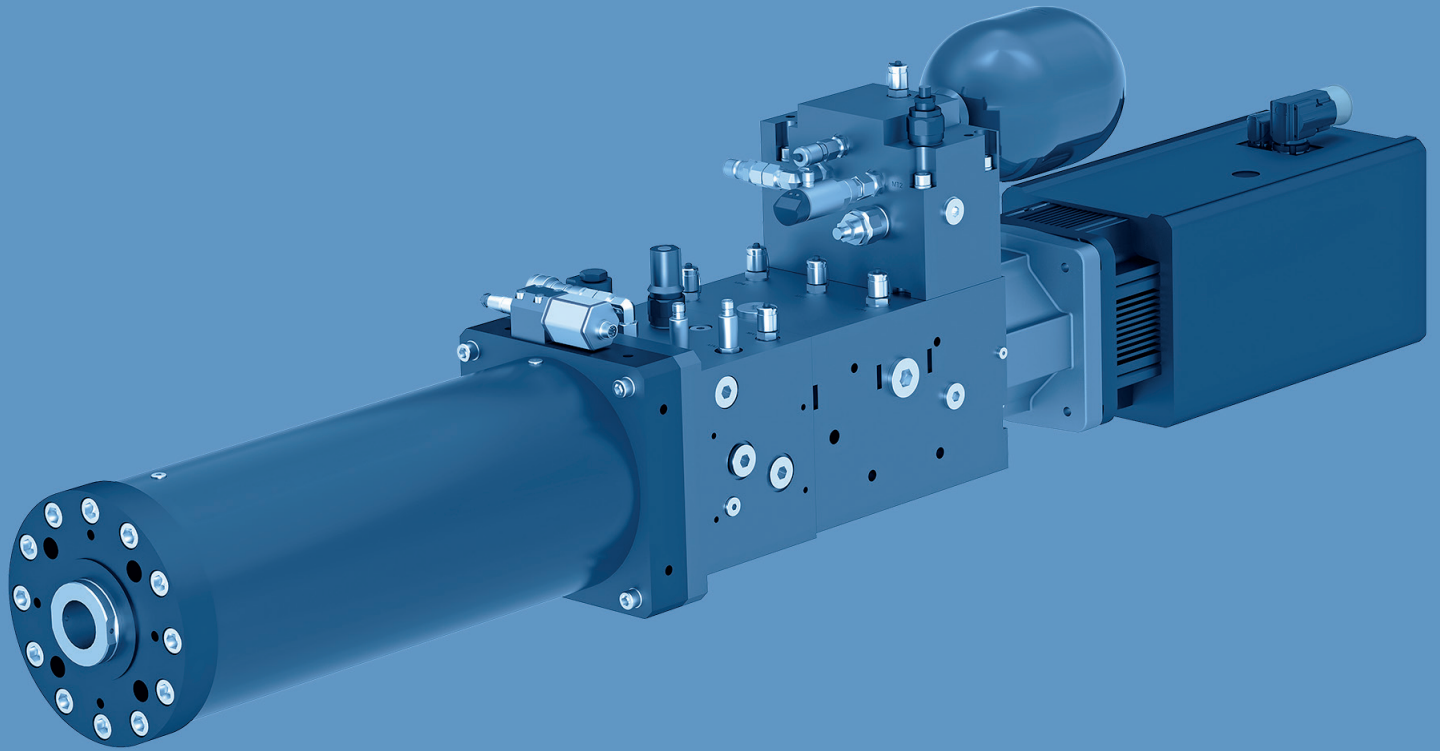


COMPACT ELECTROHYDROSTATIC ACTUATION SYSTEM



Rev. C, February 2023

A COMPACT, ENERGY EFFICIENT AND HIGH FORCE ALTERNATIVE TO
TRADITIONAL ACTUATION SYSTEMS.

WHAT MOVES YOUR WORLD

MOOG

If demanding motion systems and highly flexible designs are required, then Moog expertise is here to assist you. Through our collaborative approach, our creativity and first class technology, we help you to solve even the most complex motion tasks, increase the performance of your products and create solutions that far exceed today's expectations.

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COMPACT ELECTROHYDROSTATIC ACTUATION SYSTEM

Electrohydrostatic Actuation Systems (EAS) are emerging as viable options for industrial machine builders seeking for compact alternatives to traditional hydraulic or electromechanical motion control solutions.

Moog has designed its Compact Electrohydrostatic Actuation System (Compact EAS) to generate largely linear motion by means of the electrohydrostatic technology, comprised of a servo motor, internal gear pump and a directly linked cylinder.

These building blocks make up Moog's Compact EAS, a dynamic and attractive solution for the industrial machine manufacturing market that combines the best of two worlds, electrohydraulic (EH) and electromechanical (EM) actuation. Automation engineers moving toward electromechanical actuation in pursuit of energy efficiency and environmental cleanliness and seeking to combine this with the high-power density of electrohydraulic actuation, will find the Compact EAS an attractive solution.

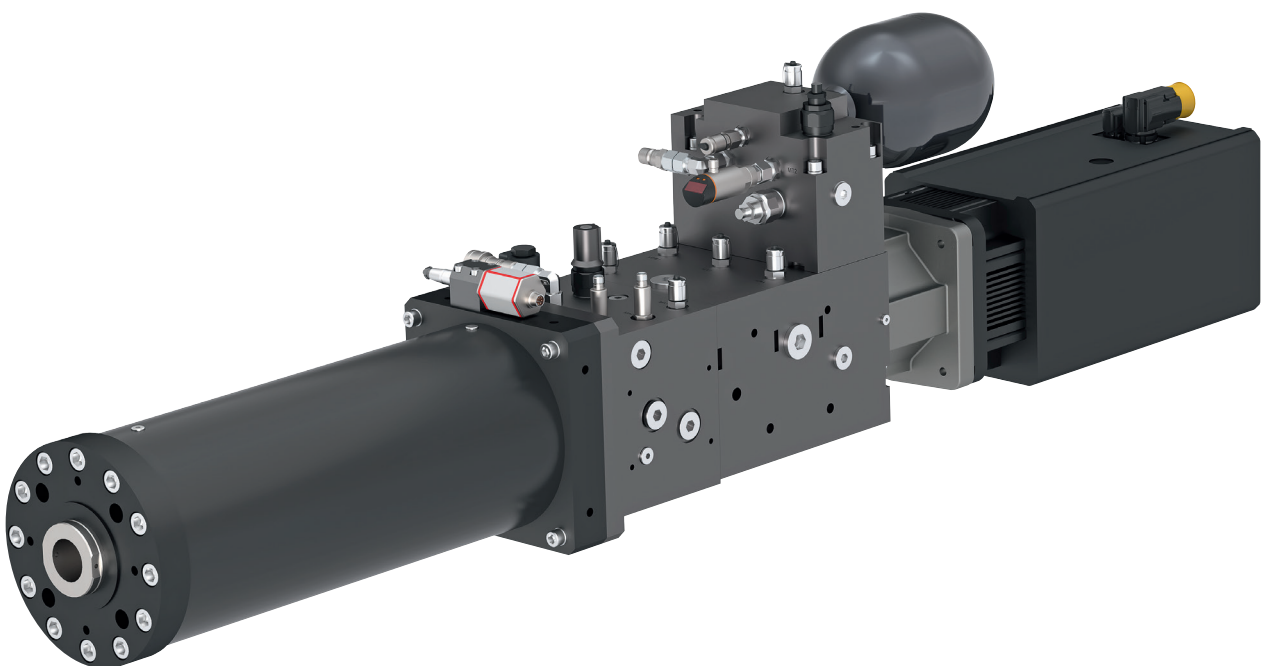
The integrated servo pump is matched to the surface area ratio of the cylinder. Speed and direction of movement is controlled without any directional or proportional valves. Because of the closed loop system, Compact EAS does not need a tank or external power pack. The necessary volume compensator is integrated.

Position control, pressure/force control and speed control as well as combinations are possible. The pressure transducer is integrated into the system. An integrated position feedback sensor is available. Key features of Compact EAS are very high energy efficiency and virtually wearless operation.

Our global engineering teams can help customers select and integrate these standardized modules as building blocks able to meet a range of unique application requirements across a number of industries. If desired, the system modules can be modified by our engineering experts to meet specific customer requirements, however specialized. The Compact EAS is a key future technology that is suitable for a broad range of applications.

Advantages

The Compact EAS is highly flexible with good scalability and variability that can be easily adapted to most types of industrial manufacturing machinery. The system's interfaces are standardized to facilitate simplified machine design. Our engineering experts assess both the onsite installation conditions and module dimensions in advance, meaning that machine design can be identified early in the project planning phase. All system spare parts are also standardized, resulting in simple, fast maintenance and reduced machine down time for our customers.



TECHNOLOGY OVERVIEW

In EM actuation systems a frequency-controlled servo motor drives a mechanical actuator via a mechanical gearbox. In EH resistance control systems, a central hydraulic power unit (HPU) drives one or more hydraulic actuators (cylinder, hydraulic motor), controlled by servo or proportional valves. Electrohydrostatic Actuation Systems (EAS) feature a frequency-controlled servo motor that drives a hydraulic actuator via hydrostatic transmission, thereby combining the advantages of EM and EH technology.

