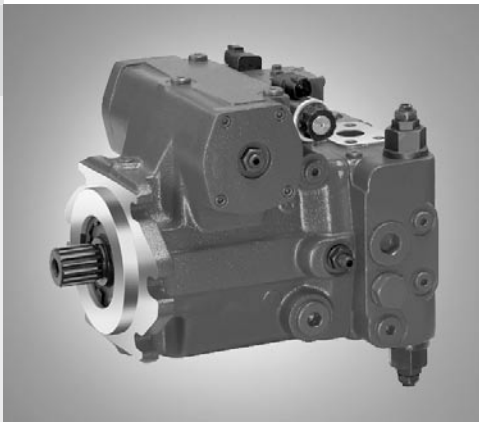
Rexroth
Bosch Group

Axial Piston Variable Pump AA4VG

RA 92 003/09.07 1/64
Replaces: 05.06

Technical data sheet



Series 32
Size 28 ... 250
Nominal pressure 5800 psi (400 bar)
Peak pressure 6500 psi (450 bar)
Closed circuit

Contents

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 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

AA4V	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 5800 psi (400 bar), peak pressure 6500 psi (450 bar)	**AA4V**

Operation mode

02	Pump in closed circuit	**G**

Size

03	≈ Displacement $V_{g\,max}$	in³/rev.	**1.71**	**2.44**	**3.42**	**4.33**	**5.49**	**7.63**	**10.98**	**15.25**
		cm³/rev.	**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	without supply filtration	▲	▲	▲	▲	▲	▲	▲	▲	**HD1**
			with supply filtration	●	●	●	●	●	●	●	●	**HD3**
		mechanical servo		●	●	●	●	●	●	●	●	**HW**
		direct operated		●	●	●	●	●	●	●	●	**DG**
		speed related (Description DA control valve in Pos. 09)	U = 12 V DC	●	●	●	●	●	●	●	●	**DA1**
			U = 24 V DC	●	●	●	●	●	●	●	●	**DA2**
	Electric control	with proportional solenoid without supply filtration	U = 12 V DC	▲	▲	▲	▲	▲	▲	▲	▲	**EP1**
			U = 24 V DC	▲	▲	▲	▲	▲	▲	▲	▲	**EP2**
		with proportional solenoid with supply filtration	U = 12 V DC	●	●	●	●	●	●	●	●	**EP3**
			U = 24 V DC	●	●	●	●	●	●	●	●	**EP4**
		with switching solenoid	U = 12 V DC	●	●	●	●	●	●	●	●	**EZ1**
			U = 24 V DC	●	●	●	●	●	●	●	●	**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 (no 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 (no code)	●	●	●	●	●	●	●	●	
	With mechanical stroke limiter, external variable	●	●	●	●	●	●	●	●	**M**

	Ports X_3, X_4 for positioning pressure	**28**	**40**	**56**	**71**	**90**	**125**	**180**	**250**	
08	Without ports X_3, X_4 (no 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. adjustable with position lever	clockwise	–	●	●	●	●	●	–	**3R**
		counter-clockwise	–	●	●	●	●	●	–	**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

AA4V	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**
		counter-clockwise	**L**

Seals

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

Shaft end (permissible input torque see page 8)

			28	40	56	71	90	125	180	250	
13	Splined shaft ANSI B92.1a–1976	for single pump	●	●	●	●	●	●	●	●	**S**
		for combination pump - 1st pump	– [1]	– [1]	●	●	– [1]	●	●	●	**T**
		only for combination pump - 2nd pump	–	●	–	–	●	–	–	–	**U**

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)

				28	40...180	250	
15	SAE flange ports A/B top and bottom		suction port S bottom	–	●	–	**52**
			suction port S at top	–	❍	–	**53**
	SAE flange ports A/B same side	right	suction port S bottom	●	–	●	**60**
		left	suction port S at top	❍	–	❍	**63**

Boost pump

			28	40	56	71	90	125	180	250	
16	Without integrated boost pump	without through drive	●	●	●	●	●	●	●	●	**N00**
		with through drive	●	●	●	●	●	●	●	●	**K..**
	With integrated boost pump	without through drive	●	●	●	●	●	●	●	●	**F00**
		with through drive	●	●	●	●	●	●	●	●	**F..**

Through drive (mounting options, see page 53)

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

Ordering Code / Standard Program

AA4V	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

	Valves	setting range		**28**	**40**	**56**	**71**	**90**	**125**	**180**	**250**	
18	With high-pressure relief valve, pilot operated	1450...6100 psi [4]	with bypass	–	–	–	●	●	●	●	●	**1**
	With high-pressure relief valve, direct operated (fixed setting)	3900...6100 psi (270...420 bar)	without bypass	●	●	●	–	–	–	–	–	**3**
			with bypass	●	●	●	–	–	–	–	–	**5**
		1450...3600 psi (100...250 bar)	without bypass	●	●	●	–	–	–	–	–	**4**
			with bypass	●	●	●	–	–	–	–	–	**6**

	Filtration		**28**	**40**	**56**	**71**	**90**	**125**	**180**	**250**	
19	Filtration in the suction line of boost pump (filter not included in supply)		●	●	●	●	●	●	●	●	**S**
	Filtration in pressure line of boost pump ports for external boost circuit filtration, (F_e and F_a)		●	●	●	●	●	●	●	●	**D**
		and cold start valve	–	●	●	●	●	●	●	–	**K**
	Filter mounted with cold start valve but without contamination indicator		–	●	●	●	●	●	●	–	**F**
	Filter mounted with cold start valve and contamination indicator through:	window	–	●	●	●	●	●	●	–	**P**
		electr. signal - DEUTSCH connector	–	●	●	●	●	●	●	–	**B**
	External supply (version without integral boost pump - N00, K..)		●	●	●	●	●	●	●	●	**E**

	Swivel angle indicator	**28**	**40**	**56**	**71**	**90**	**125**	**180**	**250**	
20	Without swivel angle indicator (no code)	●	●	●	●	●	●	●	●	
	Electrical swivel angle sensor	●	●	●	●	●	●	●	●	**R**

	Connector for solenoids (only for EP, EZ, DA)		**28**	**40**	**56**	**71**	**90**	**125**	**180**	**250**	
21	DEUTSCH connector molded, 2-pin	without suppressor diode	●	●	●	●	●	●	●	●	**P**
		with suppressor diode (only for EZ and DA)	❍	❍	❍	❍	❍	❍	❍	❍	**Q**
	HIRSCHMANN connector	without suppressor diode	▲	▲	▲	▲	▲	▲	▲	▲	**H**

	Standard / special version		
22	Standard version	no 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 **S**
[2]) 2 = 2-bolt; 4 = 4-bolt
[3]) Hub for splined shaft acc. to ANSI B92.1a-1976 (splined shaft assignment acc. to SAE J744, see page 50-52)
[4]) (100...420 bar)

● = available ❍ = on request ▲ = not for new projects – = not available

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 AA4VG 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

ν_{opt} = opt. operating viscosity 80...170 SUS (16...36 mm²/s)

depending on the circuit temperature (closed circuit).

Limits of viscosity range

The limiting values for viscosity are as follows:

ν_{min} = 42 SUS (5 mm²/s)
short term (t < 3 min)
at max. perm. temperature of t_{max} = +240 °F (+115 °C)

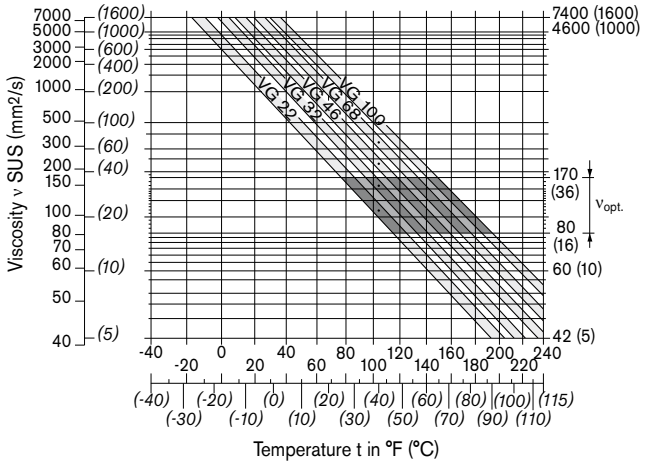
ν_{max} = 7400 SUS (1600 mm²/s)
short term (t < 3 min)
at cold start (p ≤ 435 psi / 30 bar, n ≤ 1000 rpm, t_{min} = -40 °F / -40 °C).
Only for starting up without load. Optimum operating viscosity must be reached within approx. 15 minutes.

Note that the maximum hydraulic fluid temperature of 240 °F (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 9 °F (5 K) higher than the average case drain temperature.

Special measures are necessary in the temperature range from -40 °F to -13 °F (-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 (ν_{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 °F (X °C) an operating temperature of 140 °F (60 °C) is set in the circuit. In the optimum operating viscosity range (ν_{opt}; shaded area) this corresponds to the viscosity classes VG 46 or VG 68; to be selected: VG 68.

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 240 °F (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 AA4VG, 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 (195 °F to max. 240 °F / 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} _____ 290 psi (20 bar)

For control DA, DG
boost pressure (at n = 2000 rpm) p_{Sp} _____ 365 psi (25 bar)

Boost pump:
suction pressure $p_{\sigma\,\mu\nu}$ ($\nu \leq 30$ mm²/s) __ ≥ 12 psi a (0.8 bar abs.)
at cold starts, short term (t < 3 min) ____ ≥ 7.5 psi a (0.5 bar abs.)

Output

Variable pump:
pressure at port A or B
(pressure data according to DIN 24312)

Nominal pressure p_N _____ 5800 psi (400 bar)
Peak pressure p_{max} _____ 6500 psi (450 bar)
Max. pressure stroke for p_N and p_{max}_____ 4500 psi (310 bar)

Boost pump:
peak pressure $p_{Sp\,max}$ _____ 580 psi (40 bar)

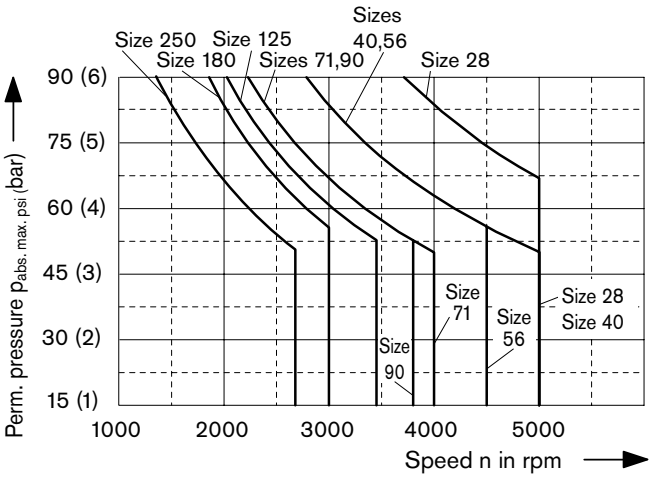
Nominal pressure:	Max. design pressure at which fatigue strength is ensured.
Peak pressure:	Max. operating pressure which is permissible for short term (t<1s).
Max. pressure stroke:	Largest difference between two successive pressure values within the pressure curve.

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 45 psi (3 bar) absolute not be exceeded (max. permissible case drain pressure 90 psi (6 bar) absolute at reduced speed, see diagram). Short term (t < 0.1 s) pressure spikes of up to 145 psi (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 -13 °F to +240 °F (-25 °C to +115 °C).

Note:
For application cases below -13 °F (-25 °C), an NBR shaft seal ring is necessary (permissible temperature range: -40 °F to +195 °F / -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		$V_{g\ max}$	in³	1.71	2.44	3.42	4.33	5.49	7.63	10.98	15.25
variable pump			cm³	28	40	56	71	90	125	180	250
boost pump (at p = 290 psi / 20 bar)		$V_{g\ Sp}$	in³	0.37	0.52	0.71	1.20	1.20	1.73	2.43	3.20
			cm³	6.1	8.6	11.6	19.6	19.6	28.3	39.8	52.5
Speed											
maximum at $V_{g\ max}$		$n_{max\ continuous}$	rpm	4250	4000	3600	3300	3050	2850	2500	2400
limited maximum [1]		$n_{max\ limited}$	rpm	4500	4200	3900	3600	3300	3250	2900	2600
intermittent maximum [2]		$n_{max\ interm.}$	rpm	5000	5000	4500	4100	3800	3450	3000	2700
minimum		n_{min}	rpm	500	500	500	500	500	500	500	500
Flow		$q_{v\ max}$	gpm	31.5	42.3	53.4	61.8	72.5	94.1	118.8	158.4
at $n_{max\ continuous}$ and $V_{g\ max}$			l/min	119	160	202	234	275	356	450	600
Power [3]	Δp = 5800 psi	P_{max}	hp	106	144	180	209	245	318	402	536
at $n_{max\ continuous}$ and $V_{g\ max}$	Δp = 400 bar		kW	79	107	134	156	183	237	300	400
Torque [3]	Δp = 5800 psi	T_{max}	lb-ft	131	187	263	333	422	587	844	1173
at $V_{g\ max}$	Δp = 400 bar		Nm	178	255	356	451	572	795	1144	1590
	Δp = 1450 psi	T	lb-ft	22.7	32.4	45.4	57.4	72.8	101.2	145.6	202.2
	Δp = 100 bar		Nm	44.5	63.5	89	112.8	143	198.8	286	398
Rotary stiffness	shaft end S	c	lb-ft/rad	23159	50892	59595	72871	116609	161010	180334	261466
			Nm/rad	31400	69000	80800	98800	158100	218300	244500	354500
	shaft end T	c	lb-ft/rad	–	–	70068	89171	–	185939	234840	394079
			Nm/rad	–	–	95000	120900	–	252100	318400	534300
	shaft end U	c	lb-ft/rad	–	37468	–	–	79362	–	–	–
			Nm/rad	–	50800	–	–	107600	–	–	–
Moment of inertia for rotary group		J_{GR}	lbs-ft²	0.0522	0.0902	0.1566	0.2302	0.3536	0.5505	1.0536	2.3327
			kgm²	0.0022	0.0038	0.0066	0.0097	0.0149	0.0232	0.0444	0.0983
Angular acceleration max. [4]		α	rad/s²	38000	30000	24000	21000	18000	14000	11000	6700
Filling capacity		V	gal	0.24	0.29	0.40	0.34	0.40	0.55	0.82	1.66
			L	0.9	1.1	1.5	1.3	1.5	2.1	3.1	6.3
Weight approx. (without through drive)		m	lbs	64	68	64	110	145	176	223	344
			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: Δp = 70...150 bar and $V_{g\ max}$
- at reversing peaks: Δp < 300 bar and t < 0.1 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 $q_v = \frac{V_g \cdot n \cdot \eta_v}{231}$ gpm $\left(\frac{V_g \cdot n \cdot \eta_v}{1000} \text{ l/min} \right)$

Torque $T = \frac{V_g \cdot \Delta p}{24 \cdot \pi \cdot \eta_{mh}}$ lb-ft $\left(\frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}} \text{ Nm} \right)$

Power $P = \frac{2 \pi \cdot T \cdot n}{33000} = \frac{q_v \cdot \Delta p}{1714 \cdot \eta_t}$ HP $\left(\frac{q_v \cdot \Delta p}{600 \cdot \eta_t} = \frac{2 \pi \cdot T \cdot n}{60000} \text{ kW} \right)$

V_g = displacement volume per revolution in in³ (cm³)

Δp = differential pressure in psi (bar)

n = speed in rpm

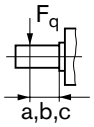
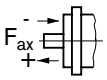
η_v = volumetric efficiency

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)	$F_{q\,max}$	lbf	562	809	1124	1416	1798	2473	3597	4946
		N	2500	3600	5000	6300	8000	11000	16000	22000
	a	in	0.69	0.69	0.69	0.79	0.79	0.89	0.98	1.14
		mm	17.5	17.5	17.5	20	20	22.5	25	29
	$F_{q\,max}$	lbf	450	650	910	1113	1424	1932	2782	3779
		N	2000	2891	4046	4950	6334	8594	12375	16809
	b	in	1.18	1.18	1.18	1.38	1.38	1.57	1.77	1.97
		mm	30	30	30	35	35	40	45	50
	$F_{q\,max}$	lbf	382	543	764	917	1178	1585	2282	3057
		N	1700	2416	3398	4077	5242	7051	10150	13600
	c	in	1.67	1.67	1.67	1.97	1.97	2.26	2.36	2.80
		mm	42.5	42.5	42.5	50	50	57.5	60	71
Axial force, max.	$-F_{ax\,max}$	lbf	350	476	654	953	973	1291	1585	933
		N	1557	2120	2910	4242	4330	5743	7053	4150
	$+F_{ax\,max}$	lbf	94	198	335	620	600	867	1112	933
		N	417	880	1490	2758	2670	3857	4947	4150

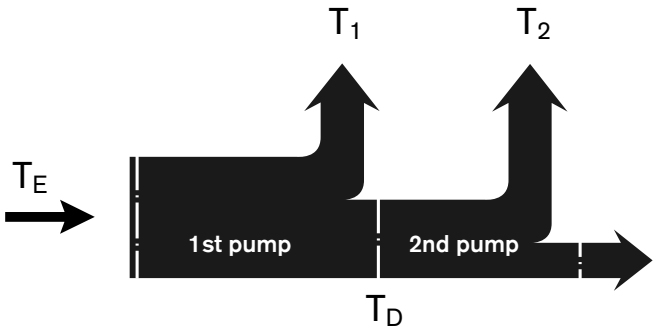
Note: special requirements apply in the case of belt drives. Please contact us.

Permissible input and through-drive torques

Size			28	40	56	71	90	125	180	250
Torque (at $V_{g\,max}$ and $\Delta p = 5800$ psi) [1]	T_{max}	lb-ft	131	187	263	333	422	587	844	1173
(at $V_{g\,max}$ and $\Delta p = 400$ bar) [1]		Nm	178	254	356	451	572	795	1144	1590
Input torque, max. [2]										
at shaft end S	$T_{E\,perm.}$	lb-ft	232	444	444	444	1210	1210	1210	1210
		Nm	314	602	602	602	1640	1640	1640	1640
ANSI B92.1a-1976 (SAE J744)			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	$T_{E\,perm.}$	lb-ft	–	–	715	715	–	1969	3002	3002
		Nm	–	–	970	970	–	2670	4070	4070
ANSI B92.1a-1976 (SAE J744)					1 3/8 in	1 3/8 in		2 in	2 1/4 in	2 1/4 in
at shaft end U [3]	$T_{E\,perm.}$	lb-ft	–	232	–	–	444	–	–	–
		Nm	–	314	–	–	602	–	–	–
ANSI B92.1a-1976 (SAE J744)				1 in			1 1/4 in			
Through-drive torque, max. [4]	$T_{D\,perm.}$	lb-ft	170	232	384	487	606	819	1298	1645
		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_{HD}
Setting range for valve **3, 5** Δp 3900 - 6100 psi (Δp 270 - 420 bar) (refer to ordering code)	6100 psi (420 bar)
	5800 psi (400 bar) [1]
	5200 psi (360 bar)
	4950 psi (340 bar)
	4650 psi (320 bar)
	4350 psi (300 bar)
	3900 psi (270 bar)
Setting range for valve **4, 6** Δp 1450 - 3600 psi (Δp 100 - 250 bar) (refer to ordering code)	3600 psi (250 bar)
	3350 psi (230 bar) [1]
	2900 psi (200 bar)
	2200 psi (150 bar)
	1450 psi (100 bar)

High-pressure relief valve, pilot operated (size 71...250)	Differential pressure setting Δp_{HD}
Setting range for valve **1** Δp 1450 - 6100 psi (Δp 100 - 420 bar) (refer to ordering code)	6100 psi (420 bar)
	5800 psi (400 bar) [1]
	5200 psi (360 bar)
	4950 psi (340 bar)
	4650 psi (320 bar)
	4350 psi (300 bar)
	3900 psi (270 bar)
	3600 psi (250 bar)
	3350 psi (230 bar)
	2900 psi (200 bar)
	2200 psi (150 bar)
	1450 psi (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_{HD} values shown in the table are possible)

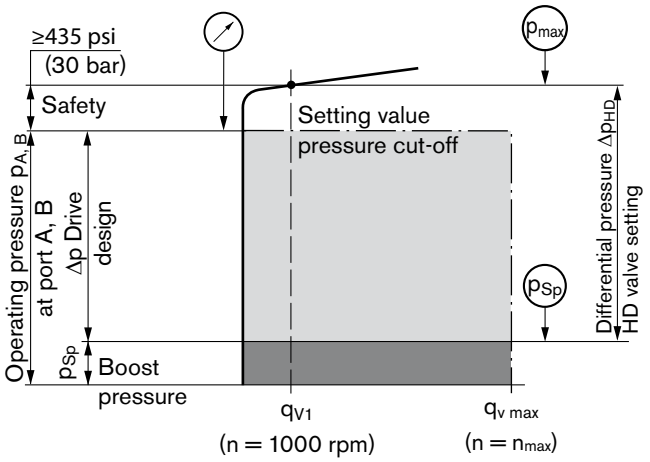
High-pressure relief valve A

Differential pressure setting : Δp_{HD} = ... psi (bar)
opening pressure of the HD valve (at $q_{V\,1}$): p_{max} = ... psi (bar)
($p_{max} = \Delta p_{HD} + p_{Sp}$)

High-pressure relief valve B

Differential pressure setting : Δp_{HD} = ... psi (bar)
opening pressure of the HD valve (at $q_{V\,1}$): p_{max} = ... psi (bar)
($p_{max} = \Delta p_{HD} + p_{Sp}$)

Setting diagram



Note: valve is set at
n = 1000 rpm and $V_{g\,max}$ ($q_{v\,1}$)

Example: boost pressure 435 psi (30 bar);
operating pressure 5800 psi (400 bar)

Operating pres. $p_{A,B}$	-	boost pres. p_{Sp}	+ safety	=	differential pres. Δp_{HD}
5800 psi	-	435 psi	+ 435 psi	=	**5800 psi**
(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 $V_{g\ min}$.

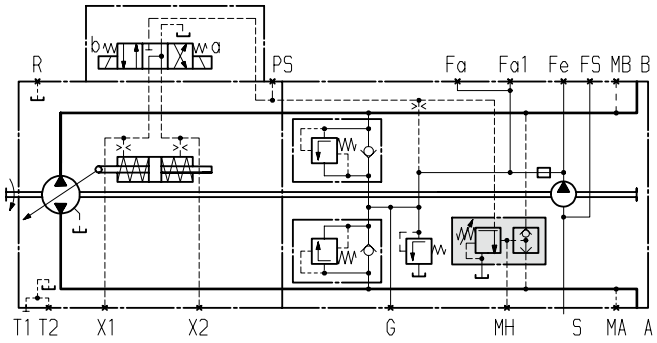
This valve prevents the operation of the high-pressure relief valves when accelerating or decelerating.

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 435 psi (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.

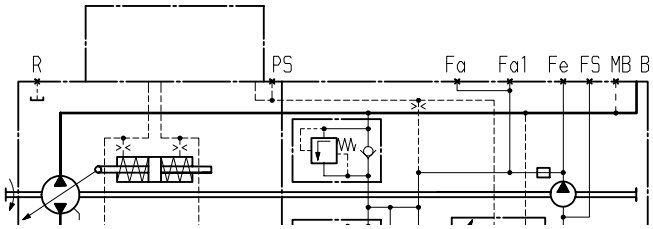
Circuit diagram with pressure cut-off.
Example: Electric two-point control, EZ1D/EZ2D



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 pilot pressure applied directly to the stroking piston through either the X_1 or X_2 port.

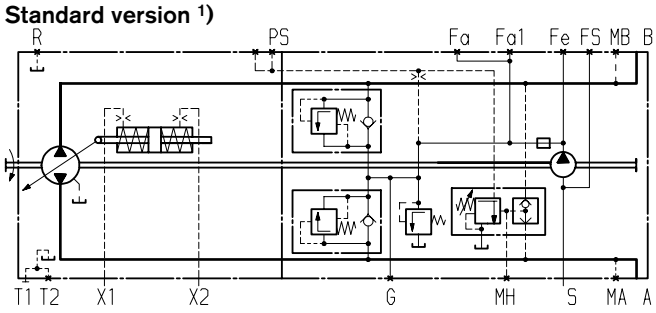
Flow direction is determined by which pilot port is pressurized (please refer to the data table at the top of page 12; control pressure column- X_1; X_2).

Pump displacement is infinitely variable and proportional to the applied pilot pressure, but is also influenced by system pressure and pump drive speed.

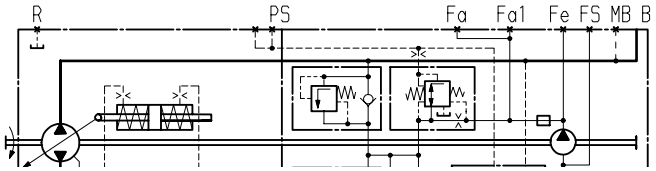
The P_s port must be used as the pilot pressure source for the selected control device, to enable the function of the built-in pressure cut-off valve. Please refer to page 10 for a description of the pressure cut-off function.

Application of the DG Control requires a review of the engine and vehicle parameters to ensure that the pump is set up correctly. All DG applications must be reviewed by a Rexroth Application Engineer.

Standard version [1)]



Version with DA control valve [1)]



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

EZ - Electric Two-Point Control, With Switching Solenoid

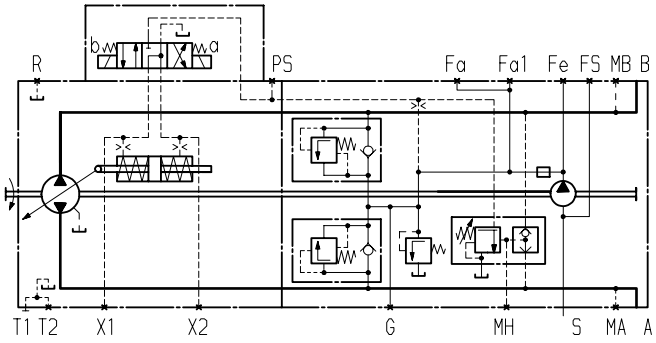
By energizing or de-energizing a control current to either switching solenoid a or b, the stroke cylinders of the pump are supplied with control pressure by the EZ control unit. In this way, the swashplate and thus the displacement is switchable without intermediate settings from $V_g = 0$ to $V_{g\,max}$.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

Solenoid technical data	EZ1	EZ2
Voltage	12 V DC (±20 %)	24 V DC (±20 %)
Neutral position $V_g = 0$	de-energized	de-energized
Position $V_{g\,max}$	current energized	current energized
Nominal resistance (at 68°F /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

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

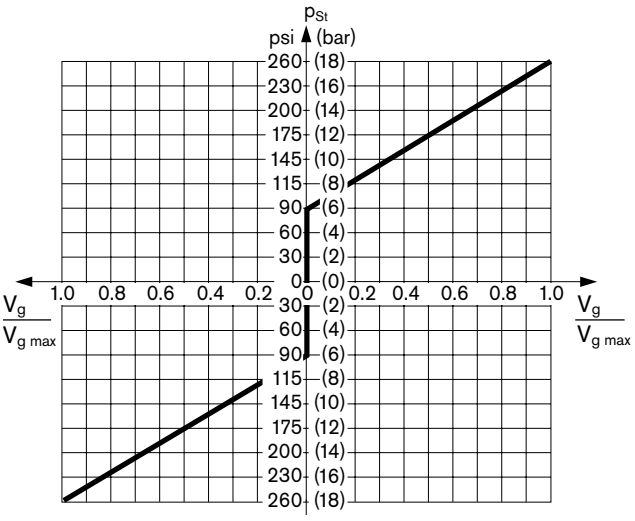
The pilot signal, which originates from an external, remote source, is pressure only. Flow is negligible as the pilot signal is only acting on the spool of the control valve.

This spool then directs control oil into and out of the stroking cylinder to adjust pump displacement as required.

A feedback lever, connected to the stroking piston, maintains the pump flow for any given pilot signal.

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

HD3: with supply filtration (standard)
HD1: without supply filtration (not permissible for new projects!)



V_g displacement at p_{St}
$V_{g\,max}$ displacement at p_{St} = 260 psi (18 bar)

Pilot pressure p_{St} = 90 - 260 psi (6 - 18 bar) at ports Y_1, Y_2

Start of control 90 psi (6 bar)

End of control 260 psi (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

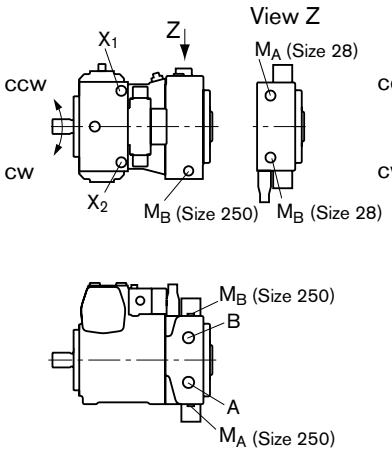
Through contamination in the control unit – e.g. in hydraulic fluid, wear particles, or particles out of a system –the valve spool can get stuck in an undefined position. In this case, the pump flow does not follow the command inputs of the machine operator anymore .

