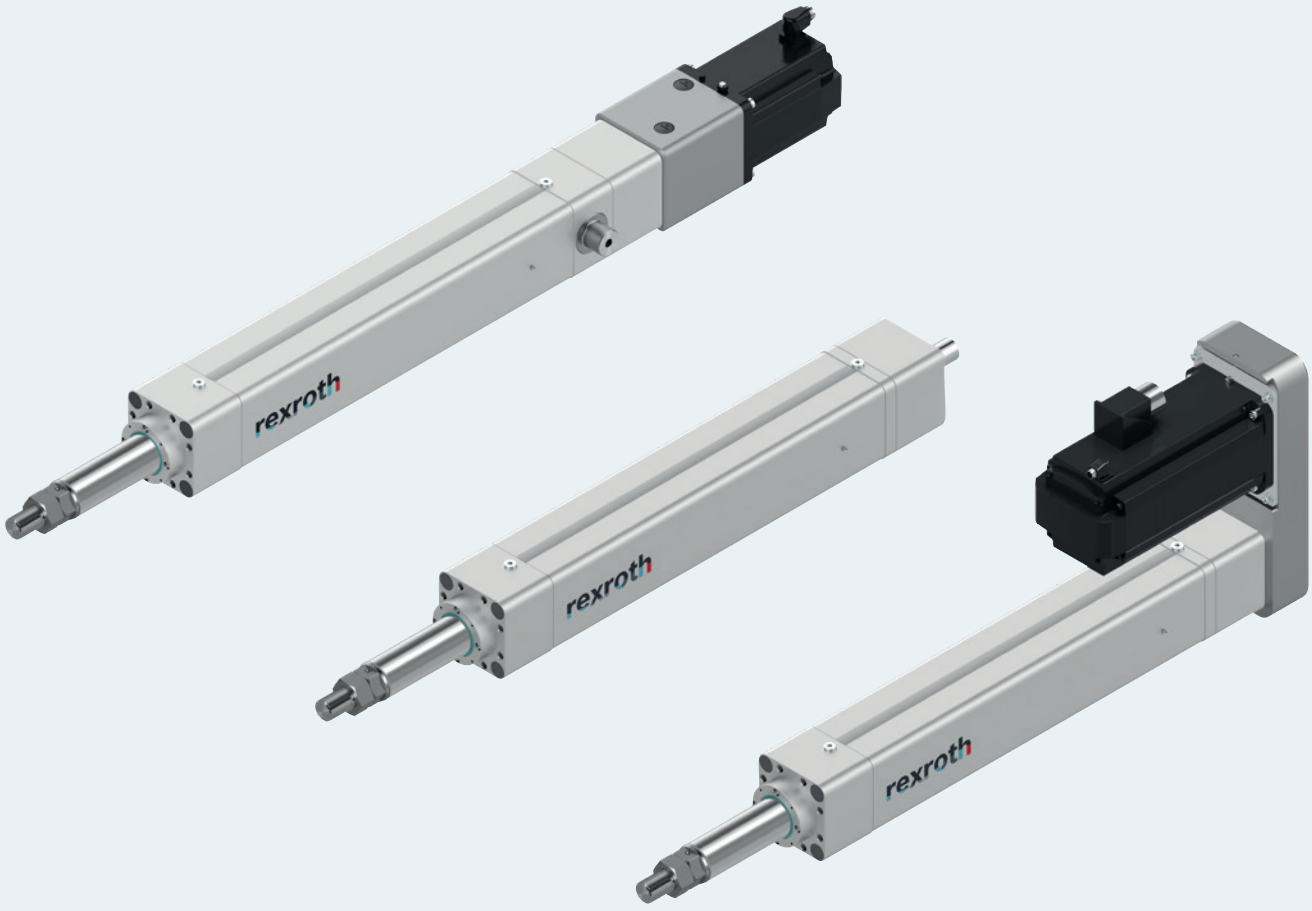
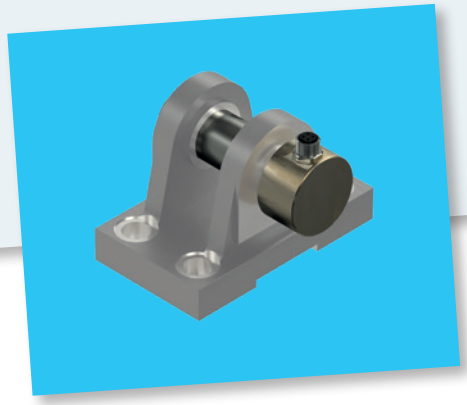
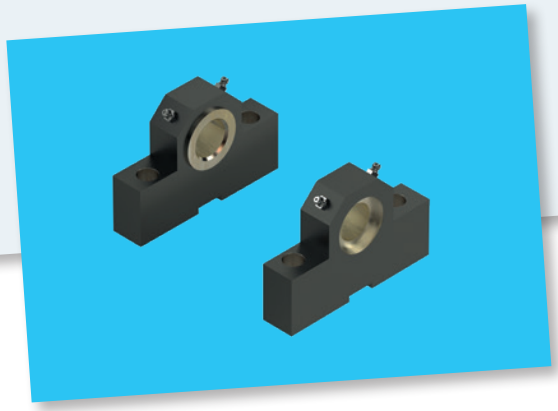
rexroth
A Bosch Company

Electromechanical cylinders
EMC-HP







www.boschrexroth.com

Identification system for short product names

Short product name		Example:	**EMC**	–	**130**	–	**HP**	–	**1**
System	=	**E**lectro**M**echanical **C**ylinder							
Size		**130** / 160 / 190 / 220							
Version	=	**H**igh **P**ower							
Generation	=	Product generation **1**							

Changes/supplements

- Chapter “Calculations” integrated
- Option tables (configuration and ordering) revised: Oil lubrication integrated
- Motor controller combinations (automation package)
- Chapter "Lubrication and maintenance": Oil lubrication integrated
- Size -115 no longer available
- New sizes 190/220 integrated

Contents

Product description

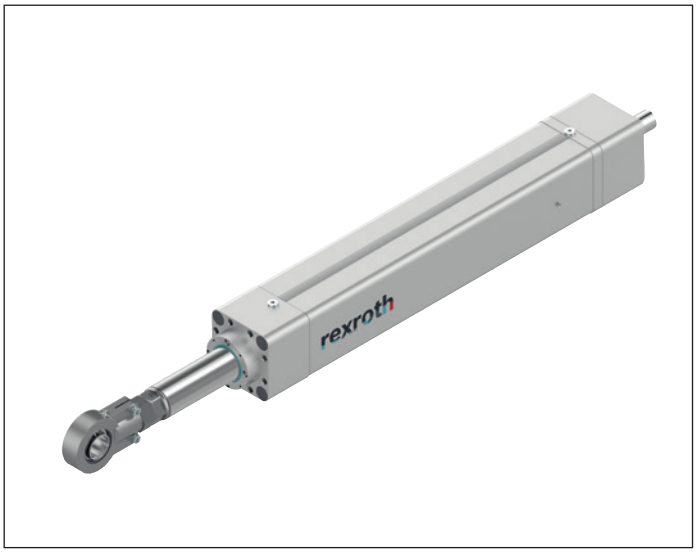
For positioning loads weighing tons with absolute, micrometer precision, powerful pressing, joining or closing and unrestricted motion sequence variation: The new electromechanical cylinders EMC high power (EMC-HP) from Rexroth leverage the advantages of modern control technology even at high forces.
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 CO_2 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-HP for heavy loads transmit the motor movement via ball or planetary screw assemblies, depending on the dynamics and force requirements. Available in various sizes and leads, the highly precise Rexroth screw drives cover a wide range of needs in a cost-effective manner. Rexroth offers the EMC-HP 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.

Structural design

The mechanical system in the electromechanical cylinder EMC-HP is based on proven planetary screw assemblies in a variety 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 seals in the seal holder can be changed. The housing fulfills the requirements for protection class IP 65, the piston rod those for IP 54. The piston rod is protected against turning. Integrated end position buffers protect the mechanical system during commissioning. 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-HP require only minimum maintenance effort. The advantage of grease lubrication is that the screw drive can cover long travel ranges before requiring re-lubrication.

Advantages

- High energy efficiency and low negative environmental impact (no risk of leaks)
- Straightforward, compact and robust structural design for space-saving integration in machine concepts and usage even in harsh environmental conditions
- Complete building system with great variability for high flexibility in a broad range of applications
- Precise positioning, high dynamics, powerful drive and a long service life thanks to precision Rexroth planetary screw assemblies
- Smart, service-oriented, freely programmable drive system allows the realization of complex travel profiles (parameters for force, position and travel speed can be set as required over the complete working travel range)



Condition as delivered

- The electromechanical cylinder EMC-HP is delivered as a completely assembled unit. The only parts not pre-assembled are the pillow blocks, clevis brackets and the switches.

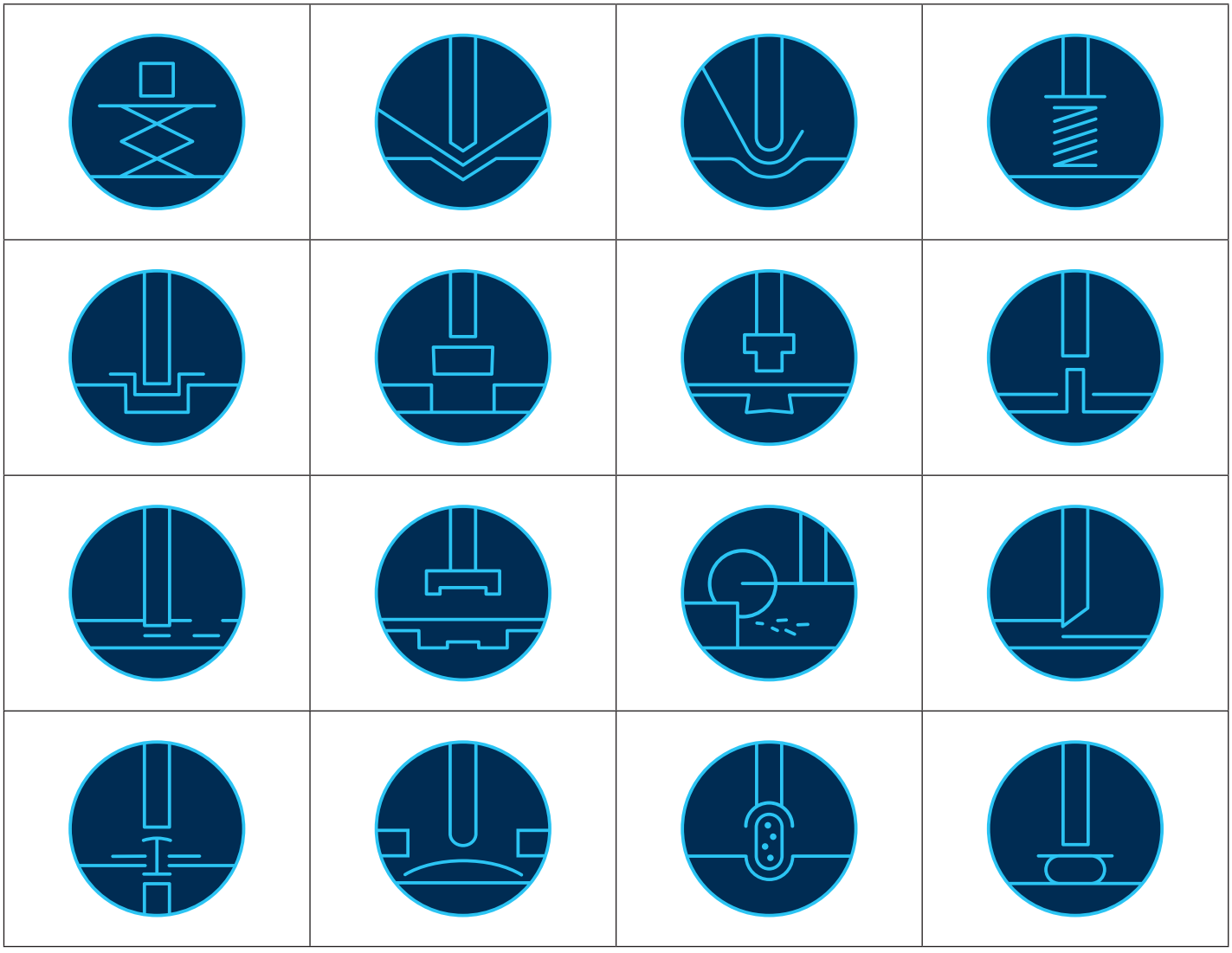
Application areas

Electromechanical cylinders EMC-HP 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 space-saving 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 machines

Application examples: Bending, lifting, pressing, transporting, etc.



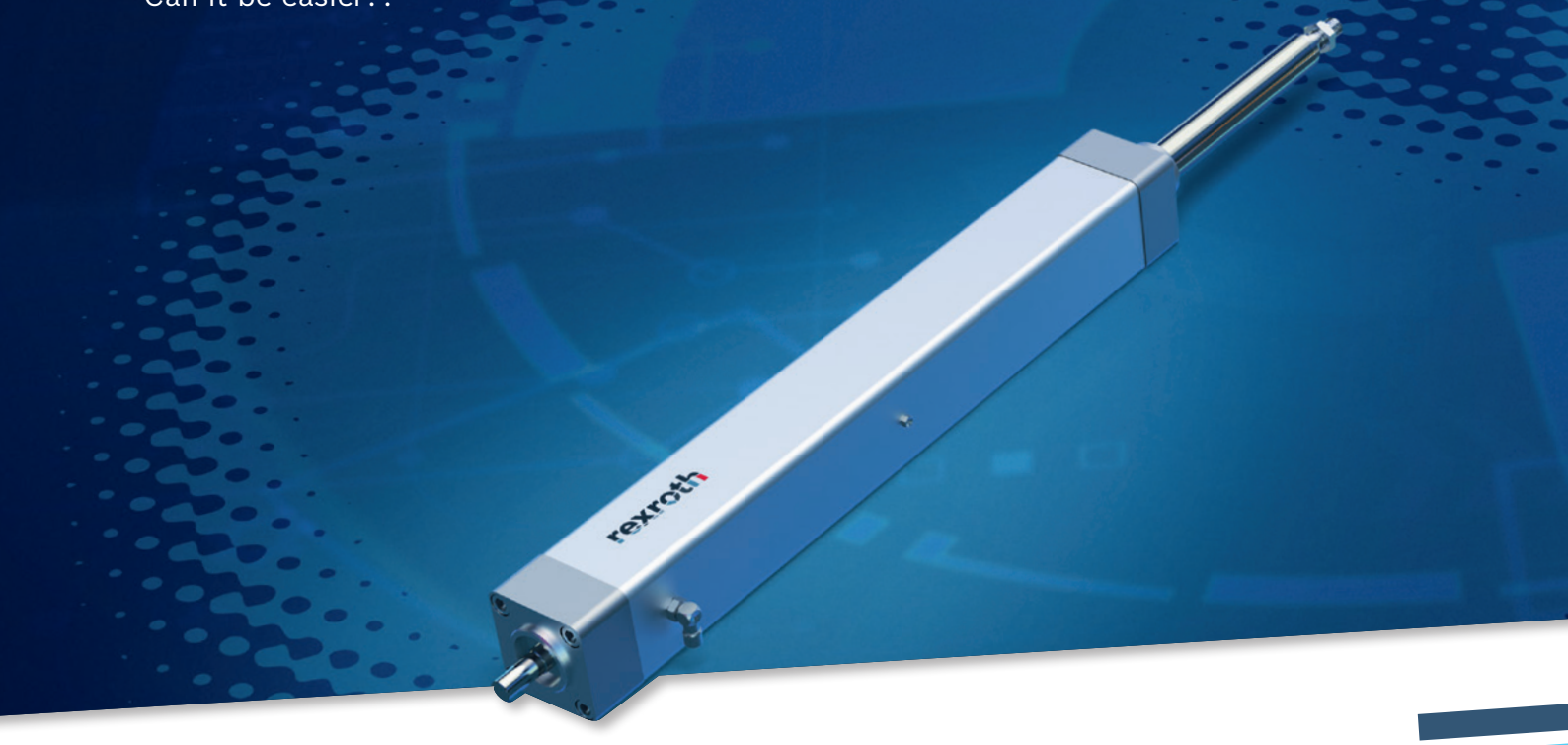
SIMPLY SAVE TIME AND MONEY: EVERYTHING FROM A SINGLE SOURCE. WITH A SINGLE MATERIAL NUMBER.

So that you can realize fully automated movements with single axes faster, all components are now available in one package.

With just a few clicks, you can design and configure motor, drive controller, mains filter and cable online.

Ordered with just one material number, your solution will be available to you in now time – and immediately ready for operation thanks to the axis parameters
stored in the motor. If necessary, the proven Rexroth service is allways available to assist you.

Really everything from a single source. Can it be easier??



Faster automation: single axis + drive + software in one package.

2 ORDERING OPTIONS, ALL FREEDOMS:

1. **Single axis**
2. **Single axis + drive (incl. mains filter/cable)**

Structural design

1 Threaded bolt (galvanized steel)
2 Lock nut (galvanized steel)
3 Piston rod:
Sizes -190/-220 made of chrome-plated steel according to DIN EN 10305
Sizes -130/-160 made of corrosion-resistant steel according to DIN EN10088
4 Thread (for mounting fastening elements)
5 Cover (aluminum, anodized)
6 Housing (aluminum, anodized)
7 Screw journal (steel)
8 Base (aluminum, anodized)
9 Lube connection:
Sizes -130/-160 on both sides
Sizes -190/-220 on one side
10 Cover for T-slot for switches (aluminum, anodized)
11 Flat gasket (fiber reinforced NBR)
12 Service openings
13 Seal holder
14 Wiper (polyurethane)

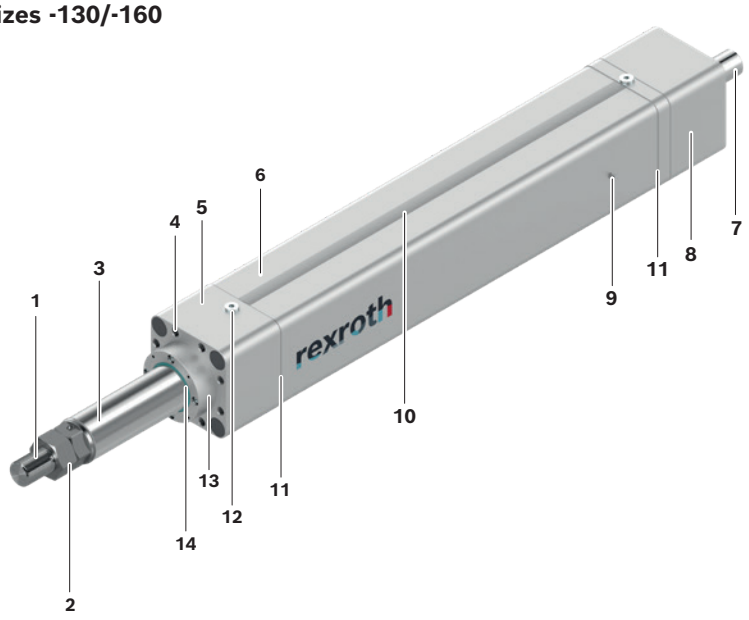
Attachments
15 Motor
16 Gear (optional)
17 Flange (aluminum, anodized)
18 Belt side drive (aluminum, anodized) for sizes -130/-160
Spur gear for sizes -190/-220
19 Trunnion (steel)

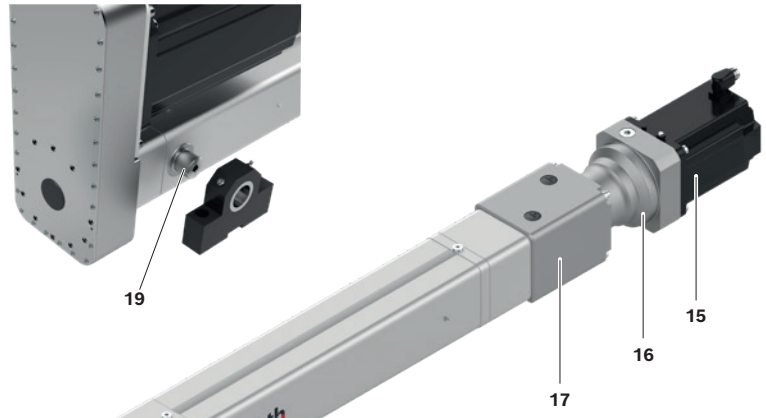
Motor flange and coupling
The motor flange is used to fasten the motor to the EMC and as a closed housing unit (IP 54) for the coupling. With the coupling, the drive torque of the motor is transmitted free of distortive stresses to the screw journal of the EMC.

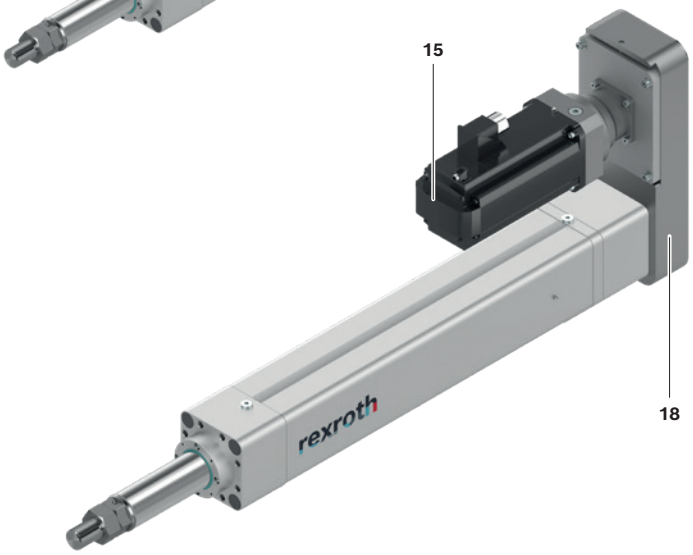
Belt side drive
This configuration results in the shortest overall length of the EMC possible.
The space-saving, closed housing (IP54) serves as protection for the belt, motor bracket and to connect fastening elements.
Gear ratio i = 1 : 1.5

Spur gear
With sizes -190/-220, the attachment of a spur gear is possible in order to realize the shortest possible overall length. The closed housing (IP54) is used as a support for the motor, or for the planetary gear and for connecting fastening elements.

Sizes -130/-160







Sizes -190/-220

For sizes -190/-220 an integrated sensor package is optionally available. It provides data and visualizes system states. This makes process and machine monitoring easy to implement.

Sensor package

LED display: Display

- Green "OK"
- Orange "Warning"
- Red "Alarm"

Depending on the lubrication variant of the EMC-HP, different system states are visualized.

Oil lubrication

- The LED display provides a visual power output display using a sensor in the cylinder.
- Rotary speed sensor for determining the travel life and the average speed (can only be read out via "IO-Link" mode of operation).

Overload "Alarm"

Warning

OK

Grease lubrication

- The LED indicates the need for re-lubrication at a defined travel life (relubrication interval).
- Rotary speed sensor for determining the travel life and the average speed.

Lubrication warning

Lubrication recommendation

OK

In both lubrication variants, the sensor package is parameterized with the corresponding data (e.g. size, screw lead, etc.) of the EMC-HP in order to be able to determine the system conditions.

Modes of operation

The sensor package can be used in 3 modes of operation:

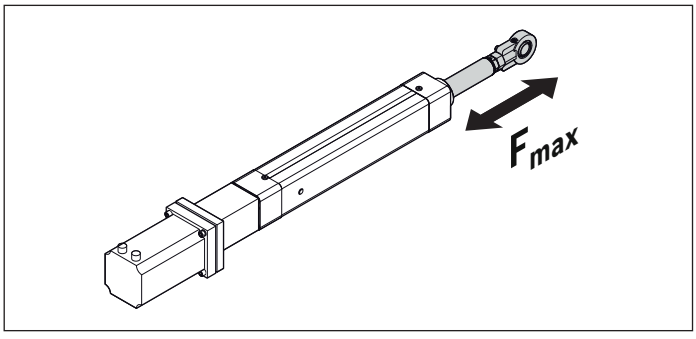
- Basic: Here, the sensor package is only connected to a voltage supply. The states are visually displayed to the user in the LED display.
- Extended: A voltage supply is also required here. The sensor package provides 2 digital signals which can be connected to a PLC, for example. In this way, appropriate measures can be implemented in the control system (e.g. indication that re-lubrication is required). "Yellow" and "Red" states of the power indicator and lubrication intervals are provided (warning & alarm).
- IO Link: If the sensor package is connected to an IO Link master, all data can be read out digitally and additional data can be queried.

Technical data

Dimensions, load capacities, maximum forces and masses

EMC-HP	PLSA d_0xP (mm)	C (kN)	F_{max} (kN)	M_p (Nm)	v_{max} (m/s)	a_{max} (m/s^2)	$s_{max\ adm.}$ (mm)	s_{min} (mm)	L_{ad} (mm) Trunnion without	L_{ad} (mm) Trunnion with	n_P (rpm)	
130	39 x 5	120	65	64.7	0.32	30	1 500	110	364.0	420.0	3 850	
	39 x 10	120	70	139.3	0.64	30	1 500	110	364.0	420.0	3 850	
160	48 x 5	179	95	94.5	0.26	30	1 500	130	418.5	482.0	3 125	
	48 x 10	179	100	198.9	0.52	30	1 500	130	418.5	482.0	3 125	
190	60 x 10	322	150	298.4	0.42	30	1 500	150	549.0	549.0	2 500	
	60 x 20	361	150	596.8	0.83	30	1 500	150	549.0	549.0	2 500	
220	75 x 10	473	250	497.4	0.33	30	1 500	190	648.5	648.5	2 000	
	75 x 20	473	250	994.7	0.66	30	1 500	190	648.5	648.5	2 000	

Note on dynamic load capacities
In relation to the desired service life, generally speaking an equivalent dynamic axial load of up to about 20% of the dynamic load capacity (**C**) has proven effective.
Do not exceed the technical data.



Mass of the EMC-HP
Weight calculation without motor and without motor attachment[1)]

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

Moved mass of system[1)]

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

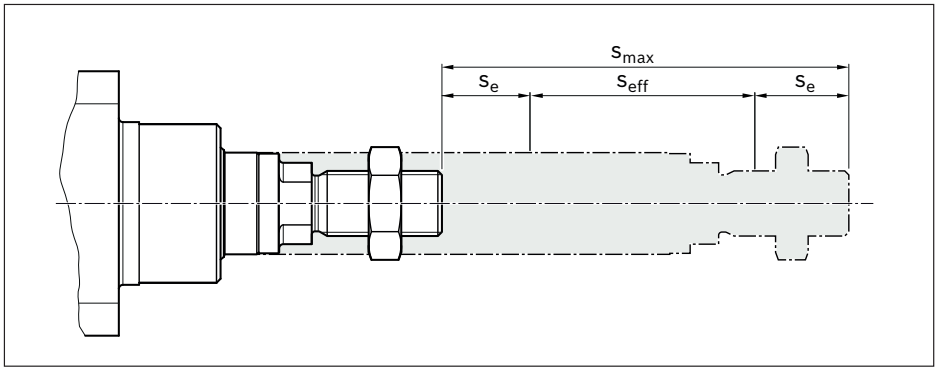
[1)] When calculating the mass of the entire system, the masses of the attachments/fastening elements must also be taken into account. For further information, see the "LinSelect" sizing tool.

