Axial piston variable double pump
A22VG series 40

RE 93221
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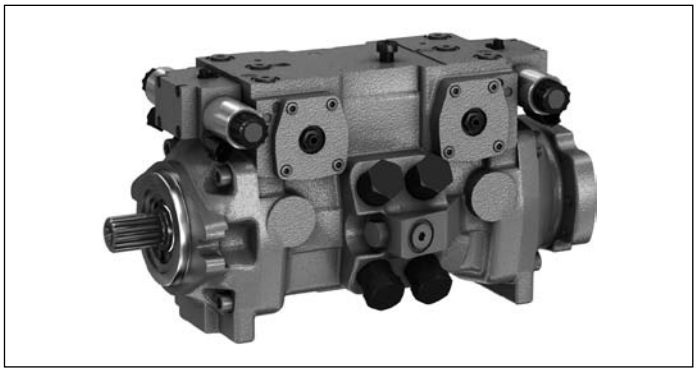


- Size 45
- Nominal pressure 380 bar
- Maximum pressure 420 bar
- Closed circuit

Features

- Variable double pump with two axial piston rotary groups of swashplate design for hydrostatic drives in a closed circuit
- The flow is proportional to the drive speed and displacement.
- The flow can be infinitely varied by adjusting the swashplate angle.
- Flow direction changes smoothly when the swashplate is moved through the neutral position.
- Only one shared port for case drain fluid for both circuits
- Compact design for tight installation conditions

Note

Only for series no smaller than 200 units per year.
Please contact us regarding smaller series.

Contents

Ordering code

01	02	03	04	05	06	07	08	09		10	11	12	13	14	15	16	17	18	19		20
A22V	**G**	**045**							**/**	**40**	**A**		**N**	**B2**	**S7**	**3**			**A**	**–**	

Axial piston unit

01	Swashplate design, variable, nominal pressure 380 bar, maximum pressure 420 bar	**A22V**

Operating mode

02	Double pump, closed circuit	**G**

Size (NG)

03	Geometric displacement, see technical data on page 7	**045**

Control device

04	Proportional control hydraulic mechanical servo, hexagon shaft with lever, free position[1)]	without neutral position switch	**HW2**
		with neutral position switch	**HW8**
	Proportional control electric	U = 12 V DC	**EP1**
		U = 24 V DC	**EP2**
	Hydraulic control, direct operated		**HT1**
	Electric control, direct operated; two pressure reducing valves per circuit	U = 12 V DC	**ET1**
		U = 24 V DC	**ET2**

Connector for solenoids[2)] (see page 23)

05	Without connector (without solenoid, only for hydraulic control)	**0**
	DEUTSCH – molded connector, 2-pin – without suppressor diode	**P**

Swivel angle sensor (see page 22)

06	Without swivel angle sensor	**0**
	Electric swivel angle sensor mounted[3)]	**R**

Pilot pressure ports		**HW**	**HT**	**EP**	**ET**	
07	Ports X_1 and X_2	●	–	●	●	**1**
	Ports X_3 and X_4	–	●	–	–	**3**
	Ports X_1, X_2 and X_3, X_4	●	–	●	●	**4**
	Ports X_5 and X_6	–	●	–	–	**5**

Mechanical stroke limiter (see page 22)

08	Without mechanical stroke limiter	**0**
	One-sided mechanical stroke limiter, externally adjustable, on opposite side to service line ports	**F**

DA control valve (see page 15)		**HW**	**HT**	**EP**	**ET**	
09	Without DA control valve	●	●	●	●	**0**
	DA control valve fixed setting	●	●	●	–	**1**

Series

10	Series 4, index 0	**40**

Configuration of ports and fastening threads

11	ANSI, port threads with O-ring seal according to ISO 11926	**A**

● = Available **–** = Not available

1) On delivery, the position of the lever may differ from that shown in the brochure or drawing. If necessary, the position of the lever can be adjusted by the customer.
2) Connectors for other electric components can deviate.
3) Please contact us if the swivel angle sensor is used for control

01	02	03	04	05	06	07	08	09		10	11	12	13	14	15	16	17	18	19		20
A22V	**G**	**045**							**/**	**40**	**A**		**N**	**B2**	**S7**	**3**			**A**	**–**	

Direction of rotation

12	Viewed on drive shaft	clockwise	**R**
		counter-clockwise	**L**

Sealing material

13	NBR (nitrile-rubber), shaft seal in FKM (fluoroelastomer)	**N**

Mounting flange

14	SAE J744, 101-2	**B2**

Drive shaft (permissible input torque, see page 17)

15	Splined shaft ANSI B92.1a, 1 1/4 in 14T 12/24DP	**S7**

Service line ports

16	Threaded ports A and B, left (viewed on drive shaft)	**3**

Boost pump[4)]

17	Without boost pump (standard)	**U**
	Boost pump	**F**

Through drive (mounting options, see page 19)

	Flange SAE J744			Hub for splined shaft[5)]			
18	Diameter	Mounting[6)]	Designation	Diameter		Designation	
	101-2 (B)	⚯	B2	7/8 in	13T 16/32DP	S4	**B2S4**
				1 in	15T 16/32DP	S5	**B2S5**

Pressure-relief valve

19	High-pressure relief valve, direct operated, without bypass (for values, see page 20)	**A**

Standard / special version

20	Standard version	**0**
	Standard version with installation variants, e.g. T ports against standard open or closed	**Y**
	Special version	**S**

● = Available – = Not available

Notes

- Observe the project planning notes on page 26!
- A pressure cut-off is not available for this unit.
- Preservation:
  - up to 12 months as standard
  - up to 24 months long-term
    (state in plain text when ordering)

4) Pressure or suction filtration required. To be supplied by customer. Boost pressure inlet at port G, a DA control valve is used at port G1.
5) Hub for splined shaft according to ANSI B92.1a
6) Mounting drillings pattern viewed on through drive with control at top

Hydraulic fluids

The A22VG variable double pump is designed for operation with HLP mineral oil according to DIN 51524.
Application notes and requirements for hydraulic fluids should be taken from the following data sheets before the start of project planning:

- 90220: Hydraulic fluids based on mineral oils and related hydrocarbons
- 90221: Environmentally acceptable hydraulic fluids
- 90222: Fire-resistant, water-free hydraulic fluids (HFDR/HFDU)

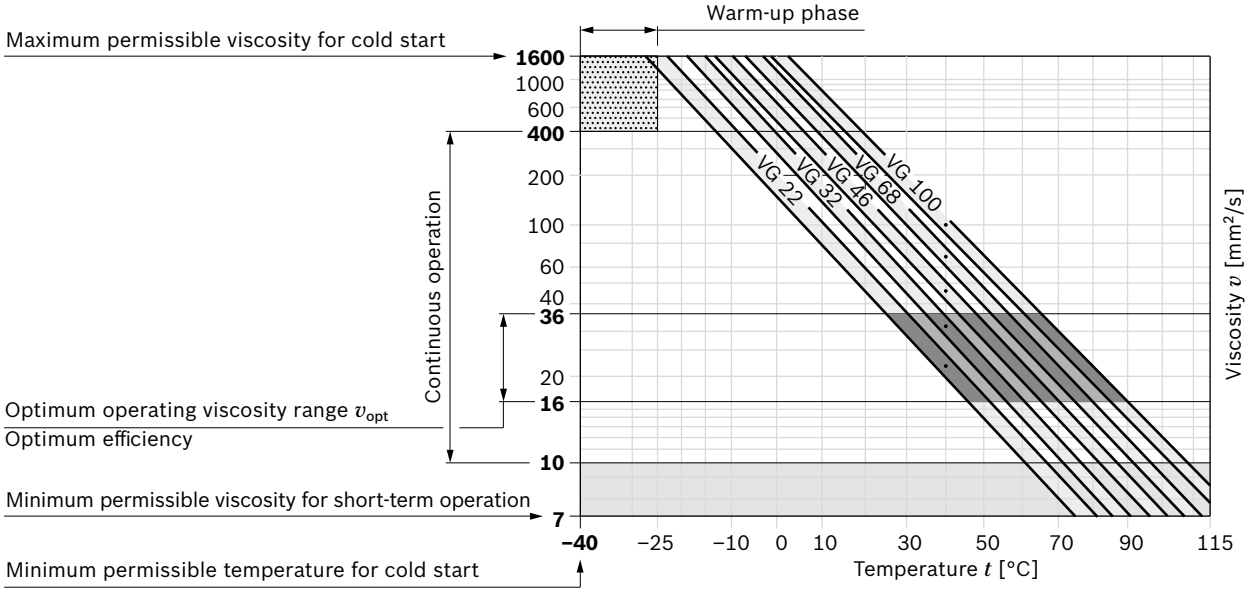
Details regarding the selection of hydraulic fluid
The hydraulic fluid should be selected such that the operating viscosity in the operating temperature range is within the optimum range (v_{opt} see selection diagram).

Note
At no point of the component may the temperature be higher than 115 °C. The temperature difference specified in the table is to be taken into account when determining the viscosity in the bearing.
If the above conditions cannot be maintained due to extreme operating parameters, please contact the responsible member of staff at Bosch Rexroth.

Viscosity and temperature of hydraulic fluids

	Viscosity	Temperature	Comment
Cold start	v_{max} ≤ 1600 mm²/s	θ_{St} ≥ -40 °C	t ≤ 3 min, n ≤ 1000 rpm, without load p ≤ 50 bar
Permissible temperature difference		ΔT ≤ 25 K	between axial piston unit and hydraulic fluid in the system
Warm-up phase	v < 1600 to 400 mm²/s	θ = -40 °C to -25 °C	At p ≤ 0.7 × p_{nom}, n ≤ 0.5 × n_{nom} and t ≤ 15 min
Continuous operation	v = 400 to 10 mm²/s		This corresponds, for example on the VG 46, to a temperature range of +5 °C to +85 °C (see selection diagram)
		θ = -25 °C to +110 °C	measured at port T Note the permissible temperature range of the shaft seal (ΔT = approx. 5 K between the bearing/shaft seal and port **T**)
	v_{opt} = 36 to 16 mm²/s		Range of optimum operating viscosity and efficiency
Short-term operation	v_{min} ≥ 7 mm²/s		t < 3 min, p < 0.3 × p_{nom}

▼ **Selection diagram**



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.

