Axial Piston Variable Pump A4VG

RA 92004-A/12.09 1/60

Data sheet

Series 40
Sizes NG45 to 175
Nominal pressure 6500 psi (450 bar)
Maximum pressure 7250 psi (500 bar)
Closed circuit

Content

Features

- Variable axial piston pump of swashplate design for hydrostatic drives in closed circuit
- The flow is proportional to the drive speed and displacement.
- The flow increases as the angle of the swashplate is adjusted from zero 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 with different control and regulating functions, for all important applications.
- Two pressure-relief valves are provided on the high pressure ports to protect the hydrostatic transmission (pump and motor) from overload.
- The high-pressure relief valves also function as boost valves.
- The integrated boost pump acts as a feed pump and control pressure supply.
- The maximum boost pressure is limited by a built-in boost pressure-relief valve.
- The integral pressure cut-off is standard
- High pressure level for high power density and good efficiency

Ordering code for standard program

A4V	G								/	40	A		N			1			A		0		
01	02	03	04	05	06	07	08	09		10	11	12	13	14	15	16	17	18	19	20	21	22	23

Axial piston unit

01	Swashplate design, variable, nominal pressure 6500 psi (450 bar), maximum pressure 7250 psi (500 bar)	**A4V**

Operation mode

02	Pump, closed circuit	**G**

Size

03	≈ Displacement $V_{g\ max}$	in cm^3	**045**	**065**	**085**	**110**	**145**	**175**	
		in in^3/rev	**2.75**	**3.97**	**5.19**	**6.71**	**8.85**	**10.68**	

	Control device			**045**	**065**	**085**	**110**	**145**	**175**	
04	Proportional control hydraulic	pilot-pressure related	p = 90 to 260 psi (6 to 18 bar)	●	●	●	●	●	●	**HP1**
		mechanical servo, hexagon shaft with lever free position		●	●	●	●	●	●	**HW2**
			with neutral position switch	●	●	●	●	●	●	**HW8**
	Proportional control electric		U = 12 V DC	●	●	●	●	●	●	**EP1**
			U = 24 V DC	●	●	●	●	●	●	**EP2**
	Two-point control electric		U = 12 V DC	●	●	●	●	●	●	**EZ1**
			U = 24 V DC	●	●	●	●	●	●	**EZ2**
	Automatic control speed related		U = 12 V DC	●	●	●	●	●	●	**DA1**
			U = 24 V DC	●	●	●	●	●	●	**DA2**
	Hydraulic control, direct controlled			●	●	●	●	●	●	**HT1**
	Electric control, direct controlled, 4/3-directional valve, one DRE valve		U = 12 V DC	❍	❍	❍	❍	❍	❍	**EV1**
			U = 24 V DC	❍	❍	❍	❍	❍	❍	**EV2**

	Pressure cut-off		**045**	**065**	**085**	**110**	**145**	**175**	
05	Without	without bypass	●	●	●	●	●	●	**0**
		with bypass	●	●	●	●	●	●	**C**
	With pressure cut-off, with bypass (not for HT1)	fixed setting	●	●	●	●	●	●	**D**

	Connector for solenoids[1]	**045**	**065**	**085**	**110**	**145**	**175**	
06	Without	●	●	●	●	●	●	**0**
	DEUTSCH - molded connector, 2-pin – without suppressor diode	●	●	●	●	●	●	**P**

	Swivel angle indicator	**045**	**065**	**085**	**110**	**145**	**175**	
07	Without	●	●	●	●	●	●	**0**
	Electric swivel angle sensor	●	●	●	●	●	●	**R**

	Auxiliary functions	**045**	**065**	**085**	**110**	**145**	**175**	
08	Without	●	●	●	●	●	●	**0**
	With mechanical stroke limiter, externally adjustable	●	●	●	●	●	●	**M**
	With ports X_3, X_4 for stroking chamber pressure	●	●	●	●	●	●	**T**
	With mechanical stroke limiter and ports X_3, X_4	●	●	●	●	●	●	**B**

● = Available ❍ = On request – = Not available

▭ = Preferred program

1) Connectors for other electric components can deviate.

Ordering code for standard program

A4V	G								/	40	A		N			1			A		0		
01	02	03	04	05	06	07	08	09		10	11	12	13	14	15	16	17	18	19	20	21	22	23

DA control valve

			HP	HW	HT	DA	EP	
09	Without		●	●	●	–	●	0
	With DA control valve, fixed setting		●	●	●	●	●	1
	With DA control valve, mech. adjustable with position lever	Actuating direction clockwise	●	●	●	●	●	2
		Actuating direction counter-clockwise	●	●	●	●	●	3
	With DA control valve, fixed setting and braking inch valve mounted, control with brake fluid according to ISO 4925, **no** mineral oil[2)]		–	–	–	❍	–	4
	With DA control valve, fixed setting and braking inch valve mounted, control with brake fluid based on mineral oil[2)]		–	–	–	❍	–	5
	With DA control valve, fixed setting, ports for pilot control device		●	●	●	❍	●	6

Series

10	Series 4, Index 0	40

Version of port and fixing threads

11	ANSI	A

Direction of rotation

12	Viewed from drive shaft	clockwise	R
		counter-clockwise	L

Seals

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

Mounting flange

			045	065	085	110	145	175	
14	SAE J744	101-2 (B)	●	–	–	–	–	–	B2
		127-2 (C)	●	–	–	–	–	–	C2
		127-2/4 (C)	–	●	●	●	–	–	C6
		152-2/4 (D)	–	–	❍	●	●	●	D6
		165-4 (E)	–	–	–	–	❍	●	E4

Drive shaft

			045	065	085	110	145	175	
15	Splined shaft ANSI B92.1a–1976	1 1/4 in 14T 12/24DP	●	●	–	–	–	–	S7
		1 1/2 in 17T 12/24DP	●	❍	–	–	–	–	S9
		1 3/8 in 21T 16/32DP	–	–	●	●	–	–	V8
		1 3/4 in 13T 8/16DP	–	–	●	●	●	●	T1
		2 in 15T 8/16DP	–	–	–	●	●	–	T2
		2 1/4 in 17T 8/16DP	–	–	–	–	–	●	T3

Service line ports

		045	065	085	110	145	175	
16	SAE flange port A and B, side (45° left)	●	●	●	●	●	●	1

Boost pump and rotary group version

			045	065	085	110	145	175	
17	Standard rotary group	boost pump integrated, through drive convertible	●	●	●	●	●	●	F
		without boost pump, through drive convertible	●	●	●	●	●	●	U
	High-speed rotary group	boost pump integrated, through drive convertible	–	–	–	●	●	❍	V
		without boost pump, through drive convertible	–	–	–	●	●	❍	W

● = Available ❍ = On request – = Not available

▭ = Preferred program

2) Cannot be combined with EV

Ordering code for standard program

A4V	G								/	40	A		N			1			A		0		
01	02	03	04	05	06	07	08	09		10	11	12	13	14	15	16	17	18	19	20	21	22	23

Through drive

	Flange SAE J744			Coupling for splined shaft[3]			045	065	085	110	145	175	
		Mounting variant											
	Diameter	Symbol	Designation	Diameter		Designation							
	Without						●	●	●	●	●	●	**0000**
	82-2 (A)		A1	5/8 in	9T 16/32DP	S2	❍	❍	❍	❍	❍	❍	**A1S2**
			A2	5/8 in	9T 16/32DP	S2	●	●	●	●	●	❍	**A2S2**
	101-2 (B)		B1	7/8 in	13T 16/32DP	S4	❍	❍	❍	❍	❍	●	**B1S4**
				1 in	15T 16/32DP	S5	❍	❍	❍	❍	❍	❍	**B1S5**
			B2	7/8 in	13T 16/32DP	S4	●	●	❍	❍	●	●	**B2S4**
				1 in	15T 16/32DP	S5	●	●	●	●	●	❍	**B2S5**
			B5[4]	7/8 in	13T 16/32DP	S4	❍	❍	❍	❍	❍	❍	**B5S4**
				1 in	15T 16/32DP	S5	❍	❍	❍	❍	❍	❍	**B5S5**
	101-4 (B)		B4	7/8 in	13T 16/32DP	S4	❍	❍	❍	❍	❍	❍	**B4S4**
				1 in	15T 16/32DP	S5	❍	❍	❍	❍	❍	❍	**B4S5**
18	127-2 (C)		C1	1 in	15T 16/32DP	S5	❍	❍	❍	❍	❍	❍	**C1S5**
				1 1/4 in	14T 12/24DP	S7	❍	❍	❍	❍	❍	❍	**C1S7**
			C2	1 in	15T 16/32DP	S5	❍	❍	❍	❍	●	❍	**C2S5**
				1 1/4 in	14T 12/24DP	S7	●	●	●	●	●	●	**C2S7**
				1 3/8 in	21T 16/32DP	V8	–	–	●	❍	●	●	**C2V8**
				1 3/4 in	13T 8/16DP	T1	–	–	–	–	●	●	**C2T1**
			C5[4]	1 in	15T 16/32DP	S5	❍	❍	❍	❍	❍	❍	**C5S5**
				1 1/4 in	14T 12/24DP	S7	❍	❍	❍	❍	❍	❍	**C5S7**
	127-4 (C)		C4	1 in	15T 16/32DP	S5	–	❍	❍	❍	❍	❍	**C4S5**
				1 1/4 in	14T 12/24DP	S7	–	❍	❍	❍	❍	❍	**C4S7**
			C6	1 3/8 in	21T 16/32DP	V8	–	–	❍	❍	❍	❍	**C6V8**
	152-4 (D)		D4	1 3/4 in	13T 8/16DP	T1	–	–	–	–	●	●	**D4T1**
			D6	1 3/8 in	21T 16/32DP	V8	–	–	–	❍	❍	❍	**D6V8**
				1 3/4 in	13T 8/16DP	T1	–	–	–	–	❍	❍	**D6T1**
	165-4 (E)		E4	1 3/4 in	13T 8/16DP	T1	–	–	–	–	–	●	**E4T1**
				2 in	15T 16/32DP	T2	–	–	–	–	–	–	**E4T2**

	High-pressure valves	045	065	085	110	145	175	
19	With high-pressure relief valve, direct controlled	●	●	●	●	●	●	**A**

	Filtration of boost circuit / external supply	045	065	085	110	145	175	
20	Filtration in the boost pump suction line	●	●	●	●	●	●	**S**
	Filtration in the boost pump pressure line: Ports for external boost circuit filtration (F_e and F_a)	●	●	●	●	●	●	**D**
	Filter mounted with cold start valve	●	●	●	●	●	●	**F**
	Filter mounted with cold start valve and electric contamination indicator	●	●	●	●	●	●	**B**
	External supply (on version without integrated boost pump)	●	●	●	●	●	●	**E**

● = Available ❍ = On request – = Not available

▭ = Preferred program

3) Coupling for splined shaft acc. to ANSI B92.1a-1976

4) Viewed from through drive

Ordering code for standard program

A4V	G								/	40	A		N			1			A		0		
01	02	03	04	05	06	07	08	09		10	11	12	13	14	15	16	17	18	19	20	21	22	23

	Pressure sensors	045	065	085	110	145	175	
21	Without	●	●	●	●	●	●	**0**

	Other sensors	045	065	085	110	145	175	
22	Without	●	●	●	●	●	●	**0**
	Speed sensor DSM[5] mounted	●	●	●	●	●	●	**V**

Standard / special version

23	Standard version		**-0**
		combined with attachment part or attachment pump	**-K**
	Special version		**-S**
		combined with attachment part or attachment pump	**-T**

Note
Short designation X refers to a special version not covered by the ordering code.

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

5) Observe the requirements for the electronics

Technical data

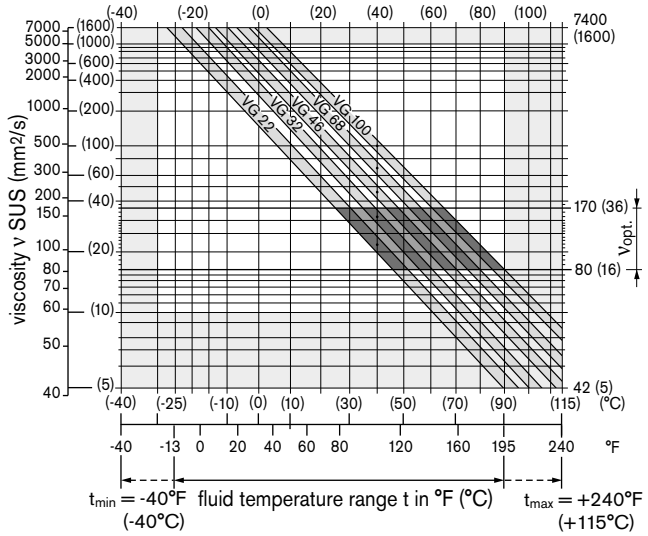
Hydraulic fluid

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

The variable pump A4VG is not suitable for operation with HFA, HFB and HFC. If HFD or environmentally acceptable hydraulic fluids are being used, the limitations regarding technical data and seals must be observed.
Please contact us.

When ordering, indicate the hydraulic fluid that is to be used.

Selection diagram



Details regarding the choice of hydraulic fluid

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

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

Example: At an ambient temperature of X °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.

Note

The case drain temperature, which is affected by pressure and speed, is always higher than the circuit temperature. At no point of the component may the temperature be higher than 240 °F (115 °C), however. The temperature difference specified below is to be taken into account when determining the viscosity in the bearing.

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

Viscosity and temperature

	Viscosity [SUS (mm²/s)]	Temperature	Comment
Storage		$T_{min} \geq$ -58 °F (-50 °C) T_{opt} = +41 °F to +68 °F (+5 °C to +20 °C)	up to 12 months with standard factory preservation up to 24 months with long-term factory preservation
(Cold) start-up[1]	ν_{max} = 7400 (1600)	$T_{St} \geq$ -40 °F (-40 °C)	t ≤ 3 min, without load (p ≤ 725 psi (50 bar)), n ≤ 1000 rpm
Permissible temperature difference		ΔT ≤ 45 °F (25 °C)	between axial piston unit and hydraulic fluid
Warm-up phase	ν < 7400 to 1850 (1600 to 400)	T = -40 °F to -13 °F (-40 °C to -25 °C)	at p_{nom}, 0.5 • n_{nom} and t ≤ 15 min
Operating phase			
Temperature difference		ΔT = approx. 9 °F (5 °C)	The temperature of the hydraulic fluid in the bearing is (depending on pressure and speed) approx. 9 °F (5 °C) higher than that of the case drain fluid at port T.
Continuous operation	ν = 1850 to 60 (400 to 10) ν_{opt} = 80 to 170 (16 to 36)	T = -13 °F to +195 °F (-25 °C to +90 °C)	no restriction within the permissible data
Short-term operation	ν_{min} = < 60 to 42 (10 to 5)	T_{max} = +240 °F (+115 °C)	t < 3 min, p < 0.3 • p_{nom}
Shaft seal ring FKM[1]		T ≤ +240 °F (+115 °C)	see page 7

1) At temperatures below -13 °F (-25 °C), an NBR shaft seal ring is required (permissible temperature range: -40 °F to +195 °F (-40 °C to +90 °C)).

Technical data

Filtration of the hydraulic fluid

Filtration improves the cleanliness level of the hydraulic fluid, which, in turn, increases the service life of the axial piston unit.

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

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

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

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

At very high hydraulic fluid temperatures 195 °F to maximum 240 °F (90 °C to maximum 115 °C), a cleanliness level of at least 19/17/14 according to ISO 4406 is necessary.

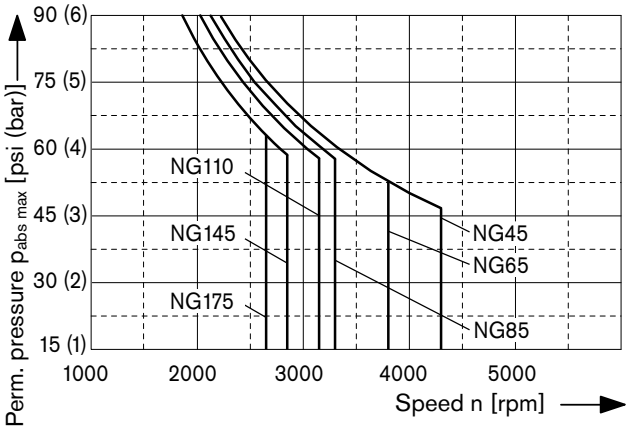
If the above classes cannot be achieved, please contact us.
For notes on filtration types, see page 55.

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 45 psi (3 bar) absolute at operating temperature not be exceeded (maximum 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 may be used for case drain temperatures from -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)).
State NBR shaft seal ring in plain text when ordering.
Please contact us.

Technical data

Operating pressure range

Pressure at service line port A or B

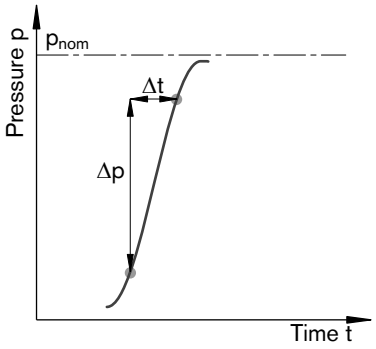
Nominal pressure p_{nom} _____ 6500 psi (450 bar) absolute

Maximum pressure p_{max} _____ 7250 psi (500 bar) absolute
Single operating period _____ 10 s
Total operating period _____ 300 h

Minimum pressure (high-pressure side) __ 365 psi (25 bar)

Minimum pressure (inlet) _____ 145 psi (10 bar)
(boost pressure setting must be higher depending on system)

Rate of pressure change $R_{A\ max}$ __ 130000 psi/s (9000 bar/s)



Boost pump

Pressure at suction port S
Duration $p_{S\ min}$ ($\nu \leq 140$ SUS) _____ ≥ 12 psi absolute
($(\nu \leq 30$ mm²/s) _____ ≥ 0.8 bar absolute)
at cold starts, short-term ($t < 3$ min) ≥ 7.5 psi (0.5 bar) absolute
Maximum $p_{S\ max}$ _____ ≤ 75 psi (5 bar) absolute

Nominal pressure $p_{Sp\ nom}$ _____ 365 psi (25 bar)
Maximum pressure $p_{Sp\ max}$ _____ 580 psi (40 bar)

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

For controls EP, HW and HP
Minimum control pressure
$p_{St\ min}$ (at n = 2000 rpm) _____ 290 psi (20 bar)

For controls DA, HT
Minimum control pressure
$p_{St\ min}$ (at n = 2000 rpm) _____ 365 psi (25 bar)

Definition

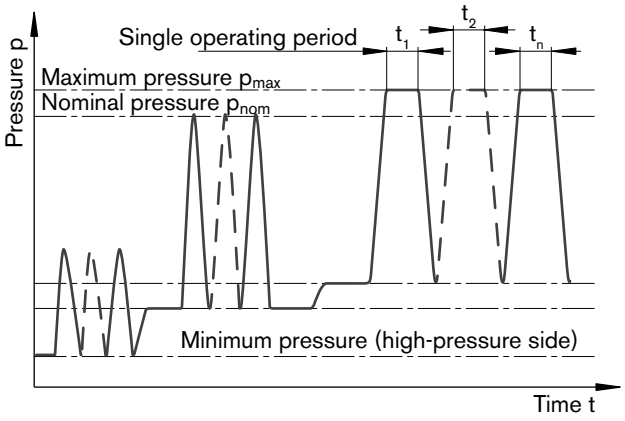
Nominal pressure p_{nom}
The nominal pressure corresponds to the maximum design pressure.

Maximum pressure p_{max}
The maximum pressure corresponds to the maximum operating pressure within the single operating period. The sum of the single operating periods must not exceed the total operating period.

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

Minimum pressure (inlet)
Minimum pressure in inlet (A or B) that is required in order to prevent damage to the axial piston unit.

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



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

Technical data

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

Size		NG		45	65	85	110	145	175
Displacement		$V_{g\,max}$	in³	2.76	3.98	5.21	6.74	8.87	10.70
variable pump			cm³	45.3	65.2	85.4	110.4	145.3	175.4
boost pump (at p = 290 psi (20 bar))		$V_{g\,Sp}$	in³	0.67	0.88	1.16	1.50	1.95	2.38
			cm³	11	14.5	19	24.5	32	39
Standard rotary group									
Speed									
at $V_{g\,max}$		$n_{nom\,S}$	rpm	4300	3800	3300	3150	2850	2650
maximum Δp = 580 psi (40 bar) (t < 15 s)		$n_{max\,40}$	rpm	4500	4000	3500	3350	3000	2800
minimum		n_{min}	rpm	500	500	500	500	500	500
Flow		$q_{v\,max}$	gpm	51.4	65.5	74.4	91.9	109.4	122.7
at $n_{nom\,S}$ and $V_{g\,max}$			l/min	195	248	282	348	414	465
Power[1]	Δp = 6250 psi	P_{max}	hp	187	239	271	335	399	447
at $n_{nom\,S}$, $V_{g\,max}$ and	Δp = 430 bar		kW	140	178	202	249	297	333
High-speed rotary group									
Speed									
at $V_{g\,max}$		$n_{nom\,H}$	rpm	–	–	–	3400	3050	3000
maximum Δp = 580 psi (40 bar) (t < 15 s)		$n_{max\,40}$	rpm	–	–	–	3600	3200	3100
minimum		n_{min}	rpm	–	–	–	500	500	500
Flow		$q_{v\,max}$	gpm	–	–	–	99.2	117.1	139.0
at $n_{nom\,H}$ and $V_{g\,max}$			l/min	–	–	–	375	443	526
Power[1]	Δp = 6250 psi	P_{max}	hp	–	–	–	362	427	507
at $n_{nom\,S}$, $V_{g\,max}$ and	Δp = 430 bar		kW	–	–	–	269	318	377
Torque[1]	Δp = 6250 psi	T_{max}	lb-ft	229	330	432	559	735	887
at $V_{g\,max}$ and	Δp = 430 bar		Nm	310	446	584	756	994	1200
	Δp = 1450 psi	T	lb-ft	53	77	100	130	171	206
	Δp = 100 bar		Nm	72	104	136	176	231	279
Rotary stiffness	drive shaft S7	c	lb-ft/rad	60568	75294	–	–	–	–
			Nm/rad	82119	102085	–	–	–	–
	drive shaft S9	c	lb-ft/rad	69986	97805	–	–	–	–
			Nm/rad	94888	132606	–	–	–	–
	drive shaft V8	c	lb-ft/rad	–	–	100167	123593	–	–
			Nm/rad	–	–	135808	167569	–	–
	drive shaft T1	c	lb-ft/rad	–	–	122536	[3]	182841	193690
			Nm/rad	–	–	166137	[3]	247899	262609
	drive shaft T2	c	lb-ft/rad	–	–	–	182317	218661	–
			Nm/rad	–	–	–	247189	296465	–
	drive shaft T3	c	lb-ft/rad	–	–	–	–	–	273789
			Nm/rad	–	–	–	–	–	371208
Moment of inertia for rotary group		J_{GR}	lb-ft²	0.1139	0.2112	0.3322	0.5173	0.7831	1.3526
			kgm²	0.0048	0.0089	0.014	0.0218	0.0330	0.0570
Angular acceleration maximum[2]		α	rad/s²	28000	22000	18000	14500	12000	10000
Filling capacity		V	gal	0.37	0.40	0.61	0.66	0.87	0.82
			L	1.4	1.5	2.3	2.5	3.3	3.1
Mass approx. (without through drive)		m	lbs	121	128	170	194	234	254
			kg	55	58	77	88	106	115

[1] Without boost pump

[2] The area of validity lies between the minimum required and maximum permissible speed.
It applies for external stimuli (e.g. engine 2 to 8 times rotary frequency, cardan shaft twice the rotary frequency).
The limit value applies for a single pump only.
The load capacity of the connection parts must be considered.