The indicated values apply assuming compliance with the specified relubrication intervals and to standard operation.
For short stroke operation (stroke < s_{min}), reduction factors must be taken into consideration.
(see chapter "Operating conditions and application").

	Total axial backlash, max. (new condition) (°)	**η**	**M_{Rs}** (Nm)	**$k_{J\ fix}$**	**$k_{J\ var}$**	**$k_{J\ m}$**	**m_s** **$k_{g\ fix}$** (kg)	**$k_{g\ var}$** (kg/mm)	**m_{ca}** **$m_{ca\ fix}$** (kg)	**$m_{ca\ var}$** (kg/mm)
	2.5	0.80	7	1 947	1.768	0.633	17.0	0.02600	5.8	0.0068
	1.4	0.80	7	1 958	1.781	2.533	17.0	0.02600	5.8	0.0068
	2.5	0.80	14	5 598	4.095	0.633	28.6	0.03500	10.7	0.0115
	1.4	0.80	14	5 618	4.091	2.533	28.6	0.03500	10.7	0.0115
	1.4	0.80	14	14 816	9.994	2.533	50.9	0.05247	22.2	0.0222
	1.0	0.80	14	14 984	10.063	10.132	50.9	0.05247	22.2	0.0222
	1.4	0.80	19	40 453	24.406	2.533	85.0	0.07268	42.3	0.0272
	1.0	0.80	19	40 774	24.407	10.132	85.0	0.07268	42.3	0.0272

Effective stroke

Excess travel must be greater than the braking distance. The acceleration travel can be assumed as a guideline value for the braking distance.



$$s_{eff} = s_{max} - 2 \cdot s_e$$

s_e	=	Excess travel	(mm)
s_{eff}	=	Effective stroke	(mm)
s_{max}	=	Maximum travel range	(mm)

Length calculation:

Overall length EMC-HP with motor attachment with flange and coupling =

$$L_{zs} + s_{max} + L_{ad} + L_f + L_m$$

Overall length EMC-HP with motor attachment with belt side drive/spur gear =

$$L_{zs} + s_{max} + L_{ad} + G$$

(for **L_f**, **L_m** and **G** see the chapter Dimension drawings)

For abbreviations, calculations, configurators and tools, see the chapter "Service and information"

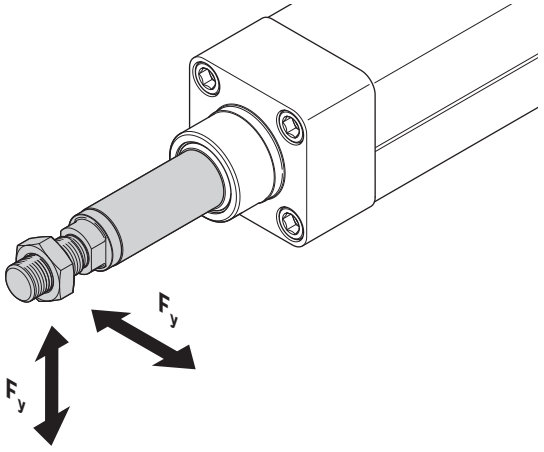
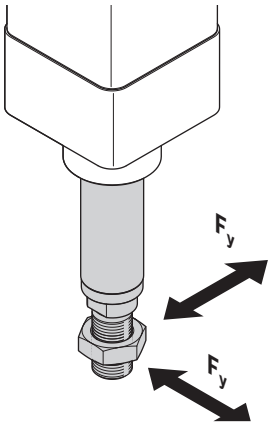
Drive data for motor attachment with flange and coupling

EMC-HP	d_0 x P (mm)	i	for motor	Flange and coupling								
				F_{max} (kN)	M_p (Nm)	v_{max} (m/s)	M_{Rs} (Nm)	$k_{J\ fix}$	$k_{J\ var}$	$k_{J\ m}$	m_{fc} (kg)	a_{max} (m/s^2)
130	39 x 5	1	MS2N07/10	65	64.7	0.32	7.0	2 847	1.768	0.633	5.40	30
	39 x 10	1	MS2N07/10	70	139.3	0.64	7.0	2 858	1.781	2.533	7.00	
160	48 x 5	1	MS2N10	95	94.5	0.26	14.0	7 688	4.095	0.633	8.90	
	48 x 5	3	MS2N10/SP100	95	33.2	0.15	7.8	1 945	0.455	0.070	16.00	
	48 x 10	1	MS2N10	100	198.9	0.52	14.0	7 708	4.091	2.533	8.90	
	48 x 10	3	MS2N10/SP100	100	69.8	0.31	7.8	1 948	0.455	0.281	16.00	
190	60 x 10	1	MS2N10	150	298.4	0.42	14.0	19 556	9.994	2.533	14.20	
	60 x 10	3	MS2N10/PG142	150	99.5	0.36	8.0	4 026	1.110	0.281	32.90	
	60 x 10	5	MS2N10/PG142	150	59.7	0.22	6.0	1 972	0.400	0.101	33.20	
	60 x 20	1	MS2N10	150	596.8	0.83	14.0	19 724	10.063	10.132	14.20	
	60 x 20	3	MS2N10/PG142	150	198.9	0.72	8.0	4 045	1.118	1.126	32.90	
	60 x 20	5	MS2N10/PG142	150	119.4	0.43	6.0	1 979	0.403	0.405	33.20	
220	75 x 10	3	MS2N10/PG190	250	165.8	0.33	12.0	10 384	2.712	0.281	58.20	
	75 x 10	5	MS2N10/PG190	250	99.5	0.20	8.0	7 142	0.976	0.101	58.50	
	75 x 20	3	MS2N10/PG190	250	331.6	0.67	12.0	10 420	2.712	1.126	58.20	
	75 x 20	5	MS2N10/PG190	250	198.9	0.40	8.0	4 775	0.976	0.405	58.50	

Drive data for motor attachment with belt side drive

EMC-HP	d_0 x P (mm)	i	for motor	Belt side drive								
				F_{max} (kN)	M_p (Nm)	v_{max} (m/s)	M_{Rs} (Nm)	$k_{J\ fix}$	$k_{J\ var}$	$k_{J\ m}$	m_{sd} (kg)	a_{max} (m/s^2)
130	39 x 5	1.5	MS2N07/10	65	44.4	0.32	8.0	4 396	0.786	0.281	14.70	30
	39 x 10	1.5	MS2N07	35	48.1	0.64	8.0	4 400	0.792	1.126	14.70	
	39 x 10	1.5	MS2N10	70	95.7	0.64	8.0	4 400	0.792	1.126	14.70	
160	48 x 5	1.5	MS2N10	95	64.9	0.26	15.9	12 888	1.820	0.281	19.70	
	48 x 5	4.5	MS2N10/SP100	95	22.8	0.10	8.4	2 542	0.202	0.031	29.20	
	48 x 10	1.5	MS2N10	100	136.7	0.52	15.9	12 897	1.818	1.126	19.70	
	48 x 10	4.5	MS2N10/SP100	100	48.0	0.20	8.4	2 543	0.202	0.125	29.20	
190	60 x 10	1	MS2N10	150	311.0	0.42	20.0	76 114	9.994	2.533	70.30	
	60 x 10	3	MS2N10/PG142	150	104.0	0.36	14.0	10 311	1.110	0.281	89.60	
	60 x 10	5	MS2N10/PG142	150	62.0	0.22	12.0	4 235	0.400	0.101	89.90	
	60 x 20	1	MS2N10	150	622.0	0.43	20.0	76 283	10.063	10.132	70.30	
	60 x 20	3	MS2N10/PG142	150	207.0	0.43	14.0	10 329	1.118	1.126	89.60	
	60 x 20	5	MS2N10/PG142	150	124.0	0.43	12.0	4 242	0.403	0.405	89.90	
220	75 x 10	3	MS2N10/PG190	250	173.0	0.33	18.0	13 159	2.712	0.281	95.10	
	75 x 10	5	MS2N10/PG190	250	104.0	0.20	14.0	5 260	0.976	0.101	95.40	
	75 x 20	3	MS2N10/PG190	250	333.0	0.43	18.0	13 195	2.712	1.126	95.10	
	75 x 20	5	MS2N10/PG190	250	200.0	0.40	14.0	5 273	0.976	0.405	95.40	

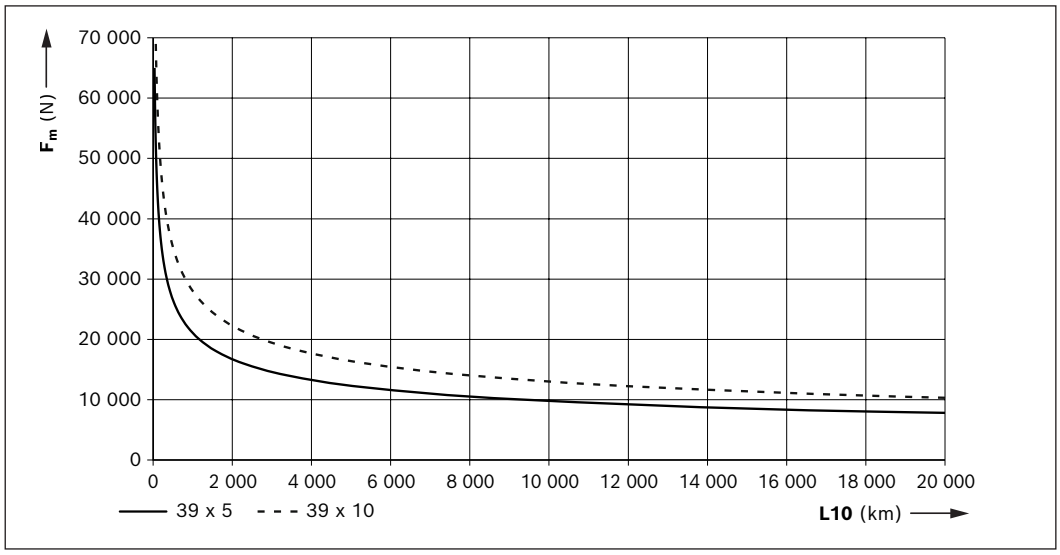
Load on the piston rod

Horizontal mounting	Vertical mounting
	

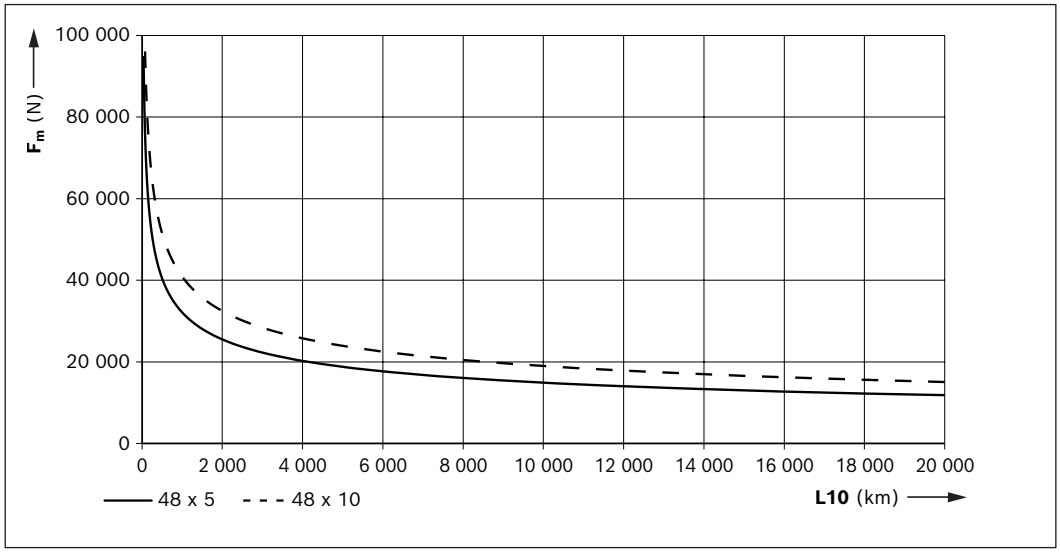
Loading the piston rod with external transverse forces is not permissible

Service life

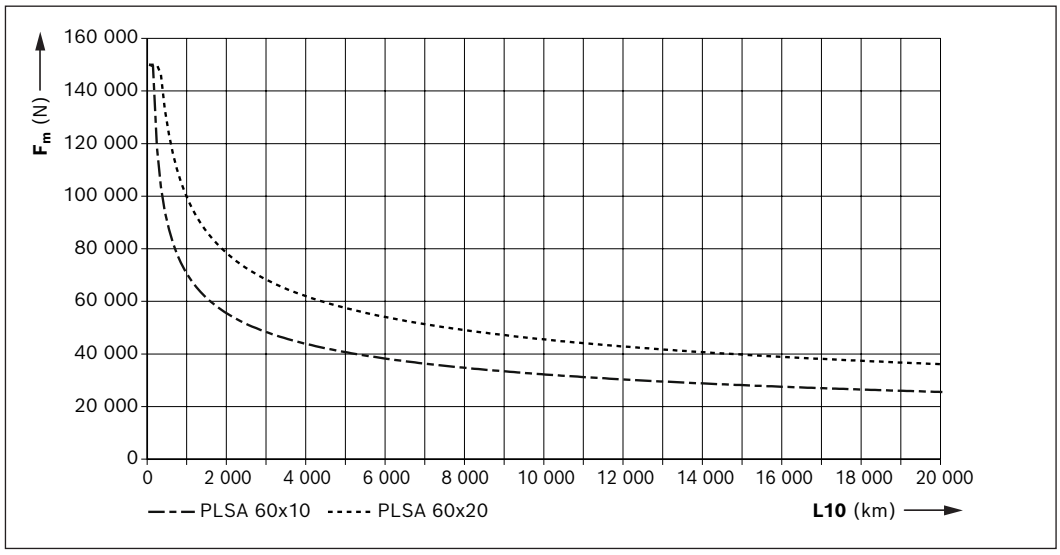
EMC-130-HP



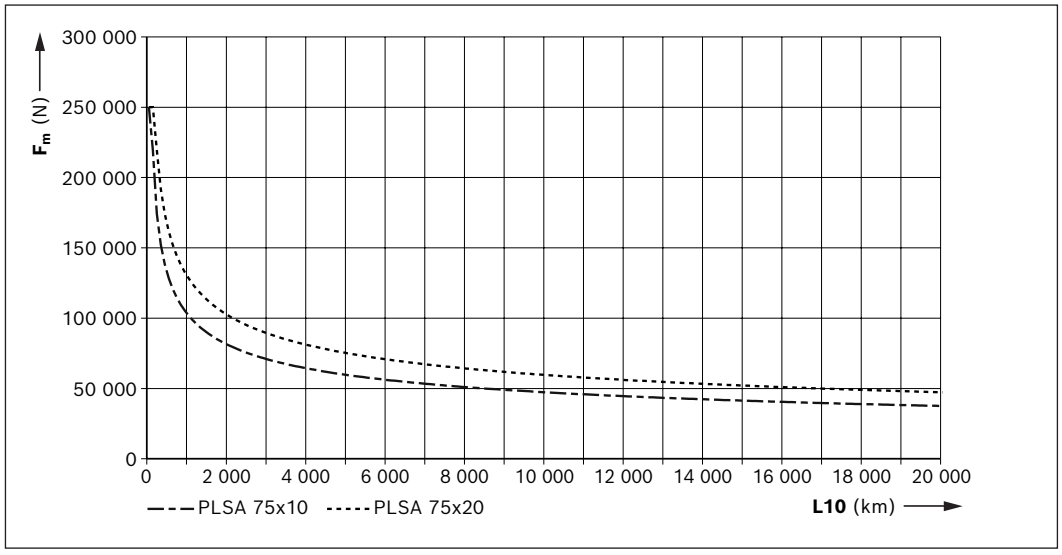
EMC-160-HP



EMC-190-HP

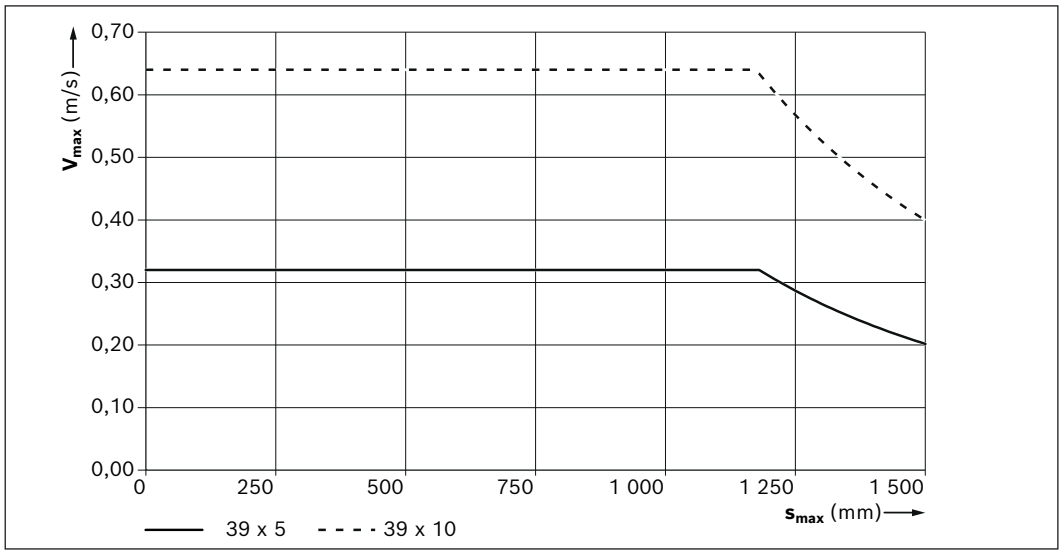


EMC-220-HP

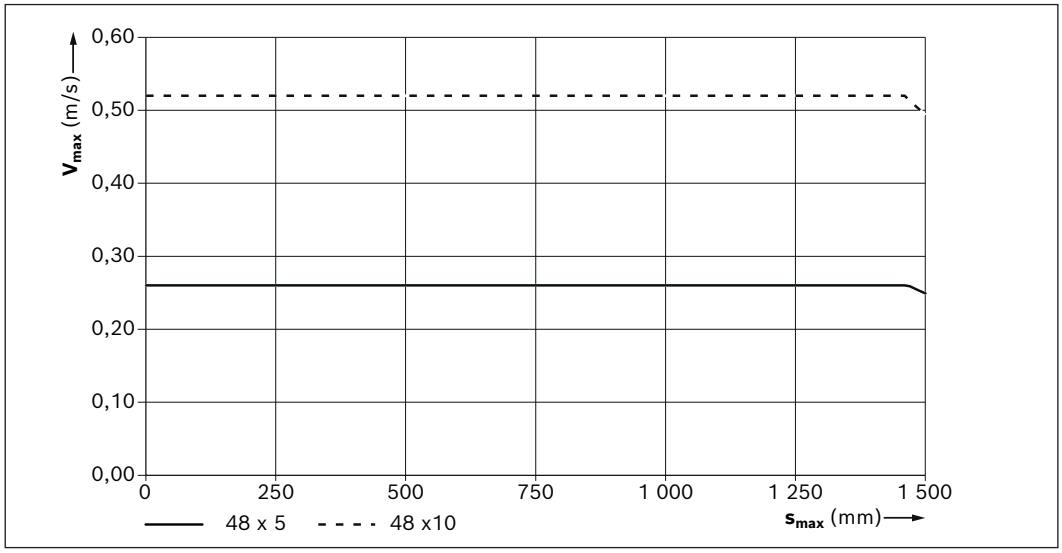


Travel speeds

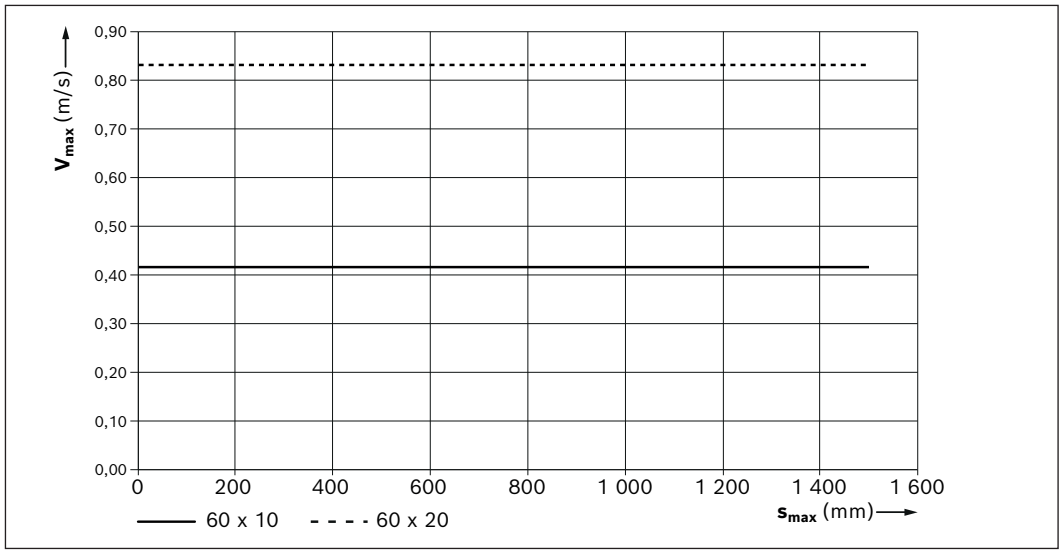
EMC-130-HP



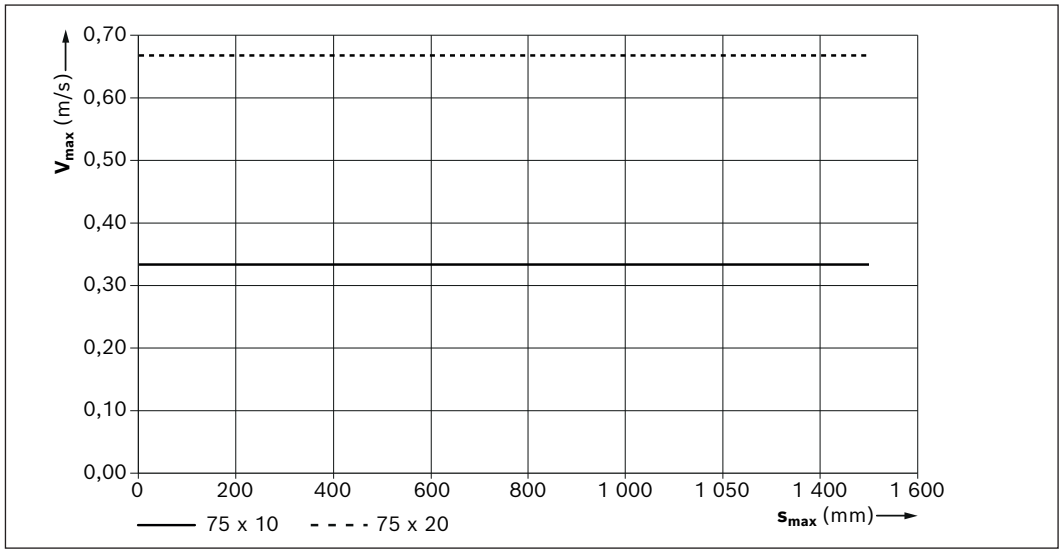
EMC-160-HP



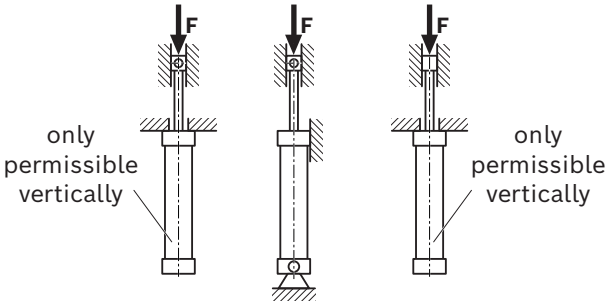
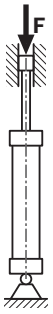
EMC-190-HP



