HYDSTAR

ISO9001认证企业

液压泵专业生产厂家-江苏海斯特

Hydraulic Pump Manufacture-Hydstar Hydraulic

Technical Manual

2023

江苏海斯特液压科技有限公司

Jiangsu Hydstar Hydraulic Technology Co., Ltd.

CONTENTS

Axial piston variable motor A10VM
Axial piston plug-in motor A10VE
Series 52

Data sheet

- Medium pressure motor with two-point control
- Sizes 28 to 85
- Nominal pressure 280 bar
- Maximum pressure 350 bar
- Open and closed circuit

Features

- Variable displacement motor with well-tried A10-rotary unit technology
- Approved for high rotational speeds
- Long service life
- High power density
- Low noise
- Minimum swivel angle can be adjusted externally
- Swashplate design

Contents

Type code A10VM

01	02	03	04		05	06	07		08	09	10	11	12	13	14
A10V	**M**			**/**		**W**		**–**	**V**		**C**				

Axial piston unit

01	Swashplate design, variable, nominal pressure 280 bar, maximum pressure 350 bar	**A10V**

Operating mode

02	Motor, open and closed circuit	**M**

Size (NG)

03	Geometric displacement, see table of values, page 9	**28**	**45**	**63**	**85**	

Control devices										
					28	**45**	**63**	**85**	
04	Two-point control	direct operated, external control pressure supply without on/off valve			●	●	●	●	**DG**
		hydraulic		switching time orifice	without	●	●	●	●	**HZ**
					with	●	●	●	●	**HZ6**
		electric with switching solenoid	U = 12 V	switching time orifice	without	●	●	●	●	**EZ1**
					with	●	●	●	●	**EZ6**
			U = 24 V	switching time orifice	without	●	●	●	●	**EZ2**
					with	●	●	●	●	**EZ7**

Series

		28 – 85	
05	Series 5, index 2	●	**52**

Direction of rotation

		28 – 85		
06	Viewed on drive shaft	variable	●	**W**

Minimum displacement						
			28	**45**	**63**	**85**	
07	$V_{g\,min}$ [cm³] steplessly adjustable[1)]	from/to	8/28	12/25	16/38	22/50	**1**
		from/to	–	26/45	40/62	48/85	**2**

Sealing material

		28 – 85	
08	FKM (fluoroelastomer)	●	**V**

Drive shaft

09	Splined shaft similar to ISO 3019-1	for high torque	●	●	●	●	**R**
		for reduced torque	–	●	●	●	**W**

Mounting flange

		28 – 85	
10	ISO 3019-1 (SAE); 2 hole	●	**C**

● = Available ○ = On request – = Not available

1) Please specify exact setting value in plain text.

01	02	03	04		05	06	07		08	09	10	11	12	13	14
A10V	**M**			**/**		**W**		**–**	**V**		**C**				

Working port				**28**	**45**	**63**	**85**	
11	Flange ports according to ISO 6162	**A** and **B** on the side, same side,	**Metric** fastening thread	●	●	●	●	**10N00**
		A and **B**; at rear;	**Metric** fastening thread	–	●	–	–	**11N00**
	Threaded port according to DIN 3852-1	**A** and **B** on the side; same side	Threaded port **metric**	●	●	●	–	**16N00**
	Flange ports according to ISO 6162	**A** and **B** on the side; same side;	Fastening thread **UNF**	●	●	●	●	**60N00**
		A and **B**; at rear;	Fastening thread **UNF**	–	●	–	–	**61N00**
	Threaded port according to ISO 11926	**A** and **B** on the side; same side	Threaded port **UN**	●	●	●	–	**66N00**

Valves		**28**	**45**	**63**	**85**	
12	Without valve	●	●	●	●	**0**
	Integrated flushing valve (only with working line ports 10N00, 60N00 and 16N00, 66N00)	●	●	●	●	**7**

Speed sensing						
13	Without speed sensing (without symbol)	●	●	●	●	

Connector for solenoids						
14	Without connector (without solenoid, only for hydraulic control)	●	●	●	●	
	DEUTSCH - molded connector, 2-pin – without suppressor diode	●	●	●	●	**P**

● = Available ○ = On request – = Not available

Notice

- ▶ Note the project planning notes on page 41.
- ▶ In addition to the type code, please specify the relevant technical data when placing your order.

Type code A10VE

01	02	03	04		05	06	07		08	09	10	11	12	13	14
A10V	**E**			**/**	**52**	**W**		**–**	**V**		**F**				

Axial piston unit

01	Swashplate design, variable, nominal pressure 280 bar, maximum pressure 350 bar	**A10V**

Operating mode

02	Motor, plug-in design, open and closed circuits	**E**

Size (NG)

03	For geometric displacement, see table of values, page 9	**28**	**45**	**63**	

Control devices

						28	**45**	**63**	
04	Two-point control	direct operated, external control pressure supply without on/off valve				●	●	○	**DG**
		hydraulic		switching time orifice	without	●	●	●	**HZ**
					with	●	●	●	**HZ6**
		electric	U = 12 V	switching time orifice	without	●	●	●	**EZ1**
		with switching solenoid			with	●	●	●	**EZ6**
			U = 24 V	switching time orifice	without	●	●	●	**EZ2**
					with	●	●	●	**EZ7**

Series

		28 ... 63	
05	Series 5, index 2	●	**52**

Direction of rotation

		28 ... 63		
06	Viewed on drive shaft	variable	●	**W**

Minimum displacement

			28	**45**	**63**	
07	$V_{g\,min}$ [cm³] steplessly adjustable[1)]	from/to	10/28	12/25	16/38	**1**
		from/to	–	26/45	40/62	**2**

Sealing material

		28 ... 63	
08	FKM (fluoroelastomer)	●	**V**

Drive shaft

			28	**45**	**63**	
09	Splined shaft similar to ISO 3019-1	for high torque	●	●	●	**R**
		for reduced torque	**–**	●	●	**W**

Mounting flange

		28 ... 63	
10	Special flange; 2 hole	●	**F**

● = Available ○ = On request – = Not available

1) Please specify exact setting value in plain text.

01	02	03	04		05	06	07		08	09	10	11	12	13	14
A10V	**E**			**/**	**52**	**W**		**–**	**V**		**F**				

Working port				**28**	**45**	**63**	
11	Flange ports according to ISO 6162	**A** and **B** on the side, same side,	**Metric** fastening thread	●	●	●	**10N00**
		A and **B**; at rear;	**Metric** fastening thread	–	●	–	**11N00**
	Threaded port according to DIN 3852-1	**A** and **B** on the side; same side	Threaded port, **metric**	●	●	●	**16N00**
	Flange ports according to ISO 6162	**A** and **B** on the side; same side;	Fastening thread **UNF**	●	●	●	**60N00**
		A and **B**; at rear;	Fastening thread **UNF**	–	●	–	**61N00**
	Threaded port according to ISO 11926	**A** and **B** on the side; same side	Threaded port, **UN**	●	●	●	**66N00**

Valves		**28**	**45**	**63**	
12	Without valve	●	●	●	**0**
	Integrated flushing valve (only with working line ports 10N00, 60N00 and 16N00, 66N00)	–	●	●	**7**

Speed sensing					
13	Without speed sensing (without symbol)	●	●	●	

Connector for solenoids					
14	Without connector (without solenoid, only for hydraulic control)	●	●	●	
	DEUTSCH - molded connector, 2-pin – without suppressor diode	●	●	●	**P**

● = Available ○ = On request – = Not available

Notice

- ▶ Note the project planning notes on page 41.
- ▶ In addition to the type code, please specify the relevant technical data when placing your order.

Hydraulic fluids

The variable displacement motor A10VM/A10VE is designed for operation with HLP mineral oil according to DIN 51524. Application instructions and requirements for hydraulic fluids should be taken from the following data sheets before the start of project planning:

- 90220: Hydraulic fluids based on mineral oils and related hydrocarbons
- 90221: Environmentally acceptable hydraulic fluids

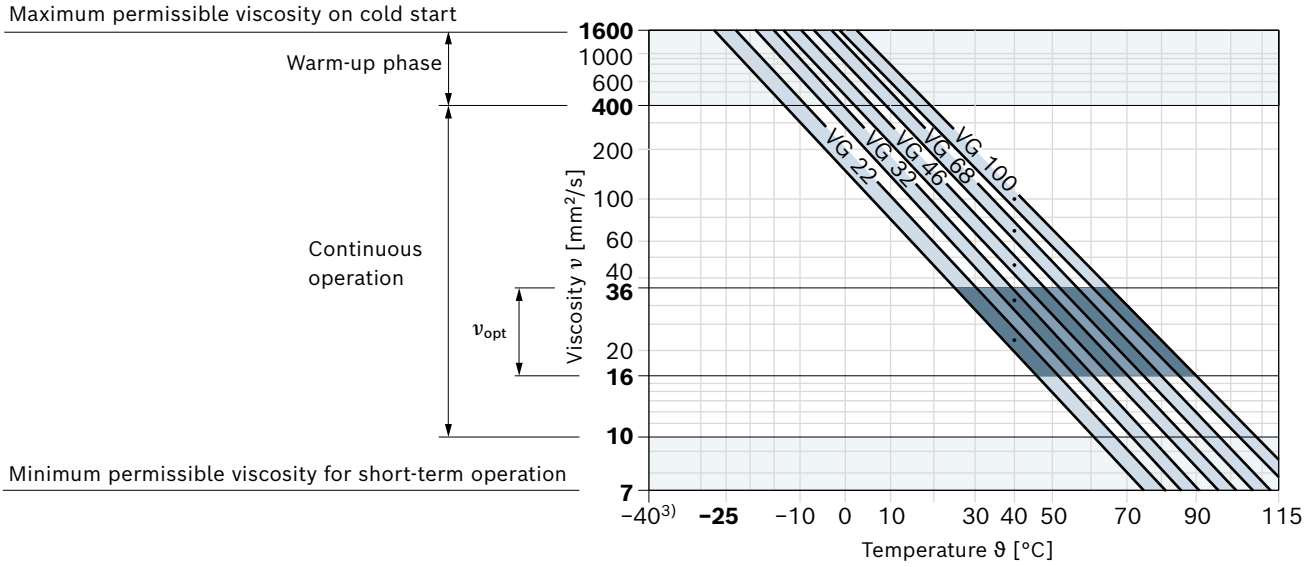
Selection of hydraulic fluid

The hydraulic fluid should be selected so that the operating viscosity in the operating temperature range is within the optimum range (v_{opt}; see selection diagram).

Viscosity and temperature of hydraulic fluids

	Viscosity	Shaft seal	Temperature[2)]	Comment
Cold start	v_{max} ≤ 1600 mm²/s	FKM	ϑ_{St} ≥ −25°C	t ≤ 3 min, without load (p ≤ 30 bar), n ≤ 1000 rpm Permissible temperature difference between axial piston unit and hydraulic fluid in the system maximum 25 K
Warm-up phase	v = 1600 ... 400 mm²/s			t ≤ 15 min, p ≤ 0.7 × p_{nom} and n ≤ 0.5 × n_{nom}
Continuous operation	v = 400 ... 10 mm²/s[1)]	FKM	ϑ ≤ +110°C	Measured at port **L_X**
	v_{opt} = 36 ... 16 mm²/s			Optimal operating viscosity and efficiency range
Short-term operation	v_{min} = 10 ... 7 mm²/s	FKM	ϑ ≤ +110°C	t ≤ 1 min, p ≤ 0.3 × p_{nom}, measured at port **L_X**

▼ **Selection diagram**



1) This corresponds, for example on the VG 46, to a temperature range of +4°C to +85°C (see selection diagram)

2) If the temperature at extreme operating parameters cannot be adhered to, please contact us.

3) For applications in the low-temperature range, please contact us.

Filtration of the hydraulic fluid

Finer filtration improves the cleanliness level of the hydraulic fluid, which increases the service life of the axial piston unit.

A cleanliness level of at least 20/18/15 under ISO 4406 should be maintained.

At a hydraulic fluid viscosity of less than 10 mm^2/s (e.g. due to high temperatures during short-term operation) at the drain port, a cleanliness level of at least 19/17/14 under ISO 4406 is required.

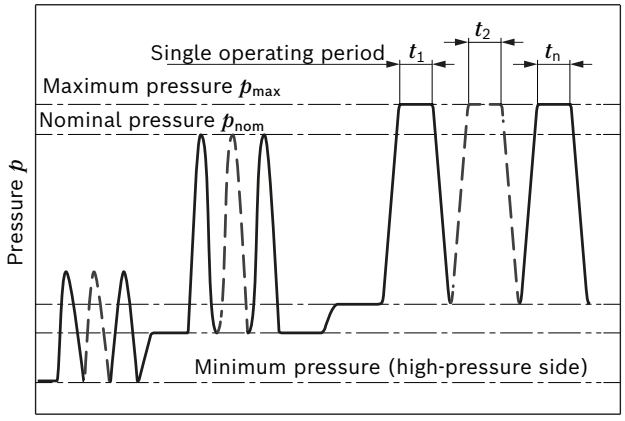
For example, viscosity corresponds to 10 mm^2/s at:

- HLP 32 a temperature of 73 °C
- HLP 46 a temperature of 85 °C

Working pressure range

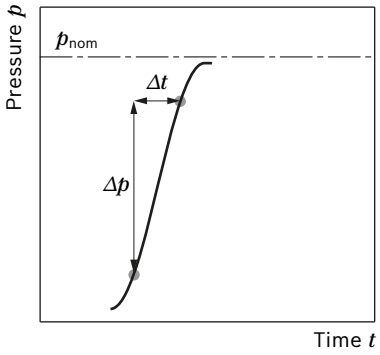
Pressure at working port A or B		Definition
Nominal pressure p_{nom}	280 bar	The nominal pressure corresponds to the maximum design pressure.
Maximum pressure p_{max}	350 bar	The maximum pressure corresponds to the maximum working pressure within a single operating period. The sum of single operating periods must not exceed the total operating period.
Single operating period	2.5 ms	
Total operating period	300 h	
Minimum pressure $p_{HD\ absolute}$ (High-pressure side)	10 bar	Minimum pressure on the high-pressure side (**A** or **B**) required to prevent damage to the axial piston unit.
Rate of pressure change $R_{A\ max}$	16000 bar/s	Maximum permissible pressure build-up and reduction speed during a pressure change across the entire pressure range.
Pressure at port A or B (low-pressure side)		
Minimum pressure $p_{ND\ min}$	2 bar abs.	Minimum pressure on the low-pressure side (**A** or **B**) required to prevent damage to the axial piston unit (see diagram, page 9).
Leakage pressure at port L, L_1		
Maximum static pressure $p_{L\ max}$	2 bar abs.	Maximum 0.5 bar higher than inlet pressure at port **A** or **B**, but not higher than $p_{L\ max}$. A drain line to the reservoir is required.