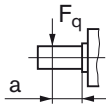
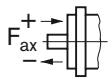
[3] On request

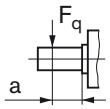
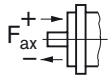
Note

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

Technical data

Permissible radial and axial loading on drive shaft

Size	NG		45	45	65	65	85	85
Drive shaft		in	1 1/4	1 1/2	1 1/4	1 1/2	1 3/8	1 3/4
Radial force maximum at distance a (from shaft collar) 	$F_{q\,max}$	lb	899	674	1169	1102	2293	1596
		N	4000	3000	5200	4900	10200	7100
	a	in	0.94	1.06	0.94	1.06	0.94	1.32
		mm	24	27	24	27	24	33.5
Axial force maximum 	+ $F_{ax\,max}$	lb	785	785	967	967	1323	1323
		N	3490	3490	4300	4300	5885	5885
	− $F_{ax\,max}$	lb	519	519	607	607	835	835
		N	2310	2310	2700	2700	3715	3715

Size	NG		110	110	110	145	145	175	175
Drive shaft		in	1 3/8	1 3/4	2	1 3/4	2	1 3/4	2 1/4
Radial force maximum at distance a (from shaft collar) 	$F_{q\,max}$	lb	3102	On request	1731	3147	2248	4271	3260
		N	13800		7700	14000	10000	19000	14500
	a	in	0.94		1.57	1.32	1.57	1.32	1.57
		mm	24		40	33.5	40	33.5	40
Axial force maximum 	+ $F_{ax\,max}$	lb	1417	1417	1417	1520	1520	1630	1630
		N	6305	6305	6305	6763	6763	7252	7252
	− $F_{ax\,max}$	lb	921	921	921	997	997	1067	1067
		N	4095	4095	4095	4437	4437	4748	4748

Note

Special requirements apply in the case of belt drives. Please contact us.

Force-transfer direction of the permissible axial force:

+ $F_{ax\,max}$ = Increase in service life of bearings

− $F_{ax\,max}$ = Reduction in service life of bearings (avoid)

Determining the size

Flow $q_v = \dfrac{V_g \cdot n \cdot \eta_v}{231}$ [gpm] $\left(\dfrac{V_g \cdot n \cdot \eta_v}{1000} \text{ [l/min]} \right)$

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

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

V_g = Displacement per revolution in in^3 (cm^3)

Δp = Differential pressure in psi (bar)

n = Speed in rpm

η_v = Volumetric efficiency

η_{mh} = Mechanical-hydraulic efficiency

η_t = Total efficiency ($\eta_t = \eta_v \cdot \eta_{mh}$)

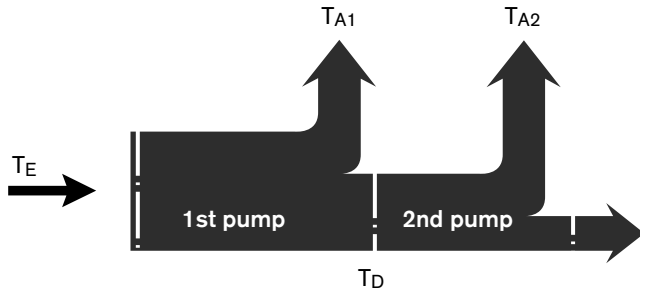
Technical data

Permissible input and through-drive torques

Size		NG		45	65	85	110	145	175
Torque at $V_{g\,max}$ and	$\Delta p = 6250$ psi[1]	T_{max}	lb-ft	229	330	432	559	735	887
	$\Delta p = 430$ bar[1]		Nm	310	446	584	756	994	1200
Input torque at drive shaft, maximum[2]									
S7	1 1/4 in	$T_{E\,max}$	lb-ft	373	373	–	–	–	–
			Nm	506	506	–	–	–	–
S9	1 1/2 in	$T_{E\,max}$	lb-ft	723	723	–	–	–	–
			Nm	980	980	–	–	–	–
V8	1 3/8 in	$T_{E\,max}$	lb-ft	–	–	601	601	–	–
			Nm	–	–	815	815	–	–
T1	1 3/4 in	$T_{E\,max}$	lb-ft	–	–	1022	1022	1022	1022
			Nm	–	–	1385	1385	1385	1385
T2	2 in	$T_{E\,max}$	lb-ft	–	–	–	1661	1661	–
			Nm	–	–	–	2252	2252	–
T3	2 1/4 in	$T_{E\,max}$	lb-ft	–	–	–	–	–	2524
			Nm	–	–	–	–	–	3422
Maximum through-drive torque		$T_{D\,max}$	lb-ft	365	365	689	689	1066	1066
			Nm	495	495	934	934	1445	1445

[1] Efficiency not considered
[2] For drive shafts with no radial force

Torque distribution



HP – Proportional control hydraulic, pilot-pressure related

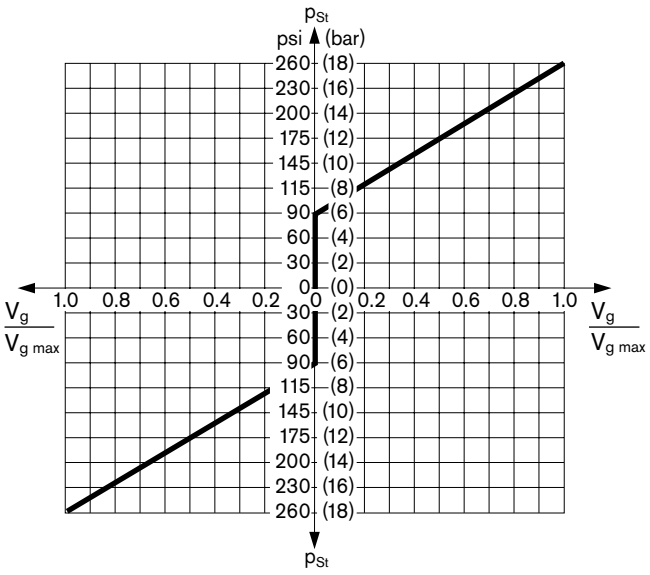
The output flow of the pump can be steplessly varied in the range between 0 and 100 %, proportional to the pilot signal difference applied at the two pilot signal ports (Y_1 and Y_2).

The pilot signal, which comes from an external source, is a pressure signal. Flow is negligible, as the pilot signal is only acting on the control piston of the control valve.

This control piston then directs control hydraulic fluid into and out of the stroke cylinder to adjust pump displacement as required.

A feedback lever connected to the stroke piston maintains the pump flow for any given pilot signal within the control range.

If the pump is also equipped with a DA control valve (see page 16), automotive operation is possible for travel drives.



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

Pilot signal p_{St} = 90 to 260 psi (6 to 18 bar) (at port Y_1, Y_2)

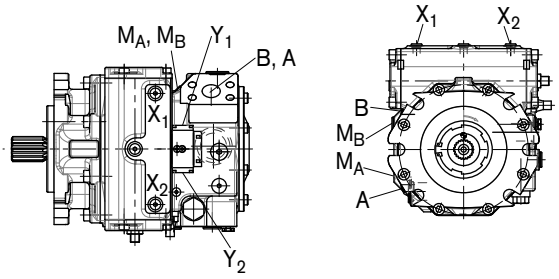
Start of control at 90 psi (6 bar)

End of control at 260 psi (18 bar) (maximum displacement $V_{g\,max}$)

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

Assignment
Direction of rotation - Control - Flow direction

		Size	Pilot signal	Control pressure	Flow direction	Operating pressure
Direction of rotation	cw	45 to 175	Y_1	X_1	B to A	M_A
			Y_2	X_2	A to B	M_B
	ccw	45 to 175	Y_1	X_1	A to B	M_B
			Y_2	X_2	B to A	M_A



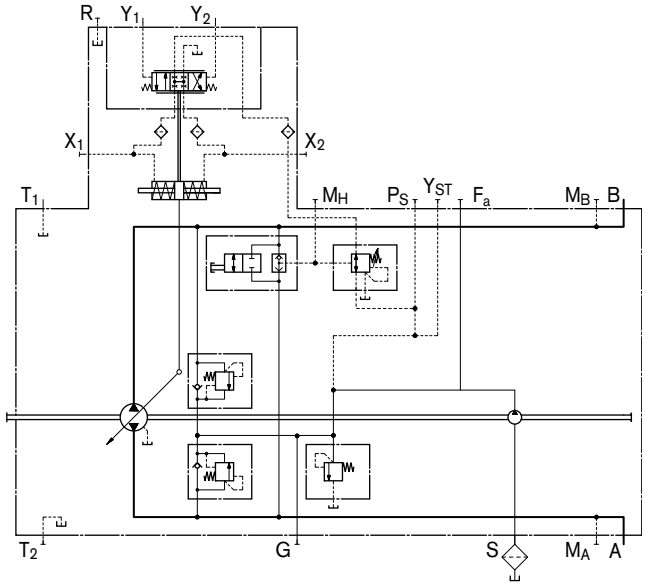
Note

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

The spool valve inside the control unit can get stuck in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the axial piston unit can no longer supply the flow specified by the operator.

Check whether your application requires that remedial measures be taken on your machine in order to bring the driven consumer into a neutral position (e. g. immediate stop).

Circuit diagram

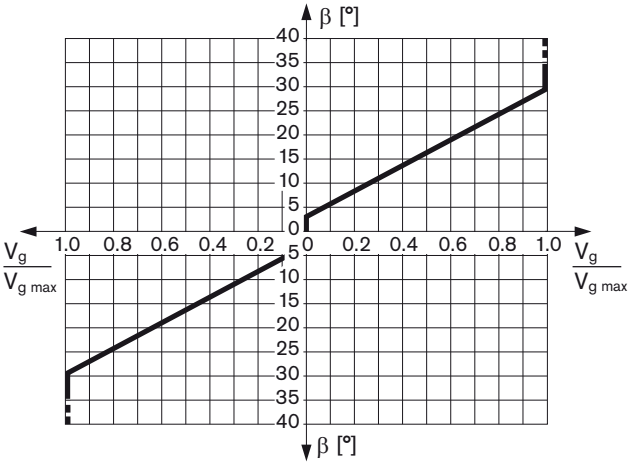


HW – Proportional control hydraulic, mechanical servo

The output flow of the pump can be steplessly varied in the range between 0 to 100 %, proportional to the rotation of the control lever between 0° and ±29°.

A feedback lever connected to the stroke 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 16), 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° (maximum displacement $V_{g\,max}$)

Mechanical stop for β: ±40°

The maximum required torque at the lever is 15 lb-in (170 Ncm). To prevent damage to the HW control unit, a positive mechanical stop must be provided for the HW control lever.

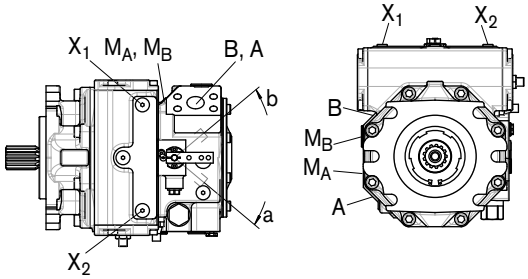
Note
Spring centering enables the pump, depending on pressure and speed, to move automatically to the neutral position ($V_g = 0$) as soon as there is no longer any torque on the control lever of the HW control unit (regardless of deflection angle).

Variation: Neutral position switch
The switch contact in the neutral position switch is closed when the control lever on the HW control unit is in its neutral position. The switch opens if the control lever is moved out of neutral in either direction.
Thus, the neutral position switch provides a monitoring function for drive units that require the pump to be in the neutral position during certain operational states (e. g. starting diesel engines).

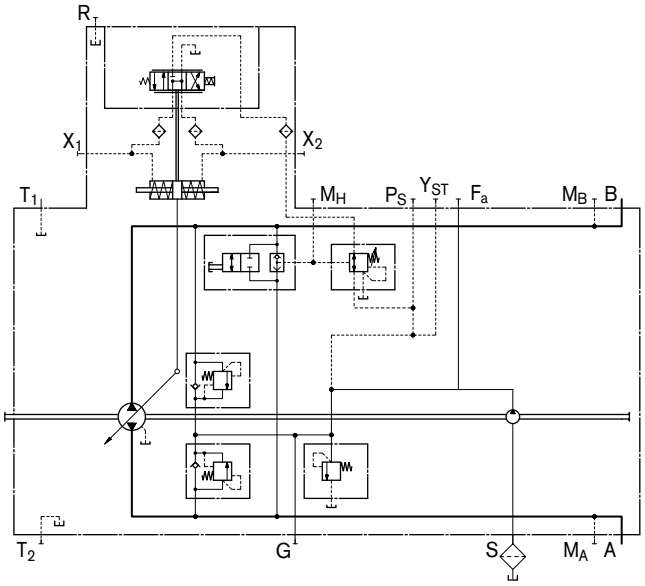
Technical data, neutral position switch	
Load capacity	20 A (continuous), without switching operating
Switching capacity	15 A / 32 V (ohmic load)
	4 A / 32 V (inductive load)
Connector version	DEUTSCH DT04-2P-EP04 (mating connector, see page 56)

Assignment
Direction of rotation - Control - Flow direction

		Size	Lever direction	Control pressure	Flow direction	Operating pressure
Direction of rotation	cw	45 to 175	a	X_2	A to B	M_B
			b	X_1	B to A	M_A
	ccw	45 to 175	a	X_2	B to A	M_A
			b	X_1	A to B	M_B



Circuit diagram



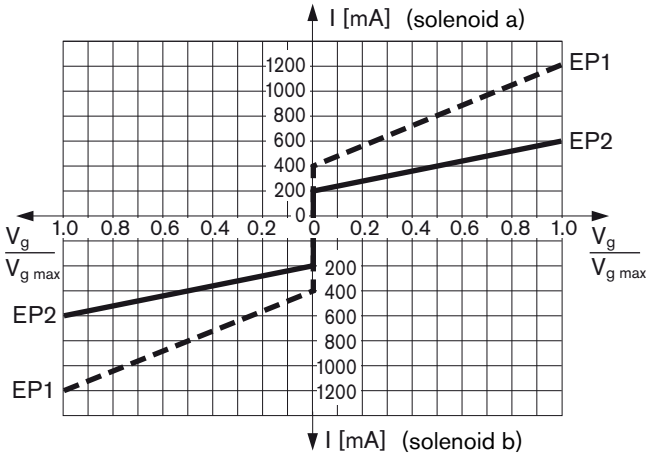
EP – Proportional control electric

The output flow of the pump can be steplessly varied in the range between 0 to 100 %, proportional to the electrical current supplied to solenoid a or b.

The electrical energy is converted into a force acting on the control piston. This control piston then directs control hydraulic fluid into and out of the stroke cylinder to adjust pump displacement as required.

A feedback lever connected to the stroke 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 16), automotive operation is possible for travel drives.



Standard
Proportional solenoid without emergency actuation.

On request
Proportional solenoid with emergency actuation and spring return.

Technical data, solenoid	EP1	EP2
Voltage	12 V (±20 %)	24 V (±20 %)
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 connector design page 56		

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

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

– Analog amplifier RA ____ RE 95230

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

Note

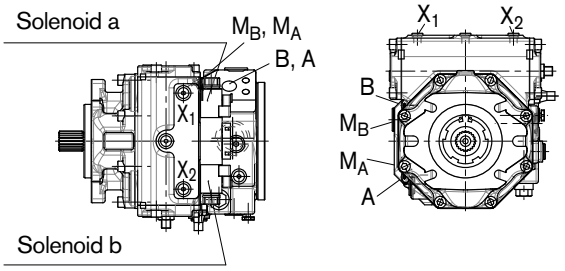
The spring return feature in the control unit is not a safety device

The spool valve inside the control unit can get stuck in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the axial piston unit can no longer supply the flow specified by the operator.

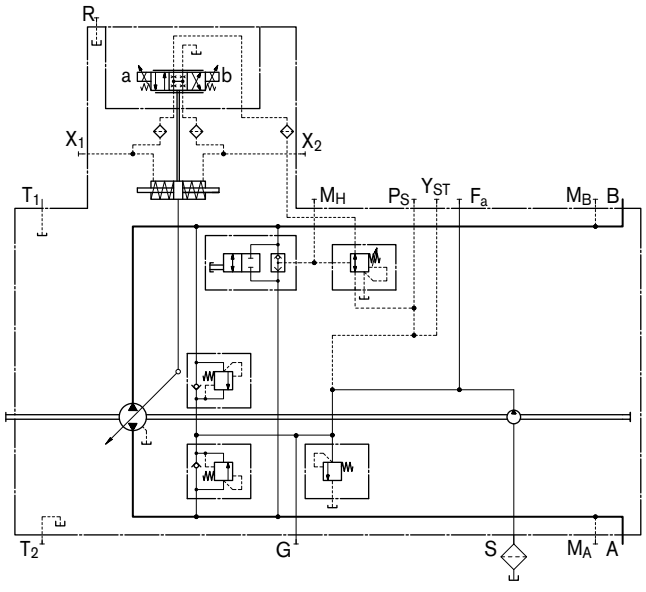
Check whether your application requires that remedial measures be taken on your machine in order to bring the driven consumer into a neutral position (e. g. immediate stop).

Assignment
Direction of rotation - Control - Flow direction

		Size	Actuation of solenoid	Control pressure	Flow direction	Operating pressure
Direction of rotation	cw	45 to 175	a	X_1	B to A	M_A
			b	X_2	A to B	M_B
	ccw	45 to 175	a	X_1	A to B	M_B
			b	X_2	B to A	M_A



Circuit diagram



EZ – Two-point control electric

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

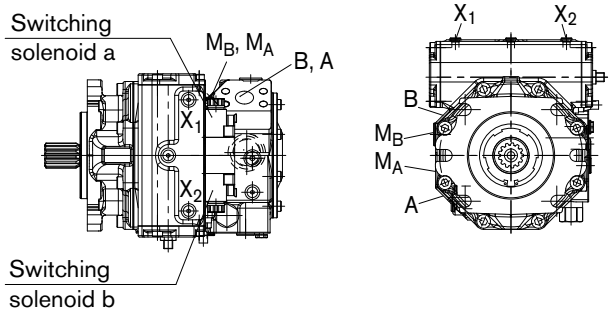
Technical data, solenoid	EZ1	EZ2
Voltage	12 V (±20 %)	24 V (±20 %)
Neutral position $V_g = 0$	de-energized	de-energized
Position $V_{g\,max}$	current energized	current energized
Nominal resistance (at 68 °F (20 °C))	5.5 Ω	21.7 Ω
Nominal power	26.2 W	26.5 W
Active current, minimum required	1.32 A	0.67 A
Actuated time	100 %	100 %
Type of protection see connector design page 56		

Standard
Switching solenoid without emergency actuation.

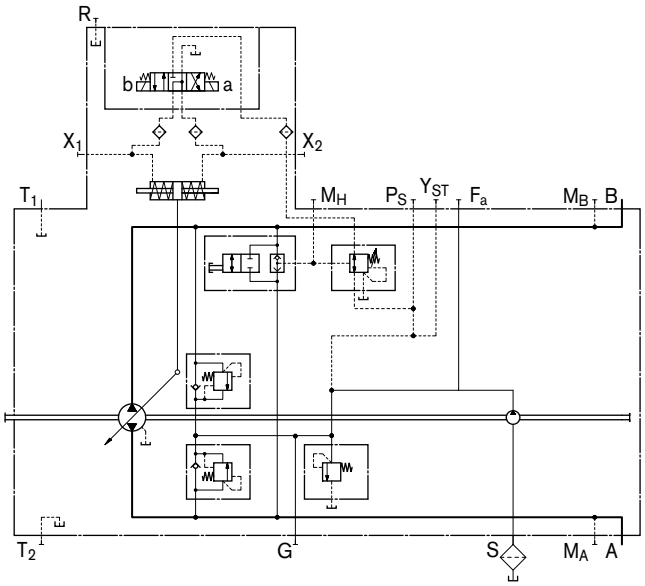
On request
Switching solenoid with emergency actuation and spring return.

Assignment
Direction of rotation - Control - Flow direction

		Size	Actuation of solenoid	Control pressure	Flow direction	Operating pressure
Direction of rotation	cw	45 to 175	a	X_2	A to B	M_B
			b	X_1	B to A	M_A
	ccw	45 to 175	a	X_2	B to A	M_A
			b	X_1	A to B	M_B



Circuit diagram



DA – Automatic control speed related

The DA closed loop control is an engine speed-dependent system for travel drives. The built-in DA control valve generates a pilot pressure that is proportional to pump (engine) drive speed. This pilot pressure is directed to the stroke cylinder of the pump by an electromagnetically actuated 4/3-directional valve. The pump displacement can be steplessly varied in each flow direction and is influenced by both the speed of the pump drive and the system pressure.
The flow direction (i. e. machine moving forward or backward) is determined by either solenoid a or b being activated.

Increasing the drive speed of the pump generates a higher pilot pressure from the DA control valve resulting in increased flow and/or delivery pressure from the pump.

Depending on the selected operating characteristics of the pump, increasing the system pressure (i. e. machine load) will have the effect of swiveling the pump back to a smaller displacement. An overload protection circuit for the engine (against stalling) is achieved by combining this pressure-dependent reduction in pump stroke with a reduction in pilot pressure as the engine speed drops.

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

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

The DA control valve can also be used in pumps with EP, HW, HT and HP control units to protect the combustion engine against overload.

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

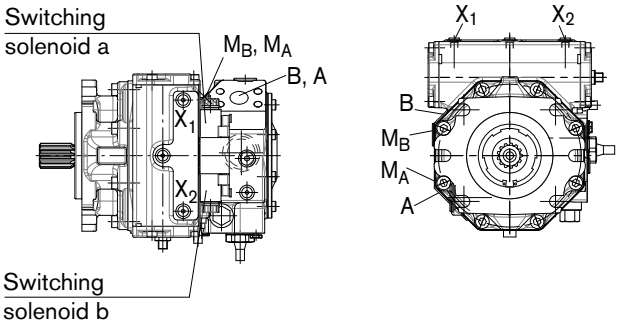
Technical data, solenoid	DA1	DA2
Voltage	12 V DC (±20 %)	24 V DC (±20 %)
Neutral position $V_{g\,0}$	de-energized	de-energized
Position $V_{g\,max}$	current energized	current energized
Nominal resistance (at 68 °F (20 °C))	5.5 Ω	21.7 Ω
Nominal power	26.2 W	26.5 W
Active current, minimum required	1.32 A	0.67 A
Actuated time	100 %	100 %
Type of protection see connector design page 56		

Standard
Switching solenoid without emergency actuation.

On request
Switching solenoid with emergency actuation and spring return.

Assignment
Direction of rotation - Control - Flow direction

		Size	Actuation of solenoid	Control pressure	Flow direction	Operating pressure
Direction of rotation	cw	45 to 175	a	X_2	A to B	M_B
			b	X_1	B to A	M_A
	ccw	45 to 175	a	X_2	B to A	M_A
			b	X_1	A to B	M_B



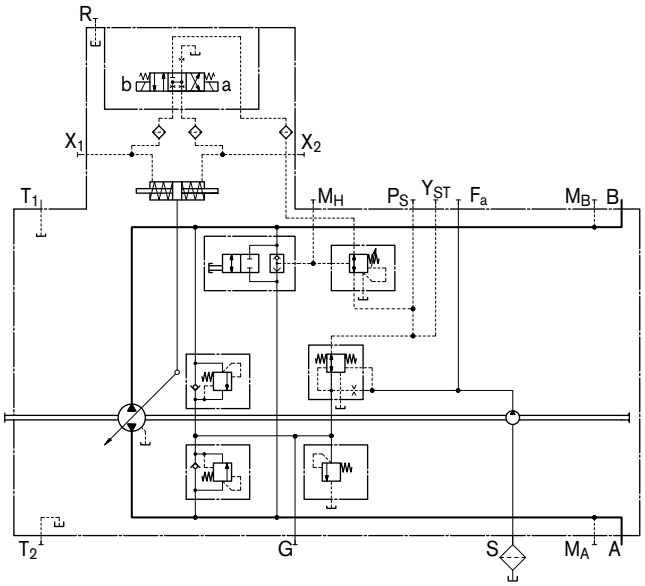
DA – Automatic control speed related

Function and control of DA control valves

DA control valve, fixed setting (1)

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

Circuit diagram



DA control valve, mechanically adjustable with position lever (2, 3)

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

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

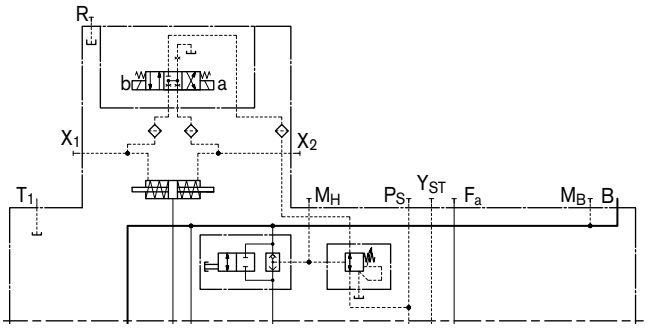
The maximum permissible operating torque at the position lever is $T_{max} = 3$ lb-ft (4 Nm).

