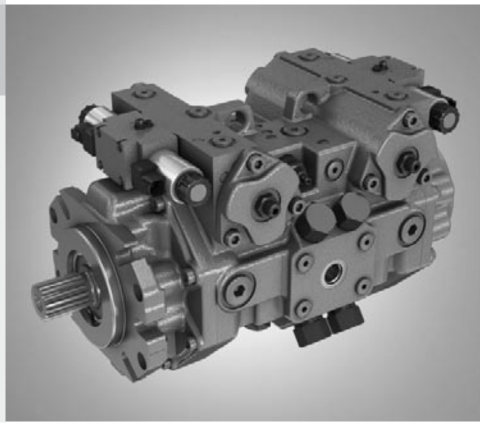
Rexroth
Bosch Group

Axial Piston Variable Double Pump A24VG

Data sheet



Series 10
Size 045-045 / 065-045 / 065-065
Nominal pressure 450 bar
Maximum pressure 500 bar
Closed circuit

Contents

Features

- Variable double pump with two axial piston rotary groups of swashplate design for hydrostatic drives in closed circuit
- The flow is proportional to the drive speed and displacement
- Two flows independent of each other
- The flow can be infinitely varied by adjusting the swashplate angle
- Flow direction changes smoothly when the swashplate is moved through the neutral position
- A wide range of highly adaptable control devices with different control and regulating functions, for all important applications
- Four pressure relief valves are provided on the high-pressure side to protect the hydrostatic transmission (pump and motor) from overload
- The high-pressure relief valves also function as boost valves
- The maximum boost pressure is limited by a built-in low-pressure relief valve
- High pressure level for high power density and good efficiency
- Compact design for tight installation conditions
- Optional through drive for mounting additional pumps

Ordering code for standard program

A24V	G								0	/	10	M						–	
01	02	03	04	05	06	07	08	09	10		11	12	13	14	15	16	17		18

Axial piston unit

01	Swashplate design, variable, nominal pressure 450 bar, maximum pressure 500 bar	**A24V**

Operating mode

02	Double pump, closed circuit	**G**

Sizes (NG)

03	Geometric displacement, see table of values on page 9		
	1st pump	2nd pump	
	NG045	NG045	**045-045**
	NG065	NG045	**065-045**
	NG065	NG065	**065-065**

Control devices, 1st pump

04	Proportional control hydraulic	pilot-pressure related	p = 6 to 18 bar	●	**HP1**
		mechanical servo, hexagon shaft with lever, free position[1)]		●	**HW2**
			with neutral position switch	●	**HW8**
	Proportional control electric		U = 12 V DC	●	**EP1**
			U = 24 V DC	●	**EP2**
	Two-point control electric		U = 12 V DC	●	**EZ1**
			U = 24 V DC	●	**EZ2**
	Hydraulic control, direct controlled			●	**HT1**
	Electric control, direct controlled, with one pressure reducing valve (DRE) and 4/3-directional valve		U = 12 V DC	❍	**EV1**
			U = 24 V DC	❍	**EV2**

Control devices, 2nd pump

05	Proportional control hydraulic	pilot-pressure related	p = 6 to 18 bar	●	**HP1**
		mechanical servo, hexagon shaft with lever, free position[1)]		●	**HW2**
			with neutral position switch	●	**HW8**
	Proportional control electric		U = 12 V DC	●	**EP1**
			U = 24 V DC	●	**EP2**
	Two-point control electric		U = 12 V DC	●	**EZ1**
			U = 24 V DC	●	**EZ2**
	Hydraulic control, direct controlled			●	**HT1**
	Electric control, direct controlled, with one pressure reducing valve (DRE) and 4/3-directional valve		U = 12 V DC	❍	**EV1**
			U = 24 V DC	❍	**EV2**

● = Available ❍ = On request – = 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.

Ordering code for standard program

A24V	G								0	/	10	M						–	
01	02	03	04	05	06	07	08	09	10		11	12	13	14	15	16	17		18

Pressure cut-off (see page 31)

	Pump 1	Pump 2	045...065	
06	Without pressure cut-off	Without pressure cut-off	●	**0**
	1x pressure cut-off, jointly for pump 1 and pump 2		●	**W**
	With pressure cut-off	Without pressure cut-off	●	**P**
	Without pressure cut-off	With pressure cut-off	●	**L**

Swivel angle sensor (see page 34)

07	Without swivel angle sensor	**0**
	Electric swivel angle sensor mounted to pumps 1 and 2[2)]	**T**

Additional function for pump 1 (see page 31)

08	Without additional function	**0**
	Mechanical stroke limiter, externally adjustable	**M**
	Ports X_3, X_4 for stroking chamber pressure	**T**
	Mechanical stroke limiter and ports X_3, X_4	**B**

Additional function for pump 2 (see page 31)

09	Without additional function	**0**
	Mechanical stroke limiter, externally adjustable	**M**
	Ports X_3, X_4 for stroking chamber pressure	**T**
	Mechanical stroke limiter and ports X_3, X_4	**B**

DA control valve

10	Without DA control valve	**0**

Series

11	Series 1, index 0	**10**

Configuration of ports and fastening threads

12	Metric, port threads with O-ring seal according to ISO 6149	**M**

Directions of rotation

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

Mounting flanges (pump 1)

			045	065	
14	SAE J744	127-2	●	–	**C2**
		127-2/4	–	●	**C6**

Drive shafts (pump 1) (permissible input torques see page 10)

			045	065	
15	Splined shaft ANSI B92.1a	1 3/8 in 21T 16/32DP	●	–	**V8**
		1 1/2 in 17T 12/24DP	●	●	**S9**

● = Available ❍ = On request – = Not available ▭ = Preferred program

2) Please contact us if the swivel angle sensor is used for control.

Ordering code for standard program

A24V	G								0	/	10	M						–	
01	02	03	04	05	06	07	08	09	10		11	12	13	14	15	16	17		18

Through drives (mounting options see page 28)

	Flange SAE J744			Coupling for splined shaft[3]					
		Mounting variant							
	Diameter	Symbol[4]	Designation	Diameter		Designation	045	065	
16	Without through drive						●	●	0000
	82-2 (A)		A1	5/8 in	9T 16/32DP	S2	❍	❍	A1S2
				3/4 in	11T 16/32DP	S3	❍	❍	A1S3
			A2	5/8 in	9T 16/32DP	S2	❍	❍	A2S2
				3/4 in	11T 16/32DP	S3	❍	❍	A2S3
	101-2 (B)		B1	7/8 in	13T 16/32DP	S4	❍	❍	B1S4
				1 in	15T 16/32DP	S5	❍	❍	B1S5
			B2	7/8 in	13T 16/32DP	S4	●	❍	B2S4
				1 in	15T 16/32DP	S5	●	❍	B2S5
			B5	7/8 in	13T 16/32DP	S4	❍	❍	B5S4
				1 in	15T 16/32DP	S5	❍	❍	B5S5
	101-4 (B)		B4	7/8 in	13T 16/32DP	S4	❍	❍	B4S4
				1 in	15T 16/32DP	S5	❍	❍	B4S5
	127-2 (C)		C1	1 in	15T 16/32DP	S5	❍	❍	C1S5
				1 1/4 in	14T 12/24DP	S7	–	❍	C1S7
			C2	1 in	15T 16/32DP	S5	❍	❍	C2S5
				1 1/4 in	14T 12/24DP	S7	–	❍	C2S7
			C5	1 in	15T 16/32DP	S5	❍	❍	C5S5
				1 1/4 in	14T 12/24DP	S7	–	❍	C5S7
	127-4 (C)		C4	1 in	15T 16/32DP	S5	❍	❍	C4S5
				1 1/4 in	14T 12/24DP	S7	–	❍	C4S7

Selection of other features

17	See table on page 5	

Standard / special version

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

● = Available ❍ = On request – = Not available

3) Coupling for splined shaft according to ANSI B92.1a
4) Mounting drillings pattern viewed on through drive with control at top

Ordering code for standard program

A24V	G								0	/	10	M						–	
01	02	03	04	05	06	07	08	09	10		11	12	13	14	15	16	17		18

Selection of other features

	Feature		Option	A1	A2	A3	A4	B1	B2
17	Connector control module[5)]pump 1		Without connector (only for hydraulic control)				X	X	
			DEUTSCH - molded connector, 2-pin – without suppressor diode	X	X	X			X
	Connector control module[5)] pump 2		Without connector (only for hydraulic control)				X	X	
			DEUTSCH - molded connector, 2-pin – without suppressor diode	X	X	X			X
	Seals		NBR (nitrile-caoutchouc), shaft seal in FKM (fluor-caoutchouc)	X	X	X	X	X	X
	Service line ports		Threaded ports A and B, on left side	X	X			X	
			Threaded ports A and B, on right side			X			
	Boost pump		Without boost pump	X	X	X	X	X	X
	High-pressure relief valve HD	Pump 1	Direct controlled, fixed setting, without bypass	X	X	X		X	X
		Pump 2	Direct controlled, fixed setting, without bypass	X	X	X		X	X
	Low-pressure relief valve ND		Fixed setting	X	X	X		X	X
	Pressure sensor	Pump 1	Without pressure sensor	X	X	X	X	X	X
			At measuring port M_A						
			At measuring port M_B						
		Pump 2	Without pressure sensor	X	X	X	X	X	X
			At measuring port M_A						
			At measuring port M_B						
	Speed sensor		Without speed sensor		X	X	X	X	X
			DSA speed sensor mounted[6)]	X					
	Other sensors	Pump 1	Without sensors	X	X	X	X	X	X
		Pump 2	Without sensors	X	X	X	X	X	X

5) Connectors for other electric components can deviate.
6) Specify ordering code of sensor according to data sheet (DSA – RE 95133) separately and observe the requirements on the electronics.

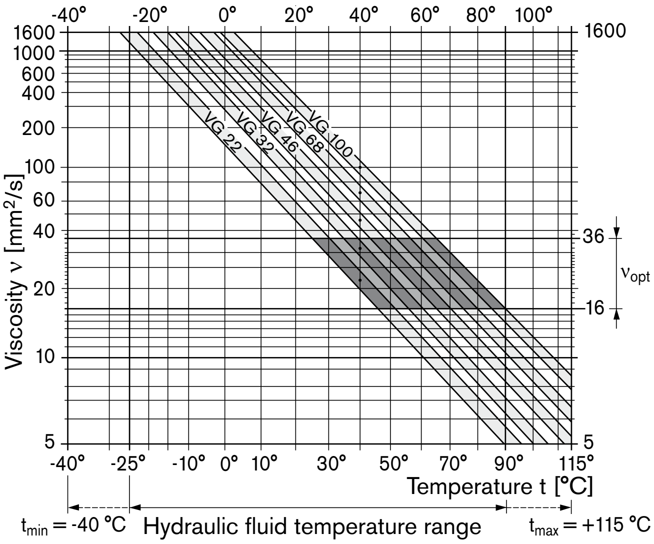
Technical data

Hydraulic fluid

Before starting project planning, please refer to our data sheets RE 90220 (mineral oil), RE 90221 (environmentally acceptable hydraulic fluids) and RE 90222 (HFD hydraulic fluids) for detailed information regarding the choice of hydraulic fluid and application conditions.

The variable double pump A24VG is not suitable for operation with HFA, HFB and HFC hydraulic fluids. If HFD or environmentally acceptable hydraulic fluids are used, the limitations regarding technical data or other seals must be observed. Please contact us.

Selection diagram



Details regarding the choice of hydraulic fluid

The correct choice of hydraulic fluid requires knowledge of the operating temperature in relation to the ambient temperature: in a closed circuit, the circuit temperature.

The hydraulic fluid should be chosen so that the operating viscosity in the operating temperature range is within the optimum range (ν_{opt} see shaded area of the selection diagram). We recommended that the higher viscosity class be selected in each case.

Example: At an ambient temperature of X °C, an operating temperature of 60 °C is set in the circuit. In the optimum operating viscosity range (ν_{opt}, shaded area), this corresponds to the viscosity classes VG 46 or VG 68; to be selected: VG 68.

Note

The case drain temperature, which is affected by pressure and speed, can be higher than the circuit temperature. At no point of the component may the temperature be higher than 115 °C. The temperature difference specified below 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 us.

Viscosity and temperature of hydraulic fluid

	Viscosity [mm²/s]	Temperature	Comment
Transport and storage at ambient temperature		$T_{min} \geq$ -50 °C T_{opt} = +5 °C to +20 °C	factory preservation: up to 12 months with standard, up to 24 months with long-term
(Cold) start-up[1]	$\nu_{max} = 1600$	$T_{St} \geq$ -40 °C	$t \leq 3$ min, without load ($p \leq 50$ bar), $n \leq 1000$ rpm
Permissible temperature difference		$\Delta T \leq 25$ K	between axial piston unit and hydraulic fluid
Warm-up phase	$\nu <$ 1600 to 400	T = -40 °C to -25 °C	at $p \leq 0.7 \cdot p_{nom}$, $n \leq 0.5 \cdot n_{nom}$ and $t \leq 15$ min
Operating phase			
Temperature difference		ΔT = approx. 5 K	between hydraulic fluid in the bearing and at port T.
Maximum temperature		115 °C	in the bearing
		110 °C	measured at port T
Continuous operation	ν = 400 to 10 ν_{opt} = 36 to 16	T = -25 °C to +90 °C	measured at port T, no restriction within the permissible data
Short-term operation	$\nu_{min} \geq 7$	T_{max} = +110 °C	measured at port T, $t < 3$ min, $p < 0.3 \cdot p_{nom}$
FKM shaft seal[1]		$T \leq$ +115 °C	see page 7

1) At temperatures below -25 °C, an NBR shaft seal is required (permissible temperature range: -40 °C to +90 °C).

Technical data

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.

To ensure the functional reliability of the axial piston unit, a gravimetric analysis of the hydraulic fluid is necessary to determine the amount of solid contaminant and to determine the cleanliness level according to ISO 4406. A cleanliness level of at least 20/18/15 is to be maintained.

Depending on the system and the application, for the A24VG, we recommend

Filter cartridges $\beta_{20} \geq 100$.

With an increasing differential pressure at the filter cartridges, the β value must not deteriorate.

At very high hydraulic fluid temperatures (90 °C to maximum 115 °C), a cleanliness level of at least 19/17/14 according to ISO 4406 is necessary.

