

Axial Piston Variable Pump A4VG

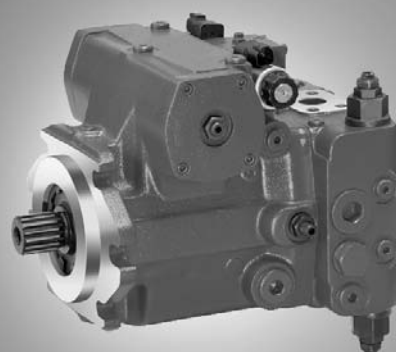
RE 92003/03.09

Replaces: 09.07

1/64

Data sheet

Series 32
Sizes 28...250
Nominal pressure 400 bar
Peak pressure 450 bar
Closed circuit



Contents

Ordering Code / Standard Program	2
Technical Data	5
High-Pressure Relief Valves	9
Pressure Cut-Off, D	10
NV - Version Without Control Unit	11
DG - Hydraulic Control, Direct Operated	11
EZ - Electric Two-Point Control, With Switching Solenoid	11
HD - Hydraulic Control, Pilot-Pressure Related	12
HW - Hydraulic Control, Mechanical Servo	13
EP - Electric Control, With Proportional Solenoid	14
DA - Hydraulic Control, Speed Related	16
Unit Dimensions, Size 28	18
Unit Dimensions, Size 40	22
Unit Dimensions, Size 56	26
Unit Dimensions, Size 71	30
Unit Dimensions, Size 90	34
Unit Dimensions, Size 125	38
Unit Dimensions, Size 180	42
Unit Dimensions, Size 250	46
Through Drive Dimensions	50
Overview of Attachments on A4VG	53
Combination Pumps A4VG + A4VG	53
Mechanical Stroke Limiter, M	54
Ports X ₃ and X ₄ for Positioning Pressure, T	54
Filtration Types	55
Swivel Angle Indicator	59
Connector for Solenoids (Only for EP, EZ, DA)	60
Rotary Inch Valve	61
Installation Situation for Coupling Assembly	62
Installation Notes	63
General Notes	64

Features

- Variable axial piston pump of swashplate design for hydrostatic closed circuit transmissions
- Flow is proportional to drive speed and displacement and is infinitely variable
- Output flow increases with the swivel angle of the swashplate from 0 to its maximum value
- Flow direction changes smoothly when the swashplate is moved through the neutral position
- A wide range of highly adaptable control devices is available for different control and regulating functions
- The pump is equipped with two pressure-relief valves on the high pressure ports 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 and control oil pump
- The maximum boost pressure is limited by a built-in boost pressure relief valve
- The integral pressure cut-off is standard

Ordering Code / Standard Program



A4V	G			D						/ 32		-	N																
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	Variable swashplate design, nominal pressure 400 bar, peak pressure 450 bar	A4V
----	---	------------

Operation mode

02	Pump in closed circuit	G
----	------------------------	----------

Size

03	≈ Displacement $V_{g\ max}$ in cm ³	28	40	56	71	90	125	180	250
----	--	-----------	-----------	-----------	-----------	-----------	------------	------------	------------

Control device

			28	40	56	71	90	125	180	250	
04	Without control unit		●	●	●	●	●	●	●	●	NV
	Hydraulic control	pilot-pressure related with supply filtration	●	●	●	●	●	●	●	●	HD3
		mechanical servo	●	●	●	●	●	●	●	●	HW
		direct operated	●	●	●	●	●	●	●	●	DG
		speed related (Description U = 12 V DC DA control valve in Pos. 09) U = 24 V DC	●	●	●	●	●	●	●	●	DA1
			●	●	●	●	●	●	●	●	DA2
	Electric control	with proportional solenoid U = 12 V DC	●	●	●	●	●	●	●	●	EP3
		with supply filtration U = 24 V DC	●	●	●	●	●	●	●	●	EP4
		with switching solenoid U = 12 V DC	●	●	●	●	●	●	●	●	EZ1
			●	●	●	●	●	●	●	●	EZ2

Pressure cut-off

		28	40	56	71	90	125	180	250	
05	With pressure cut-off (standard)	●	●	●	●	●	●	●	●	D

Neutral position switch (only for HW)

		28	40	56	71	90	125	180	250	
06	Without neutral position switch (without code)	●	●	●	●	●	●	●	●	
	With neutral position switch (with DEUTSCH connector)	●	●	●	●	●	●	●	●	L

Mechanical stroke limiter

		28	40	56	71	90	125	180	250	
07	Without mechanical stroke limiter (without code)	●	●	●	●	●	●	●	●	
	With mechanical stroke limiter, external variable	●	●	●	●	●	●	●	●	M

Ports X₃, X₄ for positioning pressure

		28	40	56	71	90	125	180	250	
08	Without ports X ₃ , X ₄ (without code)	●	●	●	●	●	●	●	●	
	With ports X ₃ , X ₄	●	●	●	●	●	●	●	●	T

DA control valve

		NV	HD1	HW	DG	DA	EP	EZ	
09	Without DA control valve	●	●	●	●	-	●	●	1
	With DA control valve, fixed setting	-	●	●	●	●	●	-	2
	With DA control valve, mech. Actuating direction - clockwise adjustable with position lever Actuating direction - counterclockwise	-	●	●	●	●	●	-	3R
		-	●	●	●	●	●	-	3L
	With DA control valve, fixed setting and hydraulic inch valve mounted, control with brake fluid	-	-	-	-	●	-	-	4
	With DA control valve, fixed setting and ports for pilot control device	-	●	●	●	●	●	-	7
	With DA control valve, fixed setting and hydraulic inch valve mounted, control with mineral oil	-	-	-	-	●	-	-	8

Ordering Code / Standard Program

A4V	G			D					/	32		-	N										
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	32
----	-------------------	----

Direction of rotation

11	Viewed from shaft end	clockwise	R
		counterclockwise	L

Seals

12	NBR (nitrile-caoutchouc), shaft seal ring in FKM (fluor-caoutchouc)	N
----	---	---

Shaft end (permissible input torque see page 8)

Shaft end (permissible input torque see page 8)			28	40	56	71	90	125	180	250	
13	Splined shaft DIN 5480	for single pump	●	●	●	●	●	●	●	●	Z
		for combination pump - 1 st pump	– ¹⁾	●	●	●	●	●	– ¹⁾	– ¹⁾	A
	Splined shaft ANSI B92.1a–1976	for single pump	●	●	●	●	●	●	●	●	S
		for combination pump - 1 st pump	– ²⁾	– ²⁾	●	●	– ²⁾	●	●	●	T
		only for combination pump - 2nd pump	–	●	–	–	●	–	–	–	U

Mounting flange

Mounting flange		28	40	56	71	90	125	180	250	
14	SAE J744 – 2-bolt	●	●	●	–	–	–	–	–	C
	SAE J744 – 4-bolt	–	–	–	–	–	–	●	●	D
	SAE J744 – 2+4-bolt	–	–	–	●	●	●	–	–	F

Service line ports (metric fixing thread)

Service line ports (metric fixing thread)			28	40...180	250	
15	SAE flange ports		–	●	–	02
	A/B top and bottom		–	○	–	03
	SAE flange ports	right	●	–	●	10
	A/B same side	left	○	–	○	13

Boost pump

[illegible]

Through drive (mounting options, see page 53)

Through drive (mounting options, see page 33)				28	40	56	71	90	125	180	250	
17	Flange SAE J744 ³⁾	Hub for splined shaft										
	82-2 (A)	5/8 in	9T 16/32DP ⁴⁾	●	●	●	●	●	●	●	●	.01
	101-2 (B)	7/8 in	13T 16/32DP ⁴⁾	●	●	●	●	●	●	●	●	.02
		1 in	15T 16/32DP ⁴⁾	●	●	●	●	●	●	●	●	.04
	127-2 (C)	1 in	15T 16/32DP ⁴⁾	–	●	–	–	–	–	–	–	.09
		1 1/4 in	14T 12/24DP ⁴⁾	–	–	●	●	●	●	●	●	.07
	152-2/4 (D)	W35	2x30x16x9g ⁵⁾	–	–	–	–	●	–	–	–	.73
		1 3/4 in	13T 8/16DP ⁴⁾	–	–	–	–	–	●	●	●	.69
	165-4 (E)	1 3/4 in	13T 8/16DP ⁴⁾	–	–	–	–	–	–	●	●	.72

Ordering Code / Standard Program

[illegible]

Valves		setting range Δp	28	40	56	71	90	125	180	250	
18	With high-pressure relief valve, pilot operated	100...420 bar with bypass	–	–	–	●	●	●	●	●	1
	With high-pressure relief valve, direct operated (fixed setting)	270...420 bar without bypass	●	●	●	–	–	–	–	–	3
		with bypass	●	●	●	–	–	–	–	–	5
		100...250 bar without bypass	●	●	●	–	–	–	–	–	4
		with bypass	●	●	●	–	–	–	–	–	6

[illegible][illegible][illegible]

Standard / special version ⁶⁾			
22	Standard version	without code	
		combined with attachment part or attachment pump	-K
	Special version		-S
		combined with attachment part or attachment pump	-SK

¹⁾ Standard for combination pump – 1st pump: shaft **Z**

2) Standard for combination pump – 1st pump: shaft **S**

³⁾ 2 = 2-bolt; 4 = 4-bolt

⁴⁾ Hub for splined shaft acc. to ANSI B92.1a-1976 (splined shaft assigned acc. to SAE J744, see page 50-52)

⁵⁾ Hub for splined shaft acc. to DIN 5480

⁶⁾ Adjustment data are included in the material number

● = available ○ = on request – = not available

 = preferred program

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 90223 (HF hydraulic fluids) for detailed information regarding the choice of hydraulic fluid and application conditions.

The variable pump A4VG is unsuitable for operation with HFA, HFB and HFC. If HFD or environmentally acceptable hydraulic fluids are being used, the limitations regarding technical data and seals mentioned in RE 90221 and RE 90223 must be observed.

When ordering, please indicate the used hydraulic fluid.

Operating viscosity range

For optimum efficiency and service life, select an operating viscosity (at operating temperature) within the optimum range of

$$v_{\text{opt}} = \text{opt. operating viscosity } 16 \dots 36 \text{ mm}^2/\text{s}$$

depending on the circuit temperature (closed circuit).

Limits of viscosity range

The limiting values for viscosity are as follows:

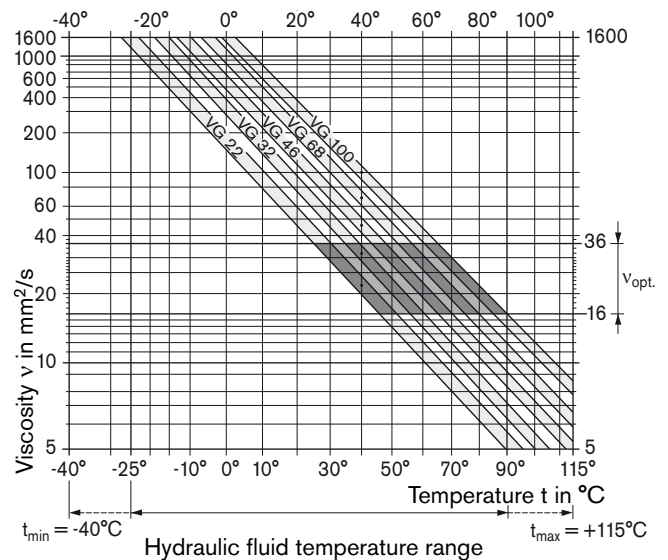
- $v_{\text{min}} = 5 \text{ mm}^2/\text{s}$
 short term ($t < 3 \text{ min}$)
 at max. perm. temperature of $t_{\text{max}} = +115^\circ\text{C}$.
- $v_{\text{max}} = 1600 \text{ mm}^2/\text{s}$
 short term ($t < 3 \text{ min}$)
 at cold start ($p \leq 30 \text{ bar}$, $n \leq 1000 \text{ rpm}$, $t_{\text{min}} = -40^\circ\text{C}$).
 Only for starting up without load. Optimum operating viscosity must be reached within approx. 15 minutes.

Note that the maximum hydraulic fluid temperature of 115°C must not be exceeded locally either (e.g. in the bearing area). The temperature in the bearing area is - depending on pressure and speed - up to 5 K higher than the average case drain temperature.

Special measures are necessary in the temperature range from -40°C to -25°C (cold start phase), please contact us.

For detailed information about use at low temperatures, see RE 90300-03-B.

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}) - the shaded area of the selection diagram. We recommended that the higher viscosity class be selected in each case.

Example: At an ambient temperature of $X^\circ\text{C}$ an operating temperature of 60°C is set. In the optimum operating viscosity range (v_{opt} ; shaded area) this corresponds to the viscosity classes VG 46 or VG 68; to be selected: VG 68.

Please note: The case drain temperature, which is affected by pressure and speed, is always higher than the circuit temperature. At no point in the system may the temperature be higher than 115°C .

If the above conditions cannot be maintained due to extreme operating parameters, please consult us.

Technical Data

Filtration

The finer the filtration, the higher the cleanliness level of the hydraulic fluid and the longer the service life of the axial piston unit.

To ensure functional reliability of the axial piston unit the hydraulic fluid must have a cleanliness level of at least

20/18/15 according to ISO 4406.

Depending on the system and the application, for the A4VG, we recommend

Filter elements $\beta_{20} \geq 100$

With a rising differential pressure at the filter elements, the β -value must not deteriorate.

At very high hydraulic fluid temperatures (90 °C to max. 115 °C) at least cleanliness level

19/17/14 according to ISO 4406 is required.

If the above classes cannot be observed, please contact us.
For notes on filtration types, see pages 55-58

Operating pressure range

Input

Variable pump (with external supply, E):

For control EP, EZ, HW and HD
boost pressure (at $n = 2000$ rpm) p_{Sp} _____ 20 bar

For control DA, DG
boost pressure (at $n = 2000$ rpm) p_{Sp} _____ 25 bar

Boost pump:

suction pressure $p_{s \min}$ ($v \leq 30$ mm²/s) _____ ≥ 0.8 bar absolute
at cold starts, short term ($t < 3$ min) _____ ≥ 0.5 bar absolute

Output

Variable pump:

pressure at port A or B

Nominal pressure p_N _____ 400 bar

Peak pressure p_{max} _____ 450 bar

Boost pump:

peak pressure $p_{Sp \max}$ _____ 40 bar
(pressure data according to DIN 24312)

Nominal pressure: Max. design pressure at which fatigue strength is ensured.

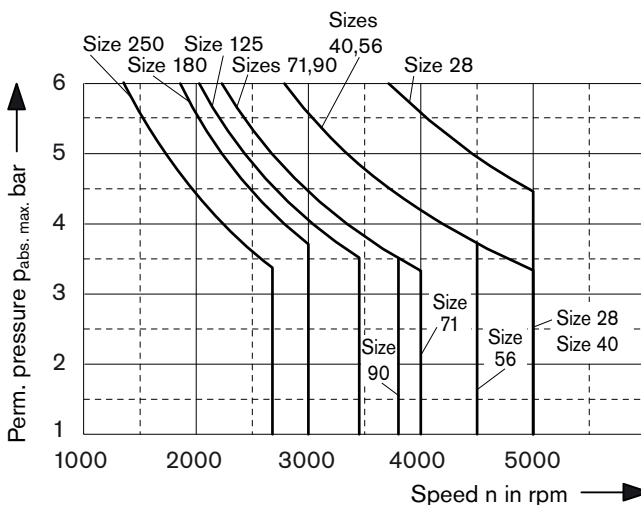
Peak pressure: Max. operating pressure which is permissible for short term ($t < 1$ s).

Shaft seal ring

Permissible pressure loading

The service life of the shaft seal ring is affected by the speed of the pump and the case drain pressure. It is recommended that the average, continuous case drain pressure at operating temperature 3 bar absolute not be exceeded (max. permissible case drain pressure 6 bar absolute at reduced speed, see diagram). Short term ($t < 0.1$ s) pressure spikes of up to 10 bar absolute are permitted. The service life of the shaft seal ring decreases with an increase in the frequency of pressure spikes.

The case pressure must be equal to or greater than the external pressure on the shaft seal ring.



Temperature range

The FKM shaft seal ring is permissible for case temperatures of -25 °C to +115 °C.

Note:

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

Technical Data

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

Size			28	40	56	71	90	125	180	250
Displacement										
variable pump	$V_{g \max}$	cm ³	28	40	56	71	90	125	180	250
boost pump (at p = 20 bar)	$V_{g Sp}$	cm ³	6.1	8.6	11.6	19.6	19.6	28.3	39.8	52.5
Speed										
maximum at $V_{g \max}$	$n_{\max \text{ continuous}}$	rpm	4250	4000	3600	3300	3050	2850	2500	2400
limited maximum ¹⁾	$n_{\max \text{ limited}}$	rpm	4500	4200	3900	3600	3300	3250	2900	2600
intermittent maximum ²⁾	$n_{\max \text{ interm.}}$	rpm	5000	5000	4500	4100	3800	3450	3000	2700
minimum	$n_{\min}$	rpm	500	500	500	500	500	500	500	500
Flow										
at $n_{\max \text{ continuous}}$ and $V_{g \max}$	$q_{v \max}$	l/min	119	160	202	234	275	356	450	600
Power ³⁾										
at $n_{\max \text{ continuous}}$ and $V_{g \max}$ $\Delta p = 400 \text{ bar}$	$P_{\max}$	kW	79	107	134	156	183	237	300	400
Torque ³⁾										
at $V_{g \max}$	$\Delta p = 400 \text{ bar}$ $T_{\max}$	Nm	178	255	356	451	572	795	1144	1590
	$\Delta p = 100 \text{ bar}$ T	Nm	44.5	63.5	89	112.8	143	198.8	286	398
Rotary stiffness	Shaft end S c	Nm/rad	31400	69000	80800	98800	158100	218300	244500	354500
	Shaft end T c	Nm/rad	–	–	95000	120900	–	252100	318400	534300
	Shaft end A c	Nm/rad	–	79600	95800	142400	176800	256500	–	–
	Shaft end Z c	Nm/rad	32800	67500	78800	122800	137000	223700	319600	624200
	Shaft end U c	Nm/rad	–	50800	–	–	107600	–	–	–
Moment of inertia for rotary group	J_{GR}	kgm ²	0.0022	0.0038	0.0066	0.0097	0.0149	0.0232	0.0444	0.0983
Angular acceleration max. ⁴⁾	α	rad/s ²	38000	30000	24000	21000	18000	14000	11000	6700
Filling capacity	V	L	0.9	1.1	1.5	1.3	1.5	2.1	3.1	6.3
Weight approx. (without through drive)	m	kg	29	31	38	50	60	80	101	156

¹⁾ Restricted maximum speed: – at half corner power (e.g. at $V_{g \max}$ and $p_N / 2$)

²⁾ Intermittent maximum speed: – at high idle speed
 – at overspeed: $\Delta p = 70 \dots 150 \text{ bar}$ and $V_{g \max}$
 – at reversing peaks: $\Delta p < 300 \text{ bar}$ and $t < 0.1 \text{ s}$.

³⁾ Without boost pump

⁴⁾ – The area of validity is situated between the minimum required and maximum permissible speed.
 It applies for external stimuli (e.g. engine 2-8 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 has to be considered.

Caution: Exceeding the permissible limit values may result in a loss of function, a reduction in service life or in the destruction of the axial piston unit.

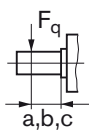
A calculation can be performed to determine the permissible values.

Determining the size

Flow	$q_v = \frac{V_g \cdot n \cdot \eta_v}{1000}$	l/min	V_g = displacement volume per revolution in cm ³ Δp = differential pressure in bar
Torque	$T = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}}$	Nm	n = speed in rpm η_v = volumetric efficiency
Power	$P = \frac{2 \pi \cdot T \cdot n}{60000} = \frac{q_v \cdot \Delta p}{600 \cdot \eta_t}$	kW	η_{mh} = mechanical-hydraulic efficiency η_t = total efficiency

Technical Data

Permissible axial and radial loading on drive shaft

Size			28	40	56	71	90	125	180	250	
Radial force, max. at distance (from shaft collar)		F _{q max}	N	2500	3600	5000	6300	8000	11000	16000	22000
		a	mm	17.5	17.5	17.5	20	20	22.5	25	29
		F _{q max}	N	2000	2891	4046	4950	6334	8594	12375	16809
		b	mm	30	30	30	35	35	40	45	50
		F _{q max}	N	1700	2416	3398	4077	5242	7051	10150	13600
		c	mm	42.5	42.5	42.5	50	50	57.5	60	71
Axial force, max.		-F _{ax max}	N	1557	2120	2910	4242	4330	5743	7053	4150
		+F _{ax max}	N	417	880	1490	2758	2670	3857	4947	4150

Note: special requirements apply in the case of belt drives. Please contact us.

Permissible input and through-drive torques

Size			28	40	56	71	90	125	180	250
Torque (at $V_{g \max}$ and $\Delta p = 400 \text{ bar}$) ¹⁾	$T_{\max}$	Nm	178	254	356	451	572	795	1144	1590
Input torque, max. ²⁾										
at shaft end Z DIN 5480	$T_{E \text{ perm.}}$	Nm	352	522	522	912	912	1460	3140	4350
			W25	W30	W30	W35	W35	W40	W50	W55
at shaft end A DIN 5480	$T_{E \text{ perm.}}$	Nm	–	912	912	1460	2190	2190	–	–
				W35	W35	W40	W45	W45		
at shaft end S ANSI B92.1a-1976 (SAE J744)	$T_{E \text{ perm.}}$	Nm	314	602	602	602	1640	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	1 3/4 in
at shaft end T ANSI B92.1a-1976 (SAE J744)	$T_{E \text{ perm.}}$	Nm	–	–	970	970	–	2670	4070	4070
					1 3/8 in	1 3/8 in		2 in	2 1/4 in	2 1/4 in
at shaft end U ³⁾ ANSI B92.1a-1976 (SAE J744)	$T_{E \text{ perm.}}$	Nm	–	314	–	–	602	–	–	–
				1 in			1 1/4 in			
Through-drive torque, max. ⁴⁾	$T_{D \text{ perm.}}$	Nm	231	314	521	660	822	1110	1760	2230

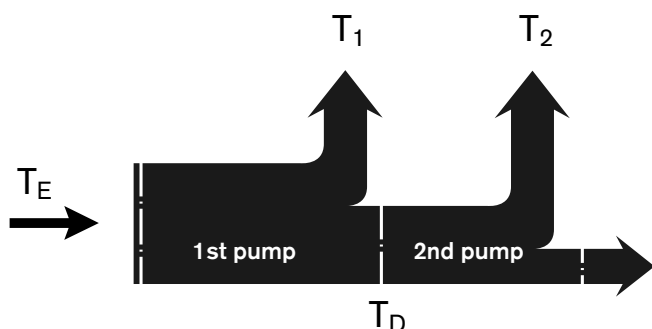
¹⁾ Efficiency not considered

²⁾ For drive shafts with no radial force

³⁾ Shaft "U" is only permitted as a shaft end on the **2nd pump** in a combination pump of the same size.

⁴⁾ Note max. input torque for **shaft S**!

Torque distribution



High-Pressure Relief Valves

Setting ranges

High-pressure relief valve, direct operated (size 28...56)	Differential pressure setting Δp_{HP}
Setting range for valve 3, 5 Δp 270 - 420 bar (refer to ordering code)	420 bar 400 bar ¹⁾ 360 bar 340 bar 320 bar 300 bar 270 bar
Setting range for valve 4, 6 Δp 100 - 250 bar (refer to ordering code)	250 bar 230 bar ¹⁾ 200 bar 150 bar 100 bar
High-pressure relief valve, pilot operated (size 71...250)	Differential pressure setting Δp_{HP}
Setting range for valve 1 Δp 100 - 420 bar (refer to ordering code)	420 bar 400 bar ¹⁾ 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. The valves will be set to this value if the differential pressure is not specified on ordering.

Please state in plain text when ordering:

(only the Δp_{HP} values shown in the table are possible)

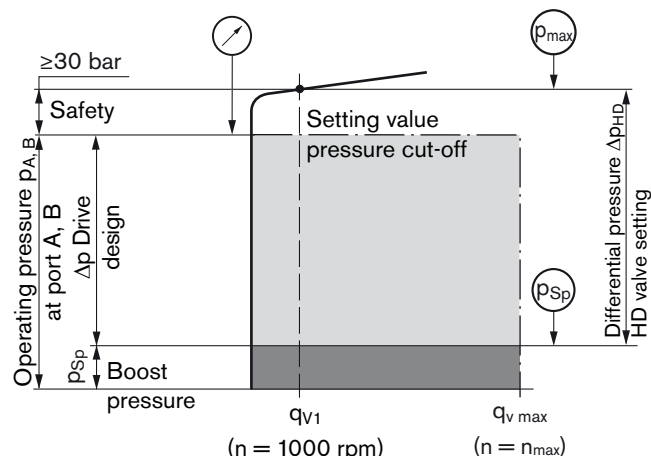
High-pressure relief valve A

Differential pressure setting : $\Delta p_{HD} = \dots \text{ bar}$
 opening pressure of the HD valve (at q_{V1}): $p_{max} = \dots \text{ bar}$
 ($p_{max} = \Delta p_{HD} + p_{Sp}$)

High-pressure relief valve B

Differential pressure setting : $\Delta p_{HD} = \dots \text{ bar}$
 opening pressure of the HD valve (at q_{V1}): $p_{max} = \dots \text{ bar}$
 ($p_{max} = \Delta p_{HD} + p_{Sp}$)

Setting diagram



Note: valve is set at
 $n = 1000 \text{ rpm}$ and $V_{g \max} (q_{V1})$

Example: boost pressure 30 bar; operating pressure 400 bar

Operating pressure $p_{A,B}$ - boost pressure p_{Sp} + safety = differential pressure Δp_{HD}
 400 bar - 30 bar + 30 bar = **400 bar**

Bypass function

The bypass function can only be used for short periods with reduced displacement, e.g. to tow a vehicle out of an immediate danger zone.

Note:

The bypass function and the pilot operated high-pressure valves (size 71...250) are not shown in these circuit diagrams.

Pressure Cut-Off, D

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

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

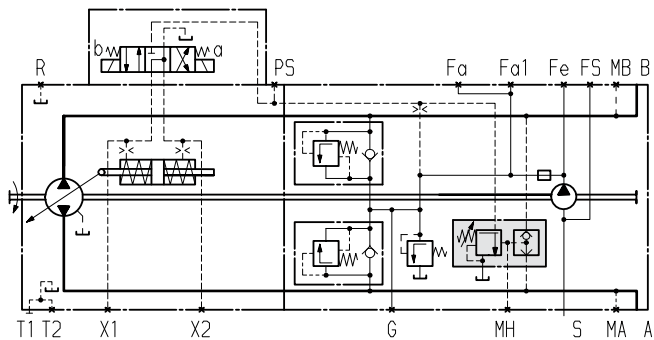
Both the pressure peaks occurring when the swashplate is swiveled rapidly and also the maximum pressure in the system are safeguarded by the high-pressure relief valves.

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 9).

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

Circuit diagram with pressure cut-off.

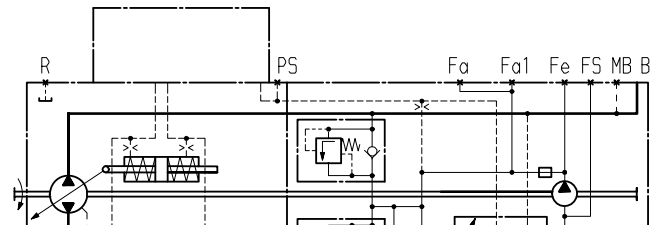
Example: Electric two-position control, EZ1D/EZ2D



NV - Version Without Control Unit

The mounting surface for the control unit is machined and is sealed with the standard seal for control units and a cover plate. This version is ready for retrofitting to control units (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 adjusting cylinder and control plate.

Standard version ¹⁾



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

DG - Hydraulic Control, Direct Operated

With the Direct Operated Hydraulic Control (DG), pump displacement is controlled by a hydraulic control pressure applied directly to the stroke cylinder through either the X_1 or X_2 port. In this way, the swashplate and thus the displacement is switchable from $V_g = 0$ to $V_{g \max}$. Each direction of through put flow is assigned to a port.

Pilot pressure 0 bar $\triangleq$ position $V_g = 0$

The required pilot pressure for position $V_{g \max}$ depends on operating pressure and speed.

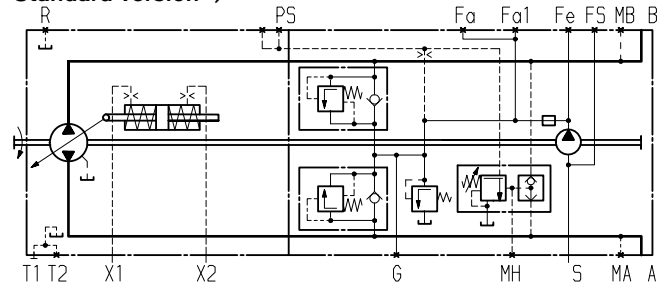
Max. permissible pilot pressure 40 bar

For project planning, please consult us.

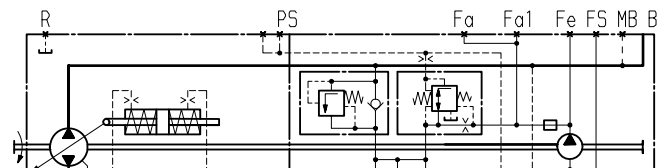
The pressure cut-off and the DA control valve only become effective if the pilot control unit used for controlling the DG control is supplied from port P_S .

Assignment of direction of rotation – control – direction of through put flow
refer to HD control, page 12 (control pressure X_1 ; X_2).

Standard version ¹⁾



Version with DA control valve ¹⁾



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

EZ - Electric Two-Position Control, With Switching Solenoid

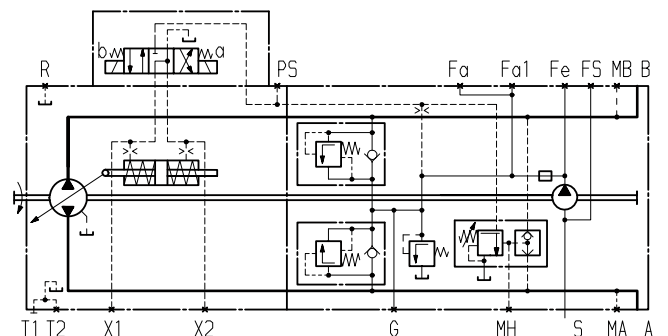
By energizing or de-energizing a control current to either switching solenoid a or b, the stroke cylinders of the pump are supplied with control pressure by the EZ control unit. In this way, the swashplate and thus the displacement is switchable without intermediate settings from $V_g = 0$ to $V_{g \max}$. Each direction of through put flow is assigned to a solenoid.

