

Axial piston variable motor AA6VM series 63

Americas



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

- ▶ All-purpose high pressure motor
- ▶ Sizes 250
- ▶ Nominal pressure 5100 psi (350 bar)
- ▶ Maximum pressure 5800 psi (400 bar)
- ▶ Open and closed circuit

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Type code

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18
AA6V		M					/	63	W		-	V					-

Axial piston unit																	250	
01	Bent-axis design, variable																●	AA6V

Drive shaft bearing				250	
02	Standard bearing (without code)			●	
	Long-life bearing			●	L

Operating mode				250
03	Motor (plug-in motor A6VE see data sheet 91606)			M

Size (NG)																	
04	Geometric displacement, see page 8																250

Control device				250
05	Proportional control, hydraulic	$\Delta p_{\text{St}} = 145 \text{ psi (10 bar)}$	●	HD1
		$\Delta p_{\text{St}} = 365 \text{ psi (25 bar)}$	●	HD2
		$\Delta p_{\text{St}} = 510 \text{ psi (35 bar)}$	●	HD3
	Proportional control, electric (with HIRSCHMANN connector – without suppressor diode)	$U = 12 \text{ V}$	●	EP1
		$U = 24 \text{ V}$	●	EP2
	Two-point control, hydraulic		●	HZ
	Two-point control, electric (with HIRSCHMANN connector – without suppressor diode)	$U = 12 \text{ V}$	○	EZ1
		$U = 24 \text{ V}$	●	EZ2
	Automatic control, high-pressure related	with minimum pressure increase $\Delta p \leq \text{approx. } 145 \text{ psi (10 bar)}$	●	HA1
		with pressure increase $\Delta p = 1450 \text{ psi (100 bar)}$	●	HA2
	Automatic control, speed related		●	DA
$p_{\text{St}}/p_{\text{HD}} = 3/100$, hydraulic travel direction valve				

Pressure control/override (only for HD, EP)					250	
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	
07	Without override (without code)			●	
	Override, hydraulic, remote controlled, proportional			●	T

Series																	
08	Series 6, index 3																63

Direction of rotation																	250
09	Viewed on drive shaft							bidirectional							●		W

Setting ranges for displacement ²⁾																	250
10	$V_{g \text{ min}} = 0 \text{ to } 0.4 \text{ } V_{g \text{ max}}$							$V_{g \text{ max}} = V_{g \text{ max}} \text{ to } 0.8 \text{ } V_{g \text{ max}}$							●		1
	$V_{g \text{ min}} > 0.4 \text{ } V_{g \text{ max}} \text{ to } 0.8 \text{ } V_{g \text{ max}}$							$V_{g \text{ max}} = V_{g \text{ max}} \text{ to } 0.8 \text{ } V_{g \text{ max}}$							●		2

● = Available ○ = On request – = Not available

1) Second pressure setting option available as standard for version D

2) Please specify exact settings for $V_{g \text{ min}}$ and $V_{g \text{ max}}$ in plain text when ordering: $V_{g \text{ min}} = \dots \text{ inch}^3 \text{ (cm}^3\text{)}$, $V_{g \text{ max}} = \dots \text{ inch}^3 \text{ (cm}^3\text{)}$

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18
AA6V		M					/	63	W		-	V					-

Sealing material 250

11	FKM (fluoroelastomer)	•	V
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Drive shaft 250

12	Splined shaft ANSI B92.1a	•	S
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Mounting flange 250

13	SAE J744 - 4-bolt	165-4	•	D
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Working port³⁾ 250

14	SAE working ports A and B at rear	51	Without valve	0	•	510
			Flushing and boost-pressure valve, mounted	7	•	517
	SAE working ports A and B at side, opposite	52	Without valve	0	•	520
			Flushing and boost-pressure valve, mounted	7	•	527
	SAE working ports A and B at side, opposite + at rear	65	Without valve	0	•	650
			Flushing and boost-pressure valve, mounted	7	•	657

Speed sensor 250

15	Without speed sensor (without code)	•	
	Prepared for speed sensor DSA/20 ⁴⁾	•	W
	Speed sensor DSA/20 mounted ⁴⁾	•	C

Swivel angle sensor 250

16	Without swivel angle sensor (without code)	•	
	Optical swivel angle sensor	•	V
	Electric swivel angle sensor	•	E

Beginning of control 250

17	At $V_{g \min}$ (standard for HA)	•	A
	At $V_{g \max}$ (standard for HD, HZ, EP, EZ, DA)	•	B

Standard/special version 250

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

• = Available ◦ = On request ▲ = Not for new projects - = Not available

Notice

- Note the project planning notes on page 33.
- In addition to the type code, please specify the relevant technical data when placing your order.

³⁾ Fastening thread SAE

⁴⁾ Specify the type code separately for sensor in accordance with data sheet 95126 (DSA/20), and observe the requirements for the electronics.

Hydraulic fluids

The variable motor AA6VM 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

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)

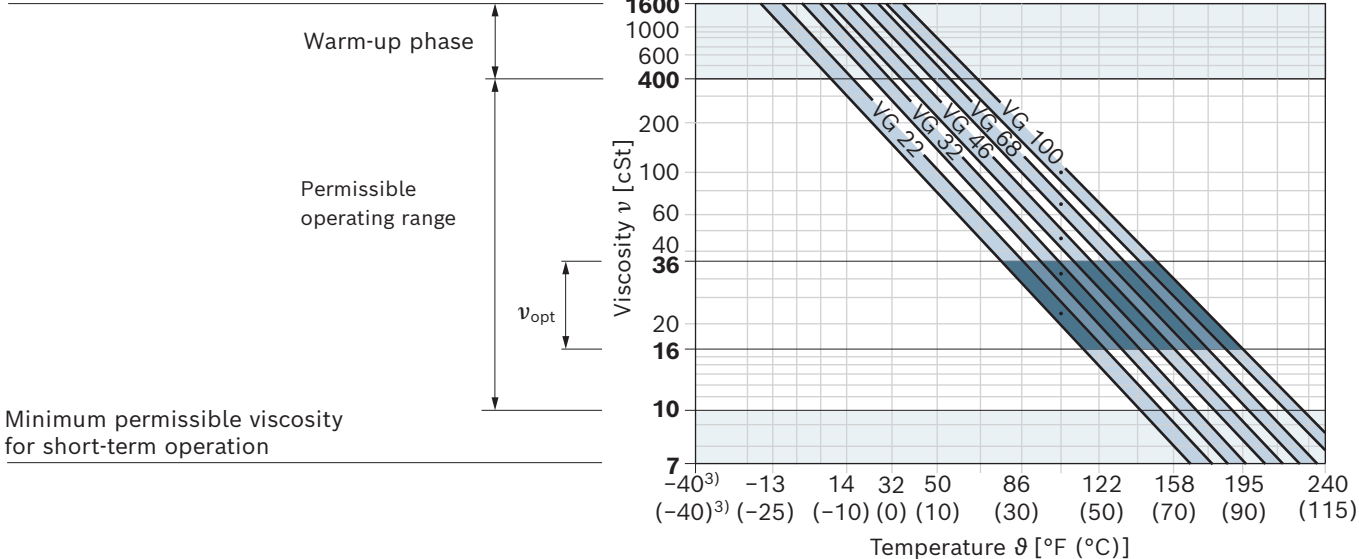
The hydraulic fluid should be selected so that the operating viscosity in the operating temperature range is within the optimum range (v_{opt} ; see selection diagram).

Viscosity and temperature of hydraulic fluids

	Viscosity	Shaft seal	Temperature ⁴⁾	Remarks
Cold start	$v_{max} \leq 1600 \text{ cSt}$	NBR ²⁾	$\vartheta_{St} \geq -40 \text{ }^{\circ}\text{F} (-40 \text{ }^{\circ}\text{C})$	$t \leq 3 \text{ min}$, without load ($p \leq 725 \text{ psi} (50 \text{ bar})$), $n \leq 1000 \text{ rpm}$ Permissible temperature difference between axial piston unit and hydraulic fluid in the system maximum $45 \text{ }^{\circ}\text{F} (25 \text{ K})$
		FKM	$\vartheta_{St} \geq -13 \text{ }^{\circ}\text{F} (-25 \text{ }^{\circ}\text{C})$	
Warm-up phase	$v = 1600 \dots 400 \text{ cSt}$			$t \leq 15 \text{ min}$, $p \leq 0.7 \times p_{nom}$ and $n \leq 0.5 \times n_{nom}$
Permissible operating range	$v = 400 \dots 10 \text{ cSt}^{1)}$	NBR ²⁾	$\vartheta \leq +172 \text{ }^{\circ}\text{F} (+78 \text{ }^{\circ}\text{C})$	Measured at port T
		FKM	$\vartheta \leq +217 \text{ }^{\circ}\text{F} (+103 \text{ }^{\circ}\text{C})$	
	$v_{opt} = 36 \dots 16 \text{ cSt}$			Optimal operating viscosity and efficiency range
Short-term operation ³⁾	$v_{min} = 10 \dots 7 \text{ cSt}$	NBR ²⁾	$\vartheta \leq +172 \text{ }^{\circ}\text{F} (+78 \text{ }^{\circ}\text{C})$	$t \leq 3 \text{ min}$, $p \leq 0.3 \times p_{nom}$, measured at port T
		FKM	$\vartheta \leq +217 \text{ }^{\circ}\text{F} (+103 \text{ }^{\circ}\text{C})$	

▼ Selection diagram

Maximum permissible viscosity on cold start



1) This corresponds, for example on the VG 46, to a temperature range of +39 °F to +185 °F (+4 °C to +85 °C) (see selection diagram)
2) Special version, please contact us

3) Please contact us.
4) 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 cSt (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 cSt:

- ▶ 163 °F (73 °C) at HLP 32
- ▶ 185 °F (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 $p_{abs} = 15 \text{ psi (1 bar)}$ 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 long service life. Identical external dimensions as motor with standard bearing. Subsequent conversion to long-life bearing is possible.

Flushing and flushing flow (recommendation)

Size	250
$q_{V \text{ flush}}$	
gpm	2.6
l/min	10

The leakage temperature can be reduced by external flushing via port **U**.

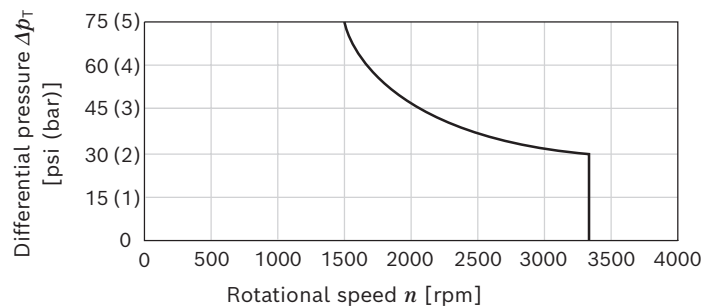
Shaft seal

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 ($t < 0.1 \text{ s}$) pressure peaks of up to 145 psi (10 bar) are allowed.

To make use of the full speed range, continuous case pressures of max. 30 psi (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.



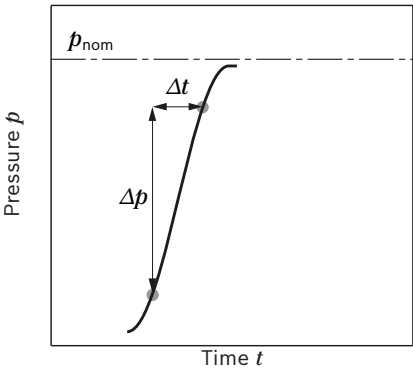
The FKM shaft seal ring may be used for leakage temperatures from -13 °F to + 239 °F (-25°C to +115°C). In application cases below -13 °F (-25 °C), an NBR shaft seal is required (permissible temperature range: -40 °F to +194 °F (-40 °C to +90 °C)).