EMC-220-HP



Axial load on the cylinder mechanics

<table>
<tr><th>EMC-HP
Size</th><th>Case I</th><th>Case II</th></tr>
<tr><td></td><td> 
</td><td> 
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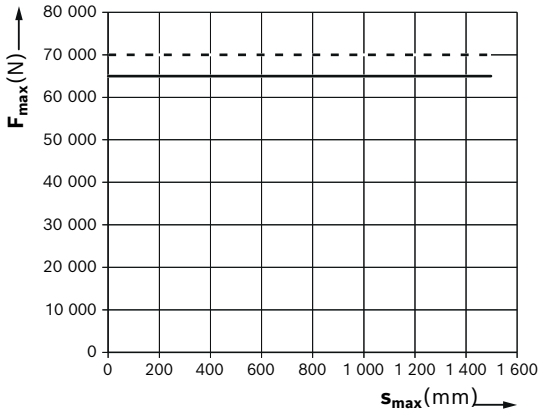
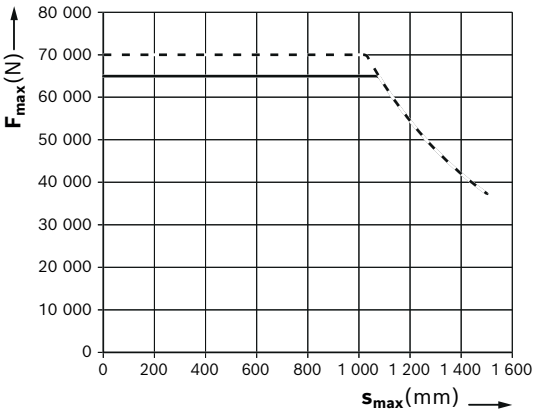
39 x 5
39 x 10</td><td> 
</td><td> 
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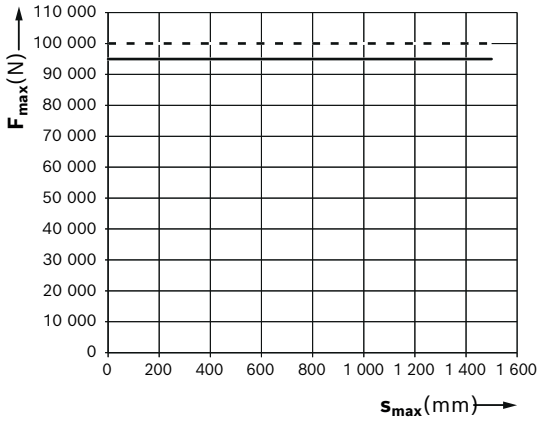
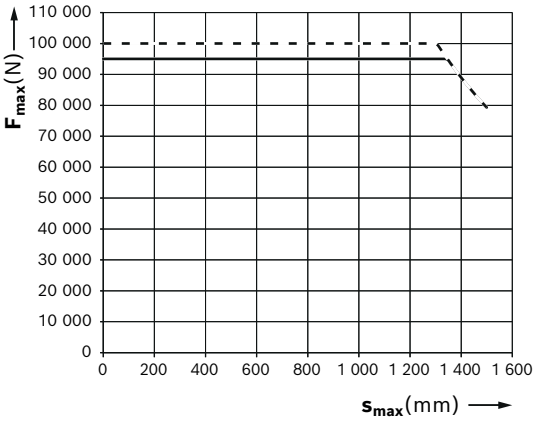
48 x 10</td><td> 
</td><td> 
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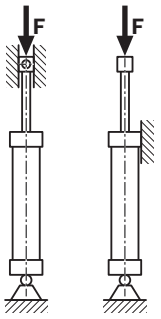
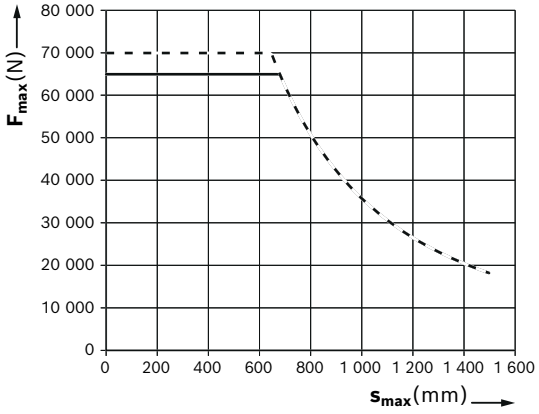
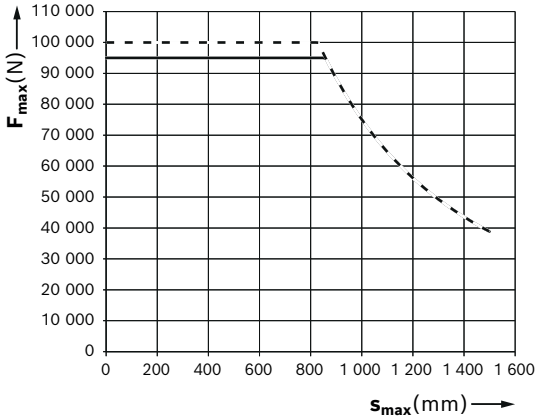
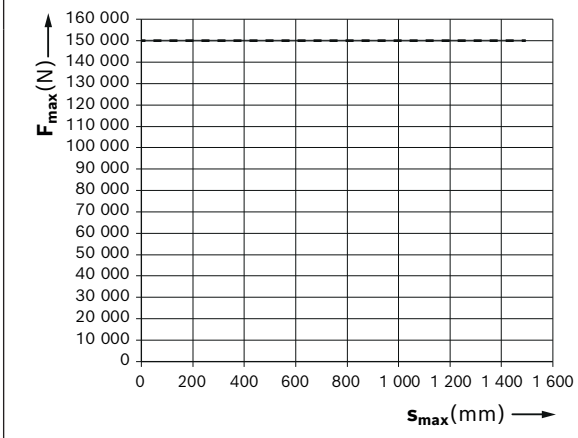
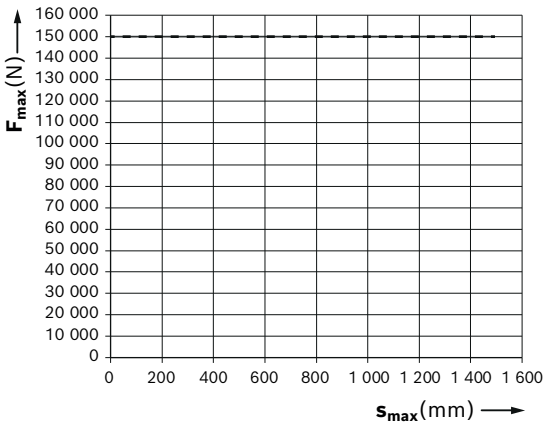
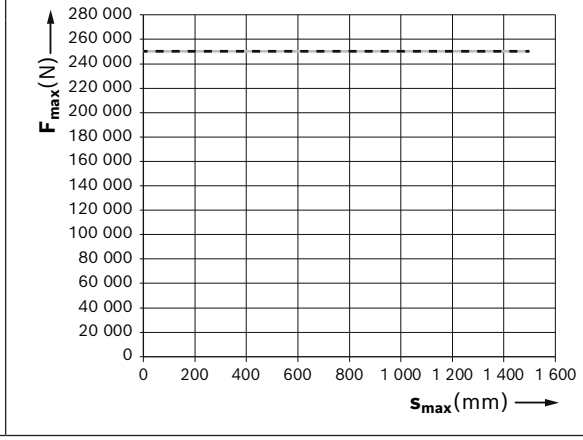
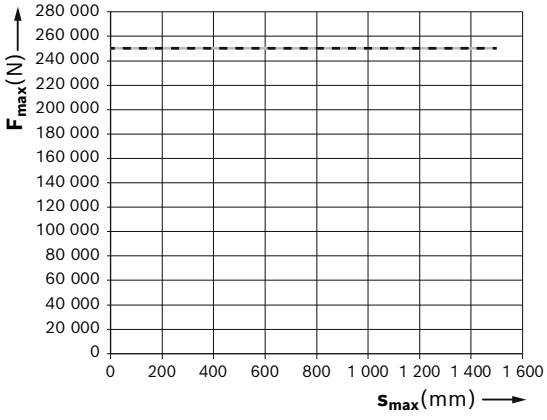
Case III

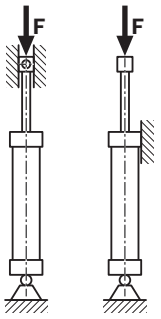

F
F

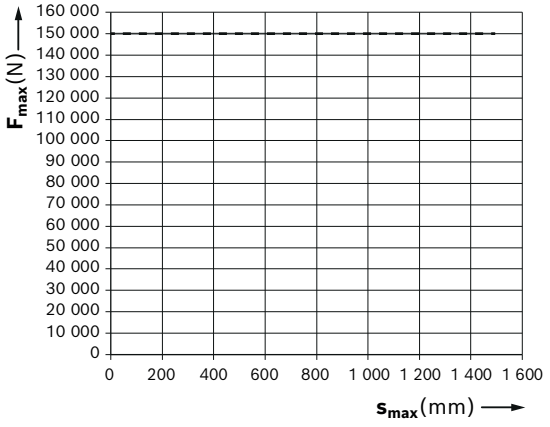

F_{max} (N)
80 000
70 000
60 000
50 000
40 000
30 000
20 000
10 000
0
0
200
400
600
800
1 000
1 200
1 400
1 600
s_{max} (mm)

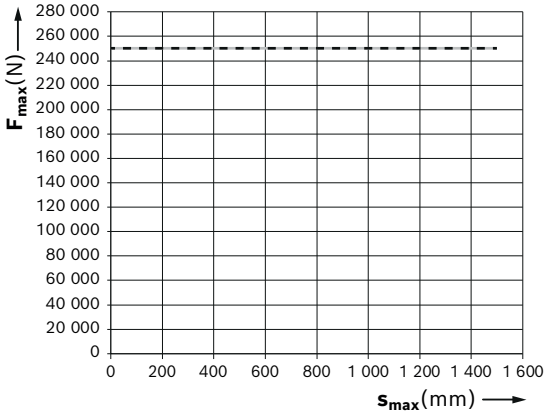

F_{max} (N)
110 000
100 000
90 000
80 000
70 000
60 000
50 000
40 000
30 000
20 000
10 000
0
0
200
400
600
800
1 000
1 200
1 400
1 600
s_{max} (mm)

EMC-HP Size	Case I	Case II
190 60 x 20 60 x 10		
220 75 x 20 75 x 10		

Case III

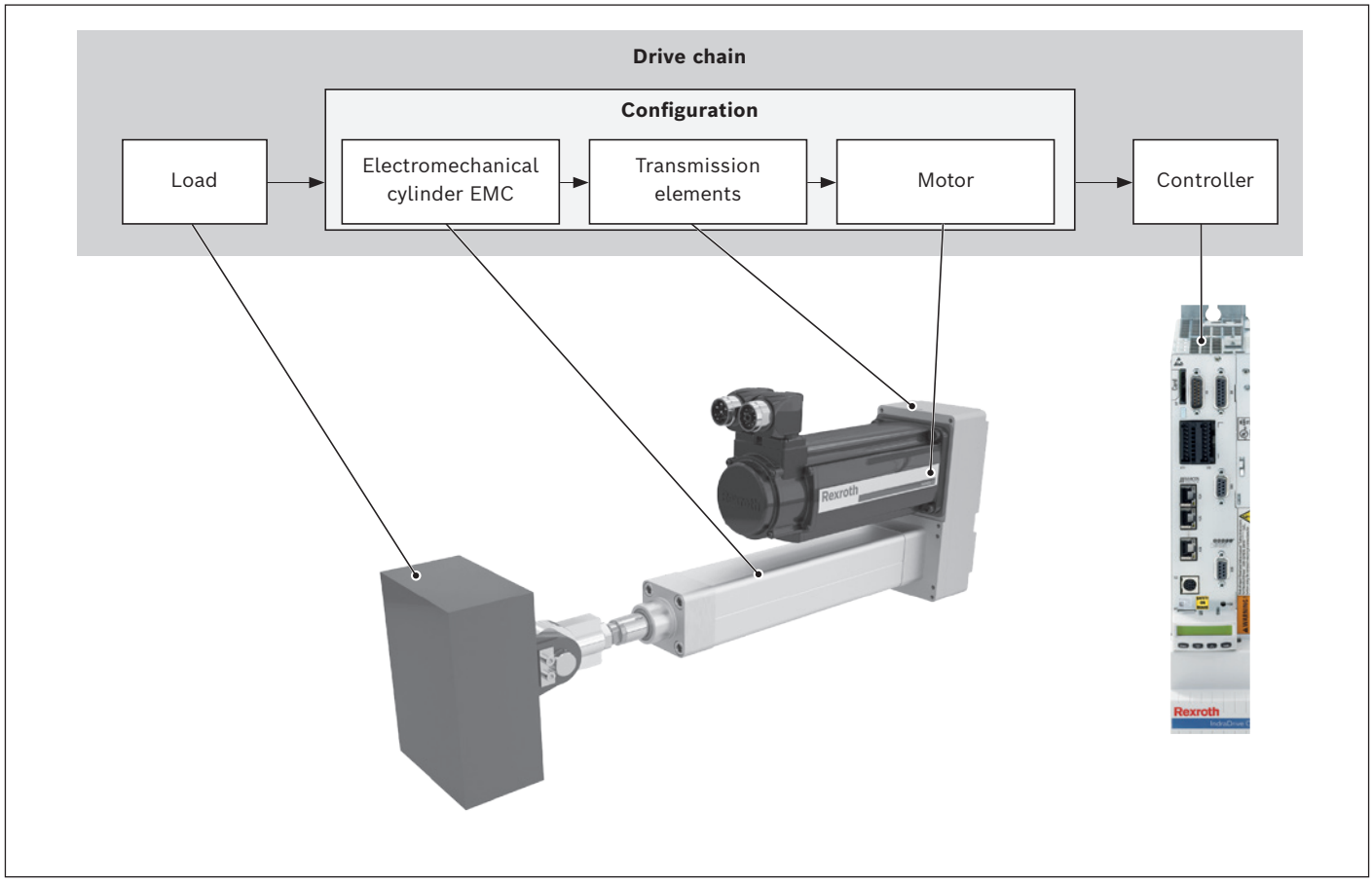

F
F


160 000
150 000
140 000
130 000
120 000
110 000
100 000
90 000
80 000
70 000
60 000
50 000
40 000
30 000
20 000
10 000
0
F_{max} (N)
0
200
400
600
800
1 000
1 200
1 400
1 600
s_{max} (mm)


280 000
260 000
240 000
220 000
200 000
180 000
160 000
140 000
120 000
100 000
80 000
60 000
40 000
20 000
0
F_{max} (N)
0
200
400
600
800
1 000
1 200
1 400
1 600
s_{max} (mm)

Calculation principles

Drive chain



The correct dimensioning and assessment of an application requires structured consideration of the entire drive chain. The basic element of the drive chain is the configuration – comprising the electromechanical cylinder EMC, the transmission element (coupling or belt side drive) and the motor, which can be ordered in this constellation as per the catalog.

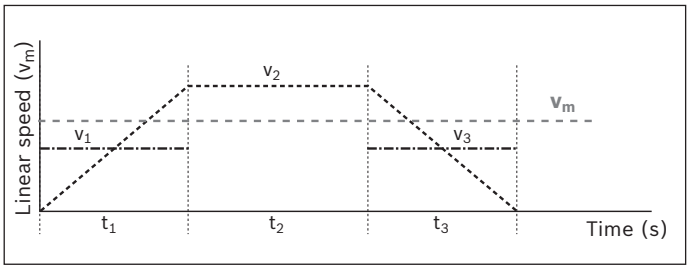
Maximum permissible loads

When selecting electromechanical cylinders EMC, maximum limits for permissible loads and forces must be taken into account. These limits can be found in chapter "Product description and technical data".

The values in this chapter are system-based, i.e. the limits are based not only on the load rating of the bearings, but also on design/material limits.

Mechanical calculation

Service life of electromechanical cylinder EMC
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.

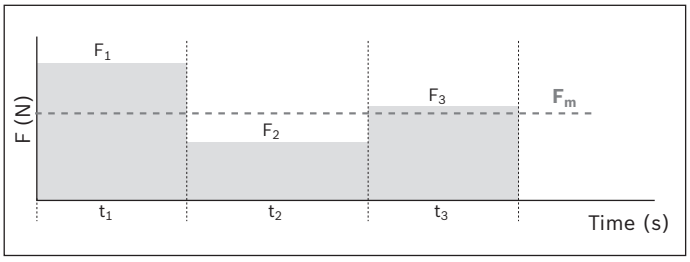


When the linear speed varies, the average speed v_m is calculated as follows:

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

$$t_{ges} = t_1 + t_2 + \ldots + t_n$$

When both the load and the rotary speed vary, the average load F_m is calculated as follows:



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

Nominal service life
– in revolutions L

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

– in hours L_h

$$L_h = \frac{L}{n_m \cdot 60}$$

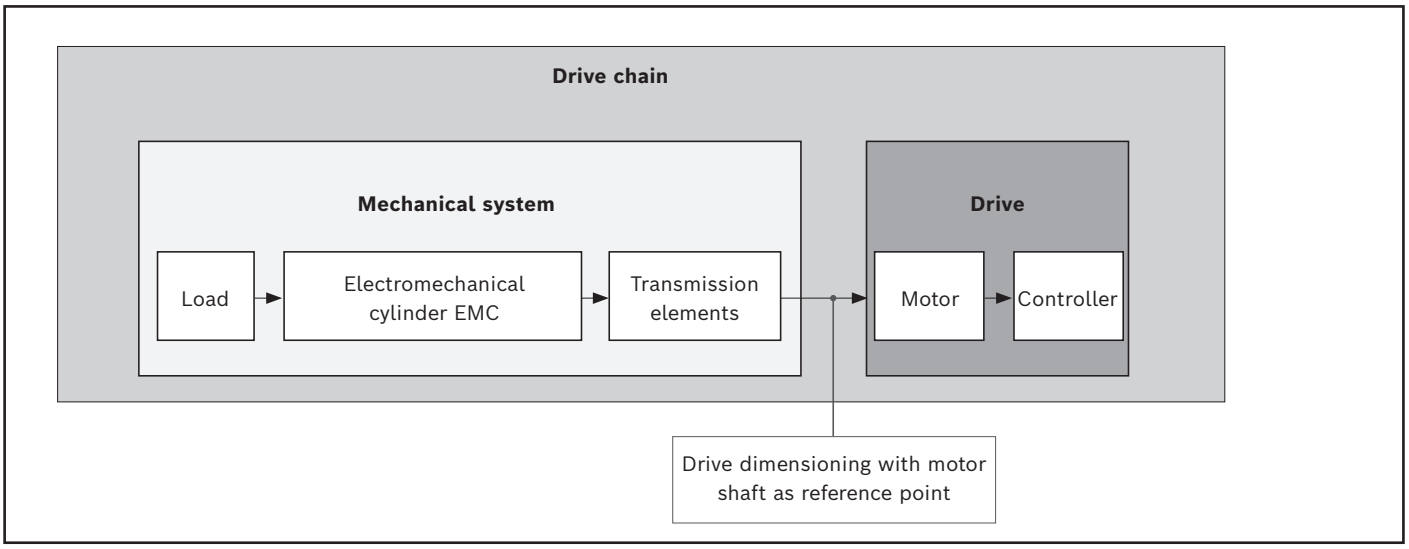
Drive torque M:

$$M = \frac{F \cdot P}{2{,}000 \cdot \pi \cdot \eta}$$

Drive dimensioning

Basic principles

For drive dimensioning, the drive chain can be divided into the **mechanical system** and **drive system**.
The **mechanical system** includes the physical components – electromechanical cylinder EMC (including gear unit transmission element) – and the load to be carried.
The electric **drive** is a motor-controller combination with corresponding performance data.
The dimensioning of the electric drive is done taking the motor shaft as a reference point.
For drive dimensioning, limits must be taken into account as well as base values. The limits must not be exceeded in order to avoid damaging the mechanical components.



Technical data and formula symbols for the mechanical system

The relevant data for flange / coupling or belt side drive is already included in the specifications for the electromechanical cylinder EMC. In other words, the corresponding maximum permissible limits for drive torque and speed, as well as the underlying friction torque and mass moment of inertia with respect 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 drive dimensioning. The data listed in the table below can be found in chapter "Technical Data" or is determined using formulas based on the descriptions on the following pages.

		Mechanical system	
		Load	EMC
Weight moment	(Nm)	M_g [4]	–
Equivalent dynamic torque	(Nm)	M_m [1]	–
Friction torque	(Nm)	–	M_{Rs} [3]
Mass moment of inertia	(kgm^2)	J_t [1]	J_s [2]
Max. permissible travel speed	(m/s)	–	v_{max} [3]
Max. permissible rotary speed	(min^{-1})		n_P [3]
Max. permissible drive torque	(Nm)	–	M_p [3], M_{pl} [1]

[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 installation position: Determine the value using the appropriate formula

Drive dimensioning with motor shaft as reference point

When dimensioning the drive, all relevant design calculation values for the mechanical components in the drive chain have to be determined and be expressed/ reduced to the motor shaft. In other words, for a combination of mechanical components within the drive chain, this will result in one value for each of the following:

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

Determination of the values for each mechanical component in the drive chain based on the motor shaft as a reference point

Friction torque M_R

With the value for friction torque of the EMC, friction is already reduced to the motor shaft.

$$M_R = M_{Rs}$$

Mass moment of inertia J_{ex}

The constants $k_{J\,fix}$, $k_{J\,var}$ and $k_{J\,m}$ used in the formulas already contain the mass moment of inertia and gear ratios for any incorporated transmission elements, and can therefore be taken from the "Drive data" table.

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

Determining the mass moment of inertia of the EMC component (including transmission elements, if used)

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

Determination of the translative 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 speed and maximum permissible rotary speed

The value for the maximum permissible speed of the EMC 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 chain (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 chain.

Drive dimensioning

Maximum permissible drive torque M_p, M_{mech}

The lower value of the permissible drive torque of all mechanical components contained in the drive chain (M_p) and allowable axial load from the user-defined installation case determines the maximum permissible drive torque of the mechanical system which needs to be taken into account as a limitation in the drive dimensioning.

The smaller value from the drive data table or that calculated from the F_{max} value from the permissible axial load on the cylinder mechanism diagram is valid.

$$M_{pl} = \frac{F_{max} \cdot P}{2{,}000 \cdot \pi \cdot \eta}$$

$$M_{mech} = \text{Minimum } (M_{p;}\, M_{pl})$$

When considering the complete drive chain (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 chain.

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 permissible value for the mechanical system.

Pre-selecting the motor

The motor can be generally preselected using the following conditions.

Condition 1:

The rotary speed of the motor must be greater than or equal to the rotary speed required for the mechanical system (but not exceeding the maximum permissible limit value).

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

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

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

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
Machining	≤ 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 less than or equal to an empirical value of 0.6. This condition roughly factors in the missing dynamic characteristics of an exact motion profile with the required motor torques.

Torque ratio:

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

Static load moment:

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

Weight moment:
For vertical installation position only!
For motor attachment via flange and coupling: i = 1

$$M_g = \frac{P \cdot (m_{ex} + m_{ca}) \cdot g}{2\,000 \cdot \pi \cdot i \cdot \eta}$$

Equivalent dynamic torque:

$$M_m = \frac{F_m \cdot P}{2\,000 \cdot \pi \cdot i \cdot \eta}$$

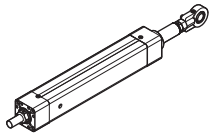
The equivalent dynamic torque can be calculated approximately via the average load F_m.
The appropriate mechanical efficiency must be used depending on the drive element BASA.

In chapter "Configuration and ordering", users can put together standard configurations including gear reducer and motor, for the various EMC 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.

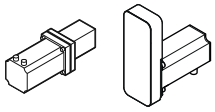
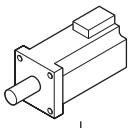
Precise drive dimensioning

Preselecting the motor according to this rough guide is no substitute for the required precise design calculations for the drive, taking all moments/torques and rotary speed levels into account. For precise calculation of the electric drive, including consideration of the specific motion profile, please refer to the performance data in the catalog "Rexroth drive technology". When dimensioning the drive, the maximum permissible values for speed, drive torque and acceleration must not be exceeded, in order to avoid damaging the mechanical system!

EMC-130-HP -1

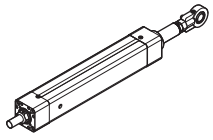
Short product name, s_{max} **EMC-130-HP-1, ... mm**	**Housing**	**Drive**	**Lubrication**			**Switches**					**Cable duct**	
											Cover profile	
		PLSA d_0xP	LSS standard lubrication[1]	LOB oil bath lubrication	LLG low-temperature grease	without sensor	PNP NC	NPN NC	PNP NO	NPN NO	without	with
	Standard	39 x 5 39 x 10	001	011	006	000	120	121	122	123	000	081

[1] LSS: Standard lubrication with Dynalub 510 with manual grease gun

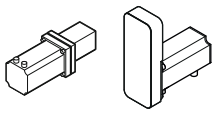
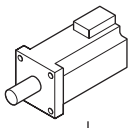
Version[2]			**Attachment interface**			**Motor**			**Motor connector position**[2]	**Automation package**		**Documentation**
							Connection 2 cables					
			Gear ratio	Mechanical interface		Motor code	without brake	with brake		Drive controller	Cables	
	F000	flangeless		without	000	without	000	000	000	⬆ Chapter "Automation package"		Standard report 001 Measurement of frictional torque 002[3] Lead deviation 003
	F001	with flange	i = 1	MS2N07	001	MS2N07-D0BHA	287	288	090			
				MS2N10	002	MS2N10-D0BHA	291	292				
						MS2N10-E0BHA	293	294	180			
	S000 S090 S180 S270	with belt side drive	i = 1.5	MS2N07	040	MS2N07-D0BHA	287	288				
				MS2N10	041	MS2N10-E0BHA	293	294	270			

[2] see page Configuration and ordering, comprehensive information
[3] Measurement of frictional torque without motor attachment

EMC-160-HP -1

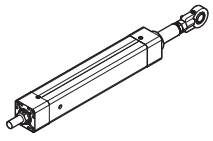
Short product name, s_{max} **EMC-160-HP-1, ... mm**	**Housing**	**Drive**	**Lubrication**			**Switches**					**Cable duct**	
											Cover profile	
		PLSA d_0xP	LSS standard lubrication[1)]	LOB oil bath lubrication	LLG low-temperature grease	without sensor	PNP NC	NPN NC	PNP NO	NPN NO	without	with
	Standard	48 x 5 48 x 10	001	011	006	000	120	121	122	123	000	081

[1)] LSS: Standard lubrication with Dynalub 510 with manual grease gun

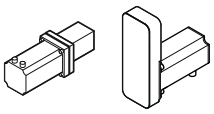
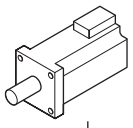
Version[2]			Attachment interface			Gearing	Motor			Motor connector position[2]	Automation package		Documentation
								Connection 2 cables					
			Gear ratio	Mechanical interface		Gear ratio	Motor code	without brake	with brake		Drive controller	Cables	
	F000	flangeless		without	000		without	000	000	000	⬆ Chapter "Automation package"		Standard report 001 Measurement of frictional torque 002[3] Lead deviation 003
	F001	with flange	i = 1	MS2N10	001	–	MS2N10-D0BHA	291	292				
			i = 1	MS2N10 with gear unit	006	i = 3	MS2N10-E0BHA	293	294	090			
	S000	with belt side drive	i = 1.5	MS2N10	041	–	MS2N10-C0BNN	289	290	180			
	S090						MS2N10-D0BHA	291	292				
	S180						MS2N10-E0BHA	293	294				
	S270			MS2N10 with gear unit	051	i = 3	MS2N10-C0BNN	289	290	270			

[2] see page Configuration and ordering, comprehensive information
[3] Measurement of frictional torque without motor attachment

EMC-190-HP -1

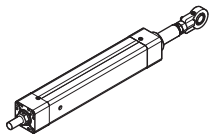
Short product name, s_{max} **EMC-190-HP-1, ... mm**	**Housing**	**Drive**	**Lubrication**			**Switches**					**Cable duct**	
											Cover profile	
		PLSA d_0xP	LSS standard lubrication[1)]	LOB oil bath lubrication	LLG low-temperature grease	without sensor	PNP NC	NPN NC	PNP NO	NPN NO	without	with
	Standard	60 x 10 60 x 20	001	011	006	000	120	121	122	123	000	082

[1)] LSS: Standard lubrication with Dynalub 510 with manual grease gun

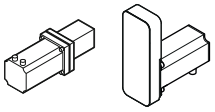
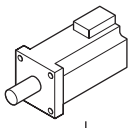
Version[2]			Attachment interface			Gearing	Motor			Motor connector position[2]	Automation package		Sensor package	Documentation
								Connection 2 cables						
			Gear ratio	Mechanical interface		Gear ratio	Motor code	without brake	with brake		Drive controller	Cables		
	F000	flangeless		without	000	i = 1	without	000	000	000	➡ Chapter "Automation package"		with 001 without 050	Standard report 001 Measurement of frictional torque 002[3] Lead deviation 003
	F001	with flange	i = 1	MS2N10	001	i = 1	without	000	000					
							MS2N10-E0BNA	301	302					
				MS2N10 with gear unit	142	i = 3	without	000	000	090				
							MS2N10-D0BHA	291	292					
							MS2N10-E0BNA	301	302					
				MS2N10 with gear unit	143	i = 5	without	000	000	180				
							MS2N10-E0BNA	301	302					
	S000 S090 S180 S270	Spur gear	i = 1	MS2N10	142	i = 1	without	000	000	270				
							MS2N10-E0BNA	301	302					
		Spur gear for planetary gear		MS2N10	143	i = 3	MS2N10-D0BHA	291	292					
					143		MS2N10-E0BNA	301	302					
					143	i = 5	MS2N10-E0BNA	301	302					

[2] see page Configuration and ordering, comprehensive information
[3] Measurement of frictional torque without motor attachment

EMC-220-HP -1

Short product name, s_{max} **EMC-220-HP-1, ... mm**	**Housing**	**Drive**	**Lubrication**			**Switches**					**Cable duct**	
											Cover profile	
		PLSA d_0xP	LSS standard lubrication[1]	LOB oil bath lubrication	LLG low-temperature grease	without sensor	PNP NC	NPN NC	PNP NO	NPN NO	without	with
	Standard	75 x 10 75 x 20	001	011	006	000	120	121	122	123	000	082

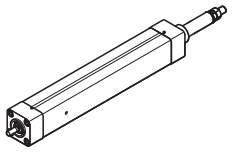
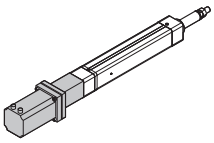
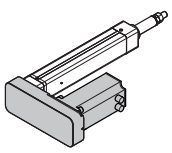
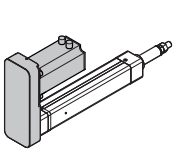
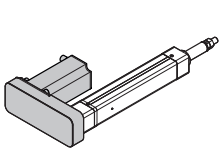
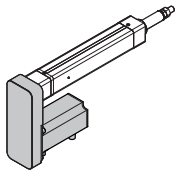
[1] LSS: Standard lubrication with Dynalub 510 with manual grease gun

