Rexroth
Bosch Group

Axial Piston Variable Pump A7VO

RE 92 202/12.07 **1**/32
Replaces: 03.06

Data sheet



Series 63
Sizes 28...160
Nominal pressure 350 bar
Peak pressure 400 bar
Open circuit

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Features

- Variable pump with axial tapered piston rotary group of bent-axis design, for hydrostatic drives in open circuits
- For use in mobile and stationary application areas
- The flow is proportional to the drive speed and to the displacement, and is infinitely variable from $q_{v\,max}$ to $q_{v\,min} = 0$
- Wide selection of control devices
- Compact, robust bearing system with long service life

Ordering Code / Standard Program

A7V	O			/	63		–			B	01	
01	02	03	04		05	06		07	08	09	10	11

Axial piston unit

01	Bent-axis design, variable, nominal pressure 350 bar, peak pressure 400 bar	**A7V**

Operation mode

02	Pump in open circuit	**O**

Size

03	≈ Displacement $V_{g\,max}$ in cm³	**28**	**55**	**80**	**107**	**160**
	See RE 92203			250	355	500

	Control device			**28**	**55**	**80**	**107**	**160**	
04	Power controller			●	●	●	●	●	**LR**
	With pressure cut-off			●	●	●	●	●	**LRD**
	With pressure cut-off and stroke limiter	Negative control	Δp = 25 bar	–	●	●	●	●	**LRDH1**
	With stroke limiter	Negative control	Δp = 25 bar	–	●	●	●	●	**LRH1**
	Pressure controller			●	●	●	●	●	**DR**
	Remote controlled			●	●	●	●	●	**DRG**
	With load sensing			–	●	●	●	●	**DRS**
	Hydraulic control, pilot-pressure related (positive control)		Δp = 10 bar	●	●	●	●	●	**HD1**
			Δp = 25 bar	●	●	●	●	●	**HD2**
	For pressure cut-off, remote controlled		Δp = 10 bar	●	●	●	●	●	**HD1G**
			Δp = 25 bar	●	●	●	●	●	**HD2G**
	Electric control with proportional solenoid (positive control)			●	●	●	●	●	**EP**
	For pressure cut-off, remote controlled			●	●	●	●	●	**EPG**

	Series	**28**	**55**	**80**	**107**	**160**	
05	Series 6, index 3	●	●	●	●	●	**63**

	Direction of rotation		**28...160**	
06	Viewed from shaft end	Clockwise	●	**R**
		Counter-clockwise	●	**L**

	Seals	**28**	**55**	**80**	**107**	**160**	
07	NBR (nitrile-caoutchouc), shaft seal ring in FKM (fluor-caoutchouc)	●	●	●	●	●	**N**

	Shaft end	**28**	**55**	**80**	**107**	**160**	
08	Splined shaft, DIN 5480	●	●	●	●	●	**Z**
	Parallel keyed shaft DIN 6885	●	●	●	●	●	**P**

	Mounting flange	**28**	**55**	**80**	**107**	**160**	
09	4-hole – ISO 3019-2	●	●	●	●	●	**B**

	Service line ports	**28**	**55**	**80**	**107**	**160**	
10	SAE flange port B or A at rear (metric fixing thread)	●	●	●	●	●	**01**
	SAE flange port S at rear (metric fixing thread)						

Standard / special version

11	Standard version (without code)	
	Special version	**-S**

= preferred program ● = available – = not available

Technical Data

Hydraulic fluid

Before starting project planning, please refer to our data sheets RE 90220 (mineral oil), RE 90221 (environmentally acceptable hydraulic fluids) and RE 90223 (HF hydraulic fluids) for detailed information regarding the choice of hydraulic fluids and application conditions.

The A7VO variable pump is not suitable for operation with HFA. If HFB, HFC and HFD or environmentally acceptable hydraulic fluids are being used, the limitations regarding technical data and seals mentioned in RE 90221 and RE 90223 must be observed.

When ordering, please indicate the used hydraulic fluid.

Operating viscosity range

We recommend that a viscosity (at operating temperature) for optimum efficiency and service life purposes of

ν_{opt} = optimum operating viscosity 16 to 36 mm²/s

be chosen, taken the tank temperature (open circuits) into account.

Limits of viscosity range

The following values apply in extreme cases:

ν_{min} = 5 mm²/s
short-term (t < 3 min)
at max. permissible temperature of t_{max} = +115°C.

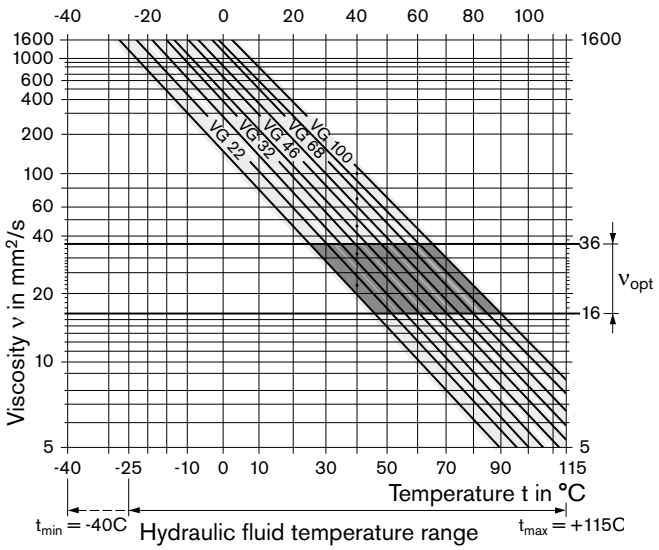
ν_{max} = 1600 mm²/s,
short-term (t < 3 min)
at cold start (p ≤ 30 bar, n ≤ 1000 rpm, t_{min} = -40°C).
Only for starting up without load. Optimum operating viscosity must be reached within approx. 15 minutes.

Note that the maximum hydraulic fluid temperature of 115°C must not be exceeded locally either (e.g. in the bearing area). The temperature in the bearing area is - depending on pressure and speed - up to 12 K higher than the average case drain temperature.

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

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

Selection diagram



Details regarding the choice of hydraulic fluid

The correct choice of hydraulic fluid requires knowledge of the operating temperature in relation to the ambient temperature, in an open circuit the tank temperature.

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

Example: At an ambient temperature of X°C an operating temperature of 60°C is set. 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 tank temperature. At no point in the system may the temperature be higher than 115°C.

If the above conditions cannot be maintained due to extreme operating parameters, we recommend flushing the case at port U.

Filtration

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

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

20/18/15 according to ISO 4406.

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

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

If the above classes cannot be observed, please contact us.

Technical Data

Operating pressure range

Input

Pressure on port S

The minimum permissible inlet pressure depends on the drive speed. The following limit values must not be exceeded or undercut.

$p_{abs\ min}$ _____ 0.8 bar

The maximum pressure $p_{abs\ max}$ also depends on the speed (see diagram on page 5).

Output

Maximum pressure on port B or A
(pressure data according to DIN 24312)

Drive shaft	Nominal pressure p_N	Peak pressure p_{max}
Without radial loading (coupling)	350 bar	400 bar
With radial loading [1] (pinion, v-belt)	315 bar	350 bar

[1]) Note permissible radial loading, see page 6

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

Peak pressure: Max. operating pressure which is permissible for short-term ($t < 0.1$ s).

Direction of flow

Direction of rotation, viewed from shaft end	
Clockwise	Counter-clockwise
S to **B**	**S** to **A**

Case drain fluid

The case drain chamber is connected to the suction chamber. A case drain line to the tank is not required (both R-ports are plugged).

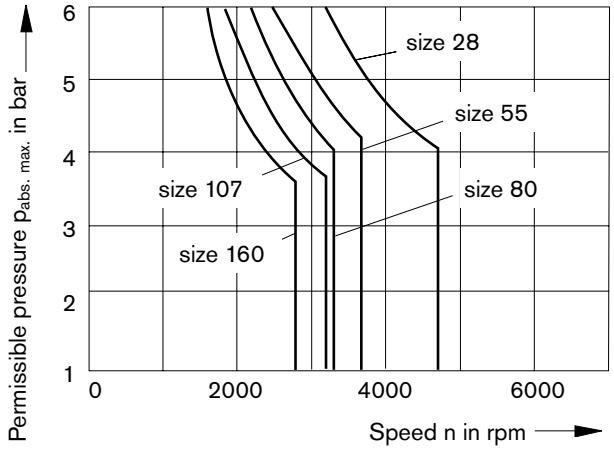
Exception:
On the version with pressure controller or pressure cut-off, a case drain line is required for discharge from port T_1 to the tank.

Shaft seal ring

Permissible pressure load

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

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



Temperature range

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

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

Technical Data

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

Size				28	55	80	107	160
Displacement		$V_{g\,max}$	cm^3	28.1	54.8	80	107	160
Speed max. [1]	at $V_{g\,max}$	n_{max1}	rpm	3150	2500	2240	2150	1900
	at $V_g < 0.74 \bullet V_{g\,max}$ (see diagram)	n_{max2}	rpm	4250	3400	3000	2900	2560
Speed max. [2]		$n_{max\,perm.}$	rpm	4750	3750	3350	3200	2850
Flow	at n_{max1} and $V_{g\,max}$	$q_{V\,max1}$	L/min	89	137	179	230	304
Power	at $q_{v\,max1}$ and $\Delta p = 350$ bar	P_{max1}	kW	52	80	105	134	177
Torque	at $V_{g\,max}$ and $\Delta p = 350$ bar	T_{max}	Nm	156	305	446	596	891
Rotary stiffness	$V_{g\,max}$ to $0{,}5 \bullet V_{g\,max}$	c_{min}	Nm/rad	5546	10594	15911	21469	36073
	$0{,}5 \bullet V_{g\,max}$ to $0_{(interpolated)}$	c_{max}	Nm/rad	16541	32103	48971	67666	104622
Moment of inertia for rotary group		J_{TW}	kgm^2	0.0042	0.0042	0.0080	0.0127	0.0253
Angular acceleration maximum		α	rad/s^2	35900	31600	24200	19200	15300
Filling capacity		V	L	0.5	0.75	1.2	1.5	2.4
Mass (approx.)		m	kg	17	25	40	49	71

[1] The values shown are valid for absolute pressure (p_{abs}) 1 bar at suction port S and for operation with mineral fluids with a specific mass of 0.88 kg/l.

[2] Maximum speed (limiting speed) with increased inlet pressure p_{abs} at suction port S and $V_g < V_{g\,max}$

Caution: Exceeding the permissible limit values may result in a loss of function, a reduction in service life or in the destruction of the axial piston unit.
Other permissible limit values with respect to speed variation, reduced angular acceleration as a function of the frequency and the permissible startup angular acceleration (lower than the maximum angular acceleration) can be found in data sheet RE 90261.

Determining the size

Flow $$q_v = \frac{V_g \bullet n \bullet \eta_v}{1000} \quad \text{L/min}$$

Torque $$T = \frac{V_g \bullet \Delta p}{20 \bullet \pi \bullet \eta_{mh}} \quad \text{Nm}$$

Power $$P = \frac{2\,\pi \bullet T \bullet n}{60000} = \frac{q_v \bullet \Delta p}{600 \bullet \eta_t} \quad \text{kW}$$

V_g = Displacement per revolution in cm^3

Δp = Differential pressure in bar

n = Speed in rpm

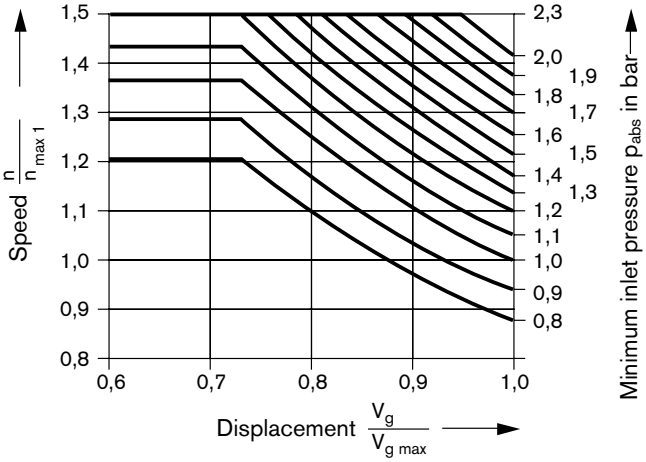
η_v = Volumetric efficiency

η_{mh} = Mechanical-hydraulic efficiency

η_t = Overall efficiency ($\eta_t = \eta_v \bullet \eta_{mh}$)

Minimum permissible inlet pressure at suction port S with increased speed

In order to avoid damage to the pump (cavitation) a minimum inlet pressure at the suction port must be assured. The minimum inlet pressure depends on the speed and the displacement of the variable pump.



Note:

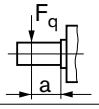
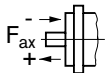
– Max. speed n_{max} (limiting speed, see table of values)

– Min. and max. permissible pressure at port S

Technical Data

Permissible radial and axial loading on the drive shaft

The specified values are maximum values and do not apply to continuous operation.

Size				28	55	80	107	160
Radial force, max. at distance a from shaft collar		$F_{q\,max}$	N	5696	9280	11657	13580	18062
		a	mm	12.5	15	17.5	20	22.5
Radial force/bar operating pressure [1]		F_q/bar	N/bar	14.2	23.2	29.1	34	45.2
Axial force, max.[2]		+ $F_{ax\,max}$	N	315	500	710	900	1120
		– $F_{ax\,max}$	N	315	500	710	900	1120
Permissible axial force/ bar operating pressure		$\pm F_{ax\,perm.}$/bar	N/bar	4.6	7.5	9.6	11.3	15.1

[1]) For toothed gear drive (DIN 867) with minimum pinion pitch circle diameter $D_{R\,min}$ and $V_{g\,max}$ ($D_{R\,min} = 2.5 \times D_{shaft\,end}$). Necessary pre-tension/bar operating pressure (radial force) for transmitting the torque with v-belt drive (DIN 7753) with minimum gear diameter $D_{K\,min}$ and $V_{g\,max}$ ($D_{K\,min} = 5 \times D_{shaft\,end}$).

[2]) Max. permissible axial force when at a downtime or when axial piston unit operating in depressurized condition.

When considering the permissible axial force, the force-transfer direction must be taken into account.

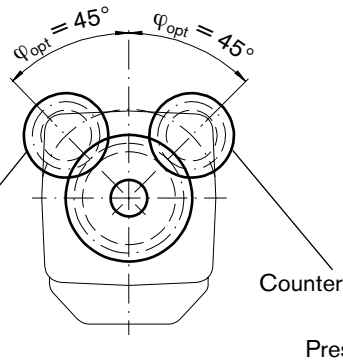
– $F_{ax\,max}$ = increase in service life of bearings

+ $F_{ax\,max}$ = reduction in service life of bearings (avoid if possible)

Effect of radial force F_q on the service life of bearings

By selecting a suitable force-transfer direction of F_q, the stress on the bearings caused by the internal transmission forces can be reduced, thus achieving the optimum service life of the bearings. Recommended position of mating gear is dependent on direction of rotation. Examples:

Toothed gear drive



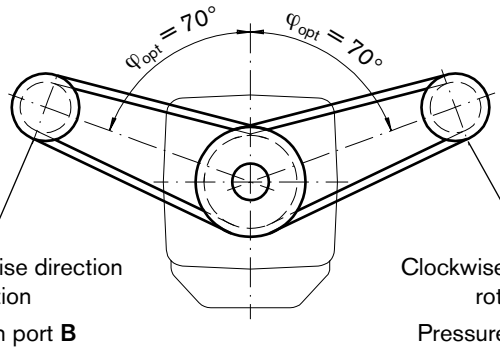
Clockwise direction of rotation

Pressure on port **B**

Counter-clockwise direction of rotation

Pressure on port **B**

V-belt drive



Clockwise direction of rotation

Pressure on port **B**

LR - Power Controller

The power controller controls the displacement of the pump depending on the operating pressure so that a defined drive power is not exceeded at a constant drive speed.

$$p_B \bullet V_g = \text{constant}$$

p_B = operating pressure; V_g = displacement

The precision of the control along the hyperbolic characteristic provides for optimum power utilization.

Operating pressure is applied to the rocker via a measuring piston. This is countered by the force of an externally adjustable spring. This determines the power setting.

If the operating pressure exceeds the set force of the spring, the rocker actuates the control valve and the pump swivels back (towards $V_{g\,min}$). Here, the leverage on the rocker is shortened and the operating pressure is able to rise in the same ratio as the displacement is reduced with exceeding the drive power ($p_B \bullet V_g$ = constant).

When not under pressure, the pump is swiveled back to its initial position at $V_{g\,max}$ by a return spring.

Setting range for start of control _____ 50 – 220 bar

The hydraulic output power (LR characteristic) is influenced by the efficiency of the pump.

Please state in clear text when ordering:

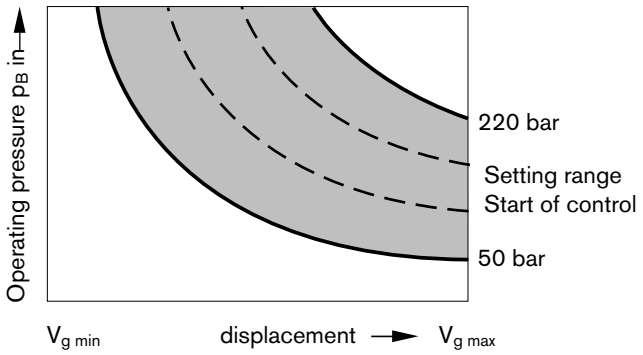
– Drive power P in kW

– Drive speed n in rpm

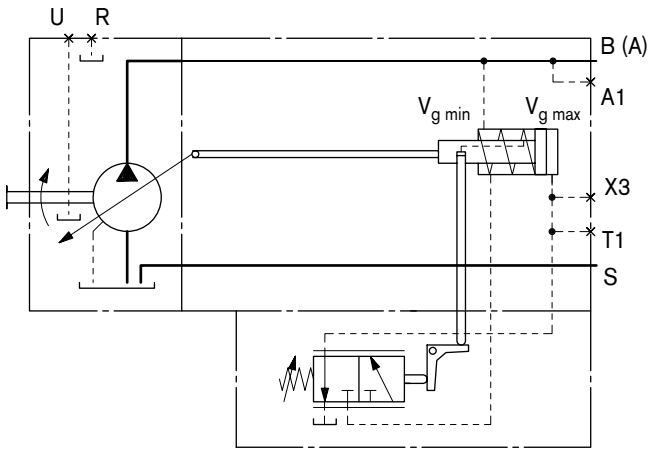
– Max. flow $q_{v\,max}$ in l/min

After clarifying the details a power diagram can be created by our computer.

LR characteristic



LR circuit diagram



LR - Power Controller

LRD Power Controller with Pressure Cut-Off

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

This function overlies the power control, i.e. the power control is executed at levels below the pressure setting.

The pressure cut-off has a fixed default pressure setting.

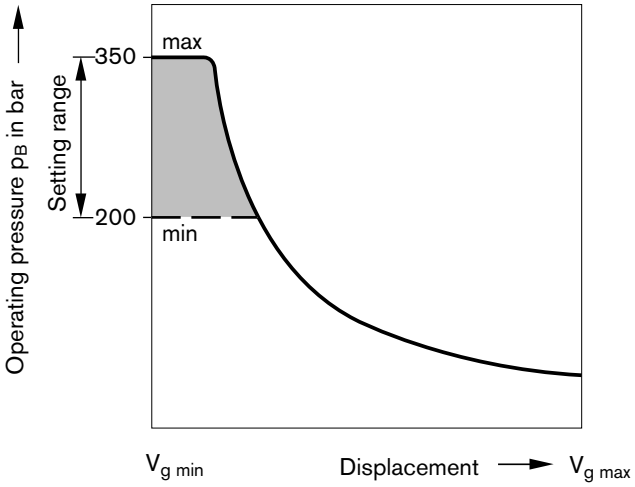
Setting range for pressure cut-off _____ 200 – 350 bar

When ordering, please state the pressure cut-off setting in plain text.

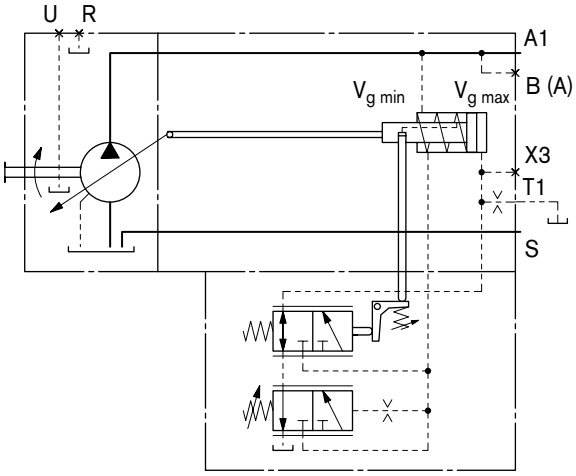
Note:

- The maximum permissible setting for the pressure cut-off must be a factor of 5 greater than that at start of power control.
  Example: start of control (power control): 50 bar
  max. permissible setting for pressure cut-off:
  50 bar • 5 = 250 bar
- On versions with pressure cut-off, a case drain line to the tank is needed (port T_1).
  When the case drain port is plugged and $t_{Tank} \leq 50°C$, the permissible actuated time for the pressure cut-off is ≤ 2 min.
- A pressure-relief valve fitted to ensure the maximum pressure in the system must be at least 20 bar above the setting for pressure cut-off when it starts to open.

LRD characteristic



LRD circuit diagram



LR - Power Controller

LR... Power control with stroke limiter

The hydraulic stroke limiter enables the displacement of the pump to be infinitely varied or limited across the entire control range. The displacement is set proportionally by the pilot pressure p_{St} applied at port X_1 (max. 40 bar).

The hydraulic stroke limiter is overridden by the power control, i.e. below the power control characteristic (hyperbolic characteristic), the displacement is adjusted depending on the pilot pressure. If the set flow or the operating pressure is such that the power control characteristic is exceeded, the power control overrides the stroke limiter and reduces the displacement along the hyperbolic characteristic.

A control pressure of 40 bar is needed to move the pump from its initial position $V_{g\,max}$ to $V_{g\,min}$.

The required control pressure is taken either from the operating pressure, or from the externally applied control pressure at the Y_3 port.

To ensure the control even at low operating pressure < 40 bar the port Y_3 must be supplied with an external control pressure of approx. 40 bar.

LRH1 Hydraulic stroke limiter (negative control)

Control from $V_{g\,max}$ to $V_{g\,min}$

With increasing pilot pressure the pump swivels to a smaller displacement.

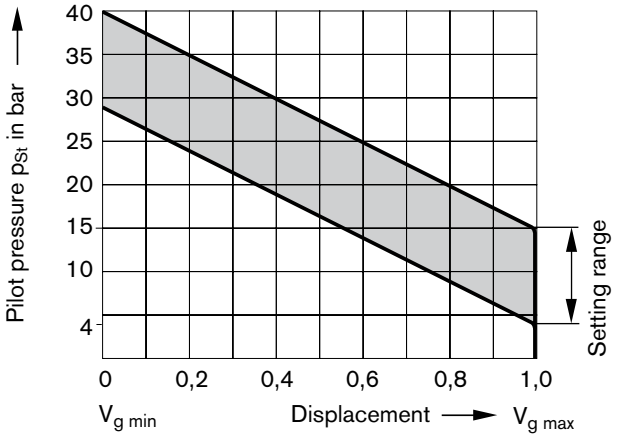
Setting range for start of control _____ 4 – 15 bar

Please specify start of control in plain text when ordering.

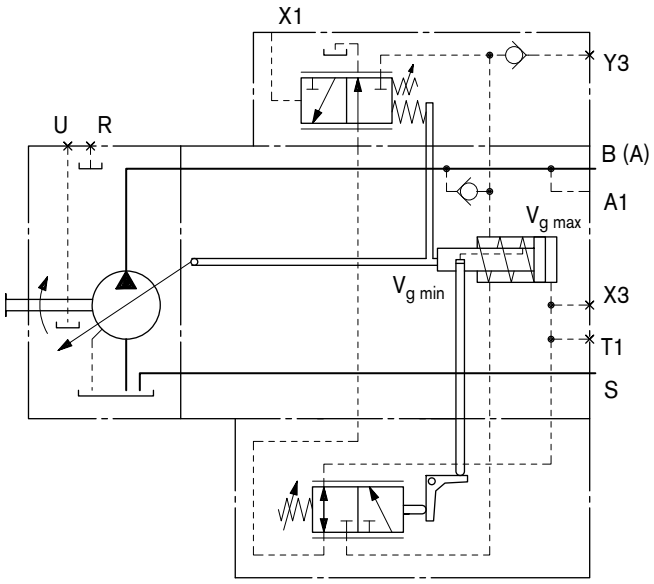
Initial position without actuation signal (pilot pressure): $V_{g\,max}$

LRH1 characteristic

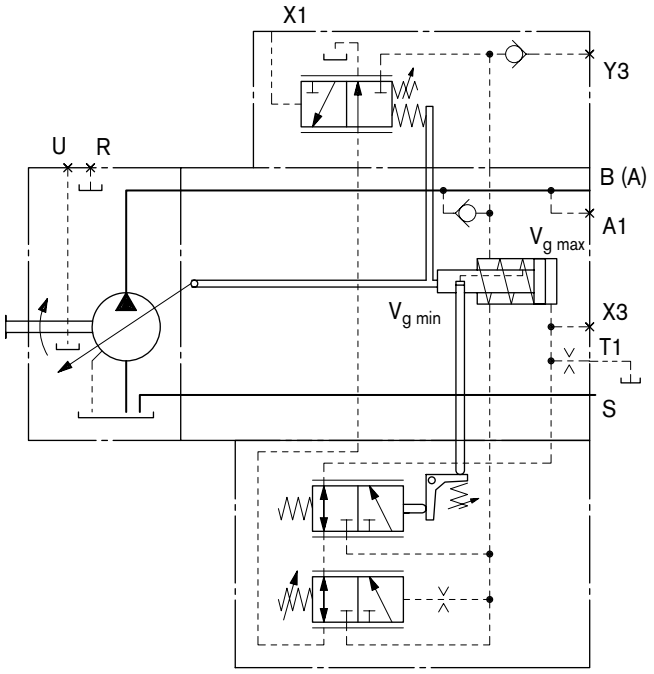
Pilot pressure increase ($V_{g\,max} - V_{g\,min}$) _____ $\Delta p = 25$ bar



LRH1 circuit diagram



LRDH1 circuit diagram



DR - Pressure Controller

Within its control range, the pressure controller maintains the pressure in a hydraulic system at a constant level, even if the flow is variable. The variable pump supplies only the amount hydraulic fluid that is actually required by the consumers. If the operating pressure exceeds the setpoint value set at the integrated pressure control valve, the pump will automatically move back and the control deviation will be reduced.

When not under pressure, the pump is swiveled back to its initial position at $V_{g\,max}$ by a control spring.

Setting range for pressure control _____ 50 – 350 bar

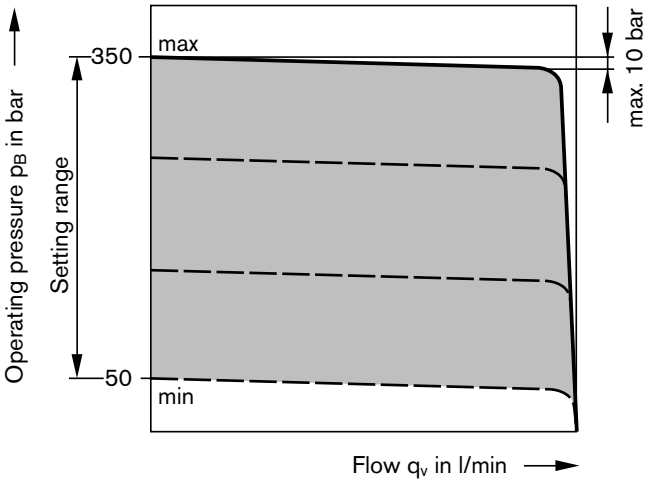
When ordering, please state the pressure controller setting in plain text.

Note:

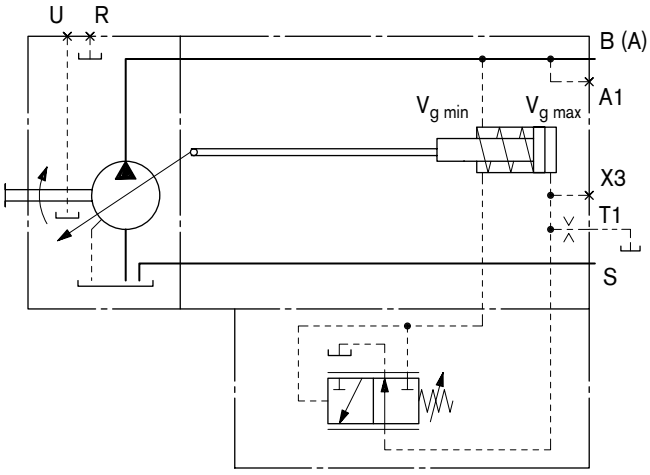
– On versions with DR pressure controller, a case drain line from port T_1 to the tank is needed .

– A pressure-relief valve fitted to ensure the maximum pressure in the system must be at least 20 bar above the controller setting when it starts to open.

DR characteristic



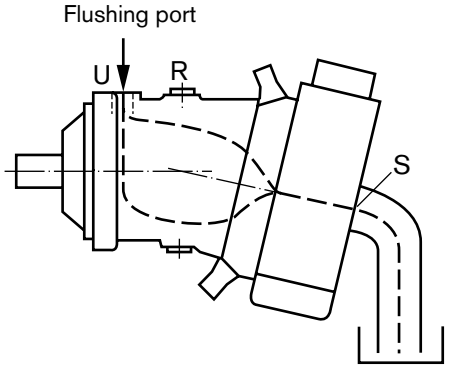
DR circuit diagram



Zero stroke operation

The standard version is configured for intermittent pressure control operation. Short-term zero stroke operation (< 10 min.) is permissible to an operating pressure of p_{max} = 315 bar at a tank temperature ≤ 50°C.

For long-term periods of zero stroke operation the bearings should be flushed at port U.



Flushing volumes (recommended)

Size	28	55	80	107	160
$q_{v\,flush}$ (l/min)	3	4	6	8	12

Temperature of flushing fluid ≤ tank temperature

DR - Pressure Controller

DRG Pressure controller, remote controlled

A sequence valve with port plate assumes the pressure control function. The valve is located separate from the pump, whereby the simple line length of 5 m should not be exceeded. The valve is supplied with high pressure from port A_1 of the pump. The control pressure from the valve is fed back to the pump via port X_3, which adjusts the displacement of the pump to $V_{g\,min}$. Please ensure that the ports T on the sequence valve and T_1 on the pump are fed back to the tank (cooler).

Setting range for pressure control _____ 50 – 315 bar

When ordering, please state the pressure controller setting in plain text.

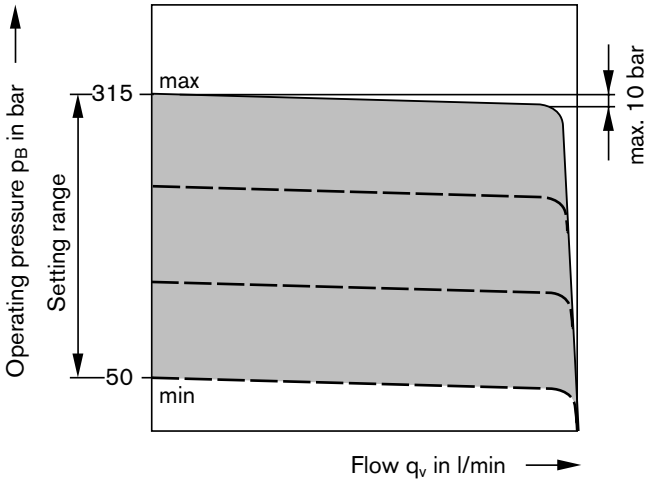
Note:

– A pressure-relief valve fitted to ensure the maximum pressure in the system must be at least 20 bar above the controller setting when it starts to open.

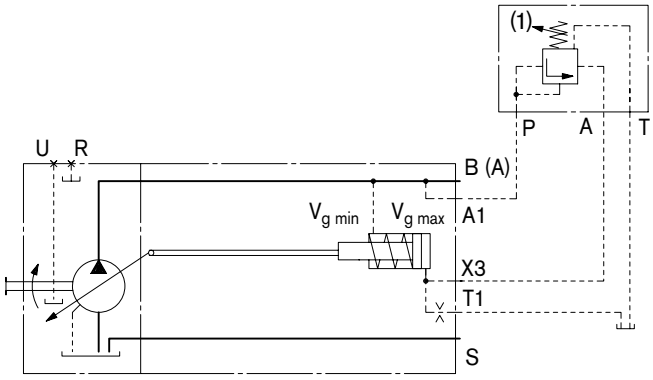
The sequence valve and port plate must be ordered separately.

Sequence valve: DZ5DP2-1X/315YMSO21
(Mat.No. R900495604)
Port plate: G 115/1 (Mat.No. R900424379)

DRG characteristic



DRG circuit diagram



Item (1) is not included in supply of the pump.

DR - Pressure Controller

DRS Pressure controller with load sensing

The load-sensing controller is a flow control option that operates as a function of the load pressure to regulate the pump displacement to match the actuator flow requirement.

The flow depends here on the cross section of the external measuring orifice (1) fitted between the pump outlet and the actuator. The flow is independent of the load pressure below the pressure control setting and within the control range of the pump.

The measuring orifice is usually a separately arranged load sensing directional valve (control block). The position of the directional valve piston determines the opening cross section of the measuring orifice and thus the flow of the pump.

The load-sensing control compares pressure before and after the measuring orifice and maintains the pressure drop (differential pressure Δp) and thus the flow constant.

If the differential pressure Δp increases, the pump is swiveled back (towards $V_{g\,min}$), and if the differential pressure Δp decreases, the pump is swiveled out (towards $V_{g\,max}$), until equilibrium is restored in the valve.

$\Delta p_{Measuring\ orifice} = p_{Pump} - p_{Consumer}$

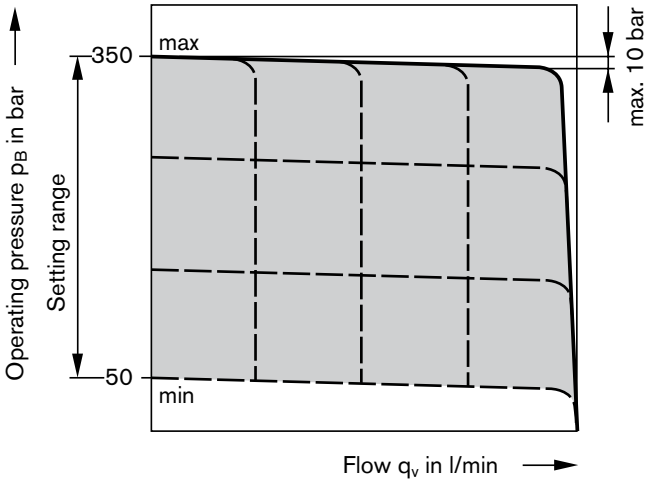
Setting range for Δp _____ 14 – 25 bar

Standard setting _____ 18 bar (please state in clear text).

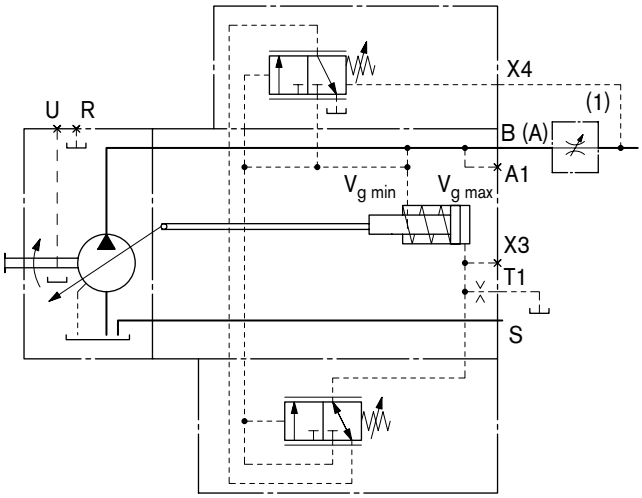
The standby pressure in zero stroke operation (measuring orifice plugged) is slightly above the Δp setting

(1) The measuring orifice (control block) is not included in the supply.

DRS characteristic



DRS circuit diagram



Item (1) is not included in supply of the pump.

HD - Hydraulic Control, Pilot-Pressure Related

The pilot-pressure related control proportionally and infinitely variable the displacement if the pump with a pilot pressure at port X_1.

Maximum permissible pilot pressure $p_{St\ max} = 40$ bar

Control from $V_{g\ min}$ to $V_{g\ max}$.

With increasing pilot pressure the pump swivels to a higher displacement.

Setting range for start of control _____ 4 – 15 bar

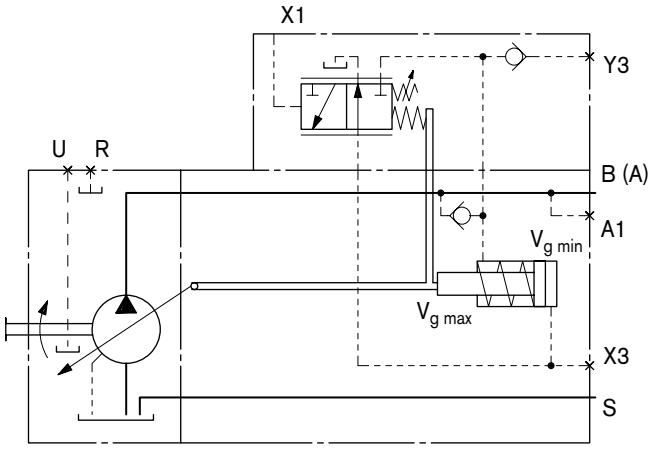
Please specify start of control in plain text when ordering.

A control pressure of 40 bar is needed to swivel the pump from its initial position $V_{g\ min}$ to $V_{g\ max}$.

The required control pressure is taken either from the operating pressure, or from the externally applied control pressure at the Y_3 port.

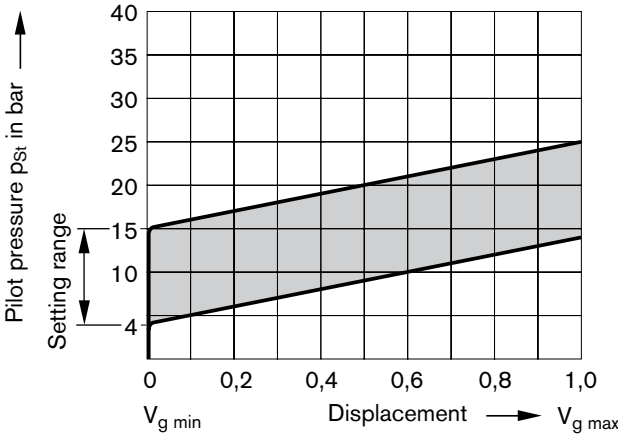
To ensure the control even at low operating pressure < 40 bar the port Y_3 must be supplied with an external control pressure of approx. 40 bar.

HD circuit diagram



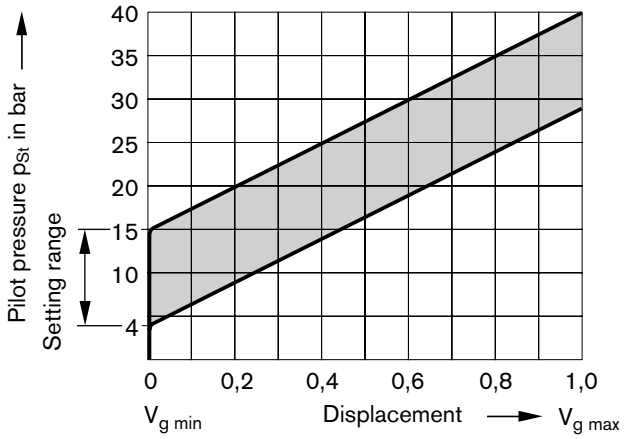
Characteristic HD1

Pilot pressure increase $V_{g\ min}$ to $V_{g\ max}$ _____ $\Delta p = 10$ bar



Characteristic HD2

Pilot pressure increase $V_{g\ min}$ to $V_{g\ max}$ _____ $\Delta p = 25$ bar



HD - Hydraulic Control, Pilot-Pressure Related

HD.G Hydraulic control, for pressure cut-off, remote controlled

A sequence valve with port plate assumes the pressure cut-off function. The valve is located separate from the pump, whereby the simple line length of 5 m should not be exceeded. The valve is supplied with high pressure from port A_1 of the pump. The control pressure for the pump is fed into the valve via port X_3 and is diverted to the tank at port A on the port plate of the sequence valve, enabling the pump to be controlled to $V_{g\,min}$ if the set pressure setpoint is exceeded .

Setting range for pressure control _____ 50 – 315 bar

When ordering, please state the pressure controller setting in plain text.

Note:

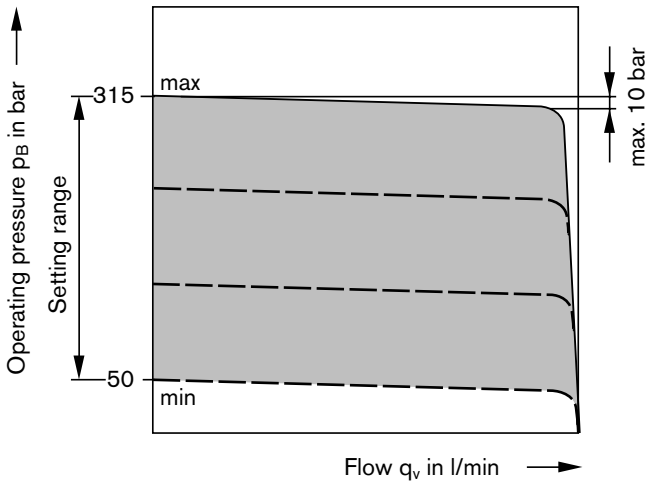
– Port A from the sequence valve must be fed back to the tank (cooler)

– A pressure-relief valve fitted to ensure the maximum pressure in the system must be at least 20 bar above the controller setting when it starts to open.

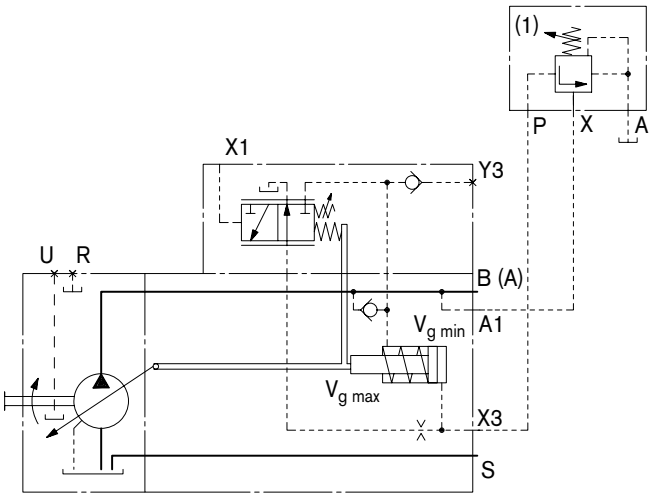
The sequence valve and port plate must be ordered separately.

Sequence valve: DZ5DP2-1X/315XYMSO20 (Mat.No. R900490554)
Port plate: G 115/1 (Mat.No. R900424379)

HD.G characteristic



HD.G circuit diagram



Item (1) is not included in supply of the pump.

Note

The spring return in the control unit is not a security device.

The control spool and/or the positioning piston can be blocked in an undefined position by internal contamination – e.g. impure hydraulic fluid, abrasion or residual contamination from system components. As a result, the variable pump can no longer provide the speed an torque specified by the operator.

– Install an appropriate emergency-off function to ensure that the driven consumer can be brought to a safe position (e.g. immediate stop).

– Maintain the specified cleanliness level 20/18/15 (< 90°C) or 19/17/14 (> 90°C) in accordance with ISO 4406.

EP - Electric Control with Proportional Solenoid

With the electric control with proportional solenoid, the pump displacement is adjusted proportionally and steplessly to the current by means of the magnetic force.

Control from $V_{g\,min}$ to $V_{g\,max}$

With increasing control current the pump swivels to a higher displacement.

A control pressure of 40 bar is needed to swivel the pump from its initial position $V_{g\,min}$ to $V_{g\,max}$.

The required control pressure is taken either from the operating pressure, or from the externally applied control pressure at the Y_3 port.

To ensure the control even at low operating pressure < 40 bar the port Y_3 must be supplied with an external control pressure of approx. 40 bar.

Note:
The pump with EP control in the fluid tank may only be installed if mineral hydraulic oil are used and the fluid temperature in the tank is no greater than 80°C.

The following electronic controllers and amplifiers are available for controlling the proportional solenoids (sizes 28 to 200) (information is also available on the Internet at www.boschrexroth.com/mobile-electronics):

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

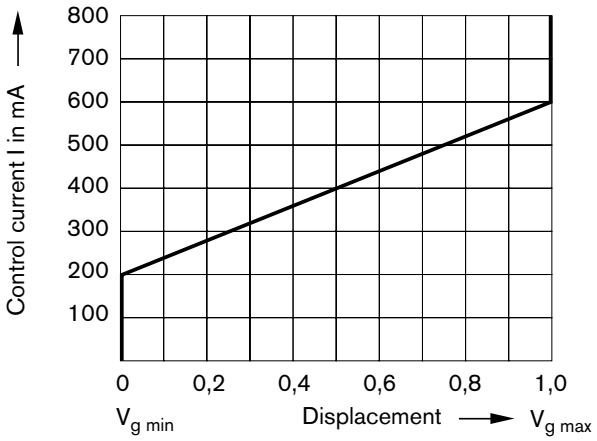
– Analog amplifier RA _____ RE 95230

The use of a proportional amplifier means that the control time can be influenced.

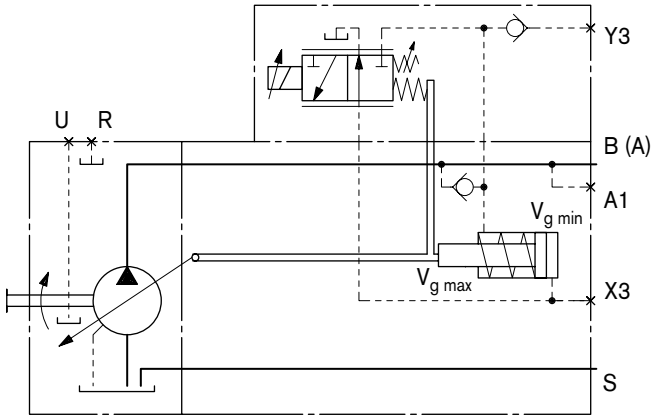
Technical data solenoid

	EP
Voltage	24V DC (±20%)
Control current	
Start of control at $V_{g\,max}$	200 mA
End of control at $V_{g\,max}$	600 mA
Limiting current	0.68 A
Nominal resistance (at 20°C)	19.5 Ω
Dither frequency	100 Hz
Actuated time	100%
Type of protection (HIRSCHMANN) according to DIN EN 60529	IP65

EP characteristic



EP circuit diagram



ED.G Electric control, for pressure cut-off, remote controlled

see HD.G

Note

The spring return in the control unit is not a security device.

The control spool and/or the positioning piston can be blocked in an undefined position by internal contamination – e.g. impure hydraulic fluid, abrasion or residual contamination from system components. As a result, the variable pump can no longer provide the speed an torque specified by the operator.

– Install an appropriate emergency-off function to ensure that the driven consumer can be brought to a safe position (e.g. immediate stop).

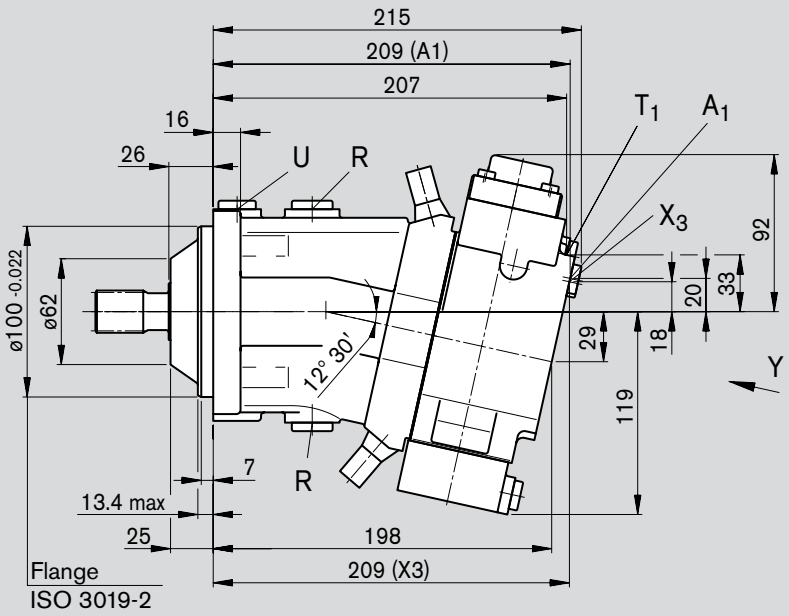
– Maintain the specified cleanliness level 20/18/15 (< 90°C) or 19/17/14 (> 90°C) in accordance with ISO 4406.

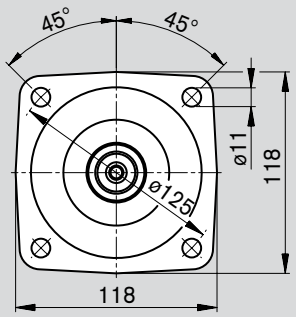
Unit Dimensions, Size 28

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

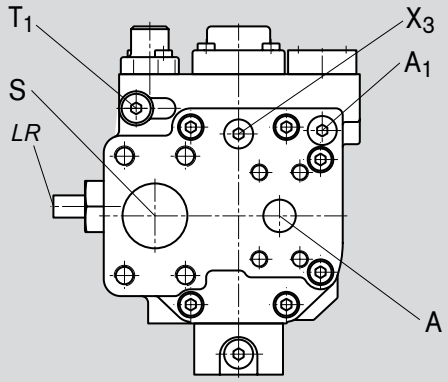
LR - Power Controller

Note: all control versions are illustrated in clockwise rotation

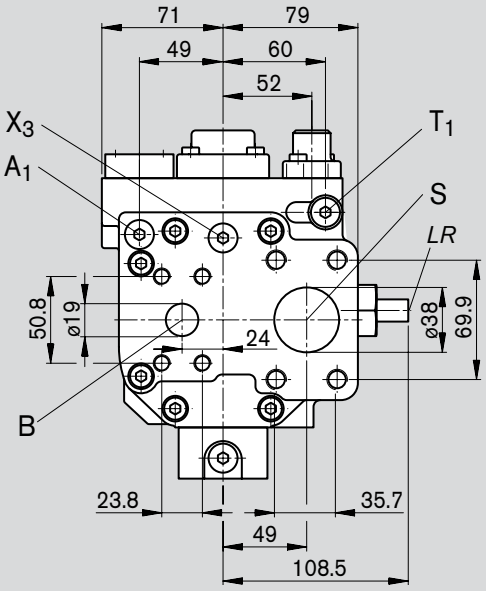




Y view
Counter-clockwise rotation



Y view
Clockwise rotation

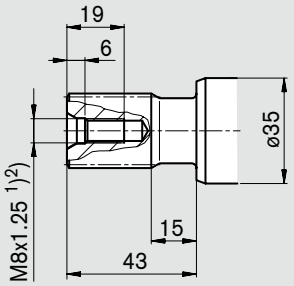


Unit Dimensions, Size 28

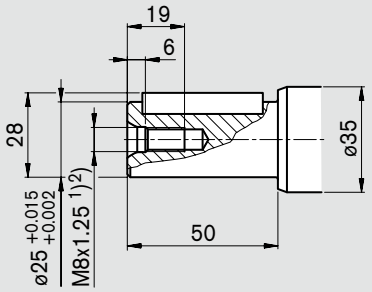
Before finalizing your design, please request a binding installation drawing. Dimensions in mm.

Shaft ends

Z Splined shaft DIN 5480
W25x1.25x30x18x9g



P Cyl. shaft with key
DIN 6885, AS8x7x40



Ports

B and A	Service line port (high-pressure series) Fixing thread	SAE J518 DIN 13	3/4 in M10x1.5; 17 deep[2)]	
S	Suction port (standard series) Fixing thread	SAE J518 DIN 13	1 1/2 in M12x1.75; 20 deep[2)]	
U	Bearing flushing [3)]	DIN 3852	M16x1.5; 12 deep	100 Nm [2)]
R	Air bleed [3)]	DIN 3852	M18x1.5; 12 deep	140 Nm [2)]
A1	High pressure [3)]	DIN 3852	M12x1.5; 12 deep	50 Nm [2)]
T_1	Pilot fluid drain [4)]	DIN 3852	M12x1.5; 12 deep	50 Nm [2)]
X_3	Override [3)]	DIN 3852	M12x1.5; 12 deep	50 Nm [2)]
Y_3	External control pressure [3)]	DIN 3852	M14x1.5; 12 deep	80 Nm [2)]
X_1	Pilot pressure	DIN 3852	M14x1.5; 12 deep	80 Nm [2)]

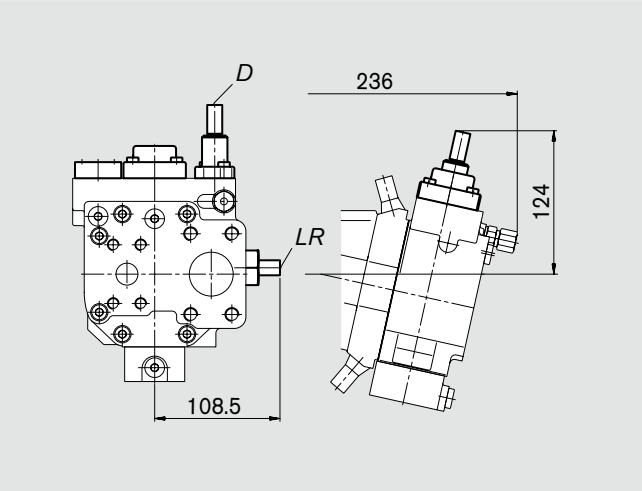
1) Center bore according to DIN 332 (thread according to DIN 13)
2) Please observe the general notes for the max. tightening torques on page 32
3) Plugged
4) Plugged, only DR, ..D.. open

Unit Dimensions, Size 28

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

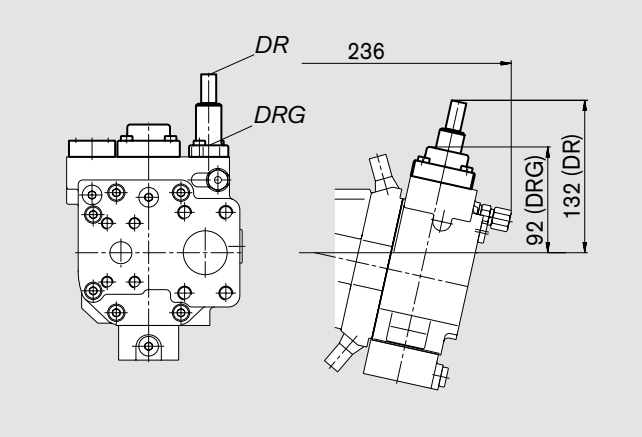
LRD

Power controller with pressure cut-off



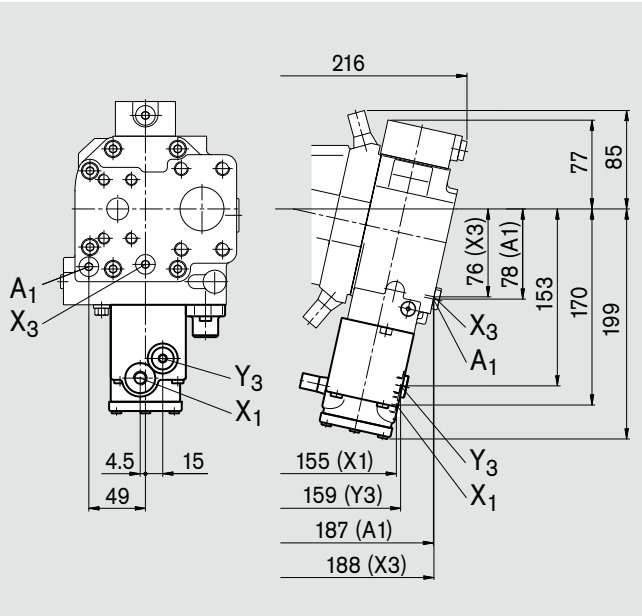
DR/DRG

Pressure controller, remote controlled



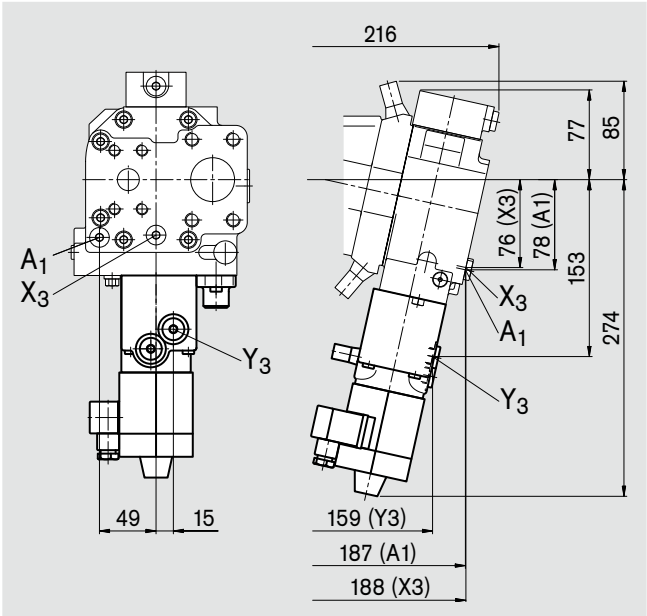
HD1/HD1G/HD2/HD2G

Hydraulic control for pressure cut-off, remote controlled



EP/EPG

Electric control for pressure cut-off, remote controlled

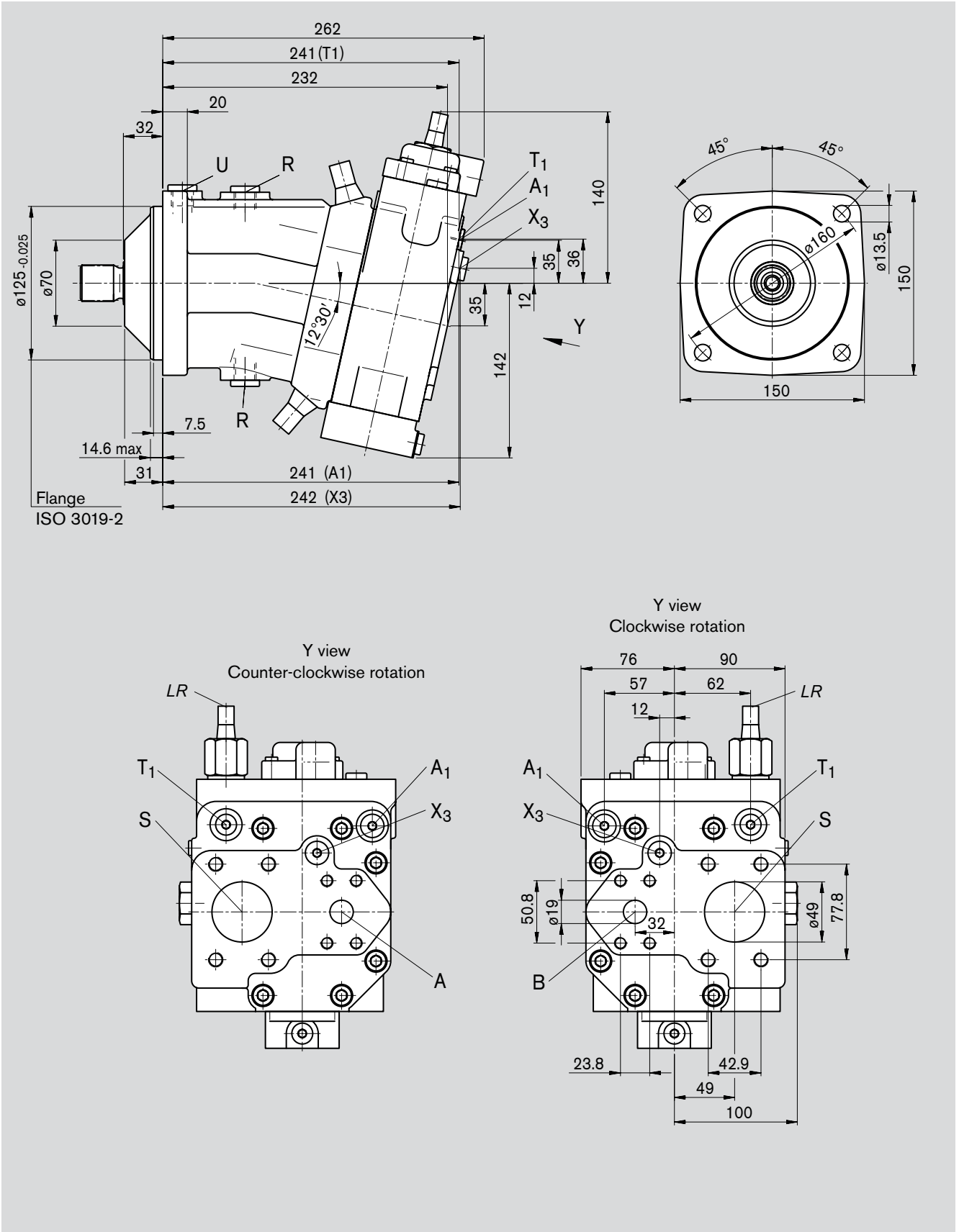


Unit Dimensions, Size 55

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

LR - Power Controller

Note: all control versions are illustrated in clockwise rotation

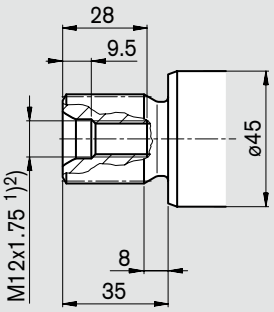


Unit Dimensions, Size 55

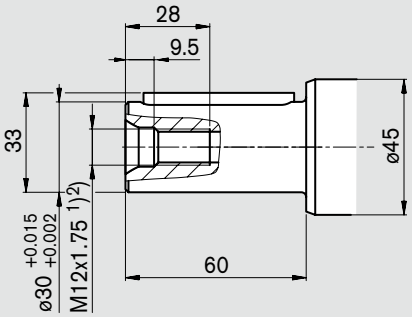
Before finalizing your design, please request a binding installation drawing. Dimensions in mm.

Shaft ends

Z Splined shaft DIN 5480
W30x2x30x14x9g



P Cyl. shaft with key
DIN 6885, AS8x7x50



Ports

B and A	Service line port (high-pressure series) Fixing thread	SAE J518 DIN 13	3/4 in M10x1.5; 17 deep[2)]	
S	Suction port (standard series) Fixing thread	SAE J518 DIN 13	2 in M12x1.75; 20 deep[2)]	
U	Bearing flushing [3)]	DIN 3852	M18x1.5; 12 deep	140 Nm [2)]
R	Air bleed [3)]	DIN 3852	M18x1.5; 12 deep	140 Nm [2)]
A1	High pressure [3)]	DIN 3852	M14x1.5; 12 deep	80 Nm [2)]
T_1	Pilot fluid drain [4)]	DIN 3852	M12x1.5; 12 deep	50 Nm [2)]
X_3	Override [3)]	DIN 3852	M14x1.5; 12 deep	80 Nm [2)]
Y_3	External control pressure [3)]	DIN 3852	M14x1.5; 12 deep	80 Nm [2)]
X_1	Pilot pressure	DIN 3852	M14x1.5; 12 deep	80 Nm [2)]
X_4	Load pressure	DIN 3852	M14x1.5; 12 deep	80 Nm [2)]

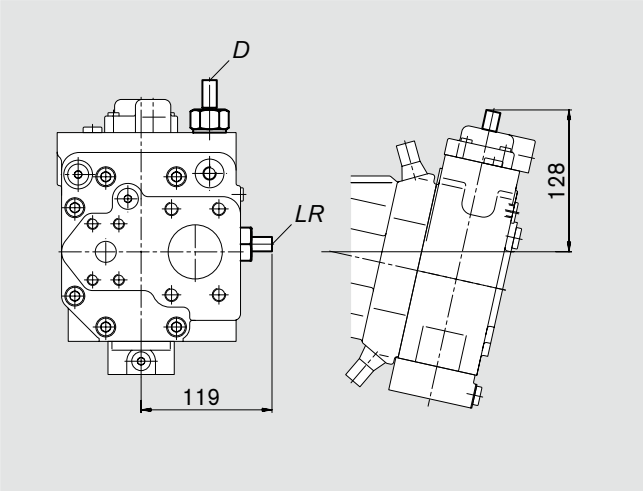
[1)] Center bore according to DIN 332 (thread according to DIN 13)
[2)] Please observe the general notes for the max. tightening torques on page 32
[3)] Plugged
[4)] Plugged, only DR, ..D.. open

Unit Dimensions, Size 55

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

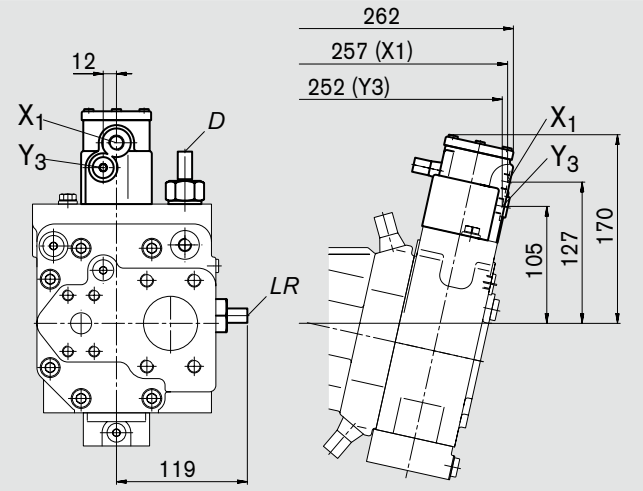
LRD

Power controller with pressure cut-off



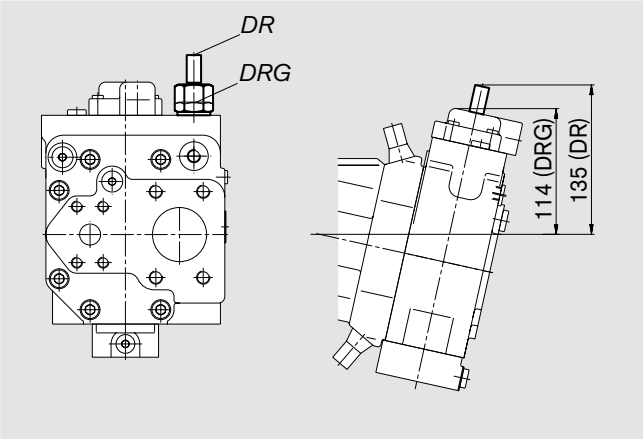
LRDH1

Power controller with pressure cut-off, stroke limiter



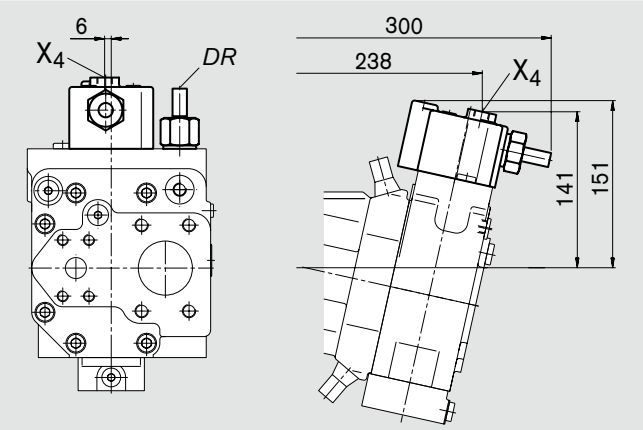
DR/DRG

Pressure controller, remote controlled



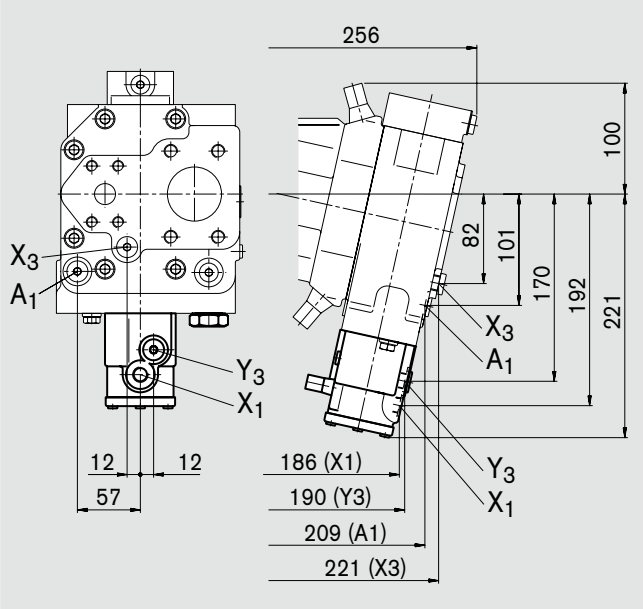
DRS

Pressure controller with load sensing



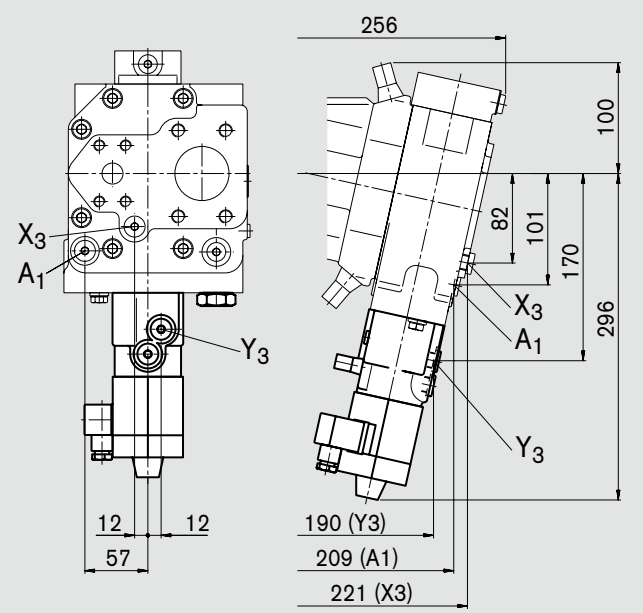
HD1/HD1G/HD2/HD2G

Hydraulic control for pressure cut-off, remote controlled



EP/EPG

Electric control for pressure cut-off, remote controlled

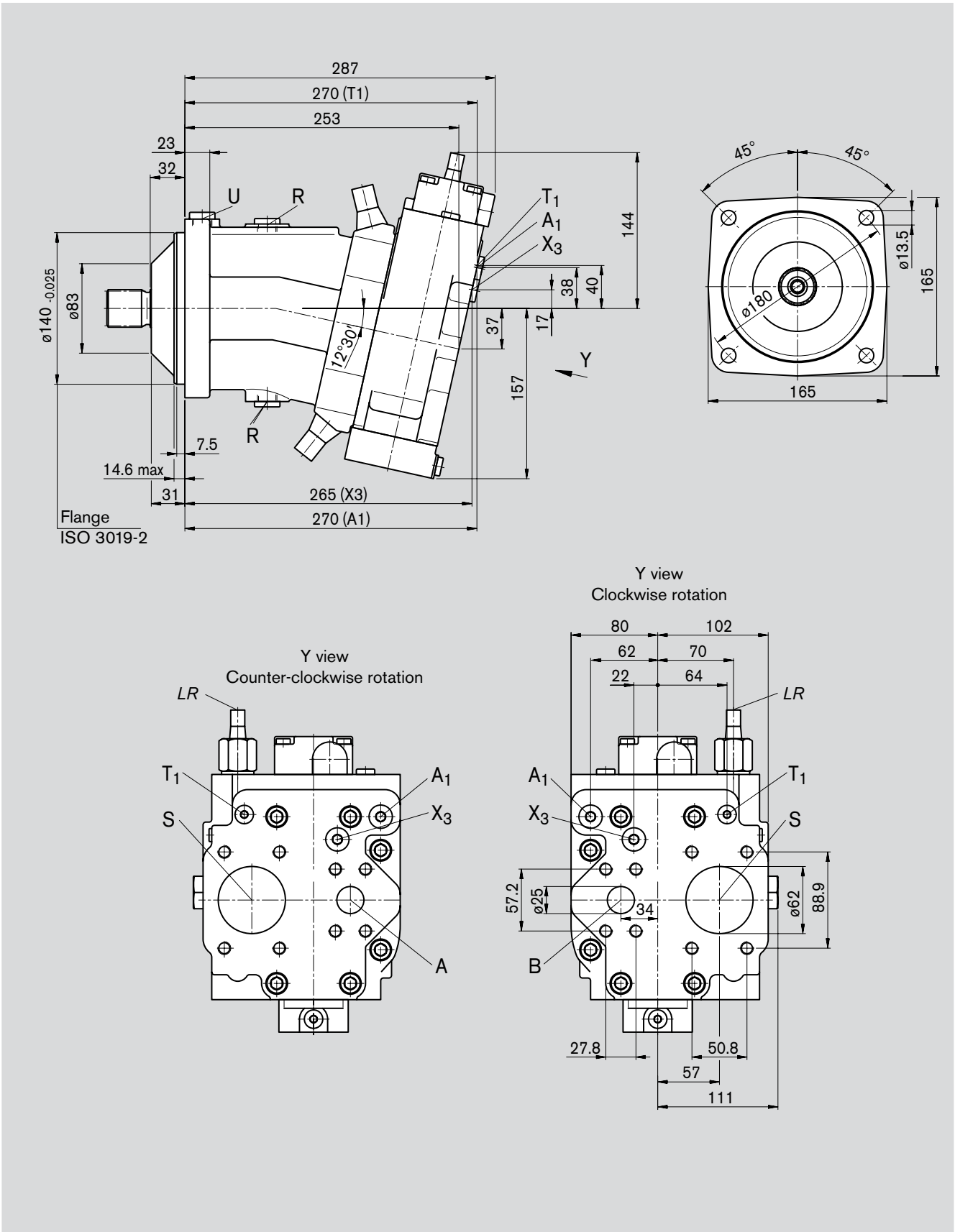


Unit Dimensions, Size 80

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

LR - Power Controller

Note: all control versions are illustrated in clockwise rotation

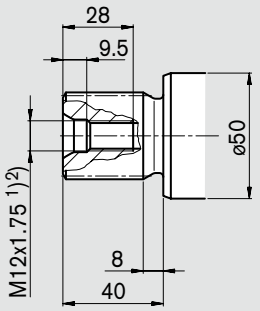


Unit Dimensions, Size 80

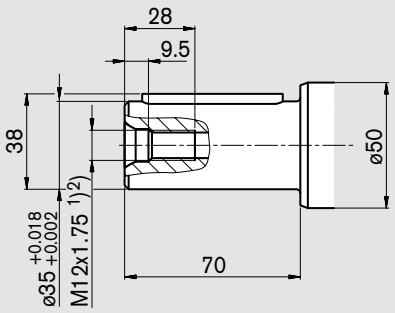
Before finalizing your design, please request a binding installation drawing. Dimensions in mm.

Shaft ends

Z Splined shaft DIN 5480
W35x2x30x16x9g



P Cyl. shaft with key
DIN 6885, AS10x8x56



Ports

B and A	Service line port (high-pressure series) Fixing thread	SAE J518 DIN 13	1 in M12x1.75; 17 deep[2)]	
S	Suction port (standard series) Fixing thread	SAE J518 DIN 13	2 1/2 in M12x1.75; 17 deep[2)]	
U	Bearing flushing [3)]	DIN 3852	M18x1.5; 12 deep	140 Nm [2)]
R	Air bleed [3)]	DIN 3852	M18x1.5; 12 deep	140 Nm [2)]
A1	High pressure [3)]	DIN 3852	M16x1.5; 12 deep	100 Nm [2)]
T_1	Pilot fluid drain [4)]	DIN 3852	M12x1.5; 12 deep	50 Nm [2)]
X_3	Override [3)]	DIN 3852	M16x1.5; 12 deep	100 Nm [2)]
Y_3	External control pressure [3)]	DIN 3852	M14x1.5; 12 deep	80 Nm [2)]
X_1	Pilot pressure	DIN 3852	M14x1.5; 12 deep	80 Nm [2)]
X_4	Load pressure	DIN 3852	M14x1.5; 12 deep	80 Nm [2)]

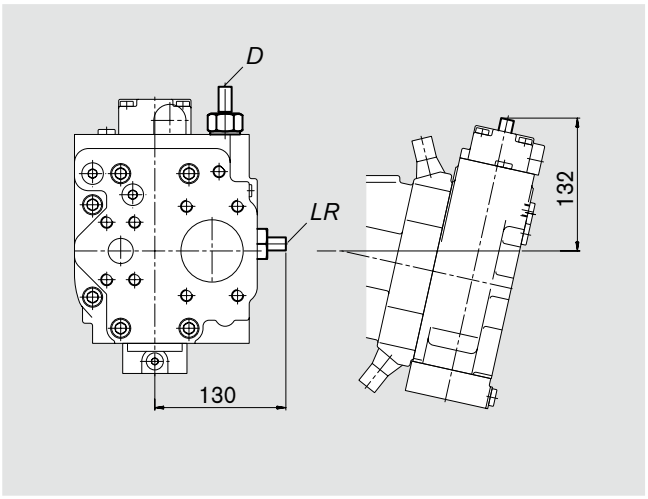
[1)] Center bore according to DIN 332 (thread according to DIN 13)
[2)] Please observe the general notes for the max. tightening torques on page 32
[3)] Plugged
[4)] Plugged, only DR, ..D.. open

Unit Dimensions, Size 80

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

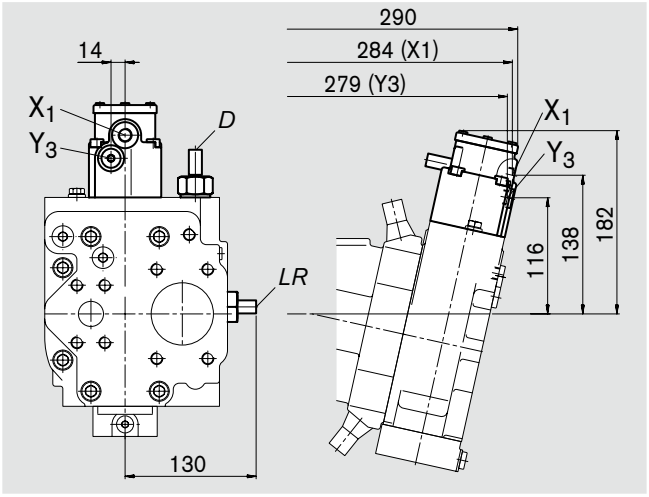
LRD

Power controller with pressure cut-off



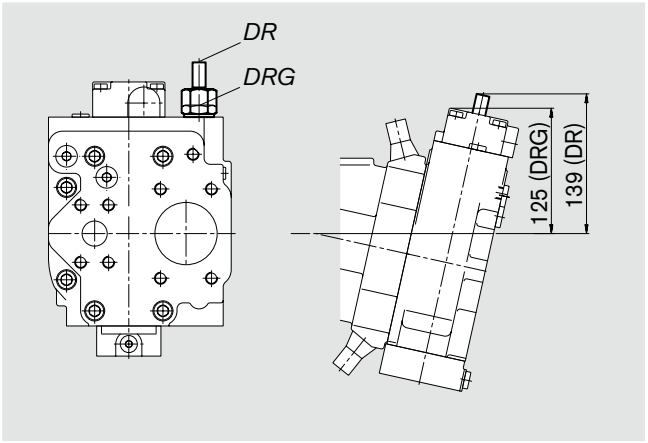
LRDH1

Power controller with pressure cut-off, stroke limiter



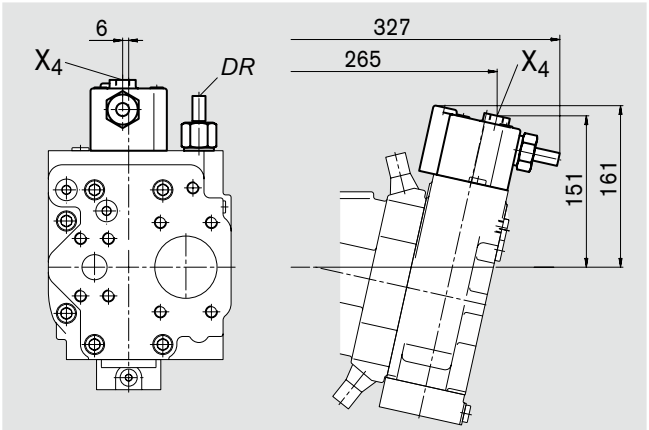
DR/DRG

Pressure controller, remote controlled



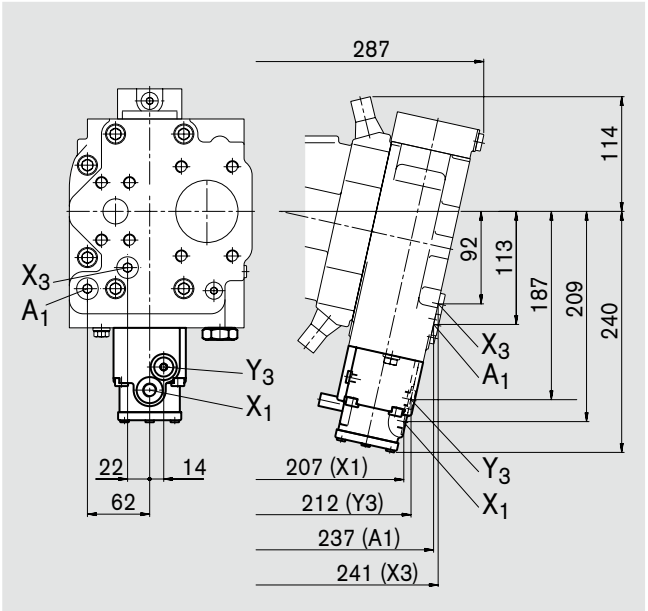
DRS

Pressure controller with load sensing



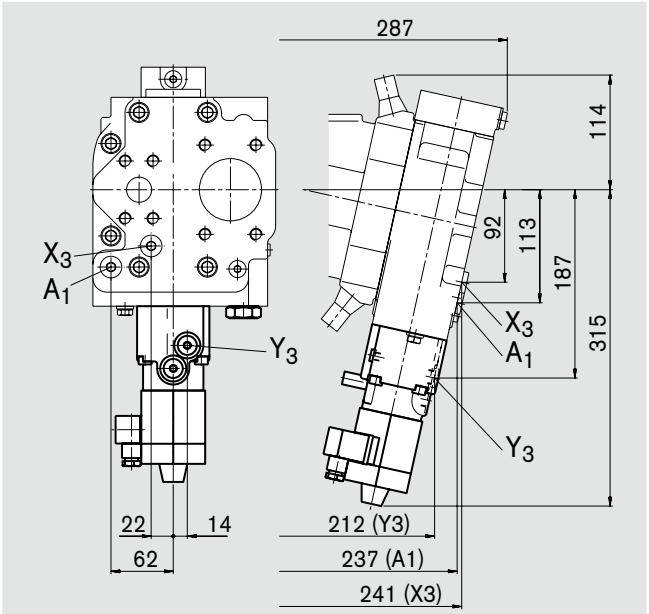
HD1/HD1G/HD2/HD2G

Hydraulic control for pressure cut-off, remote controlled



EP/EPG

Electric control for pressure cut-off, remote controlled

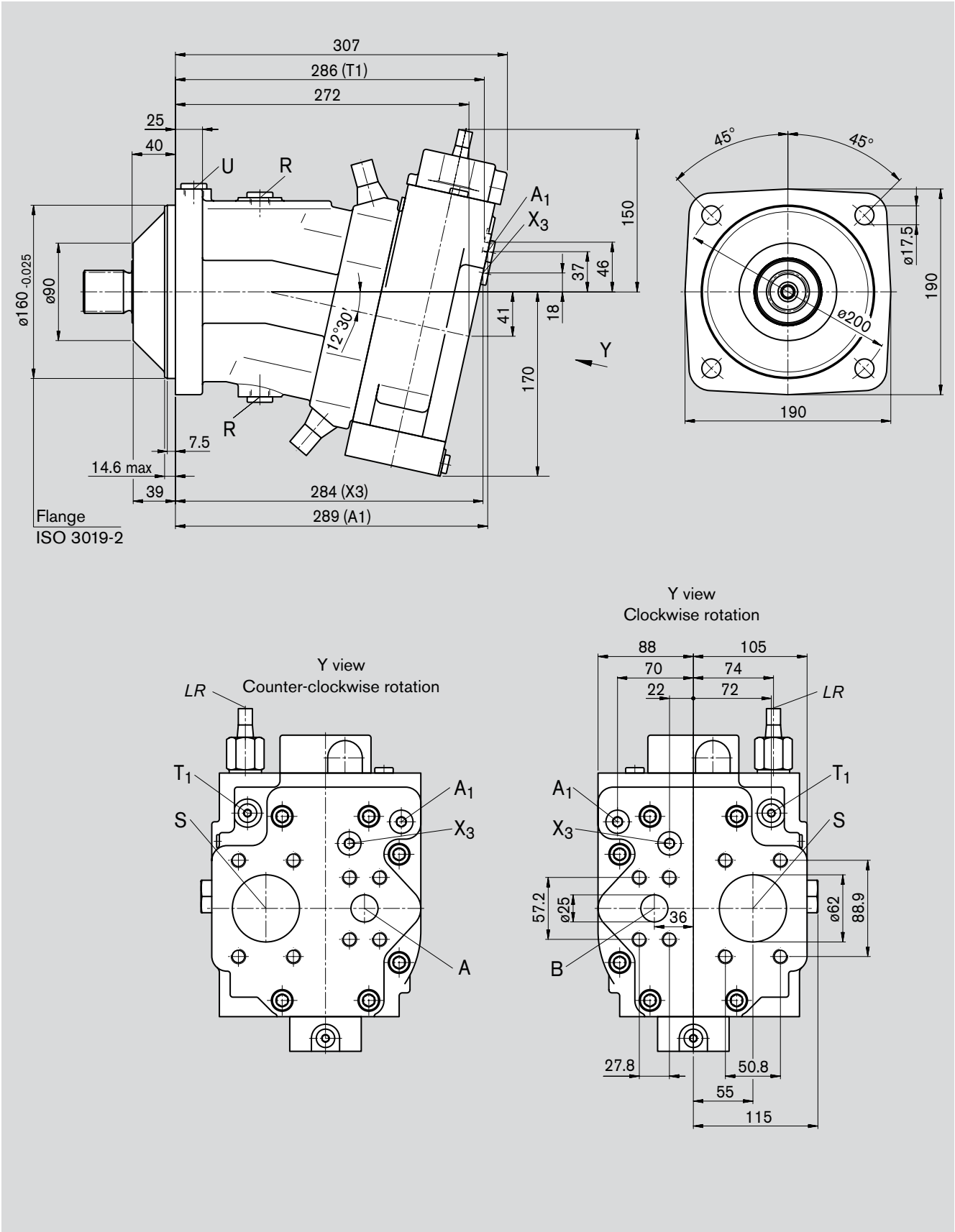


Unit Dimensions, Size 107

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

LR - Power Controller

Note: all control versions are illustrated in clockwise rotation

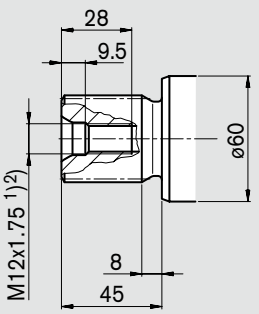


Unit Dimensions, Size 107

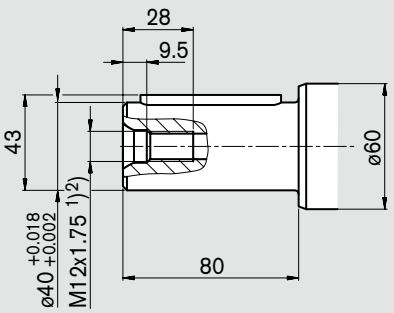
Before finalizing your design, please request a binding installation drawing. Dimensions in mm.

Shaft ends

Z Splined shaft DIN 5480
W40x2x30x18x9g



P Cyl. shaft with key
DIN 6885, AS12x8x63



Ports

B and A	Service line port (high-pressure series) Fixing thread	SAE J518 DIN 13	1 in M12x1.75; 17 deep[2)]	
S	Suction port (standard series) Fixing thread	SAE J518 DIN 13	2 1/2 in M12x1.75; 17 deep[2)]	
U	Bearing flushing [3)]	DIN 3852	M18x1.5; 12 deep	140 Nm [2)]
R	Air bleed [3)]	DIN 3852	M18x1.5; 12 deep	140 Nm [2)]
A1	High pressure [3)]	DIN 3852	M16x1.5; 12 deep	100 Nm [2)]
T_1	Pilot fluid drain [4)]	DIN 3852	M12x1.5; 12 deep	50 Nm [2)]
X_3	Override [3)]	DIN 3852	M16x1.5; 12 deep	100 Nm [2)]
Y_3	External control pressure [3)]	DIN 3852	M14x1.5; 12 deep	80 Nm [2)]
X_1	Pilot pressure	DIN 3852	M14x1.5; 12 deep	80 Nm [2)]
X_4	Load pressure	DIN 3852	M14x1.5; 12 deep	80 Nm [2)]

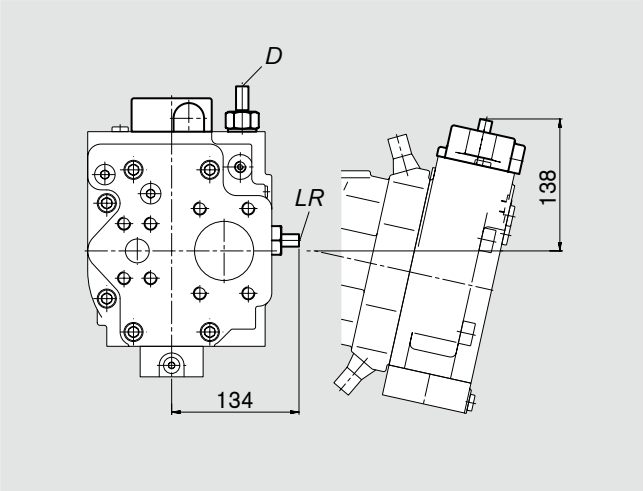
[1)] Center bore according to DIN 332 (thread according to DIN 13)
[2)] Please observe the general notes for the max. tightening torques on page 32
[3)] Plugged
[4)] Plugged, only DR, ..D.. open

Unit Dimensions, Size 107

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

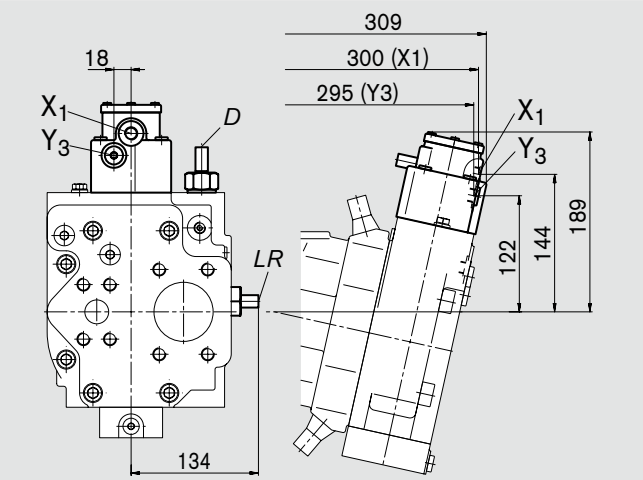
LRD

Power controller with pressure cut-off



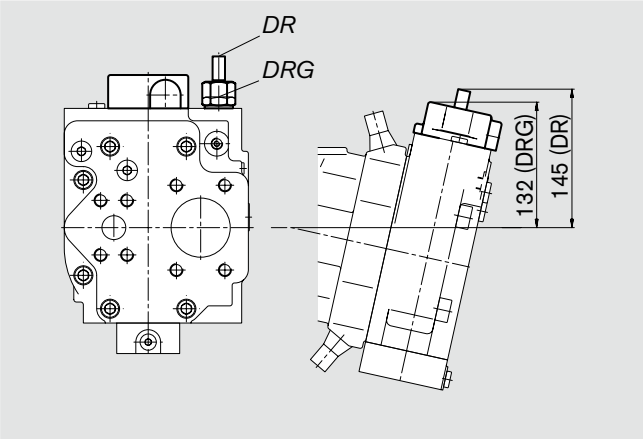
LRDH1

Power controller with pressure cut-off, stroke limiter



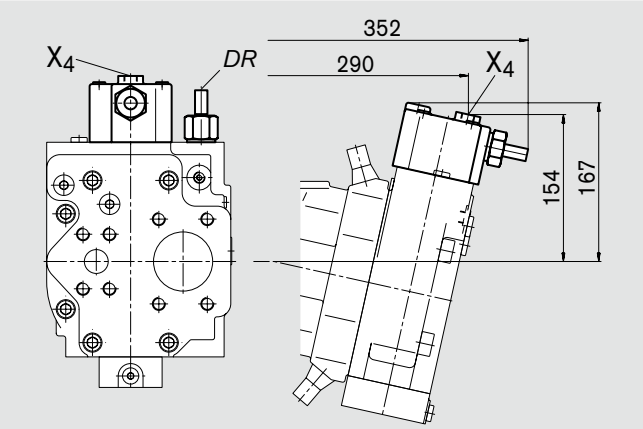
DR/DRG

Pressure controller, remote controlled



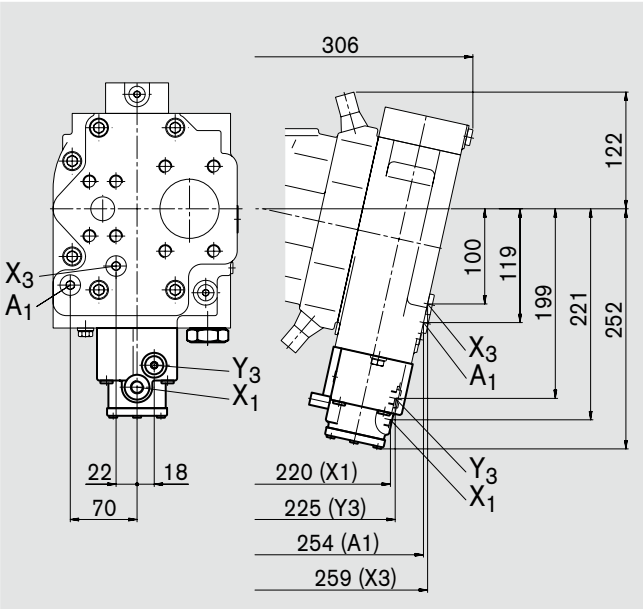
DRS

Pressure controller with load sensing



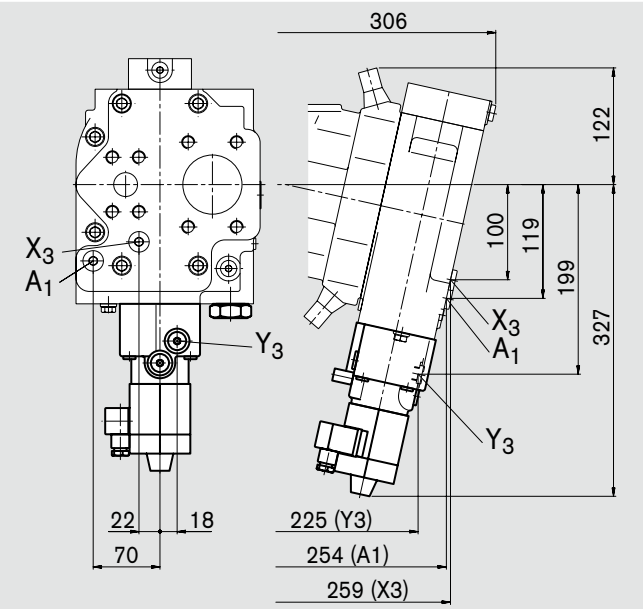
HD1/HD1G/HD2/HD2G

Hydraulic control for pressure cut-off, remote controlled



EP/EPG

Electric control for pressure cut-off, remote controlled

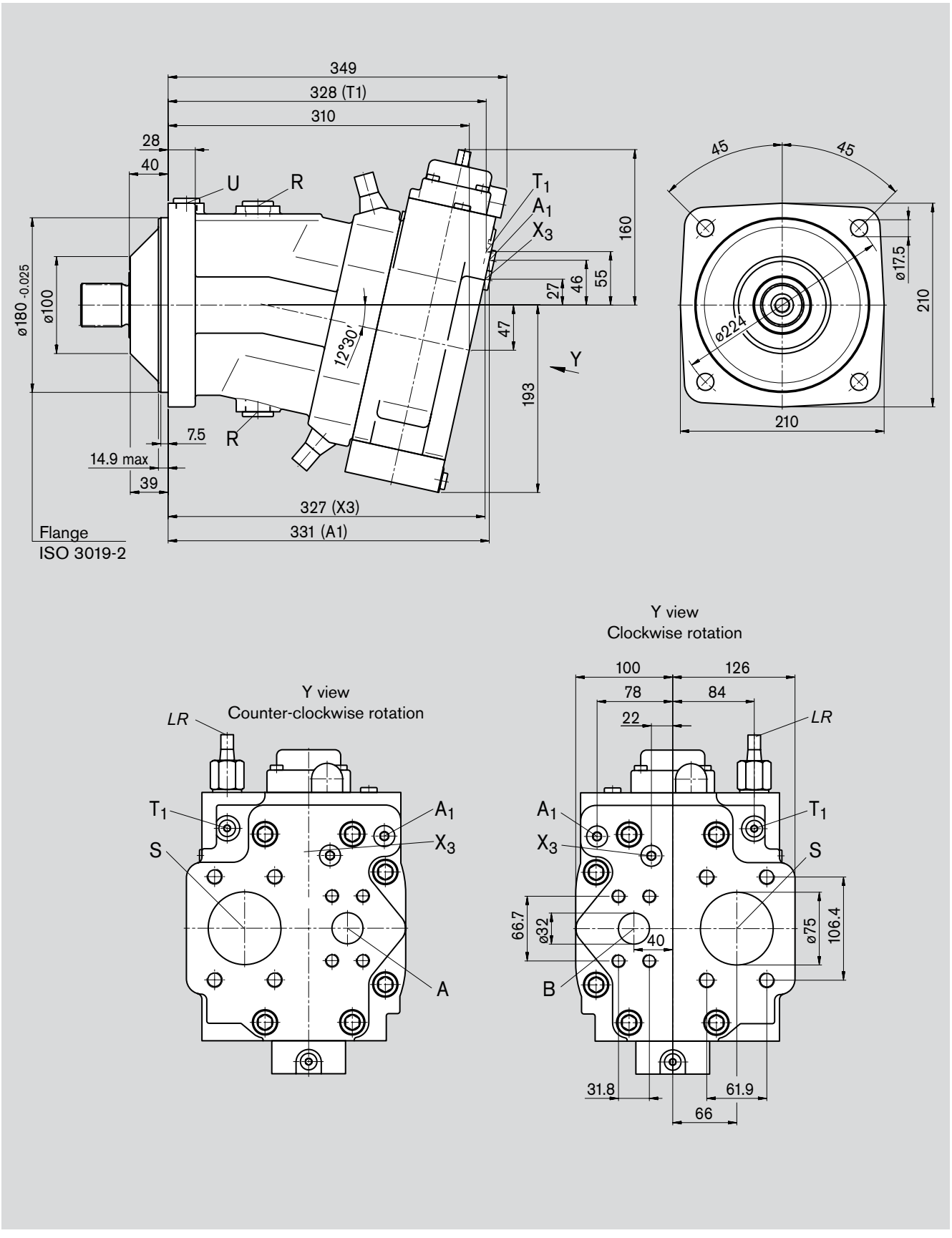


Unit Dimensions, Size 160

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

LR - Power Controller

Note: all control versions are illustrated in clockwise rotation

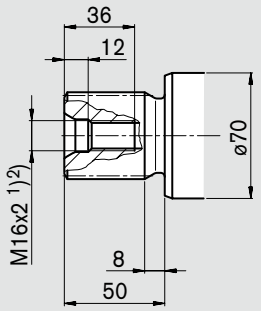


Unit Dimensions, Size 160

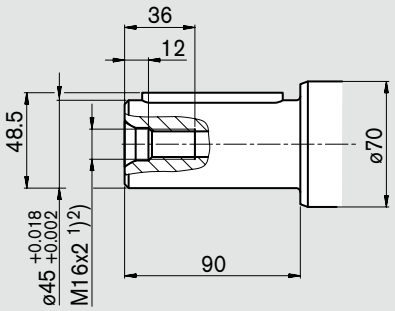
Before finalizing your design, please request a binding installation drawing. Dimensions in mm.

Shaft ends

Z Splined shaft DIN 5480
W45x2x30x21x9g



P Cyl. shaft with key
DIN 6885, AS14x9x70



Ports

B and A	Service line ports (high-pressure series) Fixing thread	SAE J518 DIN 13	1 1/4 in M14x1.5; 19 deep[2)]	
S	Suction port (standard series) Fixing thread	SAE J518 DIN 13	3 in M16x1.5; 24 deep[2)]	
U	Bearing flushing [3)]	DIN 3852	M22x1.5; 14 deep	210 Nm [2)]
R	Air bleed [3)]	DIN 3852	M26x1.5; 16 deep	230 Nm [2)]
A1	High pressure [3)]	DIN 3852	M16x1.5; 12 deep	100 Nm [2)]
T_1	Pilot fluid drain [4)]	DIN 3852	M12x1.5; 12 deep	50 Nm [2)]
X_3	Override [3)]	DIN 3852	M16x1.5; 12 deep	100 Nm [2)]
Y_3	External control pressure [3)]	DIN 3852	M14x1.5; 12 deep	80 Nm [2)]
X_1	Pilot pressure	DIN 3852	M14x1.5; 12 deep	80 Nm [2)]
X_4	Load pressure	DIN 3852	M14x1.5; 12 deep	80 Nm [2)]

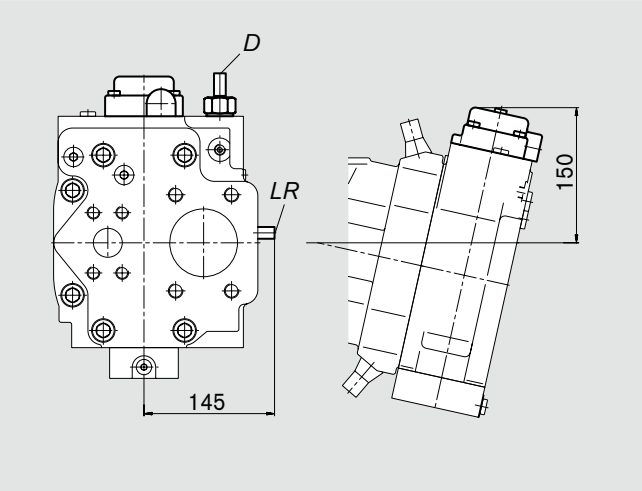
[1)] Center bore according to DIN 332 (thread according to DIN 13)
[2)] Please observe the general notes for the max. tightening torques on page 32
[3)] Plugged
[4)] Plugged, only DR, ..D.. open

Unit Dimensions, Size 160

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

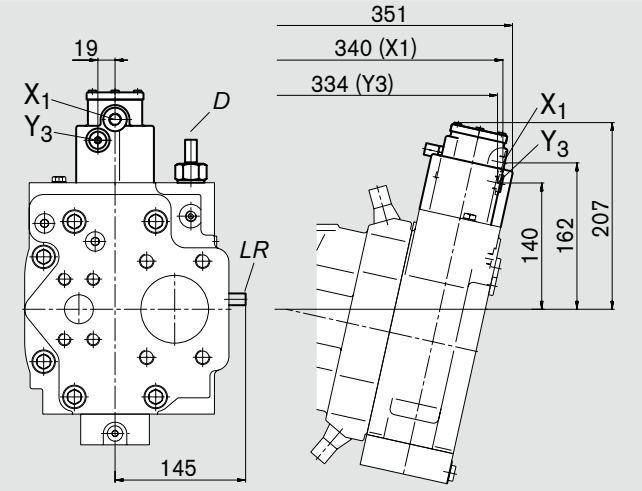
LRD

Power controller with pressure cut-off



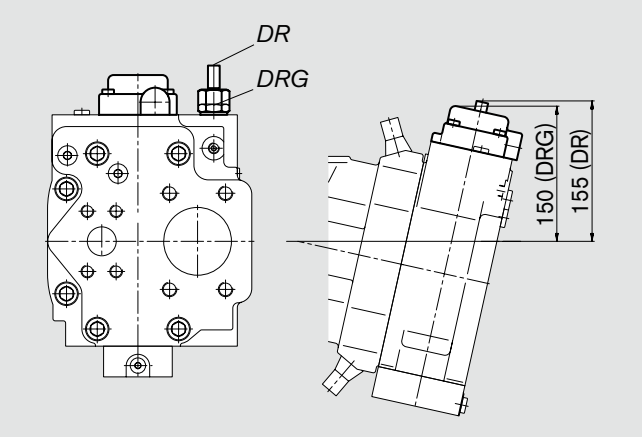
LRDH1

Power controller with pressure cut-off, stroke limiter



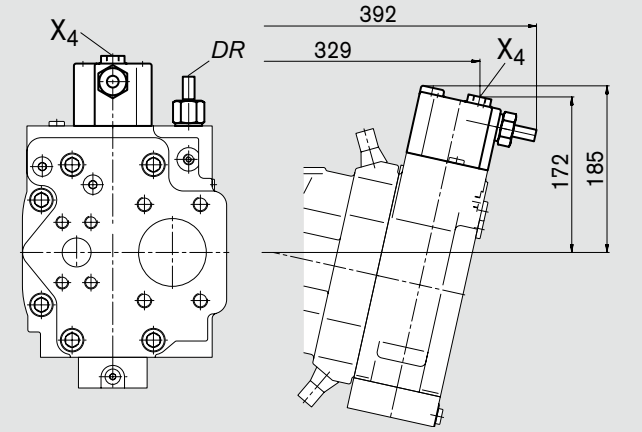
DR/DRG

Pressure controller, remote controlled



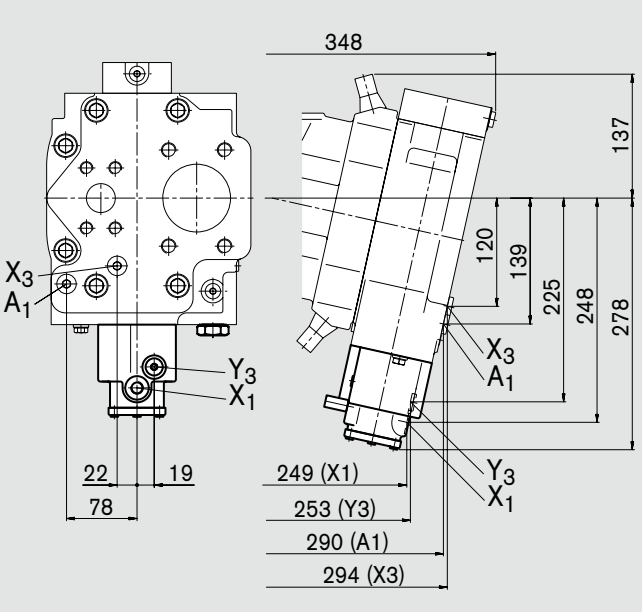
DRS

Pressure controller with load sensing



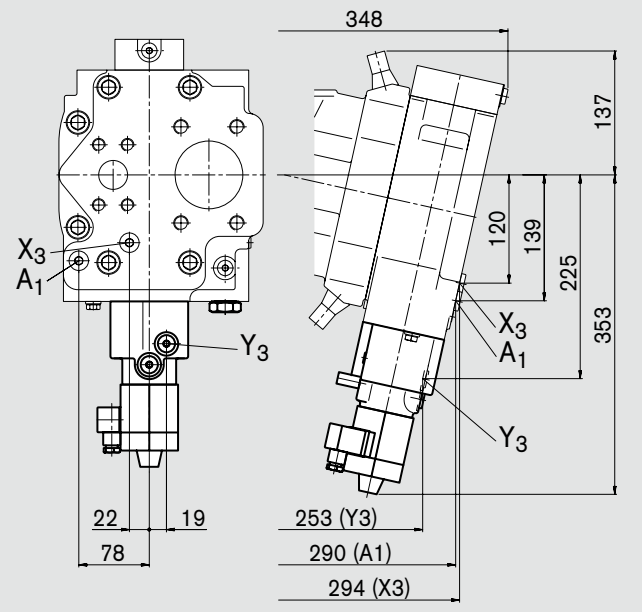
HD1/HD1G/HD2/HD2G

Hydraulic control for pressure cut-off, remote controlled



EP/EPG

Electric control for pressure cut-off, remote controlled



Installation Notes

General

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

The case drain chamber is internally connected to the suction chamber. A case drain line to the tank is not required.
Exception: when operated with pressure controller or pressure cut-off.
In all operational states, the suction line must flow into the tank below the minimum fluid level.
The minimum suction pressure at port S must not fall below of 0.8 bar absolute.

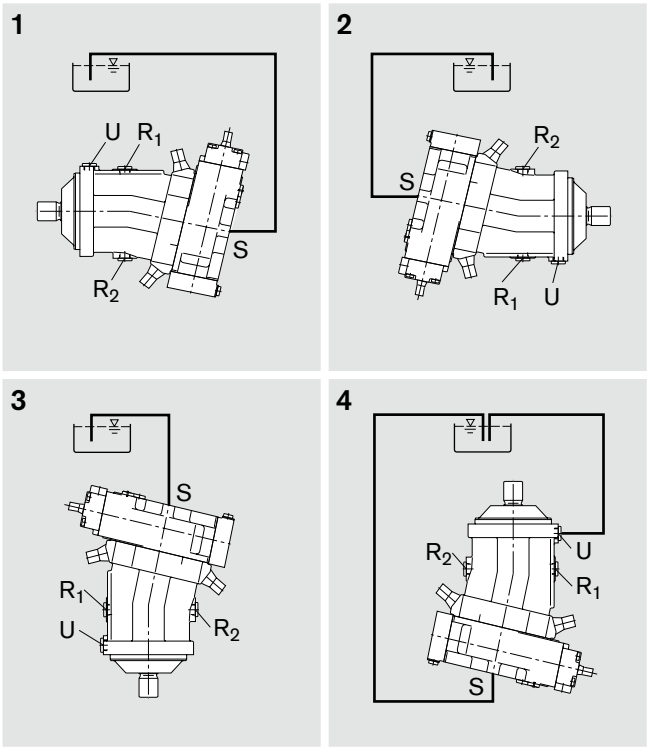
Installation position

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

Below-tank installation (standard)

Pump below the minimum fluid level of the tank.

Recommended installation positions: 1 and 2.



Installation position	Air bleeding	Filling
1	R1	S
2	R2	S
3	R_1, R_2	S
4	U	S

General Notes

– The A7VO pump is designed to be used in open circuits.

– Project planning, assembly and commissioning of the pump require the involvement of qualified personnel.

– The service line ports and function ports are only designed to accommodate hydraulic lines.

– During and shortly after operation, there is a risk of burns on the pump and especially on the solenoids. Take suitable safety precautions, e.g. wear protective clothing

– There may be shifts in the characteristic depending on the operating state of the pump (operating pressure, fluid temperature).

– Tightening torques:
  - The tightening torques specified in this data sheet are maximum values and must not be exceeded (maximum values for screw thread).
    Manufacturer's instructions for the max. permissible tightening torques of the used fittings must be observed!
  - For DIN 13 fixing screws, we recommend checking the tightening torque individually according to VDI 2230 Edition 2003.

– The data and information contained herein must be adhered to.

Bosch Rexroth AG
Hydraulics
Product Unit Axial Piston Units
Elchingen Plant
Glockeraustrasse 2
89275 Elchingen, Germany
Phone +49 (0) 73 08 82-0
Facsimile +49 (0) 73 08 72 74
info.brm-ak@boschrexroth.de
www.boschrexroth.com/axial-piston-pumps

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The data specified above only serve to describe the product. No statements concerning a certain condition or suitability for a certain application can be derived from our information. The information given does not release the user from the obligation of own judgment and verification. It must be remembered that our products are subject to a natural process of wear and aging.

Subject to change.

Axial Piston Fixed Pump AA2FO (A2FO)

RA 91401/03.08 1/28
Replaces: 07.05

Technical data sheet



Series 6

Sizes	Nominal pressure/Peak pressure
5	4550/5100 psi (315/350 bar)
10 to 200	5800/6500 psi (400/450 bar)
250 to 1000	5100/5800 psi (350/400 bar)

Open circuits

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Unit Dimensions, Sizes 23, 28, 32	12
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Unit Dimensions, Sizes 56, 63	14
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Unit Dimensions, Size 250	19
Unit Dimensions, Size 355	20
Unit Dimensions, Size 500	21
Unit Dimensions, Size 710	22
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Features

- Fixed pump with axial tapered piston rotary group of bent axis design, for hydrostatic drives in open circuits
- For use in mobile and stationary applications areas
- Output flow is proportional to drive speed and displacement
- The drive shaft bearings are designed to give the service life expected in these areas of operation
- High power density
- Compact design
- High overall efficiency
- Economical conception
- One piece pistons with piston rings

Ordering Code / Standard Program (ordering code size 5 see page 10)

			O		/	6			–	V			
01	02	03	04	05		06	07	08		09	10	11	12

Hydraulic fluid

01	Mineral oil and HFD. HFD for sizes 250 to 1000 only in combination with long-life bearing “L“ (no code)		
	HFB-, HFC hydraulic fluid	Sizes 10 to 200 (no code)	
		Sizes 250 to 1000 (only in combination with long-life bearing “L“)	**E-**

Axial piston unit

			10 to 180	200	250	355 to 1000	
02	Bent axis design, fixed	Version SAE	●	–	●	–	**AA2F**
		Version ISO	–	●	–	●	**A2F**

Drive shaft bearing

		10 to 200	250 to 500	710 to 1000	
03	Standard bearing (no code)	●	●	–	
	Long-life bearing	–	●	●	**L**

Operation mode

04	Pump, open circuits	**O**

Size

05	≈ Displacement V_g (cm^3)											
	Size		**10**	**12**	**16**	**23**	**28**	**32**	**45**	**56**	**63**	**80**
	in^3/rev.		0.63	0.73	0.98	1.40	1.71	1.95	2.78	3.42	3.84	4.91
	Size	**90**	**107**	**125**	**160**	**180**	**200**	**250**	**355**	**500**	**710**	**1000**
	in^3/rev.	5.49	6.51	7.63	9.79	10.98	12.20	15.25	21.66	30.51	43.33	61.02

Series

06		**6**

Index

07		sizes 10 to 180	**1**
		size 200	**3**
		sizes 250 to 1000	**0**

Direction of rotation

08	Viewed from shaft end	clockwise	**R**
		counter-clockwise	**L**

Seals

09	FKM (flour-caoutchouc)	**V**

Ordering Code / Standard Program (ordering code size 5 see page 10)

			O		/	6			–	V			
01	02	03	04	05		06	07	08		09	10	11	12

	Shaft end		**10**	**12**	**16**	**23**	**28**	**32**	**45**	**56**	**63**	**80**	**90**	**107**	**125**	**160**	**180**	**250**	
10	SAE Version (AA2F)	SAE Splined shaft	●	●	●	●	●	●	●	●	●	–	–	●	●	●	●	●	**S**
			–	–	–	–	–	–	–	●	●	–	–	–	–	–	–	–	**T**
			–	–	–	–	–	–	–	–	–	●	●	●	●	–	–	–	**U**
			–	–	–	–	–	–	–	–	–	●	●	–	–	–	–	–	**Q**
		Parallel keyed shaft DIN 6885	●	●	●	●	●	●	–	●	●	–	–	●	●	●	●	–	**B**
			–	–	–	–	–	–	●	–	–	–	–	–	–	–	–	–	**P**
		SAE parallel keyed shaft	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	●	**K**
									200		**355**		**500**		**710**		**1000**		
	ISO Version (A2F)	Splined shaft DIN 5480							●		–		–		–		–		**A**
									–		●		●		●		●		**Z**
		Parallel keyed shaft DIN 6885							●		–		–		–		–		**B**
									–		●		●		●		●		**P**

	Mounting flange		**10**	**12**	**16**	**23**	**28**	**32**	**45**	**56**	**63**	**80**	**90**	**107**	**125**	**160**	**180**	**250**	
11	SAE Version (AA2F)	2-hole – SAE	●	●	●	–	–	–	–	–	–	–	–	–	–	–	–	–	**C**
		4-hole – SAE	–	–	–	●	●	●	●	●	●	–	–	●	●	●	●	●	**D**
			–	–	–	–	–	–	–	–	–	●	●	–	–	–	–	–	**DN**
									200		**355**		**500**		**710**		**1000**		
	ISO Version (A2F)	4-hole – ISO							●		–		–		–		–		**B**
		8-hole – ISO							–		●		●		●		●		**H**

Service line ports

	AA2F [1]	**10**	**12**	**16**	**23**	**28**	**32**	**45**	**56**	**63**	**80**	**90**	**107**	**125**	**160**	**180**	**250**	
12	SAE flange ports A and B, at side and SAE flange port S, rear	–	–	–	●	●	●	●	●	●	●	●	●	●	●	●	●	**55**
	Threaded ports A and B, at side and SAE flange port S, rear	●	●	●	–	–	–	–	–	–	–	–	–	–	–	–	–	**56**
	A2F [2]							**200**		**355**		**500**		**710**		**1000**		
	SAE flange ports A and B, at side and SAE flange port S, rear							●		–		–		–		–		**05**
	SAE flange ports A and B, rear and SAE flange port S, rear							–		●		●		●		●		**11**

[1]) Fastening threads resp. threaded ports are SAE (UN/UNF)

[2]) Fastening threads are metric

● = available – = not available

Technical Data

Hydraulic fluid

Before starting project planning, please refer to our data sheets RE 90220 (mineral oil), RE 90221 (environmentally acceptable hydraulic fluids) and RE 90223 (HF hydraulic fluids) for detailed information regarding the choice of hydraulic fluid and application conditions.

The fixed pump AA2FO is unsuitable for operation with HFA. If HFB, HFC and HFD or environmentally acceptable hydraulic fluids are being used, the limitations regarding technical data and seals mentioned in RE 90221 and RE 90223 must be observed.

When ordering, please indicate the used hydraulic fluid.

Operating viscosity range

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

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

depending on the tank temperature (closed circuit) and tank temperature (open circuit).

Limits of viscosity range

The limiting values for viscosity are as follows:

Sizes 5 to 200:

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

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

Sizes 250 to 1000:

ν_{min} = 60 SUS (10 mm²/s),
short-term (t < 3 min)
at max. perm. temperature of
t_{max} = +195°F (+90°C)

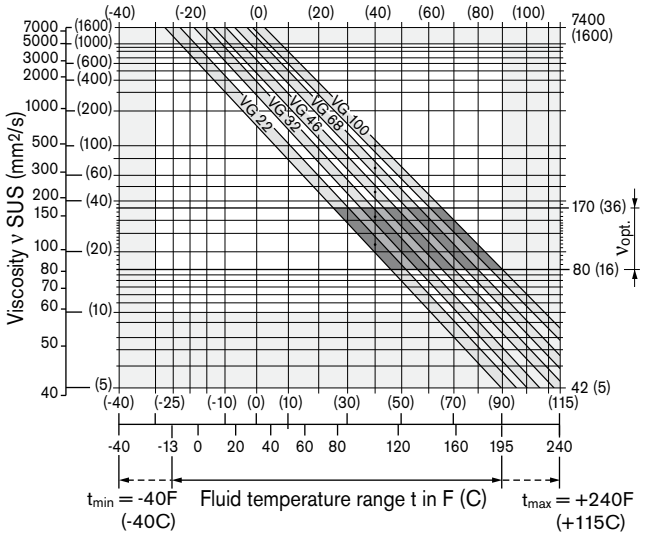
ν_{max} = 4600 SUS (1000 mm²/s),
short-term (t < 3 min)
at cold start (p ≤ 435 psi / 30 bar, n ≤ 1000 rpm,
t_{min} = -13°F / -25°C).
Only for starting up without load. Optimum operating viscosity must be reached within approx. 15 minutes.

Note that the maximum hydraulic fluid temperature of 240°F (115°C) (195°F (90°C) at size 250 to 1000) must not be exceeded locally either (e.g. in the bearing area). The temperature in the bearing area is - depending on pressure and speed - up to 22 °F (12 K) higher than the average case drain temperature.

Special measures are necessary in the temperature range from -40°F and -13°F (-40°C and -25°C) (cold start phase), please contact us.

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

Selection diagram



Details regarding the choice of hydraulic fluid

The correct choice of hydraulic fluid requires knowledge of the operating temperature in relation to the ambient temperature: in an open circuit the tank temperature.

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

Example: At an ambient temperature of X°F (X°C) an operating temperature of 140°F (60°C) is set. In the optimum operating viscosity range (ν_{opt}; shaded area) this corresponds to the viscosity classes VG 46 or VG 68; to be selected: VG 68.

Please note:
The case drain temperature, which is affected by pressure and speed, is always higher than the tank temperature. At no point in the system may the temperature be higher than 240°C (115°C) for sizes 5 to 200 or 195°F (90°C) for sizes 250 to 1000.

If the above conditions cannot be maintained due to extreme operating parameters, we recommend flushing the case at port U (size 250 to 1000).

Filtration

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

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

20/18/15 according to ISO 4406.

At very high hydraulic fluid temperatures (195°F (90°C) to max. 240°F (115°C), not permitted for sizes 250 to 1000) at least cleanliness level

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

If the above classes cannot be observed, please contact us.

Technical Data

Operational pressure range

Inlet

Pressure at port S

The minimum inlet pressure depends on speed. The following limits must not be exceeded.

$p_{abs\ min}$ 12 psi (0.8 bar)

$p_{abs\ max}$ 435 psi (30 bar)

Outlet

Maximum pressure on port A or B (pressure data according to DIN 24312)

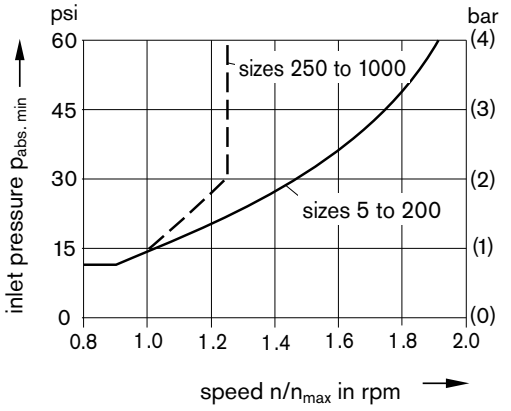
AA2F Sizes		10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	250	Nominal pressure	Peak pressure
Shaft end:	S	●	●	●	●	●	●	●					●	●	●	●		5800 psi (400 bar)	6500 psi (450 bar)
	S								●	●							●	5100 psi (350 bar)	5800 psi (400 bar)
	Q										●							4350 psi (300 bar)	5100 psi (350 bar)
	Q											●						4000 psi (280 bar)	4550 psi (315 bar)
	T								●	●								5800 psi (400 bar)	6500 psi (450 bar)
	U										●	●	●	●				5800 psi (400 bar)	6500 psi (450 bar)
	B	●	●	●	●	●	●		●	●			●	●	●	●		5100 psi (350 bar)	5800 psi (400 bar)
	P							●										5100 psi (350 bar)	5800 psi (400 bar)
	K																●	5100 psi (350 bar)	5800 psi (400 bar)

A2F Sizes		5		200	355	500	710	1000	Nominal pressure	Peak pressure
Shaft end:	Z				●	●	●	●	5100 psi (350 bar)	5800 psi (400 bar)
	A			●					5800 psi (400 bar)	6500 psi (450 bar)
	P				●	●	●	●	5100 psi (350 bar)	5800 psi (400 bar)
	B			●					5100 psi (350 bar)	5800 psi (400 bar)
	B	●							3050 psi (210 bar)	3600 psi (250 bar)
	C	●							4550 psi (315 bar)	5100 psi (350 bar)

With pulsating loads over $p_N = 4550$ psi / 315 bar ($p_{max} = 5100$ psi / 350 bar);
we recommend the use of a splined shaft (AA2FO 10 to 250: S, T or U / A2FO 200: A / A2FO 355 to 1000: Z)
Attention: sizes 10 to 200: shaft end with drives of radial force loads at the drive shaft (pinion, V-belt drives) necessitate reduction of the nominal pressure to $p_N = 4550$ psi (315 bar)! Sizes 250 to 1000 please contact us.

Minimum inlet pressure at suction port S with increased speed

In order to avoid damage of the pump a minimum inlet pressure at the suction port must be assured. The minimum inlet pressure is related to the rotational speed of the fixed pump.



Note:

- max. permissible speed $n_{max\ limit}$ (speed limit)
- min. permissible pressure at port S
- admissible values for the drive shaft seal (see next page).

Technical Data

Direction of flow

Direction of rotation, viewed on shaft end	
clockwise	counter-clockwise
S to **B**	**S** to **A**

Long-life bearing (sizes 250 to 1000)

For long service life and use with HF hydraulic fluids. Same external dimensions as pump with standard bearing. A long-life bearing can be specified. Flushing of bearing and case via port U recommended.

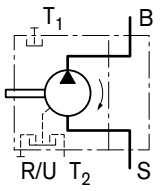
Flushing volumes (recommended)

Size		**250**	**355**	**500**	**710**	**1000**
$q_{v\ flush}$	gpm	2.6	4.2	4.2	4.2	4.2
	L/min	10	16	16	16	16

Symbol

Connections

A, B	Service line port
S	Suction port
T_1, T_2	Drain ports
R/U	Port for bearing flushing



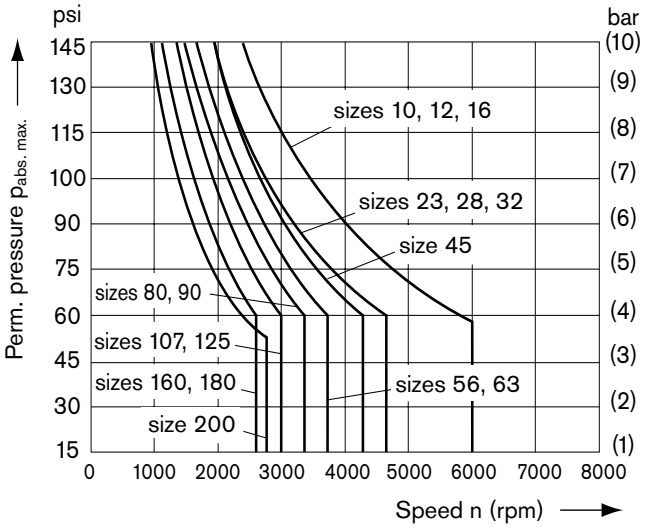
Shaft seal ring

Permissible pressure loading

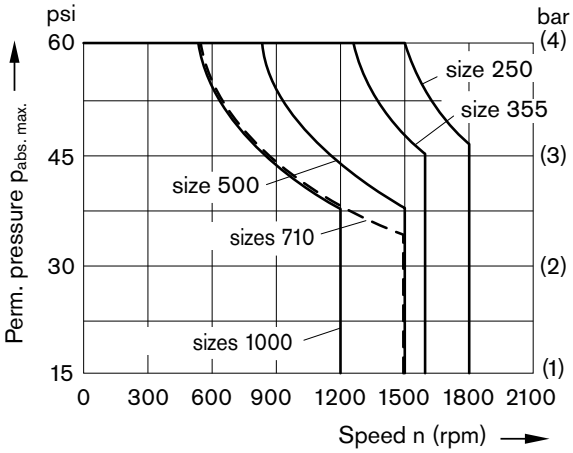
The service life of the shaft seal ring is affected by the speed of the pump and the case drain pressure. It is recommended that the average, continuous case drain pressure at operating temperature 45 psi (3 bar) absolute not be exceeded (max. permissible case drain pressure to 90 psi (6 bar) absolute 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.

Sizes 10 to 200



Sizes 250 to 1000



Temperature range

The FKM shaft seal ring is permissible for a case temperatures of

-13°F to +240°F (-25°C to +115°C) at sizes 5 to 200 and
-13°F to +195°F (-25°C to +90°C) at sizes 250 to 1000

Note:
For application cases below -13°F (-25 °C) a Buna-N (NBR) shaft seal ring is necessary (permissible temperature range -40 °F to +195 °F / -40 °C to +90 °C). Please contact us.

Technical Data

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

Size				5	10	12	16	23	28	32	45	56	63	80
Displacement		V_g	in^3	0.30	0.63	0.73	0.98	1.40	1.71	1.95	2.78	3.42	3.84	4.91
			cm^3	4.93	10.3	12	16	22.9	28.1	32	45.6	56.1	63	80.4
Max. speed		n_{max} [1]	rpm	5600	3150	3150	3150	2500	2500	2500	2240	2000	2000	1800
		$n_{max\ limit}$ [2]	rpm	8000	6000	6000	6000	4750	4750	4750	4250	3750	3750	3350
Max. flow at n_{max}		$q_{V\ max}$	gpm	7.3	8.6	10.0	13.2	15.1	18.5	21.1	27.0	29.6	33.3	38.0
			L/min	27.6	32.4	37.8	50	57	70	80	102	112	126	144
Power at	Δp = 5100 psi	P_{max}	HP	19.5[3]	25	30	39	44	55	63	80	88	99	113
	Δp = 350 bar	P_{max}	kW	14.5[3]	18.9	22	29.2		41	47	59.5	65	73.5	84
	Δp = 5800 psi	P_{max}	HP	–	30	34	45	51	63	71	91	100	113	129
	Δp = 400 bar	P_{max}	kW	–	22	25	34	38	47	53	68	75	84	96
Torque at	Δp = 5100 psi	T	lb-ft	18[3]	42	50	65	94	116	132	189	232	260	331
	Δp = 350 bar	T	Nm	24.7[3]	57	67	88	126	156	178	254	312	350	445
	Δp = 5800 psi	T	lb-ft	–	48	56	75	107	131	150	214	263	295	377
	Δp = 400 bar	T	Nm	–	65	76	101	145	178	203	290	356	400	511
Rotary stiffness		c	Nm/rad	625	922	1250	1590	2560	2930	3120	4180	5940	6250	8730
Moment of inertia for rotary group		J_{TW}	$lbs\text{-}ft^2$	0.0014	0.0095	0.0095	0.0095	0.0285	0.0285	0.0285	0.0569	0.0997	0.0997	0.1708
			kgm^2	0.00006	0.0004	0.0004	0.0004	0.0012	0.0012	0.0012	0.0024	0.0042	0.0042	0.0072
Angular acceleration max.		α	rad/s^2	5000	5000	5000	5000	6500	6500	6500	14600	7500	7500	6000
Filling capacity		V	gal		0.045	0.045	0.045	0.053	0.053	0.053	0.087	0.119	0.119	0.145
			L		0.17	0.17	0.17	0.20	0.20	0.20	0.33	0.45	0.45	0.55
Mass (approx.)		m	lbs	5.5	12	12	12	21	21	21	30	40	40	51
			kg	2.5	5.4	5.4	5.4	9.5	9.5	9.5	13.5	18	18	23

Size				90	107	125	160	180	200	250	355	500	710	1000
Displacement		V_g	in^3	5.49	6.51	7.63	9.79	10.98	12.20	15.25	21.66	30.51	43.33	61.02
			cm^3	90	106.7	125	160.4	180	200	250	355	500	710	1000
Max. speed		n_{max} [1]	rpm	1800	1600	1600	1450	1450	1550	1500	1320	1200	1200	950
		$n_{max\ limit}$ [2]	rpm	3350	3000	3000	2650	2650	2750	1800	1600	1500	1500	1200
Max. flow		$q_{V\ max}$	gpm	42.8	44.9	52.8	61.2	69.0	81.9	99.1	123.9	158.5	218.2	251.0
			L/min	162	170	200	232	261	310	375	469	600	826	950
Power at	Δp = 5100 psi	P_{max}	HP	127	134	157	183	205	244	295	368	472	670	747
	Δp = 350 bar	P_{max}	kW	95	100	117	135	152	181	219	273	350	497	554
	Δp = 5800 psi	P_{max}	HP	145	153	179	208	233	277	–	–	–	–	–
	Δp = 400 bar	P_{max}	kW	108	114	133	155	174	207	–	–	–	–	–
Torque at	Δp = 5100 psi	T	lb-ft	372	442	517	664	746	828	1036	1470	2070	2940	4141
	Δp = 350 bar	T	Nm	501	594	696	893	1003	1114	1393	1978	2785	3955	5570
	Δp = 5800 psi	T	lb-ft	422	500	586	752	845	938	–	–	–	–	–
	Δp = 400 bar	T	Nm	572	678	795	1020	1145	1272	–	–	–	–	–
Rotary stiffness		c	Nm/rad	9140	11200	11900	17400	18200	57300	73100	96100	144000	270000	324000
Moment of inertia for rotary group		J_{TW}	$lbs\text{-}ft^2$	0.1708	0.2753	0.2753	0.5221	0.5221	0.8377	1.4475	2.4205	4.2240	13.052	13.052
			kgm^2	0.0072	0.0116	0.0116	0.0220	0.0220	0.0353	0.061	0.102	0.178	0.55	0.55
Angular acceleration max.		α	rad/s^2	6000	4500	4500	3500	3500	11000	10000	8300	5500	4300	4000
Filling capacity		V	gal	0.145	0.211	0.211	0.291	0.291	0.713	0.660	0.925	1.110	2.113	2.113
			L	0.55	0.8	0.8	1.1	1.1	2.7	2.5	3.5	4.2	8	8
Mass (approx.)		m	lbs	51	71	71	99	99	145	161	242	342	715	741
			kg	23	32	32	45	45	66	73	110	155	325	336

[1] The values shown are valid for an absolute pressure (p_{abs}) of 15 psi (1 bar) at the suction inlet S and when operated on mineral oil (with a specific mass of 7.36 lbs/gal (0.88 kg/L)).

[2] By increase of the input pressure ($p_{abs} > 14.5$ psi / 1 bar) the rotational speeds can be increased to the max. admissible speeds $n_{max\ limit}$ (speed limits) (see diagram page 8).

[3] Torque at Δp = 4550 psi (315 bar)

Technical Data

Caution: Exceeding the permissible limit values may result in a loss of function, a reduction in service life or in the destruction of the axial piston unit.
Other permissible limit values with respect to speed variation, reduced angular accelaration as a function of the frequency and the permissible startup angular acceleration (lower than the maximum angular acceleration) can be found in data sheet RE 90261.

Determining the size

Flow $q_v = \frac{V_g \cdot n \cdot \eta_v}{231}$ gpm $\left(q_v = \frac{V_g \cdot n \cdot \eta_v}{1000} \text{ L/min} \right)$

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

Input power $P = \frac{2 \pi \cdot T \cdot n}{33\,000} = \frac{q_v \cdot \Delta p}{1714 \cdot \eta_t}$ HP $\left(P = \frac{2 \pi \cdot T \cdot n}{60\,000} = \frac{q_v \cdot \Delta p}{600 \cdot \eta_t} \text{ kW} \right)$

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 = Overall efficiency

Technical Data

Permissible radial and axial loading on the drive shaft

The specified values given are maximum values and do not apply to continous operation.

Size				5	10	12	16	23	28	32	45	56	63	80
Radial force, max. [1] at distance a (from shaft collar)		$F_{q\,max}$	lbf	160	472	562	730	865	1079	1214	1630	1832	2057	2304[2]
			N	710	2100	2500	3250	3850	4800	5400	7250	8150	9150	10250
		a	in	0.47	0.63	0.63	0.63	0.63	0.63	0.63	0.71	0.71	0.71	0.79
			mm	12	16	16	16	16	16	16	18	18	18	20
Axial force, max. [3]		$+F_{ax\,max}$	lbf	40	72	72	72	112	112	112	142	180	180	225
			N	180	320	320	320	500	500	500	630	800	800	1000
		$-F_{ax\,max}$	lbf	40	72	72	72	112	112	112	142	180	180	225
			N	180	320	320	320	500	500	500	630	800	800	1000
Permissible axial force/psi (bar) operating pressure		$\pm F_{ax\,per.}$/psi (bar)	lbf/psi	0.023	0.05	0.05	0.05	0.08	0.08	0.08	0.11	0.13	0.13	0.16
			N/bar	1.5	3.0	3.0	3.0	5.2	5.2	5.2	7.0	8.7	8.7	10.6

Size				90	107	125	160	180	200	250	355	500	710	1000
Radial force, max. [1] at distance a (from shaft collar)		$F_{q\,max}$	lbf	2574[2]	2720	3170	3664	4114	5148	270	337	427	674	584
			N	11450	12100	14100	16300	18300	22900	1200[4]	1500[4]	1900[4]	3000[4]	2600[4]
		a	in	0.79	0.79	0.79	0.98	0.98	0.98	1.61	2.07	2.07	2.66	2.66
			mm	20	20	20	25	25	25	41	52.5	52.5	67.5	67.5
Axial force, max. [3]		$+F_{ax\,max}$	lbf	225	281	281	360	360	360	450	562	674	989	989
			N	1000	1250	1250	1600	1600	1600	2000	2500	3000	4400	4400
		$-F_{ax\,max}$	lbf	225	281	281	360	360	360	450	562	674	989	989
			N	1000	1250	1250	1600	1600	1600	2000	2500	3000	4400	4400
Permissible axial force/psi (bar) operating pressure		$\pm F_{ax\,per.}$/psi (bar)	lbf/psi	0.16	0.20	0.20	0.26	0.26	0.26	[5]	[5]	[5]	[5]	[5]
			N/bar	10.6	12.9	12.9	16.7	16.7	16.7					

[1] During intermittent operation (sizes 5 to 200)
[2] Value for Q-shaft: $F_{q\,max}$ = 2023 lbf (9000 N)
[3] Max. permissible axial force when at standstill or when axial piston unit working in pressureless conditions.
[4] When at standstill or when axial piston unit operating in depressurized condition. Higher forces are permissible when under pressure. Please contact us.
[5] Please contact us

When considering the permissible axial force, the force-transfer direction must be taken into account:

– $F_{ax\,max}$ = increase in service life of bearings

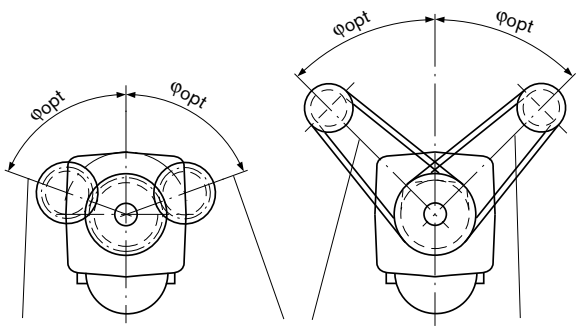
+ $F_{ax\,max}$ = reduction in service life of bearings (avoid)

Effect of radial force F_q on the service life of the bearings

By selecting a suitable force-transfer direction of F_q, the stress on the bearing caused by the internal transmission forces can be reduced, thus achieving the optimum service life for the bearings. Recommended position of mating gear is dependent on direction of rotation. Examples:

	Toothed gear drive	V-belt drive
Size	$\varphi_{opt.}$	$\varphi_{opt.}$
10 to 180	± 70°	± 45°
200 to 1000	± 45°	± 70°

Toothed gear drive **V-belt drive**



Clockwise direction of rotation
Pressure on port **B**

Counter-clockwise direction of rotation
Pressure on port **A**

Clockwise direction of rotation
Pressure on port **B**

Ordering Code / Standard Program – Size 5

A2F	5	/	60		–		7
01	02		03	04		05	06

Axial piston unit

01	Bent axis design, fixed	**A2F**

Size

02	Size		**5**
	≈ Displacement $V_{g\ max}$	in^3/rev.	0.30
		cm^3/rev.	4.93

Series

03		**60**

Direction of rotation

04	Viewed from shaft end	clockwise	**R**
		counter-clockwise	**L**

Shaft end

05	Parallel keyed shaft DIN 6885	**B**
	Tapered shaft with spigot and spring washer DIN 6888	**C**

Service line ports

06	Threads A and B at side, metric	**7**

Additional instructions in text form

Seals

The fixed pump A2F5 is equipped with Buna-N (NBR) seals in standard design.

In case of need FKM- (fluor-caoutchouc) seals please indicate when ordering in plain text:

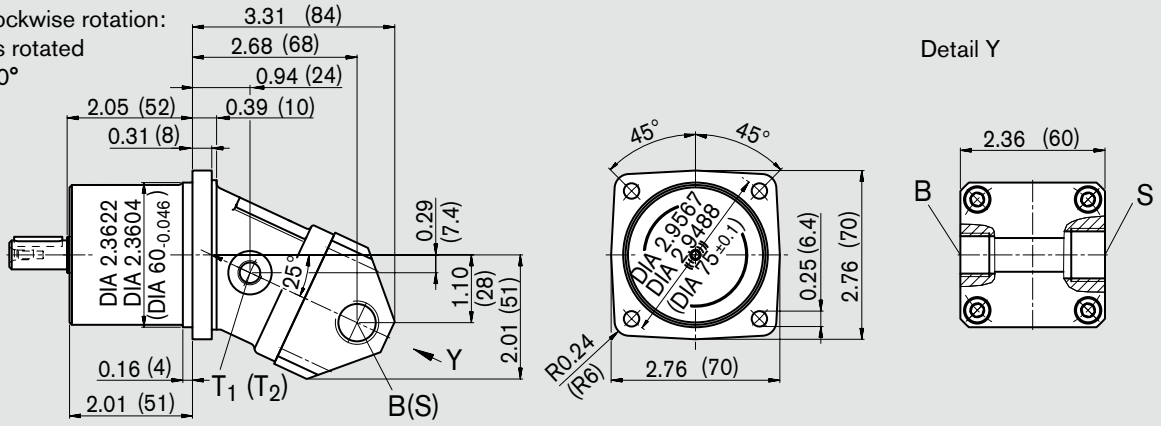
"*with FKM-seals*"

Unit Dimensions, Size 5 – ISO Design

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

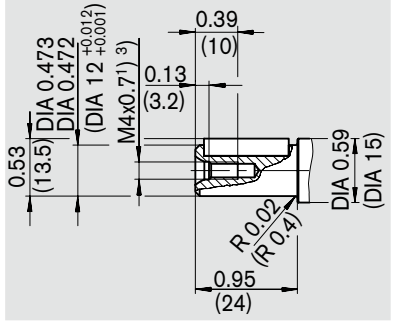
Clockwise rotation

Counter-clockwise rotation: port plate is rotated through 180°

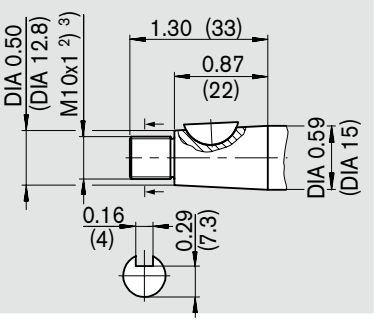


Shaft ends

B Parallel keyed shaft
DIN 6885 – A4x4x20 (mm)
p_N = 3050 psi (210 bar)



C Tapered shaft with spigot and spring washer (3x5 mm) DIN 6888 (taper 1:10) p_N = 4550 psi (315 bar)



Ports

B (A)	Service line port DIN 3852	M18x1.5; 0.47 (12) deep	100 lb-ft 3) (140 Nm)
S	Suction port DIN 3852	M22x1.5; 0.55 (14) deep	155 lb-ft 3) (210 Nm)
T_1, T_2	Case drain ports DIN 3852	M10x1; 0.31 (8) deep	20 lb-ft 3) (30 Nm)

1) Centering bore according to DIN 332 (thread according to DIN 13)

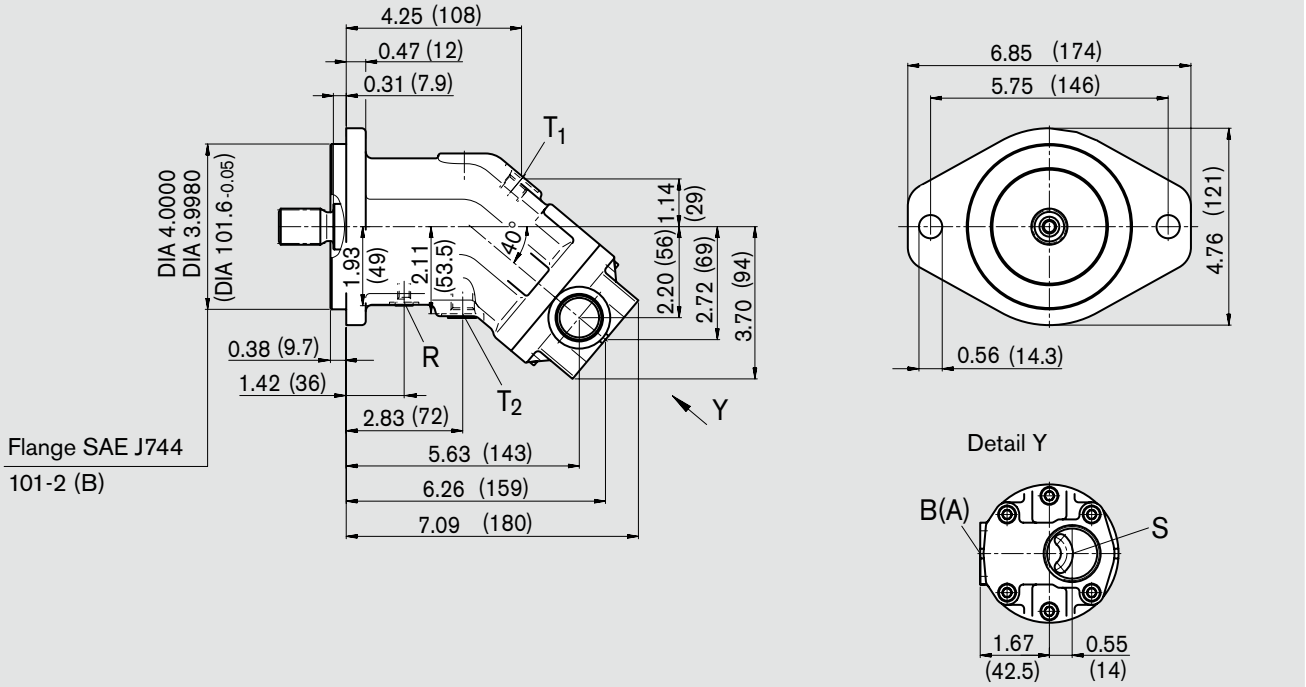
2) Thread according to DIN 3852, max. tightening torque: 20 lb-ft (30 Nm)

3) Please observe the general notes for the max. tightening torques on page 28

Unit Dimensions, Sizes 10, 12, 16 – SAE Design

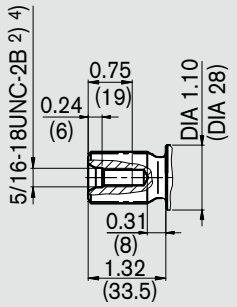
Before finalizing your design, please request a binding installation drawing.
Dimensions in inches and (millimeters)

Clockwise rotation Counter-clockwise rotation: port plate is rotated through 180°

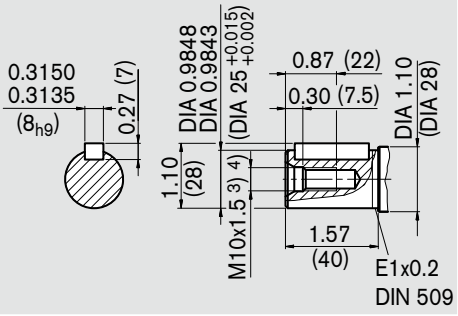


Shaft ends

S Splined shaft 7/8 in 13T 16/32 DP [1]
(SAE J744 – 22-4 (B))
p_N = 5800 psi (400 bar)



B Parallel keyed shaft
DIN 6885 – AS8x7x32 (mm)
p_N = 5100 psi (350 bar)



Ports

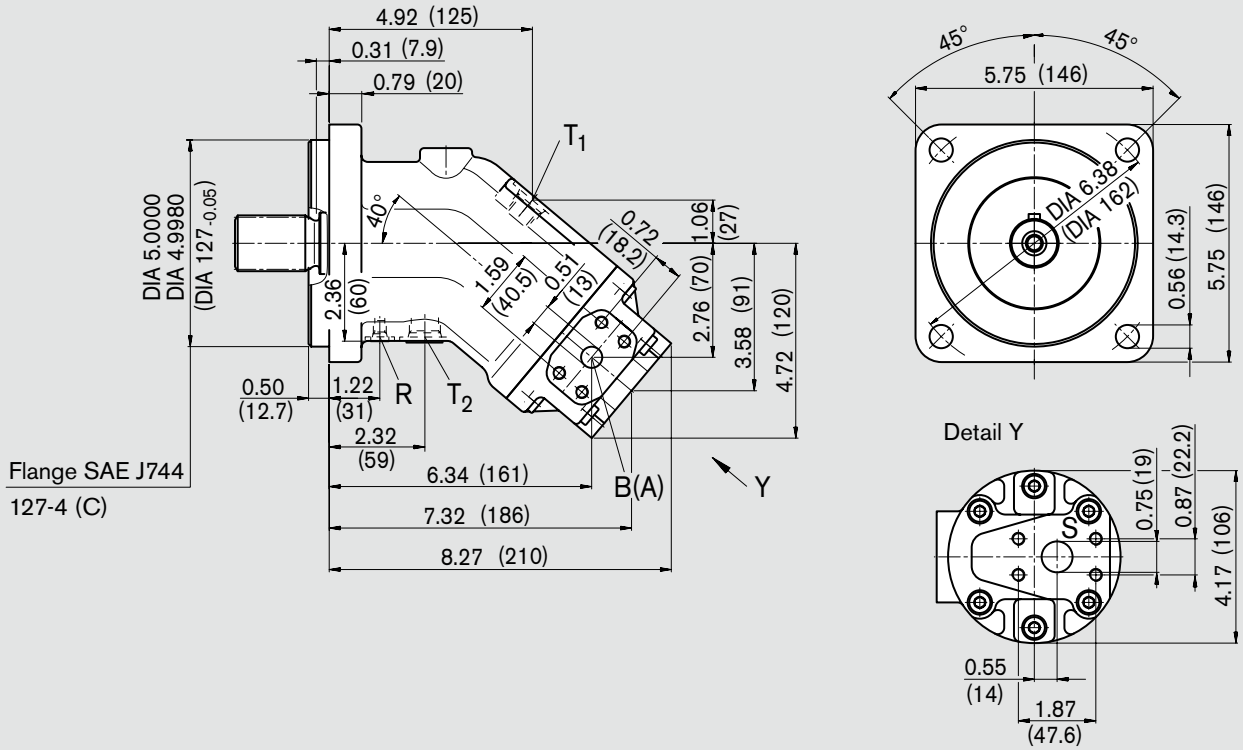
B (A)	Service line port	ISO 11926	1 1/16 in -12 UN-2B; 0.79 (20) deep	265 lb-ft (360 Nm) [4]
S	Suction port	ISO 11926	1 5/16 in -12 UN-2B; 0.79 (20) deep	400 lb-ft (540 Nm) [4]
T_1, T_2	Case drain ports (T_2 plugged)	ISO 11926	9/16 in -18 UNF-2B; 0.51 (13) deep	60 lb-ft (80 Nm) [4]
R	Air bleed (plugged)	ISO 11926	5/16 in -24 UNF-2B; 0.93 (10) deep	7 lb-ft (10 Nm) [4]

[1] ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
[2] Thread according to ISO 68
[3] Center bore according to DIN 332 (thread according to DIN 13)
[4] Please observe the general notes for the max. tightening torques on page 28

Unit Dimensions, Sizes 23, 28, 32 – SAE Design

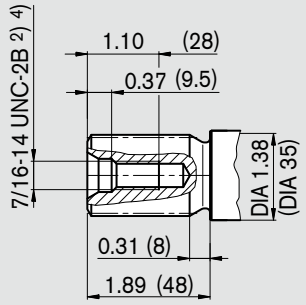
Before finalizing your design, please request a binding installation drawing.
Dimensions in inches and (millimeters)

Clockwise rotation Counter-clockwise rotation: port plate is rotated through 180°

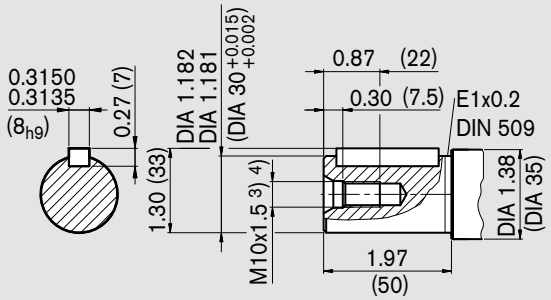


Shaft ends

S Splined shaft 1 1/4 in 14T 12/24 DP [1]
(SAE J744 – 32-4 (C))
p_N = 5800 psi (400 bar)



B Parallel keyed shaft
DIN 6885 – AS8x7x40 (mm)
p_N = 5100 psi (350 bar)



Ports

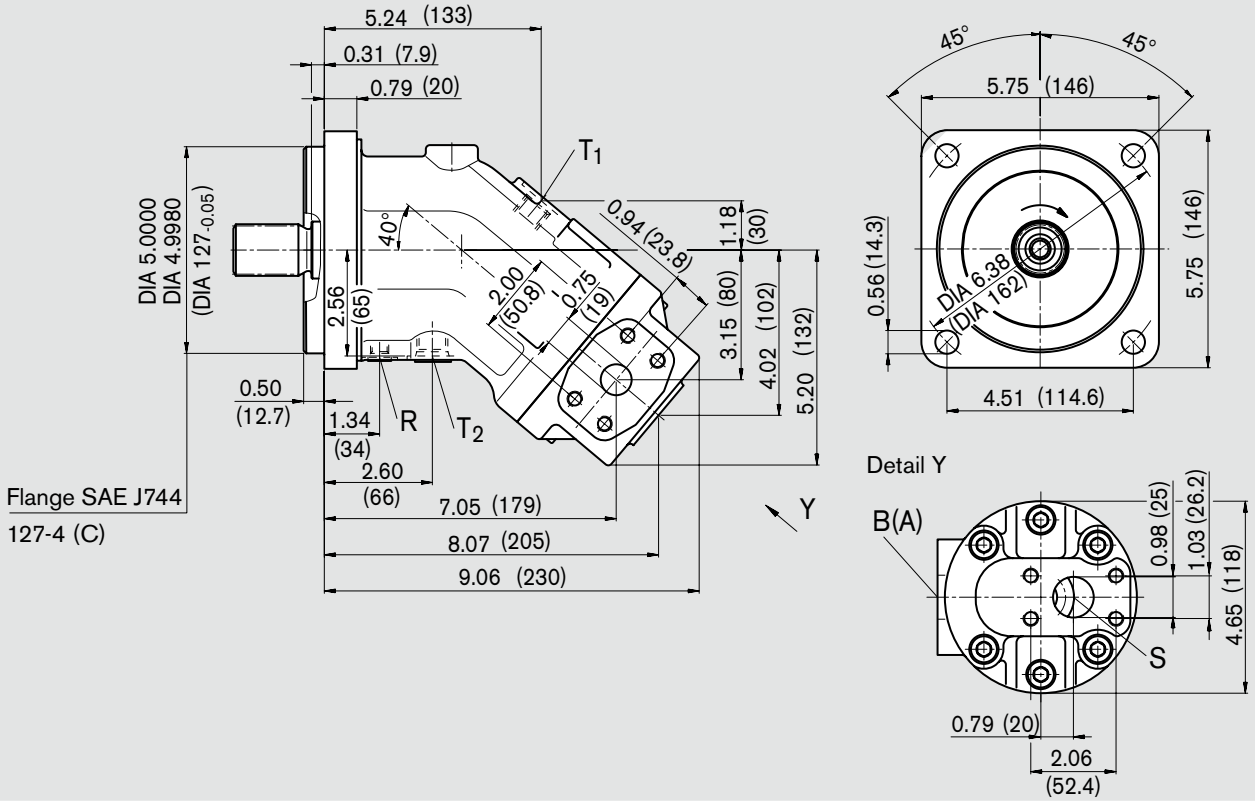
B (A)	Service line port (high pressure series) Fastening threads B/A	SAE J518 ISO 68	1/2 in 5/16 in-18 UNC-2B;	0.71 (18) deep [4]	
S	Suction port (standard pressure series) Fastening threads S	SAE J518 ISO 68	3/4 in 3/8 in-16 UNC-2B;	0.79 (20) deep [4]	
T_1, T_2	Case drain ports (T_2 plugged)	ISO 11926	3/4 in-16 UNF-2B;	0.59 (15) deep	120 lb-ft (160 Nm) [4]
R	Air bleed (plugged)	ISO 11926	5/16 in-24 UNF-2B;	0.39 (10) deep	7 lb-ft (10 Nm) [4]

[1]) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
[2]) Thread according to ISO 68
[3]) Center bore according to DIN 332 (thread according to DIN 13)
[4]) Please observe the general notes for the max. tightening torques on page 28

Unit Dimensions, Size 45 – SAE Design

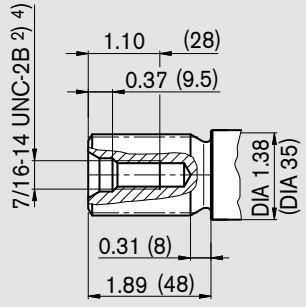
Before finalizing your design, please request a binding installation drawing.
Dimensions in inches and (millimeters)

Clockwise rotation Counter-clockwise rotation: port plate is rotated through 180°

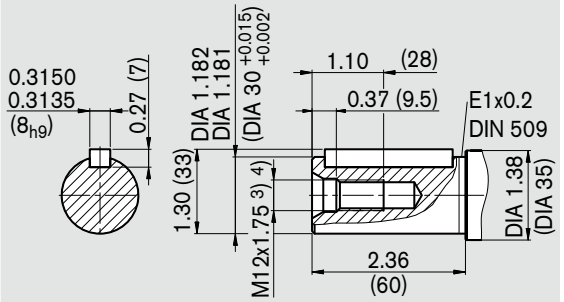


Shaft ends

S Splined shaft 1 1/4 in 14T 12/24 DP [1]
(SAE J744 – 32-4 (C))
p_N = 5800 psi (400 bar)



P Parallel keyed shaft
DIN 6885 – AS8x7x50 (mm)
p_N = 5100 psi (350 bar)



Ports

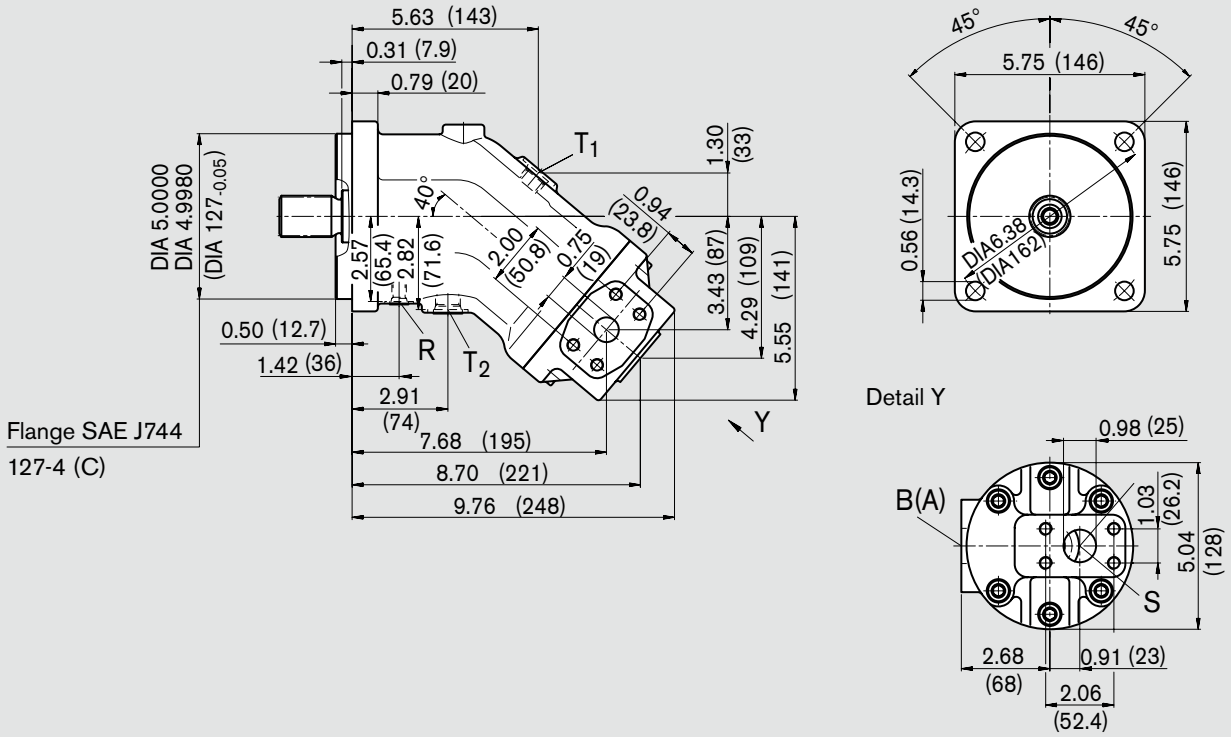
B (A)	Service line port (high pressure series) Fastening threads B/A	SAE J518 ISO 68	3/4 in 3/8 in-16 UNC-2B; 0.82 (21) deep [4]	
S	Suction port (standard pressure series) Fastening threads S	SAE J518 ISO 68	1 in 3/8 in-16 UNC-2B; 0.79 (20) deep [4]	
T_1, T_2	Case drain ports (T_2 plugged)	ISO 11926	3/4 in-16 UNF-2B; 0.59 (15) deep	120 lb-ft (160 Nm) [4]
R	Air bleed (plugged)	ISO 11926	7/16 in-20 UNF-2B; 0.47 (12) deep	30 lb-ft (40 Nm) [4]

[1] ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
[2] Thread according to ISO 68
[3] Center bore according to DIN 332 (thread according to DIN 13)
[4] Please observe the general notes for the max. tightening torques on page 28

Unit Dimensions, Sizes 56, 63 – SAE Design

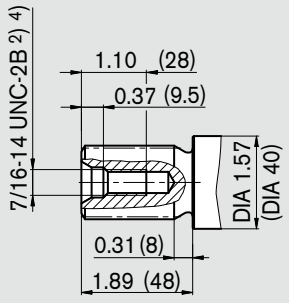
Before finalizing your design, please request a binding installation drawing.
Dimensions in inches and (millimeters)

Clockwise rotation Counter-clockwise rotation: port plate is rotated through 180°

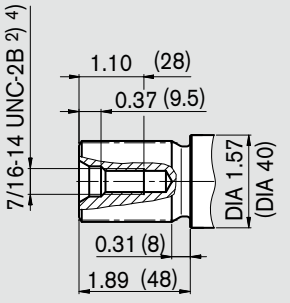


Shaft ends

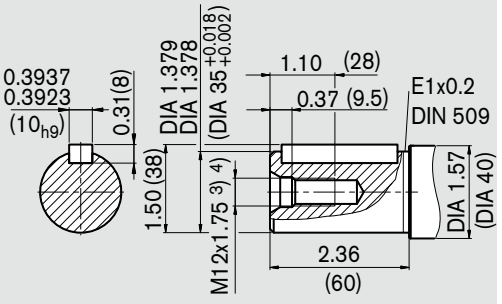
S Splined shaft 1 1/4 in 14T 12/24 DP [1]
(SAE J744 – 32-4 (C))
p_N = 5100 psi (350 bar)



T Splined shaft 1 3/8 in 21T 16/32 DP [1]
p_N = 5800 psi (400 bar)



B Parallel keyed shaft
DIN 6885 – AS10x8x50 (mm)
p_N = 5100 psi (350 bar)



Ports

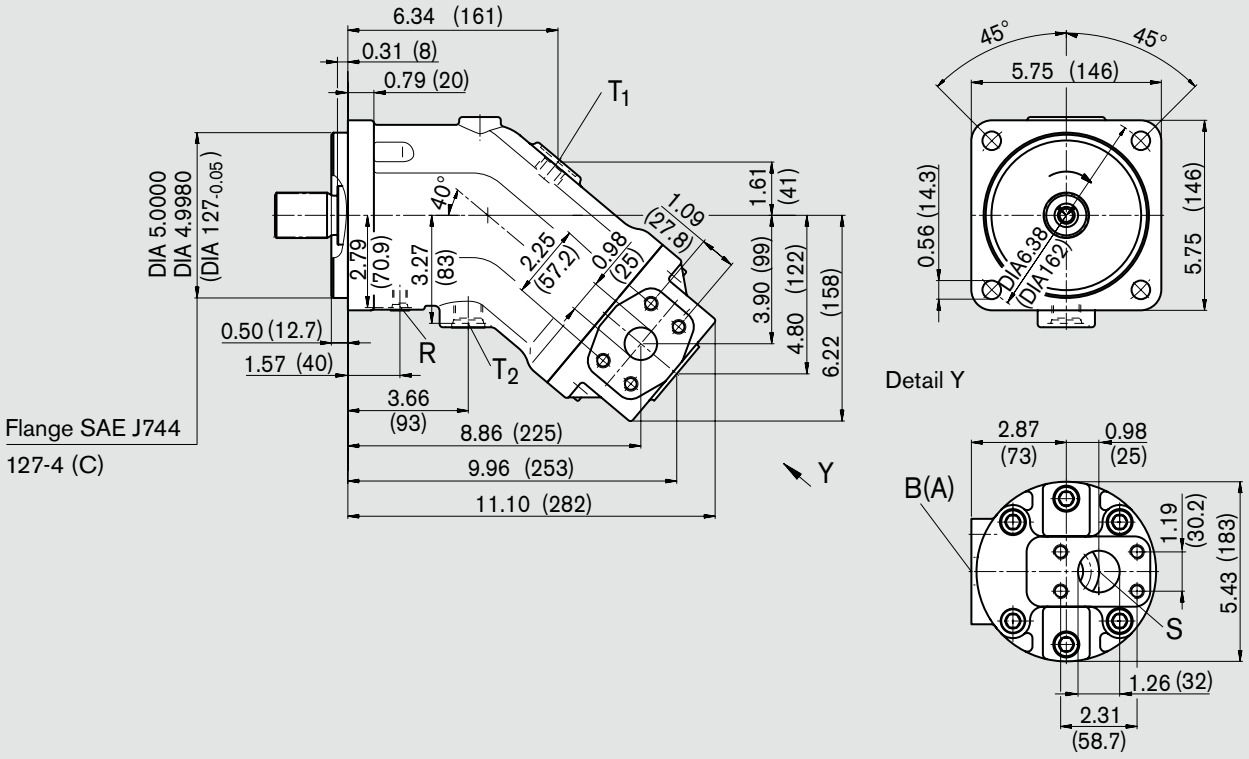
B (A)	Service line port (high pressure series)	SAE J518	3/4 in		
	Fastening threads B/A	ISO 68	3/8 in-16 UNC-2B;	0.82 (21) deep [4]	
S	Suction port (standard pressure series)	SAE J518	1 in		
	Fastening threads S	ISO 68	3/8 in-16 UNC-2B;	0.79 (20) deep [4]	
T_1, T_2	Case drain ports (T_2 plugged)	ISO 11926	3/4 in-16 UNF-2B;	0.59 (15) deep	120 lb-ft (160 Nm) [4]
R	Air bleed (plugged)	ISO 11926	7/16 in-20 UNF-2B;	0.47 (12) deep	30 lb-ft (40 Nm) [4]

[1]) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
[2]) Thread according to ISO 68
[3]) Center bore according to DIN 332 (thread according to DIN 13)
[4]) Please observe the general notes for the max. tightening torques on page 28

Unit Dimensions, Sizes 80, 90 – SAE Design

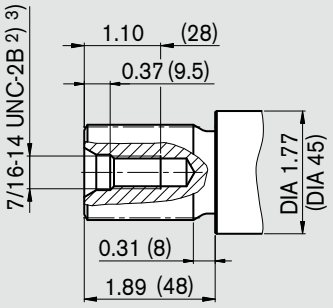
Before finalizing your design, please request a binding installation drawing.
Dimensions in inches and (millimeters)

Clockwise rotation Counter-clockwise rotation: port plate is rotated through 180°

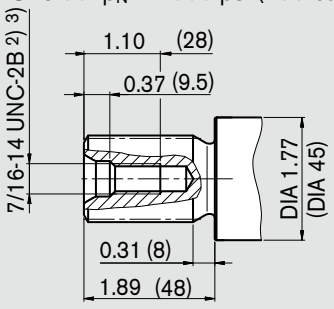


Shaft ends

U Splined shaft 1 3/8 in 21T 16/32 DP [1]
p_N = 5800 psi (400 bar)



Q Splined shaft 1 1/4 in 14T 12/24 DP [1]
(SAE J744 – 32-4 (C))
Size 80: p_N = 4350 psi (300 bar)
Size 90: p_N = 4000 psi (280 bar)



Ports

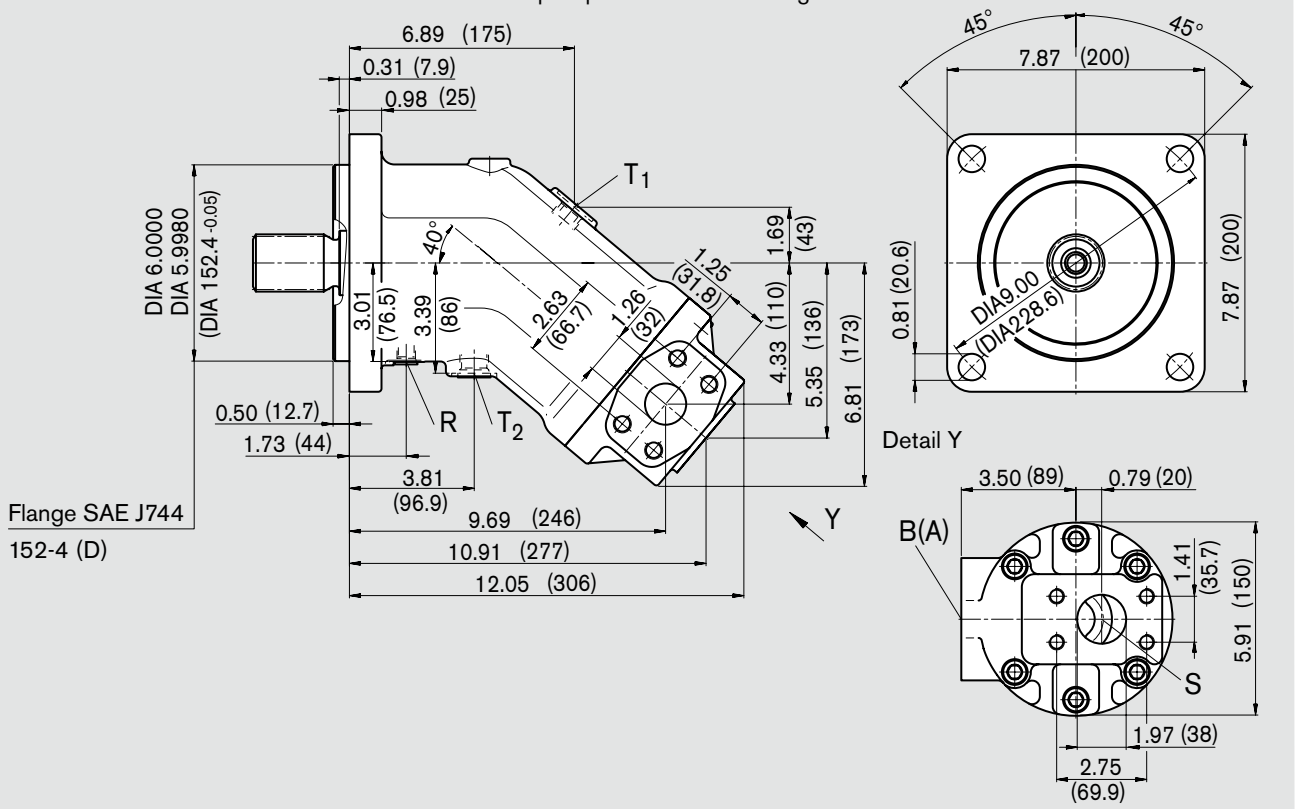
B (A)	Service line port (high pressure series) Fastening threads B/A	SAE J518 ISO 68	1 in 7/16 in-14 UNC-2B; 0.87 (22) deep [3]	
S	Suction port (standard pressure series) Fastening threads S	SAE J518 ISO 68	1 1/4 in 7/16 in-14 UNC-2B; 1.02 (26) deep [3]	
T_1, T_2	Case drain ports (T_2 plugged)	ISO 11926	7/8 in-14 UNF-2B; 0.67 (17) deep	180 lb-ft (240 Nm) [3]
R	Air bleed (plugged)	ISO 11926	7/16 in-20 UNF-2B; 0.47 (12) deep	30 lb-ft (40 Nm) [3]

[1] ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
[2] Thread according to ISO 68
[3] Please observe the general notes for the max. tightening torques on page 28

Unit Dimensions, Sizes 107, 125 – SAE Design

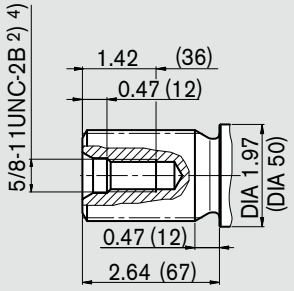
Before finalizing your design, please request a binding installation drawing.
Dimensions in inches and (millimeters)

Clockwise rotation Counter-clockwise rotation: port plate is rotated through 180°

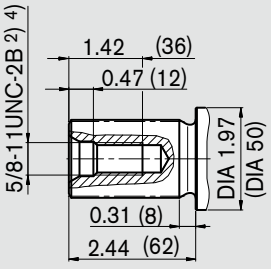


Shaft ends

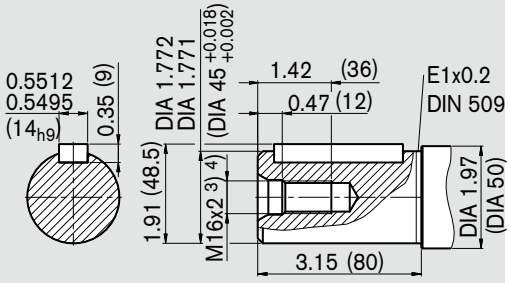
S Splined shaft 1 3/4 in 13T 8/16 DP [1]
(SAE J744 – 44-4 (D))
p_N = 5800 psi (400 bar)



U Splined shaft 1 1/2 in 23T 16/32 DP [1]
p_N = 5800 psi (400 bar)



B Parallel keyed shaft
DIN 6885 – AS14x9x63 (mm)
p_N = 5100 psi (350 bar)



Ports

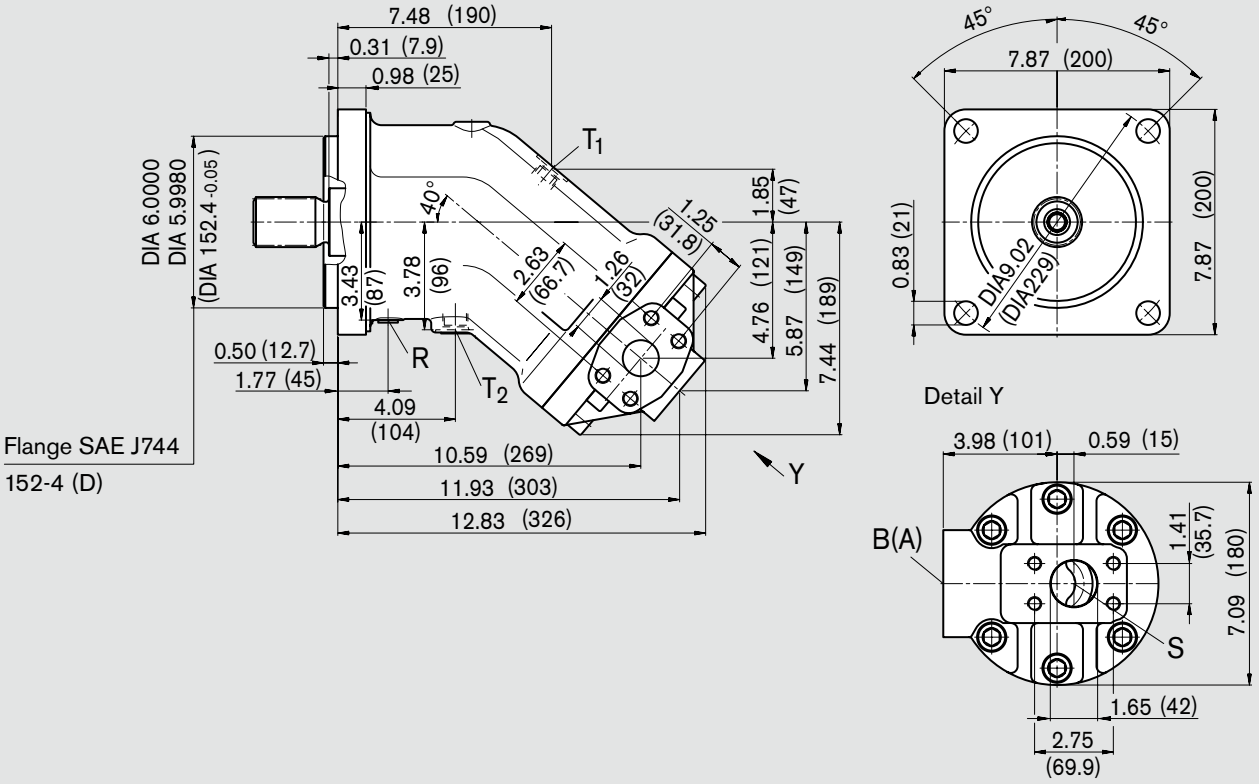
B (A)	Service line port (high pressure series) Fastening threads B/A	SAE J518 ISO 68	1 1/4 in 1/2 in -13 UNC-2B; 0.75 (19) deep [4]	
S	Suction port (standard pressure series) Fastening threads S	SAE J518 ISO 68	1 1/2 in 1/2 in -13 UNC-2B; 0.95 (24) deep [4]	
T_1, T_2	Case drain ports (T_2 plugged)	ISO 11926	7/8 in -14 UNF-2B; 0.67 (17) deep	180 lb-ft (240 Nm) [4]
R	Air bleed (plugged)	ISO 11926	7/16 in -20 UNF-2B; 0.47 (12) deep	30 lb-ft (40 Nm) [4]

[1]) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
[2]) Thread according to ISO 68
[3]) Center bore according to DIN 332 (thread according to DIN 13)
[4]) Please observe the general notes for the max. tightening torques on page 28

Unit Dimensions, Sizes 160, 180 – SAE Design

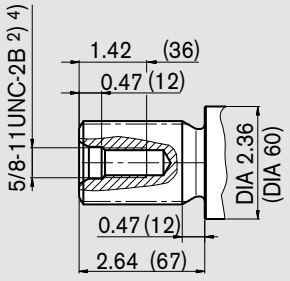
Before finalizing your design, please request a binding installation drawing.
Dimensions in inches and (millimeters)

Clockwise rotation Counter-clockwise rotation: port plate is rotated through 180°

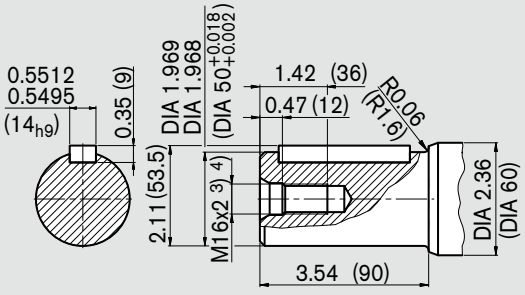


Shaft ends

S Splined shaft 1 3/4 in 13T 8/16 DP [1]
(SAE J744 – 44-4 (D))
p_N = 5800 psi (400 bar)



B Parallel keyed shaft
DIN 6885 – AS14x9x70 (mm)
p_N = 5100 psi (350 bar)



Ports

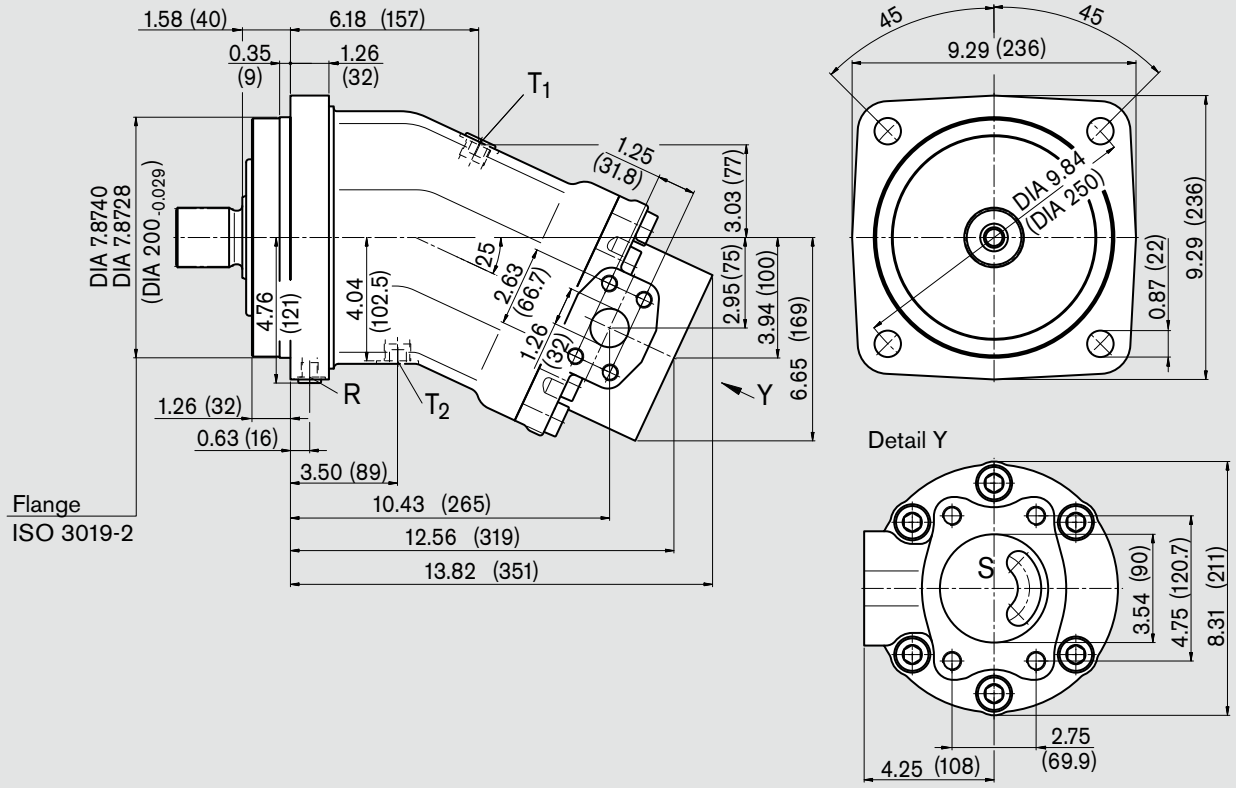
B (A)	Service line port (high pressure series) Fastening threads B/A	SAE J518 ISO 68	1 1/4 in 1/2 in-13 UNC-2B; 0.75 (19) deep [4]	
S	Suction port (standard pressure series) Fastening threads S	SAE J518 ISO 68	1 1/2 in 1/2 in-13 UNC-2B; 0.95 (24) deep [4]	
T_1, T_2	Case drain ports (T_2 plugged)	ISO 11926	7/8 in-14 UNF-2B; 0.67 (17) deep	180 lb-ft (240 Nm) [4]
R	Air bleed (plugged)	ISO 11926	9/16 in-20 UNF-2B; 0.51 (13) deep	60 lb-ft (80 Nm) [4]