Solenoid technical data	EZ1	EZ2
Voltage	12 V DC ($\pm 20\%$)	24 V DC ($\pm 20\%$)
Neutral position $V_g = 0$	de-energized	de-energized
Position $V_{g \max}$	current energized	current energized
Nominal resistance (at 20°C)	5.5 Ω	21.7 Ω
Nominal power	26.2 W	26.5 W
Current required, minimum effective	1.32 A	0.67 A
Actuated time	100 %	100 %
Type of protection	see range of connectors on page 60	

Standard: switching solenoid without manual emergency operation.
On request: manual emergency operation with spring reset available.

Assignment direction of rotation - Control - Direction of through put flow DA control see page 16.

Standard version ¹⁾

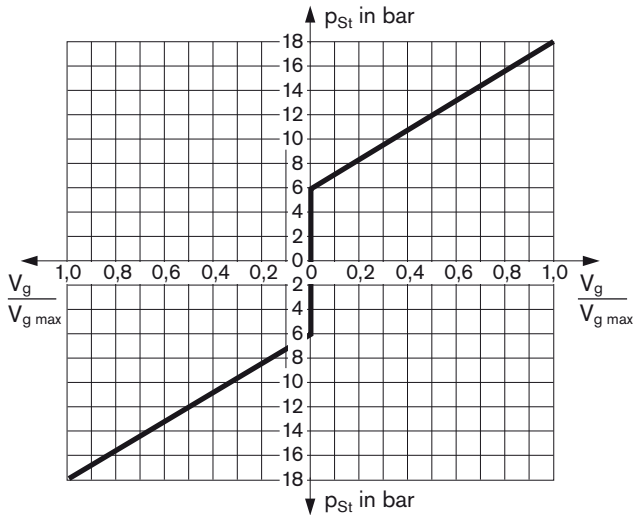


¹⁾ Size 28 and 250 without port F_{a1} and F_S

HD - Hydraulic Control, Pilot-Pressure Related

Depending on the pressure difference of the pilot pressure p_{St} in the two control lines (ports Y_1 and Y_2), the stroke cylinder of the pump is supplied with control pressure via the HD control unit. Thus, the swashplate – and, therefore, the displacement – to be infinitely adjustable. A different through put flow direction is associated with each control line.

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 pressure $p_{St} = 6 - 18\ \text{bar}$ at ports Y_1, Y_2

Start of control 6 bar

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

Please note:

The external control device must vent the Y_1 and Y_2 ports to tank pressure in neutral.

CAUTION

The spring centering in the pilot control unit is not a safety device

Through contamination in the control unit – e.g. in hydraulic fluid, wear particles, or particles out of a system – the valve spool can get stuck in an undefined position. In this case, the pump flow does not follow the command inputs of the machine operator anymore.

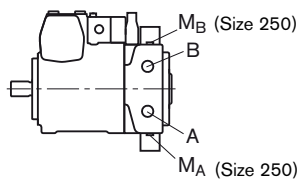
- Make sure that a proper emergency shut down function can bring the driven machine movements to a safe position immediately (e.g. stop).
- Adhere to the specified cleanliness level 20/18/15 (< 90 °C) or 19/17/14 (> 90 °C) to ISO 4406.

Assignment

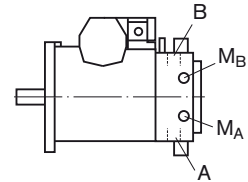
Direction of rotation - Control - Direction of through put flow

	Size	Pilot pressure	Control pressure	Through put flow	Operating pressure
Direction of rotation cw	28...56	Y_1	X_1	A to B	M_B
		Y_2	X_2	B to A	M_A
	71...250	Y_1	X_1	B to A	M_A
		Y_2	X_2	A to B	M_B
Direction of rotation ccw	28...56	Y_1	X_1	B to A	M_A
		Y_2	X_2	A to B	M_B
	71...250	Y_1	X_1	A to B	M_B
		Y_2	X_2	B to A	M_A

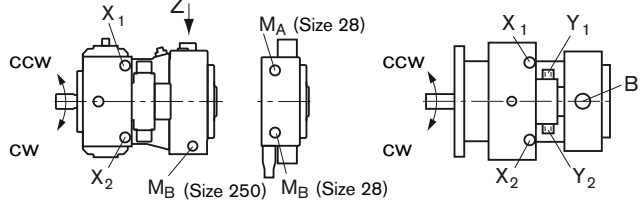
Sizes 28, 250



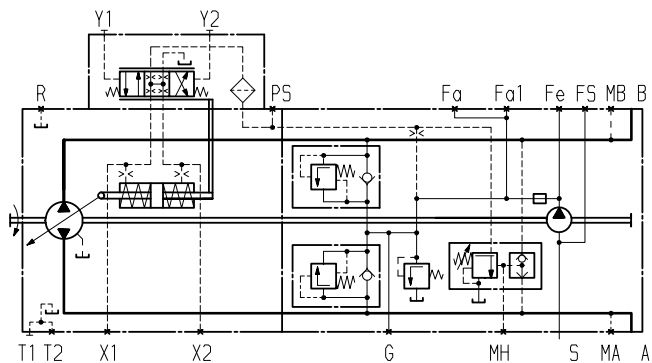
Sizes 40...180



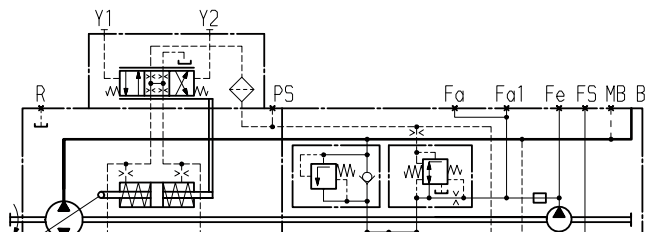
View Z



Standard version¹⁾



Version with DA control valve¹⁾

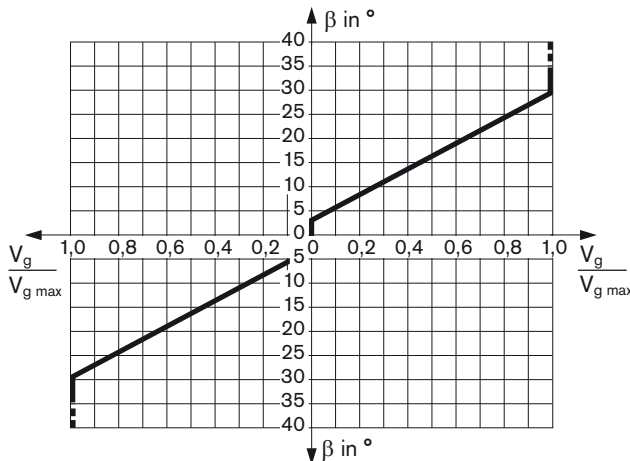


¹⁾ Size 28 and 250 without port F_{a1} and F_S

HW - Hydraulic Control, Mechanical Servo

Depending on the actuation direction a or b of the control lever, the stroke cylinder of the pump is supplied with control pressure via the HW control unit. Thus, the swashplate – and, therefore, the displacement – is infinitely adjustable. A different through put flow direction is associated with each direction of control lever actuation.

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



Swivel angle β at the control lever for deflection:

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

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

Mech. stop: sizes 28...71 $\pm 40^\circ$
sizes 90...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 linkage.

Note:

Spring centering enables the pump to move automatically into neutral position ($V_g = 0$) as soon as there is no longer any torque on the control lever of the HW control unit (regardless of deflection angle).

Variation: Neutral position switch, L

The switch contact in the neutral position switch is closed when the control lever on the HW control unit is in its neutral position. The switch opens if the control lever is moved out of neutral in either direction.

The neutral position switch provides a safety function for drive units that require zero flow under certain operating conditions (e.g. starting diesel engines).

Technical data of neutral position switch

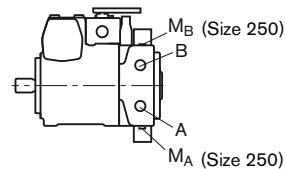
Load capacity	20 A (continuous), without switching operating
Switching capacity	15 A / 32 V (ohm's load)
	4 A / 32 V (inductive load)
Connector version	DEUTSCH connector DT04-2P-EP04 (mating connector see page 60)

Assignment

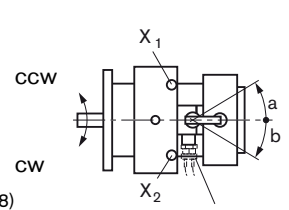
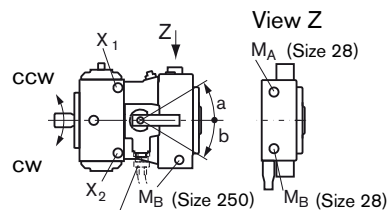
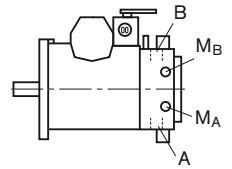
Direction of rotation - Control - Direction of through put flow

	Size	Lever direction	Control pressure	Through put flow	Operating pressure
Direction of rotation cw	28...56	a	X_2	B to A	M_A
		b	X_1	A to B	M_B
	71...250	a	X_2	A to B	M_B
		b	X_1	B to A	M_A
Direction of rotation ccw	28...56	a	X_2	A to B	M_B
		b	X_1	B to A	M_A
	71...250	a	X_2	B to A	M_A
		b	X_1	A to B	M_B

Sizes 28, 250



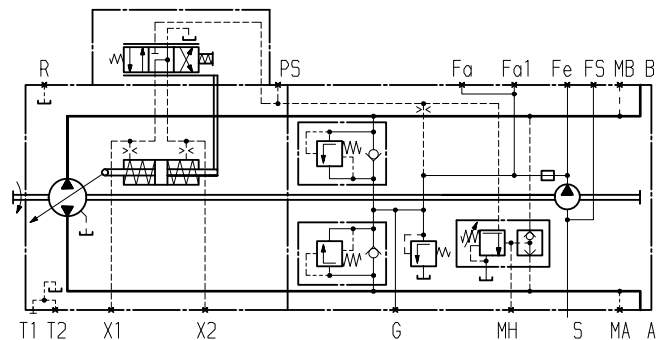
Sizes 40...180



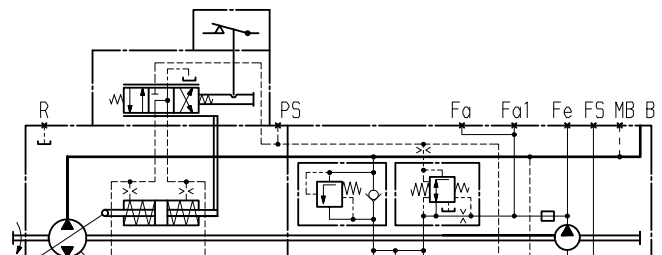
Neutral position switch

Neutral position switch

Standard version 1)



Version with DA control valve and neutral position switch 1)

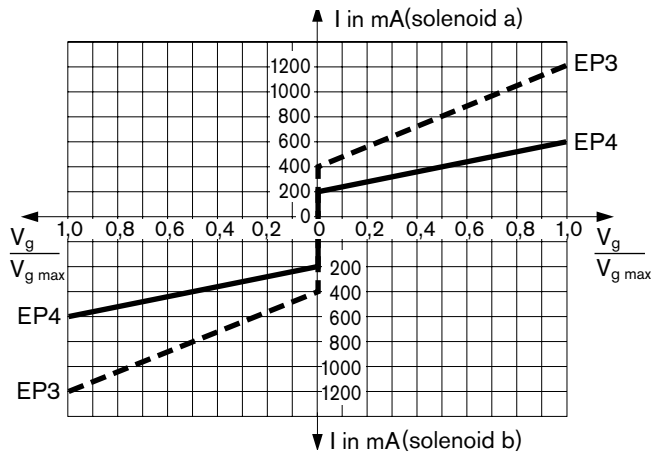


1) Size 28 and 250 without port F_{a1} and F_S

EP - Electric Control, With Proportional Solenoid

Depending on the preselected current I at the two proportional solenoids (a and b), the stroke cylinder of the pump is supplied with control pressure via the EP control unit. Thus, the swashplate – and, therefore, the displacement – to be infinitely adjustable. One direction of through put flow is assigned to each proportional solenoid.

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



Solenoid technical data	EP3	EP4
Voltage	12 V DC ($\pm 20\%$)	24 V DC ($\pm 20\%$)
Control current		
Start of control at V_{g0}	400 mA	200 mA
End of control at V_{gmax}	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
Actuated time	100 %	100 %
Type of protection	see range of connectors on page 60	

The following electronic controllers and amplifiers are available for actuating the proportional solenoids (details also available at www.boschrexroth.com/mobile-electronics):

- BODAS controller RC
 - series 20 _____ RE 95200
 - series 21 _____ RE 95201
 - series 22 _____ RE 95202
 - series 30 _____ RE 95203
 and application software
- Analog amplifier RA _____ RE 95230

CAUTION

The spring centering in the pilot control unit is not a safety device

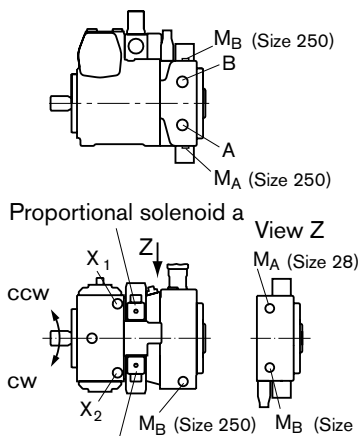
Through contamination in the control unit – e.g. in hydraulic fluid, wear particles, or particles out of a system – the valve spool can get stuck in an undefined position. In this case, the pump flow does not follow the command inputs of the machine operator anymore.

- Make sure that a proper emergency shut down function can bring the driven machine movements to a safe position immediately (e.g. stop).
- Adhere to the specified cleanliness level 20/18/15 ($< 90\text{ °C}$) or 19/17/14 ($> 90\text{ °C}$) to ISO 4406.

Assignment

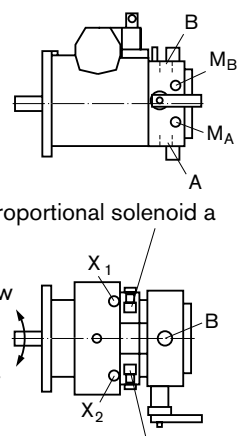
Direction of rotation - Control - Direction of through put flow					
	Size	Actuation of Solenoid	Control pressure	Through put flow	Operating pressure
Direction of rotation cw	28...56	a	X_1	A to B	M_B
		b	X_2	B to A	M_A
	71...250	a	X_1	B to A	M_A
		b	X_2	A to B	M_B
Direction of rotation ccw	28...56	a	X_1	B to A	M_A
		b	X_2	A to B	M_B
	71...250	a	X_1	A to B	M_B
		b	X_2	B to A	M_A

Sizes 28, 250



Proportional solenoid a

Sizes 40...180



Proportional solenoid a

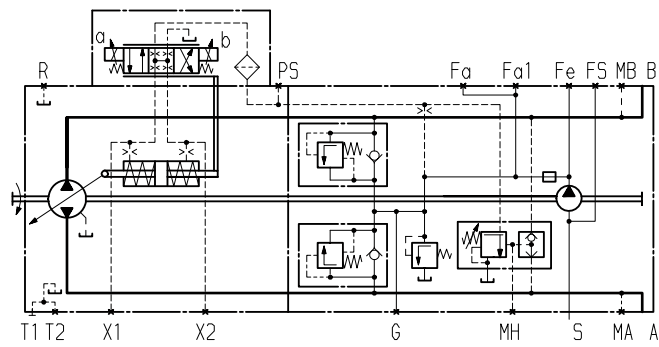
Proportional solenoid b

Proportional solenoid b

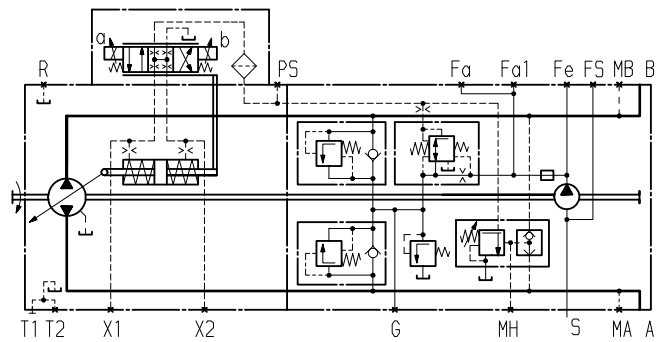
Standard: proportional solenoid without manual emergency operation.
On request: manual emergency operation with spring reset available.

EP - Electric Control, With Proportional Solenoid

Standard version¹⁾



Version with DA control valve¹⁾



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

DA - Hydraulic Control, Speed Related

The DA control is an engine speed-dependent, or automotive, type control system. The built-in DA regulating cartridge generates a pilot pressure that is proportional to pump (engine) drive speed. This pilot pressure is directed to the positioning cylinder of the pump by a solenoid actuated 4/3 way directional valve. Pump displacement is infinitely variable in each direction of flow, and is influenced by both pump drive speed and discharge pressure. Flow direction (i.e. machine forward or reverse) is controlled by energizing solenoid a or b.

Increasing pump drive speed generates a higher pilot pressure from the DA cartridge, with a subsequent increase in pump flow and/or pressure.

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

Any additional power requirement, such as implement hydraulics, may result in further engine pull down. This causes a further reduction in pilot pressure and therefore pump displacement. Automatic power division and full utilization of available power is thus achieved for both the vehicle transmission and the implement hydraulics, with priority given to the implement hydraulics.

To provide controllable reduced vehicle speed operation when high engine speeds are required for fast implement hydraulics, various inching options are available.

The DA regulating cartridge can also be used in pumps with conventional control devices, such as EP, HW or HD, to provide an engine anti-stall function, or as a combination of automotive and displacement control functions.

Application of the DA control is only appropriate on certain types of vehicle drive systems, and requires a review of the engine and vehicle parameters to ensure proper application of the pump, and safe and efficient machine operation. All DA applications must therefore be reviewed by a Rexroth Application Engineer.

Solenoid technical data	DA1	DA2
Voltage	12 V DC ($\pm 20\%$)	24 V DC ($\pm 20\%$)
Neutral position V_{g0}	de-energized	de-energized
Position $V_{g \max}$	current energized	current energized
Nominal resistance (at 20 °C)	5.5 Ω	21.7 Ω
Nominal power	26.2 W	26.5 W
Current required, minimum effective	1.32 A	0.67 A
Actuated time	100 %	100 %
Type of protection	see range of connectors on page 60	

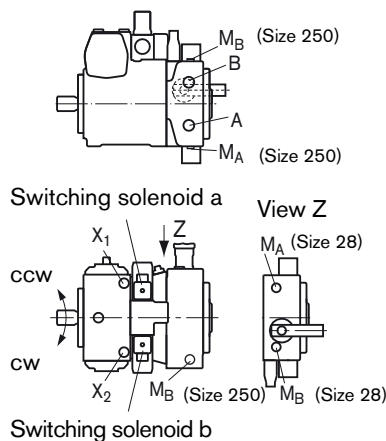
Standard: switching solenoid without manual emergency operation.
On request: manual emergency operation with spring reset available.

Assignment

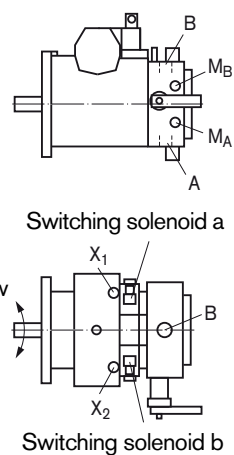
Direction of rotation - Control - Direction of through put flow

	Size	Actuation of Solenoid	Control pressure	Through put flow	Operating pressure
Direction of rotation cw	28...56	a	X_2	B to A	M_A
		b	X_1	A to B	M_B
	71...250	a	X_2	A to B	M_B
		b	X_1	B to A	M_A
Direction of rotation ccw	28...56	a	X_2	A to B	M_B
		b	X_1	B to A	M_A
	71...250	a	X_2	B to A	M_A
		b	X_1	A to B	M_B

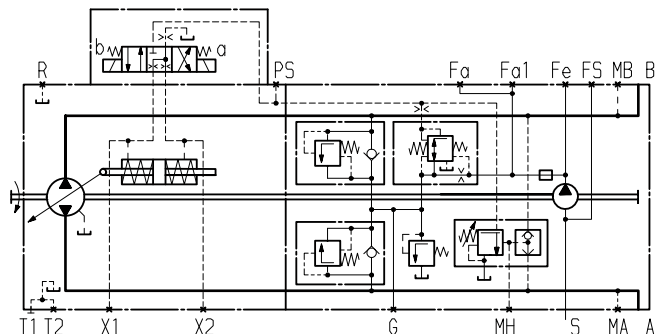
Sizes 28, 250



Sizes 40...180



Hydraulic control, speed related, DA control valve, fixed setting, DA1D2/DA2D2 1)



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

DA - Hydraulic Control, Speed Related

Function and control of DA control valves

DA control valve, fixed setting (2)

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

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

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

Pilot pressure may be reduced, independently of drive speed, through mechanical operation of the position lever (inch function).

Max. perm. operating torque at the position lever $T_{\max} = 4 \text{ Nm}$

Max. angle of rotation 70° , lever position: any.

Variation 3R _____ actuating direction of the position lever
- clockwise

Variation 3L _____ actuating direction of the position lever
- counterclockwise

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

(only for pumps with DA control unit)

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

Permits the pilot pressure to be reduced independently of the drive speed via hydraulic control (port Z).

Variation 4:

Control at port Z by means of brake fluid from the vehicle braking system (hydraulically linked with the service brake).

Variation 8:

Control at port Z by means of mineral oil.

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

Any reduction of pilot pressure, independent from the drive speed through the mechanical operation of the pilot control device.

The pilot control device is installed separately from the pump (for example in the driver's cabin) and connected with the pump by 2 hydraulic control lines via ports P_S and Y.

A suitable pilot control device must be ordered separately and is not included in supply.

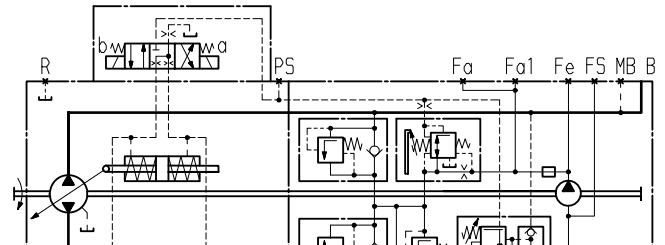
Detailed information is available from our sales department and on our website www.boschrexroth.com/da-control. Use our computer program to work out the input design that meets your needs. A DA control must be approved by Rexroth.

Note: see page 61 for rotary inch valves.

Circuit diagrams ¹⁾:

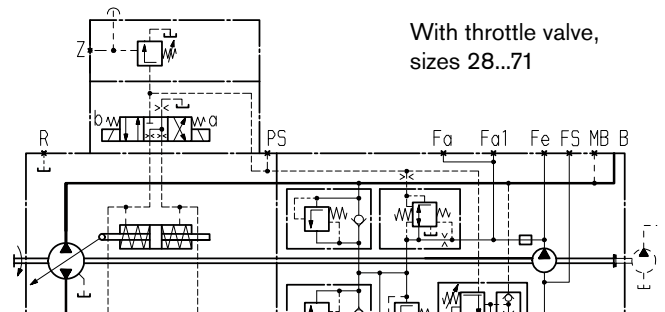
DA1D3/DA2D3

Hydraulic control, speed related, DA control valve, mech. adjustable with position lever

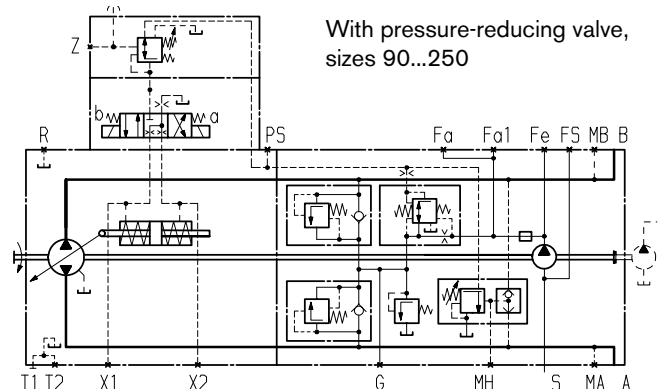


DA1D4/DA2D4

Hydraulic control, speed related, DA control valve, fixed setting, with hydraulic inch valve



With throttle valve, sizes 28...71

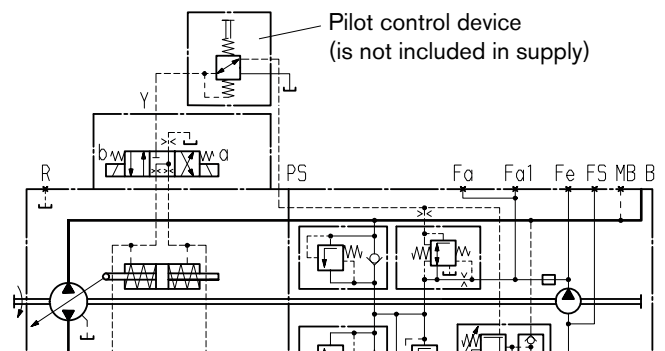


With pressure-reducing valve, sizes 90...250

DA1D7/DA2D7

Hydraulic control, speed related, DA

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



Pilot control device (is not included in supply)

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

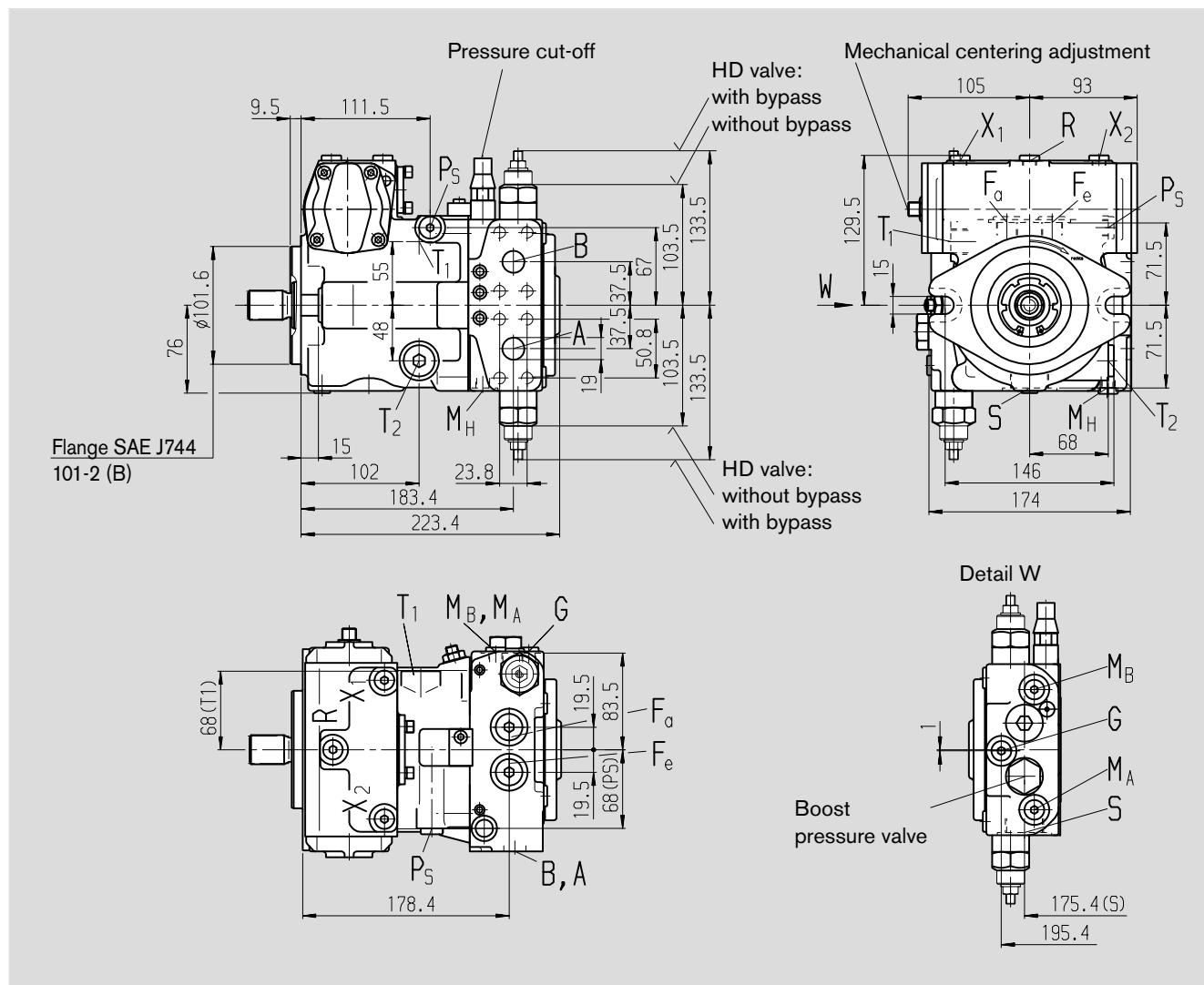
Unit Dimensions, Size 28

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

Version without control unit NV

Standard: suction port S at bottom (10)

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

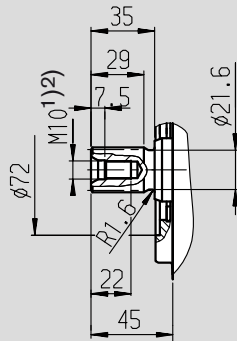


Unit Dimensions, Size 28

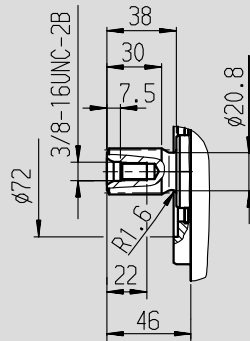
Before finalizing your design, please request a binding installation drawing. Dimensions in mm.