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

Version 2
Actuating direction of the position lever: clockwise

Version 3
Actuating direction of the position lever: counter-clockwise

Circuit diagram



DA control valve fixed setting and braking inch valve mounted (4, 5) (only for pumps with DA control unit)

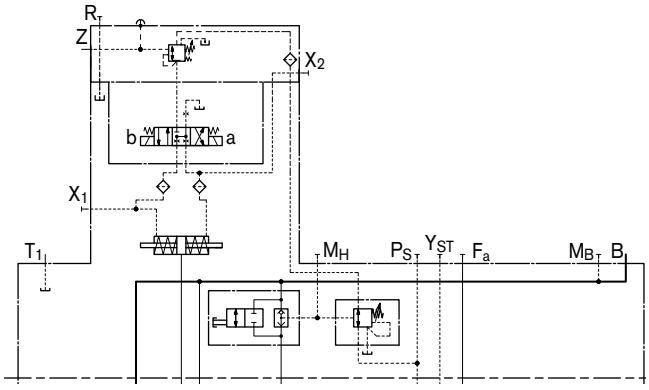
– Version with pressure reduction valve

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

Version 4
Control at port Z by means of brake fluid according to ISO 4925 (**no** mineral oil), from the vehicle braking system (hydraulically linked with the service brake).

Version 5
Control at port Z by means of brake fluid based on mineral oil.

Circuit diagram



DA control valve fixed setting, ports for pilot control device as inch valve (6)

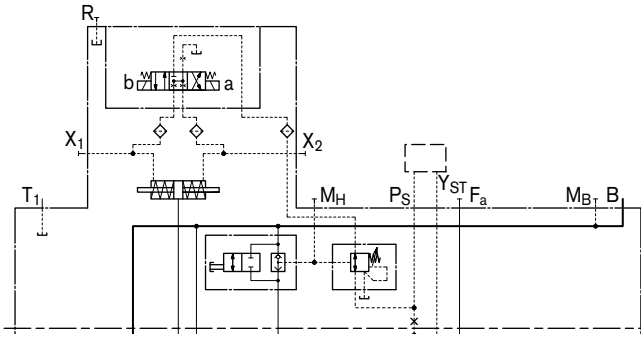
Reduction of the pilot pressure, independent of the drive speed is achieved by the mechanical actuation of the pilot control device.

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

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

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

Circuit diagram



HT – Hydraulic control, direct controlled

With the direct-controlled hydraulic control (HT), pump displacement is influenced by a hydraulic control pressure applied directly to the stroke piston through either port X_1 or X_2.

The flow direction is dependent on which control pressure port is pressurized.

Pump displacement is steplessly varied and proportional to the applied control pressure, but is also influenced by system pressure and pump drive speed.

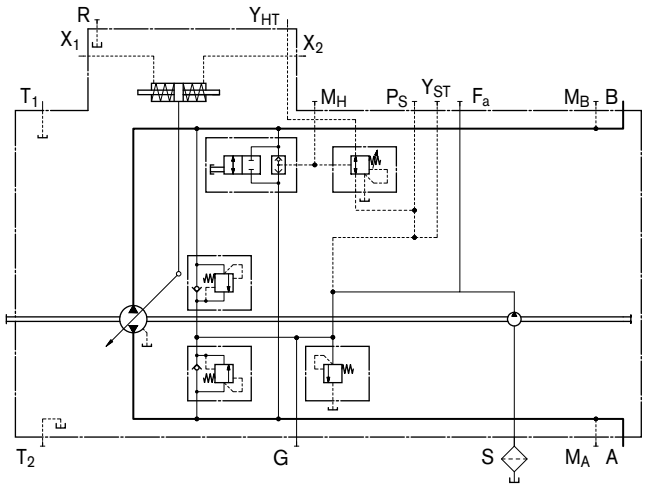
Port Y_{HT} must be used as the control pressure source for the selected control unit in order to optimally use the built-in pressure cut-off valve. See page 49 for a description of the pressure cut-off function.

Maximum permissible control pressure: 580 psi (40 bar)

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

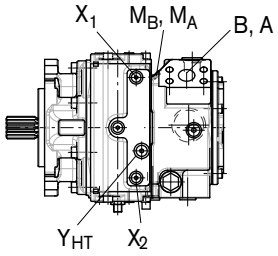
If the pump is also equipped with a DA control valve (see page 16), automotive operation is possible for travel drives.

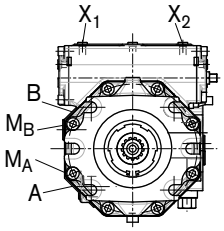
Circuit diagram



Assignment
Direction of rotation - Control - Flow direction

		Size	Control pressure	Flow direction	Operating pressure
Direction of rotation	cw	45 to 175	X_1	B to A	M_A
			X_2	A to B	M_B
	ccw	45 to 175	X_1	A to B	M_B
			X_2	B to A	M_A





EV – Electric control, direct controlled

The output flow of the pump can be steplessly varied in the range between 0 to 100 %. The control pressure level is proportional to the electric current applied to the solenoid of the pressure reducing valve. By energizing or de-energizing a control current at either switching solenoid a or b on the EV control unit, the stroke cylinder of the pump is supplied with this control pressure level.
The resulting pump displacement at a certain pilot pressure is dependent on the speed and operating pressure of the pump.

Technical data, pressure reducing valve	EV1	EV2
Voltage	12 V	24 V
Start of control at $V_{g\,0}$	800 mA	360 mA
End of control at $V_{g\,max}$	1800 mA	800 mA
Limiting current	1.8 A	0.8 A
Nominal resistance (at 68 °F (20 °C))	2.4 Ω	12 Ω
Dither frequency	200 Hz	200 Hz
Actuated time	100 %	100 %
Type of protection see connector design page 56		

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

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

– Analog amplifier RA ____ RE 95230

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

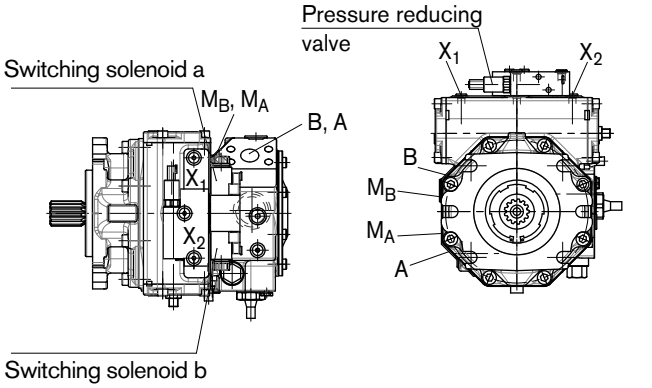
Technical data, solenoid	EV1	EV2
Voltage	12 V (±20 %)	24 V (±20 %)
Neutral position $V_g = 0$	de-energized	de-energized
Position $V_{g\,max}$	current energized	current energized
Nominal resistance (at 68 °F (20 °C))	5.5 Ω	21.7 Ω
Nominal power	26.2 W	26.5 W
Active current, minimum required	1.32 A	0.67 A
Actuated time	100 %	100 %
Type of protection see connector design page 56		

Standard
Switching solenoid without emergency actuation.

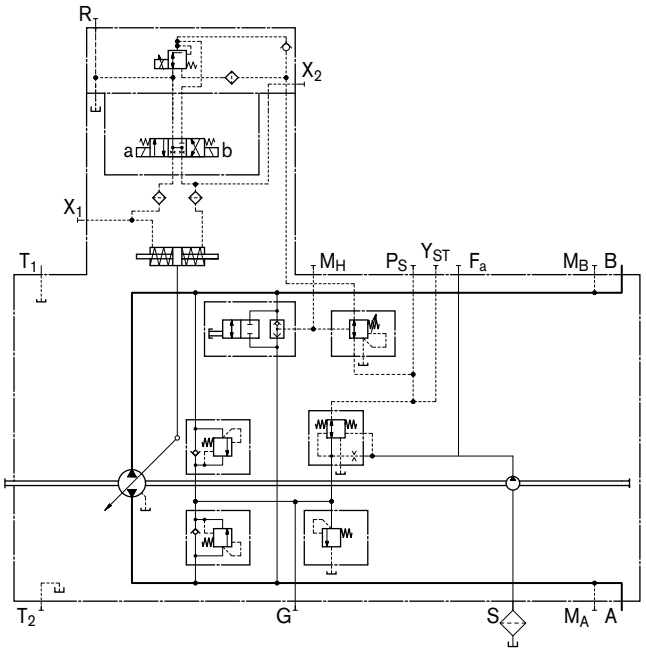
On request
Switching solenoid with emergency actuation and spring return.

Assignment
Direction of rotation - Control - Flow direction

Direction of rotation	Size	Actuation of solenoid	Control pressure	Flow direction	Operating pressure
cw	45 to 175	a	X_2	A to B	M_B
		b	X_1	B to A	M_A
ccw	45 to 175	a	X_2	B to A	M_A
		b	X_1	A to B	M_B



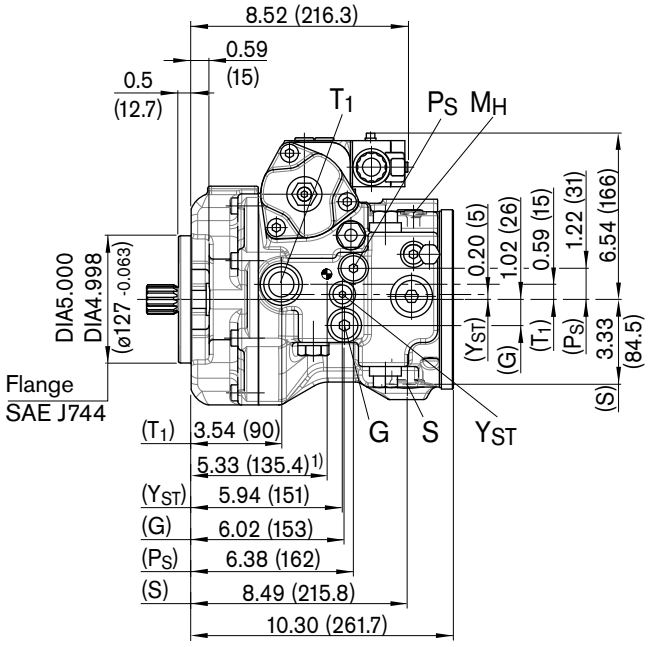
Circuit diagram

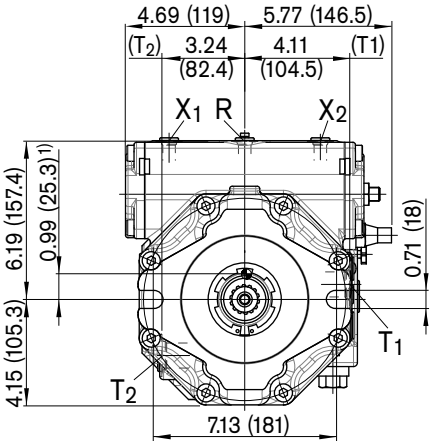


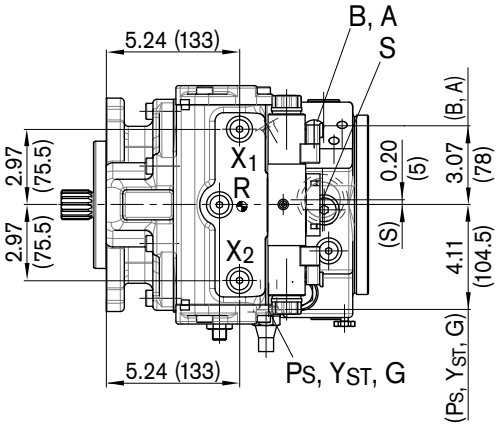
Dimensions size 45

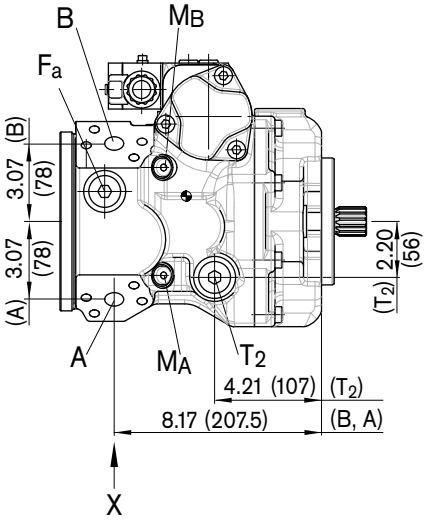
Before finalizing your design, request a binding installation drawing. Dimensions in in (mm).

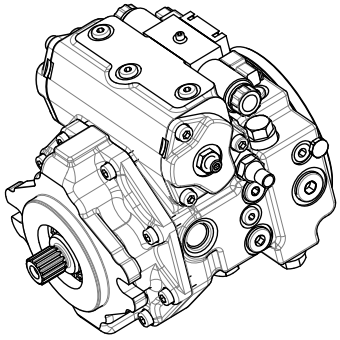
EP - Proportional control electric



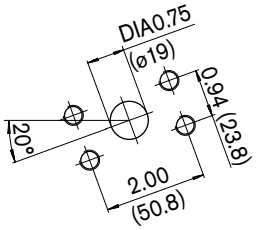








Detail X



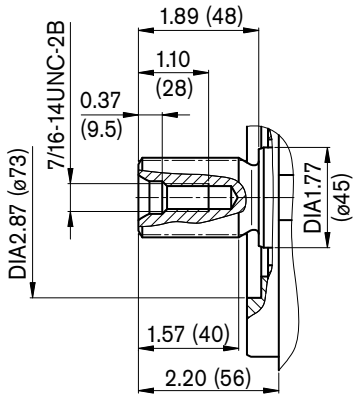
1) Center of gravity

Dimensions size 45

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

Drive shaft

S7 Splined shaft 1 1/4 in
14T 12/24DP[1] (SAE J744)



Ports

Designation	Port for	Standard	Size[2]	Maximum pressure [psi (bar)][3]	State
A, B[8]	Service line Fixing thread A/B, screw grade 8 with hardened washer	SAE J518[4] ISO 68	3/4 in 3/8-16UNC; 0.83 (21) deep	7250 (500)	O O
S	Suction	ISO 11926	1 5/16-12UN-2B; 0.79 (20) deep	75 (5)	O[5]
T_1	Tank	ISO 11926	1 1/16-12UN-2B; 0.79 (20) deep	45 (3)	O[6]
T_2	Tank	ISO 11926	1 1/16-12UN-2B; 0.79 (20) deep	45 (3)	X[6]
R	Air bleed	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	45 (3)	X
X_1, X_2	Control pressure (upstream of orifice)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	X
X_1, X_2	Control pressure (upstream of orifice, HT only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	O
X_3, X_4[7]	Stroking chamber pressure	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	X
G	Boost pressure	ISO 11926	7/8-14UNF-2B; 0.67 (17) deep	580 (40)	X
P_S	Pilot pressure, inlet	ISO 11926	3/4-16UNF-2B; 0.59 (15) deep	580 (40)	X
P_S	Pilot pressure, inlet (DA6 only)	ISO 11926	3/4-16UNF-2B; 0.59 (15) deep	580 (40)	O
Y_{ST}	Pilot pressure, outlet	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	X
Y_{ST}	Pilot pressure, outlet (DA6 only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	O
Y_{HT}	Pilot pressure, outlet (HT only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	O
M_A, M_B	Measuring pressure A, B	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	7250 (500)	X
M_H	Measuring high pressure	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	7250 (500)	X
F_a	Boost pressure, inlet	ISO 11926	1 1/16-12UN-2B; 0.79 (20) deep	580 (40)	X
Y_1, Y_2	Pilot signal (HP only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	O
Z	Inch signal (DA4 and 5 only)	ISO 11926	3/8-24UNF-2B; 0.39 (10) deep	580 (40)	O

1) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
2) Observe the general instructions on page 60 for the maximum tightening torques.
3) Short-term pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518
5) Plugged for external supply
6) Depending on installation position, T_1 or T_2 must be connected (see also page 59).
7) Optional, see page 51
8) For the maximum utilization of pressure, only grade 8 screws and hardened washers are to be used to tighten the SAE flange shells.

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

Note

The ports and fixing threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified operating conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.

Dimensions size 45

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

HP
Proportional control hydraulic, pilot-pressure related

HW
Proportional control hydraulic, mechanical servo

HT
Hydraulic control, direct controlled

EZ
Two-point control electric

EV
Electric control, direct controlled

Dimensions size 45

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

DA – Automatic control speed related

DA1
control valve fixed setting

DA2
Control valve mechanically adjustable with position lever

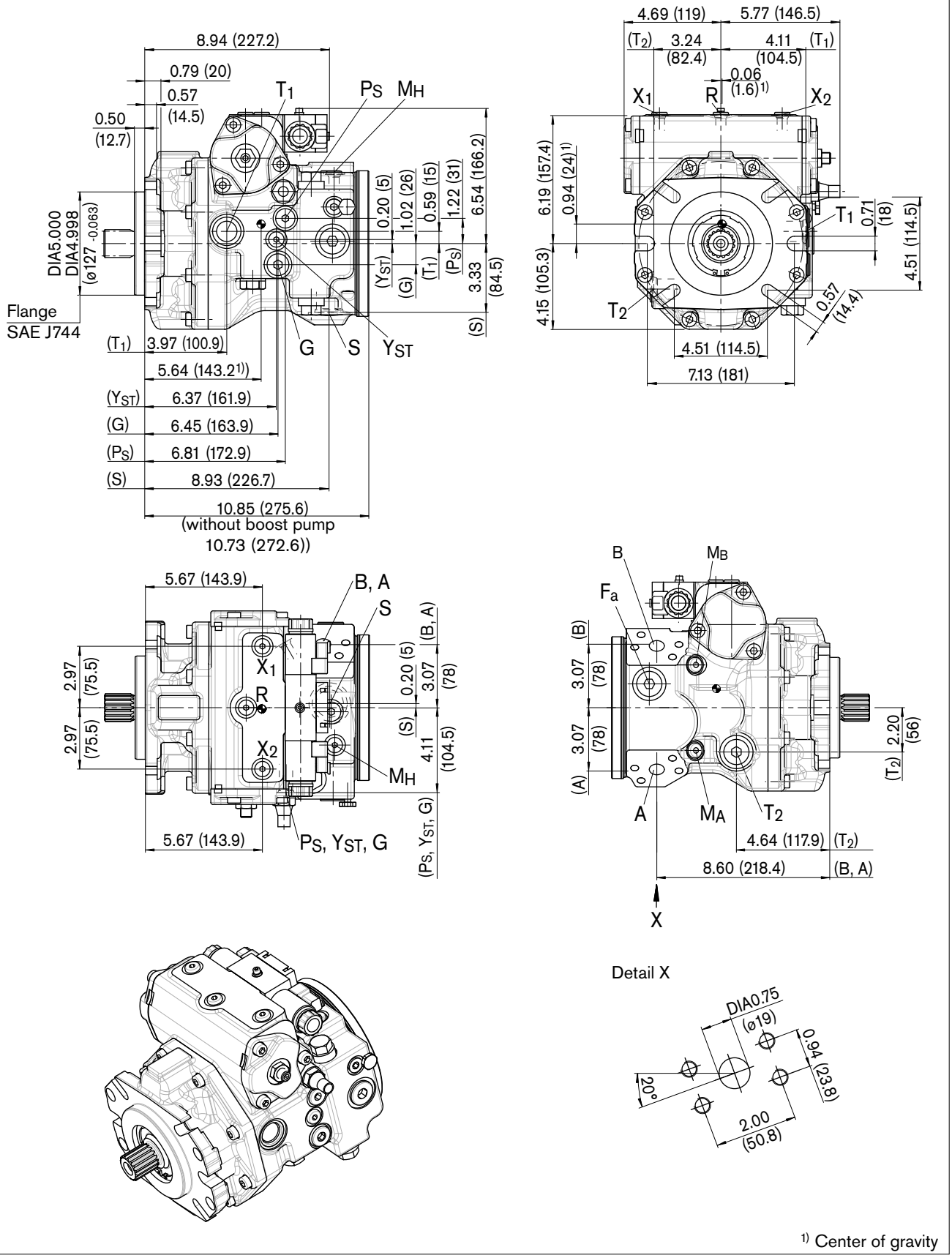
DA4, DA5
Control valve fixed setting and braking inch valve mounted

DA6
Control valve fixed setting and ports for pilot control device

Dimensions size 65

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

EP -Proportional control electric



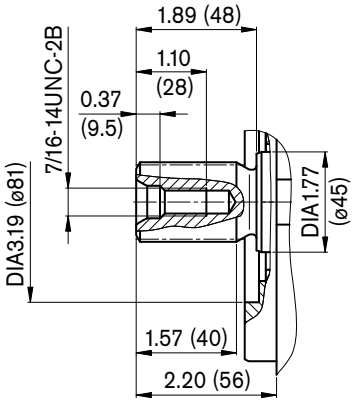
1) Center of gravity

Dimensions size 65

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

Drive shaft

S7 Splined shaft 1 1/4 in
14T 12/24DP[1] (SAE J744)



Ports

Designation	Port for	Standard	Size[2]	Maximum pressure [psi (bar)][3]	State
A, B[8]	Service line Fixing thread A/B, screw grade 8 with hardened washer	SAE J518[4] ISO 68	3/4 in 3/8-16UNC; 0.83 (21) deep	7250 (500)	O O
S	Suction	ISO 11926	1 5/16-12UN-2B; 0.79 (20) deep	75 (5)	O[5]
T_1	Tank	ISO 11926	1 1/16-12UN-2B; 0.79 (20) deep	45 (3)	O[6]
T_2	Tank	ISO 11926	1 1/16-12UN-2B; 0.79 (20) deep	45 (3)	X[6]
R	Air bleed	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	45 (3)	X
X_1, X_2	Control pressure (upstream of orifice)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	X
X_1, X_2	Control pressure (upstream of orifice, HT only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	O
X_3, X_4[7]	Stroking chamber pressure	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	X
G	Boost pressure	ISO 11926	7/8-14UNF-2B; 0.67 (17) deep	580 (40)	X
P_S	Pilot pressure, inlet	ISO 11926	3/4-16UNF-2B; 0.59 (15) deep	580 (40)	X
P_S	Pilot pressure, inlet (DA6 only)	ISO 11926	3/4-16UNF-2B; 0.59 (15) deep	580 (40)	O
Y_{ST}	Pilot pressure, outlet	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	X
Y_{ST}	Pilot pressure, outlet (DA6 only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	O
Y_{HT}	Pilot pressure, outlet (HT only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	O
M_A, M_B	Measuring pressure A, B	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	7250 (500)	X
M_H	Measuring high pressure	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	7250 (500)	X
F_a	Boost pressure, inlet	ISO 11926	1 1/16-12UN-2B; 0.79 (20) deep	580 (40)	X
Y_1, Y_2	Pilot signal (HP only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	O
Z	Inch signal (DA4 and 5 only)	ISO 11926	3/8-24UNF-2B; 0.39 (10) deep	580 (40)	O

1) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
2) Observe the general instructions on page 60 for the maximum tightening torques.
3) Short-term pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518
5) Plugged for external supply
6) Depending on installation position, T_1 or T_2 must be connected (see also page 59).
7) Optional, see page 51
8) For the maximum utilization of pressure, only grade 8 screws and hardened washers are to be used to tighten the SAE flange shells.

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

Note

The ports and fixing threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified operating conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.