Version[2]			Attachment interface			Gearing	Motor			Motor connector position[3]	Automation package		Sensor package	Documentation
								2-cable connection						
			Gear ratio	Mechanical interface		Gear ratio	Motor code	without brake	with brake		Drive controller / Cables			
	F000	flangeless		without	000		without	000	000	000	➡ Chapter "Automation package"		with 001 without 050	Standard report 001 Measurement of frictional torque 002[3] Lead deviation 003
		with flange	i = 1	MS2N10 with gear unit	190	i = 3	without	000	000					
							MS2N10-E0BNA	301	302					
							MS2N10-F1BHA	303	304					
				MS2N10 with gear unit	191	i = 5	without	000	000	090				
							MS2N10-E0BNA	301	302					
				MS2N10 with gear unit	191		MS2N10-F1BHA	303	304	180				
	S000 S090 S180 S270	Spur gear for planetary gear	i = 1	MS2N10	190	i = 3	without	000	000					
							MS2N10-E0BNA	301	302					
				MS2N10	190		MS2N10-F1BHA	303	304	270				
				MS2N10	191	i = 5	MS2N10-E0BNA	301	302					
				MS2N10	191		MS2N10-F1BHA	303	304					

[2] see page Configuration and ordering, comprehensive information
[3] Measurement of frictional torque without motor attachment

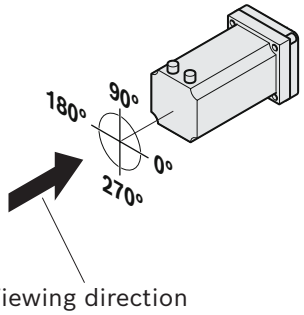
Comprehensive information

Motor attachment and motor connector position

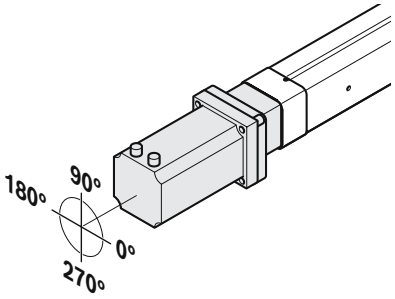
F000	F001	S000	S090	S180	S270
					

Version	Motor connector position			
	0°	90°	180°	270°
F001	000	090 ★	180	270
S000	–	090	180 ★	270
S090	000	090 ★	180	–
S180	000 ★	090	–	270
S270	000	–	180	270 ★

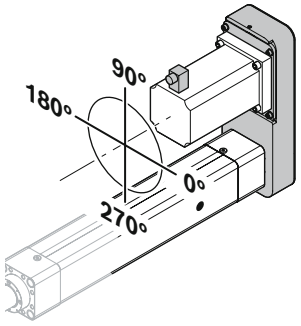
★ Standard delivery



Viewing direction

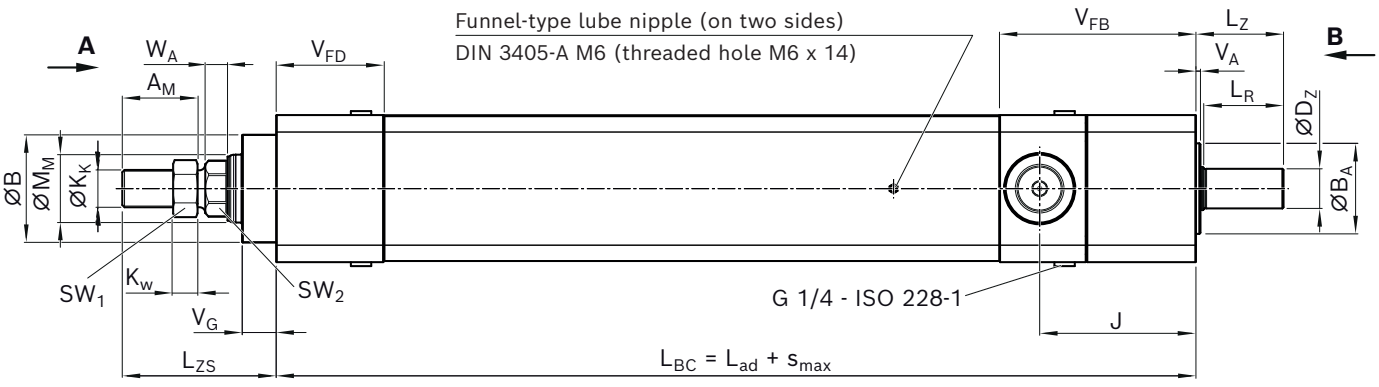


Example:
Flange F001
Motor connector position 90°



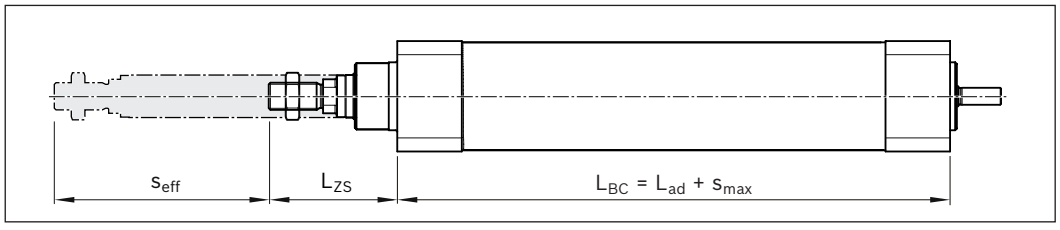
Example:
Parallel mounting S090
Motor connector position 90°

Dimension drawings for electromechanical cylinder



EMC-HP	A_M	ØB d9	$ØB_A$ h7	$ØD_Z$ h7	E	l_{RF} / Q	J	J_1	J_2	K_W	K_X	$ØK_K$	L_{ad} Trunnion without	L_{ad} Trunnion with	L_Z	L_{ZS}	L_R	$ØM_M$ f8	SW_1	SW_2
130	71	96	80	35	130	M12; 26 deep	138.0	132	196	29	50	M33x2	364.0	420.0	78.0	155.0	70.5	60	50	50
160	89	106	93	40	160	M14; 29 deep	160.0	162	242	34	65	M42x2	418.5	482.0	82.0	176.0	71.5	70	65	60
190	97	145	125	55	190	M14; 35 deep	137.5	246	351	38	75	M48x2	549.0	549.0	75.0	188.7	71.0	100	75	85
220	113	165	125	55	220	M16; 32 deep	181.0	285	431	51	95	M64x3	648.5	648.5	92.5	215.0	88.5	120	95	100

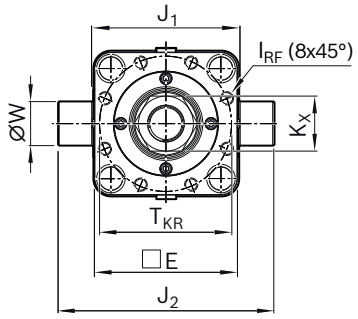
Length calculation



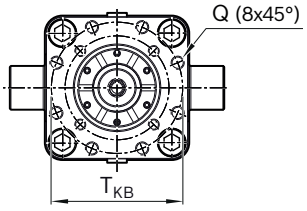
s_{eff} = stroke (depending on application; observe s_{max} (see technical data))

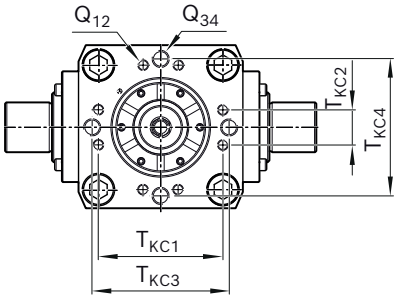
Note: The presentations are schematic. Detailed contours can be found in the CAD model.

A



B





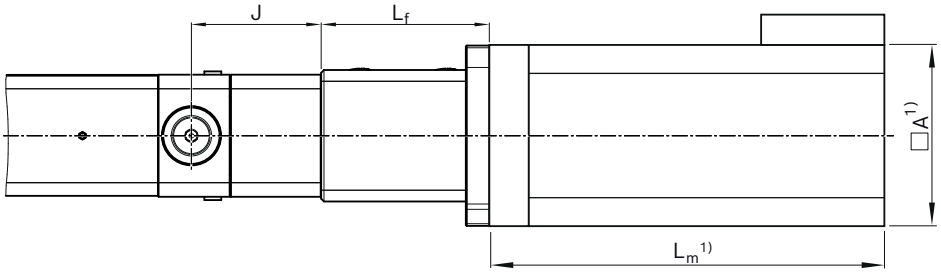
EMC-HP 190

Dimensions (mm)

	ØT$_{KR}$	ØT$_{KB}$	V$_A$	V$_{FB}$		V$_{FD}$	V$_G$	ØW h7	W$_A$	T$_{KC1}$	T$_{KC2}$	Q$_{12}$	T$_{KC3}$	T$_{KC4}$	Q$_{34}$
				Trunnion											
			±0.1	without	with										
	120.0	120	4	117.5	173.5	95.5	30	40	15.0	–	–	–	–	–	–
	145.0	145	4	135.0	198.5	105.5	30	50	17.0	–	–	–	–	–	–
	177.5	–	4	237.5	237.5	108.0	34	63	25.0	145	43	M12; 30 deep	160	160	M20; 40 deep
	200.0	185	4	289.0	289.0	115.0	37	80	33.5	–	–	–	–	–	–

Motor attachment dimension drawings

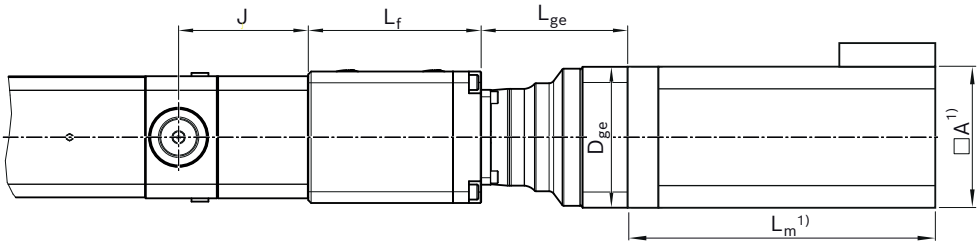
Flange coupling



EMC-HP		Dimensions (mm)	
	Motor	L_f	J
130	MS2N07	154	138.0
	MS2N10	179	
160	MS2N10	188	160.0
190		185	137.5
220		220	181.0

1) Dimensions see chapter Motors

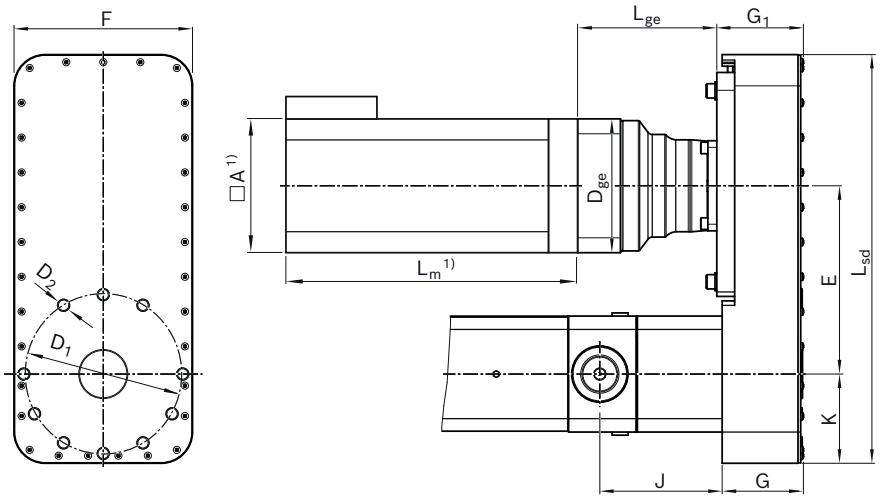
Gearing



EMC-HP		Dimensions (mm)			
	Motor	L_f	L_{ge}	D_{ge}	J
160	MS2N10	193	156.0	190	160.0
190		185	182.5	210	137.5
220		220	215.5	210	181.0

1) Dimensions see chapter Motors

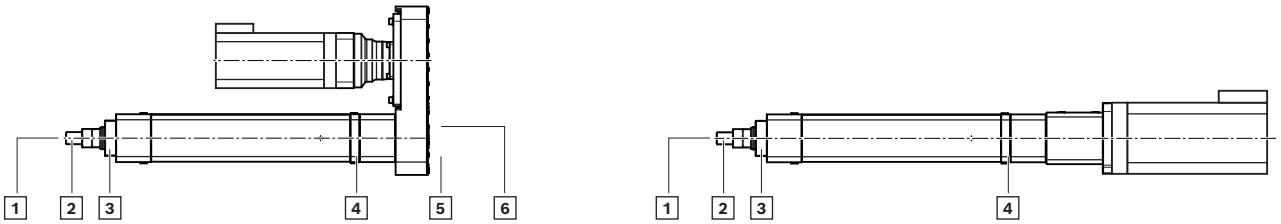
Parallel mounting

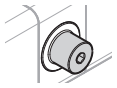
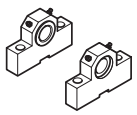
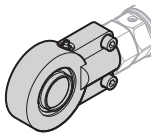
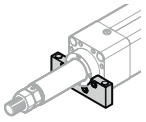
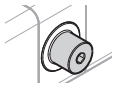
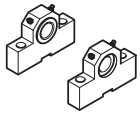
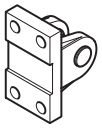
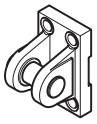
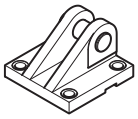
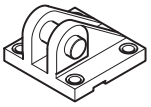
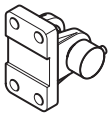
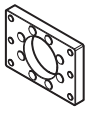


EMC-HP	Dimensions (mm)											
	D_1	D_2	E	F	G	G_1		J	K	L_{sd}	L_{ge}	D_{ge}
						Direct motor attachment	Motor attachment with gear				Gearing	Gear for motor MS2N10
130	178	M10; 25 deep	211	200	91	87	–	137.0	100.0	458	–	–
160	228	M12; 26 deep	248	255	96	87	97	159.0	127.5	504	156.0	190
190	185	M16; 40 deep	275	220	200	196	201	137.5	110.0	495	182.5	210
220	185	M16; 36 deep	275	220	160	–	218	181.0	110.0	495	218.5	210

1) Dimensions see chapter Motors

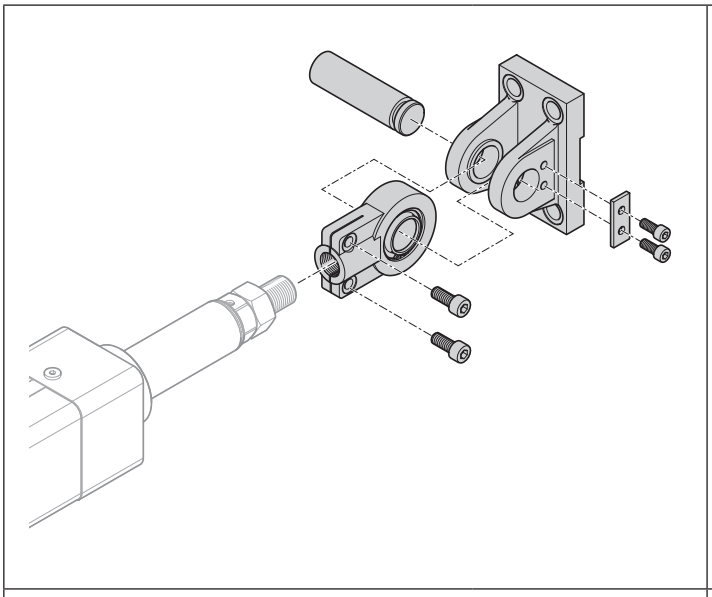
Fastening elements – Configuration and ordering

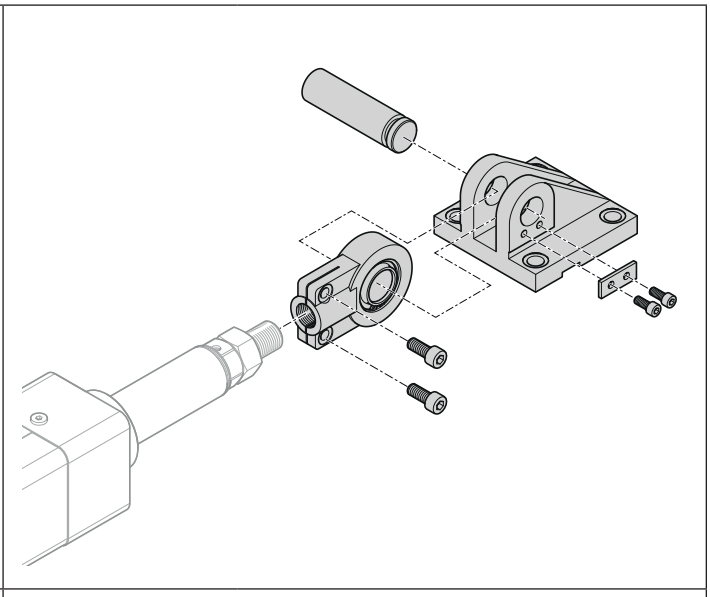


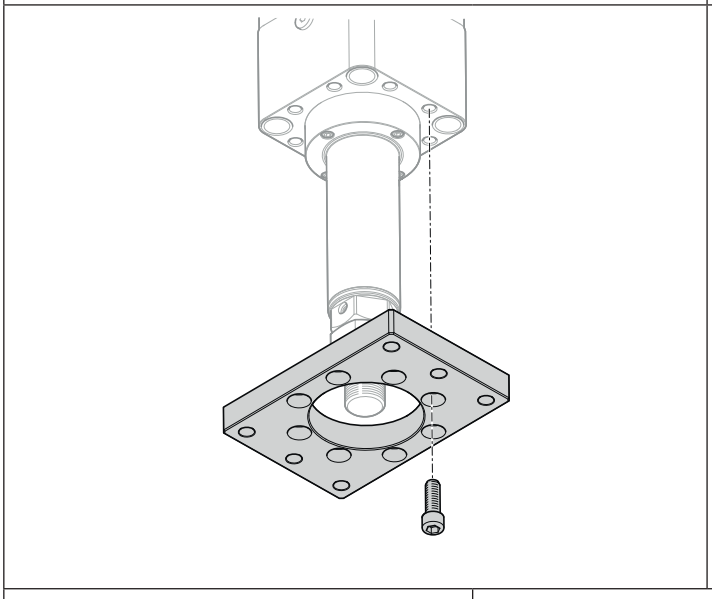
Group 1	Group 2	Group 3	Motor attachment	Group 4	Group 5	Group 6
000	011 	000	F000 F001 for motor flange	000 / 050 without trunnion	000	000
				002 / 003 with trunnion 	000	000 001 
000	012 	011 Foot mounting 	S000 S090 S180 S270 with parallel mounting	002 / 003 with trunnion 	000	000 001 
				000 / 050 without trunnion	000	000
021 					011 (not with screw cooling) 	000 021 
022 						022 
031[1] 		014 with flange 	F000 F001 for motor flange	000 / 050 without trunnion	000	031[1]  000
			S000, S09 S180, S270 with parallel mounting			

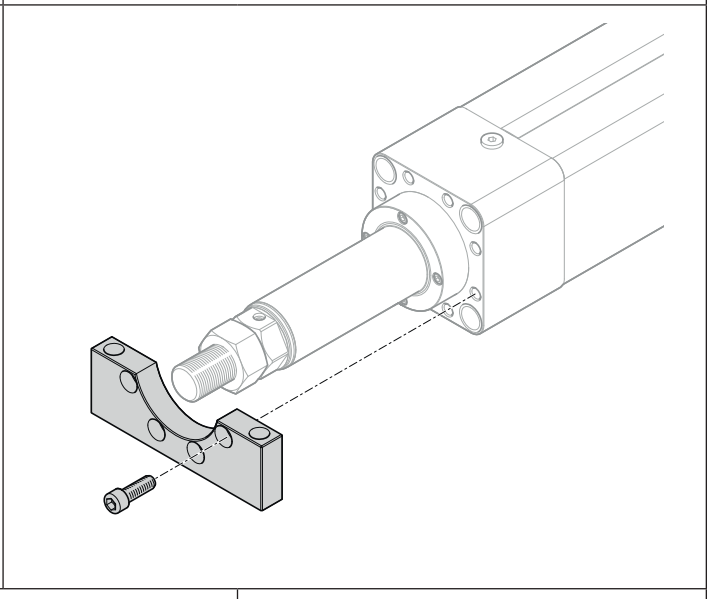
[1] With load measuring pin

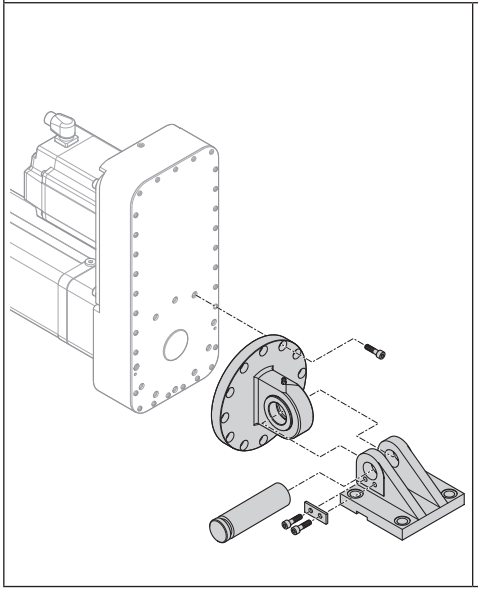
Examples

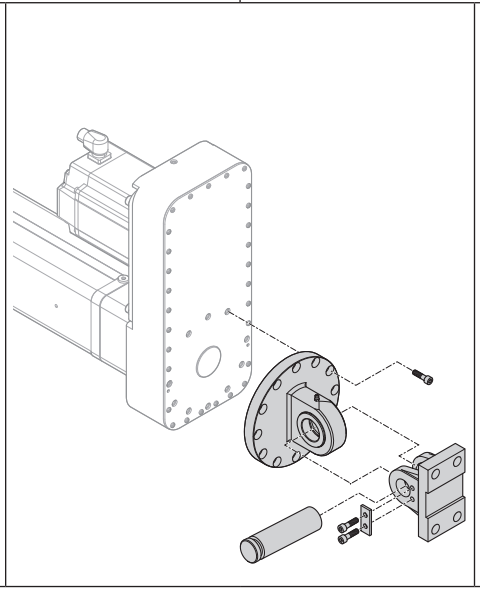


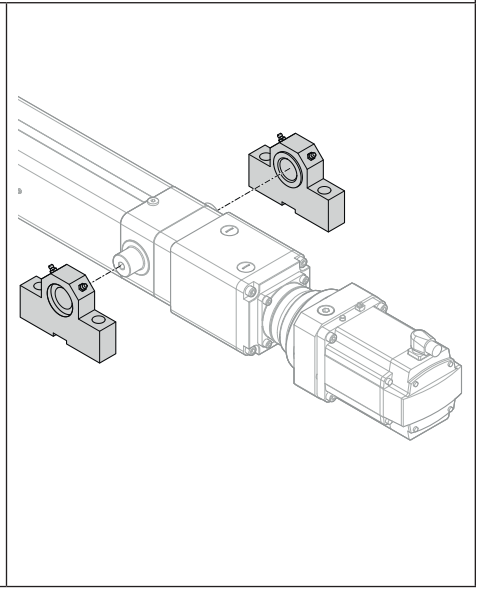








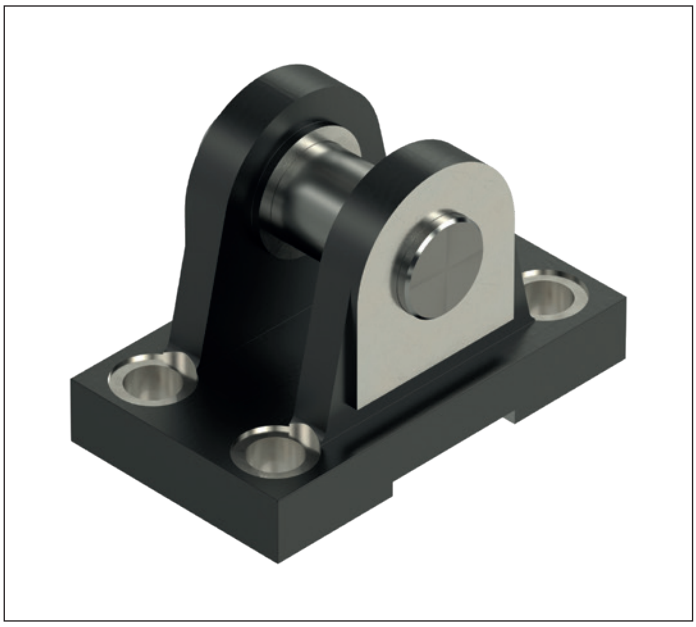


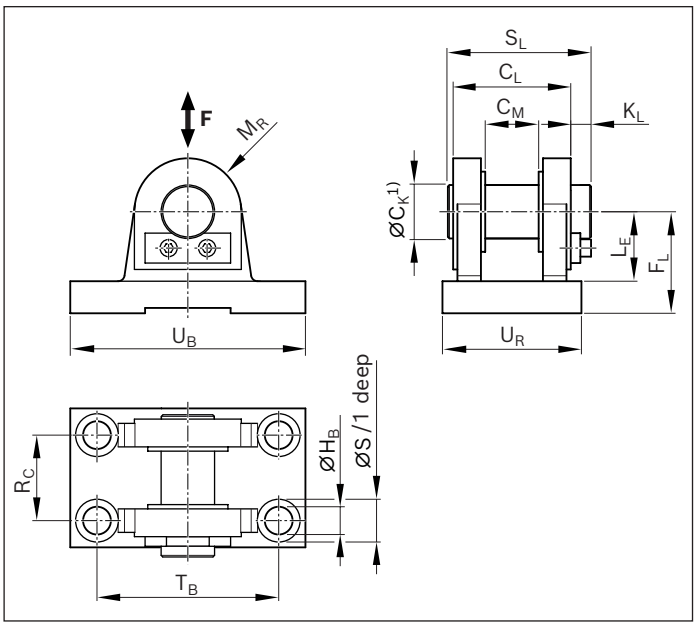


Fastening elements

Clevis bracket CLCD ISO 8132, form A

Group 1 / 6, option 021





EMC-HP	Material number	Dimensions (mm)														m
		$ØC_K$ 1) H9	C_L h16	C_M A12	F_L js12	$ØH_B$ H13	K_L	L_E min.	M_R max.	R_C js14	ØS	S_L	T_B js14	U_R max.	U_H max.	(kg)
130	R156340101	40	90	40	76	22.0	16	52	40	65	33	110	130	108	170	5.5
160	R156350101	50	110	50	95	26.0	19	65	50	80	40	133	170	130	220	10.6
190	R156360101	63	140	63	112	33.0	20	75	63	100	48	164	210	160	270	17.0
220	R156370101	80	170	80	140	39.0	26	95	80	125	57	202	250	210	320	32.0