- ▶ 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}	5100 psi (350 bar)	The nominal pressure corresponds to the maximum design pressure. 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.
Maximum pressure p_{max}	5800 psi (400 bar)	
Single operating period	10 s	
Total operating period	300 h	
Minimum pressure (high-pressure side)	365 psi (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)	10150 psi (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	130530 psi/s (9000 bar/s)	
without pressure relief valve	232060 psi/s (16000 bar/s)	
Case pressure at port T		
Continuous differential pressure $\Delta p_{T\ cont}$	30 psi (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 $p_{T\ peak}$	145 psi (10 bar)	$t < 0.1\ s$

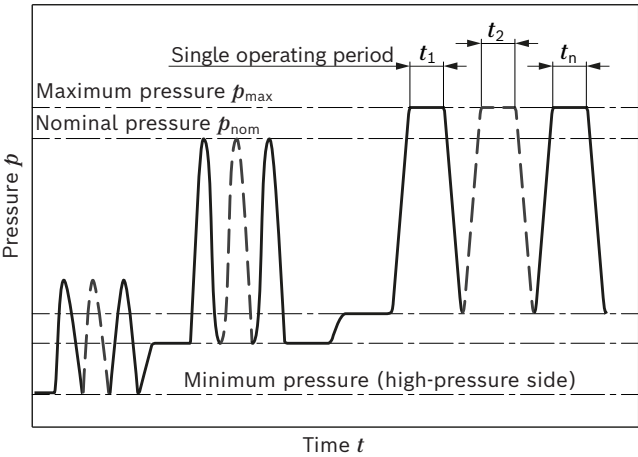
▼ Rate of pressure change $R_{A\ max}$



Notice

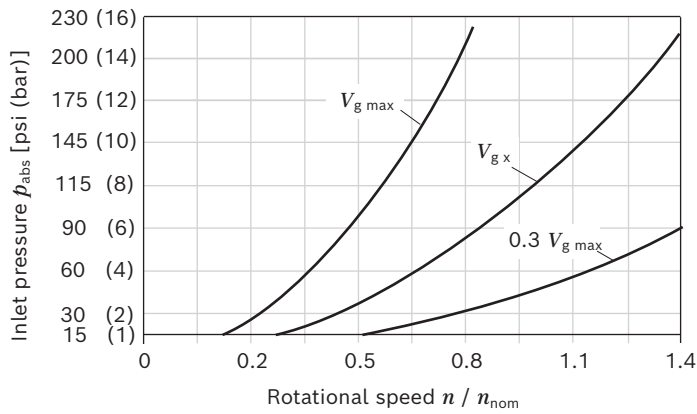
- ▶ Working pressure range applies when using hydraulic fluids based on mineral oils. Please contact us for values for other hydraulic fluids.
- ▶ The case pressure must be greater than the external pressure (ambient pressure) at the shaft seal.

▼ Pressure definition



Total operating period = $t_1 + t_2 + \dots + t_n$

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



This diagram is only valid for the optimum viscosity range of $\nu_{opt} = 36$ to 16 cSt.

If the above-mentioned conditions cannot be ensured, please contact us.

Technical data

Size	NG	250
Geometric displacement, per revolution ¹⁾	$V_{g \max}$	inch ³ 15.26
		cm ³ 250
	$V_{g \min}$	inch ³ 0
		cm ³ 0
	$V_{g \times}$	inch ³ 12.51
		cm ³ 205
Maximum rotational speed ²⁾ (complying with the maximum permissible inlet flow)	At $V_{g \max}$	n_{nom} rpm 2700
	At $V_g < V_{g \times}$ (see diagram below)	n_{max} rpm 3300
	At $V_{g 0}$	n_{max} rpm 3300
Inlet flow ³⁾	At n_{nom} and $V_{g \max}$	$q_{v \max}$ gpm 178
		l/min 675
Torque ⁴⁾	At $V_{g \max}$ and $\Delta p = 5100$ psi (350 bar)	M lb-ft 1026
		Nm 1391
Rotary stiffness	$V_{g \max}$ to $V_g/2$	$c_{\min}$ lb-ft/rad 44254
		kNm/rad 60
	$V_g/2$ to 0 (interpolated)	$c_{\min}$ lb-ft/rad 133499
		kNm/rad 181
Moment of inertia of the rotary group	J_{TW}	lb-ft ² 1.448
		kgm ² 0.061
Maximum angular acceleration	α	rad/s ² 10000
Case volume	V	gal 0.79
		l 3.00
Weight approx.	m	lbs 220
		kg 100

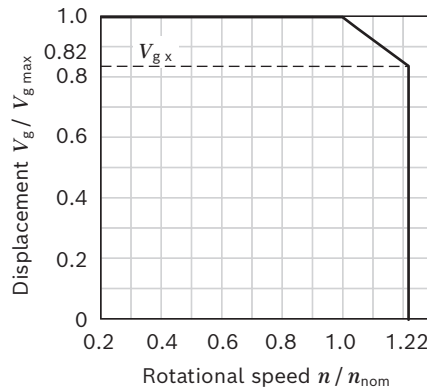
Speed range

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	$= \frac{V_g \times n}{231 \times \eta_v}$	[gpm]
Rotational speed	n	$= \frac{q_v \times 231 \times \eta_v}{V_g}$	[rpm]
Torque	M	$= \frac{V_g \times \Delta p \times \eta_{hm}}{24 \times \pi}$	[lb-ft]
Power	P	$= \frac{2 \pi \times M \times n}{33000} = \frac{q_v \times \Delta p \times \eta_t}{1714}$	[HP]

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]

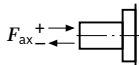
Key

- V_g Displacement per revolution [inch³ (cm³)]
- Δp Differential pressure [psi (bar)]
- n Rotational speed [rpm]
- η_v Volumetric efficiency
- η_{hm} Hydraulic-mechanical efficiency
- η_t Total efficiency ($\eta_t = \eta_v \times \eta_{hm}$)

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

Permissible radial and axial loading on the drive shafts

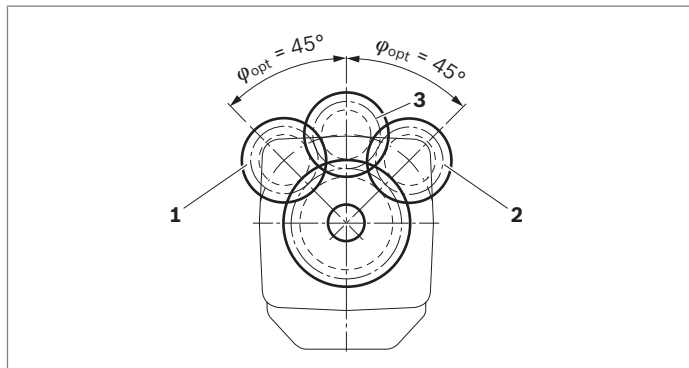
Size	NG	250
Drive shaft	Code	S
	$\varnothing$	inch 2
Maximum radial force at distance a (from shaft collar)	$F_{q \max}$	lb 270 ¹⁾
		N 1200 ¹⁾
	a	inch 1.32
		mm 33.5
Maximum torque at $F_{q \max}$	$T_{q \max}$	lb-ft 2)
		Nm 2)
Maximum differential pressure at $\Delta p_{q \max}$ $V_{g \max}$ and $F_{q \max}$		psi 2)
		bar 2)
Maximum axial force at standstill or depressurized operation	$+ F_{ax \max}$	lb 0
		N 0
	$- F_{ax \max}$	lb 270
		N 1200
Permissible axial force per bar working pressure	$+ F_{ax \text{ perm/bar}}$	lb/psi 2)
		N/bar 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)

Please note

- ▶ Maximum permissible pilot pressure: $p_{St} = 1450$ psi (100 bar)
- ▶ The control fluid is internally taken out of the high-pressure passage of the motor (**A** or **B**). For reliable control, a working pressure of at least 435 psi (30 bar) is required in **A** (**B**). If a control operation is performed at a working pressure < 435 psi (< 30 bar), an auxiliary pressure of at least 435 psi (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 5800 psi (400 bar) can occur.
- ▶ Specify the desired beginning of control in plain text when ordering, e.g. beginning of control at 145 psi (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 0.08 gpm (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 (DIA 0.047 inch (Ø1.2 mm))

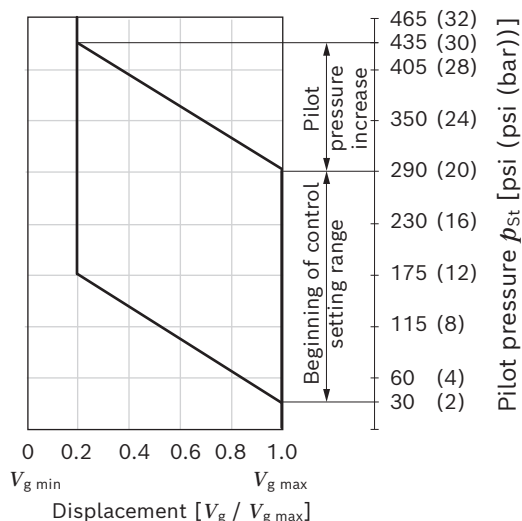
HD.D, HD.G with adjustable stroking time limiting valve

HD1, pilot pressure increase $\Delta p_{St} = 145$ psi (10 bar)

A pilot pressure increase of 145 psi (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 30 to 290 psi (2 to 20 bar), standard setting:
Beginning of control at 45 psi (3 bar) (end of control at 190 psi (13 bar))

▼ Characteristic curve HD1

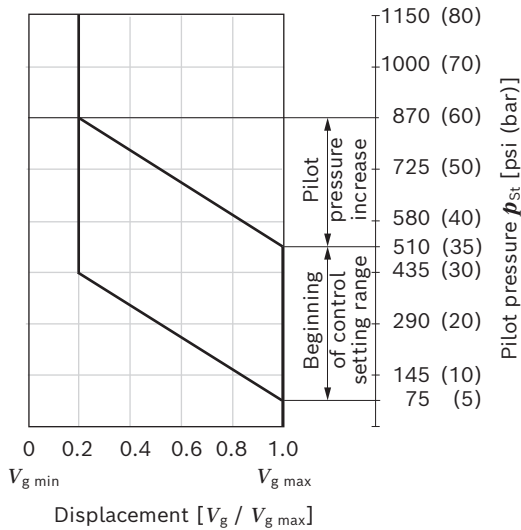


HD2, pilot pressure increase $\Delta p_{St} = 365 \text{ psi (25 bar)}$

A pilot pressure increase of 365 psi (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 75 to 510 psi (5 to 35 bar)
Beginning of control at 145 psi (10 bar) (end of control at 510 psi (35 bar))