[1] ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
[2] Thread according to ISO 68
[3] Center bore according to DIN 332 (thread according to DIN 13)
[4] Please observe the general notes for the max. tightening torques on page 28

Unit Dimensions, Size 200 – ISO Design

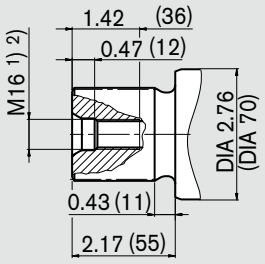
Before finalizing your design, please request a binding installation drawing.
Dimensions in inches and (millimeters)

Clockwise rotation Counter-clockwise rotation: port plate is rotated through 180°

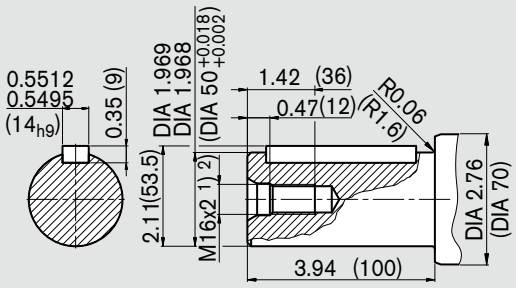


Shaft ends

A Splined shaft DIN 5480
W50x2x30x24x9g
p_N = 5800 psi (400 bar)



B Parallel keyed shaft
DIN 6885 – AS14x9x80 (mm)
p_N = 5100 psi (350 bar)



Ports

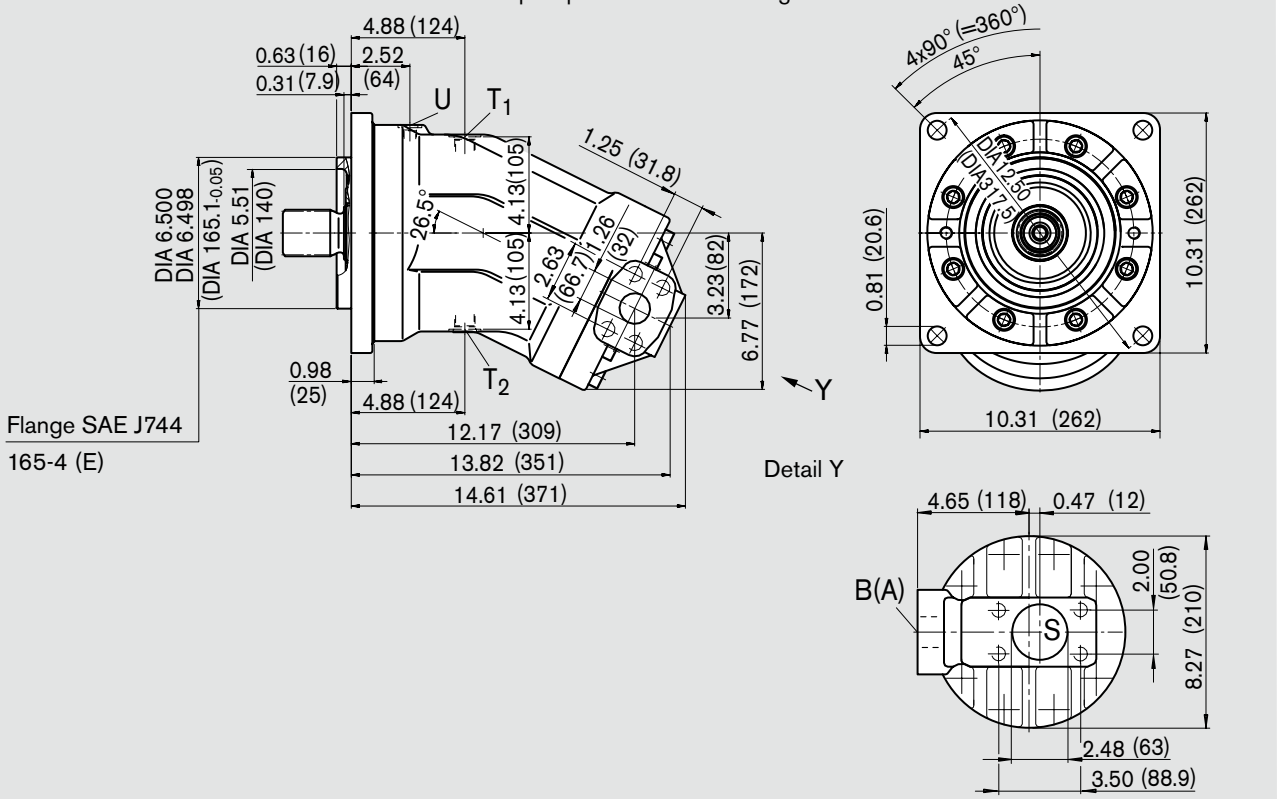
B (A)	Service line port (high pressure series) Fastening threads B/A	SAE J518 DIN13	1 1/4 in M14x2;	0.75 (19) deep 2)	
S	Suction port (standard pressure series) Fastening threads S	SAE J518 DIN13	3 1/2 in M16x2;	0.95 (24) deep 2)	
T_1, T_2	Case drain ports (T_1 plugged)	DIN 3852	M22x1.5;	0.55 (14) deep	155 lb-ft (210 Nm) 2)
R	Air bleed (plugged)	DIN 3852	M14x1.5;	0.47 (12) deep	60 lb-ft (80 Nm) 2)

1) Centering bore according to DIN 332 (thread according to DIN 13)
2) Please observe the general notes for the max. tightening torques on page 28

Unit Dimensions, Size 250 – SAE Design

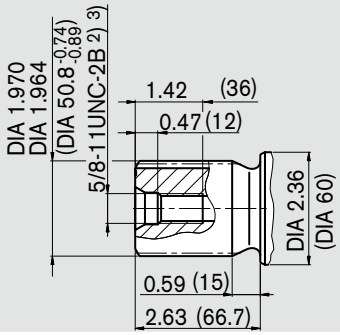
Before finalizing your design, please request a binding installation drawing.
Dimensions in inches and (millimeters)

Clockwise rotation Counter-clockwise rotation: port plate is rotated through 180°

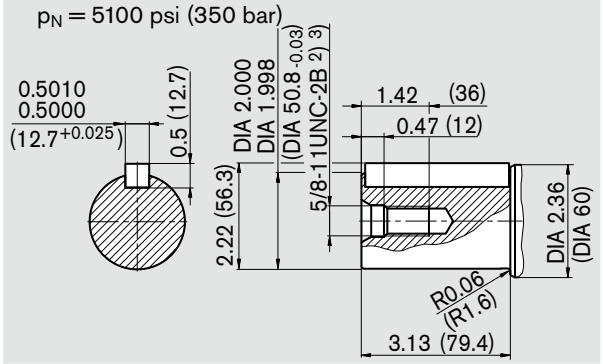


Shaft ends

S Splined shaft 2 in 15T 8/16 DP [1]
(SAE J744 – 50-4 (F))
p_N = 5100 psi (350 bar)



K Parallel keyed shaft
0.5x0.5x3.0 (in) 12.7x12.7x76.7 (mm)
p_N = 5100 psi (350 bar)



Ports

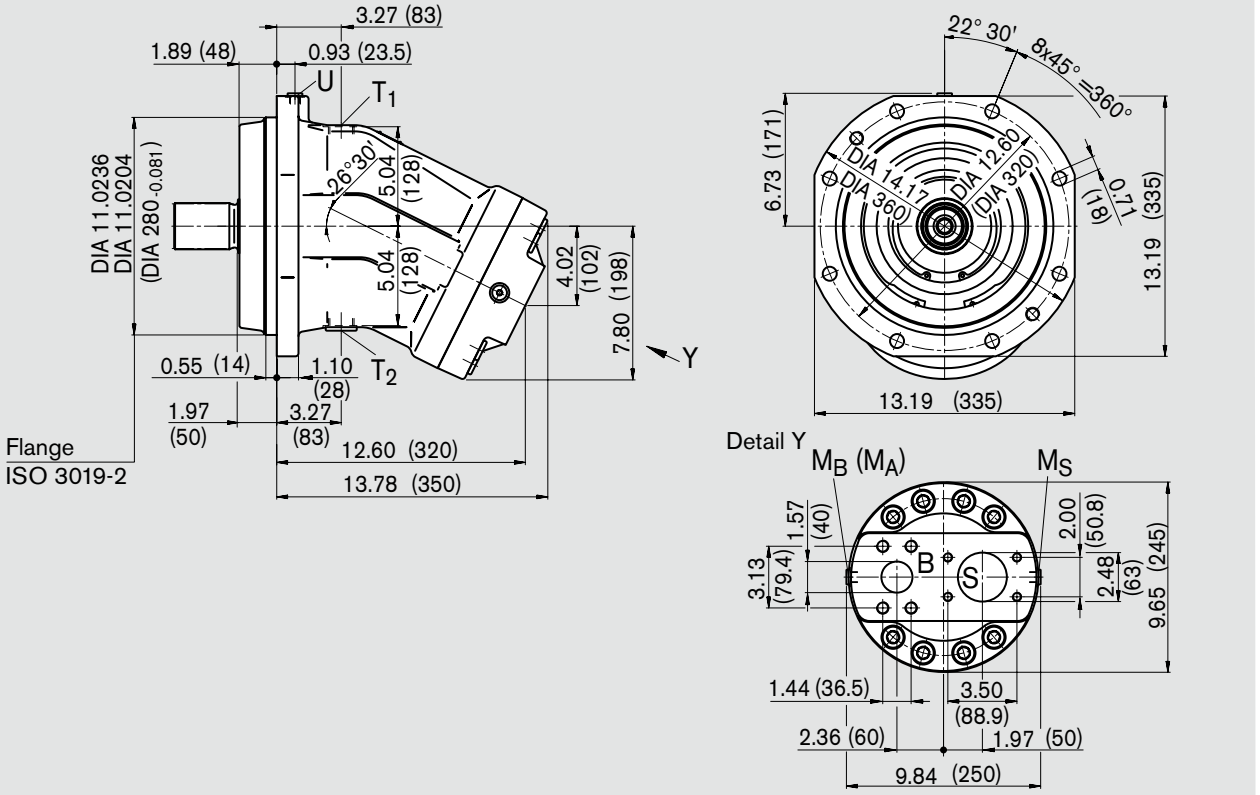
B (A)	Service line port (high pressure series) Fastening threads B/A	SAE J518 ISO 68	1 1/4 in 1/2 in -13 UNC-2B; 0.79 (20) deep [3]	
S	Suction port (standard pressure series) Fastening threads S	SAE J518 ISO 68	2 1/2 in 1/2 in -13 UNC-2B; 0.79 (20) deep [3]	
T_1, T_2	Case drain ports (T_2 plugged)	ISO 11926	7/8 in -14 UNF-2B; 0.67 (17) deep	180 lb-ft (240 Nm) [3]
U	Port for bearing flushing (plugged)	ISO 11926	9/16 in -18 UNF-2B; 0.51 (13) deep	60 lb-ft (80 Nm) [3]

[1] ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
[2] Thread according to ISO 68
[3] Please observe the general notes for the max. tightening torques on page 28

Unit Dimensions, Size 355 – ISO Design

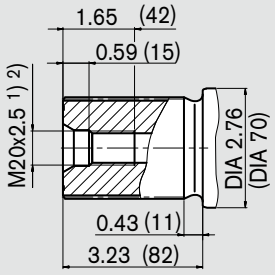
Before finalizing your design, please request a binding installation drawing.
Dimensions in inches and (millimeters)

Clockwise rotation Counter-clockwise rotation: port plate is rotated through 180°

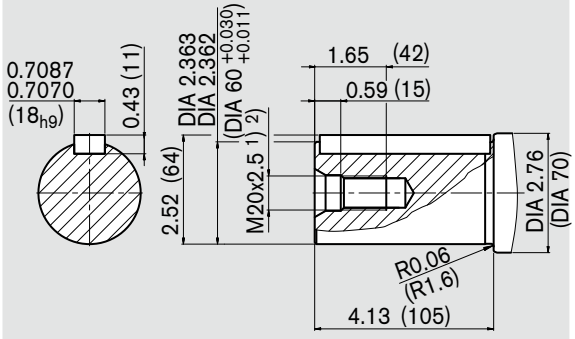


Shaft ends

Z Splined shaft DIN 5480
W60x2x30x28x9g
p_N = 5100 psi (350 bar)



P Parallel keyed shaft
DIN 6885 – AS18x11x100 (mm)
p_N = 5100 psi (350 bar)



Ports

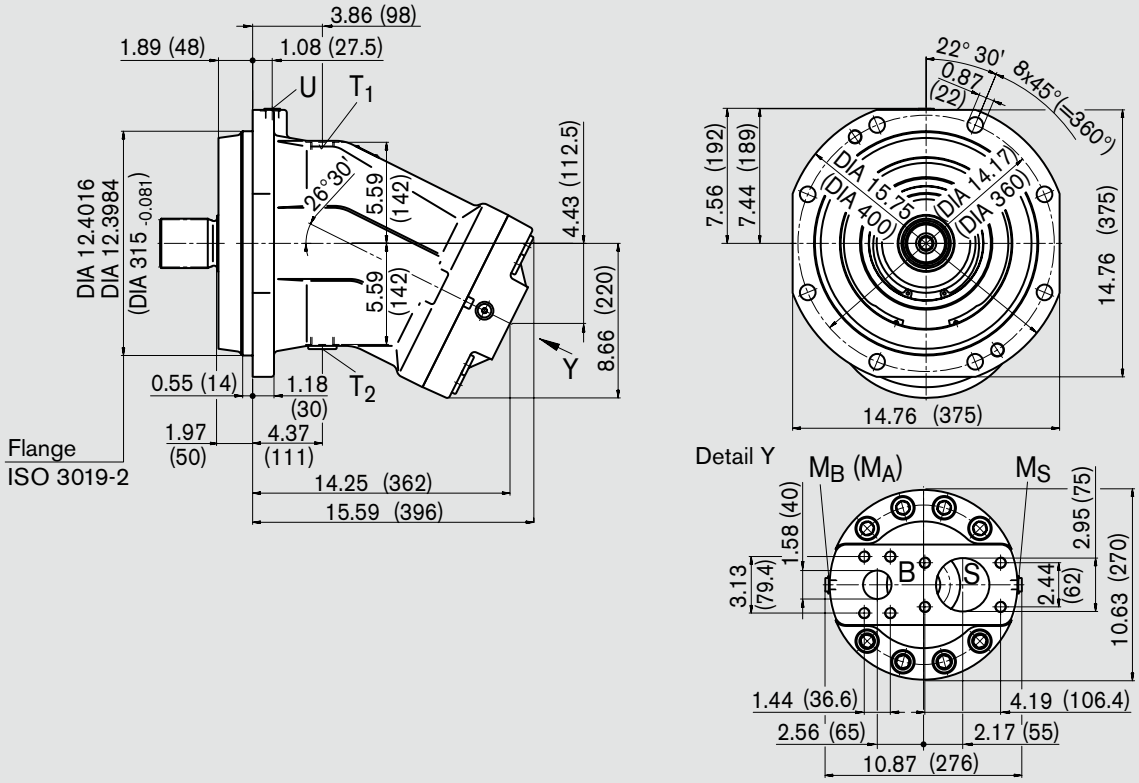
B (A)	Service line port (high pressure series) Fastening threads B/A	SAE J518 DIN13	1 1/2 in M16x2;	0.83 (21) deep 2)	
S	Suction port (standard pressure series) Fastening threads S	SAE J518 DIN13	2 1/2 in M12x1.75;	0.67 (17) deep 2)	
T_1, T_2	Case drain ports (T_2 plugged)	DIN 3852	M33x2;	0.71 (18) deep	400 lb-ft (540 Nm) 2)
U	Port for bearing flushing (plugged)	DIN 3852	M14x1.5;	0.47 (12) deep	60 lb-ft (80 Nm) 2)
M_A, M_B	Gauge ports operating pressure A, B (plugged)	DIN 3852	M14x1.5;	0.47 (12) deep	60 lb-ft (80 Nm) 2)
M_S	Gauge port suction pressure (plugged)	DIN 3852	M14x1.5;	0.47 (12) deep	60 lb-ft (80 Nm) 2)

1) Centering bore according to DIN 332 (thread according to DIN 13)
2) Please observe the general notes for the max. tightening torques on page 28

Unit Dimensions, Size 500 – ISO Design

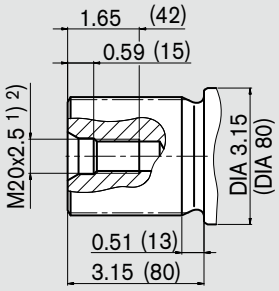
Before finalizing your design, please request a binding installation drawing.
Dimensions in inches and (millimeters)

Clockwise rotation Counter-clockwise rotation: port plate is rotated through 180°

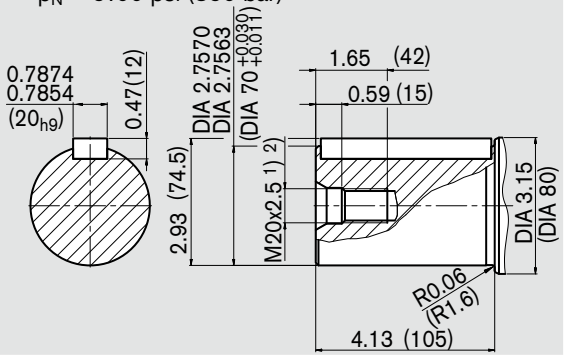


Shaft ends

Z Splined shaft DIN 5480
W70x3x30x22x9g
p_N = 5100 psi (350 bar)



P Parallel keyed shaft
DIN 6885 – AS20x12x100 (mm)
p_N = 5100 psi (350 bar)



Ports

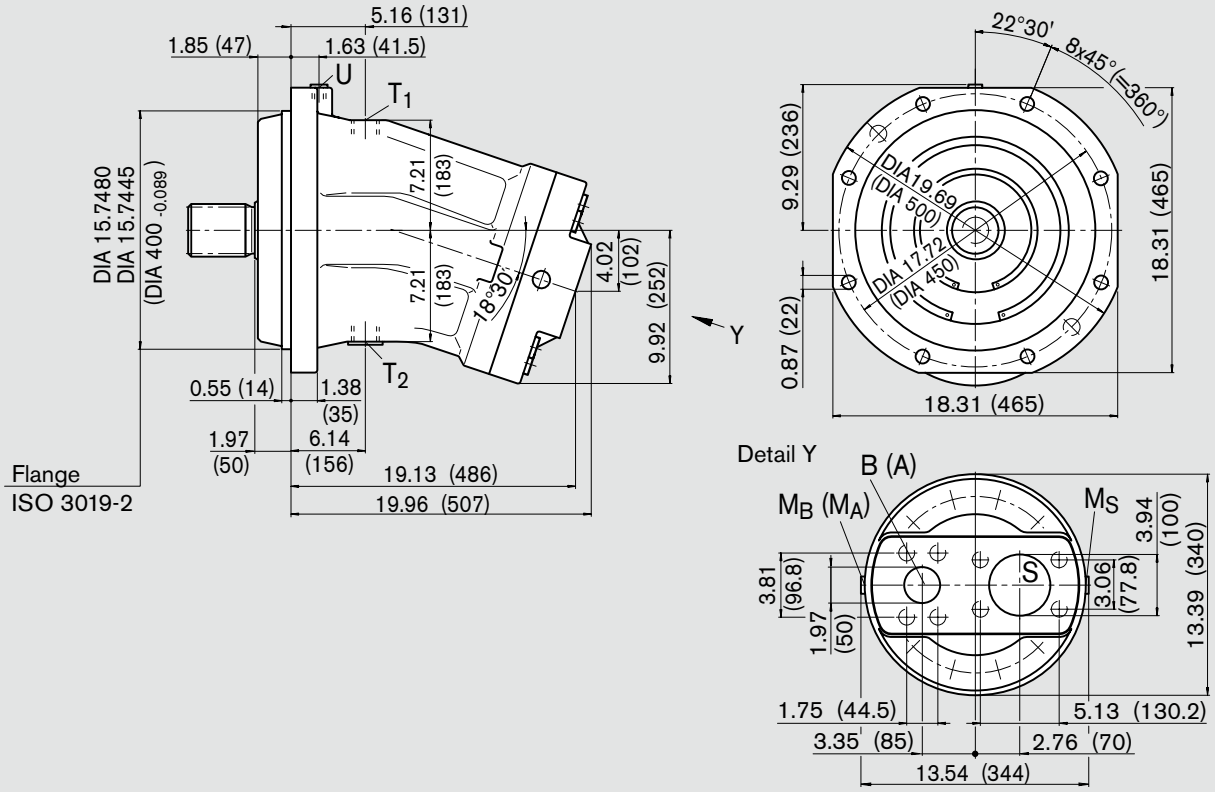
B (A)	Service line port (high pressure series) Fastening threads B/A	SAE J518 DIN13	1 1/2 in M16x2;	0.95 (24) deep 2)	
S	Suction port (standard pressure series) Fastening threads S	SAE J518 DIN13	3 in M16x2;	0.95 (24) deep 2)	
T_1, T_2	Case drain ports (T_2 plugged)	DIN 3852	M33x2;	0.71 (18) deep	400 lb-ft (540 Nm) 2)
U	Port for bearing flushing (plugged)	DIN 3852	M18x1.5;	0.47 (12) deep	100 lb-ft (140 Nm) 2)
M_A, M_B	Gauge ports operating pressure A, B (plugged)	DIN 3852	M14x1.5;	0.47 (12) deep	60 lb-ft (80 Nm) 2)
M_S	Gauge port suction pressure (plugged)	DIN 3852	M14x1.5;	0.47 (12) deep	60 lb-ft (80 Nm) 2)

1) Centering bore according to DIN 332 (thread according to DIN 13)
2) Please observe the general notes for the max. tightening torques on page 28

Unit Dimensions, Size 710 – ISO Design

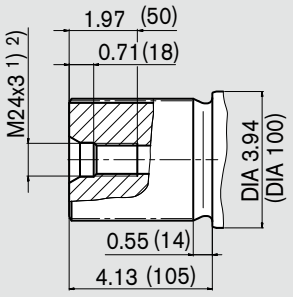
Before finalizing your design, please request a binding installation drawing.
Dimensions in inches and (millimeters)

Clockwise rotation Counter-clockwise rotation: port plate is rotated through 180°

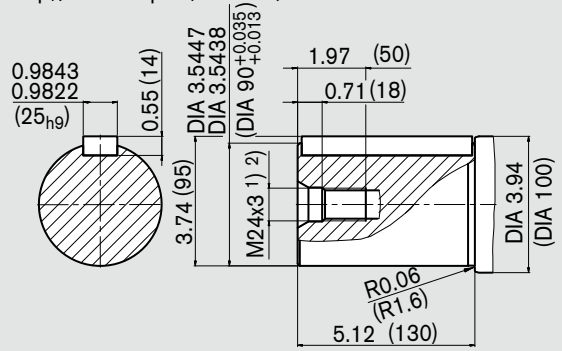


Shaft ends

Z Splined shaft DIN 5480
W90x3x30x28x9g
p_N = 5100 psi (350 bar)



P Parallel keyed shaft
DIN 6885 – AS25x14x125 (mm)
p_N = 5100 psi (350 bar)



Ports

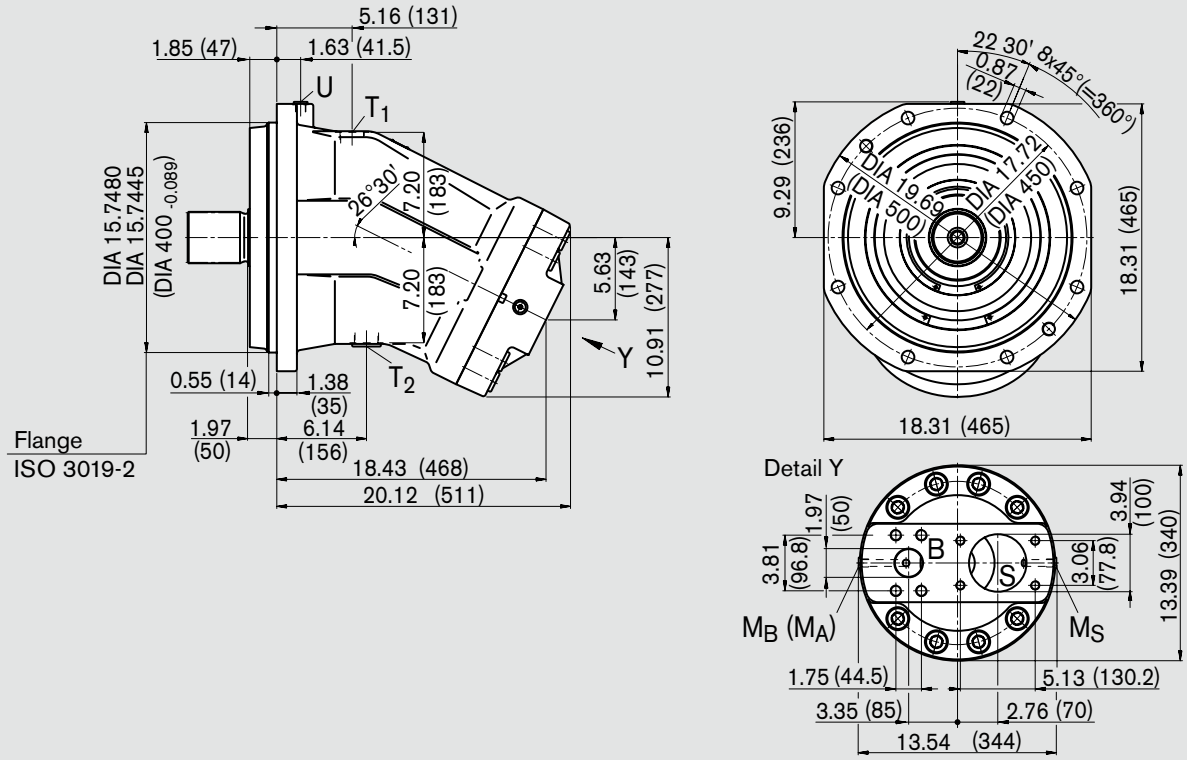
B (A)	Service line port (high pressure series) Fastening threads B/A	SAE J518 DIN13	2 in M20x2.5;	1.18 (30) deep 2)	
S	Suction port (standard pressure series) Fastening threads S	SAE J518 DIN13	4 in M16x2;	0.95 (24) deep 2)	
T_1, T_2	Case drain ports (T_2 plugged)	DIN 3852	M42x2;	0.79 (20) deep	530 lb-ft (720 Nm) 2)
U	Port for bearing flushing (plugged)	DIN 3852	M18x1.5;	0.47 (12) deep	100 lb-ft (140 Nm) 2)
M_A, M_B	Gauge operating pressure A, B (plugged)	DIN 3852	M14x1.5;	0.47 (12) deep	60 lb-ft (80 Nm) 2)
M_S	Gauge port suction pressure (plugged)	DIN 3852	M14x1.5;	0.47 (12) deep	60 lb-ft (80 Nm) 2)

1) Centering bore according to DIN 332 (thread according to DIN 13
2) Please observe the general notes for the max. tightening torques on page 28

Unit Dimensions, Size 1000 – ISO Design

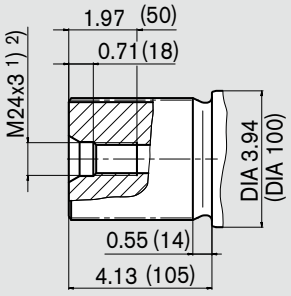
Before finalizing your design, please request a binding installation drawing.
Dimensions in inches and (millimeters)

Clockwise rotation Counter-clockwise rotation: port plate is rotated through 180°

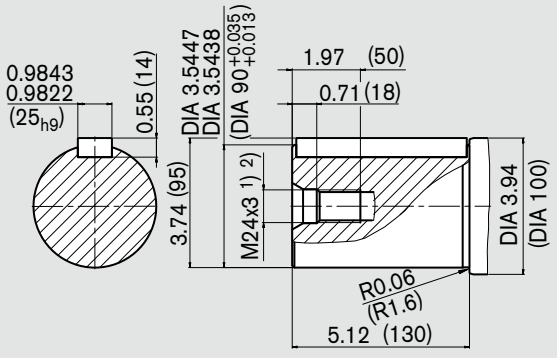


Shaft ends

Z Splined shaft DIN 5480
W90x3x30x28x9g
p_N = 5100 psi (350 bar)



P Parallel keyed shaft
DIN 6885 – AS25x14x125 (mm)
p_N = 5100 psi (350 bar)



Ports

B (A)	Service line port (high pressure series) Fastening threads B/A	SAE J518 DIN13	2 in M20x2.5;	1.18 (30) deep 2)	
S	Suction port (standard pressure series) Fastening threads S	SAE J518 DIN13	4 in M16x2;	0.95 (24) deep 2)	
T_1, T_2	Case drain ports (T_2 plugged)	DIN 3852	M42x2;	0.79 (20) deep	530 lb-ft (720 Nm) 2)
U	Port for bearing flushing (plugged)	DIN 3852	M18x1.5;	0.47 (12) deep	100 lb-ft (140 Nm) 2)
M_A, M_B	Gauge ports operating pressure A, B (plugged)	DIN 3852	M14x1.5;	0.47 (12) deep	60 lb-ft (80 Nm) 2)
M_S	Gauge port suction pressure (plugged)	DIN 3852	M14x1.5;	0.47 (12) deep	60 lb-ft (80 Nm) 2)

1) Centering bore according to DIN 332 (thread according to DIN 13), tightening torque see safety instructions
2) Please observe the general notes for the max. tightening torques on page 28

General Notes

– The AA2FO pump is designed to be used in open circuits.

– Project planning, assembly, and commissioning of the pump require the involvement of qualified personnel.

– The service line ports and function ports are only designed to accommodate hydraulic lines.

– During and shortly after operation, there is a risk of burns on the pump. Take suitable safety precautions, e.g. wear protective clothing

– There may be shifts in the characteristic depending on the operating state of the pump (operating pressure, fluid temperature).

– Tightening torques:
  - The tightening torques specified in this data sheet are maximum values and must not be exceeded (maximum values for screw thread).
    Manufacturer's instruction for the max. permissible tightening torques of the used fittings must be observed!
  - For ISO 68 / DIN 13 fixing screws, we recommend checking the tightening torque individually according to VDI 2230 Edition 2003.

– The data and information contained herein must be adhered to.

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

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Subject to change.

Rexroth
Bosch Group

PHASED OUT - Replace with A7VK, RE 94010

Axial Piston Variable Pump A2VK

RE 94001/06.10 1/12
Replaces: 07.04

Data sheet



Size	12 to 107
Series	1 and 4
Nominal pressure	250 bar
Maximum pressure	315 bar
Version for pumping plastic components	

Contents

Ordering code for standard program	2
Technical data	3
Dimensions size 12	5
Dimensions size 28	6
Dimensions size 55	7
Dimensions size 107	8
Pressure limiting valve attached	9
General instructions	12

Features

- Variable axial piston pump for pumping and metering polyurethane components
- High metering accuracy and reproducibility of the variable pumped volumes
- Robust manual adjustment via handwheel with integral precision measuring scale
- Operating pressure up to 250 bar
- Low pulsation of the pumped medium
- Pump components are compatible with the pumped media (polyol, isocyanate) due to special pairings of materials and sealing elements
- Low-noise
- Excellent volumetric efficiency for high metering accuracy
- Double shaft seals with buffer fluid ports to guarantee safe operation (and protect the environment)
- With corrosion protection

Note

Size 12 and 28 are in the phase-out program.

Replacement product is the A7VK, see RE 94010.

Ordering code for standard program

A2VK		MA				G		P	E		–	SO2

Axial piston unit

Variable pump	A2VK

Size

≙ Displacement $V_{g\,max}$ in cm³	12	28	55	107
	▲	▲	●	●

Control device

Manual adjustment	MA

Operating mode

Open circuit	O
Closed circuit	G

Direction of rotation

Looking onto drive shaft	clockwise	R
	anti-clockwise	L

Series

Size 28-107	1
Size 12	4

Model

Enclosed pump	G

Valve attachment

Without valve attached	0
Pressure limiting valve attached	1

Drive shaft

Cylindrical with key	P

Swivel angle

One-sided	E

Handwheel assembly version

Looking onto drive shaft	left side	1
	right side	2

Corrosion-protected version

	SO2

● = Available ▲ = Phase-out program

PHASED OUT -
Replace with A7VK RE 94010

Technical data

Fluid

The pump pumps and meters fluids for manufacturing polyurethane (polyol and isocyanate components).

Operating viscosity range

The following limit conditions apply:

ν_{min} _____ 1 mm^2/s,

ν_{max} _____ 2000 mm^2/s

Please contact us if higher values are required.

Operating temperature range

Optimum operating temperature range t _____ 10-50°C

Maximum operating temperature t_{max} _____ 80°C

The permitted working temperature depends on the lubricity of the fluid. The maximum fluid temperature must not be exceeded even locally (e.g. no more than 5K over the leakage fluid temperature).

Filtering the fluid

The filter should be arranged so that only filtered fluid enters the pump. The finer the filter, the longer the service life of your axial piston pump.

We recommend a filter grade $\eta_{abs.} \leq$ _____ 125 µm

Operating pressure range

Input

Open circuit:
Max. filling pressure at the port S $p_{max\ abs.}$ _____ 10 bar

Min. filling pressure at the port S $p_{min\ abs.}$ _____ 1 bar

The pump must always be filled completely.

Closed circuit:
Leakage fluid pressure $p_{max\ abs.}$ _____ 10 bar

Max. intermittent cumulative pressure A + B p_{max} ___ 250 bar

Output

Maximum pressure at port A or B
(pressure data according to DIN 24312)

Nominal pressure p_N _____ 250 bar

Maximum pressure p_{max} _____ 315 bar

Leakage fluid

Max. leakage fluid pressure $p_{L\ max}$ _____ 10 bar

In the closed circuit, pump ports A and B are separated from the housing space. The leakage fluid must be removed via port T_1 or T_2 using a separate line.

In the open circuit, the suction port S is connected to the housing space. There is no need for a line for the leakage fluid. Ports T_1 and T_2 are plugged. The filling pressure at port S acts on the shaft sealing ring via the housing space.

The service life of the shaft sealing ring decreases as the pressure of the leakage fluid or the filling pressure at port S increases.

Through put flow

Swivel direction	Direction of rotation “clockwise”		Direction of rotation “anti-clockwise”	
	open circuit	closed circuit	open circuit	closed circuit
clockwise	**S** to **B** **A** plugged	**A** to **B**	**S** to **A** **B** plugged	**B** to **A**
anti-clockwise	**S** to **A** **B** plugged	**B** to **A**	**S** to **B** **A** plugged	**A** to **B**

Installation position

Any. The pump must be completely filled with fluid. If installed with the shaft pointing upwards, the top leakage fluid port must be connected to the housing for both types of circuit to ensure that the housing is vented in the vicinity of the bearing.

Preferred installation position: drive shaft horizontal

The adjustment display in the handwheel can only be guaranteed to work if the adjusting spindle is installed -30° to +30° from the horizontal.

PHASED OUT -
Replace with A7VK RE 94010

Technical data

Table of values

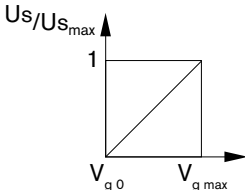
Size				12	28	55	107
Displacement	$V_{g\ max}$		cm^3	11.6	28.1	54.8	107
Flow[1] at speed n	$q_{v\ max}$	n = 735 rpm	l/min	8.3	20	39.1	76.3
		n = 970 rpm	l/min	10.9	26.4	51.6	100.7
		n = 1450 rpm	l/min	16.3	39.5	77.1	150.5
		n = 1800 rpm	l/min	20.3	49.1	95.7	186.8
Power at Δp = 250 bar and speed n	P_{max}	n = 735 rpm	kW	3.4	8.3	16.3	31.8
		n = 970 rpm	kW	4.5	11	21.5	41.9
		n = 1450 rpm	kW	6.8	16.5	32.1	62.7
		n = 1800 rpm	kW	8.4	20.4	39.9	77.8

[1]) Includes 3% loss of displacement

Control unit MA

Turning the handwheel turns a self-locking threaded spindle which steplessly adjusts the pump's swivel section, and thus the volumetric flow in the range from $V_{g\ 0}$ to $V_{g\ max}$.

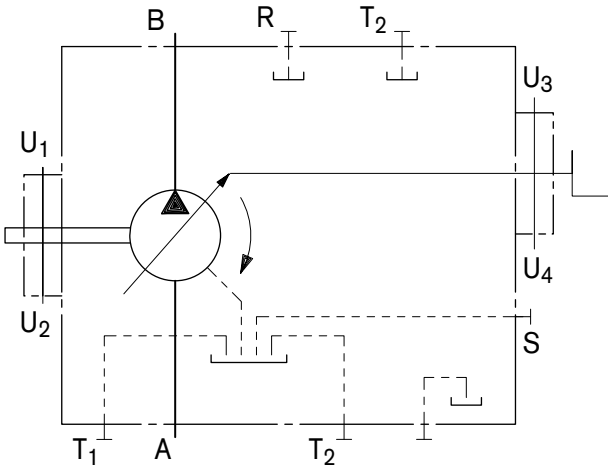
Characteristic



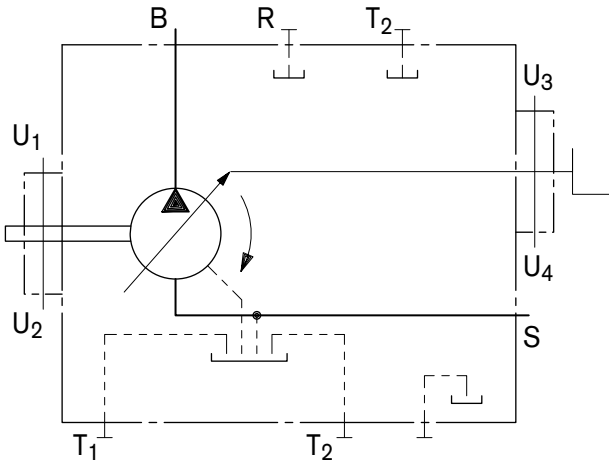
Control unit MA		12	28	55	107
Handwheel turns from $V_{g\ 0}$ to $V_{g\ max}$	U_s	10.6	12.7	16	13.4
Max. handwheel adjustment force F_{max}	N	70	70	80	120
Mass, approx. (pump with control unit)	kg	19	36	64	117

Circuit diagram

closed circuit



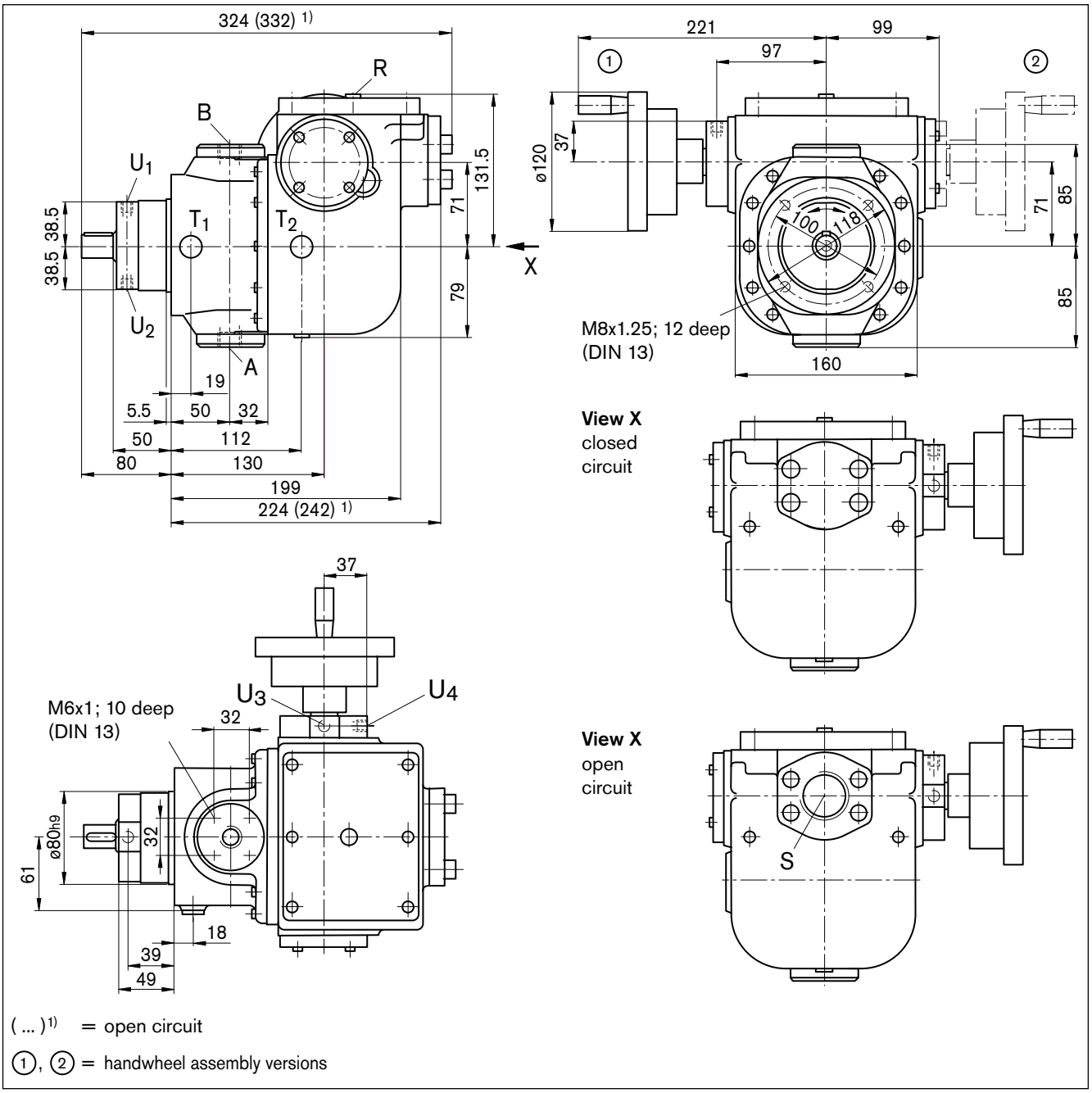
open circuit



PHASED OUT -
Replace with A7VK RE 94010

Dimensions size 12

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



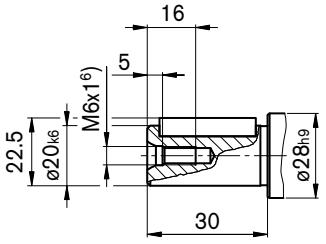
Ports

			Tightening torque, max.
A, B	Service line ports	M22x1.5 [4]	210 Nm
S	Suction port [2]	G1 1/4 [5]	720 Nm
T_1, T_2	Leakage port [3]	M12x1.5 [4]	50 Nm
R	Air bleed [3]	M12x1.5 [4]	50 Nm
U_1-U_4	Ports for buffer fluid	M10x1; 8 deep [4]	30 Nm

[2]) plugged in the closed circuit
[3]) plugged
[4]) DIN 3852
[5]) DIN ISO 228
[6]) centering hole to DIN 332

Drive shaft

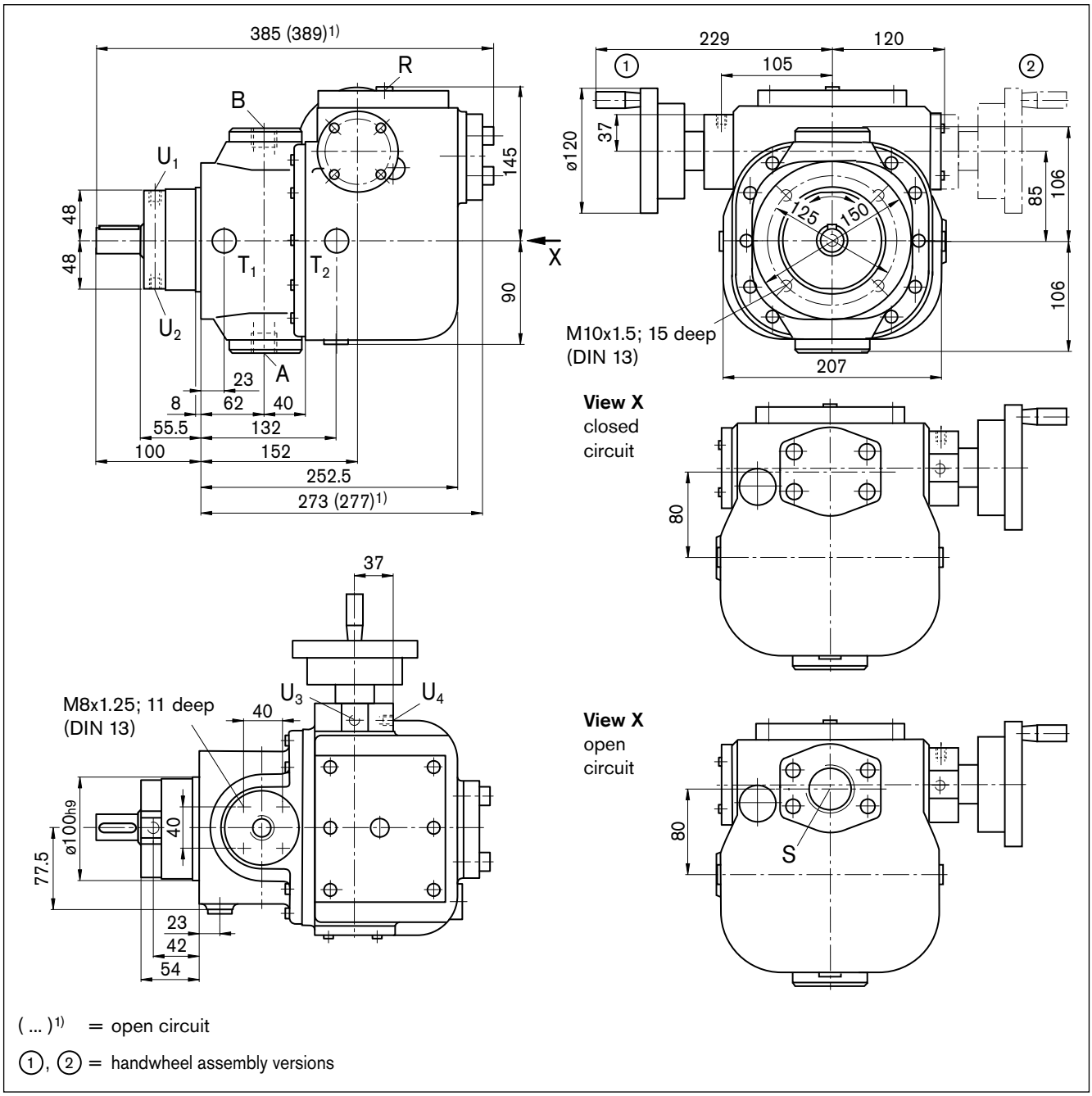
P Cylinder shaft with key
DIN 6885 – A6x6x25.5



PHASED OUT -
Replace with A7VK RE 94010

Dimensions size 28

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



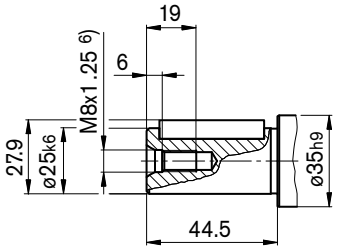
Ports

			Tightening torque, max.
A, B	Service line ports	M27x2 [4]	330 Nm
S	Suction port [2]	G1 1/2 [5]	960 Nm
T_1, T_2	Leakage port [3]	M16x1.5 [4]	100 Nm
R	Air bleed [3]	M12x1.5 [4]	50 Nm
U_1-U_4	Ports for buffer fluid	M10x1; 8 deep [4]	30 Nm

[2]) plugged in the closed circuit
[3]) plugged
[4]) DIN 3852
[5]) DIN ISO 228
[6]) centering hole to DIN 332

Drive shaft

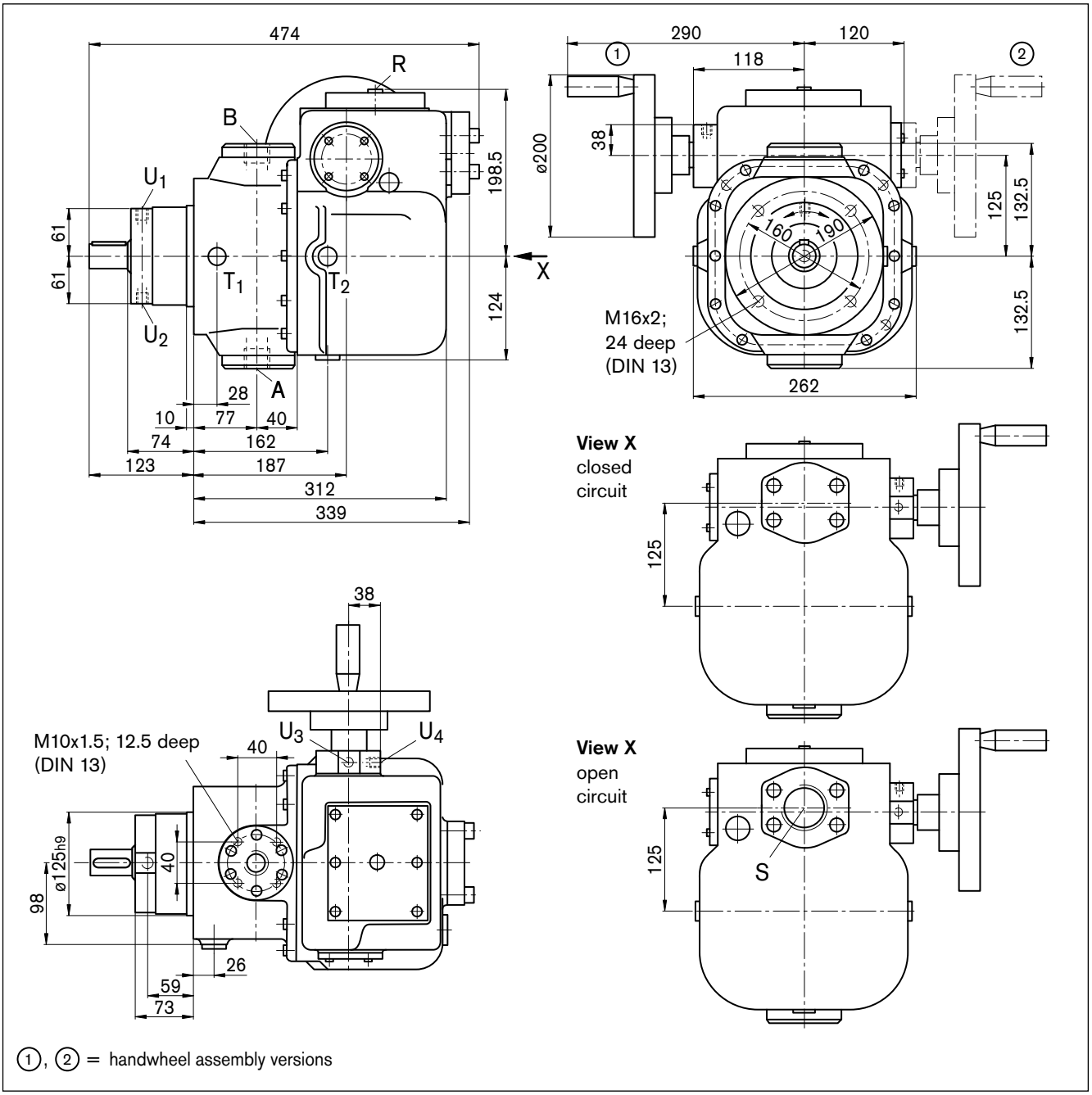
P Cylinder shaft with key
DIN 6885 – AS8x7x40



PHASED OUT -
Replace with A7VK RE 94010

Dimensions size 55

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



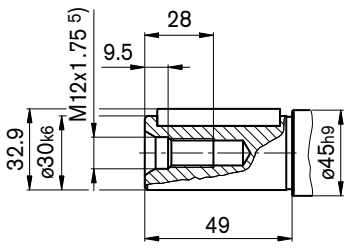
Ports

			Tightening torque, max.
A, B	Service line ports	M33x2 [3]	540 Nm
S	Suction port [1]	G2 [4]	1200 Nm
T_1, T_2	Leakage port [2]	M18x1.5 [3]	140 Nm
R	Air bleed [2]	M12x1.5 [3]	50 Nm
U_1-U_4	Ports for buffer fluid	M10x1; 8 deep [3]	30 Nm

[1] plugged in the closed circuit
[2] plugged
[3] DIN 3852
[4] DIN ISO 228
[5] centering hole to DIN 332

Drive shaft

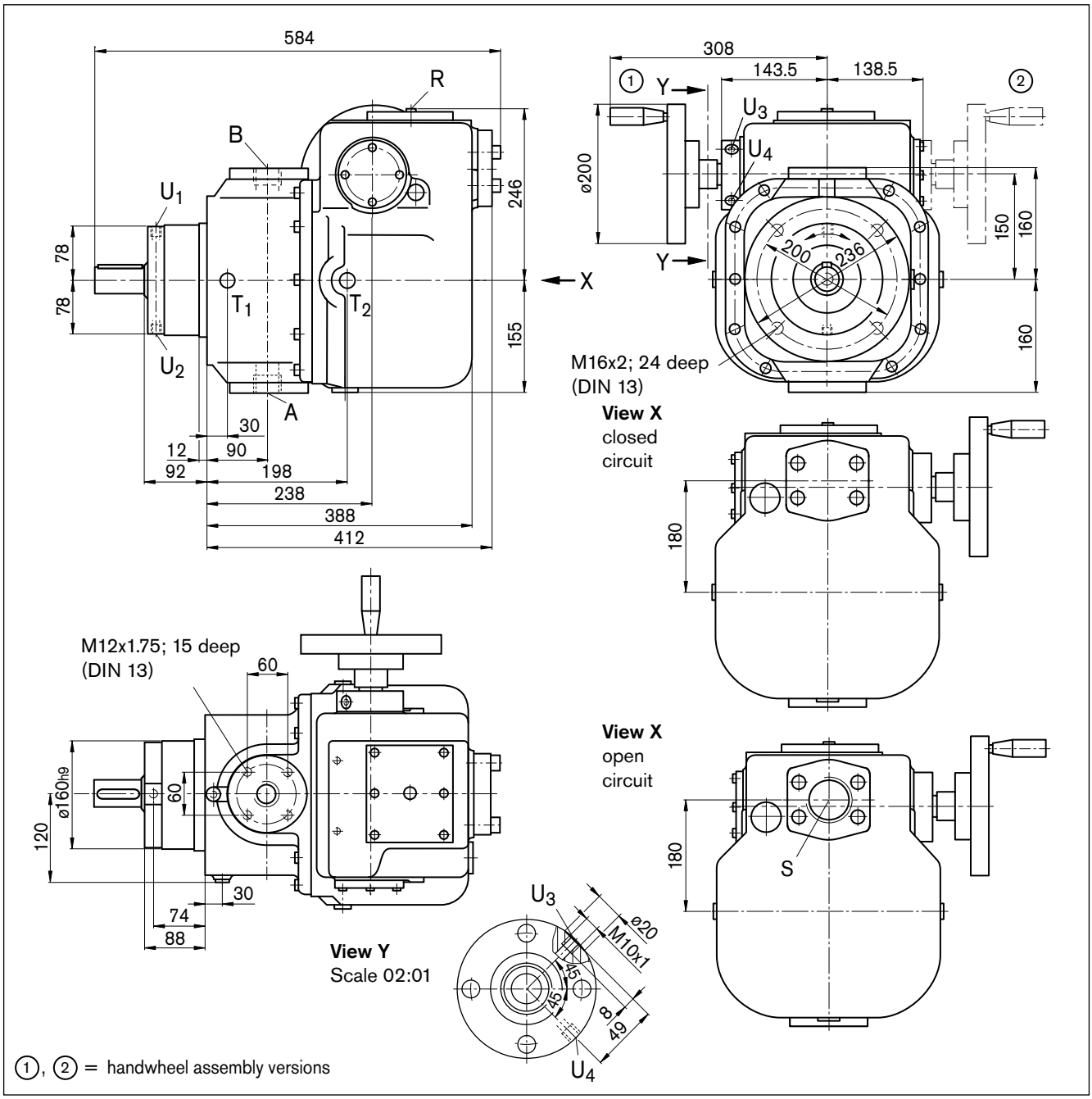
P Cylinder shaft with key
DIN 6885 – AS8x7x43



PHASED OUT -
Replace with A7VK RE 94010

Dimensions size 107

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



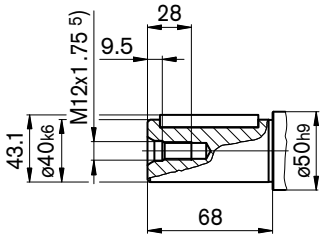
Ports

			Tightening torque, max.
A, B	Service line ports	M42x2 [3]	720 Nm
S	Suction port [1]	G2 1/2 [4]	2000 Nm
T_1, T_2	Leakage port [2]	M18x1.5 [3]	140 Nm
R	Air bleed [2]	M12x1.5 [3]	50 Nm
U_1-U_4	Ports for buffer fluid	M10x1; 8 deep [3]	30 Nm

[1] plugged in the closed circuit
[2] plugged
[3] DIN 3852
[4] DIN ISO 228
[5] centering hole to DIN 332

Drive shaft

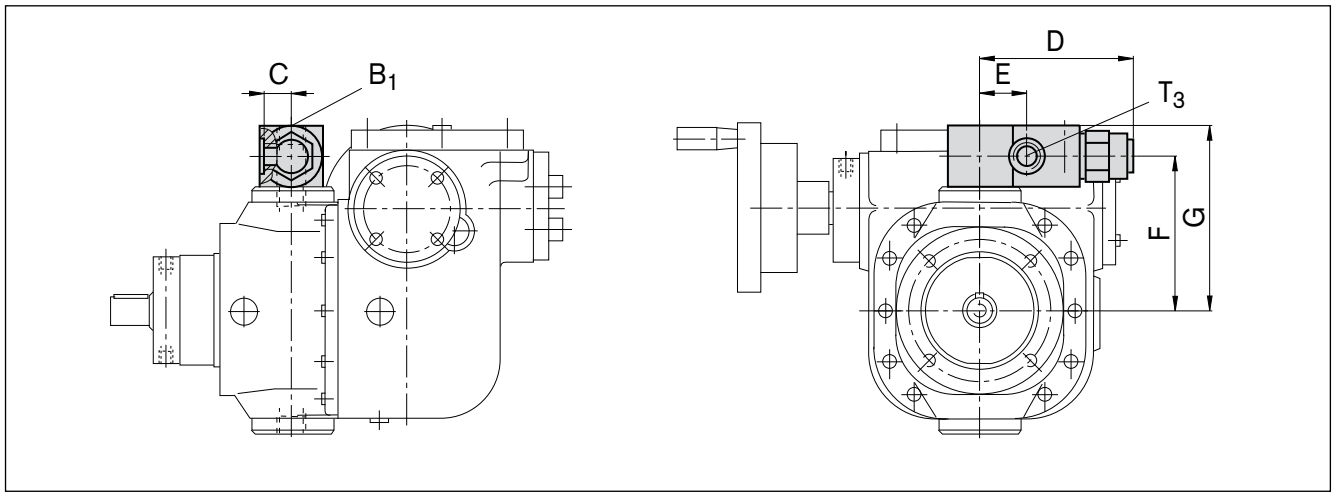
P Cylinder shaft with key
DIN 6885 – AS12x8x63



PHASED OUT -
Replace with A7VK RE 94010

Pressure limiting valve attached

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



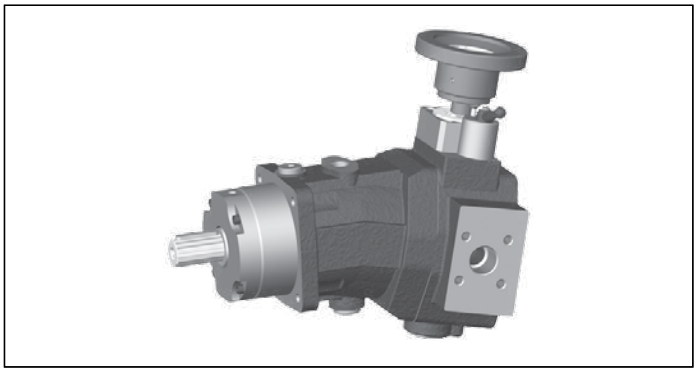
Size	C	D	E	F	G	Service line port B_1 [1)]	Tightening torque, max.	Return port T_3 [1)]	Tightening torque, max.
12	25	109	32	108	131	M22x1.5; 14 deep	210 Nm	M18x1.5; 12 deep	140 Nm
28	26.5	121	40	131	156	M27x2; 16 deep	330 Nm	M22x1.5; 14 deep	210 Nm
55	31.5	133.5	46	160.5	188.5	M33x2; 18 deep	540 Nm	M27x2; 16 deep	330 Nm
107	38.5	174	58	192.5	225	M42x2; 20 deep	720 Nm	M33x2; 20 deep	540 Nm

[1)] DIN 3852

PHASED OUT -
Replace with A7VK RE 94010

Axial piston variable pump
A7VK Series 10
Metering pump for polyurethane components

RE 94010
Issue: 04.2013
Replaces: 03.2009



- Sizes 12, 28, 55, 107
- Nominal pressure 250 bar
- Maximum pressure 315 bar
- Open and closed design

Features

- Compact design
- Reduced dimensions and mass in comparison to A2VK
- Mounting flange, drive shaft and functions identical to A2VK, thus easy to replace
- Increased corrosion protection through special surface treatment
- Manual adjustment with prescision display and clamp unit to prevent accidental adjustment
- Double shaft sealing made of special material and flushing chamber to identify damage and protect environment
- Improved volumetric efficiency through robust rotary group using proven axial tapered piston technology
- Optionally available with mounted high-pressure relief valve
- Low noise level

Closed design (A7VKG)

- High permissible filling pressure for highly-viscous media or hydraulic fluid by separating the filling channel and pump housing
- Case drain fluid must be discharged

Open design (A7VKO)

- The housing is connected to the suction chamber. A case drain line between the housing and reservoir is not requires

Note

The axial piston pump is approved for pumping polyurethane components (polyol and isocynate).

Inhalt

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General instructions	24

Ordering code

01	02	03	04		05	06	07	08	09	10	11	12		13
A7VK			**MA**	**/**	**10**	**M**		**S**			**5**		**–**	

Axial piston unit

01	Variable bent-axis design, nominal pressure 250 bar, maximum pressure 315 bar	**A7VK**

Operation modes

02	Pump, closed design	**G**
	Pump, open design	**O**

Sizes (NG)

03	Geometric displacement, see table of values on page 4	**012**	**028**	**055**	**107**	

Control device

04	Control, manual with handwheel	**MA**

Series

05	Series 1, index 0	**10**

Version of port and fixing threads

06	Metric, port threads with profile sealing ring according to DIN 3852	**M**

Directions of rotation

07	Viewed from drive shaft	clockwise (standard)	**R**
		counter-clockwise (option)	**L**

Seals

08	FKM (fluor-caoutchouc), shaft seal in PTFE (polytetrafluor ethylene)	**S**

Mounting flanges

			012	**028**	**055**	**107**	
09	Similar to ISO 3019-2 – 4-bolt (can be changed to A2VK)	80-4	●	–	–	–	**KG**
		100-4	–	●	–	–	**LG**
		125-4	–	–	●	–	**MS**
		160-4	–	–	–	●	**PS**

Drive shafts

			012	**028**	**055**	**107**	
10	Parallel keyed shaft according to DIN 6885	ø20	●	–	–	–	**P3**
		ø25	–	●	–	–	**P5**
		ø30	–	–	●	–	**P6**
		ø40	–	–	–	●	**P9**

Service line ports

11	Closed design: threaded ports A and B, at side, opposite side	**5**
	Open design: threaded ports A and S, at side, opposite side	

Pressure relief valves

12	Without pressure relief valves (standard)		**0000**
	High-pressure relief valve, diret controlled, fixed setting, Δp-setting value [bar] optional	100	**A100**
		150	**A150**
		200	**A200**
		230	**A230**
		250	**A250**

Standard / special version

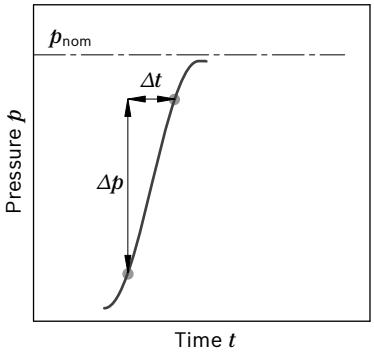
13	Standard version	**0**
	Special version	**S**

● = Available ○ = On request – = Not available

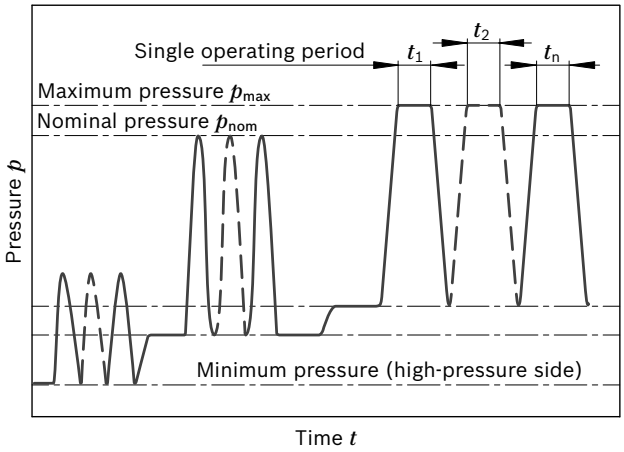
Operating pressure range

Pressure at the service line ports A or B (high-pressure side)		**Definition**
Nominal pressure p_{nom}	250 bar absolute	The nominal pressure corresponds to the maximum design pressure.
Maximum pressure p_{max}	315 bar absolute	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.
Single operating period	10 s	
Total operating period	50 h	
Minimum pressure	10 bar absolute	Minimum pressure on the high-pressure side (**A** or **B**) that is required in order to prevent damage to the axial piston unit.
Rate of pressure change $R_{A\,max}$	9000 bar/s	Maximum permissible rate of pressure build-up and pressure reduction during a pressure change over the entire pressure range.
Closed design **Pressure at the service line ports A or B (low-pressure side)**		
Minimum filling pressure	> 1 bar absolute	Depending on viscosity and flow, the filling pressure must be adjusted in such a way that a complete filling of the low pressure side of the pump is ensured.
Maximum filling pressure	30 bar absolute	
Open design **Pressure on suction port S (inlet)**		
Minimum filling pressure	1 bar absolute	Depending on viscosity and flow, the filling pressure must be adjusted in such a way that a complete filling of the low pressure side of the pump is ensured.
Maximum filling pressure	6 bar absolute	

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



▼ **Pressure definition**



Total operating period = $t_1 + t_2 + ... + t_n$

Note
Values for other hydraulic fluids, please contact us.

Shaft seal

Permissible pressure loading
The service life of the shaft seal is affected by the speed of the pump, the case pressure (case drain pressure) and the properties of the medium being pumped. Momentary (t < 0.1 s) pressure spikes of up to 10 bar absolute are permitted. The service life of the shaft seal decreases with an increase in the frequency of pressure spikes.

Note
For monitoring the shaft seal for zero leakage, we recommend connecting a barrier fluid monitor at ports **U_1** to **U_4**.

The minimum case pressure must be equal to or greater than the barrier fluid pressure. The barrier fluid pressure must be equal to or greater than the external pressure on the outer shaft seal.

Hydraulic fluids

The pump is approved for pumping and metering polyurethane components (polyol and isocynate). For other hydraulic fluids, consult with Bosch Rexroth Service.

Operating viscosity range

The limiting values for viscosity are as follows:

- v_{min} = 5 mm²/s
- v_{max} = 1600 mm²/s

Please contact us if different values are required.

On applications with highly viscous fluids bearing flushing is recommended. Recommended flushing flow:

Size	[L/min]
12	2.5
28	4
55	4
107	8

Operating temperature range

- Optimum operating temperature range t = 10 bis 50 °C
- Maximum operating temperature range t_{max} = 80 °C

The permissible operating temperature is dependent on the lubricity of the respective hydraulic fluid.

The maximum operating temperature must not be exceeded even locally.

Filtration of the hydraulic fluid

The filter should be arranged so that only filtered fluid enters the pump. The finer the filter, the longer the service life of the axial piston pump.

- We recommend a filter grade $\eta_{abs} \leq 125$ µm

Case drain fluid at closed design

The pump ports **A** and **B** are separated from the housing. The case drain fluid must be removed via port $\mathbf{T_1}$ or $\mathbf{T_2}$ using a separate line.

- Maximum case drain pressure $p_{L\,max}$ = 6 bar

Case drain fluid at open design

The housing is connected to the suction chamber. The pressure on port **S** is also applied in the housing and must not exceed 6 bar. A case drain line between the housing and reservoir is not required (port $\mathbf{T_1}$, $\mathbf{T_2}$ plugged).

Technical data

Size			NG		12	28	55	107
Displacement geometrical, per revolution			$V_{g\,max}$	cm³	11.6	28.1	54.8	107
			$V_{g\,min}$	cm³	0	0	0	0
Flow	at $V_{g\,max}$ and speed n	n = 1500 min⁻¹	q_v	L/min	17.4	42.2	82.2	160.5
		n = 1800 min⁻¹	q_v	L/min	20.9	50.6	98.6	192.6
Power	at $V_{g\,max}$, Δp = 250 bar and speed n	n = 1500 min⁻¹	P	kW	7.3	17.6	34.2	66.9
		n = 1800 min⁻¹	P	kW	8.7	21.1	41.1	80.3
Torque	at $V_{g\,max}$ and Δp = 250 bar		T	Nm	46.2	111.8	218.0	425.7
Mass (approx.)			m	kg	11.7	22.1	31	55

Determining the operating characteristics

Formulas		
Flow	$q_v = \frac{V_g \cdot n \cdot \eta_v}{1000}$	[L/min]
Torque	$T = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}}$	[Nm]
Power	$P = \frac{2 \pi \cdot T \cdot n}{60000} = \frac{q_v \cdot \Delta p}{600 \cdot \eta_t}$	[kW]

Key		
V_g	=	Displacement per revolution in cm³
Δp	=	Differential pressure in bar
n	=	Speed in min⁻¹
η_v	=	Volumetric efficiency
η_{mh}	=	Mechanical-hydraulic efficiency
η_t	=	Total efficiency ($\eta_t = \eta_v \cdot \eta_{mh}$)

Note

Theoretical values, without efficiency and tolerances; values rounded

MA control

Turning the handwheel turns a threaded spindle which steplessly adjusts the pump's rotary group, and thus the flow in the range from $V_{g\,min}$ to $V_{g\,max}$. A manual locking device, which is fitted as standard equipment, prevents unintentional adjustment. The precision adjustment display is integrated in the handwheel.

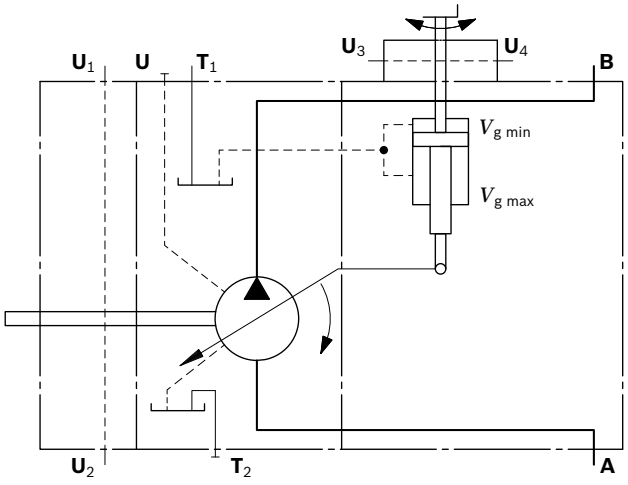
Size		12	28	55	107
Rotation on the handwheel $V_{g\,min}$ to $V_{g\,max}$	approx. U_s	23	30	40	50
Maximum torque in the handwheel T_{max}	approx. Nm	3.5	3.5	3.5	3.5

Flow direction

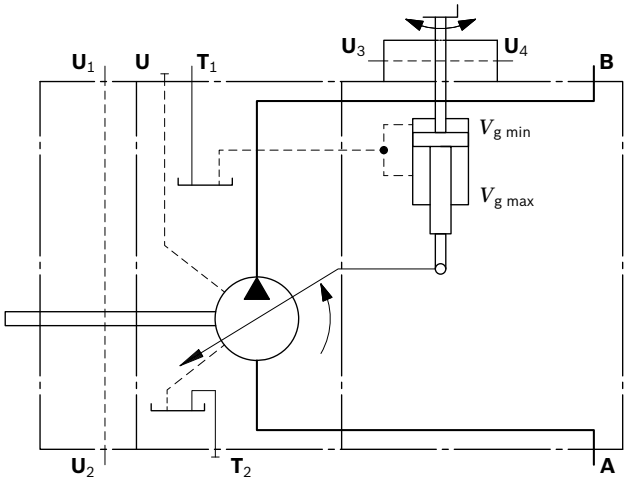
Direction of rotation, viewed from drive shaft		
Design	**clockwise**	**counter-clockwise**
Closed	**A** to **B**	**B** to **A**
Open	**S** to **A**	**S** to **A**

Closed design

▼ **Schematic clockwise**

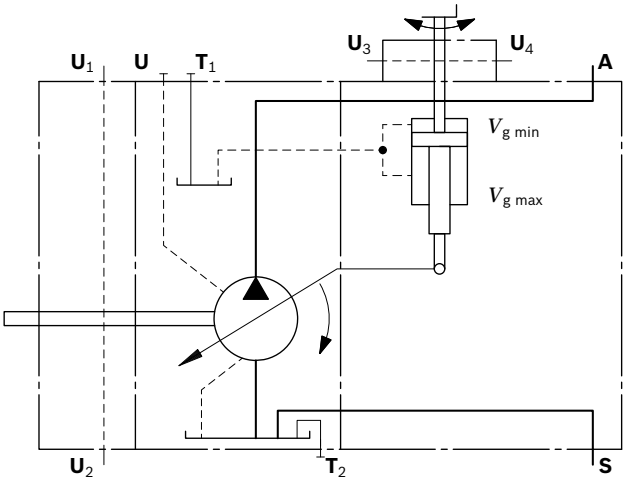


▼ **Schematic counter-clockwise**

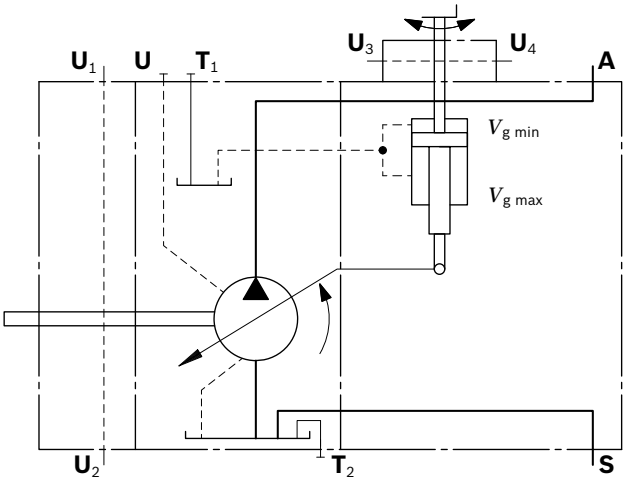


Open design

▼ **Schematic clockwise**

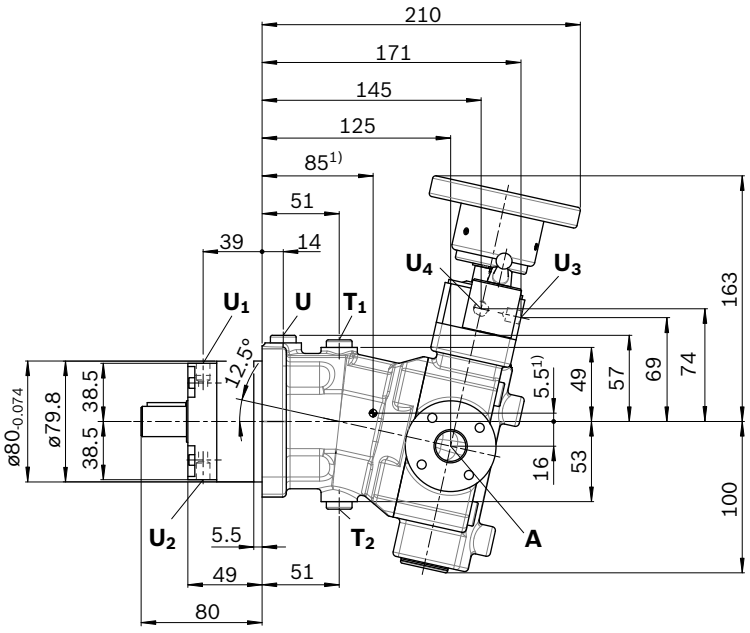


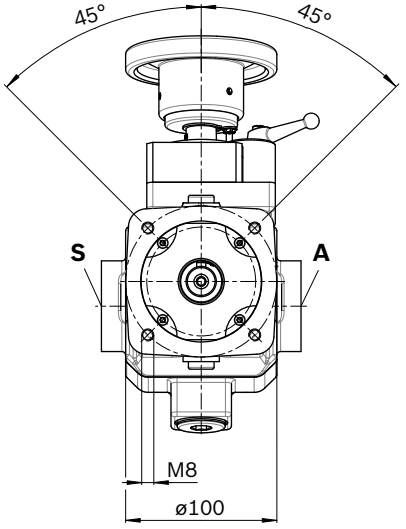
▼ **Schematic counter-clockwise**



Dimensions size 12 – open design

Direction of rotation clockwise

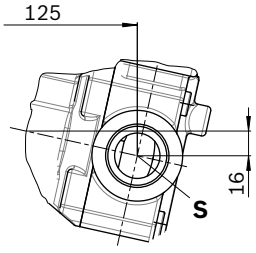


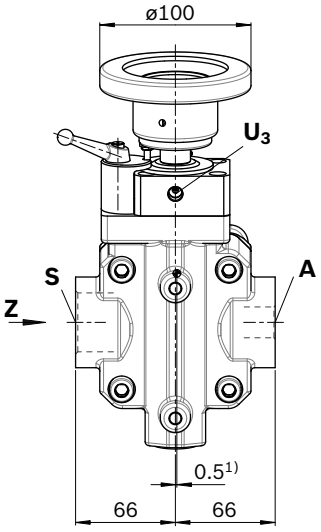


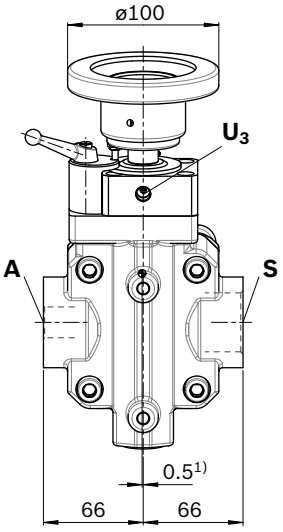
Direction of rotation counter-clockwise

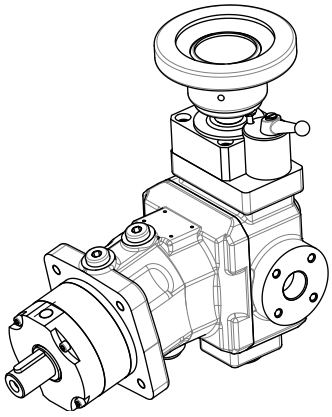
Direction of rotation clockwise

View Z





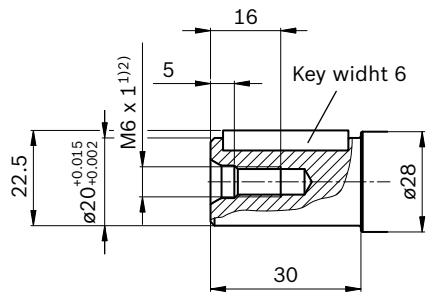




1) Center of gravity

▼ **Parallel keyed shaft to DIN 6885**

P3 – A6x6x25.5

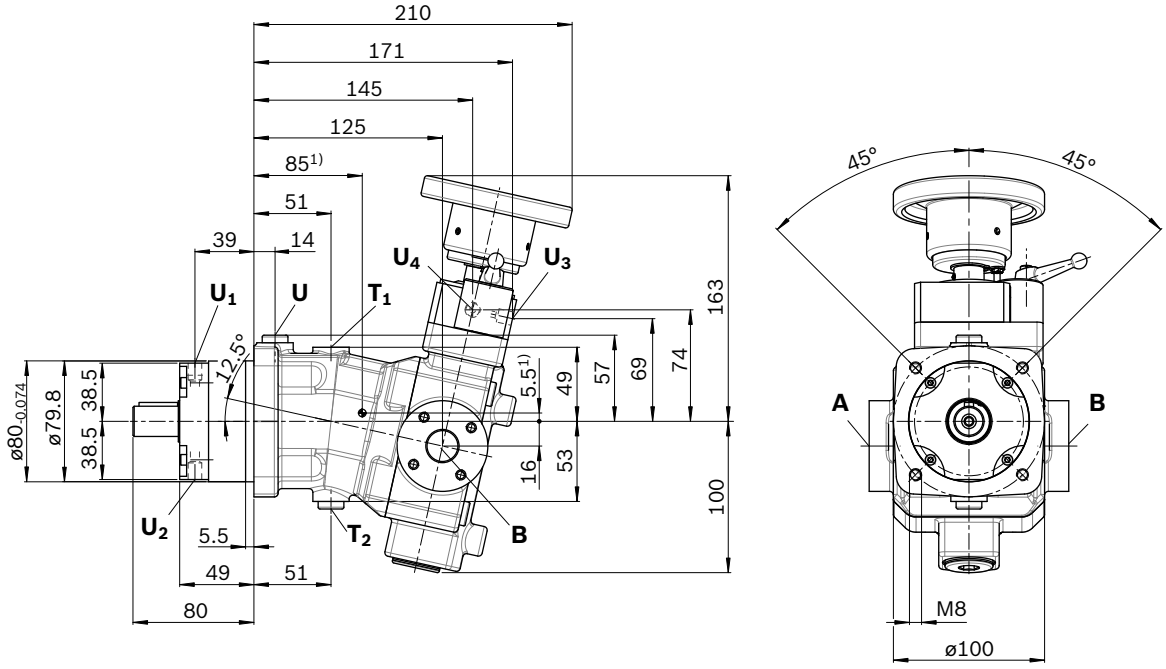


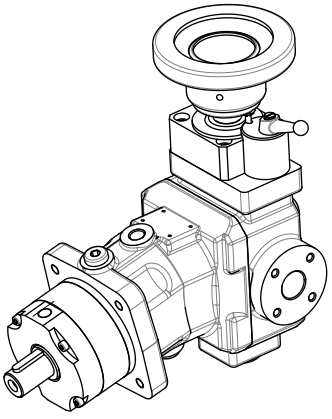
Ports		Standard[4]	Size[2]	p_{max} [bar][3]	State[6]
A	Service port	DIN 3852	M22 x 1.5; 14 tief	315	O
S	Suction/filling port	DIN ISO 228	G1 1/4; 20 tief	6	O
T_1	Case drain fluid	DIN 3852	M12 x 1.5; 12 tief	6	X
T_2	Case drain fluid	DIN 3852	M12 x 1.5; 12 tief	6	X
U	Bearing flushing	DIN 3852	M12 x 1.5; 12 tief	6	X
U_1, U_2	Barrier fluid	DIN 3852	M10 x 1; 8 tief	3[5]	O
U_3, U_4	Barrier fluid	DIN 3852	M10 x 1; 8 tief	3[5]	O

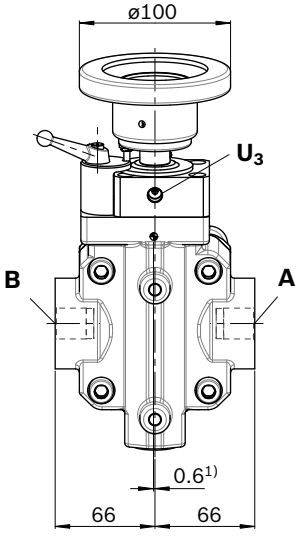
1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 24 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) The spot face can be deeper than specified in the appropriate standard.
5) The minimum case pressure must be equal to or greater than the barrier fluid pressure. The barrier fluid pressure must be equal to or greater than the external pressure on the outer shaft seal.
6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 12 – closed design

Direction of rotation clockwise and counter-clockwise identical dimensions



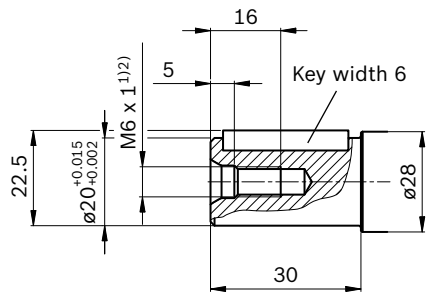




1) Center of gravity

▼ **Parallel keyed shaft DIN 6885**

P3 – A6x6x25.5

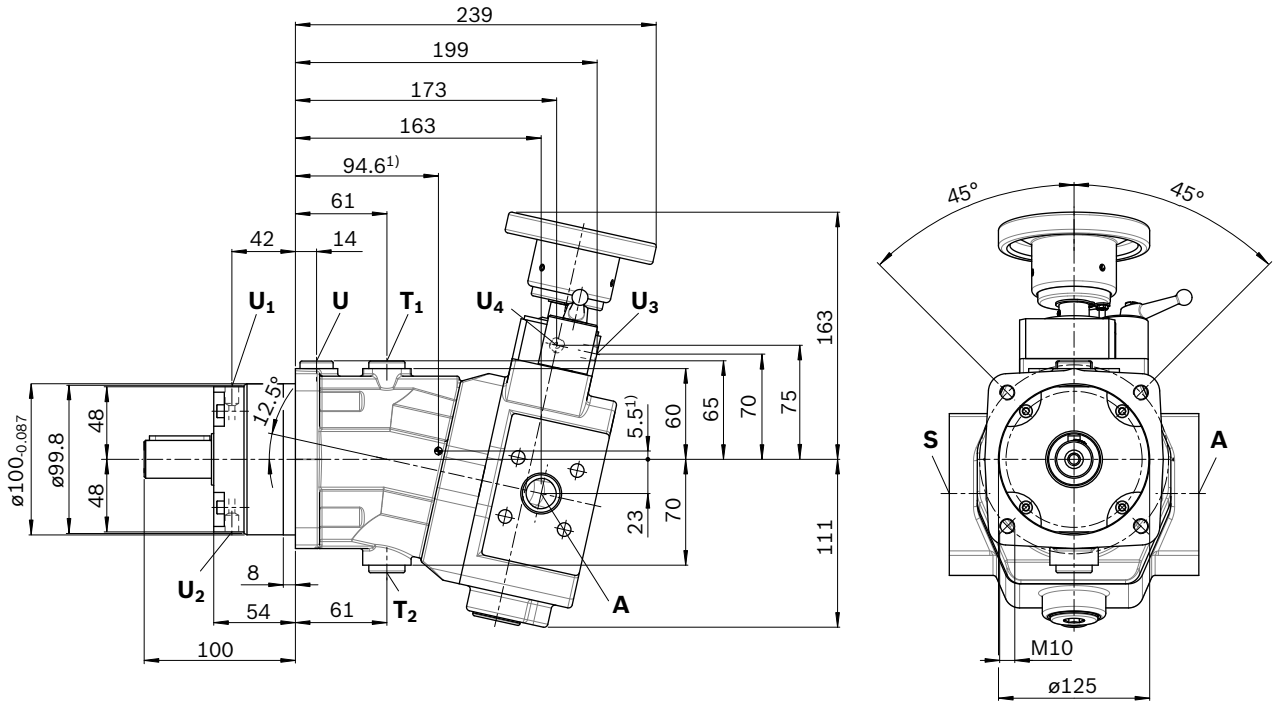


Ports		Standard[4)]	Size[2)]	p_{max} [bar][3)]		State[7)]
A	Service port	DIN 3852	M22 x 1.5; 14 tief	clockwise	30	O
				counter-clockwise	315	
B	Service port	DIN 3852	M22 x 1.5; 14 tief	clockwise	315	O
				counter-clockwise	30	
T_1	Case drain fluid	DIN 3852	M12 x 1.5; 12 tief	6		O[6)]
T_2	Case drain fluid	DIN 3852	M12 x 1.5; 12 tief	6		X[6)]
U	Bearing flushing	DIN 3852	M12 x 1.5; 12 tief	6		X
U_1, U_2	Barrier fluid	DIN 3852	M10 x 1; 8 tief	3[5)]		O
U_3, U_4	Barrier fluid	DIN 3852	M10 x 1; 8 tief	3[5)]		O

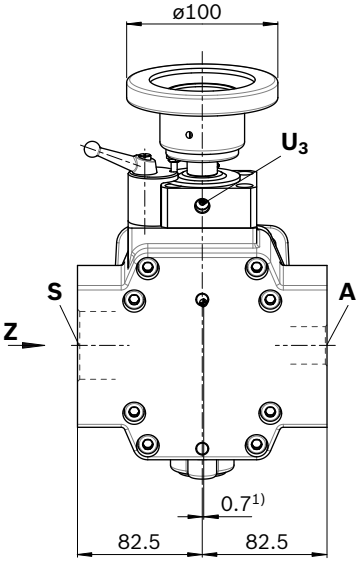
1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 24 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) The spot face can be deeper than specified in the appropriate standard.
5) The minimum case pressure must be equal to or greater than the barrier fluid pressure. The barrier fluid pressure must be equal to or greater than the external pressure on the outer shaft seal.
6) Depending on installation position, **T_1** or **T_2** must be connected (see also installation instructions page 23).
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 28 – open design

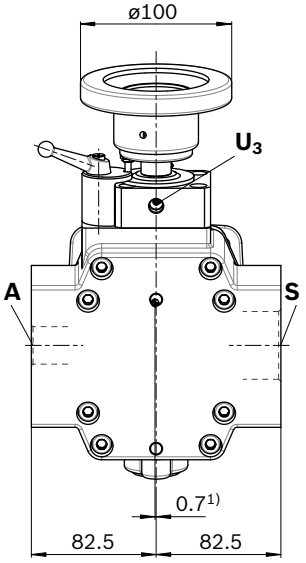
Direction of rotation clockwise



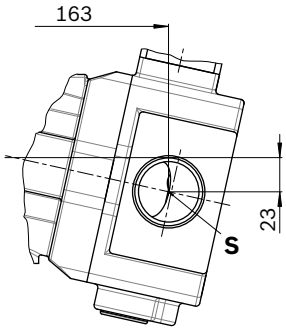
Direction of rotation counter-clockwise

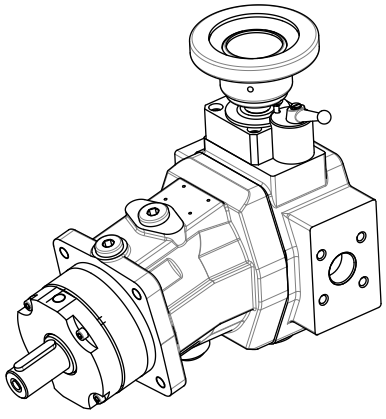


Direction of rotation clockwise



View Z

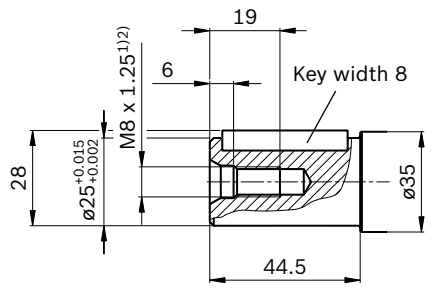




1) Center of gravity

▼ **Parallel keyed shaft DIN 6885**

P5 – AS8x7x40

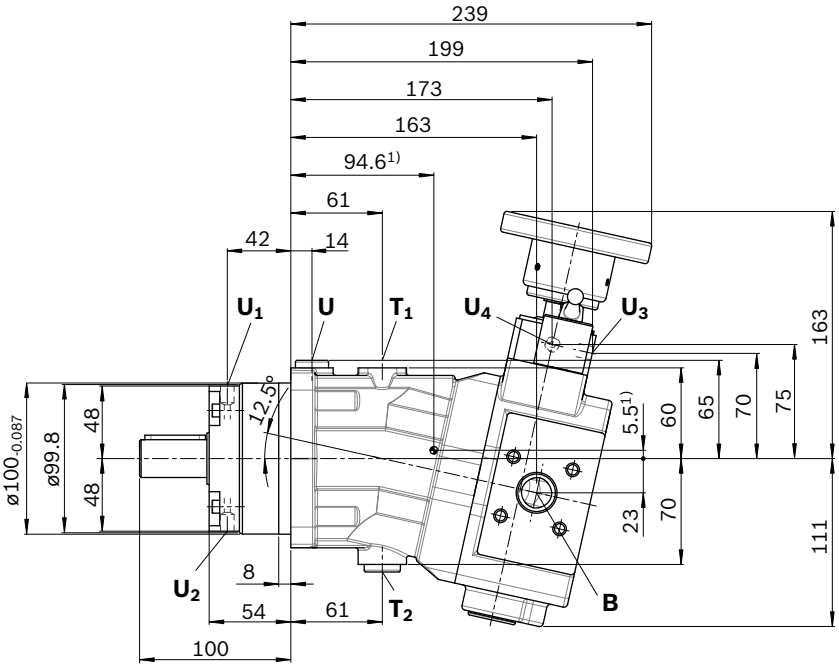


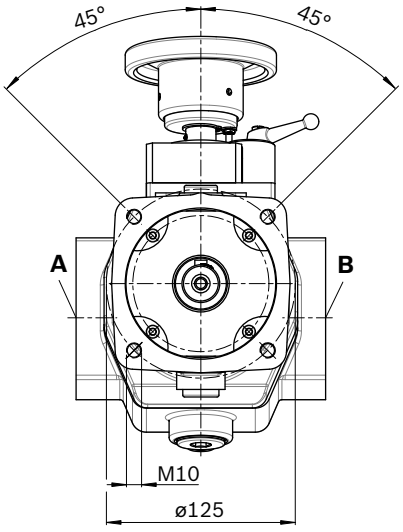
Ports		Standard[4)]	Size[2)]	p_{max} [bar][3)]	State[6)]
A	Service port	DIN 3852	M27 x 2; 16 tief	315	O
S	Suction/filling port	DIN ISO 228	G1 1/2; 20 tief	6	O
T_1	Case drain fluid	DIN 3852	M18 x 1.5; 12 tief	6	X
T_2	Case drain fluid	DIN 3852	M18 x 1.5; 12 tief	6	X
U	Bearing flushing	DIN 3852	M16 x 1.5; 12 tief	6	X
U_1, U_2	Barrier fluid	DIN 3852	M10 x 1; 8 tief	3[5)]	O
U_3, U_4	Barrier fluid	DIN 3852	M10 x 1; 8 tief	3[5)]	O

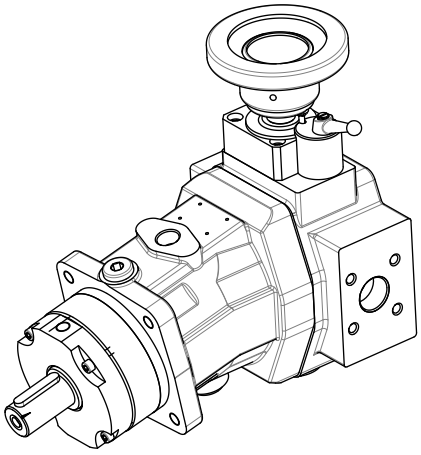
1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 24 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) The spot face can be deeper than specified in the appropriate standard.
5) The minimum case pressure must be equal to or greater than the barrier fluid pressure. The barrier fluid pressure must be equal to or greater than the external pressure on the outer shaft seal.
6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

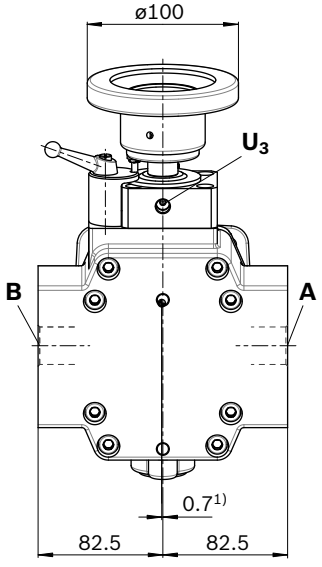
Dimensions size 28 – closed design

Direction of rotation clockwise and counter-clockwise identical dimensions





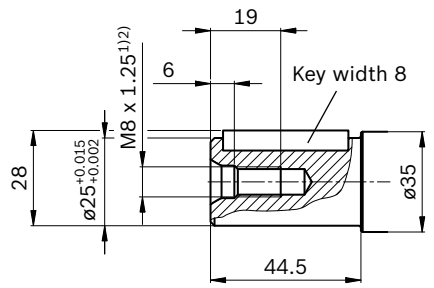




1) Center of gravity

▼ **Parallel keyed shaft DIN 6885**

P5 – AS8x7x40

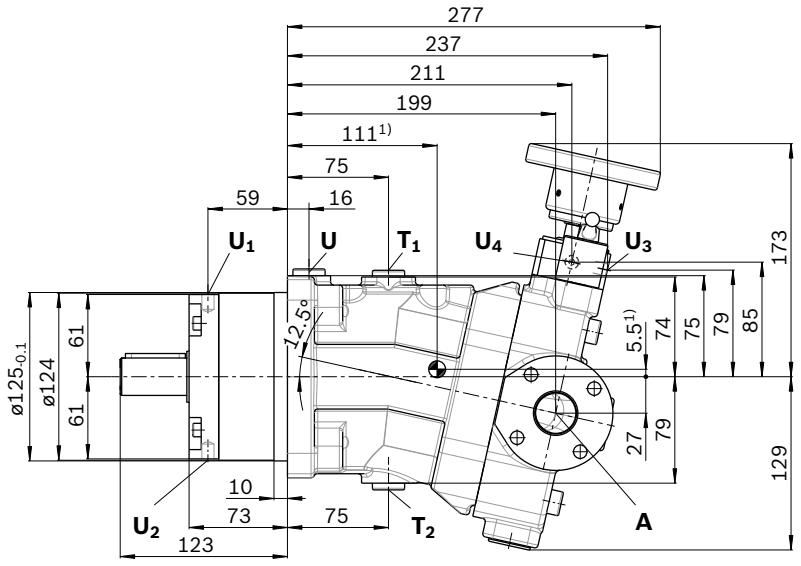


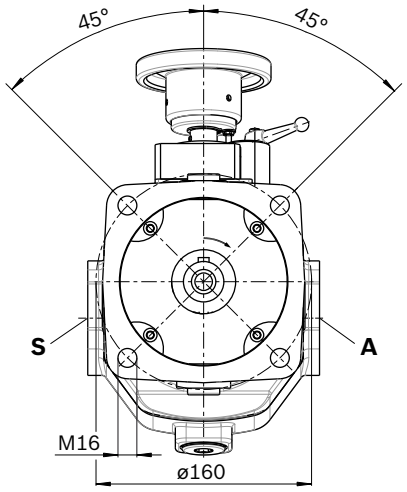
Ports		Standard[4)]	Size[2)]	p_{max} [bar][3)]		State[7)]
A	Service port	DIN 3852	M27 x 2; 16 tief	clockwise	30	O
				counter-clockwise	315	
B	Service port	DIN 3852	M27 x 2; 16 tief	clockwise	315	O
				counter-clockwise	30	
T_1	Case drain fluid	DIN 3852	M18 x 1.5; 12 tief	6		O[6)]
T_2	Case drain fluid	DIN 3852	M18 x 1.5; 12 tief	6		X[6)]
U	Bearing flushing	DIN 3852	M16 x 1.5; 12 tief	6		X
U_1, U_2	Barrier fluid	DIN 3852	M10 x 1; 8 tief	3[5)]		O
U_3, U_4	Barrier fluid	DIN 3852	M10 x 1; 8 tief	3[5)]		O

1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 24 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) The spot face can be deeper than specified in the appropriate standard.
5) The minimum case pressure must be equal to or greater than the barrier fluid pressure. The barrier fluid pressure must be equal to or greater than the external pressure on the outer shaft seal.
6) Depending on installation position, **T_1** or **T_2** must be connected (see also installation instructions page 23).
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

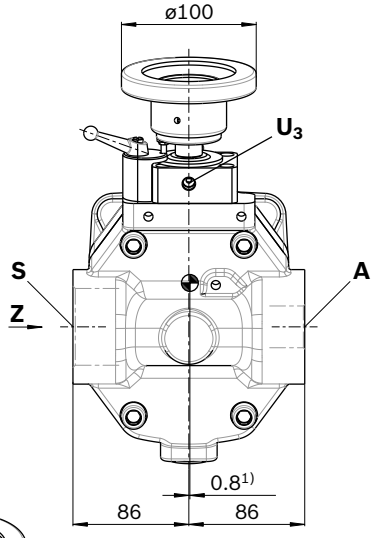
Dimensions size 55 – open design

Direction of rotation clockwise

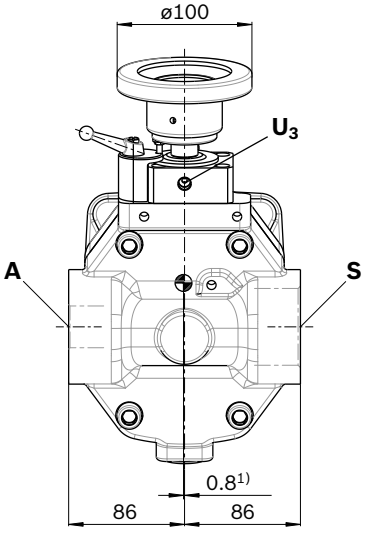




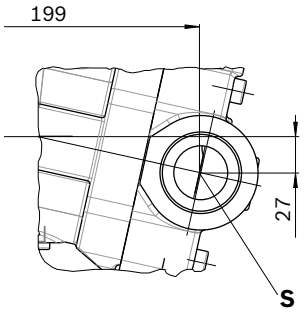
Direction of rotation counter-clockwise

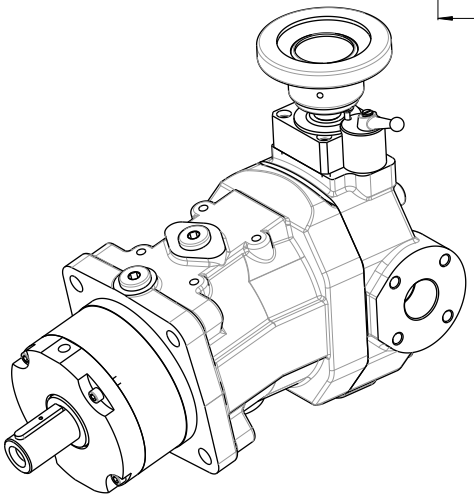


Direction of rotation clockwise



View Z

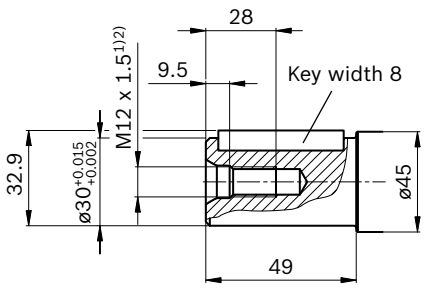




1) Center of gravity

▼ **Parallel keyed shaft DIN 6885**

P6 – AS8x7x43

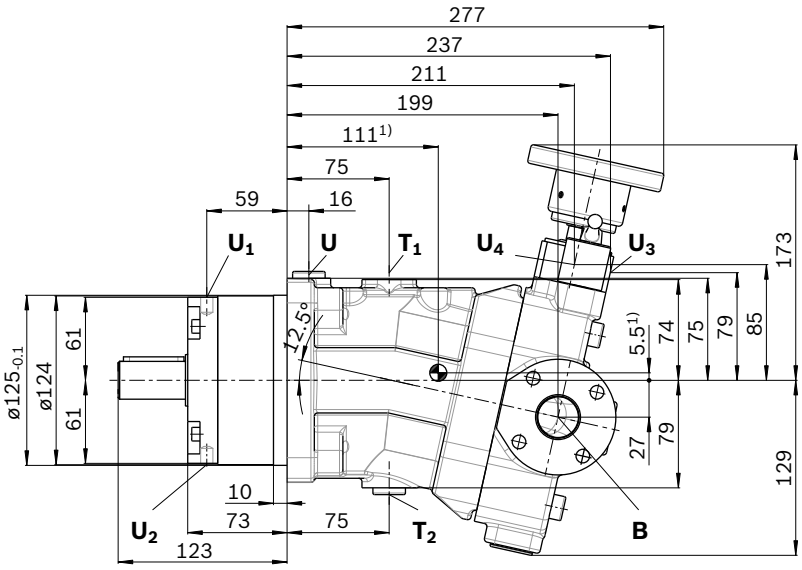


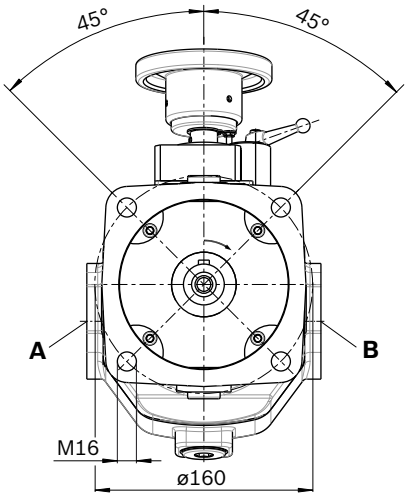
Ports		**Standard**[4)]	**Size**[2)]	**p_{max} [bar]**[3)]	**State**[6)]
A	Service port	DIN 3852	M33 x 2; 18 tief	315	O
S	Suction/filling port	DIN ISO 228	G2; 27 tief	6	O
T_1	Case drain fluid	DIN 3852	M18 x 1.5; 12 tief	6	X
T_2	Case drain fluid	DIN 3852	M18 x 1.5; 12 tief	6	X
U	Bearing flushing	DIN 3852	M18 x 1.5; 12 tief	6	X
U_1, U_2	Barrier fluid	DIN 3852	M10 x 1; 8 tief	3[5)]	O
U_3, U_4	Barrier fluid	DIN 3852	M10 x 1; 8 tief	3[5)]	O

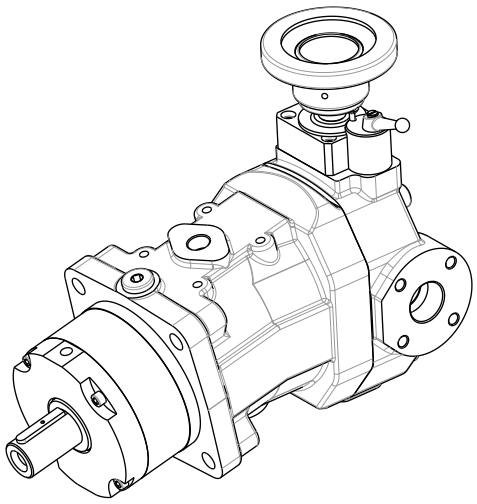
1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 24 for the maximum tightening torques.
3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) The spot face can be deeper than specified in the appropriate standard.
5) The minimum case pressure must be equal to or greater than the barrier fluid pressure. The barrier fluid pressure must be equal to or greater than the external pressure on the outer shaft seal.
6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

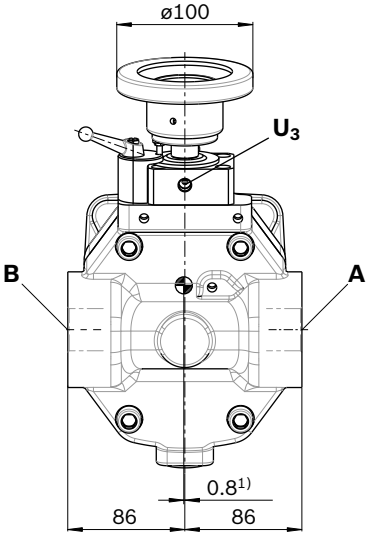
Dimensions size 55 – closed design

Direction of rotation clockwise and counter-clockwise identical dimensions





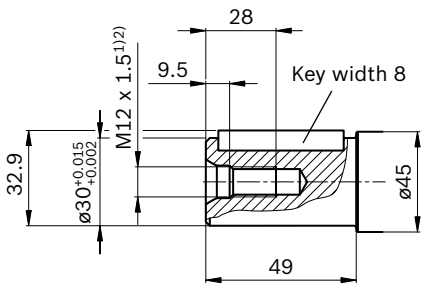




1) Center of gravity

▼ **Parallel keyed shaft DIN 6885**

P6 – AS8x7x43

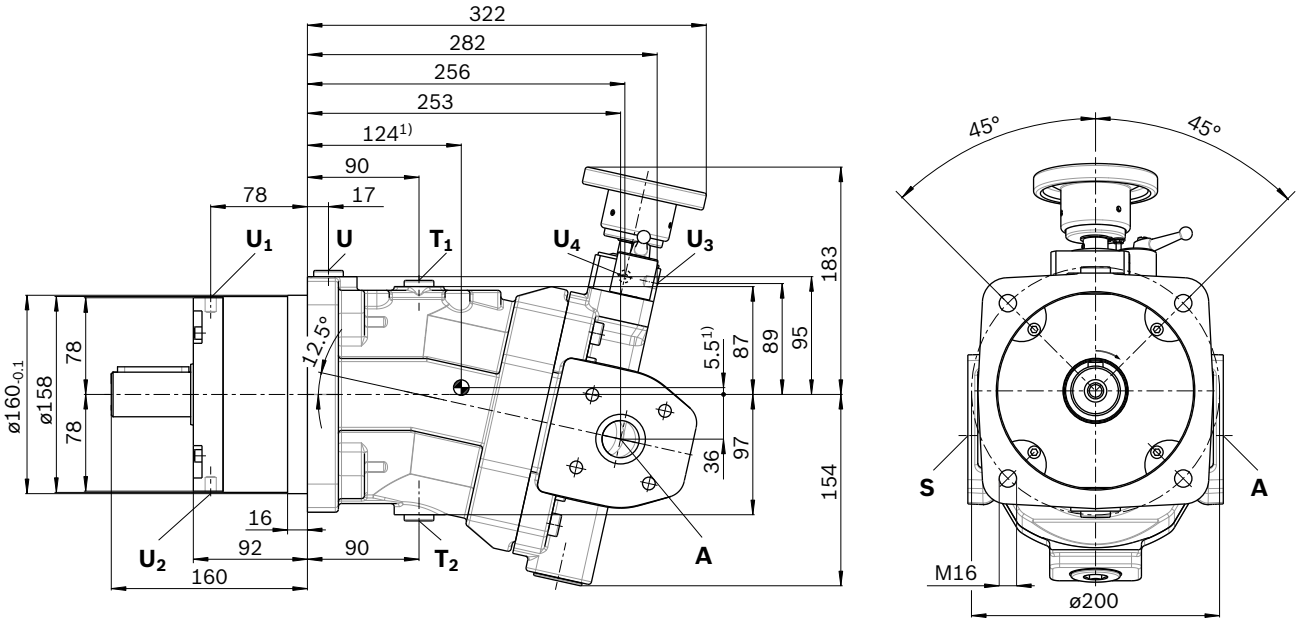


Ports		Standard[4)]	Size[2)]	p_{max} [bar][3)]		State[7)]
A	Service port	DIN 3852	M33 x 2; 18 tief	clockwise	30	O
				counter-clockwise	315	
B	Service port	DIN 3852	M33 x 2; 18 tief	clockwise	315	O
				counter-clockwise	30	
T_1	Case drain fluid	DIN 3852	M18 x 1.5; 12 tief	6		O[6)]
T_2	Case drain fluid	DIN 3852	M18 x 1.5; 12 tief	6		X[6)]
U	Bearing flushing	DIN 3852	M18 x 1.5; 12 tief	6		X
U_1, U_2	Barrier fluid	DIN 3852	M10 x 1; 8 tief	3[5)]		O
U_3, U_4	Barrier fluid	DIN 3852	M10 x 1; 8 tief	3[5)]		O

1) Center bore according to DIN 332 (thread according to DIN 13)
2) Observe the general instructions on page 24 for the maximum tightening torques.
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4) The spot face can be deeper than specified in the appropriate standard.
5) The minimum case pressure must be equal to or greater than the barrier fluid pressure. The barrier fluid pressure must be equal to or greater than the external pressure on the outer shaft seal.
6) Depending on installation position, **T_1** or **T_2** must be connected (see also installation instructions page 23).
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 107 – open design

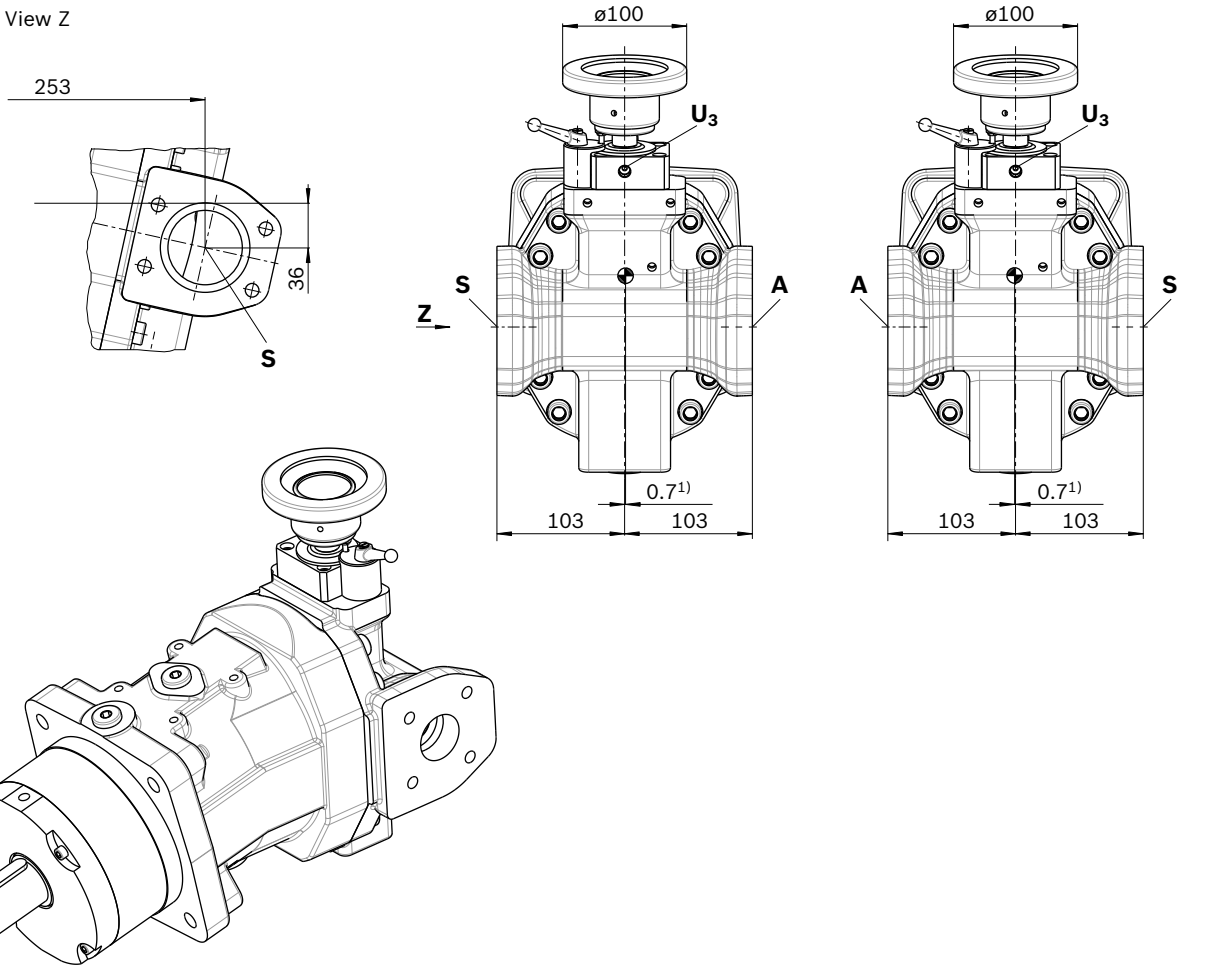
Direction of rotation clockwise

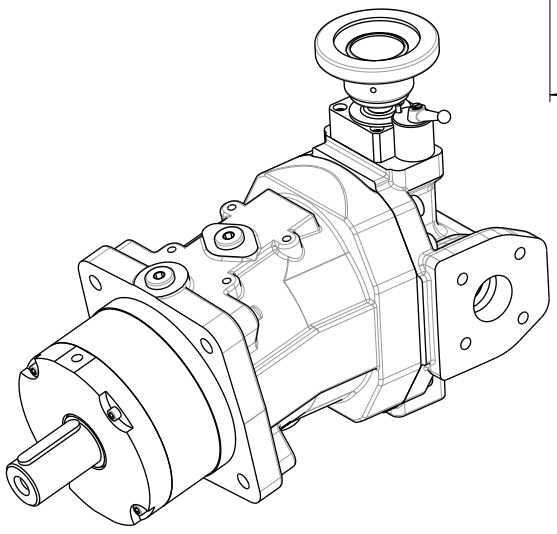


Direction of rotation counter-clockwise

Direction of rotation clockwise

View Z

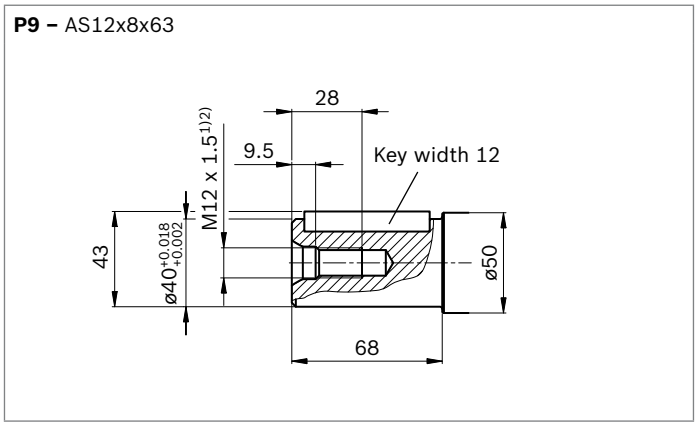




1) Center of gravity

▼ **Parallel keyed shaft DIN 6885**

P9 – AS12x8x63

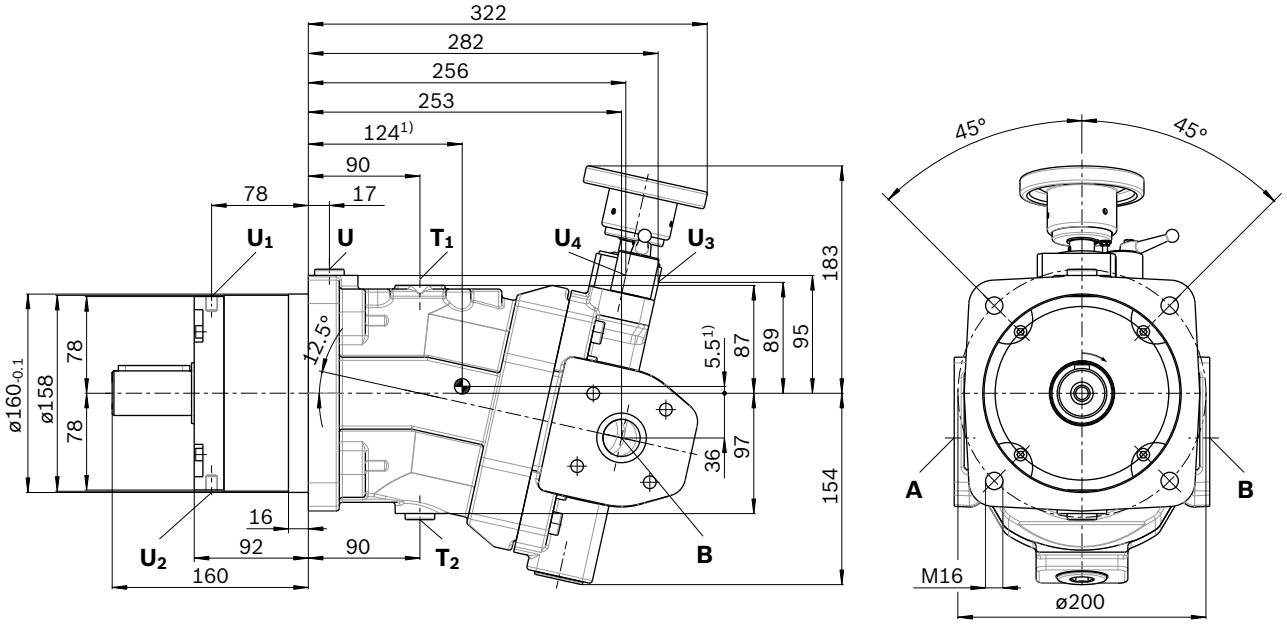


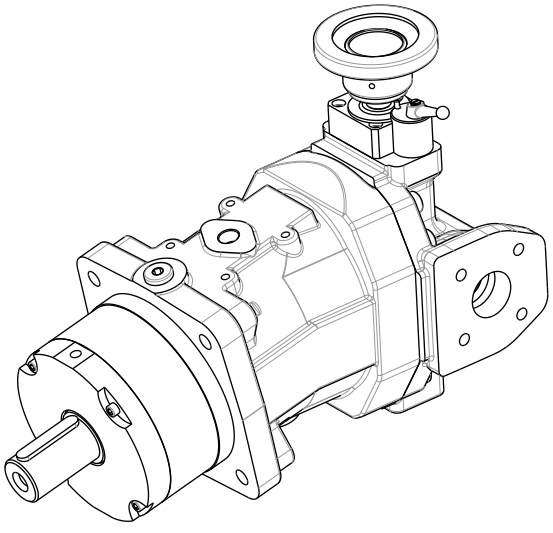
Ports		Standard[4)]	Size[2)]	p_{max} [bar][3)]	State[6)]
A	Service port	DIN 3852	M42 x 2; 20 tief	315	O
S	Suction/filling port	DIN ISO 228	G2 1/2; 30 tief	6	O
T_1	Case drain fluid	DIN 3852	M18 x 1.5; 12 tief	6	X
T_2	Case drain fluid	DIN 3852	M18 x 1.5; 12 tief	6	X
U	Bearing flushing	DIN 3852	M18 x 1.5; 12 tief	6	X
U_1, U_2	Barrier fluid	DIN 3852	M10 x 1; 8 tief	3[5)]	O
U_3, U_4	Barrier fluid	DIN 3852	M10 x 1; 8 tief	3[5)]	O

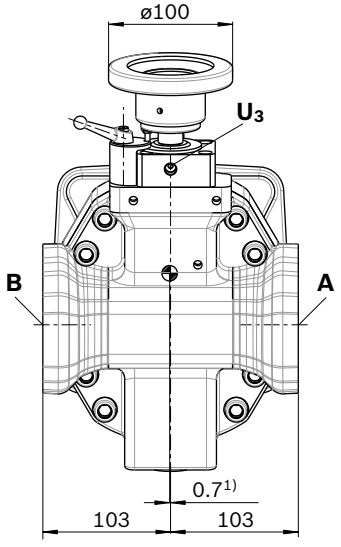
1) Center bore according to DIN 332 (thread according to DIN 13)
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3) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.
4) The spot face can be deeper than specified in the appropriate standard.
5) The minimum case pressure must be equal to or greater than the barrier fluid pressure. The barrier fluid pressure must be equal to or greater than the external pressure on the outer shaft seal.
6) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

Dimensions size 107 – closed design

Direction of rotation clockwise and counter-clockwise identical dimensions



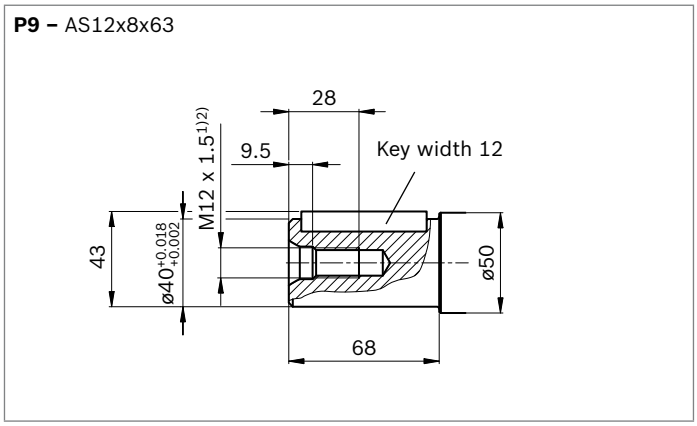




1) Center of gravity

▼ **Parallel keyed shaft DIN 6885**

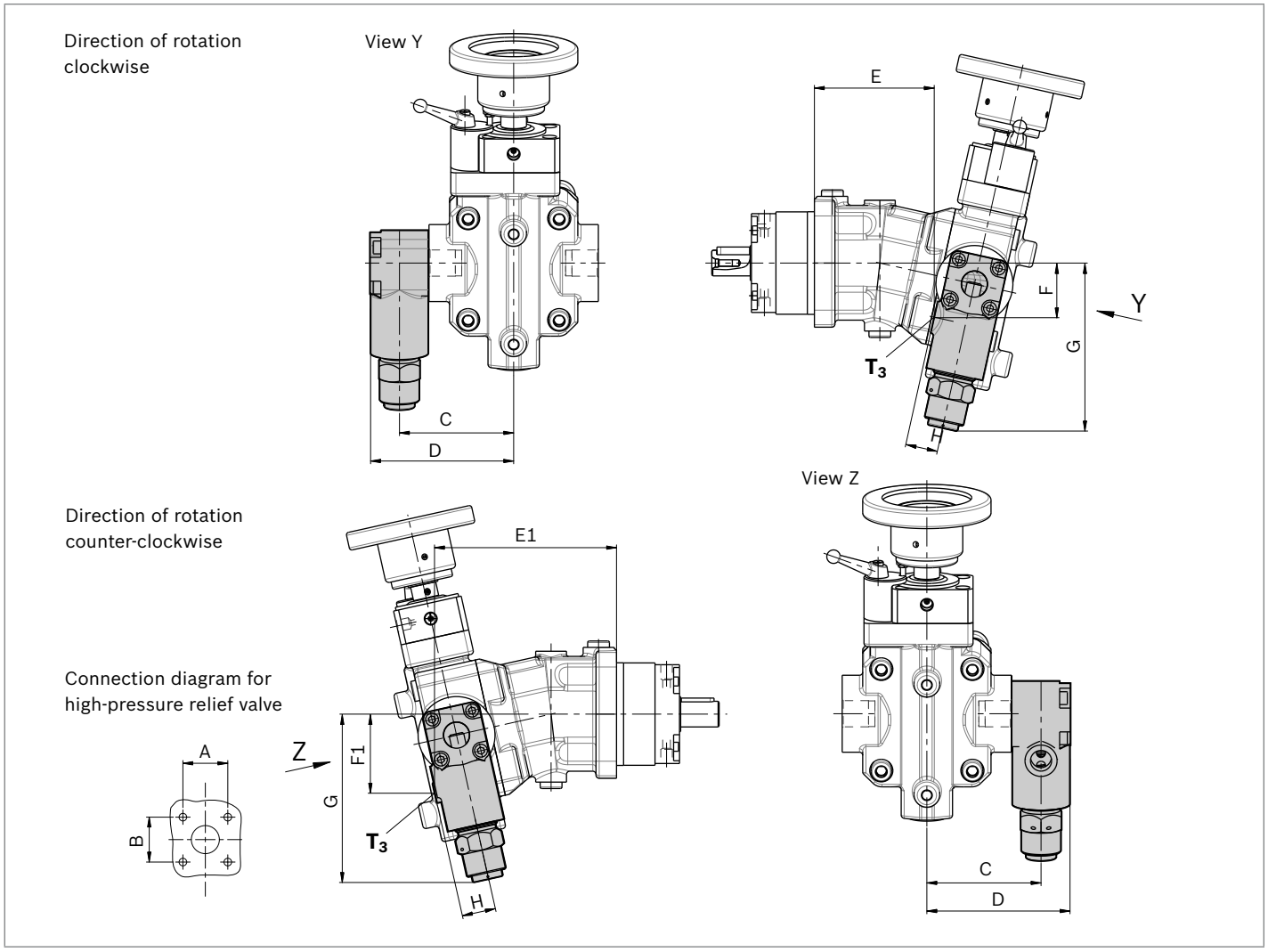
P9 – AS12x8x63



Ports		**Standard**[4)]	**Size**[2)]	**p_{max} [bar]**[3)]		**State**[7)]
A	Service port	DIN 3852	M42 x 2; 20 tief	clockwise	30	O
				counter-clockwise	315	
B	Service port	DIN 3852	M42 x 2; 20 tief	clockwise	315	O
				counter-clockwise	30	
T_1	Case drain fluid	DIN 3852	M18 x 1.5; 12 tief	6		O[6)]
T_2	Case drain fluid	DIN 3852	M18 x 1.5; 12 tief	6		X[6)]
U	Bearing flushing	DIN 3852	M18 x 1.5; 12 tief	6		X
U_1, U_2	Barrier fluid	DIN 3852	M10 x 1; 8 tief	3[5)]		O
U_3, U_4	Barrier fluid	DIN 3852	M10 x 1; 8 tief	3[5)]		O

1) Center bore according to DIN 332 (thread according to DIN 13)
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6) Depending on installation position, **T_1** or **T_2** must be connected (see also installation instructions page 23).
7) O = Must be connected (plugged on delivery)
X = Plugged (in normal operation)

High-pressure relief valve direct operated



NG	A[2)]	B[2)]	C	D	E	E1	F	F1	G	H	Service line port A, B[1)]	Return port T_3[1)]
12	32	32	89	112	93.5	142	42	53	131	25	M22 x 1.5	M18 x 1.5
28	40	40	107.5	132.5	127.5	181	54	67	143	26	M27 x 2	M22 x 1.5
55	48	48	114	142	157	221	65	79	162	31.5	M33 x 2	M27 x 2
107	60	60	135.5	168	208	272	86	100	206	38.5	M42 x 2	M33 x 2

Differential pressure setting

The following values are available for selection of the differential pressure setting (fixed setting):
Preferred values [bar]: 100, 150, 200, 230, 250
If not specified in the order, valves will be set to the differential pressure Δp = 250 bar.

Mounting

Mounting of the high-pressure relief valve depends on the direction of rotation.
With the closed design, the PRV is always mounted at pressure port **A**. As described, the position of port **A** depends here on the direction of rotation.
In the closed design, the PRV is mounted at pressure port **B** (viewed on drive shaft – right side) for clockwise rotation. For counter-clockwise rotation, it is mounted at pressure port **A** (viewed on drive shaft – left side).

1) DIN 3852, observe the general instructions on page 24 for the maximum tightening torques.

2) Fixing thread according to DIN 13; observe the general instructions on page 24 for the maximum tightening torques.

Installation instructions

General

During commissioning and operation, the axial piston unit must be filled with hydraulic fluid and air bled. The barrier liquid chambers must be filled with suitable barrier liquid. This must also observed following a relatively long stand-still as the axial piston unit may drain back to the reservoir via the hydraulic lines.
To achieve favorable noise values, decouple all connecting lines using elastic elements.
In all operating conditions, the suction and case drain lines must flow into the reservoir below the minimum fluid level.

Closed design

The case drain fluid in the pump housing must be directed to the reservoir via the highest available drain port (**T_1**, **T_2**).

Open design

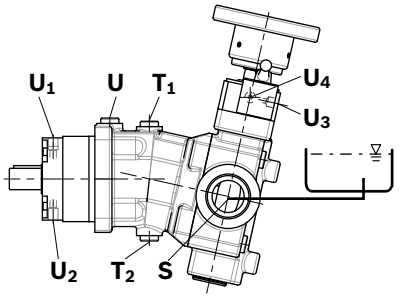
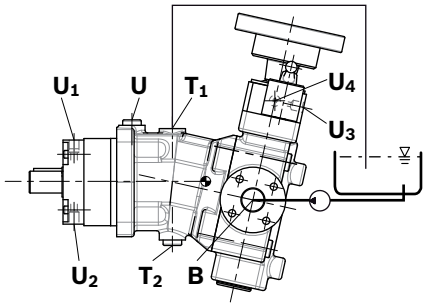
The housing is internally connected to the suction chamber. A case drain line between the housing and reservoir is not required.

Note

For monitoring the shaft seals for zero leakage, we recommend connecting a barrier fluid monitor at ports **U_1** to **U_4**.

Installation position

A standard installation shows the drive shaft in a horizontal position. Further installation positions are available upon request.

Installation position	Air bleed	Filling
1 Open design	**T_1**	**S**
		
2 Closed design	**T_1**	**T_1**
		

Key	
B	Service line port
S	Suction/filling port
T_1/**T_2**	Filling/air bleeding case drain port
U_1 bis **U_4**	Barrier fluid port
U	Bearing flushing

General instructions

- The pump A7VK is designed for pumping polyurethane components in open and closed design.
- The project planning, installation and commissioning of the axial piston unit requires the involvement of qualified personnel.
- Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, these can be requested from Bosch Rexroth.
- During and shortly after operation, there is a risk of burns on the axial piston unit and pressure relief valve on the service line port. Take appropriate safety measures (e.g. by wearing protective clothing).
- Service line ports
  - The ports and fastening threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified operating conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
  - The service line ports and function ports are only designed to accommodate hydraulic lines.
- The data and notes contained herein must be adhered to.
- Before finalizing your design, request a binding installation drawing.
- Not all versions of the product are approved for use in a safety function pursuant to ISO 13849. If you require characteristic values relating to reliability (e.g. MTTFd) for functional safety, please consult the responsible contact person at Bosch Rexroth.
- A pressure relief valve is to be fitted in the hydraulic system.
- The following tightening torques apply:
  - **Fittings:** Observe the manufacturer's instructions regarding the tightening torques of the fittings used.
  - **Mounting bolts:** For mounting bolts with metric ISO thread according to DIN 13, we recommend checking the tightening torque in individual cases in accordance with VDI 2230.
  - **Female threads in the axial piston unit:** The maximum permissible tightening torques $M_{G\,max}$ are maximum values of the female threads and must not be exceeded. For values, see the following table.
  - **Threaded plugs:** For the metallic threaded plugs supplied with the axial piston unit, the required tightening torques of threaded plugs M_V apply. For values, see the following table.

Ports **Standard**	**Thread size**	**Maximum permissible tightening torque of the female threads $M_{G\,max}$**	**Required tightening torque of the threaded plugs M_V**	**WAF hexagon socket of the threaded plugs**
DIN 3852[1)]	M10 x 1	30 Nm	15 Nm[2)]	5 mm
	M12 x 1.5	50 Nm	25 Nm[2)]	6 mm
	M16 x 1.5	100 Nm	50 Nm	8 mm
	M18 x 1.5	140 Nm	60 Nm	8 mm
	M22 x 1.5	210 Nm	80 Nm	10 mm
	M27 x 2	330 Nm	135 Nm	12 mm
	M33 x 2	540 Nm	225 Nm	17 mm
	M42 x 2	720 Nm	360 Nm	22 mm
DIN ISO 228	G1 1/4	720 Nm	–	–
	G1 1/2	960 Nm	–	–
	G2	1200 Nm	–	–
	G2 1/2	2000 Nm	–	–

1) The tightening torques apply for screws in the "dry" state as received on delivery and in the "lightly oiled" state for installation.

2) In the "lightly oiled" state, the M_V is reduced to 10 Nm for M10 x 1 and to 17 Nm for M12 x 1.5.

Bosch Rexroth AG
Mobile Applications
Glockeraustraße 4
89275 Elchingen, Germany
Tel. +49 7308 82-0
info.ma@boschrexroth.de
www.boschrexroth.com

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Rexroth
Bosch Group

Axial piston variable pump A7VO

RE 92203/06.09 **1**/52
Replaces: 05.99

Data sheet



Series 63
Sizes NG250 to 500
Nominal pressure 350 bar
Peak pressure 400 bar
Open circuit

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Features

- Variable axial piston pump with tapered piston rotary group in bent axis design for hydrostatic drives in open circuits
- For operation in mobile and industrial applications
- The flow is proportional to the drive speed and the displacement and steplessly variable from $q_{v\,max}$ to $q_{v\,min} = 0$
- Wide range of controls and adjustment devices
- Compact, robust bearing system for long service life
- Available with Long Life bearings for special fluids and extreme service life requirements
- Pressure control is standard
- Optical or electric swivel angle indicator available

Type code for standard program

	A7V		O			/	63		–	V				
01	02	03	04	05	06		07	08		09	10	11	12	13

		250	355	500	
	Fluid / Version				
01	Mineral oil and HFD. HFD only in conjunction with Long-Life-Lagerung „L“ (no code)	●	●	●	
	For operation on HFC, special high performance version A4VSO...F see RE 92053	●	●	–	
	High-Speed-Version (only mineral oil)	●	–	–	**H** [1]
	Axial piston unit				
02	Bent axis design, variable, nominal pressure 350 bar, peak pressure 400 bar				**A7V**
	Drive shaft bearings	**250**	**355**	**500**	
03	Mechanical bearings (no code)	●	●	●	
	Long-Life-bearings	●	●	●	**L**
	Type of operation				
04	Pump, open circuit				**O**
	Size				
05	Displacement $V_{g\,max}$ [cm³]	**250**	**355**	**500**	
	NG28 to160 see RE 92202				
	Control devices	**250**	**355**	**500**	
06	Pressure control	●	●	●	**DR**
	Pressure control, remotely adjustable	●	●	●	**DRG**
	Power control				
	with integrated pressure control (fixed setting)	●	●	●	**LRD**
	hydraulic stroke limiter initial position $V_{g\,max}$ Δp = 10 bar	●	●	●	**LRDH1**
	Δp = 25 bar	●	●	●	**LRDH2**
	Δp = 35 bar	●	●	●	**LRDH3**
	hydraulic stroke limiter initial position $V_{g\,min}$ Δp = 10 bar	●	●	●	**LRDN1**
	Δp = 25 bar	●	●	●	**LRDN2**
	Δp = 35 bar	●	●	●	**LRDN3**
	with pressure control remotely adjustable	●	●	●	**LRG**
	hydraulic stroke limiter initial position $V_{g\,max}$ Δp = 10 bar	●	●	●	**LRGH1**
	Δp = 25 bar	●	●	●	**LRGH2**
	Δp = 35 bar	●	●	●	**LRGH3**
	hydraulic stroke limiter initial position $V_{g\,min}$ Δp = 10 bar	●	●	●	**LRGN1**
	Δp = 25 bar	●	●	●	**LRGN2**
	Δp = 35 bar	●	●	●	**LRGN3**
	Hydraulic control, pilot pressure dependent,				
	with integrated pressure control (fixed setting) Δp = 10 bar	●	●	●	**HD1D**
	Δp = 25 bar	●	●	●	**HD2D**
	Δp = 35 bar	●	●	●	**HD3D**
	with pressure control, remotely adjustable Δp = 10 bar	●	●	●	**HD1G**
	Δp = 25 bar	●	●	●	**HD2G**
	Δp = 35 bar	●	●	●	**HD3G**
	Hydraulic control, with electric proportional valve [2]				
	with integrated pressure control (fixed setting) Control voltage 12 V	●	●	●	**EP1D**
	Control voltage 24 V	●	●	●	**EP2D**
	with pressure control, remotely adjustable Control voltage 12 V	●	●	●	**EP1G**
	control voltage 24 V	●	●	●	**EP2G**

[1] recommended for new projects

[2] for operation on HFD-fluids please observe RE 29181 (proportional pressure reducing valve type DRE4K)

Type code for standard program

	A7V		O			/	63		–	V				
01	02	03	04	05	06		07	08		09	10	11	12	13

	Series		250	355	500	
07	Series 6, Index 3		●	●	●	63

	Direction of rotation		250	355	500	
08	with view on drive shaft	clockwise	●	●	●	R
		counter clockwise	●	●	●	L

	Seals		250	355	500	
09	FKM (Fluoro-rubber)		●	●	●	V

	Drive shaft		250	355	500	
10	Splined shaft to DIN 5480		●	●	●	Z
	Keyed parallel shaft to DIN 6885		●	●	●	P

	Mounting flange		250	355	500	
11	Similar to ISO 3019-2	4-hole	●	–	–	B
		8-hole	–	●	●	H

	Service line connections	250	355	500	
12	SAE-flanged port B or A, at rear (metric fixing bolts) SAE flanged port S, at rear(metric fixing bolts)	●	●	●	01
	SAE- flanged ports B or A, on opposite side (metric fixing bolts) SAE- flanged port S, on opposite side (metric fixing bolts)	●	●	●	02

	Swivel angle indicator	250	355	500	
13	Without swivel angle indicator (no code)	●	●	●	
	With optical swivel angle indicator	●	●	●	V
	With electric swivel angle indicator	●	●	●	E

Note

Exact value for $V_{g\,min}$ and $V_{g\,max}$ (displacement) must be stated in clear text when ordering ($V_{g\,min}$ .....cm³/rev., $V_{g\,max}$ .....cm³/rev.)
Setting range $V_{g\,min}$: 0 to 0.2 • $V_{g\,max}$
$V_{g\,max}$: $V_{g\,max}$ down to 0.8 • $V_{g\,max}$

● = Available – = Not available ▭ = Preferred program

Technical data

Hydraulic fluid

For extensive information on the selection of hydraulic fluids and application conditions please consult our data sheets RE 90220 (mineral oils), RE 90221 (ecologically acceptable fluids) and RE 90223 (HF-fluids).

The variable pump A7VO is not suitable for operation on HFA fluids. When operating on HFD or ecologically acceptable fluids, limitations to the technical data and seals according to RE 90223 and RE 90221 must be observed.

For the sizes 250 and 355 with **operation on HFC-fluids**, the **A4VSO..*F*** must be used. For certain selected HFC fluids the same pressures and speeds are permissible as for operation on mineral oil. See RE 92053.

When ordering, state the fluid to be used in clear text.

Operating viscosity range

In order to obtain optimum efficiency and service life, we recommend that the operating viscosity (at operating temperature) be selected in the range

ν_{opt} = opt. viscosity range 16...36 mm²/s

referred to tank temperature (open circuit).

Limit of viscosity range

For critical operating conditions the following values apply:

ν_{min} = 10 mm²/s
for short periods (t < 3 min)
at max. permissible case drain temperature
t_{max} = +90°C.

ν_{max} = 1000 mm²/s
for short periods (on cold start maximum operating viscosity of 100 mm²/s should be reached within 15 min)
t_{min} = −25°C

Note, that the maximum fluid temperature of 90°C may not be exceeded at any point (e.g. around the bearings). The fluid temperature in the bearing area is influenced by drive speed and pressure, and is typically 12 K higher than the average case drain temperature.

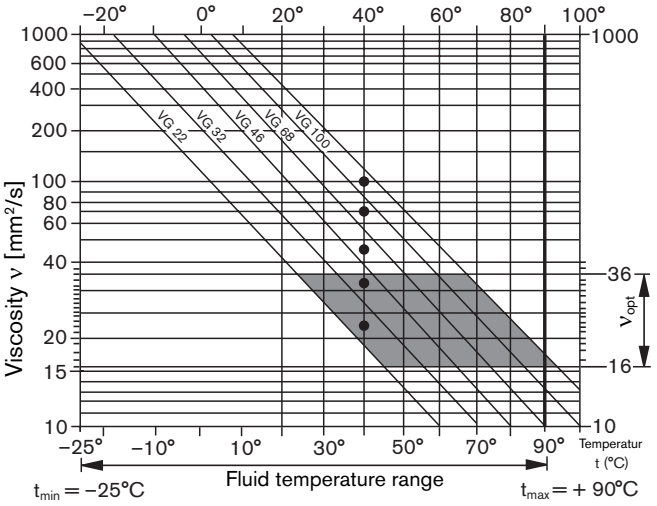
Temperature range

(see selection diagram)

t_{min} = −25°C
t_{max} = +90°C

For detailed information on operation with low temperatures see RE 90300-03-B.

Selection diagram



Notes on the selection of hydraulic fluids

In order to select the correct fluid, it is necessary to know the operating temperature in the tank (open circuit) in relation to the ambient temperature.

The hydraulic fluid should be selected so that within the operating temperature range, the viscosity lies within the optimum range (ν_{opt}) see shaded section in the selection diagram. We recommend, that the higher viscosity grade is selected in each case.

Example: at an ambient temperature of X° C the operating temperature in the tank is 60° C. In the optimum viscosity range (ν_{opt} ; shaded area), this corresponds to grades VG 46 or VG 68; select: VG 68.

Important:
The case drain temperature is influenced by pressure and speed and is always higher than the tank temperature. However the max. temperature at any point in the system may not exceed 90° C.

If the above conditions cannot be met, due to extreme operating parameters we recommend a housing flushing via port U.

Filtration

The finer the filtration, the better the achieved cleanliness of the fluid and the longer the life of the axial piston pump.

To ensure a reliable functioning of the axial piston unit, a minimum cleanliness class of

20/18/15 acc. to ISO 4406 is necessary.

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Technical data

Operating pressure range

Depending on the operating fluid, limitations may apply, see the chapter on hydraulic fluids, page 4.

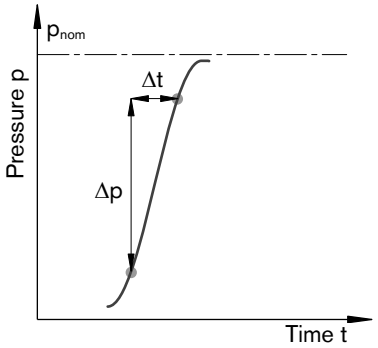
Pressure at the outlet ports (pressure ports) A or B

Nominal pressure p_{nom} 350 bar absolute

Peak pressure p_{max} 400 bar absolute
Total operating period 300 h
Individual operating period 1 s

Minimum pressure (in pump outlet) 10 bar
For a lower pressure, please consult us.

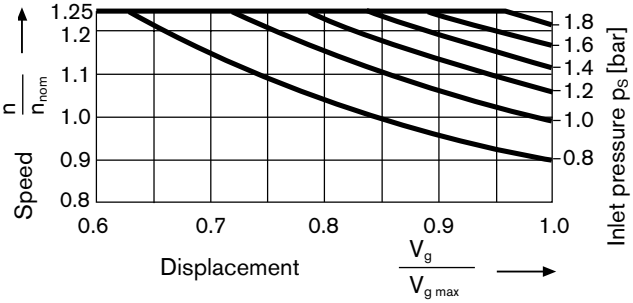
Rate of pressure change R_A 16000 bar/s



Under pulsating load conditions above 315 bar we recommend the use of a splined shaft (to DIN 5480).

Pressure at the inlet port S (Suction)
Minimum inlet pressure $p_{S\,min}$ 0.8 bar absolute
Maximum inlet pressure $p_{S\,max}$ 8 bar absolute

Minimum inlet pressure
In order to avoid damage to the axial piston pump a certain minimum inlet pressure at the pump's suction port S is necessary This minimum inlet pressure is dependent on the drive speed and the displacement of the axial piston unit.



Note
- Maximum speed n_{max} (Speed limit, see table of values, page 8)
- Minimum and maximum pressure at port S
- Permissible values for the shaft seal (see diagram on page 7)

An increase in inlet pressure results in a higher control begin of the **LR**-control curve as well as a rise of the LR.**H**- and LR.**N**-pilot pressure characteristics.
Factory setting of the control begin is done at an inlet pressure $p_{S.}$=1 bar absolute.
Exact details of the shifts in the control curves on request.

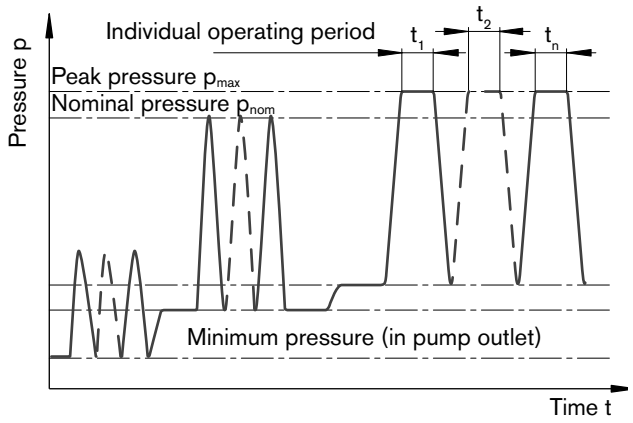
Definition

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

Peak pressure p_{max}
The peak pressure corresponds to the maximum pressure within the individual operating period. The total of the individual operating periods must not exceed the total operating period.

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

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



Total operating period = $t_1 + t_2 + ... + t_n$

Direction of flow

Direction of rotation, with view on shaft end	
clockwise	counter clockwise
S to **B**	**S** to **A**

Technical data

Long-Life-Bearings (L)

For long service life requirements and when using HFD-fluids. Identical external dimensions as units with standard bearings. A retroactive conversion to Long-Life Bearings is possible. It is recommended, that the bearings and housing be flushed via port U.

Bearing flushing

Flushing flows (recommended)

NG	250	355	500
q_{flow} (L/min)	10	16	16

Operation in standby (in pressure control mode)

Operation in standby, without external flushing via port U is only permissible for short periods:

A7VO maximum 15 min at 200 bar
3 min at 350 bar

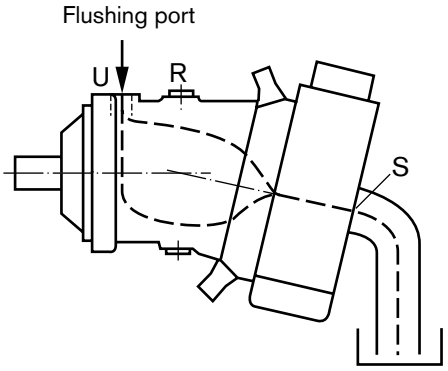
HA7VO maximum 5 min at 200 bar
1 min at 350 bar

For other pressure levels information on request

Influence of drive speed can be neglected

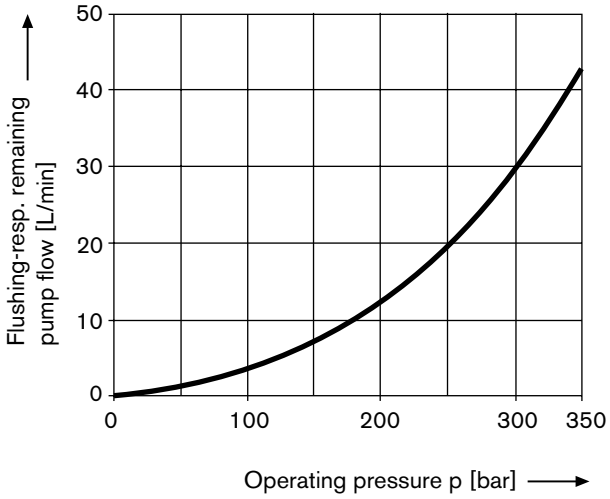
At tank temperature ≤ 50° C

For longer periods of standby operation it is necessary to implement housing flushing vie port U.



Flushing flows for A7VO same as bearing flushing

Flushing flows HA7VO (High-Speed-version)



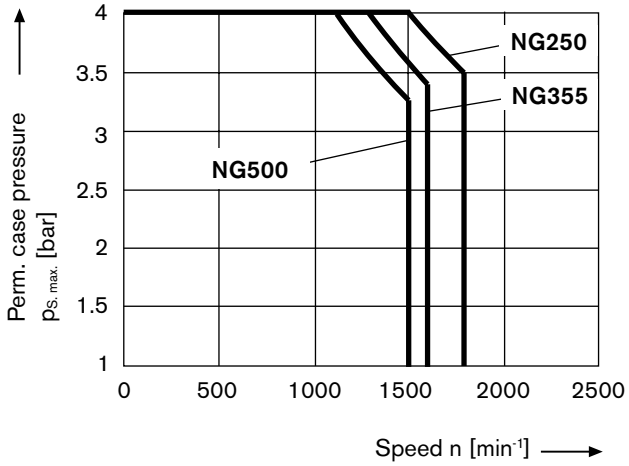
Technical data

Shaft seal FKM (Fluoro-rubber)

Permissible case pressure

The service life of the shaft seal is influenced by pump drive speed and case pressure. It is recommended not to exceed the continuous averaged case pressure of 3 bar abs. (max. perm. case pressure 4 bar abs. at reduced speed, see diagram).

The case pressure must be equal to or higher than the external pressure on the shaft seal (in case of the standard version). For the High-Speed-version please consult us.



Special operating conditions may make it necessary to restrict these values .

Important:

- maximum permissible drive speed of variable pump (see table of values, page 8)
- max. permissible case pressure $p_{S\,max}$ ——— 4 bar
- an increase in case pressure results in a higher control begin of the **HD**- and **DR**- controls.

  Exact details of the shift in control characteristics on request.

  Factory setting of the control begin at $p_S = 1$ bar.

Temperature range

The FKM shaft seal is suitable for case temperatures of -25° C to +90°C.

Technical data

Table of values (theoretical values, without considering η_{mh} and η_v; values rounded off)

Size			NG	250		355	500
		High-Speed-Version			250H		
Displacement		$V_{g\,max}$ [1]	cm^3	250	250	355	500
		$V_{g\,min}$ [1]	cm^3	0	0	0	0
Speed maximum [2][4]	at $V_{g\,max}$	n_{nom}	rpm	1500	1800	1320	1200
Speed maximum [3][4]	at $V_g \leq V_{g\,max}$	n_{max}	rpm	1800	–	1600	1500
Maximum flow [4]	at n_{nom} ($V_{g\,max}$)	$q_{v\,max\,nom}$	L /min	375	450	469	600
Maximum power [4]	at $q_{v\,nom}$ and $\Delta p = 350$ bar	P_{nom}	kW	219	262	273	350
Torque [4]	at $V_{g\,max}$ and $\Delta p = 350$ bar (continuous operation)	T_{max}	Nm	1391	1391	1978	2785
Rotary stiffness	$V_{g\,max}$ to 0.5 • $V_{g\,max}$	c_{min}	Nm/rad	59500	59500	74800	115000
	0.5 • $V_{g\,max}$ to $0_{(interpolated)}$	c_{max}	Nm/rad	181000	181000	262000	391000
Moment of inertia rotary group		J_{TW}	kgm^2	0.061	0.061	0.102	0.178
Angular acceleration maximum		α	rad/s^2	10000	10000	8300	5500
Case volume		V	L	3	3	5	7
Weight approx.		m	kg	102	102	173	234

[1] Standard setting for limitation of the swivel angle. If another setting is required, please state in clear text.
Setting range $V_{g\,max}$: $V_{g\,max}$ to 0.8 • $V_{g\,max}$
$V_{g\,min}$: 0 to 0.2 • $V_{g\,max}$

[2] Nominal speed in self priming operation with an absolute pressure (p_S) of 1 bar at inlet port S and mineral oil with a density of 0,88 kg/L

[3] The values apply for $V_g \leq V_{g\,max}$ or an increase in inlet pressure p_S at the inlet port S (see diagram page 5)

[4] Depending on the type of fluid, restrictions may be necessary, see chapter hydraulic fluids page 4

Important
Exceeding the maximum or falling below the minimum permissible values can lead to a loss of function, a reduction in operational service life or total destruction of the axial piston unit. More details on limiting values for speed fluctuations, reduction in angular acceleration dependent on the frequency and the permissible starting angular acceleration (below the maximum angular acceleration) can be found in data sheet RE 90261.

Determination of size

Flow $$q_V = \frac{V_g \cdot n \cdot \eta_V}{1000} \quad [L/min]$$

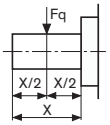
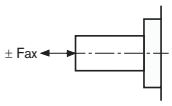
Drive torque $$T = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}} \quad [Nm]$$

Power $$P = \frac{2\pi \cdot T \cdot n}{60000} = \frac{q_V \cdot \Delta p}{600 \cdot \eta_t} \quad [kW]$$

V_g = Geometr. displacement per revolution in cm^3
Δp = Differential pressure in bar
n = Speed in rpm
η_V = Volumetric efficiency
η_{mh} = Mechanical-hydraulic efficiency
η_t = Overall efficiency ($\eta_t = \eta_V \cdot \eta_{mh}$)

Technical data

Permissible radial and axial forces on the drive shaft

Size		NG		250	355	500
Radial force, maximum [1] (at $p_{A,B}$ = 1 bar)		$F_{q\,max}$	N	1200	1500	1900
Axial force, maximum [2] (at $p_{A,B}$ = 1 bar)		$+ F_{ax\,max}$	N	4000	5000	6250
		$- F_{ax\,max}$	N	1200	1500	1900

[1] When at standstill or pressureless circulation of the axial piston unit. Under pressurized condition higher forces are permissible, please consult us

[2] Maximum permissible axial force at standstill or pressureless circulation of the axial piston unit

Regarding the permissible axial force, the direction of the force must be taken into consideration:

$- F_{ax\,max}$ = increase of bearing life

$+ F_{ax\,max}$ = decrease of bearing life

Influence of the radial force F_q on the bearing life

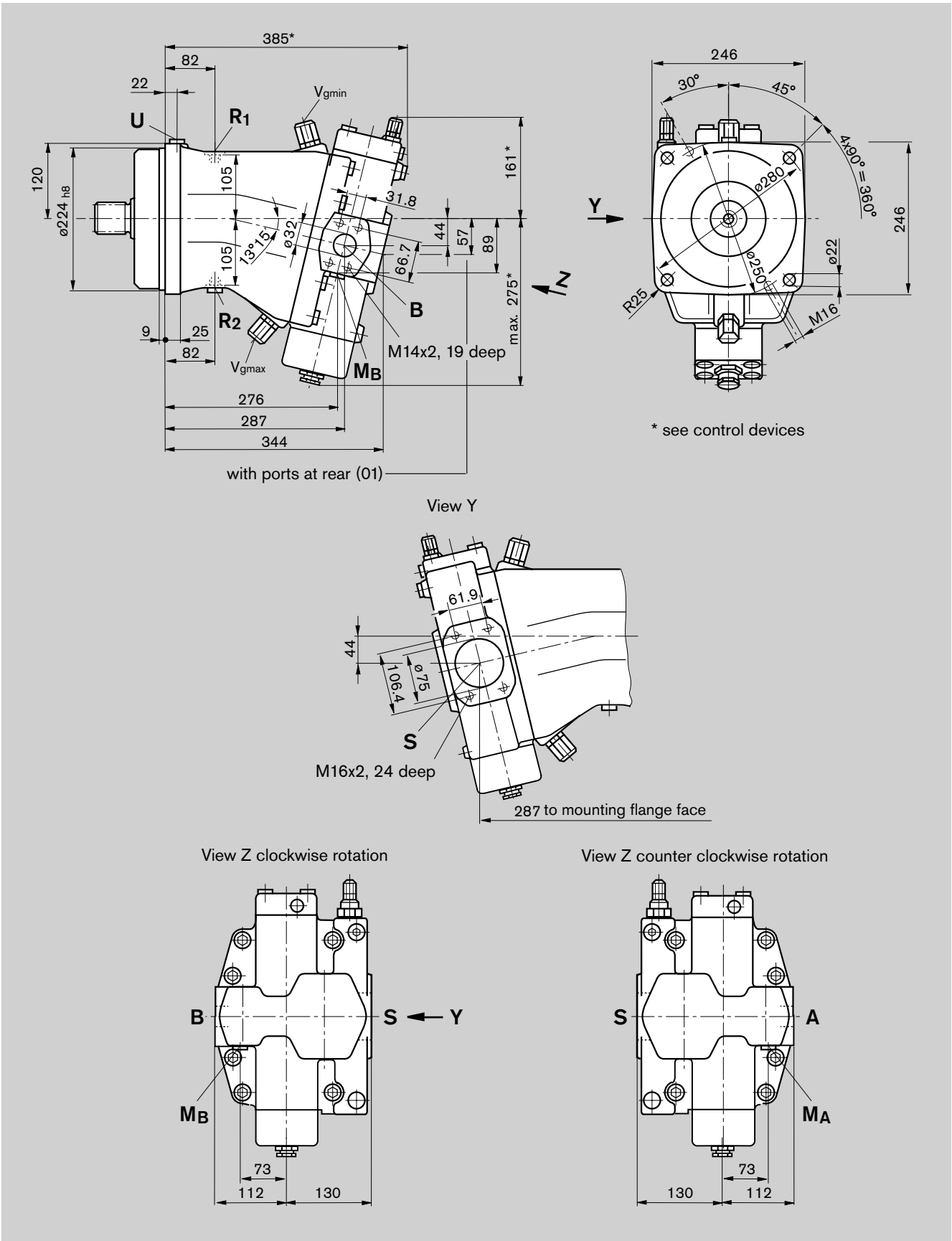
Through a favourable direction of the actuating radial force F_q,the internal load on the bearings can be compensated for and in this manner an optimum on bearing life can be obtained, please consult us.

Dimensions size 250

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

Ports A (B) and S on opposite sides (02), clockwise rotation

(without control devices)

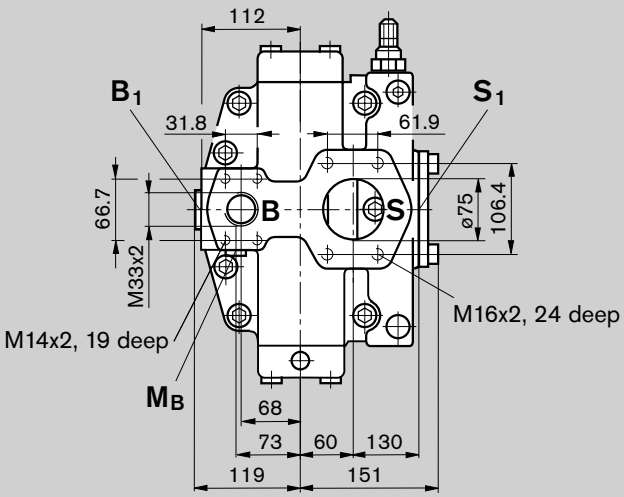


Dimensions size 250

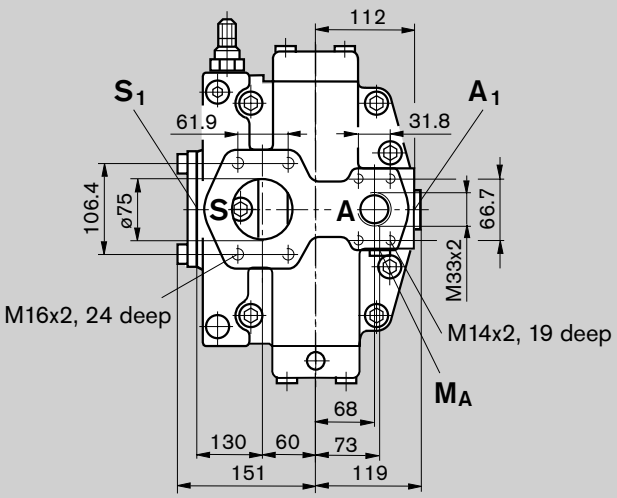
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Ports A (B) and S at rear (01)

View Z clockwise rotation

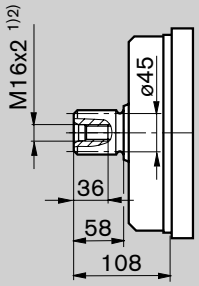


View Z counter clockwise rotation

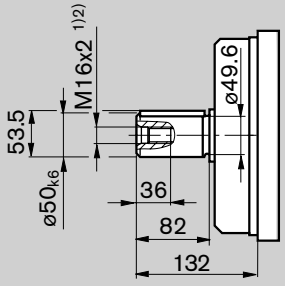


Drive shafts

Z Splined shaft DIN 5480
W50x2x24x9g



P Parallel keyed shaft
DIN 6885, AS14x9x80



1) Centering bore to DIN 332
(Thread to DIN 13)

Ports

Designation	Port for	Standard	Size[2]	Peak pressure [bar][3]	State
A, (B)	Pressure outlet (high pressure range) Fixing thread	SAE J518[4] DIN 13	1 1/4in M14x2; 19 deep	400	O
S	Suction (standard pressure range) Fixing thread	SAE J518[4] DIN 13	3 in M16x2; 24 deep	7	O
U	Flushing	DIN 3852	M14x1.5; 12 deep	3	X
R_1	Case drain	DIN 3852	M22x1.5; 14 deep	3	O
R_2	Case drain	DIN 3852	M22x1.5; 14 deep	3	X
M_A, M_B	Measuring pressure A, B	DIN 3852	M14x1.5; 12 deep	400	X

2) For the max. tightening torques the general information on page 52 must be observed

3) Depending on the application, momentary pressure spikes can occur. Take this into consideration when selecting the measuring devices and fittings.

4) Only dimensions to SAE J518

O = Must be connected (closed on delivery)

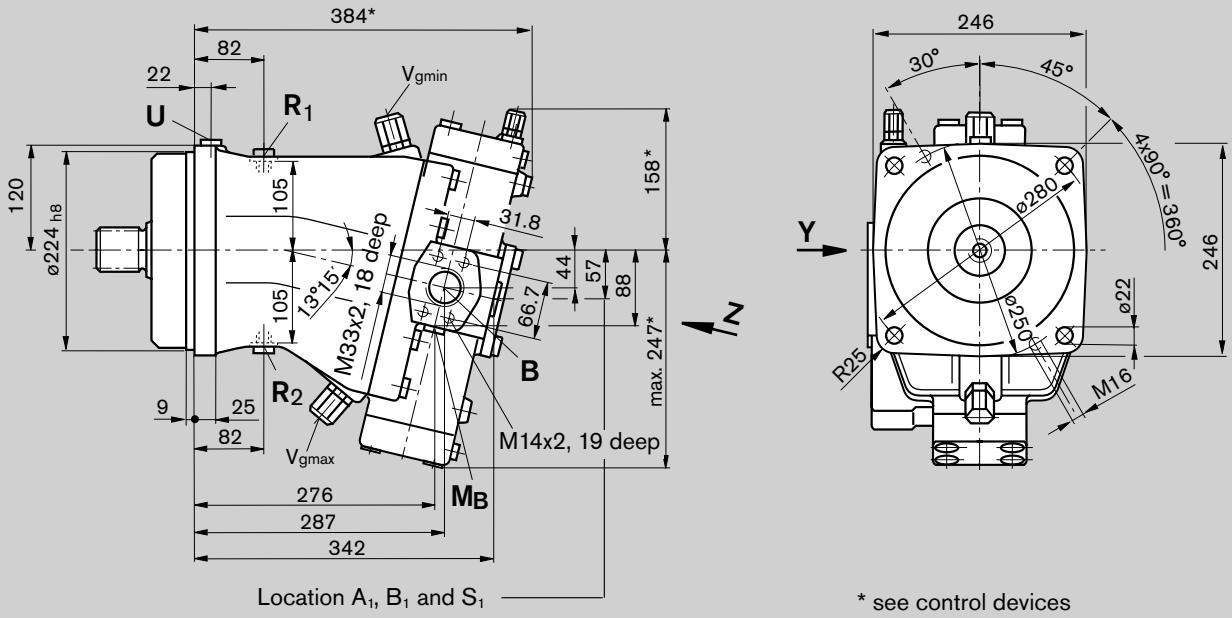
X = Plugged (in normal operation)

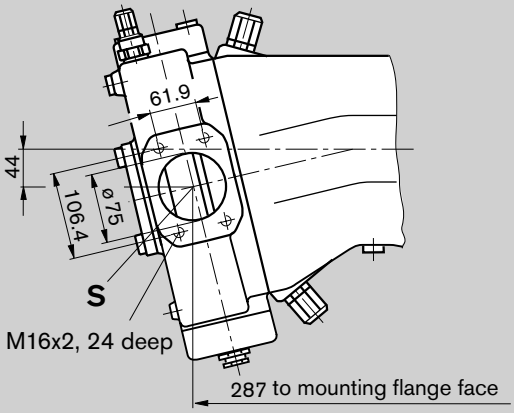
Dimensions size 250 High-Speed-Version

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

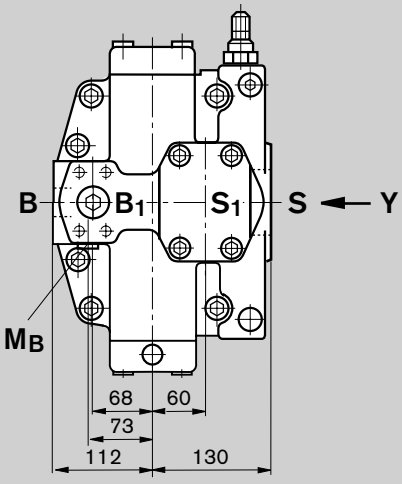
Ports A (B) and S on opposite sides (02), clockwise rotation

(without control devices)

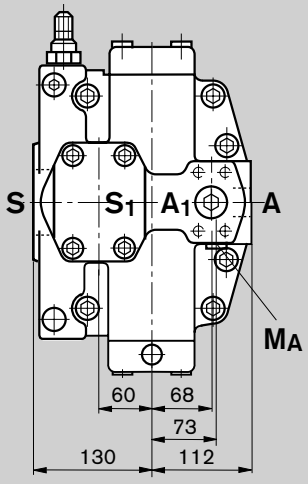




View Z clockwise rotation



View Z counter clockwise rotation

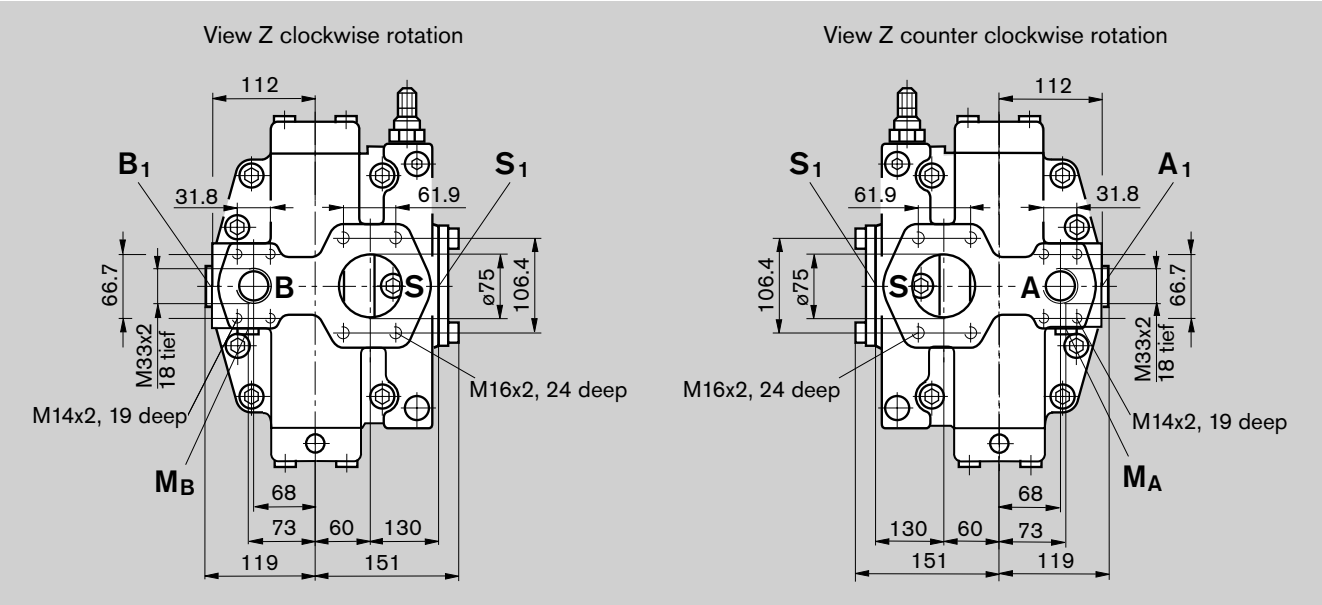


Ports A_1, B_1 and S_1 closed pressure tight with plug or flange plate, Dimensions like A, B and S

Dimensions size 250 High-Speed-Version

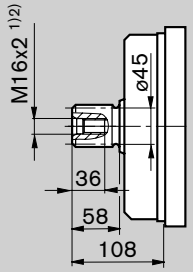
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Ports A (B) and S at rear (01)

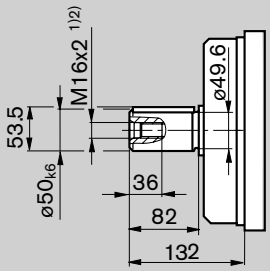


Drive shafts

Z Splined shaft DIN 5480
W50x2x24x9g



P Parellel keyed shaft
DIN 6885, AS14x9x80



1) Centering bore to DIN 332
(Thread to DIN 13)

Ports

Designation	Port for	Standard	Size[2]	Peak pressure [bar][3]	State
A, (B)	Pressure outlet (high pressure series) Fixing thread	SAE J518[4] DIN 13	1 1/4in M14x2; 19 deep	400	O
A_1, (B_1)	2. Pressure outlet (high pressure series) Fixing thread	SAE J518[4] DIN 13	1 1/4in M14x2; 19 deep	400	X [5]
S	Suction (standard pressure series) Fixing thread	SAE J518[4] DIN 13	3 in M16x2; 24 deep	3[6]	O
S_1	2. Suction (standard pressure series) Fixing thread	SAE J518[4] DIN 13	3 in M16x2; 24 deep	3[6]	X[7]
U	Flushing	DIN 3852	M14x1.5; 12 deep	3	X
R_1, R_2	Case drain	DIN 3852	M22x1.5; 14 deep	3	X[8]
M_A, M_B	Measuring outlet pressure A, B	DIN 3852	M14x1.5; 12 deep	400	X

2) For the max. tightening torques the general information on page 52 must be observed

3) Depending on the application momentary pressure spikes can occur. Take this into consideration when selecting the measuring devices and fittings.

4) Only dimensions to SAE J518

5) Closed pressure tight with plug M33x2

6) Note: suction chamber and leakage chamber are connected inside pump housing, observe permissible pressure load on shaft seal, see page 7

7) Closed pressure tight with flange plate

8) Both ports are plugged. Leakage chamber is connected with suction chamber. Separate case drain line to tank is not necessary.

O = Must be connected (closed on delivery)

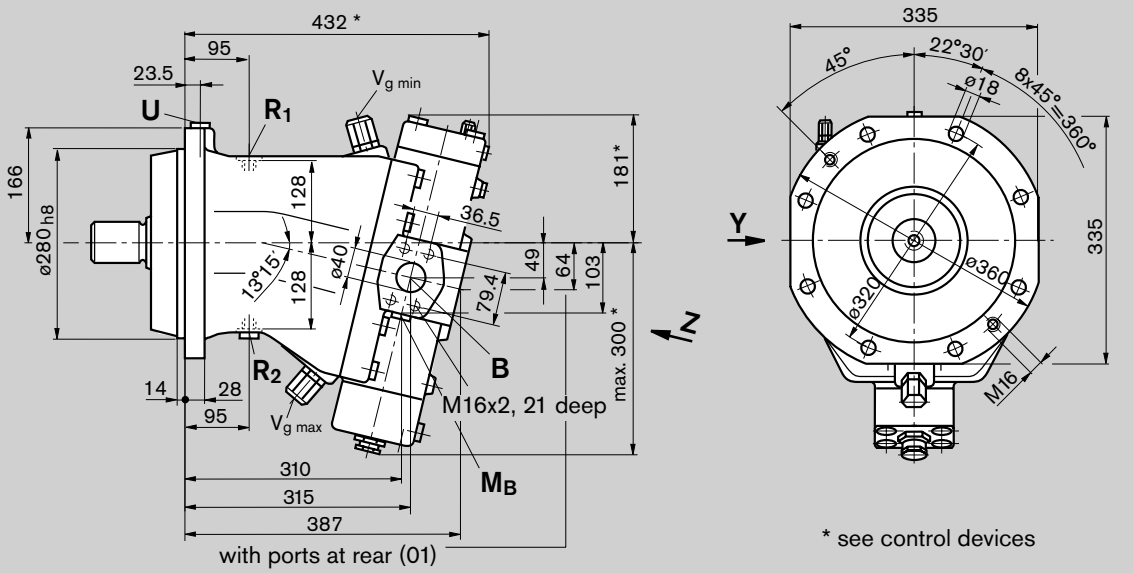
X = Plugged (in normal operation)

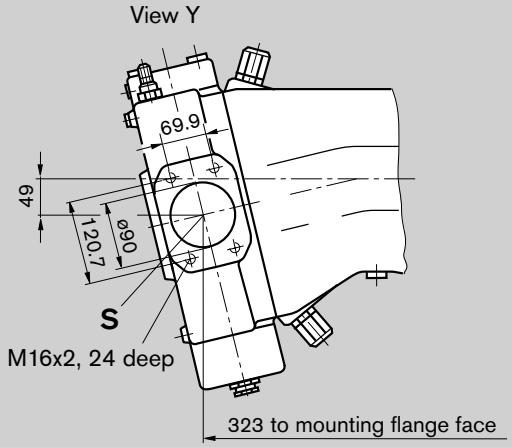
Dimensions size 355

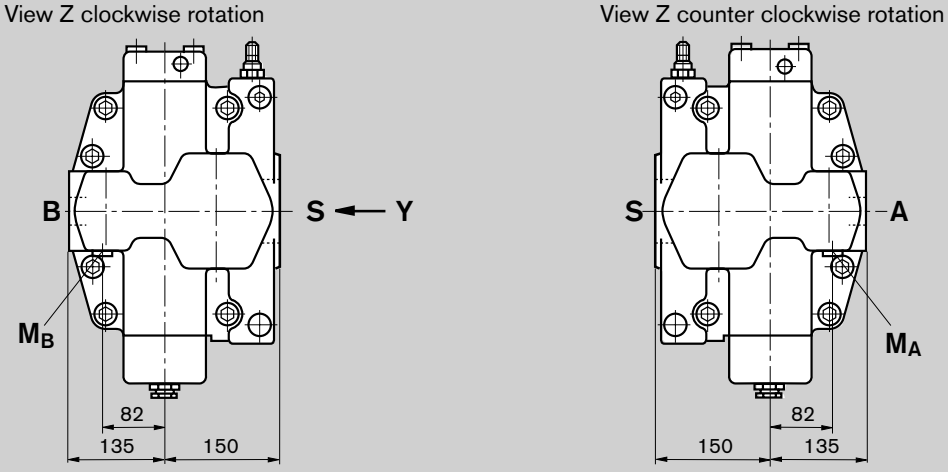
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Ports A (B) and S on opposite sides (02), clockwise rotation

(without control devices)



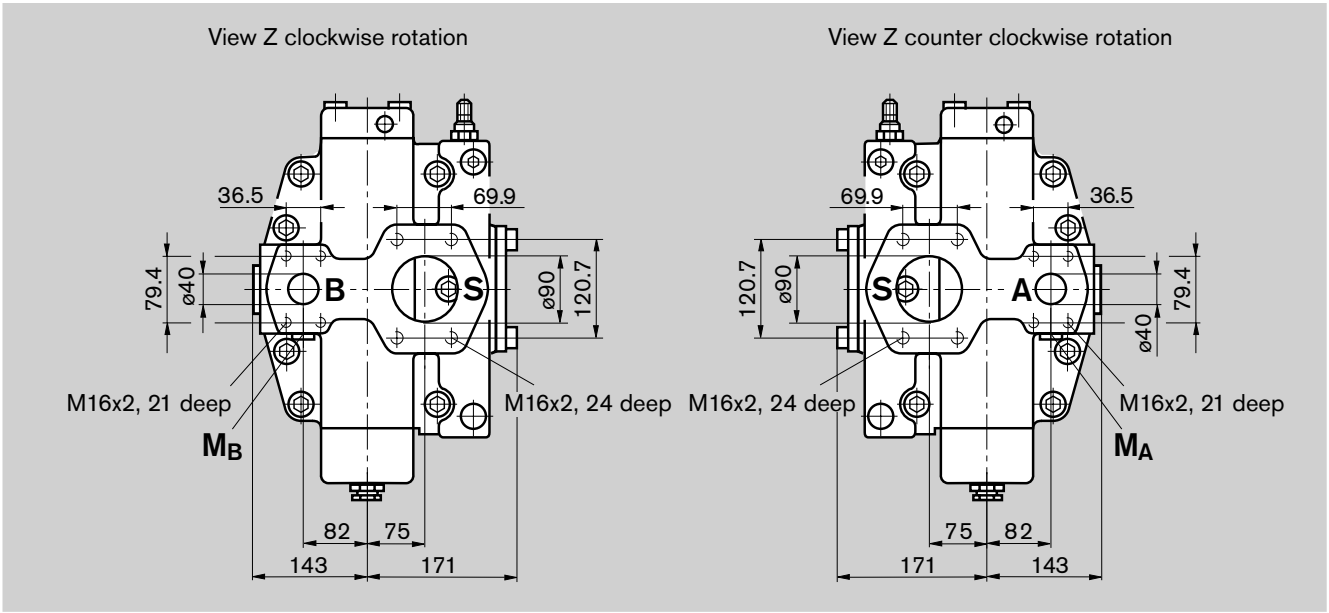




Dimensions size 355

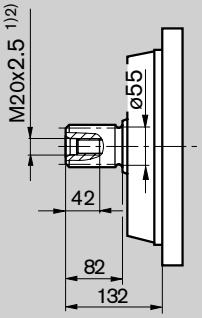
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Ports A (B) and S at rear (01)

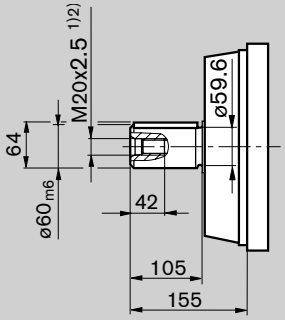


Drive shafts

Z Splined shaft DIN 5480
W60x2x28x9g



P Parallel keyed shaft
DIN 6885, AS18x11x100



[1] Centering bore to DIN 332
(Thread to DIN 13)

Ports

Designation	Port for	Standard	Size[2]	Peak pressure [bar][3]	State
A, (B)	Pressure outlet (high pressure range) Fixing thread	SAE J518[4] DIN 13	1 1/2in M16x2; 21 deep	400	O
S	Suction (standard pressure range) Fixing thread	SAE J518[4]) DIN 13	3 1/2 in M16x2; 24 deep	7	O
U	Flushing	DIN 3852	M14x1.5; 12 deep	3	X
R_1	Case drain	DIN 3852	M33x2; 18 deep	3	O
R_2	Case drain	DIN 3852	M33x2; 18 deep	3	X
M_A, M_B	Measuring outlet pressure A, B	DIN 3852	M14x1.5; 12 deep	400	X

[2] For the max. tightening torques the general information on page 52 must be observed

[3] Depending on the application momentary pressure spikes can occur. Take this into consideration when selecting the measuring devices and fittings.

