Axial piston variable pump A4VG Series 35

- High-pressure pump for applications in a closed circuit up to 530 bar
- Size 56 ... 90
- Nominal pressure 400 bar
- Maximum pressure 530 bar
- Closed circuit

Features
- High power density owing to a very high pressure level
- Integrated auxiliary pump for boost and pilot oil supply
- Flow direction changes when the swashplate is moved through the neutral position
- High-pressure relief valves with integrated boost function
- Boost-pressure relief valve
- Through drive for mounting additional pumps
- High total efficiency
- Swashplate design
- Compact design and high power density
- Especially suitable for use in electronified travel drives thanks to integrated sensors
- Supports the cross-linking of motor and machine control with the travel drive.

Contents

Type code

01	02	03	04	05	06		07	08	09	10	11	12		13	14	15	16	17	18	19	20		21
A4V	**G**			**0**	**P**	**/**	**35**			**N**			**–**							**0**	**0**	**–**	

Axial piston unit

01	Swashplate design, variable, nominal pressure 400 bar, maximum pressure 530 bar	**A4V**

Operating mode

02	Pump, closed circuit	**G**

Size (NG)

		056	071	090
03	Geometric displacement, see "Technical data" on page 7	●	●	●

Control device

			056	071	090	
04	Electric control, direct operated with two pressure reducing valves (DRE)	On-board voltage U = 12 V[1]	●	●	●	**ET1**
		On-board voltage U = 24 V[1]	●	●	●	**ET2**

Additional function

		056	071	090	
05	Without additional function	●	●	●	**0**

Connector for pressure reducing valve[2]

		056	071	090	
06	DEUTSCH molded connector, 2-pin, DT04-2P – without suppressor diode	●	●	●	**P**

Series

07	Series 3, index 5	**35**

Version of port and fastening threads

		056	071	090	
08	Metric ports according to ISO 6149 with O-ring seal, metric fastening thread according to DIN 13	●	●	●	**M**
	Ports according to ISO 11926 with O-ring seal (ANSI), metric fastening thread according to DIN 13 on the working port and on the through drive[3]	●	●	●	**D**

Direction of rotation

			056	071	090	
09	Viewed on drive shaft	Clockwise	●	●	●	**R**
		Counter-clockwise	●	●	●	**L**

Sealing material

		056	071	090	
10	NBR (nitrile rubber), shaft seal made of FKM (fluoroelastomer)	●	●	●	**N**

Mounting flange

			056	071	090	
11	SAE J744	127-2	●	–	–	**C2**
		127-2/4	–	●	●	**C6**

Drive shaft

				056	071	090	
12	Splined shaft ANSI B92.1a–1976	1 1/4 in	14T 12/24DP	●	●	○[4]	**S7**
		1 3/8 in	21T 16/32DP	●	●	–	**V8**
		1 3/4 in	13T 8/16DP	–	–	●	**T1**
	Splined shaft DIN 5480	W35×2×16×9g		●	●	●	**Z8**

Working port

			056	071	090	
13	Working port **A** and **B**, same side left	Suction port **S** bottom	●	●	●	**20**
	Working port **A** and **B**, same side right	Suction port **S** bottom	●	●	●	**21**

Boost pump

		056	071	090	
14	Without integrated boost pump	○	●	●	**U**
	Integrated boost pump	●	●	●	**G**

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

1) Valid for all electrically controlled valves
2) Connectors for other electric components may deviate.
3) Also applies to the version without through drive
4) Observe the maximum permissible input torque

01	02	03	04	05	06		07	08	09	10	11	12		13	14	15	16	17	18	19	20		21
A4V	**G**			**0**	**P**	**/**	**35**			**N**			**–**							**0**	**0**	**–**	

Through drive[5)]

							056	071	090	
15	Without through drive						●	●	●	**0000**
	Flange SAE J744			Hub for splined shaft[7)]						
	Diameter	Mounting[6)]	Code	Diameter		Code				
	82-2 (A)		A1	5/8 in	9T 16/32DP	S2	●	●	●	**A1S2**
			A2	5/8 in	9T 16/32DP	S2	●	●	●	**A2S2**
	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**
	127-2/4 (C)		C6	1 1/4 in	14T 12/24DP	S7	●	●	●	**C6S7**
			C9	1 1/4 in	14T 12/24DP	S7	●	●	●	**C9S7**

High-pressure relief valve

			056	071	090	
16	High-pressure relief valve, direct operated, fixed setting	Without bypass	●	●	●	**A**
		With bypass	●	●	●	**C**

Filtration boost circuit/external boost pressure supply

		056	071	090	
17	Filtration in the boost pump suction line	●	●	●	**S**
	Filtration in the boost pump pressure line Ports for external boost circuit filtration (**F_e** and **F_a**)	●	●	●	**D**
	External boost pressure supply (on version without integrated boost pump)	○	●	●	**E**

Pressure sensor

		056	071	090	
18	Without pressure sensor	●	●	●	**0**
	Pressure sensors at the measuring ports **M_A** and **M_B** (high pressure)[8)]	●	●	●	**4**

Other sensors 1

		056	071	090	
19	Without sensor	●	●	●	**0**

Other sensors 2

		056	071	090	
20	Without sensor	●	●	●	**0**

Standard/special version

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

● = Available ○ = On request – = Not available [shaded] = Preferred program

Notice

- Note the project planning notes on page 32!
- In addition to the type code, please specify the relevant technical data when placing your order.
- Please note that not all type code combinations are available although the individual functions are marked as being available.

5) Specifications for the version with integrated boost pump, please contact us for the version without boost pump
6) Mounting hole pattern viewed on through drive, control at top
7) Hub for splined shaft according to ANSI B92.1a-1976 (drive shaft allocation according to SAE J744)
8) Specify type code of pressure sensor acc. to data sheet PR4 (95156) separately and observe the requirements for the electronics

Hydraulic fluid

The axial piston unit is designed for operation with HLP mineral oil according to DIN 51524.
Application instructions and requirements for hydraulic fluid selection, behavior during operation as well as disposal and environmental protection should be taken from the following data sheets before the start of project planning:

- 90220: Hydraulic fluids based on mineral oils and related hydrocarbons
- 90221: Environmentally acceptable hydraulic fluids
- 90222: Fire-resistant, water-free hydraulic fluids (HFDR/HFDU)
- 90225: Limited technical data for operation with water-free and water-containing fire-resistant hydraulic fluids (HFDR, HFDU, HFAE, HFAS, HFB, HFC)

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

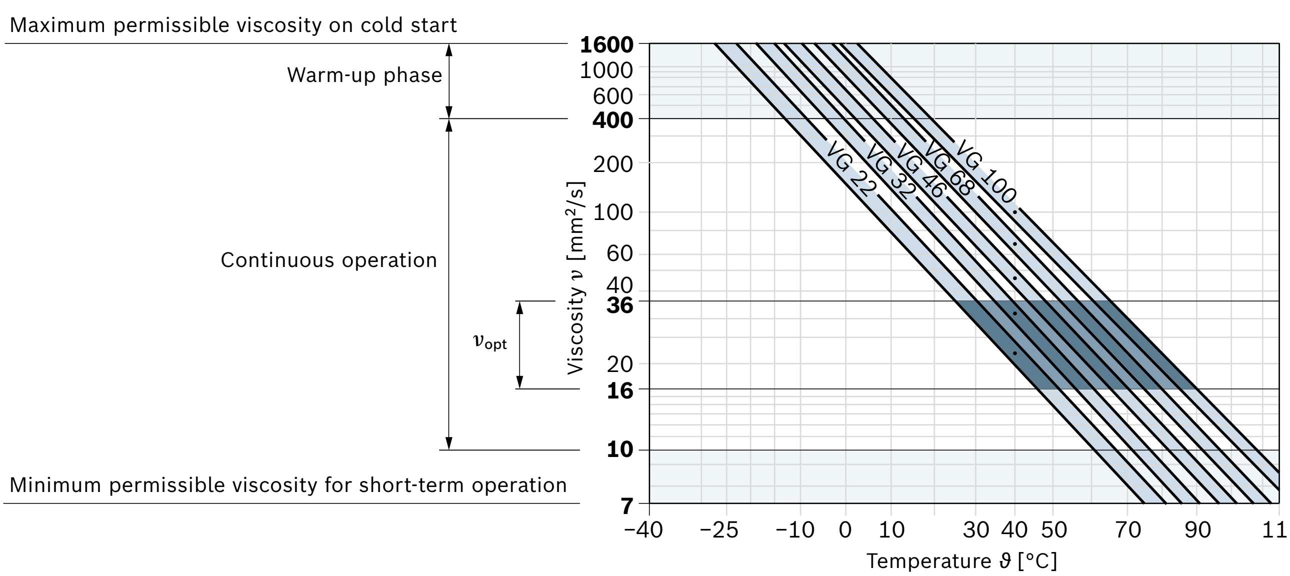
- 90245: Bosch Rexroth Fluid Rating List for Rexroth hydraulic components (pumps and motors)

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

Viscosity and temperature of hydraulic fluids

	Viscosity	Shaft seal	Temperature[3]	Comment
Cold start	$\nu_{max} \leq 1600$ mm²/s	NBR[2]	$\vartheta_{St} \geq -40$ °C	$t \leq 3$ min, without load ($p \leq 50$ bar), $n \leq 1000$ rpm Permissible temperature difference between axial piston unit and hydraulic fluid in the system maximum 25 K
		FKM	$\vartheta_{St} \geq -25$ °C	
Warm-up phase	ν = 1600 ... 400 mm²/s			$t \leq 15$ min, $p \leq 0.7 \times p_{nom}$ and $n \leq 0.5 \times n_{nom}$
Continuous operation	ν = 400 ... 10 mm²/s[1]	NBR[2]	$\vartheta \leq +85$ °C	Measured at port **T**
		FKM	$\vartheta \leq +110$ °C	
	ν_{opt} = 36 ... 16 mm²/s			Optimal operating viscosity and efficiency range
Short-term operation	ν_{min} = 10 ... 7 mm²/s	NBR[2]	$\vartheta \leq +85$ °C	$t \leq 3$ min, $p \leq 0.3 \times p_{nom}$, measured at port **T**
		FKM	$\vartheta \leq +110$ °C	

▼ **Selection diagram**



1) This corresponds, for example on the VG 46, to a temperature range of +4 °C ... +85 °C (see selection diagram)
2) Special version, please contact us
3) If the temperature at extreme operating parameters cannot be adhered to, please contact us.

Filtration of the hydraulic fluid

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

A cleanliness level of at least 20/18/15 is to be maintained according to ISO 4406.

At a hydraulic fluid viscosity of less than 10 mm²/s (e.g. due to high temperatures during short-term operation) at the drain port, a cleanliness level of at least 19/17/14 according to ISO 4406 is required.

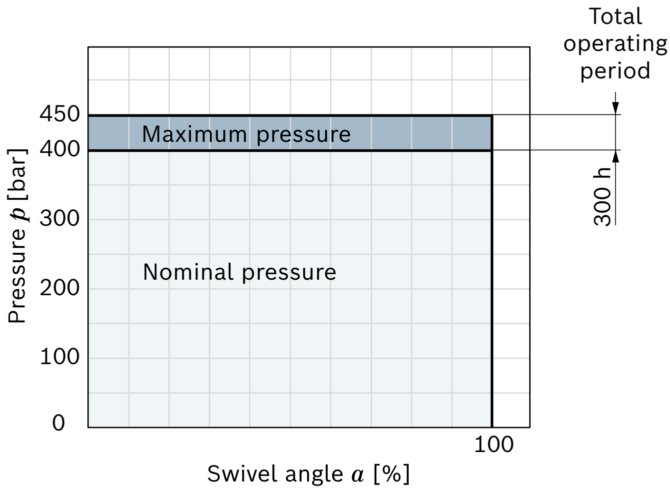
For example, the viscosity 10 mm²/s at:

- HLP 32 corresponds to a temperature of 73 °C
- HLP 46 corresponds to a temperature of 85 °C.

