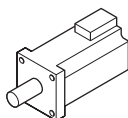

Pre-selecting the motor according to this rough guide is no substitute for the precise design calculations required for the drive, where all moments/torques and speed levels are taken into account. For precise calculation of the electric drive, including consideration of the specific motion profile, please refer to the performance data in the IndraDrive C catalog. When sizing the drive, the maximum permitted values for linear speed, drive torque and acceleration must not be exceeded, in order to avoid damaging the mechanical system!

F_m	= equivalent dynamic axial load	(N)	M_p	= maximum permissible drive torque of EMC-HD	(Nm)
g	= gravitational acceleration (= 9.81)	(m/s ²)	M_0	= continuous motor torque	(Nm)
i	= gear ratio of timing belt side drive/gear unit	(–)	M_R	= frictional torque at motor journal	(Nm)
J_{br}	= mass moment of inertia of motor brake	(kgm ²)	M_{stat}	= static longitudinal moment load	(Nm)
J_{ex}	= mass moment of inertia of mechanical system	(kgm ²)	n_{mech}	= maximum permissible rotary speed of mechanical system	(min ⁻¹)
J_m	= mass moment of inertia of the motor	(kgm ²)	n_{max}	= maximum speed of motor	(min ⁻¹)
m_{ca}	= moved mass of carriage	(kg)	P	= screw lead	(mm)
m_{ex}	= moved external load	(kg)	V	= ratio of mass moments of inertia of drive train and motor	(–)
M_g	= weight moment at motor journal	(Nm)	η	= mechanical efficiency	(–)
M_{mech}	= maximum permissible drive torque of mechanical system	(Nm)			
M_m	= equivalent dynamic torque	(Nm)			

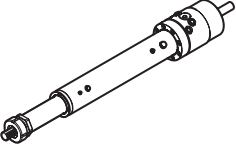
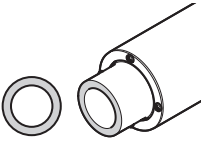
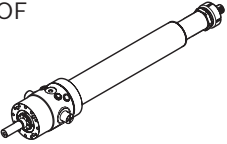
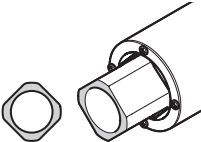
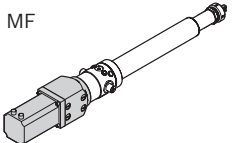
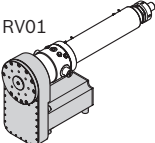
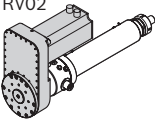
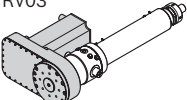
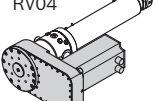
EMC-085-HD – Configuration and ordering

Short product name, s_{max} EMC-085-HD-1, ... mm	Guideway		Drive units				Lubrication		Version
	Without round flange	With round flange ¹⁾	PLSA $d_0 \times P$	BASA $d_0 \times P$	With initial greasing	Greased with low-temperature grease	Description		
			30 x 5	30 x 10	40 x 10	40 x 20	With initial greasing	Greased with low-temperature grease	Description
Round piston rod 	01	02							Without motor mount OF 
									With motor mount MF 
With anti rotation feature 	11	12	01	02	12	13	01	02 ²⁾	With timing belt side drive RV01  RV02  RV03  RV04 


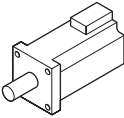

1) For vertical installation only
2) Only with PLSA drive

Gear ratio	Motor attachment		Motor			Switch				Surface finish		Documentation		
	 Description		 Without brake With brake			Without switch	1 reference switch	2 limit switches	2 limit switches and 1 reference switch	Standard	Black painted	Standard report	 Frictional torque measurement	Lead deviation
	Without	00	Without	00	00									
i = 1	With motor mount	01	MSK071D	114	115	00	01	02	03	01	13	01	02	03
		02	MSK100B	116	117									
		03	MSK101D	118	119									
			MSK101E	120	121									
i = 3	With motor mount and gear unit SP100	06	MSK071D	114	115									
		07	MSK101D	118	119									
i = 5	With motor mount and gear unit SP100	16	MSK071D	114	115									
i = 1.5	Timing belt side drive	40	MSK071D	114	115									
		41	MSK100B	116	117									
		42	MSK101D	118	119									
			MSK101E	120	121									
	i = 4.5	RV (i = 1.5) and gear unit SP100 (i = 3)	50	MSK071D	114									
i = 7.5	RV (i = 1.5) and gear unit SP100 (i = 5)	70	MSK071D	114	115									

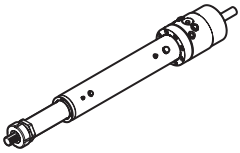
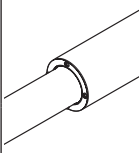
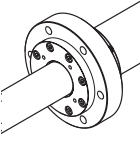
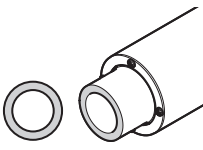
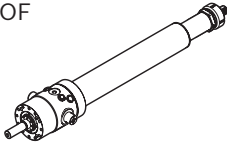
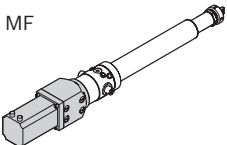
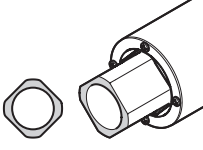
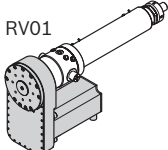
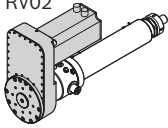
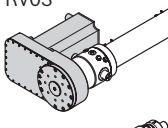
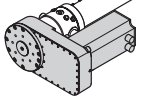
EMC-105-HD – Configuration and ordering

Short product name, s_{max} EMC-105-HD-1, ... mm	Guideway		Drive units				Lubrication		Version
	Without round flange	With round flange ¹⁾	PLSA $d_0 \times P$	BASA $d_0 \times P$	With initial greasing	Prelubricated with low-temperature grease	Description		
									
Round piston rod 	01	02							Without motor mount OF 
With anti rotation feature 	11	12	01	02	12	13	01	02 ²⁾	With motor mount MF 
									With timing belt side drive RV01  RV02  RV03  RV04 

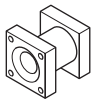

¹⁾ For vertical installation only
²⁾ Only with PLSA drive

Gear ratio	Motor attachment		Motor			Switch				Surface finish		Documentation			
	 Description		 Without brake With brake			Without switch	1 reference switch	2 limit switches	2 limit switches and 1 reference switch	Standard	Black painted	Standard report	 Frictional torque measurement	Lead deviation	
	Without	00	Without	00	00										
i = 1	With motor mount	01	MSK071D	114	115	00	01	02	03	01	13	01	02	03	
		02	MSK100B	116	117										
		03	MSK101D	118	119										
			MSK101E	120	121										
	i = 3	With motor mount and gear unit SP100	06	MSK071D	114										115
	i = 4	With motor mount and gear unit SP100	12	MSK101D	118										119
i = 5	With motor mount and gear unit SP100	16	MSK071D	114	115										
i = 7	With motor mount and gear unit SP100	26	MSK071D	114	115										
i = 1.5	Timing belt side drive	40	MSK071D	114	115										
		41	MSK100B	116	117										
		42	MSK101D	118	119										
			MSK101E	120	121										
i = 4.5	RV (i = 1.5) and gear unit SP100 (i = 3)	50	MSK071D	114	115										
i = 7.5	RV (i = 1.5) and gear unit SP100 (i = 5)	70	MSK071D	114	115										

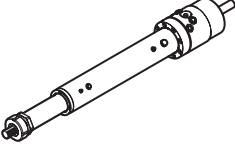
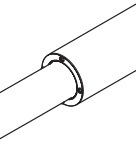
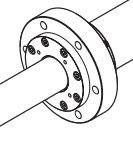

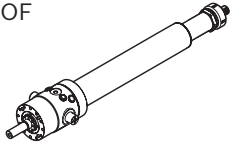
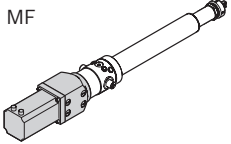
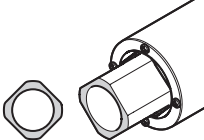
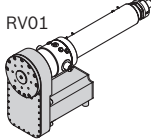
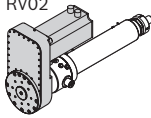
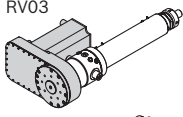
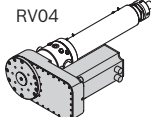
EMC-125-HD – Configuration and ordering

Short product name, s_{max} EMC-125-HD-1, ... mm	Guideway		Drive units				Lubrication		Version
	Without round flange	With round flange ¹⁾	PLSA $d_0 \times P$		BASA $d_0 \times P$		With initial greasing	Prelubricated with low-temperature grease	
			48 x 5	48 x 10	63 x 10	63 x 20	With initial greasing	Prelubricated with low-temperature grease	Description
Round piston rod 	01	02							Without motor mount OF 
									With motor mount MF 
With anti rotation feature 	11	12	01	02	12	13	01	02 ²⁾	With timing belt drive (SD) RV01  RV02  RV03  RV04 

¹⁾ For vertical installation only
²⁾ Only with PLSA drive

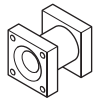
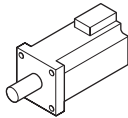
Gear ratio	Motor attachment		Motor			Switch				Surface finish		Documentation		
	 Description			Without brake	With brake	Without switch	1 reference switch	2 limit switches	2 limit switches and 1 reference switch	Standard	Black painted	Standard report	 Frictional torque measurement	Lead deviation
	Without	00	Without	000	000									
i = 1	With motor mount	02	MSK100B	116	117	00	01	02	03	01	13	01	02	03
		03	MSK101D	118	119									
			MSK101E	120	121									
i = 3	With motor mount and gear unit SP100	06	MSK100B	116	117									
	With motor mount and gear unit SP140	07	MSK101D	118	119									
i = 5	With motor mount and gear unit SP100	16	MSK071D	114	115									
i = 1.5	Timing belt side drive	41	MSK100B	116	117									
		42	MSK101D	118	119									
			MSK101E	120	121									
i = 4.5	RV (i = 1.5) and gear unit SP100 (i = 3)	51	MSK100B	116	117									
		52	MSK101D	118	119									
i = 7.5	RV (i = 1.5) and gear unit SP100 (i = 5)	70	MSK071D	114	115									

EMC-150-HD – Configuration and ordering

Short product name, s_{max} EMC-150-HD-1, ... mm	Guideway		Drive units		Lubrication		Version	
	 Without round flange	 With round flange ¹⁾	PLSA $d_0 \times P$ 60 x 10	60 x 20	BASA $d_0 \times P$ 80 x 20	With initial greasing	Prelubricated with low-temperature grease	Description
<p>Round piston rod</p> 	01	02	In preparation	In preparation	13	01	02 ²⁾	<p>Without motor mount</p> <p>OF</p>  <p>With motor mount</p> <p>MF</p> 
<p>With anti rotation feature</p> 	11	12						<p>With timing belt side drive (SD)</p> <p>RV01</p>  <p>RV02</p>  <p>RV03</p>  <p>RV04</p> 

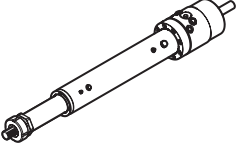
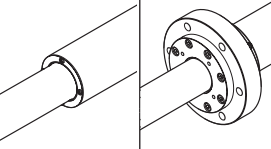
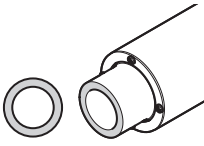
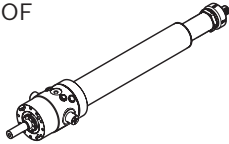
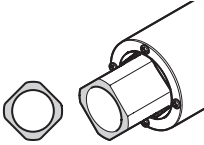
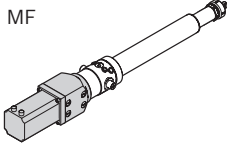
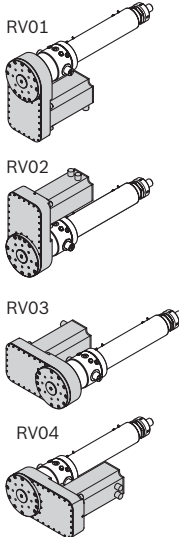
¹⁾ For vertical installation only

²⁾ Only with PLSA drive


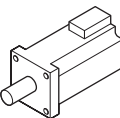
Gear ratio	Motor attachment		Motor			Switch				Surface finish		Documentation		
	 Description		 Without brake With brake			Without switch	1 reference switch	2 limit switches	2 limit switches and 1 reference switch	Standard	Black painted	Standard report	Frictional torque measurement	Lead deviation
	Without	00	Without	000	000									
i = 1	With motor mount	03	MSK101D	118	119	00	01	02	03	01	13	01	02	03
			MSK101E	120	121									
			MSK101E ³⁾	124	125									
			MSK133B ³⁾	126	127									
i = 4	With motor mount and gear unit SP140	12	MSK101D	118	119									
			MSK101E	120	121									
			MSK101E ³⁾	124	125									
i = 4	With motor mount and gear unit SP180	13	MSK101D	118	119									
			MSK101E	120	121									
			MSK101E ³⁾	124	125									
i = 5	With motor mount and gear unit SP140	17	MSK101D	118	119									
			MSK101E	120	121									
			MSK101E ³⁾	124	125									
i = 5	With motor mount and gear unit SP180	18	MSK101D	118	119									
			MSK101E	120	121									
			MSK101E ³⁾	124	125									
i = 7	With motor mount and gear unit SP180	27	MSK101D	118	119									
			MSK101E	120	121									
			MSK101E ³⁾	124	125									
i = 1.5	Timing belt side drive	42	MSK101D	118	119									
			MSK101E	120	121									
			MSK101E ³⁾	124	125									
i = 4.5	RV (i = 1.5) and gear unit SP140 (i = 3)	51	MSK101D	118	119									
			MSK101E	120	121									
			MSK101E ³⁾	124	125									
i = 4.5	RV (i = 1.5) and gear unit SP180 (i = 3)	52	MSK101D	118	119									
			MSK101E	120	121									
			MSK101E ³⁾	124	125									
i = 7.5	RV (i = 1.5) and gear unit SP140 (i = 5)	71	MSK101D	118	119									
			MSK101E	120	121									
			MSK101E ³⁾	124	125									
i = 7.5	RV (i = 1.5) and gear unit SP180 (i = 5)	72	MSK101D	118	119									
			MSK101E	120	121									
			MSK101E ³⁾	124	125									

³⁾ With blower

EMC-180-HD – Configuration and ordering

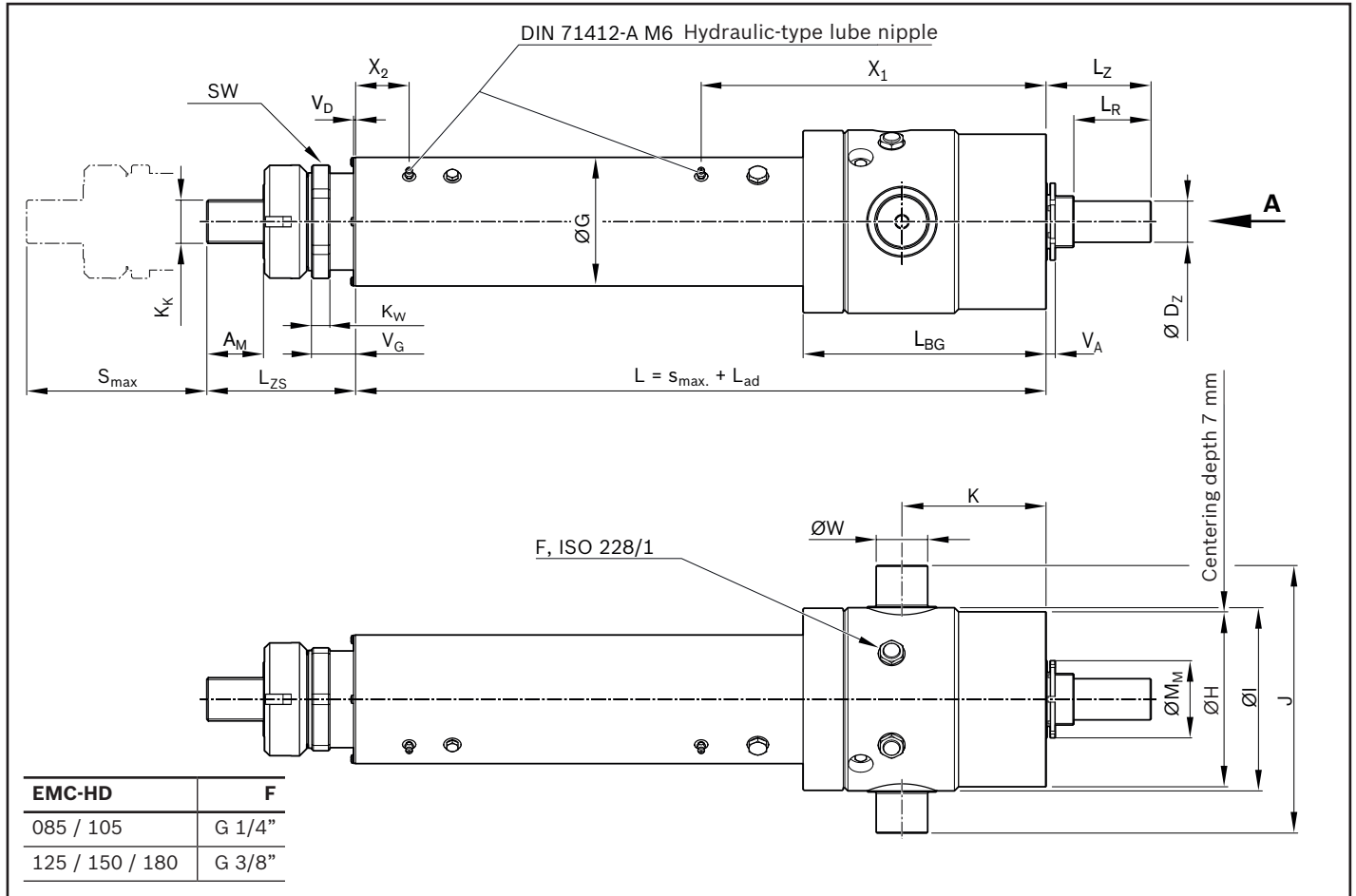
Short product name, s_{max} EMC-180-HD-1, ... mm 	Guideway 		Drive units PLSA $d_0 \times P$ 75 x 10 75 x 20		Lubrication With initial greasing Prelubricated with low-temperature grease		Version Description	
Round piston rod 	01	02	02	04	01	02 ²⁾	Without motor mount OF 	
With anti rotation feature 	11	12					With motor mount MF 	
							With timing belt side drive (SD) RV01 RV02 RV03 RV04 	