- 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 (< 195 °F / 90 °C) or 19/17/14 (> 195 °F / 90 °C) to ISO 4406.

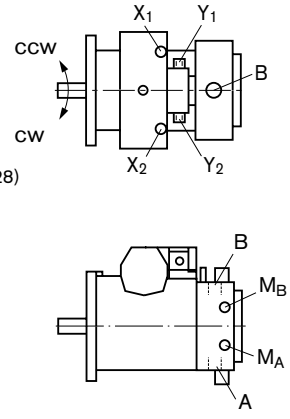
Assignment
Direction of rotation - Control - Direction of through put flow

Direction of rotation	Size	Pilot pressure	Control pressure	Through put flow	Operating pressure
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
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

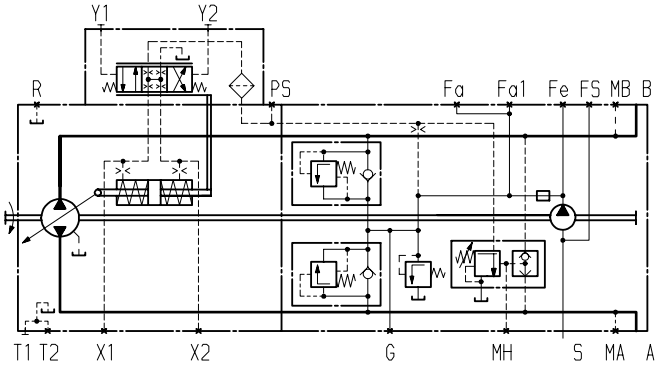
Sizes 28, 250



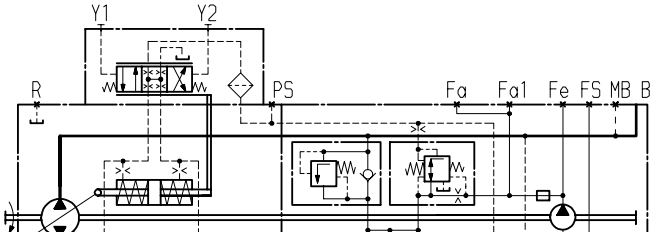
Sizes 40...180



Standard version HD3 [1)]



Version HD3 with DA control valve [1)]



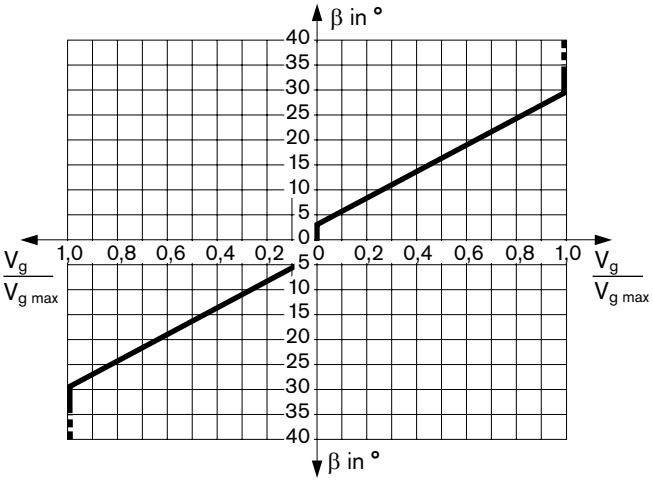
[1)] Size 28 and 250 without port F_{a1} and F_S

HW - Hydraulic Control, Mechanical Servo

The flow output of the pump is infinitely varied in the range of 0 to 100%, proportional to the rotation of the control lever between 0° and ±29° from the spring centered zero flow position.

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

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



Swivel angle β at the control lever for deflection:

Start of control at β = 3°

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

Mech. stop: sizes 28...71 _____ ±40°
sizes 90...250_____ ±35°

The maximum required torque at the lever is 15 lb-in (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.

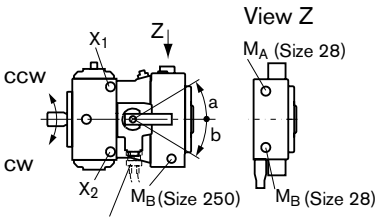
The neutral position switch provides a safety function for drive units that require zero flow under certain operating conditions (e.g. starting diesel engines).

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)

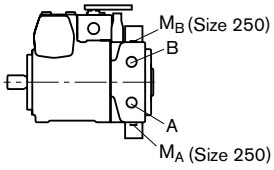
Assignment
Direction of rotation - Control - Direction of through put flow

Direction of rotation		Size	Lever direction	Control pressure	Through put flow	Operating pressure
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
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

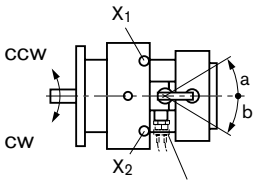
Sizes 28, 250



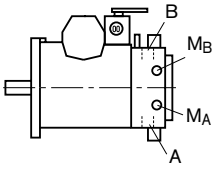
Neutral position switch



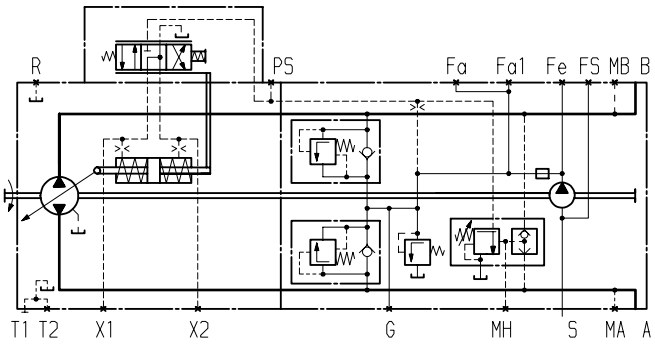
Sizes 40...180



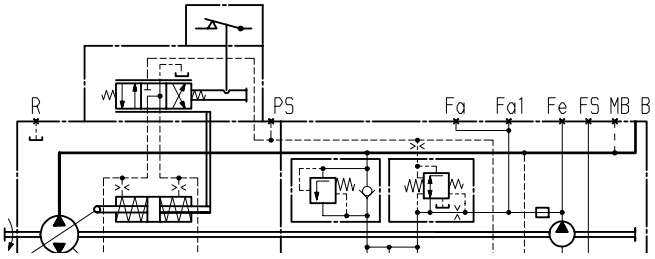
Neutral position switch



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

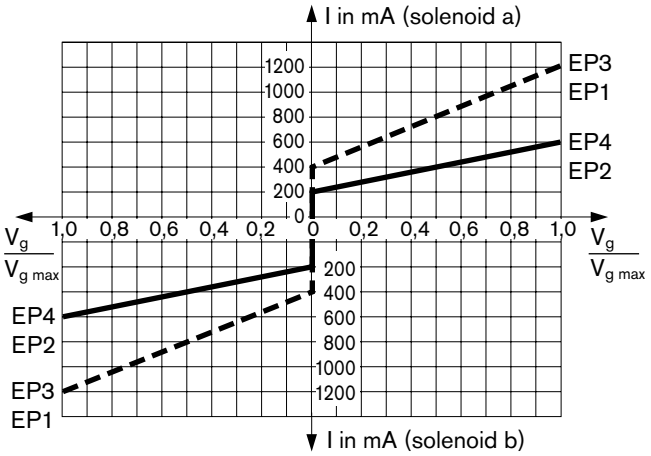
EP - Electric Control, With Proportional Solenoid

The flow output of the pump is infinitely varied in the range of 0 to 100%, proportional to an electrical current, supplied to solenoid a or b.

The electrical energy is converted to a force acting on the control spool. The spool then directs control oil in and out of the stroking piston to stroke the pump as required. A feedback lever, connected to the stroking piston, maintains the pump flow for any given current within the control range.

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

EP3/4: with supply filtration (standard)
EP1/2: without supply filtration (not permissible for new projects!)



Solenoid technical data	EP3/EP1	EP4/EP2
Voltage	12 V DC (±20 %)	24 V DC (±20 %)
Control current		
Start of control at $V_{g\,0}$	400 mA	200 mA
End of control at $V_{g\,max}$	1200 mA	600 mA
Limiting current	1.54 A	0.77 A
Nominal resistance (at 68 °F / 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

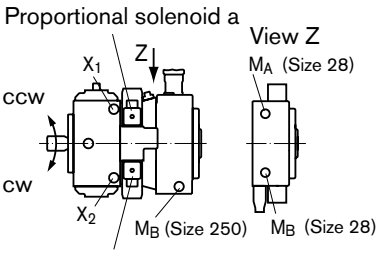
Through contamination in the control unit – e.g. in hydraulic fluid, wear particles, or particles out of a system –the valve spool can get stuck in an undefined position. In this case, the pump flow does not follow the command inputs of the machine operator anymore .

– 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 (< 195 °F / 90 °C) or 19/17/14 (> 195 °F / 90 °C) to ISO 4406.

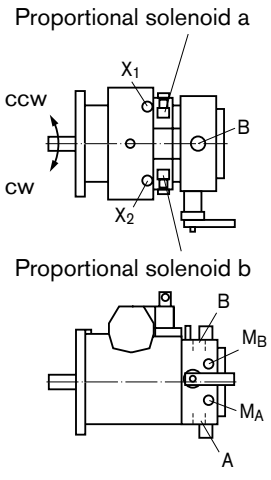
Assignment
Direction of rotation - Control - Direction of through put flow

Direction of rotation		Size	Actuation of solenoid	Control pressure	Through put flow	Operating pressure
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
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



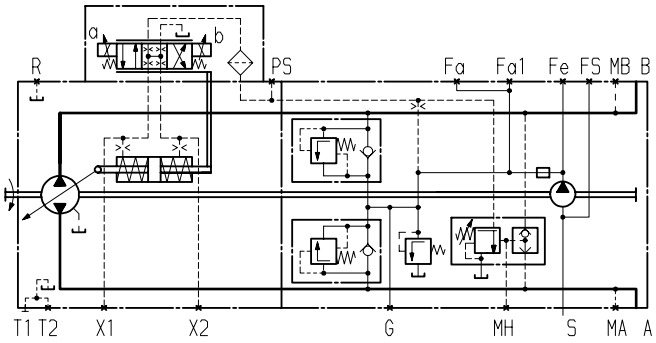
Sizes 40...180



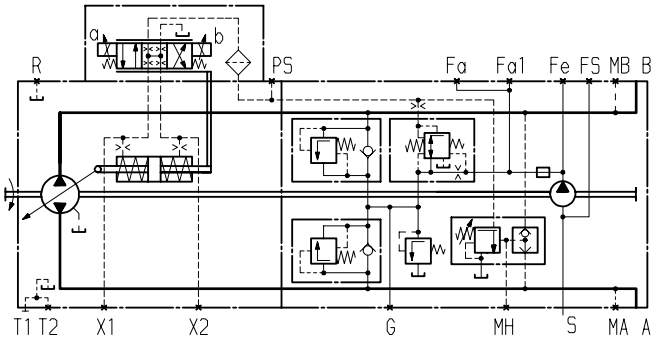
Standard: proportional solenoid without manual emergency operation.
On request: manual emergency operation with spring reset available.

EP - Electric Control, With Proportional Solenoid

Standard version EP3 [1)]



Version EP3 with DA control valve [1)]



[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 achived 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.

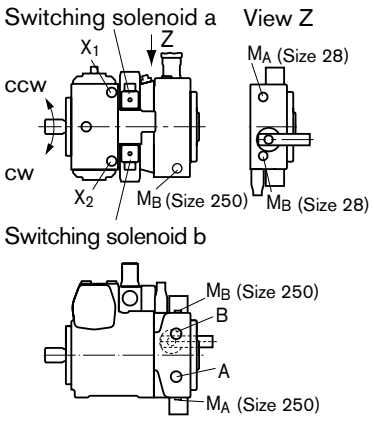
Solenoid technical data	DA1	DA2
Voltage	12 V DC (±20 %)	24 V DC (±20 %)
Neutral position $V_{g\,0}$	de-energized	de-energized
Position $V_{g\,max}$	current energized	current energized
Nominal resistance (at 68 °F / 20 °C)	5.5 Ω	21.7 Ω
Nominal power	26.2 W	26.5 W
Current required, minimum effective	1.32 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.

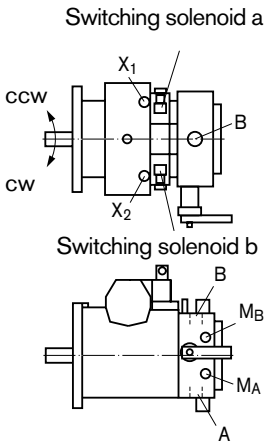
Assignment
Direction of rotation - Control - Direction of through put flow

Direction of rotation		Size	Actuation of solenoid	Control pressure	Through put flow	Operating pressure
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
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

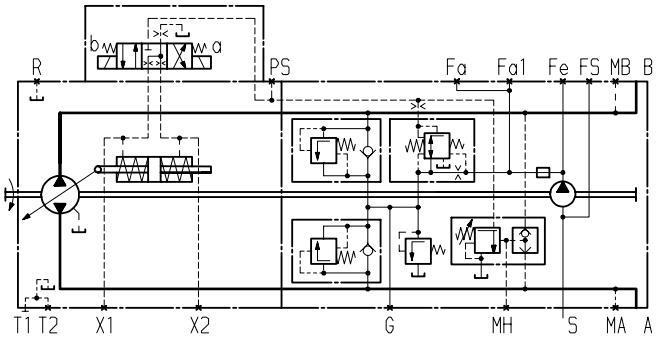
Sizes 28, 250



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 calves

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 $T_{max} = 3$ lb-ft (4 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.

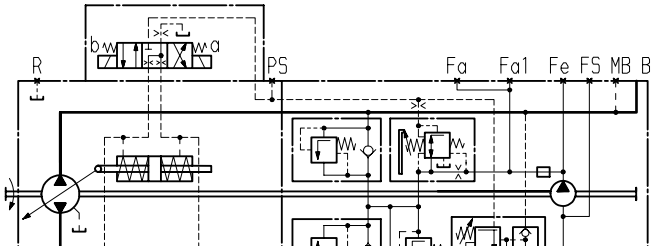
Detailed information is available from our sales department and on our website www.boschrexroth.com/da-control. Use our computer program to work out the input design that meets your needs. A DA control must be approved by Rexroth.

Note: see page 61 for rotary inch valves.

Circuit diagrams [1]:

DA1D3/DA2D3

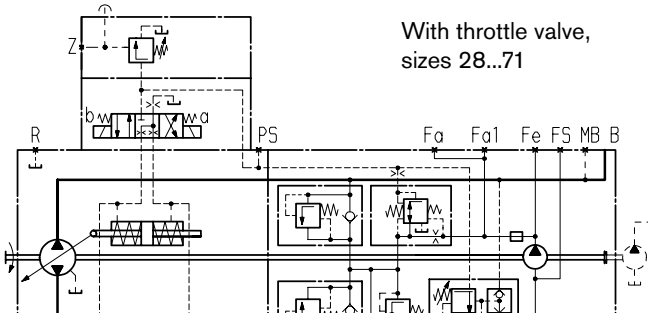
Hydraulic control, speed related, DA control valve, mech. adjustable with position lever



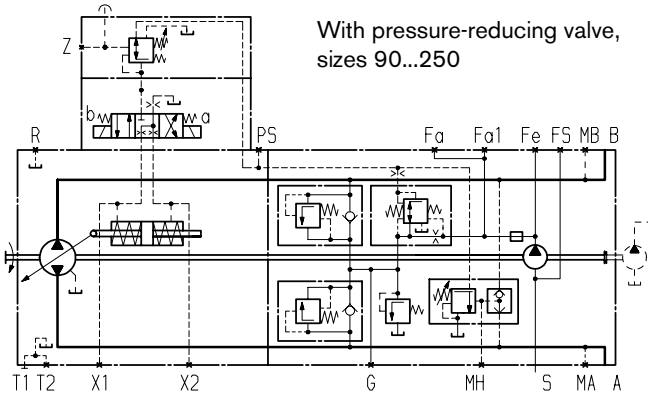
DA1D4/DA2D4

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

With throttle valve, sizes 28...71

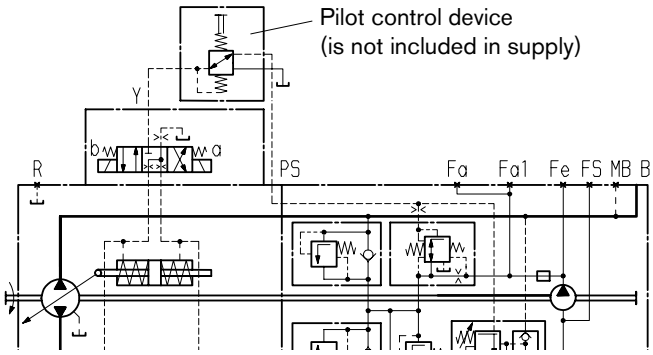


With pressure-reducing valve, sizes 90...250



DA1D7/DA2D7

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



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

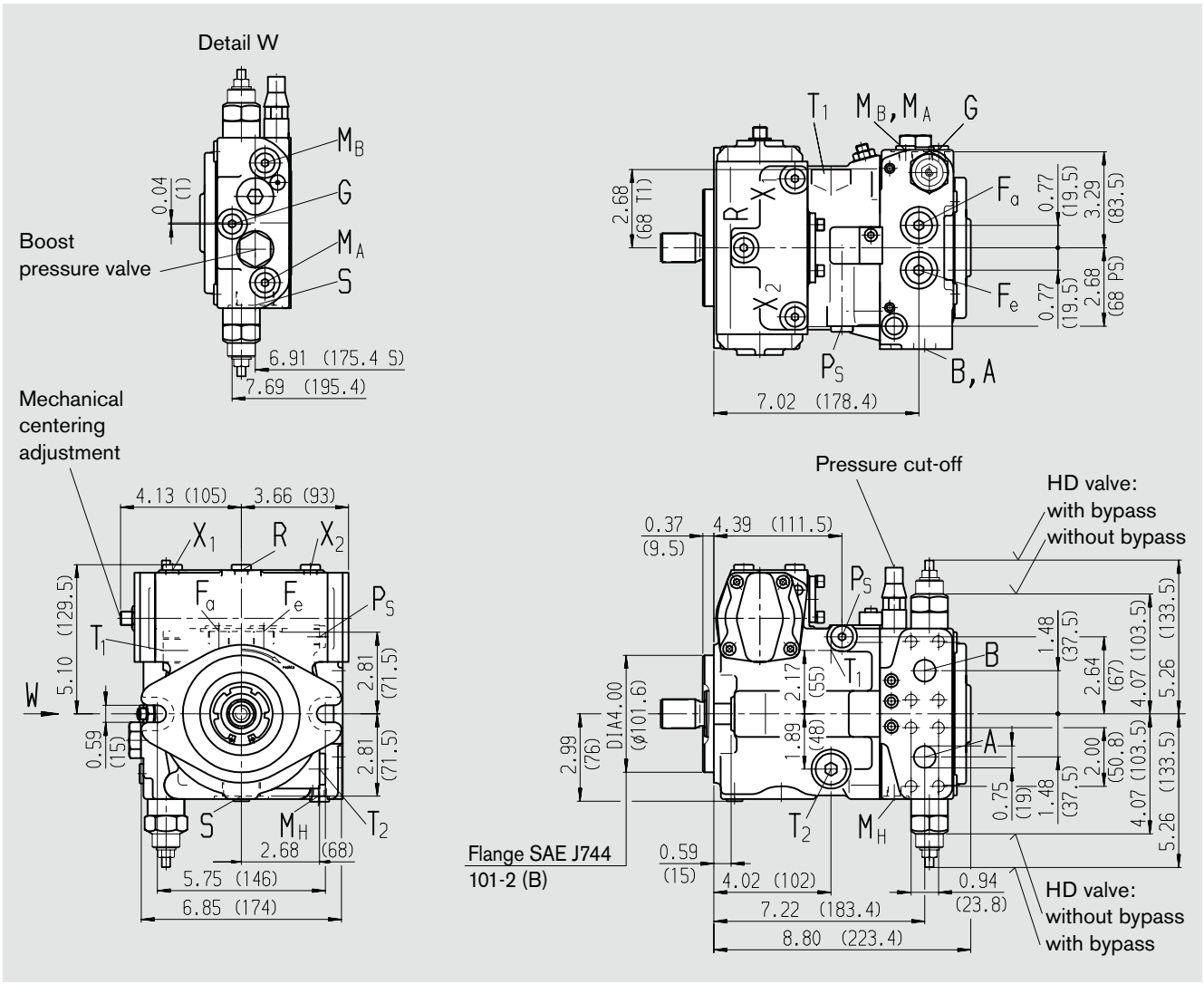
Unit Dimensions, Size 28

Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Version without control unit NV

Standard: suction port S at bottom (60)

Option: suction port S at top (63): port plate turned through 180°

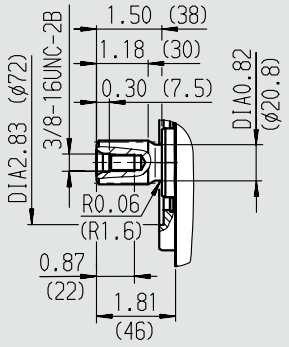


Unit Dimensions, Size 28

Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Shaft ends

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



Ports

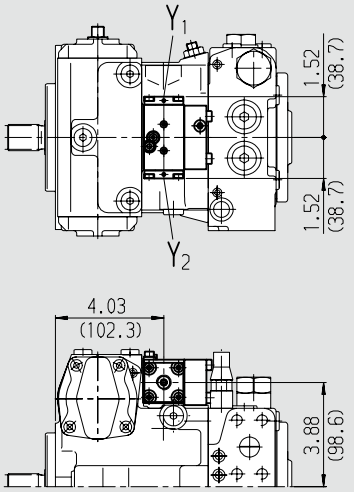
A, B	service line ports (high-pressure series)	SAE J518	3/4 in		
	fixing thread A/B	ISO 68	3/8 in -16 UNC-2B;	0.67 (17) deep [2])	
T_1	case drain or fill	ISO 11926	7/8 in -14 UNF-2B;	0.67 (17) deep	180 lb-ft (240 Nm) [2])
T_2	case drain [3])	ISO 11926	7/8 in -14 UNF-2B;	0.67 (17) deep	180 lb-ft (240 Nm) [2])
M_A, M_B	pressure gauge - operating pressure A, B [3])	ISO 11926	7/16 in -20 UNF-2B;	0.47 (12) deep	30 lb-ft (40 Nm) [2])
R	air bleed [3])	ISO 11926	7/16 in -20 UNF-2B;	0.47 (12) deep	30 lb-ft (40 Nm) [2])
S	boost suction port	ISO 11926	1 5/16 in -12 UN-2B;	0.79 (20) deep	400 lb-ft (540 Nm) [2])
X_1, X_2	port for control pressures (before orifice) [3])	ISO 11926	7/16 in -20 UNF-2B;	0.47 (12) deep	30 lb-ft (40 Nm) [2])
G	pressure port for auxiliary circuits [3])	ISO 11926	7/16 in -20 UNF-2B;	0.47 (12) deep	30 lb-ft (40 Nm) [2])
P_S	control pressure supply [3])	ISO 11926	9/16 in -18 UNF-2B;	0.51 (13) deep	60 lb-ft (80 Nm) [2])
F_a	filter output [3])	ISO 11926	3/4 in -16 UNF-2B;	0.59 (15) deep	120 lb-ft (160 Nm) [2])
F_e	filter input [3])	ISO 11926	3/4 in -16 UNF-2B;	0.59 (15) deep	120 lb-ft (160 Nm) [2])
M_H	port for balanced high pressure [3])	ISO 11926	7/16 in -20 UNF-2B;	0.47 (12) deep	30 lb-ft (40 Nm) [2])
Y_1, Y_2	remote control ports (only HD)	ISO 11926	9/16 in -18 UNF-2B;	0.51 (13) deep	60 lb-ft (80 Nm) [2])
Z	pilot pressure port (only DA4/8) [3])	DIN 3852	M10x1; 0.31 (8) deep		22 lb-ft (30 Nm) [2])
Y	pilot pressure port (only DA7)	ISO 11926	9/16 in -18 UNF-2B;	0.51 (13) deep)	60 lb-ft (80 Nm) [2])

[1]) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
[2]) Please observe the general notes for the max. tightening torques on page 64
[3]) Plugged

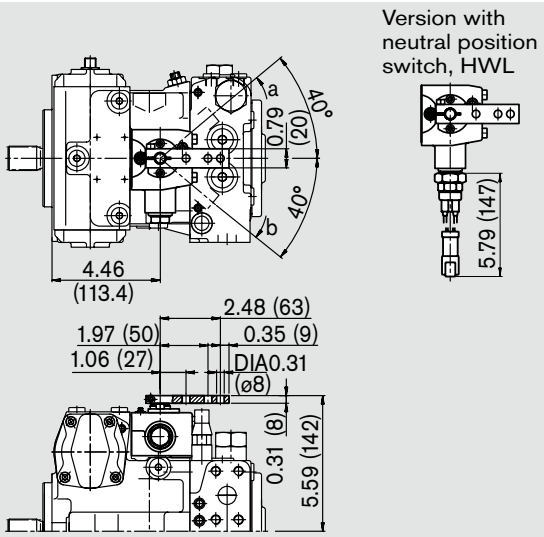
Unit Dimensions, Size 28

Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

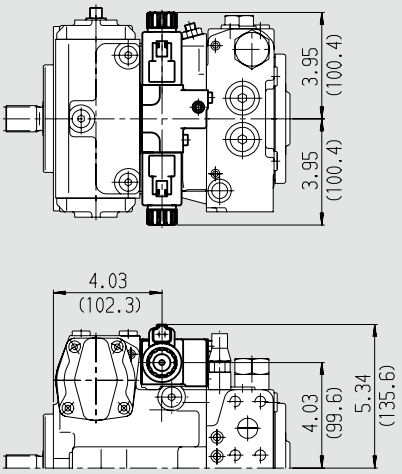
Hydraulic control, pilot-pressure related, HD



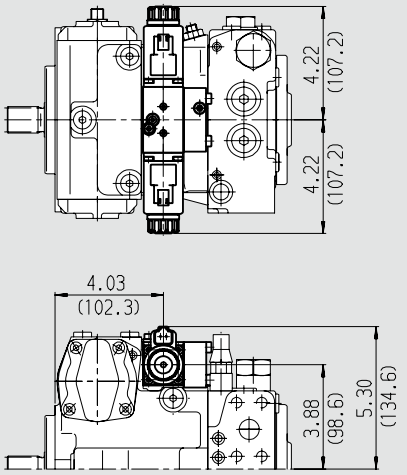
Hydraulic control, mechanical servo, HW



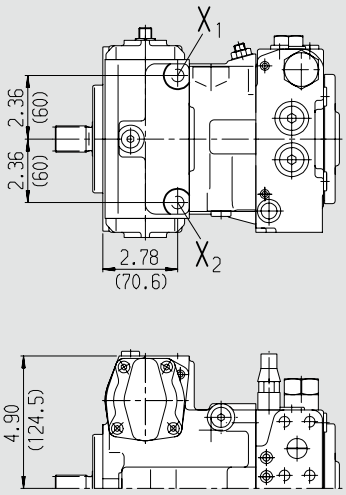
Electric two-point control with switching solenoid, EZ



Electric control with proportional solenoid, EP



Hydraulic control, direct operated, DG

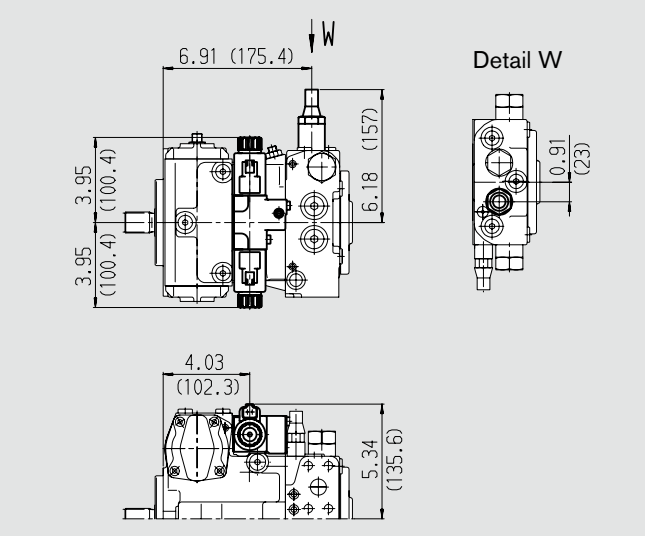


Unit Dimensions, Size 28

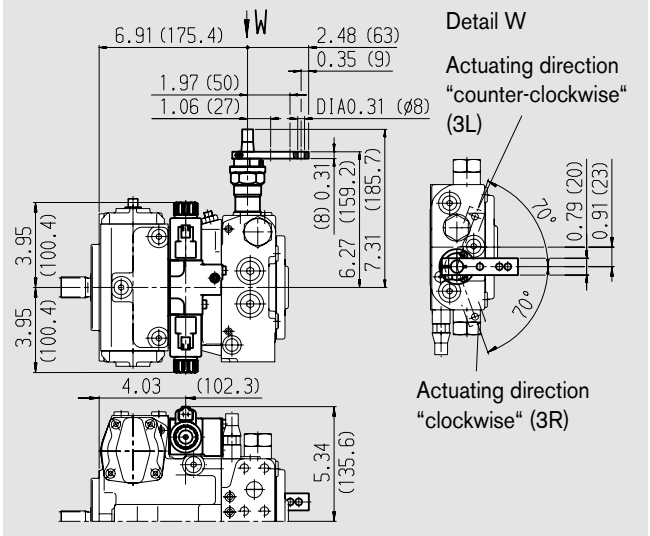
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Hydraulic control, speed related, DA