[4] Only dimensions to SAE J518

O = Must be connected (closed on delivery)

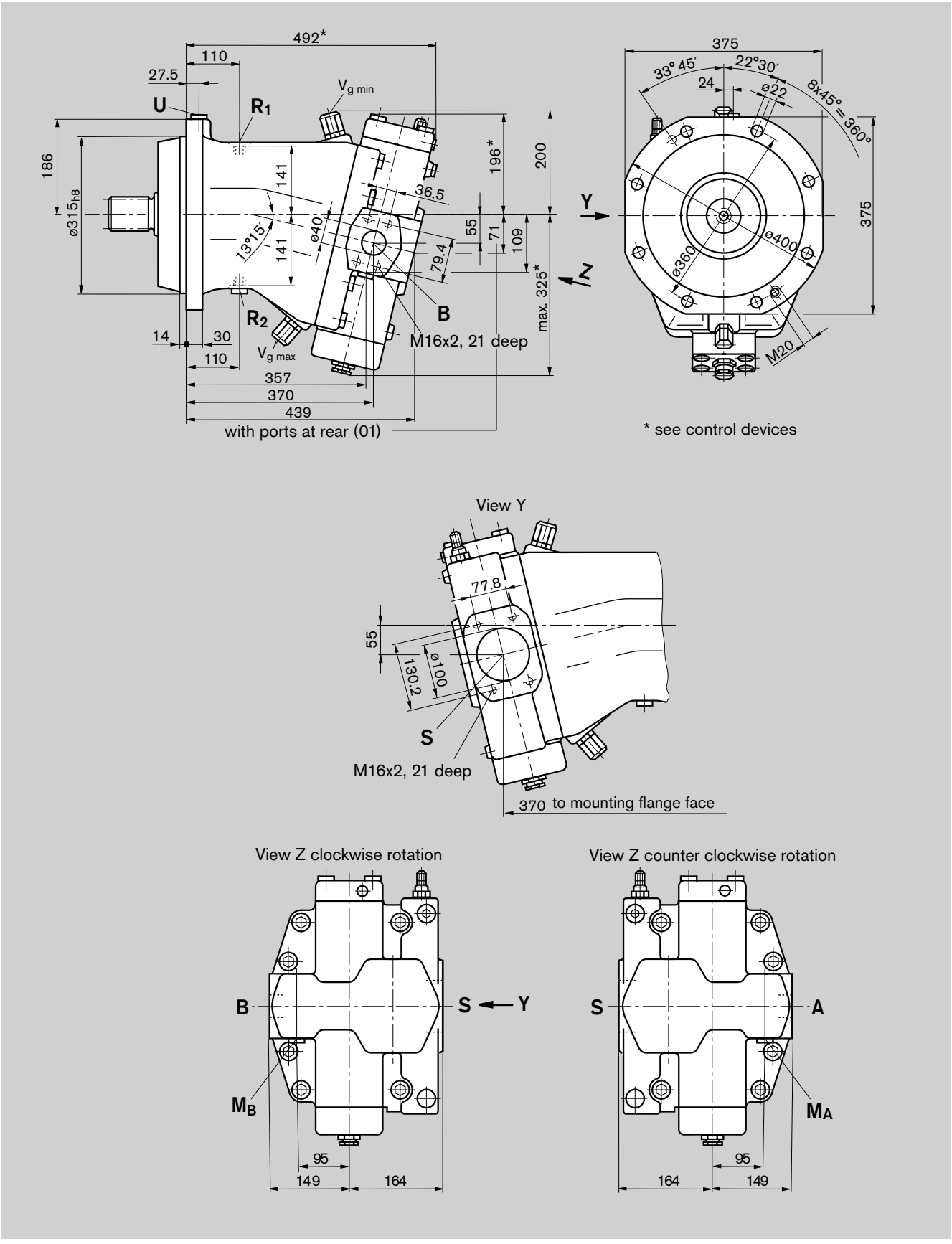
X = Plugged (in normal operation)

Dimensions size 500

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

Ports A (B) and S on opposite sides (02), clockwise rotation

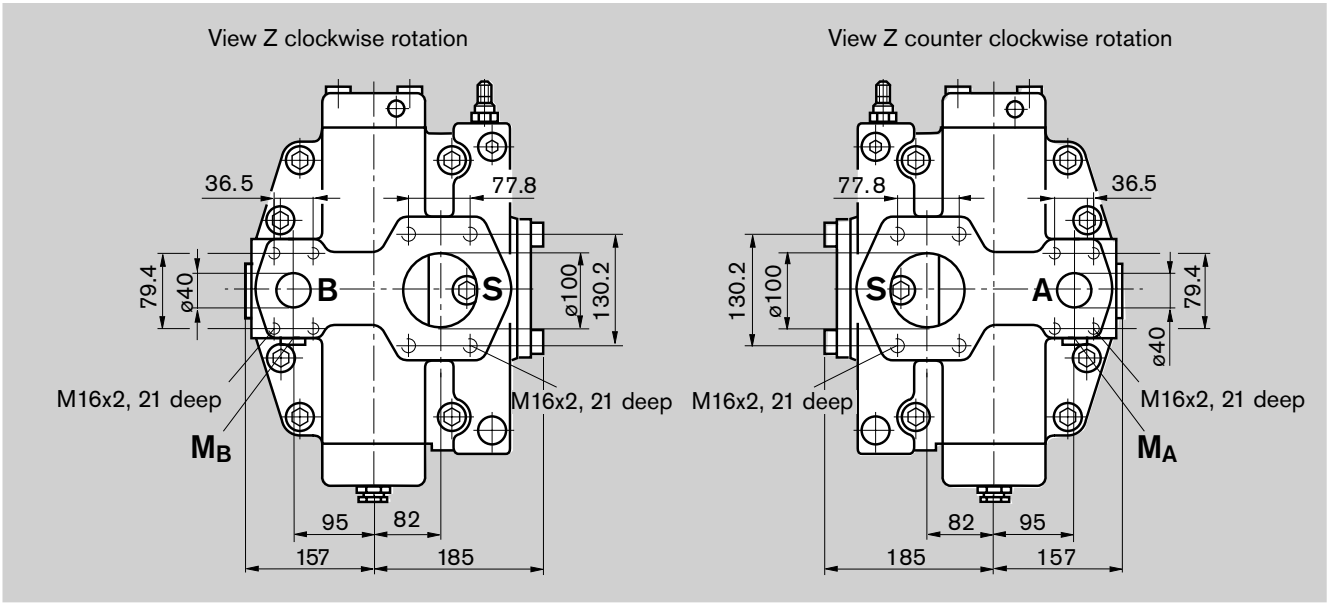
(without control devices)



Dimensions size 500

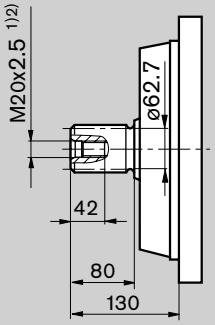
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

Ports A (B) and S at rear (01)

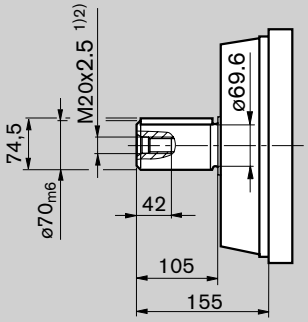


Drive shafts

Z Splined shaft DIN 5480
W70x3x22x9g



P Parallel keyed shaft
DIN 6885, AS20x12x100



[1] Centering bore to DIN 332
(Thread to DIN 13)

Ports

Designation	Port for	Standard	Size[2]	Peak pressure [bar][3]	State
A, (B)	Pressure outlet (high pressure range) Fixing thread	SAE J518[4] DIN 13	1 1/2in M16x2, 21 deep	400	O
S	Suction (standard pressure range) Fixing thread	SAE J518[4] DIN 13	4 in M16x2, 21 deep	7	O
U	Flushing	DIN 3852	M18x1.5; 12 deep	3	X
R_1	Case drain	DIN 3852	M33x2; 18 deep	3	O
R_2	Case drain	DIN 3852	M33x2; 18 deep	3	X
M_A, M_B	Measuring outlet pressure A, B	DIN 3852	M14x1.5; 12 deep	400	X

[2] For the max. tightening torques the general information on page 52 must be observed

[3] Depending on the application momentary pressure spikes can occur. Take this into consideration when selecting the measuring devices and fittings.

[4] Only dimensions to SAE J518

O = Must be connected (closed on delivery)

X = Plugged (in normal operation)

DR Pressure control

Initial position: $V_{g\,max}$ in pressureless condition

The pressure control limits the maximum pump output pressure within the control range of the pump. This max. pressure level can be set at the integrated control valve. When reaching this preset level, the pump destrokes and supplies only the amount of flow as needed by the users (actuators).

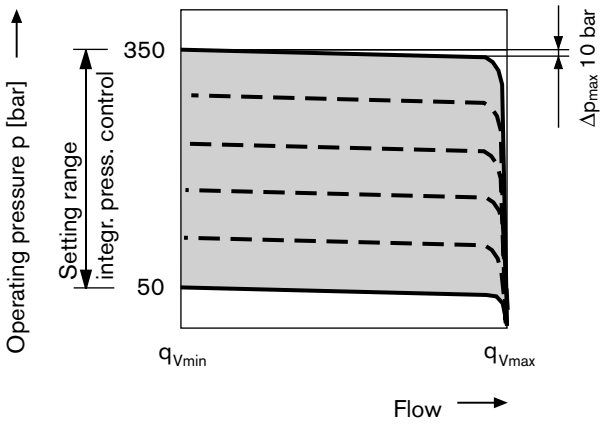
Setting range of the pressure control _____ 50 to 350 bar
Standard setting is 350 bar.

If another setting is required please state in clear text.

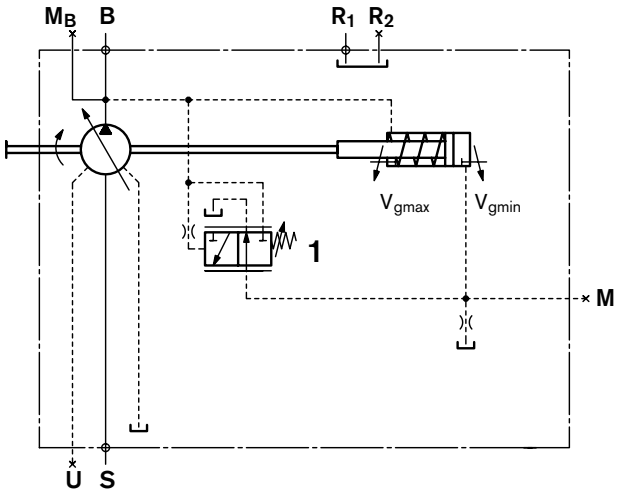
Important

- A recommended main line relief valve in the system to safeguard against excessive pressure spikes must have a cracking pressure at least 20 bar above the DR control setting.
- The control begin and the DR-control characteristic is influenced by housing pressure. An increase in housing pressure results in a higher control begin and thus a parallel shifting of the control curve (see page 7).
- Operation in standby see page 6.

Characteristic



Schematic



Sub assemblies

1 Integrated pressure control valve

Ports for

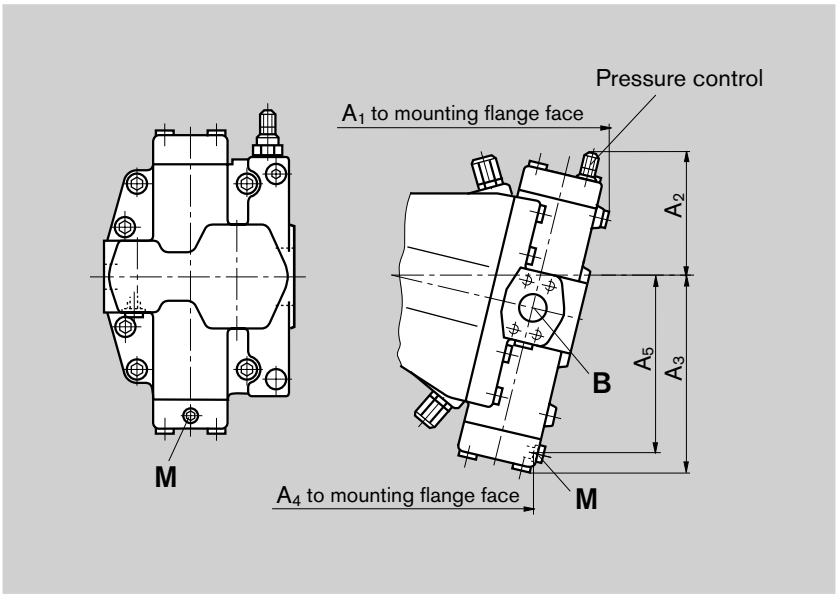
M Measuring pressure on control piston (plugged)

Dimensions **DR**

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

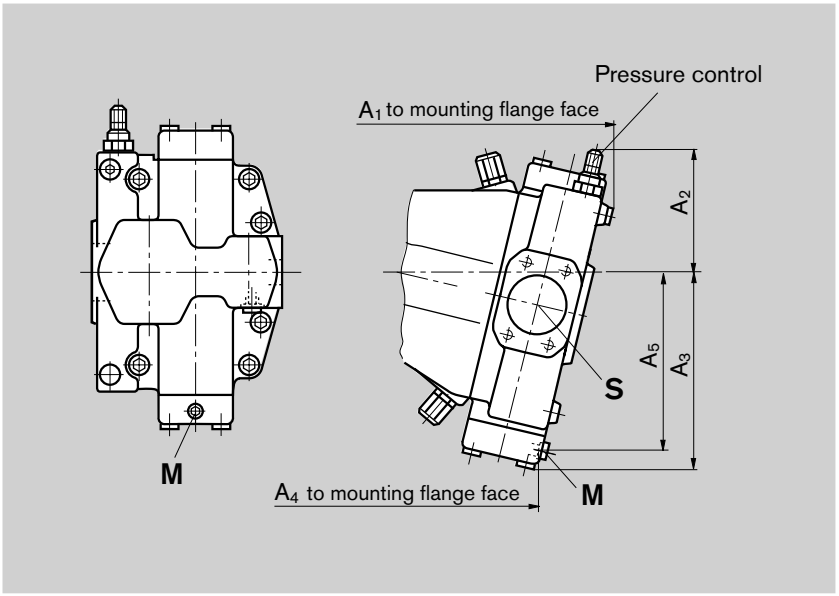
For general dimensions see pages 10 to 17

Clockwise rotation



NG	A_1	A_2	A_3	A_4	A_5
250	385	161	248	297	227
355	430	175	279	333	257
500	490	200	306	382	284

Counter clockwise rotation



Ports

Designation	Port for	Standard	Size[2)]	Peak pressure [bar][3)]	State
M	Measuring pressure on control piston	DIN 3852	M14x1.5; 12 deep	400	X

[2)] For the max. tightening torques the general information on page 52 must be observed

[3)] Depending on the application momentary pressure spikes can occur. Take this into consideration when selecting the measuring devices and fittings.

X = Plugged (in normal operation)

DRG Pressure control remotely adjustable

Initial position: $V_{g\,max}$ in pressureless condition

In order to obtain a remote adjustment of the pressure control level a separate pilot pressure relief (item 2) valve must be connected to port X_3. This relief valve is not included in the supply of the DRG control.

Setting range of the pressure control _____ 50 to 350 bar

The spring force on the pressure compensator spool causes a differential pressure between pump output pressure and pressure at X_3 (as soon as the relief valve opens and the pressure control function takes place). Standard setting of this differential pressure 25 bar.

As long as the the pressure is below the set pressure of the relief valve, the pressures on both sides of the pressure compensator spool are equal and the additional spring force keeps this spool in a shifted position (Spool in equilibrium).

As soon as the set pressure of the relief valve is reached, this valve will start to open and the pilot flow will result in a differential pressure over the compensator spool, which causes this spool to shift and brings the pump to a smaller displacement. $V_{g\,min}$.

The differential pressure at the pressure compensator spool (item 1) is normally set at 25 bar, which results in a pilot flow at X_3 of approx. 2 L/min.
In case another setting (range 14 to 50 bar) is required, please state in clear text when ordering.

As a seperate pilot relief valve we recommend:

DBD 6 (hydraulic) see RE 25402

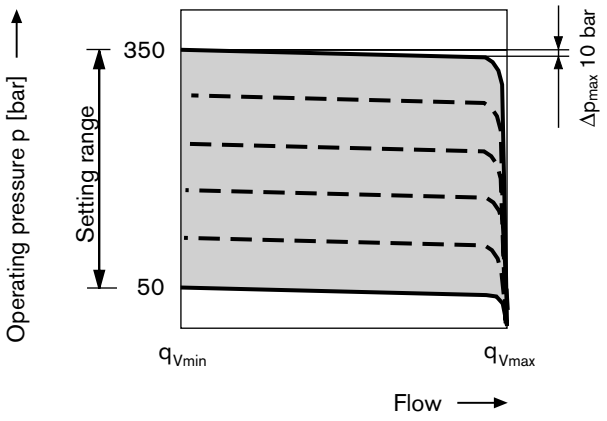
DBETR-SO 437 with dampened spool (electric) see RE 29166

The max. line lenght should not exceed 2 m.

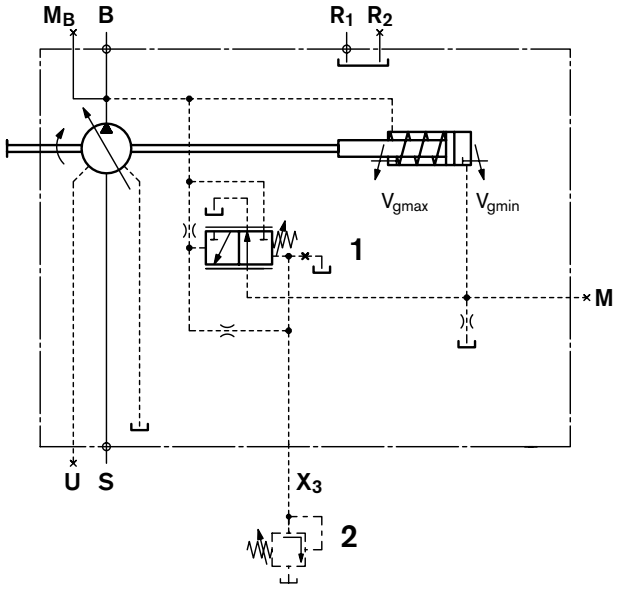
Note

- The beginning of control and the DRG control characteristic are influenced by housing pressure. An increase in housing pressure results in a higher beginning of control (see page 7) and thus a parallel shift of the control characteristic.
- Standby operation see page 6.

Characteristic



Schematic



Sub assemblies

1 Integrated pressure compensator

2 Separate pilot pressure relief valve (not in scope of supply)

Ports for

X_3 Separate pressure relief valve

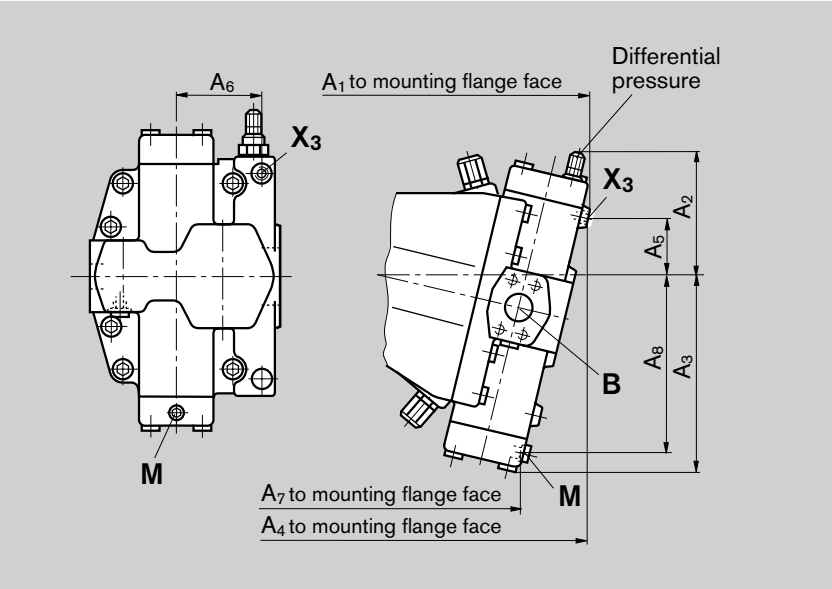
M Measuring pressure on control piston (plugged)

Dimensions DRG

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

General dimensions see page 10 to 17

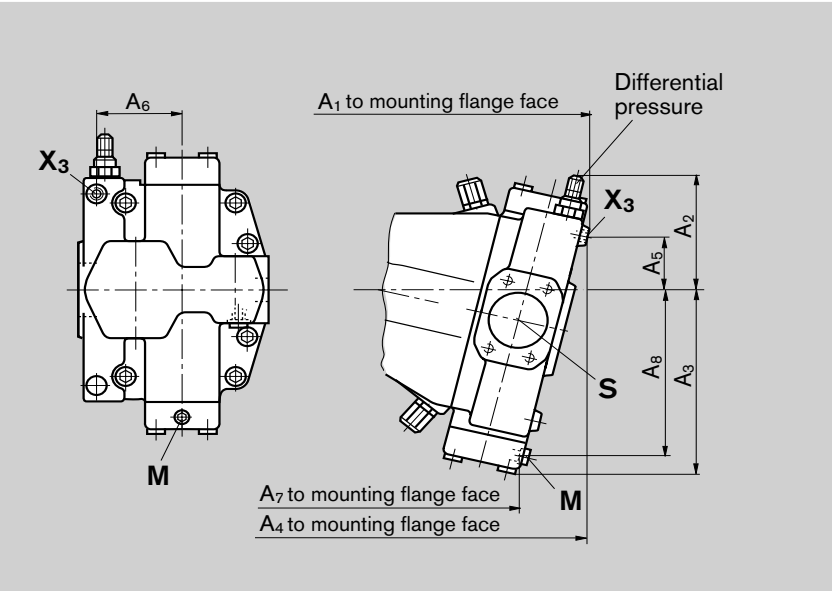
Clockwise rotation



NG	A_1	A_2	A_3	A_4	A_5
250	385	161	248	380	74
355	430	175	279	425	82
500	490	200	306	483	96

NG	A_6	A_7	A_8
250	112	297	227
355	131	333	257
500	142	382	284

Counter clockwise rotation



Ports

Designation	Ports for	Standard	Size[2]	Peak pressure [bar][3]	State
X_3	Separate pressure relief valve	DIN 3852	M14x1.5; 12 deep	400	O
M	Measuring pressure on control piston	DIN 3852	M14x1.5; 12 deep	400	X

[2] For the max. tightening torques the general information on 52 must be observed

[3] Depending on the application momentary pressure spikes can occur. Take this into consideration when selecting the measuring devices or fittings.

O = Must be connected (closed on delivery)

X = Plugged (in normal operation)

LRD Power control with integrated pressure control

Initial position: $V_{g\,max}$ in pressureless condition

Power control

The power control adjusts the pump displacement in relation to the operating pressure in such a manner, that a given drive power at constant drive speed is not exceeded .

$$p_B \bullet V_g = \text{constant (drive power)}$$

p_B = operating pressure; V_g = displacement

This precise control along the hyperbolic control characteristic permits an optimum utilisation of drive power.

The operating pressure acts on a lever mechanism via the measuring spool in the displacement control piston. It is offset by the externally set spring force which acts on the pilot valve and determines the power setting.

When the operating pressure exceeds the set spring force, the power control pilot valve is actuated via the lever mechanism and the pump swivel towards a smaller displacement $V_{g\,min}$. This in turn reduces the effective moment on the lever mechanism and the operating pressure can increase in the same ratio by which the pump output flow is reduced, without exceeding the installed drive power ($p_B \bullet V_g$ = constant).

Setting range for the control begin of the power control from 50 to 300 bar.

Note

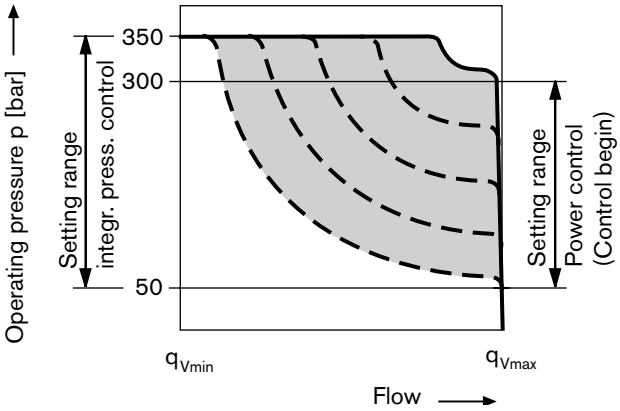
- The control begin and the LR-power control characteristic are influenced by pump inlet pressure. An increase in pump inlet pressure results in a higher control begin (see page 5) and thus a parallel shift of the control characteristic.
- The hydraulic output power (LR-characteristic) is influenced by pump efficiency

When ordering please state in clear text:

- Drive power P in kW
- Drive speed n in rpm
- Maximum flow $q_{v\,max}$ in L/min

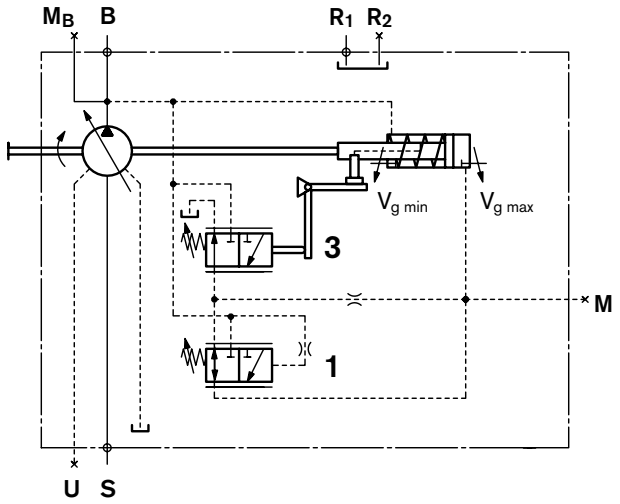
The integrated pressure control is standard and overrides the power control, description see page 24

Characteristic



Schematic

Power control with integrated pressure control



Sub assemblies

1 Pressure control

3 Power control

Port for

M Measuring pressure on control piston (plugged)

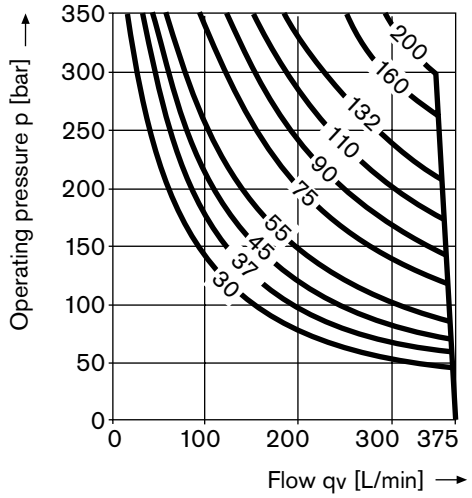
Dimensions see page 25

LRD Power control with integrated pressure control

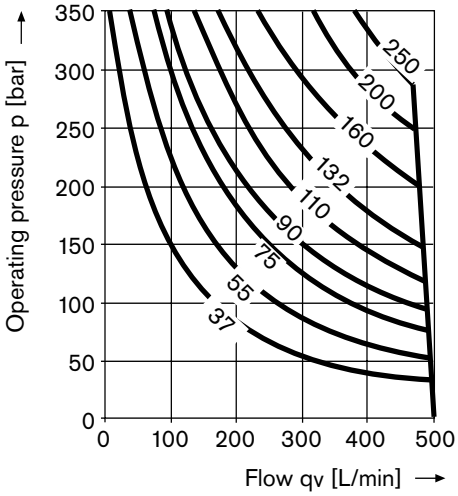
Initial position $V_{g\,max}$

Power control characteristics in kW

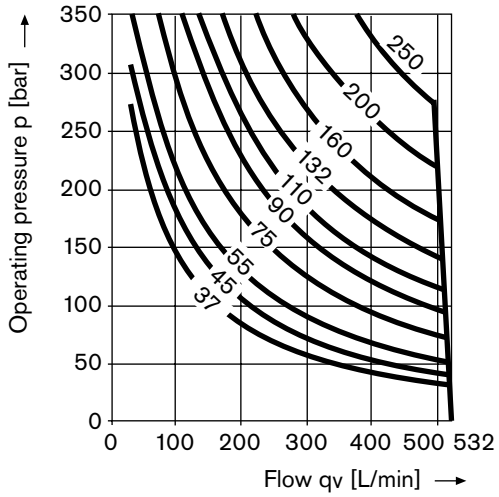
NG 250
at 1500 rpm



NG 500
at 1000 rpm



NG 355
at 1500 rpm



LRD with integrated pressure control

Initial position: $V_{g\,max}$ in pressureless condition

The pressure control is overriding the power control.

It protects the pump against excessive pressure and consequential damage.

The pressure control valve is integrated into the port plate and can be set externally.

Upon reaching the set pressure level the pump will destroke towards lower displacement.

Setting range of the pressure control_____ 50 to 350 bar
Standard setting: 350 bar.

If another setting is required please state in clear text.

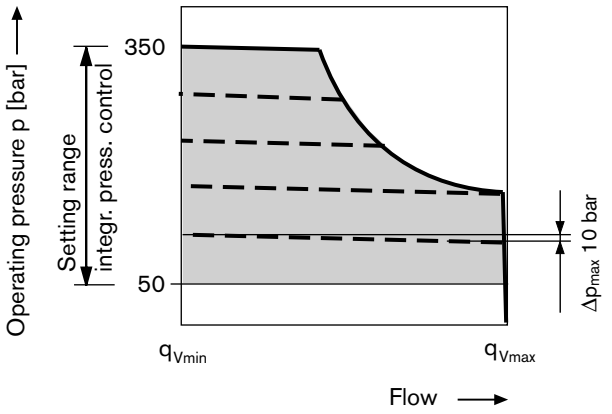
Note

– A recommended main line relief valve in the system to safeguard against excessive pressure spikes must have a cracking pressure at least 20 bar above the pressure control setting.

– The control begin and the pressure control characteristic are influenced by housing pressure. An increase in housing pressure results in a higher control begin (see page 7) and thus a parallel shift of the characteristic.

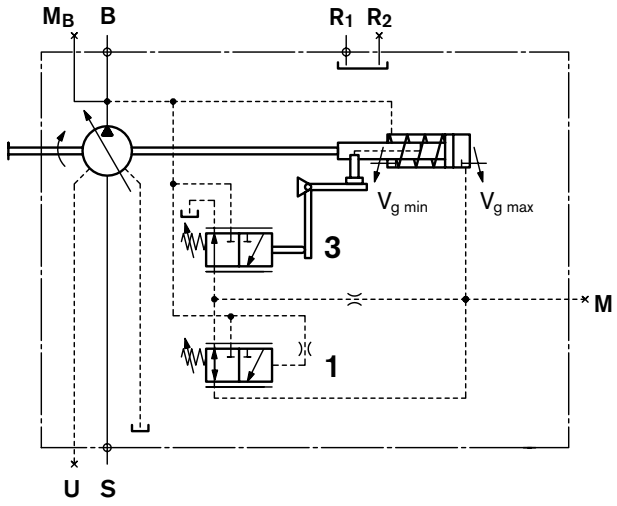
– Standby operation see page 6.

Characteristic



Schematic

Power control with integrated pressure control



Sub assemblies

1 Pressure control

3 Power control

Port for

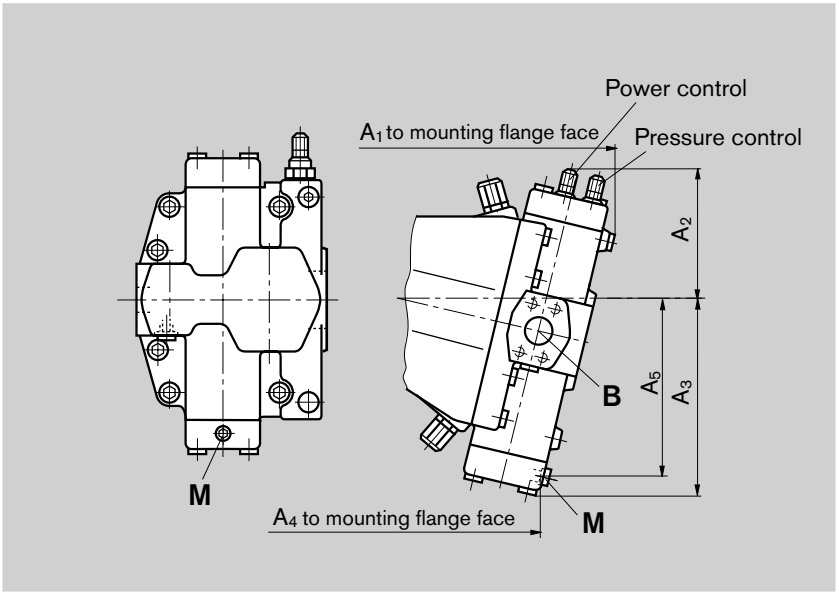
M Measuring pressure on control piston (plugged)

Dimensions LRD

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

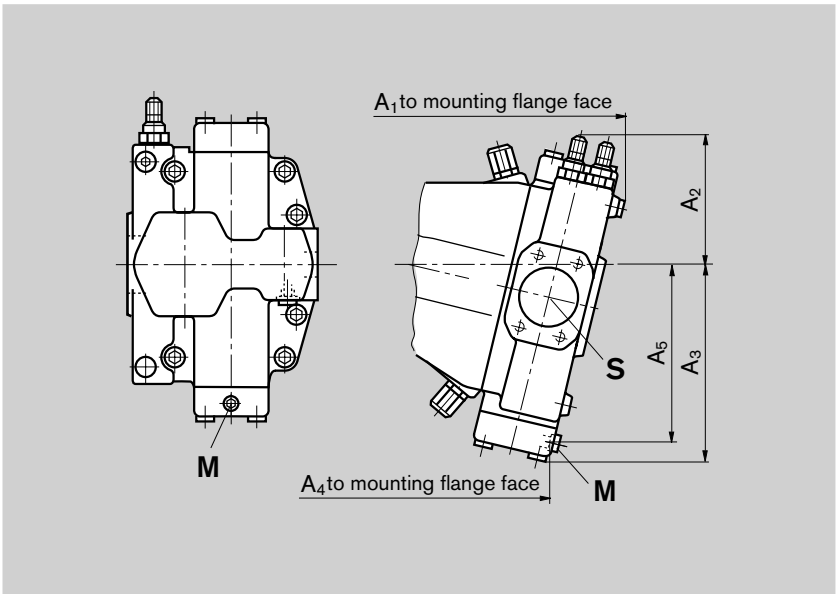
General dimensions see page 10 to 17

Clockwise rotation



NG	A_1	A_2	A_3	A_4	A_5
250	385	170	248	297	227
355	430	175	279	333	257
500	490	200	306	382	284

Counter clockwise rotation



Ports

Designation	Port for	Standard	Size[2]	Peak pressure [bar][3]	State
M	Measuring pressure on control piston	DIN 3852	M14x1.5; 12 deep	400	X

[2] For the max. tightening torques the general information on page 52 must be ovserved

[3] Depending on the application momentary pressure spikes can occur. Take this into consideration when selecting the measuring devices and fittings.

X = Plugged (in normal operation)

LRG with remotely adjustable pressure control

Initial position: $V_{g\,max}$ in pressureless condition

The remotely adjustable pressure control overrides the power control.

In order to obtain a remote adjustment of the pressure control level a separate pilot pressure relief (item 2) valve must be connected to port X_3. This relief valve is not included in the supply of the DRG control.

Setting range of the pressure control _____ 50 to 350 bar

The spring force on the pressure compensator spool causes a differential pressure between pump output pressure and pressure at X_3 (as soon as the relief valve opens and the pressure control function takes place). Standard setting of this differential pressure 25 bar.

As long as the the pressure is below the set pressure of the relief valve, the pressures on both sides of the pressure compensator spool are equal and the additional spring force keeps this spool in a shifted position (Spool in equilibrium).

As soon as the set pressure of the relief valve is reached, this valve will start to open and the pilot flow will result in a differential pressure over the compensator spool, which causes this spool to shift and brings the pump to a smaller displacement $V_{g\,min}$.

Upon reaching the set pressure control level (set pressure at pilot relief valve plus differential pressure at pressure control compensator) the pump will go over to the pressure control mode.

The differential pressure at the pressure compensator spool (item 1) is normally set at 25 bar, which results in a pilot flow at X_3 of approx. 2 L/min.
In case another setting (range 14 to 50 bar) is required, please state in clear text when ordering.

As a seperate pilot relief valve we recommend:

DBD 6 (hydraulic) see RE 25402

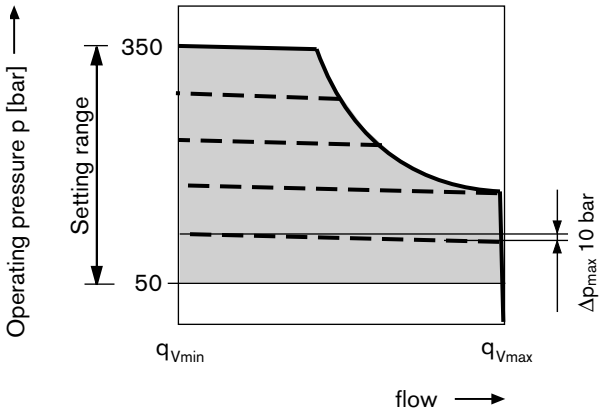
DBETR-SO 437 with dampened spool (electric) see RE 29166

The max. line lenght should not exceed 2 m.

Note

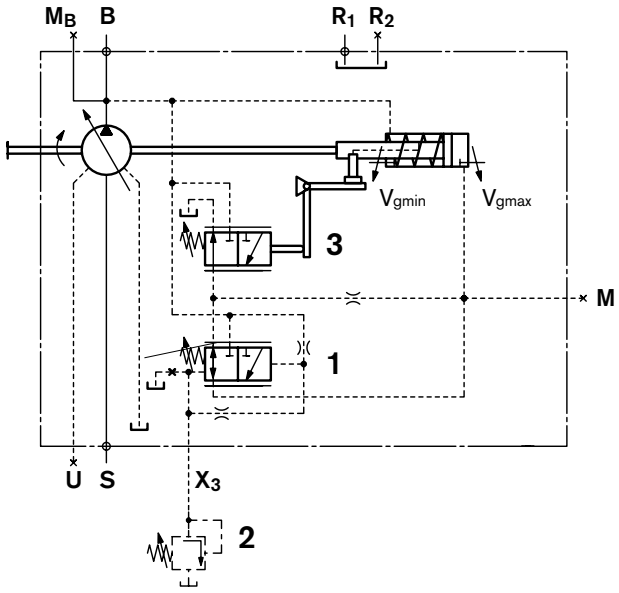
- The beginning of control and the DRG control characteristic are influenced by housing pressure. An increase in housing pressure results in a higher beginning of control (see page 7) and thus a parallel shift of the control characteristic.
- Standby operation see page 6.

Characteristic



Schematic

Power control with remotely adjustable pressure control



Sub assemblies

1 Integrated pressure control compensator

2 Separate pressure relief valve (not in scope of supply)

3 Power control

Ports for

X_3 Separate pressure relief valve

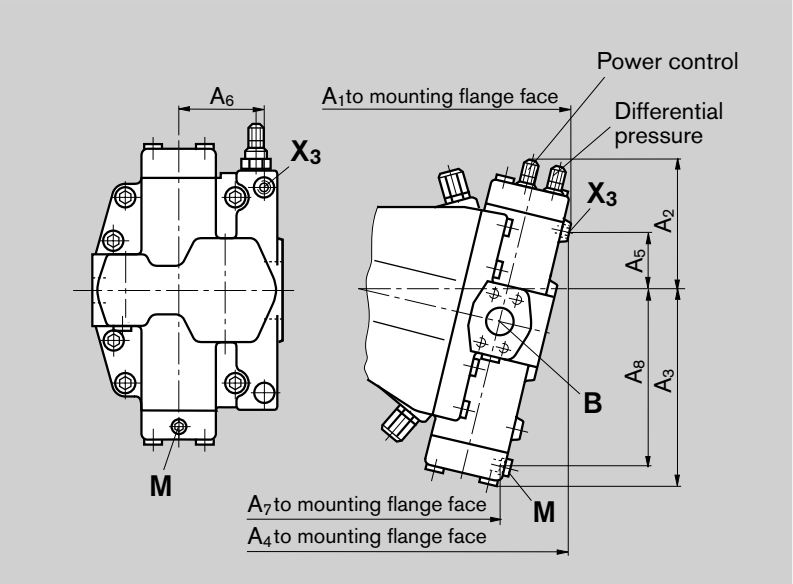
M Measuring pressure on control piston (plugged)

Dimensions LRG

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

General dimensions see page 10 to 17

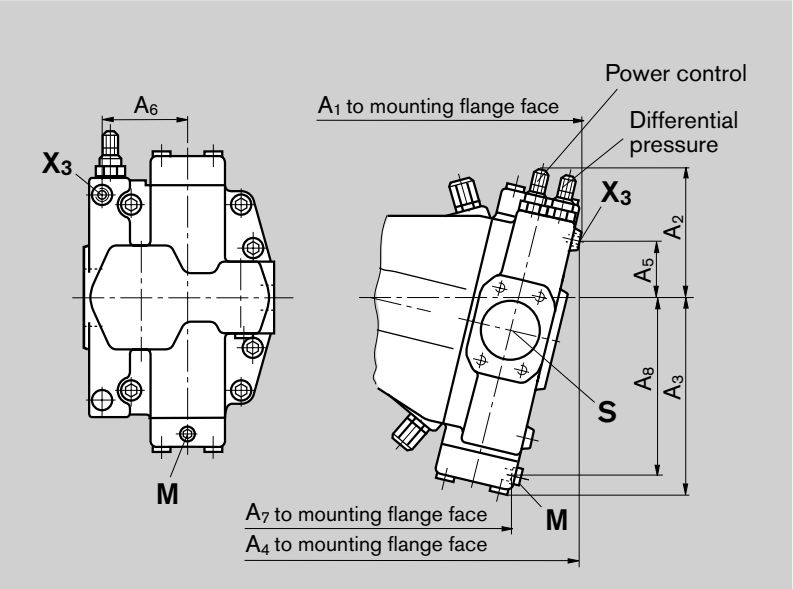
Clockwise rotation



NG	A_1	A_2	A_3	A_4	A_5
250	385	170	248	380	74
355	430	175	279	425	82
500	490	200	306	483	96

NG	A_6	A_7	A_8
250	112	297	227
355	131	333	257
500	142	382	284

Counter clockwise rotation



Ports

Designation	Ports for	Standard	Size[2)]	Peak pressure [bar][3)]	State
X_3	Separate pressure relief valve	DIN 3852	M14x1.5; 12 deep	400	O
M	Measuring pressure on control piston	DIN 3852	M14x1.5; 12 deep	400	X

[2)] For the max. tightening torques the general information on 52 must be observed

[3)] Depending on the application momentary pressure spikes can occur. Take this into consideration when selecting the measuring devices or fittings.

O = Must be connected (closed on delivery)

X = Plugged (in normal operation)

LRD**H** with hydraulic stroke limitation

Initial position: $V_{g\,max}$ in pressureless condition

The hydraulic stroke limitation is used for infinite adjustment of the displacement from $V_{g\,max}$ bis $V_{g\,min}$.

It is overridden by the power control.

The displacement is set by the pilot pressure applied at port X_1

Maximum permissible pilot pressure ——— 100 bar

The hydraulic stroke limitation takes the required control pressure from the pump output pressure. It must be noted, that the pump operating pressure must be at least 40 bar.

If the pressure is lower, the pump must be supplied with an external control pressure of at least 40 bar into port X_2.

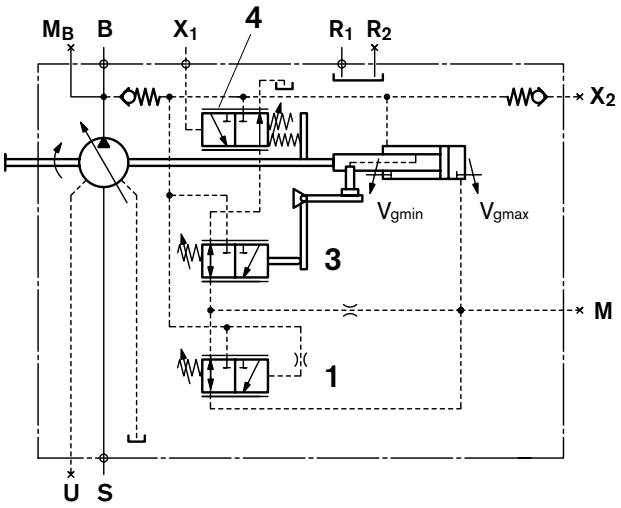
The control begin is adjustable.
Control begin (bar), please state in clear test when ordering.

Note

– The control begin and the LRDH-control characteristic are influenced by pump inlet pressure. An increase in pump inlet pressure results in a higher control begin (see page 5) and thus a parallel shift of the control characteristic.

Schematic

Power control with integrated pressure control and hydraulic stroke limitation H



Sub assemblies

1 Pressure control

3 Power control

4 Hydraulic stroke limitation H

Ports for

X_1 Pilot pressure

X_2 External control pressure (plugged)

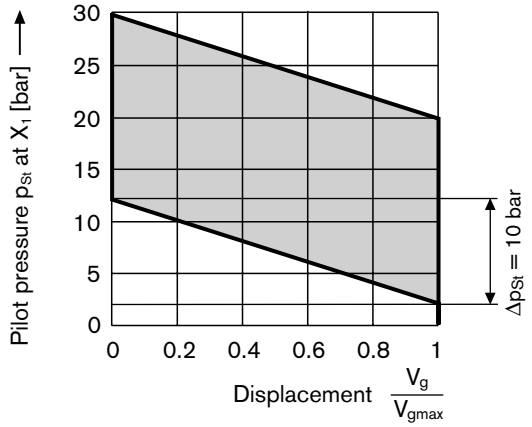
M Measuring pressure on control piston(plugged)

Dimensions see page 30

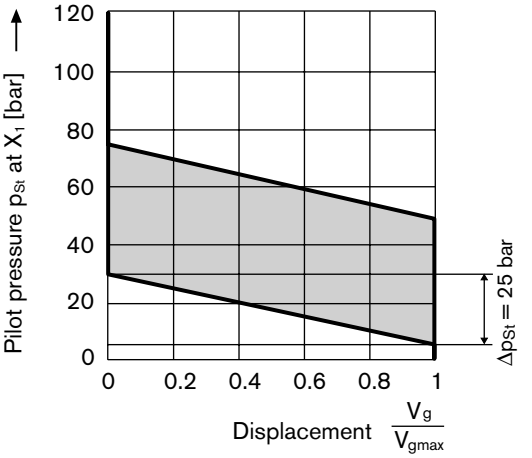
LRDH with hydraulic stroke limitation

Characteristics

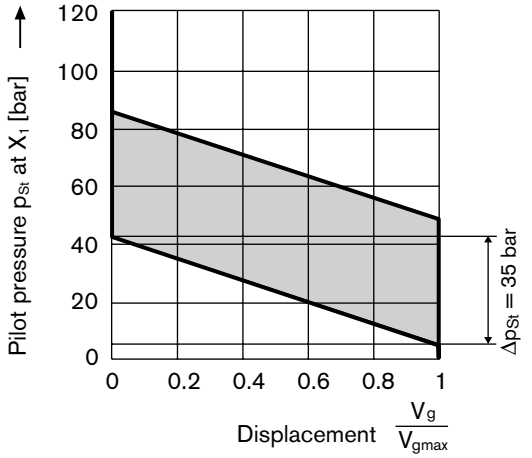
H1 Δp_{St} for hydraulic stroke limitation ——— 10 bar
Control begin adjustable ——— 2 to 20 bar
Standard setting of control begin ——— 5 bar



H2 Δp_{St} for hydraulic stroke limitation ——— 25 bar
Control begin adjustable ——— 5 to 50 bar
Standard setting of control begin ——— 10 bar



H3 Δp_{St} for hydraulic stroke limitation ——— 35 bar
Control begin adjustable ——— 7 to 50 bar
Standard setting of control begin ——— 10 bar

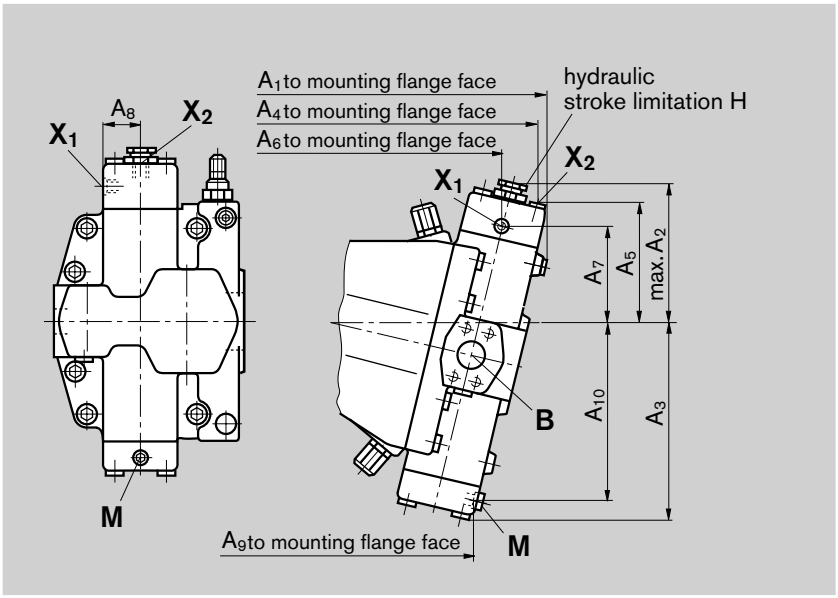


Dimensions LRDH

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

General dimensions see page 10 to 17

Clockwise rotation

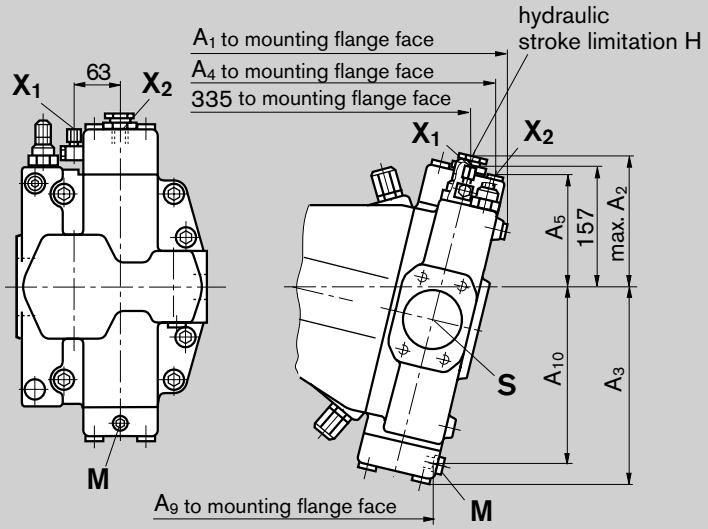


NG	A1	A2	A3	A4	A5
250	385	188	248	370	144
355	432	203	279	416	157
500	490	215	306	470	169

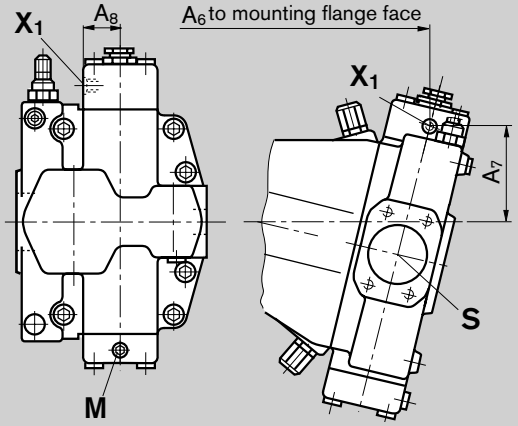
NG	A6	A7	A8	A9	A10
250	327	123	49	297	227
355	366	137	54	333	257
500	417	148	61.5	382	284

Counter clockwise rotation

Port X1, showing NG250



Port X1, showing NG355 and 500



Ports

Designation	Ports for	Standard	Size[2]	Peak pressure [bar][3]	State
X1	Pilot pressure	DIN 3852	M14x1.5; 12 deep	100	O
X2	External control pressure	DIN 3852	M14x1.5; 12 deep (NG250 a. 355)	400	X
		DIN 3852	M18x1.5; 12 deep (NG500)	400	X
M	Measuring pressure on control piston	DIN 3852	M14x1.5; 12 deep	400	X

[2] For the max. tightening torques the general information on 52 must be observed

[3] Depending on the application momentary pressure spikes can occur. Take this into consideration when selecting the measuring devices or fittings.

O = Must be connected (closed on delivery)

X = Plugged (in normal operation)

LRDN with hydraulic stroke limitation

Initial position: $V_{g\,min}$ in pressureless condition

The hydraulic stroke limitation is used for infinite adjustment of the displacement from $V_{g\,min}$ to $V_{g\,max}$.

It is overridden by the power control.

Displacement is set by the pilot pressure applied at port X_1.

Maximum permissible pilot pressure p——— 100 bar

A minimum pressure of 40 bar is required for hydraulic stroke limitation. The necessary control fluid is taken from the pump outlet pressure side.

An external control pressure is not required when the operating pressure > 40 bar and $V_{g\,min} > 0$. In this case the port X_2 must be plugged prior to commissioning. Otherwise an external control pressure source of at least 40 bar must be connected to port X_2.

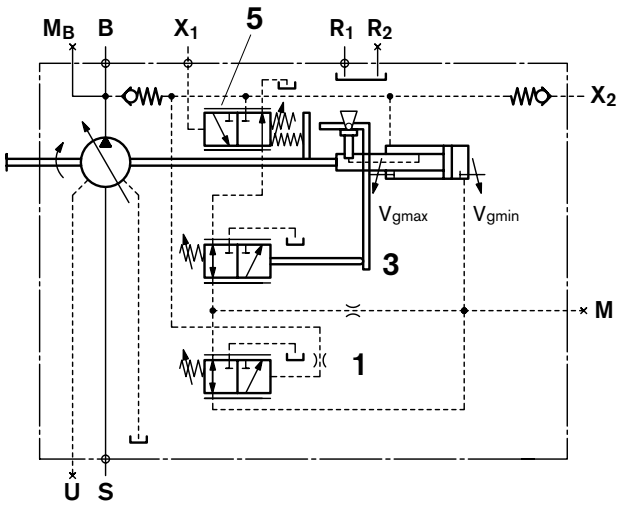
The control begin is adjustable.
Control begin (bar), please state in clear text when ordering.

Note

– The control begin and the LRDN-control characteristic are influenced by pump inlet pressure. An increase in pump inlet pressure results in a higher control begin (see page 5) and thus a parallel shift of the control characteristic.

Schematic

Power control with integrated pressure control and hydraulic stroke limitation N



Sub assemblies

1 Pressure control

3 Power control

5 Hydraulic stroke limitation N

Ports for

X_1 Pilot pressure

X_2 External control pressure

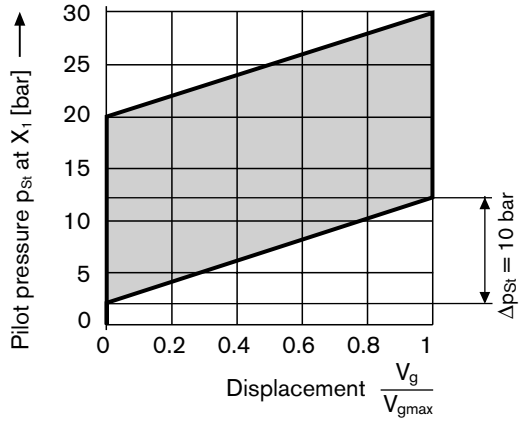
M Measuring of pressure on control piston (plugged)

Dimensions see page 33

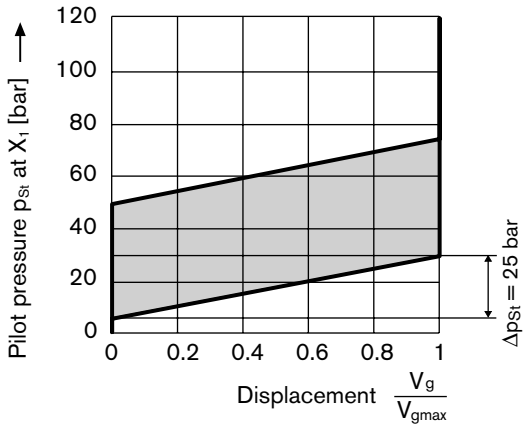
LRDN with hydraulic stroke limitation

Characteristics

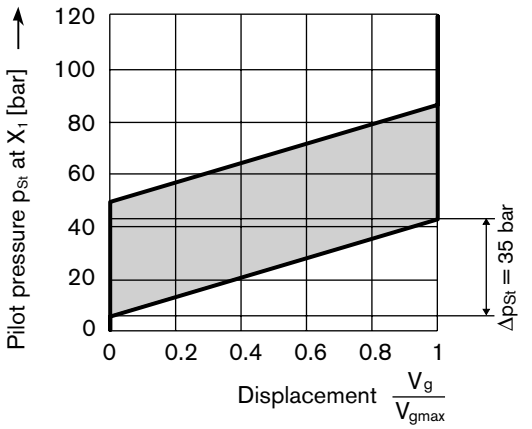
N1 Δp_{St} for hydraulic stroke limitation ——— 10 bar
Control begin adjustable ——— 2 to 20 bar
Standard setting of control begin ——— 5 bar



N2 Δp_{St} for hydraulic stroke limitation ——— 25 bar
Control begin adjustable ——— 5 to 50 bar
Standard setting of control begin ——— 10 bar



N3 Δp_{St} for hydraulic stroke limitation ——— 35 bar
Control begin adjustable ——— 7 to 50 bar
Standard setting of control begin ——— 10 bar

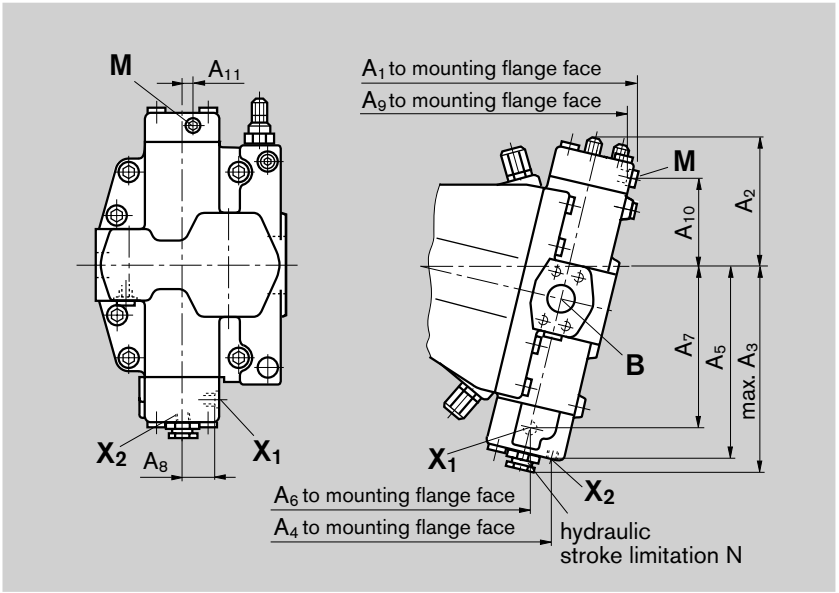


Dimensions LRDN

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

General dimensions see page 10 to 17

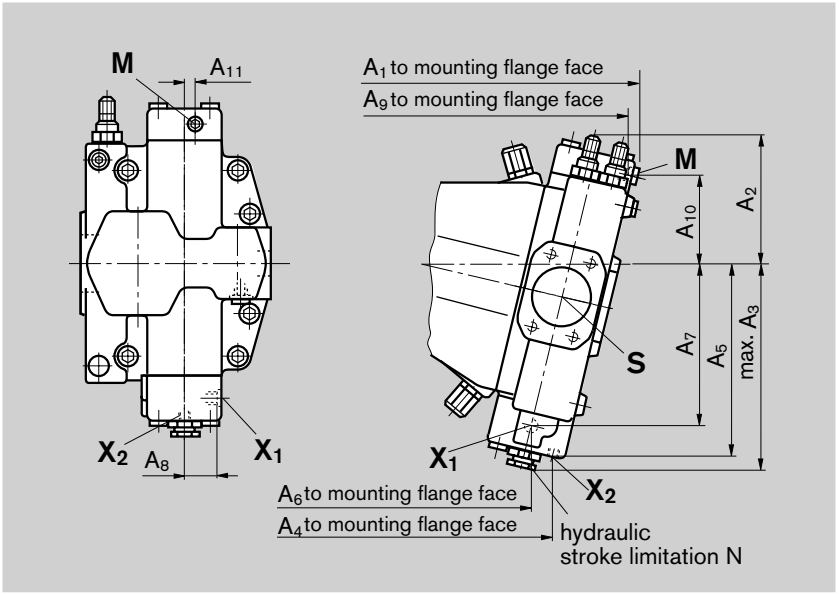
Clockwise rotation



NG	A_1	A_2	A_3	A_4	A_5	A_6
250	385	170	275	276	248	248
355	430	175	300	315	275	278
500	492	200	325	359	300	322

NG	A_7	A_8	A_9	A_{10}	A_{11}
250	210	49	377	116	14
355	234	54	425	132	20
500	258	61.5	483	144	20

Counter clockwise rotation



Ports

Designation	Ports for	Standard	Size[2]	Peak pressure [bar][3]	State
X_1	Pilot pressure	DIN 3852	M14x1.5; 12 deep	100	O
X_2	External control pressure	DIN 3852	M14x1.5; 12 deep (NG250 a. 355)	400	O [4]
		DIN 3852	M18x1.5; 12 deep (NG500)	400	O [4]
M	Measuring pressure on control piston	DIN 3852	M14x1.5; 12 deep	400	X

[2] For the max. tightening torques the general information on page 52 must be observed

[3] Depending on the application momentary pressure spikes can occur. Take this into consideration when selecting the measuring devices and fittings.

[4] If no external control pressure is connected, port X_2 must be plugged

O = Must be connected (closed on delivery)

X = Plugged (in normal operation)

HD.D Hydraulic control, pilot pressure dependent

Initial position: $V_{g\,min}$ in pressureless condition

The hydraulic pilot pressure dependent control enables an infinite adjustment of the pump displacement in accordance with the applied pilot pressure signal. The displacement setting is proportional to the pilot pressure in port X_1.

A minimum control pressure of 40 bar is required. The necessary control fluid is taken from the pump outlet pressure side.

An external control pressure is not required when the operating pressure > 40 bar and $V_{g\,min} > 0$. In this case the port X_2 must be plugged prior to commissioning. Otherwise an external control pressure of at least 40 bar must be connected to port X_2.

Maximum permissible pilot pressure p_{St} _____ 100 bar

The control begin is adjustable.
Control begin (bar), please state in clear text when ordering.

Note

– The beginning of control and the HD control characteristic are influenced by housing pressure. An increase in housing pressure results in a higher beginning of control (see page 7) and thus a parallel shift of the control characteristic.

Integrated pressure control is standard. Description see page 37

Note

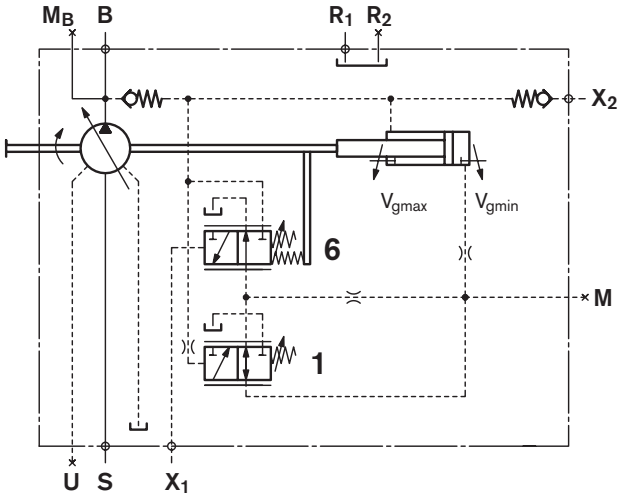
The spring return feature in the control unit is not a safety device

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 safe position (e.g. immediate stop).

Schematic

Hydraulic control, pilot pressure dependent with integrated pressure control



Sub assemblies

1 Pressure control

6 HD-pilot valve

Ports for

X_1 Pilot pressure

X_2 External control pressure

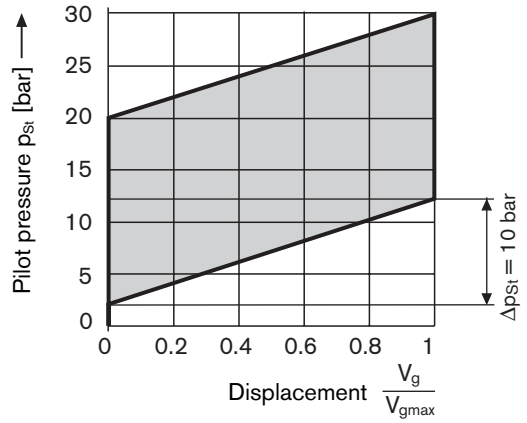
M Measuring pressure on control piston

Dimensions see page 36

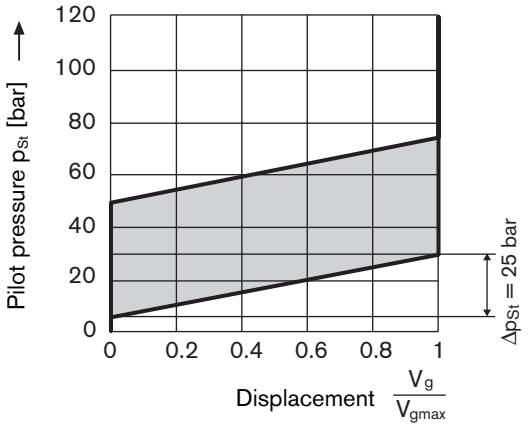
HD.D Hydraulic control, pilot pressure dependent

Characteristics

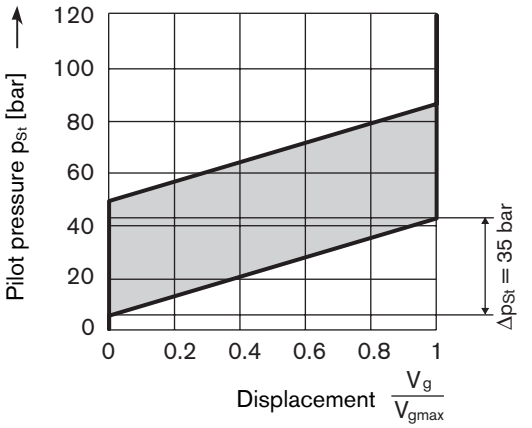
HD1D Δp_{St} _____ 10 bar
Control begin adjustable _____ 2 to 20 bar
Standard setting of control begin _____ 5 bar



HD2D Δp_{St} _____ 25 bar
Control begin adjustable _____ 5 to 50 bar
Standard setting of control begin _____ 10 bar



HD3D Δp_{St} _____ 35 bar
Control begin adjustable _____ 7 to 50 bar
Standard setting of control begin _____ 10 bar

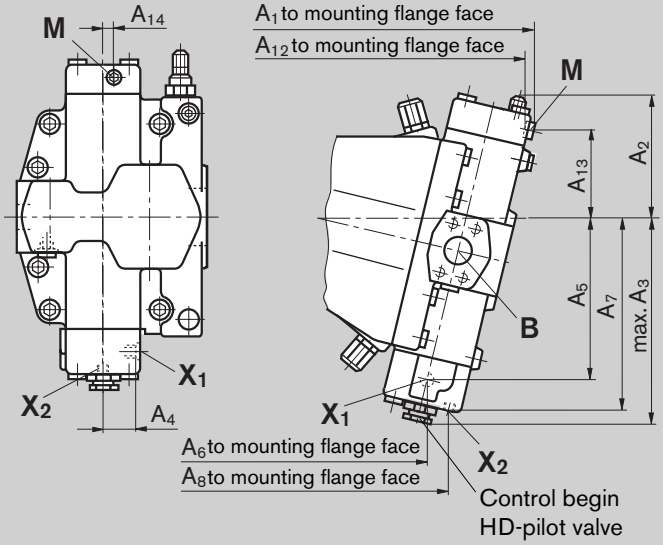


Dimensions **HD.D**

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

General dimensions see page 10 to 17

Clockwise rotation

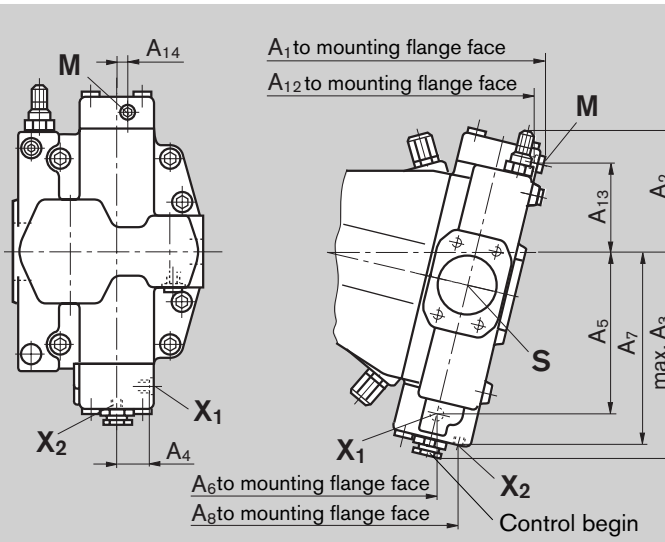


NG	A_1	A_2	A_3	A_4	A_5
250	385	161	275	49	210
355	432	181	300	54	234
500	492	200	325	61.5	258

NG	A_6	A_7	A_8
250	248	248	276
355	278	275	315
500	322	300	359

NG	A_{12}	A_{13}	A_{14}
250	377	116	14
355	425	132	20
500	483	144	20

Counter clockwise rotation



Ports

Designation	Port for	Standard	Size[2]	Peak pressure [bar][3]	State
X_1	Pilot pressure	DIN 3852	M14x1.5; 12 deep	100	O
X_2	External control pressure	DIN 3852	M14x1.5; 12 deep (NG250 a. 355)	400	O [4]
		DIN 3852	M18x1.5; 12 deep (NG500)	400	O [4]
M	Measuring pressure on control piston	DIN 3852	M14x1.5; 12 deep	400	X

[2] For the max. tightening torques the general information on page 52 must be observed

[3] Depending on the application momentary pressure spikes can occur. Take this into consideration when selecting the measuring devices and fittings.

[4] If no external control pressure is connected, port X_2 must be plugged

O = Must be connected (closed on delivery)

X = Plugged (in normal operation)

HD.D with integrated pressure control

Initial position: $V_{g\,min}$ in pressureless condition

The pressure control overrides the HD-function i.e. below the setting of the pressure control the HD-function can be operated

It protects the pump against excessive pressure and subsequential damage.

The pressure control valve is integrated into the port plate and can be set externally.

Upon reaching the set pressure control level the pump will swivel towards a lower displacement.

Setting range of the pressure control _____ 50 to 350 bar
Standard setting at 350 bar.

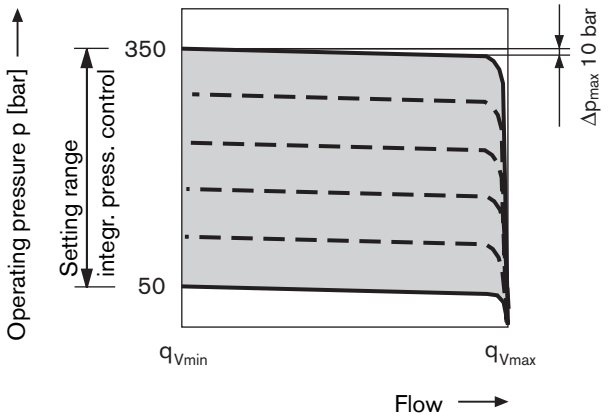
If a different setting is required, please state in clear text.

A recommended main line relief valve in the system to safeguard against excessive pressure spikes must have a cracking pressure at least 20 bar above the pressure control setting.

Note

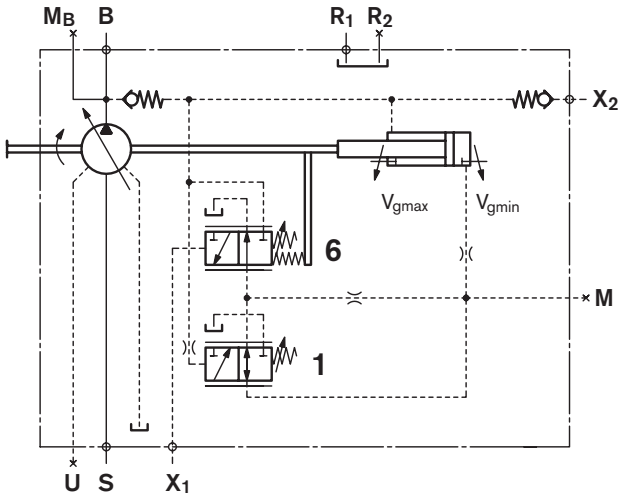
- The beginning of control and the pressure control characteristic are influenced by housing pressure. An increase in housing pressure results in a higher beginning of control (see page 7) and thus a parallel shift of the control characteristic
- Standby operation see page 6.

Characteristic



Schematic

Hydraulic control, pilot pressure dependent with integrated pressure control



Sub assemblies

1 Pressure control

6 HD-Pilot valve

Ports for

X_1 Pilot pressure

X_2 External control pressure

M Measuring pressure on control piston (plugged)

Dimensions see page 39

HD.G with remotely adjustable pressure control

Initial position: $V_{g\,min}$ in pressureless condition

The pressure control overrides the HD function.

In order to obtain a remote adjustment of the pressure control level a separate pilot pressure relief (item 2) valve must be connected to port X_3. This relief valve is not included in the supply of the DRG control.

Setting range of the pressure control _____50 to 350 bar

The spring force on the pressure compensator spool causes a differential pressure between pump output pressure and pressure at X_3 (as soon as the relief valve opens and the pressure control function takes place). Standard setting of this differential pressure 25 bar.

As long as the the pressure is below the set pressure of the relief valve, the pressures on both sides of the pressure compensator spool are equal and the additional spring force keeps this spool in a shifted position (Spool in equilibrium).

As soon as the set pressure of the relief valve is reached, this valve will start to open and the pilot flow will result in a differential pressure over the compensator spool, which causes this spool to shift and brings the pump to a smaller displacement $V_{g\,min}$.

Upon reaching the set pressure control level (set pressure at pilot relief valve plus differential pressure at pressure control compensator) the pump will go over to the pressure control mode.

The differential pressure at the pressure compensator spool (item 1) is normally set at 25 bar, which results in a pilot flow at X_3 of approx. 2 L/min.
In case another setting (range 14 to 50 bar) is required, please state in clear text when ordering.

As a seperate pilot relief valve we recommend:

DBD 6 (hydraulic) see RE 25402

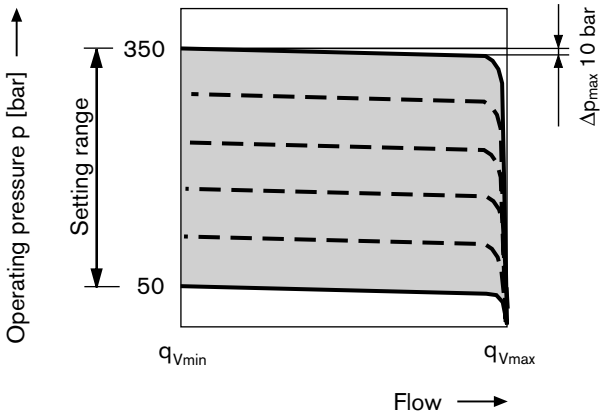
DBETR-SO 437 with dampened spool (electric) see RE 29166

The max. line lenght should not exceed 2 m.

Note

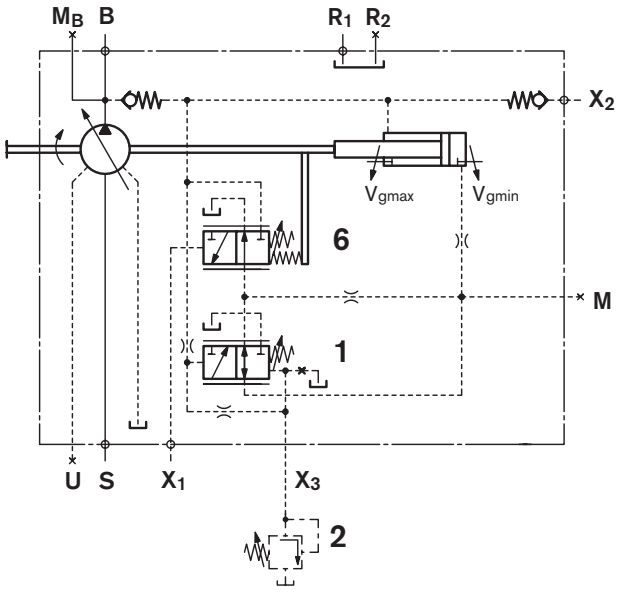
- The beginning of control and the pressure control characteristic are influenced by housing pressure. An increase in housing pressure results in a higher beginning of control (see page 7) and thus a parallel shift of the control characteristic.
- Standby operation see page 6.

Characteristic



Schematic

Hydraulic control, pilot pressure dependent with integrated pressure control



Sub assemblies

1 Integrated pressure control compensator

2 Separate pressure relief valve (not in scope of supply)

6 HD-pilot valve

Ports for

X_1 Pilot pressure

X_2 External control pressure

X_3 Separate pressure relief valve (for HDG)

M Measuring of pressure on control piston (plugged)

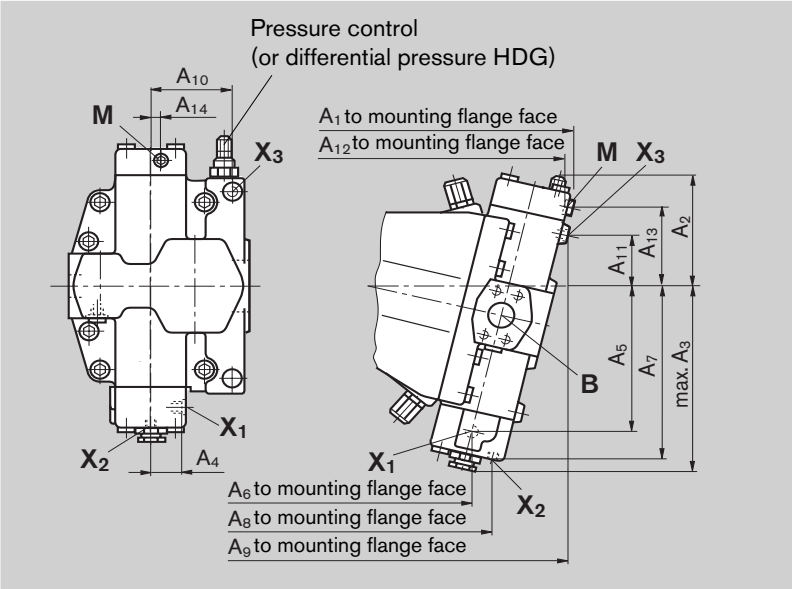
Dimensions see page 39

Dimensions HD.D and HD.G

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

General dimensions see page 10 to 17

Clockwise rotation

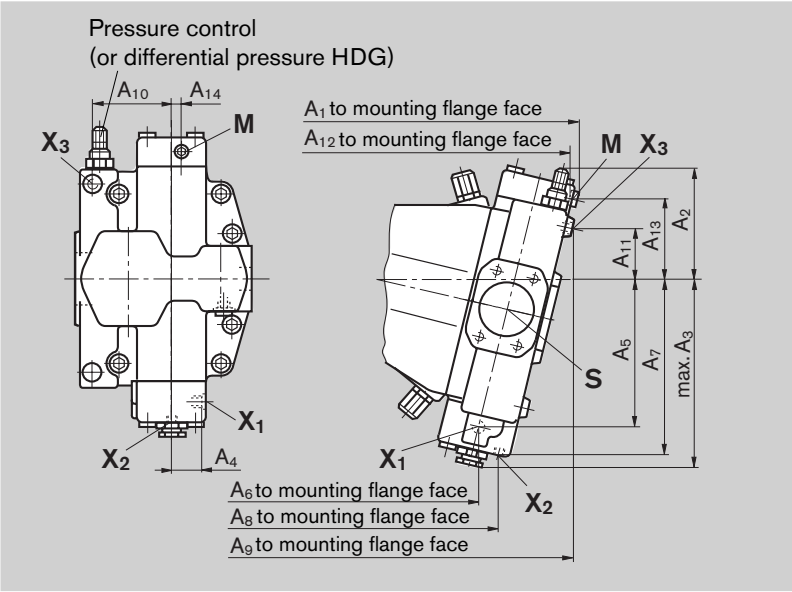


NG	A_1	A_2	A_3	A_4	A_5
250	385	161	275	49	210
355	432	181	300	54	234
500	492	200	325	61.5	258

NG	A_6	A_7	A_8	A_9	A_{10}
250	248	248	276	380	112
355	278	275	315	425	131
500	322	300	359	483	142

NG	A_{11}	A_{12}	A_{13}	A_{14}
250	74	377	116	14
355	82	425	132	20
500	96	483	144	20

Counter clockwise rotation



Ports

Designation	Port for	Standard	Size[2]	Peak pressure [bar][3]	State
X_1	Pilot pressure	DIN 3852	M14x1.5; 12 deep	100	O
X_2	External control pressure	DIN 3852	M14x1.5; 12 deep (NG250 a. 355)	400	O [4]
		DIN 3852	M18x1.5; 12 deep (NG500)	400	O [4]
X_3 (for HDG)	Separate pressure relief valve	DIN 3852	M14x1.5; 12 deep	400	O
M	Measuring of pressure on control piston	DIN 3852	M14x1.5; 12 deep	400	X

[2] For the max. tightening torques the general information on page 52 must be observed

[3] Depending on the application momentary pressure spikes can occur. Take this into consideration when selecting the measuring devices and fittings.

[4] If no external control pressure is connected, port X_2 must be plugged

O = Must be connected (closed on delivery)

X = Plugged (in normal operation)

EP.D Electric control with proportional valve

Initial position: $V_{g\,min}$ in pressureless condition

The electro-hydraulic control with proportional valve enables a stepless adjustment of the pump displacement dependent on an electric current signal.

The displacement is proportional to the current signal to the solenoid of a proportional pressure reducing valve DRE4K (see RE 29181), i.e. an increasing current signal results in an increasing displacement.

A minimum control pressure of 40 bar is required. The necessary control fluid is taken from the pump outlet pressure side.

An external control pressure is not required when the operating pressure > 40 bar and $V_{g\,min} > 0$. In this case the port X_2 must be plugged prior to commissioning. Otherwise an external control pressure of at least 40 bar must be connected to port X_2.

A pilot pressure of 30 bar is required at port P to actuate the proportional valve DRE4K.

Pilot pressure at port P

Required p_{min} ____ 30 bar

p_{max} ____ 100 bar

Important

- For operation on HF-fluids please observe the information in RE 29181 (Proportional-pressure reducing valve Type DRE4K).
- The beginning of control and the pressure control characteristic are influenced by housing pressure. An increase in housing pressure results in a higher beginning of control (see page 7) and thus a parallel shift of the control characteristic.
- Type of protection proportional valve to IP65

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 safe position (e.g. immediate stop).

Technical data proportional-press. reducing valve

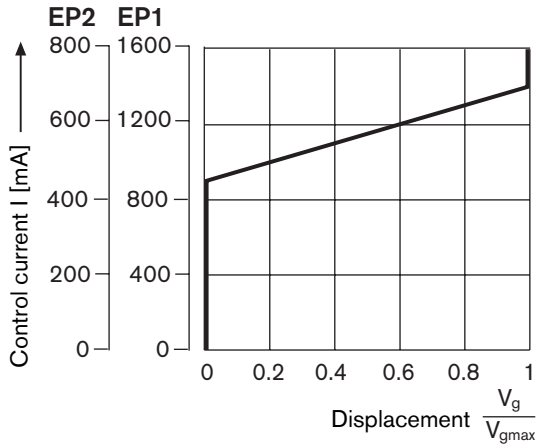
	EP1	EP2
Operating valtage (DC)	12V(±20%)	24V (±20%)
Control current		
Control begin at $V_{g\,min}$	900 mA	450 mA
Control end at $V_{g\,max}$	1400 mA	700 mA
Current limit	2,2 A	1,0 A
Nom. resistance (at 20°C)	2,4 Ω	12 Ω
Duty cycle	100 %	100 %
Type of protection (HIRSCHMANN) to DIN EN 60529	IP65	IP65

Various amplifiers for control of the proportional valve are available in the Rexroth program, see RE 29181.

Integrated pressure control EP.D is standard and overrides the EP function. Description see page 43.

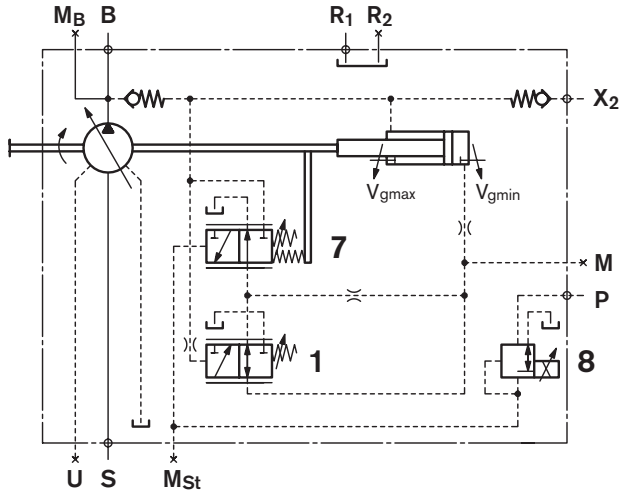
EP.D Electric control with proportional valve

Characteristic



Schematic

Electric control with proportional pressure reducing valve



Sub assemblies

1 Pressure control

7 Pilot valve

8 Proportional pressure reducing valve (see RE 29181) incl. conductor box (Hirschmann plug without suppressor diode) see page 50

Ports for

P Pilot pressure

X_2 External control pressure

M Measuring pressure on control piston (plugged)

M_{St} Measuring pilot pressure (plugged)

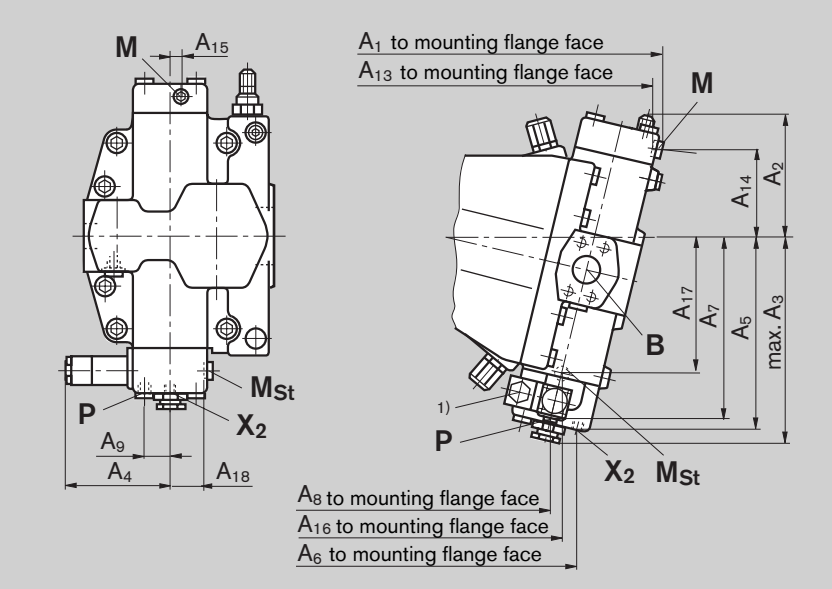
Dimensions see page 42

Dimensions **EP.D**

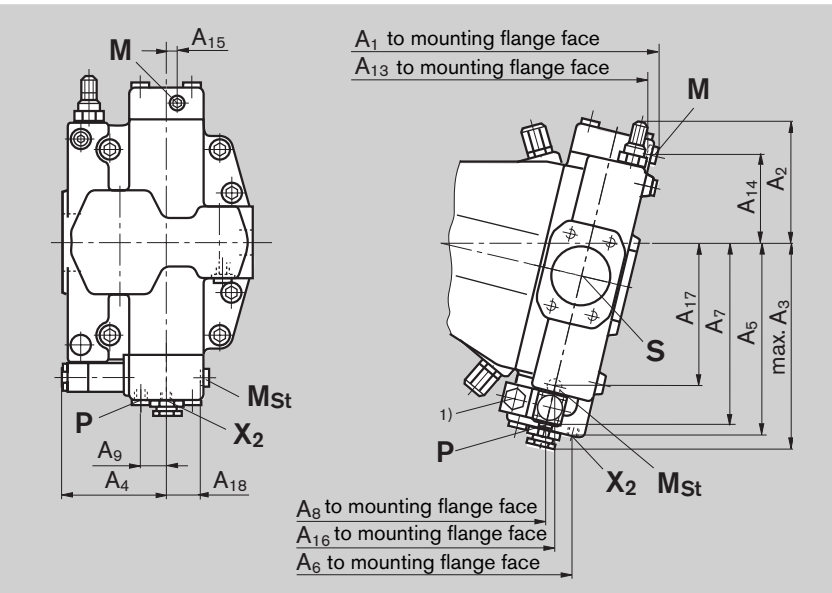
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

General dimensions see page 10 to 17

Clockwise rotation



Counter clockwise rotation



NG	A_1	A_2	A_3	A_4	A_5	A_6
250	385	161	275	115	248	276
355	432	181	300	116	275	315
500	492	200	325	123	300	359

NG	A_7	A_8	A_9	A_{10}	A_{11}	A_{12}
250	238	241	36	112	380	74
355	268	286	36	131	425	82
500	294	328	43	142	483	96

NG	A_{13}	A_{14}	A_{15}	A_{16}	A_{17}	A_{18}
250	377	116	14	248	210	49
355	425	132	20	278	234	54
500	483	144	20	322	258	61.5

[1] Cable connection M16x1.5 for cable diameter 4.5 to 10 mm
Plug description and dimensions see page 50

Ports

Designation	Port for	Standard	Size[2]	Peak pressure [bar][3]	State
P	Pilot pressure for proportional valve	DIN 3852	M14x1.5; 12 deep	100	O
X_2	External control pressure	DIN 3852	M14x1.5; 12 deep (NG250 a. 355)	400	O [4]
		DIN 3852	M18x1.5; 12 deep (NG500)	400	O [4]
M	Measuring pressure on control piston	DIN 3852	M14x1.5; 12 deep	400	X
M_{St}	Measuring pilot pressure	DIN 3852	M14x1.5; 12 deep	100	X

[2] For the max. tightening torques the general information on page 52 must be observed

[3] Depending on the application momentary pressure spikes can occur. Take this into consideration when selecting the measuring devices and fittings.

[4] If no external control pressure is connected, port X_2 must be plugged

O = Must be connected (closed on delivery)

X = Plugged (in normal operation)

EP.D with integrated pressure control

Initial position: $V_{g\,min}$ in pressureless condition

The pressure control overrides the EP-function i.e. below the setting of the pressure control the EP-function can be operated.

It protects the pump against excessive pressure and subsequential damage.

The pressure control valve is integrated into the port plate and can be set externally.

Upon reaching the set pressure control level the pump will swivel towards a lower displacement.

Setting range of the pressure control_____ 50 to 350 bar
Standard setting at 350 bar.

If a different setting is required, please state in clear text.

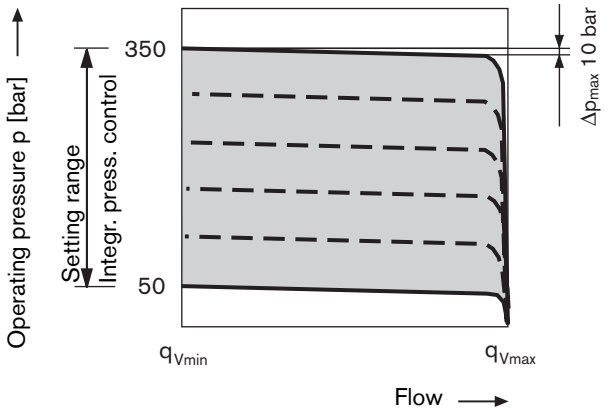
A recommended main line relief valve in the system to safeguard against excessive pressure spikes must have a cracking pressure at least 20 bar above the pressure control setting.

Note

– The beginning of control and the pressure control characteristic are influenced by housing pressure. An increase in housing pressure results in a higher beginning of control (see page 7) and thus a parallel shift of the control characteristic

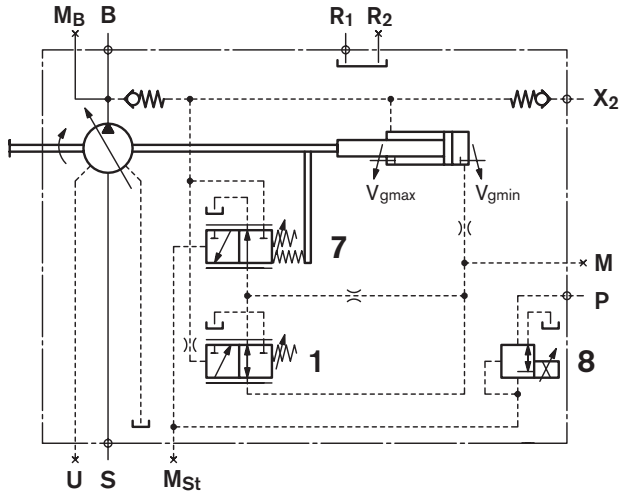
– Standby operation see page 6.

Characteristic



Schematic

Electric control with proportional pressure reducing valve



Sub assemblies

1 Pressure control

7 Pilot valve

8 Proportional pressure reducing valve incl. conductor box (Hirschmann plug without suppressor diode) see page 46

Ports for

P Pilot pressure

X_2 External control pressure

M Measuring pressure on control piston (plugged)

M_{St} Measuring pilot pressure (plugged)

Dimensions see page 45

EP.G with remotely adjustable pressure control

Initial position: $V_{g\,min}$ in pressureless condition

The pressure control overrides the EP- function.

In order to obtain a remote adjustment of the pressure control level a separate pilot pressure relief (item 2) valve must be connected to port X_3. This relief valve must be ordered separately to the DRG control.

Setting range of the pressure control _____50 to 350 bar

The spring force on the pressure compensator spool causes a differential pressure between pump output pressure and pressure at X_3 (as soon as the relief valve opens and the pressure control function takes place). Standard setting of this differential pressure 25 bar.

As long as the the pressure is below the set pressure of the relief valve, the pressures on both sides of the pressure compensator spool are equal and the additional spring force keeps this spool in a shifted position (Spool in equilibrium).

As soon as the set pressure of the relief valve is reached, this valve will start to open and the pilot flow will result in a differential pressure over the compensator spool, which causes this spool to shift and brings the pump to a smaller displacement $V_{g\,min}$.

Upon reaching the set pressure control level (set pressure at pilot relief valve plus differential pressure at pressure control compensator) the pump will go over to the pressure control mode.

The differential pressure at the pressure compensator spool (item 1) is normally set at 25 bar, which results in a pilot flow at X_3 of approx. 2 L/min.
In case another setting (range 14 to 50 bar) is required, please state in clear text when ordering.

As a seperate pilot relief valve we recommend:

DBD 6 (hydraulic) see RE 25402

DBETR-SO 437 with dampened spool (electric) see RE 29166

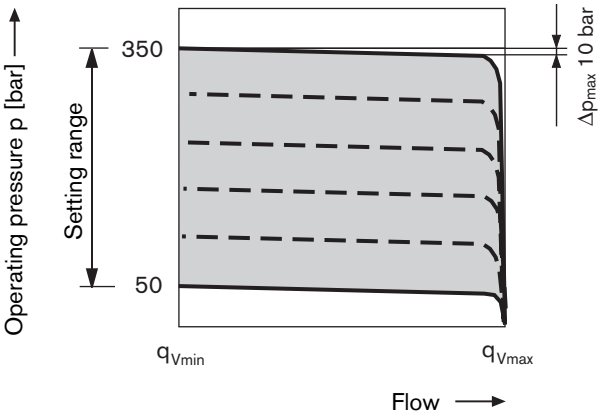
The max. line lenght should not exceed 2 m.

Note

– The beginning of control and the pressure control characteristic are influenced by housing pressure. An increase in housing pressure results in a higher beginning of control (see page 7) and thus a parallel shift of the control characteristic.

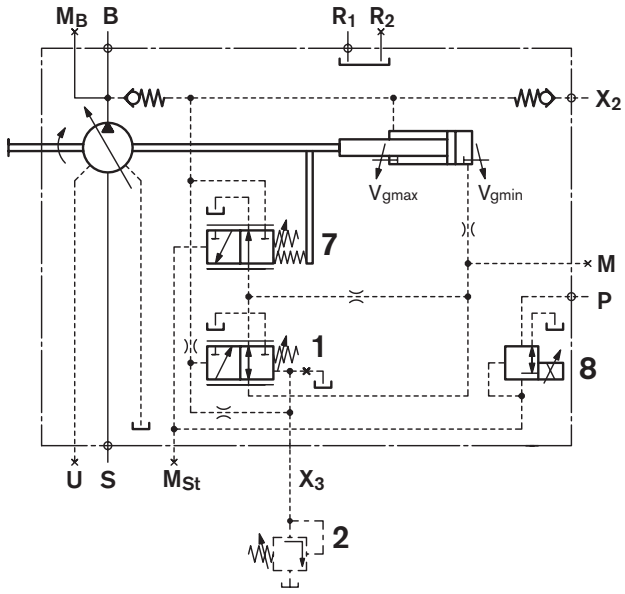
– Standby operation see page 6.

Characteristic



Schematic

Electric control with proportional pressure reducing valve and remotely adjustable pressure control



Sub assemblies

1 Integrated pressure control compensator

2 Separate pressure relief valve (not in scope of supply)

7 Pilot valve

8 Proportional pressure reducing valve

Ports for

P Pilot pressure for proportional valve

X_2 External control pressure

X_3 Separate pressure relief valve (EPG)

M Measuring pressure on control piston (plugged)

M_{St} Measuring pilot pressure (plugged)

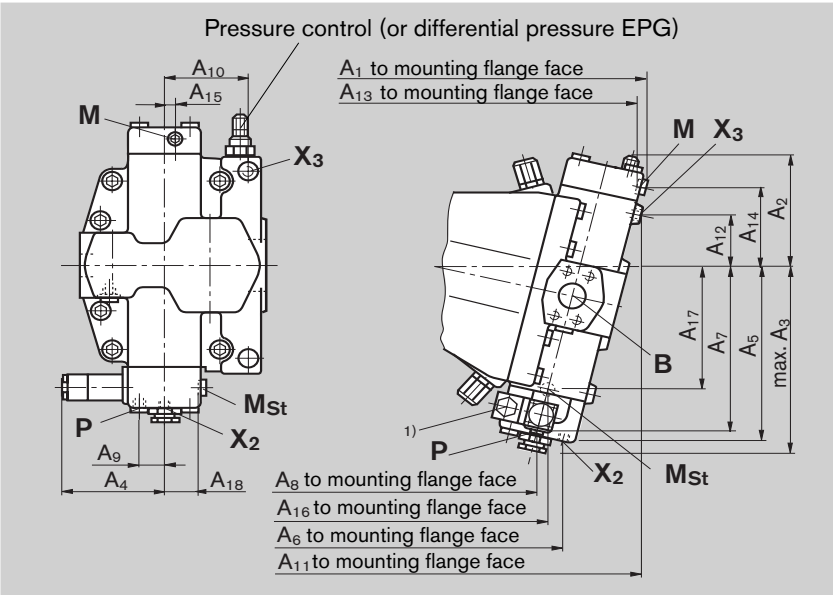
Dimensions see page 45

Dimensions EP.D and EP.G

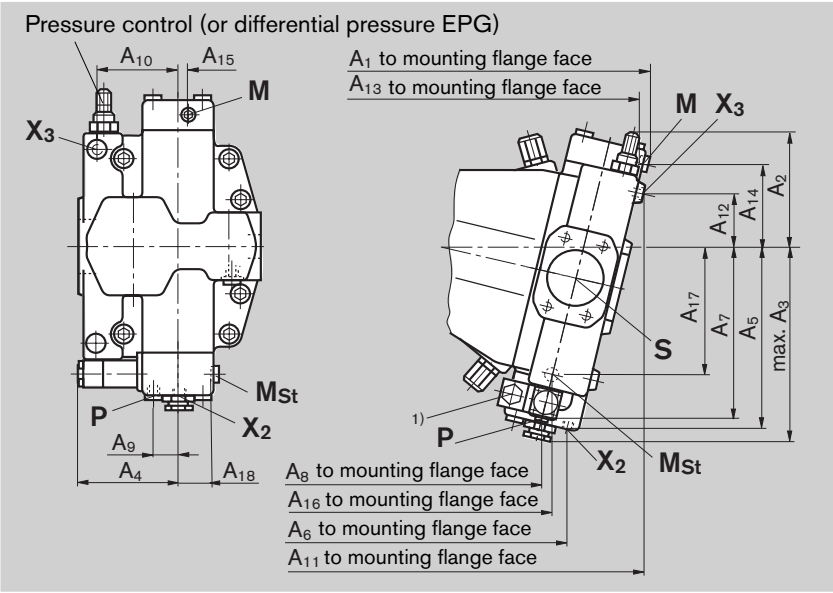
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

General dimensions see page 10 to 17

Clockwise rotation



Counter clockwise rotation



NG	A_1	A_2	A_3	A_4	A_5	A_6
250	385	161	275	115	248	276
355	432	181	300	116	275	315
500	492	200	325	123	300	359

NG	A_7	A_8	A_9	A_{10}	A_{11}	A_{12}
250	238	241	36	112	380	74
355	268	286	36	131	425	82
500	294	328	43	142	483	96

NG	A_{13}	A_{14}	A_{15}	A_{16}	A_{17}	A_{18}
250	377	116	14	248	210	49
355	425	132	20	278	234	54
500	483	144	20	322	258	61.5

[1] Cable connection M16x1.5 for cable diameter 4.5 to 10 mm
Plug description and dimensions see page 50

Ports

Designation	Port for	Standard	Size[2]	Peak pressure [bar][3]	State
P	Pilot pressure for proportional valve	DIN 3852	M14x1.5; 12 deep	100	O
X_2	External control pressure	DIN 3852	M14x1.5; 12 deep (NG250 a. 355)	400	O
		DIN 3852	M18x1.5; 12 deep (NG500)	400	O
X_3 (for EPG)	Separate pressure relief valve	DIN 3852	M14x1.5; 12 deep	400	O
M	Measuring pressure on control piston	DIN 3852	M14x1.5; 12 deep	400	X
M_{St}	Measuring pilot pressure	DIN 3852	M14x1.5; 12 deep	100	X

[2] For the max. tightening torques the general information on page 52 must be observed

[3] Depending on the application momentary pressure spikes can occur. Take this into consideration when selecting the measuring devices and fittings.

[4] If no external control pressure is connected, port X_2 must be plugged

O = Must be connected (closed on delivery)

X = Plugged (in normal operation)

Visual swivel angle indicator

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

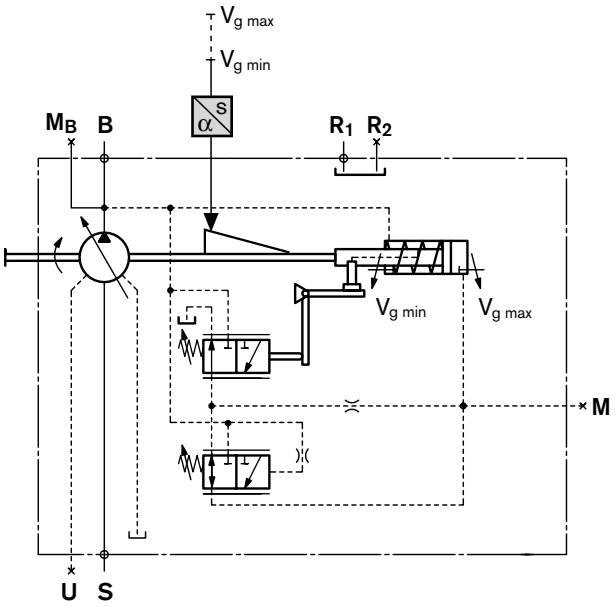
The swivel angle is indicated by a pin at the side of the port plate (the cap nut must be removed).

The protruding lenght of the pin varies in accordance with the position of the lens plate.

The pump is at zero if the pin is flush with the port plate.

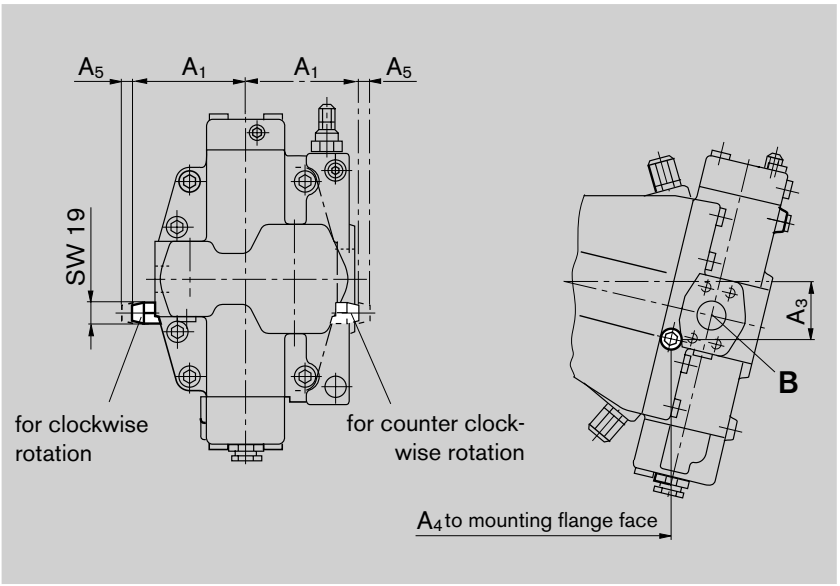
The lenght of the pin is approx. 8 mm when swivelled to max. angle $V_{g\,max}$.

Schematic example LRD – intial position $V_{g\,max}$



Dimensions

General dimensions see page 10 to 17



NG	A_1	A_3	A_4	A_5*
250	136.5	73	238	11
355	159.5	84	266	11
500	172.5	89	309	11

* Dimension to remove the cap nut

Electric swivel angle indicator

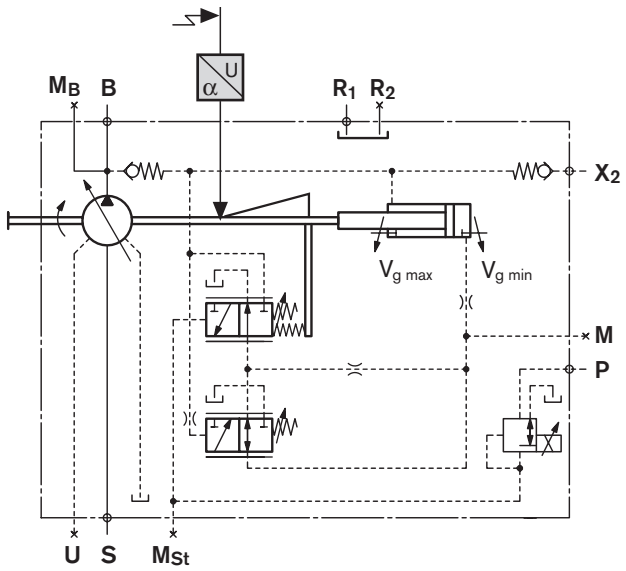
Before finalizing your design, request a binding installation drawing. Dimensions in mm.

In this case the pump swivel angle is indicated via an inductive position transducer.

It converts the displacement of the control device into an electrical signal This signal can be used to feed the value of swivel angle to an amplifier card for example.

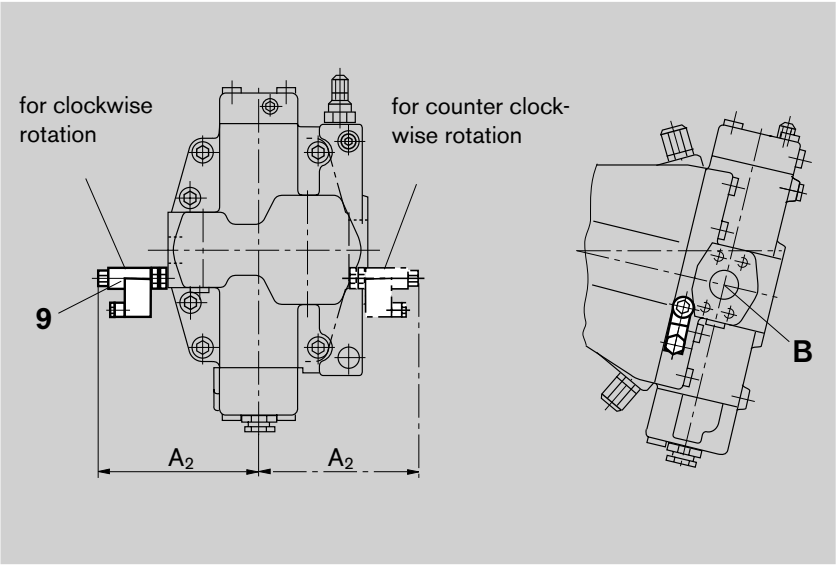
Inductive transducer Type IW9 – 03 – 01

Schematic example EPD – intial position $V_{g\,min}$



Dimensions

General dimensions see page10 to 17



NG	A_2
250	182
355	205
500	218

Sub assemblies

9 Inductive transducer IW9-03-01
with conductor box (mating plug) Hirschmann plug without suppressore diode,
with cable connection M16x1.5 for cable diameter 4.5 to 10 mm
Plug description and dimensions see page 50

Safety information

– The pump A7VO was designed for operation in open loop circuits

– Systems design, installation and commissioning requires trained technicians or tradesmen.

– All hydraulic ports can only be used for the fastening of hydraulic service lines.

– During and shortly after operation of a pump the housing and especially a solenoid can be extremely hot, avoid being burned; take suitable safety measures (wear protective clothing).

– Dependent on the operating conditions of the axial piston pump (operating pressure, fluid temperature) deviations in the performance curves can occur.

– Pressure ports:
All materials and port threads are selected and designed in such a manner, that they can withstand the peak pressures.
The machine and system manufacturer must ensure, that all connecting elements and hydraulic lines are suitable for the actual operating conditions (pressures, flow, fluid, temperature) in accordance with the necessary safety factors.

– All given data and information must be adhered to..

– The product has not been released as a component in the safety concept of a total machine system acc. to DIN EN ISO 13849.

– The following tightening torques are valid:

- Female threads in the axial piston unit:
the maximum permissible tightening torques M_{GMax} are maximum values for the female threads in the pump casting and may not be exceeded. For values see table below. -

- Fittings:
please comply with the manufacturer's information regarding the max. permissible tightening torques for the used fittings.

- Fastening bolts:
for fastening bolts to DIN 13 we recommend to check the permissible tightening torques in each individual case to VDI 2230.

- Plugs:
for the metal plugs, supplied with the axial piston unit the following min. required tightening torques M_V apply (see table)

Port thread size		Max. perm. tightening torque in female threads $M_{G\ max}$	Required tightening torque of plugs or fittings M_V	Across the flats in Allan screws
M14x1.5	DIN 3852	80 Nm	35 Nm	6 mm
M18x1.5	DIN 3852	140 Nm	60 Nm	8 mm
M22x1.5	DIN 3852	210 Nm	80 Nm	10 mm
M33x2	DIN 3852	540 Nm	225 Nm	17 mm

Bosch Rexroth AG
Hydraulics
Axial Piston Units
An den Kelterwiesen 14
72160 Horb a.N., Germany
Telefon +49 (0) 74 51 - 92 0
Telefax +49 (0) 74 51 - 82 21
info.brm-ak@boschrexroth.de
www.boschrexroth.com/axial-piston-pumps

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The data specified above only serve to describe the product. No statements concerning a certain condition or suitability for a certain application can be derived from our information. The information given does not release the user from the obligation of own judgment and verification. It must be remembered that our products are subject to a natural process of wear and aging.

Subject to change.

Rexroth
Bosch Group

External Gear Pumps
Series S

RE 10 095/02.12
Replaces:
RE 10 095/09.09

AZPS-...

Fixed pumps
$V = 4.0...28\ cm^3/rev$

SILENCE





Overview of contents

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Features

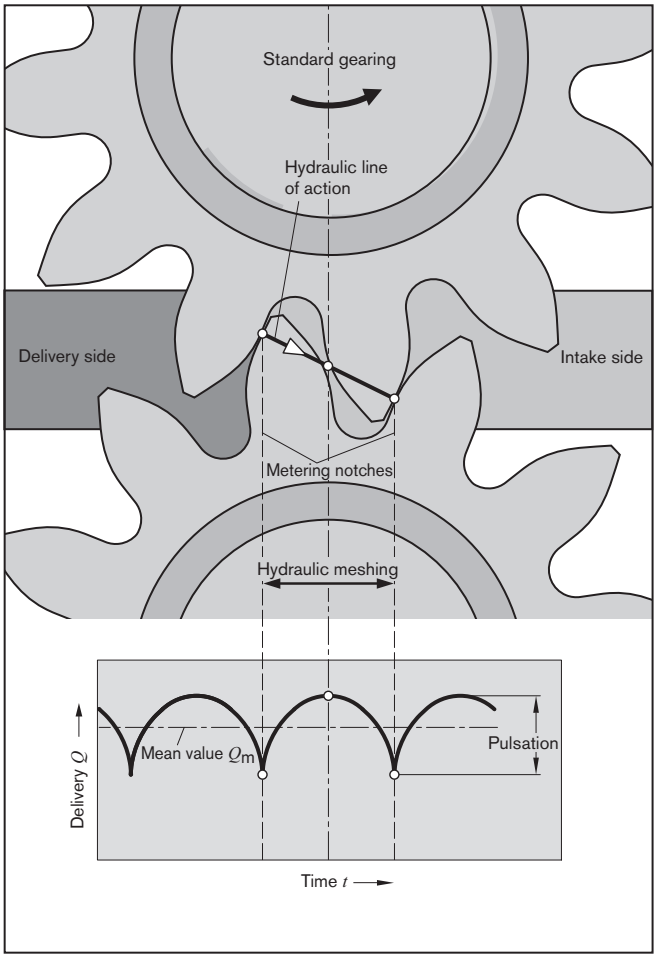
- Nominal pressure 280 bar
- Slide bearings for heavy duty applications
- Drive shafts to ISO or SAE
- Combination of several pumps possible
- Line ports:
  connection flange or screw thread
- Optimized pressure pulsation with reduced noise emissions and vibration excitation in the system
- Consistent high quality
- Considerably longer service life due to reinforced shaft and case

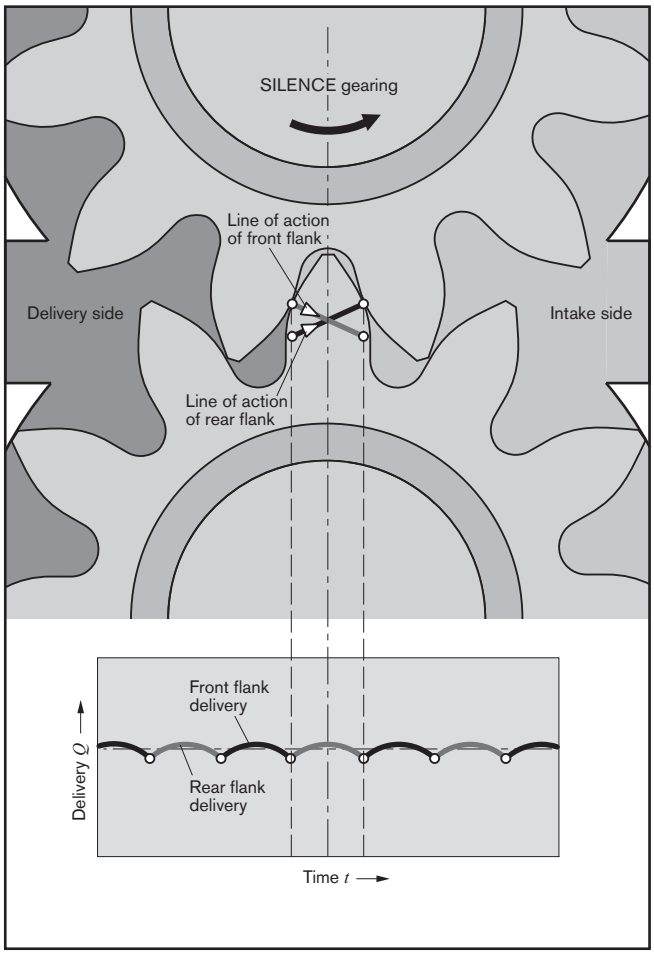
General

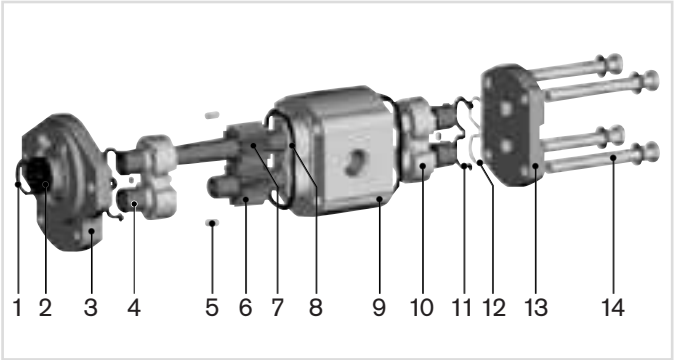
The key task of external gear units is to convert mechanical energy (torque and rotational speed) into hydraulic energy (flow and pressure). In external gear motors this is the other way round. These machines are required to be highly efficient in order to avoid unnecessary heat. This efficiency is achieved by means of precision production engineering and pressure-sensitive gap sealing.

Moreover, in the low-noise SILENCE pumps, the dual-flank principle helps to reduce flow pulsation by up to 75 %.

The displacement method







1 Retaining ring
2 Shaft seal ring
3 Front cover
4 Slide bearing
5 Centering pin
6 Gear
7 Gear (frictional)
8 Case seal
9 Pump case
10 Bearing
11 Axial zone seal
12 Support
13 End cover
14 Fixing screws

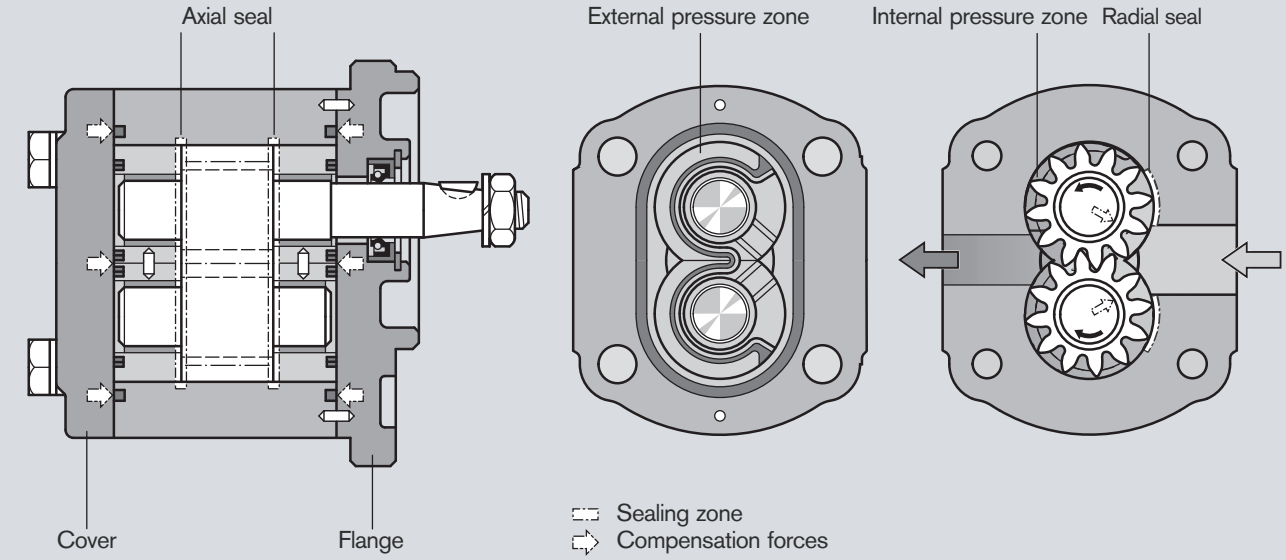
The geometry of the displacement gearing, matched in form by the rotation of the drive shaft, results in the parabolic flow characteristic shown here on the left. In a standard pump, this characteristic is repeated each time a gear tooth meshes. With their dual-flank system, the flow pulsation of SILENCE pumps is reduced by 75 % – with correspondingly lower excitation of downstream system components – at double the fundamental frequency. During this process, the gear pair exhibits an extremely reduced rear flank backlash, so that hydraulic sealing is provided not just by the front flank of the driven gear, but also by the rear flanks. In this way, the front and rear flanks alternately contribute to flow displacement. And by adapting the shape of the metering notches, the expansion of the hydraulic line of action is half that of the standard pump.

Construction

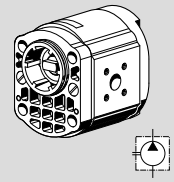
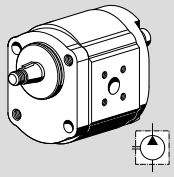
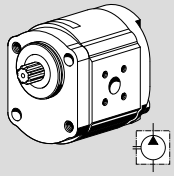
The external gear unit consists essentially of a pair of gears supported in bearing bushings and the case with a front and a rear cover. The drive shaft protrudes from the front cover where it is sealed by the shaft seal ring. The bearing forces are absorbed by special bearing bushings with sufficient elasticity to produce surface contact instead of line contact. They also ensure excellent resistance to galling – especially at low speed. The gears have 12 teeth. This keeps both flow pulsation and noise emission to a minimum.

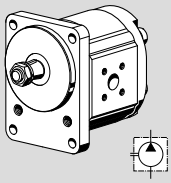
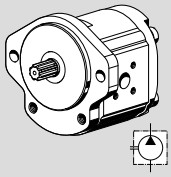
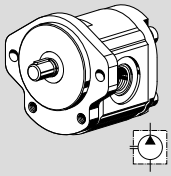
The internal sealing is achieved by forces which are proportional to delivery pressure. This ensures optimum efficiency. The bearings provide the seal at the ends of the gaps between the teeth which carry the pressurized oil. The sealing zone between the gear teeth and the bearings is controlled by the admission of operating pressure to the rear of the bearing bushings. Special seals form the boundary of the zone. The radial clearance at the tips of the gear teeth is sealed by internal forces pushing them against the case.

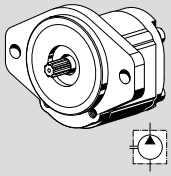
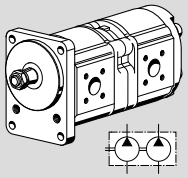
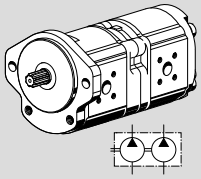
Gear pump axial compensation



Product overview of “SILENCE standard range”

Version	Page
	19
	20
	21

Version	Page
	22
	23
	24

Version	Page
	25
	26
	27

Ordering code

External gear units Single pumps “SILENCE”

AZ	P	S	–	x	x	–	016	R	C	B	20	M	B	18009	S xxxx

Function
P = Pump

Series
1x = Standard bearing
2x = Reinforced bearing

Version
1 = Phosphatized, pinned
2 = Chromatized, pinned

Size (S)
004 = 4.0 cm³/rev
005 = 5.5 cm³/rev
008 = 8.0 cm³/rev
011 = 11.0 cm³/rev
014 = 14.0 cm³/rev
016 = 16.0 cm³/rev
019 = 19.0 cm³/rev
022 = 22.5 cm³/rev
025 = 25.0 cm³/rev
028 = 28.0 cm³/rev

Direction of rotation
R = Clockwise
L = Counter-clockwise

*) Some of the special designs shown on pages 19–27 are not covered in the illustration of the ordering code.

Special design *)

Valve adjustment
200 xx = PRV 200 bar
xxx 11 = FCV 11 l/min
18009 = PRV + FCV 180 bar, 9 l/min

Rear cover
B = Standard
D = PRV residual flow internal
E = FCV residual flow external
S = FCV residual flow internal
V = PRV + FCV

Seals
M = NBR
P = FKM
K = NBR, SSR in FKM

Drive shafts

		Suitable front cover	
C	Tapered key shaft 1 : 5	**B**	**P**
H	Tapered key shaft 1 : 8	**O**	
N	Dihedral claw	**M**	
Q	Straight keyed shaft SAE J 744 16-1	**R**	
R	Splined shaft SAE J 744 16-4 9T	**R**	**C**
P	Splined shaft SAE J 744 19-4 11T	**R**	**C**
F	Splined shaft DIN 5482 B 17 x 14	**B**	**P**
S	Tapered key shaft 1 : 5 for flange A	**A**	

Front cover

B	Square flange Centering Ø 80 mm
R	SAE J 744 82-2 A 2-bolt flange Ø 82.55 mm
P	2-bolt mounting Centering Ø 50 mm
O	Square flange Centering Ø 36.47 mm
C	SAE J 744 101-2 B 2-bolt flange Ø 101.6 mm
M	2-bolt mounting Centering Ø 52 mm with seal ring
A	Outboard bearing Ø 80 mm, Type 1
N	2-bolt mounting Centering Ø 50 mm

Line ports

20	Rectangular flange
12	Thread (UN-2B) SAE seal ring BOSS
30	Rectangular flange
01	Pipe thread ISO 228/1
03	Thread, metric ISO 6149 with seal ring

Not all variants can be selected by using ordering code!
Please select the required pump by using the selection tables (standard types) or after consultation with Bosch Rexroth!
Special options are possible upon request.

Ordering code

External gear units Multiple pumps “SILENCE”

AZ	P	GGSS	–	x	x	–	032/022/016/005	R	C	B	20 20 20 20	K	B

Function
P = Pump

Series
B = 1.0...7.1 cm³/rev
S = 4.0...28 cm³/rev
F = 4.0...28 cm³/rev
N = 20.0...36 cm³/rev
G = 22.5...63 cm³/rev

Series, relates to pump section 1
1x = Standard bearing
2x = Reinforced bearing

Version, relates to pump section 1
1 = Phosphatized, pinned
2 = Chromatized, pinned

Size
corresponding to each series

Direction of rotation
R = Clockwise,
L = Counter-clockwise

Rear cover
relates to last pump section
B = Standard

Seals
M = NBR
P = FKM
K = NBR, SSR in FKM
Shaft seal relate to pump section 1

Drive shafts
relates to pump part 1

		Suitable front cover
Series B:		
H	Tapered key shaft 1 : 8	**O**
Series F, S:		
C	Tapered key shaft 1 : 5	**B**
H	Tapered key shaft 1 : 8	**O**
R	Splined shaft SAE J 744 16-4 9T	**R**
Series N, T:		
C	Tapered key shaft 1 : 5	**B**
D	Splined shaft SAE J 744 22-4 13T	**C**
N	Dihedral claw	**M**
Series G, U:		
C	Tapered key shaft 1 : 5	**B**
D	Splined shaft SAE J 744 22-4 13T	**C**
H	Tapered key shaft 1 : 8	**O**

Front cover
relates to pump part 1

O	Square flange Centering Ø 25.38 mm
B	Square flange Centering Ø 80 mm
O	Square flange Centering Ø 36.47 mm
R	SAE J 744 82-2 A Centering Ø 82.55 mm 2-bolt mounting
B	Square flange Centering Ø 100 mm
C	SAE J 744 101-2 B Centering Ø 101.6 mm 2-bolt mounting
M	Centering Ø 52 mm with seal ring
B	Square flange Centering Ø 105 mm
C	SAE J 744 101-2 B Centering Ø 101.6 mm 2-bolt mounting
O	Square flange Centering Ø 50.78 mm

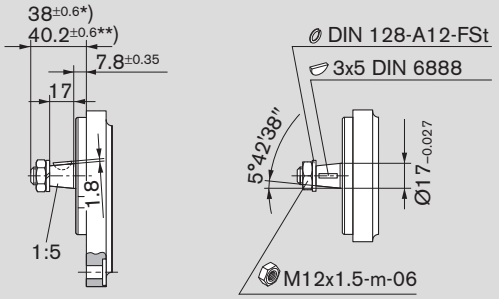
Line ports
every pump parts

02	Thread, metric DIN 3852 T1
20	Rectangular flange
07	Square flange SAE Thread, metric
20	Rectangular flange
07	Square flange SAE Thread, metric
20	Rectangular flange

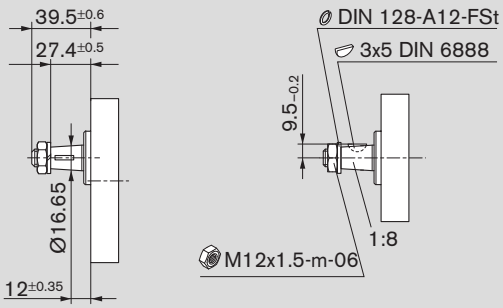
Not all variants can be selected by using ordering code!
Please select the required pump by using the selection tables (standard types) or after consultation with Bosch Rexroth!
Special options are possible upon request.

Drive shafts

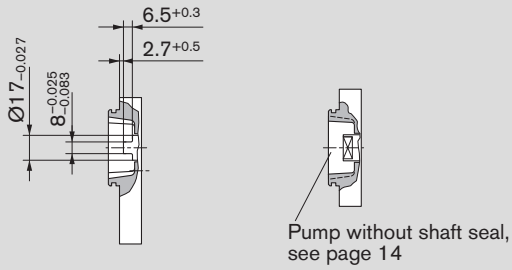
C



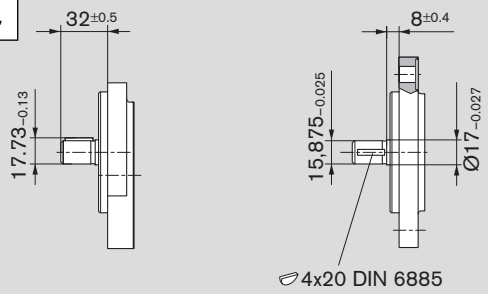
H



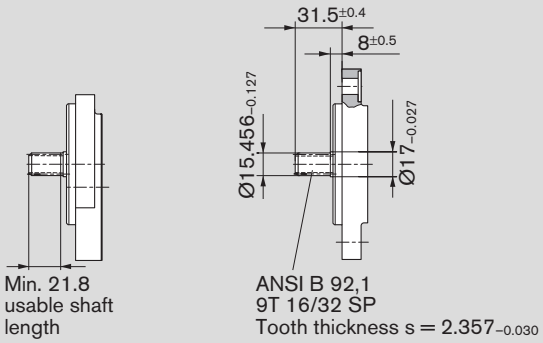
N



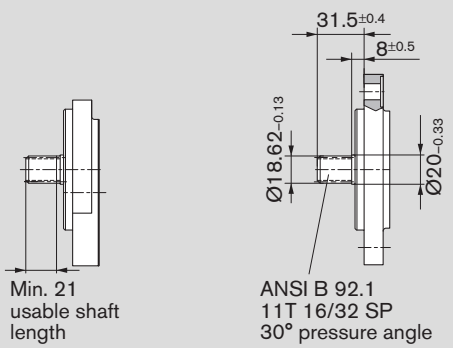
Q



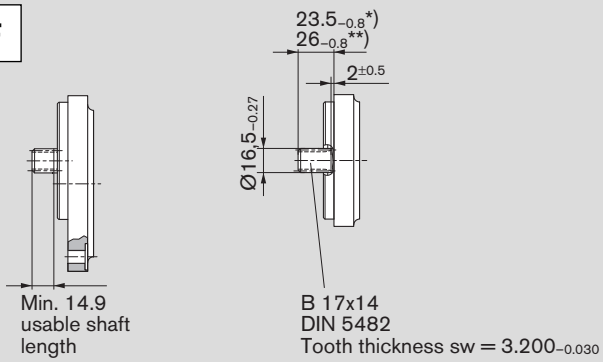
R



P



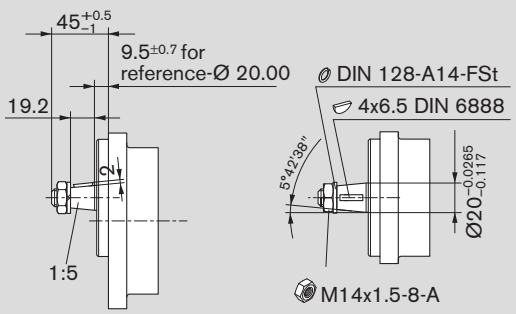
F



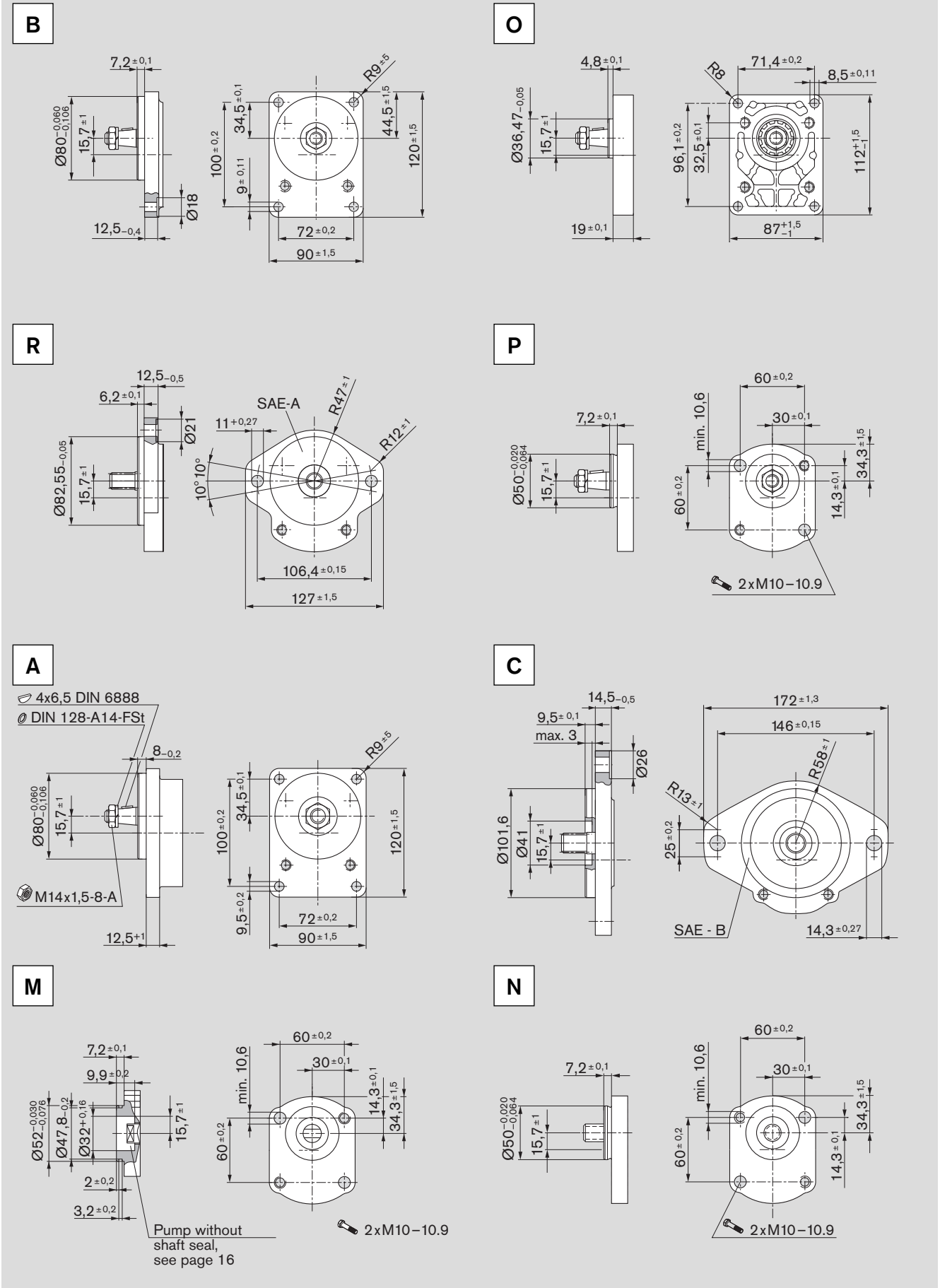
*) in combination with front cover B

**) in combination with front cover P

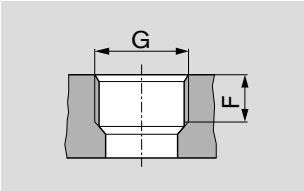
S



Front cover


B
7,2±0,1
Ø80−0,060 −0,106
15,7±1
Ø18
12,5−0,4
R9±5
34,5±0,1
44,5±1,5
100±0,2
9±0,11
120±1,5
72±0,2
90±1,5
O
4,8±0,1
Ø36,47−0,05
15,7±1
19±0,1
R8
71,4±0,2
8,5±0,11
96,1±0,2
32,5±0,1
112+1,5 −1
87+1,5 −1
R
12,5−0,5
6,2±0,1
Ø21
Ø82,55−0,05
15,7±1
SAE-A
11+0,27
R47±1
R12±1
10° 10°
106,4±0,15
127±1,5
P
7,2±0,1
Ø50−0,020 −0,064
15,7±1
60±0,2
min. 10,6
30±0,1
34,3±1,5
60±0,2
14,3±0,1
2xM10−10.9
A
4x6,5 DIN 6888
DIN 128-A14-FSt
8−0,2
Ø80−0,060 −0,106
15,7±1
M14x1,5-8-A
12,5+1
R9±5
34,5±0,1
100±0,2
120±1,5
9,5±0,2
72±0,2
90±1,5
C
14,5−0,5
9,5±0,1
max. 3
Ø26
Ø101,6
Ø41
15,7±1
172±1,3
146±0,15
R58±1
R13±1
25±0,2
SAE - B
14,3±0,27
M
7,2±0,1
9,9±0,2
Ø52−0,030 −0,076
Ø47,8−0,2
Ø32+0,16
15,7±1
2±0,2
3,2±0,2
Pump without shaft seal, see page 16
60±0,2
min. 10,6
30±0,1
14,3±0,1
34,3±1,5
60±0,2
2xM10−10.9
N
7,2±0,1
Ø50−0,020 −0,064
15,7±1
60±0,2
min. 10,6
30±0,1
34,3±1,5
60±0,2
14,3±0,1
2xM10−10.9

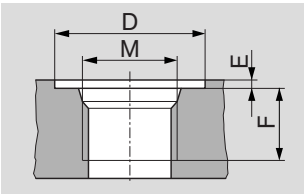
Line ports



01 **Pipe thread ISO 228/1**

At pressures $p_2 > 210$ bar limited service life

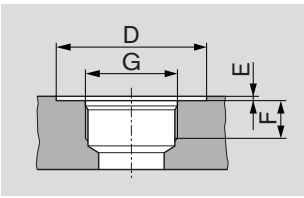
Ordering code	Size	Pressure side G	Pressure side F	Suction side G	Suction side F
01	4...16 cm³	G 1/2	16	G 3/4	16
	19...28 cm³	G 3/4		G 1	19



03 **Thread, metric ISO 6149 with seal ring**

At pressures $p_2 > 210$ bar limited service life

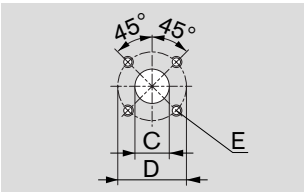
Ordering code	Size	Pressure side M	Pressure side D	Pressure side E	Pressure side F	Suction side M	Suction side D	Suction side E	Suction side F
03	4...5.5 cm³	M 18 x 1.5	29	0.5	16	M 18 x 1.5	29	0.5	16
	8...16 cm³	M 22 x 1.5	34		18	M 27 x 1.5	40		19
	19...28 cm³					M 33 x 2	46		22



12 **Thread (UN-2B, UNF-2B) SAE Seal ring BOSS**

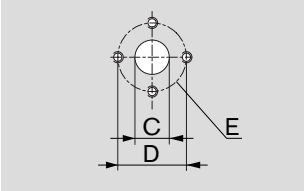
At pressures $p_2 > 210$ bar limited service life

Ordering code	Size	Pressure side G	Pressure side D	Pressure side E	Pressure side F	Suction side G	Suction side D	Suction side E	Suction side F
12	4...5.5 cm³	9/16–18 UNF-2B	25	0.5	13	9/16–18 UNF-2B	25	0.5	13
	8 cm³	7/8–14 UNF-2B	35		16	7/8–14 UNF-2B	35		16
	11...28 cm³					1 1/16–12 UN-2B	45		19



20 **Rectangular flange**

Ordering code	Size	Pressure side C	Pressure side D	Pressure side E	Suction side C	Suction side D	Suction side E
20	4...5.5 cm³	15	35	M6, depth 13	15	40	M6, depth 13
	8...16 cm³				20		
	19...28 cm³				26	55	M8, depth 13



30 **Rectangular flange**

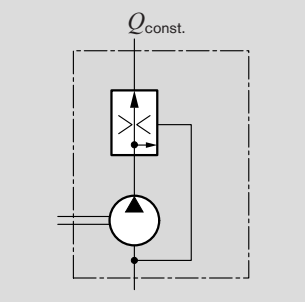
Ordering code	Size	Pressure side C	Pressure side D	Pressure side E	Suction side C	Suction side D	Suction side E
30	4...8 cm³	13.5	30.2	M6, depth 13	13.5	30.2	M6, depth 13
	11...28 cm³				20.0	39.7	M8, depth 13

Gear pumps with integral valves

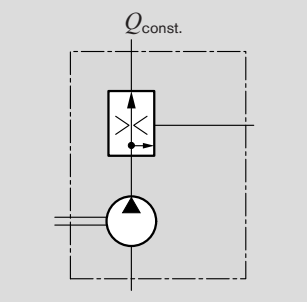
In order to reduce external pipework it is possible to incorporate a flow-control valve or pressure-relief valve in the rear cover of the gear pump. A typical application of this is in the supply of hydraulic oil in power steering systems. The pump delivers a constant flow irrespective of the speed at which it is driven. The excess flow is either returned internally to the suction port or distributed externally to other items of equipment.



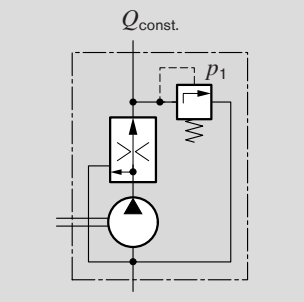
Upon request



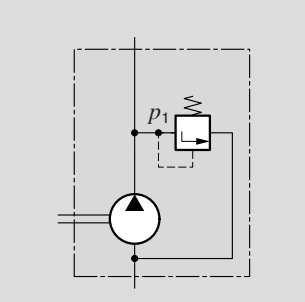
3-way flow-control valve.
Excess flow returned to suction line
$Q_{const.}$ = 2...30 l/min



3-way flow-control valve.
Excess flow distributed externally; loadable
$Q_{const.}$ = 2...30 l/min



3-way flow-control valve with pressure-relief valve.
Excess flow returned to suction line
$Q_{const.}$ = 2...30 l/min
p_1 = 100...180 bar



Pressure-relief valve.
Discharge returned to suction line
p_1 = 5...250 bar

Ordering code

S	xxx17

E	xxx12

V	15011

D	180xx

Design calculations for pumps

The design calculations for pumps are based on the following parameters:

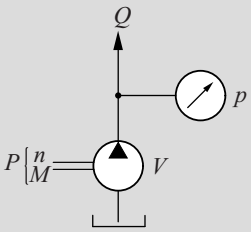
V	[cm³/rev]	Displacement
Q	[l/min]	Delivery
p	[bar]	Pressure
M	[Nm]	Drive torque
n	[rev/min]	Drive speed
P	[kW]	Drive power

It is also necessary to allow for different efficiencies such as:

η_v	Volumetric efficiency
η_{hm}	Hydraulic-mechanical efficiency
η_t	Overall efficiency

The following formulas describe the various relationships.
They include correction factors for adapting the parameters to the usual units encountered in practice.

Caution: Diagrams providing approximate selection data will be found on subsequent pages.



$$Q = V \cdot n \cdot \eta_v \cdot 10^{-5}$$

$$p = \frac{M \cdot \eta_{hm}}{1.59 \cdot V}$$

$$P = \frac{p \cdot Q}{6 \cdot \eta_t}$$

$$V = \frac{Q}{n \cdot \eta_v} \cdot 10^5$$

$$V = \frac{M \cdot \eta_{hm}}{159 \cdot p}$$

$$Q = \frac{6 \cdot P \cdot \eta_t}{p}$$

$$n = \frac{Q}{V \cdot \eta_v} \cdot 10^5$$

$$M = \frac{1.59 \cdot V \cdot p}{\eta_{hm}}$$

$$p = \frac{6 \cdot P \cdot \eta_t}{Q}$$

[%]

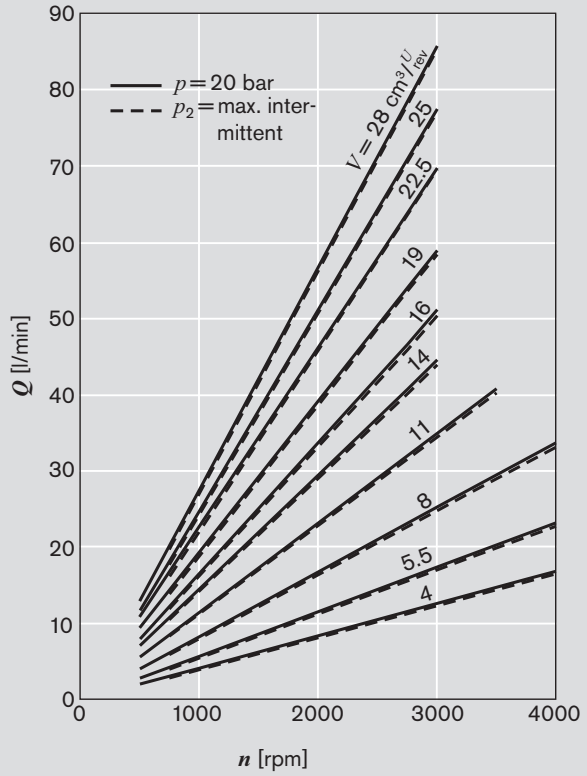
n —— η_v ⟶ Q
M —— η_{hm} ⟶ p
P —— η_t ⟶ $p \cdot Q$

V [cm³/rev] Q [l/min] p [bar]
n [rev/min] P [kW] M [Nm]

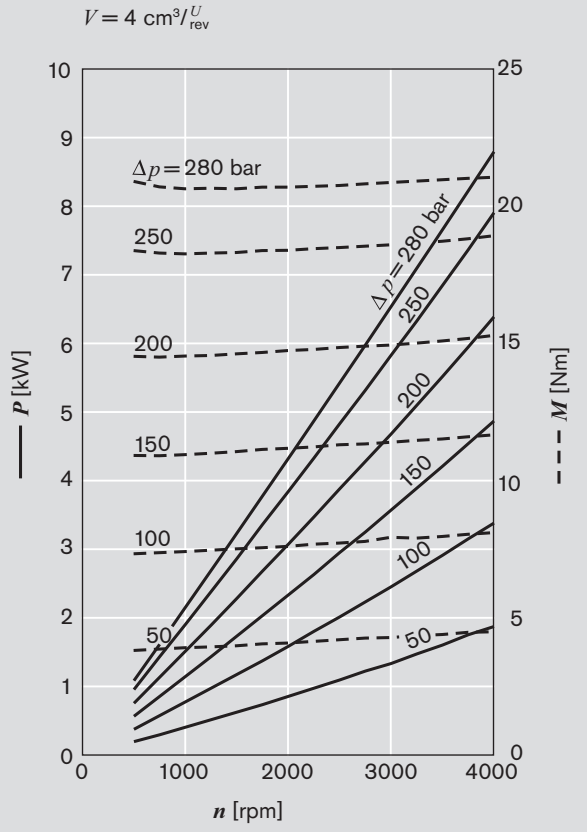
Caution: η [%] e.g. 95 [%]

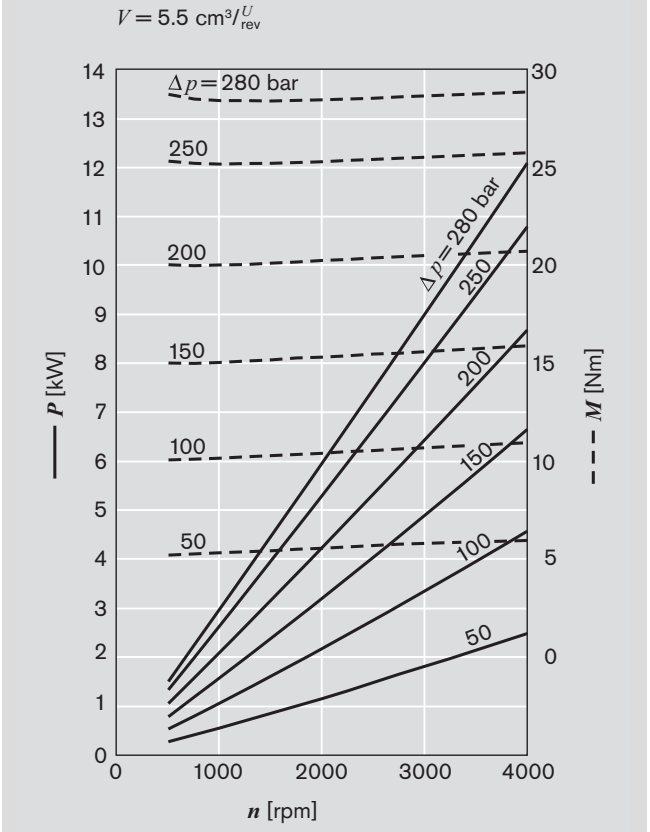
Performance charts

$\nu = 35\ mm^2/s$, $\vartheta = 50\,°C$

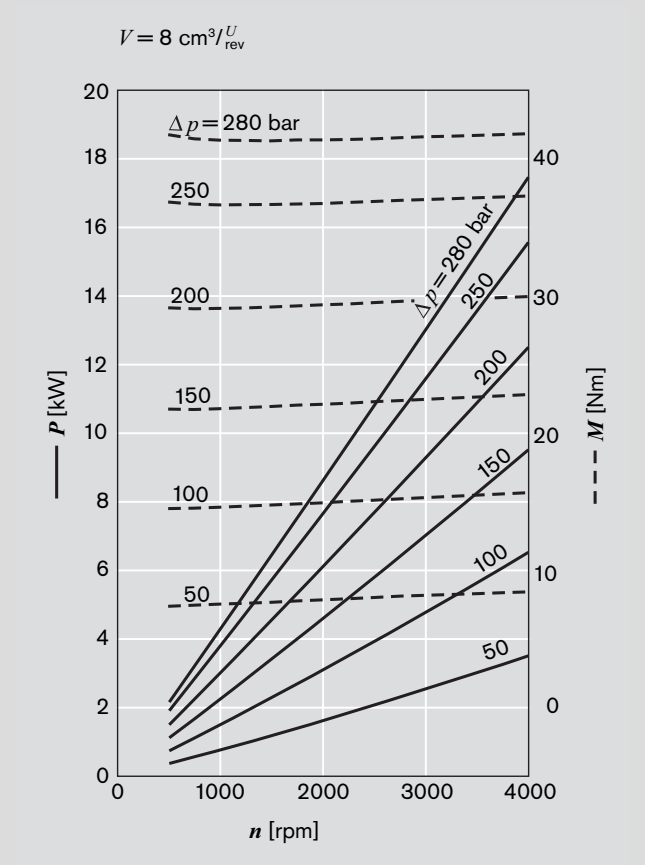


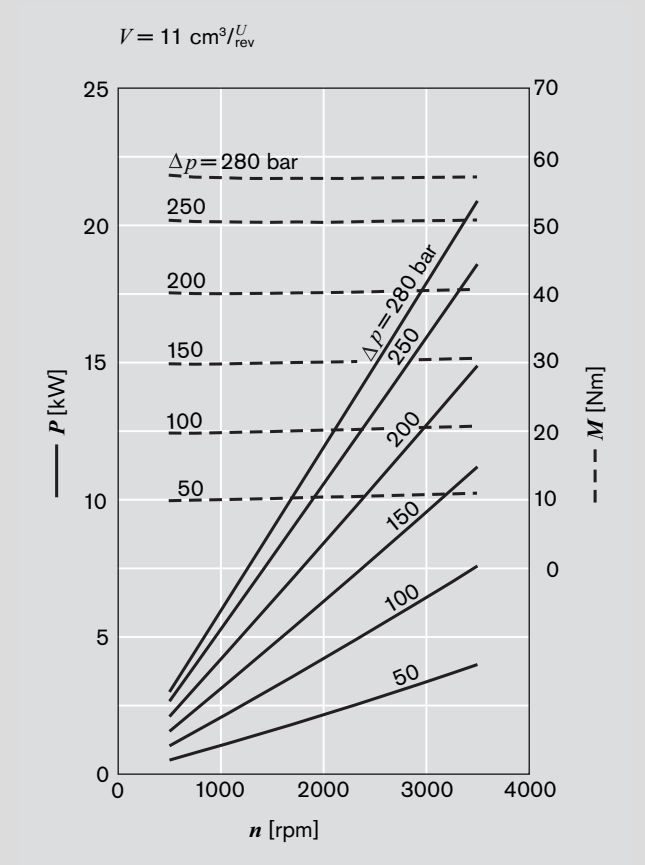
$Q = f(n,V)$ incl. η_v
$P = f(n,p)$ —— incl. η_t
$M = f(n,p)$ - - - incl. η_{hm}

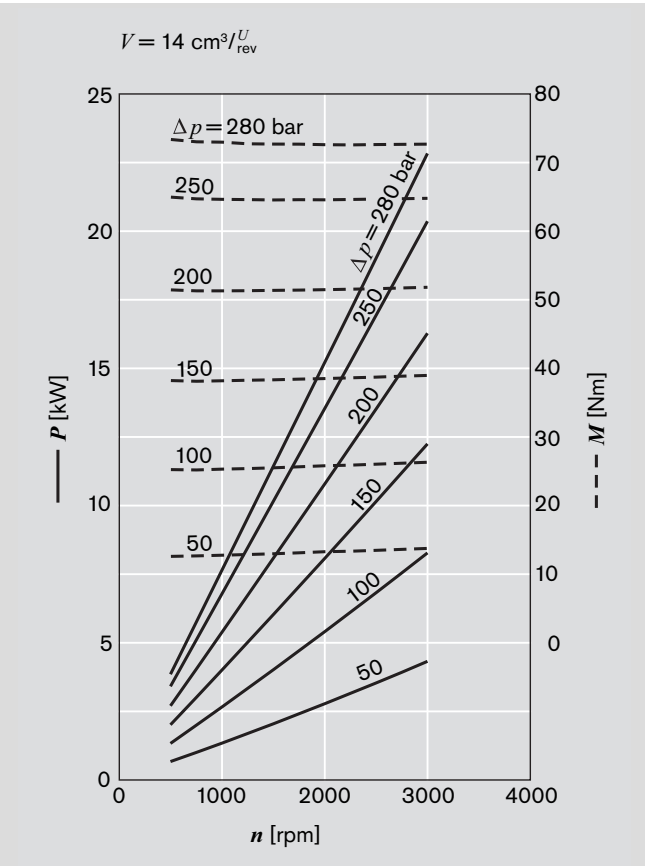


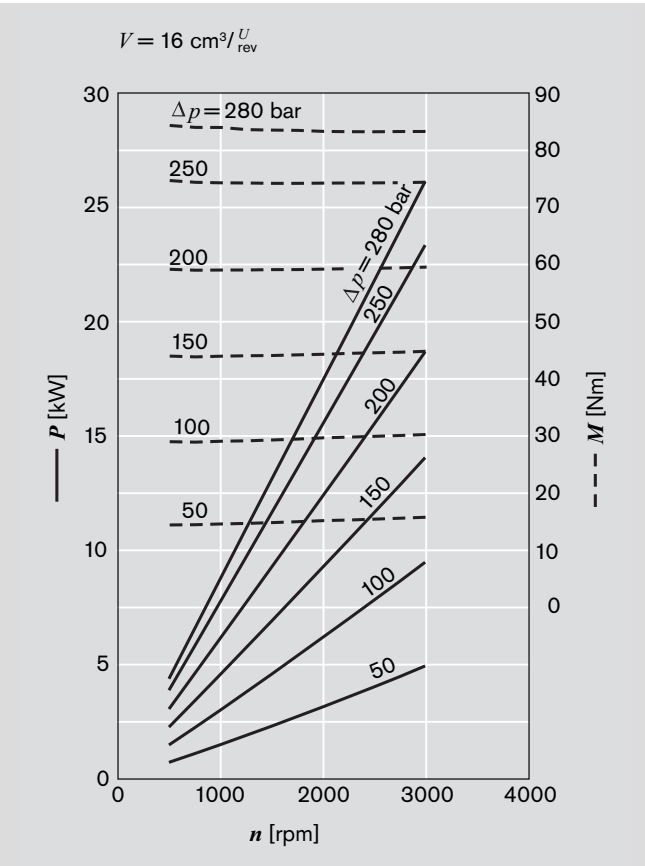


Performance charts (continued)

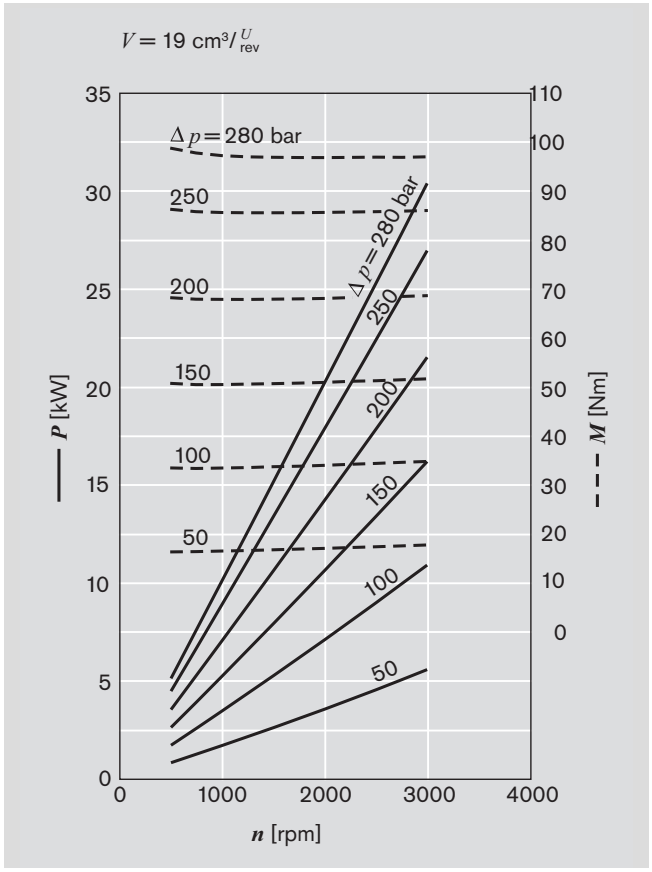


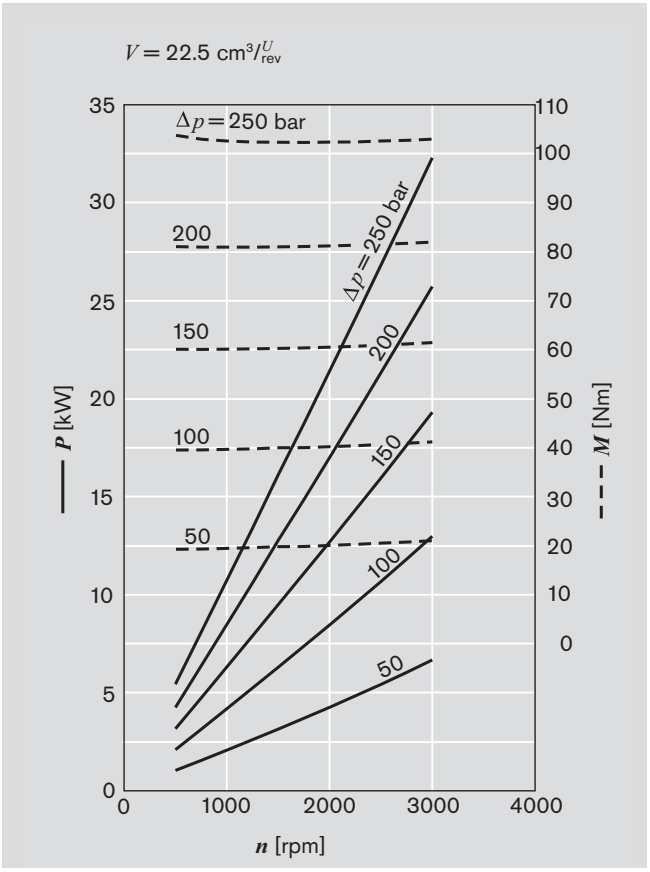


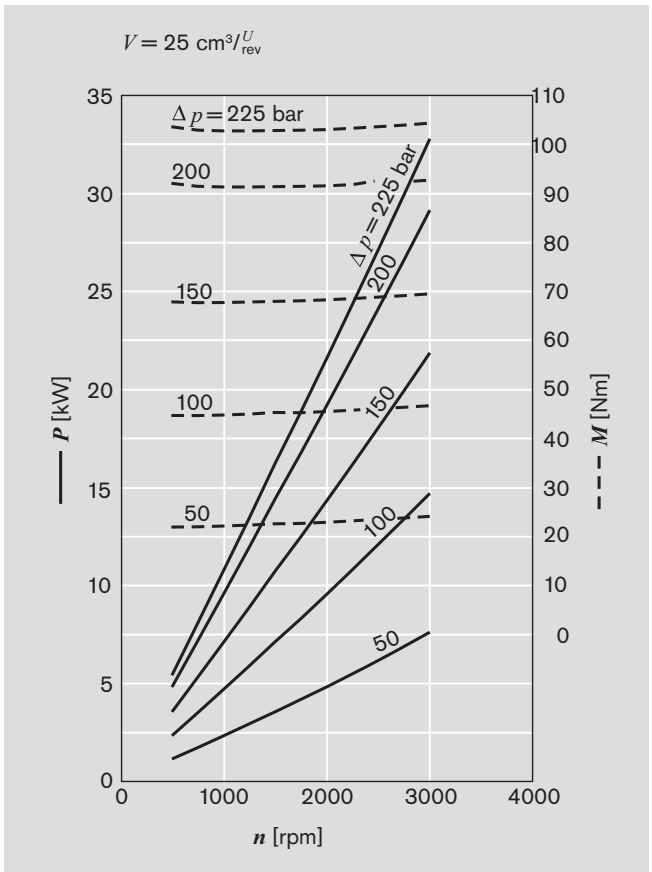


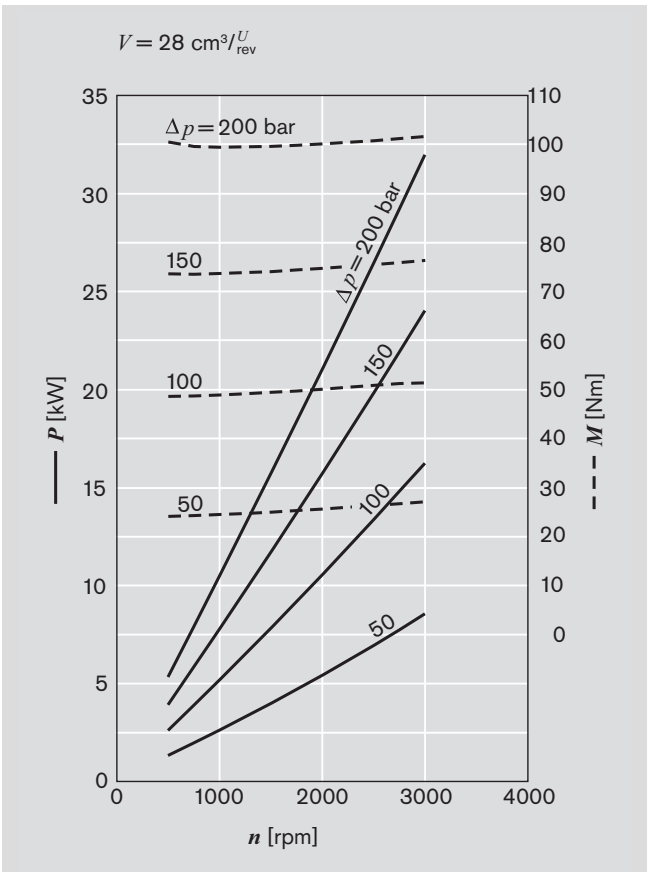


Performance charts (continued)





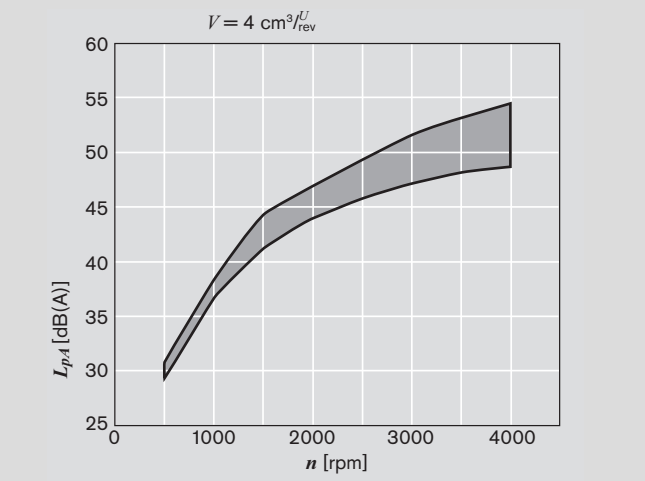


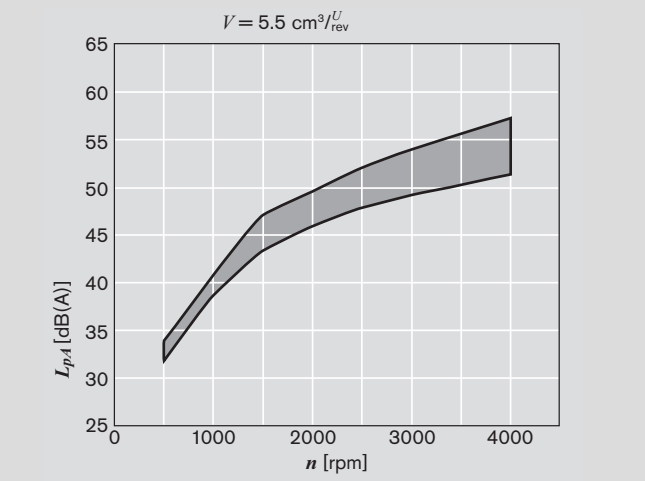


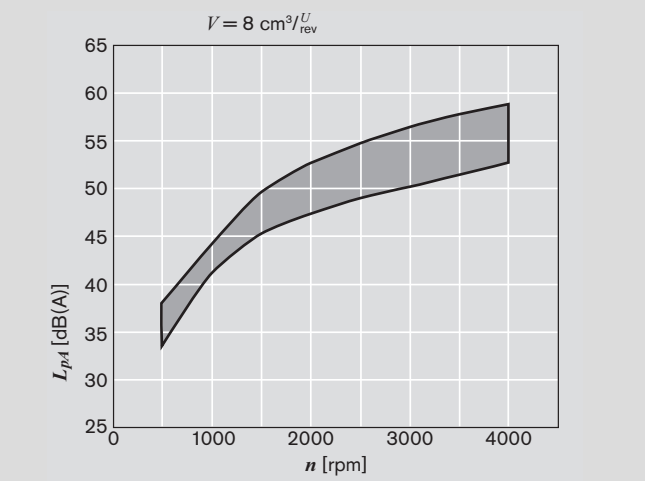
Noise charts

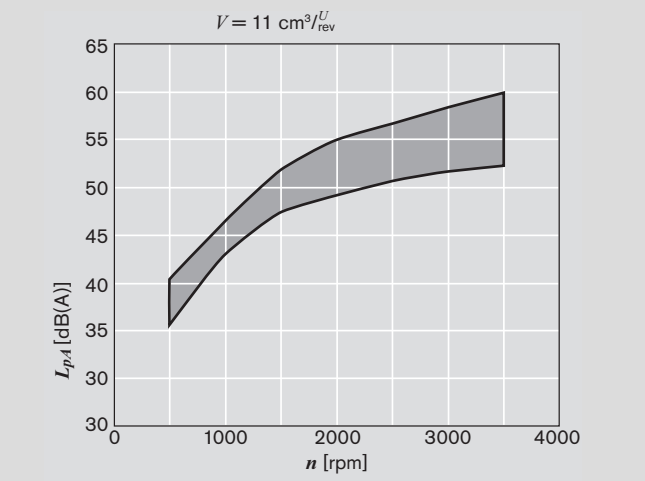
Noise level dependent on rotational speed, pressure range between 10 bar and pressure value p_2 (see page 15 Specifications table).
Oil data: $\nu = 32$ mm²/s, $\vartheta = 50$ °C.
Sound pressure level calculated from noise measurements made in the sound absorbent measuring room compliant with DIN 45635, Part 26.
Spacing between measuring sensor – pump: 1 m.

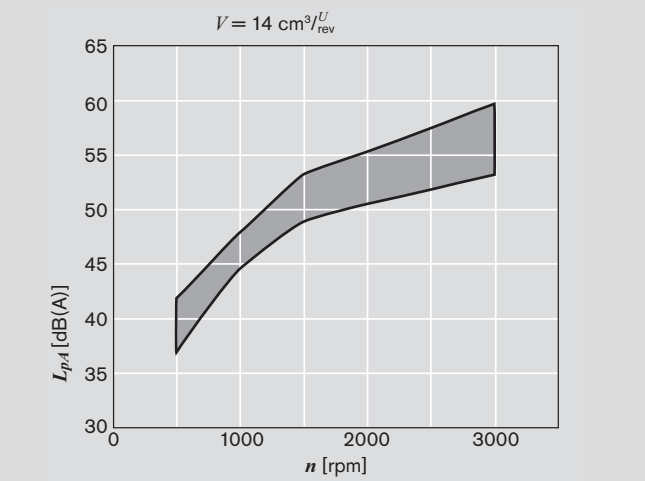
These are typical characteristic values for the respective model. They describe the airborne sound emitted solely by the pump. Environmental influences (installation site, piping, further system components) are not taken into consideration.
Each value applies for a single pump.

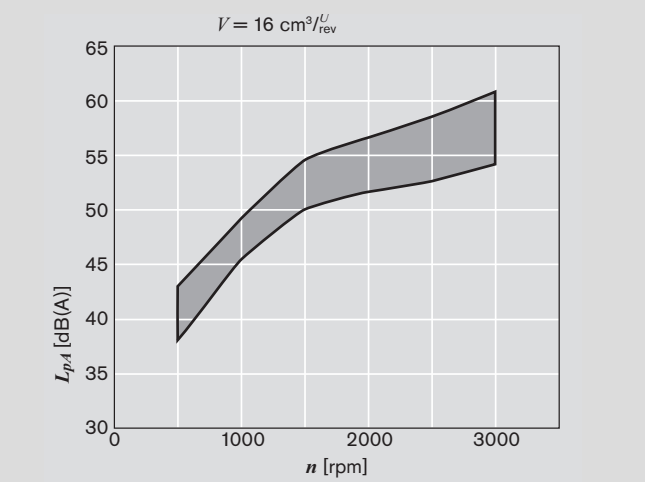




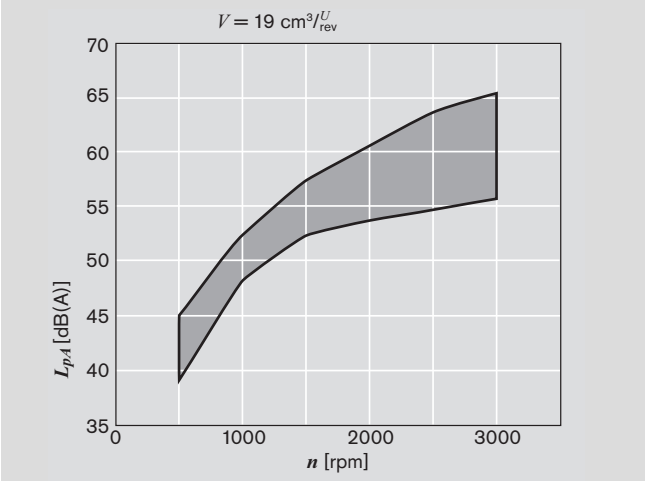


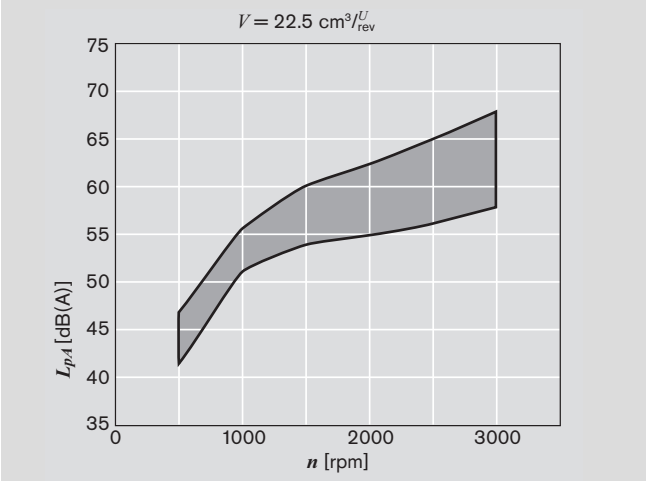


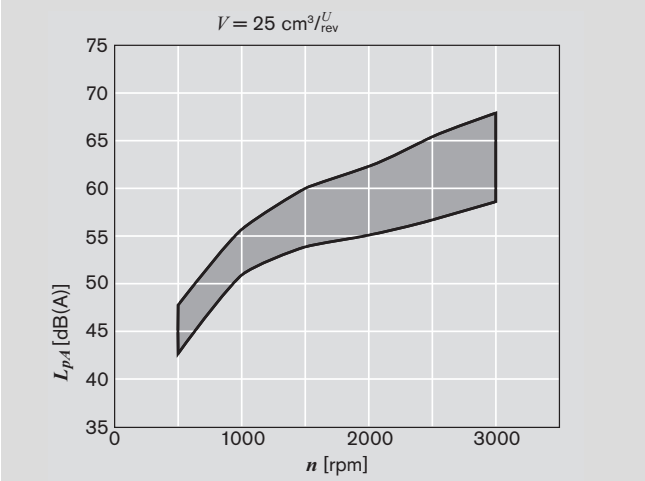


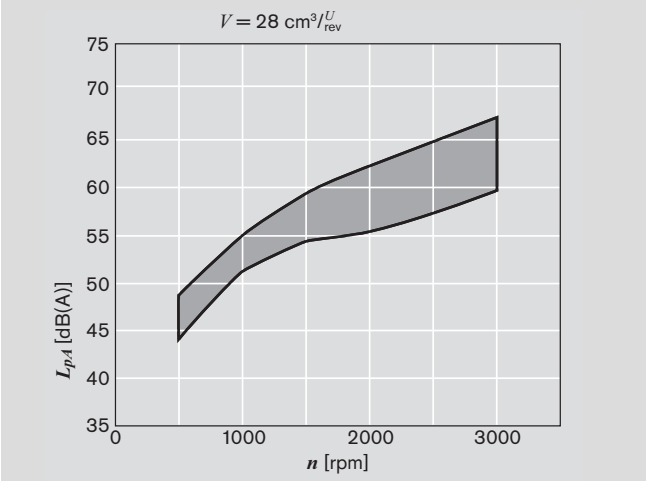


Noise charts (continued)









Specification

General	
Construction	External gear pump
Mounting	Flange or through-bolting with spigot
Line ports	Screw, flange
Direction of rotation (looking on shaft)	Clockwise or counter-clockwise, the pump may only be driven in the direction indicated
Installation position	Any
Load on shaft	Radial and axial forces after consulting
Ambient temperature range	–30 °C...+80 °C or max. 110 °C with FKM seal
Hydraulic fluid	– Mineral oil compliant with DIN 51 524, 1–3, however under higher load at least HLP compliant with DIN 51 524 Part 2 recommended. – Comply with RE 90220 – Further operating fluids possible after consultation
Viscosity	12...800 mm^2/s permitted range 20...100 mm^2/s recommended range ...2000 mm^2/s range permitted for starting
Hydraulic fluid temperature range	max. +80 °C with NBR seals*) max. +110 °C with FKM seals**)
Filtration ***)	At least cleanliness level 20/18/15 compliant with ISO 4406 (1999)

*) NBR = Perbunan®
**) FKM = Viton®
***) During the application of control systems or devices with critical counter-reaction, such as steering and brake valves, the type of filtration selected must be adapted to the sensitivity of these devices/systems.

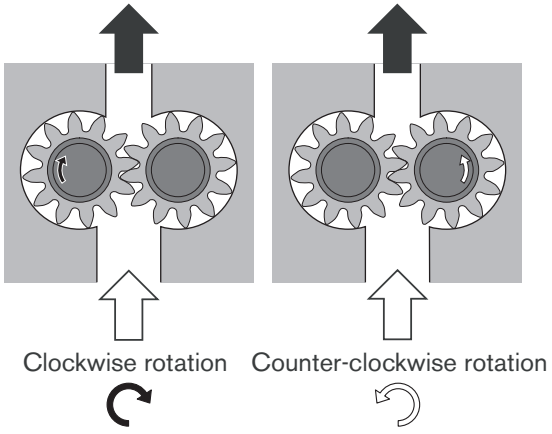
Safety requirements pertaining to the whole systems are to be observed.

In the case of applications with high numbers of load cycles please consulting.

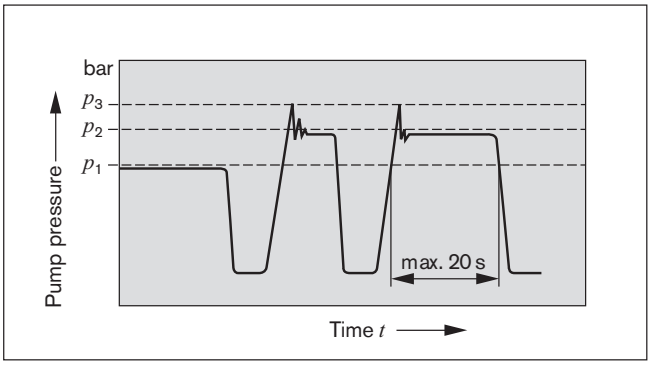
Definition of direction of rotation

Always look on the drive shaft.

Caution: Dimensions drawings always show clockwise-rotation pumps.On counter-clockwise-rotation pumps the positions of the drive shaft and the suction and pressure ports are different.



