

# Axial Piston Variable Pump A4VG

**RE 92003/06.12**  
Replaces: 06.09

1/68

## Data sheet

Series 32  
Size 28 to 250  
Nominal pressure 400 bar  
Maximum pressure 450 bar  
Closed circuit



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## Features

- Variable axial piston pump of swashplate design for hydrostatic drives in closed circuit.
- The flow is proportional to the drive speed and displacement.
- The flow can be infinitely varied by adjusting the swashplate angle.
- Flow direction changes smoothly when the swashplate is moved through the neutral position.
- A wide range of highly adaptable control devices with different control and regulating functions, for all important applications.
- Two 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 integrated boost pump acts as a feed pump and control pressure supply.
- The maximum boost pressure is limited by a built-in low-pressure relief valve.
- As standard with integrated pressure cut-off

# Ordering code for standard program

<b>A4V</b>	<b>G</b>			<b>D</b>					/	<b>32</b>			<b>-</b>	<b>N</b>									
01	02	03	04	05	06	07	08	09		10	11		12	13	14	15	16	17	18	19	20	21	22

### Axial piston unit

01	Swashplate design, variable, nominal pressure 400 bar, maximum pressure 450 bar																			<b>A4V</b>
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### Operating mode

02	Pump, closed circuit																			<b>G</b>
----	----------------------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	----------

### Sizes (NG)

03	Geometric displacement, see table of values on page 8									<b>28</b>	<b>40</b>	<b>56</b>	<b>71</b>	<b>90</b>	<b>125</b>	<b>180</b>	<b>250</b>
----	---	--	--	--	--	--	--	--	--	-----------	-----------	-----------	-----------	-----------	------------	------------	------------

### Control devices

		<b>28</b>	<b>40</b>	<b>56</b>	<b>71</b>	<b>90</b>	<b>125</b>	<b>180</b>	<b>250</b>																		
04	Without control module										●	●	●	●	●	●	●	●	NV								
	Proportional control hydraulic	pilot-pressure related $p = 6$ to 18 bar		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	HD3								
		mechanical servo <sup>1)</sup>		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	HW							
	Proportional control electric	U = 12 V DC		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	EP3							
		U = 24 V DC		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	EP4						
	Two-point control electric	U = 12 V DC		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	EZ1						
		U = 24 V DC		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	EZ2						
	Automatic control speed-related	U = 12 V DC		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	DA1						
		U = 24 V DC		●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	DA2						
	Hydraulic control, direct controlled										●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●

### Pressure cut-off (see page 55)

		<b>28</b>	<b>40</b>	<b>56</b>	<b>71</b>	<b>90</b>	<b>125</b>	<b>180</b>	<b>250</b>											
05	Pressure cut-off (standard)									●	●	●	●	●	●	●	●	●	●	D

### Neutral position switch (only for HW, see page 13)

		<b>28</b>	<b>40</b>	<b>56</b>	<b>71</b>	<b>90</b>	<b>125</b>	<b>180</b>	<b>250</b>											
06	Without neutral position switch (without code)										●	●	●	●	●	●	●	●	●	
	Neutral position switch										●	●	●	●	●	●	●	●	●	L

### Mechanical stroke limiter (see page 56)

		<b>28</b>	<b>40</b>	<b>56</b>	<b>71</b>	<b>90</b>	<b>125</b>	<b>180</b>	<b>250</b>											
07	Without mechanical stroke limiter (without code)										●	●	●	●	●	●	●	●	●	
	Mechanical stroke limiter, externally adjustable										●	●	●	●	●	●	●	●	●	M

### Ports X<sub>3</sub>, X<sub>4</sub> for stroking chamber pressure (see page 56)

		<b>28</b>	<b>40</b>	<b>56</b>	<b>71</b>	<b>90</b>	<b>125</b>	<b>180</b>	<b>250</b>											
08	Without ports X <sub>3</sub> , X <sub>4</sub> (without code)										●	●	●	●	●	●	●	●	●	
	Ports X <sub>3</sub> , X <sub>4</sub> for stroking chamber pressure										●	●	●	●	●	●	●	●	●	T

### DA control valve (see page 17)

			<b>NV</b>	<b>HD</b>	<b>HW</b>	<b>DG</b>	<b>DA</b>	<b>EP</b>	<b>EZ</b>											
09	Without DA control valve										●	●	●	●	-	●	●	●	●	1
	DA control valve fixed setting										-	●	●	●	●	●	●	-	●	2
	DA control valve mechanically adjustable, with position lever	actuating direction right		-	●	●	●	●	●	●	-	●	●	-	●	3R				
		left		-	●	●	●	●	●	●	-	●	●	-	●	3L				
	DA control valve fixed setting and braking inch valve mounted, control with brake fluid	according to ISO 4925, no mineral oil		-	-	-	-	●	-	-	-	●	-	-	●	4				
		based on mineral oil		-	-	-	-	●	-	-	-	●	-	-	●	8				
	DA control valve fixed setting, ports for pilot control device										-	●	●	●	●	●	●	-	●	7

● = Available      ○ = On request      - = Not available       = Preferred program

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

<b>A4V</b>	<b>G</b>			<b>D</b>					<b>/</b>	<b>32</b>		<b>-</b>	<b>N</b>										
01	02	03	04	05	06	07	08	09		10	11		12	13	14	15	16	17	18	19	20	21	22

## Series

10	Series 3, index 2	<b>32</b>
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## Directions of rotation

11	Viewed on drive shaft	clockwise	<b>R</b>
		counter-clockwise	<b>L</b>

## Seals

12	NBR (nitrile-caoutchouc), shaft seal in FKM (fluor-caoutchouc)	<b>N</b>
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## Drive shafts (permissible input torques see page 9)

		28	40	56	71	90	125	180	250	
13	Splined shaft DIN 5480	for single pump	●	●	●	●	●	●	●	<b>Z</b>
		for combination pump – 1st pump	– <sup>2)</sup>	●	●	●	●	– <sup>2)</sup>	– <sup>2)</sup>	<b>A</b>
	Splined shaft ANSI B92.1a	for single pump	●	●	●	●	●	●	●	<b>S</b>
		for combination pump – 1st pump	– <sup>3)</sup>	– <sup>3)</sup>	●	●	– <sup>3)</sup>	●	●	<b>T</b>
	Only for combination pump – 2nd pump	–	●	–	–	●	–	–	<b>U</b>	

## Mounting flanges

		28	40	56	71	90	125	180	250	
14	SAE J744	2-hole	●	●	●	–	–	–	–	<b>C</b>
		4-hole	–	–	–	–	–	●	●	<b>D</b>
		2+4-hole	–	–	–	●	●	●	–	<b>F</b>

## Service line ports

		28	40 to 180	250		
15	SAE flange ports A and B, top and bottom	suction port S bottom	–	●	–	<b>02</b>
		top	–	○	–	<b>03</b>
	SAE flange ports A and B, same side	right suction port S bottom	●	–	●	<b>10</b>
		left suction port S top	○	–	○	<b>13</b>

## Boost pump

		28	40	56	71	90	125	180	250	
16	Without integrated boost pump	without through drive	●	●	●	●	●	●	●	<b>N00</b>
		with through drive	●	●	●	●	●	●	●	<b>K..</b>
	Integrated boost pump	without through drive	●	●	●	●	●	●	●	<b>F00</b>
		with through drive	●	●	●	●	●	●	●	<b>F..</b>

## Through drives (mounting options, see page 53)

		28	40	56	71	90	125	180	250		
17	Flange SAE J744 <sup>4)</sup>	Coupling for splined shaft									
	82-2 (A)	5/8 in	9T 16/32DP <sup>5)</sup>	●	●	●	●	●	●	●	<b>.01</b>
	101-2 (B)	7/8 in	13T 16/32DP <sup>5)</sup>	●	●	●	●	●	●	●	<b>.02</b>
		1 in	15T 16/32DP <sup>5)</sup>	●	●	●	●	●	●	●	<b>.04</b>
	127-2 (C)	1 in	15T 16/32DP <sup>5)</sup>	–	●	–	–	–	–	–	<b>.09</b>
		1 1/4 in	14T 12/24DP <sup>5)</sup>	–	–	●	●	●	●	●	<b>.07</b>
	152-2/4 (D)	W35	2x16x9g <sup>6)</sup>	–	–	–	●	–	–	–	<b>.73</b>
		1 3/4 in	13T 8/16DP <sup>5)</sup>	–	–	–	–	●	●	●	<b>.69</b>
165-4 (E)	1 3/4 in	13T 8/16DP <sup>5)</sup>	–	–	–	–	–	●	●	<b>.72</b>	

● = Available    ○ = On request    – = Not available

■ = Preferred program

- 2) Standard for combination pump – 1st pump: shaft **Z**
- 3) Standard for combination pump – 1st pump: shaft **S**
- 4) 2 = 2-hole; 4 = 4-hole
- 5) Coupling for splined shaft according to ANSI B92.1a
- 6) Coupling for splined shaft according to DIN 5480

# Ordering code for standard program

<b>A4V</b>	<b>G</b>			<b>D</b>						<b>/ 32</b>		<b>- N</b>											
01	02	03	04	05	06	07	08	09		10	11		12	13	14	15	16	17	18	19	20	21	22

Valves (see page 54)			Setting range $\Delta p$	28	40	56	71	90	125	180	250		
18	High-pressure relief valve, pilot operated	100 to 420 bar	with bypass	-	-	-	●	●	●	●	●	1	
	High-pressure relief valve direct controlled, fixed setting	250 to 420 bar	w/o bypass	●	●	●	-	-	-	-	-	3	
			with bypass	●	●	●	-	-	-	-	-	5	
		100 to 250 bar	w/o bypass	●	●	●	-	-	-	-	-	-	4
			with bypass	●	●	●	-	-	-	-	-	-	6

Filtration boost circuit / external supply (see pages 57 to 60)			28	40	56	71	90	125	180	250		
19	Filtration in the boost pump suction line		●	●	●	●	●	●	●	●	S	
	Filtration in the boost pump pressure line		●	●	●	●	●	●	●	●	D	
	Ports for external boost circuit filtration ( $F_e$ and $F_a$ )		-	●	●	●	●	●	●	●	-	K
	and cold start valve		-	●	●	●	●	●	●	●	-	F
	Filter mounted with cold start valve		-	●	●	●	●	●	●	●	-	F
	Filter mounted with cold start valve and contamination indicator through:	inspection window	-	●	●	●	●	●	●	●	-	P
electric signal		-	●	●	●	●	●	●	●	-	B	
External supply (on version without integrated boost pump – N00, K...)			●	●	●	●	●	●	●	●	E	

Swivel angle sensor (see page 61)			28	40	56	71	90	125	180	250	
20	Without swivel angle sensor (without code)		●	●	●	●	●	●	●	●	
	Electric swivel angle sensor mounted <sup>7)</sup>		●	●	●	●	●	●	●	●	●

Connector for solenoids <sup>8)</sup> (see page 62)			28	40	56	71	90	125	180	250	
21	DEUTSCH molded connector, 2-pin	without suppressor diode	●	●	●	●	●	●	●	●	P
		with suppressor diode (only for EZ and DA)	●	●	●	●	●	●	●	●	Q

Standard / special version			
22	Standard version	without code	
		combined with attachment part or attachment pump	-K
	Special version		-S
		combined with attachment part or attachment pump	-SK

● = Available

○ = On request

- = Not available

■ = Preferred program

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

8) Connectors for other electric components can deviate

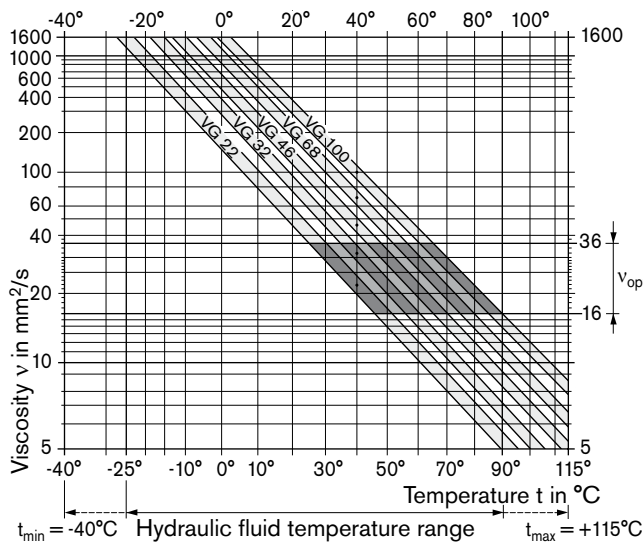
# Technical data

## 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 pump A4VG 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 ( $v_{opt}$  see shaded area of the selection diagram). We recommend 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 ( $v_{opt}$ , shaded area), this corresponds to the viscosity classes VG 46 and 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 [mm <sup>2</sup> /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 <sup>1)</sup>	$v_{max} = 1600$	$T_{St} \geq -40$ °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	$v < 1600$ 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		$\Delta T = \text{approx. } 5$ K	between hydraulic fluid in the bearing and at port T
Maximum temperature		115 °C 110 °C	in the bearing measured at port T
Continuous operation	$v = 400$ to 10 $v_{opt} = 36$ to 16	$T = -25$ °C to $+90$ °C	measured at port T, no restriction within the permissible data
Short-term operation	$v_{min} \geq 7$	$T_{max} = +110$ °C	measured at port T, $t < 3$ min, $p < 0.3 \cdot p_{nom}$
FKM shaft seal <sup>1)</sup>		$T \leq +115$ °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 A4VG, we recommend

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

With an increasing differential pressure at the filter cartridges, the  $\beta$  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.

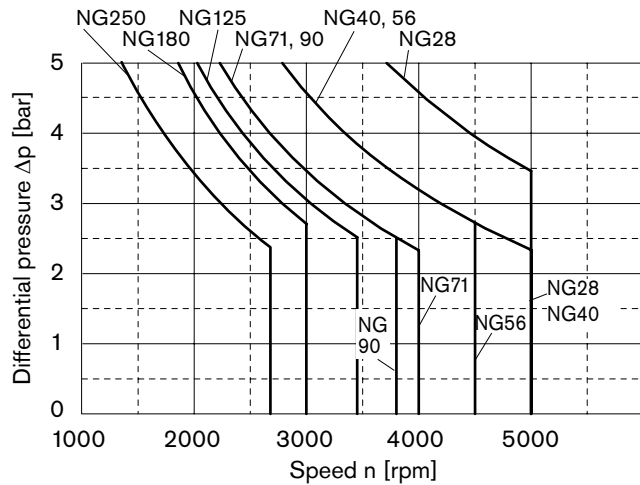
If the above classes cannot be achieved, please contact us. For notes on filtration types, see page 57.

### 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 or B

Nominal pressure  $p_{nom}$  \_\_\_\_\_ 400 bar absolute

Maximum pressure  $p_{max}$  \_\_\_\_\_ 450 bar absolute

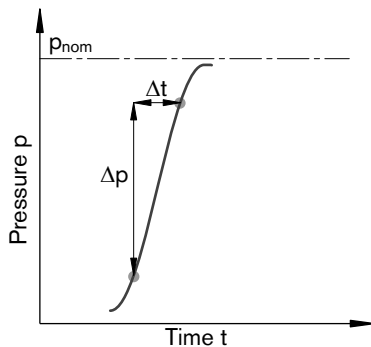
Single operating period \_\_\_\_\_ 10 s

Total operating period at  $n_{nom}$  \_\_\_\_\_ 300 h

Minimum pressure (high-pressure side) \_\_\_\_\_ 25 bar absolute

Minimum pressure (low-pressure side) \_\_\_\_\_ 10 bar over  $p_G$   
(boost pressure setting must be higher, depending on system)

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



### Boost pump

#### Pressure at suction port S

Continuous  $p_{S\ min}$  ( $v \leq 30\ mm^2/s$ ) \_\_\_\_\_  $\geq 0.8$  bar absolute

Short-term, on cold start ( $t < 3\ min$ ) \_\_\_\_\_  $\geq 0.5$  bar absolute

Maximum  $p_{S\ max}$  \_\_\_\_\_  $\leq 5$  bar absolute

Nominal pressure  $p_{Sp\ nom}$  \_\_\_\_\_ 25 bar absolute

Maximum pressure  $p_{Sp\ max}$  \_\_\_\_\_ 40 bar absolute

#### 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 HD

Minimum control pressure

$p_{St\ min}$  (at  $n = 2000\ rpm$ ) \_\_\_\_\_ 20 bar over  $p_G$

For control DA, DG, EZ

Minimum control pressure

$p_{St\ min}$  (at  $n = 2000\ rpm$ ) \_\_\_\_\_ 25 bar over  $p_G$

### 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)

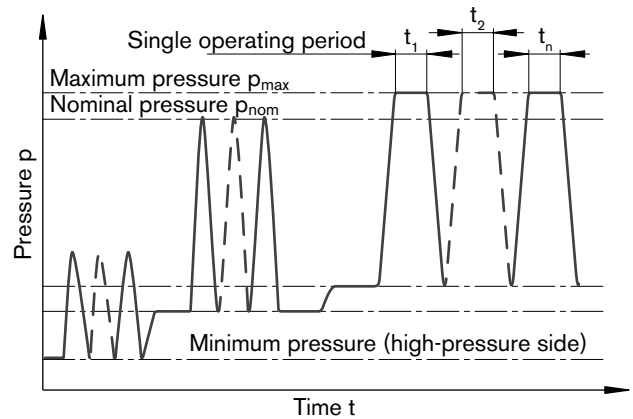
Minimum pressure at the high-pressure side (A or B) which is required in order to prevent damage to the axial piston unit.

### 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 =  $t_1 + t_2 + \dots + t_n$

# Technical data

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

Size	NG		28	40	56	71	90	125	180	250	
Displacement geometric, per revolution											
variable pump	$V_{g \max}$	cm <sup>3</sup>	28	40	56	71	90	125	180	250	
boost pump (at p = 20 bar)	$V_{g Sp}$	cm <sup>3</sup>	6.1	8.6	11.6	19.6	19.6	28.3	39.8	52.5	
Speed <sup>1)</sup>											
maximum at $V_{g \max}$	$n_{nom}$	rpm	4250	4000	3600	3300	3050	2850	2500	2400	
limited maximum <sup>2)</sup>	$n_{max}$	rpm	4500	4200	3900	3600	3300	3250	2900	2600	
intermittent maximum <sup>3)</sup>	$n_{max}$	rpm	5000	5000	4500	4100	3800	3450	3000	2700	
minimum	$n_{min}$	rpm	500	500	500	500	500	500	500	500	
Flow											
at $n_{nom}$ and $V_{g \max}$	$q_v$	L/min	119	160	202	234	275	356	450	600	
Power <sup>4)</sup>											
at $n_{nom}$ , $V_{g \max}$ and $\Delta p = 400$ bar	P	kW	79	107	134	156	183	238	300	400	
Torque <sup>4)</sup>											
at $V_{g \max}$ and $\Delta p = 400$ bar	T	Nm	178	255	357	452	573	796	1146	1592	
	T	Nm	45	64	89	113	143	199	286	398	
Rotary stiffness drive shaft	S	c	kNm/rad	31.4	69	80.8	98.8	158.1	218.3	244.5	354.5
	T	c	kNm/rad	–	–	95	120.9	–	252.1	318.4	534.3
	A	c	kNm/rad	–	79.6	95.8	142.4	176.8	256.5	–	–
	Z	c	kNm/rad	32.8	67.5	78.8	122.8	137	223.7	319.6	624.2
	U	c	kNm/rad	–	50.8	–	–	107.6	–	–	–
Moment of inertia for rotary group	$J_{GR}$	kgm <sup>2</sup>	0.0022	0.0038	0.0066	0.0097	0.0149	0.0232	0.0444	0.0983	
Maximum angular acceleration <sup>5)</sup>	$\alpha$	rad/s <sup>2</sup>	38000	30000	24000	21000	18000	14000	11000	6700	
Case volume	V	L	0.9	1.1	1.5	1.3	1.5	2.1	3.1	6.3	
Mass approx. (without through drive)	m	kg	29	31	38	50	60	80	101	156	
Center of gravity <sup>6)</sup>	X	mm	< 5	< 5	< 5	< 5	< 5	< 5	< 5	< 5	
	Y	mm	24	20	20	15	20	30	33	30	
	Z	mm	105	112	106	135	145	160	180	203	

1) The values are valid:

- for the optimum viscosity range from  $v_{opt} = 36$  to  $16$  mm<sup>2</sup>/s
- with hydraulic fluid based on mineral oils

2) Limited maximum speed:

- at half of corner power (e. g. at  $V_{g \max}$  and  $p_N / 2$ )

3) Intermittent maximum speed:

- at high idle speed
- at overspeed:  $\Delta p = 70$  to  $150$  bar and  $V_{g \max}$
- at reversing peaks:  $\Delta p < 300$  bar and  $t < 0.1$  s.

4) Without boost pump

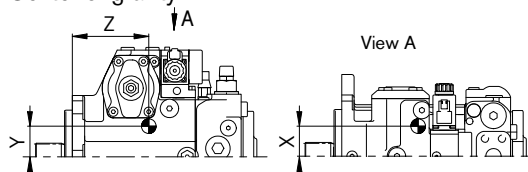
5) The data are valid for values between the minimum required and maximum permissible speed.

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.

6) Center of gravity


**Note:**

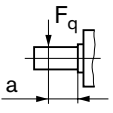
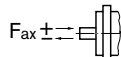
Operation above the maximum values or below the minimum values may result in a loss of function, a reduced service life or in the destruction of the axial piston unit. We recommend testing the loads by means of experiment or calculation / simulation and comparison with the permissible values.

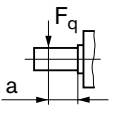
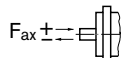


# Technical data

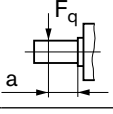
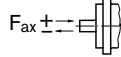
## Permissible radial and axial forces of the drive shafts

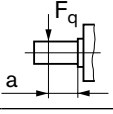
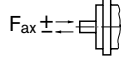
Splined shaft DIN 5480

Size	NG		28	40	40	56	56	71	71	90	
Drive shaft			W25	W30	W35	W30	W35	W35	W40	W35	
Maximum radial force at distance a (from shaft collar)		$F_{q \max}$	N	3030	3608	3092	5051	4329	5489	4803	6957
		a	mm	17.5	17.5	20	17.5	20	20	22.5	20
Maximum axial force		$-F_{ax \max}$	N	1557	2120	2120	2910	2910	4242	4242	4330
		$+F_{ax \max}$	N	417	880	880	1490	1490	2758	2758	2670

Size	NG		90	125	125	180	250	
Drive shaft			W45	W40	W45	W50	W55	
Maximum radial force at distance a (from shaft collar)		$F_{q \max}$	N	5411	8455	7516	9740	12298
		a	mm	25	22.5	25	27.5	29
Maximum axial force		$-F_{ax \max}$	N	4330	6053	6053	7500	4150
		$+F_{ax \max}$	N	2670	3547	3547	4500	4150

Splined shaft ANSI B92.1a

Size	NG		28	40	40	56	56	71	71	90	
Drive shaft		in	1	1	1 1/4	1 1/4	1 3/8	1 1/4	1 3/8	1 1/4	
Maximum radial force at distance a (from shaft collar)		$F_{q \max}$	N	2983	4261	3409	4772	4338	6050	5500	7670
		a	mm	19	19	24	24	24	24	24	24
Maximum axial force		$-F_{ax \max}$	N	1557	2120	2120	2910	2910	4242	4242	4330
		$+F_{ax \max}$	N	417	880	880	1490	1490	2758	2758	2670

Size	NG		90	125	125	180	180	250	250	
Drive shaft		in	1 3/4	1 3/4	2	1 3/4	2 1/4	1 3/4	2 1/4	
Maximum radial force at distance a (from shaft collar)		$F_{q \max}$	N	5478	7609	6658	10956	8522	15217	11836
		a	mm	33.5	33.5	40	33.5	40	33.5	40
Maximum axial force		$-F_{ax \max}$	N	4330	6053	6053	7500	7500	4150	4150
		$+F_{ax \max}$	N	2670	3547	3547	4500	4500	4150	4150

### Note

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

# Technical data

## Permissible input and through-drive torques

Size	NG		28	40	56	71	90	125	180	250
Torque at $V_{g \max}$ and $\Delta p = 400 \text{ bar}^1$	T	Nm	178	255	357	452	573	796	1146	1592
Input torque at drive shaft, maximum <sup>2)</sup>										
DIN 5480	Z	$T_{E \max}$	Nm	352	522	522	912	912	1460	4350
				W25	W30	W30	W35	W35	W40	W50
	A	$T_{E \max}$	Nm	–	912	912	1460	2190	2190	–
					W35	W35	W40	W45	W45	
ANSI B92.1a (SAE J744)	S	$T_{E \max}$	Nm	314	602	602	602	1640	1640	1640
				1 in	1 1/4 in	1 1/4 in	1 1/4 in	1 3/4 in	1 3/4 in	1 3/4 in
	T	$T_{E \max}$	Nm	–	–	970	970	–	2670	4070
						1 3/8 in	1 3/8 in		2 in	2 1/4 in
U <sup>3)</sup>	$T_{E \max}$	Nm	–	314	–	–	602	–	–	–
				1 in			1 1/4 in			
Maximum through-drive torque <sup>4)</sup>	$T_{D \max}$	Nm	231	314	521	660	822	1110	1760	2230

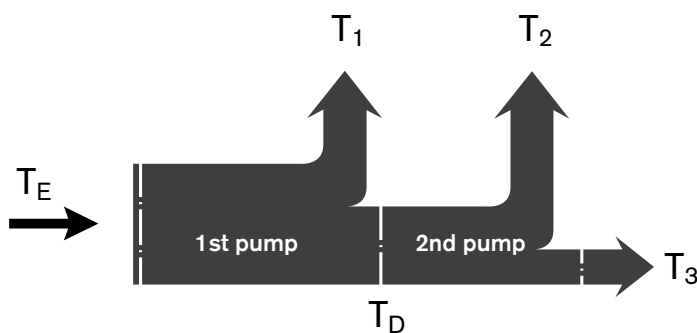
1) Efficiency not considered

2) For drive shafts without radial force

3) Shaft "U" is only permissible as a drive shaft for the **2nd pump** in a combination pump of the same size.

4) Note maximum input torque at **shaft S!**

## Torque distribution



$T_E$  and  $T_D$  consists as follows:

$$T_E = T_1 + T_2 + T_3$$

$$T_D = T_2 + T_3$$

$$T_E < T_{E \max}$$

$$T_D < T_{D \max}$$

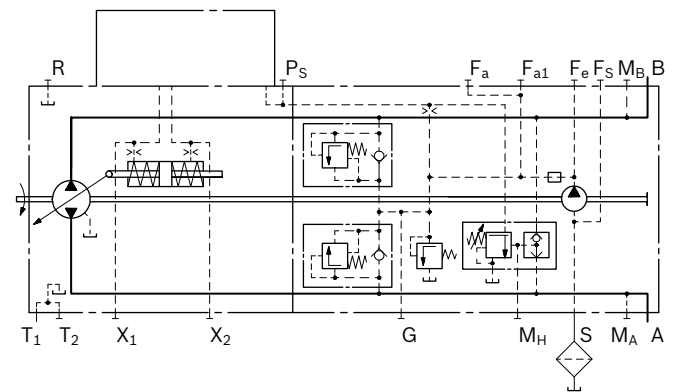
## Determining the operating characteristics

Flow	$q_v = \frac{V_g \cdot n \cdot \eta_v}{1000}$	[L/min]	$V_g$ = Displacement per revolution in $\text{cm}^3$
			$\Delta p$ = Differential pressure in bar
Torque	$T = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}}$	[Nm]	$n$ = Speed in rpm
			$\eta_v$ = Volumetric efficiency
Power	$P = \frac{2 \pi \cdot T \cdot n}{60000} = \frac{q_v \cdot \Delta p}{600 \cdot \eta_t}$	[kW]	$\eta_{mh}$ = Mechanical-hydraulic efficiency
			$\eta_t$ = Total efficiency ( $\eta_t = \eta_v \cdot \eta_{mh}$ )

# NV – Version without control module

The mounting surface for the control module is machined and is sealed with the standard seal for control modules and a cover plate. This version is ready for retrofitting to control modules (HD, HW, EP, EZ). When used directly for "DA" control and in combinations with "DA" control, the appropriate adjustments must be made to the spring assembly of the control cylinder and control plate.

## Standard version<sup>1)</sup>



1) Sizes 28 and 250 without ports Fa1 and Fs

# DG – Hydraulic control, direct controlled

With the direct hydraulic control (DG), the output flow of the pump is controlled by a hydraulic control pressure, applied directly to the stroking piston through either port X1 or X2.

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.

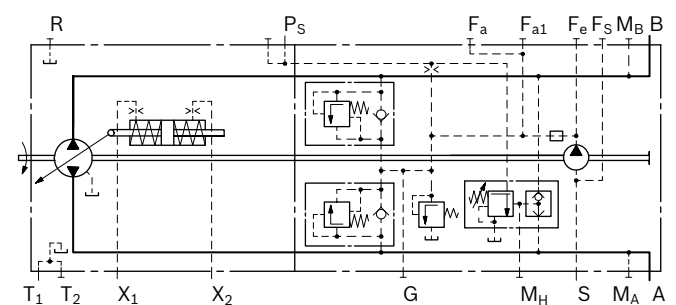
The pressure cut-off and the DA control valve only become effective if the pilot control device used for controlling the DG control is supplied from port Ps.

Maximum permissible control pressure: 40 bar

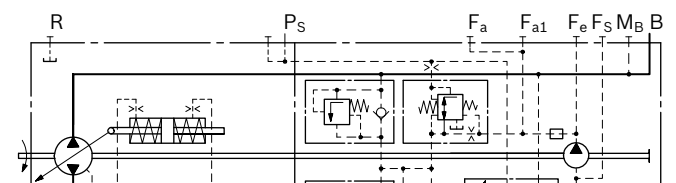
*Use of the DG control requires a review of the engine and vehicle parameters to ensure that the pump is set up correctly. We recommend that all DG applications be reviewed by a Bosch Rexroth application engineer.*

If the pump is also equipped with a DA control valve (see page 17), automotive operation is possible for travel drives.

## Standard version<sup>1)</sup>



## Version with DA control valve<sup>1)</sup>



1) Sizes 28 and 250 without ports Fa1 and Fs

### Correlation Direction of rotation – Control – Flow direction

		Size	Control pressure	Flow direction	Operating pressure
Direction of rotation	cw	28 to 56	X1	A to B	M <sub>B</sub>
			X2	B to A	M <sub>A</sub>
		71 to 250	X1	B to A	M <sub>A</sub>
			X2	A to B	M <sub>B</sub>
	ccw	28 to 56	X1	B to A	M <sub>A</sub>
			X2	A to B	M <sub>B</sub>
71 to 250		X1	A to B	M <sub>B</sub>	
		X2	B to A	M <sub>A</sub>	

# HD – Proportional control hydraulic, pilot-pressure related

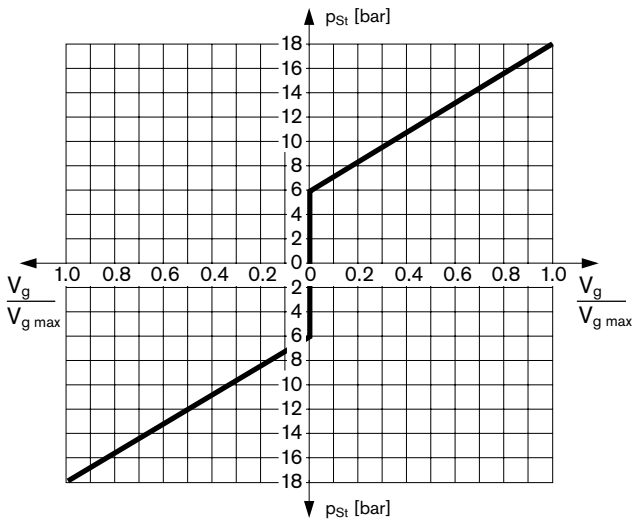
The output flow of the pump is infinitely variable between 0 to 100 %, proportional to the difference in pilot pressure applied to the two control ports (Y<sub>1</sub> and Y<sub>2</sub>).

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.

If the pump is also equipped with a DA control valve (see page 17), automotive operation is possible for travel drives.



$V_g$  = Displacement at  $p_{St}$

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

Pilot signal  $p_{St} = 6\ \text{to}\ 18\ \text{bar}$  (at port Y<sub>1</sub>, Y<sub>2</sub>)

Beginning of control at 6 bar

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

**Note:**

In the neutral position, the HD 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.

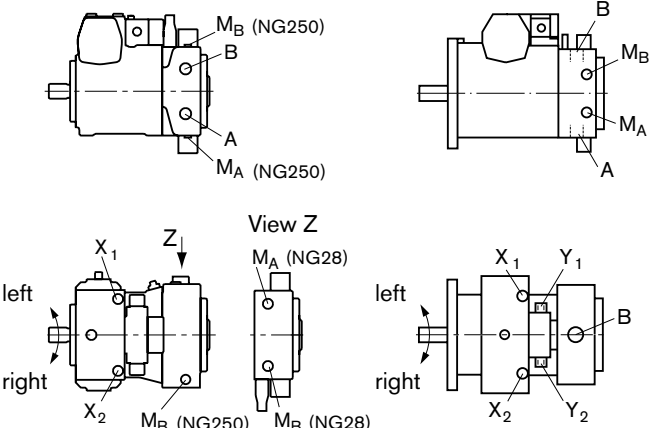
Check whether the application on your machine requires additional safety measures, in order to bring the driven actuator into a controlled and safe position (immediate stop). If necessary, make sure these are properly implemented.