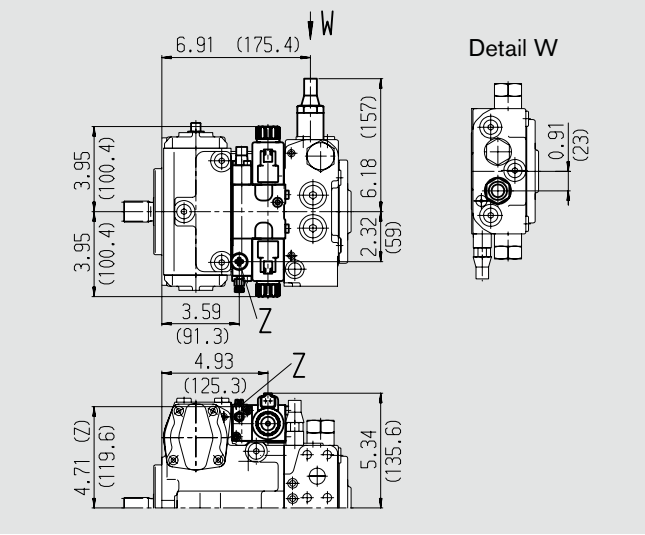
Control valve, fixed setting, DA2



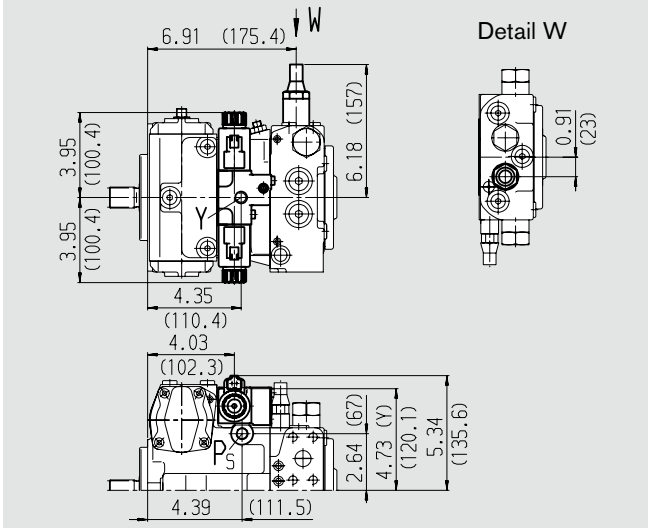
Control valve, mech. adjustable with position lever, DA3



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



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



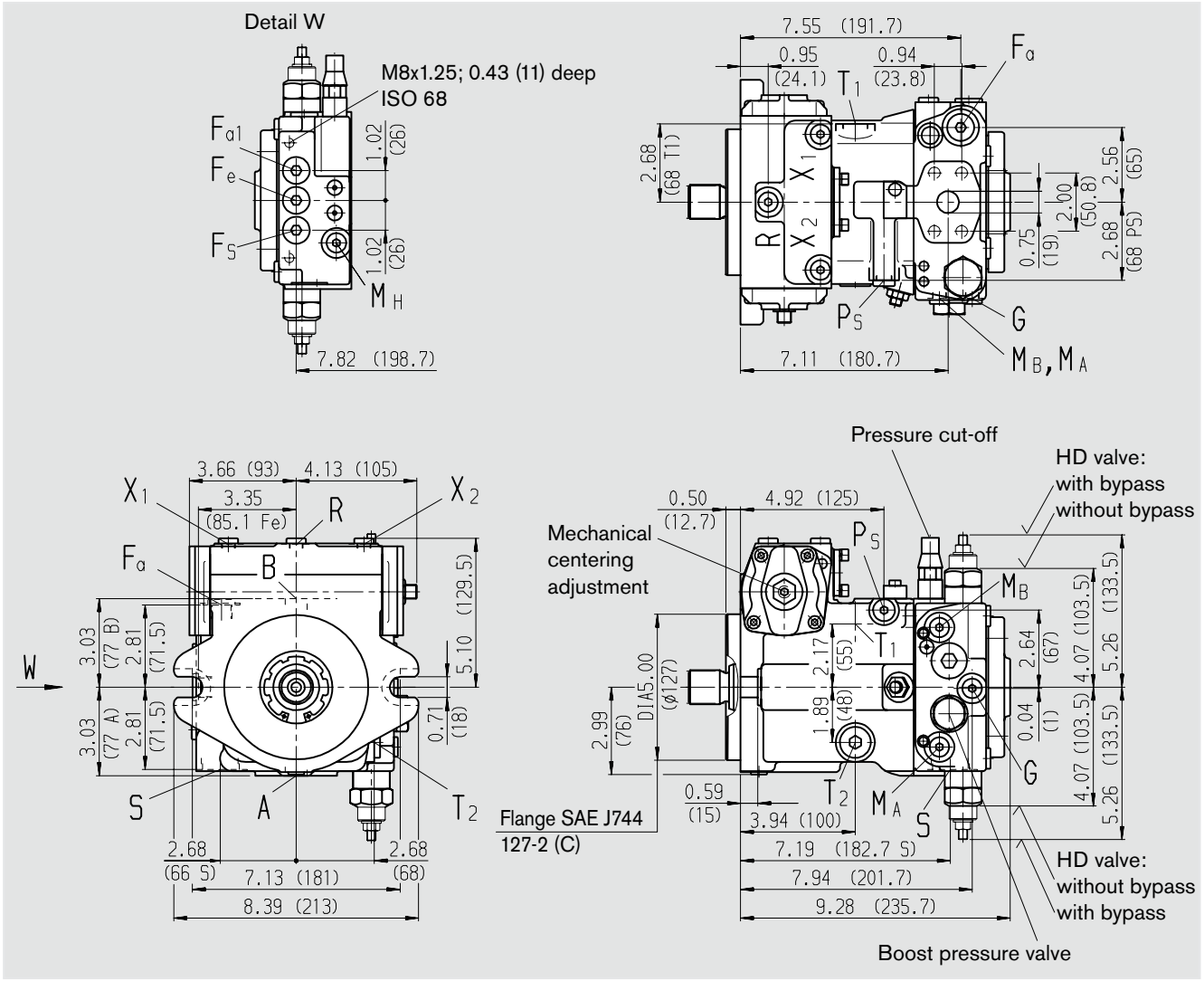
Unit Dimensions, Size 40

Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Version without control unit NV

Standard: suction port S at bottom (52)

Option: suction port S at top (53): port plate turned through 180°

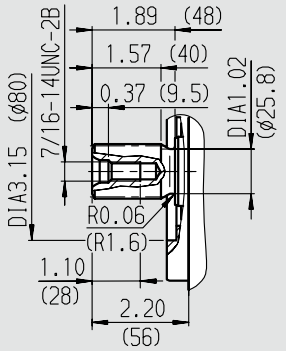


Unit Dimensions, Size 40

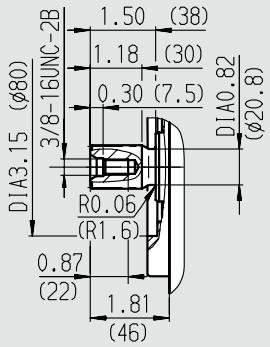
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Shaft ends

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



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



Ports

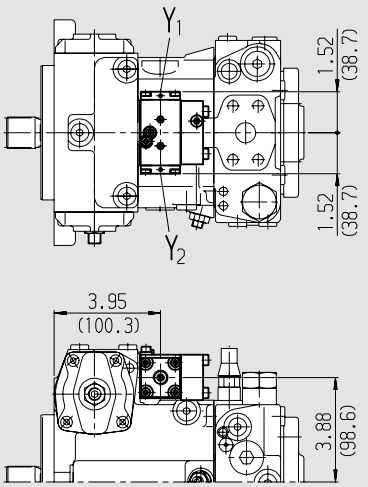
A, B	service line ports (high-pressure series)	SAE J518	3/4 in		
	fixing thread A/B	ISO 68	3/8 in -16 UNC-2B;	0.67 (17) deep [2])	
T_1	case drain or fill	ISO 11926	7/8 in -14 UNF-2B;	0.67 (17) deep	180 lb-ft (240 Nm) [2])
T_2	case drain [3])	ISO 11926	7/8 in -14 UNF-2B;	0.67 (17) deep	180 lb-ft (240 Nm) [2])
M_A, M_B	pressure gauge - operating pressure A, B [3])	ISO 11926	7/16 in -20 UNF-2B;	0.47 (12) deep	30 lb-ft (40 Nm) [2])
R	air bleed [3])	ISO 11926	7/16 in -20 UNF-2B;	0.47 (12) deep	30 lb-ft (40 Nm) [2])
S	boost suction port	ISO 11926	1 5/16 in -12 UN-2B;	0.79 (20) deep	400 lb-ft (540 Nm) [2])
X_1, X_2	port for control pressures (before orifice) [3])	ISO 11926	7/16 in -20 UNF-2B;	0.47 (12) deep	30 lb-ft (40 Nm) [2])
G	pressure port for auxiliary circuits [3])	ISO 11926	7/16 in -20 UNF-2B;	0.47 (12) deep	30 lb-ft (40 Nm) [2])
P_S	control pressure supply [3])	ISO 11926	9/16 in -18 UNF-2B;	0.51 (13) deep	60 lb-ft (80 Nm) [2])
F_a	filter output [3])	ISO 11926	3/4 in -16 UNF-2B;	0.51 (13) deep	120 lb-ft (160 Nm) [2])
F_{a1}	filter output (filter assembly) [3])	DIN 3852	M18x1.5;	0.47 (12) deep	100 lb-ft (140 Nm) [2])
F_e	filter input [3])	DIN 3852	M18x1.5;	0.47 (12) deep	100 lb-ft (140 Nm) [2])
F_S	filter output [3])	DIN 3852	M18x1.5;	0.47 (12) deep	100 lb-ft (140 Nm) [2])
M_H	port for balanced high pressure [3])	ISO 11926	7/16 in -20 UNF-2B;	0.47 (12) deep	30 lb-ft (40 Nm) [2])
Y_1, Y_2	remote control ports (only HD)	ISO 11926	9/16 in -18 UNF-2B;	0.51 (13) deep	60 lb-ft (80 Nm) [2])
Z	pilot pressure port (only DA4/8) [3])	DIN 3852	M10x1; 0.31 (8) deep		22 lb-ft (30 Nm) [2])
Y	pilot pressure port (only DA7)	ISO 11926	9/16 in -18 UNF-2B;	0.51 (13) deep)	60 lb-ft (80 Nm) [2])

[1]) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
[2]) Please observe the general notes for the max. tightening torques on page 64
[3]) Plugged

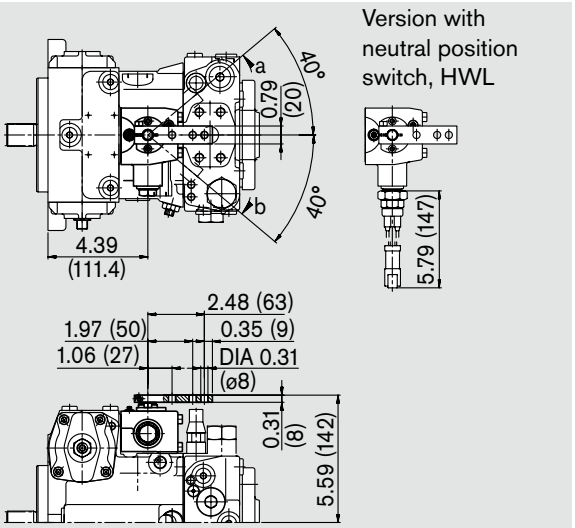
Unit Dimensions, Size 40

Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

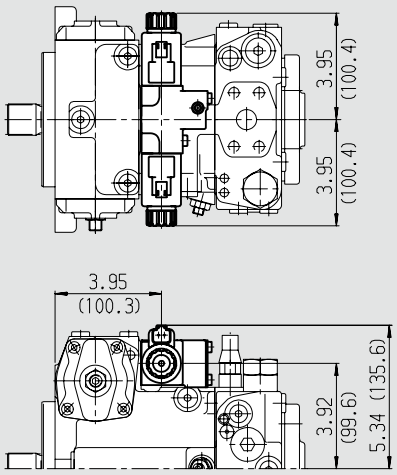
Hydraulic control, pilot-pressure related, HD



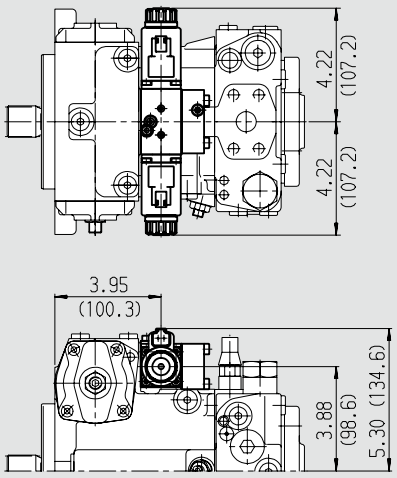
Hydraulic control, mechanical servo, HW



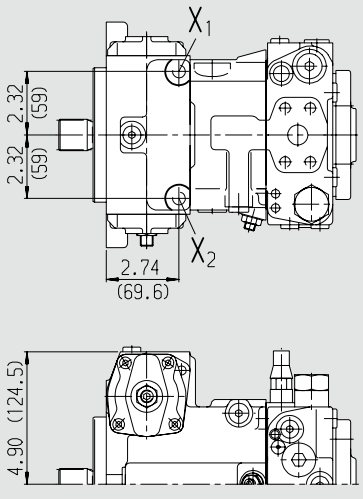
Electric two-point control with switching solenoid, EZ



Electric control with proportional solenoid, EP



Hydraulic control, direct operated, DG

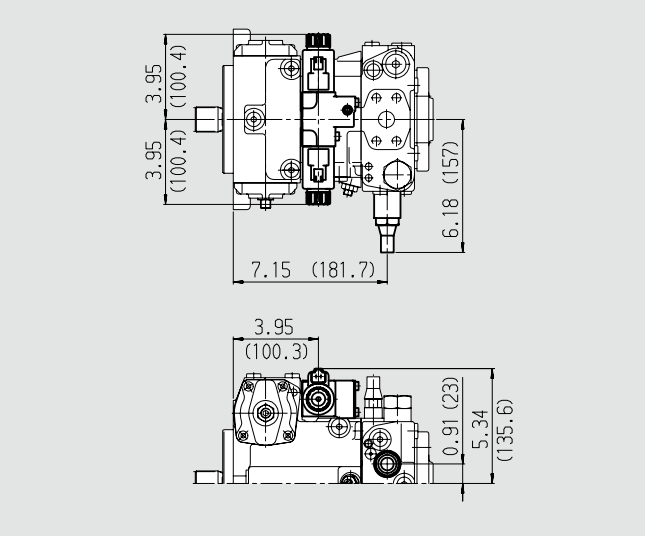


Unit Dimensions, Size 40

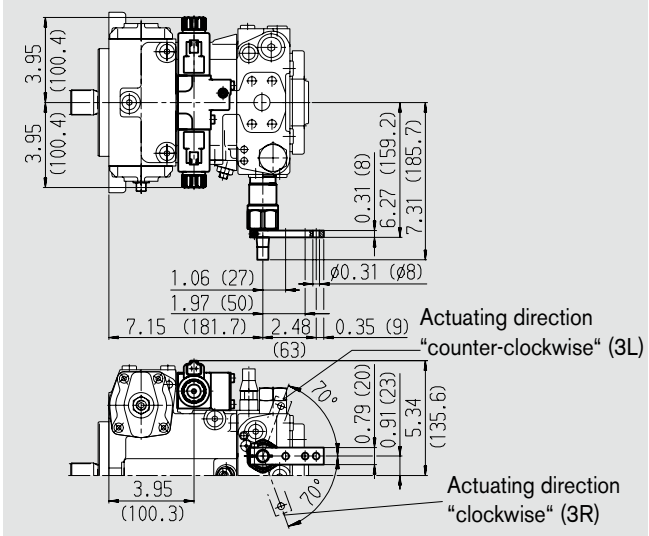
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Hydraulic control, speed related, DA

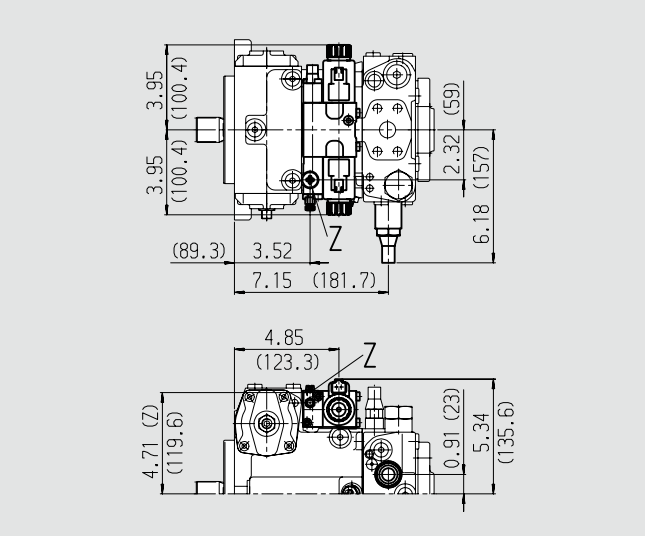
Control valve, fixed setting, DA2



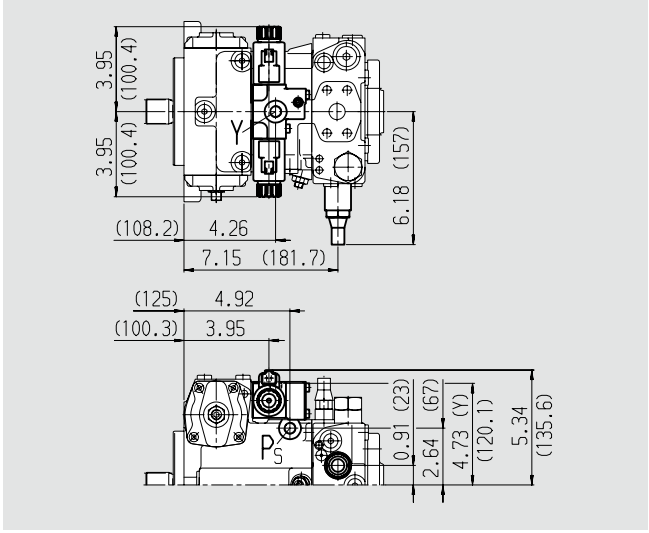
Control valve, mech. adjustable with position lever, DA3



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



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



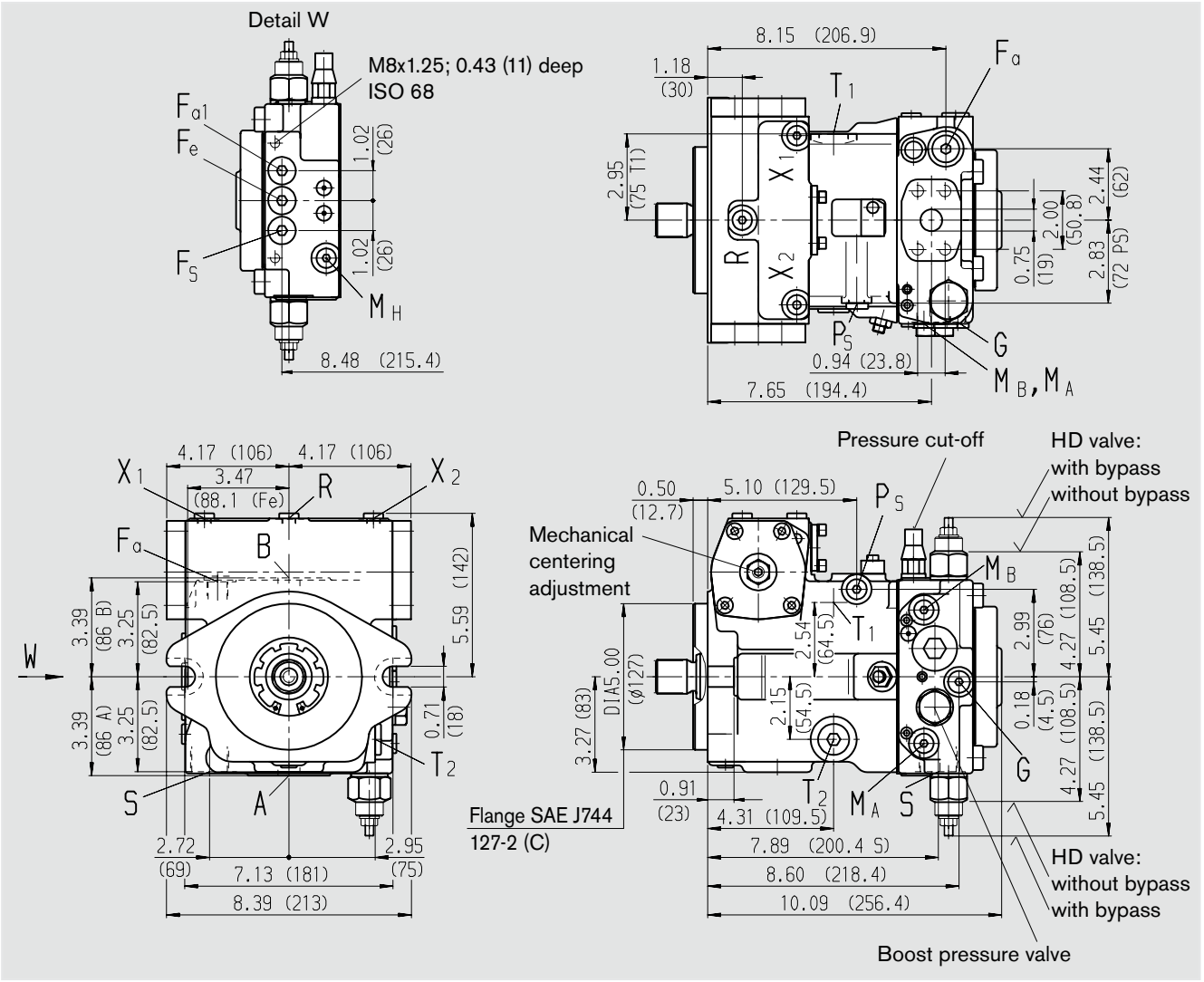
Unit Dimensions, Size 56

Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Version without control unit NV

Standard: suction port S at bottom (52)

Option: suction port S at top (53): port plate turned through 180°

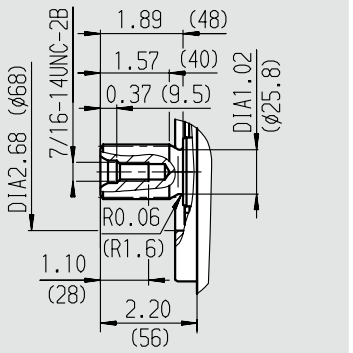


Unit Dimensions, Size 56

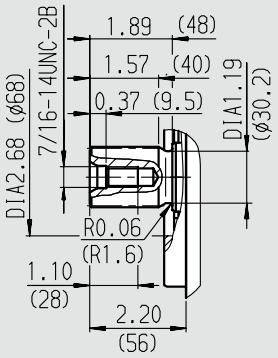
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Shaft ends

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



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



Ports

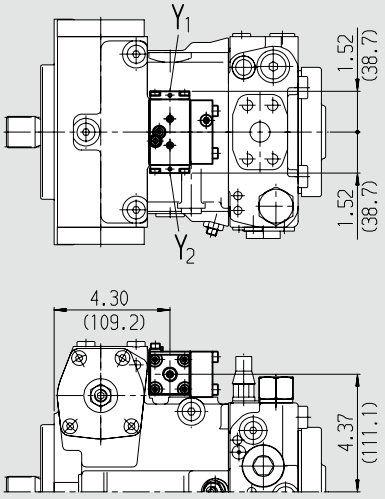
A, B	service line ports (high-pressure series)	SAE J518	3/4 in		
	fixing thread A/B	ISO 68	3/8 in -16 UNC-2B;	0.67 (17) deep [2])	
T_1	case drain or fill	ISO 11926	1 1/16 in -12 UN-2B;	0.79 (20) deep	265 lb-ft (360 Nm) [2])
T_2	case drain [3])	ISO 11926	1 1/16 in -12 UN-2B;	0.79 (20) deep	265 lb-ft (360 Nm) [2])
M_A, M_B	pressure gauge - operating pressure A, B [3])	ISO 11926	7/16 in -20 UNF-2B;	0.47 (12) deep	30 lb-ft (40 Nm) [2])
R	air bleed [3])	ISO 11926	7/16 in -20 UNF-2B;	0.47 (12) deep	30 lb-ft (40 Nm) [2])
S	boost suction port	ISO 11926	1 5/16 in -12 UN-2B;	0.79 (20) deep	400 lb-ft (540 Nm) [2])
X_1, X_2	port for control pressures (before orifice) [3])	ISO 11926	7/16 in -20 UNF-2B;	0.47 (12) deep	30 lb-ft (40 Nm) [2])
G	pressure port for auxiliary circuits [3])	ISO 11926	9/16 in -18 UNF-2B;	0.51 (13) deep	60 lb-ft (80 Nm) [2])
P_S	control pressure supply [3])	ISO 11926	9/16 in -18 UNF-2B;	0.51 (13) deep	60 lb-ft (80 Nm) [2])
F_a	filter output [3])	ISO 11926	3/4 in -16 UNF-2B;	0.59 (15) deep	120 lb-ft (160 Nm) [2])
F_{a1}	filter output (filter assembly) [3])	DIN 3852	M18x1.5;	0.47 (12) deep	100 lb-ft (140 Nm) [2])
F_e	filter input [3])	DIN 3852	M18x1.5;	0.47 (12) deep	100 lb-ft (140 Nm) [2])
F_S	filter output [3])	DIN 3852	M18x1.5;	0.47 (12) deep	100 lb-ft (140 Nm) [2])
M_H	port for balanced high pressure [3])	ISO 11926	7/16 in -20 UNF-2B;	0.47 (12) deep	30 lb-ft (40 Nm) [2])
Y_1, Y_2	remote control ports (only HD)	ISO 11926	9/16 in -18 UNF-2B;	0.51 (13) deep	60 lb-ft (80 Nm) [2])
Z	pilot pressure port (only DA4/8) [3])	DIN 3852	M10x1; 0.31 (8) deep		22 lb-ft (30 Nm) [2])
Y	pilot pressure port (only DA7)	ISO 11926	9/16 in -18 UNF-2B;	0.51 (13) deep)	60 lb-ft (80 Nm) [2])

[1]) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
[2]) Please observe the general notes for the max. tightening torques on page 64
[3]) Plugged

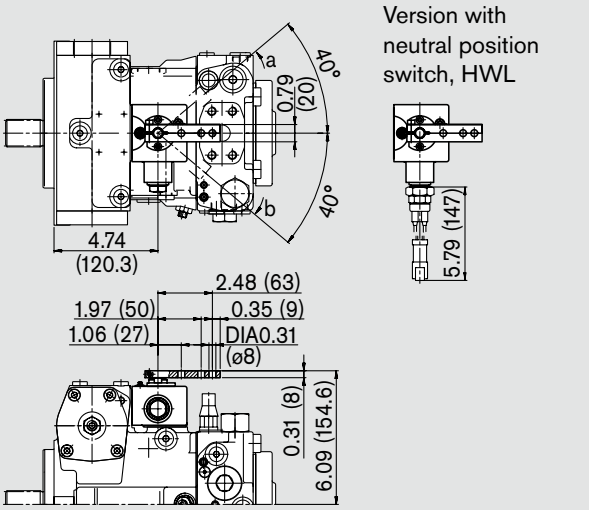
Unit Dimensions, Size 56

Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

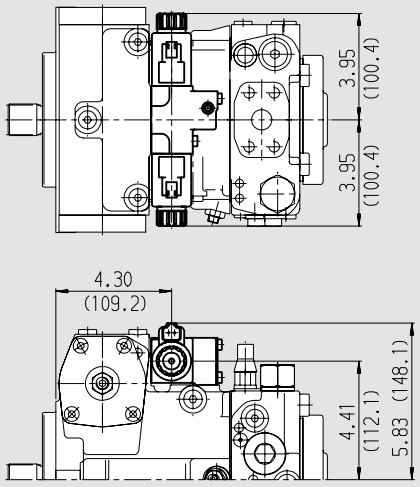
Hydraulic control, pilot-pressure related, HD