Shaft ends

Z Splined shaft DIN 5480
W25x1.25x30x18x9g



S Splined shaft 1 in
15T 16/32DP ³⁾
(SAE J744 – 25-4 (B-B))



Ports

A, B	service line ports (high-pressure series)	SAE J518	3/4 in	
	fixing thread A/B	DIN 13	M10x1.5; 17 deep ²⁾	
T ₁	case drain or fill	DIN 3852	M22x1.5; 14 deep	210 Nm ²⁾
T ₂	case drain ⁴⁾	DIN 3852	M22x1.5; 14 deep	210 Nm ²⁾
M _A , M _B	pressure gauge - operating pressure A, B ⁴⁾	DIN 3852	M12x1.5; 12 deep	50 Nm ²⁾
R	air bleed ⁴⁾	DIN 3852	M12x1.5; 12 deep	50 Nm ²⁾
S	boost suction port	DIN 3852	M33x2; 18 deep	540 Nm ²⁾
X ₁ , X ₂	port for control pressures (before orifice) ⁴⁾	DIN 3852	M12x1.5; 12 deep	50 Nm ²⁾
G	pressure port for auxiliary circuits ⁴⁾	DIN 3852	M12x1.5; 12 deep	50 Nm ²⁾
P _S	control pressure supply ⁴⁾	DIN 3852	M14x1.5; 12 deep	80 Nm ²⁾
F _a	filter output ⁴⁾	DIN 3852	M18x1.5; 12 deep	140 Nm ²⁾
F _e	filter input ⁴⁾	DIN 3852	M18x1.5; 12 deep	140 Nm ²⁾
M _H	port for balanced high pressure ⁴⁾	DIN 3852	M12x1.5; 12 deep	50 Nm ²⁾
Y ₁ , Y ₂	remote control ports (only HD)	DIN 3852	M14x1.5; 12 deep	80 Nm ²⁾
Z	pilot pressure port (only DA4/8) ⁴⁾	DIN 3852	M10x1; 8 deep	30 Nm ²⁾
Y	pilot pressure port (only DA7)	DIN 3852	M14x1.5; 12 deep	80 Nm ²⁾

¹⁾ Center bore acc. to DIN 332 (thread acc. to DIN 13)

²⁾ Please observe the general notes for the max. tightening torques on page 64

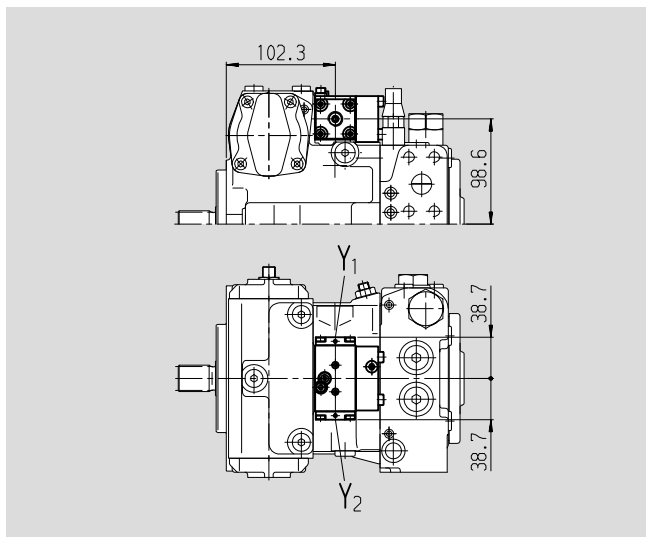
³⁾ ANSI B92.1a-1976, 30° pressure angle, flat root; side fit, tolerance class 5

4) Plugged

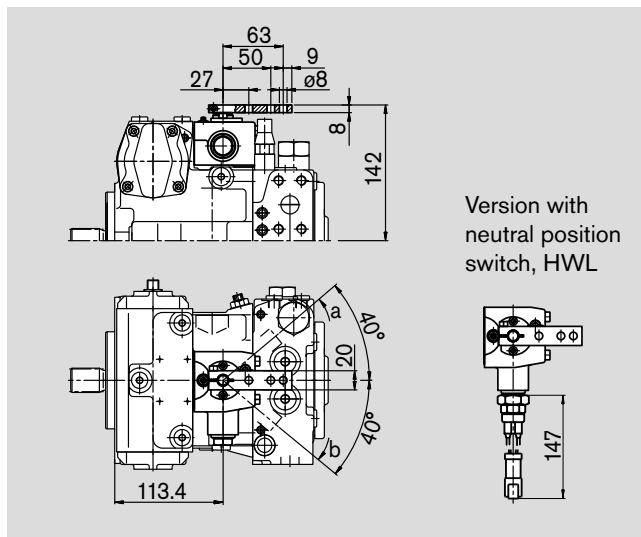
Unit Dimensions, Size 28

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

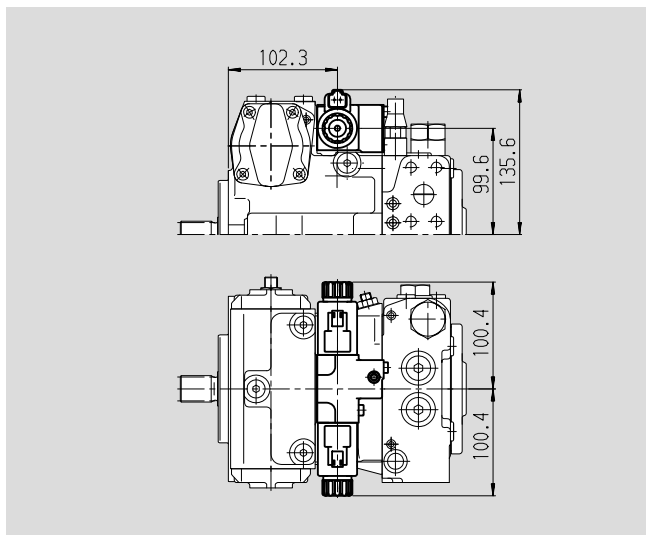
Hydraulic control, pilot-pressure related, HD



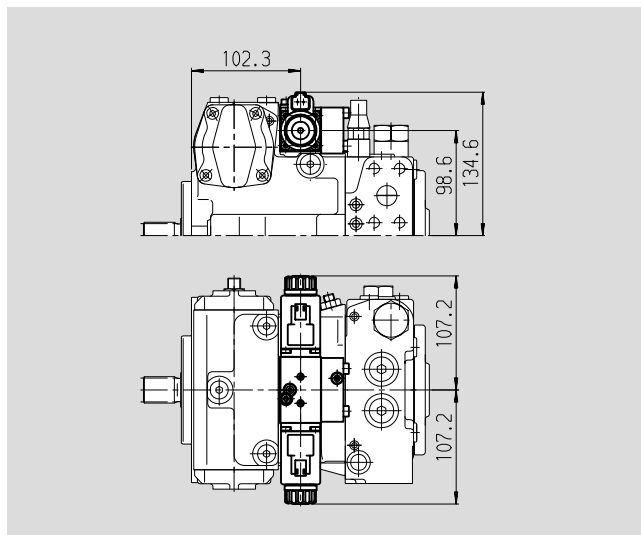
Hydraulic control, mechanical servo, HW



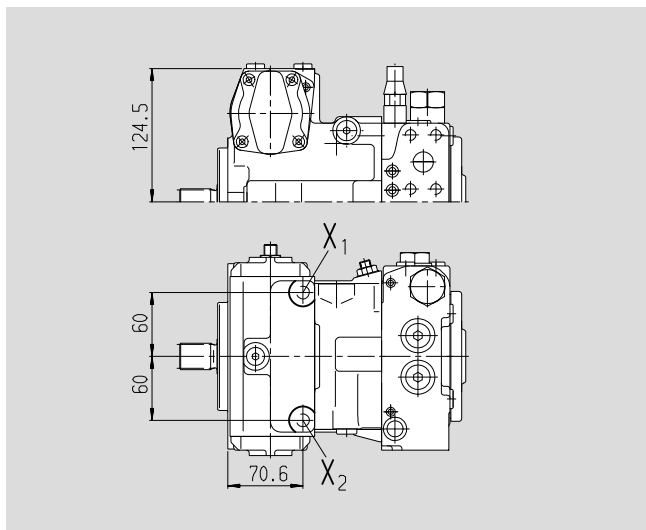
Electric two-position control with switching solenoid, EZ



Electric control with proportional solenoid, EP



Hydraulic control, direct operated, DG

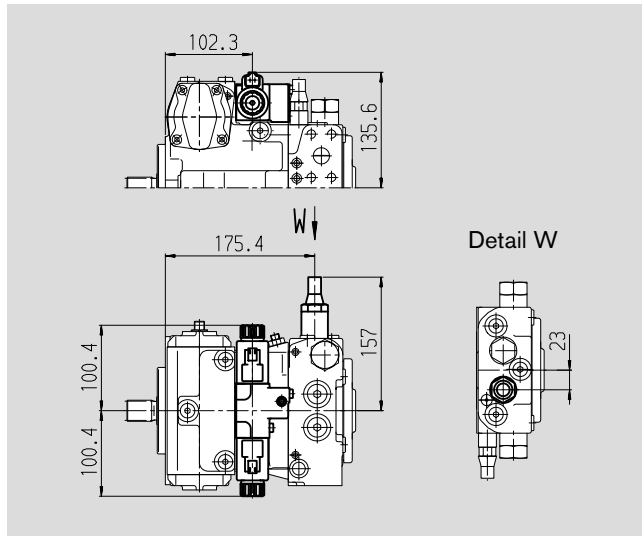


Unit Dimensions, Size 28

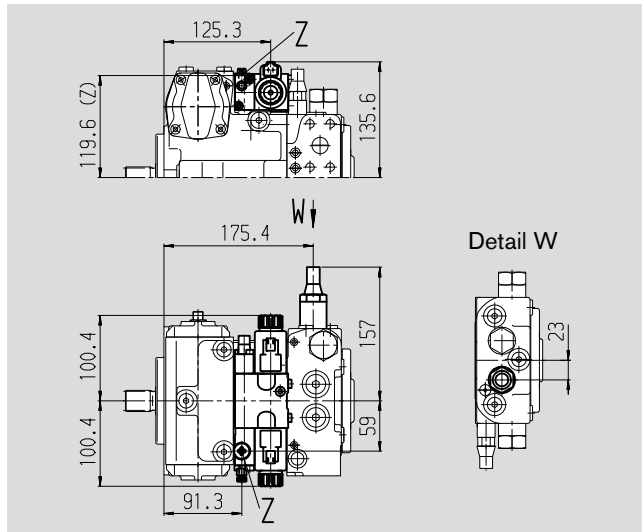
Before finalizing your design, please request a binding installation drawing. Dimensions in mm.

Hydraulic control, speed related, DA

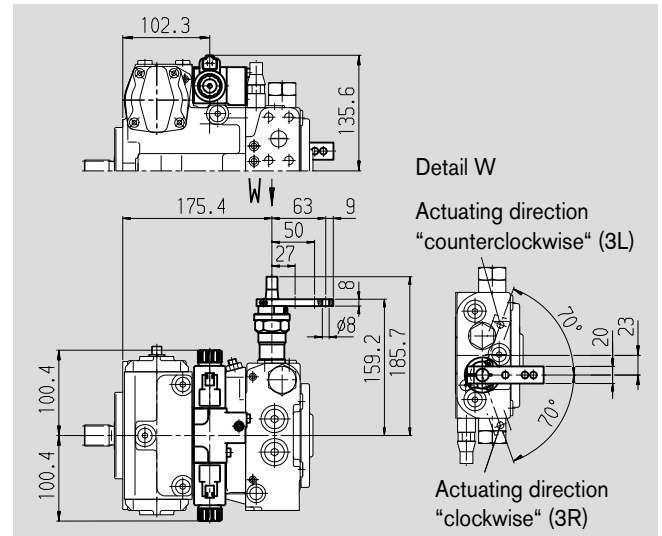
Control valve, fixed setting, DA2



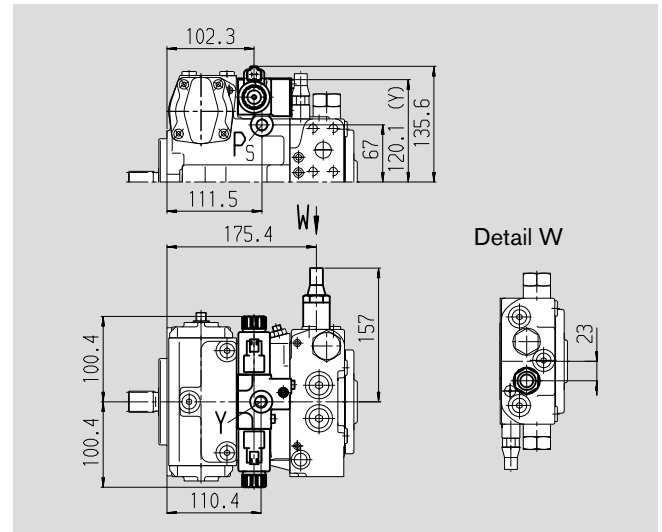
Control valve, fixed setting and hydraulic inch valve mounted, DA4/DA8



Control valve, mech. adjustable with position lever, DA3



Control valve, fixed setting and ports for pilot control device, DA7

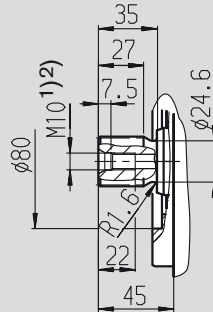


Unit Dimensions, Size 40

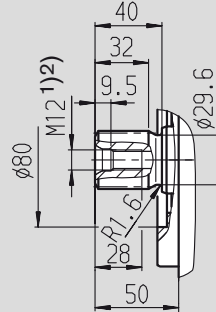
Before finalizing your design, please request a binding installation drawing. Dimensions in mm.

Shaft ends

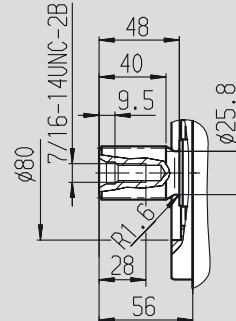
Z Splined shaft DIN 5480
W30x2x30x14x9g



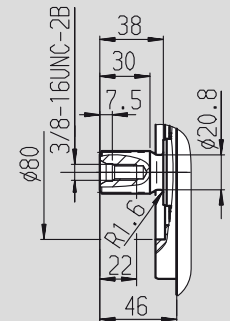
A Splined shaft DIN 5480
W35x2x30x16x9g



S Splined shaft 1 1/4 in
14T 12/24DP ³⁾
(SAE J744 – 32-4 (C))



U Splined shaft 1 in
15T 16/32DP ³⁾
(SAE J744 – 25-4 (B-B))



Ports

A, B	service line ports (high-pressure series)
	fixing thread A/B
T ₁	case drain or fill
T ₂	case drain ⁴⁾
M _A , M _B	pressure gauge - operating pressure A, B ⁴⁾
R	air bleed ⁴⁾
S	boost suction port
X ₁ , X ₂	port for control pressures (before orifice) ⁴⁾
G	pressure port for auxiliary circuits ⁴⁾
P _S	control pressure supply ⁴⁾
F _a	filter output ⁴⁾
F _{a1}	filter output (mountable filter) ⁴⁾
F _e	filter input ⁴⁾
F _S	port from filter to suction line (cold start) ⁴⁾
M _H	port for balanced high pressure ⁴⁾
Y ₁ , Y ₂	remote control ports (only HD)
Z	pilot pressure port (only DA4/8) ⁴⁾
Y	pilot pressure port (only DA7)

SAE J518	3/4 in	–
DIN 13	M10x1.5; 17 deep ²⁾	
DIN 3852	M22x1.5; 14 deep	210 Nm ²⁾
DIN 3852	M22x1.5; 14 deep	210 Nm ²⁾
DIN 3852	M12x1.5; 12 deep	50 Nm ²⁾
DIN 3852	M12x1.5; 12 deep	50 Nm ²⁾
DIN 3852	M33x2; 18 deep	540 Nm ²⁾
DIN 3852	M12x1.5; 12 deep	50 Nm ²⁾
DIN 3852	M12x1.5; 12 deep	50 Nm ²⁾
DIN 3852	M14x1.5; 12 deep	80 Nm ²⁾
DIN 3852	M18x1.5; 12 deep	140 Nm ²⁾
DIN 3852	M18x1.5; 12 deep	140 Nm ²⁾
DIN 3852	M18x1.5; 12 deep	140 Nm ²⁾
DIN 3852	M18x1.5; 12 deep	140 Nm ²⁾
DIN 3852	M12x1.5; 12 deep	50 Nm ²⁾
DIN 3852	M14x1.5; 12 deep	80 Nm ²⁾
DIN 3852	M10x1; 8 deep	30 Nm ²⁾
DIN 3852	M14x1.5; 12 deep	80 Nm ²⁾

¹⁾ Center bore acc. to DIN 332 (thread acc. to DIN 13)

²⁾ Please observe the general notes for the max. tightening torques on page 64

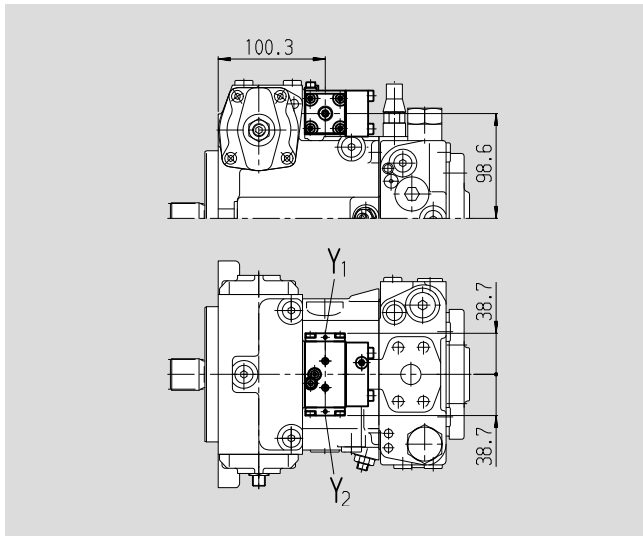
³⁾ ANSI B92.1a-1976, 30° pressure angle, flat root; side fit, tolerance class 5

⁴⁾ Plugged

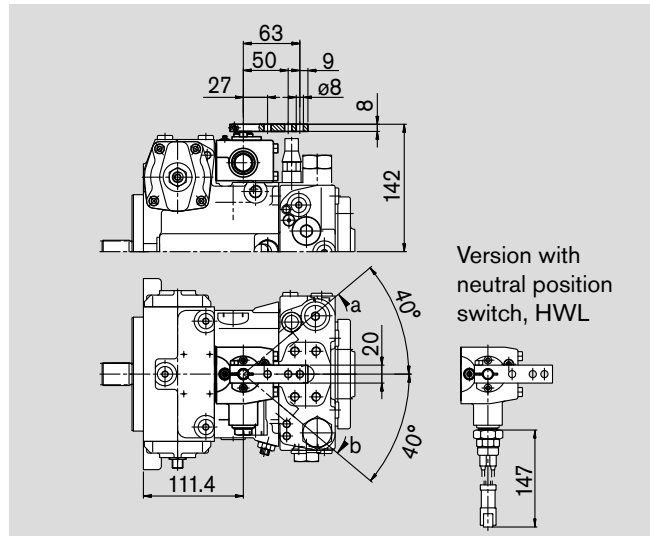
Unit Dimensions, Size 40

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

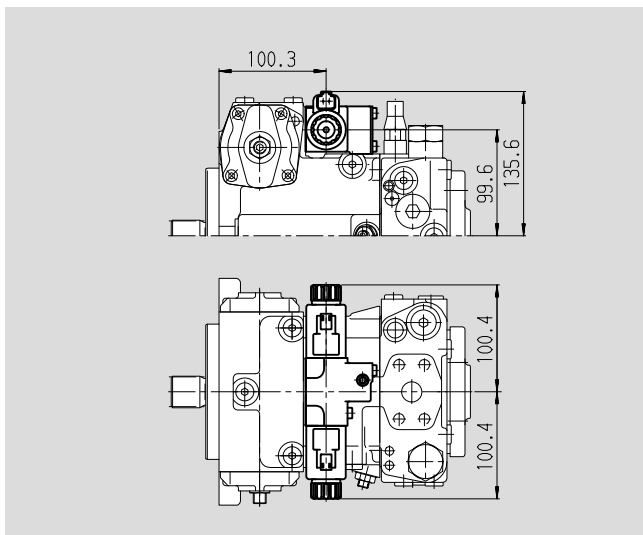
Hydraulic control, pilot-pressure related, HD



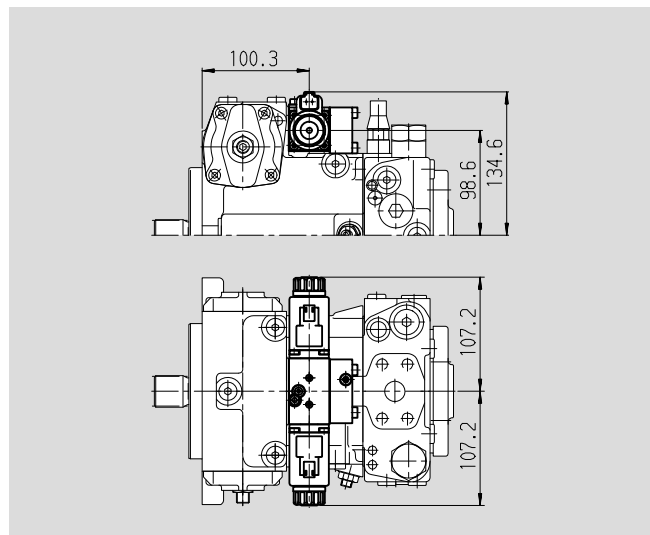
Hydraulic control, mechanical servo, HW



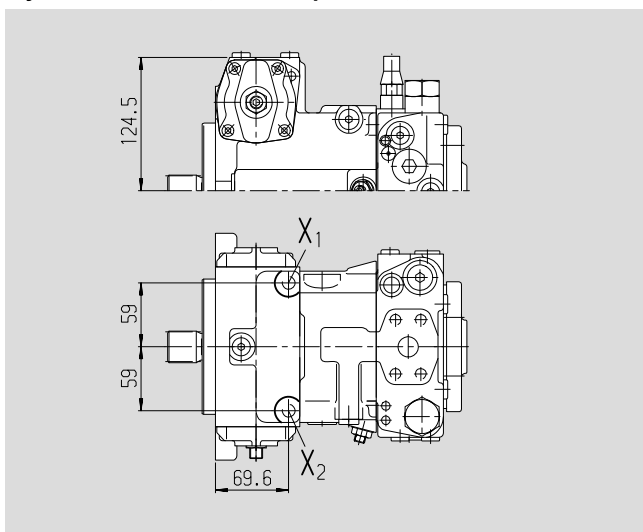
Electric two-position control with switching solenoid, EZ



Electric control with proportional solenoid, EP



Hydraulic control, direct operated, DG

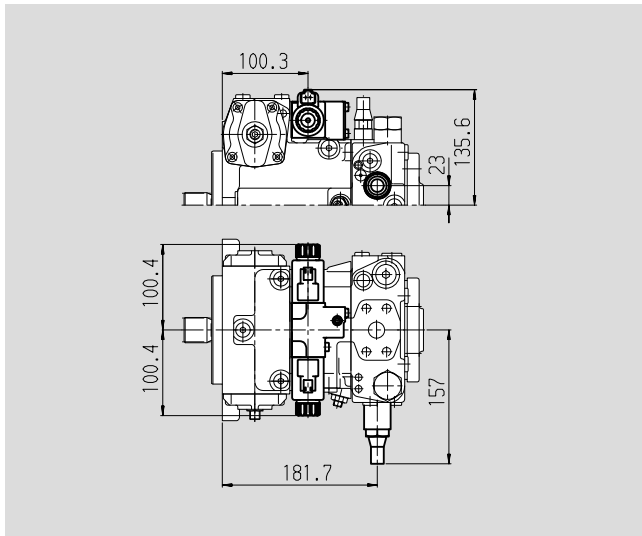


Unit Dimensions, Size 40

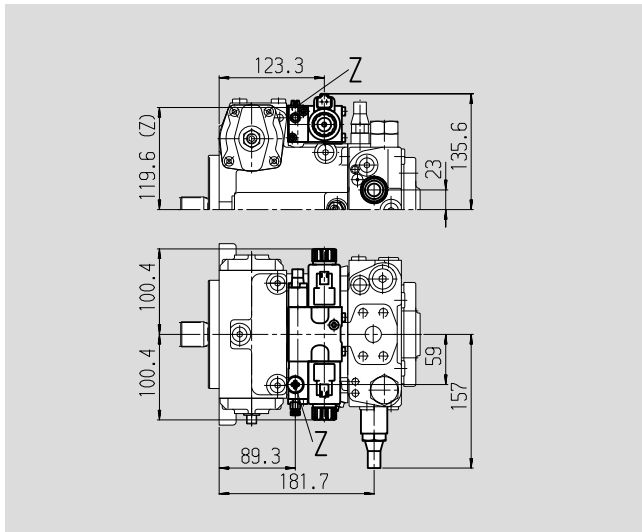
Before finalizing your design, please request a binding installation drawing. Dimensions in mm.

Hydraulic control, speed related, DA

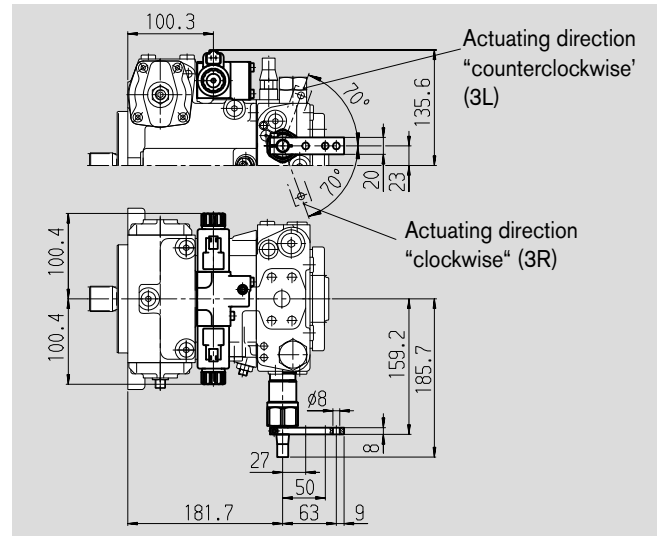
Control valve, fixed setting, DA2



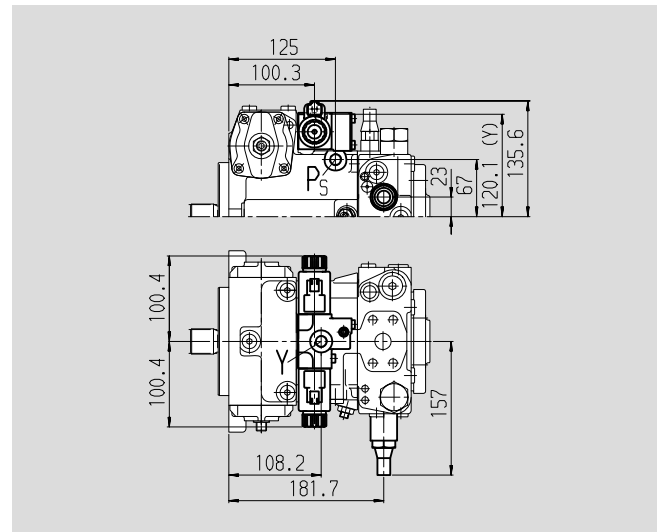
Control valve, fixed setting and hydraulic inch valve mounted, DA4/DA8



Control valve, mech. adjustable with position lever, DA3



Control valve, fixed setting and ports for pilot control device, DA7



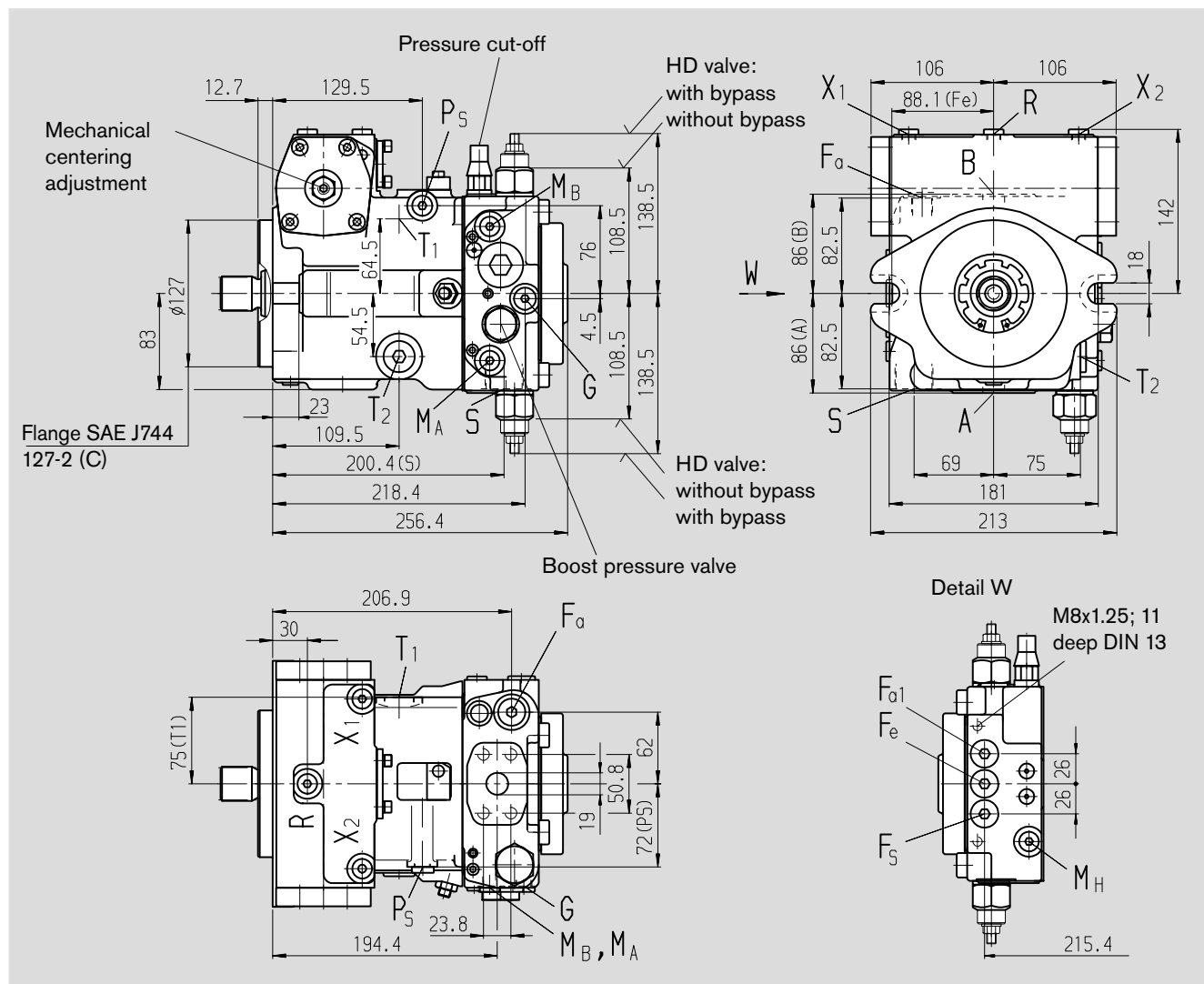
Unit Dimensions, Size 56

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

Version without control unit NV

Standard: suction port S at bottom (02)

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

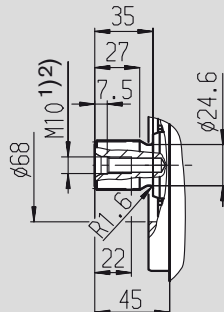


Unit Dimensions, Size 56

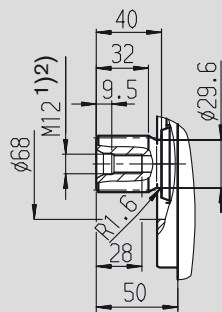
Before finalizing your design, please request a binding installation drawing. Dimensions in mm.