**Correlation**  
**Direction of rotation – Control – Flow direction**

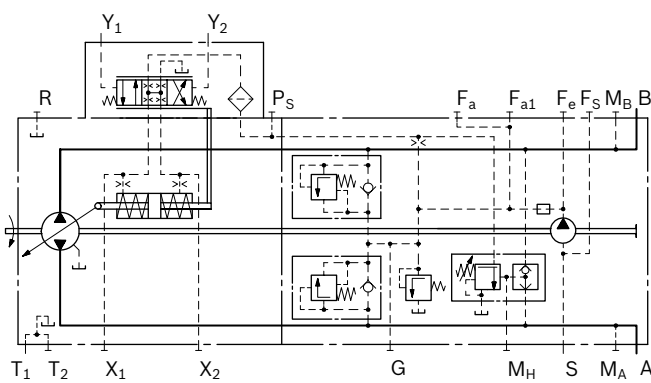
	Size	Pilot signal	Control pressure	Flow direction	Operating pressure
Direction of rotation CW	28 to 56	Y <sub>1</sub>	X <sub>1</sub>	A to B	M <sub>B</sub>
		Y <sub>2</sub>	X <sub>2</sub>	B to A	M <sub>A</sub>
	71 to 250	Y <sub>1</sub>	X <sub>1</sub>	B to A	M <sub>A</sub>
		Y <sub>2</sub>	X <sub>2</sub>	A to B	M <sub>B</sub>
Direction of rotation CCW	28 to 56	Y <sub>1</sub>	X <sub>1</sub>	B to A	M <sub>A</sub>
		Y <sub>2</sub>	X <sub>2</sub>	A to B	M <sub>B</sub>
	71 to 250	Y <sub>1</sub>	X <sub>1</sub>	A to B	M <sub>B</sub>
		Y <sub>2</sub>	X <sub>2</sub>	B to A	M <sub>A</sub>

**Sizes 28, 250**

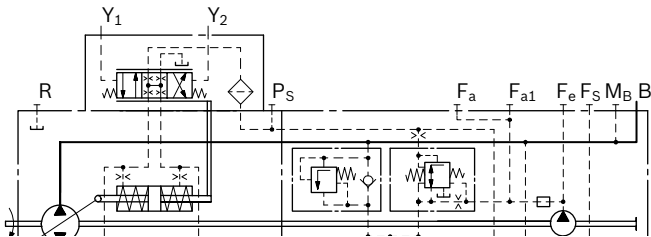
**Sizes 40 to 180**



**Standard version<sup>1)</sup>**



**Version with DA control valve<sup>1)</sup>**



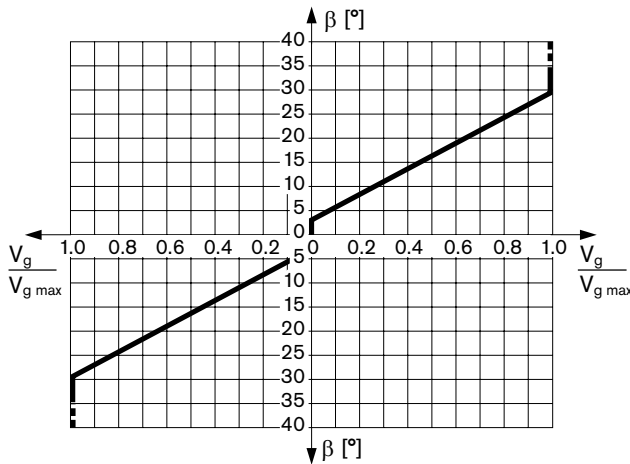
1) Sizes 28 and 250 without ports Fa1 and Fs

# 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°.

If the pump is also equipped with a DA control valve (see page 17), automotive operation is possible for travel drives.



Swivel angle  $\beta$  at the control lever for pump displacement change:

Beginning of control at  $\beta = 3^\circ$

End of control at  $\beta = 29^\circ$  (maximum displacement  $V_{g \text{ max}}$ )

Mechanical stop for  $\beta$ :

Size 28 to 71 \_\_\_\_\_  $\pm 40^\circ$   
 Size 90 to 250 \_\_\_\_\_  $\pm 35^\circ$

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.

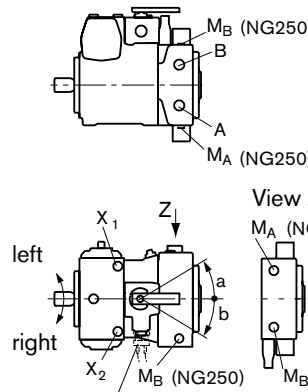
Thus, the neutral position switch provides a monitoring function for drive units that require the pump to be in the neutral position during certain operating conditions (e. g. starting diesel engines).

Technical data, neutral position switch	
Load capacity	20 A (continuous), w/o 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 62)

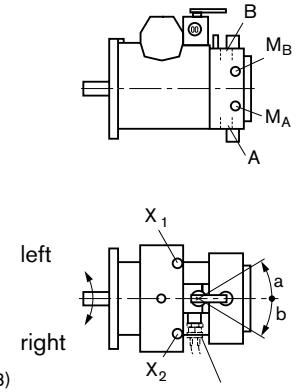
**Correlation**  
**Direction of rotation – Control – Flow direction**

	Size	Lever direction	Control pressure	Flow direction	Operating pressure	
Direction of rotation	CW	28 to 56	a	$X_2$	B to A	$M_A$
			b	$X_1$	A to B	$M_B$
	CCW	71 to 250	a	$X_2$	A to B	$M_B$
			b	$X_1$	B to A	$M_A$
Direction of rotation	CW	28 to 56	a	$X_2$	A to B	$M_B$
			b	$X_1$	B to A	$M_A$
	CCW	71 to 250	a	$X_2$	B to A	$M_A$
			b	$X_1$	A to B	$M_B$

**Sizes 28, 250**



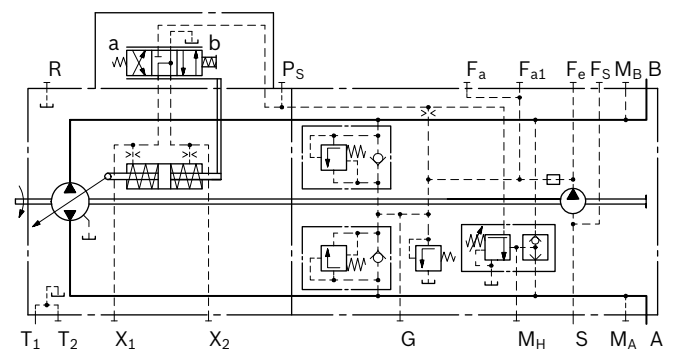
**Sizes 40 to 180**



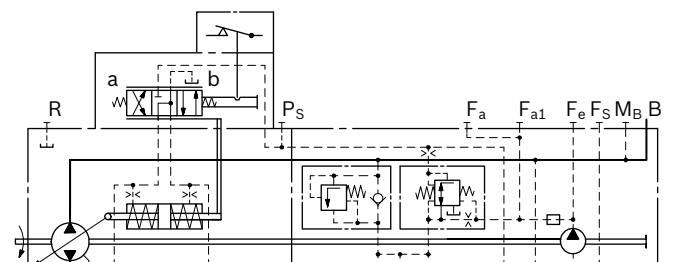
**Neutral position switch**

**Neutral position switch**

**Standard version<sup>1)</sup>**



**Version with DA control valve and neutral position switch<sup>1)</sup>**



<sup>1)</sup> Sizes 28 and 250 without ports  $F_{a1}$  and  $F_s$

# EP – Proportional control electric

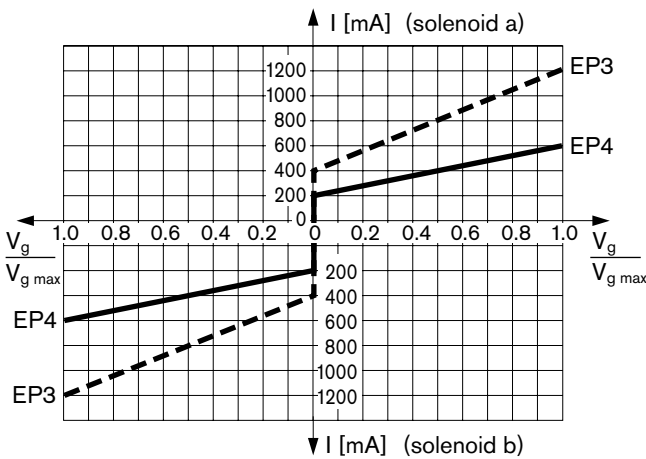
The output flow of the pump is infinitely variable between 0 to 100 %, proportional to the electrical current supplied to solenoid a or b.

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.

If the pump is also equipped with a DA control valve (see page 17), automotive operation is possible for travel drives.



### Technical data, solenoid

	EP3	EP4
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 page 62

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](http://www.boschrexroth.com/mobile-electronics).

### Note

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

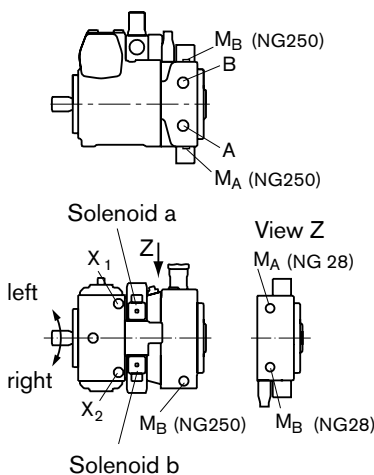
The control module can stick in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the control will no longer respond correctly to the operator's commands.

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.

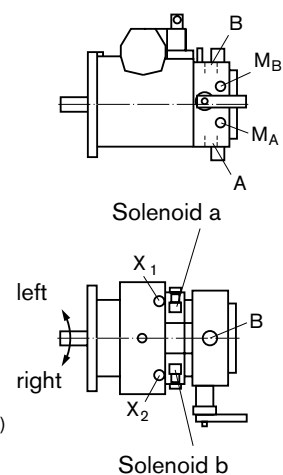
### Correlation Direction of rotation – Control – Flow direction

	Size	Actuation of solenoid	Control pressure	Flow direction	Operating pressure
Direction of rotation CW	28 to 56	a	X <sub>1</sub>	A to B	M <sub>B</sub>
		b	X <sub>2</sub>	B to A	M <sub>A</sub>
	71 to 250	a	X <sub>1</sub>	B to A	M <sub>A</sub>
		b	X <sub>2</sub>	A to B	M <sub>B</sub>
Direction of rotation CCW	28 to 56	a	X <sub>1</sub>	B to A	M <sub>A</sub>
		b	X <sub>2</sub>	A to B	M <sub>B</sub>
	71 to 250	a	X <sub>1</sub>	A to B	M <sub>B</sub>
		b	X <sub>2</sub>	B to A	M <sub>A</sub>

### Sizes 28, 250



### Sizes 40 to 180



### Standard

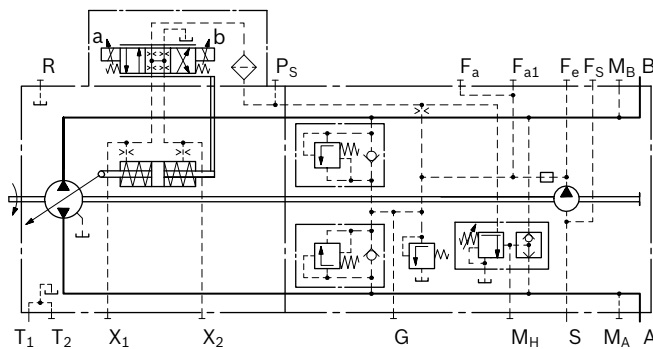
Proportional solenoid without manual override.

### On request

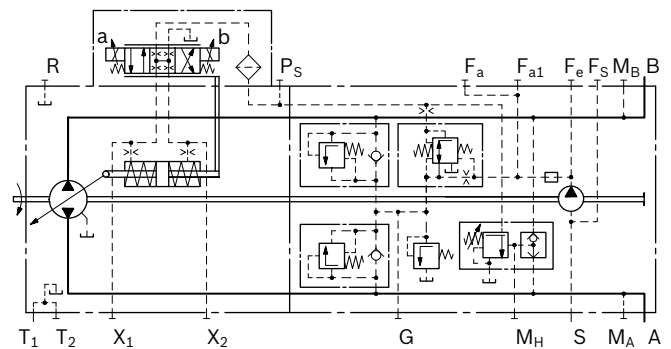
Proportional solenoid with manual override and spring return.

# EP – Proportional control electric

Standard version<sup>1)</sup>



Version with DA control valve<sup>1)</sup>



1) Sizes 28 and 250 without ports F<sub>a1</sub> and F<sub>s</sub>

# 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.

**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 page 62		

**Standard**

Switching solenoid without manual override.

**On request**

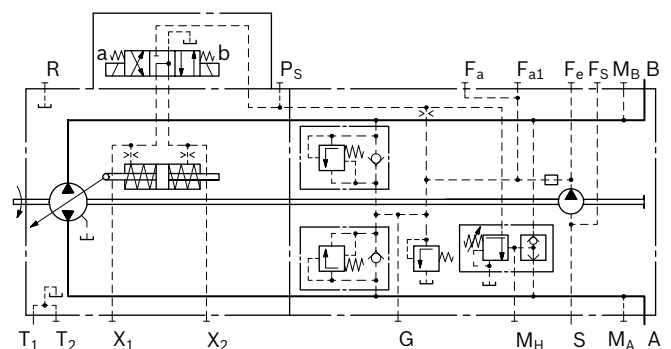
Switching solenoid with manual override and spring return.

**Correlation**

**Direction of rotation – Control – Flow direction**

	Size	Actuation of solenoid	Control pressure	Flow direction	Operating pressure
Direction of rotation	CW	a	X <sub>2</sub>	B to A	M <sub>A</sub>
		b	X <sub>1</sub>	A to B	M <sub>B</sub>
	71 to 250	a	X <sub>2</sub>	A to B	M <sub>B</sub>
		b	X <sub>1</sub>	B to A	M <sub>A</sub>
Direction of rotation	28 to 56	a	X <sub>2</sub>	A to B	M <sub>B</sub>
		b	X <sub>1</sub>	B to A	M <sub>A</sub>
	71 to 250	a	X <sub>2</sub>	B to A	M <sub>A</sub>
		b	X <sub>1</sub>	A to B	M <sub>B</sub>

Standard version<sup>1)</sup>



1) Sizes 28 and 250 without ports F<sub>a1</sub> and F<sub>s</sub>

# DA – Automatic control speed-related

The DA closed loop control is an engine speed-dependent system for travel drives. The built-in DA control valve generates a control pressure which is proportional to pump (engine) drive speed. This control pressure is directed to the stroking cylinder of the pump by a solenoid actuated 4/3-way directional valve. The pump displacement is infinitely variable in each flow direction and is influenced by both pump drive speed and system pressure. The flow direction (e. g. machine moving forward or backward) is determined by either solenoid a or b being activated.

Increasing pump drive speed generates a higher control pressure from the DA control valve, with a subsequent increase in pump flow.

Depending on the selected pump operating characteristics, increasing system pressure (e. g. machine load) causes the pump to swivel back towards a smaller displacement. Engine overload protection (anti-stall) is achieved by the combination of this pressure-related pump de-stroking, and the reduction of control pressure as the engine speed drops.

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

Various override options are available for the DA control function to allow controlled operation of the implement hydraulics with high rpm at reduced vehicle speed.

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

*DA closed loop control is only suitable for certain types of drive systems and requires review of the engine and vehicle parameters to ensure that the pump is used correctly and that machine operation is safe and efficient. We recommend that all DA applications be reviewed by a Bosch Rexroth application engineer.*

### Technical data, solenoid

	DA1	DA2
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 page 62		

### Standard

Switching solenoid without manual override.

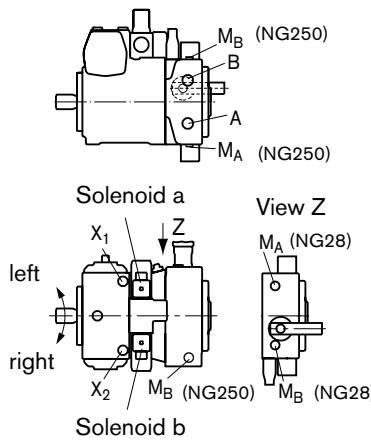
### On request

Switching solenoid with manual override and spring return.

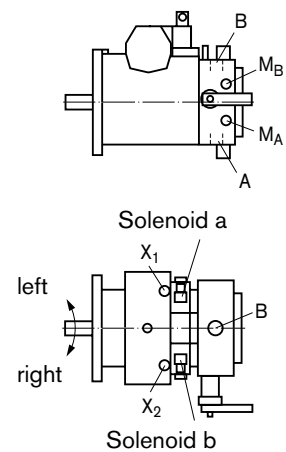
### Correlation Direction of rotation – Control – Flow direction

	Size	Actuation of solenoid	Control pressure	Flow direction	Operating pressure
Direction of rotation CW	28 to 56	a	$X_2$	B to A	$M_A$
		b	$X_1$	A to B	$M_B$
	71 to 250	a	$X_2$	A to B	$M_B$
		b	$X_1$	B to A	$M_A$
Direction of rotation CCW	28 to 56	a	$X_2$	A to B	$M_B$
		b	$X_1$	B to A	$M_A$
	71 to 250	a	$X_2$	B to A	$M_A$
		b	$X_1$	A to B	$M_B$

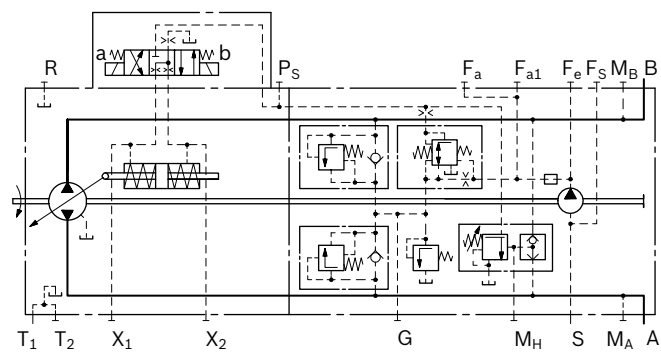
### Sizes 28, 250



### Sizes 40 to 180



### DA control valve fixed setting, DA1D2/DA2D2<sup>1)</sup>



1) Sizes 28 and 250 without ports  $F_{a1}$  and  $F_s$



# DA – Automatic control speed-related

## Function and control of DA control valves

### DA control valve fixed setting (2)

Control pressure is generated in relation to drive speed. When ordering, state in plain text: start of control (set at factory).

### DA control valve mechanically adjustable with position lever (3)

Control pressure is generated in relation to drive speed. When ordering, state in plain text: start of control (set at factory).

Any reduction of the control pressure possible, independently of the drive speed, through mechanical actuation of the position lever (inch function).

The maximum permissible actuation torque at the position lever is  $T_{max} = 4 \text{ Nm}$ .

Maximum angle of rotation  $70^\circ$ , lever position: any.

#### Version 3R

Actuating direction of the position lever: right

#### Version 3L

Actuating direction of the position lever: left

### DA control valve fixed setting and braking inch valve mounted (4, 8)

(only for pumps with DA control module)

- Version with throttle valve size 28, 40, 56, 71
- Version with pressure reducing valve size 90, 125, 180, 250

Any reduction of the control pressure possible, independently of the drive speed via hydraulic control (port Z).

#### Version 4:

Control at port Z by means of brake fluid according to ISO 4925 (no mineral oil), from the vehicle braking system (hydraulically linked with the service brake).

#### Version 8:

Control at port Z by means of brake fluid based on mineral oil.

### DA control valve fixed setting, ports for pilot control device as inch valve (7)

Any reduction of the pilot pressure possible, independently of the drive speed is achieved by the mechanical actuation of the pilot control device.

The pilot control device is installed separately from the pump (for example in the driver's cabin) and connected to the pump by two hydraulic control lines via ports  $P_S$  and Y.

A suitable pilot control device must be ordered separately and is not included in the delivery contents.

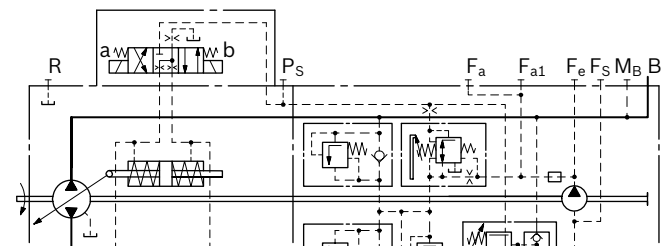
Detailed information is available from our sales department and on the Internet at [www.boschrexroth.com/da-control](http://www.boschrexroth.com/da-control). Use our computer program to work out the input design that meets your needs. All DA applications must be approved by a Bosch Rexroth application engineer.

Note: Rotary inch valves, see page 63.

## Schematics<sup>1)</sup>:

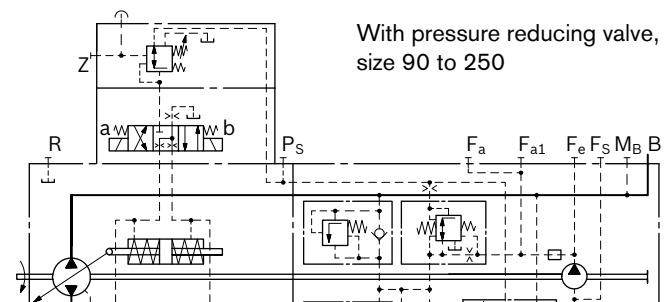
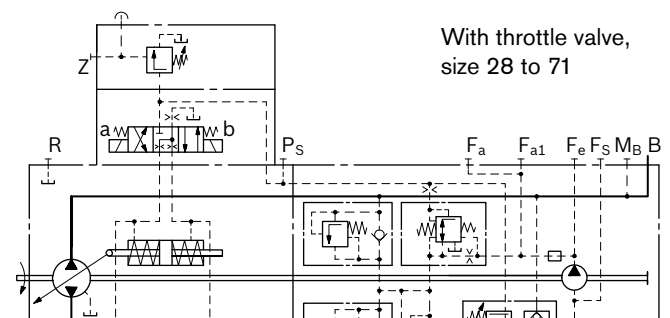
### DA1D3/DA2D3

DA control valve mechanically adjustable with position lever



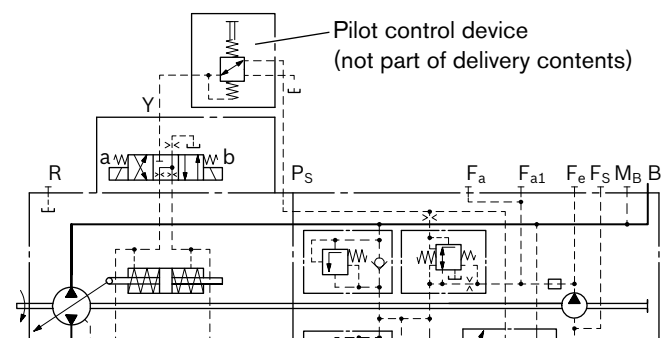
### DA1D4/DA2D4

DA control valve fixed setting, with hydraulic inch valve



### DA1D7/DA2D7

DA control valve fixed setting, with separately attached pilot control device as inch valve



1) Size 28 and 250 without port  $F_{a1}$  and  $F_S$

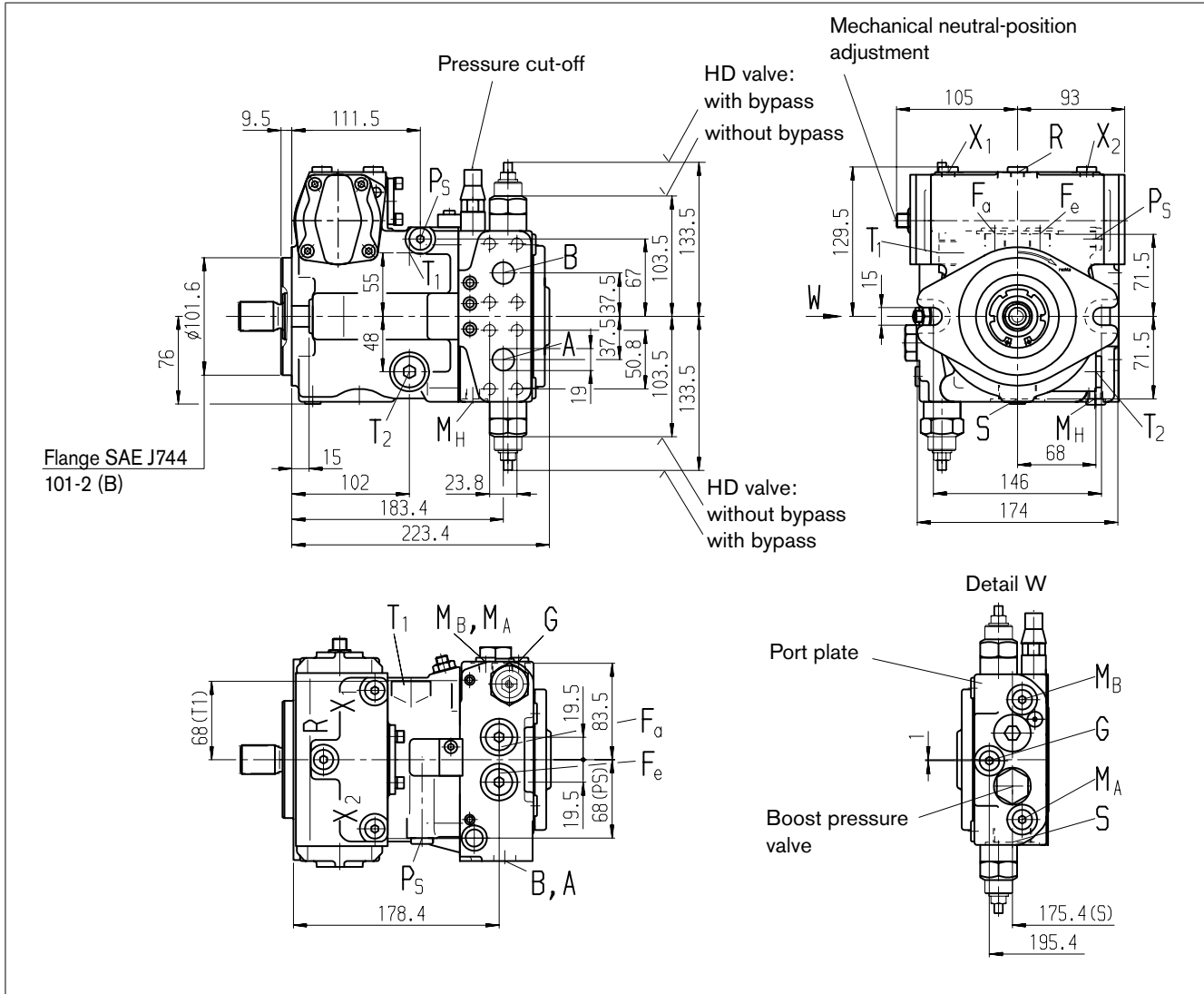
# Dimensions size 28

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

## NV – Version without control module

Standard: Suction port S at bottom (10)

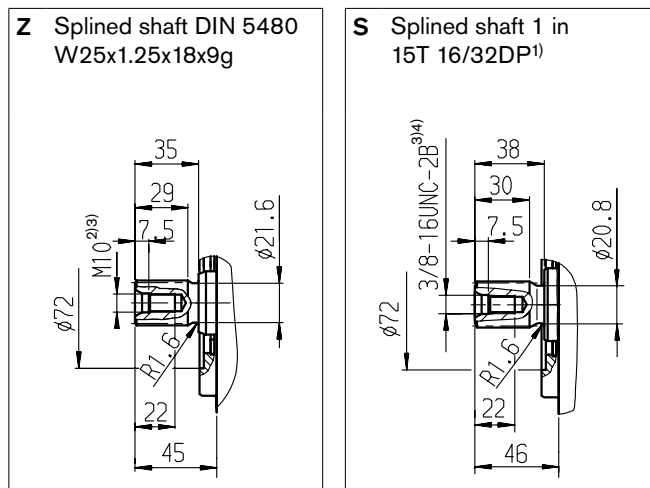
Option: Suction port S at top (13): port plate turned through 180°



# Dimensions size 28

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

## Drive shafts



## Ports

Designation	Port for	Standard	Size <sup>3)</sup>	Maximum pressure [bar] <sup>5)</sup>	State <sup>11)</sup>
A, B	Service line Fastening thread A/B	SAE J518 <sup>6)</sup> DIN 13	3/4 in M10 x 1.5; 17 deep	450	O
S	Suction line	DIN 3852 <sup>9)</sup>	M33 x 2; 18 deep	5	O <sup>7)</sup>
T <sub>1</sub>	Drain line	DIN 3852 <sup>9)</sup>	M22 x 1.5; 14 deep	3	O <sup>8)</sup>
T <sub>2</sub>	Drain line	DIN 3852 <sup>9)</sup>	M22 x 1.5; 14 deep	3	X <sup>8)</sup>
R	Air bleed	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	3	X
X <sub>1</sub> , X <sub>2</sub>	Control pressure (upstream of orifice)	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	40	X
X <sub>1</sub> , X <sub>2</sub>	Control pressure (upstream of orifice, DG only)	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	40	O
X <sub>3</sub> , X <sub>4</sub> <sup>10)</sup>	Stroking chamber pressure	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	40	X
G	Boost pressure	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	40	X
P <sub>S</sub>	Pilot pressure	DIN 3852 <sup>9)</sup>	M14 x 1.5; 12 deep	40	X
P <sub>S</sub>	Pilot pressure (DA7 only)	DIN 3852 <sup>9)</sup>	M14 x 1.5; 12 deep	40	O
Y	Pilot pressure (DA7 only)	DIN 3852 <sup>9)</sup>	M14 x 1.5; 12 deep	40	O
M <sub>A</sub> , M <sub>B</sub>	Measuring pressure A, B	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	450	X
M <sub>H</sub>	Measuring high pressure	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	450	X
F <sub>a</sub>	Boost pressure inlet	DIN 3852 <sup>9)</sup>	M18 x 1.5; 12 deep	40	X
F <sub>e</sub>	Boost pressure outlet	DIN 3852 <sup>9)</sup>	M18 x 1.5; 12 deep	40	X
Y <sub>1</sub> , Y <sub>2</sub>	Pilot signal (HD only)	DIN 3852 <sup>9)</sup>	M14 x 1.5; 12 deep	40	O
Z	Inch signal (DA4 and 8 only)	DIN 3852 <sup>9)</sup>	M10 x 1; 8 deep	40	X

1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

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

3) Observe the general instructions on page 68 for the maximum tightening torques.

4) Thread according to ASME B1.1

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

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

7) Plugged with external supply.

8) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also installation instructions on pages 65 and 66).