Principally, this allows for the electrical coupling of several machine axes in a common electrical intermediate circuit (DC-Bus), and enables demand driven energy distribution that includes an energy recovery capability.

Depending on the required performances, installation interfaces, work environment, we support the customer in selection of the most appropriate EAS solution.

Customized EAS

- Composed by EPU (Electrohydrostatic Pump Unit) plus customized manifold, servo drive and controller
- Customized solution tailored on the specific application requirement

Modular EAS

- Composed by EPU (Electrohydrostatic Pump Unit) plus

standard manifold, servo drive and controller

- Modular solution that can help machine builder to save time and cost related to a specific development
- High speed module available as an option

Compact EAS

- System composed by servo motor, internal gear servo pump, hydraulic manifold, cylinder, compensation tank
- Ideal for applications that require a compact solution

Applications

The Compact EAS is suitable for a range of industrial manufacturing machinery. It can be used on

- Bending machines
- Cutting machines
- Forming machines
- Presses
- Special machines
- General replacement of spindle drives with servo motor
- Material handling
- Testing machines (laboratory)
- Food industry

Features	Benefits
High force capability and force density	Provides an attractive alternative to EH and EM actuation
Low noise emission	Quiet machine operation
Environmentally clean due to lower oil requirement	Lowers maintenance and operating costs
The drive is wear-resistant and absolutely overload-safe	<ul style="list-style-type: none"> • Long lifetime of drive components and moving parts • After an overload occurs, machine or equipment can be quickly and easily restarted
The drive has only a few electrical interfaces	<ul style="list-style-type: none"> • Low startup effort and cost • No staff with knowledge of hydraulics is required
The integrated hydraulic system is a stand-alone system (self-contained)	<ul style="list-style-type: none"> • Saving of procurement and maintenance costs required for an external hydraulic power pack with all of its piping and tubing • The linear drive is easy and cost-effective to install in machines and equipment
Simple and compact design with no classic valve and control technology	<ul style="list-style-type: none"> • The linear drive requires up to 50 % less energy, reducing operational costs • Low costs for commissioning, training, and maintenance
Hydraulic system throttle losses are kept to a minimum	The drive is energy-efficient and has low cooling requirements
Standardized linear drive with very few components and modular design	<ul style="list-style-type: none"> • Low planning costs associated with system integration • Large number of designs and sizes are available

SCOPE OF DELIVERY

Basic Version - Complete Drive Unit

- Motor, pump, cylinder, compensation tank, valves, pressure switch
- Oil filling with high performance fluid PF-700
- Drift protection (not a safety component)
- Pressure transducers

Options

- Servo converter with safety relay and interface cards (e.g. analog, CANopen, Ethernet, etc.)
- Line filter, mains line choke, brake resistor
- Motor cable, encoder cable
- Parameterization software
- Start-up on-site
- Integrated position feedback sensor (absolute)

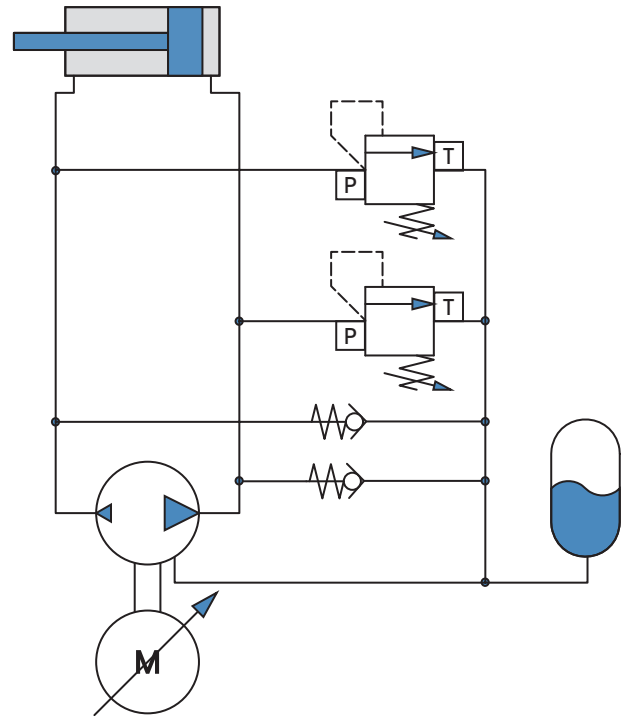
Performance Fluid PF-700

Performance Fluid PF-700 was developed especially for all power transmission systems with special requirements on tribology, temperature, oxidation and shearing stability. The result is a very high application period at minimum degradation.

- Very low frictional losses, therefore significantly enhanced efficiency of power transmission
- Energy saving
- High viscosity index
- Outstanding wear protection characteristics
- Compatible with commonly used sealing materials

For the Compact EAS, exclusive use of PF-700 is mandatory.

System Drawing



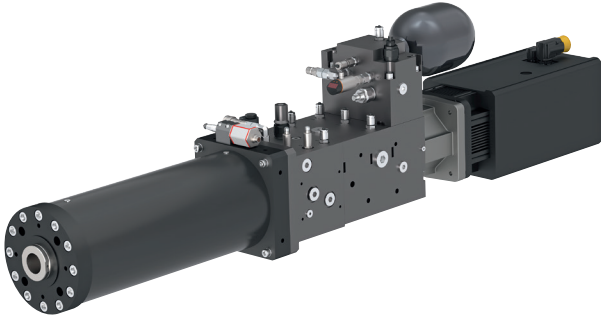
Data Standard Sizes

	Size 10	Size 16	Size 20	Size 32	Size 40
Force F [kN]	v [mm/s]				
25	475	730	940	1,230	1,600
50	300	470	620	830	1,020
75	190	295	390	510	640
100	115	180	230	305	400
125	115	180	230	305	400
150	75	115	150	195	255
175	75	115	150	195	255
200	75	115	150	195	255
225	60	90	115	150	195
250	60	90	115	150	195
275	60	90	115	150	195
300	45	70	90	120	155
350	45	70	90	120	155
400	35	55	70	95	120
450	35	55	70	95	120
500	30	45	60	80	100