1) For vertical installation only
 2) Only with PLSA drive

Gear ratio	Motor attachment		Motor			Switch				Surface finish		Documentation		
	 Description		 Without brake With brake			Without switch	1 reference switch	2 limit switches	2 limit switches and 1 reference switch	Standard	Black painted	Standard report	Frictional torque measurement	Lead deviation
	Without	00	Without	000	000									
i = 1	With motor mount	03	MSK101D	118	119	00	01	02	03	01	13	01	02	03
			MSK101E	120	121									
			MSK101E ³⁾	124	125									
		04	MSK133B ³⁾	126	127									
	MSK133D ³⁾		128	129										
	With motor mount and gear unit SP180	07	MSK101D	118	119									
			MSK101E	120	121									
			MSK101E ³⁾	124	125									
		08	MSK133B ³⁾	126	127									
	MSK133D ³⁾		128	129										
With motor mount and gear unit XP050S	17	MSK101D	118	119										
		MSK101E	120	121										
		MSK101E ³⁾	124	125										
	18	MSK133B ³⁾	126	127										
MSK133D ³⁾		128	129											
With motor mount and gear unit SP180	27	MSK101D	118	119										
		MSK101E	120	121										
		MSK101E ³⁾	124	125										

³⁾ With blower

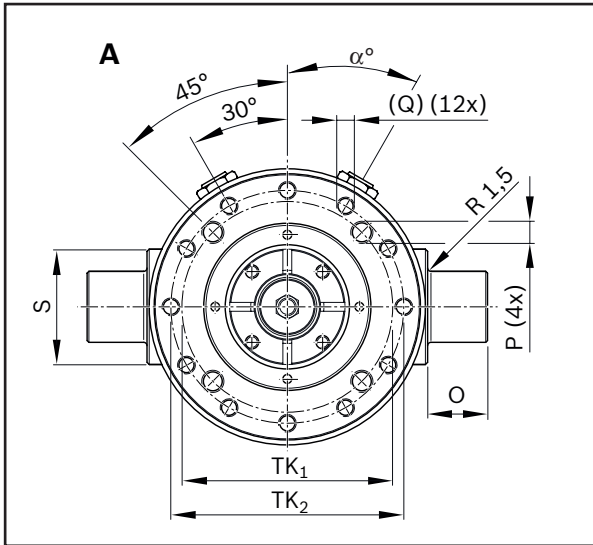
Dimensional drawings for electromechanical cylinder



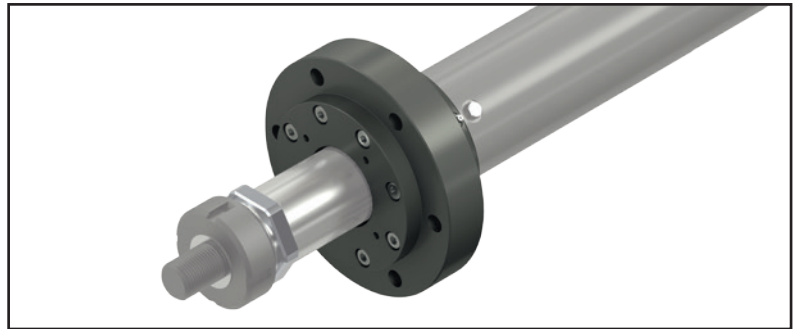
EMC-HD	Drive unit	$d_0 \times P$ (mm)	Dimensions (mm)																		
			EMC-HD (base cylinder)																		
			A_M	α	$\varnothing D_Z$	$\varnothing G$	$\varnothing H$	$\varnothing I$	J	K	K_K	K_W	L_{ad}	L_{BG}	L_R	L_Z	L_{ZS}	$\varnothing M_M$	SW	$V_G^{1)}$	V_D
			-0.1	(°)	h7		-0.05														
085	PLSA	30 x 5	36	30	25	85	120	124.5	180.5	105	M27x2	14.0	352	185	70	91.8	116.5	52	65	42.5	2
		30 x 10											352								
	BASA	40 x 10											352								
		40 x 20											370								
105	PLSA	39 x 5	45	15	35	105	145	148	214.0	120	M33x2	18.0	404	221	70	92.0	132.5	65	90	48.5	2
		39 x 10											404								
	BASA	50 x 10											394								
		50 x 20											416								
125	PLSA	48 x 5	55	30	40	125	170	178	260.0	140	M42x2	17.5	442	236	75	102.0	152.5	75	100	50.5	2
		48 x 10											442								
	BASA	63 x 10											405								
		63 x 20											427								
150	PLSA	60 x 10 ²⁾	64	15	60	150	200	202	304.0	180	M48x2	28.0		301	98	130.0	180	100	130	66.0	2
		60 x 20 ²⁾																			
BASA	80 x 20	586																			
180	PLSA	75 x 10	84	30	85	180	260	263	391.0	220	M64x3	30.0	677	366	105	142.0	208	130	150	66.5	2
		75 x 20											677								

¹⁾ at position 0 mm

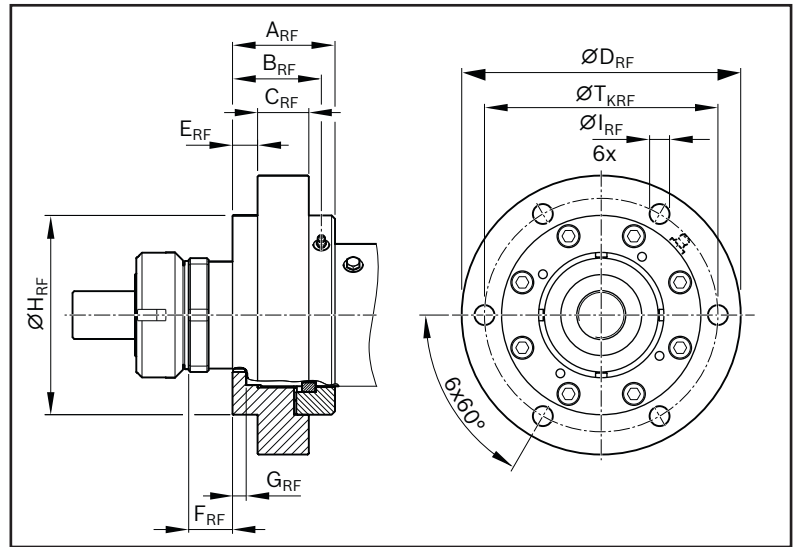
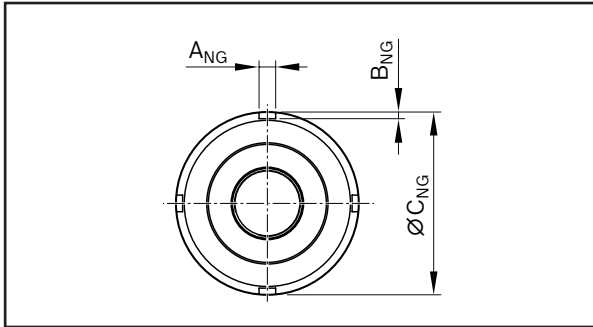
²⁾ In preparation



Round flange, for vertical installation only



Lock nut on threaded mounting interface

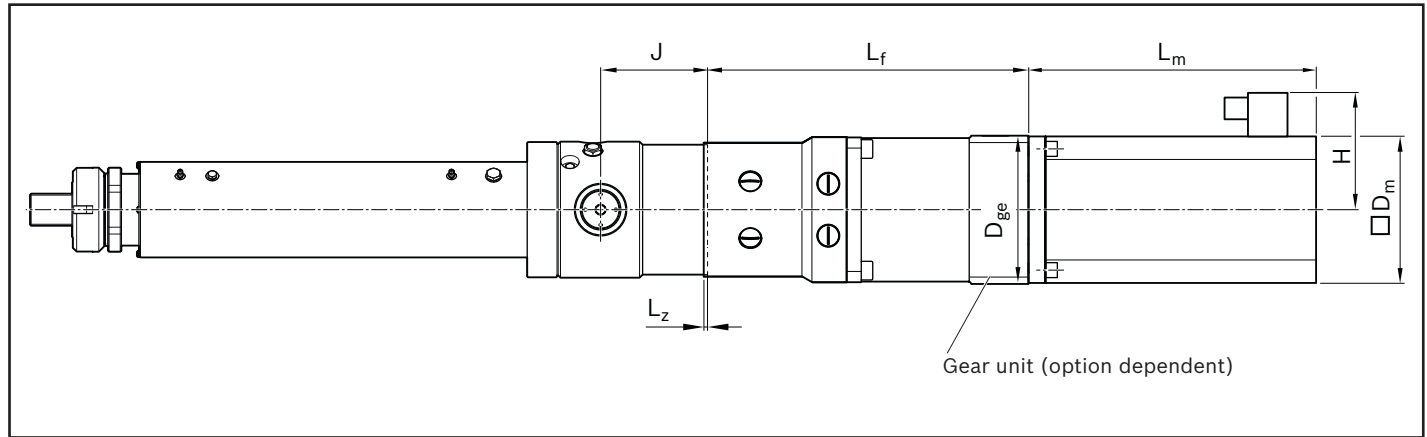


X ₂	X ₁	V _A	ØW h7	J	ØTK ₁	ØTK ₂	O	P	Q	S	Lock nut			Round flange										m _{RF} (kg)
											A _{NG}	B _{NG}	ØC _{NG}	ØT _{KRF}	ØD _{RF}	A _{RF}	B _{RF}	C _{RF}	E _{RF}	F _{RF}	G _{RF}	ØH _{RF} ±0,1	ØI _{RF}	
52	256	7.8	32	180.5	95	105	27	M10 22 deep	M8 18 deep	52	8	4.0	77	155	185	76	66	35	15	32.5	10	130	13.5	8.2
52	320	10.0	40	214.0	120	125	32	M10 23 deep	M10 23 deep	62	10	4.0	95	170	200	88	76	40	20	38.5	10	150	13.5	10.2
52	335	9.0	50	260.0	130	147	40	M12 26 deep	M12 26 deep	68	10	4.0	110	205	245	90	78	45	22	38.5	12	175	17.5	15.8
67	419	14.0	63	304.0	166	178	50	M14 32 deep	M14 32 deep	90	11	4.5	130	245	295	109	97	50	22	47.0	17	210	22.0	26.2
67	499	14.0	80	391.0	215	230	63	M16 33 deep	M16 33 deep	110	12	5.0	155	290	335	116	95	55	20	50.0	15	245	26.0	35.8

Dimensional drawings for motor attachments with flange and coupling

MF01

MF01 with gear unit



Note: The drawing for motor attachment with flange and coupling is schematic. Detailed contours can be found in the CAD model.

EMC-HD	Motor	Option Motor attachment	i	Dimensions (mm)								
				L _m		D _m	D _{ge}	L _f	J	H	L _z	
				with brake	without brake							
EMC-085-HD	MSK071D	01	1	347	312	140	-	153.5	105	132	3	
		06	3				150	339.5				
		16	5				150	339.5				
	MSK100B	02	1	368	368	192	-	178.5		166		
		MSK101D	03	1	410	410	192	-				178.5
			07	3	410	410	192	190				339.5
MSK101E	03	1	501	501	192	-	178.5					
EMC-105-HD	MSK071D	01	1	347	312	140	-	165.0	120	132	4	
	MSK100B	02	1	368	368	192	-	190.0		166		
	MSK101D	03	1	410	410	192	-	190.0		166		
	MSK101E	03	1	501	501	192	-	190.0		166		
	MSK071D	06	3	347	312	140	150	351.0		132		
	MSK101D	12	4	410	410	192	190	351.0		166		
	MSK071D	16	5	347	312	140	150	351.0		132		
	MSK071D	26	7	347	312	140	150	351.0		132		
EMC-125-HD	MSK071D	16	5	347	312	140	150	368.0	140	132	5	
		MSK100B	02	1	368	368	192	-		207.0		166
	06		3	368	368	192	190	368.0		166		
	MSK101D	03	1	410	410	192	-	207.0		166		
		07	3	410	410	192	190	388.3		166		
	MSK101E	03	1	501	501	192	-	207.0		166		