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

10) Optional, see page 56

11) O = Must be connected (plugged on delivery)

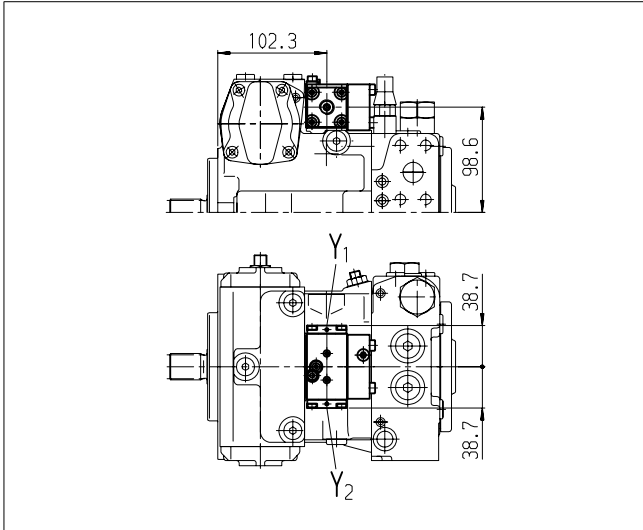
X = Plugged (in normal operation)

# Dimensions size 28

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

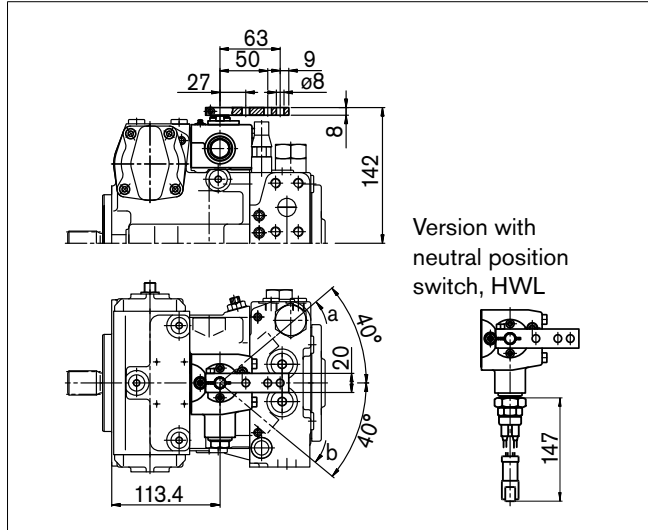
## HD

Proportional control hydraulic, pilot-pressure related



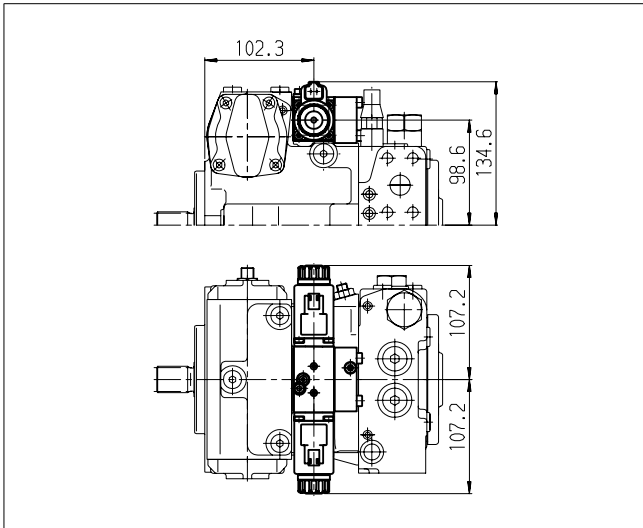
## HW

Proportional control hydraulic, mechanical servo



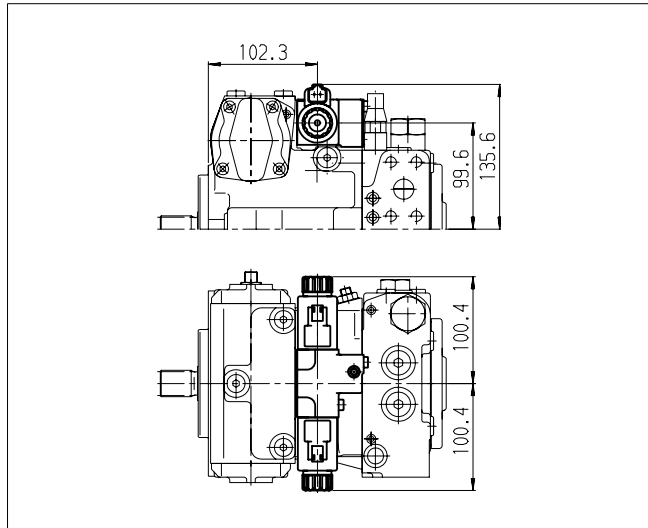
## EP

Proportional control electric



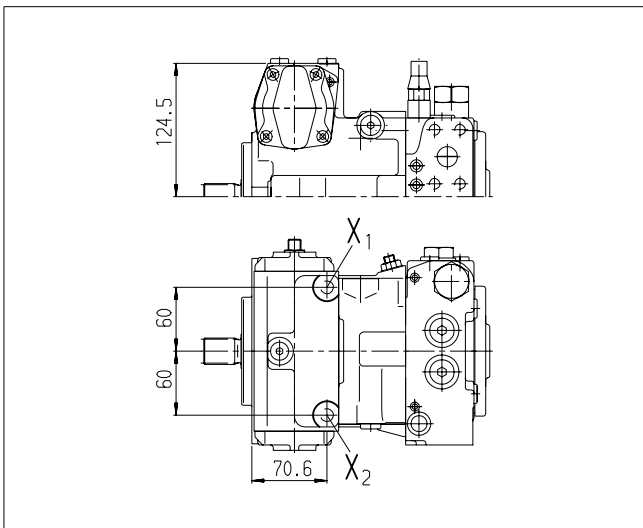
## EZ

Two-point control electric



## DG

Hydraulic control, direct controlled

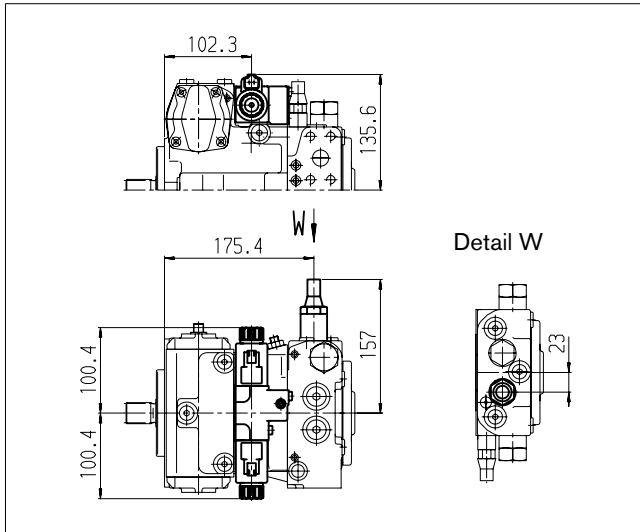


# Dimensions size 28

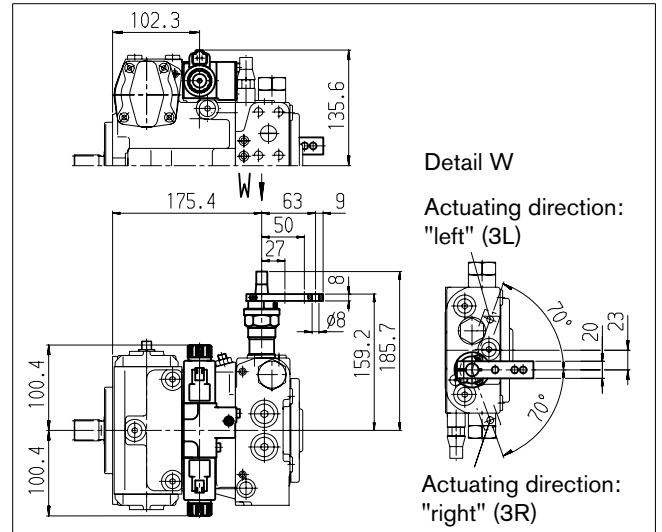
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

## DA – control valve

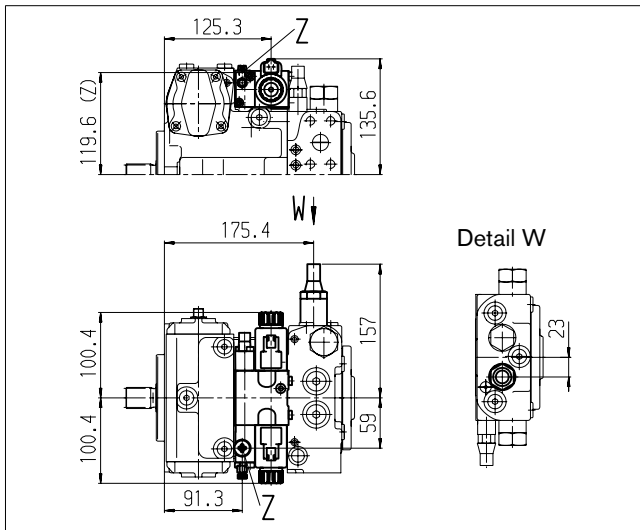
Version 2 – fixed setting



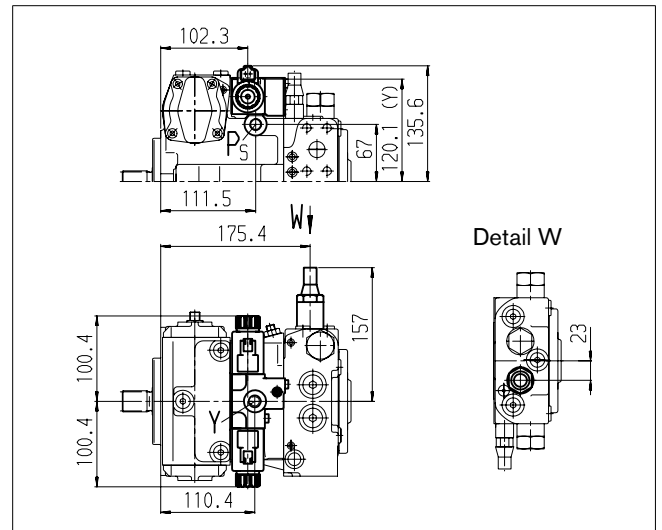
Version 3 – mechanically adjustable with position lever



Version 4/8 – fixed setting and inch valve mounted



Version 7 – fixed setting and ports for pilot control device



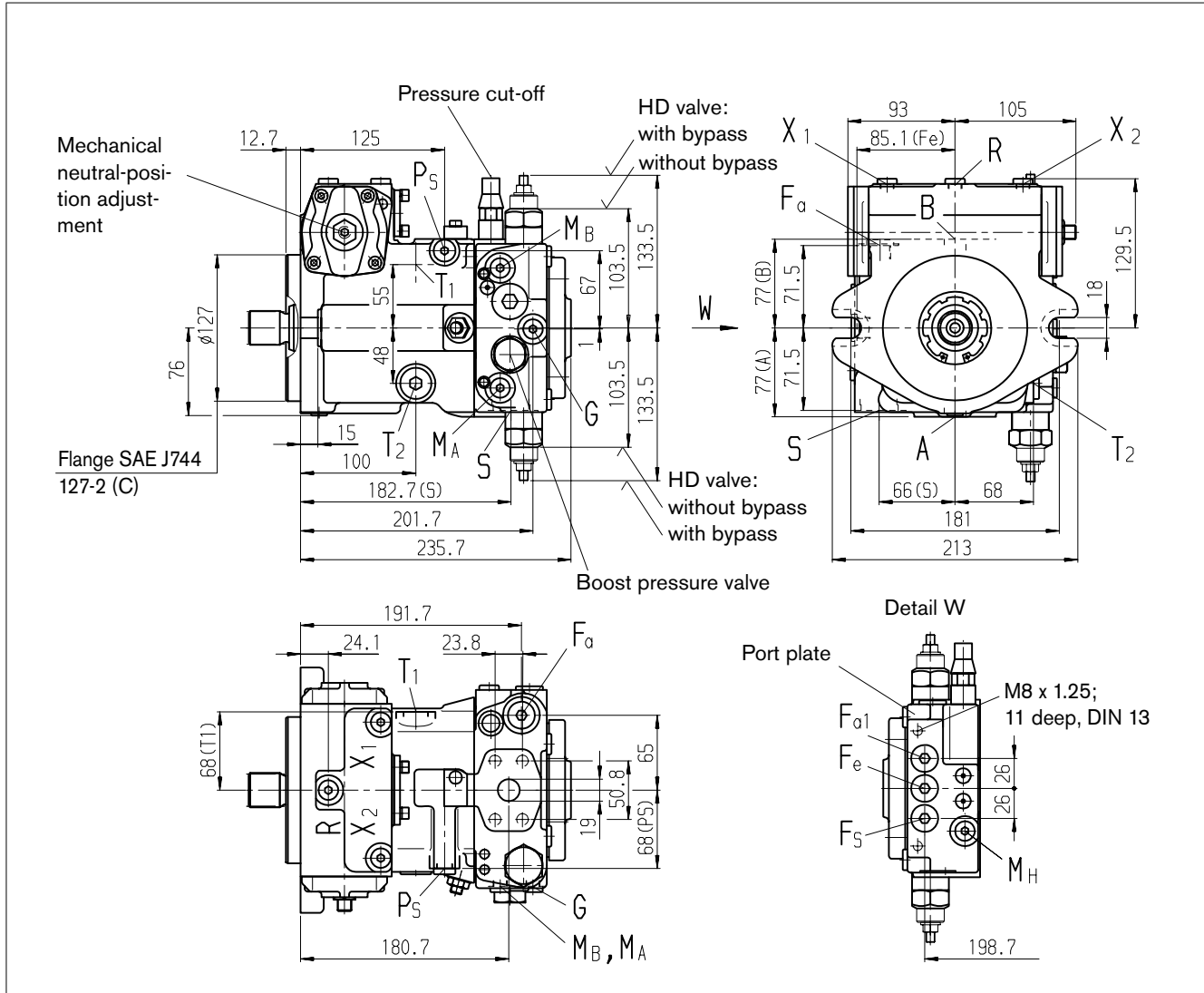
# Dimensions size 40

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

## NV – Version without control module

Standard: Suction port S at bottom (02)

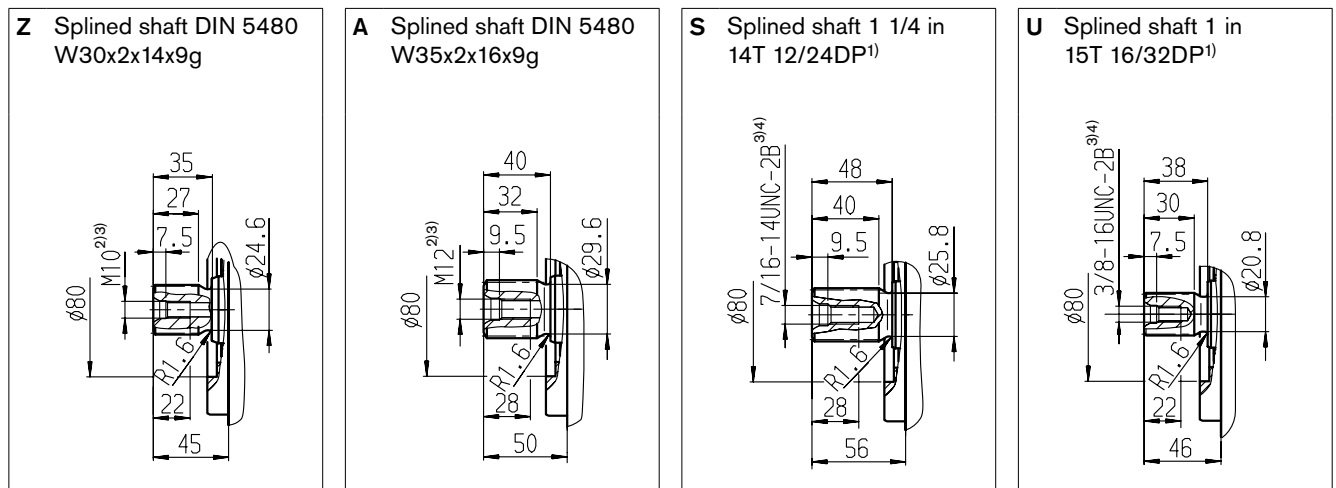
Option: Suction port S at top (03); port plate turned through 180°



# Dimensions size 40

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

## Drive shafts



## Ports

Designation	Port for	Standard	Size <sup>3)</sup>	Maximum pressure [bar] <sup>5)</sup>	State <sup>11)</sup>
A, B	Service line Fastening thread A/B	SAE J518 <sup>6)</sup> DIN 13	3/4 in M10 x 1.5; 17 deep	450	O
S	Suction line	DIN 3852 <sup>9)</sup>	M33 x 2; 18 deep	5	O <sup>7)</sup>
T <sub>1</sub>	Drain line	DIN 3852 <sup>9)</sup>	M22 x 1.5; 14 deep	3	O <sup>8)</sup>
T <sub>2</sub>	Drain line	DIN 3852 <sup>9)</sup>	M22 x 1.5; 14 deep	3	X <sup>8)</sup>
R	Air bleed	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	3	X
X <sub>1</sub> , X <sub>2</sub>	Control pressure (upstream of orifice)	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	40	X
X <sub>1</sub> , X <sub>2</sub>	Control pressure (upstream of orifice, DG only)	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	40	O
X <sub>3</sub> , X <sub>4</sub> <sup>10)</sup>	Stroking chamber pressure	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	40	X
G	Boost pressure	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	40	X
P <sub>S</sub>	Pilot pressure	DIN 3852 <sup>9)</sup>	M14 x 1.5; 12 deep	40	X
P <sub>S</sub>	Pilot pressure (DA7 only)	DIN 3852 <sup>9)</sup>	M14 x 1.5; 12 deep	40	O
Y	Pilot pressure (DA7 only)	DIN 3852 <sup>9)</sup>	M14 x 1.5; 12 deep	40	O
M <sub>A</sub> , M <sub>B</sub>	Measuring pressure A, B	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	450	X
M <sub>H</sub>	Measuring high pressure	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	450	X
F <sub>a</sub>	Boost pressure inlet	DIN 3852 <sup>9)</sup>	M18 x 1.5; 12 deep	40	X
F <sub>a1</sub>	Boost pressure, inlet (mountable filter)	DIN 3852 <sup>9)</sup>	M18 x 1.5; 12 deep	40	X
F <sub>e</sub>	Boost pressure outlet	DIN 3852 <sup>9)</sup>	M18 x 1.5; 12 deep	40	X
F <sub>S</sub>	Line from filter to suction line (cold start)	DIN 3852 <sup>9)</sup>	M18 x 1.5; 12 deep	40	X
Y <sub>1</sub> , Y <sub>2</sub>	Pilot signal (HD only)	DIN 3852 <sup>9)</sup>	M14 x 1.5; 12 deep	40	O
Z	Inch signal (DA4 and 8 only)	DIN 3852 <sup>9)</sup>	M10 x 1; 8 deep	40	X

1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

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

3) Observe the general instructions on page 68 for the maximum tightening torques.

4) Thread according to ASME B1.1

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

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

7) Plugged with external supply.

8) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also installation instructions on pages 65 and 66).

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

10) Optional, see page 56

11) O = Must be connected (plugged on delivery)

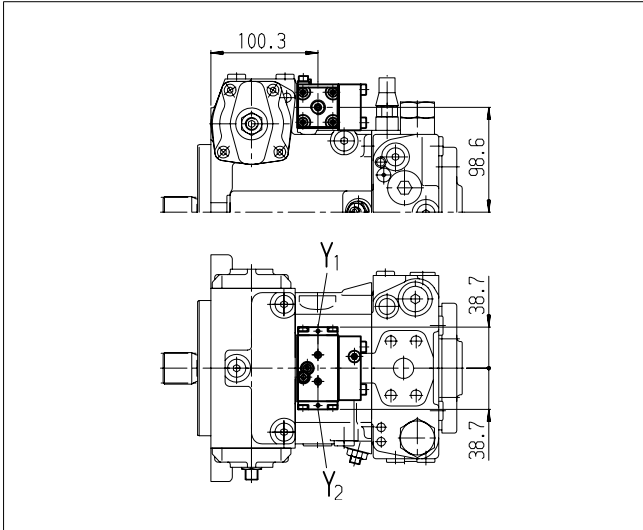
X = Plugged (in normal operation)

# Dimensions size 40

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

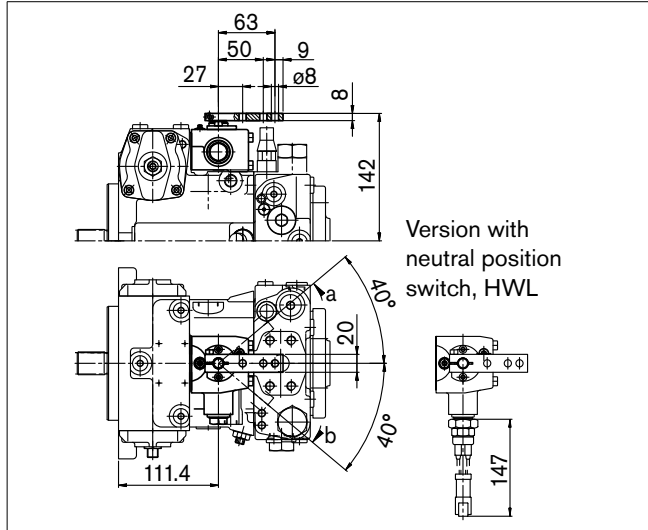
## HD

Proportional control hydraulic, pilot-pressure related



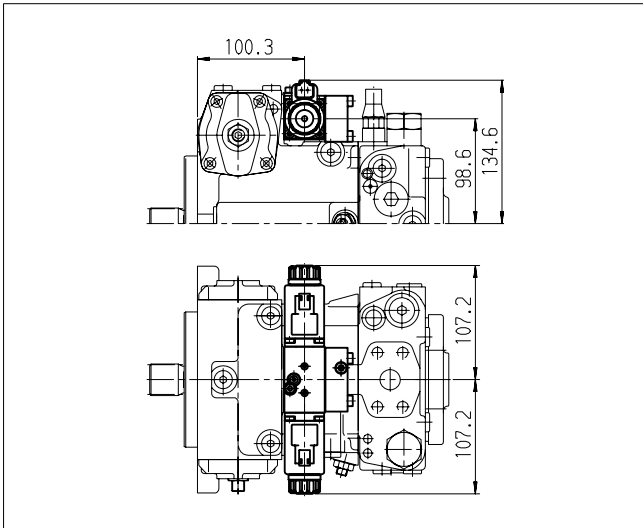
## HW

Proportional control hydraulic, mechanical servo



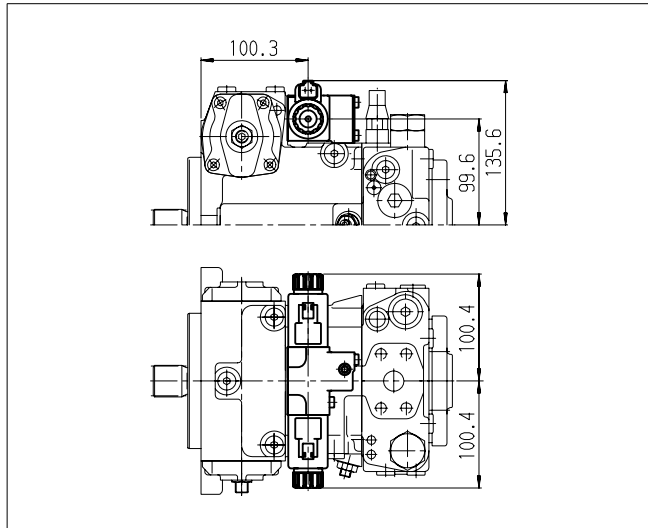
## EP

Proportional control electric



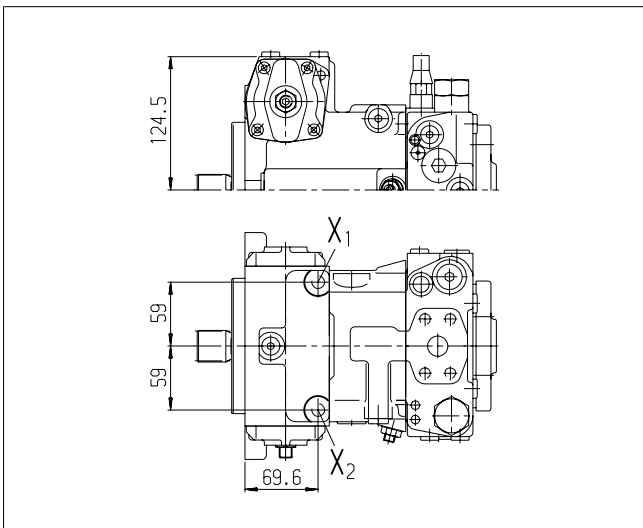
## EZ

Two-point control electric



## DG

Hydraulic control, direct controlled



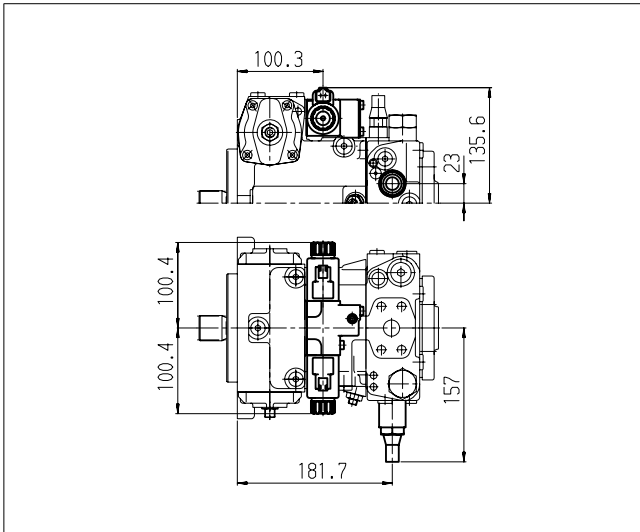


# Dimensions size 40

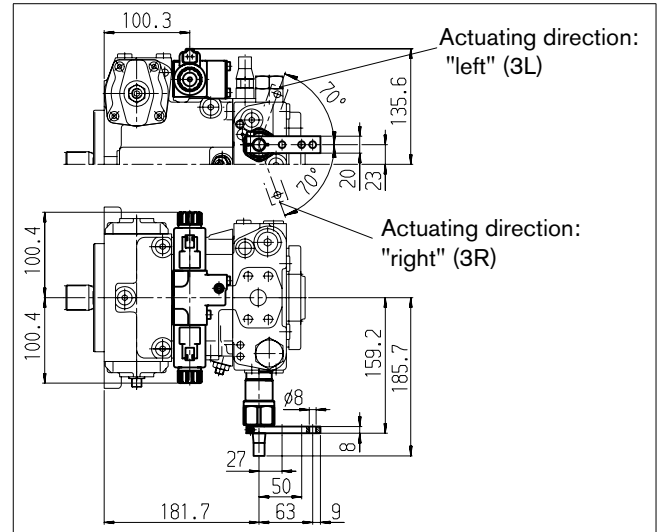
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

## DA – control valve

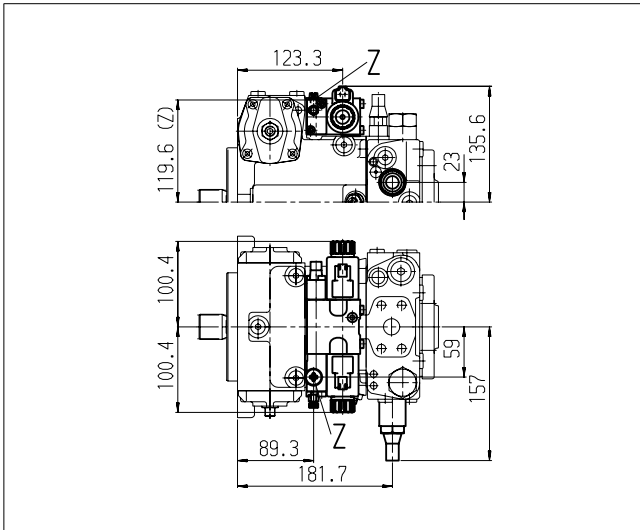
Version 2 – fixed setting



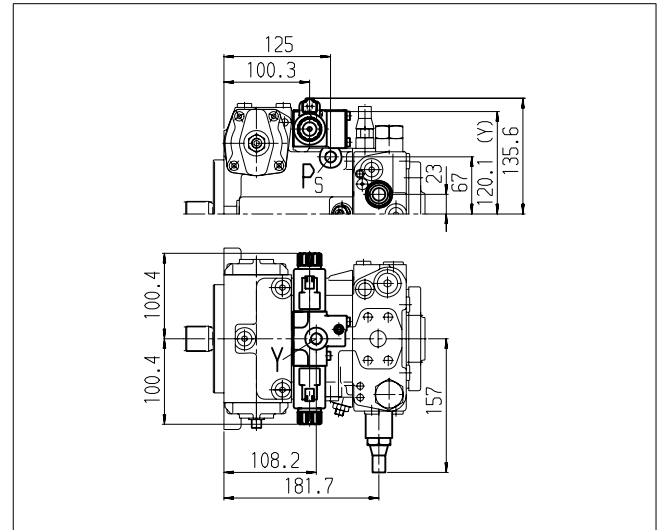
Version 3 – mechanically adjustable with position lever



Version 4/8 – fixed setting and inch valve mounted



Version 7 – fixed setting and ports for pilot control device



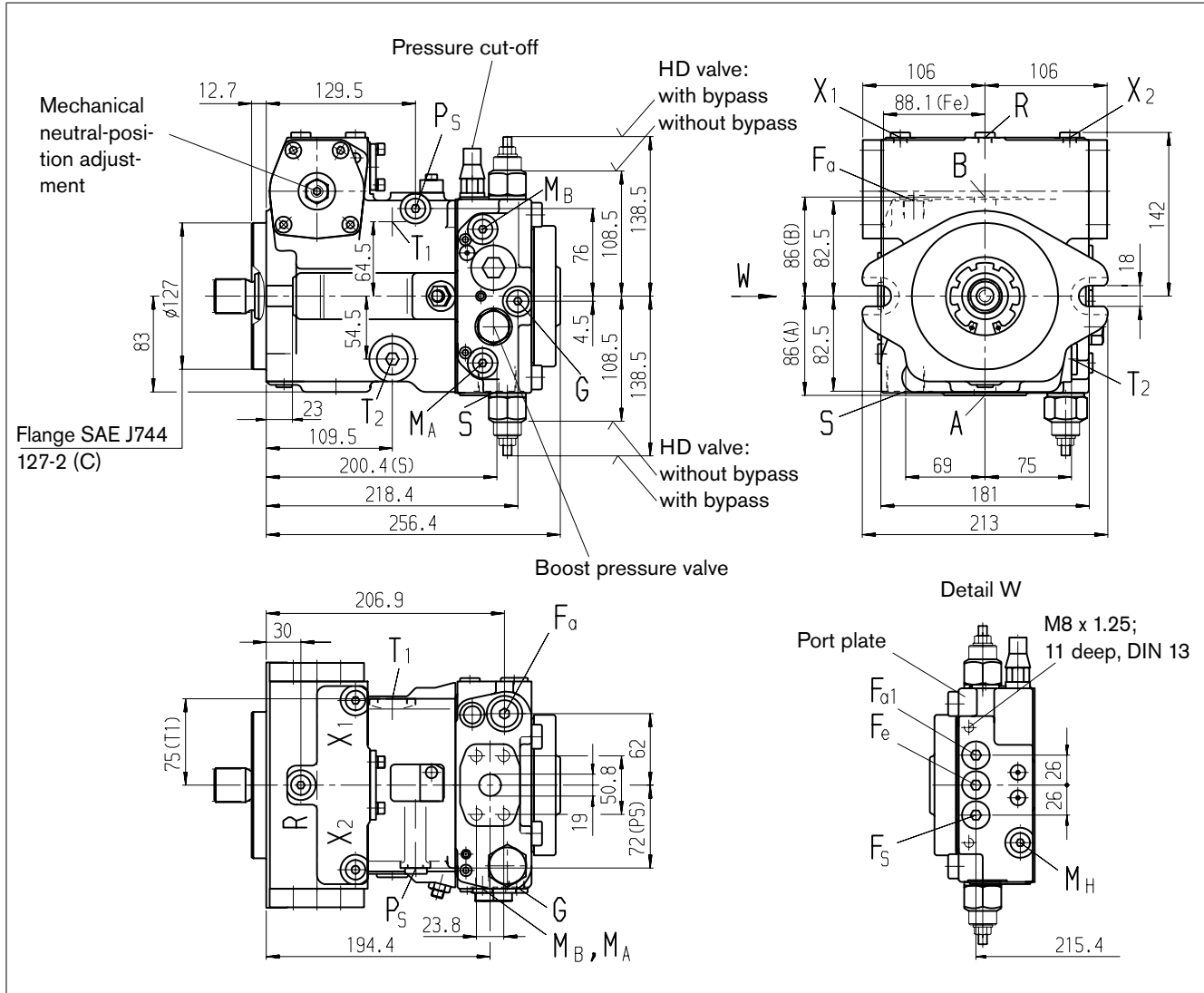
# Dimensions size 56

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

## NV – Version without control module

Standard: Suction port S at bottom (02)

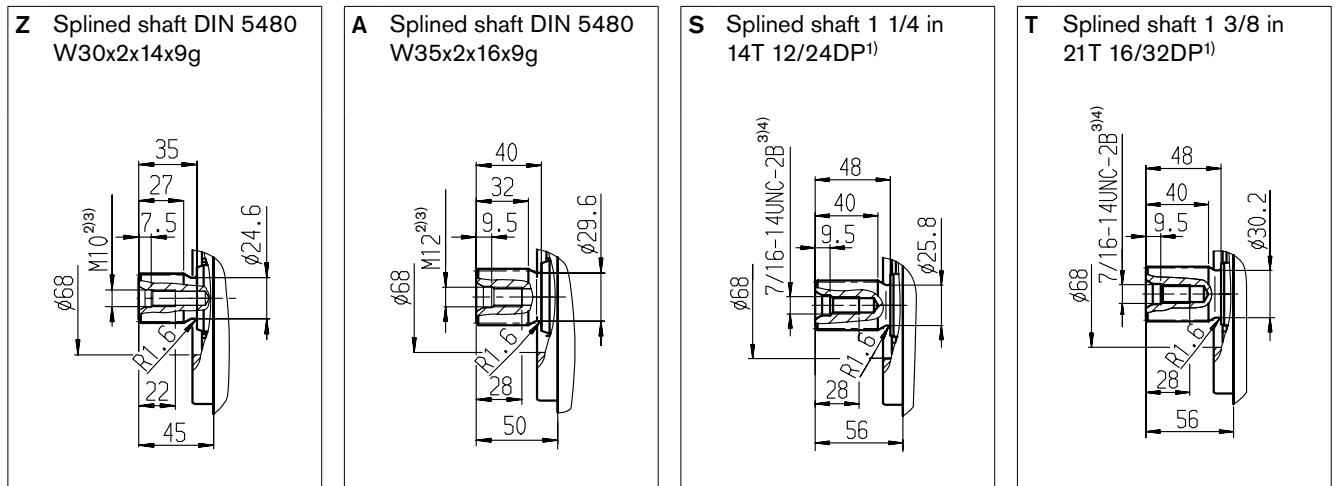
Option: Suction port S at top (03); port plate turned through 180°



# Dimensions size 56

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

## Drive shafts



## Ports

Designation	Port for	Standard	Size <sup>3)</sup>	Maximum pressure [bar] <sup>5)</sup>	State <sup>11)</sup>
A, B	Service line Fastening thread A/B	SAE J518 <sup>6)</sup> DIN 13	3/4 in M10 x 1.5; 17 deep	450	O
S	Suction line	DIN 3852 <sup>9)</sup>	M33 x 2; 18 deep	5	O <sup>7)</sup>
T <sub>1</sub>	Drain line	DIN 3852 <sup>9)</sup>	M22 x 1.5; 14 deep	3	O <sup>8)</sup>
T <sub>2</sub>	Drain line	DIN 3852 <sup>9)</sup>	M22 x 1.5; 14 deep	3	X <sup>8)</sup>
R	Air bleed	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	3	X
X <sub>1</sub> , X <sub>2</sub>	Control pressure (upstream of orifice)	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	40	X
X <sub>1</sub> , X <sub>2</sub>	Control pressure (upstream of orifice, DG only)	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	40	O
X <sub>3</sub> , X <sub>4</sub> <sup>10)</sup>	Stroking chamber pressure	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	40	X
G	Boost pressure	DIN 3852 <sup>9)</sup>	M14 x 1.5; 12 deep	40	X
P <sub>S</sub>	Pilot pressure	DIN 3852 <sup>9)</sup>	M14 x 1.5; 12 deep	40	X
P <sub>S</sub>	Pilot pressure (DA7 only)	DIN 3852 <sup>9)</sup>	M14 x 1.5; 12 deep	40	O
Y	Pilot pressure (DA7 only)	DIN 3852 <sup>9)</sup>	M14 x 1.5; 12 deep	40	O
M <sub>A</sub> , M <sub>B</sub>	Measuring pressure A, B	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	450	X
M <sub>H</sub>	Measuring high pressure	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	450	X
F <sub>a</sub>	Boost pressure inlet	DIN 3852 <sup>9)</sup>	M18 x 1.5; 12 deep	40	X
F <sub>a1</sub>	Boost pressure, inlet (mountable filter)	DIN 3852 <sup>9)</sup>	M18 x 1.5; 12 deep	40	X
F <sub>e</sub>	Boost pressure outlet	DIN 3852 <sup>9)</sup>	M18 x 1.5; 12 deep	40	X
F <sub>S</sub>	Line from filter to suction line (cold start)	DIN 3852 <sup>9)</sup>	M18 x 1.5; 12 deep	40	X
Y <sub>1</sub> , Y <sub>2</sub>	Pilot signal (HD only)	DIN 3852 <sup>9)</sup>	M14 x 1.5; 12 deep	40	O
Z	Inch signal (DA4 and 8 only)	DIN 3852 <sup>9)</sup>	M10 x 1; 8 deep	40	X

1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

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

3) Observe the general instructions on page 68 for the maximum tightening torques.