▼ **Pressure definition**



Total operating period = $t_1 + t_2 + ... + t_n$

▼ **Rate of pressure change** $R_{A\ max}$



Flow direction

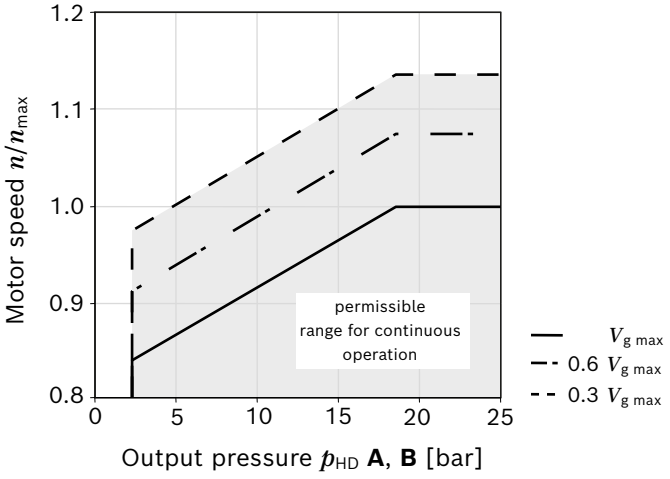
Direction of rotation viewed on drive shaft	clockwise	counter-clockwise
	B to **A**	**A** to **B**

Notice
Working pressure range applies when using hydraulic fluids based on mineral oils. Please contact us for values for other hydraulic fluids.

Technical data

Size			NG		28	45	63	85
Displacement geometric, per revolution			$V_{g\,max}$	cm³	28	45	62	87
			$V_{g\,min}$*)	cm³	8(VM) 10(VE)	12	16	22
Maximum rotational speed[1)2)]	at $V_{g\,max}$		n_{nom}	rpm	4700	4000	3300	3100
	at $V_{g\,min}$		$n_{max\,perm}$	rpm	5400	4600	3900	3560
Minimum rotational speed Continuous operation	at $V_{g\,max}$		n_{min}	rpm	250	250	250	250
Inlet flow	at n_{nom} and $V_{g\,max}$		$q_{v\,max}$	l/min	131.6	180	205	270
Torque	at $V_{g\,max}$ and p_N= 280 bar		M_{max}	Nm	125	200	276	387
Actual starting torque, approx.	at n= 0 rpm and p_N= 280 bar		M	Nm	92	149	205	253
Rotary stiffness Drive shaft		R	c	Nm/rad	2600	41000	69400	152900
		W	c	Nm/rad	19800	34400	54000	117900
Moment of inertia of the rotary group			J_{TW}	kgm²	0.0017	0.0033	0.0056	0,012
Maximum angular acceleration[3)]			α	rad/s²	5500	4000	3300	2700
Case volume			V	l	0.6	0.7	0.8	1.0
Weight approx.			m	kg	14	18	26	34

Permissible motor speed depending on output pressure (low pressure)



Notice

- Theoretical values, without efficiency and tolerances; values rounded
- Operation above the maximum values or below the minimum values may result in a loss of function, a reduced service life or in the destruction of the axial piston unit. We recommend checking loads through tests or calculation/simulation and comparing them with the permissible values.
- **Setting of minimum displacement*):**
  The minimum displacement can be steplessly adjusted within the ranges (or screw length) of type code position 1 or 2.
  Please specify minimum displacement in plain text.

For formulas to determine the characteristics, see page 10

1) The values are applicable:
   – for the optimum viscosity range from ν_{opt} = 36 to 16 mm²/s
   – with hydraulic fluid based on mineral oils
2) The maximum rotational speed depends on the output pressure at the working port **A** (**B**) (see diagram).
3) The data are valid for values between the minimum required And maximum permissible rotational speed. Valid for external excitation (e.g. diesel engine 2 to 8 times rotary frequency; cardan shaft twice the rotary frequency). The limit value is only valid for a single pump. The load capacity of the connection parts must be considered.

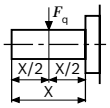
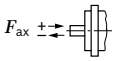
Working pressure range

Determination of the characteristics				
Flow	q_v	$= \frac{V_g \times n}{1000 \times \eta_v}$		[l/min]
Torque	M	$= \frac{1.59 \times V_g \times \Delta p \times \eta_{hm}}{100}$		[Nm]
Power	P	$= \frac{2\,\pi \times M \times n}{60000}$	$= \frac{q_v \times \Delta p \times \eta_t}{600}$	[kW]
Output speed	n	$= \frac{q_v \times 1000 \times \eta_v}{V_g}$		[rpm]

Key

V_g	=	Displacement per revolution [cm³]
Δp	=	Differential pressure [bar]
n	=	Rotational speed [rpm]
η_v	=	Volumetric efficiency
η_{hm}	=	Hydraulic-mechanical efficiency
η_t	=	Total efficiency ($\eta_t = \eta_v \times \eta_{hm}$)

Permissible radial and axial loading on the drive shafts

Size		NG		28	45	63	85
Radial force maximum at X/2		$F_{q\,max}$	N	1200	1500	1700	2000
Axial force maximum		$\pm F_{ax\,max}$	N	1000	1500	2000	3000

Notice

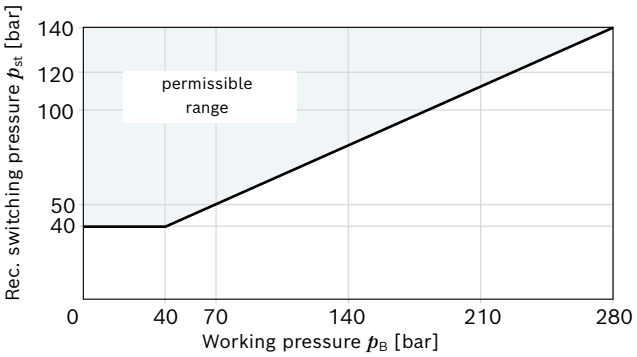
- The specified values are maximum values and must not be exceeded in continuous operation. For radial and axial loading, please contact us.

DG – Two-point control, direct operated

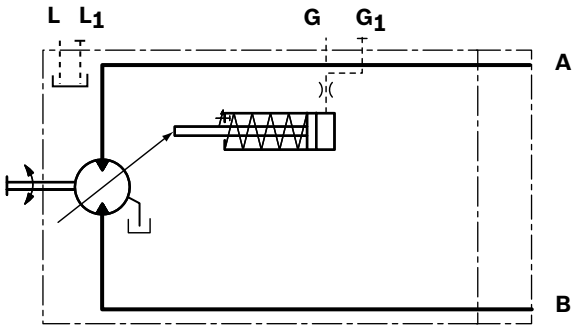
The variable displacement motor is set to minimum swivel angle by connecting an external switching pressure to port **G** (**G**$_1$).
This will supply control fluid directly to the stroking piston; a minimum control pressure of p_{st} ≥ 40 bar is required.
The variable displacement motor can only be switched between $V_{g\,max}$ or $V_{g\,min}$. $V_{g\,min}$ Please specify the pre-setting in plain text.
Please note that the required switching pressure at port **G** (**G**$_1$) is directly dependent on the actual working pressure p_B in port **A** or **B**. (see switching pressure characteristic curve).
The maximum permissible switching pressure is 280 bar.

- Switching pressure p_{st} in **G** (**G**$_1$) = 0 bar ≙ $V_{g\,max}$
- Switching pressure p_{st} in **G** (**G**$_1$) ≥ 40 bar ≙ $V_{g\,min}$

▼ **Switching pressure characteristic curve**



▼ **Circuit diagram**

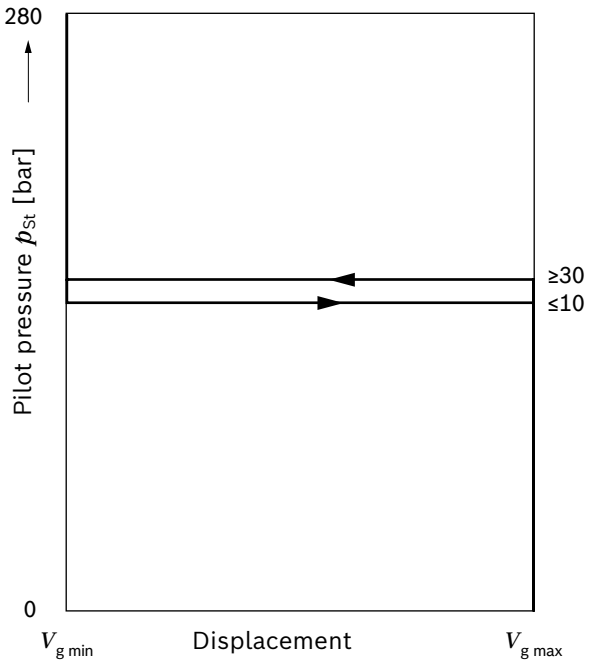


HZ/HZ6 – Two-point control, hydraulic

The variable motor is set to minimum swivel angle by connecting the pilot pressure p_X to port **X** ($p_X \geq 30$ bar). This supplies the stroking piston with control pressure via the on/off valve.
The control pressure is taken internally from the relevant high-pressure side; a minimum working pressure difference of $\Delta p_{A,B} \geq 30$ bar is required.
The motor can only be switched between $V_{g\,max}$ or $V_{g\,min}$.
$V_{g\,min}$ - pre-setting for order please state in plain text.

Pilot pressure $p_X \leq 10$ bar ≙ $V_{g\,max}$
Pilot pressure $p_X \geq 30$ bar ≙ $V_{g\,min}$

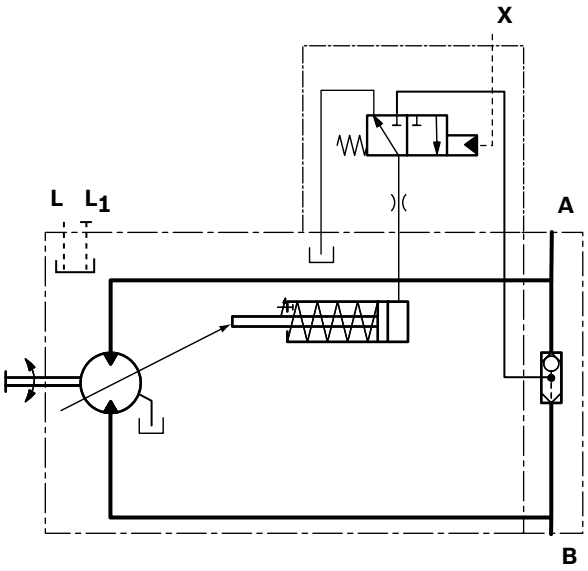
▼ **HZ/HZ6 characteristic curve**



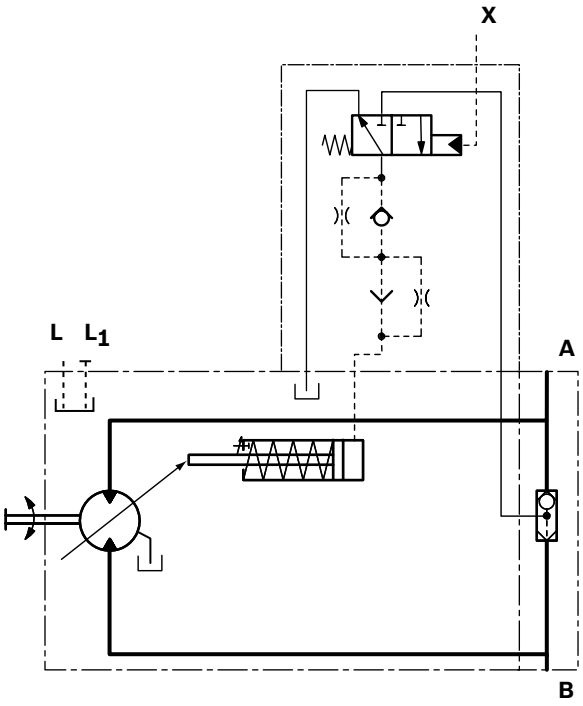
HZ/HZ6 characteristics	
Minimum pilot pressure	30 bar
Maximum permissible pilot pressure	280 bar

Version HZ6 with orifice for the switching time extension
The switching process is delayed by an orifice.
This allows for damped switching.
Standard orifice diameter is 0.25 mm.
Other orifice diameters upon request.