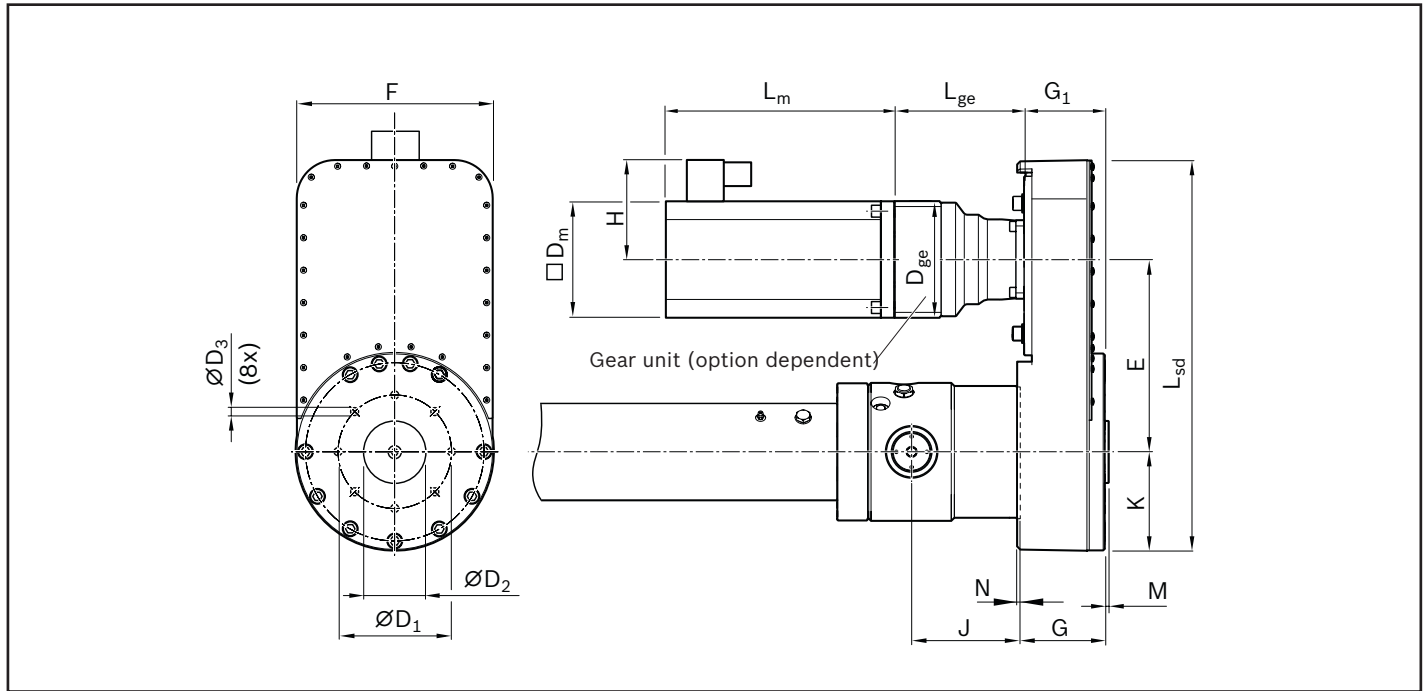
EMC-HD	Motor	Option Motor attachment	i	Dimensions (mm)					J	H	L _z
				L _m		D _m	D _{ge}	L _f			
				with brake	without brake						
EMC-150-HD	MSK101D	03	1	410	410	192	–	249	180	166	5
	MSK101E	03	1	501	501	192	–	249		166	
	MSK101E ¹⁾	03	1	672	672	208	–	249		166	
	MSK133B ¹⁾	04	1	807	622	260	–	245		214	
	MSK101D	12	4	410	410	192	190	420		166	
	MSK101E	12	4	501	501	192	190	420		166	
	MSK101E ¹⁾	12	4	672	672	208	190	420		166	
	MSK101D	17	5	410	410	192	190	420		166	
	MSK101E	17	5	501	501	192	190	420		166	
	MSK101E ¹⁾	17	5	672	672	208	190	420		166	
	MSK101D	13	4	410	410	192	210	452		166	
	MSK101E	13	4	501	501	192	210	452		166	
	MSK101E ¹⁾	13	4	672	672	208	210	452		166	
	MSK101D	18	5	410	410	192	210	452		166	
	MSK101E	18	5	501	501	192	210	452		166	
	MSK101E ¹⁾	18	5	672	672	208	210	452		166	
	MSK101D	27	7	410	410	192	210	452		166	
	MSK101E	27	7	501	501	192	210	452		166	
MSK101E ¹⁾	27	7	672	672	208	210	452	166			
EMC-180-HD	MSK101D	03	1	410	410	192	–	259	220	166	5
	MSK101E	03	1	501	501	192	–	259		166	
	MSK101E ¹⁾	04	1	672	672	208	–	259		166	
	MSK133B ¹⁾	04	1	807	622	260	–	255		214	
	MSK133D ¹⁾	04	1	907	722	260	–	255		238	
	MSK101D	07	3	410	410	192	210	462		166	
	MSK101E	07	3	501	501	192	210	462		166	
	MSK101E ¹⁾	07	3	672	672	208	210	462		166	
	MSK133B ¹⁾	08	3	807	622	260	260	490		214	
	MSK133D ¹⁾	08	3	907	722	260	260	490		238	
	MSK101D	17	5	410	410	192	210	462		166	
	MSK101E	17	5	501	501	192	210	462		166	
	MSK101E ¹⁾	17	5	672	672	208	210	462		166	
	MSK133B ¹⁾	18	5	807	622	260	260	490		214	
	MSK133D ¹⁾	18	5	907	722	260	260	490		238	
	MSK101D	27	7	410	410	192	210	462		166	
	MSK101E	27	7	501	501	192	210	462		166	
	MSK101E ¹⁾	27	7	672	672	208	210	462		166	

¹⁾ With fans (illustration differs)

Dimensional drawings for motor attachments with timing belt side drive

RV01, RV02, RV03, RV04

RV01, RV02, RV03, RV04 with gear unit



Note: The drawing for motor attachment with timing belt side drive is schematic. Detailed contours can be found in the CAD model.


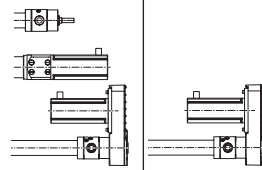
EMC-HD	Motor	Option Motor attachment	i Dimensions (mm)																								
			L _{sd}	E	K	G	G ₁	J	M	N	L _m		L _{ge}	D _m	D _{ge}	H	F	ØD ₁	ØD ₂	ØD ₃							
												with brake	without brake														
EMC-085-HD	MSK071D	40	1.5	458	211	100	99	99	105	5	4	347	312	-	-	132	200	100	60	M8 (8x) 16 deep							
		50	4.5					109						156	150												
		70	7.5					109						156	150												
	MSK100B	41	1.5					99						368	368						-	192	-	166			
	MSK101D	42	1.5					99						410	410						-	192	-	166			
MSK101E	42	1.5	99	501	501	-	192	-	166																		
EMC-105-HD	MSK071D	40	1.5	458	211	100	99	99	120	5	4	347	312	-	-	132	200	104	60	M8 (12x) 21 deep							
	MSK071D	50	4.5					109						156	150												
	MSK071D	70	7.5					109						156	150												
	MSK100B	41	1.5					99						368	368						-	192	-	166			
	MSK101D	42	1.5					504						248	128						102	102	9	410	410	-	192
MSK101E	42	1.5	504	248	128	102	102	9	501	501	-	192	-	166	255	104	60	M8 (12x) 21 deep									
EMC-125-HD	MSK100B	41	1.5	504	248	128	109	104	140	5	4	368	368	-	192	-	166	255	145	80	M12 (8x) 22 deep						
	MSK101D	42	1.5					114														410	410	-	192	-	166
	MSK101E	42	1.5					114														501	501	-	192	-	166
	MSK100B	51	4.5					114														368	368	192	192	190	166
	MSK101D	52	4.5					114														410	410	156	192	190	166
	MSK071D	70	7.5					114														347	312	140	140	132	132


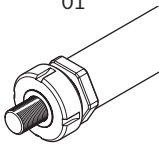

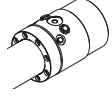
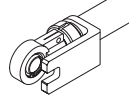

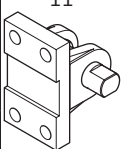
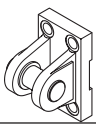
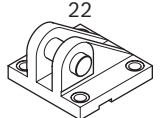
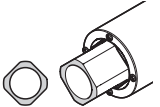
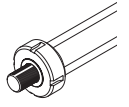
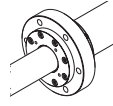
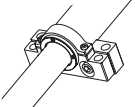
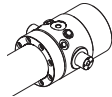
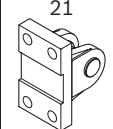
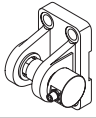
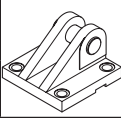
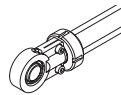
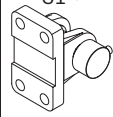
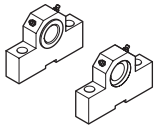
EMC-HD	Motor	Option Motor attachment	i	Dimensions (mm)																	
				L _{sd}	E	K	G	G ₁	J	M	N	L _m		L _{ge}	D _m	D _{ge}	H	F	ØD ₁	ØD ₂ -0.15	ØD ₃
												with brake	without brake								
EMC-150-HD	MSK101D	42	1.5	574	290.3	135	140	141	180	5	4	410	410	-	192	-	166	270	145	80	M12 (12x) 24 deep
	MSK101E	42	1.5									501	501	-	192	-					
	MSK101E ¹⁾	42	1.5									672	672	-	208	-					
	MSK101D	51	4.5									410	410	171	192	190					
	MSK101E	51	4.5									501	501	171	192	190					
	MSK101E ¹⁾	51	4.5									672	672	171	208	190					
	MSK101D	52	4.5									410	410	171	192	190					
	MSK101E	52	4.5									501	501	203	192	190					
	MSK101E ¹⁾	52	4.5									672	672	203	208	190					
	MSK101D	71	7.5									410	410	171	192	210					
	MSK101E	71	7.5									501	501	171	192	210					
	MSK101E ¹⁾	71	7.5									672	672	171	208	210					
	MSK101D	72	7.5									410	410	171	192	210					
	MSK101E	72	7.5									501	501	203	192	210					
	MSK101E ¹⁾	72	7.5									672	672	203	208	210					
EMC-180-HD	MSK101D	42	1.5	752	397.1	182.5	149	145	220	8	4	410	410	-	192	-	166	365	194	80	M16 (10x) 28 deep
	MSK101E	42	1.5									501	501	-	192	-	166				
	MSK101E ¹⁾	42	1.5									672	672	-	208	-	166				
	MSK133B ¹⁾	43	1.5									807	622	-	260	-	214				
	MSK133D ¹⁾	43	1.5									907	722	-	260	-	238				
	MSK101D	51	4.5									410	410	171	192	190	166				
	MSK101E	51	4.5									501	501	171	192	190	166				
	MSK101E ¹⁾	51	4.5									672	672	171	208	190	166				
	MSK101E	52	4.5									501	501	203	192	210	166				
	MSK101E ¹⁾	52	4.5									672	672	203	208	210	166				
	MSK133B ¹⁾	53	4.5									807	622	239	260	260	214				
	MSK101D	71	7.5									410	410	171	192	190	166				
	MSK101E	71	7.5									501	501	171	192	190	166				
	MSK101E ¹⁾	71	7.5									672	672	171	208	190	166				
	MSK101E	72	7.5									501	501	203	192	210	166				
MSK101E ¹⁾	72	7.5	672	672	203	208	210	166													

¹⁾ With fans (illustration differs)

Mounting elements – configuration and ordering

Mounting elements

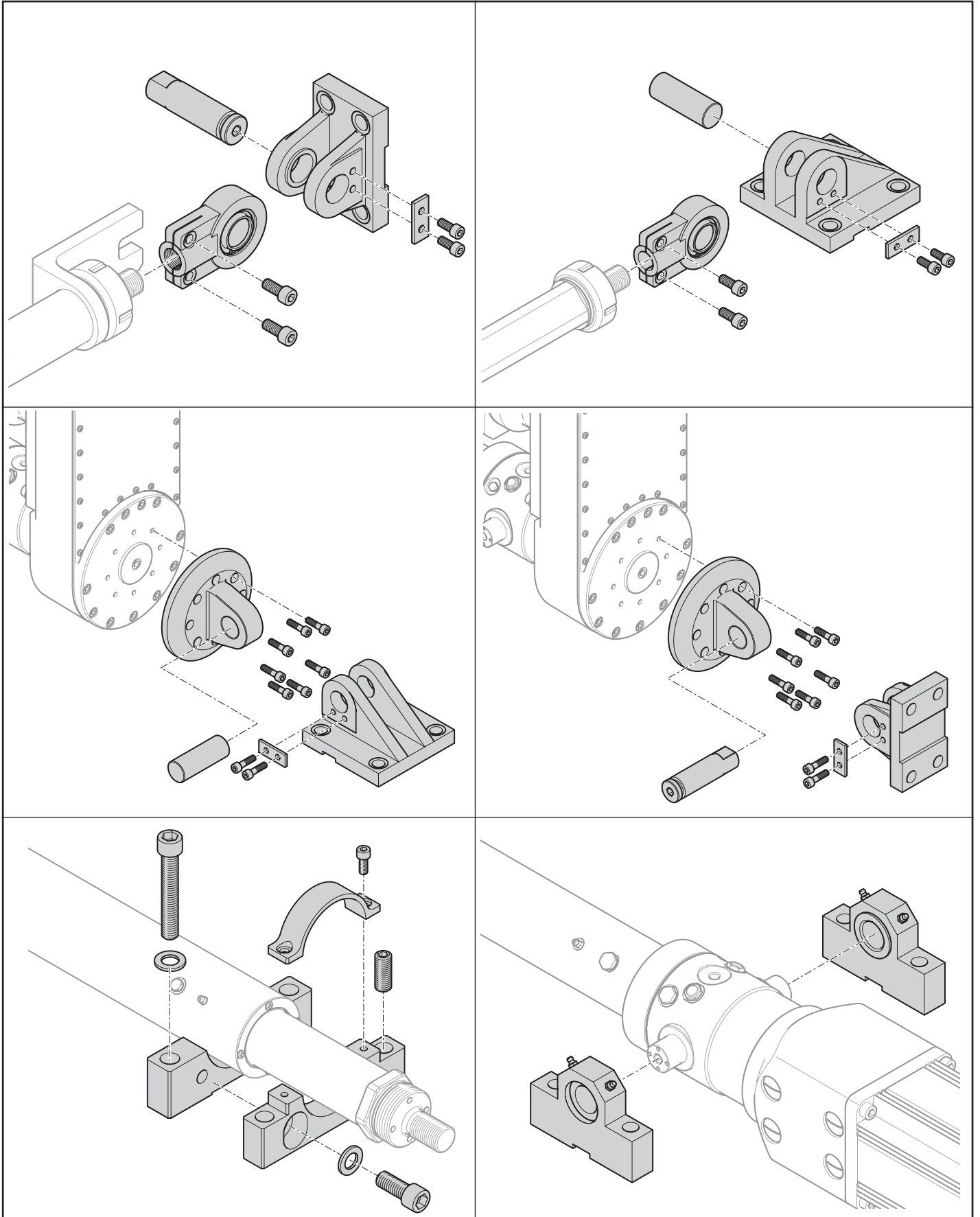
Version	Group 1	Group 2 ³⁾	Version ³⁾	Group 3	Group 4 ³⁾	Group 5 ³⁾	Group 6		
Guide with round piston rod 	00	01 	Without round flange 	00	01 	00	00		
	00	02 				11	11 	00	
	11 							21 	
								22 	
Guide with ant rotation feature 	00	11 	With round flange 	11 	02 	00	00		
	21 								31 ²⁾ 
	22 	12 							00
	31 ¹⁾ 								01 
				00	01	00	00		

¹⁾ With load measuring only on "With anti rotation feature" option (see "Attachments and Accessories" section)

²⁾ With load measuring only on "With anti rotation feature" option (see "Attachments and Accessories" section) NOT to be used in combination with round flange or foot mounting!

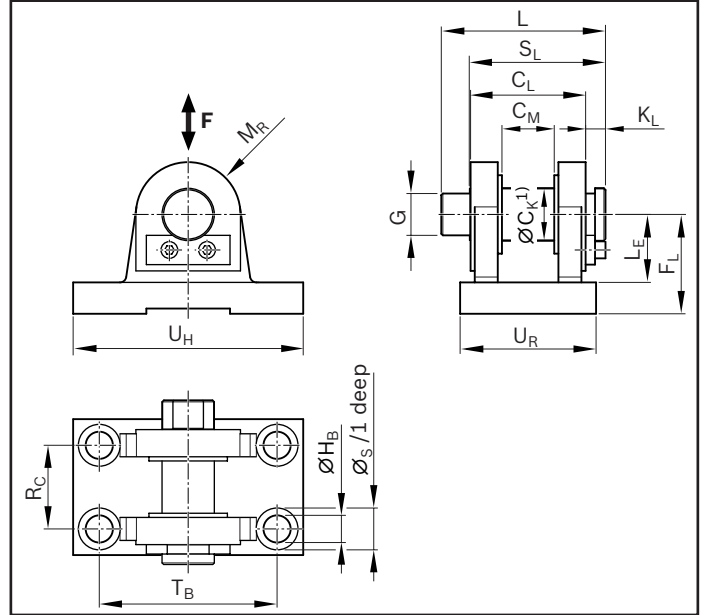
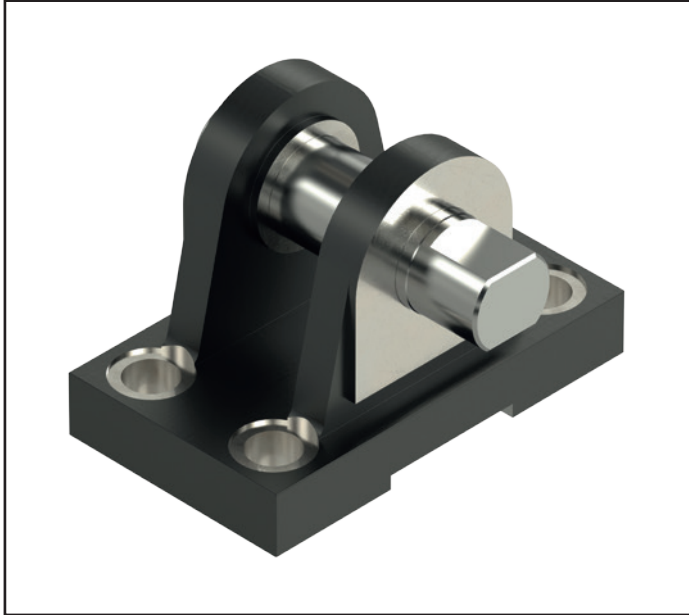
³⁾ Pre-assembled on delivery

Examples



Mounting elements

Clevis bracket CLCD (comparable with ISO 8132) for spherical rod end bearing with clevis, form A Group 1, option 11