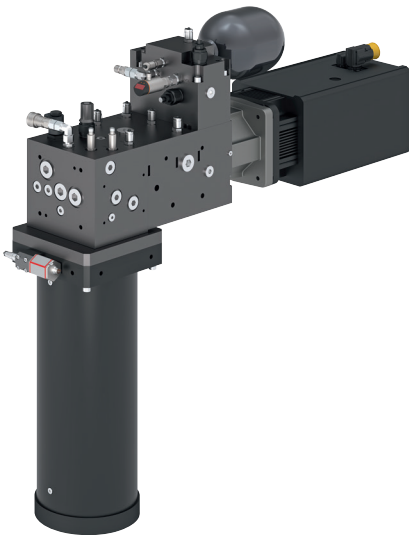
Additional data on request

COMPACT EAS - DESIGNS

Linear



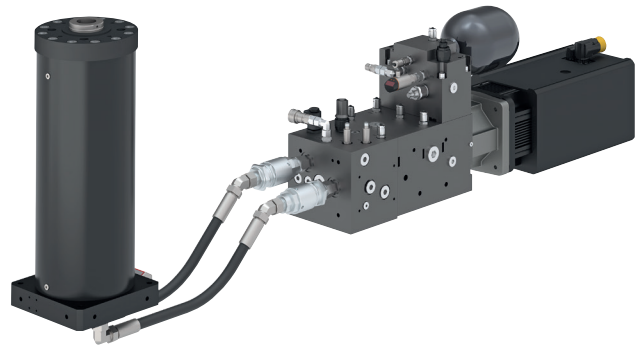
Orthogonal



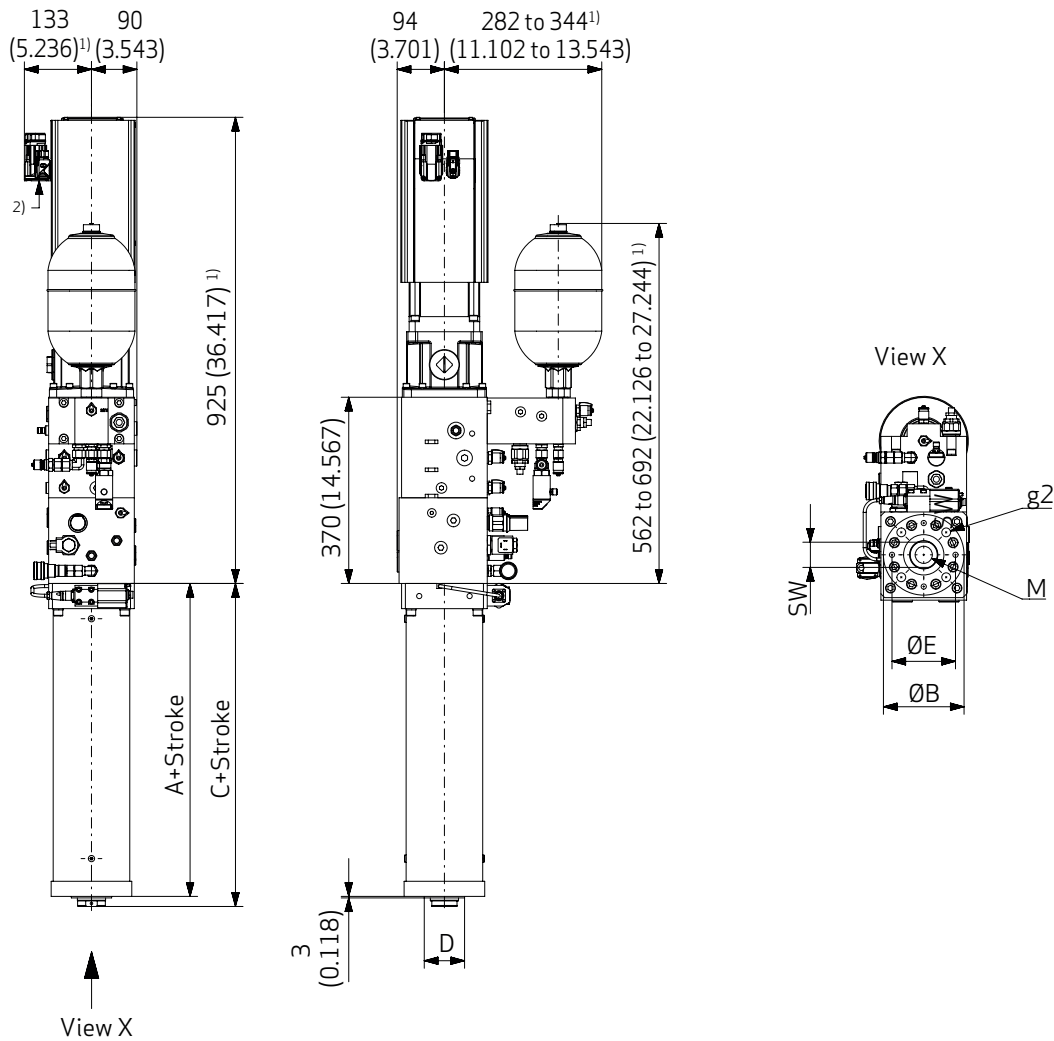
Special Designs

The special split design has been developed for use in very cramped installation situations. The pump group and the servomotor form a unit and the cylinder forms its own unit.

The units are hydraulically connected by pipes or hoses. The split version offers extended design options compared to the standard series. All advantages of the Compact EAS are preserved.



DIMENSIONS SIZE 10 LINEAR



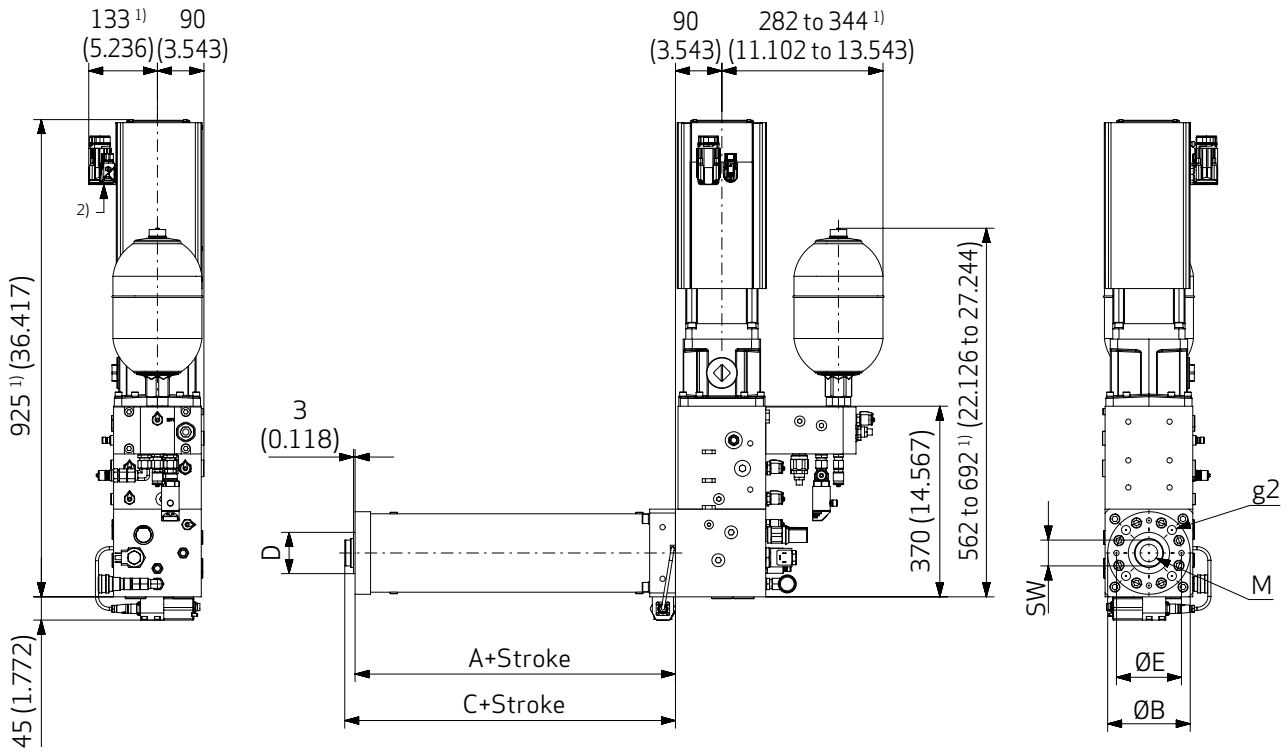
Force F [kN]	Ø Piston	Ø D	A	C	M	g2	Ø B	Ø E	SW
25	40 (1.575)	40 f7	195 (7.677)	215 (8.465)	M16 x 1	4 x M20	160 (6.299)	126 (4.961)	24
50	50 (1.969)	50 f7	195 (7.677)	215 (8.465)	M20 x 1.5	4 x M20	160 (6.299)	126 (4.961)	30
75	63 (2.480)	63 f7	212 (8.346)	232 (9.134)	M30 x 2	4 x M20	160 (6.299)	126 (4.961)	41
125	80 (3.150)	80 f7	221 (8.701)	241 (9.488)	M36 x 2	4 x M20	160 (6.299)	126 (4.961)	50
200	100 (3.937)	100 f7	258 (10.157)	278 (10.945)	M42 x 2	4 x M24	240 (9.449)	160 (6.299)	65
275	114 (4.488)	114 f7	267 (10.512)	287 (11.299)	M48 x 2	4 x M24	240 (9.449)	160 (6.299)	75
350	128 (5.039)	128 f7	272 (10.709)	292 (11.496)	M48 x 2	4 x M30	260 (10.236)	210 (8.268)	80
450	142.5 (5.610)	142.5 f7	288 (11.339)	308 (12.126)	M64 x 2	4 x M30	260 (10.236)	210 (8.268)	90
500	157 (6.181)	157 f7	288 (11.339)	308 (12.126)	M64 x 2	4 x M30	260 (10.236)	210 (8.268)	95

All dimensions in mm (inch), all dimensions for reference only

¹⁾ Depending on version

²⁾ Plug position may be rotated in 90° steps

DIMENSIONS SIZE 10 ORTHOGONAL



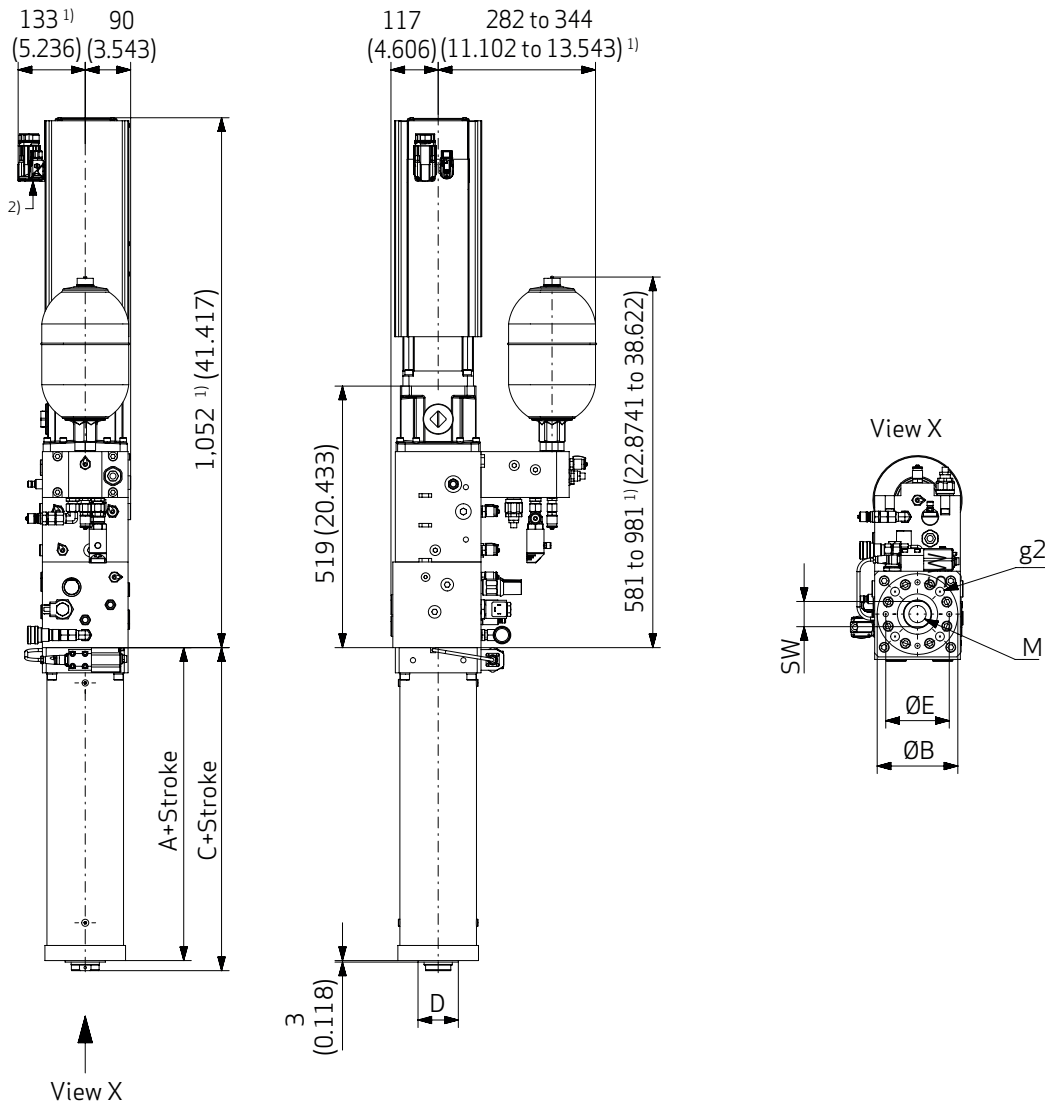
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DIMENSIONS SIZE 16 LINEAR