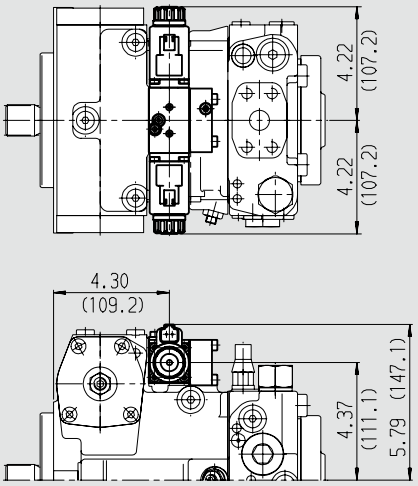
Hydraulic control, mechanical servo, HW



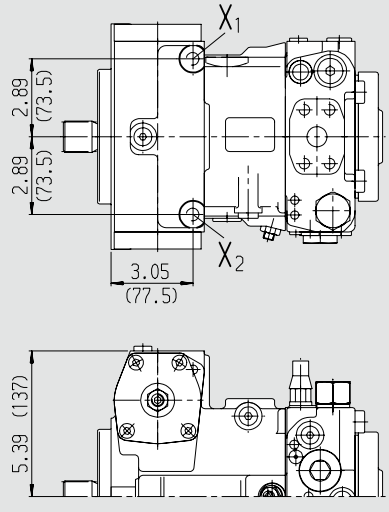
Electric two-point control with switching solenoid, EZ



Electric control with proportional solenoid, EP



Hydraulic control, direct operated, DG

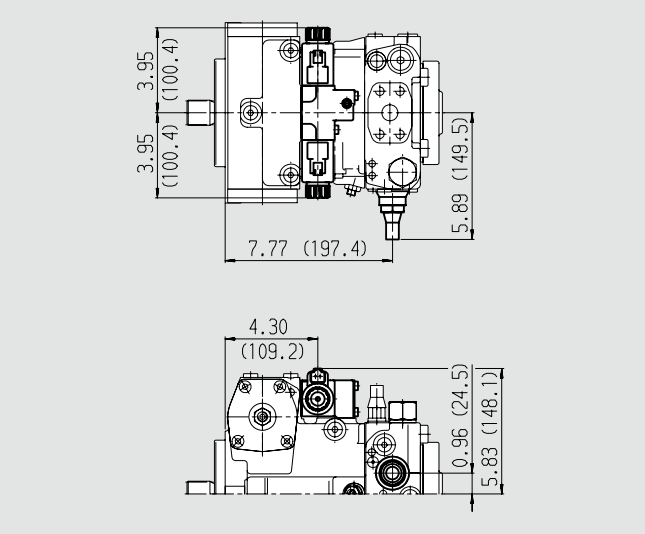


Unit Dimensions, Size 56

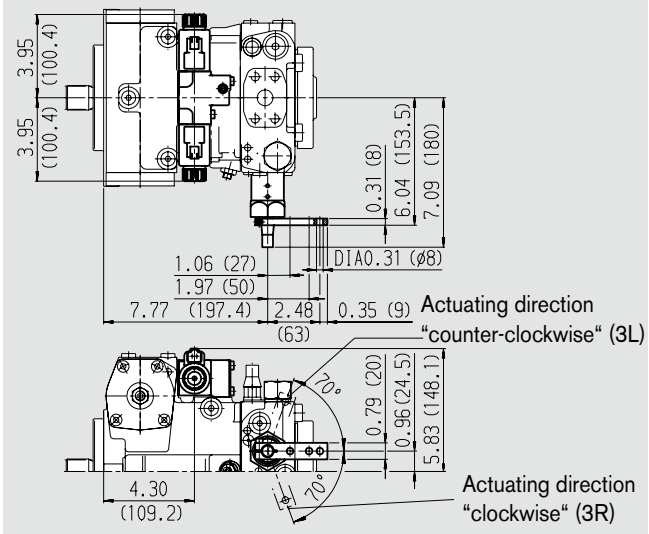
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Hydraulic control, speed related, DA

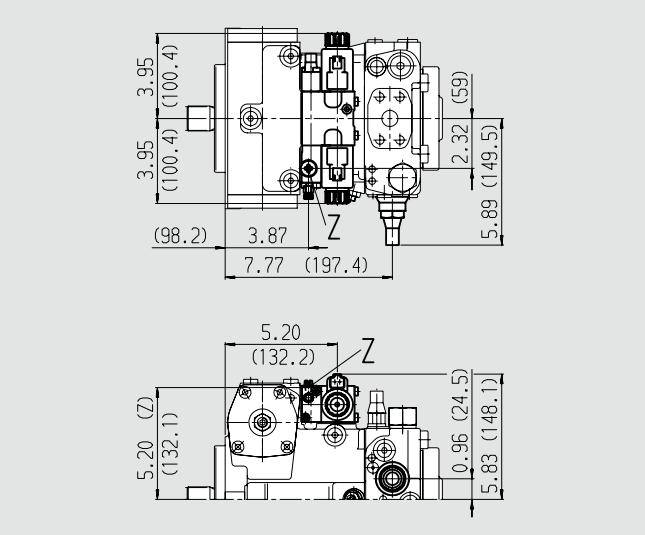
Control valve, fixed setting, DA2



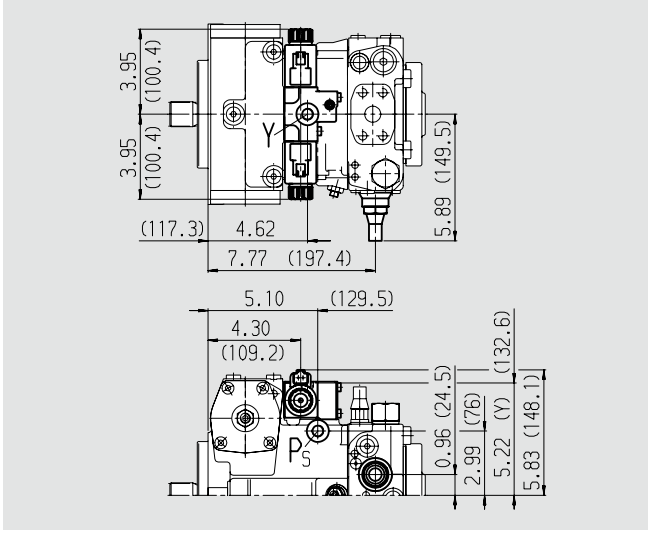
Control valve, mech. adjustable with position lever, DA3



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



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



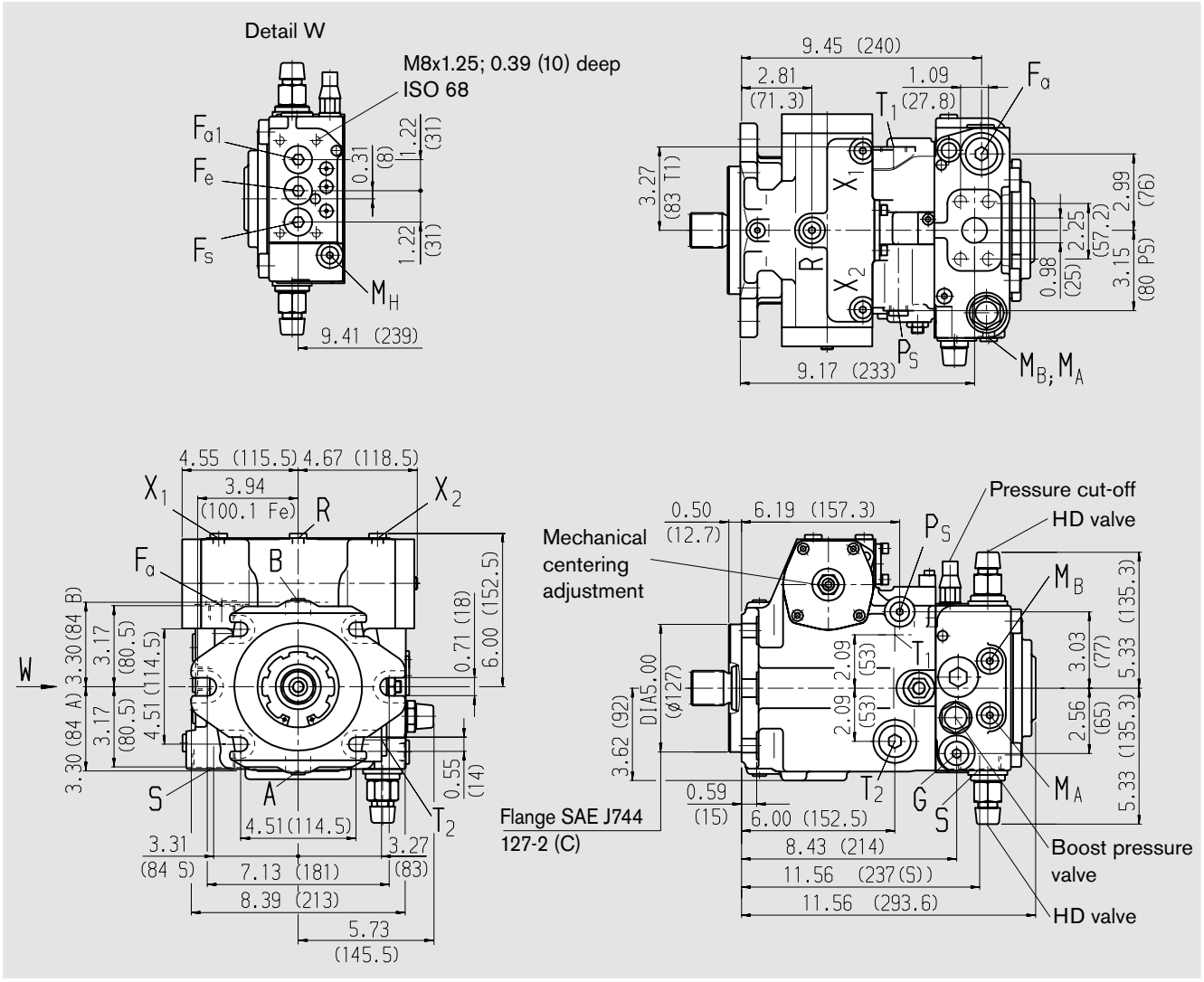
Unit Dimensions, Size 71

Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Version without control unit NV

Standard: suction port S at bottom (52)

Option: suction port S at top (53): port plate turned through 180°

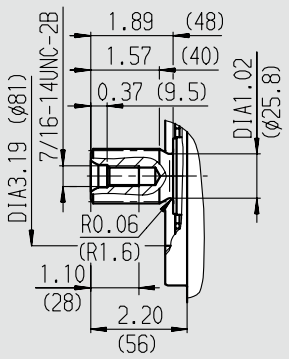


Unit Dimensions, Size 71

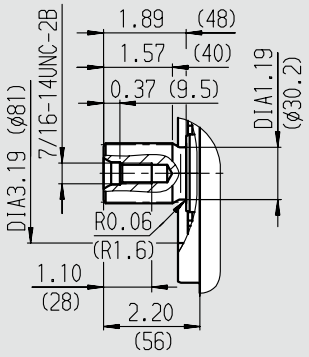
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Shaft ends

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



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



Ports

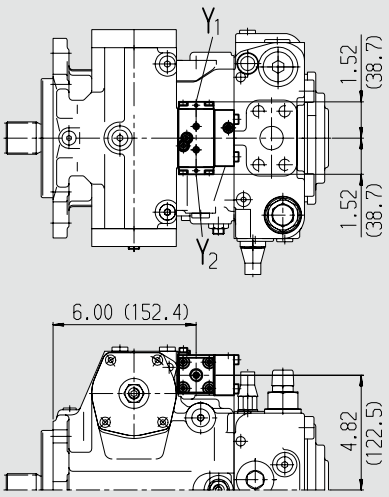
A, B	service line ports (high-pressure series)	SAE J518	1 in		
	fixing thread A/B	ISO 68	7/16 in -14 UNC-2B;	0.67 (17) deep [2])	
T_1	case drain or fill	ISO 11926	1 1/16 in -12 UN-2B;	0.79 (20) deep	265 lb-ft (360 Nm) [2])
T_2	case drain [3])	ISO 11926	1 1/16 in -12 UN-2B;	0.79 (20) deep	265 lb-ft (360 Nm) [2])
M_A, M_B	pressure gauge - operating pressure A, B [3])	ISO 11926	7/16 in -20 UNF-2B;	0.47 (12) deep	30 lb-ft (40 Nm) [2])
R	air bleed [3])	ISO 11926	7/16 in -20 UNF-2B;	0.47 (12) deep	30 lb-ft (40 Nm) [2])
S	boost suction port	ISO 11926	1 5/8 in -12 UN-2B;	0.79 (20) deep	710 lb-ft (960 Nm) [2])
X_1, X_2	port for control pressures (before orifice) [3])	ISO 11926	7/16 in -20 UNF-2B;	0.47 (12) deep	30 lb-ft (40 Nm) [2])
G	pressure port for auxiliary circuits [3])	ISO 11926	3/4 in -16 UNF-2B;	0.59 (15) deep	120 lb-ft (160 Nm) [2])
P_S	control pressure supply [3])	ISO 11926	9/16 in -18 UNF-2B;	0.51 (13) deep	60 lb-ft (80 Nm) [2])
F_a	filter output [3])	ISO 11926	1 1/16 in -12 UN-2B;	0.79 (20) deep	265 lb-ft (360 Nm) [2])
F_{a1}	filter output (filter assembly) [3])	DIN 3852	M22x1.5;	0.55 (14) deep	150 lb-ft (210 Nm) [2])
F_e	filter input [3])	DIN 3852	M22x1.5;	0.55 (14) deep	150 lb-ft (210 Nm) [2])
F_S	filter output [3])	DIN 3852	M22x1.5;	0.55 (14) deep	150 lb-ft (210 Nm) [2])
M_H	port for balanced high pressure [3])	ISO 11926	7/16 in -20 UNF-2B;	0.47 (12) deep	30 lb-ft (40 Nm) [2])
Y_1, Y_2	remote control ports (only HD)	ISO 11926	9/16 in -18 UNF-2B;	0.51 (13) deep	60 lb-ft (80 Nm) [2])
Z	pilot pressure port (only DA4/8) [3])	DIN 3852	M10x1; 0.31 (8) deep		22 lb-ft (30 Nm) [2])
Y	pilot pressure port (only DA7)	ISO 11926	9/16 in -18 UNF-2B;	0.51 (13) deep)	60 lb-ft (80 Nm) [2])

[1]) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
[2]) Please observe the general notes for the max. tightening torques on page 64
[3]) Plugged

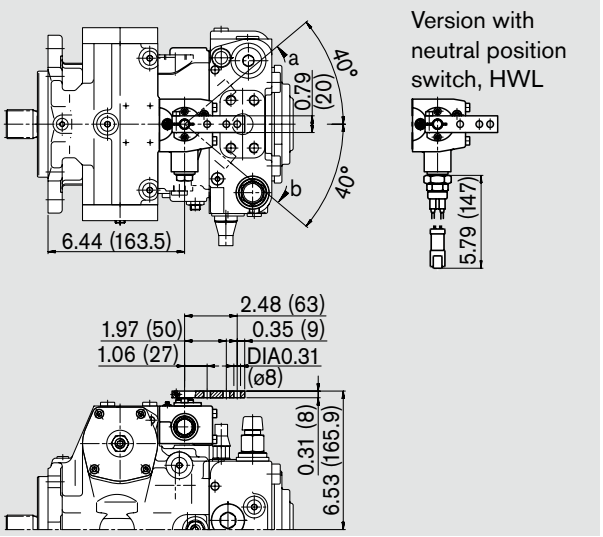
Unit Dimensions, Size 71

Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

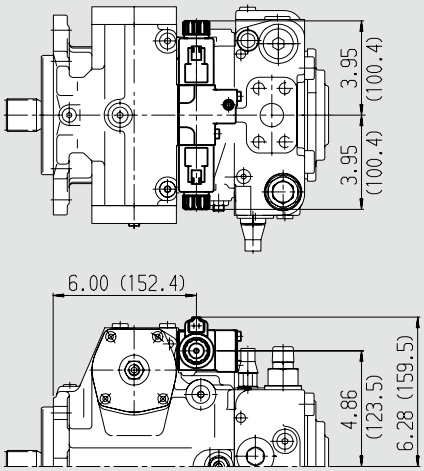
Hydraulic control, pilot-pressure related, HD



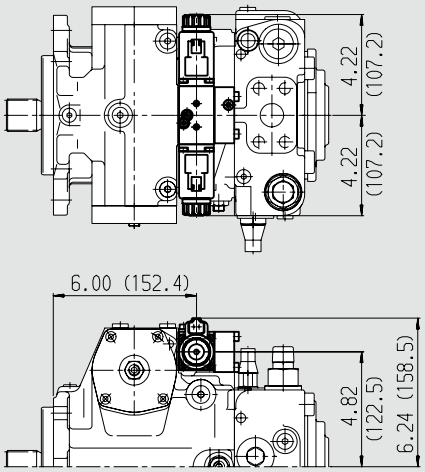
Hydraulic control, mechanical servo, HW



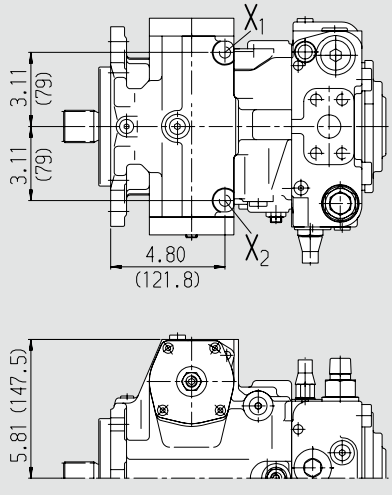
Electric two-point control with switching solenoid, EZ



Electric control with proportional solenoid, EP



Hydraulic control, direct operated, DG

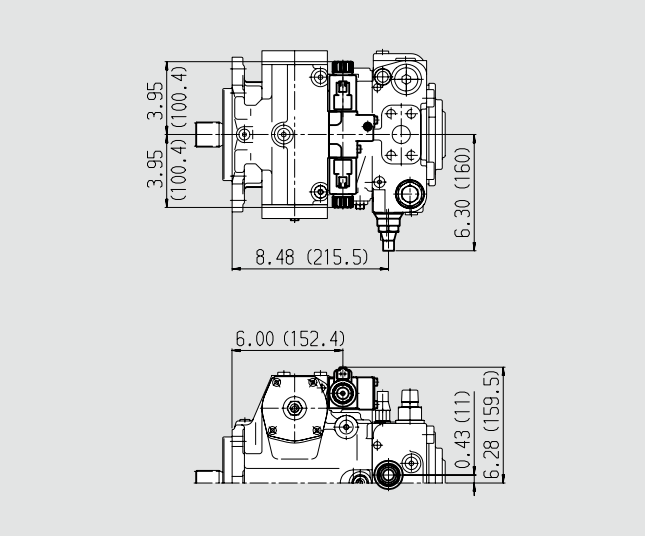


Unit Dimensions, Size 71

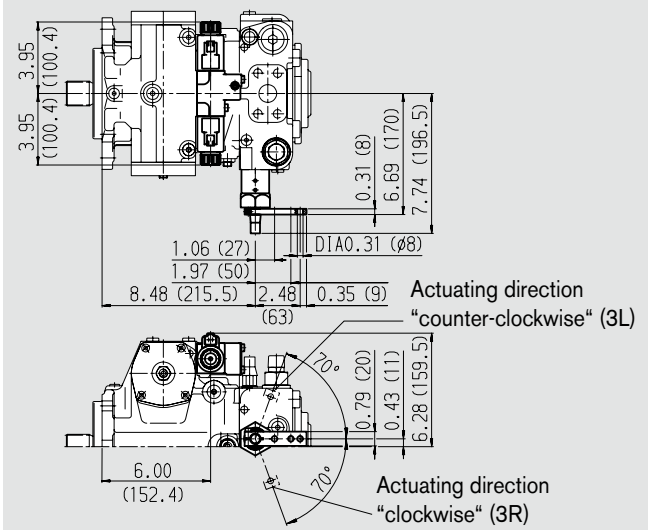
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Hydraulic control, speed related, DA

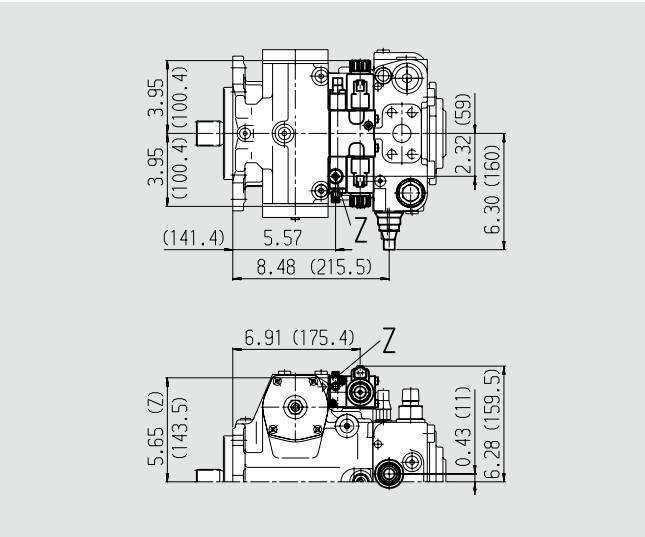
Control valve, fixed setting, DA2



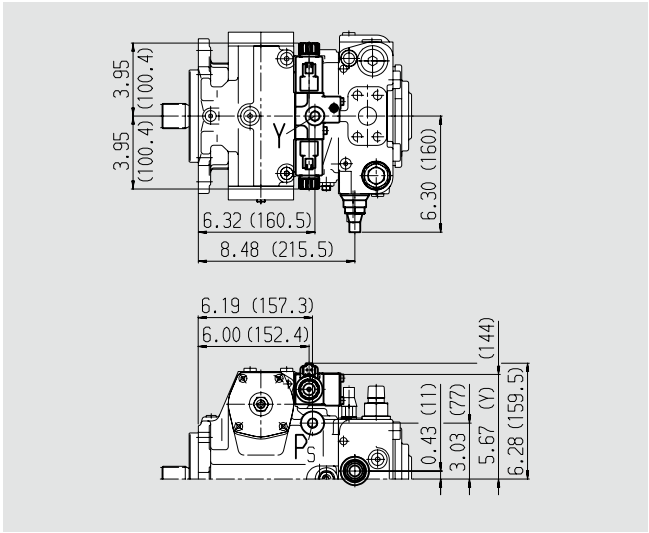
Control valve, mech. adjustable with position lever, DA3



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



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



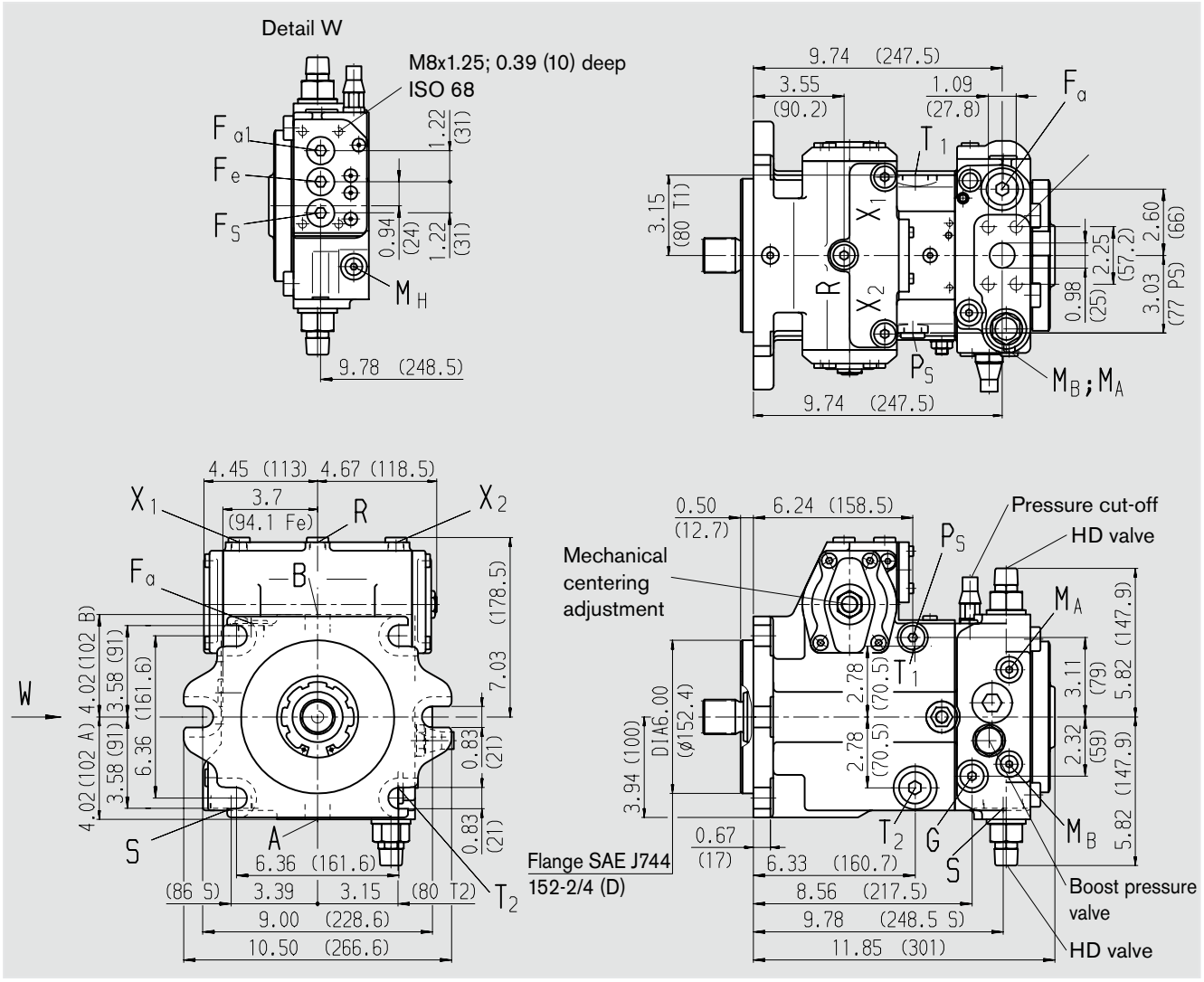
Unit Dimensions, Size 90

Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Version without control unit NV

Standard: suction port S at bottom (52)

Option: suction port S at top (53): port plate turned through 180°

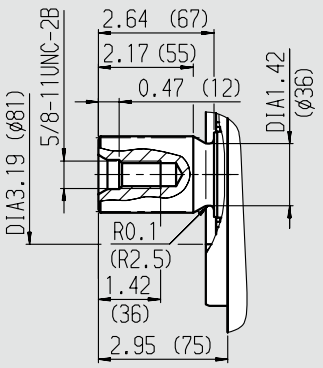


Unit Dimensions, Size 90

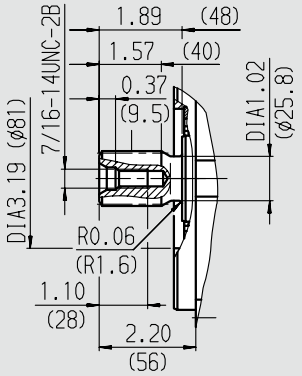
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Shaft ends

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



U Splined shaft 1 1/4in
14T 12/24DP [1])
(SAE J744 – 32-4 (C))



Ports

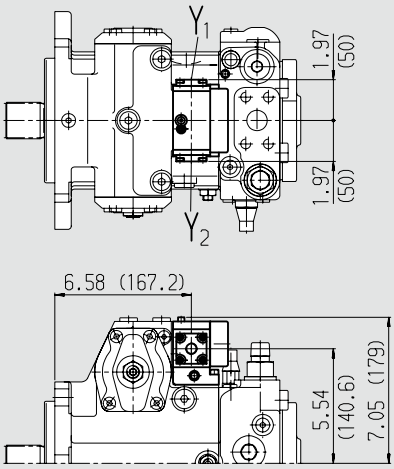
A, B	service line ports (high-pressure series)	SAE J518	1 in		
	fixing thread A/B	ISO 68	7/16 in -14 UNC-2B;	0.67 (17) deep [2])	
T_1	case drain or fill	ISO 11926	1 1/16 in -12 UN-2B;	0.79 (20) deep	265 lb-ft (360 Nm) [2])
T_2	case drain [3])	ISO 11926	1 1/16 in -12 UN-2B;	0.79 (20) deep	265 lb-ft (360 Nm) [2])
M_A, M_B	pressure gauge - operating pressure A, B [3])	ISO 11926	7/16 in -20 UNF-2B;	0.47 (12) deep	30 lb-ft (40 Nm) [2])
R	air bleed [3])	ISO 11926	9/16 in -18 UNF-2B;	0.51 (13) deep	60 lb-ft (80 Nm) [2])
S	boost suction port	ISO 11926	1 5/8 in -12 UN-2B;	0.79 (20) deep	710 lb-ft (960 Nm) [2])
X_1, X_2	port for control pressures (before orifice) [3])	ISO 11926	9/16 in -18 UNF-2B;	0.51 (13) deep	60 lb-ft (80 Nm) [2])
G	pressure port for auxiliary circuits [3])	ISO 11926	3/4 in -16 UNF-2B;	0.59 (15) deep	120 lb-ft (160 Nm) [2])
P_S	control pressure supply [3])	ISO 11926	9/16 in -18 UNF-2B;	0.51 (13) deep	60 lb-ft (80 Nm) [2])
F_a	filter output [3])	ISO 11926	1 1/16 in -12 UN-2B;	0.79 (20) deep	265 lb-ft (360 Nm) [2])
F_{a1}	filter output (filter assembly) [3])	DIN 3852	M22x1.5;	0.55 (14) deep	150 lb-ft (210 Nm) [2])
F_e	filter input [3])	DIN 3852	M22x1.5;	0.55 (14) deep	150 lb-ft (210 Nm) [2])
F_S	filter output [3])	DIN 3852	M22x1.5;	0.55 (14) deep	150 lb-ft (210 Nm) [2])
M_H	port for balanced high pressure [3])	ISO 11926	7/16 in -20 UNF-2B;	0.47 (12) deep	30 lb-ft (40 Nm) [2])
Y_1, Y_2	remote control ports (only HD)	ISO 11926	9/16 in -18 UNF-2B;	0.51 (13) deep	60 lb-ft (80 Nm) [2])
Z	pilot pressure port (only DA4/8) [3])	DIN 3852	M10x1; 0.31 (8) deep		22 lb-ft (30 Nm) [2])
Y	pilot pressure port (only DA7)	ISO 11926	9/16 in -18 UNF-2B;	0.51 (13) deep)	60 lb-ft (80 Nm) [2])