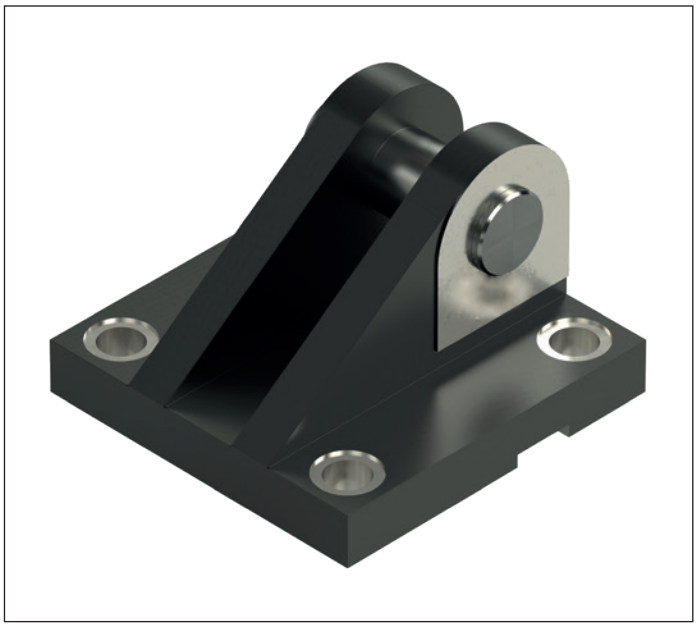
1) Matching bolt Ø h6 (bolt and bolt locking feature are included in the scope of supply and are not ready-mounted on delivery)

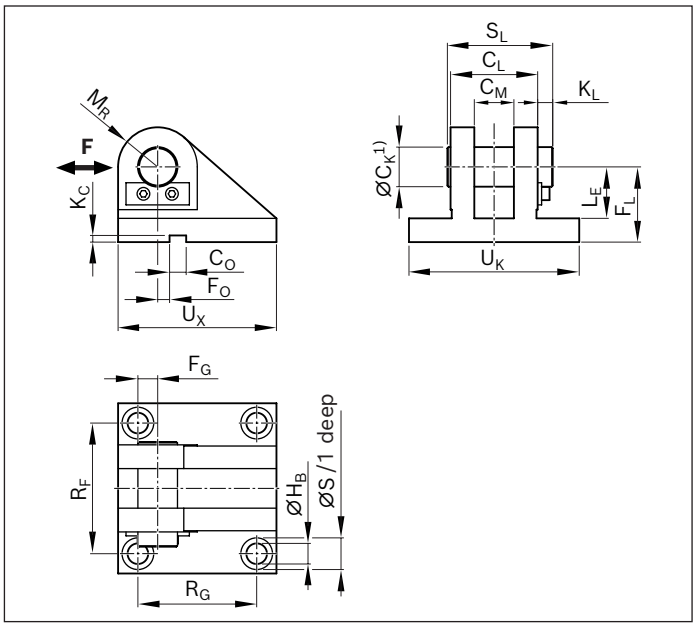
Material:

- Bolts, steel
- Bearing block, bare cast iron

Clevis bracket CLCA ISO 8132, form B

Group 1 / 6, option 022





EMC-HP	Material number	Dimensions (mm)																			m
		$ØC_K$[1)] H9	C_L h16	C_M A12	C_O N9	F_G js14	F_L js12	F_O js14	$ØH_B$ H13	K_C +0.3	K_L	L_E min.	M_R max.	R_F js14	R_G js14	ØS	S_L	U_K max.	U_X max.	(kg)
130	R156340102	40	90	40	36	17.5	76	6	22.0	8.4	16	52	40	140	125	33	110	185	170	8.5
160	R156350102	50	110	50	36	25.0	95	0	26.0	8.4	19	65	50	165	150	40	133	215	200	13.5
190	R156360102	63	140	63	50	33.0	112	0	33.0	11.4	20	75	63	210	170	48	164	270	230	27.5
220	R156370102	80	170	80	50	45.0	140	0	39.0	11.4	26	95	80	250	210	57	202	320	280	47.0

[1)] Matching bolt Ø h6 (bolt and bolt locking feature are included in the scope of supply and are not ready-mounted on delivery)

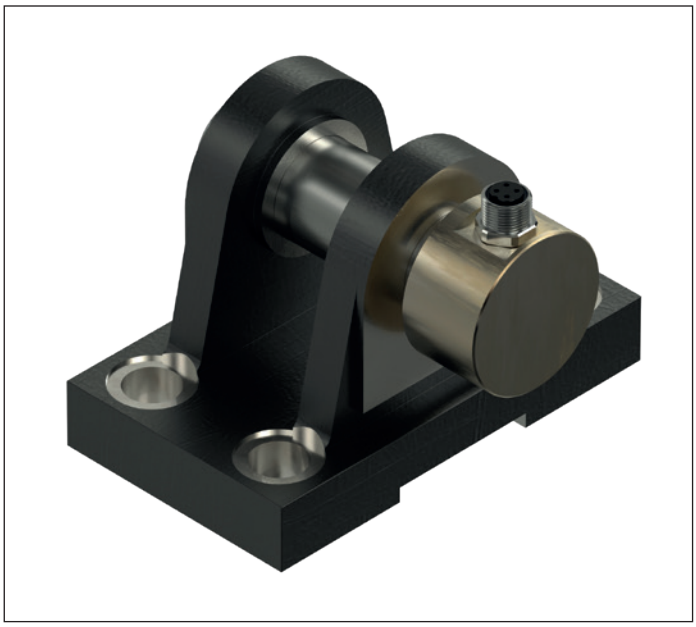
Material:

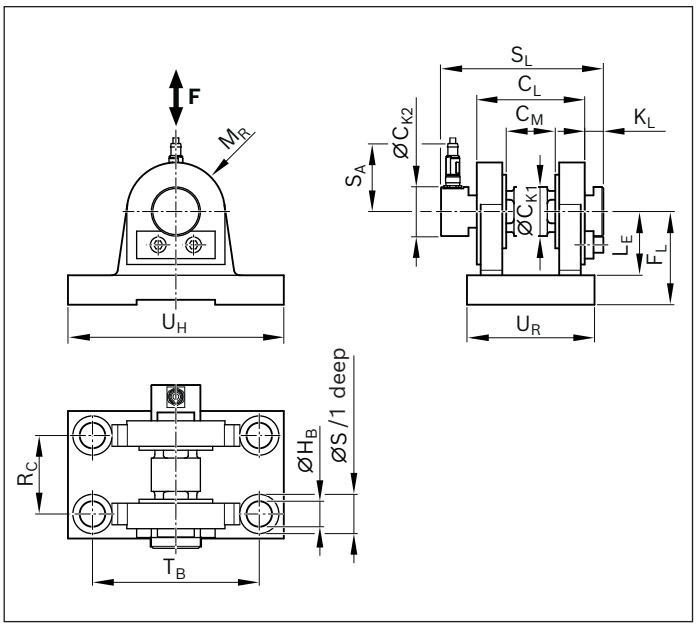
- Bolts, steel
- Bearing block, bare cast iron

Fastening elements

Clevis bracket CLCD (comparable with ISO 8132), form A, with load measuring pin

Group 1 / 6, option 031





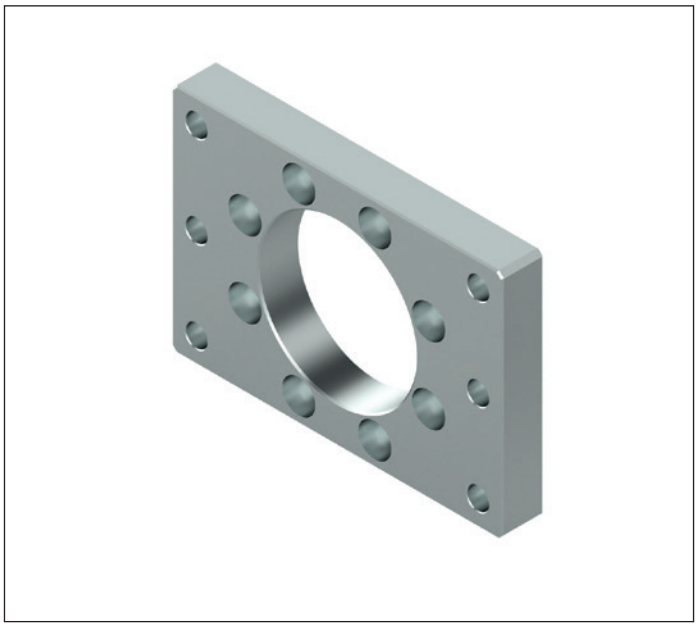
EMC-HP	Material number	Dimensions (mm)																m
		$ØC_{K1}$ [1] H9	$ØC_{K2}$	C_L h16	C_M A12	F_L js12	$ØH_B$ H13	K_L [2]	L_E min.	M_R max.	R_C js14	ØS	S_L [2]	T_B js14	U_R max.	U_H max.	S_A [2]	(kg)
130	R156340103	40	40	90	40	76	22.0	13	52	40	65	33	135.0	130	108	170	61.0	6.8
160	R156350103	50	50	110	50	95	26.0	20	65	50	80	40	166.5	170	130	220	69.5	11.0
190	R156360103	63	63	140	63	112	33	20	75	63	100	48	164.0	210	160	270	51.5	25.5
220	R156370103	80	80	170	80	140	39	26	95	80	125	57	202.0	250	210	320	60.0	48.4

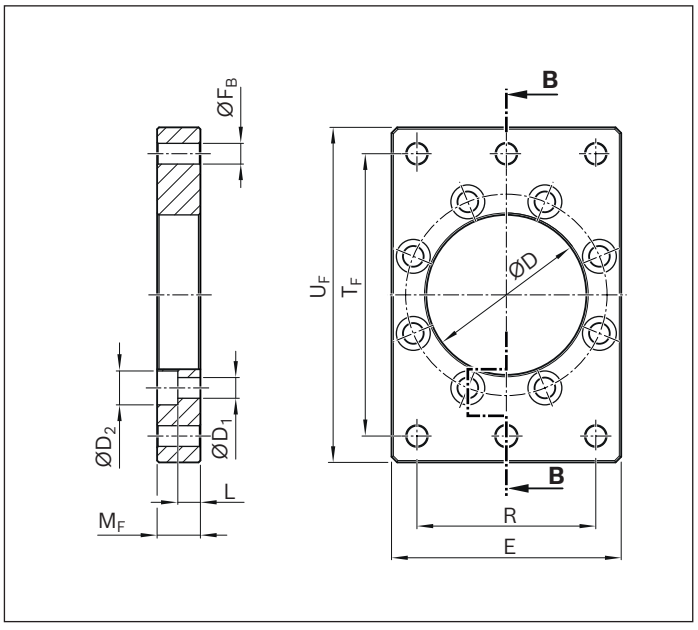
[1] Matching bolt ø f8. For detailed information on the load measuring pin see chapter "Force sensor."
[2] Values deviate from ISO 8132 standard

Material:

- Bolts, steel
- Bearing block, bare cast iron

Flange mounting
Group 3, option 014





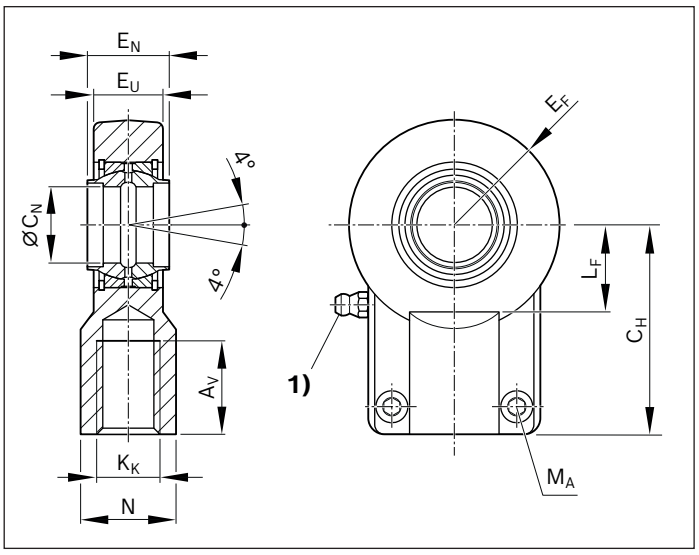
EMC-HP	Material number	Dimensions (mm)										
		ØD H11	ØD1 H13	ØD2 H13	E	$ØF_B$	L	M_F	R ±0.2	T_F ±0.2	U_F	m (kg)
130	R156540067	96	13	20.0	140	13	12	25	110	170	200	4.0
160	R156550067	106	15	24.0	170	15	13	28	135	200	230	6.5
190	R156560067	145	15	24.0	200	18	13	28	165	230	260	7.5
220	R156570067	165	17	25.5	230	17	12	28	135	260	290	9.8

Material:
– Galvanized steel

Fastening elements

Spherical rod end bearing CGKD (clampable)

Group 2, option 012



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

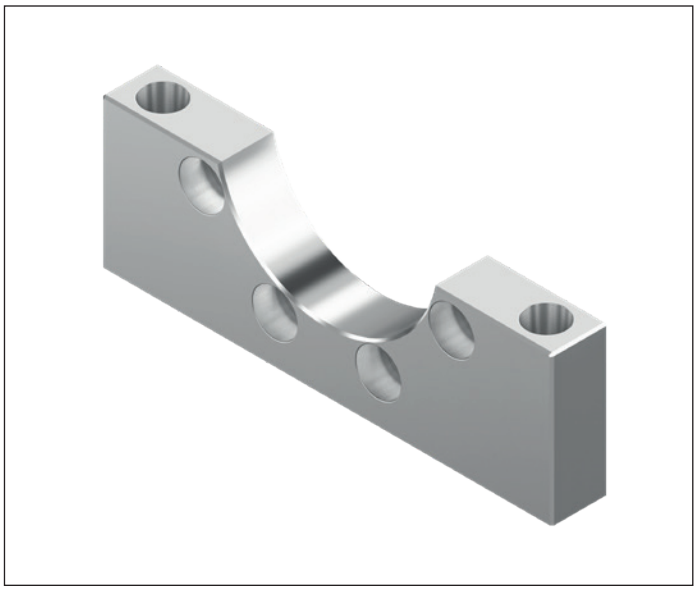
EMC-HP	Material number	Dimensions (mm)									Clamping screw		m3)
		A_V min.	N max.	C_H js13	E_F max.	ØC_N2) H7	E_N h12	E_U max.	K_K	L_F min.	ISO 4762-10.9	M_A (Nm)	(kg)
130	R900322029	46	47	97	50.0	40	40	34.0	M33x2	39	M10x30	59	2.10
160	R900322719	57	58	120	63.0	50	50	42.0	M42x2	47	M12x35	100	4.00
190	R156560062	64	70	140	72.5	63	63	53.5	M48x2	58	M16x40	250	7.20
220	R156570062	86	91	180	92.0	80	80	68.0	M64x3	74	M20x50	490	15.00

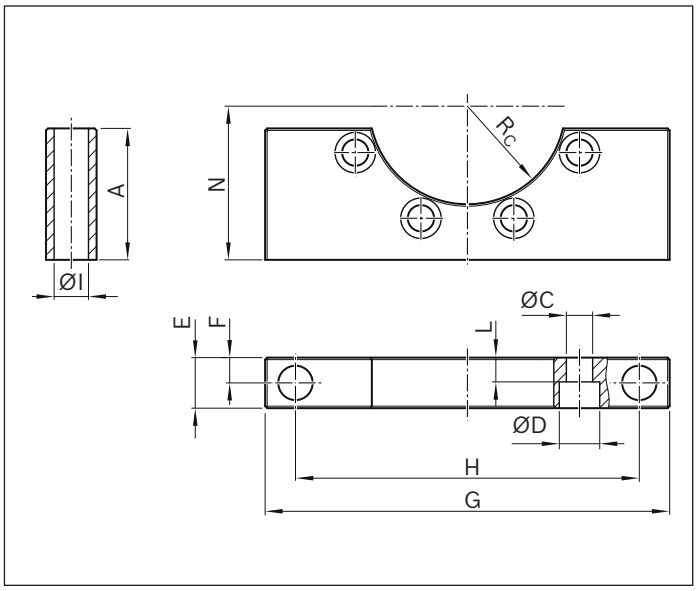
2) Matching bolt Ø m6
3) Add mass for basis cylinder weight

Material:

- Steel
- Female connector, steel

Foot mounting
Group 3, option 011





EMC-HP	Material number	Dimensions (mm)											
		A	ØC H13	ØD H13	E	F ±0.1	G	H ±0.2	ØI H13	L	N	R_C	m (kg)
130	R156540065	65	13	20.0	25	12.5	200	170	17	12	76	48.00	0.8
160	R156550065	85	15	24.0	28	14.0	230	200	17	13	95	53.00	1.3
190	R156560065	100	15	24.0	28	14.0	260	220	17	13	110	72.50	1.5
220	R156570065	130	17	25.5	28	14.0	290	260	17	12	140	82.55	2.3

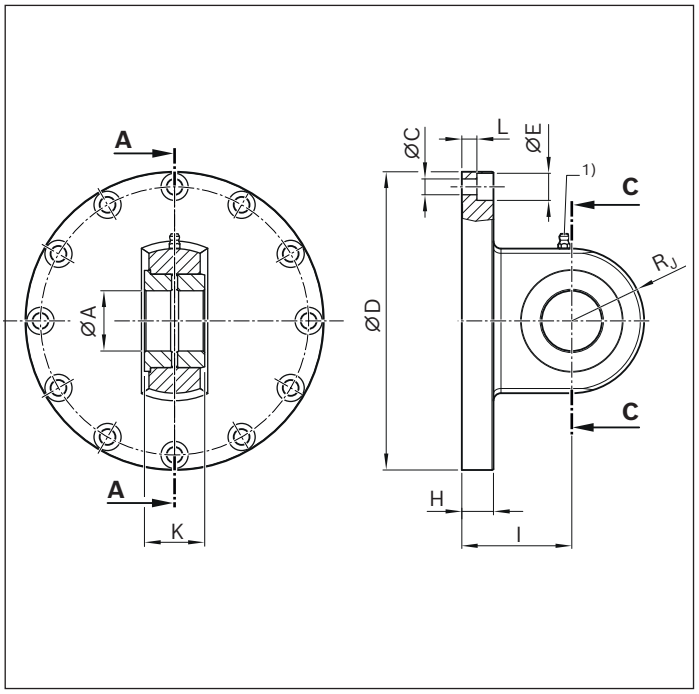
Material:
– Aluminum, anodized

- only to support the dead weight of the EMC-HP
- no axial forces may be transmitted
- use only in combination with trunnion or pivot head

Fastening elements

Pivot head

Group 5, option 011



[1] Lube nipple, hydraulic type A as per DIN 71412

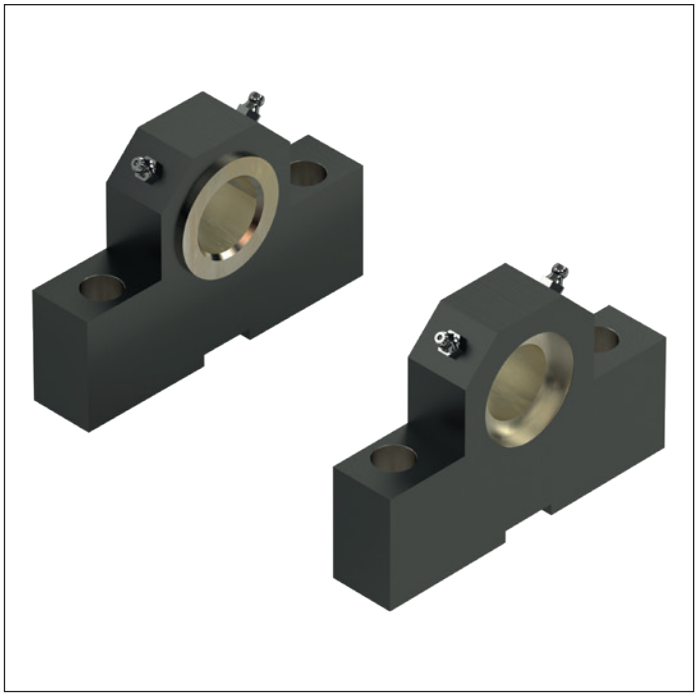
EMC-HP	Material number	Dimensions (mm)									
		ØA H9	ØC	ØD	ØE	H	I	K h12	L	R_J	m (kg)
130	R156540068	40	10.5	198	18	21	73	40	10	48	7.0
160	R156550068	50	12.5	253	20	23	88	50	10	58	12.6
190	R156560068	63	17.5	218	26	27	102	63	11	65	16.0
220	R156570068	80	17.5	218	26	27	122	80	11	83	21.8

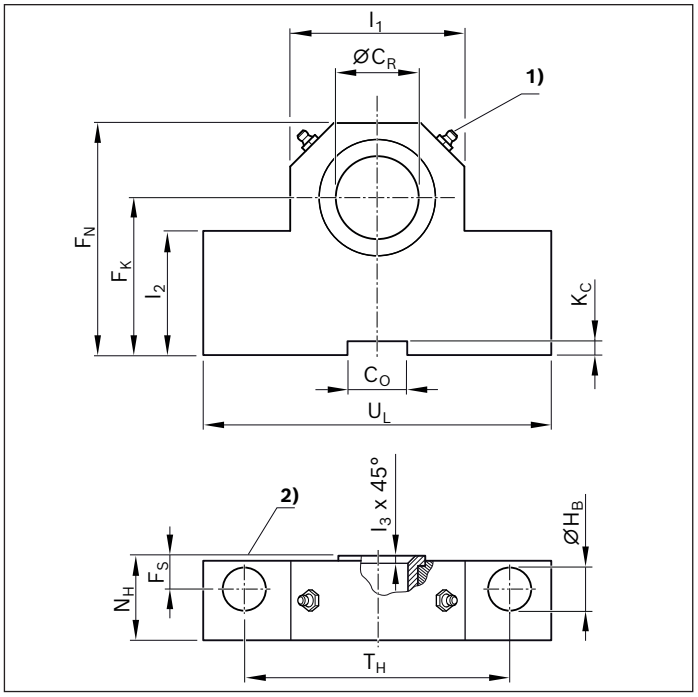
Material:

- Steel
- Female connector, cast iron

Pillow block CLTB

Group 6, option 001





[1] Lube nipple, hydraulic type A as per DIN 71412
[2] Trunnion location face (inside)

EMC-HP	Material number	Dimensions (mm)													m[3]
		$ØC_R$ H7	C_O N9	F_K js12	F_N max.	F_S js14	$ØH_B$ H13	K_C +0.3	l_1	l_2	l_3	N_H max.	T_H js14	U_L max.	(kg)
130	R156340160	40	36	76	120	16	22.0	8.4	88	60	2.5	41	125	170	7.30
160	R156350160	50	36	95	140	20	26.5	8.4	100	75	2.5	51	160	210	14.50
190	R156360160	63	50	112	180	25	33.0	11.4	130	85	3.0	61	200	265	23.10
220	R156370160	80	50	140	220	31	39.0	11.4	160	112	3.5	81	250	325	52.30

[3] Add mass for basis cylinder weight, figure per pair

Material:

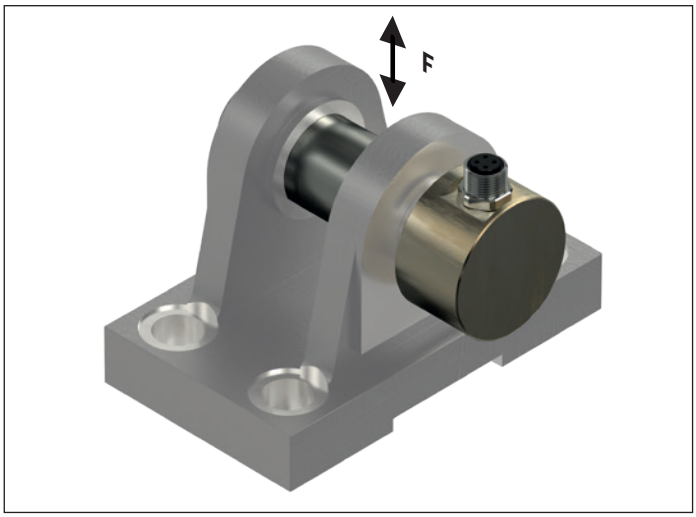
- Steel / cast iron
- Female connector, cast bronze

Note

Pillow blocks are always supplied in pairs.

Force sensor

Clevis bracket with load measuring pin



If your application requires precise load sensing, there is a clevis bracket version available with a load measuring pin. This option can be selected both at the piston rod end connected to the spherical rod end bearing, and at the belt side drive connected to the pivot head.
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 bolt is not permissible. It may only be inserted by hand.
Like the standard bolt, it is secured axially and against rotation on one side of the bearing block using the bolt locking feature included.
For force control at the controller level, a control component with an analog input is required.
Connection cable is included.