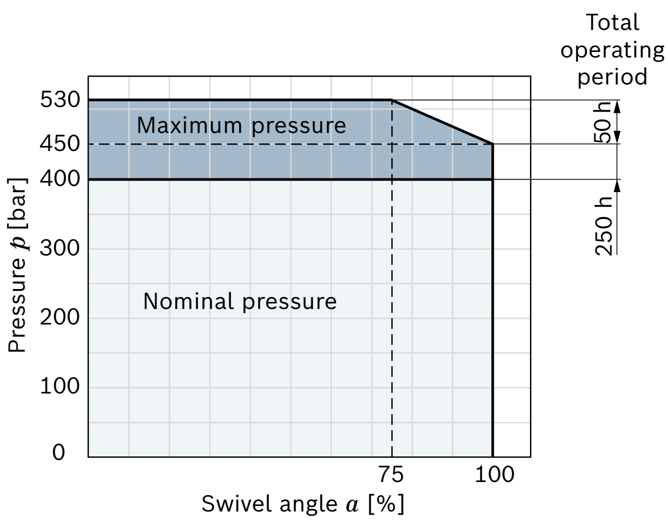
Working pressure range

Pressure at working port A or B		Definition
Nominal pressure p_{nom}	400 bar	The nominal pressure corresponds to the maximum design pressure.
Maximum pressure p_{max}	450 bar	The maximum pressure corresponds to the maximum working pressure within a single operating period. The sum of single operating periods must not exceed the total operating period. Within the total operating period of 300 h, a maximum pressure of 450 bar to 530 bar is permissible for a limited period of 50 h. With 530 bar, the axial piston unit may thereby only be swiveled out by a maximum of 75%, see characteristic curve "maximum pressure p_{max} up to 530 and total operating period" on page 6. Observe the information regarding "Project planning with a maximum pressure from 450 bar to 530 bar" on page 6.
Maximum single operating period	10 s	
Total operating period	300 h	
Swivel angle	100%	
Maximum pressure p_{max}	530 bar	
Maximum single operating period	10 s	
Total operating period	50 h	
Swivel angle	Maximum 75%	
Minimum pressure (low-pressure side)	10 bar above case pressure	Minimum pressure on the low-pressure side (**A** or **B**) required to prevent damage to the axial piston unit.
Rate of pressure change $R_{A\ max}$	9000 bar/s	Maximum permissible pressure build-up and reduction speed during a pressure change across the entire pressure range.
Boost pump		
Nominal pressure $p_{Sp\ nom}$	25 bar	
Maximum pressure $p_{Sp\ max}$	30 bar	
Pressure at suction port **S** (inlet)		
Continuous $p_{S\ min}$	≥0.8 bar absolute	$\nu \leq 30$ mm²/s
Short-term, at a cold start	≥0.5 bar absolute	$t < 3$ min
Maximum pressure $p_{S\ max}$	≤5 bar absolute	
Control pressure		
Required control pressure p_{St} at n = 2000 rpm	25 bar above case pressure	Required control pressure p_{St}, to ensure the function of the control. The required control pressure is dependent on the rotational speed and working pressure.
Case pressure at port T		
Maximum differential pressure $\Delta p_{T\ max}$	See the diagram	Permissible differential pressure at the shaft seal (housing to ambient pressure)
Pressure peaks $p_{T\ peak}$	10 bar	$t < 0.1$ s, maximum 1000 pressure peaks permissible

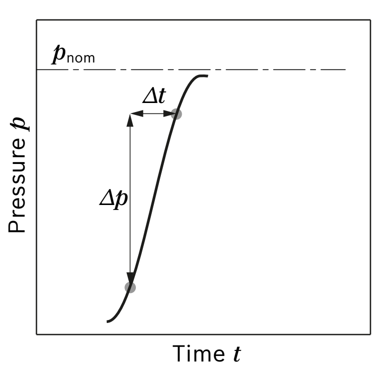
▼ **Maximum pressure p_{max} up to 450 bar and total operating period**



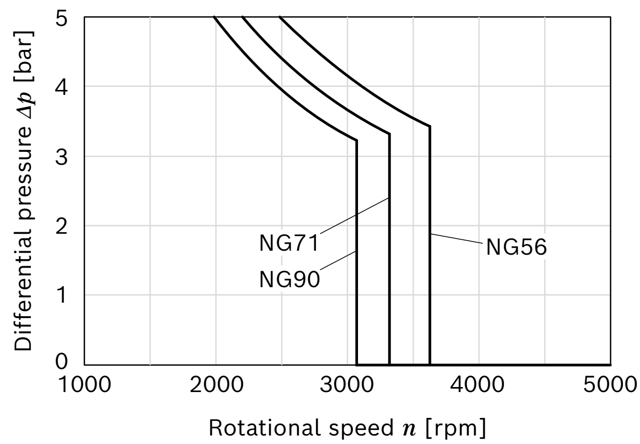
▼ **Maximum pressure p_{max} up to 530 bar and total operating period**



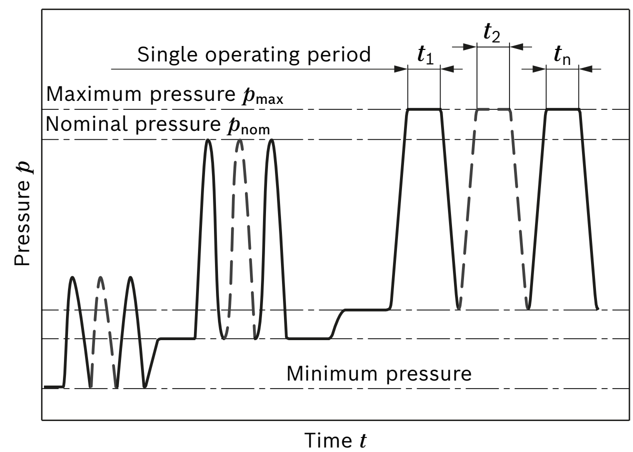
▼ **Rate of pressure change $R_{A\ max}$**



▼ **Maximum differential pressure at the shaft seal**



▼ **Pressure definition**



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

Notice

- Working pressure range applies when using hydraulic fluids based on mineral oils. Please contact us for values for other hydraulic fluids.
- In addition to the hydraulic fluid and the temperature, the service life of the shaft seal is influenced by the rotational speed of the axial piston unit and the case pressure.
- The service life of the shaft seal decreases with increasing frequency of pressure peaks and increasing mean differential pressure.
- The case pressure must be greater than the ambient pressure.
- Project planning with a maximum pressure from 450 bar to 530 bar must be realized via your competent contact partner at Bosch Rexroth.

Technical data

Size			**NG**		**56**	**71**	**90**
Geometric displacement, per revolution							
	Variable pump		$V_{g\,max}$	cm^3	56	71	90
	Boost pump (at p = 20 bar)		$V_{g\,Sp}$	cm^3	13.8	18.9	18.9
Rotational speed[1)]	Maximum at $V_{g\,max}$		$n_{nom\,S}$	rpm	3600	3300 [2)]	3050
	At $\Delta p \geq 40$ bar (t < 15 s)		$n_{max\,40}$	rpm	4050	On request	3500
	Minimum		n_{min}	rpm	500	500	500
Flow	At n_{nom} and $V_{g\,max}$		q_v	l/min	202	234	284
Power[3)]	At n_{nom}, $V_{g\,max}$ and Δp = 400 bar		P	kW	134	156	189
Torque[3)]	With $V_{g\,max}$ and	Δp = 400 bar	M	Nm	357	452	573
		Δp = 100 bar	M	Nm	89	113	143
Rotary stiffness of drive shaft		S7	c	kNm/rad	80.8	98.8	107.6
		V8	c	kNm/rad	95	120.9	–
		T1	c	kNm/rad	–	–	158.1
		Z8	c	kNm/rad	95.8	122.8	137
Moment of inertia of the rotary group			J_{TW}	kgm^2	0.0066	0.0097	0.0149
Maximum angular acceleration[4)]			α	rad/s^2	24000	21000	18000
Case volume			V	l	1.6	2.1	2.0
Weight (without through drive) approx.[5)]			m	kg	37	48	49

Notice

- Theoretical values, without efficiency and tolerances; values rounded
- Operation above the maximum values or below the minimum values may result in a loss of function, a reduced service life or in the destruction of the axial piston unit. Bosch Rexroth recommends testing the loads by means of experiment or calculation / simulation and comparison with the permissible values.

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

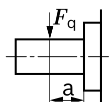
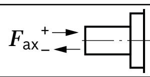
Key

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

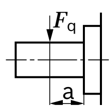
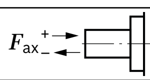
1) The values are applicable:
   - for the optimum viscosity range from ν_{opt} = 36 to 16 mm^2/s
   - for hydraulic fluid based on mineral oils (for HF hydraulic fluids, observe the technical data in 90225)
2) Valid for a suction pressure of 0.9 bar absolutelute With a suction pressure of 0.8 bar absolutelute, the maximum permissible rotational speed is 3200 rpm, for the version without integrated boost pump, the speed limitation below 3300 rpm does not apply.
3) Without boost pump
4) The data are valid for values between the minimum required and maximum permissible rotational speed.
   Valid for external excitation (e.g. diesel engine 2 to 8 times rotary frequency; cardan shaft twice the rotary frequency).
   The limit value is only valid for a single pump.
   The load capacity of the connection parts must be considered.
5) Weight may vary by equipment.

Permissible radial and axial loading of the drive shaft

▼ Splined shaft ANSI B92.1a

Size		**NG**		**56**	**56**	**71**	**71**	**90**	**90**
Drive shaft			in	1 1/4	1 3/8	1 1/4	1 3/8	1 1/4	1 3/4
Maximum radial force at distance a (to the shaft collar)		$F_{q\ max}$	N	4772	4338	6050	5500	7670	5478
		a	mm	24	24	24	24	24	33.5
Maximum axial force		$+ F_{ax\ max}$	N	2910	2910	4242	4242	4330	4330
		$- F_{ax\ max}$	N	1490	1490	2758	2758	2670	2670

▼ Splined shaft DIN 5480

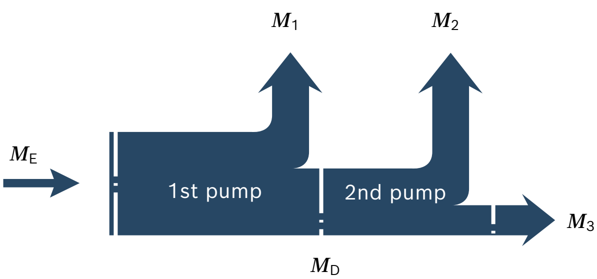
Size		**NG**		**56**	**71**	**90**
Drive shaft				W35	W35	W35
Maximum radial force at distance a (to the shaft collar)		$F_{q\ max}$	N	4329	5489	6957
		a	mm	20	20	20
Maximum axial force		$+ F_{ax\ max}$	N	2910	4242	4330
		$- F_{ax\ max}$	N	1490	2758	2670

Notice
- The axial and radial loading generally influence the bearing service life.
- Special requirements apply in the case of belt drive and cardan shaft. Please contact us.