Definitions of pressures



p_1 max. continuous pressure
p_2 max. intermittent pressure
p_3 max. peak pressure

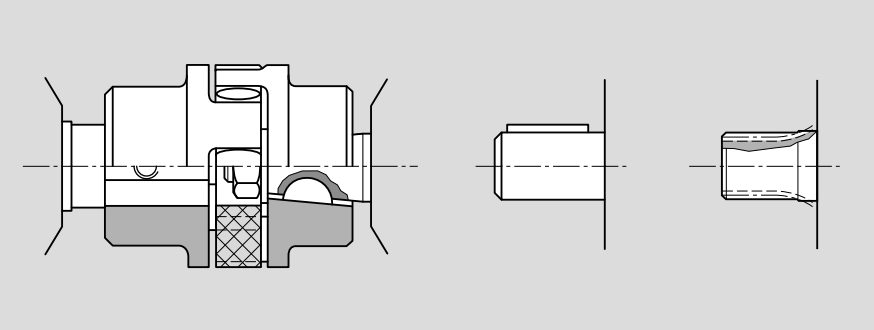
Series				AZPS-1x						AZPS-2x			
Displacement		V	cm^3/rev	4	5.5	8	11	14	16	19	22.5	25	28
Suction pressure		p_e	bar	0.7...3 (absolute), with tandem pumps: p_e (p_2) = max. 0.5 > p_e (p_1)									
Max. continuous pressure		p_1		250							220	195	170
Max. intermittent pressure		p_2		280							250	225	200
Max. peak pressure		p_3		300							290	265	240
Min. rotational speed		<100	rpm	600	500	500	500	500	500	500	500	500	500
at bar	12 mm^2/s	100...180		1200	1200	1000	1000	800	800	800	800	800	800
		180... p_2		1400	1400	1400	1200	1000	1000	1000	1000	1000	1000
	25 mm^2/s	p_2		700	700	700	600	500	500	500	500	500	500
Max. rotational speed at		p_2		4000			3500	3000	3000	3500	3500	3000	3000

Drive arrangement

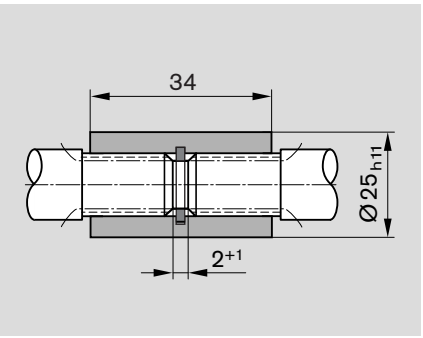
1. Flexible couplings
The coupling must not transfer any radial or axial forces to the pump.

The maximum radial runout of shaft spigot is 0.2 mm.

Refer to the fitting instructions provided by the coupling manufacturer for details of the maximum permitted shaft misalignment.



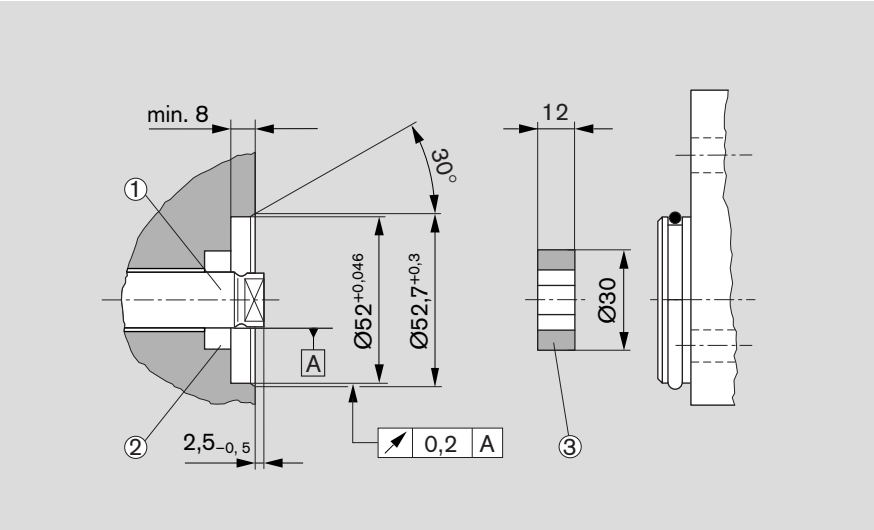
2. Coupling sleeve
Used on shafts with DIN or SAE splining. Caution: There must be no radial or axial forces exerted on the pump shaft or coupling sleeve. The coupling sleeve must be free to move axially. The distance between the pump shaft and drive shaft must be 2^{+1}. Oil-bath or oil-mist lubrications is necessary.



Splined shaft	M_{max} [Nm]	V [cm³/ rev]	p_{max} [bar]
DIN	100	4...28	p_{max}
SAE 9t	110		
SAE 11t	180		

3. Drive shaft with tang
For the close-coupling of the pumps to electric motor or internal-combustion engine, gear, etc. The pump shaft has a special tang and driver ③ (not included in supply).
There is no shaft sealing.

The recommended arrangements and dimensions for the drive end and sealing are as follows.



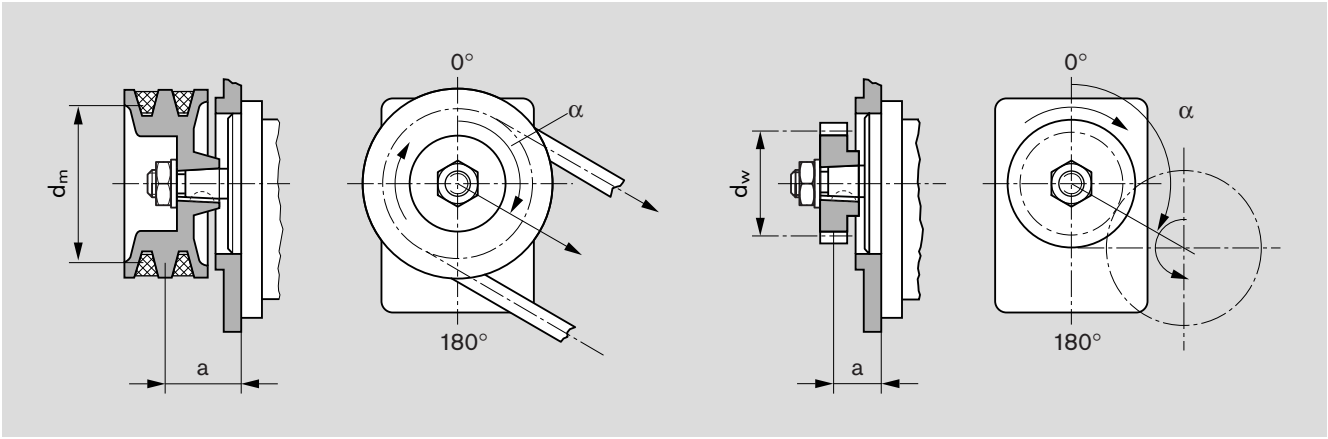
① Drive shaft
Case-hardening steel DIN 17 210
e.g. 20 MnCrS 5
case-hardened 0.6 deep; HRC $60^{\pm 3}$
Surface for sealing ring
ground without rifling $R_{max.} \leq 4\mu m$

② Radial shaft seal ring
Rubber-covered seal (see DIN 3760, Type AS, or double-lipped ring).
Cut 15° chamfer or fit shaft seal ring with protection sleeve.

M_{max} [Nm]	V [cm³/rev]	p_{max} [bar]
65	4...14	280
	16	230
85	19	250
	22.5	210
	25	190
	28	170

4. V-belts and straight gearwheels or helical toothed gear drives without outboard bearing

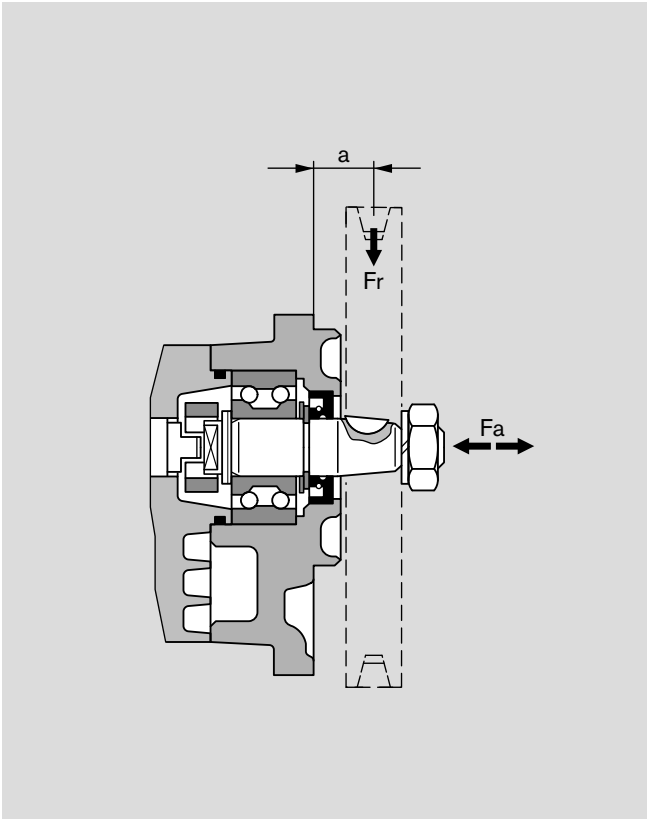
When proposing to use V-belt or gear drive, please submit details of the application for our comments (especially dimensions a, d_m, d_w and angle α). For helical toothed gear drives, details of the helix angle β are also required.

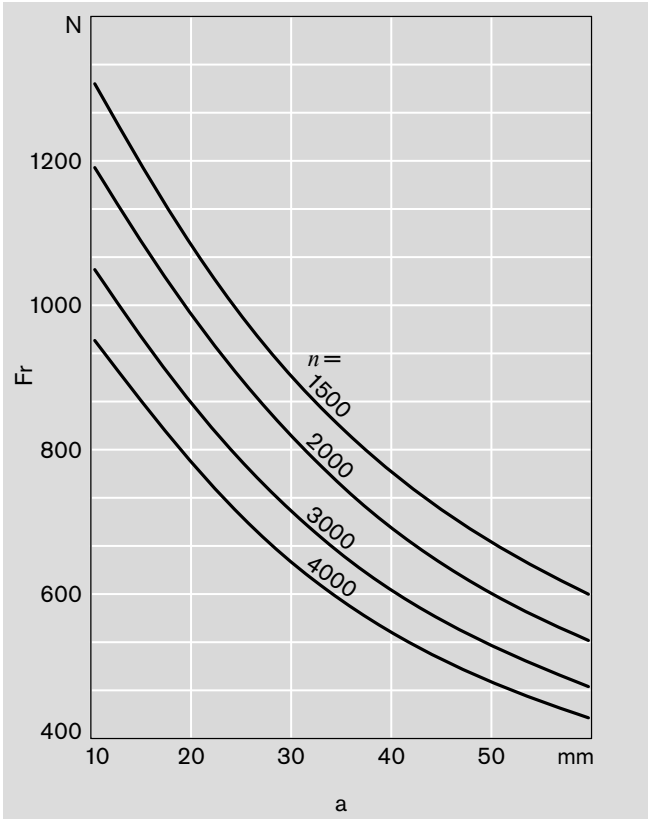


5. Outboard bearing

Outboard bearing eliminate possible problems when the pumps are driven by V-belts or gearwheels. The diagrams below show the maximum radial and axial loads that can be tolerated based on a bearing life of L_H = 1,000 hours.

M_{max} [Nm]	V [cm³/rev]	p_{max} [bar]
65	4...14	280
	16	230





Multiple gear pumps

Gear pumps are well-suited to tandem combinations of pumps in which the drive shaft of the first pump is extended to drive a second pump and sometimes a third pump in the same manner. A coupling is fitted between each pair of pumps.
In most cases each pump is isolated from its neighbor, i.e. the suction ports are separate from one another. A common suction port is also possible as an option.
Caution: Basically, the specifications for the single pumps apply, but with certain restrictions:
Max. speed: This is determined by the highest rated pump speed in use.
Pressures: These are restricted by the strength of the drive shaft, the through drives and the drivers.Appropriate data is given in the dimensional drawings.

Pressure restrictions during standard through drive
In the case of series N, the driver for the second pumping stage can carry a load of up to $S_{max.} = 95$ Nm, i.e. there is a pressure restriction for the second stage and any further stages.

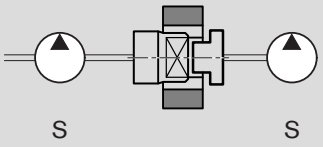
Drive shaft		Max. transferrable drive torque * [Nm]
C	1:5	155
N	Claw	65 or 85
D	SAE 13t	320
P	SAE 11t	180

* These values only apply when the conditions described above are complied with. Bosch Rexroth is to be consulted if the stated values are exceeded.

If the first stage is driven through a tang (driver) or outboard bearing type 1, pressure restrictions apply as indicated in the formula below.

Reinforced through drives are available for applications with higher transfer torques and/or rotational vibrations. Customized designs available on request.

$M_{max.} = 65$ Nm

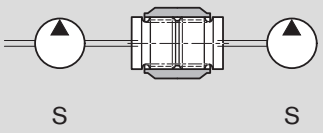


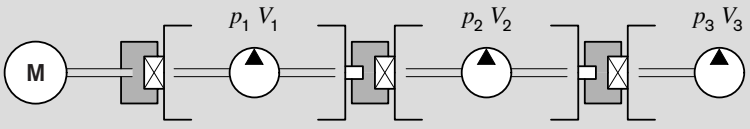
Combinations

Series pump 1	$M_{max.}$ [Nm]	Series pump 2
S	65	S
S	65	F
S	12	B – 1x
F	65	S
S	25	B – 2x

For configuration of multiple pumps we recommend the pump is positioned with the largest displacement on the drive side.

$M_{max.} = 160$ Nm



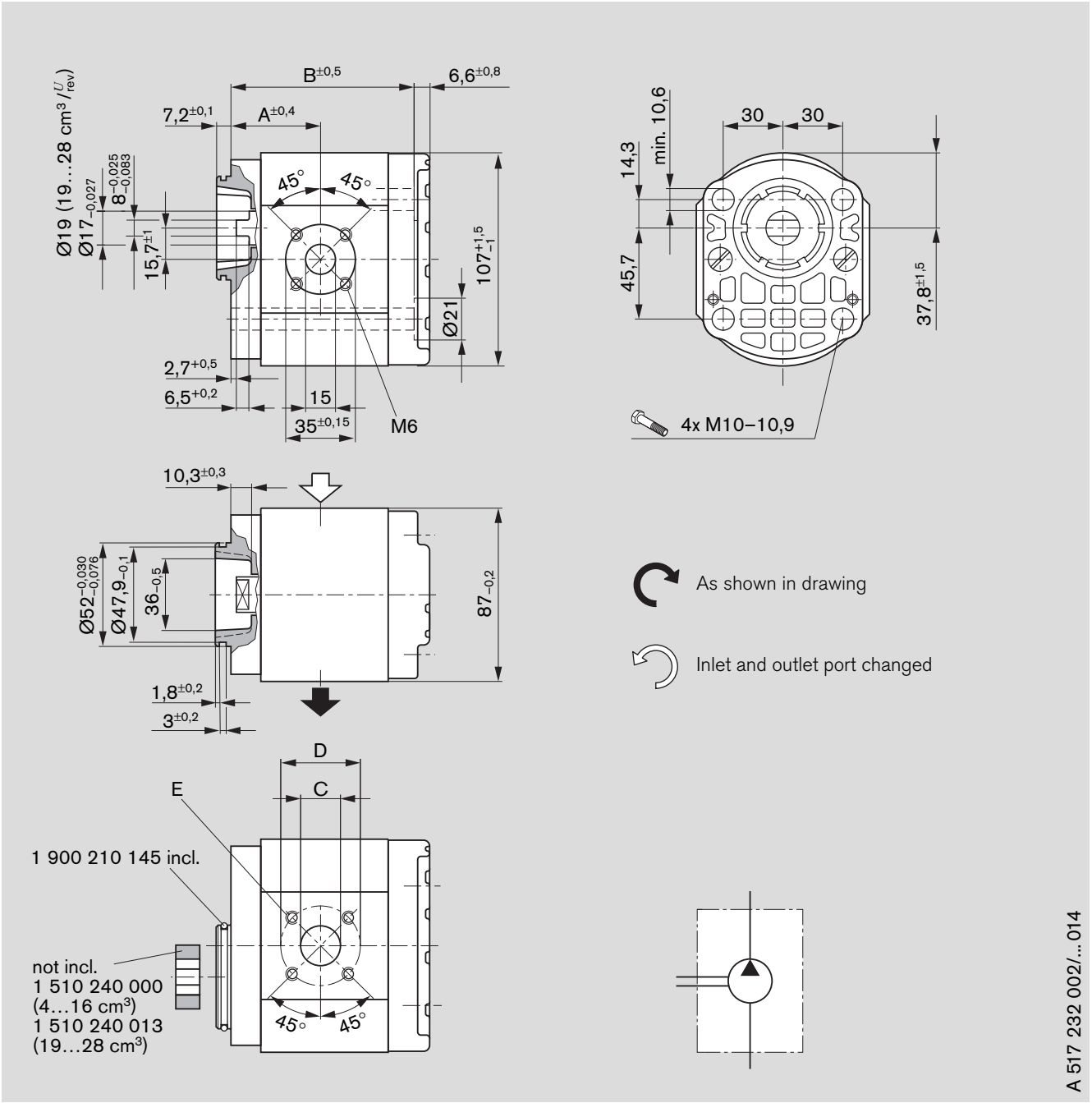


$$M_{max.} \geqq \Delta p_1 \cdot V_1 \cdot 0.0177 + \Delta p_2 \cdot V_2 \cdot 0.0177 + \Delta p_3 \cdot V_3 \cdot 0.0177$$

Δp [bar] V [cm³/rev]

Dimensions

Standard range



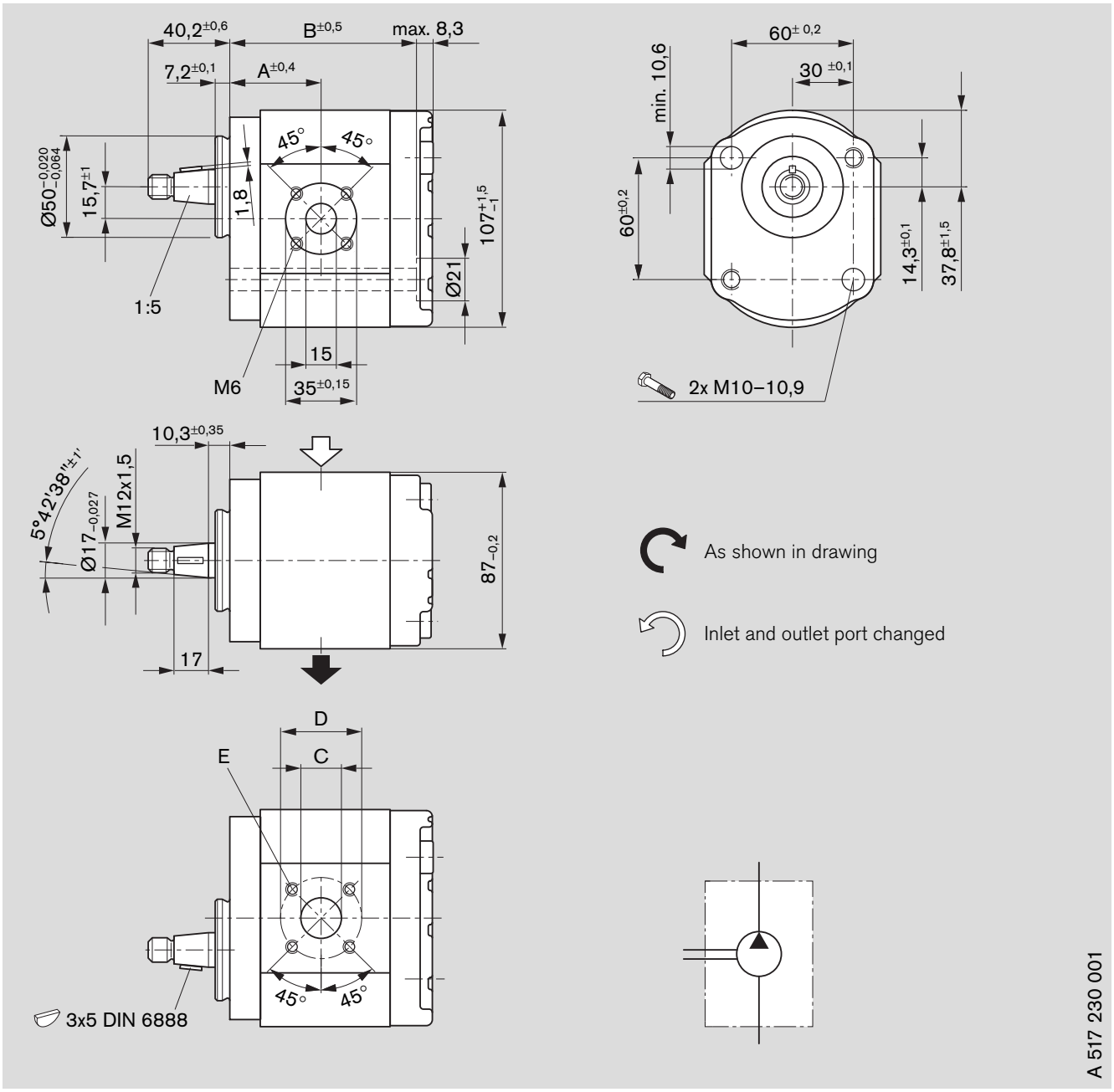
Ordering code:

AZPS – xx – ☐☐☐ ☐ N M 20 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D	E
4	**0 517 215 301**	**0 517 215 001**	280	4000	2.15	37.4	73.7	15	40	M6 13 depth
5.5	**0 517 315 301**	**0 517 315 001**	280	4000	2.2	38.6	76.2	15	40	
8	**0 517 415 301**	**0 517 415 001**	280	4000	2.3	40.7	80.3	20	40	
11	**0 517 515 302**	**0 517 515 001**	280	3500	2.4	44.5	85.3	20	40	
14	**0 517 515 303**	**0 517 515 002**	280	3000	2.55	45	90.3	20	40	
16	**0 517 615 301**	**0 517 615 001**	230	3000	2.6	45	93.7	20	40	
19	**0 517 615 302**	**0 517 615 002**	250	3500	3.0	55.8	110.7	26	55	M8 13 depth
22.5	**0 517 715 301**	**0 517 715 001**	210	3500	3.2	58.5	116.1	26	55	
25	**0 517 715 302**	**0 517 715 002**	190	3000	3.3	60.6	120.3	26	55	
28	**0 517 715 303**	**0 517 715 003**	170	3000	3.4	63	125.1	26	55	

Dimensions

Standard range



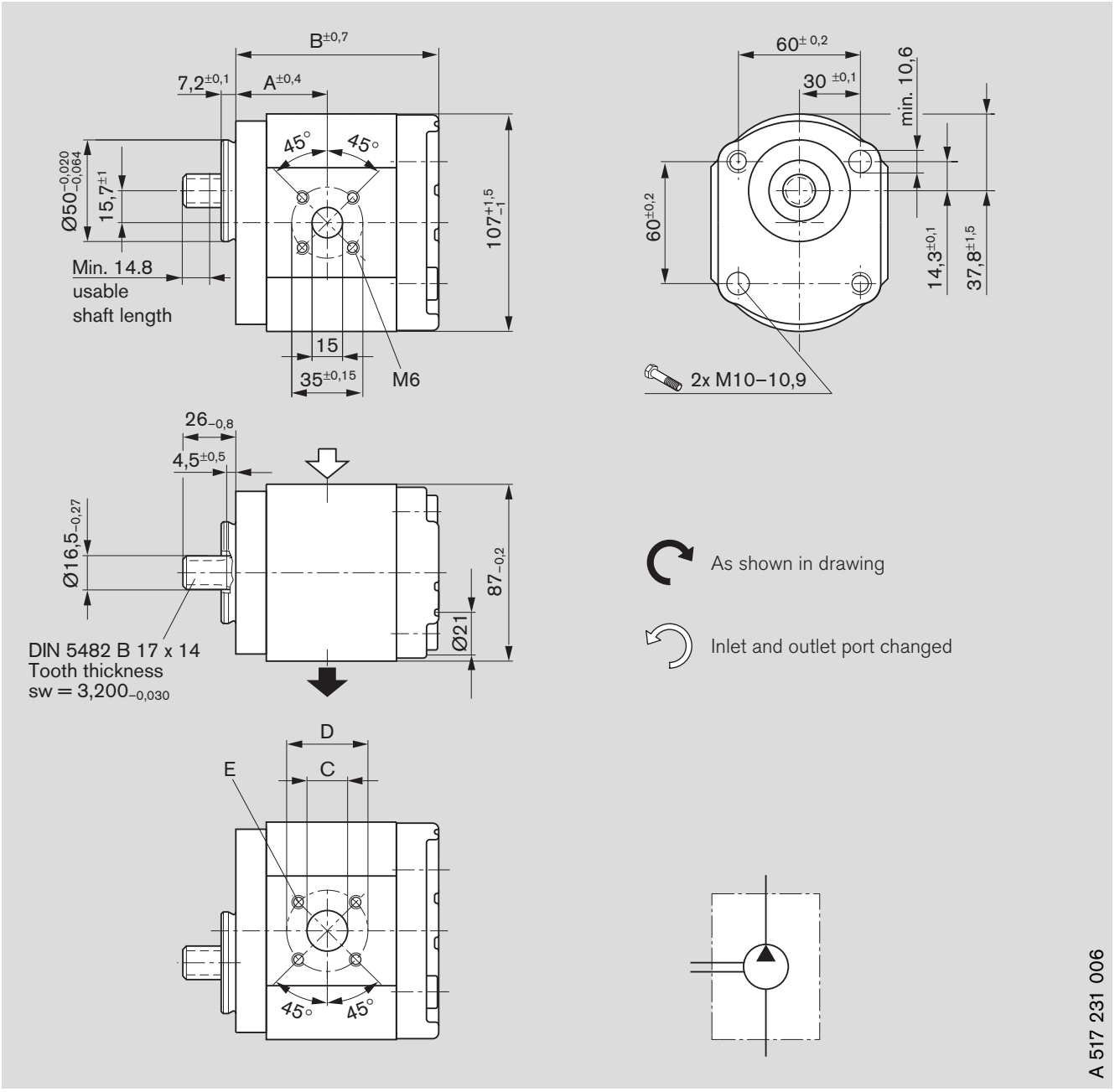
Ordering code:

AZPS – xx – ☐☐☐ ☐ C P 20 K B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D	E
4			280	4000						M6 13 depth
5.5			280	4000						
8			280	4000						
11	**0 517 515 304**		280	3500	3.1	44.5	85.3	20	40	
14	**0 517 515 306**		280	3000	3.3	45	90.3	20	40	
16	**0 517 615 303**		280	3000	3.4	45	93.7	20	40	
19			280	3500						
22.5			250	3500						
25			225	3000						
28			200	3000						

Dimensions

Standard range



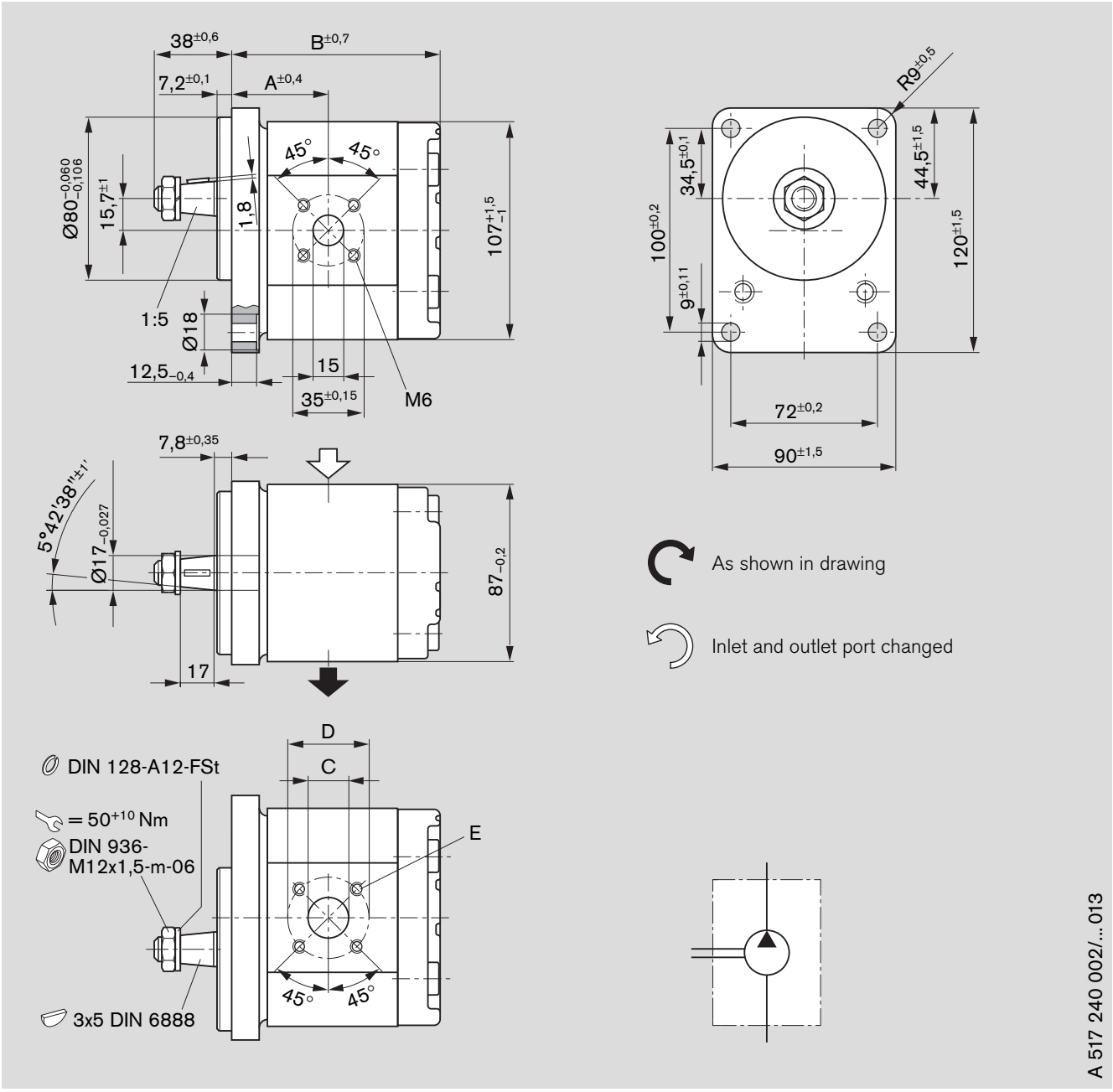
Ordering code:

AZPS – xx – ☐☐☐ ☐ F N 20 K B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D	E
4			280	4000						M6 13 depth
5.5			280	4000						
8			280	4000						
11			280	3500						
14			280	3000						
16		**0 517 615 003**	280	3000	3.3	45	100.5	20	40	
19			280	3500						
22.5			250	3500						
25			225	3000						
28			200	3000						

Dimensions

Standard range



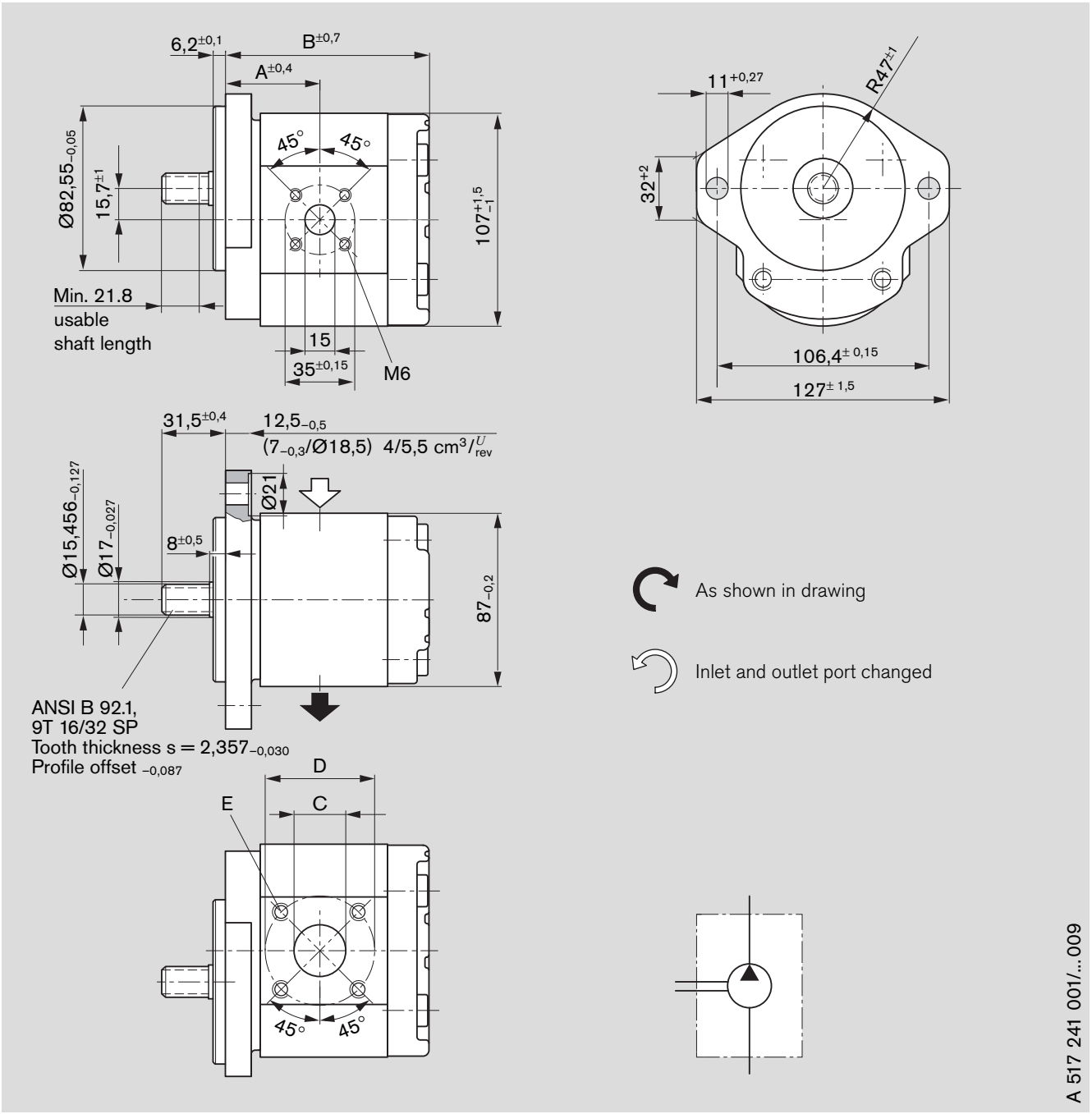
Ordering code:

AZPS – xx – ☐☐☐ ☐ C B 20 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D	E
4	**0 517 225 301**	**0 517 225 001**	280	4000	3.4	39.9	83	15	40	M6 13 depth
5.5	**0 517 325 301**	**0 517 325 001**	280	4000	3.5	41.1	85.5	15	40	
8	**0 517 425 301**	**0 517 425 001**	280	4000	3.6	43.2	89.6	20	40	
11	**0 517 525 301**	**0 517 525 001**	280	3500	3.8	47	94.6	20	40	
14	**0 517 525 302**	**0 517 525 002**	280	3000	3.9	47.5	99.6	20	40	
16	**0 517 625 301**	**0 517 625 001**	280	3000	–	47.5	103	20	40	
19	**0 517 625 302**	**0 517 625 002**	280	3500	4.5	58.3	120	26	55	M8 13 depth
22.5	**0 517 725 301**	**0 517 725 001**	250	3500	4.6	61	125.4	26	55	
25	**0 517 725 302**	**0 517 725 002**	225	3000	4.8	63.1	129.6	26	55	
28	**0 517 725 303**	**0 517 725 003**	200	3000	4.9	65.5	134.4	26	55	

Dimensions

Standard range



Ordering code:

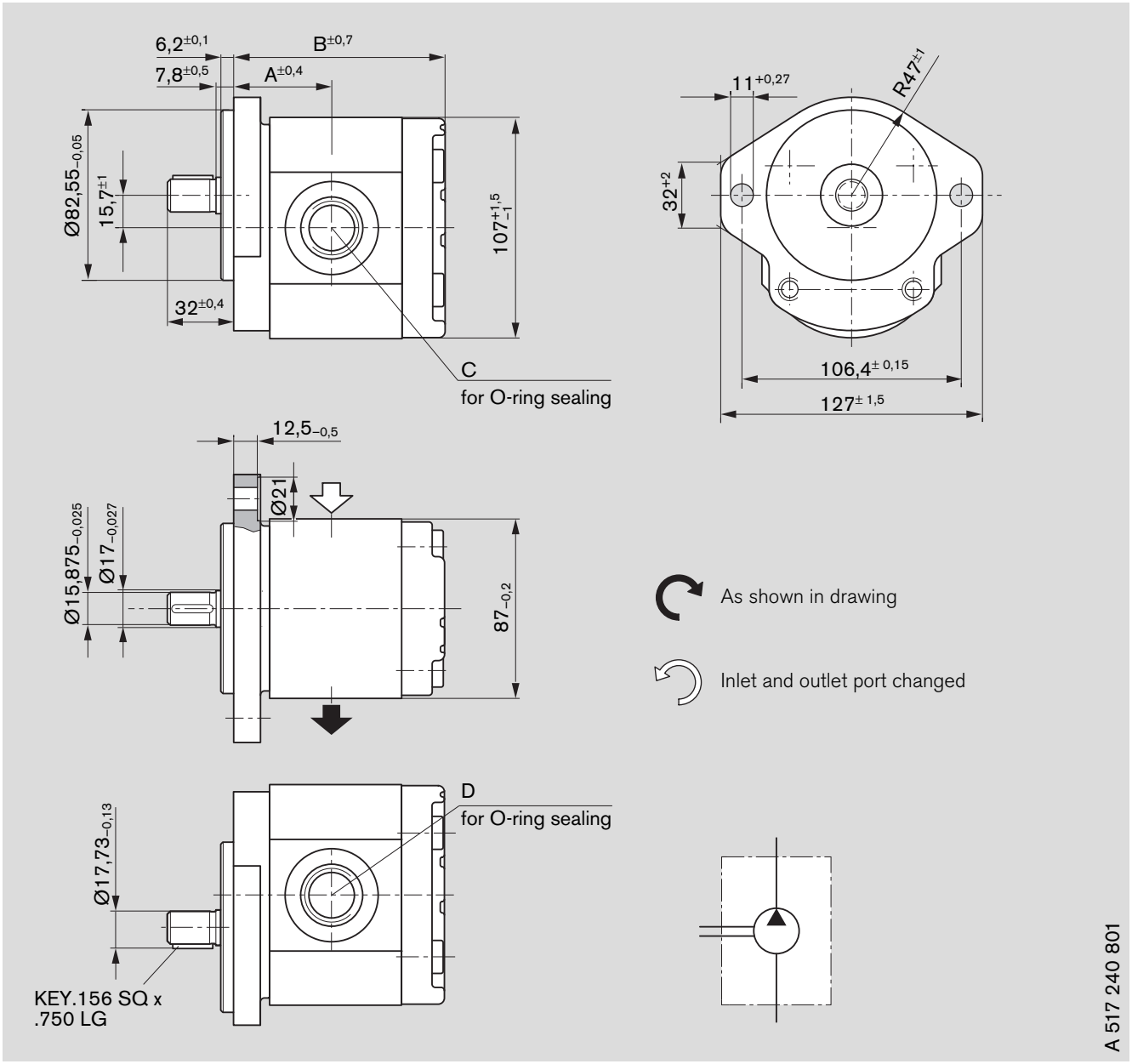
AZPS – xx – ☐☐☐ ☐ R R 20 M B

AZPS – 1x – 0 1 6 L R R 20 P B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D	E
4	**0 517 225 302**	**0 517 225 002**	280	4000	3.4	39.9	83	15	40	M6 13 depth
5.5	**0 517 325 302**	**0 517 325 002**	280	4000	3.5	41.1	85.5	15	40	
8	**0 517 425 302**	**0 517 425 002**	280	4000	3.6	43.2	89.6	20	40	
11	**0 517 525 303**	**0 517 525 003**	280	3500	3.7	47	94.6	20	40	
14	**0 517 525 304**	**0 517 525 004**	280	3000	3.9	47.5	99.6	20	40	
16	**0 517 625 303**	**0 517 625 003**	280	3000	3.9	47.5	103	20	40	
19	**0 517 625 304**	**0 517 625 004**	280	3500	4.4	58.3	120	26	55	M8 13 depth
22.5	**0 517 725 304**	**0 517 725 004**	250	3500	4.6	61	125.4	26	55	
25	**0 517 725 305**	**0 517 725 005**	225	3000	4.7	63.1	129.6	26	55	
28	**0 517 725 306**	**0 517 725 006**	200	3000	4.8	65.5	134.4	26	55	

Dimensions

Standard range



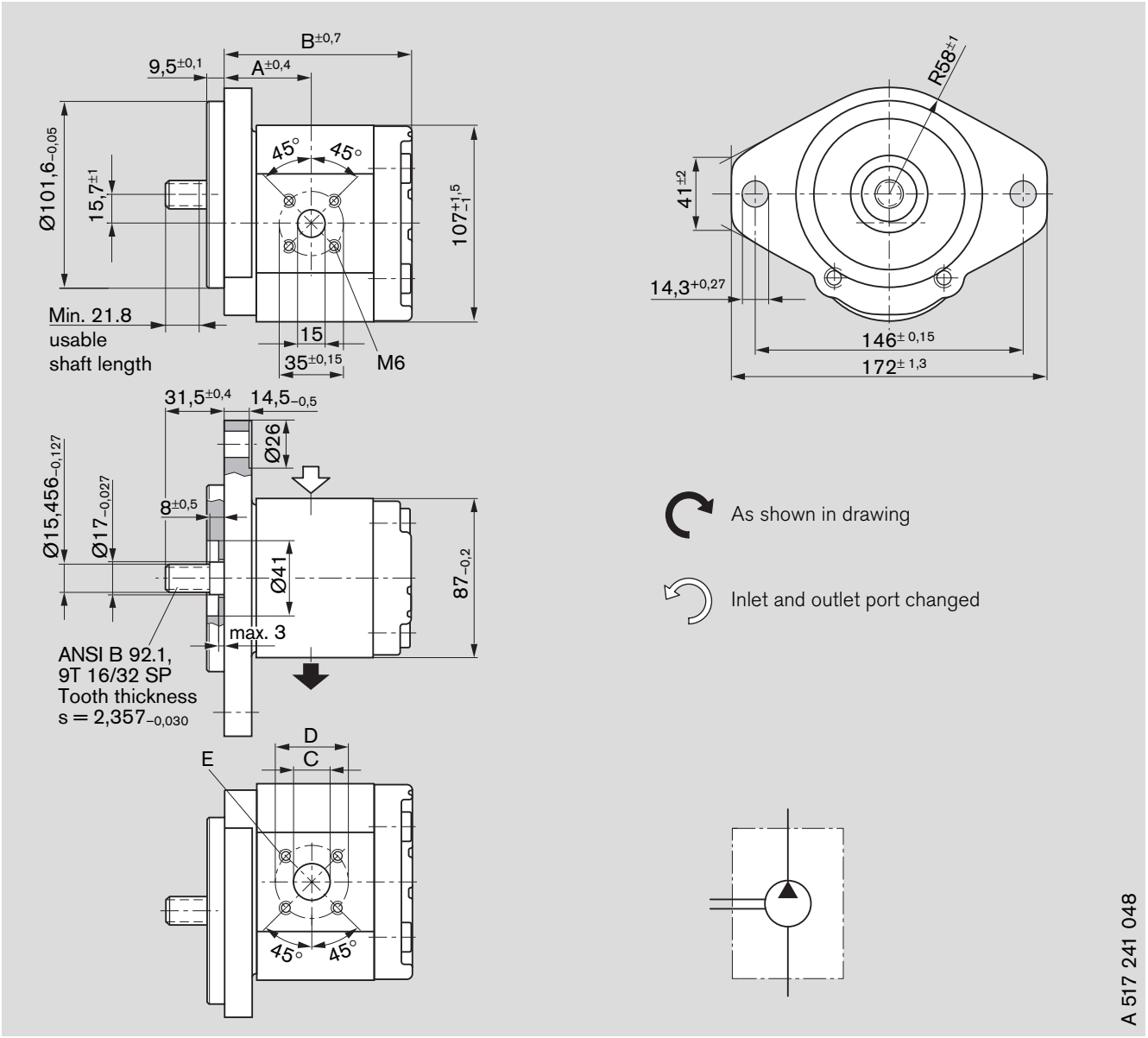
Ordering code:

AZPS – xx – ☐☐☐ ☐ Q R 12 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D
4			260	4000					
5.5			260	4000					
8		**0 517 425 003**	260	4000	3.6	43.2	89.6	7/8″-14 UNF-2B 16 depth	
11			260	3500					
14			230	3000					
16			200	3000					
19			210	3500					
22.5			180	3500					
25			160	3000					
28			140	3000					

Dimensions

Standard range



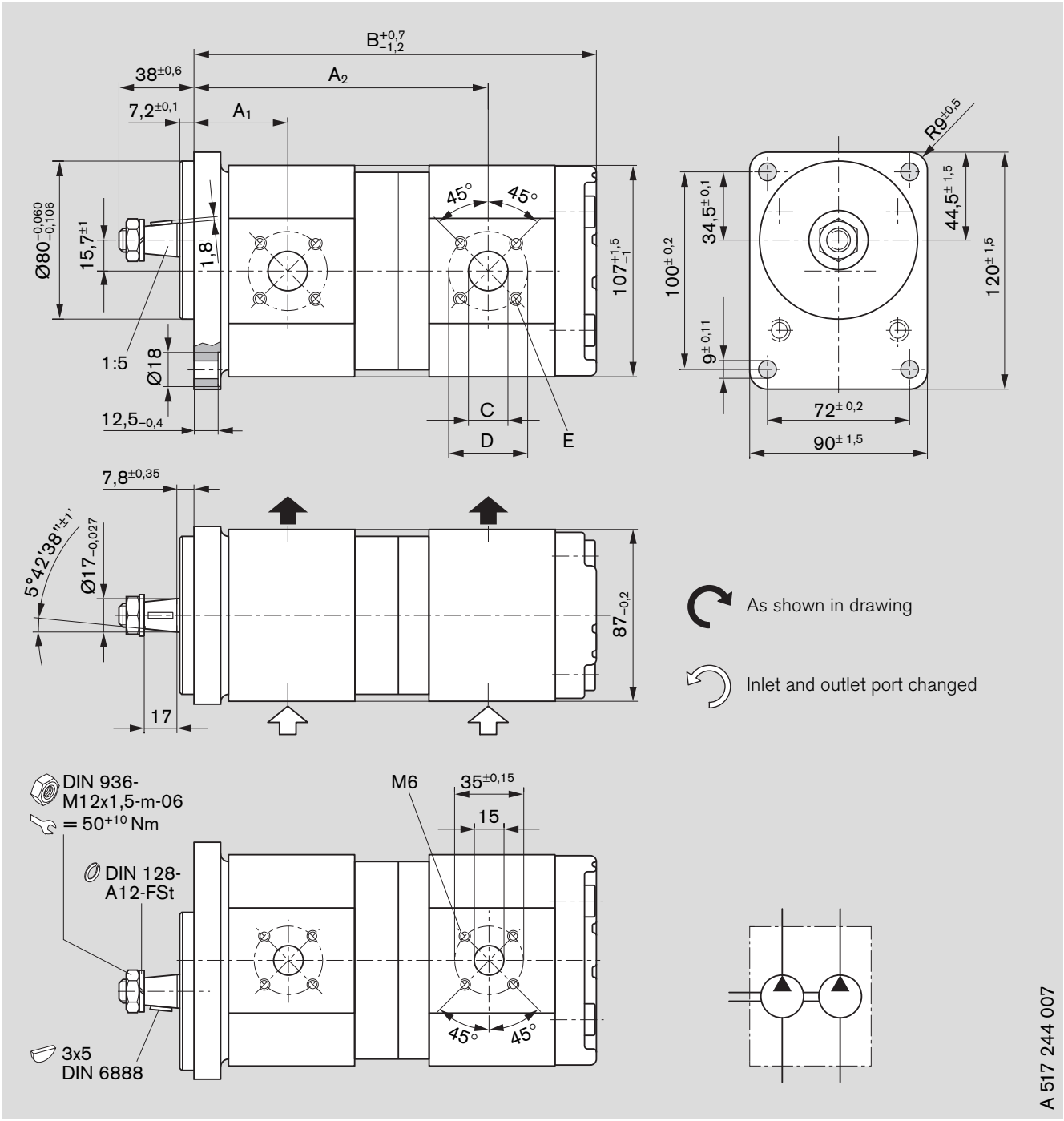
Ordering code:

AZPS – xx – ☐☐☐ ☐ R C 20 K B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	Max. operating pressure [bar]	Max. rotation speed [rpm]	kg	Dimension [mm] A	B	C	D	E
4			280	4000						M6 13 depth
5.5			280	4000						
8			280	4000						
11	**0 517 525 306**		280	3500	4.3	47	95.2	20	40	
14			280	3000						
16			280	3000						
19			280	3500						M8 13 depth
22.5			250	3500						
25		**0 517 725 008**	225	3000	5.2	63.1	130.2	26	55	
28			200	3000						

Dimensions

Standard range



Ordering code:

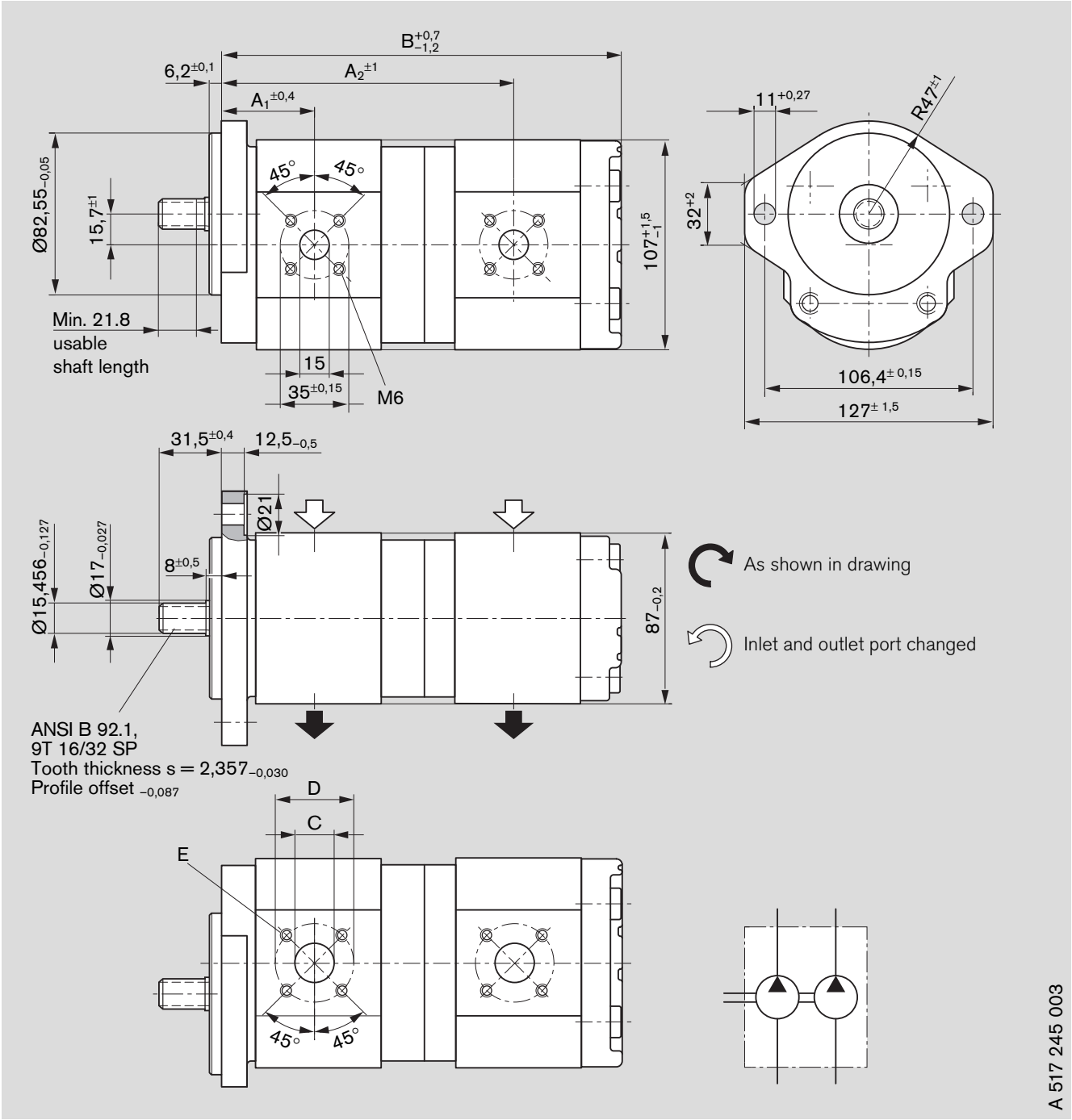
AZPSS – xx – ☐☐☐/☐☐☐ ☐ C B 20 20 M B

Displacement [cm³/rev] P1	P2	Ordering-No. L	R	Max. operating pressure [bar] P1	P2	Max. rotation speed [rpm]	kg	Dimension [mm] A_1	A_2	B	C*)	D	E
16	5.5	**0 517 665 304**		280	280	3000	5.8	47.5	142.8	187.0	20	40	M6 13 depth
16	8			280	280	3000							
16	11	**0 517 665 305**		280	280	3000	6.1	47.5	148.7	196.3	20	40	
14	11		**0 517 565 011**	280	260	3000	5.9	47.5	145.3	192.5	20	40	

*) at 4 and 5.5 cm³ Ø15

Dimensions

Standard range



Ordering code:

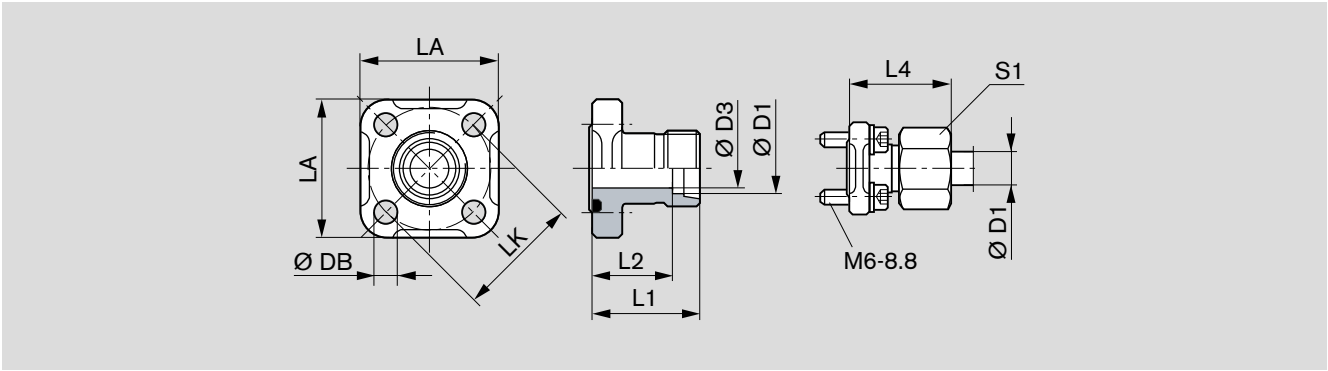
AZPSS – xx – ☐☐☐/☐☐☐ ☐ R R 20 20 M B

Displacement [cm³/rev] P1	P2	Ordering-No. L	R	Max. operating pressure [bar] P1	P2	Max. rotation speed [rpm]	kg	Dimension [mm] A_1	A_2	B	C*)	D	E
16	5.5		**0 517 665 007**	280	280	3000	5.8	47.5	142.8	186.9	20	40	M6 13 depth

*) at 4 and 5.5 cm³ Ø15

Fittings

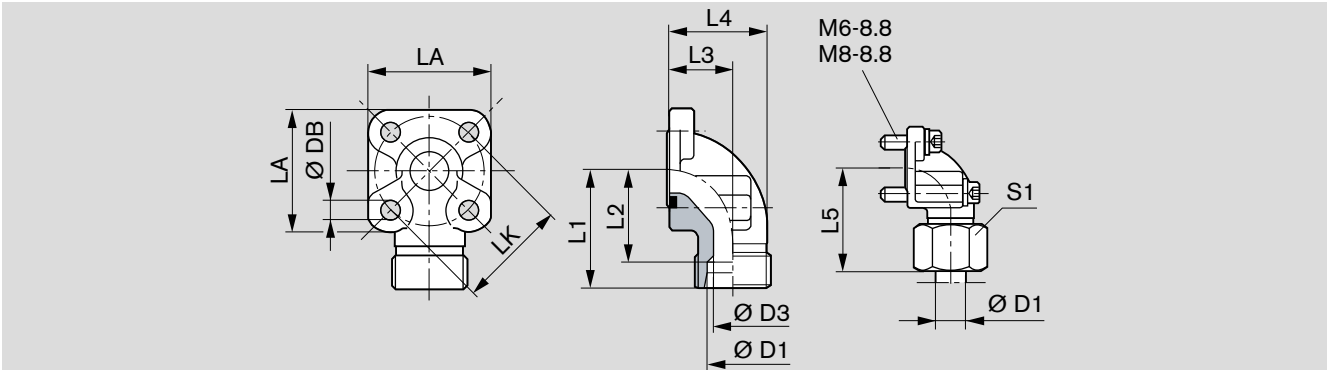
Gear pump flange, straight, for rectangular flange 20 see page 8



LK	D1	D3	L1	L2	L4	LA	S1	DB	Screws 4x	Seal ring NBR *)	Mass [kg]	Part number	p [bar]
35	10L	8	30	23.0	39.0	40	19	6.4	M6x22	20x2.5	0.09	**1 515 702 064**	315
35	12L	10	30	23.0	39.0	40	22	6.4	M6x22	20x2.5	0.10	**1 515 702 065**	315
35	15L	12	30	23.0	38.0	40	27	6.4	M6x22	20x2.5	0.10	**1 515 702 066**	250
40	15L	12	35	28.0	43.0	42	27	6.4	M6x22	24x2.5	0.12	**1 515 702 067**	100
40	18L	15	35	27.5	44.0	42	32	6.4	M6x22	24x2.5	0.13	**1 515 702 068**	100
40	22L	19	35	27.5	44.5	42	36	6.4	M6x22	24x2.5	0.12	**1 515 702 069**	100
40	28L	24	42	27.5	34.5	42	41	6.4	M6x22	24x2.5	0.15	**1 515 702 008**	100

Complete fittings with seal ring, metric screw set, nuts and olive. *) NBR = Perbunan®

Gear pump flange, 90° angle, for rectangular flange 20 see page 8



LK	D1	D3	L1	L2	L3	L4	L5	LA	S1	DB	Screws 2x	Screws 2x	Seal ring NBR *)	Mass [kg]	Part number	p (bar)
35	10L	8	38	31.0	16.5	26.5	47.0	40	19	6.4	M6x22	M6x35	20x2.5	0.16	**1 515 702 070**	315
35	12L	10	38	31.0	16.5	26.5	47.0	40	22	6.4	M6x22	M6x35	20x2.5	0.16	**1 515 702 071**	315
35	15L	12	38	31.0	16.5	26.5	46.0	40	27	6.4	M6x22	M6x35	20x2.5	0.15	**1 515 702 072**	250
35	16S	12	38	29.5	20.0	31.0	48.0	40	30	6.4	M6x22	M6x40	20x2.5	0.18	**1 515 702 002**	315
35	18L	15	38	29.5	20.0	31.0	47.0	40	32	6.4	M6x22	M6x40	20x2.5	0.18	**1 545 702 006**	250
35	20S	16	45	34.5	25.0	38.0	56.0	40	36	6.4	M6x22	M6x45	20x2.5	0.24	**1 515 702 017**	315
40	15L	12	38	31.0	22.5	36.5	46.0	42	27	6.4	M6x22	M6x22	24x2.5	0.15	**1 515 702 073**	100
40	18L	15	38	30.5	22.5	36.5	47.0	42	32	6.4	M6x22	M6x22	24x2.5	0.17	**1 515 702 074**	100
40	20S	16	40	29.5	22.5	35.5	50.0	42	36	6.4	M6x22	M6x45	24x2.5	0.20	**1 515 702 011**	250
40	22L	19	38	30.5	22.5	36.5	47.5	42	36	6.4	M6x22	M6x22	24x2.5	0.17	**1 515 702 075**	100
40	28L	22	40	32.5	28.0	43.0	49.0	42	41	6.4	M6x20	M6x50	24x2.5	0.24	**1 515 702 010**	100
40	35L	31	41	30.5	34.0	55.0	52.0	42	50	6.4	M6x22	M6x60	24x2.5	0.33	**1 515 702 018**	100

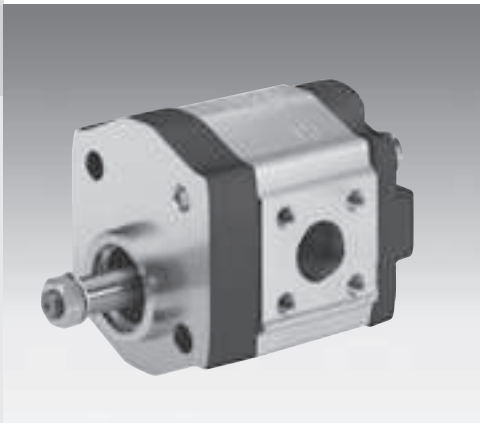
Complete fittings with seal ring, metric screw set, nuts and olive. *) NBR = Perbunan®

Rexroth
Bosch Group

External gear pump
Series B

RE 10 088/09.13
Replaces: RE 10 088/09.12

AZPB-3x



Fixed pumps
$V = 1.0...7.1$ cm^3/rev

Overview of contents

Contents	Page
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Product overview	3
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Ordering code multiple pumps	5
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Front cover	6
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Design calculations for pumps	12
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The AZ configurator	29
Ordering-No.	30

Features

- Nominal pressure 250 bar (up to 6.3 cm^3/rev)
- Slide bearings for heavy duty applications
- Standardized drive shafts
- Line ports:
  Connection flange or internal thread
- Long service life through reinforced design
  of shafts and cast iron cover
- Consistent high quality through mass production
- Numerous configuration variants available
- Same mounting dimensions as the AZPB-1x

General

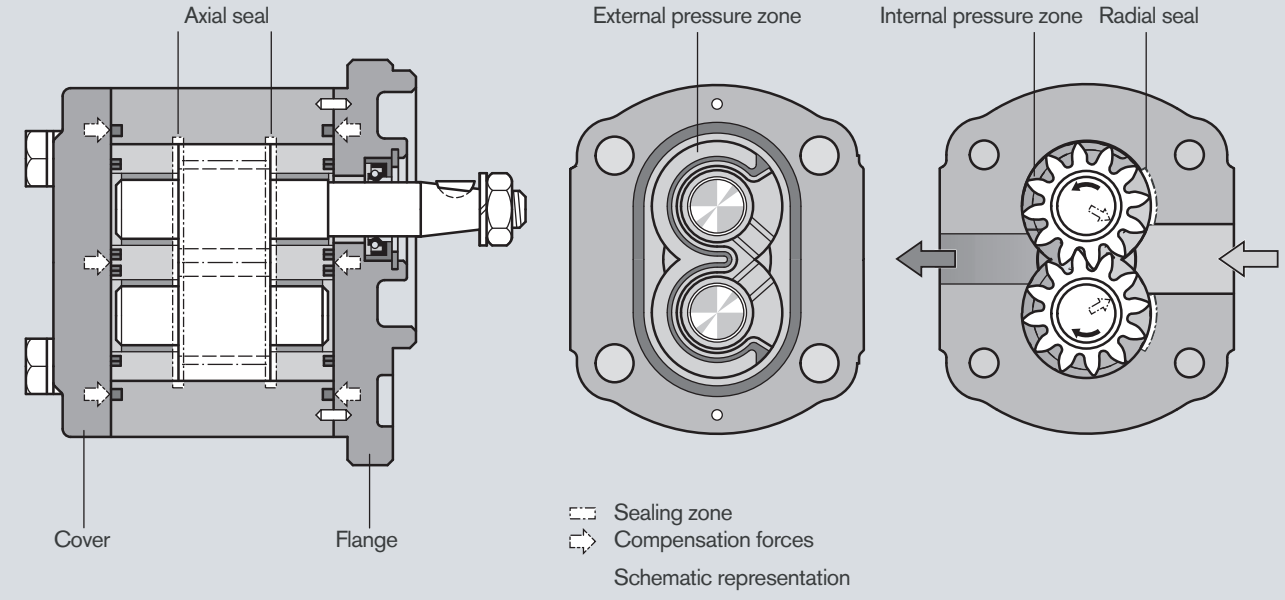
Rexroth external gear pumps are available as standard gear pumps in the 4 series of B, F, N and G and as SILENCE gear pumps in the S, T and U series, and as the SILENCE PLUS version in the J series, in which the displacements are graded by different gear widths. Further configuration variants are given by different flanges, shafts, valve arrangements and multiple pump combinations.

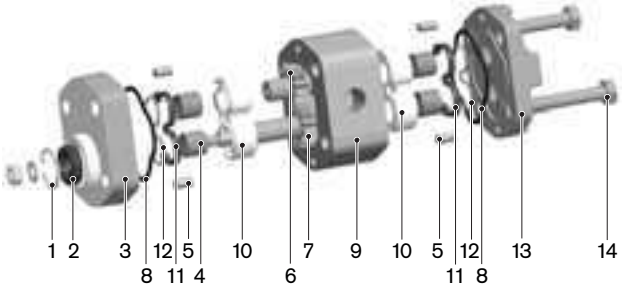
Construction

The external gear pump consists essentially of a pair of gears supported in bearing bushings and the housing with a front and a rear cover. The drive shaft protrudes from the front cover where it is sealed by the shaft seal ring. The bearing forces are absorbed by special slide bearings with sufficient elasticity to produce surface contact instead of line contact. They also ensure excellent resistance to galling – especially at low speed. The gear wheels of the standard and SILENCE pumps have 12 teeth and the gear wheels of the SILENCE PLUS have 7 non-evolute teeth. This keeps both flow pulsation and noise emission to a minimum.

The internal sealing is achieved by forces which are proportional to delivery pressure. This ensures optimum efficiency. The bearings provide the seal at the ends of the gaps between the teeth which carry the pressurized oil. The sealing zone between the gear teeth and the bearings is controlled by the admission of operating pressure to the rear of the bearings. Special seals form the boundary of the zone. The radial clearance at the tips of the gear teeth is sealed by internal forces pushing them against the case.

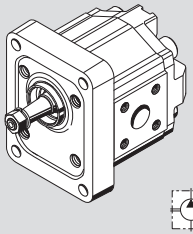
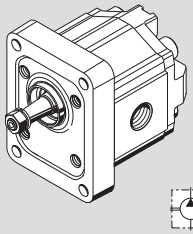
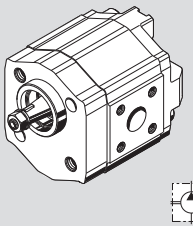
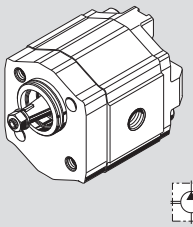
Axial and radial compensation for gear pump

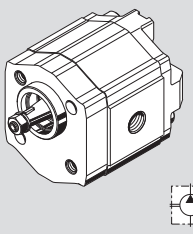
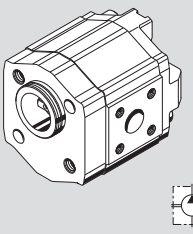
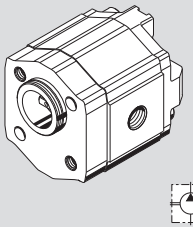
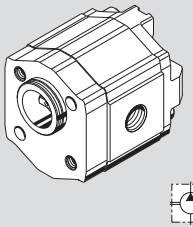


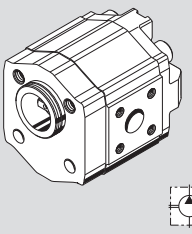
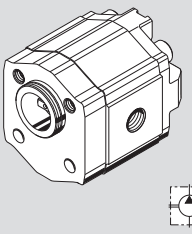


1 Retaining ring
2 Shaft seal ring
3 Front cover
4 Slide bearing
5 Centering pin
6 Gear
7 Gear (driving)
8 Housing seal
9 Pump housing
10 Bearing
11 Axial zone seal
12 Supporting element
13 End cover
14 Fixing screws

Overview of “Series B” standard program

Version	Page
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Version	Page
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	23

Version	Page
	24
	25

Ordering code

External gear units Single pumps Standard

AZ	P	B	–	x	x	–	4.0	R	C	P	02	M	D	200 xx	S xxxx

Function
P = Pump

Series
3 = 3rd generation

Version
2 = corrosion-resistant, pinned

Size (B)
1.0 = 1.00 cm^3/rev
2.0 = 2.00 cm^3/rev
2.5 = 2.50 cm^3/rev
3.1 = 3.15 cm^3/rev
4.0 = 4.00 cm^3/rev
4.5 = 4.50 cm^3/rev
5.0 = 5.00 cm^3/rev
6.3 = 6.30 cm^3/rev
7.1 = 7.10 cm^3/rev

Direction of rotation
R = Clockwise
L = Counterclockwise

Special design *)

Valve adjustment
200 xx = PRV 200 bar

Rear cover
B = Standard
A = Axial inlet and outlet port

Seals
M = NBR
K = NBR, shaft seal ring in FKM
P = FKM

*) Some of the special designs shown on pages 16–25 are not covered in the illustration of the ordering code.

Drive shafts

		Suitable front cover
C	Tapered key shaft 1:5	**P**
H	Tapered key shaft 1:8	**O**
N	Dihedral Claw	**M** **Y**

Front cover

P	2-bolt mounting Centering Ø 32 mm
O	Square flange Centering Ø 25.28 mm
M	2-bolt mounting Centering Ø 32 mm, with seal ring
Y	2-bolt mounting Centering Ø 32 mm, with seal ring, mounting on series F

Line ports

01	Pipe thread ISO 228/1
02	Thread, metric ISO 9974-1
20	Rectangular flange

Not all variants can be selected by using the ordering code!
Please select the required pump by using the selection tables (standard types from standard range, see pages 16…25) or after consultation with Bosch Rexroth!
Special options are possible upon request.

Ordering code

External gear units, Multiple pumps, Standard

AZ	P	BB	–	x	x	–	4.0/4.0	R	H	O	20 20	K	B

Function
P = Pump

Series
B = 1.0...7.1 cm³/rev
S = 4.0...28 cm³/rev
F = 4.0...28 cm³/rev
J = 12.0...16 cm³/rev
T = 20.0...36 cm³/rev
N = 20.0...36 cm³/rev
U = 22.5...63 cm³/rev
G = 22.5...63 cm³/rev

Series, relates to pump section 1
2 = Housing width 110 mm

Version, relates to pump section 1
2 = corrosion-resistant, pinned

Size
as per individual Series

Direction of rotation
R = Clockwise
L = Counterclockwise

Rear cover
relates to last pump stage
B = Standard

Seals
M = NBR
K = NBR, shaft seal ring pump stage 1 in FKM
P = FKM

Drive shafts
relates to pump stage 1

Series B:

		Suitable front cover
H	Tapered key shaft 1:8	**O**

Series F, S, J:

C	Tapered key shaft 1:5	**B**
H	Tapered key shaft 1:8	**O**
R	Splined shaft SAE J 744 16-4 9T	**R**

Series N, T:

C	Tapered key shaft 1:5	**B**
D	Splined shaft SAE J 744 22-4 13T	**C**

Series G, U:

C	Tapered key shaft 1:5	**B**
D	Splined shaft SAE J 744 22-4 13T	**C**
H	Tapered key shaft 1:8	**O**

Front cover
relates to pump stage 1

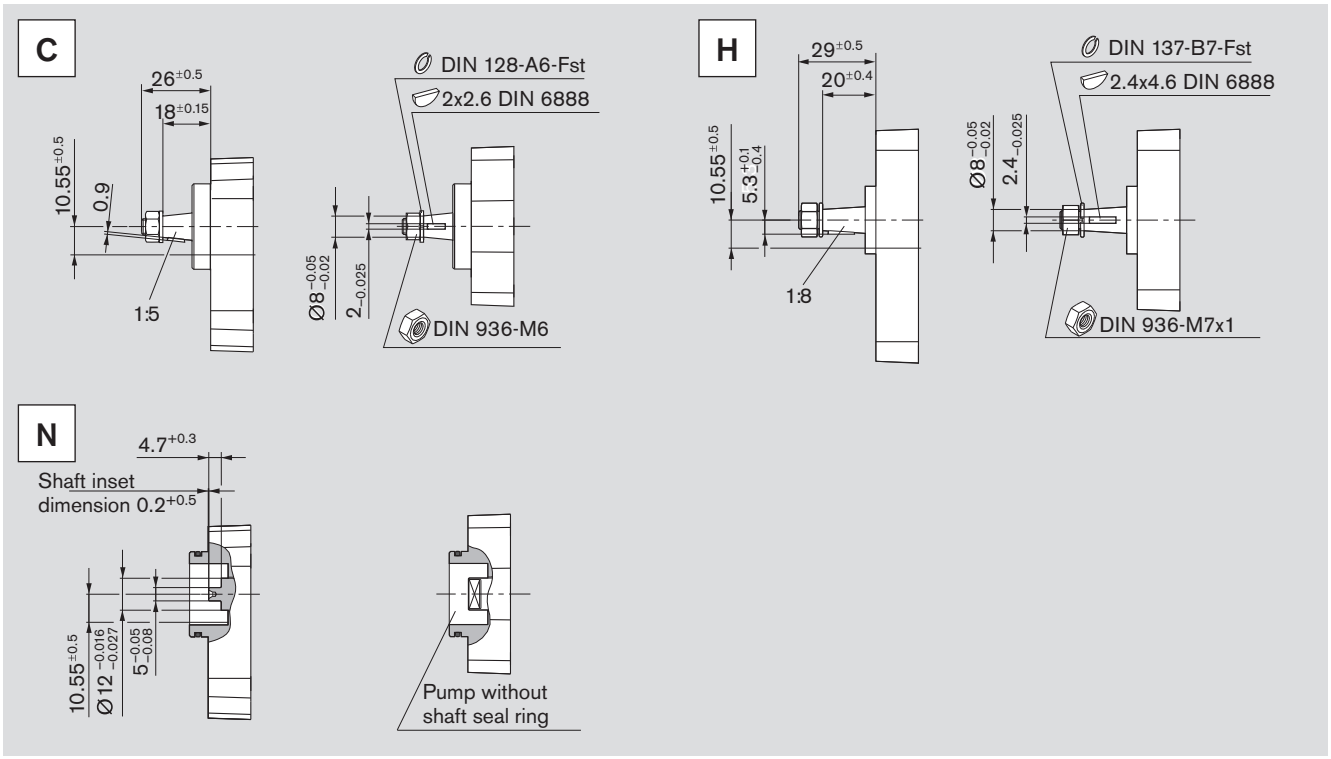
O	Square flange Centering Ø 25.38 mm
B	Square flange Centering Ø 80 mm
O	Square flange Centering Ø 36.47 mm
R	SAE J 744 82-2 A Centering Ø 82.55 mm 2-hole mounting
B	Square flange Centering Ø 100 mm
C	SAE J 744 101-2 B Centering Ø 101.6 mm 2-hole mounting
B	Square flange Centering Ø 105 mm
C	SAE J 744 101-2 B Centering Ø 101.6 mm 2-hole mounting
O	Square flange Centering Ø 50.78 mm

Line ports
every pump stage

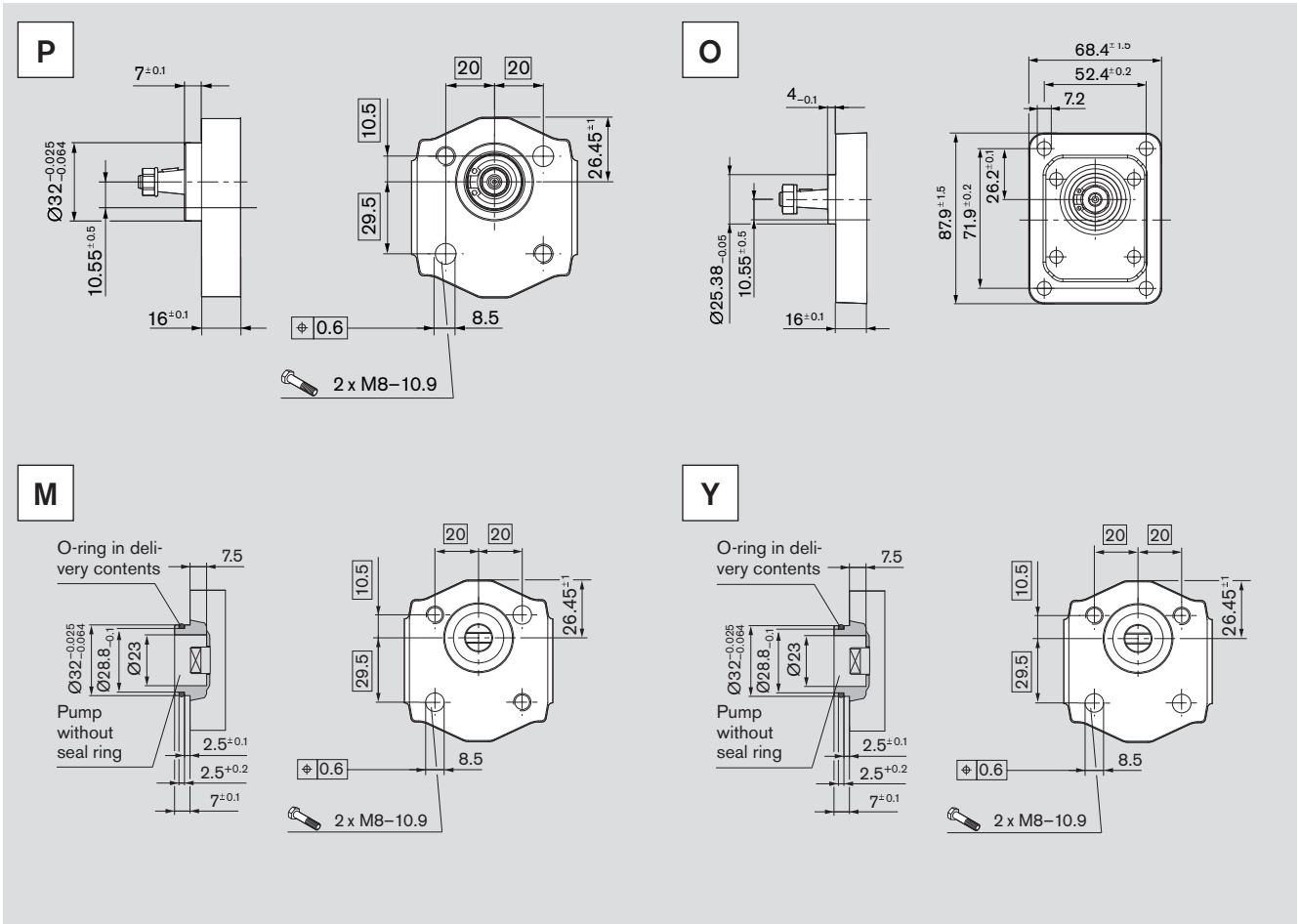
01	Pipe thread ISO 228/1
20	Rectangular flange
20	Rectangular flange
30	Rectangular flange
07	Square flange SAE thread, metric
20	Rectangular flange
07	Square flange SAE thread, metric
20	Rectangular flange
30	Rectangular flange

Not all variants can be selected by using the ordering code!
Please select the required pump by using the selection tables (standard types from standard range, see pages 16…25) or after consultation with Bosch Rexroth!
Special options are possible upon request.

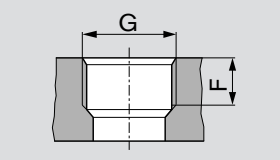
Drive shafts



Front cover



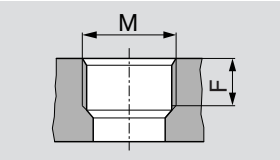
Line ports



01 **Pipe thread ISO 228/1**

Limited service life compared to line port 20

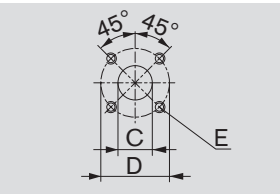
Ordering code	Size	Pressure side G	Pressure side F	Suction side G	Suction side F
01	1...3.15 cm³	G 3/8	13	G 3/8	13
	4.0...7.1 cm³	G 3/8		G 1/2	13



02 **Pipe thread ISO 9974-1**

Limited service life compared to line port 20

Ordering code	Size	Pressure side M	Pressure side F	Suction side M	Suction side F
02	1...3.15 cm³	14x1.5	13	M18x1.5	13
	4...7.1 cm³			M22x1,5	

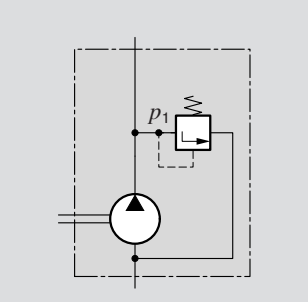


20 **Rectangular flange**

Ordering code	Size	Pressure side C	Pressure side D	Pressure side E	Suction side C	Suction side D	Suction side E
20	2...2.5 cm³	12	30	M6 depth 13	12	30	M6 depth 11.5
	3.15...7.1 cm³	15	35		15	35	

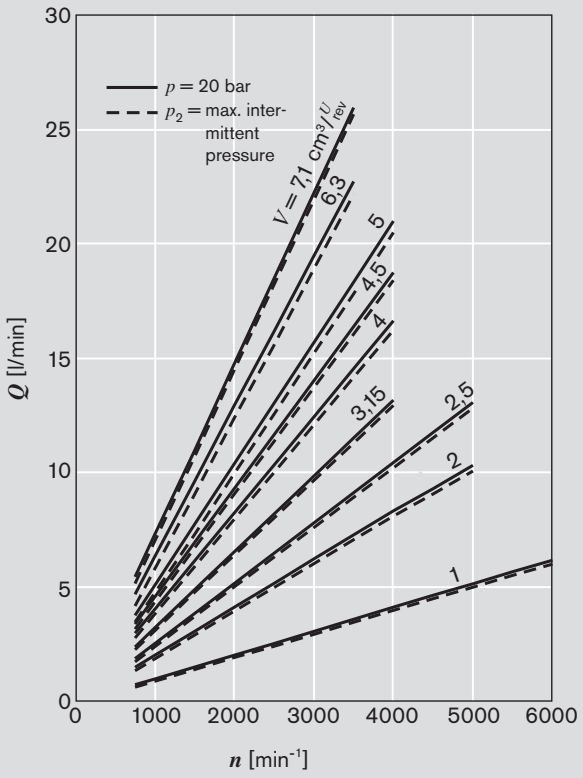
Gear pumps with integrated pressure-relief valve

In order to reduce external pipework it is possible to incorporate a pressure-relief valve in the cover of the gear pump.



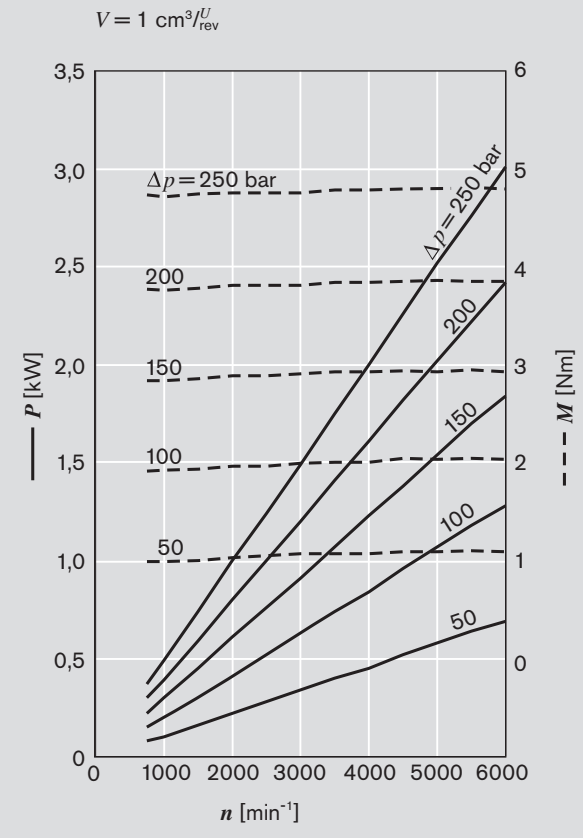
Pressure-relief valve.
Discharge returned to suction line
p_1 = 5...250 bar

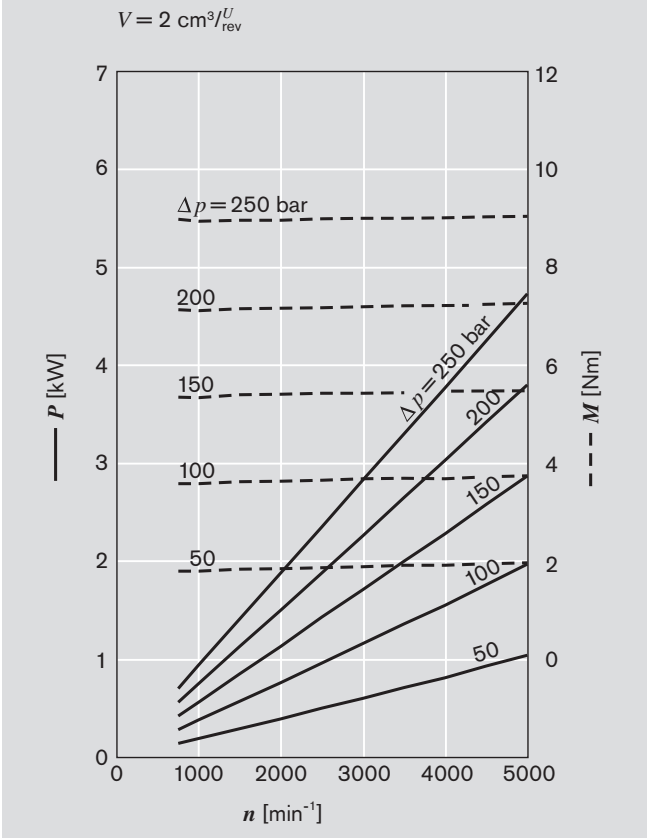
Performance charts



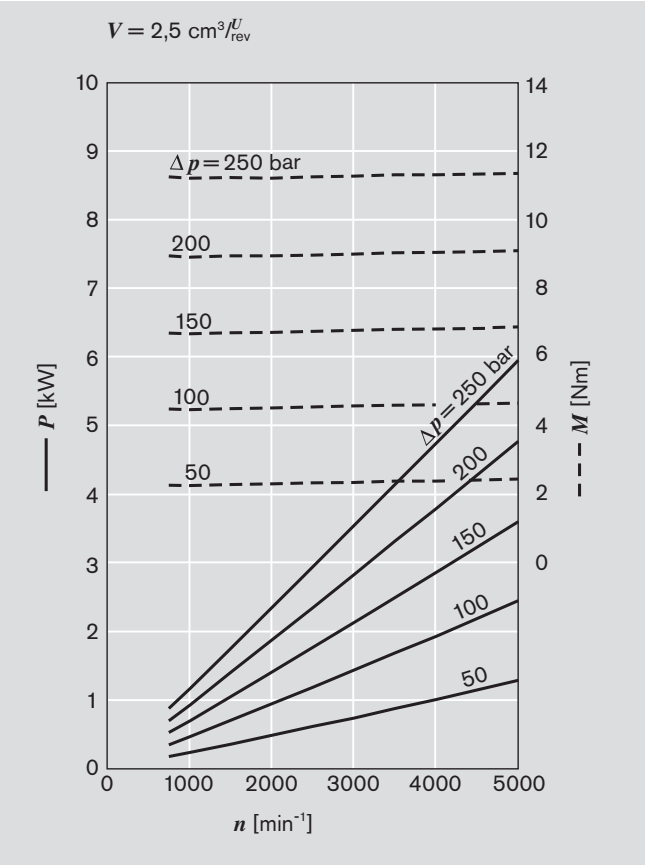
$\nu = 35\ mm^2/s$, $\vartheta = 50\,°C$

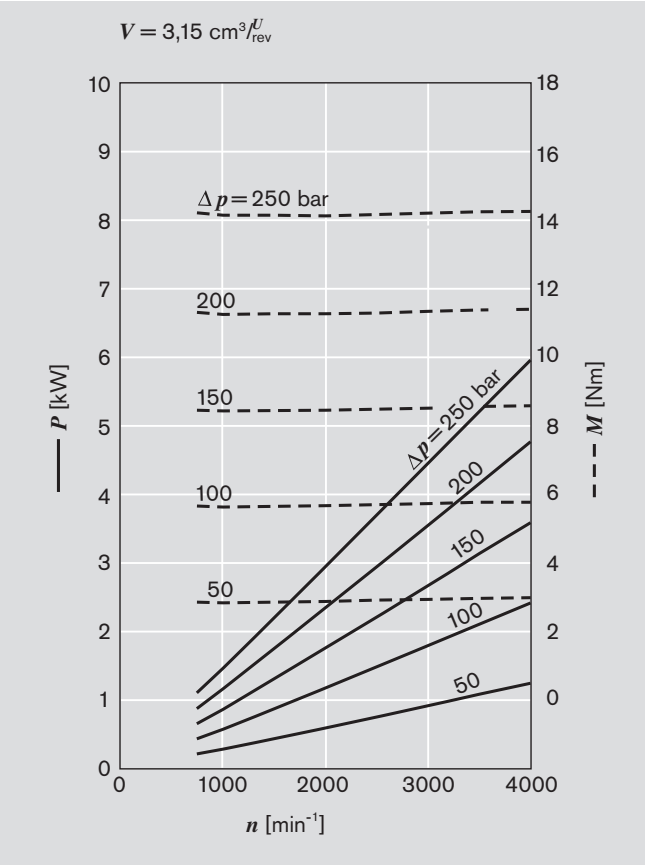
$Q = f(n,V)$ incl. η_v
$P = f(n,p)$ —— incl. η_t
$M = f(n,p)$ – – – incl. η_{hm}

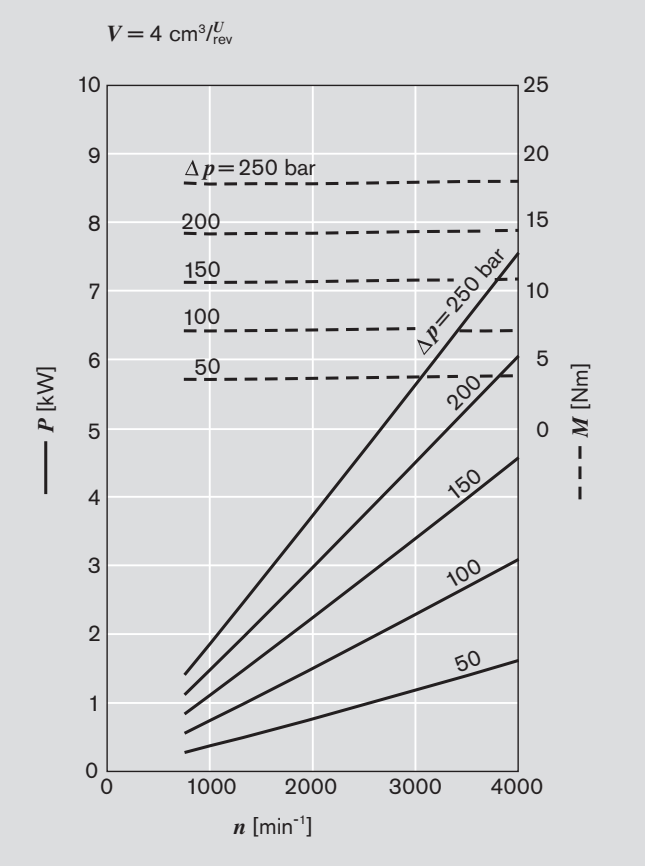


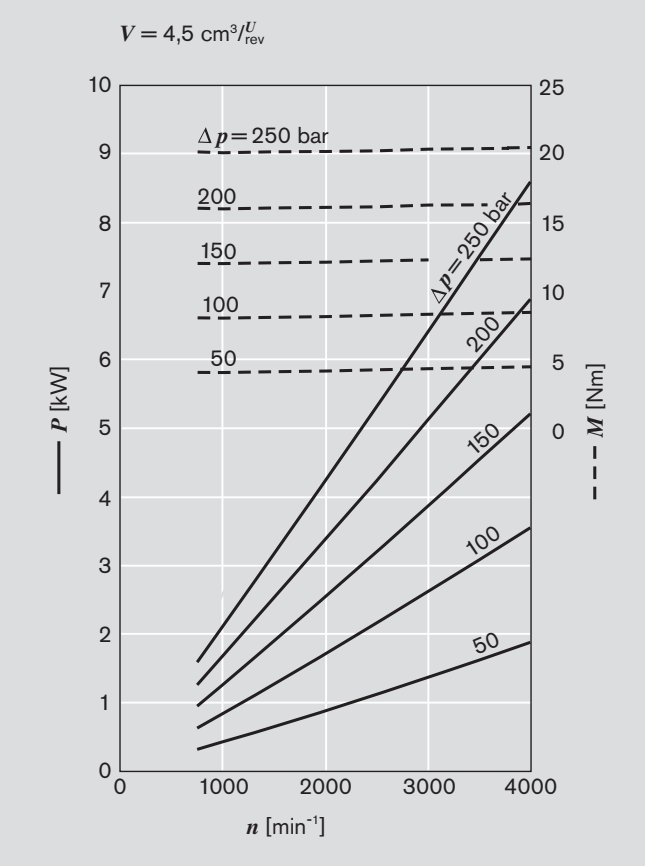


Performance charts (continued)

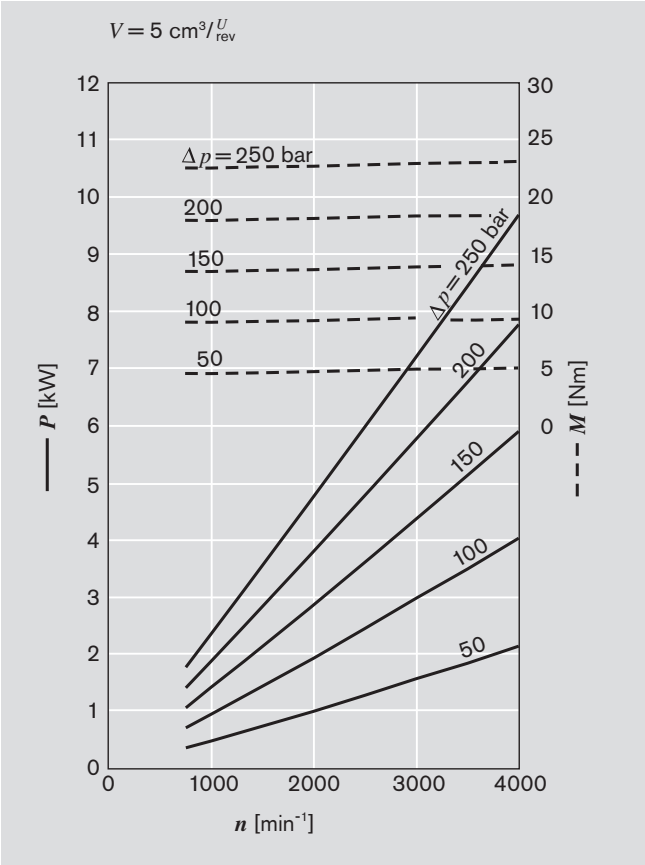


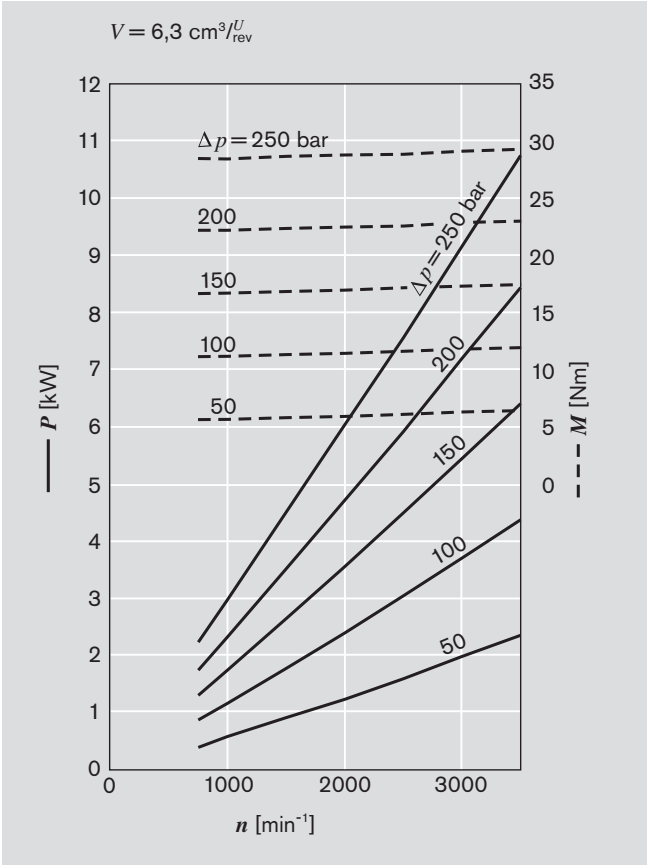


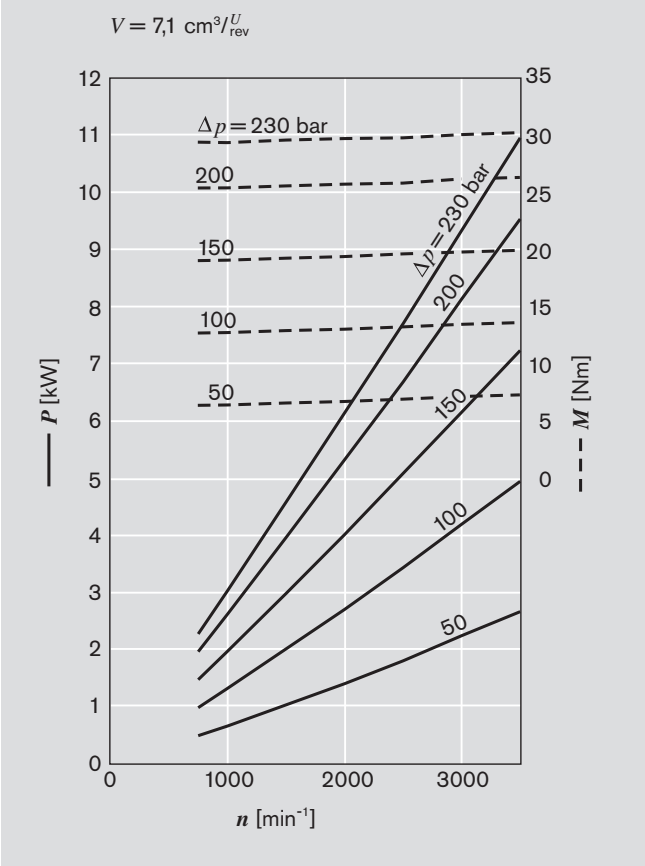




Performance charts (continued)



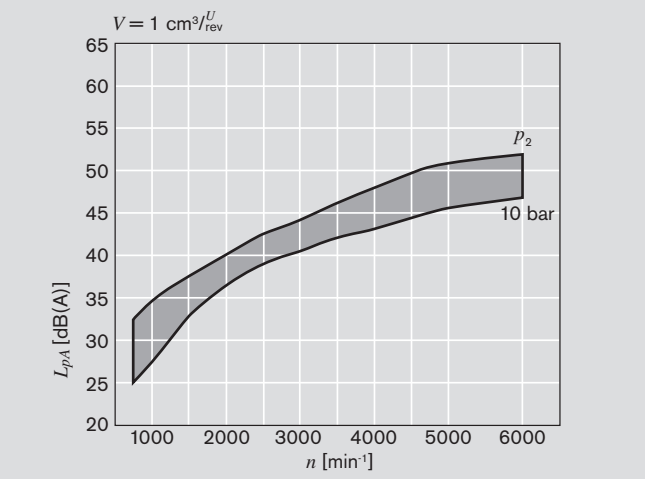


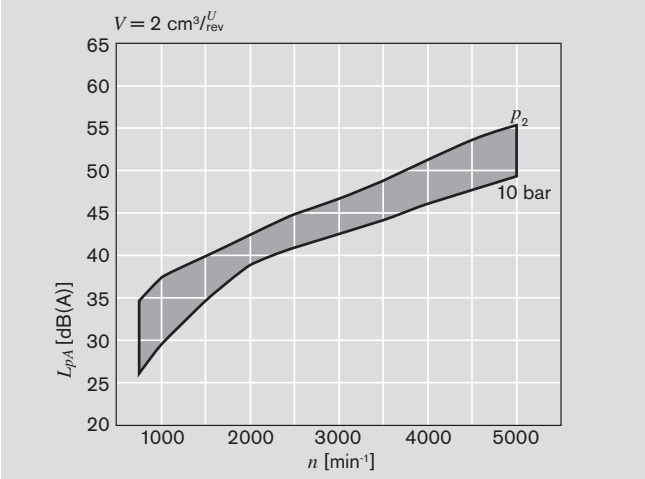


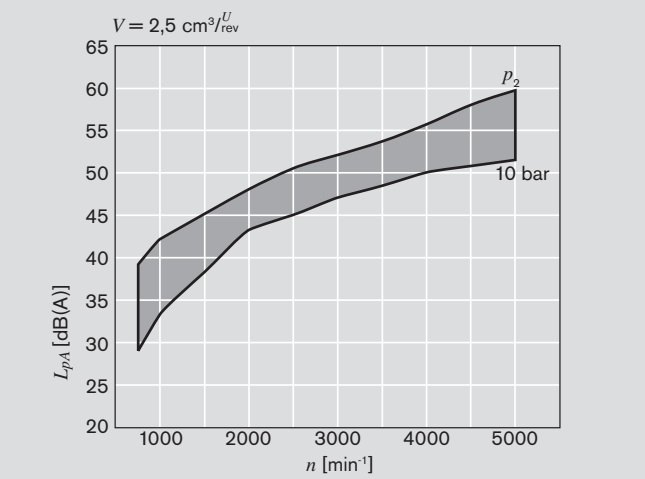
Noise charts

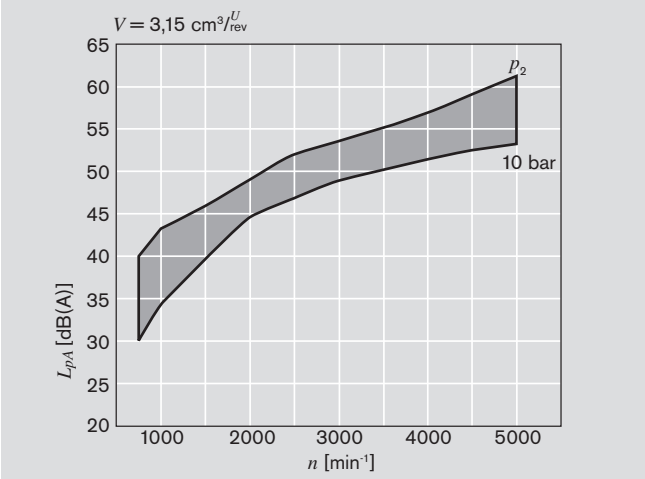
Noise level depending on the rotational speed, pressure range between 10 bar and pressure value p_2 (see page 13 Specifications table).
Oil data: $\nu = 32$ mm²/s, $\vartheta = 50$ °C.
Sound pressure level calculated from noise measurements made in the sound absorbent measuring room compliant with DIN 45635, Part 26.
Distance between measuring instrument – pump: 1 m.

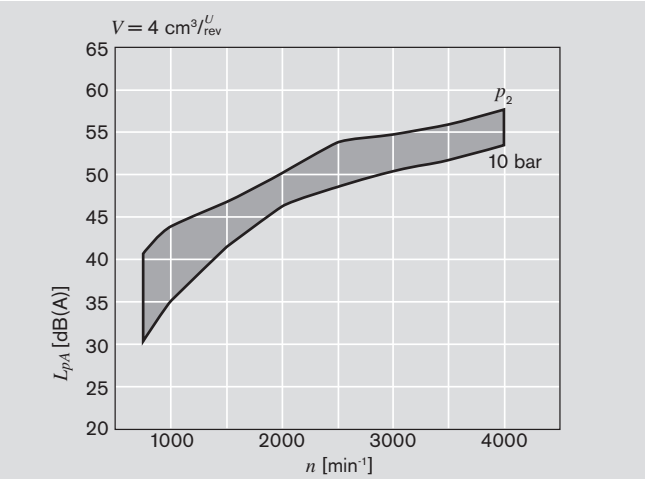
These are typical characteristic values for the respective pump size.
They describe the airborne sound emitted solely by the pump. Environmental influences (installation site, piping, further system components) are not taken into consideration.
Each value applies for a single pump.

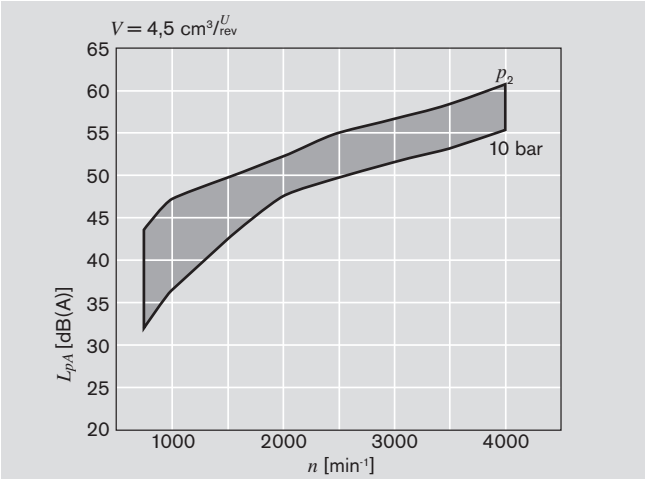




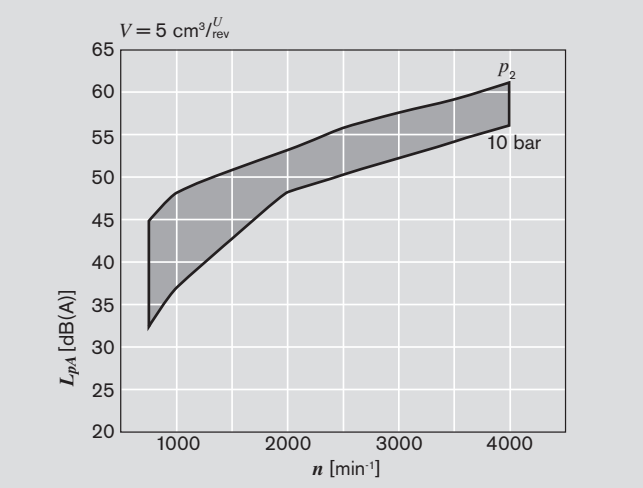


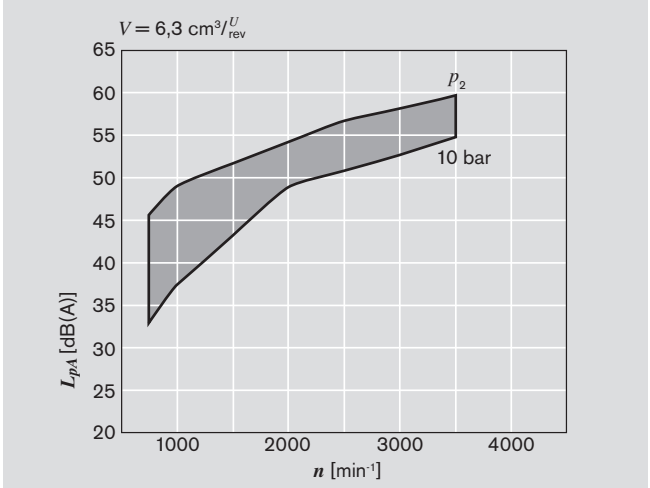


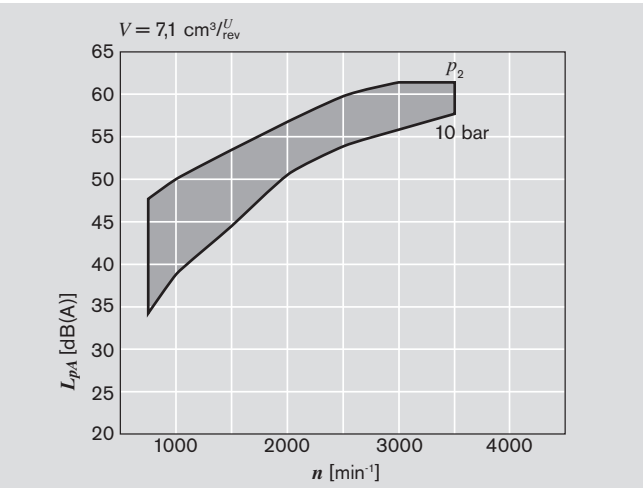




Noise charts (continued)







Design calculations for pumps

The design calculations for pumps are based on the following parameters:

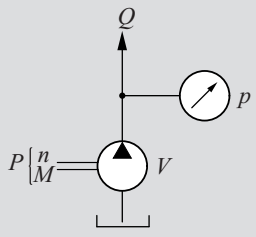
V	[cm³/rev]	Displacement
Q	[l/min]	Delivery
p	[bar]	Pressure
M	[Nm]	Drive torque
n	[rev/min]	Drive speed
P	[kW]	Drive power

It is also necessary to allow for different efficiencies such as:

η_v	Volumetric efficiency
η_{hm}	Hydraulic-mechanical efficiency
η_t	Overall efficiency

The following formulas describe the various relationships.
They include correction factors for adapting the parameters to the usual units encountered in practice.

Caution: Diagram for approximate selection data can be found on pages 8...10.



$$Q = V \cdot n \cdot \eta_v \cdot 10^{-5}$$

$$p = \frac{M \cdot \eta_{hm}}{1.59 \cdot V}$$

$$P = \frac{p \cdot Q}{6 \cdot \eta_t}$$

$$V = \frac{Q}{n \cdot \eta_v} \cdot 10^5$$

$$V = \frac{M \cdot \eta_{hm}}{159 \cdot p}$$

$$Q = \frac{6 \cdot P \cdot \eta_t}{p}$$

$$n = \frac{Q}{V \cdot \eta_v} \cdot 10^5$$

$$M = \frac{1.59 \cdot V \cdot p}{\eta_{hm}}$$

$$p = \frac{6 \cdot P \cdot \eta_t}{Q}$$

[%]

n —— η_v ⟶ Q
M —— η_{hm} ⟶ p
P —— η_t ⟶ $p \cdot Q$

V [cm³/rev] Q [l/min] p [bar]
n [rev/min] P [kW] M [Nm]

Caution: η [%] e.g. 95 [%]

Specification

General	
Construction	External gear pump
Mounting	Flange or through-bolting with spigot
Line ports	Flange or thread
Direction of rotation (looking on shaft)	Clockwise or counter-clockwise; the pump may only be driven in the direction indicated
Installation position	Any
Load on shaft	Radial and axial forces only after consulting
Ambient temperature range	–30 °C...+80 °C with NBR seals or –20 °C...+110 °C with FKM seals
Hydraulic fluid	– Mineral oil compliant with DIN 51 524, 1–3, however under higher load at least HLP compliant with DIN 51 524 Part 2 recommended. – Comply with RE 90220 – Further operating fluids possible after consultation
Viscosity	12...800 mm^2/s permitted range 20...100 mm^2/s recommended range ...2000 mm^2/s range permitted for starting
Hydraulic fluid temperature range	max. +80 °C with NBR seals *) max. +110 °C with FKM seals **)
Filtration ***)	At least cleanliness level 20/18/15 compliant with ISO 4406 (1999)
Efficiency	on request, depending on load cycle
Service life	on request, depending on load cycle

*) NBR = Perbunan®
**) FKM = Viton®
***) On hydraulic systems or devices with critical counter-reaction, such as steering and counterbalance valves, the type of filtration selected must be adapted to the sensitivity of these devices/systems.

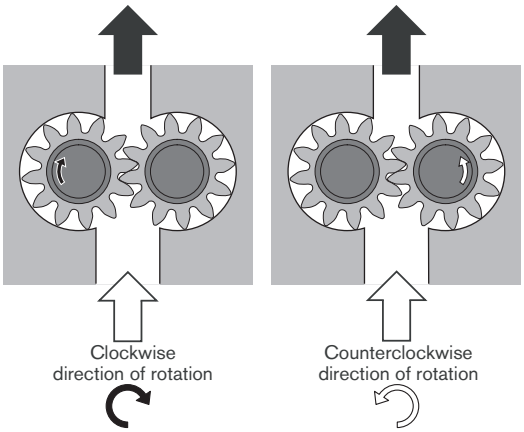
Safety requirements pertaining to the whole systems are to be observed.

In the case of applications with high numbers of load cycles please consult Bosch Rexroth.

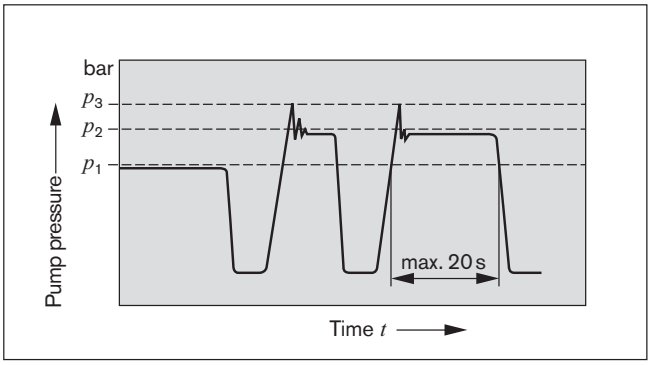
Definition of direction of rotation

Always look on the drive shaft.

Caution: Dimensional drawings always show clockwise-rotating pumps. For counterclockwise-rotating pumps the positions of the drive shaft and the suction and pressure ports are different.



Definitions of pressures



p_1 max. continuous pressure
p_2 max. intermittent pressure
p_3 max. peak pressure

AZPB-3x

Displacement	V	cm^3/rev	1	2	2.5	3.15	4	4.5	5	6.3	7.1
Suction pressure	p_e	bar	0.7...3 (absolute)								
max. continuous pressure	p_1		220	220	220	220	220	220	220	220	200
max. intermittent pressure	p_2		250	250	250	250	250	250	250	250	230
max. peak pressure	p_3		270	270	270	270	270	270	270	270	250
min. rotational speed		rpm	750	750	750	750	750	750	750	750	750
max. rotational speed at	p_2		6,000	5,000	5,000	4,000	4,000	4,000	4,000	3,500	3,500

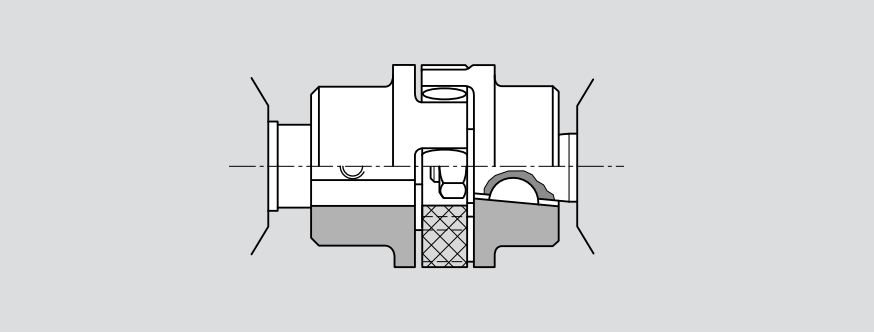
Project planning up to 280 bar (p_2) possible in agreement with Product Management, External Gear Units.

Drive arrangement

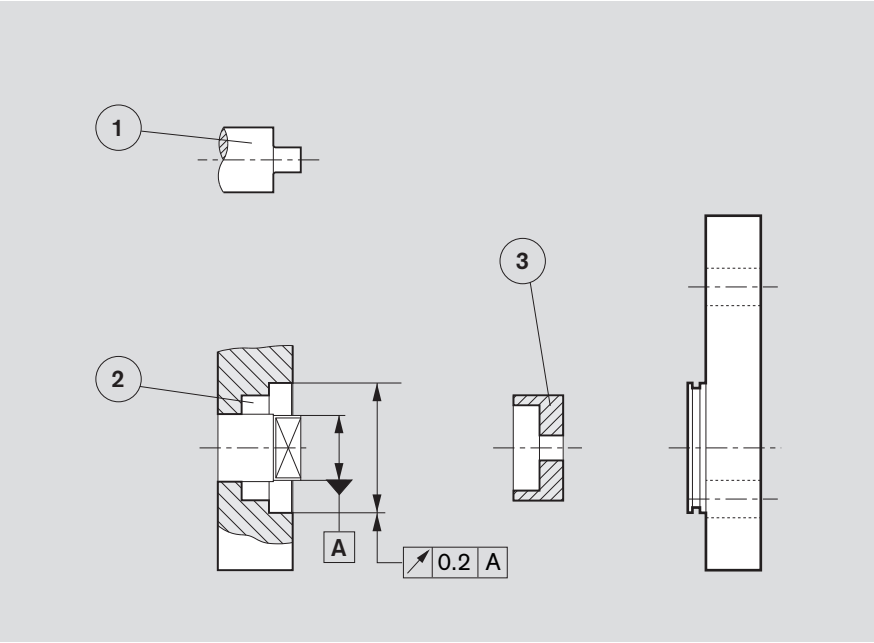
The coupling must not transfer any radial or axial forces to the pump.

1. Flexible couplings
Refer to the fitting instructions provided by the coupling manufacturer for details of the maximum permitted shaft misalignment.

The maximum radial runout from the pump shaft to the spigot is 0.2 mm.



2. Drive shaft with tang
For directly mounting the pump to an electric motor or an internal-combustion engine, gear, etc. the pump shaft has a special tang and driver ③ (not included in delivery).
There is no shaft sealing.



The recommended arrangements and dimensions for the drive end and sealing are as follows.

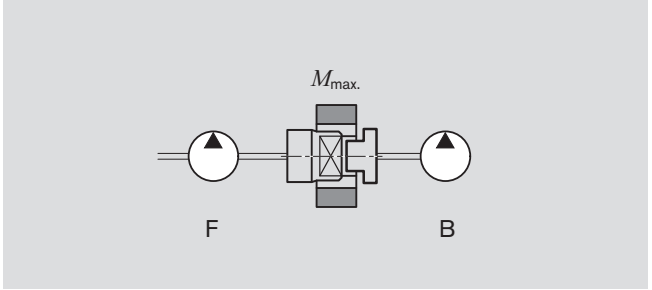
Transferrable torque:
AZPB-3x = 25 Nm.
Suitable couplings for AZPB-3x:
1 510 001 002 for AZPFB,
1 510 240 001 for AZPBB.

① **Drive shaft**
Case-hardening steel DIN 17 210
e.g. 20 MnCrS 5
case-hardened 1.0 deep; HRA $83^{\pm 2}$
Surface for sealing ring
ground without rifling $R_t \leq 4\mu m$

② **Radial shaft seal**
with rubber covered seal
(see DIN 3760, Type AS, or double-lipped ring).
Please take note of the seal ring manufacturer's guidelines for arrangement of the installation space.

Multiple gear pumps

Gear pumps are suitable for multiple setups, whereby the drive shaft for the 1st pump is extended to a second and even a 3rd pump. A coupling is fitted between each pair of pumps.
In most cases each pump is isolated from its neighbor, i.e. the suction ports are separate from one another. A common suction port is also possible as an option.
Caution: Basically, the specifications for the single pumps apply, but with certain restrictions:
Max. speed: This is determined by the highest rated pump speed in use.
Pressures: These are restricted by the strength of the drive shaft, the through drives and the drivers. Appropriate data is given in the dimensional drawings.



Combinations

Series Pump 1	$M_{max.}$ [Nm]	Series Pump 2
F	25	B
B	25	B

When configuring multiple pumps, the pumps are to be ordered according to the largest displacement on the drive side, e.g. BB, FB, SB, JB as double, FBB, SBB, JBB, NFB, GFB, TSB, USB as triple.

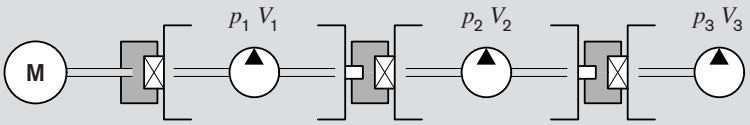
Pressure restrictions
In the case of series B (AZPB-3x), the driver for the second pumping stage can carry a load of up to $M_{max.} = 25$ Nm, i.e. there is a pressure restriction for the second stage and any further stages.

Drive shaft		max. transferrable drive torque * [Nm]
C	1:5	26
H	1:8	30
N	Claw	25

* These values only apply when the conditions described above are complied with. Bosch Rexroth is to be consulted if the stated values are exceeded.

If the first stage is driven through a tang (driver) or outboard bearing type 1, pressure restrictions apply as indicated in the formula below.

Reinforced through drives are available for applications with higher transfer torques and/or rotational vibrations. Customized designs available on request.

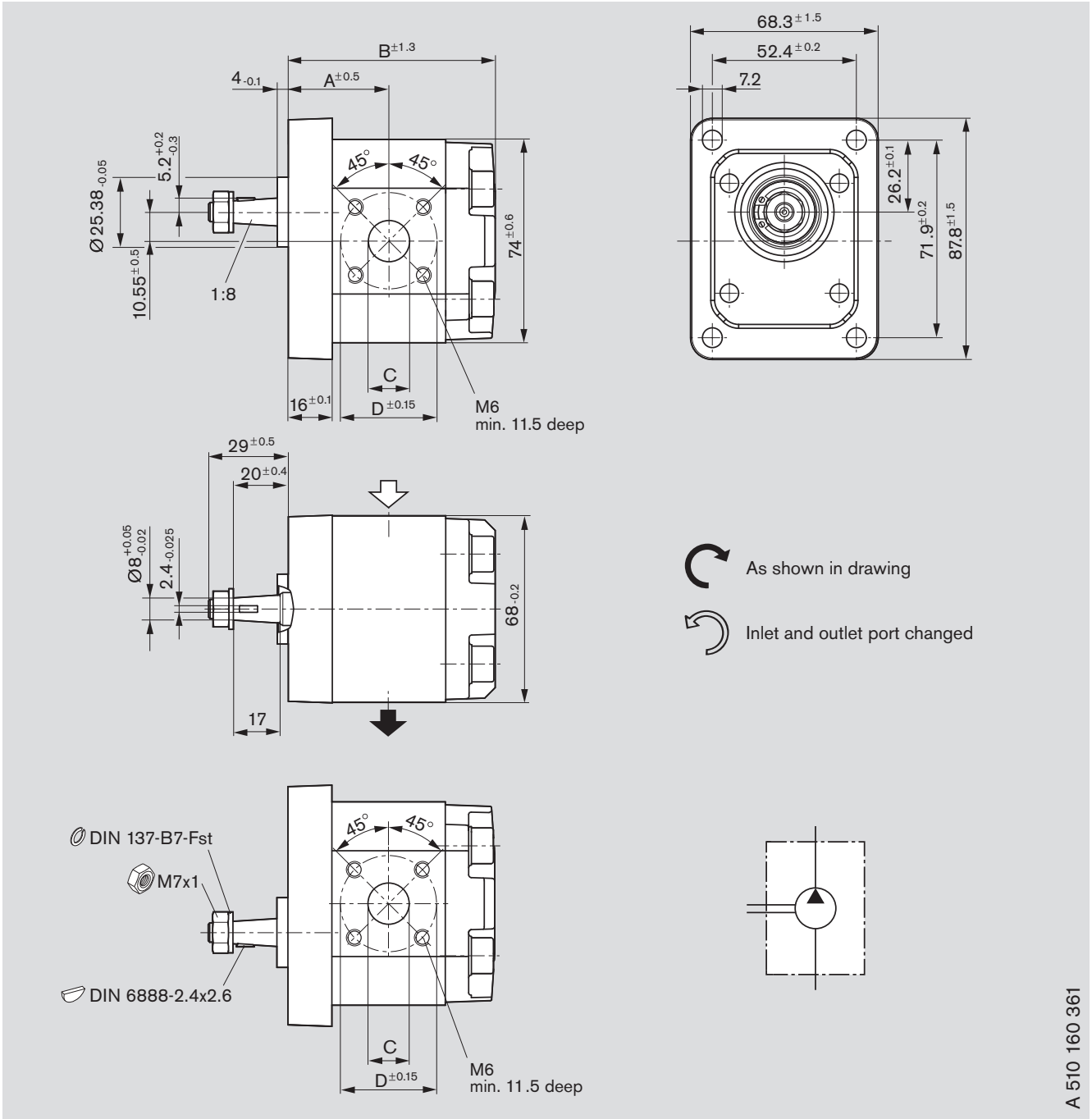


$$M_{max.} \geqq \Delta p_1 \cdot V_1 \cdot 0{,}0177 + \Delta p_2 \cdot V_2 \cdot 0{,}0177 + \Delta p_3 \cdot V_3 \cdot 0{,}0177$$

Δp [bar] V [cm³/rev]

Dimensions

Standard range



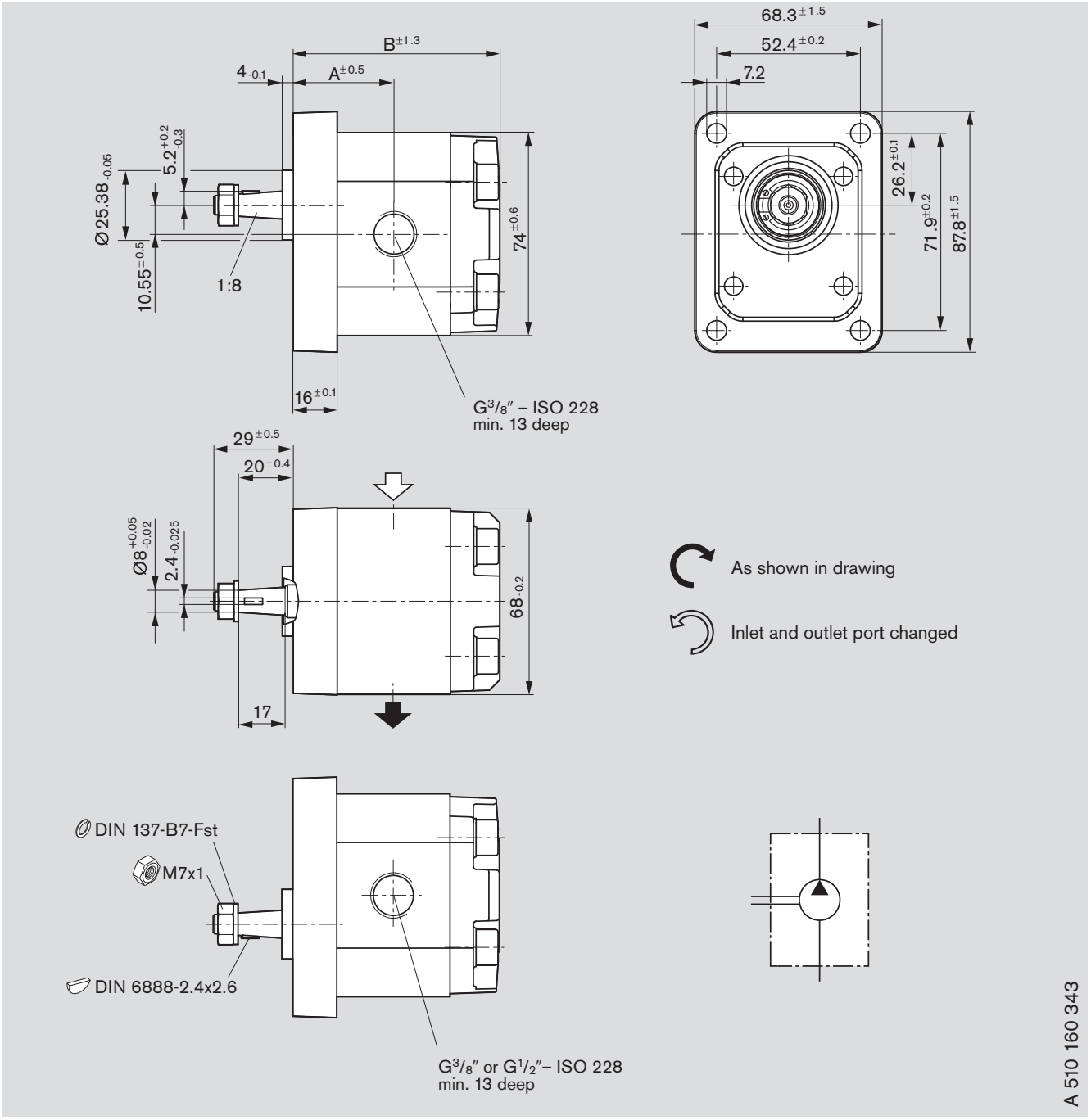
Ordering code:

AZPB – 32 – ☐☐☐ ☐ H O 20 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	max. operating pressure [bar]	max. rotation speed [rpm]	Mass [kg]	Dimension [mm] A	B	C	D
2	**0 510 120 326**	**0 510 120 028**	250	5,000		32.8	67.9	12	30
2.5	**0 510 120 327**	**0 510 120 029**	250	5,000		33.8	69.8	12	30
3.15	**0 510 120 328**	**0 510 120 030**	250	4,000		35.0	72.3	15	35
4	**0 510 120 329**	**0 510 120 031**	250	4,000		36.6	75.5	15	35
4.5	**0 510 120 330**	**0 510 120 032**	250	4,000		37.6	77.4	15	35
5	**0 510 120 331**	**0 510 120 033**	250	4,000		38.6	79.5	15	35
6.3	**0 510 120 332**	**0 510 120 034**	250	3,500		41.0	84.2	15	35
7.1	**0 510 120 333**	**0 510 120 035**	230	3,500		42.5	87.3	15	35

Dimensions

Standard range



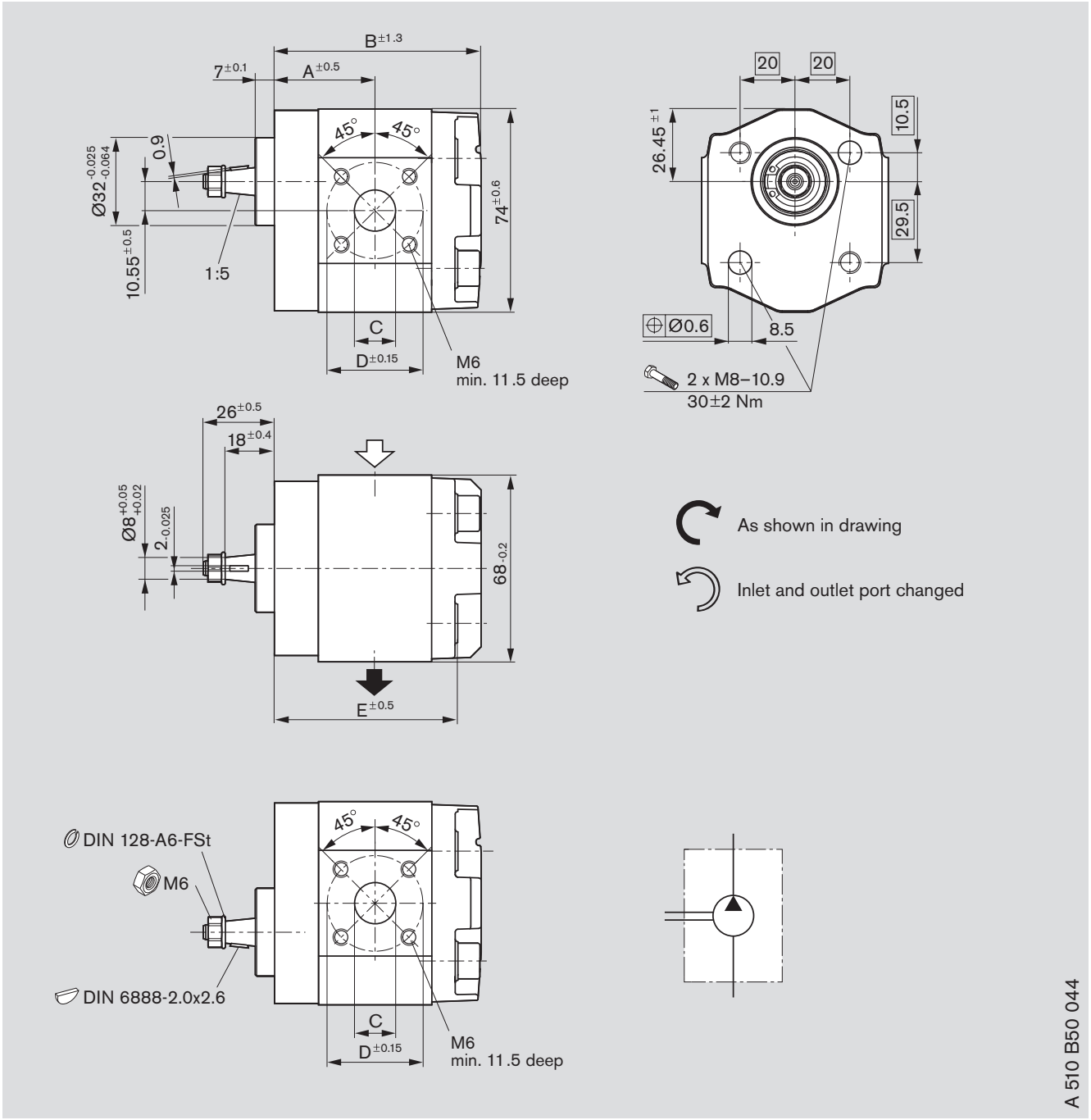
Ordering code:

AZPB – 32 – ☐☐☐ ☐ H O 01 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	max. operating pressure [bar]	max. rotation speed [rpm]	Mass [kg]	Dimension [mm] A	B	Version
1	**0 510 020 303**	**0 510 020 003**	250	6,000		30.9	64.1	3/8
2	**0 510 120 318**	**0 510 120 020**	250	5,000		32.8	67.9	3/8
2.5	**0 510 120 319**	**0 510 120 021**	250	5,000		33.8	69.8	3/8
3.15	**0 510 120 320**	**0 510 120 022**	250	4,000		35.0	72.3	3/8
4	**0 510 120 321**	**0 510 120 023**	250	4,000		36.6	75.5	1/2
4.5	**0 510 120 322**	**0 510 120 024**	250	4,000		37.6	77.4	1/2
5	**0 510 120 323**	**0 510 120 025**	250	4,000		38.6	79.5	1/2
6.3	**0 510 120 324**	**0 510 120 026**	250	3,500		41.0	84.2	1/2
7.1	**0 510 120 325**	**0 510 120 027**	230	3,500		42.5	87.3	1/2

Dimensions

Standard range



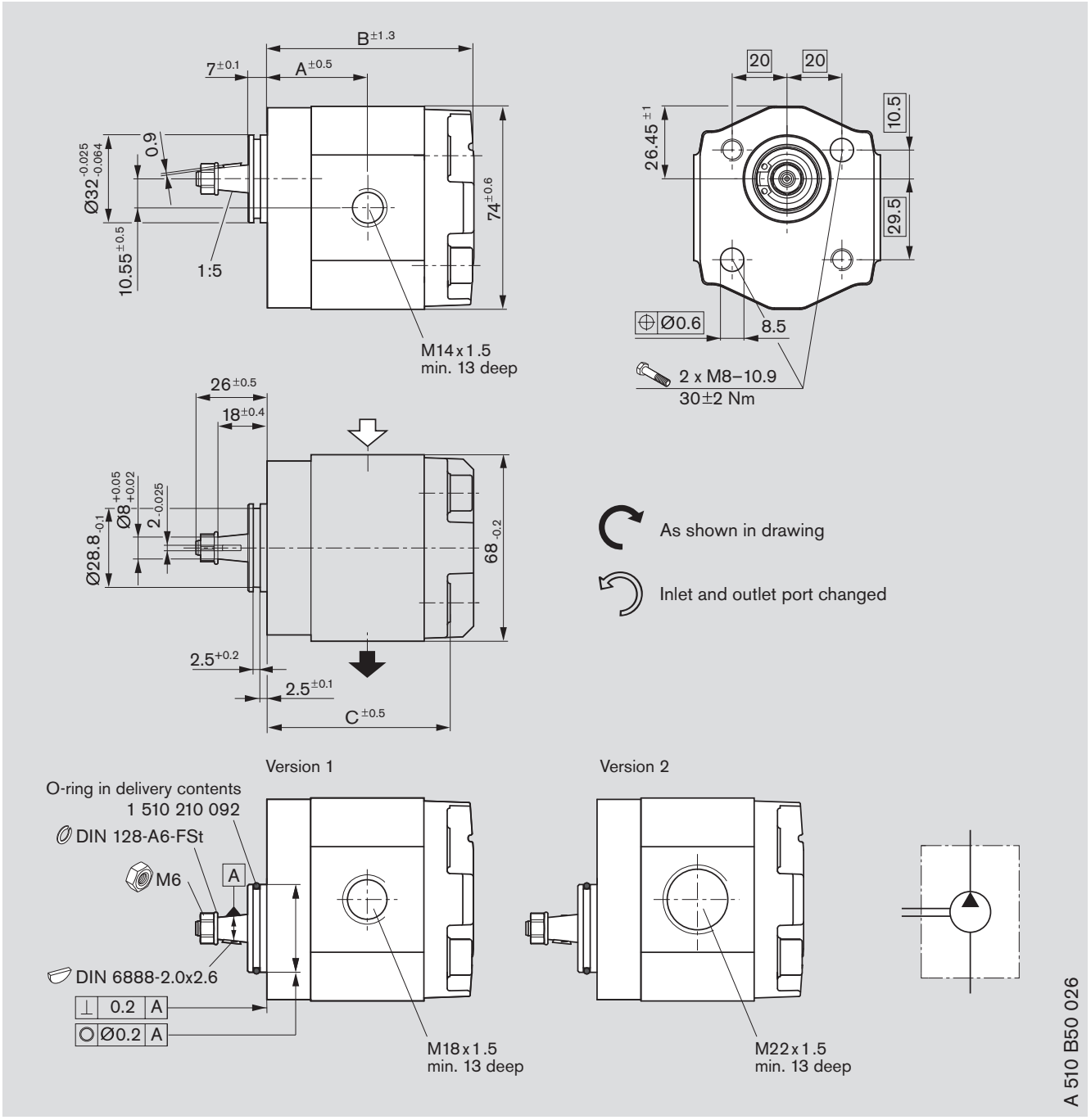
Ordering code:

AZPB – 32 – ☐☐☐ ☐ C P 20 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	max. operating pressure [bar]	max. rotation speed [rpm]	Mass [kg]	Dimension [mm] A	B	C	D	E
2	**0 510 110 332**	**0 510 110 025**	250	5,000		32.8	67.9	12	30	59.0
2.5	**0 510 110 333**	**0 510 110 026**	250	5,000		33.8	69.8	12	30	60.9
3.15	**0 510 112 325**	**0 510 112 019**	250	4,000		35.0	72.3	15	35	63.4
4	**0 510 114 336**	**0 510 114 030**	250	4,000		36.6	75.5	15	35	66.6
4.5	**0 510 114 337**	**0 510 114 031**	250	4,000		37.6	77.4	15	35	68.5
5	**0 510 114 338**	**0 510 114 032**	250	4,000		38.6	79.5	15	35	70.6
6.3	**0 510 122 324**	**0 510 122 020**	250	3,500		41.0	84.2	15	35	75.3
7.1	**0 510 122 325**	**0 510 122 021**	230	3,500		42.5	87.3	15	35	78.4

Dimensions

Standard range



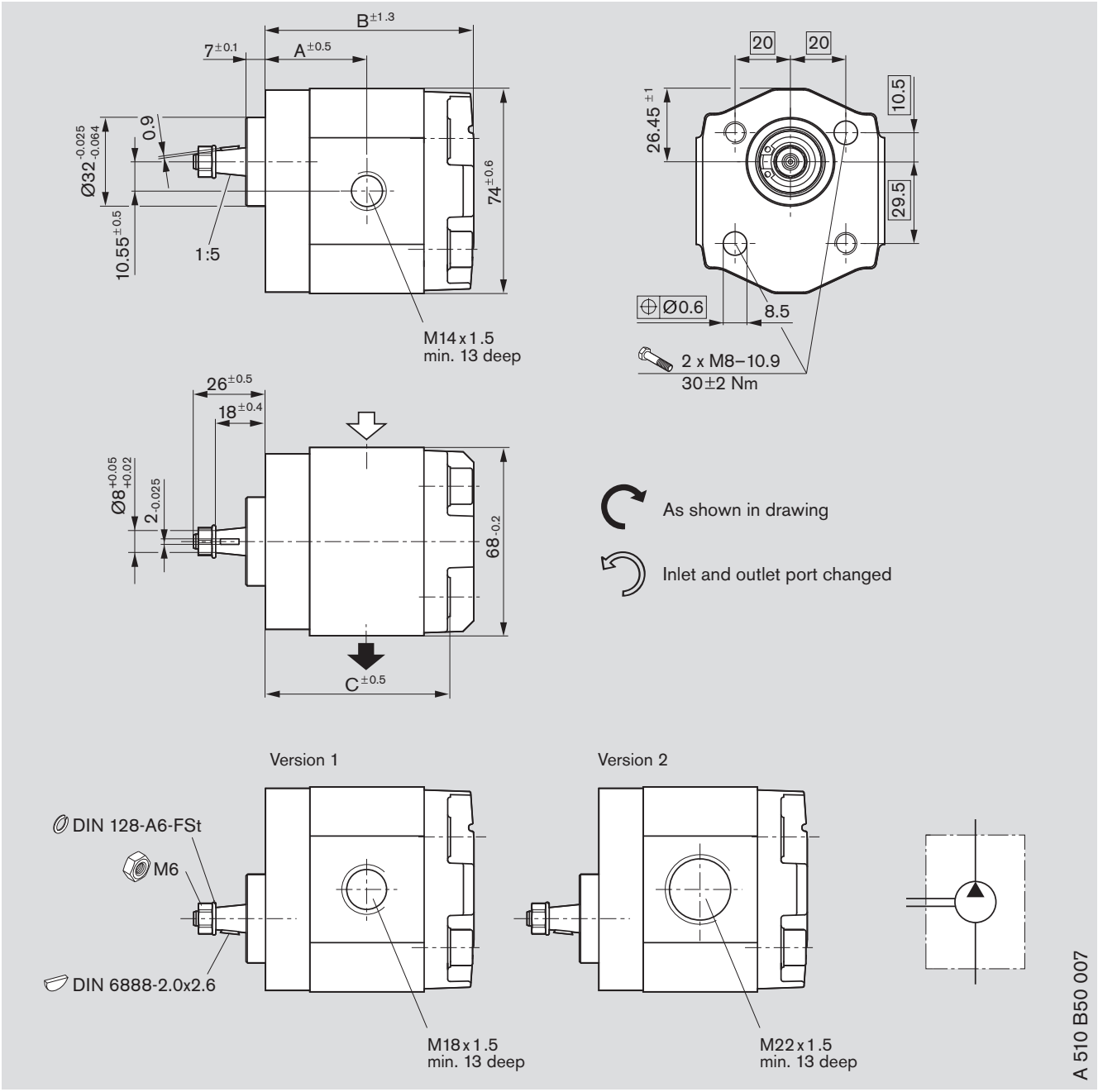
Ordering code:

AZPB – 32 – ☐☐☐ ☐ C P 02 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	max. operating pressure [bar]	max. rotation speed [rpm]	Mass [kg]	Dimension [mm] A	B	C	Version
1	**0 510 010 315**	**0 510 010 010**	250	6,000		30.9	64.1	55.2	1
2	**0 510 110 328**	**0 510 110 022**	250	5,000		32.8	67.9	59.0	1
2.5	**0 510 110 329**	**0 510 110 023**	250	5,000		33.8	69.8	60.9	1
3.15	**0 510 112 323**	**0 510 112 018**	250	4,000		35.0	72.3	63.4	1
4	**0 510 114 330**	**0 510 114 025**	250	4,000		36.6	75.5	66.6	2
4.5	**0 510 114 331**	**0 510 114 026**	250	4,000		37.6	77.4	68.5	2
5	**0 510 114 332**	**0 510 114 027**	250	4,000		38.6	79.5	70.6	2
6.3	**0 510 122 320**	**0 510 122 016**	250	3,500		41.0	84.2	75.3	2
7.1	**0 510 122 321**	**0 510 122 017**	230	3,500		42.5	87.3	78.4	2

Dimensions

Standard range



Ordering code:

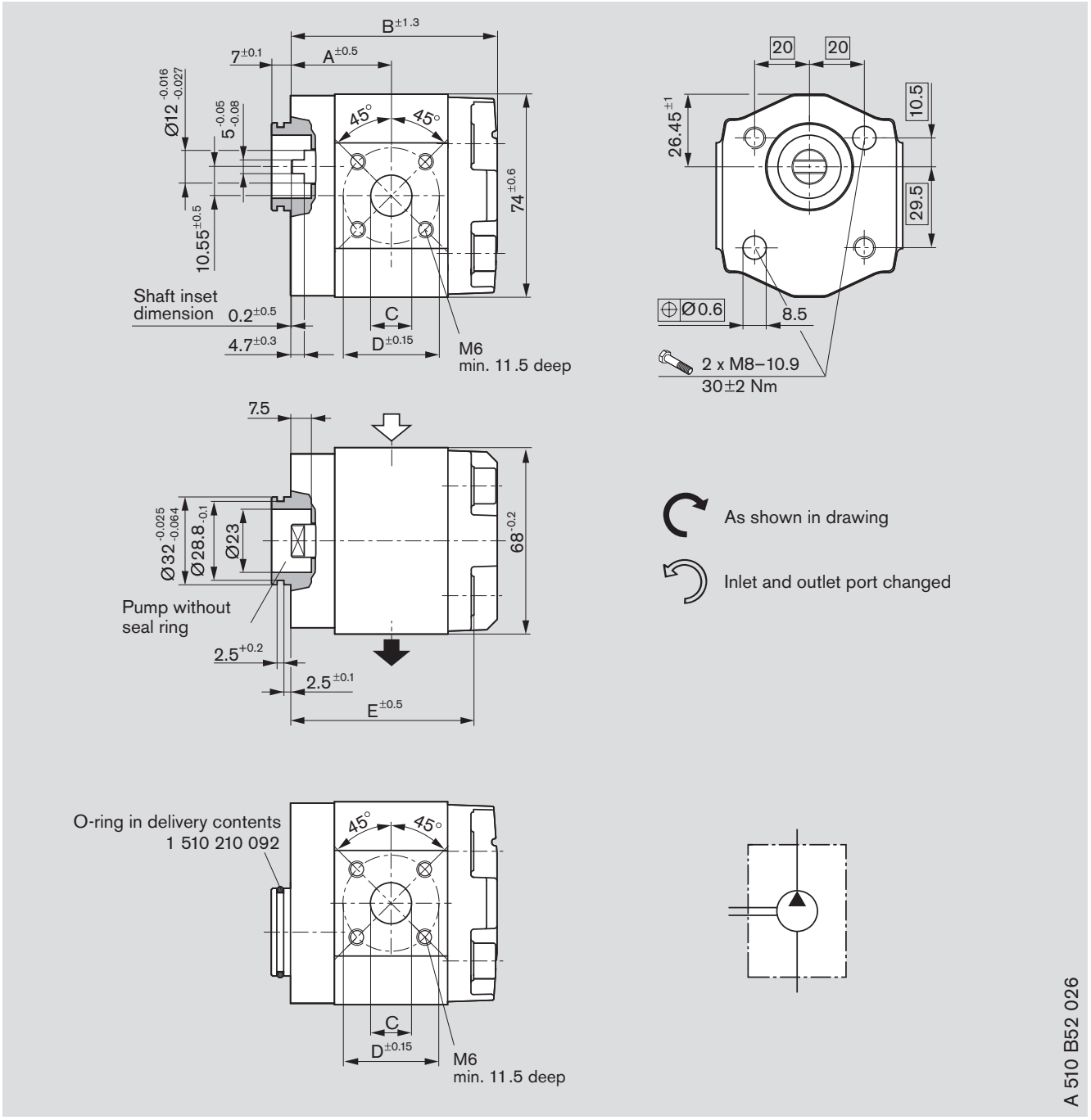
AZPB – 32 – ☐☐☐ ☐ C P 02 M B

AZPB – 32 – ☐☐☐ ☐ C P 02 K B*

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	max. operating pressure [bar]	max. rotation speed [rpm]	Mass [kg]	Dimension [mm] A	B	C	Version
1	**0 510 010 313**	**0 510 010 008**	250	6,000		30.9	64.1	55.2	1
2	**0 510 110 324**	**0 510 110 017**	250	5,000		32.8	67.9	59.0	1
2.5	**0 510 110 325**	**0 510 110 018**	250	5,000		33.8	69.8	60.9	1
3.15		**0 510 112 015***	250	4,000		35.0	72.3	63.4	1
3.15	**0 510 112 321**	**0 510 112 014**	250	4,000		35.0	72.3	63.4	1
4	**0 510 114 324**	**0 510 114 018**	250	4,000		36.6	75.5	66.5	2
4.5	**0 510 114 325**	**0 510 114 019**	250	4,000		37.6	77.4	68.5	2
5	**0 510 114 326**	**0 510 114 020**	250	4,000		38.6	79.5	70.6	2
6.3	**0 510 122 316**	**0 510 122 012**	250	3,500		41.0	84.2	75.3	2
7.1	**0 510 122 317**	**0 510 122 013**	230	3,500		42.5	87.3	78.4	2

Dimensions

Standard range



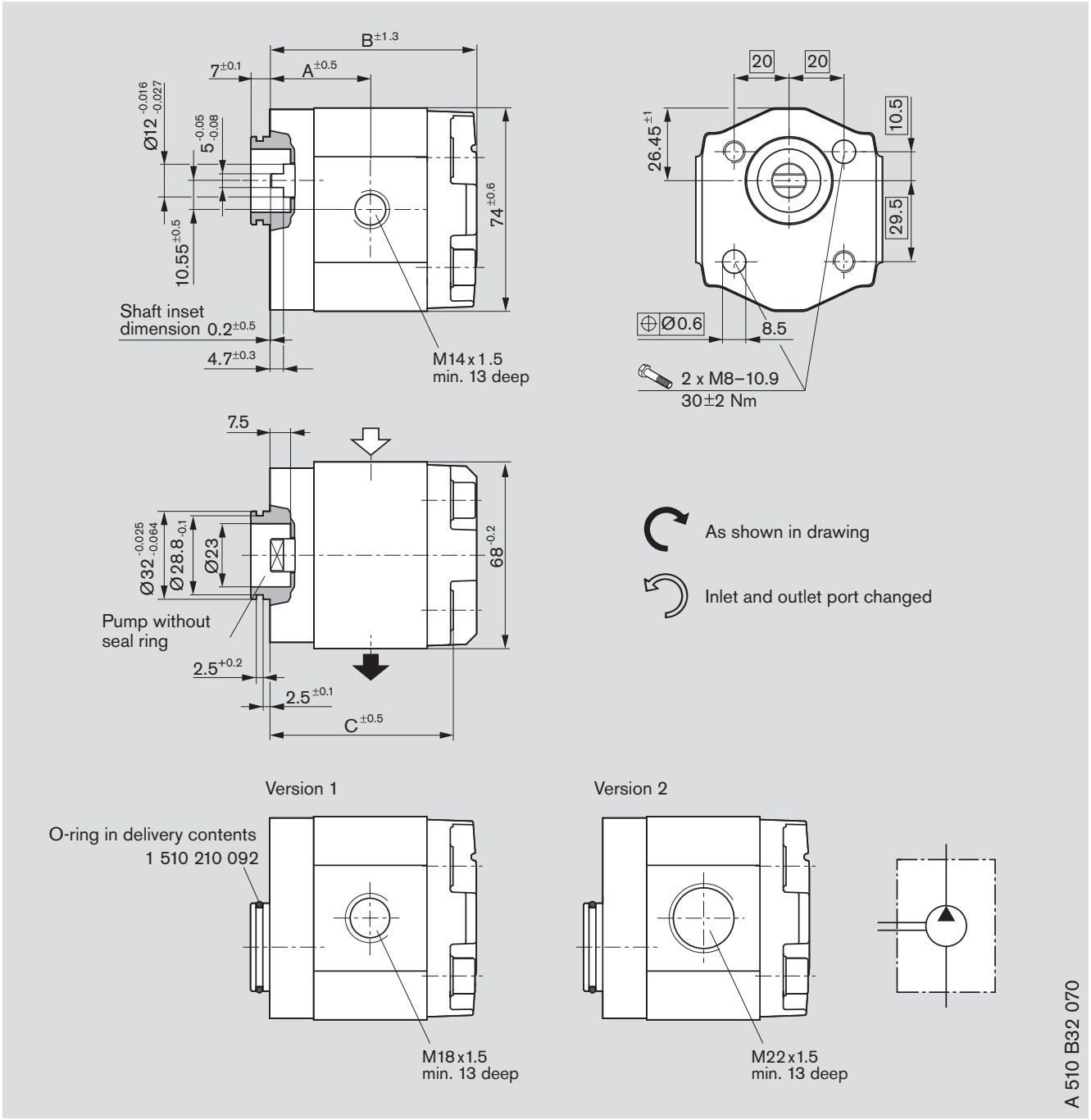
Ordering code:

AZPB – 32 – ☐☐☐ ☐ N M 20 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	max. operating pressure [bar]	max. rotation speed [rpm]	Mass [kg]	Dimension [mm] A	B	C	D	E
2	**0 510 110 334**	**0 510 110 027**	250	5,000		32.8	67.9	12	30	59.0
2.5	**0 510 110 335**	**0 510 110 028**	250	5,000		33.8	69.8	12	30	60.9
3.15	**0 510 112 326**	**0 510 112 020**	250	4,000		35.0	72.3	15	35	63.4
4	**0 510 114 339**	**0 510 114 033**	250	4,000		36.6	75.5	15	35	66.6
4.5	**0 510 114 340**	**0 510 114 034**	250	4,000		37.6	77.4	15	35	68.5
5	**0 510 114 341**	**0 510 114 035**	250	4,000		38.6	79.5	15	35	70.6
6.3	**0 510 122 326**	**0 510 122 022**	250	3,500		41.0	84.2	15	35	75.3
7.1	**0 510 122 327**	**0 510 122 023**	230	3,500		42.5	87.3	15	35	78.4

Dimensions

Standard range



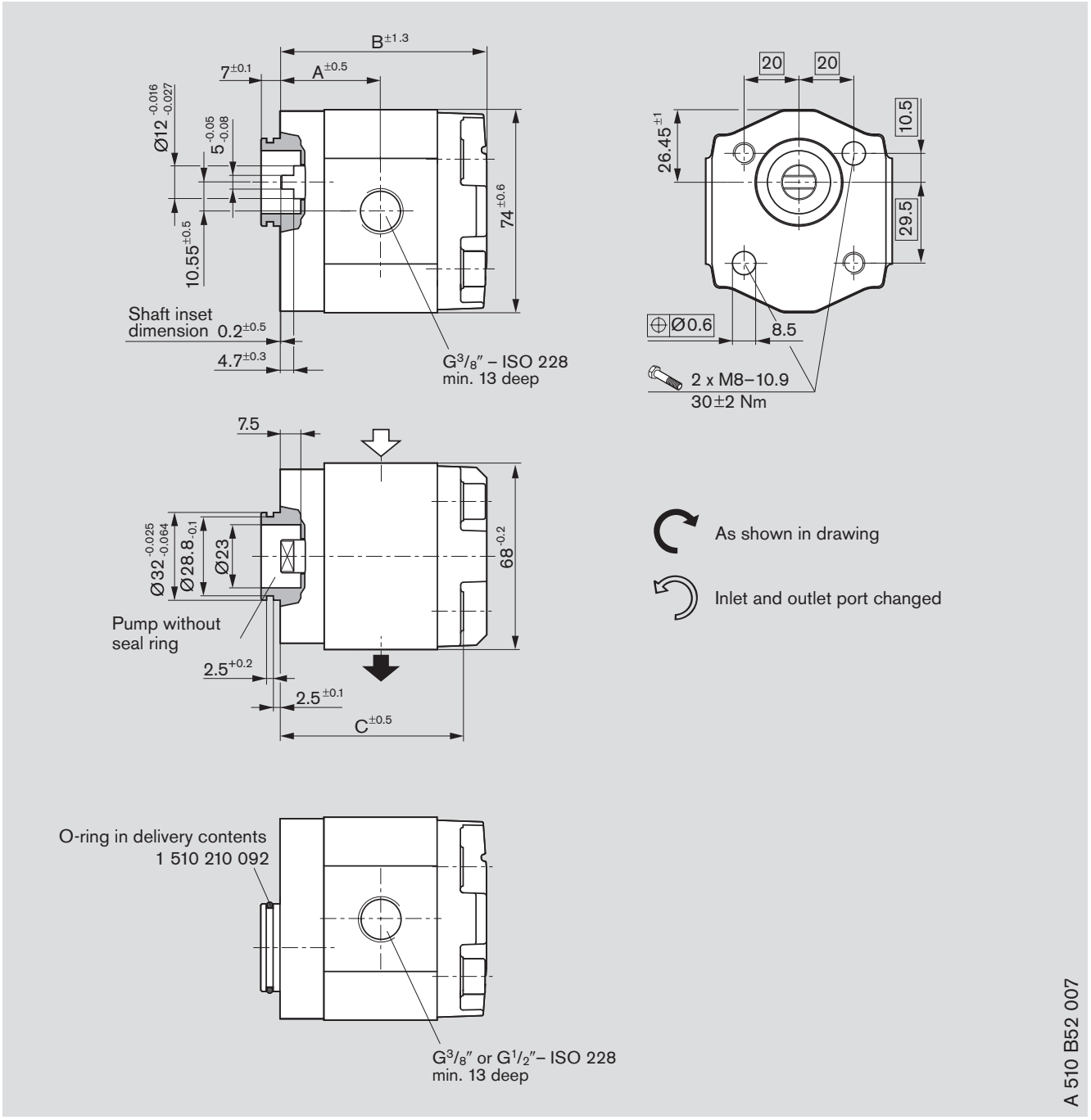
Ordering code:

AZPB – 32 – ☐☐☐ ☐ N M 02 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	max. operating pressure [bar]	max. rotation speed [rpm]	Mass [kg]	Dimension [mm] A	B	C	Version
1	**0 510 010 314**	**0 510 010 009**	250	6,000		30.9	64.1	55.2	1
2	**0 510 110 326**	**0 510 110 019**	250	5,000		32.8	67.9	59.0	1
2.5	**0 510 110 327**	**0 510 110 020**	250	5,000		33.8	69.8	60.9	1
3.15	**0 510 112 322**	**0 510 112 016**	250	4,000		35.0	72.3	63.4	1
4	**0 510 114 327**	**0 510 114 021**	250	4,000		36.6	75.5	66.6	2
4.5	**0 510 114 328**	**0 510 114 022**	250	4,000		37.6	77.4	68.5	2
5	**0 510 114 329**	**0 510 114 023**	250	4,000		38.6	79.5	70.6	2
6.3	**0 510 122 318**	**0 510 122 014**	250	3,500		41.0	84.2	75.3	2
7.1	**0 510 122 319**	**0 510 122 015**	230	3,500		42.5	87.3	78.4	2

Dimensions

Standard range



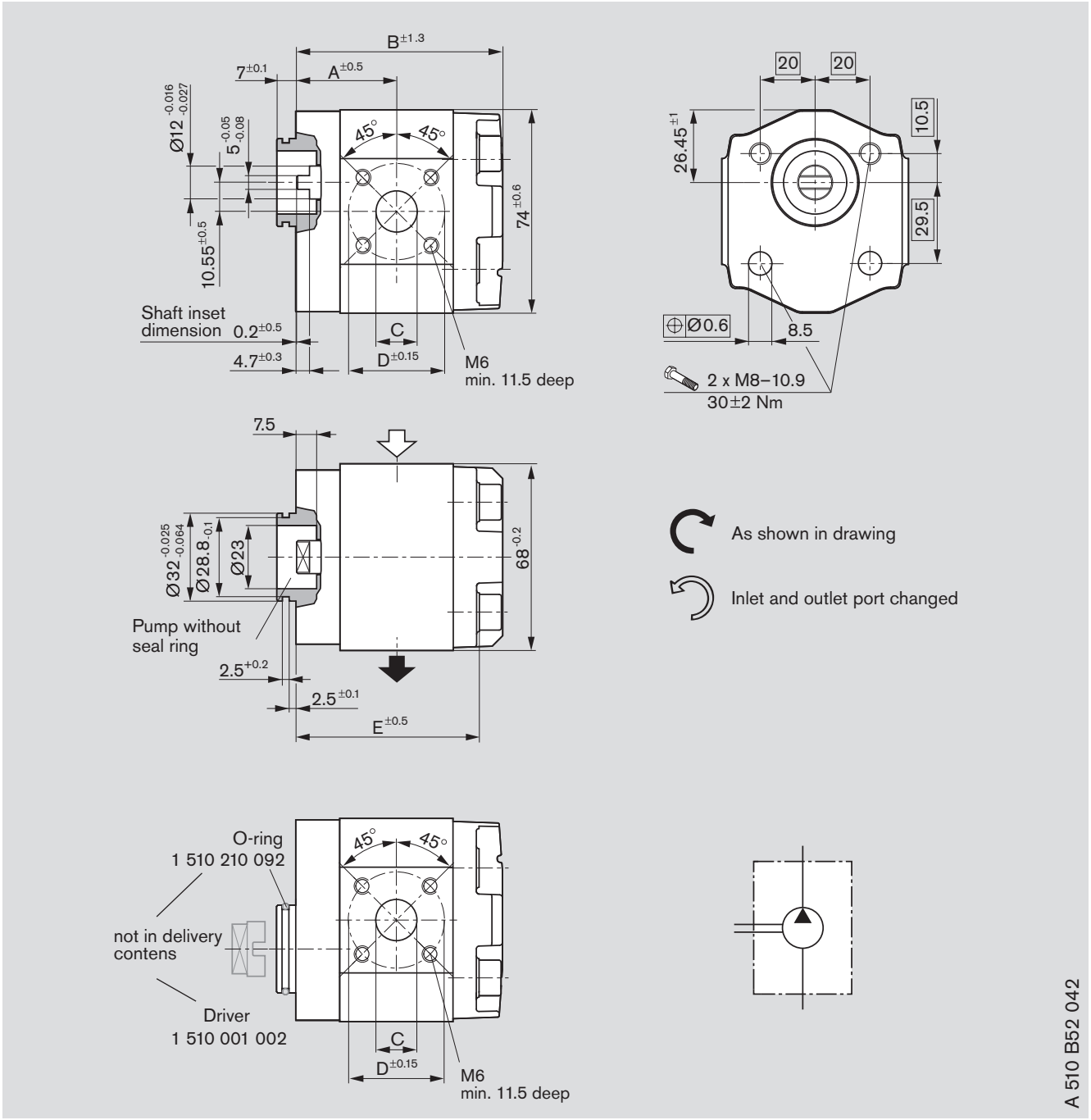
Ordering code:

AZPB – 32 – ☐☐☐ ☐ N M 01 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	max. operating pressure [bar]	max. rotation speed [rpm]	Mass [kg]	Dimension [mm] A	B	C	Version
1	**0 510 010 316**	**0 510 010 011**	250	6,000		30.9	64.1	55.2	3/8
2	**0 510 110 330**	**0 510 110 021**	250	5,000		32.8	67.9	59.0	3/8
2.5	**0 510 110 331**	**0 510 110 024**	250	5,000		33.8	69.8	60.9	3/8
3.15	**0 510 112 324**	**0 510 112 017**	250	4,000		35.0	72.3	63.4	3/8
4	**0 510 114 333**	**0 510 114 028**	250	4,000		36.6	75.5	66.6	1/2
4.5	**0 510 114 334**	**0 510 114 024**	250	4,000		37.6	77.4	68.5	1/2
5	**0 510 114 335**	**0 510 114 029**	250	4,000		38.6	79.5	70.6	1/2
6.3	**0 510 122 322**	**0 510 122 018**	250	3,500		41.0	84.2	75.3	1/2
7.1	**0 510 122 323**	**0 510 122 019**	230	3,500		42.5	87.3	78.4	1/2

Dimensions

Standard range



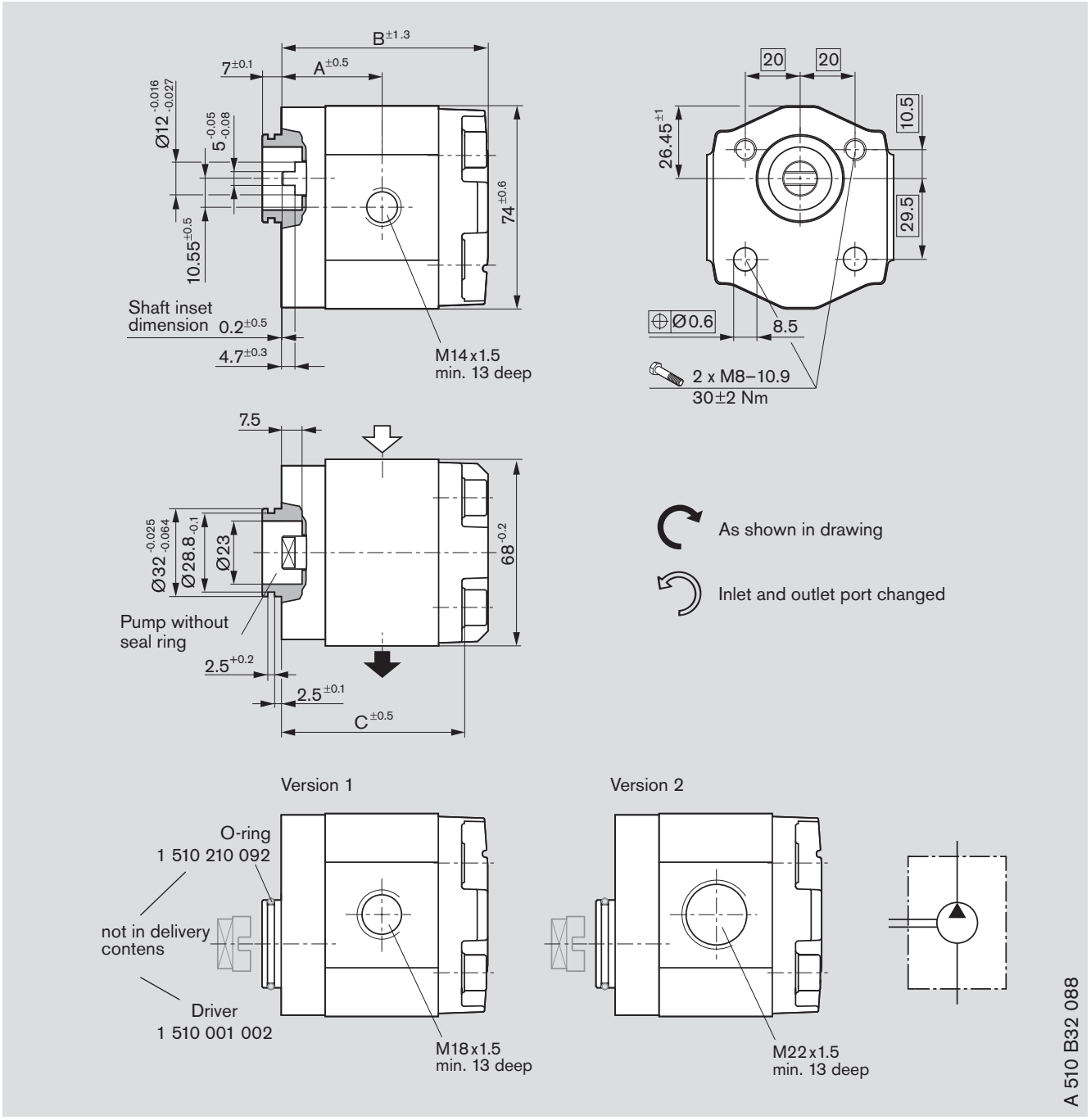
Ordering code:

AZPB – 32 – ☐☐☐ ☐ N Y 20 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	max. operating pressure [bar]	max. rotation speed [rpm]	Mass [kg]	Dimension [mm] A	B	C	D	E
2	**1 519 222 469**	**1 519 222 468**	250	5,000		32.8	67.9	12	30	59.0
2.5	**1 519 222 471**	**1 519 222 470**	250	5,000		33.8	69.8	12	30	60.9
3.15	**1 519 222 473**	**1 519 222 472**	250	4,000		35.0	72.3	15	35	63.4
4	**1 519 222 475**	**1 519 222 474**	250	4,000		36.6	75.5	15	35	66.6
4.5	**1 519 222 477**	**1 519 222 476**	250	4,000		37.6	77.4	15	35	68.5
5	**1 519 222 479**	**1 519 222 478**	250	4,000		38.6	79.5	15	35	70.6
6.3	**1 519 222 481**	**1 519 222 480**	250	3,500		41.0	84.2	15	35	75.3
7.1	**1 519 222 483**	**1 519 222 482**	230	3,500		42.5	87.3	15	35	78.4

Dimensions

Standard range



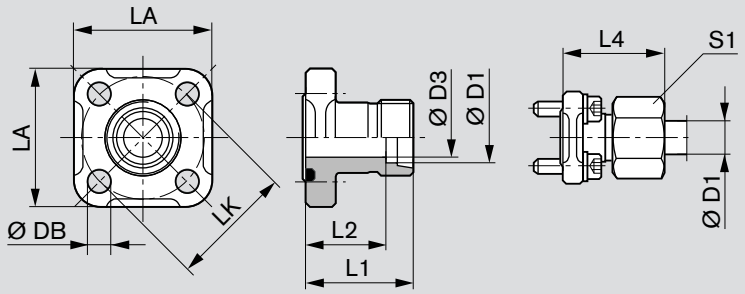
Ordering code:

AZPB – 32 – ☐☐☐ ☐ N Y 02 M B

Displacement [cm³/rev]	Ordering-No. L	Ordering-No. R	max. operating pressure [bar]	max. rotation speed [rpm]	Mass [kg]	Dimension [mm] A	B	C	Version
1	**1 519 222 444**	**1 519 222 443**	250	6,000		30.9	64.1	55.2	1
2	**1 519 222 446**	**1 519 222 445**	250	5,000		32.8	67.9	59.0	1
2.5	**1 519 222 448**	**1 519 222 447**	250	5,000		33.8	69.8	60.9	1
3.15	**1 519 222 450**	**1 519 222 449**	250	4,000		35.0	72.3	63.4	1
4	**1 519 222 452**	**1 519 222 451**	250	4,000		36.6	75.5	66.6	2
4.5	**1 519 222 454**	**1 519 222 453**	250	4,000		37.6	77.4	68.5	2
5	**1 519 222 456**	**1 519 222 455**	250	4,000		38.6	79.5	70.6	2
6.3	**1 519 222 458**	**1 519 222 457**	250	3,500		41.0	84.2	75.3	2
7.1	**1 519 222 460**	**1 519 222 459**	230	3,500		42.5	87.3	78.4	2

Fittings

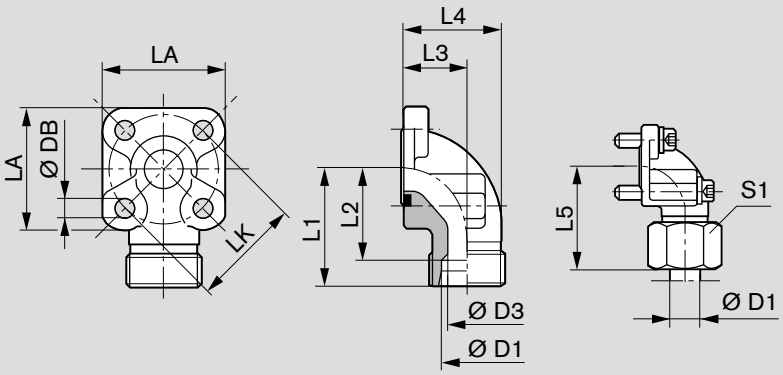
Gear pump flange, straight, for rectangular flange 20 see page 7



LK	D1	D3	L1	L2	L4	LA	S1	DB	Screws (metr.) 4 pieces	Seal ring	Mass kg	Part number	*p* (bar)
35	10L	8	30	23.0	39.0	40	19	6.4	M6x22	20x2.5	0.09	**1 515 702 064**	315
35	12L	10	30	23.0	39.0	40	22	6.4	M6x22	20x2.5	0.10	**1 515 702 065**	315
35	15L	12	30	23.0	38.0	40	27	6.4	M6x22	20x2.5	0.10	**1 515 702 066**	250

Complete fittings with seal ring, metric screw set, nuts and olive.

Gear pump flange, 90° angle, for rectangular flange 20 see page 7



LK	D1	D3	L1	L2	L3	L4	L5	LA	S1	DB	Screws 2 pieces	2 pieces	Seal ring	Mass kg	Part number	*p* (bar)
35	10L	8	38	31.0	16.5	26.5	47.0	40	19	6.4	M6x22	M6x35	20x2.5	0.16	**1 515 702 070**	315
35	12L	10	38	31.0	16.5	26.5	47.0	40	22	6.4	M6x22	M6x35	20x2.5	0.16	**1 515 702 071**	315
35	15L	12	38	31.0	16.5	26.5	46.0	40	27	6.4	M6x22	M6x35	20x2.5	0.15	**1 515 702 072**	250
35	16S	12	38	29.5	20.0	31.0	48.0	40	30	6.4	M6x22	M6x40	20x2.5	0.18	**1 515 702 002**	315
35	18L	15	38	29.5	20.0	31.0	47.0	40	32	6.4	M6x22	M6x40	20x2.5	0.18	**1 545 702 006**	250
35	20S	16	45	34.5	25.0	38.0	56.0	40	36	6.4	M6x22	M6x45	20x2.5	0.24	**1 515 702 017**	315

Complete fittings with seal ring, metric screw set, nuts and olive.

Notes on commissioning and maintenance

Filter recommendation
The major share of premature failures in external gear pumps is caused by contaminated hydraulic fluid.
Since a warranty cannot be issued for wear caused by dirt, we recommended filtration compliant with cleanliness level 20/18/15 ISO 4406, which reduces the degree of contamination to a permissible limit in terms of the size and concentration of dirt particles:

Operating pressure [bar]	>160	<160
Contamination class ISO 4406	18/15	19/16
To be reached with $\beta_X = 75$	20	25

We recommend that a full-flow filter always be used.
Basic contamination of the hydraulic fluid used may not exceed class 20/18/15 according to ISO 4406. Experience has shown that new fluid quite often lies above this value. In such instances a filling device with special filter should be used.

General
- The pumps supplied by us have been checked for function and performance. No modifications of any kind may be made to the pumps; any such changes will render the warranty null and void!
- Pump may only be operated in compliance with permitted data (see page 12).

Project planning notes
Where external gear pumps are used we recommend that the following note be adhered to.

Technical data
All stated technical data is dependent on production tolerances and is valid for specific marginal conditions.
Note that, as a consequence, variance is possible, and at certain marginal conditions (e.g. viscosity) **the technical data may change**.

Characteristics
When designing the external gear pump, note the maximum possible service data based on the characteristics shown on pages 8 – 10.

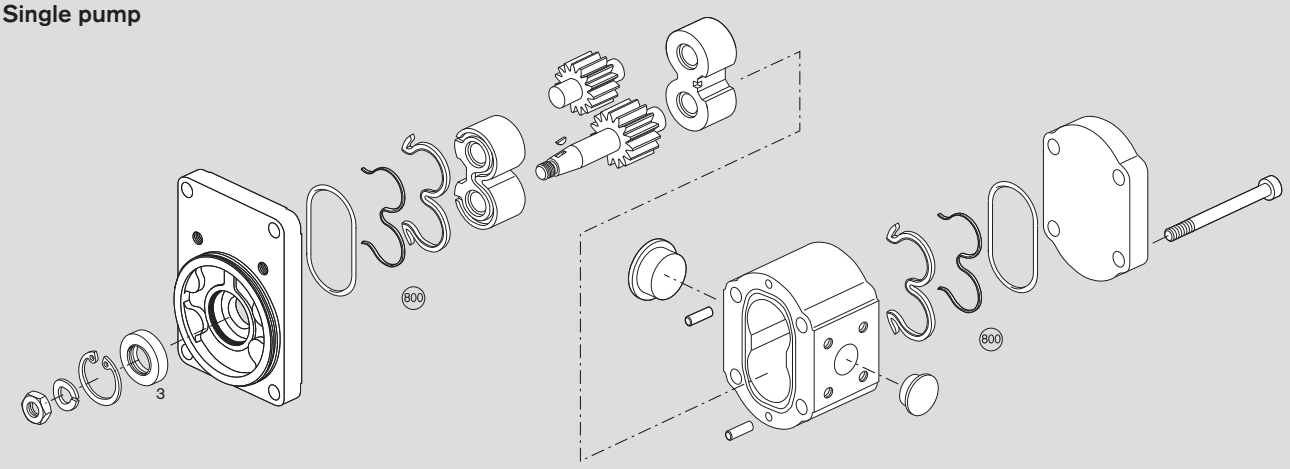
Additional information on the proper handling of hydraulic products from Bosch Rexroth is available in our document: “General product information for hydraulic products” RE 07 008.

Contained in delivery
The components with characteristics as described under ordering code and device measurements, pages 16 – 25, are contained in delivery.

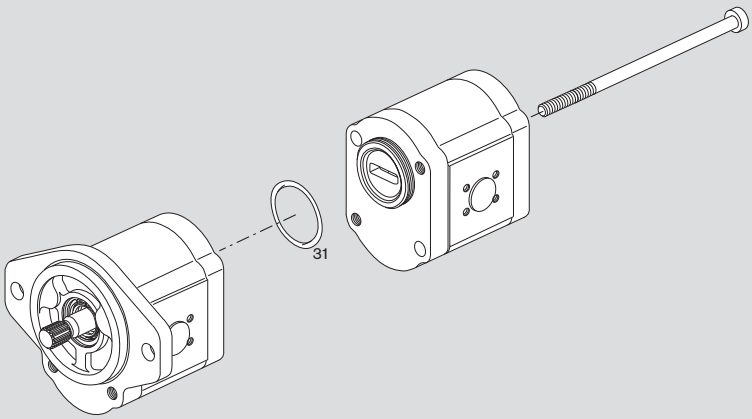
You can find further information in our publication: “General Operating Instructions for External Gear Units” RE 07 012-B1.

Spare parts

Single pump



Multiple pump



Page	Ordering code	Figure	Seal kit "B" Item 800 NBR	Shaft seal ring Item 3	Dimension	Material
16	**AZPB – 32 –** ☐☐☐☐ **H O 20 M B**	A510160361	1517010248	1510283074	22 x 12 x 6	NBR
17	**AZPB – 32 –** ☐☐☐☐ **H O 01 M B**	A510160343	1517010248	1510283074	22 x 12 x 6	NBR
18	**AZPB – 32 –** ☐☐☐☐ **C P 20 M B**	A510B50044	1517010248	1510283074	22 x 12 x 6	NBR
19	**AZPB – 32 –** ☐☐☐☐ **C P 02 M B**	A510B50026	1517010248	1510283074	22 x 12 x 6	NBR
20	**AZPB – 32 –** ☐☐☐☐ **C P 02 K B**	A510B50007	1517010248	1510283071	22 x 12 x 6	FKM
21	**AZPB – 32 –** ☐☐☐☐ **N M 20 M B**	A510B52026	1517010248	–	–	–
22	**AZPB – 32 –** ☐☐☐☐ **N M 02 M B**	A510B32070	1517010248	–	–	–
23	**AZPB – 32 –** ☐☐☐☐ **N M 01 M B**	A510B52007	1517010248	–	–	–
24	**AZPB – 32 –** ☐☐☐☐ **N Y 20 M B**	A510B52042	1517010248	–	–	–
25	**AZPB – 32 –** ☐☐☐☐ **N Y 02 M B**	A510B32088	1517010248	–	–	–

NBR = Perbunan®

FKM = Viton®

For multiple pumps

Seal ring Item 31 NBR	1 900 210 127

Rexroth
Bosch Group

External Gear Pumps Series F

RA 10089/08.11 1/60
Replaces: RA 10097

AZPF-...





Fixed pumps
Size 4.0...28 cm^3/rev (.25 - 1.71 in^3/rev)

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Features

- Displacements 4 cc - 28 cc
- Nominal pressure 280 bar
- Slide bearings for heavy duty applications
- Drive shafts to SAE or ISO
- Ports:
  threaded or flange
- Wide range of configurations
- Tandem and multi-pump configurations

General

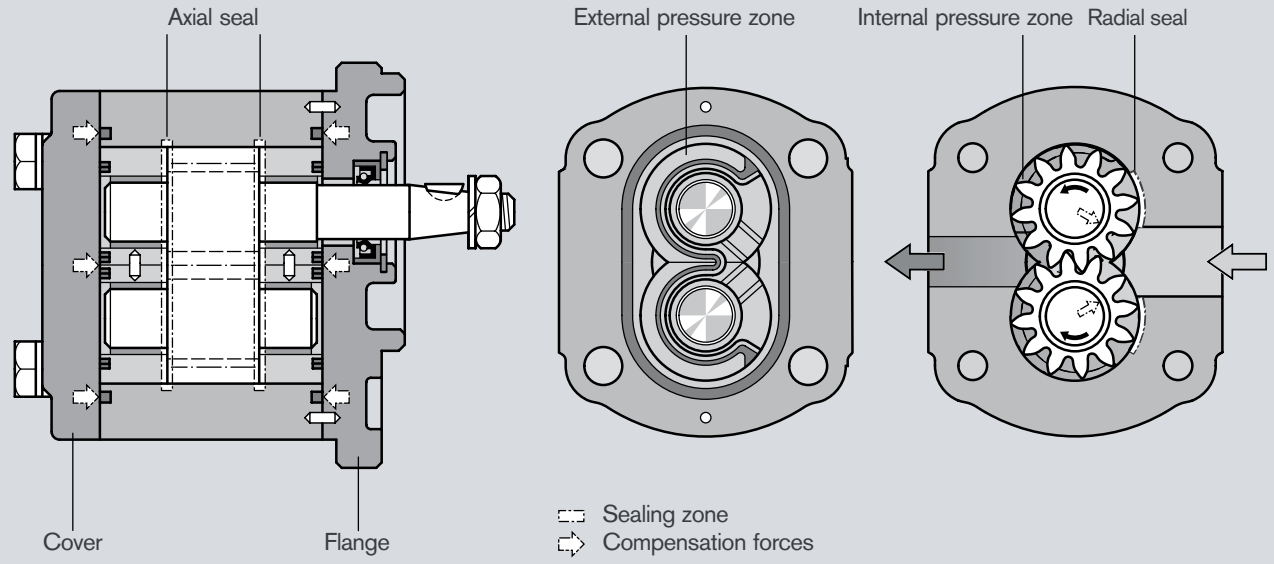
Rexroth external gear pumps are available as standard gear pumps in the B, F, N and G series, and as SILENCE gear pumps in the S, T and U series. The displacements are graded by different gear widths. Further configuration variants are given by different flanges, shafts, valve arrangements and multiple pump combinations.