Dimensions size 65

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

HP
Proportional control hydraulic, pilot-pressure related

HW
Proportional control hydraulic, mechanical servo

HT
Hydraulic control, direct controlled

EZ
Two-point control electric

EV
Electric control, direct controlled

Dimensions size 65

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

DA – Automatic control speed related

DA1
Control valve fixed setting

DA2
Control valve mechanically adjustable with position lever

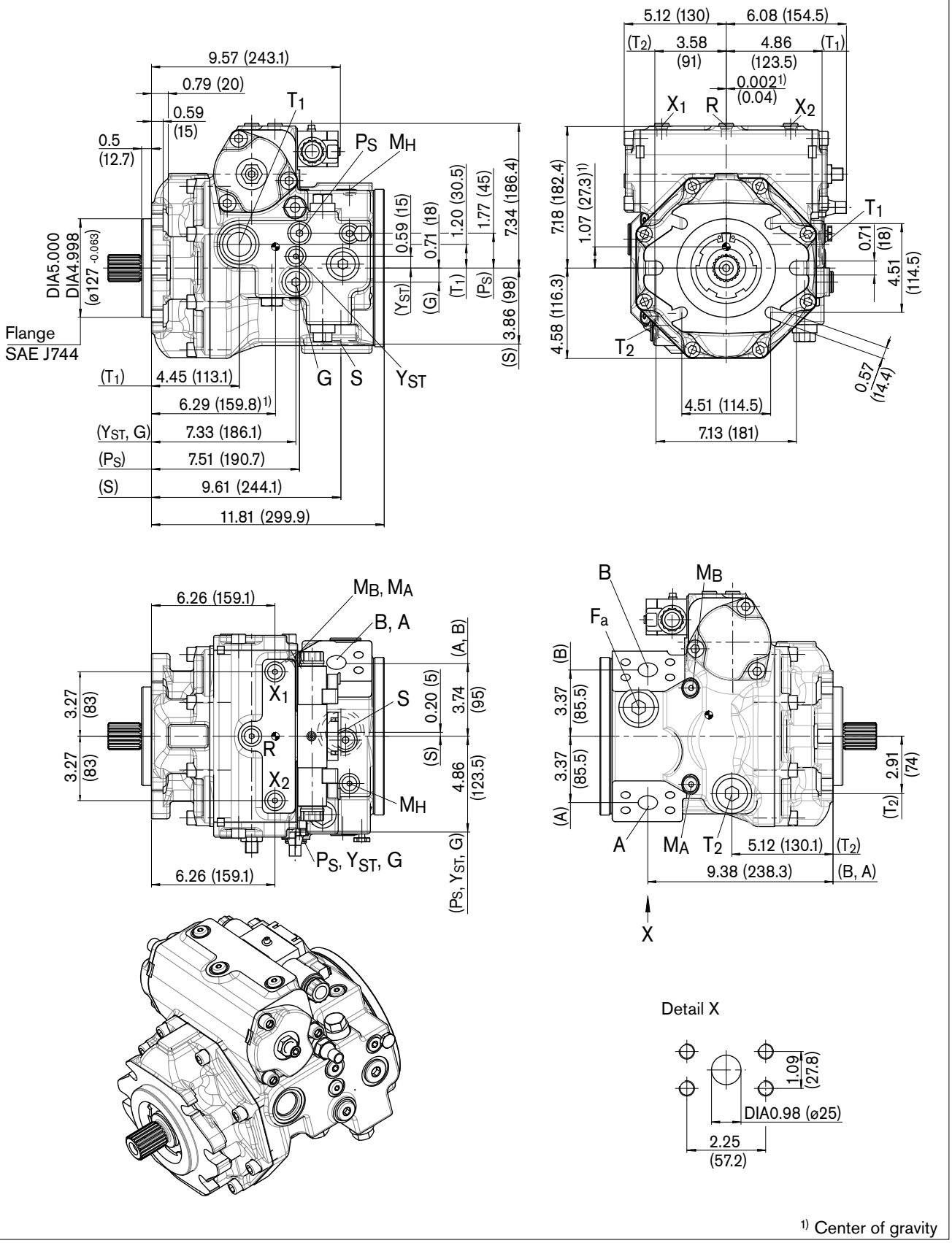
DA4, DA5
Control valve fixed setting and braking inch valve mounted

DA6
Control valve fixed setting and ports for pilot control device

Dimensions size 85

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

EP - Proportional control electric



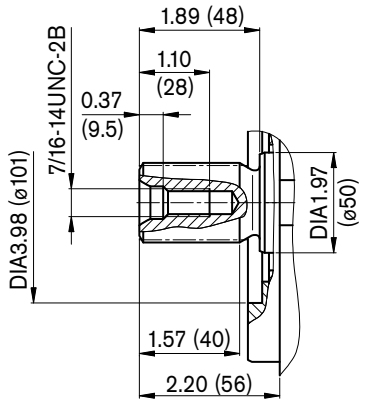
1) Center of gravity

Dimensions size 85

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

Drive shaft

V8 Splined shaft 1 3/8 in
21T 16/32DP[1] (DIN ISO 3019-1)



Ports

Designation	Port for	Standard	Size[2]	Maximum pressure [psi (bar)][3]	State
A, B[8]	Service line Fixing thread A/B, screw grade 8 with hardened washer	SAE J518[4] ISO 68	1 in 7/16-14UNC; 0.87 (22) deep	7250 (500)	O O
S	Suction	ISO 11926	1 5/8-12UN-2B; 0.79 (20) deep	75 (5)	O[5]
T_1	Tank	ISO 11926	1 5/16-12UN-2B; 0.79 (20) deep	45 (3)	O[6]
T_2	Tank	ISO 11926	1 5/16-12UN-2B; 0.79 (20) deep	45 (3)	X[6]
R	Air bleed	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	45 (3)	X
X_1, X_2	Control pressure (upstream of orifice)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	X
X_1, X_2	Control pressure (upstream of orifice, HT only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	O
X_3, X_4[7]	Stroking chamber pressure	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	X
G	Boost pressure	ISO 11926	7/8-14UNF-2B; 0.67 (17) deep	580 (40)	X
P_S	Pilot pressure, inlet	ISO 11926	3/4-16UNF-2B; 0.59 (15) deep	580 (40)	X
P_S	Pilot pressure, inlet (DA6 only)	ISO 11926	3/4-16UNF-2B; 0.59 (15) deep	580 (40)	O
Y_{ST}	Pilot pressure, outlet	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	X
Y_{ST}	Pilot pressure, outlet (DA6 only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	O
Y_{HT}	Pilot pressure, outlet (HT only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	O
M_A, M_B	Measuring pressure A, B	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	7250 (500)	X
M_H	Measuring high pressure	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	7250 (500)	X
F_a	Boost pressure, inlet	ISO 11926	1 5/16-12UN-2B; 0.79 (20) deep	580 (40)	X
Y_1, Y_2	Pilot signal (HP only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	O
Z	Inch signal (DA4 and 5 only)	ISO 11926	3/8-24UNF-2B; 0.39 (10) deep	580 (40)	O

1) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
2) Observe the general instructions on page 60 for the maximum tightening torques.
3) Short-term pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518
5) Plugged for external supply
6) Depending on installation position, T_1 or T_2 must be connected (see also page 59).
7) Optional, see page 51
8) For the maximum utilization of pressure, only grade 8 screws and hardened washers are to be used to tighten the SAE flange shells.

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

Note

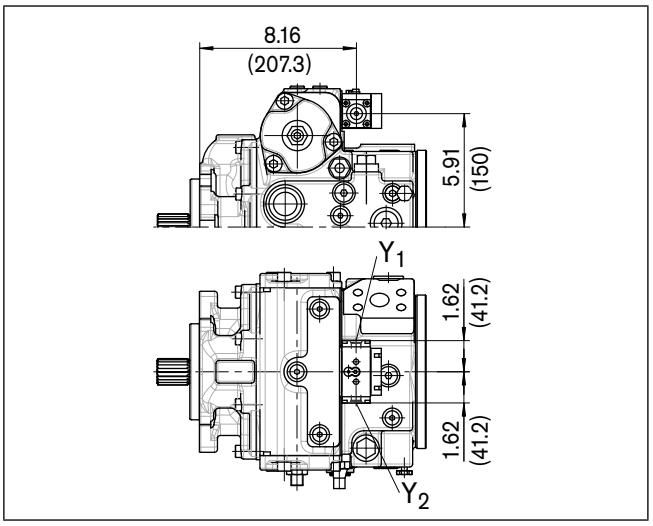
The ports and fixing threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified operating conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.

Dimensions size 85

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

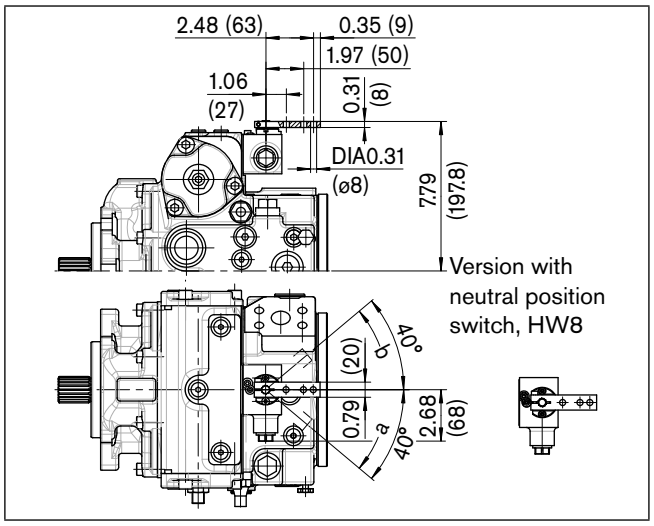
HP

Proportional control hydraulic, pilot-pressure related



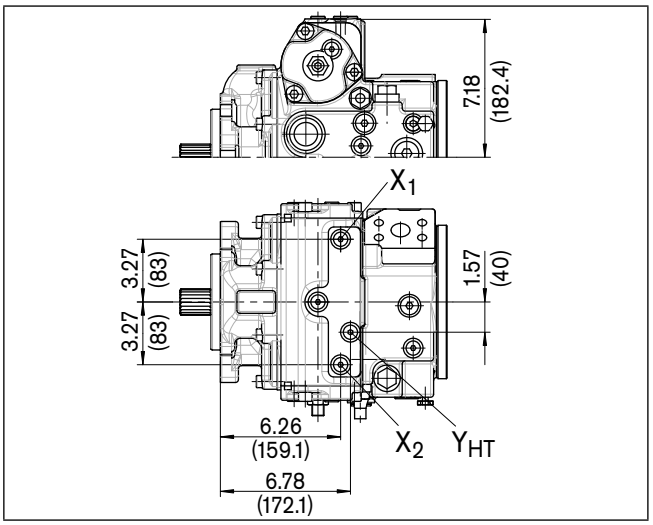
HW

Proportional control hydraulic, mechanical servo



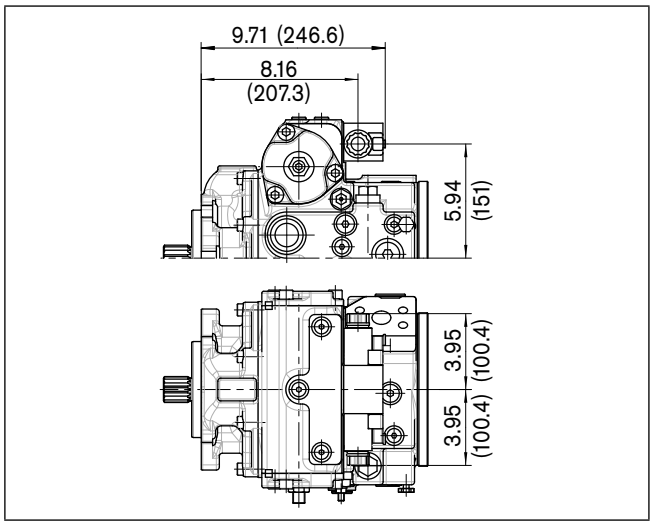
HT

Hydraulic control, direct controlled



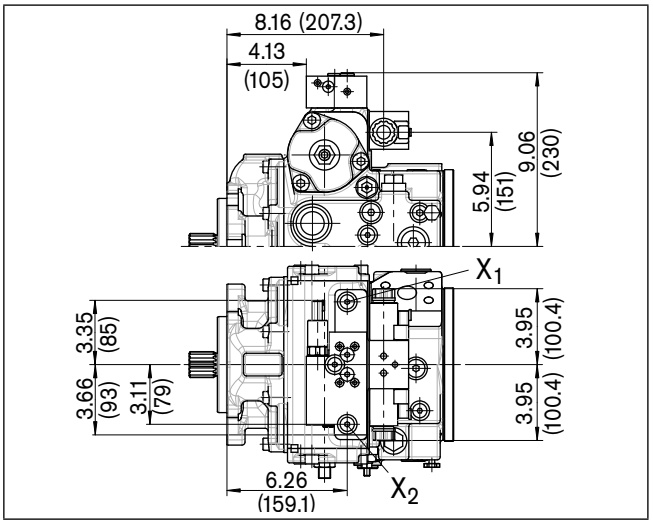
EZ

Two-point control electric



EV

Electric control, direct controlled



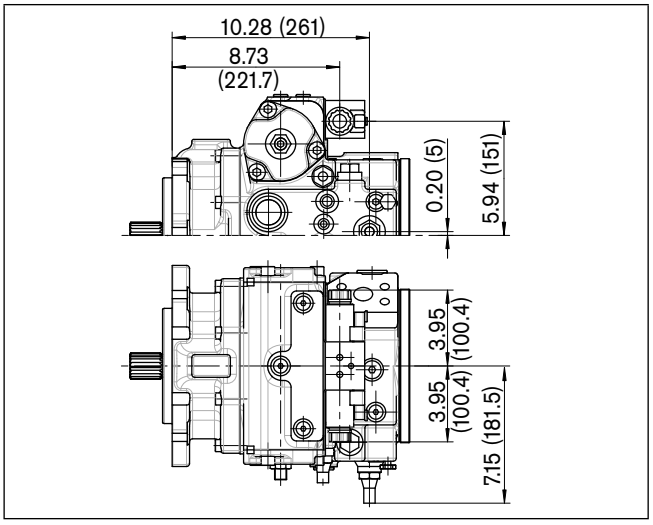
Dimensions size 85

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

DA – Automatic control speed related

DA1

Control valve fixed setting



DA2

Control valve mechanically adjustable with position lever

DA4, DA5

Control valve fixed setting and braking inch valve mounted

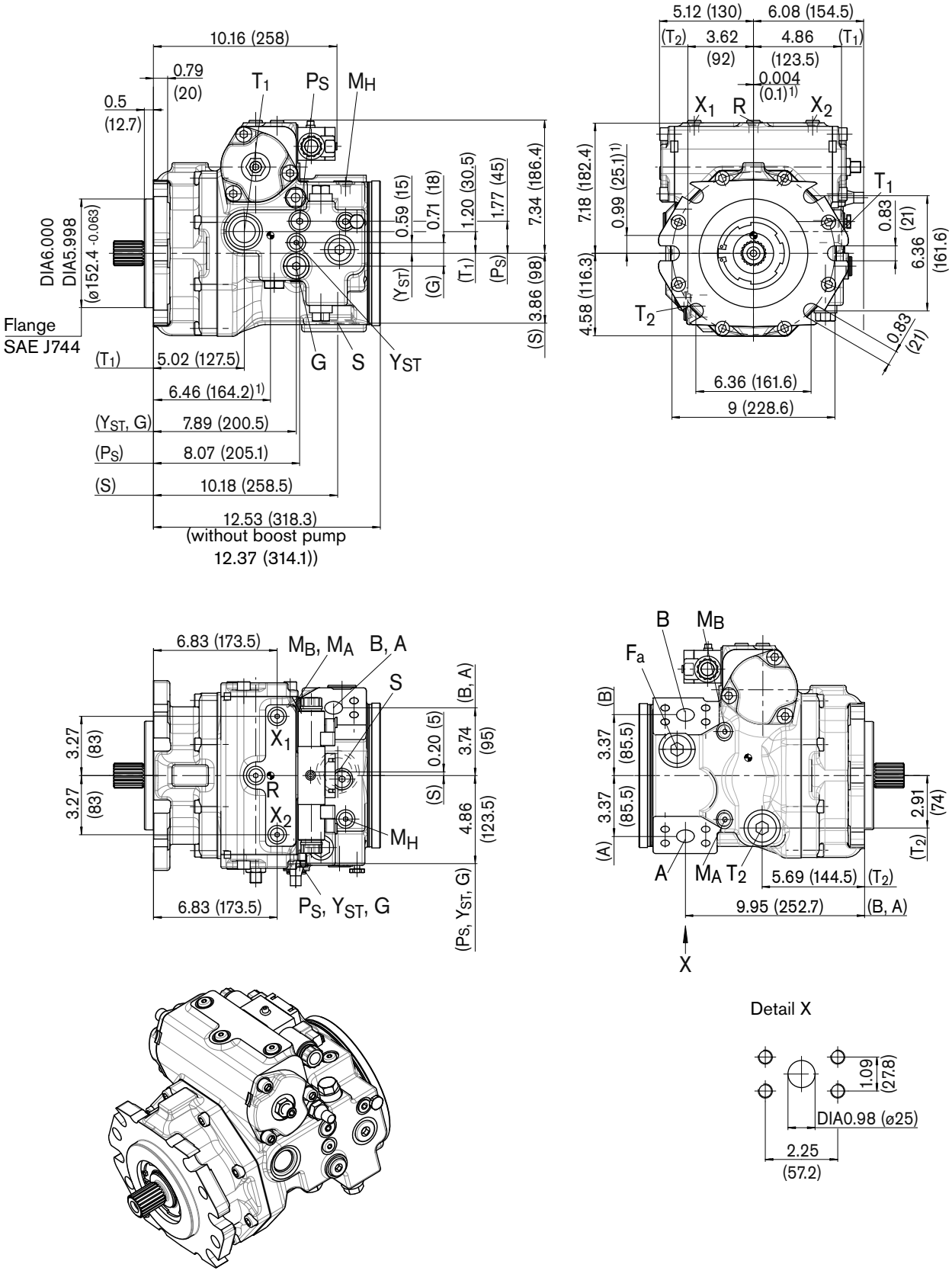
DA6

Control valve fixed setting and ports for pilot control device

Dimensions size 110

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

EP - Proportional control electric



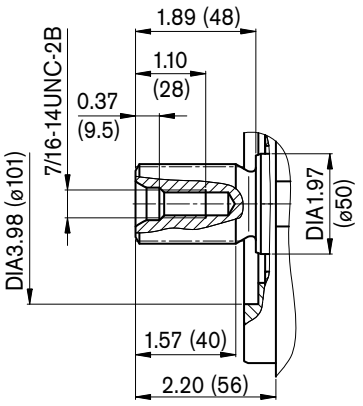
1) Center of gravity

Dimensions size 110

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

Drive shaft

V8 Splined shaft 1 3/8 in
21T 16/32DP[1] (DIN ISO 3019-1)



Ports

Designation	Port for	Standard	Size[2]	Maximum pressure [psi (bar)][3]	State
A, B[8]	Service line Fixing thread A/B, screw grade 8 with hardened washer	SAE J518[4] ISO 68	1 in 7/16-14UNC; 0.87 (22) deep	7250 (500)	O O
S	Suction	ISO 11926	1 5/8-12UN-2B; 0.79 (20) deep	75 (5)	O[5]
T_1	Tank	ISO 11926	1 5/16-12UN-2B; 0.79 (20) deep	45 (3)	O[6]
T_2	Tank	ISO 11926	1 5/16-12UN-2B; 0.79 (20) deep	45 (3)	X[6]
R	Air bleed	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	45 (3)	X
X_1, X_2	Control pressure (upstream of orifice)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	X
X_1, X_2	Control pressure (upstream of orifice, HT only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	O
X_3, X_4[7]	Stroking chamber pressure	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	X
G	Boost pressure	ISO 11926	7/8-14UNF-2B; 0.67 (17) deep	580 (40)	X
P_S	Pilot pressure, inlet	ISO 11926	3/4-16UNF-2B; 0.59 (15) deep	580 (40)	X
P_S	Pilot pressure, inlet (DA6 only)	ISO 11926	3/4-16UNF-2B; 0.59 (15) deep	580 (40)	O
Y_{ST}	Pilot pressure, outlet	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	X
Y_{ST}	Pilot pressure, outlet (DA6 only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	O
Y_{HT}	Pilot pressure, outlet (HT only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	O
M_A, M_B	Measuring pressure A, B	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	7250 (500)	X
M_H	Measuring high pressure	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	7250 (500)	X
F_a	Boost pressure, inlet	ISO 11926	1 5/16-12UN-2B; 0.79 (20) deep	580 (40)	X
Y_1, Y_2	Pilot signal (HP only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	O
Z	Inch signal (DA4 and 5 only)	ISO 11926	3/8-24UNF-2B; 0.39 (10) deep	580 (40)	O

1) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
2) Observe the general instructions on page 60 for the maximum tightening torques.
3) Short-term pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518
5) Plugged for external supply
6) Depending on installation position, T_1 or T_2 must be connected (see also page 59).
7) Optional, see page 51
8) For the maximum utilization of pressure, only grade 8 screws and hardened washers are to be used to tighten the SAE flange shells.

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

Note

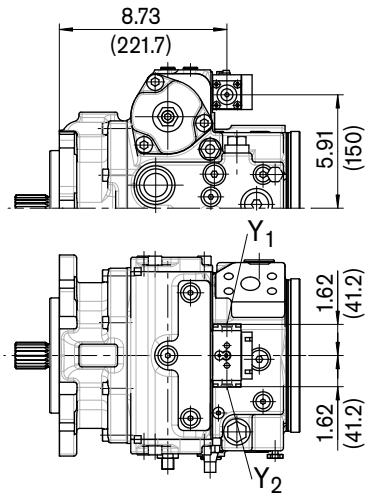
The ports and fixing threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified operating conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.