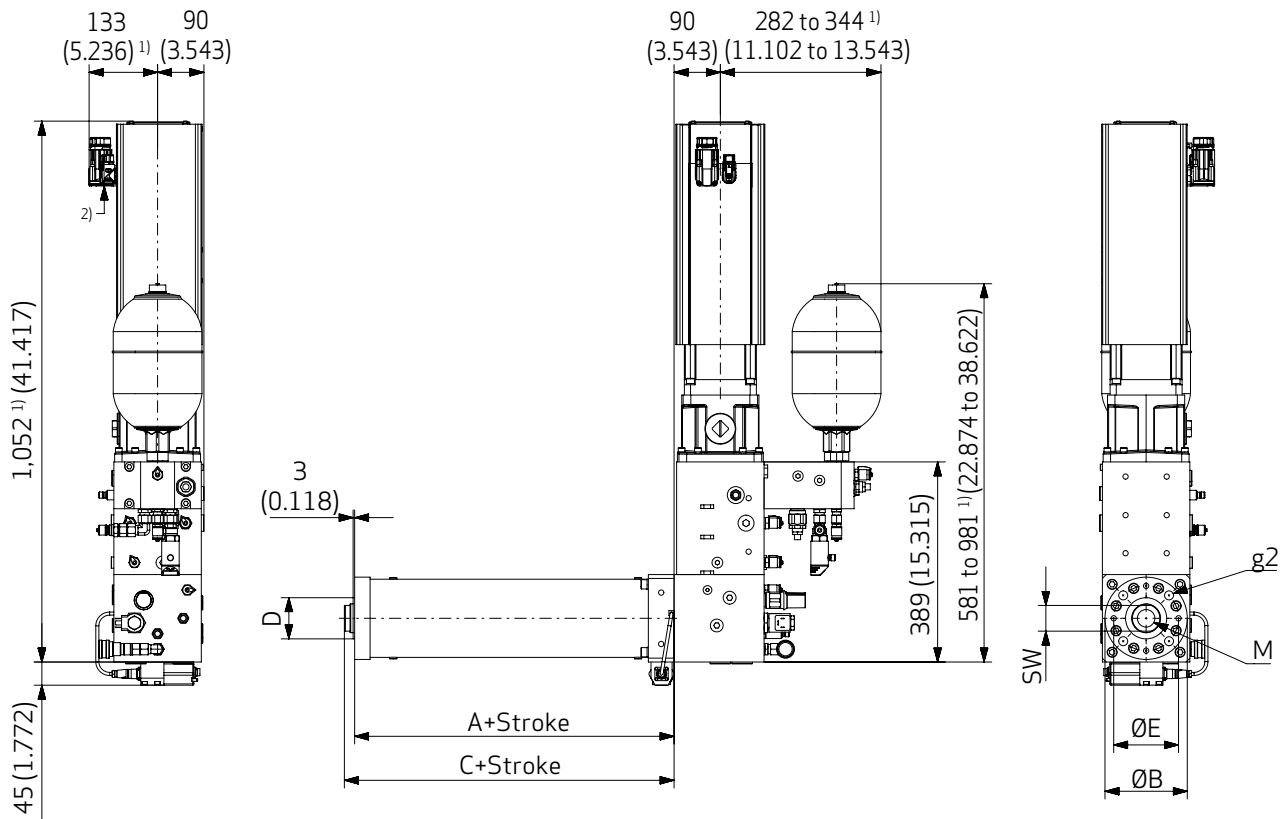
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DIMENSIONS SIZE 16 ORTHOGONAL



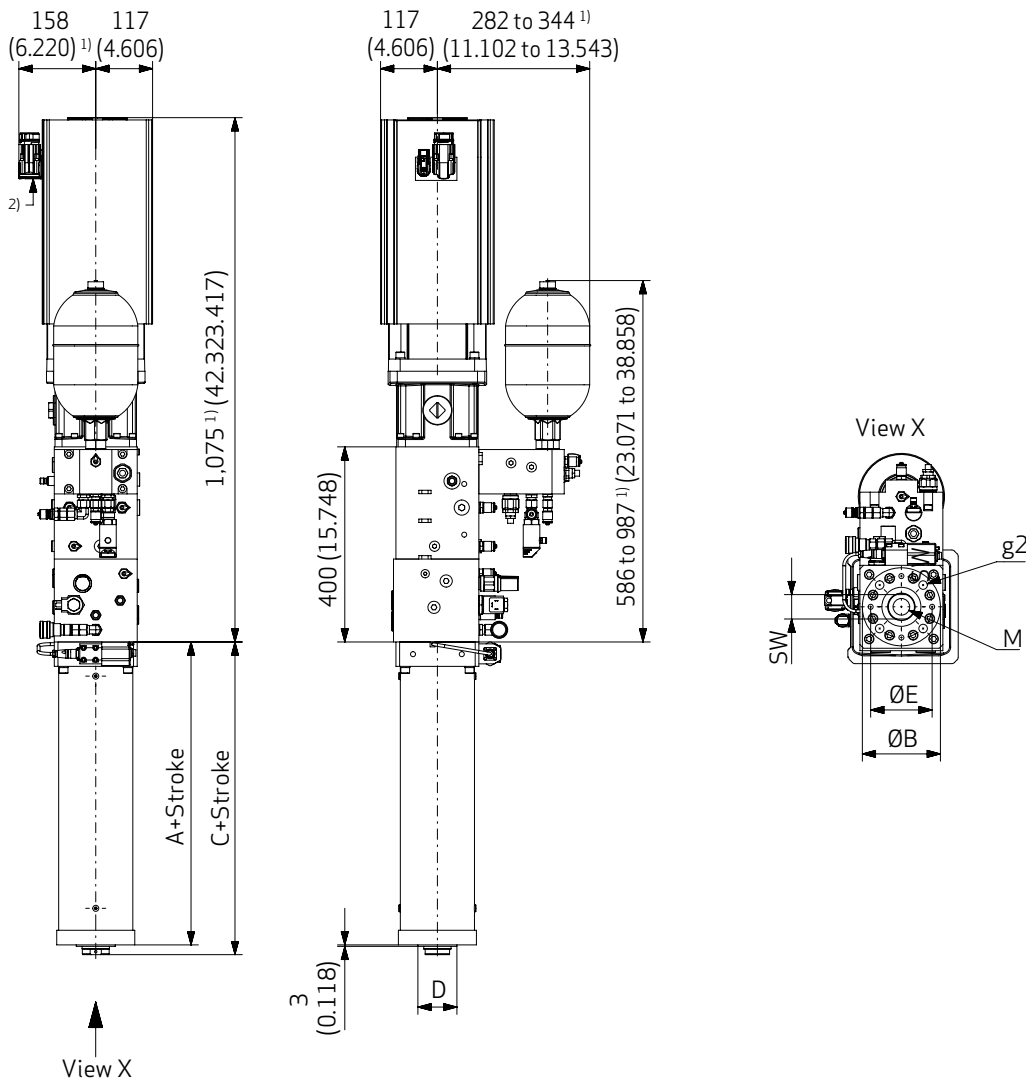
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DIMENSIONS SIZE 20 LINEAR