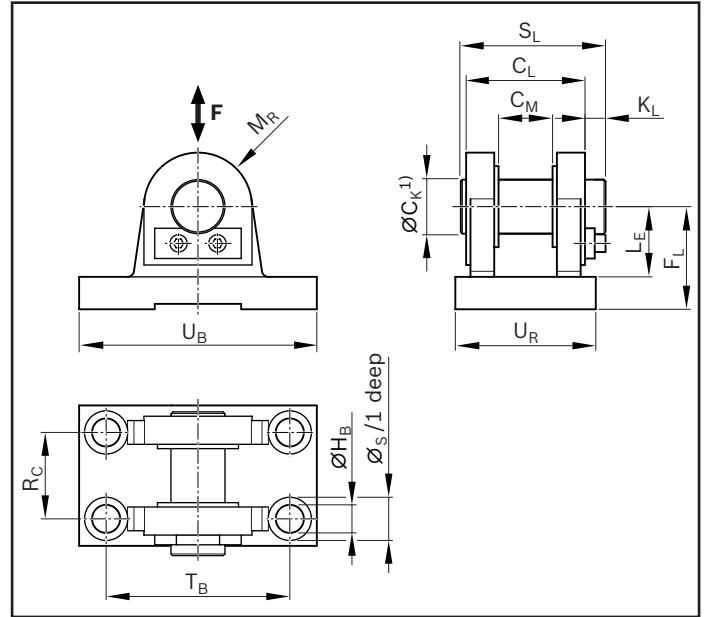
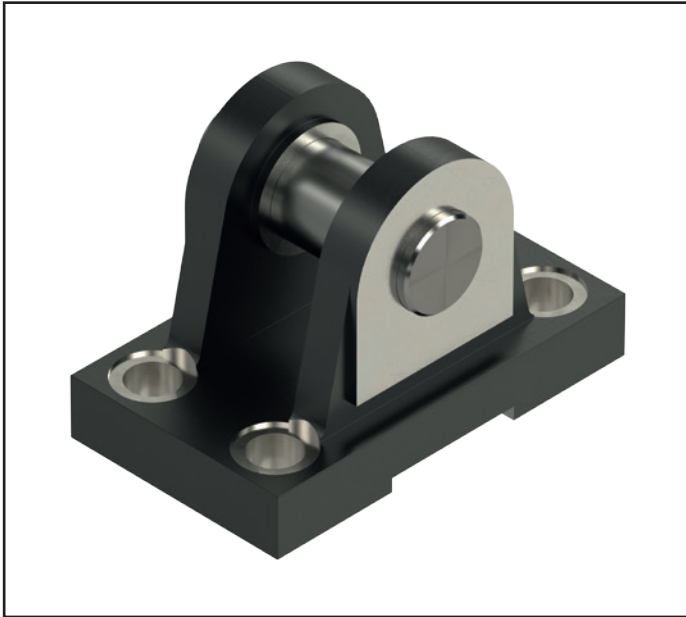


EMC-HD	Part number	Dimensions (mm)																m (kg)
		$\varnothing C_K^{1)}$ H9	C_L h16	C_M A12	F_L js12	$\varnothing H_B$ H13	K_L	L_E min.	M_R max.	R_C js14	$\varnothing S$	$S_L^{2)}$	$L^{2)}$	$G^{2)}$ f7	T_B js14	U_R max.	U_H max.	
085	R156330100	32	70	32	65	17.5	13	43	32	50	26	90.5	114.5	25	110	85	143	3.15
105	R156340100	40	90	40	76	22.0	16	52	40	65	33	112.0	135.0	30	130	108	170	5.75
125	R156350100	50	110	50	95	26.0	19	65	50	80	40	130.0	157.0	40	170	130	220	10.95
150	R156360100	63	140	63	112	33.0	20	75	63	100	48	165.0	198.0	53	210	160	270	17.70
180	R156370100	80	170	80	140	39.0	26	95	80	125	57	192.0	230.0	70	250	210	320	33.40

¹⁾ Matching pivot pin $\varnothing f7$ (pin and pin locking feature are included in the scope of supply and are not ready-mounted on delivery)

²⁾ Values deviate from ISO 8132 standard

Note: Non-dimensioned contours may deviate from the illustration and/or from the CAD file.

Clevis bracket CLCD ISO 8132, form A
Group 1/6, option 21


EMC-HD	Part number	Dimensions (mm)														m
		$\varnothing C_K^{1)}$ H9	C_L h16	C_M A12	F_L js12	$\varnothing H_B$ H13	K_L	L_E min.	M_R max.	R_C js14	$\varnothing S$	S_L	T_B js14	U_R max.	U_H max.	
085	R156330101	32	70	32	65	17.5	13	43	32	50	26	87	110	85	143	3.0
105	R156340101	40	90	40	76	22.0	16	52	40	65	33	110	130	108	170	5.5
125	R156350101	50	110	50	95	26.0	19	65	50	80	40	133	170	130	220	10.6
150	R156360101	63	140	63	112	33.0	20	75	63	100	48	164	210	160	270	17.0
180	R156370101	80	170	80	140	39.0	26	95	80	125	57	202	250	210	320	32.0

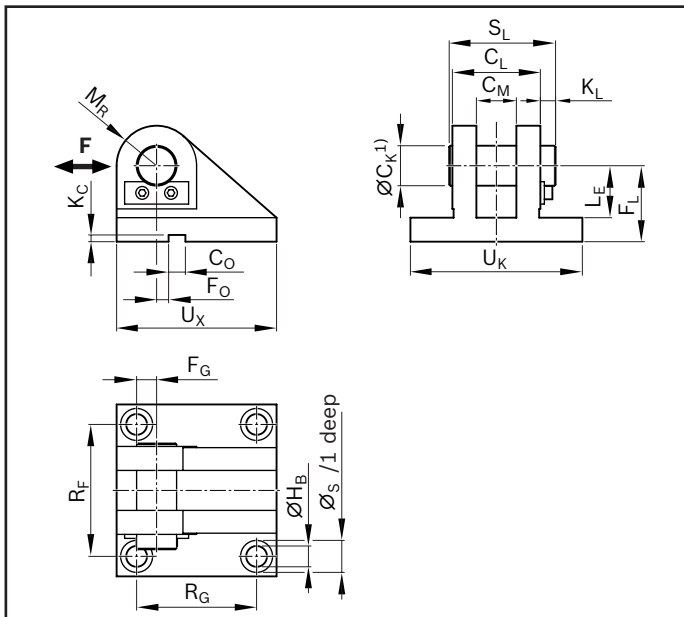
¹⁾ Matching pivot pin \varnothing m6 (pin and pin locking feature are included in the scope of supply and are not ready-mounted on delivery)

Note: Non-dimensioned contours may deviate from the illustration and/or from the CAD file.

Mounting elements

Clevis bracket CLCA ISO 8132, form B

Group 1 / 6, option 22

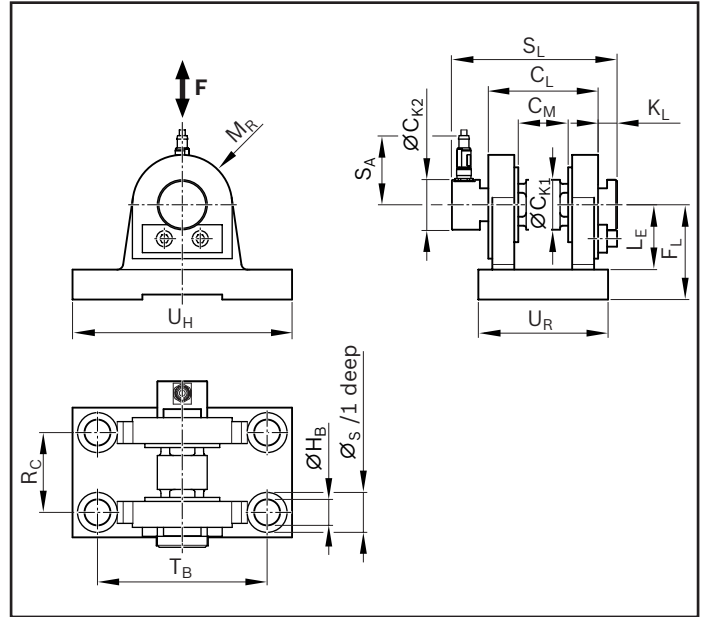
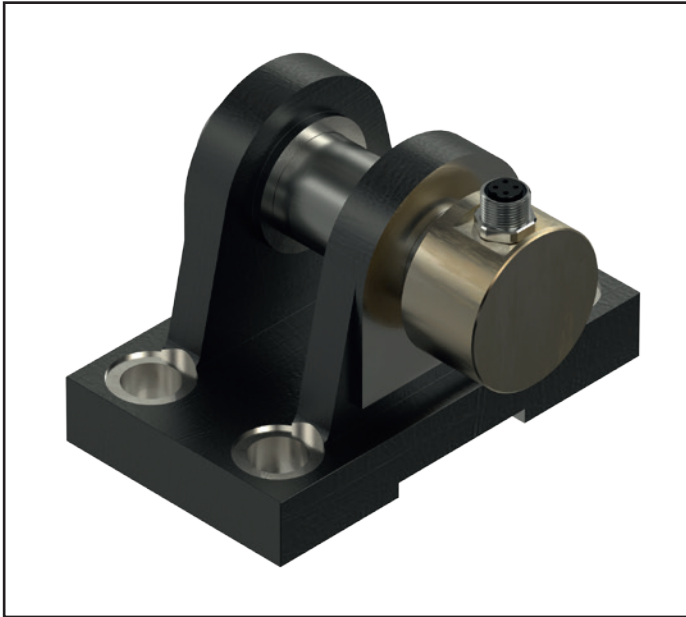


EMC-HD	Part number	Dimensions (mm)																		m
		$\varnothing C_K^{1)}$ H9	C_L h16	C_M A12	C_O N9	F_G js14	F_L js12	F_O js14	$\varnothing H_B$ H13	K_C +0.3	K_L	L_E min.	M_R max.	R_F js14	R_G js14	$\varnothing S$	S_L	U_K max.	U_X max.	
085	R156330102	32	70	32	25	14.5	65	6	17.5	5.4	13	43	32	110	110	26	87	145	145	4.5
105	R156340102	40	90	40	36	17.5	76	6	22.0	8.4	16	52	40	140	125	33	110	185	170	8.5
125	R156350102	50	110	50	36	25.0	95	0	26.0	8.4	19	65	50	165	150	40	133	215	200	13.5
150	R156360102	63	140	63	50	33.0	112	0	33.0	11.4	20	75	63	210	170	48	164	270	230	23.4
180	R156370102	80	170	80	50	45.0	140	0	39.0	11.4	26	95	80	250	210	57	202	320	280	38.5

¹⁾ Matching pivot pin \varnothing m6 (pin and pin locking feature are included in the scope of supply and are not ready-mounted on delivery)

Note: Non-dimensioned contours may deviate from the illustration and/or from the CAD file.

Clevis bracket CLCD (comparable with ISO 8132), form A, with load measuring pin Group 1 / 6, option 31



EMC-HD	Part number	Dimensions (mm)																m (kg)
		$\varnothing C_{K1}^{1)}$ H9	$\varnothing C_{K2}$	C_L h16	C_M A12	F_L js12	$\varnothing H_B$ H13	$K_L^{2)}$	L_E min.	M_R max.	R_C js14	$\varnothing S$	$S_L^{2)}$	T_B js14	U_R max.	U_H max.	$S_A^{2)}$	
085	R156330103	32	50	70	32	65	17.5	12	43	32	50	26	117.0	110	85	143	69.5	3.5
105	R156340103	40	40	90	40	76	22.0	13	52	40	65	33	135.0	130	108	170	61.0	6.8
125	R156350103	50	50	110	50	95	26.0	20	65	50	80	40	166.5	170	130	220	69.5	11.0
150	R156360103	63	63	140	63	112	33.0	17	75	63	100	48	189.0	210	160	270	73	22.0
180	R156370103	80	80	170	80	140	39.0	95	80	125	57	250	225.0	250	210	320	93.0	34.5

¹⁾ Matching pivot pin \varnothing f8. For detailed information on the load measuring pin see "Load Sensor" section.

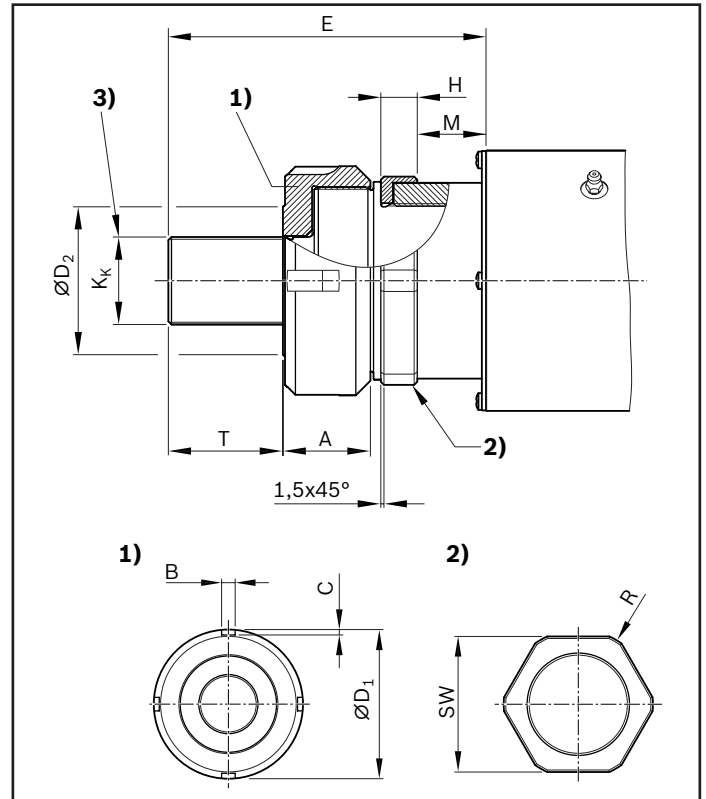
²⁾ Values deviate from ISO 8132 standard

Note: Non-dimensioned contours may deviate from the illustration and/or from the CAD file.

Mounting elements

Threaded mounting interface for version round piston rod

Group 2, option 01



- 1) Lock nut on threaded mounting interface
- 2) Wrench flats for supporting the drive torque
- 3) Fastening thread for absorbing tensile/compressive forces

EMC-HD	Dimensions (mm)							Lock nut	K _K	M ⁴⁾	R	T	SW max.
	A	B	C	ØD ₁	ØD ₂	E ⁴⁾	H ⁵⁾						
085	31	8	4.0	77	41	116.5	14.0	M60x1.5	M27x2	28.5	R36	37	65
105	37	10	4.0	95	72	132.5	18.0	M74x2	M33x2	30.5	R50	44	90
125	42	10	4	110	71	152.5	17.5	M90x2	M42x2	33.0	R55	56	100
150	47	11	4.5	130	80	180.0	28.0	M105x2	M48x2	38.0	R73	63	130
180	53	12	5.0	155	100	225.0	28.5	M130x2	M64x3	36.5	R82.5	85	150

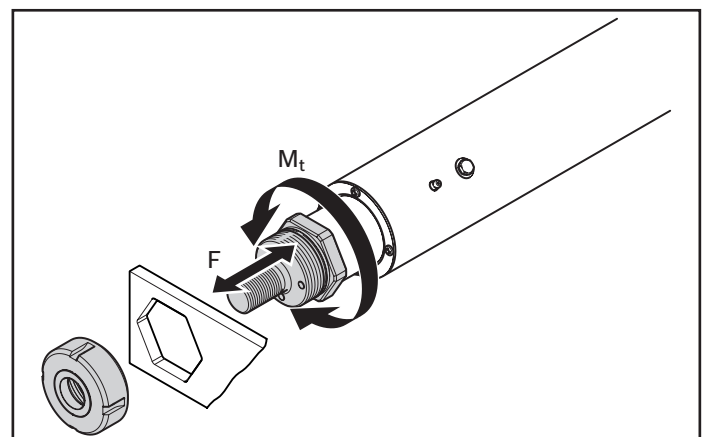
⁴⁾ Dimensions E and M are shown in retracted state (stroke = 0 mm)!