4) Thread according to ASME B1.1

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

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

7) Plugged with external supply.

8) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also installation instructions on pages 65 and 66).

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

10) Optional, see page 56

11) O = Must be connected (plugged on delivery)

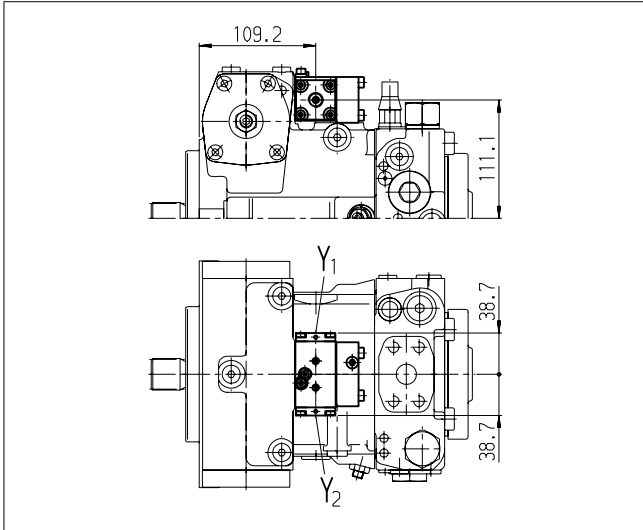
X = Plugged (in normal operation)

# Dimensions size 56

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

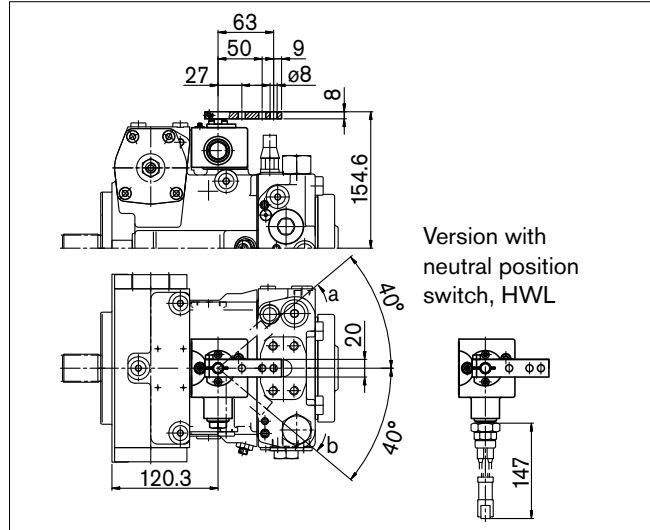
## HD

Proportional control hydraulic, pilot-pressure related



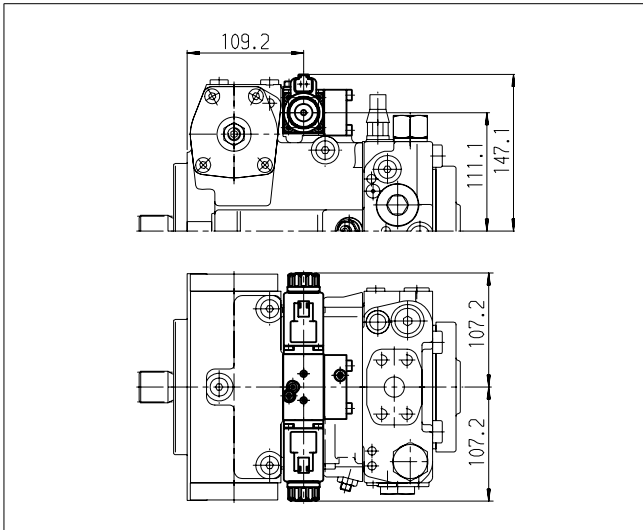
## HW

Proportional control hydraulic, mechanical servo



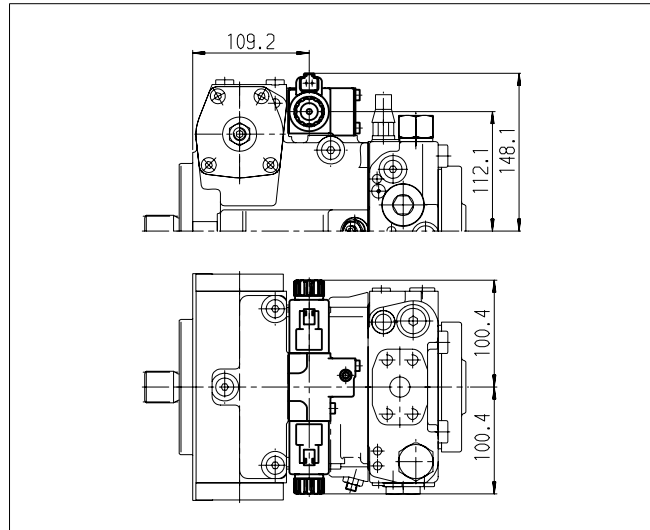
## EP

Proportional control electric



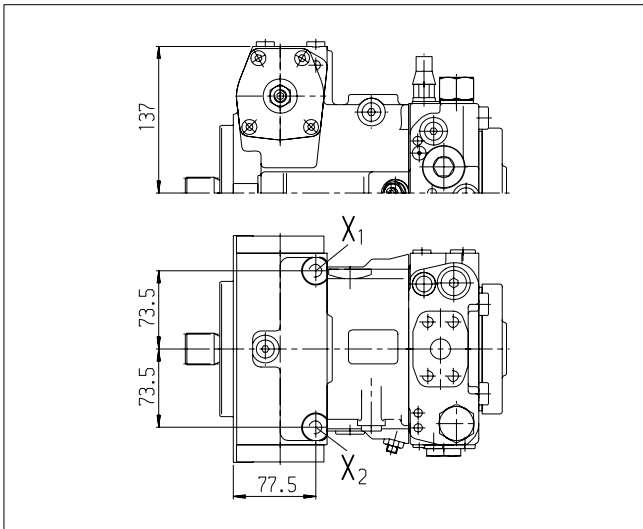
## EZ

Two-point control electric



## DG

Hydraulic control, direct controlled

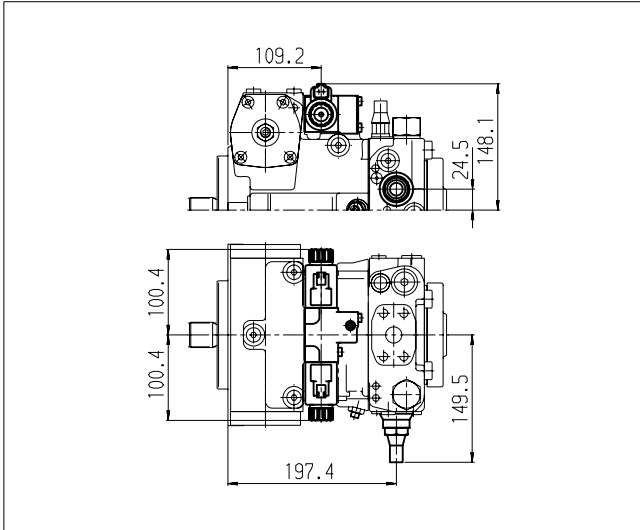


# Dimensions size 56

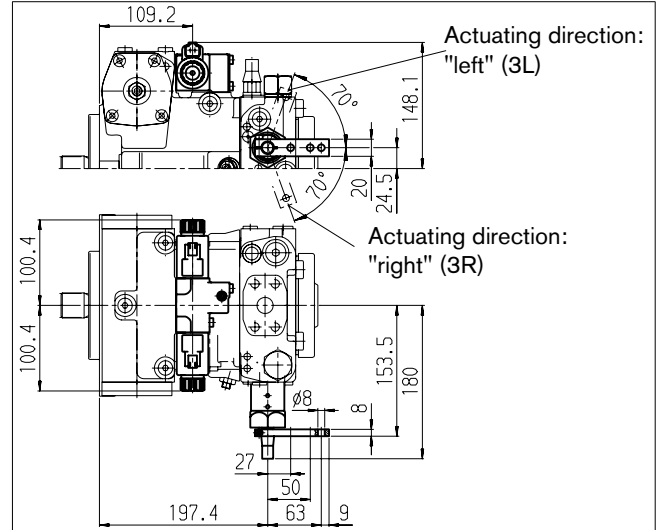
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

## DA – control valve

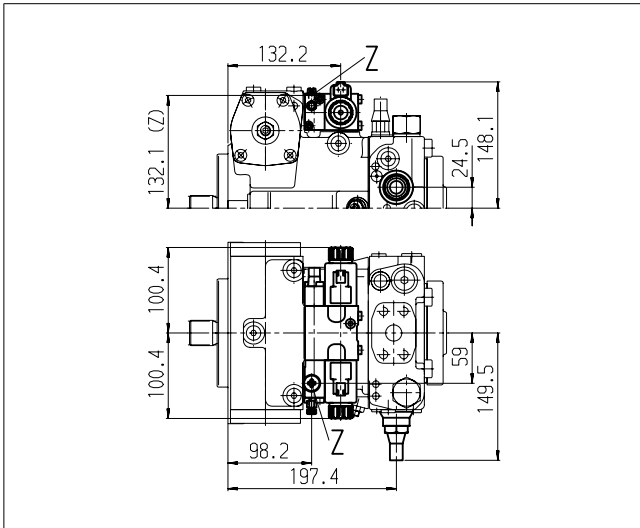
Version 2 – fixed setting



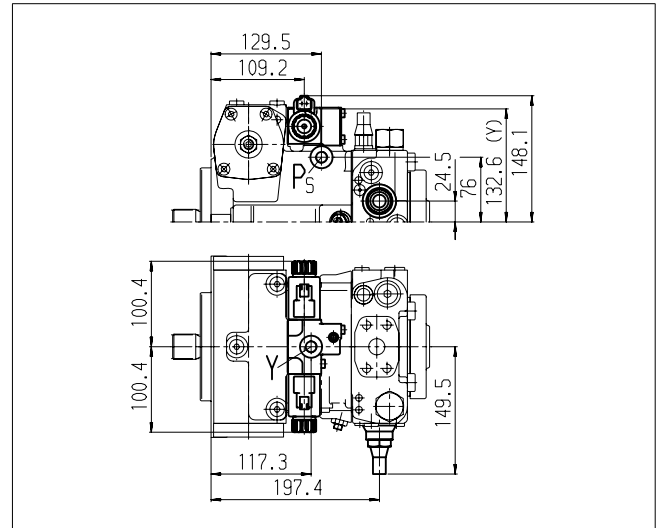
Version 3 – mechanically adjustable with position lever



Version 4/8 – fixed setting and inch valve mounted



Version 7 – fixed setting and ports for pilot control device

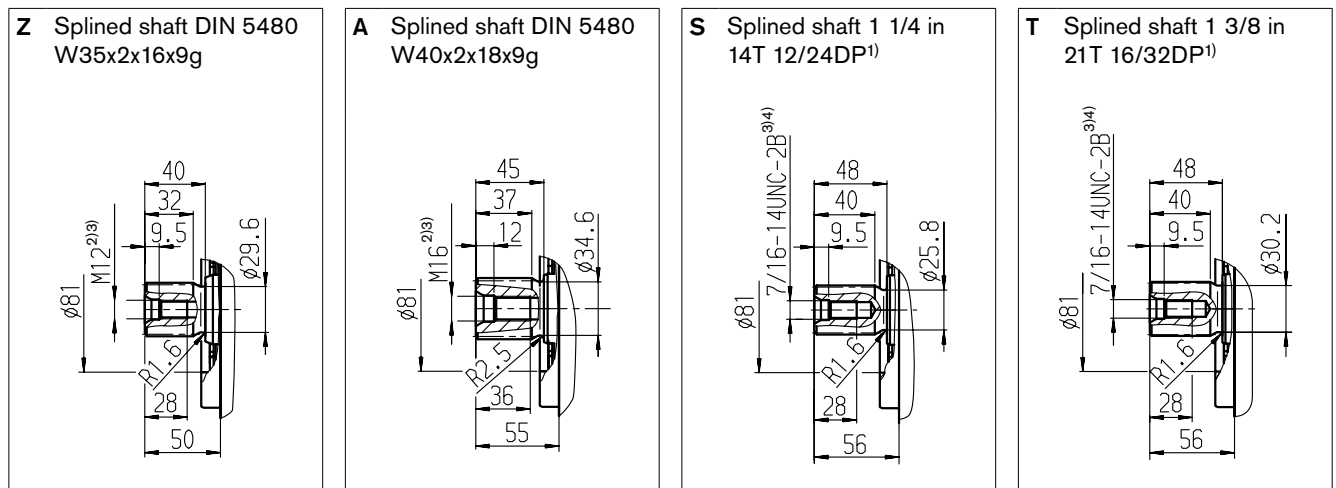




# Dimensions size 71

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

## Drive shafts



## Ports

Designation	Port for	Standard	Size <sup>3)</sup>	Maximum pressure [bar] <sup>5)</sup>	State <sup>11)</sup>
A, B	Service line Fastening thread A/B	SAE J518 <sup>6)</sup> DIN 13	1 in M12 x 1.75; 17 deep	450	O
S	Suction line	DIN 3852 <sup>9)</sup>	M42 x 2; 20 deep	5	O <sup>7)</sup>
T <sub>1</sub>	Drain line	DIN 3852 <sup>9)</sup>	M26 x 1.5; 16 deep	3	O <sup>8)</sup>
T <sub>2</sub>	Drain line	DIN 3852 <sup>9)</sup>	M26 x 1.5; 16 deep	3	X <sup>8)</sup>
R	Air bleed	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	3	X
X <sub>1</sub> , X <sub>2</sub>	Control pressure (upstream of orifice)	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	40	X
X <sub>1</sub> , X <sub>2</sub>	Control pressure (upstream of orifice, DG only)	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	40	O
X <sub>3</sub> , X <sub>4</sub> <sup>10)</sup>	Stroking chamber pressure	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	40	X
G	Boost pressure	DIN 3852 <sup>9)</sup>	M18 x 1.5; 12 deep	40	X
P <sub>S</sub>	Pilot pressure	DIN 3852 <sup>9)</sup>	M14 x 1.5; 12 deep	40	X
P <sub>S</sub>	Pilot pressure (DA7 only)	DIN 3852 <sup>9)</sup>	M14 x 1.5; 12 deep	40	O
Y	Pilot pressure (DA7 only)	DIN 3852 <sup>9)</sup>	M14 x 1.5; 12 deep	40	O
M <sub>A</sub> , M <sub>B</sub>	Measuring pressure A, B	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	450	X
M <sub>H</sub>	Measuring high pressure	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	450	X
F <sub>a</sub>	Boost pressure inlet	DIN 3852 <sup>9)</sup>	M26 x 1.5; 16 deep	40	X
F <sub>a1</sub>	Boost pressure, inlet (mountable filter)	DIN 3852 <sup>9)</sup>	M22 x 1.5; 14 deep	40	X
F <sub>e</sub>	Boost pressure outlet	DIN 3852 <sup>9)</sup>	M22 x 1.5; 14 deep	40	X
F <sub>S</sub>	Line from filter to suction line (cold start)	DIN 3852 <sup>9)</sup>	M22 x 1.5; 14 deep	40	X
Y <sub>1</sub> , Y <sub>2</sub>	Pilot signal (HD only)	DIN 3852 <sup>9)</sup>	M14 x 1.5; 8 deep	40	O
Z	Inch signal (DA4 and 8 only)	DIN 3852 <sup>9)</sup>	M10 x 1; 12 deep	40	X

1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

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

3) Observe the general instructions on page 68 for the maximum tightening torques.

4) Thread according to ASME B1.1

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

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

7) Plugged with external supply.

8) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also installation instructions on pages 65 and 66).

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

10) Optional, see page 56

11) O = Must be connected (plugged on delivery)

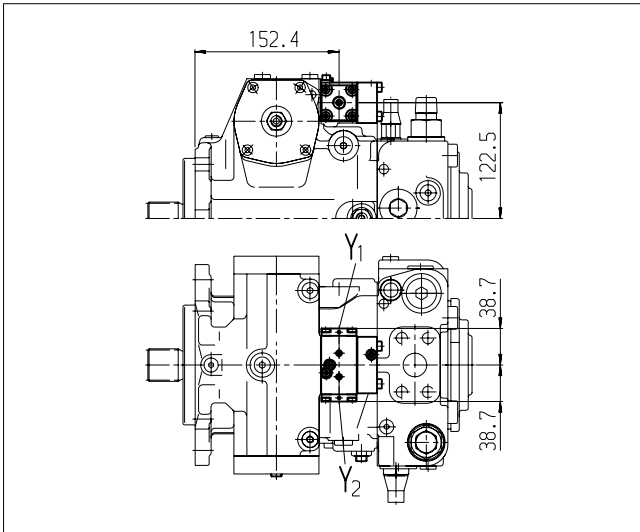
X = Plugged (in normal operation)

# Dimensions size 71

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

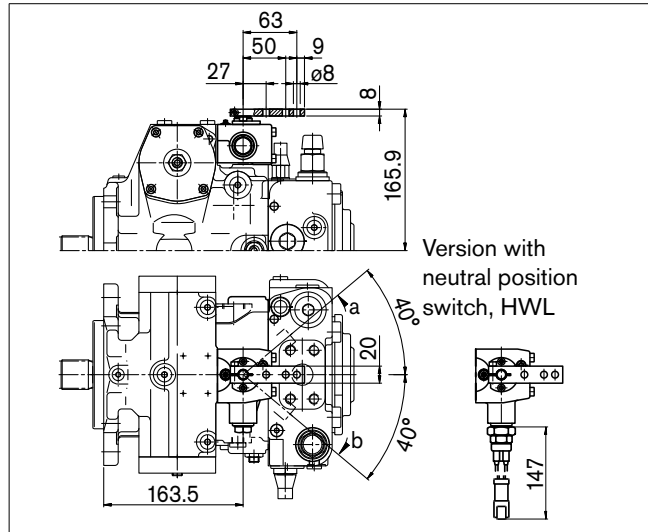
## HD

Proportional control hydraulic, pilot-pressure related



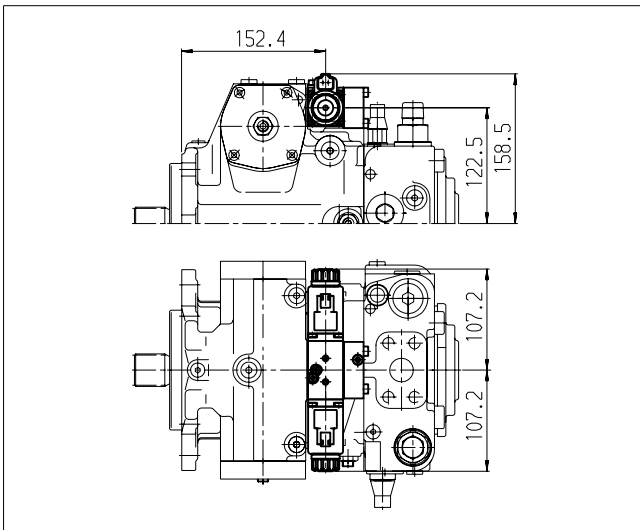
## HW

Proportional control hydraulic, mechanical servo



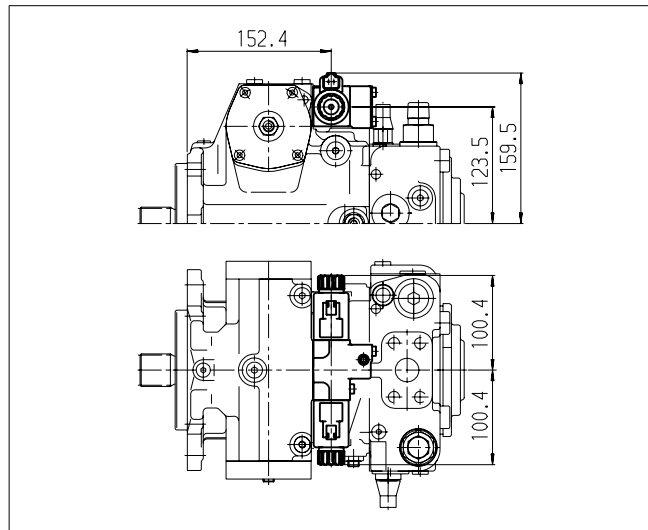
## EP

Proportional control electric



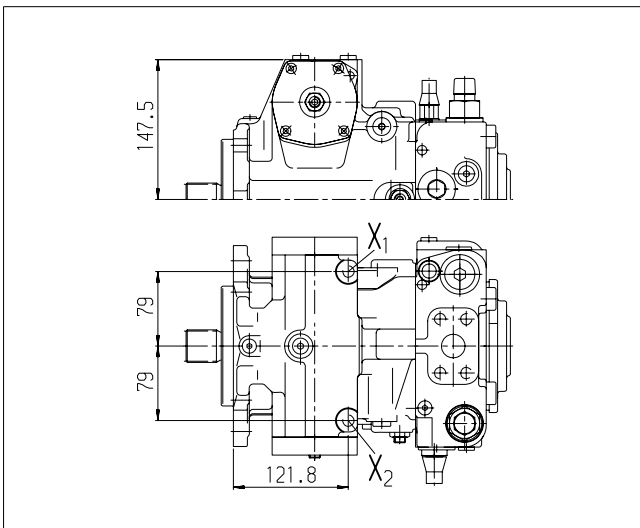
## EZ

Two-point control electric



## DG

Hydraulic control, direct controlled



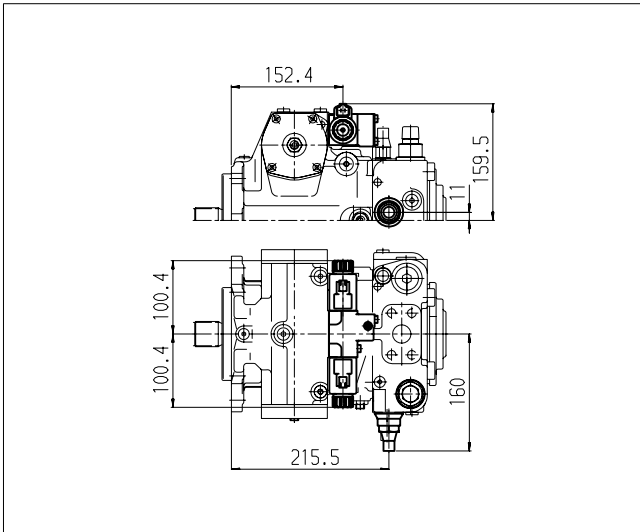


# Dimensions size 71

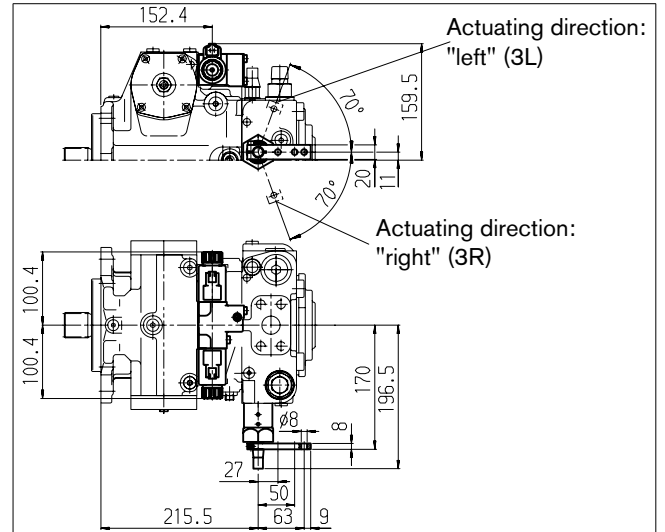
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

## DA – control valve

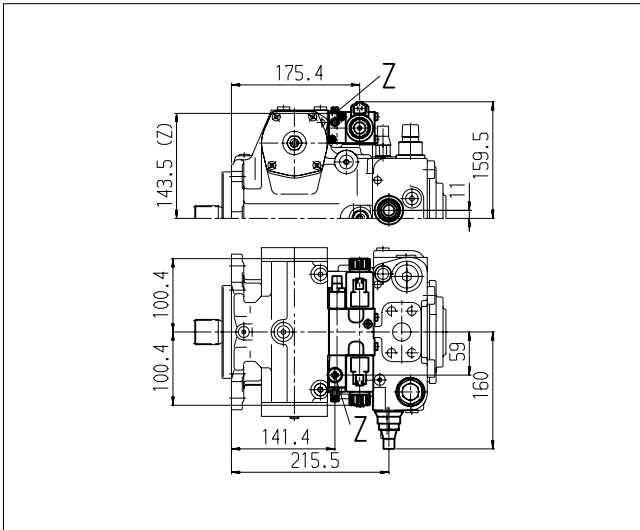
Version 2 – fixed setting



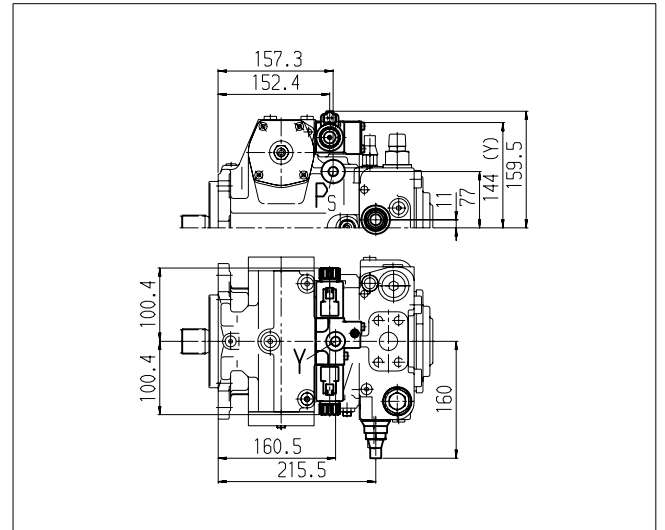
Version 3 – mechanically adjustable with position lever



Version 4/8 – fixed setting and inch valve mounted



Version 7 – fixed setting and ports for pilot control device



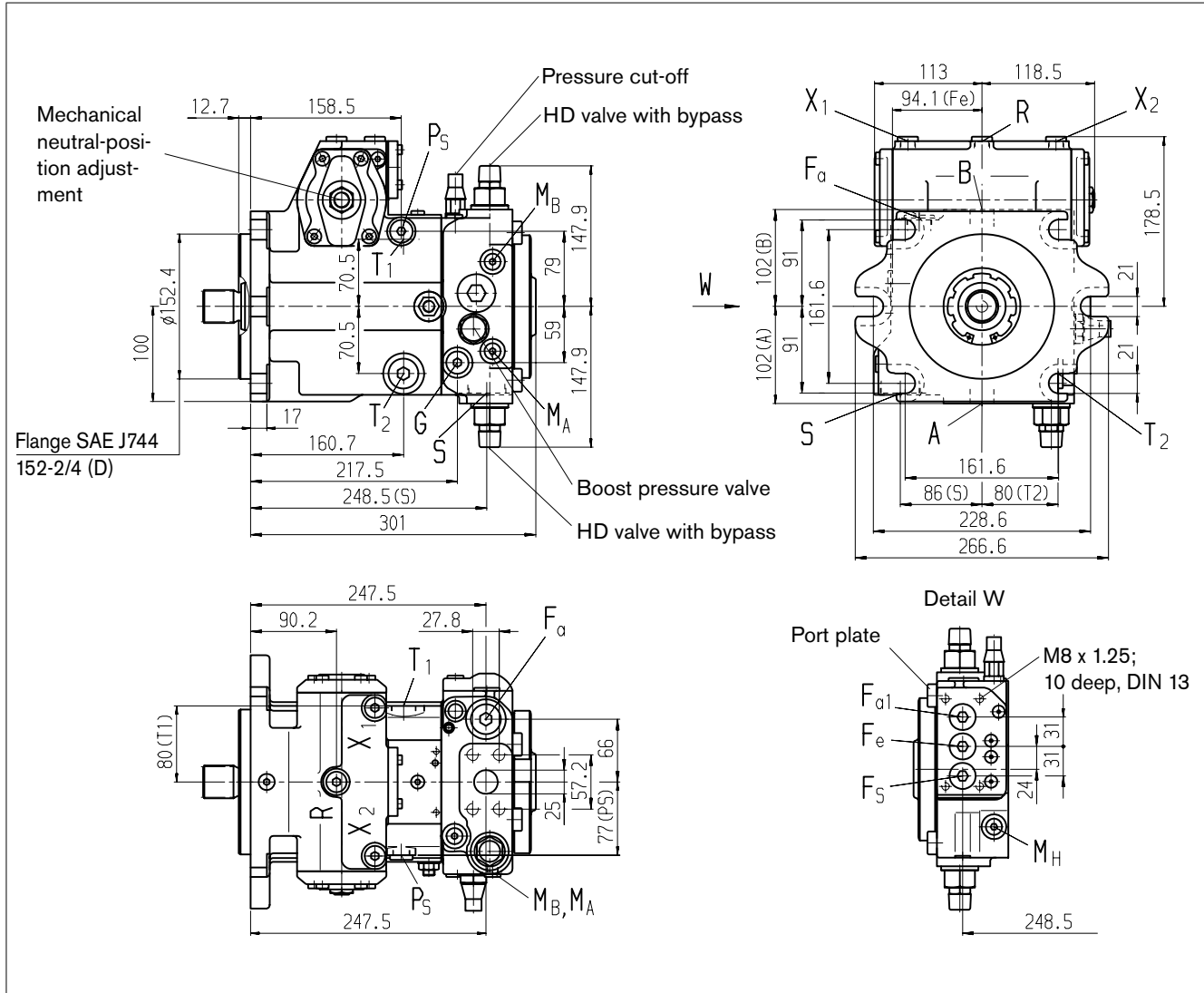
# Dimensions size 90

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

## NV – Version without control module

Standard: Suction port S at bottom (02)

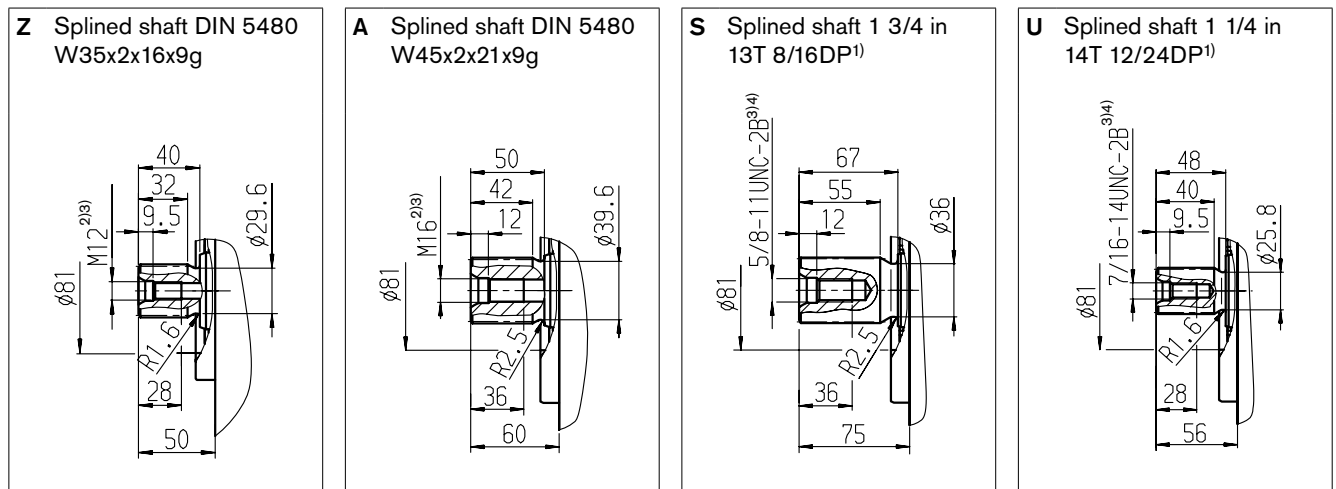
Option: Suction port S at top (03); port plate turned through 180°



# Dimensions size 90

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

## Drive shafts



## Ports

Designation	Port for	Standard	Size <sup>3)</sup>	Maximum pressure [bar] <sup>5)</sup>	State <sup>11)</sup>
A, B	Service line Fastening thread A/B	SAE J518 <sup>6)</sup> DIN 13	1 in M12 x 1.75; 17 deep	450	O
S	Suction line	DIN 3852 <sup>9)</sup>	M42 x 2; 20 deep	5	O <sup>7)</sup>
T <sub>1</sub>	Drain line	DIN 3852 <sup>9)</sup>	M26 x 1.5; 16 deep	3	O <sup>8)</sup>
T <sub>2</sub>	Drain line	DIN 3852 <sup>9)</sup>	M26 x 1.5; 16 deep	3	X <sup>8)</sup>
R	Air bleed	DIN 3852 <sup>9)</sup>	M16 x 1.5; 12 deep	3	X
X <sub>1</sub> , X <sub>2</sub>	Control pressure (upstream of orifice)	DIN 3852 <sup>9)</sup>	M16 x 1.5; 12 deep	40	X
X <sub>1</sub> , X <sub>2</sub>	Control pressure (upstream of orifice, DG only)	DIN 3852 <sup>9)</sup>	M16 x 1.5; 12 deep	40	O
X <sub>3</sub> , X <sub>4</sub> <sup>10)</sup>	Stroking chamber pressure	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	40	X
G	Boost pressure	DIN 3852 <sup>9)</sup>	M18 x 1.5; 12 deep	40	X
P <sub>S</sub>	Pilot pressure	DIN 3852 <sup>9)</sup>	M18 x 1.5; 12 deep	40	X
P <sub>S</sub>	Pilot pressure (DA7 only)	DIN 3852 <sup>9)</sup>	M18 x 1.5; 12 deep	40	O
Y	Pilot pressure (DA7 only)	DIN 3852 <sup>9)</sup>	M18 x 1.5; 12 deep	40	O
M <sub>A</sub> , M <sub>B</sub>	Measuring pressure A, B	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	450	X
M <sub>H</sub>	Measuring high pressure	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	450	X
F <sub>a</sub>	Boost pressure inlet	DIN 3852 <sup>9)</sup>	M26 x 1.5; 16 deep	40	X
F <sub>a1</sub>	Boost pressure, inlet (mountable filter)	DIN 3852 <sup>9)</sup>	M22 x 1.5; 14 deep	40	X
F <sub>e</sub>	Boost pressure outlet	DIN 3852 <sup>9)</sup>	M22 x 1.5; 14 deep	40	X
F <sub>S</sub>	Line from filter to suction line (cold start)	DIN 3852 <sup>9)</sup>	M22 x 1.5; 14 deep	40	X
Y <sub>1</sub> , Y <sub>2</sub>	Pilot signal (HD only)	DIN 3852 <sup>9)</sup>	M14 x 1.5; 12 deep	40	O
Z	Inch signal (DA4 and 8 only)	DIN 3852 <sup>9)</sup>	M10 x 1; 8 deep	40	X

1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

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

3) Observe the general instructions on page 68 for the maximum tightening torques.

