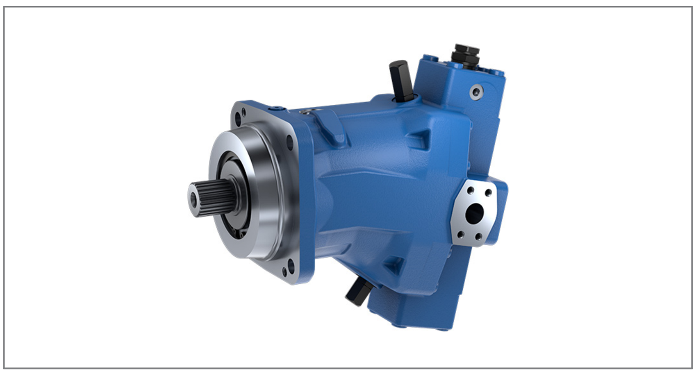
rexroth
A Bosch Company

Axial piston variable motor A6VM series 63



- All-purpose high pressure motor
- Sizes 250 to 1000
- Nominal pressure 350 bar
- Maximum pressure 400 bar
- Open and closed circuit

Features
- Robust motor with long service life
- Approved for high rotational speeds
- High control range (can be swiveled to zero)
- High torque
- Large variety of controls
- Optionally with mounted flushing and boost-pressure valve
- Bent-axis design

Contents

Type code

01	02	03	04	05	06	07		08	09	10		11	12	13	14	15	16	17		18
A6V		**M**					**/**	**63**	**W**		**–**	**V**							**–**	

Axial piston unit

			250	355	500	1000	
01	Bent-axis design, variable		●	●	●	●	**A6V**

Drive shaft bearing

			250	355	500	1000	
02	Standard bearing (without code)		●	●	●	–	
	Long-life bearing		●	●	●	●	**L**

Operating mode

			250	355	500	1000	
03	Motor (plug-in motor A6VE see data sheet 91606)		●	●	●	●	**M**

Size (NG)

04	Geometric displacement, see page 8		**250**	**355**	**500**	**1000**

Control device

			250	355	500	1000	
05	Proportional control, hydraulic	Δp_{St} = 10 bar	●	●	●	●	**HD1**
		Δp_{St} = 25 bar	●	●	●	●	**HD2**
		Δp_{St} = 35 bar	●	●	●	●	**HD3**
	Proportional control, electric (with HIRSCHMANN connector – without suppressor diode)	U = 12 V	●	●	●	●	**EP1**
		U = 24 V	●	●	●	●	**EP2**
	Two-point control, hydraulic		●	●	●	●	**HZ**
	Two-point control, electric (with HIRSCHMANN connector – without suppressor diode)	U = 12 V	●	○	●	○	**EZ1**
		U = 24 V	●	○	●	○	**EZ2**
	Automatic control, high-pressure related	with minimum pressure increase Δp ≤ approx. 10 bar	●	●	●	●	**HA1**
		with pressure increase Δp = 100 bar	●	●	●	●	**HA2**
	Automatic control, speed related p_{St}/p_{HD} = 3/100, hydraulic travel direction valve		●	●	●	○	**DA**

Pressure control/override (only for HD, EP)

			250	355	500	1000	
06	Without pressure control/override (without code)		●	●	●	●	
	Pressure control	Fixed setting[1]	●	●	●	●	**D**
		Hydraulic, remote controlled, proportional	●	●	●	●	**G**

Override of the HA1 and HA2 controls

			250	355	500	1000	
07	Without override (without code)		●	●	●	●	
	Override, hydraulic, remote controlled, proportional		●	●	●	●	**T**

Series

08	Series 6, index 3	**63**

Direction of rotation

			250	355	500	1000	
09	Viewed on drive shaft	variable	●	●	●	●	**W**

Setting ranges for displacement[2]

			250	355	500	1000	
10	$V_{g\,min}$ = 0 to 0.4 $V_{g\,max}$	$V_{g\,max}$ = $V_{g\,max}$ to 0.8 $V_{g\,max}$	●	●	●	●	**1**
	$V_{g\,min}$ > 0.4 $V_{g\,max}$ to 0.8 $V_{g\,max}$	$V_{g\,max}$ = $V_{g\,max}$ to 0.8 $V_{g\,max}$	●	●	●	●	**2**

● = Available ○ = On request – = Not available

1) Second pressure setting option available as standard for version D
2) Please specify exact settings for $V_{g\,min}$ and $V_{g\,max}$ in plain text when ordering: $V_{g\,min}$ = ... cm^3, $V_{g\,max}$ = ... cm^3

01	02	03	04	05	06	07		08	09	10		11	12	13	14	15	16	17		18
A6V		**M**					**/**	**63**	**W**		**–**	**V**							**–**	

Sealing material

		250	355	500	1000	
11	FKM (fluoroelastomer)	●	●	●	●	**V**

Drive shaft

		250	355	500	1000	
12	Splined shaft DIN 5480	●	●	●	●	**Z**
	Parallel keyed shaft DIN 6885	●	●	●	●	**P**

Mounting flange

			250	355	500	1000	
13	ISO 3019-2	4-hole	●	–	–	–	**B**
		8-hole	–	●	●	●	**H**

Working port[3]

					250	355	500	1000	
14	SAE working ports **A** and **B** at rear	**01**	Without valve	**0**	●	●	●	●	**010**
			Flushing and boost-pressure valve, mounted	**7**	●	●	●	●	**017**
	SAE working ports **A** and **B** at side, opposite	**02**	Without valve	**0**	●	●	●	●	**020**
			Flushing and boost-pressure valve, mounted	**7**	●	●	●	●	**027**
	SAE working ports **A** and **B** at side, opposite + at rear	**15**	Without valve	**0**	●	●	●	●	**150**
			Flushing and boost-pressure valve, mounted	**7**	●	●	●	●	**157**
	Port plate with 1-stage pressure relief valves (pilot operated) for mounting a counterbalance valve MHB32[4]	**38**	Without valve	**0**	●[5]	–	–	–	**380**
			Mounted counterbalance valve	**8**	●[5]	–	–	–	**388**

Speed sensor

		250	355	500	1000	
15	Without speed sensor (without code)	●	●	●	●	
	Prepared for speed sensor DSA/20[6]	●	●	●	○	**W**
	Speed sensor DSA1/20 mounted[6]	●	●	●	○	**C**
	Speed sensor DSA2/20 mounted[6]	●	●	●	○	**K**

Swivel angle sensor

		250	355	500	1000	
16	Without swivel angle sensor (without code)	●	●	●	●	
	Optical swivel angle sensor	●	●	●	●	**V**
	Electric swivel angle sensor	●	●	●	●	**E**

Beginning of control

		250	355	500	1000	
17	At $V_{g\ min}$ (standard for HA)	●	●	●	●	**A**
	At $V_{g\ max}$ (standard for HD, HZ, EP, EZ, DA)	●	●	●	●	**B**

Standard/special version

18	Standard version (without code)	
	Special version	**-S**

● = Available ○ = On request – = Not available

Notice

- Note the project planning notes on page 42.
- In addition to the type code, please specify the relevant technical data when placing your order.

3) Fastening thread metric
4) Not possible in conjunction with control DA.
5) Counterbalance valve MHB32, please contact us.
6) Sensor DSA/20 in accordance with data sheet 95126. Observe the requirements for the electronics.

Hydraulic fluids

The variable motor A6VM is designed for operation with HLP mineral oil according to DIN 51524.
Application instructions and requirements for hydraulic fluid selection, behavior during operation as well as disposal and environmental protection 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
- 90222: Fire-resistant, water-free hydraulic fluids (HFDR/HFDU)
- 90225: Limited technical data for operation with waterfree and water-containing fire-resistant hydraulic fluids (HFDR, HFDU, HFA, HFB, HFC, HFC-E)

Selection of hydraulic fluid
Bosch Rexroth evaluates hydraulic fluids on the basis of the Fluid Rating according to the technical data sheet 90235.
Hydraulic fluids with positive evaluation in the Fluid Rating are listed in the following data sheet:

- 90245: Bosch Rexroth Fluid Rating List for Rexroth hydraulic components (pumps and motors)

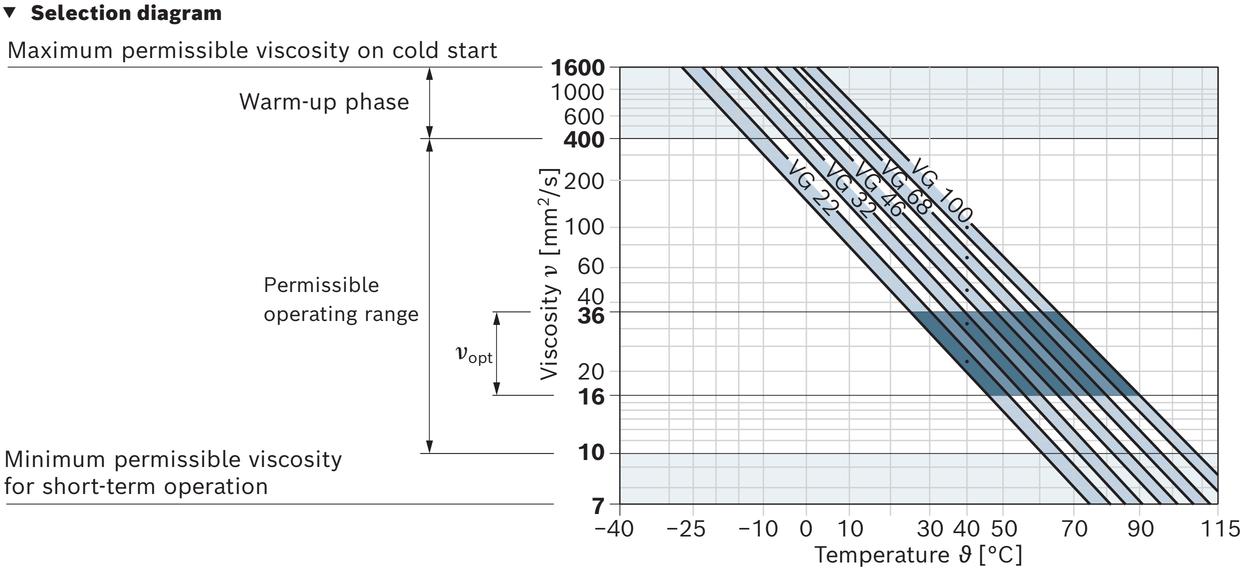
The hydraulic fluid should be selected so that the operating viscosity in the operating temperature range is within the optimum range (ν_{opt}; see selection diagram).

Notice
The axial piston unit is not suitable for operation with HFA hydraulic fluids.
Please consult with us before operation with HFB and HFC hydraulic fluids.

Viscosity and temperature of hydraulic fluids

	Viscosity	Shaft seal	Temperature[3]	Remarks
Cold start	ν_{max} ≤ 1600 mm²/s	NBR[2]	ϑ_{St} ≥ −40°C	t ≤ 3 min, without load (p ≤ 50 bar), n ≤ 1000 rpm
		FKM	ϑ_{St} ≥ −25°C	Permissible temperature difference between axial piston unit and hydraulic fluid in the system maximum 25 K
Warm-up phase	ν = 1600 ... 400 mm²/s			t ≤ 15min, p ≤ 0.7 × p_{nom} and n ≤ 0.5 × n_{nom}
Permissible operating range	ν = 400 ... 10 mm²/s[1]	NBR[2]	ϑ ≤ +78°C	Measured at port **T**
		FKM	ϑ ≤ +103°C	
	ν_{opt} = 36 ... 16 mm²/s			Optimal operating viscosity and efficiency range
Short-term operation	ν_{min} = 10 ... 7 mm²/s	NBR[2]	ϑ ≤ +78°C	t ≤ 3 min, p ≤ 0.3 × p_{nom}, measured at port **T**
		FKM	ϑ ≤ +103°C	

▼ **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) Special version, please contact us
3) If the temperature at extreme operating parameters cannot be adhered to, 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 is to be maintained according to ISO 4406.
At a hydraulic fluid viscosity of less than 10 mm²/s (e.g. due to high temperatures during short-term operation), a cleanliness level of at least 19/17/14 according to ISO 4406 is required.
Examples of temperatures of hydraulic fluids at a viscosity of 10 mm²/s:

- 73°C at HLP 32
- 85°C at HLP 46

Effect of case pressure on beginning of control

An increase in case pressure affects the beginning of control of the variable motor when using the following control options:

- HD, EP, HA.T: Increase
- DA: Reduction

With the following control options, an increase in case pressure will have no effect on the beginning of control:

- HA

The factory setting for the beginning of control is made at p_{abs} = 1 bar case pressure.

Flow direction

Direction of rotation, viewed on drive shaft	
Clockwise	Counter-clockwise
A to **B**	**B** to **A**

Bearing

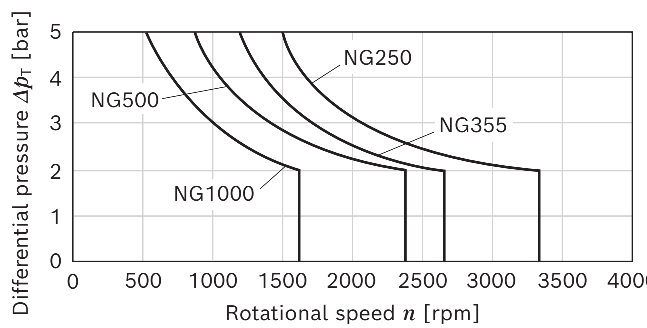
Long-life bearing

For a longer service life, the unit is optionally available with long-life bearing. Identical external dimensions as motor with standard bearing. Subsequent conversion to long-life bearing is possible.

Shaft seal

Permissible pressure load

The service life of the shaft seal is influenced by the rotational speed of the axial piston unit and the leakage pressure in the housing (case pressure). Momentary (t < 0.1 s) pressure peaks of up to 10 bar are allowed.
To make use of the full speed range, continuous case pressures of max. 2 bar are permitted. Higher case pressures are permissible at lower speeds (see diagram).
The service life of the shaft seal decreases with increasing frequency of pressure peaks and increasing mean differential pressure.
The pressure in the housing must be equal to or greater than the ambient pressure.



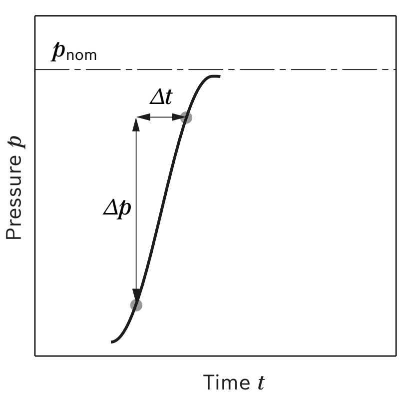
The FKM shaft seal ring may be used for leakage temperatures from -25°C to +115°C. In application cases below -25°C, an NBR shaft seal is required (permissible temperature range: -40 °C to +90 °C).

- For the permitted temperature range for axial piston variable motor A6VM, see "Viscosity and temperature of hydraulic fluids" on page 4.

Working pressure range

Pressure at working port A or B		Definition
Nominal pressure p_{nom}	350 bar	The nominal pressure corresponds to the maximum design pressure.
Maximum pressure p_{max}	400 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	10 s	
Total operating period	300 h	
Minimum pressure (high-pressure side)	25 bar	Minimum pressure at the high-pressure side (**A** or **B**) which is required to prevent damage to the axial piston unit.
Minimum pressure – operation as a pump (inlet)	see diagram on page 7	To prevent damage to the axial piston motor during operation as a pump (change of the high-pressure side with constant direction of rotation, e.g. during brake applications) a minimum pressure has to be ensured at the working port (inlet). The minimum pressure is dependent on the rotational speed and displacement of the axial piston unit (see the characteristic curve)
Summation pressure p_{Su} (pressure **A** + pressure **B**)	700 bar	The summation pressure is the sum of the pressures at the ports for the working lines (**A** and **B**)
Rate of pressure change $R_{A\ max}$		Maximum permissible speed of pressure build-up and reduction during a pressure change across the entire pressure range.
with integrated pressure relief valve	9000 bar/s	
without pressure relief valve	16000 bar/s	
Case pressure at port T		
Continuous differential pressure $\Delta p_{T\ cont}$	2 bar	Maximum, averaged differential pressure at the shaft seal (case pressure to ambient pressure)
Maximum differential pressure $\Delta p_{T\ max}$	see diagram on page 5	Permissible differential pressure at the shaft seal (case pressure to ambient pressure)
Pressure peaks $p_{T\ peak}$	10 bar	t < 0.1 s

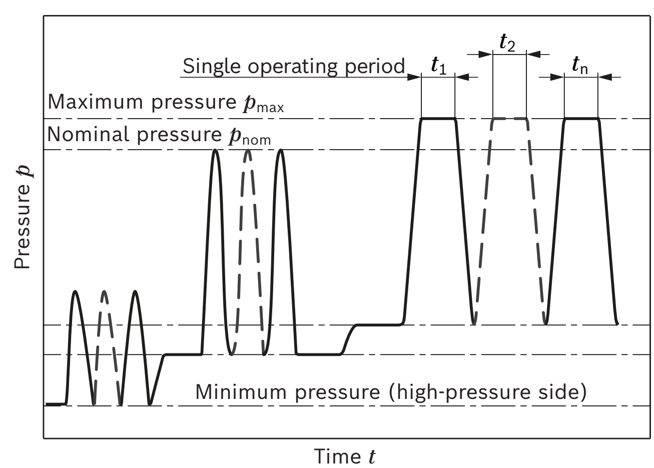
▼ **Rate of pressure change $R_{A\ max}$**



Notice

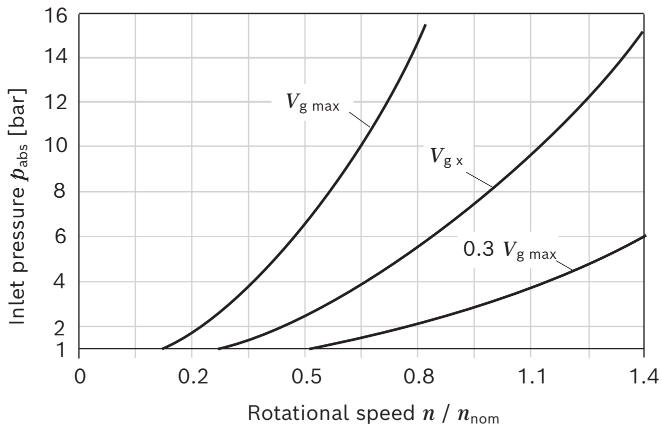
- Working pressure range applies when using hydraulic fluids based on mineral oils. Please contact us for values for other hydraulic fluids.
- The case pressure must be greater than the external pressure (ambient pressure) at the shaft seal.

▼ **Pressure definition**



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

▼ **Minimum pressure – operation as a pump (inlet)**



This diagram is only valid for the optimum viscosity range of ν_{opt} = 36 to 16 mm^2/s.
If the above-mentioned conditions cannot be ensured, please contact us.