[1]) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
[2]) Please observe the general notes for the max. tightening torques on page 64
[3]) Plugged

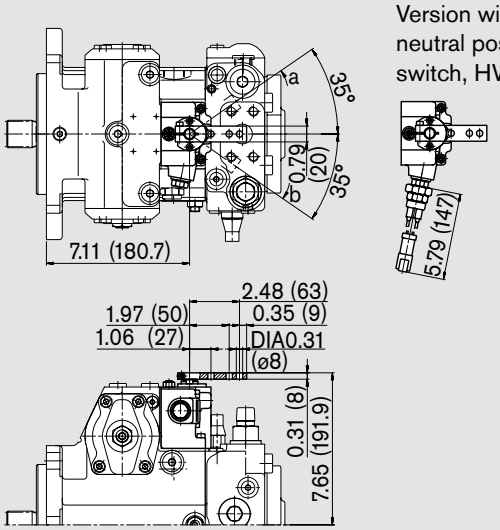
Unit Dimensions, Size 90

Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Hydraulic control, pilot-pressure related, HD

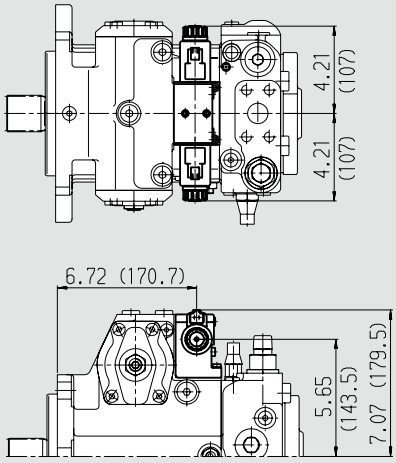


Hydraulic control, mechanical servo, HW

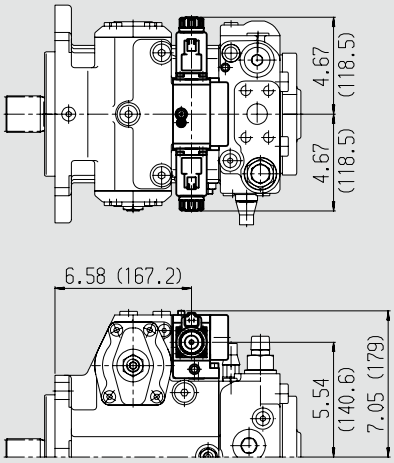


Version with neutral position switch, HWL

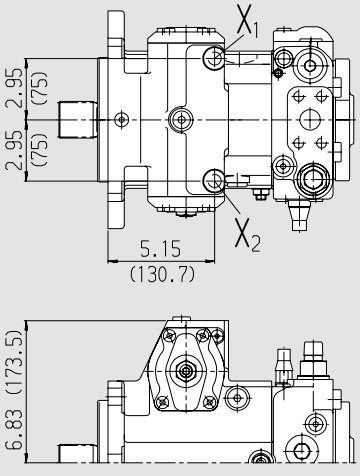
Electric two-point control with switching solenoid, EZ



Electric control with proportional solenoid, EP



Hydraulic control, direct operated, DG

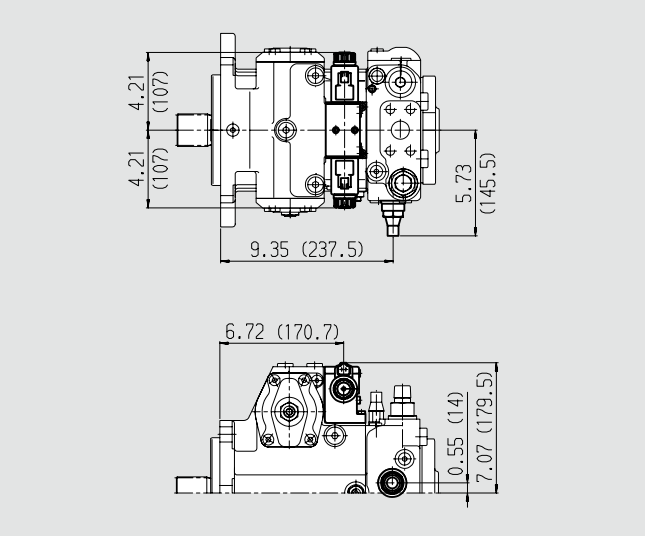


Unit Dimensions, Size 90

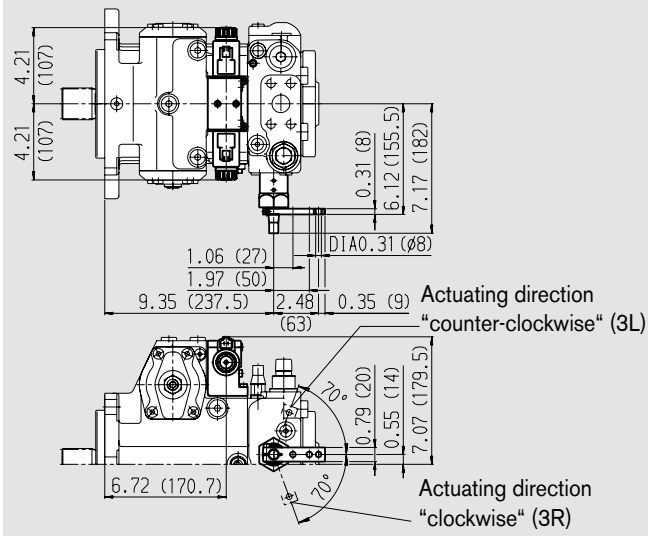
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Hydraulic control, speed related, DA

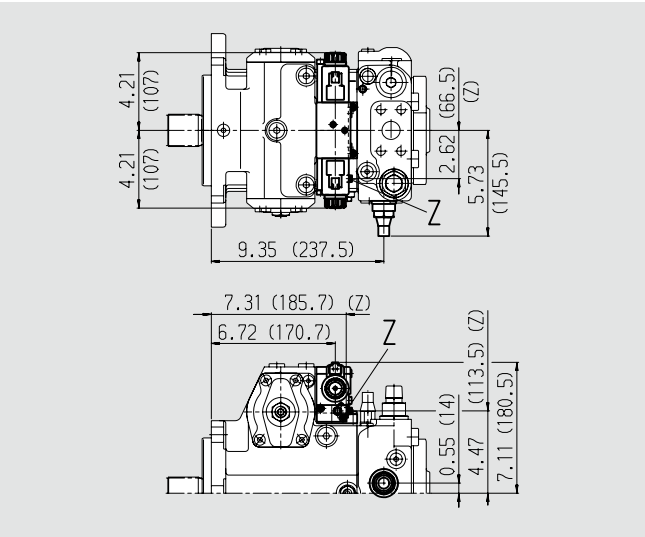
Control valve, fixed setting, DA2



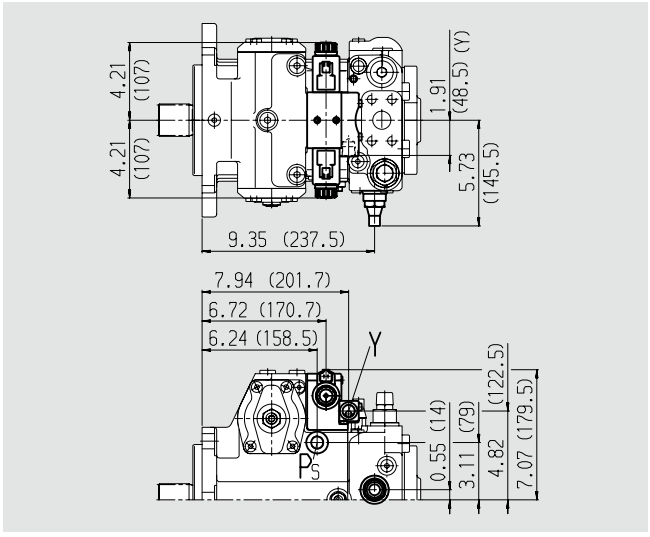
Control valve, mech. adjustable with position lever, DA3



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



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



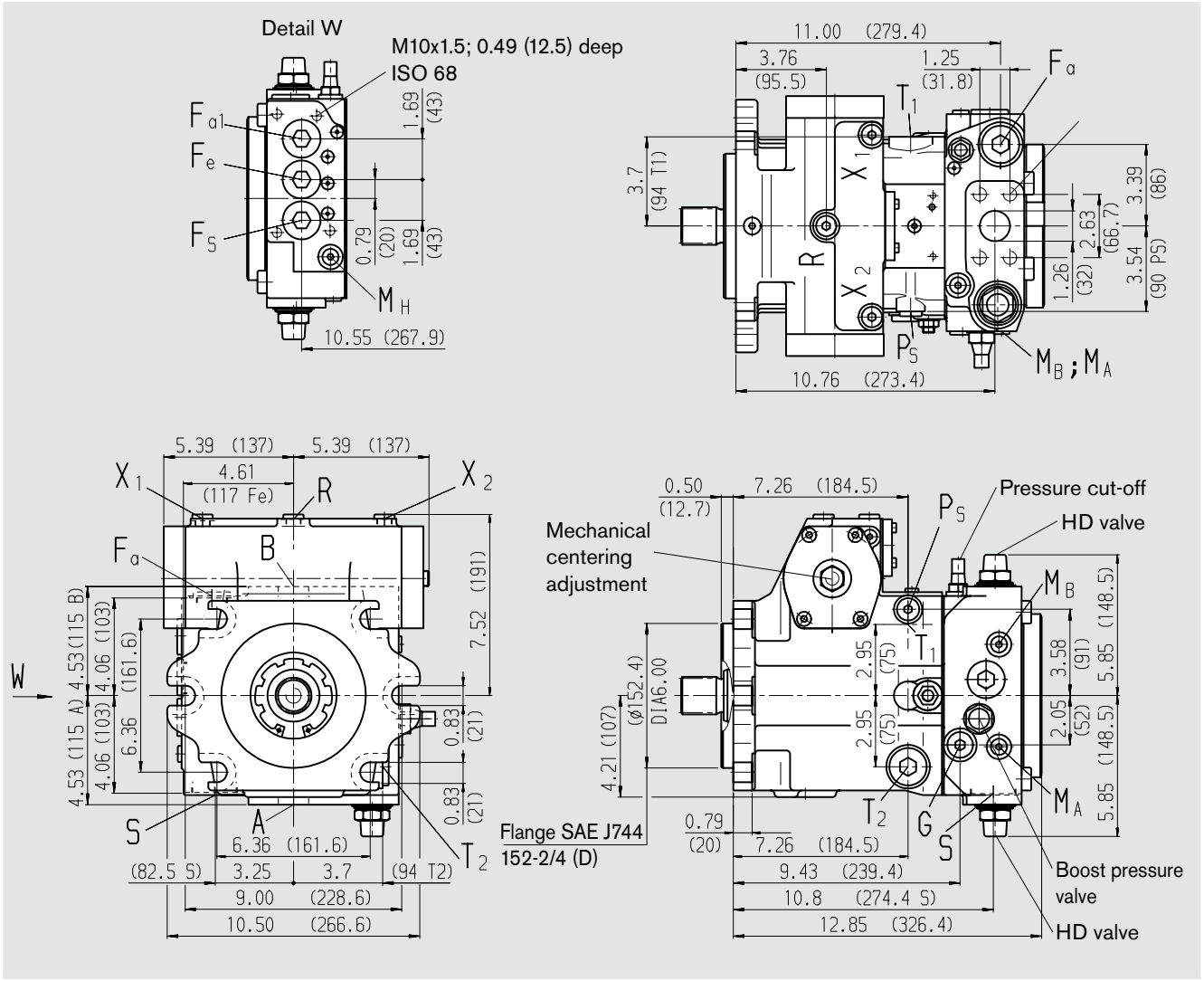
Unit Dimensions, Size 125

Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Version without control unit NV

Standard: suction port S at bottom (52)

Option: suction port S at top (53): port plate turned through 180°

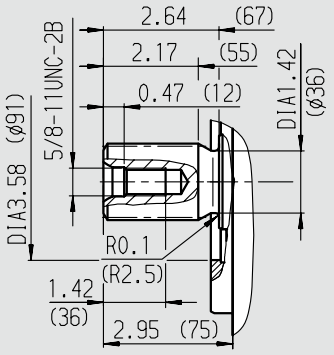


Unit Dimensions, Size 125

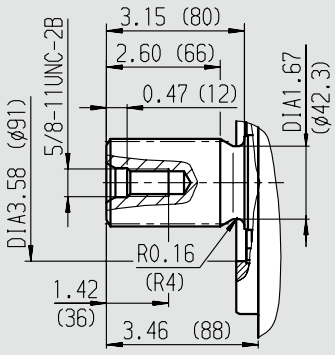
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Shaft ends

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



T Splined shaft 2in
15T 8/16DP [1])
(SAE J744 – 50-4 (F))



Ports

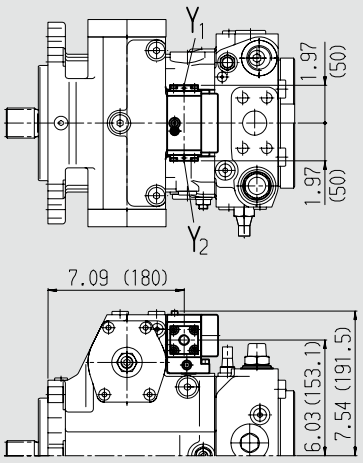
A, B	service line ports (high-pressure series)	SAE J518	1 1/4 in		
	fixing thread A/B	ISO 68	1/2 in -13 UNC-2B;	0.75 (19) deep [2])	
T_1	case drain or fill	ISO 11926	1 5/16 in -12 UN-2B;	0.79 (20) deep	400 lb-ft (540 Nm) [2])
T_2	case drain [3])	ISO 11926	1 5/16 in -12 UN-2B;	0.79 (20) deep	400 lb-ft (540 Nm) [2])
M_A, M_B	pressure gauge - operating pressure A, B [3])	ISO 11926	7/16 in -20 UNF-2B;	0.47 (12) deep	30 lb-ft (40 Nm) [2])
R	air bleed [3])	ISO 11926	9/16 in -18 UNF-2B;	0.51 (13) deep	60 lb-ft (80 Nm) [2])
S	boost suction port	ISO 11926	1 7/8 in -12 UN-2B;	0.79 (20) deep	330 lb-ft (450 Nm) [2])
X_1, X_2	port for control pressures (before orifice) [3])	ISO 11926	9/16 in -18 UNF-2B;	0.51 (13) deep	60 lb-ft (80 Nm) [2])
G	pressure port for auxiliary circuits [3])	ISO 11926	7/8 in -14 UNF-2B;	0.67 (17) deep	180 lb-ft (240 Nm) [2])
P_S	control pressure supply [3])	ISO 11926	9/16 in -18 UNF-2B;	0.51 (13) deep	60 lb-ft (80 Nm) [2])
F_a	filter output [3])	ISO 11926	1 5/16 in -12 UN-2B;	0.79 (20) deep	400 lb-ft (540 Nm) [2])
F_{a1}	filter output (filter assembly) [3])	DIN 3852	M33x1.5;	0.71 (18) deep	400 lb-ft (540 Nm) [2])
F_e	filter input [3])	DIN 3852	M33x1.5;	0.71 (18) deep	400 lb-ft (540 Nm) [2])
F_S	filter output [3])	DIN 3852	M33x1.5;	0.71 (18) deep	400 lb-ft (540 Nm) [2])
M_H	port for balanced high pressure [3])	ISO 11926	7/16 in -20 UNF-2B;	0.47 (12) deep	30 lb-ft (40 Nm) [2])
Y_1, Y_2	remote control ports (only HD)	ISO 11926	9/16 in -18 UNF-2B;	0.51 (13) deep	60 lb-ft (80 Nm) [2])
Z	pilot pressure port (only DA4/8) [3])	DIN 3852	M10x1; 0.31 (8) deep		22 lb-ft (30 Nm) [2])
Y	pilot pressure port (only DA7)	ISO 11926	9/16 in -18 UNF-2B;	0.51 (13) deep)	60 lb-ft (80 Nm) [2])

[1]) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
[2]) Please observe the general notes for the max. tightening torques on page 64
[3]) Plugged

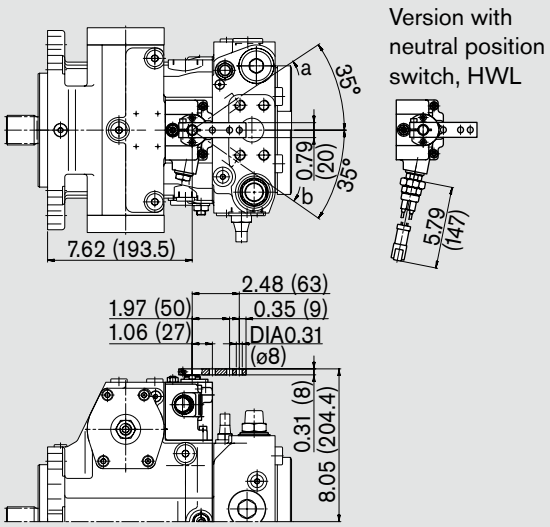
Unit Dimensions, Size 125

Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

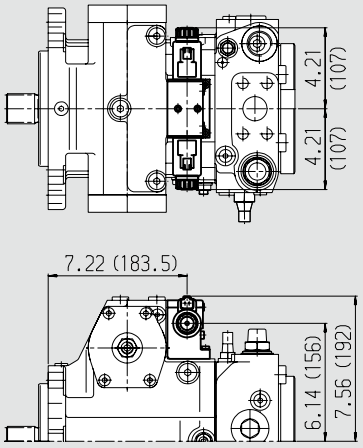
Hydraulic control, pilot-pressure related, HD



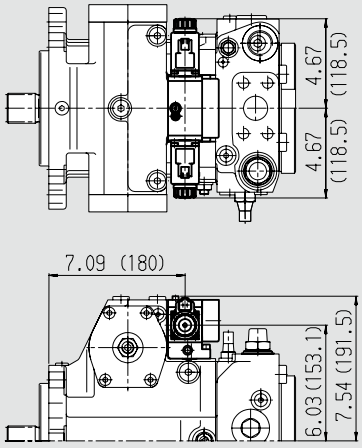
Hydraulic control, mechanical servo, HW



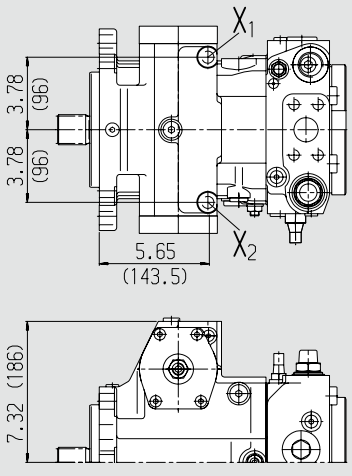
Electric two-point control with switching solenoid, EZ



Electric control with proportional solenoid, EP



Hydraulic control, direct operated, DG

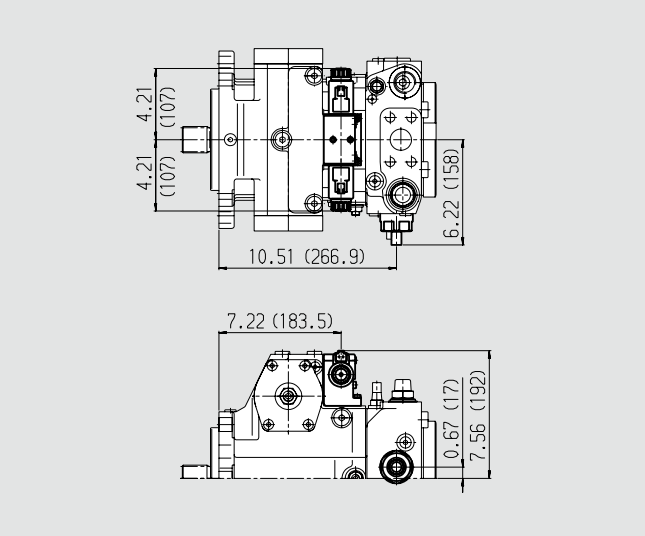


Unit Dimensions, Size 125

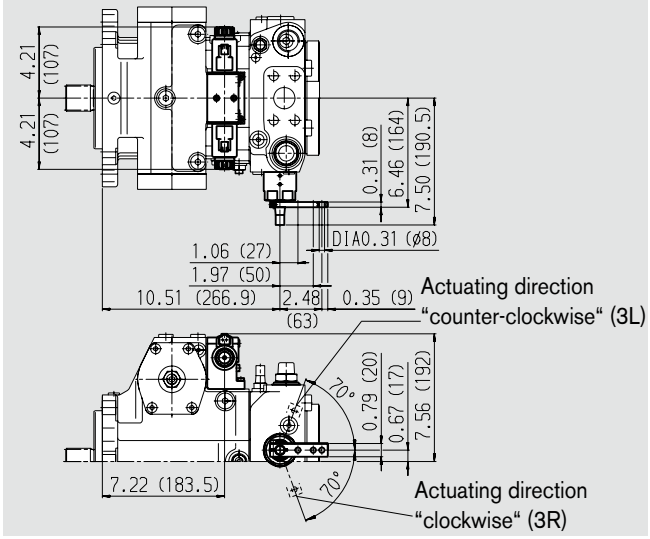
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Hydraulic control, speed related, DA

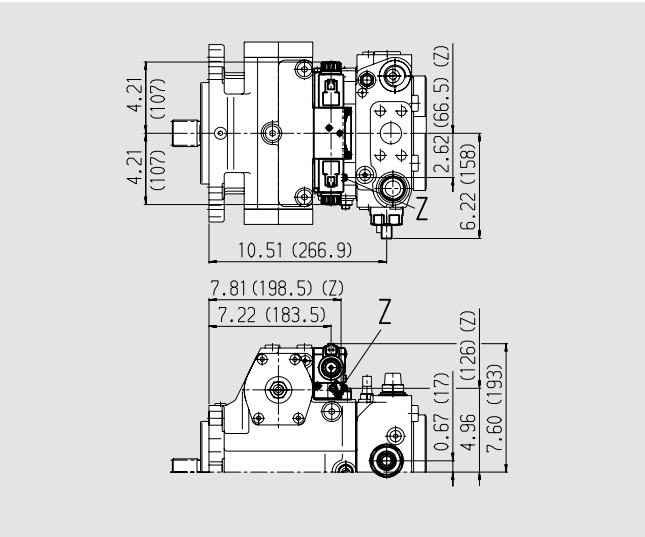
Control valve, fixed setting, DA2



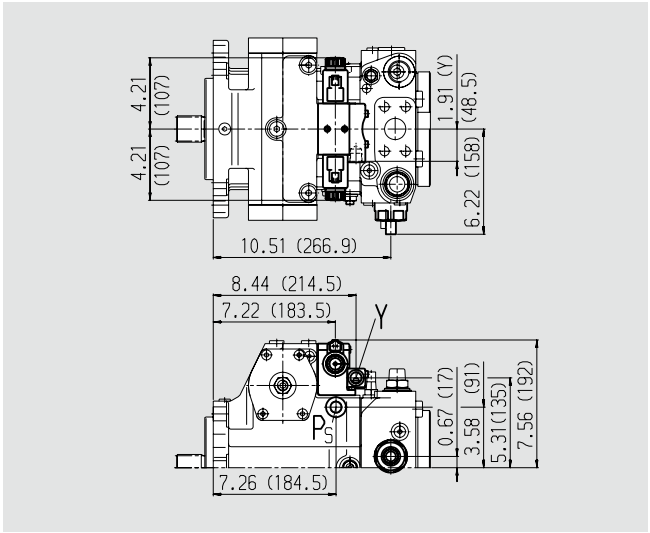
Control valve, mech. adjustable with position lever, DA3



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



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



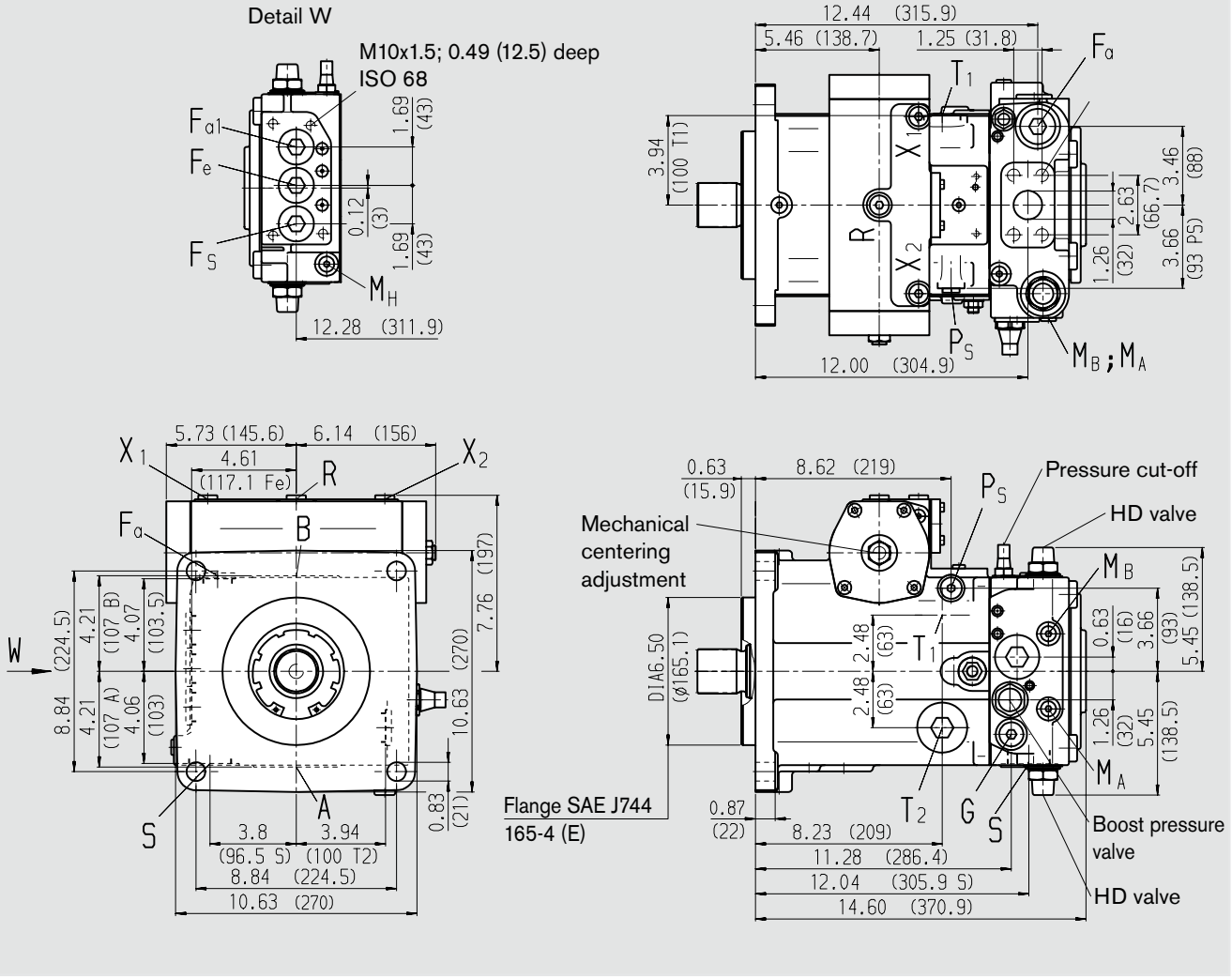
Unit Dimensions, Size 180

Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Version without control unit NV

Standard: suction port S at bottom (52)

Option: suction port S at top (53): port plate turned through 180°

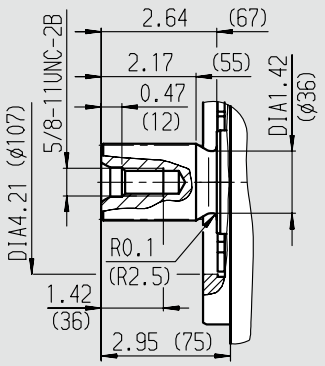


Unit Dimensions, Size 180

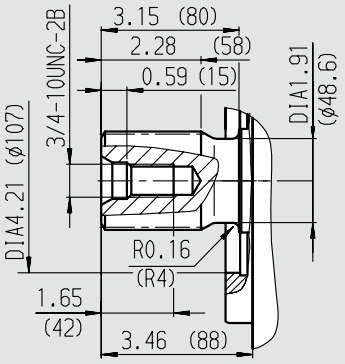
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Shaft ends