▼ HD2 characteristic curve

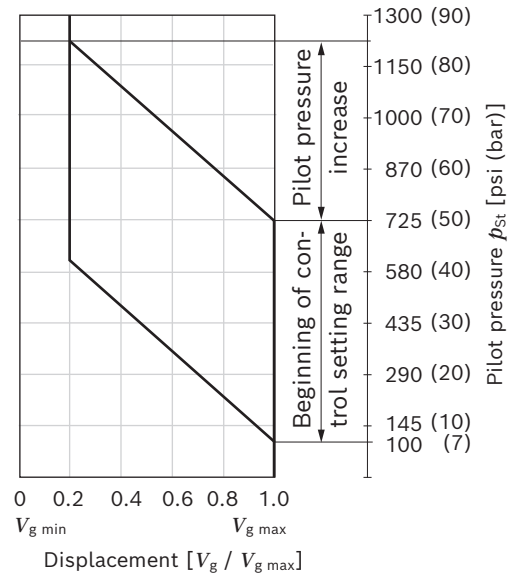


HD3, pilot pressure increase $\Delta p_{St} = 510 \text{ psi (35 bar)}$

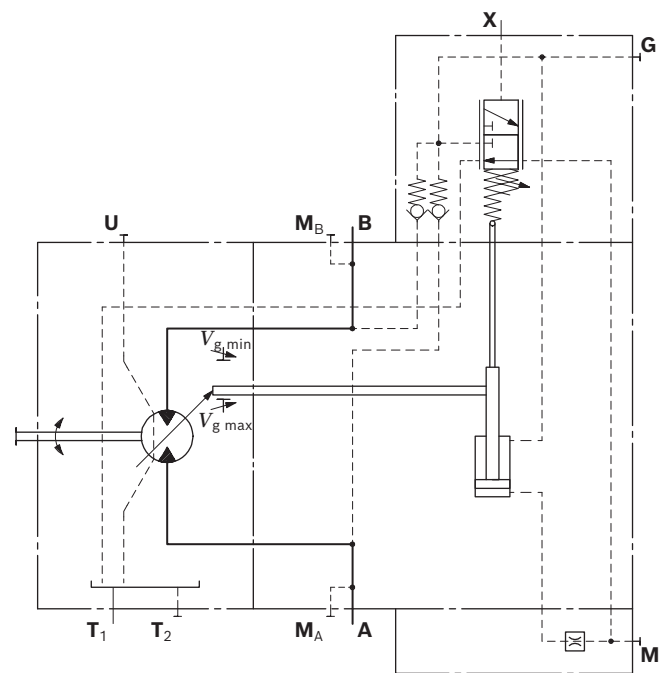
A pilot pressure increase of 510 psi (35 bar) at port **X** results in a decrease in displacement from $V_{g \max}$ to $0.2 V_{g \max}$.

- ▶ Beginning of control, setting range 100 to 725 psi (7 to 50 bar)
Beginning of control at 145 psi (10 bar) (end of control at 650 psi (45 bar))

▼ Characteristic curve HD3



▼ Circuit diagram HD1, HD2, HD3



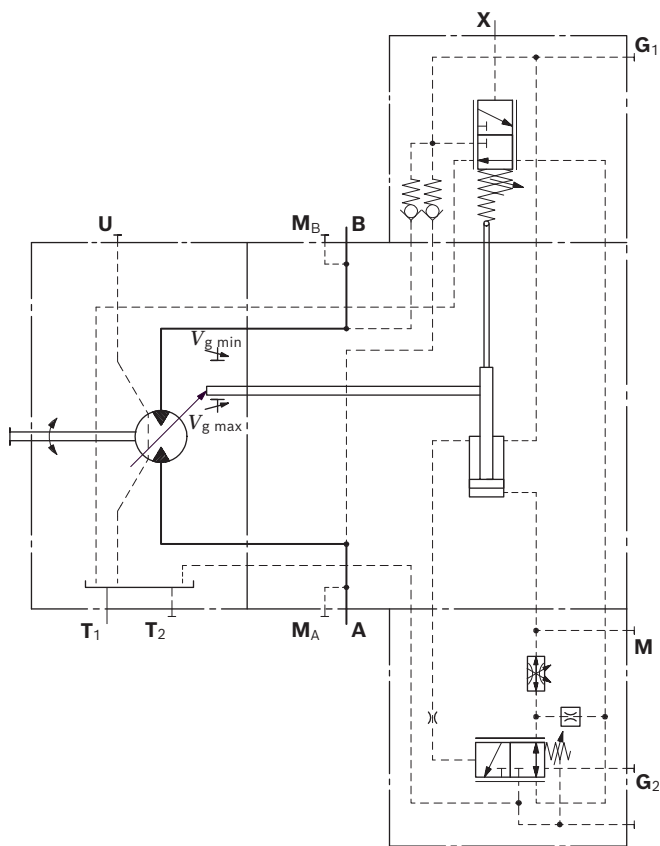
HD.D Pressure control, fixed setting

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
1150 to 5100 psi (80 to 350 bar)

▼ **Circuit diagram HD.D**



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

By connecting an external pilot pressure at port **G₂**, the setting of the pressure controller can be overridden and a 2nd pressure setting can be realized.

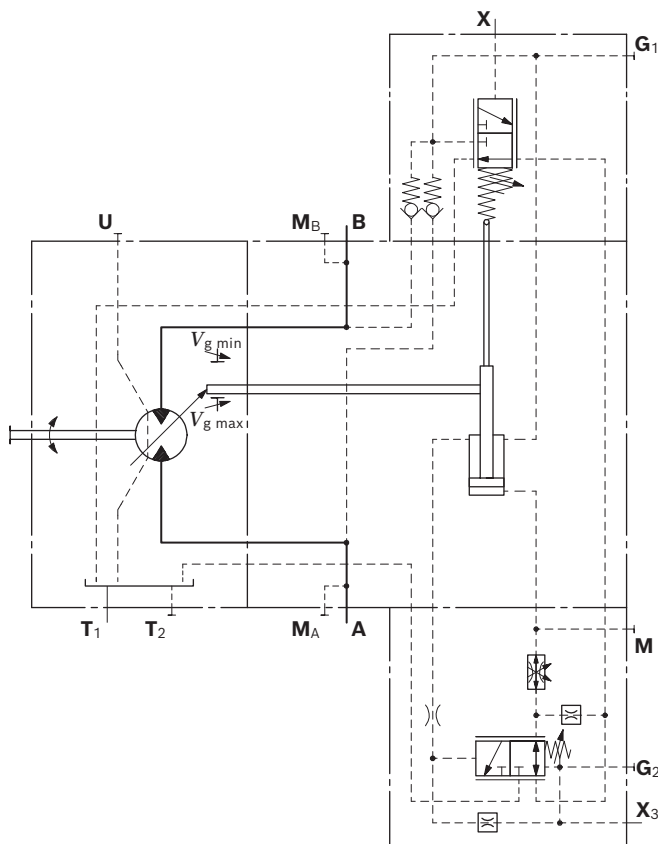
- Required pilot pressure at port **G₂**: $p_{St} \geq 1450$ psi
(100 bar)

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

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 **X₃**, 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 1150 psi (80 bar) and 5100 psi (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 365 psi (25 bar). A separate pressure relief valve is recommended: DBD 6 (hydraulic) as per data sheet 25402. The maximum line length should not exceed 6 ft (2 m).

▼ Circuit diagram HD.G



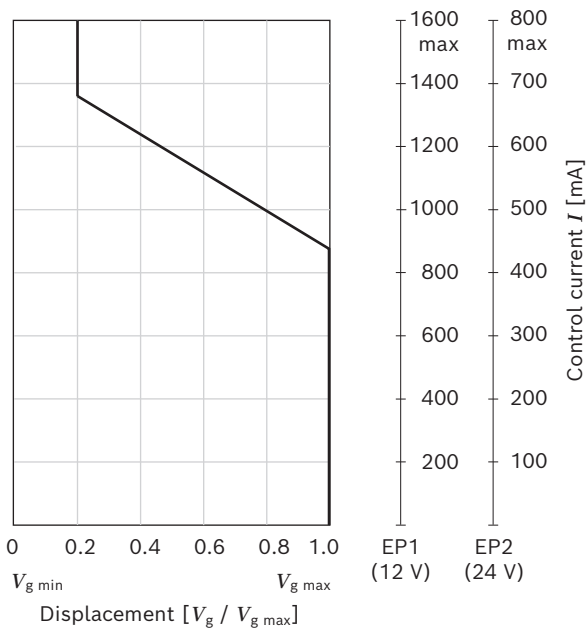
EP – Proportional control, electric

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 fluid supply is connected to port **P** with a pressure of $p_{min} = 435\text{psi}$ (30 bar) is required ($p_{max} = 1450\text{psi}$ (100 bar)).

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

▼ **Characteristic curve EP**



Please note

- ▶ The control fluid 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

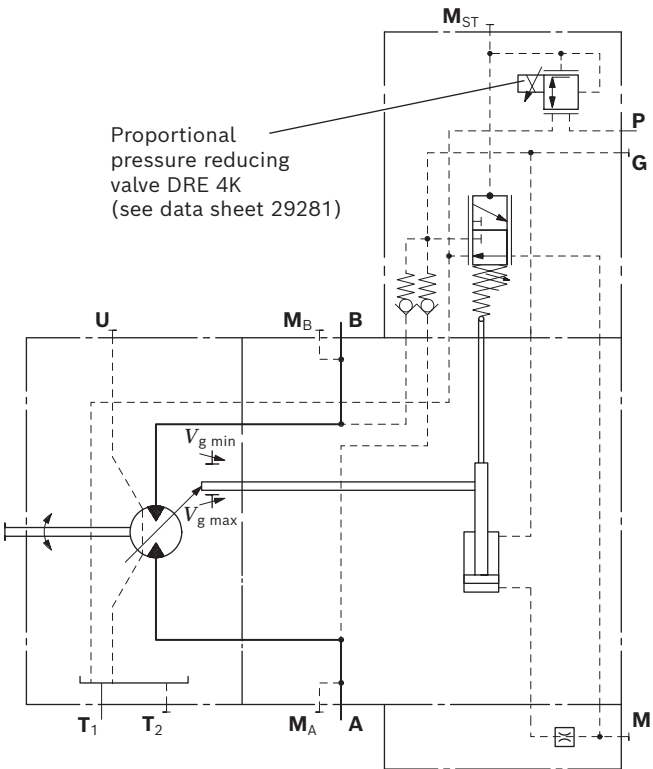
The stroking time damping impacts the swivel behavior of the motor and consequently the machine response speed. EP1, EP2 with nozzle (DIA 0.047 inch (ø1.2 mm))

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 $V_{g\text{ max}}$	900 mA	450 mA
End of control at 0.2 $V_{g\text{ max}}$	Approx. 1360 mA	Approx. 680 mA
Current limit	2.2 A	1.0 A
Nominal resistance (at 68 °F (20°C))	2.4 Ω	12 Ω
Duty cycle	100%	100%
Type of protection: see connector version page 26		

See also proportional pressure reducing valve DRE 4K (data sheet 29281 – Proportional pressure reducing valve)

▼ **Circuit diagram EP1, EP2**



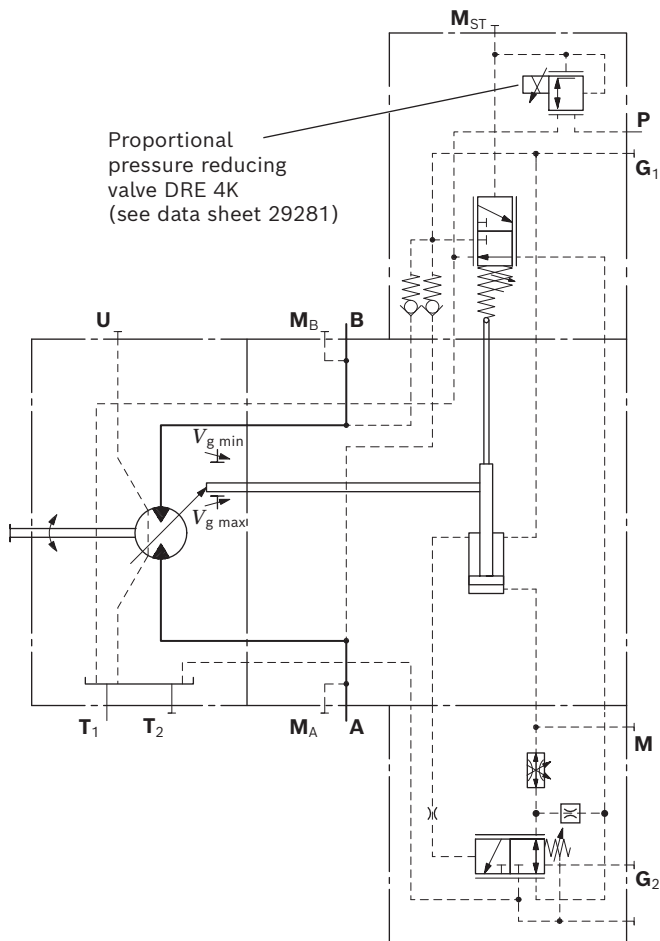
EP.D pressure control, fixed setting

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
 1150 to 5100 psi (80 to 350 bar)

▼ Circuit diagram EP.D



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

By connecting an external pilot pressure at port **G₂**, the setting of the pressure controller can be overridden and a 2nd pressure setting can be realized.