Technical data

Size		NG		250	355	500	1000
Geometric displacement, per revolution[1]		$V_{g\,max}$	cm³	250	355	500	1000
		$V_{g\,min}$	cm³	0	0	0	0
		$V_{g\,x}$	cm³	205	300	417	1000
Maximum rotational speed[2] (complying with the maximum permissible inlet flow)	At $V_{g\,max}$	n_{nom}	rpm	2700	2240	2000	1600
	At $V_g < V_{g\,x}$ (see diagram below)	n_{max}	rpm	3300	2650	2400	1600
	At $V_{g\,0}$	n_{max}	rpm	3300	2650	2400	1600
Inlet flow[3]	At n_{nom} and $V_{g\,max}$	$q_{v\,max}$	l/min	675	795	1000	1600
Torque[4]	At $V_{g\,max}$ and Δp = 350 bar	M	Nm	1391	1978	2785	5571
Rotary stiffness	$V_{g\,max}$ to $V_g/2$	c_{min}	kNm/rad	60	75	115	281
	$V_g/2$ to 0 (interpolated)	c_{min}	kNm/rad	181	262	391	820
Moment of inertia of the rotary group		J_{TW}	kgm²	0,061	0.102	0.178	0.55
Maximum angular acceleration		α	rad/s²	10000	8300	5500	4000
Case volume		V	l	3.00	5.0	7.0	16.0
Weight approx.		m	kg	100	170	210	430

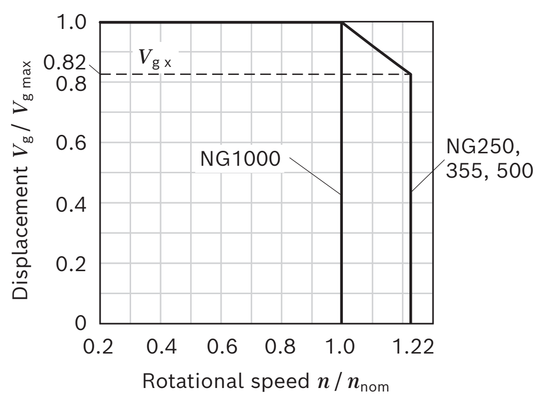
Speed range

The minimum rotational speed n_{min} is not limited. For applications with requirements on the evenness of the rotation at low rotational speeds, please contact us.

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. Other permissible limit values, such as speed variation, reduced angular acceleration as a function of the frequency and the permissible angular acceleration at start (lower than the maximum angular acceleration) can be found in data sheet 90261.

- **Permissible displacement depending on the rotational speed**



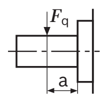
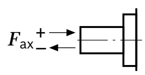
Determination of the operating characteristics				
Inlet flow	q_v	=	$\frac{V_g \times n}{1000 \times \eta_v}$	[l/min]
Rotational speed	n	=	$\frac{q_v \times 1000 \times \eta_v}{V_g}$	[rpm]
Torque	M	=	$\frac{V_g \times \Delta p \times \eta_{hm}}{20 \times \pi}$	[Nm]
Power	P	=	$\frac{2\pi \times M \times n}{60000} = \frac{q_v \times \Delta p \times \eta_t}{600}$	[kW]

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 ($\eta_t = \eta_v \times \eta_{hm}$)

1) The minimum and maximum displacement can be steplessly varied, see type code on page 2. (Standard setting if ordering code is missing: $V_{g\,min} = 0.2 \times V_{g\,max}$, $V_{g\,max} = V_{g\,max}$).
2) The values are applicable:
   – for the optimum viscosity range from ν_{opt} = 36 to 16 mm²/s
   – with hydraulic fluid based on mineral oils
3) Observe the limitation of displacement due to the counterbalance valve.
4) Torque without radial force, with radial force see page 9.

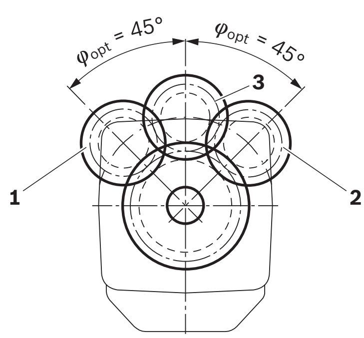
Permissible radial and axial loading on the drive shafts

Size		NG		250	355	500	1000
Drive shaft		Code		**Z, P**	**Z, P**	**Z, P**	**Z, P**
		⌀	mm	50	60	70	90
Maximum radial force at distance a (from shaft collar)		$F_{q\ max}$	N	1200[1]	1500[1]	1900[1]	2600[1]
		a	mm	41.0	52.5	52.5	67.5
Maximum torque at $F_{q\ max}$		$M_{q\ max}$	Nm	[2]	[2]	[2]	[2]
Maximum differential pressure at V_{gmax} and $F_{q\ max}$		$\Delta p_{q\ max}$	bar	[2]	[2]	[2]	[2]
Maximum axial force at standstill or depressurized operation		+ $F_{ax\ max}$	N	0	0	0	0
		– $F_{ax\ max}$	N	1200	1500	1900	2600
Permissible axial force per bar working pressure		+ $F_{ax\ perm/bar}$	N/bar	[2]	[2]	[2]	[2]

Effect of radial force F_q on bearing service life

By selecting a suitable direction of radial force F_q, the load on the bearings, caused by the internal rotary group forces can be reduced, thus optimizing the bearing service life. Recommended position of mating gear is dependent on the direction of rotation. Examples:

▼ **Gear output drive**



1 "Counter-clockwise" rotation, pressure at port **B**
2 "Clockwise" rotation, pressure at port **A**
3 "Bi-directional" direction of rotation

Notice
- ▶ The values given are maximum values and do not apply to continuous operation.
- ▶ The permissible axial force in direction $-F_{ax}$ is to be avoided as the bearing service life is reduced.
- ▶ Special requirements apply in the case of belt output drives. Please contact us.

1) When at standstill or when axial piston unit working in depressurized conditions. Higher forces are permissible under pressure, please contact us.
2) Please contact us.

HD – Proportional control, hydraulic

The proportional hydraulic control provides infinite adjustment of the displacement. The control is proportional to the pilot pressure at port **X**.

HD1, HD2, HD3

- Beginning of control at $V_{g\,max}$ (maximum torque, minimum rotational speed at minimum pilot pressure)
- End of control at $V_{g\,min}$ (minimum torque, maximum permissible rotational speed, at maximum pilot pressure)

Notice

- Maximum permissible pilot pressure: p_{St} = 100 bar
- The control oil is internally taken out of the high-pressure passage of the motor (**A** or **B**).
  For reliable control, a working pressure of at least 30 bar is required in **A** (**B**). If a control operation is performed at a working pressure < 30 bar, an auxiliary pressure of at least 30 bar must be applied at port **G** using an external check valve. For lower pressures, please contact us.
  Please note that at port **G** up to 400 bar can occur.
- Specify the desired beginning of control in plain text when ordering, e.g. beginning of control at 10 bar.
- The beginning of control and the HD-characteristic curve are influenced by case pressure. An increase in case pressure causes an increase in the beginning of control (see "Effect of case pressure on beginning of control" on page 5) and thus a parallel shift of the characteristic curve.
- A leakage flow of maximum 0.3 l/min can occur at port **X** due to internal leakage (working pressure > pilot pressure). The external control is to be suitably configured to avoid an independent build-up of pilot pressure.

Stroking time damping

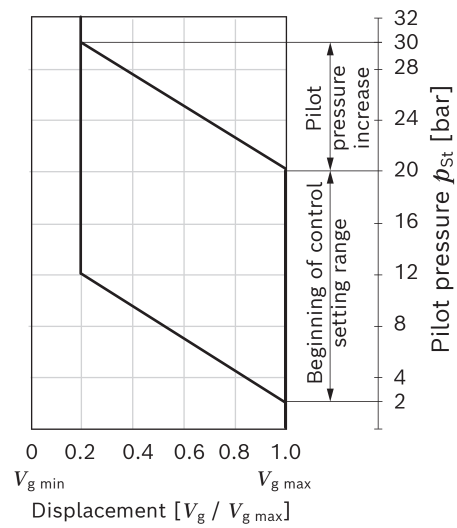
The stroking time damping impacts the swivel behavior of the motor and consequently the machine response speed.
HD1, HD2 and HD3 with nozzle (⌀1.2 mm)
HD.D, HD.G with adjustable stroking time limiting valve

HD1, pilot pressure increase Δp_{St} = 10 bar

A pilot pressure increase of 10 bar at port **X** results in a decrease in displacement from $V_{g\,max}$ to 0.2 $V_{g\,max}$.

- Beginning of control, setting range 2 to 20 bar, standard setting:
  Beginning of control at 3 bar (end of control at 13 bar)

▼ **Characteristic curve HD1**

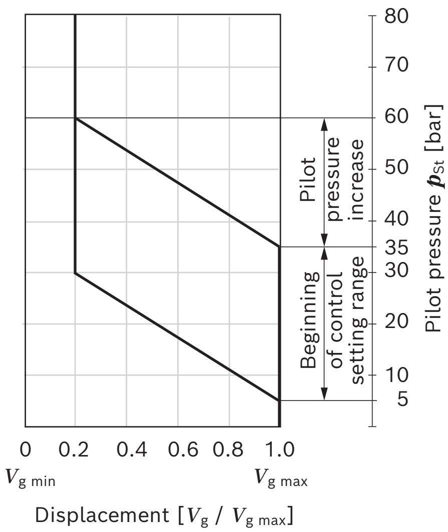


HD2, pilot pressure increase Δp_{St} = 25 bar

A pilot pressure increase of 25 bar at port **X** results in a decrease in displacement from $V_{g\,max}$ to 0.2 $V_{g\,max}$.

- Beginning of control, setting range 5 to 35 bar
  Beginning of control at 10 bar (end of control at 35 bar)

▼ **HD2 characteristic curve**

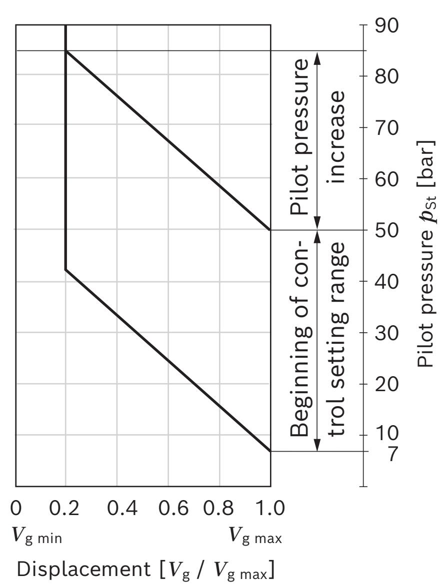


HD3, pilot pressure increase Δp_{St} = 35 bar

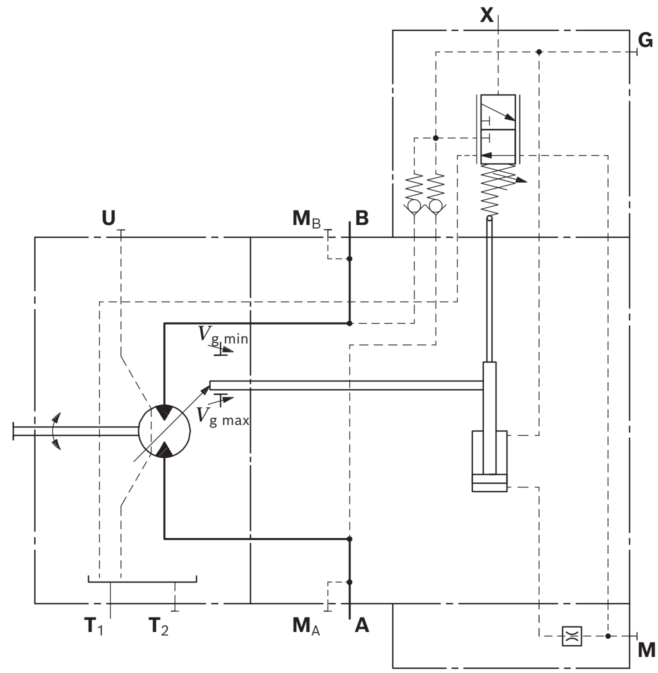
A pilot pressure increase of 35 bar at port **X** results in a decrease in displacement from $V_{g\,max}$ to 0.2 $V_{g\,max}$.

- Beginning of control, setting range 7 to 50 bar
  Beginning of control at 10 bar (end of control at 45 bar)

▼ **Characteristic curve HD3**



▼ **Circuit diagram HD1, HD2, HD3**



HD.D Pressure control, fixed setting

The pressure control overrides the HD control function.
If the load torque or a reduction in motor swivel angle causes the system pressure to reach the setpoint value of the pressure control, the motor will swivel towards a larger displacement.
The increase in displacement and the resulting reduction in pressure cause the control deviation to decrease.
With the increase in displacement the motor provides more torque, while the pressure remains constant.

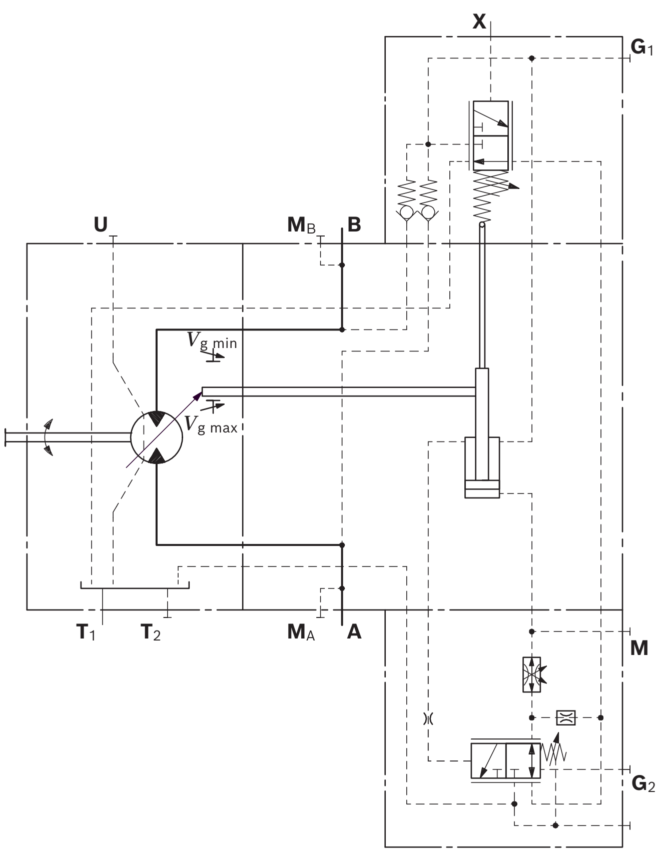
- Setting range of the pressure control valve 80 to 350 bar

Pressure control with 2nd pressure setting available as standard with HD.D.
By connecting an external pilot pressure at port **G**$_2$, the setting of the pressure controller can be overridden and a 2nd pressure setting can be realized.

- Required pilot pressure at port **G**$_2$: p_{St} ≥ 80 bar

When ordering, please specify the 2nd pressure setting in plain text.

▼ **Circuit diagram HD.D**

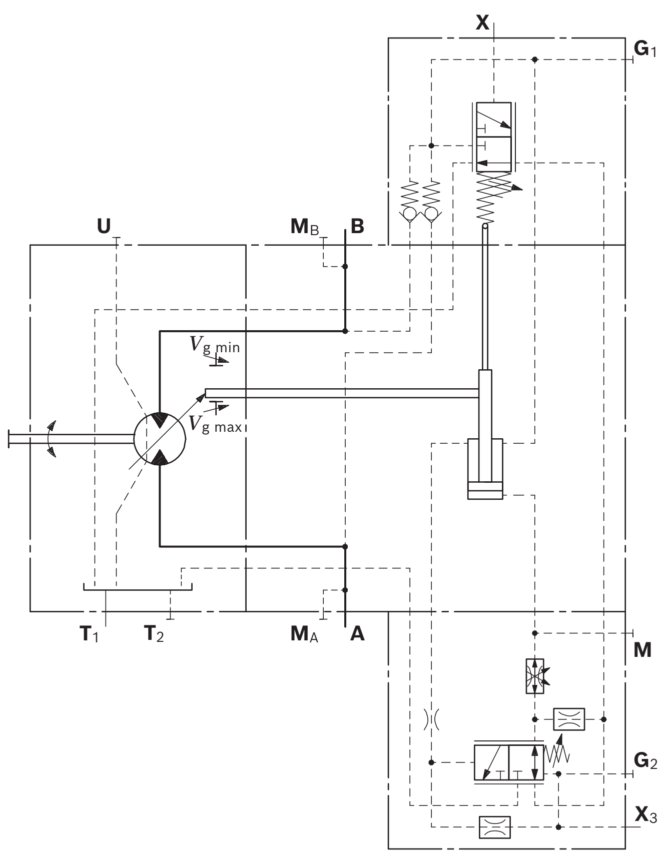


HD.G pressure control, remote controlled

The remote controlled pressure control continuously regulates the motor to maximum displacement when the pressure command value is reached $V_{g\,max}$. A pressure relief valve (not included in the scope of delivery), which is arranged separately from the motor and connected to port $\mathbf{X}_3$, controls the internal pressure cut-off valve. As long as the pressure command value is not reached, the valve is evenly pressurized from both sides in addition to the spring force and is closed. The pressure command value is between 80 bar and 350 bar. When the pressure command value at the separate pressure relief valve is reached, it opens, reducing the pressure on the spring side towards the reservoir. The internal control valve switches and the motor swivels to maximum displacement $V_{g\,max}$.

The differential pressure at the control valve is set as standard to 25 bar. A separate pressure relief valve is recommended: DBD 6 (hydraulic) as per data sheet 25402. The maximum line length should not exceed 2 m.

▼ **Circuit diagram HD.G**

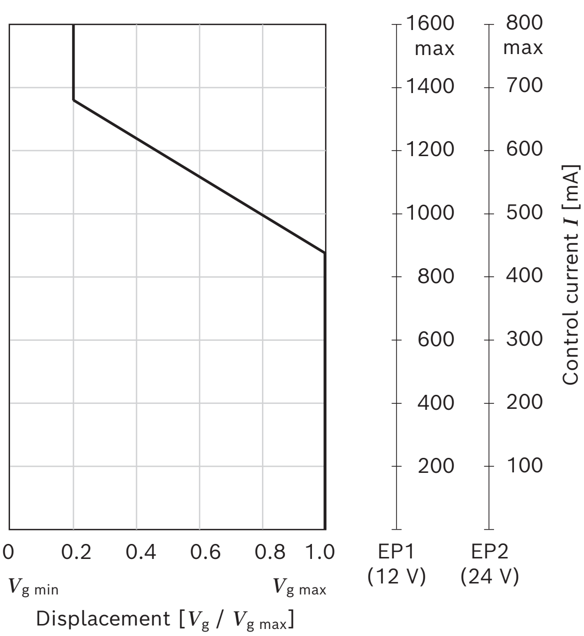


EP – Proportional control, electric

The electric control with proportional valve provides infinite adjustment of the displacement. Control is proportional to the electric control current applied to the solenoid.
An external control oil supply is connected to port **P** with a pressure of p_{min} = 30 bar is required (p_{max} = 100 bar).