Shaft ends

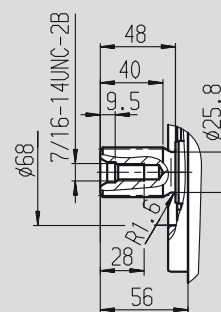
Z Splined shaft DIN 5480
W30x2x30x14x9g



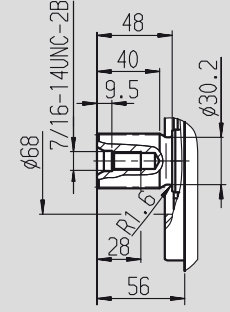
A Splined shaft DIN 5480
W35x2x30x16x9g



S Splined shaft 1 1/4 in
14T 12/24DP ³⁾
(SAE J744 – 32-4 (C))



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



Ports

A, B	service line ports (high-pressure series) fixing thread A/B
T ₁	case drain or fill
T ₂	case drain ⁴⁾
M _A , M _B	pressure gauge - operating pressure A, B ⁴⁾
R	air bleed ⁴⁾
S	boost suction port
X ₁ , X ₂	port for control pressures (before orifice) ⁴⁾
G	pressure port for auxiliary circuits ⁴⁾
P _S	control pressure supply ⁴⁾
F _a	filter output ⁴⁾
F _{a1}	filter output (mountable filter) ⁴⁾
F _e	filter input ⁴⁾
F _S	port from filter to suction line (cold start) ⁴⁾
M _H	port for balanced high pressure ⁴⁾
Y ₁ , Y ₂	remote control ports (only HD)
Z	pilot pressure port (only DA4/8) ⁴⁾
Y	pilot pressure port (only DA7)

SAE J518	3/4 in	
DIN 13	M10x1.5; 17 deep ²⁾	
DIN 3852	M22x1.5; 14 deep	210 Nm ²⁾
DIN 3852	M22x1.5; 14 deep	210 Nm ²⁾
DIN 3852	M12x1.5; 12 deep	50 Nm ²⁾
DIN 3852	M12x1.5; 12 deep	50 Nm ²⁾
DIN 3852	M33x2; 18 deep	540 Nm ²⁾
DIN 3852	M12x1.5; 12 deep	50 Nm ²⁾
DIN 3852	M14x1.5; 12 deep	80 Nm ²⁾
DIN 3852	M14x1.5; 12 deep	80 Nm ²⁾
DIN 3852	M18x1.5; 12 deep	140 Nm ²⁾
DIN 3852	M18x1.5; 12 deep	140 Nm ²⁾
DIN 3852	M18x1.5; 12 deep	140 Nm ²⁾
DIN 3852	M18x1.5; 12 deep	140 Nm ²⁾
DIN 3852	M12x1.5; 12 deep	50 Nm ²⁾
DIN 3852	M14x1.5; 12 deep	80 Nm ²⁾
DIN 3852	M10x1; 8 deep	30 Nm ²⁾
DIN 3852	M14x1.5; 12 deep	80 Nm ²⁾

¹⁾ Center bore acc. to DIN 332 (thread acc. to DIN 13)

²⁾ Please observe the general notes for the max. tightening torques on page 64

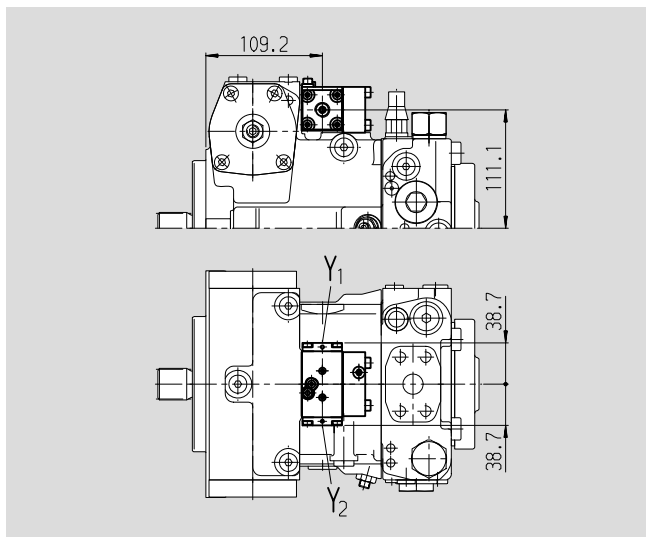
³⁾ ANSI B92.1a-1976, 30° pressure angle, flat root; side fit, tolerance class 5

⁴⁾ Plugged

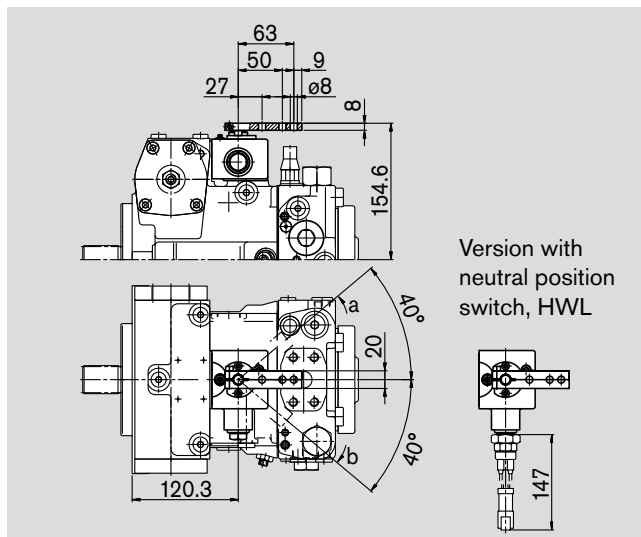
Unit Dimensions, Size 56

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

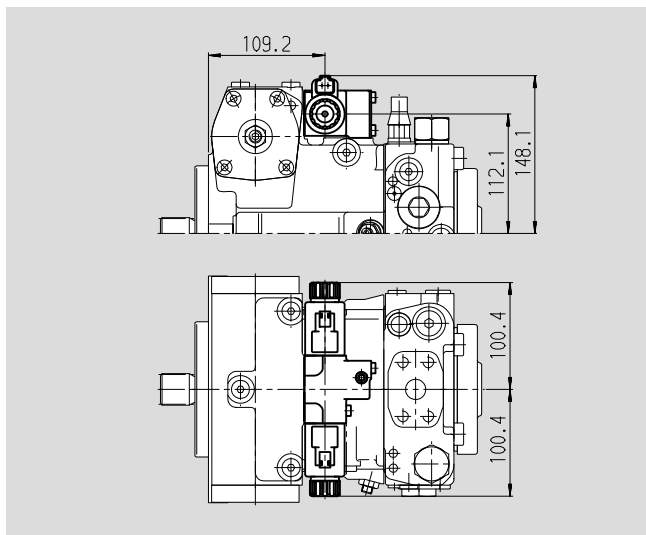
Hydraulic control, pilot-pressure related, HD



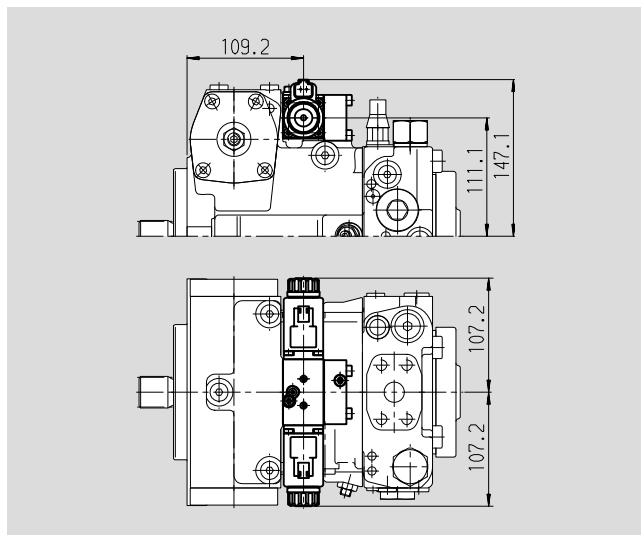
Hydraulic control, mechanical servo, HW



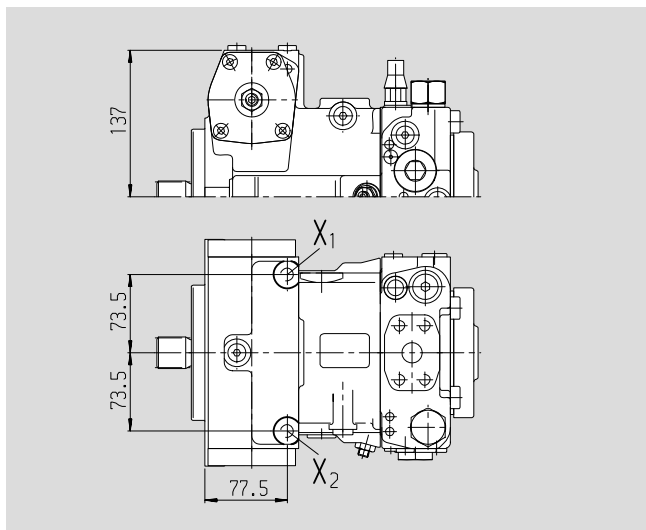
Electric two-position control with switching solenoid, EZ



Electric control with proportional solenoid, EP



Hydraulic control, direct operated, DG

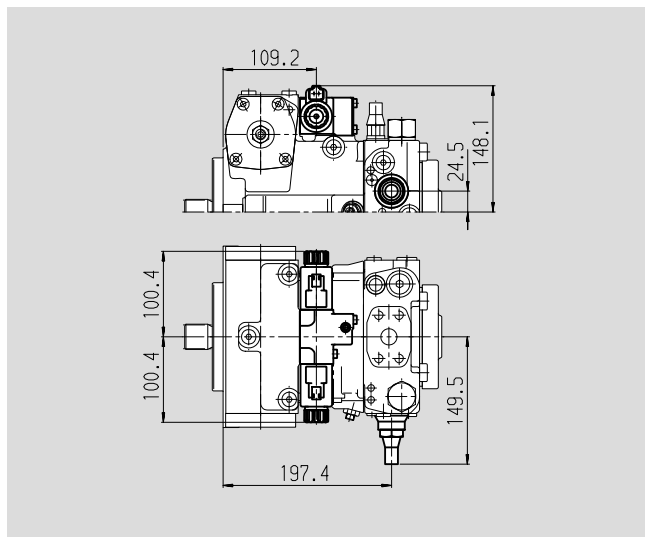


Unit Dimensions, Size 56

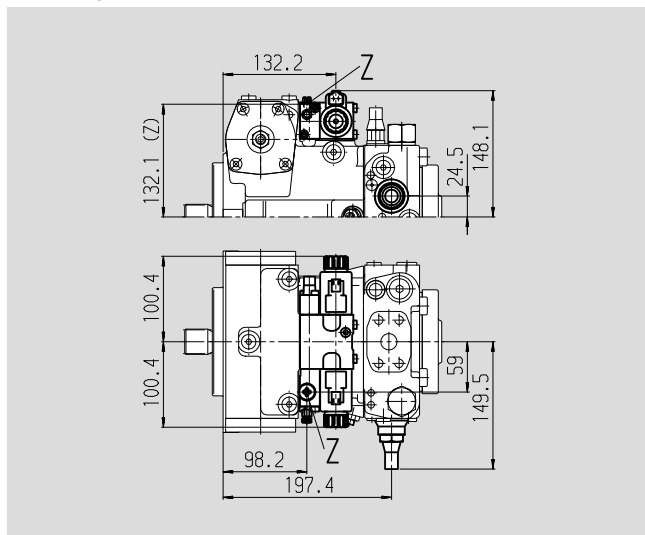
Before finalizing your design, please request a binding installation drawing. Dimensions in mm.

Hydraulic control, speed related, DA

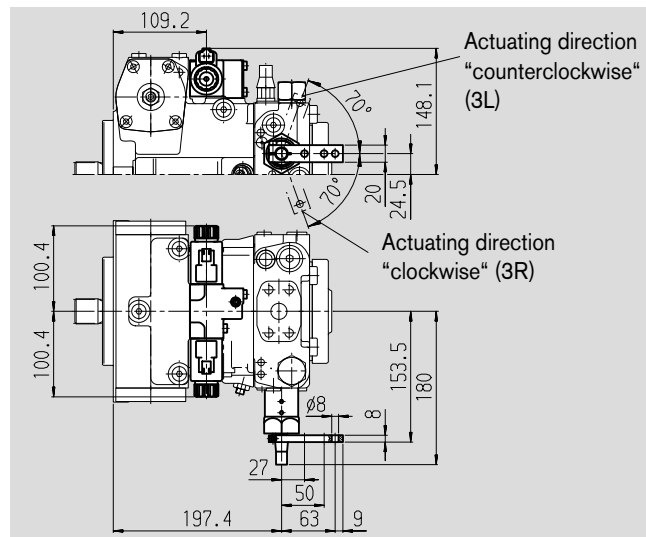
Control valve, fixed setting, DA2



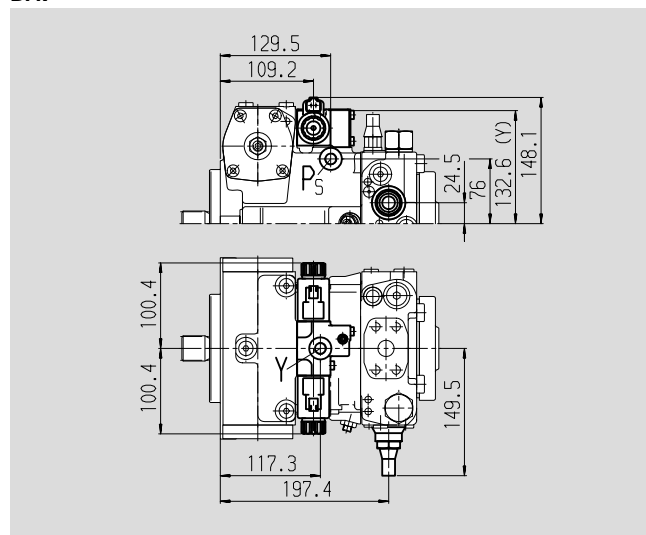
Control valve, fixed setting and hydraulic inch valve mounted, DA4/DA8



Control valve, mech. adjustable with position lever, DA3



Control valve, fixed setting and ports for pilot control device, DA7



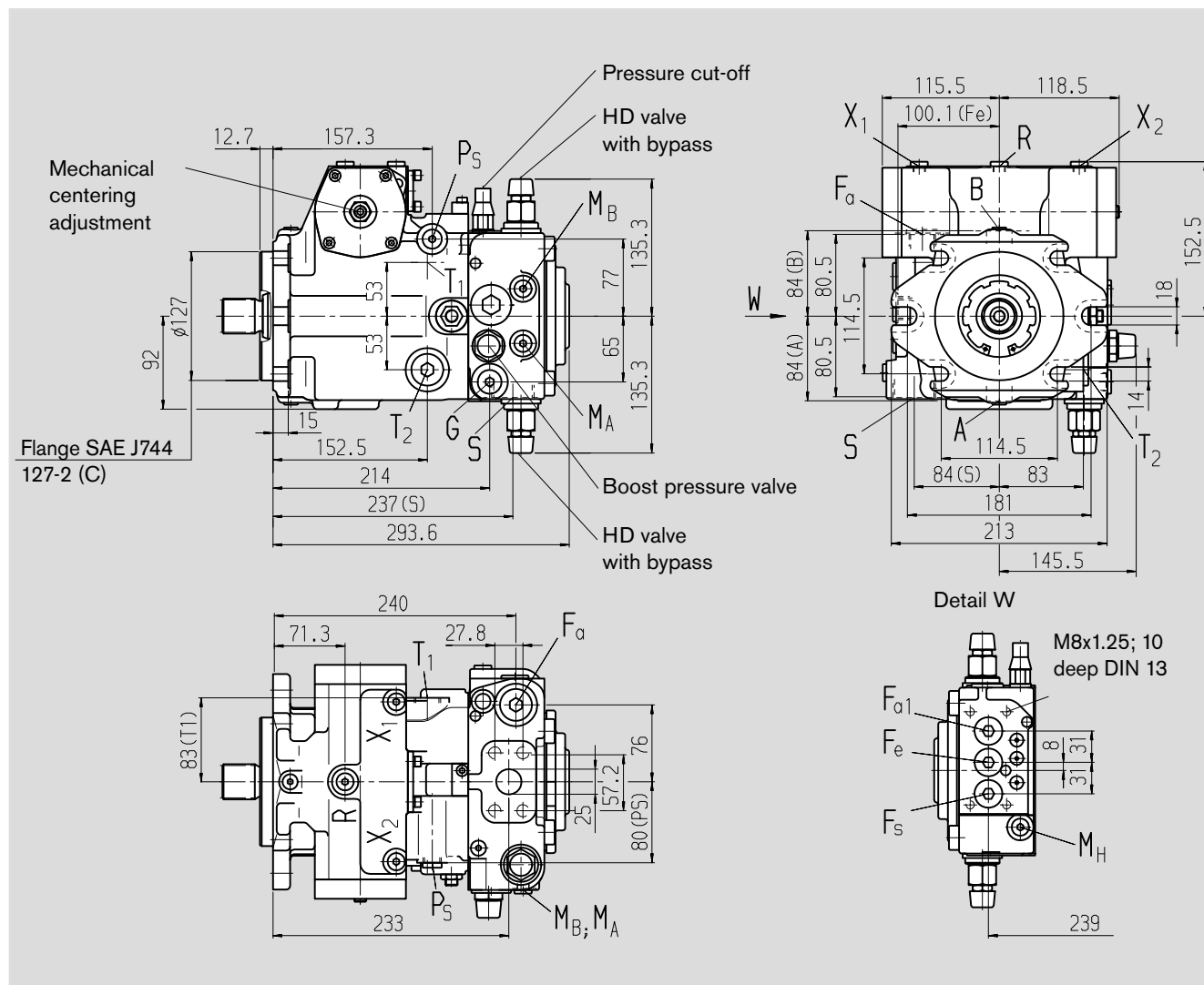
Unit Dimensions, Size 71

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

Version without control unit NV

Standard: suction port S at bottom (02)

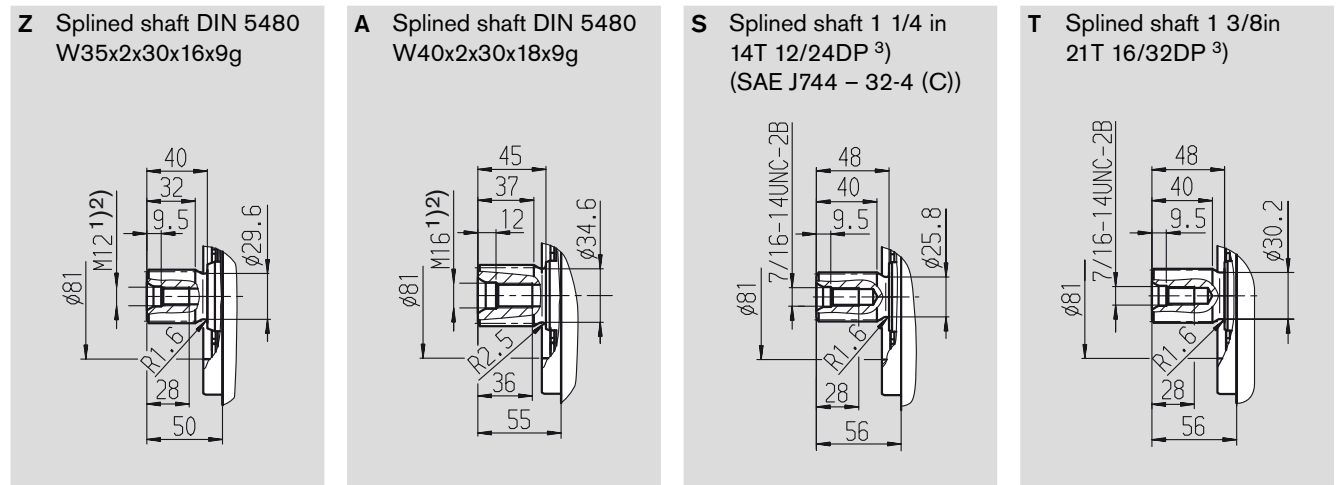
Option: suction port S at top (03): port plate turned through 180°



Unit Dimensions, Size 71

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

Shaft ends



Ports

A, B	service line ports (high-pressure series) fixing thread A/B	SAE J518	1 in	
		DIN 13	M12x1.75; 17 deep ²⁾	
T ₁	case drain or fill	DIN 3852	M26x1.5; 16 deep	230 Nm ²⁾
T ₂	case drain ⁴⁾	DIN 3852	M26x1.5; 16 deep	230 Nm ²⁾
M _A , M _B	pressure gauge - operating pressure A, B ⁴⁾	DIN 3852	M12x1.5; 12 deep	50 Nm ²⁾
R	air bleed ⁴⁾	DIN 3852	M12x1.5; 12 deep	50 Nm ²⁾
S	boost suction port	DIN 3852	M42x2; 20 deep	720 Nm ²⁾
X ₁ , X ₂	port for control pressures (before orifice) ⁴⁾	DIN 3852	M12x1.5; 12 deep	50 Nm ²⁾
G	pressure port for auxiliary circuits ⁴⁾	DIN 3852	M18x1.5; 12 deep	140 Nm ²⁾
P _S	control pressure supply ⁴⁾	DIN 3852	M14x1.5; 12 deep	80 Nm ²⁾
F _a	filter output ⁴⁾	DIN 3852	M26x1.5; 16 deep	230 Nm ²⁾
F _{a1}	filter output (mountable filter) ⁴⁾	DIN 3852	M22x1.5; 14 deep	210 Nm ²⁾
F _e	filter input ⁴⁾	DIN 3852	M22x1.5; 14 deep	210 Nm ²⁾
F _S	port from filter to suction line (cold start) ⁴⁾	DIN 3852	M22x1.5; 14 deep	210 Nm ²⁾
M _H	port for balanced high pressure ⁴⁾	DIN 3852	M12x1.5; 12 deep	50 Nm ²⁾
Y ₁ , Y ₂	remote control ports (only HD)	DIN 3852	M14x1.5; 12 deep	80 Nm ²⁾
Z	pilot pressure port (only DA4/8) ⁴⁾	DIN 3852	M10x1; 8 deep	30 Nm ²⁾
Y	pilot pressure port (only DA7)	DIN 3852	M14x1.5; 12 deep	80 Nm ²⁾

¹⁾ Center bore acc. to DIN 332 (thread acc. to DIN 13)

²⁾ Please observe the general notes for the max. tightening torques on page 64

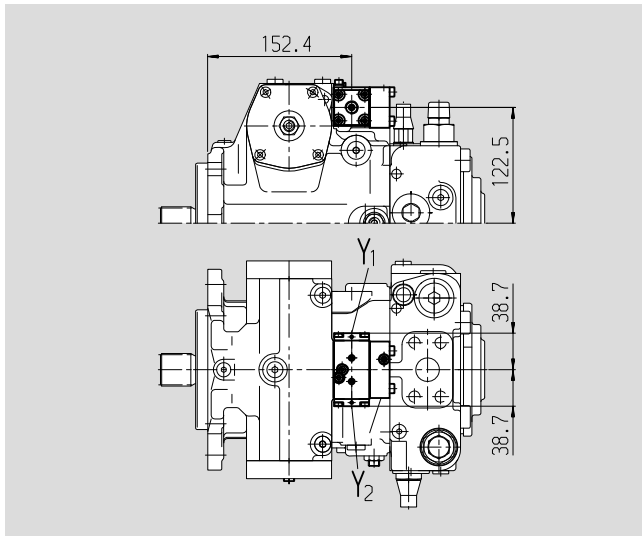
³⁾ ANSI B92.1a-1976, 30° pressure angle, flat root; side fit, tolerance class 5

⁴⁾ Plugged

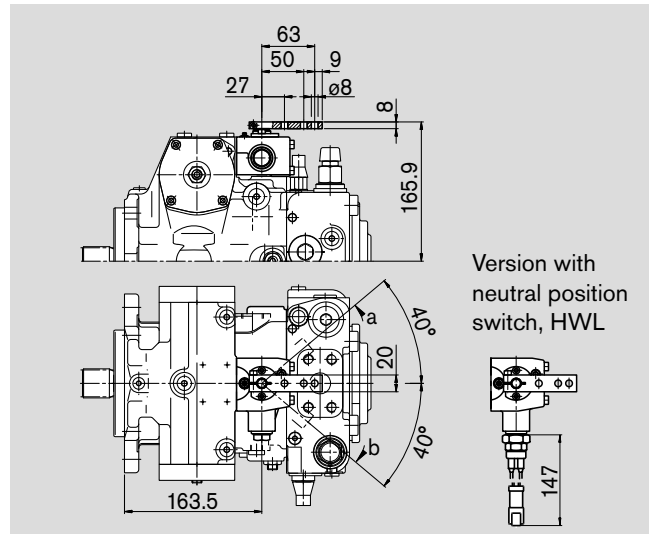
Unit Dimensions, Size 71

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

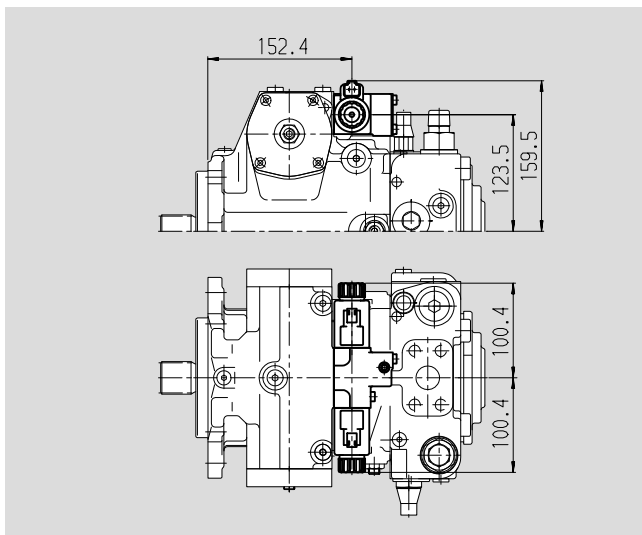
Hydraulic control, pilot-pressure related, HD



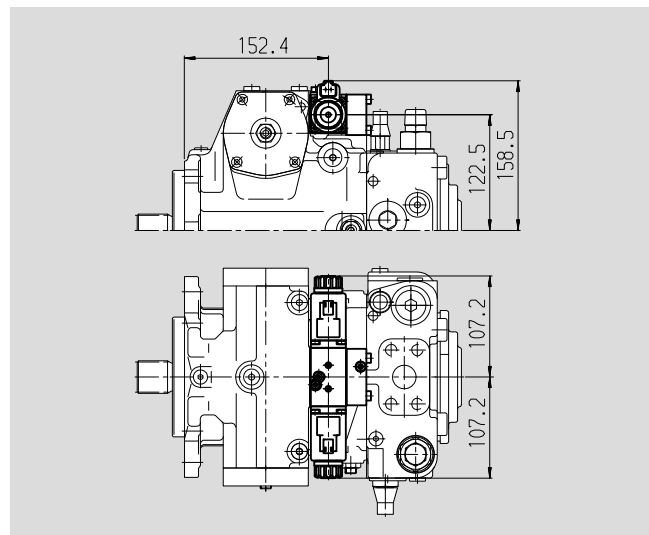
Hydraulic control, mechanical servo, HW



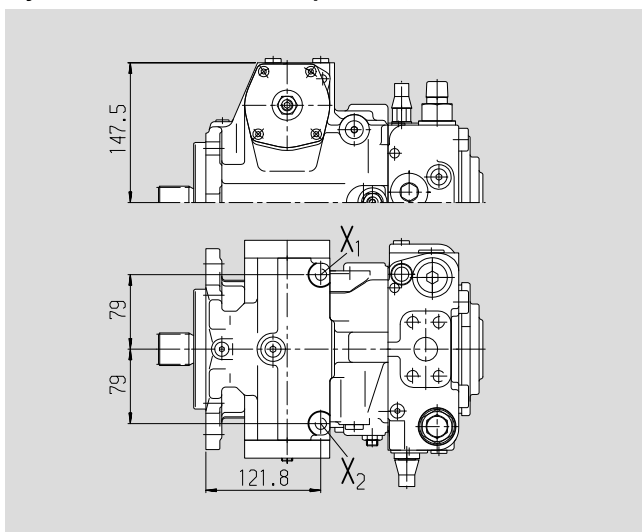
Electric two-position control with switching solenoid, EZ



Electric control with proportional solenoid, EP



Hydraulic control, direct operated, DG

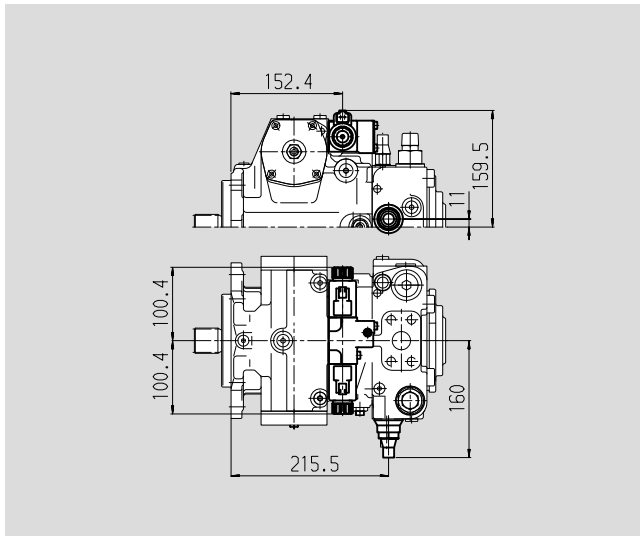


Unit Dimensions, Size 71

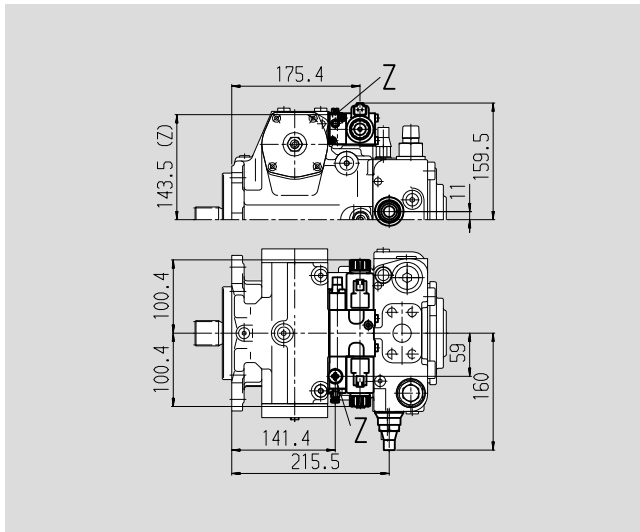
Before finalizing your design, please request a binding installation drawing. Dimensions in mm.