▼ **HZ circuit diagram**



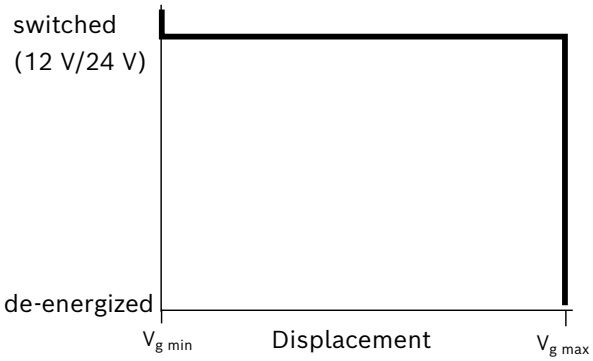
▼ **HZ6 circuit diagram**



EZ1, EZ2,EZ6, EZ7 - Two-point control, electric

The variable displacement motor is set to minimum swivel angle by actuating the switching solenoid. This supplies the stroking piston with control pressure via the on/off valve. The control pressure is taken internally from the relevant high-pressure side; a minimum working pressure difference of $\Delta p_{A,B} \geq 30$ bar is required.
The motor can only be switched between $V_{g\,max}$ or $V_{g\,min}$.
$V_{g\,min}$ - pre-setting for order please state in plain text.

▼ **EZx characteristic curve**



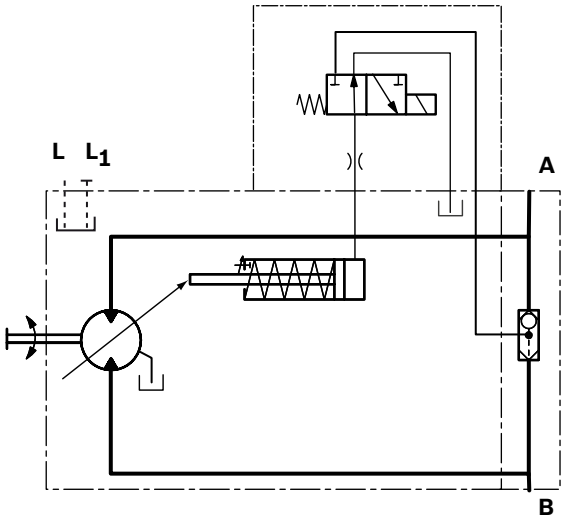
De-energized ≙ $V_{g\,max}$
Energized ≙ $V_{g\,min}$

Solenoid technical data	EZ1/EZ6	EZ2/EZ7
Nominal voltage	12V DC ±15%	24V DC ±15%
Nominal current at 20 °C	1.5 A	0.8 A
Duty cycle	100%	100%
Type of protection of device connector	see connector for solenoids on page 36	
Ambient temperature	-20 °C to +60 °C	
Hydraulic fluid temperature	-20 °C to +100 °C	
Viscosity range at continuous operation	10 mm²/s to 420mm²/s[1)]	

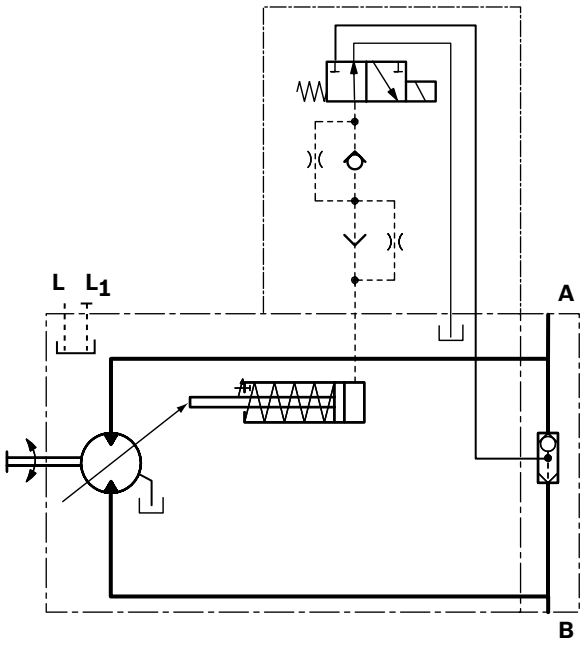
Please contact us if the temperature and viscosity ranges cannot be complied with.

EZ6/EZ7 version with orifice for switching time extension
The switching process is delayed by an orifice.
This allows for damped switching.
Standard orifice diameter is 0.25 mm.
Other orifice diameters upon request.

▼ **EZ1/EZ2 circuit diagram**



▼ **EZ6/EZ7 circuit diagram**



1) In the range between 420 mm²/s and 1600 mm²/s only limited function

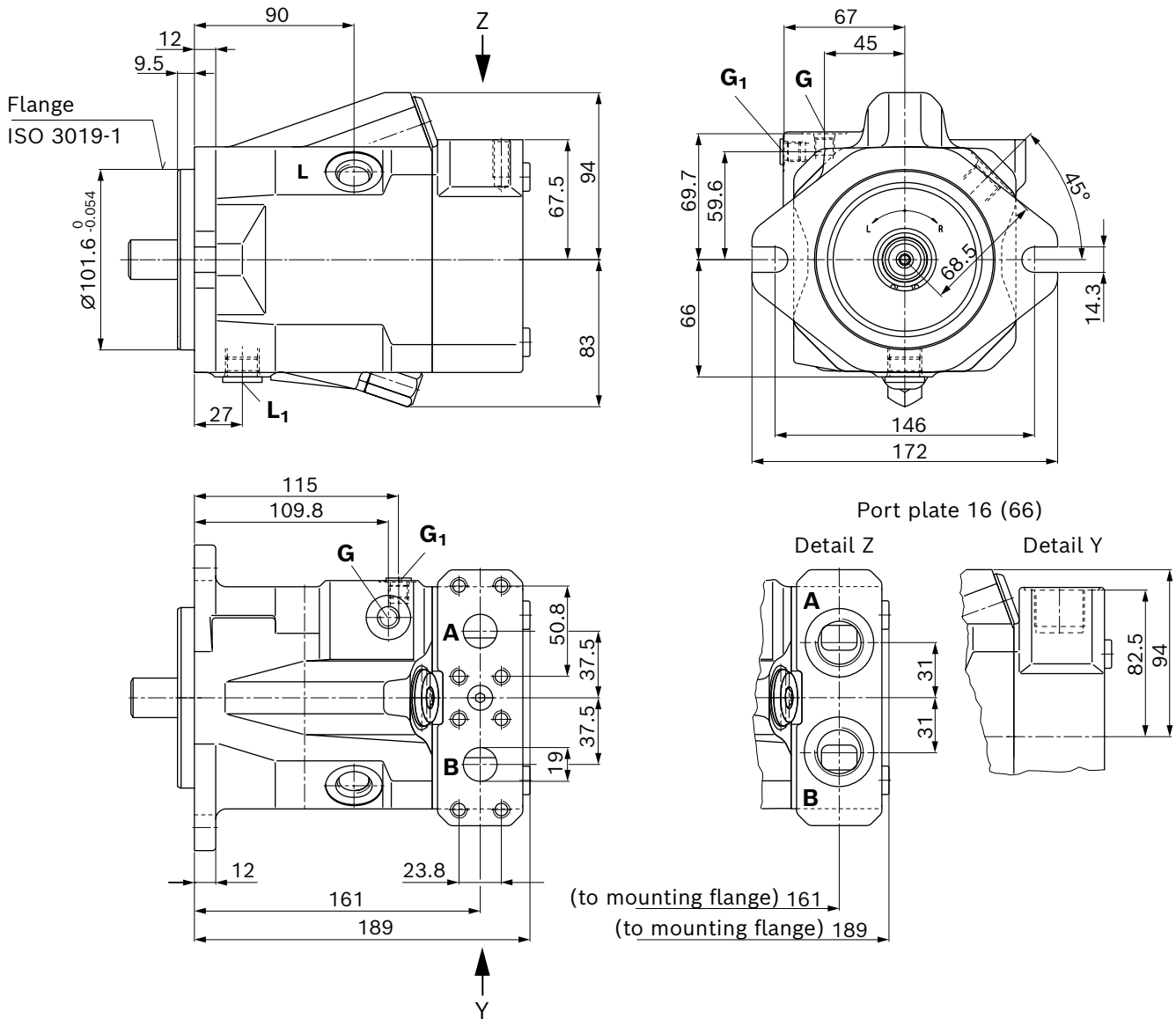
Dimensions [mm]

A10VM - Dimensions, size 28

DG – Two-point control, direct operated

Port plate 10 (60) and 16 (66) N000

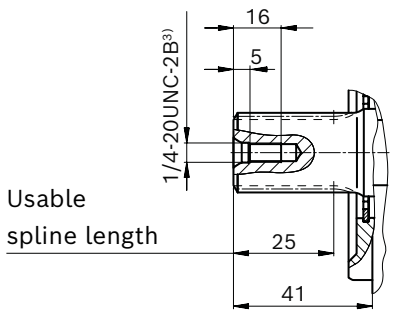
Port plate 10 (60)



Dimensions [mm]

▼ **Splined shaft 7/8 in (similar to ISO 3019-1)**

R – 13T 16/32DP[1)2)]

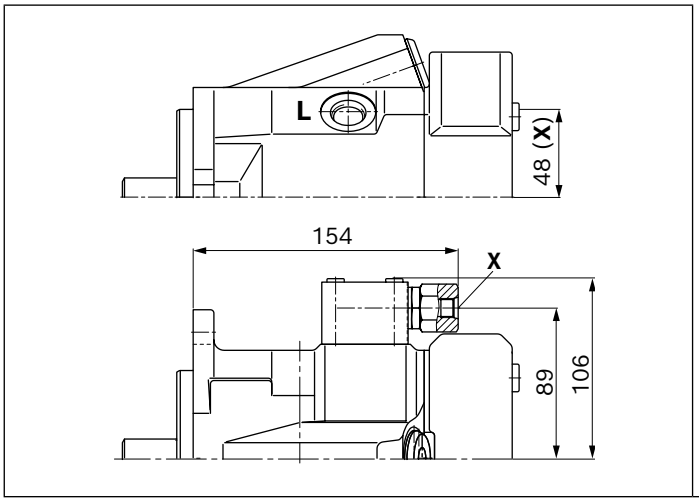


Port plate ports		Standard	Size	p_{max} [bar][4)]	State[7)]
Port plate 10					
A, **B**	Working port (high-pressure series) Fastening thread	ISO 6162-2 DIN 13	3/4 in M10×1.5; 17 deep	350	O
Port plate 60					
A, **B**	Working port (high-pressure series) Fastening thread	ISO 6162-2 ASME B1.1	3/4 in 3/8-16UNC-2B; 21 deep	350	O
Port plate 16					
A, **B**	Working port	DIN 3852-1	M27 × 2; 16 deep	350	O
Port plate 66					
A, **B**	Working port	ISO 11926	1 1/16-12UN-2B; 20 deep	350	O
Other ports					
L	Drain port	ISO 11926[5)]	3/4-16UNF-2B; 15 deep	4	O[6)]
L_1	Drain port	ISO 11926[5)]	3/4-16UNF-2B; 15 deep	4	X[6)]
G	External control pressure (with DG control)	ISO 11926[5)]	7/16-20UNF-2B; 12 deep	350	O
G_1	External control pressure (with DG control)	ISO 11926[5)]	7/16-20UNF-2B; 12 deep	350	X
X	Pilot pressure (with HZ control)	ISO 11926	7/16-20UNF-2B; 12 deep	350	O

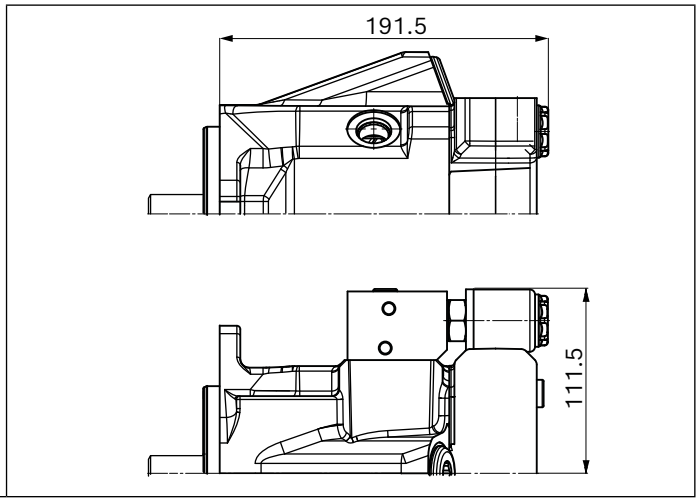
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Spline runout is a deviation from the ISO 3019-1 standard.
3) Thread according to ASME B1.1
4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
5) The countersink can be deeper than specified in the standard.
6) Depending on the installation position, **L** or **L_1** must be connected (see also installation instructions on pages 37 and 38).
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions [mm]

▼ **HZ, HZ6** – Two-point control, hydraulic



▼ **EZx** – Two-point control, electric



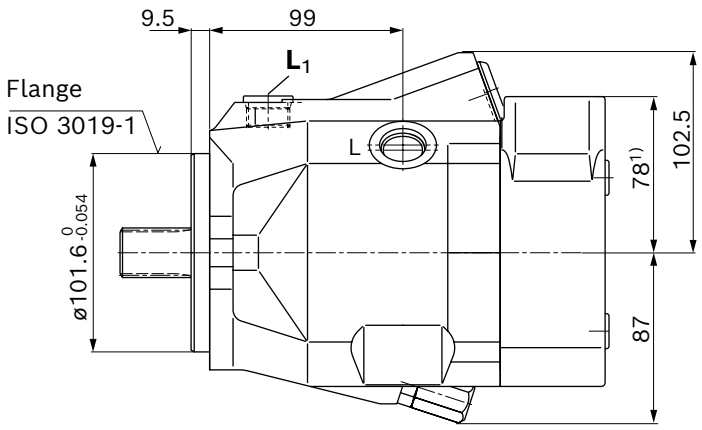
Dimensions [mm]