- Required pilot pressure at port **G₂**: $p_{St} \geq 1450$ psi (100 bar).

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

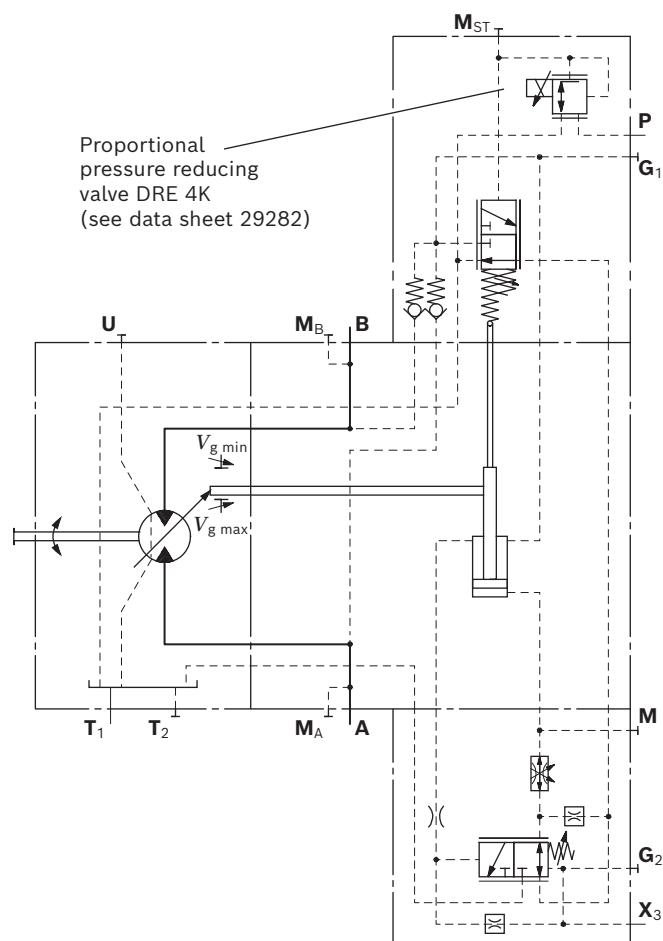
EP.G pressure control, remote controlled

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 **X₃**, 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 1145psi (80 bar) and 5100 psi (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 365 psi (25 bar).

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

▼ Circuit diagram EP.G

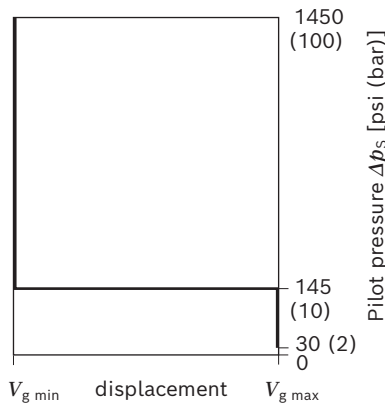


HZ – Two-point control, hydraulic

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 > 145 psi (10 bar) activated, minimum torque, maximum permissible rotational speed)

▼ Characteristic curve HZ



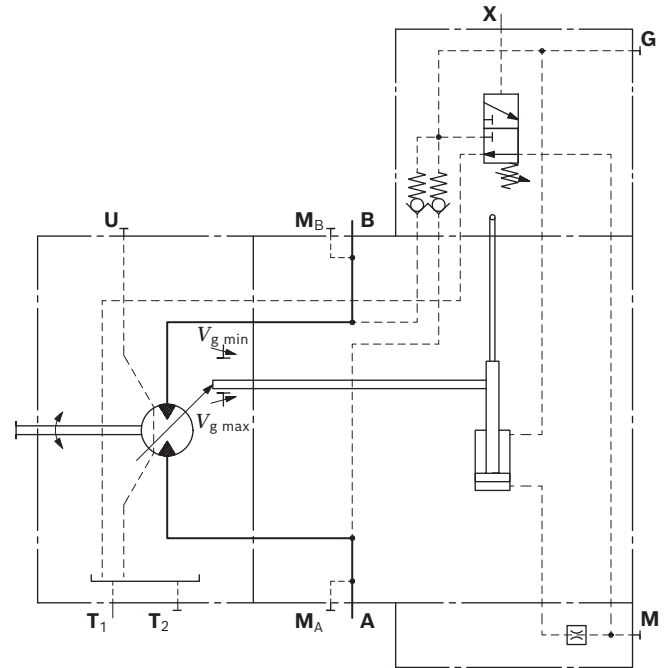
Please note

- ▶ Maximum permissible pilot pressure: 1450 psi (100 bar)
- ▶ The control fluid is internally taken out of the high-pressure passage of the motor (**A** or **B**). For reliable control, a working pressure of at least 435 psi (30 bar) is required in **A** (**B**). If a control operation is performed at a working pressure < 435 psi (30 bar), an auxiliary pressure of at least 435 psi (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 5800 psi (400 bar) can occur.
- ▶ A leakage flow of maximum 0.08 gpm (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 (DIA 0.047 inch (ø1.2 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.

Please note

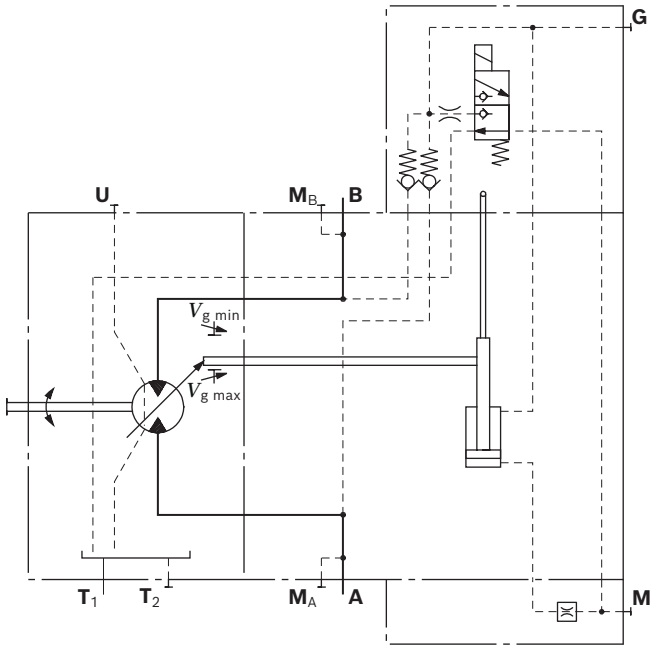
- The control fluid is internally taken out of the high-pressure passage of the motor (**A** or **B**). For reliable control, a working pressure of at least 435 psi (30 bar) is required in **A** (**B**). If a control operation is performed at a working pressure < 435 psi (30 bar), an auxiliary pressure of at least 435 psi (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 5800 psi (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 (DIA 0.047 inch (Ø1.2 mm))

Technical data, on/off valve	EZ2
Voltage	24 V (±20%)
Position $V_{g\ max}$	de-energized
Position $V_{g\ min}$	Current switched on
Nominal resistance (at 68°F (20°C))	23 Ω
Nominal power	26 W
Minimum active current required	1.04 A
Duty cycle	100%
Type of protection: see connector version page 26	

▼ Circuit diagram 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)

Please note

- ▶ For safety reasons, lifting winch drives are not permissible with beginning of control at $V_{g \min}$ (standard for HA).
- ▶ The control fluid is internally taken out of the high-pressure passage of the motor (**A** or **B**). For reliable control, a working pressure of at least 435 psi (30 bar) is required in **A** (**B**). If a control operation is performed at a working pressure < 435 psi (30 bar), an auxiliary pressure of at least 435 psi (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 5800 psi (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 0.08 gpm (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

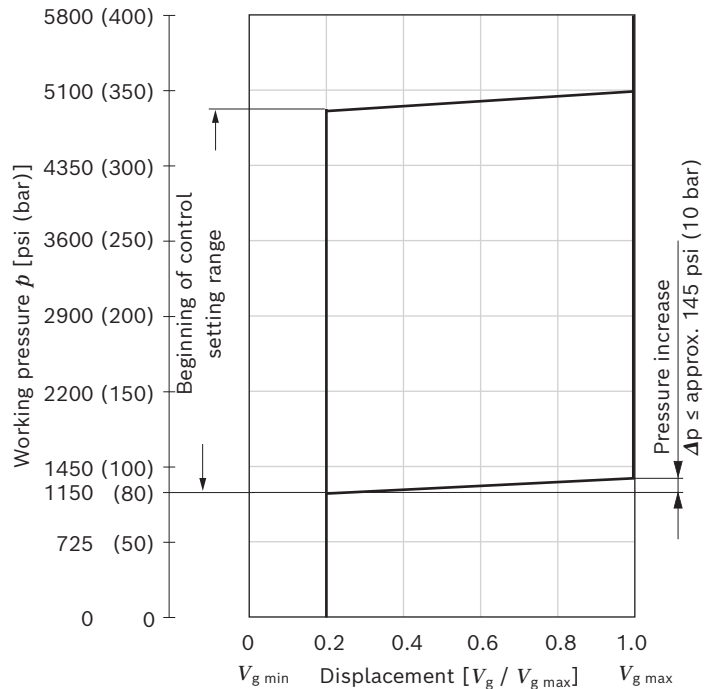
The stroking time damping impacts the swivel behavior of the motor and consequently the machine response speed. Standard with nozzle (DIA 0.047 inch (Ø1.2 mm))

HA1 with minimum pressure increase, positive control

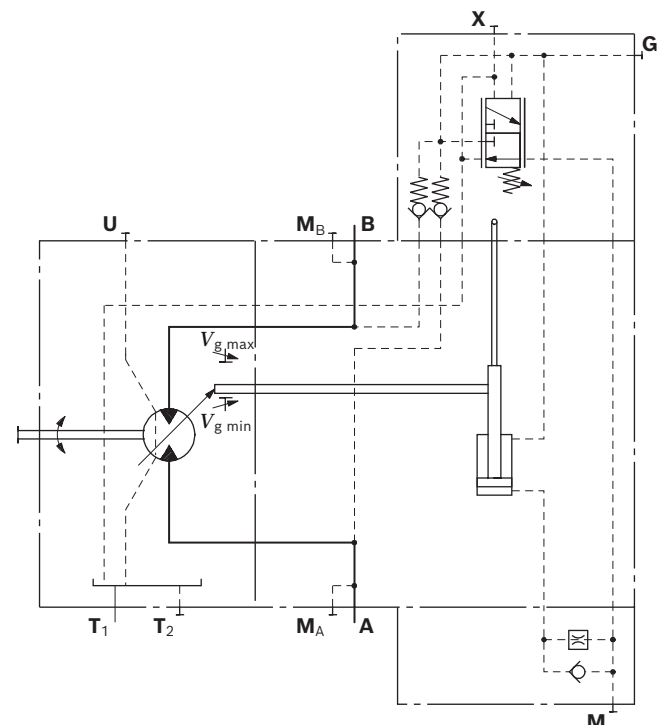
A working pressure increase of $\Delta p \leq \text{approx. } 145 \text{ psi}$

(10 bar) results in an increase in displacement from $V_{g \min}$ to $V_{g \max}$. Setting range of the pressure control valve 1150 to 4950 psi (80 to 340 bar), specify the desired beginning of control in plain text when ordering, e.g. beginning of control at 4350 psi (300 bar).