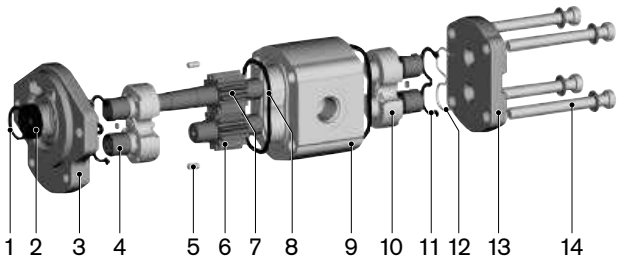
Construction

The external gear pump consists essentially of a pair of gears supported in bearing bushings, and the case with a front and a rear cover. The drive shaft protrudes from the front cover where it is sealed by the shaft seal ring. The bearing forces are absorbed by special bearing bushings with sufficient elasticity to produce surface contact instead of line contact. They also ensure excellent resistance to galling – especially at low speed. The gears have 12 teeth. This keeps both flow pulsation and noise emission to a minimum.

The internal sealing is achieved by forces which are proportional to delivery pressure. This ensures optimum efficiency. The bearings provide the seal at the ends of the gaps between the teeth which carry the pressurized oil. The sealing zone between the gear teeth and the bearing is controlled by the admission of operating pressure to the rear of the bearing bushings. Special seals form the boundary of the zone. The radial clearance at the tips of the gear teeth is sealed by internal forces pushing them against the case.

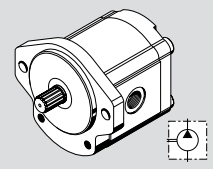
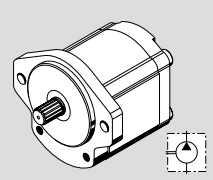
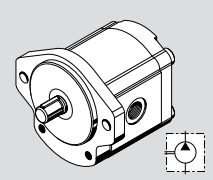
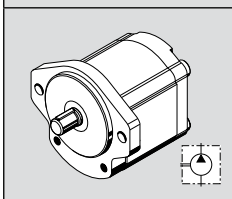
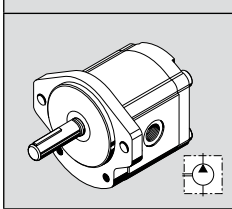
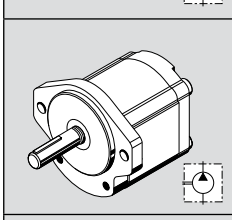
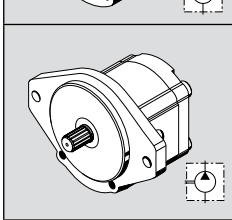
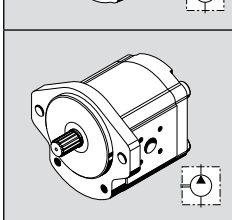
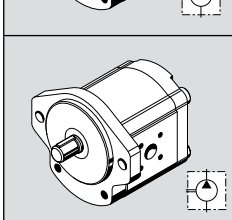
Gear pump axial compensation

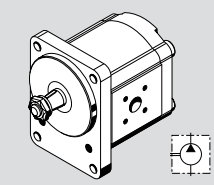
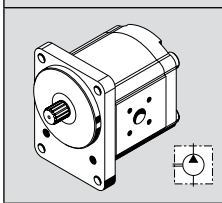
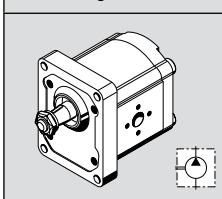
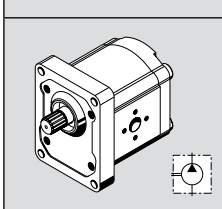
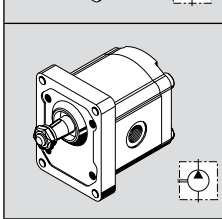
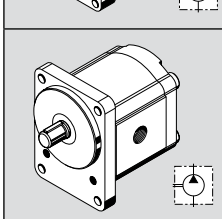
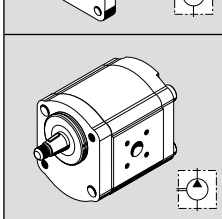
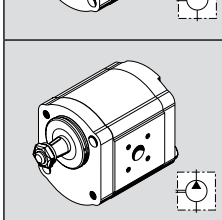
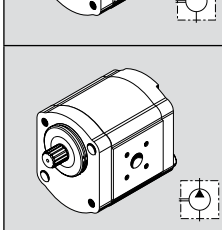


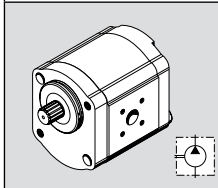
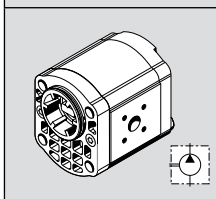
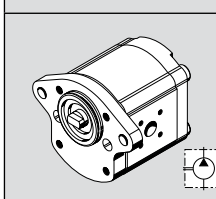
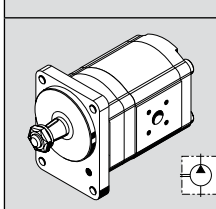
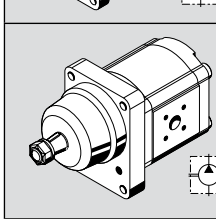
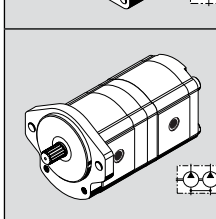
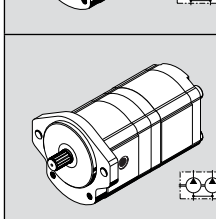
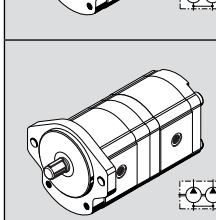
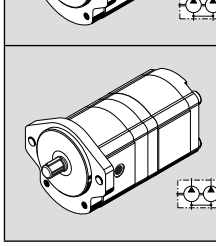


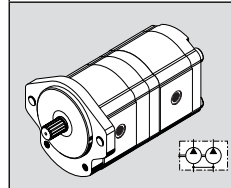
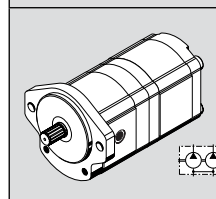
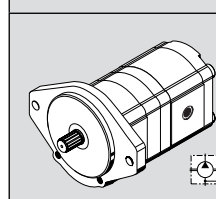
1 Retaining ring
2 Shaft seal ring
3 Front cover
4 Slide bearing
5 Centering pin
6 Gear (driven)
7 Gear (drive)
8 Case seal
9 Pump case
10 Bearing
11 Axial zone seal
12 Support
13 End cover
14 Fixing screws

Product overview of "Series F" standard types

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AZ P F – 1☐ or 2☐ - 016 R R R 12 M B -☐☐☐ ☐☐ -S☐☐☐☐

Special Design*

PRV (bar) FCV (l/min)

Example:
180 bar, 9 l/min = 180 09
Use XXX if valve not applicable

Function

P = Pump

Size (F)

.25 in3 (4.1 cm3) = 004
.34 in3 (5.6 cm3) = 005
.50 in3 (8.2 cm3) = 008
.69 in3 (11.3 cm3) = 011
.88 in3 (14.4 cm3) = 014
1.00 in3 (16.5 cm3) = 016
1.20 in3 (19.6 cm3) = 019
1.40 in3 (22.9 cm3) = 022
1.55 in3 (25.5 cm3) = 025
1.74 in3 (28.5 cm3) = 028

Direction of rotation

Right = R
Left = L

End cover

Standard	= B
Rear ports	= A
FCV, excess flow ext.	= E
PRV + FCV	= V
Priority flow control	= P
Pressure relief valve	= D

Seals

NBR	= M
FPM	= P
NBR, shaft seal in FPM	= K

Drive shafts

		Matching front flange	
C	Conical 1:5 (Tapered key)	B	P
S	Conical 1:5 for flange A (Tapered key)	A	
H	Conical 1:8 (Tapered key)	O	
N	Dihedral claw (Dog tang)	M	
A	Straight keyed ISO Ø 18 mm	B	
Q	Straight keyed SAE J744 16-1 A	R	
Q	SAE 5/8" Keyed, long *Use SO022 suffix	R	
R	9T spline SAE J744 16-4 9T	R	C
P	11T spline SAE J744 19-4 11T	R	C
F	Spline shaft DIN 5482 B17x14	B	P

Front flange

B	Square flange Pilot Ø 80 mm
R	SAE J744 82-2 A 2-bolt flange Ø 82.55 mm
P	Transmission flange Pilot Ø 50 mm
O	Square flange Pilo Ø 36.47 mm
C	SAE J744 102-2 B 2-bolt flange Ø 101.6 mm
M	2-bolt flange Pilot Ø 52 mm with O-ring
A	Outboard bearing Pilot Ø 80 mm Type 1
N	2-bolt mounting Pilot Ø 50 mm
T	4-bolt mounting Ø 52 mm w/O-ring
G	Outboard bearing Ø 80 mm Type 2

Line connections

20	Rectangular flange
12	Thread (UN-2B) SAE O-ring BOSS
01	BSP pipe thread ISO 228/1
30	Rectangular flange
07	Split flange SAE* ISO 61 62-1 Type 1 Metric threads
40	Split flange SAE* ISO 61 62-1 Type 2 UNC threads
03	Thread, metric ISO 6149 w/seal ring

*07 and 40 line connections limited to 19 cc and larger sizes.

AZ P F F F - □□ - 022 / 016/005 R R R 12 / 12 / 12 M B -S□□□□

Special Design*

Function
P = Pump

Model **
F = 4.0 ... 28.0 cm³/rev

Series
1x = Standard bearing
2x = Reinforced bearing

Size
Based on available sizes per series

Direction of rotation
Right = R
Left = L

Rear cover
refers on the last pumps part

Model F, Standard	= B

Seals

NBR	= M
FPM	= P
NBR, shaft seal in FPM	= K

Drive shafts

		Matching front flange
Q	Straight keyed SAE J744 16-1A	R
P	11T spline SAE J744 19-4 11T	R C
R	9T spline SAE J744 16-4 9T	R C

Front flange

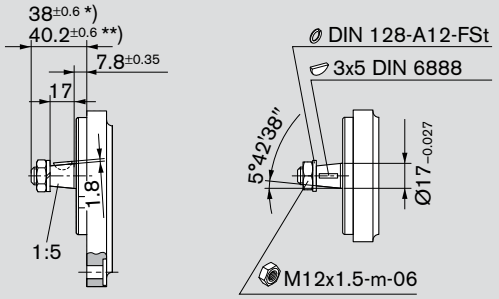
C	SAE J744 101-2 B 2-bolt flange Ø 101.6 mm
R	SAE J744 82-2 A 2-bolt flange Ø 82.55 mm

Line connections

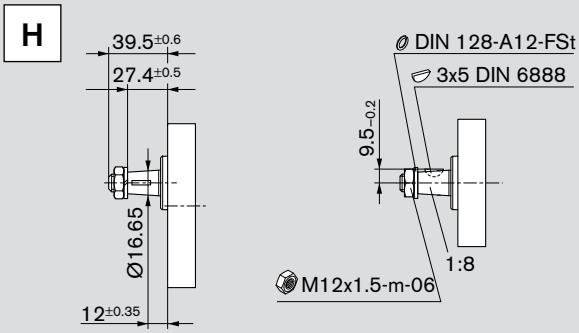
12	Thread (UN-2B) SAE O-ring BOSS

Drive shafts

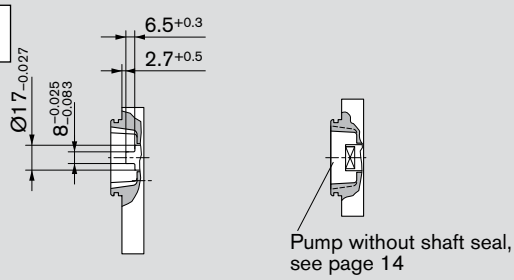
C



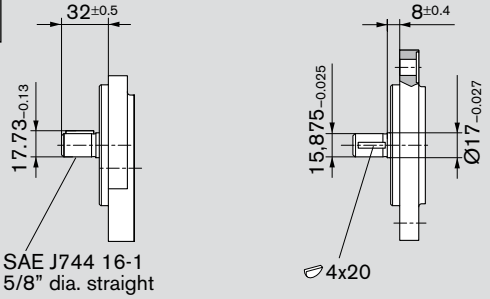
H



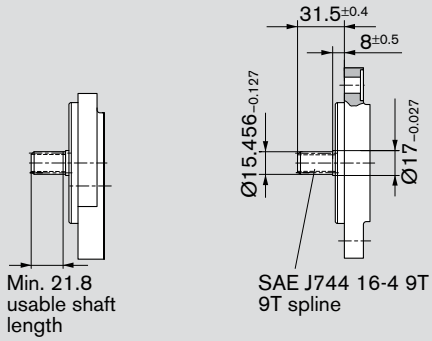
N



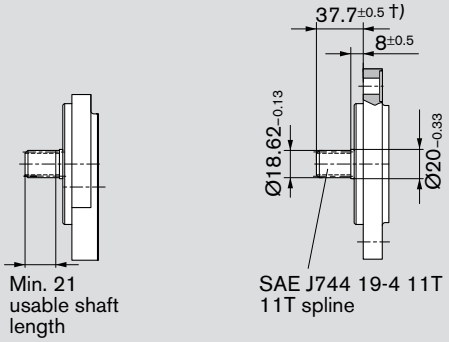
Q



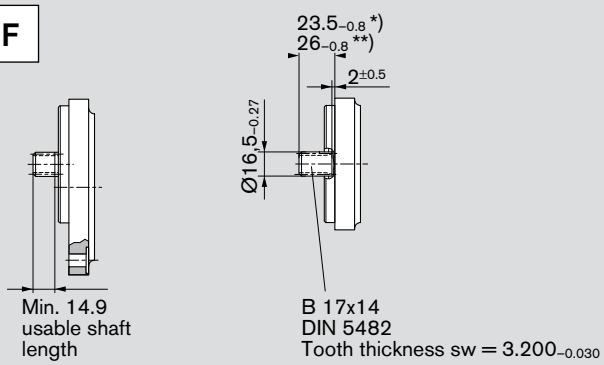
R



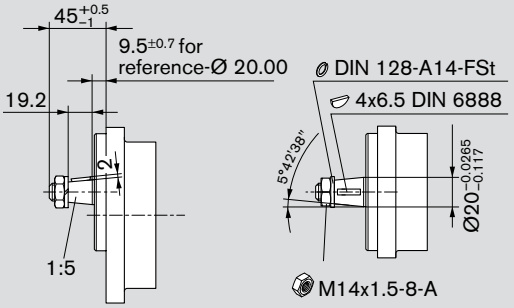
P



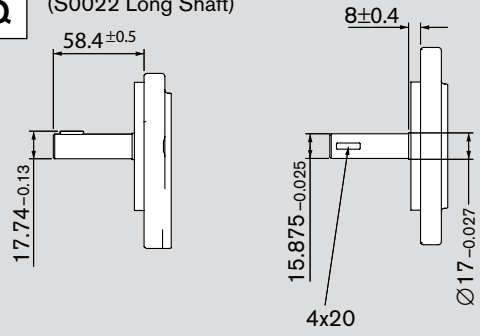
F



S

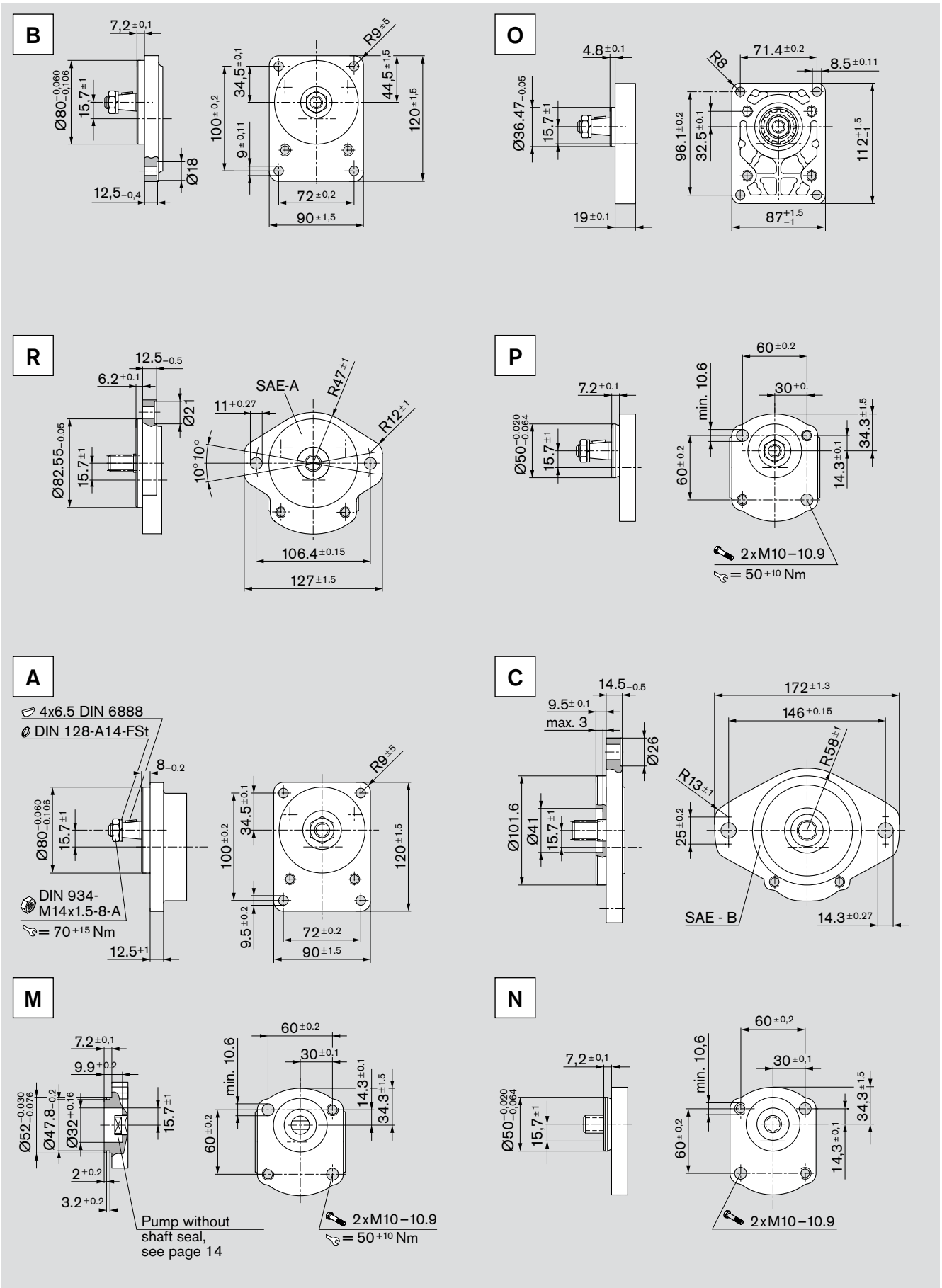


Q (S0022 Long Shaft)

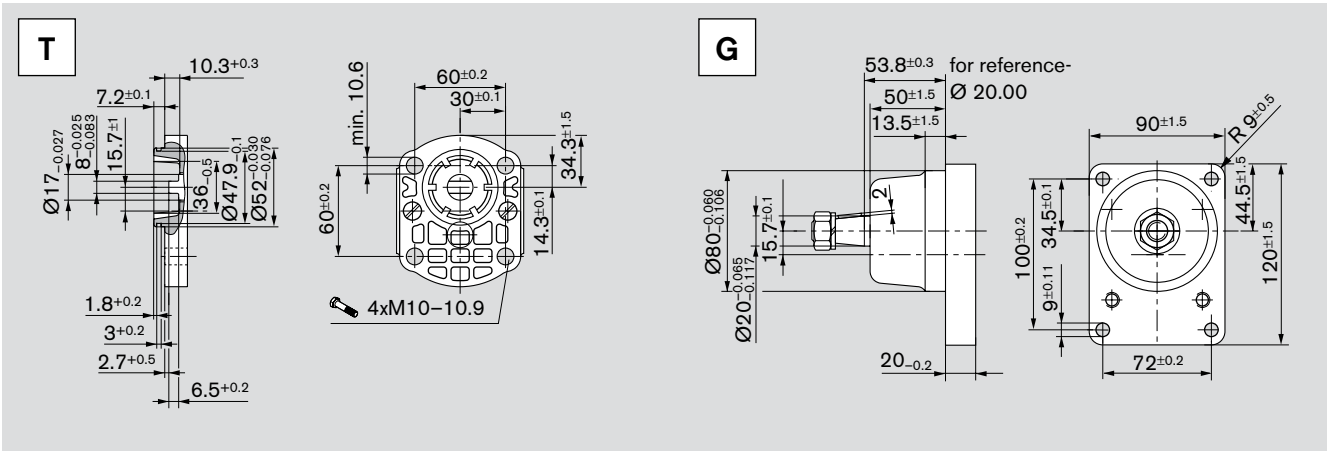


*) in combination with front cover B
**) in combination with front cover P
†) Older version dim. is 31.5±0.4. Some units still use this length. Check specific pump for dimensions.

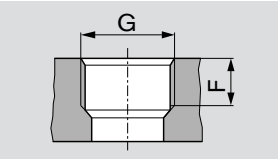
Front cover


B
7,2 ±0,1
Ø80 −0,060 −0,106
15,7 ±1
Ø18
12,5 −0,4
R9 ±5
34,5 ±0,1
44,5 ±1,5
100 ± 0,2
9 ± 0,11
120 ±1,5
72 ±0,2
90 ±1,5
O
4.8 ±0.1
Ø36.47 −0.05
15.7 ±1
19 ±0.1
R8
71.4 ±0.2
8.5 ±0.11
96.1 ±0.2
32.5 ±0.1
112 +1.5 −1
87 +1.5 −1
R
12.5 −0.5
6.2 ±0.1
Ø21
Ø82.55 −0.05
15.7 ±1
SAE-A
R47 ±1
11 +0.27
R12 ±1
10° 10°
106.4 ±0.15
127 ±1.5
P
7.2 ±0.1
Ø50 −0.020 −0.064
15.7 ±1
60 ±0.2
min. 10.6
30 ±0.
34.3 ±1.5
60 ±0.2
14.3 ±0.1
2xM10−10.9
= 50 +10 Nm
A
4x6.5 DIN 6888
DIN 128-A14-FSt
8 −0.2
Ø80 −0,060 −0,106
15.7 ±1
DIN 934-
M14x1.5-8-A
= 70 +15 Nm
12.5 +1
R9 ±5
34.5 ±0.1
100 ±0.2
120 ±1.5
9.5 ±0.2
72 ±0.2
90 ±1.5
C
14.5 −0.5
9.5 ± 0.1
max. 3
Ø26
Ø101.6
Ø41
15.7 ±1
172 ±1.3
146 ±0.15
R58 ±1
R13 ±1
25 ±0.2
SAE - B
14.3 ±0.27
M
7.2 ±0.1
9.9 ±0.2
Ø52 −0.030 −0.076
Ø47.8 −0.2
Ø32 +0.16
15.7 ±1
2 ±0.2
3.2 ±0.2
Pump without
shaft seal,
see page 14
60 ±0.2
min. 10.6
30 ±0.1
14.3 ±0.1
34.3 ±1.5
60 ±0.2
2xM10−10.9
= 50 +10 Nm
N
7,2 ±0,1
Ø50 −0,020 −0,064
15,7 ±1
60 ±0,2
min. 10,6
30 ±0,1
34,3 ±1,5
60 ±0,2
14,3 ±0,1
2xM10−10.9

Front cover (continued)



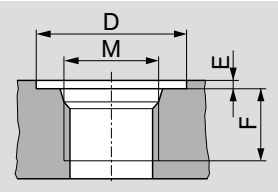
Ports



01 **Pipe thread ISO 228/1**

At pressures $p_2 > 210$ bar limited fatigue strength

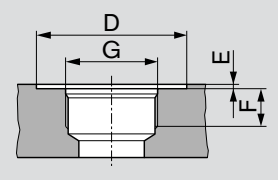
Ordering code	Size	Pressure side G	Pressure side F	Suction side G	Suction side F
01	4...16 cm³	G 1/2	16	G 3/4	16
	19...28 cm³	G 3/4		G 1	19



03 **Thread, metric ISO 6149 with seal ring**

At pressures $p_2 > 210$ bar limited service life

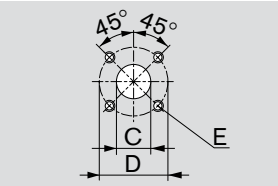
Ordering code	Size	Pressure side M	D	E	F	Suction side M	D	E	F
03	4...5.5 cm³	M 18 x 1.5	29	0.5	16	M 18 x 1.5	29	0.5	16
	8...16 cm³	M 22 x 1.5	34		18	M 27 x 2	40		19
	19...28 cm³					M 33 x 2	46		22



12 **Thread (UN-2B, UNF-2B) SAE J1926-1 seal ring BOSS**

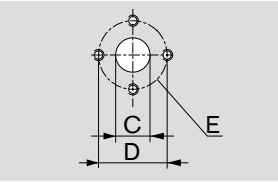
At pressures $p_2 > 210$ bar limited service life

Ordering code	Size	Pressure side G	D	Emax	F	Suction side G	D	Emax	F
12	4...5.5 cm³	3/4–16 UNF-2B	30	2.4	14.3	7/8–14 UNF-2B	34	2.4	16.7
	8 cm³ – 14 cm³	7/8–14 UNF-2B	34		16.7	1-1/16–12 UN-2B	41		19
	16...28 cm³					1 5/16–12 UN-2B	49	3.2	19



20 **Rectangular flange**

Ordering code	Size	Pressure side C	D	E	Suction side C	D	E
20	4...5.5 cm³	15	35	M 6, depth 13	15	40	M 6, depth 13
	8...22.5 cm³				20		
	19...28 cm³ *)				26	55	M 8, depth 13



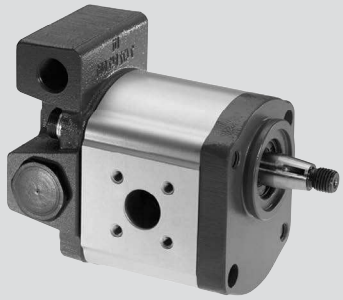
30 **Rectangular flange**

Ordering code	Size	Pressure side C	D	E	Suction side C	D	E
30	4...8 cm³	13.5	30.2	M 6, depth 13	13.5	30.2	M 6, depth 13
	11...28 cm³				20.0	39.7	M 8, depth 13

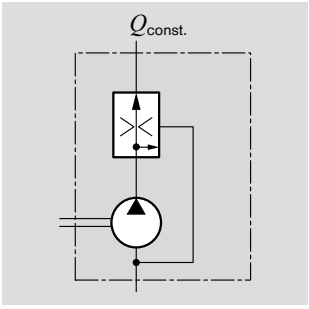
*) Dimension of Series 2

Gear pumps with integral valves

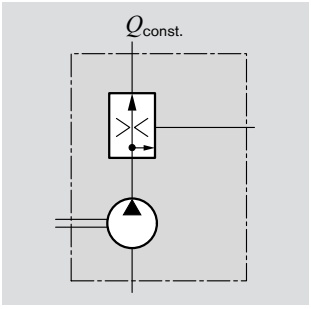
In order to reduce external pipework it is possible to incorporate a flow-control valve or pressure-relief valve in the rear cover of the gear pump. A typical application of this is in the supply of hydraulic oil in power steering systems. The pump delivers a constant flow irrespective of the speed at which it is driven. The excess flow is either returned internally to the suction port or distributed externally to other items of equipment.



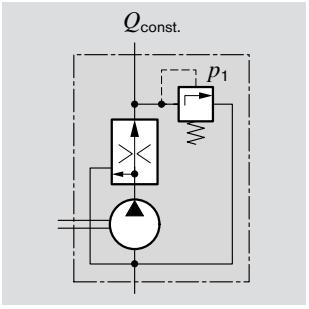
upon request



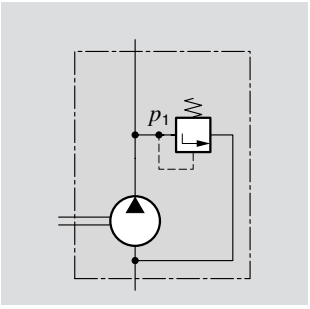
3-way flow-control valve.
Excess flow returned to suction line
$Q_{const.}$ = 2...30 l/min



3-way flow-control valve.
Excess flow distributed externally; loadable
$Q_{const.}$ = 2...30 l/min



3-way flow-control valve with pressure-relief valve.
Excess flow returned to suction line
$Q_{const.}$ = 2...30 l/min
p_1 = 100...180 bar



Pressure-relief valve.
Discharge returned to suction line
p_1 = 5...250 bar

Ordering code

S	**xxx17**

E	**xxx12**

V	**15011** *

D	**180xx**

Design calculations for pumps

The design calculations for pumps are based on the following parameters:

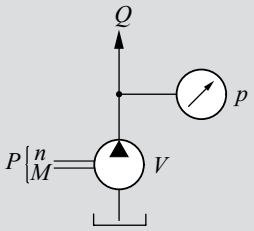
V	[cm³/rev]	Displacement
Q	[l/min]	Delivery
p	[bar]	Pressure
M	[Nm]	Drive torque
n	[rev/min]	Drive speed
P	[kW]	Drive power

It is also necessary to allow for different efficiencies such as:

η_v	Volumetric efficiency
η_{hm}	Hydraulic-mechanical efficiency
η_t	Overall efficiency

The following formulas describe the various relationships.
They include correction factors for adapting the parameters to the usual units encountered in practice.

Caution: Diagrams providing approximate selection data will be found on subsequent pages.



$$Q = V \cdot n \cdot \eta_v \cdot 10^{-5}$$

$$p = \frac{M \cdot \eta_{hm}}{1.59 \cdot V}$$

$$P = \frac{p \cdot Q}{6 \cdot \eta_t}$$

$$V = \frac{Q}{n \cdot \eta_v} \cdot 10^5$$

$$V = \frac{M \cdot \eta_{hm}}{159 \cdot p}$$

$$Q = \frac{6 \cdot P \cdot \eta_t}{p}$$

$$n = \frac{Q}{V \cdot \eta_v} \cdot 10^5$$

$$M = \frac{1.59 \cdot V \cdot p}{\eta_{hm}}$$

$$p = \frac{6 \cdot P \cdot \eta_t}{Q}$$

[%]

n —— η_v ⟶ Q
M —— η_{hm} ⟶ p
P —— η_t ⟶ $p \cdot Q$

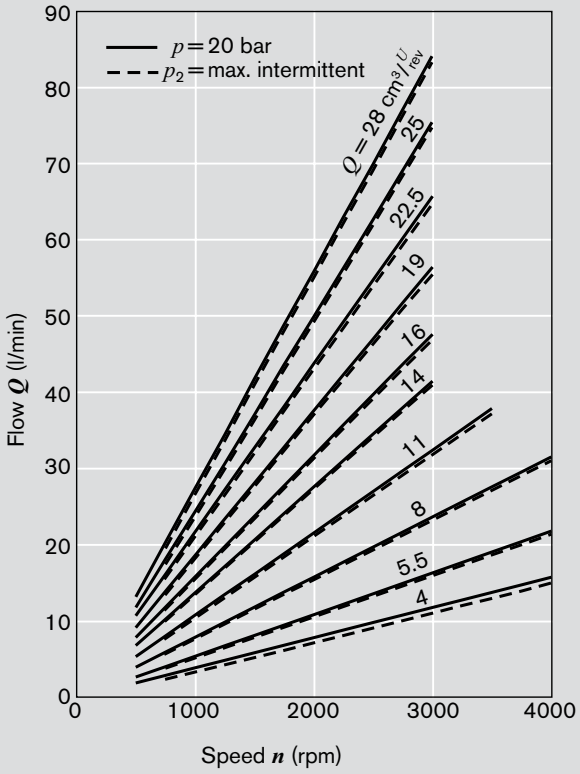
V [cm³/rev] Q [l/min] p [bar]
n [rev/min] P [kW] M [Nm]

Caution: η [%] e.g. 95 [%]

* Some versions have relief line returning to reservoir. Contact factory for additional information.

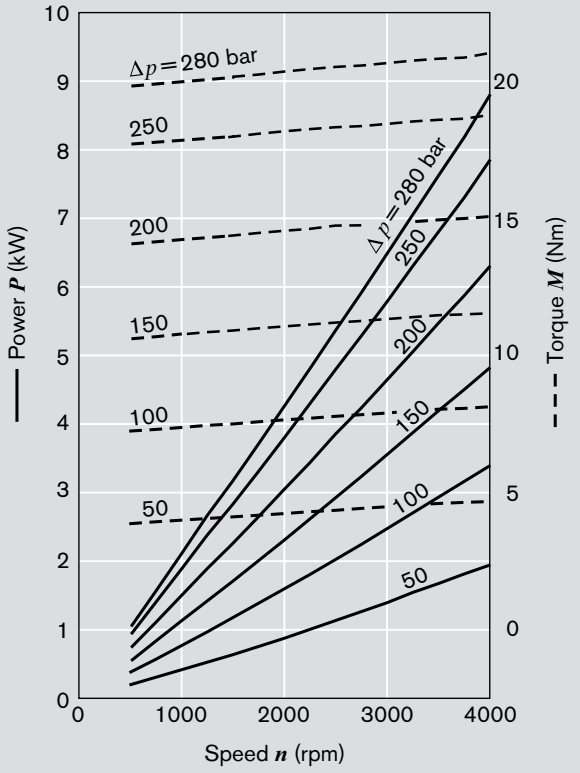
Performance charts

$\nu = 32$ mm²/s, $\vartheta = 50$ °C

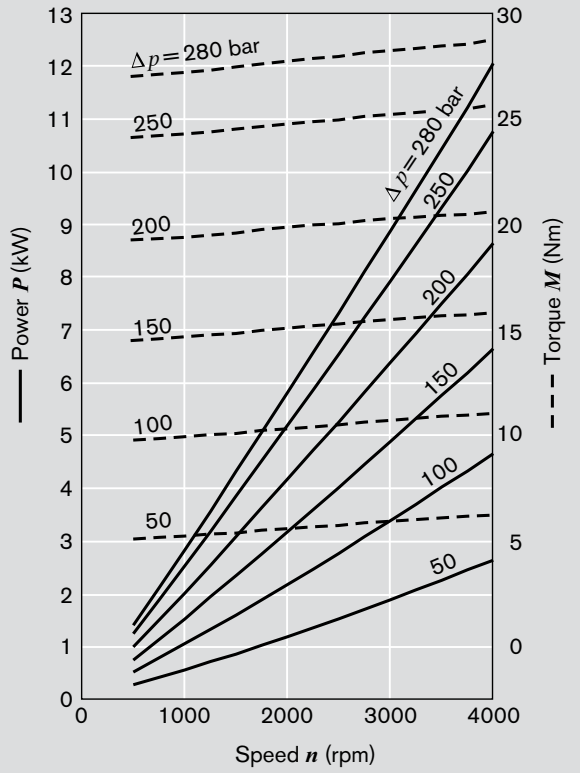


$Q = f(n,V)$ incl. η_v
$P = f(n,p)$ —— incl. η_t
$M = f(n,p)$ - - - incl. η_{hm}

4 cm³/rev *(V)*

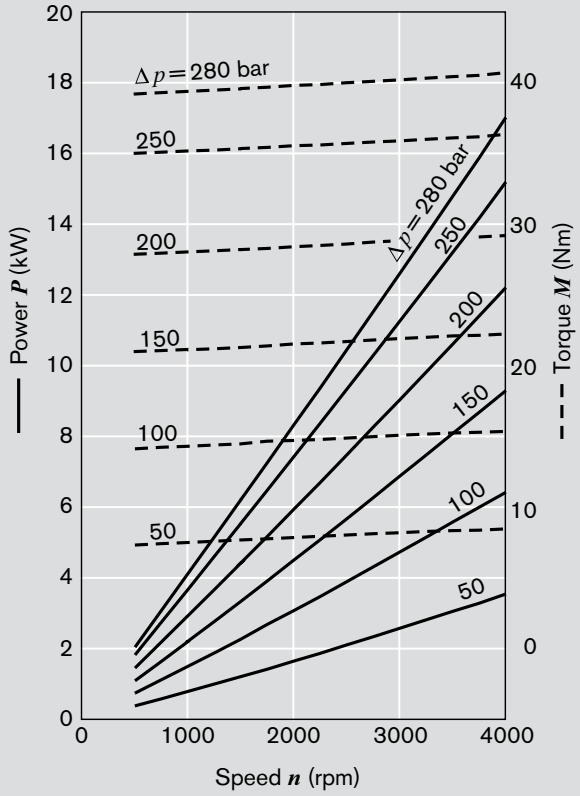


5.5 cm³/rev *(V)*

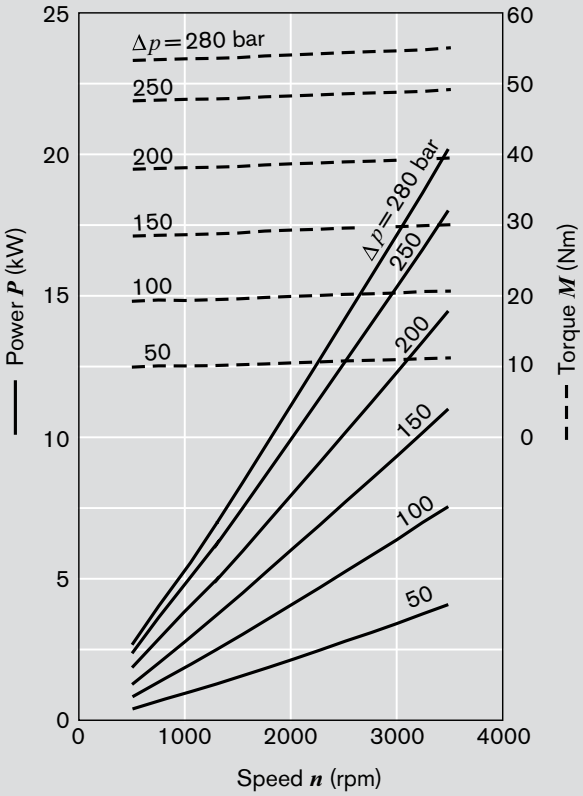


Performance charts (continued)

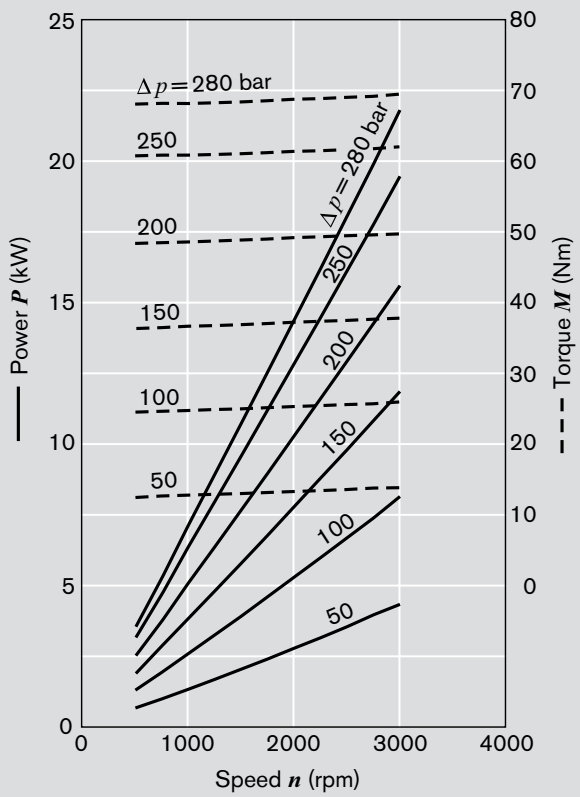
8 cm³/rev *(V)*



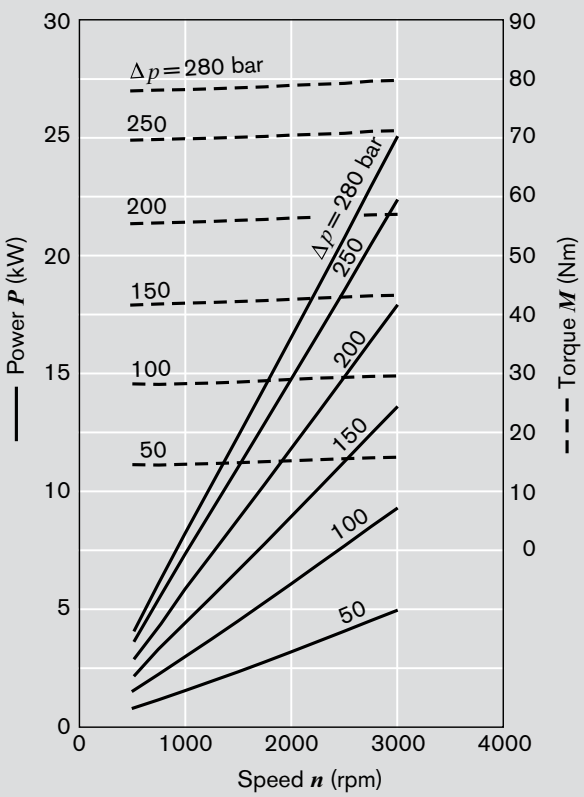
11 cm³/rev *(V)*



14 cm³/rev *(V)*

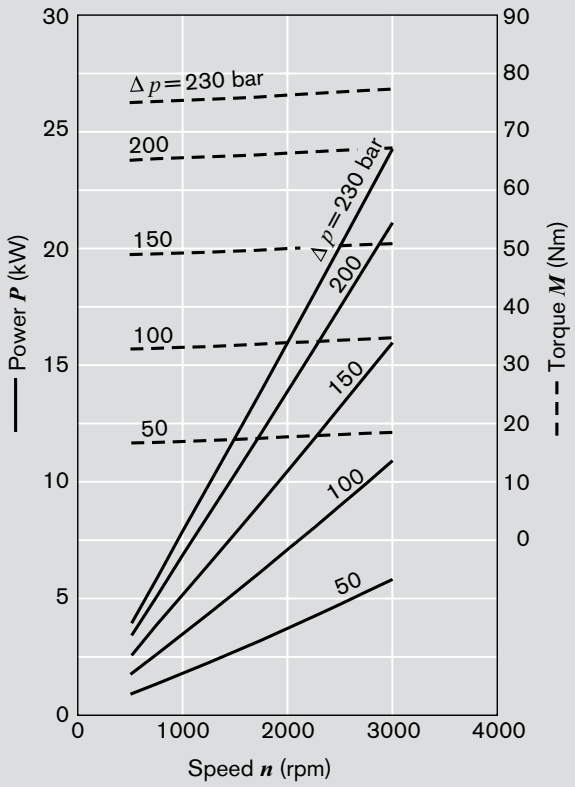


16 cm³/rev *(V)*

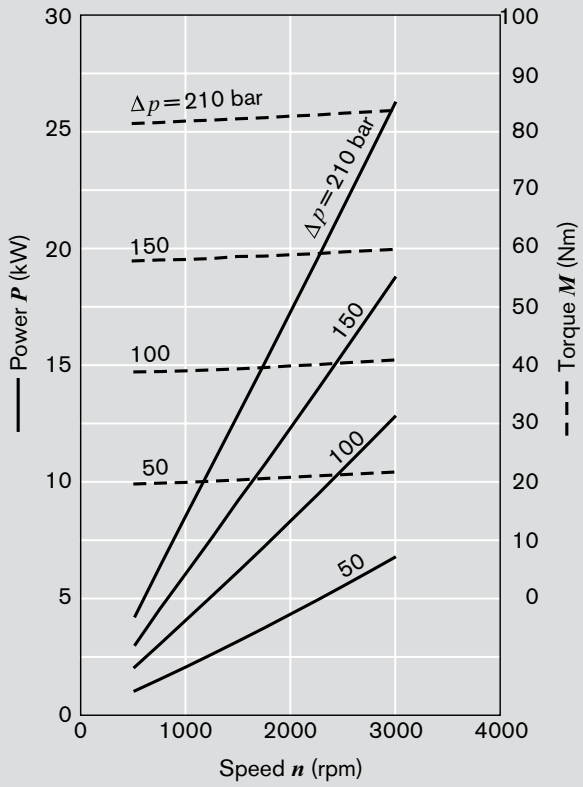


Performance charts (continued)

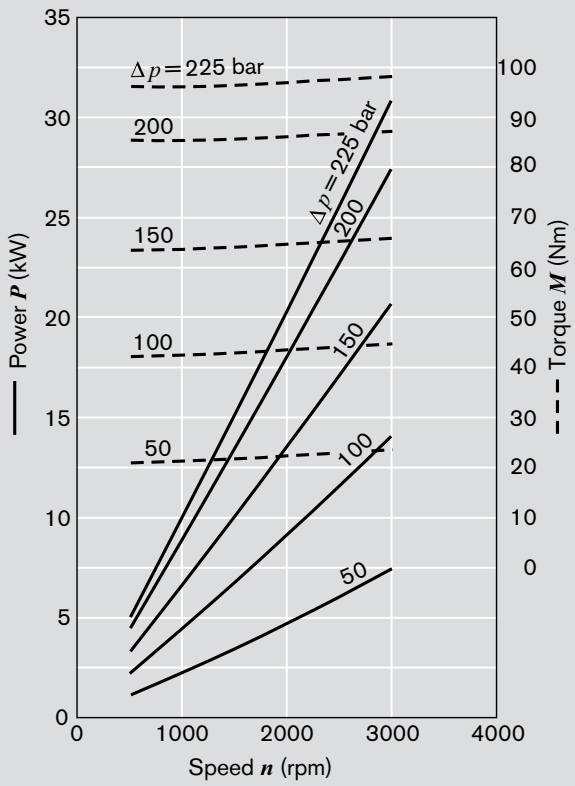
19 cm³/rev *(V)*



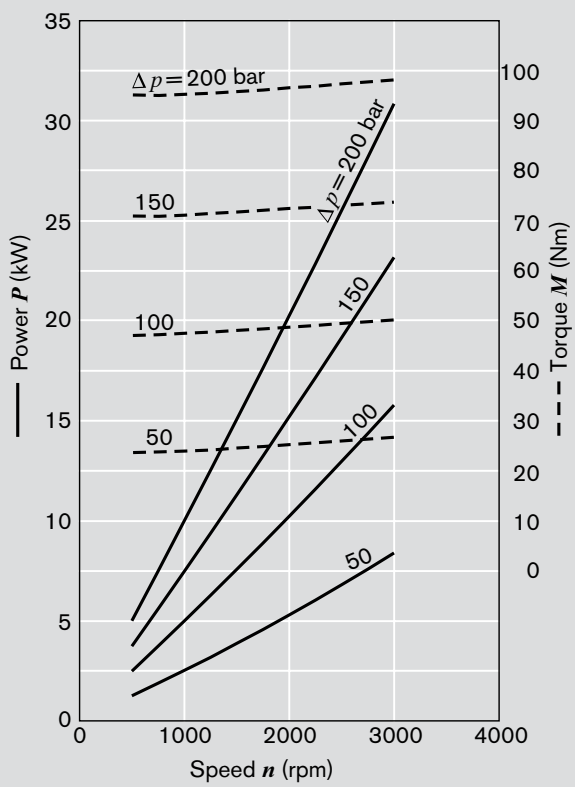
22.5 cm³/rev *(V)*



25 cm³/rev *(V)*



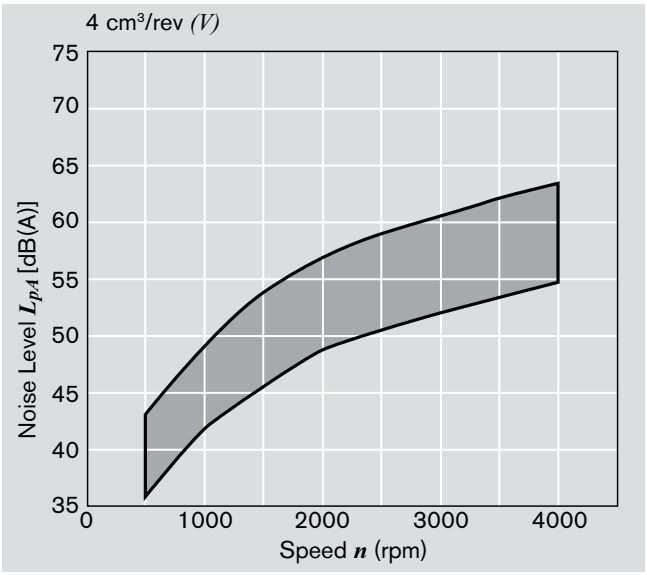
28 cm³/rev *(V)*

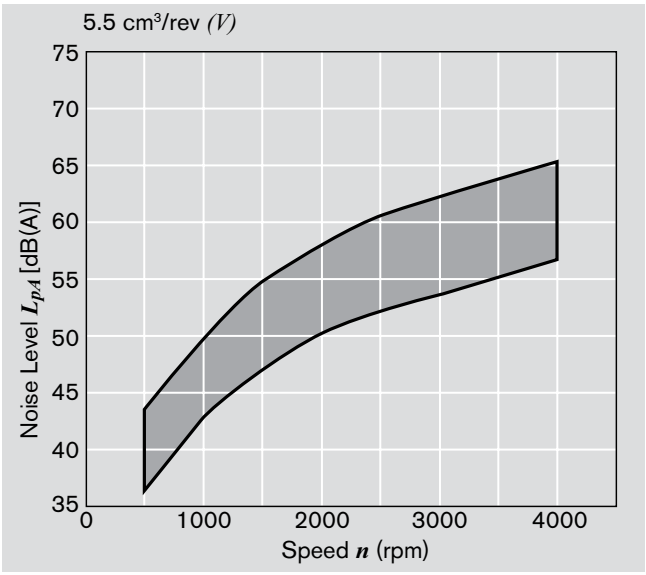


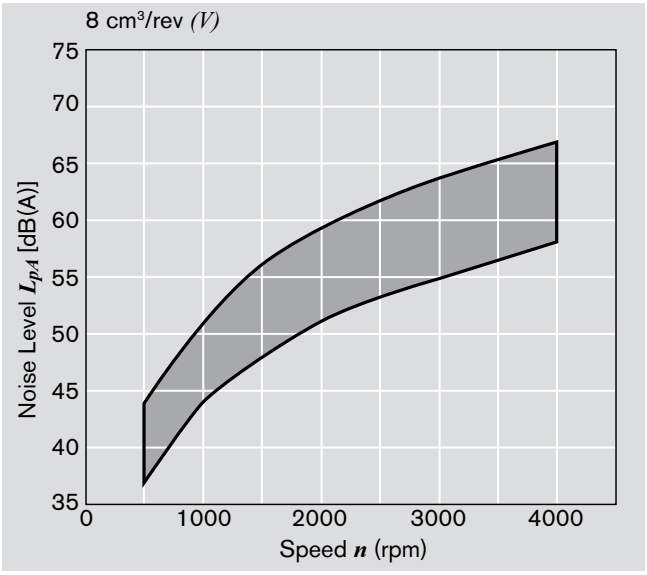
Noise charts

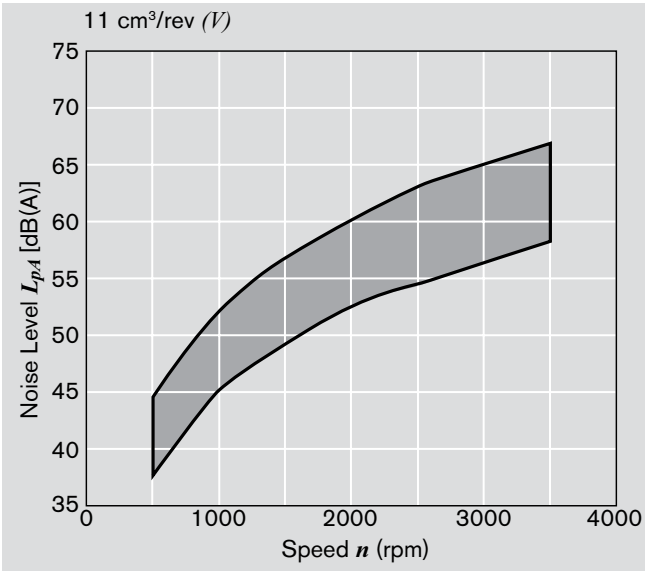
Noise level dependent on rotational speed, pressure range between 10 bar and pressure value p_2 (see page 16 Specifications table).
Oil data: $\nu = 32$ mm²/s, $\vartheta = 50$ °C.
Sound pressure level calculated from noise measurements made in the sound absorbent measuring room compliant with DIN 45 635, Part 26.
Spacing between measuring sensor – pump: 1 m.

These are typical characteristic values for the respective model. They describe the airborne sound emitted solely by the pump. Environmental influences (installation site, piping, further system components) are not taken into consideration.
Each value applies for a single pump.

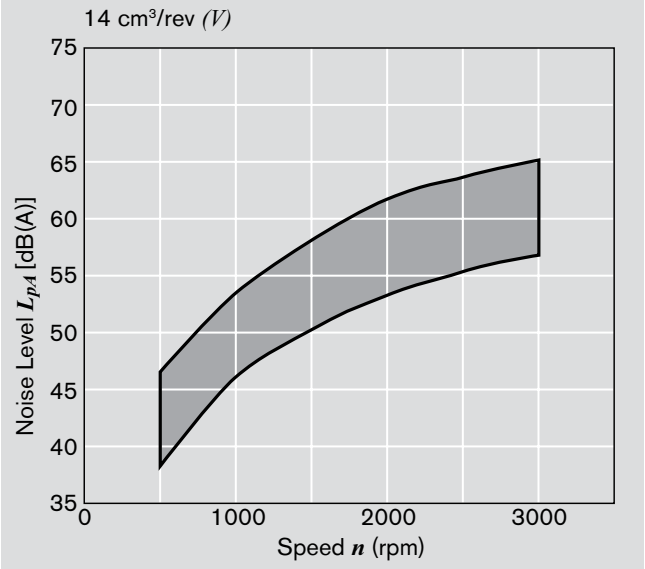


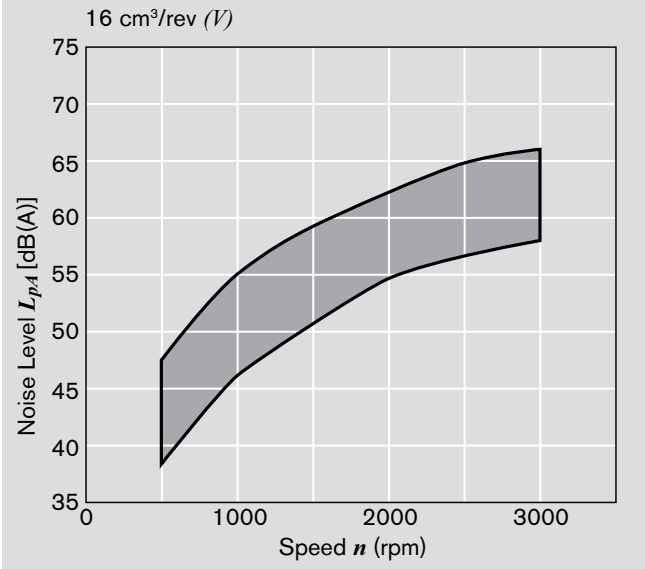


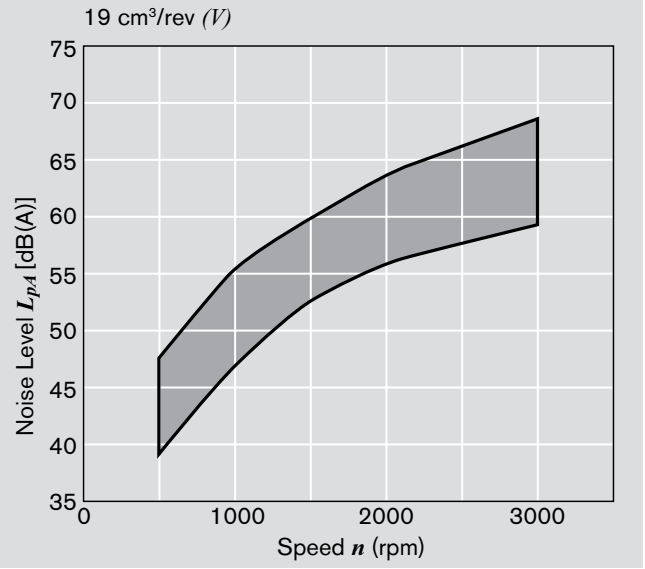


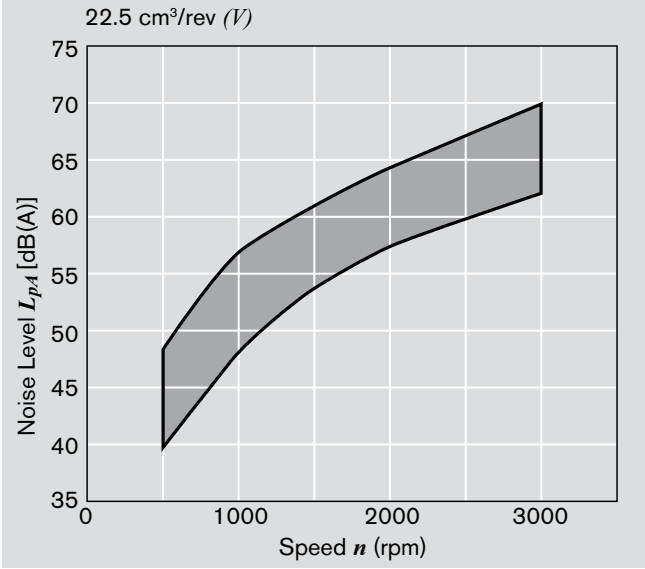


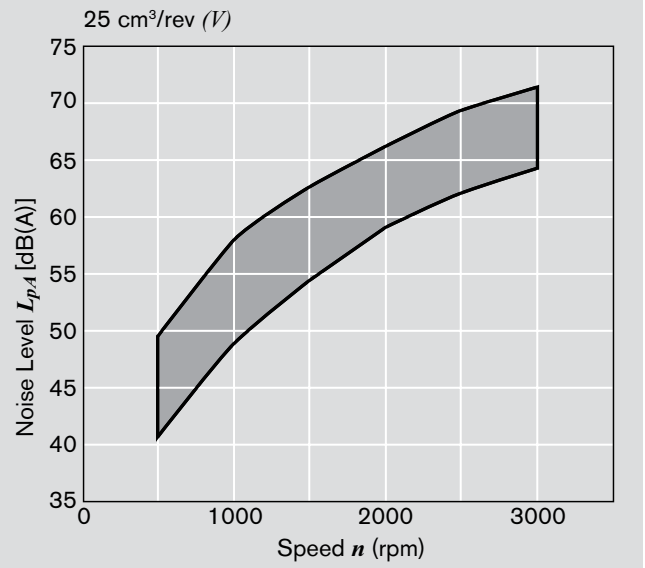
Noise charts (continued)

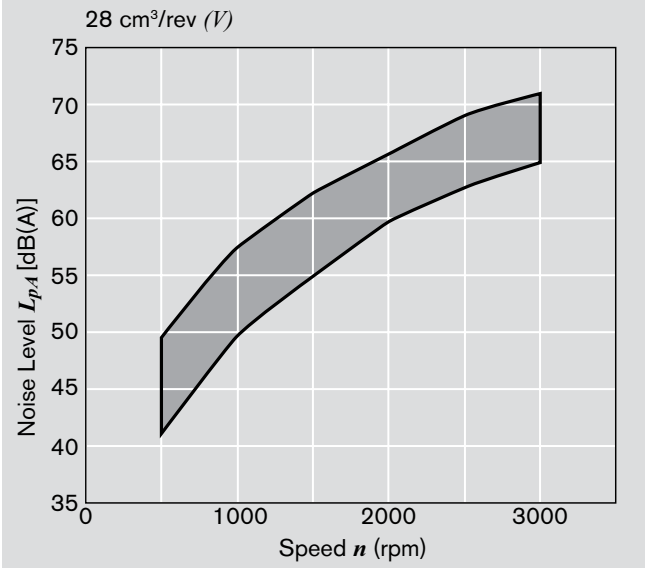












Specifications

General	
Construction	External gear pump
Mounting	Flange or through-bolting with spigot
Ports	Threaded, flange
Direction of rotation (looking on shaft)	Clockwise or counter-clockwise, the pump may only be driven in the direction indicated
Installation position	Any
Load on shaft	Radial and axial forces after consulting
Ambient temperature range	–30 °C...+80 °C (–22 °F... +176 °F) or max. 110 °C (230 °F) with FPM seal
Fluids	– Mineral oil compliant with DIN 51 524, 1–3, however under higher load at least HLP compliant with DIN 51 524 Part 2 recommended. – Comply with RE 90220 – Further operating fluids possible after consultation
Viscosity	12...800 mm^2/s permitted range 20...100 mm^2/s recommended range ...2000 mm^2/s range permitted for starting
Fluid temperature range	max. +80 °C (176 °F) with NBR seals*) max. +110 °C (230 °F) with FPM seals**)
Filtration ***)	At least cleanliness level 20/18/15 compliant with ISO 4406 (1999)

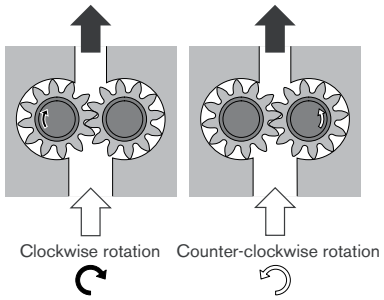
*) NBR = Perbunan®
**) FPM = Viton®
***) During the application of control systems or devices with critical counter-reaction, such as steering and brake valves, the type of filtration selected must be adapted to the sensitivity of these devices/systems.

Safety requirements pertaining to the whole systems are to be observed.

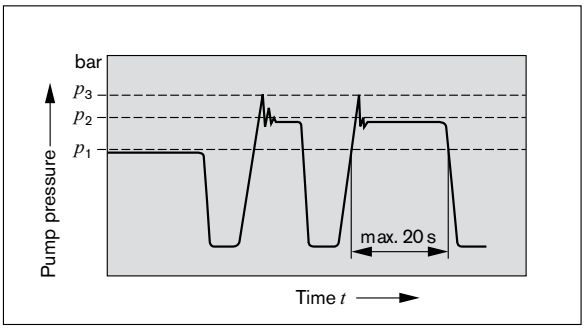
In the case of applications with high numbers of load cycles please consult the factory.

Definition of direction of rotation

Always look on the drive shaft.
Caution: Dimensions drawings always show clockwise-rotation pumps. On counter-clockwise-rotation pumps the positions of the drive shaft and the suction and pressure ports are different.



Definitions of pressures



p_1 max. continuous pressure
p_2 max. intermittent pressure
p_3 max. peak pressure

AZPF-1x* *)

Displacement	V	cm^3/rev	4	5.5	8	11	14	16	19	22.5	22.5
Suction pressure	p_e	bar	0.7...3 (absolute), with tandem pumps: p_e (p_2) = max. 0.5 > p_e (p_1)								
Max. continuous pressure	p_1		250*						210	180	210
Max. intermittent pressure	p_2		280*						230	210	230
Max. peak pressure	p_3		300						250	230	250
Min. rotational speed	<100	rpm	600	500	500	500	500	500	500	500	500
at bar 12 mm^2/s	100...180		1200	1200	1000	1000	800	800	800	800	800
	180... p_2		1400	1400	1400	1200	1000	1000	1000	1000	1000
25 mm^2/s	p_2		700	700	700	600	500	500	500	500	500
Max. rotational speed at	p_2		4000			3500	3000	3000	3000	2500	3000

*) Version with extended bearings

AZPF-2x*

Displacement	V	cm^3/rev	4	5.5	8	11	14	16	19	22.5	25	28
Suction pressure	p_e	bar	0.7...3 (absolute), with tandem pumps: p_e (p_2) = max. 0.5 > p_e (p_1)									
Max. continuous pressure	p_1		250							220	195	170
Max. intermittent pressure	p_2		280							250	225	200
Max. peak pressure	p_3		300							290	265	240
Min. rotational speed	<100	rpm	600	500	500	500	500	500	500	500	500	500
at bar 12 mm^2/s	100...180		1200	1200	1000	1000	800	800	800	800	800	800
	180... p_2		1400	1400	1400	1200	1000	1000	1000	1000	1000	1000
25 mm^2/s	p_2		700	700	700	600	500	500	500	500	500	500
Max. rotational speed at	p_2		4000			3500	3000	3000	3500	3500	3000	3000

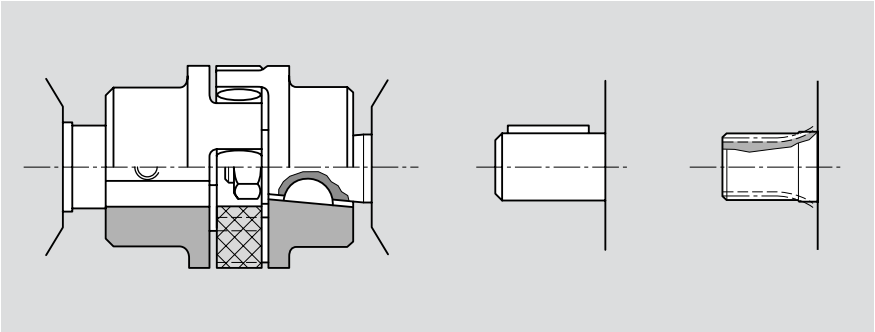
* Pumps with threaded ports may experience reduced life if used continuously above 210 bar.

Drive arrangements

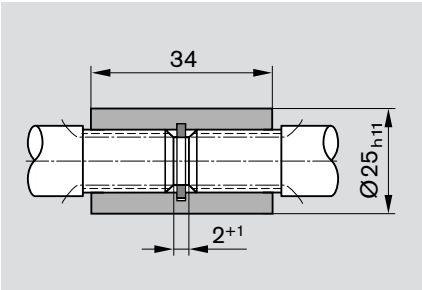
1. Flexible couplings
The coupling must not transfer any radial or axial forces to the pump.

The maximum radial runout of shaft spigot is 0.2 mm.

Refer to the fitting instructions provided by the coupling manufacturer for details of the maximum permitted shaft misalignment.



2. Coupling sleeve
Used on shafts with DIN or SAE splining. Caution: There must be no radial or axial forces exerted on the pump shaft or coupling sleeve. The coupling sleeve must be free to move axially. The distance between the pump shaft and drive shaft must be 2^{+1}. Oil-bath or oil-mist lubrications is necessary.



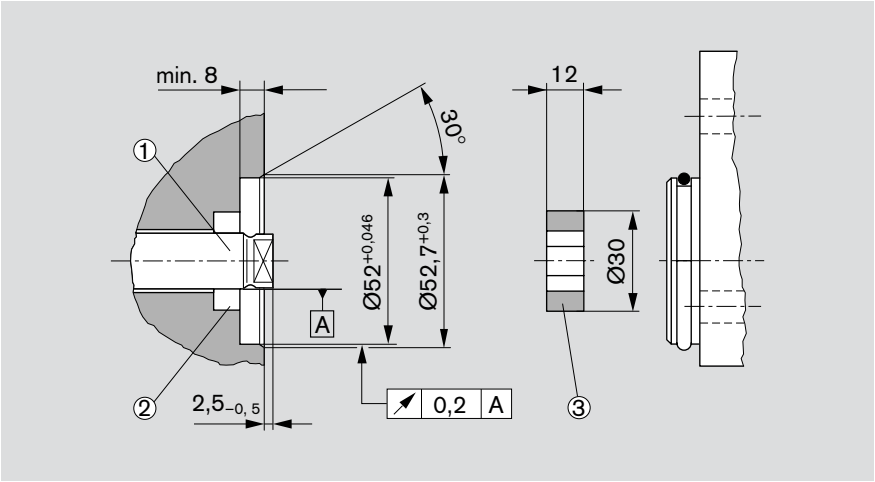
Splined shaft	Torque M_{max} [Nm]	Displacement V [cm³/rev]	Pressure p_{max} [bar]
DIN	100	4...28	p_{max}
SAE 9t	110		
SAE 11t	180		

3. Drive shaft with tang
For the close-coupling of pumps to electric motor or internal-combustion engine, gear, etc.
The pump shaft has a special tang and driver ③ (not included in supply).
There is no shaft seal.

The recommended arrangements and dimensions for the drive end and sealing are as follows.

① Drive shaft
Case-hardening steel DIN 17 210
e.g. 20 MnCrS 5
case-hardened 0.6 deep; HRC 60 ±3.
Surface for sealing ring
ground without rifling $R_{max.} \leq 4\mu m$

② Radial shaft seal ring
Rubber-covered seal (see DIN 3760, Type AS or double-lipped ring).
Cut 15° chamfer or fit shaft seal ring with protection sleeve.



Drive with tang

AZPF-1x

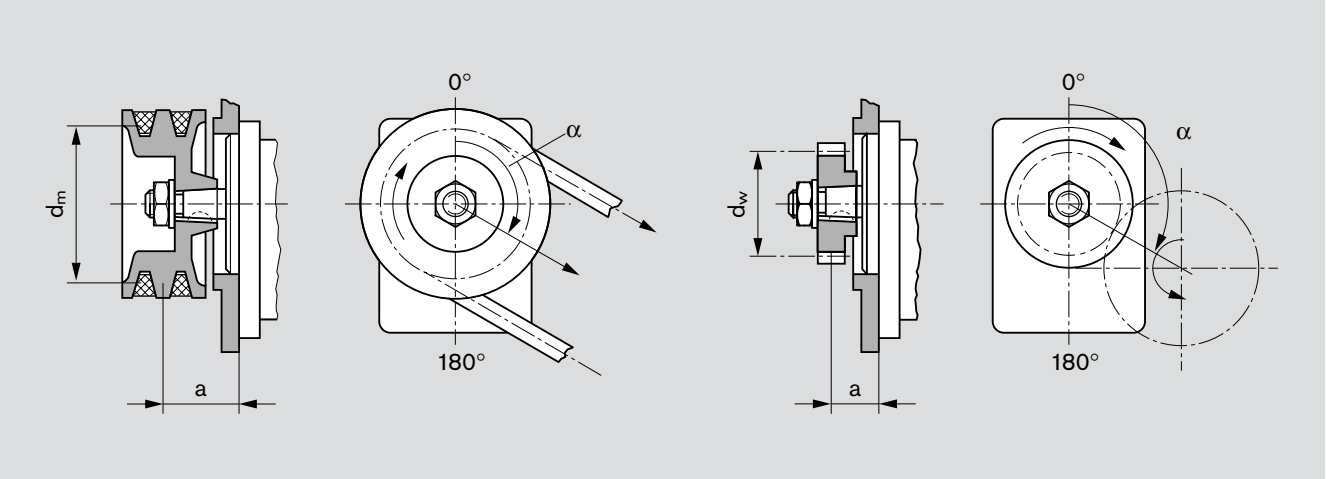
Torque $M_{max.}$ [Nm]	Displacement V [cm³/rev]	Pressure $p_{max.}$ [bar]
65	4...14	280
	16	230
65	19	190
	22.5	160

AZPF-2x

Torque $M_{max.}$ [Nm]	Displacement V [cm³/rev]	Pressure $p_{max.}$ [bar]
85	4...14	280
	16	280
	19	250
	22.5	210
	25	190
	28	170

4. V-belts and gearwheels without outboard bearing

When proposing to use V-belt or gear drive, please submit details of the application for our evaluation (especially dimensions a, d_m, d_w and angle α).

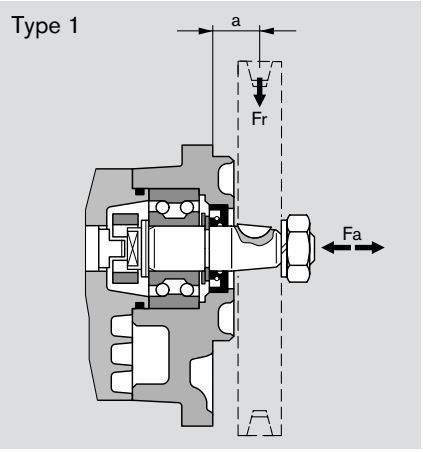


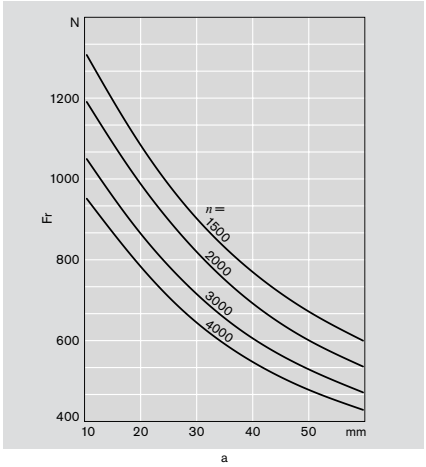
5. Outboard bearing

Outboard bearings eliminate possible problems when pumps are driven by V-belts or gearwheels. The diagrams below show the maximum radial and axial loads that can be tolerated based on a bearing life of $L_H = 1000$ hours.

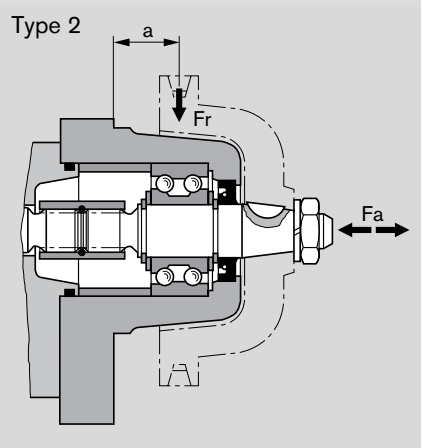
Torque $M_{max.}$ [Nm]	Displacement V [cm³/rev]	Pressure $p_{max.}$ [bar]
65	16	230
	19	190
	22.5	160

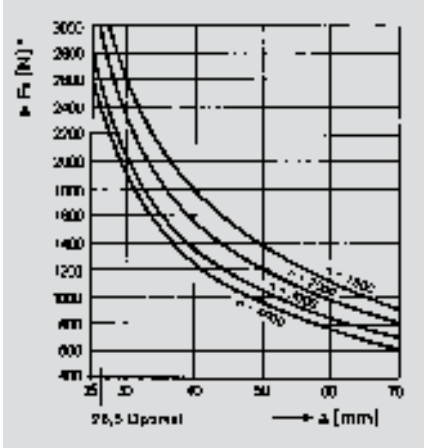
Type 1





Type 2





Multiple gear pumps

Gear pumps are well-suited to tandem combinations of pumps in which the drive shaft of the first pump is extended to drive a second pump and sometimes a third pump in the same manner. A coupling is fitted between each pair of pumps.
In most cases each pump is isolated from its neighbor, i.e. the suction ports are separate from one another. A common suction port is also possible as an option.

Caution: Basically, the specifications for the single pumps apply, but with certain restrictions:
Max. speed: This is determined by the highest rated pump speed in use.
Pressures: These are restricted by the strength of the drive shaft, the through drives and the drivers. Appropriate data is given in the dimensional drawings.

Pressure restrictions during standard through drive
In the case of series S, the driver for the second pumping stage can carry a load of up to $M_{max.}$ = 65 Nm, i.e. there is a pressure restriction for the second stage and any further stages.

$M_{max.}$ [Nm]	V [cm³/rev]	$p_{max.}$ [bar]
65	16	230
	19	190
	22.5	160
	25	140
	28	130

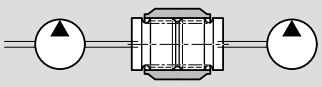
If the first stage is driven through a tang (driver) or outboard bearing type 1, pressure restrictions apply as indicated in the formula below.

Reinforced through drives are available for applications with higher transfer torques and/or rotational vibrations. Customized designs available on request.

In instances where common inlet is required, contact factory to determine flow capability.

Reinforced through drive

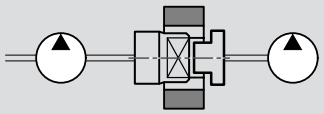
$M_{max.}$ = 160 Nm



F F

Standard through drive

$M_{max.}$ = 65 Nm



F F

Combinations

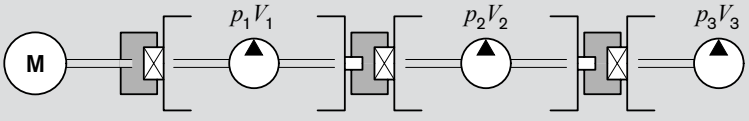
Series pump 1	Torque $M_{max.}$ [Nm]	Series pump 2
F	65	F
F	65	S
F	12	B

Max. transferrable drive torque *

Function	Code letter	Designation	Max. transferrable drive torque * [Nm]
Splined shafts	R	SAE J744 16-4 9T	110
	P	SAE J744 19-4-11T	180
Tapered key shaft	C	1:5	155
	H	1:8	160
Cylinder shafts	G	Shafts Ø 15.875	55
	A	Shafts Ø 18	75
	Q	5/8" keyed SAE J744 16-1A	55
Claw	N	Dihedral claw	65

* These values only apply when the conditions described on page 16 are complied with. Bosch Rexroth is to be consulted if the stated values are exceeded.

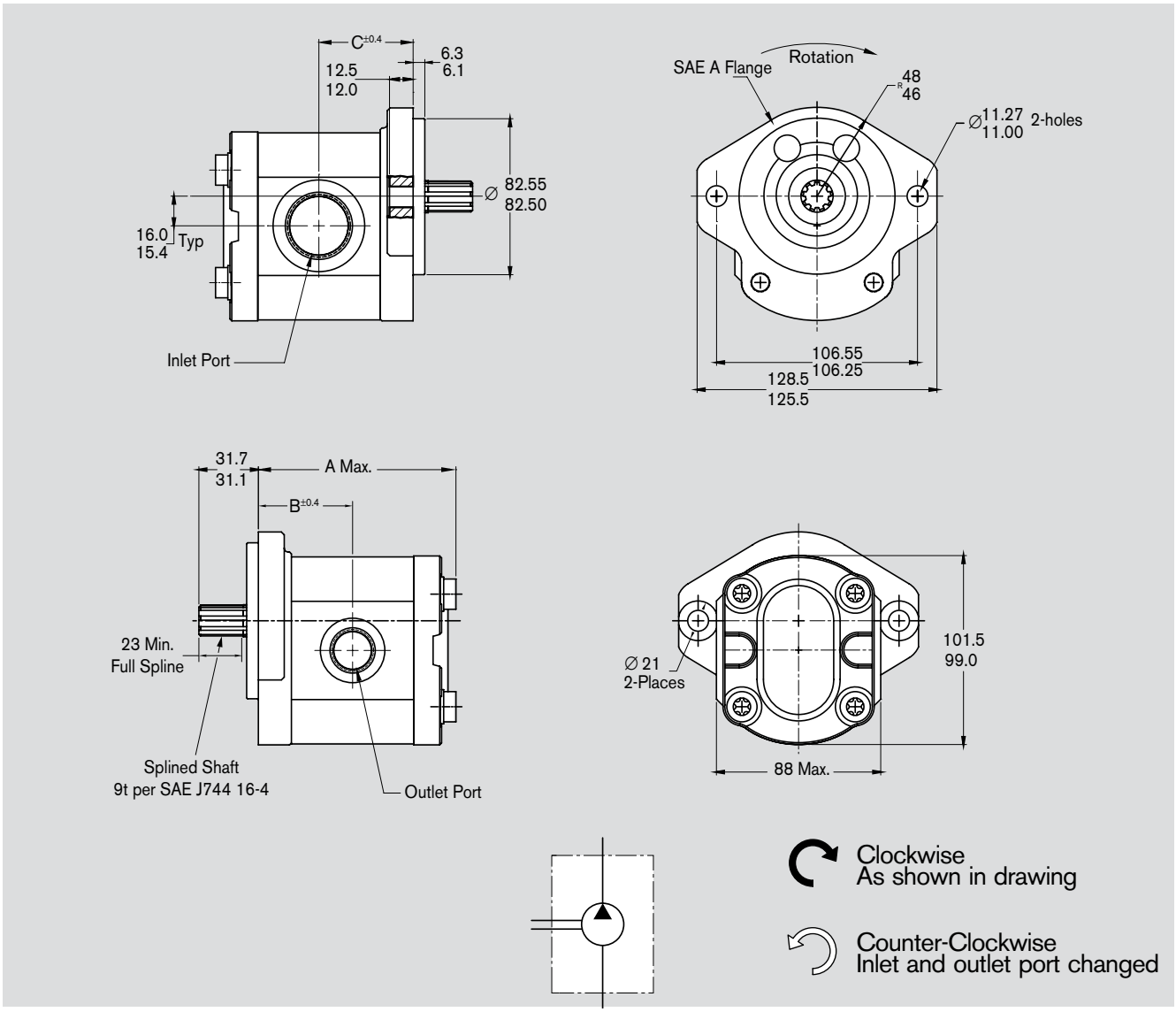
Torque M_{max} calculation



$$M_{max.} \geqq \Delta p_1 \cdot V_1 \cdot 0.0177 + \Delta p_2 \cdot V_2 \cdot 0.0177 + \Delta p_3 \cdot V_3 \cdot 0.0177$$

Δp [bar] V [cm³/rev]

Example: 19 cc + 16 cc tandem (F+F) with R splined shaft
Pressure P_1 = 200 / P_2 = 150
$M_{max.}$ = (200 x 16 x .0177) + (150 x 19 x .0177) = 56.64 + 50.45 = 107.08
R shaft acceptable because $M_{max.}$ is <110 [Nm]



Ordering code

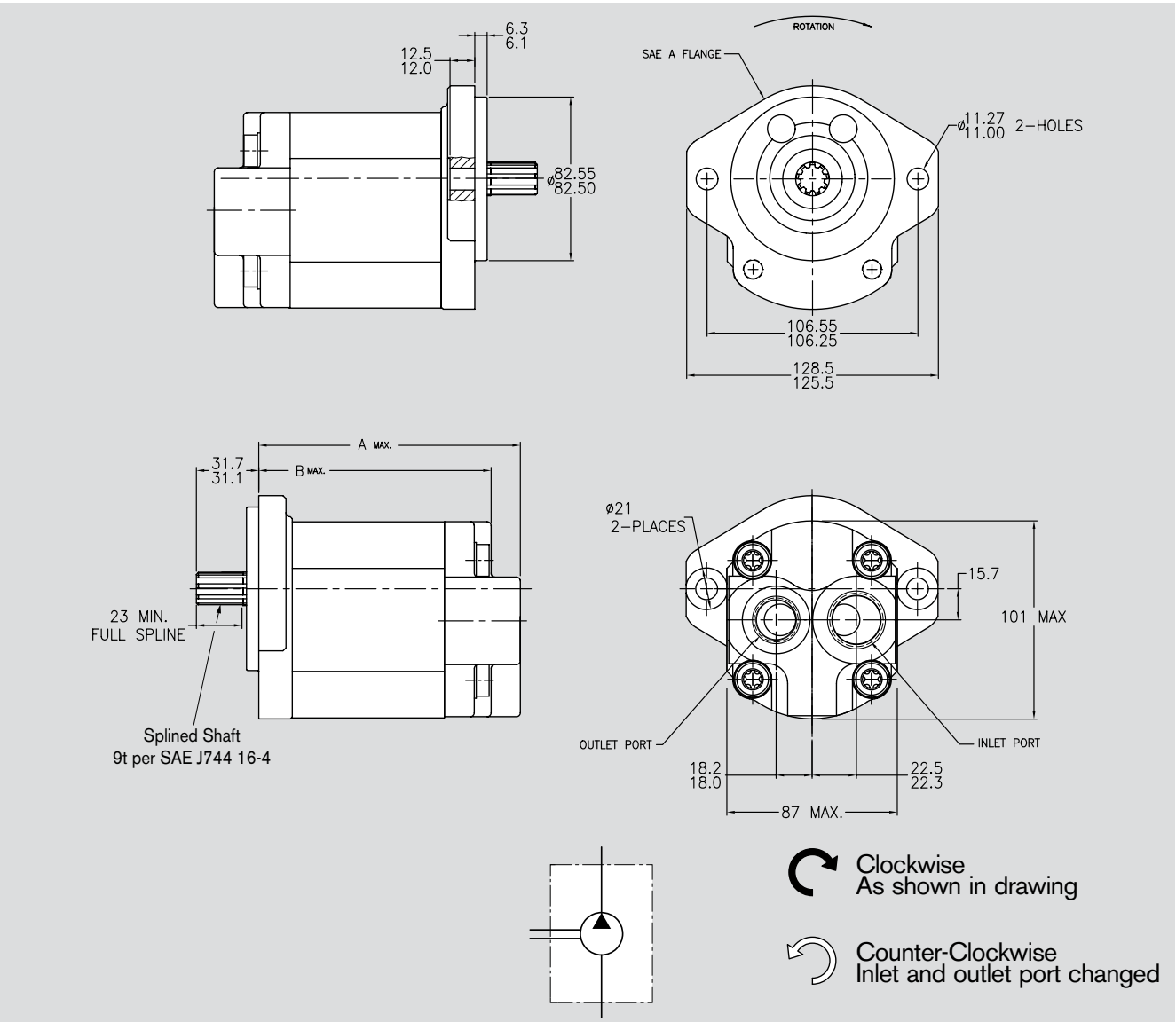
AZPF – 12 – ☐☐☐ ☐ R R 12 MB

AZPF – 22 – ☐☐☐ ☐ R R 12 MB*

Displacement	Ordering Number		Dimension (mm)				
	L	R				Inlet Port (SAE O-Ring Boss)	Outlet Port (SAE O-Ring Bpss)
(cm^3/rev)			A	B	C		
4.0	9 510 290 036	9 510 290 015	85.0	39.9	39.9	-10	-8
5.5	9 510 290 037	9 510 290 005	85.6	41.1	41.1	-10	-8
8.0	9 510 290 038	9 510 290 017	91.6	43.2	43.2	-12	-10
11.0	9 510 290 039	9 510 290 414	96.6	47.0	47.0	-12	-10
14.0	9 510 290 040	9 510 290 004	101.8	47.5	47.5	-12	-10
16.0	9 510 290 127	9 510 290 056	105.0	49.9	49.9	-16	-10
19.0	9 510 290 128	9 510 290 125	110.0	52.4	52.4	-16	-10
22.5	9 510 290 129	9 510 290 126	115.4	55.1	55.1	-16	-10
25.0	9 510 290 117*	9 510 290 111*	131.6	63.2	63.2	-16	-10
28.0	9 510 290 120*	9 510 290 114*	136.5	65.6	65.6	-16	-10

Notes:

1. Refer to page 16 for performance specifications by displacement size.
2. Contact factory for product weight.



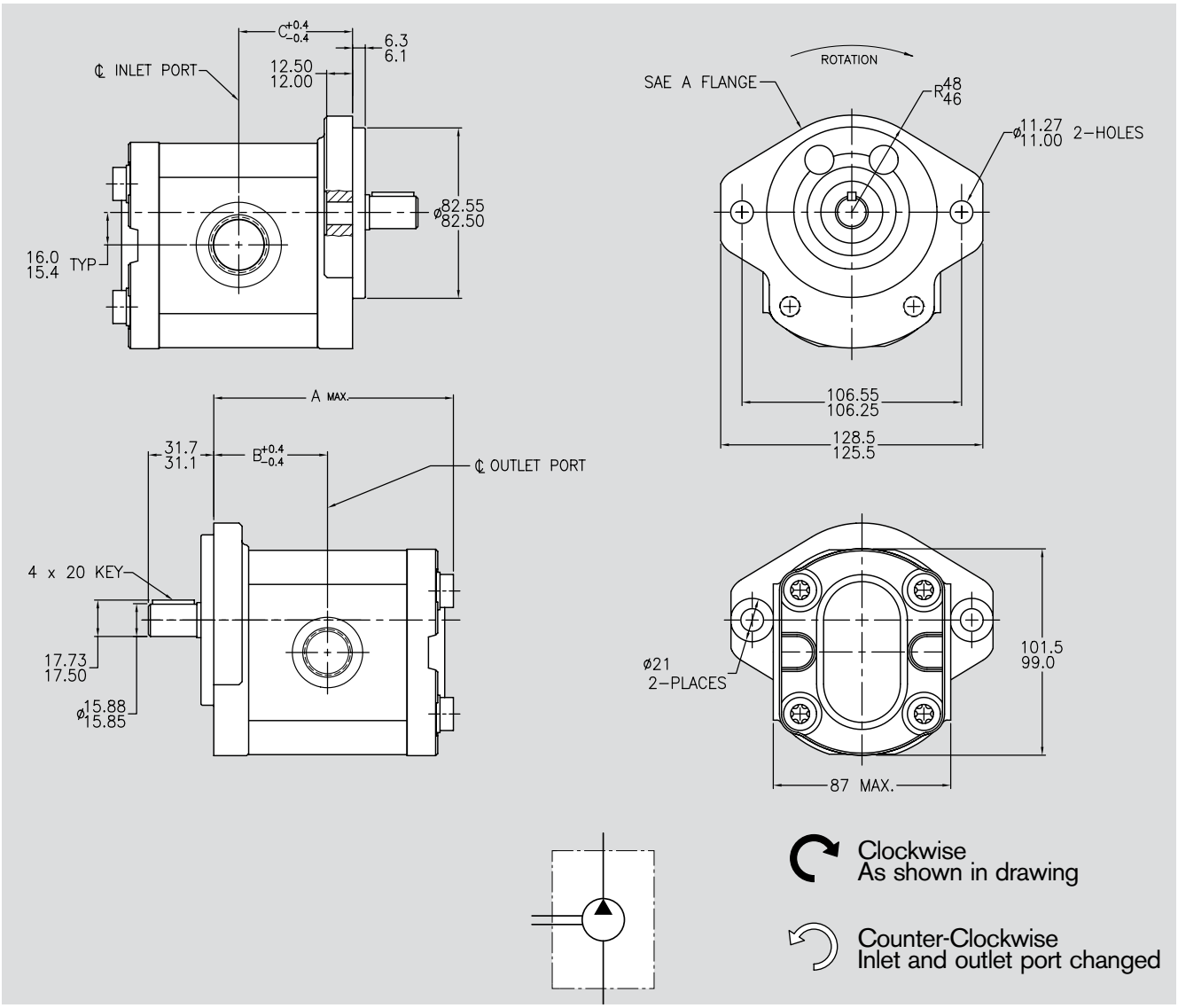
Ordering code

AZPF – 12 – ☐☐☐ ☐ R R 12 MA

Displacement	Ordering Number		Dimension (mm)				
	↺	↻				Inlet Port	Outlet Port
(cm^3/rev)	L	R	A	B	C	(SAE O-Ring Boss)	(SAE O-Ring Bpss)
4.0	9 510 290 083	9 510 290 075	100.3	85.0		-12	-10
5.5	9 510 290 084	9 510 290 076	103.3	88.4		-12	-10
8.0	9 510 290 085	9 510 290 077	107.4	92.5		-12	-10
11.0	9 510 290 086	9 510 290 078	112.4	97.5		-12	-10
14.0	9 510 290 087	9 510 290 079	117.4	102.5		-12	-10
16.0	9 510 290 088	9 510 290 080	120.8	105.5		-12	-10
19.0	9 510 290 089	9 510 290 081	126.8	110.9		-12	-10
22.5	9 510 290 090	9 510 290 082	131.2	116.3		-12	-10
25.0							
28.0							

Notes:

1. Refer to page 16 for performance specifications by displacement size.
2. Contact factory for availability of units with no ordering number listed.
3. Contact factory for product weight.



Ordering code

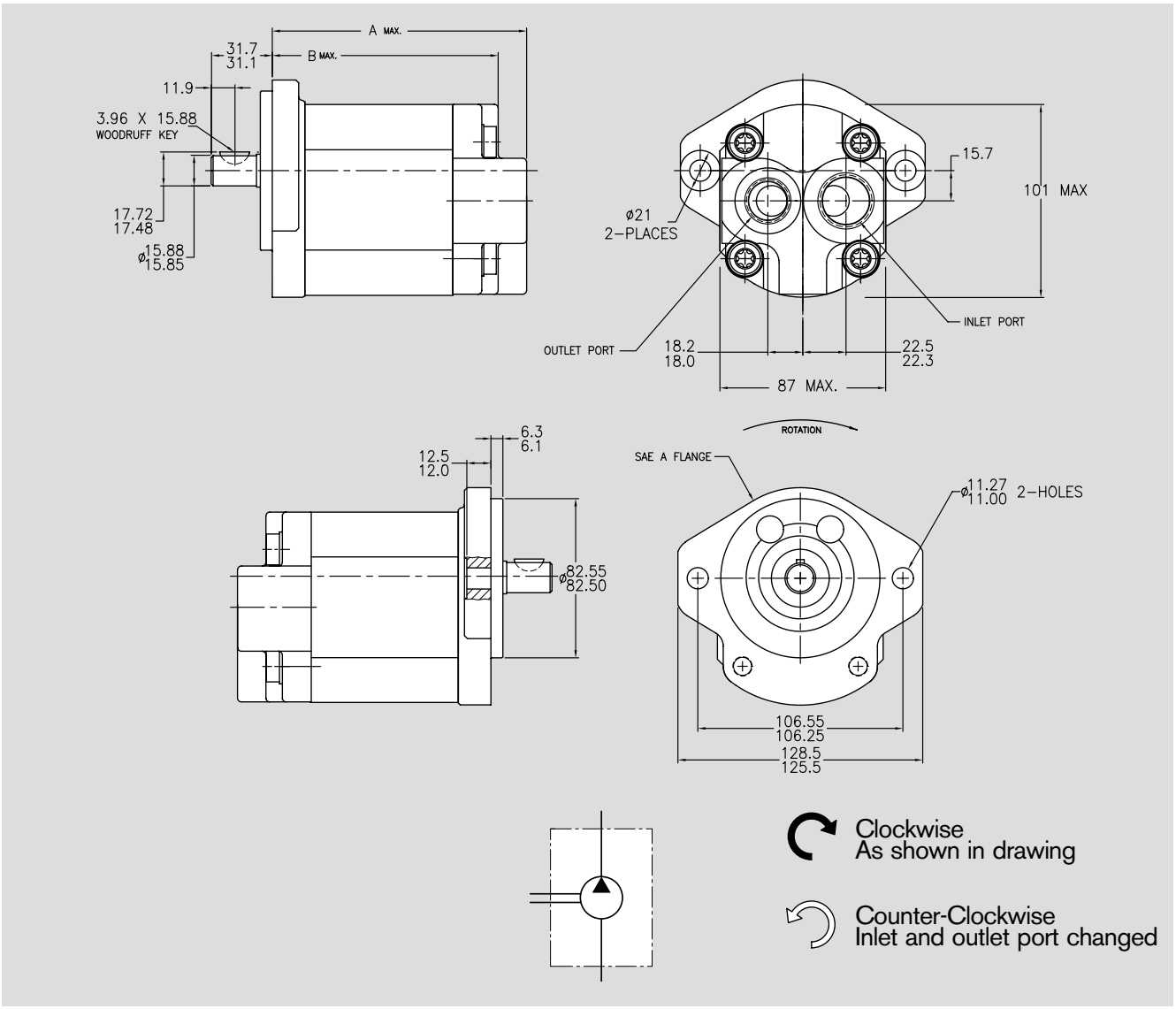
AZPF – 12 – ☐☐☐ ☐Q R 12 MB

AZPF – 22 – ☐☐☐ ☐Q R 12 MB*

Displacement	Ordering Number		Dimension (mm)				
	↺	↻				Inlet Port	Outlet Port
(cm^3/rev)	L	R	A	B	C	(SAE O-Ring Boss)	(SAE O-Ring Bpss)
4.0	9 510 290 044	9 510 290 021	85.0	39.9	39.9	-10	-8
5.5	9 510 290 045	9 510 290 022	85.6	41.1	41.1	-10	-8
8.0	9 510 290 046	9 510 290 023	91.6	43.2	43.2	-12	-10
11.0	9 510 290 047	9 510 290 024	96.6	47.0	47.0	-12	-10
14.0	9 510 290 048	9 510 290 025	101.8	47.5	47.5	-12	-10
16.0	9 510 290 130	9 510 290 122	105.0	49.9	49.9	-16	-10
19.0	9 510 290 131	9 510 290 123	110.0	52.4	52.4	-16	-10
22.5	9 510 290 132	9 510 290 124	115.4	55.1	55.1	-16	-10
25.0	9 510 290 118*	9 510 290 112*	131.6	63.2	63.2	-16	-10
28.0	9 510 290 121*	9 510 290 115*	136.4	65.6	65.6	-16	-10

Notes:

1. Refer to page 16 for performance specifications by displacement size.
2. Contact factory for product weight.



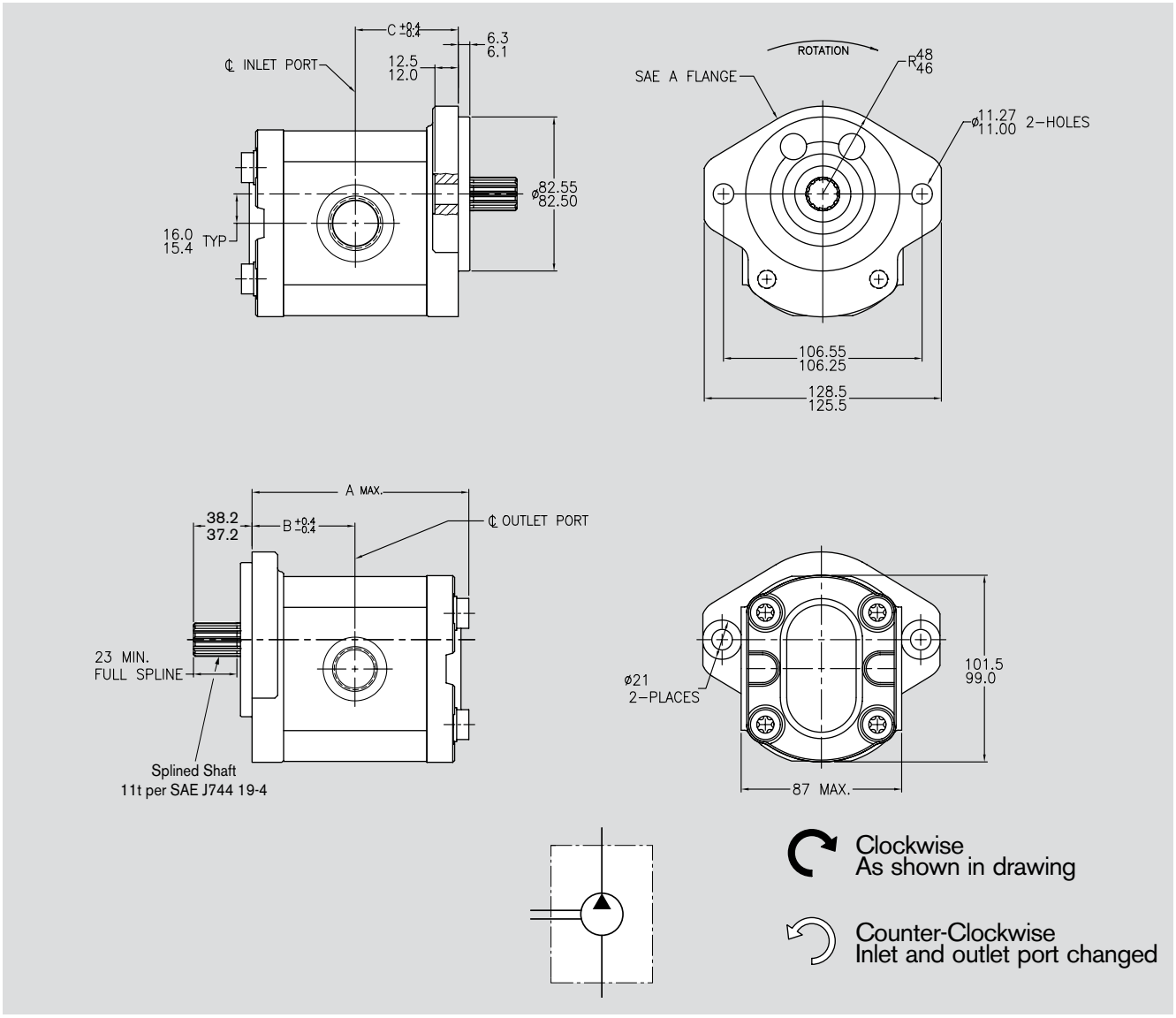
Ordering code

AZPF – 12 – ☐☐☐ ☐Q R 12 MA

Displacement	Ordering Number		Dimension (mm)				
	↺	↻				Inlet Port	Outlet Port
(cm^3/rev)	L	R	A	B	C	(SAE O-Ring Boss)	(SAE O-Ring Bpss)
4.0	9 510 290 099	9 510 290 091	100.8	85.9		-12	-10
5.5	9 510 290 100	9 510 290 092	103.3	88.4		-12	-10
8.0	9 510 290 101	9 510 290 093	107.4	92.5		-12	-10
11.0	9 510 290 102	9 510 290 094	112.4	97.5		-12	-10
14.0	9 510 290 103	9 510 290 095	117.4	102.5		-12	-10
16.0	9 510 290 104	9 510 290 096	120.8	105.9		-12	-10
19.0	9 510 290 105	9 510 290 097	126.8	110.9		-12	-10
22.5	9 510 290 106	9 510 290 098	131.2	116.3		-12	-10
25.0							
28.0							

Notes:

1. Refer to page 16 for performance specifications by displacement size.
2. Contact factory for availability of units with no ordering number listed.
3. Contact factory for product weight.



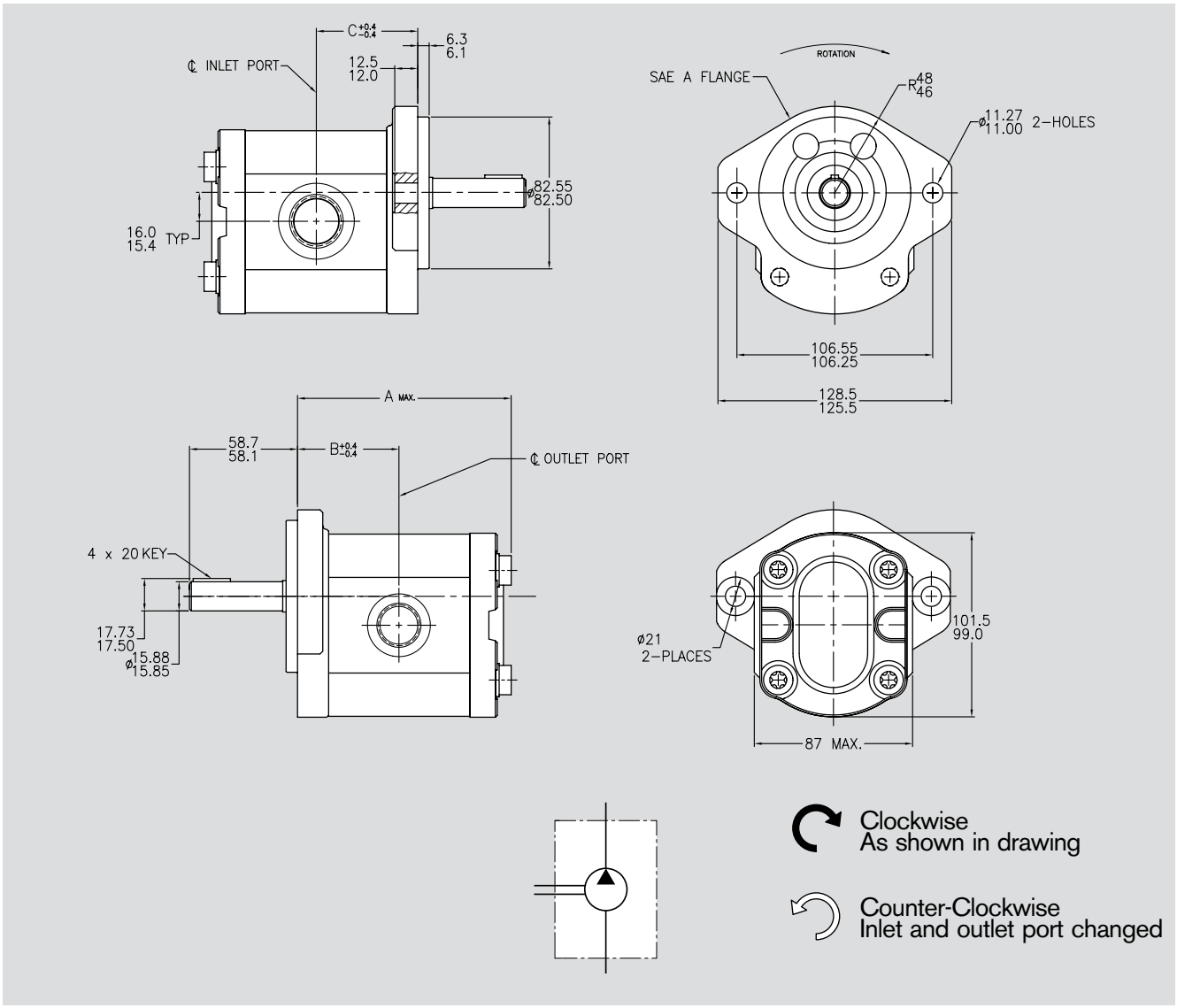
Ordering code

AZPF – 22 – ☐☐☐ ☐ P R 12 MB

Displacement	Ordering Number		Dimension (mm)				
	L	R	A	B	C	Inlet Port (SAE O-Ring Boss)	Outlet Port (SAE O-Ring Bpss)
(cm^3/rev)							
4.0	9 510 290 444	9 510 290 453	85.0	40.5	40.5	-10	-8
5.5	9 510 290 445	9 510 290 454	85.6	41.1	41.1	-10	-8
8.0	9 510 290 446	9 510 290 455	91.6	43.2	43.2	-12	-10
11.0	9 510 290 447	9 510 290 456	96.6	47.0	47.0	-12	-10
14.0	9 510 290 448	9 510 290 457	101.6	47.5	47.5	-12	-10
16.0	9 510 290 449	9 510 290 458	105.0	49.9	49.9	-16	-10
19.0	9 510 290 450	9 510 290 459	110.0	52.4	52.4	-16	-10
22.5	9 510 290 439	R918 000 008	115.4	55.1	55.1	-16	-10
25.0	9 510 290 451	9 510 290 460	131.6	63.2	63.2	-16	-10
28.0	9 510 290 452	9 510 290 461	136.4	65.6	65.6	-16	-10

Notes:

1. Refer to page 16 for performance specifications by displacement size.
2. Contact factory for product weight.



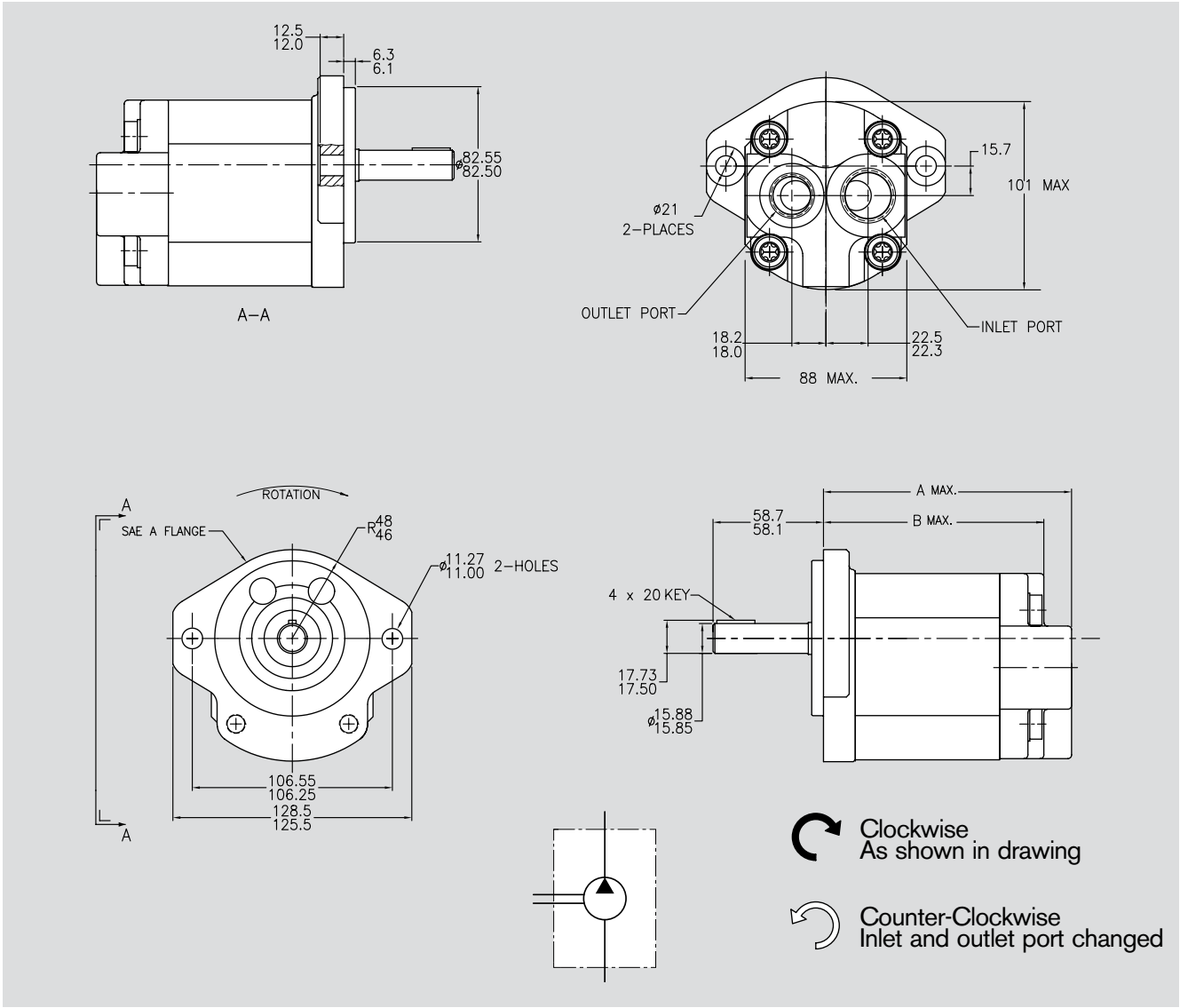
Ordering code

AZPF – 12 – ☐☐☐ ☐Q R 12 MB - S0022

Displacement	Ordering Number		Dimension (mm)				
	↺	↻				Inlet Port	Outlet Port
(cm^3/rev)	L	R	A	B	C	(SAE O-Ring Boss)	(SAE O-Ring Bpss)
4.0		9 510 290 417	85.0	39.9	39.9	-10	-8
5.5		9 510 290 259	85.6	41.1	41.1	-10	-8
8.0	9 510 290 214	9 510 290 191	91.6	43.2	43.2	-12	-10
11.0	9 510 290 254	9 510 290 209	96.6	47.0	47.0	-12	-10
14.0	9 510 290 215	9 510 290 133	101.8	47.5	47.5	-12	-10
16.0	9 510 290 255	9 510 290 210	105.0	49.9	49.9	-16	-10
19.0	9 510 290 256	9 510 290 211	110.0	52.4	52.4	-16	-10
22.5	9 510 290 257	9 510 290 212	115.4	55.1	55.1	-16	-10
25.0							
28.0							

Notes:

1. Refer to page 16 for performance specifications by displacement size.
2. Contact factory for availability of units with no ordering number listed.
3. Contact factory for product weight.



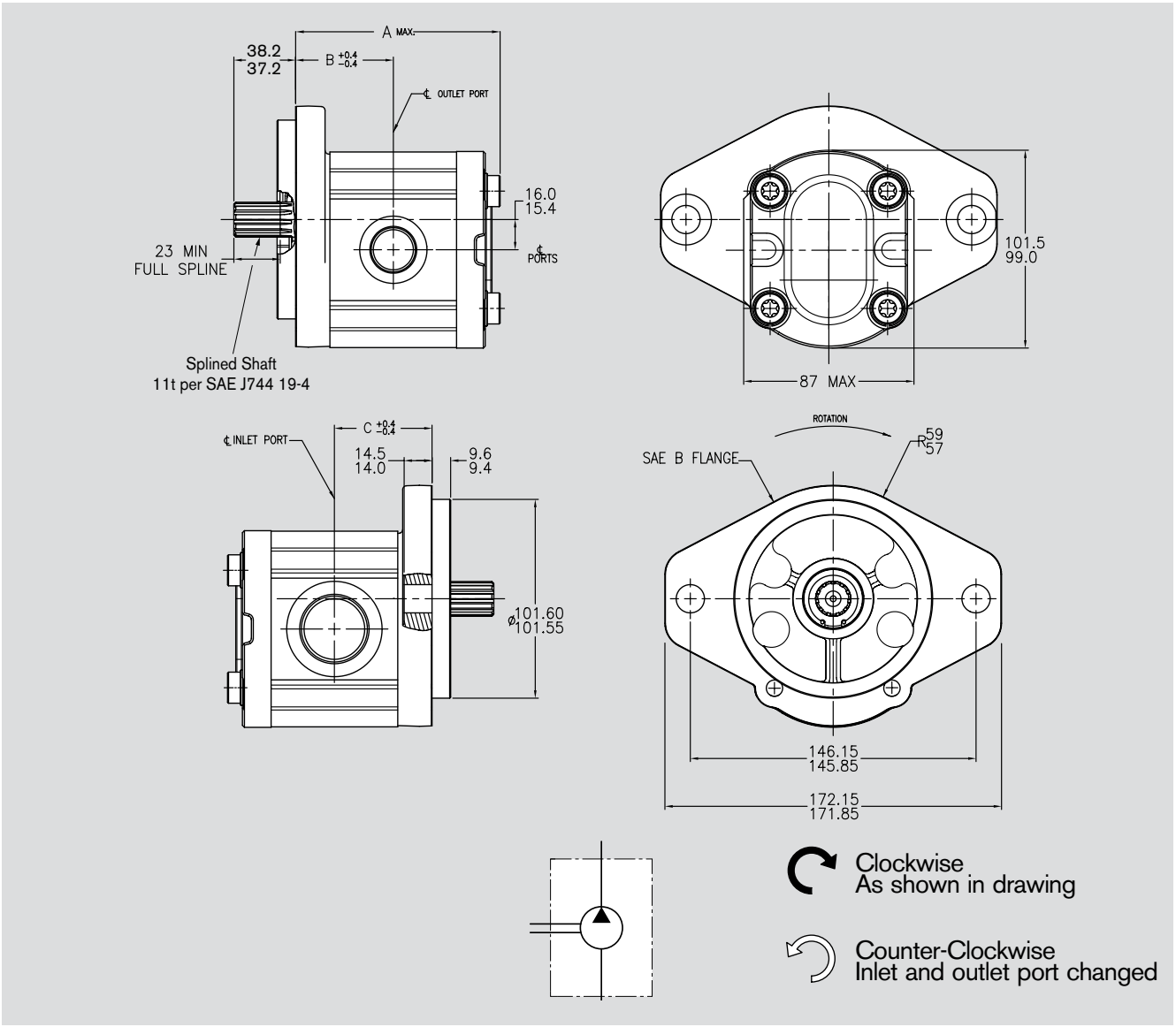
Ordering code

AZPF – 12 – ☐☐☐ ☐Q R 12 MA - S0022

Displacement	Ordering Number		Dimension (mm)				
	↺	↻				Inlet Port	Outlet Port
(cm^3/rev)	L	R	A	B	C	(SAE O-Ring Boss)	(SAE O-Ring Bpss)
4.0							
5.5							
8.0		9 510 290 317	107.4	92.5		-12	-10
11.0		9 510 290 134	112.4	97.5		-12	-10
14.0							
16.0							
19.0	9 510 290 135	9 510 290 213	125.8	110.9		-12	-10
22.5							
25.0							
28.0							

Notes:

1. Refer to page 16 for performance specifications by displacement size.
2. Contact factory for availability of units with no ordering number listed.
3. Contact factory for product weight.



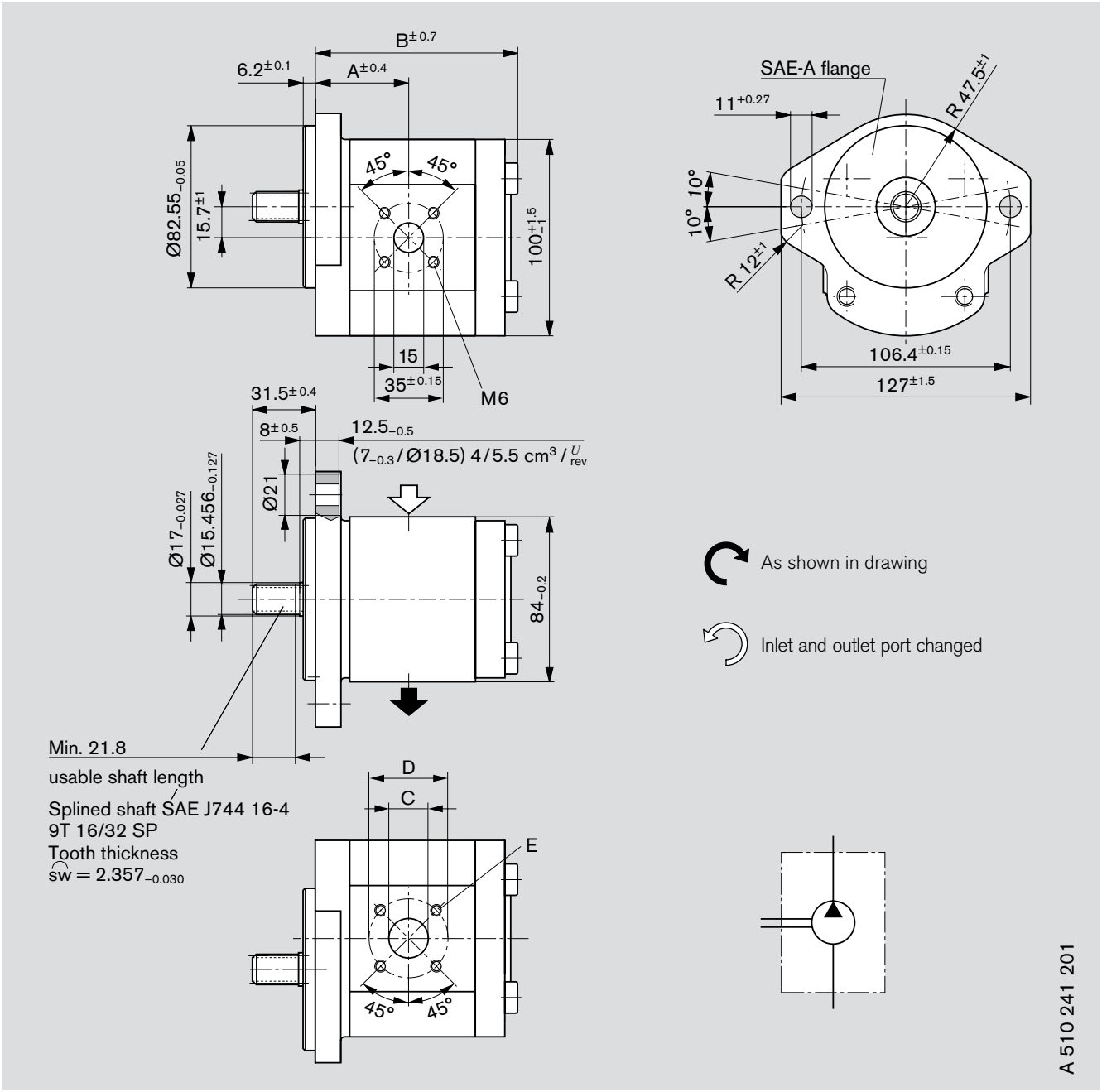
Ordering code

AZPF – 22 – ☐☐☐ ☐ P C 12 MB

Displacement	Ordering Number		Dimension (mm)				
	L	R	A	B	C	Inlet Port (SAE O-Ring Boss)	Outlet Port (SAE O-Ring Bpss)
(cm^3/rev)							
4.0		9 510 290 462	85.0	40.5	40.5	-10	-8
5.5		9 510 290 463	85.0	41.1	41.1	-10	-10
8.0		9 510 290 464	91.6	43.2	43.2	-12	-10
11.0		9 510 290 465	96.6	47.0	47.0	-12	-10
14.0		9 510 290 466	101.6	47.5	47.5	-12	-10
16.0		9 510 290 467	105.0	49.9	49.9	-16	-10
19.0		9 510 290 468	110.0	52.4	52.4	-16	-10
22.5		9 510 290 469	115.4	55.1	55.1	-16	-10
25.0		9 510 290 470	131.6	63.2	63.2	-16	-10
28.0		9 510 290 471	136.4	65.6	65.6	-16	-10

Notes:

1. Refer to page 16 for performance specifications by displacement size.
2. Contact factory for availability of units with no ordering number listed.
3. Contact factory for product weight.



Ordering code

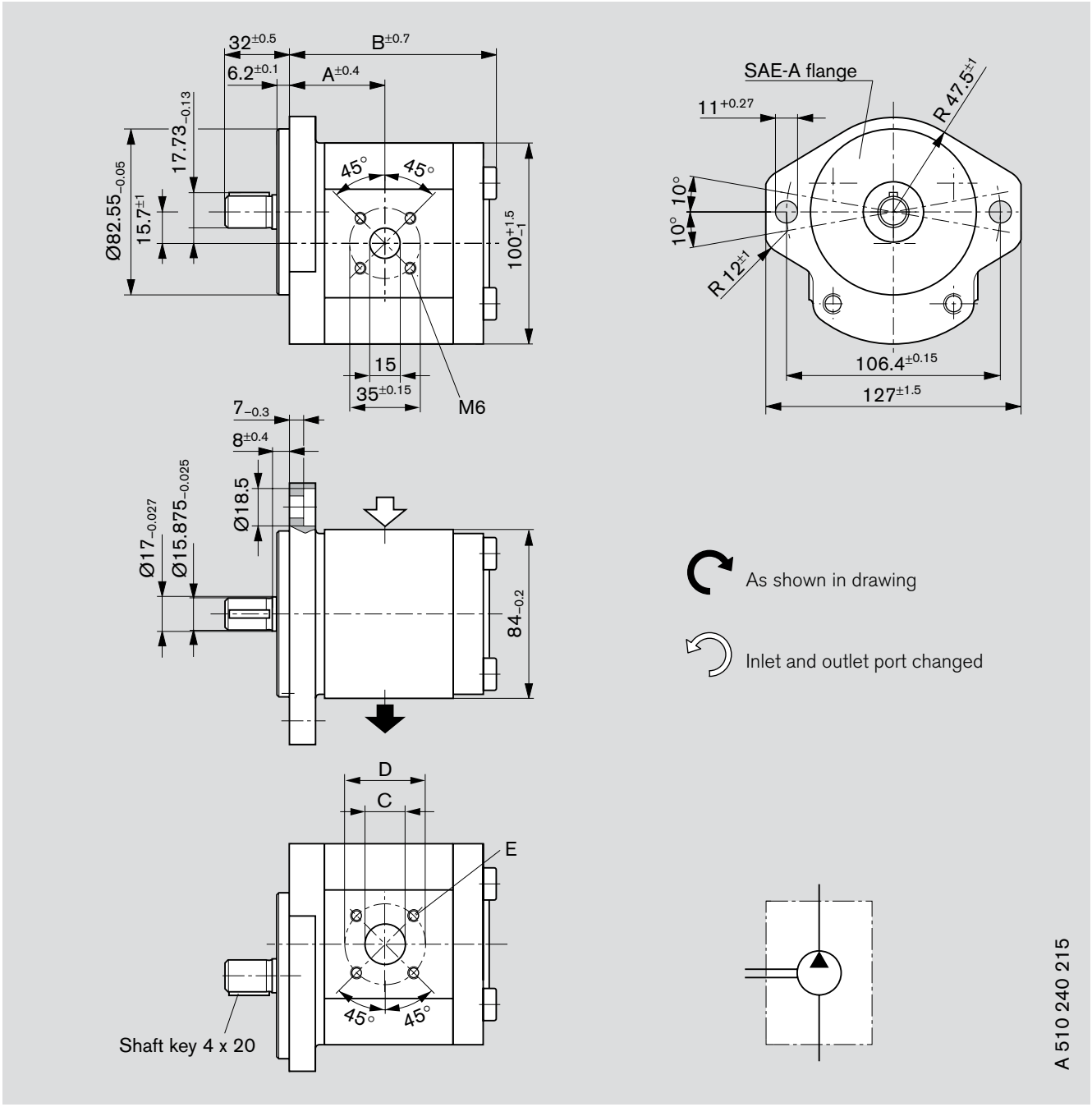
AZPF – 10 – ☐☐☐ ☐ R R 20 M B

AZPF – 11 – ☐☐☐ ☐ R R 20 K B*

Displacement [cm³/rev]	Ordering No. L	Ordering No. R	kg	Dimension [mm] A	B	C	D	E
4	**0 510 225 314**	**0 510 225 013**	3.15	39.9	85.0	15	40	M6
5.5	**0 510 325 313**	**0 510 325 013**	3.2	41.1	87.5	15	40	depth 13
8	**0 510 425 314**	**0 510 425 020**	3.3	43.2	91.6	20	40	
11	**0 510 525 324***	**0 510 525 019**	3.5	47.0	96.6	20	40	
14	**0 510 525 325**	**0 510 525 020**	3.6	47.5	101.6	20	40	
16	**0 510 625 329**	**0 510 625 028**	3.8	47.5	105.0	20	40	
19	**0 510 625 330***	**0 510 625 029***	3.9	47.5	110.0	20	40	
22.5	**0 510 725 361**	**0 510 725 077***	4.1	55.1	115.4	20	40	

Note:

1. Refer to page 16 for performance specifications by displacement size.



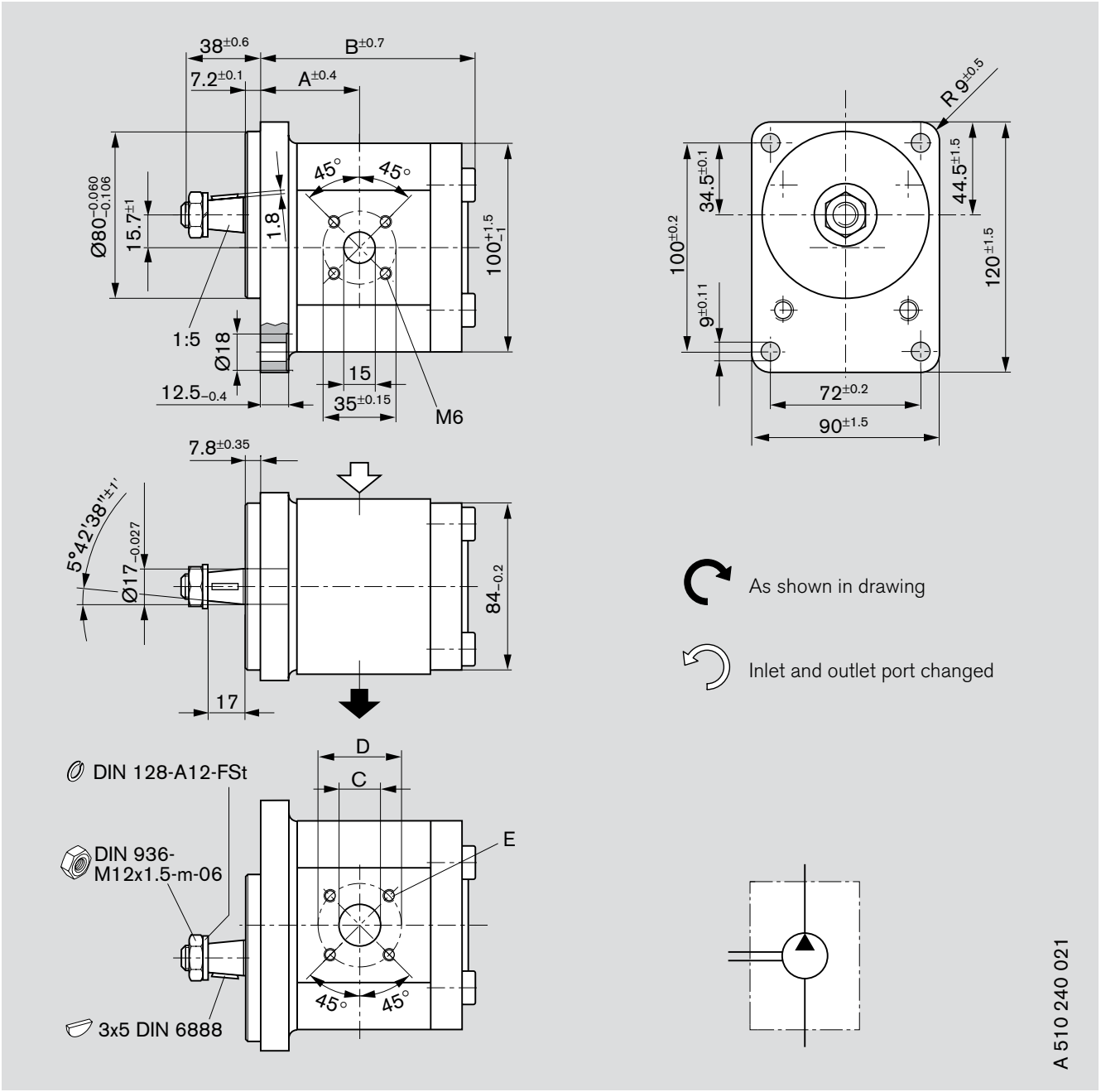
Ordering code

AZPF – 1X – ☐☐☐ ☐ Q R 20 M B

Displacement [cm³/rev]	Ordering No. L	Ordering No. R	kg	Dimension [mm] A	B	C	D	E
4		**0 510 225 014**	3.2	39.9	84.5	15	40	M6
5.5		**0 510 325 016**	3.3	41.1	87.0	15	40	depth 13
8		**0 510 425 025**	3.3	43.2	91.1	20	40	
11		**0 510 525 033**	3.5	47.0	96.1	20	40	
16		**0 510 625 042**	3.8	47.5	104.5	20	40	
19		**0 510 625 043**	3.9	47.5	109.5	20	40	
22.5	**0 510 725 396**	**0 510 725 060**	3.9	55.1	114.9	20	40	

Notes:

1. Refer to page 16 for performance specifications by displacement size.
2. Contact factory for availability of units with no ordering number listed.



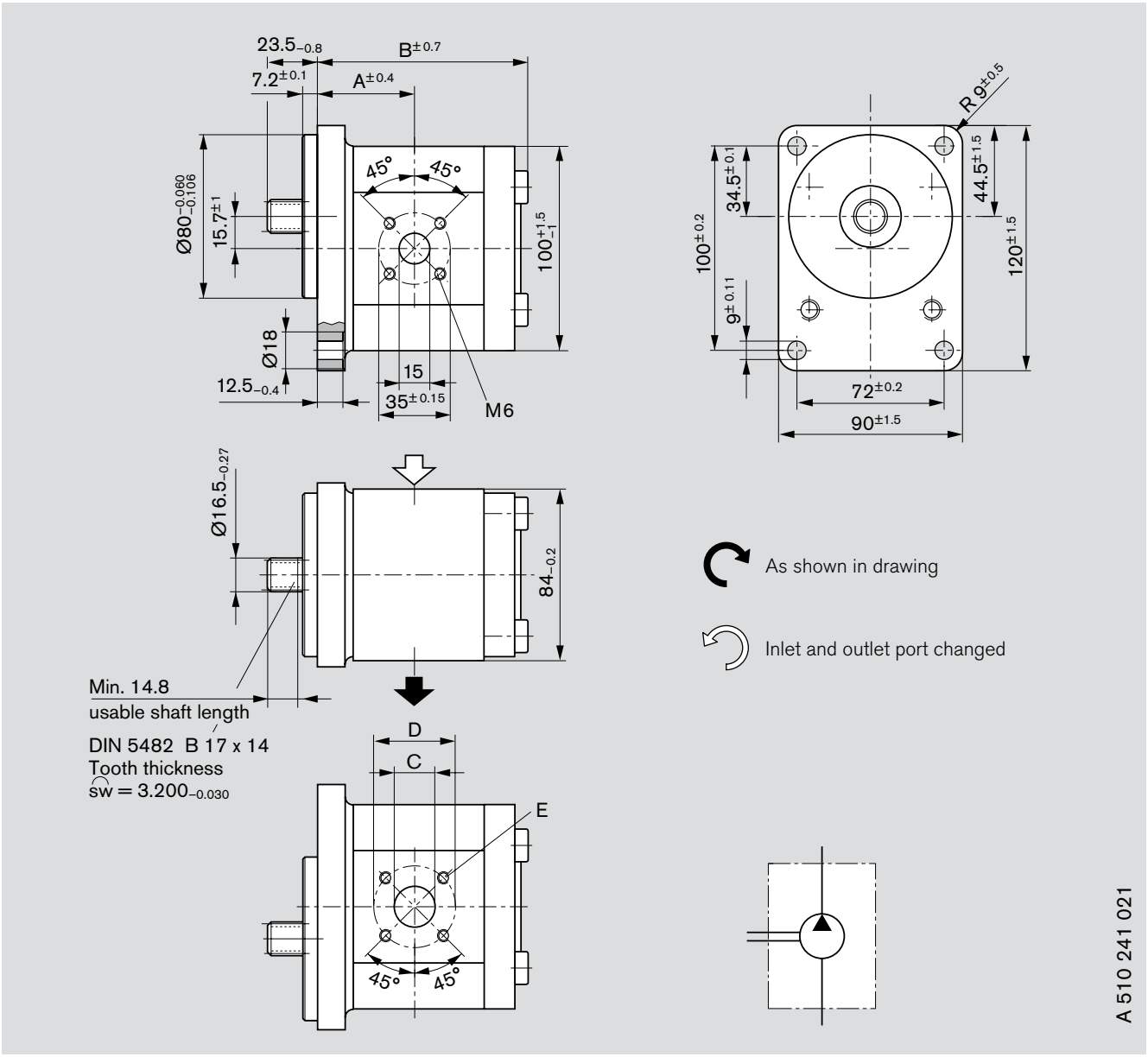
Ordering code

AZPF – 1X – ☐☐☐ ☐ C B 20 M B*

Displacement [cm³/rev]	Ordering No. L	Ordering No. R	kg	Dimension [mm] A	B	C	D	E
4	**0 510 225 306**	**0 510 225 006**	3.2	39.9	85.0	15	40	M6
5.5	**0 510 325 306**	**0 510 325 006**	3.2	41.1	87.5	15	40	depth 13
8	**0 510 425 307**	**0 510 425 009**	3.3	43.2	91.6	20	40	
11	**0 510 525 311**	**0 510 525 009**	3.5	47.0	96.6	20	40	
14	**0 510 525 319**	**0 510 525 018**	3.7	47.5	101.6	20	40	
16	**0 510 625 315**	**0 510 625 022**	3.7	47.5	105.0	20	40	
19	**0 510 625 314**	**0 510 625 013**	3.8	47.5	110.0	20	40	
22.5	**0 510 725 330**	**0 510 725 030**	3.8	55.1	115.4	20	40	

Note:

1. Refer to page 16 for performance specifications by displacement size.



Ordering code

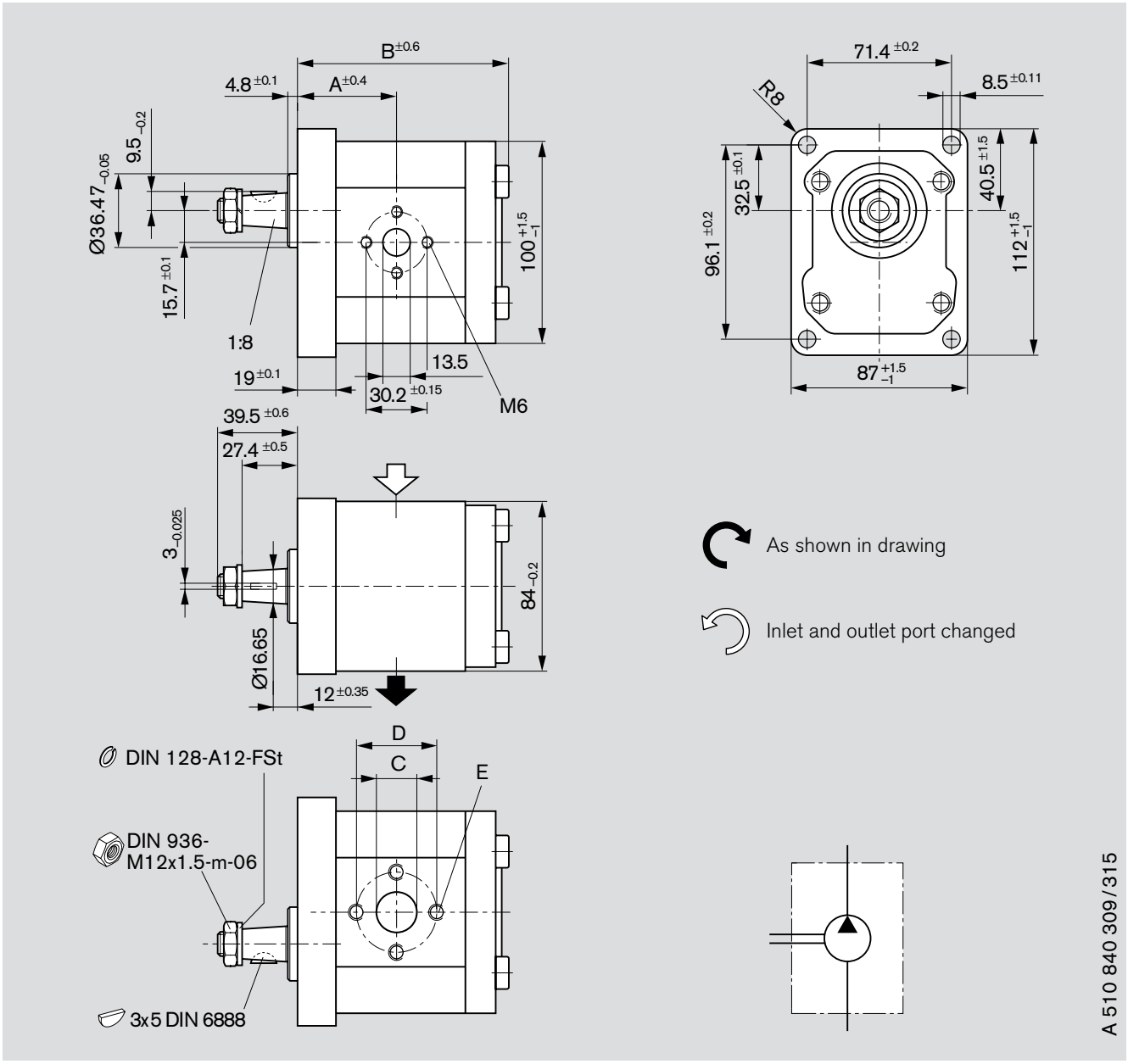
AZPF – 10 – ☐☐☐ ☐ F B 20 M B

AZPF – 11 – ☐☐☐ ☐ F B 20 M B*

Displacement [cm³/rev]	Ordering No. L	Ordering No. R	kg	Dimension [mm] A	B	C	D	E
4	**0 510 225 307**	**0 510 225 007**	3.1	39.9	85.0	15	40	M6
5.5	**0 510 325 307**	**0 510 325 007**	3.2	41.1	87.5	15	40	depth 13
8	**0 510 425 308**	**0 510 425 010**	3.3	43.2	91.6	20	40	
9	**0 510 425 336***		3.4	43.7	92.4	20	40	
11	**0 510 525 312**	**0 510 525 010**	3.5	47.0	96.6	20	40	
14	**0 510 525 328**	**0 510 525 030**	3.6	47.5	101.6	20	40	
16	**0 510 625 317**	**0 510 625 015**	3.65	47.5	105.0	20	40	
19	**0 510 625 316**	**0 510 625 014**	3.8	47.5	110.0	20	40	
22.5	**0 510 725 349**		4.4	61.1	127.4	20	40	
22.5		**0 510 725 062**	4.0	55.1	115.4	20	40	

Notes:

1. Refer to page 16 for performance specifications by displacement size.
2. Contact factory for availability of units with no ordering number listed.



Ordering code

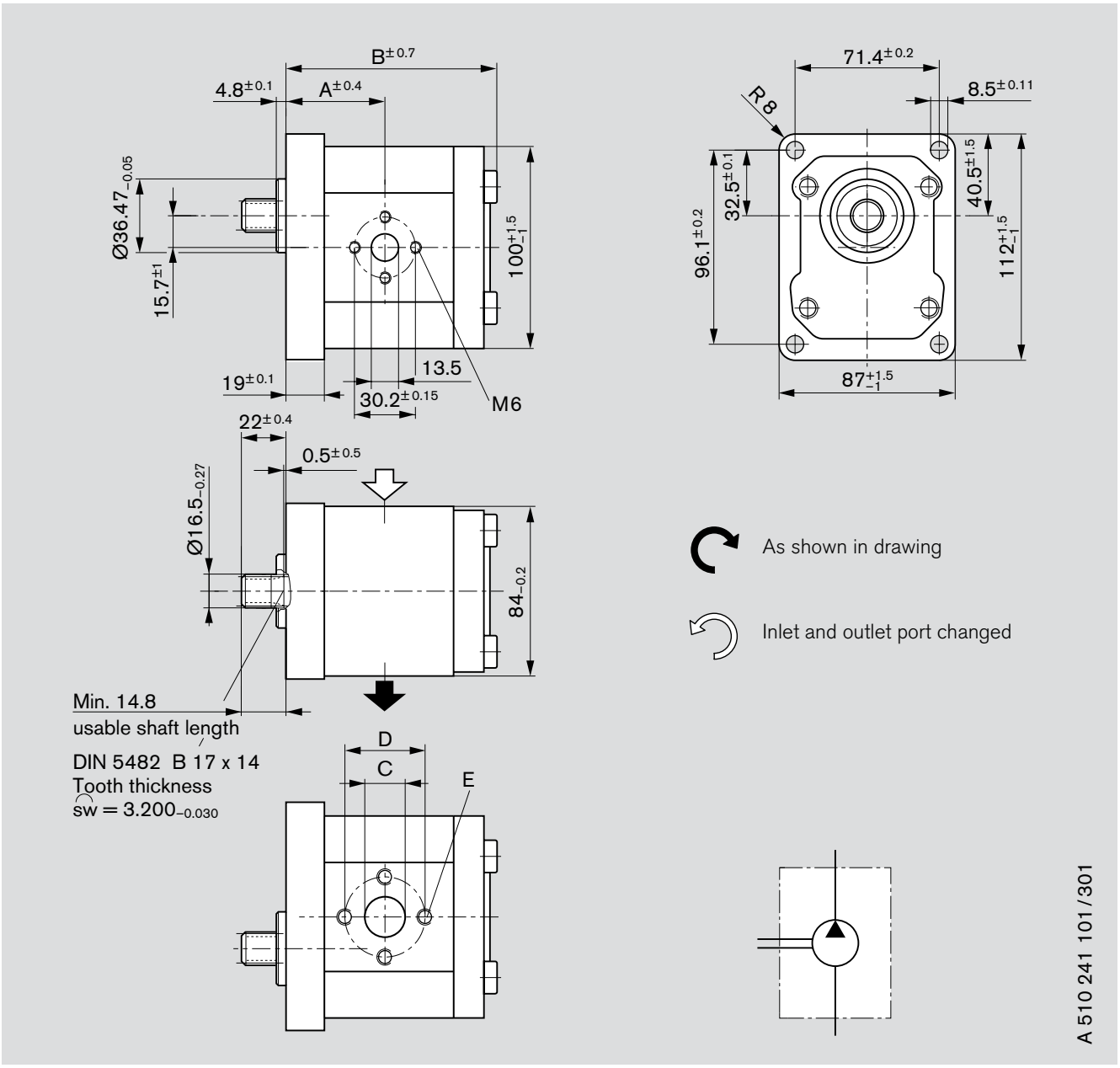
AZPF – 12 – ☐☐☐ ☐ H O 30 K B

AZPF – 22 – ☐☐☐ ☐ H O 30 K B*

Displacement [cm³/rev]	Ordering No. L	Ordering No. R	kg	Dimension [mm] A	B	C	D	E
4	**0 510 225 317**	**0 510 225 022**	3.1	41.4	84.1	13.5	30.2	M6
5.5	**0 510 325 320**	**0 510 325 025**	3.2	42.6	86.6	13.5	30.2	depth 13
8	**0 510 425 334**	**0 510 425 043**	3.3	44.7	92.5	13.5	30.2	
11	**0 510 525 374**	**0 510 525 074**	3.4	48.5	97.5	13.5	30.2	M8
14	**0 510 525 375**	**0 510 525 075**	3.6	49.0	102.5	13.5	30.2	depth 13
16	**0 510 625 381**	**0 510 625 075**	3.6	49.0	105.9	13.5	30.2	
19	**0 510 625 386***	**0 510 625 076***	4.1	59.9	121.1	20.0	39.7	
22.5	**0 510 725 410***	**0 510 725 112***	4.2	62.6	126.5	20.0	39.7	
25	**0 510 725 411***	**0 510 725 113***	4.4	64.7	132.5	20.0	39.7	
28	**0 510 725 412***	**0 510 725 114***	4.5	67.1	137.3	20.0	39.7	

Note:

1. Refer to page 16 for performance specifications by displacement size.



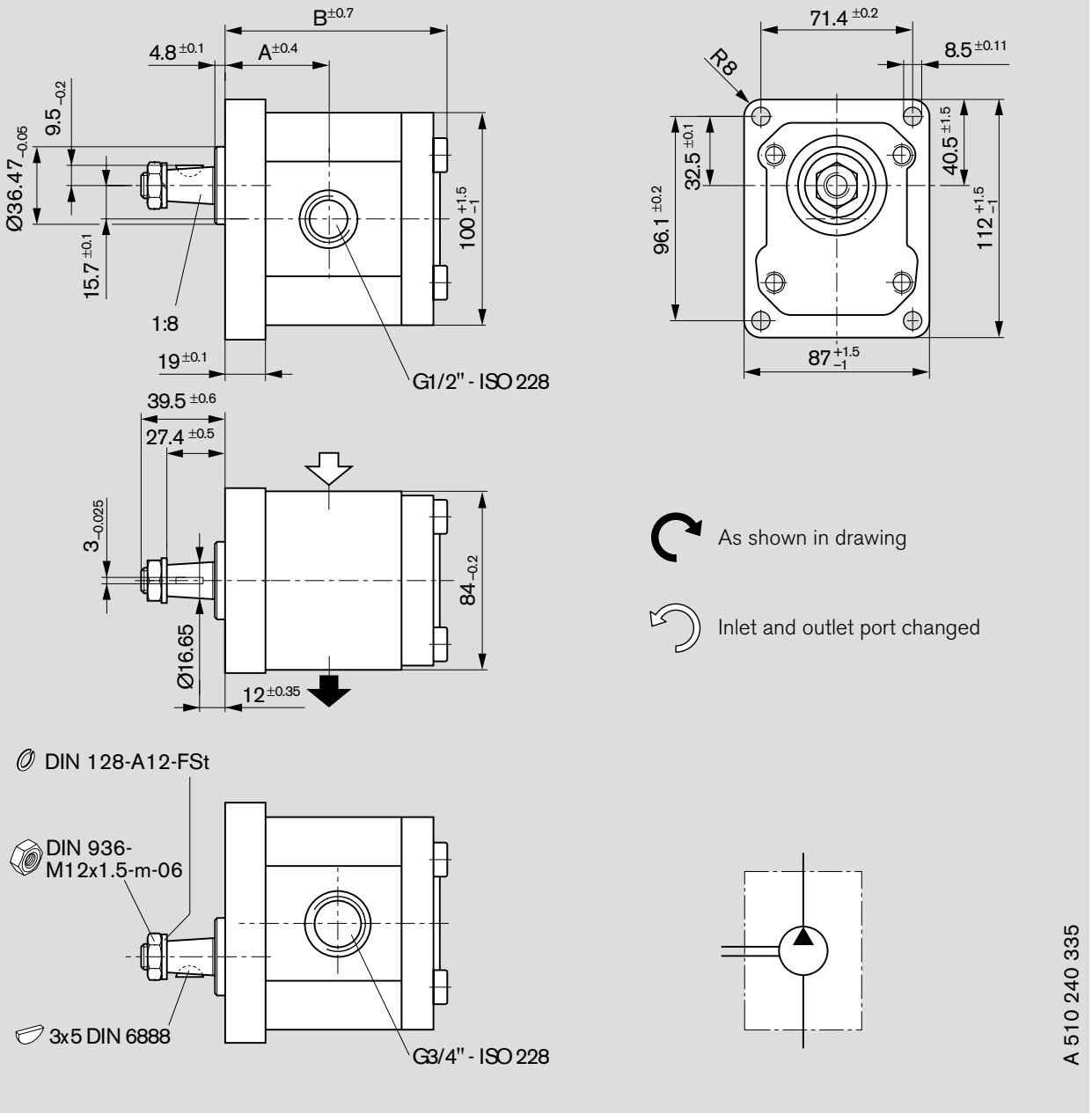
Ordering code

AZPF – 10 – ☐☐☐ ☐ F O 30 M B
AZPF – 10 – ☐☐☐ ☐ F O 30 P B*
AZPF – 21 – ☐☐☐ ☐ F O 30 P B**

Displacement [cm³/rev]	Ordering No. L	Ordering No. R	kg	Dimension [mm] A	B	C	D	E
8	**0 510 425 315**	**0 510 425 021**	3.3	44.7	93.1	13.5	30.2	M6, depth 13
11	**0 510 525 323**	**0 510 525 024**	3.4	48.5	98.1	20.0	39.7	M8, depth 13
11	**0 510 525 331***		3.3	48.5	98.1	20.0	39.7	
14		**0 510 525 034***	3.4	49.0	103.1	20.0	39.7	
16	**0 510 625 327***	**0 510 625 039***	3.5	49.0	106.5	20.0	39.7	
19		**0 510 625 049***	3.7	49.0	111.5	20.0	39.7	
19	**0 510 625 332****		4.0	59.9	123.5	20.0	39.7	
22.5	**0 510 725 348****	**0 510 725 076****	4.2	62.6	127.8	20.0	39.7	

Notes:

1. Refer to page 16 for performance specifications by displacement size.
2. Contact factory for availability of units with no ordering number listed.



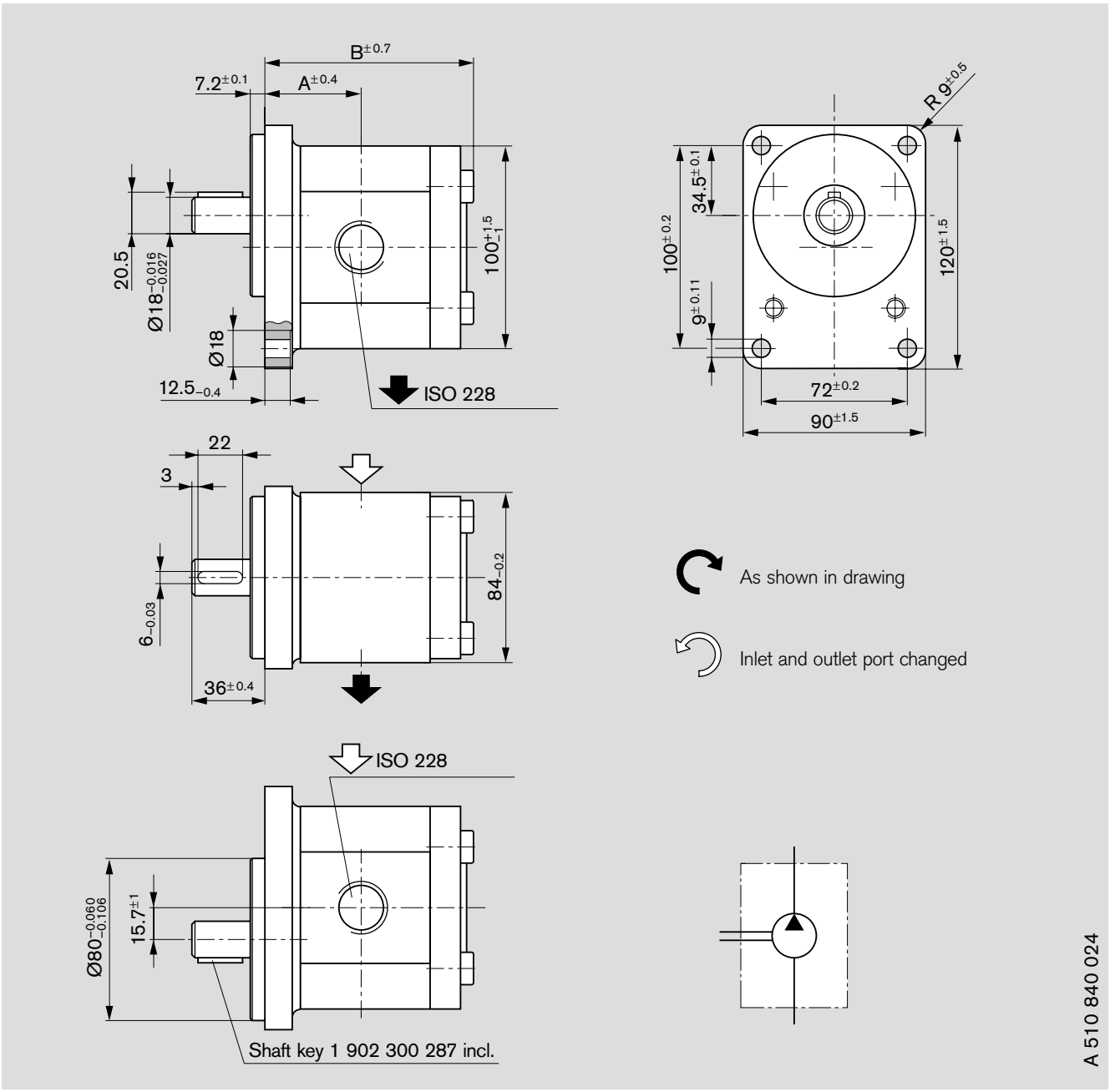
Ordering code

AZPF – 10 – ☐☐☐ ☐ H O 01 M B

Displacement [cm³/rev]	Ordering No. L	Ordering No. R	kg	Dimension [mm] A	B	G
4						ISO 228
5.5		**0 510 325 018**	3.1	42.6	89.0	depth 16
8		**0 510 425 027**	3.15	44.7	93.1	
11		**0 510 525 039**	3.3	48.5	98.1	
14		**0 510 525 040**	3.4	49.0	103.1	
16		**0 510 625 047**	3.58	49.0	106.5	
19		**0 510 625 052**	3.6	49.0	111.5	
22.5		**0 510 725 084**	3.8	56.6	116.4	

Notes:

1. Refer to page 16 for performance specifications by displacement size.
2. Contact factory for availability of units with no ordering number listed.



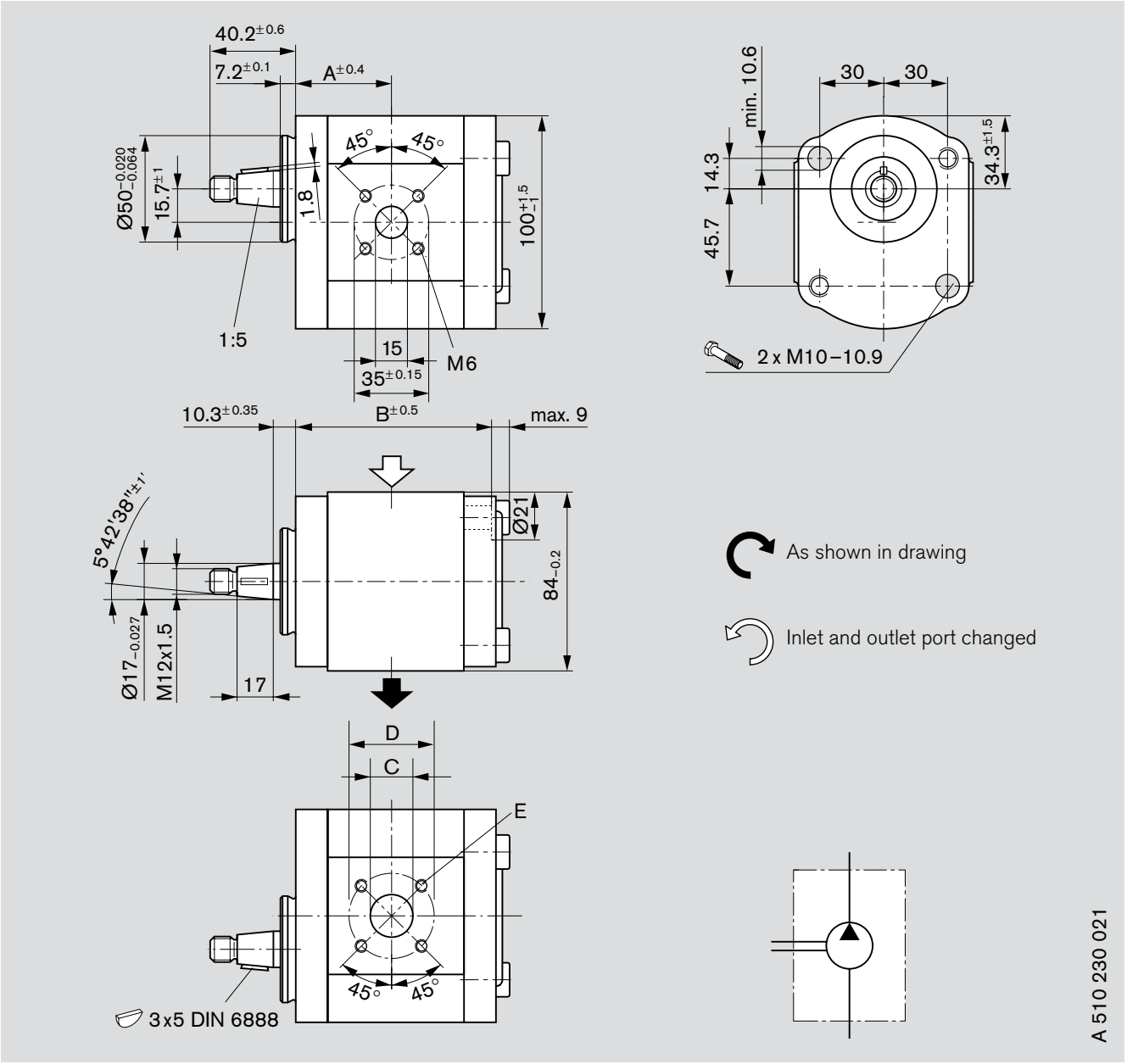
Ordering code

AZPF – 11 – ☐☐☐ ☐ A B 01 M B

Displacement [cm³/rev]	Ordering No. L	Ordering No. R	kg	Dimension [mm] A	B	G
4	**0 510 225 318**	**0 510 225 023**	3.3	39.9	84.3	G 1/2 – ISO 228
5.5	**0 510 325 321**	**0 510 325 026**	3.3	41.1	85.2	depth 16
8	**0 510 425 335**	**0 510 425 044**	3.4	43.2	89.3	
11	**0 510 525 376**	**0 510 525 076**	3.6	45.6	94.3	G 3/4 – ISO 228
14						depth 16
16	**0 510 625 382**	**0 510 625 077**	3.8	49.9	102.7	
19						
22.5	**0 510 725 418**	**0 510 725 120**	4.1	55.1	114.7	

Notes:

1. Refer to page 16 for performance specifications by displacement size.
2. Contact factory for availability of units with no ordering number listed.



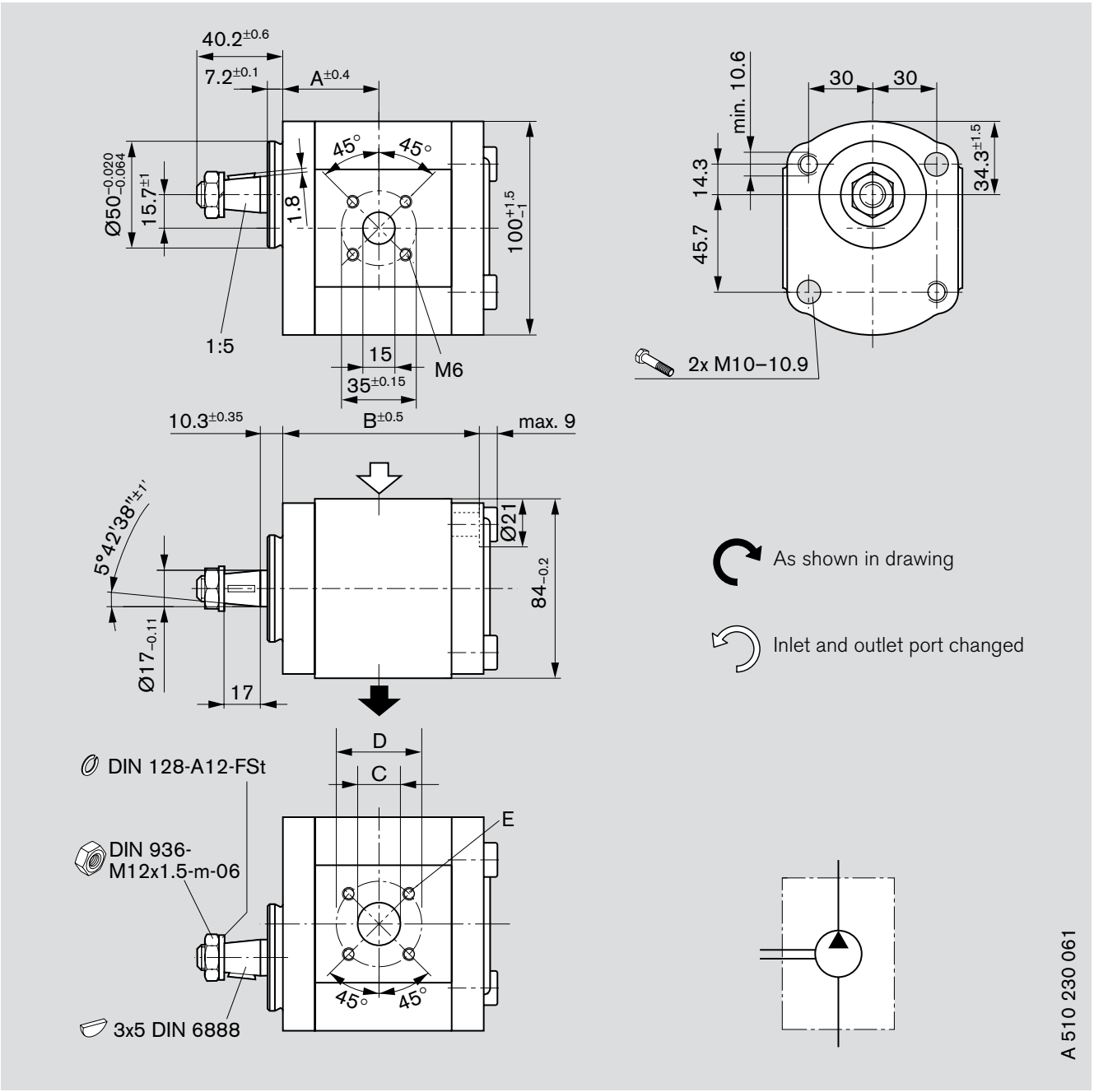
Ordering code

AZPF – 1X – ☐☐☐ ☐ **C P 20 M B**
AZPF – 1X – ☐☐☐ ☐ **C P 20 K B***
AZPF – 1X – ☐☐☐ ☐ **C P 20 P B****

Displacement [cm³/rev]	Ordering No. L	Ordering No. R	kg	Dimension [mm] A	B	C	D	E
4	**0 510 215 009***	**0 510 215 309***	2.5	37.7	73.7	15	40	M6 depth 13
5.5	**0 510 315 307**	**0 510 315 006***	2.65	38.6	76.2	15	40	
8	**0 510 415 316***		2.7	40.6	80.3	20	40	
11	**0 510 515 309***	**0 510 515 007***	2.75	44.5	85.5	20	40	
14	**0 510 515 316***	**0 510 515 018***	3.1	45.0	90.3	20	40	
16	**0 510 515 317****	**0 510 615 010***	2.9	45.0	93.7	20	40	
19	**0 510 615 318***	**0 510 615 005***	3.2	45.0	98.7	20	40	
22.5	**0 510 715 306***		3.3	52.5	104.1	20	40	

Notes:

1. Refer to page 16 for performance specifications by displacement size.
2. Contact factory for availability of units with no ordering number listed.



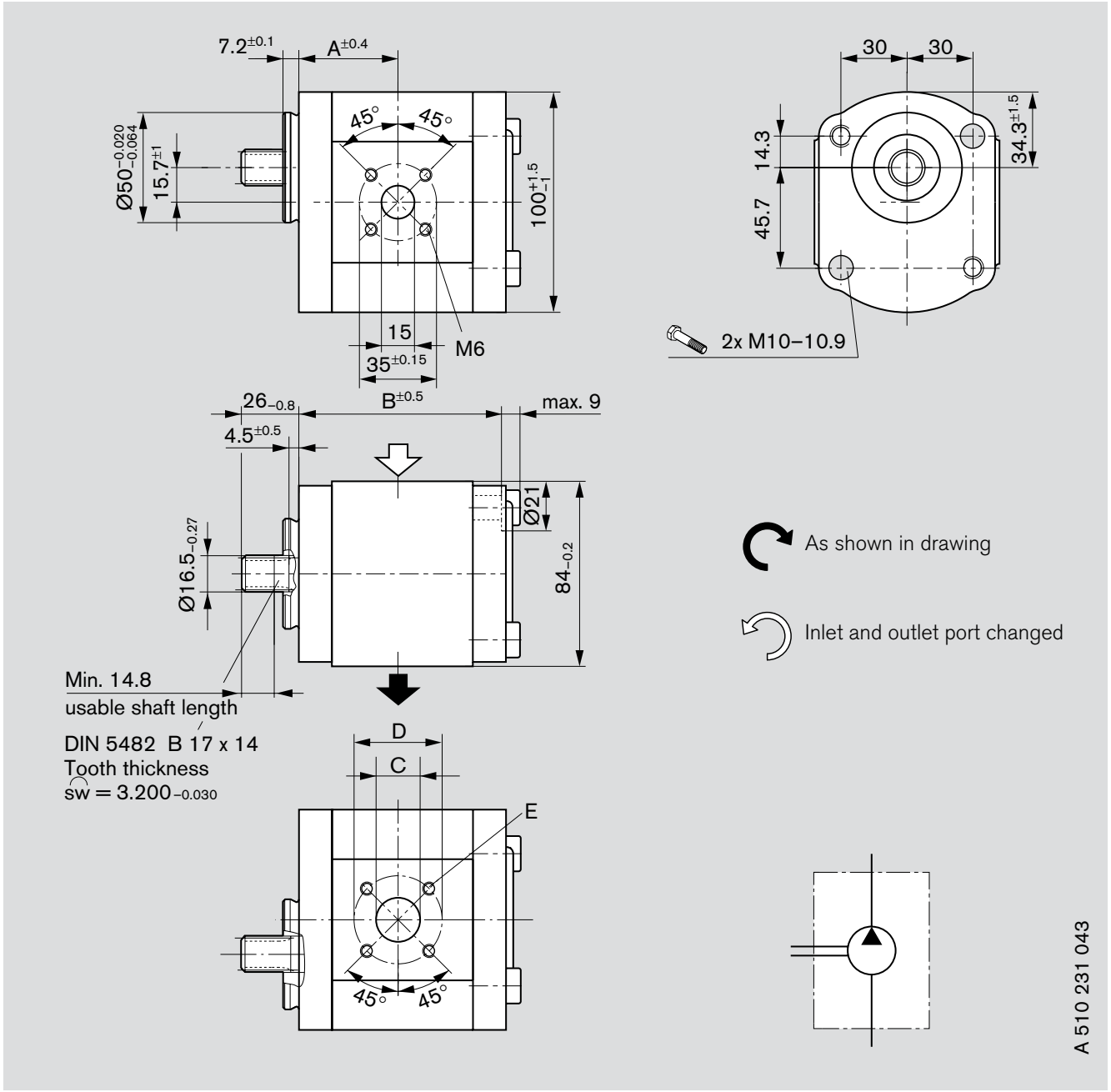
Ordering code

AZPF – 1X – ☐ ☐ ☐ ☐ C N 20 M B

Displacement [cm³/rev]	Ordering No. L	Ordering No. R	kg	Dimension [mm] A	B	C	D	E
4	**0 510 215 306**	**0 510 215 006**	2.6	37.4	73.7	15	40	M6
5.5	**0 510 315 304**	**0 510 315 004**	2.6	38.6	76.2	15	40	depth 13
8	**0 510 415 313**	**0 510 415 005**	2.8	40.7	80.3	20	40	
11	**0 510 515 310**	**0 510 515 004**	2.9	44.5	85.3	20	40	
14		**0 510 515 015**	3.0	45.0	90.3	20	40	
16	**0 510 615 314**	**0 510 615 006**	3.1	45.0	93.7	20	40	
19	**0 510 615 341**		3.2	45.0	98.7	20	40	

Notes:

1. Refer to page 16 for performance specifications by displacement size.
2. Contact factory for availability of units with no ordering number listed.



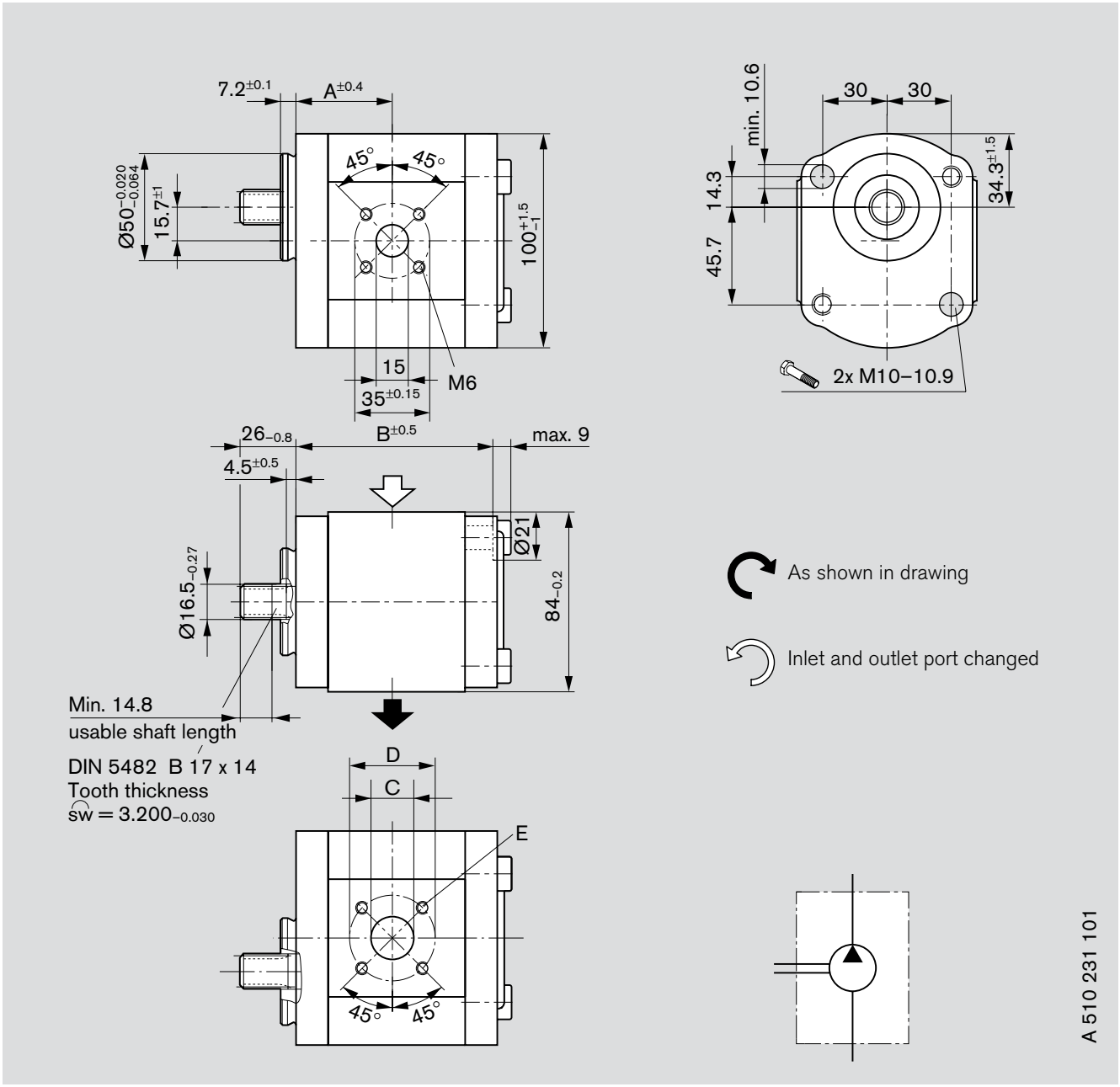
Ordering code

AZPF – 1X – ☐☐☐ ☐ **F N 20 M B**

Displacement [cm³/rev]	Ordering No. L	Ordering No. R	kg	Dimension [mm] A	B	C	D	E
5.5		**0 510 315 007**	2.55	38.6	76.2	15	40	M6 depth 13
8								
11		**0 510 515 011**	2.85	44.5	85.3	20	40	
14								
16								
19		**0 510 615 009**	3.2	45.0	98.7	20	40	
19								
22.5								

Notes:

1. Refer to page 16 for performance specifications by displacement size.
2. Contact factory for availability of units with no ordering number listed.

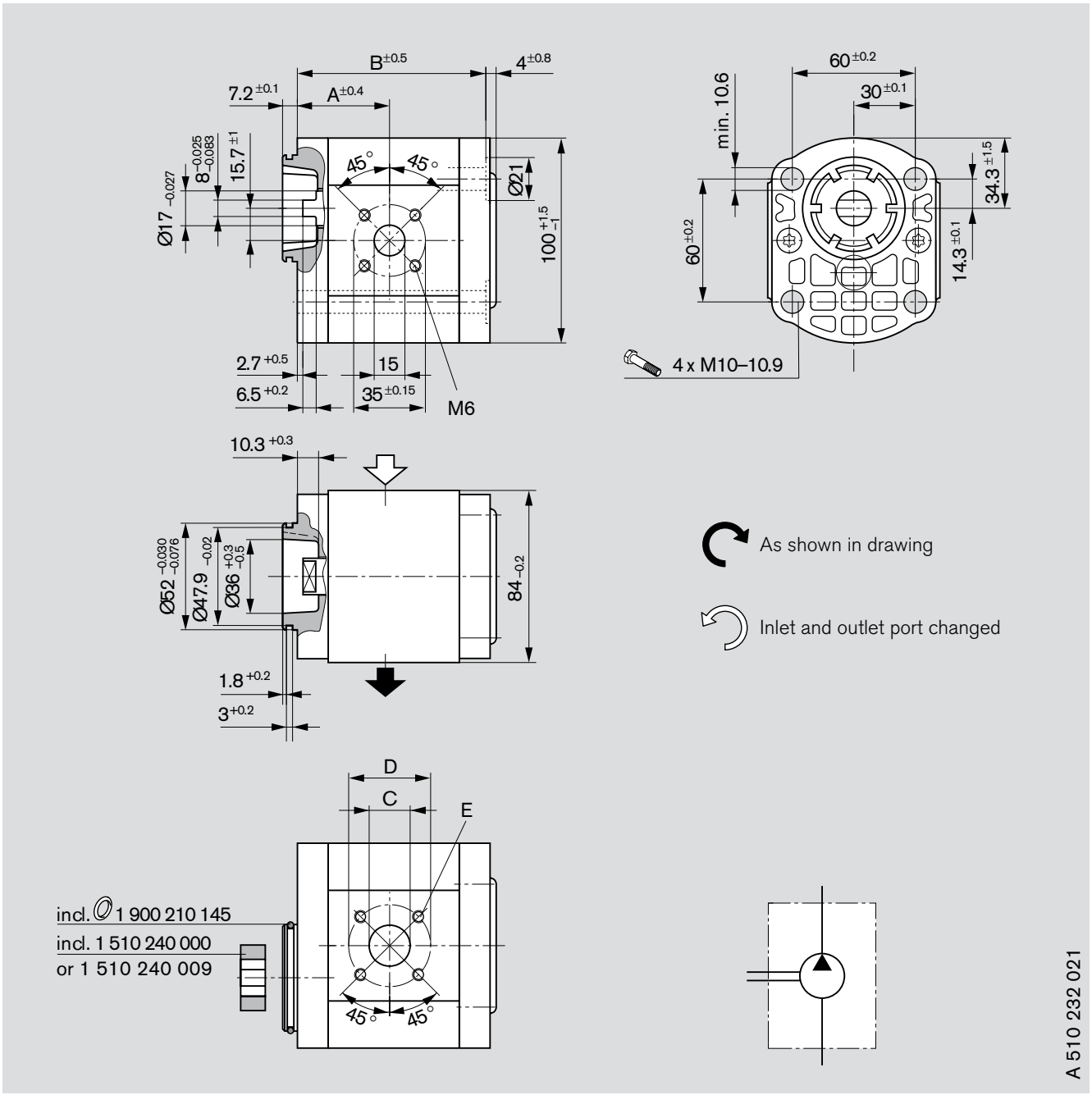


Ordering code

AZPF – 1X – ☐☐☐ ☐ **F P 20 P B**
AZPF – 22 – ☐☐☐ ☐ **F P 20 P B***
AZPF – 1X – ☐☐☐ ☐ **F P 20 P B S xxxx****

Displacement [cm³/rev]	Ordering No. L	Ordering No. R	kg	Dimension [mm] A	B	C	D	E
5.5								M6 depth 13
8	**0 510 415 328**		2.7	40.7	80.3	20	15	
11	**0 510 515 337**	**0 510 515 012**	2.8	44.5	85.3	20	15	
14	**0 510 515 338**	**0 510 515 013**	3.0	45.0	90.3	20	15	
16								
19								
22.5	**0 510 715 320****	**0 510 715 008***	3.6	58.6	116.1	20	15	

Notes:
1. Refer to page 16 for performance specifications by displacement size.
2. Contact factory for availability of units with no ordering number listed.