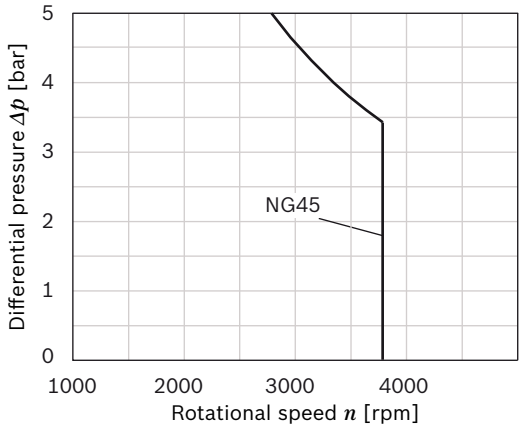
We recommend, depending on the system and application, for the A22VG: filter cartridges $\beta_{20} \geq 100$.

At very high hydraulic fluid temperatures (90 °C to maximum 110 °C, measured at port T), a cleanliness level of at least 19/17/14 according to ISO 4406 is necessary.

Shaft seal

Permissible pressure loading

The service life of the shaft seal is influenced by the speed of the axial piston unit and the leakage pressure in the housing (case pressure). Momentary pressure spikes (t < 0.1 s) of up to 10 bar are permitted. The service life of the shaft seal decreases with increasing frequency of pressure spikes and increasing mean differential pressure. The case pressure must be equal to or higher than the ambient pressure.

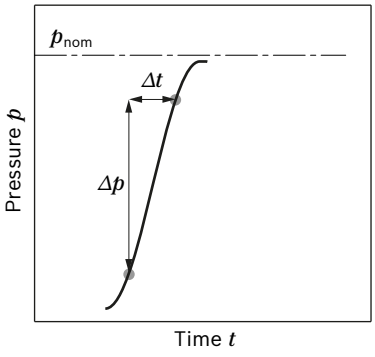


The FKM shaft seal may be used for leakage temperatures from –25 °C to +115 °C. For application cases below –25 °C, an NBR shaft seal is required (permissible temperature range: –40 °C to +90 °C).

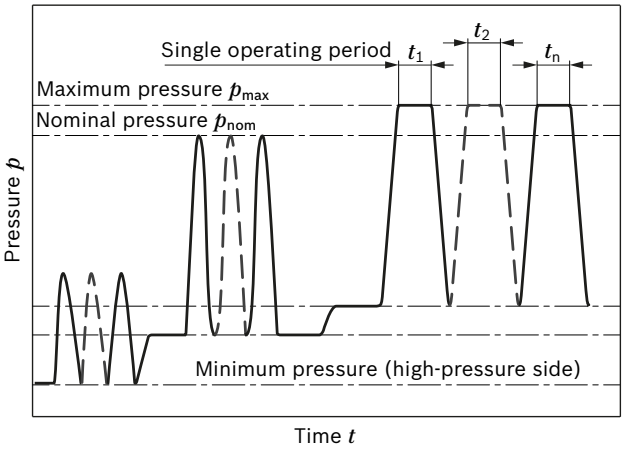
Operating pressure range

Pressure at service line port A or B		Definition
Nominal pressure p_{nom}	380 bar absolute	The nominal pressure corresponds to the maximum design pressure.
Maximum pressure p_{max}	420 bar absolute	The maximum pressure corresponds to the maximum operating pressure within the single operating period. The sum of the 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 absolute	Minimum pressure at the high-pressure side (A or B) which is required in order to prevent damage to the axial piston unit.
Minimum pressure (low-pressure side)	10 bar above case pressure	Minimum pressure at the low-pressure side (A or B) which is required in order to prevent damage to the axial piston unit. Boost pressure setting must be higher depending on system.
Rate of pressure change $R_{A\,max}$	9000 bar/s	Maximum permissible rate of pressure build-up and reduction during a pressure change over the entire pressure range.
Boost pump		
Nominal pressure $p_{Sp\,nom}$	25 bar absolute	
Maximum pressure $p_{Sp\,max}$	30 bar absolute	
Pressure at suction port S (inlet)		
Continuous $p_{S\,min}$ ($v \leq 30$ mm²/s)	≥0.8 bar absolute	
Short-term, on cold start (t < 3 min)	≥0.5 bar absolute	
Maximum pressure $p_{S\,max}$	≤5 bar absolute	
Control pressure		
Minimum control pressure $p_{St\,min}$		To ensure the function of the control, a minimum control pressure $p_{St\,min}$ at n = 2000 rpm is required depending on the rotational speed and operating pressure.
Controls EP and HW	18 bar above case pressure	
Controls ET and HT	25 bar above case pressure	

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



▼ **Pressure definition**



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

Note

Operating pressure range valid when using hydraulic fluids based on mineral oils. Values for other hydraulic fluids, please contact us.

Technical data

Size			NG		45
Displacement geometric, per revolution	variable pump (for each rotary group)		$V_{g\,max}$	cm^3	2 x 46
	boost pump (at p = 25 bar)		$V_{g\,Sp}$	cm^3	14.9
Rotational speed[1]	maximum at $V_{g\,max}$		n_{nom}	rpm	3300[6]
	limited maximum[2]		n_{max1}	rpm	3550
	intermittent maximum[3]		n_{max2}	rpm	3800
	minimum		n_{min}	rpm	500
Flow	at $V_{g\,max}$ and n_{nom}		q_v	l/min	2 x 152
Power[4]	at $V_{g\,max}$, n_{nom} and Δp = 380 bar		P	kW	192
Torque[4]	at $V_{g\,max}$ and	Δp = 300 bar	T	Nm	556
		Δp = 100 bar	T	Nm	146
Rotary stiffness drive shaft	1 1/4 in S7	Pump 1	c_1	Nm/rad	73804
		Pump 2	c_2	Nm/rad	23066
Moment of inertia (see graphic below)	rotary group 1		J_{TW1}	kgm^2	0.003327
	rotary group 2		J_{TW2}	kgm^2	0.003293
Maximum angular acceleration for each rotary group[5]			α	rad/s^2	4000
Case volume			V	L	1.7
Weight with HT control (approx.)			m	kg	53

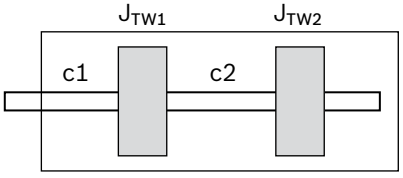
Determination the operating characteristics

Flow	$q_v = \frac{V_g \times n \times \eta_v}{1000}$	[l/min]
Torque	$T = \frac{V_g \times \Delta p}{20 \times \pi \times \eta_{mh}}$	[Nm]
Power	$P = \frac{2 \pi \times T \times n}{60000} = \frac{q_v \times \Delta p}{600 \times \eta_t}$	[kW]

Key

V_g	=	Displacement per revolution [cm^3]
Δp	=	Differential pressure [bar]
n	=	Rotational speed [rpm]
η_v	=	Volumetric efficiency
η_{mh}	=	Mechanical-hydraulic efficiency
η_t	=	Total efficiency ($\eta_t = \eta_v \times \eta_{mh}$)

▼ **Spring-mass system with moment of inertia**

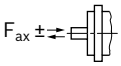


Notes

- Theoretical values, without efficiency levels 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. Bosch Rexroth recommends checking the loading by means of testing or calculation / simulation and comparison with the permissible values.
- Transport and storage
  - $\theta_{min} \geq -50$ °C
  - θ_{opt} = +5 °C to +20 °C

1) The values are valid:
   - for the optimum viscosity range of v_{opt} = 36 to 16 mm^2/s
   - with hydraulic fluid based on mineral oil
2) limited maximum speed:
   At half corner power (e.g., at $V_{g\,max}$ and p_{nom} /2)
3) Intermittent maximum speed at:
   - high idle
   - overspeed: Δp = 70 to 150 bar and $V_{g\,max}$
   - reversing peaks: Δp < 300 bar and t < 0.1 s.
4) Without boost pump
5) The data are valid for values between the minimum required and maximum permissible rotational speed. Valid for external excitation (e. g. diesel engine 2 to 8 times rotary frequency; cardan shaft twice the rotary frequency). The limit value applies for a single pump only. The load capacity of the connection parts must be considered.
6) When using a boost pump, please consult with the responsible plant.

Permissible radial and axial forces of the drive shaft

Size		NG		45
Drive shaft			in	1 1/4
Maximum radial force at distance a (from shaft collar)		$F_{q\,max}$	N	3190
		a	mm	24
Maximum axial force		$\pm F_{ax\,max}$	N	1500

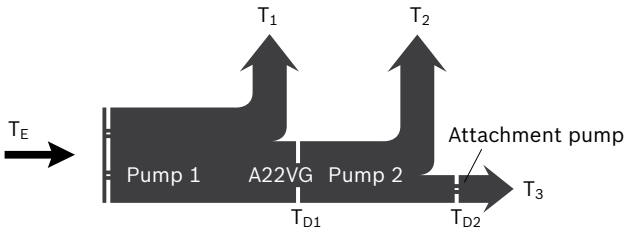
Note

Special requirements apply in the case of belt drive and cardan shaft. Please contact us.