Dimensions size 110

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

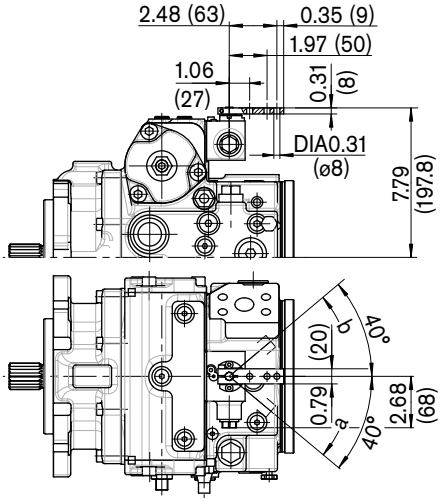
HP

Proportional control hydraulic, pilot-pressure related

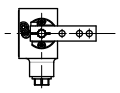


HW

Proportional control hydraulic, mechanical servo

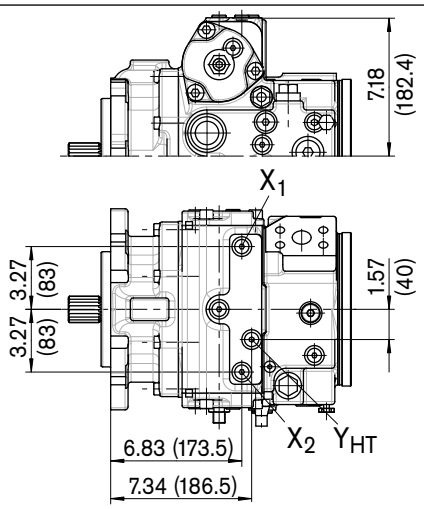


Version with neutral position switch, HW8



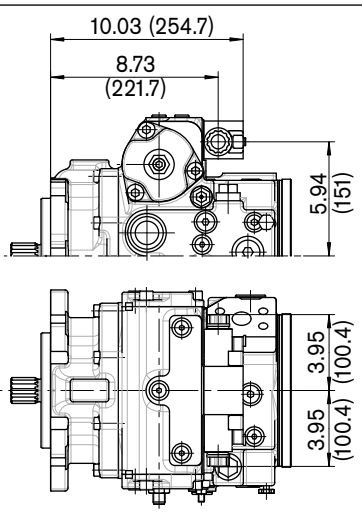
HT

Hydraulic control, direct controlled



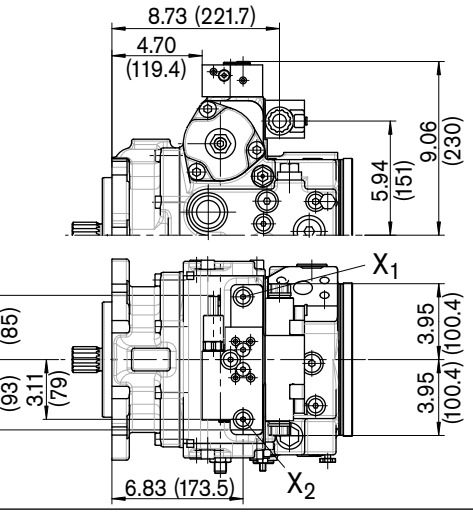
EZ

Two-point control electric



EV

Electric control, direct controlled



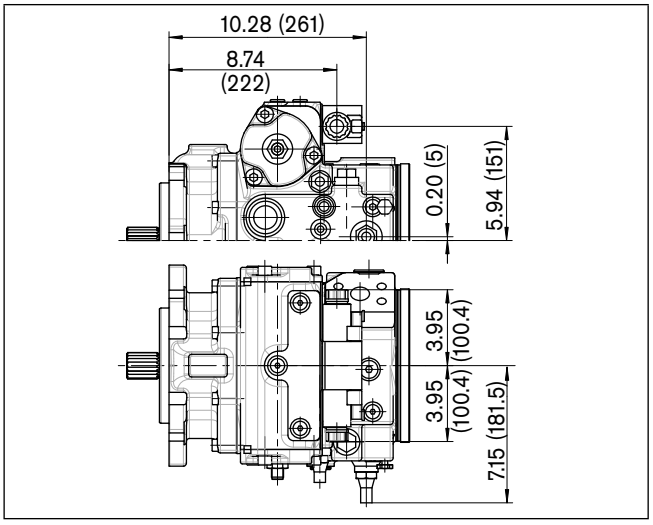
Dimensions size 110

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

DA – Automatic control speed related

DA1

Control valve fixed setting



DA2

Control valve mechanically adjustable with position lever

DA4, DA5

Control valve fixed setting and braking inch valve mounted

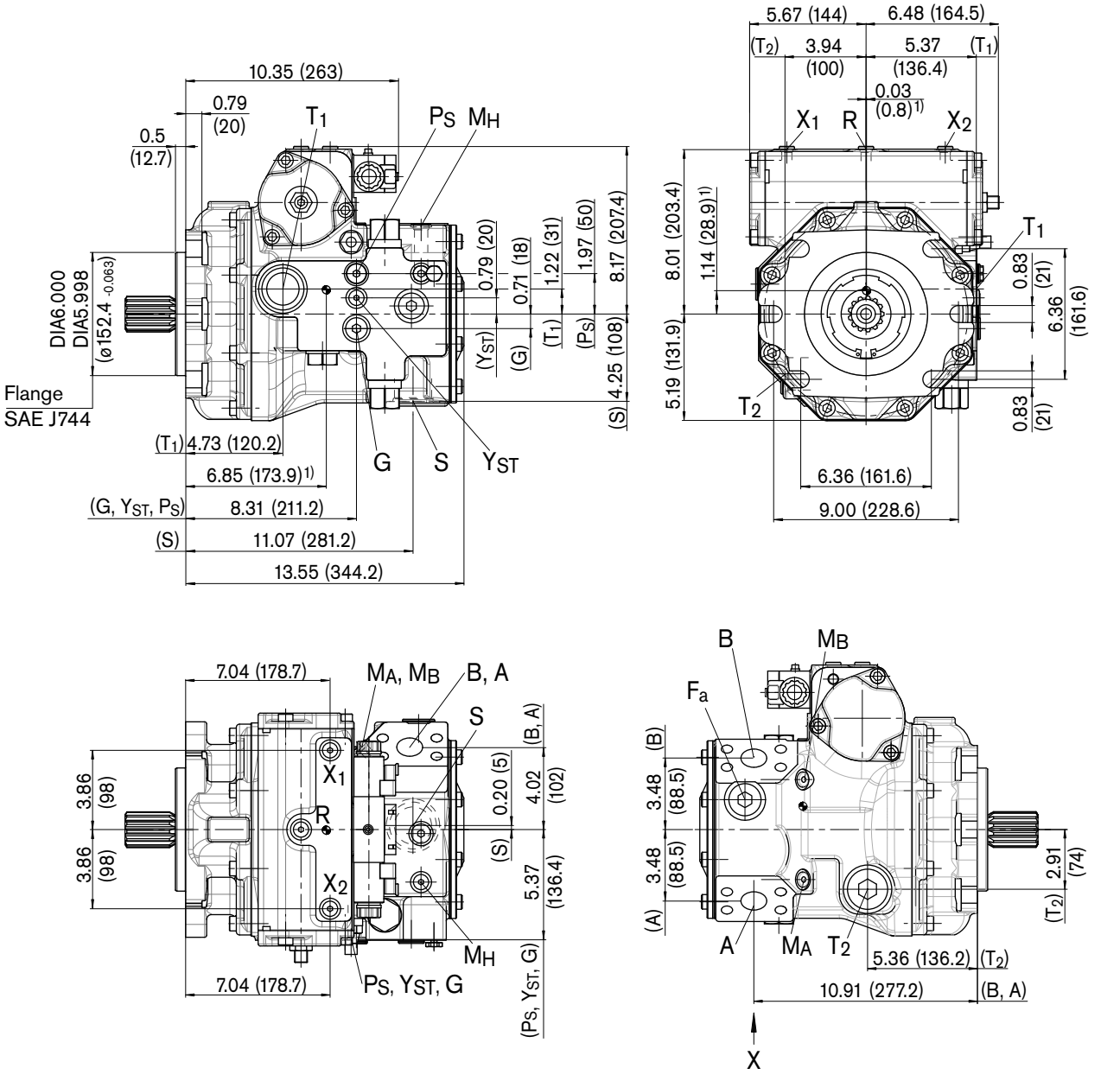
DA6

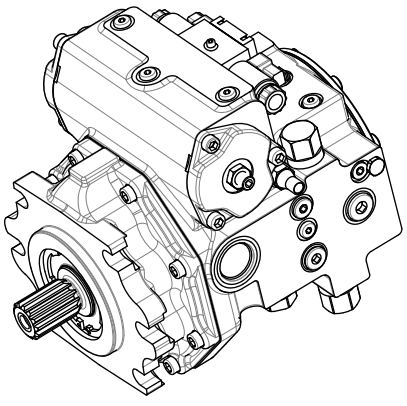
Control valve fixed setting and ports for pilot control device

Dimensions size 145

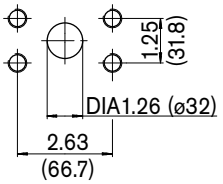
Before finalizing your design, request a binding installation drawing. Dimensions in in (mm).

EP - Proportional control electric





Detail X



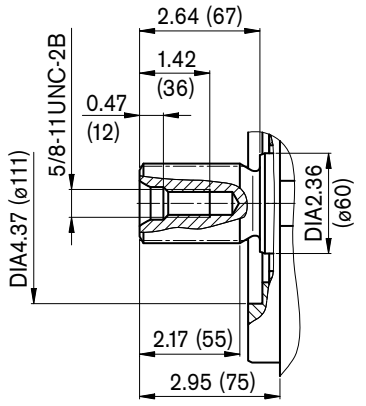
1) Center of gravity

Dimensions size 145

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

Drive shaft

T1 Splined shaft 1 3/4 in
13T 8/16DP[1] (SAE J744)



Ports

Designation	Port for	Standard	Size[2]	Maximum pressure [psi (bar)][3]	State
A, B[8]	Service line Fixing thread A/B, screw grade 8 with hardened washer	SAE J518[4] ISO 68	1 1/4 in 1/2-13UNC; 0.75 (19) deep	7250 (500)	O O
S	Suction	ISO 11926	1 7/8-12UN-2B; 0.79 (20) deep	75 (5)	O[5]
T_1	Tank	ISO 11926	1 5/8-12UN-2B; 0.77 (19.5) deep	45 (3)	O[6]
T_2	Tank	ISO 11926	1 5/8-12UN-2B; 0.77 (19.5) deep	45 (3)	X[6]
R	Air bleed	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	45 (3)	X
X_1, X_2	Control pressure (upstream of orifice)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	X
X_1, X_2	Control pressure (upstream of orifice, HT only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	O
X_3, X_4[7]	Stroking chamber pressure	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	X
G	Boost pressure	ISO 11926	7/8-14UNF-2B; 0.67 (17) deep	580 (40)	X
P_S	Pilot pressure, inlet	ISO 11926	3/4-16UNF-2B; 0.59 (15) deep	580 (40)	X
P_S	Pilot pressure, inlet (DA6 only)	ISO 11926	3/4-16UNF-2B; 0.59 (15) deep	580 (40)	O
Y_{ST}	Pilot pressure, outlet	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	X
Y_{ST}	Pilot pressure, outlet (DA6 only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	O
Y_{HT}	Pilot pressure, outlet (HT only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	O
M_A, M_B	Measuring pressure A, B	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	7250 (500)	X
M_H	Measuring high pressure	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	7250 (500)	X
F_a	Boost pressure, inlet	ISO 11926	1 5/16-12UN-2B; 0.79 (20) deep	580 (40)	X
Y_1, Y_2	Pilot signal (HP only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	O
Z	Inch signal (DA4 and 5 only)	ISO 11926	3/8-24UNF-2B; 0.39 (10) deep	580 (40)	O

1) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
2) Observe the general instructions on page 60 for the maximum tightening torques.
3) Short-term pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518
5) Plugged for external supply
6) Depending on installation position, T_1 or T_2 must be connected (see also page 59).
7) Optional, see page 51
8) For the maximum utilization of pressure, only grade 8 screws and hardened washers are to be used to tighten the SAE flange shells.

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

Note

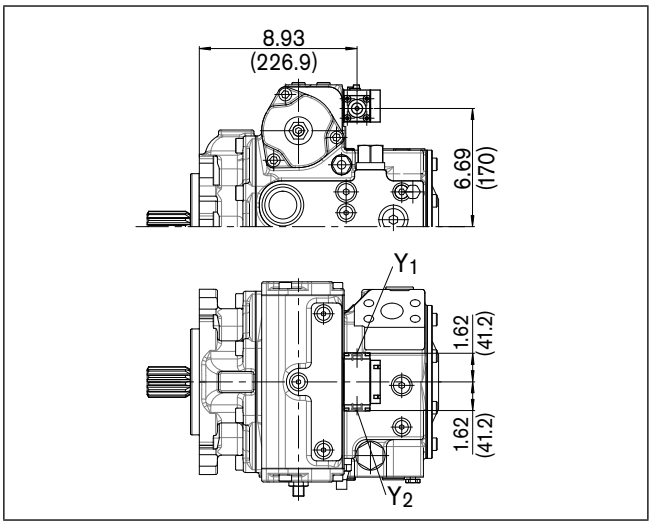
The ports and fixing threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified operating conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.

Dimensions size 145

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

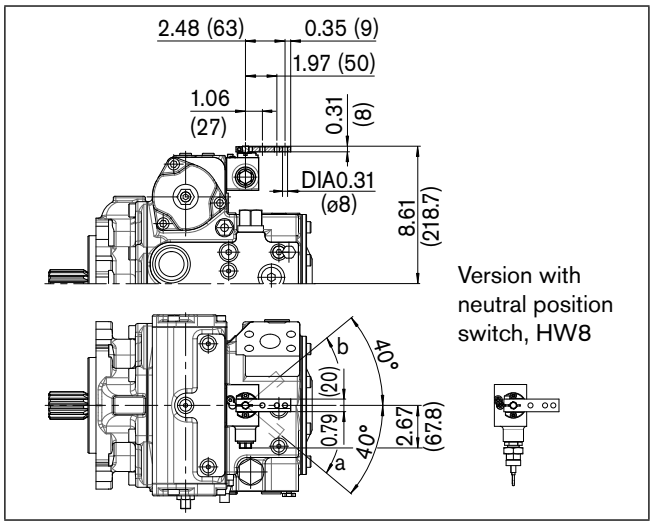
HP

Proportional control hydraulic, pilot-pressure related



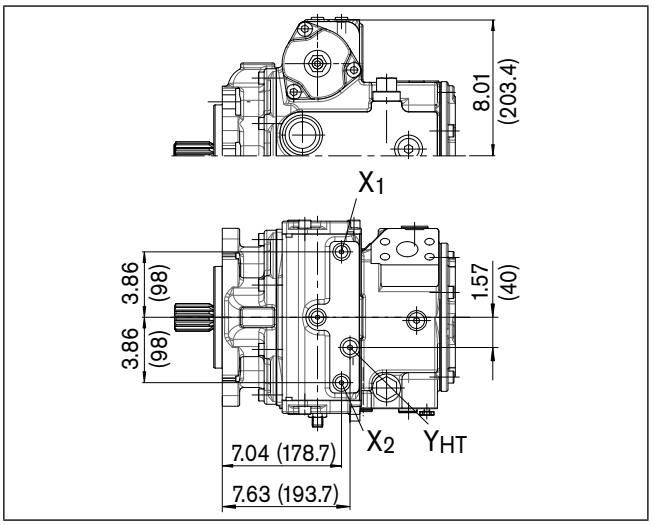
HW

Proportional control hydraulic, mechanical servo



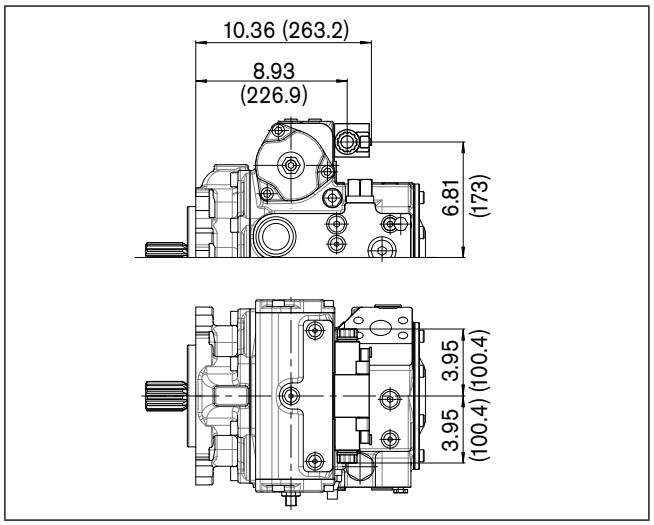
HT

Hydraulic control, direct controlled



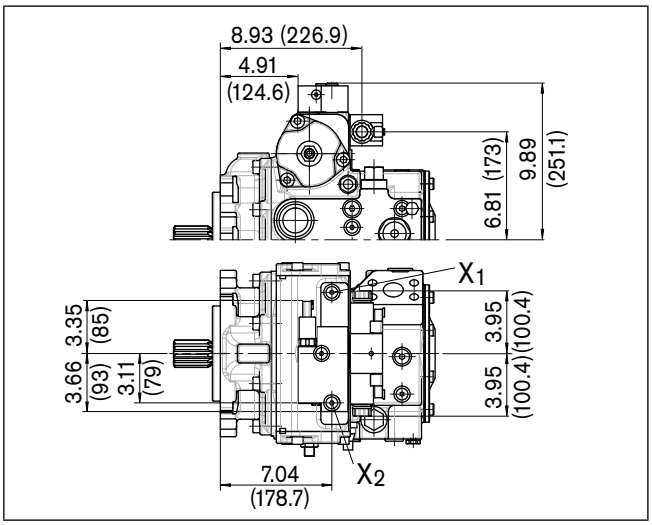
EZ

Two-point control electric



EV

Electric control, direct controlled



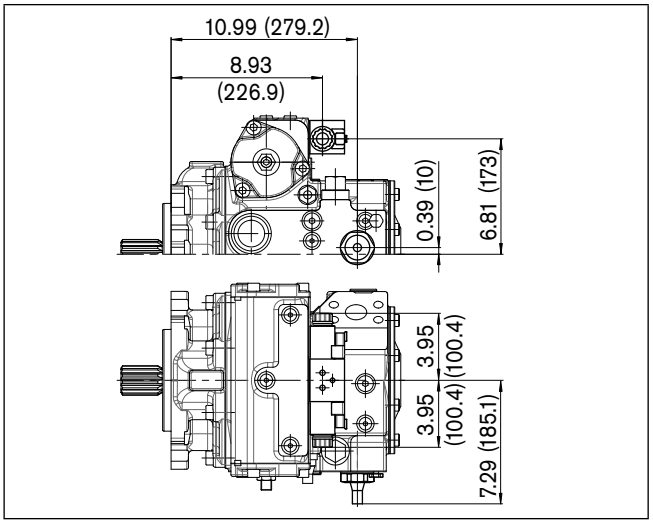
Dimensions size 145

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

DA – Automatic control speed related

DA1

Control valve fixed setting

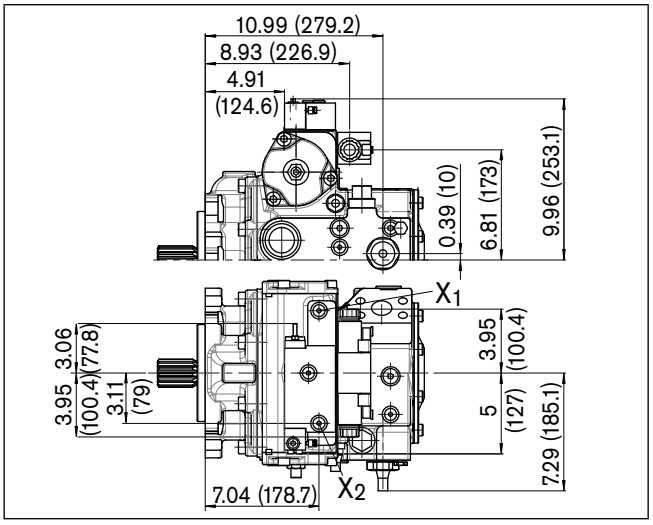


DA2

Control valve mechanically adjustable with position lever

DA4, DA5

Control valve fixed setting and braking inch valve mounted



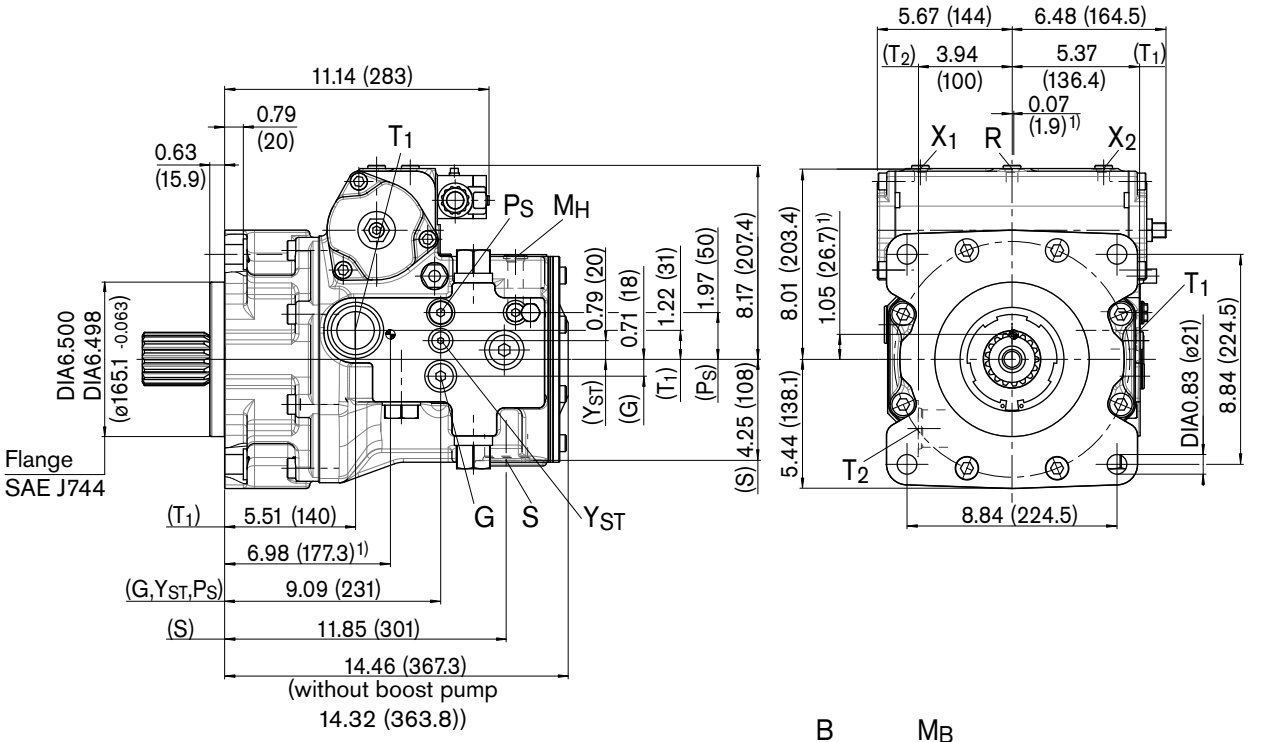
DA6

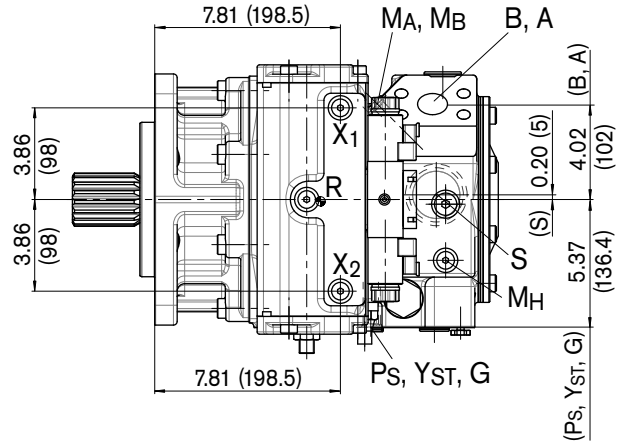
Control valve fixed setting and ports for pilot control device

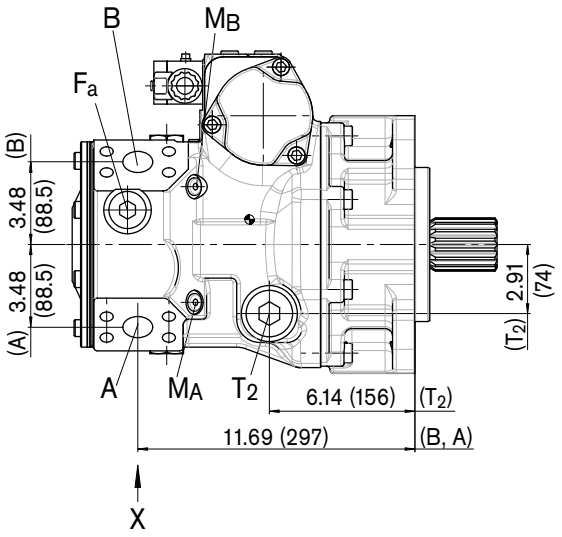
Dimensions size 175

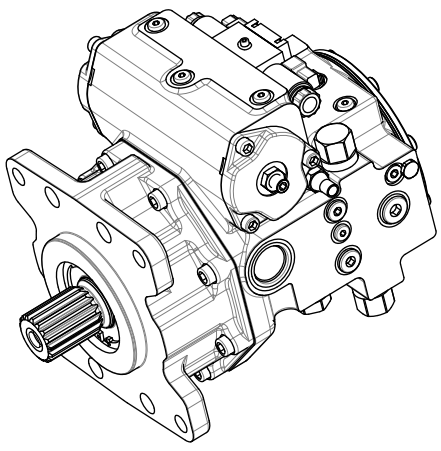
Before finalizing your design, request a binding installation drawing. Dimensions in in (mm).