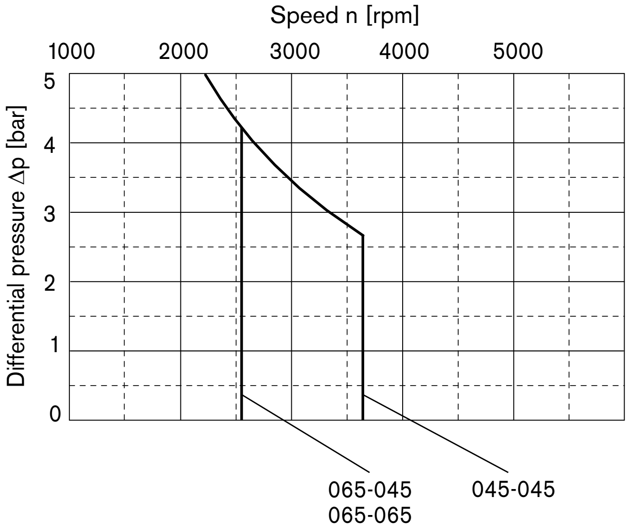
If the above classes cannot be achieved, please contact us.

Shaft seal

Permissible pressure loading

The service life of the shaft seal is influenced by the speed of the axial piston unit and the case drain pressure (case pressure p_G). The mean differential pressure of 2 bar between the case and the ambient pressure may not be enduringly exceeded at normal operating temperature. For a higher differential pressure at reduced speed, see diagram. Momentary pressure spikes ($t < 0.1$ s) of up to 10 bar are permitted. The service life of the shaft seal decreases with an increase in the frequency of pressure spikes.

The case pressure must be equal to or higher than the ambient pressure.



These values are valid for an ambient pressure $p_{abs} = 1$ bar.

Temperature range

The FKM shaft seal may be used for case drain temperatures from -25 °C to +115 °C.

Note

For application cases below -25 °C, an NBR shaft seal is required (permissible temperature range: -40 °C to +90 °C). State NBR shaft seal in plain text when ordering. Please contact us.

Technical data

Operating pressure range
(operating with mineral oil)

Pressure at service line port A_1, A_2 or B_1, B_2

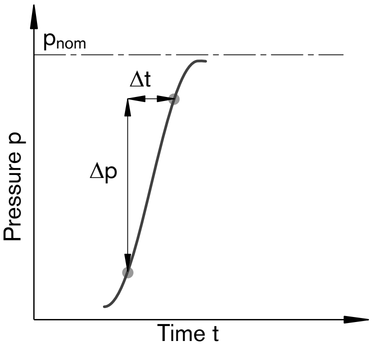
Nominal pressure p_{nom} ________ 450 bar absolute

Maximum pressure p_{max} ________ 500 bar absolute
Single operating period ________ 10 s
Total operating period ________ 300 h

Minimum pressure (high-pressure side) ___25 bar absolute

Minimum pressure (low-pressure side) ___ 10 bar above p_G
(boost pressure setting must be higher depending on system)

Rate of pressure change $R_{A\ max}$ ________ 9000 bar/s



Control pressure
To ensure the function of the control, the following control pressure is required depending on the speed and operating pressure (measuring point, port P_S):

For controls EP, HW and HP
Minimum control pressure
$p_{St\ min}$ (at n = 2000 rpm) ________ 20 bar above p_G

For controls HT, EV, EZ
Minimum control pressure
$p_{St\ min}$ (at n = 2000 rpm) ________ 25 bar above p_G

Note
Values for other hydraulic fluids, please contact us

p_G = case pressure

Definition

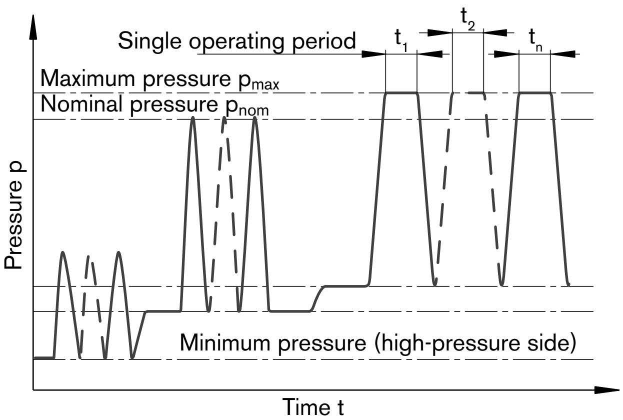
Nominal pressure p_{nom}
The nominal pressure corresponds to the maximum design pressure.

Maximum pressure p_{max}
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.

Minimum pressure (high-pressure side)
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)
Minimum pressure at the low-pressure side (A or B) which is required in order to prevent damage to the axial piston unit.

Rate of pressure change R_A
Maximum permissible rate of pressure rise and reduction during a pressure change over the entire pressure range.



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

Technical data

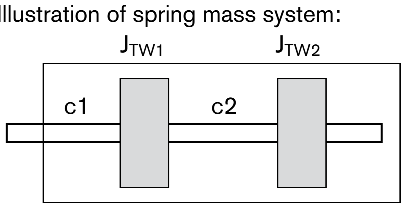
Table of values (theoretical values, without efficiency and tolerances; values rounded)

Size				NG		045-045	065-045	065-065
Displacement geometric, per revolution								
variable double pump				$V_{g\,max}$	cm^3	2 x 45.3	1 x 65.2 + 1 x 45.3	2 x 65.2
Speed[1]								
maximum at $V_{g\,max}$				n_{nom}	rpm	3700	2600	2600
at $\Delta p \geq 40$ bar ($t < 15$ s)				$n_{max\,40}$	rpm	3900	2800	2800
minimum				n_{min}	rpm	500	500	500
Flow								
at n_{nom} and $V_{g\,max}$				q_v	L/min	2 x 168	1 x 170 + 1 x 118	2 x 170
Power[2]								
at n_{nom}, $V_{g\,max}$ and $\Delta p = 430$ bar				P	kW	240	206	243
Torque[2]								
at $V_{g\,max}$ and	$\Delta p = 430$ bar			T	Nm	620	756	892
	$\Delta p = 100$ bar			T	Nm	144	176	208
Rotary stiffness[3] drive shaft	1 3/8	V8	pump 1	c1	kNm/rad	97	–	–
			pump 2	c2	kNm/rad	20	–	–
	1 1/2	S9	pump 1	c1	kNm/rad	–	133	133
			pump 2	c2	kNm/rad	–	21	22
Moment of inertia[3]			rotary group 1	J_{TW1}	kgm^2	0.0048	0.0089	0.0089
			rotary group 2	J_{TW2}	kgm^2	0.0048	0.0048	0.0089
Maximum angular acceleration[4]				α	rad/s^2	28000	22000	22000
Case Volume				V	L	2.8	2.9	3.0
Mass approx. (without through drive)				m	kg	90	93	97

1) The values are valid:
- for the optimum viscosity range from $\nu_{opt} = 36$ to 16 mm^2/s
- with hydraulic fluid based on mineral oils.

2) Without boost pump

3) Illustration of spring mass system:



4) The data are valid for values between the minimum required and maximum permissible speed.
Valid for external excitation (e. g. 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.

Note

Operation above the maximum values or below the minimum values may result in a loss of function, a reduced service life or in the destruction of the axial piston unit. We recommend testing the loads by means of experiment or calculation / simulation and comparison with the permissible values.

Technical data

Permissible radial and axial forces of the drive shafts

Size		NG		045-045	045-045	065-045	065-065
Drive shaft			in	1 3/8	1 1/2	1 1/2	1 1/2
Maximum radial force at distance a (from shaft collar)		$F_{q\,max}$	N	3474	2970	4670	4670
		a	mm	24	27	27	27
Maximum axial force		$+F_{ax\,max}$	N	3490	3490	4300	4300
		$-F_{ax\,max}$	N	2310	2310	2700	2700

Note

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

Determining the operating characteristics

Flow $$q_v = \frac{V_g \cdot n \cdot \eta_v}{1000} \quad \text{[L/min]}$$

Torque $$T = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}} \quad \text{[Nm]}$$

Power $$P = \frac{2\,\pi \cdot T \cdot n}{60000} = \frac{q_v \cdot \Delta p}{600 \cdot \eta_t} \quad \text{[kW]}$$

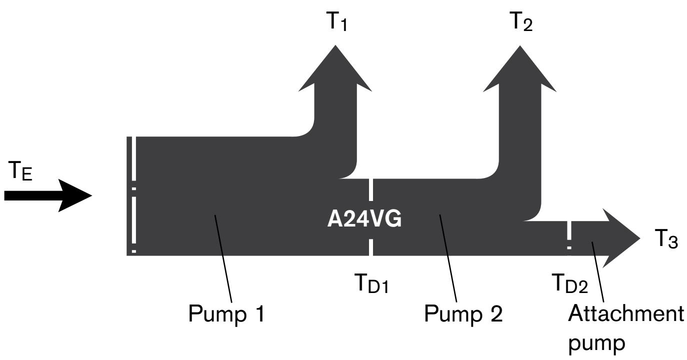
V_g = Displacement per revolution in cm^3
Δp = Differential pressure in bar
n = Speed in rpm
η_v = Volumetric efficiency
η_{mh} = Mechanical-hydraulic efficiency
η_t = Total efficiency ($\eta_t = \eta_v \cdot \eta_{mh}$)

Permissible input and through-drive torques

Size			NG		045-045	065-045	065-065
Torque at $V_{g\,max}$ and Δp = 430 bar[1)]			T	Nm	620	756	892
Input torque at drive shaft, maximum[2)]							
	V8	1 3/8 in	$T_{E\,max}$	Nm	970	970	–
	S9	1 1/2 in	$T_{E\,max}$	Nm	1125	1125	1125
Maximum through-drive torque			$T_{D1\,max}$	Nm	495	495	495
			$T_{D2\,max}$	Nm	$T_{D2\,perm} = T_{D1\,max} - T_2$	$T_{D2\,perm} = T_{D1\,max} - T_2$	$T_{D2\,perm} = T_{D1\,max} - T_2$

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

Torque distribution



T_E consists as follows:
$T_E = T_1 + T_2 + T_3$
$T_E < T_{E\,max}$

HT – Hydraulic control, direct controlled

With the direct hydraulic control (HT), the output flow of the pump is controlled by a hydraulic control pressure, applied directly to the stroking piston through either port X_1 or X_2.

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.

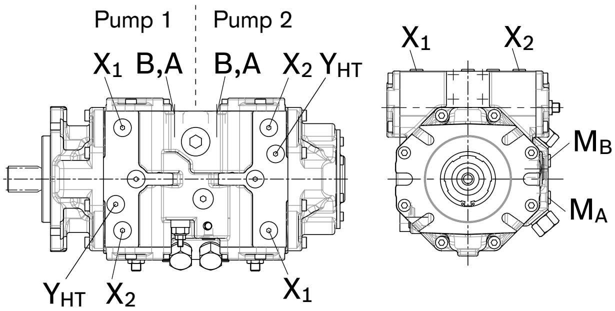
In order to use the optional built-in pressure cut-off valve, port Y_{HT} must be used as the control pressure source for the selected control module. See page 29 for a description of the pressure cut-off function.

Maximum permissible control pressure: 40 bar

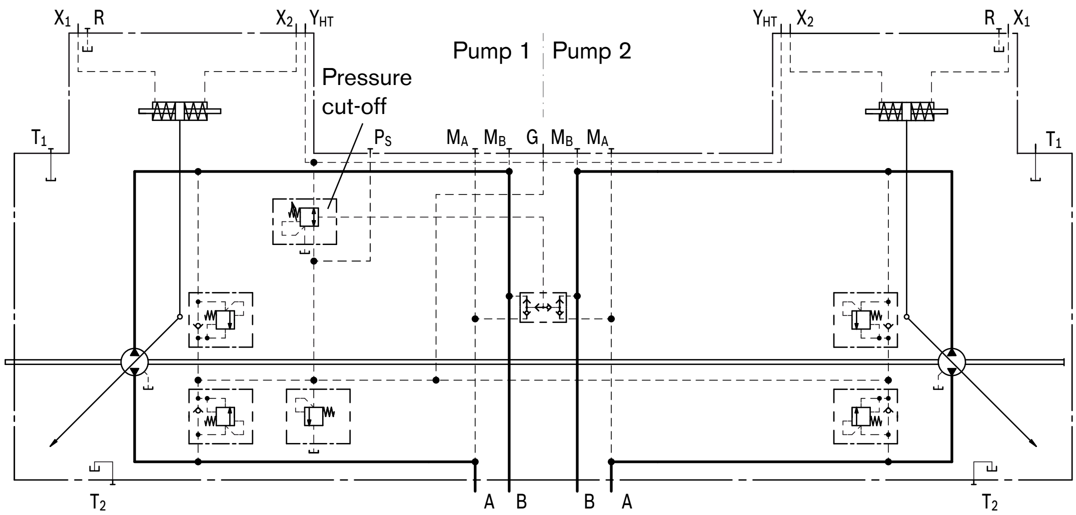
Use of the HT control requires a review of the engine and vehicle parameters to ensure that the pump is set up correctly. We recommend that all HT applications be reviewed by a Bosch Rexroth application engineer.

Correlation
Direction of rotation - Control - Flow direction

Direction of rotation	clockwise				counter-clockwise			
Pump	Pump 1		Pump 2		Pump 1		Pump 2	
Control pressure	X_1	X_2	X_1	X_2	X_1	X_2	X_1	X_2
Flow direction	B to A	A to B	A to B	B to A	A to B	B to A	B to A	A to B
Operating pressure	M_A	M_B	M_B	M_A	M_B	M_A	M_A	M_B



Schematic
Illustration with service line ports on left side



Note

The combination and operation of all controls must be considered in the complete system!