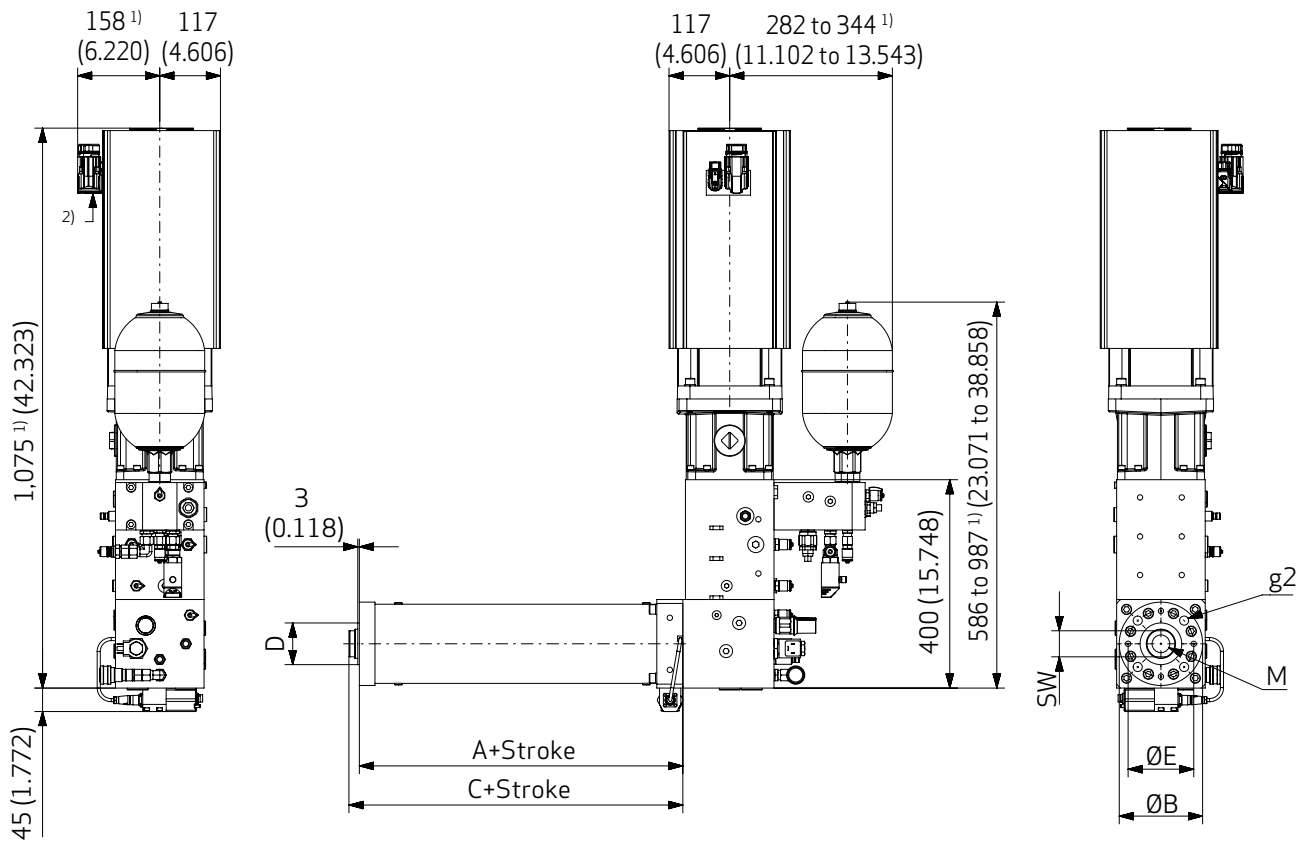
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DIMENSIONS SIZE 20 ORTHOGONAL



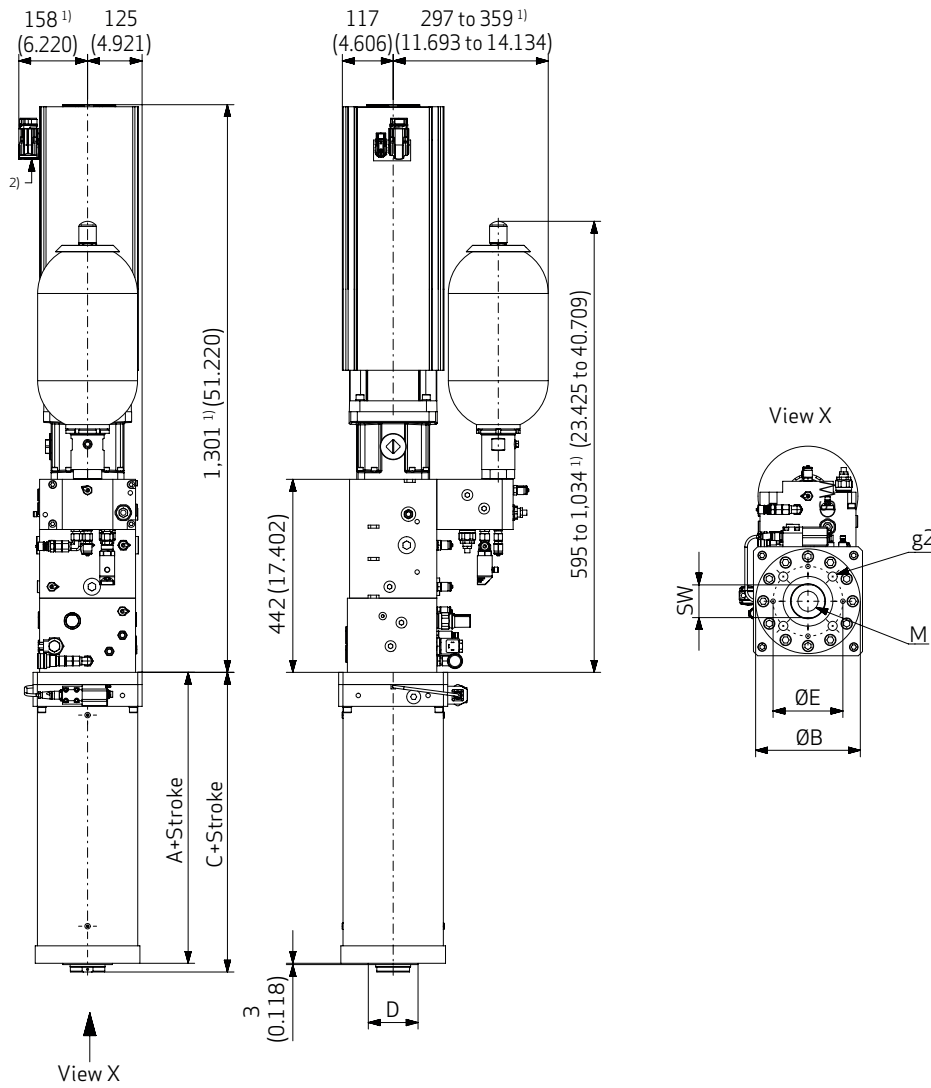
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DIMENSIONS SIZE 32 LINEAR



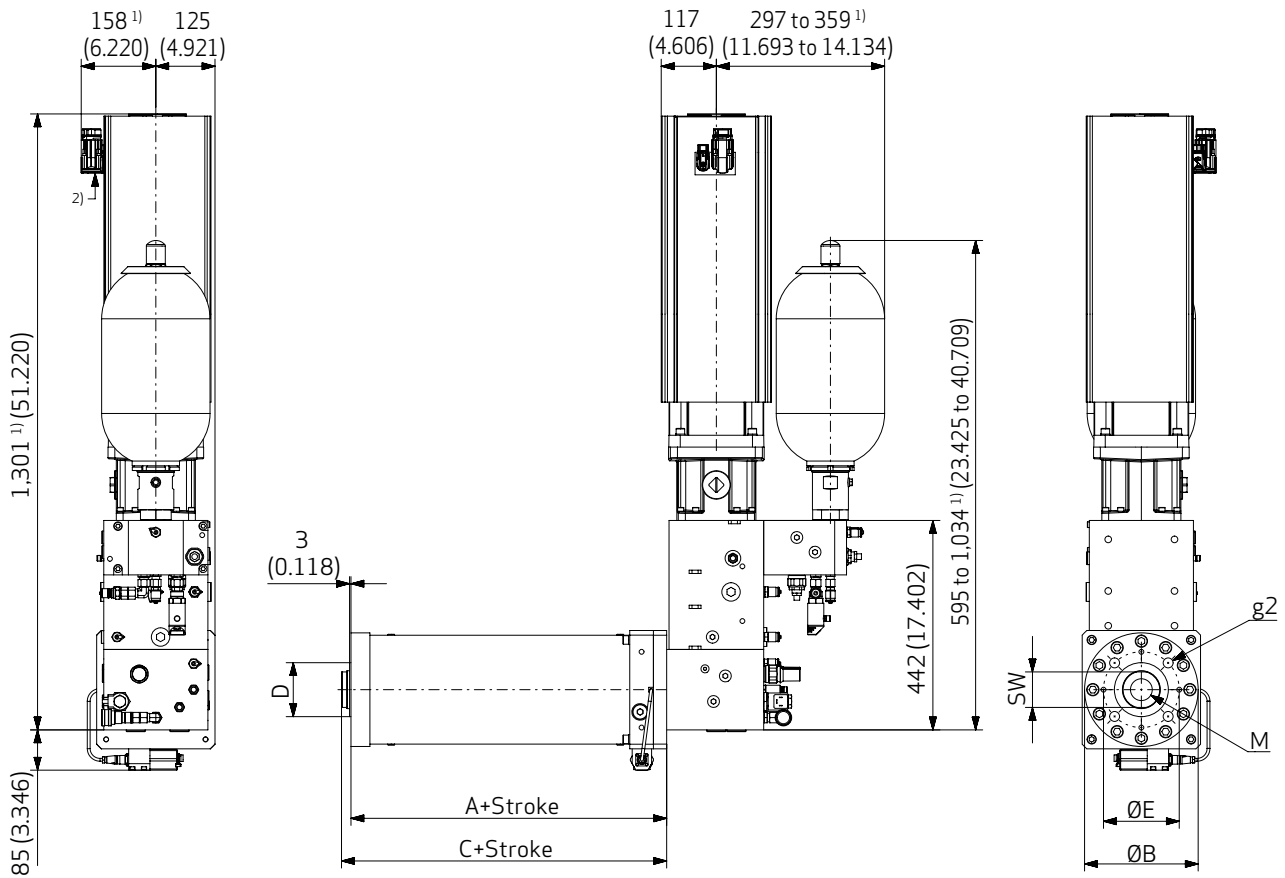
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DIMENSIONS SIZE 32 ORTHOGONAL