Permissible input and through-drive torques

Size		NG		45
Torque at $V_{g\,max}$ and Δp = 380 bar[1]		T	Nm	556
Maximum input torque at drive shaft[2]				
S7	1 1/4 in	$T_{E\,max}$	Nm	602
Maximum through-drive torque		$T_{D1\,max}$	Nm	300
		$T_{D2\,max}$	Nm	$T_{D2\,perm} = 300 - T_2$

▼ **Torque distribution**

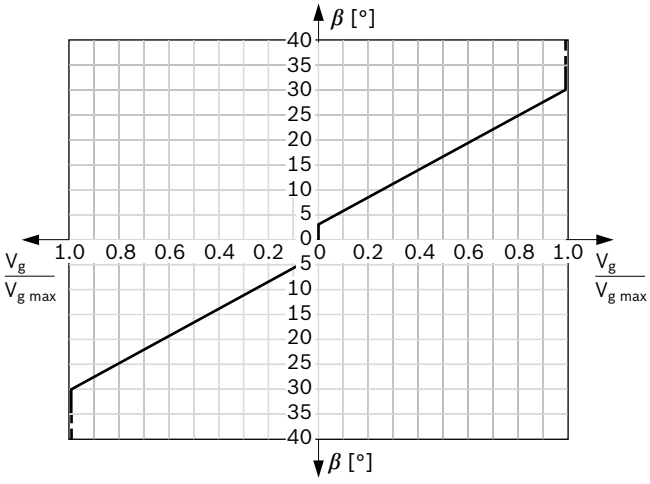


Torque – A22VG	1st pump	T_1		
	2nd pump	T_2		
Torque – attachment pump		T_3		
Input torque		T_E	=	$T_1 + T_2 + T_3$
		T_E	<	$T_{E\,max}$
Through-drive torque		T_{D1}		
		T_{D2}		

1) Efficiency not considered
2) For drive shafts without radial force

HW – proportional control hydraulic, mechanical servo

The output flow of the pump is infinitely variable between 0 to 100%, proportional to the swivel angle of the control lever.
A feedback lever, connected to the stroking piston maintains the pump flow for a given position of the control lever. If the pump is also equipped with a DA control valve (see page 15), automotive operation is possible for travel drives.



Swivel angle β at the control lever for pump displacement change:

- Start of control at β = ±3°
- End of control at β (max. displacement $V_{g\,max}$) at ±30°
- Rotation limiting β of the control lever (internal) ±38°

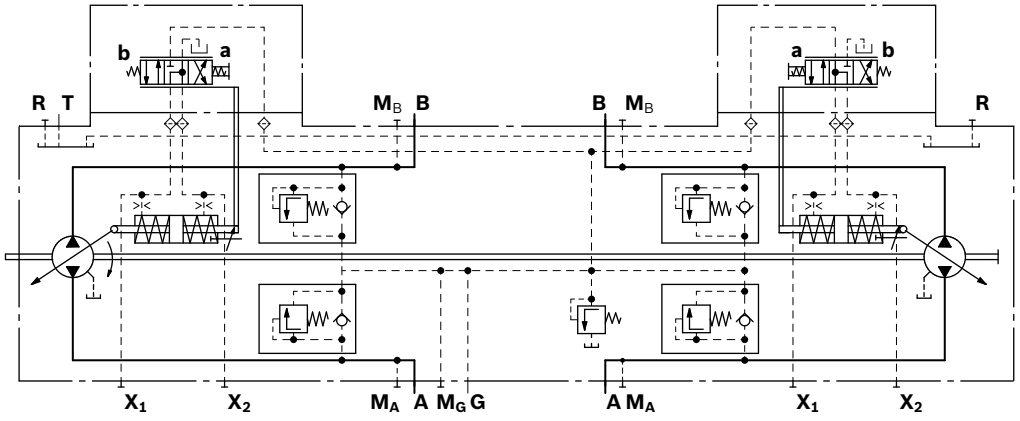
The maximum required torque at the lever is 170 Ncm. To prevent damage to the HW control module, a mechanical stop must be provided by the customer for the HW control lever.

Note
Spring centering enables the pump, depending on pressure and rotational speed, to move automatically to the neutral position (V_g = 0) as soon as there is no longer any torque on the control lever of the HW control module (regardless of deflection angle).

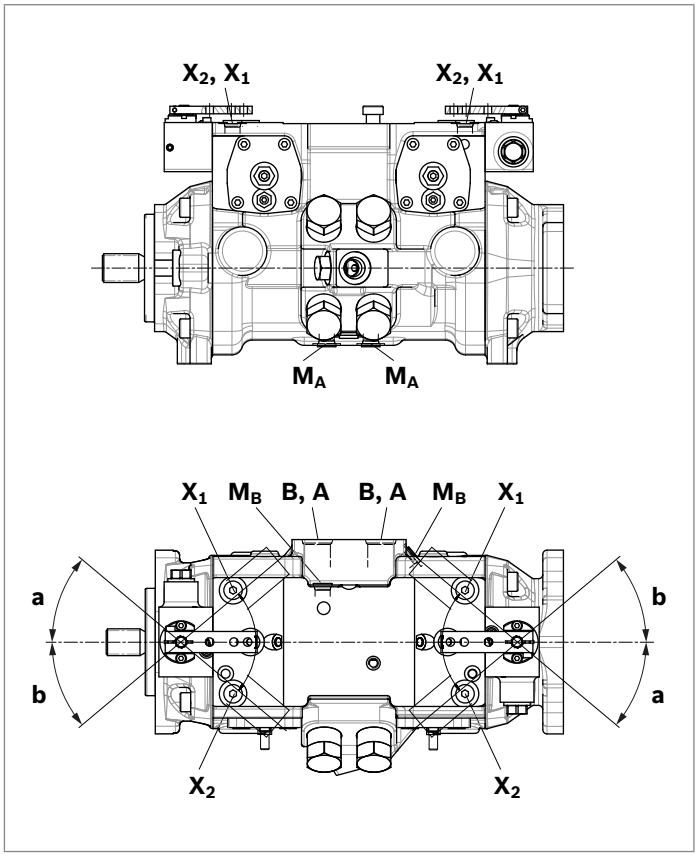
Variation: Neutral position switch
The switch contact in the neutral position switch is closed when the control lever on the HW control module is in its neutral position. The switch opens when the control lever is moved out of neutral in either direction.
Thus, the neutral position switch provides a monitoring function for drive units that require the pump to be in the neutral position during certain operating conditions (e.g. starting diesel engines).

Technical data	
Load capacity	20 A (continuous), without switching operations
Switching capacity	15 A / 32 V (resistive load)
	4 A / 32 V (inductive load)
Connector version	DEUTSCH DT04-2P-EP04 (Mating connector, see page 23)

▼ **Schematic**

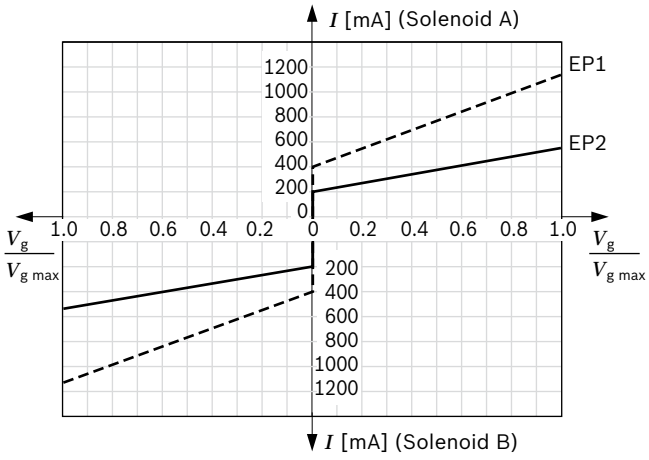


Assignment of direction of rotation, control and flow direction								
Direction of rotation	clockwise				counter-clockwise			
Pump	Pump 1		Pump 2		Pump 1		Pump 2	
Lever direction	a	b	a	b	a	b	a	b
Control pressure (X_3, X_4 optional, see page 21)	X_2	X_1	X_1	X_2	X_2	X_1	X_1	X_2
	X_4	X_3	X_3	X_4	X_4	X_3	X_3	X_4
Flow direction	A to B	B to A	B to A	A to B	B to A	A to B	A to B	B to A
Operating pressure	M_B	M_A	M_A	M_B	M_A	M_B	M_B	M_A



EP – Proportional control electric

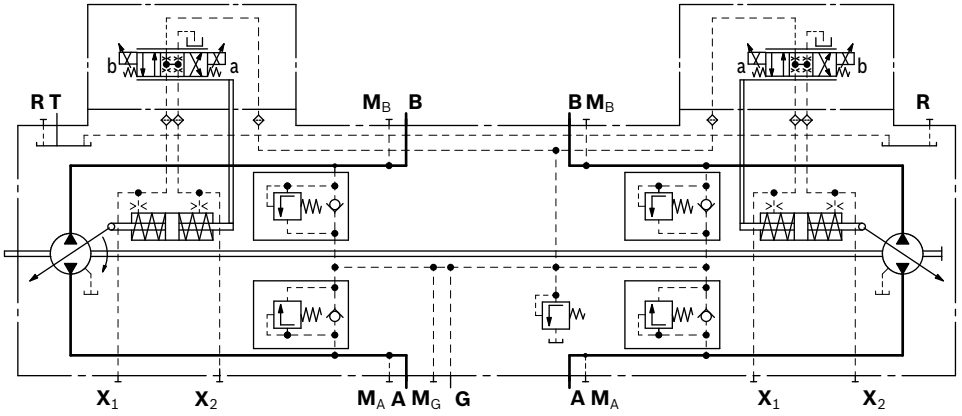
The output flow of the pump is infinitely variable between 0 to 100%, proportional to the electrical current supplied to solenoid **a** or **b**.
The electrical energy is converted into a force acting on the control spool.
This valve spool then directs control oil into and out of the stroking cylinder to adjust pump displacement as required. A feedback lever, connected to the stroking piston maintains the pump flow for a given current within the control range.
If the pump is also equipped with a DA control valve (see page 15), automotive operation is possible for travel drives.