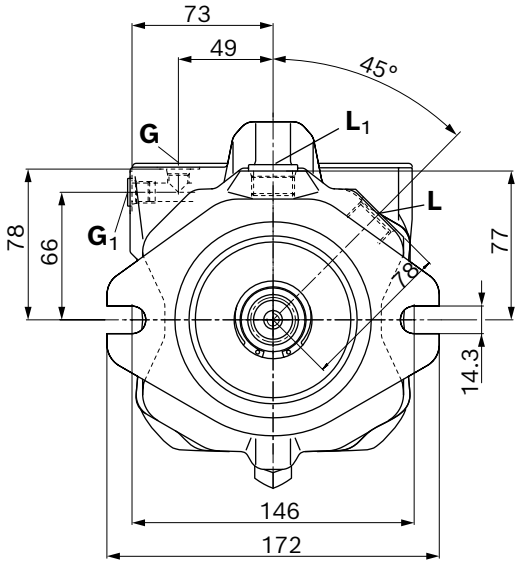
A10VM - Dimensions, size 45

DG – Two-point control, direct operated

Port plate 10 (60), 16 (66) and 11 (61) N000

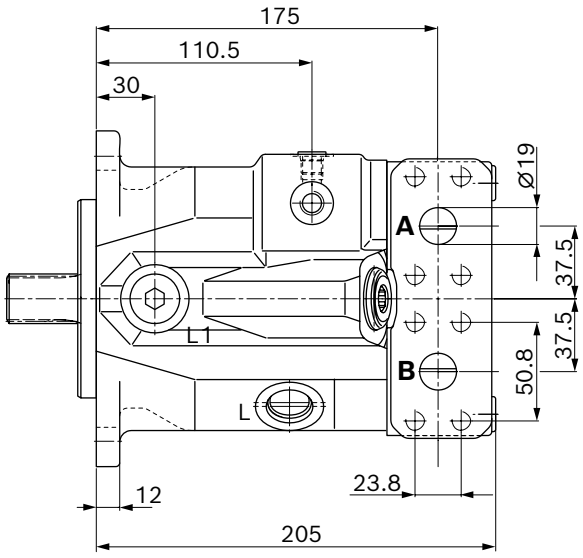
Port plate 10 (60)

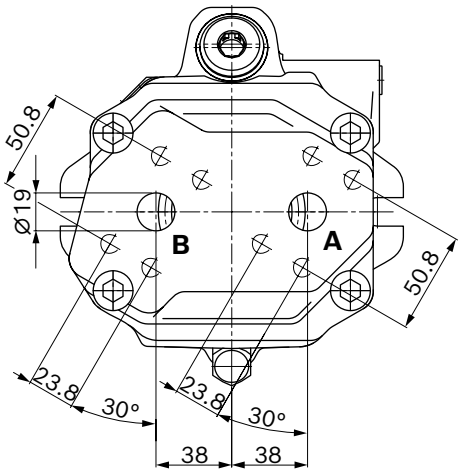




View Z

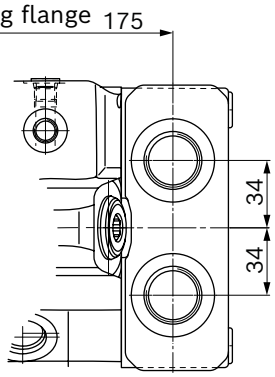
Port plate 11 (61)

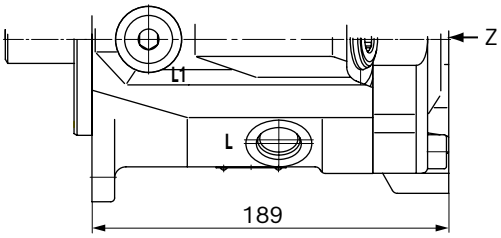




Port plate 16 (66)

to mounting flange



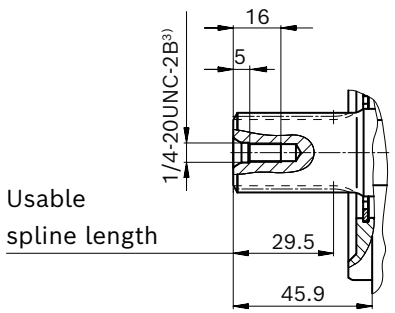


1) 79.5 mm with port plate 16 (66)

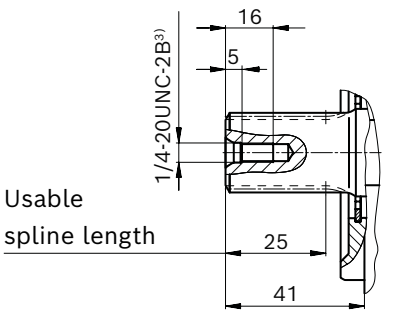
Dimensions [mm]

▼ **Splined shaft (similar to ISO 3019-1)**

R – 1 in 15T 16/32DP[1)2)]



W – 7/8 in 13T 16/32DP[1)2)]

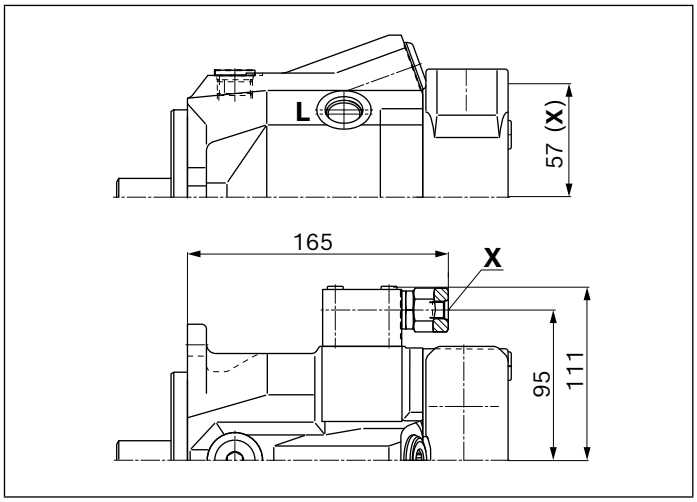


Port plate ports		Standard	Size	p_{max} [bar][4)]	State[7)]
Port plate 10; 11					
A, **B**	Working port (high-pressure series) Fastening thread	ISO 6162-2 DIN 13	3/4 in M10 × 1.5; 17 deep	350	O
Port plate 60; 61					
A, **B**	Working port (high-pressure series) Fastening thread	ISO 6162-2 ASME B1.1	3/4 in 3/8-16UNC-2B; 21 deep	350	O
Port plate 16					
A, **B**	Working port	DIN 3852-1	M27 × 2; 16 deep	350	O
Port plate 66					
A, **B**	Working port	ISO 11026	1 1/16-12UN-2B; 20 deep	350	O
Other ports					
L	Drain port	ISO 11926[5)]	7/8-14UNF-2B; 17 deep	4	O[6)]
L_1	Drain port	ISO 11926[5)]	7/8-14UNF-2B; 17 deep	4	X[6)]
G	External control pressure (with DG control)	ISO 11926[5)]	7/16-20UNF-2B; 12 deep	350	O
G_1	External control pressure (with DG control)	ISO 11926[5)]	7/16-20UNF-2B; 12 deep	350	X
X	Pilot pressure (with HZ control)	ISO 11926	7/16-20UNF-2B; 12 deep	350	O

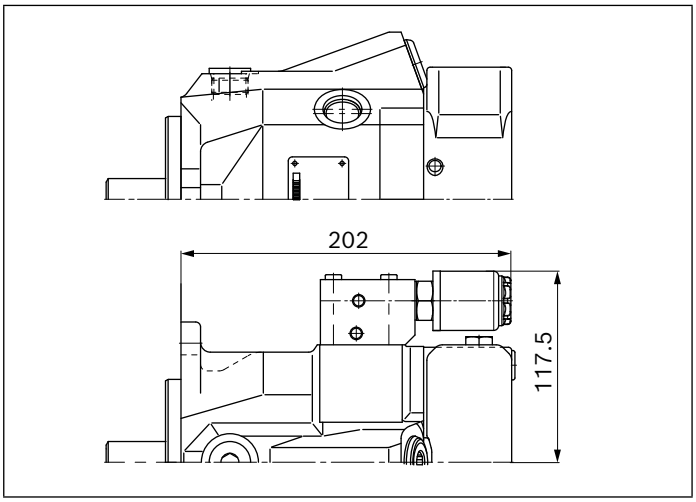
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Spline runout is a deviation from the ISO 3019-1 standard.
3) Thread according to ASME B1.1
4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
5) The countersink can be deeper than specified in the standard.
6) Depending on the installation position, **L** or **L_1** must be connected (see also installation instructions on pages 37 and 38).
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions [mm]

▼ **HZ, HZ6** – Two-point control, hydraulic



▼ **EZx** – Two-point control, electric,
Port plate 16 (66)



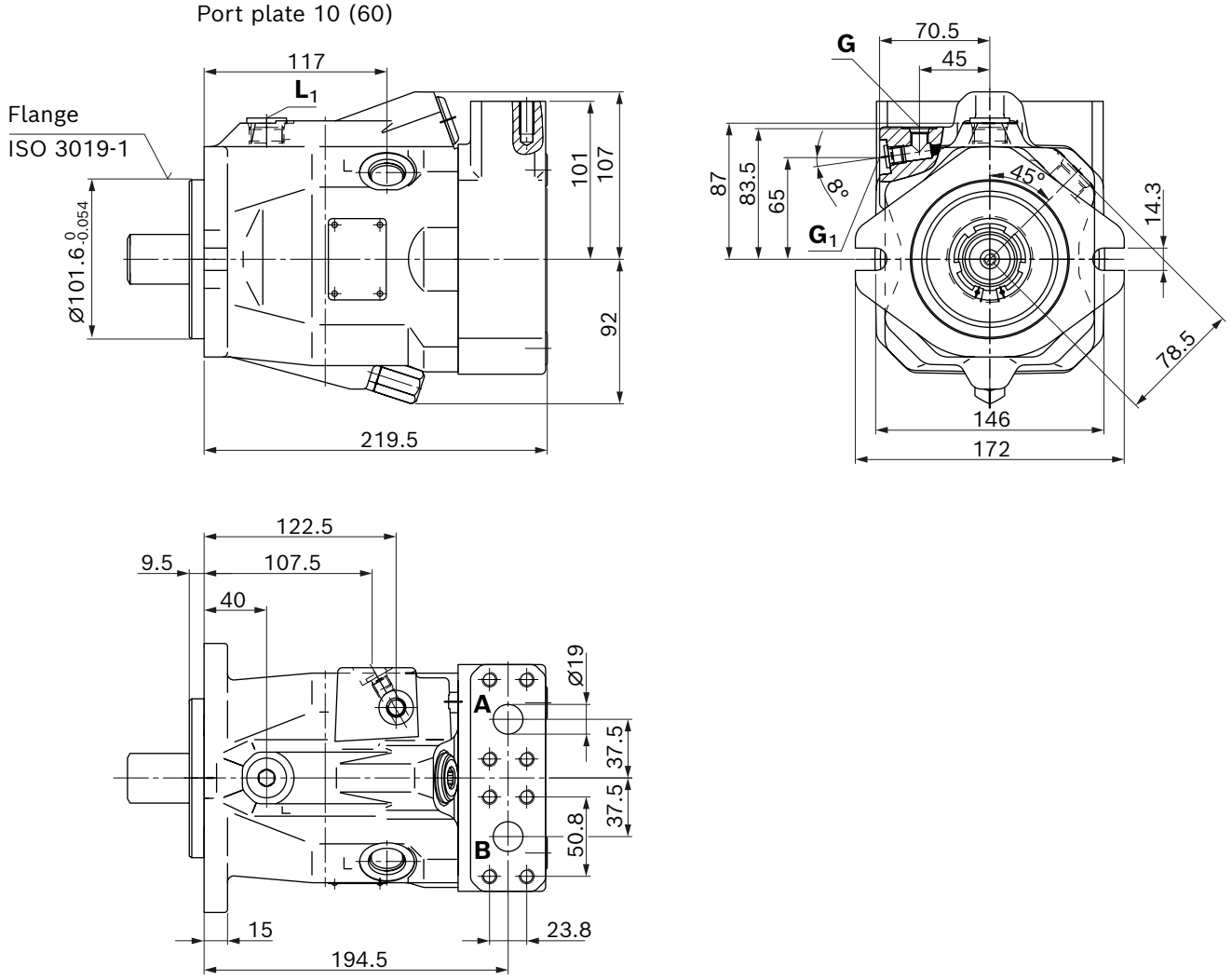
Dimensions [mm]

A10VM - Dimensions, size 63

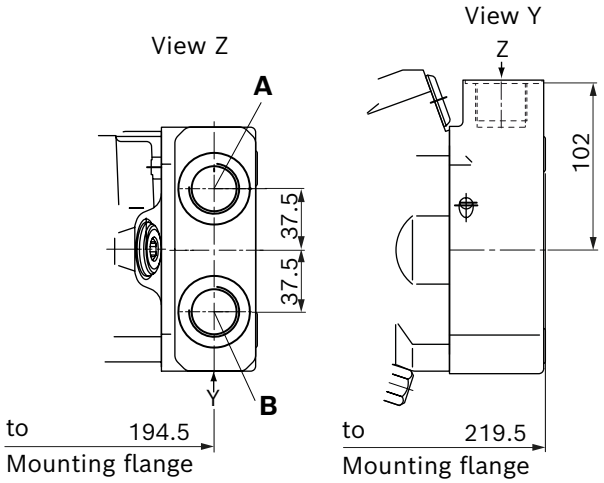
DG – Two-point control, direct operated

Port plate 10 (60) and 16 (66)N000

Port plate 10 (60)