EP - Proportional control electric

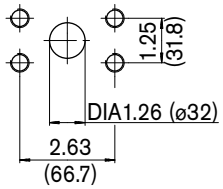








Detail X



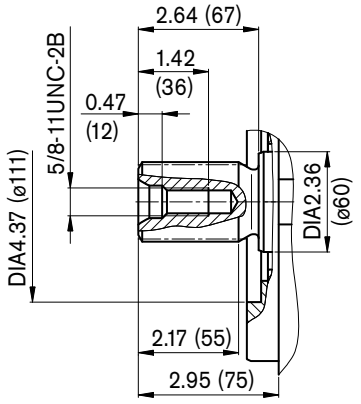
1) Center of gravity

Dimensions size 175

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

Drive shaft

T1 Splined shaft 1 3/4 in
13T 8/16DP[1] (SAE J744)



Ports

Designation	Port for	Standard	Size[2]	Maximum pressure [psi (bar)][3]	State
A, B[8]	Service line Fixing thread A/B, screw grade 8 with hardened washer	SAE J518[4] ISO 68	1 1/4 in 1/2-13UNC; 0.75 (19) deep	7250 (500)	O O
S	Suction	ISO 11926	1 7/8-12UN-2B; 0.79 (20) deep	75 (5)	O[5]
T_1	Tank	ISO 11926	1 5/8-12UN-2B; 0.77 (19.5) deep	45 (3)	O[6]
T_2	Tank	ISO 11926	1 5/8-12UN-2B; 0.77 (19.5) deep	45 (3)	X[6]
R	Air bleed	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	45 (3)	X
X_1, X_2	Control pressure (upstream of orifice)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	X
X_1, X_2	Control pressure (upstream of orifice, HT only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	O
X_3, X_4[7]	Stroking chamber pressure	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	X
G	Boost pressure	ISO 11926	7/8-14UNF-2B; 0.67 (17) deep	580 (40)	X
P_S	Pilot pressure, inlet	ISO 11926	3/4-16UNF-2B; 0.59 (15) deep	580 (40)	X
P_S	Pilot pressure, inlet (DA6 only)	ISO 11926	3/4-16UNF-2B; 0.59 (15) deep	580 (40)	O
Y_{ST}	Pilot pressure, outlet	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	X
Y_{ST}	Pilot pressure, outlet (DA6 only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	O
Y_{HT}	Pilot pressure, outlet (HT only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	O
M_A, M_B	Measuring pressure A, B	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	7250 (500)	X
M_H	Measuring high pressure	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	7250 (500)	X
F_a	Boost pressure, inlet	ISO 11926	1 5/16-12UN-2B; 0.79 (20) deep	580 (40)	X
Y_1, Y_2	Pilot signal (HP only)	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	O
Z	Inch signal (DA4 and 5 only)	ISO 11926	3/8-24UNF-2B; 0.39 (10) deep	580 (40)	O

1) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
2) Observe the general instructions on page 60 for the maximum tightening torques.
3) Short-term pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518
5) Plugged for external supply
6) Depending on installation position, T_1 or T_2 must be connected (see also page 59).
7) Optional, see page 51
8) For the maximum utilization of pressure, only grade 8 screws and hardened washers are to be used to tighten the SAE flange shells.

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

Note

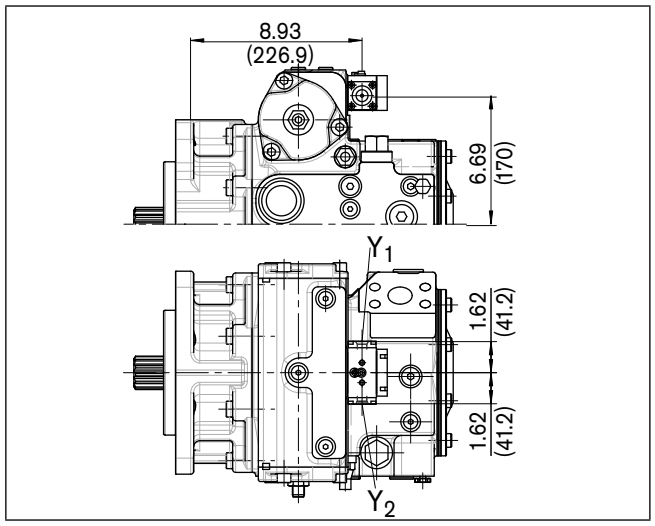
The ports and fixing threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified operating conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.

Dimensions size 175

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

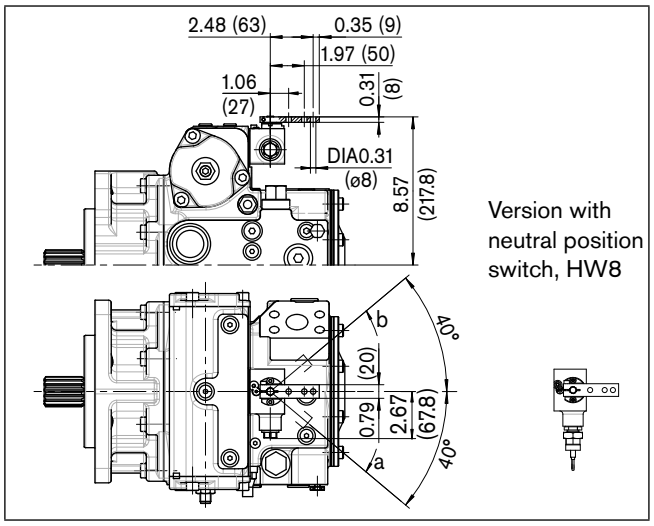
HP

Proportional control hydraulic, pilot-pressure related



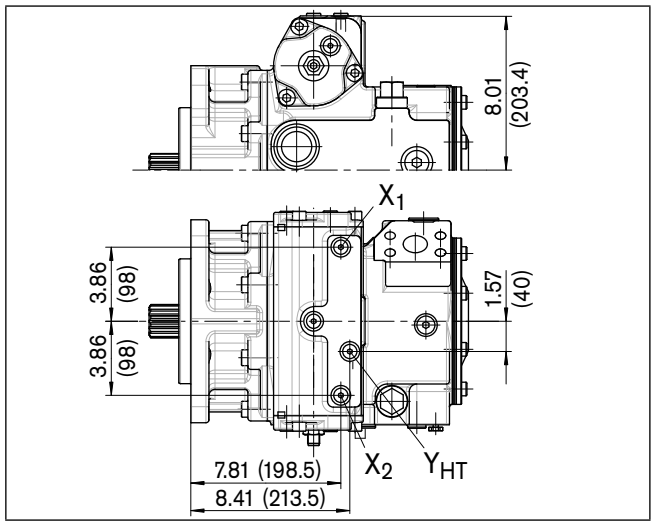
HW

Proportional control hydraulic, mechanical servo



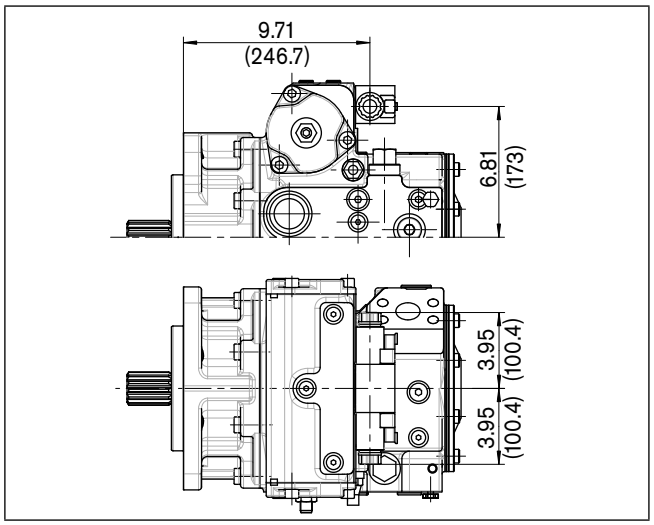
HT

Hydraulic control, direct controlled



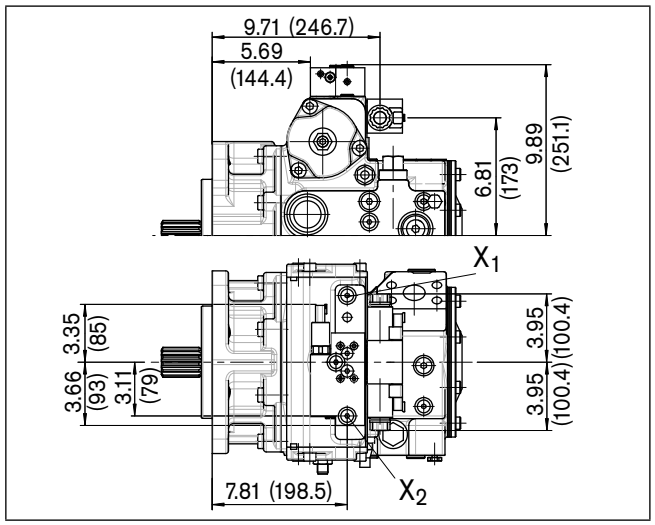
EZ

Two-point control electric



EV

Electric control, direct controlled



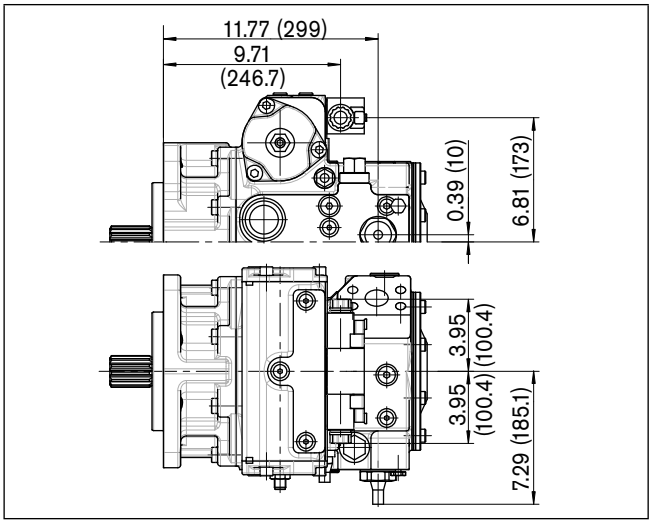
Dimensions size 175

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

DA – Automatic control speed related

DA1

Control valve fixed setting

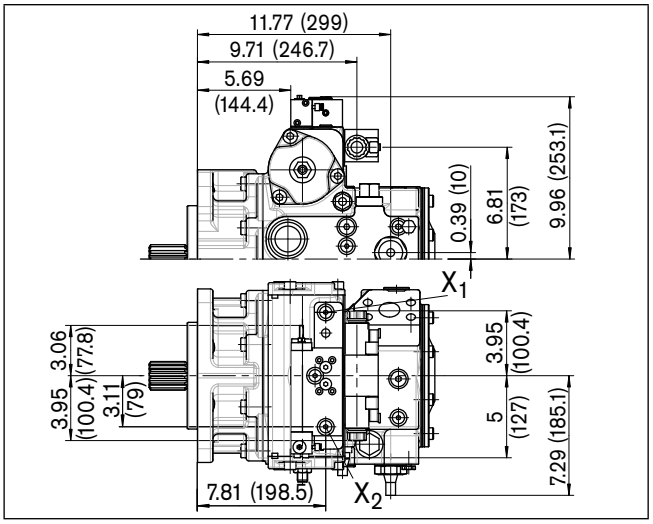


DA2

Control valve mechanically adjustable with position lever

DA4, DA5

Control valve fixed setting and braking inch valve mounted



DA6

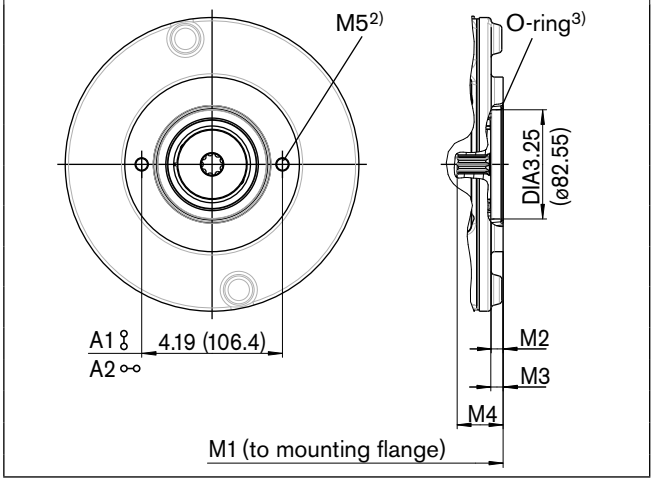
Control valve fixed setting and ports for pilot control device

Through drive dimensions

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

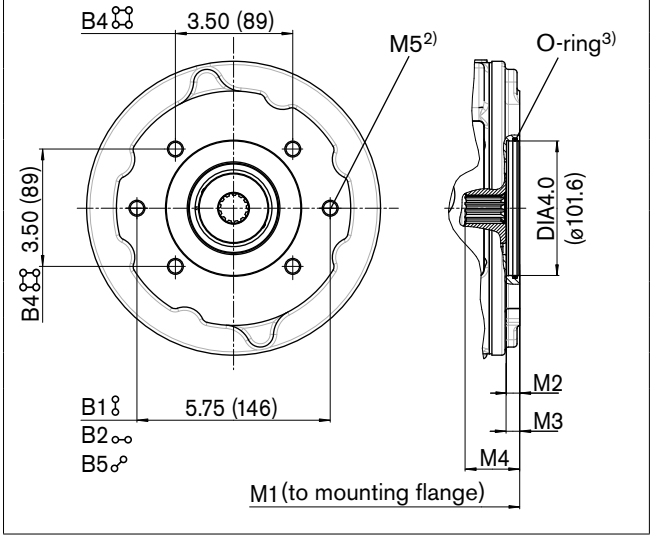
Flange SAE J744			Coupling for splined shaft[1]									
	Mounting variant											
Diameter	Symbol	Designation	Diameter		Designation	045	065	085	110	145	175	
Without						●	●	●	●	●	●	**0000**
82-2 (A)		A1	5/8 in	9T 16/32DP	S2	❍	❍	❍	❍	❍	❍	**A1S2**
		A2	5/8 in	9T 16/32DP	S2	●	●	●	●	●	❍	**A2S2**
101-2 (B)		B1	7/8 in	13T 16/32DP	S4	❍	❍	❍	❍	❍	●	**B1S4**
			1 in	15T 16/32DP	S5	❍	❍	❍	❍	❍	❍	**B1S5**
		B2	7/8 in	13T 16/32DP	S4	●	●	❍	❍	●	●	**B2S4**
			1 in	15T 16/32DP	S5	●	●	●	●	●	❍	**B2S5**
		B5[4]	7/8 in	13T 16/32DP	S4	❍	❍	❍	❍	❍	❍	**B5S4**
			1 in	15T 16/32DP	S5	❍	❍	❍	❍	❍	❍	**B5S5**
101-4 (B)		B4	7/8 in	13T 16/32DP	S4	❍	❍	❍	❍	❍	❍	**B4S4**
			1 in	15T 16/32DP	S5	❍	❍	❍	❍	❍	❍	**B5S5**

82-2



NG		M1	M2	M3	M4	M5
45	in	10.54	0.35	0.37	1.39	3/8-16UNC-2B; 0.59 (15) deep
	mm	267.7	9	9.4	35.3	
65	in	11.09	0.35	0.37	1.63	
	mm	281.6	9	9.4	41.3	
85	in	12.04	0.35	0.37	1.41	
	mm	305.9	9	9.4	35.8	
110	in	12.77	0.35	0.37	1.36	
	mm	324.3	9	9.4	34.6	
145	in	13.63	0.35	0.37	1.37	
	mm	346.2	9	9.3	34.7	
175	in	14.54	0.35	0.36	1.31	
	mm	369.3	9	9.1	33.4	

101-2
101-4



NG		M1	M2	M3	M4	M5
45	in	10.66	0.39	0.49	1.70	1/2-13UNC-2B; 0.63 (16) deep
	mm	270.7	10	12.4	43.3	
65	in	11.20	0.39	0.49	1.74	
	mm	284.6	10	12.4	44.3	
85	in	12.16	0.39	0.43	1.89	
	mm	308.9	10	10.9	47.9	
110	in	12.89	0.39	0.43	1.96	
	mm	327.3	10	10.9	49.9	
145	in	13.75	0.39	0.41	1.62	
	mm	349.2	10	10.3	41.2	
175	in	14.66	0.39	0.41	1.63	
	mm	372.3	10	10.3	41.3	

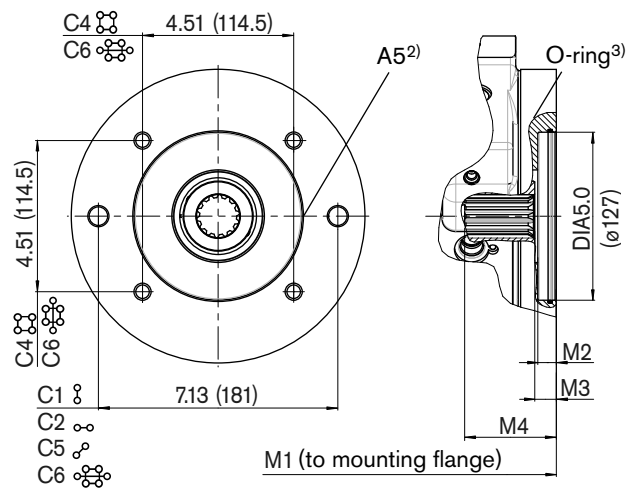
[1] Coupling for splined shaft according to ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
[2] Thread according to ISO 68, observe the general instructions on page 60 for the maximum tightening torques.
[3] O-ring included in the delivery contents
[4] Viewed from through drive

Through drive dimensions

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

Flange SAE J744			Coupling for splined shaft[1]								
	Mounting variant										
Diameter	Symbol	Designation	Diameter		Designation	045	065	085	110	145	175	
127-2 (C)		C1	1 in	15T 16/32DP	S5	❍	❍	❍	❍	❍	❍	**C1S5**
			1 1/4 in	14T 12/24DP	S7	❍	❍	❍	❍	❍	❍	**C1S7**
		C2	1 in	15T 16/32DP	S5	❍	❍	❍	❍	●	❍	**C2S5**
			1 1/4 in	14T 12/24DP	S7	●	●	●	●	●	●	**C2S7**
			1 3/8 in	21T 16/32DP	V8	–	–	●	❍	●	●	**C2V8**
			1 3/4 in	13T 8/16DP	T1	–	–	–	–	●	●	**C2T1**
		C5[4]	1 in	15T 16/32DP	S5	❍	❍	❍	❍	❍	❍	**C5S5**
			1 1/4 in	14T 12/24DP	S7	❍	❍	❍	❍	❍	❍	**C5S7**
127-4 (C)		C4	1 in	15T 16/32DP	S5	–	❍	❍	❍	❍	❍	**C4S5**
			1 1/4 in	14T 12/24DP	S7	–	❍	❍	❍	❍	❍	**C4S7**
		C6	1 3/8 in	21T 16/32DP	V8	–	–	❍	❍	❍	❍	**C6V8**

127-2
127-4



NG		M1	M2	M3	M4
45	in	10.78	0.55	0.61	2.11
	mm	273.7	14	15.4	53.7
65	in	11.32	0.55	0.61	2.23
	mm	287.6	14	15.4	56.7
85	in	12.40	0.55	0.59	2.25
	mm	314.9	14	14.9	57.1
110	in	13.12	0.55	0.67	2.29
	mm	333.3	14	16.9	58.2
145	in	13.98	0.55	0.64	2.74
	mm	355.2	14	16.3	69.6
175	in	14.89	0.55	0.64	2.47
	mm	378.3	14	16.3	62.7

M5	
NG 45 to 65, 2-hole	5/8-11UNC-2B; 0.75 (19) deep
NG 85 to 175, 2-hole	5/8-11UNC-2B; 0.83 (21) deep
NG 85 to 175, 4-hole	1/2-13UNC-2B; 0.63 (16) deep

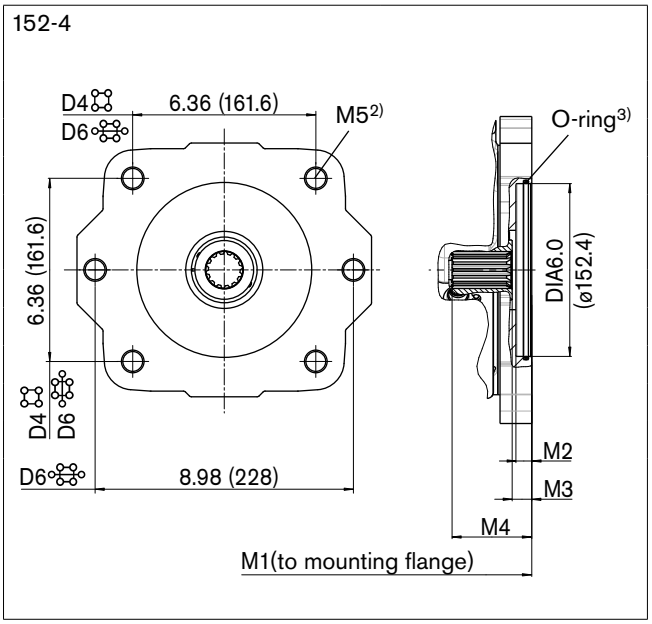
[1] Coupling for splined shaft according to ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
[2] Thread according to ISO 68, observe the general instructions on page 60 for the maximum tightening torques.
[3] O-ring included in the delivery contents
[4] Viewed from through drive

Through drive dimensions

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

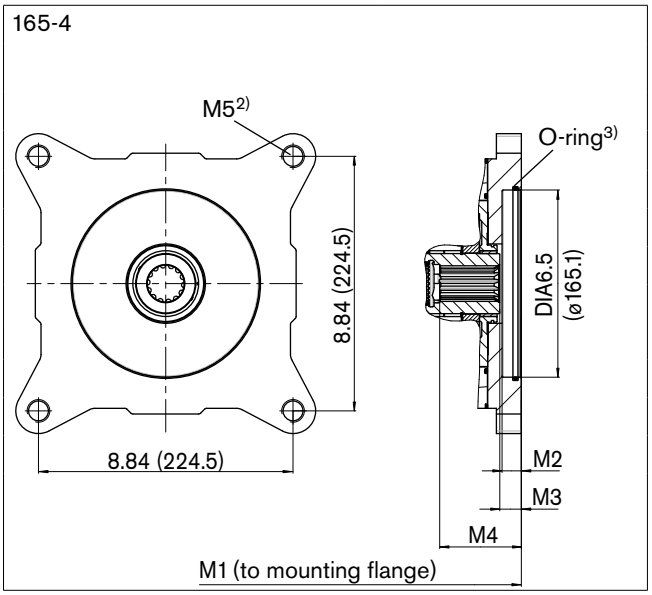
Flange SAE J744			Coupling for splined shaft[1]							
	Mounting variant									
Diameter	Symbol	Designation	Diameter	Designation	045	065	085	110	145	175	
152-4 (D)	⌘	D4	1 3/4 in 13T 8/16DP	T1	–	–	–	–	●	●	**D4T1**
	⌘	D6	1 3/8 in 21T 16/32DP	V8	–	–	–	❍	❍	❍	**D6V8**
			1 3/4 in 13T 8/16DP	T1	–	–	–	–	❍	❍	**D6T1**
165-4 (E)	⌘	E4	1 3/4 in 13T 8/16DP	T1	–	–	–	–	–	●	**E4T1**

152-4



NG		M1	M2	M3	M4	M5
110	in	13.28	0.55	0.63	2.24	3/4-10UNC-2B; 0.87 (22) deep
	mm	337.4	14	15.9	56.9	
145	in	14.02	0.55	0.39	2.93	
	mm	356.2	14	10	74.4	
175	in	14.93	0.55	0.70	3.00	
	mm	379.3	14	17.8	76.3	

165-4



NG		M1	M2	M3	M4	M5
175	in	15.0	0.67	0.76	3.07	3/4-10UNC-2B; 0.87 (22) deep
	mm	381	17	19.4	77.9	

[1] Coupling for splined shaft according to ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
[2] Thread according to ISO 68, observe the general instructions on page 60 for the maximum tightening torques.
[3] O-ring included in the delivery contents

Overview of attachments

Through drive[1]			Attachment for 2nd pump						
Flange	Coupling for splined shaft	Short code	A4VG/40 NG (shaft)	AA4VG/32 NG (shaft)	AA10VG NG (shaft)	AA10VO/31 NG (shaft)	A10VO/53 NG (shaft)	AA11VO NG (shaft)	External gear pump
82-2 (A)	5/8 in	**A_S2**	–	–	–	18 (U)	10 (U)	–	Size F NG4 to 22[2]
101-2 (B)	7/8 in	**B_S4**	–	–	18 (S)	28 (S,R) 45 (U,W)	28 (S,R) 45 (U,W)	–	Size N NG20 to 32[2] Size G NG38 to 45[2]
	1 in	**B_S5**	–	28 (S)	28, 45 (S)	45 (S,R)	45 (S,R) 60 (U,W)	40 (S)	–
101-4 (B)	7/8 in	**B4S4**	–	–	–	–	–	–	–
	1 in	**B4S5**	–	–	–	–	–	–	–
127-2 (C)	1 in	**C_S5**	–	40 (U)	–	–	–	–	–
	1 1/4 in	**C_S7**	45 (S7)	40, 56, 71 (S)	63 (S)	71 (S,R) 100 (U,W)	85 (U,W)	60 (S)	–
	1 3/8 in	**C2V8**	–	56, 71 (T)	–	–	–	60 (T)	–
	1 3/4 in	**C2T1**	–	–	63 (T)	–	–	–	–
127-4 (C)	1 in	**C4S5**	–	–	–	–	60 (U,W)	–	–
	1 1/4 in	**C4S7**	65 (S7)	71 (S)	–	–	60 (S,R)	–	–
	1 3/8 in	**C6V8**	85, 110 (V8)	71 (T)	–	–	–	60 (T)	–
152-2/4 (D)	1 3/8 in	**D6V8**	85, 110 (V8)	–	–	–	–	75 (T)	–
	1 3/4 in	**D_T1**	85, 110, 145, 175 (T1)	90, 125 (S)	–	140 (S)	–	95, 130, 145 (S)	–
165-4 (E)	1 3/4 in	**E4T1**	145, 175 (T1)	180, 250 (S)	–	–	–	190, 260 (S)	–
	2 in	**E4T2**	145 (T2)	–	–	–	–	190 (T)	–

[1] Availability of the individual sizes, see ordering code on page 4.