Permissible input and through-drive torques

Size				NG		56	71	90
Torque at $V_{g\,max}$ and Δp = 400 bar[1]				M	Nm	357	452	573
Maximum input torque on drive shaft[2]								
	ANSI B92.1a–1976	**S7**	1 1/4 in	$M_{E\,max}$	Nm	602	602	602[3]
		V8	1 3/8 in	$M_{E\,max}$	Nm	970	970	–
		T1	1 3/4 in	$M_{E\,max}$	Nm	–	–	1640
	DIN 5480	**Z8**	W35	$M_{E\,max}$	Nm	912	912	912
Maximum through-drive torque				$M_{D\,max}$	Nm	521	660	822

▼ **Distribution of torques**

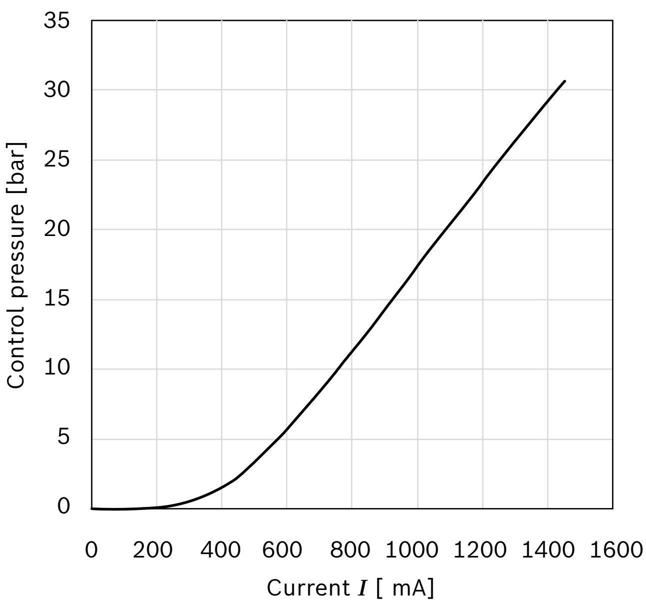


Torque at 1st pump	M_1		
Torque at 2nd pump	M_2		
Torque at 3rd pump	M_3		
Input torque	M_E	=	$M_1 + M_2 + M_3$
	M_E	<	$M_{E\,max}$
Through-drive torque	M_D	=	$M_2 + M_3$
	M_D	<	$M_{D\,max}$

1) Efficiency not considered
2) For drive shafts free of radial force
3) Observe the maximum permissible input torque

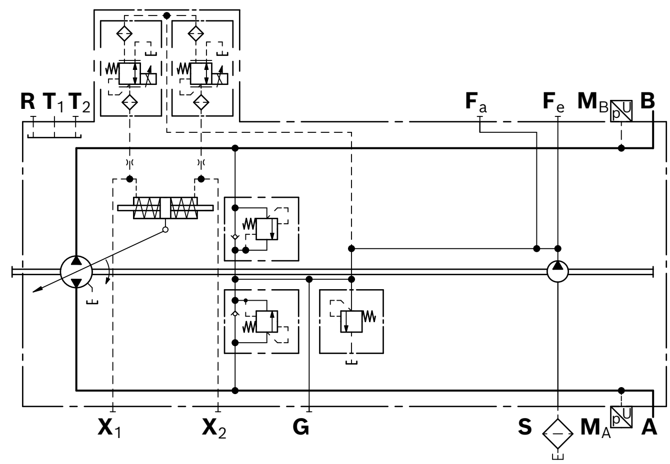
ET – Electric control, direct operated

The output flow of the pump is infinitely variable in the range between 0 and 100%. Depending on the preselected current I at solenoids **a** and **b** of the pressure reducing valves, the stroking cylinder of the pump is proportionally supplied with control pressure. The two control pressures $\mathbf{X_1}$ and $\mathbf{X_2}$ can be controlled independently. The pump displacement that arises at a certain control current is dependent on the rotational speed and working pressure of the pump. A different flow direction is associated with each pressure reducing valve.
Maximum permissible control pressure: 30 bar.

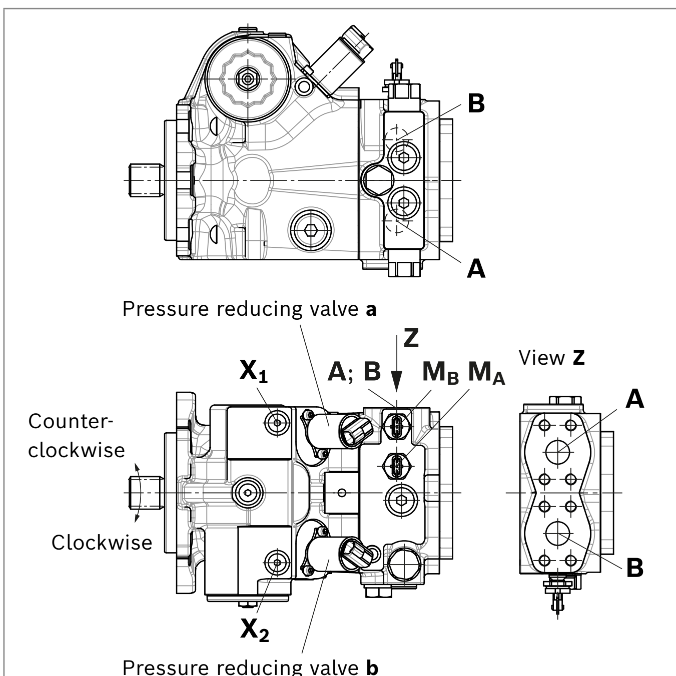


Technical data, pressure reducing valve[1]	**ET1**	**ET2**
On-board voltage in the vehicle	12 V	24 V
Permissible voltage U	9.6 to 28.8 V	
Current limit	1.45 A	
Nominal resistance (at 20 °C)	4.05 Ω	
Dither		
Frequency	100 Hz	
Minimum oscillation range[2]	250 mA	
Duty cycle	100%	
Type of protection: see connector version page 27		

▼ **Circuit diagram**



Correlation of direction of rotation, control and flow direction				
Direction of rotation	Clockwise		Counter-clockwise	
Actuation of pressure reducing valve	**a**	**b**	**a**	**b**
Control pressure	$\mathbf{X_1}$	$\mathbf{X_2}$	$\mathbf{X_1}$	$\mathbf{X_2}$
Flow direction	**A** to **B**	**B** to **A**	**B** to **A**	**A** to **B**
Working pressure	$\mathbf{M_B}$	$\mathbf{M_A}$	$\mathbf{M_A}$	$\mathbf{M_B}$



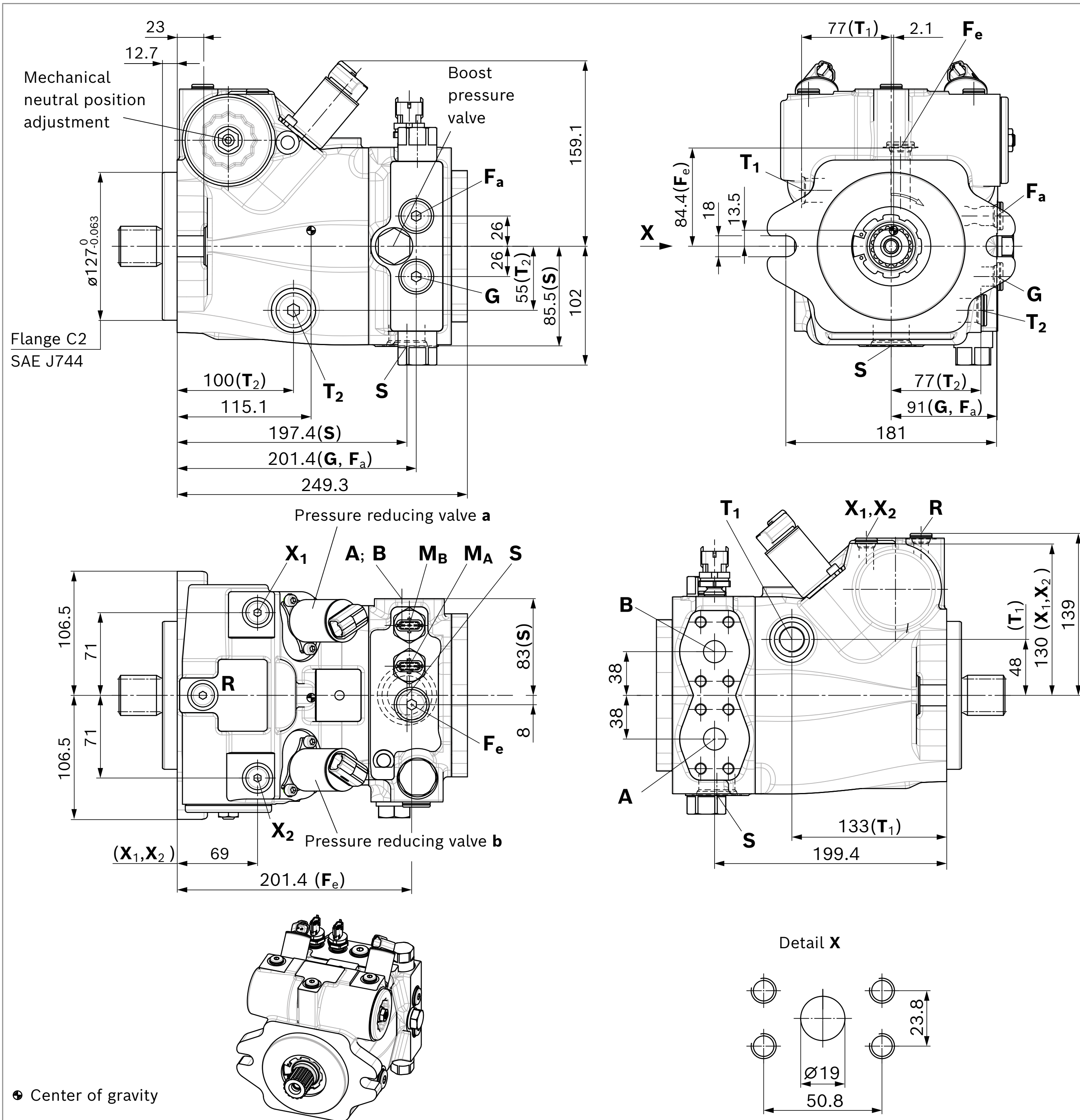
1) For further information on the pressure reducing valve, see data sheet 64659.
Notice: The leakage flow and the control flow differ from the parameter in data sheet 64659.

2) Minimum required oscillation range of the control current ΔIp-p (peak to peak) within the respective control range (start of control to end of control)

Dimensions, size 56

ET – Electric control, direct operated

Standard: Working port **A** and **B**, same side left, suction port **S** bottom (20)

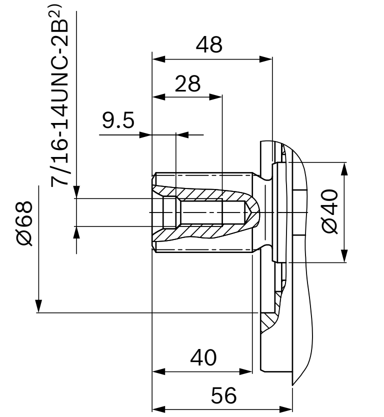


Notice

Option: Working port **A** and **B,** same side right, suction port **S** bottom (21), installation drawing on request

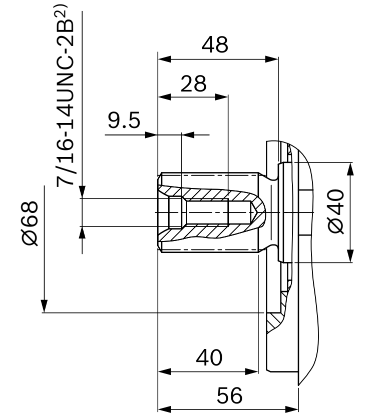
▼ **Splined shaft ANSI B92.1a**

S7 – 1 1/4 in 14T 12/24DP[1)]