4) Thread according to ASME B1.1

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

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

7) Plugged with external supply.

8) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also installation instructions on pages 65 and 66).

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

10) Optional, see page 56

11) O = Must be connected (plugged on delivery)

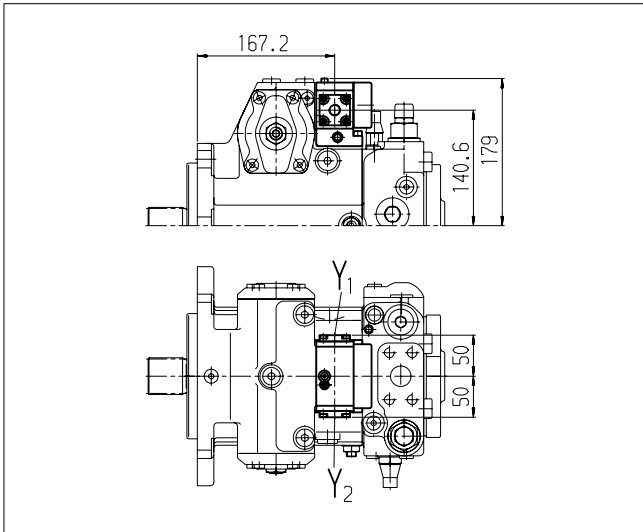
X = Plugged (in normal operation)

# Dimensions size 90

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

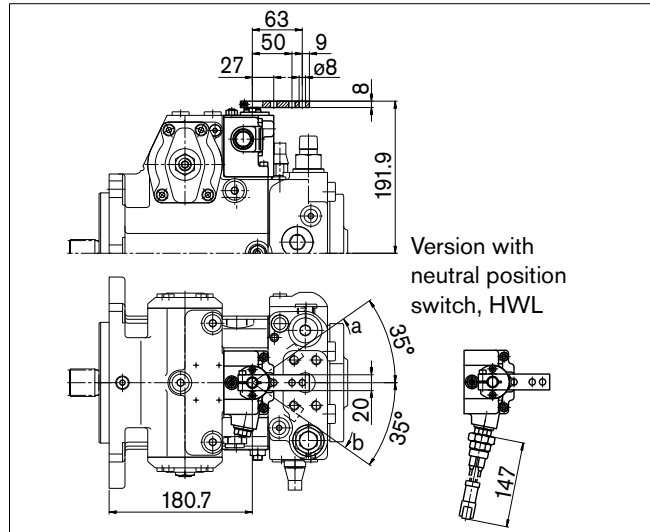
## HD

Proportional control hydraulic, pilot-pressure related



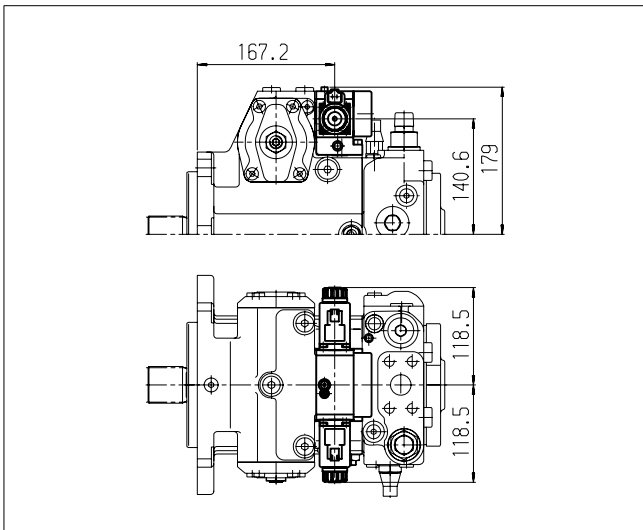
## HW

Proportional control hydraulic, mechanical servo



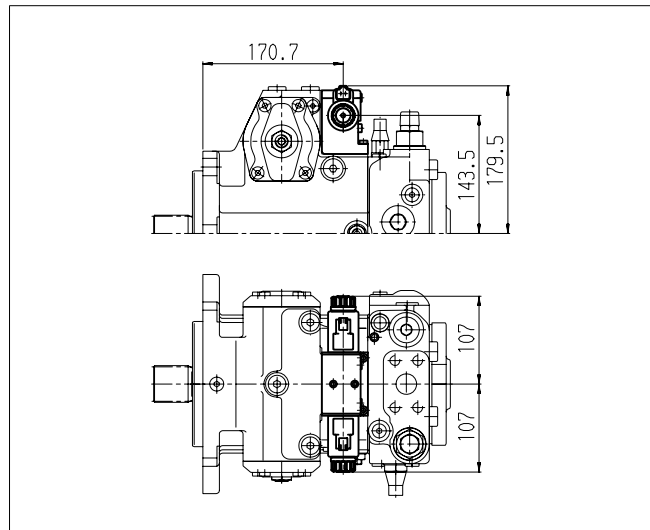
## EP

Proportional control electric



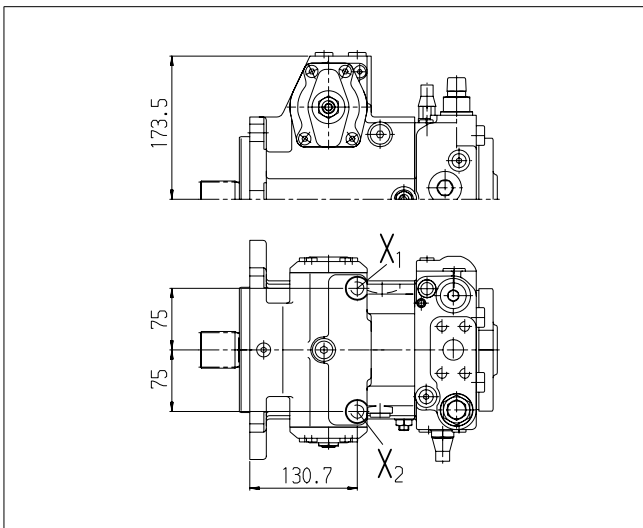
## EZ

Two-point control electric



## DG

Hydraulic control, direct controlled

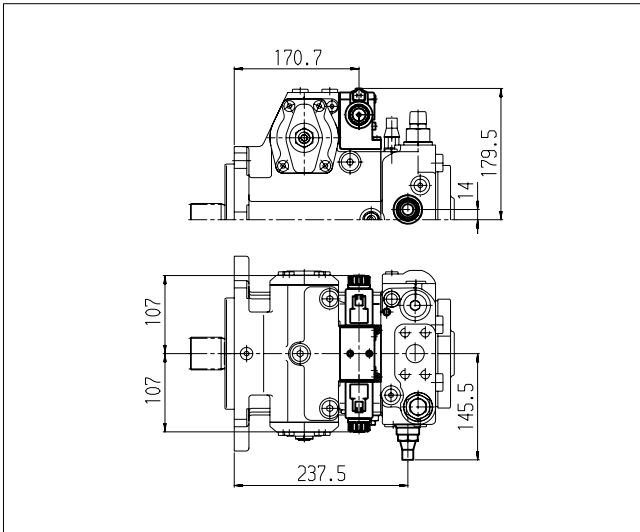


# Dimensions size 90

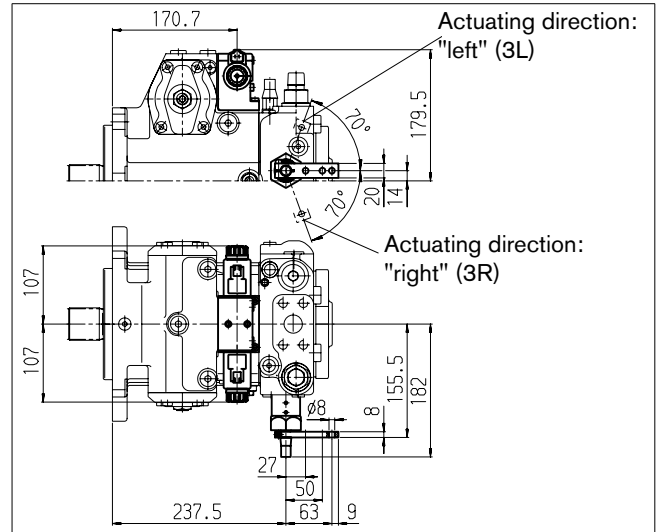
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

## DA – control valve

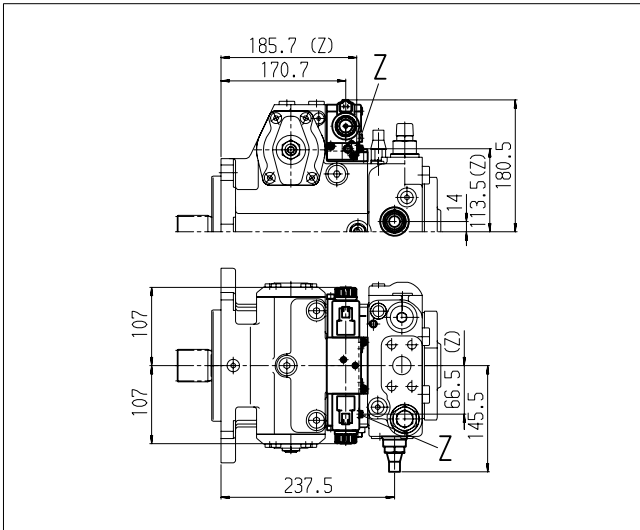
Version 2 – fixed setting



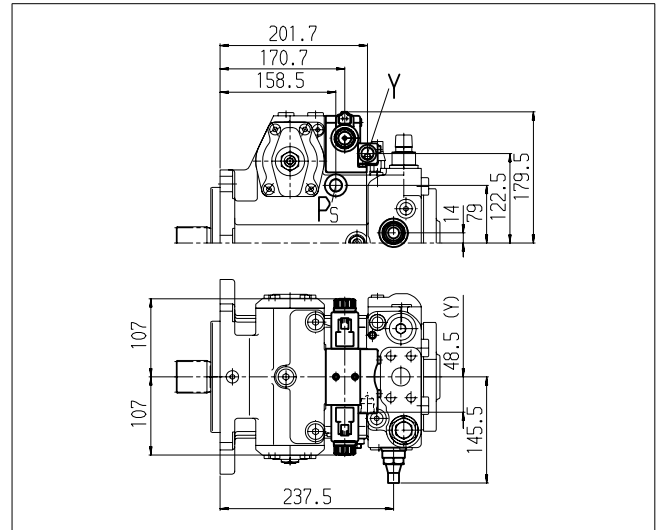
Version 3 – mechanically adjustable with position lever



Version 4/8 – fixed setting and inch valve mounted



Version 7 – fixed setting and ports for pilot control device



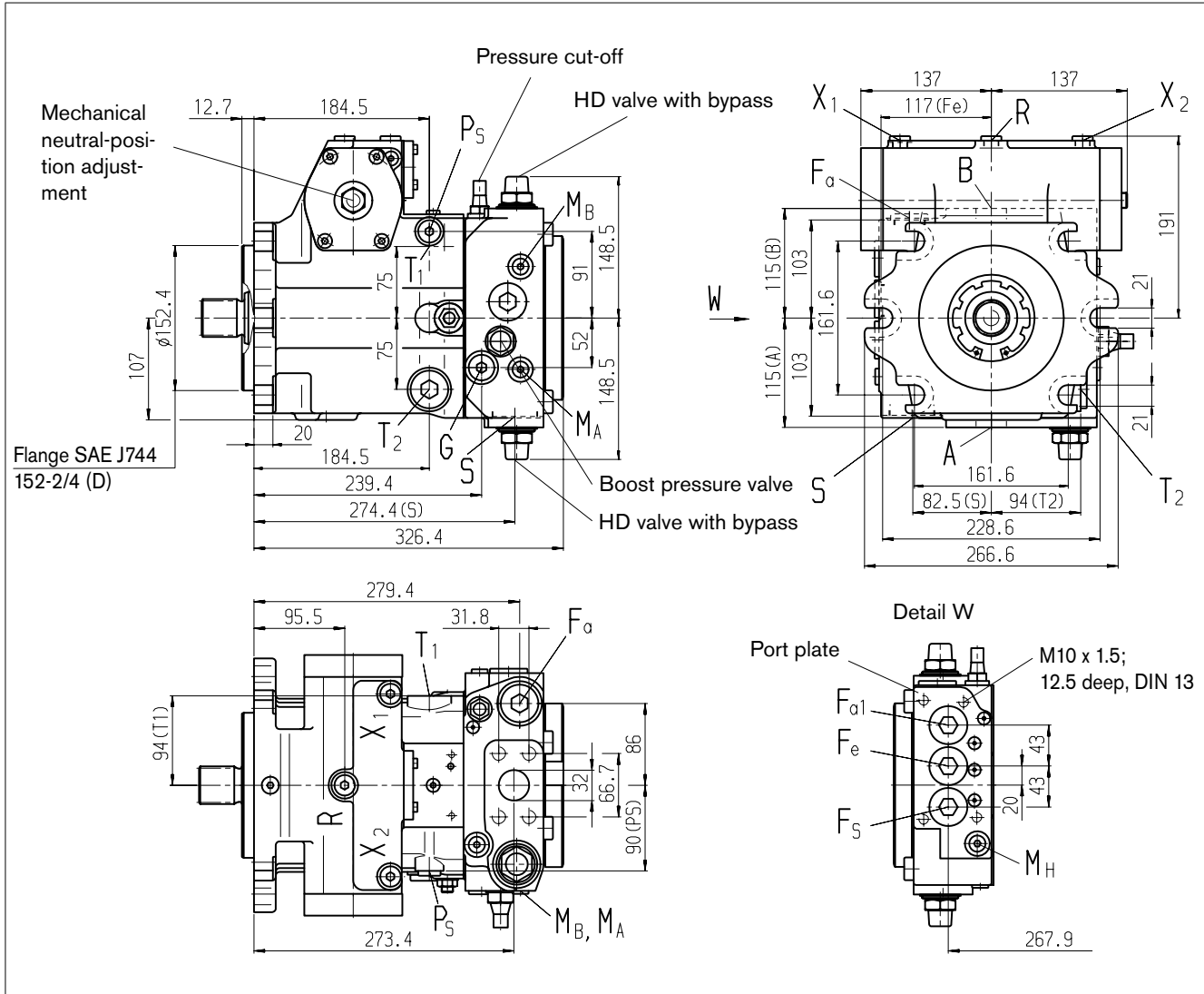
# Dimensions size 125

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

## NV – Version without control module

Standard: Suction port S at bottom (02)

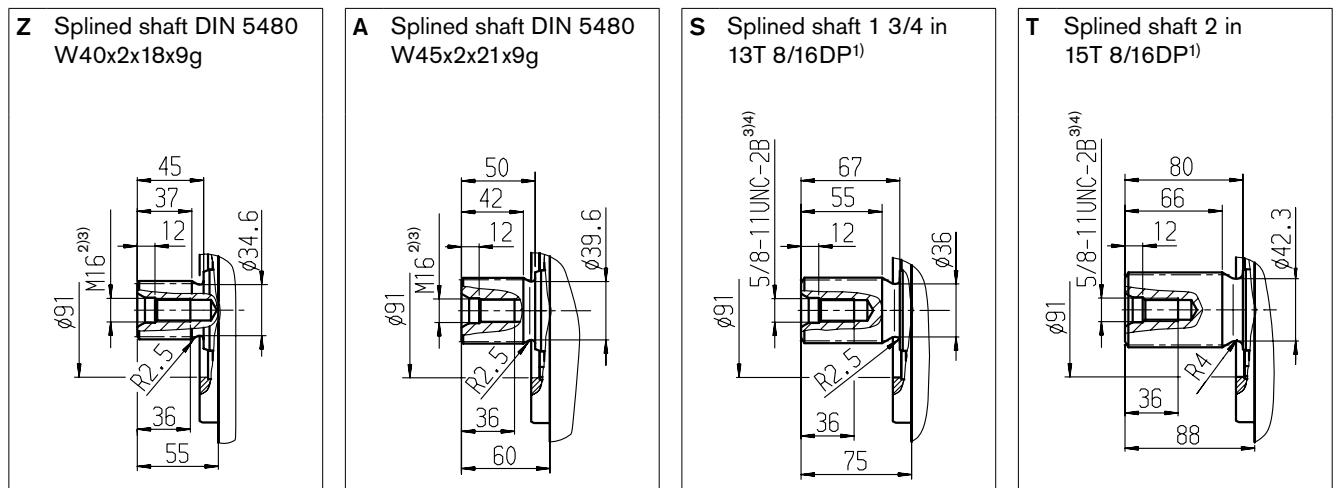
Option: Suction port S at top (03); port plate turned through 180°



# Dimensions size 125

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

## Drive shafts



## Ports

Designation	Port for	Standard	Size <sup>3)</sup>	Maximum pressure [bar] <sup>5)</sup>	State <sup>11)</sup>
A, B	Service line Fastening thread A/B	SAE J518 <sup>6)</sup> DIN 13	1 1/4 in M14 x 2; 19 deep	450	O
S	Suction line	DIN 3852 <sup>9)</sup>	M48 x 2; 22 deep	5	O <sup>7)</sup>
T <sub>1</sub>	Drain line	DIN 3852 <sup>9)</sup>	M33 x 2; 18 deep	3	O <sup>8)</sup>
T <sub>2</sub>	Drain line	DIN 3852 <sup>9)</sup>	M33 x 2; 18 deep	3	X <sup>8)</sup>
R	Air bleed	DIN 3852 <sup>9)</sup>	M16 x 1.5; 12 deep	3	X
X <sub>1</sub> , X <sub>2</sub>	Control pressure (upstream of orifice)	DIN 3852 <sup>9)</sup>	M16 x 1.5; 12 deep	40	X
X <sub>1</sub> , X <sub>2</sub>	Control pressure (upstream of orifice, DG only)	DIN 3852 <sup>9)</sup>	M16 x 1.5; 12 deep	40	O
X <sub>3</sub> , X <sub>4</sub> <sup>10)</sup>	Stroking chamber pressure	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	40	X
G	Boost pressure	DIN 3852 <sup>9)</sup>	M22 x 1.5; 14 deep	40	X
P <sub>S</sub>	Pilot pressure	DIN 3852 <sup>9)</sup>	M18 x 1.5; 12 deep	40	X
P <sub>S</sub>	Pilot pressure (DA7 only)	DIN 3852 <sup>9)</sup>	M18 x 1.5; 12 deep	40	O
Y	Pilot pressure (DA7 only)	DIN 3852 <sup>9)</sup>	M18 x 1.5; 12 deep	40	O
M <sub>A</sub> , M <sub>B</sub>	Measuring pressure A, B	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	450	X
M <sub>H</sub>	Measuring high pressure	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	450	X
F <sub>a</sub>	Boost pressure inlet	DIN 3852 <sup>9)</sup>	M33 x 2; 18 deep	40	X
F <sub>a1</sub>	Boost pressure, inlet (mountable filter)	DIN 3852 <sup>9)</sup>	M33 x 2; 18 deep	40	X
F <sub>e</sub>	Boost pressure outlet	DIN 3852 <sup>9)</sup>	M33 x 2; 18 deep	40	X
F <sub>S</sub>	Line from filter to suction line (cold start)	DIN 3852 <sup>9)</sup>	M33 x 2; 18 deep	40	X
Y <sub>1</sub> , Y <sub>2</sub>	Pilot signal (HD only)	DIN 3852 <sup>9)</sup>	M14 x 1.5; 12 deep	40	O
Z	Inch signal (DA4 and 8 only)	DIN 3852 <sup>9)</sup>	M10 x 1; 8 deep	40	X

1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

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

3) Observe the general instructions on page 68 for the maximum tightening torques.

4) Thread according to ASME B1.1

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

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

7) Plugged with external supply.

8) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also installation instructions on pages 65 and 66).

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

10) Optional, see page 56

11) O = Must be connected (plugged on delivery)

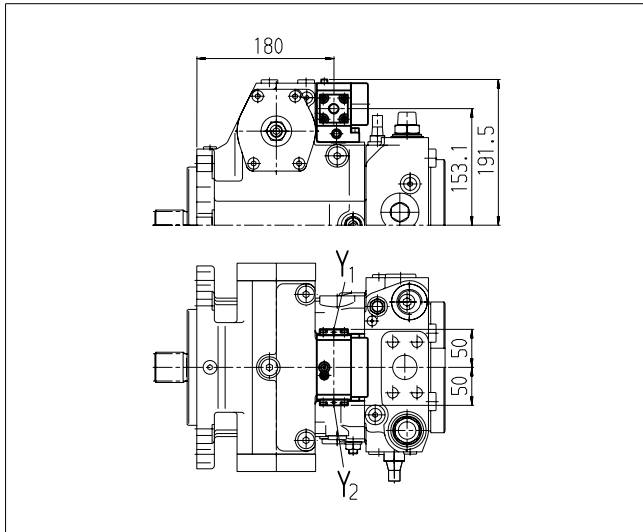
X = Plugged (in normal operation)

# Dimensions size 125

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

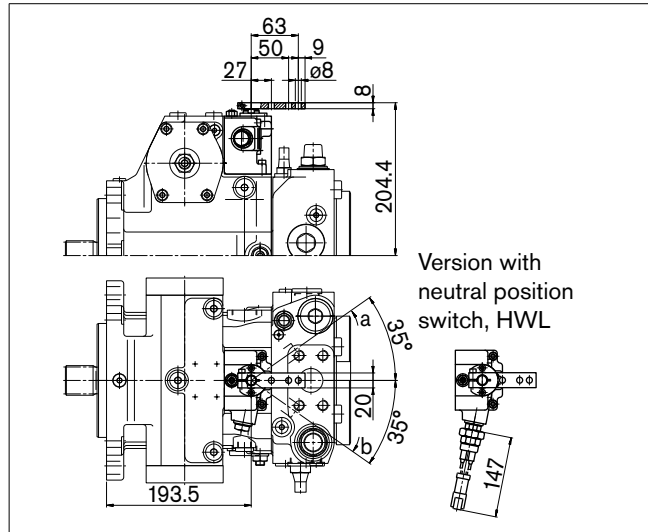
## HD

Proportional control hydraulic, pilot-pressure related



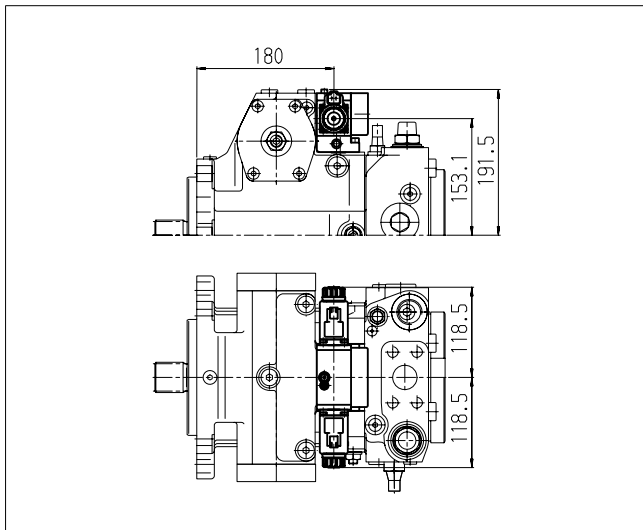
## HW

Proportional control hydraulic, mechanical servo



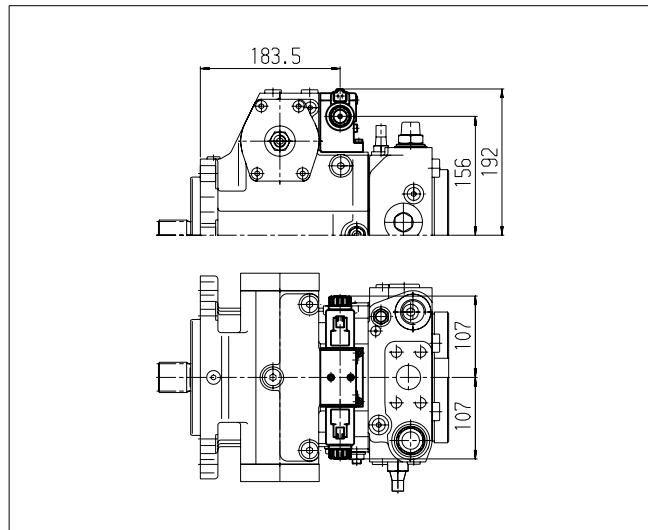
## EP

Proportional control electric



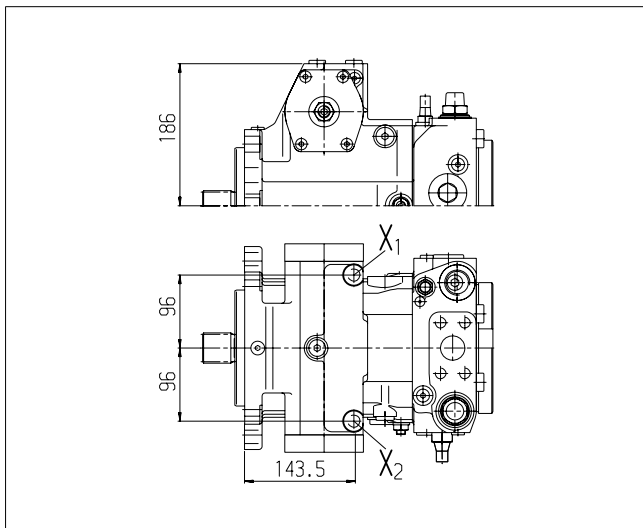
## EZ

Two-point control electric



## DG

Hydraulic control, direct controlled



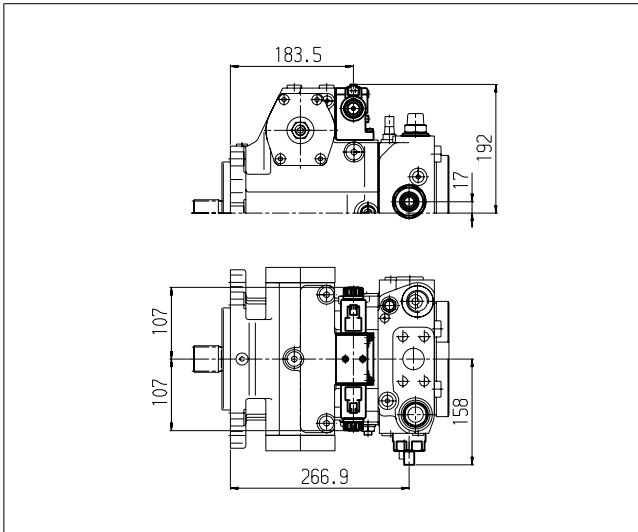


# Dimensions size 125

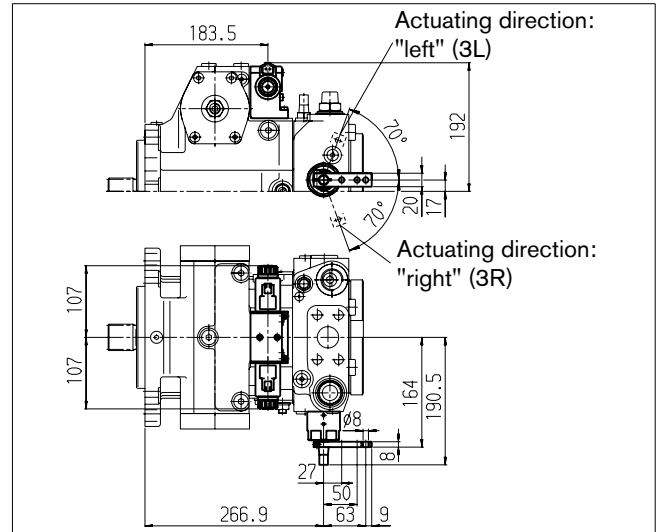
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

## DA – control valve

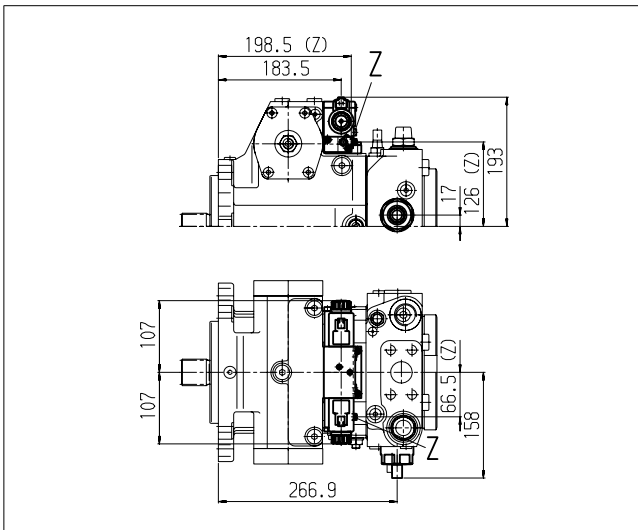
Version 2 – fixed setting



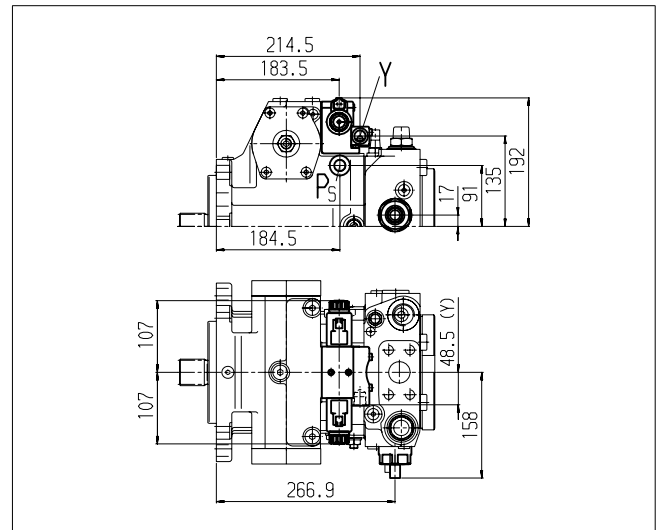
Version 3 – mechanically adjustable with position lever



Version 4/8 – fixed setting and inch valve mounted



Version 7 – fixed setting and ports for pilot control device



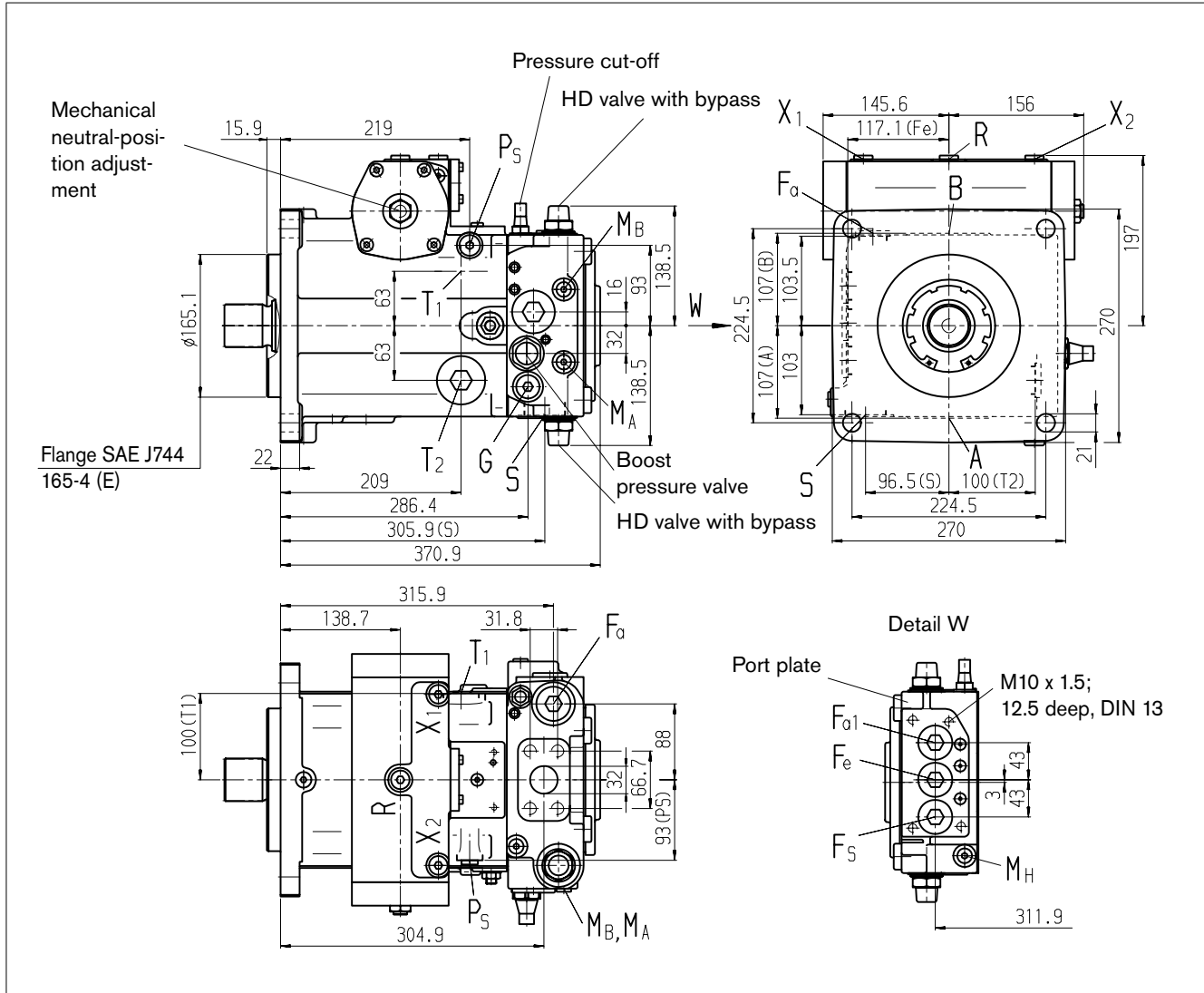
# Dimensions size 180

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

## NV – Version without control module

Standard: Suction port S at bottom (02)