⁵⁾ Maximum dimension of customer-built attachment

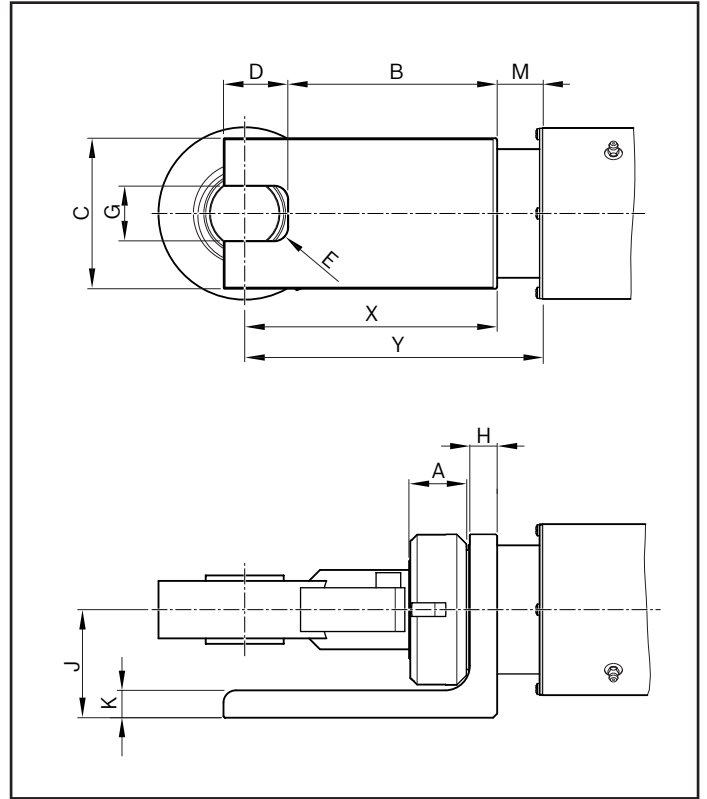
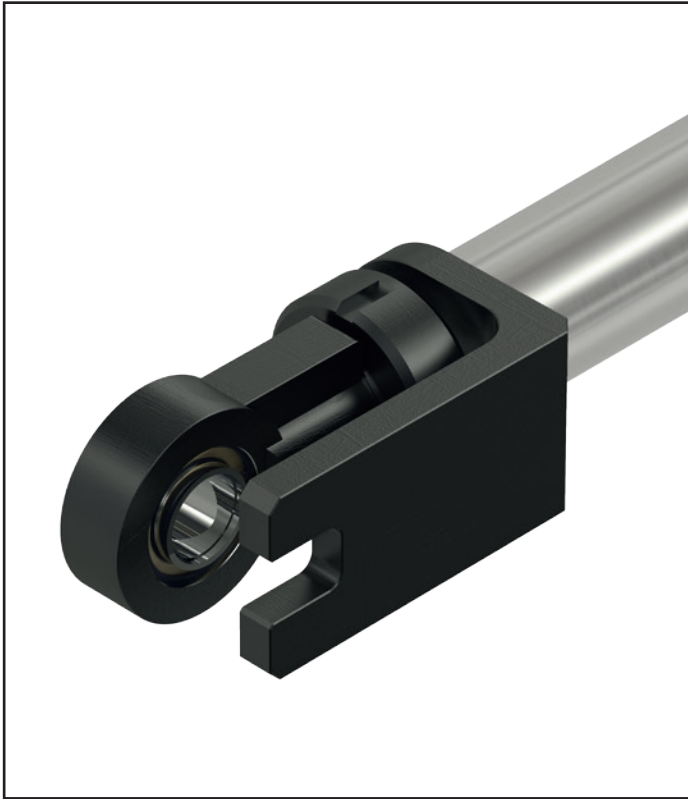
The mass is included in the basis cylinder weight

Notes on mounting

The wrench flats provide positive-locking support for the drive torque. Tensile and compressive axial forces are absorbed via the fastening thread. During installation, screw the lock nut all the way onto the threaded mounting interface. After screwing on and radially aligning the connection element, screw back the lock nut against the connection element (maximum 1.5 turns). The lock nut is not intended to fix the customer's attachment axially on the wrench flats.



Spherical rod end bearing CGKD (clampable) with clevis
Group 2, option 02



EMC-HD	Dimensions (mm)												m ²⁾ (kg)
	A	B	C	D	E	G H7	H	J	K	M ¹⁾	X	Y ¹⁾	
085	31	114	75	34	R6	25	15.0	62	15	28.5	131.0-134.0	159.5-162.5	2.6
105	37	131	95	47	R5	30	18.0	73	18	30.5	154.0-157.0	184.5-187.5	4.6
125	42	153	110	47	R10	40	20.0	79	15	33.0	183.5-186.5	216.5-219.5	7.8
150	47	175	135	75	R15	53	28.0	105	28	38.0	218.0-221.0	256.0-259.0	14.6
180	53	215	160	80	R15	70	28.5	120	25	36.5	266.5-271.0	303.0-307.5	24.5

¹⁾ Dimensions M and Y are shown in retracted state (stroke = 0 mm)!

²⁾ Add mass to basis cylinder weight

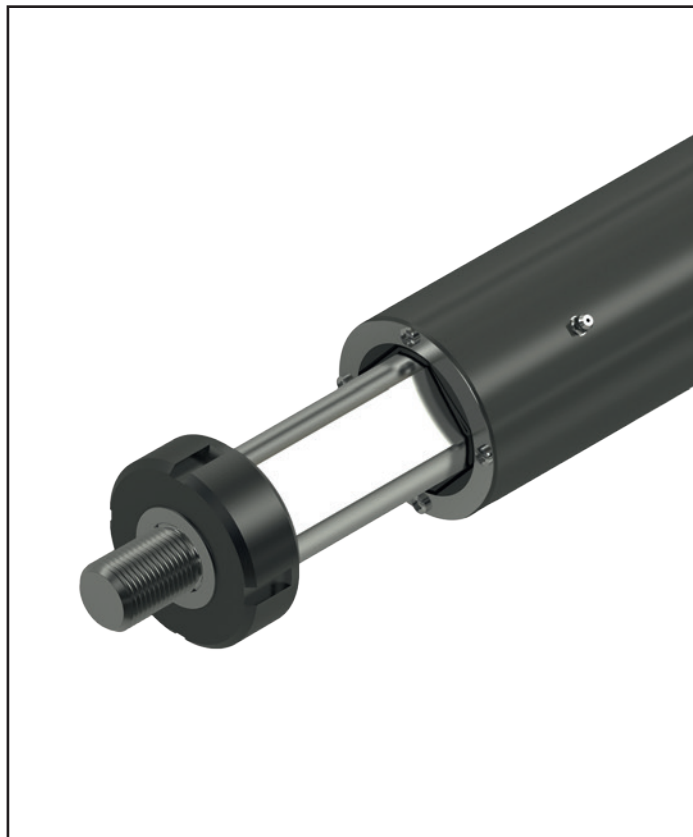
Note

The matching pivot pin is included with the clevis bracket for spherical rod end bearing with clevis (group 1, option 11). Customer-built connection elements dimensions analog to clevis brackets (group 1, option 11).

Mounting elements

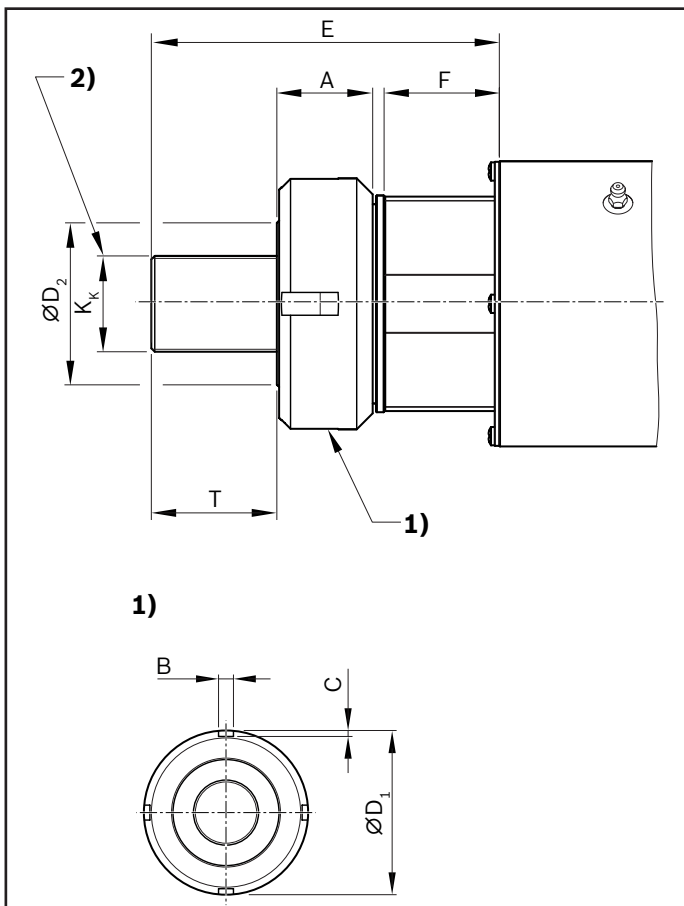
Threaded mounting interface for version with integrated anti rotation feature

Group 2, option 11



1) Lock nut on threaded mounting interface

2) Fastening thread for absorbing tensile/compressive forces



EMC-HD	Dimensions (mm)									
	A	B	C	ØD ₁	ØD ₂	E ³⁾	F ³⁾	Lock nut	K _K	T max.
085	31	8	4.0	77	41	116.5	42.5	M60x1.5	M27x2	37
105	37	10	4.0	95	72	132.5	48.5	M74x2	M33x2	44
125	42	10	4.0	110	71	152.5	50.5	M90x2	M42x2	56
150	47	11	4.5	130	80	180.0	66.0	M105x2	M48x2	63
180	53	12	5.0	155	99	208.0	65.0	M130x2	M64x3	84

³⁾ Dimensions E and F are shown in retracted state (stroke = 0 mm)!

The mass is included in the basis cylinder weight

Notes on mounting

The drive torque is absorbed by the integrated anti rotation feature.

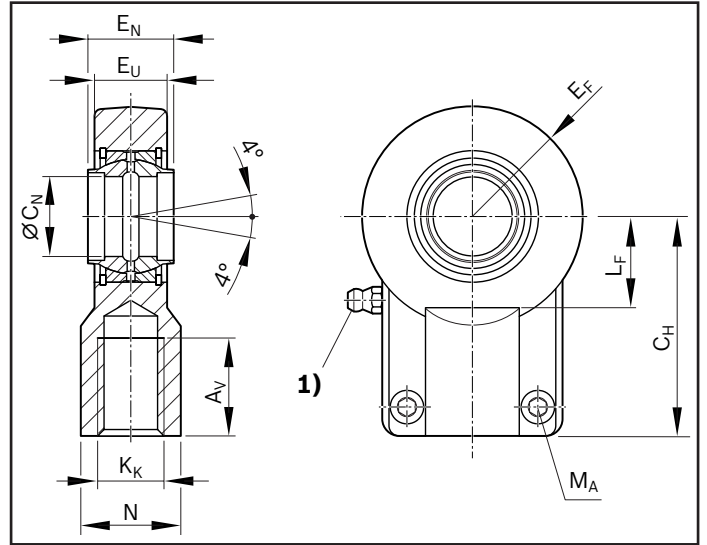
Use with spherical rod end bearing only.

Tensile and compressive axial forces are absorbed via the fastening thread.

During installation, screw the lock nut all the way onto the threaded mounting interface.

After screwing on and radially aligning the connection element, screw back the lock nut against the connection element (maximum 1.5 turns).

Spherical rod end bearing CGKD (clampable) Group 2, option 12



1) Lube nipple, hydraulic type A as per DIN 71412

EMC-HD	Part number	Dimensions (mm)										Clamping screw		m ³⁾ (kg)
		A _V min.	N max.	C _H js13	E _F max.	∅C _N ²⁾ H7	E _N h12	E _U max.	K _K	L _F min.	ISO 4762-10.9	M _A (Nm)		
085	R900322049	37	38	80	40.0	32	32	28.0	M27x2	30	M10x25	59	1.15	
105	R900322029	46	47	97	50.0	40	40	34.0	M33x2	39	M10x30	59	2.10	
125	R900322719	57	58	120	63.0	50	50	42.0	M42x2	47	M12x35	100	4.00	
150	R349952200	64	70	140	72.5	63	63	53.5	M48x2	58	M16x40	250	7.20	
180	R349952300	86	91	180	92.0	80	80	68.0	M64x3	74	M20x50	490	15.0	

2) Matching pivot pin ∅ m6

3) Add mass to basis cylinder weight

Notes on mounting

During installation, screw the lock nut all the way onto the threaded mounting interface.

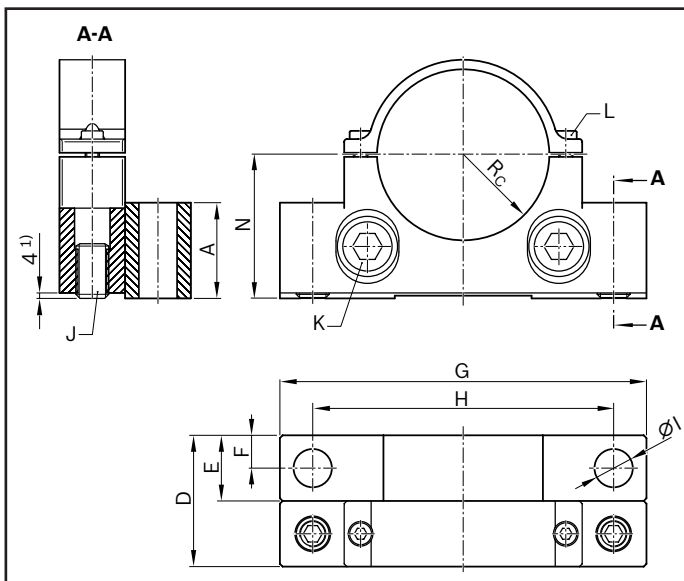
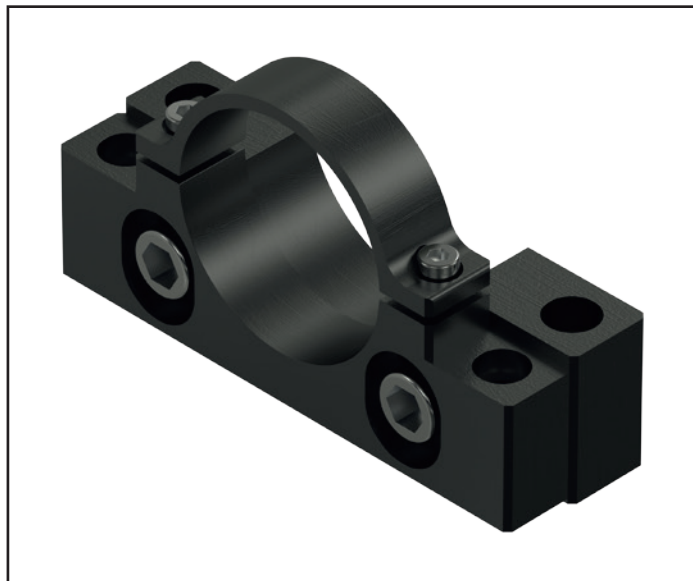
After screwing on and radially aligning the connection element, screw back the lock nut against the connection element (maximum 1.5 turns).

Then tighten clamping screws to the stated tightening torque (M_A).

Mounting elements

Foot mount

Group 3, option 11



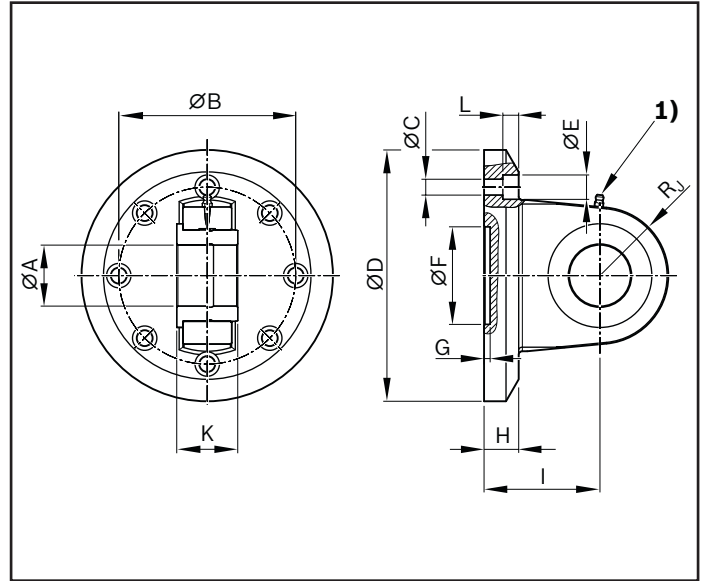
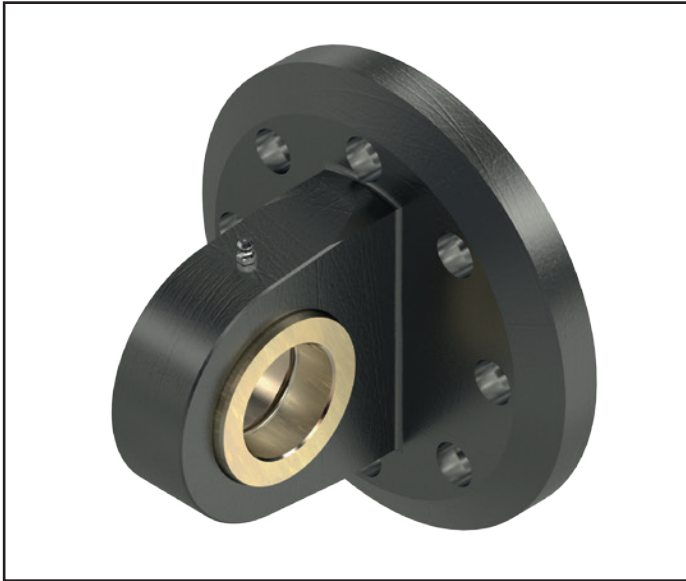
1) The foot mount can be adjusted for height in a range of +/-4 mm

EMC-HD	Part number	Dimensions (mm)								J Set screw ISO 4026	K Bolt ISO 4762	L Bolt ISO 4762	N	m ²⁾ (kg)
		A	R _c	D	E	F	G	H	ØI					
085	R156330130	55	43	60	32	16	195	162	19	M16X40	M16x40	M8x20	65	1.4
105	R156340130	50	53	70	40	20	232	182	22	M16x40	M16x40	M8x20	76	2.0
125	R156350131	65	63	96	48	24	268	220	28	M24x40	M16x55	M10x25	95	4.0
150	R156360130	77	76	106	58	29	310	254	33	M24x40	M24x70	M12x30	112	6.4
180	R156370130	106	91	118	70	35	400	327	39	M24X40	M24x70	M16x45	140	11.5

2) Add mass to basis cylinder weight

Note

This mounting element is suitable to support the cylinder housing, and can be mounted at any position on the cylinder housing. It is not designed to absorb axial forces!