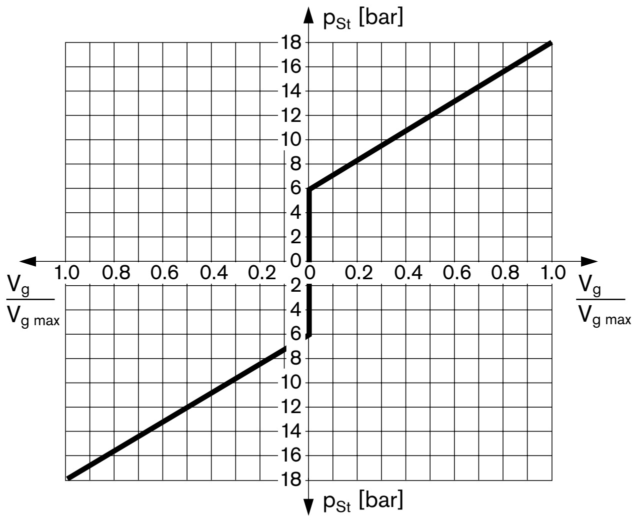
HP – Proportional control hydraulic, pilot-pressure related

The output flow of the pump is infinitely variable between 0 to 100 %, proportional to the difference in pilot pressure applied to the two control ports (Y_1 and Y_2).

The pilot signal, coming from an external source, is a pressure signal. Flow is negligible, as the pilot signal acts only on the spool of the control valve.

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 any given pilot signal within the control range.



V_g = Displacement at p_{St}
$V_{g\ max}$ = Displacement at p_{St} = 18 bar

Pilot signal p_{St} = 6 to 18 bar (at port Y_1, Y_2)

Beginning of control at 6 bar

End of control at 18 bar (maximum displacement $V_{g\ max}$)

Note
In the neutral position, the HP control module must be vented to reservoir via the external pilot control device.

Note

The spring return feature in the control module is not a safety device

The control module can stick in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the control will no longer respond correctly to the operator's commands.

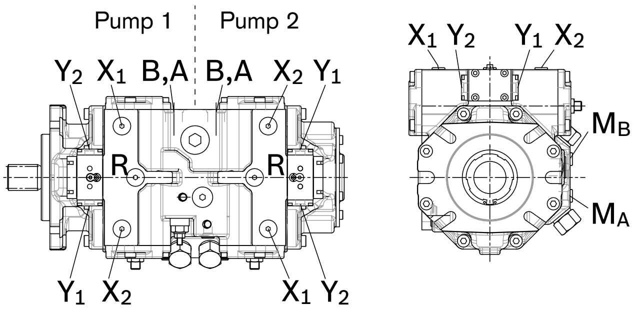
Check whether the application on your machine requires additional safety measures, in order to bring the driven actuator into a controlled and safe position (immediate stop). If necessary, make sure these are properly implemented.

Note

The combination and operation of all controls must be considered in the complete system!

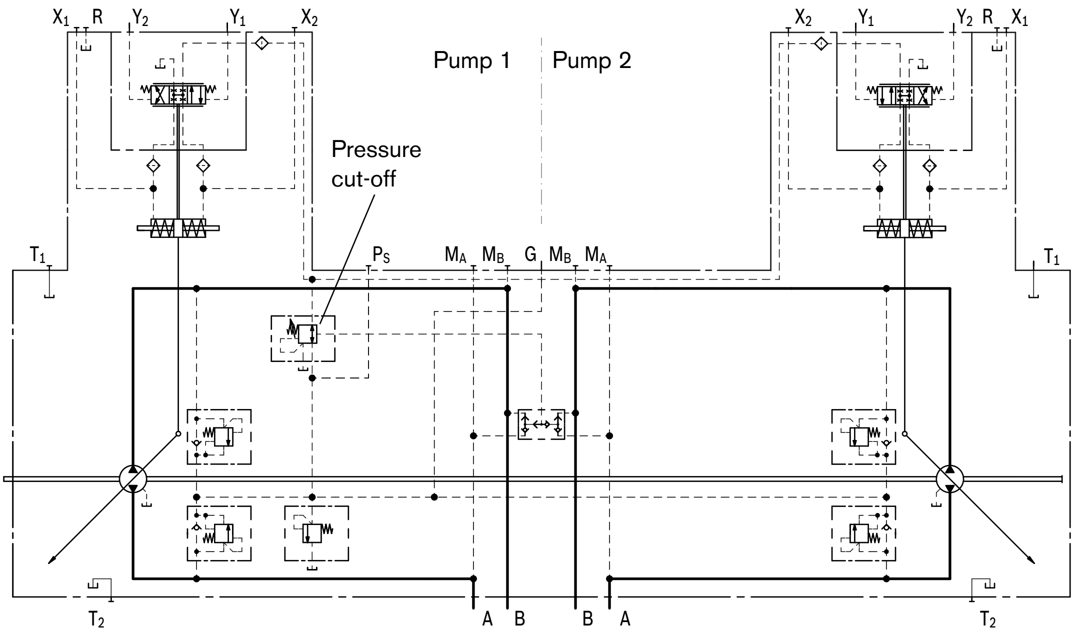
HP – Proportional control hydraulic, pilot-pressure related

Correlation Direction of rotation - Control - Flow direction								
Direction of rotation	clockwise				counter-clockwise			
Pump	Pump 1		Pump 2		Pump 1		Pump 2	
Pilot signal	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2
Control pressure	X_2	X_1	X_2	X_1	X_2	X_1	X_2	X_1
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



Schematic

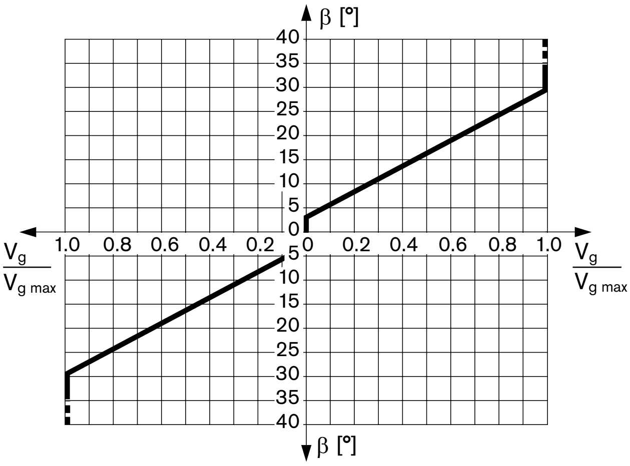
Illustration with service line ports on left side



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 between 0° and ±29° from the spring centered zero flow position.

A feedback lever, connected to the stroking piston maintains the pump flow for any given position of the control lever between 0° and 29°.



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

Start of control at β = 3°

End of control β = 29° (maximum displacement $V_{g\,max}$)

Mechanical stop for β: ±40°

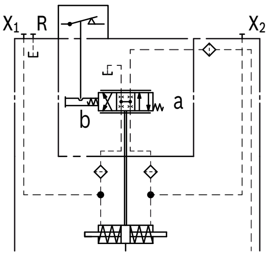
The maximum required torque at the lever is 170 Ncm. To prevent damage to the HW control module, a positive mechanical stop must be provided for the HW control lever.

Note
Spring centering enables the pump, depending on pressure and 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, neutral position switch	
Load capacity	20 A (continuous), without switching operating
Switching capacity	15 A / 32 V (resistive load)
	4 A / 32 V (inductive load)
Connector design	DEUTSCH DT04-2P-EP04 (mating connector, see page 33)

Schematic with neutral position switch



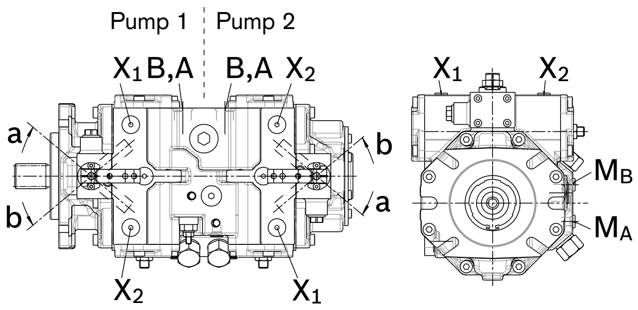
Note

The combination and operation of all controls must be considered in the complete system!

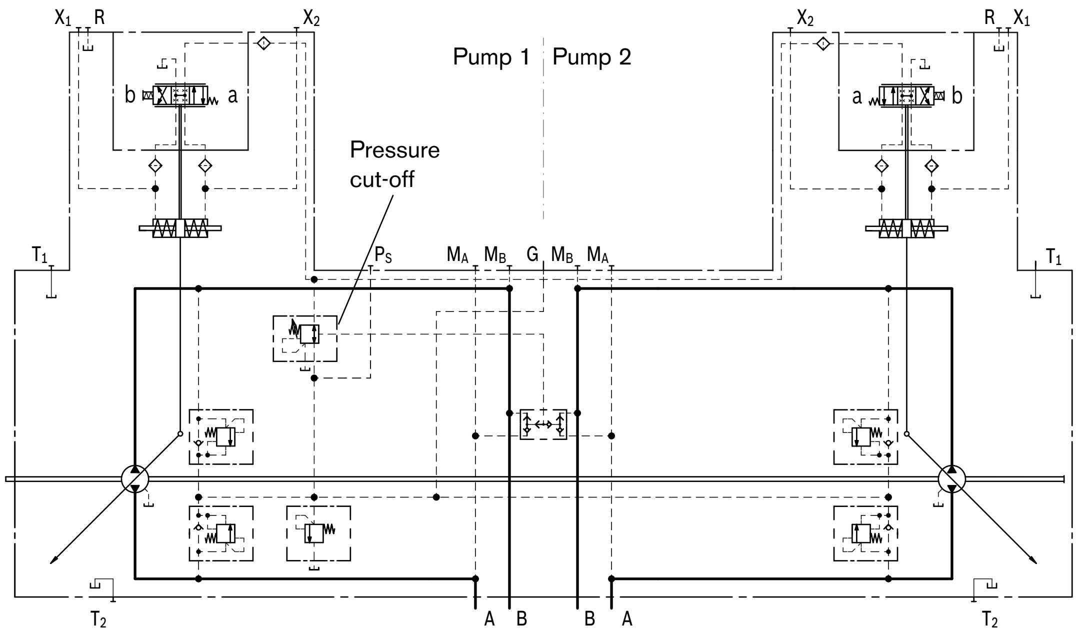
HW – Proportional control hydraulic, mechanical servo

Correlation
Direction of rotation - Control - 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_2	X_1	X_2	X_1	X_2	X_1	X_2	X_1
Flow direction	A to B	B to A	A to B	B to A	B to A	A to B	B to A	A to B
Operating pressure	M_B	M_A	M_B	M_A	M_A	M_B	M_A	M_B



Schematic
Illustration with service line ports on left side



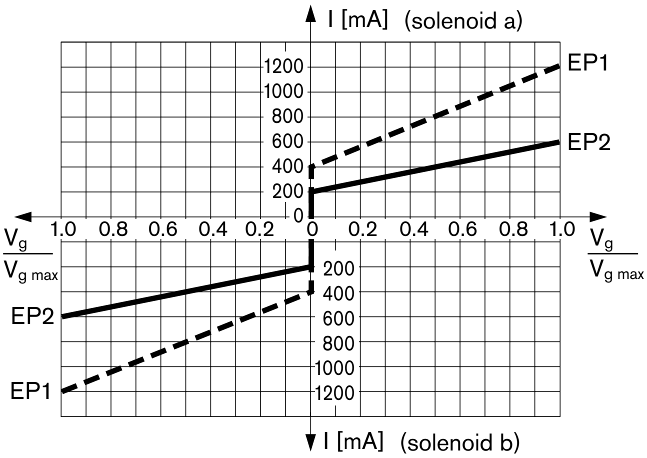
EP – Proportional control electric

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 spool of the control valve.

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 any given current within the control range.



Standard
Proportional solenoid without manual override.

On request
Proportional solenoid with manual override and spring return.

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 $V_{g\,max}$	1200 mA	600 mA
Limiting current	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 design on page 33		

The following electronic controllers and amplifiers are available for controlling the proportional solenoids:

– BODAS controller RC
  Series 20 ______ RE 95200
  Series 21 ______ RE 95201
  Series 22 ______ RE 95202
  Series 30 ______ RE 95203, RE 95204
  and application software

– Analog amplifier RA ______ RE 95230

Further information can also be found on the Internet at www.boschrexroth.com/mobilelektronik.

Note

The spring return feature in the control module is not a safety device

The control module can stick in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the control will no longer respond correctly to the operator's commands.

Check whether the application on your machine requires additional safety measures, in order to bring the driven actuator into a controlled and safe position (immediate stop). If necessary, make sure these are properly implemented.

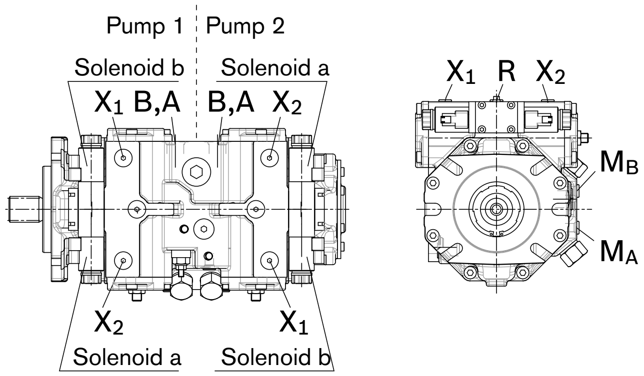
Note

The combination and operation of all controls must be considered in the complete system!