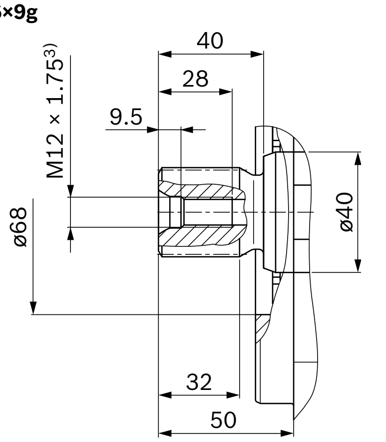
▼ **Splined shaft ANSI B92.1a**

V8 – 1 3/8 in 21T 16/32DP[1)]



▼ **Splined shaft DIN 5480**

Z8 – W35×2×16×9g



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

Ports version "M", metric		Standard	Size	p_{max} [bar][4]	State[10]
A, B	Working port Fastening thread	ISO 6162-2[5] DIN 13	P19M M10 × 1.5; 17 deep	530	O
S	Suction port	ISO 6149	M33 × 2; 22 deep	5	O[6]
T_1	Drain port	ISO 6149	M22 × 1.5; 15.5 deep	3	O[7]
T_2	Drain port	ISO 6149	M22 × 1.5; 15.5 deep	3	X[7]
R	Air bleed port	ISO 6149	M14 × 1.5; 11.5 deep	3	X
X_1, X_2	Control pressure port	ISO 6149	M14 × 1.5; 11.5 deep	30	X
G	Boost pressure port inlet	ISO 6149	M18 × 1.5; 14.5 deep	30	X
M_A, M_B	Measuring port pressure A, B	ISO 6149	M14 × 1.5; 11.5 deep	530	X[8]
F_a	Boost pressure port inlet	ISO 6149	M18 × 1.5; 14.5 deep	30	X[9]
F_e	Boost pressure port outlet	ISO 6149	M18 × 1.5; 14.5 deep	30	X[9]

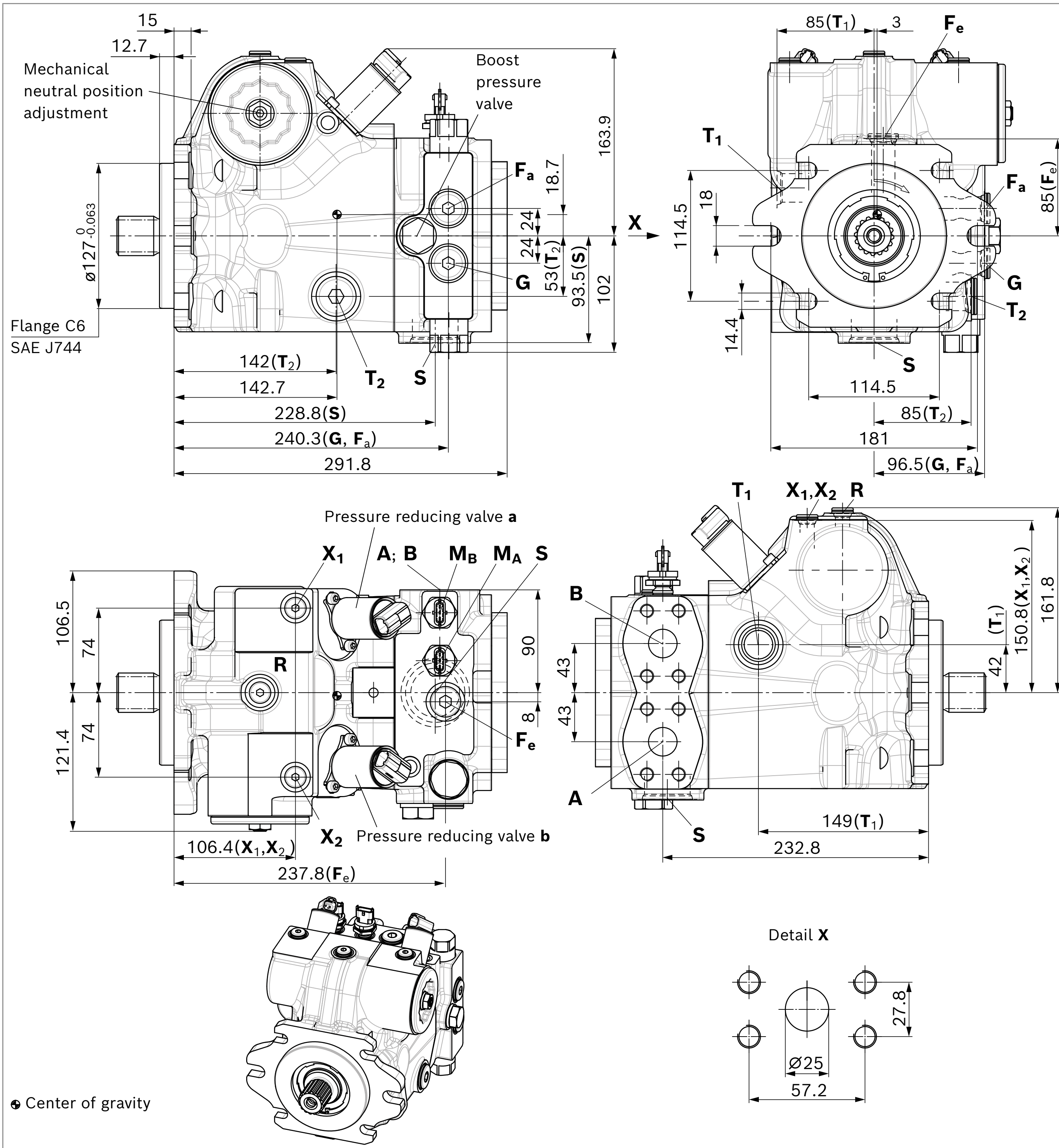
Ports version "D", ANSI, metric fastening thread		Standard	Size	p_{max} [bar][4]	State[10]
A, B	Working port Fastening thread	ISO 6162-2[5] DIN 13	P19M M10 × 1.5; 17 deep	530	O
S	Suction port	ISO 11926	1 5/16 -12 UN-2B; 20 deep	5	O[6]
T_1	Drain port	ISO 11926	7/8 -14 UNF-2B; 17 deep	3	O[7]
T_2	Drain port	ISO 11926	7/8 -14 UNF-2B; 17 deep	3	X[7]
R	Air bleed port	ISO 11926	9/16 -18 UNF-2B; 13 deep	3	X
X_1, X_2	Control pressure port	ISO 11926	9/16 -18 UNF-2B; 13 deep	30	X
G	Boost pressure port inlet	ISO 11926	3/4 -16 UNF-2B; 15 deep	30	X
M_A, M_B	Measuring port pressure A, B	ISO 6149	M14 x 1.5; 11.5 deep	530	X[8]
F_a	Boost pressure port inlet	ISO 11926	3/4 -16 UNF-2B; 15 deep	30	X[9]
F_e	Boost pressure port outlet	ISO 11926	3/4 -16 UNF-2B; 15 deep	30	X[9]

4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
5) Only dimensions according to ISO 6162-2, diameter in detail X is a deviation from the standard.
6) Plugged for external boost pressure supply.
7) Depending on installation position, **T_1** or **T_2** must be connected (see also installation instructions on page 29).
8) Pressure sensor mounted or **M_A**, **M_B** plugged.
9) Must be connected for filtration in the pressure line.
10) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions, size 71

ET – Electric control, direct operated

Standard: Working port **A** and **B**, same side left, suction port **S** bottom (20)

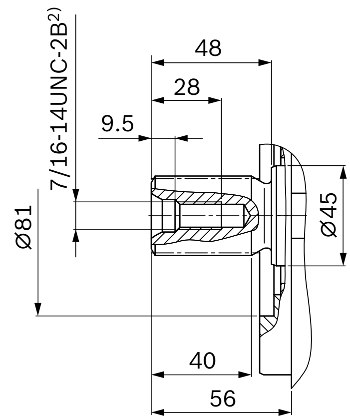


Notice

Option: Working port **A** and **B,** same side right, suction port **S** bottom (21), installation drawing on request

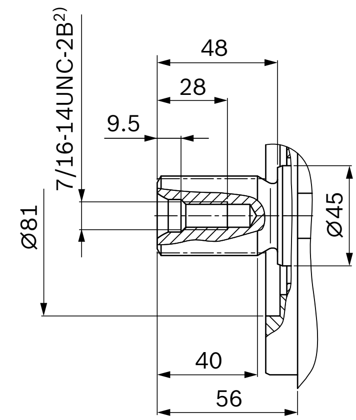
▼ Splined shaft ANSI B92.1a

S7 – 1 1/4 in 14T 12/24DP[1)]



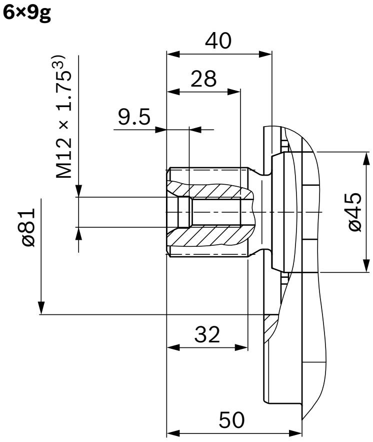
▼ Splined shaft ANSI B92.1a

V8 – 1 3/8 in 21T 16/32DP[1)]



▼ Splined shaft DIN 5480

Z8 – W35×2×16×9g



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

Ports version "M", metric		Standard	Size	p_{max} [bar][4]	State[10]
A, B	Working port Fastening thread	ISO 6162-2[5] DIN 13	P25M M12 × 1.75; 23 deep	530	O
S	Suction port	ISO 6149	M42 × 2; 20 deep	5	O[6]
$\mathbf{T_1}$	Drain port	ISO 6149	M27 × 2; 19 deep	3	O[7]
$\mathbf{T_2}$	Drain port	ISO 6149	M27 × 2; 19 deep	3	X[7]
R	Air bleed port	ISO 6149	M14 × 1.5; 11.5 deep	3	X
$\mathbf{X_1}$, $\mathbf{X_2}$	Control pressure port	ISO 6149	M14 × 1.5; 11.5 deep	30	X
G	Boost pressure port inlet	ISO 6149	M22 × 1.5; 15.5 deep	30	X
$\mathbf{M_A}$, $\mathbf{M_B}$	Measuring port pressure A, B	ISO 6149	M14 × 1.5; 11.5 deep	530	X[8]
$\mathbf{F_a}$	Boost pressure port inlet	ISO 6149	M22 × 1.5; 15.5 deep	30	X[9]
$\mathbf{F_e}$	Boost pressure port outlet	ISO 6149	M22 × 1.5; 15.5 deep	30	X[9]