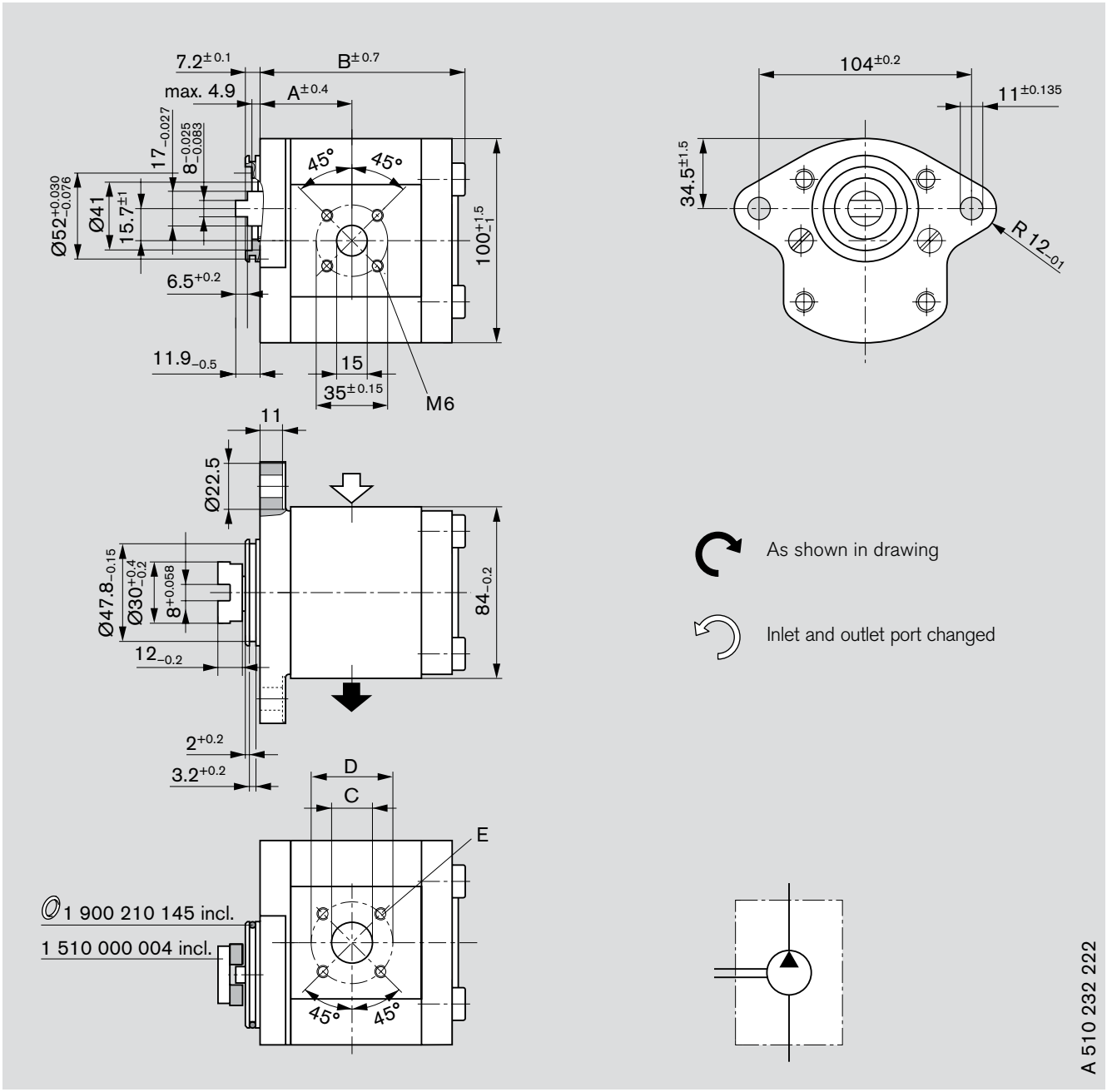
Ordering code

AZPF – 1X – ☐☐☐ ☐ N T 20 M B

Displacement [cm³/rev]	Ordering No. L	Ordering No. R	kg	Dimension [mm] A	B	C	D	E
4	**0 510 215 307**	**0 510 215 007**	2.5	37.4	73.7	15	40	M6
5.5	**0 510 315 305**	**0 510 315 005**	2.5	38.6	76.2	15	40	depth 13
8	**0 510 415 314**	**0 510 415 006**	2.5	40.7	80.3	20	40	
11	**0 510 515 311**	**0 510 515 005**	2.6	44.5	85.3	20	40	
14	**0 510 515 340**	**0 510 515 019**	2.38	45.0	90.3	20	40	
16	**0 510 615 315**	**0 510 615 007**	3.0	45.0	93.7	20	40	
19	**0 510 615 321**	**0 510 615 008**	3.0	45.0	98.7	20	40	
22.5	**0 510 715 307**	**0 510 715 004**	3.2	52.6	104.1	20	40	

Note:

1. Refer to page 16 for performance specifications by displacement size.



Ordering code

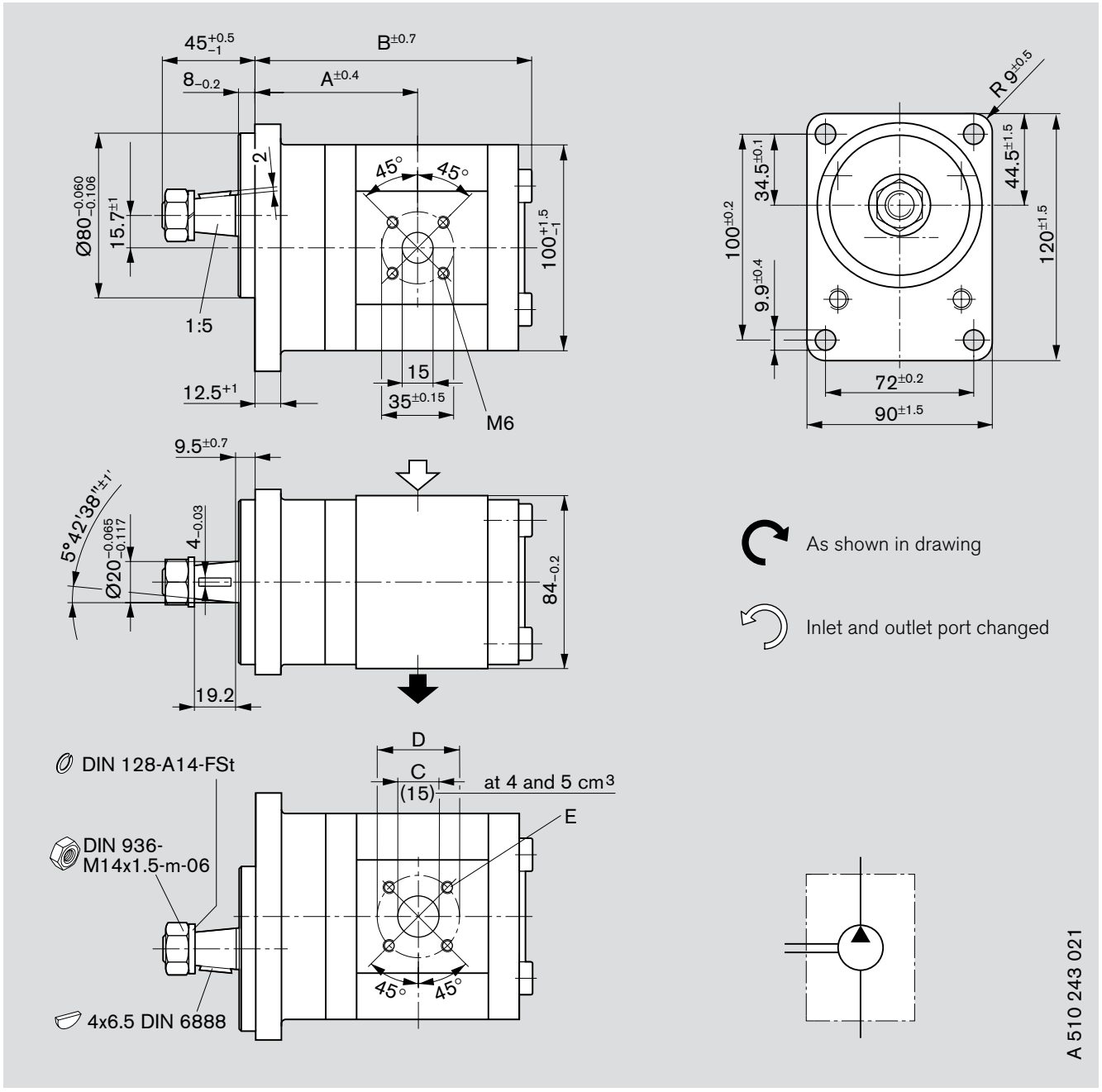
AZPF – 1X – ☐☐☐ ☐ **N L 20 K B**

AZPF – 21 – ☐☐☐ ☐ **N L 20 K B***

Displacement [cm³/rev]	Ordering No. L	Ordering No. R	kg	Dimension [mm] A	B	C	D	E
4		**0 510 225 012**	2.8	37.4	81.7	15	40	M6
5.5	**0 510 325 312**	**0 510 325 012**	2.82	38.6	84.4	15	40	depth 13
8	**0 510 425 331**	**0 510 425 019**	3.0	40.7	88.5	20	40	
11		**0 510 525 025**	3.1	44.5	93.3	20	40	
16	**0 510 625 358**	**0 510 625 027**	3.3	45.0	101.9	20	40	
19	**0 510 625 368**	**0 510 625 032**	3.5	45.0	106.9	20	40	
22.5		**0 510 725 044***	4.0	58.6	122.5	20	40	

Notes:

1. Refer to page 16 for performance specifications by displacement size.
2. Contact factory for availability of units with no ordering number listed.



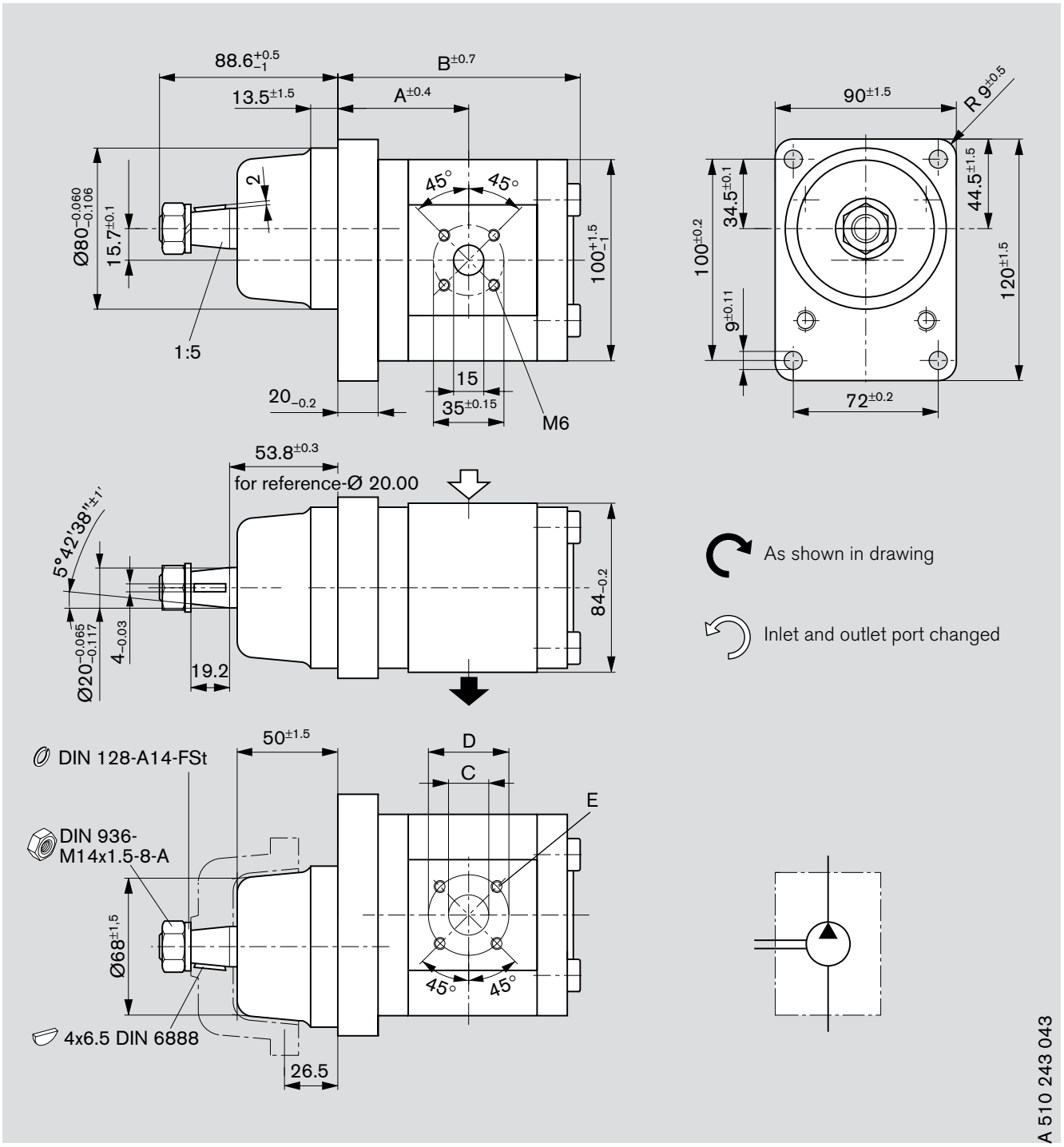
Ordering code

AZPF – 1X – ☐ ☐ ☐ ☐ S A 20 M B

Displacement [cm³/rev]	Ordering No. L	Ordering No. R	kg	Dimension [mm] A	B	C	D	E
4	**0 510 245 300**	**0 510 245 001**	3.1	71.1	114.2	15	40	M6
5.5	**0 510 345 300**	**0 510 345 001**	3.1	72.3	116.7	15	40	depth 13
8	**0 510 445 300**	**0 510 445 001**	3.3	74.4	120.8	20	40	
11	**0 510 545 300**	**0 510 545 001**	3.5	78.2	125.8	20	40	
14				78.7	130.8	20	40	
16	**0 510 645 300**	**0 510 645 004**	3.6	78.7	134.2	20	40	
19		**0 510 645 002**	3.9	78.7	139.2	20	40	
22.5				92.3	156.6	20	40	

Notes:

1. Refer to page 16 for performance specifications by displacement size.
2. Contact factory for availability of units with no ordering number listed.



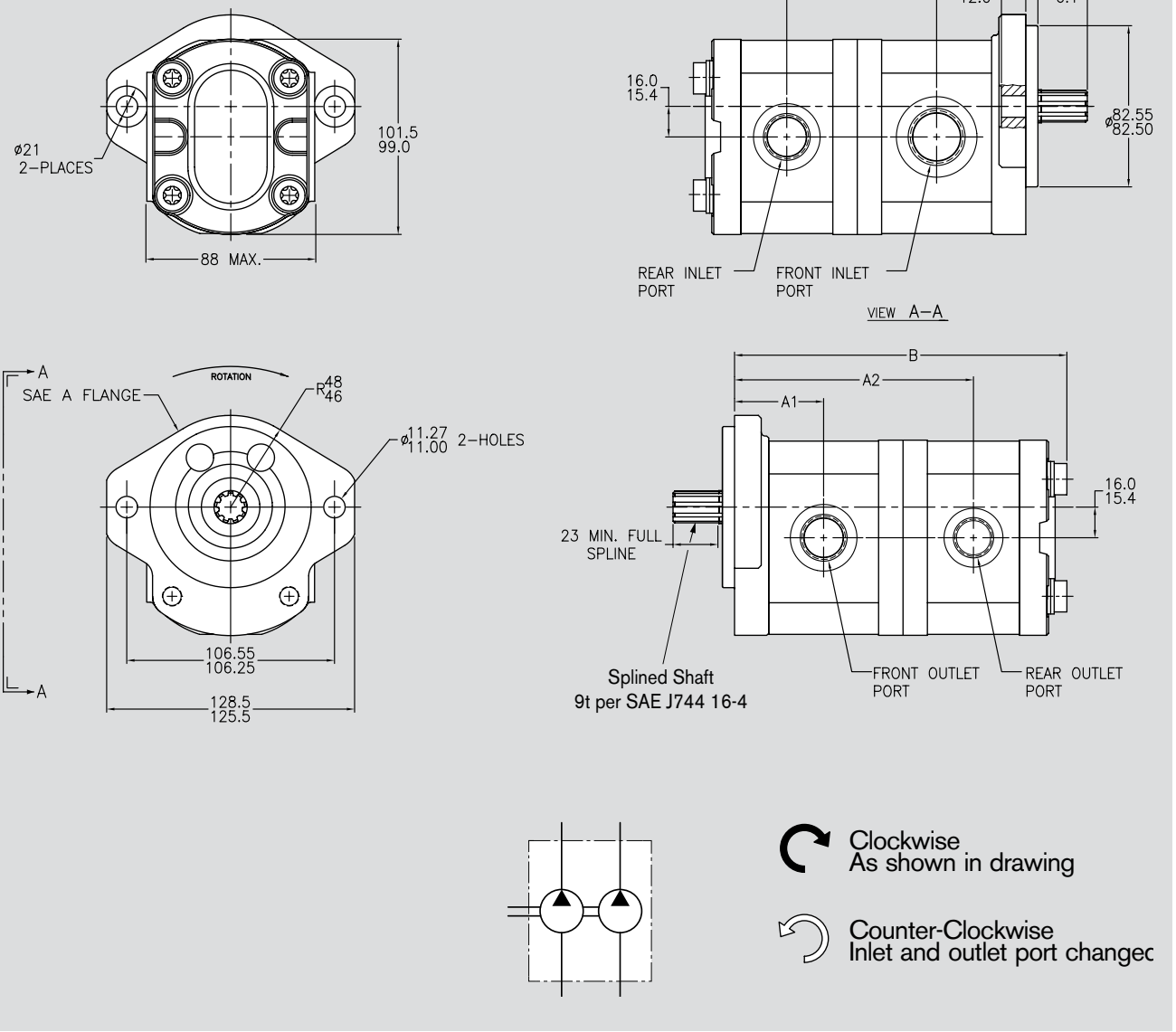
Ordering code

AZPF – 1X – ☐☐☐ ☐ S G 20 M B

Displacement [cm³/rev]	Ordering No. L	Ordering No. R	kg	Dimension [mm] A	B	C	D	E
11		**0 510 545 003**	3.8	64.5	113.8	20	40	M6
14	**0 510 545 302**	**0 510 545 002**	4.0	65.0	118.8	20	40	depth 13
16		**0 510 645 005**	4.1	65.0	122.0	20	40	
19		**0 510 645 003**	4.3	65.0	127.0	20	40	

Notes:

1. Refer to page 16 for performance specifications by displacement size.
2. Contact factory for availability of units with no ordering number listed.



Ordering code

AZPFF – 12 – ☐☐☐ - ☐☐☐ ☐ RR1212MB
AZPFF – 12 – ☐☐☐ - ☐☐☐ ☐ RR1212MB-S0040*
AZPFF – 12 – ☐☐☐ - ☐☐☐ ☐ RR1212KB**

Ordering code

AZPFF – 12 – ☐☐☐ - ☐☐☐ ☐ RR1212MB
AZPFF – 12 – ☐☐☐ - ☐☐☐ ☐ RR1212MB-S0040*
AZPFF – 12 – ☐☐☐ - ☐☐☐ ☐ RR1212KB**

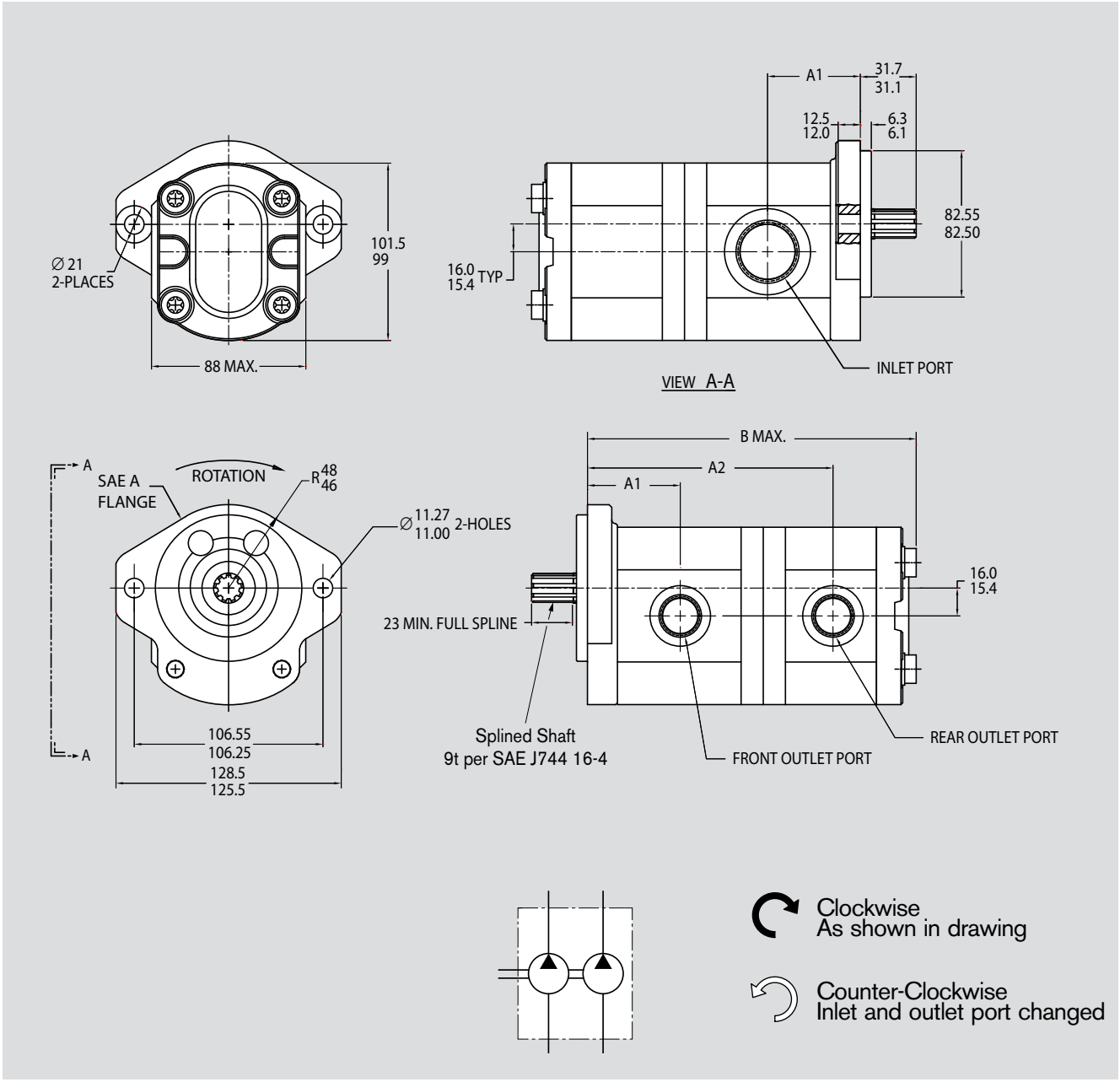
Displacement	Ordering Number		Dimension (mm)				
	↺	↻				Inlet Port	Outlet Port
(cm^3/rev)	L	R	A1	A2	B	(SAE O-Ring Boss)	(SAE O-Ring Bpss)
008 / 008		9 510 290 034	43.2	119.5	166.2	-12 / -12	-8 / -8
008 / 008		9 510 290 373**	43.2	119.6	166.2	-12 / -12	-8 / -8
011 / 005		9 510 290 142	45.7	122.4	170.9	-12 / -10	-10 / -8
011 / 005		9 510 290 374**	45.7	122.5	170.9	-12 / -10	-10 / -8
011 / 011	9 510 290 234		45.7	127.1	176.2	-12 / -12	-10 / -10
011 / 011	9 510 290 375**		45.7	127.1	176.2	-12 / -12	-10 / -10
014 / 005		9 510 290 143	48.2	127.4	175.9	-12 / -10	-10 / -8
014 / 005		9 510 290 376**	48.2	127.5	175.9	-12 / -10	-10 / -8
014 / 008		9 510 290 144	48.2	129.0	176.2	-12 / -12	-10 / -10
014 / 008		9 510 290 377**	48.2	129.6	176.2	-12 / -12	-10 / -10
014 / 014		9 510 290 402	48.2	134.5	186.2	-12 / -12	-10 / -10
016 / 014		9 510 290 203	49.9	137.6	191.5	-16 / -12	-10 / -10
016 / 014		9 510 290 378**	49.9	137.9	191.5	-16 / -12	-10 / -10
016 / 016		9 510 290 405*	49.9	138.6	193.0	-12 / -12	-10 / -10
019 / 014		9 510 290 333*	52.4	142.9	196.5	-16 / -16	-12 / -12
022 / 008		9 510 290 425	55.1	143.3	191.9	-12 / -12	-10 / -10
022 / 011		9 510 290 195	55.1	197.3	196.9	-12 / -12	-10 / -10
022 / 011		9 510 290 379**	55.1	147.3	196.9	-12 / -12	-10 / -10
022 / 016		9 510 290 406*	55.1	150.0	203.4	-12 / -12	-10 / -10
025 / 014		9 510 290 403*	63.2	164.5	216.2	-12 / -12	-10 / -10

Notes:

1. Refer to page 19 - "Multiple Gear Pumps" for max operating pressures and torque.
   Maximum pressure for each pump module is limited to displacement ratings as stated on page 16.
2. Contact factory for availability of units with no ordering number listed.

* Non-standard size inlet port.

** Viton shaft seal.



Ordering code

AZPFF – 12 – ☐☐☐ - ☐☐☐ ☐ RR1212MB-S0014
AZPFF – 12 – ☐☐☐ - ☐☐☐ ☐ RR1212MB-S0529*
AZPFF – 12 – ☐☐☐ - ☐☐☐ ☐ RR1212MB-S0516**

Ordering code

AZPFF – 12 – ☐☐☐ - ☐☐☐ ☐ RR1212MB-S0014
AZPFF – 12 – ☐☐☐ - ☐☐☐ ☐ RR1212MB-S0529*
AZPFF – 12 – ☐☐☐ - ☐☐☐ ☐ RR1212MB-S0516**

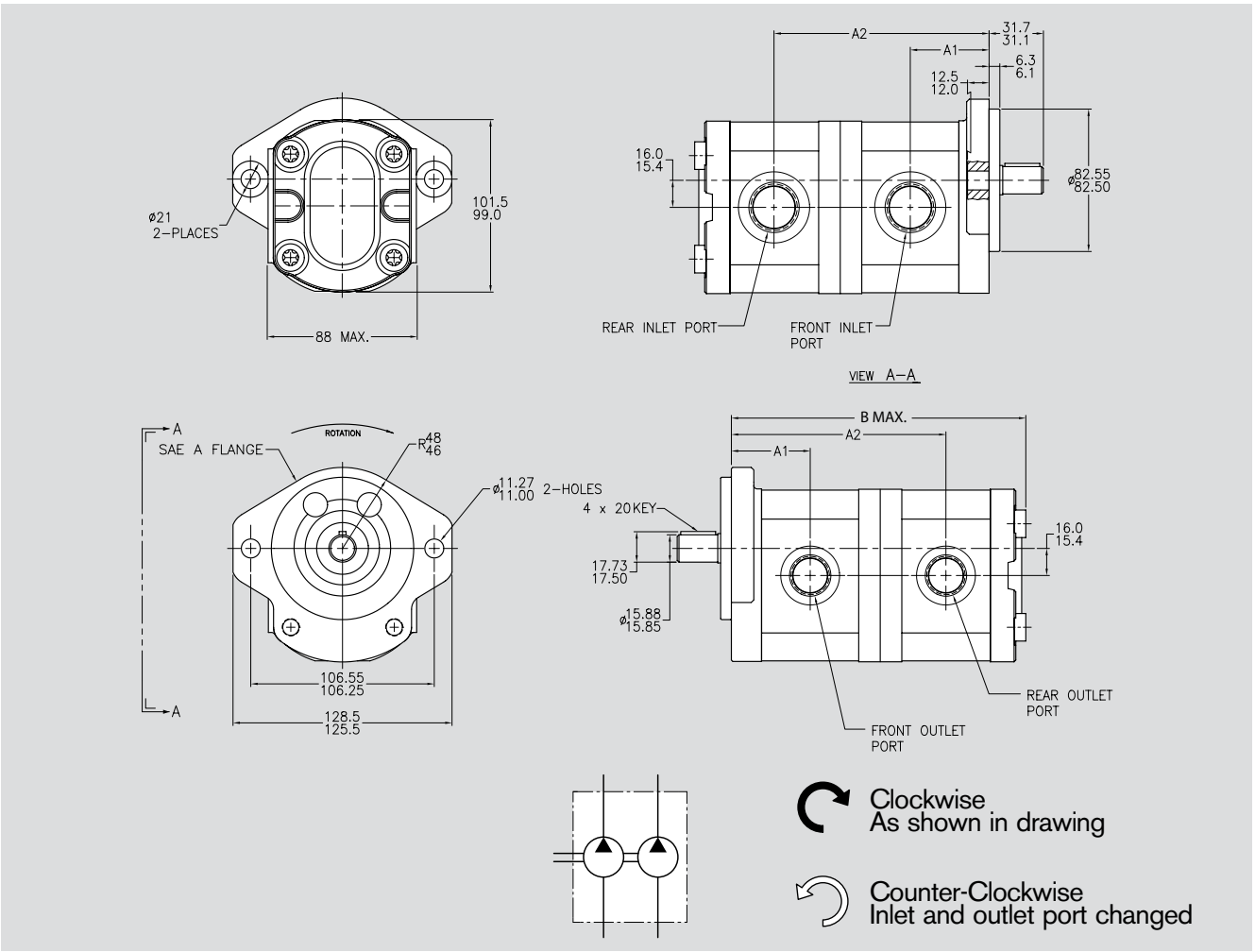
Displacement	Ordering Number		Dimension (mm)				
	↺	↻				Inlet Port	Outlet Port
(cm^3/rev)	L	R	A1	A2	B	(SAE O-Ring Boss)	(SAE O-Ring Bpss)
004 / 004		9 510 290 032**	39.3	109.6	156.8	-12	-8 / -8
004 / 004	9 510 290 415**		39.9	109.7	156.8	-12	-8 / -8
008 / 004		9 510 290 012	43.2	116.2	161.5	-12	-10 / -8
008 / 004		9 510 290 031*	43.3	116.3	161.5	-12	-8 / -8
008 / 008		9 510 290 440*	43.2	119.6	166.2	-12	-8 / -8
011 / 004		9 510 290 013	45.7	121.2	166.5	-12	-10 / -8
011 / 008		9 510 290 054	45.7	124.6	171.2	-12	-10 / -10
011 / 008	9 510 290 073**		45.7	124.6	171.2	-16	-10 / -10
011 / 011		9 510 290 145**	45.7	127.1	176.3	-16	-10 / -10
014 / 004		9 510 290 109	48.2	126.2	171.5	-12	-10 / -8
014 / 005		9 510 290 407	48.2	127.5	175.9	-12	-10 / -8
014 / 008		9 510 290 147**	48.2	129.6	176.2	-16	-10 / -10
014 / 014		9 510 290 146**	48.2	133.6	186.2	-16	-10 / -10
016 / 004		9 510 290 014	49.9	129.6	173.0	-16	-10 / -8
016 / 008		9 510 290 055	49.9	133.0	181.5	-16	-10 / -10
016 / 014		9 510 290 202	49.9	137.9	191.5	-16	-10 / -10
019 / 008	9 510 290 008		52.4	137.9	186.5	-16	-10 / -10
019 / 008		9 510 290 201	52.4	137.9	186.5	-16	-10 / -10
019 / 014		9 510 290 074	52.4	143.0	196.5	-16	-10 / -10
022 / 004		9 510 290 002	55.1	140.1	183.4	-16	-10 / -8
022 / 011		9 510 290 473	55.1	145.9	196.9	-16	-10 / -10

Notes:

1. Refer to page 19 - "Multiple Gear Pumps" for max operating pressures and torque.
   Maximum pressure for each pump module is limited to displacement ratings as stated on page 16.
2. Contact factory for availability of units with no ordering number listed.
3. Contact factory to confirm sufficient flow through inlet port. Provide working pressure for both pump modules and speed.

* Non-standard size outlet port.

** Common inlet port, size is non-standard.



Ordering code

AZPFF – 12 – ☐☐☐ - ☐☐☐ ☐ QR1212MB

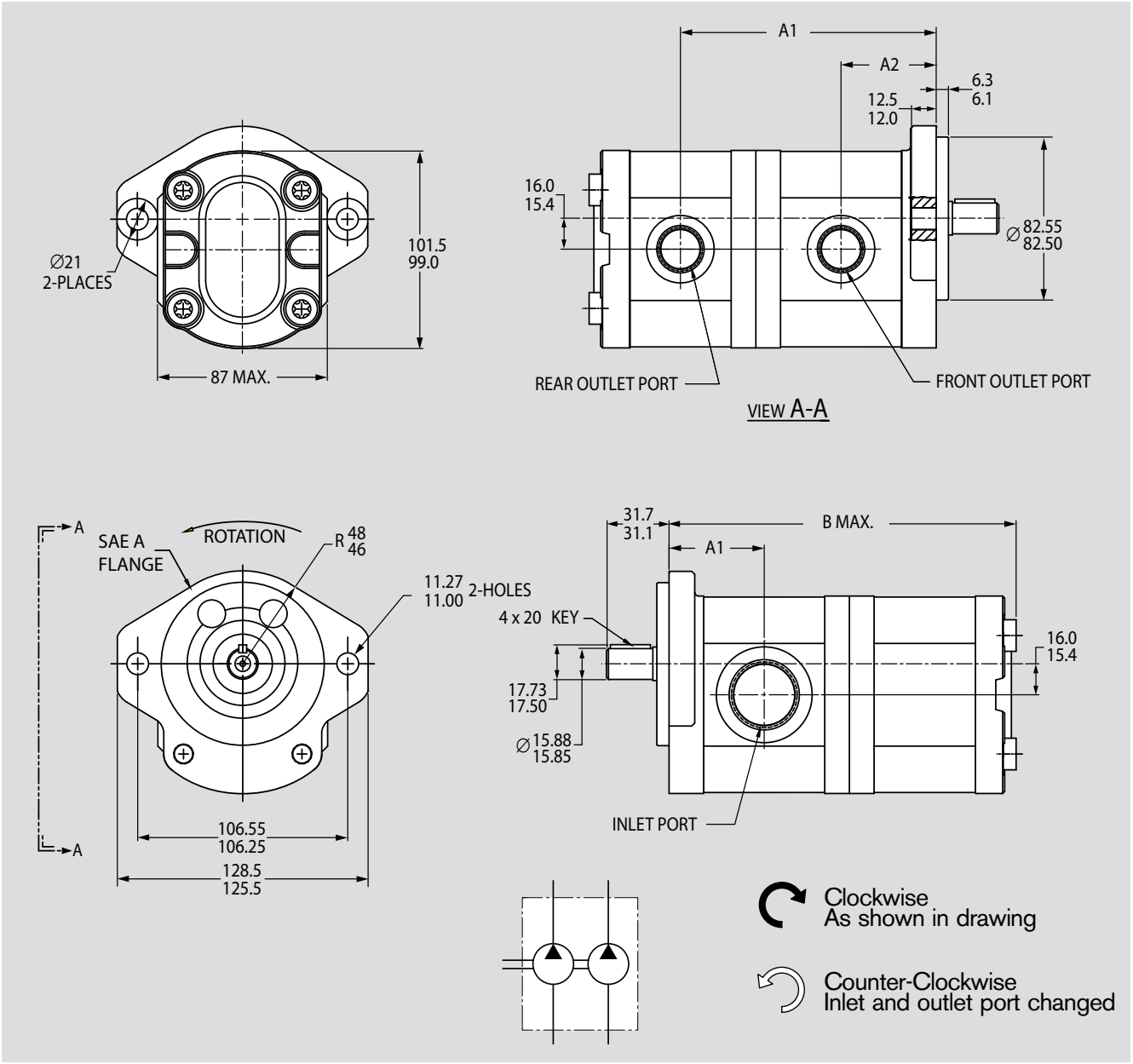
AZPFF – 12 – ☐☐☐ - ☐☐☐ ☐ QR1212PB*

Displacement	Ordering Number		Dimension (mm)				
	L	R				Inlet Port (SAE O-Ring Boss)	Outlet Port (SAE O-Ring Bpss)
(cm^3/rev)			A1	A2	B		
005 / 005		9 510 290 232	41.1	113.3	161.8	-10 / -10	-8 / -8
005 / 005	9 510 290 412		41.1	113.4	161.8	-10 / -10	-8 / -8
008 / 004		9 510 290 138	43.2	155.0	161.5	-12 / -10	-10 / -8
008 / 008		9 510 290 137	45.7	155.0	166.2	-12 / -12	-10 / -10
011 / 004		9 510 290 139	45.7	121.3	164.6	-12 / -10	-10 / -8
011 / 005		9 510 290 140	45.7	122.5	170.9	-12 / -10	-10 / -8
011 / 008		9 510 290 141	45.7	124.6	171.2	-12 / -12	-10 / -10
014 / 004		9 510 290 411*	48.2	126.2	171.5	-12 / -10	-10 / -8
014 / 005		9 510 290 052	48.2	127.4	175.9	-12 / -10	-10 / -8
014 / 011		9 510 290 229	48.2	124.6	183.1	-12 / -12	-10 / -10
016 / 004		9 510 290 206	49.9	129.6	173.0	-16 / -10	-10 / -8
025 / 005		9 510 290 216	63.2	157.4	204.0	-16 / -10	-10 / -8

Notes:

1. Refer to page 19 - "Multiple Gear Pumps" for max operating pressures and torque.
   Maximum pressure for each pump module is limited to displacement ratings as stated on page 16.
2. Contact factory for availability of units with no ordering number listed.

* All seals are Viton.



Ordering code

AZPFF – 12 – ☐☐☐ - ☐☐☐ ☐ QR1212MB-S0014

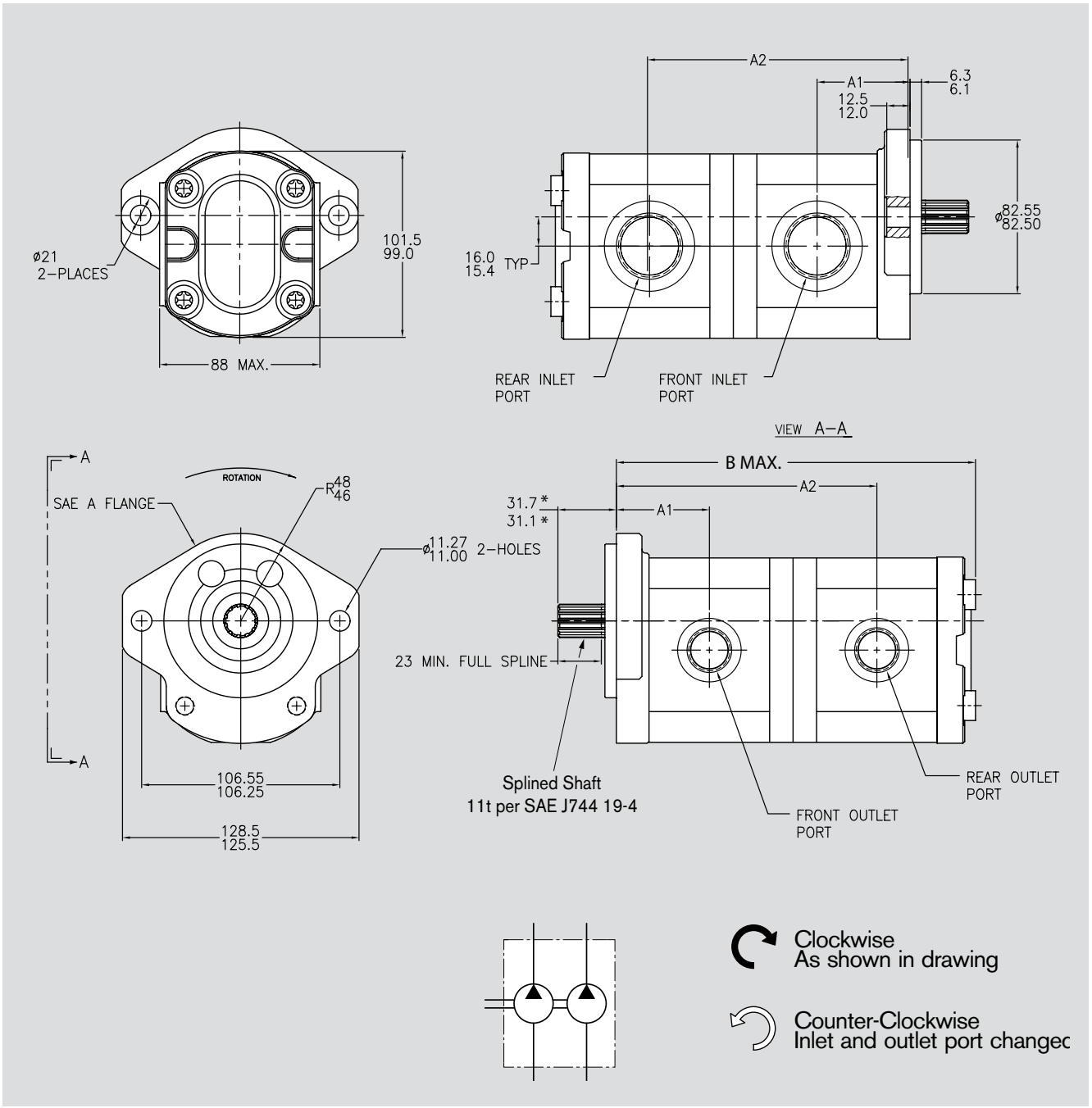
AZPFF – 12 – ☐☐☐ - ☐☐☐ ☐ QR1212MB-S0516*

Displacement	Ordering Number*		Dimension (mm)				
	↺	↻				Inlet Port	Outlet Port
(cm^3/rev)	L	R	A1	A2	B	(SAE O-Ring Boss)	(SAE O-Ring Bpss)
005 / 005		9 510 290 219	41.1	113.4	161.8	-10	-8 / -8
008 / 008		9 510 290 192	43.2	119.5	166.2	-12	-10 / -10
011 / 011		9 510 290 053*	45.6	127.0	175.3	-16	-10 / -10
014 / 008	9 510 290 217*		48.2	129.5	176.2	-16	-10 / -10
016 / 008		9 510 290 395	49.9	133.0	181.5	-16	-10 / -10

Notes:

1. Refer to page 19 - "Multiple Gear Pumps" for max operating pressures and torque.
   Maximum pressure for each pump module is limited to displacement ratings as stated on page 16.
2. Contact factory for availability of units with no ordering number listed.
3. Contact factory to confirm sufficient flow through inlet port. Provide working pressure for both pump modules and speed.

* Common inlet port, size is non-standard.



Ordering code

AZPFF – 12 – ☐☐☐ - ☐☐☐ ☐ **PR1212MB**

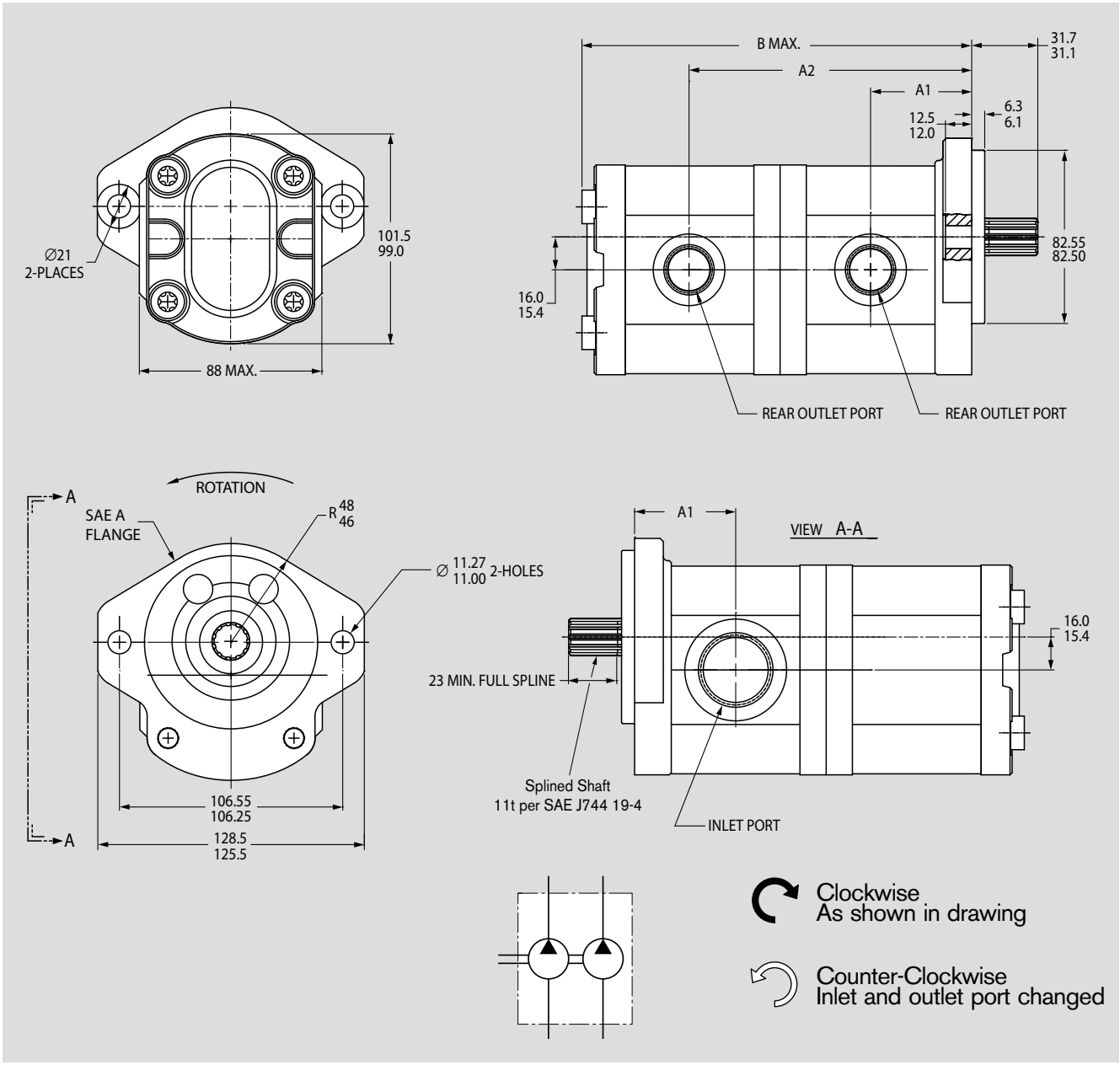
AZPFF – 22 – ☐☐☐ - ☐☐☐ ☐ **PR1212MB***

Displacement	Ordering Number		Dimension (mm)				
	↺	↻				Inlet Port	Outlet Port
(cm^3/rev)	L	R	A1	A2	B	(SAE O-Ring Boss)	(SAE O-Ring Bpss)
016 / 016		9 510 290 108	49.9	139.6	193.0	-16 / -16	-10 / -10
022 / 016		9 510 290 408	55.1	150.0	203.4	-16 / -16	-10 / -10
028 / 016		9 510 290 409*	65.6	171.0	226.3	-16 / -16	-10 / -10

Notes:

1. Refer to page 19 - "Multiple Gear Pumps" for max operating pressures and torque.
   Maximum pressure for each pump module is limited to displacement ratings as stated on page 16.
2. Contact factory for availability of units with no ordering number listed.

* Shaft dimension for 9510290409 is 37.2 – 38.2 mm.



Ordering code

AZPFF – 22 – ☐☐☐ - ☐☐☐ ☐ PR1212MB-S0014
AZPFF – 22 – ☐☐☐ - ☐☐☐ ☐ PR1212MB-S0516*
AZPFF – 12 – ☐☐☐ - ☐☐☐ ☐ PR1212MB-S0516**

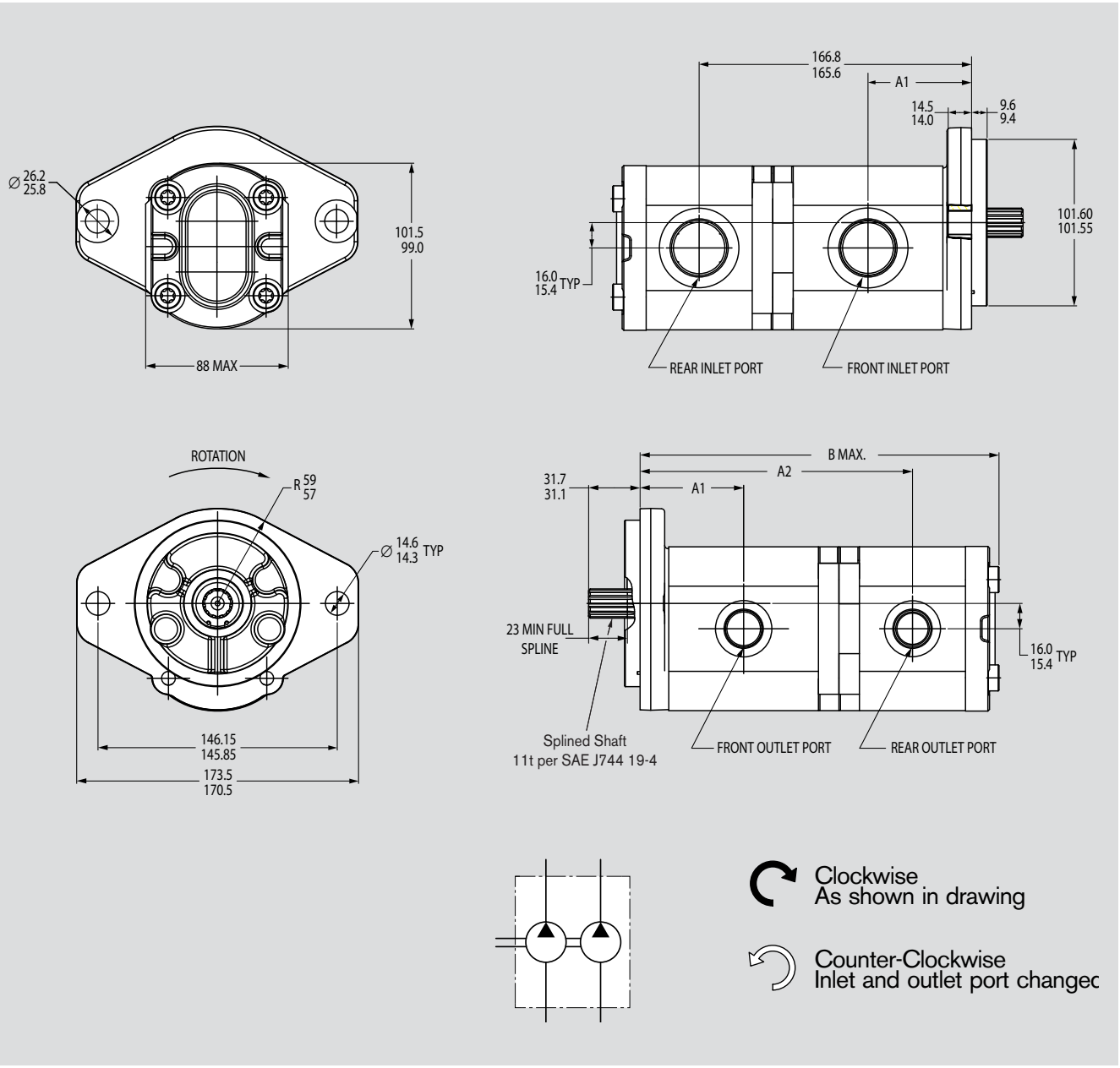
Displacement	Ordering Number		Dimension (mm)				
						Inlet Port	Outlet Port
(cm^3/rev)	L	R	A1	A2	B	(SAE O-Ring Boss)	(SAE O-Ring Bpss)
014 / 005	9 510 290 434*		48.2	126.4	172.1	-16	-10 / -8
014 / 014	9 510 290 258		48.2	133.6	186.2	-16	-10 / -10
022 / 004		9 510 290 430	61.1	152.1	197.3	-16	-10 / -8

Notes:

1. Refer to page 19 - "Multiple Gear Pumps" for max operating pressures and torque.
   Maximum pressure for each pump module is limited to displacement ratings as stated on page 16.
2. Contact factory for availability of units with no ordering number listed.
3. Contact factory to confirm sufficient flow through inlet port. Provide working pressure for both pump modules and speed.

* Common inlet port, size is non-standard -22 design.

** Common inlet port, size is non-standard -12 design.



Ordering code

AZPFF – 12 – ☐☐☐ - ☐☐☐ ☐ PC1212MB

AZPFF – 22 – ☐☐☐ - ☐☐☐ ☐ PC1212MB*

Displacement	Ordering Number		Dimension (mm)				
	L	R	A1	A2	B	Inlet Port (SAE O-Ring Boss)	Outlet Port (SAE O-Ring Bpss)
(cm^3/rev)							
016 / 016		9 510 290 398	50.0	140.0	193.0	-16 / -16	-10 / -10
025 / 016		9 510 290 399*	63.0	166.0	219.6	-16 / -16	-10 / -10

Notes:

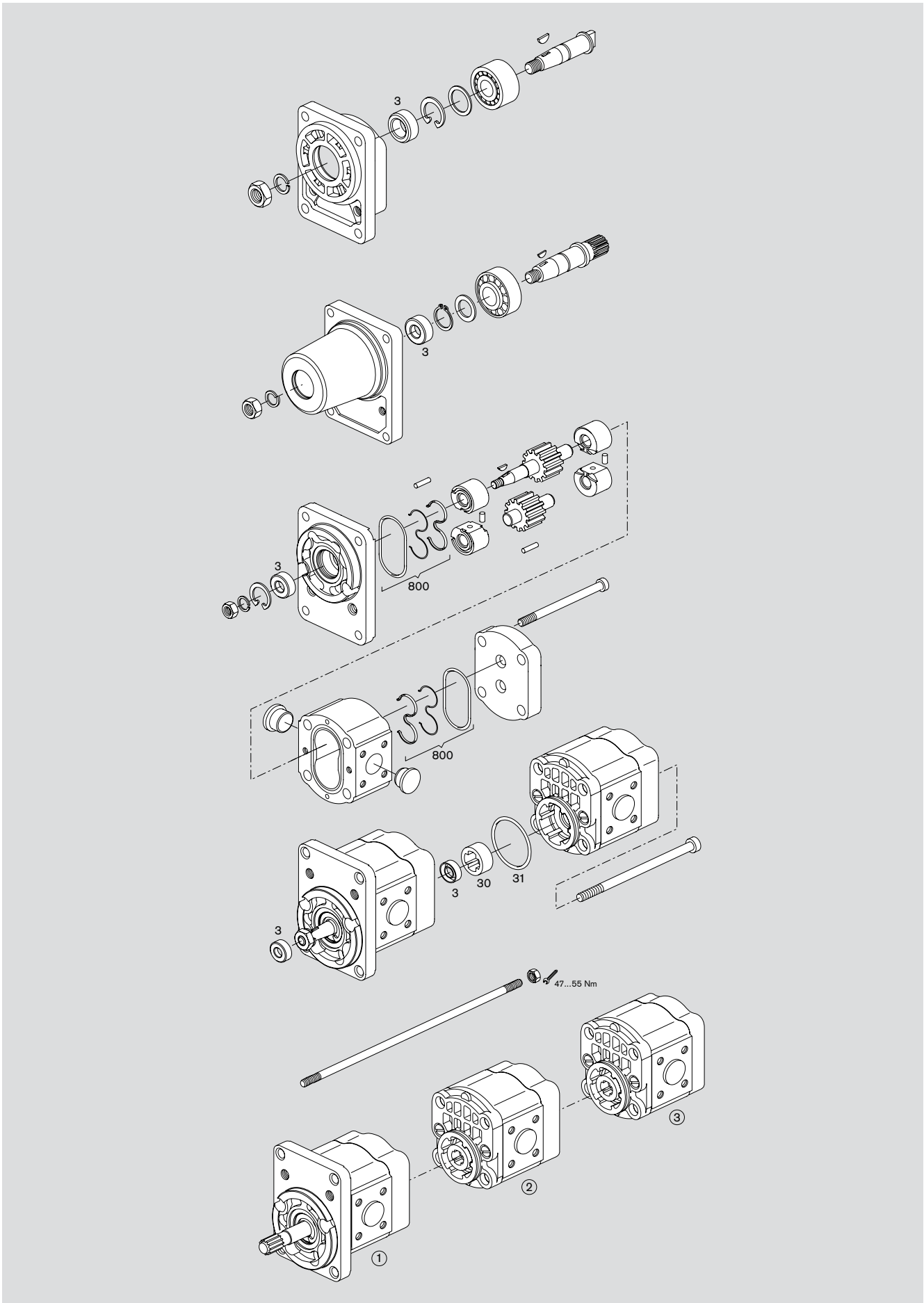
1. Refer to page 19 - "Multiple Gear Pumps" for max operating pressures and torque.
   Maximum pressure for each pump module is limited to displacement ratings as stated on page 16.
2. Contact factory for availability of units with no ordering number listed.

Service parts

Pg.	Ordering code	Seal Pos. 800 and Pos. 3	Seal kit Pos. 800 1 517 010 ...	Shaft seal ring Pos. 3 1 510 283 ...	Shaft Seal Material	Shaft Seal Dimension	Seal ring Pos. 31 1 900 210 ...	Material	Dimension
20	AZPF – 12 – □□□□ RR12**MB**	R98640006P	152 NBR	035	NBR	17x30x7			
	AZPF – 22 – □□□□ RR12**MB**	R98640006P	152 NBR	035	FPM	17x30x7			
21	AZPF – 12 – □□□□ RR12**MA**	R98640006P	152 NBR	035	NBR	17x30x7			
22	AZPF – 12 – □□□□ QR12**MB**	R98640006P	152 NBR	035	NBR	17x30x7			
	AZPF – 22 – □□□□ QR12**MB**	n/a	152 NBR	035	NBR	17x30x7			
23	AZPF – 12 – □□□□ QR12**MA**	R98640006P	152 NBR	035	NBR	17x30x7			
24	AZPF – 22 – □□□□ PR12**MB**	n/a	152 NBR	009	NBR	17x30x7			
25	AZPF – 12 – □□□□ QR12**MB** – S0022	R98640006P	152 NBR	035	NBR	17x30x7			
26	AZPF – 12 – □□□□ QR12**MA** – S0022	R98640006P	152 NBR	035	NBR	17x30x7			
27	AZPF – 22 – □□□□ PC12**CB**	n/a	152 NBR	009	NBR	20x40x7			
28	AZPF – 12 – □□□□ RR20MB	R98640006P	152 NBR	035	NBR	17x30x7			
	AZPF – 12 – □□□□ RR20KB	n/a	152 NBR	065	FPM	17x30x7			
29	AZPF – 1X – □□□□ QR20**MB**	R98640006P	152 NBR	035	NBR	17x30x7			
30	AZPF – 1X – □□□□ CB20**MB**	R98640006P	152 NBR	035	NBR	17x30x7			
31	AZPF – 1X – □□□□ FB20**MB**	R98640006P	152 NBR	035	NBR	17x30x7			
32	AZPF – 1X – □□□□ HO30KB	––	152 NBR	044	FPM	18x30x7			
	AZPF – 2X – □□□□ HO30KB	––	152 NBR	044	FPM	18x30x7			
33	AZPF – 1X – □□□□ FO30MB	R98640006P	152 NBR	035	NBR	17x30x7			
	AZPF – 1X – □□□□ FO30PB	n/a	193 FPM	065	FPM	17x30x7			
	AZPF – 2X – □□□□ FO30PB	n/a	193 FPM	065	FPM	17x30x7			
34	AZPF – 1X – □□□□ HO01**MB**	R98640006P	152 NBR	035	NBR	17x30x7			
35	AZPF – 1X – □□□□ AB01**MB**	––	208 FPM	037	NBR	18x30x7			
36	AZPF – 1X – □□□□ CP20MB	R98640006P	152 NBR	035	NBR	17x30x7			
	AZPF – 1X – □□□□ CP20KB	n/a	152 NBR	065	FPM	17x30x7			
	AZPF – 1X – □□□□ CP20PB	n/a	193 FPM	065	FPM	17x30x7			
37	AZPF – 1X – □□□□ CN20**MB**	R98640006P	152 NBR	035	NBR	17x30x7			
38	AZPF – 1X – □□□□ FN20**MB**	R98640006P	152 NBR	035	NBR	17x30x7			
39	AZPF – 1X – □□□□ FP20**PB**	n/a	193 FPM	065	FPM	17x30x7			
	AZPF – 2X – □□□□ FP20**PB**	n/a	193 FPM	065	FPM	17x30x7			
40	AZPF – 1X – □□□□ NT20**MB**	R98640006P	152 NBR	035	NBR	17x30x7			
41	AZPF – 1X – □□□□ NL20**KB**	n/a	152 NBR	065	FPM	17x30x7			
	AZPF – 2X – □□□□ NL20**KB**	n/a	152 NBR	065	FPM	17x30x7			
42	AZPF – 1X – □□□□ SA20MB	R98640006P	152 NBR	035	NBR	17x30x7			
	AZPF – 1X – □□□□ SA20KB	n/a	152 NBR	065	FPM	17x30x7			
43	AZPF – 1X – □□□□ SG20MB	n/a	152 NBR	009	NBR	20x40x7			
44	AZPFF – 1X – □□□ – □□□□ RR1212MB	R98640006P (2x)	152 (2x) NBR	035	NBR	17x30x7	145	NBR	45x2.5
	AZPFF – 1X – □□□ – □□□□ RR1212KB	n/a	152 (2x) NBR	065	FPM	17x30x7	145	NBR	45x2.5
46	AZPFF – 1X – □□□ – □□□□ RR1212MB – S0XXX	R98640006P (2x)	152 (2x) NBR	035	NBR	17x30x7	145	NBR	45x2.5
48	AZPFF – 1X – □□□ – □□□□ QR1212MB	R98640006P (2x)	152 (2x) NBR	035	NBR	17x30x7	145	NBR	45x2.5
	AZPFF – 1X – □□□ – □□□□ QR1212PB	n/a	152 (2x) NBR	065	FPM	17x30x7	1 520 210 101	FPM	45x2.5
49	AZPFF – 1X – □□□ – □□□□ QR1212MB – S0XXX	R98640006P (2x)	152 (2x) NBR	035	NBR	17x30x7	145	NBR	45x2.5
50	AZPFF – 1X – □□□ – □□□□ PR1212MB	R98640006P (2x)	152 (2x) NBR	009	NBR	20x40x7	145	NBR	45x2.5
	AZPFF – 2X – □□□ – □□□□ PR1212MB	R98640006P (2x)	152 (2x) NBR	009	NBR	20x40x7	145	NBR	45x2.5
51	AZPFF – 1X – □□□ – □□□□ PR1212MB – S0XXX	R98640006P (2x)	152 (2x) NBR	009	NBR	20x40x7	145	NBR	45x2.5
	AZPFF – 2X – □□□ – □□□□ PR1212MB – S0XXX	R98640006P (2x)	152 (2x) NBR	009	NBR	20x40x7	145	NBR	45x2.5
52	AZPFF – 1X – □□□ – □□□□ PC1212MB	R98640006P (2x)	152 (2x) NBR	009	NBR	20x40x7	145	NBR	45x2.5
	AZPFF – 2X – □□□ – □□□□ PC1212MB	R98640006P (2x)	152 (2x) NBR	009	NBR	20x40x7	145	NBR	45x2.5

NBR = Perbunan® FPM = Viton®

For further service parts refer to CD-ROM HYparts 1 987 760 010


3
3
3
800
800
3
30
31
3
47...55 Nm
①
②
③

Rexroth
Bosch Group

External Gear Pumps
F, N, & G Series

RA 10 097/02.06 **1**/96
Replaces 11.04



Fixed displacement pumps
Sizes 4.0...63 cm³ (.25...3.84 in³)

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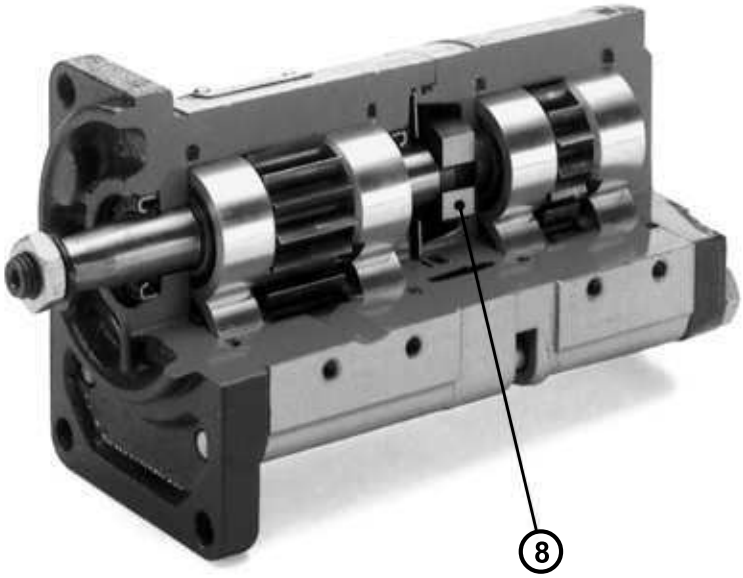
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Features

- Displacements of 4cc to 63cc
- Plain bearings for heavy duty applications
- Drive shafts SAE or ISO
- Multiple Pump Assemblies
- Port connections: flange or threaded
- Optimized pressure pulsation, which reduces noise levels and vibration excitation in the system
- Consistent high quality
- Considerably longer life due to reinforced shaft and housing



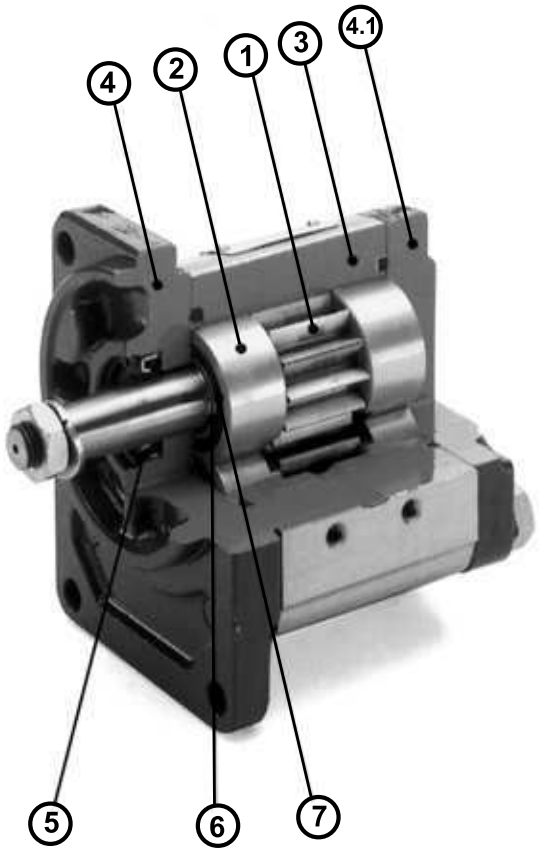


Fig. 1

① Gears
② Bearings
③ Extruded aluminium body
④ Covers
⑤ Shaft seal
⑥ Plain-bearing
⑦ Thrust pressure seal
⑧ Center coupling

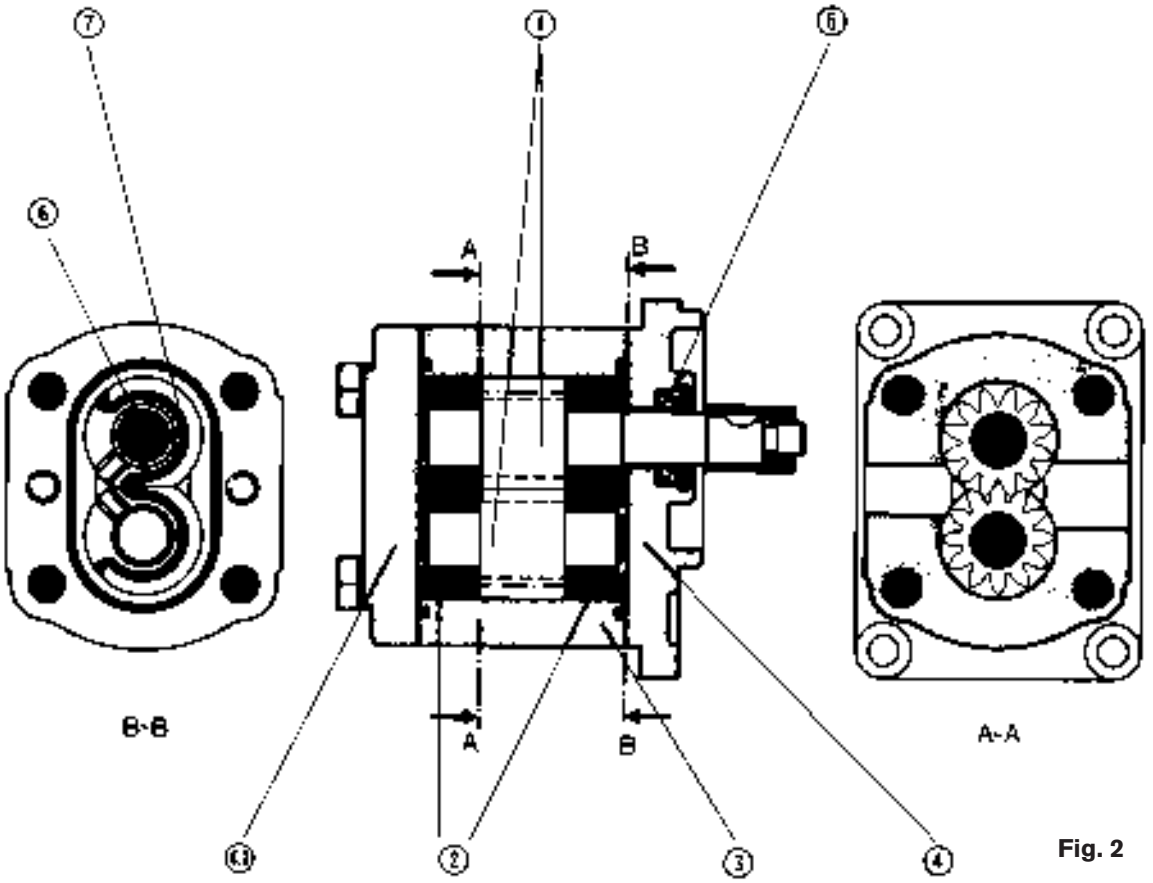


Fig. 2

There is no doubt that the gear-type pump is the most widely used design in hydraulic systems. It is simple in construction, reliable in operation and the most cost-effective way of generating hydraulic pressure.

Bosch Rexroth has been involved with the design, development and manufacture of gear pumps for many decades. Well-proven designs, the use of specially developed materials, constant testing and sophisticated mass production techniques ensure products of the very highest quality. Universal application is assured by a carefully graded range of sizes and a variety of different design options.

Basic design

The pump (see FIG. 2) consists essentially of a pair of gears ① supported in bearings ② and the body ③ with front and rear covers ④ and ④.1. The drive shaft protrudes from the front cover where it is sealed by the shaft seal ⑤.

The bearing forces are absorbed by special bearing-bushings with sufficient elasticity to produce surface contact instead of line contact ⑥. They also assure good operation under emergency conditions especially at low speed.

The gears have 12 teeth and this keeps both flow pulsation and noise emission to a minimum.

The internal sealing is pressure-sensitive, which provides optimum efficiency.

The bearings provide the seal at the ends of the gaps between the teeth, which carry the pressurized oil ②. The sealing zone between the gear teeth and the bearings is controlled by the admission of operating pressure to the rear of the bearings. Special seals ⑦ form the boundary of the zone.
The radial clearance at the tips of the gear teeth is sealed by forcing them against the body.

Specifications & Ratings

General	
Construction	external gear-type pump
Mounting	flange or through-bolting with pilot
Line connections	screw, flange
Direction of rotation (Fig. 4)	clockwise or counter-clockwise The pump may only be driven in the direction indicated.
Mounting position	any
Ambient temperature range	–15 °C to +60 °C (+5°F to 140°F)
Fluid	mineral oil-based hydraulic fluids to DIN/ISO, other fluids to order
Viscosity – centistokes (mm²/s)	12 ... 800 mm²/s permitted range 20 ... 100 mm²/s recommended range ... 2000 mm²/s max. cold start
Fluid temperature range	–15 °C to +80 °C (+5°F to 176°F)
Filter **) (further informations see page 27)	contamination class 10 to NAS 1638 obtained with filter $\beta_{25} = 75$

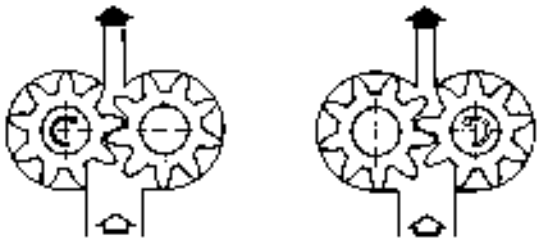
**) During the application of control systems or devices with critical counter-reaction, such as steering and brake valves, the type of filtration selected must be adapted to the sensitivity of these devices/systems.

Safety requirements pertaining to the whole system are to be observed.

In the case of applications with high numbers of load cycles please check.

As viewed looking at end of drive shaft.

Note: Dimensional drawings always show clockwise-rotation pumps. On counter-clockwise-rotation pumps, the positions of the drive shaft and the suction and delivery ports are different.

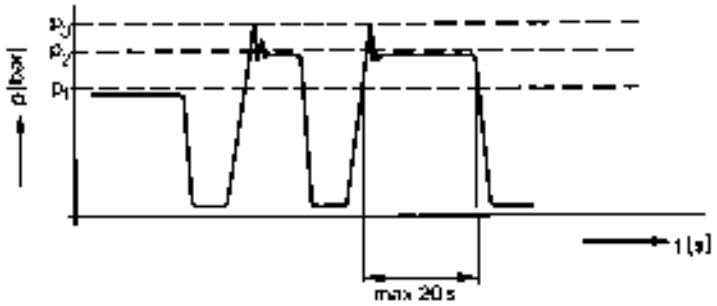


Clockwise rotation

Counter-Clockwise rotation



Definitions of pressures



Duration of load

p_1 max. continuous pressure
p_2 max. intermittent pressure
p_3 max. peak pressure

Fig. 4

Design calculations for pumps

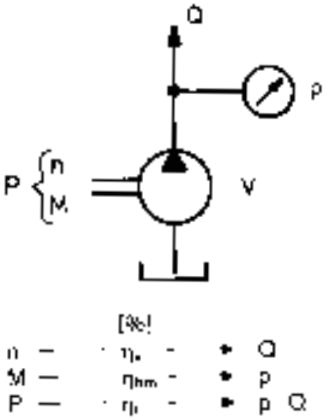
The design calculations for pumps are based on the following parameters:

V [cm³/rev] Displacement
Q [l/min] Delivery
p [bar] Pressure
M [Nm] Drive torque
n [rev/min] Drive speed
P [kW] Drive power

It is also necessary to allow for different efficiences such as:

η_v Volumetric efficiency
η_{hm} Hydraulic-mechanical efficiency
η_t Overall efficiency

The formulas down in Fig. 5 describe the various relationships. They include correction factors for adapting the parameters to the usual units encountered in practice.



$Q = V \cdot n \cdot \eta_v \cdot 10^{-3}$	$V = \frac{Q}{n \cdot \eta_v} \cdot 10^3$	$n = \frac{Q}{V \cdot \eta_v} \cdot 10^3$
$p = \frac{M \cdot \eta_{hm}}{1{,}59 \cdot V}$	$V = \frac{M \cdot \eta_{hm}}{1{,}59 \cdot p}$	$M = 1{,}59 \cdot V \cdot p \frac{1}{\eta_{hm}}$
$P = \frac{p \cdot Q}{6 \cdot \eta_t}$ $p \cdot Q$ 600	$Q = \frac{6 \cdot P \cdot \eta_t}{p}$	$p = \frac{6 \cdot P \cdot \eta_t}{Q}$
V [cm³/U] Q [l/min] p [bar] n [U/min] P [kW] M [Nm]	Note η [%] z. B. Attention e.g. 95 [%] p.e.	

Fig. 5

Notes on installation

Further information see “General operating and Maintenance Instructions”. 1 987 762 101

Installation and commissioning
- Fill the pump with fluid before installing.
- Check the direction of rotation.
- Before installing the pump, clean the pipes thoroughly of all dirt, scale, sand, swarf, etc. Welded pipes in particular must be pickled or flushed out.
- Before starting up the pump for the first time, the entire hydraulic system must be thoroughly purged of air.
- Cover the shaft seal when spraying or brush-painting the equipment.
- Pay close attention to the specification, especially speeds, pressures and suction vacuum.

Filter recommendations
By far the largest number of premature failures to gear pumps are due to contaminated fluid.
Since our guarantee does not apply to wear resulting from dirt in the system, we recommend filtering, which reduces the size and concentration of the contamination particles to a permitted minimum.

Operating pressure [bar]	>160	<160
Contamination class NAS 1638	9	10
Contamination class ISO 4406	18/15	19/16
Achieved with filter $\beta_X = 75$	20	25

Fig. 6

Full-flow filtering is always recommended.
The initial contamination of the fluid with which the system is filled must not exceed Class 10 to NAS 1638. Past experience has shown that even brand new fluids often exceed this value. In such cases a filter incorporating a special element will have to be used.

Drive arrangements

1. Flexible couplings
The coupling must not transfer any radial or axial forces to the pump.

The maximum radial runout of shaft pilot is 0.2 mm. Refer to the fitting instructions provided by the coupling manufacturer for details of the maximum permitted shaft misalignment.

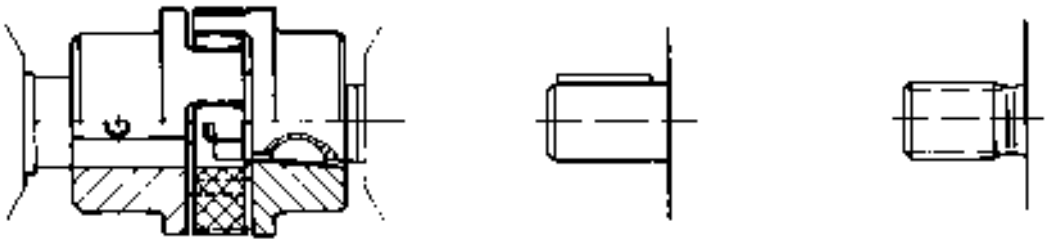
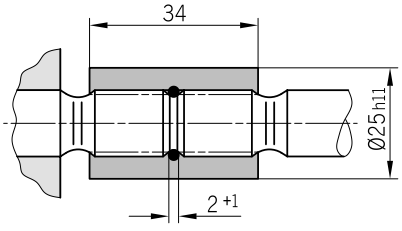


Fig. 7

2. Sleeve couplings
Used on shafts with DIN or SAE splining. **Note:** There must be no radial or axial forces exerted on the pump or sleeve coupling. The sleeve must be free to move axially. The distance between the pump shaft and drive shaft must be 2^{+1}.
Oil-bath or oil-mist lubrication is necessary.



Size
B 17 x 14 DIN 5482
M_{max} = 190 Nm

3. Tang Drive (Ref. Fig. 8 & 9)
For the close-coupling of pumps to engines, gearboxes, etc. the pump shaft has a special drive dog which combines with a center coupling ③ (included with the pumps). There is no shaft seal.

The recommended arrangements and dimensions for the drive end and sealing are as follows.

① **Drive shaft**
Case-hardening steel DIN 17 210
e.g. 20 Mn CrS 5
case-hardened 0.6 deep; HRc 60 ±3.
Surface for sealing ring
ground without rifling $R_t \leqq 4\mu m$

② **Radial shaft seal**
Rubber-covered seal (see DIN 3760, Type AS or double-lipped ring).
Cut 15° chamfer or fit shaft seal with protective sleeve.

F Series

M_{max} [Nm]	V [$cm^3/_{rev}$]	$p_{max.}$ [bar]
65	16 19 22,5	230 190 160

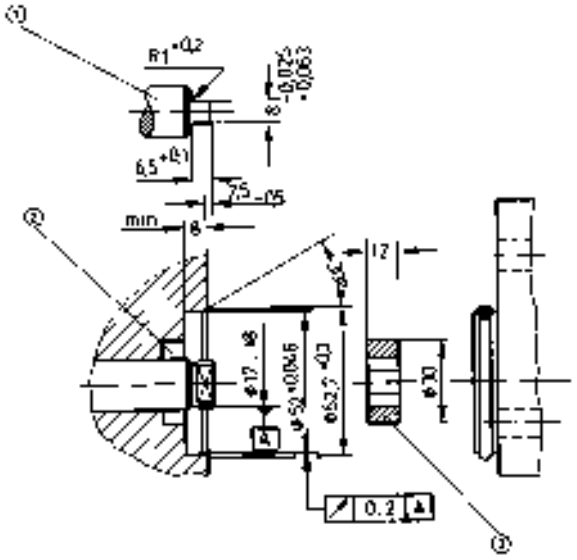
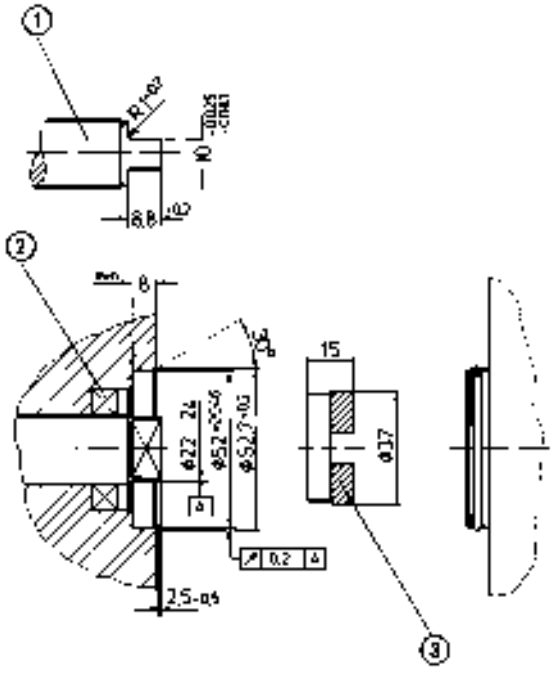


Fig. 8

N Series



G Series

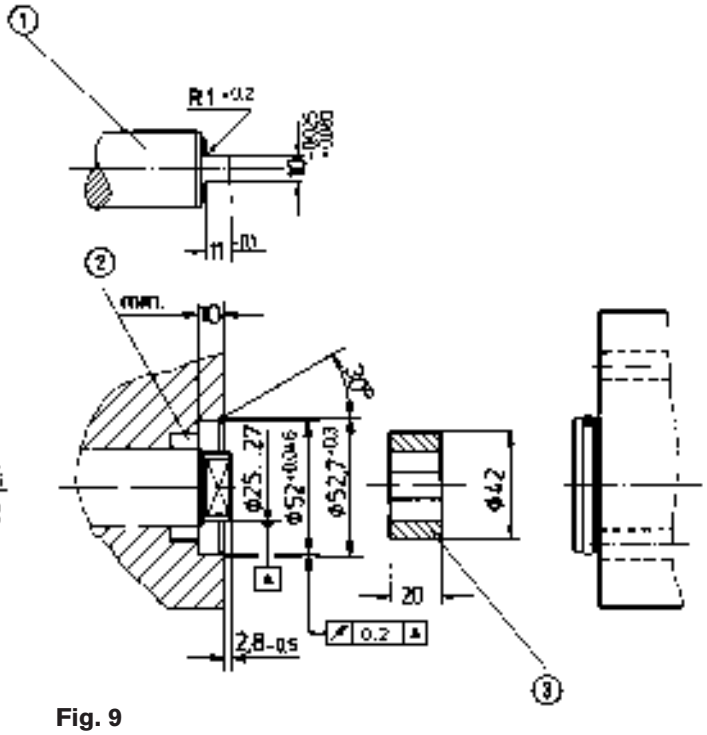


Fig. 9

4. V-belts and gearwheels without outrigger bearings
(Ref. Fig. 10)

When proposing to use V-belt or gearwheel drive, please submit details of the application for our comments (especially dimensions a, d_m, d_w and angle α).

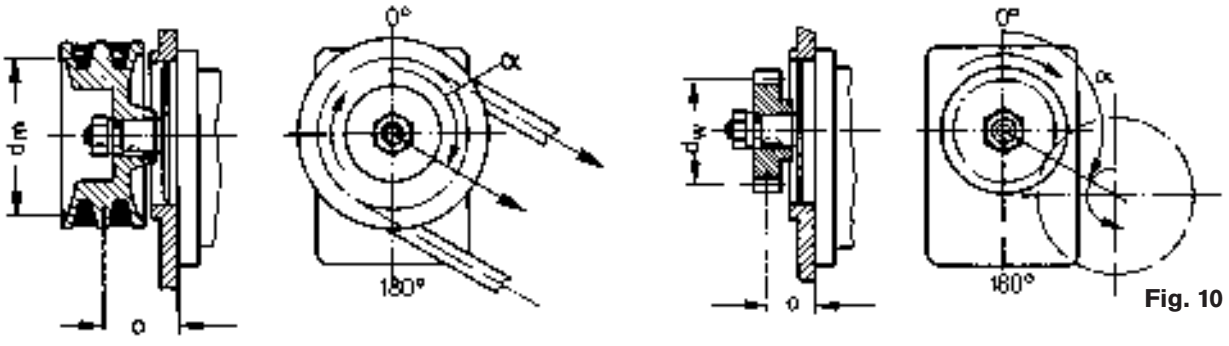
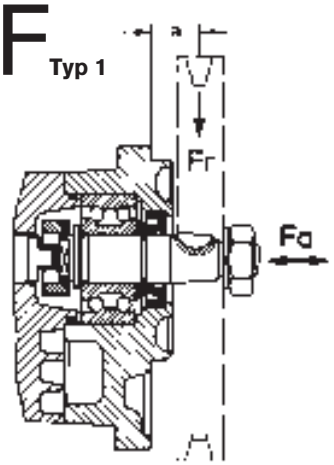


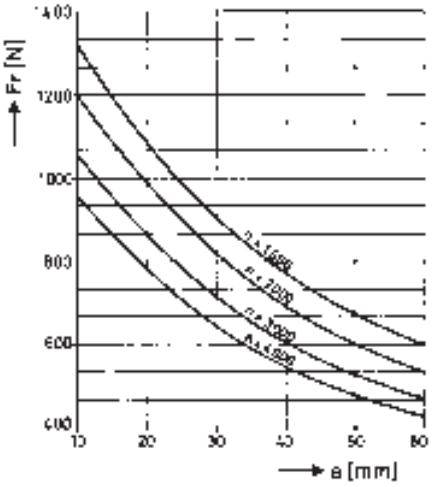
Fig. 10

5. Outrigger bearings (Ref. Fig. 11)
Outrigger bearings eliminate possible problems when the pumps are driven by V-belts or gearwheels. The diagrams below show the maximum overhung and thrust loads that can be tolerated referred to a bearing life of $L_H = 1000$ hours.

Size F Typ 1



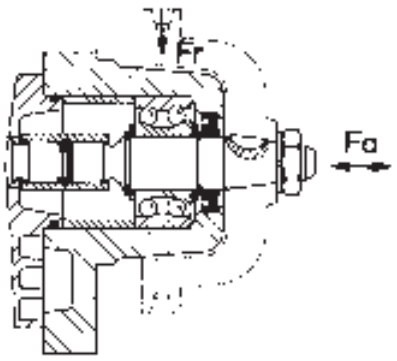
M_{max} [Nm]	V [cm³/U]	p_{max} [bar]
66	16	230
	19	190
	22.5	160



Size F Typ 2

a (26.5 Optimal)

Fr is reduced by 0.7 Fa when axial loading Fa is applied



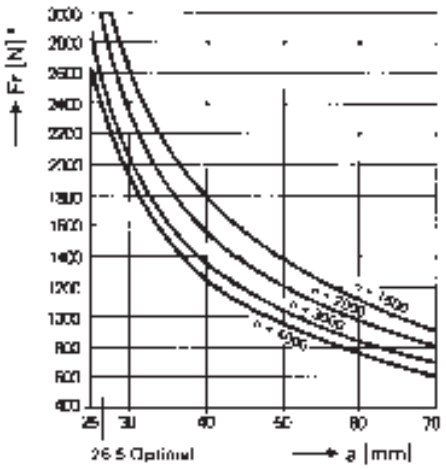


Fig. 11

Multiple gear pumps

F & N Series

Ref. Fig. 12

Gear pumps are well-suited to tandem combinations of pumps in which the drive shaft of the first pump is extended to drive a second pump, and sometimes a third pump in the same manner.

A coupling is fitted between each pair of pumps. In most cases, each pump is isolated from its neighbour,(i. e. the suction and delivery ports are separate).

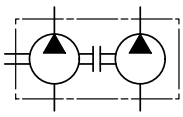
Specifications: Basically, the specifications for the individual pumps apply, but with certain restrictions:

Max. speed: This is determined by the highest rated pump speed in use.

Pressures: These are restricted by the strength of the drive shaft, the transmissions and the couplings. Appropriate data is given in the dimensional drawings and the graph on the following page.

Multiple Gear Pumps

Combinations



	M_{max} (Torque)	
F	65	**F**
N	65	**F**
N	95	**N**

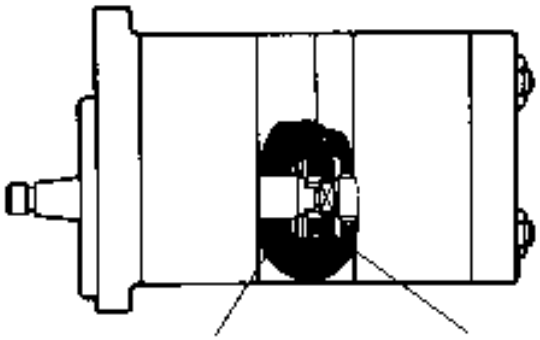


Fig. 12

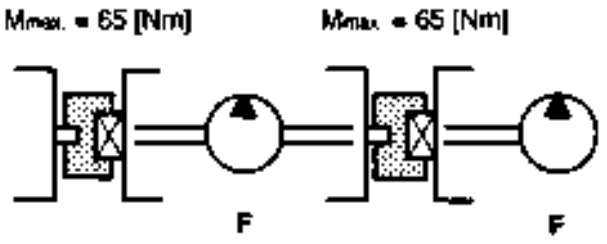
Multiple pump units – Pressure & Torque Ratings

In the case of Size F the center coupling for the second pump can carry a load of up to M_{max} = 65 Nm. The pressure restriction for the second pump is as follows:

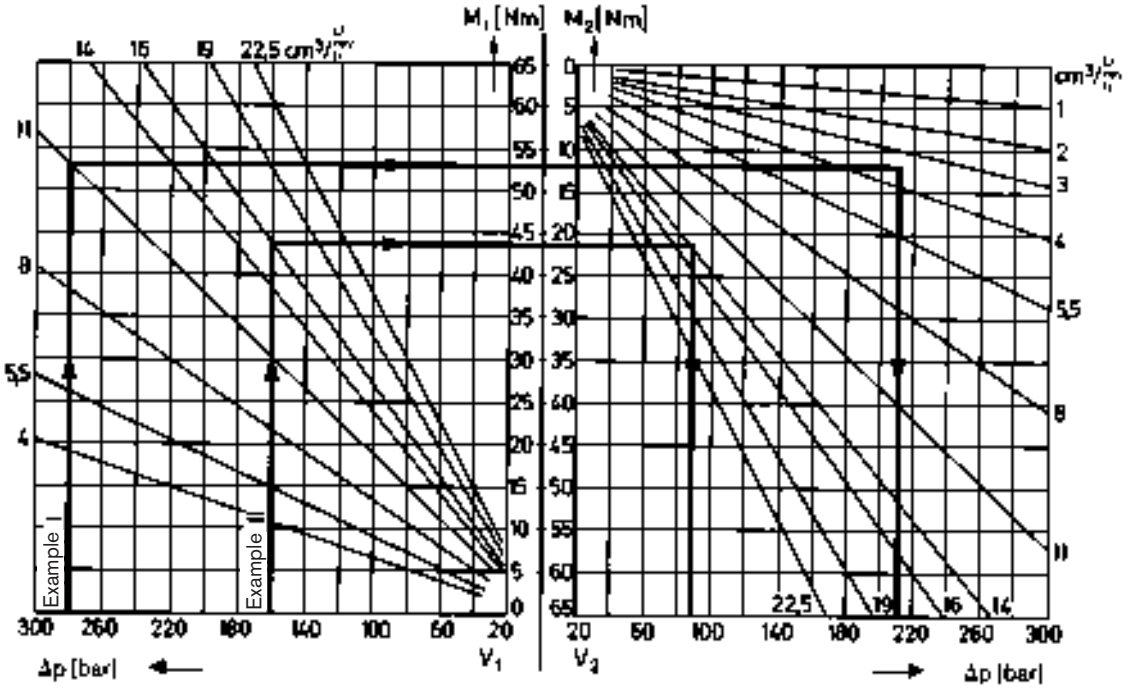
V [cm³/rev]	P_{max} [bar]
16	230
19	190
22.5	160

If the first pump is driven through a dog and center coupling or Type 1 outrigger bearing, the pressure restrictions for both pumps are as indicated in the diagram below.

In the case of applications with high numbers of load cycles, please contact the factory.



Reinforced transmissions are available for applications with higher transfer torques and/or torsional vibrations. Customized designs are available on request.



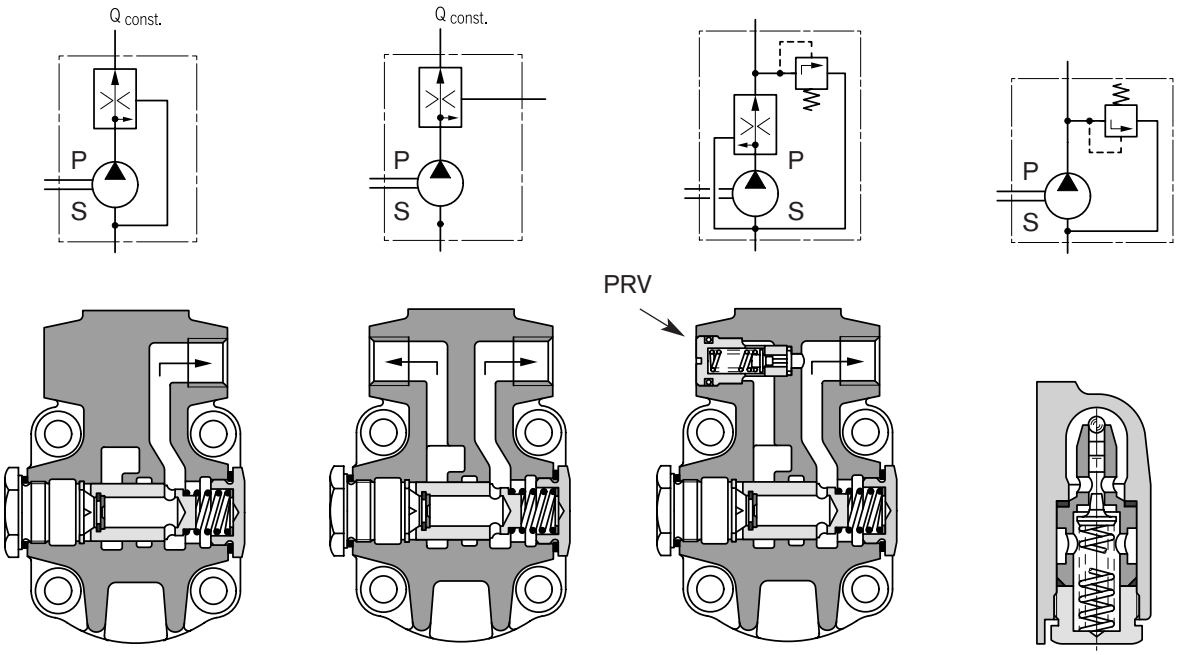
Beispiel, Example, Exemple

Fig. 13

Gear pumps with integral valves



In order to reduce external pipework it is possible to incorporate a flow control valve or pressure relief valve in the end cover of the pump. A typical application of this is in power-assisted steering systems. The pump delivers a constant flow irrespective of the speed at which it is driven. The excess flow is either returned internally to the suction or distributed externally to other items of equipment.



3-way flow control valve. Excess flow returned to suction

Rear Cover Model Code
S

3-way flow control valve. Excess flow distributed externally; loadable

Rear Cover Model Code
E

3-way flow control valve with pressure relief valve (PRV). Excess flow returned to suction

Rear Cover Model Code
V

Pressure relief valve. Discharge returned to suction

Rear Cover Model Code
D

Fig. 14

Ordering Code (N Series Pump)

A Z P N - 1 □ - 0 3 2 R D C 1 2 M B – S □ □ □ □ *

Function

P = Pump

Size (N)

1.28 in³ (20.4 cm³) = 020
1.44 in³ (23.1 cm³) = 022
1.61 in³ (25.8 cm³) = 025
1.78 in³ (28.4 cm³) = 028
2.02 in³ (32.4 cm³) = 032
2.28 in³ (36.4 cm³) = 036

Direction of rotation

Right = R
Left = L

End cover

Standard = B
Rear Ports = A

Seals

NBR = M
FPM = P
NBR, shaft seal in FPM = K

Drive shafts

		Matching front flange	
C	Conical 1:5 (Tapered key)	B	
N	Dog (Tang)	M	
D	Spline shaft SAE B 13T	C	
P	Spline shaft SAE 11T	R	C
Q	SAE 3/4" Keyed Short	R	C
Q	SAE 3/4" Keyed Long - use S0022 Suffix	R	C
X	Special (SO Code Defines Special Shaft)	R	C

Front flange

B	Square flange Pilot Ø 100 mm
C	SAE B 2-bolt
M	Transmission flange Pilot Ø 52 mm with O-ring
R	SAE A 2-bolt

Line connections

20	Rectangular flange
12	Thread (UN-2B) SAE O-ring BOSS
07	Split flange SAE Code 61 Metric bolts
40	Split flange SAE Code 61 UNC bolts

* Common Suffix Codes:
S0075 – Tapered shaft
Contact Factory for additional codes.

Size N

20 ... 36 cm³/rev

N Series Pump Product Index

(Reference page 43 for ordering code designators)

AZPF-XX-XXXX _ _ _ MB

Page Number	Ordering code	Shaft Type	Mounting Flange	Ports	Port Orientation
49	AZPN-12-XXXXPC12MB	P	C	12	side
50	AZPN-12-XXXXPC12MA	P	C	12	rear
51	AZPN-12-XXXXPR12MB	P	R	12	side
52	AZPN-12-XXXXPR12MA	P	R	12	rear
53	AZPN-12-XXXXQC12MB	Q	C	12	side
54	AZPN-12-XXXXQC12MA	Q	C	12	rear
55	AZPN-12-XXXXQR12MB	Q	R	12	side
56	AZPN-12-XXXXQR12MA	Q	R	12	rear
57	AZPN-12-XXXXRR12MB	R	R	12	side
58	AZPN-12-XXXXRR12MA	R	R	12	rear
59	AZPN-12-XXXXDC12MB	D	C	12	side
60	AZPN-12-XXXXDC12MA	D	C	12	rear
61	AZPN-12-XXXXDR12MB	D	R	12	side
62	AZPN-12-XXXXDR12MA	D	R	12	rear
63	AZPN-12-XXXXXR12MB-S0075	X-S0075	R	12	side
64	AZPN-12-XXXXXR12MA-S0075	X-S0075	R	12	rear
65	AZPN-12-XXXXDC20MB	D	C	20	side
66	AZPN-12-XXXXCB20MB	C	B	20	side
67	AZPN-12-XXXXNM20MB	N	M	20	side

N Series Performance Ratings

Size		**020**	**022**	**025**	**028**	**032**	**036**
Displacement	cm^3/rev	20.4	23.1	25.8	28.4	32.4	36.4
Inlet pressure	bar	min. 0.7 max. 3 (absolute)					
max. continuous pressure p_1	bar	230	230	230	210	180	160
	psi	3335	3335	3335	3045	2610	2610
max. intermittent pressure p_2	bar	250	250	250	230	200	180
	psi	3625	3625	3625	3335	2900	2610
max. peak pressure p_3	bar	270	270	270	250	220	200
	psi	3915	3915	3915	3625	3190	2900
min. rotational speed (RPM) ≦ 100	RPM	500	500	500	500	500	500
max. rotational speed at (RPM) p_1		2500	2500	2500	2300	2300	2100
p_2		3000	3000	3000	2800	2800	2600

N Series Pumps
SAE O-Ring BOSS - Standard Porting

	Side Ports		Rear Port	
Displacement (cc)	Inlet	Outlet	Inlet	Outlet
20	-16	-10	-16	-12
22	-16	-10	-16	-12
25	-20	-12	-16	-12
28	-20	-12	-16	-12
32	-20	-12	-16	-12
36	-20	-12	-16	-12

SAE Porting - Specifications and Dimensions per SAE J1926/1

Dash Size	**Thread Size (in)**
-2	5/16-24 UNF-2B
-3	3/8-24 UNF-2B
-4	7/16-20 UNF-2B
-5	1/2-20 UNF-2B
-6	9/16-18 UNF-2B
-8	3/4-16 UNF-2B
-10	7/8-14 UNF-2B
-12	1-1/16-12 UN-2B
-14	1-3/16-12 UN-2B
-16	1-5/16-12 UN-2B
-20	1-5/8-12 UN-2B
-24	1-7/8-12 UN-2B
-32	2-1/2-12 UN-2B

Note: Ratings represent units incorporating SAE O-Ring BOSS threaded ports. Pressure ratings may differ for other types of ports.

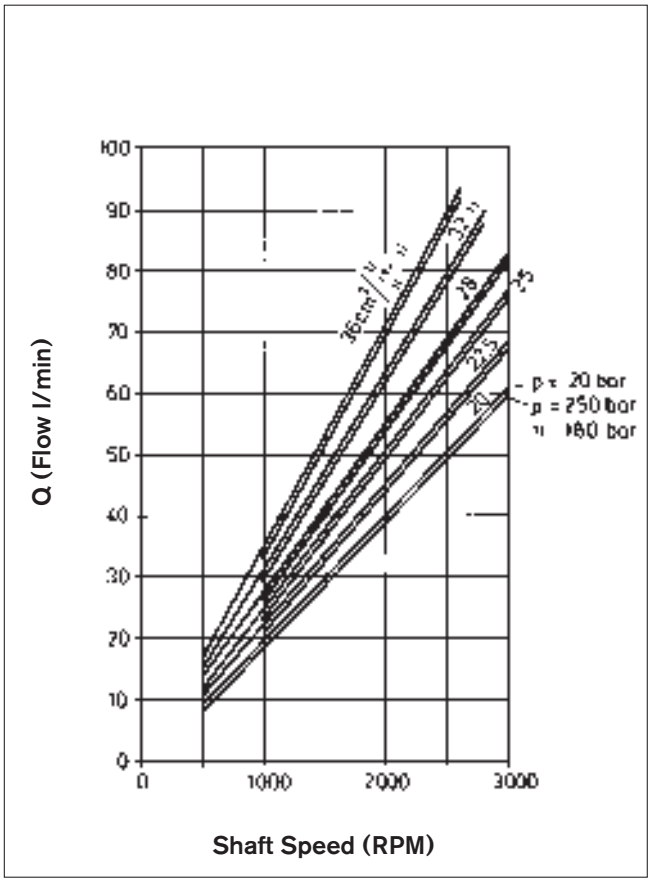
Diagrams

Size N

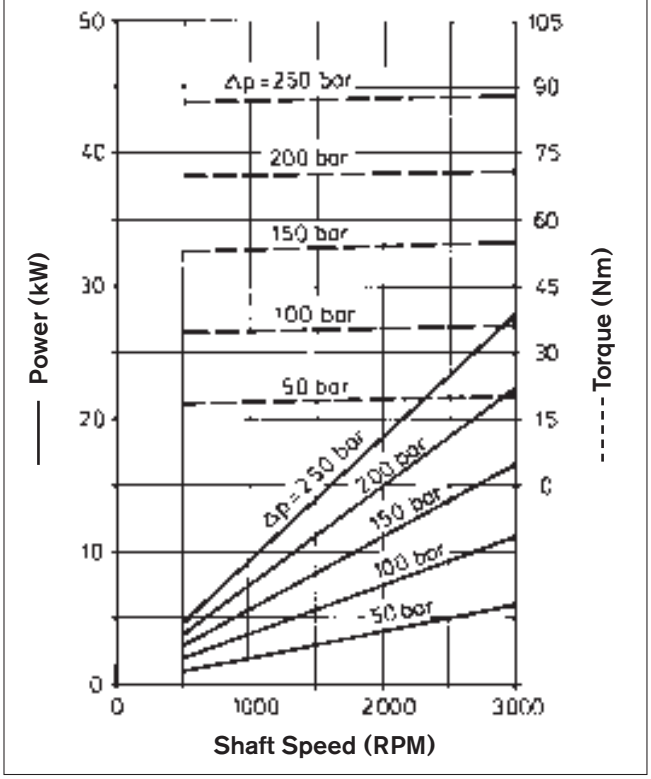
$\nu = 35\ mm^2/s$, T = 50 °C

Unit Conversions

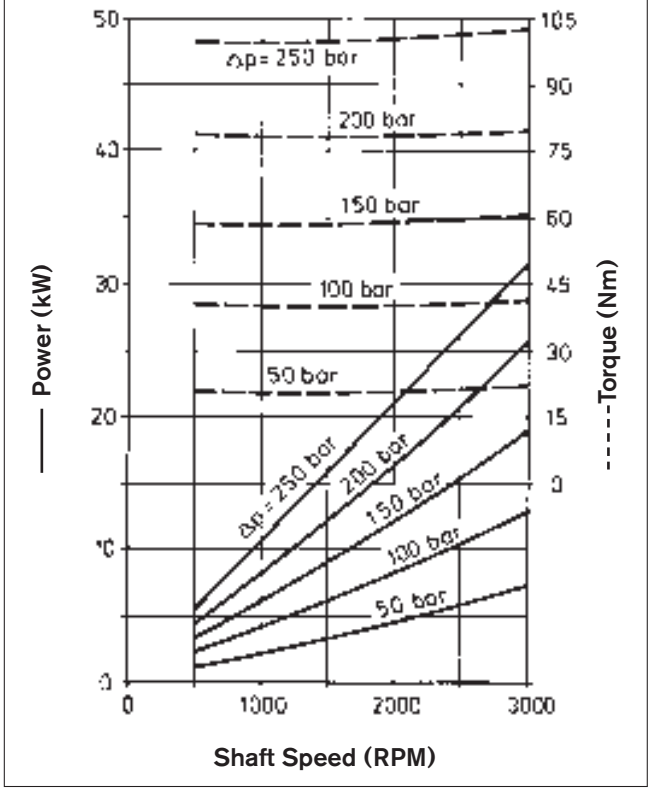
Pressure: psi = bar x 14.7
Torque: ft-lbs = (Nm) x .738
Power: hp = (kW) x 1.341
Volume: in^3 = (cc) x 16.39
gpm = (LPM) x .2642



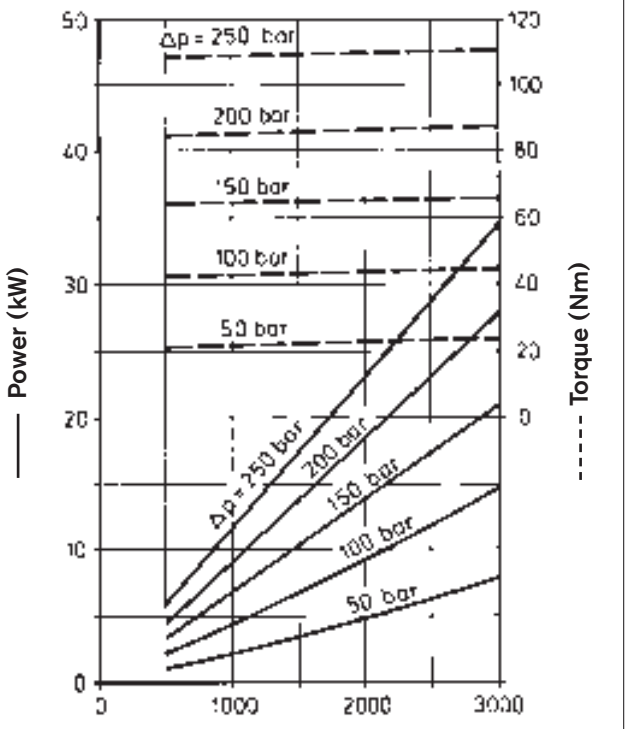
20 cm^3/rev



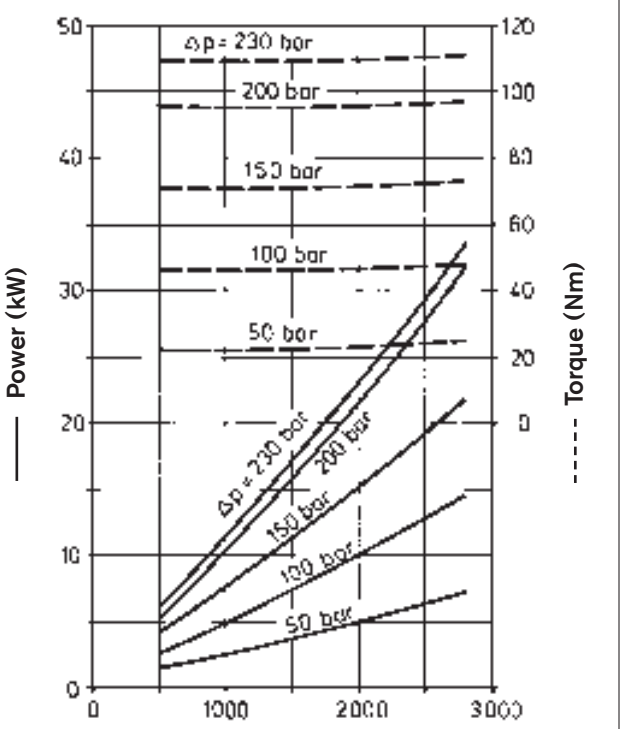
22.5 cm^3/rev



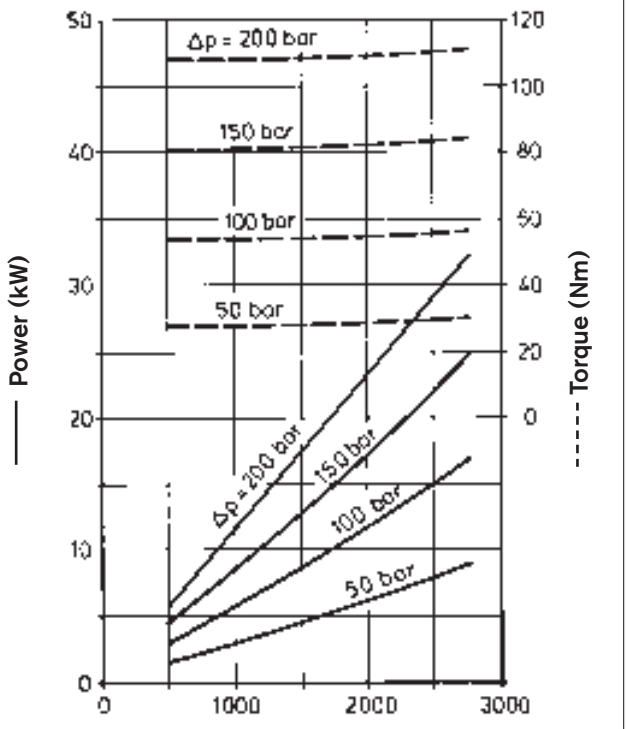
25 cm³/rev



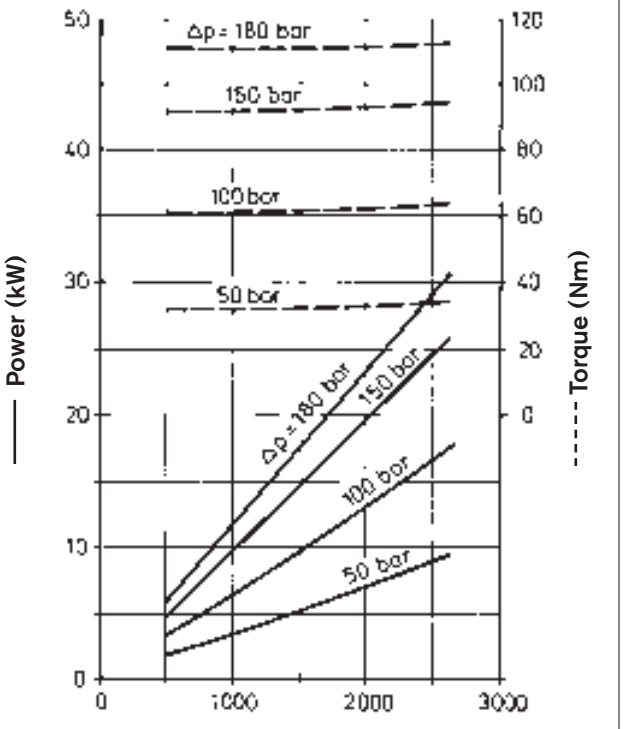
28 cm³/rev

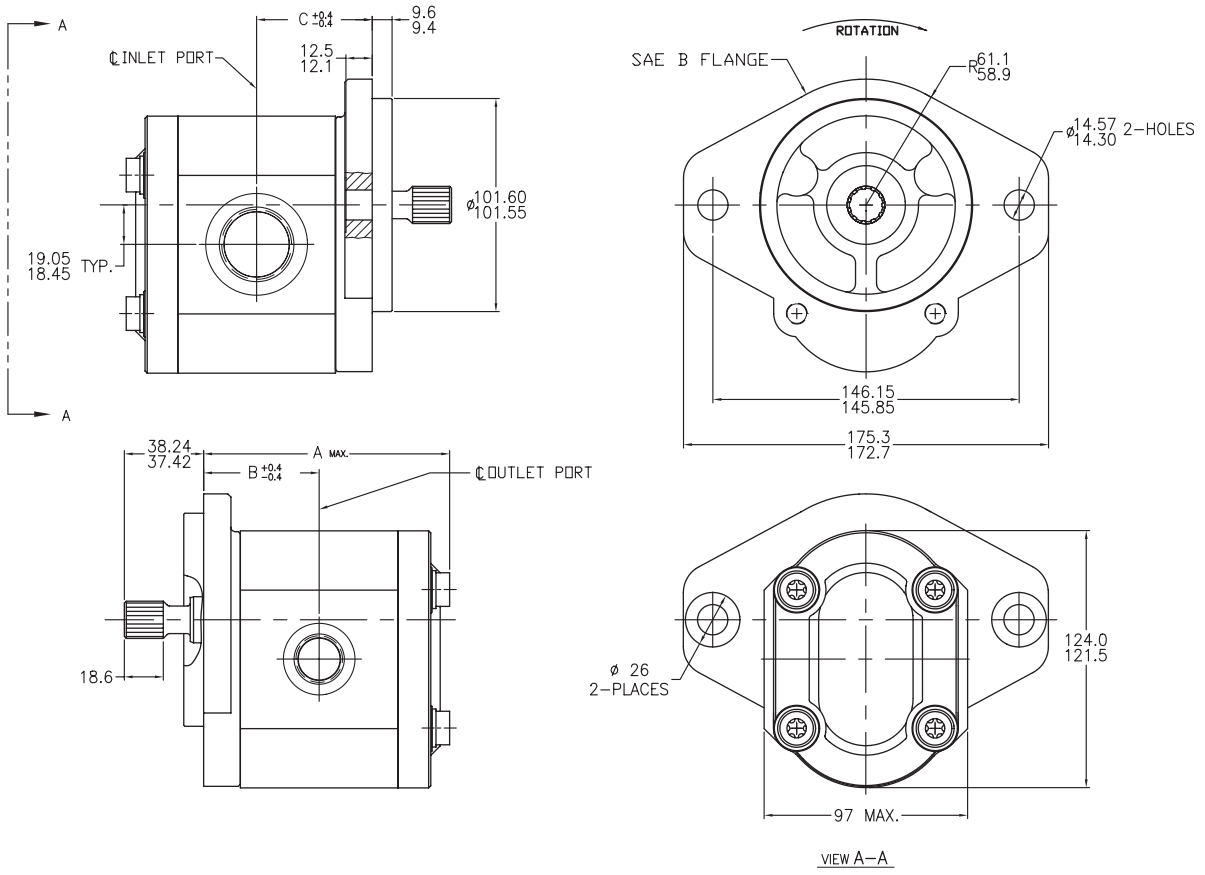


32 cm³/rev

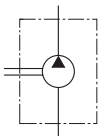


36 cm³/rev





Features	Details
Shaft	11t spline
Front Cover	SAE B 2-bolt
Ports	SAE ORB
Rear Cover	Standard



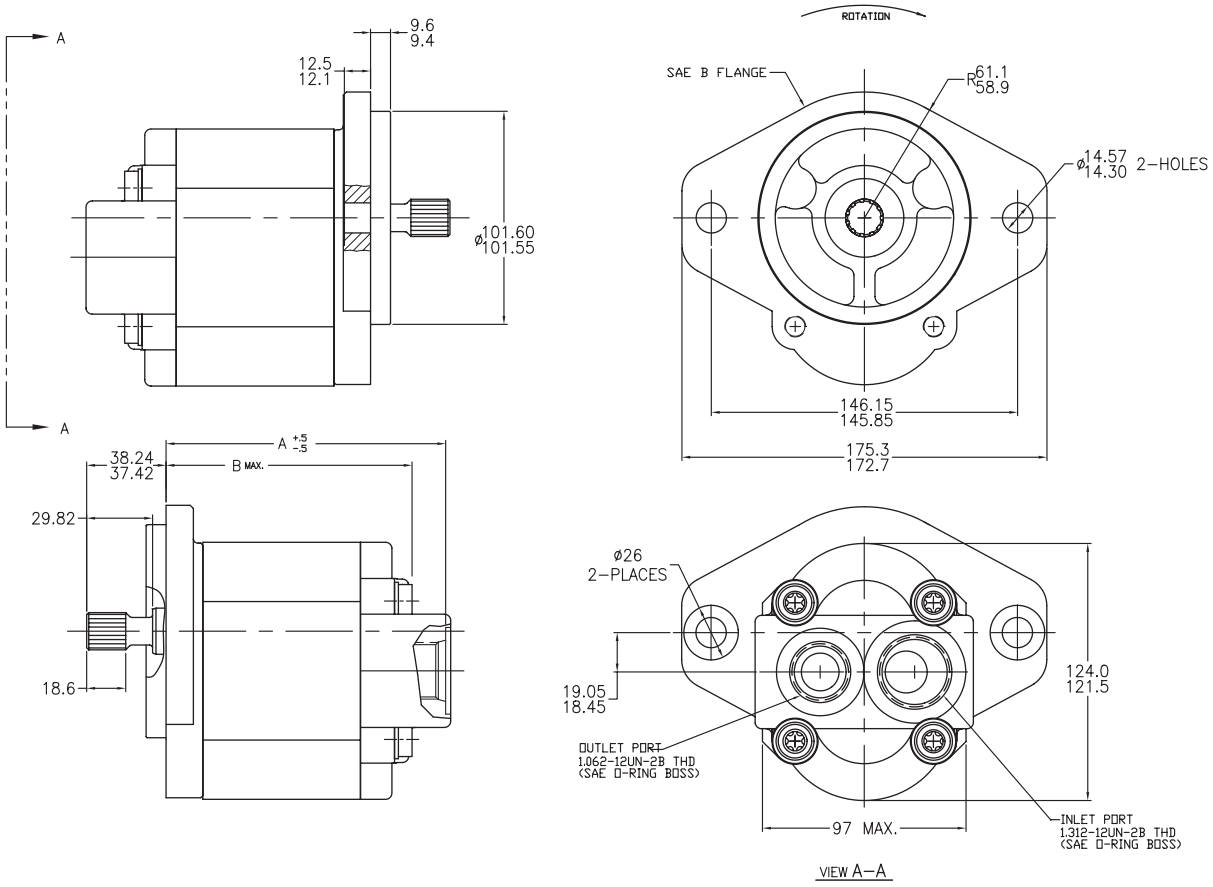
Clockwise
As shown in drawing

Counter-Clockwise
Inlet and outlet port changed

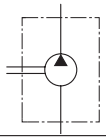
Ordering code
AZPN – X X – □□□□ P C 12 MB

Displacement	Ordering-Number *		Max. operating pressure	Max. rotation speed	Dimension [mm]				
	L	R			A	B	C	Inlet Port ** (SAE O-Ring BOSS)	Outlet Port (SAE O-Ring BOSS)
[cm³/rev]			[bar]	[min⁻¹]					
20.0	**9 510 390 153**	**9 510 390 147**	230	3000	109.8	52.1	52.1	-16	-10
22.0	**9 510 390 154**	**9 510 390 148**	230	3000	114.7	53.6	53.1	-16	-10
25.0	**9 510 390 155**	**9 510 390 149**	230	3000	115.8	55.1	55.1	-20	-12
28.0	**9 510 390 156**	**9 510 390 150**	210	2800	118.8	56.6	56.1	-20	-12
32.0	**9 510 390 157**	**9 510 390 151**	180	2800	123.3	58.8	58.8	-20	-12
36.0	**9 510 390 158**	**9 510 390 152**	160	2600	129.7	61.1	61.1	-20	-12

* Contact factory for availabilty of units with no ordering number listed.
** Refer to page 46 for SAE O-Ring Boss Specifications and Dimensions.



Features	Details
Shaft	11t spline
Front Cover	SAE B 2-bolt
Ports	SAE ORB
Rear Cover	Rear ports



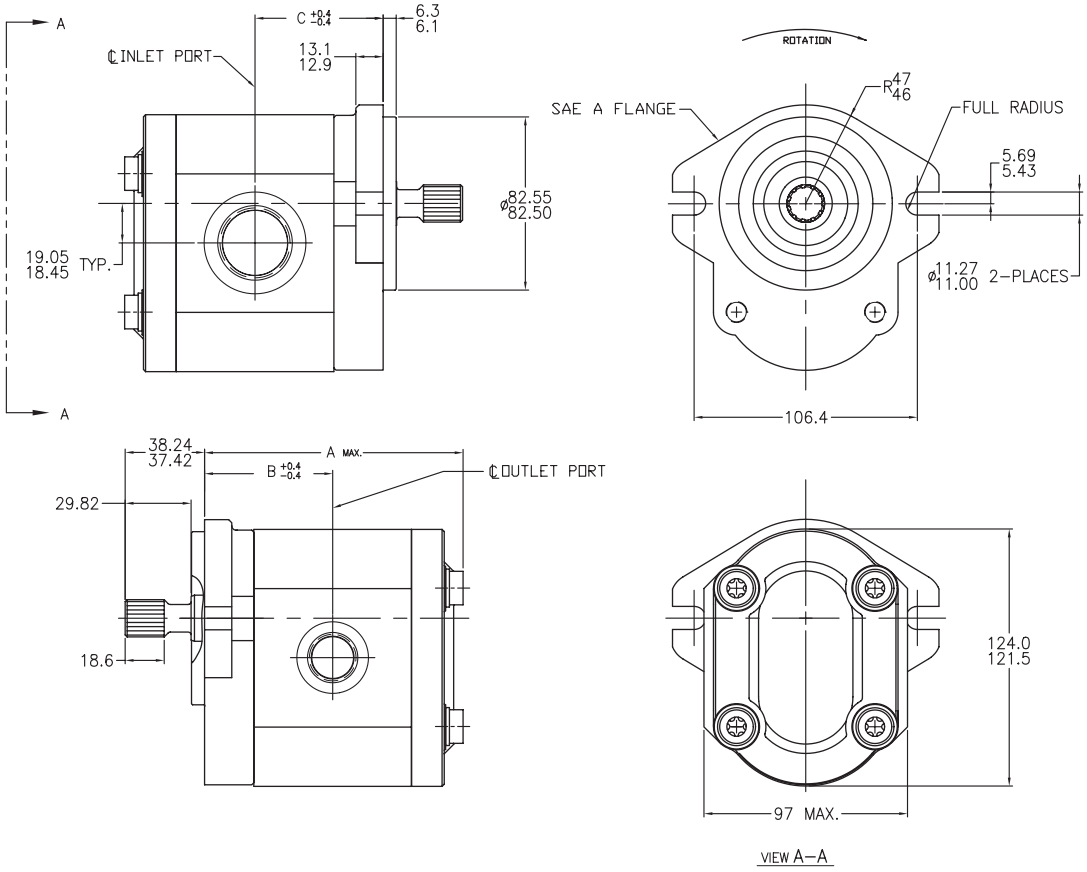
Clockwise
As shown in drawing

Counter-Clockwise
Inlet and outlet port changed

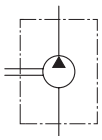
Ordering code
AZPN – X X – □ □ □ □ P C 12 MA

Displacement	Ordering-Number *		Max. operating pressure	Max. rotation speed	Dimension [mm]			Inlet Port **	Outlet Port
	L	R			A	B		(SAE O-Ring BOSS)	(SAE O-Ring BOSS)
[cm³/rev]			[bar]	[min⁻¹]					
20.0	**9 510 390 104**	**9 510 390 098**	230	3000	128.1	110.0		-16	-12
22.0	**9 510 390 105**	**9 510 390 099**	230	3000	131.1	114.9		-16	-12
25.0	**9 510 390 106**	**9 510 390 100**	230	3000	134.1	116.0		-16	-12
28.0	**9 510 390 107**	**9 510 390 101**	210	2800	137.1	119.0		-16	-12
32.0	**9 510 390 108**	**9 510 390 102**	180	2800	141.6	123.5		-16	-12
36.0	**9 510 390 109**	**9 510 390 103**	160	2600	146.1	124.4		-16	-12

* Contact factory for availabilty of units with no ordering number listed.
** Refer to page 46 for SAE O-Ring Boss Specifications and Dimensions.



Features	Details
Shaft	11t spline
Front Cover	SAE A 2-bolt
Ports	SAE ORB
Rear Cover	Standard



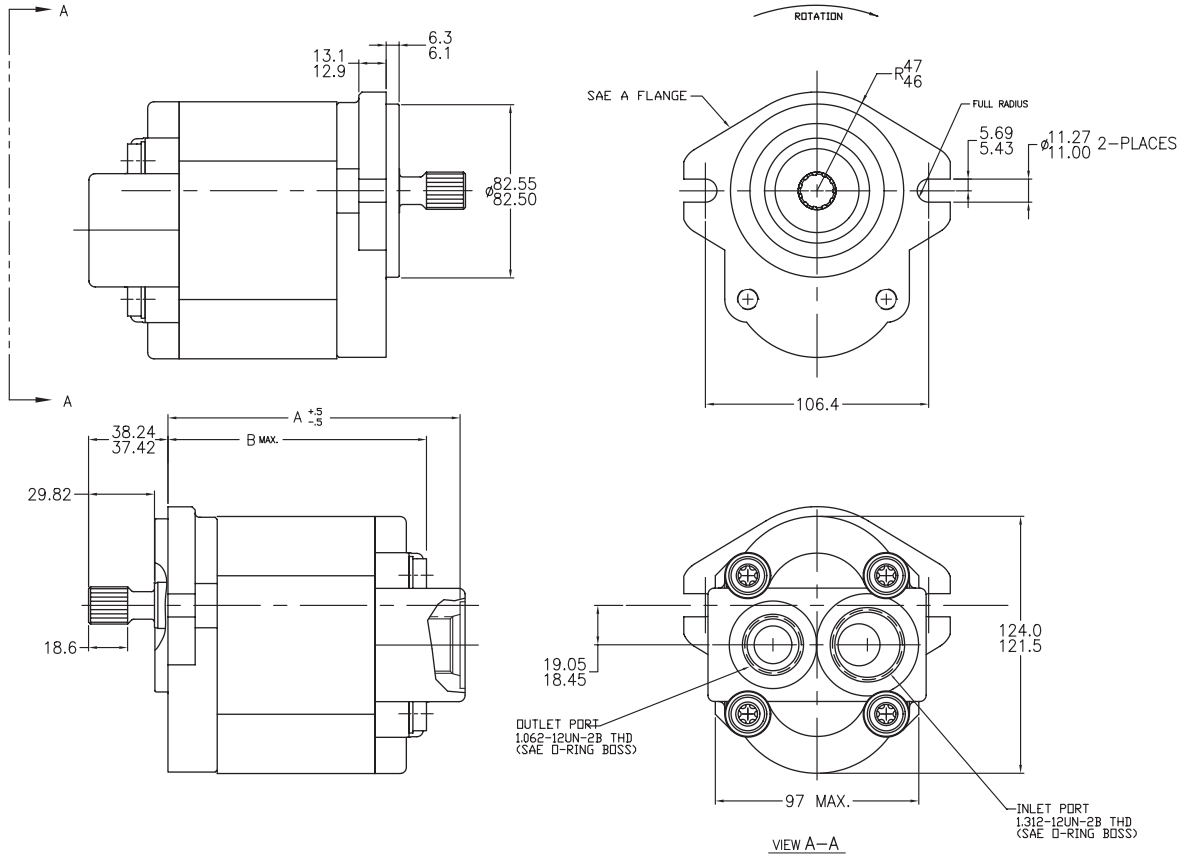
Clockwise
As shown in drawing

Counter-Clockwise
Inlet and outlet port changed

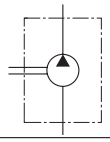
Ordering code
AZPN – X X – □ □ □ □ P R 12 MB

Displacement	Ordering-Number *		Max. operating pressure	Max. rotation speed	Dimension [mm]				
	L	R			A	B	C	Inlet Port ** (SAE O-Ring BOSS)	Outlet Port (SAE O-Ring BOSS)
[cm³/rev]			[bar]	[min⁻¹]					
20.0	**9 510 390 165**	**9 510 390 159**	230	3000	115.4	58.1	58.1	-16	-10
22.0	**9 510 390 166**	**9 510 390 160**	230	3000	118.4	59.6	59.6	-16	-10
25.0	**9 510 390 167**	**9 510 390 161**	230	3000	121.4	61.1	61.1	-20	-12
28.0	**9 510 390 168**	**9 510 390 162**	210	2800	124.4	62.6	62.6	-20	-12
32.0	**9 510 390 169**	**9 510 390 163**	180	2800	128.5	64.8	64.8	-20	-12
36.0	**9 510 390 170**	**9 510 390 164**	160	2600	133.0	67.1	67.1	-20	-12

* Contact factory for availabilty of units with no ordering number listed.
** Refer to page 46 for SAE O-Ring Boss Specifications and Dimensions.



Features	Details
Shaft	11t spline
Front Cover	SAE A 2-bolt
Ports	SAE ORB
Rear Cover	Rear ports



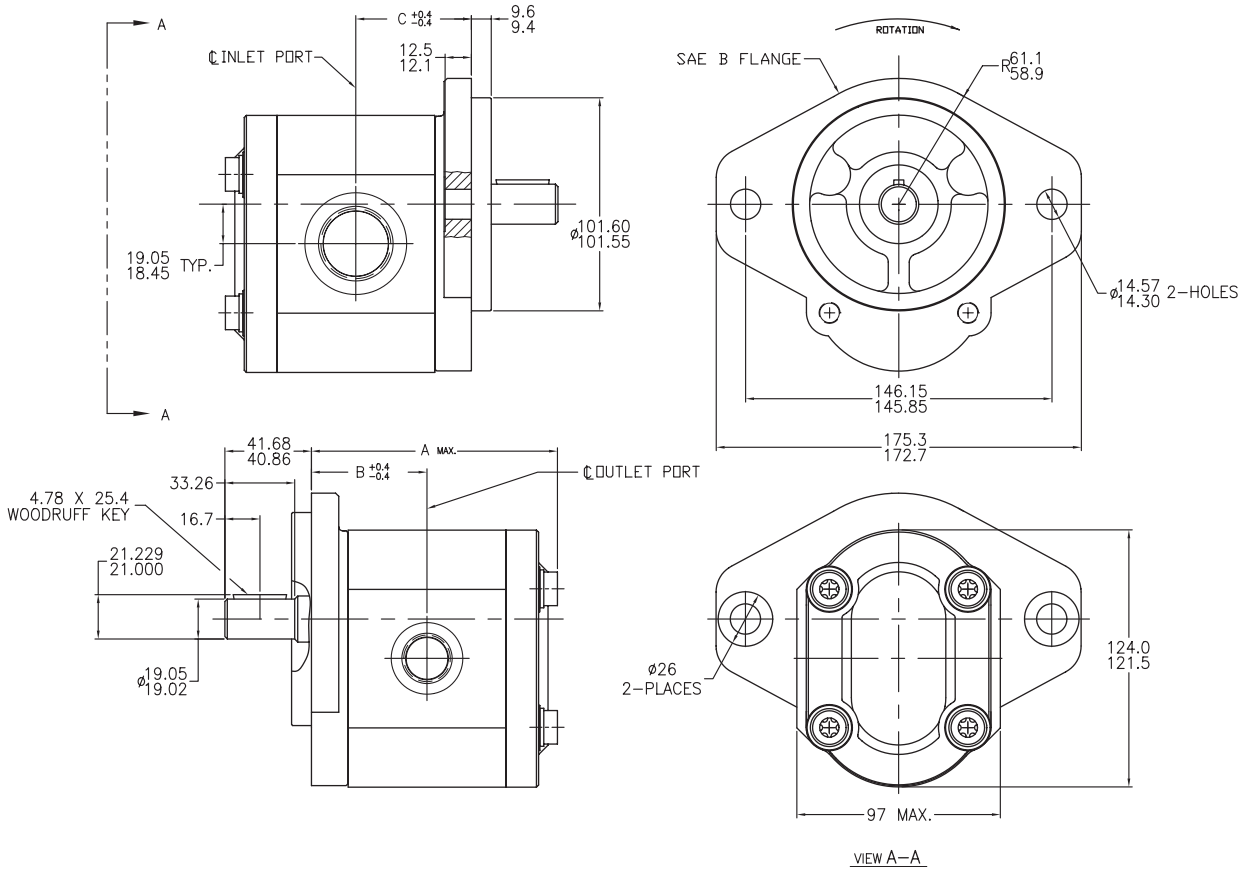
Clockwise
As shown in drawing

Counter-Clockwise
Inlet and outlet port changed

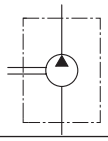
Ordering code
AZPN – X X – □ □ □ □ P R 12 MA

Displacement	Ordering-Number *		Max. operating pressure	Max. rotation speed	Dimension [mm]			Inlet Port **	Outlet Port
	L	R			A	B		(SAE O-Ring BOSS)	(SAE O-Ring BOSS)
[cm³/rev]			[bar]	[min⁻¹]					
20.0	**9 510 390 092**	**9 510 390 086**	230	3000	134.1	116.0		-16	-12
22.0	**9 510 390 093**	**9 510 390 087**	230	3000	137.1	120.9		-16	-12
25.0	**9 510 390 094**	**9 510 390 088**	230	3000	140.1	122.0		-16	-12
28.0	**9 510 390 095**	**9 510 390 089**	210	2800	143.1	125.0		-16	-12
32.0	**9 510 390 096**	**9 510 390 090**	180	2800	147.6	129.5		-16	-12
36.0	**9 510 390 097**	**9 510 390 091**	160	2600	152.1	135.9		-16	-12

* Contact factory for availabilty of units with no ordering number listed.
** Refer to page 46 for SAE O-Ring Boss Specifications and Dimensions.



Features	Details
Shaft	3/4" keyed
Front Cover	SAE B 2-bolt
Ports	SAE ORB
Rear Cover	Standard



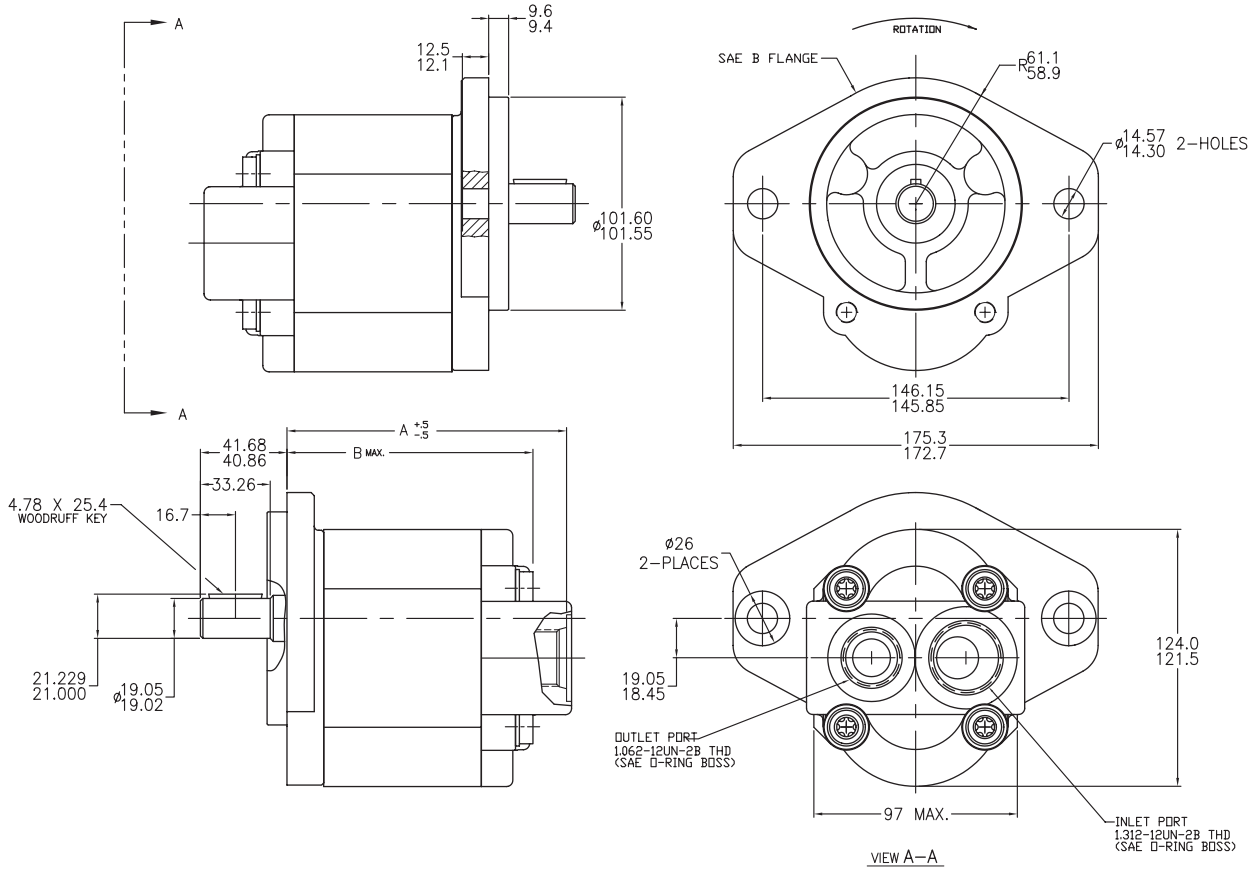
Clockwise
As shown in drawing

Counter-Clockwise
Inlet and outlet port changed

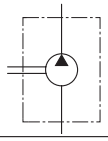
Ordering code
AZPN – X X – □□□□ Q C 12 MB

Displacement	Ordering-Number *		Max. operating pressure	Max. rotation speed	Dimension [mm]				
	L	R			A	B	C	Inlet Port ** (SAE O-Ring BOSS)	Outlet Port (SAE O-Ring BOSS)
[cm³/rev]			[bar]	[min⁻¹]					
20.0	**9 510 390 055**	**9 510 390 049**	230	3000	109.4	52.1	52.1	-16	-10
22.0	**9 510 390 056**	**9 510 390 050**	230	3000	112.4	53.6	53.6	-16	-10
25.0	**9 510 390 057**	**9 510 390 051**	230	3000	115.4	55.1	55.1	-20	-12
28.0	**9 510 390 058**	**9 510 390 052**	210	2800	118.4	56.6	56.6	-20	-12
32.0	**9 510 390 059**	**9 510 390 053**	180	2800	122.5	58.8	58.8	-20	-12
36.0	**9 510 390 060**	**9 510 390 054**	160	2600	127.0	61.1	61.1	-20	-12

* Contact factory for availabilty of units with no ordering number listed.
** Refer to page 46 for SAE O-Ring Boss Specifications and Dimensions.



Features	Details
Shaft	3/4″ keyed
Front Cover	SAE B 2-bolt
Ports	SAE ORB
Rear Cover	Rear ports



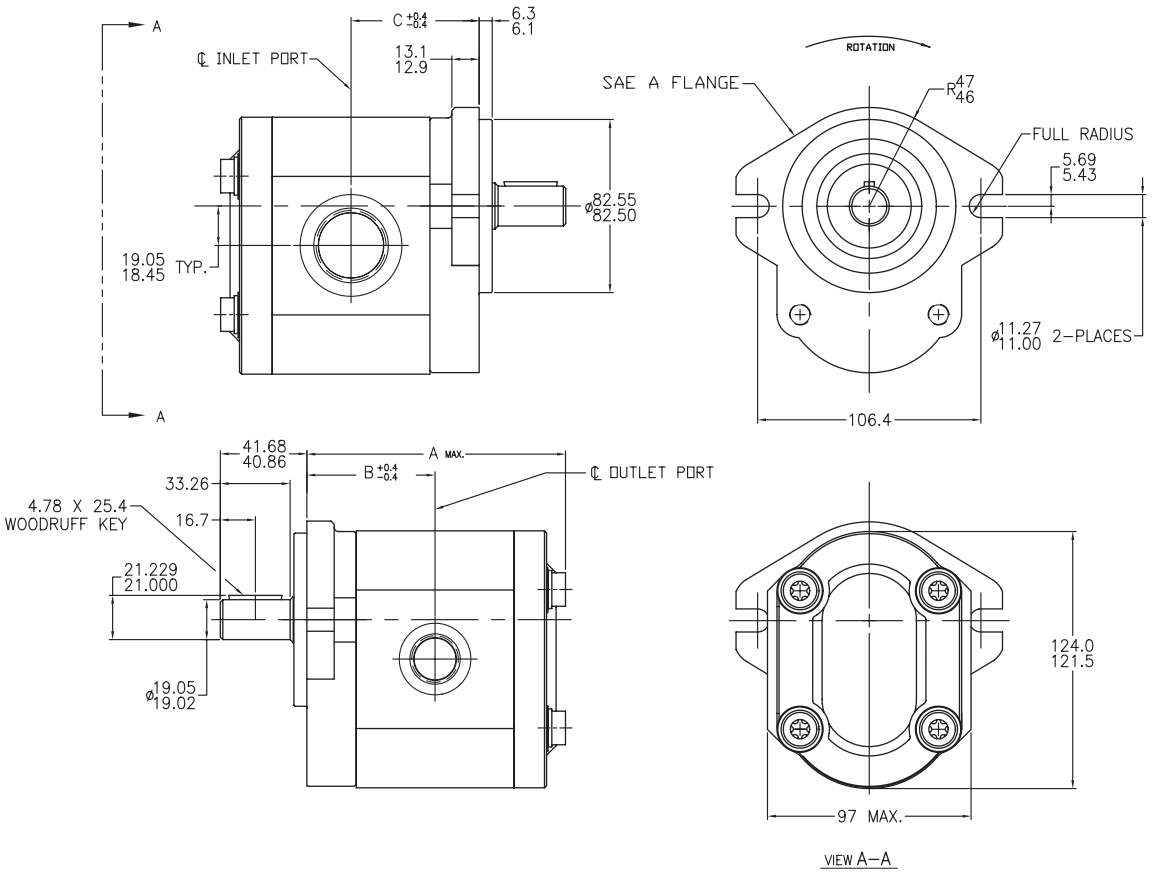
Clockwise
As shown in drawing

Counter-Clockwise
Inlet and outlet port changed

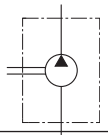
Ordering code
AZPN – X X – □ □ □ □ Q C 12 MA

Displacement	Ordering-Number *		Max. operating pressure	Max. rotation speed	Dimension [mm]			Inlet Port **	Outlet Port
	L	R			A	B		(SAE O-Ring BOSS)	(SAE O-Ring BOSS)
[cm³/rev]			[bar]	[min⁻¹]					
20.0	**9 510 390 067**	**9 510 390 061**	230	3000	128.1	110.0		-16	-12
22.0	**9 510 390 068**	**9 510 390 062**	230	3000	131.1	114.9		-16	-12
25.0	**9 510 390 069**	**9 510 390 063**	230	3000	134.1	116.0		-16	-12
28.0	**9 510 390 070**	**9 510 390 064**	210	2800	137.1	119.0		-16	-12
32.0	**9 510 390 071**	**9 510 390 065**	180	2800	141.6	123.5		-16	-12
36.0	**9 510 390 072**	**9 510 390 066**	160	2600	146.1	129.9		-16	-12

* Contact factory for availabilty of units with no ordering number listed.
** Refer to page 46 for SAE O-Ring Boss Specifications and Dimensions.



Features	Details
Shaft	3/4″ keyed
Front Cover	SAE A 2-bolt
Ports	SAE ORB
Rear Cover	Standard



Clockwise
As shown in drawing

Counter-Clockwise
Inlet and outlet port changed

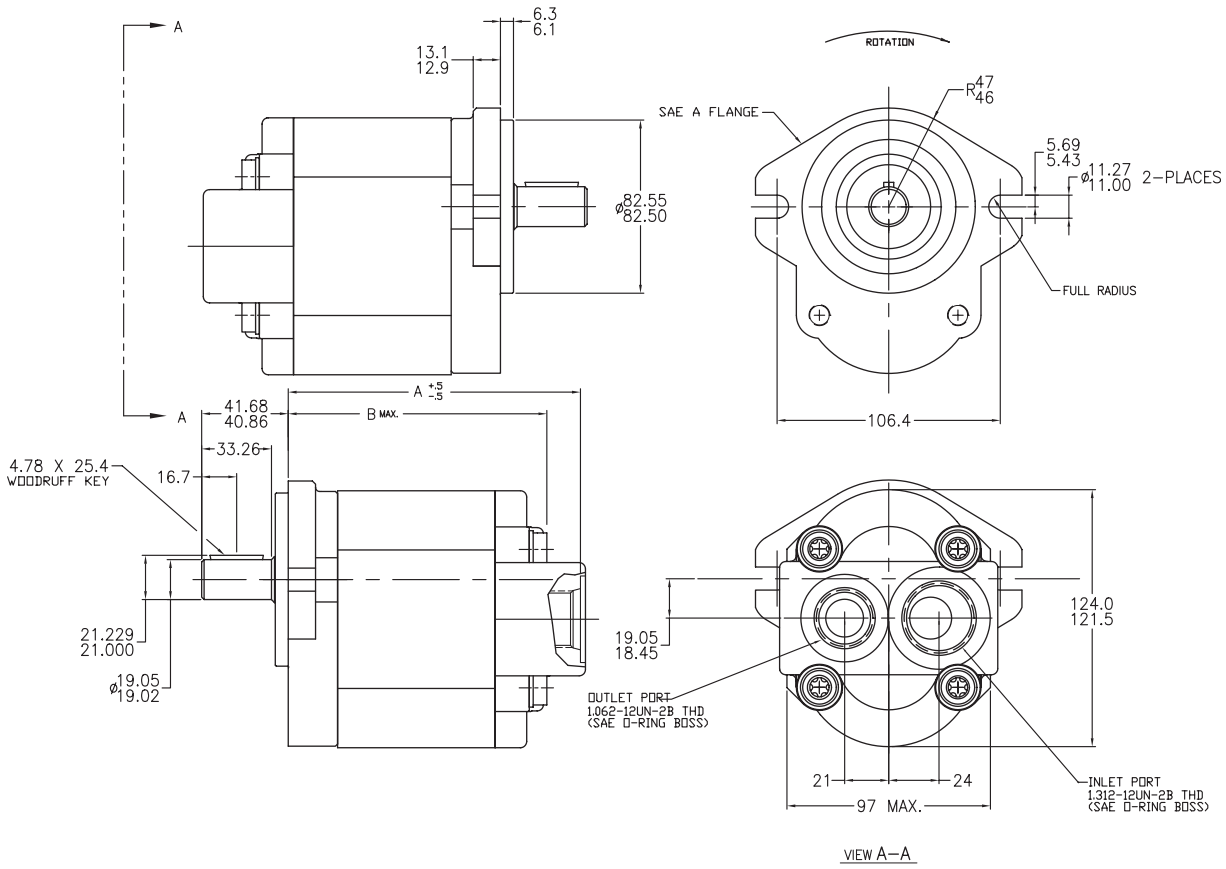
Ordering code

AZPN – X X – □ □ □ □ Q R 12 MB

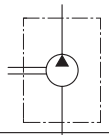
Displacement	Ordering-Number *		Max. operating pressure	Max. rotation speed	Dimension [mm]				
	L	R			A	B	C	Inlet Port ** (SAE O-Ring BOSS)	Outlet Port (SAE O-Ring BOSS)
[cm³/rev]			[bar]	[min⁻¹]					
20.0	**9 510 390 079**	**9 510 390 073**	230	3000	115.4	58.1	58.1	-16	-10
22.0	**9 510 390 080**	**9 510 390 074**	230	3000	118.4	59.6	59.6	-16	-10
25.0	**9 510 390 081**	**9 510 390 075**	230	3000	121.4	61.1	61.1	-20	-12
28.0	**9 510 390 082**	**9 510 390 076**	210	2800	124.4	62.6	62.6	-20	-12
32.0	**9 510 390 083**	**9 510 390 077**	180	2800	128.5	64.8	64.8	-20	-12
36.0	**9 510 390 084**	**9 510 390 078**	160	2600	133.0	67.1	67.1	-20	-12

* Contact factory for availabilty of units with no ordering number listed.

** Refer to page 46 for SAE O-Ring Boss Specifications and Dimensions.



Features	Details
Shaft	3/4″ keyed
Front Cover	SAE A 2-bolt
Ports	SAE ORB
Rear Cover	Rear ports



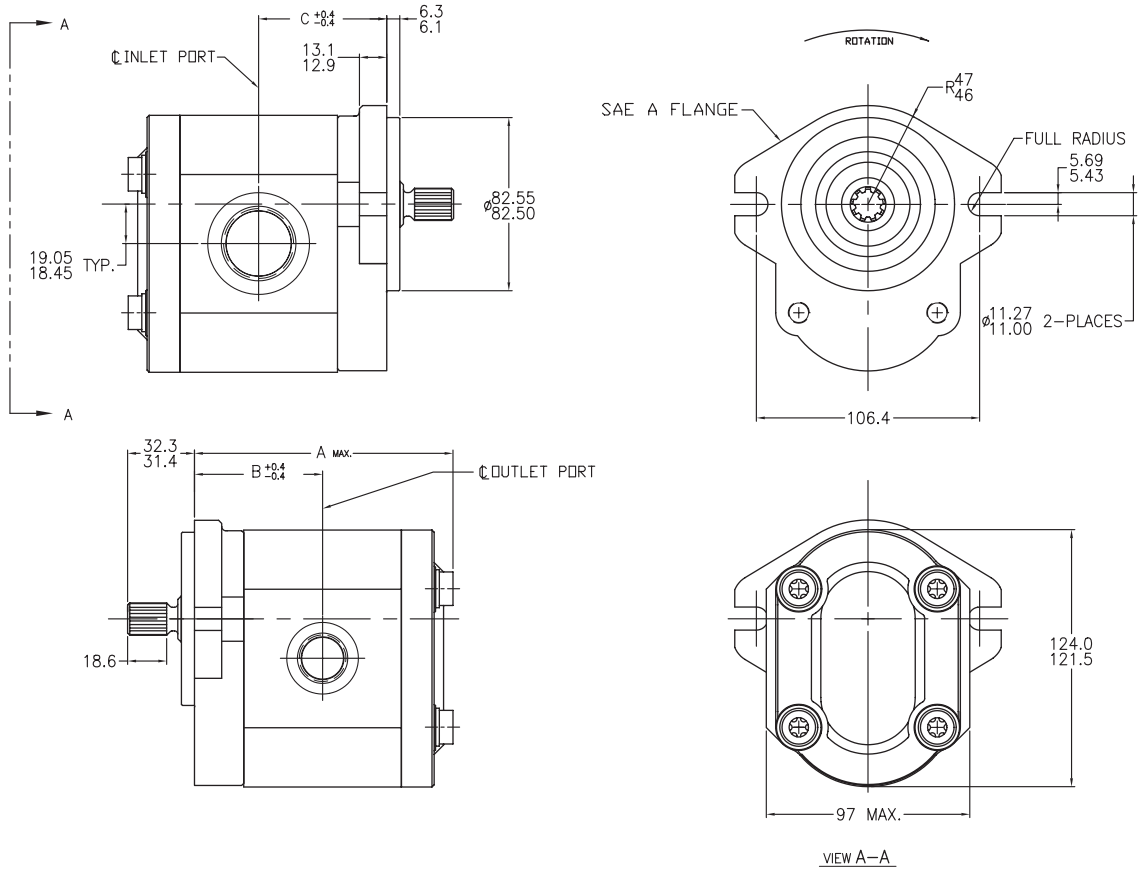
Clockwise
As shown in drawing

Counter-Clockwise
Inlet and outlet port changed

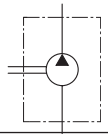
Ordering code
AZPN – X X – □ □ □ □ Q R 12 MA

Displacement	Ordering-Number *		Max. operating pressure	Max. rotation speed	Dimension [mm]			Inlet Port ** (SAE O-Ring	Outlet Port (SAE O-Ring
[cm³/rev]	L	R	[bar]	[min⁻¹]	A	B		BOSS)	BOSS)
20.0	**9 510 390 128**	**9 510 390 122**	230	3000	115.4	58.1		-16	-12
22.0	**9 510 390 129**	**9 510 390 123**	230	3000	118.4	59.6		-16	-12
25.0	**9 510 390 130**	**9 510 390 124**	230	3000	121.4	61.1		-16	-12
28.0	**9 510 390 131**	**9 510 390 125**	210	2800	124.4	62.6		-16	-12
32.0	**9 510 390 132**	**9 510 390 126**	180	2800	128.5	64.8		-16	-12
36.0	**9 510 390 133**	**9 510 390 127**	160	2600	133.0	67.1		-16	-12

* Contact factory for availabilty of units with no ordering number listed.
** Refer to page 46 for SAE O-Ring Boss Specifications and Dimensions.



Features	Details
Shaft	9t spline
Front Cover	SAE A 2-bolt
Ports	SAE ORB
Rear Cover	Standard



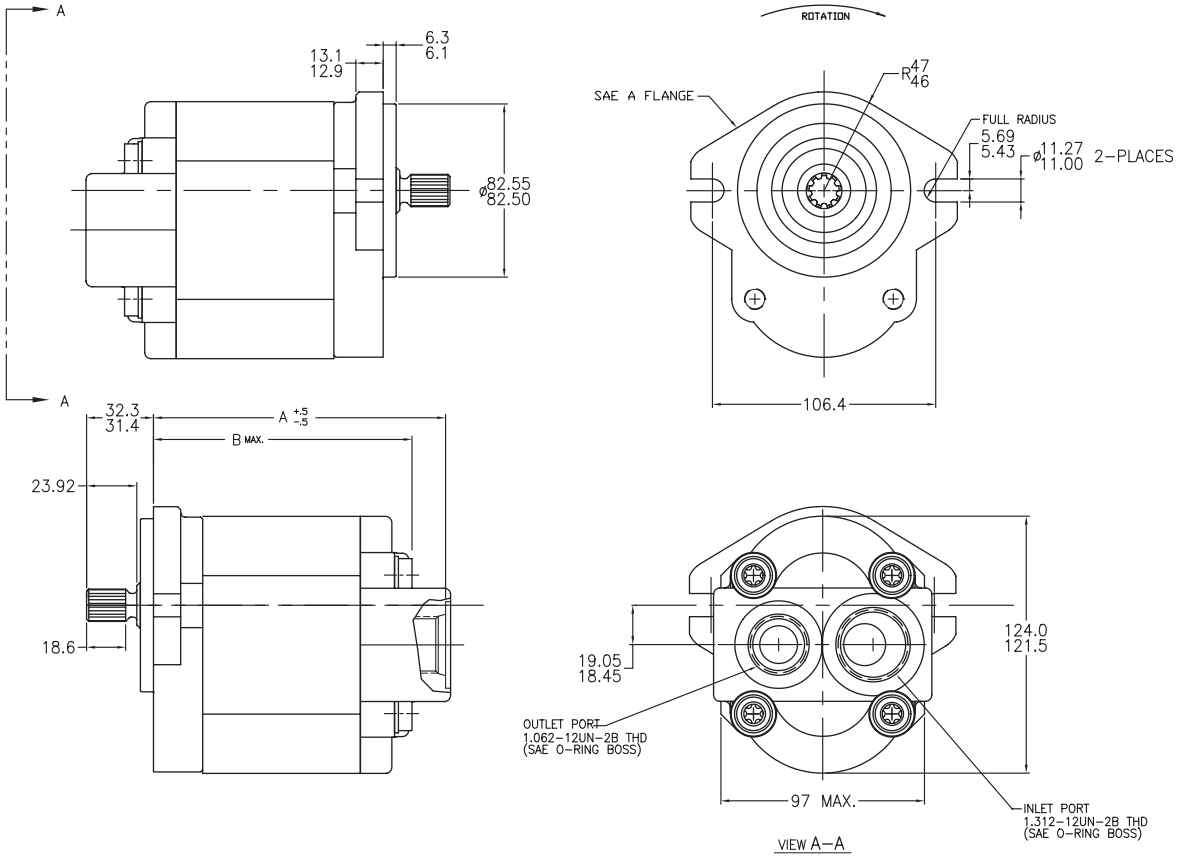
Clockwise
As shown in drawing

Counter-Clockwise
Inlet and outlet port changed

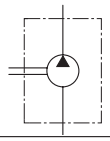
Ordering code
AZPN – X X – □□□□ R R 12 MB

Displacement	Ordering-Number *		Max. operating pressure	Max. rotation speed	Dimension [mm]				
	L	R			A	B	C	Inlet Port ** (SAE O-Ring BOSS)	Outlet Port (SAE O-Ring BOSS)
[cm³/rev]			[bar]	[min⁻¹]					
20.0	**9 510 390 031**	**9 510 390 025**	230	3000	117.7	58.1	58.1	-16	-10
22.0	**9 510 390 032**	**9 510 390 026**	230	3000	120.7	59.6	59.6	-16	-10
25.0	**9 510 390 033**	**9 510 390 027**	230	3000	123.7	61.1	61.1	-20	-12
28.0	**9 510 390 034**	**9 510 390 028**	210	2800	126.7	62.6	62.6	-20	-12
32.0	**9 510 390 035**	**9 510 390 029**	180	2800	130.8	64.8	64.8	-20	-12
36.0	**9 510 390 036**	**9 510 390 030**	160	2600	135.3	67.1	67.1	-20	-12

* Contact factory for availabilty of units with no ordering number listed.
** Refer to page 46 for SAE O-Ring Boss Specifications and Dimensions.



Features	Details
Shaft	9t spline
Front Cover	SAE A 2-bolt
Ports	SAE ORB
Rear Cover	Rear ports



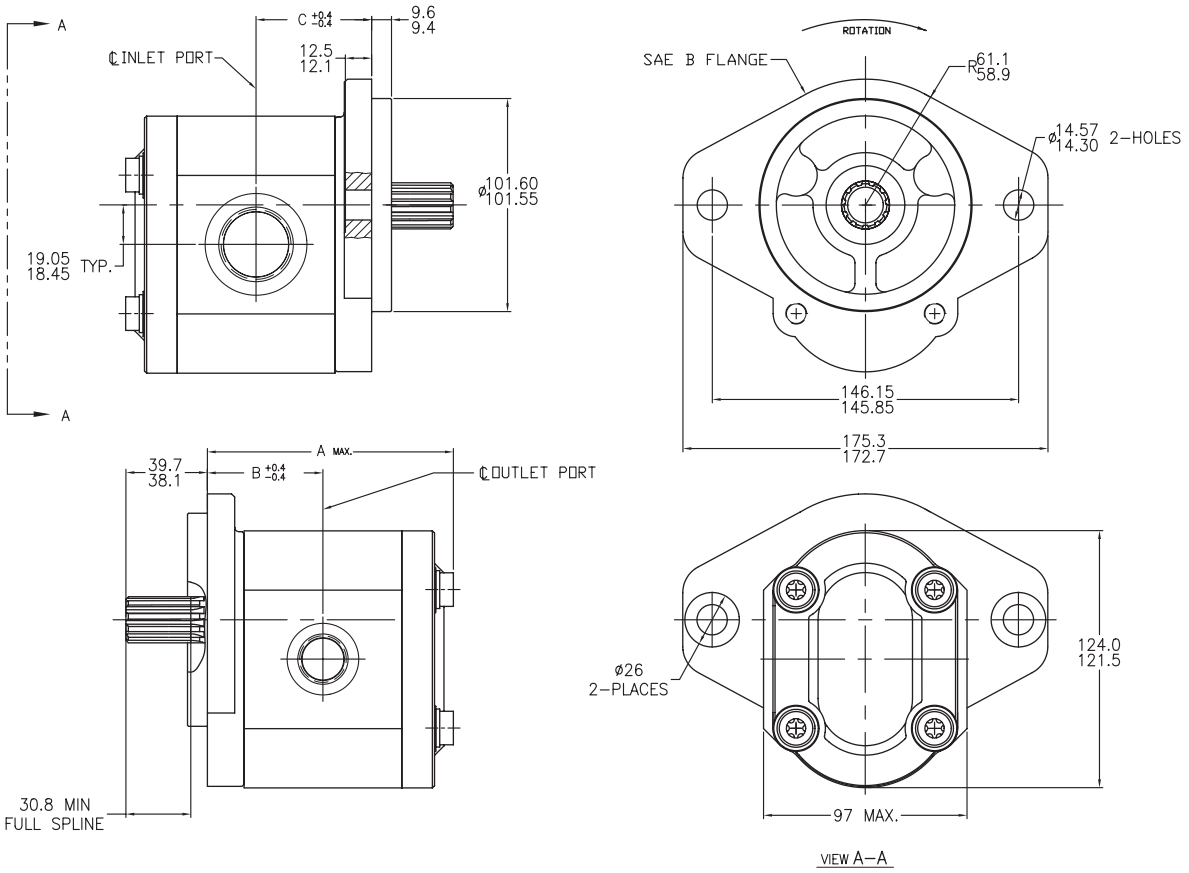
Clockwise
As shown in drawing

Counter-Clockwise
Inlet and outlet port changed

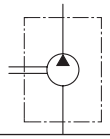
Ordering code
AZPN – X X – □ □ □ □ R R 12 MA

Displacement	Ordering-Number *		Max. operating pressure	Max. rotation speed	Dimension [mm]			Inlet Port ** (SAE O-Ring	Outlet Port (SAE O-Ring
[cm³/rev]	L	R	[bar]	[min⁻¹]	A	B		BOSS)	BOSS
20.0	**9 510 390 043**	**9 510 390 037**	230	3000	134.1	116.0		-16	-12
22.0	**9 510 390 044**	**9 510 390 038**	230	3000	131.1	120.9		-16	-12
25.0	**9 510 390 045**	**9 510 390 039**	230	3000	140.1	122.0		-16	-12
28.0	**9 510 390 046**	**9 510 390 040**	210	2800	143.1	125.0		-16	-12
32.0	**9 510 390 047**	**9 510 390 041**	180	2800	147.6	129.5		-16	-12
36.0	**9 510 390 048**	**9 510 390 042**	160	2600	152.1	135.9		-16	-12

* Contact factory for availabilty of units with no ordering number listed.
** Refer to page 46 for SAE O-Ring Boss Specifications and Dimensions.



Features	Details
Shaft	13t spline
Front Cover	SAE B 2-bolt
Ports	SAE ORB
Rear Cover	Standard



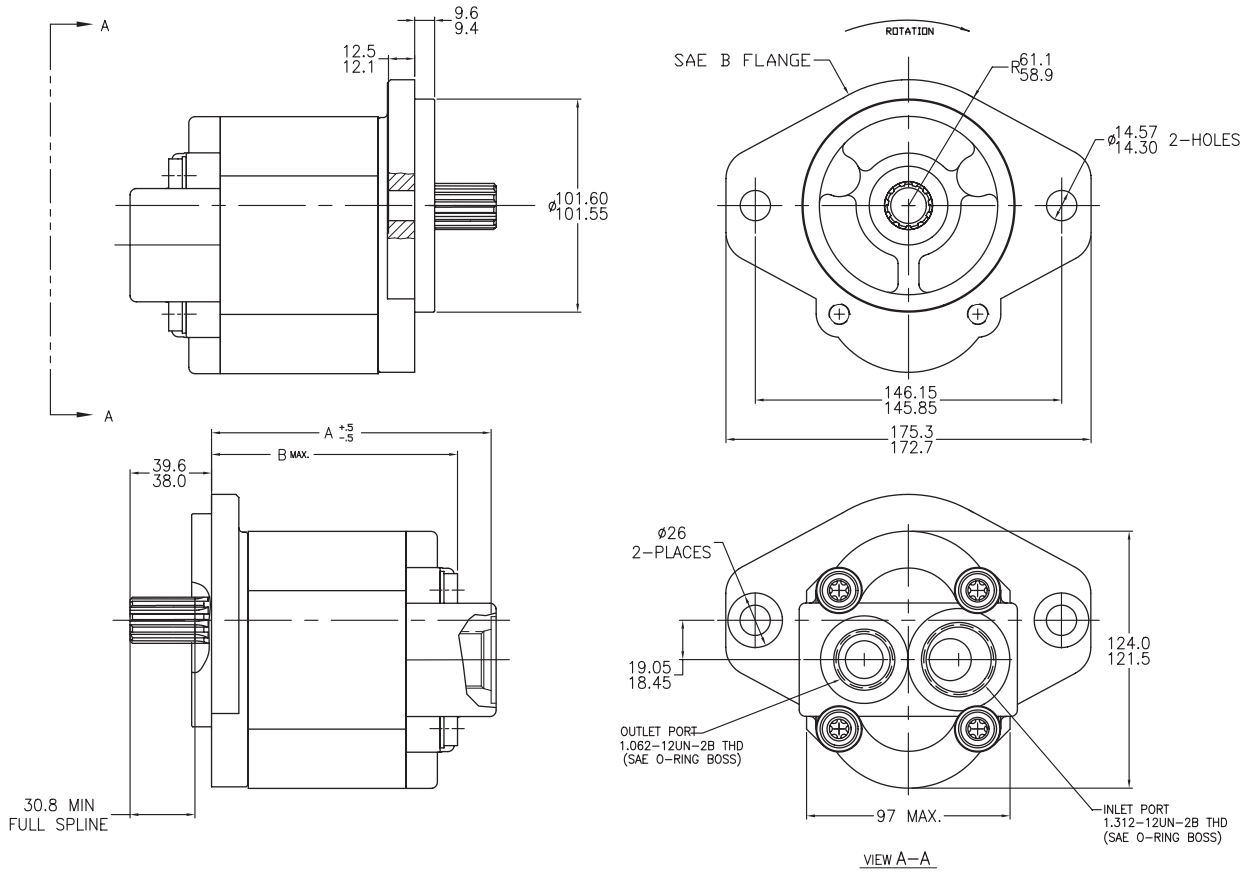
Clockwise
As shown in drawing

Counter-Clockwise
Inlet and outlet port changed

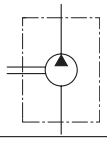
Ordering code
AZPN – X X – □□□□ D C 12 MB

Displacement	Ordering-Number *		Max. operating pressure	Max. rotation speed	Dimension [mm]				
	L	R			A	B	C	Inlet Port ** (SAE O-Ring BOSS)	Outlet Port (SAE O-Ring BOSS)
[cm³/rev]			[bar]	[min⁻¹]					
20.0	**9 510 390 007**	**9 510 390 001**	230	3000	109.8	52.1	52.1	-16	-10
22.0	**9 510 390 008**	**9 510 390 002**	230	3000	114.7	53.6	53.6	-16	-10
25.0	**9 510 390 009**	**9 510 390 003**	230	3000	115.8	55.1	55.1	-20	-12
28.0	**9 510 390 010**	**9 510 390 004**	210	2800	118.8	56.6	56.6	-20	-12
32.0	**9 510 390 011**	**9 510 390 005**	180	2800	123.3	58.8	58.8	-20	-12
36.0	**9 510 390 012**	**9 510 390 006**	160	2600	129.7	61.1	61.1	-20	-12

* Contact factory for availabilty of units with no ordering number listed.
** Refer to page 46 for SAE O-Ring Boss Specifications and Dimensions.



Features	Details
Shaft	13t spline
Front Cover	SAE B 2-bolt
Ports	SAE ORB
Rear Cover	Rear ports



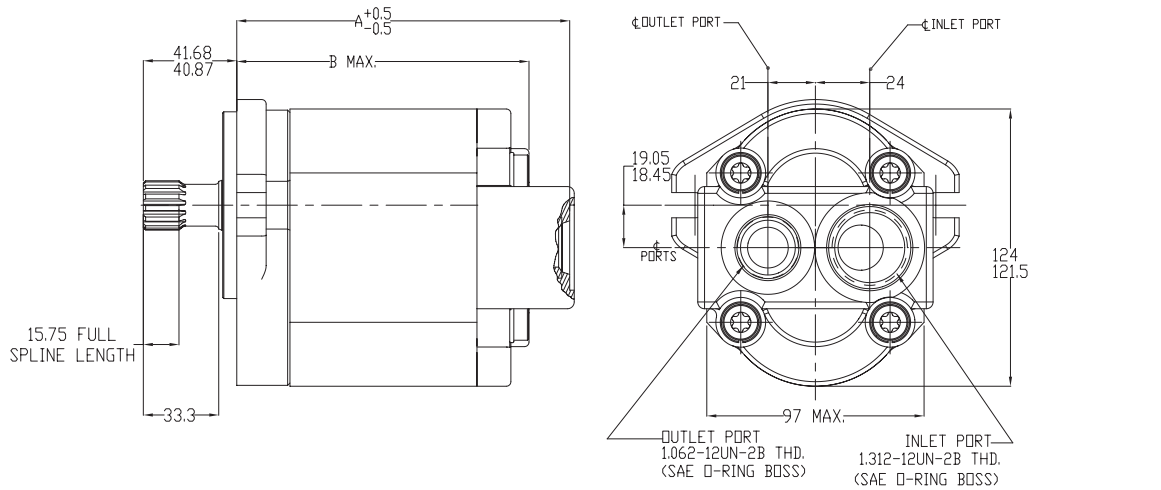
Clockwise
As shown in drawing

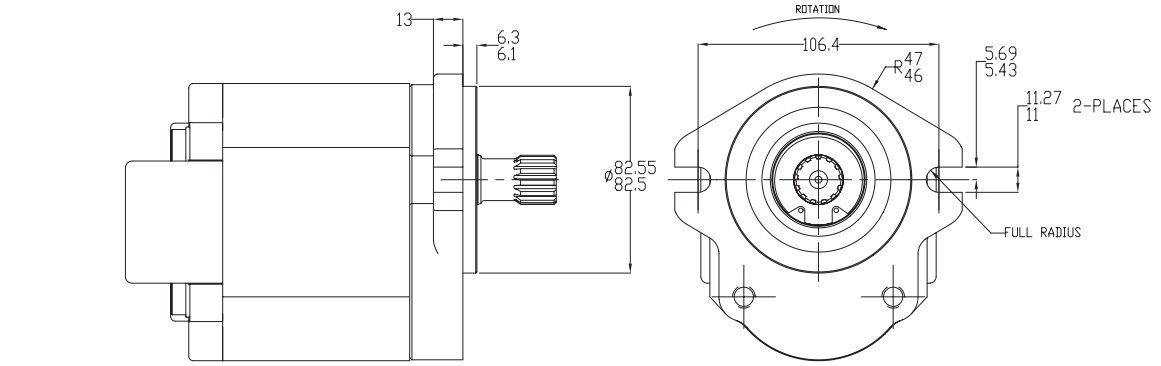
Counter-Clockwise
Inlet and outlet port changed

Ordering code
AZPN – X X – □ □ □ □ D C 12 MA

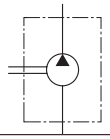
Displacement	Ordering-Number *		Max. operating pressure	Max. rotation speed	Dimension [mm]			Inlet Port ** (SAE O-Ring	Outlet Port (SAE O-Ring
[cm³/rev]	L	R	[bar]	[min⁻¹]	A	B		BOSS)	BOSS
20.0	**9 510 390 019**	**9 510 390 013**	230	3000	128.1	110.0		-16	-12
22.0	**9 510 390 020**	**9 510 390 014**	230	3000	131.1	114.9		-16	-12
25.0	**9 510 390 021**	**9 510 390 015**	230	3000	134.1	116.0		-16	-12
28.0	**9 510 390 022**	**9 510 390 016**	210	2800	137.1	119.0		-16	-12
32.0	**9 510 390 023**	**9 510 390 017**	180	2800	141.6	123.5		-16	-12
36.0	**9 510 390 024**	**9 510 390 018**	160	2600	146.1	129.9		-16	-12

* Contact factory for availabilty of units with no ordering number listed.
** Refer to page 46 for SAE O-Ring Boss Specifications and Dimensions.





Features	Details
Shaft	13t spline
Front Cover	SAE A 2-bolt
Ports	SAE ORB
Rear Cover	Rear ports



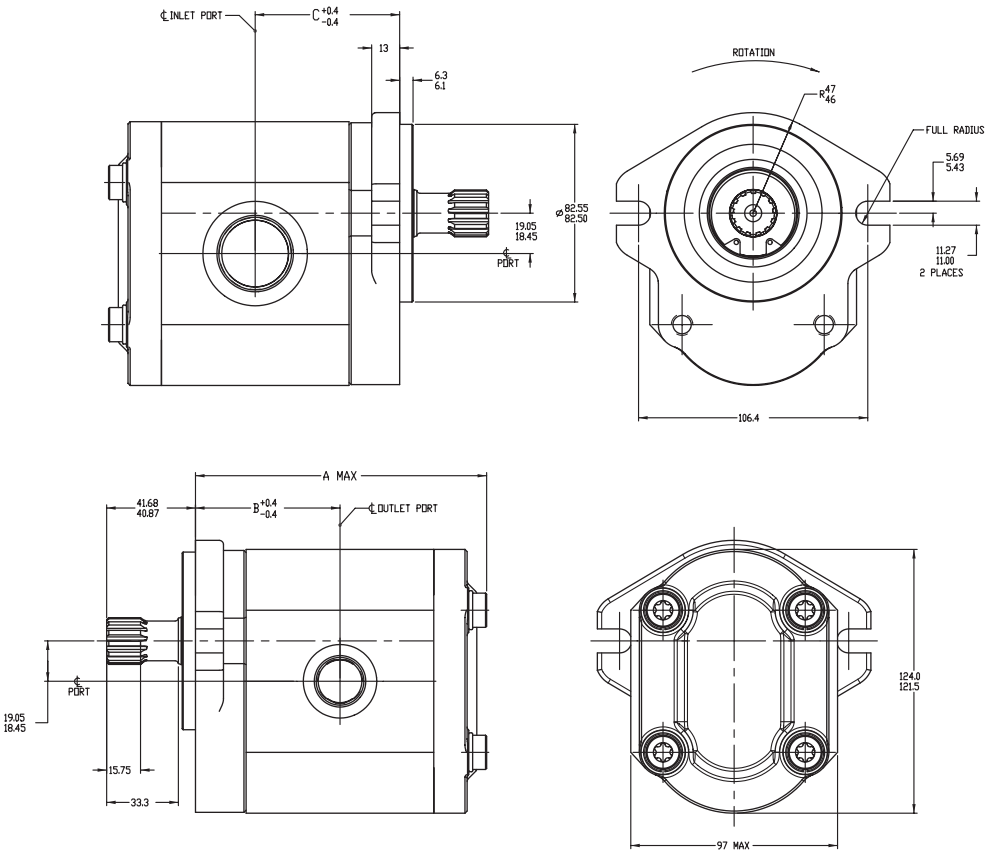
Clockwise
As shown in drawing

Counter-Clockwise
Inlet and outlet port changed

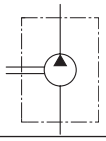
Ordering code
AZPN – X X – □ □ □ □ D R 12 MA

Displacement	Ordering-Number *		Max. operating pressure	Max. rotation speed	Dimension [mm]			Inlet Port ** (SAE O-Ring	Outlet Port (SAE O-Ring
[cm³/rev]	L	R	[bar]	[min⁻¹]	A	B		BOSS)	BOSS
20.0	*	**9 510 390 175**	230	3000	133.6	116.0		-16	-12
22.0	**9 510 390 188**	**9 510 390 176**	230	3000	136.6	119.0		-16	-12
25.0	*	**9 510 390 177**	230	3000	139.6	124.0		-16	-12
28.0	*	**9 510 390 178**	210	2800	142.6	125.0		-16	-12
32.0	*	**9 510 390 179**	180	2800	147.1	129.5		-16	-12
36.0	*	**9 510 390 180**	160	2600	151.6	134.0		-16	-12

* Contact factory for availabilty of units with no ordering number listed.
** Refer to page 46 for SAE O-Ring Boss Specifications and Dimensions.



Features	Details
Shaft	13t spline
Front Cover	SAE A 2-bolt
Ports	SAE ORB
Rear Cover	Standard



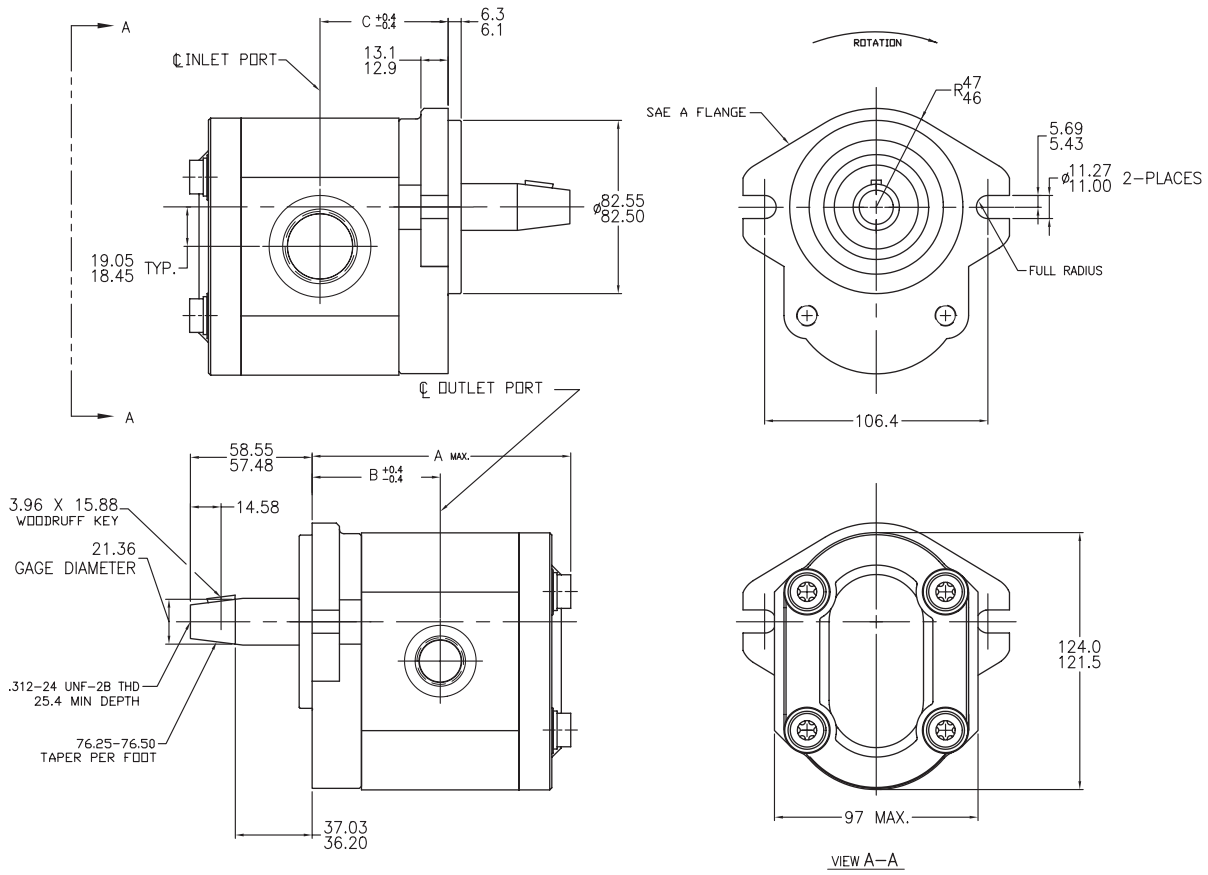
Clockwise
As shown in drawing

Counter-Clockwise
Inlet and outlet port changed

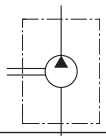
Ordering code
AZPN – X X – □□□□ D R 12 MB

Displacement	Ordering-Number *		Max. operating pressure	Max. rotation speed	Dimension [mm]			Inlet Port **	Outlet Port
[cm³/rev]	L	R	[bar]	[min⁻¹]	A	B	C	(SAE O-Ring BOSS)	(SAE O-Ring BOSS)
20.0	*	*							
22.0	*	*							
25.0	*	*							
28.0	**9 510 390 174**	*	210	2800	124.7	62.8	62.8	-20	-12
32.0	*	**9 510 390 173**	180	2800	129.3	64.8	64.8	-20	-12
36.0	*	**9 510 390 190**	160	2600	135.7	67.1	67.1	-20	-12

* Contact factory for availabilty of units with no ordering number listed.
** Refer to page 46 for SAE O-Ring Boss Specifications and Dimensions.



Features	Details
Shaft	Taper keyed
Front Cover	SAE A 2-bolt
Ports	SAE ORB
Rear Cover	Standard



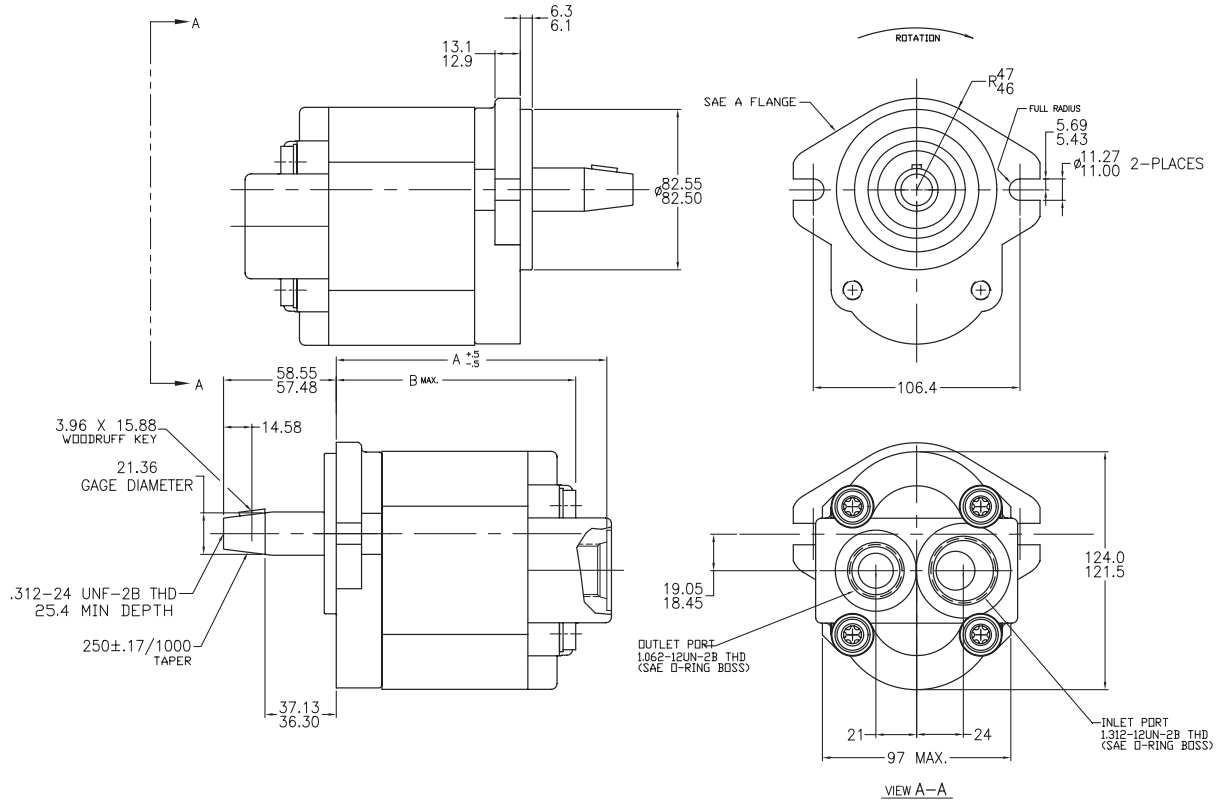
Clockwise
As shown in drawing

Counter-Clockwise
Inlet and outlet port changed

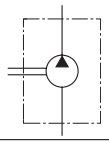
Ordering code
AZPN – X X – □ □ □ X R 12 MB-S0075

Displacement	Ordering-Number *		Max. operating pressure	Max. rotation speed	Dimension [mm]				
	↺	↻						Inlet Port ** (SAE O-Ring	Outlet Port (SAE O-Ring
[cm³/rev]	L	R	[bar]	[min⁻¹]	A	B	C	BOSS)	BOSS)
20.0	**9 510 390 116**	**9 510 390 110**	230	3000	115.8	58.1	58.1	-16	-10
22.0	**9 510 390 117**	**9 510 390 111**	230	3000	120.7	59.6	59.6	-16	-10
25.0	**9 510 390 118**	**9 510 390 112**	230	3000	121.8	61.1	61.1	-20	-12
28.0	**9 510 390 119**	**9 510 390 113**	210	2800	124.8	62.6	62.6	-20	-12
32.0	**9 510 390 120**	**9 510 390 114**	180	2800	129.3	64.8	64.8	-20	-12
36.0	**9 510 390 121**	**9 510 390 115**	160	2600	135.7	67.1	67.1	-20	-12

* Contact factory for availabilty of units with no ordering number listed.
** Refer to page 46 for SAE O-Ring Boss Specifications and Dimensions.