- Beginning of control at $V_{g\,max}$ (maximum torque, minimum rotational speed at minimum control current)
- End of control at $V_{g\,min}$ (minimum torque, maximum permissible rotational speed at maximum control current)

▼ **Characteristic curve EP**



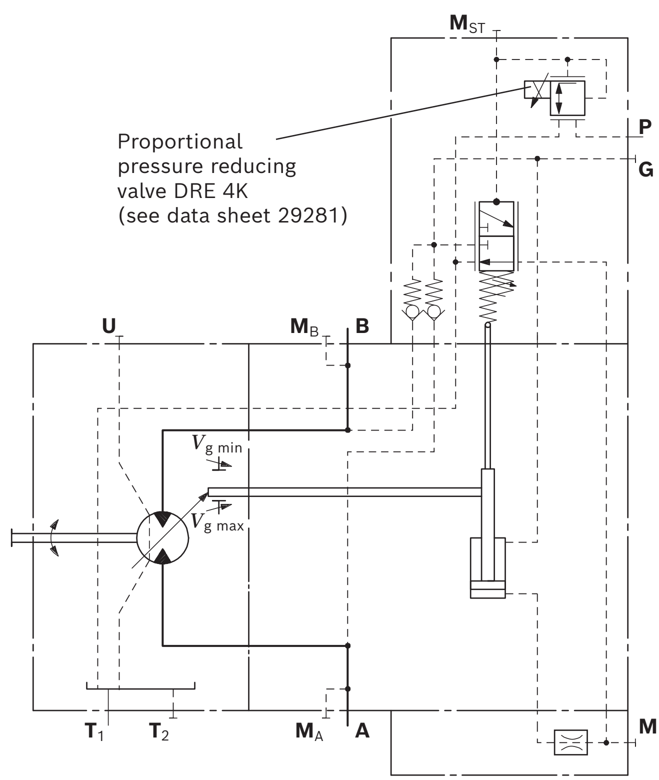
Notice

- The control oil is internally taken out of the high-pressure passage of the motor (**A** or **B**). For reliable control, a working pressure of at least 30 bar is required in **A** (**B**). If a control operation is performed at a working pressure < 30 bar, an auxiliary pressure of at least 30 bar must be applied at port **G** using an external check valve. For lower pressures at port **G**, please contact us.
  Please note that at port **G** up to 400 bar can occur.
- Please note the following:
  The beginning of control and the EP characteristic curve are influenced by the case pressure. An increase in case pressure causes an increase in the beginning of control (see "Effect of case pressure on beginning of control" on page 5) and thus a parallel shift of the characteristic curve.

Stroking time damping
The stroking time damping impacts the swivel behavior of the motor and consequently the machine response speed.
EP1, EP2 with nozzle (⌀1.2 mm)
EP.D, EP.G with adjustable stroking time limiting valve

Technical data, proportional valve	EP1	EP2
Voltage	12 V (±20%)	24 V (±20%)
Control current		
Start of control at $V_{g\,max}$	900 mA	450 mA
End of control at 0.2 $V_{g\,max}$	Approx. 1360 mA	Approx. 680 mA
Current limit	2.2 A	1.0 A
Nominal resistance (at 20°C)	2.4 Ω	12 Ω
Duty cycle	100%	100%
Type of protection: see connector version page 35		
See also Proportional pressure reducing valve DRE 4K (data sheet 29281)		

▼ **Circuit diagram EP1, EP2**



EP.D pressure control, fixed setting

The pressure control overrides the EP control function. If the load torque or a reduction in motor swivel angle causes the system pressure to reach the setpoint value of the pressure control, the motor will swivel towards a larger displacement.

The increase in displacement and the resulting reduction in pressure cause the control deviation to decrease.

With the increase in displacement the motor provides more torque, while the pressure remains constant.

- Setting range of the pressure control valve 80 to 350 bar

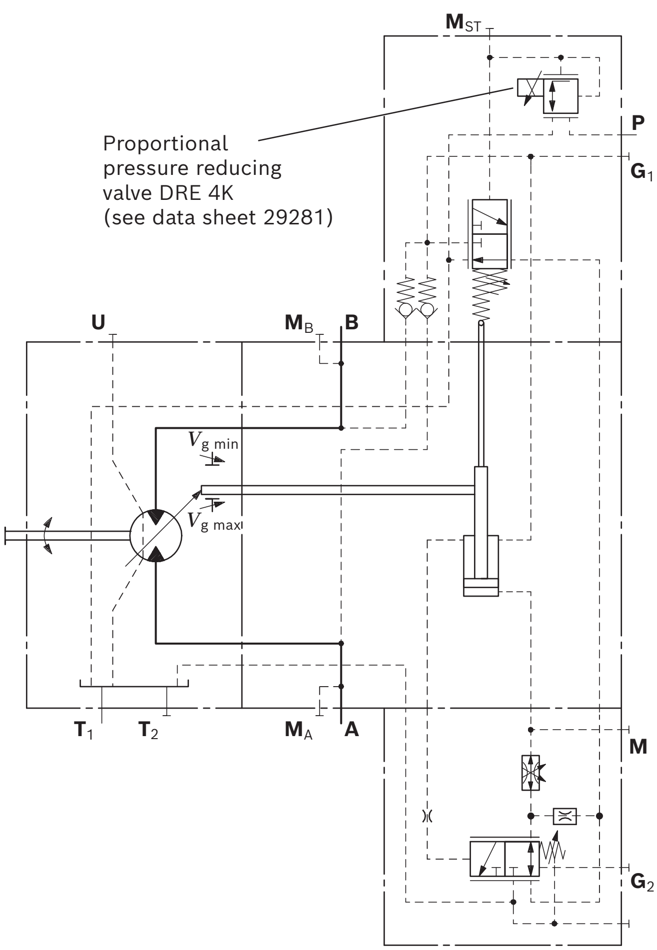
Pressure control with 2nd pressure setting is available as standard with EP.D control.

By connecting an external pilot pressure at port $\mathbf{G_2}$, the setting of the pressure controller can be overridden and a 2nd pressure setting can be realized.

- Required pilot pressure at port $\mathbf{G_2}$: $p_{St} \geq 80$ bar.

When ordering, please specify the 2nd pressure setting in plain text.

▼ **Circuit diagram EP.D**



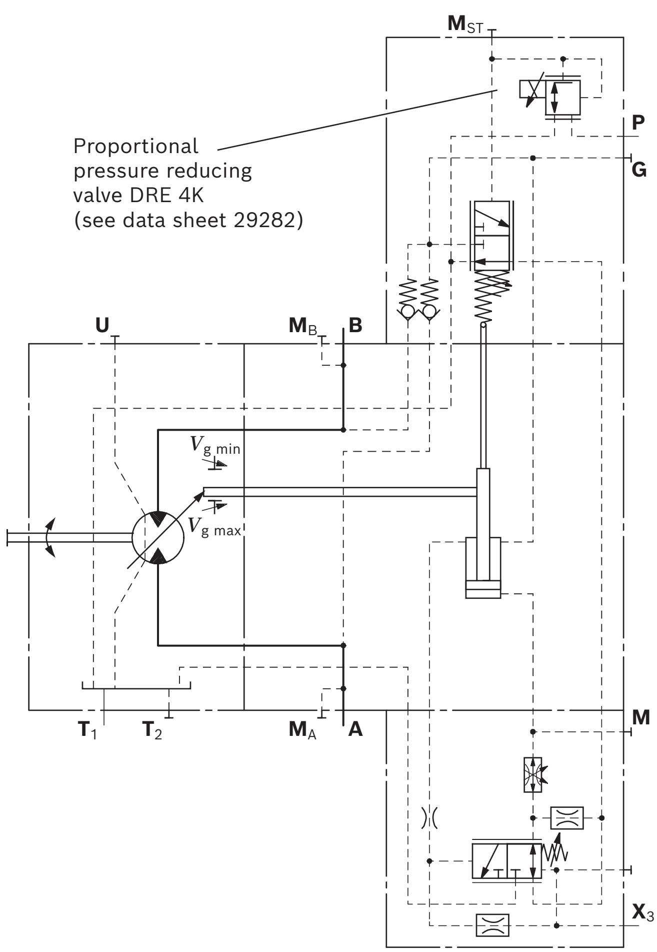
EP.G pressure control, remote controlled

The remote controlled pressure control continuously regulates the motor to maximum displacement when the pressure command value is reached $V_{g\ max}$. A pressure relief valve (not included in the scope of delivery), which is arranged separately from the motor and connected to port **X**$_3$, controls the internal pressure cut-off valve. As long as the pressure command value is not reached, the valve is evenly pressurized from both sides in addition to the spring force and is closed. The pressure command value is between 80 bar and 350 bar. When the pressure command value at the separate pressure relief valve is reached, it opens, reducing the pressure on the spring side towards the reservoir. The internal control valve switches and the motor swivels to maximum displacement $V_{g\ max}$.

- ▶ The differential pressure at the control valve is set as standard to 25 bar.

A separate pressure relief valve is recommended: DBD 6 (hydraulic) as per data sheet 25402. The maximum line length should not exceed 2 m.

▼ **Circuit diagram EP.G**

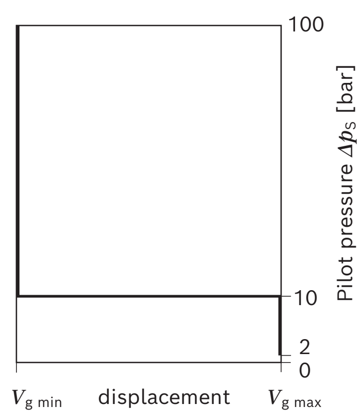


HZ – Two-point control, hydraulic

The hydraulic two-point control allows the displacement to be set to either $V_{g\,min}$ or $V_{g\,max}$ by switching the pilot pressure at port **X** on or off.

- Position at $V_{g\,max}$ (without pilot pressure, maximum torque, minimum rotational speed)
- Position at $V_{g\,min}$ (with pilot pressure > 10 bar activated, minimum torque, maximum permissible rotational speed)

▼ **Characteristic curve HZ**



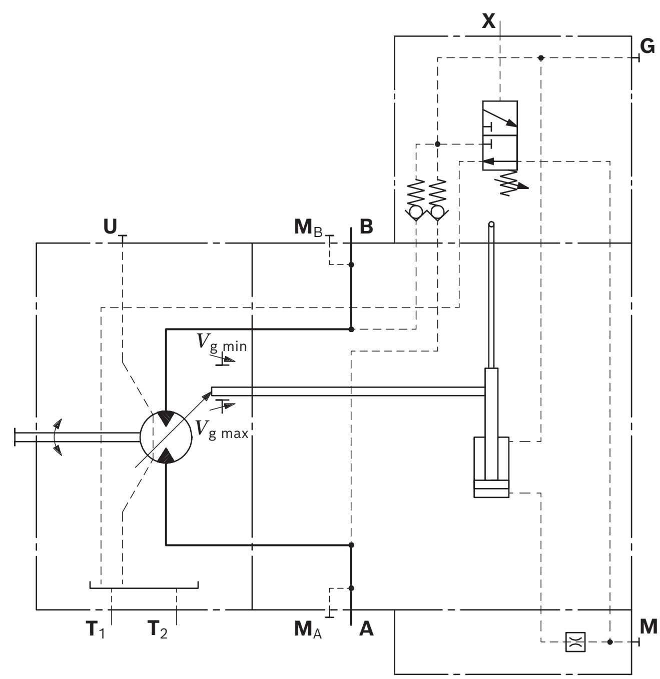
Notice

- Maximum permissible pilot pressure: 100 bar
- The control oil is internally taken out of the high-pressure passage of the motor (**A** or **B**).
  For reliable control, a working pressure of at least 30 bar is required in **A** (**B**). If a control operation is performed at a working pressure < 30 bar, an auxiliary pressure of at least 30 bar must be applied at port **G** using an external check valve. For lower pressures, please contact us.
  Please note that at port **G** up to 400 bar can occur.
- A leakage flow of maximum 0.3 l/min can occur at port **X** due to internal leakage (working pressure > pilot pressure). The external control is to be suitably configured to avoid an independent build-up of pilot pressure.

Stroking time damping

The stroking time damping impacts the swivel behavior of the motor and consequently the machine response speed.
Standard with nozzle (⌀1.2 mm)

▼ **HZ circuit diagram**



EZ – Two-point control, electric

The electric two-point control with enables the displacement to be adjusted to $V_{g\ min}$ or $V_{g\ max}$ by applying or canceling the electric current at the on/off valve.

Notice

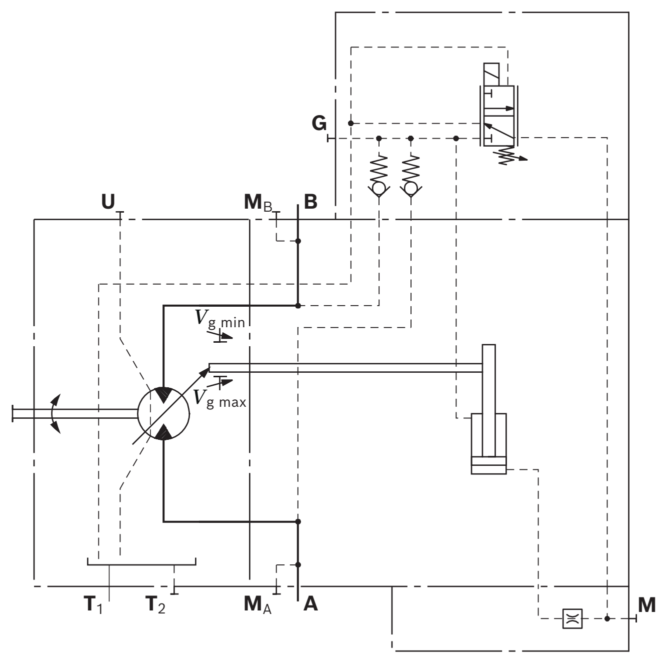
- The control oil is internally taken out of the high-pressure passage of the motor (**A** or **B**). For reliable control, a working pressure of at least 30 bar is required in **A** (**B**). If a control operation is performed at a working pressure < 30 bar, an auxiliary pressure of at least 30 bar must be applied at port **G** using an external check valve. For lower pressures, please contact us.
  Please note that at port **G** up to 400 bar can occur.

Stroking time damping

The stroking time damping impacts the swivel behavior of the motor and consequently the machine response speed.
Standard with nozzle (⌀1.2 mm)

Technical data, solenoid with Ø37	EZ1	EZ2
Voltage	12 V (±20%)	24 V (±20%)
Position $V_{g\ max}$	de-energized	de-energized
Position $V_{g\ min}$	Current switched on	Current switched on
Nominal resistance (at 20°C)	5.5 Ω	21.7 Ω
Nominal power	26.2 W	26.5 W
Minimum active current required	1.32 A	0.67 A
Duty cycle	100%	100%
Type of protection (Connector see page 35)	IP65	IP65

▼ **Circuit diagram EZ1, EZ2**



HA – Automatic control, high-pressure related

The automatic high-pressure related control adjusts the displacement automatically depending on the working pressure.
The displacement of the A6VM motor with HA control is $V_{g\,min}$ (maximum rotational speed and minimum torque). The control device measures internally the working pressure at **A** or **B** (no control line required) and upon reaching the beginning of control, the controller swivels the motor from $V_{g\,min}$ to $V_{g\,max}$. The displacement is modulated between $V_{g\,min}$ and $V_{g\,max}$ depending on the load.

HA1, HA2

- Beginning of control at $V_{g\,min}$
  (minimum torque, maximum rotational speed)
- End of control at $V_{g\,max}$
  (maximum torque, minimum rotational speed)

Notice

- For safety reasons, lifting winch drives are not permissible with beginning of control at $V_{g\,min}$ (standard for HA).
- The control oil is internally taken out of the high-pressure passage of the motor (**A** or **B**).
  For reliable control, a working pressure of at least 30 bar is required in **A** (**B**). If a control operation is performed at a working pressure < 30 bar, an auxiliary pressure of at least 30 bar must be applied at port **G** using an external check valve. For lower pressures, please contact us.
  Please note that at port **G** up to 400 bar can occur.
- The beginning of control and the HA characteristic curve are influenced by the case pressure. An increase in case pressure causes an increase in the beginning of control (see page 5) and thus a parallel shift of the characteristic curve. Only for HA.T control.
- A leakage flow of maximum 0.3 l/min occurs at port **X** (working pressure > pilot pressure). To avoid a build-up of pilot pressure, pressure must be relieved from port **X** to the reservoir. Only for HA.T control.

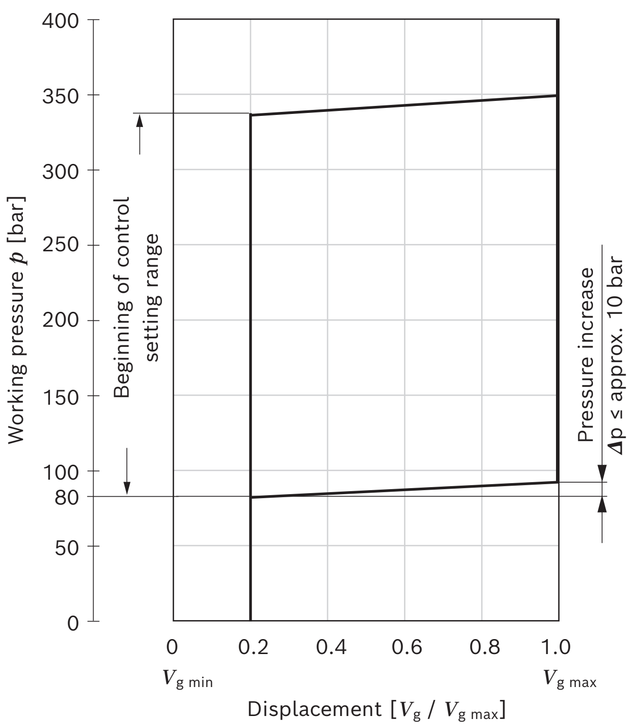
Stroking time damping

The stroking time damping impacts the swivel behavior of the motor and consequently the machine response speed.
Standard with nozzle (⌀1.2 mm)

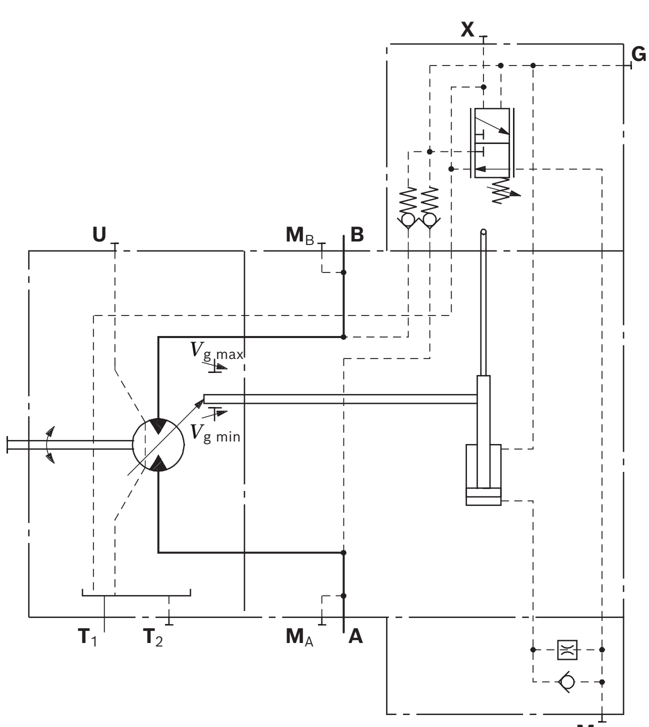
HA1 with minimum pressure increase, positive control

A working pressure increase of Δp ≤ approx. 10 bar results in an increase in displacement from $V_{g\,min}$ to $V_{g\,max}$. Setting range of the pressure control valve 80 to 340 bar, specify the desired beginning of control in plain text when ordering, e.g. beginning of control at 300 bar.