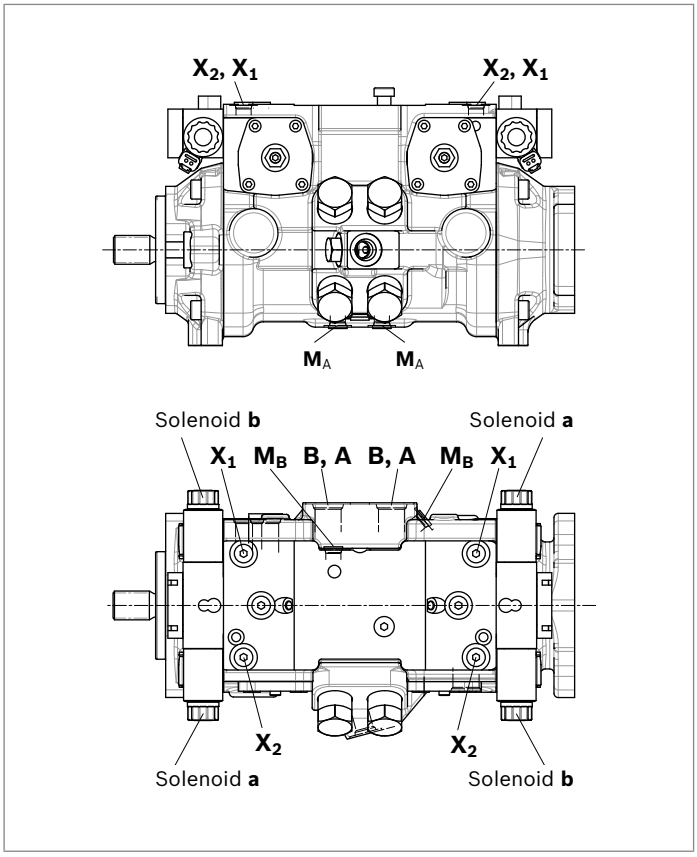
Technical data, solenoid	EP1	EP2
Voltage	12 V (±20%)	24 V (±20%)
Control current		
Beginning of control at V_g= 0	400 mA	200 mA
End of control at $V_{g\,max}$	1115 mA	560 mA
Current limit	1.54 A	0.77 A
Nominal resistance (at 20 °C)	5.5 Ω	22.7 Ω
Dither frequency	100 Hz	100 Hz
Duty cycle	100 %	100 %
Type of protection, see connector version on page 23		

Various BODAS controllers with application software and amplifiers are available for controlling the proportional solenoids.
Further information can also be found on the internet at www.boschrexroth.com/mobile-electronics.

▼ **Schematic**

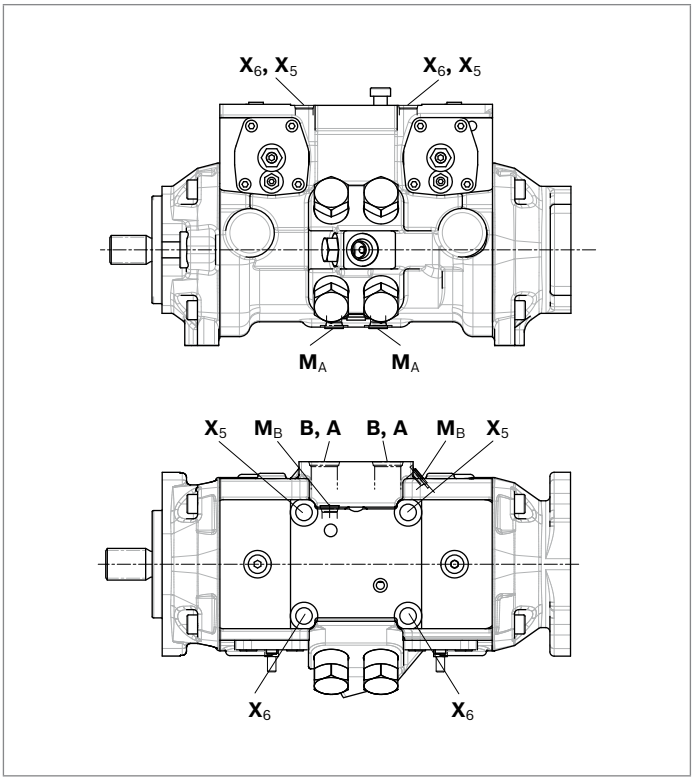


Assignment of direction of rotation, control and flow direction								
Direction of rotation	clockwise				counter-clockwise			
Pump	Pump 1		Pump 2		Pump 1		Pump 2	
Actuation of solenoid	a	b	a	b	a	b	a	b
Control pressure (X_3, X_4 optional, see page 21)	X_2	X_1	X_1	X_2	X_2	X_1	X_1	X_2
	X_4	X_3	X_3	X_4	X_4	X_3	X_3	X_4
Flow direction	A to B	B to A	B to A	A to B	B to A	A to B	A to B	B to A
Operating pressure	M_B	M_A	M_A	M_B	M_A	M_B	M_B	M_A

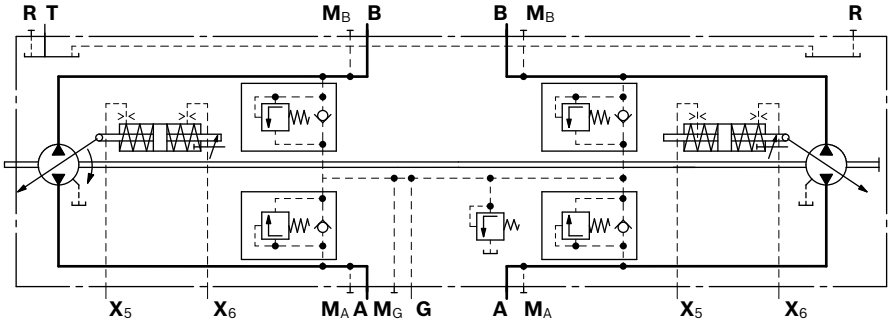


HT – Hydraulic control, direct operated

With the direct hydraulic control, the flow of the pump is influenced by a hydraulic control pressure that is applied directly to the stroking piston through $\mathbf{X_5}$ or $\mathbf{X_6}$.
Flow direction is determined by which control pressure port is pressurized (refer to table below).
Pump displacement is infinitely variable and proportional to the applied control pressure, but is also influenced by system pressure and pump drive speed.
Maximum permissible control pressure: 30 bar
Use of the HT control requires a review of the engine and vehicle parameters to ensure that the pump is set up correctly. We recommend that all HT applications be reviewed by a Bosch Rexroth application engineer.
The DA control valve only becomes effective if the pilot control device used for controlling the HT control is supplied from port **Y**.



▼ **Schematic**

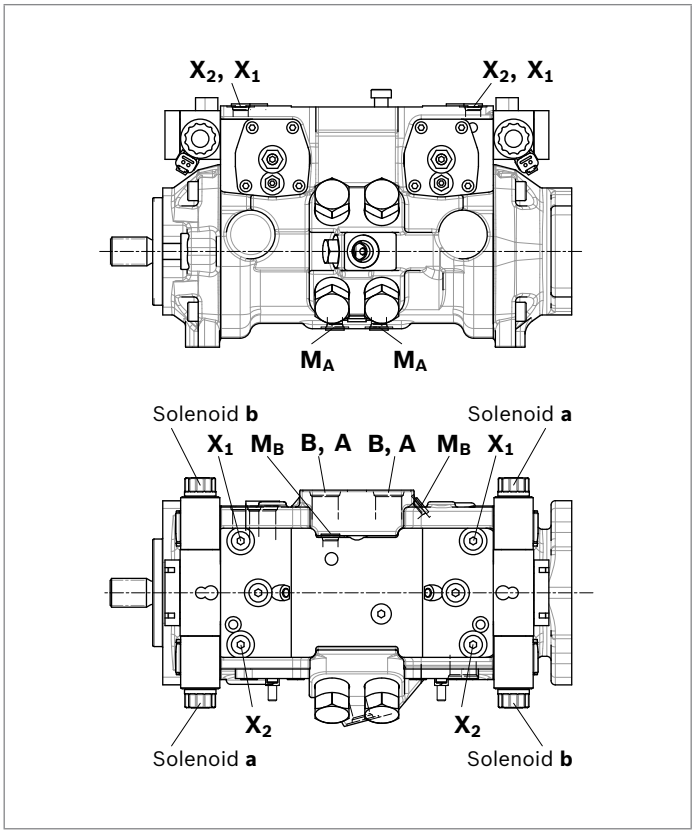


Assignment of direction of rotation, control and flow direction								
Direction of rotation	clockwise				counter-clockwise			
Pump	Pump 1		Pump 2		Pump 1		Pump 2	
Control pressure (X_3, X_4 optional, see page 21)	X_6	X_5	X_5	X_6	X_6	X_5	X_5	X_6
	X_4	X_3	X_3	X_4	X_4	X_3	X_3	X_4
Flow direction	A to B	B to A	B to A	A to B	B to A	A to B	A to B	B to A
Operating pressure	M_B	M_A	M_A	M_B	M_A	M_B	M_B	M_A

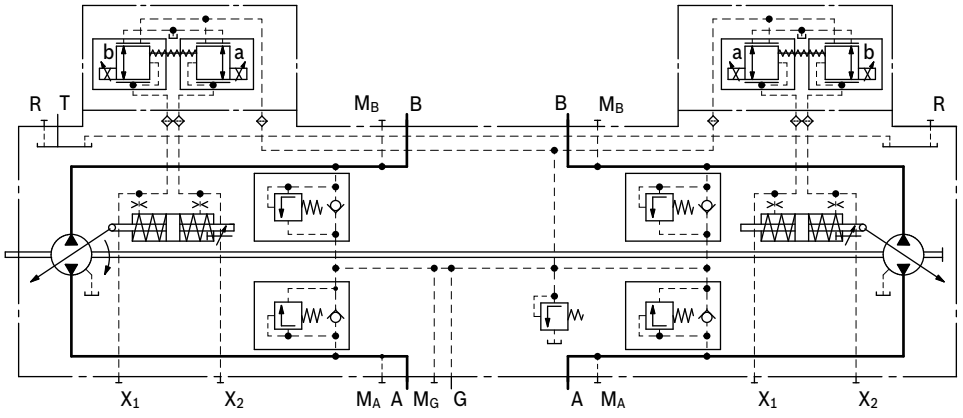
ET – Electric control, direct operated

The output flow of the pump is infinitely variable in the range 0 to 100%. Depending on the preselected current I (mA) at solenoids **a** and **b** of the pressure reducing valves, the stroking cylinder of the pump is proportionally supplied with control pressure. The pump displacement that arises at a certain control current is dependent on the rotational speed and operating pressure of the pump. A different flow direction is associated with each pressure reducing valve.
Maximum permissible control pressure: 30 bar