Swivel bearing
Group 5, option 11


1) Lube nipple, hydraulic type A as per DIN 71412

EMC-HD	Part number	Dimensions (mm)											m ²⁾ (kg)	
		ØA H9	ØB	ØC	ØD	ØE	ØF H7	G	H max.	I	R _J	K h12		L
085	R156330151	32	100	9	162	15	60	5	22.7	65	39	32	9	4.1
105	R156340151	40	104	9	158	15	60	5	21.0	73	44	40	9	4.4
125	R156350151	50	145	13	206	20	80	5	28.4	95	56	50	13	10.8
150	R156360151	63	145	13	206	20	80	5	27.0	102	62	63	13	11.8
180	R156370151	80	197	18	250	26	80	9	27.0	122	82	80	16	20.0

2) Add mass to basis cylinder weight

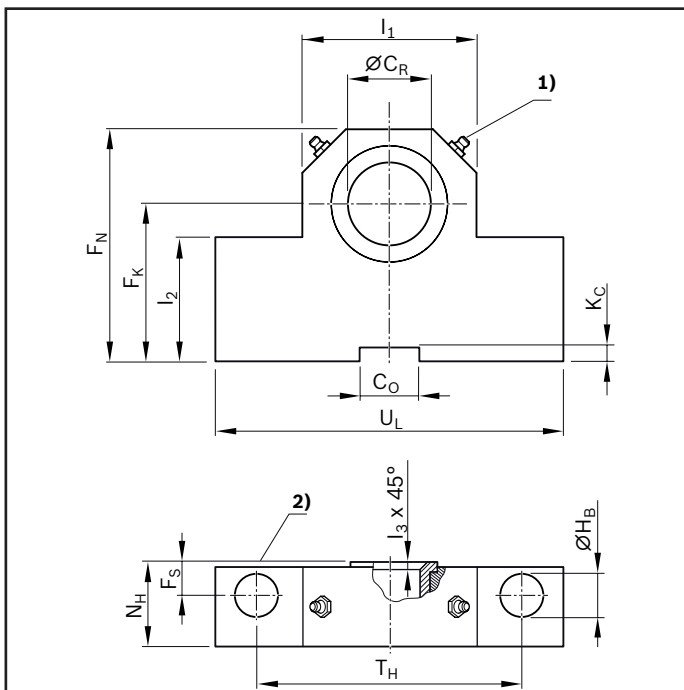
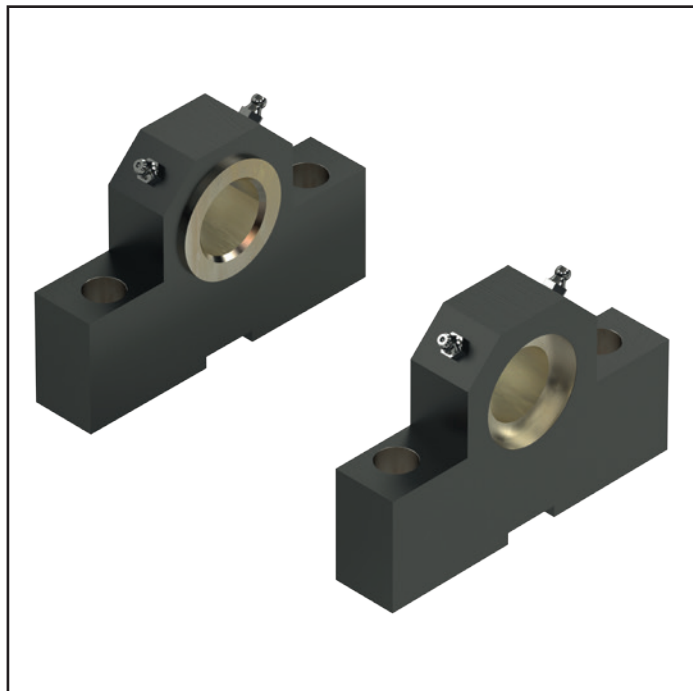
Note

If the swivel bearing installation position is horizontal, load the socket collar.

Mounting elements

Trunnion bearing block CLTB

Group 6, option 01



1) Lube nipple, hydraulic type A as per DIN 71412

2) Location of trunnion contact surface (inside)

EMC-HD	Part number	Dimensions (mm)													m ³⁾ (kg)
		$\varnothing C_R$ H7	C_O N9	F_K js12	F_N max.	F_S js14	$\varnothing H_B$ H13	K_C +0.3	l_1	l_2	l_3	N_H max.	T_H js14	U_L max.	
085	R156330160	32	25	65	100	15	17.5	5.4	70	52	2.5	33	110	150	4.55
105	R156340160	40	35	76	120	16	22.0	8.4	88	60	2.5	41	125	170	7.30
125	R156350160	50	36	95	140	20	26.5	8.4	100	75	2.5	51	160	210	14.50
150	R156360160	63	50	112	180	25	33.0	11.4	130	85	3.0	61	200	265	23.10
180	R156370160	80	50	140	220	31	39.0	11.4	160	112	3.5	81	250	325	52.30

3) Add mass to basis cylinder weight, figure per pair

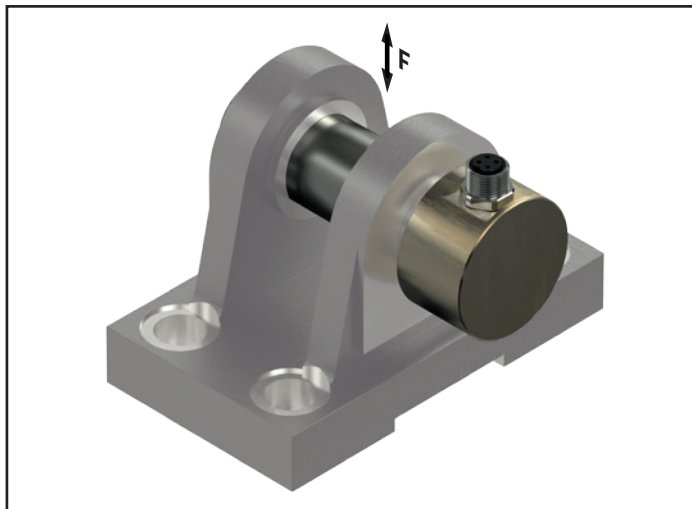
Note

Trunnion bearing blocks are always supplied in pairs.

Non-dimensioned contours may deviate from the illustration and/or from the CAD file.

Load sensor

Clevis bracket with load measuring pin



If your application requires precise load sensing, there is a clevis bracket version with load measuring pin available for this purpose. This option can be selected both at the piston rod end connected to the spherical rod end bearing, and at the timing belt side drive connected to the swivel bearing. Thanks to the thin-film technology used, the load cells are very robust and stable over the long term. The load cells are compliant with the EN 61326 standard for electromagnetic compatibility (EMC) and are designed to sense both tensile and compressive forces.

Note

The use of a hammer or press to fit the pin is not permitted. It may only be inserted by hand.

The load measuring pin is not suitable for measuring torques and may therefore only be used with the cylinder option "Guideway with anti rotation feature".

It is secured axially and against twisting, like the standard pin, on one side of the bracket using the pin locking feature supplied.

For force control at the controller level, a control unit with an analog input is required.

Connection cable is supplied.

Output signal 4 - 20 mA, reduced measurement range and test certificate available on request.

Technical data

Metrological specifications

Material	Stainless steel
Protection class	IP 65
Hardness (load sensing range)	38 HRC
Mechanical system	
Operating load	150% of MR
Load at fracture	300% of MR
Accuracy	
Non-linearity	±0.5% of MR
Repeatability	±0.25% of MR
Hysteresis	±0.2% of MR
Temperature drift at zero point	±0.05% of MR/K.
Temperature drift over measuring range	±0.05% of MR/K.
Compensated temperature	+10 ... +40 °C
Operating temperature	-20 ... +60 °C

MR = measuring range
MR/K. = measuring range per Kelvin

Electrical specifications

		EMC-HD
Output signal	0 kN	0 ±0.03 V
Output signal	MR	-10 ... 10 V ±0.2 V
Power supply		24 ±2 V
Tare (zero setting function)		7.2 ... 24 V
Current consumption		max. 50 mA
Bandwidth		2.5 ±0.2 KHz
Connection		Plug M12x1

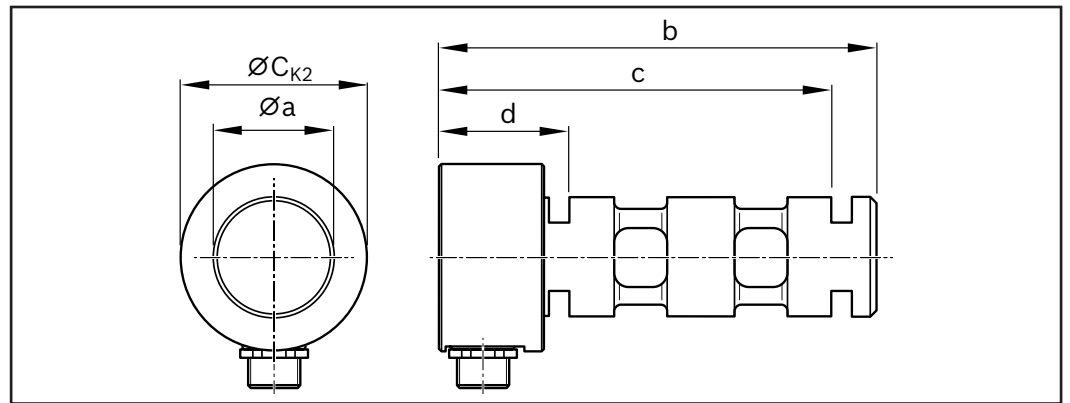
Technical data, connection cable

Length	5 m
Rated voltage	250 V
Rated current	4 A
Plug outlet	Angled
1st connection type	Socket M12x1, 4-pin
2nd connection type	Flying leads
Type of cable	PUR black, shielded
Suitable for flexing installation	yes
Cable cross-section	4 x 0.34 mm ²
Cable diameter D	5.9 ±0.2 mm
Bending radius, stationary	>10 x D
Bending radius, flexing	>5 x D
Bending cycle	> 2 mill.
Ambient temperature, stationary	-25 ... +80 °C
Ambient temperature, in motion	-40 ... +80 °C
Protection class	IP 65

Features

- ▶ For pulling and pressure forces
- ▶ Corrosion-resistant stainless steel version
- ▶ Integrated amplifier
- ▶ Low temperature coefficient
- ▶ High long term stability
- ▶ High shock and vibration resistance
- ▶ For dynamic or static measurements
- ▶ Good reproducibility
- ▶ Easy assembly

Dimensions



EMC-HD	Part number	Dimensions (mm)					Measuring range (kN)	Weight (kg)
		$\varnothing a$ f8	$\varnothing C_{k2}$	b	c	d		
085	R1563 370 80	32	50	117.0	105.0	35.0	50	0.9
105	R1563 470 80	40	40	135.0	122.0	32.0	80	1.3
125	R1563 570 80	50	50	166.5	146.5	36.5	110	2.2
150	R1563 670 80	63	63	189.0	172.0	32.0	190	4.6
180	R1563 770 80	80	80	225.0	204.0	34.0	300	8.8

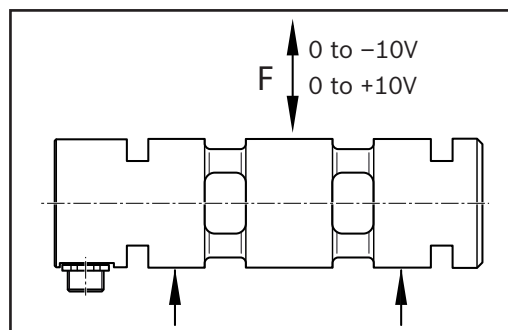
Connection diagram

Load measuring pin

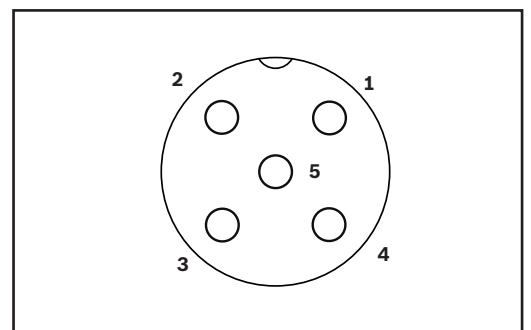
- 1 Supply (+)
- 2 Tare
- 3 Mass
- 4 Output
- 5 Internal allocation

Connection cable

- 1 brn = brown, power supply (+)
- 2 wht = white, Tara
- 3 blu = blue, mass
- 4 blk = black, output



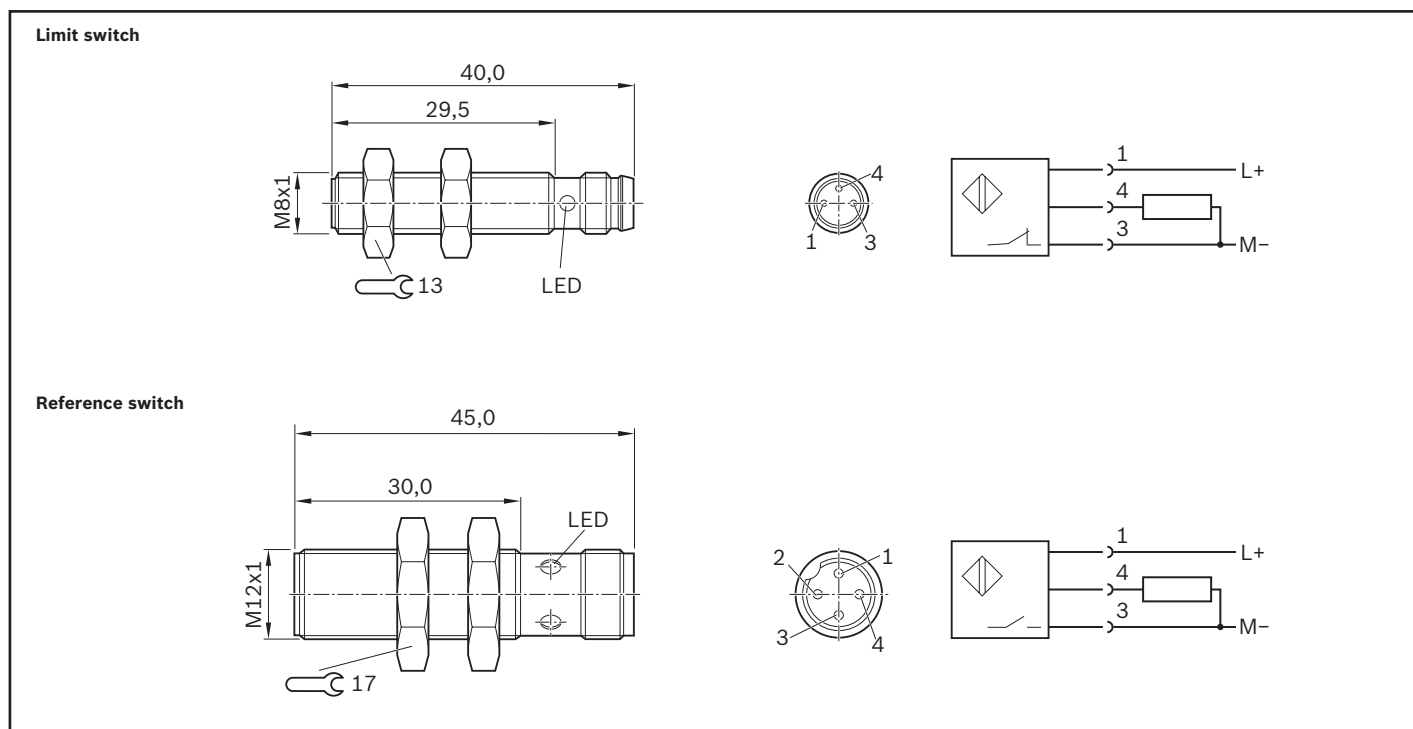
Output signal depending on load direction