▼ Characteristic curve HA1



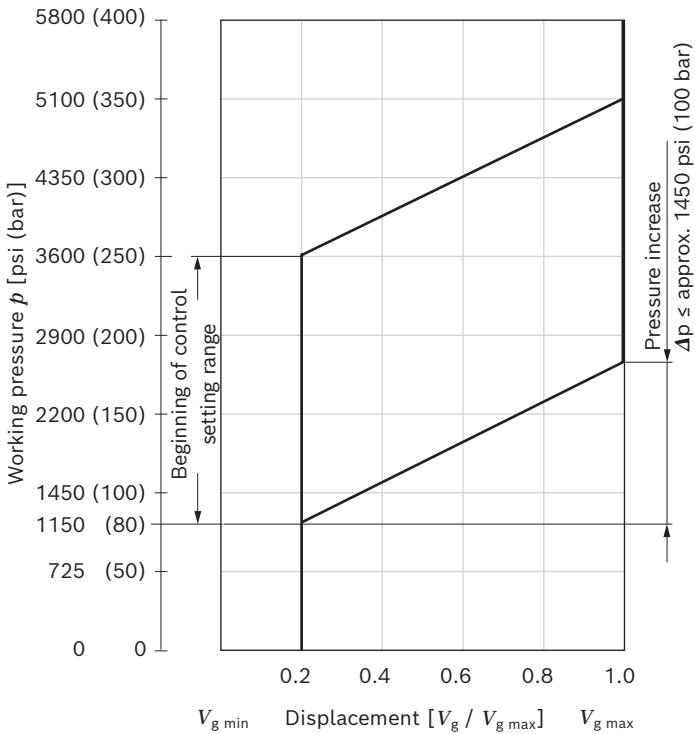
▼ Circuit diagram HA1



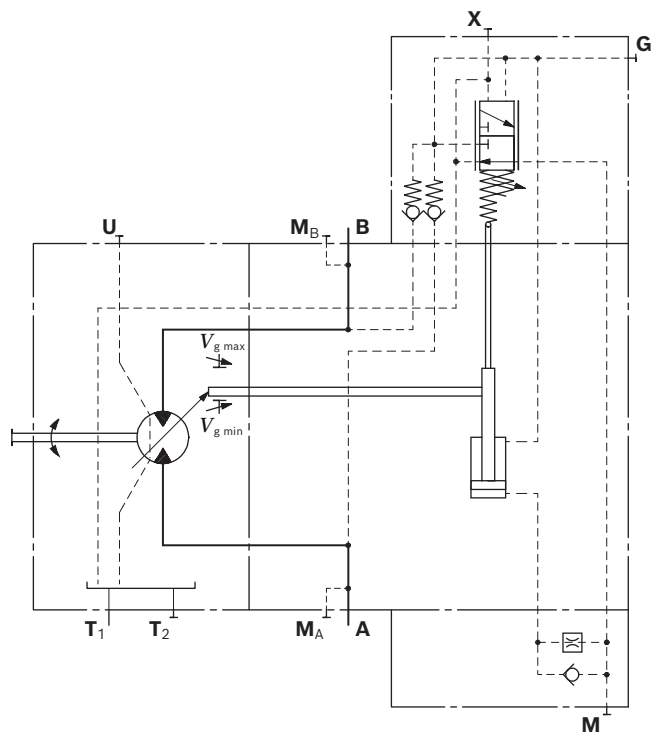
HA2 with pressure increase, positive control

A working pressure increase of $\Delta p \leq$ approx. 1450 psi (100 bar) results in an increase in displacement from $V_{g \text{ min}}$ to $V_{g \text{ max}}$. Setting range of the pressure control valve 1150 to 3600 (80 to 250 bar), specify the desired beginning of control in plain text when ordering, e.g. beginning of control at 2900 psi (200 bar).

▼ Characteristic curve HA2



▼ Circuit diagram HA2



HA.T override, hydraulic,, remote controlled, proportional

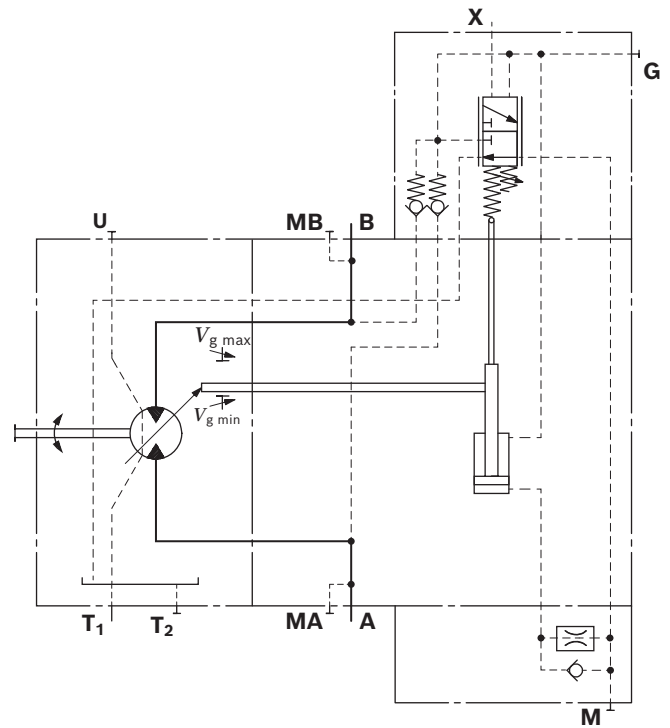
With the HA.T control, the beginning of control can be influenced by applying a pilot pressure to port **X**. For each 15 psi (1 bar) of pilot pressure increase, the beginning of control is reduced by 115 psi (8 bar). If the pilot pressure is sufficiently high, the motor swivels to $V_{g \max}$, regardless of the working pressure. (Requirement for safe adjustment: minimum working pressure of 435 psi (30 bar))

Beginning of control setting	4350 psi (300 bar)	4350 psi (300 bar)	4350 psi (300 bar)
Pilot pressure at port X	0 psi (0 bar)	145 psi (10 bar)	580 psi (40 bar) ¹⁾
Beginning of control at	4350 psi (300 bar)	3200 psi (220 bar)	0 psi (0 bar)

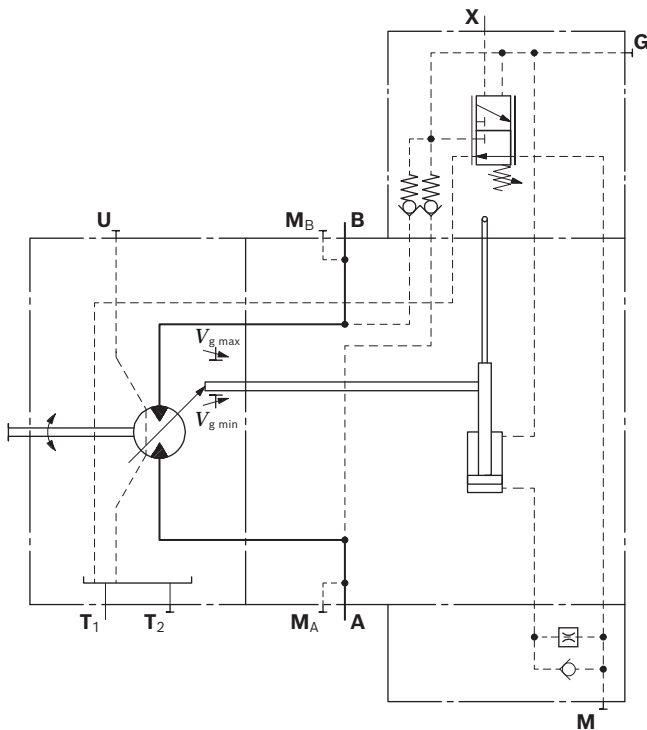
Please note

Maximum permissible pilot pressure 1450 psi (100 bar).

▼ Circuit diagram HA2T



▼ Circuit diagram HA1T



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.

Please note

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

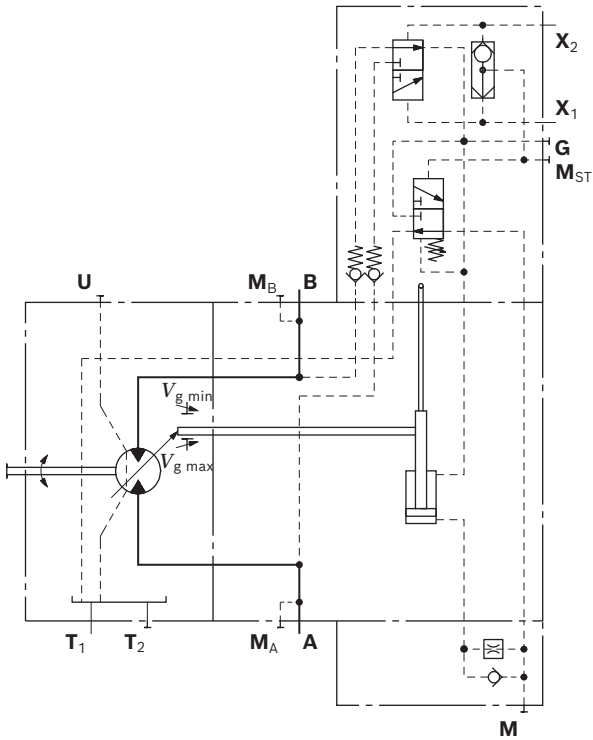
The stroking time damping impacts the swivel behavior of the motor and consequently the machine response speed. Standard with nozzle (DIA 0.047 inch (Ø1.2 mm))

DA hydraulic travel direction valve,

Depending on the direction of rotation (travel direction), the travel direction valve is switched by using pilot pressure ports **X₁** or **X₂**. The maximum permissible pilot pressure is $p_{st} = 365$ psi (25 bar). Momentary ($t < 0.1$ s) pressure peaks of up to 580 psi (40 bar) are permitted.