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

Technical data

Metrological specifications

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

MB = Measurement range
MB/K. = Measurement range per Kelvin

Electrical specifications

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

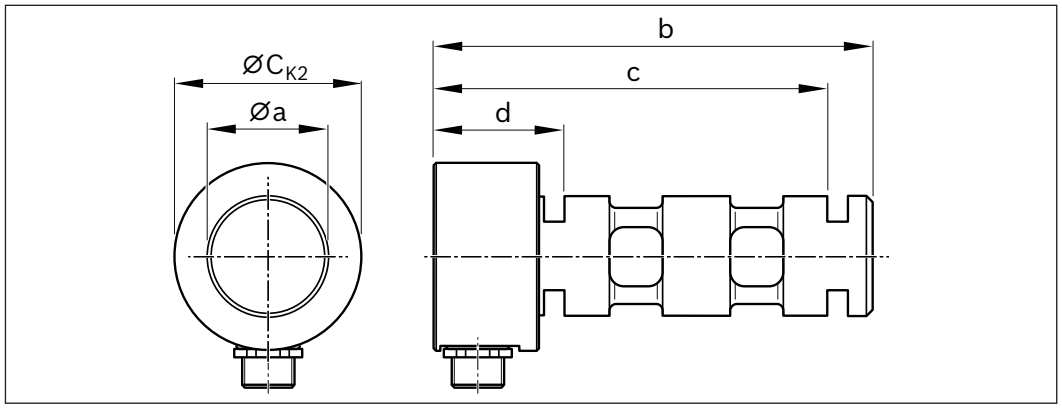
Technical data, connection cable

Length	5 m
Rated voltage	250 V
Rated current	4 A
Connector outlet	angled
Connection type 1	Female connector M12x1, 4-pin
Connection type 2	flying leads
Type of cable	PUR black, shielded
Suitable for drag chains	yes
Cable cross-section	4x0.34 mm^2
Cable diameter D	5.9 ±0.2 mm
Static bending radius	>10 x D
Dynamic bending radius	>5 x D
Bending cycles	> 2 Mio
Ambient temperature, stationary	-25 ... +80 °C
Ambient temperature, in motion	-40 ... +80 °C
Protection class	IP 65

Features

- For tensile and compressive 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 mounting

Dimensions

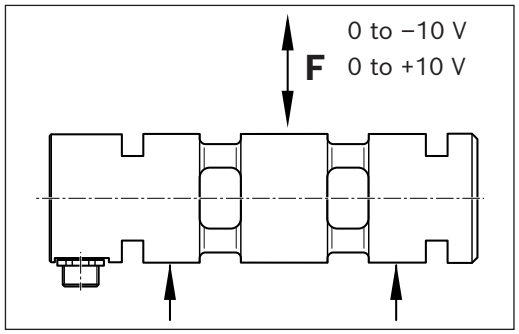


EMC-HP	Material number	Dimensions (mm)					Measurement range	Weight
		Øa f8	ØC_{K2}	b	c	d	(kN)	(kg)
115	R156337080	32	32	131.0	119.0	49.0	50	0.9
130	R156347080	40	40	135.0	122.0	32.0	80	1.3
160	R156357080	50	50	166.5	146.5	36.5	110	2.2
190	R156367080	63	63	189.0	172.0	32.0	190	4.6
220	R156377080	80	80	225.0	204.0	34.0	300	8.8

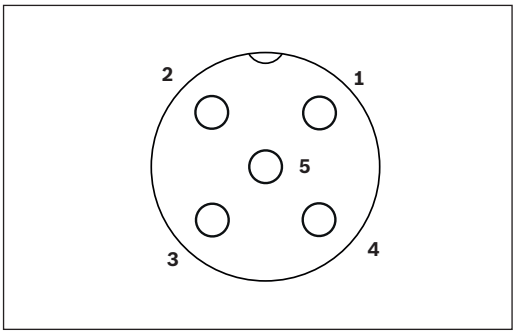
Connection diagram

Load measuring pin
1 Supply (V+)
2 Tare
3 GND (0 V)
4 Output
5 internal assignment

Connection cable
1 brn = brown, supply (V+)
2 wht = white, tare
3 blu = blue, GND (0 V)
4 blk = black, output



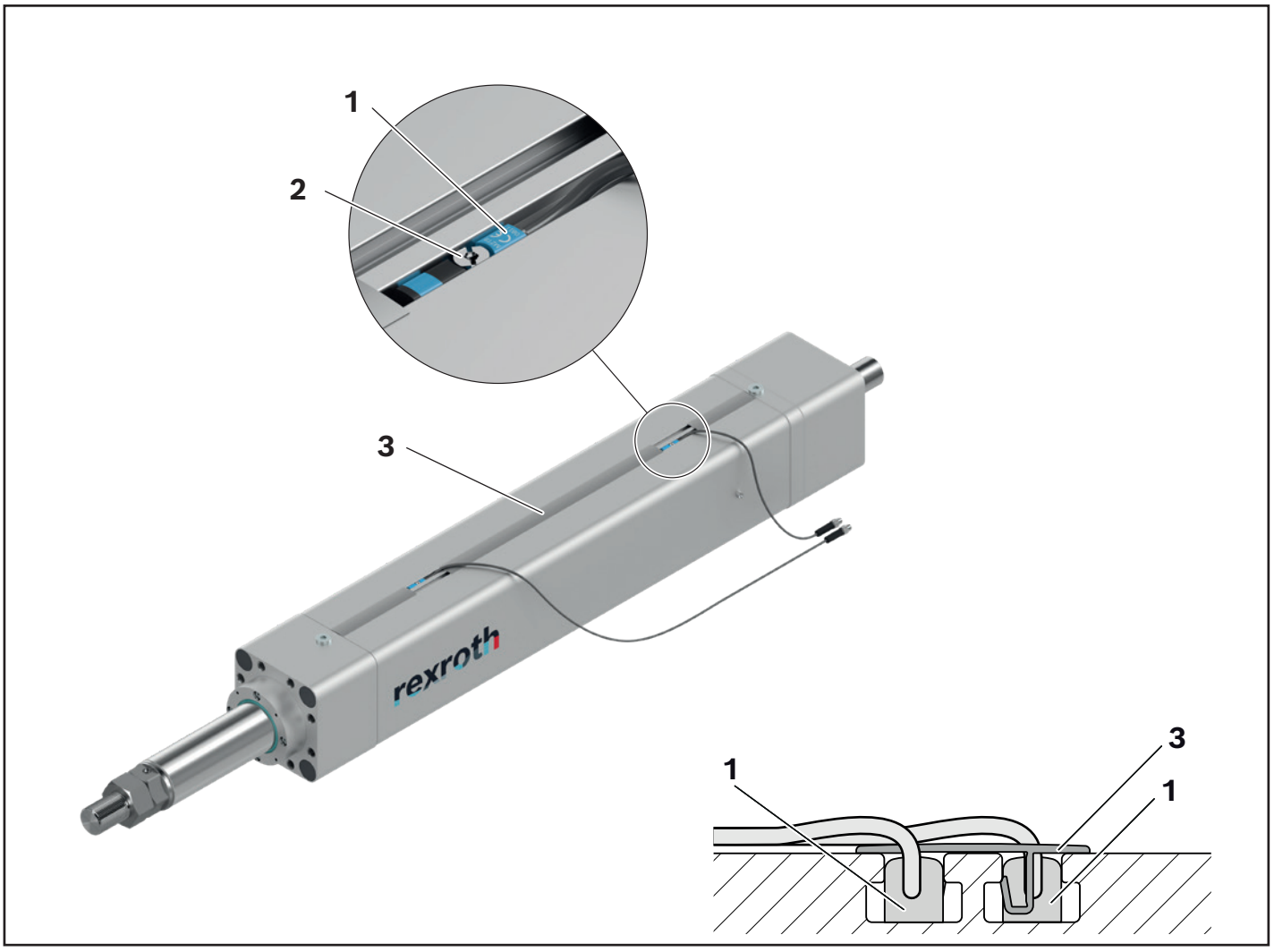
Output signal depending on direction of loading



Connection diagram for measuring bolt

Switching system

Switch mounting



- The switches (magnetic field sensors (**1**)) can be inserted into both T-slots of the housing
- Insert the switch so that the clamping screw (**2**) points outwards
- Cover section (**3**) optionally available
- For more information see instructions EMC-HP R320103219

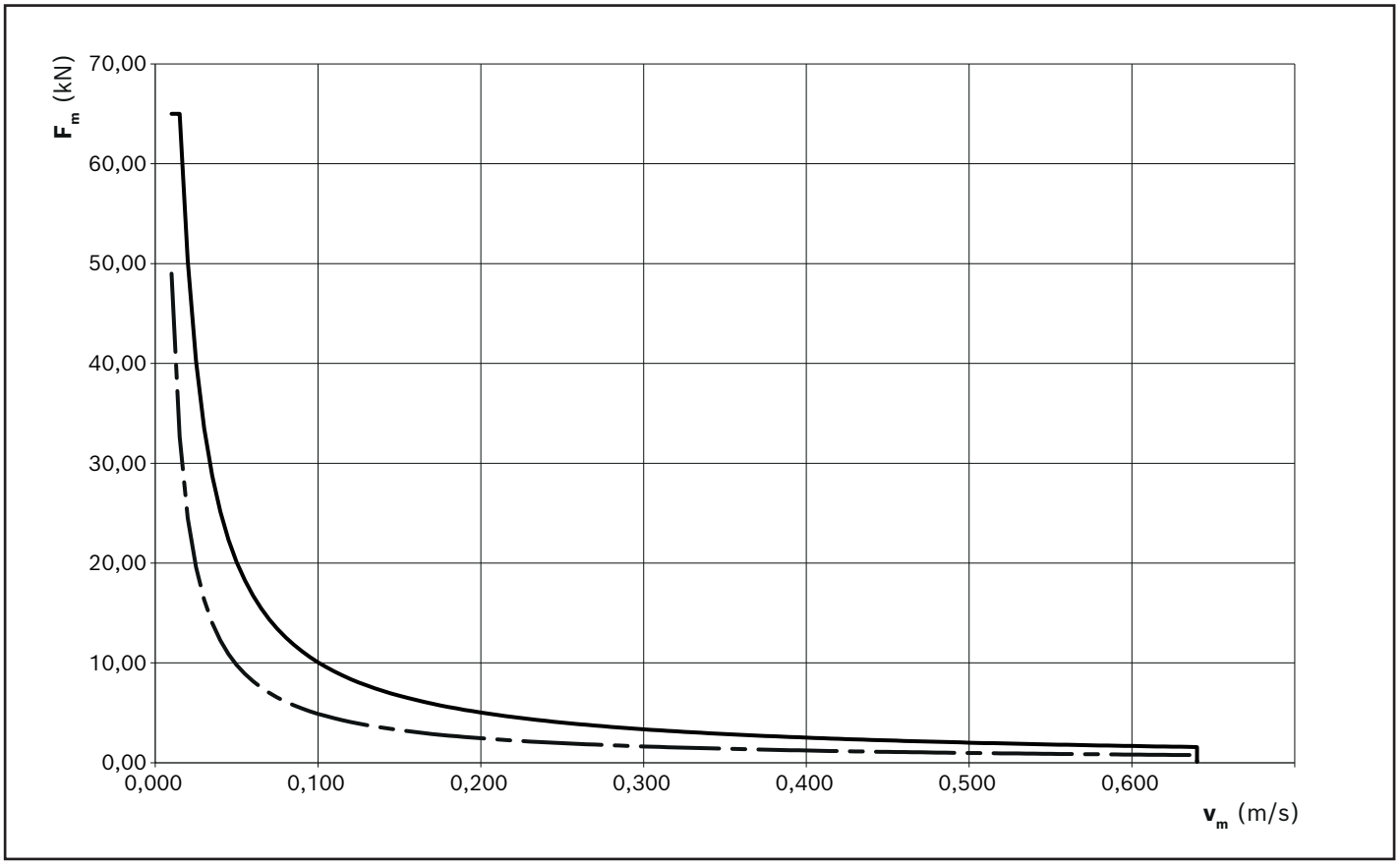
Cooling

The requirements of the application require an adjustment of the effective power of the cylinder. Various possibilities are offered for this purpose.

- The standard variant is the EMC-HP with grease lubrication. Cooling is effected by natural convection of the thermal energy to the environment. This cost-effective version covers the majority of applications.
- Another variant is the EMC-HP with oil lubrication. This combination of a fluid on the inside and natural convection to the outside allows a more effective utilization of the cylinder

The selected option has an influence on the possible continuous power output of the cylinder.

Continuous effective power
Performance curves



Example EMC-130-HP with PLSA 39 x 10

——— LOB; oil lubrication

——— – – LSS; grease lubrication

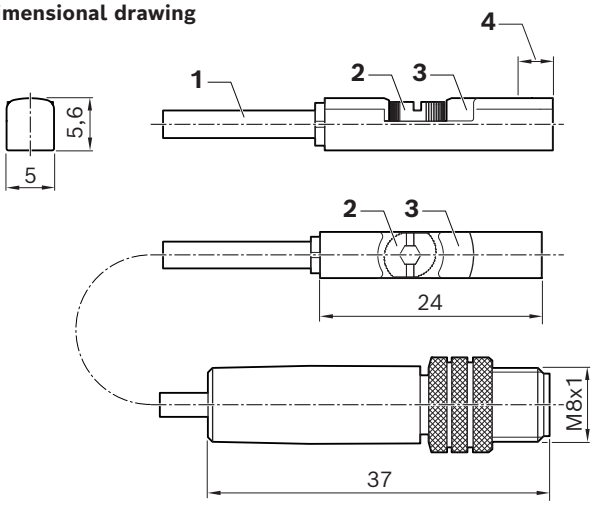
F_m = medium force

v_m = average speed

Switching system

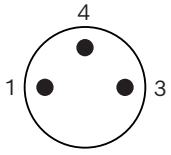
Magnetic switches with M8x1 connector

Dimensional drawing



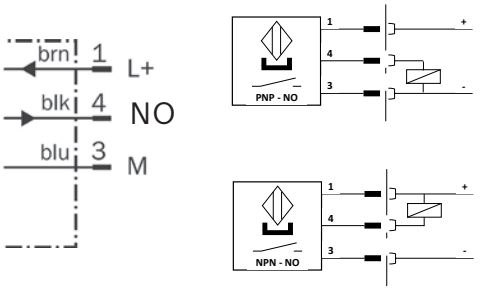
1) Connection
2) Fastening screw
3) LED display
4) Position of sensor element: 2 mm

1 brown (+)
3 blue (-)
4 black (signal)

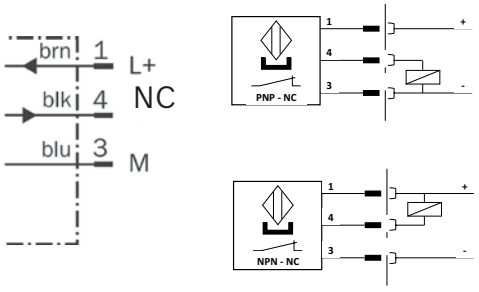


Connection diagram

R913037444
R913037446



R913037443
R913037445



Material numbers / technical data

Use	Limit switch	Reference switch	Limit switch	Reference switch
Material number	R913037445	R913037444	R913037443	R913037446
Designation	MZT8-03VPO-KRDS14	MZT8-03VPS-KRDS13	MZT8-03VNO-KRDS16	MZT8-03VNS-KRDS15
Functional principle	magnetic			
Operating voltage	10 - 30 VDC			
Load current	≦ 200 mA			
Switching function	PNP/NC	PNP/NO	NPN/NC	NPN/NO
Connection type	0.5 m cable and M8x1 plug, 3-pin with knurled screw connection			
Function indicator	✓			
Short-circuit protection	✓			
Reverse polarity protection	✓			
Switch-on suppression	✓			
Switching frequency	3 kHz			
Pulse elongation (off delay)	20 ms			
Max. permissible starting speed	5 m/s			
Suitable for drag chains*	✓			
Torsion-resistant*	✓			
Welding spark-resistant*	–			
Cable cross-section*	3x0.14 mm^2			
Cable diameter D*	2.9 ±0.15 mm			
Static bending radius*	≧ 5xD			
Dynamic bending radius*	≧ 10xD			
Bending cycles*	> 2 Mio.			
Max. permissible travel speed*	5 m/s			
Max. permissible acceleration*	≦ 5 m/s^2			
Ambient temperature	–30 °C bis +80 °C			
Protection class	IP 68			
MTTFd (per EN ISO 13849-1)	MTTFd = 2,339.0 years			
Certifications and approvals**	CE cULus LISTED RoHS			

*) Technical data only for the cast-on connection line (0.5 m) on the magnetic sensor. Available extension cables offer even more performance, e.g. for use in a cable drag chain (see below).

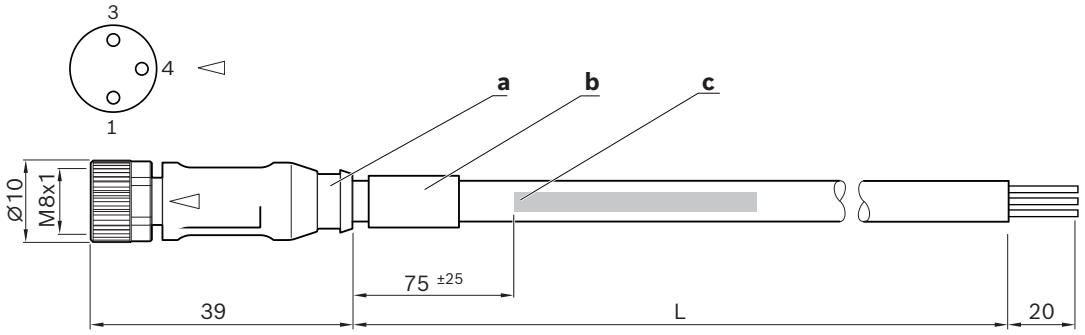
**) These products do not need a CCC certificate for the Chinese market. Document "Sales information CCC" available on request.

Switching system

Extensions

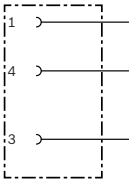
Assembled on one end

Dimensional drawing



Connection diagram

1 brown (+)
3 blue (-)
4 black (signal)

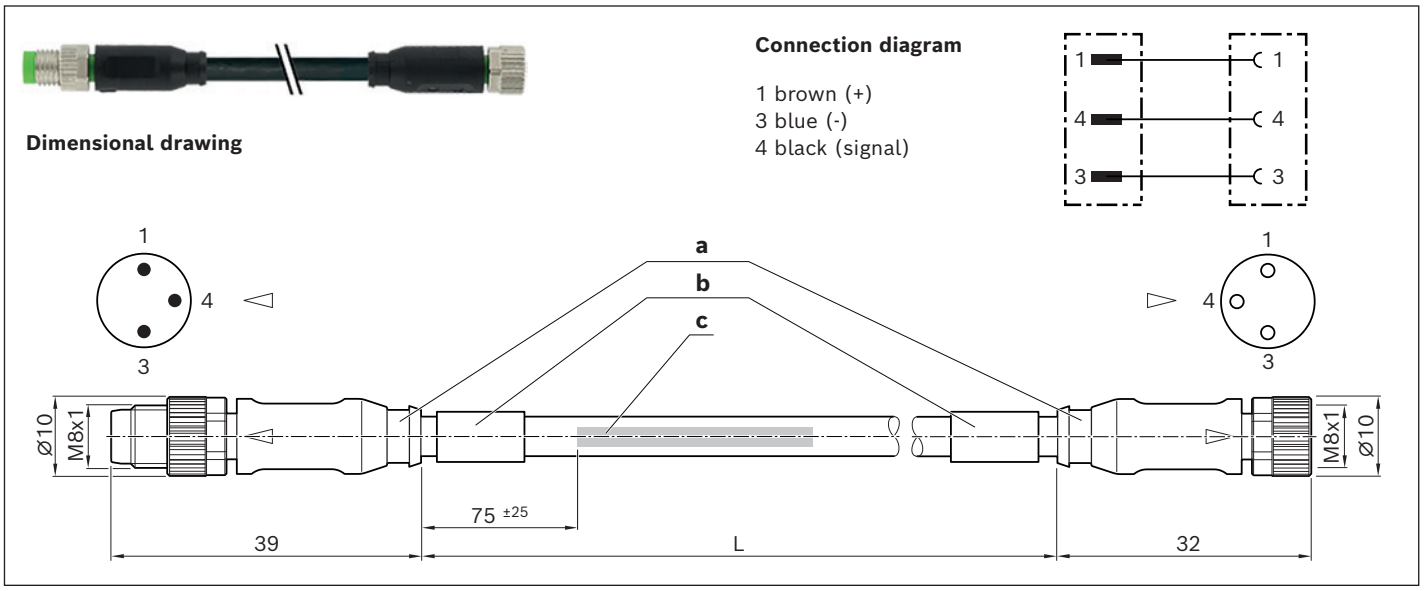


Material number

Use	Extension cable		
Material number	R911344602	R911344619	R911344620
Designation	7000-08041-6500500	7000-08041-6501000	7000-08041-6501500
Length (L)	5.0 m	10.0 m	15.0 m
Connection type 1	Female connector, straight, M8x1, 3-pin		
Connection type 2	Unassembled cable end		

a) Contour for 6.5 mm corrugated tube (inner diameter)
b) Cable grommet
c) Cable printing per printing specification

Assembled on two sides



Material number

Use	Extension cable				
Material number	R911344621	R911344622	R911344623	R911344624	R911344625
Designation	7000-88001-6500050	7000-88001-6500100	7000-88001-6500200	7000-88001-6500500	7000-88001-6501000
Length (L)	0.5 m	1.0 m	2.0 m	5.0	10.0
Connection type 1	Female connector, straight, M8x1, 3-pin				
Connection type 2	Connector, straight, M8x1, 3-pin				

Technical data for extensions pre-assembled on one or two sides

Function indicator	–
Operating voltage indicator	–
Operating voltage	10 - 30 VDC
Type of cable	PUR black
Suitable for drag chains	✓
Torsion-resistant	✓
Weld spark-resistant	✓
Cable cross-section	3x0.25 mm^2
Cable diameter D	4.1 ±0.2 mm
Static bending radius	≧ 5xD
Dynamic bending radius	≧ 10xD
Bending cycles	> 10 mil.
Max. permissible travel speed	3.3 m/s for 5 m travel range (typ.), up to 5 m/s for 0.9 m travel range
Max. permissible acceleration	≦ 30 m/s^2
Ambient temperature fixed ext.	-40 °C to +85 °C
Ambient temperature flexible ext.	-25 °C to +85 °C
Protection class	IP 68
Certifications and approvals	CE, cULus LISTED, CSA C US, PG, RoHS

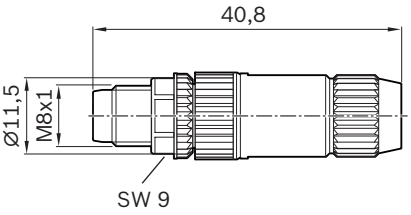
a) Contour for 6.5 mm corrugated tube (inner diameter)
b) Cable grommet
c) Cable printing per printing specification

Switching system

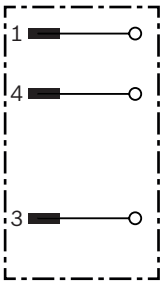
Connectors

R901388333

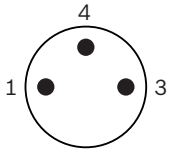
Dimensional drawing



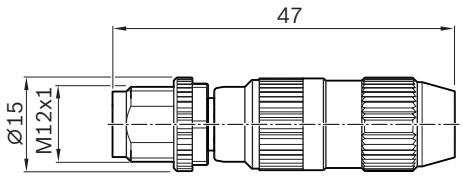
Connection diagram

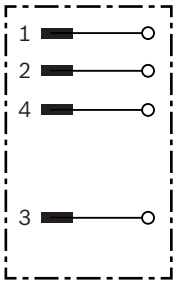


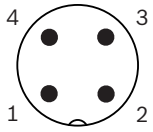
Connector side view



R901388352







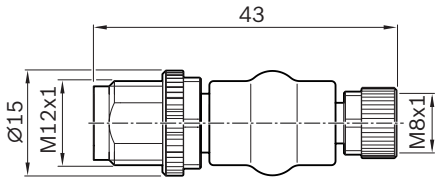
Material numbers / technical data

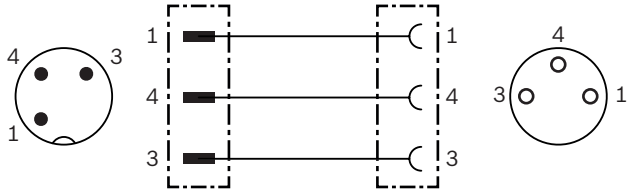
Use	Connector, single	
Material number	R901388333	R901388352
Designation	7000-08331-0000000	7000-12491-0000000
Version	straight	
Operating current per contact	max. 4 A	
Operating voltage	max. 32 V AC/DC	
Connection type	Connector, straight, M8x1, 3-pin, IDC, self-locking screw	Connector, straight, M12x1, 4-pin, IDC, self-locking screw
Function indicator	-	
Operating voltage indicator	-	
Connection cross-section	0.14...0.34 mm²	
Ambient temperature	-25 °C to +85 °C	
Protection class	IP 67 (inserted and screwed down)	
Certifications and approvals		

Adapters

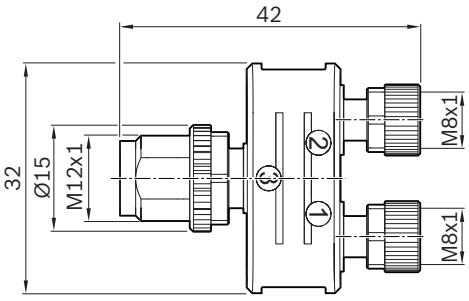
Dimensional drawing **Connection diagram**

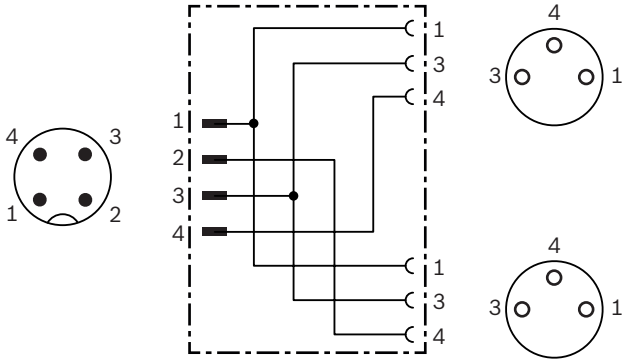
R911344591





R911344592



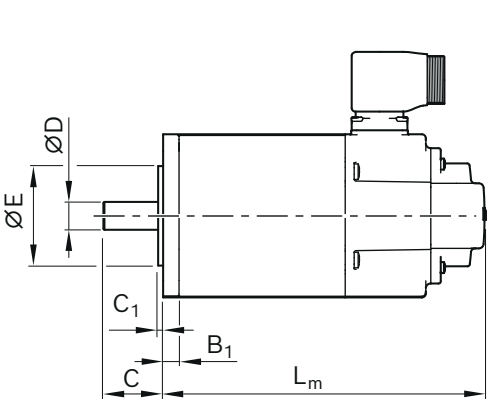


Material numbers / technical data

Use	Adapters	
Material number	R911344591	R911344592
Designation	7000-42201-0000000	7000-41211-0000000
Version	straight	
Operating current per contact	max. 4 A	
Operating voltage	max. 32 V AC/DC	
Connection type 1	Female connector, straight, M8x1, 3-pin, self-locking screw thread	2 X female connectors, straight, M8x1, 3-pin, self-locking screw thread
Connection type 2	Male connector, straight, M12x1, 3-pin, self-locking screw thread	Connector, straight, M12x1, 4-pin, self-locking screw thread
Function indicator	–	
Operating voltage indicator	–	
Connection cross-section	–	
Ambient temperature	-25 °C to +85 °C	
Protection class	IP 67 (inserted and screwed down)	
Certifications and approvals	RoHS	c UL us LISTED, RoHS

IndraDyn S – servo motors MS2N

Motor schematic



Dimensions / motor data

Motor code	Dimensions (mm)											
	□ A	B_1	C	C_1	⌀ D_{k6}	⌀ E_{j6}	⌀ F	⌀ G	H Cables 2	H Cables 1	L_m Brake without	L_m Brake with
MS2N03-B0BYN	58	7.5	20	2.5	9	40	63	4.5	84	99	163	192
MS2N03-D0BYN	58	7.5	23	2.5	11	40	63	4.5	84	99	203	232
MS2N04-B0BTN	82	8	30	2.5	14	50	95	6.6	108	123	162	194.5
MS2N04-C0BTN	82	8	30	2.5	14	50	95	6.6	108	123	194	226.5
MS2N04-D0BQN	82	8	30	2.5	14	50	95	6.6	108	123	226	258.5
MS2N05-B0BTN	98	9	40	3	19	95	115	9	124	139	188	218
MS2N05-C0BTN	98	9	40	3	19	95	115	9	124	139	224	254
MS2N05-D0BRN	98	9	40	3	19	95	115	9	124	139	260	290
MS2N06-B1BNN	116	14	50	3	24	95	130	9	156	156	164	201
MS2N06-C0BTN	116	14	50	3	24	95	130	9	156	156	184	202
MS2N06-D0BRN	116	14	50	3	24	95	130	9	156	156	224	261
MS2N06-D1BNN	116	14	50	3	24	95	130	9	156	156	224	261
MS2N06-E0BRN	116	14	50	3	24	95	130	9	156	156	264	301

MS2N07/ MS2N10 see next page

The table lists motors that might not be used with this product.