▼ **Characteristic curve HA1**



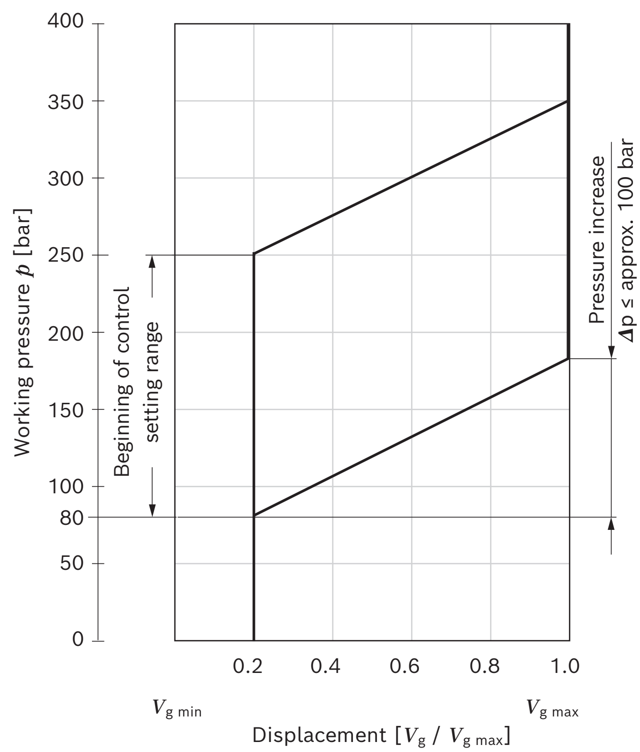
▼ **Circuit diagram HA1**



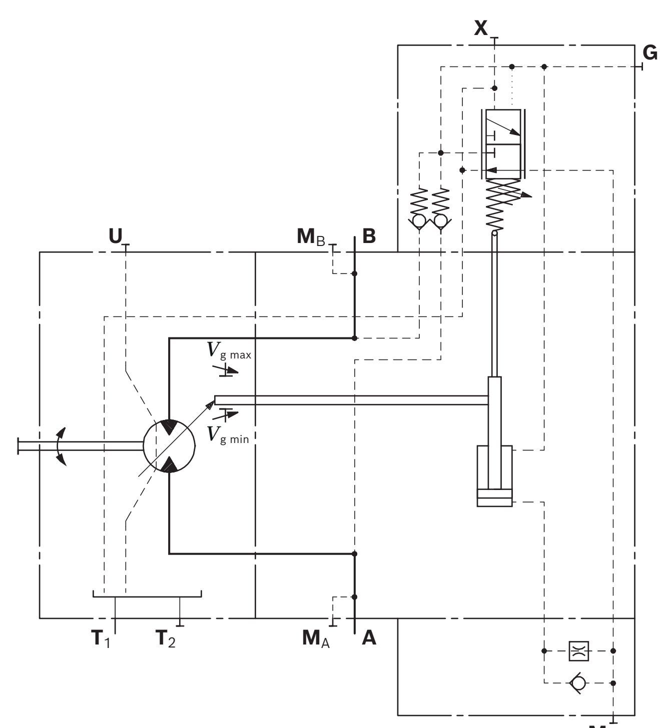
HA2 with pressure increase, positive control

A working pressure increase of Δp ≤ approx. 100 bar results in an increase in displacement from $V_{g\,min}$ to $V_{g\,max}$. Setting range of the pressure control valve 80 to 250 bar, specify the desired beginning of control in plain text when ordering, e.g. beginning of control at 200 bar.

▼ **Characteristic curve HA2**



▼ **Circuit diagram HA2**



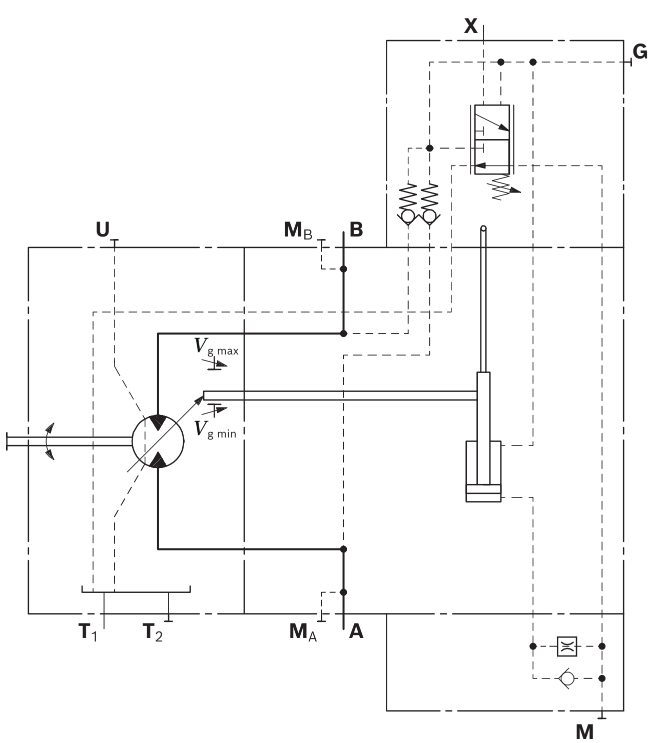
HA.T override, hydraulic remote controlled, proportional

With the HA.T control, the beginning of control can be influenced by applying a pilot pressure to port **X**.
For each 1 bar of pilot pressure increase, the beginning of control is reduced by 8 bar.
If the pilot pressure is sufficiently high, the motor swivels to $V_{g\ max.}$ regardless of the working pressure.
(Requirement for safe adjustment: minimum working pressure of 30 bar)

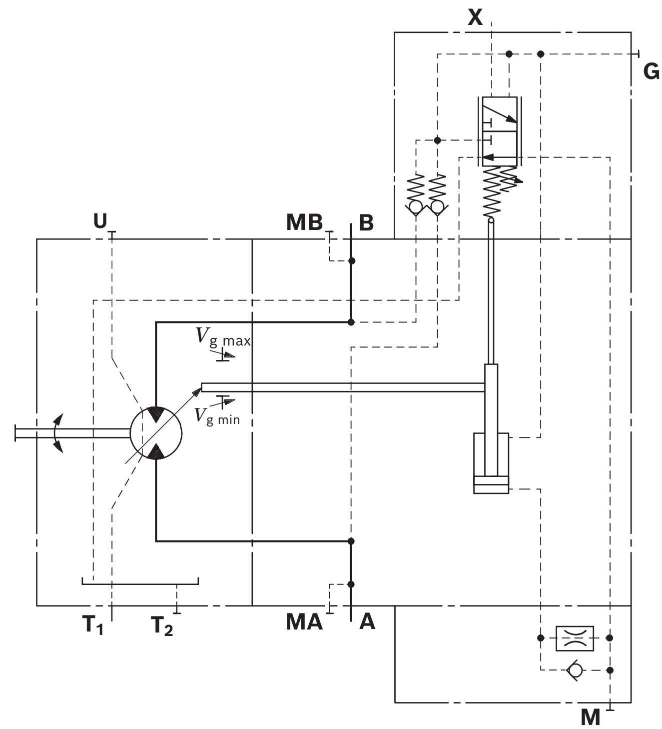
Example: Influence of pilot pressure on beginning of control (Beginning of control setting: 300 bar)			
Pilot pressure at port **X**	0 bar	10 bar	40 bar[1)]
Beginning of control at	300 bar	220 bar	0 bar

Notice
Maximum permissible pilot pressure 100 bar.

▼ **Circuit diagram HA1T**



▼ **Circuit diagram HA2T**



1) HA control overridden; motor at $V_{g\ max}$

DA – Automatic control, speed related

The variable motor A6VM with automatic speed-related control is intended for use in hydrostatic travel drives in combination with the variable pump A4VG with DA control.
A drive speed-related pilot pressure signal is generated by the A4VG variable pump, and that signal, together with the working pressure, regulates the swivel angle of the hydraulic motor.
Increasing drive speed, i.e. increasing pilot pressure, causes the motor to swivel to a smaller displacement (lower torque, higher rotational speed), depending on the working pressure.
If the working pressure exceeds the pressure command value of the controller, the variable motor swivels to a larger displacement (higher torque, lower rotational speed).

- Pressure ratio p_{St}/p_{HD} = 3/100

DA control is only suitable for certain types of travel drive systems and requires review of the motor and vehicle parameters to ensure that the motor is used correctly and that machine operation is safe and efficient.
We recommend that all DA applications be reviewed by a Bosch Rexroth application engineer.
Our Sales department will provide you detailed information.

Notice

- The beginning of control and the DA characteristic curve are influenced by case pressure. An increase in case pressure causes a reduction in the beginning of control (see "Effect of case pressure on beginning of control" on page 5) and thus a parallel shift of the characteristic curve.

Stroking time damping

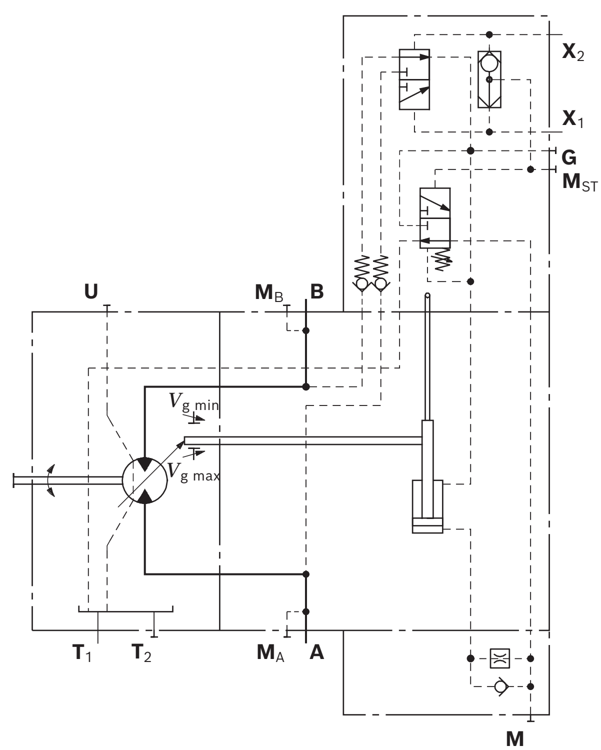
The stroking time damping impacts the swivel behavior of the motor and consequently the machine response speed.
Standard with nozzle (Ø1.2 mm)

Hydraulic travel direction valve

Depending on the direction of rotation (travel direction), the travel direction valve is switched by using pilot pressure ports **X**$_1$ or **X**$_2$. The maximum permissible pilot pressure is p_{st} = 25 bar. Momentary (t < 0.1 s) pressure peaks of up to 40 bar are permitted.

Direction of rotation	Working pressure in	Pilot pressure in
Clockwise	**A**	**X**$_1$
Counter-clockwise	**B**	**X**$_2$

▼ **Circuit diagram DA**

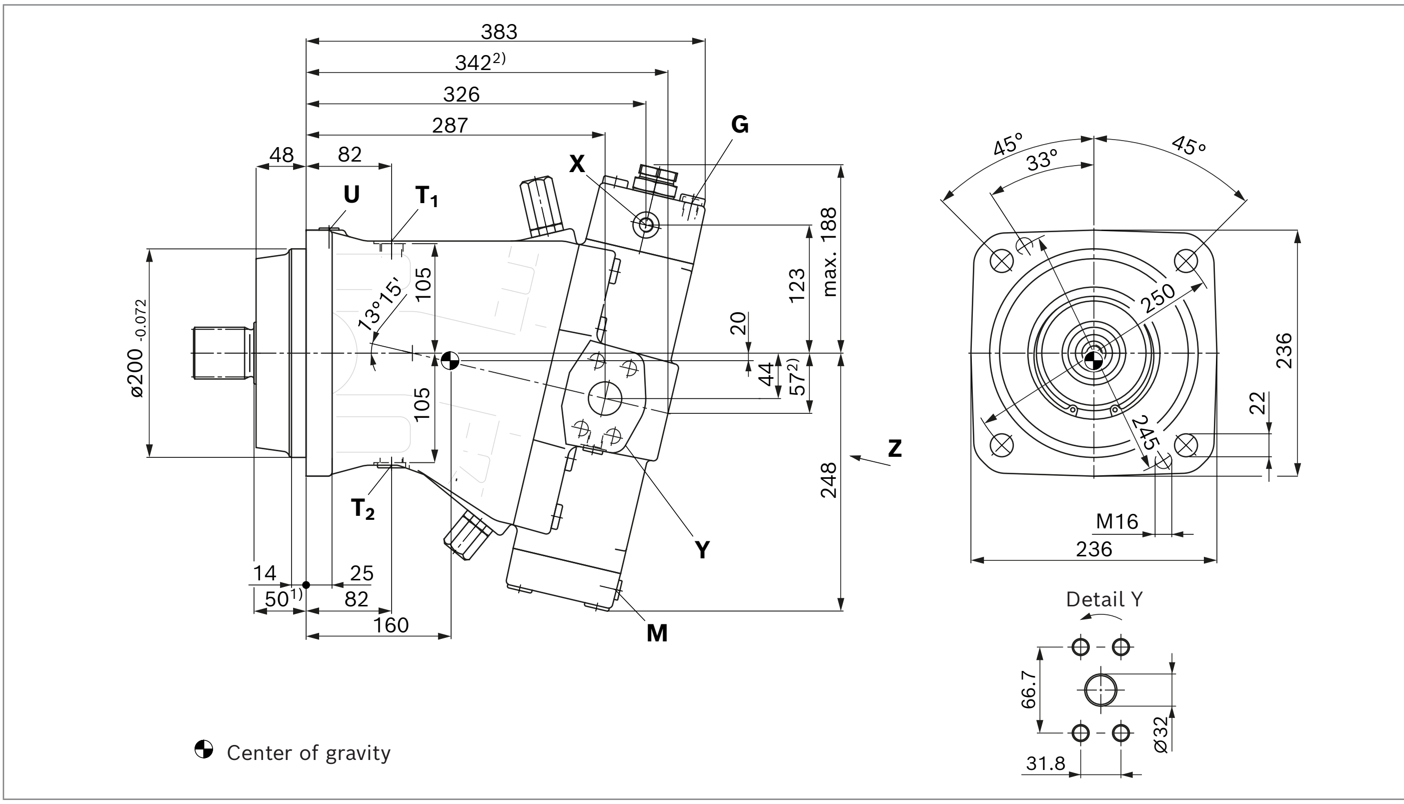


Dimensions, size 250

HD1, HD2, HD3 – Proportional control, hydraulic

HZ – Two-point control, hydraulic

Port plate 02 — SAE working ports **A** and **B** at side, opposite

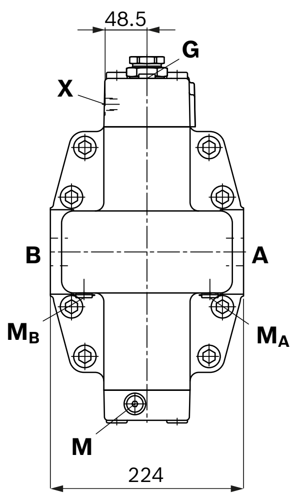


Ports		Standard	Size	p_{max} [bar][3)]	State[7)]
A, B	Working port Fastening thread A/B	SAE J518[4)] DIN 13	1 1/4 in M14 × 2; 19 deep	400	O
A_1, B_1	Additional working port for plate 15 Fastening thread A_1/B_1	SAE J518[4)] DIN 13	1 1/4 in M14 × 2; 19 deep	400	O
T_1	Drain port	DIN 3852[6)]	M22 × 1.5; 14 deep	3	O[5)]
T_2	Drain port	DIN 3852[6)]	M22 × 1.5; 14 deep	3	X[5)]
G (G_1)	Synchronous control	DIN 3852[6)]	M14 × 1.5; 12 deep	400	X
G_2	2nd pressure setting (HD.D, EP.D)	DIN 3852[6)]	M14 × 1.5; 12 deep	400	X
P	Pilot oil supply (EP)	DIN 3852[6)]	M14 × 1.5; 12 deep	100	O
U	Bearing flushing	DIN 3852[6)]	M14 × 1.5; 12 deep	3	X
X	Pilot signal (HD, HZ, HA1T/HA2T)	DIN 3852[6)]	M14 × 1.5; 12 deep	100	O
X	Pilot signal (HA1, HA2)	DIN 3852[6)]	M14 × 1.5; 12 deep	3	X
X_1, X_2	Pilot signal (DA)	DIN 2353-CL	8B-ST	40	O
X_3	Pilot signal (HD.G, EP.G)	DIN 3852[6)]	M14 × 1.5; 12 deep	400	O
M	Stroking chamber measurement	DIN 3852[6)]	M14 × 1.5; 12 deep	400	X
M_A, M_B	Measuring pressure A/B	DIN 3852[6)]	M14 × 1.5; 12 deep	400	X
M_{St}	Pilot pressure measuring	DIN 3852[6)]	M14 × 1.5; 12 deep	400	X