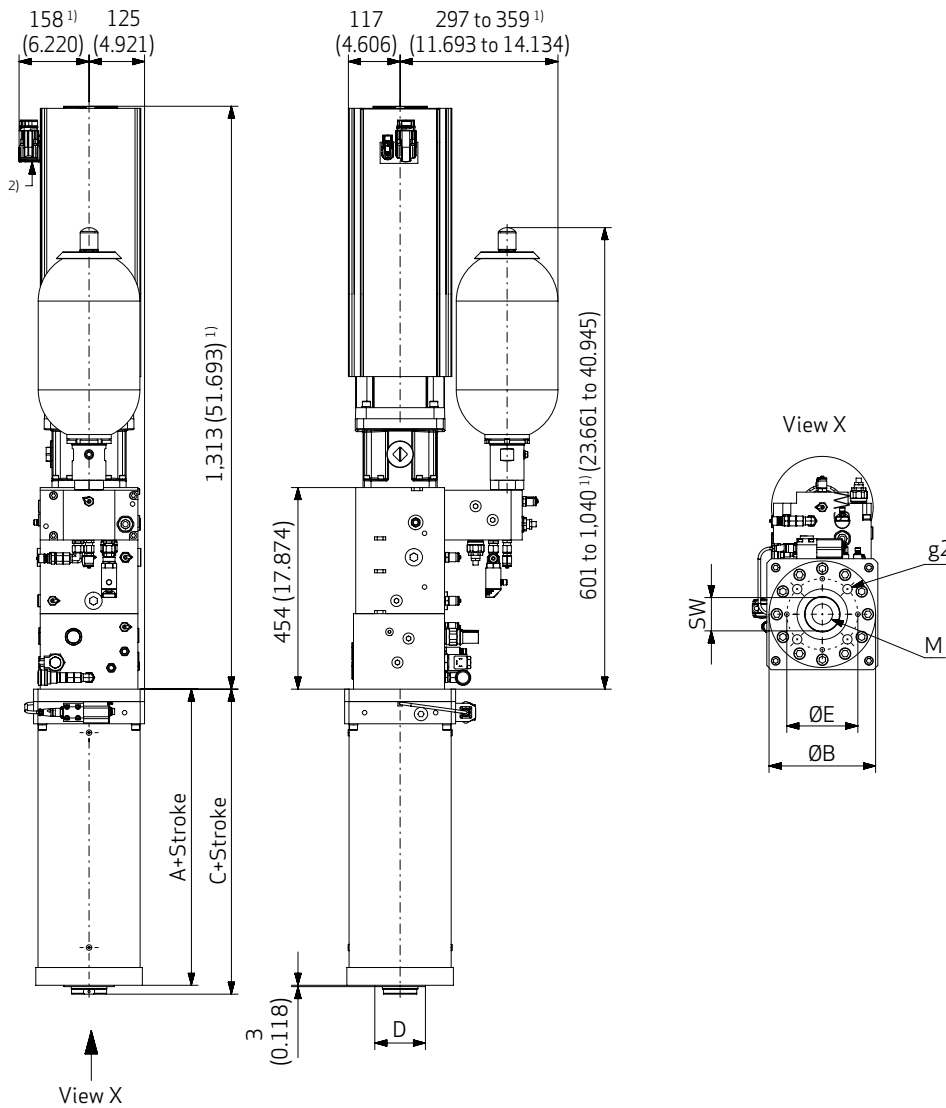
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500	157 (6.181)	157 f7	288 (11.339)	308 (12.126)	M64 x 2	4 x M30	260 (10.236)	210 (8.268)	95

All dimensions in mm (inch), all dimensions for reference only

¹⁾ Depending on version

²⁾ Plug position may be rotated in 90° steps

DIMENSIONS SIZE 40 LINEAR



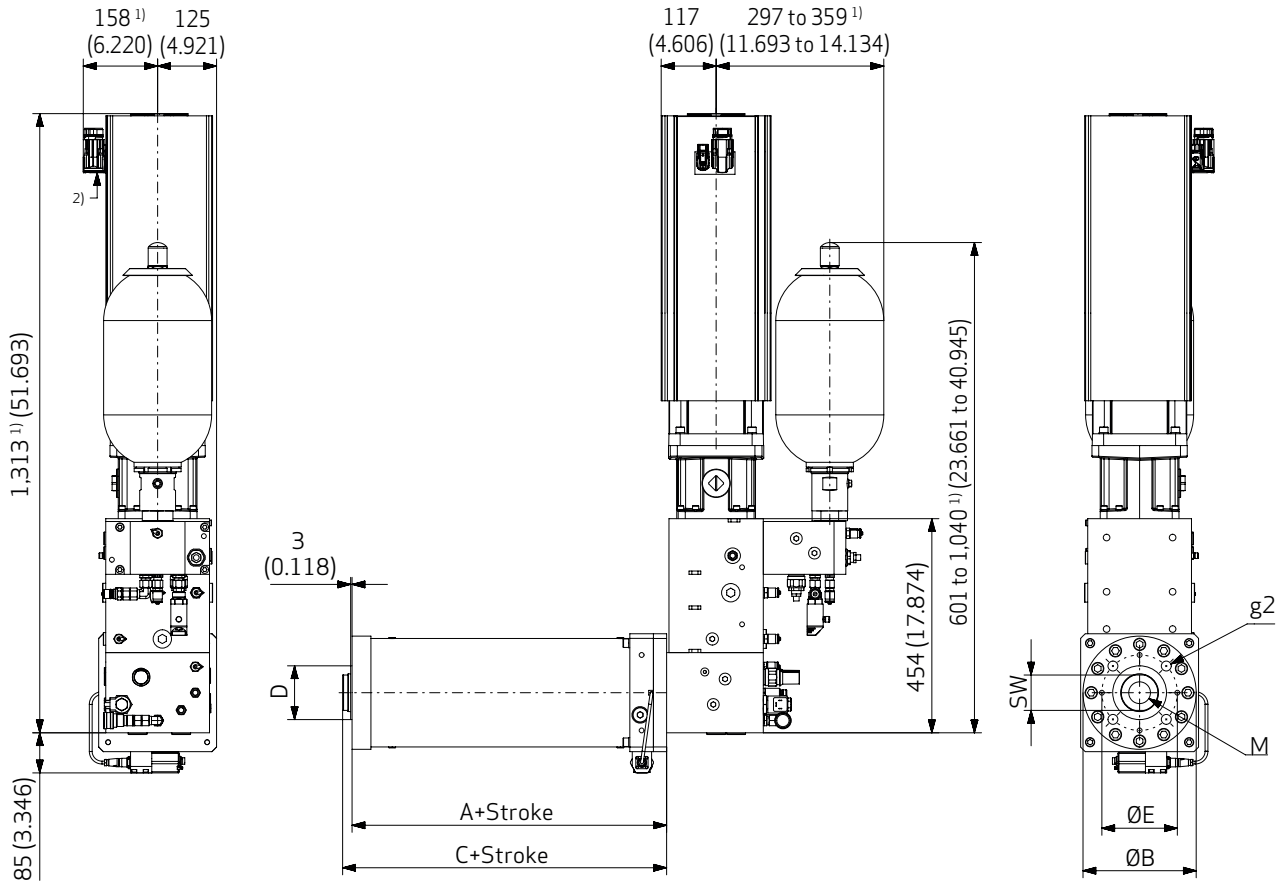
Force F [kN]	Ø Piston	Ø D	A	C	M	g2	Ø B	Ø E	SW
25	40 (1.575)	40 f7	195 (7.677)	215 (8.465)	M16 x 1	4 x M20	160 (6.299)	126 (4.961)	24
50	50 (1.969)	50 f7	195 (7.677)	215 (8.465)	M20 x 1.5	4 x M20	160 (6.299)	126 (4.961)	30
75	63 (2.480)	63 f7	212 (8.346)	232 (9.134)	M30 x 2	4 x M20	160 (6.299)	126 (4.961)	41
125	80 (3.150)	80 f7	221 (8.701)	241 (9.488)	M36 x 2	4 x M20	160 (6.299)	126 (4.961)	50
200	100 (3.937)	100 f7	258 (10.157)	278 (10.945)	M42 x 2	4 x M24	240 (9.449)	160 (6.299)	65
275	114 (4.488)	114 f7	267 (10.512)	287 (11.299)	M48 x 2	4 x M24	240 (9.449)	160 (6.299)	75
350	128 (5.039)	128 f7	272 (10.709)	292 (11.496)	M48 x 2	4 x M30	260 (10.236)	210 (8.268)	80
450	142.5 (5.610)	142.5 f7	288 (11.339)	308 (12.126)	M64 x 2	4 x M30	260 (10.236)	210 (8.268)	90
500	157 (6.181)	157 f7	288 (11.339)	308 (12.126)	M64 x 2	4 x M30	260 (10.236)	210 (8.268)	95