Technical data, solenoid	ET1	ET2
Voltage	12 V (±20%)	24 V (±20%)
Current limit	1.54 A	0.77 A
Nominal resistance (at 20 °C)	5.5 Ω	22.7 Ω
Dither frequency	100 Hz	100 Hz
Duty cycle	100 %	100 %
Type of protection, see connector version on page 23		



▼ **Schematic**



Assignment of direction of rotation, control and flow direction								
Direction of rotation	clockwise				counter-clockwise			
Pump	Pump 1		Pump 2		Pump 1		Pump 2	
Actuation of solenoid	a	b	a	b	a	b	a	b
Control pressure (X_3, X_4 optional, see page 21)	X_2	X_1	X_1	X_2	X_2	X_1	X_1	X_2
	X_4	X_3	X_3	X_4	X_4	X_3	X_3	X_4
Flow direction	A to B	B to A	B to A	A to B	B to A	A to B	A to B	B to A
Operating pressure	M_B	M_A	M_A	M_B	M_A	M_B	M_B	M_A

DA – Control valve, fixed setting

Speed related pilot pressure supply

The DA closed loop control is an engine speed-dependent system for travel drives. The built-in DA control valve generates a pilot pressure which is proportional to pump (engine) drive speed. The pump displacement is infinitely variable in each flow direction and is influenced by both pump drive speed and system pressure.

Increasing the pump drive speed causes the DA control valve to generate a higher pilot pressure with a resulting increase in the flow from the pump.

Depending on the selected pump operating characteristics, increasing system pressure (e.g. machine load) causes the pump to swivel back towards a smaller displacement.

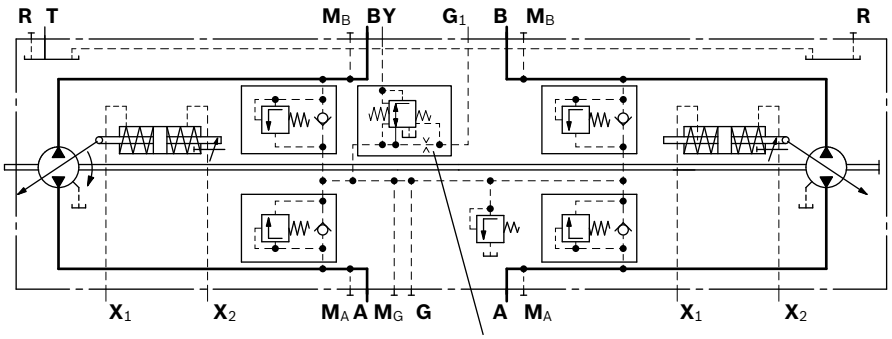
Diesel engine overload protection (anti-stall) is achieved by the combination of this pressure-related pump de-stroking, and the reduction of pilot pressure as the engine speed drops.

Any additional power requirement, e.g. for hydraulic functions from attachments, could cause the engine speed to drop further. This would cause a further reduction in pilot pressure and thus of pump displacement. Automatic power distribution and full exploitation of the available power are achieved in this way, both for the travel drive and for the implement hydraulics, with priority given to the implement hydraulics.

The DA control valve can also be used in pumps with EP, HT and HW control modules to protect the combustion engine against overload.

DA closed loop control is only suitable for certain types of drive systems and requires review of the engine and vehicle parameters to ensure that the pump 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.

▼ **Schematic**

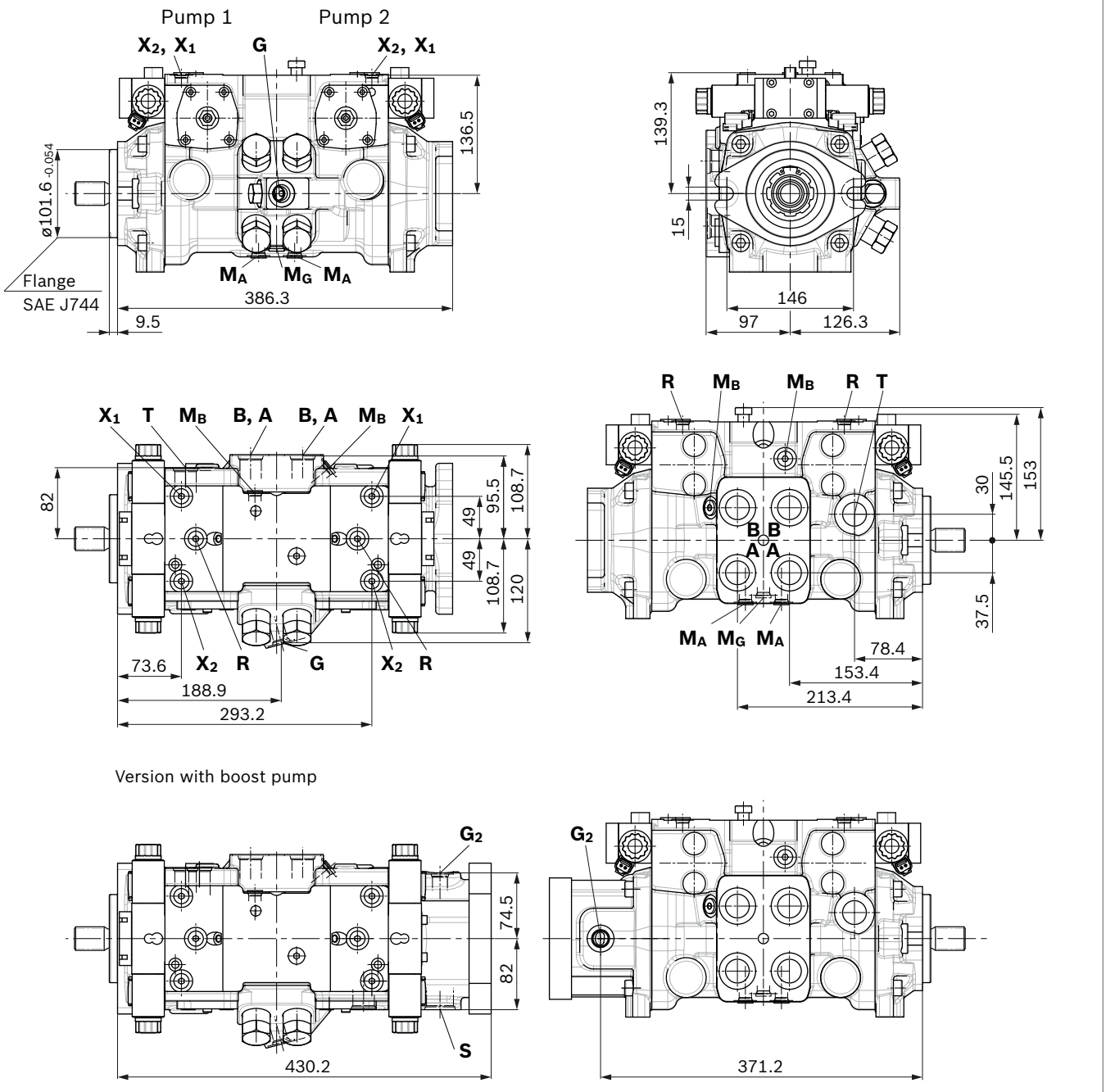


DA control valve

Dimensions size 45

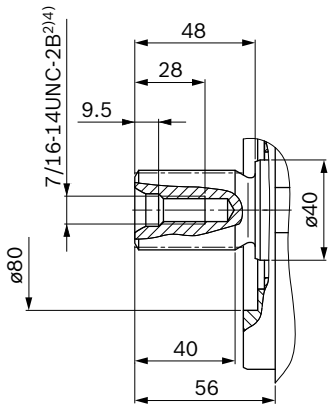
EP – Proportional control electric

ET – Electric control, direct operated



▼ **Splined shaft SAE J744**

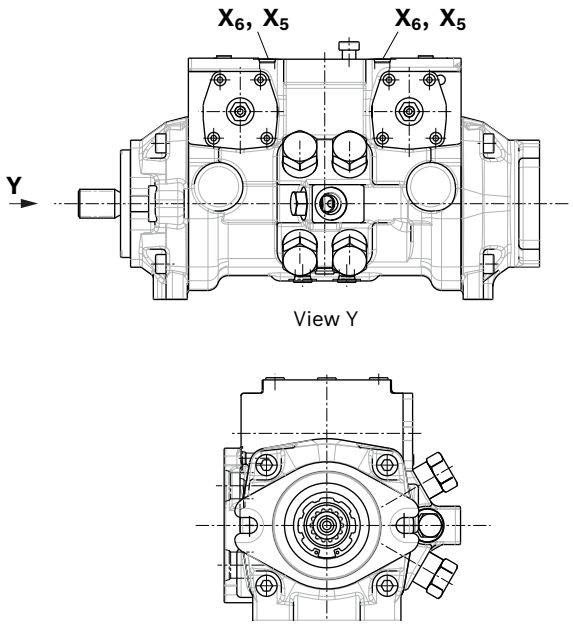
S7 – 1 1/4 in 14T 12/24DP[1)]