Hydraulic control, speed related, DA

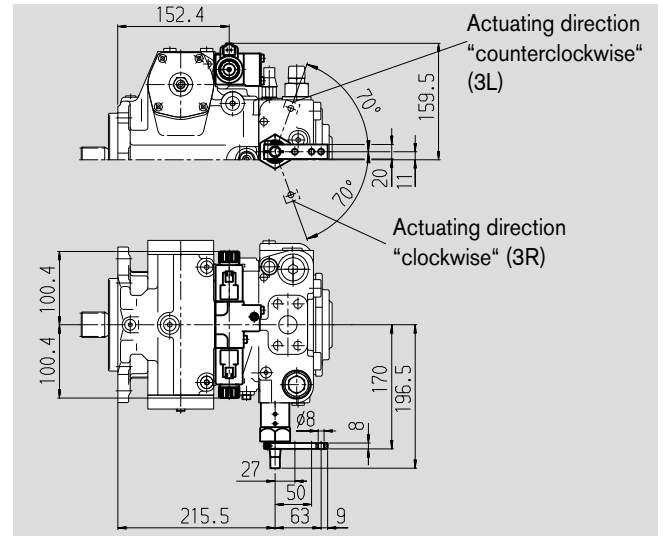
Control valve, fixed setting, DA2



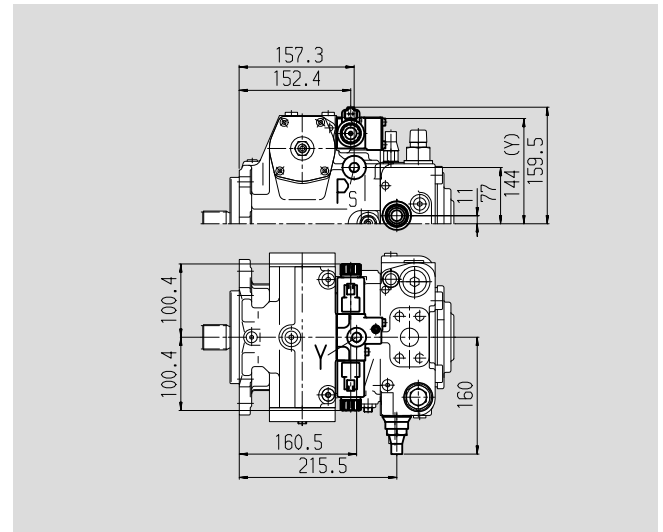
Control valve, fixed setting and hydraulic inch valve mounted, DA4/DA8



Control valve, mech. adjustable with position lever, DA3



Control valve, fixed setting and ports for pilot control device, DA7



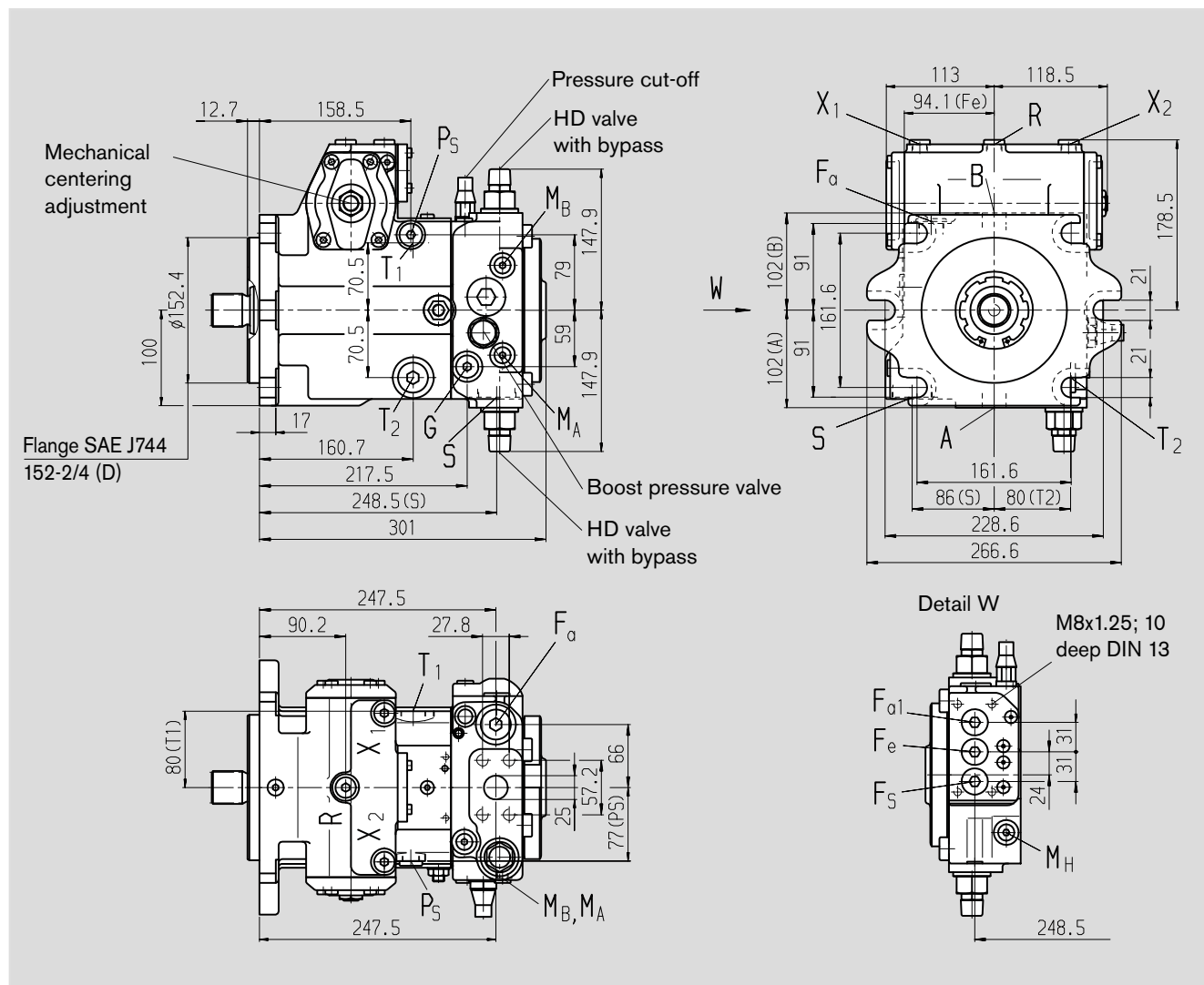
Unit Dimensions, Size 90

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

Version without control unit NV

Standard: suction port S at bottom (02)

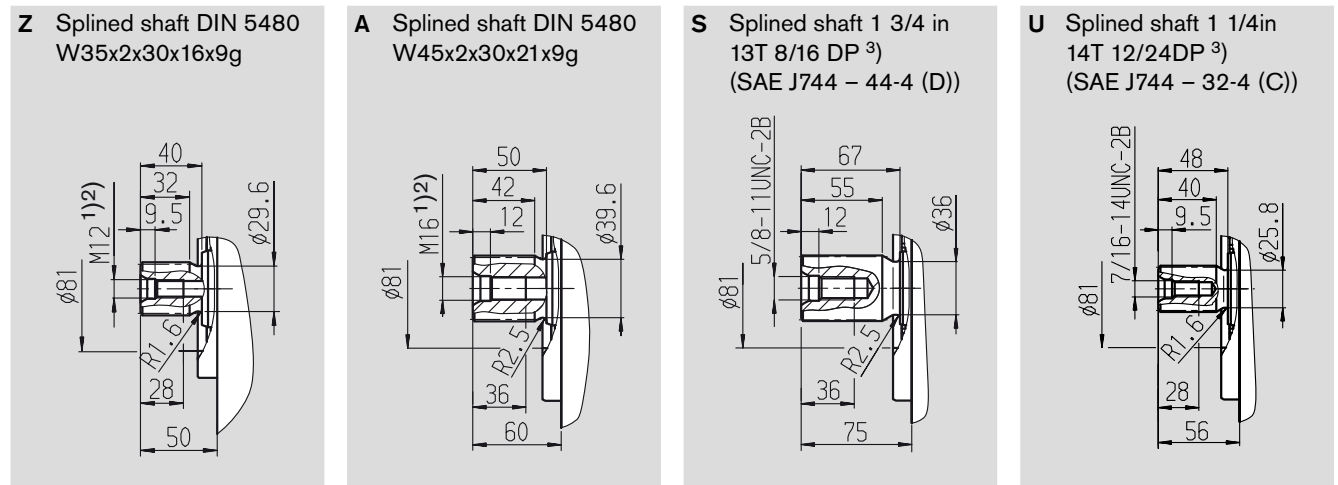
Option: suction port S at top (03): port plate turned through 180°



Unit Dimensions, Size 90

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

Shaft ends



Ports

A, B	service line ports (high-pressure series)	SAE J518	1 in	
	fixing thread A/B	DIN 13	M12x1.75; 17 deep ²⁾	
T ₁	case drain or fill	DIN 3852	M26x1.5; 16 deep	230 Nm ²⁾
T ₂	case drain ⁴⁾	DIN 3852	M26x1.5; 16 deep	230 Nm ²⁾
M _A , M _B	pressure gauge - operating pressure A, B ⁴⁾	DIN 3852	M12x1.5; 12 deep	50 Nm ²⁾
R	air bleed ⁴⁾	DIN 3852	M16x1.5; 12 deep	100 Nm ²⁾
S	boost suction port	DIN 3852	M42x2; 20 deep	720 Nm ²⁾
X ₁ , X ₂	ports for control pressure (before orifice) ⁴⁾	DIN 3852	M16x1.5; 12 deep	100 Nm ²⁾
G	pressure port for auxiliary circuits ⁴⁾	DIN 3852	M18x1.5; 12 deep	140 Nm ²⁾
P _S	control pressure supply ⁴⁾	DIN 3852	M18x1.5; 12 deep	140 Nm ²⁾
F _a	filter output ⁴⁾	DIN 3852	M26x1.5; 16 deep	230 Nm ²⁾
F _{a1}	filter output (mountable filter) ⁴⁾	DIN 3852	M22x1.5; 14 deep	210 Nm ²⁾
F _e	filter input ⁴⁾	DIN 3852	M22x1.5; 14 deep	210 Nm ²⁾
F _S	port from filter to suction line (cold start) ⁴⁾	DIN 3852	M22x1.5; 14 deep	210 Nm ²⁾
M _H	port for balanced high pressure ⁴⁾	DIN 3852	M12x1.5; 12 deep	50 Nm ²⁾
Y ₁ , Y ₂	remote control ports (only HD)	DIN 3852	M14x1.5; 12 deep	80 Nm ²⁾
Z	pilot pressure port (only DA4/8) ⁴⁾	DIN 3852	M10x1; 8 deep	30 Nm ²⁾
Y	pilot pressure port (only DA7)	DIN 3852	M18x1.5; 12 deep	140 Nm ²⁾

¹⁾ Center bore acc. to DIN 332 (thread acc. to DIN 13)

²⁾ Please observe the general notes for the max. tightening torques on page 64

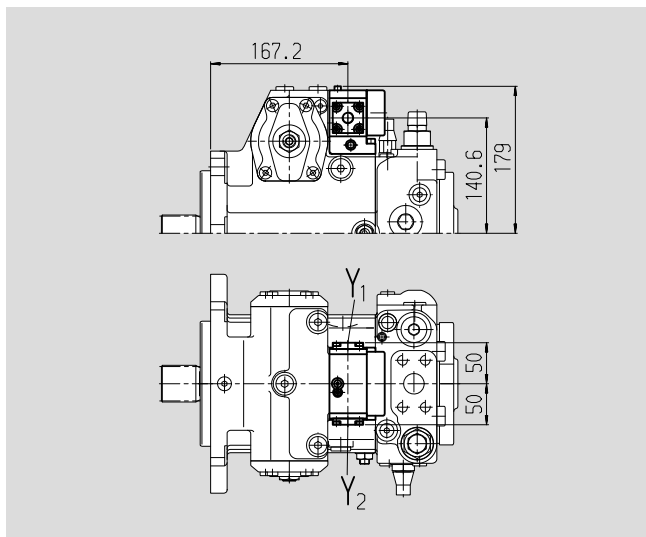
³⁾ ANSI B92.1a-1976, 30° pressure angle, flat root; side fit, tolerance class 5

⁴⁾ Plugged

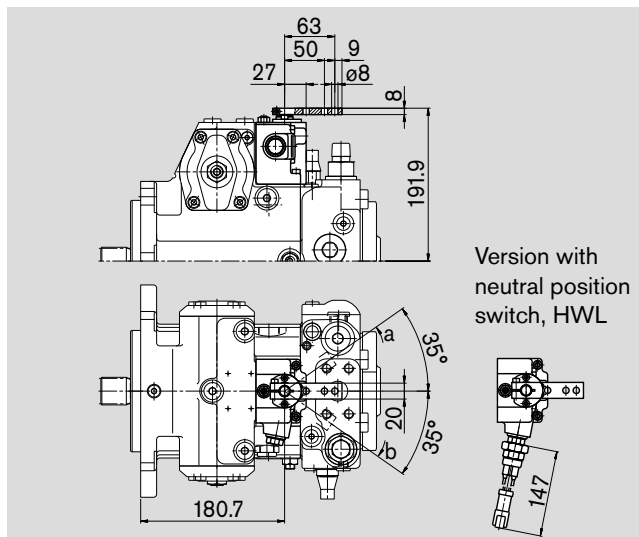
Unit Dimensions, Size 90

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

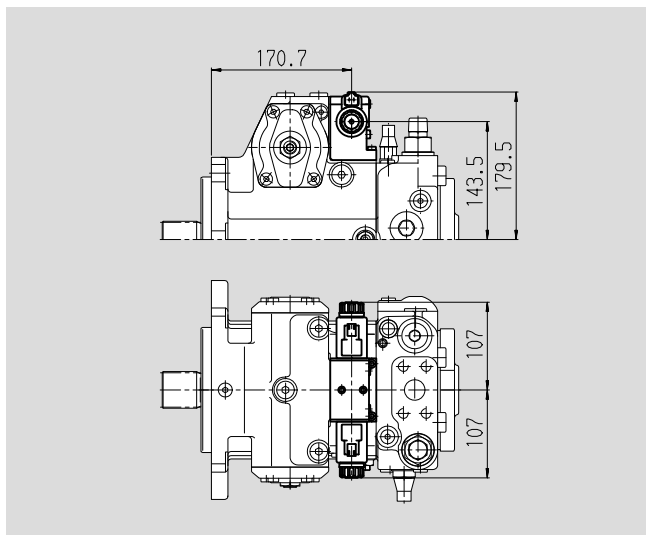
Hydraulic control, pilot-pressure related, HD



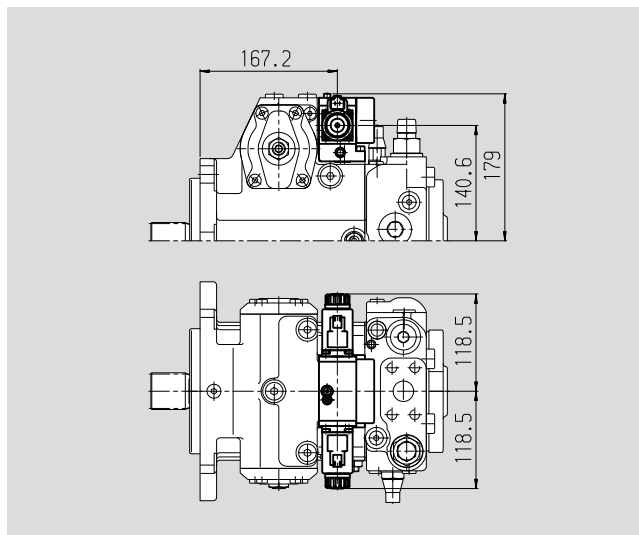
Hydraulic control, mechanical servo, HW



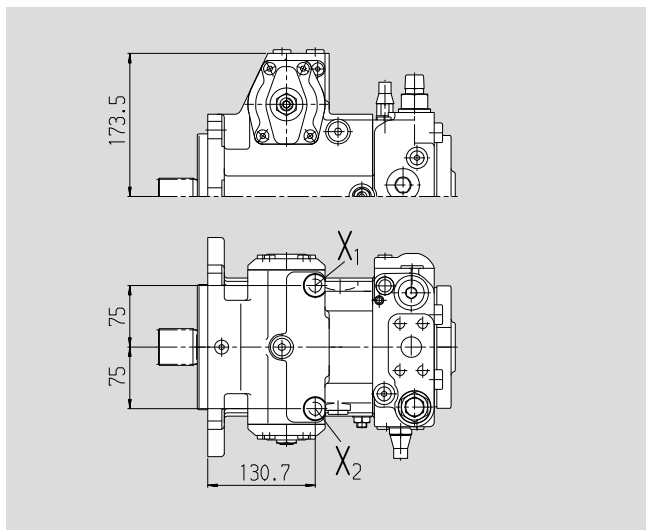
Electric two-position control with switching solenoid, EZ



Electric control with proportional solenoid, EP



Hydraulic control, direct operated, DG

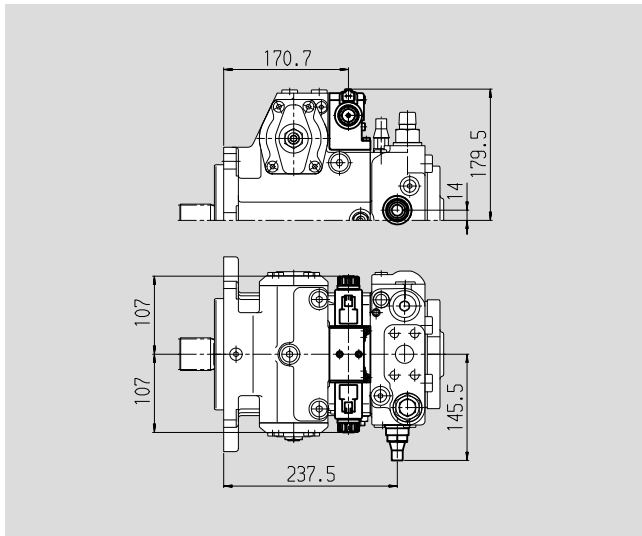


Unit Dimensions, Size 90

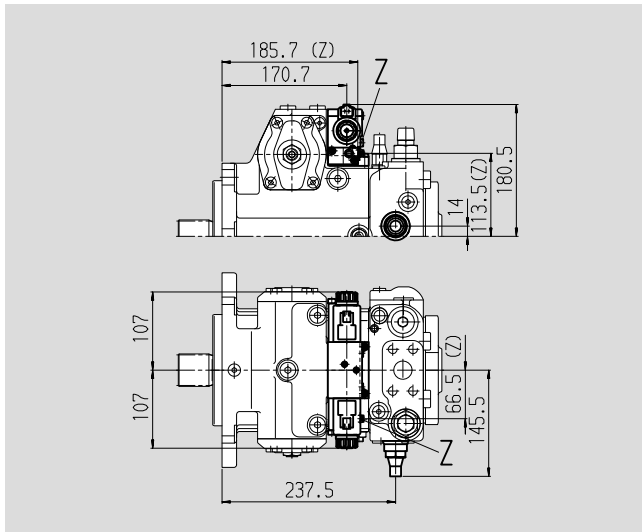
Before finalizing your design, please request a binding installation drawing. Dimensions in mm.

Hydraulic control, speed related, DA

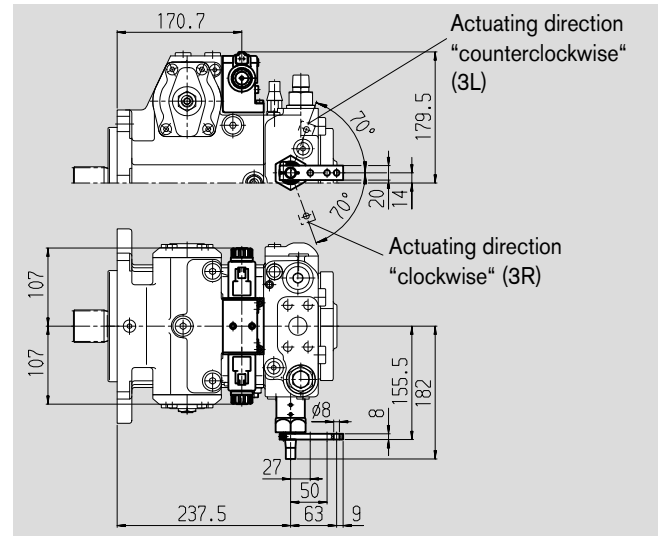
Control valve, fixed setting, DA2



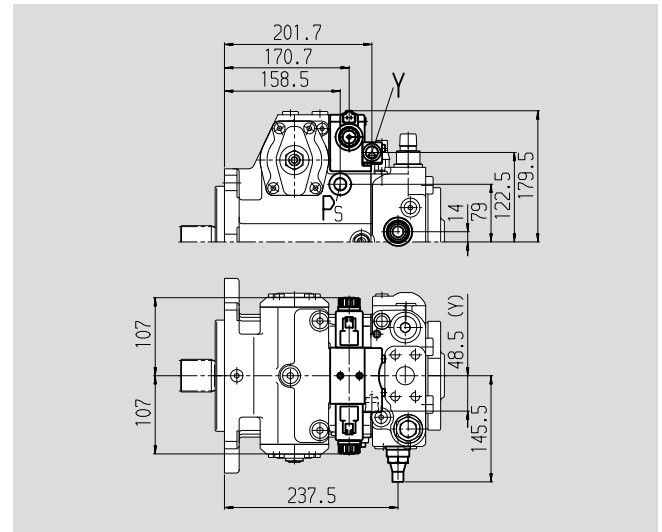
Control valve, fixed setting and hydraulic inch valve mounted, DA4/DA8



Control valve, mech. adjustable with position lever, DA3



Control valve, fixed setting and ports for pilot control device, DA7



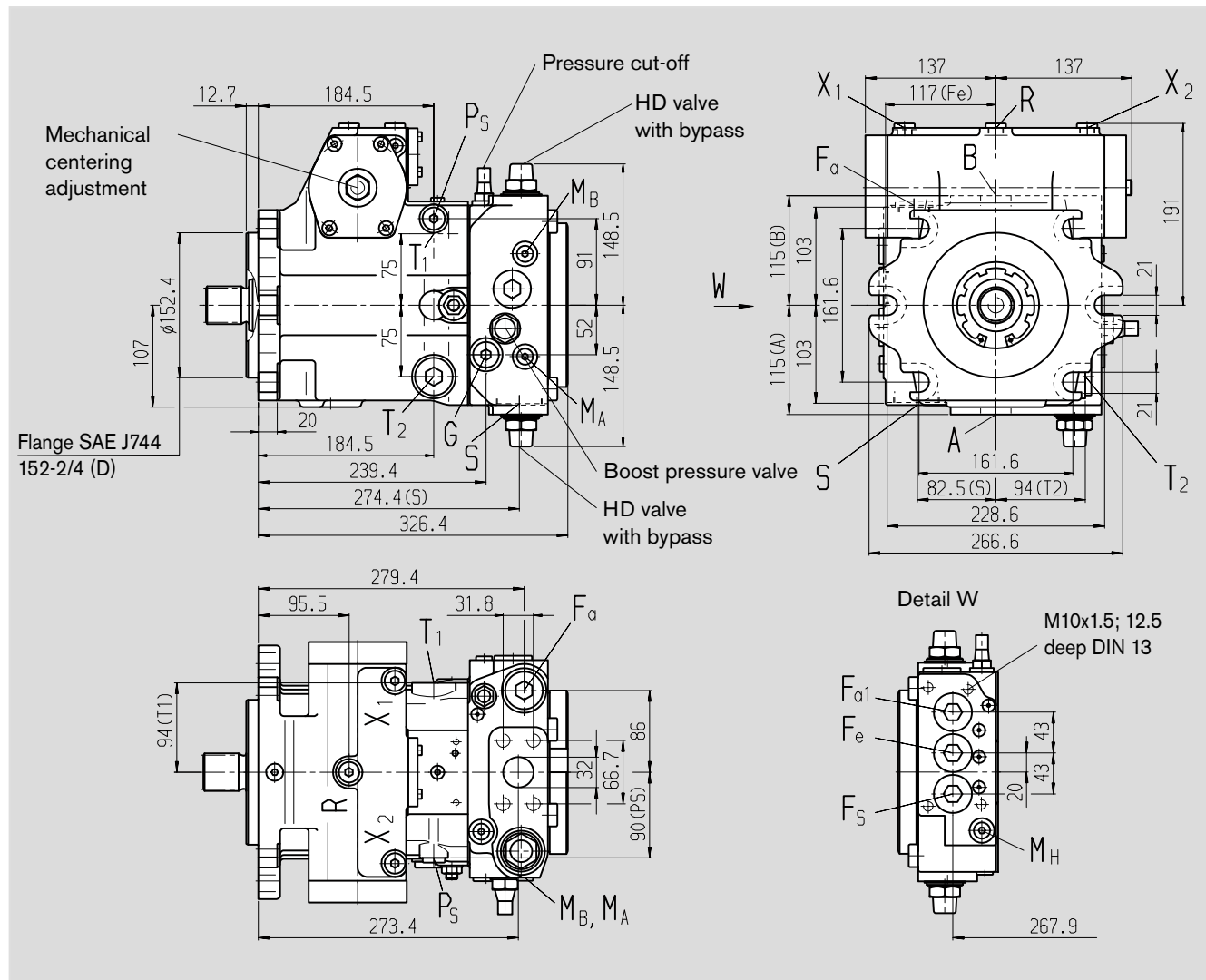
Unit Dimensions, Size 125

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

Version without control unit NV

Standard: suction port S at bottom (02)

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

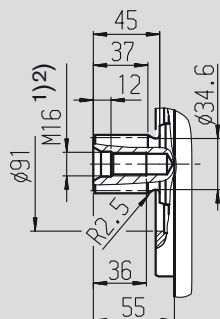


Unit Dimensions, Size 125

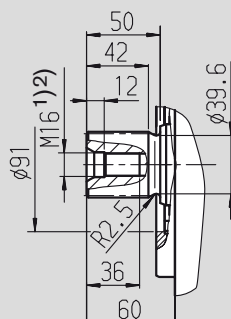
Before finalizing your design, please request a binding installation drawing. Dimensions in mm.