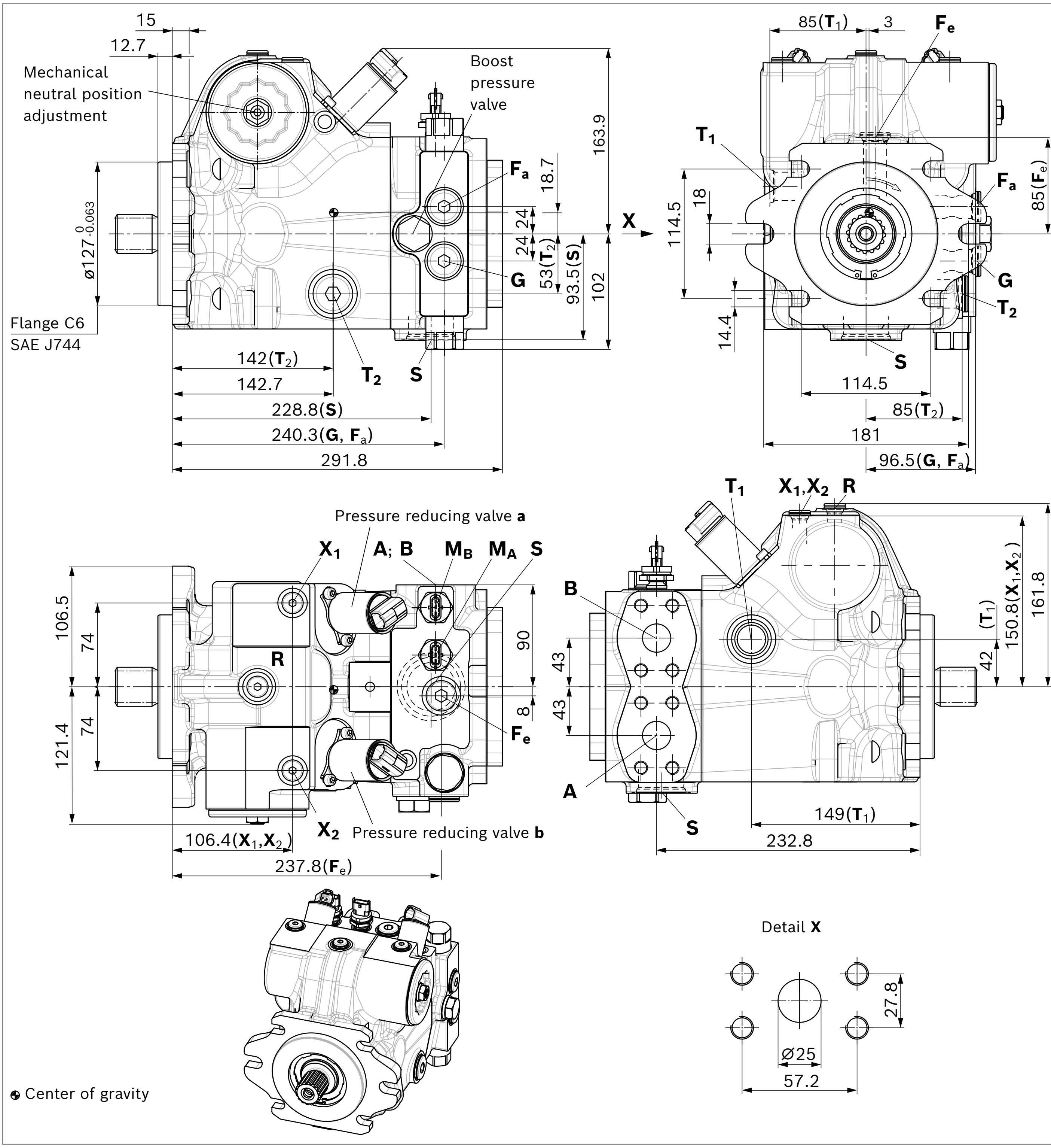
Ports version "D", ANSI, metric fastening thread		Standard	Size	p_{max} [bar][4]	State[10]
A, B	Working port Fastening thread	ISO 6162-2[5] DIN 13	P25M M12 x 1.75; 23 deep	530	O
S	Suction port	ISO 11926	1 5/8 -12 UN-2B; 20 deep	5	O[6]
$\mathbf{T_1}$	Drain port	ISO 11926	1 1/16 -12 UN-2B; 20 deep	3	O[7]
$\mathbf{T_2}$	Drain port	ISO 11926	1 1/16 -12 UN-2B; 20 deep	3	X[7]
R	Air bleed port	ISO 11926	9/16 -18 UNF-2B; 13 deep	3	X
$\mathbf{X_1}$, $\mathbf{X_2}$	Control pressure port	ISO 11926	9/16 -18 UNF-2B; 13 deep	30	X
G	Boost pressure port inlet	ISO 11926	7/8 -14 UNF-2B; 17 deep	30	X
$\mathbf{M_A}$, $\mathbf{M_B}$	Measuring port pressure A, B	ISO 6149	M14 x 1.5; 11.5 deep	530	X[8]
$\mathbf{F_a}$	Boost pressure port inlet	ISO 11926	7/8 -14 UNF-2B; 17 deep	30	X[9]
$\mathbf{F_e}$	Boost pressure port outlet	ISO 11926	7/8 -14 UNF-2B; 17 deep	30	X[9]

4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
5) Only dimensions according to ISO 6162-2, diameter in detail X is a deviation from the standard.
6) Plugged for external boost pressure supply.
7) Depending on installation position, $\mathbf{T_1}$ or $\mathbf{T_2}$ must be connected (see also installation instructions on page 29).
8) Pressure sensor mounted or $\mathbf{M_A}$, $\mathbf{M_B}$ plugged.
9) Must be connected for filtration in the pressure line.
10) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions, size 90

ET – Electric control, direct operated

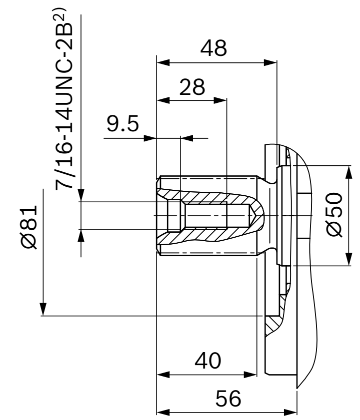
Standard: Working port **A** and **B**, same side left, suction port **S** bottom (20)



> **Notice**
> Option: Working port **A** and **B,** same side right, suction port **S** bottom (21), installation drawing on request

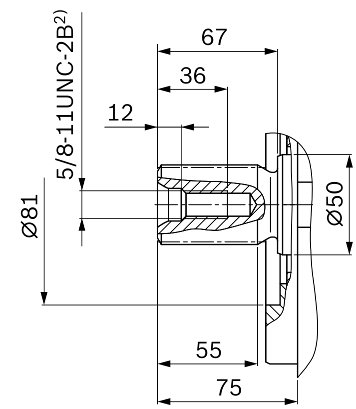
▼ **Splined shaft ANSI B92.1a**

S7 – 1 1/4 in 14T 12/24DP[1)]



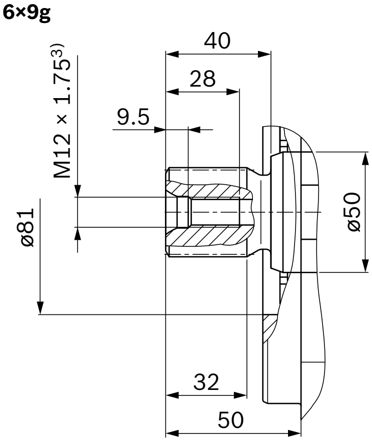
▼ **Splined shaft ANSI B92.1a**

T1 – 1 3/4 in 13T 8/16DP[1)]



▼ **Splined shaft DIN 5480**

Z8 – W35×2×16×9g



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

Ports version "M", metric		Standard	Size	p_{max} [bar][4]	State[10]
A, B	Working port Fastening thread	ISO 6162-2[5] DIN 13	P25M M12 × 1.75; 23 deep	530	O
S	Suction port	ISO 6149	M42 × 2; 20 deep	5	O[6]
$\mathbf{T}_1$	Drain port	ISO 6149	M27 × 2; 19 deep	3	O[7]
$\mathbf{T}_2$	Drain port	ISO 6149	M27 × 2; 19 deep	3	X[7]
R	Air bleed port	ISO 6149	M14 × 1.5; 11.5 deep	3	X
$\mathbf{X}_1$, $\mathbf{X}_2$	Control pressure port	ISO 6149	M14 × 1.5; 11.5 deep	30	X
G	Boost pressure port inlet	ISO 6149	M22 × 1.5; 15.5 deep	30	X
$\mathbf{M}_A$, $\mathbf{M}_B$	Measuring port pressure A, B	ISO 6149	M14 × 1.5; 11.5 deep	530	X[8]
$\mathbf{F}_a$	Boost pressure port inlet	ISO 6149	M22 × 1.5; 15.5 deep	30	X[9]
$\mathbf{F}_e$	Boost pressure port outlet	ISO 6149	M22 × 1.5; 15.5 deep	30	X[9]

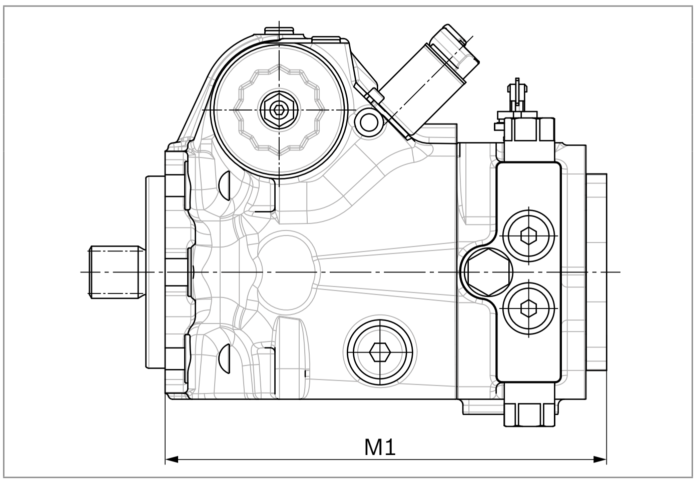
Ports version "D", ANSI, metric fastening thread		Standard	Size	p_{max} [bar][4]	State[10]
A, B	Working port Fastening thread	ISO 6162-2[5] DIN 13	P25M M12 x 1.75; 23 deep	530	O
S	Suction port	ISO 11926	1 5/8 -12 UN-2B; 20 deep	5	O[6]
$\mathbf{T}_1$	Drain port	ISO 11926	1 1/16 -12 UN-2B; 20 deep	3	O[7]
$\mathbf{T}_2$	Drain port	ISO 11926	1 1/16 -12 UN-2B; 20 deep	3	X[7]
R	Air bleed port	ISO 11926	9/16 -18 UNF-2B; 13 deep	3	X
$\mathbf{X}_1$, $\mathbf{X}_2$	Control pressure port	ISO 11926	9/16 -18 UNF-2B; 13 deep	30	X
G	Boost pressure port inlet	ISO 11926	7/8 -14 UNF-2B; 17 deep	30	X
$\mathbf{M}_A$, $\mathbf{M}_B$	Measuring port pressure A, B	ISO 6149	M14 x 1.5; 11.5 deep	530	X[8]
$\mathbf{F}_a$	Boost pressure port inlet	ISO 11926	7/8 -14 UNF-2B; 17 deep	30	X[9]
$\mathbf{F}_e$	Boost pressure port outlet	ISO 11926	7/8 -14 UNF-2B; 17 deep	30	X[9]

4) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
5) Only dimensions according to ISO 6162-2, diameter in detail X is a deviation from the standard.
6) Plugged for external boost pressure supply.
7) Depending on installation position, $\mathbf{T}_1$ or $\mathbf{T}_2$ must be connected (see also installation instructions on page 29).
8) Pressure sensor mounted or $\mathbf{M}_A$, $\mathbf{M}_B$ plugged.
9) Must be connected for filtration in the pressure line.
10) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions, through drive

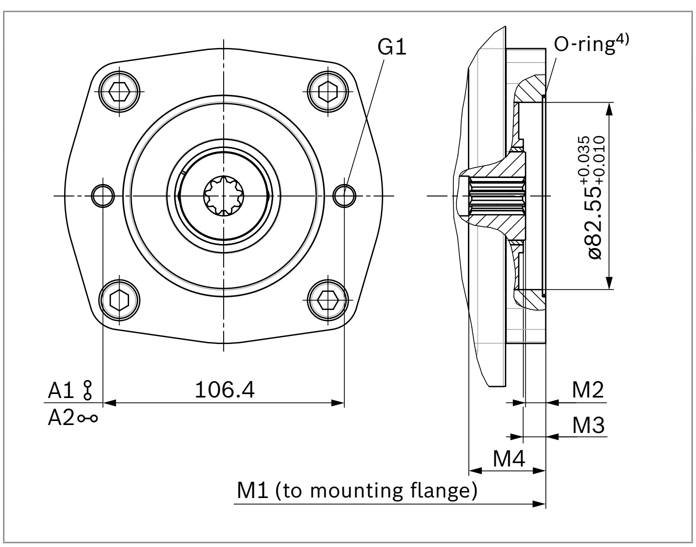
Flange SAE J744[1]			Hub for splined shaft[2]						
Diameter	**Mounting[3]**	**Code**	**Diameter**		**Code**	**56**	**71**	**90**	
Without through drive						●	●	●	**0000**
82-2 (A)	8	A1	5/8 in	9T 16/32DP	S2	●	●	●	**A1S2**
	∞	A2	5/8 in	9T 16/32DP	S2	●	●	●	**A2S2**