Version

- Plain shaft without shaft seal ring
- Multi-turn encoder
- Advanced encoder (C)
- Protection class IP 64
- With or without holding brake
- Special ground connection terminal near motor flange (used as needed)

Motor data								Motor connection 1/2 cable(s)	Holding brake	Type code	Material number
n_{max} (rpm)	M_0 (Nm)	M_{max} (Nm)	M_{br} (Nm)	J_m (kg/m²)	J_{br} (kg/m²)	m_m (kg)	m_{br} (kg)				
9 000	0.73	3.46	1.8	0.000023	0.000007	1.4	0.4	1	N	MS2N03-B0BYN-CMSH0-NNNNE-NN	R911384767
								1	Y	MS2N03-B0BYN-CMSH1-NNNNE-NN	R911384769
9 000	1.15	6.8	1.8	0.000037	0.000007	2.0	0.4	1	N	MS2N03-D0BYN-CMSH0-NNNNE-NN	R911384772
								1	Y	MS2N03-D0BYN-CMSH1-NNNNE-NN	R911384773
6 000	1.75	5.9	5.0	0.000070	0.000040	2.7	0.7	1	N	MS2N04-B0BTN-CMSH0-NNNNE-NN	R911384527
								1	Y	MS2N04-B0BTN-CMSH1-NNNNE-NN	R911384528
6 000	2.80	12.0	5.0	0.000110	0.000050	3.7	0.7	1	N	MS2N04-C0BTN-CMSH0-NNNNE-NN	R911384531
								1	Y	MS2N04-C0BTN-CMSH1-NNNNE-NN	R911384532
6 000	3.85	18.1	5.0	0.000160	0.000040	4.7	0.7	1	N	MS2N04-D0BQN-CMSH0-NNNNE-NN	R911384535
								1	Y	MS2N04-D0BQN-CMSH1-NNNNE-NN	R911384536
6 000	3.75	10.6	10.0	0.000170	0.000110	4.0	1.1	1	N	MS2N05-B0BTN-CMSH0-NNNNE-NN	R911384542
								1	Y	MS2N05-B0BTN-CMSH1-NNNNE-NN	R911384543
6 000	6.10	20.8	10.0	0.000290	0.000110	5.9	1.1	1	N	MS2N05-C0BTN-CMSH0-NNNNE-NN	R911384546
								1	Y	MS2N05-C0BTN-CMSH1-NNNNE-NN	R911384547
6 000	7.90	31.3	10.0	0.000400	0.000110	7.3	1.1	1	N	MS2N05-D0BRN-CMSH0-NNNNE-NN	R911384550
								1	Y	MS2N05-D0BRN-CMSH1-NNNNE-NN	R911384551
6 000	3.25	9.5	10.0	0.000480	0.000110	5.1	1.1	1	N	MS2N06-B1BNN-CMSH0-NNNNE-NN	R911384929
								1	Y	MS2N06-B1BNN-CMSH1-NNNNE-NN	R911384930
6 000	6.00	16.0	10.0	0.000390	0.000110	6.4	1.0	1	N	MS2N06-C0BTN-CMSH0-NNNNE-NN	R911384933
								1	Y	MS2N06-C0BTN-CMSH1-NNNNE-NN	R911384934
6 000	9.70	32.0	15.0	0.000650	0.000140	9.0	1.5	1	N	MS2N06-D0BRN-CMSH0-NNNNE-NN	R911384937
								1	Y	MS2N06-D0BRN-CMSH2-NNNNE-NN	R911384938
6 000	9.00	38.4	15.0	0.001400	0.000140	9.0	1.5	1	N	MS2N06-D1BNN-CMSH0-NNNNE-NN	R911384941
								1	Y	MS2N06-D1BNN-CMSH2-NNNNE-NN	R911384942
6 000	13.0	49.0	15.0	0.000890	0.000140	11.5	1.5	1	N	MS2N06-E0BRN-CMSH0-NNNNE-NN	R911384945
								1	Y	MS2N06-E0BRN-CMSH2-NNNNE-NN	R911384946

Motor code	Dimensions (mm)											
	□ A	B_1	C	C_1	Ø D_{k6}	Ø E_{j6}	Ø F	Ø G	H		L_m	
									Cables		Brake	
									2	1	without	with
MS2N07-B1BNN	140	18	58	4	32	130	165	11	180	180	176	230
MS2N07-C0BQN	140	18	58	4	32	130	165	11	180	180	205	259
MS2N07-C1BRN	140	18	58	4	32	130	165	11	180	180	205	259
MS2N07-D0BHA	140	18	58	4	32	130	165	11	203	-	384	438
MS2N07-D0BRN	140	18	58	4	32	130	165	11	180	-	263	317
MS2N07-D1BNN	140	18	58	4	32	130	165	11	180	180	263	317
MS2N07-E0BQN	140	18	58	4	32	130	165	11	203	-	321	375
MS2N07-E1BNN	140	18	58	4	32	130	165	11	203	-	321	375
MS2N10-C0BNN	196	20	80	4	38	180	215	14	270	-	238	298
MS2N10-D0BHA	196	20	80	4	38	180	215	14	274	-	394	454
MS2N10-E0BHA	196	20	80	4	38	180	215	14	274	-	452	512
MS2N10-E0BNA	196	20	80	4	38	180	215	14	270		452	512
MS2N10-F1BHA	196	20	80	4	38	180	215	14	276		510	570

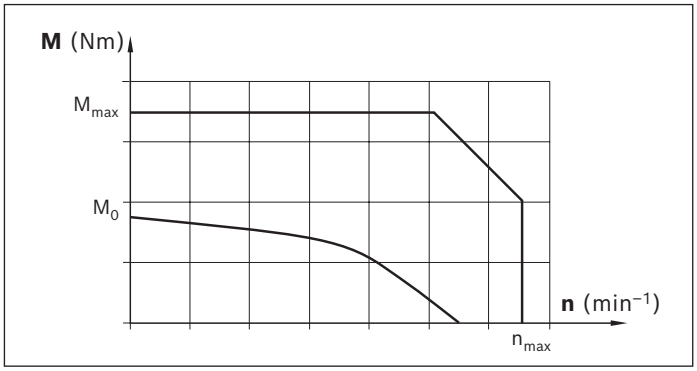
[1] Self-cooling
[2] External cooling 230 V

The table lists motors that might not be used with this product.

Motor data								Motor connection 1/2 cable(s)	Holding brake	Type code	Material number
n_{max} (rpm)	M_0 (Nm)	M_{max} (Nm)	M_{br} (Nm)	J_m (kg/m²)	J_{br} (kg/m²)	m_m (kg)	m_{br} (kg)				
6 000	7.40	21.0	20.0	0.001970	0.000260	9.5	2.0	1	N	MS2N07-B1BNN-CMSH0-NNNNE-NN	R911384951
								1	Y	MS2N07-B1BNN-CMSH1-NNNNE-NN	R911384952
6 000	12.8	35.7	20.0	0.001200	0.000260	12.0	2.0	1	N	MS2N07-C0BQN-CMSH0-NNNNE-NN	R911384955
								1	Y	MS2N07-C0BQN-CMSH1-NNNNE-NN	R911384956
6 000	11.5	42.2	20.0	0.003050	0.000260	12.0	2.0	1	N	MS2N07-C1BRN-CMSH0-NNNNE-NN	R911384959
								1	Y	MS2N07-C1BRN-CMSH1-NNNNE-NN	R911384960
4 000	35.5	73.2	36.0	0.002100	0.000410	20.0	2.5	2	N	MS2N07-D0BHA-CMVH0-NNNNE-NN	R914503253
								2	Y	MS2N07-D0BHA-CMVH2-NNNNE-NN	R914503254
6 000	22.0	73.2	36.0	0.002100	0.000410	17.5	2.5	2	N	MS2N07-D0BRN-CMVH0-NNNNE-NN	R914504164
								2	Y	MS2N07-D0BRN-CMVH2-NNNNE-NN	R911394492
6 000	18.9	84.8	36.0	0.005290	0.000410	17.5	2.5	1	N	MS2N07-D1BNN-CMSH0-NNNNE-NN	R911384965
								1	Y	MS2N07-D1BNN-CMSH2-NNNNE-NN	R911384966
6 000	29.2	109.5	36.0	0.003000	0.000410	23.0	3.0	2	N	MS2N07-E0BQN-CMVH0-NNNNE-NN	R914501679
								2	Y	MS2N07-E0BQN-CMVH2-NNNNE-NN	R914504165
6 000	25.8	128.5	36.0	0.007520	0.000410	23.0	3.0	2	N	MS2N07-E1BNN-CMVH0-NNNNE-NN	R914504166
								2	Y	MS2N07-E1BNN-CMVH2-NNNNE-NN	R914504167
6 000	30.2	70.5	53.0	0.004800	0.001470	23.5	5.0	2	N	MS2N10-C0BNN-CMVH0-NNNNE-NN	R914503255
								2	Y	MS2N10-C0BNN-CMVH2-NNNNE-NN	R914503256
4 000	82.4	142.0	53.0	0.008100	0.001470	35.0	5.0	2	N	MS2N10-D0BHA-CMVH0-NNNNE-NN	R914503257
								2	Y	MS2N10-D0BHA-CMVH2-NNNNE-NN	R914503258
6 000	119.0	214.0	90.0	0.011400	0.002700	46.0	7.0	2	N	MS2N10-E0BHA-CMAH0-NNNNE-NN	R914503270
								2	Y	MS2N10-E0BHA-CMAH3-NNNNE-NN	R914503271
6 000	119.0	214.0	90.0	0.011400	0.002700	46.0	7.0	2	N	MS2N10-E0BNA-CMAH0-NNNNE-NN	R914509918
									Y	MS2N10-E0BNA-CMAH3-NNNNE-NN	R914502696
4 000	145.0	333.0	90.0	0.032900	0.002700	60.0	7.0	2	N	MS2N10-F1BHA-CMAH0-NNNNE-NN	R914509919
									Y	MS2N10-F1BHA-CMAH3-NNNNE-NN	R914509920

For abbreviations see chapter "Service and Information"

Motor characteristic
(Schematic)



Automation package

2 ORDERING OPTIONS

- Single axis
- Single axis + drive (incl. mains filter/cable (optional))

Ordering options	System	Options				
		Motor MS2N	Drive controller		Cables	Mains filter
			Indra-Drive HCS	ctrlX Drive		
1	EMC-HP	—	—	—	—	—
		✔	—	—	—	—
2		✔	✔	—	optional	included
			—	✔	optional	included

Motor/controller combinations

Several motor-controller combinations are available in order to provide the most cost-effective solution for every customer application. When dimensioning the drive, always consider the motor-controller combination.
For more information on motors, controllers and control systems, please refer to the Rexroth automation solutions
➠ Chapter "Further information".

IndraDrive drive family
The converters of the IndraDrive C series generate a DC link direct voltage from the grid supply voltage and from it a controlled AC output voltage with variable amplitude and frequency for operation of a servo motor.
The compact format contains additional mains connection components, making it particularly suitable for single-axis applications.

Version
- Basic Universal or Basic Universal with Safe Motion
- Multi-Ethernet for communication with a superior controller
- More interfaces or integrated controls available
- For the converter HCS01, a smart function kit for pressing and joining applications is available
- Brake resistor included
- Adapters included
- Separate mains filter included

IndraDrive Cs
HCS01.1E-W0054

IndraDrive C
HCS03.1E-W0100

ctrlX drive family
With ctrlX DRIVE, Bosch Rexroth has developed the most compact, modular drive system worldwide for their customers. In addition to space-saving dimensions and maximum scalability, an almost unlimited number of combination options for the user, mature engineering tools and high energy efficiency are among the advantages of ctrlX DRIVE. The Bosch Rexroth servo motors are the perfect team players in the ctrlX DRIVE portfolio.
With compact dimensions, they combine highest dynamics with maximum accuracy for the position, rotary speed and torque values.

- EtherCAT SOE with Safe Torque Off or EtherCAT SOE with safe field bus
- Multi-Ethernet for communication with a superior controller
- More interfaces or integrated controls available
- Adapters included
- Separate mains filter included

ctrlX Drive (XCS)

Motor/controller combinations

Motor				Drive controller				
	Brake			Without controller	HCS	Controller option		
	Without	With				BASIC		
						UNIVERSAL		
						MultiEthernet		
						(B-ET) + L3	(B-ET) + S4	
						Safe torque off	Safe motion	
Without motor	000			000	Without	000	000	
Motor not listed								
MS2N03-B0BYN-CMSHx	203	204	1 cable		HCS01-W0008	102	101	
MS2N03-D0BYN-CMSHx	207	208			HCS01-W0018	302	301	
MS2N04-B0BTN-CMSHx	211	212						
MS2N04-C0BTN-CMSHx	215	216						
MS2N04-D0BQN-CMSHx	219	220						
MS2N05-B0BTN-CMSHx	223	224						
MS2N05-C0BTN-CMSHx	227	228			HCS01-W0028	402	401	
MS2N05-D0BRN-CMSHx	231	232						
MS2N06-B1BNN-CMSHx	235	236			HCS01-W0008	102	101	
MS2N06-C0BTN-CMSHx	239	240			HCS01-W0028	402	401	
MS2N06-D0BRN-CMSHx	243	244						
MS2N06-D1BNN-CMSHx	247	248						
MS2N06-E0BRN-CMSHx	251	252			HCS01-W0054	502	501	
MS2N07-B1BNN-CMSHx	255	256			HCS01-W0018	302	301	
MS2N07-C0BQN-CMSHx	259	260			HCS01-W0028	402	401	
MS2N07-C1BRN-CMSHx	263	264			HCS01-W0054	502	501	
MS2N07-D1BNN-CMSHx	269	270						
MS2N07-D0BHA-CMVHx	287	288	2 cables					
MS2N07-D0BRN-CMVHx	295	296						
MS2N07-E1BNN-CMVHx	299	300						
MS2N07-E0BQN-CMVHx	297	298			HCS03-W0100	702	701	
MS2N10-C0BNN-CMVHx	289	290			HCS01-W0054	502	501	
MS2N10-D0BHA-CMVHx	291	292						
MS2N10-E0BHA-CMAHx	293	294			HCS03-W0100	702	701	
MS2N10-E0BNA-CMAHx	301	302			-	-	-	
MS2N10-F1BHA-CMAHx	303	304			-	-	-	

The table lists motors that might not be used with this product.

					Cable option					
	XCS2	**Controller option**		**Without**	**Controller HCS / XCS2**					
		MultiEthernet			**1 cable**			**2 cables**		
		**CAT SOE**								
		+ T0	**+FSoE + M5**		**5 m**	**10 m**	**15 m**	**5 m**	**10 m**	**15 m**
		Safe torque off	**Safe motion**							
	Without	000	000	000	000	000	000	000	000	000
	XCS2-W0023	2100	2130		105	110	115	-	-	-
	XCS2-W0054	3100	3130							
	XCS2-W0023	2100	2130							
	XCS2-W0054	3100	3130							
	XCS2-W0023	2100	2130							
	XCS2-W0054	3100	3130							
	XCS2-W0070	4100	4130		-	-	-	205	210	215
	XCS2-W0054	3100	3130							
	XCS2-W0070	4100	4130							
	XCS2-W0100	5100	5130							
	XCS2-W0100	5100	5130							
	XCS2-W0150	7100	7130							

Motor/controller/cable combinations

Hybrid cable (power and encoder cable combined, 1 cable)								
Motor	**Drive controller**	**Technical data**						
		Cable designation Part number	**Cable weight (approxi-mately)** kg/m	**Cable outside diameter D** (mm)	**Bending radius minimum** Fixed installation	**Bending radius minimum** Flexible installation	**Bending cycle**	
MS2N03-B0BYN-CMSHx	HCS01.1E-W0008	RH2-021DBB-NN-xxx,x 5m R911372050 10m R911372052 15m R911372053	0.26	13.0 +/- 0.3	5 x D	7.5 x D	> 5 mill.	
MS2N06-B1BNN-CMSHx								
MS2N03-D0BYN-CMSHx	HCS01.1E-W0018	RH2-023DBB-NN-xxx,x 5m R911372062 10m R911372064 15m R911372065						
MS2N04-B0BTN-CMSHx								
MS2N04-C0BTN-CMSHx								
MS2N04-D0BQN-CMSHx								
MS2N05-B0BTN-CMSHx								
MS2N07-B1BNN-CMSHx								
MS2N05-C0BTN-CMSHx	HCS01.1E-W0028							
MS2N05-D0BRN-CMSHx								
MS2N06-C0BTN-CMSHx								
MS2N06-D0BRN-CMSHx								
MS2N06-D1BNN-CMSHx								
MS2N07-C0BQN-CMSHx								
MS2N06-E0BRN-CMSHx	HCS01.1E-W0054	RH2-024DBB-NN-xxx,x 5m R911374454 10m R911379794 15m R911379795						
MS2N07-C1BRN-CMSHx								
MS2N07-D1BNN-CMSHx								

MS2N03-B0BYN-CMSHx	XCS2-W0023	RHB2-021DCB-NN-xxx,x 5m R914507997 10m R914508010 15m R914508018	0.27	13.0 +/- 0.3	5 x D	7.5 x D	> 5 mill.	
MS2N03-D0BYN-CMSHx								
MS2N04-B0BTN-CMSHx								
MS2N04-C0BTN-CMSHx								
MS2N04-D0BQN-CMSHx								
MS2N05-B0BTN-CMSHx								
MS2N05-C0BTN-CMSHx								
MS2N05-D0BRN-CMSHx								
MS2N06-B1BNN-CMSHx								
MS2N06-C0BTN-CMSHx								
MS2N06-D1BNN-CMSHx								
MS2N07-B1BNN-CMSHx								
MS2N07-C0BQN-CMSHx								
MS2N06-D0BRN-CMSHx	XCS2-W0054	RHB2-022DCB-NN-xxx,x 5m R914508036 10m R914508046 15m R914508052						
MS2N06-E0BRN-CMSHx								
MS2N07-C1BRN-CMSHx								
MS2N07-D1BNN-CMSHx								

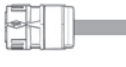
The table lists motors that might not be used with this product.

Motor cable

Motor/controller/cable combinations

Power and encoder cable separate, 2 cables

Motor	Drive controller	Technical data power cable						
		Cable designation Part number	Cable weight (approxi-mately) kg/m	Cable outside diameter D (mm)	Bending radius minimum Fixed installation	 Flexible installation	Bending cycle	
MS2N07-D0BHA-CMVHx MS2N07-E1BNN-CMVHx	HCS01.1E-W0054	RL2-044DBB-NN-xxx,x 5m R911374900 10m R911379527 15m R911379528	0.23	12.2 +/- 0.5				
MS2N07-D0BRN-CMVHx MS2N10-C0BNN-CMVHx MS2N10-D0BHA-CMVHx	HCS01.1E-W0054	RL2-044EBB-NN-xxx,x 5m R911374902 10m R911384595 15m R911384596	0.33	14.8 +/- 0.5	5 x D	7.5 x D	> 5 mill.	
MS2N07-E0BQN-CMVHx	HCS03.1E-W0100	RL2-046EBB-NN-xxx,x 5 m R911376628 10m R911376666 15m R911376667						
MS2N10-E0BHA-CMAHx	HCS03.1E-W0100	RL2-066HBB-NN-xxx,x 5m R911373948 10m R911375037 15m R911375038	0.84	22.2 +/- 1.0				

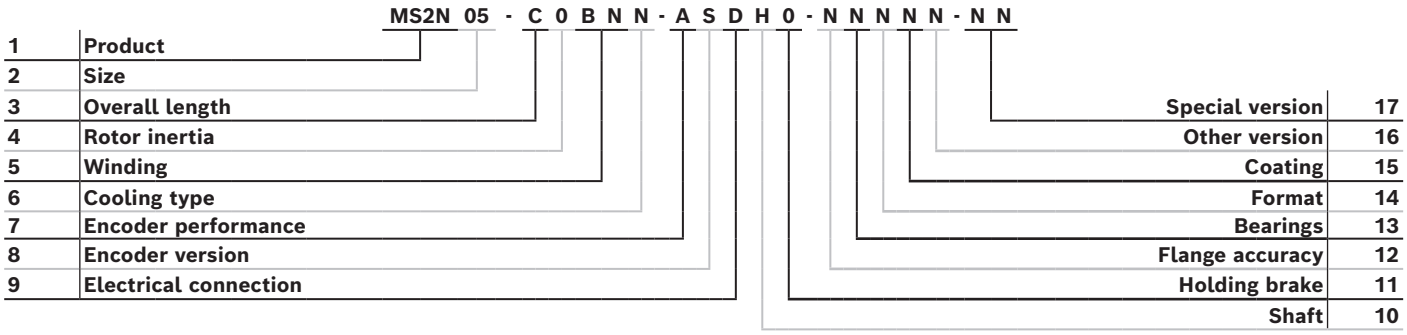
MS2N07-D0BHA-CMVHx	XCS2-W0054	RLB2-042DBB-NN-xxx,x 5m R911397223 10m R911397225 15m R911397226	0.23	12.2 +/- 0.5				
MS2N07-E1BNN-CMVHx	XCS2-W0070							
MS2N07-D0BRN-CMVHx MS2N10-C0BNN-CMVHx	XCS2-W0054	RLB2-042ECB-NN-xxx,x 5m R911396693 10m R911396695 15m R911396696	0.33	14.8 +/- 0.5				
MS2N07-E0BQN-CMVHx	XCS2-W0070							
MS2N10-D0BHA-CMVHx	XCS2-W0070	RLB2-042GDB-NN-xxx,x 5m R911397170 10m R911397173 15m R911397174"	0.58	18.2 +/- 0.6				
MS2N10-E0BHA-CMAHx	XCS2-W0100	RLB2-063HDB-NN-xxx,x 5m R911395186 10m R911395188 15m R911395189"	0.84	22.2 +/- 1.0	5 x D	7.5 x D	> 5 mill.	
MS2N10-E0BNA-CMAHx	XCS2-W0100	RLB2-063JEB-NN-xxx,x 5m R911395201 10m R911395203 15m R911395204	1,2	25,5+/-1,0				
MS2N10-F1BHA-CMAHx	XCS2-W0150	RLB2-064JEB-NN-xxx,x 5m R914503275 10m R914503276 15m R914510782						

The table lists motors that might not be used with this product.

		Technical data encoder cable						
		Cable designation **Part number**	**Cable weight (approxi-mately)** kg/m	**Cable outside diameter D** (mm)	**Bending radius minimum** Fixed installation	 Flexible installation	**Bending cycle**	
		RG2-002AAB-NN-XXX,X 5 m R911371232 10m R911371935 15m R911371936						
		RG2-007AAB-NN-XXX,X 5m R911382615 10m R911382617 15m R911382618	0.08	7.2 +/-0.2	4 x D	7.5 x D	> 5 mill.	
		RG2-007AAB-NN-XXX,X 5m R911382615 10m R911382617 15m R911382618						

Type designation

MS2N05 type designation / features (example)

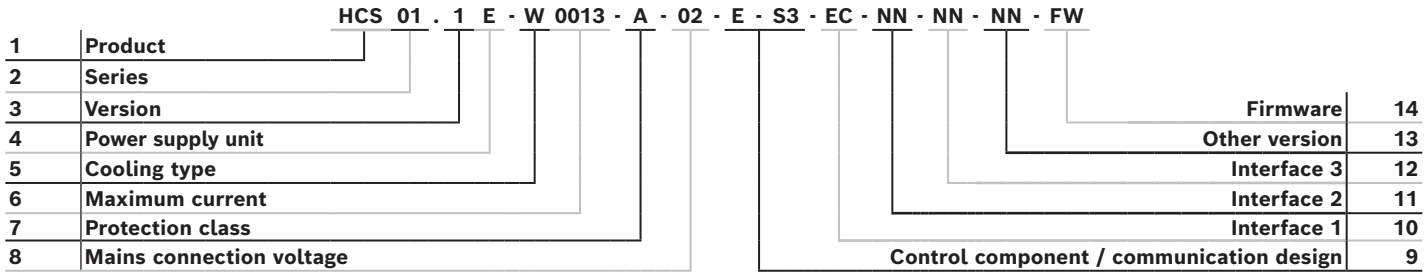


Description / options

1	**Product**	MS2N
2	**Size**	05
3	**Overall length**	B, C, D, E
4	**Rotor inertia**	0 = low inertia / 1 = mean inertia
5	**Winding**	BY = 9000 1/min / BT = 6000 1/min / BR = 4500 1/min / BQ = 4000 1/min BN = 3000 1/min / BH = 2000 1/min
6	**Cooling type**	N = self-cooling / A = external cooling axial 230 V/50 Hz
7	**Encoder performance**	Basic - 16 signal periods, Hiperface® = A Standard - 128 signal periods, Hiperface® (SIL2, PL d)= B Advanced - 20-bit, ACURO®Link (SIL2, PL d)= C Advanced - 20-bit, ACURO®Link (SIL2, PL e)= H
8	**Encoder version**	Single-turn - 1 revolution absolute = S Multi-turn - 4096 revolutions absolute = M
9	**Electrical connection**	Two-cable connection 2x M17, rotatable = D Single-cable connection M17, rotatable = H Single-cable connection M23, rotatable = S
10	**Shaft**	Smooth, without shaft seal ring = H / Smooth, with shaft seal ring = G Keyway, half-spine balancing without shaft seal ring = L Keyway, half-spine balancing with shaft seal ring = K
11	**Holding brake**	Without holding brake = 0 / size 1, electrically releasing = 1
12	**Flange accuracy**	Standard = N
13	**Bearings**	Standard bearing = N
14	**Format**	B5 / IM3001, PT1000 = N
15	**Coating**	Standard painting RAL 9005 black = N
16	**Other version**	None = N / Additional earthing connection = E / Sealing air connection = P
17	**Special version**	None = NN

▶ Further information on MS2N synchronous servo motors ➠ Chapter "Further information"

Type designation controller HCS01 (example)

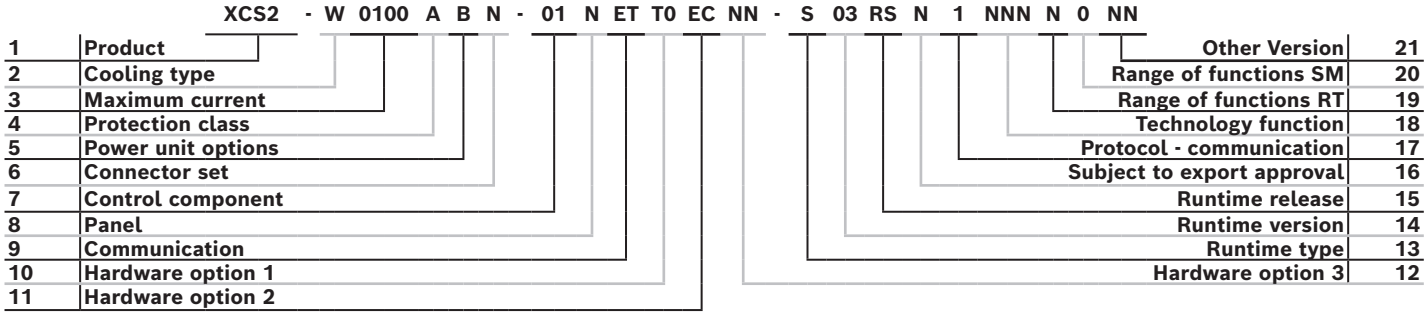


Description / options

1	**Product**	HCS
2	**Series**	01
3	**Version**	1
4	**Power supply unit**	E = infeed
5	**Cooling type**	W = air, internal
6	**Maximum current**	02:0003 = 3 A / 0006 = 6 A / 0009 = 9 A / 0013 = 13 A / 0018 = 18 A 03: 0005 = 5 A / 0008 = 8 A /0018 = 8 A /0028 = 28 A / 0054 = 54 A
7	**Protection class**	A = IP20
8	**Mains connection voltage**	02 = 3 x AC 110...230 V / 03 = 3 x AC 200...500 V
9	**Control component version | Communication**	A-CC = Advanced | Sercos III Master / B-ET = Basic | Multi-Ethernet/ E-S3 = Economy Sercos III
11	**Interface 1**	EC = Encoder IndraDyn / Hiperface / 1VSS / TTL / Endat 2.1/2.2
12	**Interface 2**	CN = CANopen / EC = Multi-encoder interface / EM = Encoder emulation / ET = Multi-Ethernet NN = Not equipped / PB = PROFIBUS
13	**Interface 3**	L3 = STO (Safe Torque Off) L4 = STO (Safe Torque Off) and SBC (Safe Brake Control) NN = Not equipped / S4 = Safe Motion
14	**Other version**	NN = None
15	**Firmware**	