Connection diagram for load measuring pin

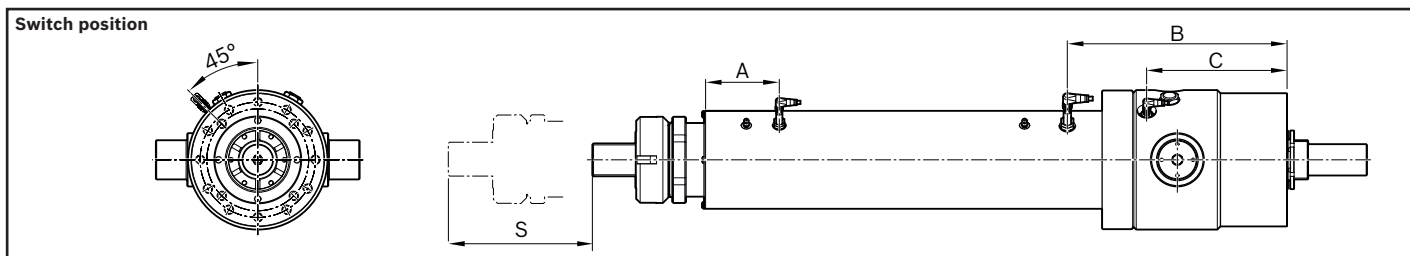
Switch mounting

Proximity switches

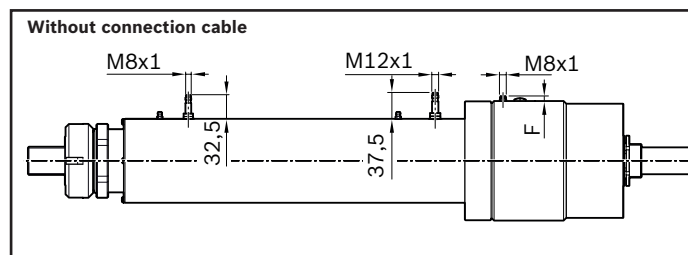
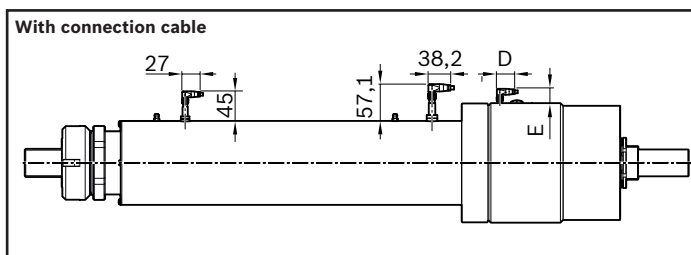


Technical data, proximity switches

	Limit switch	Reference switch
Part number	R9130 307 57	R9130 307 58
		
Function principle	proximity	proximity
Operating voltage	10 ... 30 V DC	10 ... 30 V DC
Load current	< 200 mA	< 200 mA
Switching function	PNP/normally closed (NC)	PNP/normally open (NO)
Connection type	Plug connector, M8x1, 3-pin	Plug connector, M12x1, 4-pin
Function indication	✓	✓
Short-circuit protection	✓	✓
Reverse polarity protection	✓	✓
Switching frequency	3 kHz	2 kHz
Reproducibility	< 0.05 mm	< 0.05 mm
Max. permissible approach speed	1 m/s	1 m/s
Ambient temperature	-25 °C to +70 °C	-25 °C to +70 °C
Protection class	IP 68	IP 68
MTTFd (as per EN 13849)	835 years at 40 °C	835 years at 40 °C
Certification and approval		



The switching point of the limit switch is up to 5 mm outside of the maximum travel path.



EMC-HD	Dimensions (mm)						
	A	B	C	D	E	F	S
085	91	210	135	27	18.5	6	75
105	94	265	165	27	24.0	11	100
125	94	280	180	27	18.5	6	100
150	114	339	239	0	27.0	0	100
180	114	399	299	0	17.0	-10 ¹⁾	100

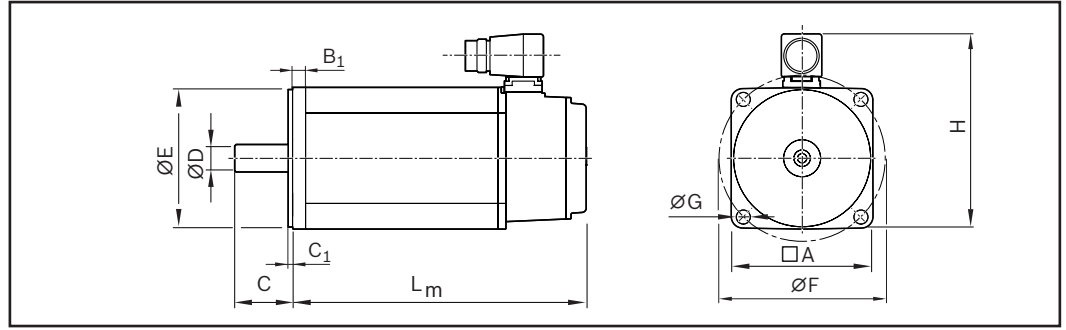
¹⁾ Countersunk to a depth of 10 mm in the bearing housing, therefore straight plugs are also used on the connection cable

S = reference position

Technical data, cables

	Limit switch cable		Reference switch cable	
Part number	R9873 914 96		R9013 912 55	
Pin assignment				
Type of cable	PUR black		PUR black	
Length	5.0 m		5.0 m	
Operating voltage	10 ... 30 V DC		10 ... 30 V DC	
1st connection type	Angled female connector, M8x1, 3-pin		Socket, straight, M8x1, 3-pin	
2nd connection type	Flying lead		Flying lead	
Function indication	-		✓	
Operating voltage indicator	✓		✓	
Suitable for flexing installation	✓		✓	
Cable cross-section	3 x 0.34 mm ²		3 x 0.34 mm ²	
Cable diameter D	4.3 ± 0.2 mm		4.3 ± 0.2 mm	
Bending radius, stationary	> 5 x D		> 5 x D	
Bending radius, flexing	> 10 x D		> 10 x D	
Bending cycle	> 2 million		> 2 million	
Max. perm. travel speed	3.3 m/s		3.3 m/s	
Max. perm. acceleration	5 m/s ²		5 m/s ²	
Ambient temperature fixed & moving	-25 °C to +80 °C		-25 °C to +80 °C	
Ambient temperature, flexing installation	-25 °C to +60 °C		-25 °C to +60 °C	
Protection class	IP 68		IP 68	
Certification and approval				

IndraDyn S – Servo Motors MSK



Schematic motor illustration

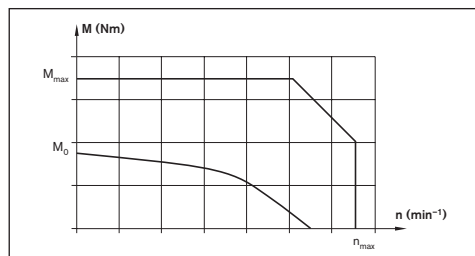
Motor	Dimensions (mm)									L _m	
	A	B ₁	C	C ₁	ØD k6	ØE j6	ØF	ØG	H	Without holding brake	With holding brake
MSK071D-0300	140	16.5	58	4	32	130	165	11	202	312	347
MSK100B-0300	192	17.5	60	4	32	130	215	14	262	368	368
MSK101D-0300	192	17.5	80	4	38	180	215	14	262	410	410
MSK101E-0300	192	17.5	80	4	38	180	215	14	262	501	501
MSK101E-0300 ¹⁾	208	17.5	80	4	38	180	215	14	262	672	672
MSK133B-0202 ¹⁾	260	15.0	110	5	48	250	300	18	368	622	807
MSK133D-0202 ¹⁾	260	15.0	110	5	48	250	300	18	368	722	907

Motor data

Motor	n _{max} (min ⁻¹)	M ₀ (Nm)	M _{max} (Nm)	M _{br} (Nm)	J _m (kgm ²)	J _{Br} (kgm ²)	m _m (kg)	m _{br} (kg)
MSK071D-0300	3 800	17.5	66.0	Without	0.00230	-	18.0	-
MSK071D-0300		17.5	66.0	23	0.00230	0.00030	18.0	1.6
MSK100B-0300	4 500	28.0	102.0	Without	0.01920	-	34.0	-
MSK100B-0300		28.0	102.0	32	0.01920	0.00124	34.0	2.5
MSK101D-0300	4 600	50.0	160.0	Without	0.00932	-	40.0	-
MSK101D-0300		50.0	160.0	70	0.00932	0.00300	40.0	3.8
MSK101E-0300		70.0	231.0	Without	0.0138	-	53.5	-
MSK101E-0300		70.0	231.0	70	0.0138	0.00300	53.5	3.8
MSK101E-0300 ¹⁾	4 600	105	231	Without	0.0138	-	57.8	-
MSK101E-0300 ¹⁾		105	231	70	0.0138	0.00300	57.8	3.8
MSK133B-0202 ¹⁾	3 300	152	320	Without	0.0476	-	91.6	-
MSK133B-0202 ¹⁾	3 000	152	320	200 ^{+40%} ^{-20%}	0.0476	0.02500	91.6	60.0
MSK133D-0202 ¹⁾	3 300	250	520	Without	0.0780	-	127.0	-
MSK133D-0202 ¹⁾	3 000	250	520	224 ^{+40%} ^{-20%}	0.0780	0.02500	127.0	60.0

¹⁾ With fans (illustration differs)

Motor torque speed curve (schematic)



- J_{br} = mass moment of inertia of holding brake
- J_m = mass moment of inertia of motor
- L_m = length of motor
- M₀ = standstill torque
- M_{br} = holding torque of holding brake when switched off
- M_{max} = maximum possible motor torque
- m_m = mass of motor
- m_{br} = mass of holding brake
- n_{max} = maximum rotary speed

Motor option	Motor	Motor part number	External holding brake part number	Fan part number	Version		Type designation
					Holding brake Without	With	
114	MSK071D-0300	R911310539	-		X		MSK071D-0300-NN-M1-UG0-NNNN
115		R911310168	-			X	MSK071D-0300-NN-M1-UG1-NNNN
116	MSK100B-0300	R911315705	-		X		MSK100B-0300-NN-M1-AG0-NNNN
117		R911310478	-			X	MSK100B-0300-NN-M1-AG1-NNNN
118	MSK101D-0300	R911315888	-		X		MSK101D-0300-NN-M1-AG0-NNNN
119		R911310895	-			X	MSK101D-0300-NN-M1-AG2-NNNN
120	MSK101E-0300	R911317226	-		X		MSK101E-0300-NN-M1-AG0-NNNN
121		R911310891	-			X	MSK101E-0300-NN-M1-AG2-NNNN
124	MSK101E-0300 ¹⁾	R911317226	-	R911325863	X		MSK101E-0300-NN-M1-AG0-NNNN
125		R911310891	-	R911325863		X	MSK101E-0300-NN-M1-AG2-NNNN
126	MSK133B-0202 ¹⁾	R911344559	-	- ³⁾	X		MSK133B-0202-SA-M1-EG0-NPNN
127		R911344559	R039612359 ²⁾	- ³⁾		X	MSK133B-0202-SA-M1-EG0-NPNN
128	MSK133D-0202 ¹⁾	R911344560	-	- ³⁾	X		MSK133D-0202-SA-M1-EG0-NPNN
129		R911344560	R039612359 ²⁾	- ³⁾		X	MSK133D-0202-SA-M1-EG0-NPNN

¹⁾ With blower

²⁾ Motors MSK133B/ MSK133D do not have their own holding brakes

³⁾ The fan is integrated in the motor part number

Versions:

- Plain shaft with shaft seal
- Multi-turn absolute encoder M1 (Hiperface)
- Cooling system: natural convection
- Protection class IP65 (housing)
- With or without holding brake

Note

The motors can be supplied complete with controllers and control systems. For further motor types and details regarding motors, control devices and control systems, see the following Rexroth Catalogs on drive technology:

- Drive System Rexroth IndraDrive, R999000018
- Automation systems and control components, R999000026
- Rexroth IndraDyn S Synchronous Motors MSK, R911296288

Recommended motor/ controller combinations

Motor	Controller ¹⁾	Controller ²⁾
MSK 071D	HCS01.1E-W0054	HCS01.1E-W0028
MSK 100B	HCS03.1E-W0100	HCS02.1E-W0054
MSK 101D	HCS03.1E-W0150	HCS03.1E-W0100
MSK 101E	HCS03.1E-W0210	HCS03.1E-W0100
MSK 133B	HCS03.1E-W0210	HCS03.1E-W0100
MSK 133D	HCS03.1E-W0210	HCS03.1E-W0150

¹⁾ Design for maximum current / maximum torque of the motor

If the acceleration torque is not required, a drive controller 1-2 power ratings lower may also be adequate.

²⁾ Design for continuous current at standstill / continuous torque at standstill of the motor

The relevant DC bus continuous power and increased current demand on acceleration are to be taken into account!

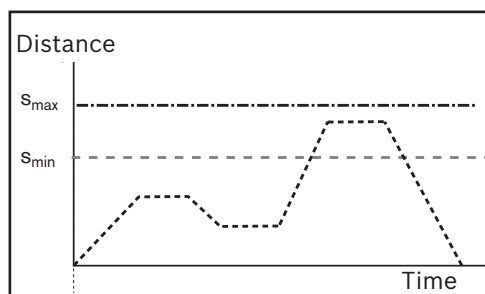
Due to the need to take into account the drive controller's power and the effect of accessories (mains choke), detail design is essential in any case.

Operating conditions and usage

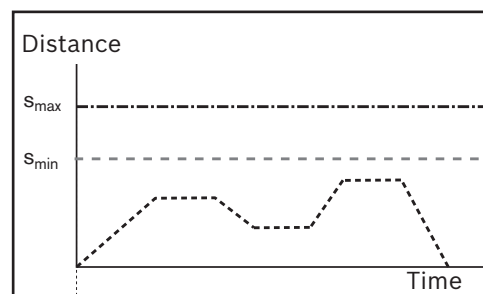
Normal operating conditions

Ambient temperature, cylinder with Rexroth servo motor	0 °C ... 40 °C, above 40 °C loss of performance
Ambient temperature cylinder mechanical system	-10 °C ... +50 °C (up to +60 °C with low duty cycle and power)
Ambient temperature cylinder mechanical system with PLSA and low-temperature grease	-30 °C ... +50 °C (up to +60 °C with low duty cycle and power)
Protection class	IP 65
Duty cycle	100% (depending on power required, the permissible duty cycle may be limited due to heat generation)
Normal stroke	The distance traveled per cycle is $\geq s_{min}$ (see diagram).

Stroke definition



Normal stroke



Short stroke

Short stroke: The distance traveled per cycle is $< s_{min}$ (see diagram).

Note:

- Short stroke operation only permitted with regular lubrication strokes (larger s_{min})
- Calculate nominal service life with reduced dynamic load rating
- Shorten maintenance interval

Contact Bosch Rexroth for further details.

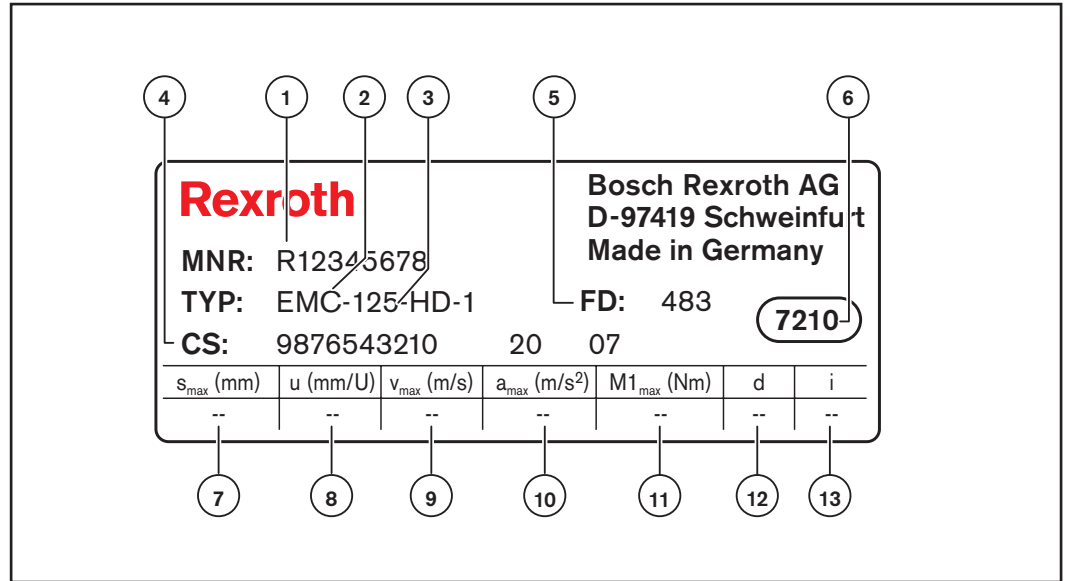
Note

For more information about Intended use and safety, see “Safety for linear systems R320103152” and “Instructions EMC-HD R320103139”.