▼ **Without through drive**



NG	M1
56	249.3
71	291.8
90	291.8

▼ **82-2 (A)**

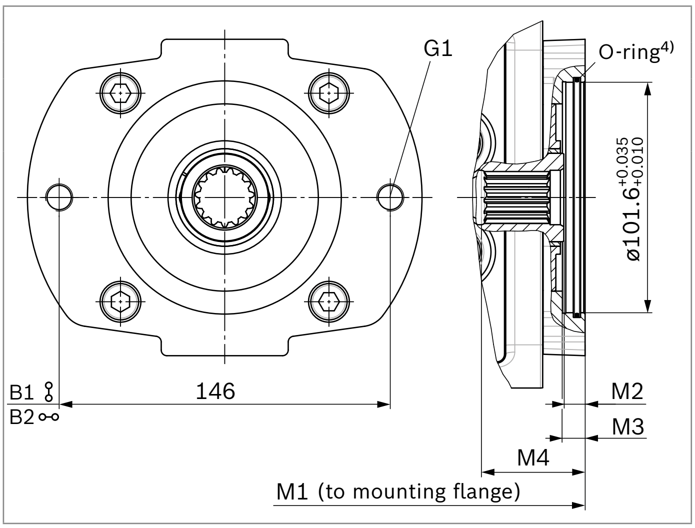


NG	M1	M2[5]	M3	M4	G1[6]
56	253.3	min. 8.8	11.9	44	M10 x 1.5; 13 deep
71	295.8	min. 8.8	9.9	45	
90	295.8	min. 8.8	9.9	33.9	

1) The through-drive flange is only supplied with a metric fastening thread.
2) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
3) Mounting holes pattern viewed on through drive with control at top
4) O-ring included in the scope of delivery
5) According to SAE J744
6) Thread according to DIN 13

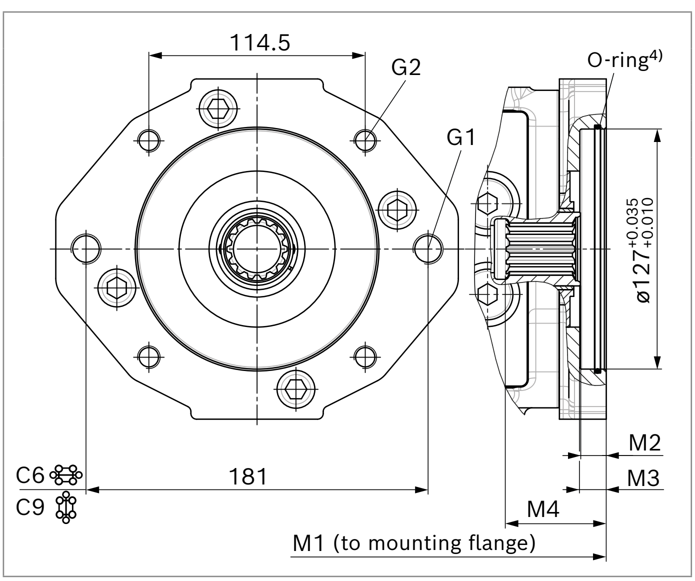
Flange SAE J744[1)]			Hub for splined shaft[2)]						
Diameter	**Mounting[3)]**	**Code**	**Diameter**		**Code**	**56**	**71**	**90**	
101-2 (B)		B1	7/8 in	13T 16/32DP	S4	●	●	●	**B1S4**
		B1	1 in	15T 16/32DP	S5	●	●	●	**B1S5**
		B2	7/8 in	13T 16/32DP	S4	●	●	●	**B2S4**
		B2	1 in	15T 16/32DP	S5	●	●	●	**B2S5**
127-2/4 (C)		C6	1 1/4 in	14T 12/24DP	S7	●	●	●	**C6S7**
		C9	1 1/4 in	14T 12/24DP	S7	●	●	●	**C9S7**

▼ **101-2 (B)**



NG	M1	M2[5)]	M3	M4	G1[6)]
56	254.3	min. 8.8	10	40	M12 x 1.75; 18.5 deep
71	296.8	min. 8.8	10	40	
90	296.8	min. 8.8	10	45.5	

▼ **127-2/4 (C)**



NG	M1	M2[5)]	M3	M4	G1[6)] 2-hole	G2[6)] 4-hole
56	260.6	min. 8.8	14	52	M16 x 2; 24.8 deep	M12 x 1.75; 19 deep
71	303.1	min. 8.8	14	56		
90	303.1	min. 8.8	14	52		

1) The through-drive flange is only supplied with a metric fastening thread.
2) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5
3) Mounting holes pattern viewed on through drive with control at top
4) O-ring included in the scope of delivery
5) According to SAE J744
6) Thread according to DIN 13

Overview of mounting options

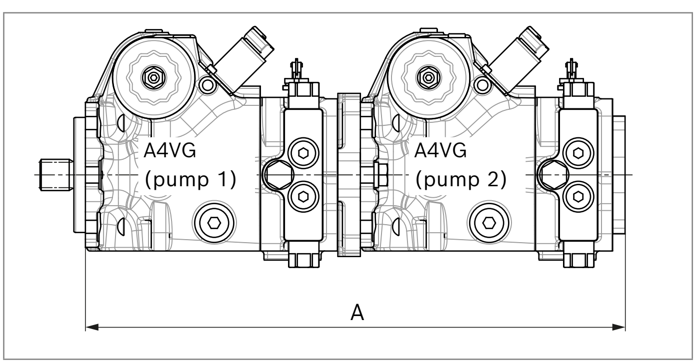
Through drive[1]			Mounting option – 2nd pump							
Flange	**Hub for splined shaft**	**Code**	**A4VG/35 NG (shaft)**	**A4VG/32 NG (shaft)**	**A10VG/10 NG (shaft)**	**A10VO/3x NG (shaft)**	**A10V(S)O/5x NG (shaft)**	**A11VO/1 NG (shaft)**	**A1VO/10 NG (shaft)**	**External gear pump[2]**
82-2 (A)	5/8 in	**A_S2**	–	–	–	–	–	–	–	AZPF, AZPS NG4 ... 28 AZPW NG5 ... 22
101-2 (B)	7/8 in	**B_S4**	–	–	18 (S)	28 (S) 45 (U)	28 (S) 45 (U)	–	35 (S4)	AZPN-11 NG20 ... 25 AZPG-22 NG28 ... 100
	1 in	**B_S5**	–	28 (U)	28, 45 (S)	45 (S)	45 (S) 60, 63, 72 (U)	40 (S)	35 (S5)	–
127-2 (C)	1 1/4 in	**C6S7**	56, 71, 90 (S7)	40, 56, 71 (S)	63 (S)	71, 88 (S) 100 (U)	85, 100 (U)	–	–	–
127-4 (C)	1 1/4 in	**C6S7**	71, 90 (S7)	–	–	71 (S)	60, 63, 72 (S) 85, 100 (U)	60 (S)	–	–

Notice
The mounting options listed only apply for drive shaft versions with undercut. Please contact us for drive shafts without undercut.

Combination pumps A4VG + A4VG

Total length A

A4VG	A4VG 2nd pump[3]		
1st pump	**NG056**	**NG071**	**NG090**
NG056	509.9	–	–
NG071	552.4	594.9	–
NG090	552.4	594.9	594.9



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 pumps must be linked by a "**+**".

Order example:
A4VG090ET20P/35MRNC6T1-20GC6S7AS400-0 +
A4VG071ET20P/35MRNC6S720G0000AS400-0
A tandem pump consisting of two equal sizes is permissible without additional supports where the dynamic acceleration does not exceed maximum 10 g (= 98.1 m/s2).
From size 71, the 4-hole mounting flange must be used for mounting the 1st pump.
For combination pumps consisting of more than two pumps, the mounting flange must be rated for the permissible moment of inertia, please contact us.

Notice
- The combination pump type code is shown in shortened form in the order confirmation.
- The permissible through-drive torques are to be observed (see page 9).

1) Availability of the individual sizes, see type code on page 3.
2) Bosch Rexroth recommends special versions of the gear pumps. Please contact us.
3) 2nd pump without through drive

High-pressure relief valves

The two high-pressure relief valves protect the hydrostatic gear (pump and motor) from overloading. 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 peaks or high rates of pressure change.

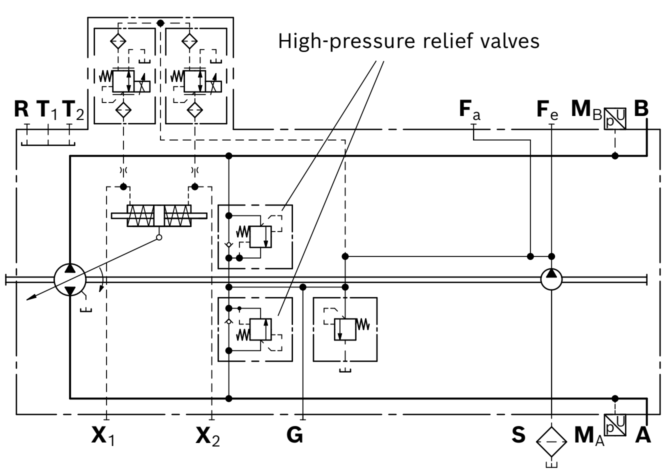
Setting ranges

High-pressure relief valve, direct operated	Differential pressure setting Δp_{HD}
Setting	400 bar
	440 bar
	470 bar
	500 bar

Settings on high-pressure relief valve A and B	
Differential pressure setting	Δp_{HD} = ... bar
Cracking pressure of the HD valve (at q_{V1}): ($p_{max} = \Delta p_{HD} + p_{Sp}$)	p_{max} = ... bar

The valve settings are set to be size-independent at a theoretical displacement of approx. 70 l/min at $V_{g\ max}$ ($q_{v\ 1}$). There may be deviations in the cracking pressures with other operating parameters.

▼ **Circuit diagram**

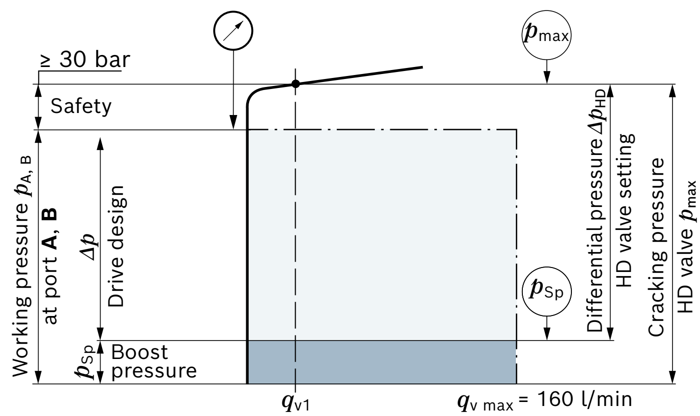


Example: Δp drive design = 470 bar ($p_{A,\ B} - p_{Sp}$)

Working pressure $p_{A,B}$	–	Boost pressure p_{Sp}	+	Safety	=	Differential pressure Δp_{HD}
495 bar	–	25 bar	+	30 bar	=	**500 bar**

▶ Cracking pressure of the HD valve (at q_{V1}):
p_{max} = 525 bar ($p_{max} = \Delta p_{HD} + p_{Sp}$)

▼ **Setting diagram**



Key	
HD valve	High-pressure relief valve
Cracking pressure HD valve p_{max}	When the set pressure value is reached, the HD valve opens and thus protects the hydrostatic gear (pump and motor) from overloading
Differential pressure HD valve Δp_{HD}	Cracking pressure HD valve (absolute) minus the boost pressure setting
Working pressure $p_{A,\ B}$	The total design of the customer machine is based on this pressure value. It comprises the boost pressure setting and the Δp drive design.
Δp Drive design	Differential pressure value determining the available torque at the hydraulic motor ($p_{A,\ B} - p_{Sp}$).
Boost pressure p_{Sp}	Boost pressure setting of the low-pressure valve
Safety	Required distance between working pressure (and/or pressure cut-off) and cracking pressure of the high-pressure relief valve to ensure the intended function of the high-pressure relief valve.