Features	Details
Shaft	Taper keyed
Front Cover	SAE A 2-bolt
Ports	SAE ORB
Rear Cover	Rear ports



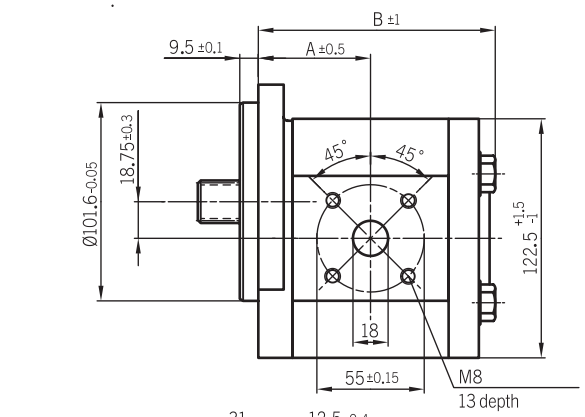
Clockwise
As shown in drawing

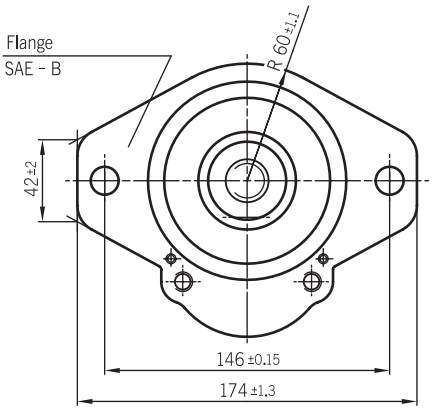
Counter-Clockwise
Inlet and outlet port changed

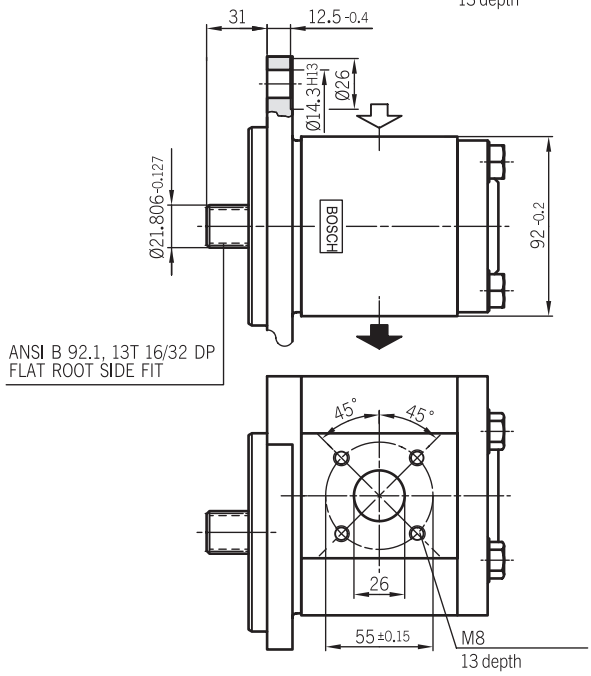
Ordering code
AZPN – X X – □ □ □ X R 12 MA-S0075

Displacement	Ordering-Number *		Max. operating pressure	Max. rotation speed	Dimension [mm]			Inlet Port ** (SAE O-Ring	Outlet Port (SAE O-Ring
[cm³/rev]	L	R	[bar]	[min⁻¹]	A	B		BOSS)	BOSS
20.0	**9 510 390 140**	**9 510 390 134**	230	3000	134.1	116.0		-16	-12
22.0	**9 510 390 141**	**9 510 390 135**	230	3000	137.1	120.9		-16	-12
25.0	**9 510 390 142**	**9 510 390 136**	230	3000	140.1	122.0		-16	-12
28.0	**9 510 390 143**	**9 510 390 137**	210	2800	143.1	125.0		-16	-12
32.0	**9 510 390 144**	**9 510 390 138**	180	2800	147.6	129.5		-16	-12
36.0	**9 510 390 145**	**9 510 390 139**	160	2600	152.1	135.9		-16	-12

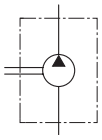
* Contact factory for availabilty of units with no ordering number listed.
** Refer to page 46 for SAE O-Ring Boss Specifications and Dimensions.







Features	Details
Shaft	13t spline
Front Cover	SAE B 2-bolt
Ports	DIN 8901/8902
Rear Cover	Standard



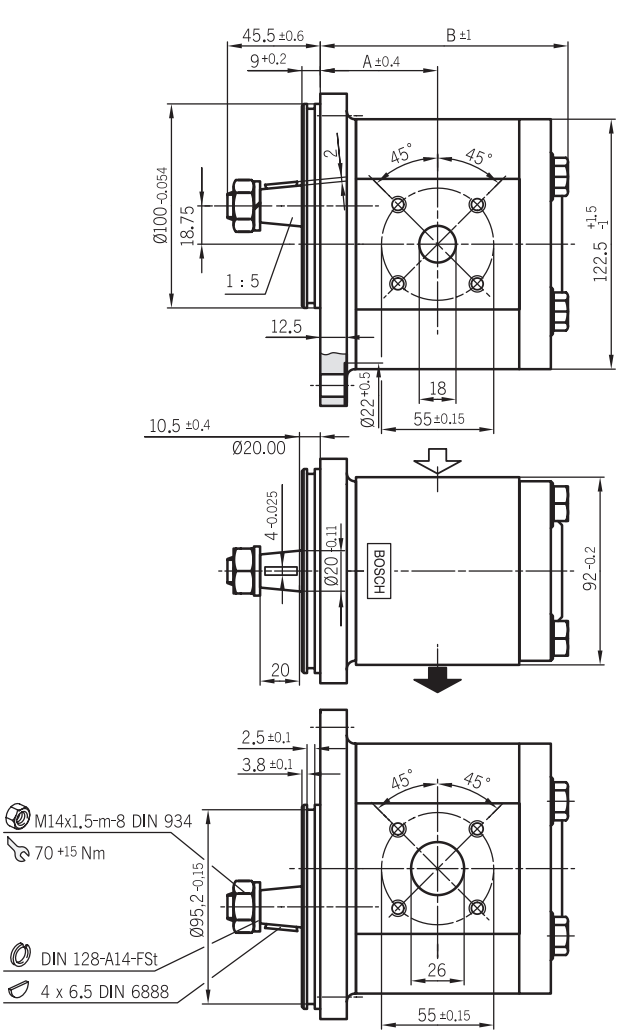
Clockwise
As shown in drawing

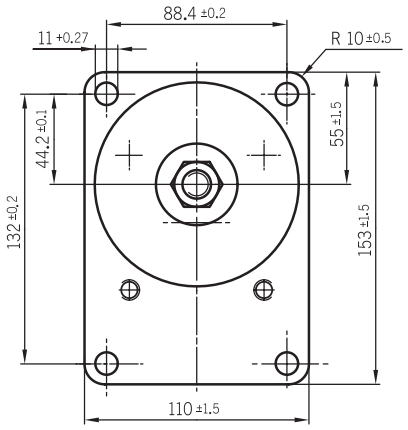
Counter-Clockwise
Inlet and outlet port changed

Ordering code
AZPN – X X – □□□□ D C 20 MB

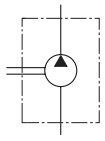
Displacement [cm³/rev]	Ordering-Number * L	Ordering-Number * R	Max. operating pressure [bar]	Max. rotation speed [min⁻¹]	Dimension [mm] A	B			
25.0	**0 510 725 377**	**0 510 725 057**	230	3000	55.0	116.1			
28.0		**0 510 725 058**	210	2800	56.5	119.1			
36.0	**0 510 725 363**		160	2600	61.0	128.1			

* Contact factory for availabilty of units with no ordering number listed.
** Refer to page 46 for SAE O-Ring Boss Specifications and Dimensions.





Features	Details
Shaft	1:5 taper keyed
Front Cover	Sq. flange 100mm
Ports	DIN 8901/8902
Rear Cover	Standard



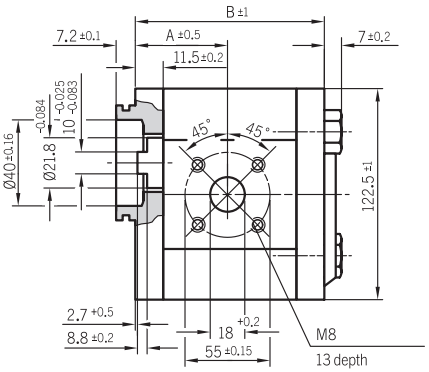
Clockwise
As shown in drawing

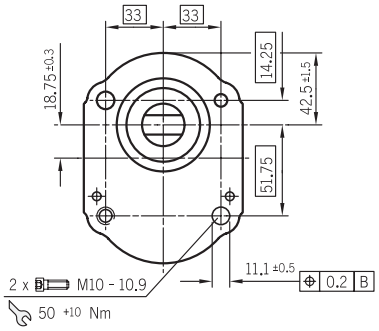
Counter-Clockwise
Inlet and outlet port changed

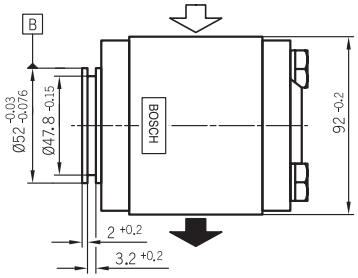
Ordering code
AZPN – X X – □□□□ C B 20 MB

Displacement [cm³/rev]	Ordering-Number * L	Ordering-Number * R	Max. operating pressure [bar]	Max. rotation speed [min⁻¹]	Dimension [mm] A	B			
20.0	**0 510 625 335**	**0 510 625 035**	230	3000	52.0	109.8			
25.0	**0 510 725 352**	**0 510 725 047**	230	3000	55.0	115.8			
28.0	**0 510 725 364**	**0 510 725 055**	210	2800	56.5	118.8			
32.0	**0 510 725 353**	**0 510 725 048**	180	2800	59.0	123.3			

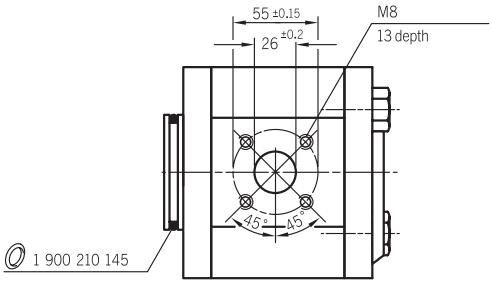
* Contact factory for availabilty of units with no ordering number listed.

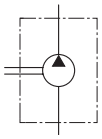






Features	Details
Shaft	Tang
Front Cover	Transmission
Ports	DIN 8901/8902
Rear Cover	Thru drive





Clockwise
As shown in drawing

Counter-Clockwise
Inlet and outlet port changed

Ordering code
AZPN – X X – □ □ □ □ N M 20 MB

Displacement [cm³/rev]	Ordering-Number * L	Ordering-Number * R	Max. operating pressure [bar]	Max. rotation speed [min⁻¹]	Dimension [mm] A	B			
25.0		**0 510 715 006**	230	3000	55.0	109.1			
32.0		**0 510 715 007**	180	2800	59.0	116.6			

* Contact factory for availabilty of units with no ordering number listed.

Ordering Code (G Series Pump)

A Z P G - 2 2 - 0 4 5 - R D C 1 2 M B

Function

P = Pump

Size (G)

1.99 in³ (32.6 cm³) = 032
2.20 in³ (36.0 cm³) = 036
2.75 in³ (45.0 cm³) = 045
3.42 in³ (56.0 cm³) = 056
3.84 in³ (63.0 cm³) = 063

Direction of rotation

Right = R
Left = L

End cover

Standard = B

Seals

NBR = M
FPM = P
NBR, shaft seal in FPM = K

Drive shafts

		Matching front flange
C	Conical 1:5 (Tapered key)	B
S	Conical 1:5 for flange A (Tapered key)	A
H	Conical 1:8 (Tapered key)	O
N	Dog (Tang)	M
Q	Cylindrical (Straight Key) SAE B 7/8”	C
D	Spline shaft SAE B 13T	C
F	Spline shaft DIN 5482 B17x14	B

Front flange

B	Square flange Pilot Ø 105 mm
O	Square flange Pilot Ø 50.78 mm
C	SAE B 2-bolt
M	Transmission flange Pilot Ø 52 mm with O-ring
A	Outrigger bearing Pilot Ø 105 mm (outboard bearing)

Line connections

20	Rectangular flange
30	Rectangular flange
07	Split flange SAE Code 61 Metric bolts
40	Split flange SAE Code 61 UNC bolts
12	Thread (UN-23) SAE O-Ring BOSS

Note: Consult Factory for Availability

Size G

4 ... 28 cm³/rev

Check sezes

N Series Pump Product Index

(Reference page 43 for ordering code designators)

AZPF-XX-XXXX _ _ _ MB

Page Number	Shaft Ordering code	Mounting Type	Flange	Port Ports	Orientation
73	AZPG-22-XXXXDC12MB	D	C	12	side
74	AZPG-22-XXXXDC12MA	D	C	12	rear
75	AZPG-22-XXXXQC12MB	Q	C	12	side
76	AZPG-22-XXXXQC12MA	Q	C	12	rear
77	AZPG-22-XXXXDC40MB	D	C	40	side
78	AZPG-22-XXXXQC40MB	Q	C	40	side

G Series Performance Ratings

Size		**32**	**36**	**45**	**56**	**63**
Displacement:	cm^3/rev	32	36	45	56	63
	cu in/rev	1.95	2.20	2.75	3.42	3.84
Range Speed:	Min RPM	400	400	400	400	400
	Max RPM	2800	2800	2600	2300	2300
Pressure - Rated: p_1	(Bar)	250	250	250	195	170
	(PSI)	3625	3625	3625	2828	2465
Intermittent: p_2	(Bar)	280	280	280	225	200
	(PSI)	4060	4060	4060	3263	2900
Max Peak: p_3	(Bar)	300	300	300	250	230
	(PSI)	4350	4350	4350	3625	3335
Inlet Pressure:	Continuous	0.7 - 3.0 bar absolute (9in Hg vacuum to 29 PSIG				
	Intermittent	0.1 - 10 bar absolute (26in Hg vacuum to 130 PSIG				

G Series Pumps
SAE O-Ring BOSS - Standard Porting

	Side Ports		Rear Port	
Displacement	Inlet	Outlet	Inlet	Outlet
32	-20	-16	-20	-16
36	-20	-16	-20	-16
45	-20	-16	-20	-16
56	-24	-20	-20	-16
63	-24	-20	-20	-16

SAE Porting - Specifications and Dimensions per SAE J1926/1

Dash Size	**Thread Size (in)**
-2	5/16-24 UNF-2B
-3	3/8-24 UNF-2B
-4	7/16-20 UNF-2B
-5	1/2-20 UNF-2B
-6	9/16-18 UNF-2B
-8	3/4-16 UNF-2B
-10	7/8-14 UNF-2B
-12	1-1/16-12 UN-2B
-14	1-3/16-12 UN-2B
-16	1-5/16-12 UN-2B
-20	1-5/8-12 UN-2B
-24	1-7/8-12 UN-2B
-32	2-1/2-12 UN-2B

Split Flange SAE Porting - Specifications and Dimensions per SAE J518 (Code 61)

Nominal Flange Size	**Flange Dash Size**	**Port Diamenter (max)**	
		Inches	**mm**
1/2	-8	0.50	13
3/4	-12	0.75	19
1	-16	1.00	25
1-1/4	-20	1.25	32
1-1/2	-24	1.50	38
2	-32	2.00	51

Note: Ratings represent units incorporating SAE O-Ring BOSS threaded ports. Pressure ratings may differ for other types of ports.

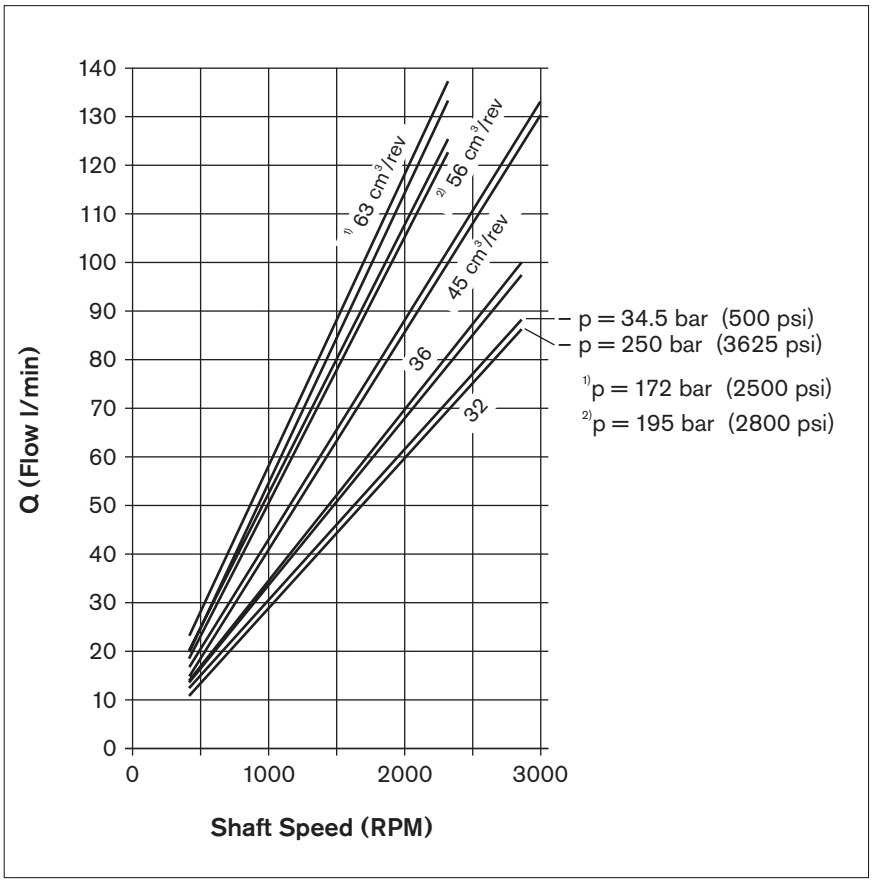
Diagrams

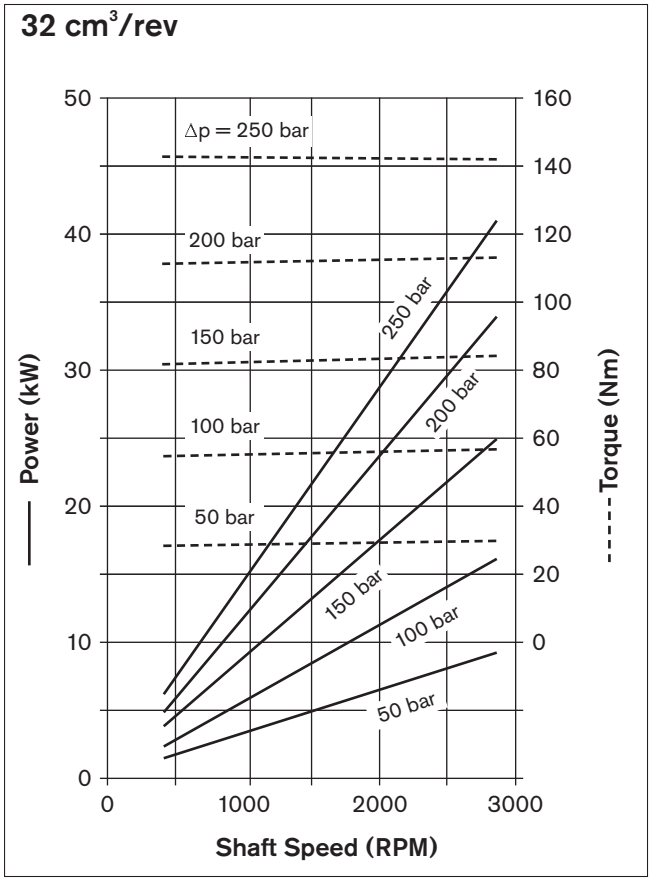
Size G

$\nu = 35\ mm^2/s$, T = 50 °C

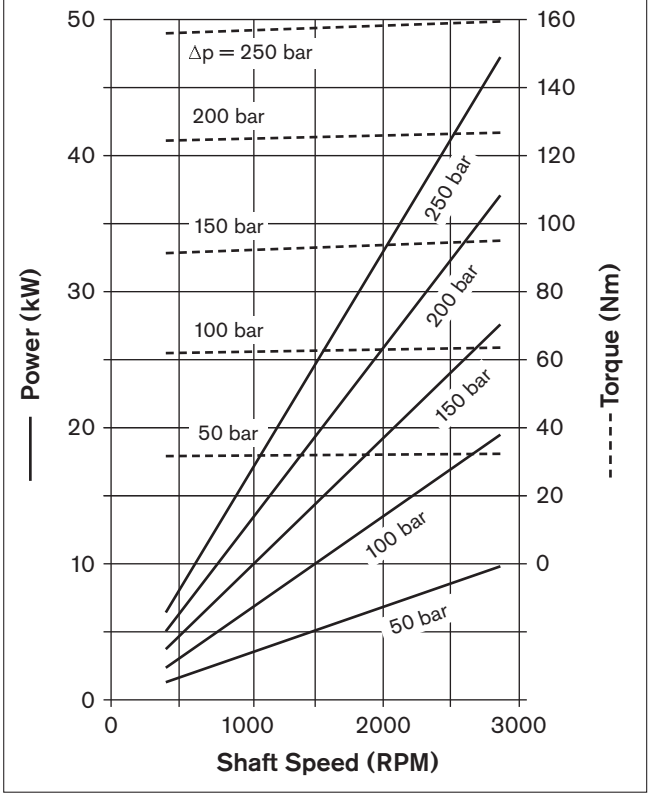
Unit Conversions

Pressure: psi = bar x 14.7
Torque: ft-lbs = (Nm) x .738
Power: hp = (kW) x 1.341
Volume: in3 = (cc) x 16.39
gpm = (LPM) x .2642

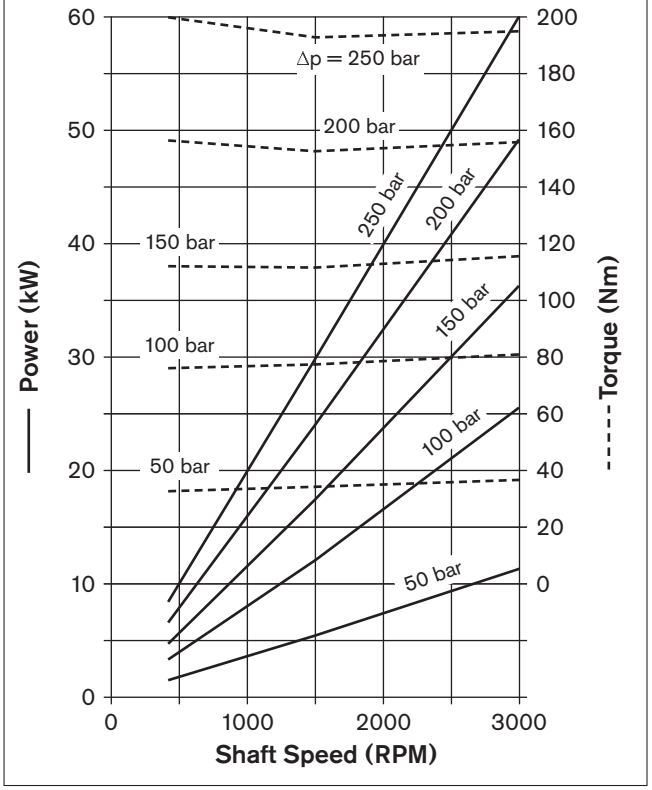




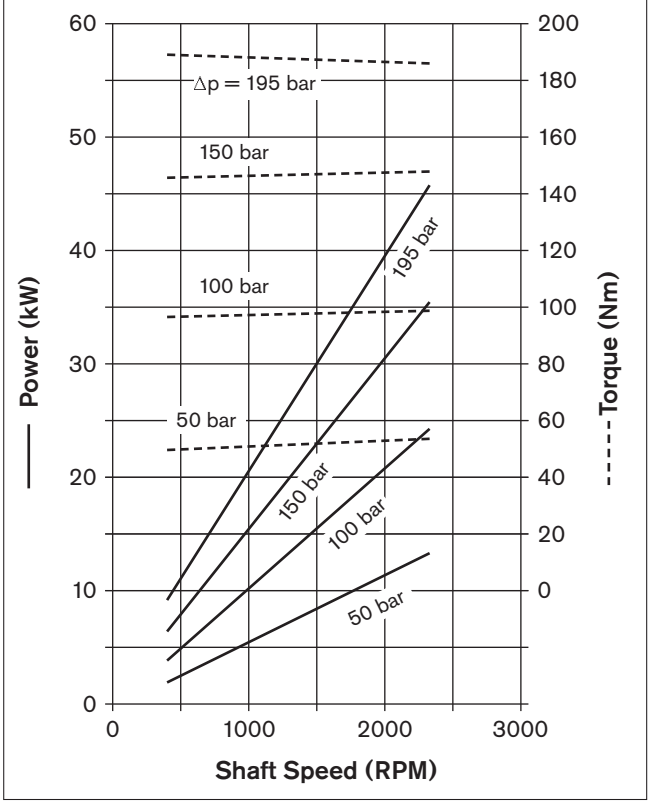
36 cm³/rev



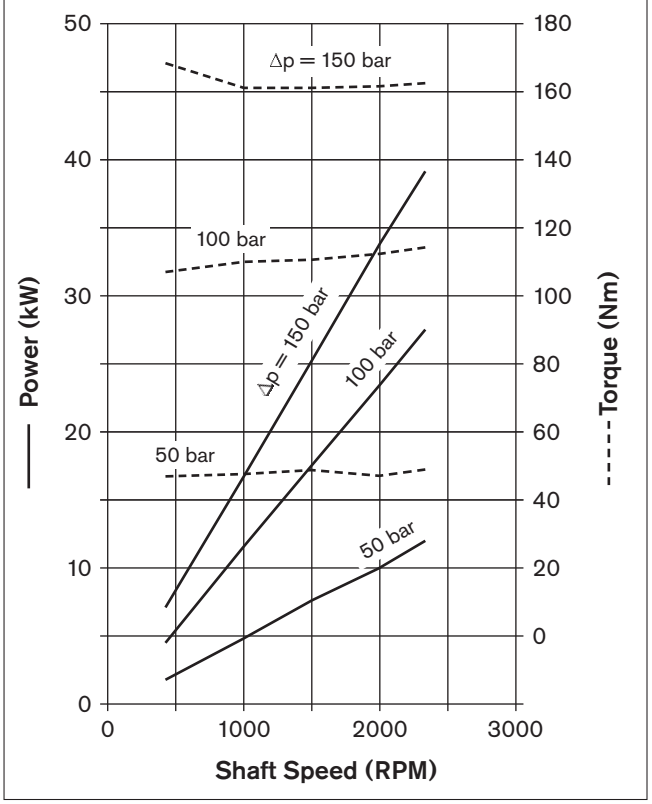
45 cm³/rev

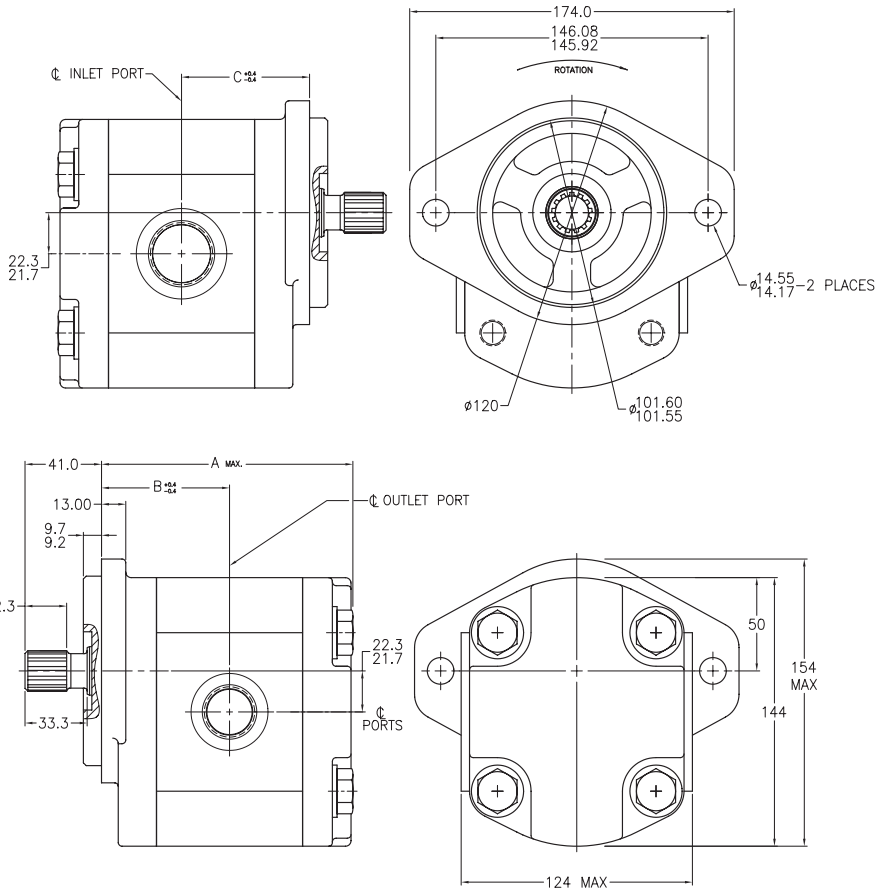


56 cm³/rev

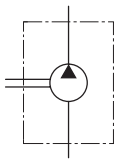


63 cm³/rev





Features	Details
Shaft	13t spline
Front Cover	SAE B 2-bolt
Ports	SAE ORB
Rear Cover	Standard



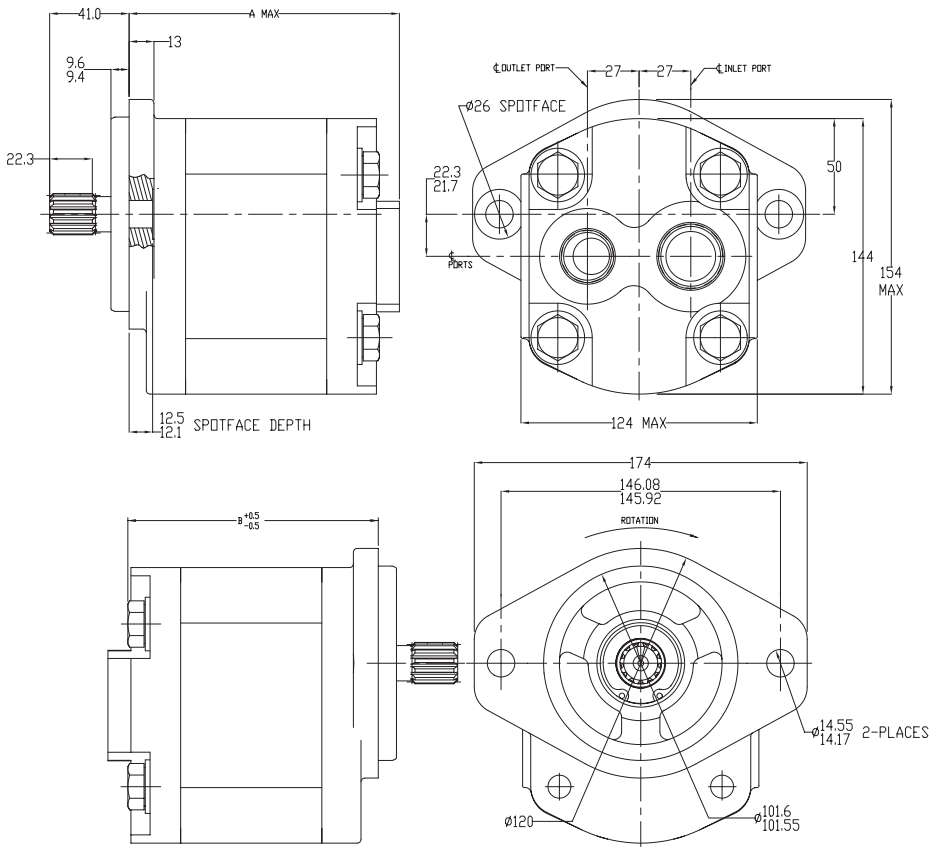
Clockwise
As shown in drawing

Counter-Clockwise
Inlet and outlet port changed

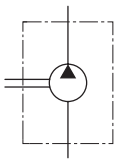
Ordering code
AZPG – 2 2 – □ □ □ □ D C 12 MB

Displacement	Ordering-Number *		Max. operating pressure	Max. rotation speed	Dimension [mm]				
	L	R			A	B	C	Inlet Port** (SAE O-Ring BOSS)	Outlet Port** (SAE O-Ring BOSS)
[cm³/rev]			[bar]	[min⁻¹]					
32.0	**9 510 490 014**	**9 510 490 004**	250	2800	139.2	70.3	70.3	-20	-16
36.0	**9 510 490 015**	**9 510 490 005**	250	2800	142.5	72.0	72.0	-20	-16
45.0	**9 510 490 017**	**9 510 490 007**	250	2600	149.9	75.7	75.7	-24	-20
56.0	**9 510 490 019**	**9 510 490 009**	195	2300	159.0	80.2	80.2	-24	-20
63.0	**9 510 490 020**	**9 510 490 010**	170	2300	164.8	83.1	83.1	-24	-20

* Contact factory for availabilty of units with no ordering number listed.
** Refer to page 70 for SAE O-Ring Boss Specifications and Dimensions.



Features	Details
Shaft	13t spline
Front Cover	SAE B 2-bolt
Ports	SAE ORB
Rear Cover	Rear ports



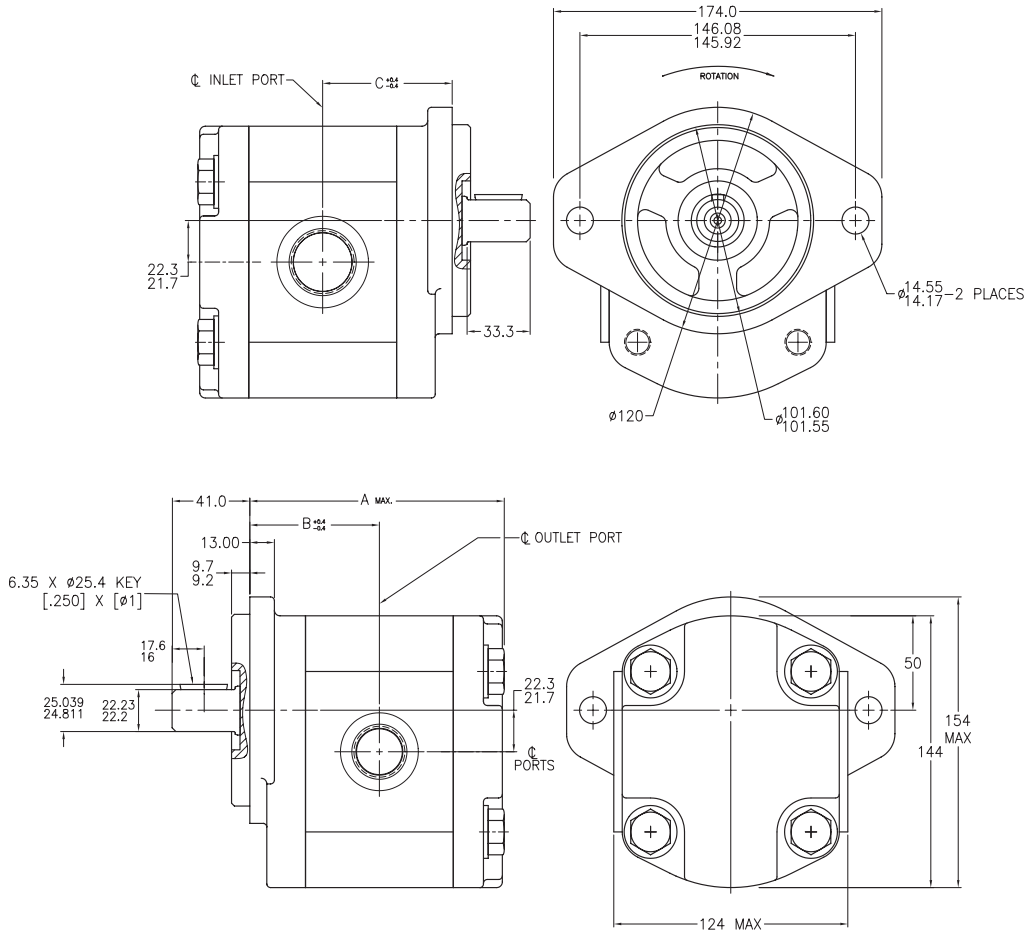
Clockwise
Inlet and outlet port changed

Counter-Clockwise
As shown in drawing

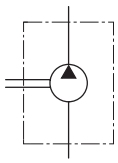
Ordering code
AZPG – 2 2 – □□□□ D C 12 MA

Displacement	Ordering-Number *		Max. operating pressure	Max. rotation speed	Dimension [mm]			Inlet Port** (SAE O-Ring BOSS)	Outlet Port** (SAE O-Ring BOSS)
[cm³/rev]	L	R	[bar]	[min⁻¹]	A	B			
32.0	**9 510 490 074**	**9 510 490 064**	250	2800	149.4	138.7		-20	-16
36.0	**9 510 490 075**	**9 510 490 065**	250	2800	152.8	142.0		-20	-16
45.0	**9 510 490 077**	**9 510 490 067**	250	2600	160.2	149.4		-20	-16
56.0	**9 510 490 079**	**9 510 490 069**	195	2300	169.2	158.5		-20	-16
63.0	**9 510 490 080**	**9 510 490 070**	170	2300	175.1	164.3		-20	-16

* Contact factory for availabilty of units with no ordering number listed.
** Refer to page 70 for SAE O-Ring Boss Specifications and Dimensions.



Features	Details
Shaft	7/8 keyed
Front Cover	SAE B2-bolt
Ports	SAE ORB
Rear Cover	Standard



Clockwise
Inlet and outlet port changed

Counter-Clockwise
As shown in drawing

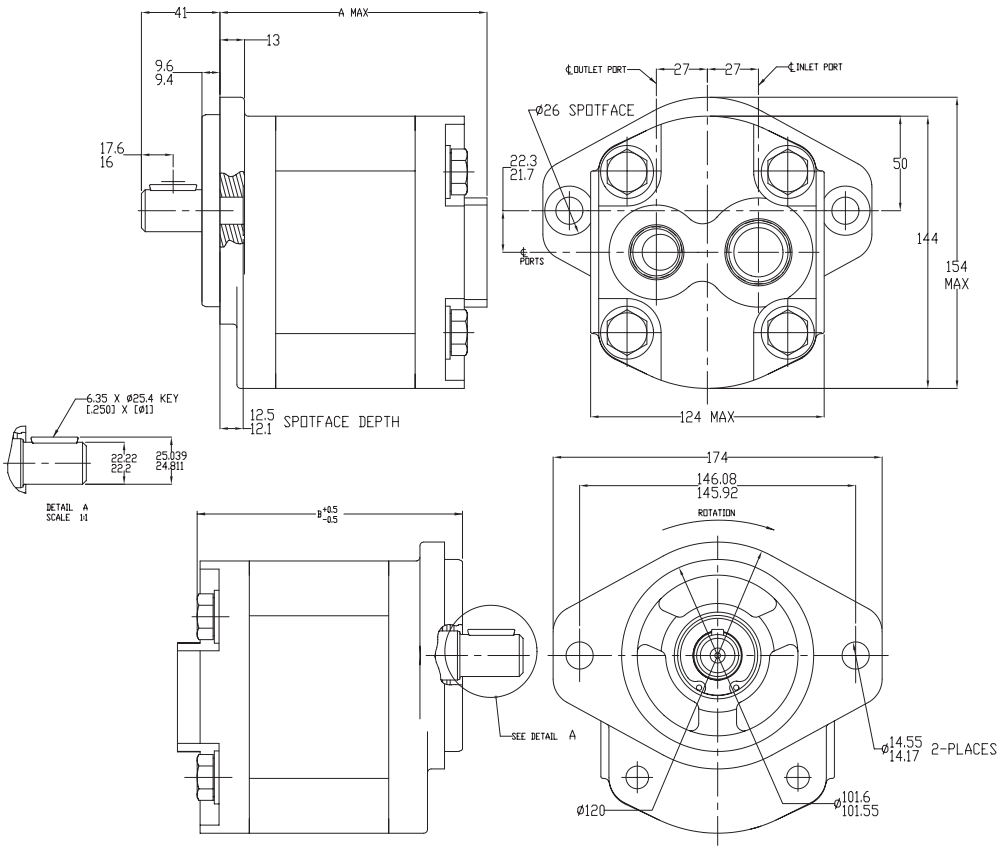
Ordering code

AZPG – 2 2 – ☐ ☐ ☐ ☐ Q C 12 MB

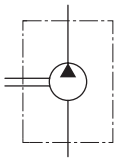
Displacement	Ordering-Number *		Max. operating pressure	Max. rotation speed	Dimension [mm]			Inlet Port** (SAE O-Ring BOSS)	Outlet Port** (SAE O-Ring BOSS)
[cm³/rev]	L	R	[bar]	[min⁻¹]	A	B	C		
32.0	**9 510 490 034**	**9 510 490 024**	250	2800	139.2	70.3	70.3	-20	-16
36.0	**9 510 490 035**	**9 510 490 025**	250	2800	142.5	72.0	72.0	-20	-16
45.0	**9 510 490 037**	**9 510 490 027**	250	2600	149.9	75.7	75.7	-24	-20
56.0	**9 510 490 039**	**9 510 490 029**	195	2300	159.0	80.2	80.2	-24	-20
63.0	**9 510 490 040**	**9 510 490 030**	170	2300	164.8	83.1	83.1	-24	-20

* Contact factory for availabilty of units with no ordering number listed.

** Refer to page 70 for SAE O-Ring Boss Specifications and Dimensions.



Features	Details
Shaft	7/8″ key
Front Cover	SAE B 2-bolt
Ports	SAE ORB
Rear Cover	Rear ports



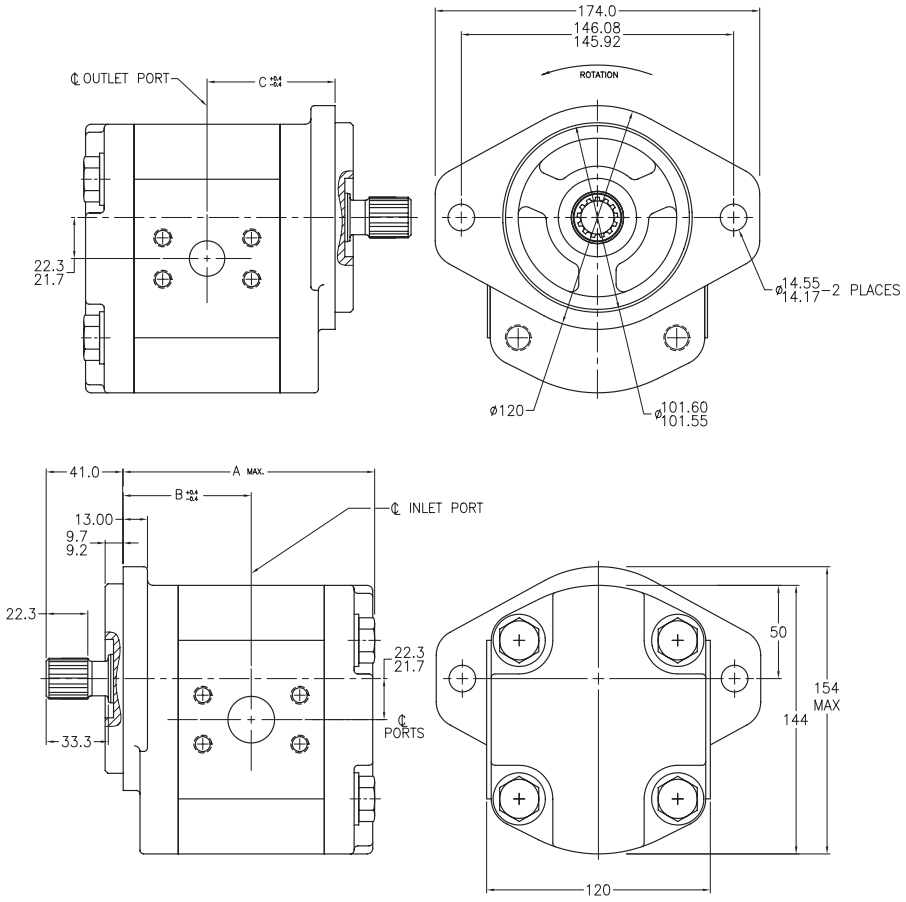
Clockwise
Inlet and outlet port changed

Counter-Clockwise
As shown in drawing

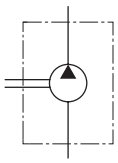
Ordering code
AZPG – 2 2 – □ □ □ □ Q C 12 MA

Displacement	Ordering-Number *		Max. operating pressure	Max. rotation speed	Dimension [mm]			Inlet Port** (SAE O-Ring BOSS)	Outlet Port** (SAE O-Ring BOSS)
[cm³/rev]	L	R	[bar]	[min⁻¹]	A	B			
32.0	**9 510 490 114**	**9 510 490 104**	250	2800	149.4	138.7		-20	-16
36.0	**9 510 490 115**	**9 510 490 105**	250	2800	152.8	142.0		-20	-16
45.0	**9 510 490 117**	**9 510 490 107**	250	2600	160.2	149.4		-20	-16
56.0	**9 510 490 119**	**9 510 490 109**	195	2300	169.2	158.5		-20	-16
63.0	**9 510 490 120**	**9 510 490 110**	170	2300	175.1	164.3		-20	-16

* Contact factory for availabilty of units with no ordering number listed.
** Refer to page 70 for SAE O-Ring Boss Specifications and Dimensions.



Features	Details
Shaft	13t spline
Front Cover	SAE B 2-bolt
Ports	SAE Split flange
Rear Cover	Standard



Clockwise
Inlet and outlet port changed

Counter-Clockwise
As shown in drawing

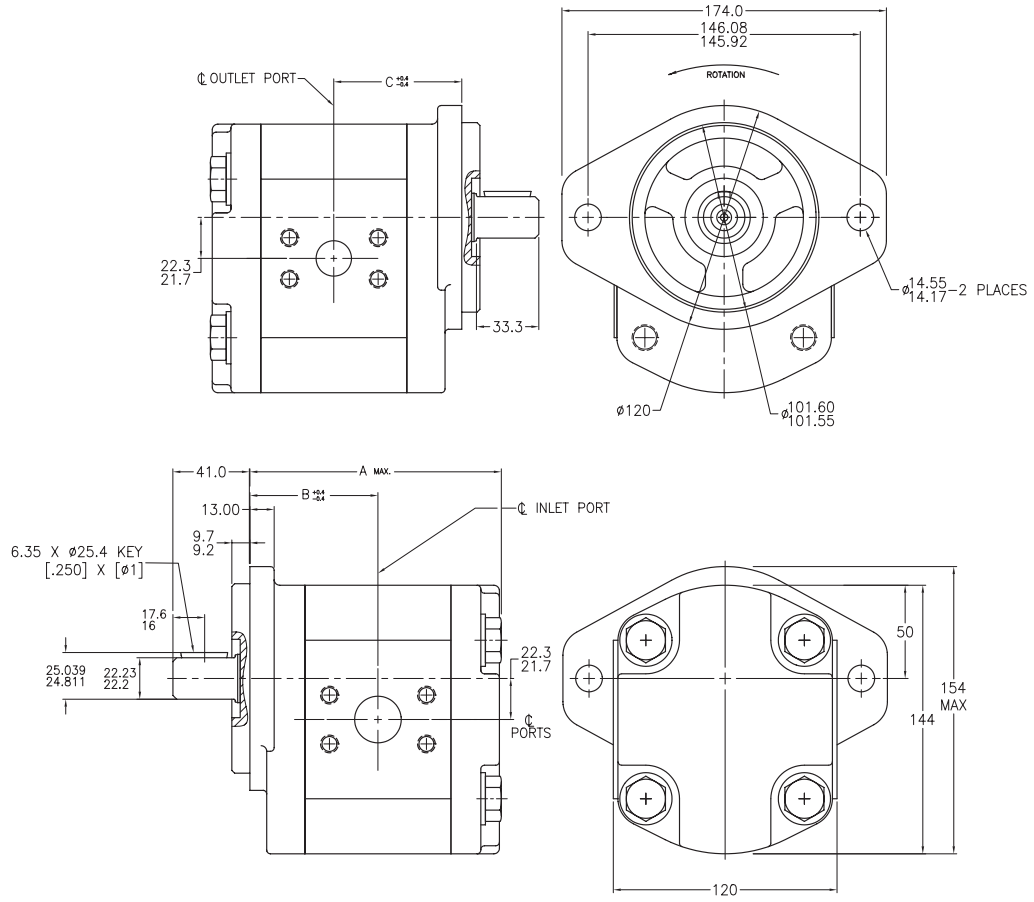
Ordering code

AZPG – 2 2 – ☐ ☐ ☐ ☐ D C 40 MB

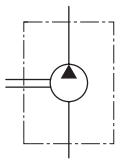
Displacement	Ordering-Number *		Max. operating pressure	Max. rotation speed	Dimension [mm]			Port Size Per SAE J 518	
[cm³/rev]	L	R	[bar]	[min⁻¹]	A	B	C	Inlet Port**	Outlet Port**
32.0	**9 510 490 054**	**9 510 490 044**	250	2800	139.2	70.3	70.3	-16	-12
36.0	**9 510 490 055**	**9 510 490 045**	250	2800	142.5	72.0	72.0	-16	-12
45.0	**9 510 490 057**	**9 510 490 047**	250	2600	149.9	75.7	75.7	-20	-16
56.0	**9 510 490 059**	**9 510 490 049**	195	2300	159.0	80.2	80.2	-24	-20
63.0	**9 510 490 060**	**9 510 490 050**	170	2300	164.8	83.1	83.1	-24	-20

* Contact factory for availabilty of units with no ordering number listed.

** Refer to page 70 for SAE Split flange porting Specifications and Dimensions.



Features	Details
Shaft	7/8" keyed
Front Cover	SAE B 2-bolt
Ports	SAE Split flange
Rear Cover	Standard



Clockwise
Inlet and outlet port changed

Counter-Clockwise
As shown in drawing

Ordering code
AZPG – 2 2 – □□□□ Q C 40 MB

Displacement	Ordering-Number *		Max. operating pressure	Max. rotation speed	Dimension [mm]			Port Size Per SAE J 518	
[cm³/rev]	L	R	[bar]	[min⁻¹]	A	B	C	Inlet Port**	Outlet Port**
32.0	**9 510 490 094**	**9 510 490 084**	250	2800	139.2	70.3	70.3	-16	-12
36.0	**9 510 490 095**	**9 510 490 085**	250	2800	142.5	72.0	72.0	-16	-12
45.0	**9 510 490 097**	**9 510 490 087**	250	2600	149.9	75.7	75.7	-20	-16
56.0	**9 510 490 099**	**9 510 490 089**	195	2300	159.0	80.2	80.2	-24	-20
63.0	**9 510 490 100**	**9 510 490 090**	170	2300	164.8	83.1	83.1	-24	-20

* Contact factory for availabilty of units with no ordering number listed.
** Refer to page 70 for SAE Split flange porting Specifications and Dimensions.

Ordering code

External Gear Pumps – Multiple Pumps

AZ	P	GGFF	–	□□	–	032 / 022 / 016 / 005	R	R	R	12	12	12	12	M	B

Function
P = Pump

Model **
F = 4.0 ... 28.0 cm³/rev
N = 20.0 ... 36.0 cm³/rev
G = 32.0 ... 63.0 cm³/rev

Series
1x = Standard bearing
2x = Reinforced bearing

Size
Based on available sizes per series

Direction of rotation
Right = **R**
Left = **L**

Rear cover
refers on the last pumps part

Model F	Standard	= **B**
Model N	Standard	= **B**
Model G	Standard	= **B**

Seals

NBR	= **M**
NBR, Shaft Seal in FPM	= **K**

Drive shafts

Model F:

Q	Cylindrical (Straight Way) SAE A 5/8″		**R**
P	Spline Shaft SAE 11T		**R** **C**
R	Multiple spline shaft SAE A 5/8″ 9T		**R** **C**

Model N:

P	Spline Shaft SAE 11T		**R** **C**
D	Multiple spline shaft SAE B 13T		**C**
Q	SAE 3/4” Keyed, Short		**R** **C**

Model G:

D	Multiple spline shaft SAE B 13T		**C**
Q	Cylindrical (Straight Key) SAE B 7/8″		**C**

Front cover

C	SAE B 2-bolt flange Pilot Ø 101.6 mm	
R	SAE A 2-bolt flange Ø 82.55 mm	

Model N:

R	SAE A 2-bolt flange Ø 82.55 mm	
C	SAE B 2-bolt flange Pilot Ø 101.6 mm	

Model G:

C	SAE B 2-bolt flange Pilot Ø 101.6 mm	

Port connections

12	Thread (UN-2B) SAE O-Ring BOSS	
12	Thread (UN-2B) SAE O-Ring BOSS	
12	Thread (UN-2B) SAE O-Ring BOSS	
40	Split Flange SAE Code 61 UNC bolts	

* Contact factory for availabilty of units with no ordering number listed
** Refer to page 18 for SAE O-Ring Boss Specifications and dimensions

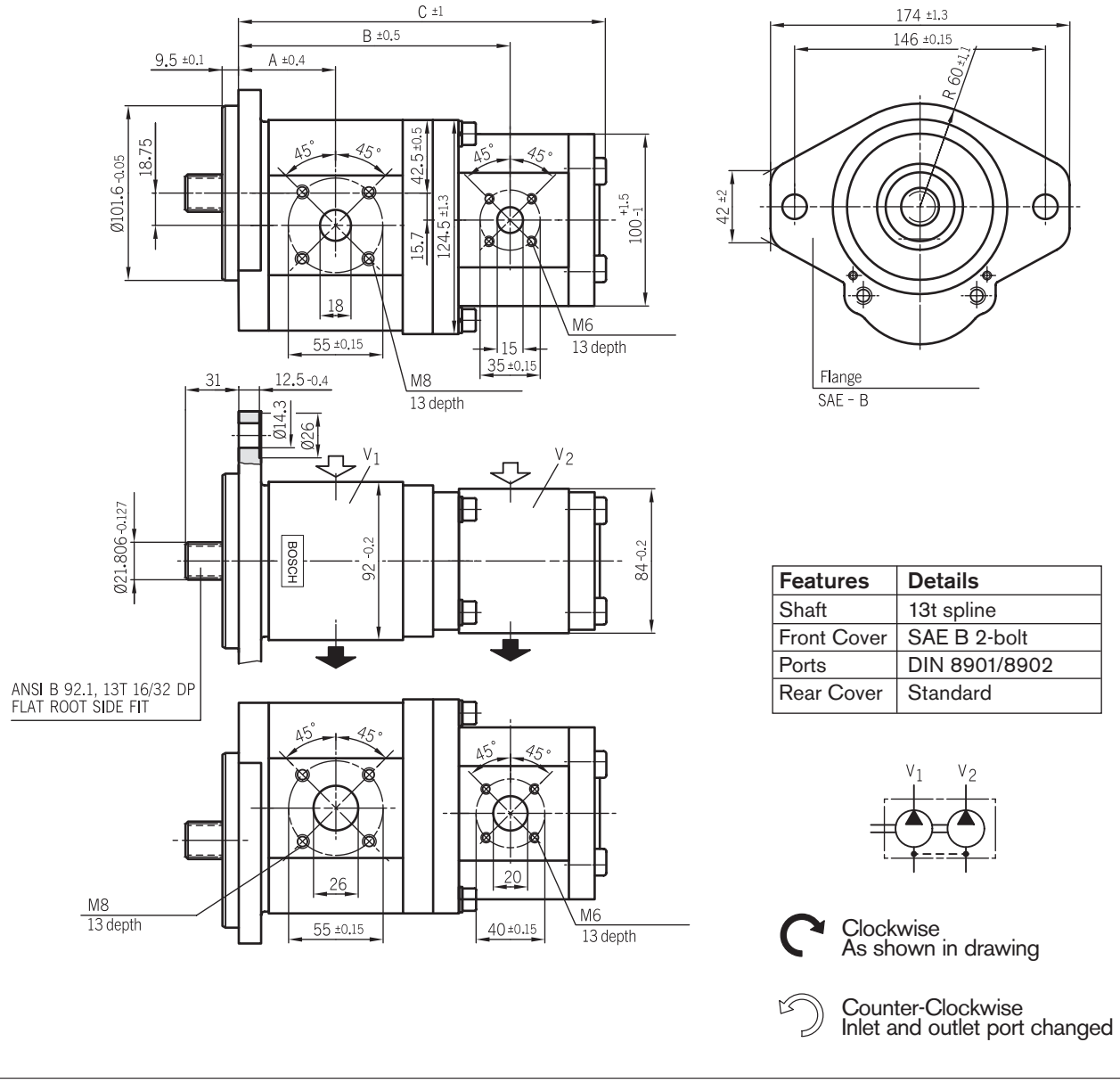
F + F
F + F + F
N + F

N Series Pump Product Index

(Reference page 43 for ordering code designators)

AZPF-XX-XXXX _ _ _ MB

Page Number	Ordering code	Shaft Type	Mounting Flange	Ports	Port Orientation
82	AZPFF-XX-XXX/XXXXRR1212MB	R	R	12	side
83	AZPFF-XX-XXX/XXXXQR1212MB	Q	R	12	side
84	AZPFF-XX-XXX/XXXXPR1212MB	P	R	12	side
85	AZPFF-XX-XXX/XXXXCB2020MB	C	B	20	side
86	AZPFF-XX-XXX/XXXXFB2020MB	F	B	20	side
87	AZPFF-XX-XXX/XXXXNM2020MB	N	M	20	side
88	AZPFF-XX-XXX/XXXXRR2020MB	R	R	20	side
89	AZPFF-XX-XXX/XXXXSA2020MB	S	A	20	side
90	AZPFFF-XX-XXX/XXX/XXXXFB202020MB	F	B	20	side
91	AZPNF-XX-XXX/XXXXDC2020KB	D	C	20	side



Features	Details
Shaft	13t spline
Front Cover	SAE B 2-bolt
Ports	DIN 8901/8902
Rear Cover	Standard

Ordering code

AZPNF – X X – □□□ / □□□□ D C 20 20 KB

Displacement [cm³/rev]	Ordering-Number * L	Ordering-Number * R	Max. operating pressure [bar]	Max. rotation speed [min⁻¹]	Dimension [mm] A	B	C		
025 / 014		**0 510 766 010**	250	3000	55.1	155.1	209.2		
028 / 016	**0 510 767 311**	**0 510 767 018**	230	2800	56.5	158.0	215.6		
032 / 014		**0 510 768 021**	200/250	2800	59.0	162.6	216.7		

* Contact factory for availabilty of units with no ordering number listed.

Seal Kits (reference Fig. 15)

Example Model Code: AZPF – 12 – 008 R**R**R 12**M**B

Model Code Designator for Shaft ⌋ ⌊ Model Code Designator for Seal

	Model Code For Shaft	Shaft Description	Model Code For Seal	Seal Material	Seal Pos. 800 & Pos. 3	Sets of Seals Sps. 800	Shaft Seal Pos. 3	O-ring Pos. 31
F Series Pump	R	SAE 9T Spline	M	NBR	R98640006P	1517010152	1510283035	—
			P	FPM	—	1517010193	1510283027	—
			K	NBR W/FPM SHAFT SEAL	—	1517010152	1510283027	—
	Q	5/8" Straight Key	M	NBR	R98640006P	1517010152	1510283035	—
			P	FPM	—	1517010193	1510283027	—
			K	NBR W/FPM SHAFT SEAL	—	1517010152	1510283027	—
	P	SAE 11T Spline	M	NBR	R98640007P	1517010152	1510283037	—
			P	FPM	—	1517010193	1510283044	—
			K	NBR W/FPM SHAFT SEAL	—	1517010152	1510283044	—
	C	1:5 Tapered Key	M	NBR	R98640006P	1517010152	1510283035	—
			P	FPM	—	1517010193	1510283027	—
			K	NBR W/FPM SHAFT SEAL	—	1517010152	1510283027	—
	S	1:5 Tapered for Flange A	M	NBR	—	1517010152	1510283009	—
			P	FPM	—	1517010193	1510283015	—
			K	NBR W/FPM SHAFT SEAL	—	1517010152	1510283015	—
	H	1:8 Tapered Key	M	NBR	R98640006P	1517010152	1510283008	—
			P	FPM	—	1517010193	1510283027	—
			K	NBR W/FPM SHAFT SEAL	—	1517010152	1510283027	—
	N	Dog	M	NBR	R98640006P	1517010152	1510283008	1900210145
			P	FPM	—	1517010193	1510283027	1900210145
			K	NBR W/FPM SHAFT SEAL	—	1517010152	1510283027	—
	A	18mm Straight Key	M	NBR	R98640007P	1517010152	1510283037	—
			P	FPM	—	1517010193	1510283027	—
			K	NBR W/FPM SHAFT SEAL	—	1517010152	1510283027	—
	F	Din 5482 B17x14 Spline	M	NBR	R98640006P	1517010152	1510283008	—
			P	FPM	—	1517010193	1510283027	—
			K	NBR W/FPM SHAFT SEAL	—	1517010152	1510283027	—
N Series Pump	P	SAE 11T Spline	M	NBR	R98640011P	1517010194	1510283023	—
			P	FPM	—	1517010197	1510283028	—
			K	NBR W/FPM SHAFT SEAL	—	1517010194	1510283028	—
	Q	SAE 3/4" Keyed Shaft	M	NBR	R98640011P	1517010194	1510283023	—
			P	FPM	—	1517010197	1510283028	—
			K	NBR W/FPM SHAFT SEAL	—	1517010194	1510283028	—
	R	SAE 9T Spline	M	NBR	R98640011P	1517010194	1510283023	—
			P	FPM	—	1517010197	1510283028	—
			K	NBR W/FPM SHAFT SEAL	—	1517010194	1510283028	—
	D	SAE 13T Spline	M	NBR	R98640011P	1517010194	1510283023	—
			P	FPM	—	1517010197	1510283028	—
			K	NBR W/FPM SHAFT SEAL	—	1517010194	1510283028	—
	Q-S0022	SAE 3/4" Keyed, Long	M	NBR	R98640011P	1517010194	1510283023	—
			P	FPM	—	1517010197	1510283028	—
			K	NBR W/FPM SHAFT SEAL	—	1517010194	1510283028	—
	C	1:5 Tapered Key	M	NBR	R98640011P	1517010194	1510283023	—
			P	FPM	—	1517010197	1510283028	—
			K	NBR W/FPM SHAFT SEAL	—	1517010194	1510283028	—
	N	Dog (tang)	M	NBR	R98640011P	1517010194	1510283023	—
			P	FPM	—	1517010197	1510283028	—
			K	NBR W/FPM SHAFT SEAL	—	1517010194	1510283028	—
	H	1:8 Tapered Key	M	NBR	R98640011P	1517010194	1510283023	—
			P	FPM	—	1517010197	1510283028	—
			K	NBR W/FPM SHAFT SEAL	—	1517010194	1510283028	—
	A	ISO Keyed, 18mm	M	NBR	R98640011P	1517010194	1510283023	—
			P	FPM	—	1517010197	1510283028	—
			K	NBR W/FPM SHAFT SEAL	—	1517010194	1510283028	—
G Series Pump	D	SAE B - 13T Spline	M	NBR	R98640012P	—	—	—
			P	FPM	—	—	—	—
			K	NBR W/FPM SHAFT SEAL	—	—	—	—
	Q	SAE 7/8" Keyed Shaft	M	NBR	R98640012P	—	—	—
			P	FPM	—	—	—	—
			K	NBR W/FPM SHAFT SEAL	—	—	—	—
	C	1:5 Tapered Key	M	NBR	R98640012P	—	—	—
			P	FPM	—	—	—	—
			K	NBR W/FPM SHAFT SEAL	—	—	—	—
	S	1:5 Tapered Key (flange A)	M	NBR	R98640012P	—	—	—
			P	FPM	—	—	—	—
			K	NBR W/FPM SHAFT SEAL	—	—	—	—
	H	1:8 Tapered Key	M	NBR	R98640012P	—	—	—
			P	FPM	—	—	—	—
			K	NBR W/FPM SHAFT SEAL	—	—	—	—
	N	Dog (tang)	M	NBR	R98640012P	—	—	—
			P	FPM	—	—	—	—
			K	NBR W/FPM SHAFT SEAL	—	—	—	—
	F	DIN 5482 B17x14 Spline	M	NBR	R98640012P	—	—	—
			P	FPM	—	—	—	—
			K	NBR W/FPM SHAFT SEAL	—	—	—	—

1) For G series rear port models, use seal kit R98640013P

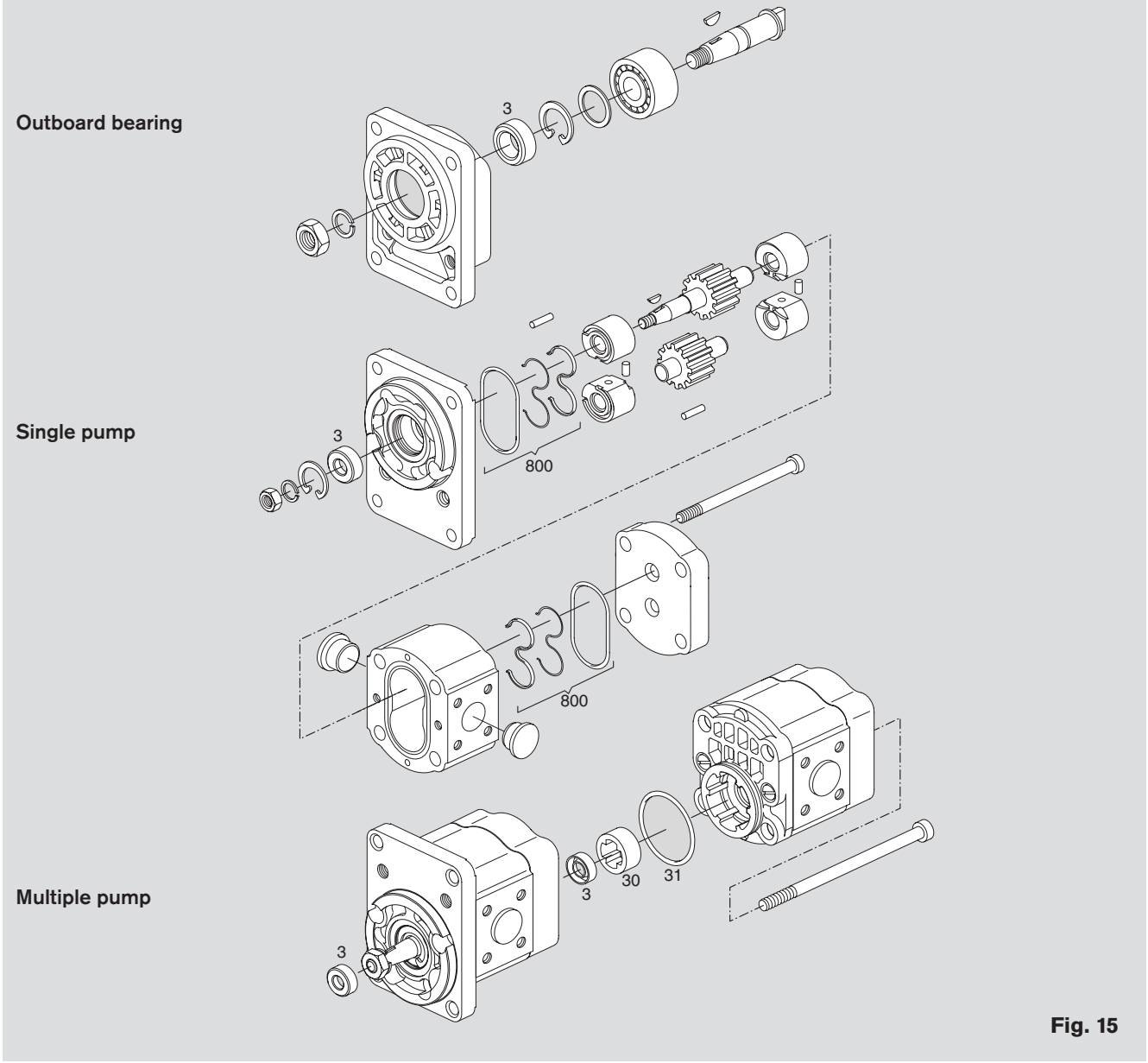

Outboard bearing
3
Single pump
3
800
800
Multiple pump
3
3
30
31

Fig. 15

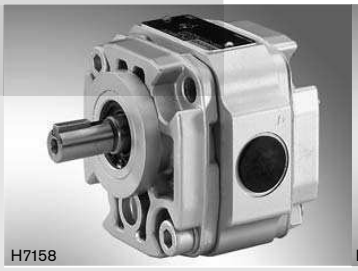
Rexroth
Bosch Group

Internal gear pump, fixed displacement

RE 10213/04.05 1/24
Replaces: 06.02

Type PGF

Frame sizes 1, 2 and 3
Component series: 2X (FS1 and 2)
3X (FS3)
Maximum operating pressure 250 bar
Maximum displacement 1.7 to 40 cm^3



Type PGF1… for direct mounting



Type PGF3… 3-fold combination

Table of contents

Contents	Page
Features	1
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Function, section, symbol	3
Technical data	4 and 5
Characteristic curves	6 to 8
Unit dimensions	9 to 17
Suction and pressure ports	18 and 19
Multiple pumps	20
Installation notes	21
Commissioning notes	22
Engineering notes	23

Features

- Fixed displacement
- Low operating noise
- Low flow pulsation
- High efficiency even at low viscosity due to sealing gap compensation
- Long service life due to plain bearings and sealing gap compensation
- Suitable for a wide viscosity and speed range
- Excellent suction characteristics
- All frame sizes and sizes can be combined with each other
- Can be combined with PGH internal gear pumps, PV7 vane pumps and axial piston pumps
- Valve technology can be integrated in the cover plate on enquiry

Ordering code

PG	F	–	/							*

Series
Medium-pressure pump **= F**

Frame size - component series
FS1 – component series 2X **= 1–2X**
(component series 20 to 29: unchanged installation and connection dimensions)
FS2 – component series 2X **= 2–2X**
(component series 20 to 29: unchanged installation and connection dimensions)
FS3 – component series 3X **= 3–3X**
(component series 30 to 39: unchanged installation and connection dimensions)

Size

	Size	Displacement/ revolution	
FS1	1.7	1.7 cm³	**= 1,7**
	2.2	2.2 cm³	**= 2,2**
	2.8	2.8 cm³	**= 2,8**
	3.2	3.2 cm³	**= 3,2**
	4.1	4.1 cm³	**= 4,1**
	5.0	5.0 cm³	**= 5,0**
FS2	6.3	6.5 cm³	**= 006**
	8.0	8.2 cm³	**= 008**
	11.0	11.0 cm³	**= 011**
	13.0	13.3 cm³	**= 013**
	16.0	16.0 cm³	**= 016**
	19.0	18.9 cm³	**= 019**
	22.0	22.0 cm³	**= 022**
FS3	20.0	20.6 cm³	**= 020**
	22.0	22.2 cm³	**= 022**
	25.0	25.4 cm³	**= 025**
	32.0	32.5 cm³	**= 032**
	40.0	40.5 cm³	**= 040**

Order example: **PGF2–2X/011RE01VE4**
Material-Nummer: **R900932271**

Not all of the variants according to the type code are possible! Please select the requested pump on the basis of the selection table (preferred types, pages 9 to 17) or consult Bosch Rexroth!

Special options on enquiry (e.g. integrated valve technology).

Further details in clear text

Options
N = Anti-cavitation valve
D = Pressure relief valve
K = Cover plate for mounting the next smaller size

Mounting flange centring
K4 = Special flange to ISO 7653-1985 (for truck PTO)
E4 = 4-hole mounting flange to ISO 3019/2 and VDMA 24560 part 1
U2 = SAE 2-hole mounting flange
M = 2-hole mounting, centring Ø 32 mm (FS1), centring Ø 52 mm (FS2 and 3)
P = 2 hole mounting, centring Ø 50 mm
P1 = 2-hole mounting, centring Ø 45.24 mm
P2 = 2-hole mounting, centring Ø 63 mm

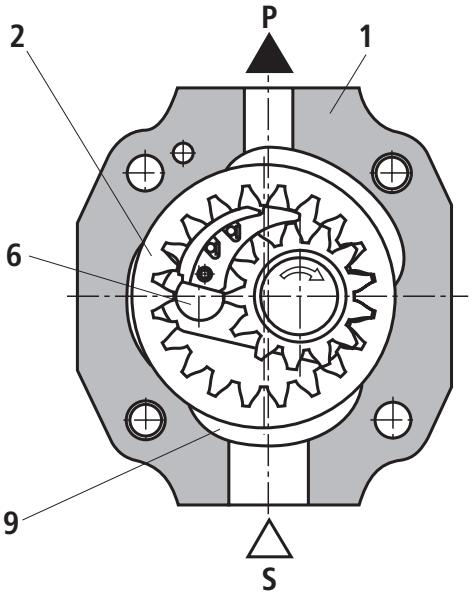
Seal material
V = FKM seals
Please observe our regulations to data sheet RE 07075!

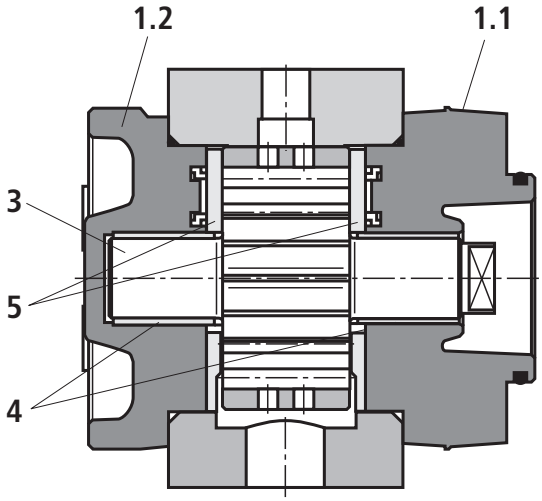
Suction and pressure port
01 = BSP to ISO 228/1
07 = SAE flange connection
20 = Square flange connection to DIN 3901 or DIN 3902, metric mounting thread

Shaft versions
A = Cylindrical
E = Cylindrical with output
T = Involute splines
J = Involute splines with output
N = Two flats for claw coupling
L = Two flats for claw coupling with output
S = Conical 1 : 5
O = Conical with output 1 : 5

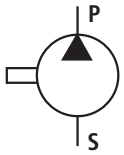
Direction of rotation (viewed to shaft end)
R = Clockwise
L = Counter-clockwise

Function, section, symbol





Symbol



Design

PGF hydraulic pumps are leak gap-compensated internal gear pumps with a fixed displacement.

They basically consist of a housing (1), bearing cover (1 .1), cover plate (1 .2), internal gear (2), pinion shaft (3), plain bearings (4), axial discs (5) and stop pin (6) as well as the segment assembly (7), which is composed of a segment (7.1), segment carrier (7.2) and the sealing rolls (7.3).

Suction and displacement process

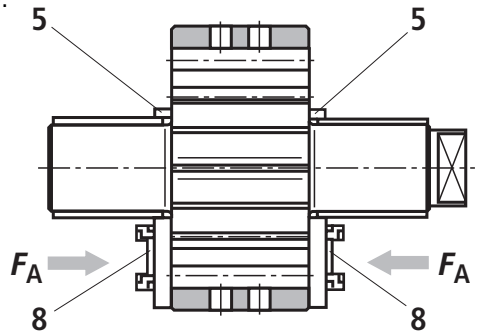
The pinion (3) which is carried in hydro-dynamic bearings drives the internally toothed ring gear (2) in the direction of rotation shown.

During rotation, the volume is increased in the suction area at an angle of approx. 180°. A negative pressure is generated and fluid flows into the chambers.

The sickle-shaped segment assembly (7) separates the suction chamber from the pressure chamber. Within the pressure chamber the teeth of the pinion (3) mesh with the tooth spaces of the internal gear (2). The fluid is then displaced through the pressure channel (P).

Axial compensation

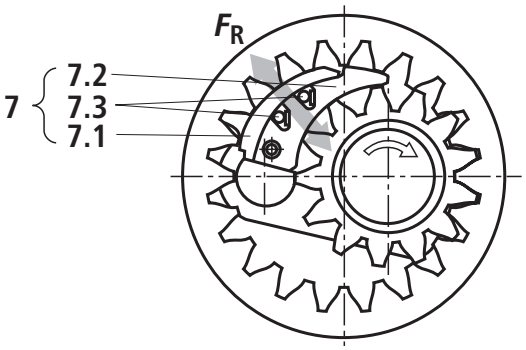
Axial compensation force F_A acts in the area of the pressure chamber and is generated by the pressure field (8) in the axial discs (5).



The axial longitudinal gaps between rotating and fixed parts are therefore extremely small and ensure optimum axial sealing of the pressure chamber.

Radial compensation

Radial compensation force F_R acts on the segment (7.1) and segment carrier (7.2).



The area ratios and the position of the sealing rolls (7.3) between the segments and the segment carrier are designed to provide virtually leak gap-free sealing between the internal gear (2), the segment assembly (7) and the pinion (3).

Spring elements under the sealing rolls (7.3) ensure adequate contact pressure, even at very low pressures.

Hydrodynamic and hydrostatic bearing

The forces acting on the pinion shaft (3) are absorbed by the hydrodynamically lubricated radial plain bearings (4), while those acting on the internal gear (2) are absorbed by the hydrostatic bearing (9).

Tooth form

Involute teeth were selected for the gear. Their long length of contact results in low flow and pressure pulsation; these low pulsation rates greatly contribute to low-noise operation.

Technical data (for applications outside these parameters, please consult us!)

General

Design	Internal gear pump, gap-compenated
Type	PGF
Mounting type	2-hole mounting, SAE 2-hole mounting flange to ISO 3019/1, 4-hole mounting to VDMA 24560 part 1 and ISO 3019/2
Pipe connections	Square flange connection; SAE flange connection; BSP to ISO 228/1
Installation orientation	Optional
Shaft loading	Radial and axial forces (e.g. pulley) **only** after consultation
Direction of rotation (viewed to shaft end)	Clockwise or counter-clockwise – **not** reversing!

Frame size			**FS1**					
Size	Size		1.7	2.2	2.8	3.2	4.1	5.0
Weight	m	kg	0.8	0.9	1.0	1.0	1.1	1.3
Speed range [1]	n_{min}	min^{-1}	600					
	n_{max}	min^{-1}	4500	3600	4000	3600	3600	3600
Displacement	V	cm^3	1.7	2.2	2.8	3.2	4.1	5.0
Flow [2]	q_V	L/min	2.4	3.2	4.1	4.6	6.0	7.2
Operating pressure, absolute – Inlet	p	bar	0.8 to 2					
– Output, continuous	p_{max}	bar	180	210	210	210	210	180
– Output, intermittent [3]	p_{max}	bar	210	250	250	250	250	210
Min. required drive power at $\Delta p = 0$ bar		kW	0.75	0.75	0.75	0.75	0.75	0.75

Frame size			**FS2**						
Size	Size		6.3	8	11	13	16	19	22
Weight [4]	m	kg	2.1	2.2	2.4	2.6	2.7	2.9	3.1
Speed range [1]	n_{min}	min^{-1}	600						600
	n_{max}	min^{-1}	3600						3000
Displacement	V	cm^3	6.5	8.2	11	13.3	16	18.9	22
Flow [2]	q_V	L/min	9.4	11.9	16	19.3	23.2	27.4	31.9
Operating pressure, absolute – Inlet	p	bar	0.6 to 3						
– Output, continuous	p_{max}	bar	210	210	210	210	210	210	180
– Output, intermittent [3]	p_{max}	bar	250	250	250	250	250	250	210
Min. required drive power at $\Delta p = 0$ bar		kW	0.75	0.75	0.75	0.75	0.75	1.1	1.1

For footnotes, see page 5

Technical data (for applications outside these parameters, please consult us!)

Frame size			FS3				
Size	Size		20	22	25	32	40
Weight [4]	m	kg	3.3	3.7	4.1	4.5	4.9
Speed range [1]	n_{min}	min^{-1}	500				
	n_{max}	min^{-1}	3600	3400	3200	3000	2500
Displacement	V	cm^3	20.6	22.2	25.4	32.5	40.5
Flow [2]	q_V	L/min	29.9	32.2	36.8	47.1	58.7
Operating pressure, absolute – Inlet	p	bar	0.6 to 3				
– Outlet, continuous	p_{max}	bar	210	210	210	210	180
– Outlet, intermittent [3]	p_{max}	bar	250	250	250	250	210
Min. required drive power at $\Delta p = 0$ bar		kW	1.1	1.1	1.5	1.5	2.2

Hydraulic

Hydraulic fluid [5]		HL mineral oil to DIN 51524 part 1 / HLP - mineral oil to DIN 51524 part 2 **Please note our regulations according to data sheet RE 07075!**
Hydraulic fluid temperature range	°C	– 20 to + 100; for other temperatures, please consult us!
Ambient temperature range	°C	– 20 to + 60
Viscosity range	mm^2/s	10 to 300; permissible starting viscosity 2000
Max. permissible degree of contamination of the hydraulic fluid Cleanliness class to ISO 4406 (c)		Class 20/18/15 [6]
Permissible radial loading of the pinion shaft		On enquiry

[1] In the case of other speeds, please consult us (e.g. impulse control)

[2] Measured at $n = 1450$ min^{-1} and $p = 10$ bar

[3] Max 6 s, not exceeding 15 % of the duty cycle, max. $2 \cdot 10^6$ load cycles

[4] For pumps with 2-hole mounting as flanged version
- Frame size 2 approx. 0.9 kg heavier
- Frame size 3 approx. 1.0 kg heavier

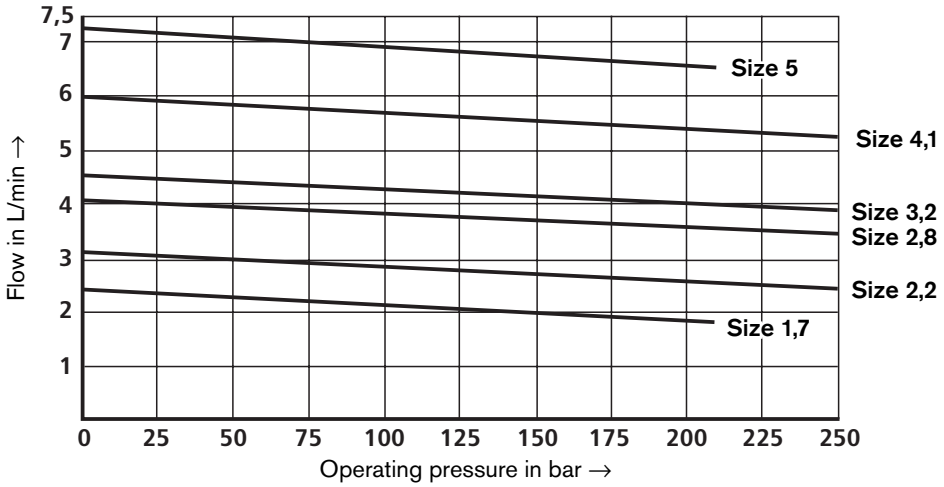
[5] Other fluids on enquiry

[6] The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and at the same time prolongs the service life of components.

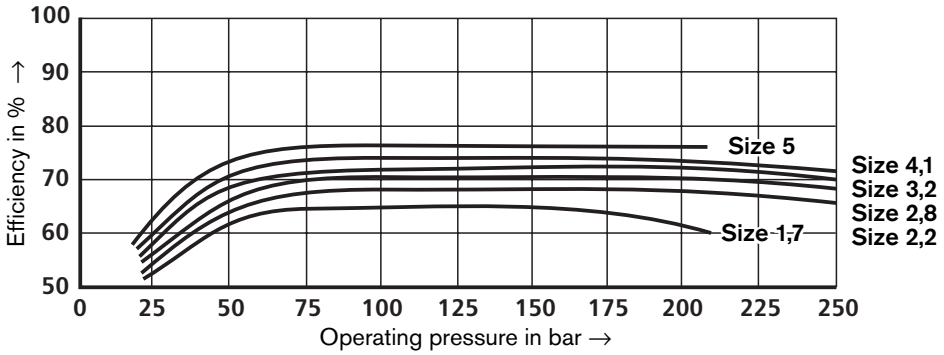
For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.

Average characteristic curve values of frame size 1 (measured at $n = 1450\ min^{-1}$; $\nu = 46\ mm^2/s$ and $\vartheta = 40\ °C$)

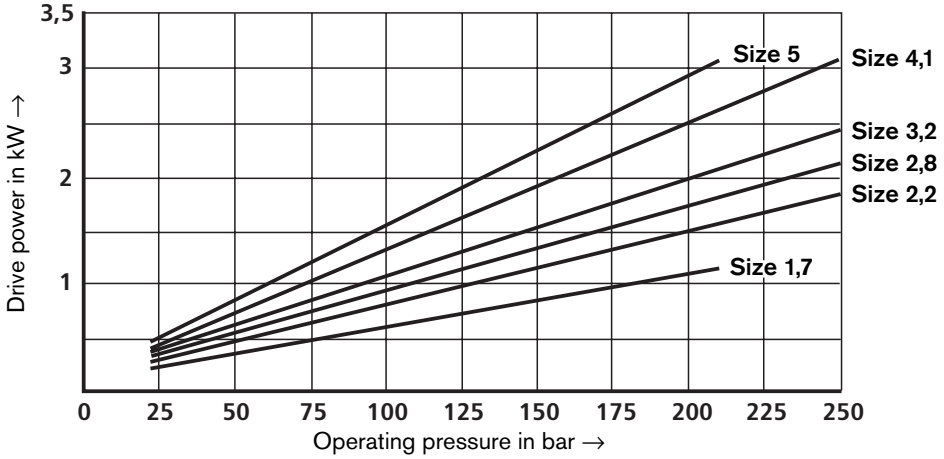
Flow



Efficiency



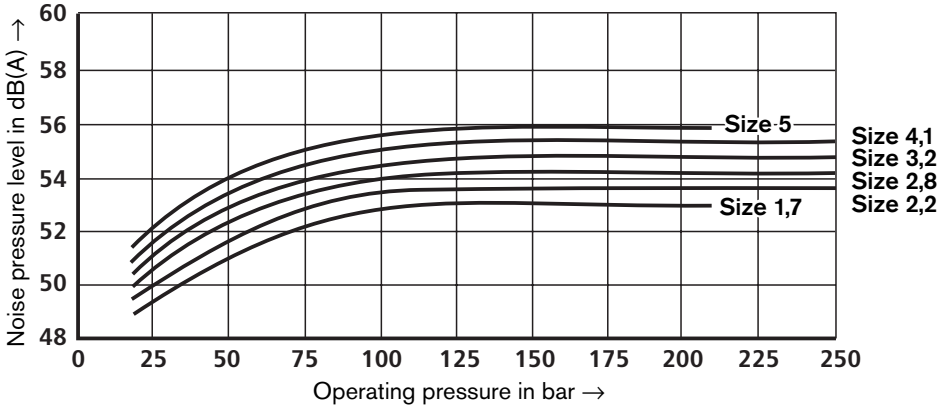
Drive power



Noise pressure level

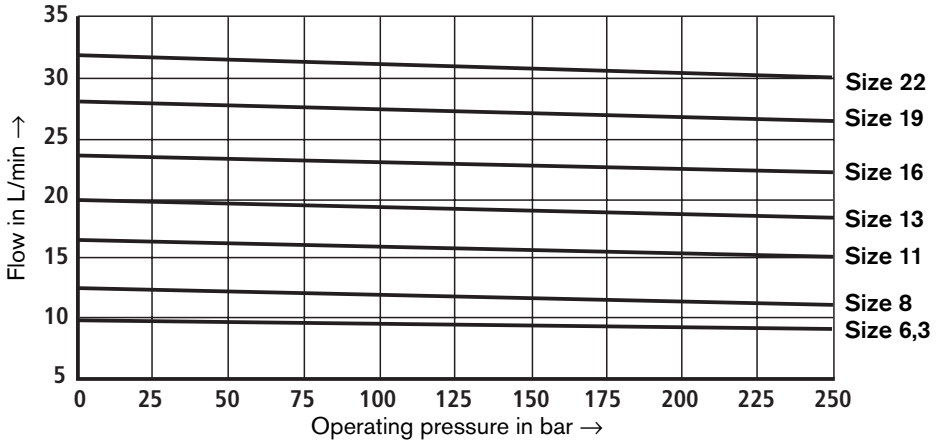
Measured in the low-reflexion anechoic chamber in line with DIN 45635, sheet 26

Distance between microphone – pumps = 1 m

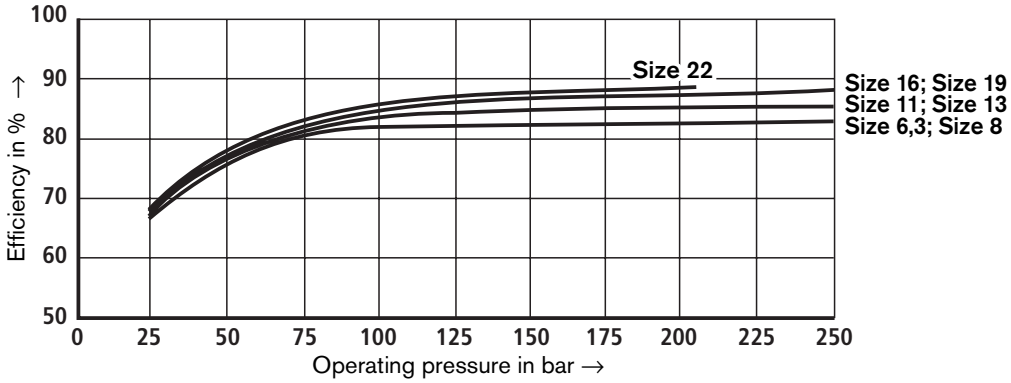


Average characteristic curve values of frame size 2 (measured at $n = 1450\ min^{-1}$; $\nu = 46\ mm^2/s$ and $\vartheta = 40\ °C$)

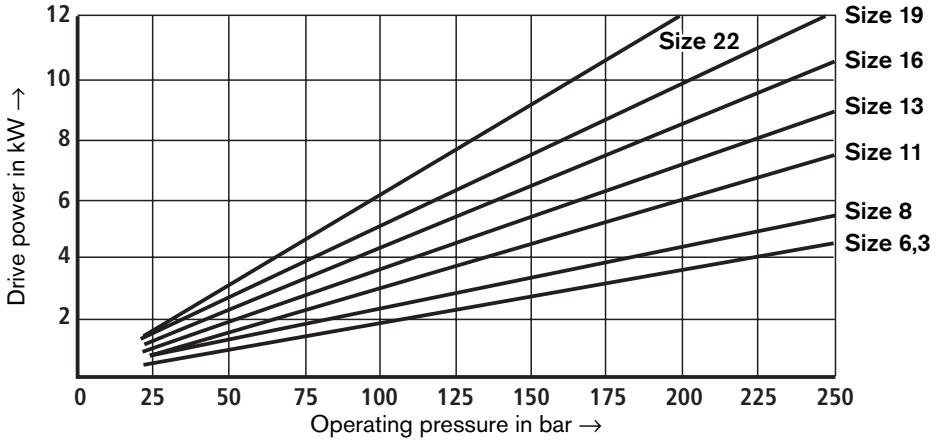
Flow



Efficiency



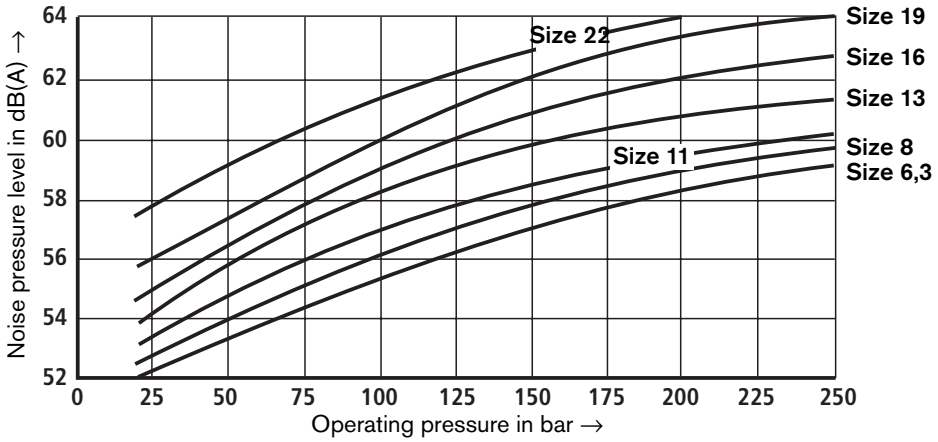
Drive power



Noise pressure level

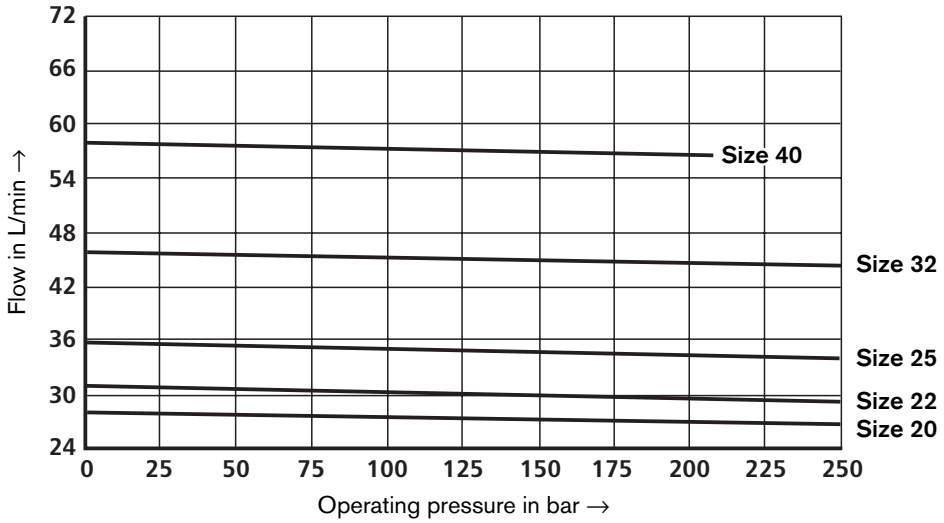
Measured in the low-reflexion anechoic chamber in line with DIN 45635, sheet 26

Distance between microphone – pumps = 1 m

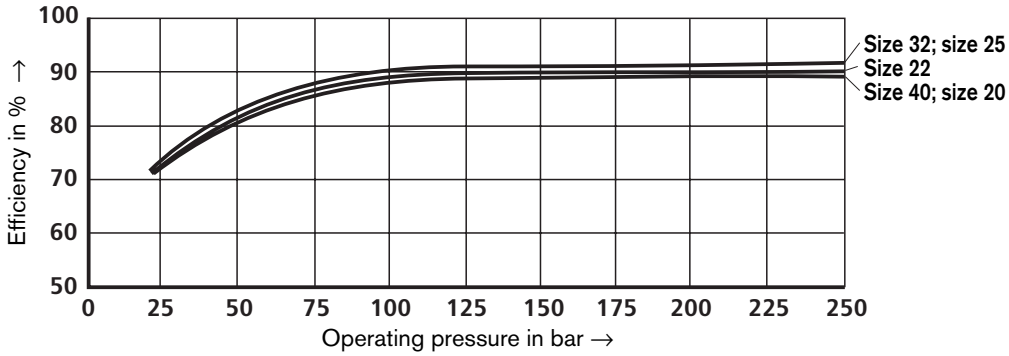


Average characteristic curve values of frame size 3 (measured at $n = 1450\ min^{-1}$; $\nu = 46\ mm^2/s$ and $\vartheta = 40\ °C$)

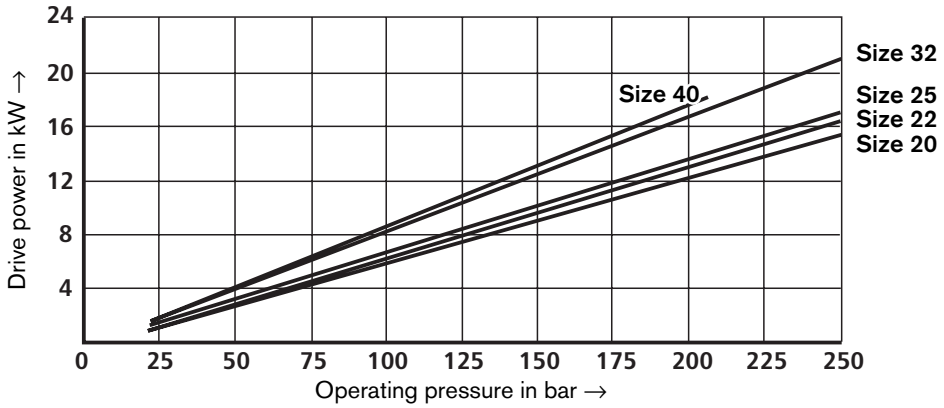
Flow



Efficiency



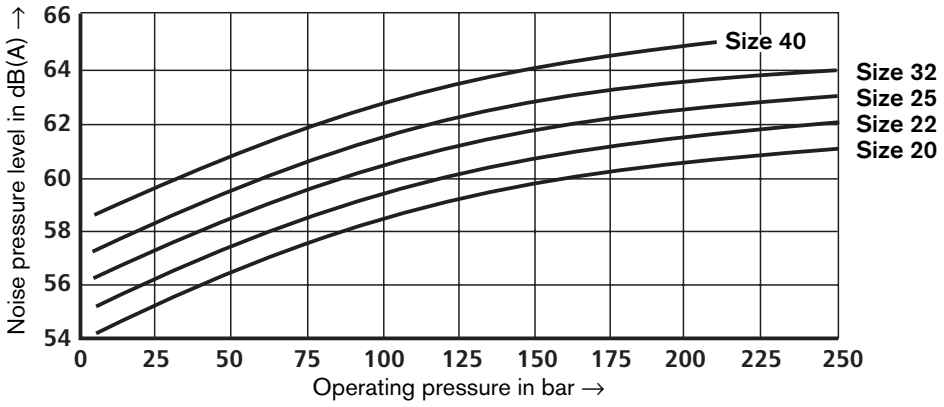
Drive power



Noise pressure level

Measured in the low-reflexion anechoic chamber in line with DIN 45635, sheet 26

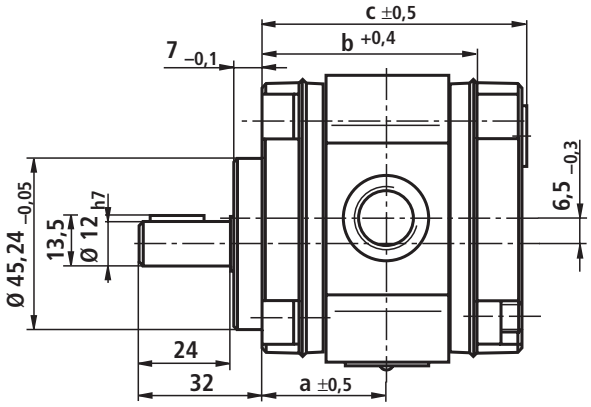
Distance between microphone – pumps = 1 m

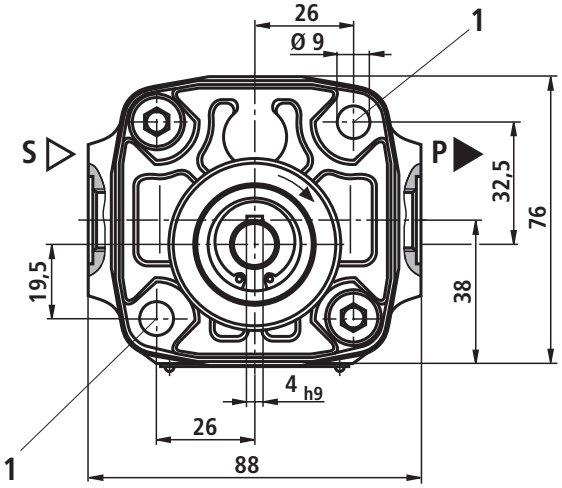


Unit dimensions and selection tables for frame size 1 (nominal dimensions in mm)

PGF1-2X/… $\begin{matrix}R\\L\end{matrix}$ **A01VP1** (cylindrical drive shaft)

Type **Size**	Material no. "R" clockwise	Material no. "L" counter-clockwise	Dimensions a	b	c	S	P
PGF1-2X/ **1,7** .A01VP1	R900932132	R900932183	29.6	49.1	62.5	G 1/4; 14	G 1/4; 12.5
PGF1-2X/ **2,2** .A01VP1	R900932133	R900050982	29.6	49.1	62.5	G 1/4; 14	G 1/4; 12.5
PGF1-2X/ **2,8** .A01VP1	R900932134	R900969246	30.7	51.4	64.8	G 3/8; 14	G 1/4; 12.5
PGF1-2X/ **3,2** .A01VP1	R900932135	R900961100	31.5	53.0	66.4	G 3/8; 14	G 1/4; 12.5
PGF1-2X/ **4,1** .A01VP1	R900932136	R900087045	33.4	56.7	70.1	G 3/8; 14	G 3/8; 12.5
PGF1-2X/ **5,0** .A01VP1	R900932137	R900969249	35.2	60.4	74.4	G 1/2; 14	G 3/8; 12.5



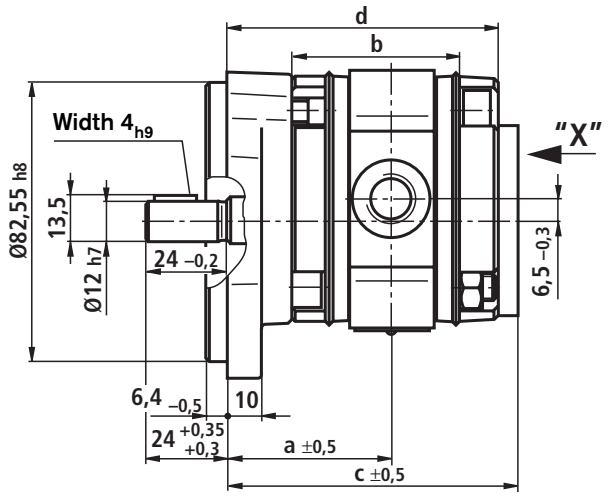


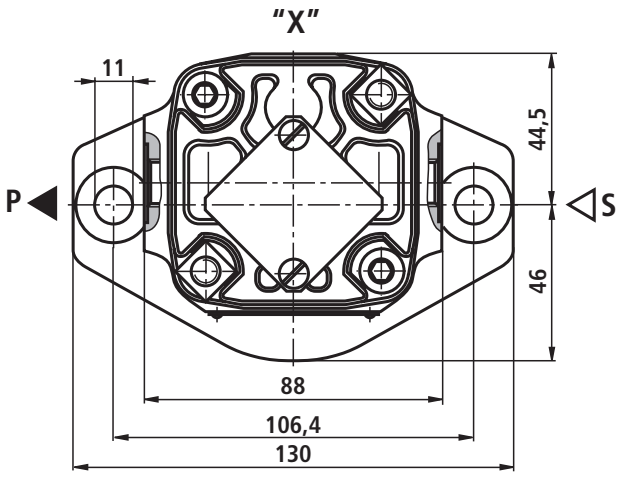
1 Through hole for socket head cap screw M8 DIN 912
Tightening torque M_T = 25 (+5) Nm

b = Clamping length

PGF1-2X/…RE01VU2 (cylindrical drive shaft with output); clockwise rotation

Type **Size**	Material no.	Dimensions a	b	c	d	S	P
PGF1-2X/ **1,7** RE01VU2	R900086159	48.6	49.1	85.7	79.7	G 1/4; 14	G 1/4; 12.5
PGF1-2X/ **2,2** RE01VU2	R900086160	48.6	49.1	85.7	79.7	G 1/4; 14	G 1/4; 12.5
PGF1-2X/ **2,8** RE01VU2	R900086161	49.7	51.4	88.0	82.0	G 3/8; 14	G 1/4; 12.5
PGF1-2X/ **3,2** RE01VU2	R900086162	50.5	53.0	89.6	83.6	G 3/8; 14	G 1/4; 12.5
PGF1-2X/ **4,1** RE01VU2	R900086163	52.4	56.7	93.2	87.2	G 3/8; 14	G 3/8; 12.5
PGF1-2X/ **5,0** RE01VU2	R900086164	54.2	60.4	97.0	91.0	G 1/2; 14	G 3/8; 12.5





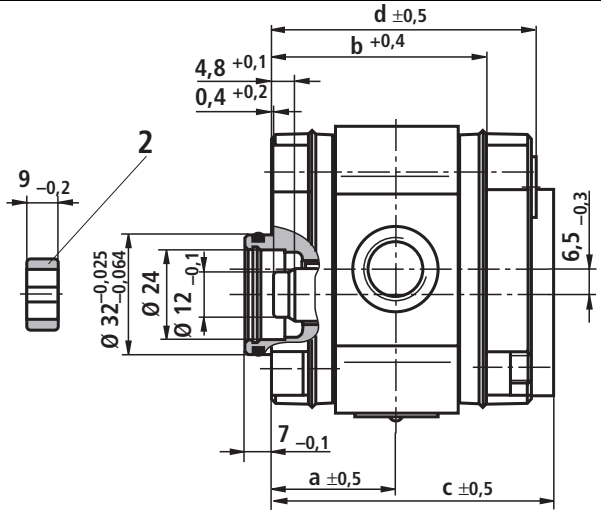
1 Through hole for socket head cap screw M8 DIN 912
Tightening torque M_T = 25 (+5) Nm

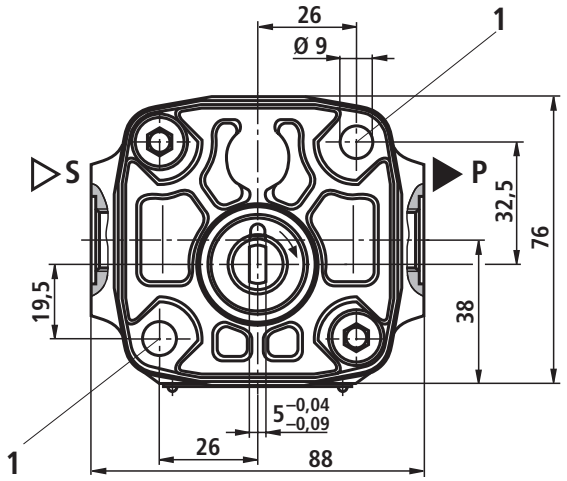
b = Clamping length

Unit dimensions and selection tables for frame size 1 (nominal dimensions in mm)

PGF1-2X/… $\frac{R}{L}$ **N01VM** (drive shaft for claw coupling); rear pump

Type **Size**	Material no. "R" clockwise	Material no. "L" counter-clockwise	Dimensions a	b	d	S	P
PGF1-2X/ **1,7** .N01VM	R900969230	R900086147	29.6	49.1	62.5	G 1/4; 14	G 1/4; 12.5
PGF1-2X/ **2,2** .N01VM	R900969229	R900086148	29.6	49.1	62.5	G 1/4; 14	G 1/4; 12.5
PGF1-2X/ **2,8** .N01VM	R900201587	R900086149	30.7	51.4	64.8	G 3/8; 14	G 1/4; 12.5
PGF1-2X/ **3,2** .N01VM	R900965822	R900086150	31.5	53.0	66.4	G 3/8; 14	G 1/4; 12.5
PGF1-2X/ **4,1** .N01VM	R900088915	R900932131	33.4	56.7	70.1	G 3/8; 14	G 3/8; 12.5
PGF1-2X/ **5,0** .N01VM	R900969253	R900086152	35.2	60.4	74.4	G 1/2; 14	G 3/8; 12.5





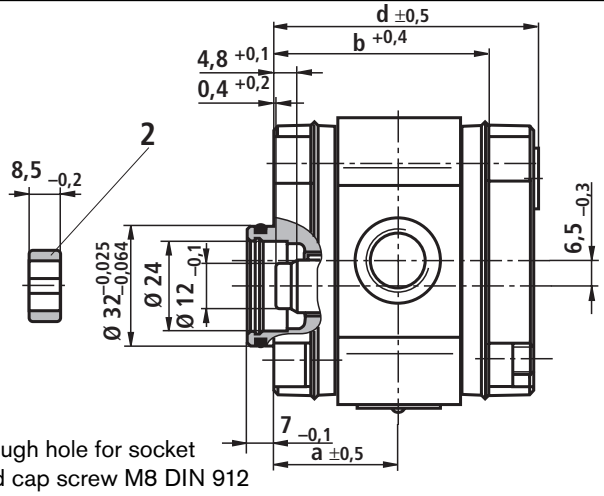
1 Through hole for socket head cap screw M8 DIN 912
Tightening torque M_T = 25 (+5) Nm

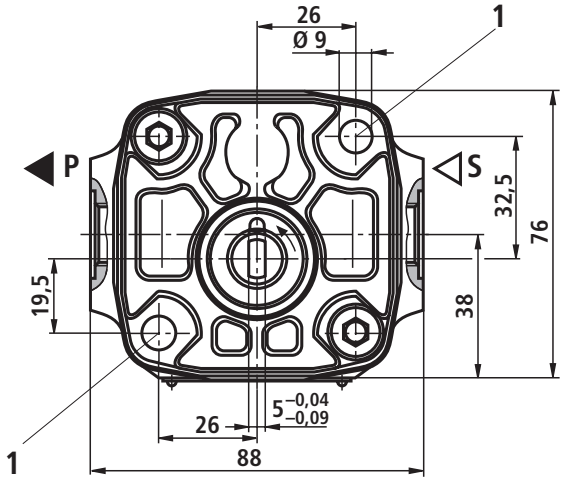
2 Follower, material no. **R900984336** included in scope of supply

b = Clamping length

PGF1-2X/… $\frac{R}{L}$ **L01VM** (drive shaft for claw coupling with output); mddle pump

Type **Size**	Material no. "R" clockwise	Material no. "L" counter-clockwise	Dimensions a	b	c	d	S	P
PGF1-2X/ **1,7** .L01VM	R900086165	R900932093	29,6	49,1	67,1	61,1	G 1/4; 14	G 1/4; 12,5
PGF1-2X/ **2,2** .L01VM	R900086166	R900932094	29,6	49,1	67,1	61,1	G 1/4; 14	G 1/4; 12,5
PGF1-2X/ **2,8** .L01VM	R900932138	R900051293	30,7	51,4	69,4	63,4	G 3/8; 14	G 1/4; 12,5
PGF1-2X/ **3,2** .L01VM	R900086168	R900051294	31,5	53,0	71,0	65,0	G 3/8; 14	G 1/4; 12,5
PGF1-2X/ **4,1** .L01VM	R900086169	R900088913	33,4	56,7	74,7	68,7	G 3/8; 14	G 3/8; 12,5
PGF1-2X/ **5,0** .L01VM	R900086170	R900051295	35,2	60,4	78,4	72,4	G 1/2; 14	G 3/8; 12,5





1 Through hole for socket head cap screw M8 DIN 912
Tightening torque M_T = 25 (+5) Nm

2 Follower, material no. **R900984336** included in scope of supply

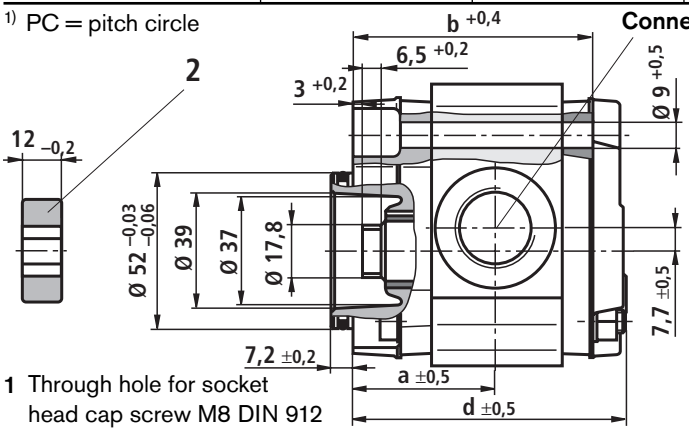
b = Clamping length

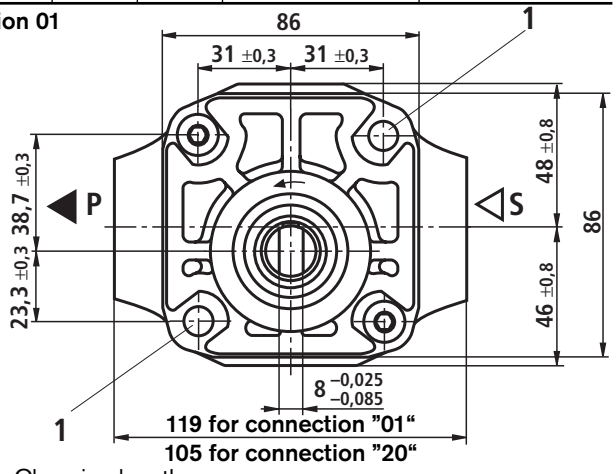
Unit dimensions and selection tables for frame size 2 (nominal dimensions in mm)

PGF2-2X/… $\frac{R}{L}$ **N…VM** (drive shaft for claw coupling); rear pump

Type **Size**	Material no. "R" clockwise	Material no. "L" counter-clockwise	Dimensions a	b	d	S	P
PGF2-2X/ **006** .N01VM	R900068313	R900563948	46	76	87	G 3/4; 16	G 1/2; 14
PGF2-2X/ **008** .N01VM	R900061740	R900062364	47.5	79.5	90.5	G 3/4; 16	G 1/2; 14
PGF2-2X/ **011** .N01VM	R900247694	R900077364	50.5	85	96	G 3/4; 16	G 1/2; 14
PGF2-2X/ **013** .N20VM	R900969260	R900034010	53	90	101	Ø20. PC Ø40 [1]	Ø12. PC Ø35 [1]
PGF2-2X/ **016** .N20VM	R900983411	R900033354	55.5	95	106	Ø20. PC Ø40 [1]	Ø12. PC Ø35 [1]
PGF2-2X/ **019** .N20VM	R900969261	R900932120	58.5	101	112	Ø26. PC Ø55 [1]	Ø12. PC Ø35 [1]
PGF2-2X/ **022** .N20VM	R900937783	R900081192	61.5	107	118	Ø26. PC Ø55 [1]	Ø12. PC Ø35 [1]

[1] PC = pitch circle





1 Through hole for socket head cap screw M8 DIN 912
Tightening torque M_T = 25 (+5) Nm

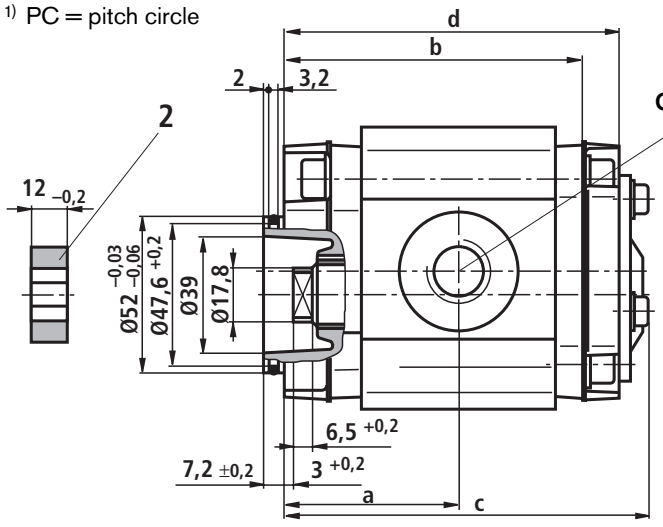
2 Follower, material no. **R900981428** included in sope of supply

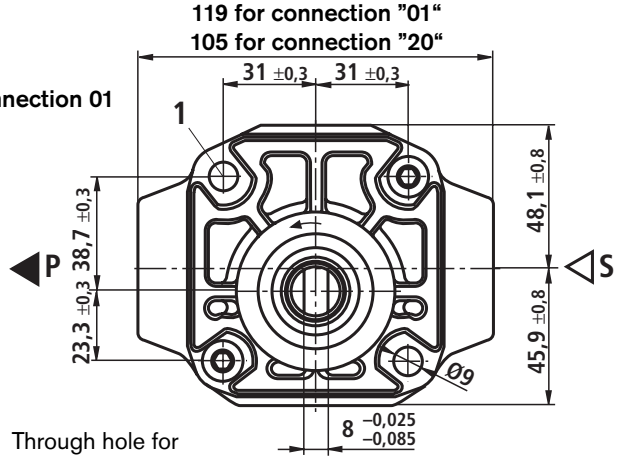
b = Clamping length

PGF2-2X/… $\frac{R}{L}$ **L…VM** (drive shaft for claw coupling with output); middle pump

Type **Size**	Material no. "R" clockwise	Material no. "L" counter-clockwise	Dimensions a	b	c	d	S	P
PGF2-2X/ **006** .L01VM	R900567307	R900066012	46	76	99	89	G 3/4; 16	G 1/2; 14
PGF2-2X/ **008** .L01VM	R900563291	R900070239	47.5	79.5	102.5	92.5	G 3/4; 16	G 1/2; 14
PGF2-2X/ **011** .L01VM	R900561146	R900079232	50.5	85	108	98	G 3/4; 16	G 1/2; 14
PGF2-2X/ **013** .L20VM	R900049570	R900058674	53	90	113	103	Ø20. PC Ø40 [1]	Ø12. PC Ø35 [1]
PGF2-2X/ **016** .L20VM	R900064718	R900983463	55.5	95	118	108	Ø20. PC Ø40 [1]	Ø12. PC Ø35 [1]
PGF2-2X/ **019** .L20VM	R900932243	R900983464	58.5	101	124	114	Ø26. PC Ø55 [1]	Ø12. PC Ø35 [1]
PGF2-2X/ **022** .L20VM	R900932186	R900983933	61.5	107	130	120	Ø26. PC Ø55 [1]	Ø12. PC Ø35 [1]

[1] PC = pitch circle





1 Through hole for head cap screw M8 DIN 912
Tightening torque M_T = 25 (+5) Nm

2 Follower, material no. **R900981428** included in scope of supply

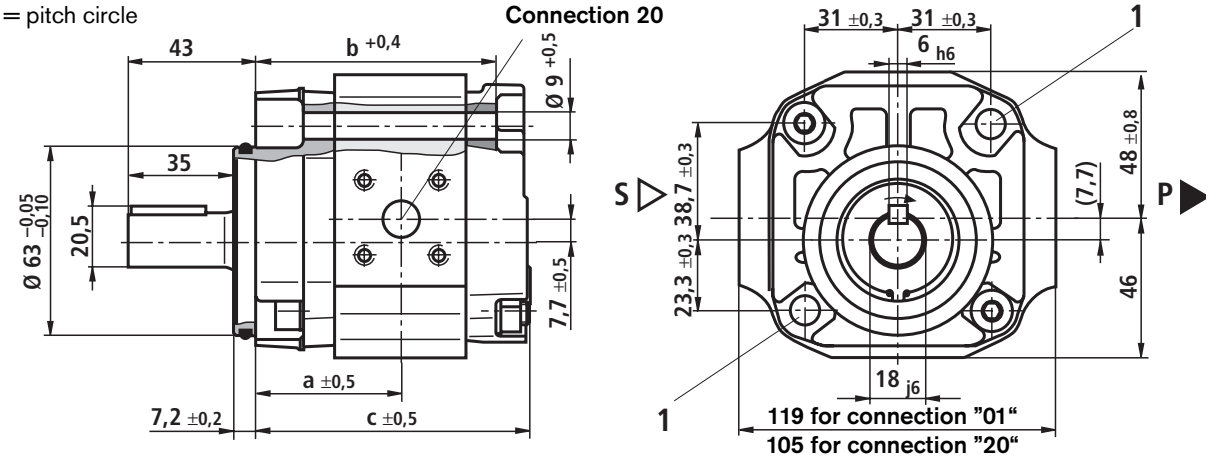
b = Clamping length

Unit dimensions and selection tables for frame size 2 (nominal dimensions in mm)

PGF2-2X/…RA…VP2 (cylindrical drive shaft); clockwise rotation

Type **Size**	Material no.	Dimensions a	b	c	S	P
PGF2-2X/ **006** RA01VP2	R900932272	46	76	87	G 3/4; 16	G 1/2; 14
PGF2-2X/ **008** RA01VP2	R900564037	47.8	79.5	90.5	G 3/4; 16	G 1/2; 14
PGF2-2X/ **011** RA01VP2	R900568523	50.5	85	96	G 3/4; 16	G 1/2; 14
PGF2-2X/ **013** RA20VP2	R900032712	53	90	101	Ø20, PC Ø40 [1]	Ø12, PC Ø35 [1]
PGF2-2X/ **016** RA20VP2	R900932275	55.5	95	106	Ø26, PC Ø55 [1]	Ø12, PC Ø35 [1]
PGF2-2X/ **019** RA20VP2	R900571401	58.5	101	112	Ø26, PC Ø55 [1]	Ø12, PC Ø35 [1]

[1] PC = pitch circle



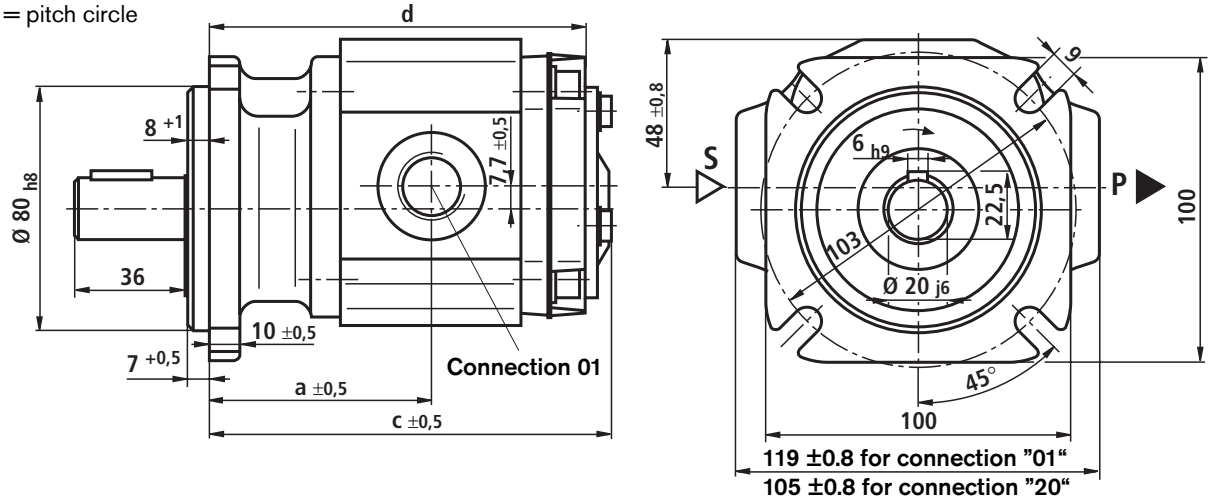
1 Through hole for socket head cap screw M8 DIN 912
Tightening torque M_A = 25 (+5) Nm

b = Clamping length

PGF2-2X/…RE…VE4 (cylindrical drive shaft with output); clockwise rotation

Type **Size**	Material no.	Dimensions a	c	d	S	P
PGF2-2X/ **006** RE01VE4	R900932265	63	114	104	G 3/4; 16	G 1/2; 14
PGF2-2X/ **008** RE01VE4	R900932266	64.8	117.5	107.5	G 3/4; 16	G 1/2; 14
PGF2-2X/ **011** RE01VE4	R900932271	67.5	123	113	G 3/4; 16	G 1/2; 14
PGF2-2X/ **013** RE20VE4	R900943181	70	128	118	Ø20, PC Ø40 [1]	Ø12, PC Ø35 [1]
PGF2-2X/ **016** RE20VE4	R900932193	72.5	133	123	Ø20, PC Ø40 [1]	Ø12, PC Ø35 [1]
PGF2-2X/ **019** RE20VE4	R900943182	75.5	139	129	Ø26, PC Ø55 [1]	Ø12, PC Ø35 [1]
PGF2-2X/ **022** RE20VE4	R900932126	78.5	144	134	Ø26, PC Ø55 [1]	Ø12, PC Ø35 [1]

[1] PC = pitch circle

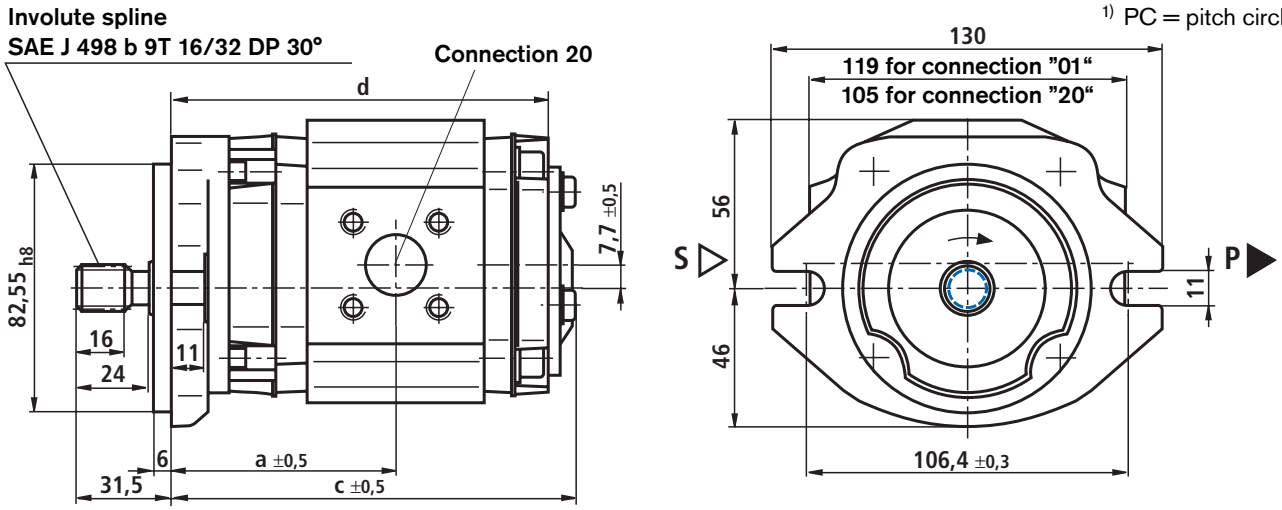


Unit dimensions and selection tables for frame size 2 (nominal dimensions in mm)

PGF2-2X/… R / L **J.VU2** (splined drive shaft with output)

Type **Size**	Material no. "R" clockwise	Material no. "L" counter-clockwise	Dimensions a	c	d	S	P
PGF2-2X/ **006** RJ01VU2	R900931660	R900247697	65	116	106	G 3/4; 16	G 1/2; 14
PGF2-2X/ **008** RJ01VU2	R900953363	R900247698	67	119.5	109.5	G 3/4; 16	G 1/2; 14
PGF2-2X/ **011** RJ01VU2	R900938281	R900247699	69.5	125	115	G 3/4; 16	G 1/2; 14
PGF2-2X/ **013** RJ20VU2	R900932264	R900969259	72	130	120	Ø20, PC Ø40 [1]	Ø12, PC Ø35 [1]
PGF2-2X/ **016** RJ20VU2	R900932085	R900936173	74.5	135	125	Ø20, PC Ø40 [1]	Ø12, PC Ø35 [1]
PGF2-2X/ **019** RJ20VU2	R900022882	R900984300	77.5	141	131	Ø26, PC Ø55 [1]	Ø12, PC Ø35 [1]
PGF2-2X/ **022** RJ20VU2	R900054053	R900935718	80.5	147	137	Ø26, PC Ø55 [1]	Ø12, PC Ø35 [1]

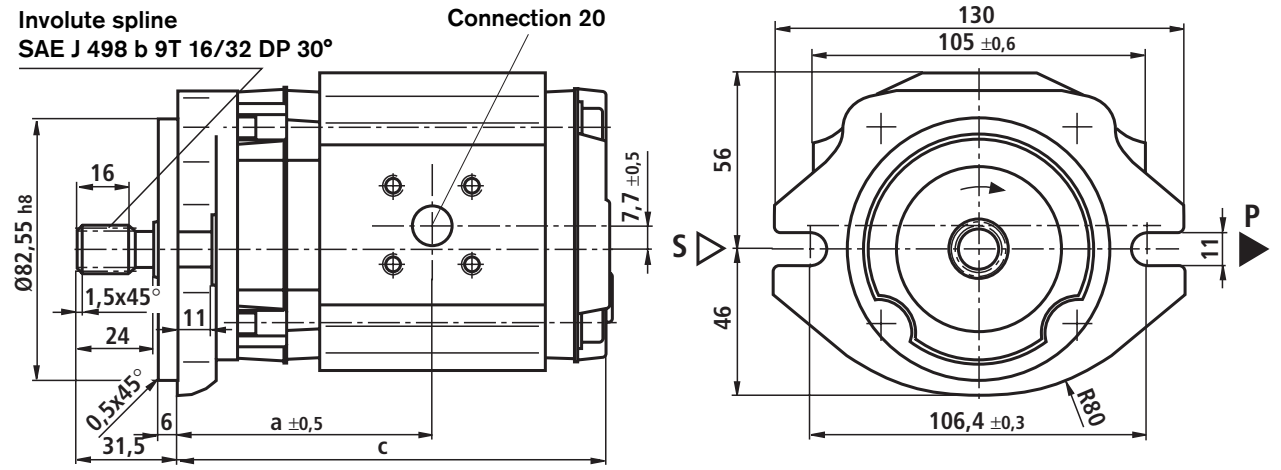
[1] PC = pitch circle



PGF2-2X/…RT20VU2 (splined drive shaft)

Type **Size**	Material no. "R" clockwise	Dimensions a	c	S	P
PGF2-2X/ **006** RT20VU2	–	65.0	106.2	Ø20; PC Ø40 [1]	Ø12; PC Ø35 [1]
PGF2-2X/ **008** RT20VU2	R900983482	67.0	109.7	Ø20; PC Ø40 [1]	Ø12; PC Ø35 [1]
PGF2-2X/ **011** RT20VU2	–	69.5	115.2	Ø20; PC Ø40 [1]	Ø12; PC Ø35 [1]
PGF2-2X/ **013** RT20VU2	R900573243	72.0	120.2	Ø20; PC Ø40 [1]	Ø12; PC Ø35 [1]
PGF2-2X/ **016** RT20VU2	R900929805	74.5	125.2	Ø20; PC Ø40 [1]	Ø12; PC Ø35 [1]
PGF2-2X/ **019** RT20VU2	R900983485	77.5	131.0	Ø26; PC Ø55 [1]	Ø12; PC Ø35 [1]

[1] PC = pitch circle



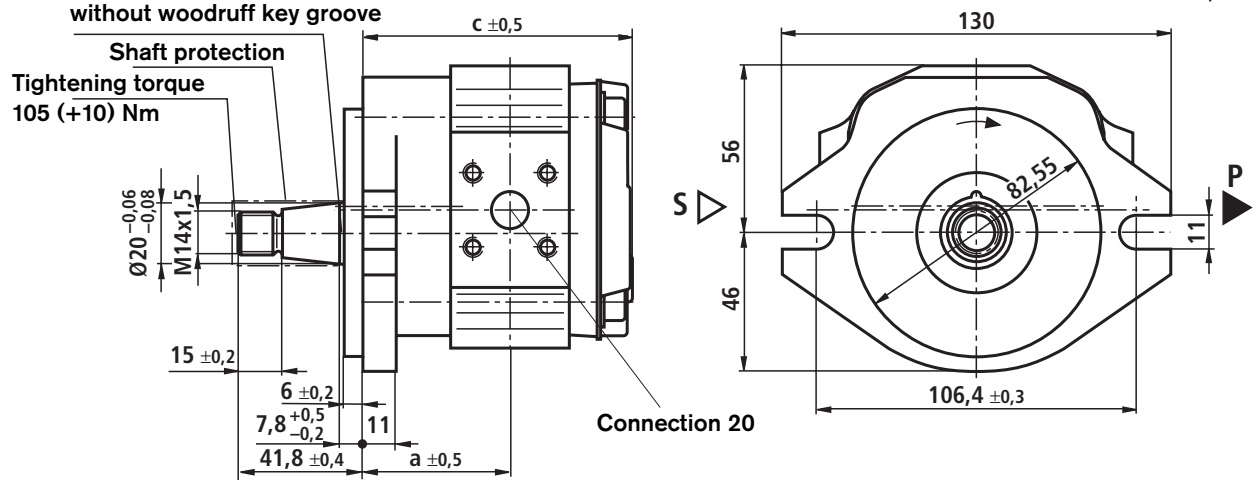
Unit dimensions and selection tables for frame sizes 2 and 3 (nominal dimensions in mm)

PGF2-2X/…RS20VU2 (conical drive shaft)

Type **Size**	Material no. "R" clockwise	Dimensions a	c	S	P
PGF2-2X/ **006** RS20VU2	R900946180	49.2	90.4	Ø20; PC Ø40 [1]	Ø12; PC Ø35 [1]
PGF2-2X/ **008** RS20VU2	R900619661	50.7	93.9	Ø20; PC Ø40 [1]	Ø12; PC Ø35 [1]
PGF2-2X/ **011** RS20VU2	R900946237	53.7	99.4	Ø20; PC Ø40 [1]	Ø12; PC Ø35 [1]
PGF2-2X/ **013** RS20VU2	R900619662	56.2	104.4	Ø20; PC Ø40 [1]	Ø12; PC Ø35 [1]
PGF2-2X/ **016** RS20VU2	R900619663	58.7	109.4	Ø20; PC Ø40 [1]	Ø12; PC Ø35 [1]
PGF2-2X/ **019** RS20VU2	R900955134	61.7	115.4	Ø26; PC Ø55 [1]	Ø12; PC Ø35 [1]
PGF2-2X/ **022** RS20VU2	R900950915	64.7	121.4	Ø26; PC Ø55 [1]	Ø12; PC Ø35 [1]

[1] PC = pitch circle

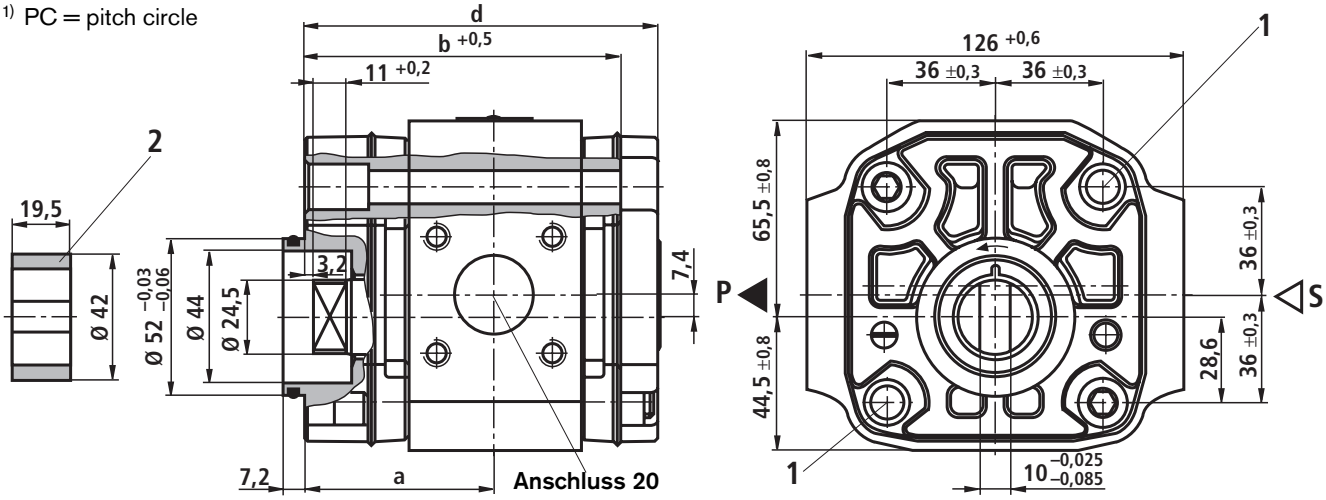
Conical shaft end, similar to DIN ISO 6519, without woodruff key groove



PGF3-3X/… $\frac{R}{L}$ **N…VM** (drive shaft for claw coupling); counter-clockwise rotation; rear pump

Type **Size**	Material no. "R" clockwise	Material no. "L" counter-clockwise	Dimensions a	b	d	S	P
PGF3-3X/ **020** .N20VM	R900969263	R900051928	60.5	101.5	112.5	Ø26, PC Ø55 [1]	Ø12, PC Ø35 [1]
PGF3-3X/ **022** .N20VM	R900969264	R900202496	61.5	103.5	114.5	Ø26, PC Ø55 [1]	Ø12, PC Ø35 [1]
PGF3-3X/ **025** .N20VM	R900983758	R900034369	63.5	107.5	118.5	Ø26, PC Ø55 [1]	Ø12, PC Ø35 [1]
PGF3-3X/ **032** .N07VM	R900937747	R900051539	68	116.5	127.5	SAE 1 1/4"	SAE 3/4"
PGF3-3X/ **040** .N07VM	R900965546	R900932122	73	126.5	137.5	SAE 1 1/4"	SAE 3/4"

[1] PC = pitch circle



1 Through hole for socket head cap screw M10 DIN 912
Tightening torque M_T = 49 (+5) Nm

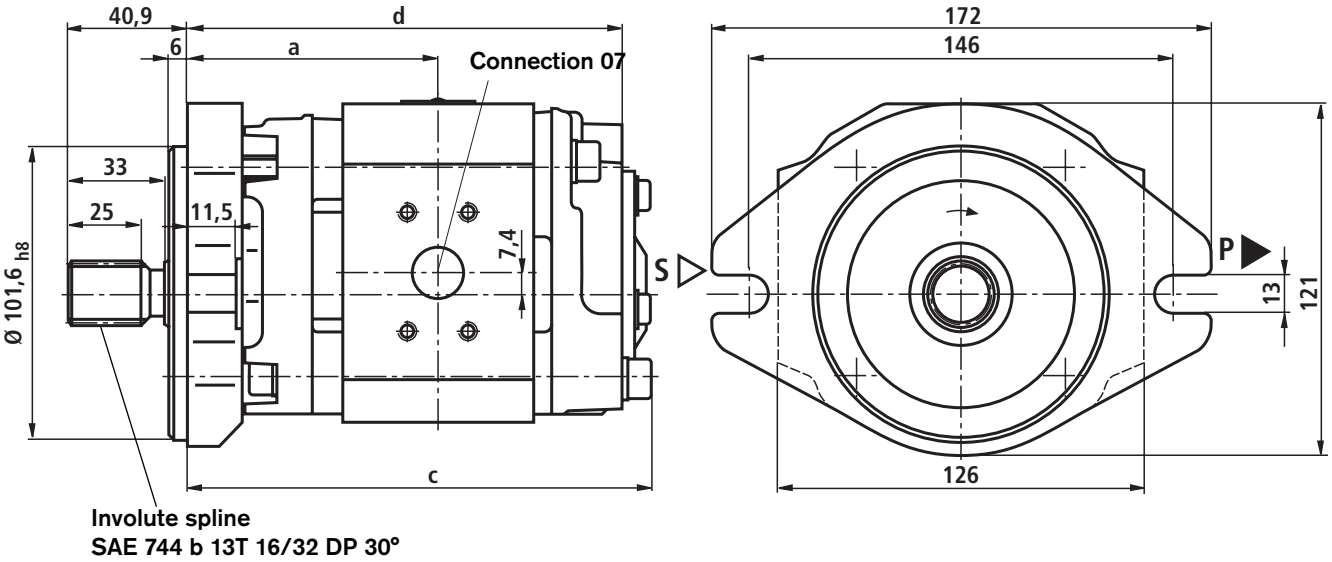
2 Follower, material no. **R900983603** included in scope of supply

b = Clamping length

Unit dimensions and selection tables for frame size 3 (nominal dimensions in mm)

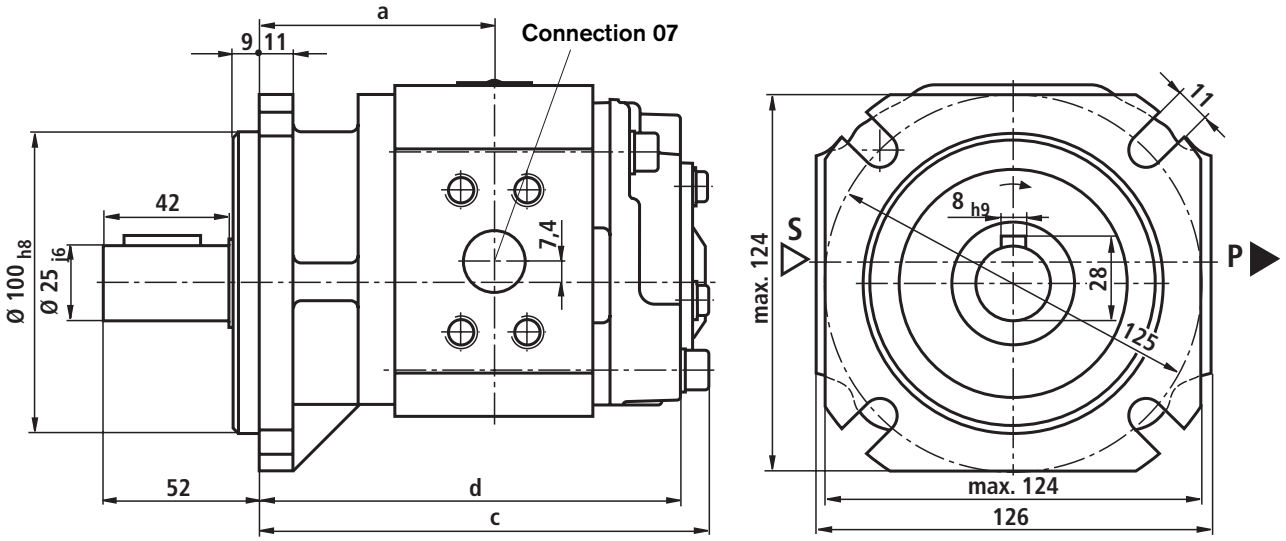
PGF3-3X/…$^{R}_{L}$ J07VU2 (splined drive shaft with output)

Type **Size**	Material no. "R" clockwise	Material no. "L" counter-clockwise	Dimensions **a**	**c**	**d**	**S**	**P**
PGF3-3X/ **020** J07VU2	R900983792	R900948466	79.5	144.5	134.5	SAE 1 1/4"	SAE 3/4"
PGF3-3X/ **022** J07VU2	R900931657	R900969265	80.5	146.5	136.5	SAE 1 1/4"	SAE 3/4"
PGF3-3X/ **025** J07VU2	R900029617	R900950057	82.5	150.5	140.5	SAE 1 1/4"	SAE 3/4"
PGF3-3X/ **032** J07VU2	R900029561	R900984213	87	159.5	149.5	SAE 1 1/4"	SAE 3/4"
PGF3-3X/ **040** J07VU2	R900931426	R900969266	95	169.5	159.5	SAE 1 1/4"	SAE 3/4"



PGF3-3X/…RE07VE4 (cylindrical drive shaft with output); clockwise rotation

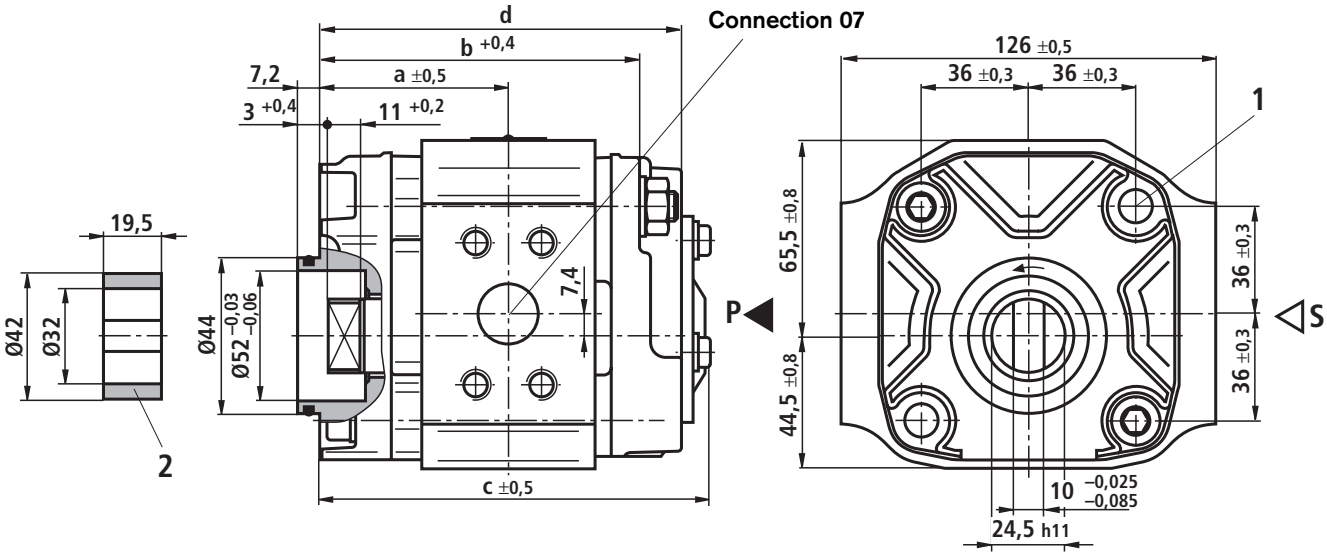
Type **Size**	Material no.	Dimensions **a**	**c**	**d**	**S**	**P**
PGF3-3X/ **020** RE07VE4	R900063299	71	136	126	SAE 1 1/4"	SAE 3/4"
PGF3-3X/ **022** RE07VE4	R900035217	72	138	128	SAE 1 1/4"	SAE 3/4"
PGF3-3X/ **025** RE07VE4	R900932088	74	142	132	SAE 1 1/4"	SAE 3/4"
PGF3-3X/ **032** RE07VE4	R900932112	78.5	151	141	SAE 1 1/4"	SAE 3/4"
PGF3-3X/ **040** RE07VE4	R900932111	83.5	161	151	SAE 1 1/4"	SAE 3/4"



Unit dimensions and selection tables for frame size 3 (nominal dimensions in mm)

PGF3-3X/… $\frac{R}{L}$ **L07VM** (drive shaft for claw coupling with output); middle pump

Type **Size**	Material no. "R" clockwise	Material no. "L" counter-clockwise	Dimensions **a**	**b**	**c**	**d**	**S**	**P**
PGF3-3X/ **020** L07VM	R900073539	R900758721	60.5	101.5	125.5	115.5	SAE 1 1/4"	SAE 3/4"
PGF3-3X/ **022** L07VM	R900073077	R900743099	61.5	103.5	127.5	117.5	SAE 1 1/4"	SAE 3/4"
PGF3-3X/ **025** L07VM	R900960119	R900932121	63.5	107.5	131.5	121.5	SAE 1 1/4"	SAE 3/4"
PGF3-3X/ **032** L07VM	R900034370	R900074369	68	116.5	140.5	130.5	SAE 1 1/4"	SAE 3/4"
PGF3-3X/ **040** L07VM	R900058224	R900083281	73	126.5	150.5	140.5	SAE 1 1/4"	SAE 3/4"

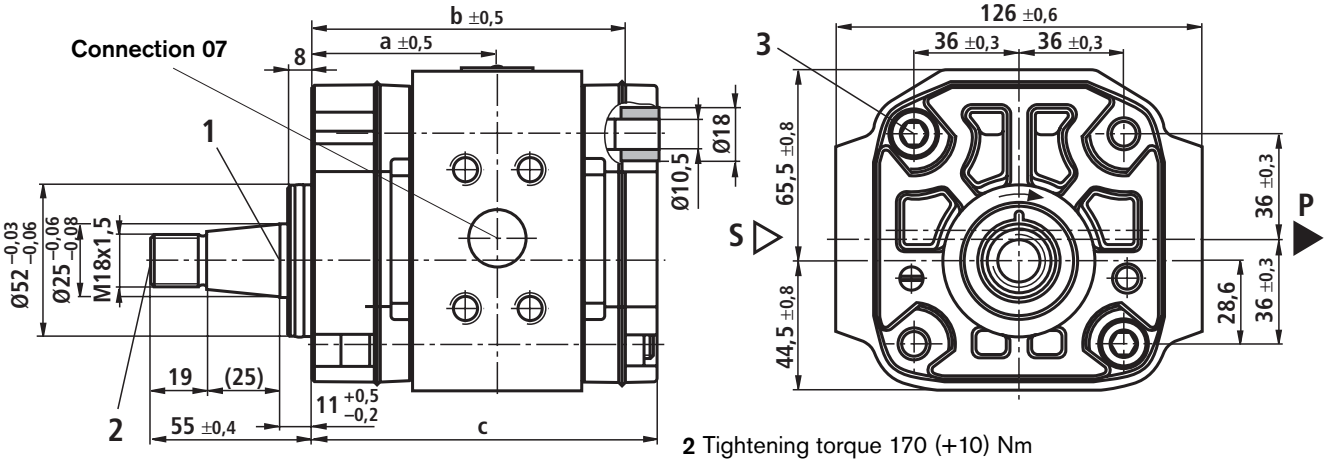


1 Through hole for socket head cap screw M10 DIN 912
Tightening torque M_T = 49 (+5) Nm

2 Follower, mat. no. **R900983603** included in scope of supply
b = Clamping length

PGF3-3X/…RS07VM (conical drive shaft)

Type **Size**	Material no. "R" clockwise	Dimensions **a**	**b**	**c**	**S**	**P**
PGF3-3X/ **020** RS07VM	R900965136	60.5	101.5	112.5	SAE 1 1/4"	SAE 3/4"
PGF3-3X/ **022** RS07VM	R900969222	61.5	103.5	114.5	SAE 1 1/4"	SAE 3/4"
PGF3-3X/ **025** RS07VM	R900969223	63.5	107.5	118.5	SAE 1 1/4"	SAE 3/4"
PGF3-3X/ **032** RS07VM	R900984249	68	116.5	127.5	SAE 1 1/4"	SAE 3/4"
PGF3-3X/ **040** RS07VM	R900969224	76	126.5	137.5	SAE 1 1/4"	SAE 3/4"



1 Shaft end conical, similar to DIN ISO 6519, without woodruff key groove

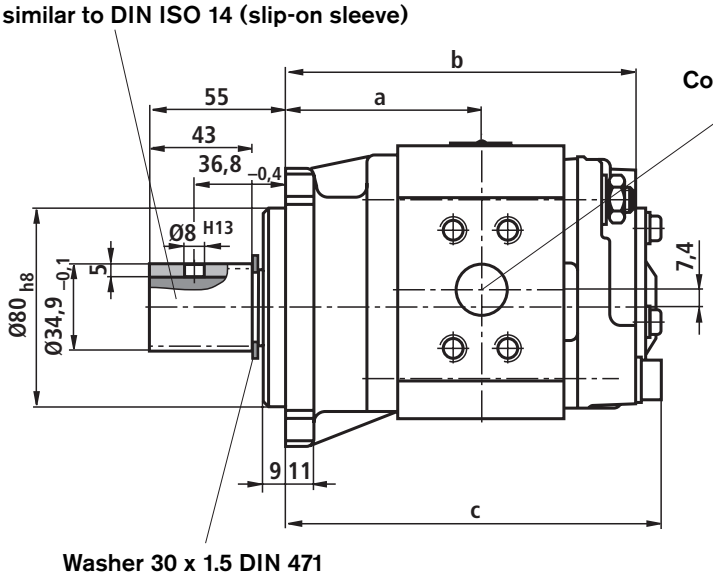
2 Tightening torque 170 (+10) Nm
3 Fixing screw M10, tightening torque 49 (+5) Nm
b = Clamping length

Unit dimensions and selection tables for frame size 3 (nominal dimensions in mm)

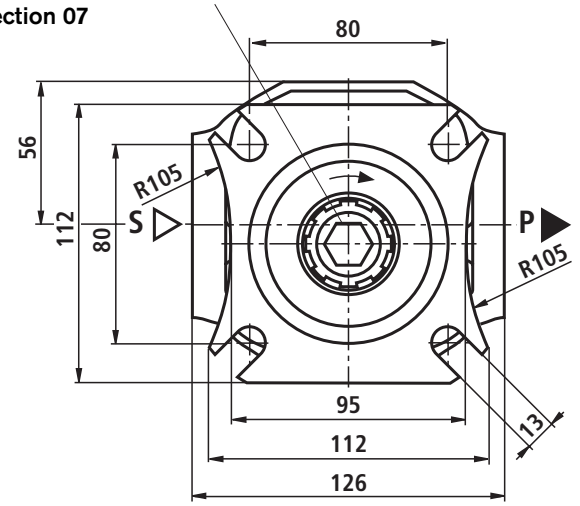
PGF3-3X/… $\begin{matrix}\mathbf{R}\\\mathbf{L}\end{matrix}$ **O07VK4** (conical drive shaft with output)

Type **Size**	Material no. "R" clockwise	Material no. "L" counter-clockwise	Dimensions **a**	**b**	**c**	**S**	**P**
PGF3-3X/ **020** .O07VK4	R900969302	R900619706	71	126	136.5	SAE 1 1/4"	SAE 3/4"
PGF3-3X/ **022** .O07VK4	R900619709	R900619708	72	128	138.5	SAE 1 1/4"	SAE 3/4"
PGF3-3X/ **025** .O07VK4	R900943169	R900619710	74	132	142.5	SAE 1 1/4"	SAE 3/4"
PGF3-3X/ **032** .O07VK4	R900943168	R900943167	78.5	141	151.5	SAE 1 1/4"	SAE 3/4"
PGF3-3X/ **040** .O07VK4	R900619712	R900619711	83.5	151	161.5	SAE 1 1/4"	SAE 3/4"

Splined shaft profile B8x32x35
similar to DIN ISO 14 (slip-on sleeve)



Hexagon socket A/F17; M_T = 170 (+25) Nm



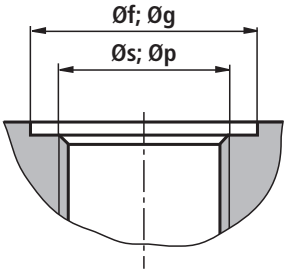
Suction and pressure ports (nominal dimensions in mm)

PGF1, type of connection 01
BSP thread to ISO 228/1

	Suction port dimensions		Pressure port dimensions	
Size	**s**	**f**	**p**	**g**
1,7	G 1/4; 14	23	G 1/4; 12.5	23
2,2	G 1/4; 14	23	G 1/4; 12.5	23
2,8	G 3/8; 14	26	G 1/4; 12.5	23
3,2	G 3/8; 14	26	G 1/4; 12.5	23
4,1	G 3/8; 14	26	G 3/8; 12.5	26
5,0	G 1/2; 14	27	G 3/8; 12.5	26

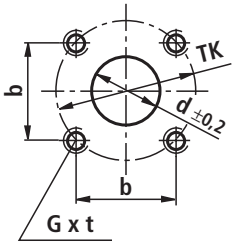
PGF2, type of connection 01
BSP thread to ISO 228/1

	Suction port dimensions		Pressure port dimensions	
Size	**s**	**f**	**p**	**g**
006	G 3/4; 16	35	G 1/2; 14	35
008	G 3/4; 16	35	G 1/2; 14	35
011	G 3/4; 16	35	G 1/2; 14	35
013	G 3/4; 16	35	G 1/2; 14	35
016	G 1; 18	40	G 1/2; 14	35
019	G 1; 18	40	G 1/2; 14	35
022	G 1; 18	40	G 1/2; 14	35



PGF2, type of connection 20 square flange connection

	Suction port dimensions						Pressure port dimensions					
Size	**d**	**b**	**PC**	**Thread**	**t**	***M* in Nm**	**d**	**b**	**PC**	**Thread**	**t**	***M* in Nm**
006	20	28.3	40	M6	10	10	12	24.8	35	M6	12	10
008	20	28.3	40	M6	10	10	12	24.8	35	M6	12	10
011	20	28.3	40	M6	10	10	12	24.8	35	M6	12	10
013	20	28.3	40	M6	10	10	12	24.8	35	M6	12	10
016	20	28.3	40	M6	10	10	12	24.8	35	M6	12	10
019	26	38.9	55	M8	12	25	12	24.8	35	M6	12	10
022	26	38.9	55	M8	12	25	12	24.8	35	M6	12	10



Tightening torque: *M*

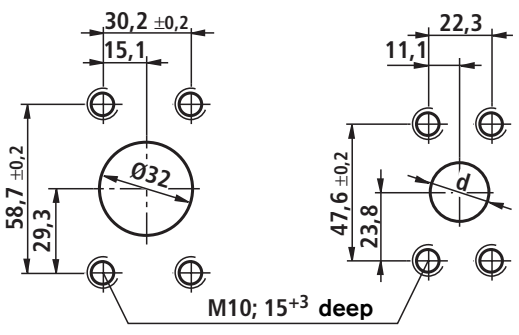
PGF3, type of connection 20 square flange connection

	Suction port dimensions						Pressure port dimensions					
Size	**d**	**b**	**PC**	**Thread**	**t**	***M* in Nm**	**d**	**b**	**PC**	**Thread**	**t**	***M* in Nm**
020	26	38.9	55	M8	12	25	12	24.8	35	M6	10	10
022	26	38.9	55	M8	12	25	12	24.8	35	M6	10	10
025	26	38.9	55	M8	12	25	12	24.8	35	M6	10	10
032	26	38.9	55	M8	12	25	20	38.9	55	M8	12	25
040	26	38.9	55	M8	12	25	20	38.9	55	M8	12	25

PGF3, Type of connection 07 SAE flange connection

Suction port SAE 1 1/4“ S

Pressure port SAE 3/4“ S



Tightening torque: 49 (+5) Nm

Size	**d**
020	16
022	16
025	16
032	20
040	20

Suction and pressure flanges

Connection 20

Pressure flange types **PGF2** and **PGF3**
of sizes 020, 022 and 025 with pitch circle Ø 35 mm

Flange type	Designation	Material no.
Flange QA	35,0–4x6,4→L10–PN315	R900321436
Flange QA	35,0–4x6,4→L12–PN315	R900321437
Flange QA	35,0–4x6,4→S16–PN315	R900323235
Angled flange QA	35,0–4x6,4→L10–PN315	R900321444
Angled flange QA	35,0–4x6,4→L12–PN315	R900321445
Angled flange QA	35,0–4x6,4→L18–PN250	R900991790
Angled flange QA	35,0–4x6,4→S16–PN315	R900321447
Angled flange QA	35,0–4x6,4→S20–PN315	R900321448

Suction flange types **PGF2** and **PGF3**
of sizes 006 to 016 with pitch circle Ø 40 mm

Flange type	Designation	Material no.
Flange QA	40,0–4x6,4→L18–PN100	R900321434
Flange QA	40,0–4x6,4→L22–PN100	R900321435
Flange QA	40,0–4x6,4→L28–PN100	R900323237
Angled flange QA	40,0–4x6,4→L18–PN100	R900321441
Angled flange QA	40,0–4x6,4→L22–PN100	R900321442
Angled flange QA	40,0–4x6,4→L28–PN100	R900321443

Suction and pressure flange type **PGF3** of sizes 020 to 040 and **PFG2** of sizes 019 and 022 with pitch circle Ø 55 mm, p_{max} 100 bar

Flange type	Designation	Material no.
Flange QA	55,0–4x8,4→L42–PN100	R900702278
Angled flange QA	55,0–4x8,4→L42–PN100	R900071314

For dimensions and detailed information, see AB 22-35 and RN 206.21.

Connection 07

Suction flange type **PGF3**

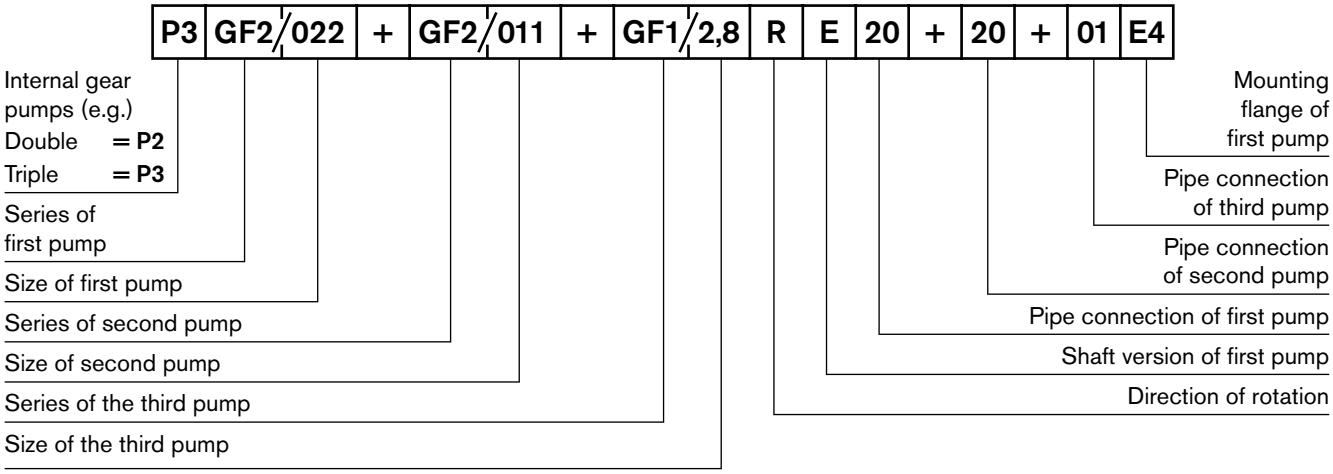
Designation	Material no.
SAE 1 1/4S-G 1 1/4 (with threaded connection)	R900014153
SAE 1 1/4S-42,0x3,0 (with welded neck)	R900012341

Pressure flange type **PGF3**

Designation	Material no.
SAE 3/4S-G 3/4 (with threaded connection)	R900024202
SAE 3/4S-25,0x4,0 (with welded neck)	R900056163
SAE 3/4S-20,0x3,0 (with welded neck)	R900056167

For dimensions and detailed information, see AB 22-15.

Multiple pumps – ordering code



Multiple pumps – engineering notes

- The valid general technical data are the same as for single pumps (see pages 4 and 5).
- Combined pumps must all have the same direction of rotation.
- The pump that is subjected to the greatest loads should be the first pump.
- The engineer must verify the maximum through-drive torque for every application. This is also valid for existing (coded) multiple pumps.

Maximum **drive torques** in Nm

Shaft	N	L	A	E	J
PGF1	14	14	30	30	–
PGF2	70	70	70	140	140
PGF3	140	140	–	230	230

- Common suction is **not** possible.
- For reasons of strength and stability, we recommend the use of ISO 4-hole mounting flanges to VDMA “E4“ for combinations of three or more pumps.

Selection:

- The front pump must have shaft version E, J or L.
- The middle pmp must have shaft version L.
- The rear pump must have shaft version N.
- If a pump of the next smaller frame size is to be mounted, the first pump must show “K” at the end of the designation (e.g. PGF3 + PGF2 ⇒ front pump: PGF3-3X/032RJ07VU2**K**)

- The drive torque of a pump stage can be calculated as follows:

$$T = \frac{\Delta p \bullet V \bullet 0.0159}{\eta_{\text{hydr.-mech.}}}$$

T : drive torque in Nm
Δp : operating pressure in bar
V : displacement in cm^3
η : hydraulic-mechanical efficiency

Maximum **output torques** in Nm

Shaft	N	L	A	E	J
PGF1	–	14	–	14	–
PGF2	–	70	–	70	70
PGF3	–	140	–	140	140

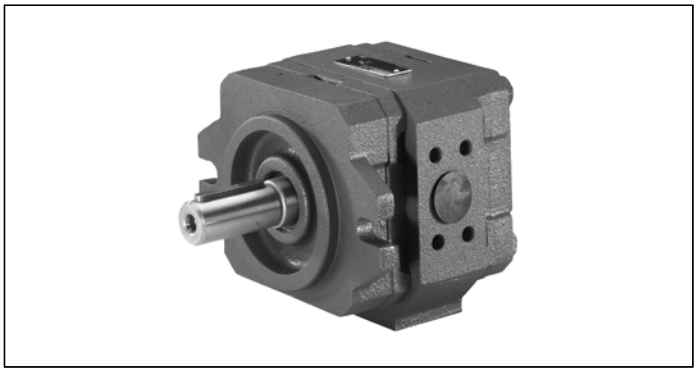
- Before operating pump combinations with different media, please consult Rexroth Hydraulics.
- PGF combinations are assembled without combination parts
- The pumps are not sealed from each other.

Dimensions:

- The dimensions of connections are the same as for single pumps (see page 18).
- The total length of the pump is obtained by adding up the dimensions “d” of the single pumps (see pages 9 to 17).
- With the combination of PGF2 and PGF1 the constructive length of PGF2 (dimension d) increases by 4.5 mm.
  With the combination of PGF3 and PGF2 the constructive length of PGF3 (dimension d) increases by 2 mm.
  With the combination of PGF3 and PGF1 the constructive length of PGF3 (dimension d) increases by 12.5 mm.

Internal gear pump PGH
Fixed displacement
Series 2X

RE 10223
Edition: 04.2013
Replaces: 03.2005



- Frame sizes 2 and 3
- Size 5 to 16
- Maximum pressure 350 bar
- Displacement 5.2 to 16.0 cm^3

Features

- Fixed displacement
- Low operating noise
- Low flow pulsation
- High efficiency even at low rotational speed and viscosity due to sealing gap compensation
- Suitable for a wide viscosity and speed range
- All frame sizes and sizes can be optionally combined with each other
- Can be combined with internal gear pumps, radial piston pumps and external gear pumps

Contents

Ordering code	2
Functional description	3
Technical data	4
Characteristic median values for frame sizes 2 and 3	5
Dimensions frame size 2	6
Dimensions frame size 3	7
Multiple pump units	9
SAE connection flanges	12
Pump safety block	12
Engineering notes	13
Installation instructions	14
Commissioning instructions	15

Ordering code

01	02	03		04		05	06	07	08	09	10	11
PG	**H**		–	**2X**	**/**				**07**		**U2**	

Type

01	Internal gear pump, fixed displacement, gap compensated	**PG**

Series

02	High pressure pump, maximum pressure 350 bar	**H**

Frame sizes BG

03	BG2	**2**
	BG3	**3**

Unit series

04	Unit series 20 to 29 (20 to 29: unchanged installation and connection dimensions)	**2X**

Sizes		**NG**	
05	BG2	5	**005**
		6	**006**
		8	**008**
	BG3	11	**011**
		13	**013**
		16	**016**

Directions of rotation

06	Viewed on drive shaft	clockwise	**R**
		counter-clockwise	**L**

Drive shafts

07	Parallel keyed shaft, DIN 6885		**E**
	Splined shaft to SAE J744 with involute spline to ANSI B92.1a	16-4 (A) 9T 16/32DP	**R**
		19-4 11T 16/32DP	**S**

Line ports

08	Suction and pressure port to SAE, pressure port standard pressure series	**07**

Seals

09	FKM (fluor-caoutchouc)	**V**
	FKM (fluor-caoutchouc), shaft seal in NBR (nitrile-caoutchouc)[1)]	**W**

Mounting flange

10	SAE 2-hole	**U2**

11	Further parameters in clear text	

Ordering example

PGH3-2X/016RE07VU2

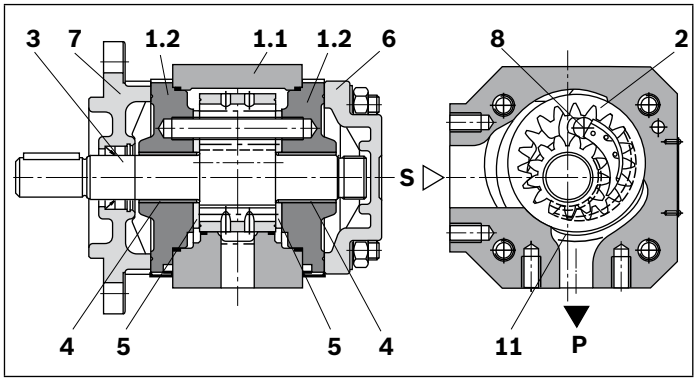
Material number

R900951305

Not all of the variants according to the ordering code are possible! Please select the desired pump with the help of the selection table (page 6 to 8) or after consultation with Bosch Rexroth.

1) For HFC-fluids

Functional description



Assembly

PGF hydraulic pumps are leak gap-compensated internal gear pumps with a fixed displacement.

They consist basically of housing (**1.1**), bearing cover (**1.2**), ring gear (**2**), pinion shaft (**3**), slide bearings (**4**), axial discs (**5**), end cover (**6**), mounting flange (**7**) and stop pin (**8**), as well as the segment assembly (**9**), which is composed of a segment (**9.1**), segment carrier (**9.2**) and the sealing rolls (**9.3**).

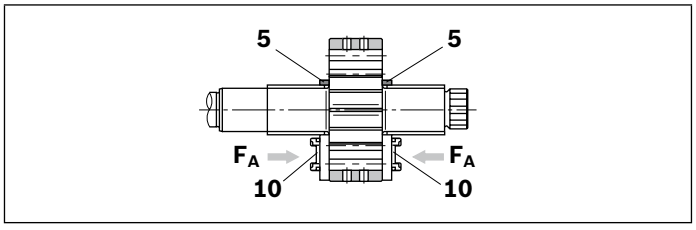
Suction and displacement process

The hydro dynamically supported pinion shaft (**3**) drives the internally toothed ring gear (**2**) in the direction of rotation shown.

During rotation, the volume is increased in the suction area over an angle of approx. 90 °. A negative pressure is generated and fluid flows into the chambers.

The sickle-shaped segment assembly (**9**) separates the suction chamber from the pressure chamber. Within the pressure chamber, the teeth of the pinion shaft (**3**) mesh with the tooth spaces of the ring gear (**2**). The fluid is then displaced through the pressure channel (**P**).

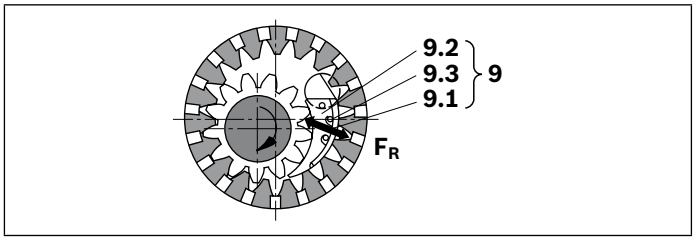
Axial compensation



The axial compensation force F_A acts in the area of the pressure chamber and is generated by the pressure zone (**10**) in the axial discs (**5**).

The axial, longitudinal gaps between rotating and fixed parts are therefore extremely small and ensure optimum axial sealing of the pressure chamber.

Radial compensation



The radial compensation force F_R acts on the segment (**9.1**) and segment carrier (**9.2**).

Depending on the operating pressure the two segment assemblies (**9.1**) and (**9.2**) are pressed against the pinion shaft-head diameter (**3**) and the ring gear(**2**) .

The area ratios and the position of the sealing rolls (**9.3**) between the segment and segment carrier are designed to provide virtually gap-free sealing between the ring gear (**2**), the segment assembly (**9**) and the pinion shaft (**3**).

Spring elements under the sealing rolls (**9.3**) ensure adequate contact pressure, even at very low pressures.

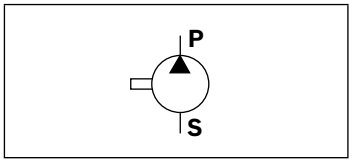
Hydrodynamic and hydrostatic bearing

The forces acting on the pinion shaft (**3**) are absorbed by hydro dynamically lubricated radial slide bearings (**4**) while those acting on the ring gear (**2**) are absorbed by the hydrostatic bearing (**11**).

Splines

Involute splining was selected for the splines. Their long length of contact results in a low flow and pressure pulsation; these low pulsation rates greatly contribute to the low-noise operation.

▼ **Symbol**



Technical data

Frame size		**BG**	**2**	**2**	**2**	**3**	**3**	**3**
Size		NG	5	6	8	11	13	16
Displacement, geometric	V_g	cm^3	5.24	6.5	8.2	11.0	13.3	16.0
Drive speed	n_{min}	rpm	600	600	600	600	600	600
	n_{max}	rpm	3000	3000	3000	3000	3000	3000
Operating pressure, absolute								
Inlet	p	bar	0.8 to 2 (short-term at start 0.6 bar)					
Outlet continuous								
Standard fluid	p_n	bar	315	315	315	315	315	315
Special fluid [1]	p_n	bar	210	210	210	210	210	210
intermittend [2]								
Standard fluid	p_{max}	bar	350	350	350	350	350	350
Special fluid [1]	p_{max}	bar	230	230	230	230	230	230
Flow (at n = 1450 rpm, p = 10 bar, ν = 46 mm^2/s)	q_V	l/min	7.5	9.3	11.8	15.8	19.1	23.0
weight	m	kg	4.3	4.4	4.6	4.8	5	5.3
Shaft loading			Radial and axial forces (e. g., belt pulley) only after consultation					
Type of mounting			Flange mounting					

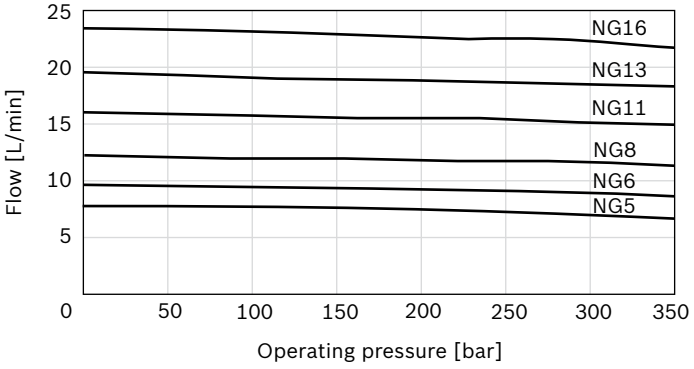
Hydraulic fluid			
Standard fluid		HLP mineral oil according to DIN 51524 Part 2	
Special fluid		▶ Environmentally acceptable fluids HEES according to DIN ISO 15380 ▶ Fire resistant anhydrous fluids HFD-U according to VDMA 24317 ▶ Hydrous polymer-solutions HFC according to DIN EN ISO 12922[3] ▶ Observe our application instructions and application requirements in the data sheets 90220 (HLP), 90221 (HEES) and 90222 (HFD-U). ▶ Other fluids on request!	
Temperature range	°C	Standard fluid	–10 to +80, for other temperatures please consult us!
		Special fluid	–10 to +50, for other temperatures please consult us!
Ambient temperature range	°C		–20 to +60
Viscosity range	mm/s^2		10 to 300; permissible starting viscosity 2000
Maximum permissible degree of contamination of the hydraulic fluid. Cleanliness level according to ISO 4406 (c)			Class 20/18/15[4]

Note
Please contact us if the unit is to be used outside the specified values!

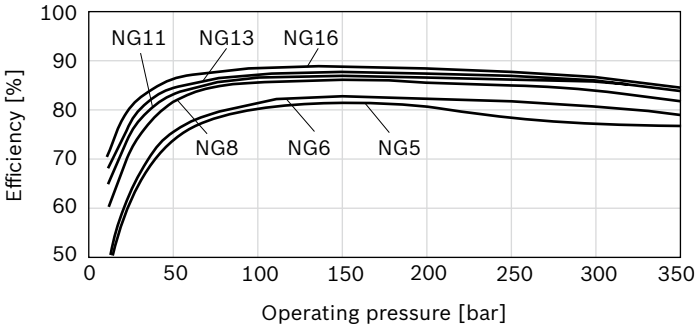
1) For special fluids observe restrictions of the technical data!
2) Maximum 10 s, at most 50 % of the duty cycle
3) Execution of seals W
4) Cleanliness levels specified for the components must be maintained in the hydraulic systems. Effective filtration prevents malfunctions and simultaneously extends the service life of the components.
For the selection of the filters see data sheets 50070, 50076, 50081, 50086, 50087 and 50088.