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



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



Ports

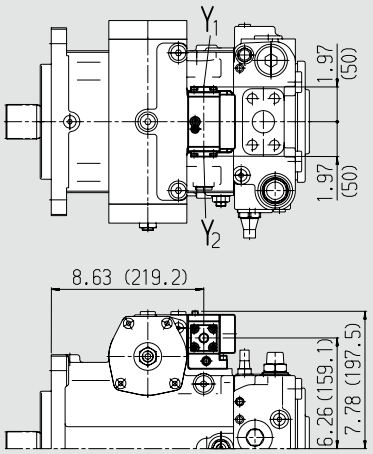
A, B	service line ports (high-pressure series)	SAE J518	1 1/4 in		
	fixing thread A/B	ISO 68	1/2 in -13 UNC-2B;	0.75 (19) deep [2])	
T_1	case drain or fill	ISO 11926	1 5/8 in -12 UN-2B;	0.79 (20) deep	710 lb-ft (960 Nm) [2])
T_2	case drain [3])	ISO 11926	1 5/8 in -12 UN-2B;	0.79 (20) deep	710 lb-ft (960 Nm) [2])
M_A, M_B	pressure gauge - operating pressure A, B [3])	ISO 11926	7/16 in -20 UNF-2B;	0.47 (12) deep	30 lb-ft (40 Nm) [2])
R	air bleed [3])	ISO 11926	9/16 in -18 UNF-2B;	0.51 (13) deep	60 lb-ft (80 Nm) [2])
S	boost suction port	ISO 11926	1 7/8 in -12 UN-2B;	0.79 (20) deep	330 lb-ft (450 Nm) [2])
X_1, X_2	port for control pressures (before orifice) [3])	ISO 11926	9/16 in -18 UNF-2B;	0.51 (13) deep	60 lb-ft (80 Nm) [2])
G	pressure port for auxiliary circuits [3])	ISO 11926	7/8 in -14 UNF-2B;	0.67 (17) deep	180 lb-ft (240 Nm) [2])
P_S	control pressure supply [3])	ISO 11926	9/16 in -18 UNF-2B;	0.51 (13) deep	60 lb-ft (80 Nm) [2])
F_a	filter output [3])	ISO 11926	1 5/16 in -12 UN-2B;	0.79 (20) deep	400 lb-ft (540 Nm) [2])
F_{a1}	filter output (filter assembly) [3])	DIN 3852	M33x1.5;	0.71 (18) deep	400 lb-ft (540 Nm) [2])
F_e	filter input [3])	DIN 3852	M33x1.5;	0.71 (18) deep	400 lb-ft (540 Nm) [2])
F_S	filter output [3])	DIN 3852	M33x1.5;	0.71 (18) deep	400 lb-ft (540 Nm) [2])
M_H	port for balanced high pressure [3])	ISO 11926	7/16 in -20 UNF-2B;	0.47 (12) deep	30 lb-ft (40 Nm) [2])
Y_1, Y_2	remote control ports (only HD)	ISO 11926	9/16 in -18 UNF-2B;	0.51 (13) deep	60 lb-ft (80 Nm) [2])
Z	pilot pressure port (only DA4/8) [3])	DIN 3852	M10x1; 0.31 (8) deep		22 lb-ft (30 Nm) [2])
Y	pilot pressure port (only DA7)	ISO 11926	9/16 in -18 UNF-2B;	0.51 (13) deep)	60 lb-ft (80 Nm) [2])

[1]) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
[2]) Please observe the general notes for the max. tightening torques on page 64
[3]) Plugged

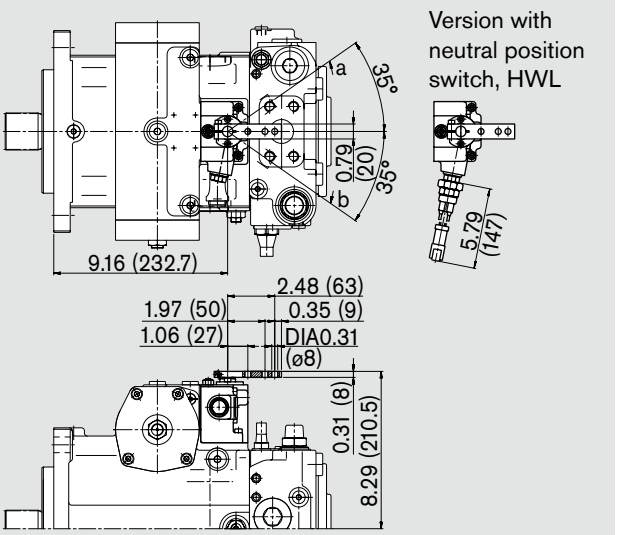
Unit Dimensions, Size 180

Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

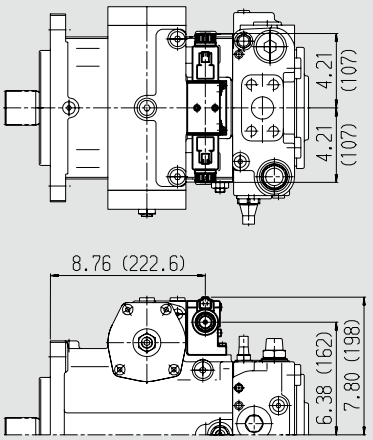
Hydraulic control, pilot-pressure related, HD



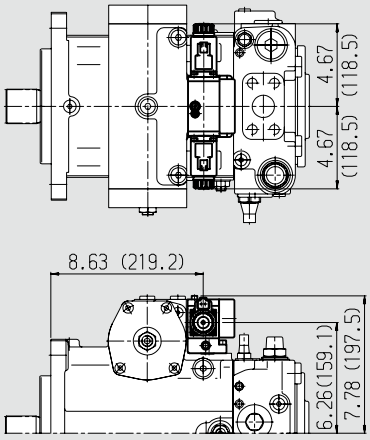
Hydraulic control, mechanical servo, HW



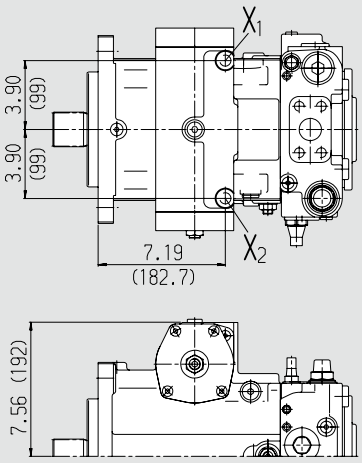
Electric two-point control with switching solenoid, EZ



Electric control with proportional solenoid, EP



Hydraulic control, direct operated, DG

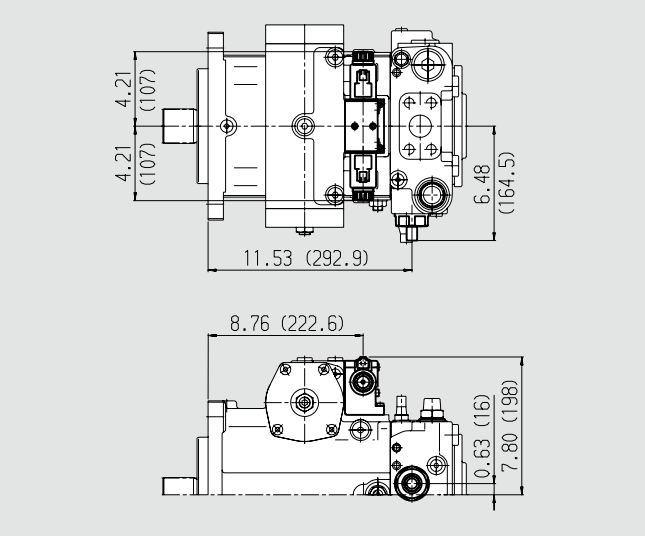


Unit Dimensions, Size 180

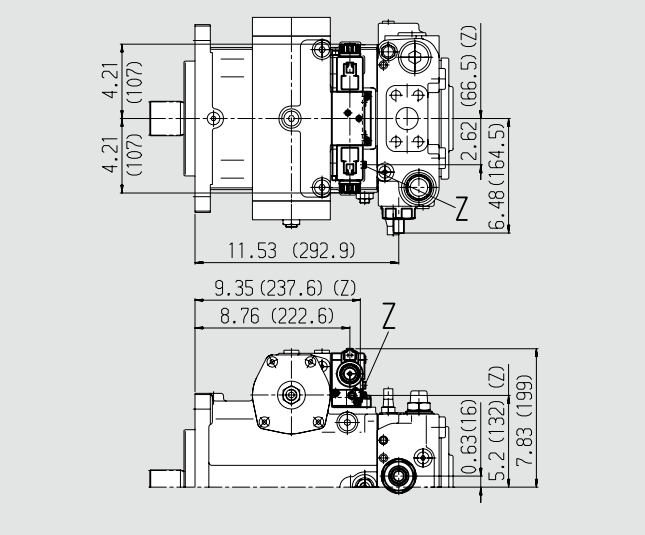
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Hydraulic control, speed related, DA

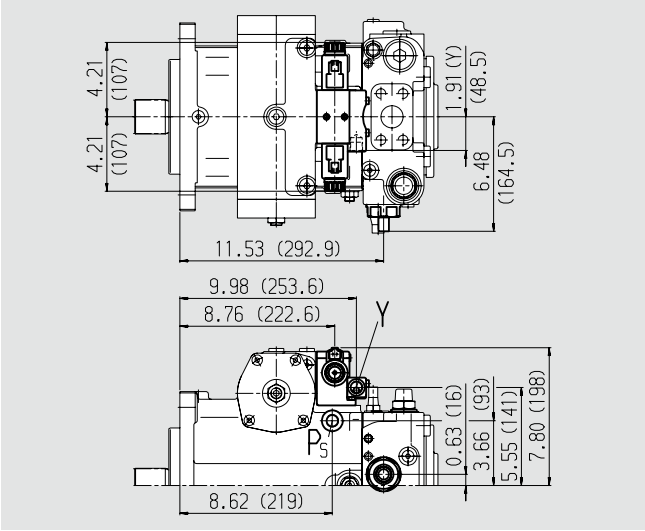
Control valve, fixed setting, DA2



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



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



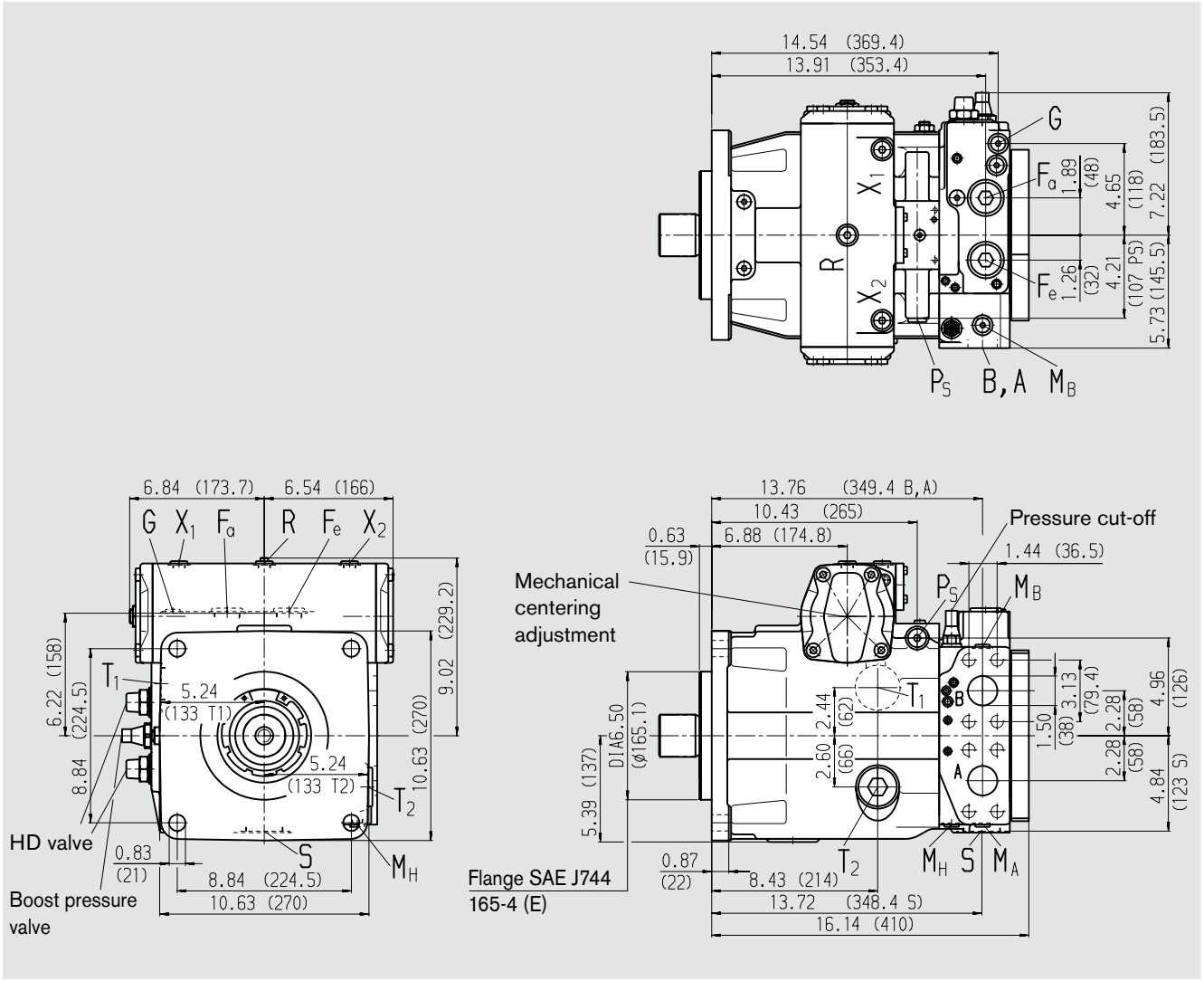
Unit Dimensions, Size 250

Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Version without control unit NV

Standard: suction port S at bottom (60)

Option: suction port S at top (63): port plate turned through 180°

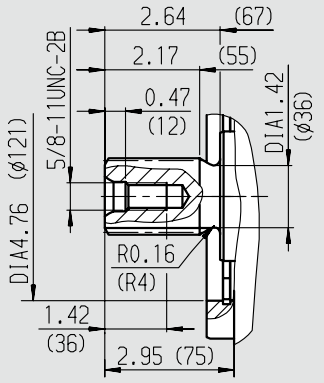


Unit Dimensions, Size 250

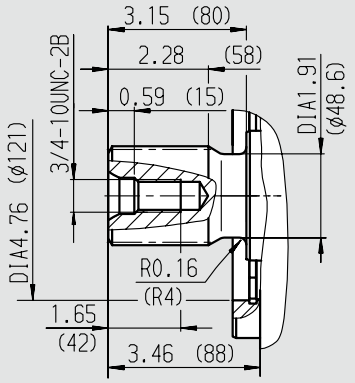
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Shaft ends

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



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



Ports

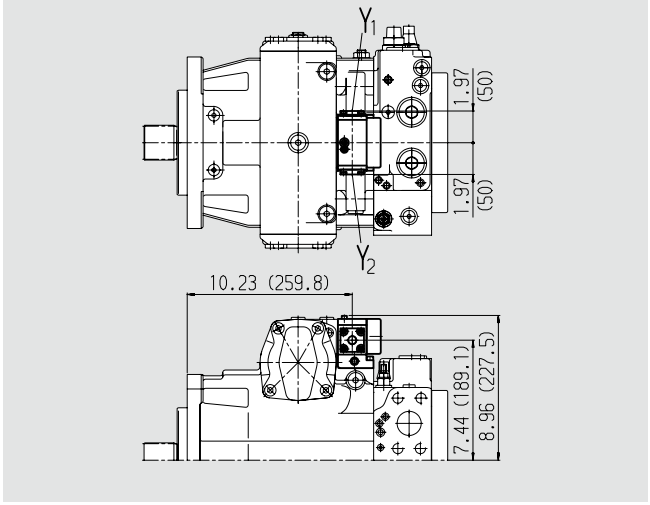
A, B	service line ports (high-pressure series)	SAE J518	1 1/2 in	
	fixing thread A/B	ISO 68	5/8 in -11 UNC-2B; 0.83 (21) deep [2])	
T_1	case drain or fill	ISO 11926	1 5/8 in -12 UN-2B; 0.79 (20) deep	710 lb-ft (960 Nm) [2])
T_2	case drain [3])	ISO 11926	1 5/8 in -12 UN-2B; 0.79 (20) deep	710 lb-ft (960 Nm) [2])
M_A, M_B	pressure gauge - operating pressure A, B [3])	ISO 11926	9/16 in -18 UNF-2B; 0.51 (13) deep	60 lb-ft (80 Nm) [2])
R	air bleed [3])	ISO 11926	9/16 in -18 UNF-2B; 0.79 (20) deep	60 lb-ft (80 Nm) [2])
S	boost suction port	ISO 11926	1 7/8 in -12 UN-2B; 0.79 (20) deep	330 lb-ft (450 Nm) [2])
X_1, X_2	port for control pressures (before orifice) [3])	ISO 11926	9/16 in -18 UNF-2B; 0.51 (13) deep	60 lb-ft (80 Nm) [2])
G	pressure port for auxiliary circuits [3])	ISO 11926	9/16 in -18 UNF-2B; 0.51 (13) deep	60 lb-ft (80 Nm) [2])
P_S	control pressure supply [3])	ISO 11926	3/4 in -16 UNF-2B; 0.47 (12) deep	120 lb-ft (160 Nm) [2])
F_a	filter output [3])	ISO 11926	1 5/16 in -12 UN-2B; 0.79 (20) deep	400 lb-ft (540 Nm) [2])
F_e	filter input [3])	ISO 11926	1 5/16 in -12 UN-2B; 0.79 (20) deep	400 lb-ft (540 Nm) [2])
M_H	port for balanced high pressure [3])	ISO 11926	9/16 in -18 UNF-2B; 0.51 (13) deep	60 lb-ft (80 Nm) [2])
Y_1, Y_2	remote control ports (only HD)	ISO 11926	9/16 in -18 UNF-2B; 0.47 (12) deep	60 lb-ft (80 Nm) [2])
Z	pilot pressure port (only DA4/8) [3])	DIN 3852	M10x1; 0.31 (8) deep	22 lb-ft (30 Nm) [2])
Y	pilot pressure port (only DA7)	ISO 11926	9/16 in -18 UNF-2B; 0.51 (13) deep)	60 lb-ft (80 Nm) [2])

[1]) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
[2]) Please observe the general notes for the max. tightening torques on page 64
[3]) Plugged

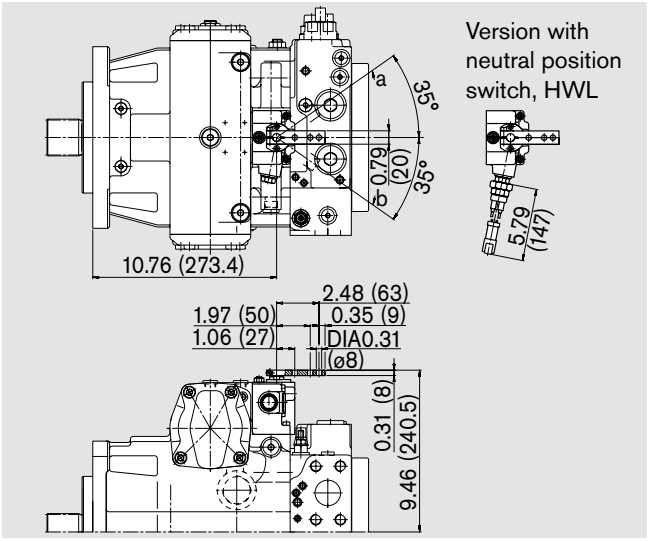
Unit Dimensions, Size 250

Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

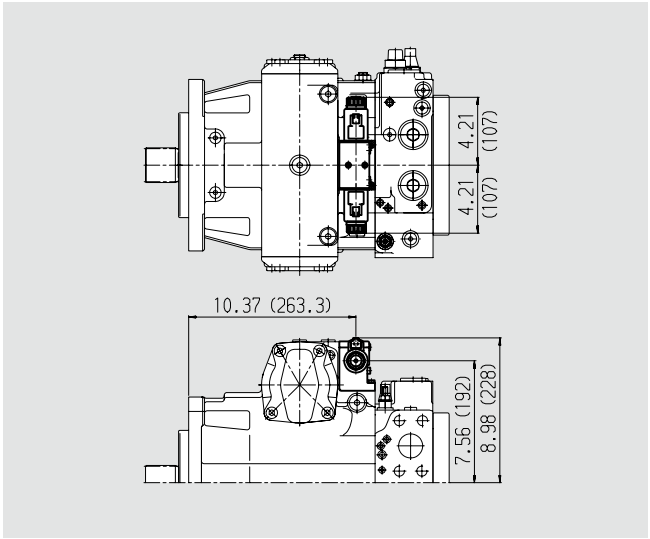
Hydraulic control, pilot-pressure related, HD



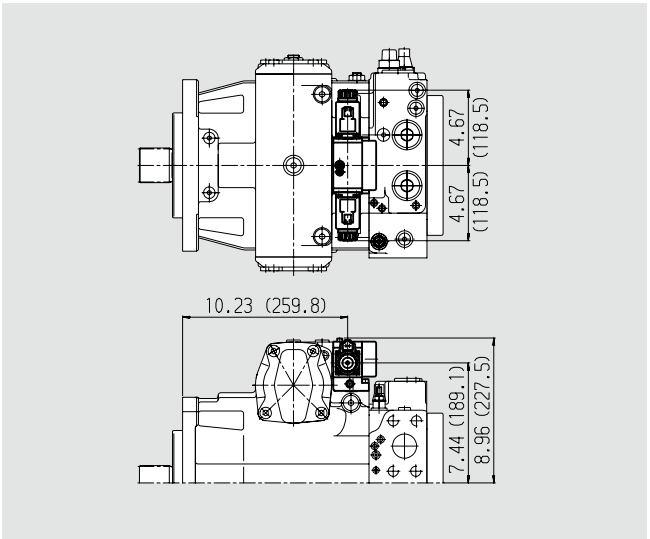
Hydraulic control, mechanical servo, HW



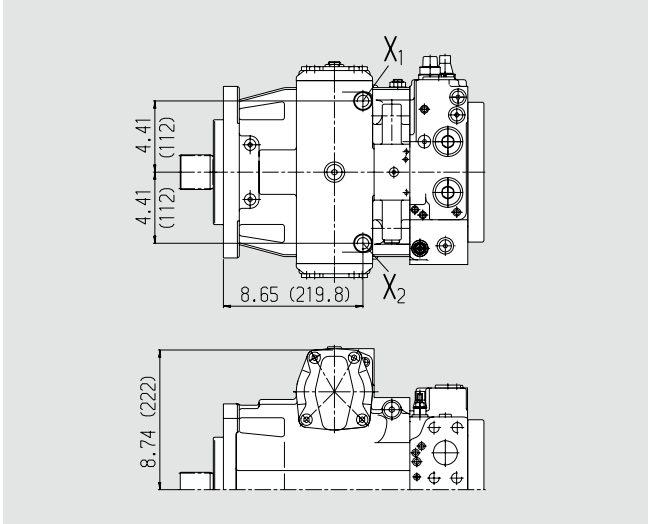
Electric two-point control with switching solenoid, EZ



Electric control with proportional solenoid, EP



Hydraulic control, direct operated, DG

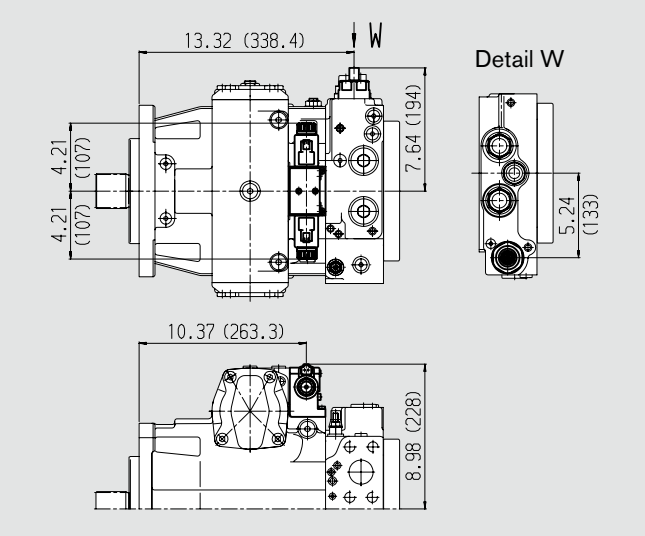


Unit Dimensions, Size 250

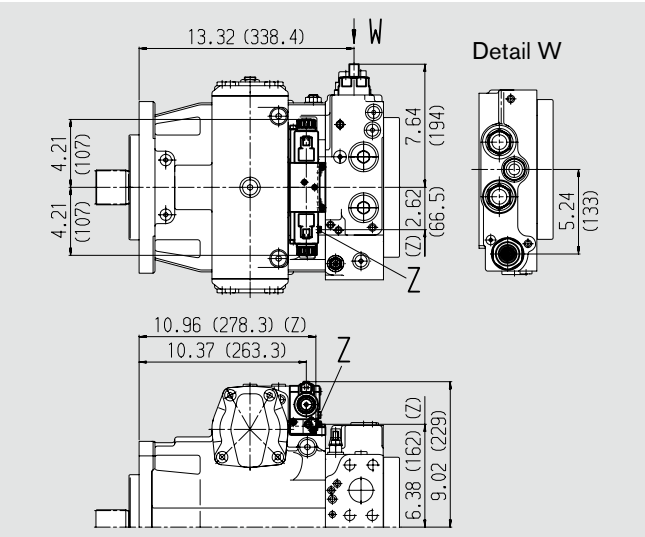
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Hydraulic control, speed related, DA

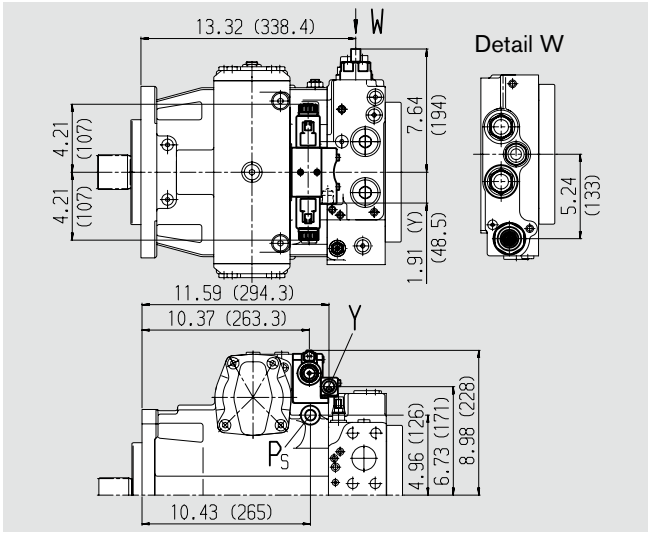
Control valve, fixed setting, DA2



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



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

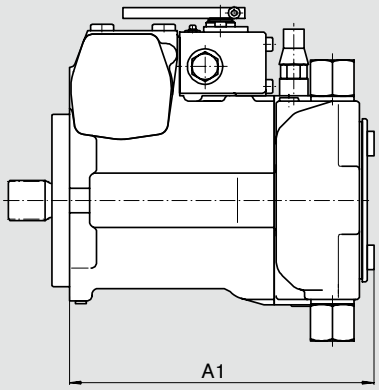


Through Drive Dimensions

Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

N00 **Without boost pump, without through drive**

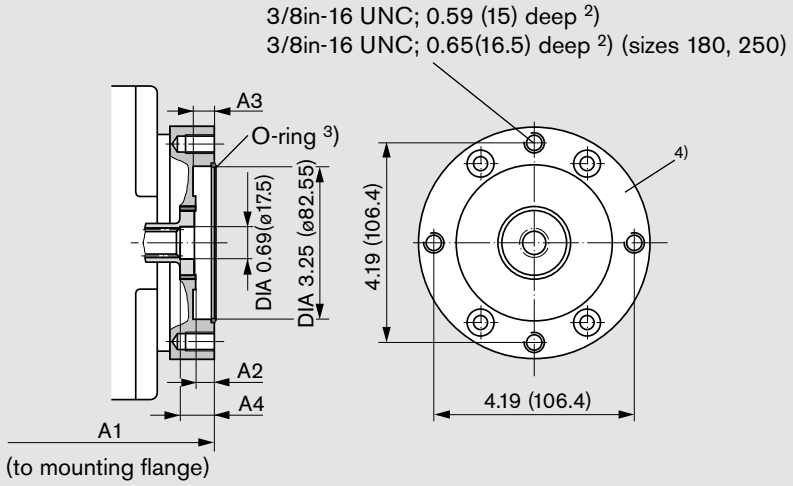
F00 **With boost pump, without through drive**