Notice
Upon response of the high-pressure relief valve, the permissible temperature and viscosity must be complied with.

Option: Bypass function

A connection between the two high-pressure passages **A** and **B** can be established using the bypass function (e.g. for machine towing).

- **Towing speed**
  The maximum towing speed depends on the gear ratio in the vehicle and must be calculated by the vehicle manufacturer. The corresponding flow of q_v = 30 l/min may not be exceeded.
- **Towing distance**
  Only tow the vehicle out of the immediate danger zone.

For further information on the bypass function, see the instruction manual.

Notice

The bypass function is not illustrated in the circuit diagrams.

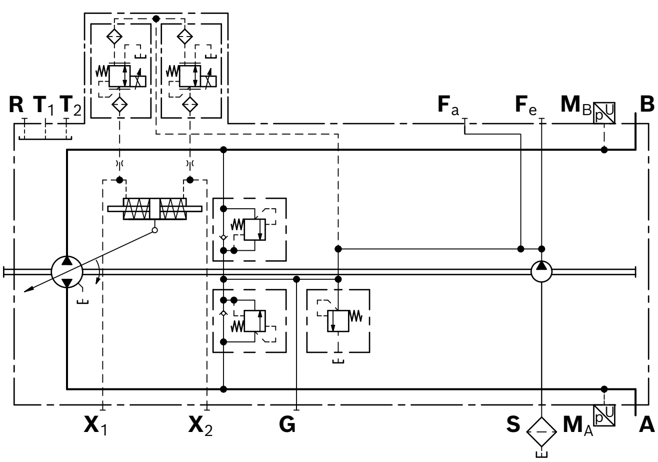
Filtration in the boost pump suction line

Version S

Filter version	Suction filter
Recommendation	With contamination indicator, with cold start valve
Recommended flow resistance at filter element	
At ν = 30 mm²/s, $n = n_{max}$	Δp = 0.1 bar
At ν = 1000 mm²/s, $n = n_{max}$	Δp = 0.3 bar
Pressure at suction port S	
Continuous $p_{S\ min}$ (ν ≤ 30 mm²/s)	≥ 0.8 bar absolute
Short-term, at a cold start (t < 3 min)	≥ 0.5 bar absolute
Maximum pressure $p_{S\ max}$	≤ 5 bar absolute

Use of version S is preferred.
The suction filter is not included in the scope of delivery.

▼ **Circuit diagram**



Filtration in the boost pump pressure line

Version D

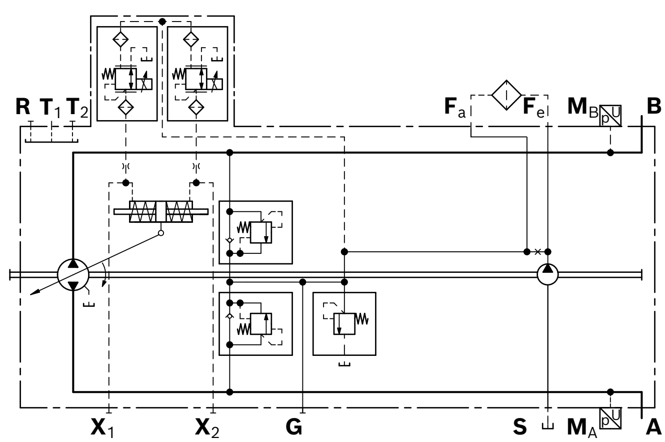
Ports for external boost circuit filtration

Ports	
Boost pressure inlet	Port F_a
Boost pressure outlet	Port F_e
Filter version	**Boost pressure filter**
Recommendation	With contamination indicator, with cold start valve
Filter arrangement	Separate in the pressure line (inline filter)

The boost pressure filter is not included in the scope of delivery.

Notice
- ▶ Filters with a bypass are **not recommended**. Please contact us for applications with a bypass.
- ▶ The pressure drop at the filter is viscosity- and contamination-dependent. Note the maximum permissible pressure of the boost pump in combination with the set feed pressure.

▼ **Circuit diagram**

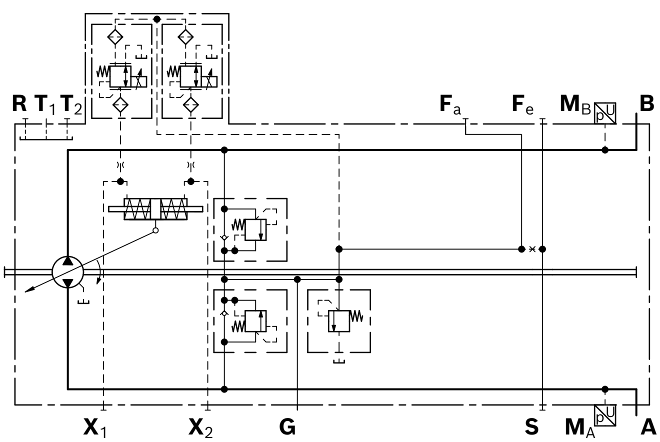


Notice
Bosch Rexroth has a comprehensive filter range on offer. An inline filter, e.g. the 110 LEN (see data sheet 51448), is suitable for charge pressure filtration. Further information can also be found at www.boschrexroth.com/filter.

External boost pressure supply

Version E
This variant should be used in versions without integrated boost pump (**U**).
Port **S** is plugged.
The boost pressure supply comes from port **G**.
The filter should be installed separately on port **G** before the boost pressure supply.
To ensure functional reliability, maintain the required cleanliness level for the boost fluid fed in at port **G** (see page 5).

▼ **Circuit diagram**



Boost-pressure relief valve

The boost-pressure relief valve is used to limit the boost pressure level. It limits the boost pressure depending on the case pressure.

Setting range

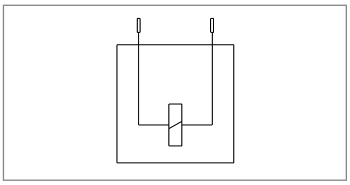
Boost-pressure relief valve	Differential pressure setting p_{St} ($p_{Sp} = \Delta p_{Sp} + p_T$)
Standard value	**25 bar**
Optional value	30 bar

The valve settings are performed at n = 2000 rpm. There may be deviations in the cracking pressures with other operating parameters.

Connector for the pressure reducing valve

DEUTSCH DT04-2P-EP04
Molded, 2-pin
The following type of protection ensues with the installed mating connector:
- IP6K5 (ISO 20653) and
- IP6K9K (ISO 20653)

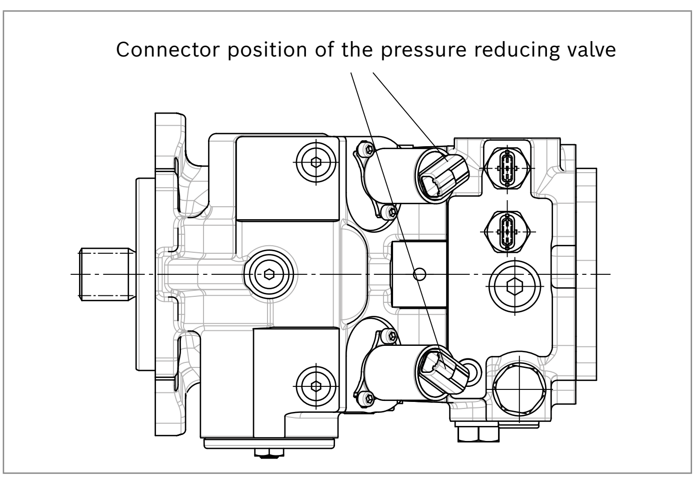
▼ **Switching symbol**



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

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

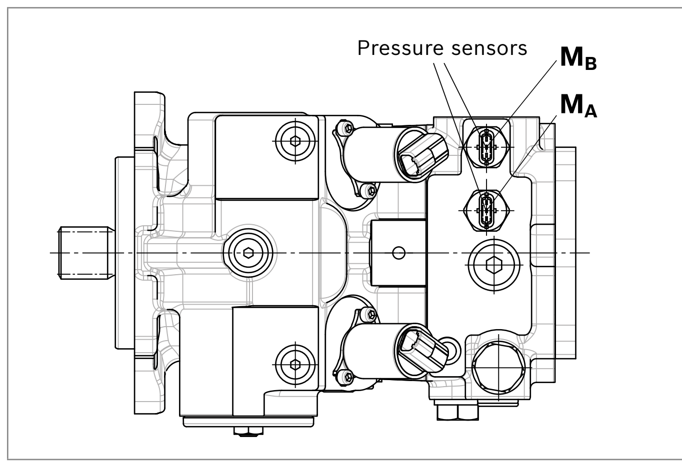
The mating connector is not included in the scope of delivery. This can be supplied by Bosch Rexroth on request (material number R902601804).



Pressure sensor

The pressure on the working ports **A** and **B** can be recorded using the mounted PR4 pressure sensors (version M; 0 to 600 bar) in $\mathbf{M_A}$ and $\mathbf{M_B}$. Type code, technical data, dimensions and details on the connector, plus safety instructions about the sensor can be found in the relevant data sheet 95156.

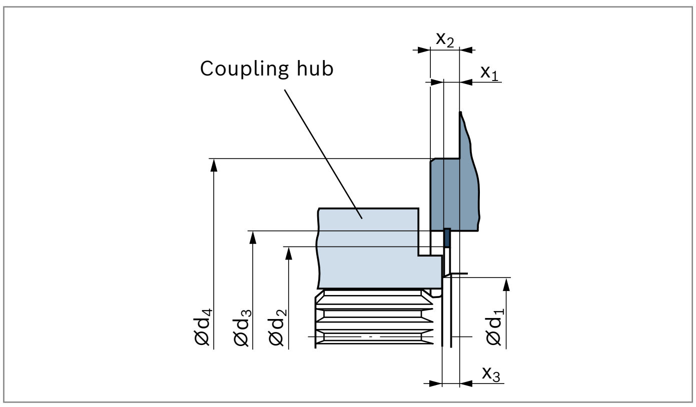
Notice
- Due to the working pressure range of the A4VG series 35, with a nominal pressure of 400 bar and a maximum pressure of 530 bar, only version M of the PR4 pressure sensor is approved.
- On delivery, the position of the pressure sensor connector position differs from that shown in the drawing.



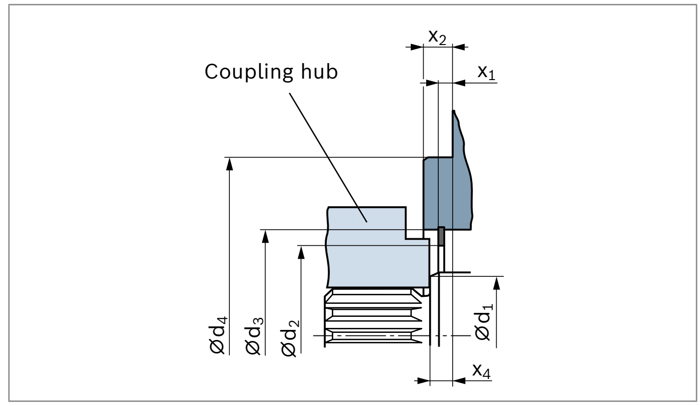
Installation dimensions for coupling assembly

To ensure that rotating components (coupling hub) and fixed components (housing, retaining ring) 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)
Splined shaft **S7**, **V8** or **T1**
The outer diameter of the coupling hub must be smaller than the inner diameter of the retaining ring (dimension d_2) in the area near the drive shaft collar (dimension $x_2 - x_3$).