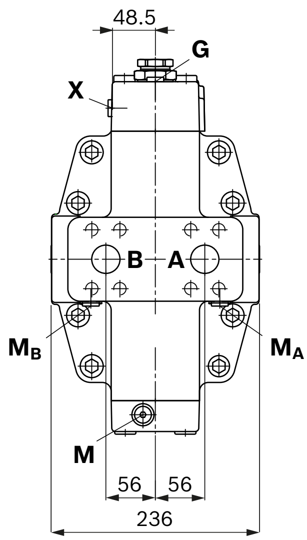
1) To shaft collar
2) Port plate 1/15 – SAE working ports **A** and **B** at rear
3) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.
5) Depending on installation position, **T_1** or **T_2** must be connected (see also installation instructions on page 39).
6) The countersink may be deeper than specified in the standard.
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

▼ Location of working ports on the port plates (View **Z**)

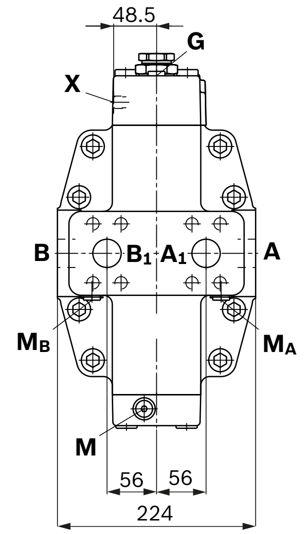
02 SAE working ports **A** and **B** at side, opposite



01 SAE working ports **A** and **B** at rear

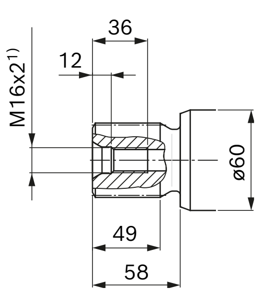


15 SAE working ports **A** and **B** at side, opposite, A_1 and B_1 at rear



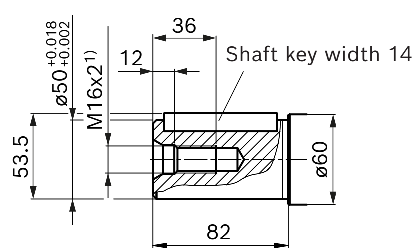
▼ Splined shaft DIN 5480

Z – W50×2×24×9g



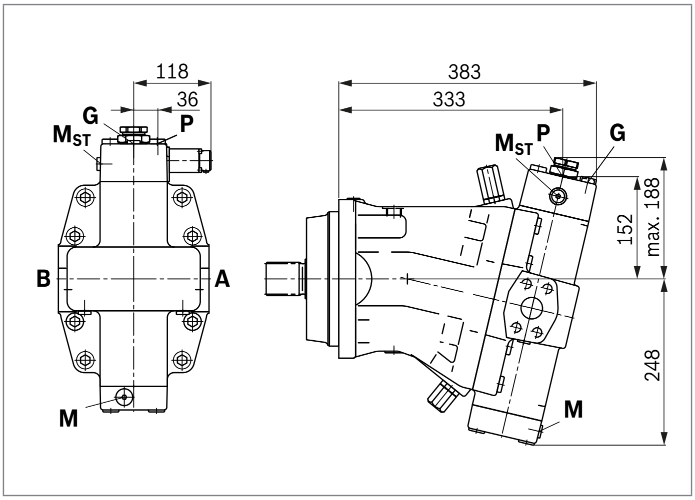
▼ Parallel keyed shaft DIN 6885

P – AS14×9×80

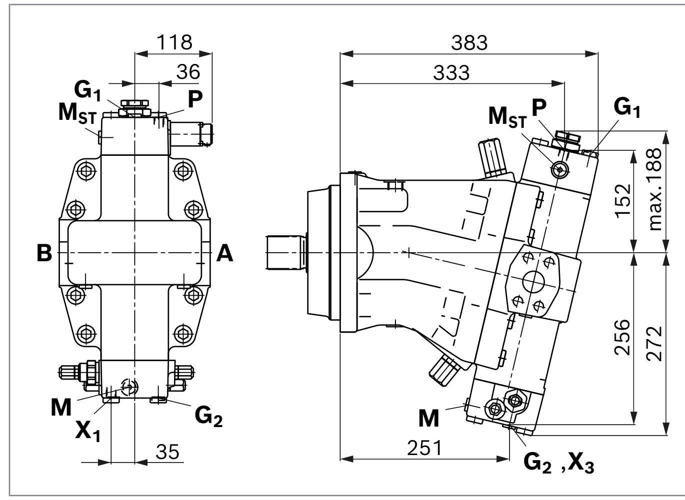


1) Center bore according to DIN 332 (thread according to DIN 13)

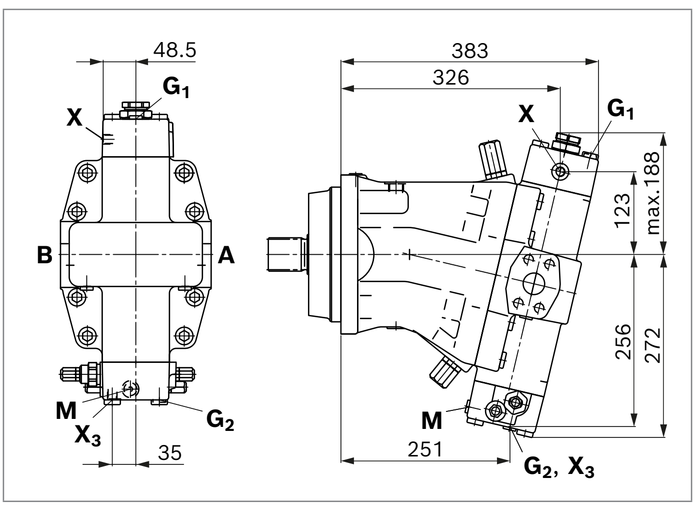
▼ **EP1, EP2** – Proportional control, electric



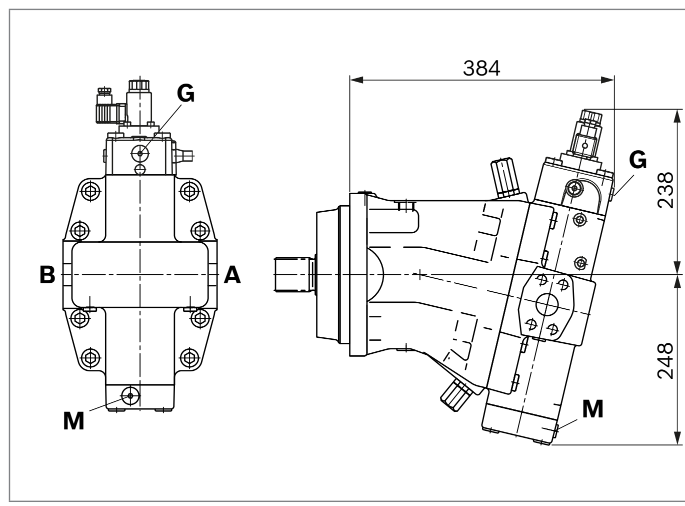
▼ **EP.D, EP.G** – Proportional control, electric, with fixed pressure control setting; remote controlled (EP.G)



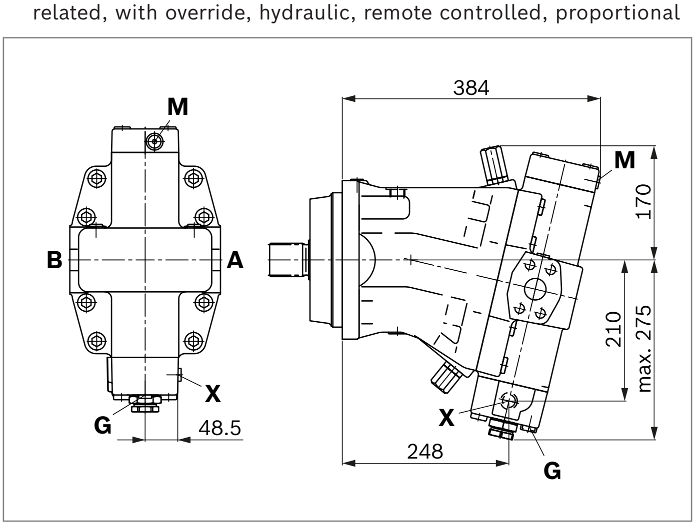
▼ **HD.D, HD.G** – Proportional control, hydraulic, with fixed pressure control setting; remote controlled (HD.G)



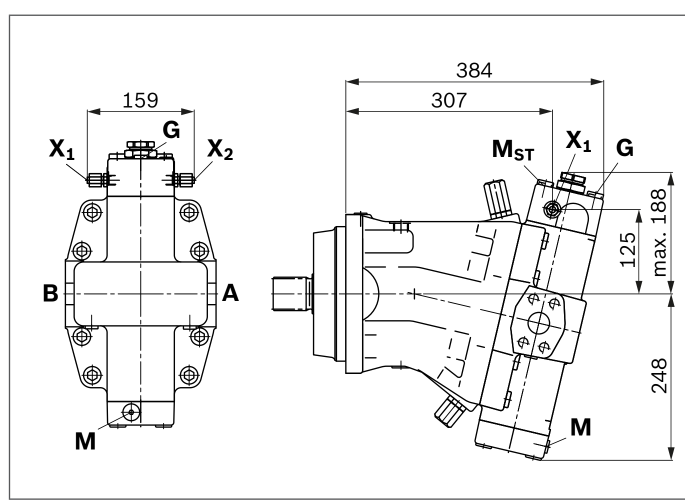
▼ **EZ1, EZ2** – Two-point control, electric



▼ **HA1, HA2 / HA1T, HA2T** – Automatic control, high-pressure related, with override, hydraulic, remote controlled, proportional



▼ **DA** – Automatic control, speed related, with hydraulic travel direction valve

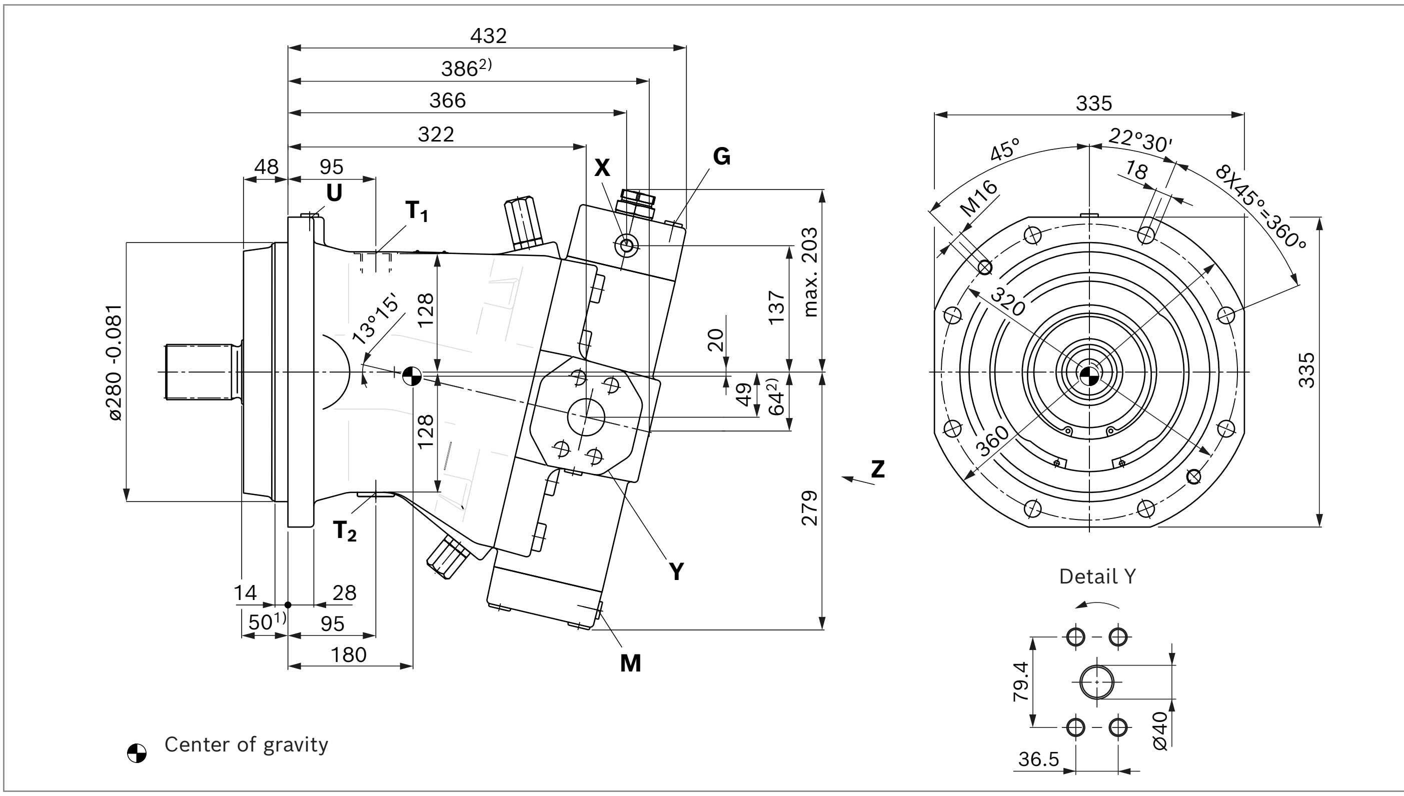


Dimensions, size 355

HD1, HD2 – Proportional control, hydraulic

HZ – Two-point control, hydraulic

Port plate 02 — SAE working ports **A** and **B** at side, opposite

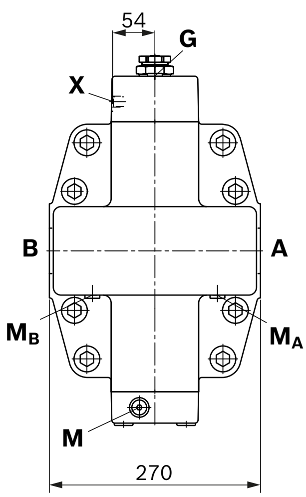


Ports		Standard	Size	p_{max} **[bar]**[3)]	State[7)]
A, B	Working port Fastening thread A/B	SAE J518[4)] DIN 13	1 1/2 in M16 × 2; 24 deep	400	O
A$_1$, **B**$_1$	Additional working port for plate 15 Fastening thread A$_1$/B$_1$	SAE J518[4)] DIN 13	1 1/2 in M16 × 2; 24 deep	400	O
T$_1$	Drain port	DIN 3852[6)]	M33 × 2; 18 deep	3	O[5)]
T$_2$	Drain port	DIN 3852[6)]	M33 × 2; 18 deep	3	X[5)]
G (**G**$_1$)	Synchronous control	DIN 3852[6)]	M14 × 1.5; 12 deep	400	X
G$_2$	2nd pressure setting (HD.D, EP.D)	DIN 3852[6)]	M14 × 1.5; 12 deep	400	X
P	Pilot oil supply (EP)	DIN 3852[6)]	M14 × 1.5; 12 deep	100	O
U	Bearing flushing	DIN 3852[6)]	M14 × 1.5; 12 deep	3	X
X	Pilot signal (HD, HZ, HA1T/HA2T)	DIN 3852[6)]	M14 × 1.5; 12 deep	100	O
X	Pilot signal (HA1, HA2)	DIN 3852[6)]	M14 × 1.5; 12 deep	3	X
X$_1$, **X**$_2$	Pilot signal (DA)	DIN 2353-CL	8B-ST	40	O
X$_3$	Pilot signal (HD.G, EP.G)	DIN 3852[6)]	M14 × 1.5; 12 deep	400	O
M	Stroking chamber measurement	DIN 3852[6)]	M14 × 1.5; 12 deep	400	X
M$_A$, **M**$_B$	Measuring pressure A/B	DIN 3852[6)]	M14 × 1.5; 12 deep	400	X
M$_{ST}$	Pilot pressure measuring	DIN 3852[6)]	M14 × 1.5; 12 deep	400	X

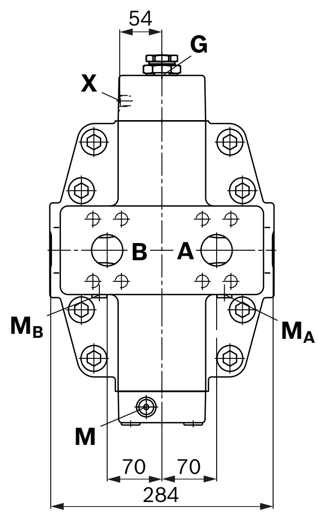
1) To shaft collar
2) Port plate 1/15 – SAE working ports **A** and **B**
3) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.
5) Depending on installation position, **T**$_1$ or **T**$_2$ must be connected (see also installation instructions on page 39).
6) The countersink may be deeper than specified in the standard.
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

▼ **Location of working ports on the port plates** (View **Z**)

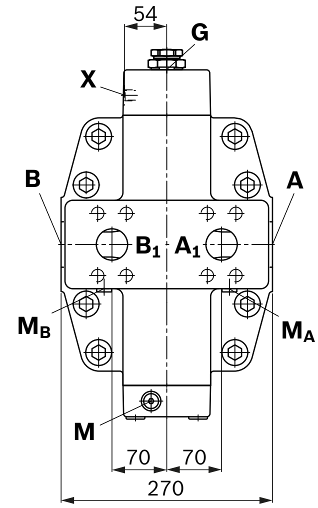
02 SAE working ports **A** and **B** at side, opposite



01 SAE working ports **A** and **B** at rear

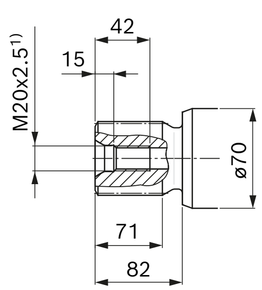


15 SAE working ports **A** and **B** at side, opposite, $\mathbf{A}_1$ and $\mathbf{B}_1$ at rear



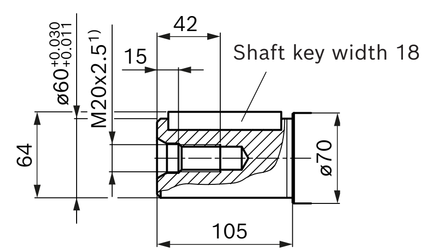
▼ **Splined shaft DIN 5480**

Z – W60×2×28×9g



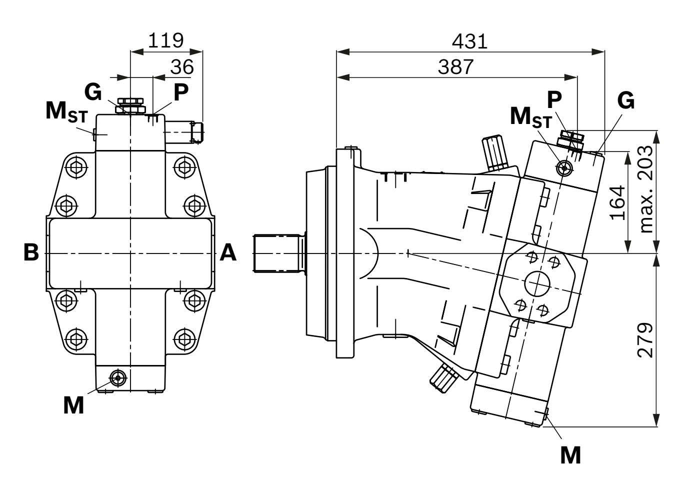
▼ **Parallel keyed shaft DIN 6885**

P – AS18×11×100

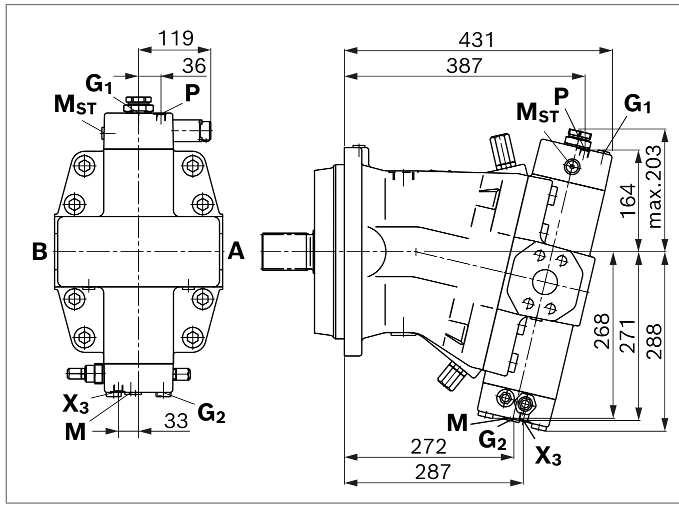


1) Center bore according to DIN 332 (thread according to DIN 13)