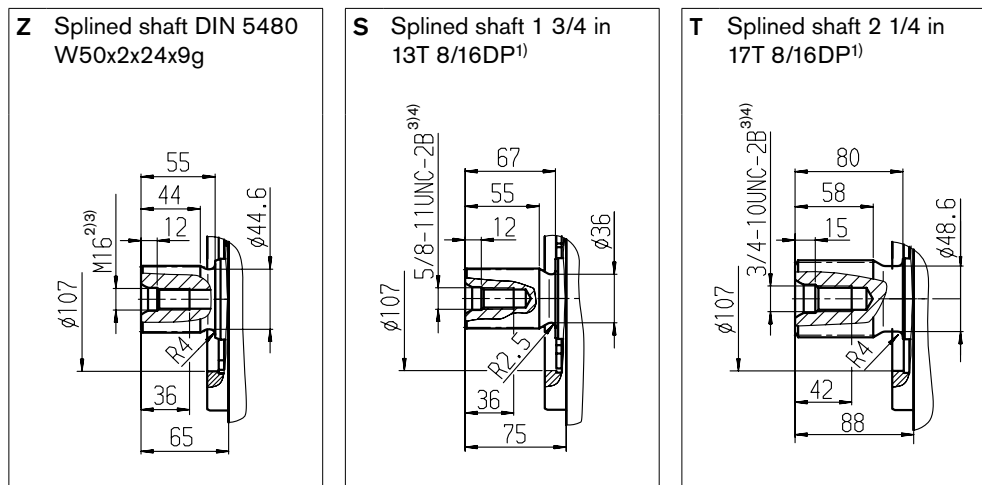
Option: Suction port S at top (03); port plate turned through 180°



# Dimensions size 180

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

## Drive shafts



## Ports

Designation	Port for	Standard	Size <sup>3)</sup>	Maximum pressure [bar] <sup>5)</sup>	State <sup>11)</sup>
A, B	Service line Fastening thread A/B	SAE J518 <sup>6)</sup> DIN 13	1 1/4 in M14 x 2; 19 deep	450	O
S	Suction line	DIN 3852 <sup>9)</sup>	M48 x 2; 22 deep	5	O <sup>7)</sup>
T <sub>1</sub>	Drain line	DIN 3852 <sup>9)</sup>	M42 x 2; 20 deep	3	O <sup>8)</sup>
T <sub>2</sub>	Drain line	DIN 3852 <sup>9)</sup>	M42 x 2; 20 deep	3	X <sup>8)</sup>
R	Air bleed	DIN 3852 <sup>9)</sup>	M16 x 1.5; 12 deep	3	X
X <sub>1</sub> , X <sub>2</sub>	Control pressure (upstream of orifice)	DIN 3852 <sup>9)</sup>	M16 x 1.5; 12 deep	40	X
X <sub>1</sub> , X <sub>2</sub>	Control pressure (upstream of orifice, DG only)	DIN 3852 <sup>9)</sup>	M16 x 1.5; 12 deep	40	O
X <sub>3</sub> , X <sub>4</sub> <sup>10)</sup>	Stroking chamber pressure	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	40	X
G	Boost pressure	DIN 3852 <sup>9)</sup>	M22 x 1.5; 14 deep	40	X
P <sub>S</sub>	Pilot pressure	DIN 3852 <sup>9)</sup>	M18 x 1.5; 12 deep	40	X
P <sub>S</sub>	Pilot pressure (DA7 only)	DIN 3852 <sup>9)</sup>	M18 x 1.5; 12 deep	40	O
Y	Pilot pressure (DA7 only)	DIN 3852 <sup>9)</sup>	M18 x 1.5; 12 deep	40	O
M <sub>A</sub> , M <sub>B</sub>	Measuring pressure A, B	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	450	X
M <sub>H</sub>	Measuring high pressure	DIN 3852 <sup>9)</sup>	M12 x 1.5; 12 deep	450	X
F <sub>a</sub>	Boost pressure inlet	DIN 3852 <sup>9)</sup>	M33 x 2; 18 deep	40	X
F <sub>a1</sub>	Boost pressure, inlet (mountable filter)	DIN 3852 <sup>9)</sup>	M33 x 2; 18 deep	40	X
F <sub>e</sub>	Boost pressure outlet	DIN 3852 <sup>9)</sup>	M33 x 2; 18 deep	40	X
F <sub>S</sub>	Line from filter to suction line (cold start)	DIN 3852 <sup>9)</sup>	M33 x 2; 18 deep	40	X
Y <sub>1</sub> , Y <sub>2</sub>	Pilot signal (HD only)	DIN 3852 <sup>9)</sup>	M14 x 1.5; 12 deep	40	O
Z	Inch signal (DA4 and 8 only)	DIN 3852 <sup>9)</sup>	M10 x 1; 8 deep	40	X

1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

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

3) Observe the general instructions on page 68 for the maximum tightening torques.

4) Thread according to ASME B1.1

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

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

7) Plugged with external supply.

8) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also installation instructions on pages 65 and 66).

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

10) Optional, see page 56

11) O = Must be connected (plugged on delivery)

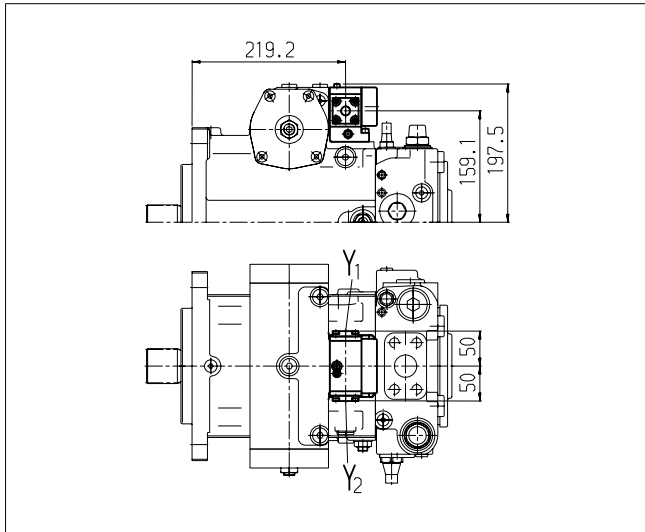
X = Plugged (in normal operation)

# Dimensions size 180

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

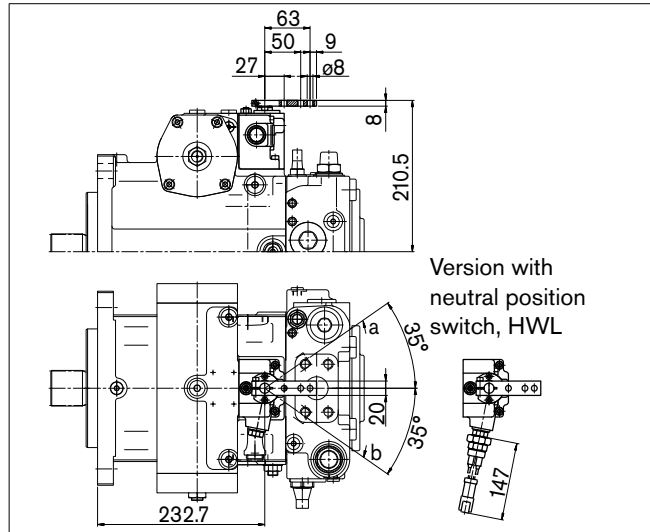
## HD

Proportional control hydraulic, pilot-pressure related



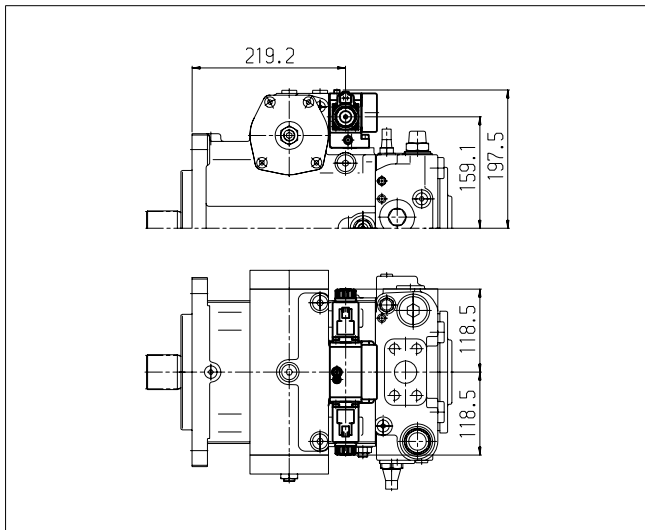
## HW

Proportional control hydraulic, mechanical servo



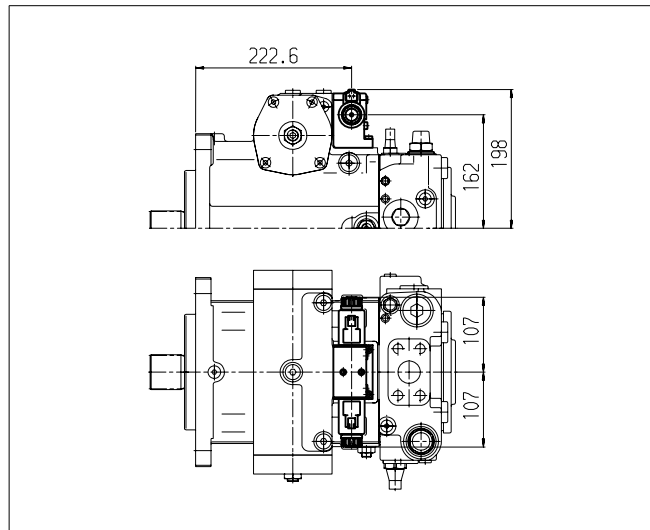
## EP

Proportional control electric



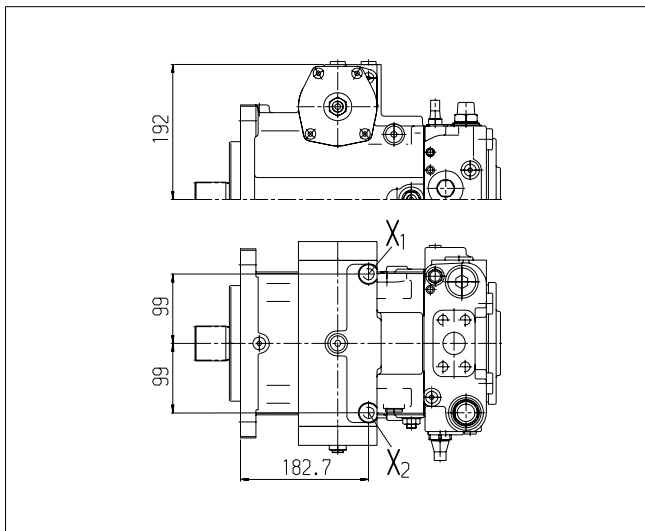
## EZ

Two-point control electric



## DG

Hydraulic control, direct controlled

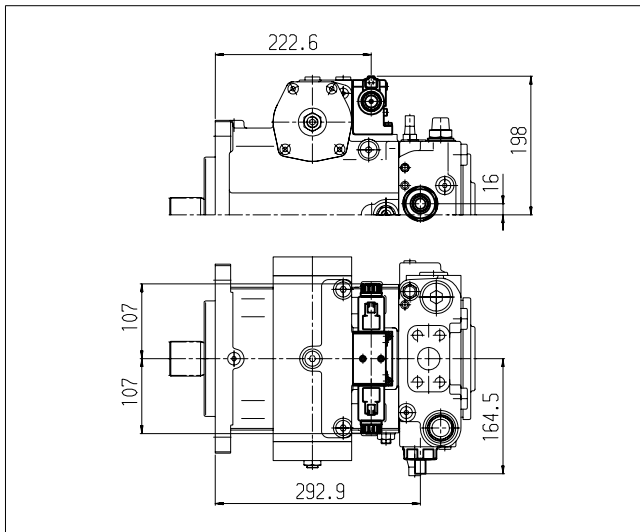


# Dimensions size 180

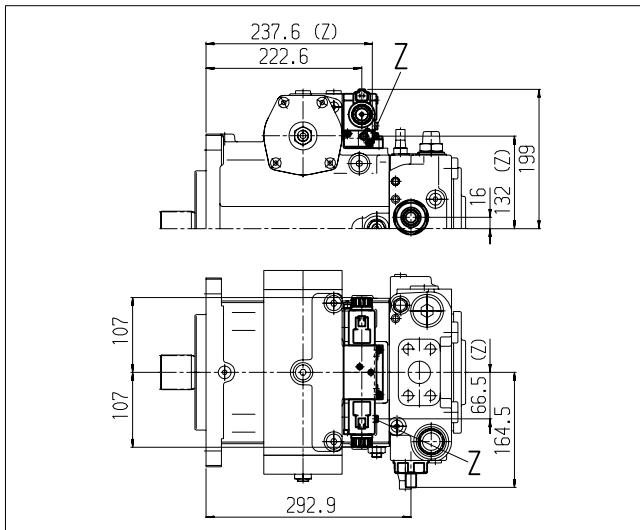
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

## DA – control valve

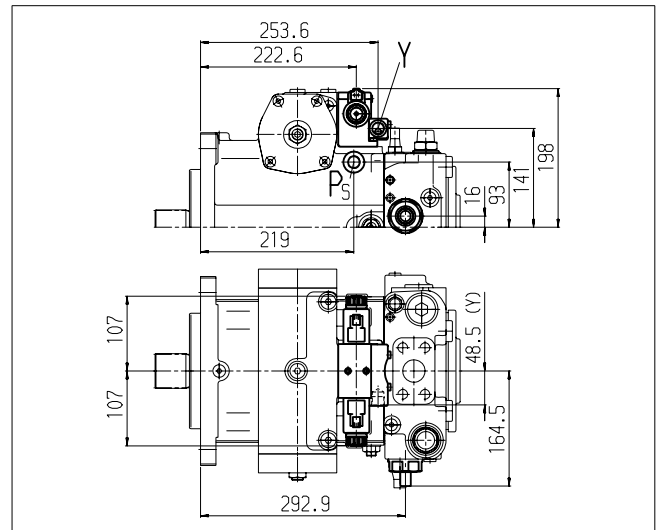
Version 2 – fixed setting



## Version 4/8 – fixed setting and inch valve mounted



## Version 7 – fixed setting and ports for pilot control device



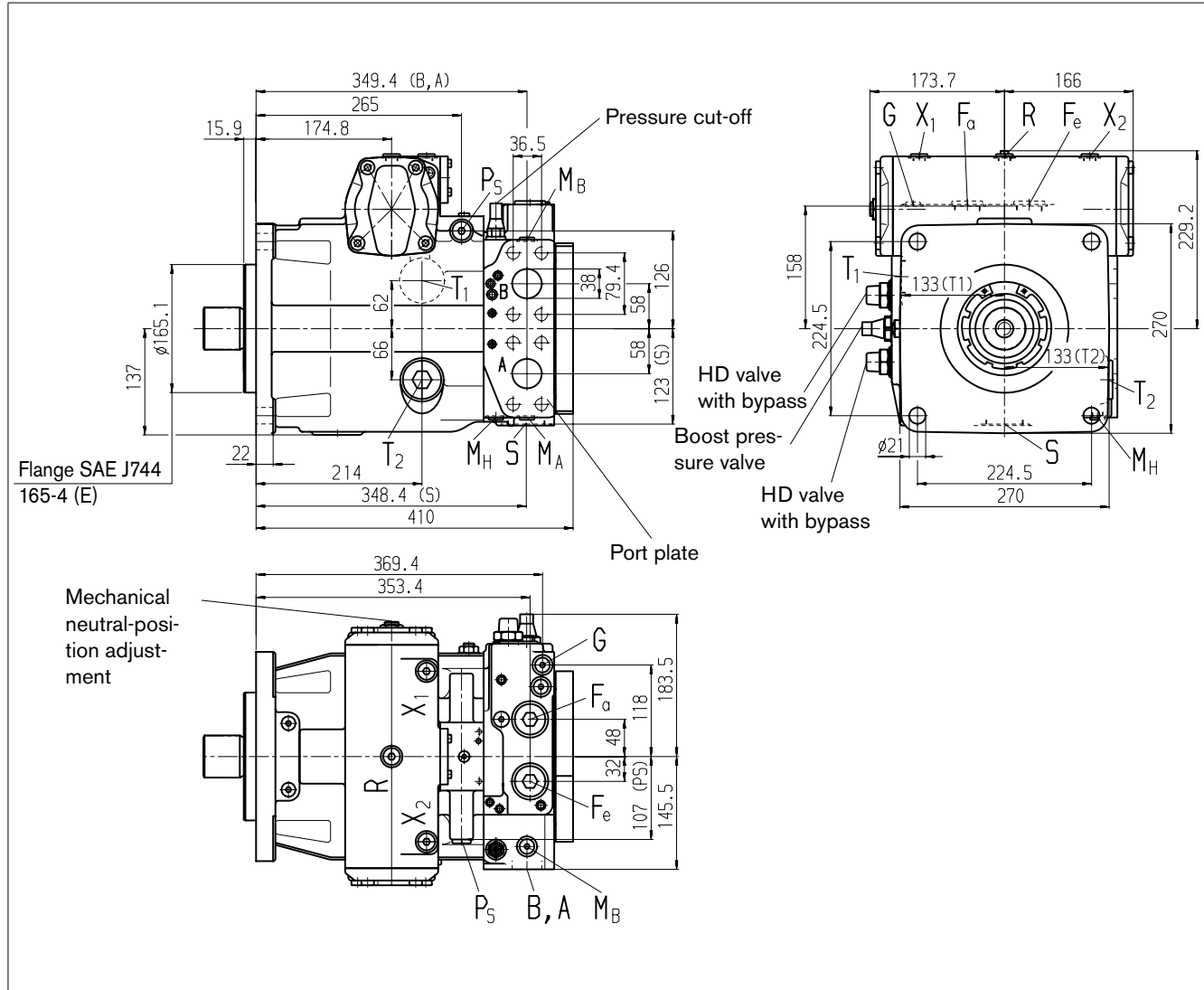
# Dimensions size 250

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

## NV – Version without control module

Standard: Suction port S at bottom (10)

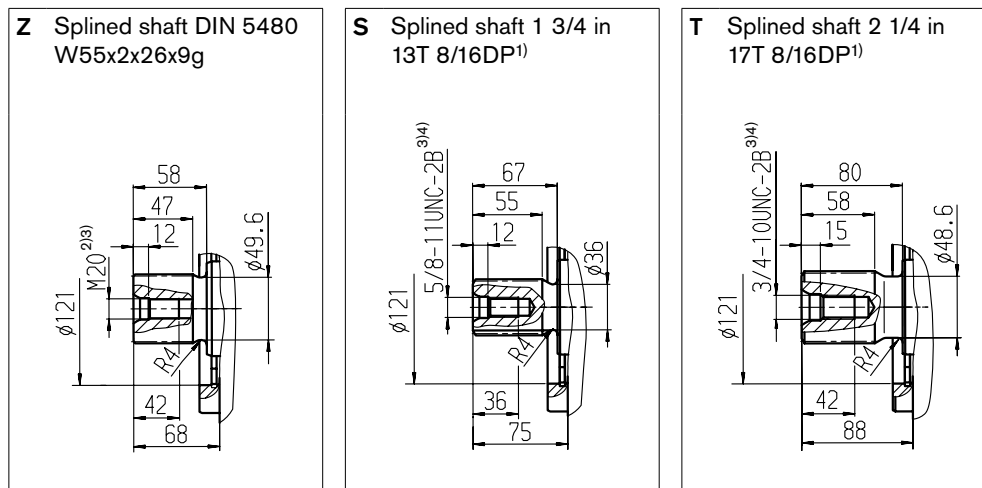
Option: Suction port S at top (13): port plate turned through 180°



# Dimensions size 250

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

## Drive shafts



## Ports

Designation	Port for	Standard	Size <sup>3)</sup>	Maximum pressure [bar] <sup>5)</sup>	State <sup>11)</sup>
A, B	Service line Fastening thread A/B	SAE J518 <sup>6)</sup> DIN 13	1 1/2 in M16 x 2; 21 deep	450	O
S	Suction line	DIN 3852 <sup>9)</sup>	M48 x 2; 22 deep	5	O <sup>7)</sup>
T <sub>1</sub>	Drain line	DIN 3852 <sup>9)</sup>	M42 x 2; 20 deep	3	O <sup>8)</sup>
T <sub>2</sub>	Drain line	DIN 3852 <sup>9)</sup>	M42 x 2; 20 deep	3	X <sup>8)</sup>
R	Air bleed	DIN 3852 <sup>9)</sup>	M16 x 1.5; 12 deep	3	X
X <sub>1</sub> , X <sub>2</sub>	Control pressure (upstream of orifice)	DIN 3852 <sup>9)</sup>	M16 x 1.5; 12 deep	40	X
X <sub>1</sub> , X <sub>2</sub>	Control pressure (upstream of orifice, DG only)	DIN 3852 <sup>9)</sup>	M16 x 1.5; 12 deep	40	O
X <sub>3</sub> , X <sub>4</sub> <sup>10)</sup>	Stroking chamber pressure	DIN 3852 <sup>9)</sup>	M16 x 1.5; 12 deep	40	X
G	Boost pressure	DIN 3852 <sup>9)</sup>	M14 x 1.5; 12 deep	40	X
P <sub>S</sub>	Pilot pressure	DIN 3852 <sup>9)</sup>	M18 x 1.5; 12 deep	40	X
P <sub>S</sub>	Pilot pressure (DA7 only)	DIN 3852 <sup>9)</sup>	M18 x 1.5; 12 deep	40	O
Y	Pilot pressure (DA7 only)	DIN 3852 <sup>9)</sup>	M18 x 1.5; 12 deep	40	O
M <sub>A</sub> , M <sub>B</sub>	Measuring pressure A, B	DIN 3852 <sup>9)</sup>	M14 x 1.5; 12 deep	450	X
M <sub>H</sub>	Measuring high pressure	DIN 3852 <sup>9)</sup>	M14 x 1.5; 12 deep	450	X
F <sub>a</sub>	Boost pressure inlet	DIN 3852 <sup>9)</sup>	M33 x 2; 18 deep	40	X
F <sub>e</sub>	Boost pressure outlet	DIN 3852 <sup>9)</sup>	M33 x 2; 18 deep	40	X
Y <sub>1</sub> , Y <sub>2</sub>	Pilot signal (HD only)	DIN 3852 <sup>9)</sup>	M14 x 1.5; 12 deep	40	O
Z	Inch signal (DA4 and 8 only)	DIN 3852 <sup>9)</sup>	M10 x 1; 8 deep	40	X

1) ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

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

3) Observe the general instructions on page 68 for the maximum tightening torques.

4) Thread according to ASME B1.1

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

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

7) Plugged with external supply.

8) Depending on installation position, T<sub>1</sub> or T<sub>2</sub> must be connected (see also installation instructions on pages 65 and 66).

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

10) Optional, see page 56

11) O = Must be connected (plugged on delivery)

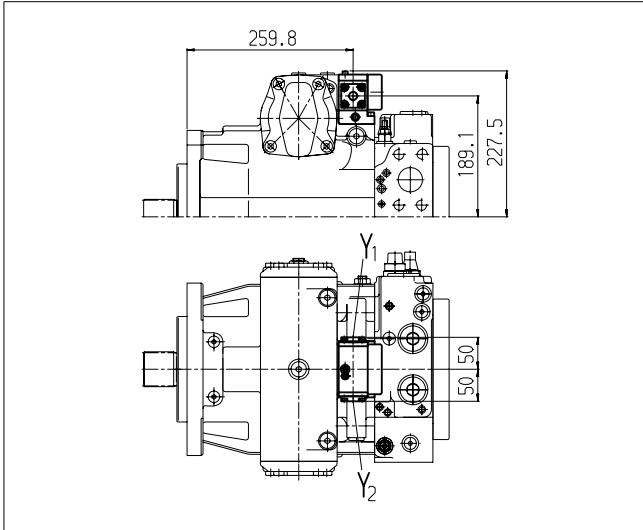
X = Plugged (in normal operation)

# Dimensions size 250

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

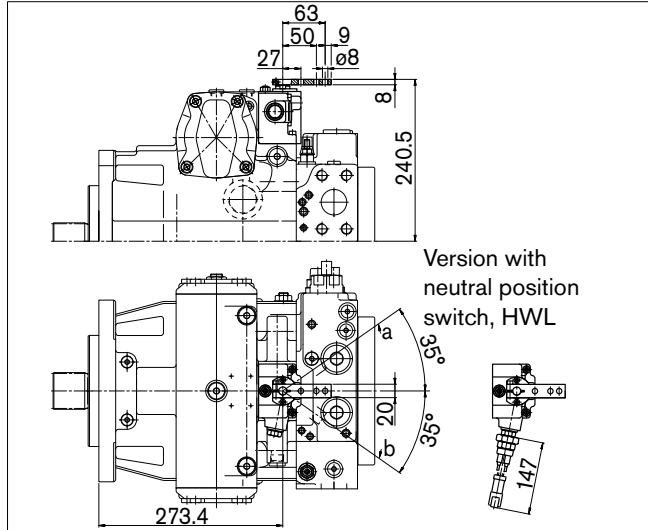
## HD

Proportional control hydraulic, pilot-pressure related



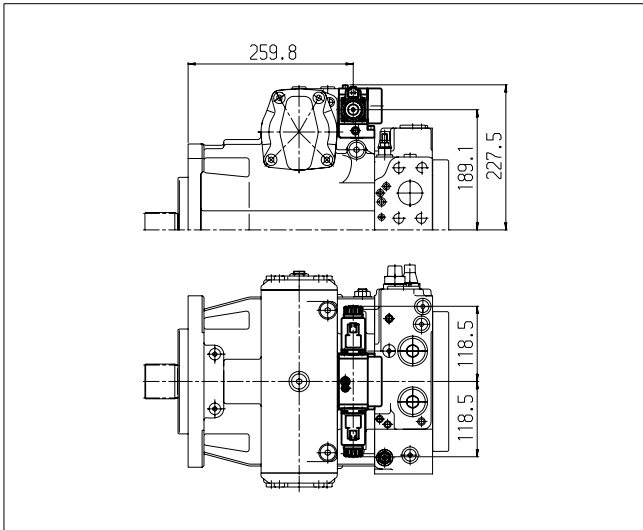
## HW

Proportional control hydraulic, mechanical servo



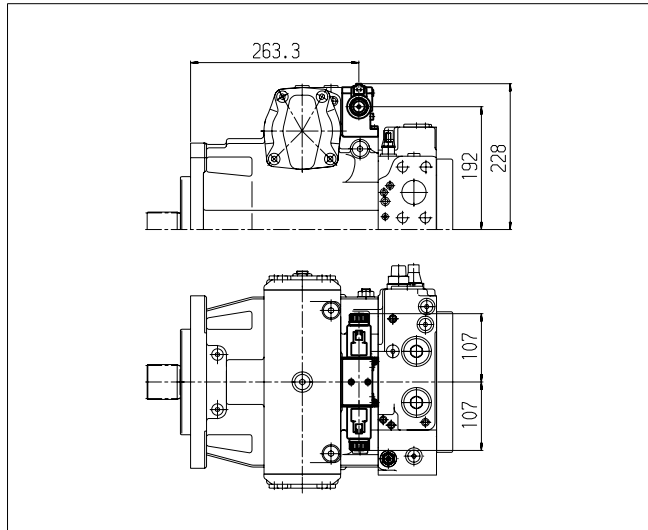
## EP

Proportional control electric



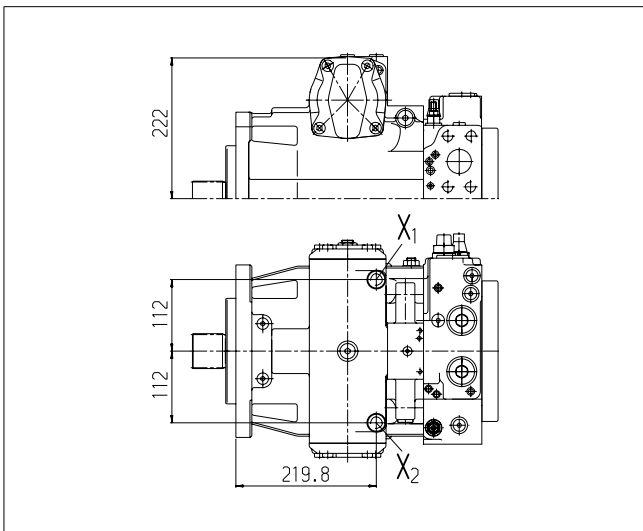
## EZ

Two-point control electric



## DG

Hydraulic control, direct controlled



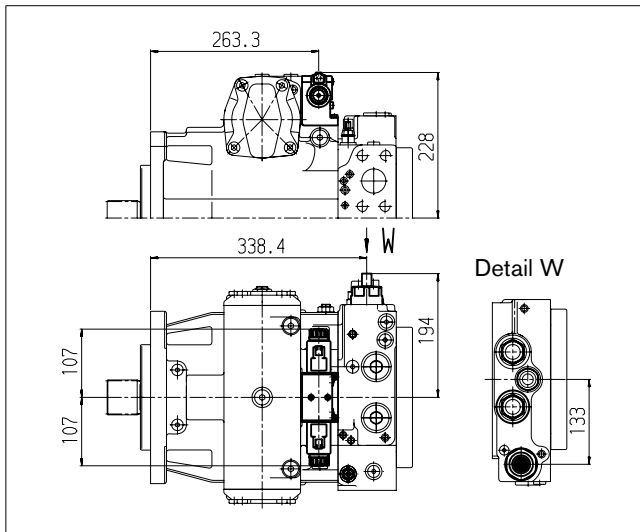


# Dimensions size 250

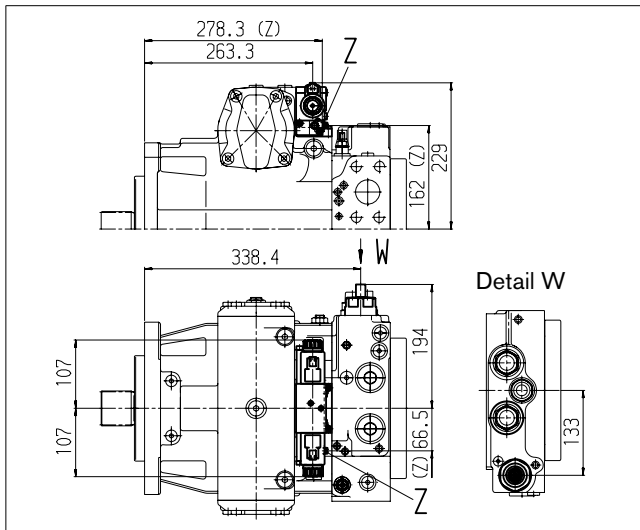
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