Shaft ends

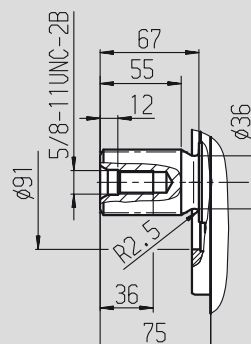
Z Splined shaft DIN 5480
W40x2x30x18x9g



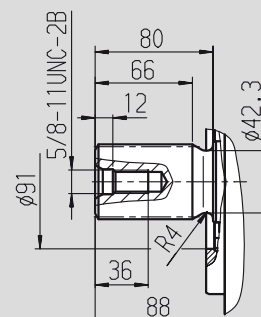
A Splined shaft DIN 5480
W45x2x30x21x9g



S Splined shaft 1 3/4 in
13T 8/16 DP ³⁾
(SAE J744 – 44-4 (D))



T Splined shaft 2 in
15T 8/16DP ³⁾
(SAE J744 – 50-4 (F))



Ports

A, B	service line ports (high-pressure series) fixing thread A/B
T ₁	case drain or fill
T ₂	case drain ⁴⁾
M _A , M _B	pressure gauge - operating pressure A, B ⁴⁾
R	air bleed ⁴⁾
S	boost suction port
X ₁ , X ₂	port for control pressures (before orifice) ⁴⁾
G	pressure port for auxiliary circuits ⁴⁾
P _S	control pressure supply ⁴⁾
F _a	filter output ⁴⁾
Fa1	filter output (mountable filter) ⁴⁾
F _e	filter input ⁴⁾
F _S	port from filter to suction line (cold start) ⁴⁾
M _H	port for balanced high pressure ⁴⁾
Y ₁ , Y ₂	remote control ports (only HD)
Z	pilot pressure port (only DA4/8) ⁴⁾
Y	pilot pressure port (only DA7)

SAE J518	1 1/4 in
DIN 13	M14x2; 19 deep ²⁾
DIN 3852	M33x2; 18 deep 540 Nm ²⁾
DIN 3852	M33x2; 18 deep 540 Nm ²⁾
DIN 3852	M12x1.5; 12 deep 50 Nm ²⁾
DIN 3852	M16x1.5; 12 deep 100 Nm ²⁾
DIN 3852	M48x2; 22 deep 960 Nm ²⁾
DIN 3852	M16x1.5; 12 deep 100 Nm ²⁾
DIN 3852	M22x1.5; 14 deep 210 Nm ²⁾
DIN 3852	M18x1.5; 12 deep 140 Nm ²⁾
DIN 3852	M33x2; 18 deep 540 Nm ²⁾
DIN 3852	M33x2; 18 deep 540 Nm ²⁾
DIN 3852	M33x2; 18 deep 540 Nm ²⁾
DIN 3852	M12x1.5; 12 deep 50 Nm ²⁾
DIN 3852	M14x1.5; 12 deep 80 Nm ²⁾
DIN 3852	M10x1; 8 deep 30 Nm ²⁾
DIN 3852	M18x1.5; 12 deep 140 Nm ²⁾

¹⁾ Center bore acc. to DIN 332 (thread acc. to DIN 13)

²⁾ Please observe the general notes for the max. tightening torques on page 64

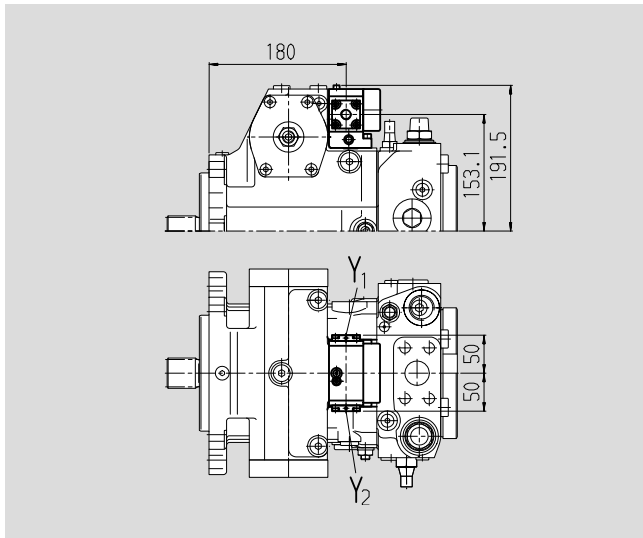
³⁾ ANSI B92.1a-1976, 30° pressure angle, flat root; side fit, tolerance class 5

⁴⁾ Plugged

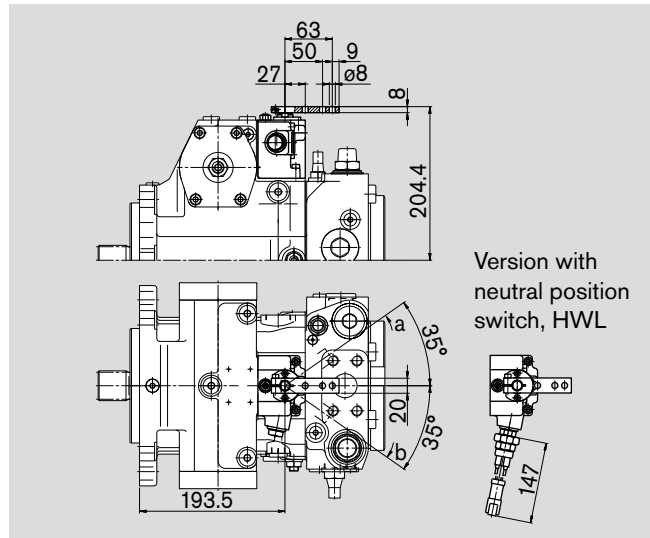
Unit Dimensions, Size 125

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

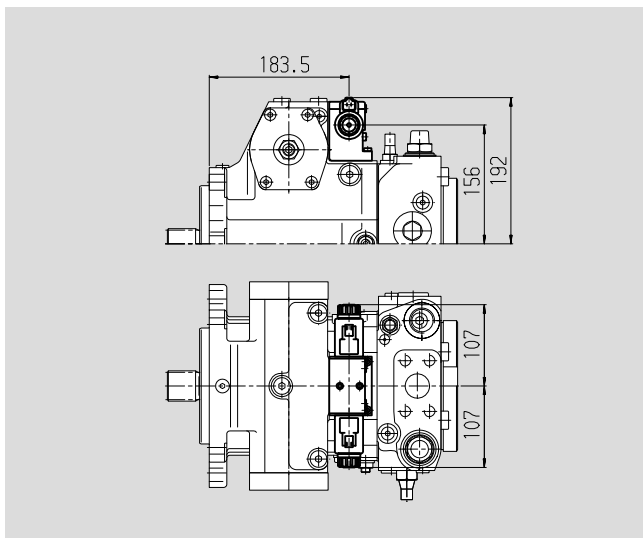
Hydraulic control, pilot-pressure related, HD



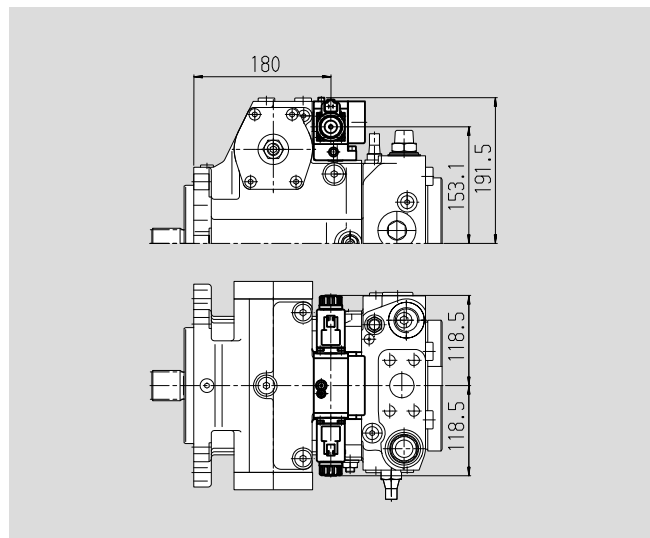
Hydraulic control, mechanical servo, HW



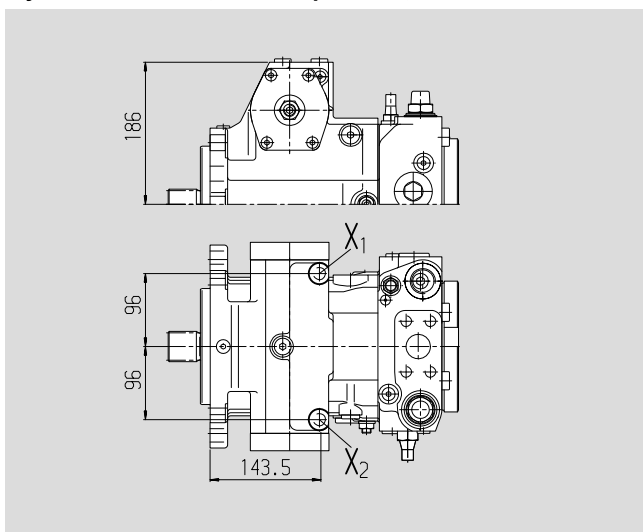
Electric two-position control with switching solenoid, EZ



Electric control with proportional solenoid, EP



Hydraulic control, direct operated, DG

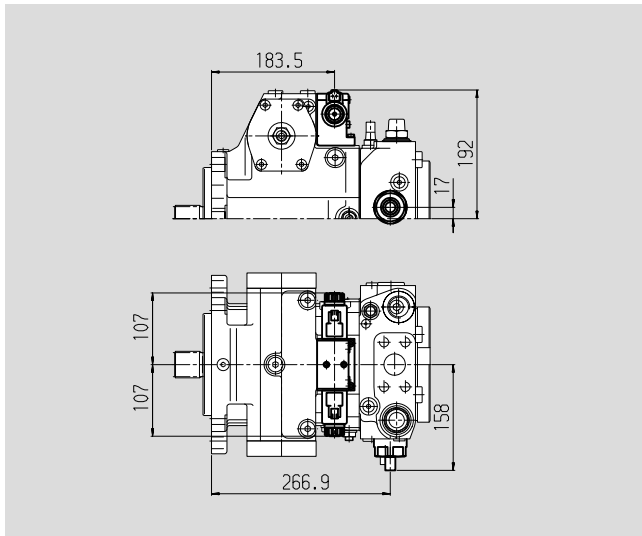


Unit Dimensions, Size 125

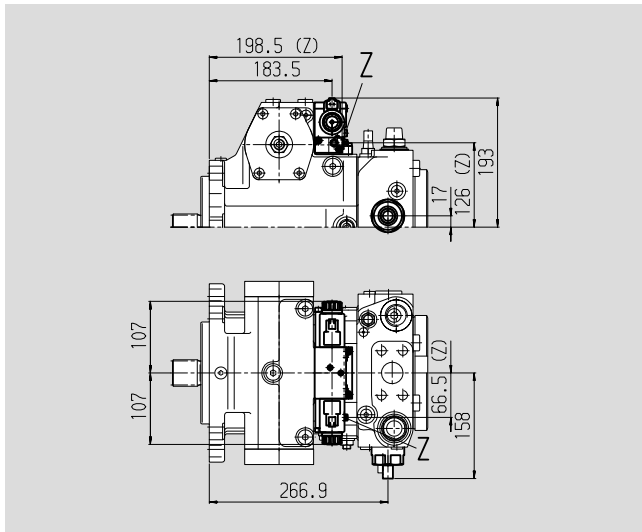
Before finalizing your design, please request a binding installation drawing. Dimensions in mm.

Hydraulic control, speed related, DA

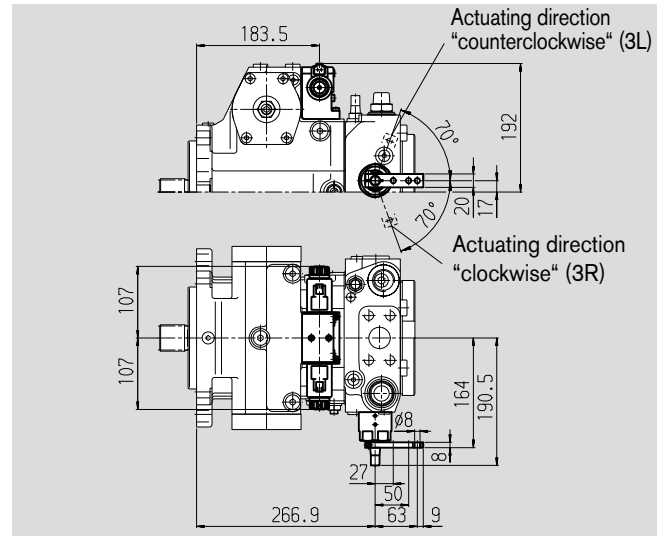
Control valve, fixed setting, DA2



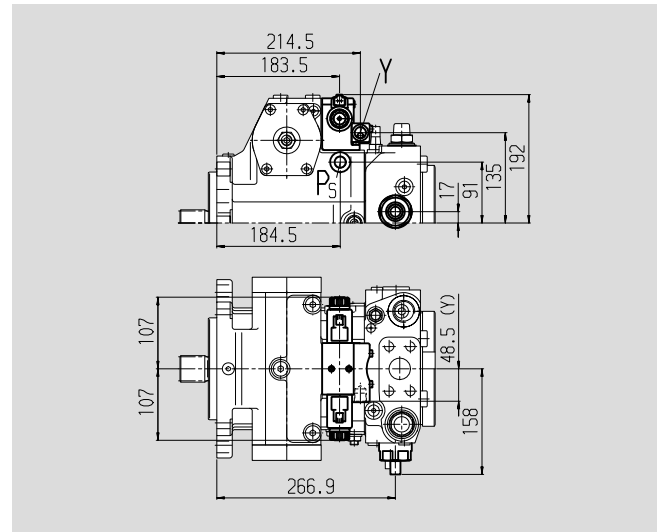
Control valve, fixed setting and hydraulic inch valve mounted, DA4/DA8



Control valve, mech. adjustable with position lever, DA3



Control valve, fixed setting and ports for pilot control device, DA7

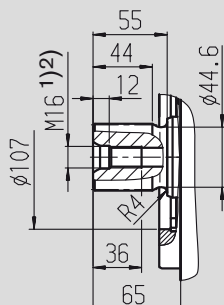


Unit Dimensions, Size 180

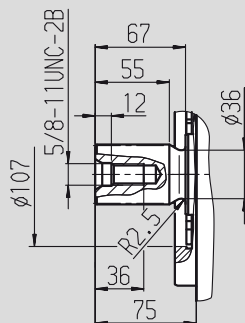
Before finalizing your design, please request a binding installation drawing. Dimensions in mm.

Shaft ends

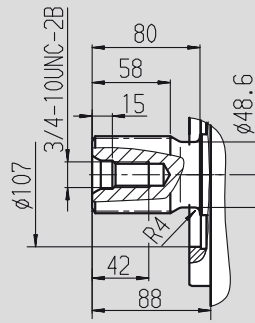
Z Splined shaft DIN 5480
W50x2x30x24x9g



S Splined shaft 1 3/4 in
13T 8/16 DP³⁾
(SAE J744 – 44-4 (D))



T Splined shaft 2 1/4 in
17T 8/16DP ³⁾



Ports

A, B	service line ports (high-pressure series)	SAE J518	1 1/4 in	
	fixing thread A/B	DIN 13	M14x2; 19 deep ²⁾	
T ₁	case drain or fill	DIN 3852	M42x2; 20 deep	720 Nm ²⁾
T ₂	case drain ⁴⁾	DIN 3852	M42x2; 20 deep	720 Nm ²⁾
M _A , M _B	pressure gauge - operating pressure A/B ⁴⁾	DIN 3852	M12x1.5; 12 deep	50 Nm ²⁾
R	air bleed ⁴⁾	DIN 3852	M16x1.5; 12 deep	100 Nm ²⁾
S	boost suction port	DIN 3852	M48x2; 22 deep	960 Nm ²⁾
X ₁ , X ₂	ports for control pressure (before orifice) ⁴⁾	DIN 3852	M16x1.5; 12 deep	100 Nm ²⁾
G	pressure port for auxiliary circuits ⁴⁾	DIN 3852	M22x1.5; 14 deep	210 Nm ²⁾
P _S	control pressure supply ⁴⁾	DIN 3852	M18x1.5; 12 deep	140 Nm ²⁾
F _a	filter output ⁴⁾	DIN 3852	M33x2; 18 deep	540 Nm ²⁾
F _{a1}	filter output (mountable filter) ⁴⁾	DIN 3852	M33x2; 18 deep	540 Nm ²⁾
F _e	filter input ⁴⁾	DIN 3852	M33x2; 18 deep	540 Nm ²⁾
F _S	port from filter to suction line (cold start) ⁴⁾	DIN 3852	M33x2; 18 deep	540 Nm ²⁾
M _H	port for balanced high pressure ⁴⁾	DIN 3852	M12x1.5; 12 deep	50 Nm ²⁾
Y ₁ , Y ₂	remote control ports (only HD)	DIN 3852	M14x1.5; 12 deep	80 Nm ²⁾
Z	pilot pressure port (only DA4/8) ⁴⁾	DIN 3852	M10x1; 8 deep	30 Nm ²⁾
Y	pilot pressure port (only DA7)	DIN 3852	M18x1.5; 12 deep	140 Nm ²⁾

¹⁾ Center bore acc. to DIN 332 (thread acc. to DIN 13)

²⁾ Please observe the general notes for the max. tightening torques on page 64

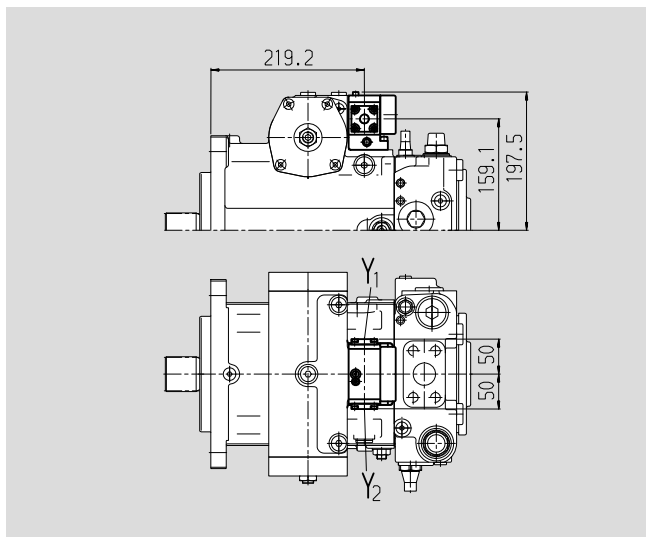
³⁾ ANSI B92.1a-1976, 30° pressure angle, flat root; side fit, tolerance class 5

4) Plugged

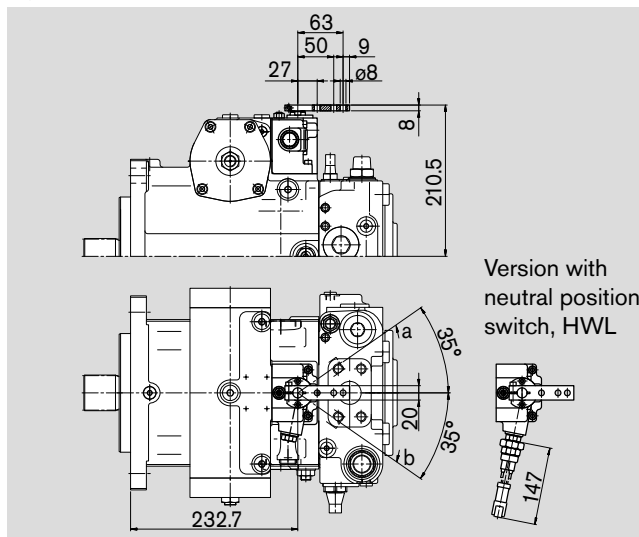
Unit Dimensions, Size 180

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

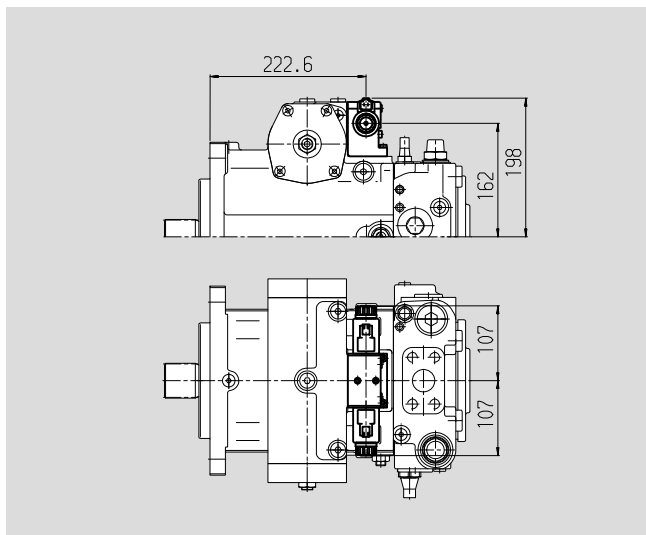
Hydraulic control, pilot-pressure related, HD



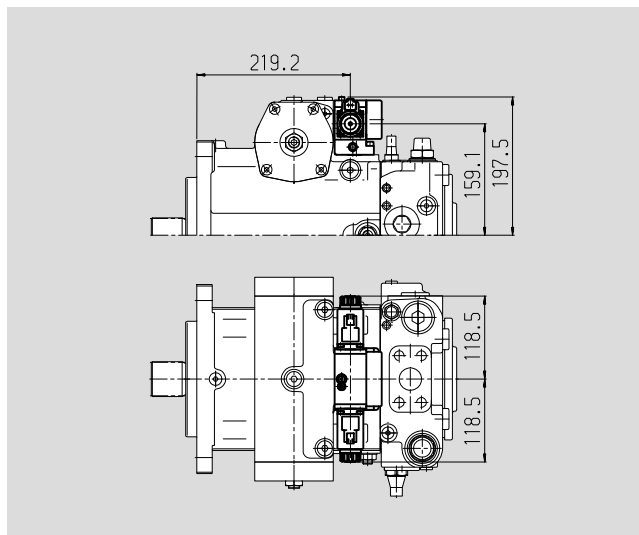
Hydraulic control, mechanical servo, HW



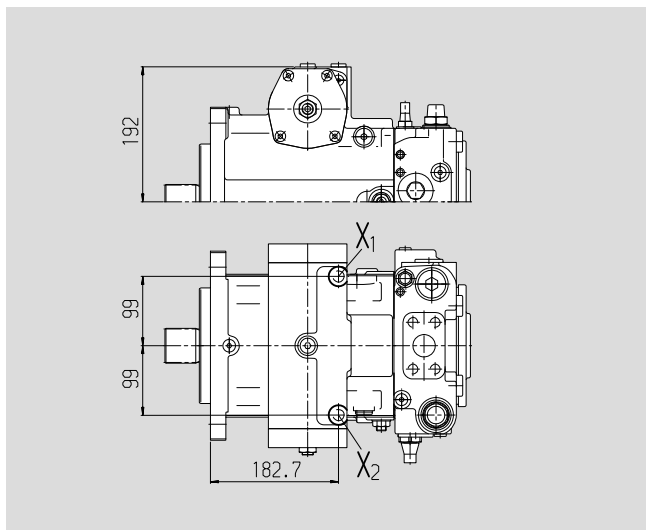
Electric two-position control with switching solenoid, EZ



Electric control with proportional solenoid, EP



Hydraulic control, direct operated, DG

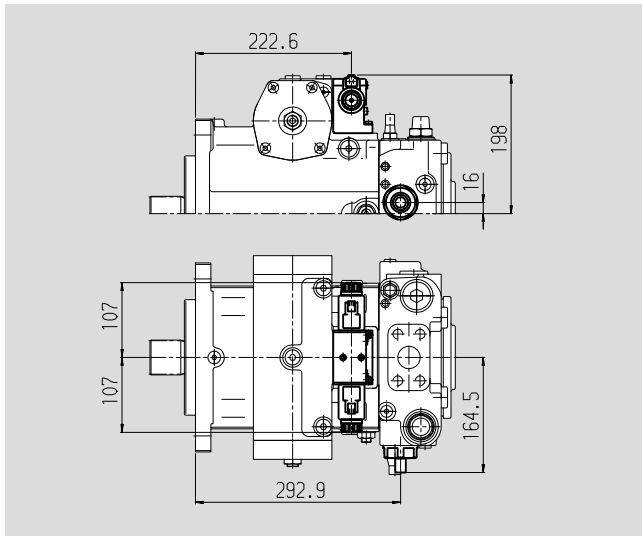


Unit Dimensions, Size 180

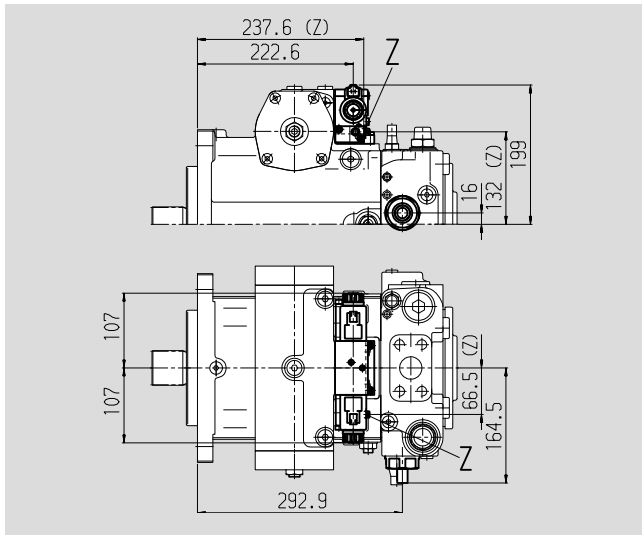
Before finalizing your design, please request a binding installation drawing. Dimensions in mm.

Hydraulic control, speed related, DA

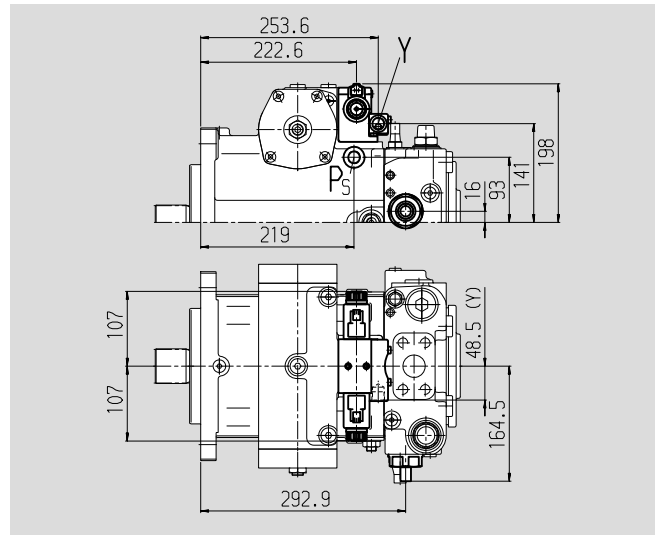
Control valve, fixed setting, DA2



Control valve, fixed setting and hydraulic inch valve mounted, DA4/DA8



Control valve, fixed setting and ports for pilot control device, DA7



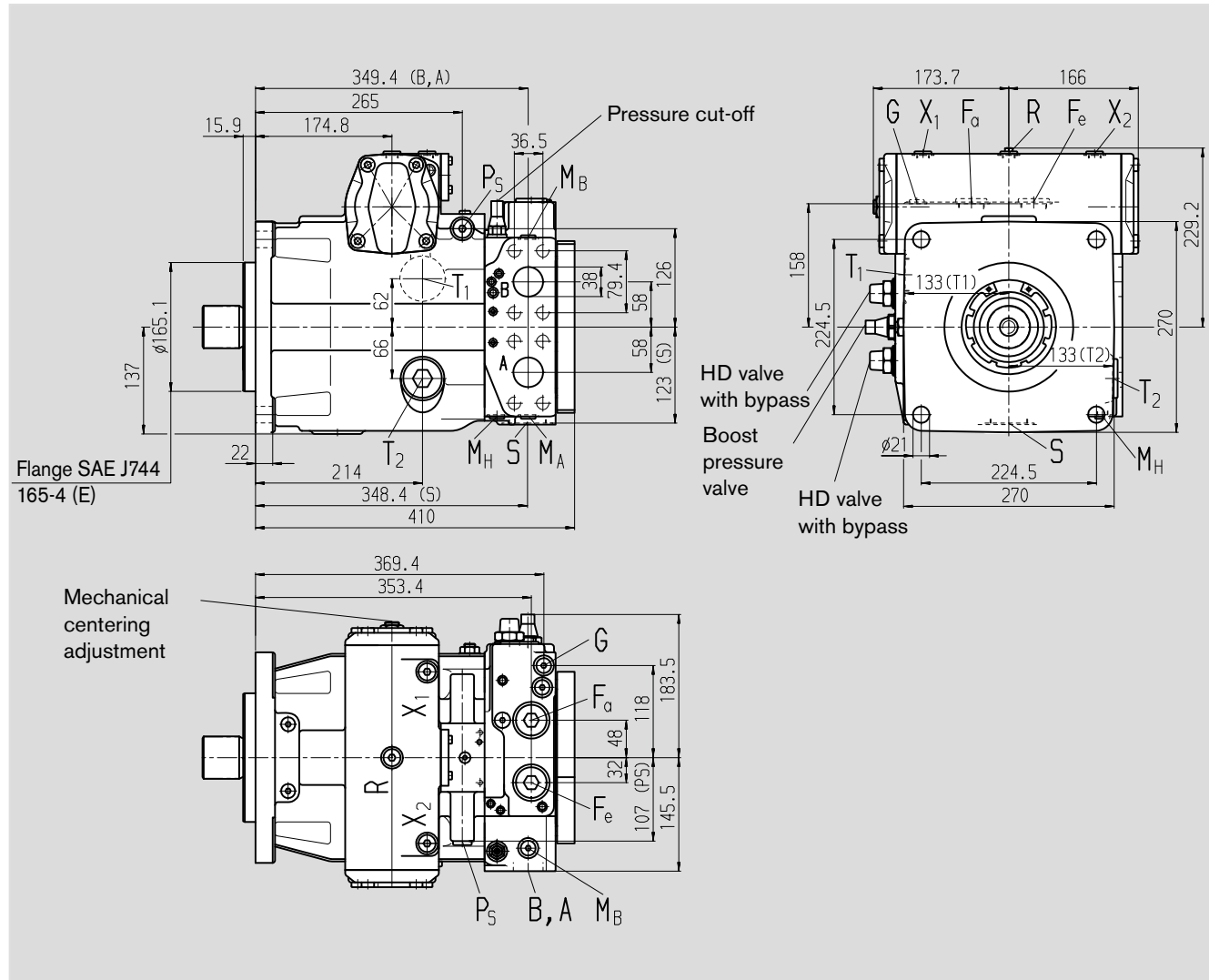
Unit Dimensions, Size 250

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

Version without control unit NV

Standard: suction port S at bottom (10)

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

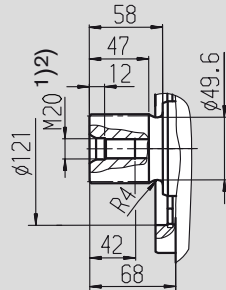


Unit Dimensions, Size 250

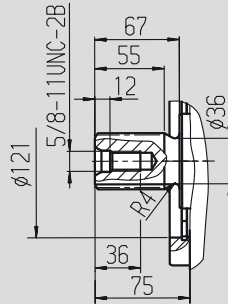
Before finalizing your design, please request a binding installation drawing. Dimensions in mm.