Direction of rotation	Working pressure in	Pilot pressure in
Clockwise	A	X₁
Counter-clockwise	B	X₂

▼ Circuit diagram DA

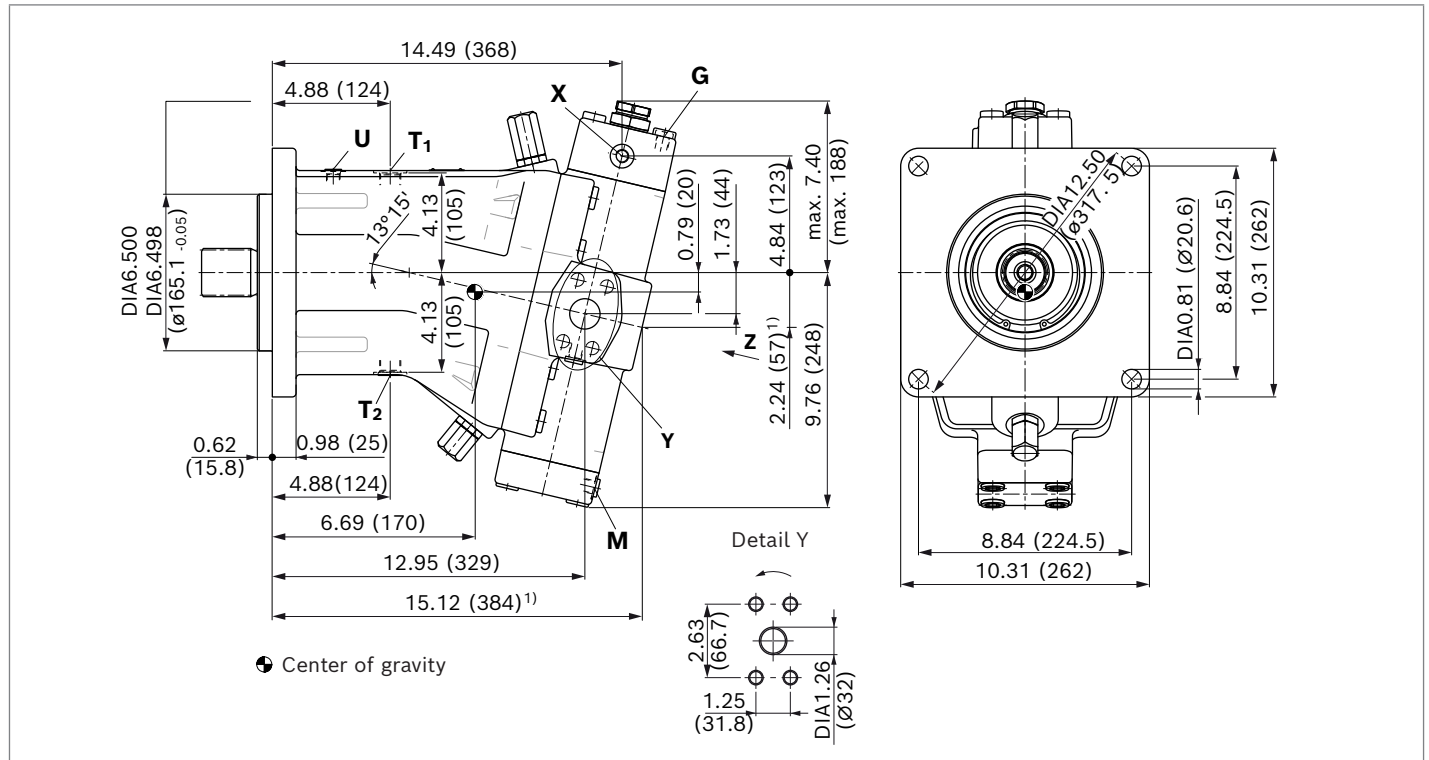


Dimensions, size 250

HD1, HD2, HD3 – Proportional control, hydraulic

HZ – Two-point control, hydraulic

Port plate 2 – SAE working ports **A** and **B** at side, opposite



Ports	Standard	Size	$p_{\max}$ [psi (bar)] ³⁾	State ⁷⁾
A, B	Working port Fastening thread A/B	SAE J518 ⁴⁾ ASME B1.1	1 1/4 in 1/2-13UNC-2B; 0.75 (19) deep	5800 (400) O
A₁, B₁	Additional working port for plate 65 Fastening thread A ₁ /B ₁	SAE J518 ⁴⁾ ASME B1.1	1 1/4 in 1/2-13UNC-2B; 0.75 (19) deep	5800 (400) O
T₁	Drain port	ISO11926 ⁶⁾	7/8 in -14 UN-2B; 0.67 (17) deep	45 (3) O ⁵⁾
T₂	Drain port	ISO11926 ⁶⁾	7/8 in -14 UN-2B; 0.67 (17) deep	45 (3) X ⁵⁾
G (G₁)	Synchronous control	ISO11926 ⁶⁾	9/16 in -18 UNF-2B; 0.51 (13) deep	5800 (400) X
G₂	2nd pressure setting (HD.D, EP.D)	ISO11926 ⁶⁾	9/16 in -18 UNF-2B; 0.51 (13) deep	5800 (400) X
P	Pilot oil supply (EP)	ISO11926 ⁶⁾	9/16 in -18 UNF-2B; 0.51 (13) deep	1450 (100) O
U	Bearing flushing	ISO11926 ⁶⁾	9/16 in -18 UNF-2B; 0.51 (13) deep	45 (3) X
X	Pilot signal (HD, HZ, HA1T/HA2T)	ISO11926 ⁶⁾	9/16 in -18 UNF-2B; 0.51 (13) deep	1450 (100) O
X	Pilot signal (HA1, HA2)	ISO11926 ⁶⁾	9/16 in -18 UNF-2B; 0.51 (13) deep	45 (3) X
X₁, X₂	Pilot signal (DA)	DIN 2353-CL	8B-ST	580 (40) O
X₃	Pilot signal (HD.G, EP.G)	ISO11926 ⁶⁾	9/16 in -18 UNF-2B; 0.51 (13) deep	5800 (400) O
M	Stroking chamber measurement	ISO11926 ⁶⁾	9/16 in -18 UNF-2B; 0.51 (13) deep	5800 (400) X
M_A, M_B	Measuring pressure A/B	ISO11926 ⁶⁾	9/16 in -18 UNF-2B; 0.51 (13) deep	5800 (400) X
M_{St}	Pilot pressure measuring	ISO11926 ⁶⁾	9/16 in -18 UNF-2B; 0.51 (13) deep	5800 (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.

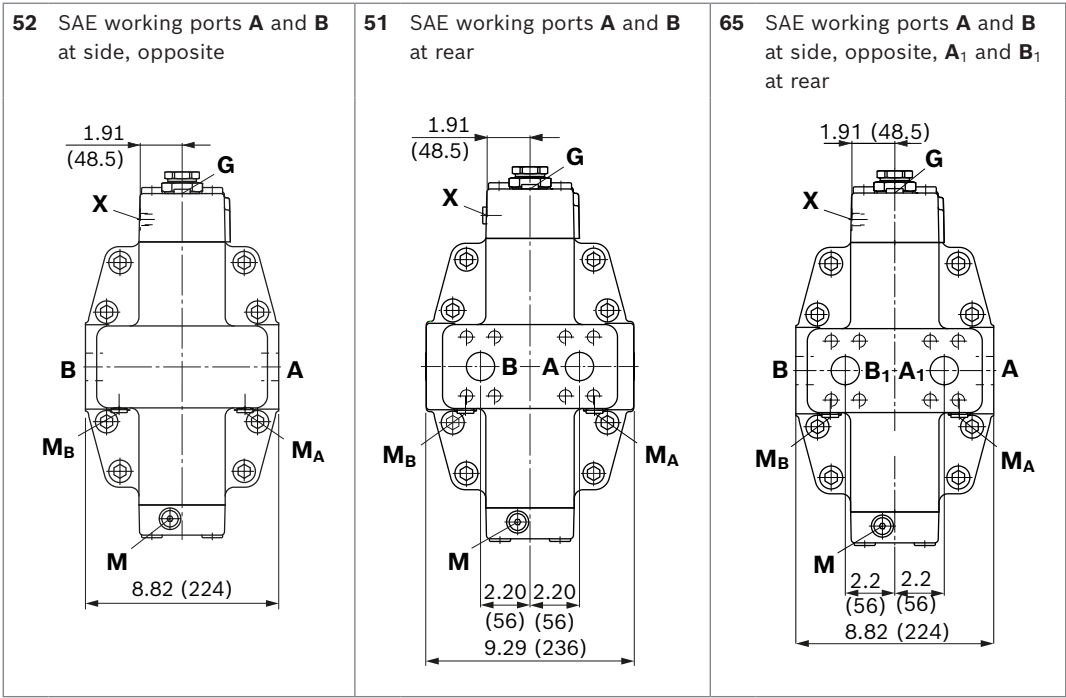
4) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.

5) Depending on installation position, **T₁** or **T₂** must be connected (see also installation instructions on page 30).

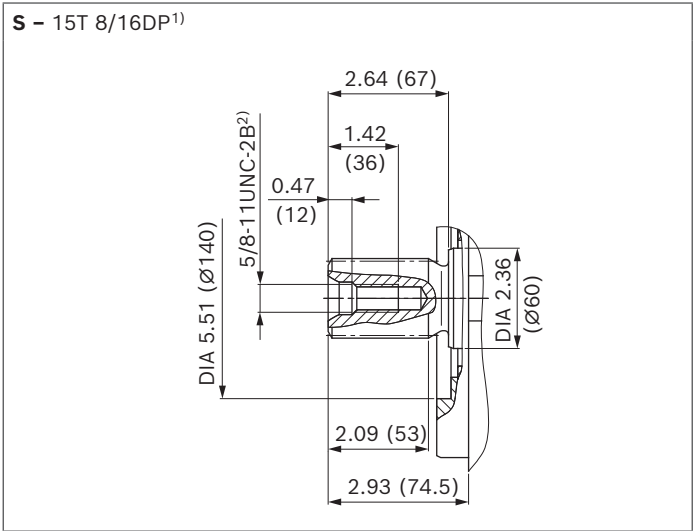
6) The countersink may be deeper than specified in the standard.