## DA – control valve

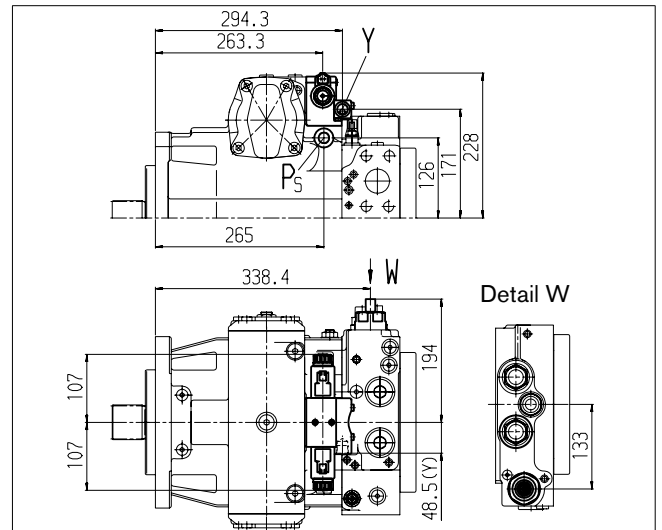
Version 2 – fixed setting



## Version 4/8 – fixed setting and inch valve mounted



## Version 7 – fixed setting and ports for pilot control device

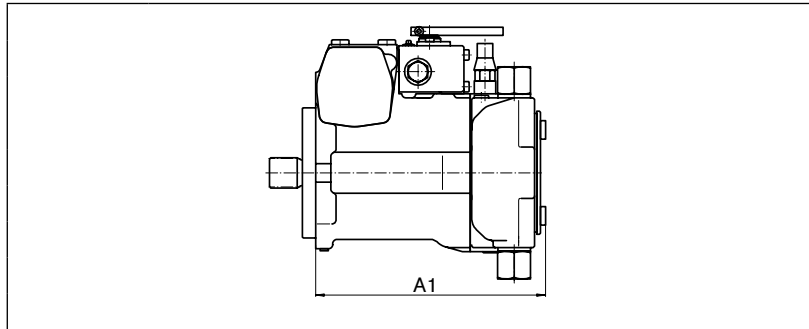


# Through drive dimensions

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

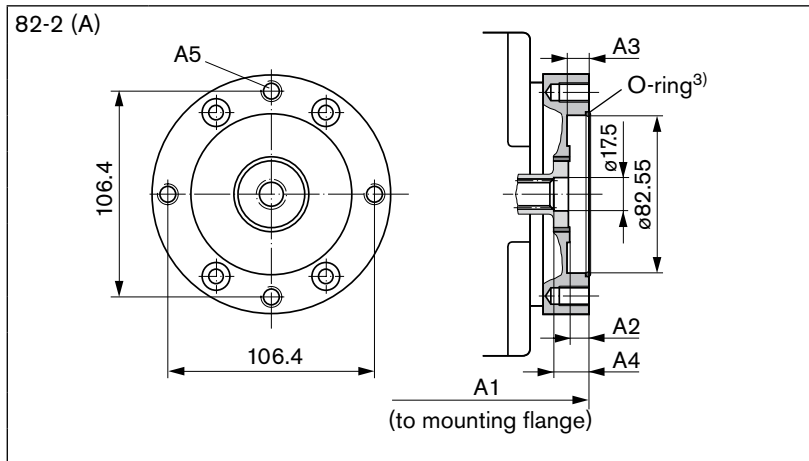
Flange SAE J744	Coupling for splined shaft (according to ANSI B92.1a) <sup>1)</sup>		28	40	56	71	90	125	180	250	
82-2 (A)	5/8 in	9T 16/32DP	●	●	●	●	●	●	●	●	.01
101-2 (B)	7/8 in	13T 16/32DP	●	●	●	●	●	●	●	●	.02
	1 in	15T 16/32DP	●	●	●	●	●	●	●	●	.04

**N00** – Without boost pump, without through drive / **F00** – With boost pump, without through drive



NG	A1 (N00)	A1 (F00)
28	213.9	223.4
40	220.2	235.7
56	239.4	256.4
71	279.1	293.6
90	287	301
125	320.9	326.4
180	370.9	370.9
250	398.2	409

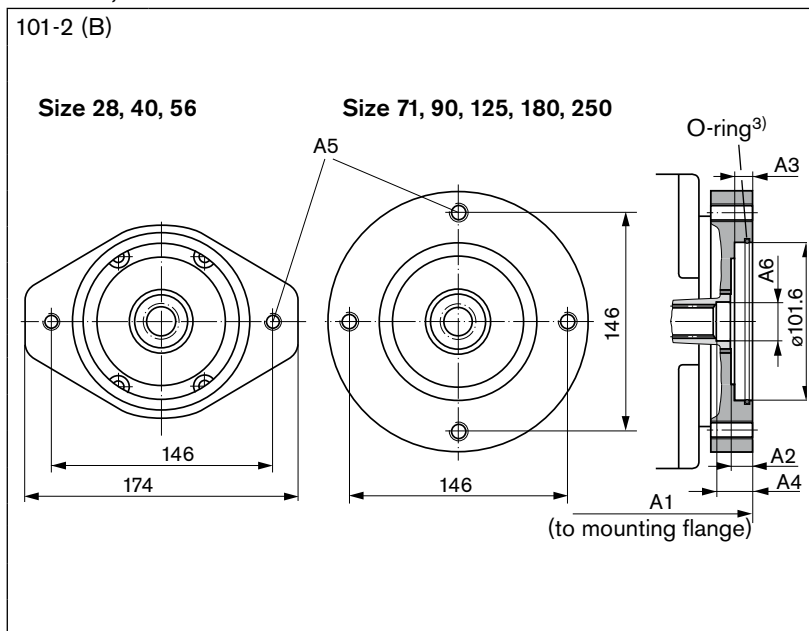
## F01/K01<sup>4)</sup>



NG	A1 (F01)	A1 (K01)	A2	A3	A4
28	227.9	227.9	7.5	7.5	14.5
40	239.7	234.2	9	9	18
56	261.4	254.9	10	10	18
71	297.6	297.6	9	10	17
90	304	304	9	8	-
125	330.9	330.9	10.5	9	-
180	378.4	378.4	7.5	7.5	15.5
250	426.9	426.2	11	11	18

NG	A5 <sup>2)</sup>
28 to 125	M10 x 1.5; 15 deep
180, 250	M10 x 1.5; 16.5 deep

## F02/K02; F04/K04<sup>4)</sup>



NG	A1	A2	A3	A4 (02)	A4 (04)
28	230.4	9.7	9.7	16.2	13.7
40	240.7	11	11 <sup>5)</sup>	17	16
56	262.4	12	11	19.5	18.5
71	300.6	13	9.8	17	15.5
90	305	9	11	17	15
125	330.9	10	11	17	16.5
180	381.4	11	11	19	18
250	428.9	11	11	16	15.5

NG	A5 <sup>2)</sup>
28 to 56	M12 x 1.75; 19 deep
71, 90, 180, 250	M12 x 1.75; 21 deep
125	M12 x 1.75; 18 deep

	A6
F02 / K02	ø 24
F04 / K04	ø 27

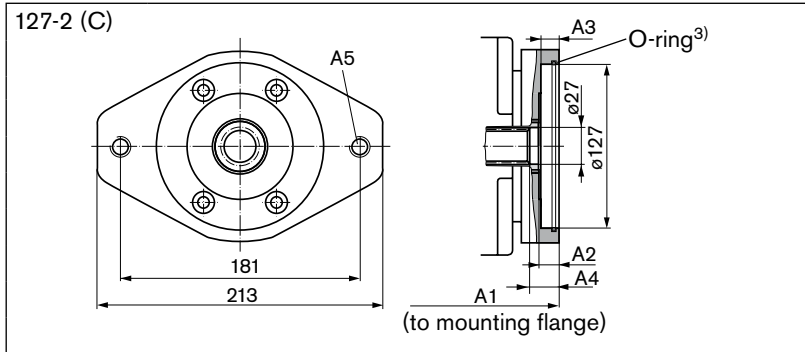
- 1) 30° pressure angle, flat root, side fit, tolerance class 5
- 2) Thread according to DIN 13, observe the general instructions on page 68 for the maximum tightening torques.
- 3) O-ring included in the delivery contents
- 4) The illustration shows the 2-hole version. Please state in plain text whether the 2-hole horizontal or the 2-hole vertical version is used.
- 5) For F04/K04 9.7 mm

# Through drive dimensions

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

Flange SAE J744	Coupling for splined shaft (according to ANSI B92.1a) <sup>1)</sup>	28	40	56	71	90	125	180	250	
127-2 (C)	1 in 15T 16/32DP	-	●	-	-	-	-	-	-	.09
	1 1/4 in 14T 12/24DP	-	-	●	●	●	●	●	●	.07
152-2/4 (D)	W35 2x16x9g (according to DIN 5480)	-	-	-	-	●	-	-	-	.73
	1 3/4 in 13T 8/16DP	-	-	-	-	-	●	●	●	.69

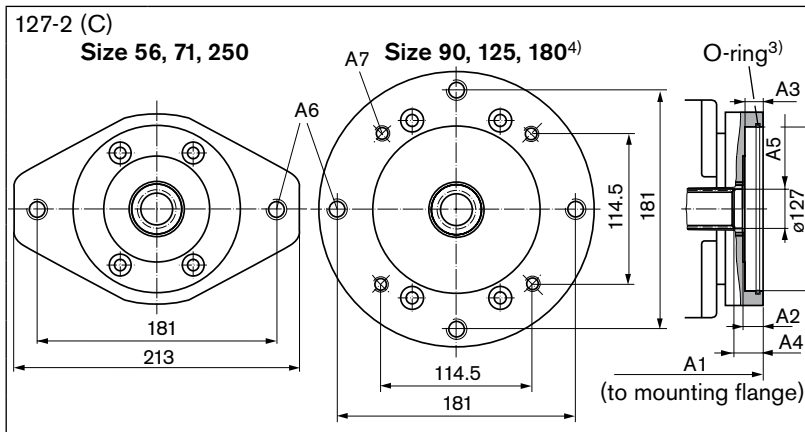
## F09/K09



NG	A1	A2	A3	A4
40	244.7	14	14	19.5

NG	A5 <sup>2)</sup>
40	M16 x 2; 20 deep

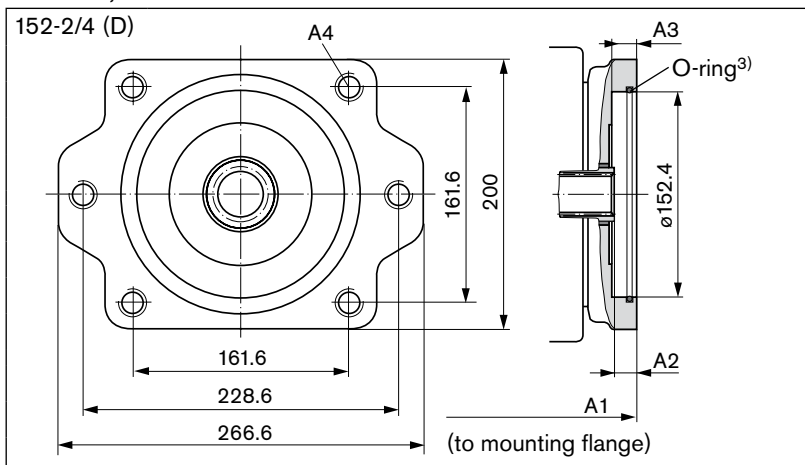
## F07/K07<sup>5)</sup>



NG	A1	A2	A3	A4	A5
56	266.4	15	14	17.5	$\phi 32.7$
71	303.6	15	13.5	20	
90	309	13	14	20.5	
125	335.9	15	15.5	22.5	$\phi 33.5$
180	384.4	14	19	17	
250	425.9	16	14	16	

NG	A6 <sup>2)</sup>	A7 <sup>2)</sup>
56	M16 x 2; 20 deep	-
71, 250	M16 x 2; 24 deep	-
90, 125, 180	M16 x 2; 23 deep	M12 x 1.75; 18 deep

## F73/K73; F69/K69<sup>6)</sup>



NG	A1	A2	A3	A4 <sup>2)</sup>
90	309	12	14	
125	343.9	18	14	M20 x 2.5;
180	391.9	20.9	18	20 deep
250	444.9	9	17	

1) 30° pressure angle, flat root, side fit, tolerance class 5

2) Thread according to DIN 13, observe the general instructions on page 68 for the maximum tightening torques.

3) O-ring included in the delivery contents

4) Size 180 only with SAE 2-hole flange

5) The illustration shows the 4- and the 2-hole version. Please state in plain text whether the 4-hole, the 2-hole horizontal or the 2-hole vertical version is used.

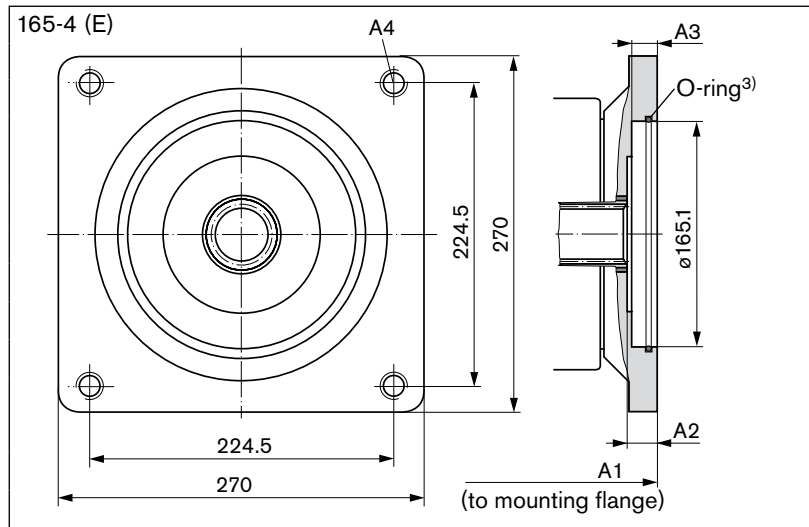
6) The illustration shows the 4+2-hole version. Please state in plain text whether the 2-hole, the 4-hole or the 4+2-hole version is used.

# Through drive dimensions

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

Flange SAE J744	Coupling for splined shaft (according to ANSI B92.1a) <sup>1)</sup>	28	40	56	71	90	125	180	250	
165-4 (E)	1 3/4 in 13T 8/16DP	-	-	-	-	-	-	●	●	.72

## F72/K72



NG	A1	A2	A3	A4 <sup>2)</sup>
180	391.9	20.9	18	M20 x 2.5;
250	444.9	9	17	20 deep

1) 30° pressure angle, flat root, side fit, tolerance class 5

2) Thread according to DIN 13, observe the general instructions on page 68 for the maximum tightening torques.

3) O-ring included in the delivery contents

## Overview of mounting options

Through drive <sup>1)</sup>			Mounting options – 2nd pump						
Flange	Coupling for splined shaft	Short code	A4VG/32 NG (shaft)	A10V(S)O/31 Size (shaft)	A10V(S)O/53 Size (shaft)	A4FO NG (shaft)	A11VO/1 NG (shaft)	A10VG NG (shaft)	External gear pump <sup>2)</sup>
82-2 (A)	5/8 in	F/K01	-	18 (U)	10 (U)	-	-	-	Series F Size 4 to 22
101-2 (B)	7/8 in	F/K02	-	28 (S, R) 45 (U, W)	28 (S, R) 45 (U, W)	16 (S) 22 (S) 28 (S)	-	18 (S)	Series N Size 20 to 36 Series G Size 32 to 50
	1 in	F/K04	28 (S)	45 (S, R)	45 (S, R) 60 (U, W)	-	40 (S)	28 (S) 45 (S)	-
127-2 (C)	1 in	F/K09	40 (U)	71 (U, W)	60 (U, W)	-	-	-	-
	1 1/4 in	F/K07	40 (S) 56 (S) 71 (S)	71 (S, R) 100 (U, W)	85 (U, W)	-	60 (S)	63 (S)	-
152-2/4 (D)	W35	F/K73	90 (Z)	-	-	-	-	-	-
	1 3/4 in	F/K69	90 (S) 125 (S)	140 (S)	-	-	95 (S) 130 (S) 145 (S)	-	-
165-4 (E)	1 3/4 in	F/K72	180 (S) 250 (S)	-	-	-	190 (S) 260 (S)	-	-

1) Availability of the individual sizes, see ordering code on page 3.

2) Bosch Rexroth recommends special versions of the gear pumps. Please contact us.

# Combination pumps A4VG + A4VG

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

## Total length A

A4VG (1st pump)	A4VG (2nd pump) <sup>3)</sup>							
	NG28	NG40	NG56	NG71	NG90	NG125	NG180	NG250
NG28	453.8	–	–	–	–	–	–	–
NG40	464.1	480.4	–	–	–	–	–	–
NG56	485.8	502.1	522.8	–	–	–	–	–
NG71	524.0	539.3	560.0	597.2	–	–	–	–
NG90	528.4	544.7	565.4	602.6	610.0	–	–	–
NG125	554.3	571.6	592.3	629.5	644.9	670.3	–	–
NG180	604.8	620.1	640.8	678.0	692.9	718.3	762.8	–
NG250	652.3	661.6	682.3	719.5	745.9	771.3	815.8	854.8

1) 2nd pump without through drive and with boost pump, F00

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 "+".

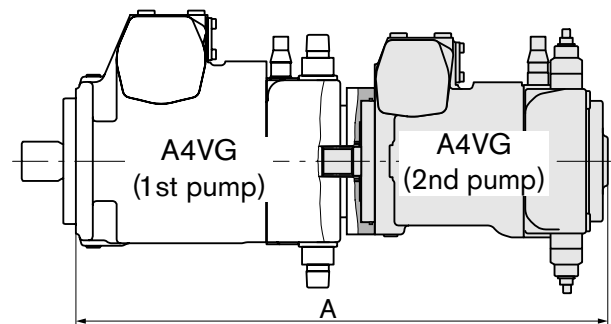
### Ordering example:

**A4VG56EP3D1/32R-NAC02F073SP + A4VG56EP3D1/32R-NSC02F003SP**

A tandem pump consisting of two equal sizes is permissible without additional supports assuming that the dynamic acceleration does not exceed maximum 10 g (= 98.1 m/s<sup>2</sup>).

We recommend the use of the 4-hole mounting flanges for size 71 and larger.

For combination pumps consisting of more than two pumps, the mounting flange must be rated for the permissible mass torque.



# High-pressure relief valves

The two 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 ranges

High-pressure relief valve, direct controlled (size 28 to 56)	Differential pressure setting $\Delta p_{HD}$
Setting range for valve <b>3, 5</b> $\Delta p$ 250 - 420 bar (see ordering code)	420 bar
	400 bar <sup>1)</sup>
	360 bar
	340 bar
	320 bar
	300 bar
	270 bar
	250 bar
Setting range for valve <b>4, 6</b> $\Delta p$ 100 - 250 bar (see ordering code)	250 bar
	230 bar <sup>1)</sup>
	200 bar
	150 bar
	100 bar
High-pressure relief valve, pilot operated (size 71 to 250)	Differential pressure setting $\Delta p_{HD}$
Setting range for valve <b>1,</b> $\Delta p$ 100 - 420 bar (see ordering code)	420 bar
	400 bar <sup>1)</sup>
	360 bar
	340 bar
	320 bar
	300 bar
	270 bar
	250 bar
	230 bar
	200 bar
	150 bar
100 bar	

1) Standard differential pressure setting. If not specified in the order, valves will be set to this value.

## When ordering, state in plain text:

(only the  $\Delta p_{HD}$  values stated in the table are possible)

### High-pressure relief valve A

Differential pressure setting \_\_\_\_\_  $\Delta p_{HD} = \dots$  bar

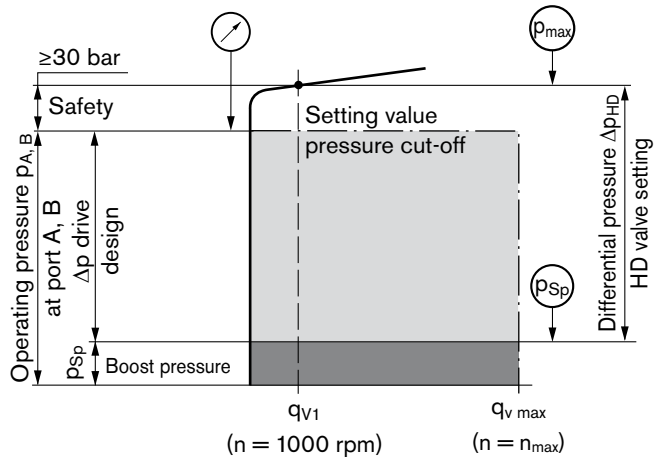
Cracking pressure of the HD valve (at  $q_{V1}$ ) \_\_\_\_\_  $p_{max} = \dots$  bar  
( $p_{max} = \Delta p_{HD} + p_{Sp}$ )

### High-pressure relief valve B

Differential pressure setting \_\_\_\_\_  $\Delta p_{HD} = \dots$  bar

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

## Setting diagram



## Note

The valve settings are made at  $n = 1000$  rpm and at  $V_{g max}(q_{V1})$ . There may be deviations in the cracking pressures with other operating parameters.

## Example:

Operating pressure  $p_{A,B}$  \_\_\_\_\_ 400 bar  
Boost pressure  $p_{Sp}$  \_\_\_\_\_ 30 bar  
Differential pressure  $\Delta p_{HD}$  \_\_\_\_\_ 400 bar

$$p_{A,B} - p_{Sp} + \text{Safety} = \Delta p_{HD}$$

$$400 \text{ bar} - 30 \text{ bar} + 30 \text{ bar} = 400 \text{ bar}$$

## Bypass function

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

## Towing speed

The maximum towing speed is dependent on the gear ratio in the vehicle and must be calculated by the vehicle manufacturer. The corresponding flow of  $Q = 30$  L/min must not be exceeded.

## Towing distance

The vehicle may only be towed out of the immediate danger zone.

## Note:

The bypass function and the pilot-controlled high pressure relief valves (size 71 to 250) are not illustrated in the circuit diagrams.

## 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  $V_{g \text{ min}}$ .

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

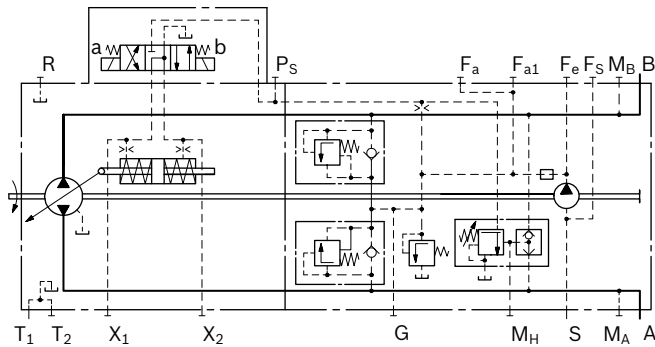
The high-pressure relief valves protect against the pressure spikes which occur during fast swiveling of the swashplate and limit the maximum pressure in the system.

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 54).

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

### Schematic with pressure cut-off

**Example: two-point control electric, EZ1D/EZ2D**



# 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, the stroke of the stroke piston and thus the maximum swivel angle of the pump is limited.

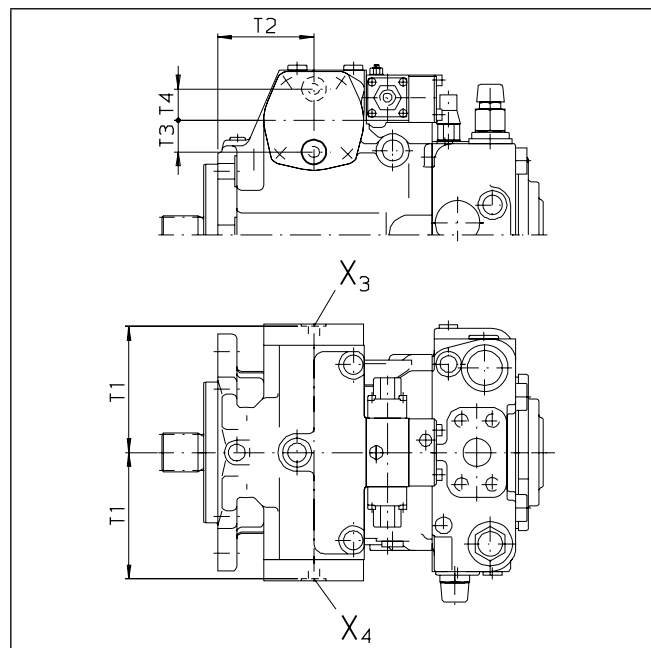
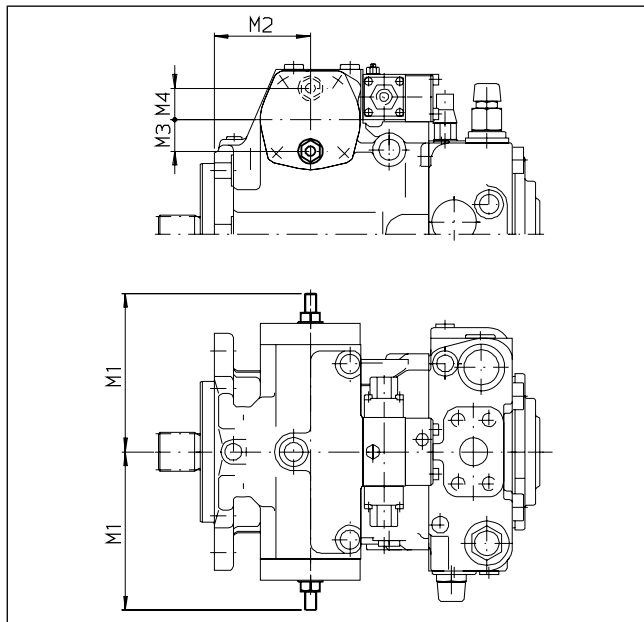
### Dimensions

NG	M1	M2	M3	M4
28	110.6 max	40.1	24	-
40	110.6 max	38.1	24	-
56	130.5 max	44	25.5	-
71	135.4 max	86.3	-	28.5
90	147 max	95.7	31.5	-
125	162 max	104.5	-	35.5
180	181.6 max	138.7	38	-
250	198.9 max	174.8	39.5	-

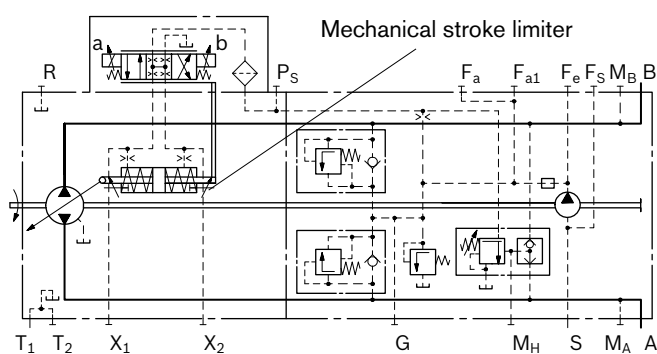
# Ports X<sub>3</sub> and X<sub>4</sub> for stroking chamber pressure

### Dimensions

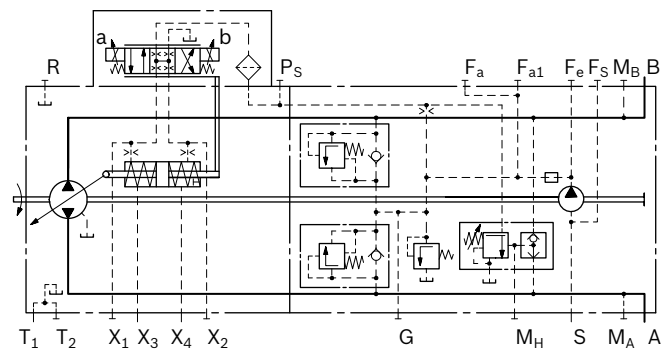
NG	T1	T2	T3	T4
28	92	40.1	-	24
40	92	38.1	-	24
56	104.5	44	-	25
71	113.5	86.3	28	-
90	111.5	95.7	-	30
125	136	104.5	34	-
180	146.5	138.7	-	35
250	164.5	174.8	-	38



### Schematic<sup>1)</sup>



### Schematic<sup>1)</sup>



Designation	Port for	Standard <sup>2)</sup>	Size <sup>3)</sup>	Maximum pressure [bar] <sup>4)</sup>	State <sup>5)</sup>
X <sub>3</sub> , X <sub>4</sub>	Stroking chamber pressure	DIN 3852	M12 x 1.5; 12 deep	40	X
X <sub>3</sub> , X <sub>4</sub>	Stroking chamber pressure (size 250 only)	DIN 3852	M16 x 1.5; 12 deep	40	X

- Sizes 28 and 250 without ports F<sub>a1</sub> and F<sub>S</sub>
  - The spot face can be deeper than specified in the appropriate standard.
  - Observe the general instructions on page 68 for the maximum tightening torques.
  - Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
  - X = Plugged (in normal operation)
- Before finalizing your design, request a binding installation drawing. Dimensions in mm.



# Filtration boost circuit / external supply

## Version S (standard)

### Filtration in the suction line of the boost pump

Standard version (preferred)

Filter type \_\_\_\_\_ filter **without** bypass

Recommendation \_\_\_\_\_ **with** contamination indicator

Recommended differential pressure at filter cartridge

At  $v = 30 \text{ mm}^2/\text{s}$ ,  $n = n_{\text{max}}$  \_\_\_\_\_  $\Delta p \leq 0.1 \text{ bar}$

At  $v = 1000 \text{ mm}^2/\text{s}$ ,  $n = n_{\text{max}}$  \_\_\_\_\_  $\Delta p \leq 0.3 \text{ bar}$

Pressure at suction port S:

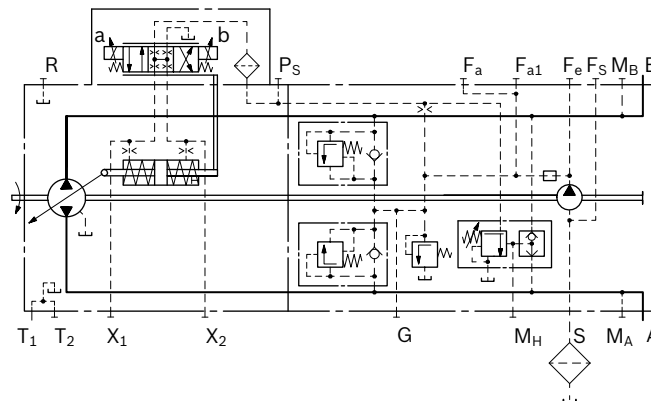
Continuous  $p_{S \text{ min}}$  ( $v \leq 30 \text{ mm}^2/\text{s}$ ) \_\_\_\_\_  $\geq 0.8 \text{ bar absolute}$

Short-term, on cold start ( $t < 3 \text{ min}$ ) \_\_\_\_\_  $\geq 0.5 \text{ bar absolute}$

Maximum  $p_{S \text{ max}}$  \_\_\_\_\_  $\leq 5 \text{ bar absolute}$

The filter is not included in the delivery contents.

### Schematic version S (standard)



## Version E

### External supply

This variation should be used in versions **without** integrated boost pump (N00 or K..).

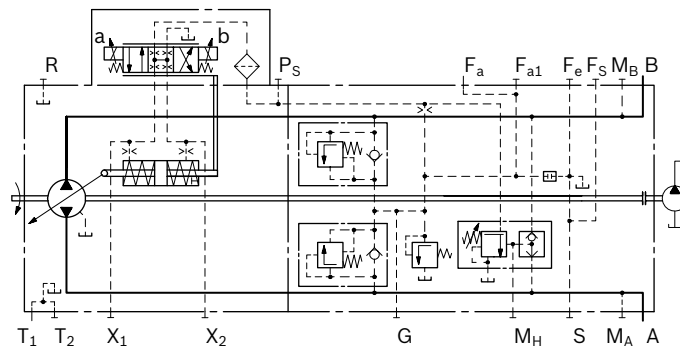
Port S is plugged.

Supply comes from port  $F_a$ .

Filter arrangement \_\_\_\_\_ separate

To ensure the functional reliability, maintain the required cleanliness level for the boost fluid fed in at port  $F_a$  (see page 6).

### Schematic version E



## Version D

### Filtration in the pressure line of the boost pump, ports for external boost circuit filter

Boost pressure inlet \_\_\_\_\_ port  $F_a$

Boost pressure outlet \_\_\_\_\_ port  $F_e$

Filter type \_\_\_\_\_

Filter with bypass are **not recommended**. For applications with bypass please contact us.

Recommendation \_\_\_\_\_ **with** contamination indicator

### Note

For versions with **DG** control (with pilot pressure not from boost circuit), the following filter type should be used:

Filter **with** bypass and **with** contamination indicator

Filter arrangement \_\_\_\_\_

Separate in the pressure line (inline filter)

Permissible differential pressure at filter cartridge

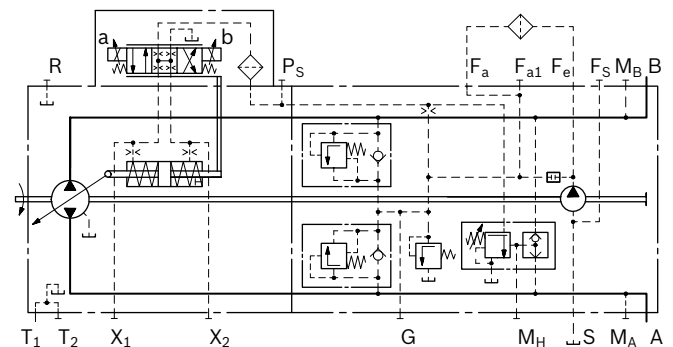
At  $v = 30 \text{ mm}^2/\text{s}$  \_\_\_\_\_  $\Delta p \leq 1 \text{ bar}$

At cold start \_\_\_\_\_  $\Delta p \leq 3 \text{ bar}$

(valid for entire speed range  $n_{\text{min}} - n_{\text{max}}$ )

The filter is not included in the delivery contents.

### Schematic version D



# Filtration boost circuit / external supply

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

## Version K

**Filtration in the pressure line of the boost pump, with cold start valve and ports for external boost circuit filter**

Version as version D, but with additional cold start valve.

The port plate is equipped with **cold start valve** and thereby protects the system from damage.

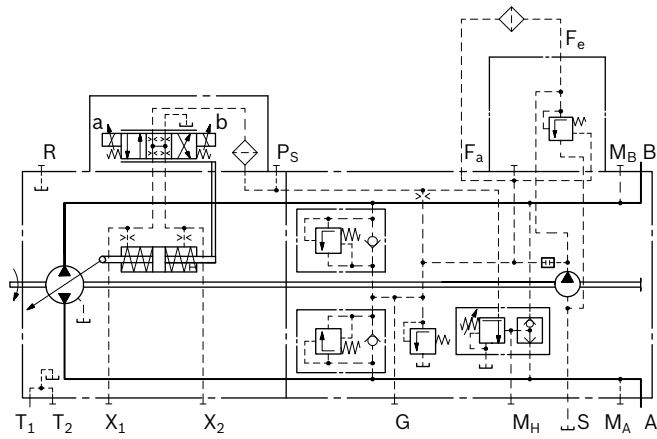
The valve opens at a differential pressure  $\Delta p \geq 6$  bar.