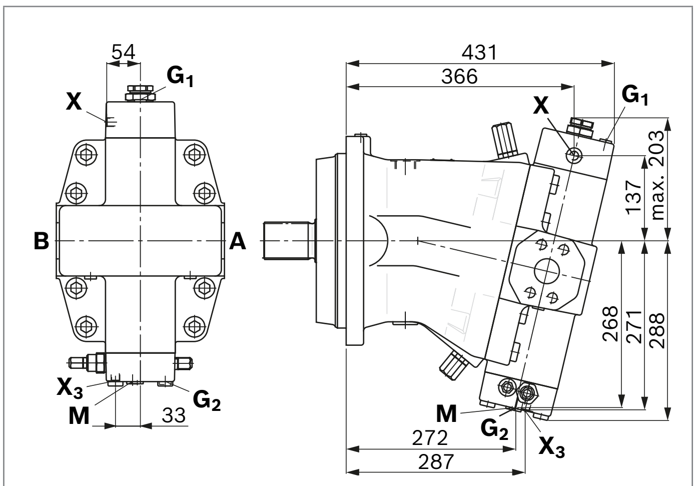
▼ **EP1, EP2** – Proportional control, electric



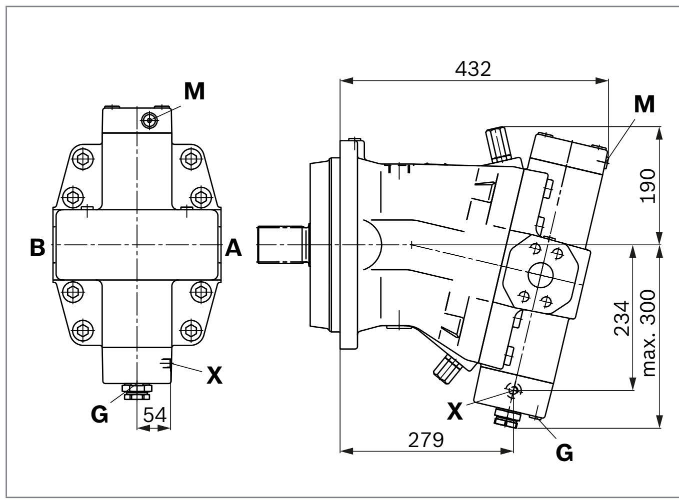
▼ **EP.D, EP.G** – Proportional control, electric, with fixed pressure control setting; remote controlled (EP.G)



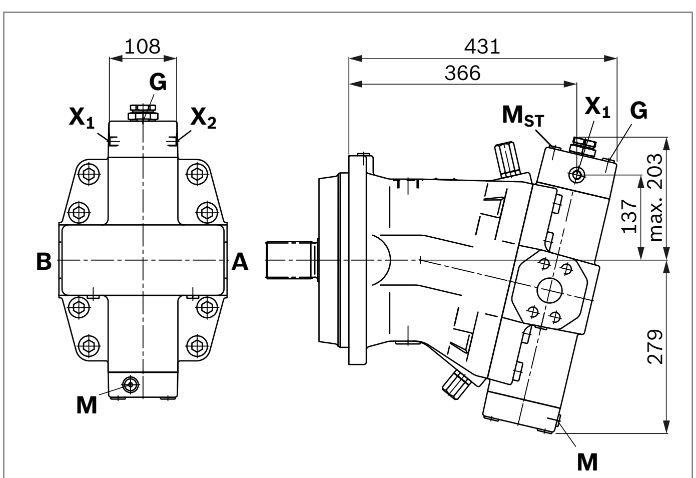
▼ **HD.D, HD.G** – Proportional control, hydraulic, with fixed pressure control setting; remote controlled (HD.G)



▼ **HA1, HA2 / HA1T, HA2T** – Automatic control, high-pressure related, with override, hydraulic, remote controlled, proportional



▼ **DA** – Automatic control, speed related, with hydraulic travel direction valve

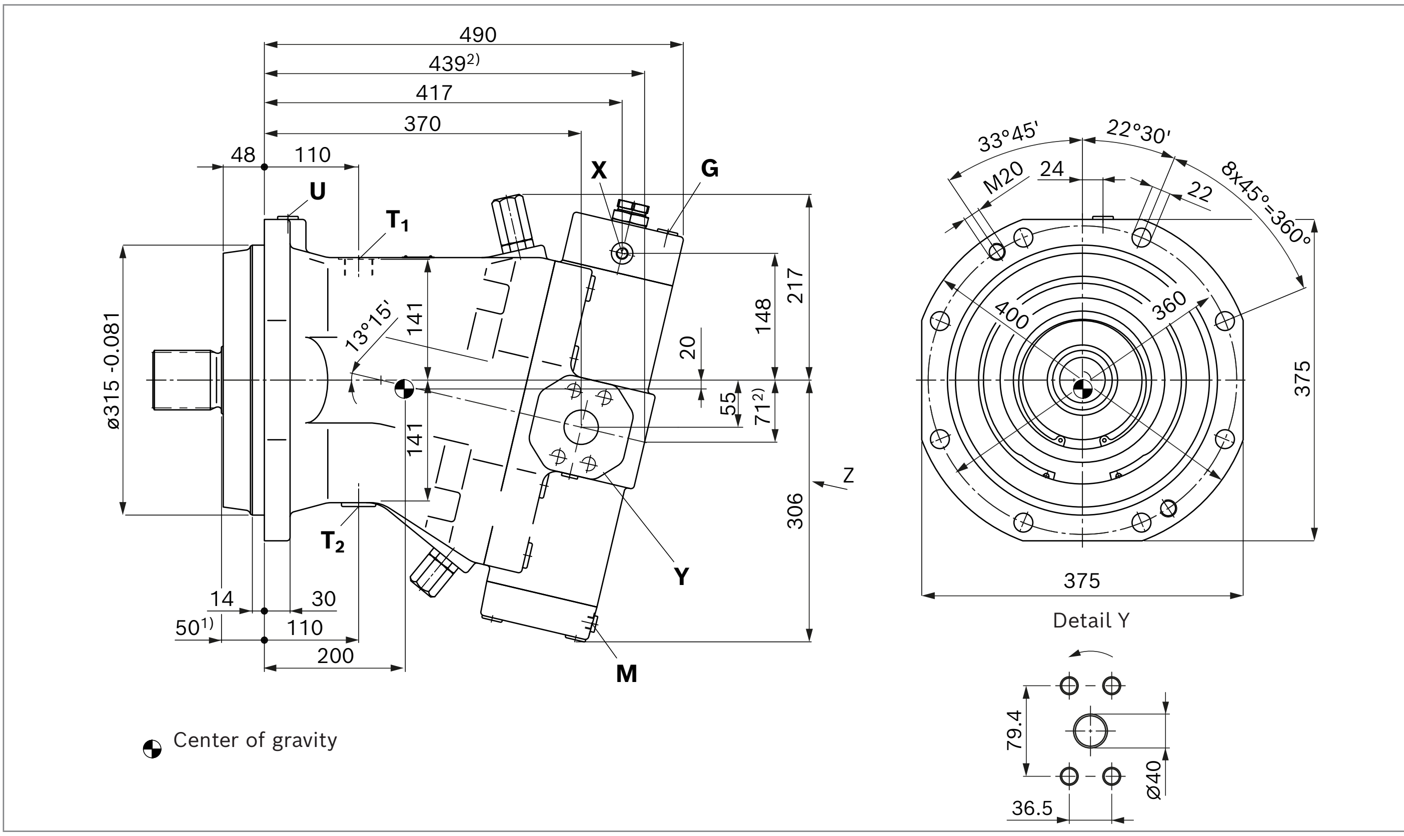


Dimensions, size 500

HD1, HD2 – Proportional control, hydraulic

HZ – Two-point control, hydraulic

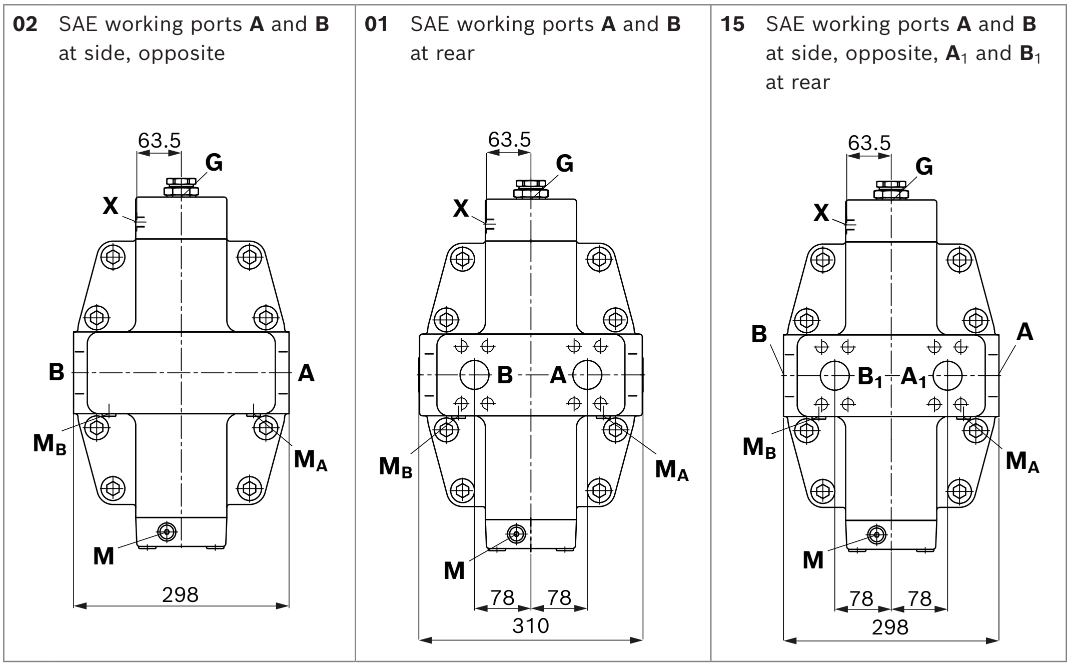
Port plate 02 — SAE working ports **A** and **B** at side, opposite



Ports		Standard	Size	p_{max} [bar][3]	State[7]
A, B	Working port Fastening thread A/B	SAE J518[4] DIN 13	1 1/2 in M16 × 2; 24 deep	400	O
A$_1$, **B**$_1$	Additional working port for plate 15 Fastening thread A_1/B_1	SAE J518[4] DIN 13	1 1/2 in M16 × 2; 24 deep	400	O
T$_1$	Drain port	DIN 3852[6]	M33 × 2; 18 deep	3	O[5]
T$_2$	Drain port	DIN 3852[6]	M33 × 2; 18 deep	3	X[5]
G (**G**$_1$)	Synchronous control	DIN 3852[6]	M18 × 1.5; 12 deep	400	X
G$_2$	2nd pressure setting (HD.D, EP.D)	DIN 3852[6]	M18 × 1.5; 12 deep	400	X
P	Pilot oil supply (EP)	DIN 3852[6]	M14 × 1.5; 12 deep	100	O
U	Bearing flushing	DIN 3852[6]	M18 × 1.5; 12 deep	3	X
X	Pilot signal (HD, HZ, HA1T/HA2T)	DIN 3852[6]	M14 × 1.5; 12 deep	100	O
X	Pilot signal (HA1, HA2)	DIN 3852[6]	M14 × 1.5; 12 deep	3	X
X$_1$, **X**$_2$	Pilot signal (DA)	DIN 2353-CL	8B-ST	40	O
X$_3$	Pilot signal (HD.G, EP.G)	DIN 3852[6]	M14 × 1.5; 12 deep	400	O
M	Stroking chamber measurement	DIN 3852[6]	M14 × 1.5; 12 deep	400	X
M$_A$, **M**$_B$	Measuring pressure A/B	DIN 3852[6]	M14 × 1.5; 12 deep	400	X
M$_{St}$	Pilot pressure measuring	DIN 3852[6]	M14 × 1.5; 12 deep	400	X

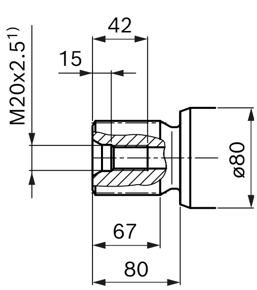
1) To shaft collar
2) Port plate 1/15 – SAE working ports **A** and **B** at rear
3) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.
5) Depending on installation position, **T**$_1$ or **T**$_2$ must be connected (see also installation instructions on page 39).
6) The countersink may be deeper than specified in the standard.
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

▼ **Location of working ports on the port plates** (View **Z**)



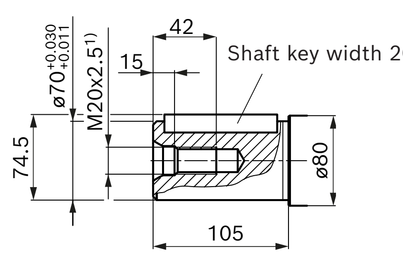
▼ **Splined shaft DIN 5480**

Z – W70×3×22×9g



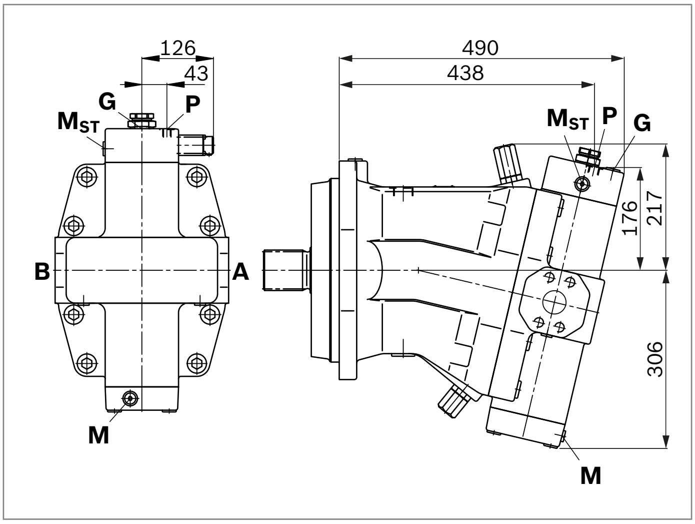
▼ **Parallel keyed shaft DIN 6885**

P – AS20×12×100

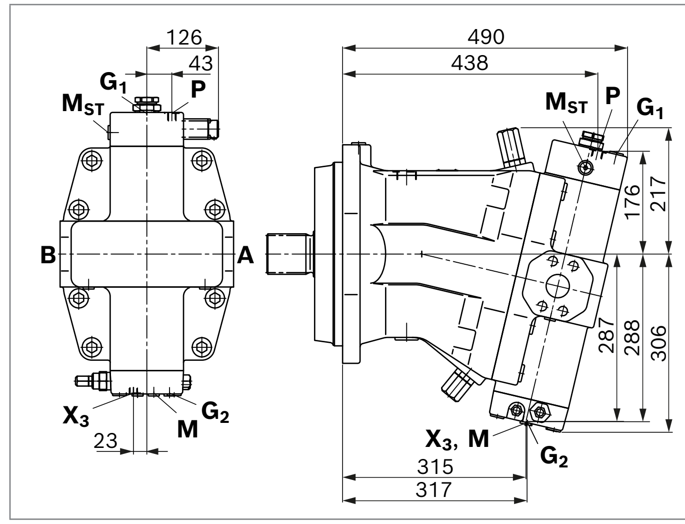


1) Center bore according to DIN 332 (thread according to DIN 13)

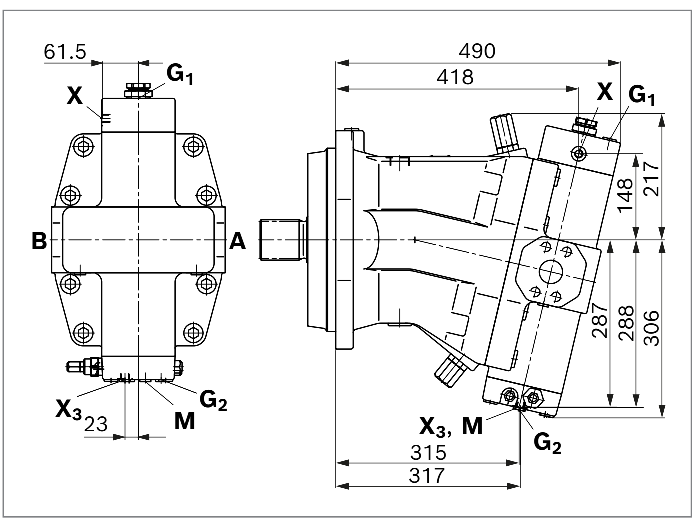
▼ **EP1, EP2** – Proportional control, electric



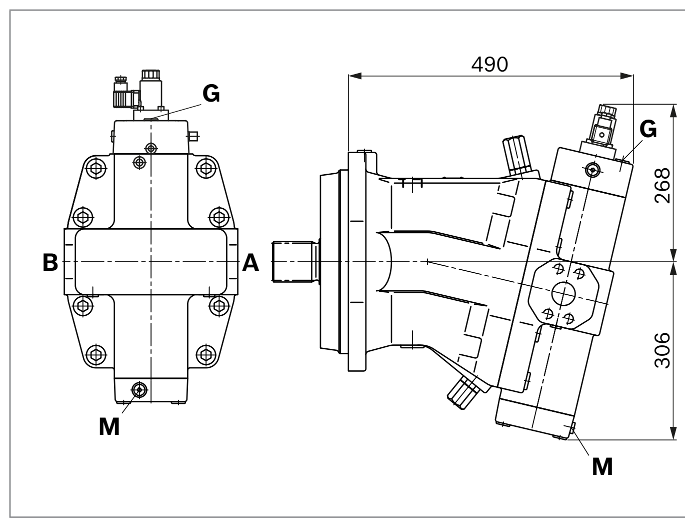
▼ **EP.D, EP.G** – Proportional control, electric, with fixed pressure control setting; remote controlled (EP.G)