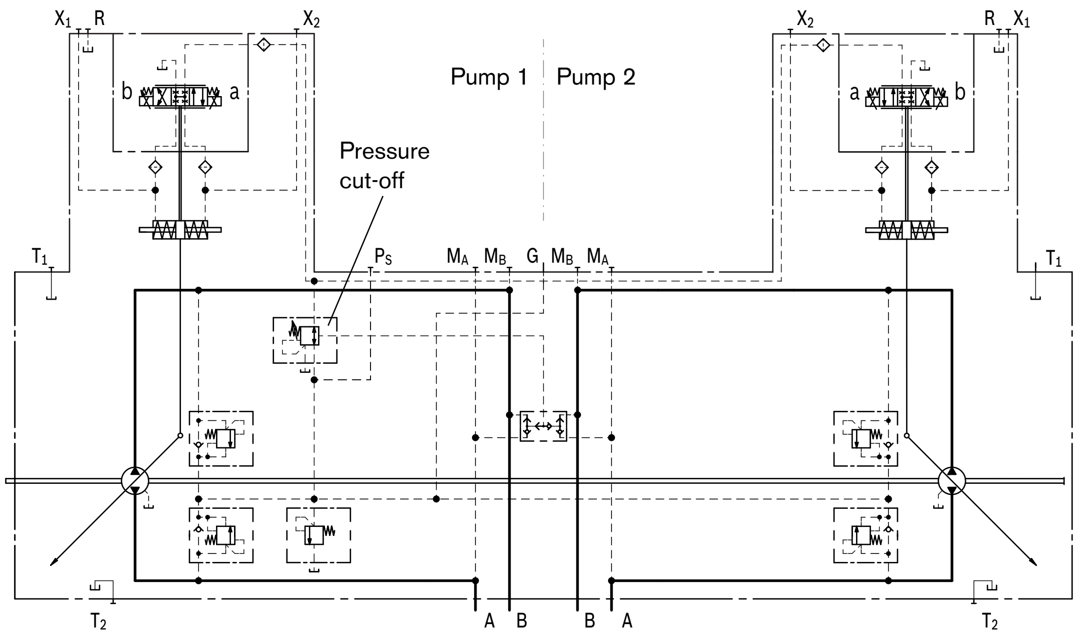
EP – Proportional control electric

Correlation
Direction of rotation - Control - 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_2	X_1	X_2	X_1	X_2	X_1	X_2	X_1
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



Schematic
Illustration with service line ports on left side



EZ – Two-point control electric

By energizing either switching solenoid a or b, internal control pressure is connected directly to the stroking piston and the pump swivels to maximum displacement. With the EZ control, pump flow is switchable between $V_g = 0$ and $V_{g\,max}$.
Flow direction is determined by which solenoid is energized.

Standard
Switching solenoid without manual override.

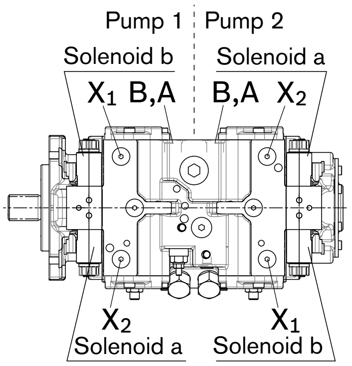
On request
Switching solenoid with manual override and spring return.

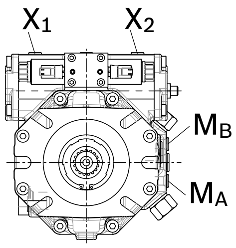
Technical data, solenoid

	EZ1	EZ2
Voltage	12 V (±20 %)	24 V (±20 %)
Neutral position $V_g = 0$	de-energized	de-energized
Displacement $V_{g\,max}$	energized	energized
Nominal resistance (at 20 °C)	5.5 Ω	21.7 Ω
Nominal power	26.2 W	26.5 W
Minimum required current	1.32 A	0.67 A
Duty cycle	100 %	100 %
Type of protection see connector design on page 33		

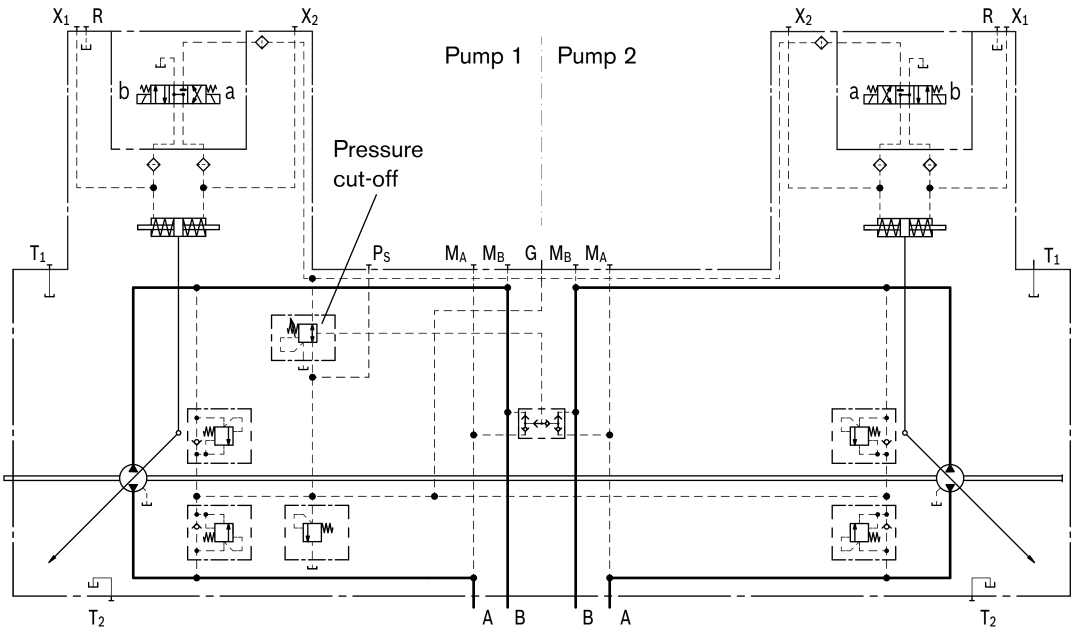
Correlation
Direction of rotation - Control - Flow direction

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_1	X_2	X_1	X_2	X_1	X_2	X_1	X_2
Flow direction	B to A	A to B	A to B	B to A	A to B	B to A	B to A	A to B
Operating pressure	M_A	M_B	M_B	M_A	M_B	M_A	M_A	M_B





Schematic
Illustration with service line ports on left side



Note
The combination and operation of all controls must be considered in the complete system!

EV – Electric control, direct controlled

With the direct electric control (EV), the output flow of the pump is infinitely variable between 0 to 100 %, controlled by the control pressure of the pressure reducing valve. This control pressure level is proportional to the electric current, applied to the solenoid of the pressure reducing valve. This control pressure is then connected directly to the stroking cylinder of the pump by energizing either switching solenoid a or b on the EV control module, which determines the direction of the pump flow.
The resulting pump displacement at a certain control pressure is also influenced by pump drive speed and operating pressure.

Technical data, pressure reducing valve

	EV1	EV2
Voltage	12 V	24 V
Control current		
Beginning of control at $V_g = 0$	515 mA	255 mA
End of control at $V_{g\,max}$	990 mA	495 mA
Limiting current	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 design on page 33		

Depending on the operating point, the specified values may vary slightly.

The following electronic controllers and amplifiers are available for controlling the proportional solenoids:

- BODAS controller RC
  Series 20 ______ RE 95200
  Series 21 ______ RE 95201
  Series 22 ______ RE 95202
  Series 30 ______ RE 95203, RE 95204
  and application software
- Analog amplifier RA ______ RE 95230

Further information can also be found on the Internet at www.boschrexroth.com/mobile-electronics.

Technical data, solenoid

	EV1	EV2
Voltage	12 V (±20 %)	24 V (±20 %)
Neutral position $V_g = 0$	de-energized	de-energized
Displacement V_g	energized	energized
Nominal resistance (at 20 °C)	5.5 Ω	21.7 Ω
Nominal power	26.2 W	26.5 W
Minimum required current	1.32 A	0.67 A
Duty cycle	100%	100%
Type of protection see connector design on page 33		

Standard
Switching solenoid without manual override.

On request
Switching solenoid with manual override and spring return.

Correlation Direction of rotation - Control - 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_1	X_2	X_1	X_2	X_1	X_2	X_1	X_2
Flow direction	B to A	A to B	A to B	B to A	A to B	B to A	B to A	A to B
Operating pressure	M_A	M_B	M_B	M_A	M_B	M_A	M_A	M_B

Note

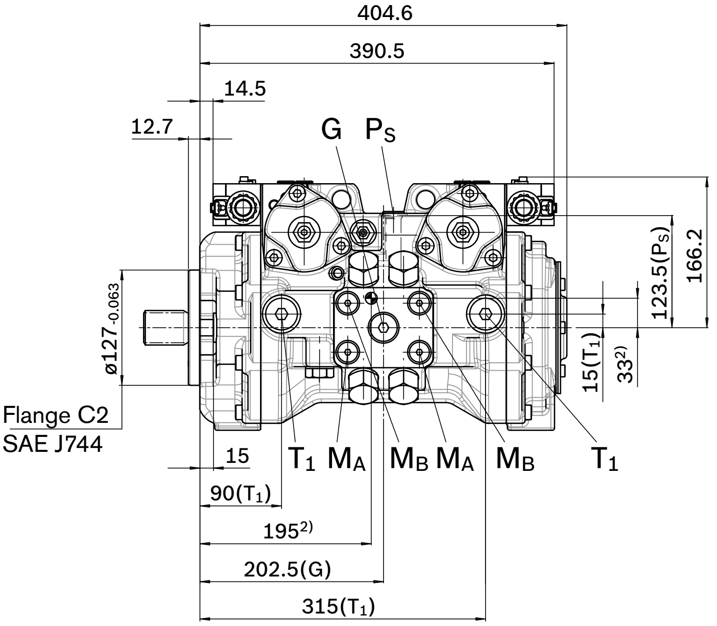
The combination and operation of all controls must be considered in the complete system!

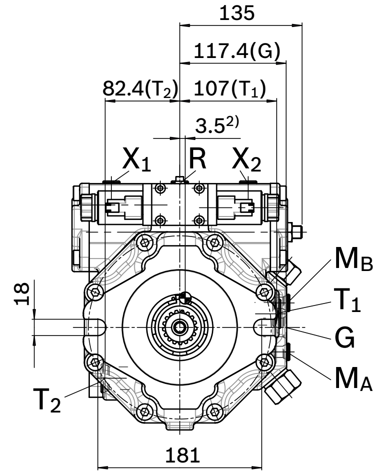
Dimensions size 045-045

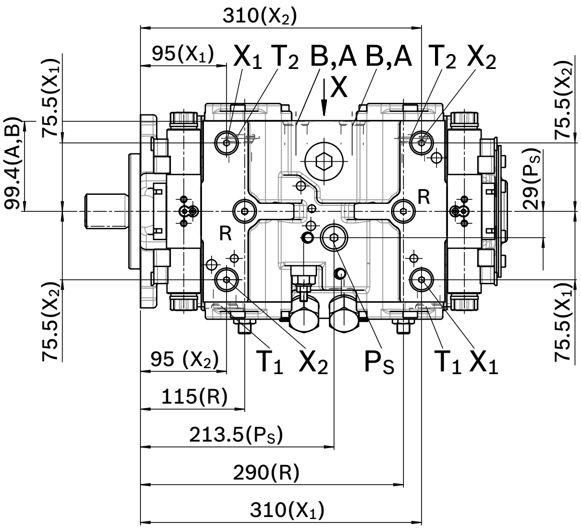
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

EP – Proportional control electric

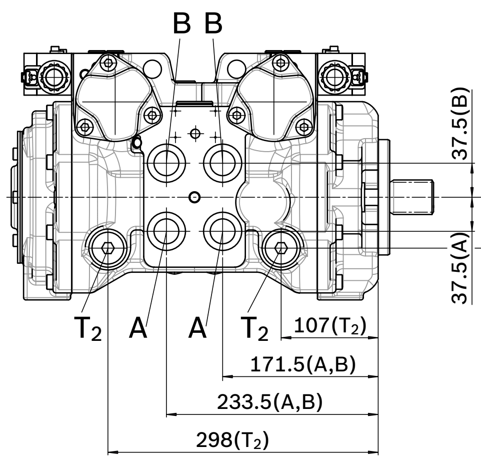
Threaded ports A and B, on left side (viewed on drive shaft)1)

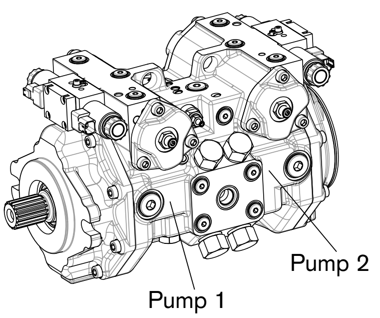






View X





1) For threaded ports A and B, on right side (viewed on drive shaft), the complete case and thus the dimensions are mirrored.

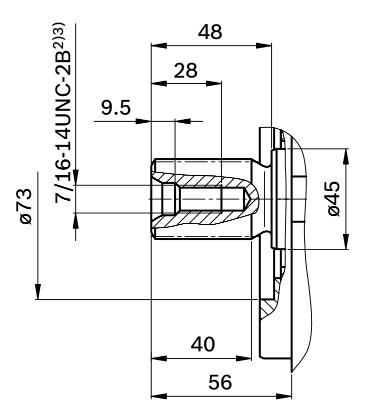
2) Center of gravity

Dimensions size 045-045

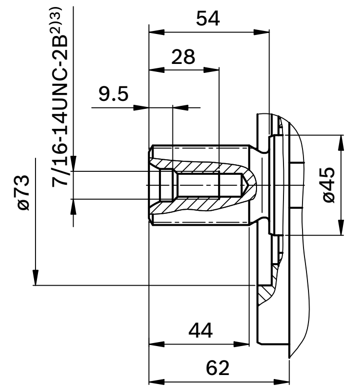
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shafts

V8 Splined shaft 1 3/8 in
21T 16/32DP[1)]



S9 Splined shaft 1 1/2 in
17T 12/24DP[1)]



Ports

Designation	Port for	Standard[4)]	Size[3)]	Maximum pressure [bar][5)]	State[8)] Pump 1	Pump 2
A, B	Service line	ISO 6149	M27 x 2; 19 deep	500	O	O
T_1	Drain line	ISO 6149	M27 x 2; 19 deep	3	X[6)]	X[6)]
T_2	Drain line	ISO 6149	M27 x 2; 19 deep	3	X[6)]	O[6)]
R	Air bleed	ISO 6149	M14 x 1.5; 11.5 deep	3	X	X
X_1, X_2	Control pressure (upstream of orifice)	ISO 6149	M14 x 1.5; 11.5 deep	40	X	X
X_1, X_2	Control pressure (upstream of orifice, HT only)	ISO 6149	M14 x 1.5; 11.5 deep	40	O	O
X_3, X_4[7)]	Stroking chamber pressure	ISO 6149	M14 x 1.5; 11.5 deep	40	X	X
G	Boost pressure	ISO 6149	M22 x 1.5; 17 deep	40	O	
P_S	Pilot pressure, inlet	ISO 6149	M18 x 1.5; 14.5 deep	40	X	
Y_{HT}	Pilot pressure, outlet (HT only)	ISO 6149	M14 x 1.5; 11.5 deep	40	O	O
M_A, M_B	Measuring pressure A, B	ISO 6149	M14 x 1.5; 11.5 deep	500	X	X
Y_1, Y_2	Pilot signal (HP only)	ISO 6149	M14 x 1.5; 11.5 deep	40	O	O