7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

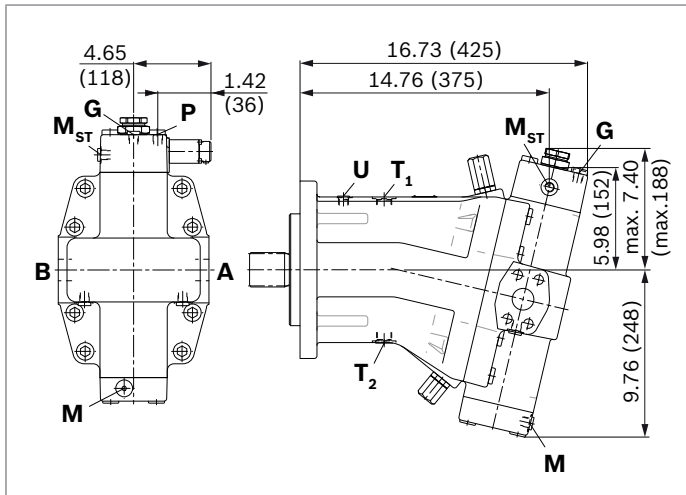
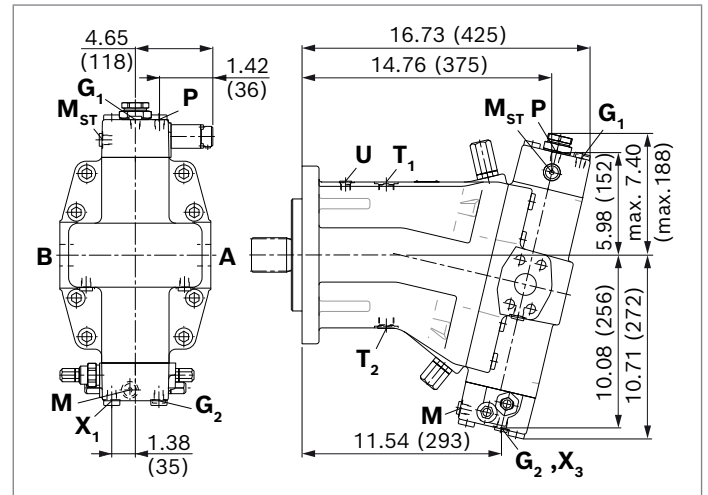
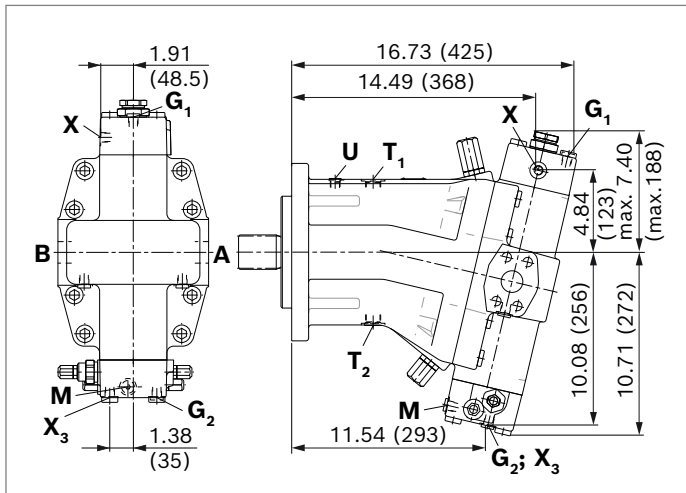
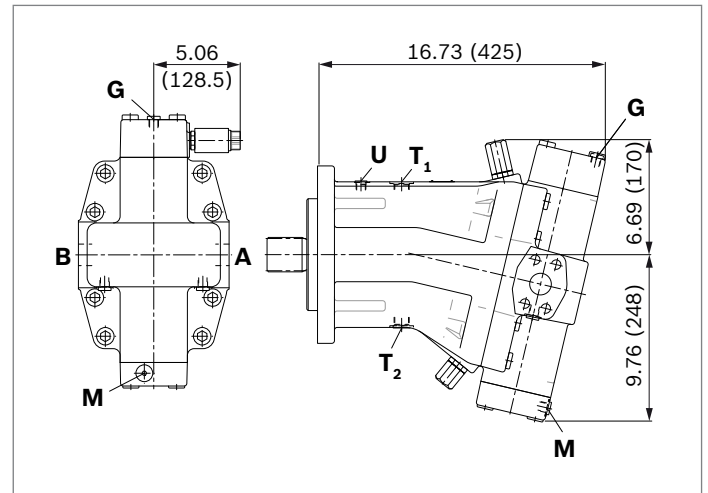
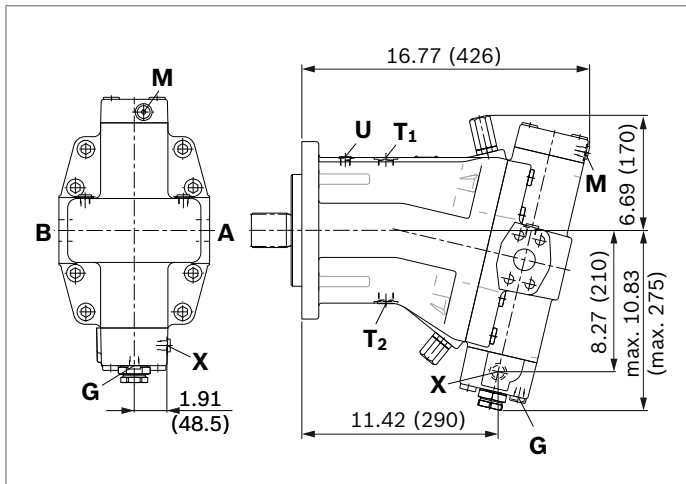
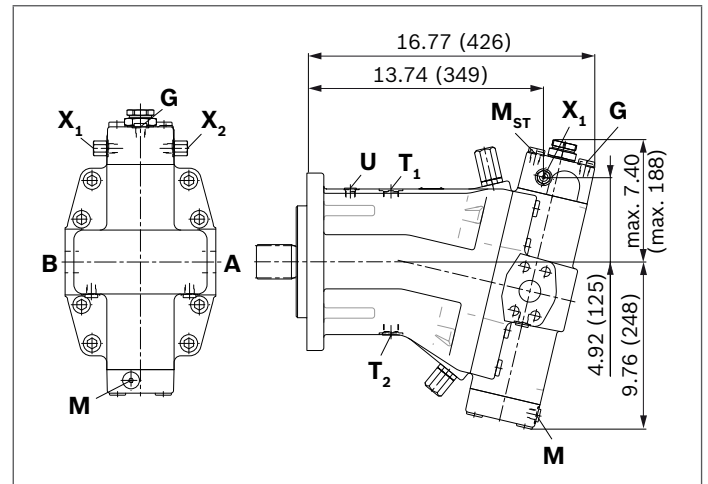
▼ **Location of working ports on the port plates** (View Z)



▼ **Splined shaft 2 in (SAE J744)**



1) Involute toothing acc. to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1

▼ **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


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 0.18 inch to 0.39 inch (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 230 psi (16 bar)

Switching pressure of flushing spool Δp

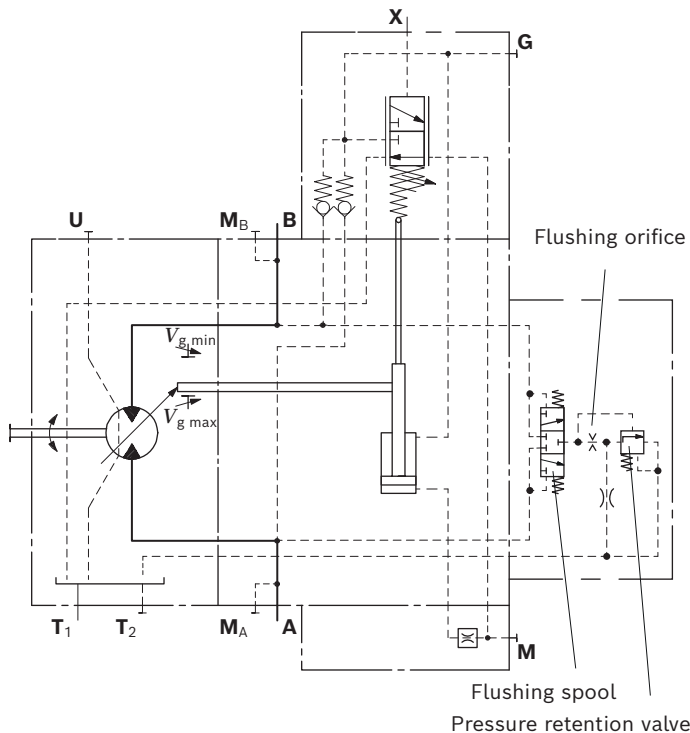
- 115 ± 15 psi (8 ± 1 bar)

Flushing flow q_v

Orifices can be used to adjust the flushing flows as required. The following parameters are based on:

$\Delta p_{ND} = p_{ND} - p_G = 365$ psi (25 bar) and $\nu = 10$ cSt
(p_{ND} = low pressure, p_G = case pressure)

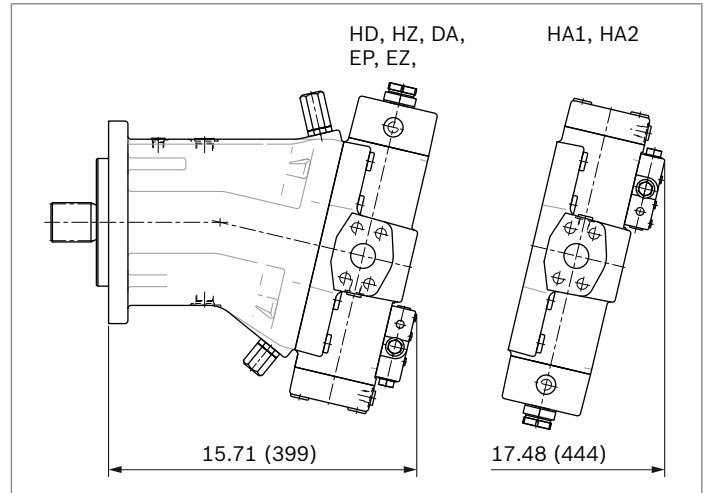
▼ Circuit diagram



Flushing valve

Material number of orifice	ϕ [inch (mm)]	q_v [gpm (l/min)]
R902290110	0.079 (2.0)	2.6 (10)

▼ Dimensions



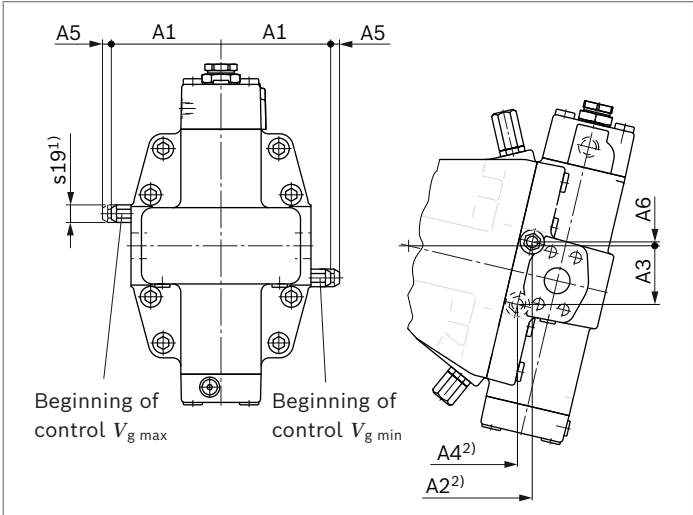
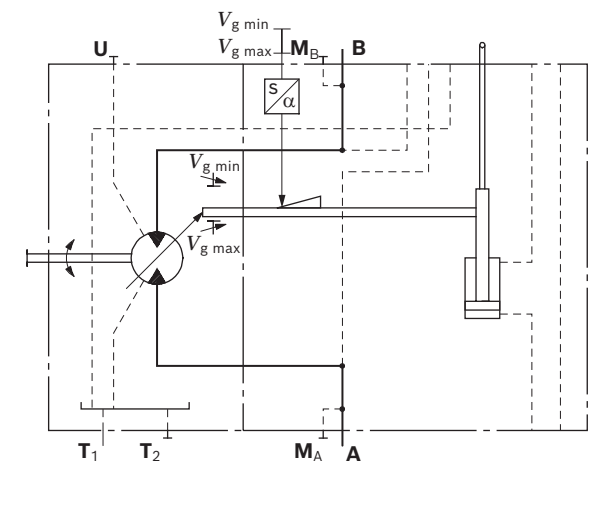
Swivel angle indicator

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 0.31 inch (8 mm) (visible after removal of the cap nut).

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



NG	A1	A2 ²⁾	A3	A4 ²⁾	A5 ³⁾	A6
250	5.37	11.7	2.87	11	0.43	0.2
	(136.5)	(298)	(73)	(280)	(11)	(5)

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.

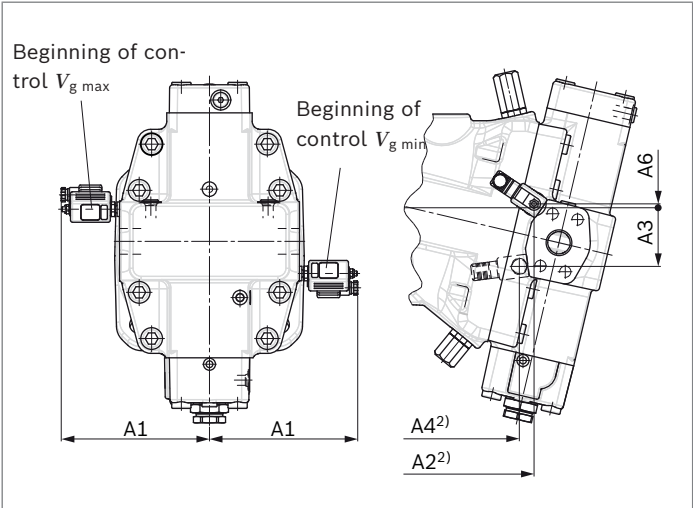
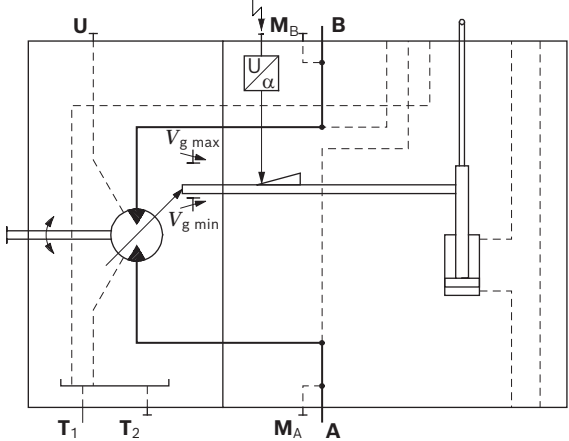
This signal can be used to transmit the swivel position to an electric control unit.