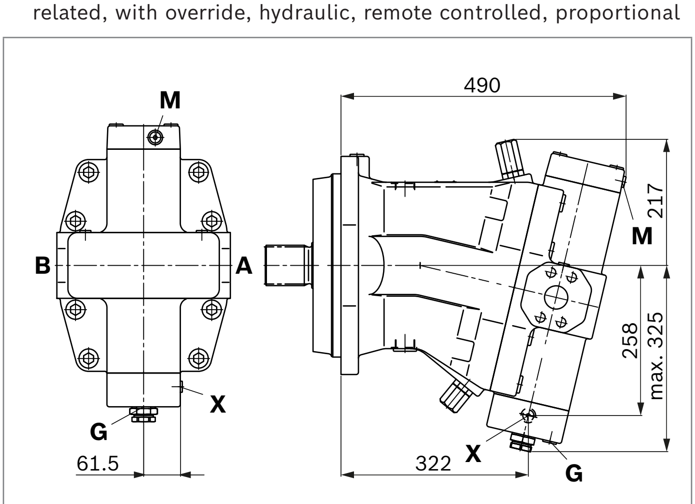
▼ **HD.D, HD.G** – Proportional control, hydraulic, with fixed pressure control setting; remote controlled (HD.G)



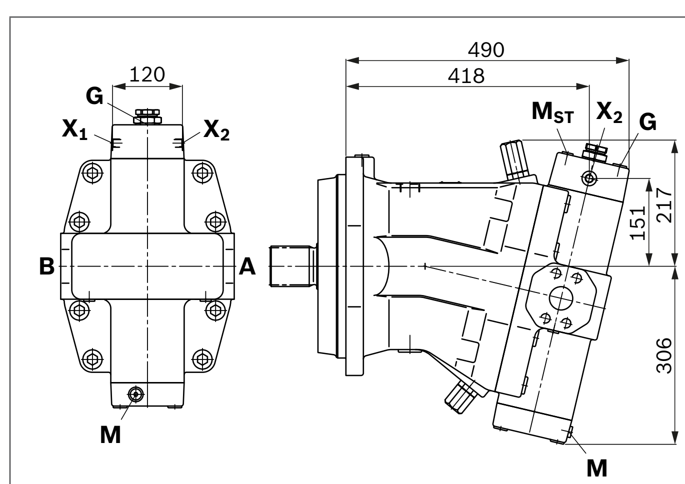
▼ **EZ1, EZ2** – Two-point control, electric



▼ **HA1, HA2 / HA1T, HA2T** – Automatic control, high-pressure related, with override, hydraulic, remote controlled, proportional



▼ **DA** – Automatic control, speed related, with hydraulic travel direction valve

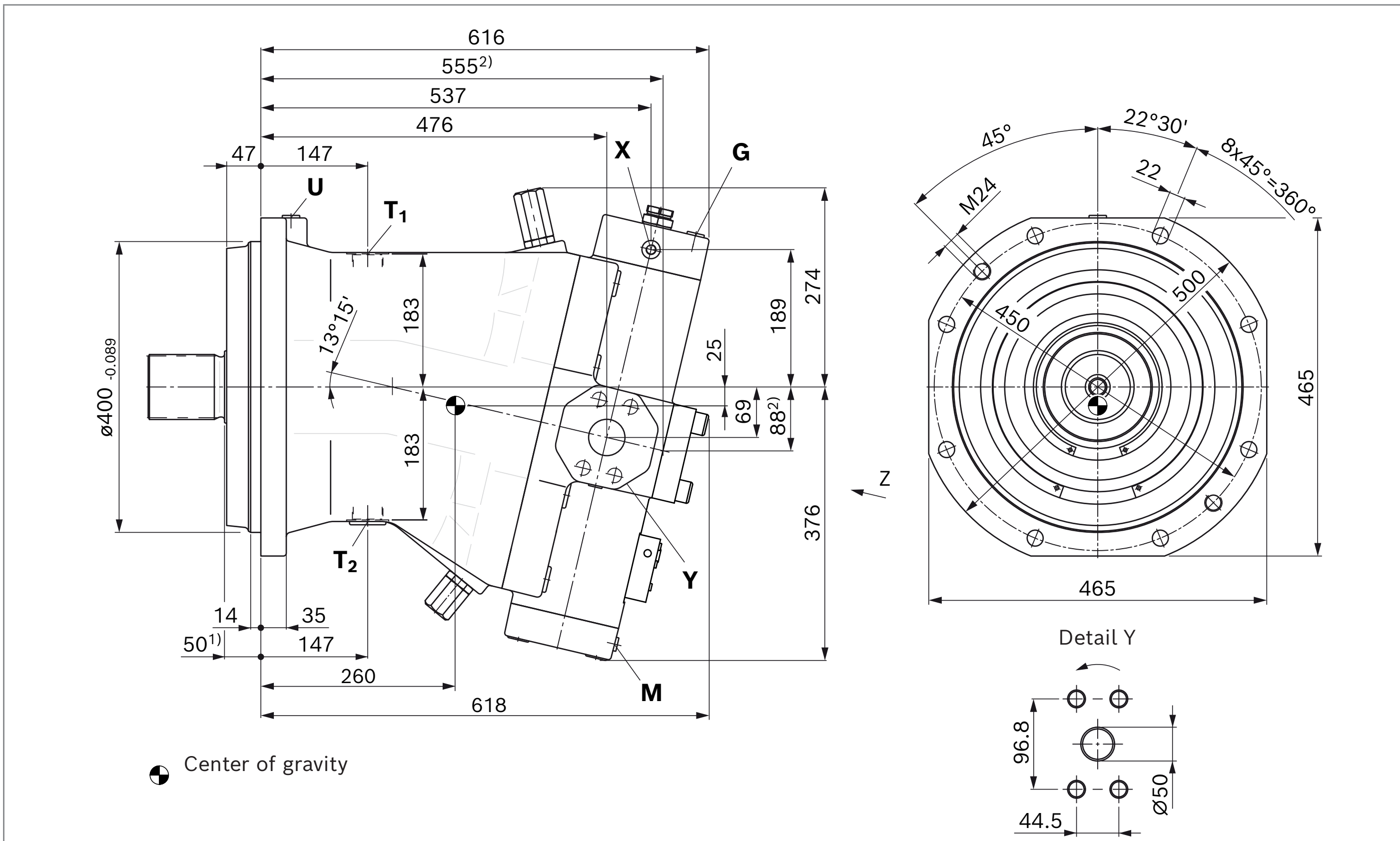


Dimensions, size 1000

HD1, HD2 – Proportional control, hydraulic

HZ – Two-point control, hydraulic

Port plate 02 — SAE working ports **A** and **B** at side, opposite

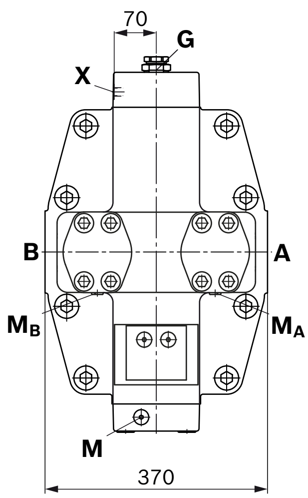


Ports		Standard	Size	p_{max} **[bar]**[3)]	State[7)]
A, B	Working port Fastening thread A/B	SAE J518[4)] DIN 13	2 in M20 × 2.5; 24 deep	400	O
A_1, B_1	Additional working port for plate 15 Fastening thread A_1/B_1	SAE J518[4)] DIN 13	2 in M20 × 2.5; 24 deep	400	O
T_1	Drain port	DIN 3852[6)]	M42 × 2; 20 deep	3	O[5)]
T_2	Drain port	DIN 3852[6)]	M42 × 2; 20 deep	3	X[5)]
G (G_1)	Synchronous control	DIN 3852[6)]	M18 × 1.5; 12 deep	400	X
G_2	2nd pressure setting (HD.E, EP.E)	DIN 3852[6)]	M18 × 1.5; 12 deep	400	X
P	Pilot oil supply (EP)	DIN 3852[6)]	M14 × 1.5; 12 deep	100	O
U	Bearing flushing	DIN 3852[6)]	M18 × 1.5; 12 deep	3	X
X	Pilot signal (HD, HZ, HA1T/HA2T)	DIN 3852[6)]	M14 × 1.5; 12 deep	100	O
X	Pilot signal (HA1, HA2)	DIN 3852[6)]	M14 × 1.5; 12 deep	3	X
X_3	Pilot signal (HD.G, EP.G)	DIN 3852[6)]	M14 × 1.5; 12 deep	400	O
M	Stroking chamber measurement	DIN 3852[6)]	M14 × 1.5; 12 deep	400	X
M_A, M_B	Measuring pressure A/B	DIN 3852[6)]	M14 × 1.5; 12 deep	400	X
M_{St}	Pilot pressure measuring	DIN 3852[6)]	M14 × 1.5; 12 deep	400	X

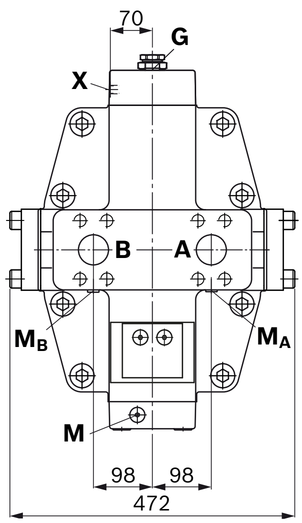
1) To shaft collar
2) Port plate 1/15 – SAE working ports **A** and **B** at rear
3) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.
5) Depending on installation position, **T_1** or **T_2** must be connected (see also installation instructions on page 39).
6) The countersink may be deeper than specified in the standard.
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

▼ **Location of working ports on the port plates** (View **Z**)

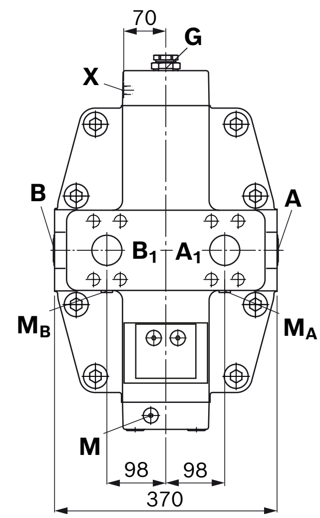
02 SAE working ports **A** and **B** at side, opposite



01 SAE working ports **A** and **B** at rear

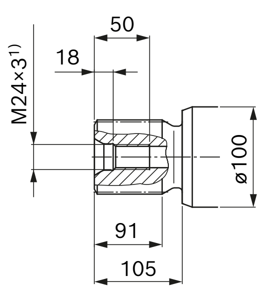


15 SAE working ports **A** and **B** at side, opposite, $\mathbf{A}_1$ and $\mathbf{B}_1$ at rear



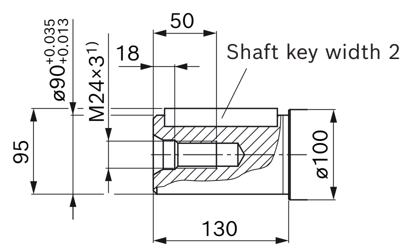
▼ **Splined shaft DIN 5480**

Z – W90×3×28×9g



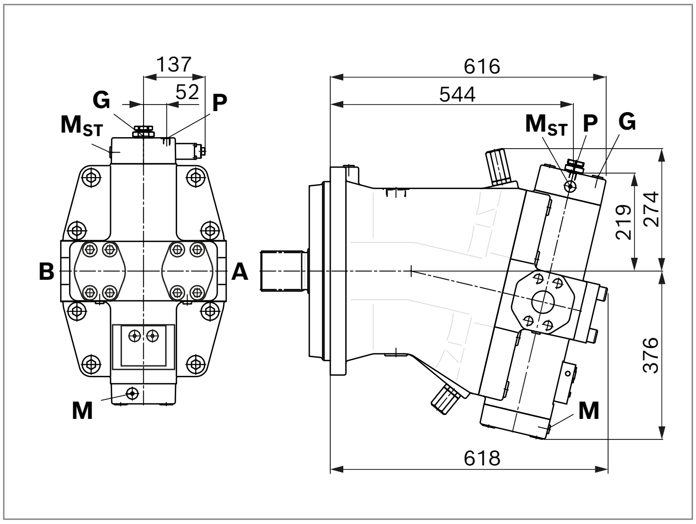
▼ **Parallel keyed shaft DIN 6885**

P – AS25×14×125

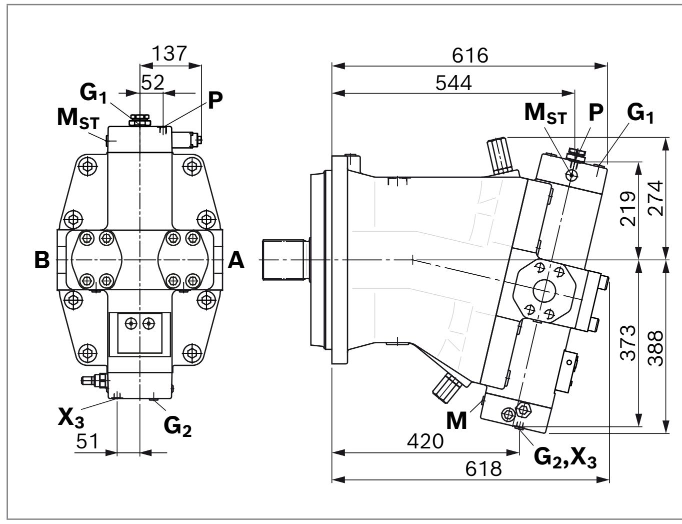


1) Center bore according to DIN 332 (thread according to DIN 13)

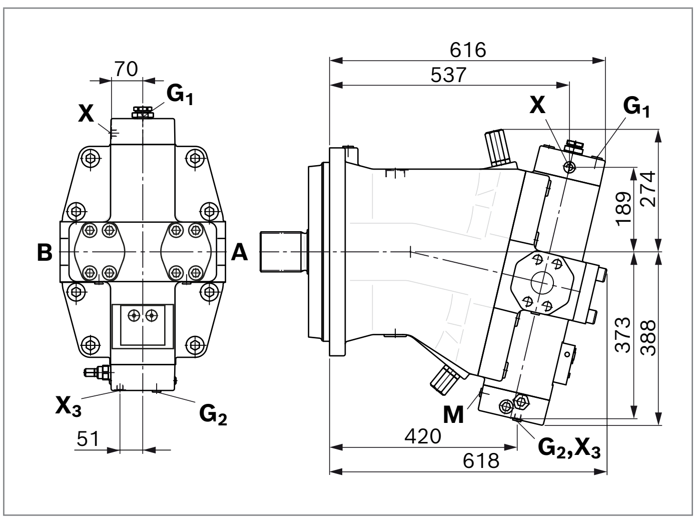
▼ **EP1, EP2** – Proportional control, electric



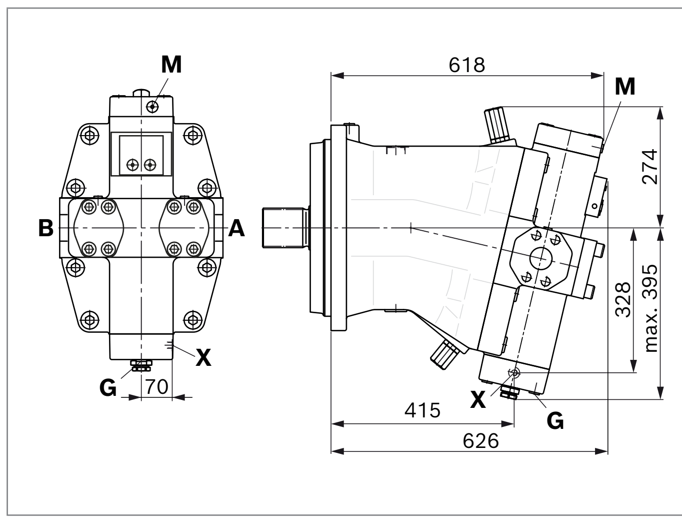
▼ **EP.D, EP.G** – Proportional control, electric, with fixed pressure control setting; remote controlled (EP.G)



▼ **HD.D, HD.G** – Proportional control, hydraulic, with fixed pressure control setting; remote controlled (HD.G)



▼ **HA1, HA2 / HA1T, HA2T** – Automatic control, high-pressure related, with override, hydraulic, remote controlled, proportional



Connector for solenoids

HIRSCHMANN DIN EN 175 301-803-A/ISO 4400

Without bidirectional suppressor diode

Type of protection:

- IP65 (DIN/EN 60529)

The seal ring in the cable fitting is suitable for lines of diameter 4.5 mm to 10 mm.

The mating connector is 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 91604-01-B.

Flushing and boost-pressure valve

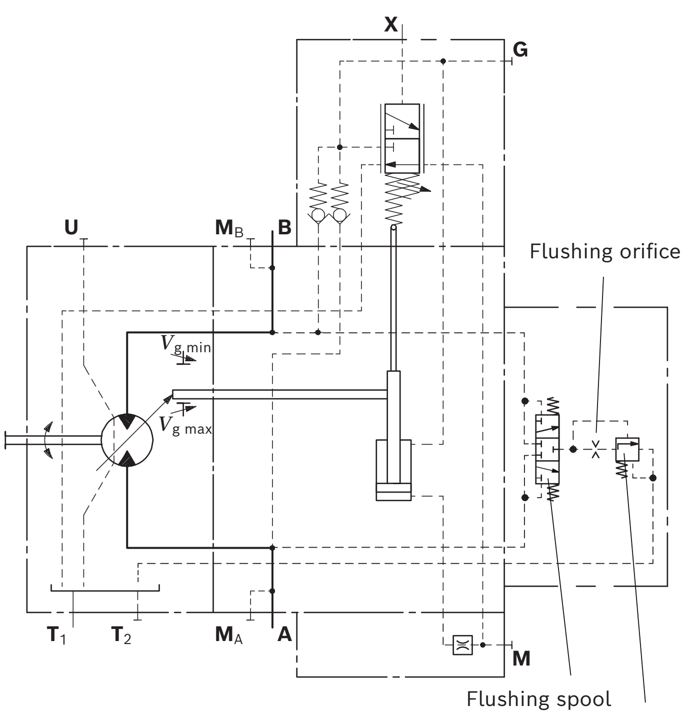
The flushing and boost-pressure valve is used to remove heat from the hydraulic circuit.
In an open and closed circuit, it is used for flushing the housing and additionally safeguarding the minimum boost pressure in a closed circuit.
Hydraulic fluid is directed from the respective low-pressure side into the motor housing. This is then fed into the reservoir, together with the leakage. In the closed circuit, the removed hydraulic fluid must be replaced by cooled hydraulic fluid supplied by the boost pump.
The valve is mounted on the port plate.