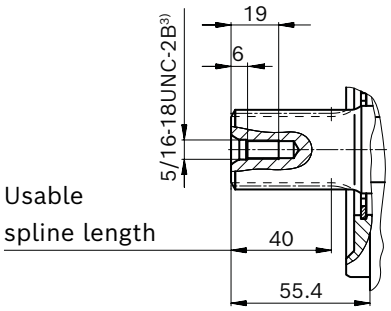
Port plate 16 (66)



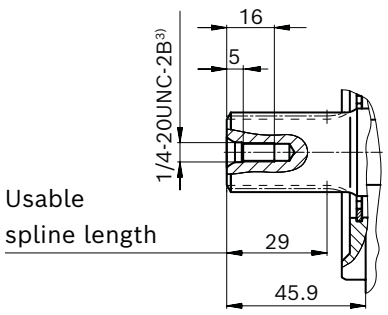
Dimensions [mm]

▼ **Splined shaft (similar to ISO 3019-1)**

R – 1 1/4 in 14T 12/24DP[1)2)]



W – 1 in 15T 16/32DP[1)2)]

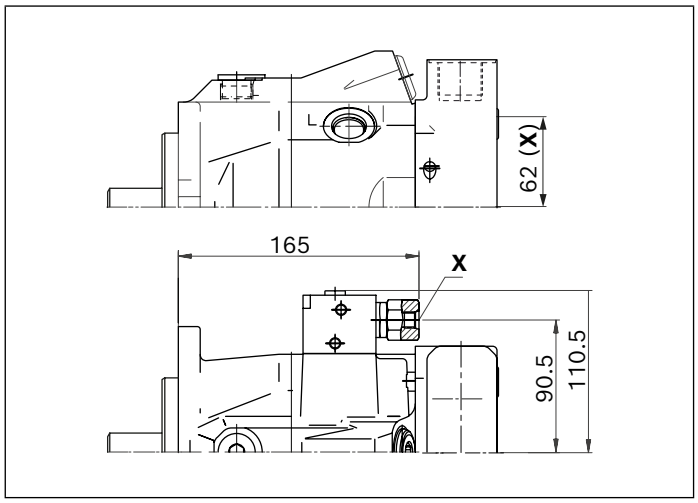


Port plate ports		Standard	Size	p_{max} [bar][4)]	State[7)]
Port plate 10					
A, **B**	Working port (high-pressure series) Fastening thread	ISO 6162-2 DIN 13	3/4 in M10 × 1.5; 17 deep	350	O
Port plate 60					
A, **B**	Working port (high-pressure series) Fastening thread	ISO 6162-2 ASME B1.1	3/4 in 3/8-16UNC-2B; 21 deep	350	O
Port plate 16					
A, **B**	Working port	DIN 3852-1	M27 × 2; 16 deep	350	O
Port plate 66					
A, **B**	Working port	ISO 11926	1 1/16-12UN-2B; 20 deep	350	O
Other ports					
L	Drain port	ISO 11926[5)]	7/8-14UNF-2B; 17 deep	4	O[6)]
L_1	Drain port	ISO 11926[5)]	7/8-14UNF-2B; 17 deep	4	X[6)]
G	External control pressure (with DG control)	ISO 11926[5)]	7/16-20UNF-2B; 12 deep	350	O
G_1	External control pressure (with DG control)	ISO 11926[5)]	7/16-20UNF-2B; 12 deep	350	X
X	Pilot pressure (with HZ control)	ISO 11926	7/16-20UNF-2B; 12 deep	350	O

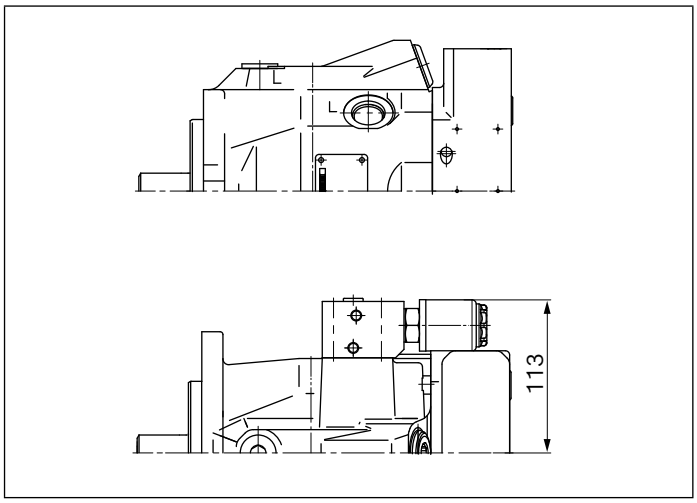
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Spline runout is a deviation from the ISO 3019-1 standard.
3) Thread according to ASME B1.1
4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
5) The countersink can be deeper than specified in the standard.
6) Depending on the installation position, **L** or **L_1** must be connected (see also installation instructions on pages 37 and 38).
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions [mm]

▼ **HZ, HZ6** – Two-point control, hydraulic



▼ **EZx** – Two-point control, electric

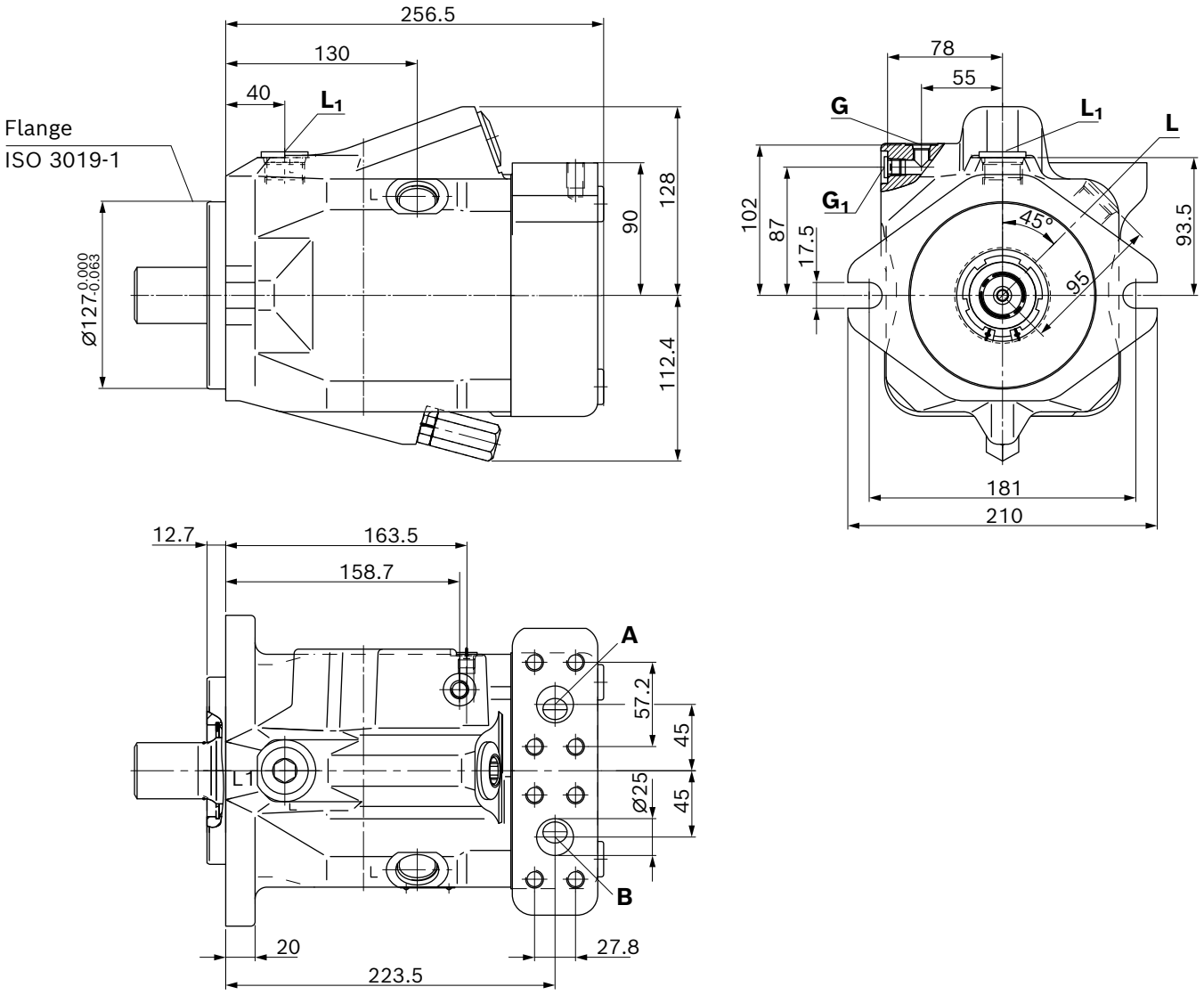


Dimensions [mm]

A10VM - Dimensions, size 85

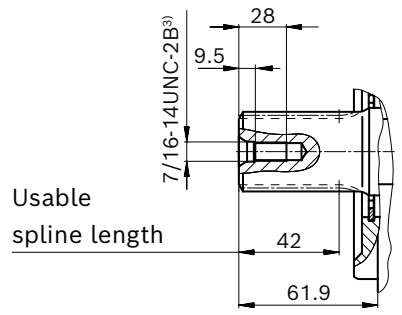
DG – Two-point control, direct operated

Port plate 10 (60) N000

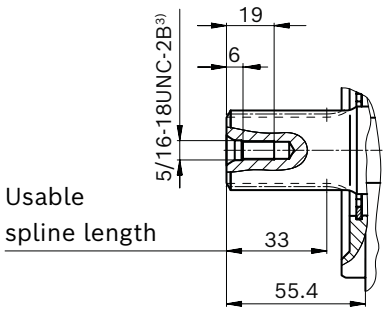


▼ **Splined shaft (similar to ISO 3019-1)**

R – 1 1/2 in 17T 12/24DP[1)2)]



W – 1 1/4 in 14T 12/24DP[1)2)]

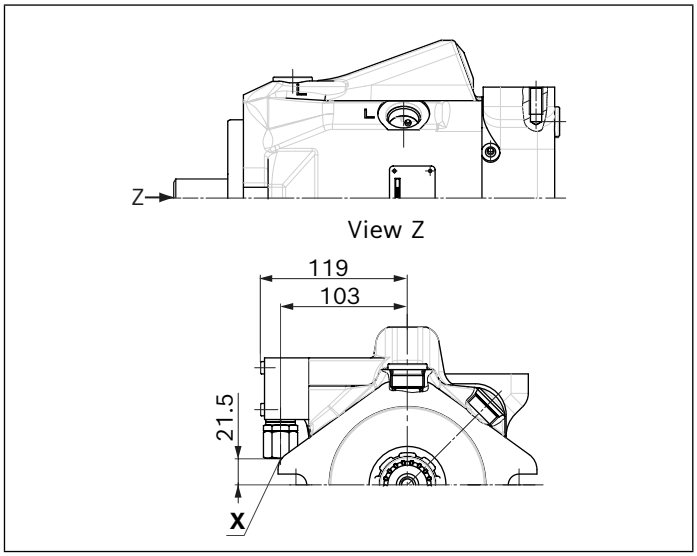


Port plate ports		Standard	Size	p_{max} [bar][4)]	State[7)]
Port plate 10					
A, **B**	Working port (high-pressure series) Fastening thread	ISO 6162-2 DIN 13	1 in M12 × 1.75; 17 deep	350	O
Port plate 60					
A, **B**	Working port (high-pressure series) Fastening thread	ISO 6162-2 ASME B1.1	1 in 7/16-14UNC-2B; 22 deep	350	O
Other ports					
L	Drain port	ISO 11926[5)]	1 1/16-12UNF-2B; 20 deep	4	O[6)]
L_1	Drain port	ISO 11926[5)]	1 1/16-12UNF-2B; 20 deep	4	X[6)]
G	External control pressure (with DG control)	ISO 11926[5)]	7/16-20UNF-2B; 12 deep	350	O
G_1	External control pressure (with DG control)	ISO 11926[5)]	7/16-20UNF-2B; 12 deep	350	X
X	Pilot pressure (with HZ control)	ISO 11926	7/16-20UNF-2B; 10 deep	350	O

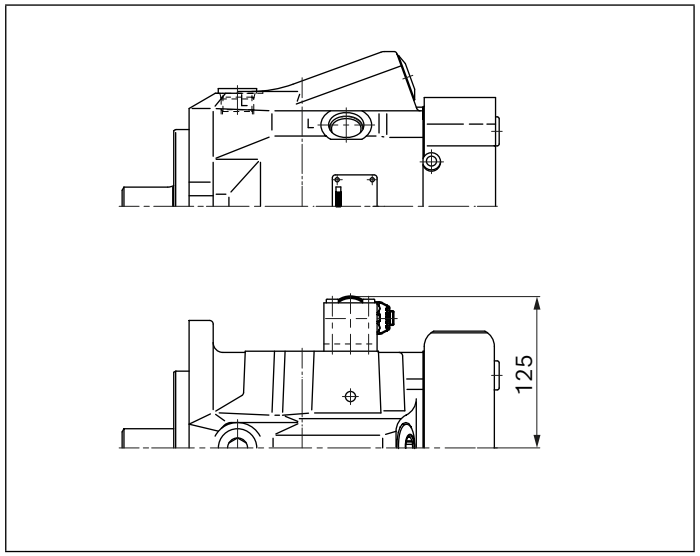
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Spline runout is a deviation from the ISO 3019-1 standard.
3) Thread according to ASME B1.1
4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
5) The countersink can be deeper than specified in the standard.
6) Depending on the installation position, **L** or **L_1** must be connected (see also installation instructions on pages 37 and 38).
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