Shaft ends

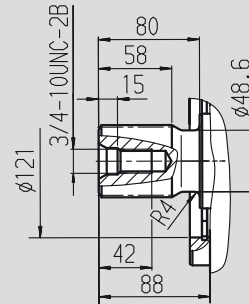
Z Splined shaft DIN 5480
W55x2x30x26x9g



S Splined shaft 1 3/4 in
13T 8/16 DP ³⁾
(SAE J744 – 44-4 (D))



T Splined shaft 2 1/4 in
17T 8/16DP ³⁾



Ports

A, B	service line ports (high-pressure series)
	fixing thread A/B
T ₁	case drain or fill
T ₂	case drain ⁴⁾
M _A , M _B	pressure gauge - operating pressure A/B ⁴⁾
R	air bleed ⁴⁾
S	boost suction port
X ₁ , X ₂	ports for control pressure (before orifice) ⁴⁾
G	pressure port for auxiliary circuits ⁴⁾
P _S	control pressure supply ⁴⁾
F _a	filter output ⁴⁾
F _e	filter input ⁴⁾
M _H	port for balanced high pressure ⁴⁾
Y ₁ , Y ₂	remote control ports (only HD)
Z	pilot pressure port (only DA4/8) ⁴⁾
Y	pilot pressure port (only DA7)

SAE J518	1 1/2 in	
DIN 13	M16x2; 21 deep ²⁾	
DIN 3852	M42x2; 20 deep	720 Nm ²⁾
DIN 3852	M42x2; 20 deep	720 Nm ²⁾
DIN 3852	M14x1.5; 12 deep	80 Nm ²⁾
DIN 3852	M16x1.5; 12 deep	100 Nm ²⁾
DIN 3852	M48x2; 22 deep	960 Nm ²⁾
DIN 3852	M16x1.5; 12 deep	100 Nm ²⁾
DIN 3852	M14x1.5; 12 deep	80 Nm ²⁾
DIN 3852	M18x1.5; 12 deep	140 Nm ²⁾
DIN 3852	M33x2; 18 deep	540 Nm ²⁾
DIN 3852	M33x2; 18 deep	540 Nm ²⁾
DIN 3852	M14x1.5; 12 deep	80 Nm ²⁾
DIN 3852	M14x1.5; 12 deep	80 Nm ²⁾
DIN 3852	M10x1; 8 deep	30 Nm ²⁾
DIN 3852	M18x1.5; 12 deep	140 Nm ²⁾

¹⁾ Center bore acc. to DIN 332 (thread acc. to DIN 13)

²⁾ Please observe the general notes for the max. tightening torques on page 64

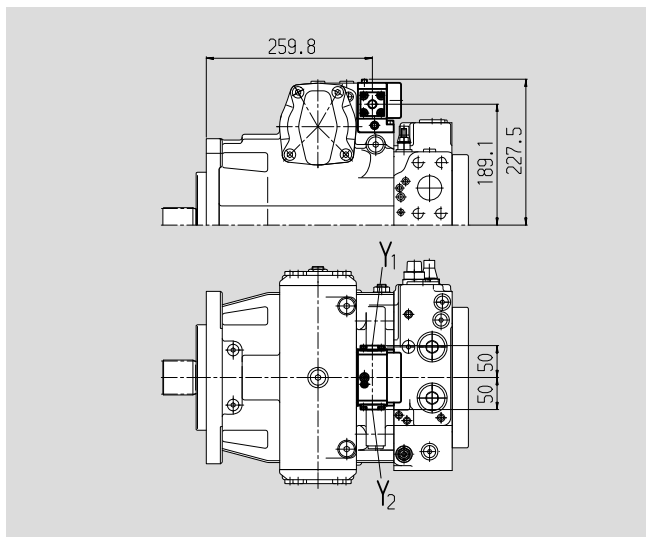
³⁾ ANSI B92.1a-1976, 30° pressure angle, flat root; side fit, tolerance class 5

⁴⁾ Plugged

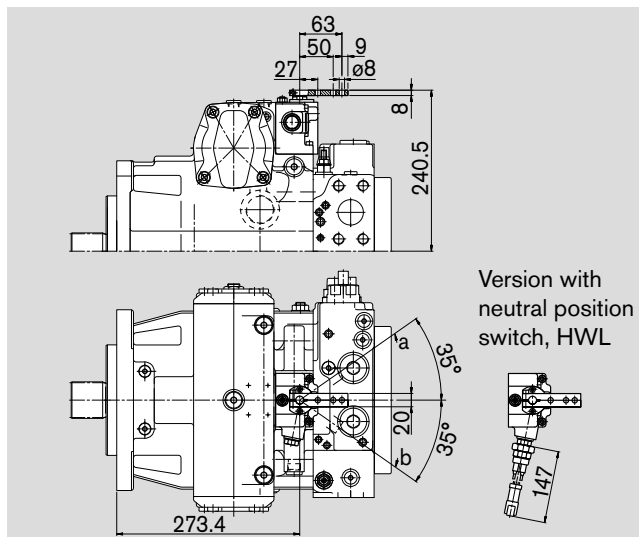
Unit Dimensions, Size 250

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

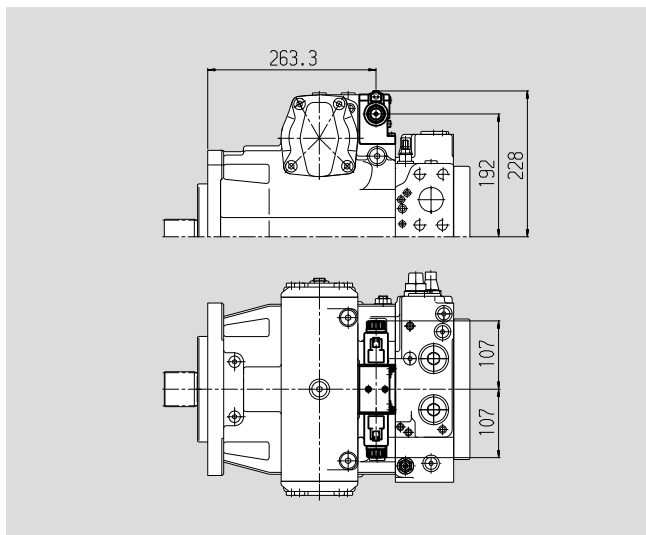
Hydraulic control, pilot-pressure related, HD



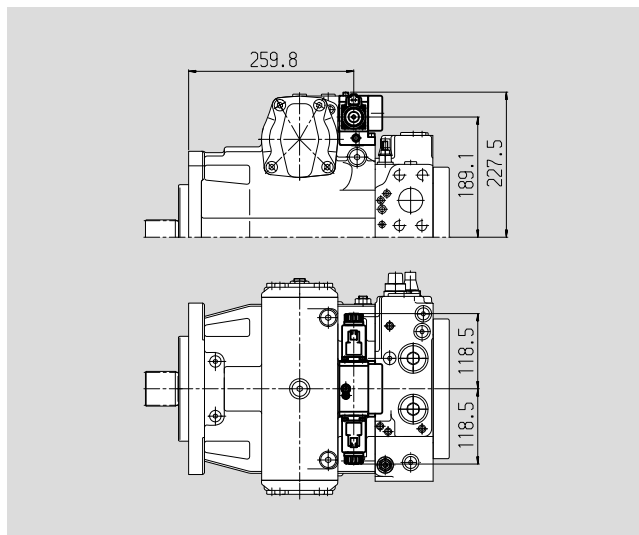
Hydraulic control, mechanical servo, HW



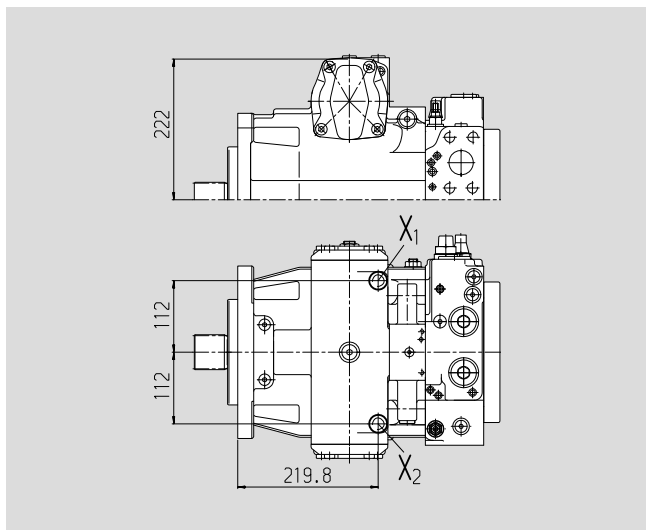
Electric two-position control with switching solenoid, EZ



Electric control with proportional solenoid, EP



Hydraulic control, direct operated, DG

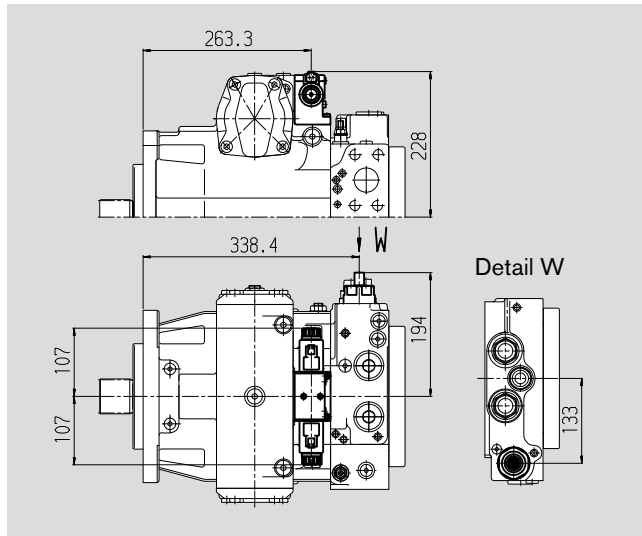


Unit Dimensions, Size 250

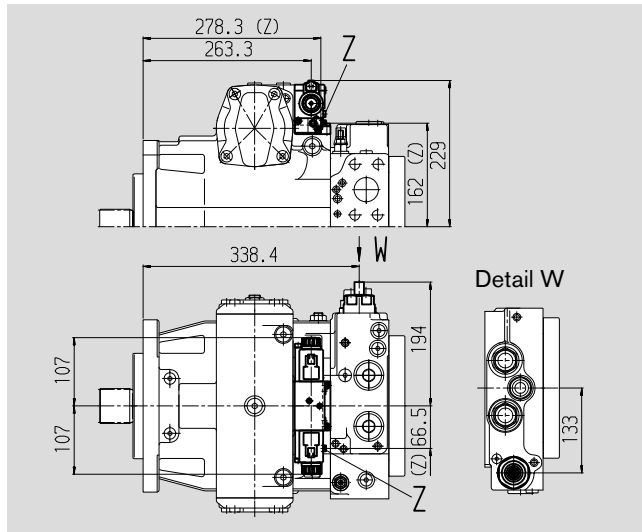
Before finalizing your design, please request a binding installation drawing. Dimensions in mm.

Hydraulic control, speed related, DA

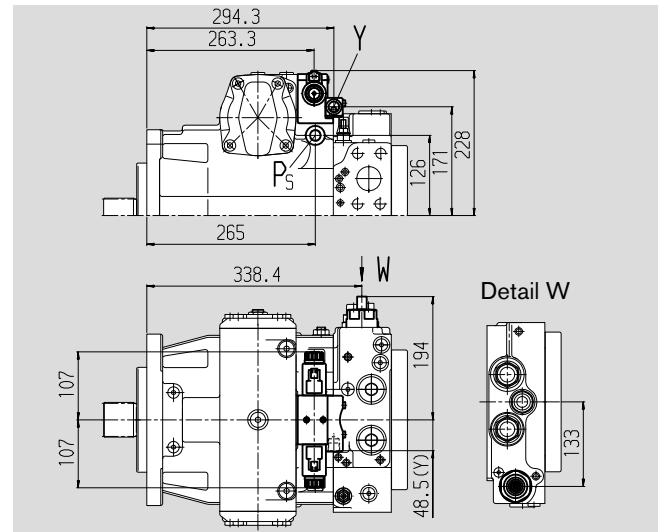
Control valve, fixed setting, DA2



Control valve, fixed setting and hydraulic inch valve mounted, DA4/DA8

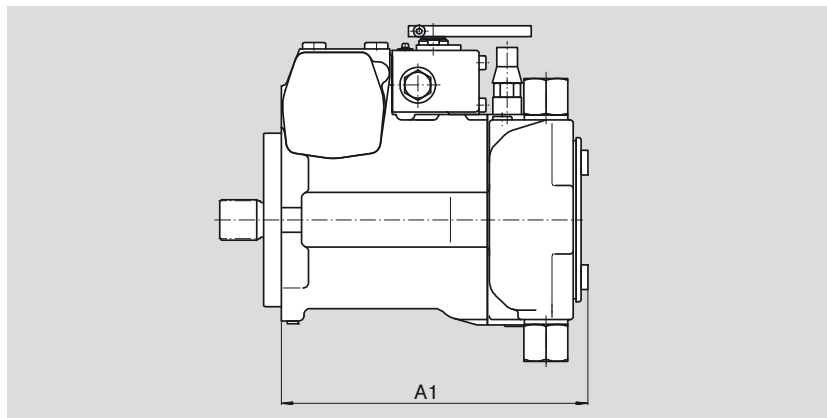


Control valve, fixed setting and ports for pilot control device, DA7



Through Drive Dimensions

N00 Without boost pump, without through drive
F00 With boost pump, without through drive

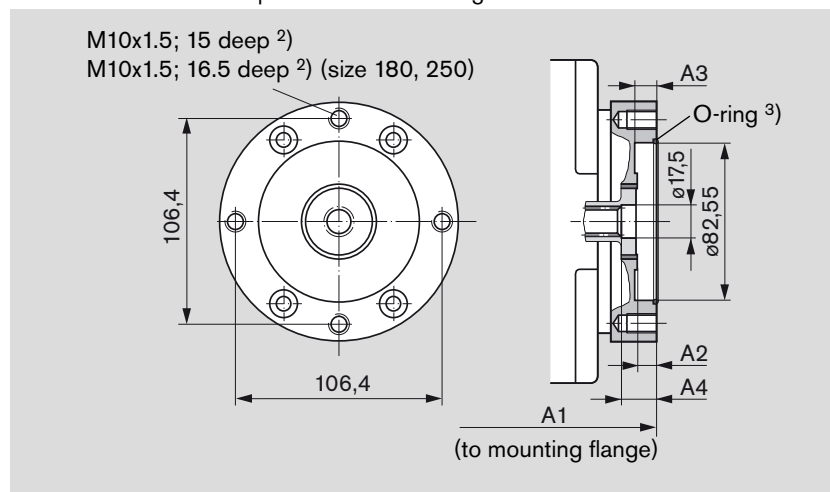


Before finalizing your design, please request a binding installation drawing. Dimensions in mm.

Size	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 Flange SAE J744 – 82-2 (A)

Hub for splined shaft according to ANSI B92.1a-1976 5/8 in 9T 16/32DP¹⁾ (SAE J744 – 16-4 (A))



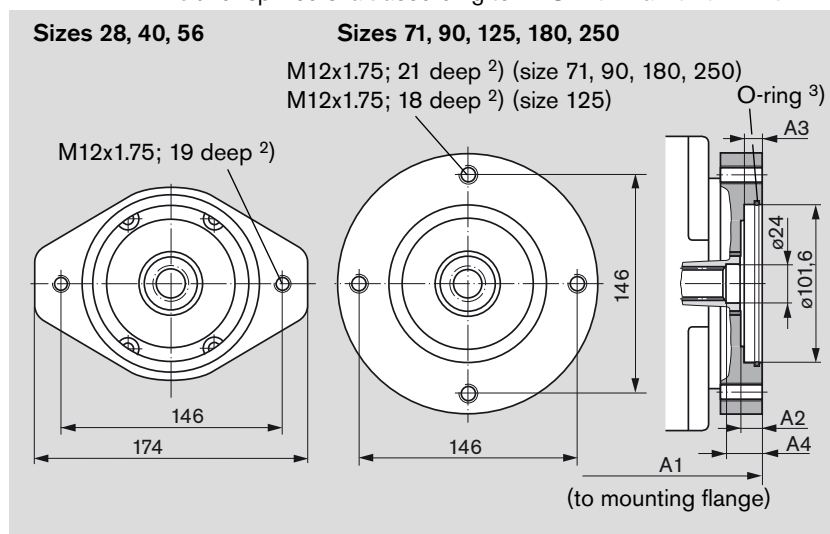
Size	A1 (F01)	A1 (K01)	A2	A3	A4
28	227.9	227.9	7.5	7.5	14.5
40	239.7	234.2	9	9	18
56	261.4	254.9	10	10	18
71	297.6	297.6	9	10	17
90	304	304	9	8	–
125	330.9	330.9	10.5	9	–
180	378.4	378.4	7.5	7.5	15.5
250	426.9	426.2	11	11	18

Shown is the 2-bolt version

Please specify in plain text whether the 2-bolt horizontal or 2-bolt vertical version is used.

F02/K02 Flange SAE J744 – 101-2 (B)

Hub for splined shaft according to ANSI B92.1a-1976 7/8 in 13T 16/32DP¹⁾ (SAE J744 – 22-4 (B))



Size	A1	A2	A3	A4
28	230.4	9.7	9.7	16.2
40	240.7	11	11	17
56	262.4	12	11	19.5
71	300.6	13	9.8	17
90	305	9	11	17
125	330.9	10	11	17
180	381.4	11	11	19
250	428.9	11	11	16

Shown is the 2-bolt version

Please specify in plain text whether the 2-bolt horizontal or 2-bolt vertical version is used.

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

²⁾ Thread acc. to DIN 13, please observe the general notes for the max. tightening torques on page 64

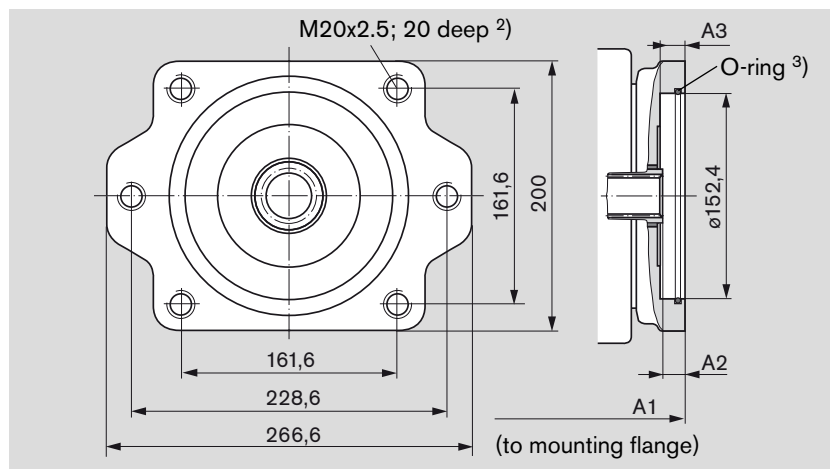
³⁾ O-ring included in supply

Through Drive Dimensions

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

F73/K73 Flange SAE J744 – 152-2/4 (D)

Hub for splined shaft acc. to DIN 5480 W35x2x30x16x9g



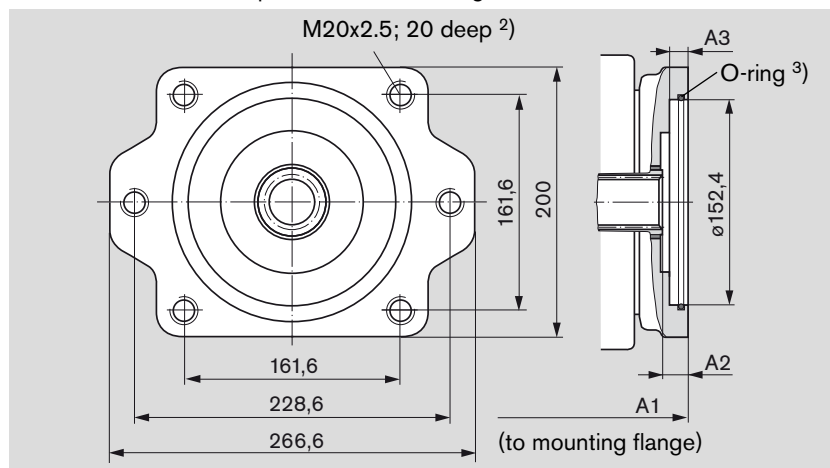
Size	A1	A2	A3
90	309	12	14

Shown is the 4+2-bolt version

Please specify in plain text whether the 2-bolt, 4-bolt or 4+2-bolt version is used.

F69/K69 Flange SAE J744 – 152-2/4 (D)

Hub for splined shaft according to ANSI B92.1a-1976 1 3/4 in 13T 8/16DP¹⁾ (SAE J744 – 44-4 (D))



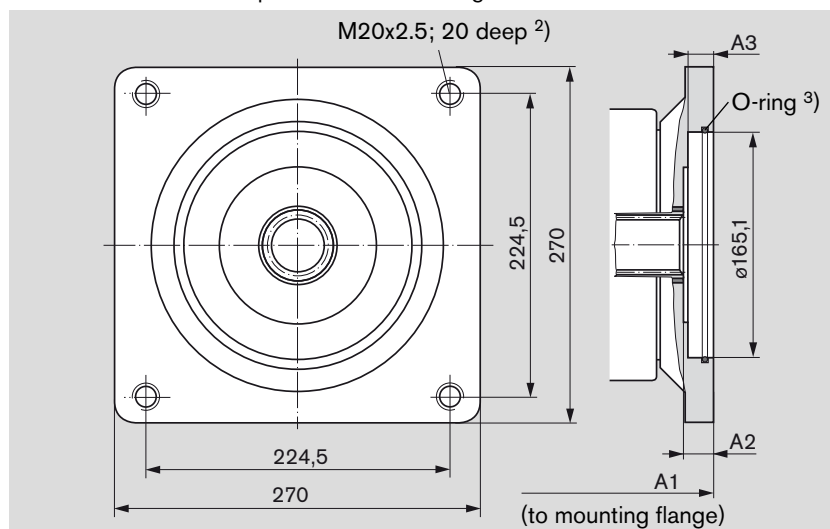
Size	A1	A2	A3
125	343.9	18	14
180	391.9	20.9	18
250	444.9	9	17

Shown is the 4+2-bolt version

Please specify in plain text whether the 2-bolt, 4-bolt or 4+2-bolt version is used.

F72/K72 Flange SAE J744 – 165-4 (E)

Hub for splined shaft according to ANSI B92.1a-1976 1 3/4 in 13T 8/16DP¹⁾ (SAE J744 – 44-4 (D))



Size	A1	A2	A3
180	391.9	20.9	18
250	444.9	9	17

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

²⁾ Thread acc. to DIN 13, please observe the general notes for the max. tightening torques on page 64

³⁾ O-ring included in supply

Overview of Attachments on A4VG

Through drive – A4VG											Through drive
Flange	Hub for splined shaft	Code	A4VG Size (shaft)	A10V(S)O/31 Size (shaft)	A10V(S)O/53 Size (shaft)	A4FO Size (shaft)	A11VO Size (shaft)	A10VG Size (shaft)	External gear pump		Available for size
82-2 (A)	5/8 in	F/K01	–	18 (U)	10 (U)	–	–	–	Size F Size 4-22 ¹⁾		28...250
101-2 (B)	7/8 in	F/K02	–	28 (S,R)	28 (S,R)	16 (S) 22 (S)	–	18 (S)	Size N Size 20-32 ¹⁾		28...250
				45 (U)	45 (U,W)	28 (S)			Size G Size 38-45 ¹⁾		
	1 in	F/K04	28 (S)	45 (S,R)	45 (S,R) 60 (U,W)	–	40 (S)	28 (S) 45 (S)	–		28...250
127-2 (C)	1 in	F/K09	40 (U)	–	–	–	–	–	–		40
	1 1/4 in	F/K07	40 (S), 56 (S) 71 (S)	71 (S,R) 100 (U)	85 (U)	–	60 (S)	63 (S)	–		56...250
152-2/4 (D)	W35	F/K73	90 (Z)	–	–	–	–	–	–		90
	1 3/4 in	F/K69	90 (S) 125 (S)	140 (S)	–	–	95 (S) 130 (S)	–	–		125...250
165-4 (E)	1 3/4 in	F/K72	180 (S) 250 (S)	–	–	–	190 (S) 260 (S)	–	–		180...250

¹⁾ Rexroth recommends special gear pump versions. Please contact us.

Combination Pumps A4VG + A4VG

Overall length A

A4VG (1st pump)	A4VG (2nd pump) ¹⁾							
	Size 28	Size 40	Size 56	Size 71	Size 90	Size 125	Size 180	Size 250
Size 28	453.8	–	–	–	–	–	–	–
Size 40	464.1	480.4	–	–	–	–	–	–
Size 56	485.8	502.1	522.8	–	–	–	–	–
Size 71	524.0	539.3	560.0	597.2	–	–	–	–
Size 90	528.4	544.7	565.4	602.6	610.0	–	–	–
Size 125	554.3	571.6	592.3	629.5	644.9	670.3	–	–
Size 180	604.8	620.1	640.8	678.0	692.9	718.3	762.8	–
Size 250	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

Combination pumps make it possible to have independent circuits without the need to fit splitter gearboxes.

When ordering combination pumps, the type designations of the 1st and 2nd pumps must be linked by a "+".

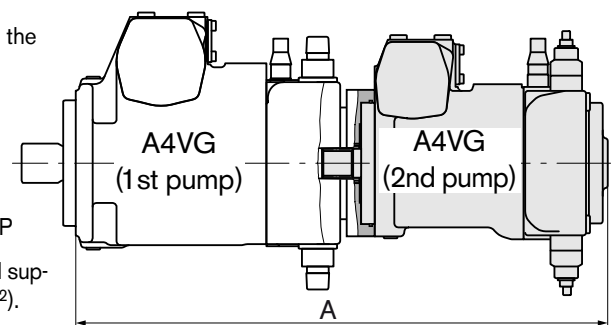
Example of order:

A4VG56EP3D1/32R-NAC02**F073**SP + A4VG56EP3D1/32R-NSC02**F003**SP

A tandem pump combined of two equal sizes is permissible without additional supports where the dynamic acceleration does not exceed max. 10 g ($\approx 98.1 \text{ m/s}^2$).

We recommend the use of 4-bolt mounting flanges from size 71 and larger.

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



Mechanical Stroke Limiter, M

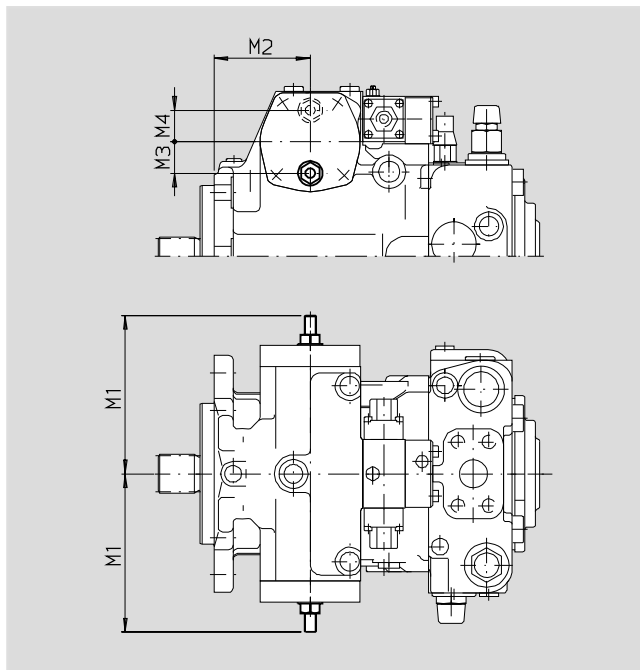
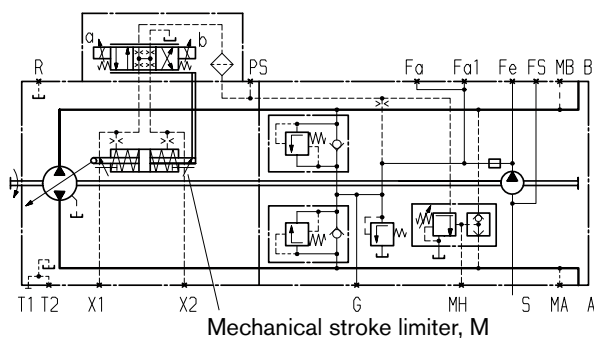
The mechanical stroke limiter is an additional function allowing continuous reduction of the maximum displacement of the pump, regardless of the control unit used.

The stroke of the stroke cylinder and hence the maximum swivel angle of the pump are limited by means of two adjusting screws.

Dimensions

Size	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	–

Circuit diagram ¹⁾

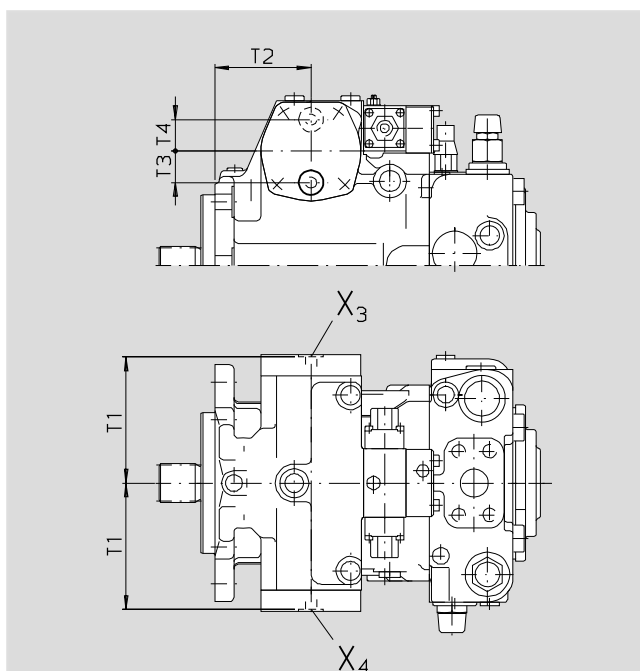
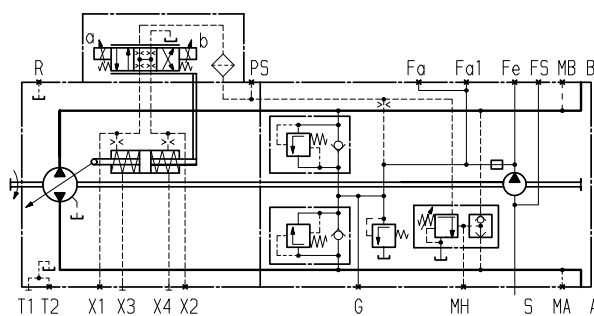


Ports X₃ and X₄ for Positioning Pressure, T

Dimensions

Size	T1	T2	T3	T4	X ₃ , X ₄
28	92	40.1	–	24	M12x1.5
40	92	38.1	–	24	M12x1.5
56	104.5	44	–	25	M12x1.5
71	113.5	86.3	28	–	M12x1.5
90	111.5	95.7	–	30	M12x1.5
125	136	104.5	34	–	M12x1.5
180	146.5	138.7	–	35	M12x1.5
250	164.5	174.8	–	38	M16x1.5

Circuit diagram ¹⁾



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

Filtration Types

Standard: Filtration in the suction line of the boost pump, S

Standard version (preferred)

Filter type: _____ filter **without** bypass

Recommendation: _____ **with** contamination indicator

Flow resistance at the filter element:

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

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

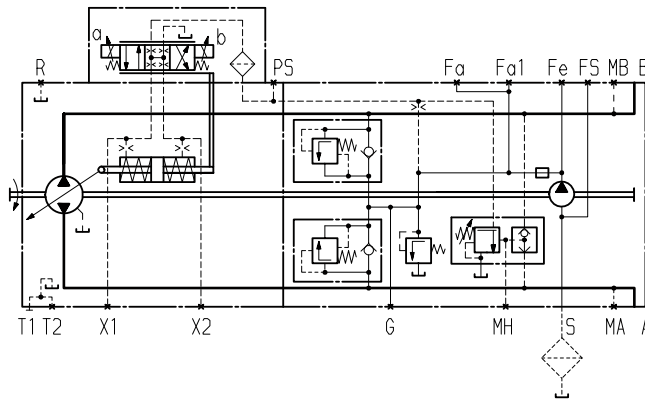
Pressure at port S of the boost pump:

at $v = 30 \text{ mm}^2/\text{s}$ _____ $p \geq 0.8 \text{ bar}$

at cold start ($v = 1600 \text{ mm}^2/\text{s}$, $n \leq 1000 \text{ rpm}$) _____ $p \geq 0.5 \text{ bar}$

Filter is not included in supply.