All dimensions in mm (inch), all dimensions for reference only

¹⁾ Depending on version

²⁾ Plug position may be rotated in 90° steps

DIMENSIONS SIZE 40 ORTHOGONAL



Force F [kN]	Ø Piston	Ø D	A	C	M	g2	Ø B	Ø E	SW
25	40 (1.575)	40 f7	195 (7.677)	215 (8.465)	M16 x 1	4 x M20	160 (6.299)	126 (4.961)	24
50	50 (1.969)	50 f7	195 (7.677)	215 (8.465)	M20 x 1.5	4 x M20	160 (6.299)	126 (4.961)	30
75	63 (2.480)	63 f7	212 (8.346)	232 (9.134)	M30 x 2	4 x M20	160 (6.299)	126 (4.961)	41
125	80 (3.150)	80 f7	221 (8.701)	241 (9.488)	M36 x 2	4 x M20	160 (6.299)	126 (4.961)	50
200	100 (3.937)	100 f7	258 (10.157)	278 (10.945)	M42 x 2	4 x M24	240 (9.449)	160 (6.299)	65
275	114 (4.488)	114 f7	267 (10.512)	287 (11.299)	M48 x 2	4 x M24	240 (9.449)	160 (6.299)	75
350	128 (5.039)	128 f7	272 (10.709)	292 (11.496)	M48 x 2	4 x M30	260 (10.236)	210 (8.268)	80
450	142.5 (5.610)	142.5 f7	288 (11.339)	308 (12.126)	M64 x 2	4 x M30	260 (10.236)	210 (8.268)	90
500	157 (6.181)	157 f7	288 (11.339)	308 (12.126)	M64 x 2	4 x M30	260 (10.236)	210 (8.268)	95

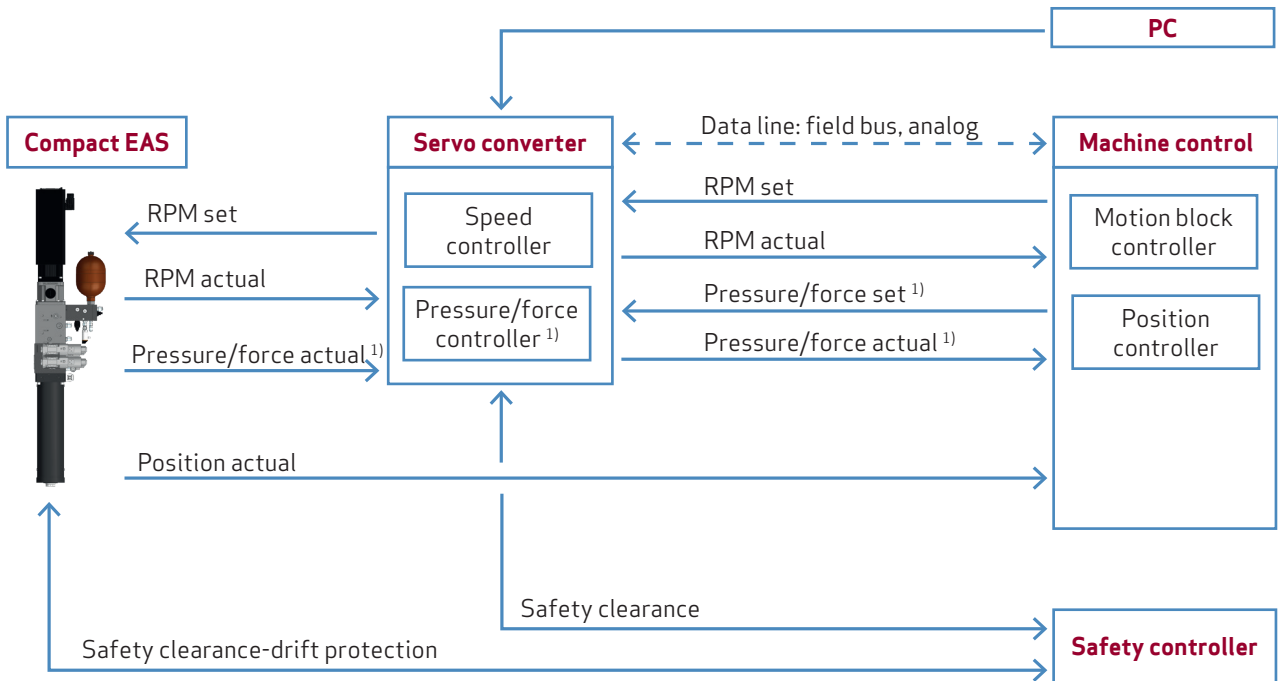
All dimensions in mm (inch), all dimensions for reference only