A10VM - Dimensions, size 85

▼ **HZ, HZ6** – Two-point control, hydraulic



▼ **EZx** – Two-point control, electric

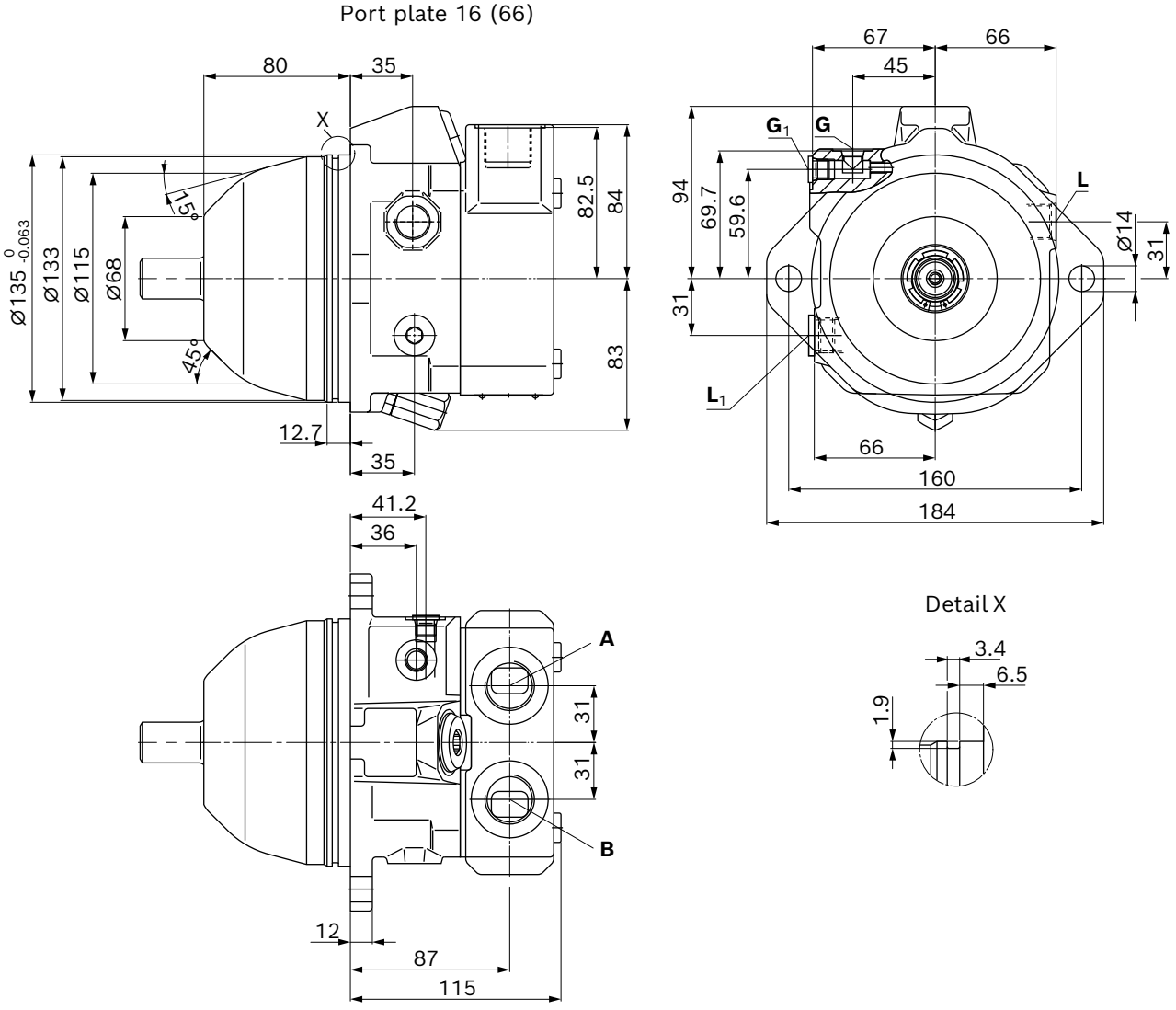


A10VE - Dimensions, size 28

DG – Two-point control, direct operated

Port plate 10 (60) and 16 (66)N000

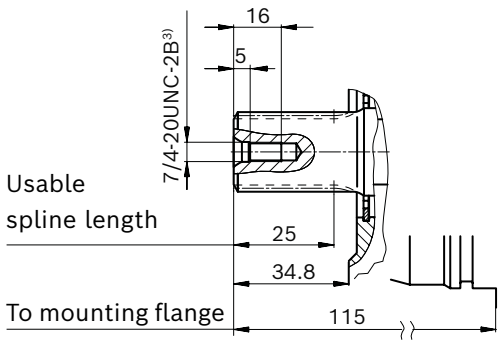
Port plate 16 (66)



A10VE - Dimensions, size 28

▼ **Splined shaft (similar to ISO 3019-1)**

R – 7/8 in 13T 16/32DP[1)2)]

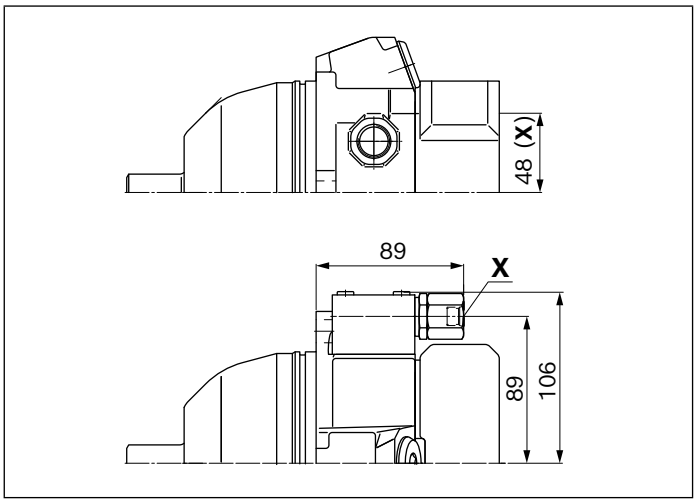


Port plate ports		Standard	Size	p_{max} [bar][4)]	State[7)]
Port plate 10					
A, **B**	Working port (high-pressure series) Fastening thread	ISO 6162-2 DIN 13	3/4 in M10 × 1.5; 17 deep	350	O
Port plate 60					
A, **B**	Working port (high-pressure series) Fastening thread	ISO 6162-2 ASME B1.1	3/4 in 3/8-16UNC-2B; 21 deep	350	O
Port plate 16					
A, **B**	Working port	DIN 3852-1	M27 × 2; 16 deep	350	O
Port plate 66					
A, **B**	Working port	ISO 11926	1 1/16-12UN-2B; 20 deep	350	O
Other ports					
L	Drain port	ISO 11926[5)]	3/4-16UNF-2B; 15 deep	4	O[6)]
L_1	Drain port	ISO 11926[5)]	3/4-16UNF-2B; 15 deep	4	X[6)]
G	External control pressure (with DG control)	ISO 11926[5)]	7/16-20UNF-2B; 12 deep	350	O
G_1	External control pressure (with DG control)	ISO 11926[5)]	7/16-20UNF-2B; 12 deep	350	X
X	Pilot pressure (with HZ control)	ISO 11926	7/16-20UNF-2B; 12 deep	350	O

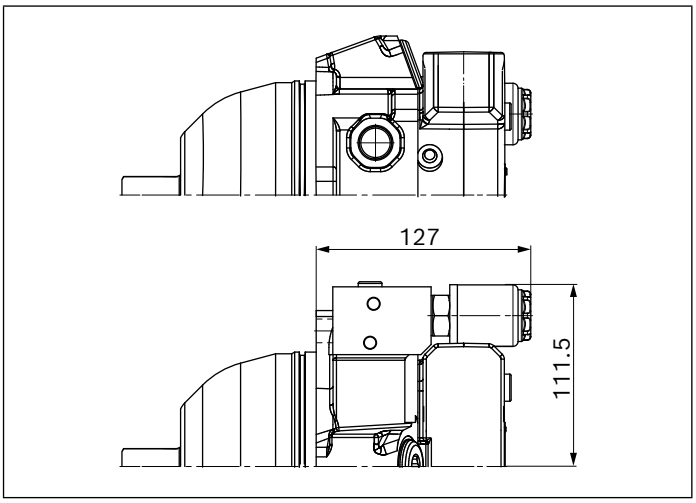
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Spline runout is a deviation from the ISO 3019-1 standard.
3) Thread according to ASME B1.1
4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
5) The countersink can be deeper than specified in the standard.
6) Depending on the installation position, **L** or **L_1** must be connected (see also installation instructions on pages 37 and 38).
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

A10VE - Dimensions, size 28

▼ **HZ, HZ6** - Two-point control, electric



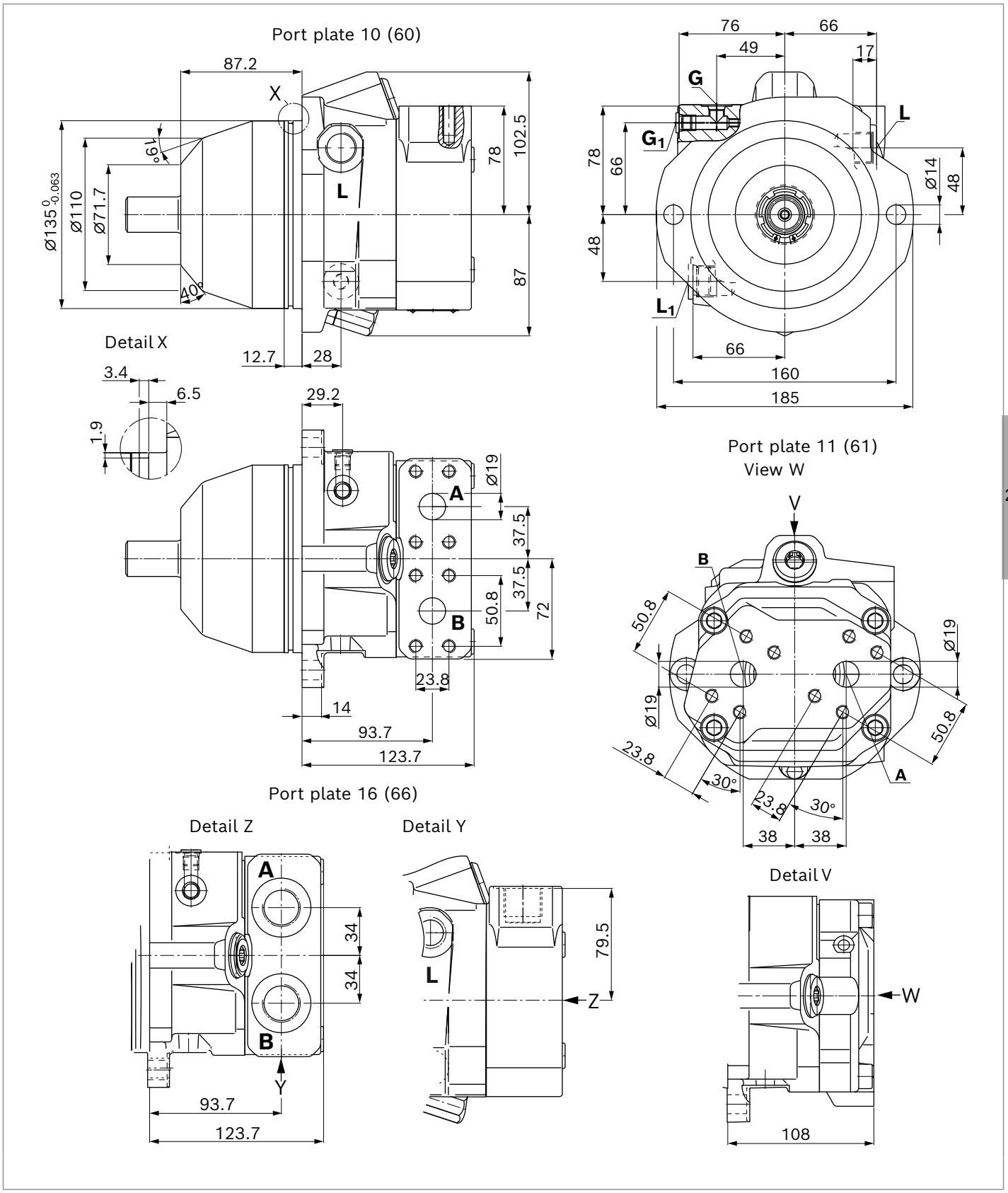
▼ **EZx** – Two-point control, electric



A10VE - Dimensions, size 45

DG – Two-point control, direct operated

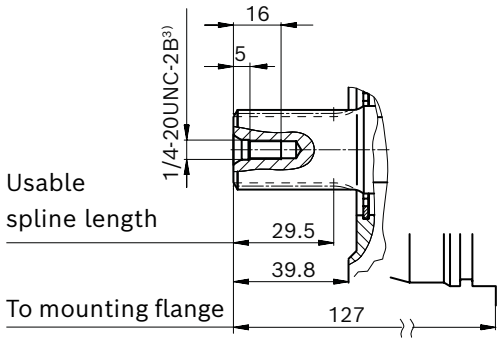
Port plate 10 (60), 11 (61) and 16 (66)N000