Circuit diagram - standard version S



Variation: External supply, E

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

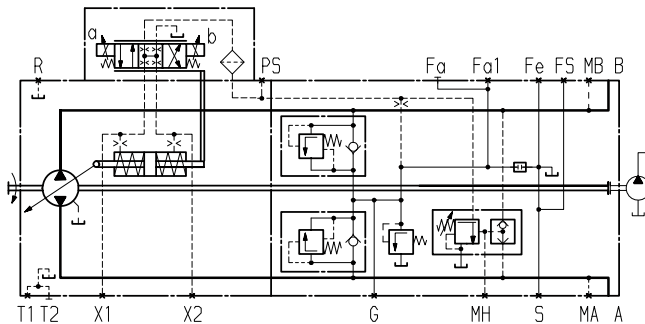
Port S is plugged.

Supply comes from port Fa.

Filter arrangement: _____ separate

For functional reliability ensure required cleanliness level for the boost pressure fluid at port Fa (see page 6).

Circuit diagram variation E (external supply)



Variation:

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

Filter input: Port Fe

Filter output: Port Fa

Filter type: Filter with bypass are **not recommended**.
When applying with bypass please consult us.

Recommendation: **with** contamination indicator

Note:

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

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

Filter arrangement: separately in the pressure line (line filter)

Flow resistance at the filter element:

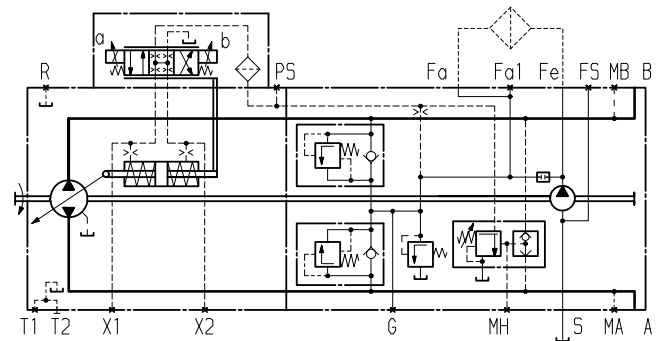
at $v = 30 \text{ mm}^2/\text{s}$ _____ $\Delta p \leq 1 \text{ bar}$

for cold start _____ $\Delta p \leq 3 \text{ bar}$

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

Filter is not included in supply.

Circuit diagram variation D



Filtration Types

Variation:

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

Version similar to variation D, however additionally with cold start valve:

- Port plate is equipped with **cold start valve** and therefore protects the pump from damage.
The valve opens at flow resistance $\Delta p \geq 6$ bar.

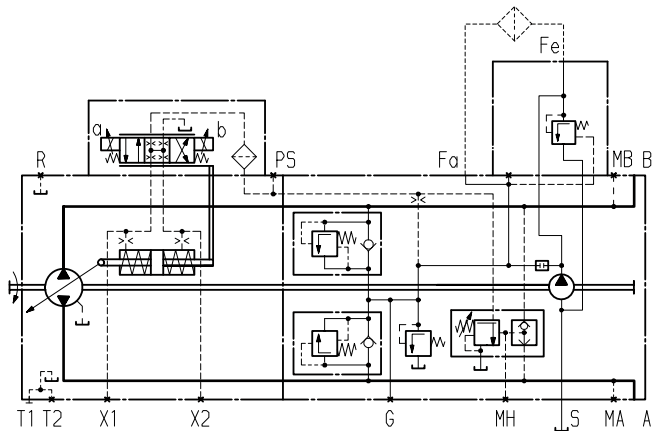
Port F_e : Filter input (at the cold start valve)

Port F_a : Filter output

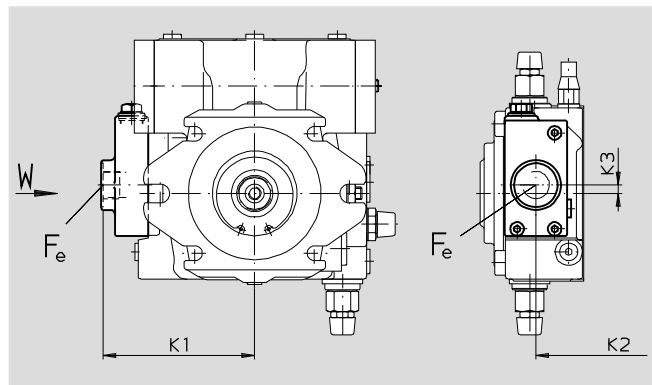
Filter arrangement _____ separately in the pressure line (line filter)

Filter is not included in supply.

Circuit diagram variation K (with cold start valve)



Dimensions variation K (with cold start valve)



Size	K1	K2	K3	F_e 1)	$T_{max.}$ 2)
40	122.5	198.7	0	M18x1.5; 15 deep	140 Nm
56	125.5	215.4	0	M18x1.5; 15 deep	140 Nm
71	145.5	239.0	8	M26x1.5; 16 deep	230 Nm
90	139.5	248.5	24	M26x1.5; 16 deep	230 Nm
125	172.0	267.9	20	M33x2; 18 deep	540 Nm
180	173.0	311.9	3	M33x2; 18 deep	540 Nm

1) DIN 3852

2) Please observe the general notes for the max. tightening torques on page 64

Variation:

Filtration in pressure line of boost pump, filter mounted, supplied, F

Filter type _____ filter **without** bypass

Filter grade (absolute) _____ 20 microns

Filter material _____ glass fiber

Pressure capacity _____ 100 bar

Filter arrangement _____ connected to pump

Note:

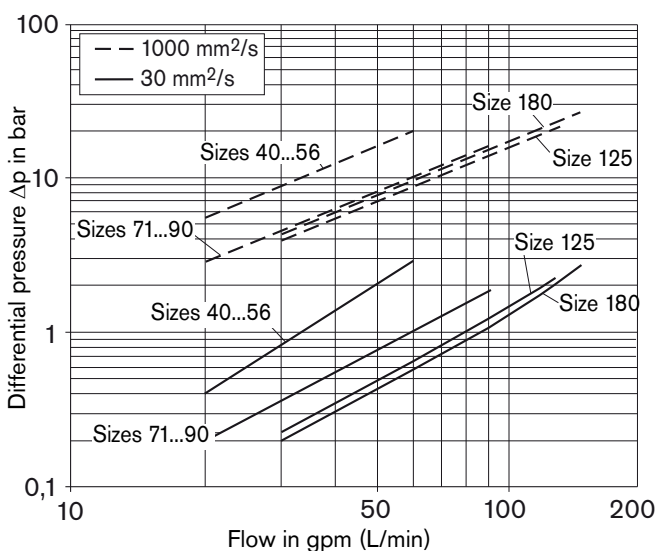
- Port plate is equipped with **cold start valve** and therefore protects the pump from damage.

The valve opens at flow resistance $\Delta p \geq 6$ bar.

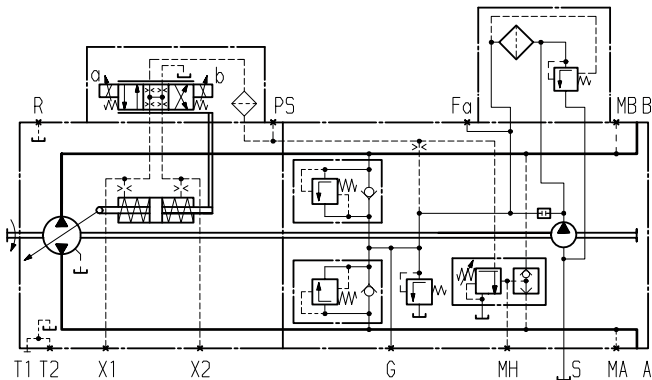
Recommendation: **with** contamination indicator (variation P, L, M, B)
(differential pressure $\Delta p = 5$ bar)

Filter characteristic

Differential pressure/volumetric flow characteristics conforming to ISO 3968 (valid for new filter element).



Circuit diagram variation F (with mountable filter)



Filtration Types

Variation:

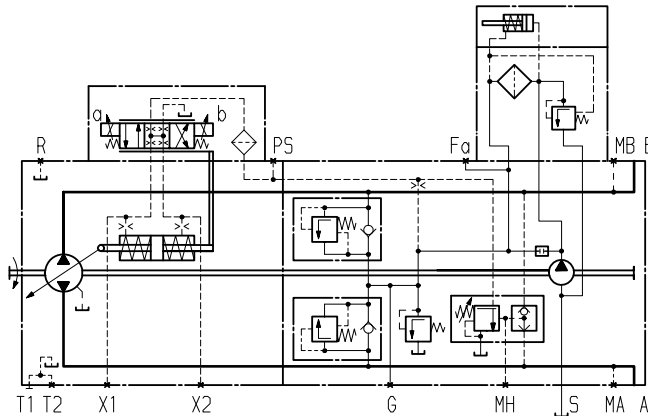
Filtration in pressure line of the boost pump, filter mounted, supplied, with visual contamination indicator, P

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

Indication: green/red window

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

Circuit diagram variation P



Variation:

Filtration in the pressure line of the boost pump, filter mounted, supplied, with Electric contamination indicator with DEUTSCH connector, B

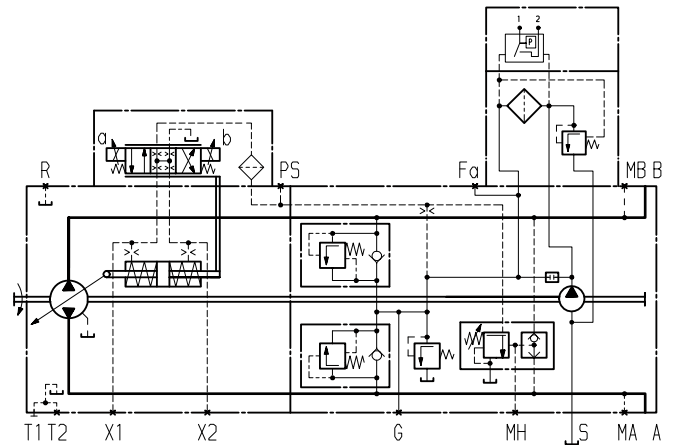
Version similar to variation F, however additionally with Electric contamination indicator.

Indication: Electric

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

Max. switching power at 24 V DC _____ 60 W

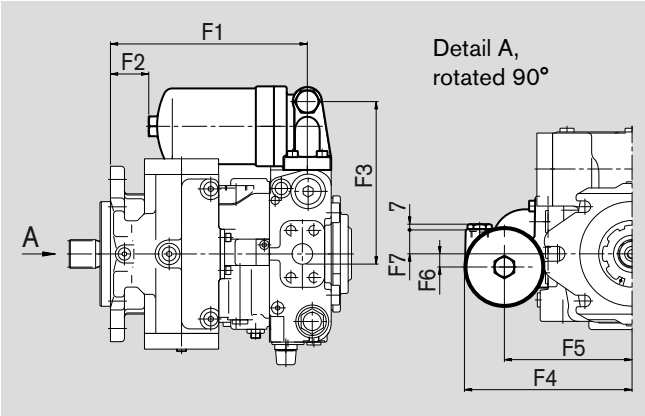
Circuit diagram variation B



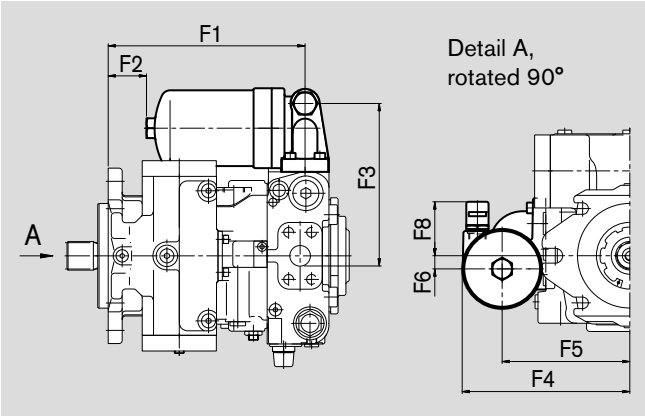
Filtration Types

Dimensions with mountable filter

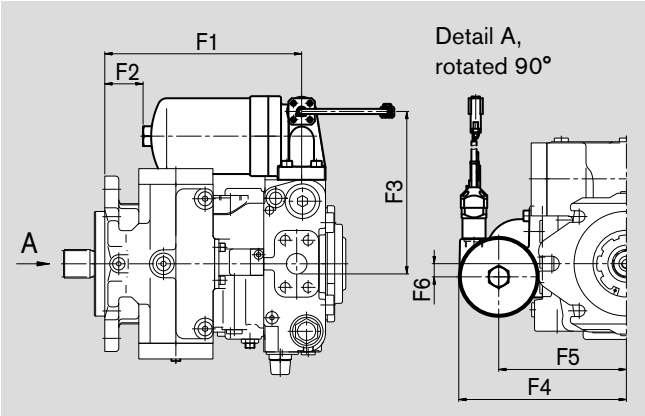
Variation F



Variation P: viewing window



Variation B: electr. signal with DEUTSCH connector



Size	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 Indicator

Electric swivel angle sensor, R

For swivel angle indicator, the pump swivel position is measured by an electric swivel angle sensor. The sensor has a robust, sealed case and a built-in electronic specially developed for automotive applications.

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

Technical Data

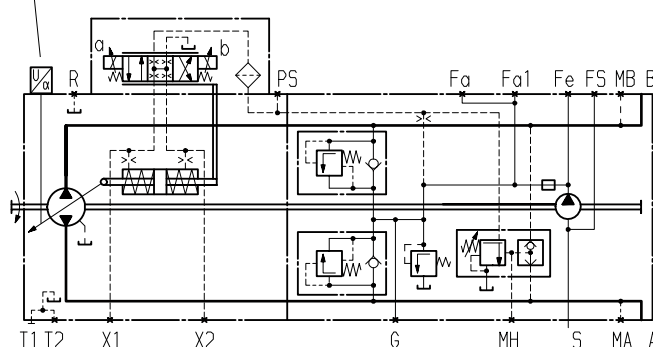
Supply voltage U_b	10...30 V DC		
Output voltage U_a	0,5 V ($V_{g \max a}$)	2,5 V ($V_{g 0}$)	4,5 V ($V_{g \max b}$)
Reserve-connect protection	Short circuit-resistant		
EMC resistance	Details on request		
Operating temperature range	-40 °C...+125 °C		
Vibration resistance sinusoidal vibration EN 60068-2-6	10g / 5...2000 Hz		
Shock resistance: continuous shock IEC 68-2-29	25g		
Salt spray resistance (DIN 50 021-SS)	96h		
Type of protection DIN/EN 60529	IP67 and IP69K		
Case material	Plastic		

Output voltage

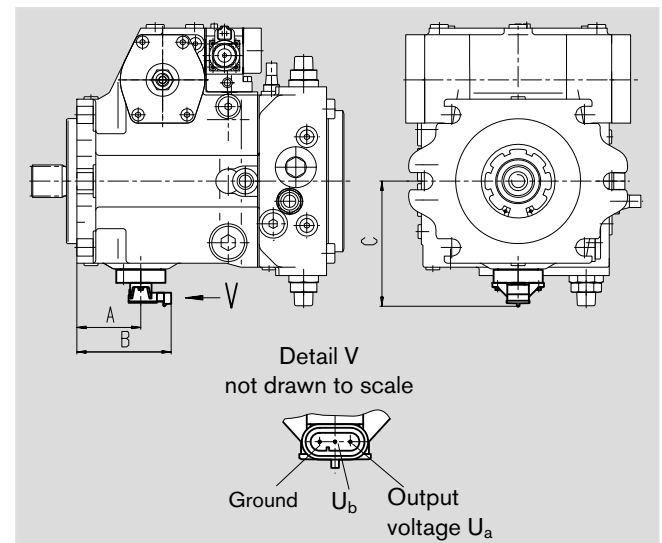
Direction of rotation	Direction of through put flow	Output voltage	
		at V_{g0}	at $V_{g \max}$
clockwise	A to B	2.5 V	4.5 V
	B to A	2.5 V	0.5 V
counter-clockwise	B to A	2.5 V	4.5 V
	A to B	2.5 V	0.5 V

Circuit diagram

Electric swivel angle sensor



Dimensions



Size	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,
Rexroth mat. no. R902602132

comprising:

	AMP no.
– 1 socket case, 3-pins	282087-1
– 3 single wire seal, yellow	281934-2
– 3 socket contact 1.8 - 3.3 mm	283025-1

The mating connector is not included in supply.
This can be supplied by Rexroth on request.

Connector for Solenoids (Only for EP, EZ, DA)

DEUTSCH DT04-2P-EP04, 2-pin

Molded, without bi-directional suppressor diode (standard) **_P**

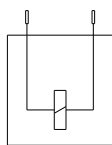
Molded, with bi-directional suppressor diode
(only for switching solenoids on control unit EZ1/2, DA) **___Q**

Type of protection according to DIN/EN 60529: IP67 and IP69K

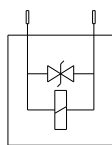
The protection circuit with a bi-directional suppressor diode is necessary for limiting overvoltages. Overvoltages are generated by disconnecting the current using switches, relay contacts or by unplugging an energized mating connector.

Circuit symbol

without bi-directional suppressor diode



with bi-directional suppressor diode



Mating connector

DEUTSCH DT06-2S-EP04

Rexroth Mat. No. R902601804

consisting of:

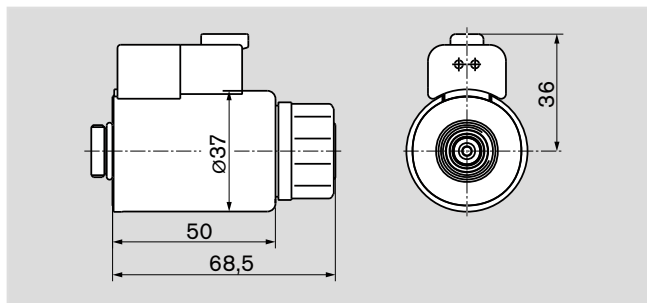
DT designation

– 1 case _____ DT06-2S-EP04

– 1 wedge _____ W2S

– 2 sockets _____ 0462-201-16141

The mating connector is not included in supply.
This can be supplied by Rexroth on request.



Note for round solenoids:

The position of the connector can be changed by turning the solenoid body.

Proceed as follows:

1. Loosen the fixing nut (1)
2. Turn the solenoid body (2) to the desired position
3. Tighten the fixing nut
Tightening torque of the fixing nut: 5^{+1} Nm
(width across flats WAF26, 12-sided DIN 3124)

Rotary Inch Valve

The rotary inch valve permits the control pressure to be reduced independent from the drive speed through the mechanical operation of the actuating lever. Maximum rotation angle 90°. The lever may be fixed in any position.

The valve is mounted separately from the pump and connected with a pump by the hydraulic control line at port P_S (max. line length approximately 2 meters).

The rotary inch valve must be ordered separately.

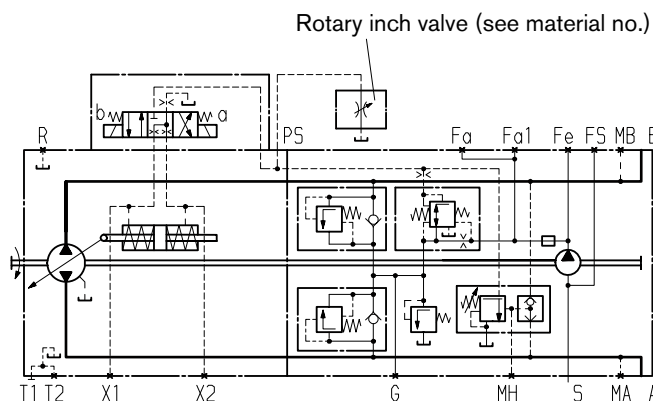
Size	Material no.	Direction of actuation of position lever
28, 40, 56, 71, 90	R902048734	clockwise
	R902048735	counterclockwise
125	R902048740	clockwise
	R902048741	counterclockwise
180, 250	R902048744	clockwise
	R902048745	counterclockwise

Attention:

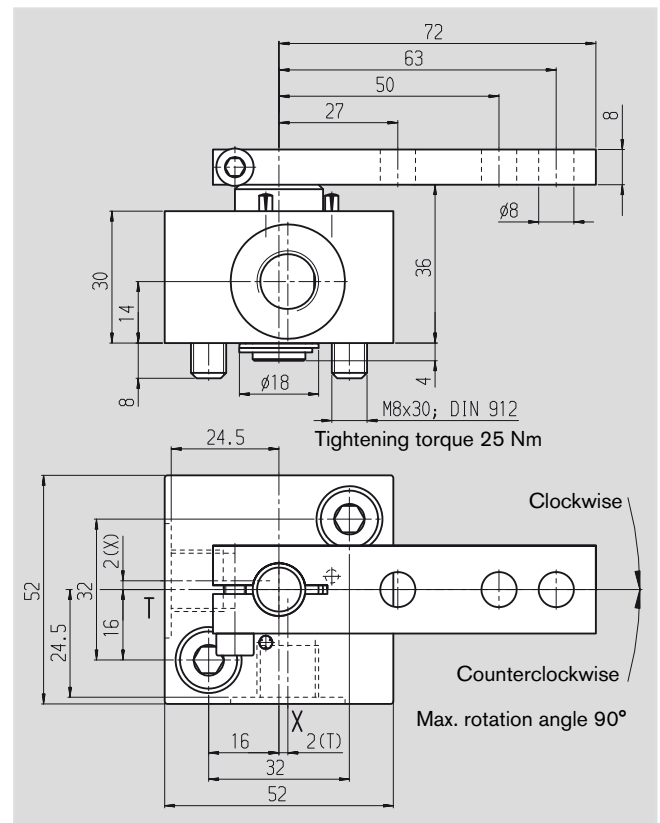
The rotary inch valve can be used independently from the control unit.

Circuit diagram:

hydraulic control, speed related, DA
with separate rotary inching valve



Unit dimensions



Ports

X pressure port
DIN 3852 M14x1.5; 12 deep 80 Nm ¹⁾

T drain tank
DIN 3852 M14x1.5; 12 deep 80 Nm ¹⁾

¹⁾ Please observe the general notes for the max. tightening torques on page 64

Installation Situation for Coupling Assembly

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

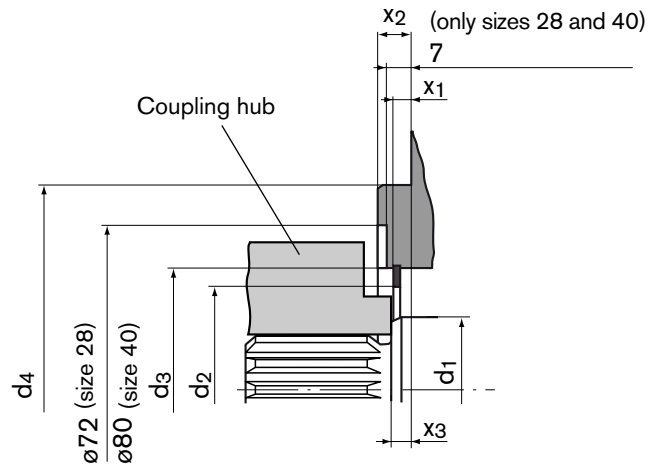
Size 28 and 40 (with free turning):

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

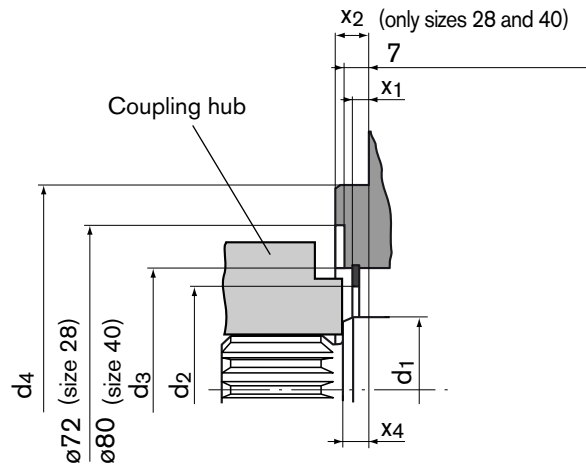
Size 56 to 250 (without free turning):

- SAE splined shaft (shaft S or T)
The outer diameter of the coupling hub must be smaller than the inner diameter of the retaining ring d_2 at the zone of the drive shaft collar (measure $x_2 - x_3$).
- DIN splined shaft (shaft Z or AT)
The outer diameter of the coupling hub must be smaller than the case diameter d_3 at the zone of the drive shaft collar (measure $x_2 - x_4$).

SAE splined shaft (spline acc. to ANSI B92.1a-1976)



DIN splined shaft (spline acc. to DIN 5480)



Size	$\varnothing d_1$	$\varnothing d_{2 \min}$	$\varnothing d_3$	$\varnothing d_4$	x_1	x_2	x_3	x_4
28	35	43.4	55 ± 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 ± 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 ± 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 ± 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 ± 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 ± 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 ± 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 Notes

General

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

The pump case drain connection (i.e. T_1/T_2) must be directed to the tank via the highest case drain port. The minimum suction pressure at port S must not fall below 0.8 bar abs. (cold start 0.5 bar absolute).

In all operating states, the suction line and case drain line must flow into the tank below the minimum fluid level.

Installation position

See examples below. Additional installation positions are available upon request.

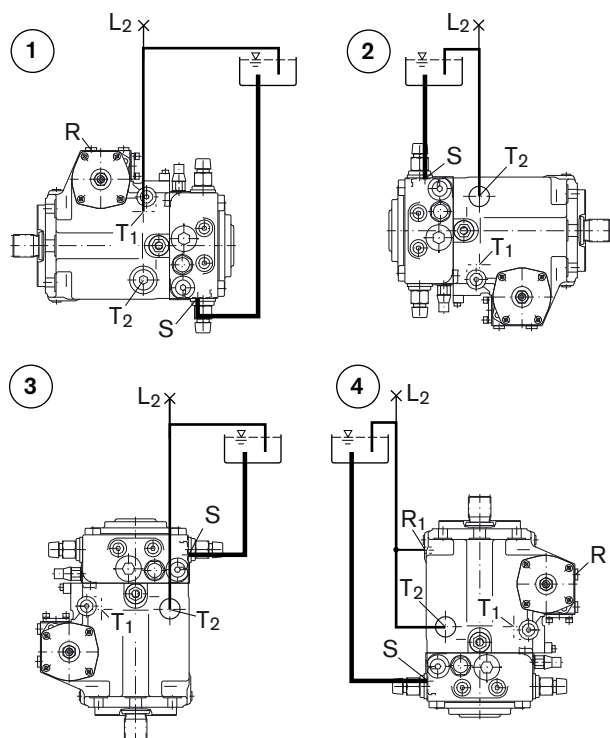
Note:

With size 71...250, installation position "shaft at top" must be specified at time of order (pump is supplied with additional vent port R_1 in flange area).

Below-tank installation (standard)

Pump below the minimum fluid level of the tank.

Recommended installation positions: 1 and 2.



Installation position	Air bleeding	Filling
1	R	S + T_1 (L_2)
2	L_2	S + T_2 (L_2)
3	L_2	S + T_2 (L_2)
4	R + L_2 (size 28 - 56) R ₁ + L_2 (size 71-250)	S + T_2 (L_2)

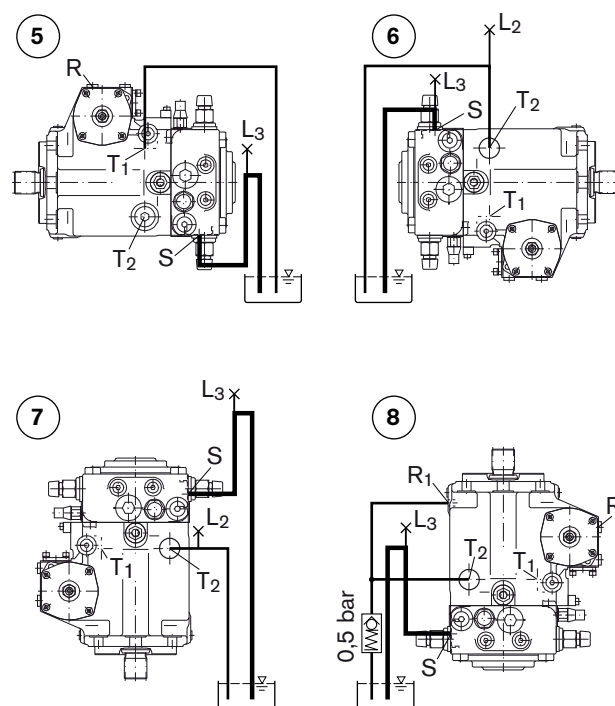
Above-tank installation

Pump above the min. fluid level of the tank

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

Recommendation for installation position 8 (shaft upwards):

A check valve in the case drain line (opening pressure 0.5 bar) can prevent draining of the case interior.



Installation position	Air bleeding	Filling
5	R	T_1 + (L_3)
6	L_2	S (L_3) + T_2 (L_2)
7	L_2 + L_3	S (L_3) + T_2 (L_2)
8	R + L_3 (size 28 - 56) R ₁ + L_3 (size 71-250)	S (L_3) + T_2

General Notes

- The A4VG pump is designed to be used in closed circuits.
- Project planning, assembly and commissioning of the pump require the involvement of qualified personnel.
- The service line ports and function ports are only designed to accommodate hydraulic lines.
- During and shortly after operation, there is a risk of burns on the pump and especially on the solenoids. Take suitable safety precautions, e.g. wear protective clothing
- There may be shifts in the characteristic depending on the operating state of the pump (operating pressure, fluid temperature).
- Tightening torques:
 - The tightening torques specified in this data sheet are maximum values and must not be exceeded (maximum values for screw thread).
Manufacturer's instruction for the max. permissible tightening torques of the used fittings must be observed!
 - For DIN 13 fixing screws, we recommend checking the tightening torque individually according to VDI 2230 Edition 2003.
- The data and information contained herein must be adhered to.