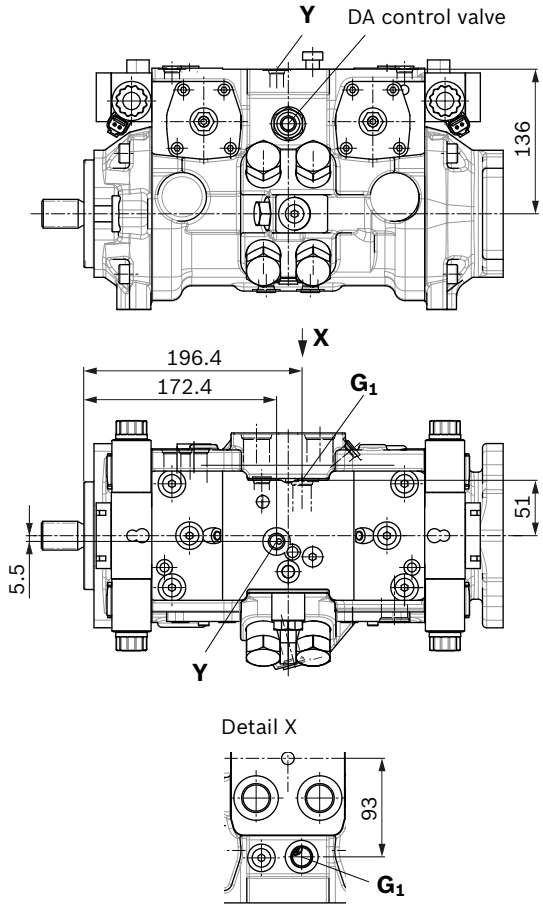
Ports		**Standard**[3)]	**Size [in]**[4)]	**$p_{max\ abs}$ [bar]**[5)]	**State**[7)]
A, B	Working port	ISO 11926	1 1/16-12 UN-2B; 20 deep	420	O
S	Suction port (only for boost pump)	ISO 11926	1 5/16-12 UN-2B; 20 deep	5	O
T	Drain port	ISO 11926	1 1/16-12 UN-2B; 20 deep	3	O
R	Air bleed	ISO 11926	9/16-18 UNF-2B; 13 deep	3	X
X_1, X_2	Control pressure (upstream of orifice, only HP, HW, EP, ET)	ISO 11926	9/16-18 UNF-2B; 13 deep	30	X
X_5, X_6	Control pressure (upstream of orifice, HT only)	ISO 11926	9/16-18 UNF-2B; 13 deep	30	O
X_3, X_4[6)]	Stroking chamber pressure	ISO 11926	7/16-20 UNF-2B; 12 deep	30	X
Y	Pilot pressure, outlet (only for DA control valve)	ISO 11926	9/16-18 UNF-2B; 13 deep	30	O
G	Boost pressure, inlet	ISO 11926	3/4-16 UNF-2B; 15 deep	30	O
G_1	Boost pressure, inlet (only for DA control valve)	ISO 11926	3/4-16 UNF-2B; 13 deep	30	O
G_2	Boost pressure, outlet (only for boost pump)	ISO 11926	3/4-16 UNF-2B; 15 deep	30	O
M_G	Measuring boost pressure G	ISO 11926	9/16-18 UNF-2B; 13 deep	30	X
M_A, M_B	Measuring pressure A, B	ISO 11926	9/16-18 UNF-2B; 13 deep	420	X

1) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) The spot face can be deeper than specified in the appropriate standard.
4) For notes on tightening torques, see instruction manual
5) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
6) Optional, see page 21
7) O = Must be connected (plugged on delivery)
X = Plugged (normal operation)

▼ **HT – Hydraulic control, direct operated**



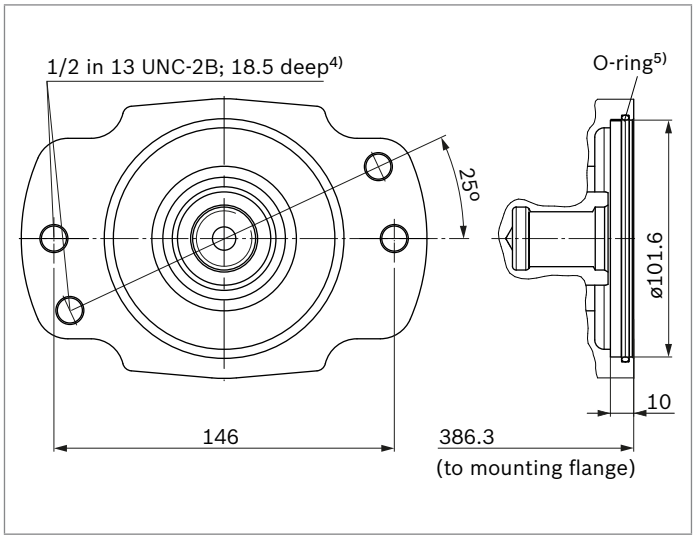
▼ **DA control valve**



Through drive dimensions

Flange SAE J744[1]			Hub for splined shaft[2]			Availability	Short code
Diameter	attachment[3]	Designation	Diameter		Designation	045	
101-2 (B)	⚯	B2	7/8 in	13T 16/32DP	S4	●	B2S4
			1 in	15T 16/32DP	S5	●	B2S5

▼ **101-2**



Overview of attachment options

Through drive			Attachment option – additional pumps		
Flange	Hub for splined shaft	Short code	A10VG NG (shaft)	A10V(S)O/53 NG (shaft)	External gear pump[6]
101-2 (B)	7/8 in	B2S4	18 (S)	28 (S)	Series N, NG20 to 36
				45 (U)	Series G, NG32 to 50
	1 in	B2S5	28, 45 (S)	45 (S)	–
				60 (U)	

Combination pumps

By using combination pumps, it is possible to have independent circuits without the need for splitter gearboxes. When ordering combination pumps, the type designations of the 1st and 2nd pump must be linked by a "**+**".

Ordering example

A22VG045HT100100/40AR + AZPN....

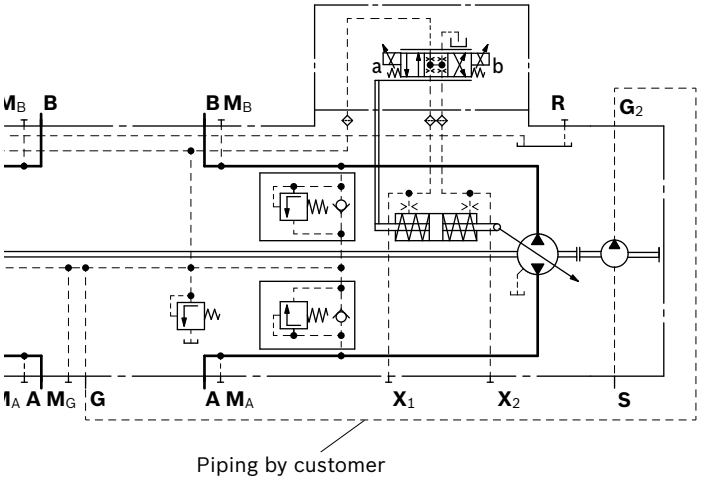
The A22VG variable double pump is permissible without additional supports where the dynamic mass acceleration does not exceed maximum 10 g (= 98.1 m/s^2). When mounting another pump on the A22VG, the mounting flange must be rated for the permissible mass torque.

1) The through-drive flange is only supplied with the fastening thread corresponding to the ordering code designation.
2) According to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
3) Mounting drillings pattern viewed on through drive, with control at top
4) Thread according to ASME B1.1, for notes on tightening torques, see instruction manual
5) O-ring included in the scope of delivery
6) Bosch Rexroth recommends special versions of the external gear pumps. Please contact us.

Boost pump

The boost pump continuously supplies a volume of fluid (boost volume) from a reservoir to the low-pressure side of the closed circuit via a check valve to replenish the internal leakage of the variable double pump and consumer.
The boost pump is an internal gear pump that is driven directly via the drive shaft. The pressure port $\mathbf{G_2}$ of the boost pump must be externally piped up to port **G** (or $\mathbf{G_1}$ by the customer for version with DA control valve) (see example circuit diagram below). Suction or pressure filtration is to be provided by the customer.

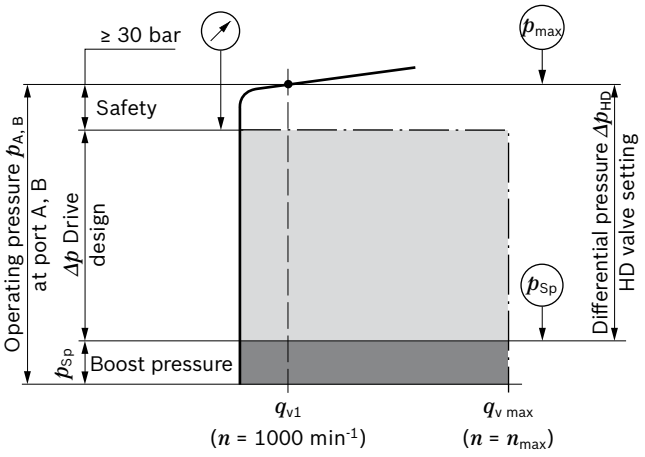
▼ **Schematic**



High-pressure relief valves

The four high-pressure relief valves protect the hydrostatic transmission (pump and motor) from overload. They limit the maximum pressure in the respective high-pressure line and serve simultaneously as boost valves.
High-pressure relief valves are not working valves and are only suitable for pressure spikes or high rates of pressure change.