[2] Rexroth recommends special versions of the gear pumps. Please contact us.

Combination pumps A4VG + A4VG

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

Overall length A

A4VG (1st pump)		A4VG (2nd pump)[1] NG45	NG65	NG85	NG110	NG145	NG175
NG45	in	21.20	–	–	–	–	–
	mm	538.4	–	–	–	–	–
NG65	in	21.86	22.53	–	–	–	–
	mm	555.3	572.2	–	–	–	–
NG85	in	22.70	23.37	24.20	–	–	–
	mm	576.6	593.5	614.8	–	–	–
NG110	in	23.43	24.09	24.93	25.69	–	–
	mm	595	611.9	633.2	652.6	–	–
NG145	in	24.29	24.95	25.79	26.56	27.57	–
	mm	616.9	633.8	655.1	674.5	700.4	–
NG175	in	25.20	25.86	26.70	27.46	28.48	29.46
	mm	640	656.9	678.2	697.6	723.5	748.3

[1] 2nd pump without through drive and with boost pump, F0000/V0000

By using combination pumps, it is possible to have independent circuits without the need for splitter gearboxes.

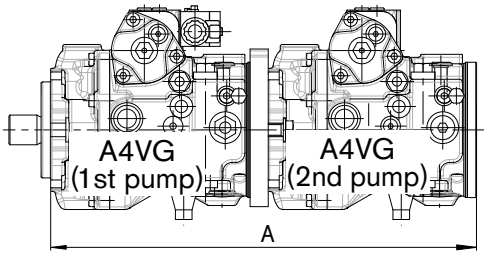
When ordering combination pumps, the type designations of the 1st and 2nd pumps must be linked by a "**+**".

Order example:
A4VG065EP1DP000/40ARNC6S71FC2S7AS00-0+
A4VG045EP1DP000/40ARNC2S71F0000AS00-0

A tandem pump consisting of two equal sizes is permissible without additional supports where the dynamic acceleration does not exceed maximum 10 $g = 322$ ft/s^2 (= 98.1 m/s^2).

We recommend the use of 4-hole mounting flanges for NG85 and larger.

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



Pressure cut-off

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

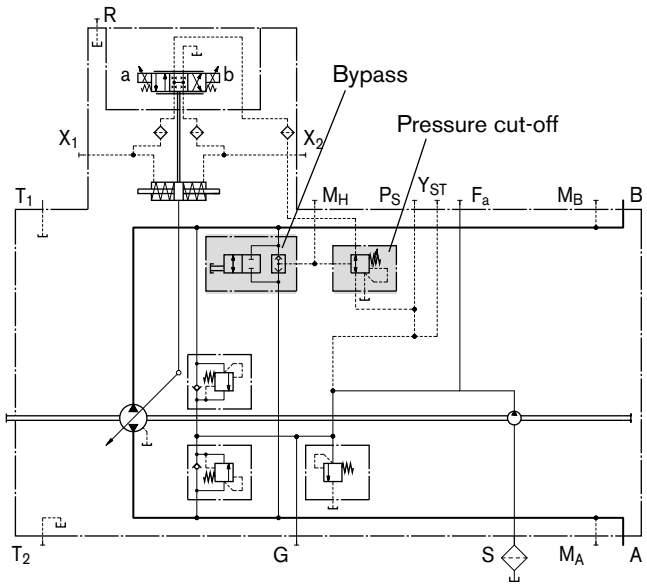
This valve prevents the operation of the high-pressure relief valves when accelerating or decelerating.

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

The setting range of the pressure cut-off may be anywhere within the entire operating pressure range. However, it must be set 435 psi (30 bar) lower than the setting of the high-pressure relief valves (see setting diagram, page 50).

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

Circuit diagram with pressure cut-off
Example: electric control, EPD



Bypass function

A connection between the two high-pressure channels can be established through the bypass valve.

Towing speed

The maximum towing speed is dependent on the gear ratio in the vehicle and must be calculated by the vehicle manufacturer. The corresponding flow of Q = 7.9 gpm (30 l/min) must not be exceeded.

Towing distance

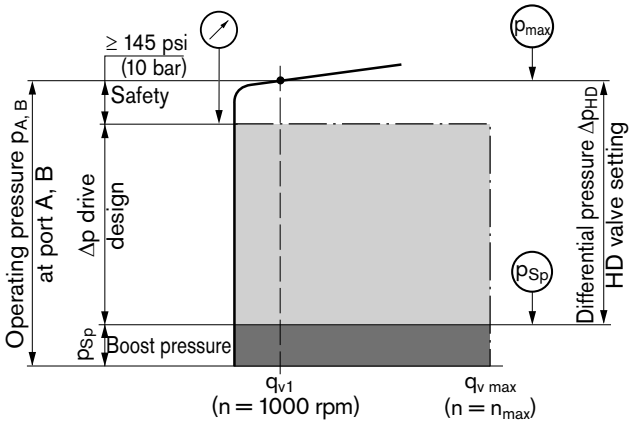
The vehicle may only be towed out of the immediate danger zone.

High-pressure relief valves

The two high-pressure relief valves protect the hydrostatic transmission (pump and motor) from overload. They limit the maximum pressure in the respective high-pressure line and serve simultaneously as boost valves.

Setting diagram

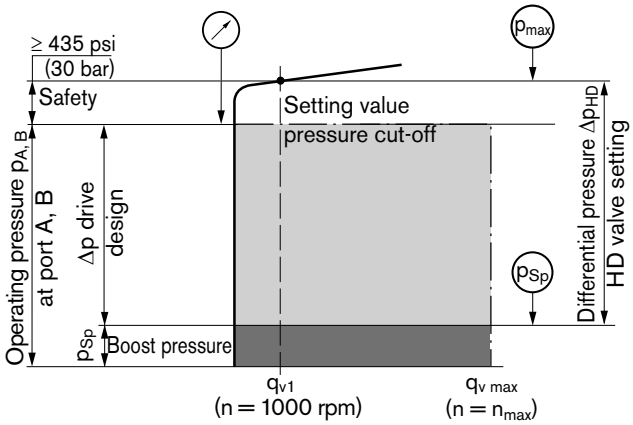
Version without pressure cut-off



Example: boost pressure 290 psi (20 bar);
operating pressure 6500 psi (450 bar)

Oper. press. $p_{A,B}$	– Boost press. p_{Sp}	= Different. press. Δp_{HD}
6500 psi	– 290 psi	= **6210 psi**
(450 bar	– 20 bar	= **430 bar)**

Version with pressure cut-off



Example: boost pressure 290 psi (20 bar);
operating pressure 6500 psi (450 bar)

Oper. press. $p_{A,B}$	– Boost press. p_{Sp}	+ safety	= Different. press. Δp_{HD}
6500 psi	– 290 psi	+ 435 psi	= **6645 psi**
(450 bar	– 20 bar	+ 30 bar	= **460 bar**)

When ordering, state differential pressure setting in plain text:
The following values are available for selection for the differential pressure setting:
Preferred values [bar]: 400, 420, 450
Optional values [bar]: 340, 370, 460, 470, 480
If not specified in the order, the valves are set to the differential pressure Δp = 420 bar.

High-pressure relief valve A
Differential pressure setting _____ Δp_{HD} = ... psi (bar)

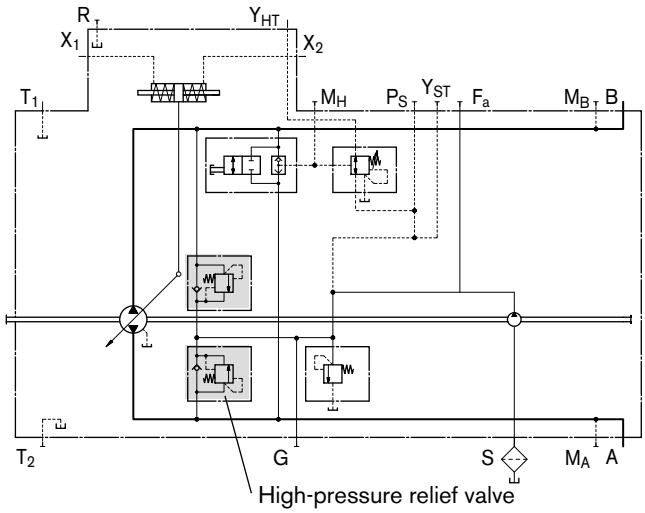
Opening pressure of the HD valve (at $q_{V\,1}$) _ p_{max} = ... psi (bar)
($p_{max} = \Delta p_{HD} + p_{Sp}$)

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)
($p_{max} = \Delta p_{HD} + p_{Sp}$)

Note

The valve settings are made at **n = 1000 rpm** and at **$V_{g\,max}$ ($q_{v\,1}$)**. There may be deviations in the opening pressures with other operating parameters.



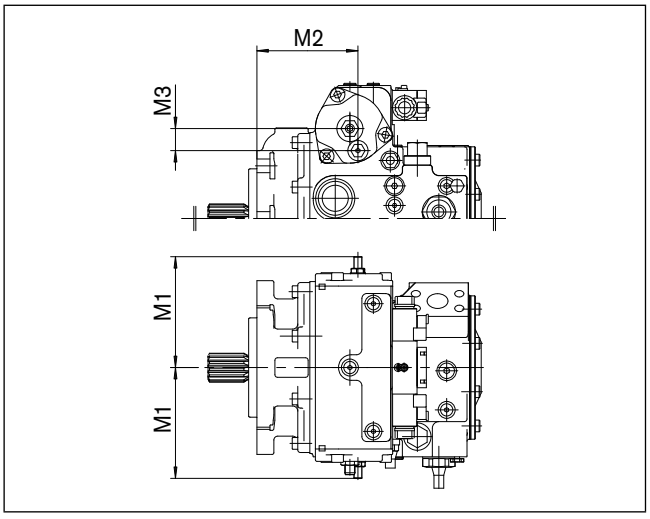
Mechanical stroke limiter

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

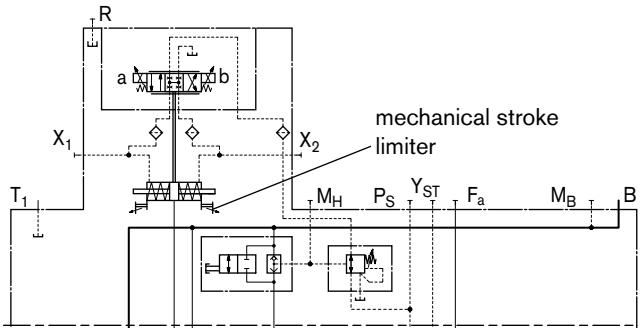
The stroke of the stroke cylinder and hence the maximum swivel angle of the pump are limited by means of two adjusting screws.

Dimensions

NG		M1	M2	M3
45	in	5.63	4.81	0.98
	mm	143	122.1	24.9
65	in	5.63	5.24	0.98
	mm	143	133	24.9
85	in	6.19	5.48	1.09
	mm	157.3	139.2	27.7
110	in	6.19	6.05	1.09
	mm	157.3	153.6	27.7
145	in	6.70	6.10	1.33
	mm	170.1	155	33.8
175	in	6.70	6.88	1.33
	mm	170.1	174.8	33.8



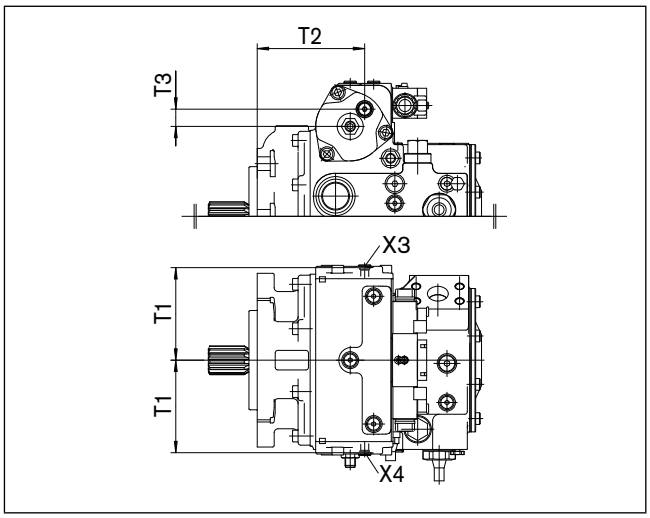
Circuit diagram



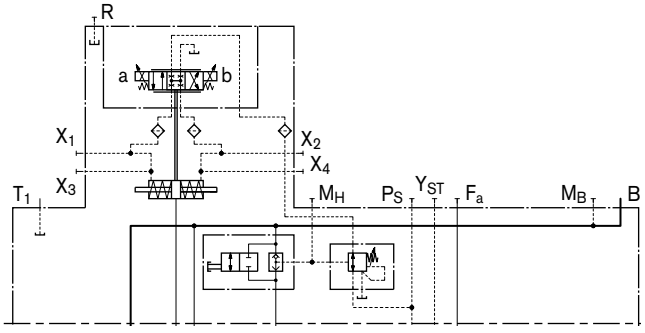
Ports X_3 and X_4 for stroking chamber pressure

Dimensions

NG		T1	T2	T3
45	in	4.61	5.17	0.86
	mm	117	131.3	21.8
65	in	4.61	5.60	0.86
	mm	117	142.2	21.8
85	in	5.04	5.80	0.86
	mm	128	147.4	21.8
110	in	5.04	6.37	0.86
	mm	128	161.8	21.8
145	in	5.59	6.49	1.04
	mm	142	164.9	26.4
175	in	5.59	7.27	1.04
	mm	142	184.7	26.4



Circuit diagram



Designation	Port for	Standard	Size[2]	Maximum pressure [psi (bar)][2]	State
X_3, X_4	Stroking chamber pressure	ISO 11926	9/16-18UNF-2B; 0.51 (13) deep	580 (40)	X

1) Observe the general instructions on page 60 for the maximum tightening torques.
2) Short-term pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings. Before finalizing your design, request a binding installation drawing. Dimensions in in (mm).

Filtration boost circuit / external supply

Version S (standard)
Filtration in the suction line of the boost pump

Standard version (preferred)

Filter type _____ filter **without** bypass

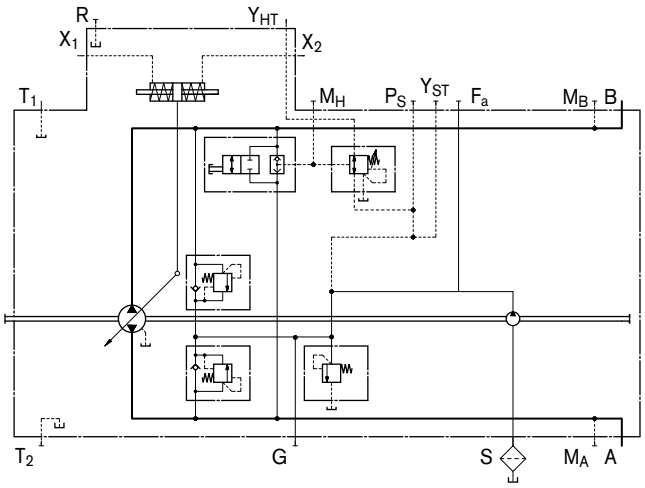
Recommendation _____ **with** contamination indicator

Flow resistance at filter cartridge
With $\nu = 140$ SUS, $n = n_{max}$ _____ $\Delta p \leq 1.5$ psi
(30 mm²/s, $n = n_{max}$ _____ $\Delta p \leq 0.1$ bar)
With $\nu = 4600$ SUS, $n = n_{max}$ _____ $\Delta p \leq 4.5$ psi
(1000 mm²/s, $n = n_{max}$ _____ $\Delta p \leq 0.3$ bar)

Pressure at port S of the boost pump
Suction pressure $p_{S\,min}$ ($\nu \leq 140$ SUS) ____ ≥ 12 psi absolute
($(\nu \leq 30$ mm²/s) _ ≥ 0.8 bar absolute)
at cold starts, short-term ($t < 3$ min) ≥ 7.5 psi (0.5 bar) absolute
Suction pressure $p_{S\,max}$ _____ ≤ 75 psi (5 bar) absolute

The filter is not included in the delivery contents.

Circuit diagram - standard version S



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

Boost pressure inlet _____ port F_a

Boost pressure outlet _____ port F_e

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

Recommendation _____ **with** contamination indicator

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

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

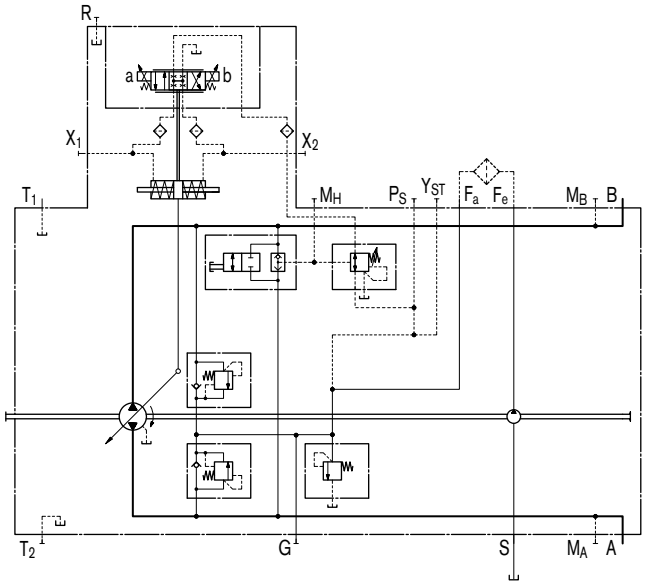
Filter arrangement
Separate in the pressure line (line filter)

Flow resistance at filter cartridge
With $\nu = 140$ SUS (30 mm²/s) _____ $\Delta p \leq 15$ psi (1 bar)
At cold start _____ $\Delta p \leq 45$ psi (3 bar)

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

The filter is not included in the delivery contents.

Circuit diagram - version D (external boost circuit filter)



Filtration boost circuit / external supply

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

Filter type _____ filter **without** bypass

Filter grade (absolute) _____ 20 microns

Filter material _____ glass fiber

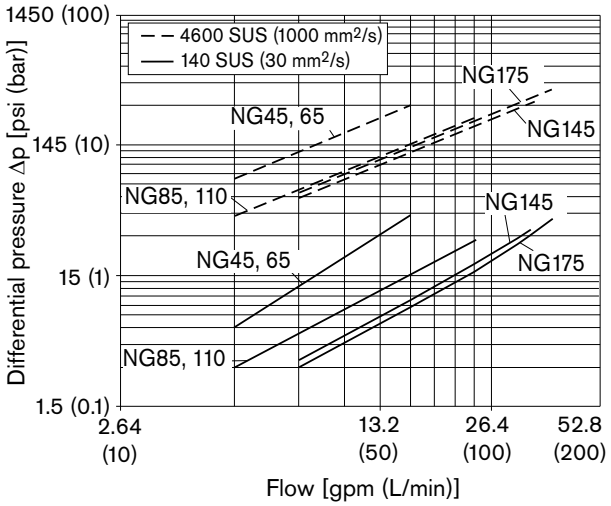
Pressure capacity _____ 1450 psi (100 bar)

Filter arrangement _____ mounted on pump

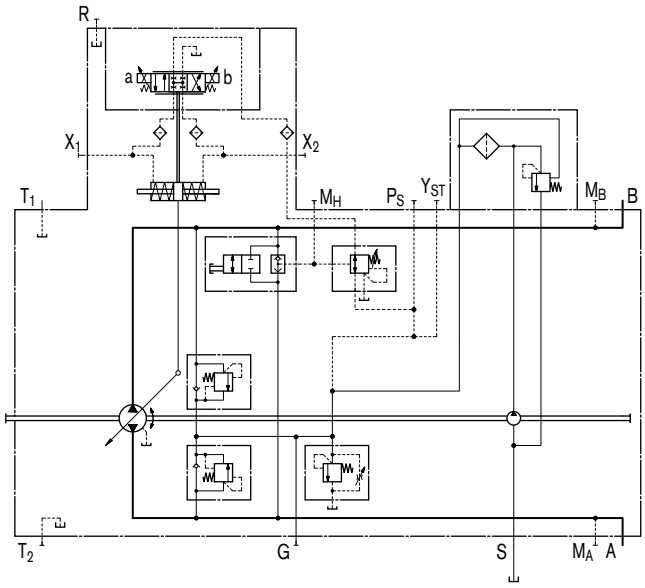
Note
Filter is equipped with **cold start valve** and thereby protects the system from damage.
The valve opens at flow resistance $\Delta p \geq 90$ psi (6 bar).

Recommendation
With contamination indicator (variation B)
(differential pressure $\Delta p = 75$ psi (5 bar))

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



Circuit diagram - version F (with mountable filter)



Version B
Filtration in pressure line of boost pump, filter mounted, with electric contamination indicator

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

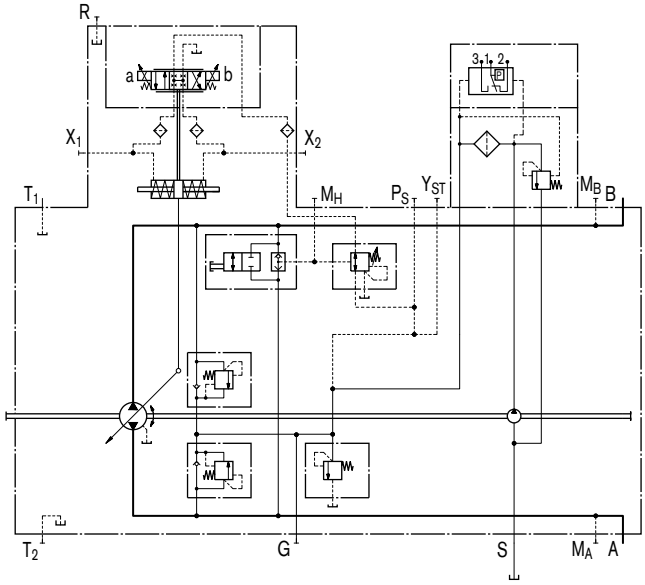
Indication _____ electric

Connector design _____ DEUTSCH DT04-2P-EP04
(mating connector, see page 56)

Differential pressure (switching pressure) _$\Delta p = 75$ psi (5 bar)

Maximum switching capacity at 24 V DC _____ 60 W

Circuit diagram - version B



Filtration boost circuit / external supply

Version E
External supply

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

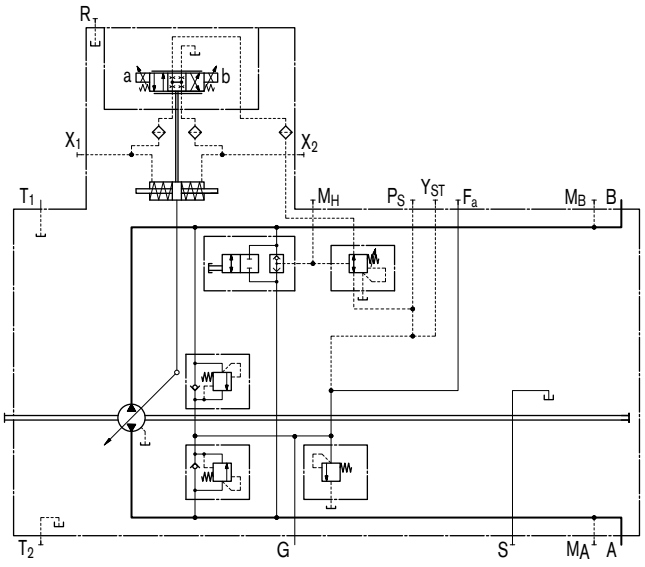
Port S is plugged.