Size	A1 (N00)	A1 (F00)
28	8.42 (213.9)	8.8 (223.4)
40	8.67 (220.2)	9.28 (235.7)
56	9.43 (239.4)	10.09 (256.4)
71	10.99 (279.1)	11.56 (293.6)
90	11.30 (287.0)	11.85 (301.0)
125	12.63 (320.9)	12.85 (326.4)
180	14.60 (370.9)	14.60 (370.9)
250	15.68 (398.2)	16.10 (409.0)

F01/K01 **Flange** SAE J744 – 82-2 (A)

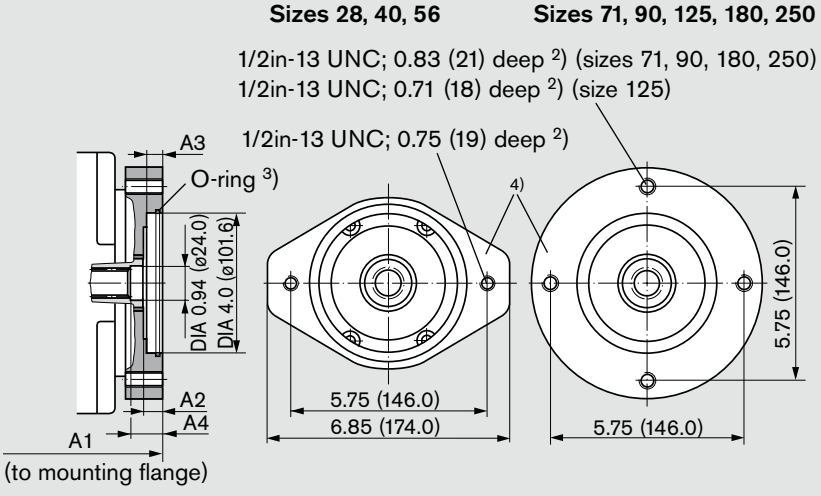
Hub for splined shaft according to ANSI B92.1a-1976 5/8 in 9T 16/32DP [1] (SAE J744 – 16-4 (A))



Size	A1 (F01)	A1 (K01)	A2	A3	A4
28	8.97	8.97	0.30	0.30	0.57
	(227.9)	(227.9)	(7.5)	(7.5)	(14.5)
40	9.44	9.22	0.35	0.35	0.71
	(239.7)	(234.2)	(9.0)	(9.0)	(18.0)
56	10.29	10.04	0.39	0.39	0.71
	(261.4)	(254.9)	(10.0)	(10.0)	(18.0)
71	11.72	11.72	0.35	0.39	0.67
	(297.6)	(297.6)	(9.0)	(10.0)	(17.0)
90	11.97	11.97	0.35	0.31	–
	(304.0)	(304.0)	(9.0)	(8.0)	–
125	13.03	13.03	0.41	0.35	–
	(330.9)	(330.9)	(10.5)	(9.0)	–
180	14.90	14.90	0.30	0.30	0.61
	(378.4)	(378.4)	(7.5)	(7.5)	(15.5)
250	16.81	16.78	0.43	0.43	0.71
	(426.9)	(426.2)	(11.0)	(11.0)	(18.0)

F02/K02 **Flange** SAE J744 – 101-2 (B)

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



Size	A1	A2	A3	A4
28	9.07	0.38	0.38	0.64
	(230.4)	(9.7)	(9.7)	(16.2)
40	9.48	0.43	0.43	0.67
	(240.7)	(11.0)	(11.0)	(17.0)
56	10.33	0.47	0.43	0.77
	(262.4)	(12.0)	(11.0)	(19.5)
71	11.83	0.51	0.39	0.67
	(300.6)	(13.0)	(9.8)	(17.0)
90	12.01	0.35	0.43	0.67
	(305)	(9.0)	(11.0)	(17.0)
125	13.03	0.39	0.43	0.67
	(330.9)	(10.0)	(11.0)	(17.0)
180	15.02	0.43	0.43	0.75
	(381.4)	(11.0)	(11.0)	(19.0)
250	16.89	0.43	0.43	0.63
	(428.9)	(11.0)	(11.0)	(16.0)

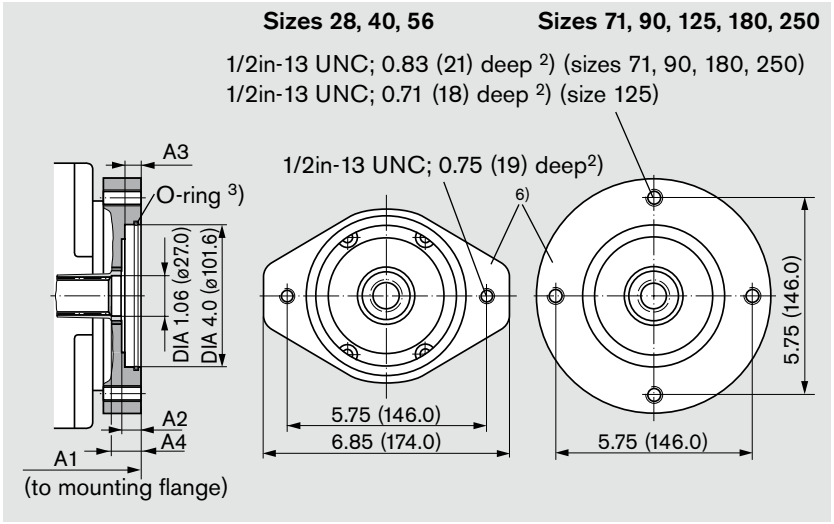
[1] 30° pressure angle, flat root; side fit, tolerance class 5
[2] Thread acc. to ISO 68, please observe the general notes for the max. tightening torques on page 64
[3] O-ring included in supply
[4] Shown is the 2-bolt version. Please specify in plain text whether the 2-bolt horizontal or 2-bolt vertical version is used.

Through Drive Dimensions

Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

F04/K04 **Flange** SAE J744 – 101-2 (B)

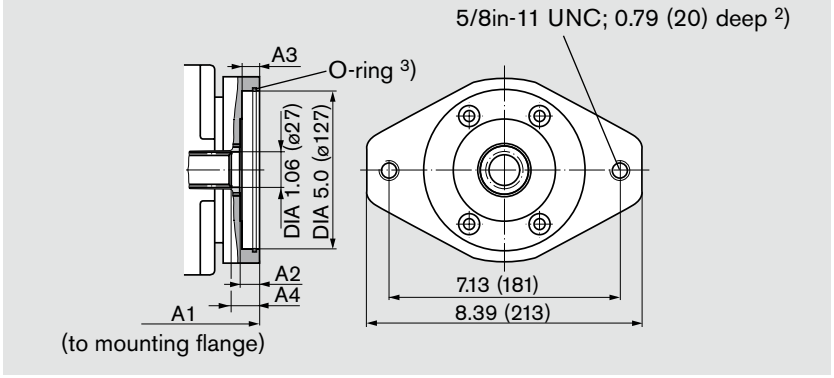
Hub for splined shaft according to ANSI B92.1a-1976 1 in 15T 16/32DP [1] (SAE J744 – 25-4 (B-B))



Size	A1	A2	A3	A4
28	9.07	0.38	0.38	0.54
	(230.4)	(9.7)	(9.7)	(13.7)
40	9.48	0.43	0.38	0.63
	(240.7)	(11.0)	(9.7)	(16.0)
56	10.33	0.51	0.43	0.73
	(262.4)	(13.0)	(11.0)	(18.5)
71	11.83	0.51	0.39	0.61
	(300.6)	(13.0)	(9.8)	(15.5)
90	12.01	0.35	0.43	0.59
	(305.0)	(9.0)	(11.0)	(15.0)
125	13.03	0.39	0.43	0.65
	(330.9)	(10.0)	(11.0)	(16.5)
180	15.02	0.43	0.43	0.71
	(381.4)	(11.0)	(11.0)	(18.0)
250	16.89	0.43	0.43	0.61
	(428.9)	(11.0)	(11.0)	(15.5)

F09/K09 **Flange** SAE J744 – 127-2 (C)

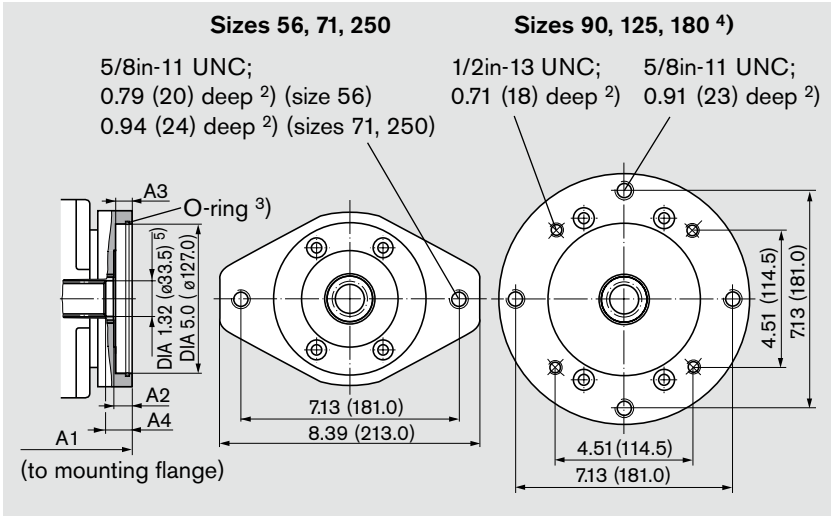
Hub for splined shaft according to ANSI B92.1a-1976 1 in 15T 16/32DP [1] (SAE J744 – 25-4 (B-B))



Size	A1	A2	A3	A4
40	9.63	0.55	0.55	0.77
	(244.7)	(14.0)	(14.0)	(19.5)

F07/K07 **Flange** SAE J744 – 127-2 (C)

Hub for splined shaft according to ANSI B92.1a-1976 1 1/4 in 14T 12/24DP [1] (SAE J744 – 32-4 (C))



Size	A1	A2	A3	A4
56	10.49	0.59	0.55	0.69
	(266.4)	(15.0)	(14.0)	(17.5)
71	11.95	0.59	0.53	0.79
	(303.6)	(15.0)	(13.5)	(20.0)
90	12.17	0.51	0.55	0.81
	(309.0)	(13.0)	(14.0)	(20.5)
125	13.22	0.59	0.61	0.89
	(335.9)	(15.0)	(15.5)	(22.5)
180	15.13	0.55	0.75	0.67
	(384.4)	(14.0)	(19.0)	(17.0)
250	16.77	0.63	0.55	0.63
	(425.9)	(16.0)	(14.0)	(16.0)

Shown is the 4-bolt and 2-bolt version. Please specify in plain text whether the 4-bolt, 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 ISO 68, Please observe the general notes for the max. tightening torques on page 64
[3] O-ring included in supply
[4] Size 180 only with SAE 2-bolt flange
[5] Size 56: DIA 1.29 (ø32.7)
[6] Shown is the 2-bolt version. Please specify in plain text whether the 2-bolt horizontal or 2-bolt vertical version is used.

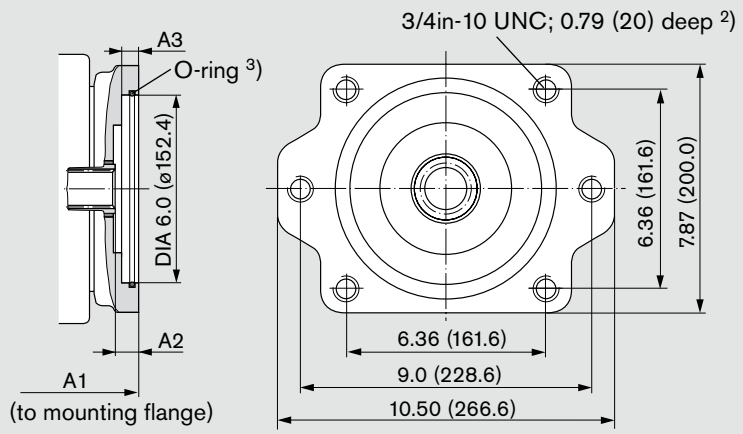
Through Drive Dimensions

Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

F90/K90

Flange SAE J744 – 152-2/4 (D)

Hub for splined shaft according to ANSI B92.1a-1976 1 1/4 in 14T 12/24DP [1] (SAE J744 – 32-4 (C)



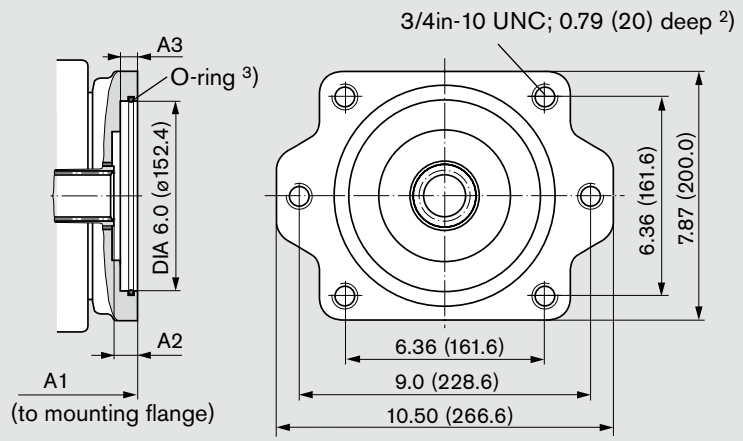
Size	A1	A2	A3
90	12.17	0.47	0.55
	(309.0)	(12.0)	(14.0)

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 8/16DP [1] (SAE J744 – 44-4 (D))



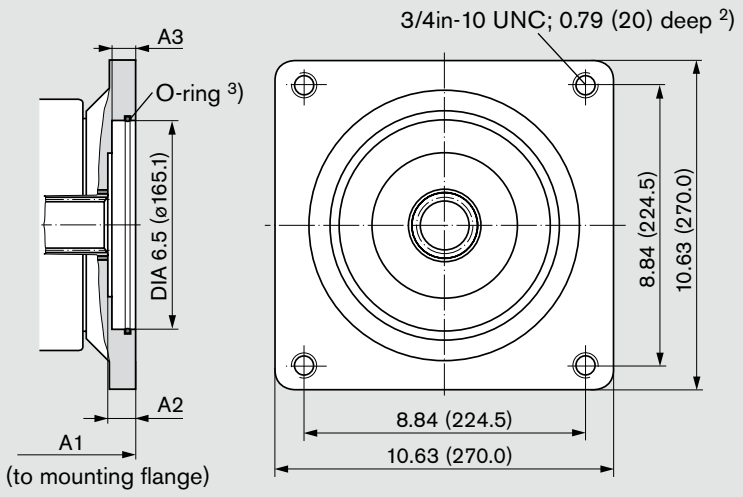
Size	A1	A2	A3
125	13.54	0.71	0.55
	(343.9)	(18.0)	(14.0)
180	15.43	0.82	0.71
	(391.9)	(20.9)	(18.0)
250	17.52	0.35	0.67
	(444.9)	(9.0)	(17.0)

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 8/16DP [1] (SAE J744 – 44-4 (D))



Size	A1	A2	A3
180	15.43	0.82	0.71
	(391.9)	(20.9)	(18)
250	17.52	0.35	0.67
	(444.9)	(9)	(17)

[1] 30° pressure angle, flat root, side fit, tolerance class 5
[2] Thread acc. to ISO 68, please observe the general notes for the max. tightening torques on page 64
[3] O-ring included in supply

Overview of Attachments on AA4VG

Through drive – AA4VG										Through drive
Flange	Hub for splined shaft	Code	AA4VG Size (shaft)	AA10V(S)O/31 Size (shaft)	A10V(S)O/53 Size (shaft)	A4FO Size (shaft)	AA11VO Size (shaft)	AA10VG 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) 45 (U)	28 (S,R) 45 (U,W)	16 (S) 22 (S) 28 (S)	–	18 (S)	Size N Size 20-32 [1] Size G Size 38-45 [1]	28...250
	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)	1 1/4 in	**F/K90**	90 (U)	–	–	–	–	–	–	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 AA4VG + AA4VG

Overall length A

AA4VG (1st pump)		**AA4VG (2nd pump) [1]**							
		Size 28	**Size 40**	**Size 56**	**Size 71**	**Size 90**	**Size 125**	**Size 180**	**Size 250**
Size 28	in	17.87							
	mm	(453.8)	–	–	–	–	–	–	–
Size 40	in	18.27	18.91						
	mm	(464.1)	(480.4)	–	–	–	–	–	–
Size 56	in	19.13	19.77	20.58					
	mm	(485.8)	(502.1)	(522.8)	–	–	–	–	–
Size 71	in	20.63	21.23	22.05	23.51				
	mm	(524.0)	(539.3)	(560.0)	(597.2)	–	–	–	–
Size 90	in	20.80	21.44	22.26	23.72	24.02			
	mm	(528.4)	(544.7)	(565.4)	(602.6)	(610.0)	–	–	–
Size 125	in	21.82	22.50	23.32	24.78	25.39	26.39		
	mm	(554.3)	(571.6)	(592.3)	(629.5)	(644.9)	(670.3)	–	–
Size 180	in	23.81	24.41	25.23	26.69	27.28	28.28	30.03	
	mm	(604.8)	(620.1)	(640.8)	(678.0)	(692.9)	(718.3)	(762.8)	–
Size 250	in	25.68	26.05	26.86	28.33	29.37	30.37	32.19	33.65
	mm	(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 "**+**".

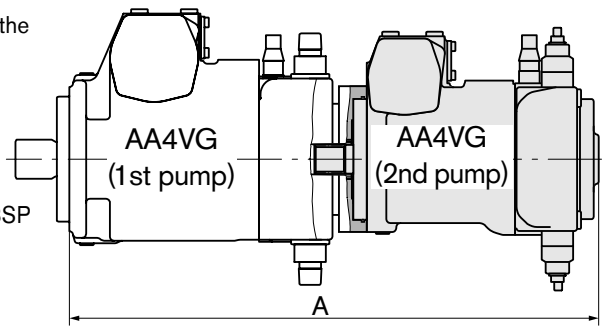
Example of order:

AA4VG56EP3D1/32R-N**T**C52**F07**3SP + AA4VG56EP3D1/32R-N**S**C52F003SP

A tandem pump combined of two equal sizes is permissible without additional supports where the dynamic acceleration does not exceed max. 0.022 lbs (= 322 ft/s^2) {10 *g* (= 98.1 m/s^2)}.

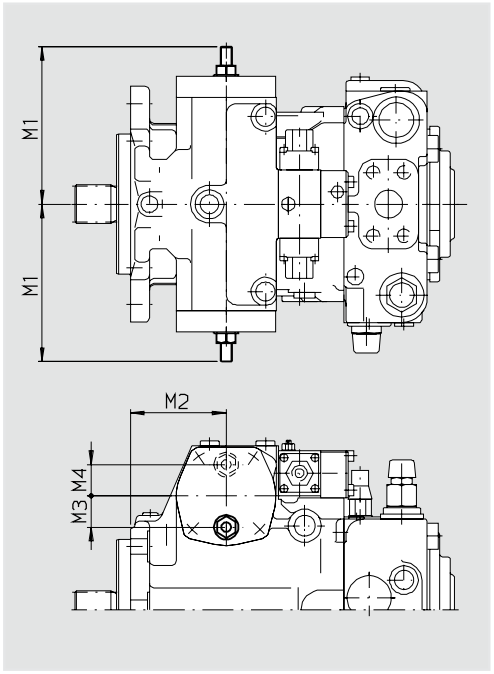
We recommend the use of 4-bolt mounting flanges from size 71 and larger.

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



Mechanical Stroke Limiter, M

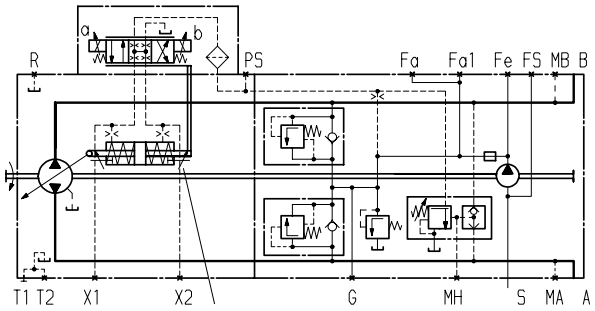
The mechanical stroke limiter is an additional function allowing continuous reduction of the maximum displacement of the pump, regardless of the control unit used. The stroke of the stroke cylinder and hence the maximum swivel angle of the pump are limited by means of two adjusting screws.



Dimensions

Size	M1 max.	M2	M3	M4
28	4.35 (110.6)	1.58 (40.1)	0.94 (24.0)	–
40	4.35 (110.6)	1.50 (38.1)	0.94 (24.0)	–
56	5.14 (130.5)	1.73 (44.0)	1.00 (25.5)	–
71	5.33 (135.4)	3.40 (86.3)	–	1.12 (28.5)
90	5.79 (147.0)	3.77 (95.7)	1.24 (31.5)	–
125	6.38 (162.0)	4.11 (104.5)	–	1.40 (35.5)
180	7.15 (181.6)	5.46 (138.7)	1.50 (38.0)	–
250	7.83 (198.9)	6.88 (174.8)	1.56 (39.5)	–

Circuit diagram [1])

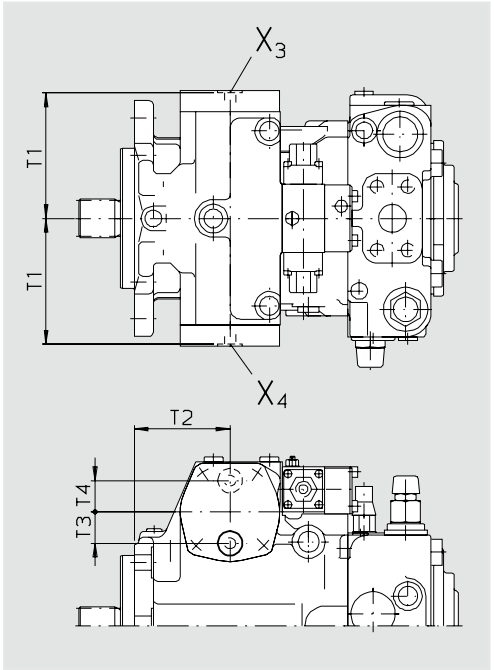


Mechanical stroke limiter, M

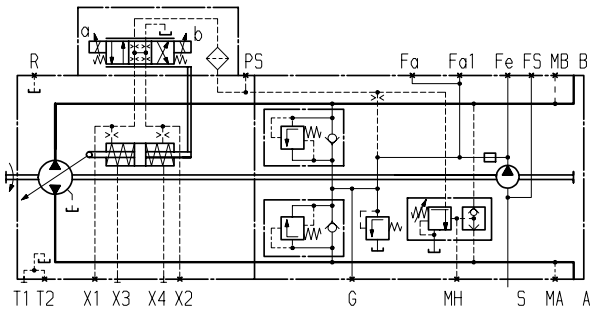
Ports X_3 and X_4 for Positioning Pressure, T

Dimensions

Size	T1	T2	T3	T4	X_3, X_4
28	3.62 (92.0)	1.58 (40.1)	–	0.94 (24.0)	7/16in-20 UNF-2B
40	3.62 (92.0)	1.50 (38.1)	–	0.94 (24.0)	7/16in-20 UNF-2B
56	4.11 (104.5)	1.73 (44.0)	–	0.98 (25.0)	7/16in-20 UNF-2B
71	4.47 (113.5)	3.40 (86.3)	1.10(28.0)	–	7/16in-20 UNF-2B
90	4.39 (111.5)	3.77 (95.7)	–	1.18 (30.0)	7/16in-20 UNF-2B
125	5.35 (136.0)	4.11 (104.5)	1.34 (34.0)	–	7/16in-20 UNF-2B
180	5.77 (146.5)	5.46 (138.7)	–	1.38 (35.0)	7/16in-20 UNF-2B
250	6.48 (164.5)	6.88 (174.8)	–	1.50 (38.0)	9/16in-18 UNF-2B



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 $\nu = 140$ SUS, $n = n_{max}$ _____ $\Delta p \leq 1.5$ psi
($30\ mm^2/s$, $n = n_{max}$ _____ $\Delta p \leq 0.1$ bar)

at $\nu = 4600$ SUS, $n = n_{max}$ _____ $\Delta p \leq 4.5$ psi
($1000\ mm^2/s$, $n = n_{max}$ _____ $\Delta p \leq 0.3$ bar)

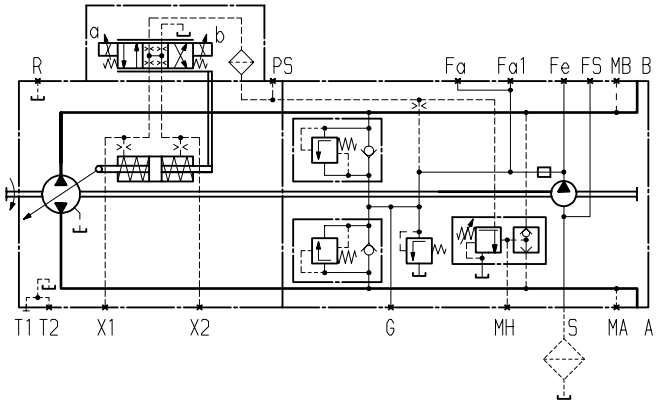
Pressure at port S of the boost pump:

at $\nu = 140$ SUS _____ $p \geq 12$ psi
($30\ mm^2/s$ _____ $p \geq 0.8$ bar)

at cold start $\nu = 7400$ SUS, $n \leq 1000$ rpm _____ $p \geq 7.5$ psi
($\nu = 1600\ mm^2/s$, $n \leq 1000$ rpm) _ $p \geq 0.5$ 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...).

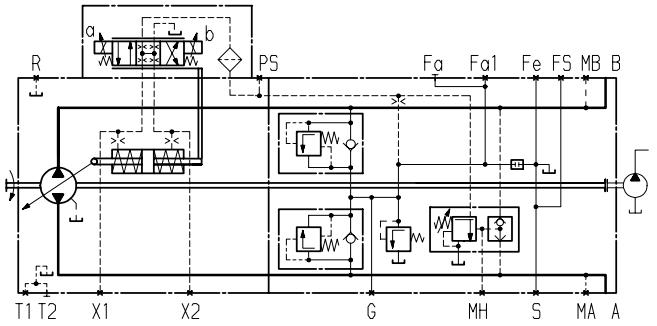
Port S is plugged.

Supply comes from port F_a.

Filter arrangement: _____ separate

For functional reliability ensure required cleanliness level for the boost pressure fluid at port F_a (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 F_e
Filter output: Port F_a
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)

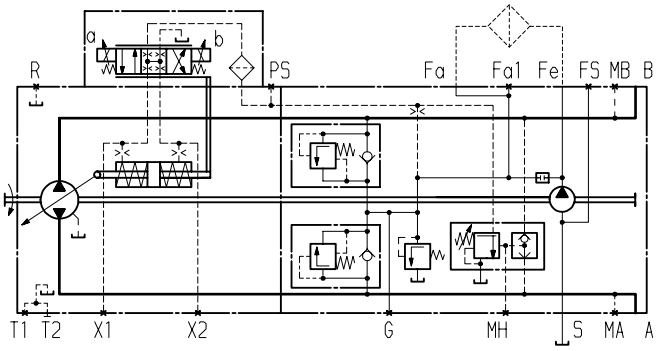
Flow resistance at the filter element:

at $\nu = 140$ SUS ($30\ mm^2/s$) _____ $\Delta p \leq 15$ psi (1 bar)

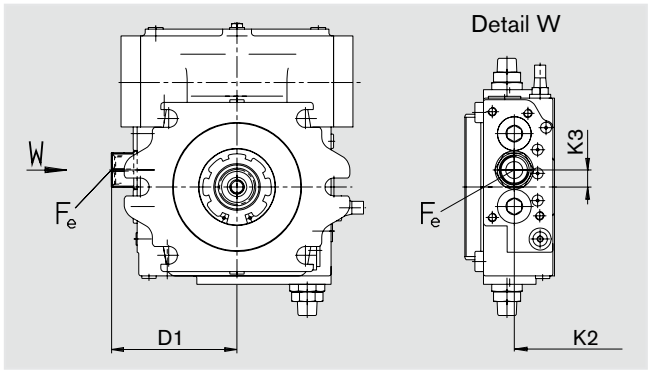
for cold start _____ $\Delta p \leq 45$ psi (3 bar)
(valid for entire speed range $n_{min} - n_{max}$)

Filter is not included in supply.

Circuit diagram variation D



Dimensions variation D



Size	D1[1)]	F_e[2)]	
28	see page 18	3/4in-16 UNF-2B	0.59 (15) deep
40	4.49 (113)	3/4in-16 UNF-2B	0.59 (15) deep
56	4.57 (116)	3/4in-16 UNF-2B	0.59 (15) deep
71	5.27 (133.9)	1 1/16in-12 UN	0.63 (16) deep
90	5.04 (128)	1 1/16in-12 UN	0.63 (16) deep
125	5.83 (148)	1 5/16in-12 UN-2B	0.71 (18) deep
180	5.87 (149)	1 5/16in-12 UN-2B	0.71 (18) deep
250	see page 46	1 5/16in-12 UN-2B	0.79 (20) deep

[1)] Dimensions of K2 and K3 see page 56 variation K
[2)] ISO 11926, tightening torque T_{max} see page 56 variation K

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 $\Delta p \geq 90$ psi (6 bar).