¹⁾ Depending on version

²⁾ Plug position may be rotated in 90° steps

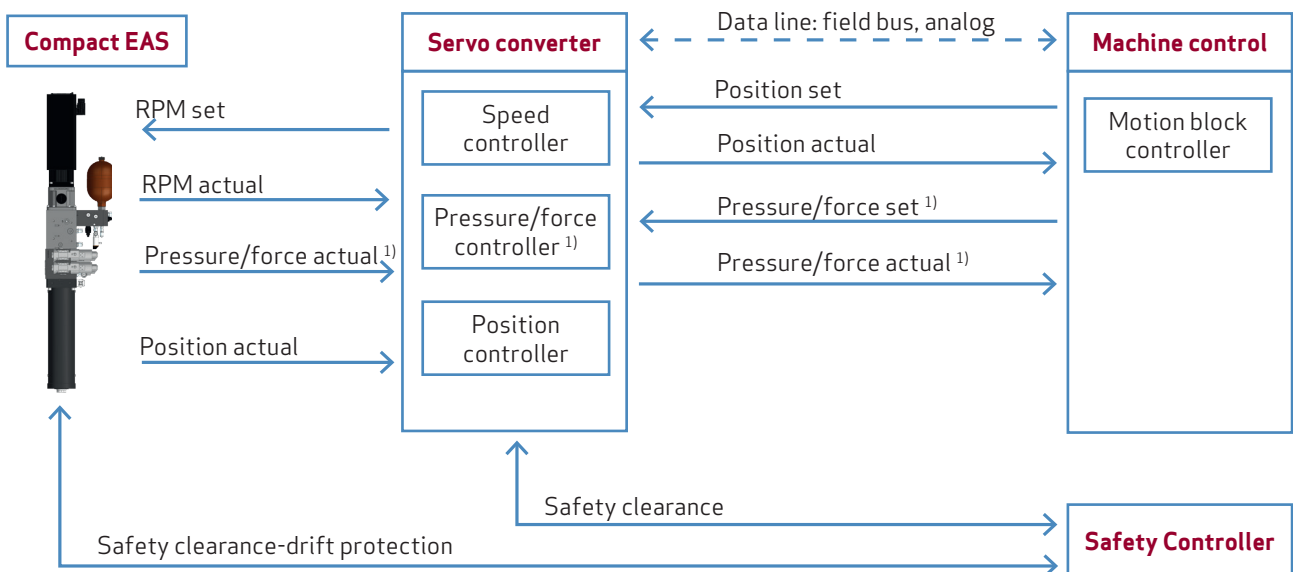
CONTROL PRINCIPLE

Speed and Pressure/Force Control Integrated in the Servo Converter



¹⁾ Only with option pressure/force control

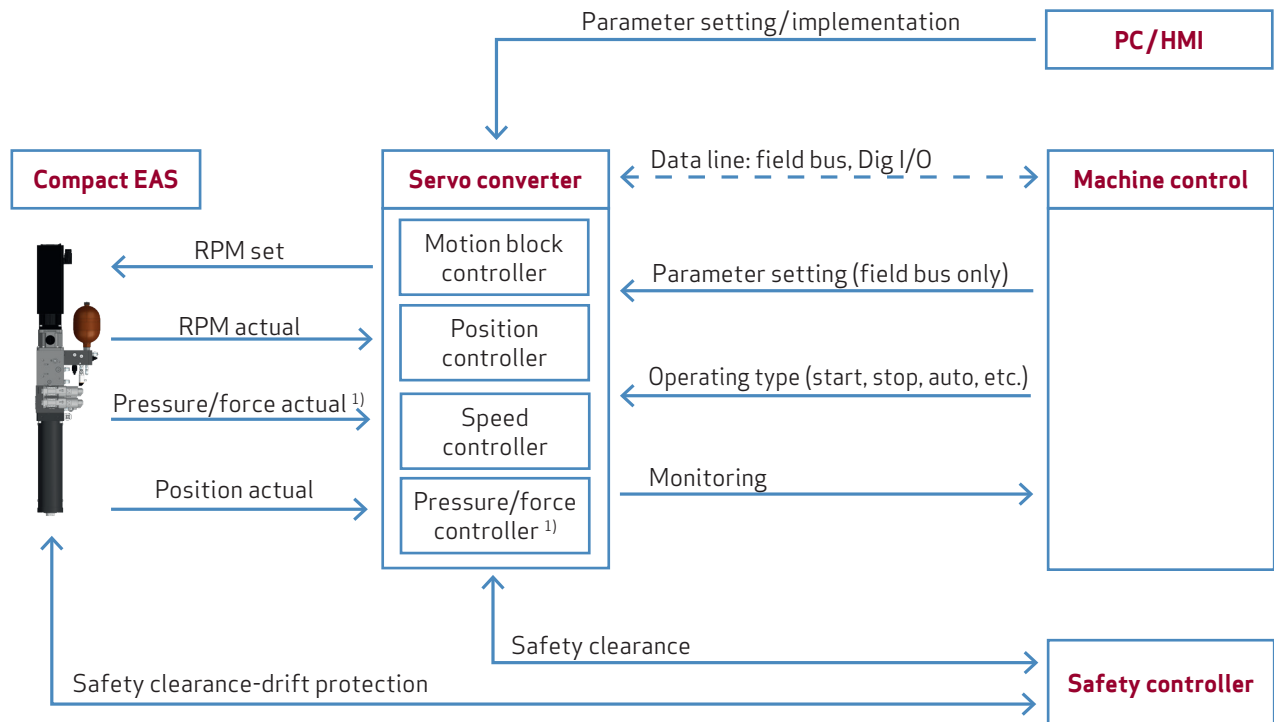
Speed, Position and Pressure/Force Controller Integrated in the Servo Converter



¹⁾ Only with option pressure/force control

CONTROL PRINCIPLE

Motion Block Control Integrated in the Servo Converter



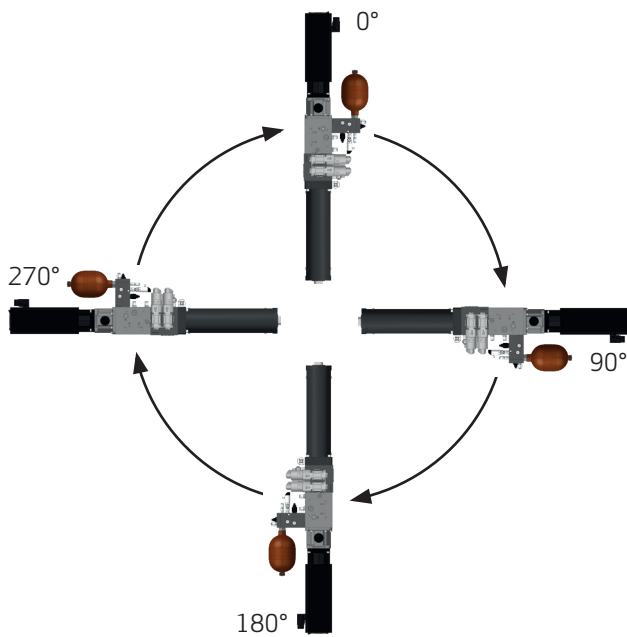
¹⁾ Only with option pressure/force control

INSTALLATION

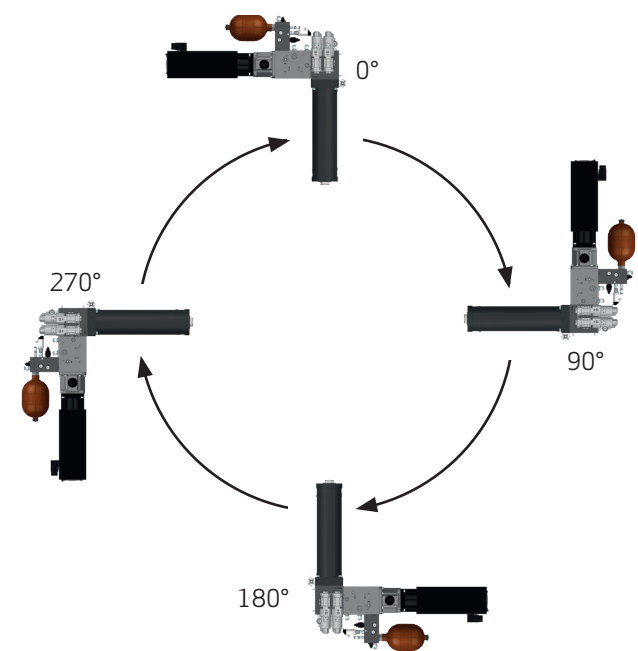
Recommended Installation Orientation

- Preferred mounting position for bleeding: 0°, 90°, 180°, 270° (clockwise in side view)
- Standard Compact EAS can be bled in the machine, if installed in preferred mounting position

Linear

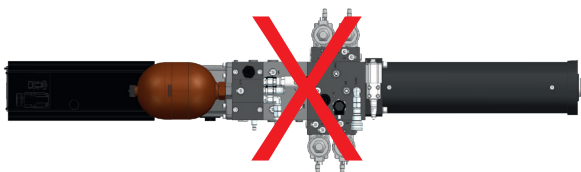
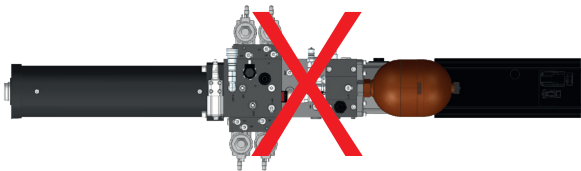


Orthogonal



Non-recommended Installation Position

- Accumulator sideways



COMPACT EAS

General Technical Data

Pump version	Internal gear pump
Motor version	Brushless servo motor, natural or liquid cooled (oil/water)
Ambient temperature range	0 to +40 °C (32 to 104 °F)
Installation position	Any
Working force	Up to 500 kN
Stroke length	50, 100, 200, 300, 400 mm
Linear feedback system (option)	Absolute encoder SSI
Position accuracy	< 0.01 mm
Repeatability	< 0.01 mm
Pressure accuracy	0.5 % FS (full scale)
IP rating	IP54/IP64
Control	Position, pressure/force and speed control
Service interval	3 years or 20,000 operating hours or 10 million load changes, whatever comes first
Operating fluid	Fluid PF-700

ABOUT MOOG

Hydraulic Solutions

Since Bill Moog invented the first commercially viable servo valve in 1951, Moog has set the standard for world-class hydraulic technology. Today, Moog products are used in a variety of applications - providing high power, enhanced productivity and ever better performance for some of the world's most demanding applications.

Electric Solutions

Clean operation, low noise generation, less maintenance and reduced power consumption make Moog electric solutions ideal for applications worldwide. Moog is the ideal partner for applications where transitioning technologies requires special expertise.

Hybrid Solutions

By incorporating the advantages of existing hydraulic and electric technologies - including modular flexibility, increased efficiency and cleanliness - into innovative hybrid solutions, Moog offers new performance potential in specialized applications.



Simulation Table



Flight Simulation

NOTES

ORDERING CODE

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

CEAS -

1	Compact EAS
---	--------------------

2	Design
L	Linear
O	Orthogonal
X	Split (on request)

3	Size
10	10/5
16	16/8
20	20/10
32	32/16
40	40/20

4	Motor type
D	Type D
E	Type E
M	Type M
S	Type S

5	Motor size
071	Size 071 (type D)
080	Size 080 (type E)
100	Size 100 (type D)
112	Size 112 (type E)
140	Size 140 (type M)
200	Size 200 (type M)

6	Motor length
	Depending on motor

7	Motor cooling
O	Fan
W	Liquid
C	Convection

8	Cylinder
	Piston/rod - stroke

9	Electrical connection (depending on motor)
A	Connector box
B	Plug

10	Connector orientation (seen on motor shaft, accumulator on top)
L	Left
R	Right
U	Bottom

19	Version
N	Standard
X	Special

18	Motor encoder
A	Resolver
D	SRS50
H	ECN1325
E	EK1H

17	Continuous load holding
O	Without
A	Load holding A-side
B	Load holding B-side
C	Load holding A- and B-side

16	Cooling unit
K	Without
E	Oil/air 1 kW
M	Oil/air 2.2 kW
H	Oil/water 3 kW

15	Nominal motor rpm x100
20	2,000
30	3,000
45	4,500

14	Linear measuring system
K	Without
S	SSI

13	Pressure close
2	No pressure close (standard)
4	Pressure close A-side
5	Pressure close B-side
6	Pressure close A- and B-side

12	Stop function ¹⁾
1	Extending (PL c)
2	Extending and retracting (PL c)
4	Performance level D/E (extending) 2-channel
6	Performance level D/E (both directions) 2-channel

11	Connector box main outlet port
K	Without
L	Left
R	Right
P	Pump side
M	Motor side

¹⁾ According to EN ISO 13849-1 for function "safe stop".

MORE PRODUCTS. MORE SUPPORT.

Moog designs a range of motion control products to complement those featured in this document. Moog also provides service and support for all of our products. For more information, contact the Moog facility closest to you.

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Moog Compact Electrohydrostatic Actuation System
KEM/Rev. C, February 2023, Id. CDL63354-en