For more information on installation / initial operation see “Instructions EMC-HD R320103139”.

PDF files of these documents can be found on the Internet at:
www.boschrexroth.com/mediadirectory

Name plate



1	MNR	Part number
2	TYP	Short product name
3	125	Size
4	CS	Customer information
5	FD	Date of manufacture
6	7210	Manufacturing location
7	s_{\max}	Maximum travel range
8	u	Lead constant without motor attachment
9	v_{\max}	Maximum linear speed
10	a_{\max}	Maximum acceleration
11	$M1_{\max}$	Maximum drive torque at motor journal
12	d	Direction of rotation of the motor for travel in positive (+) direction
13	i	Gear ratio

Note

The stated values describe the mechanical limits of the axis.

Lubrication and maintenance

Grease lubrication

The advantage of grease lubrication is that the ball or planetary screw assemblies can run for long distances on one supply of grease. As a result, a lubricating system is not required in many cases.

All commercially available high-quality ball bearing greases may be used. Read the lubricant manufacturer's specifications carefully!

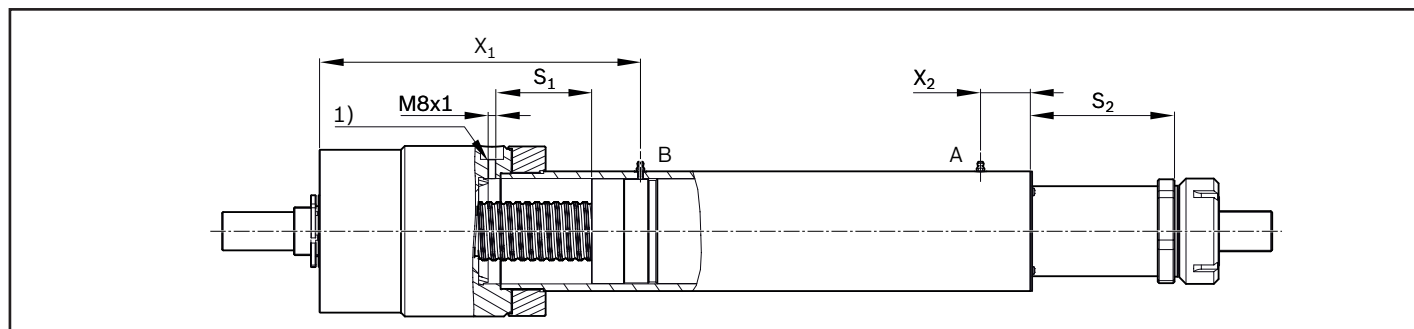
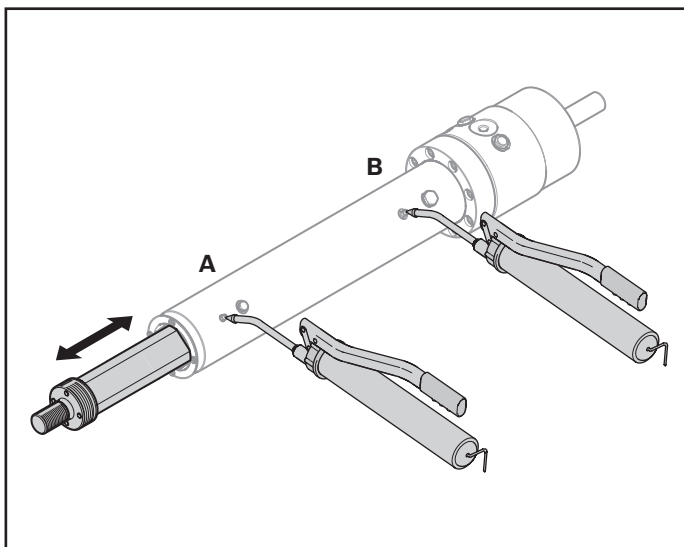
Greases in accordance with DIN 51825 K2K and, for higher loads, KP2K of NLGI Class 2 in accordance with DIN 51818 are recommended for the longest possible lubrication intervals. Tests have shown that greases of NLGI Class 00 achieve only about 50% of the running performance of Class 2 at higher loads.

Lubrication position and notes on lubrication

Basic lubrication is applied in-factory before shipment. The electromechanical cylinders are designed for grease lubrication. Screw drive (B) and guideway (A) must be relubricated. There are 3 options for reaching the lubrication position:

- move the piston rod to stroke position S_2 (this is also reference position) see figure
- with limit switch fitted, extend by S_1 from the limit switch position.
- without limit switch, extend from the rear end position (mechanical hard stop) by $S_1 + 8$ mm.

The lubrication of the guideway (A) can be carried out regardless of the position of the screw drive nut. For more information, see "Instructions for EMC-HD, R320103139".



¹⁾ Limit switch bore

EMC-HD	X_1 (mm)	$X_2^{2)}$ (mm)	S_1 (mm)	$S_2^{2)}$ (mm)
085	256	52	75	117
105	320	52	100	148
125	335	52	100	150
150	419	67	100	166
180	499	67	100	167

²⁾ Deviates with the round flange option. Please take note of the appropriate dimensional drawings.

Recommended lubricants

Note

Do not use greases with solid lubricant components (e.g. graphite or MoS₂ additives). Dynalub 520 is recommended for centralized lubrication systems.

For lubrication quantity and lubrication intervals see "Instructions EMC-HD R320103139".

Grease		Low-temperature grease (-30 ... +60 °C)
Consistency class NLGI 2 as per DIN 51818 We recommend Dynalub 510 (Bosch Rexroth) Cartridge (400 g) R341603700 Bucket (5 kg) R341603500	Consistency class NLGI 00 as per DIN 51818 We recommend Dynalub 520 (Bosch Rexroth) Cartridge (400 g) R341604300 Bucket (5 kg) R341604200	Klüber BEM 34-132 R341603600
May also be used	May also be used	
Elkalub GLS 135 / N2 (Chemie-Technik) Castrol Longtime PD2 (Castrol)	Elkalub GLS 135 / N00 (Chemie-Technik) Castrol Longtime PD 00 (Castrol)	

Documentation

Standard report

Option 01

The standard report serves to confirm that the checks listed in the report have been carried out and that the measured values lie within the permissible tolerances. Controls listed in the standard report:

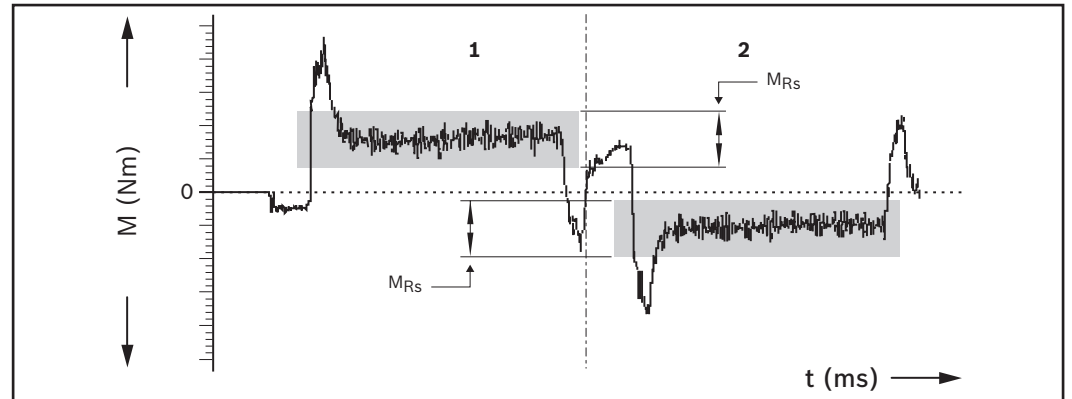
- Functional checks on mechanical components
- Functional checks on electrical components
- Design in accordance with order confirmation

Frictional torque of complete system

Option 02

All items contained in the standard report. The moment of friction M is measured over the entire travel range.

Example diagram



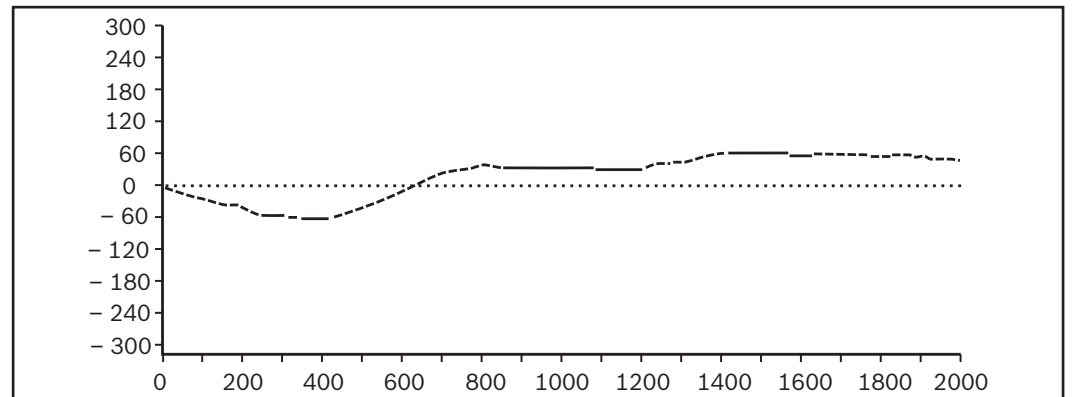
- 1) Advance
- 2) Return

M_{Rs} = frictional torque (N)
 t = travel time (ms)

Lead deviation of screw drive

Option 03

All items contained in the standard report. In addition to graphical illustration (see illustration), a measurement report is supplied in tabular form.



Ordering example EMC-125-HD

EMC-125-HD – Configuration and ordering

Short product name, s_{max} EMC-125-HD-1 ... mm	Guideway		Drive units				Lubrication	Version	Motor attachment		Motor		Switch				Surface finish		Documentation				
	Without round flange	With round flange ¹⁾	PLSA $d_p \times P$	BASA $d_p \times P$	With initial greasing	Prelubricated with low-temperature grease	Description	Gear ratio	Description	Without brake	With brake	Without switch	1 reference switch	2 limit switches	2 limit switches and 1 reference switch	Standard	Black painted	Standard report	Frictional torque measurement	Lead deviation			
Round piston rod	01	02					OF	Without motor mount	Without	00	Without	000	000										
							MF	With motor mount	i = 1	With motor mount	02	MSK100B	116	117									
									i = 3	With motor mount and gear unit SP100	03	MSK101D	118	119									
									i = 3	With motor mount and gear unit SP140	06	MSK101E	120	121									
			01	02	12	13	01	02 ²⁾	i = 5	With motor mount and gear unit SP100	07	MSK101D	118	119									
With anti rotation feature	11	12							i = 5	With motor mount and gear unit SP100	16	MSK071D	114	115	00	01	02	03	01	13	01	02	03
								RV01	i = 1.5	Timing belt side drive	41	MSK100B	116	117									
								RV02			42	MSK101D	118	119									
								RV03				MSK101E	120	121									
								RV04	i = 4.5	RV (i = 1.5) and gear unit SP100 (i = 3)	51	MSK100B	116	117									
									i = 4.5	RV (i = 1.5) and gear unit SP100 (i = 3)	52	MSK101D	118	119									
									i = 7.5	RV (i = 1.5) and gear unit SP100 (i = 5)	70	MSK071D	114	115									

Mounting elements – configuration and ordering

Mounting elements

Version	Group 1	Group 2 ²⁾	Version ³⁾	Group 3	Group 4 ²⁾	Group 5 ²⁾	Group 6
Guide with round piston rod	00	01	Without round flange	00	01	00	00
	00	02			11	21	00
	11					22	
	00	11		11		31 ²⁾	
Guide with anti rotation feature	00		With round flange	00	02	00	00
	21				00	01	
	22						
	31 ¹⁾				01	00	

¹⁾ With load measuring only on "With anti rotation feature" option (see "Attachments and Accessories" section)
²⁾ With load measuring only on "With anti rotation feature" option (see "Attachments and Accessories" section) NOT to be used in combination with round flange or foot mounting!
³⁾ Pre-assembled on delivery

Examples

Electromechanical Cylinder EMC-125-HD-1

Order data	Option	Explanation
Short product name	EMC-125-HD-1	
Max. travel range	580	580 mm
Guideway	11	Without round flange, with anti rotation feature
Drive unit	02	Planetary screw assembly 48 x 10
Lubrication	01	With initial greasing
Version	MF	With motor mount
Motor attachment	03	Motor mount and coupling for MSK 101D
Motor	118	MSK 101D, without brake
Switch	02	Two limit switches
Surface finish	01	Standard
Documentation	01	Frictional torque
Mounting elements	21	Clevis bracket
	12	Spherical rod end bearing CGKD
	00	Without
	02	Trunnion mount
	00	Without
	01	Trunnion bearing block CLTB

Inquiry or ordering

To be completed by customer	Option
Inquiry	
Order	

Bosch Rexroth AG
97419 Schweinfurt
Germany

Order data	Option
Short product name	E M C - - - - - H D - 1
Max. travel range (mm) =	
Guideway =	
Drive unit =	
Lubrication =	
Version =	
Motor attachment =	
Motor =	
Switch =	
Surface finish =	
Documentation =	
Mounting elements	Group 1
	Group 2
	Group 3
	Group 4
	Group 5
	Group 6

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contact person here:**
[www.boschrexroth.com/
contact](http://www.boschrexroth.com/contact)



Order quantity	Quantity
One-off	
Monthly	
Annually	
Per order	
Comments	

From	
Company	
Address	
Name	
Department	
Fax	
Email	

Glossary (definitions)

Dynamic load rating C:

Constant that is used to calculate the service life of a screw drive. The value for the dynamic load rating C represents the load under which 90% of a sufficiently large number of identical screw drives can achieve a service life of one million revolutions.

Limit switch:

Limit switches are used to monitor the end position of moving parts. They emit a signal when the component reaches a certain position, usually the beginning or end of a stroke. The signal can be electrical, pneumatic or mechanical. Typical forms of limit switches with electrical signals are roller lever switches or non-contacting switches such as photoelectric sensors and proximity switches.

Service life:

The nominal life is expressed by the number of revolutions (or number of operating hours at constant rotary speed) that will be attained or exceeded by 90% of a sufficiently large number of identical screw drives before the first signs of material fatigue become evident.

Maximum force F_{max} :

Maximum permissible mechanical load in axial direction.

Positioning accuracy:

The positioning accuracy is the maximum deviation between the actual position and the target position, as defined in VDI/DGQ 3441.

Reference switch:

Reference switches are used to detect the position of a moved component, e.g. screw drive nut in the cylinder. The switch emits a signal when the component reaches a defined position (reference mark). Reference switches are required for incremental measuring systems or motors with incremental encoders during start-up and after any interruption to the power supply.

Lead:

Relating to screws or threaded shafts, the lead is the linear distance traveled per revolution of the screw or shaft. In the case of a single thread (single-start screws), this is the distance between two thread crests or two grooves (running tracks).

Gear ratio:

This relates to the transmission and conversion of movements, linear and rotary speeds, forces and torques in a geared mechanism. The gear ratio (also known as reduction ratio) is the ratio between the drive variable and the output variable, e.g. the ratio of input speed to output speed.

Repeatability:

The repeatability indicates how precisely a linear system positions itself when approaching a position repeatedly from the same direction (unidirectional motion). It is stated as the deviation between the actual position and the target position.

Further Information

The screenshot shows the Bosch Rexroth website homepage. At the top, there is a navigation menu with options like 'Home', 'Produkte', 'Ersatzteile', 'Service', 'Training', 'Forschung und Entwicklung', 'Unternehmen', 'Kontakt', and 'Log in'. Below the navigation is a search bar. The main content area features a large banner for 'Bosch Rexroth. The Drive & Control Company' with a sub-header 'Wirtschaftlich, präzise, sicher und energieeffizient'. Below this, there are several smaller sections: 'Automatisierung - fit für Industrie 4.0', 'Trainingsprogramm 2016', 'VariocFlow plus', 'D&G-Newsletter', and 'Unsere Service-Hotline'. The footer contains the text 'Bosch Rexroth AG, R999000326 (2015-12)'.

Bosch Rexroth homepage:

<http://www.boschrexroth.com/de/de/>

Product information

EMC-HD:

<http://www.boschrexroth.com/de/de/produkte/produktgruppen/lineartechnik/linearsysteme/aktuatoren/emc-hd/em-zylinder-emc-hd>



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