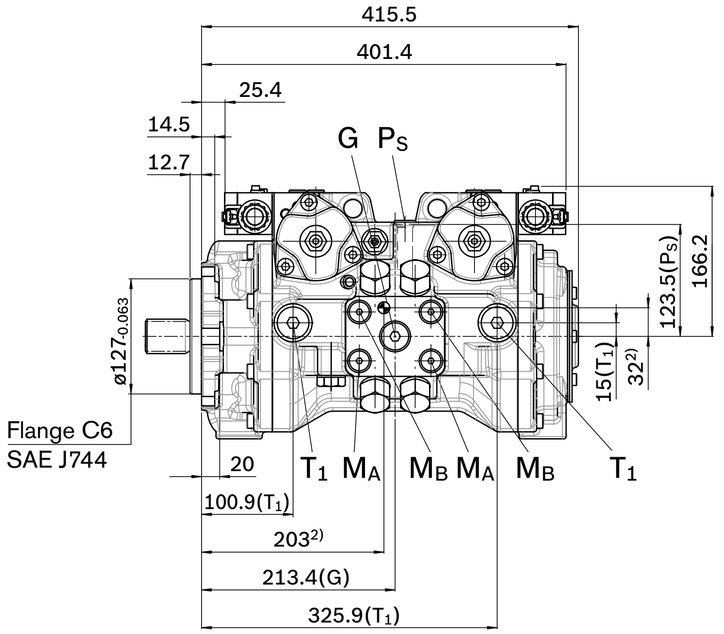
1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) Observe the general instructions on page 38 for the maximum tightening torques.
4) The spot face can be deeper than specified in the appropriate standard.
5) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
6) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on pages 36 and 37).
7) Optional, see page 31
8) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

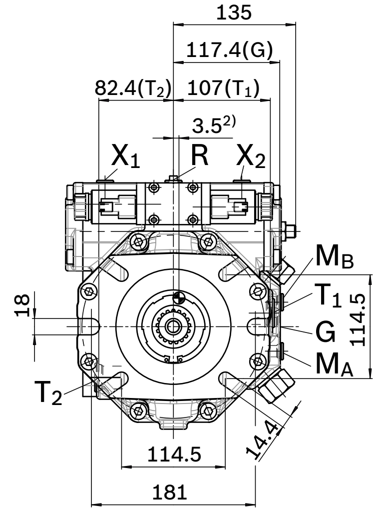
Dimensions size 065-045

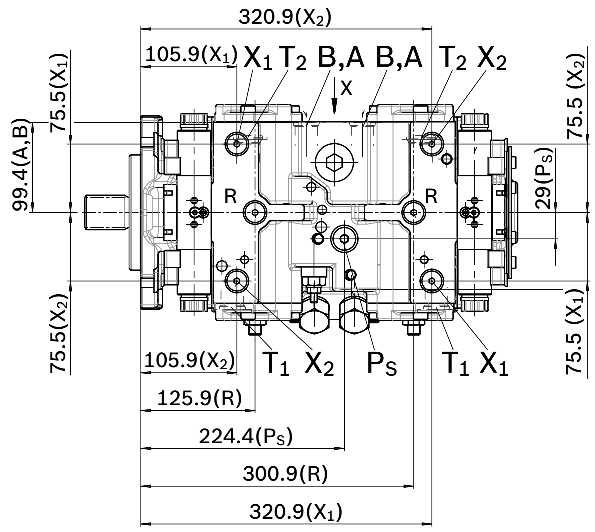
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

EP – Proportional control electric

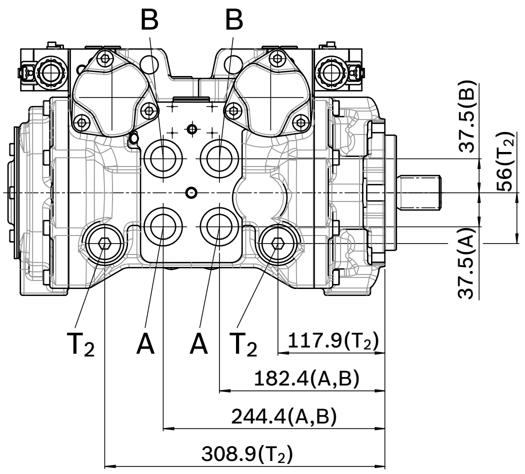
Threaded ports A and B, on left side (viewed on drive shaft)[1)]

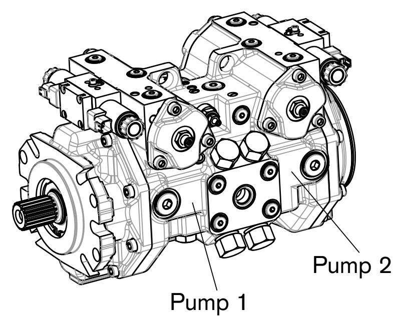






View X





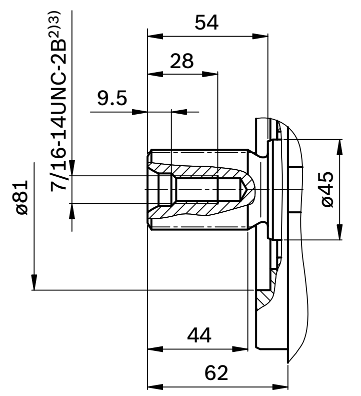
1) For threaded ports A and B, on right side (viewed on drive shaft), the complete case and thus the dimensions are mirrored.
2) Center of gravity

Dimensions size 065-045

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shaft

S9 Splined shaft 1 1/2 in 17T 12/24DP[1)]



Ports

Designation	Port for	Standard[4)]	Size[3)]	Maximum pressure [bar][5)]	State[8)] Pump 1	Pump 2
A, B	Service line	ISO 6149	M27 x 2; 19 deep	500	O	O
T_1	Drain line	ISO 6149	M27 x 2; 19 deep	3	X[6)]	X[6)]
T_2	Drain line	ISO 6149	M27 x 2; 19 deep	3	X[6)]	O[6)]
R	Air bleed	ISO 6149	M14 x 1.5; 11.5 deep	3	X	X
X_1, X_2	Control pressure (upstream of orifice)	ISO 6149	M14 x 1.5; 11.5 deep	40	X	X
X_1, X_2	Control pressure (upstream of orifice, HT only)	ISO 6149	M14 x 1.5; 11.5 deep	40	O	O
X_3, X_4[7)]	Stroking chamber pressure	ISO 6149	M14 x 1.5; 11.5 deep	40	X	X
G	Boost pressure	ISO 6149	M22 x 1.5; 17 deep	40	O	
P_S	Pilot pressure, inlet	ISO 6149	M18 x 1.5; 14.5 deep	40	X	
Y_{HT}	Pilot pressure, outlet (HT only)	ISO 6149	M14 x 1.5; 11.5 deep	40	O	O
M_A, M_B	Measuring pressure A, B	ISO 6149	M14 x 1.5; 11.5 deep	500	X	X
Y_1, Y_2	Pilot signal (HP only)	ISO 6149	M14 x 1.5; 11.5 deep	40	O	O

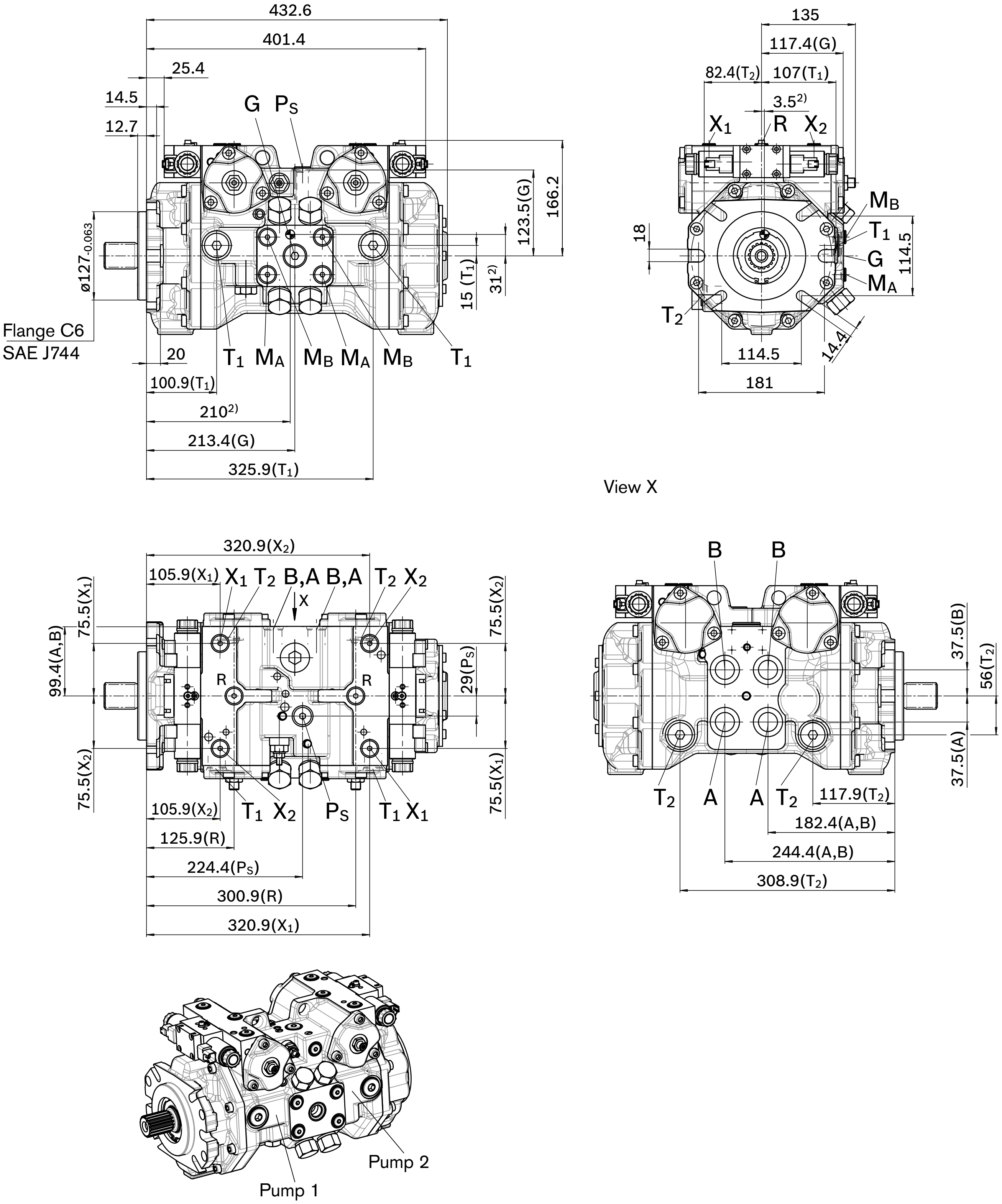
1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) Observe the general instructions on page 38 for the maximum tightening torques.
4) The spot face can be deeper than specified in the appropriate standard.
5) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
6) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on pages 36 and 37).
7) Optional, see page 31
8) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 065-065

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

EP – Proportional control electric

Threaded ports A and B, on left side (viewed on drive shaft)[1)]



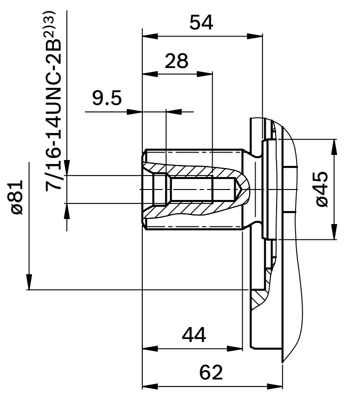
1) For threaded ports A and B, on right side (viewed on drive shaft), the complete case and thus the dimensions are mirrored.
2) Center of gravity

Dimensions size 065-065

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Drive shaft

S9 Splined shaft 1 1/2 in
17T 12/24DP[1]



Ports

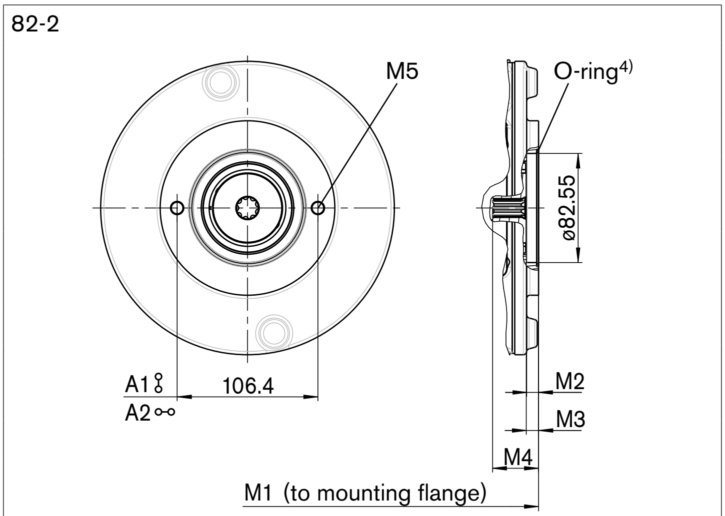
Designation	Port for	Standard[4]	Size[3]	Maximum pressure [bar][5]	State[8] Pump 1	Pump 2
A, B	Service line	ISO 6149[7]	M27 x 2; 19 deep	500	O	O
T_1	Drain line	ISO 6149[7]	M27 x 2; 19 deep	3	X[6]	X[6]
T_2	Drain line	ISO 6149[7]	M27 x 2; 19 deep	3	X[6]	O[6]
R	Air bleed	ISO 6149[7]	M14 x 1.5; 11.5 deep	3	X	X
X_1, X_2	Control pressure (upstream of orifice)	ISO 6149[7]	M14 x 1.5; 11.5 deep	40	X	X
X_1, X_2	Control pressure (upstream of orifice, HT only)	ISO 6149[7]	M14 x 1.5; 11.5 deep	40	O	O
X_3, X_4[7]	Stroking chamber pressure	ISO 6149[7]	M14 x 1.5; 11.5 deep	40	X	X
G	Boost pressure	ISO 6149[7]	M22 x 1.5; 17 deep	40	O	
P_S	Pilot pressure, inlet	ISO 6149[7]	M18 x 1.5; 14.5 deep	40	X	
Y_{HT}	Pilot pressure, outlet (HT only)	ISO 6149[7]	M14 x 1.5; 11.5 deep	40	O	O
M_A, M_B	Measuring pressure A, B	ISO 6149[7]	M14 x 1.5; 11.5 deep	500	X	X
Y_1, Y_2	Pilot signal (HP only)	ISO 6149[7]	M14 x 1.5; 11.5 deep	40	O	O