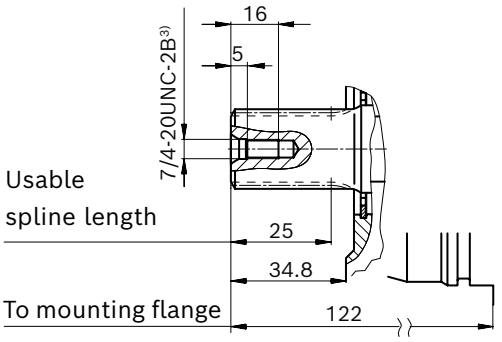
A10VE - Dimensions, size 45

▼ **Splined shaft (similar to ISO 3019-1)**

R – 1 in 15T 16/32DP[1)2)]



W – 7/8 in 13T 16/32DP[1)2)]

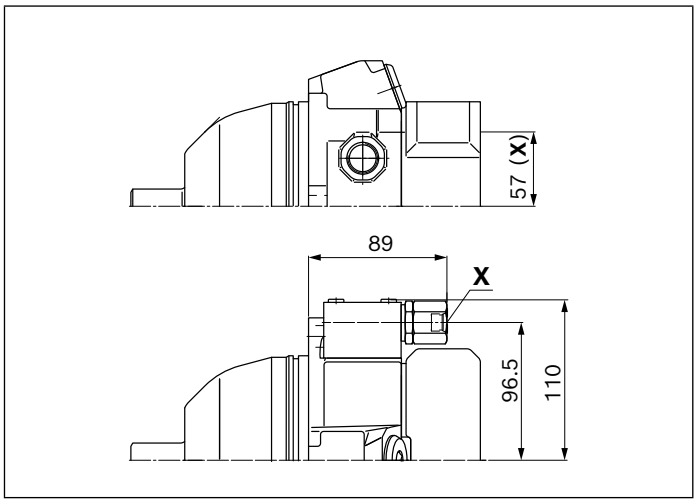


Port plate ports		Standard	Size	p_{max} [bar][4)]	State[7)]
Port plate 10; 11					
A, **B**	Working port (high-pressure series) Fastening thread	ISO 6162-2 DIN 13	3/4 in M10 × 1.5; 17 deep	350	O
Port plate 60; 61					
A, **B**	Working port (high-pressure series) Fastening thread	ISO 6162-2 ASME B1.1	3/4 in 3/8-16UNC-2B; 21 deep	350	O
Port plate 16					
A, **B**	Working port	DIN 3852-1	M27 × 2; 16 deep	350	O
Port plate 66					
A, **B**	Working port	ISO 11926	1 1/16-12UN-2B; 20 deep	350	O
Other ports					
L	Drain port	ISO 11926[5)]	7/8-14UNF-2B; 17 deep	4	O[6)]
L_1	Drain port	ISO 11926[5)]	7/8-14UNF-2B; 17 deep	4	X[6)]
G	External control pressure (with DG control)	ISO 11926[5)]	7/16-20UNF-2B; 12 deep	350	O
G_1	External control pressure (with DG control)	ISO 11926[5)]	7/16-20UNF-2B; 12 deep	350	X
X	Pilot pressure (with HZ control)	ISO 11926	7/16-20UNF-2B; 12 deep	350	O

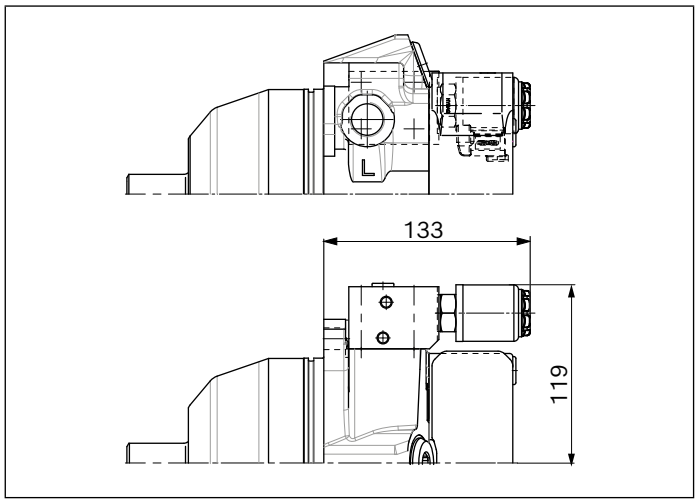
1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Spline runout is a deviation from the ISO 3019-1 standard.
3) Thread according to ASME B1.1
4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
5) The countersink can be deeper than specified in the standard.
6) Depending on the installation position, **L** or **L_1** must be connected (see also installation instructions on pages 37 and 38).
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

A10VE - Dimensions, size 45

▼ **HZ, HZ6** - Two-point control, electric



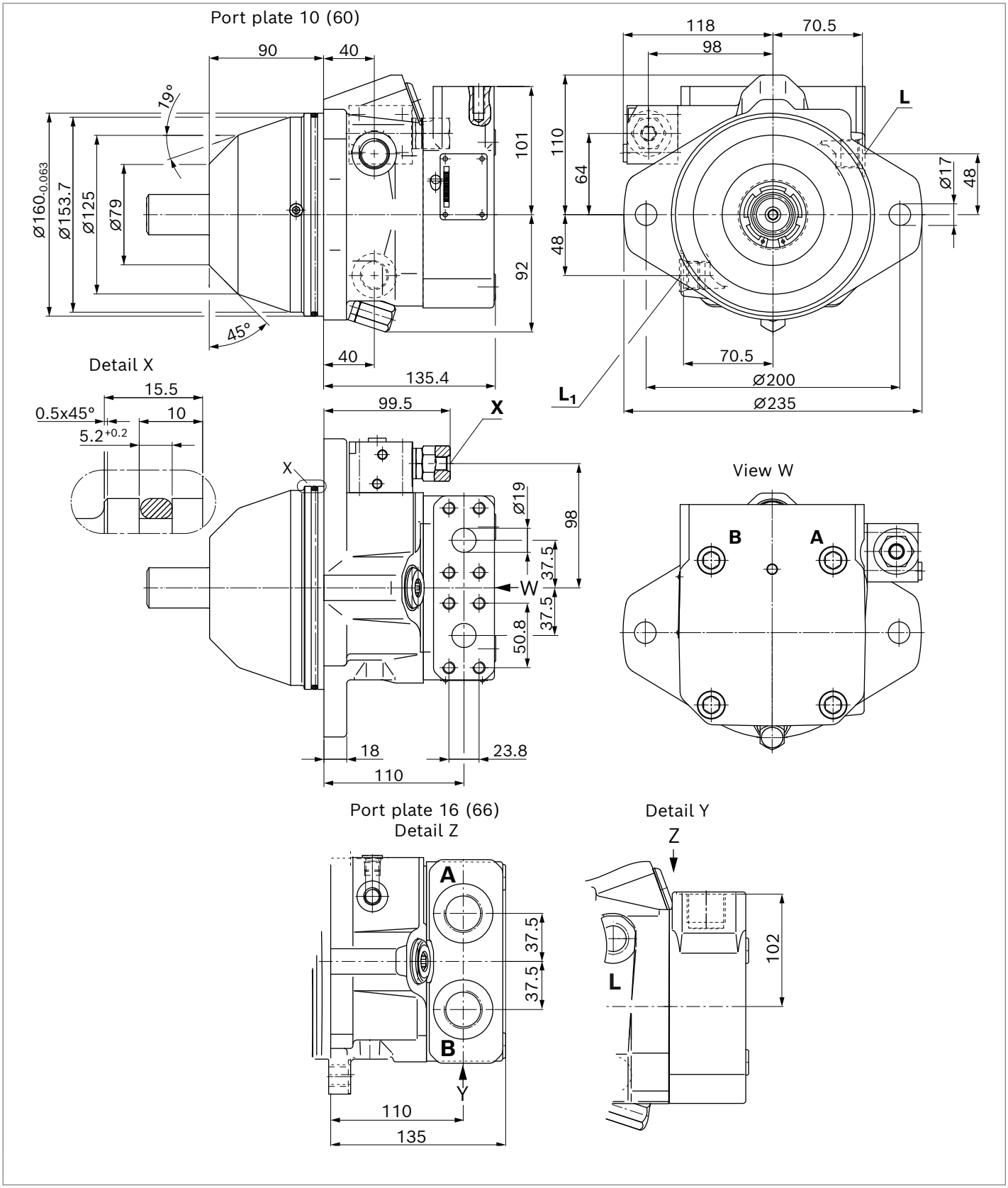
▼ **EZx** – Two-point control, electric



A10VE - dimensions, size 63

HZ, HZ6 - Two-point control, electric

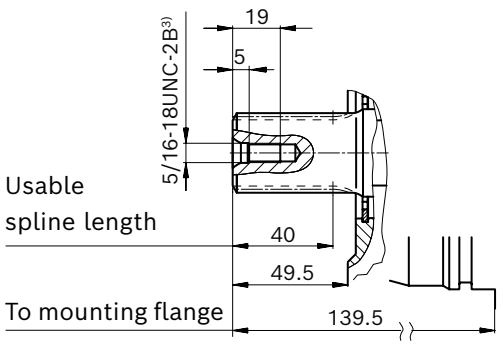
Port plate 10 (60) and 16 (66)N000



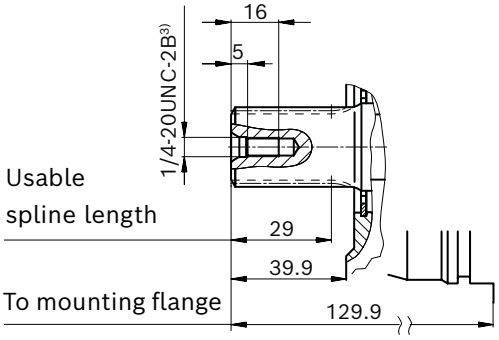
A10VE - dimensions, size 63

▼ **Splined shaft (similar to ISO 3019-1)**

R – 1 1/4 in 14T 12/24DP[1)2)]



W – 1 in 15T 16/32DP[1)2)]

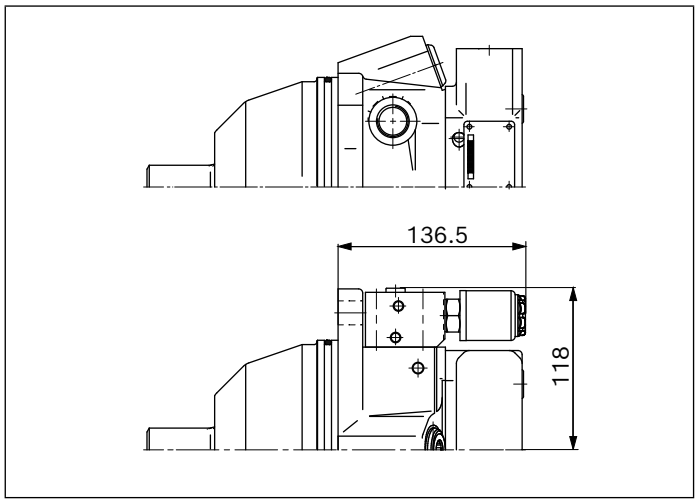


Port plate ports		Standard	Size	p_{max} [bar][4)]	State[7)]
Port plate 10					
A, **B**	Working port (high-pressure series) Fastening thread	ISO 6162-2 DIN 13	3/4 in M10 × 1.5; 17 deep	350	O
Port plate 60					
A, **B**	Working port (high-pressure series) Fastening thread	ISO 6162-2 ASME B1.1	3/4 in 3/8-16UNC-2B; 21 deep	350	O
Port plate 16					
A, **B**	Working port	DIN 3852-1	M27 × 2; 16 deep	350	O
Port plate 66					
A, **B**	Working port	ISO 11926	1 1/16-12UN-2B; 20 deep	350	O
Other ports					
L	Drain port	ISO 11926[5)]	7/8-14UNF-2B; 17 deep	4	O[6)]
L_1	Drain port	ISO 11926[5)]	7/8-14UNF-2B; 17 deep	4	X[6)]
X	Pilot pressure	ISO 11926	7/16-20UNF-2B; 12 deep	350	O

1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Spline runout is a deviation from the ISO 3019-1 standard.
3) Thread according to ASME B1.1
4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
5) The countersink can be deeper than specified in the standard.
6) Depending on the installation position, **L** or **L_1** must be connected (see also installation instructions on pages 37 and 38).
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

A10VE - dimensions, size 63

▼ **EZx** – Two-point control, electric



Flushing and boost-pressure valve

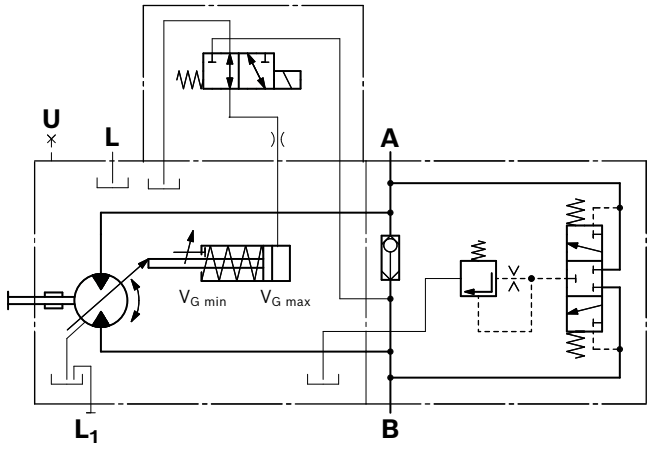
Order option ...N007
The flushing and boost-pressure valve is used in a closed circuit to prevent increased heat and to protect the minimum boost pressure (set to 16 bar). The valve is integrated in the port plate.
A quantity of hydraulic fluid determined by an orifice is taken from the respective low-pressure side and discharged into the motor housing. Together with the leakage, it is discharged to the reservoir via the drain port.
The hydraulic fluid removed from the circuit must be replaced by the boost pump with cooled hydraulic fluid.