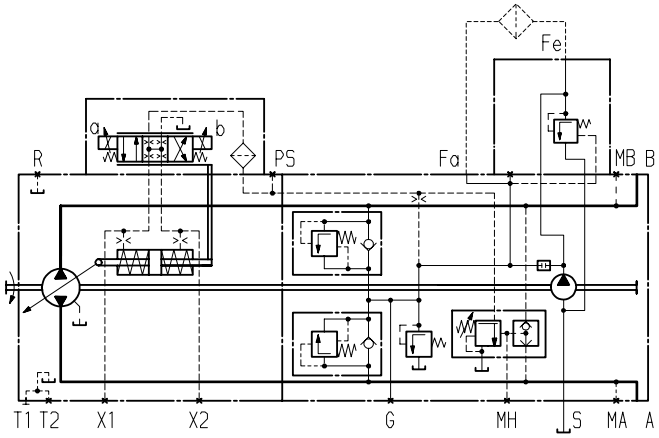
Port F_e : Filter input (at the cold start valve)

Port F_a : Filter output

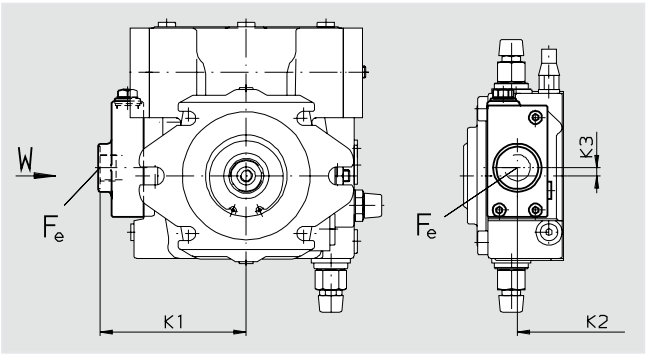
Filter arrangement _____ separately in the pressure line (line filter)

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	4.82	7.82	0	3/4in-16 UNF-2B	120 lb-ft
	(122.5)	(198.7)	(0)	0.59 (15) deep	(160 Nm)
56	4.94	8.48	0	3/4in-16 UNF-2B	120 lb-ft
	(125.5)	(215.4)	(0)	0.59 (15) deep	(160 Nm)
71	5.73	9.41	0.31	1 1/16in-12 UN	265 lb-ft
	(145.5)	(239.0)	(8)	0.63 (16) deep	(360 Nm)
90	5.49	9.78	0.94	1 1/16in-12 UN	265 lb-ft
	(139.5)	(248.5)	(24)	0.63 (16) deep	(360 Nm)
125	6.77	10.55	0.79	1 5/16in-12 UN-2B	400 lb-ft
	(172.0)	(267.9)	(20)	0.71 (18) deep	(540 Nm)
180	6.81	12.28	0.12	1 5/16in-12 UN-2B	400 lb-ft
	(173.0)	(311.9)	(3)	0.71 (18) deep	(540 Nm)

[1]) ISO 11926

[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 _____ 1450 psi (100 bar)

Filter arrangement _____ connected to pump

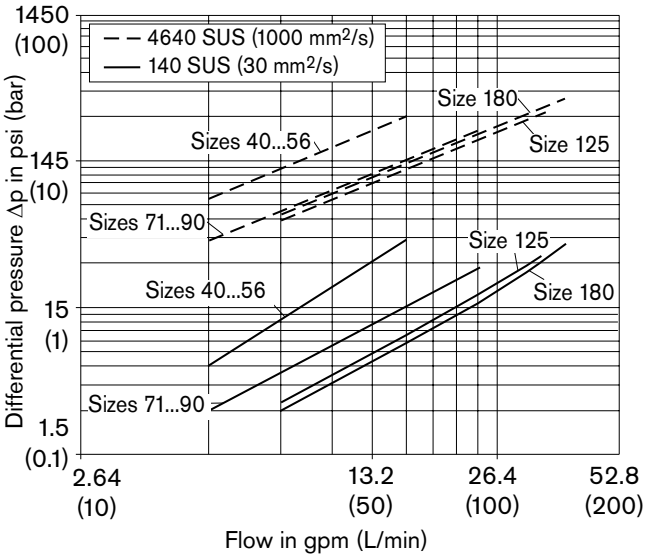
Note:

– Port plate is equipped with cold start valve and therefore protects the pump from damage.
The valve opens at flow resistance $\Delta p \geq 90$ psi (6 bar).

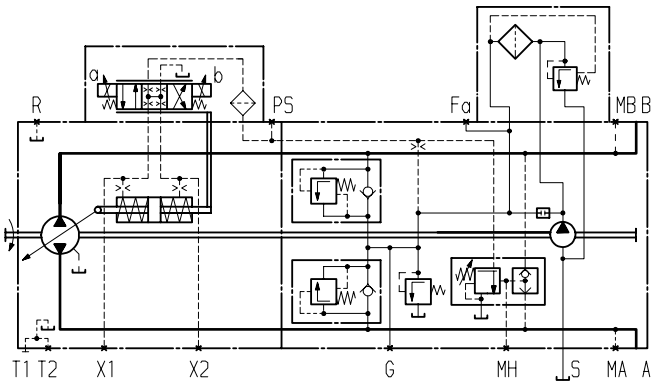
Recommendation: **with** contamination indicator (variation P, L, M, B)
(differential pressure $\Delta p = 75$ psi / 5 bar)

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

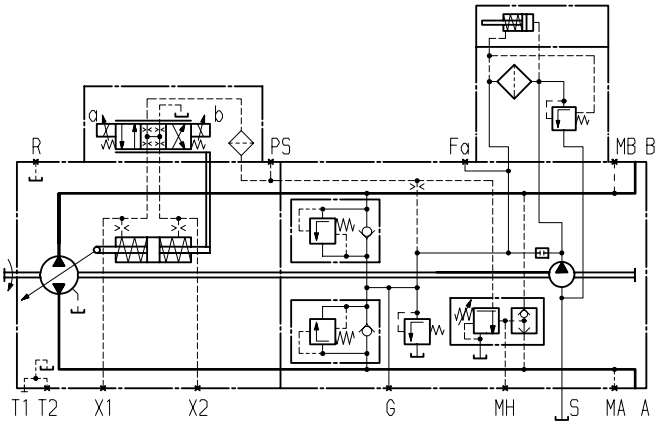
Variation:
Filtration in pressure line of the boost pump, filter mounted, supplied, with visual contamination indicator, P

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

Indication: green/red window

Differential pressure (switching pressure) Δp = 75 psi (5 bar)

Circuit diagram variation P



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

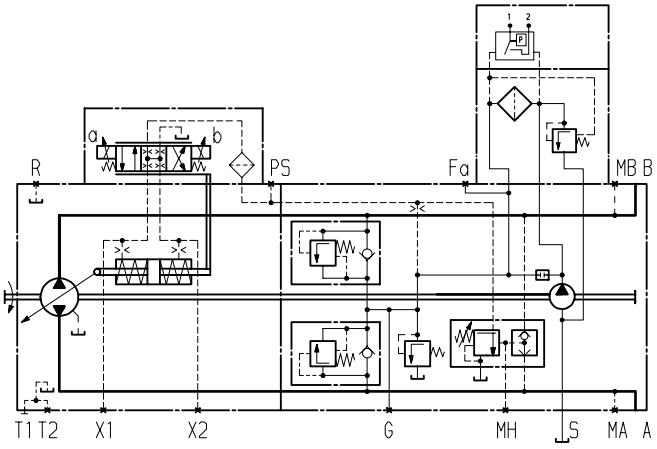
Version similar to variation F, however additionally with electrical contamination indicator.

Indication: electrical

Differential pressure (switching pressure) Δp = 75 psi (5 bar)

Max. switching power at 24 V DC _____ 60 W

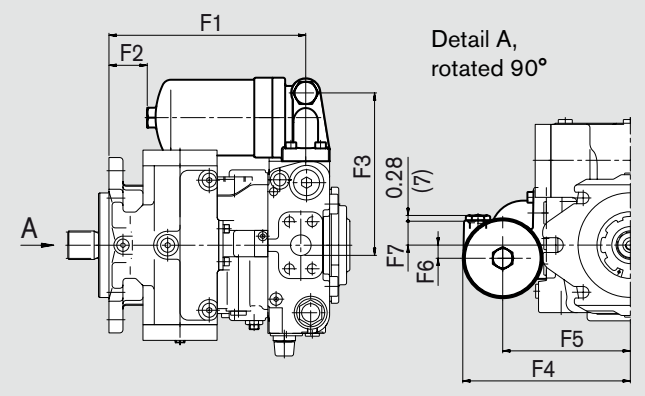
Circuit diagram variation B



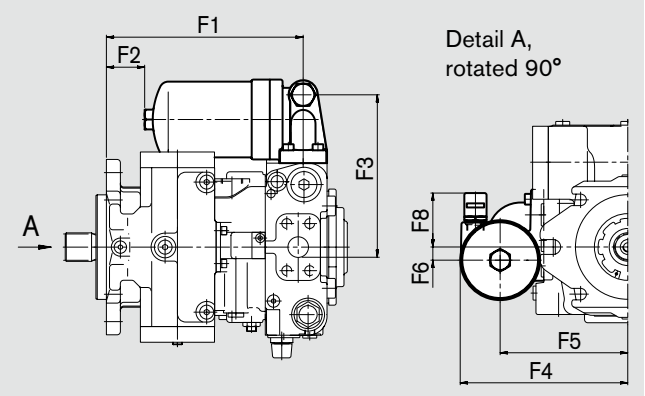
Filtration Types

Dimensions with mountable filter

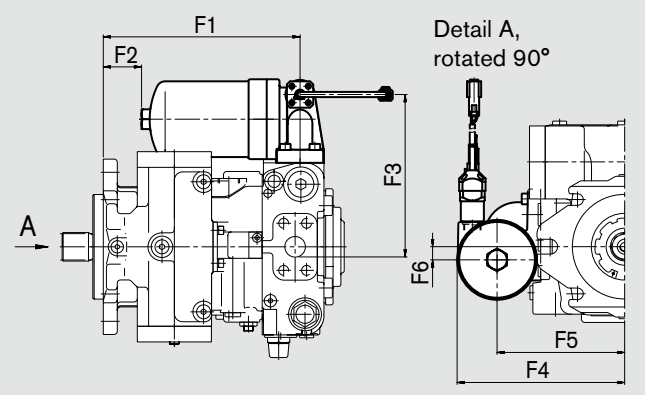
Variation F



Variation P: viewing window



Variation B: electr. signal with DEUTSCH connector



Size	F1	F2	F3	F4	F5	F6	F7	F8
40	7.94	1.88	6.30	6.89	5.31	0	1.65	3.09
	(201.7)	(47.7)	(160)	(175)	(135)	(0)	(42)	(78.5)
56	8.60	2.54	6.42	7.01	5.43	0	1.65	3.09
	(218.4)	(64.4)	(163)	(178)	(138)	(0)	(42)	(78.5)
71	9.41	1.83	7.28	8.01	6.01	0.63	1.14	2.58
	(239)	(46.5)	(185)	(203.5)	(155)	(16)	(29)	(65.5)
90	9.78	2.20	7.05	7.78	5.87	0	1.77	3.21
	(248.5)	(56)	(179)	(197.5)	(149)	(0)	(45)	(81.5)
125	9.29	2.34	7.91	8.64	6.73	0	2.09	3.52
	(235.9)	(59.4)	(201)	(219.5)	(171)	(0)	(53)	(89.5)
180	11.02	1.59	7.95	8.68	6.77	0.67	1.42	2.85
	(279.9)	(40.3)	(202)	(220.4)	(171.9)	(17)	(36)	(72.5)

Swivel Angle Indicator

Electrical 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).

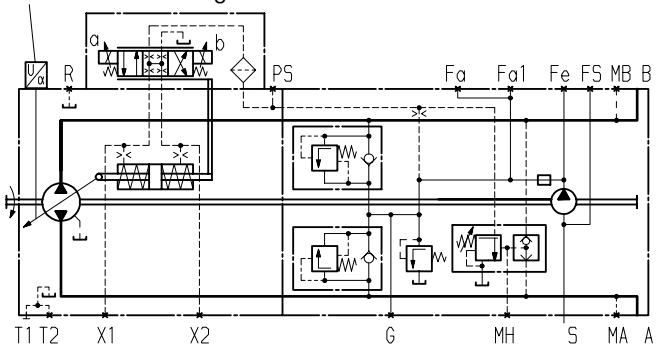
Technical Data			
Supply voltage U_b	10...30 V DC		
Output voltage U_a	0,5 V ($V_{g\ max\ a}$)	2,5 V ($V_{g\ 0}$)	4,5 V ($V_{g\ max\ b}$)
Reserve-connect protection	Short circuit-resistant		
EMC resistance	Details on request		
Operating temperature range	-40 °F...+257 °F (-40 °C...+125 °C)		
Vibration resistance sinusoidal vibration EN 60068-2-6	10*g* / 5...2000 Hz		
Shock resistance: continuous shock IEC 68-2-29	25*g*		
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}	Output voltage 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

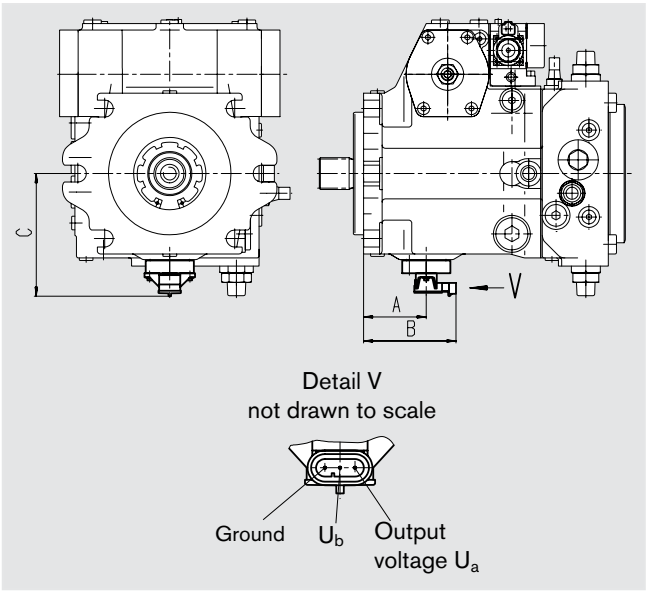
Circuit diagram

Electrical swivel angle sensor



Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Dimensions



Size	A	B	C
28	2.23 (56.6)	3.70 (94.0)	4.69 (119.0)
40	2.31 (58.6)	3.78 (96.0)	4.69 (119.0)
56	2.39 (60.5)	3.84 (97.5)	5.06 (128.5)
71	2.82 (71.6)	4.28 (108.6)	5.41 (137.5)
90	2.78 (70.7)	4.24 (107.7)	5.73 (145.5)
125	3.07 (78.0)	4.53 (115.0)	6.00 (152.5)
180	3.96 (100.7)	5.42 (137.7)	6.04 (153.5)
250	4.14 (105.1)	5.59 (142.1)	7.11 (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 0.07 - 0.13 in (1.8 - 3.3 mm)	183025-1

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**

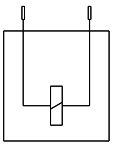
Molded, with bi-directional suppressor diode
(only for switching solenoids on control unit EZ1/2, DA) **____Q**

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

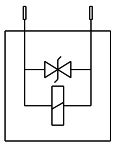
The protection circuit with a bi-directional suppressor diode is necessary for limiting overvoltages. Overvoltages are generated by disconnecting the current using switches, relay contacts or by unplugging an energized mating connector.

Circuit symbol

without bi-directional suppressor diode



with bi-directional suppressor diode

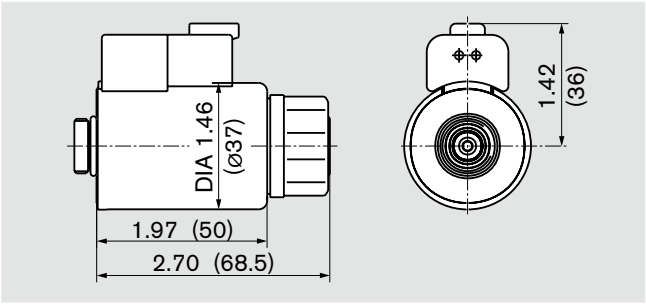


Mating connector

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.



HIRSCHMANN DIN EN 175 301-803-A /ISO 4400

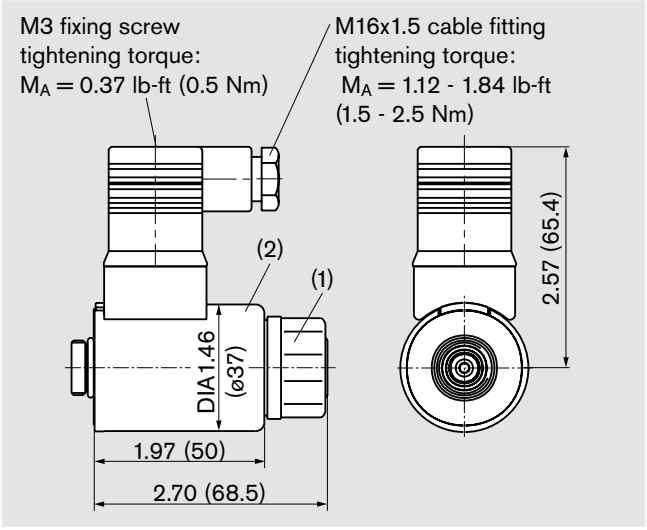
(not for new projects)

without bi-directional suppressor diode **_____H**

Type of protection according to DIN/EN 60529: IP65

The seal ring in the cable fitting is suitable for line diameters from 0.18 in to 0.39 in (4.5 mm to 10 mm).

The HIRSCHMANN connector is included in supply for the pump.



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: $3.69^{+0.74}$ lb-ft (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.

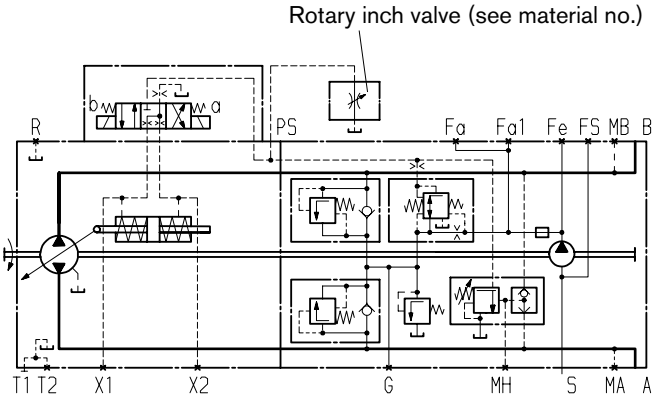
The valve is mounted separately from the pump and connected with a pump by the hydraulic control line at port P_S (max. line length approximately 6.5 ft / 2 meters).

The rotary inch valve must be ordered separately.

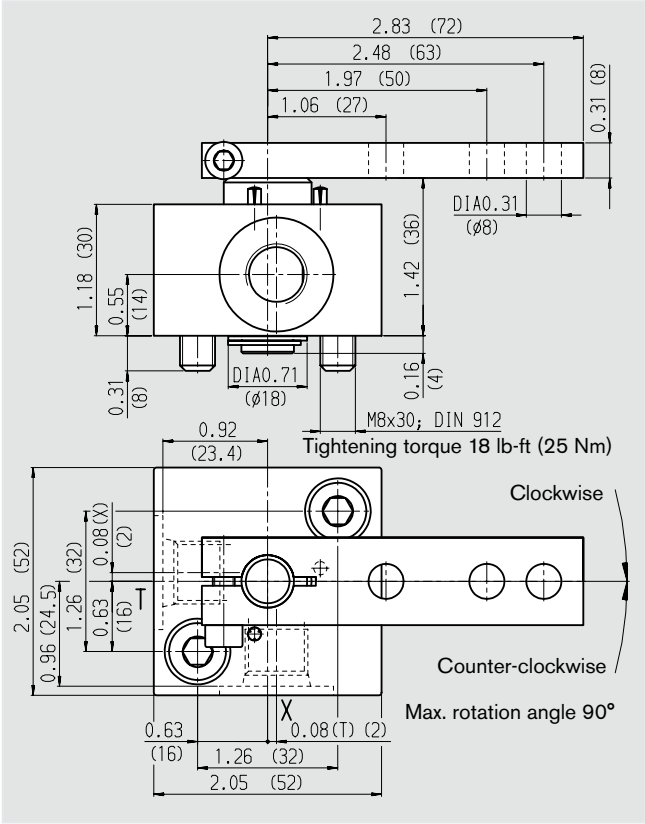
Size	Material no.	Direction of actuation of position lever
28, 40, 56, 71, 90	R902048738 R902048739	clockwise counter-clockwise
125	R902048742 R902048743	clockwise counter-clockwise
180, 250	R902048746 R902048747	clockwise counter-clockwise

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
ISO 11926 — 9/16 in-18 UNF-2B; 0.51 (13 deep) — 60 lb-ft (80 Nm) [1]

T drain tank
ISO 11926 — 9/16 in-18 UNF-2B; 0.51 (13 deep) — 60 lb-ft (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.

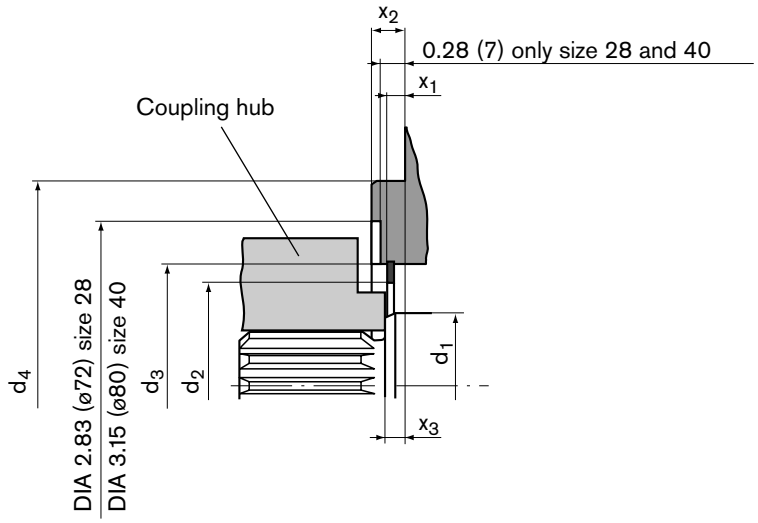
Size 28 and 40 (with free turning):

– SAE and DIN splined shaft
Please observe diameter of the free turning (size 28: DIA 2.83 / ø72, size 40: DIA 3.15 / ø80).

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 $\mathbf{d_2}$ at the zone of the drive shaft collar (measure $x_2 - x_3$).

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



Size	ød1	ød2 min	ød3	ød4	x1	x2	x3
28	1.38	1.71	2.165 ±0.004	4.00	0.130 $^{+0.008}$	0.374 $_{-0.02}$	0.315 $^{+0.035}_{-0.024}$
	(35)	(43.4)	(55 ±0.1)	(101.6)	(3.3 $^{+0.2}$)	(9.5 $_{-0.5}$)	($8^{+0.9}_{-0.6}$)
40	1.57	2.02	2.480 ±0.004	5.00	0.169 $^{+0.008}$	0.500 $_{-0.02}$	0.315 $^{+0.035}_{-0.024}$
	(40)	(51.4)	(63 ±0.1)	(127)	(4.3 $^{+0.2}$)	(12.7 $_{-0.5}$)	($8^{+0.9}_{-0.6}$)
56	1.57	2.14	2.677 ±0.004	5.00	0.276 $^{+0.008}$	0.500 $_{-0.02}$	0.315 $^{+0.035}_{-0.024}$
	(40)	(54.4)	(68 ±0.1)	(127)	(7.0 $^{+0.2}$)	(12.7 $_{-0.5}$)	($8^{+0.9}_{-0.6}$)
71	1.77	2.62	3.189 ±0.004	5.00	0.276 $^{+0.008}$	0.500 $_{-0.02}$	0.315 $^{+0.035}_{-0.024}$
	(45)	(66.5)	(81 ±0.1)	(127)	(7.0 $^{+0.2}$)	(12.7 $_{-0.5}$)	($8^{+0.9}_{-0.6}$)
90	1.97	2.62	3.189 ±0.004	6.00	0.268 $^{+0.008}$	0.500 $_{-0.02}$	0.315 $^{+0.035}_{-0.024}$
	(50)	(66.5)	(81 ±0.1)	(152.4)	(6.8 $^{+0.2}$)	(12.7 $_{-0.5}$)	($8^{+0.9}_{-0.6}$)
125	2.17	3.00	3.583 ±0.004	6.00	0.276 $^{+0.008}$	0.500 $_{-0.02}$	0.315 $^{+0.035}_{-0.024}$
	(55)	(76.3)	(91 ±0.1)	(152.4)	(7.0 $^{+0.2}$)	(12.7 $_{-0.5}$)	($8^{+0.9}_{-0.6}$)
180	2.36	3.46	4.213 ±0.004	6.50	0.291 $^{+0.008}$	0.626 $_{-0.02}$	0.315 $^{+0.035}_{-0.024}$
	(60)	(88)	(107 ±0.1)	(165.1)	(7.4 $^{+0.2}$)	(15.9 $_{-0.5}$)	($8^{+0.9}_{-0.6}$)
250	2.95	4.12	4.76	6.50	0.248 $^{+0.008}$	0.626 $_{-0.02}$	0.315 $^{+0.035}_{-0.024}$
	(75)	(104.6)	(121)	(165.1)	(6.3 $^{+0.2}$)	(15.9 $_{-0.5}$)	($8^{+0.9}_{-0.6}$)

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 12 psi (0.8 bar) abs. (cold start 7.5 psi / 0.5 bar absolute).

In all operating conditions, 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)

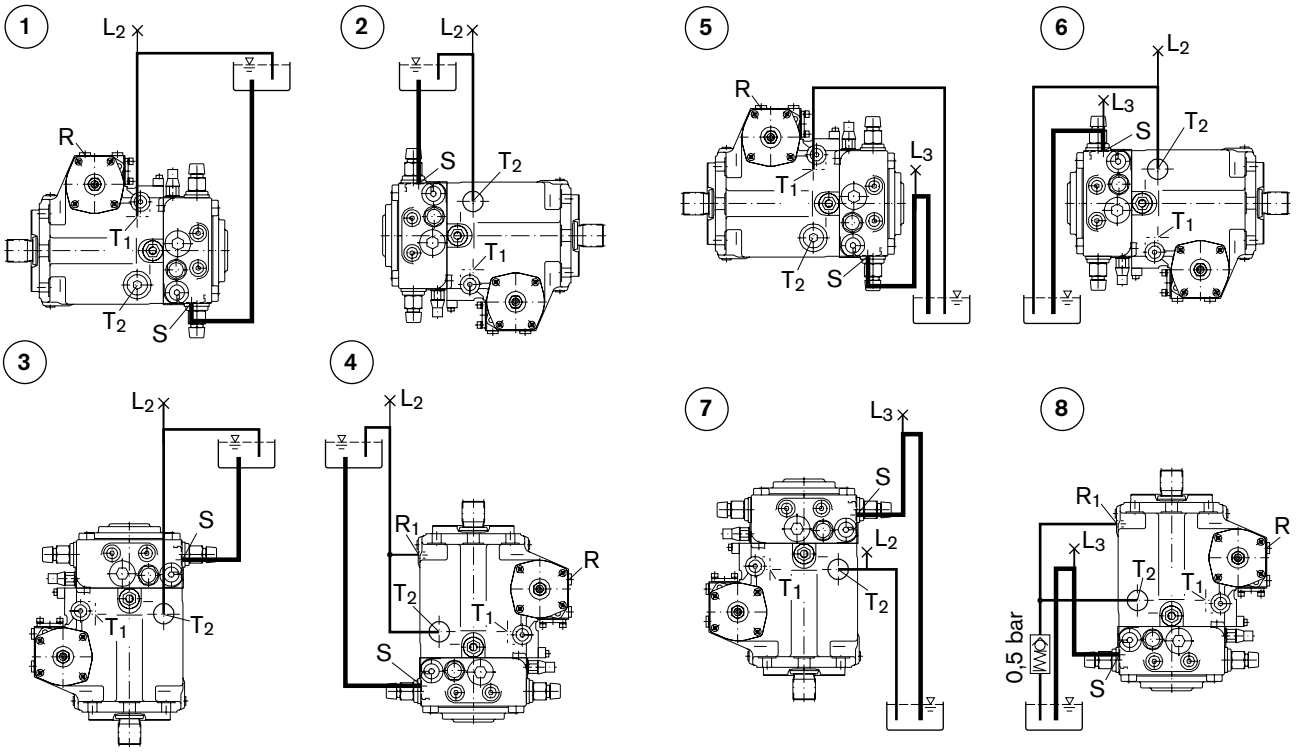
Pump below the minimum fluid level of the tank.

Recommended installation positions: 1 and 2.

Above-tank installation

Pump above the min. fluid level of the tank

Observe the maximum permissible suction height h_{max} = 31.5in (800 mm). Recommendation for installation position 8 (shaft upwards):
A check valve in the case drain line (opening pressure 7.5 psi / 0.5 bar) can prevent draining of the case interior.



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)

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 AA4VG 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 ISO 68 / 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.

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