1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ASME B1.1
3) Observe the general instructions on page 38 for the maximum tightening torques.
4) The spot face can be deeper than specified in the appropriate standard.
5) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
6) Depending on installation position, T_1 or T_2 must be connected (see also installation instructions on pages 36 and 37).
7) Optional, see page 31
8) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

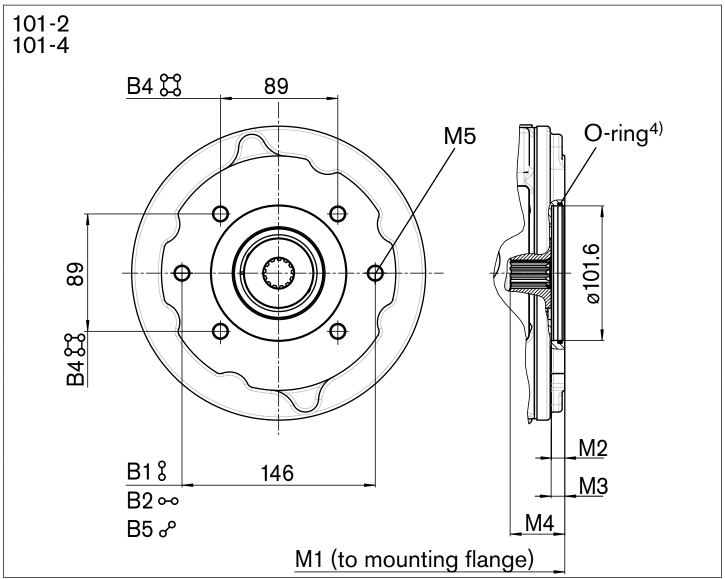
Through drive dimensions

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Flange SAE J744[1)]			Coupling for splined shaft[2)]					
	Mounting variant							
Diameter	Symbol[3)]	Designation	Diameter		Designation	045	065	
Without through drive						●	●	**0000**
82-2 (A)		A1	5/8 in	9T 16/32DP	S2	○	○	**A1S2**
			3/4 in	11T 16/32DP	S3	○	○	**A1S3**
		A2	5/8 in	9T 16/32DP	S2	○	○	**A2S2**
			3/4 in	11T 16/32DP	S3	○	○	**A2S3**
101-2 (B)		B1	7/8 in	13T 16/32DP	S4	○	○	**B1S4**
			1 in	15T 16/32DP	S5	○	○	**B1S5**
		B2	7/8 in	13T 16/32DP	S4	●	○	**B2S4**
			1 in	15T 16/32DP	S5	●	○	**B2S5**
		B5	7/8 in	13T 16/32DP	S4	○	○	**B5S4**
			1 in	15T 16/32DP	S5	○	○	**B5S5**
101-4 (B)		B4	7/8 in	13T 16/32DP	S4	○	○	**B4S4**
			1 in	15T 16/32DP	S5	○	○	**B4S5**



NG	M1[5)]	M2	M3	M4	M5[6)]
045-045	412.6	9	9.4	35	M10 x 1.5; 13 deep
065-065	447.4	9	9.4	35	
065-045	423.5	9	9.4	35	



NG	M1[5)]	M2	M3	M4	M5[6)]
045-045	412.6	10	15	38	M12 x 1.75; 16 deep
065-065	447.4	10	15	38	
065-045	423.5	10	15	38	

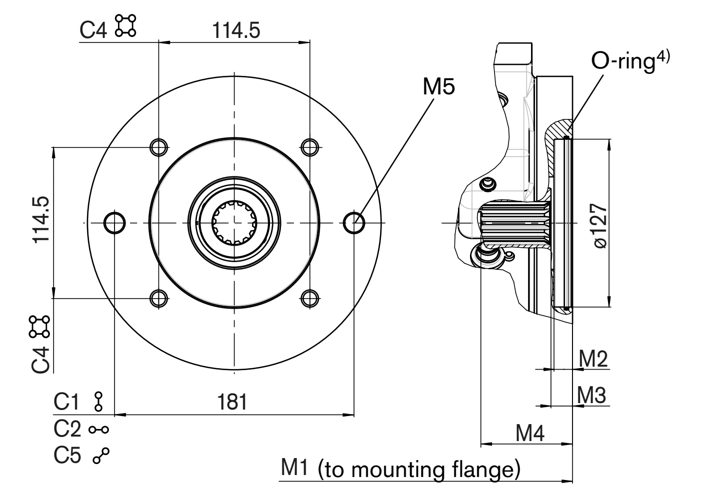
1) The through-drive flange is only supplied with the fastening thread corresponding to the ordering code designation.
2) Coupling for splined shaft according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
3) Mounting drillings pattern viewed on through drive with control at top
4) O-ring included in the delivery contents
5) Installation length M1 is valid for standard mounting flange (without integrated boost pump).
6) Thread according to DIN 13, observe the general instructions on page 38 for the maximum tightening torques.

Through drive dimensions

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Flange SAE J744[1]			Coupling for splined shaft[2]					
	Mounting variant							
Diameter	Symbol[3]	Designation	Diameter		Designation	045	065	
127-2 (C)	⚬⚬ (vertical)	C1	1 in	15T 16/32DP	S5	❍	❍	**C1S5**
			1 1/4 in	14T 12/24DP	S7	–	❍	**C1S7**
	⚬⚬ (horizontal)	C2	1 in	15T 16/32DP	S5	❍	❍	**C2S5**
			1 1/4 in	14T 12/24DP	S7	–	❍	**C2S7**
	⚬⚬ (diagonal)	C5	1 in	15T 16/32DP	S5	❍	❍	**C5S5**
			1 1/4 in	14T 12/24DP	S7	–	❍	**C5S7**
127-4 (C)	⚬⚬⚬⚬	C4	1 in	15T 16/32DP	S5	❍	❍	**C4S5**
			1 1/4 in	14T 12/24DP	S7	–	❍	**C4S7**

127-2
127-4



NG	M1[5]	M2	M3	M4
045-045	427.6	14	13	53
065-065	462.4	14	13	53
065-045	438.5	14	13	53

M5[6]	2-hole	4-hole
045-045 **065-065** **065-045**	M16 x 2; 19 deep	M12 x 1.75; 19 deep

1) The through-drive flange is only supplied with the fastening thread corresponding to the ordering code designation.
2) Coupling for splined shaft 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) O-ring included in the delivery contents
5) Installation length M1 is valid for standard mounting flange (without integrated boost pump).
6) Thread according to DIN 13, observe the general instructions on page 38 for the maximum tightening torques.

Overview of mounting options

Through drive[1]			Mounting option – additional pump						
Flange	Coupling for splined shaft	Short code	A4VG/40 NG (shaft)	A4VG/32 NG (shaft)	A10VG NG (shaft)	A10VO/31 NG (shaft)	A10VO/53 NG (shaft)	A11VO NG (shaft)	External gear pump[2]
82-2 (A)	5/8 in	**A_S2**	–	–	–	18 (U)	10 (U)	–	Series F Size 4 to 22
	3/4 in	**A_S3**	–	–	–	18 (S, R)	10 (S) 18 (S, R)	–	–
101-2 (B)	7/8 in	**B_S4**	–	–	18 (S)	28 (S, R) 45 (U, W)	28 (S, R) 45 (U, W)	–	Series N Size 20 to 36 Series G Size 32 to 50
	1 in	**B_S5**	–	28 (S)	28,45 (S)	45 (S, R)	45 (S,R) 60 (U,W)	40 (S)	–
101-4 (B)	7/8 in	**B4S4**	–	–	–	–	–	–	–
	1 in	**B4S5**	–	–	–	–	–	–	–
127-2 (C)	1 in	**C_S5**	–	40 (U)	–	71 (U, W)	–	–	–
	1 1/4 in	**C_S7**	45 (S7) 65 (S7)	40, 56, 71 (S)	63 (S)	71 (S,R) 100 (U,W)	85 (U, W)	60 (S)	–
127-4 (C)	1 1/4 in	**C4S7**	65 (S7)	71 (S)	–	–	60 (S, R)	–	–

1) Availability of the individual sizes, see ordering code on page 4.
2) Bosch Rexroth recommends special versions of the gear pumps. Please contact us.

Pressure cut-off

The pressure cut-off is a pressure control which, after reaching the set pressure, adjusts the displacement of the pump back to $V_{g\ min}$.

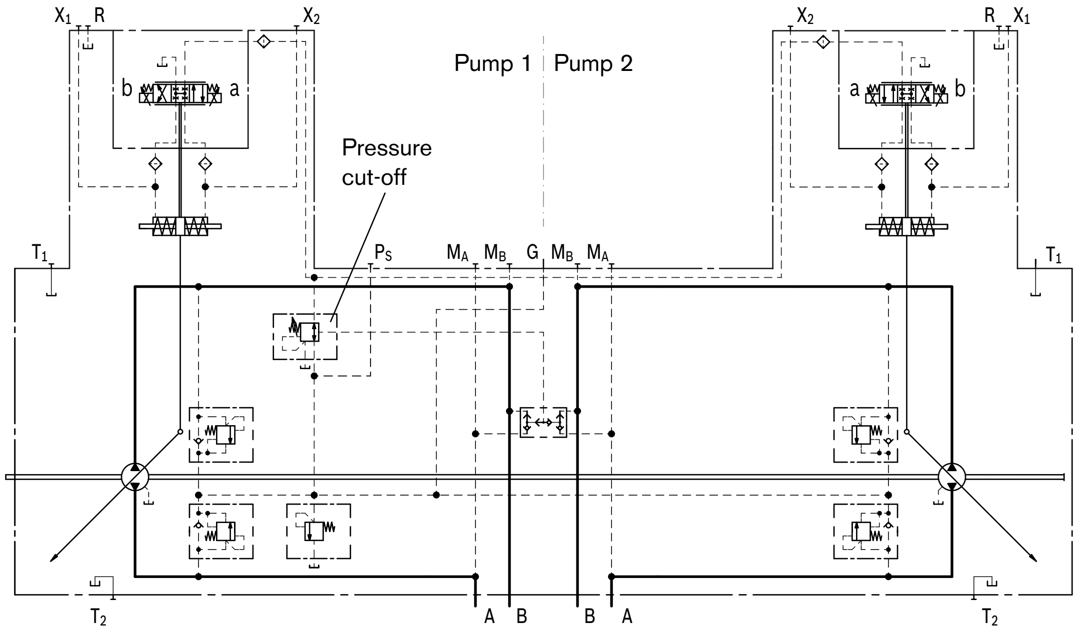
This valve prevents the operation of the high-pressure relief valves when accelerating or decelerating.

The high-pressure relief valves protect against the pressure spikes which occur during fast swiveling of the swashplate and limit the maximum pressure in the system.

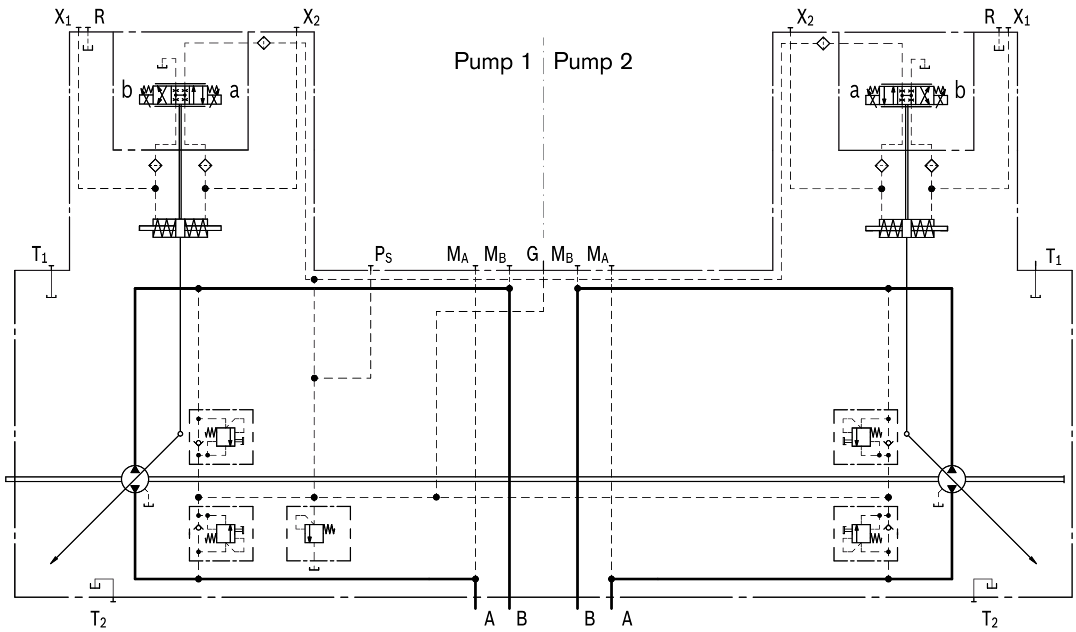
The setting range of the pressure cut-off may be anywhere within the entire operating pressure range. However, it must be set 30 bar lower than the setting of the high-pressure relief valves (see setting diagram, page 30).

Please state the setting value of the pressure cut-off in plain text when ordering.