Inductive position transducer

Type of protection:

► IP65 (DIN/EN 60529)

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



NG	A1	A2 ²⁾	A3	A4 ²⁾	A6
250	7.28	10.1	2.87	9.37	0.2
	(185)	(256)	(73)	(238)	(5)

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.

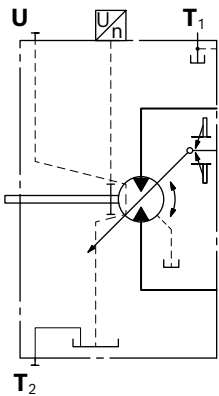
In addition to the rotational speed, DSA/20 sensor detects the direction of rotation of the motor and the temperature at the installation location.

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 (DSA/20).

The sensor is mounted on the port provided for this purpose with one (DSA/20) mounting bolt.

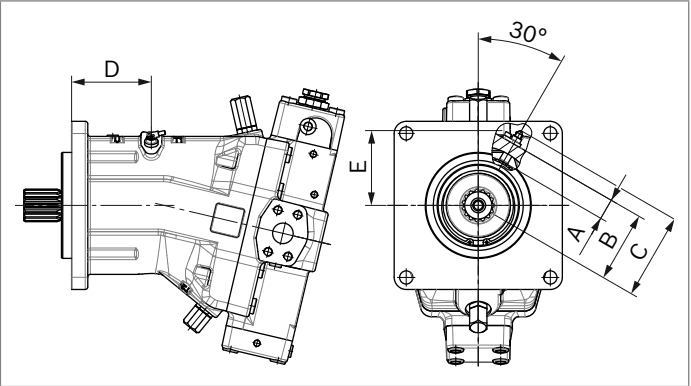
We recommend ordering the A6VM variable motor complete with mounted sensor.

Circuit diagram



Dimensions

Version "C" with DSA/20 sensor (NG250)



NG	250
Speed sensor	DSA/20
Number of teeth	78
A Installation depth (tolerance ± 0.004 (± 0.1))	1.28 (32.5)
B Contact surface	4.35 (110.5)
C	5.28 (134)
D	4.88 (124)
E	4.61 (117)

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 (**T₁**, **T₂**). 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
T₁, T₂	Drain port
SB	Baffle (baffle plate)
h_{t min}	Minimum required immersion depth (7.87 inch (200 mm))
h_{min}	Minimum required distance to reservoir bottom (3.94 inch (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.

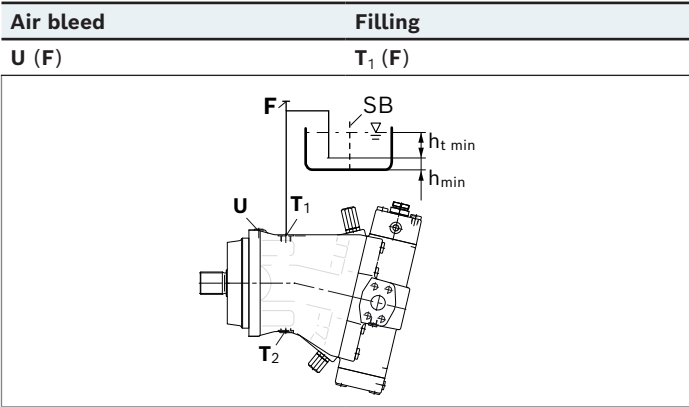
Installation position

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

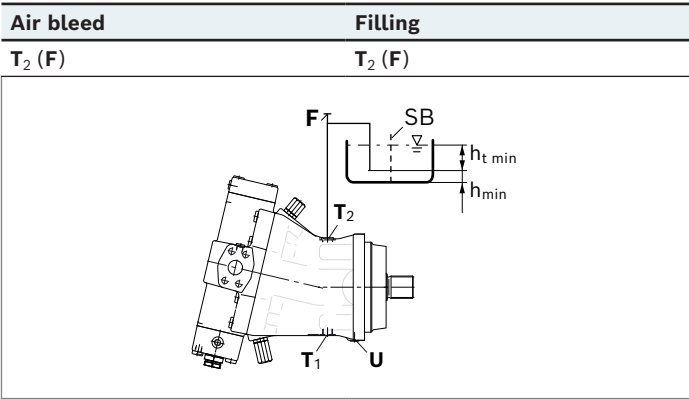
Below-reservoir installation (standard)

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

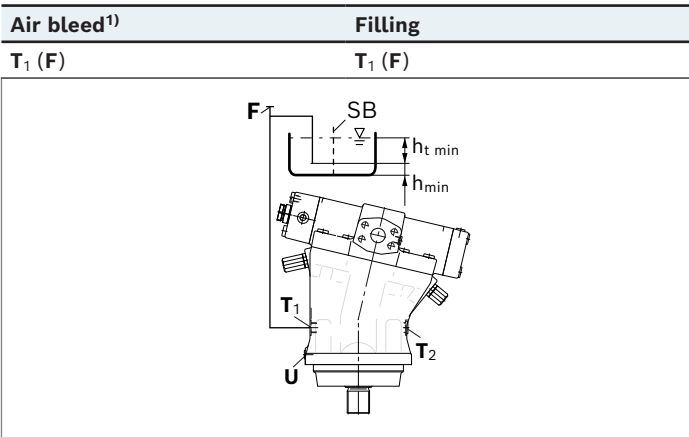
▼ Installation position 1



▼ Installation position 2

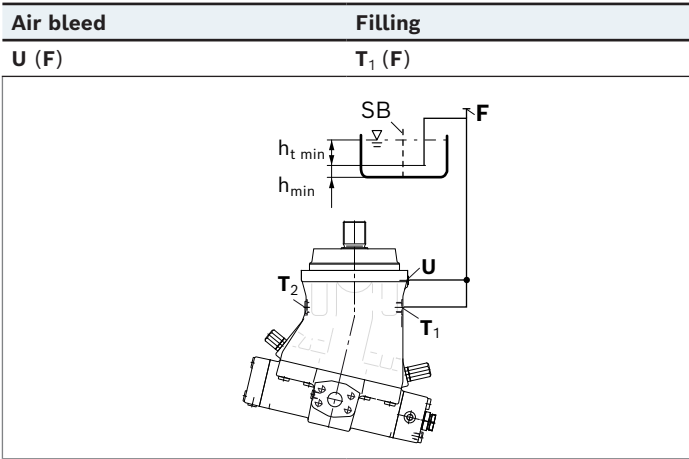


▼ Installation position 3



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.

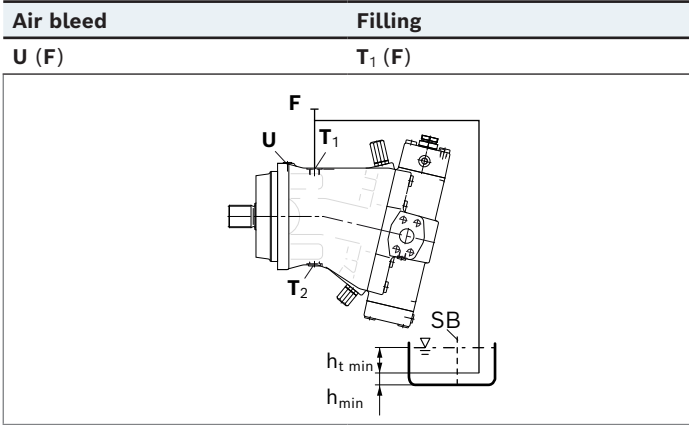
▼ Installation position 4



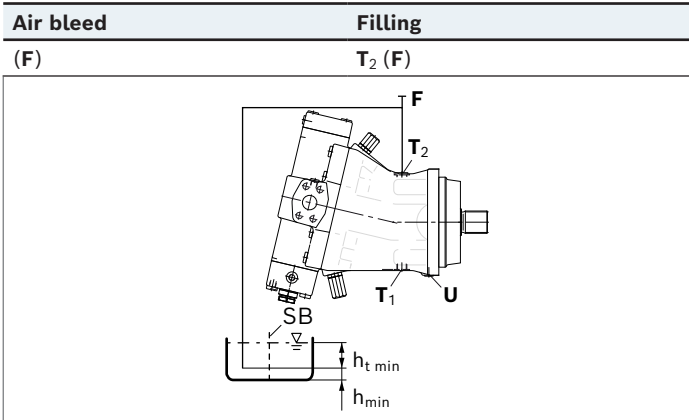
Above-reservoir installation

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

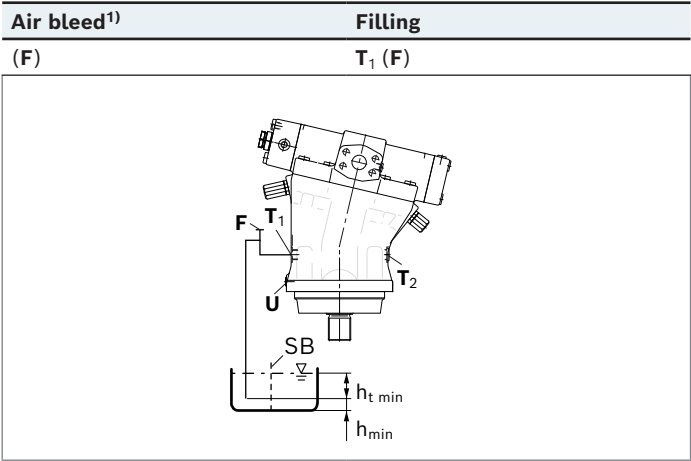
▼ **Installation position 5**



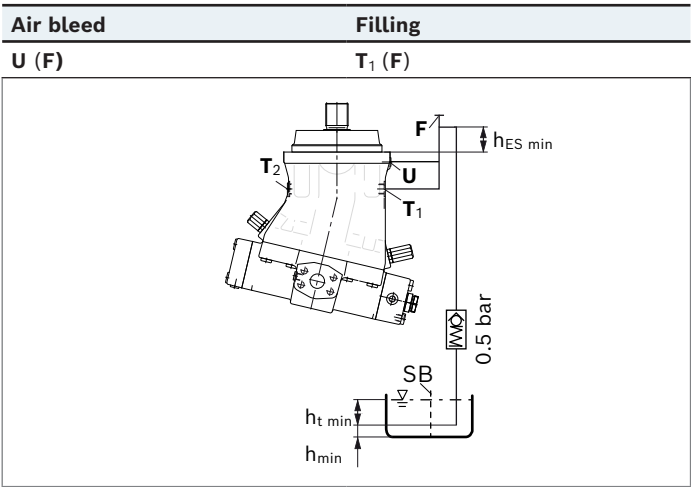
▼ **Installation position 6**



▼ **Installation position 7**



▼ **Installation position 8**



Notice

To prevent the axial piston unit from draining, a height difference $h_{ES\ min}$ of at least 0.98 inch (25 mm) to the mounting flange is required in installation position 8. Alternatively, a check valve (cracking pressure 7.5 psi (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
Instruction manual	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
	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

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