▶ Further information on the controller ➠ Chapter "Further information"

Type designation controller XCS2 (example)



Description / options

1	**Product**	1: X =ctrlX DRIVE / 2: C = converter, feed-in / 3: S = single axis / 4: 2 = generation 2; 1 = generation 1
2	**Cooling type**	W = air, internal
3	**Maximum current**	0100 = 100 A (example) / 23, 54, 70. 100 ...
4	**Protection class**	A = IP20, 3 x AC 200...500 V
5	**Power unit options**	B = Brake transistor (XCS ≥ W0100) / R = Brake transistor/brake resistor integrated (XCS ≤ W0070)
6	**Connector set**	N = Without motor connector set
7	**Control component**	01 = ctrlX DRIVE / 02 = ctrlX DRIVEplus
8	**Panel**	N = Without panel / A = With panel
9	**Communication**	ET = Multi-Ethernet (RJ45) / X3 = ctrlX Core
10	**Hardware option 1**	T0 = Safe Torque Off (STO) / M5 = SafeMotion (M5)
11	**Hardware option 2**	EC = Multi-encoder interface / NN = Not equipped
12	**Hardware option 3**	ET = Multi-Ethernet / DA = I/O extension digital/analog / NN = Not equipped
13	**Runtime type**	S = Standard
14	**Runtime version**	02 = Version 02 (XCS1) / 03 = Version 03 (XCS2)
15	**Runtime release**	RS = Current release
16	**Subject to export approval**	N = No (maximum output frequency < 599 Hz)
17	**Protocol - communication**	0 = Defined via ctrlX CORE apps (XCS2) 1 = Sercos III / 2 = EtherCAT (SoE) / 4 = PROFINET IO
18	**Technology function**	NNN = None TF1 = Install technology apps (XCS2) TE1 = Install/program technology apps (XCS2) TX1 = Install/program technology apps incl. LIBs (Bosch Rexroth libraries) (XCS2)
19	**Range of functions RT**	N = DRIVE Runtime P = DRIVE Runtime Productivity
20	**Range of functions SafeMotion**	0 = Hardware option / 1 ≠ SafeMotion 3 = SafeMotion Speed / 5 = SafeMotion Position
21	**Other Version**	NN = No

▶ Further information on the controller ➠ Chapter "Further information"

Mains filter

Controller / mains filter option						
Controller			**Mains filter**			
	Option	**Weight (kg)**		**Option**	**Weight (kg)**	**Material number**
HCS01-W0008	101 / 102	1.3	NFD03.1-480-007	007	0.88	R911286917
HCS01-W0018	301 / 302	2.1	NFD03.1-480-007	007	0.88	R911286917
HCS01-W0028	401 / 402	2.1	NFD03.1-480-016	016	1.00	R911286918
HCS01-W0054	501 / 502	4.6	NFD03.1-480-030	030	1.67	R911286919
HCS03-W0100	701 / 702	8.0	NFD03.1-480-055	055	2.21	R911286920
CtrlX Drive XCS2-W0023A	2100 / 2130	3.0	NFD03.1-480-016	016	1.00	R911286918
	2160 / 2161					
CtrlX Drive XCS2-W0054A	3100 / 3130	6.3	NFD03.1-480-030	030	1.67	R911286919
	3160 / 3161					
CtrlX Drive XCS2-W0070A	4100 / 4130	6.3	NFD03.1-480-055	055	2.21	R911286920
CtrlX Drive XCS2-W0100A	5100 / 5130	18.1	NFD03.1-480-055	055	2.21	R911286920

Mains filter option	
Assembly	R039949992

Option	**Material number**	**Type**
000	Without mains filter	
001	Only CMS: with mains filter	
007	R911286917	NFD03.1-480-007 = 7 A
016	R911286918	NFD03.1-480-016 = 16A
030	R911286919	NFD03.1-480-030 = 30A
055	R911286920	NFD03.1-480-055 = 55A
100	R911383506	XNF1-1A-0100N = 100A

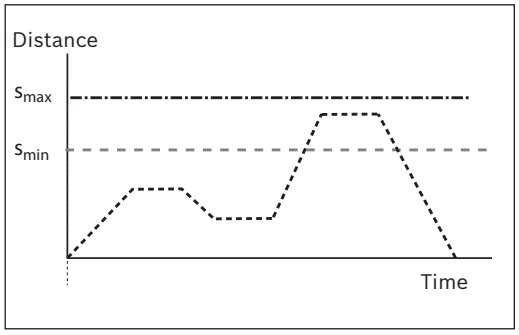
▶ Further information on the controller ➠ Chapter "Further information"

Operating conditions and usage

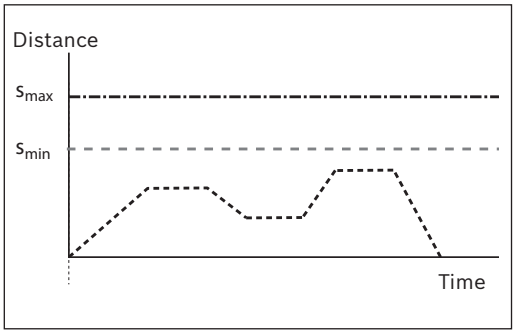
Standard operating conditions

Ambient temperature of cylinder with Rexroth servo motor	0 °C ... 40 °C, above 40 °C loss of performance
Ambient temperature of cylinder mechanics	-10 °C ... +50 °C (up to +70 °C with low duty cycle and power)
Ambient temperature of cylinder mechanics with PLSA and low-temperature grease	-30 °C ... +50 °C (up to +60 °C with low duty cycle and power)
Ambient temperature of cylinder mechanics oil lubrication	0 °C ... +50 °C
Protection class	IP 54; housing 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 ≥ s_{min} (see diagram)

Stroke definition



Normal stroke



Short stroke

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

Notice:
- Short stroke operation only permissible with regular lubrication strokes (larger s_{min})
- Perform service life expectancy calculation with reduction to the load capacity
- Adapt maintenance interval

Contact Bosch Rexroth for further details.

Notes

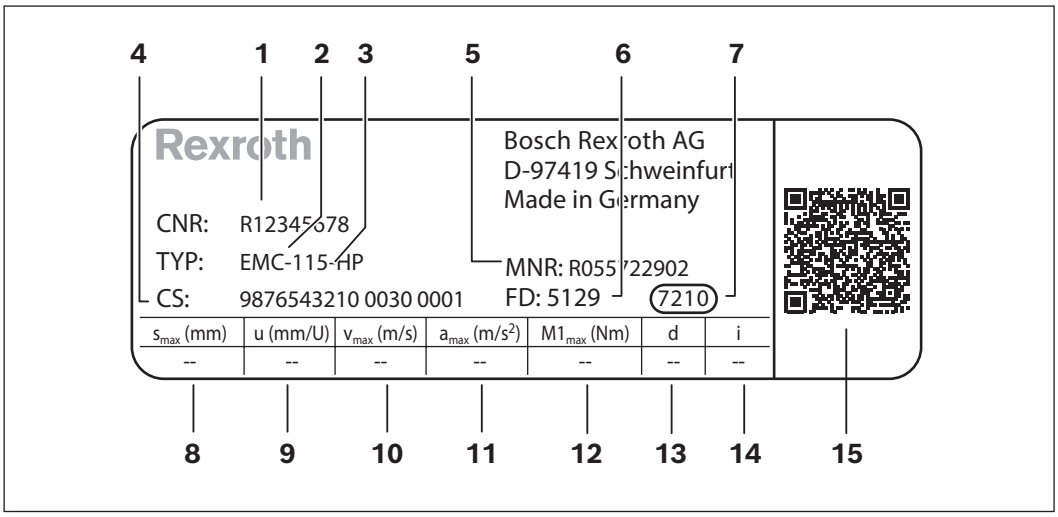
For more information about intended use and safety, see "Safety instructions for linear motion systems R320103152" and "Instructions EMC-HP R320103219."

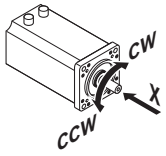
For more information on assembly/commissioning see "Instructions EMC-HP R320103219."

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

Parameterization (commissioning)

The name plate contains reference information on the production of the linear motion system as well as technical commissioning parameters.



1	CNR	Customer's material number
2	TYP	Short product name
3	115	Size
4	CS	Customer information
5	MNR	Material number
6	FD	Date of manufacture
7	7 210	Manufacturing location
8	s_{max}	Maximum travel range
9	u	Feed constant without motor attachment
10	v_{max}	Maximum speed
11	a_{max}	Maximum acceleration rate
12	$M1_{max}$	Maximum drive torque at motor journal
13	d	Direction of motor rotation to travel in positive (+) direction CW = clockwise CCW = counterclockwise 
14	i	Gear ratio
15		QR code (for commissioning)

Note

The values given describe the mechanical limit values of the axle.
Limit values for the included fastening elements and application-related installation cases are not taken into account here.

Lubrication and maintenance

Grease lubrication

The EMC-HP is designed for grease lubrication. Basic lubrication is applied in-factory before shipment.
The advantage of grease lubrication is that the planetary screw assembly can run long distances before requiring re-lubrication.

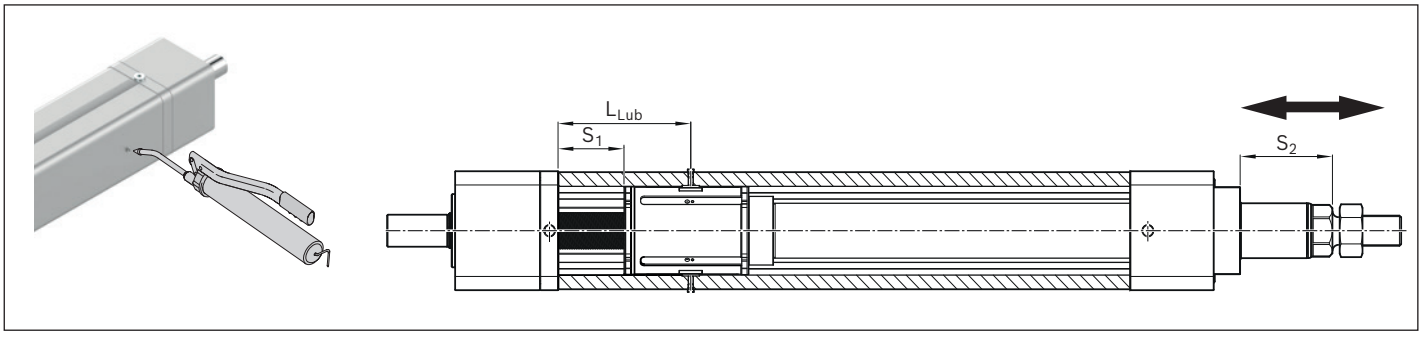
Recommended lubricants

Do not use lubricants with solid particles (e.g. graphite or MoS_2 additives). Dynalub 520 is recommended for central lubrication systems. For lubrication quantities and lubrication intervals, see "Instructions EMC-HP R320103219."

Grease		**Low-temperature grease** (–30 ... +60 °C)
Consistency class NLGI 2 in accordance with DIN 51818 We recommend Dynalub 510 (Bosch Rexroth) Cartridge (400 g) R341603700 Bucket (5 kg) R341603500	**Consistency class NLGI 00 in accordance with DIN 51818** We recommend Dynalub 520 (Bosch Rexroth) Cartridge (400 g) R341604300 Bucket (5 kg) R341604200	Klüber BEM 34-132 R341603600
Can also be used	**Can also be used**	
Elkalub GLS 135 / N2 (Chemie-Technik) Tribol GR 100-2 PD (Castrol)	Elkalub GLS 135 / N00 (Chemie-Technik) Tribol GR 100-00 PD (Castrol)	

Lubrication position

a) Move the piston rod to stroke position **S_2** (reference position) see figure
b) Without limit switch, extend from the rear end position by **S_1**.
For more information, see "Instructions EMC-HP, R320103219."



EMC-HP	**Dimensions** (mm)		
	L_{Lub} ±1.5	**S_1**	**S_2**
130	151.0	75	116.0
160	164.5	75	118.0
190	160.0	75	127.5
220	180.0	75	135.5

Oil lubrication

When the "Oil lubrication" option is selected, the EMC-HP is maintenance-free under the following operating conditions:

Operating conditions	**Value/condition**
Ambient temperature	0 °C ... 50 °C
Ambient temperature of cylinder with Rexroth servo motor	0 °C ... 40 °C. Above 40 °C loss of performance
Travel range s_{min}	see technical data
Load	$F_m/C \leq 0.2$
Average rotary speed	$n_m > 30$ rpm
Oil service life	14 000 h
Oil mileage	15 000 km
Oil check interval	Recommendation every 4 years. An oil with 220 mm²/s (40 °C) viscosity is used by default (e.g. Shell Tonna S3 M 220)
	annual check if operating conditions differ

Installation position	
Horizontal	±5° inclination; intended for normal operation. (normal operating conditions)
Vertical	The following applies to travel range s: - **Piston rod extends upwards** (➡ Fig. 1): the cylinder must **not be exclusively** operated **in the** limited travel range. - **Piston rod extends downwards** (➡ Fig. 2): the cylinder must **not be exclusively** operated **in the** limited travel range.

$\mathbf{x_{pos}}$ = current stroke position (mm)

$\mathbf{s_{max}}$ = Maximum travel range (mm)

Limitless travel range

Limited travel range

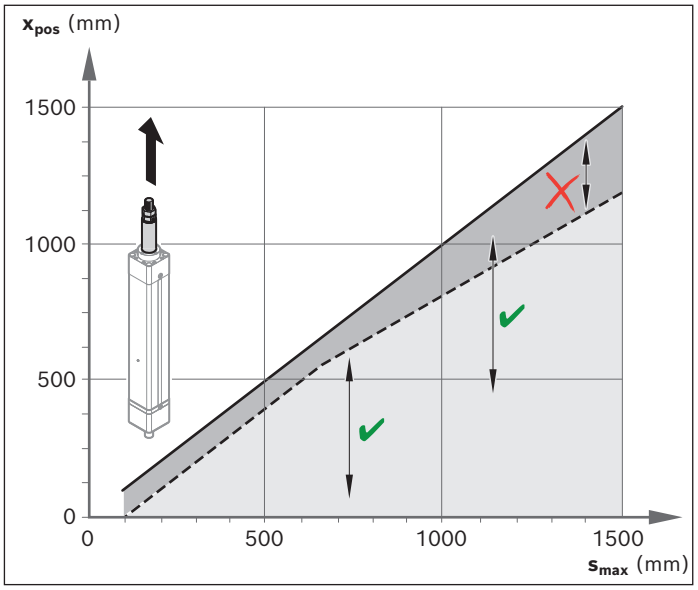


Fig. 1:

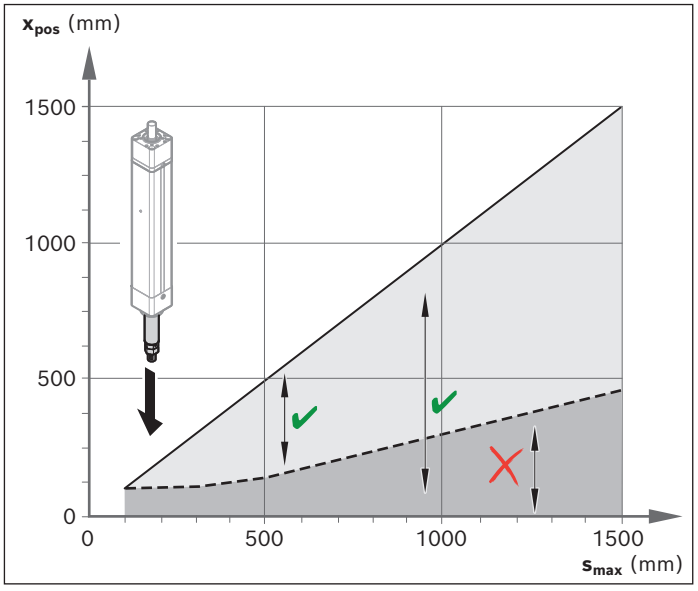


Fig. 2:

For more information, see "Instructions EMC-HP oil lubrication, R320103237."

Documentation

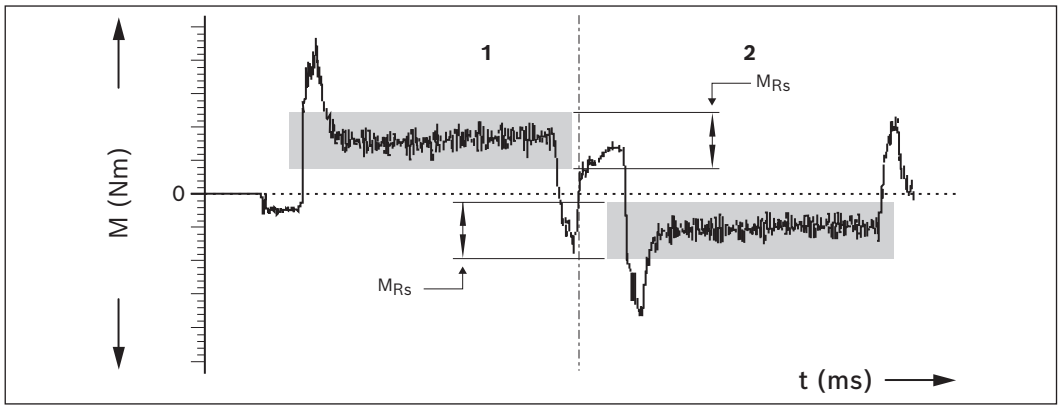
Standard report
Option 01

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.
Checks listed in
the standard report:

- Functional checks of mechanical components
- Functional checks of electrical components
- Version as per order confirmation

Measurement of frictional torque of complete system
Option 02
All items as per the standard report.
The friction torque M is measured over the entire travel range.

Example diagram

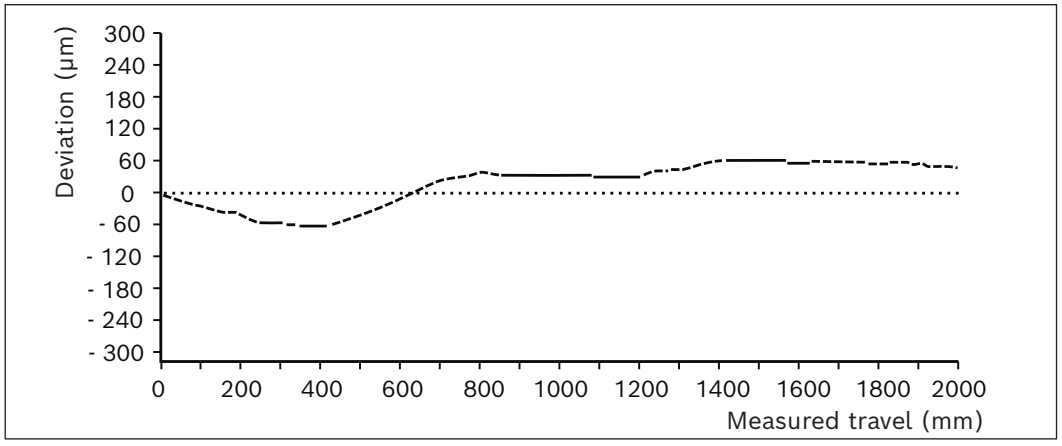


1) Advance
2) Return

M_{Rs} = Friction torque (N)
t = Travel time (ms)

Lead deviation of screw drive
Option 03
All items as per the standard report.
In addition to the graphical illustration (see figure), a measurement report is included in tabular form.

Example diagram



Further information

Bosch Rexroth Linear Motion Technology homepage	
Product information on electromechanical cylinders EMC-HP (instructions, configurator, etc.)	
Product overview, automation solutions (motors, drives, control systems, etc.)	

Glossary (definitions)

Dynamic load capacity C:
Constant that is used to calculate the service life of a screw drive. The value for the dynamic load capacity **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 types of limit switches with electrical signals are roller lever switches or non-contacting switches such as light barriers 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 commissioning 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 quotient of input speed to output speed.

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

Abbreviations

Abbreviation/ index	Designation	Unit
a	Acceleration	(m/s^2)
a_{max}	Maximum acceleration rate	(m/s^2)
BASA	Ball screw assembly	(–)
B_t	Belt type	(–)
c_{spe}	Specific spring rate	(N)
C_{gw}	Dynamic load capacity, guideway	(N)
C_{bs}	Dynamic load capacity, ball screw assembly	(N)
C_{fb}	Dynamic load capacity, fixed bearing	(N)
d_0	Nominal diameter, ball screw assembly	(mm)
d_3	Belt pulley diameter	(mm)
f_w	Load factor	(–)
F_n	Axial load of the ball screw assembly	(N)
F_{eff}	Effective equivalent axial load	(N)
F_{bp}	Max. belt drive transmission force	(N)
F_{comb}	Combined equivalent bearing load	(N)
F_{mbs}	Dynamically equivalent load on bearing of the ball screw assembly	(N)
F_{mgw}	Dynamically equivalent load on bearing of the guideway	(N)
F_n	Axial load of the ball screw assembly	(N)
$F_{t\ perm}$	Belt elasticity limit	(N)
F_y	Load due to a resulting force in y-direction	(N)
$F_{y\ max}$	Maximum dynamic load in y-direction	(N)
F_z	Load due to a resulting force in z-direction	(N)
$F_{z\ max}$	Maximum dynamic load in z-direction	(N)
g	Gravitational acceleration (= 9.81)	(m/s^2)
i	Gear ratio	(–)
I_y	Planar moment of inertia about the y-axis	(cm^4)
I_z	Planar moment of inertia about the z-axis	(cm^4)
J_{br}	Mass moment of inertia of the motor brake	(kg/m^2)
J_c	Mass moment of inertia of the coupling	(kg/m^2)
J_{dc}	Mass moment of inertia of the drive train	(kg/m^2)
J_{ex}	Mass moment of inertia of the mechanical system	(kg/m^2)
J_{ge}	Mass moment of inertia of the gear about the motor journal	(kg/m^2)
J_m	Mass moment of inertia of the motor	(kg/m^2)
J_s	Mass moment of inertia of the linear motion system	(kg/m^2)
J_{sd}	Mass moment of inertia of the belt side drive about the motor journal	(kg/m^2)
J_t	Translative mass moment of inertia of external load based on the linear motion system screw journal	(kg/m^2)
$k_{g\ fix}$	Constant for fixed portion of mass	(kg)
$k_{g\ var}$	Constant for variable-length portion of mass	(kg/mm)

Abbreviation/ index	Designation	Unit
$k_{J\ fix}$	Constant for fixed portion of mass moment of inertia	(kg/mm^2)
$k_{J\ m}$	Constant for mass-specific portion of mass moment of inertia	(mm^2)
$k_{J\ var}$	Constant for variable-length portion of mass moment of inertia	(kg/mm)
L	Length of the linear motion system	(mm)
L_{ad}	Additional length	(mm)
L_c	Length nut/length nut and housing	(mm)
L_{ca}	Carriage length	(mm)
L_{bs}	Nominal service life (ball screw assembly, fixed bearing)	(rpm)
L_{hbs}	Nominal service life (ball screw assembly, fixed bearing)	(h)
L_{gw}	Nominal service life of the guideway	(m)
L_{hgw}	Nominal service life of the guideway	(h)
L_W	Centerline-to-centerline distance between carriages	(mm)
m_{br}	Holding brake mass	(kg)
m_{ca}	Moved mass of system of carriage	(kg)
m_{ex}	Moved external load	(kg)
m_{fc}	Mass of flange and coupling	(kg)
m_m	Mass of the motor	(kg)
m_s	Mass of the linear system (without attachments)	(kg)
m_{sd}	Mass of the timing belt side drive	(kg)
M_0	Continuous motor torque	(Nm)
M_{cN}	Rated torque of coupling	(Nm)
M_g	Weight moment at motor journal	(Nm)
M_{ge}	Maximum permissible acceleration torque of the gear (at the output drive)	(Nm)
M_L	Dynamic longitudinal moment load capacity	(Nm)
M_m	Equivalent dynamic torque	(Nm)
M_{max}	Max. possible motor torque	(Nm)
M_{mech}	Maximum permissible drive torque for mechanical system	(Nm)
M_p	Maximum permissible drive torque (at drive journal)	(Nm)
M_R	Frictional torque at motor journal	(Nm)
M_{Rge}	Friction torque of the gear at the motor journal	(Nm)
M_{Rs}	Friction torque of system	(Nm)
M_{Rsd}	Friction torque of belt side drive at motor journal	(Nm)
M_{sd}	Maximum permissible drive torque of the belt side drive	(Nm)
M_{stat}	Static load moment	(Nm)
M_t	Dynamic torsional moment load capacity	(Nm)
M_x	Dynamic torsional moment around the x-axis	(Nm)
$M_{x\ max}$	Maximum permissible torsional moment around the x-axis	(Nm)

Abbreviation/ index	Designation	Unit
M_y	Dynamic torsional moment around the y-axis	(Nm)
$M_{y\ max}$	Maximum permissible torsional moment around the y-axis	(Nm)
M_z	Dynamic torsional moment around the z-axis	(Nm)
$M_{z\ max}$	Maximum permissible torsional moment around the z-axis	(Nm)
n	Rotary speed of the ball screw assembly	(rpm)
$n_1, n_2, \ldots n_n$	Rotary speed in acceleration and braking phases	(rpm)
$n_{A1 \ldots n}$	Starting speed in phase 1 ... n	(rpm)
$n_{E1 \ldots n}$	Ending speed in phase 1 ... n	(rpm)
n_{ge}	Maximum permissible rotary speed of the gear	(rpm)
n_m	Average rotary speed of the ball screw assembly	(rpm)
n_{mech}	Maximum permissible rotary speed for mechanical system	(rpm)
n_{max}	Max. motor speed	(rpm)
n_p	Maximum permissible rotary speed of the linear motion system	(rpm)
P	Screw lead/ball screw assembly lead	(mm)
P_{app}	Effective power in application	(W)
Keyway	Keyway	(–)
$q_{t1..n}$	Time step of the phases	(%)
s_a	Acceleration travel	(mm)
s_e	Excess travel	(mm)
s_{eff}	Effective stroke	(mm)
s_{min}	Minimum travel range	(mm)
s_{max}	Maximum travel range	(mm)
$s_{max\ adm}$	Maximum selectable travel range	(mm)
SPU	Screw support	(–)
TT	Carriage	(–)
t_a	Acceleration/braking time	(s)
$t_1, t_2, \ldots t_n$	Time for phase 1 ... n	(s)
t_{total}	Sum of time steps	(s)
u	Feed constant	(mm/rev)
$v_1, v_2, \ldots v_n$	Speed in phase 1 ... n	(m/s)
v_{max}	Maximum permissible speed	(m/s)
v_{mech}	Maximum permissible speed of mechanical system	(m/s)
v_{mgw}	Average speed of the guideway	(m/s)
V	Ratio of mass moments of inertia of drive chain and motor	(–)
x_{pos}	current stroke position	(mm)
z_1	Application point of the effective force	(mm)
π	Pi	(–)

Note:

This catalog may possibly not include all abbreviations listed here.

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