Supply comes from port G.

Filter arrangement _____separate

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

Circuit diagram - version E (external supply)

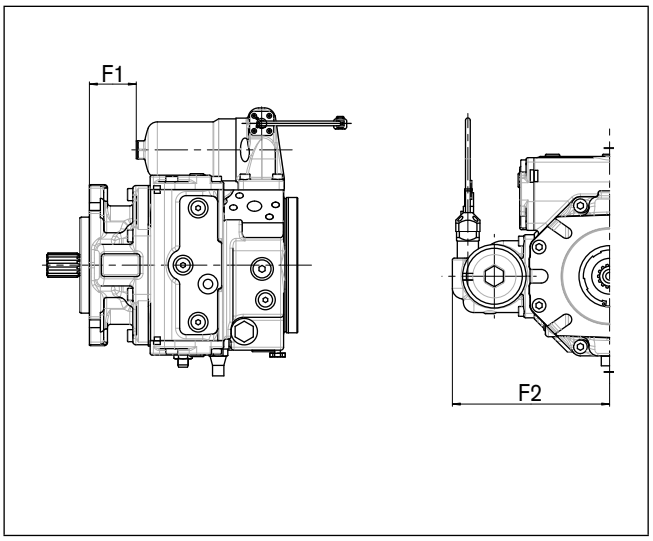


Filtration boost circuit / external supply

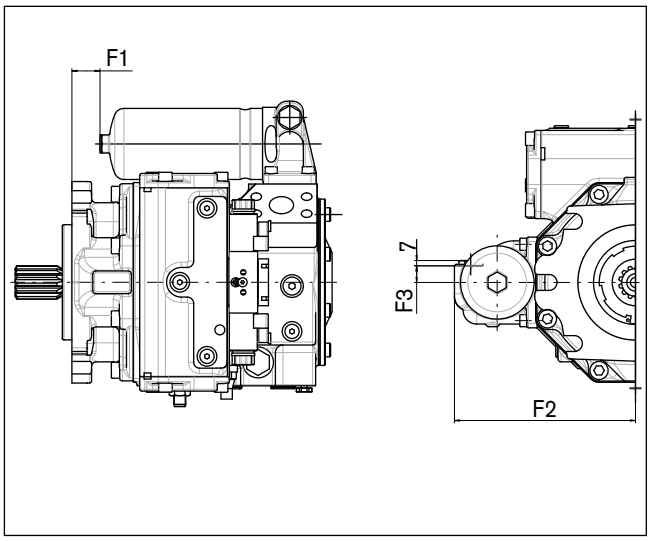
Before finalizing your design, request a binding installation drawing. Dimensions in in (mm).

Dimensions

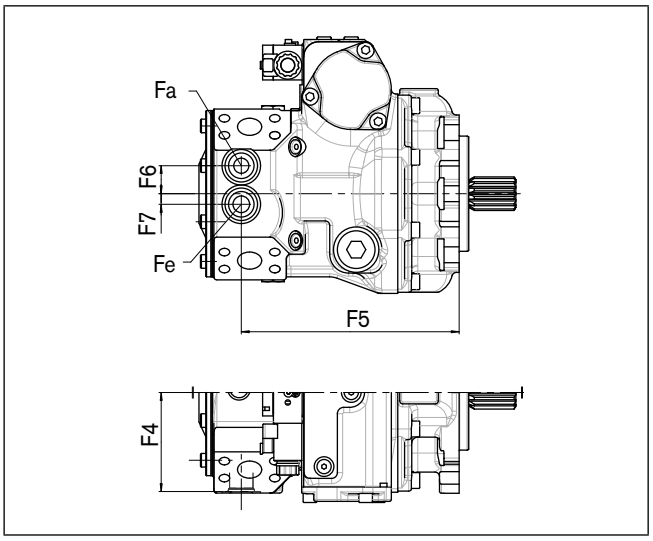
Version B
Filter mounted with electric contamination indicator



Version F
Filter mounted without electric contamination indicator



Version D, ports for line filter



NG		F1	F2	F3	F4	F5	F6	F7	F_a, F_e
45	in	1.85	8.19	0.87	4.11	8.39	1.18	0.39	1 1/16-12UN-2B; 0.79 (20) deep
	mm	47.1	208	22	104.5	213.1	30	10	
65	in	2.44	8.19	0.87	4.11	8.98	1.18	0.39	
	mm	62	208	22	104.5	228	30	10	
85	in	2.44	9.04	0.87	4.76	9.85	1.46	0.55	1 5/16-12UN-2B; 0.79 (20) deep
	mm	62.1	229.5	22	121	250.1	37	14	
110	in	3.01	9.04	0.87	4.76	10.41	1.46	0.55	
	mm	76.5	229.5	22	121	264.5	37	14	
145	in	1.46	9.04	0.87	5.16	11.35	1.46	0.55	
	mm	37.2	239.5	22	131	288.2	37	14	
175	in	2.24	9.04	0.87	5.16	12.13	1.46	0.55	
	mm	57	239.5	22	131	308	37	14	

Connector for solenoids

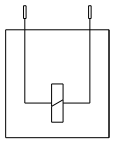
DEUTSCH DT04-2P-EP04, 2-pin

Molded, without bidirectional suppressor diode ____ **P**

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

Circuit symbol

Without bidirectional suppressor diode

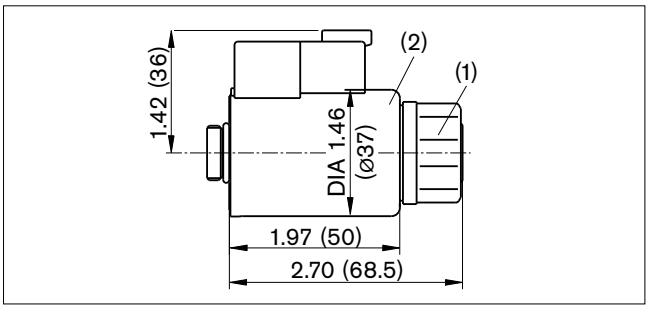


Mating connector

DEUTSCH DT06-2S-EP04
Rexroth Mat. No. R902601804

Consisting of:	DT designation
– 1 case	DT06-2S-EP04
– 1 wedge	W2S
– 2 female connectors	0462-201-16141

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



Changing connector position

If necessary, you can change the position of the connector by turning the solenoid.

To do this, proceed as follows:

1. Loosen the fixing nut (1) of the solenoid. To do this, turn the fixing nut (1) one turn counter-clockwise.
2. Turn the solenoid body (2) to the desired position.
3. Retighten the fixing nut. Tightening torque of the fixing nut: 3.7+0.7 lb-ft (5+1 Nm) (WAF 26, 12-sided DIN 3124)

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

Sensors

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

Speed sensor

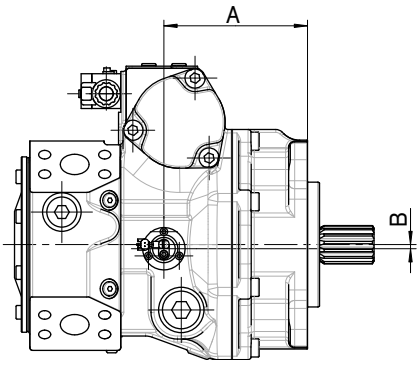
Version A4VG...V has teeth on the rotary group.

With a speed sensor installed, a signal proportional to pump speed can be generated.

The DSM sensor measures the speed and direction of rotation and offers additional diagnostic functions. Ordering code, technical data, dimensions and details on the connector of the DSM sensor can be found in data sheet RE 95132.

The DSM sensor is mounted on the port provided for this purpose with a fixing screw.

Dimensions



Cable length to connector end, approx. 39.4 in (1000 mm).

NG		A	B
45	in	4.84	0.22
	mm	123	5.5
65	in	5.43	0.22
	mm	137.9	5.5
85	in	5.79	0.22
	mm	147.1	5.5
110	in	6.36	0.22
	mm	161.5	5.5
145	in	7.13	0.22
	mm	181.2	5.5
175	in	7.91	0.22
	mm	201.0	5.5

Sensors

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

Electric swivel angle sensor

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

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

Characteristics			
Supply voltage U_b	10 to 30 V DC		
Output voltage U_a	1 V ($V_{g\,max}$)	2.5 V ($V_{g\,0}$)	4 V ($V_{g\,max}$)
Reverse-connect protection	Short circuit-resistant		
EMC resistance	Details on request		
Operating temperature range	-40 °F to 240 °F (-40 °C to +115 °C)		
Vibration resistance sinusoidal vibration EN 60068-2-6	10*g* / 5 to 2000 Hz		
Shock resistance continuous shock IEC 68-2-29	25*g*		
Resistance to salt spray DIN 50 021-SS	96h		
Type of protection DIN/EN 60529	IP67 and IP69K		
Case material	Plastic		

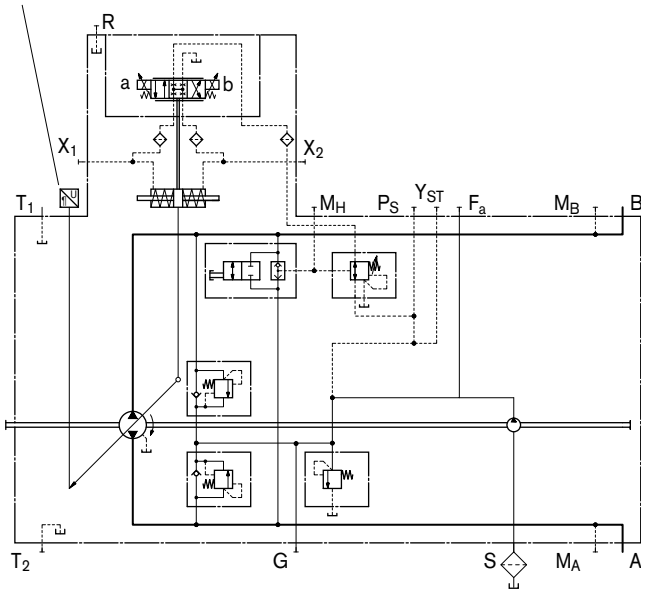
Output voltage

		Flow direction[1]	Operating pressure	Output voltage
Direction of rotation	cw	B to A	M_A	> 2.5 V
		A to B	M_B	< 2.5 V
	ccw	A to B	M_B	> 2.5 V
		B to A	M_A	< 2.5 V

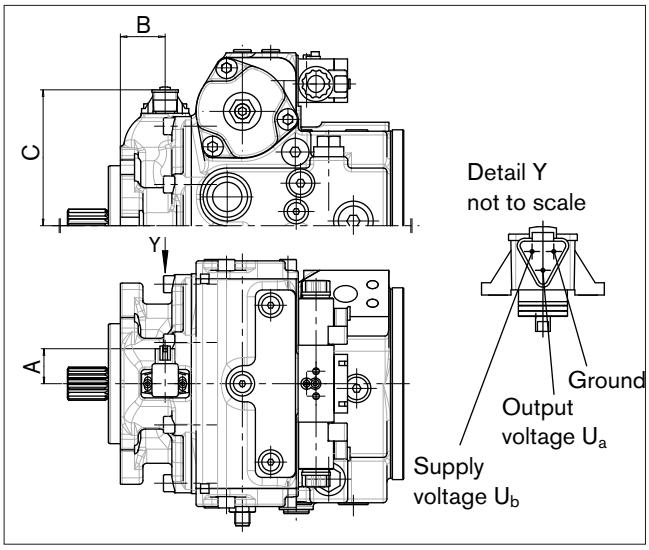
[1] For flow direction, see controls

Circuit diagram

Electric swivel angle sensor



Dimensions



NG		A	B	C
45	in	1.46	1.57	5.31
	mm	37	39.9	134.8
65	in	1.46	1.55	5.31
	mm	37	39.4	134.8
85	in	1.46	1.87	5.66
	mm	37	47.4	143.8
110	in	1.46	2.03	5.86
	mm	37	51.5	148.8
145	in	1.46	2.09	6.33
	mm	37	53.1	160.8
175	in	1.46	2.54	6.33
	mm	37	64.4	160.8

Mating connector

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

Consisting of:

	DT designation
– 1 case	DT06-3S-EP04
– 1 wedge	W3S
– 3 female connectors	0462-201-16141

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

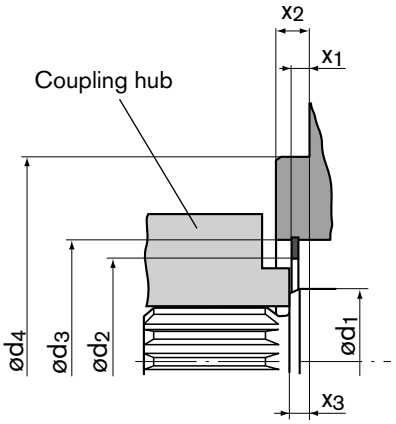
Installation situation for coupling assembly

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

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.

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

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



NG	Mounting flange		ød1	ød2 min	ød3	ød4	x1	x2	x3
45	101-2 (B)	in	1.77	1.99	2.874 ±0.004	4.00	0.161 $^{+0.008}$	0.38 $_{-0.02}$	0.315 $^{+0.035}_{-0.024}$
		mm	45	50.5	73 ±0.1	101.6	4.1 $^{+0.2}$	9.7 $_{-0.5}$	8 $^{+0.9}_{-0.6}$
	127-2 (C)	in	1.77	1.99	2.874 ±0.004	5.00	0.004 $^{+0.008}$	0.5 $_{-0.02}$	0.315 $^{+0.035}_{-0.024}$
		mm	45	50.5	73 ±0.1	127	0.1 $^{+0.2}$	12.7 $_{-0.5}$	8 $^{+0.9}_{-0.6}$
65	127-2/4 (C)	in	1.77	2.30	3.189 ±0.004	5.00	0.252 $^{+0.008}$	0.5 $_{-0.02}$	0.315 $^{+0.035}_{-0.024}$
		mm	45	58.5	81 ±0.1	127	6.4 $^{+0.2}$	12.7 $_{-0.5}$	8 $^{+0.9}_{-0.6}$
85	127-2/4 (C)	in	1.97	2.54	3.583 ±0.004	5.00	0.138 $^{+0.008}$	0.5 $_{-0.02}$	0.315 $^{+0.035}_{-0.024}$
		mm	50	64.4	91 ±0.1	127	3.5 $^{+0.2}$	12.7 $_{-0.5}$	8 $^{+0.9}_{-0.6}$
	152-2/4 (D)	in	On request						
		mm							
110	127-2/4 (C)	in	On request						
		mm							
	152-2/4 (D)	in	2.17	2.93	3.976 ±0.004	6.00	0.236 $^{+0.008}$	0.5 $_{-0.02}$	0.315 $^{+0.035}_{-0.024}$
		mm	55	74.4	101 ±0.1	152.4	6.0 $^{+0.2}$	12.7 $_{-0.5}$	8 $^{+0.9}_{-0.6}$
145	152-2/4 (D)	in	2.36	3.32	4.370 ±0.004	6.00	0.291 $^{+0.008}$	0.5 $_{-0.02}$	0.315 $^{+0.035}_{-0.024}$
		mm	60	84.4	111 ±0.1	152.4	7.4 $^{+0.2}$	12.7 $_{-0.5}$	8 $^{+0.9}_{-0.6}$
	165-4 (E)	in	On request						
		mm							
175	152-2/4 (D)	in	On request						
		mm							
	165-4 (E)	in	2.36	3.32	4.370 ±0.004	6.50	0.276 $^{+0.008}$	0.63 $_{-0.02}$	0.315 $^{+0.035}_{-0.024}$
		mm	60	84.4	111 ±0.1	165.1	7.0 $^{+0.2}$	15.9 $_{-0.5}$	8 $^{+0.9}_{-0.6}$

Installation instructions

General

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

The case drain fluid in the case interior must be directed to the tank via the highest tank port (T_1, T_2). The minimum suction pressure at port S must not fall below 12 psi (0.8 bar) absolute (cold start 7.5 psi (0.5 bar) absolute).

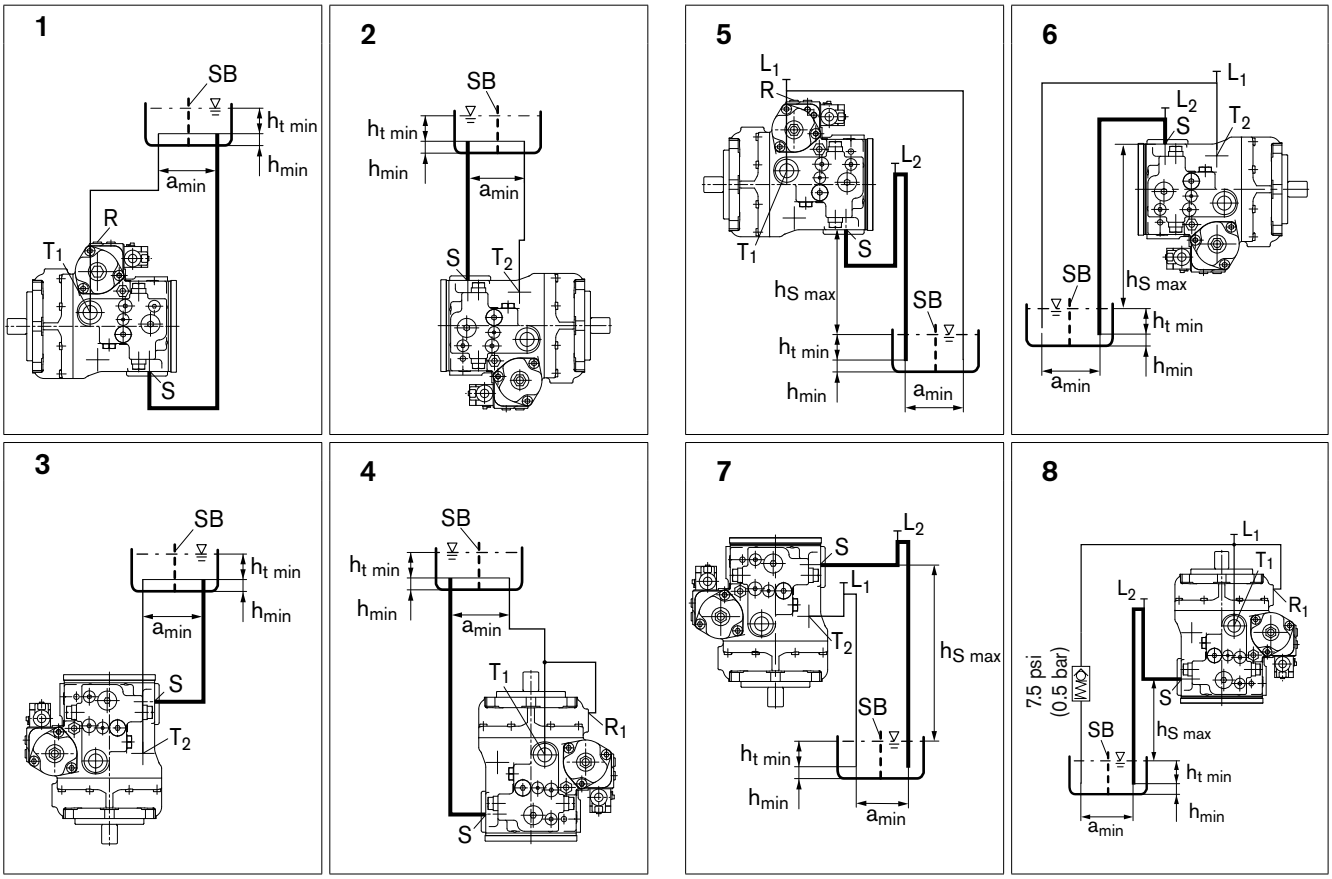
In all operational states, the suction line and tank line must flow into the tank below the minimum fluid level.

Installation position
See examples below. Additional installation positions are available upon request.
Recommended installation positions: 1 and 2.
Note: With the "shaft up" installation position, an R_1-port is necessary (special version).

Below-tank installation (standard)
Pump below minimum fluid level of the tank.

Above-tank installation
Pump above minimum fluid level of the tank

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



$h_{S\ max} = 31.5$ in (800 mm), $h_{t\ min} = 7.87$ in (200 mm), $h_{min} = 3.94$ in (100 mm), SB = baffle (baffle plate)

When designing the tank, ensure adequate distance a_{min} between the suction line and the case drain line to prevent the heated, return flow from being drawn directly back into the suction line.

Installation position	Air bleed	Filling
1	R	$S + T_1$
2	–	$S + T_2$
3	–	$S + T_2$
4	R_1	$S + T_1$

Installation position	Air bleed	Filling
5	$L_2 + R$	$L_1 + L_2$
6	L_2 (S) + L_1 (T_2)	L_2 (S) + L_1 (T_2)
7	L_2 (S) + L_1 (T_2)	L_2 (S) + L_1 (T_2)
8	$L_2 + R_1$	$L_1 + L_2$

General instructions

- The A4VG pump is designed to be used in closed circuit.
- Project planning, assembly and commissioning of the axial piston unit 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 axial piston unit and especially on the solenoids. Take appropriate safety measures (e. g. by wearing protective clothing).
- Depending on the operational state of the axial piston unit (operating pressure, fluid temperature), the characteristic may shift.
- Pressure ports:
  The ports and fixing threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified operating conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
- The data and notes contained herein must be adhered to.
- The following tightening torques apply:
  - Threaded hole for axial piston unit:
    The maximum permissible tightening torques $M_{G\ max}$ are maximum values for the threaded holes and must not be exceeded. For values, see the following table.
  - Fittings:
    Observe the manufacturer's instruction regarding the tightening torques of the used fittings.
  - Fixing screws:
    For fixing screws according to ISO 68 / DIN 13, we recommend checking the tightening torque individually according to VDI 2230.
  - Locking screws:
    For the metal locking screws supplied with the axial piston unit, the required tightening torques of locking screws M_V apply. For values, see the following table.
- The product is not approved as a component for the safety concept of a general machine according to DIN EN ISO 13849.

Threaded port sizes		Maximum permissible tightening torque of the threaded holes $M_{G\ max}$	Required tightening torque of the locking screws M_V	WAF hexagon socket for the locking screws
Standard	Size			
ISO 11926	3/8-24 UNF-2B	15 lb-ft	5 lb-ft	5/32 in
		20 Nm	7 Nm	
	9/16-18 UNF-2B	59 lb-ft	18 lb-ft	1/4 in
		80 Nm	25 Nm	
	3/4-16 UNF-2B	118 lb-ft	46 lb-ft	5/16 in
		160 Nm	62 Nm	
	7/8-14 UNF-2B	177 lb-ft	94 lb-ft	3/8 in
		240 Nm	127 Nm	
	1 1/16-12 UN-2B	266 lb-ft	108 lb-ft	9/16 in
		360 Nm	147 Nm	
	1 5/16-12 UN-2B	398 lb-ft	146 lb-ft	5/8 in
		540 Nm	198 Nm	
	1 5/8-12 UN-2B	708 lb-ft	236 lb-ft	3/4 in
		960 Nm	320 Nm	
	1 7/8-12 UN-2B	885 lb-ft	288 lb-ft	3/4 in
		1200 Nm	390 Nm	

Bosch Rexroth Corporation
Hydraulics
Axial & Radial Piston Units
8 Southchase Court
Fountain Inn, SC 29644-9018, USA
Telephone (864) 967-2777
Facsimile (864) 967-8900
www.boschrexroth-us.com