Cracking pressure of pressure retention valve
(observe when setting the primary valve)
- Fixed setting 16 bar

Switching pressure of flushing spool Δp
- 8±1 bar

Flushing flow q_v
Orifices can be used to adjust the flushing flows as required. The following parameters are based on:
$\Delta p_{ND} = p_{ND} - p_G$ = 25 bar and ν = 10 mm²/s
(p_{ND} = low pressure, p_G = case pressure)

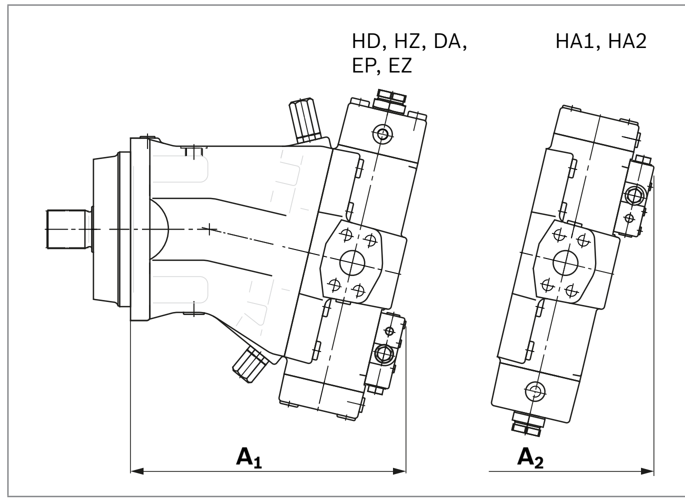
▼ **Circuit diagram**



Flushing valve

Size	Material number of orifice	ø [mm]	q_v [l/min]
250	R902290110	2.0	10
355...1000	R910928643	2.5	16

▼ **Dimensions**



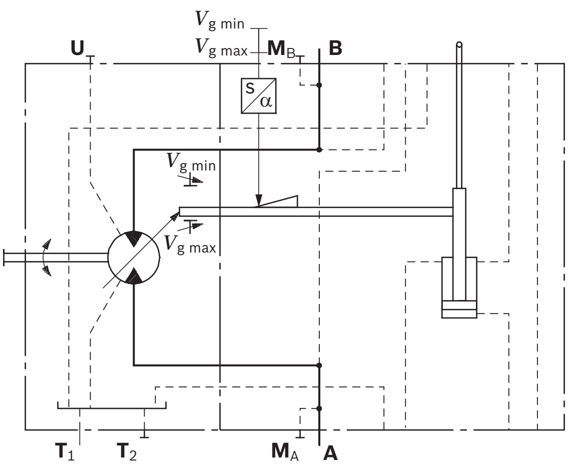
NG	A1	A2
250	357	402
355	397	446
500	440	504
1000	552	629

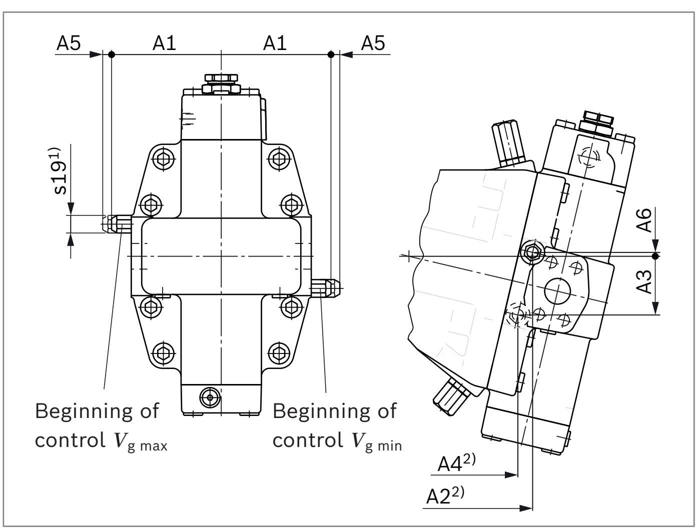
Swivel angle indicator

Optical (V)

The swivel position is indicated by a pin on the side of the port plate. The length of the protruding pin depends on the position of the lens plate.
If the pin is flush with the port plate, the motor is set to beginning of control. At maximum swivel, the pin length is 8 mm (visible after removal of the cap nut).

▼ **Example: Beginning of control at $V_{g\ max}$**





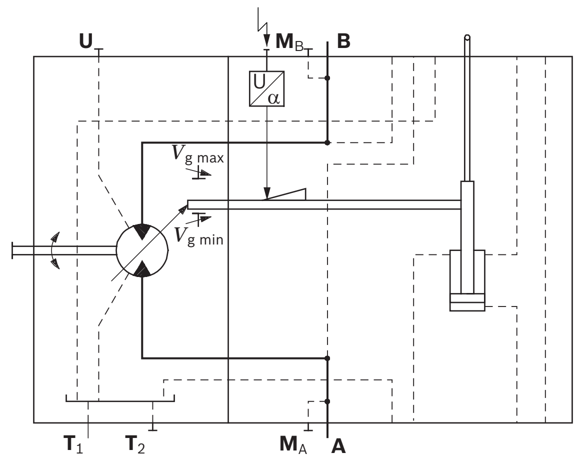
NG	A1	A2[2)]	A3	A4	A5[3)]	A6
250	136.5	256	73	238	11	5
355	159.5	288	84	266	11	8
500	172.5	331	89	309	11	3
1000	208.5	430	114	402	11	3

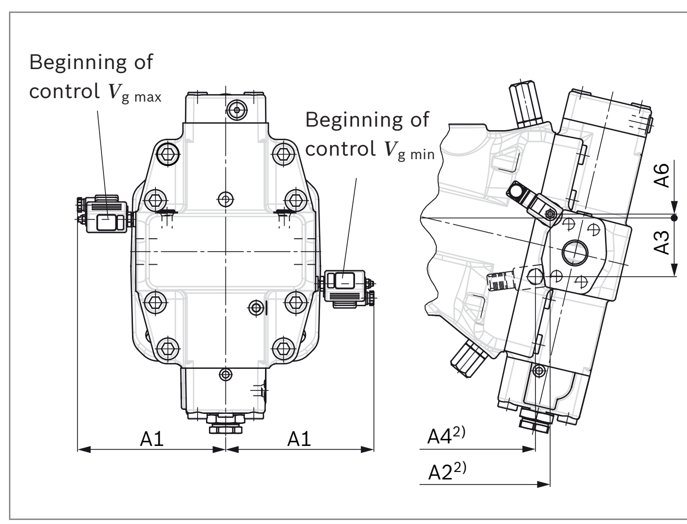
Electrical (E)

The motor position is reported here via an inductive position transducer. It converts the travel of the control device into an electrical signal.
This signal can be used to transmit the swivel position to an electric control unit.
Inductive position transducer
Type of protection:

- IP65 (DIN/EN 60529)

▼ **Example: Beginning of control at $V_{g\ min}$**





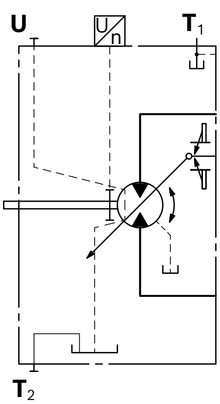
NG	A1	A2[2)]	A3	A4	A6
250	185	256	73	238	5
355	208	288	84	266	8
500	221	331	89	309	3
1000	257	430	114	402	3

1) Width across flats
2) Dimension to mounting flange
3) Required clearance for removal of the cap nut

Speed sensor

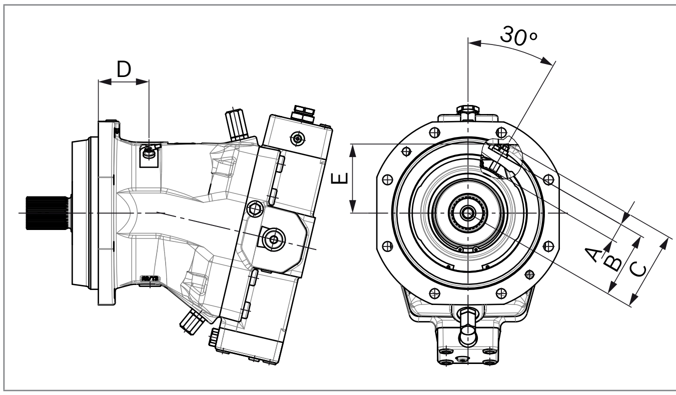
Version A6VM...W ("prepared for speed sensor DSA/20", i.e. without sensor) includes a spline on the rotary group. On deliveries without sensor, the port is plugged with a pressure-resistant cover.
The motor speed can be recorded by the mounted speed sensor DSA/20. The proportional frequency signal required is generated by splines at the rotary group.
In addition to the rotational speed, DSA/20 sensor detects the direction of rotation of the motor and the temperature at the installation location.
Type code, technical data, dimensions and details on the connector, plus safety instructions about the sensor can be found in the relevant data sheet 95126.
The sensor is mounted on the port provided for this purpose with one mounting bolt.
We recommend ordering the A6VM variable motor complete with mounted sensor.

▼ **Circuit diagram**



▼ **Dimensions**

Version "C" and "K" (DSA/20 mounted)



Nominal size			250	355	500
Number of teeth			78	90	99
Dimension	A	Installation depth (tolerance ±0.1)	32.5	32.5	32.5
	B	Contact surface	110.5	122.5	132.5
	C		134	146	156
	D		82	93	113
	E		117	127	136

Installation instructions

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. Particularly with the "drive shaft up/down" installation position, filling and air bleeding must be carried out completely as there is, for example, a danger of dry running.
The leakage in the housing area must be directed to the reservoir via the highest drain port ($\mathbf{T}_1$, $\mathbf{T}_2$).
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.
To prevent the transmission of structure-borne noise, use elastic elements to decouple all connecting lines from all vibration-capable components (e.g., reservoir, frame parts).
Under 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.

Key	
F	Filling/air bleeding
U	Bearing flushing / air bleed port
$\mathbf{T}_1$, $\mathbf{T}_2$	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 simplify the filling and air bleeding.

Installation position

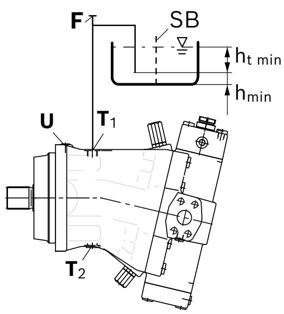
See the following examples **1** to **8**.
Further installation positions are available upon request.
Recommended installation positions: **1** and **2**

Below-reservoir installation (standard)

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

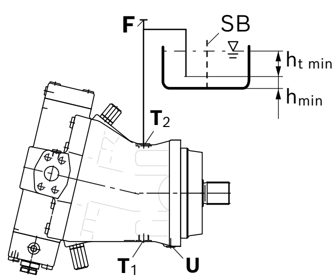
▼ Installation position 1

Air bleed	Filling
U (**F**)	$\mathbf{T}_1$ (**F**)



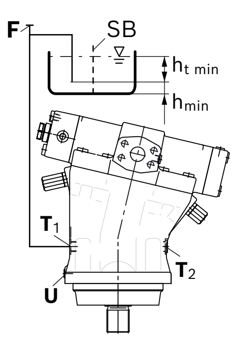
▼ Installation position 2

Air bleed	Filling
$\mathbf{T}_2$ (**F**)	$\mathbf{T}_2$ (**F**)



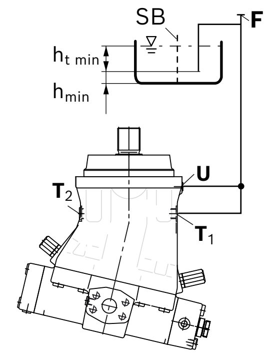
▼ Installation position 3

Air bleed[1)]	Filling
$\mathbf{T}_1$ (**F**)	$\mathbf{T}_1$ (**F**)



▼ Installation position 4

Air bleed	Filling
U (**F**)	$\mathbf{T}_1$ (**F**)



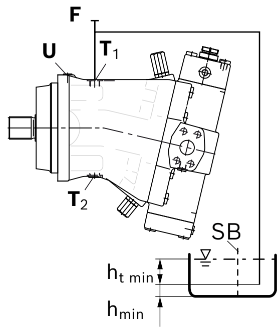
1) Because complete air bleeding and filling are not possible in this position, the motor should be air bled and filled in a horizontal position before installation.

Above-reservoir installation

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

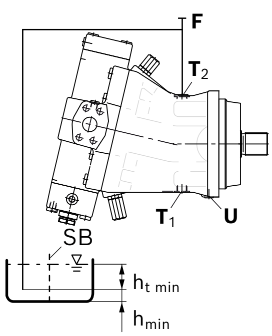
▼ **Installation position 5**

Air bleed	Filling
U (**F**)	**T**1 (**F**)



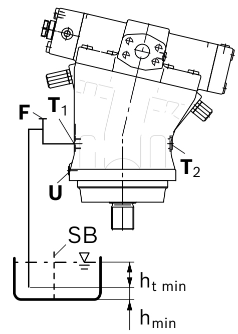
▼ **Installation position 6**

Air bleed	Filling
(**F**)	**T**2 (**F**)



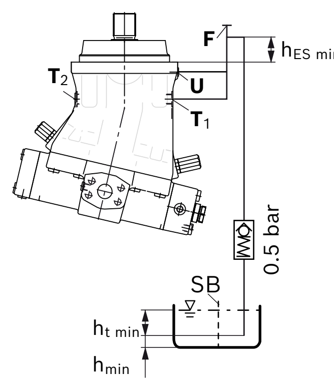
▼ **Installation position 7**

Air bleed[1]	Filling
(**F**)	**T**1 (**F**)



▼ **Installation position 8**

Air bleed	Filling
U (**F**)	**T**1 (**F**)



Notice

To prevent the axial piston unit from draining, a height difference $h_{ES\ min}$ of at least 25 mm to the mounting flange is required in installation position 8 Alternatively, a check valve (cracking pressure 0.5 bar) can be installed in the drain line to prevent the housing area from emptying.

1) Because complete air bleeding and filling are not possible in this position, the motor should be air bled and filled in a horizontal position before installation.

Project planning notes

- The motor A6VM is designed to be used in open and closed circuits.
- The project planning, installation and commissioning of the axial piston unit requires the involvement of skilled personnel.
- Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, this can be requested from Bosch Rexroth.
- Before finalizing your design, please request a binding installation drawing.
- The specified data and notes contained herein must be observed.
- For safety reasons, controls with beginning of control at $V_{g\,min}$ (e.g., HA) are not permissible for winch drives, e.g. anchor winches!
- Depending on the operating conditions of the axial piston unit (working pressure, fluid temperature), the characteristic curve may shift.
- 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 configuration variants of the product are approved for use in safety functions according to ISO 13849. Please consult the proper contact at Bosch Rexroth if you require reliability parameters (e.g., $MTTF_d$) for functional safety.
- Depending on the type of control used, electromagnetic effects can be produced when using solenoids. When a direct current is applied, solenoids do not cause electromagnetic interference nor is their operation impaired by electromagnetic interference. Other behavior can result when a modulated direct current (e.g. PWM signal) is applied. Appropriate testing and measures should be taken by the machine manufacturer to ensure other components or operators (e.g. with pacemaker) are not affected by this potential.
- Please note the details regarding the tightening torques of port threads and other screw connections in the instruction manual.
- The pressure control (hydraulic or electronic) is not an adequate safeguard against pressure overload. Therefore, a pressure relief valve must be provided in the hydraulic system (integrated into the pump or externally in the system). In this connection, observe the technical limits of the pressure relief valve.
- Please note that a hydraulic system is an oscillating system. This can lead, for example, to the stimulation the natural frequency within the hydraulic system during operation at constant rotational speed over a long period of time. The frequency of the motor to be observed is 7 times the rotational speed frequency. This can be prevented, for example, with suitably designed hydraulic lines.
- Please note the details regarding the tightening torques of port threads and other screw connections in the instruction manual.
- The ports and fastening threads are designed for the p_{max} permissible pressures of the respective ports, see the connection tables. The machine or system manufacturer must ensure that 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.
- Please note that the series connection of motors and the operation under summation pressure affect the efficiency of the units.
- The control behavior of the motor can change slightly due to natural influences such as running-in or setting behavior over time. Calibration may be required.

Safety instructions

- During and shortly after operation, there is a risk of burns 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 must test whether remedial measures are needed on the machine for the application concerned in order to bring the driven consumer into a safe position (e.g. safe stop) and ensure any measures are properly implemented.
- In certain conditions, moving parts in high-pressure relief valves might get stuck in an undefined position due to contamination (e.g. contaminated hydraulic fluid). This can result in restriction or loss of load-holding functions in lifting winches.
  Therefore it is the machine and/or system manufacturers responsibility to make sure that the load can always be put in a safe mode if needed. Also, he needs to ensure that these measures are properly implemented.
- When using the axial piston motor in winch drives, make certain that the technical limit values are not exceeded under all operating conditions.
  If the axial piston motor is extremely overloaded (e.g. if the maximum permissible rotational speeds are exceeded during weighing of the anchor while the ship is in motion), the rotary group may be damaged and, in the worst case, the axial piston motor may burst. The machine manufacturer/system manufacturer is to undertake additional measures, up to and including encapsulation.

Related documentation

Product-specific documentation

Document type	Title	Document number
Data sheet	Speed sensor DSA, series 20	95126
	Technical Data for Torsional Vibration Calculation	90261
	Pressure relief valve, direct operated	25402
	Proportional pressure reducing valve	29281
	Storage and preservation of axial piston units	90312
Operating instructions	Axial piston plug-in motor A6VM series 63	91604-01-B

Documentation for hydraulic fluids

Document type	Title	Document number
Data sheet	Hydraulic fluids based on mineral oils and related hydrocarbons	90220
	Environmentally acceptable hydraulic fluids	90221
	Fire-resistant, water-free hydraulic fluids (HFDR/HFDU)	90222
	Axial piston units for operation with fire-resistant hydraulic fluids (HFDR, HFDU, HFA, HFB, HFC-E)	90225
	Rating of hydraulic fluids used in Rexroth hydraulic components (pumps and motors)	90235
	Bosch Rexroth Fluid Rating List for Rexroth hydraulic components (pumps and motors)	90245

Bosch Rexroth AG
An den Kelterwiesen 14
72160 Horb a.N.
Germany
Phone +49 7451 92-0
sales.mobile.horb@boschrexroth.de
www.boschrexroth.com