Schematic with pressure cut-off
Example: electric control, EP_D



Schematic without pressure cut-off



Illustrations with service line ports on left side

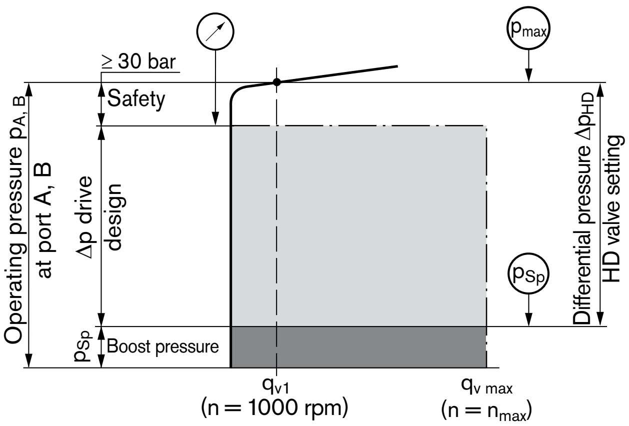
High-pressure relief valves

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 diagram

Version without pressure cut-off

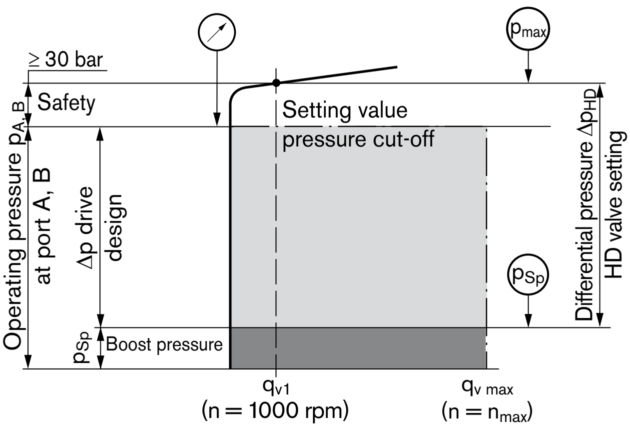


Example:

Operating pressure $p_{A,B}$	450 bar
Boost pressure p_{Sp}	20 bar
Differential pressure Δp_{HD}	430 bar

$p_{A,B}$ 450 bar – p_{Sp} 20 bar = Δp_{HD} **430 bar**

Version with pressure cut-off



Example:

Operating pressure $p_{A,B}$	450 bar
Boost pressure p_{Sp}	20 bar
Differential pressure Δp_{HD}	460 bar

$p_{A,B}$ 450 bar – p_{Sp} 20 bar + Safety 30 bar = Δp_{HD} **460 bar**

When ordering, state differential pressure setting in plain text:
The following values are available for selection of the differential pressure setting (fixed setting):
Preferred values [bar]: 400, 410, 420, 430, 440, 450, 460, 470
Optional values [bar]: 300, 320, 340, 360, 380
If not specified in the order, valves will be set to the differential pressure Δp = 420 bar.

High-pressure relief valve A

Differential pressure setting ________________ Δp_{HD} = ... bar

Cracking pressure of the HD valve (at $q_{V\ 1}$) ______ p_{max} = ... bar
($p_{max} = \Delta p_{HD} + p_{Sp}$)

High-pressure relief valve B

Differential pressure setting ________________ Δp_{HD} = ... bar

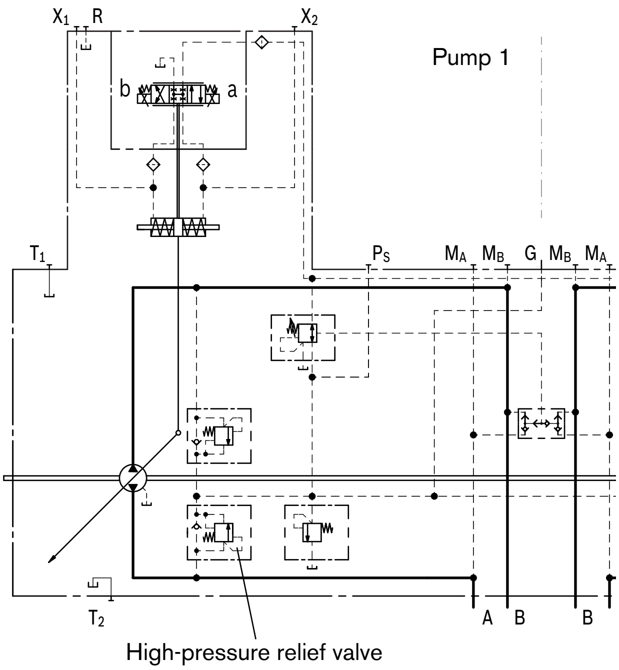
Cracking pressure of the HD valve (at $q_{V\ 1}$) ______ p_{max} = ... bar
($p_{max} = \Delta p_{HD} + p_{Sp}$)

Note

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.

Schematic

Illustration with service line ports on left side



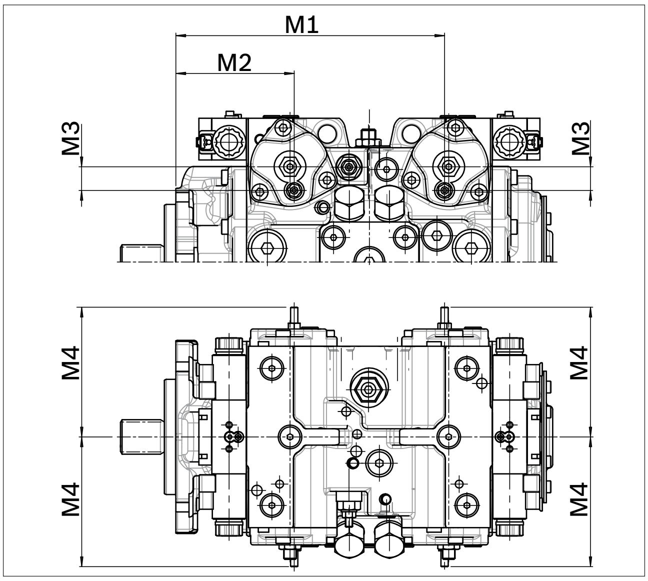
Mechanical stroke limiter

The mechanical stroke limiter is an auxiliary function allowing the maximum displacement of the pump to be steplessly reduced, regardless of the control module used.

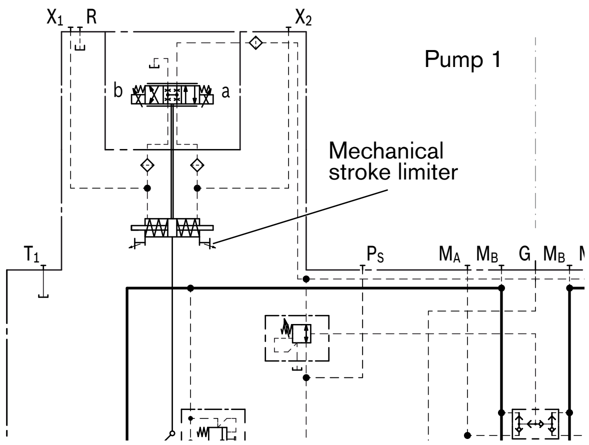
With two threaded pins per pump, the stroke of the stroke piston and thus the maximum swivel angle of each pump is limited.

Dimensions

NG	M1	M2	M3	M4
045-045	285.4	119.6	26.1	143
065-065	296.3	130.6	26.1	143
065-045	296.3	130.6	26.1	143



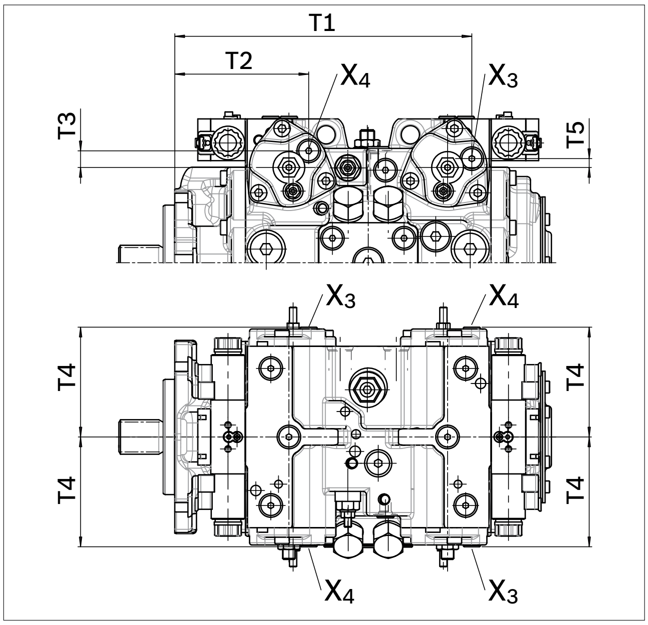
Schematic
Illustration with service line ports on left side



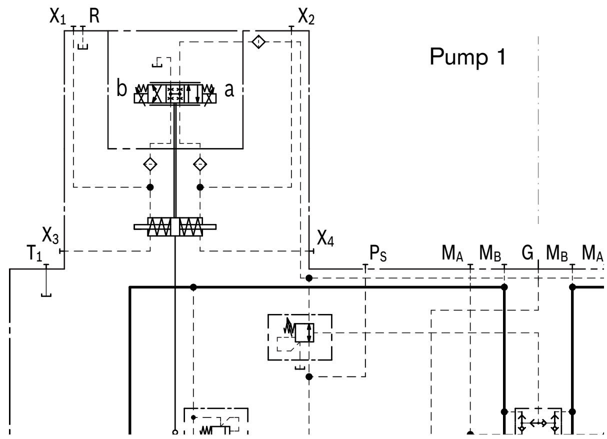
Ports X_3 and X_4 for stroking chamber pressure

Dimensions

NG	T1	T2	T3	T4	T5
045-045	316.8	136.8	18.3	117	9.7
065-065	327.7	147.7	18.3	117	9.7
065-045	327.7	147.7	18.3	117	9.7



Schematic
Illustration with service line ports on left side



Designation	Port for	Standard[1]	Size[2]	Maximum pressure [bar][3]	State[4]	
					Pump 1	Pump 2
X_3, X_4	Stroking chamber pressure	ISO 6149	M14 x 1.5; 11.5 deep	40	X	X

1) The spot face can be deeper than specified in the appropriate standard.
2) Observe the general instructions on page 38 for the maximum tightening torques.
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)

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Filtration boost circuit / external supply

Version E
External supply

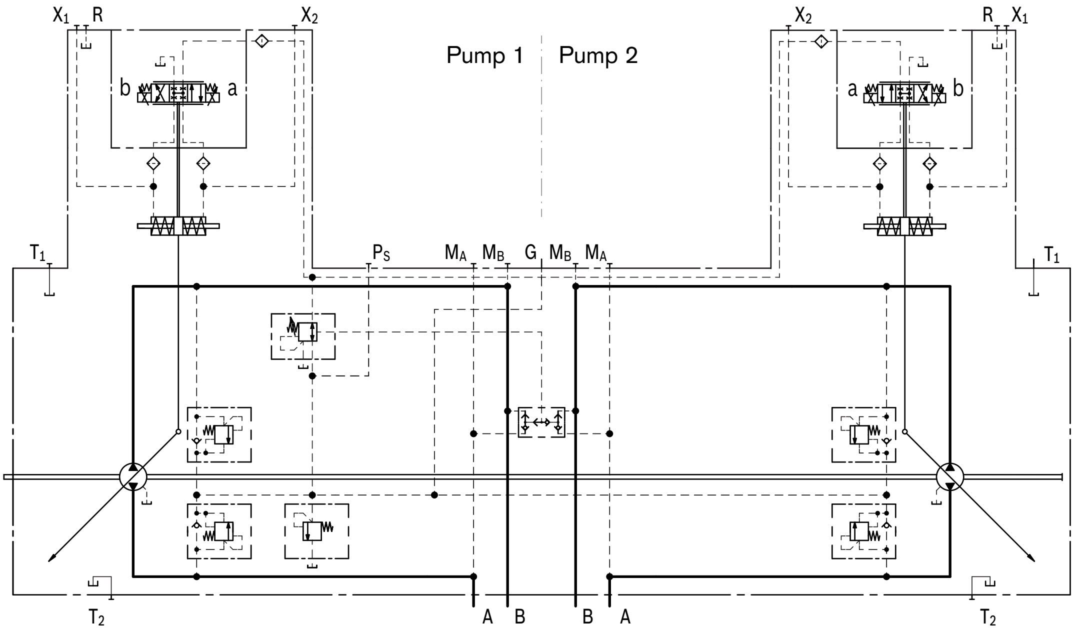
This variation should be used in versions **without** integrated boost pump.

Supply comes from port G.

Filter arrangement ______________________________separate

To ensure the functional reliability, maintain the required cleanliness level for the boost fluid fed in at port G (see page 7).

Schematic version E
Illustration shows service line ports on left side



Connector for solenoids

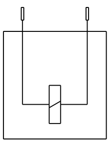
DEUTSCH DT04-2P-EP04

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
Bosch Rexroth Mat. No. R902601804

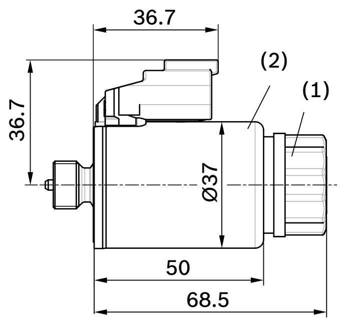
Consisting of: DT designation

– 1 housing ________ DT06-2S-EP04

– 1 wedge ________ W2S

– 2 sockets ________ 0462-201-16141

The mating connector is not included in the delivery contents. This can be supplied by Bosch Rexroth on request.



Changing connector orientation

If necessary, you can change the connector orientation by turning the solenoid housing.

To do this, proceed as follows:

1. Loosen the mounting nut (1) of the solenoid. To do this, turn the mounting nut (1) one turn counter-clockwise.
2. Turn the solenoid body (2) to the desired orientation.
3. Retighten the mounting nut. Tightening torque: 5+1 Nm. (size WAF 26, 12kt DIN 3124)

On delivery, the connector orientation may differ from that shown in the brochure or drawing.

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

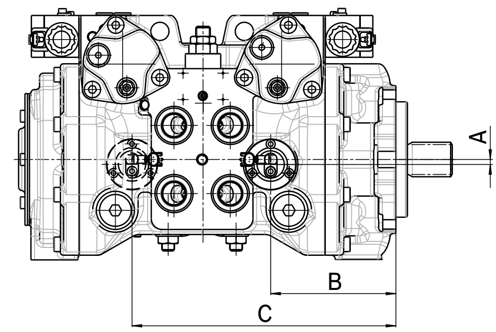
Speed sensor

With the speed sensor DSA mounted, a signal proportional to pump speed can be generated. The DSA sensor measures the speed and direction of rotation.