Setting the valves



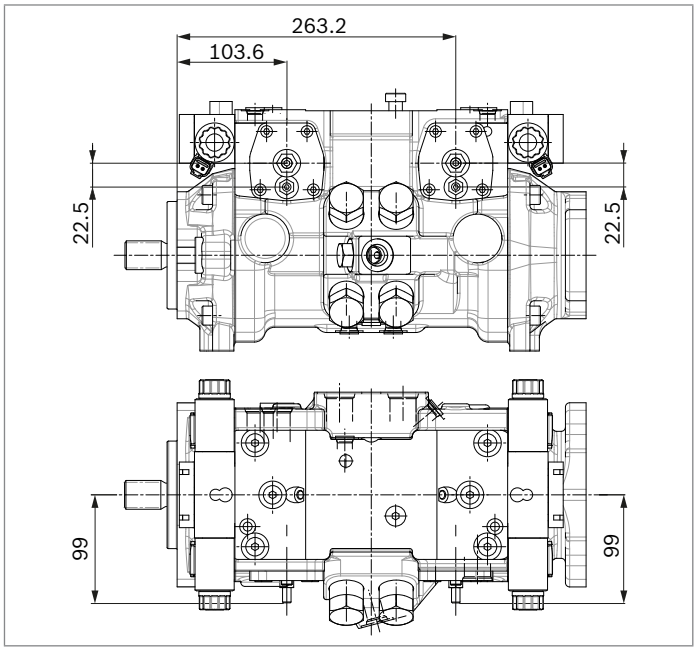
- The valve settings are made at n = 1000 rpm and at $V_{g\,max}$ ($q_{v\,1}$). There may be deviations in the cracking pressures with other operating parameters.
- The differential pressure setting is preset in the range Δp = 250 to 390 bar in increments of 10 bar.
- When ordering, state differential pressure setting in plain text.

Settings on high-pressure relief valve A and B (Pump 1 and 2)	
Differential pressure setting	Δp_{HD} = ... bar
Cracking pressure of the HD valve (at $q_{V\,1}$) ($p_{max} = \Delta p_{HD} + p_{Sp}$)	p_{max} = ... bar

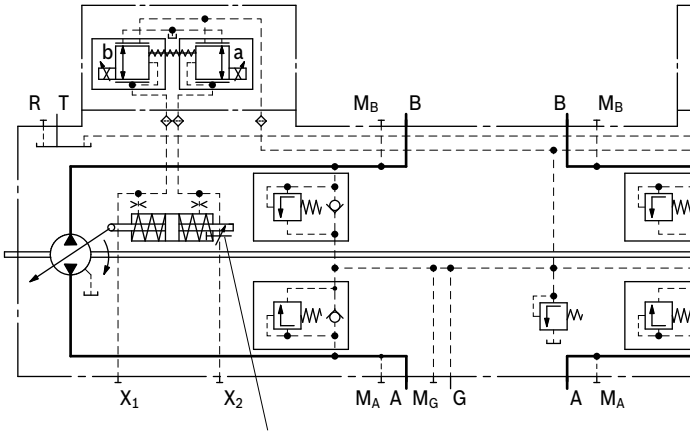
Mechanical stroke limiter

The mechanical stroke limiter is an additional function allowing the maximum displacement of the pump to be steplessly reduced, regardless of the control module used. With one threaded pin per pump, the stroke of the stroking piston and thus the maximum swivel angle per pump is limited on one side.

Dimensions



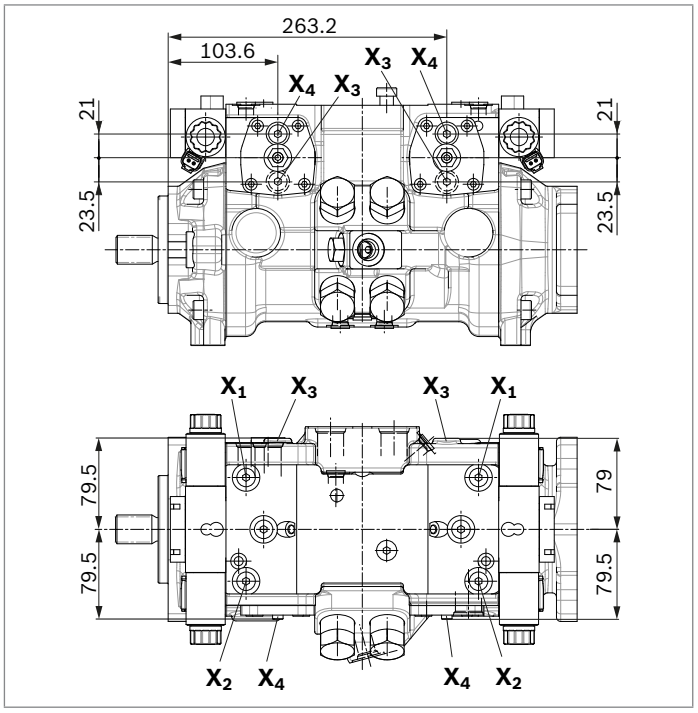
▼ **Schematic**



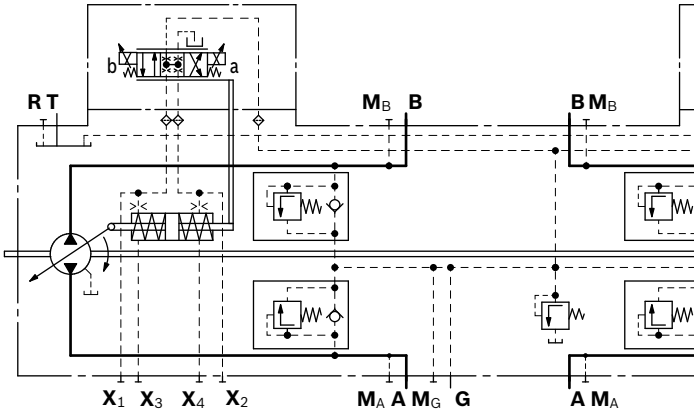
Mechanical stroke limiter, on one side

Ports X_3 and X_4 for stroking chamber pressure

Dimensions



▼ **Schematic**



Ports		Standard[1)]	Size [in][2)]	$p_{max\ abs}$ [bar][3)]	State[4)]
X_3, X_4	Stroking chamber pressure	ISO 11926	7/16-20 UNF-2B; 12 deep	30	X

1) The spot face can be deeper than specified in the appropriate standard.

2) For notes on tightening torques, see instruction manual

3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.

4) X = Plugged (in normal operation)

Swivel angle sensor

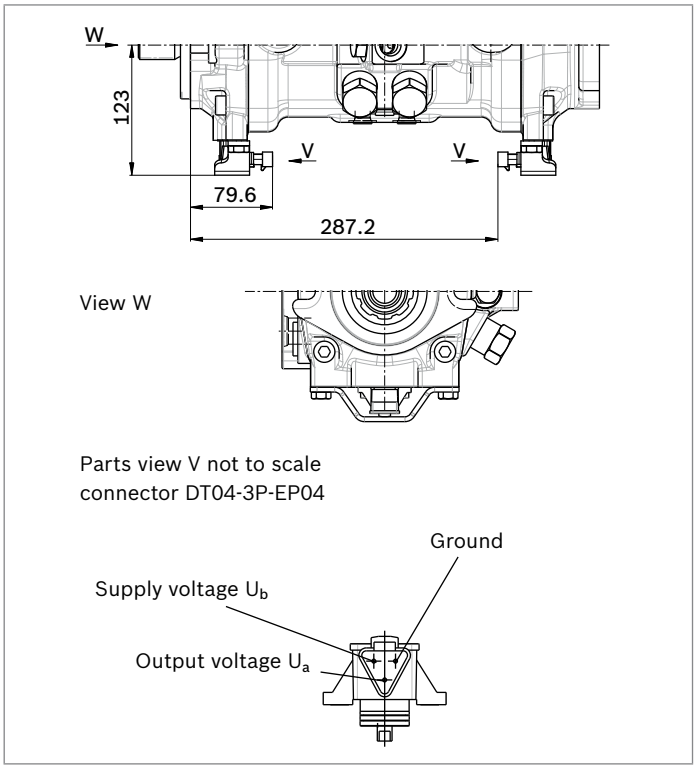
For the swivel angle indicator, the pump swivel angle is measured by an electric swivel angle sensor.
As an output parameter, the Hall-effect swivel angle sensor delivers a voltage proportional to the swivel angle (see table of output voltages).
Please contact us if the swivel angle sensor is used for control.

Characteristics			
Supply voltage U_b	10 to 30 V DC		
Output voltage U_a	1 V ($V_{g\,max}$)	2.5 V ($V_{g\,0}$)	4 V ($V_{g\,max}$)
Reverse polarity protection	Short circuit-resistant		
EMC resistance	Details on request		
Operating temperature range	–40 °C to +115 °C		
Vibration resistance sinusoidal vibration EN 60068-2-6	10 g / 5 to 2000 Hz		
Shock resistance continuous shock IEC 68-2-29	25 g		
Salt spray resistance DIN 50 021-SS	96h		
Type of protection with mounted mating connector	IP67 (DIN/EN 60529) and IP69K (DIN 40050-9)		
Housing material	Plastic		

Output voltage

Direction of rotation	Flow direction[1)]	Operating pressure	Output voltage
cw	**B** to **A**	M_A	> 2.5 V
	A to **B**	M_B	< 2.5 V
ccw	**A** to **B**	M_B	> 2.5 V
	B to **A**	M_A	< 2.5 V

Dimensions

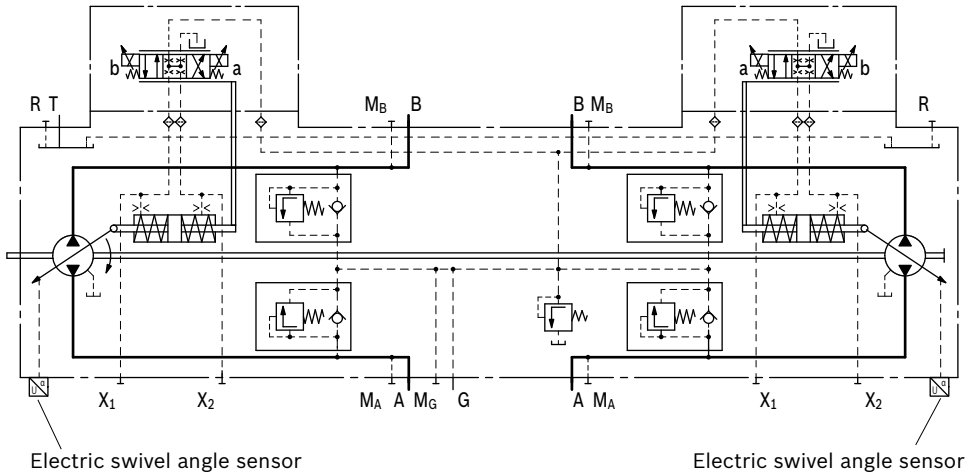


▼ **Mating connector DEUTSCH DT06-3S-EP04**

Consisting of	DT designation
1 housing	DT06-3S-EP04
1 wedge	W3S
3 sockets	0462-201-16141

The mating connector is not included in the scope of delivery. This can be supplied by Bosch Rexroth on request (material number R902603524).