DIN splined shaft (spline according to DIN 5480)
Splined shaft **Z8**
The outer diameter of the coupling hub must be smaller than the case diameter d_3 in the area near the drive shaft collar (dimension $x_2 - x_4$).



NG	$Ød_1$ SAE splined shaft	$Ød_1$ DIN splined shaft	$Ød_{2\ min}$	$Ød_3$	$Ød_4$	x_1	x_2	x_3	x_4
56	38.5	37.1	54.4	68±0.1	$127^{0}_{-0.063}$	7.0+0.2	12.7–0.5	$8^{+0.9}_{-0.6}$	$10^{+0.9}_{-0.6}$
71	43.5	42.1	66.5	81±0.1	$127^{0}_{-0.063}$	7.0+0.2	12.7–0.5	$8^{+0.9}_{-0.6}$	$10^{+0.9}_{-0.6}$
90	48.5	47.1	66.5	81±0.1	$127^{0}_{-0.063}$	6.8+0.2	12.7–0.5	$8^{+0.9}_{-0.6}$	$10^{+0.9}_{-0.6}$

Installation instructions

General

The axial piston unit must be filled with hydraulic fluid and air bled during commissioning and operation. This must also be observed following a longer standstill as the axial piston unit may empty via the hydraulic lines.
The leakage in the housing area must be directed to the reservoir via the highest drain port (**T**$_1$, **T**$_2$).
For combination pumps, the leakage must be drained off at each single pump.
If a shared drain line is used for several units, make sure that the respective case pressure in each unit is not exceeded. The shared drain line must be dimensioned to ensure that the maximum permissible case pressure of all connected units is not exceeded in any operating condition, particularly at cold start. If this is not possible, separate drain lines must be laid, if necessary.
To achieve favorable noise values, decouple all connecting lines using elastic elements and avoid above-reservoir installation.
Under all operating conditions, the suction line and drain line must flow into the reservoir below the minimum fluid level. The permissible suction height h_S results from the total pressure loss; it must not, however, be higher than $h_{S\ max}$ = 800 mm.
The suction pressure at port **S** must also not fall below the minimum value of 0.8 bar absolute during operation (cold start 0.5 bar absolute).

Installation position

See the following examples 1 to 10.
Further installation positions are available upon request.
Recommended installation position: 1 and 2.

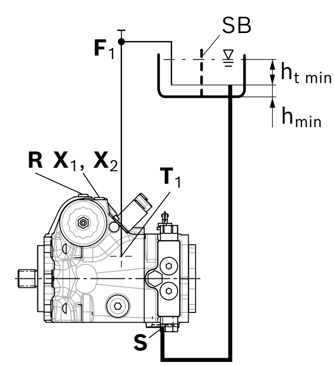
Notice

- If filling the stroking chambers via **X**$_1$ to **X**$_2$ is not possible in the final installation position, then this must take place before installation, e.g. in installation position 2.
- To prevent unexpected actuation and damage, the stroking chambers must be air bled via the ports **X**$_1$, **X**$_2$ depending on the installation position.
- In certain installation positions, an influence on the adjustment or control can be expected. Gravity, dead weight and case pressure can cause minor characteristic shifts and changes in response time.

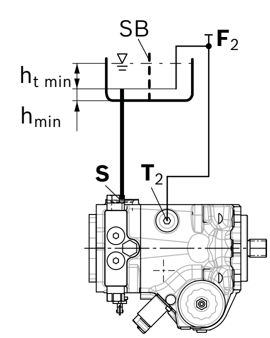
Below-reservoir installation (standard)

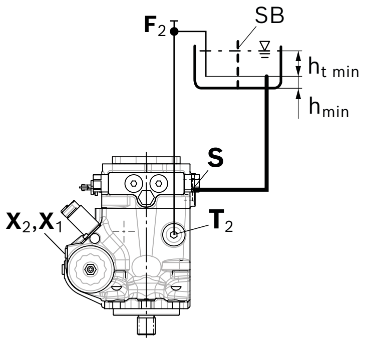
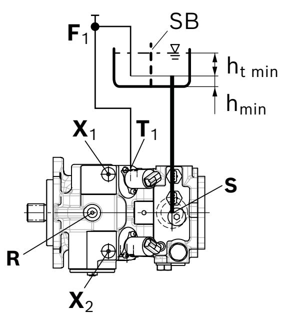
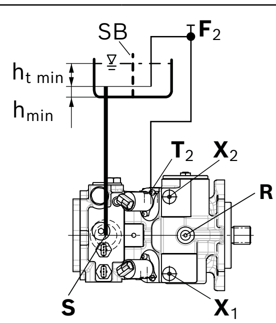
Below-reservoir installation means that the axial piston unit is installed outside of the reservoir below the minimum fluid level.

Installation position	Air bleed the housing	Air bleed the stroking chamber	Filling
1	**R**	**X**$_1$, **X**$_2$	**S** + **T**$_1$ + **X**$_1$ + **X**$_2$



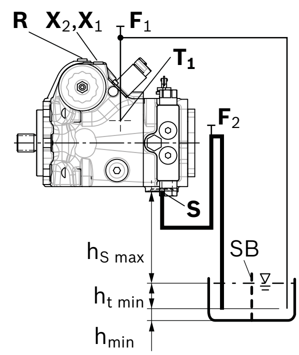
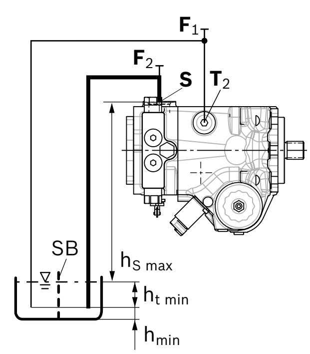
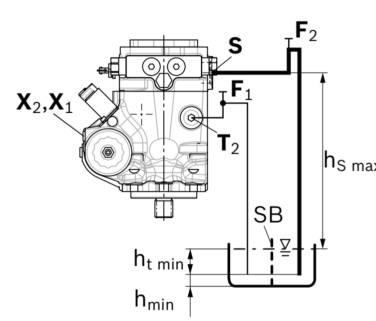
Installation position	Air bleed the housing	Air bleed the stroking chamber	Filling
2	–	–	**S** + **T**$_2$



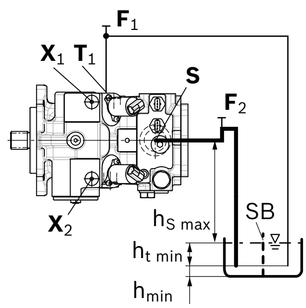
Installation position	Air bleed the housing	Air bleed the stroking chamber	Filling
3	–	$\mathbf{X_1}$, $\mathbf{X_2}$	$\mathbf{S}$ + $\mathbf{T_2}$ + $\mathbf{X_1}$ + $\mathbf{X_2}$
			
4	–	$\mathbf{X_1}$	$\mathbf{S}$ + $\mathbf{T_1}$ + $\mathbf{X_1}$
			
5	–	$\mathbf{X_2}$	$\mathbf{S}$ + $\mathbf{T_2}$ + $\mathbf{X_2}$
			

Above-reservoir installation

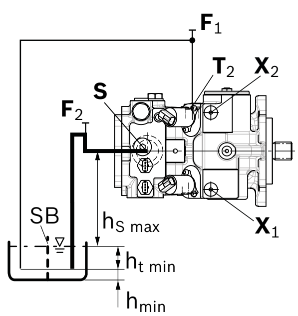
Above-reservoir installation means that the axial piston unit is installed above the minimum fluid level of the reservoir. Observe the maximum permissible suction height $h_{S\ max}$ = 800 mm.

Installation position	Air bleed the housing	Air bleed the stroking chamber	Filling
6	$\mathbf{F_2}$ + **R**	$\mathbf{X_1}$, $\mathbf{X_2}$	$\mathbf{F_1}$ + $\mathbf{F_2}$ + $\mathbf{X_1}$ + $\mathbf{X_2}$
			
7	$\mathbf{F_2}$ (**S**) + $\mathbf{F_1}$ ($\mathbf{T_2}$)	–	$\mathbf{F_2}$ (**S**) + $\mathbf{F_1}$ ($\mathbf{T_2}$)
			
8	$\mathbf{F_2}$ (**S**) + $\mathbf{F_1}$ ($\mathbf{T_2}$)	$\mathbf{X_1}$, $\mathbf{X_2}$	$\mathbf{F_2}$ (**S**) + $\mathbf{F_1}$ ($\mathbf{T_2}$) + $\mathbf{X_1}$ + $\mathbf{X_2}$
			

Installation position	Air bleed the housing	Air bleed the stroking chamber	Filling
9	F_2 (**S**) + F_1 (T_1)	X_1	F_2 (**S**) + F_1 (T_1) + X_1



Installation position	Air bleed the housing	Air bleed the stroking chamber	Filling
10	F_2 (**S**) + F_1 (T_2)	X_2	F_2 (**S**) + F_1 (T_2) + X_2



Key	
F_1, F_2	Filling/air bleeding
R	Air bleed port
S	Suction port
T_1, T_2	Drain port
X_1, X_2	Control pressure 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)

Notice

Ports F_1 and F_2 are part of the external piping and must be provided by the customer to make filling and air bleeding easier.

Project planning notes

- The pump is designed for use in a closed circuit.
- Project planning, installation and commissioning of the axial piston units requires the involvement of skilled personnel.
- Before using the axial piston unit, please read the appropriate instruction manual thoroughly and in full. If necessary, this can be requested from Bosch Rexroth.
- Before finalizing your design, request a binding installation drawing.
- The specified data and notes contained herein must be observed.
- Depending on the operational state of the axial piston unit (operating pressure, fluid temperature), the characteristic may shift.
- Preservation: Our axial piston units are supplied as standard with preservative protection for a maximum of 12 months. If longer preservative protection is required (maximum 24 months), please specify this in plain text when placing your order. The preservation periods apply under optimal storage conditions, details of which can be found in the data sheet 90312 or the instruction manual.
- Not all versions of the product are approved for use in safety functions according to ISO 13849. Please consult the responsible contact person at Bosch Rexroth if you require reliability parameters (e.g. $MTTF_D$) for functional safety.
- Depending on the type of control used, electromagnetic effects can be produced when using solenoids. Applying a direct voltage signal (DC) to solenoids does not create electromagnetic interference (EMI) nor is the solenoid affected by EMI. Electromagnetic interference (EMI) potential exists when operating and controlling a solenoid with a modulated direct voltage signal (e.g. PWM signal). Appropriate testing and measures should be taken by the machine manufacturer to ensure other components or operators (e.g. with pacemaker) are not affected by this potential.
- Be sure to add a pressure relief valve to the hydraulic system.
- With dynamic power flow (switch of pumps to operation as a motor) a maximum of 95% $V_{g\ max}$ is permissible. We recommend configuring the software accordingly.
- For drives that are operated for a long period with constant rotational speed, the natural frequency of the hydraulic system can be stimulated by the stimulator frequency of the pump (rotational speed frequency ×9). This can be prevented with suitably designed hydraulic lines.
- Please note the details regarding the tightening torques of port threads and other threaded joints in the instruction manual.
- Working ports:
  - The ports and fastening threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
  - The service ports and function ports are only designed to accommodate hydraulic lines.

Safety instructions

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

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