Ordering code, technical data, dimensions and details on the connector, plus safety instructions about the sensor can be found in the relevant data sheet (DSA – RE 95133).

The sensor is mounted on the port provided for this purpose with a mounting bolt.

Dimensions



Service line ports on left side

NG	A	B	Number of teeth
045-045	5.5	127	32
065-065	5.5	137.9	45
065-045	5.5	137.9	45

Service line ports on right side

NG	A	C	Number of teeth
045-045	5.5	278	32
065-065	5.5	288.9	45
065-045	5.5	288.9	32

Swivel angle sensor

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

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.

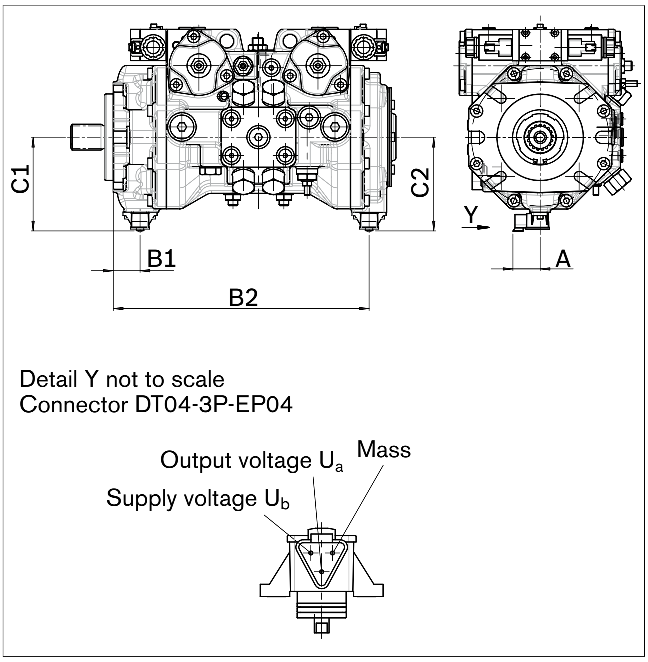
Characteristics			
Supply voltage U_b	10 to 30 V DC		
Output voltage U_a	1 V ($V_{g\,max}$)	2.5 V ($V_{g\,0}$)	4 V ($V_{g\,max}$)
Reverse voltage protection	Short circuit-resistant		
EMC resistance	Details on request		
Operating temperature range	-40 °C to +115 °C		
Vibration resistance sinusoidal vibration EN 60068-2-6	10 *g* / 5 to 2000 Hz		
Shock resistance continuous shock IEC 68-2-29	25 *g*		
Resistance to salt spray DIN 50 021-SS	96 h		
Type of protection with mounted mating connector	IP67 – DIN/EN 60529 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
	cw	A to B	M_B	< 2.5 V
	ccw	A to B	M_B	> 2.5 V
	ccw	B to A	M_A	< 2.5 V

1) For flow direction, see controls

Dimensions



NG	A	B1	B2	C1	C2
045-045	37	35.9	325.2	134.8	134.8
065-065	37	39.4	348	134.8	134.8
065-045	37	39.4	336.6	134.8	134.8

Mating connector

DEUTSCH DT06-3S-EP04
Bosch Rexroth Mat. No. R902603524

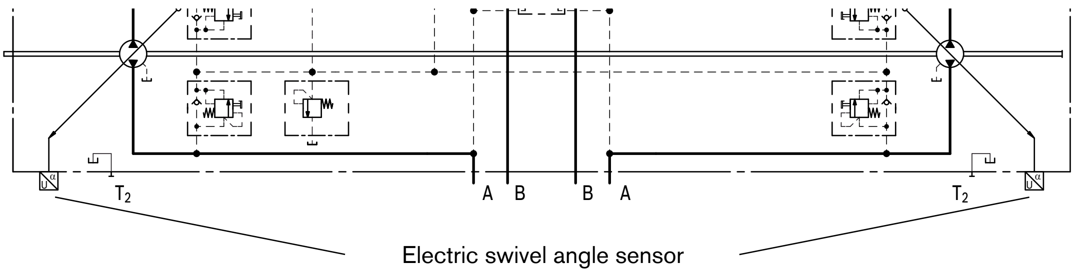
Consisting of: DT designation

- 1 housing ____ DT06-3S-EP04
- 1 wedge ____ W3S
- 3 sockets ____ 0462-201-16141

The mating connector is not included in the delivery contents. This can be supplied by Bosch Rexroth on request.

Schematic

Illustration with service line ports on left side



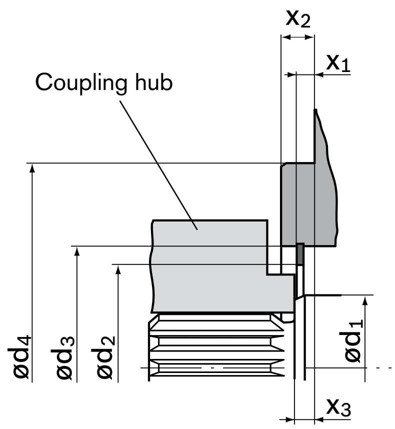
Installation dimensions for coupling assembly

Before finalizing your design, request a binding installation drawing. Dimensions in mm.

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

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

The outer diameter of the shoulder on coupling hub must be smaller than the inner diameter of the circlip **d_2** in the area near the drive shaft collar (dimension $x_2 - x_3$).



NG	Mounting flange	$ød_1$	$ød_{2\ min}$	$ød_3$	$ød_4$	x_1	x_2	x_3 (approx.)
45	127-2 (C)	45	50.5	73 ± 0.1	127	0.1	$12.7_{-0.5}$	8
65	127-2/4 (C)	45	58.5	81 ± 0.1	127	6.4	$12.7_{-0.5}$	8

Installation instructions

General

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

The case drain fluid in the pump housing must be directed to the reservoir via the highest available drain port (T_1, T_2).

For combinations of multiple units, make sure that the respective case pressure in each unit 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.

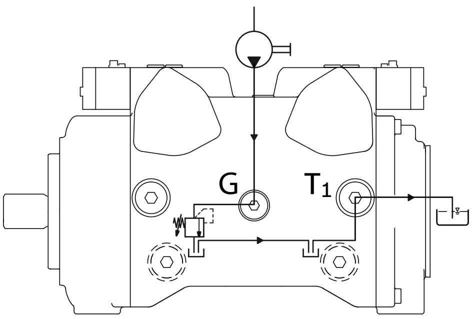
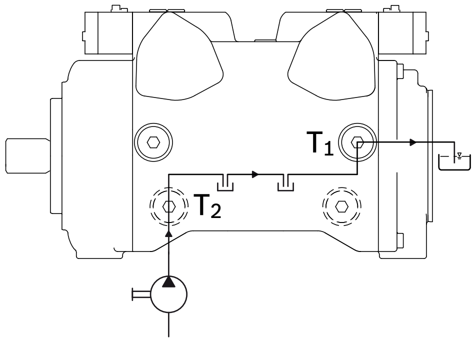
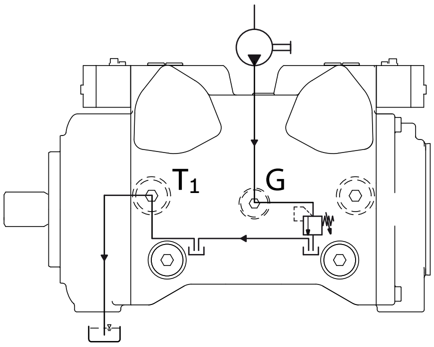
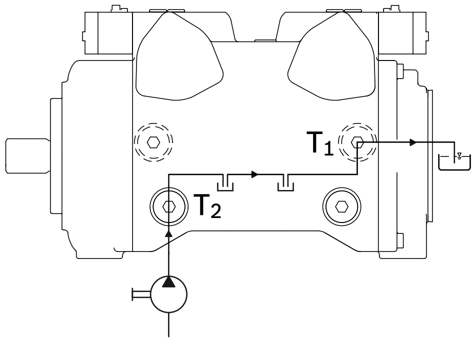
In all operating conditions, the drain line must flow into the reservoir below the minimum fluid level.

Connection of the drain line

Besides the actual case drain fluid, an additional cooling fluid flow is needed in the housing for lubricating and cooling the rotary group in the housing. To guarantee the flushing of both rotary groups, the connection specifications for the T-ports must be observed.

Internal flushing: If the integrated boost pressure valve is used, internal flushing is guaranteed.

External flushing: If the boost pressure is backed up with an external pressure-relief valve, external flushing of the pump housing via the T-ports will be necessary.

	Internal flushing	External flushing
Threaded ports A and B, on left side (viewed on drive shaft)		
Threaded ports A and B, on right side (viewed on drive shaft)		

Installation instructions

Installation position

See the following examples 1 to 8
Further installation positions are possible upon request.

Recommended installation position: 1

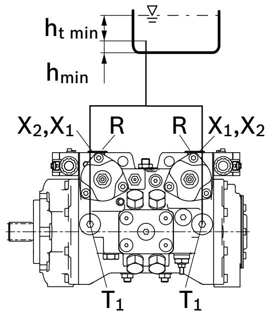
Notes

- If it is not possible to fill the stroking chambers via X_1 to 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 bled via the ports X_1, X_2 or X_3, X_4 depending on the installation position.
- 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.

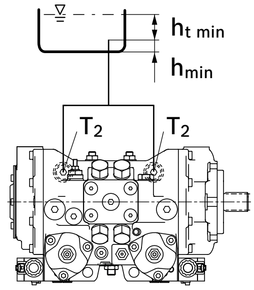
Below-reservoir installation (standard)

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

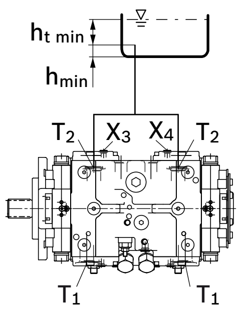
1



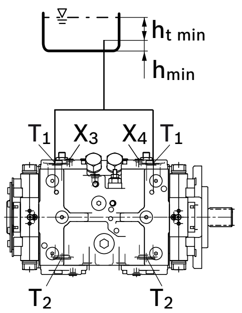
2



3



4



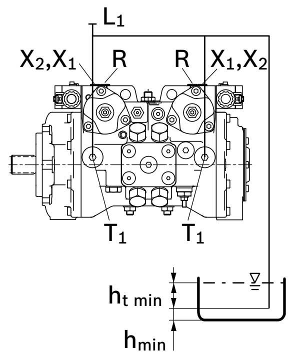
Installation position	Bleeding the case	Bleeding the stroking chamber	Filling
1	R	X_1, X_2	$T_1 + X_1 + X_2$
2	–	–	T_2
3	–	X_3, X_4	$T_2 + X_3 + X_4$
4	–	X_3, X_4	$T_1 + X_3 + X_4$

Note instructions!

Above-reservoir installation

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

5



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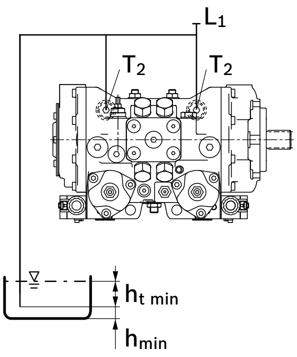

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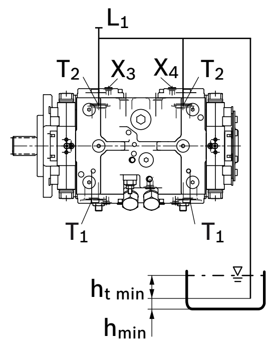

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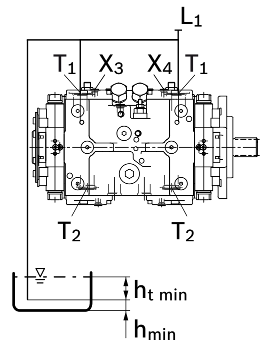

Installation position	Bleeding the case	Bleeding the stroking chamber	Filling
5	R	X_1, X_2	$L_1 + X_1 + X_2$
6	L_1 (T_2)	–	L_1 (T_2)
7	L_1 (T_2)	X_3, X_4	L_1 (T_2) + $X_3 + X_4$
8	L1 (T1)	X_3, X_4	L_1 (T_1) + $X_3 + X_4$

Note instructions!

L_1, L_2	Filling / air bleed
R	Air bleed port
T_1, T_2	Drain port
$h_{t\ min}$	Minimum required immersion depth (200 mm)
h_{min}	Minimum required spacing to reservoir bottom (100 mm)

General instructions

– The pump A24VG is designed to be used in closed circuit.

– The project planning, installation and commissioning of the axial piston unit requires the involvement of qualified personnel.

– Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, these can be requested from Bosch Rexroth.

– 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).

– Depending on the operating conditions of the axial piston unit (operating pressure, fluid temperature), the characteristic may shift.

– Service line 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 service line ports and function ports can only be used to accommodate hydraulic lines.

– The data and notes contained herein must be adhered to.

– The product is not approved as a component for the safety concept of a general machine according to ISO 13849.

– The following tightening torques apply:

  - Fittings:
    Observe the manufacturer's instruction regarding tightening torques for the used fittings.

  - Mounting bolts:
    For mounting bolts with metric ISO thread according to DIN 13 or with thread according to ASME B1.1, we recommend checking the tightening torque in individual cases in accordance with VDI 2230.

  - Female threads in the axial piston unit:
    The maximum permissible tightening torques $M_{G\,max}$ are maximum values of the female threads and must not be exceeded. For values, see the following table.

  - Threaded plugs:
    For the metallic threaded plugs supplied with the axial piston unit, the required tightening torques of threaded plugs M_V apply. For values, see the following table.

Ports Standard	Size of thread	Maximum permissible tightening torque of the female threads $M_{G\,max}$	Required tightening torque of the threaded plugs M_V	WAF hexagon socket of the threaded plugs
ISO 6149	M14 x 1.5	80 Nm	45 Nm	6 mm
	M18 x 1.5	140 Nm	70 Nm	8 mm
	M22 x 1.5	210 Nm	100 Nm	10 mm
	M27 x 2	330 Nm	170 Nm	12 mm

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