▼ **Schematic**



1) For flow direction, see controls

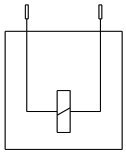
Connector for solenoids

DEUTSCH DT04-2P-EP04

Molded, 2-pin, without bidirectional suppressor diode. There is the following type of protection with mounted mating connector:

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

▼ **Circuit symbol**



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

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

The mating connector is not included in the scope of delivery. This can be supplied by Bosch Rexroth on request (material number R902601804).

Note

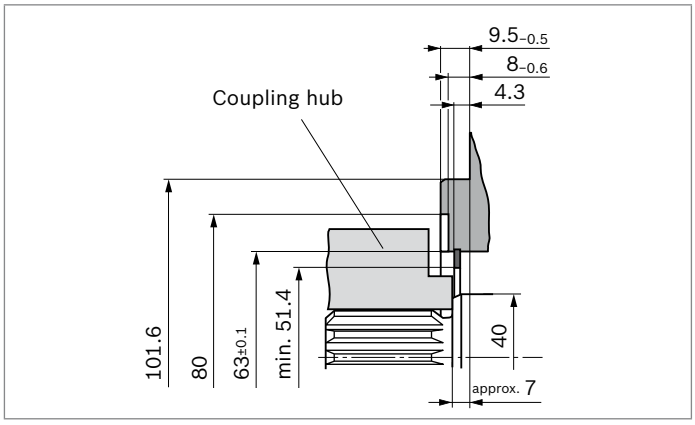
- If necessary, you can change the connector orientation by turning the solenoid housing.
- Refer to the instruction manual for the procedure.

Installation dimensions for coupling assembly

To ensure that rotating components (coupling hub) and fixed components (housing, snap ring) do not come into contact with each other, the installation conditions described here must be observed. This depends on the size and the splined shaft.

SAE splined shaft (spline according to ANSI B92.1a)

The outer diameter of the coupling hub must be smaller than the inner diameter of the snap ring (dimension d_2) in the area near the drive shaft collar (dimension $x_2 - x_3$). Please observe diameter d_5 of the free turning.



Installation instructions

General

During commissioning and operation, the axial piston unit must be filled with hydraulic fluid and air bled. This must also observed following a relatively long standstill as the axial piston unit may drain back to the reservoir via the hydraulic lines.

The leakage in the housing must be directed to the reservoir via the highest drain port **T**.

For combinations of multiple units, the leakage must be drained at each pump. If a shared drain line is used for this purpose, make certain that the respective case pressure is not exceeded. In the event of pressure differences at the drain ports of the units, the shared drain line must be changed so that the minimum permissible case pressure of all connected units is not exceeded in any situation. If this is not possible, separate drain lines must be laid if necessary.

To achieve favorable noise values, decouple all connecting lines using elastic elements and avoid above-reservoir installation.

In all operating conditions, the suction and drain lines must flow into the reservoir below the minimum fluid level. The permissible suction height h_S results from the overall loss of pressure; it must not, however, be higher than $h_{S\ max}$ = 800 mm. The minimum suction pressure at port **S** must also not fall below 0.8 bar absolute during operation (cold start 0.5 bar absolute).

When designing the reservoir, ensure adequate space between the suction line and the drain line. This prevents the heated, return flow from being drawn directly back into the suction line.

Installation position

See the following examples 1 to 4.

Further installation positions are possible upon request.

Notes

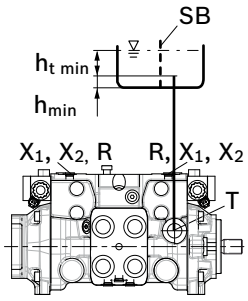
- If it is not possible to fill the stroking chambers via $\mathbf{X_1}$ to $\mathbf{X_4}$ in the final installation position, this must be done prior to installation.
- To prevent unexpected actuation and damage, the stroking chambers must be air bled via ports $\mathbf{X_1}$, $\mathbf{X_2}$ or $\mathbf{X_3}$, $\mathbf{X_4}$ depending on the installation position.
- For HT control, $\mathbf{X_1}$, $\mathbf{X_2}$ are not present and are replaced by $\mathbf{X_5}$, $\mathbf{X_6}$.
- In certain installation positions, an influence on the control characteristics can be expected. Gravity, dead weight and case pressure can cause minor shifts in control characteristics and changes in response time.

Key	
L	Filling / air bleed
R	Air bleed port
S	Suction port
T	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)
$h_{S\ max}$	Maximum permissible suction height (800 mm)

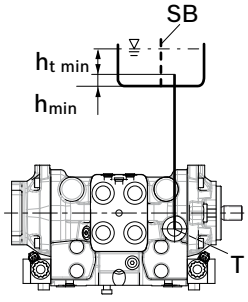
Below-reservoir installation (standard)

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

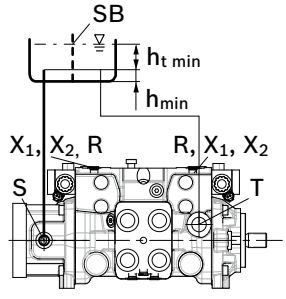
Installation position	Air bleed the housing	Air bleed the stroking chamber	Filling
1 Without boost pump	R	X_1, X_2	T + X_1 + X_2



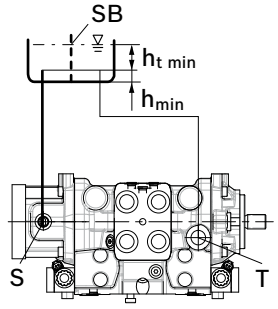
2 Without boost pump	–	–	T



3 With boost pump	R	X_1, X_2	S + T + X_1 + X_2



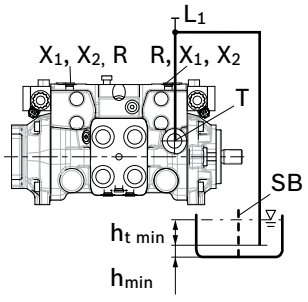
4 With boost pump	–	–	S + T



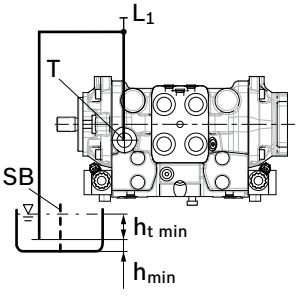
Above-reservoir installation

Above-reservoir installation means that the axial piston unit is installed above the minimum fluid level of the reservoir. Observe the maximum permissible suction height $h_{S\ max}$ = 800 mm.

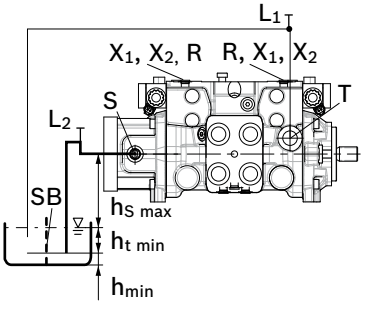
Installation position	Air bleed the housing	Air bleed the stroking chamber	Filling
5 Without boost pump	R	X_1, X_2	L_1 + X_1 + X_2



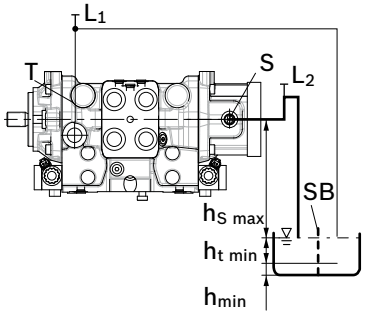
6 Without boost pump	L_1	–	L_1



7 With boost pump	R + L_2 (S)	X_1, X_2	L_1 + L_2(S) + X_1 + X_2



8 With boost pump	L_1 + L_2 (S)	–	L_1 + L_2(S)



For legend and notes, see page 24.

Project planning notes

- The pump A22VG is designed to be used in closed circuit.
- The project planning, installation and commissioning of the axial piston unit requires the involvement of qualified skilled person.
- Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, these can be requested from Bosch Rexroth.
- Before finalizing your design, request a binding installation drawing.
- The data and notes contained herein must be adhered to.
- Depending on the operating conditions of the axial piston unit (operating pressure, fluid temperature), the characteristic curve may shift.
- Not all variants of the product are approved for use in safety functions according to ISO 13849. Please consult the responsible contact person at Bosch Rexroth if you require reliability parameters (e.g. $MTTF_d$) for functional safety.
- Working ports:
  - The ports and fastening threads are designed for the specified maximum pressure. 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 working ports and function ports can only be used to accommodate hydraulic lines.

Safety instructions

- During and shortly after operation, there is a risk of burns on the axial piston unit and especially on the solenoids. Take appropriate safety measures (e.g. by wearing protective clothing).
- Moving parts in control and regulation systems (e.g. valve spools) may in certain circumstances become stuck in an undefined position due to contamination (e.g. contaminated hydraulic fluid, abrasion or residual dirt from components). As a result, the hydraulic fluid flow or build-up of torque of the axial piston unit will no longer respond correctly to the operator’s commands. Even the use of different filter cartridges (external or internal inlet filter) will not rule out a fault but merely minimize the risk. The machine/system manufacturer must test whether remedial measures are needed on the machine for the application concerned in order to set the consumer being driven to a safe position (e.g. safe stop) and if necessary to ensure it is properly implemented.

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