Boost pressure inlet \_\_\_\_\_ port  $F_a$   
 Boost pressure outlet \_\_\_\_\_ port  $F_e$

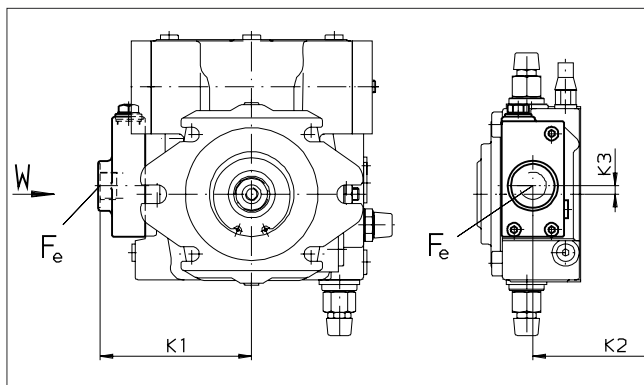
Filter arrangement \_\_\_ separate in the pressure line (inline filter)

The filter is not included in the delivery contents.

### Schematic version K (with cold start valve)



### Dimensions, version K (with cold start valve)



NG	K1	K2	K3	$F_e^{1) 2)}$
40	122.5	198.7	0	M18 x 1.5; 15 deep
56	125.5	215.4	0	M18 x 1.5; 15 deep
71	145.5	239.0	8	M26 x 1.5; 16 deep
90	139.5	248.5	24	M26 x 1.5; 16 deep
125	172.0	267.9	20	M33 x 2; 18 deep
180	173.0	311.9	3	M33 x 2; 18 deep

- 1) Thread according to DIN 3852, observe the general instructions on page 68 for the maximum tightening torques.
- 2) The spot face can be deeper than specified in the appropriate standard.

## Version F

**Filtration in the pressure line of the boost pump, filter mounted**

Filter type \_\_\_\_\_ filter **without** bypass

Filtration grade (absolute) \_\_\_\_\_ 20 microns

Filter material \_\_\_\_\_ glass fiber

Pressure rating \_\_\_\_\_ 100 bar

Filter arrangement \_\_\_\_\_ mounted on pump

The filter is equipped with **cold start valve** and thereby protects the system from damage.

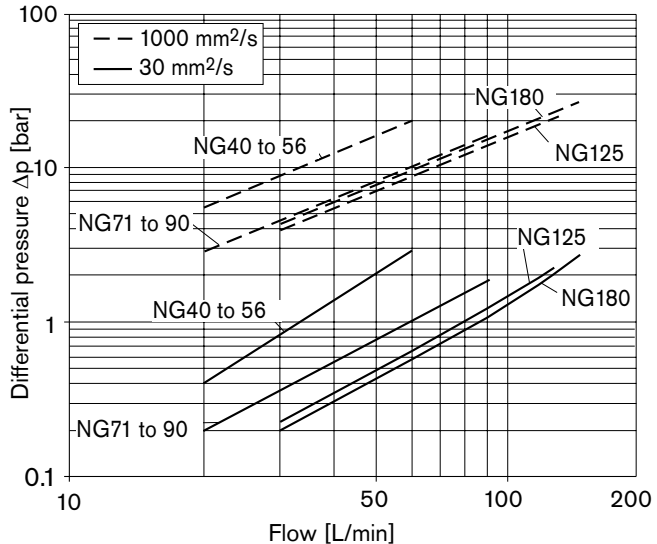
The valve opens at a differential pressure  $\Delta p \geq 6$  bar.

### Recommendation

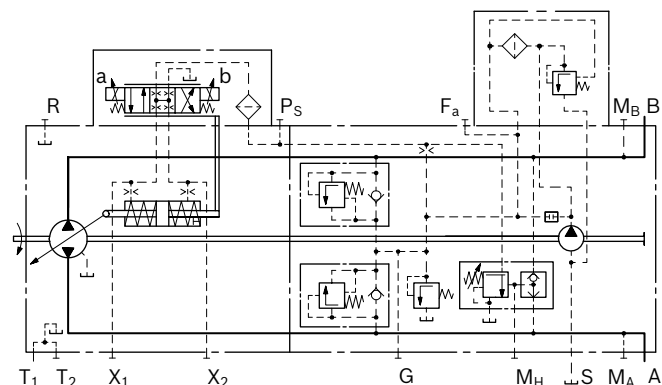
**With** contamination indicator (version P, B)  
 (differential pressure  $\Delta p = 5$  bar)

### Filter characteristics

Differential pressure/flow characteristics to ISO 3968 (valid for clean filter cartridge).



### Schematic version F (with filter)



# Filtration boost circuit / external supply

## Version P

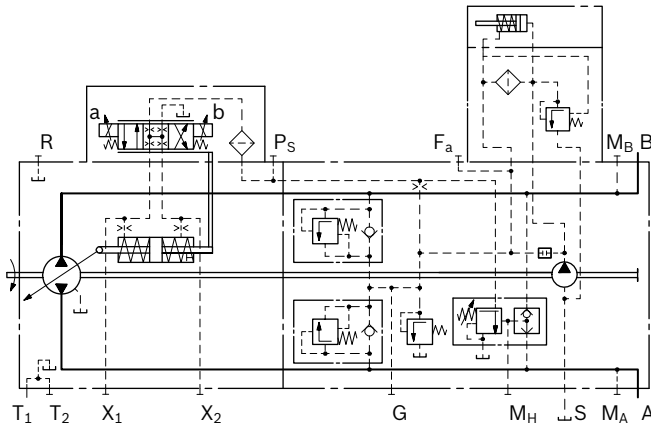
**Filtration in the pressure line of the boost pump, filter mounted, with visual contamination indicator**

Version similar to variation F, however additionally with visual contamination indicator.

Indication \_\_\_\_\_ Green/red window

Differential pressure (switching pressure) \_\_\_\_\_  $\Delta p = 5 \text{ bar}$

### Schematic version P



## Version B

**Filtration in the pressure line of the boost pump, filter mounted, with electric contamination indicator**

Filtration similar to variation F, however additionally with electric contamination indicator.

Indication \_\_\_\_\_ electric

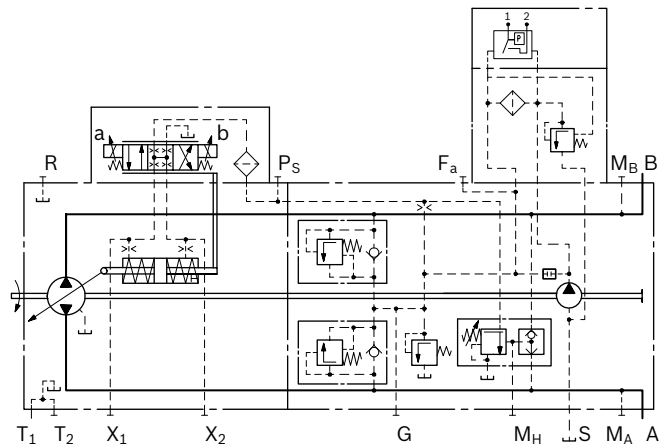
Connector design \_\_\_\_\_ DEUTSCH DT04-2P-EP04 (mating connector, see page 62)

Differential pressure (switching pressure) \_\_\_\_\_  $\Delta p = 5 \text{ bar}$

Maximum switching capacity at  
 12 V DC \_\_\_\_\_ 36 W  
 24 V DC \_\_\_\_\_ 72 W

Type of protection: IP 67 \_\_\_\_\_ DIN/EN 60529

### Schematic version B



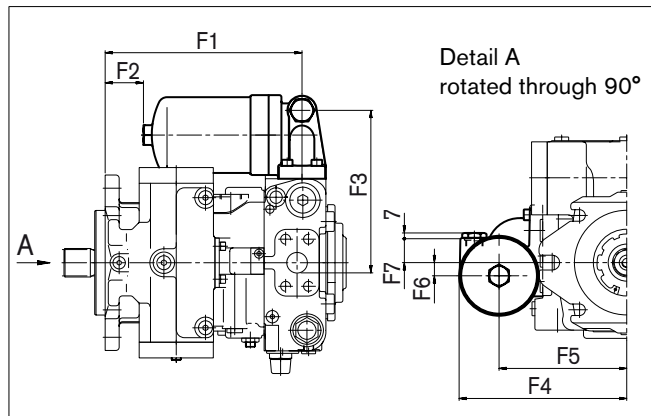
# Filtration boost circuit / external supply

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

## Dimensions with filter fitted

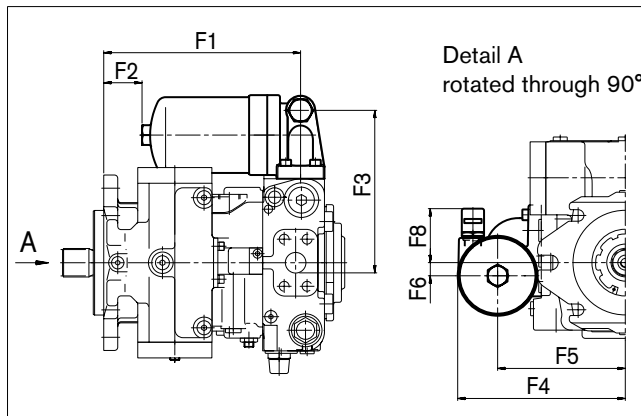
### Version F

Filter mounted without contamination indicator



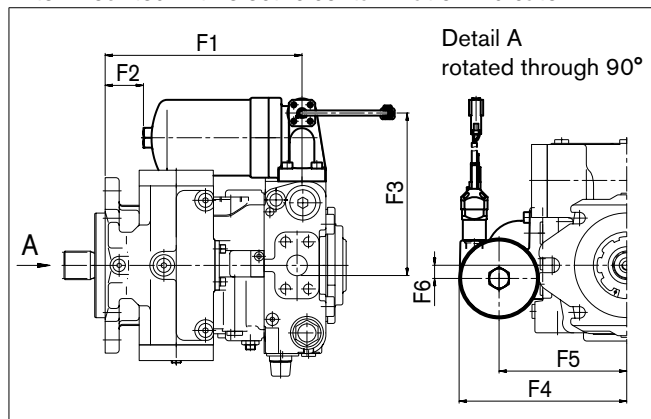
### Version P

Filter mounted with contamination indicator with window



### Version B

Filter mounted with electric contamination indicator



NG	F1	F2	F3	F4	F5	F6	F7	F8
40	201.7	47.7	160	175	135	0	42	78.5
56	218.4	64.4	163	178	138	0	42	78.5
71	239	46.5	185	203.5	155	16	29	65.5
90	248.5	56	179	197.5	149	0	45	81.5
125	235.9	59.4	201	219.5	171	0	53	89.5
180	279.9	40.3	202	220.4	171.9	17	36	72.5

# Swivel angle sensor

For the swivel angle indicator, the pump swivel angle is measured by an electric swivel angle sensor.

As an output parameter, the Hall-effect swivel angle sensor delivers a voltage proportional to the swivel angle (see table of output voltages).

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

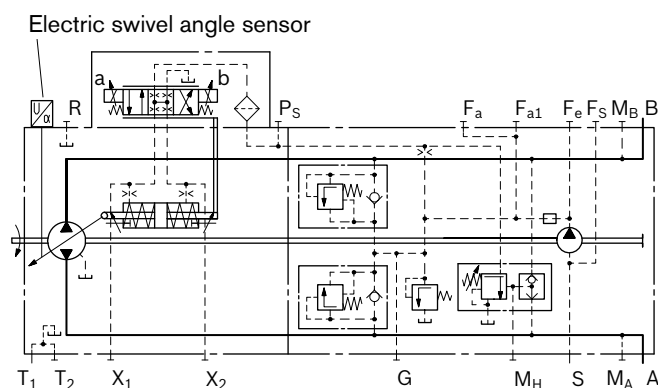
### Characteristics

Supply voltage $U_b$	10 to 30 V DC		
Output voltage $U_a$	0.5 V ( $V_{g\ max}$ )	2.5 V ( $V_{g\ 0}$ )	4.5 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

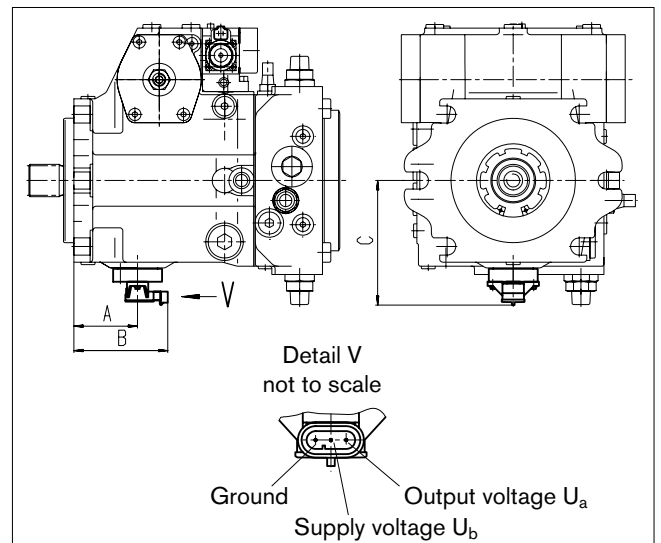
Direction of rotation	Flow direction	Operating pressure	Output voltage	
			at $V_{g0}$	at $V_{g\ max}$
CW	A to B	$M_B$	2.5 V	4.5 V
	B to A	$M_A$	2.5 V	0.5 V
CCW	B to A	$M_A$	2.5 V	4.5 V
	A to B	$M_B$	2.5 V	0.5 V

### Schematic



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

### Dimensions



NG	A	B	C
28	56.6	94	119
40	58.6	96	119
56	60.5	97.5	128.5
71	71.6	108.6	137.5
90	70.7	107.7	145.5
125	78	115	152.5
180	100.7	137.7	153.5
250	105.1	142.1	180.5

### Mating connector

AMP Superseal 1.5; 3-pin  
Bosch Rexroth Mat. No. R902602132

- Consisting of: AMP No.
- 1 socket case, 3-pins \_\_\_\_\_ 282087-1
  - 3 single wire seals, yellow \_\_\_\_\_ 281934-2
  - 3 socket contacts 1.8 - 3.3 mm \_\_\_\_\_ 283025-1

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

# Connector for solenoids

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

## DEUTSCH DT04-2P-EP04

Molded, 2-pin, without bidirectional suppressor diode (standard) \_\_\_\_\_ **P**

Molded, 2-pin, with bidirectional suppressor diode (only for switching solenoid on control module EZ1/2, DA) \_\_\_ **Q**

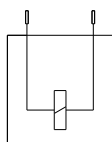
There is the following type of protection with mounted mating connector:

IP67 \_\_\_\_\_ DIN/EN 60529  
and IP69K \_\_\_\_\_ DIN 40050-9

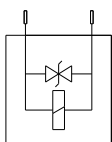
The protection circuit with bidirectional suppressor diode is needed to limit overvoltages. Overvoltages are caused by switching off the current with switches, relay contacts or by disconnecting the mating connector while voltage is applied.

### Circuit symbol

**Without** bidirectional suppressor diode



**with** bidirectional suppressor diode

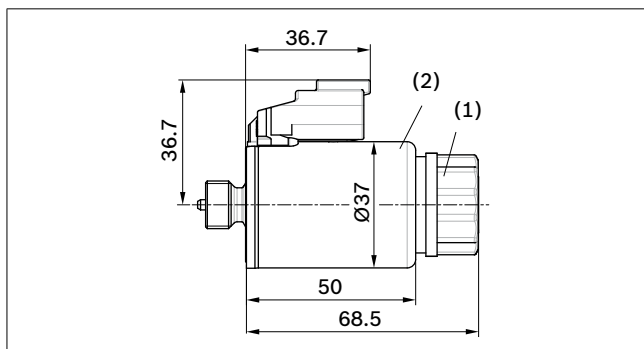


### Mating connector

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. (WAF26, 12-sided DIN 3124)

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

# Rotary inch valve

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

Any reduction of the pilot pressure possible, independently of the drive speed, through mechanical actuation of the position lever. Maximum angle of rotation 90°, lever position: any.

The valve is arranged separately from the pump and is connected to the pump by a hydraulic control line via port P<sub>S</sub> (maximum line length: approx. 2 m).

The rotary inch valve must be ordered separately.

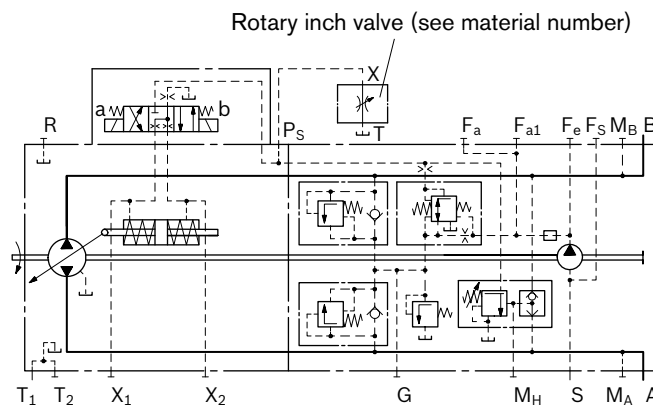
NG	Material No.	Actuating direction of the position lever
28, 40, 56, 71, 90	R902048734 R902048735	right left
125	R902048740 R902048741	right left
180, 250	R902048744 R902048745	right left

Note:

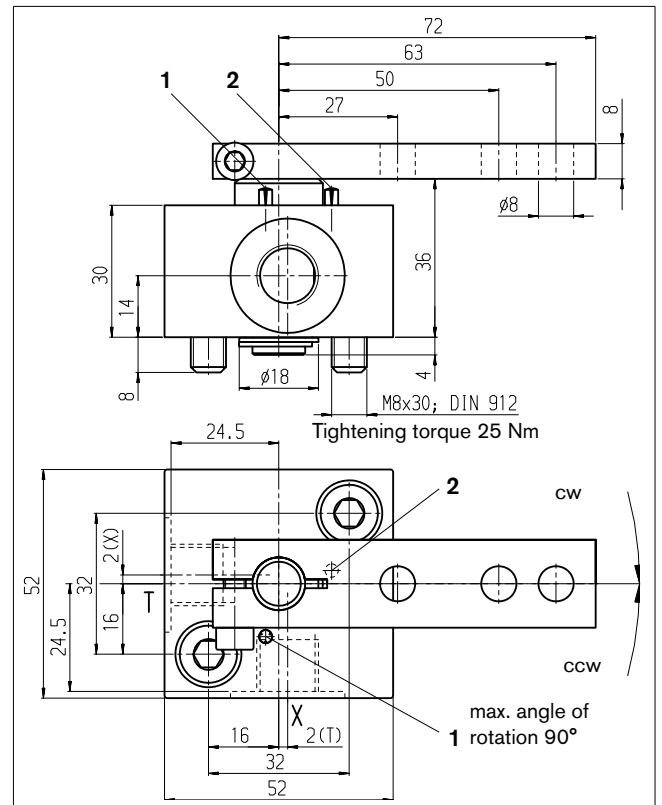
The rotary inch valve can be used regardless of the control module.

### Schematic:

Hydraulic control, speed-related, DA with separately attached rotary inch valve



## Dimensions



### Note

Limitation 1 and 2 are function stops for inching. They are not to be used as a mechanical limitation within the system. We recommend limiting the angle of rotation to 85° within the system.

Designation	Port for	Standard	Size <sup>1)</sup>	Maximum pressure [bar] <sup>2)</sup>	State <sup>3)</sup>
X	Pilot pressure	DIN 3852	M14 x 1.5; 12 deep	40	O
T	Drain line	DIN 3852	M14 x 1.5; 12 deep	3	O

1) Observe the general instructions on page 68 for the maximum tightening torques.

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

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

# 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.

## Size 28 and 40 (with free turning):

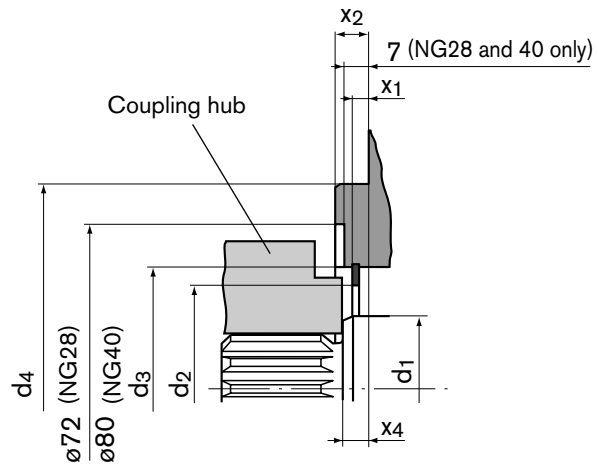
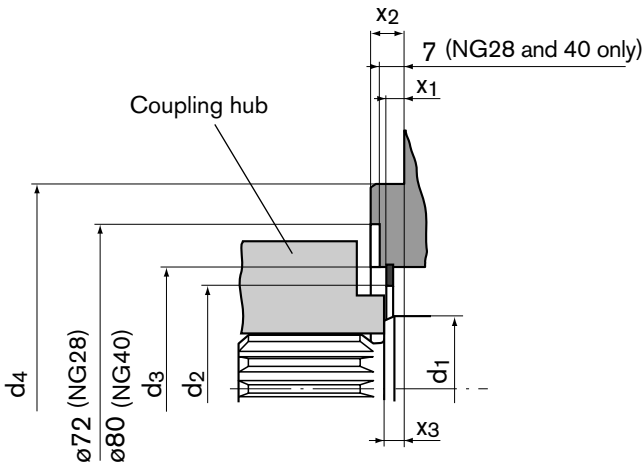
- SAE and DIN splined shaft  
Note diameter of free turning (size 28:  $\varnothing 72$ , size 40:  $\varnothing 80$ ).

## Size 56 to 250 (without free turning):

- SAE splined shaft (shaft S or T)  
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  $x_2 - x_3$ ).
- DIN splined shaft (shaft Z or A)  
The outer diameter of the shoulder on coupling hub must be smaller than the case diameter  $d_3$  in the area near the drive shaft collar (dimension  $x_2 - x_4$ ).

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

### DIN splined shaft (splines according to DIN 5480)



NG	$\varnothing d_1$	$\varnothing d_{2 \text{ min}}$	$\varnothing d_3$	$\varnothing d_4$	$x_1$	$x_2$	$x_3$	$x_4$
28	35	43.4	$55 \pm 0.1$	101.6	$3.3^{+0.2}$	$9.5_{-0.5}$	$8^{+0.9}_{-0.6}$	$10^{+0.9}_{-0.6}$
40	40	51.4	$63 \pm 0.1$	127	$4.3^{+0.2}$	$12.7_{-0.5}$	$8^{+0.9}_{-0.6}$	$10^{+0.9}_{-0.6}$
56	40	54.4	$68 \pm 0.1$	127	$7.0^{+0.2}$	$12.7_{-0.5}$	$8^{+0.9}_{-0.6}$	$10^{+0.9}_{-0.6}$
71	45	66.5	$81 \pm 0.1$	127	$7.0^{+0.2}$	$12.7_{-0.5}$	$8^{+0.9}_{-0.6}$	$10^{+0.9}_{-0.6}$
90	50	66.5	$81 \pm 0.1$	152.4	$6.8^{+0.2}$	$12.7_{-0.5}$	$8^{+0.9}_{-0.6}$	$10^{+0.9}_{-0.6}$
125	55	76.3	$91 \pm 0.1$	152.4	$7.0^{+0.2}$	$12.7_{-0.5}$	$8^{+0.9}_{-0.6}$	$10^{+0.9}_{-0.6}$
180	60	88	$107 \pm 0.1$	165.1	$7.4^{+0.2}$	$15.9_{-0.5}$	$8^{+0.9}_{-0.6}$	$10^{+0.9}_{-0.6}$
250	75	104.6	121	165.1	$6.3^{+0.2}$	$15.9_{-0.5}$	$8^{+0.9}_{-0.6}$	$10^{+0.9}_{-0.6}$



# 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.

Particularly in the installation position "drive shaft upwards" filling and air bleeding must be carried out completely as there is, for example, a danger of dry running.

The case drain fluid in the pump housing must be directed to the reservoir via the highest available drain port (T<sub>1</sub>, T<sub>2</sub>).

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

## Installation position

See the following examples 1 to 12.

Further installation positions are available upon request.

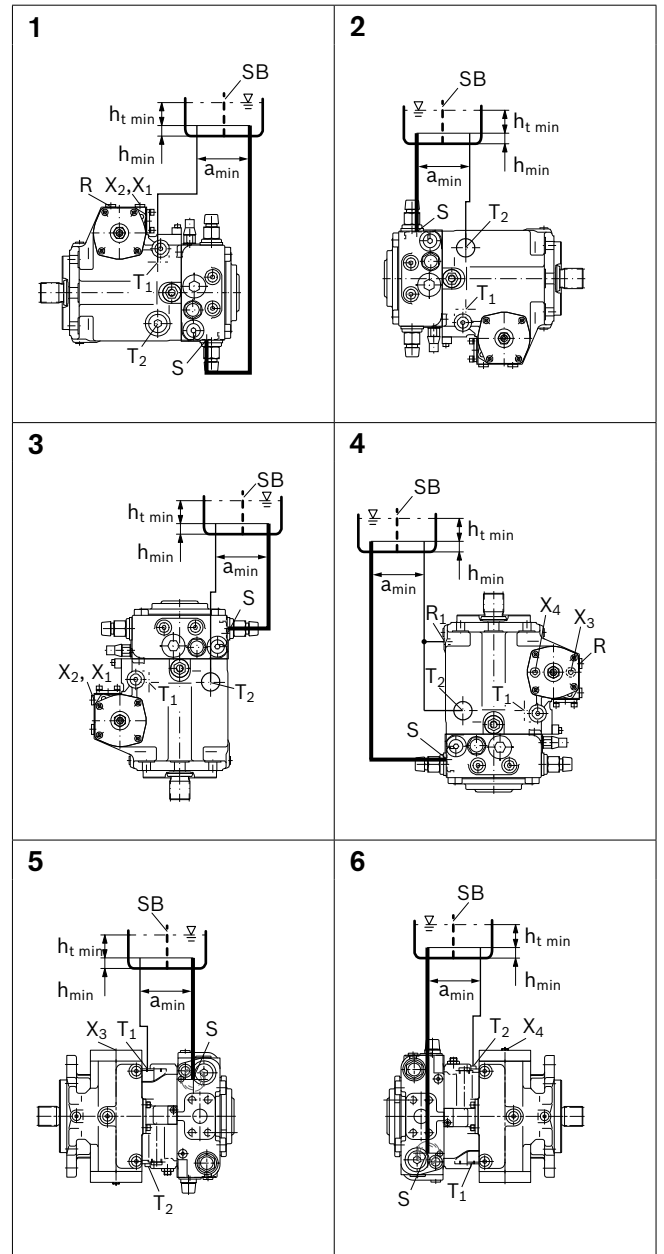
Recommended installation positions: 1 and 2.

### Notes

- Size 71 to 250  
With the "drive shaft upwards" installation position, an R<sub>1</sub>-port is necessary (special version).
- If it is not possible to fill the stroking chambers via X<sub>1</sub> to X<sub>4</sub> 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<sub>1</sub>, X<sub>2</sub> or X<sub>3</sub>, X<sub>4</sub> 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.



Installation position	Bleeding the case	Bleeding the stroking chamber	Filling
1	R	X <sub>1</sub> , X <sub>2</sub>	S + T <sub>1</sub> + X <sub>1</sub> + X <sub>2</sub>
2	-	-	S + T <sub>2</sub>
3	-	X <sub>1</sub> , X <sub>2</sub>	S + T <sub>2</sub> + X <sub>1</sub> + X <sub>2</sub>
4	R <sub>1</sub>	X <sub>3</sub> , X <sub>4</sub>	S + T <sub>2</sub> + X <sub>3</sub> + X <sub>4</sub>
5	-	X <sub>3</sub>	S + T <sub>1</sub> + X <sub>3</sub>
6	-	X <sub>4</sub>	S + T <sub>2</sub> + X <sub>4</sub>

Note instructions!

Key, see page 64.

# Installation instructions

## Above-reservoir installation

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

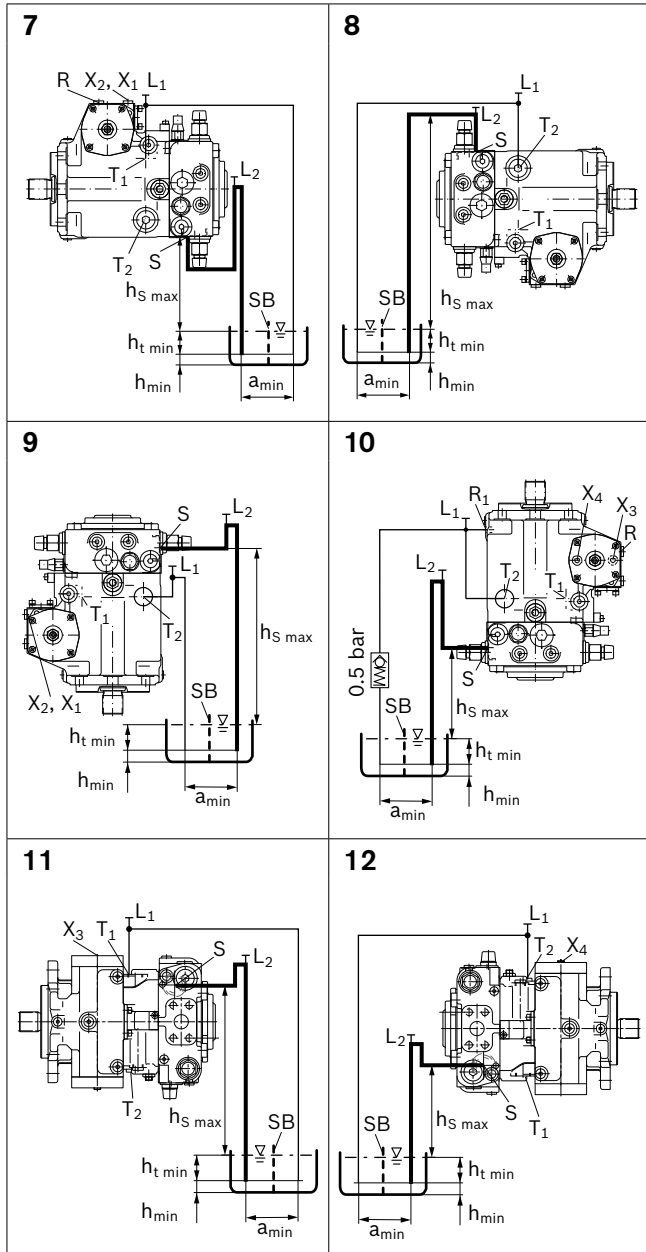
Observe the maximum permissible suction height  $h_{S\ max} = 800\ mm$ .

Recommendation for installation position 10 (drive shaft upward): A check valve in the drain line (cracking pressure 0.5 bar) can prevent draining of the pump housing.

Installation position	Bleeding the case	Bleeding the stroking chamber	Filling
7	$L_2 + R$	$X_1, X_2$	$L_1 + L_2 + X_1 + X_2$
8	$L_2 (S) + L_1 (T_2)$	–	$L_2 (S) + L_1 (T_2)$
9	$L_2 (S) + L_1 (T_2)$	$X_1, X_2$	$L_2 (S) + L_1 (T_2) + X_1 + X_2$
10	$L_2 + R_1$	$X_3, X_4$	$L_1 + L_2 + X_3 + X_4$
11	$L_2 (S) + L_1 (T_1)$	$X_3$	$L_2 (S) + L_1 (T_1) + X_3$
12	$L_2 (S) + L_1 (T_2)$	$X_4$	$L_2 (S) + L_1 (T_2) + X_4$

Comply with notes on page 65!

- L<sub>1</sub>, L<sub>2</sub>** Filling / air bleed
- R** Air bleed port
- S** Suction port
- T<sub>1</sub>, T<sub>2</sub>** Drain port
- SB** Baffle (baffle plate)
- h<sub>t min</sub>** Minimum required immersion depth (200 mm)
- h<sub>min</sub>** Minimum required spacing to reservoir bottom (100 mm)
- h<sub>S max</sub>** Maximum permissible suction height (800 mm)
- a<sub>min</sub>** When designing the reservoir, ensure adequate space between the suction line and the drain line. This prevents the heated, return flow from being drawn directly back into the suction line.



# Notes

## General instructions

- The pump A4VG 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 instructions regarding the tightening torques of the fittings used.
  - Mounting bolts:
    - For mounting bolts with metric ISO thread according to DIN 13 or 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		Maximum permissible tightening torque of the female threads $M_{G \max}$	Required tightening torque of the threaded plugs $M_V^{1)}$	WAF hexagon socket of the threaded plugs
Standard	Size of thread			
DIN 3852	M10 x 1	30 Nm	15 Nm <sup>2)</sup>	5 mm
	M12 x 1.5	50 Nm	25 Nm <sup>2)</sup>	6 mm
	M14 x 1.5	80 Nm	35 Nm	6 mm
	M16 x 1.5	100 Nm	50 Nm	8 mm
	M18 x 1.5	140 Nm	60 Nm	8 mm
	M22 x 1.5	210 Nm	80 Nm	10 mm
	M26 x 1.5	230 Nm	120 Nm	12 mm
	M33 x 2	540 Nm	225 Nm	17 mm
	M42 x 2	720 Nm	360 Nm	22 mm
	M48 x 2	900 Nm	400 Nm	24 mm

- 1) The tightening torques apply for screws in the "dry" state as received on delivery and in the "lightly oiled" state for installation.
- 2) In the "lightly oiled" state, the  $M_V$  is reduced to 10 Nm for M10 x 1 and 17 Nm for M12 x 1.5.