Standard flushing flows

At low pressure p_{ND} = 20 bar and orifice of Ø1.6 mm, the standard flushing quantity is 5.5 l/min (sizes 28 - 85).
Please specify other orifice diameters in plain text.
Other flushing flows:

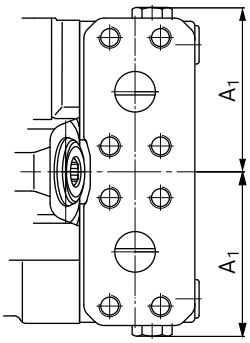
Orifice diameter [mm]	Flushing flow [l/min]
1.2	3.5
1.6	5.5
1.8	7.2

▼ **Circuit diagram**

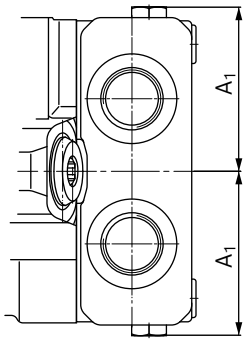


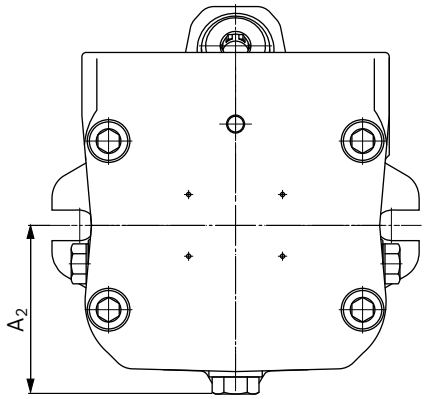
▼ **Dimensions A10VM and A10VE.**

Port plate 10 (60)



Port plate 16 (66)





Size	A_1	A_2
28	72	72
45	77	77
63	77	82
85	–	–

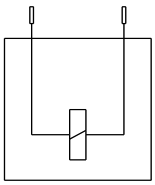
Connector for solenoids

DEUTSCH DT04-2P-EP04

Molded, 2-pin, without bidirectional suppressor diode
The installed mating connector has the following type of protection:

- IP67 (DIN/EN 60529) and
- IP69K (DIN 40050-9)

▼ **Switching symbol**



▼ **Mating connector DEUTSCH DT06-2S-EP04**

Consisting of	DT designation
1 housing	DT06-2S-EP04
1 wedge	W2S
2 sockets	0462-201-16141

The mating connector is not included in the scope of delivery.

Notice

If necessary, you can change the position of the connector by turning the solenoid body.
The procedure is defined in the instruction manual manual.

Installation instructions for A10VM

General

The axial piston unit must be filled with hydraulic fluid and air bled during commissioning and operation. This must also be observed following a longer standstill as the axial piston unit may empty via the hydraulic lines.
Please contact us regarding the installation position "drive shaft at top or bottom".
The leakage in the housing area must be directed to the reservoir via the highest positioned drain port (**L**, $\mathbf{L_1}$).
If a shared drain line is used for several units, make sure that the respective case pressure in each unit is not exceeded. The shared drain line must be dimensioned to ensure that the maximum permissible case pressure of all connected units is not exceeded in any operating condition, particularly at cold start. If this is not possible, separate drain line must be laid, if necessary.
To achieve favorable noise values, decouple all connecting lines using elastic elements and avoid above-reservoir installation.
In all operating conditions, the drain line must flow into the reservoir below the minimum fluid level.

Notice

In certain installation positions, an influence on the adjustment or control can be expected. Gravity, dead weight and case pressure can cause minor characteristic shifts and changes in actuating time.

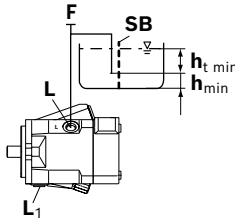
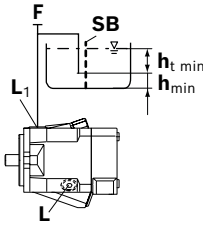
Connector for solenoids

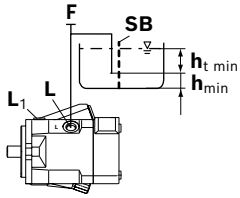
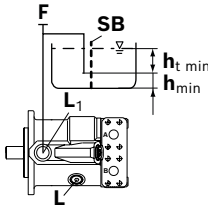
Installation position

See the following examples **1** to **8**.
Further installation positions are available upon request.
Recommended installation position: **1, 3, 5** and **7**

Below-reservoir installation (standard)

Below-reservoir installation means that the axial piston unit is installed outside of the reservoir below the minimum fluid level.

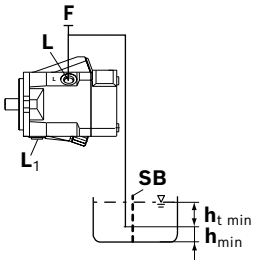
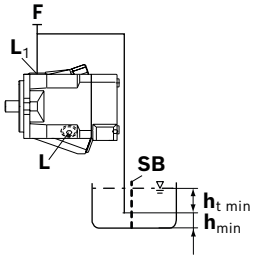
Installation position A10VM, NG 28	Air bleed	Filling
1 	**F**, **L**	**F**, **L**
2 	**F**, L_1	**F**, L_1

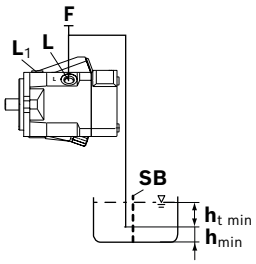
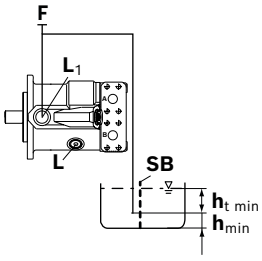
Installation position A10VM, NG 45 to 85	Air bleed	Filling
3 	**F**, **L**	**F**, **L**
4 	**F**, L_1	**F**, L_1

Key	
F	Filling / Air bleeding
L, L_1	Drain port
SB	Baffle (baffle plate)
$h_{t\ min}$	Minimum required immersion depth (200 mm)
h_{min}	Minimum required distance to reservoir bottom (100 mm)

Above-reservoir installation

Above-reservoir installation means that the axial piston unit is installed above the minimum fluid level of the reservoir.

Installation position NG 28	Air bleed	Filling
5 	**F**, **L**	**F**, **L**
6 	**F**, L_1	**F**, L_1

Installation position NG 45 to 85	Air bleed	Filling
7 	**F**, **L**	**F**, **L**
8 	**F**, L_1	**F**, L_1

Notice

Port **F** is part of the external piping and must be provided on the customer side to make filling and air bleeding easier.

Installation instructions for A10VE

General

The axial piston unit must be filled with hydraulic fluid and air bled during commissioning and operation. This must also be observed following a longer standstill as the axial piston unit may empty via the hydraulic lines.
Please contact us regarding the installation position "drive shaft at top or bottom".
The leakage in the housing area must be directed to the reservoir via the highest available drain port (**L**). If this is not possible, separate drain line must be laid, if necessary. To achieve favorable noise values, decouple all connecting lines using elastic elements and avoid above-reservoir installation.
In all operating conditions, the drain line must flow into the reservoir below the minimum fluid level.

Notice
In certain installation positions, an influence on the adjustment or control can be expected. Gravity, dead weight and case pressure can cause minor characteristic shifts and changes in actuating time.

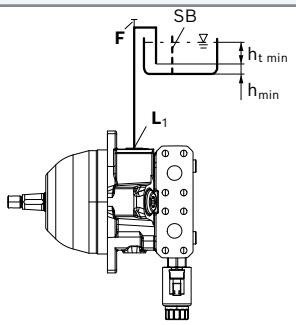
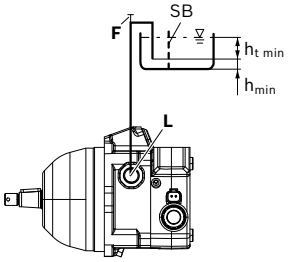
For key, see page 40.

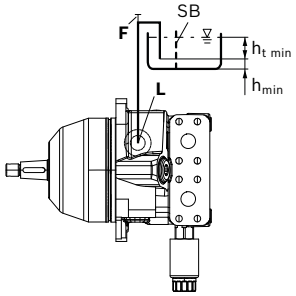
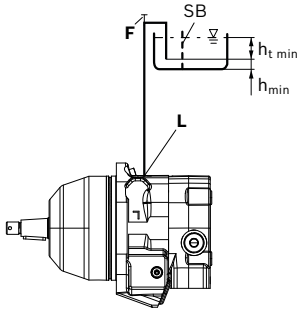
Installation position

See the following examples **1** to **8**.
Further installation positions are available upon request.
Recommended installation position: **2** and **4**

Below-reservoir installation (standard)

Below-reservoir installation means that the axial piston unit is installed outside of the reservoir below the minimum fluid level.

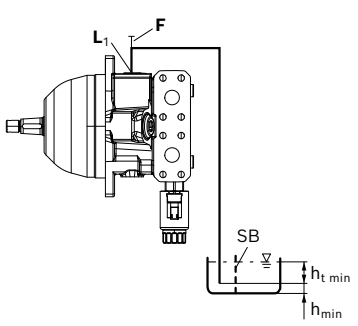
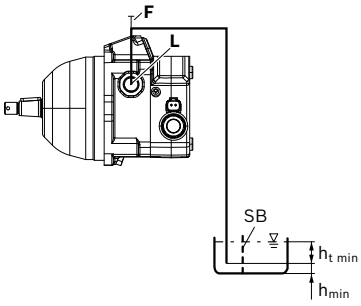
Installation position NG 18 to 28	Air bleed	Filling
1 	**F**	**L_1**
2 	**F**	**L**

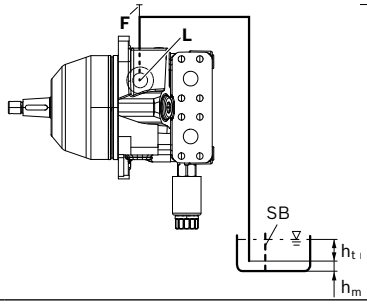
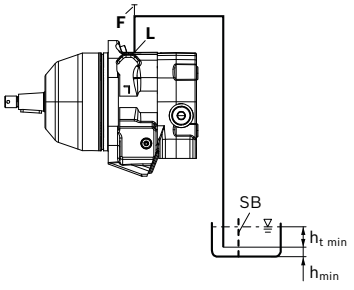
Installation position NG 37 to 45	Air bleed	Filling
3 	**F**	**L**
4 	**F**	**L**

Installation instructions for A10VE

Above-reservoir installation

Above-reservoir installation means that the axial piston unit is installed above the minimum fluid level of the reservoir.

Installation position NG 18 to 28	Air bleed	Filling
5 	F	L_1
6 	F	L

Installation position NG 37 to 45	Air bleed	Filling
7 	F	L
8 	F	L

Key	
F	Filling / Air bleeding
L, L_1	Drain port
SB	Baffle (baffle plate)
$h_{t\,min}$	Minimum required immersion depth (200 mm)
h_{min}	Minimum required distance to reservoir bottom (100 mm)

Notice

Port **F** is part of the external piping and must be provided on the customer side to make filling and air bleeding easier.

Project planning notes

- The axial piston variable motor, A10VM and A10VE, is intended to be used in open and closed circuits.
- Project planning, installation and commissioning of the axial piston units requires the involvement of skilled personnel.
- Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly.
- Before finalizing your design, request a binding installation drawing.
- The specified data and notes contained herein must be observed.
- Depending on the operating conditions of the axial piston unit (working pressure, fluid temperature), the characteristic curve may shift.
- The characteristic curve may also shift due to the dither frequency or control electronics.
- Preservation: Our axial piston units are supplied as standard with preservation protection for a maximum of 12 months. If longer preservation protection is required (maximum 24 months), please specify this in plain text when placing your order. The preservation periods apply under optimal storage conditions, details of which can be found in the data sheet 90312 or the instruction manual.
- Not all versions of the product are approved for use in safety functions according to ISO 13849.
- Depending on the type of control used, electromagnetic effects can be produced when using solenoids. Use of the recommended direct current (DC) on the electromagnet does not produce any electromagnetic interference (EMI) nor is the electromagnet influenced by EMI. A possible electromagnetic interference (EMI) exists if the solenoid is supplied with modulated direct current (e.g. PWM signal). The machine manufacturer should conduct appropriate tests and take appropriate measures to ensure that other components or operators (e.g. with a pacemaker) are not affected by this potentiality.
- Pressure controllers are not safeguards against pressure overload. Be sure to add a pressure relief valve to the hydraulic system.
- For drives that are operated for a long period of time with constant rotational speed, the natural frequency of the hydraulic system can be stimulated by the excitation frequency of the pump (rotational speed frequency ×9). This can be prevented with suitably designed hydraulic lines.
- Please note the details regarding the tightening torques of port threads and other threaded joints in the instruction manual.
- Working ports:
  - The ports and fastening threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
  - The service ports and function ports are only intended to accommodate hydraulic lines.

Safety instructions

- During and shortly after operation, there is a risk of burning on the axial piston unit and especially on the solenoids. Take the appropriate safety measures (e.g. by wearing protective clothing).
- Moving parts in control equipment (e.g. valve spools) can, under certain circumstances, get stuck in position as a result of contamination (e.g. contaminated hydraulic fluid, abrasion, or residual dirt from components). As a result, the hydraulic fluid flow and the build-up of torque in the axial piston unit can no longer respond correctly to the operator's specifications. Even the use of various filter elements (external or internal flow filtration) will not rule out a fault but merely reduce the risk. The machine/system manufacturer should test whether additional measures are required on the machine for the relevant application in order to bring the driven consumer into a safe position (e.g., safe stop) and make sure any measures are properly implemented.