Characteristic median values for frame sizes 2 and 3

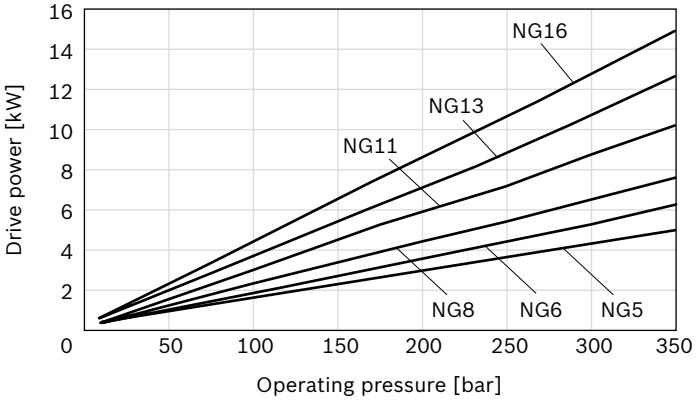
▼ **Flow**



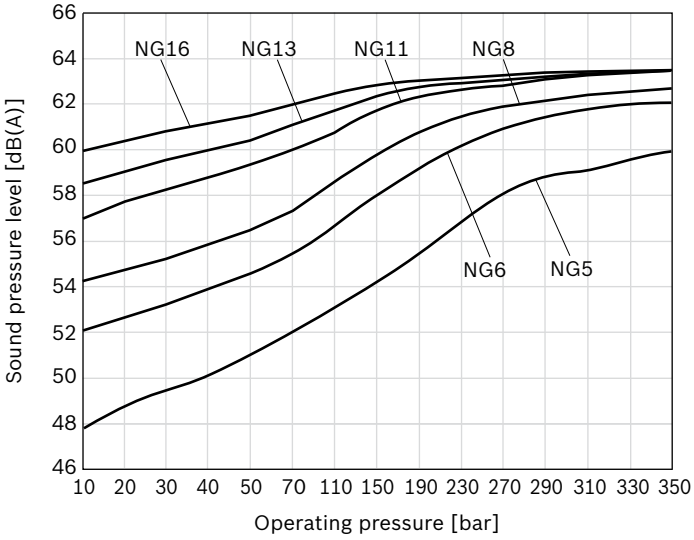
▼ **Efficiency**



▼ **Drive power**



▼ **Sound pressure level**

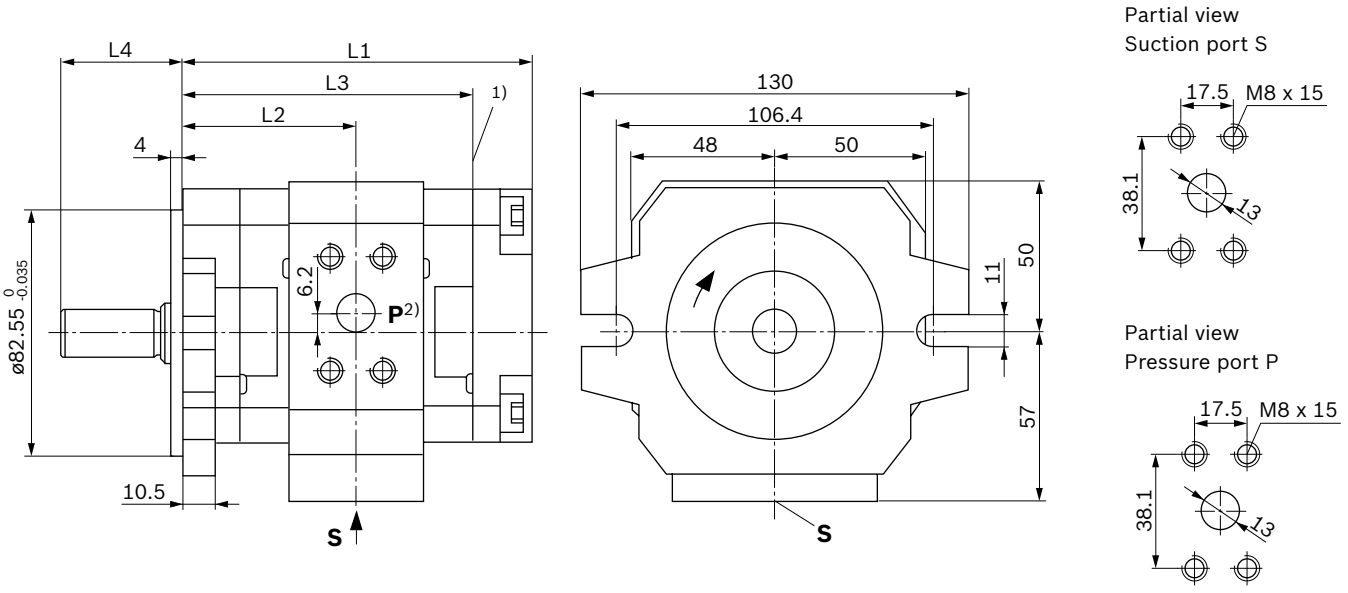


Note

- Characteristics measured at n = 1450 rpm; ν = 41 mm²/s; θ = 50 °C
- Sound pressure level measured in acoustic room according to DIN 45635, page 26; distance sound sensor – pump = 1 m

Dimensions frame size 2

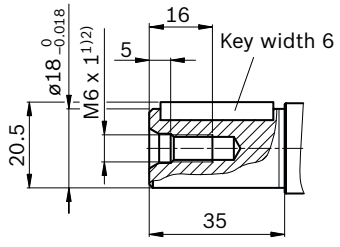
With parallel keyed shaft or splined shaft SAE J744 and SAE-mounting flange 82–2



Type			Material numbers	L1	L2	L3	L4	Suction port S[4]	Pressure port P[4]
PGH2-2X/	**005**	R[3] **E** 07VU2	R900968999	110	54.2	89.5	41	1/2 in; 5000 psi	1/2 in; 5000 psi
		L	R900703725						
		R[3] **R** 07VU2	R900972378				31.5		
		L	R900703727						
	006	R[3] **E** 07VU2	R900951301	112.5	55.5	92	41	1/2 in; 5000 psi	1/2 in; 5000 psi
		L	R900961547						
		R[3] **R** 07VU2	R900961549				31.5		
		L	R900961550						
	008	R[3] **E** 07VU2	R900951302	116	57.3	95.5	41	1/2 in; 5000 psi	1/2 in; 5000 psi
		L	R900961548						
		R[3] **R** 07VU2	R900961551				31.5		
		L	R900961552						

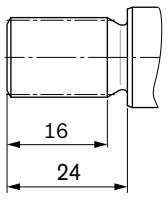
▼ **Parallel keyed shaft DIN 6885**

E



▼ **Splined shaft SAE J744**

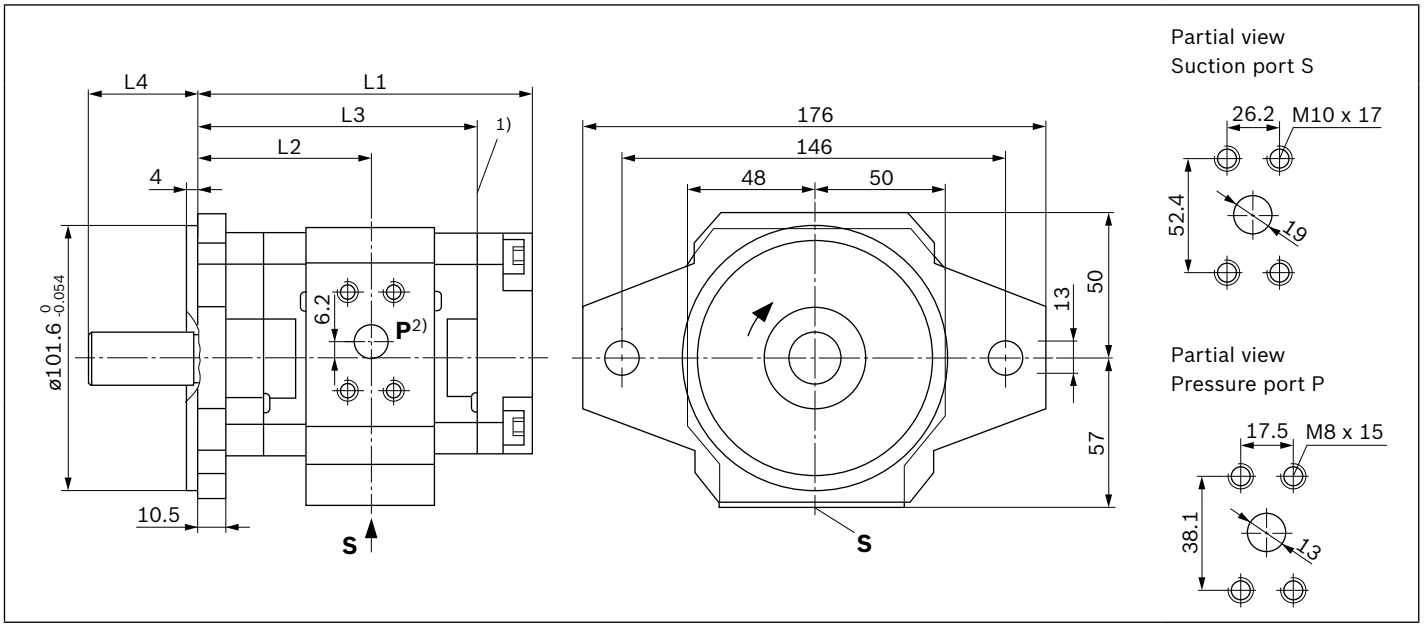
R - 16-4 (A) in 9T 16/32DP[5)6)]



1) At multiple pump units the combination part starts here
2) Shown are pumps in clockwise rotation, pumps in counter clockwise rotation have the pressure port on the opposite side!
3) Preferably available
4) Standard pressure range
5) In multiple pump units suitable as middle and rear pump
6) Involute spline to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

Dimensions frame size 3

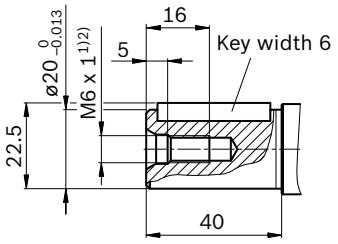
With parallel keyed shaft and SAE-mounting flange 101–2



Type				Material numbers	L1	L2	L3	L4	Suction port S[4]	Pressure port P[4]
PGH3-2X/	**011**	R[3]	**E** 07VU2	R900951303	128	66.5	107.5	41	1 in; 3000 psi	1/2 in; 5000 psi
		L		R900961553						
	013	R[3]	**E** 07VU2	R900951304	133	69	112.5	41	1 in; 3000 psi	1/2 in; 5000 psi
		L		R900961554						
	016	R[3]	**E** 07VU2	R900951305	138	71.5	117.5	41	1 in; 3000 psi	1/2 in; 5000 psi
		L		R900961555						

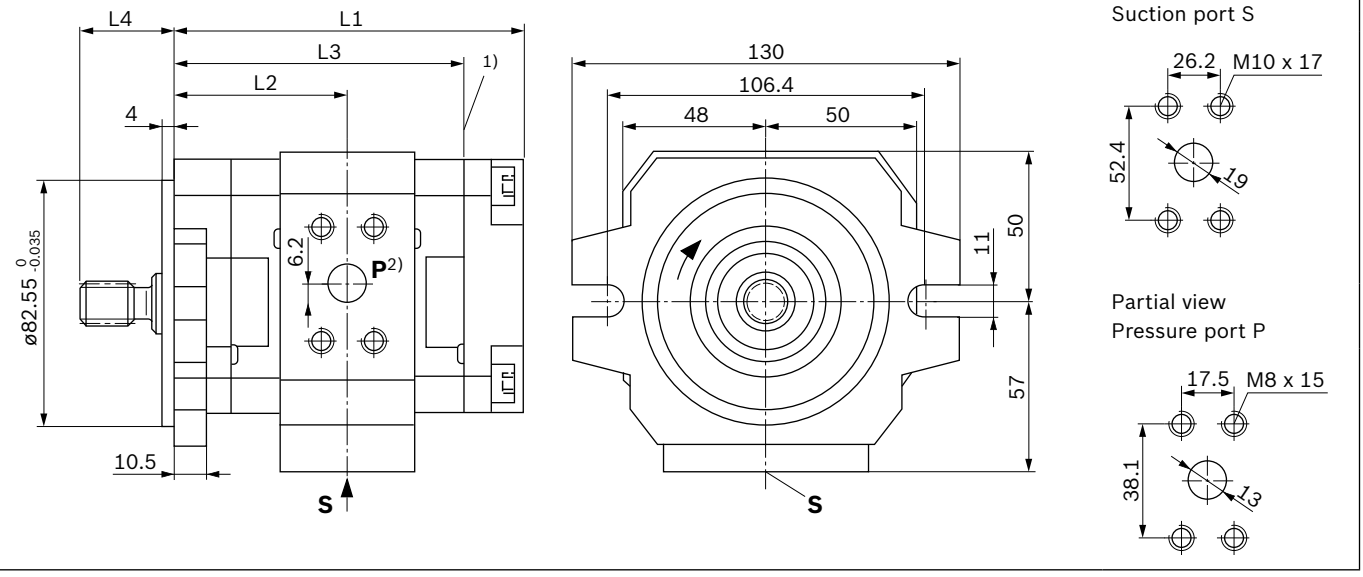
▼ **Parallel keyed shaft DIN 6885**

E



1) At multiple pump units the combination part starts here
2) Shown are pumps in clockwise rotation, pumps in counter clockwise rotation have the pressure port on the opposite side!
3) Preferably available
4) Standard pressure range

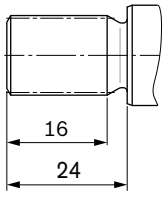
With splined shaft SAE J744 and SAE-mounting flange 82–2



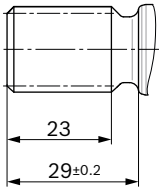
Type				Material numbers	L1	L2	L3	L4	Suction port S[4]	Pressure port P[4]
PGH3-2X/	**011**	R[3]	**R** 07VU2	R900961556	121.5	60	101	31.5	1 in; 3000 psi	1/2 in; 5000 psi
		L		R900961559						
		R	**S** 07VU2	R901267181				37		
	013	R[3]	**R** 07VU2	R900961557	126.5	62.5	106	31.5	1 in; 3000 psi	1/2 in; 5000 psi
		L		R900961560						
		R	**S** 07VU2	R901281697				37		
	016	R[3]	**R** 07VU2	R900961558	131.5	65	111	31.5	1 in; 3000 psi	1/2 in; 5000 psi
		L		R900961561						
		R	**S** 07VU2	R901281698				37		

▼ **Splined shaft SAE J744**

R - 16-4 (A) in 9T 16/32DP[5)6)]



S - 19-4 in 11T 16/32DP[6)]



1) At multiple pump units the combination part starts here
2) Shown are pumps in clockwise rotation, pumps in counter clockwise rotation have the pressure port on the opposite side!
3) Preferably available
4) Standard pressure range
5) In multiple pump units suitable as middle and rear pump
6) Involute spline according to ANSI B92.1a, 30° pressure angle, flat root, side fit, tolerance class 5

Multiple pump units

All internal gear pumps type PGH are combinable, every pump has a through drive connection. The combination options and the material numbers for the necessary combination parts can be taken from the following table.

Rear pump	**Front pump**	
	PGH2-2X	**PGH3-2X**
PGH2-2X/...R...U2	R900886137	R900886137
PGH3-2X/...R...U2	R900886137	R900886137
PGP2-2X/...J...U2	R900886137	R900886137
PGF2-2X/...J...U2	R900886137	R900886137
AZPF...RR...B	R900886137	R900886137
PR4-1X...WA	R901015657	R901015657

Ordering code

01	02		03		04		05		06		07	08	09	10		11	12		13	14	15
		/		+		/		+		/					+			+			

Type

01	2-fold	**P2**
	3-fold	**P3**

02	Series of the first pump[1)]	

03	Size of the first pump[1)]	

04	Series of the second pump[1)]	

05	Size of the second pump[1)]	

06	Series of the third pump[1)]	

07	Size of the third pump[1)]	

Direction of rotation

08	Viewed on drive shaft	clockwise	**R**
		counter-clockwise	**L**

Drive shaft of the first pump

09	Parallel keyed shaft, DIN 6885		**E**
	Splined shaft to SAE J744 with involute tooth system to ANSI B92.1a	16-4 (A) 9T 16/32DP	**R**
		19-4 11T 16/32DP	**S**

Line port of the first pump

10	Suction and pressure port to SAE, pressure port standard pressure series	**07**

Drive shaft of the second pump[2)]

11	Parallel keyed shaft, DIN 6885		**A**
	Splined shaft to SAE J744 with involute tooth system to ANSI B92.1a	16-4 (A) 9T 16/32DP	**J**
			R

Line port of the second pump

12	Suction and pressure port to SAE, pressure port standard pressure series	**07**

Drive shaft of the third pump[2)]

13	Parallel keyed shaft, DIN 6885		**A**
	Splined shaft to SAE J744 with involute tooth system to ANSI B92.1a	16-4 (A) 9T 16/32DP	**J**
			R

Line port of the third pump

14	Suction and pressure port to SAE, pressure port standard pressure series	**07**

Mounting flange of the first pump

15	SAE 2-hole[2)]	**U2**

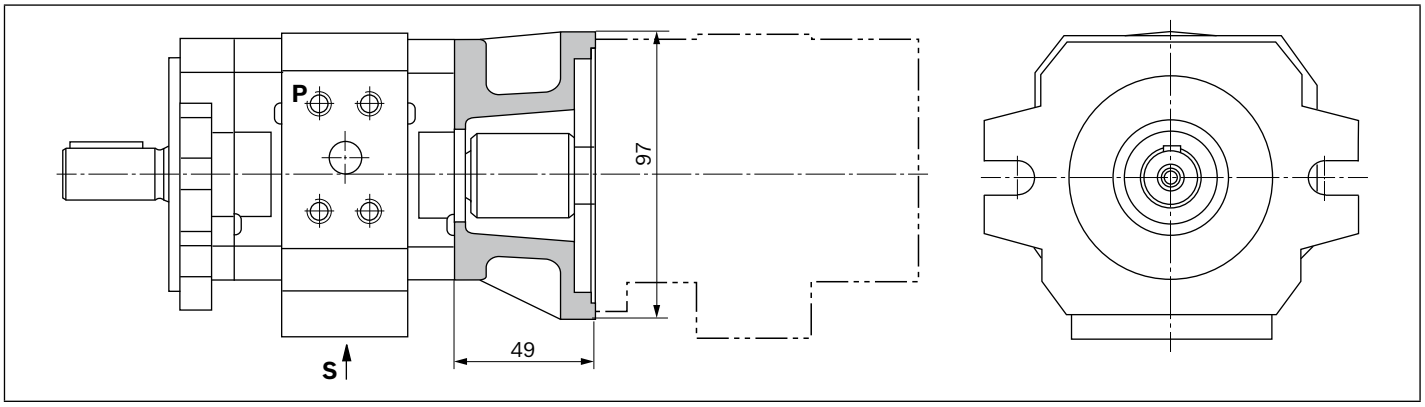
1) Detailed information see ordering code page 2
2) See table page 9

Dimensions

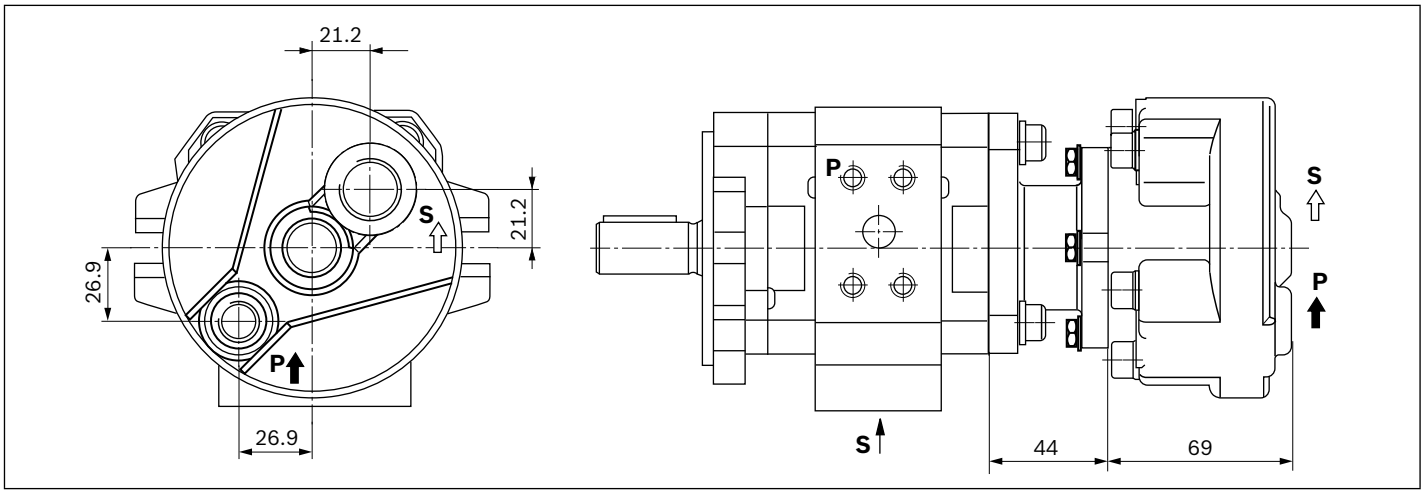
The dimensional drawings show the first pump and the combination part.[1)]

PGH2/PGH3

PGH2 with combination part for PGH2, PGH3, PGF2, PGP2, AZPF

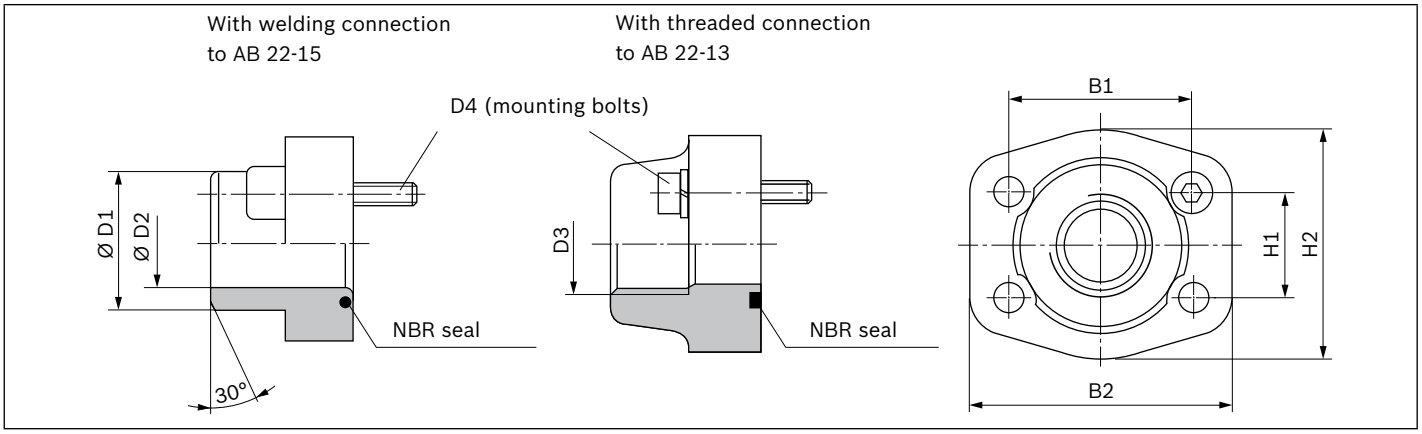


PGH2/PGH3 + R4-Mini



1) Dimensions of the single pumps see page 6 to 8 or the relevant data sheets of the rear pump.

SAE connection flanges



PGH		Flange	Material number[1] for flange with		Dimensioning							
Suction flange	**Pressure flange**	**NG, pressure**	**Welding port**	**Threaded connection[2]**	**B1**	**B2**	**H1**	**H2**	**D1**	**D2**	**D3**	**D4**
PGH2/005/ 006/008	PGH2/005/ 006/008 PGH3/011/ 013/016	1/2 in 5000 psi	R900026298	R900024200	38.1	54	17.5	46	20	14	G1/2	M8 x 30
PGH3/011/013/016,	–	1 in 3000 psi	R900012937	R900014154	52.4	70	26.2	59	35	27	G1	M10 x 35

Pump safety block

For limitation of the operating pressure or (and) for solenoid-actuated relief of operating pressure we recommend our pump-pressure-safety-block to data sheets 25880 and 25891.

1) The material numbers comprise the flange, the O-ring (NBR) and the mounting bolts.
2) Pipe thread "G" according to DIN EN ISO 228/1

Rexroth
Bosch Group

Internal gear pump, fixed displacement

RE 10227/12.10 1/24
Replaces: 04.07

Type PGH


H7417_d

Frame size 4 and 5
Component series: 3X
Maximum operating pressure 350 bar
Maximum displacement volume 250 cm^3

Table of contents

Contents	Page
Features	1
Ordering code single pumps	2
Function, section, symbol	3
Technical data	4 and 5
Characteristic curves	On request
Unit dimensions single pumps	6 to 11
Ports	12
Pump combinations	13
Unit dimensions pump combinations	14 to 18
Project planning information	19 to 22
Commissioning notes	23

Features

- Fixed displacement
- Low operating noise
- Little flow pulsation
- High efficiency also at low speed and viscosity due to sealing gap compensation
- Suitable for broad viscosity and speed ranges
- All frame sizes and sizes can be combined with each other in any form
- Can be combined with internal gear pumps, vane pumps and axial piston pumps
- Suitable for operation with HFC fluid (seal design "W")
- Use:

  For fatigue-resistant drives with high power and high pressures with very large load cycle numbers, e.g. plastics processing machines, automated presses, foundry machines and other applications with accumulator charging operation.

Information on available spare parts:
www.boschrexroth.com/spc

Ordering code: Single pumps

PG	H	–3X/						*

Series
High pressure pump **= H**

Frame size
BG4 **= 4**
BG5 **= 5**

Component series: Component series 30 to 39 **= 3X**
(30 to 39: Unchanged installation and connection dimensions)

Size	Size	Displacement/ revolution	
BG4	20	20.10 cm³	**= 020**
	25	25.30 cm³	**= 025**
	32	32.70 cm³	**= 032**
	40	40.10 cm³	**= 040**
	50	50.70 cm³	**= 050**
BG5	63	64.70 cm³	**= 063**
	80	81.40 cm³	**= 080**
	100	100.20 cm³	**= 100**
	125	125.30 cm³	**= 125**
	160	162.80 cm³	**= 160**
	200	200.40 cm³	**= 200**
	250	250.50 cm³	**= 250**

Not all variants are possible according to the type key! Please select the desired pump using the selection tables (pages 6 to 11) or after consultation with Bosch Rexroth.

Further details in the plain text

Type of connection
U2 = SAE 2-hole mounting flange
E4 = [1] ISO 4-hole mounting flange according to ISO 3019-2 and VDMA 24560

Seal material
V = FKM seals
W = [2] Shaft seal ring made of NBR (remaining seals made of FKM)

Line connection [3]
07 = SAE flange standard pressure series
11 = SAE flange high-pressure series

Shaft design
E = Cylindrical
R = SAE involute gear

Direction of rotation (looking at the shaft end)
R = Clockwise
L = Counterclockwise (on request)

[1] Only in connection with cylindrical shaft (according to VDMA), only with clockwise rotation

[2] In case of operation with HFC fluid

[3] For each size, one type of connection **07** or **11** has been determined:
07: PGH5-3X/200/250…
11: PGH4-3X/020/025/032/040/050…
PGH5-3X/063/080/100/125/160...

The suction ports have all been designed in standard pressure series (dimensions see page 12).

Standard types PGH4-3X	
Type	Material no.
PGH4-3X/020RE11VU2	R901147100
PGH4-3X/025RE11VU2	R901147101
PGH4-3X/032RE11VU2	R901147102
PGH4-3X/040RE11VU2	R901147103
PGH4-3X/050RE11VU2	R901147104

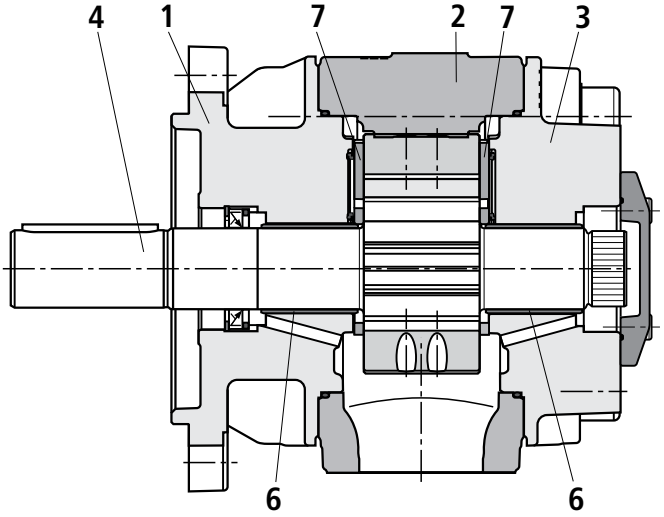
Standard types PGH5-3X	
Type	Material no.
PGH5-3X/063RE11VU2	R901147115
PGH5-3X/080RE11VU2	R901147116
PGH5-3X/100RE11VU2	R901147117
PGH5-3X/125RE11VU2	R901147118
PGH5-3X/160RE11VU2	R901147119
PGH5-3X/200RE07VU2	R901147120
PGH5-3X/250RE07VU2	R901147121

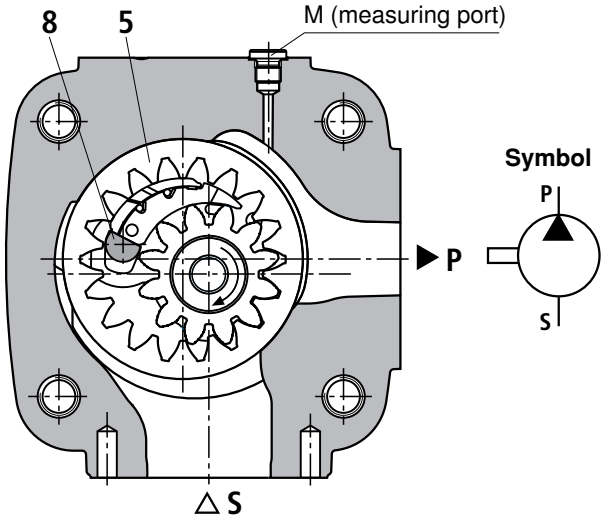
Function, section, symbol

Structure

Hydraulic pumps of type PGH.-3X are gap-compensated internal gear pumps with fixed displacement.

They mainly consist of: Mounting flange (1), housing (2), cover with through-drive (3), pinion shaft (4), internal gear (5), sliding bearings (6), axial washers (7) and stop pin (8) as well as the radial compensation consisting of segment (9), segment support (10) and the seal rolls (11).





Suction and displacement procedure

The hydro-dynamically mounted pinion shaft (4) drives the toothed internal gear (5) in the direction of rotation shown.

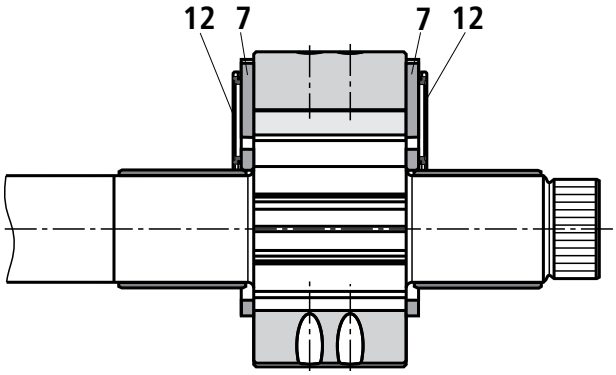
The tooth clearances opening in the suction area prime the fluid. The fluid is transported into the tooth clearances of pinion and internal gear, from the suction area (S) into the pressure area (P).

There, the fluid is displaced from the closing tooth clearances and delivered into the pressure port (P).

Suction and discharge area are separated by the radial compensation elements (9 to 11) and the tooth engagement between internal gear and pinion shaft.

Axial compensation

The displacement chamber in the pressure area is axially sealed by axial washers (7).

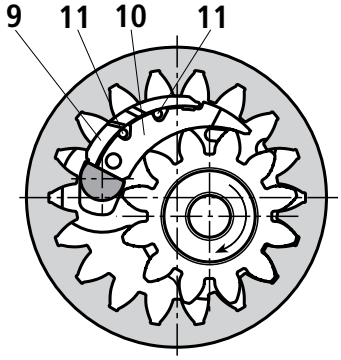


The sides of the axial washers facing away from the displacement area are backed by a pressure field (12). These fields balance the axial washers vis-à-vis the displacement area, which results in a perfect sealing with low mechanical losses.

Radial compensation

The radial compensation elements consist of segment (9), segment support (10) and seal rolls (11).

Segment (9) and segment support (10) are arranged in the pressure field so that the resulting compressive force is basically accepted by the stop pin.



A small compressive force component presses segment and segment support onto the tooth tips of pinion shaft and internal gear and in this way provides for the separation of the pressure area from the suction area with automatic clearance adjustment.

This is the prerequisite for constantly high volumetric efficiency during the entire operating time.

The clearance adjustment of segment and segment support is made possible by the seal rolls located inbetween.

Hydro-dynamic and hydrostatic mounting

The pinion shaft (4) is accepted by hydro-dynamically lubricated radial sliding bearings (6).

The internal gear (5) is mounted hydrostatically in the housing.

Gearing

The gearing with involute edges has a large meshing length for little flow and pressure pulsation and thus guarantees low-noise running.

Technical Data (For applications outside these parameters, please consult us!)

general

Design	Internal gear pump, gap-compensated
Type of connection	SAE 2-hole flange according to ISO 3019-1 or 4-hole flange according to VDMA 24560 and ISO 3019-2
Line connection	Flange port
Shaft load	Radial and axial forces (e.g. belt pulley) **only** after coordination
Direction of rotation (looking at the shaft end)	Clockwise or counterclockwise (on request) – **not** bidirectional!

hydraulic

Hydraulic fluid			HLP – mineral oil according to DIN 51524 part 2 HFC – water polymer solutions according to DIN EN ISO 12922 [1) 2)]: Seal design W HEES – fluids according to DIN ISO 15380 [1)] HFD-U – fluids according to VDMA 24317 [1)], DIN EN ISO 12922 [1)] **Please observe our specifications according to data sheet RE 90220** **Other fluids on request!**
Hydraulic fluid temperature range	HLP fluid	°C	–10 to +80; for other temperatures please consult us!
	Special fluid	°C	–10 to +50; for other temperatures please consult us!
Ambient temperature range		°C	–20 to +60
Viscosity range		mm^2/s	10 to 300 (to n = 1800 min^{-1}) 10 to 100 (to n = 3000 min^{-1}) 2000 admissible start viscosity (400 to 1800 min^{-1})
Max. admissible level of contamination of the hydraulic fluid cleanliness class according to ISO 4406 (c)			Class 20/18/15 [3)]

[1)] **Attention!**
To these media, the limitations for special fluids apply

[2)] Hydraulic fluid HFC: Input speed n_{max} = 2000 min^{-1}

[3)] The cleanliness classes specified for the components must be adhered to in hydraulic systems. Efficient filtration prevents failures and simultaneously increases the service life of the components.
For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.

Technical Data (For applications outside these parameters, please consult us!)

Frame size	Frame size		PGH4				
Size	Size		20	25	32	40	50
Weight	m	kg	14	14.5	15	16	17
Speed range [1]	n_{min}	min^{-1}	200	200	200	200	200
	n_{max}	min^{-1}	3000	3000	3000	3000	3000
Displacement	V	cm^3	20.1	25.3	32.7	40.1	50.7
Flow [2]	q_V	l/min	28.9	36.3	46.9	57.6	72.8
Moment of inertia (around drive axis)	J	kgm^2	0.00037	0.00045	0.00055	0.00066	0.00081
Power consumption	P_{ad}	kW					
Min. drive power necessary (with p ≈ 1 bar)			1.1	1.1	1.1	1.1	1.5
Max. admissible drive power			35	44	56	61	76
Operating pressure, absolute – Input	p	bar	0.8 to 2 (shortly, upon start 0.6 bar)				
Nominal pressure	p_N	bar					
– Output, continuous	HLP fluid		315				250
	Special fluid [3]		220				175
intermittent [4]	p_{max}	bar					
	HLP fluid		350				315
	Special fluid [3]		245				210

Frame size	Frame size		PGH5						
Size	Size		63	80	100	125	160	200	250
Weight	m	kg	42	43.5	45.5	48	52	55.5	60.5
Speed range [1]	n_{min}	min^{-1}	200	200	200	200	200	200	200
	n_{max}	min^{-1}	3000	3000	3000	3000	3000	3000	3000
Displacement	V	cm^3	64.7	81.4	100.2	125.3	162.8	200.4	250.5
Flow [2]	q_V	l/min	92.8	116.9	143.8	179.8	233.7	287.7	359.6
Moment of inertia (around drive axis)	J	kgm^2	0.00237	0.00289	0.00329	0.00407	0.00506	0.00623	0.00760
Power consumption	P_{ad}	kW							
Min. drive power necessary (with p ≈ 1 bar)			1.8	2.2	3	4	5.5	7.5	7.5
Max. admissible drive power			96	103	129	161	134	140	134
Operating pressure, absolute – Input	p	bar	0.8 to 2 (shortly, upon start 0.6 bar)						
Nominal pressure	p_N	bar							
– Output, continuous	HLP fluid		315				210	170	135
	Special fluid [3]		220				145	115	90
intermittent [4]	p_{max}	bar							
	HLP fluid		350				260	210	170
	Special fluid [3]		245				180	145	115

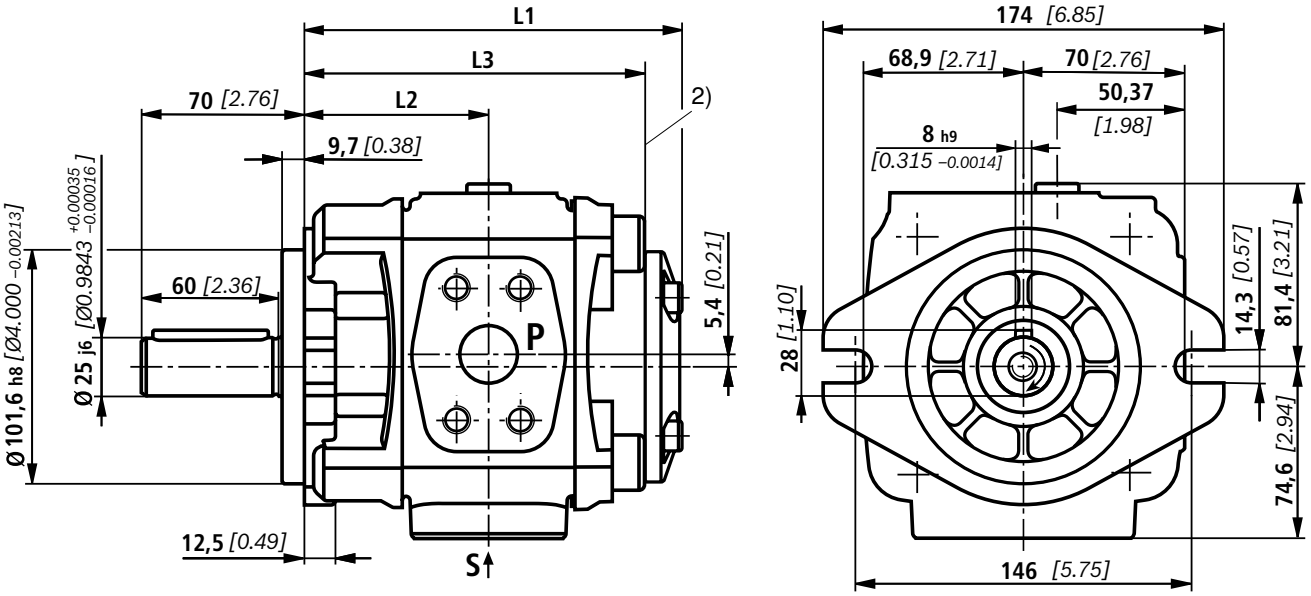
[1] Hydraulic fluid HFC: Input speed n_{max} = 2000 min^{-1}
[2] Measured with n = 1450 min^{-1}, p = 10 bar and = 30 mm^2/s
[3] **Attention!**
To these media, the limitations for special fluids apply
[4] Max 10 s, max. 50 % of the duty cycle

Unit dimensions of frame size 4 (dimensions in mm *[inch]*)

PGH4-3X/...$^{R}_{L}$E...VU2

Drive shaft cylindrical,
SAE 2-hole mounting flange

Type Size	Material no. "R" clockwise	"L" counter-clockwise	L1	L2	L3	S [1]	P [1]
PGH4-3X/020..E11VU2	R901147100	On request	145 *[5.71]*	70.5 *[2.78]*	129 *[5.08]*	1" S	3/4" H
PGH4-3X/025..E11VU2	R901147101	On request	150 *[5.91]*	73 *[2.87]*	134 *[5.28]*	1 1/4" S	3/4" H
PGH4-3X/032..E11VU2	R901147102	On request	157 *[6.18]*	76.5 *[3.01]*	141 *[5.55]*	1 1/2" S	1" H
PGH4-3X/040..E11VU2	R901147103	On request	164 *[6.46]*	80 *[3.15]*	148 *[5.83]*	1 1/2" S	1" H
PGH4-3X/050..E11VU2	R901147104	On request	174 *[6.85]*	85 *[3.35]*	158 *[6.22]*	2" S	1" H



[1] S = Standard pressure series;
H = High-pressure series;
exact dimensions see table page 12

[2] For multiple pumps, the combination part starts from here

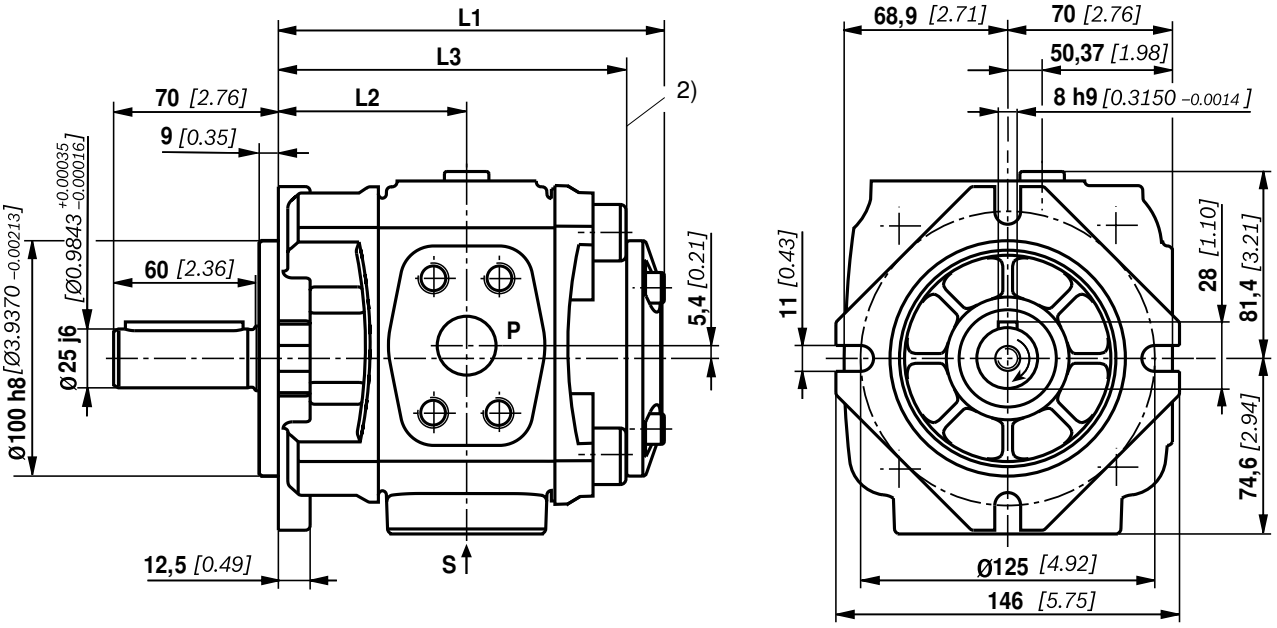
The figure shows a pump with clockwise rotation, in case of pumps with counterclockwise rotation, the pressure port is on the opposite side!

Unit dimensions of frame size 4 (dimensions in mm *[inch]*)

PGH4-3X/... RE...VE4

Drive shaft cylindrical,
4-hole mounting flange according to ISO 3019-2
and VDMA 24560

Type Size	Material no. "R" clockwise	L1	L2	L3	S [1]	P [1]
PGH4-3X/020RE11VE4	R901147105	145 *[5.71]*	70.5 *[2.78]*	129 *[5.08]*	1" S	3/4" H
PGH4-3X/025RE11VE4	R901147106	150 *[5.91]*	73.0 *[2.87]*	134 *[5.28]*	1 1/4" S	3/4" H
PGH4-3X/032RE11VE4	R901147107	157 *[6.18]*	76.5 *[3.01]*	141 *[5.55]*	1 1/2" S	1" H
PGH4-3X/040RE11VE4	R901147108	164 *[6.46]*	80 *[3.15]*	148 *[5.83]*	1 1/2" S	1" H
PGH4-3X/050RE11VE4	R901147109	174 *[6.85]*	85 *[3.35]*	158 *[6.22]*	2" S	1" H



[1] S = Standard pressure series;
H = High-pressure series;
exact dimensions see table page 12

[2] For multiple pumps, the combination part starts from here

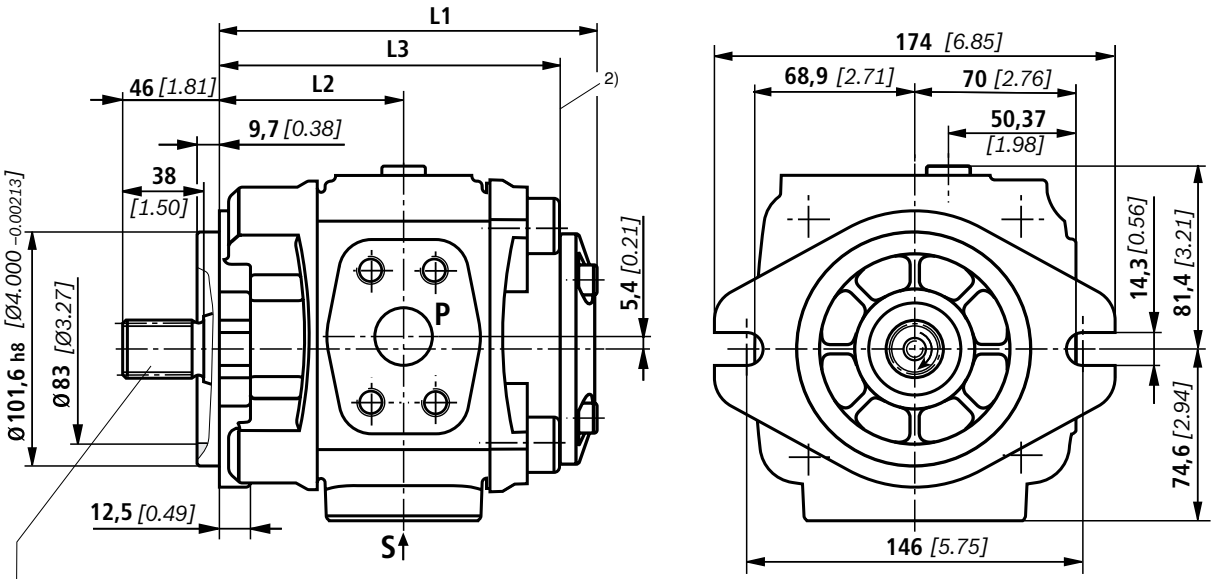
Unit dimensions of frame size 4 (dimensions in mm *[inch]*)

PGH4-3X/...$^{R}_{L}$R...VU2

Drive shaft splined, SAE 2-hole mounting flange

(central and back pump in pump combinations)

Type Size	Material no. "R" clockwise	Material no. "L" counter-clockwise	L1	L2	L3	S [1]	P [1]
PGH4-3X/020..R11VU2	R901147110	On request	145 *[5.71]*	70.5 *[2.78]*	129 *[5.08]*	1" S	3/4" H
PGH4-3X/025..R11VU2	R901147111	On request	150 *[5.91]*	73 *[2.87]*	134 *[5.28]*	1 1/4" S	3/4" H
PGH4-3X/032..R11VU2	R901147112	On request	157 *[6.18]*	76.5 *[3.01]*	141 *[5.55]*	1 1/2" S	1" H
PGH4-3X/040..R11VU2	R901147113	On request	164 *[6.46]*	80 *[3.15]*	148 *[5.83]*	1 1/2" S	1" H
PGH4-3X/050..R11VU2	R901147114	On request	174 *[6.85]*	85 *[3.35]*	158 *[6.22]*	2" S	1" H



Shaft 25-4; SAE J744 JUL 88;
Involute gear
ANSI B92.1a-1976,
15T 16/32 DP 30°

[1] S = Standard pressure series;
H = High-pressure series;
exact dimensions see table page 12

[2] For pump combinations, the combination part starts from here

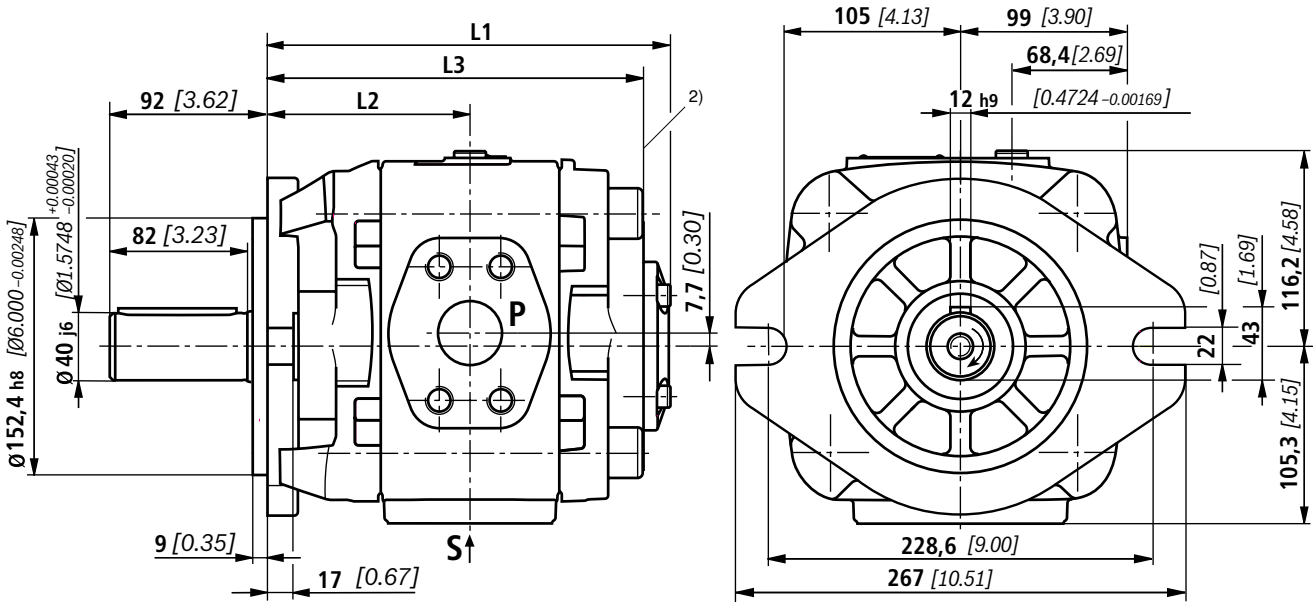
The figure shows a pump with clockwise rotation, in case of pumps with counterclockwise rotation, the pressure port is on the opposite side!

Unit dimensions of frame size 5 (dimensions in mm *[inch]*)

PGH5-3X/... $\begin{matrix}R\\L\end{matrix}$ E...VU2

Drive shaft cylindrical, SAE 2-hole mounting flange

Type Size	Material no. "R" clockwise	"L" counter-clockwise	L1	L2	L3	S [1]	P [1]
PGH5-3X/063..E11VU2	R901147115	On request	210 *[8.27]*	105.5 *[4.15]*	194 *[7.64]*	2" S	1 1/4" H
PGH5-3X/080..E11VU2	R901147116	On request	218 *[8.58]*	109.5 *[4.31]*	202 *[7.95]*	2" S	1 1/4" H
PGH5-3X/100..E11VU2	R901147117	On request	227 *[8.94]*	114 *[4.49]*	211 *[8.31]*	2 1/2" S	1 1/2" H
PGH5-3X/125..E11VU2	R901147118	On request	239 *[9.41]*	120 *[4.72]*	223 *[8.78]*	2 1/2" S	1 1/2" H
PGH5-3X/160..E11VU2	R901147119	On request	257 *[10.12]*	129 *[5.08]*	241 *[9.49]*	3" S	2" H
PGH5-3X/200..E07VU2	R901147120	On request	275 *[10.83]*	138 *[5.43]*	259 *[10.20]*	3 1/2" S	2" S
PGH5-3X/250..E07VU2	R901147121	On request	299 *[11.77]*	150 *[5.91]*	283 *[11.14]*	3 1/2" S	2 1/2" S



[1] S = Standard pressure series;
H = High-pressure series;
exact dimensions see table page 12

[2] For pump combinations, the combination part starts from here

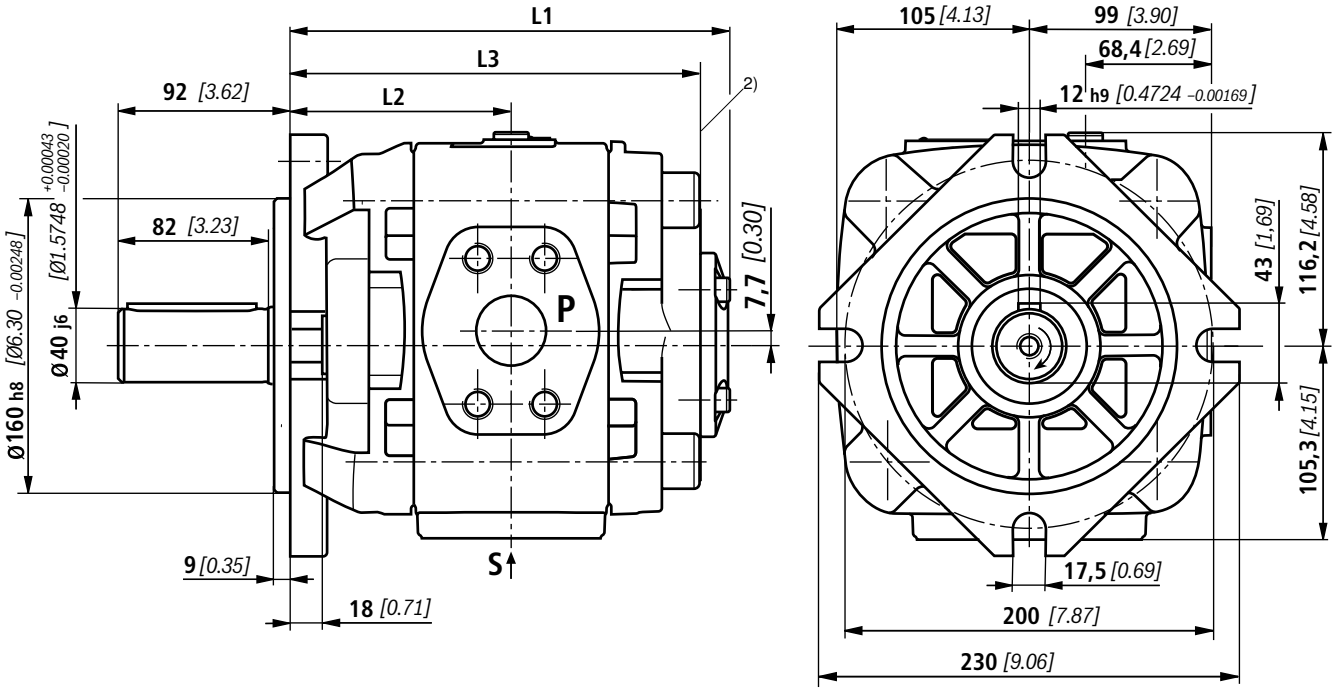
The figure shows a pump with clockwise rotation, in case of pumps with counterclockwise rotation, the pressure port is on the opposite side!

Unit dimensions of frame size 5 (dimensions in mm *[inch]*)

PGH5-3X/...RE...VE4

Drive shaft cylindrical,
4-hole mounting flange according to ISO 3019-2
and VDMA 24560

Type Size	Material no. "R" clockwise	L1	L2	L3	S [1]	P [1]
PGH5-3X/063RE11VE4	R901147122	210 *[8.27]*	105.5 *[4.15]*	194 *[7.64]*	2" S	1 1/4" H
PGH5-3X/080RE11VE4	R901147123	218 *[8.58]*	109.5 *[4.31]*	202 *[7.95]*	2" S	1 1/4" H
PGH5-3X/100RE11VE4	R901147124	227 *[8.94]*	114 *[4.49]*	211 *[8.31]*	2 1/2" S	1 1/2" H
PGH5-3X/125RE11VE4	R901147125	239 *[9.41]*	120 *[4.72]*	223 *[8.78]*	2 1/2" S	1 1/2" H
PGH5-3X/160RE11VE4	R901147126	257 *[10.12]*	129 *[5.08]*	241 *[9.49]*	3" S	2" H
PGH5-3X/200RE07VE4	R901147127	275 *[10.83]*	138 *[5.43]*	259 *[10.20]*	3 1/2" S	2" S
PGH5-3X/250RE07VE4	R901147128	299 *[11.77]*	150 *[5.91]*	283 *[11.14]*	3 1/2" S	2 1/2" S



[1] S = Standard pressure series;
H = High-pressure series;
exact dimensions see table page 12

[2] For pump combinations, the combination part starts from here

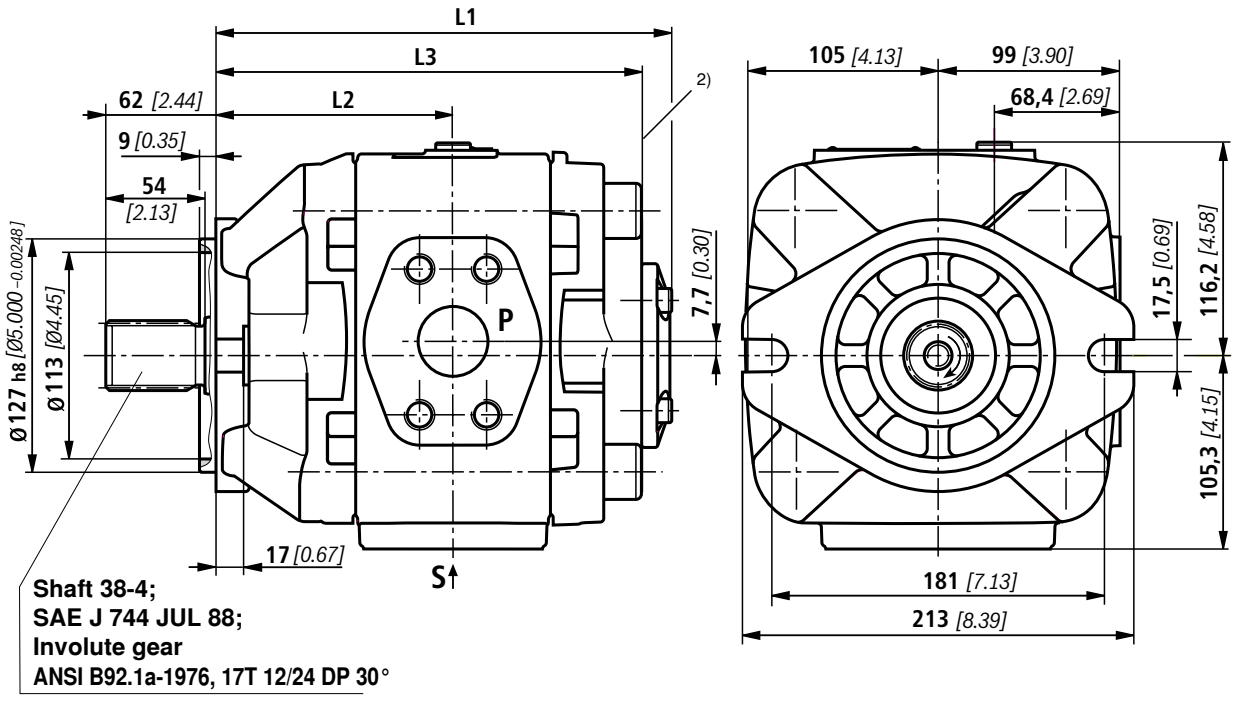
Unit dimensions of frame size 5 (dimensions in mm *[inch]*)

PGH5-3X/...$^{R}_{L}$R...VU2

Drive shaft splined, SAE 2-hole mounting flange

(central and back pump for pump combinations)

Type Size	Material no. "R" clockwise	Material no. "L" counter-clockwise	L1	L2	L3	S [1]	P [1]
PGH5-3X/063..R11VU2	R901147129	On request	219 *[8.62]*	114.5 *[4.51]*	203 *[7.99]*	2" S	1 1/4" H
PGH5-3X/080..R11VU2	R901147130	On request	227 *[8.94]*	118.5 *[4.67]*	211 *[8.31]*	2" S	1 1/4" H
PGH5-3X/100..R11VU2	R901147131	On request	236 *[9.29]*	123 *[4.84]*	220 *[8.66]*	2 1/2" S	1 1/2" H
PGH5-3X/125..R11VU2	R901147132	On request	248 *[9.76]*	129 *[5.08]*	232 *[9.13]*	2 1/2" S	1 1/2" H
PGH5-3X/160..R11VU2	R901147133	On request	266 *[10.47]*	138 *[5.43]*	250 *[9.84]*	3" S	2" H
PGH5-3X/200..R07VU2	R901147134	On request	284 *[11.18]*	147 *[5.79]*	268 *[10.55]*	3 1/2" S	2" S
PGH5-3X/250..R07VU2	R901147135	On request	308 *[12.13]*	159 *[6.26]*	292 *[11.50]*	3 1/2" S	2 1/2" S



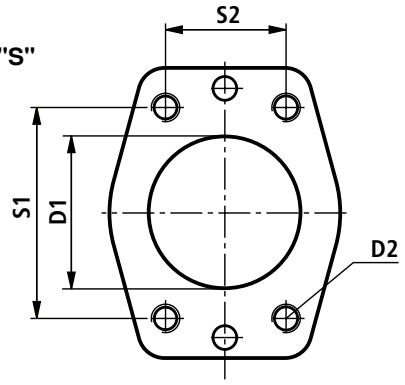
[1] S = Standard pressure series;
H = High-pressure series;
exact dimensions see table page 12

[2] For pump combinations, the combination part starts from here

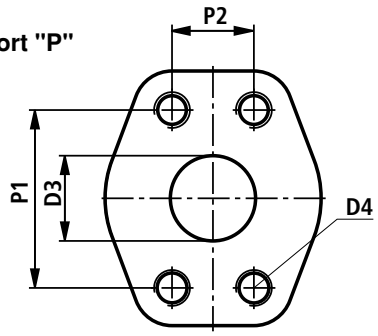
The figure shows a pump with clockwise rotation, in case of pumps with counterclockwise rotation, the pressure port is on the opposite side!

Ports (dimensions in mm *[inch]*)

Suction port "S"

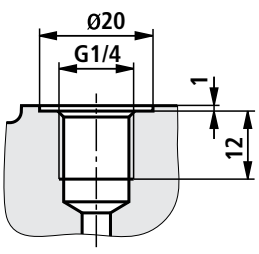


Pressure port "P"

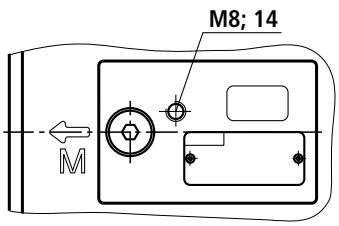


Frame size	Size	Porting pattern/ suction port S	D1	D2	S1	S2	Porting pattern/ pressure port P	D3	D4	P1	P2
4	**020**	1" 5000 PSI	Ø25 *[Ø0.984]*	M10; 18	52.4 *[2.063]*	26.2 *[1.032]*	3/4" 6000 PSI	Ø19 *[Ø0.748]*	M10; 18	50.8 *[2.000]*	23.8 *[0.937]*
	025	1 1/4" 4000 PSI	Ø32 *[Ø1.260]*	M10; 18	58.7 *[2.311]*	30.2 *[1.189]*	3/4" 6000 PSI	Ø19 *[Ø0.748]*	M10; 18	50.8 *[2.000]*	23.8 *[0.937]*
	032	1 1/2" 3000 PSI	Ø38 *[Ø1.496]*	M12; 21	69.9 *[2.752]*	35.7 *[1.406]*	1" 6000 PSI	Ø25.4 *[Ø1.000]*	M12; 23	57.2 *[2.252]*	27.8 *[1.094]*
	040	1 1/2" 3000 PSI	Ø38 *[Ø1.496]*	M12; 21	69.9 *[2.752]*	35.7 *[1.406]*	1" 6000 PSI	Ø25.4 *[Ø1.000]*	M12; 23	57.2 *[2.252]*	27.8 *[1.094]*
	050	2" 3000 PSI	Ø51 *[Ø2.008]*	M12; 21	77.8 *[3.063]*	42.9 *[1.689]*	1" 6000 PSI	Ø25.4 *[Ø1.000]*	M12; 23	57.2 *[2.252]*	27.8 *[1.094]*
5	**063**	2" 3000 PSI	Ø51 *[Ø2.008]*	M12; 21	77.8 *[3.063]*	42.9 *[1.689]*	1 1/4" 6000 PSI	Ø32 *[Ø1.260]*	M12; 21	66.6 *[2.622]*	31.8 *[1.252]*
	080	2" 3000 PSI	Ø51 *[Ø2.008]*	M12; 21	77.8 *[3.063]*	42.9 *[1.689]*	1 1/4" 6000 PSI	Ø32 *[Ø1.260]*	M12; 21	66.6 *[2.622]*	31.8 *[1.252]*
	100	2 1/2" 2500 PSI	Ø64 *[2.520]*	M12; 23	88.9 *[3.500]*	50.8 *[2.000]*	1 1/2" 6000 PSI	Ø38 *[Ø1.496]*	M16; 30	79.3 *[3.122]*	36.5 *[1.437]*
	125	2 1/2" 2500 PSI	Ø64 *[2.520]*	M12; 23	88.9 *[3.500]*	50.8 *[2.000]*	1 1/2" 6000 PSI	Ø38 *[Ø1.496]*	M16; 30	79.3 *[3.122]*	36.5 *[1.437]*
	160	3" 2000 PSI	Ø76 *[Ø2.992]*	M16; 30	106.4 *[4.189]*	61.9 *[2.437]*	2" 6000 PSI	Ø51 *[Ø2.008]*	M20; 35	96.8 *[3.811]*	44.5 *[1.752]*
	200	3 1/2" 500 PSI	Ø89 *[Ø3.504]*	M16; 30	120.7 *[4.752]*	69.9 *[2.752]*	2" 3000 PSI	Ø51 *[Ø2.008]*	M12; 23	77.8 *[3.063]*	42.9 *[1.689]*
	250	3 1/2" 500 PSI	Ø89 *[Ø3.504]*	M16; 30	120.7 *[4.752]*	69.9 *[2.752]*	2 1/2" 2500 PSI	Ø64 *[Ø2.520]*	M12; 23	88.9 *[3.500]*	50.8 *[2.000]*

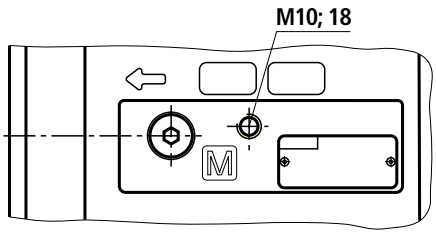
Measuring port PGH4-3X/... and PGH5-3X/...



Transport thread PGH4-3X/...



Transport thread PGH5-3X/...

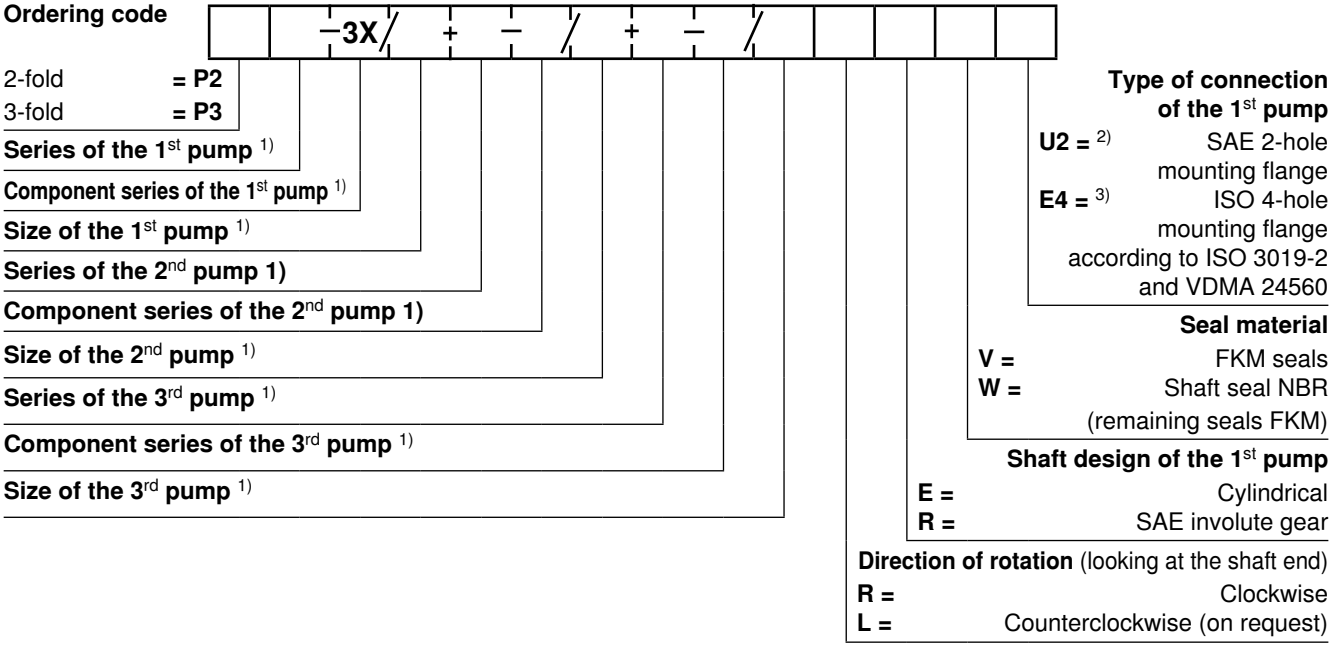


Pump combinations

All internal gear pumps of type PGH-3X can be combined; each pump has an output shaft gearing. The combination options and the material numbers of the necessary combination parts are shown in the following figure.

Please observe the project planning information for pump combinations on page 21.

Front pump / Back pump		Material no. PGH4-3X	Material no. PGH5-3X
PGH2-2X/...R...U2	(RE10223)	R901155288	R901155283
PGH3-2X/...R...U2	(RE10223)	R901155288	R901155283
PGH4-3X/...R...U2		R901155289	R901155284
PGH5-3X/...R...U2		–	R901155285
PGF2-2X/...J...U2	(RE10213)	R901155288	R901155283
PGP2-2X/...J...U2	(RE10231)	R901155288	R901155283
PGF3-3X/...J...U2	(RE10213)	R901155287	R901155282
PGP3-3X/...J...U2	(RE10231)	R901155287	R901155282
PVV/Q1-1X/...J…B	(RE10335)	R901155287	R901155282
PVV/Q2-1X/...J…B	(RE10335)	R901155287	R901155282
PVV/Q4-1X/...J…C	(RE10335)	–	R901155286
PVV/Q5-1X/...J…C	(RE10335)	–	R901155286
AZPF-1X/...RR...B	(RE10089)	R901155288	R901155283



Order example:

P3GH5-3X/160+GH5-3X/100+GH4-3X/050REVE4

1) For detailed information refer to the ordering code page 2

2) In connection with cylindrical and splined shaft

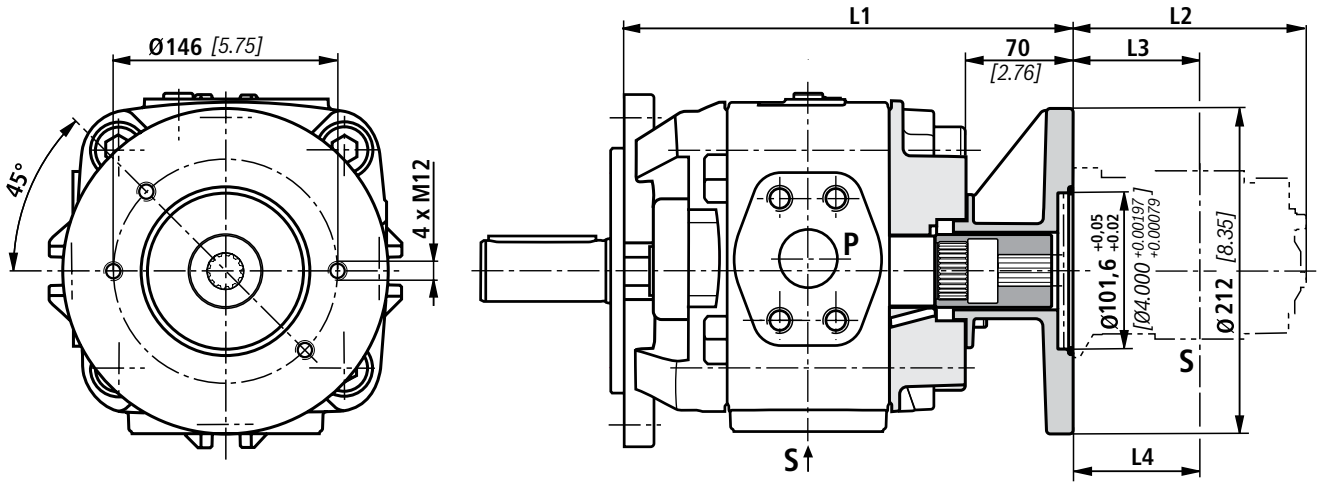
3) Only in connection with cylindrical shaft (according to VDMA); only with clockwise rotation

Unit dimensions pump combinations (dimensions in mm *[inch]*)

The dimensional drawings show the front pump and the combination part.

Combination part PGH5-3X+GF3-3X/VV1-1X/VV2-1X/K02

Material no.: **R901155282**



PGH5-3X.. Size	PGH5-3X/..RE..U2 PGH5-3X/..RE..E4 L1	PGH5-3X/..RR..U2 L1
63	264 *[10.39]*	273 *[10.75]*
80	272 *[10.71]*	281 *[11.06]*
100	281 *[11.06]*	290 *[11.42]*
125	293 *[11.54]*	302 *[11.89]*
160	311 *[12.24]*	320 *[12.60]*
200	329 *[12.95]*	338 *[13.31]*
250	353 *[13.90]*	362 *[14.25]*

PGF3/PGP2 Size	L2	L3
20	144.5 *[5.69]*	79.5 *[3.13]*
22	146.5 *[5.77]*	80.5 *[3.17]*
25	150.5 *[5.93]*	82.5 *[3.25]*
32	159.5 *[6.28]*	87 *[3.43]*
40	169.5 *[6.67]*	92 *[3.62]*

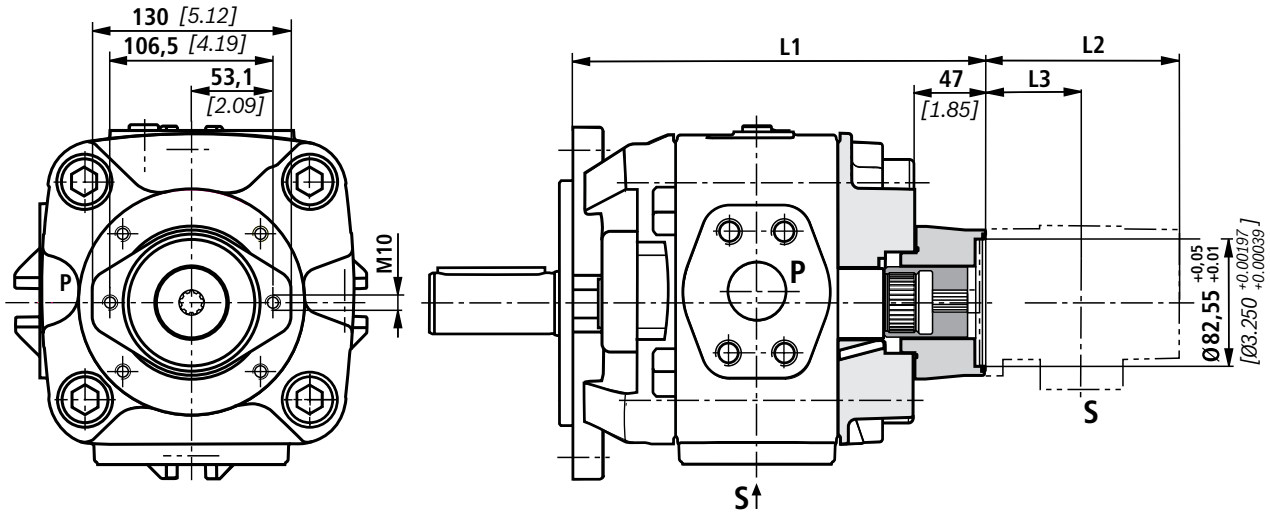
PVV..UMB Frame size	L2	L3 (P)	L4 (S)
1	156 *[6.14]*	133 *[5.24]*	63.5 *[2.50]*
2	163 *[6.42]*	38 *[1.50]*	120.5 *[4.75]*

Unit dimensions pump combinations (dimensions in mm *[inch]*)

The dimensional drawings show the front pump and the combination part.

Combination part PGH5-3X+GH2/3-2X/GF2-2X/AZPF-1X/K01

Material no.: **R901155283**



PGH5-3X.. Size	PGH5-3X/..RE..U2 PGH5-3X/..RE..E4 L1	PGH5-3X/..RR..U2 L1
63	241 *[9.49]*	250 *[9.84]*
80	249 *[9.80]*	258 *[10.16]*
100	258 *[10.16]*	267 *[10.51]*
125	270 *[10.63]*	279 *[10.98]*
160	288 *[11.34]*	297 *[11.69]*
200	306 *[12.05]*	315 *[12.40]*
250	330 *[12.99]*	339 *[13.35]*

PGH2 Size	L2	L3
005	110 *[4.33]*	54 *[2.13]*
006	112.5 *[4.43]*	55.5 *[2.19]*
008	116 *[4.57]*	57 *[2.24]*

PGH3 Size	L2	L3
011	121.5 *[4.78]*	60 *[2.36]*
013	126.5 *[4.98]*	62.5 *[2.46]*
016	131.5 *[5.18]*	65 *[2.56]*

PGF2/PGP2 Size	L2	L3
006	116 *[4.567]*	65 *[2.559]*
008	119.5 *[4.705]*	67 *[2.638]*
011	125 *[4.921]*	69.5 *[2.736]*
013	130 *[5.118]*	72 *[2.835]*
016	135 *[5.315]*	74.5 *[2.933]*
019	141 *[5.551]*	77.5 *[3.051]*
022	147 *[5.787]*	80.5 *[3.169]*

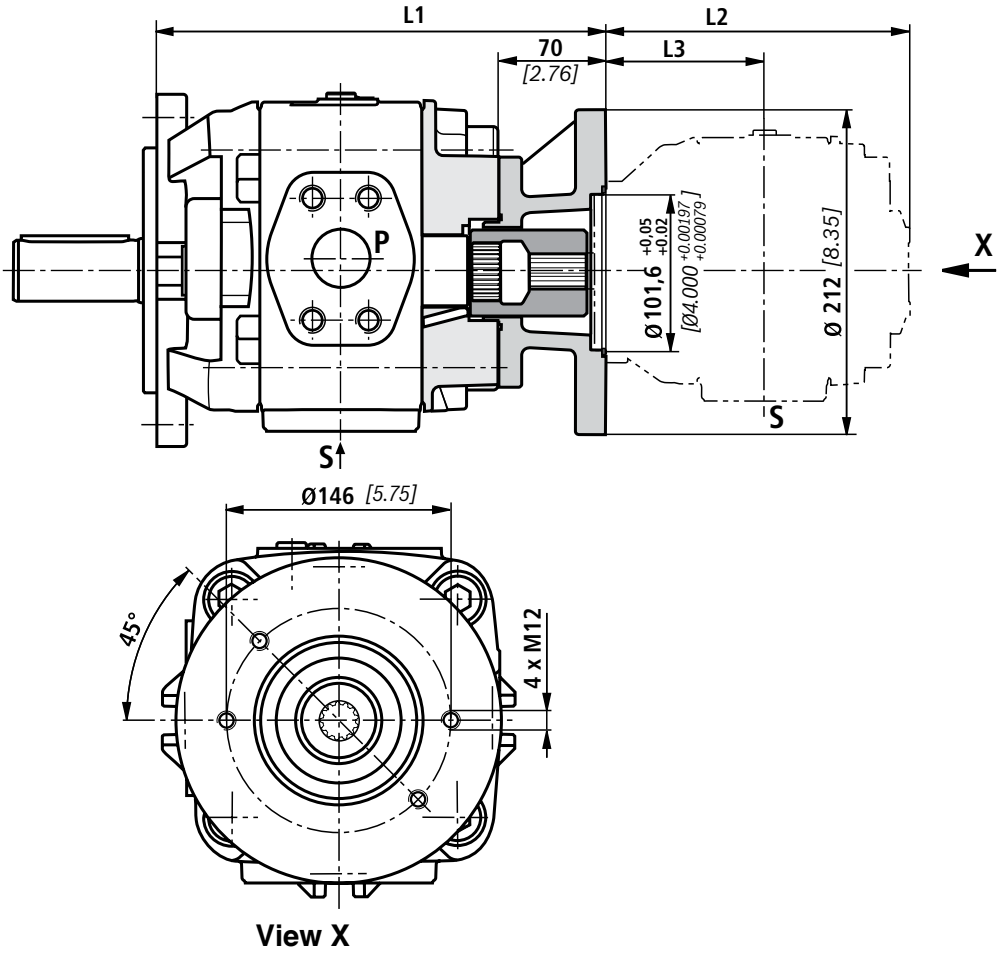
AZPF Size	L2	L3
004	85 *[3.346]*	40 *[1.575]*
005	87.5 *[3.445]*	41 *[1.614]*
008	91.5 *[3.602]*	43 *[1.692]*
011	96.5 *[3.799]*	47 *[1.850]*
014	101.5 *[3.996]*	47.5 *[1.870]*
016	105 *[4.134]*	47.5 *[1.870]*
019	110 *[4.331]*	47.5 *[1.870]*
022	115.5 *[4.547]*	55 *[2.165]*

Unit dimensions pump combinations (dimensions in mm *[inch]*)

The dimensional drawings show the front pump and the combination part.

Combination part PGH5-3X+GH4-3X..R

Material no.: **R901155284**



PGH5-3X.. Size	PGH5-3X/..RE..U2 PGH5-3X/..RE..E4 L1	PGH5-3X/..RR..U2 L1
63	264 *[10.39]*	273 *[10.75]*
80	272 *[10.71]*	281 *[11.06]*
100	281 *[11.06]*	290 *[11.42]*
125	293 *[11.54]*	302 *[11.89]*
160	311 *[12.24]*	320 *[12.60]*
200	329 *[12.95]*	338 *[13.31]*
250	353 *[13.90]*	362 *[14.25]*

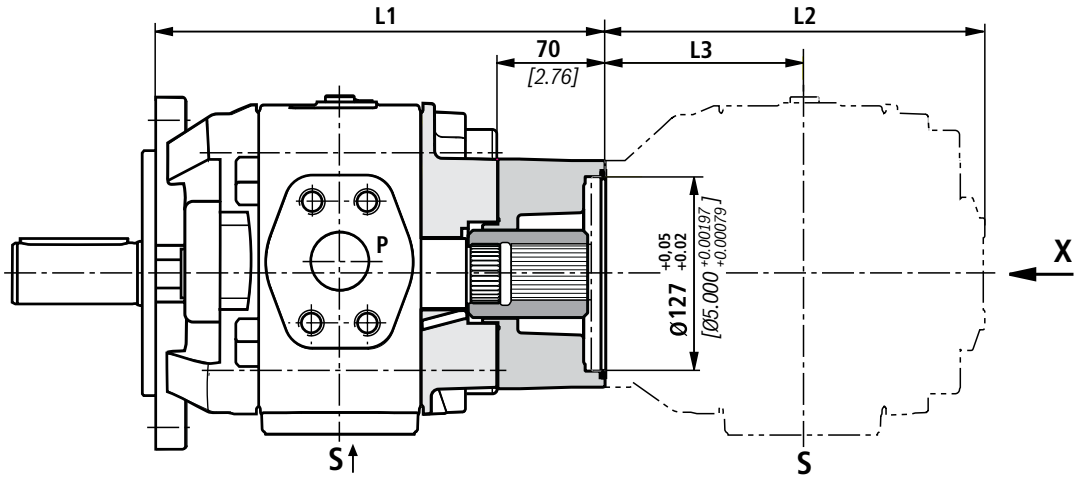
PGH4-3X…R..U2 Size	L2	L3
20	145 *[5.71]*	70.5 *[2.78]*
25	150 *[5.91]*	73 *[2.87]*
32	157 *[6.18]*	76.5 *[3.01]*
40	164 *[6.46]*	80 *[3.15]*
50	174 *[6.85]*	85 *[3.35]*

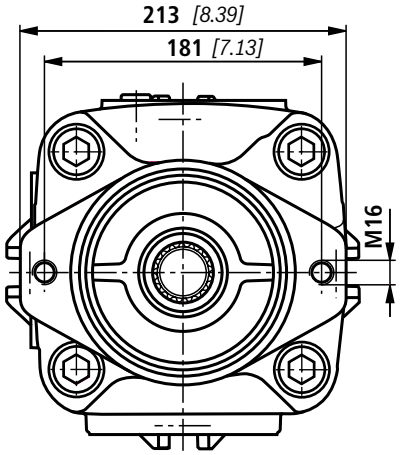
Unit dimensions pump combinations (dimensions in mm *[inch]*)

The dimensional drawings show the front pump and the combination part.

Combination part PGH5-3X+GH5-3X..R

Material no.: **R901155285**





View X

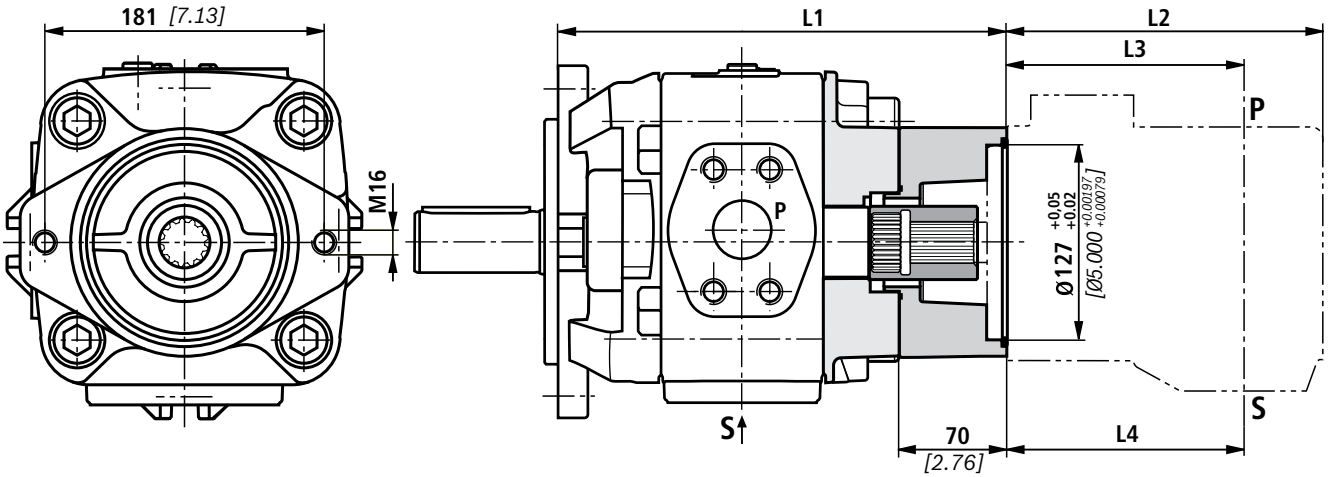
PGH5-3X.. Size	PGH5-3X/..RE..U2 PGH5-3X/..RE..E4 L1	PGH5-3X/..RR..U2 L1
63	264 *[10.39]*	273 *[10.75]*
80	272 *[10.71]*	281 *[11.06]*
100	281 *[11.06]*	290 *[11.42]*
125	293 *[11.54]*	302 *[11.89]*
160	311 *[12.24]*	320 *[12.60]*
200	329 *[12.95]*	338 *[13.31]*
250	353 *[13.90]*	362 *[14.25]*

PGH5-3X…R..U2 Size	L2	L3
63	219 *[8.62]*	114.5 *[4.51]*
80	227 *[8.94]*	118.5 *[4.67]*
100	236 *[9.29]*	123 *[4.84]*
125	248 *[9.76]*	129 *[5.08]*
160	266 *[10.47]*	138 *[5.43]*
200	284 *[11.18]*	147 *[5.79]*
250	308 *[12.13]*	159 *[6.26]*

Unit dimensions pump combinations (dimensions in mm *[inch]*)

The dimensional drawings show the front pump and the combination part.

Combination part: PGH5-3X+VV4/5-1X..J
Material no. R901155286



PGH5-3X.. Size	PGH5-3X/..RE..U2 PGH5-3X/..RE..E4 L1	PGH5-3X/..RR..U2 L1
63	264 *[10.39]*	273 *[10.75]*
80	272 *[10.71]*	281 *[11.06]*
100	281 *[11.06]*	290 *[11.42]*
125	293 *[11.54]*	302 *[11.89]*
160	311 *[12.24]*	320 *[12.60]*
200	329 *[12.95]*	338 *[13.31]*
250	353 *[13.90]*	362 *[14.25]*

PVV..UMB Frame size	L2	L3 (P)	L4 (S)
4	186 *[7.32]*	38 *[1.50]*	126 *[4.96]*
5	216 *[8.50]*	43 *[1.69]*	153 *[6.02]*

Rexroth
Bosch Group

Internal gear pump, fixed displacement

RE 10231/06.05 1/12
Replaces: 11.99

Type PGP

Frame sizes 2 and 3
Component series: 2X (FS2)
3X (FS3)
Maximum operating pressure 350 bar
Maximum displacement 6 to 32 cm^3


H7065

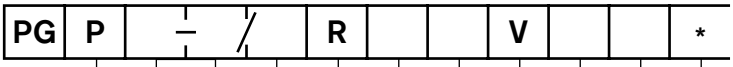
Table of contents

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Technical data	4
Characteristic curves	5, 6
Unit dimensions	7, 8
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Commissioning notes	11
Engineering notes	12

Features

- Fixed displacement
- Low operating noise
- Little flow pulsation
- High efficiency also at low viscosity due to sealing gap compensation
- Long service life due to plain bearings and sealing gap compensation
- Suitable for a wide viscosity and speed range
- Excellent suction characteristics
- Can be combined with PGH and PGF internal gear pumps as well as vane and axial piston pumps

Ordering code



Series
High pressure pump **= P**

Frame size – component series
FS2 **= 2–2X**
(Component series 20 to 29: unchanged installation and connection dimensions)
FS3 **= 3–3X**
(Component series 30 to 39: unchanged installation and connection dimensions)

Size	Displacement/revolution Size		
FS2	6.3	6.5 cm³	**= 006**
	8.0	8.2 cm³	**= 008**
	11.0	11.0 cm³	**= 011**
	13.0	13.3 cm³	**= 013**
	16.0	16.0 cm³	**= 016**
FS3	20.0	20.6 cm³	**= 020**
	22.0	22.2 cm³	**= 022**
	25.0	25.4 cm³	**= 025**
	32.0	32.5 cm³	**= 032**

Direction of rotation (viewed to shaft end)
R = Clockwise

Shaft versions
E = Cylindrical with output
J = SAE involute spline with output

Suction and pressure port
20 = Square flange connection to DIN 3901 or 3902, metric mounting thread
07 = SAE flange connection, FS3 only

Seal material
V = FKM seals

Mounting flange centring
E4 = 4-hole mounting flange to ISO 3019/2 and VDMA 24560 part 1
U2 = SAE 2-hole mounting flange

Option
K = Suitable for mounting a PGF pump of the next smaller frame size

Further details in clear text

Please note!

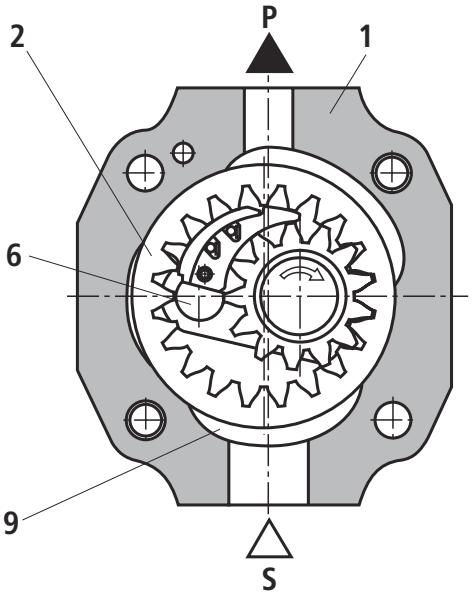
Not all variants according to the type code are possible! Please select the desired pump on the basis of the selection tables (standard types, pages 7 to 9) or consult Bosch Rexroth!

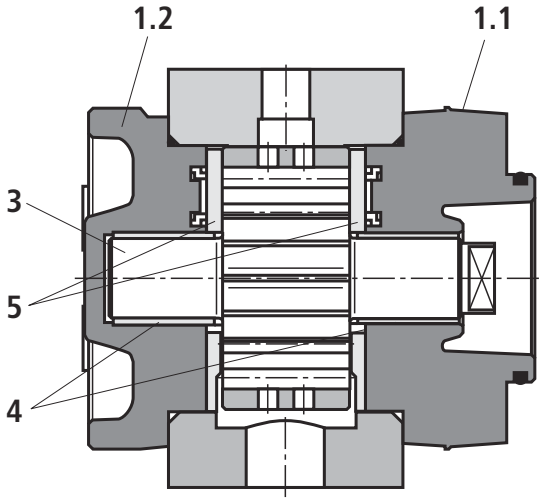
Special options (e.g. integrated valve technology) are possible on enquiry.

Order example: PGP3–3X/025RE20VE4

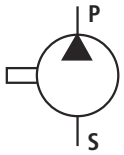
Material number: R900086823

Function, section, symbol





Symbol



Design

Hydraulic pumps of type PGF are leakage gap-compensated internal gear pumps with fixed displacement.

They basically consist of housing (1), bearing cover (1.1), end cover (1.2), internal gear (2), pinion shaft (3), plain bearings (4), axial plates (5), abutment pin (6) as well as segment assembly (7), which comprises segment (7.1), segment carrier (7.2) and sealing rolls (7.3).

Suction and displacement process

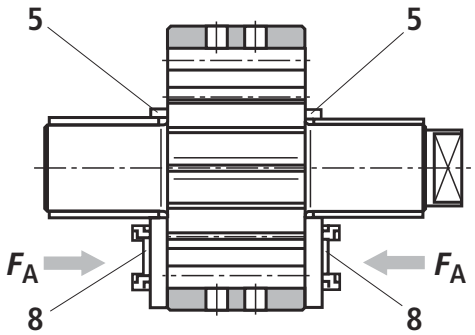
Pinion shaft (3) which is supported on hydrodynamic bearings drives internal gear (2) in the direction of rotation shown.

During rotation, the volume increases in the suction area within an angle of approx. 180 °. A negative pressure develops and fluid flows into the chambers.

The sickle-shaped segment assembly (7) separates the suction chamber from the pressure chamber. Within the pressure chamber, the teeth of pinion shaft (3) mesh with the teeth spaces of internal gear (2). The fluid is then displaced via pressure channel (P).

Axial compensation

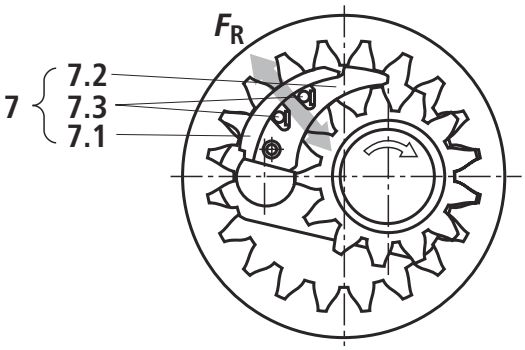
Axial compensation force F_A acts within the pressure chamber and is generated by pressure field (8) in axial plates (5).



Axial longitudinal gaps between rotating and fixed parts are therefore extremely small, which ensures optimum axial sealing of the pressure chamber.

Radial compensation

Radial compensation force F_R acts on segment (7.1) and segment carrier (7.2).



The area ratios and the position of sealing rolls (7.3) between the segment and the segment carrier are designed so that largely leakage-gap-free sealing is achieved between internal gear (2), segment assembly (7) and pinion shaft (3).

Spring elements under sealing rolls (7.3) ensure adequate contact pressure, even at very low pressures.

Hydrodynamic and hydrostatic bearings

The forces acting on pinion shaft (3) are absorbed by hydrodynamically lubricated radial plain bearings (4), and those acting on internal gear (2) are absorbed by hydrostatic bearing (9).

Gearing

The gear teeth are of involute design. Their long meshing length results in little flow and pressure pulsation; these low pulsation rates greatly contribute low-noise operation.

Technical data (for applications outside these parameters, please consult us!)

General

Design			Internal gear pump, gap-compensated				
Type			PGP				
Type of mounting			2-hole direct mounting, SAE 2-hole mounting flange to ISO 3019/1, 4-hole mounting flange to VDMA 24560 part 1 and ISO 3019/2				
Pipe connections			Square flange connection; SAE flange connection				
Installation orientation			Optional				
Shaft loading			Radial and axial forces (e.g. pulley) **only** after consultation				
Direction of rotation (viewed to shaft end)			Clockwise – **not** reversing!				
Frame size			**FS2**				
Size	Size		6.3	8	11	13	16
Weight	m	kg	3.0	3.1	3.3	3.5	3.6
Speed range	n_{min}	min^{-1}	600				
	n_{max}	min^{-1}	1800				
Displacement	V	cm^3	6.5	8.2	11	13.3	16
Flow [1]	q_V	L/min	9.4	11.9	16	19.3	23.2
Operating pressure, absolute – Inlet	p	bar	0.8 to 2				
– Outlet, continuous	p_{max}	bar	250				
– Outlet, intermittent [4]	p_{max}	bar	315 [2] / 350 [3]				
Frame size			**FS3**				
Size			20	22	25	32	
Weight	m	kg	4.3	4.7	5.1	5.5	
Speed range	n_{min}	min^{-1}	600				
	n_{max}	min^{-1}	1800				
Displacement	V	cm^3	20.6	22.2	25.4	32.5	
Flow [1]	q_V	L/min	29.9	32.2	36.8	47.1	
Operating pressure, absolute – Inlet	p	bar	0.8 to 2				
– Outlet, continuous	p_{max}	bar	250				
– Outlet, intermittent [4]	p_{max}	bar	315 [2] / 350 [3]			280 [2] / 315 [3]	
Hydraulic fluid			HL mineral oil to DIN 51524 part 1 / HLP mineral oil to DIN 51524 part 2 **Please observe our regulations according to data sheet RE 07075!** **Other hydraulic fluids on enquiry!**				
Hydraulic fluid temperature range		°C	– 10 to + 80; for other temperatures, please consult us!				
Ambient temperature range		°C	– 20 to + 60				
Viscosity range		mm^2/s	10 to 300; permissible starting viscosity 2000 (only at pressureless circulation)				
Max. permissible degree of contamination of the hydraulic fluid cleanliness class to ISO 4401 (c)			Class 20/18/15 [5]				

[1] Measured at $n = 1450\ min^{-1}$

[2] Maximum number of load cycles 10 x 10^6, duration max. 6 s, but not longer than 15% of duty cycle

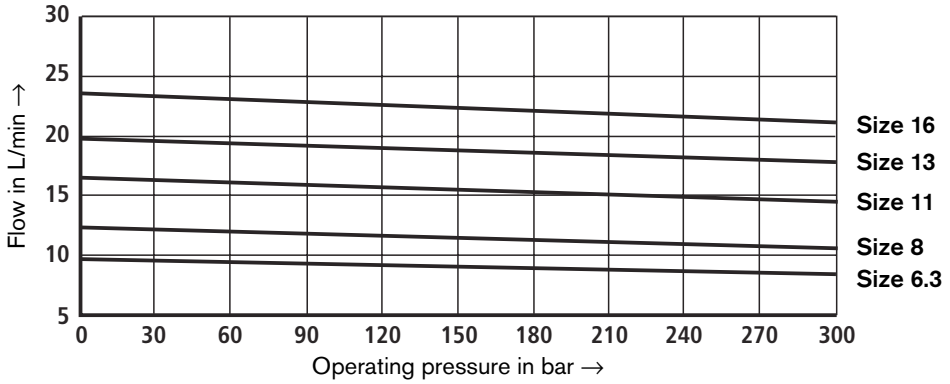
[3] Maximum number of load cycles 10 x 10^6, duration max. 1 s, but not longer than 10% of duty cycle

[4] Caution, this value must also not be exceeded by pressure peaks.

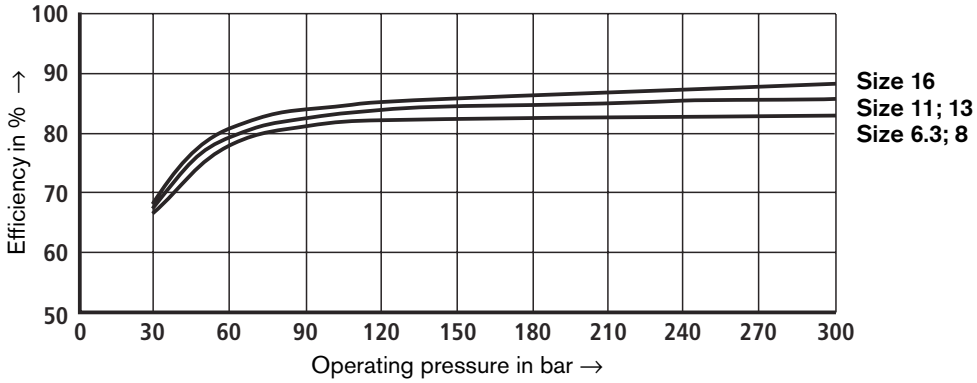
[5] The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.
For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.

Average characteristic curve values of frame size 2 (measured at $n = 1450\ min^{-1}$; $\nu = 46\ mm^2/s$ and $\vartheta = 40\ °C$)

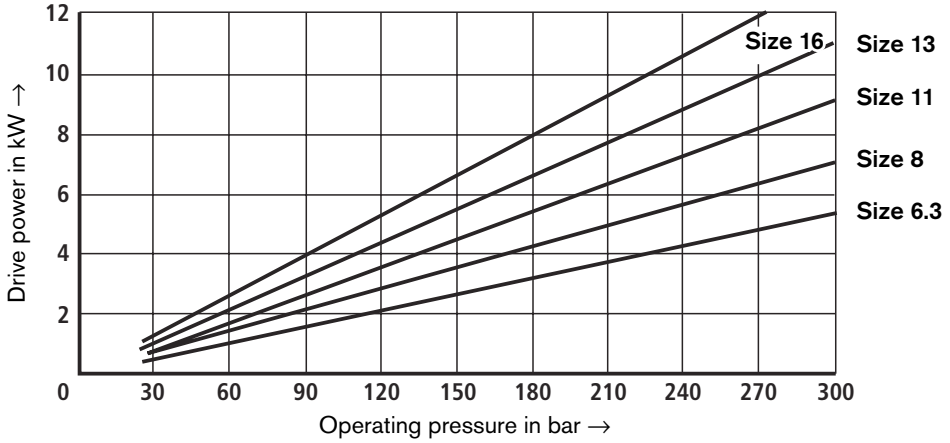
Flow



Efficiency



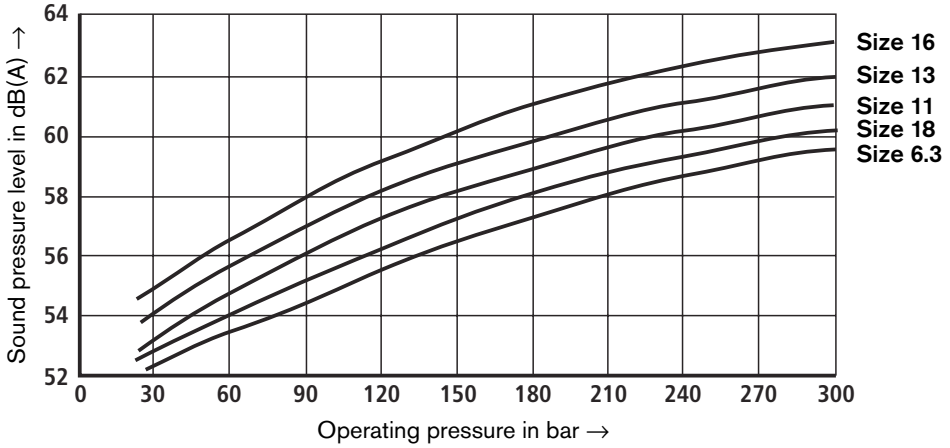
Drive power



Sound pressure level

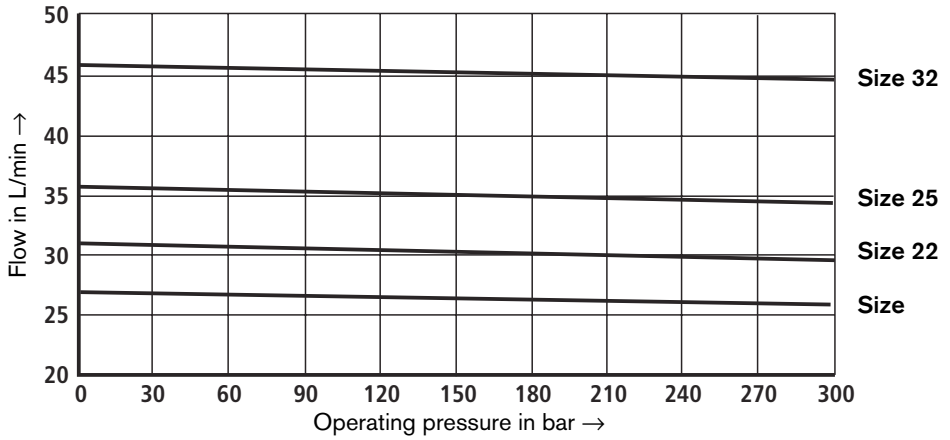
Measured in an anechoic chamber in line with DIN 45635, page 26

Distance between microphone and pump = 1 m

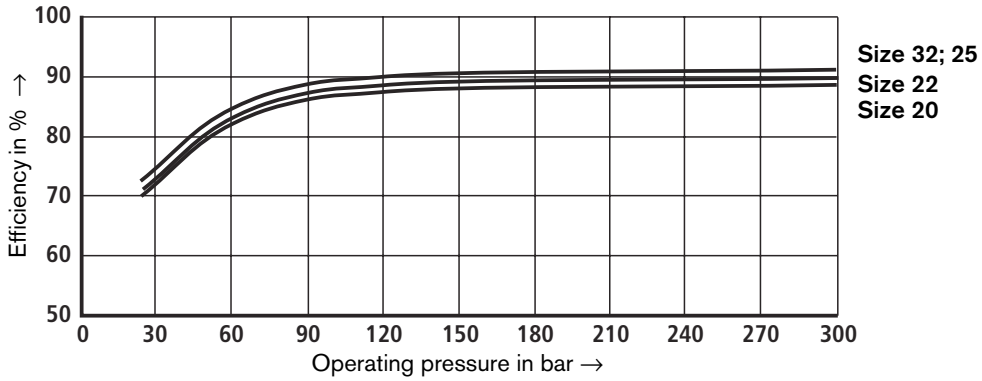


Average characteristic curve values of frame size 3 (measured at $n = 1450\ min^{-1}$; $\nu = 46\ mm^2/s$ and $\vartheta = 40\ °C$)

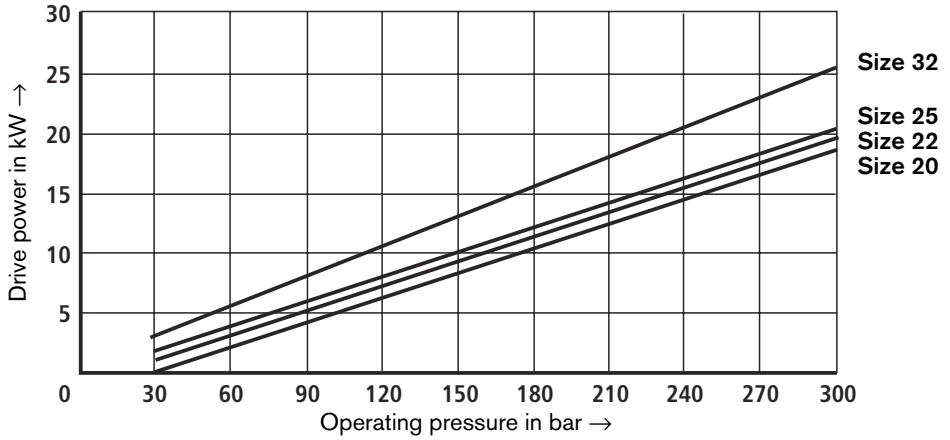
Flow



Efficiency



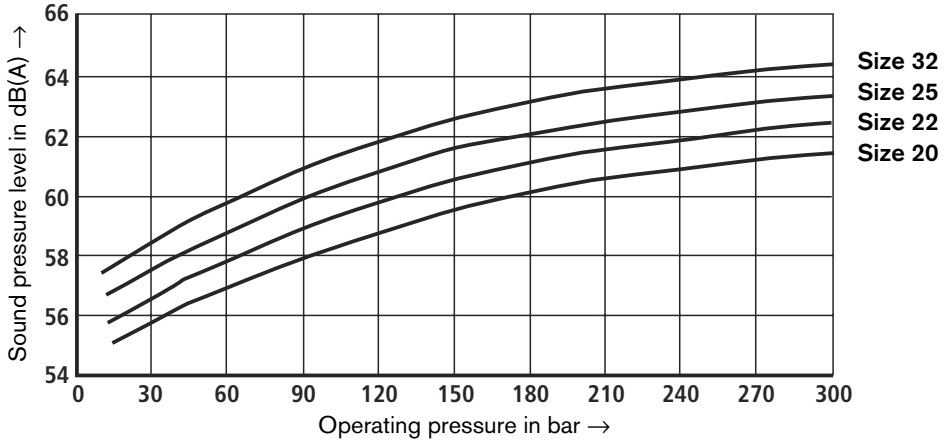
Drive power



Sound pressure level

Measured in an anechoic chamber in line with DIN 45635, page 26

Distance between microphone and pump = 1 m

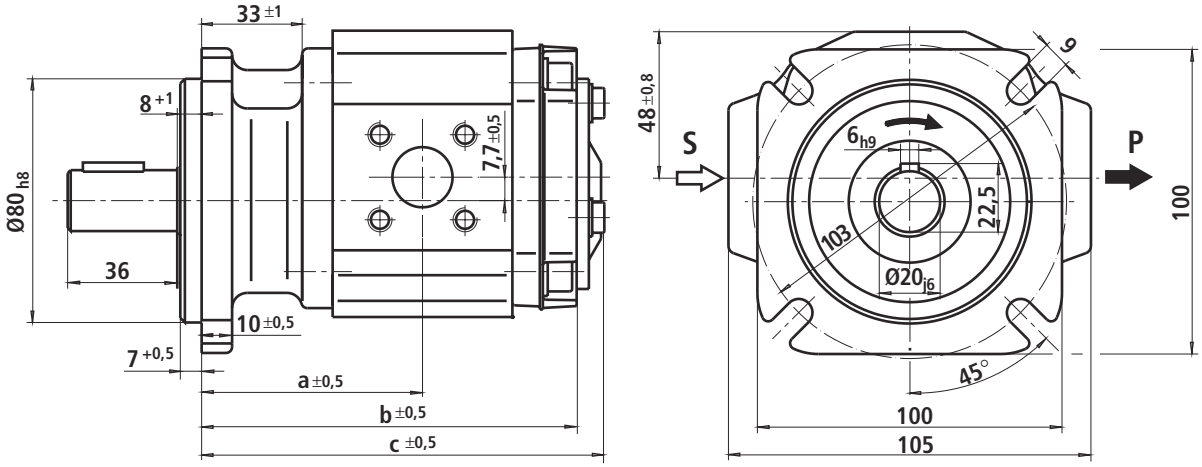


Unit dimensions and selection tables for frame size 2 (nominal dimensions in mm)

PGP2-2X/...RE20VE4 (cylindrical drive shaft with output, clockwise rotation)

Type **Size**	Material no.	Ports		Dimensions		
		S (suction)	**P** (pressure)	**a**	**b**	**c**
PGP2-2X/ **006** RE20VE4	R900932129	Ø20, PC Ø40 [1]	Ø6, PC Ø35 [2]	63	104	114
PGP2-2X/ **008** RE20VE4	R900081891	Ø20, PC Ø40 [1]	Ø8, PC Ø35 [2]	64.8	107.5	117.5
PGP2-2X/ **011** RE20VE4	R900932114	Ø20, PC Ø40 [1]	Ø12, PC Ø35 [2]	67.5	113	123
PGP2-2X/ **013** RE20VE4	R900086819	Ø20, PC Ø40 [1]	Ø12, PC Ø35 [2]	70	118	128
PGP2-2X/ **016** RE20VE4	R900932177	Ø20, PC Ø40 [1]	Ø12, PC Ø35 [2]	72.5	123	133

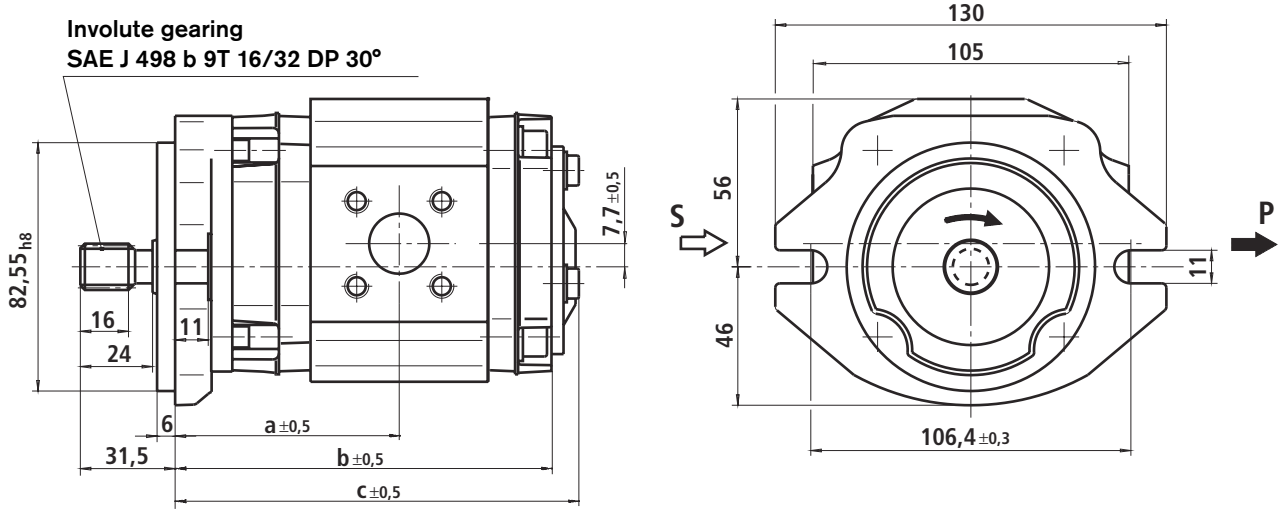
PC = pitch circle [1] mounting thread M6; 9 deep [2] mounting thread M6; 12 deep



PGP2-2X/...RJ20VU2 (splined drive shaft with output, clockwise rotation)

Type **Size**	Material no.	Ports		Dimensions		
		S (suction)	**P** (pressure)	**a**	**b**	**c**
PGP2-2X/ **006** RJ20VU2	R900984018	Ø20, PC Ø40 [1]	Ø6, PC Ø35 [2]	65	106	116
PGP2-2X/ **008** RJ20VU2	R900984019	Ø20, PC Ø40 [1]	Ø8, PC Ø35 [2]	67	109.5	119.5
PGP2-2X/ **011** RJ20VU2	R900984020	Ø20, PC Ø40 [1]	Ø12, PC Ø35 [2]	69.5	115	125
PGP2-2X/ **013** RJ20VU2	R900984021	Ø20, PC Ø40 [1]	Ø12, PC Ø35 [2]	72	120	130
PGP2-2X/ **016** RJ20VU2	R900984022	Ø20, PC Ø40 [1]	Ø12, PC Ø35 [2]	74.5	125	135

PC = pitch circle [1] mounting thread M6; 9 deep [2] mounting thread M6; 12 deep

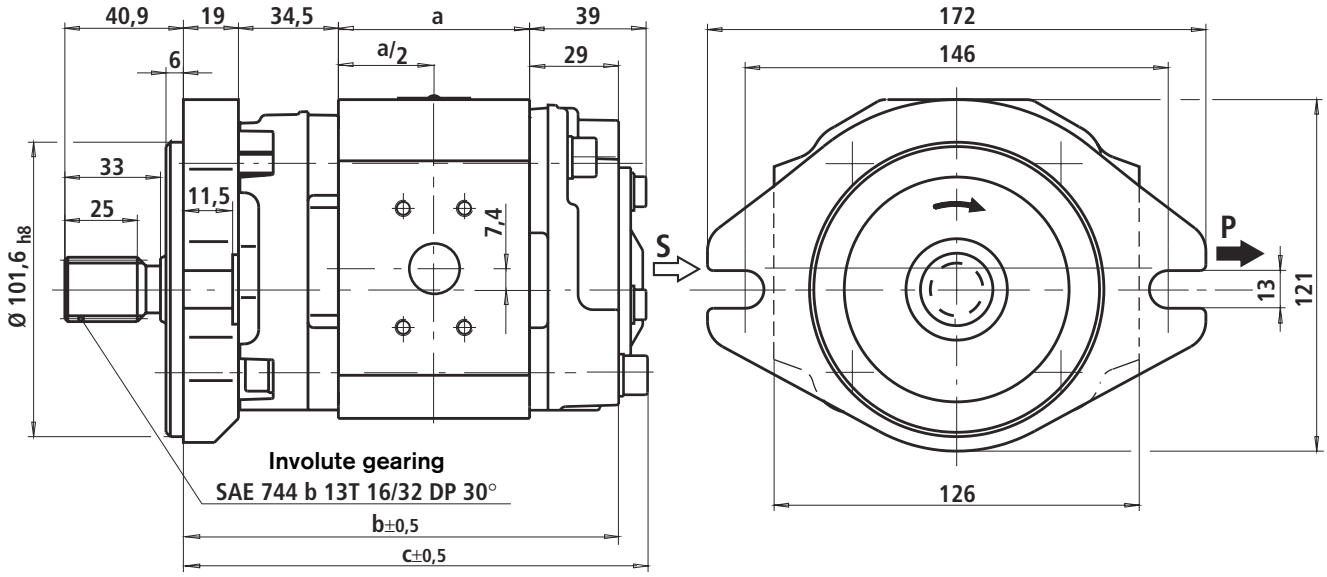


Unit dimensions and selection tables for size 3 (nominal dimensions in mm)

PGP3-3X/...RJ..VU2 (splined shaft with output, clockwise rotation)

Type **Size**	Material no.	Ports		Dimensions		
		S (suction)	**P** (pressure)	**a**	**b**	**c**
PGP3-3X/ **020** RJ20VU2	R900984025	Ø20, PC Ø55 [1]	Ø12, PC Ø35 [2]	52	134.5	144.5
PGP3-3X/ **022** RJ20VU2	R900984026	Ø20, PC Ø55 [1]	Ø12, PC Ø35 [2]	54	136.5	146.5
PGP3-3X/ **025** RJ20VU2	R900984027	Ø20, PC Ø55 [1]	Ø12, PC Ø35 [2]	58	140.5	150.5
PGP3-3X/ **032** RJ07VU2	R900984028	SAE 1 1/4" S [3]	SAE 3/4" S [3]	67	149.5	159.5

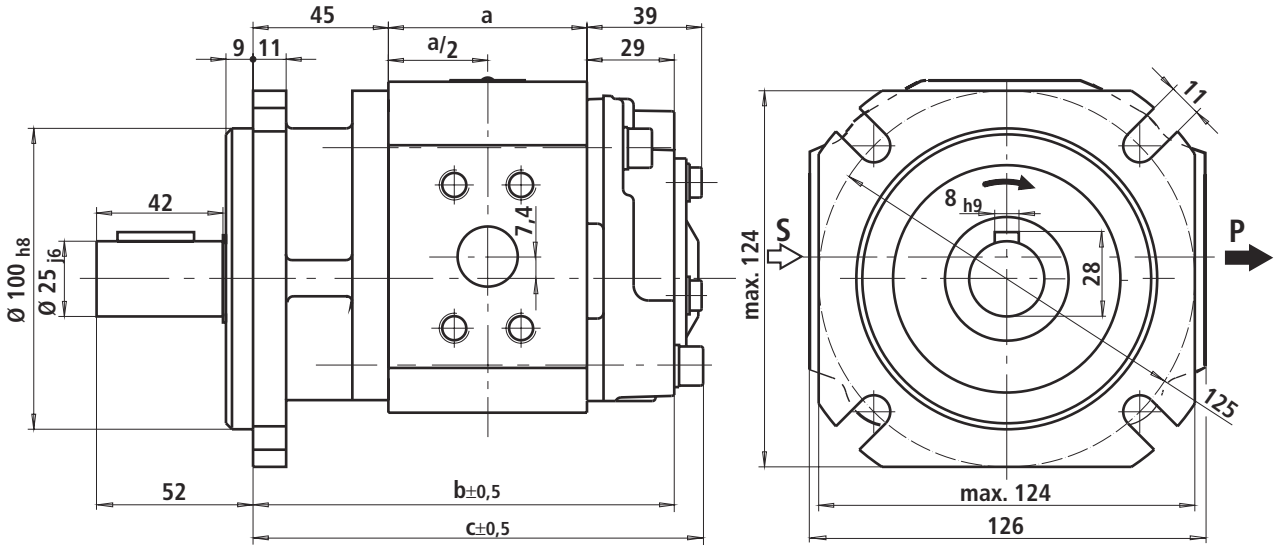
PC = pitch circle [1] mounting thread M8; 12 deep [2] mounting thread M6; 12 deep [3] standard pressure series



PGP3-3X/...RE..VE4 (cylindrical drive shaft, clockwise rotation)

Type **Size**	Material no.	Ports		Dimensions		
		S (suction)	**P** (pressure)	**a**	**b**	**c**
PGP3-3X/ **020** RE20VE4	R900932178	Ø20, PC Ø55 [1]	Ø12, PC Ø35 [2]	52	126	136
PGP3-3X/ **022** RE20VE4	R900080776	Ø20, PC Ø55 [1]	Ø12, PC Ø35 [2]	54	128	138
PGP3-3X/ **025** RE20VE4	R900086823	Ø20, PC Ø55 [1]	Ø12, PC Ø35 [2]	58	132	142
PGP3-3X/ **032** RE07VE4	R900086824	SAE 1 1/4" S [3]	SAE 3/4" S [3]	67	141	151

PC = pitch circle [1] mounting thread M8; 12 deep [2] mounting thread M6; 12 deep [3] standard pressure series



Multiple pumps – ordering code



Double = **P2**

Series of 1st pump
PGP, see page 2

Size of 1st pump
PGP, see page 2

Series of 2nd pump
PGF, see RE 10213

Size of 2nd pump
PGF, see RE 10213

Direction of rotation (viewed to shaft end)
Clockwise = **R**

Further details in clear text

Mounting flange for 1st pump
E4 [1] = 4-hole mounting flange to ISO 3019/2 and VDMA 24560 part 1
U2 [2] = SAE 2-hole mounting flange

Pipe connection of 2nd pump
20 = Square flange connection to DIN 3901 or 3902, metric mounting thread
07 = SAE flange connection

Pipe connection of 1st pump
20 = Square flange connection to DIN 3901 or 3902, metric mounting thread
07 = SAE flange connection

Shaft version of 1st pump
E = Cylindrical, with output
J = SAE involute splined shaft with output

[1] only in conjunction with cylindrical shaft
[2] only in conjunction with splined shaft

Order example: P2GP3/032+GF2/008RE07+20E4
Triple pump on enquiry

Multiple pumps – engineering notes

- The general technical data are identical with those of the single pumps (PGP, see page 4; PGF, see RE 10213).
- Combined pumps must all have the same direction of rotation.
- The pump that is subjected to the greatest loads should be provided as first pump.
- The engineer must verify the maximum troughdrive torque for each application. This is also valid for existing (coded) multiple pumps.
- The drive torque of a pump stage can be calculated as follows:

$$T = \frac{\Delta p \cdot V \cdot 0.0159}{\eta_{\text{hydr.-mech.}}}$$

T : drive torque in Nm
Δp : operating pressure in bar
V : displacement in cm^3
η : hydraulic-mechanical efficiency

Permissible maximum torques in Nm:

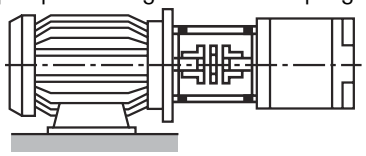
	Input side			Output side
	Cylindrical shaft ..E	Splined shaft ..J	Double-faced for claw coupling ..N	
PGP2	140	140	70	70
PGP3	230	230	140	140
PGF2	140	140	70	70
PGF3	230	230	140	140

- Common suction is **not** possible.
- The pumps are not sealed against each other.
- Rear pumps must have shaft version “N“ (double face).
- Front pumps must have shaft version “E“ (cylindrical) or “J“ (splined).
- Multiple pumps PGP and PGF are mounted without combination parts.
- The total length of the pump is obtained by adding the longitudinal dimensions “b” of the individual pumps.
(PGP, see pages 7 to 9, PGF, see RE 10213)

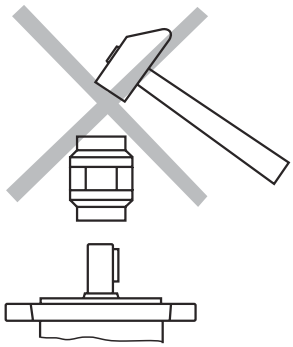
Installation notes

Drive

El. motor + pump mounting bracket + coupling + pump

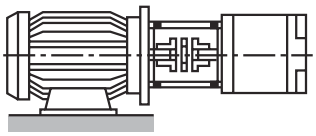


- No radial and axial forces permitted on the pump drive shaft!
- Motor and pump must be exactly aligned!
- Always use a coupling that is suitable for compensating for shaft offsets!
- When installing the coupling, avoid axial forces, that is, **do not hammer or press the coupling onto the shaft!** Use the female thread of the drive shaft!

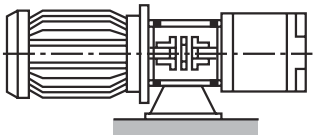


Installation orientation

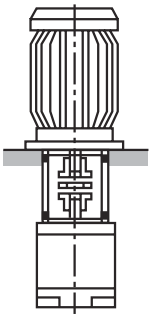
B3



B5



V1



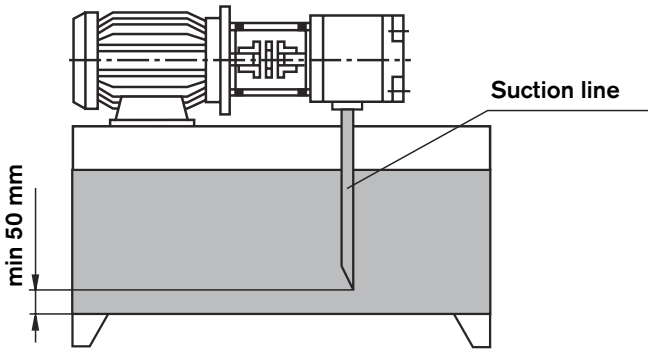
Fluid tank

- Adjust the useful capacity of the tank to the operating conditions
- The permissible fluid temperature must not be exceeded; if required, provide cooler

Lines and connections

- Remove protective plug from pump
- We recommend the use of seamless precision steel pipes according to DIN 2391 and pipe connections that can be loosened
- Select the clear width of pipes according to the connections (suction velocity 1 to 1.5 m/s)
- For inlet pressure, see page 4
- Thoroughly clean pipes and fittings before their installation

Recommendation for piping



- The returning oil must **under no circumstances** be re-aspired directly, i.e. select the largest possible distance between suction and return line
- The return oil outlet must always be immersed in the oil
- Ensure suction-tight installation of the pipes

Filters

- If possible, use return line or pressure filters.
  (Use suction filters only in conjunction with an underpressure switch/clogging indicator)

Hydraulic fluid

- Please observe our regulations according to data sheet RE 07075
- We recommend the use of branded hydraulic oils
- Different oil grades must not be mixed, since this can result in decomposition and deterioration of the lubricating properties
- The fluid must be changed at certain intervals depending on the operating conditions. This involves cleaning of the fluid tank from residues.

Commissioning notes

Preparations

- Check whether the system is thoroughly and properly installed.
- Fill the hydraulic fluid only in through filters with the required minimum retention rate.
- Fill the pump completely with hydraulic fluid via the suction or pressure tube.
- Check direction of rotation of the motor for compliance with the direction of rotation according to the pump type.

Bleeding

- Open the bleeding port of the system by hand or change over to circulation at zero pressure in accordance with the operating instructions of the system. During bleeding, the pressureless discharge of entrapped air must be ensured.
- To bleed the pump, briefly switch the motor on and then switch it immediately off again (inching mode). Repeat this process until the pump is completely bled.
- Re-close the open bleeding ports by hand.

Commissioning

- When it is ensured that the pump is completely bled, switch the motor on. Let the pump run at zero pressure until the system is completely bled. For system bleeding, observe the operating instructions for the system.
- Commission the system according to the operating instructions and load pumps.
- After some time in operation, check the hydraulic fluid in the tank for bubbles or foaming on the surface.

Operation

- During operation, take note of changes in the noise emission. Due to warming up of the operating medium, a slight increase in the noise level is normal. A remarkable increase in the noise level or brief, stochastic changes in the noise characteristics can indicate the aspiration of air. In the case of too short suction pipes or low oil levels of the operating medium, air can also be sucked in through a vortex.
- Changes in the operating velocities, temperatures, increase in noise or power requirement indicate wear or damage to the system or the pump.

Re-commissioning

- Inspect the pump and system for leakage. Loss of oil indicates leakage below the hydraulic fluid level. An increased hydraulic fluid level in the tank indicates leakage above the hydraulic fluid level.
- When the pump is arranged above the hydraulic fluid level, the pump can drain via leaking points, e.g. a worn-out shaft seal ring. In this case, it must be bled again during re-commissioning. Have the damage repaired.
- After repair and maintenance were carried out, re-bleeding is required.
- Switch the motor on when the system is in flawless condition.

General

- Pumps delivered by us are tested for function and performance. Never make any changes of whatever nature to the pump, otherwise the warranty will become void!
- Repairs may only be carried out by the manufacturer or his authorised dealers and agencies. Repairs carried out by the customer are not covered by the warranty.

⚠ Important notes

- Adjustments, maintenance and repair of the pump may only be carried out by authorised, trained and instructed personnel!
- The pump may only be operated within the permissible limits (see page 4).
- The pump may only be operated when in perfect condition!
- When work is to be carried out on the pump, the system must be switched off and depressurised!
- Unauthorised conversions or changes that affect safety and function are not permitted!
- Attach protective guards (e.g. coupling protection) and do not remove any existing protective equipment!
- Make sure that all fixing screws are always properly tightened (observe prescribed tightening torque)!
- The generally valid safety regulations and regulations for the prevention of accidents must be strictly observed!

Engineering notes

Comprehensive notes and suggestions can be found in The Hydraulic Trainer, Volume 3 RE 00281, "notes on the planning and design of hydraulic systems".

When using internal gear pumps, provide an additional manual, switchable or automatic bleeding option. The bleed point for manual bleeding must be provided in the pressure line upstream of the first valve or check valve in order that bleeding can be carried out at zero pressure.

Technical data

All technical data given depend on manufacturing tolerances and are valid in conjunction with certain boundary conditions.

Please note that certain deviations are therefore possible, and that technical data may vary under certain boundary conditions (e.g. viscosity).

Characteristic curves

When dimensioning the drive motor, observe the max. permissible operating data on the basis of the characteristic curves shown on pages 5 and 6.

Sound pressure level

The sound pressure level values shown on pages 5 and 6 were measured in line with DIN 45635, page 26. This means that only the noise emitted by the pump is shown. Influences by the surroundings (such as place of installation, piping, etc.) were eliminated.

The values always refer to only one pump.

With internal gear pumps, the excitation of valves, pipes, machine parts, etc. is very low due to the low flow pulsation (approx. 2 to 3 %).

Nevertheless, under unfavourable conditions, the sound pressure level at the place of installation of the power unit can be 5 to 10 dB(A) higher than the values of the pump itself.

Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

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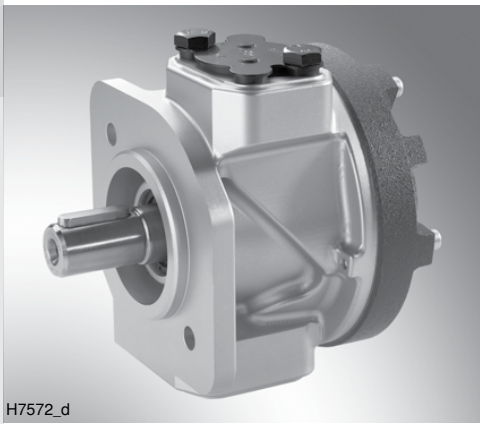
The data specified above only serve to describe the product. No statements concerning a certain condition or suitability for a certain application can be derived from our information. The information given does not release the user from the obligation of own judgment and verification. It must be remembered that our products are subject to a natural process of wear and aging.

Rexroth
Bosch Group

Gerotor pump, fixed displacement volume

RE 10545/12.11 1/12

Type PGZ


H7572_d

Component series 1X
Maximum operating pressure 15 bar
Maximum displacement 140 cm³

Table of contents

Contents	Page
Features	1
Ordering code	2
Function, section, symbol	3
Technical data	4 and 5
Unit dimensions, standard types	6 to 9
Ports	10
Project planning information	10 to 12

Features

- Low-pressure pump with fixed displacement
- Very low operating noise
- Suitable for wide viscosity and speed ranges
- Very good suction behavior
- Flexible combination possibilities with Rexroth axial piston, internal gear and vane pumps

- Use:
  For cooling, filtration or lubrication circuits at low pressures in industrial or mobile applications, e.g. plastics processing machines, machine tools, presses and wind turbines.

Information on available spare parts:
www.boschrexroth.com/spc

Ordering code

PG	Z	−1X/		R		07	V		*

Series
Gerotor pump, low-pressure **= Z**

Frame size
BG4 **= 4**
BG5 **= 5**

Component series: Component series 10 to 19 **= 1X**
(10 to 19: Unchanged installation and connection dimensions)

Size

	Size	Displacement volume/ rotation	
BG4	20	21.0 cm³	**= 20**
	32	33.4 cm³	**= 32**
	40	42.1 cm³	**= 40**
	50	52.0 cm³	**= 50**
	63	64.4 cm³	**= 63**
	80	84.2 cm³	**= 80**
BG5	63	64.4 cm³	**= 63**
	80	84.2 cm³	**= 80**
	100	105.3 cm³	**= 100**
	140	136.3 cm³	**= 140**

Direction of rotation
Clockwise (viewed on the shaft end) **= R**

Shaft design
A = Cylindrical
T = SAE involute gear 11T
R = SAE involute gear 13T

Line connection
07 = SAE flange standard pressure series

Seal material
V = FKM seals

Type of connection
E4 = ISO 4-hole mounting flange according to ISO 3019-2 and VDMA 24560
U2 = SAE 2-hole mounting flange
B2 = ISO 2-hole mounting flange according to ISO 3019-2, secondary pump for through-drive KB2
B3 = ISO 2-hole mounting flange according to ISO 3019-2, secondary pump for through-drive KB3

Further details in the plain text e.g. special designs

Standard types PGZ-1X	
Type Size	**Material No.**
PGZ4-1X/**020**RA07VE4	**R901230020**
PGZ4-1X/**032**RA07VE4	**R901230024**
PGZ4-1X/**040**RA07VE4	**R901230028**
PGZ4-1X/**050**RA07VE4	**R901230032**
PGZ4-1X/**063**RA07VE4	**R901230036**
PGZ4-1X/**080**RA07VE4	**R901230040**
PGZ5-1X/**100**RA07VE4	**R901230052**
PGZ5-1X/**140**RA07VE4	**R901230056**

The possible flange shaft configurations can be found in the selection tables on the pages 6 to 9.

Function, section

Construction

Hydraulic pumps of the PGZ type are gerotor pumps with fixed displacement.

They mainly consist of: Flange housing (1), shaft (2), the displacer elements inner rotor (3) and outer rotor (4), as well as driving disk (5) and cover (6).

Suction and displacement procedure

Via the driving disk the shaft drives the inner rotor in the direction of rotation shown. The inner rotor meshes with the outer rotor and causes the same to rotate as well.

The tooth clearances opening in the suction area (S) prime the hydraulic fluid. The suction and pressure area are separated on the opposite side of the meshing area (Z) by a radial gap (R) created by the tooth profile of the outer and the inner rotor sliding against each other.

Within the pressure area (P) the hydraulic fluid is pumped into the pressure port as the chambers become.

Properties

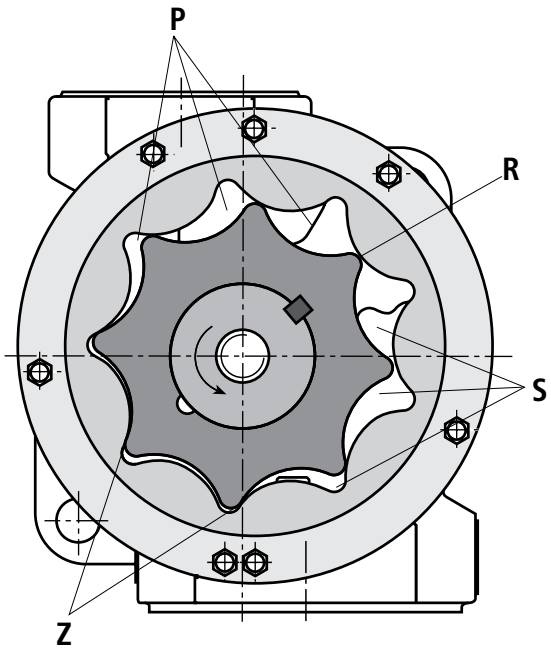
The gearing with cycloid contour is characterized by a large meshing length. Filling zone and displacement area cover a large rotation angle. This results in low flow pulsation and thus very low operating noise.
The shaft and the displacer are supported by a slide bearing and work in a wear-free manner when used as intended.

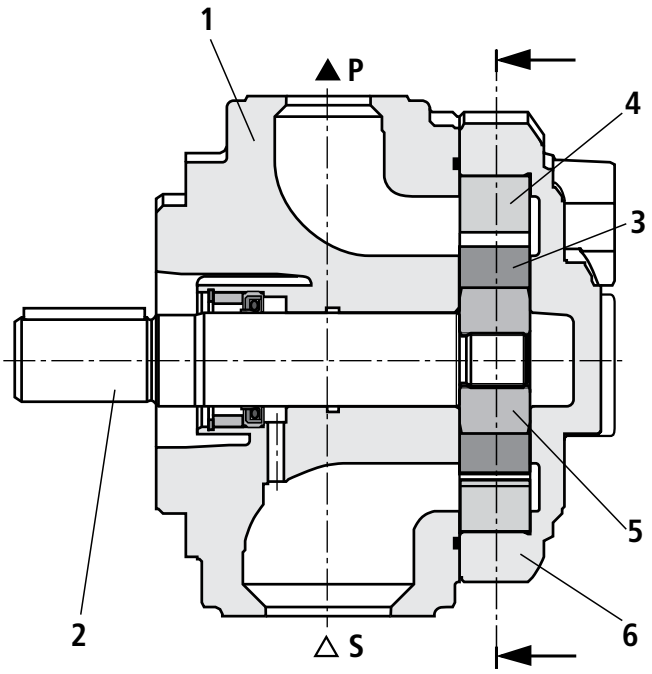
Gerotor pumps PGZ are self-priming.

Materials used

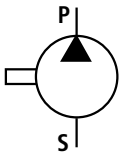
Flange housing (1): Aluminum

Shaft (2), inner rotor (3), outer rotor (4), and driving disk (5): Steel
Cover (6): Cast iron





Symbol



Technical data (For applications outside these parameters, please consult us!)

general

Type	Gerotor pump
Type of connection	ISO 4-hole mounting flange according to ISO 3019-2 and VDMA 24560 SAE 2-hole mounting flange ISO 2-hole mounting flange according to ISO 3019-2, matching through-drive KB2 ISO 2-hole mounting flange according to ISO 3019-2, matching through-drive KB3
Line connection	Flange connection
Shaft load	Radial and axial forces cannot be transmitted
Direction of rotation (viewed on shaft end)	Clockwise

hydraulic

Hydraulic fluid	HLP - mineral oil according to DIN 51524 part 2 **Please observe our specification according to data sheet RE 90220** **Other fluids upon request!**
Hydraulic fluid temperature range °C	–20 to +80, observe the admissible viscosity range!
Ambient temperature range °C	–20 to +80
Viscosity range mm^2/s	10 to 2000
Max admissible degree of contamination of the hydraulic fluid - cleanliness class according to ISO 4406 (c)	Class 21/18/15 [1]

Frame size 4	**Frame size**		**PGZ4**					
Size	**Size**		**20**	**32**	**40**	**50**	**63**	**80**
Displacement	V	cm^3	21.0	33.4	42.1	52.0	64.4	84.2
Weight	m	kg	4.7	5.3	5.6	6.0	6.7	7.8
Flow [2]	q_V	l/min	28	46	58	71	88	116
Mass moment of inertia (around drive axis)	J	kgm^2	0.00086	0.00134	0.00167	0.00205	0.00253	0.00329
Speed range	n_{min}	rpm	200	200	200	200	200	200
	n_{max}	rpm	3000	3000	3000	3000	2300	1800
Operating pressure, absolute – Inlet	p	bar	0.7 to 2 (short-time during start 0.5 bar)					
Nominal pressure – Outlet, continuous	p_N	bar	15					
Min required driving power		kW						
– at $\Delta p \approx 1$ bar, $n = 1{,}450$ min^{-1}			0.75	1.1	1.1	1.1	1.1	1.1
– at $\Delta p \approx 10$ bar, $n = 1{,}450$ min^{-1}			1.5	2.2	2.2	2.2	3.0	3.0
Sound pressure level at 0 – 15 bar [3]		dB(A)	55	56	57	59	60	62

[1] The cleanliness classes specified for the components must be adhered to in hydraulic systems.
An efficient filtration prevents failures and simultaneously increases the lifetime of the components.
For the selection of filters, see data sheets RE 50070, RE 50076, RE 50081, RE 50086 and RE 50088.

[2] Measured at $n = 1.450$ rpm, $p = 10$ bar, and $v = 30$ mm^2/s

[3] Measured in sound-absorbent acoustic room at $n = 1450$ rpm and $\nu = 30$ mm^2/s

Technical data (For applications outside these parameters, please consult us!)

Frame size 5	**Frame size**		**PGZ5**			
Size	**Size**		**63**	**80**	**100**	**140**
Displacement	V	cm^3	64.4	84.2	105.3	136.3
Weight	m	kg	6,6	7,7	8,9	10,7
Flow [1]	q_V	l/min	88	116	144	186
Mass moment of inertia (around drive axis)	J	kgm^2	0.00253	0.00329	0.00410	0.00529
Speed range	n_{min}	rpm	200	200	200	200
	n_{max}	rpm	3000	2300	1800	1500
Operating pressure, absolute – Inlet	p	bar	0.7 to 2 (short-time during start 0.5 bar)			
Nominal pressure – Outlet, continuous	p_N	bar	15			
Min required driving power		kW				
– at $\Delta p \approx 1$ bar, $n = 1{,}450$ min^{-1}			1.1	1.1	1.5	1.5
– at $\Delta p \approx 10$ bar, $n = 1{,}450$ min^{-1}			3.0	3.0	4.0	5.5
Sound pressure level at 0 – 15 bar [2]		dB(A)	60	62	63	66

[1] Measured at $n = 1{,}450$ rpm, $p = 10$ bar, and $v = 30$ mm^2/s

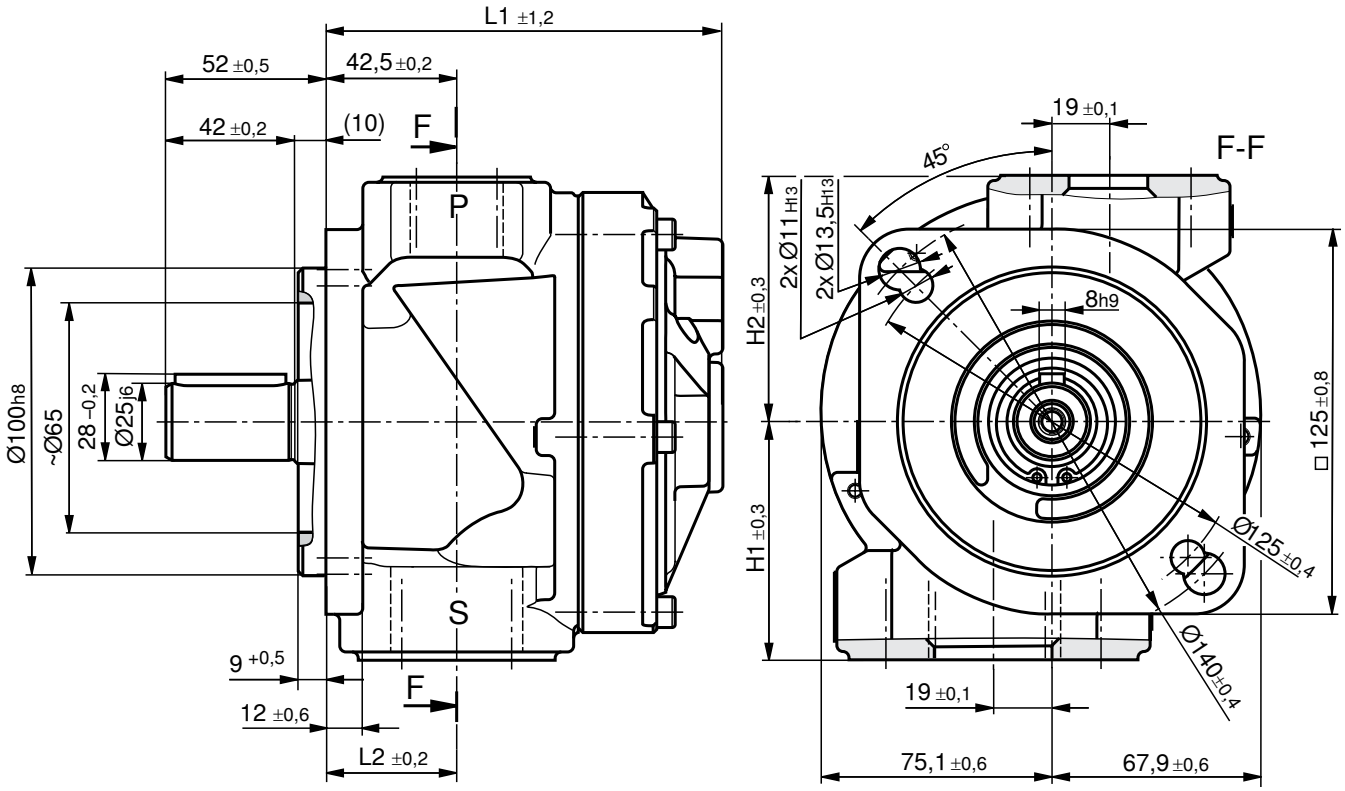
[2] Measured in sound-absorbent acoustic room at $n = 1450$ rpm and $\nu = 30$ mm^2/s

Unit dimensions frame sizes 4 and 5, type...VE4 (dimensions in mm)

PGZ $\frac{4}{5}$ -1X/ … RA07VE4

Drive shaft cylindrical,

4-hole mounting flange according to ISO 3019-2 and VDMA 24560



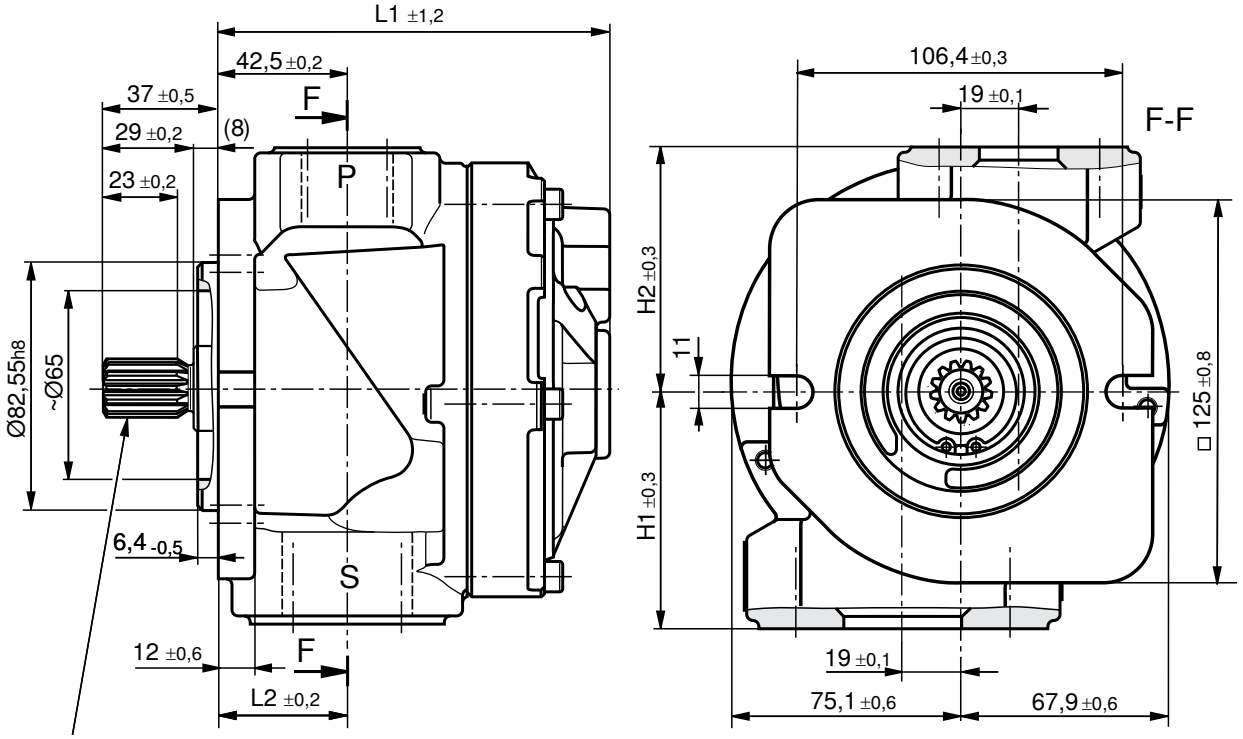
Type Size	Material No.	L1	L2	H1	H2	S [1]	P [1]
PGZ4-1X/**020**RA07VE4	**R901230020**	116,5	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**032**RA07VE4	**R901230024**	121,5	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**040**RA07VE4	**R901230028**	125	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**050**RA07VE4	**R901230032**	129	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**063**RA07VE4	**R901230036**	134	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**080**RA07VE4	**R901230040**	142	42,5	77,4	79,6	1 1/2“	1“
PGZ5-1X/**063**RA07VE4	**R901230044**	134	48,5	72,9	76,1	2“	1 1/4“
PGZ5-1X/**080**RA07VE4	**R901230048**	142	48,5	72,9	76,1	2“	1 1/4“
PGZ5-1X/**100**RA07VE4	**R901230052**	150,5	48,5	72,9	76,1	2“	1 1/4“
PGZ5-1X/**140**RA07VE4	**R901230056**	163	48,5	72,9	76,1	2“	1 1/4“

[1] Exact dimensions see table page 10

Unit dimensions frame sizes 4 and 5, type...VU2 (dimensions in mm)

PGZ $\frac{4}{5}$ -1X/ … RT07VU2

Drive shaft splined,
SAE 2-hole mounting flange



Involute gear ANSI B92.1-1996
11T 16/32 DP30°

Type Size	Material No.	L1	L2	H1	H2	S [1]	P [1]
PGZ4-1X/**020**RT07VU2	**R901230021**	116,5	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**032**RT07VU2	**R901230025**	121,5	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**040**RT07VU2	**R901230029**	125	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**050**RT07VU2	**R901230033**	129	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**063**RT07VU2	**R901230037**	134	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**080**RT07VU2	**R901230041**	142	42,5	77,4	79,6	1 1/2“	1“
PGZ5-1X/**063**RT07VU2	**R901230045**	134	48,5	72,9	76,1	2“	1 1/4“
PGZ5-1X/**080**RT07VU2	**R901230049**	142	48,5	72,9	76,1	2“	1 1/4“
PGZ5-1X/**100**RT07VU2	**R901230053**	150,5	48,5	72,9	76,1	2“	1 1/4“
PGZ5-1X/**140**RT07VU2	**R901230057**	163	48,5	72,9	76,1	2“	1 1/4“

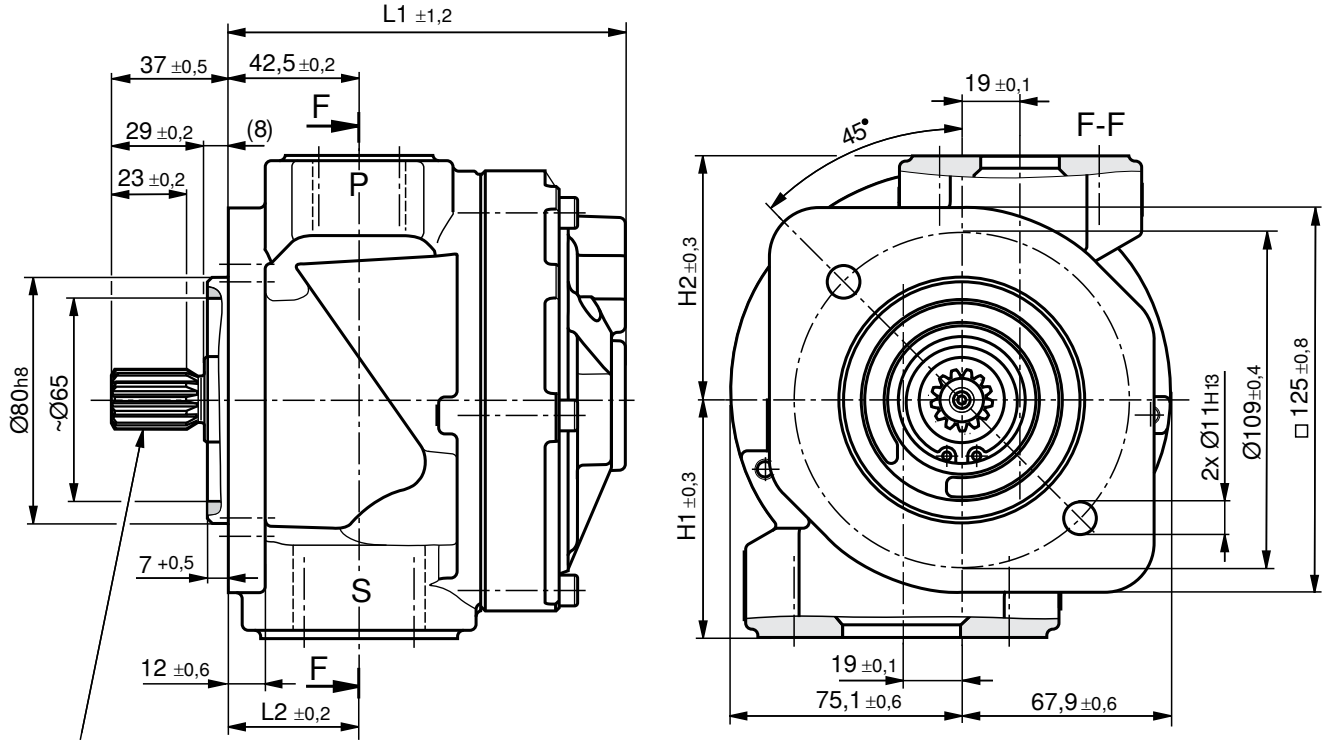
[1] Exact dimensions see table page 10

Unit dimensions frame sizes 4 and 5, type...VB2 (dimensions in mm)

PGZ $\frac{4}{5}$ -1X/ … RT07VB2

Drive shaft splined,
ISO 2-hole mounting flange according to ISO 3019-2

(Secondary pump for through-drive KB2)



Involute gear ANSI B92.1-1996
11T 16/32 DP30°

Type Size	Material No.	L1	L2	H1	H2	S [1]	P [1]
PGZ4-1X/**020**RT07VB2	**R901230022**	116,5	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**032**RT07VB2	**R901230026**	121,5	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**040**RT07VB2	**R901230030**	125	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**050**RT07VB2	**R901230034**	129	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**063**RT07VB2	**R901230038**	134	42,5	77,4	79,6	1 1/2“	1“
PGZ4-1X/**080**RT07VB2	**R901230042**	142	42,5	77,4	79,6	1 1/2“	1“
PGZ5-1X/**063**RT07VB2	**R901230046**	134	48,5	72,9	76,1	2“	1 1/4“
PGZ5-1X/**080**RT07VB2	**R901230050**	142	48,5	72,9	76,1	2“	1 1/4“
PGZ5-1X/**100**RT07VB2	**R901230054**	150,5	48,5	72,9	76,1	2“	1 1/4“
PGZ5-1X/**140**RT07VB2	**R901230058**	163	48,5	72,9	76,1	2“	1 1/4“

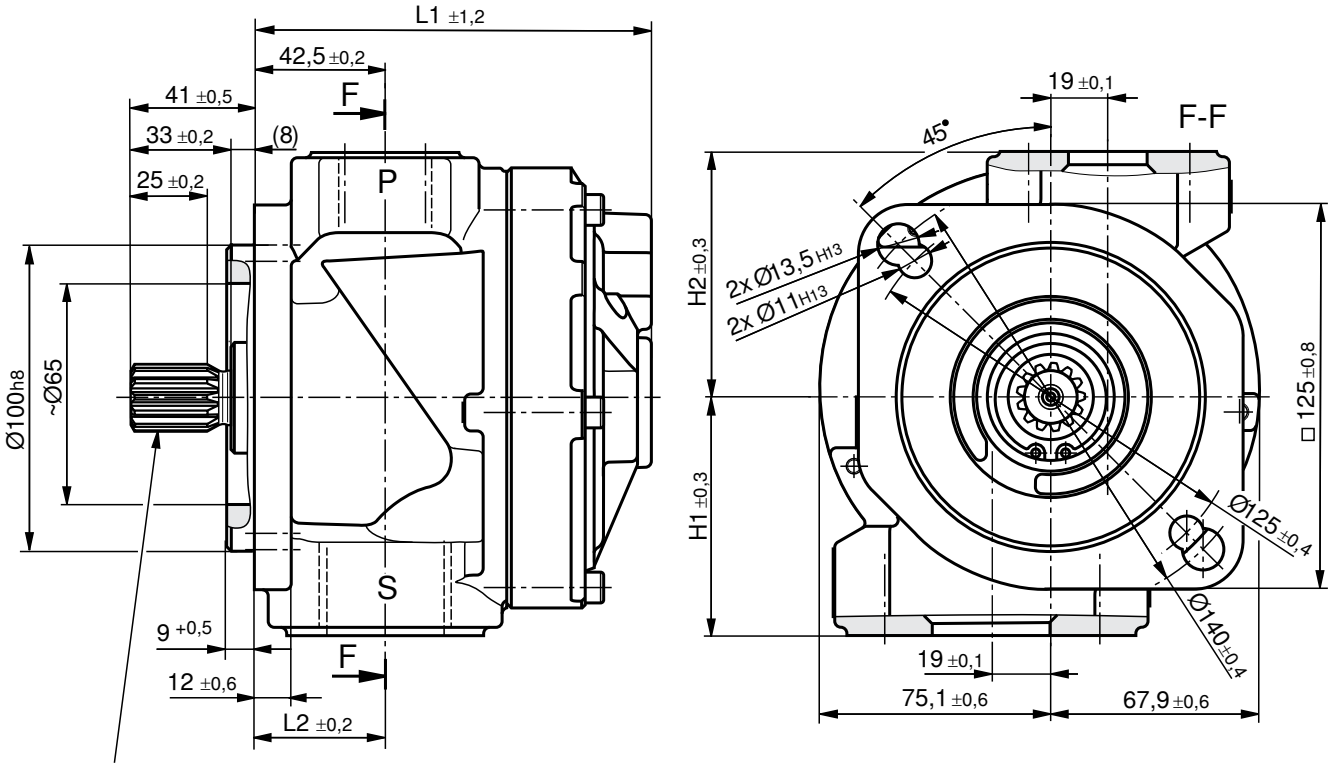
[1] Exact dimensions see table page 10

Unit dimensions frame sizes 4 and 5, type...VB3 (dimensions in mm)

PGZ $\frac{4}{5}$ -1X/ … RR07VB3

Drive shaft splined,
ISO 2-hole mounting flange according to ISO 3019-2

(Secondary pump for through-drive KB3)



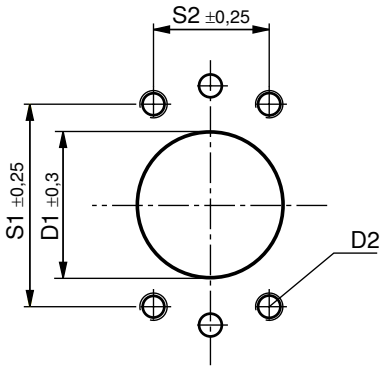
Involute gear ANSI B92.1-1996
13T 16/32 DP30°

Type Size	Material No.	L1	L2	H1	H2	S [1]	P [1]
PGZ4-1X/**020**RR07VB3	**R901230023**	116,5	42,5	77,4	79,6	1 1/2"	1"
PGZ4-1X/**032**RR07VB3	**R901230027**	121,5	42,5	77,4	79,6	1 1/2"	1"
PGZ4-1X/**040**RR07VB3	**R901230031**	125	42,5	77,4	79,6	1 1/2"	1"
PGZ4-1X/**050**RR07VB3	**R901230035**	129	42,5	77,4	79,6	1 1/2"	1"
PGZ4-1X/**063**RR07VB3	**R901230039**	134	42,5	77,4	79,6	1 1/2"	1"
PGZ4-1X/**080**RR07VB3	**R901230043**	142	42,5	77,4	79,6	1 1/2"	1"
PGZ5-1X/**063**RR07VB3	**R901230047**	134	48,5	72,9	76,1	2"	1 1/4"
PGZ5-1X/**080**RR07VB3	**R901230051**	142	48,5	72,9	76,1	2"	1 1/4"
PGZ5-1X/**100**RR07VB3	**R901230055**	150,5	48,5	72,9	76,1	2"	1 1/4"
PGZ5-1X/**140**RR07VB3	**R901230059**	163	48,5	72,9	76,1	2"	1 1/4"

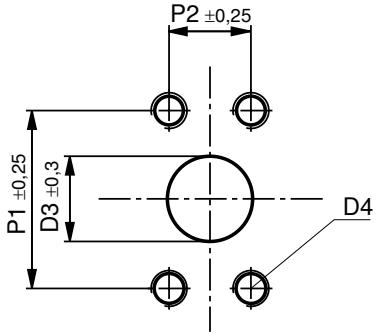
[1] Exact dimensions see table page 10

Ports (dimensions in mm)

Hole pattern of suction port “S”



Hole pattern of discharge port “P”



Frame size	Hole pattern / suction port S	D1	D2	S1	S2	Hole pattern / discharge port P	D3	D4	P1	P2
4	1 1/2“	Ø38,1	M12; 21	69,9	35,7	1“	Ø25,4	M10; 16	52,4	26,2
5	2“	Ø50,8	M12; 21	77,8	42,9	1 1/4“	Ø31,8	M10; 18	58,7	30,2

Project planning information

1. General notes

This project planning information relates to the specific properties of the Rexroth PGZ.-1X gerotor pump. Please find comprehensive general information and suggestions in The Hydraulic Trainer, Volume 3 “Planning and Design of Hydraulic Power Systems”, RE 00281.

1.1 Intended use

Rexroth gerotor pumps are intended for the use in cooling, filtration, and lubrication circuits in the fields of machine and plant engineering. During project planning, the basic principles of the EU Machinery Directive or comparable national regulations outside of the EU have to be observed.

The pumps must not be used in potentially explosive atmospheres in accordance with Directive 94/9/EC (ATEX). The use as hydraulic motor is inadmissible!

1.2 Technical data

The plant or machine manufacturer has to ensure the compliance with the admissible technical data and operating conditions. The pump itself does not contain a device to prevent operation outside of the admissible data.

All mentioned technical features are average values and are applicable for the specified boundary conditions. In case of modifications to the boundary conditions (e.g. viscosity), the technical data may change as well. Tolerances are possible in accordance with state of the art.

Operating the pump outside of the admissible technical data (pages 4, 5) is possible to a certain extent, however, this requires an explicit written approval of Bosch Rexroth.

2. Hydraulic project planning

2.1 Installation location

When installing the pump more than 10 m below the tank, take additional measures to ensure that the inlet pressure is reduced to the maximum admissible value.

2.2 Suction line

The line cross-sections have to be dimensioned for the rated flows in a manner that an ideal suction speed of 0.6 to 1.2 m/s is achieved on average. The suction speed must not exceed a maximum value of 2 m/s.

The suction cross-sections at the very pump are dimensioned for the maximum flow and thus are a reference only. During continuous operation at speeds lower than the admissible maximum speed, the suction tube diameter is to be dimensioned smaller than the suction port of the pump in accordance with the actual suction speed.
All in all the suction line has to be designed in a way that the admissible inlet operating pressure is complied with (0.7 to 2 bar absolute)! Bends and a combination of the suction tubes of several pumps must be avoided.

If suction filters have to be used, it has to be ensured on the system side that the lowest admissible inlet operating pressure is not exceeded even when the filter is clogged.

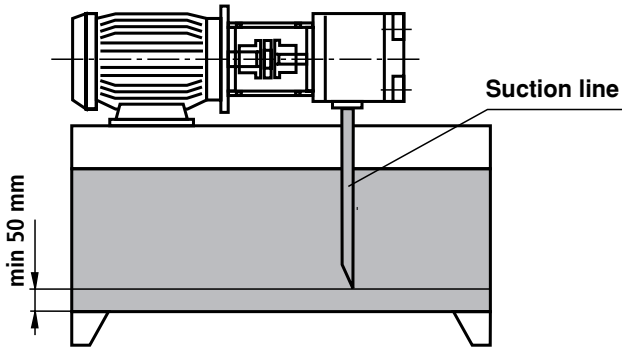
Please observe air tightness of the transitions and dimensional stability of the suction hose as regards to the external air pressure.

Project planning information

(continuation of 2.2 Suction line)

The value for the immersion depth of the suction tube should be selected as high as possible. Depending on the internal tank pressure, the viscosity of the hydraulic fluid, and the flow situation within the tank, no vortex must be formed even at maximum flow. Otherwise there is the risk of aspiring air.

We recommend selecting suction tubes according to AB 23-03.



2.3 Pressure limitation

The gerotor pump PGZ is not equipped with devices for not exceeding the maximum operating pressure. Setting and limiting the admissible operating pressure has to be ensured on the system side.

3. Mechanical project planning

3.1 Installation and disassembly option

For installing and disassembling the pump on or from the drive the accessibility has to be provided for on the system side.

Screws of the property class 8.8 or 10.9 have to be provided for mounting purposes.

3.2 Mounting

On the machine side, the screws have to be accessible in a way that the required tightening torque can be applied. The tightening torque is oriented on the operating conditions and elements involved in the screw connection and has to be specified by the manufacturer when engineering the power unit, the machine, or the plant.

3.3 Required power unit functions

Hydraulic power units should be equipped with the following features at least:

– Tanks, the internal pressure of which corresponds to the ambient pressure in accordance with the design, have to be equipped with breather filters for pressure compensation purposes.

– The hydraulic fluid should be filled in through filling connections with rule out filling with unfiltered hydraulic fluid.

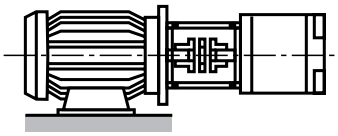
– The ingress of contaminants or moisture into the system must be avoided. When using the pump in a highly contaminated environment, the tank is to be pre-loaded by means of air pressure for this. If external cleansing of the tank is intended or to be expected during the period of use, tank fittings for tubes, lines, or hoses have to be selected ensuring a safe seal against external pressurization with water jet.

3.4 Ambient conditions

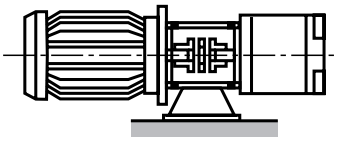
When operating the pump in salt-containing or corrosive environments or when when the pump can be exposed to strongly abrasive substances, it has to be ensured on the system side that the shaft seal and the sealing area of the shaft do not make direct contact with the environment and that the pump is equipped with a suitable corrosion protection.

3.5 Installation positions

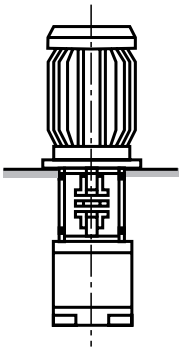
IM B3



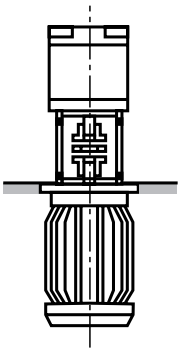
IM B5



IM V1



IM V2



Project planning information

4. Maintenance schedule and operational safety

For safe operation and a long lifetime of the pump a maintenance schedule has to be developed for the power unit, the machine, or the plant. The maintenance schedule has to ensure that the planned or admissible operating conditions of the pump are complied with during the period of use.

In particular, compliance with the following operating parameters has to be ensured:

- The required oil cleanliness
- The operating temperature range
- The level of the hydraulic fluid

Furthermore, the pump and the plant have to be checked for modifications of the following parameters on a regular basis:

- Vibrations
- Noise
- Temperature pump – hydraulic fluid in tank
- Foam formation in the tank
- Leak-proofness
- Operating pressure when using lubrication systems

Modifications of these parameters indicate wear of components (e.g. drive motor, coupling, pump, etc.). The reason has to be determined and remedied immediately.

In order to achieve high operational safety of the pump in the machine or plant we recommend checking the parameters mentioned above continuously and automatically and the automatic shut-down in case of changes exceeding the usual fluctuations in the designed operating range.

Plastic components of drive couplings should be replaced regularly, however, after 5 years at the latest. The corresponding information of the manufacturer is paramount.

For preventive maintenance of the pump we recommend having the seals replaced after an operating period of 5 years at the most by an authorized Bosch Rexroth service company.

5. Accessories

5.1 SAE connection flanges

We recommend selecting the SAE flanges for suction and pressure port according to AB 22-15 (with welded connection) or AB 22-13 (with threaded connection).

5.2 Other accessories

To install the Rexroth PGZ.-1X gerotor pump on electric motors we recommend selecting the pump mounting brackets according to AB 41-20 and torsionally flexible couplings according to AB 33-22.

☞ **Note!**

Please observe the following documentation in addition:

- **Data sheet RE 07008** General information on hydraulic products
- **Data sheet RE 07900** General information on installation, commissioning, and maintenance of hydraulic systems
- **Data sheet RE 90220** General information on hydraulic fluids on mineral oil basis

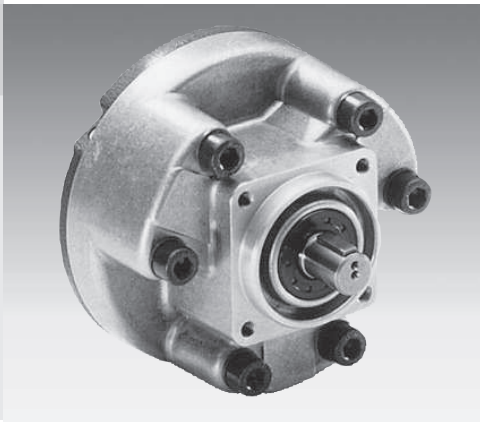
Bosch Rexroth AG
Hydraulics
Zum Eisengießer 1
97816 Lohr am Main, Germany
Phone +49 (0) 93 52 / 18-0
Fax +49 (0) 93 52 / 18-23 58
documentation@boschrexroth.de
www.boschrexroth.de

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Radial piston pump, fixed displacement

RA 11260/08.05 1/8

Model PR4



Sizes 0.40 to 2.00 cm^3 (0.024 to 0.122 in^3)
Component series 1X
Maximum operating pressure 700 bar (10150 PSI)

List of contents

Contents	Page
Ordering code	2
Symbol	2
Function, section	3
Technical data, noise pressure level	4
Characteristic curves	5
Unit dimensions	6
Installation notes	7
Engineering notes	8
Commissioning notes	8

Features

- Self-priming, valve-controlled
- Very low noise
- Long service life due to hydrodynamically lubricated plain bearings
- Very compact design, therefore installation-friendly dimensions
- Can be combined with fixed and variable displacement vane pumps
- Five sizes

Ordering code

PR	4	– 1X /	W		01		01	*

Type of component
Pump, radial = **PR**

Series = **4**

Component series
Component series 10 to 19 = **1X**
(10 to 19: unchanged installation and connection dimensions)

Component size
Component size pressure stage (maximum)
0.40 cm³ (0.024 in³) = **0.40-700**
0.63 cm³ (0.038 in³) = **0.63-700**
1.00 cm³ (0.061 in³) = **1.00-450**
1.60 cm³ (0.098 in³) = **1.60-250**
2.00 cm³ (0.122 in³) = **2.00-175**

Direction of rotation
Clockwise and counter-clockwise rotation = **W**

Note: All five sizes are pumps with 3 pistons!

Shaft version
A = Cylindrical shaft end
G = Splined shaft end for combination with vane pumps

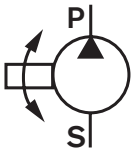
Pipe connection
01 = Pipe thread to ISO 228/1

Seal material
M = NBR seals
V = FKM seals

Number of pressure ports
01 = 1 pressure port

Further details in clear text

Symbol



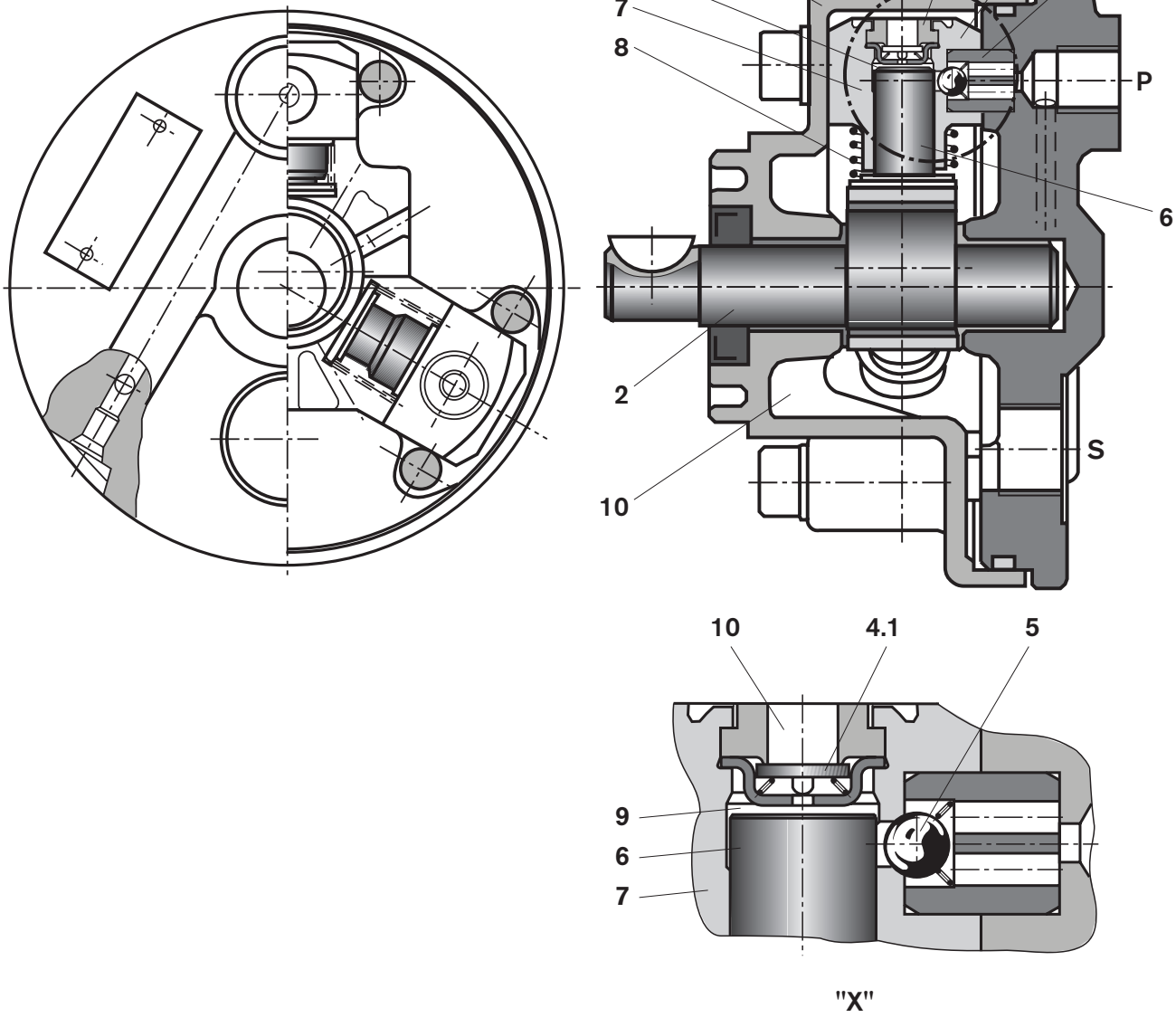
Function, section

These pumps are valve-controlled, self-priming radial piston pumps with fixed displacement.

They basically consist of housing (1), eccentric shaft (2) and pump elements (3), with suction valve (4), pressure valve (5) and piston (6).

Suction and displacement process

Pistons (6) are arranged radially to eccentric shaft (2). Piston (6) is guided in cylinder (7) and pressed by spring (8) onto eccentric (2). During the downward stroke of piston (6), the working chamber (9) in cylinder (7) increases in size. The resulting negative pressure lifts suction valve plate (4.1) from the sealing edge. This opens the connection between suction chamber (10) to working chamber (9). The working chamber fills with fluid. During the upward movement of piston (6), the suction valve closes and pressure valve (5) opens. Fluid can now flow via pressure port (P) to the system.



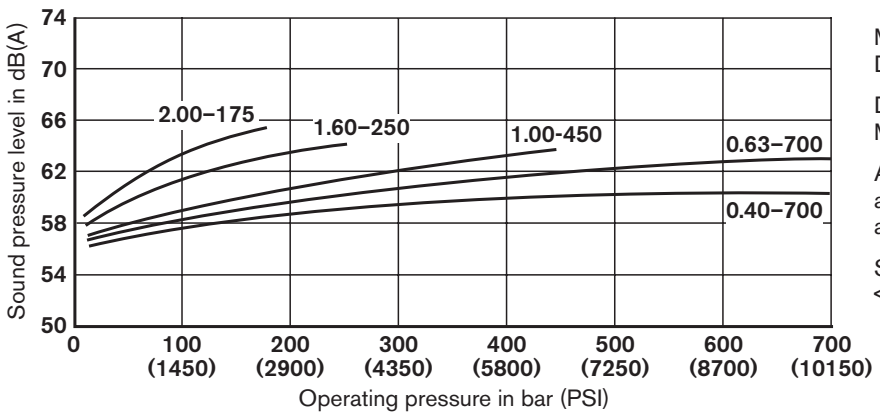
Technical data (for applications outside these parameters, please consult us!)

Speed range		rpm	Size 0.40 1000 to 3400 Size 0.63 1000 to 3000 Size 1.00 1000 to 2000 Size 1.60 1000 to 2000 Size 2.00 1000 to 2000
Operating pressure	Inlet	bar (PSIA)	0.8 to 1.5 absolute (11.6 to 21.7)
	Outlet	bar (PSI)	Size 0.40 700 (10150) Size 0.63 700 (10150) Size 1.00 450 (6525) Size 1.60 250 (3625) Size 2.00 175 (2540)
Max. permissible torque (drive shaft)		Nm (lb-ft)	10 (7.38)
Installation orientation			Size 0.40-700 Horizontal installation: The suction port should be located vertically above the pressure port. This arrangement improves bleeding of the pump. Vertical installation: No restrictions. All other sizes can be installed at any position.
Shaft loading			Radial and axial forces **cannot** be absorbed!
Type of mounting			Face mounting
Pipe connections			Screw-in fittings
Direction of rotation (viewed to shaft end)			Counter-clockwise or clockwise, has no influence on the direction of flow
Hydraulic fluid			HLP mineral oil to DIN 51524 part 2 **Please note the regulations laid down in RE 07075!**
Hydraulic fluid temperature range		°C (°F)	–10 to +70 (14 to 158)
Viscosity range		mm^2/s (SUS)	10 to 200 (46 to 927)
Max. permissible degree of contamination of the hydraulic fluid – cleanliness classes to ISO 4406 (c)			Class 20/18/15 1)
Weight		kg (lbs.)	2.6 (5.73)

1) The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, prolongs the service life of components.

For the selection of filters, see data sheet RE 51144.

Sound pressure level (average value) – measured at $n = 1450$ rpm, $\nu = 41$ mm^2/s (190 SUS) and $\vartheta = 50$ °C (122 °F)



Measured in an anechoic chamber to DIN 45 635, part 26

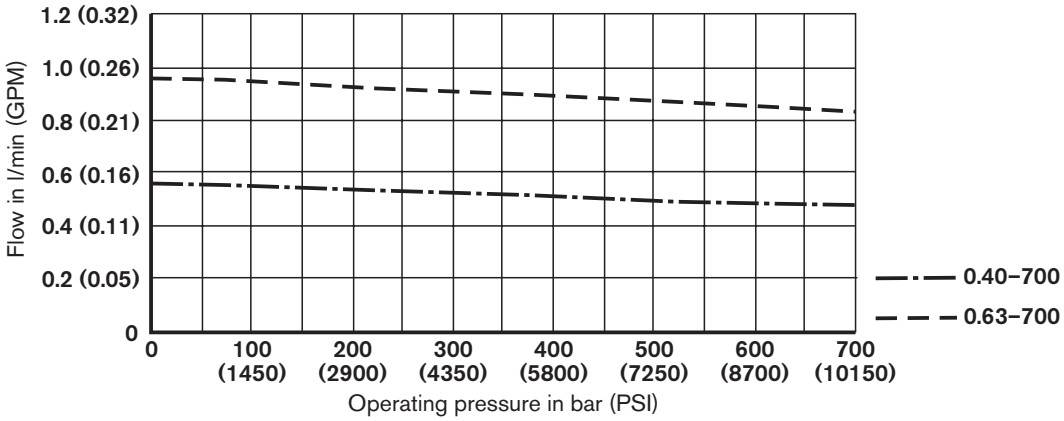
Distance:
Microphone – pump = 1 m (3.28 ft.)

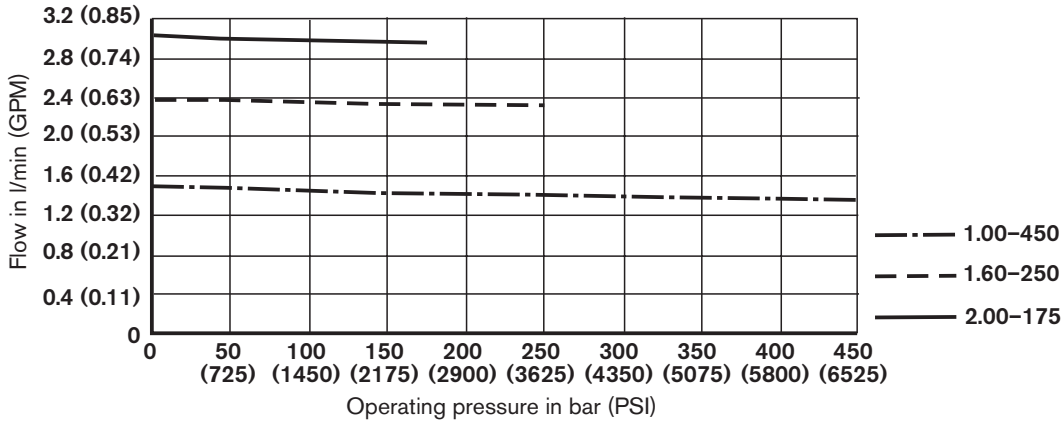
At a system pressure below 4 bar (58 PSI) and a viscosity > 150 mm^2/s (695 SUS), audible valve noise may occur.

Sound pressure level at system pressure < 4 bar (58 PSI): ≤ 58 dB(A)

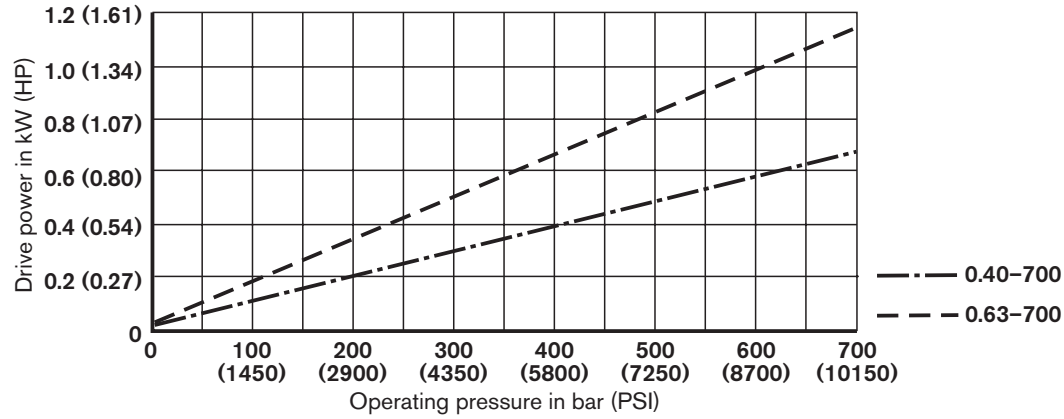
Characteristic curves – measured at $n = 1450$ rpm, $\nu = 41$ mm²/s (190 SUS) and $\vartheta = 50$ °C (122 °F)

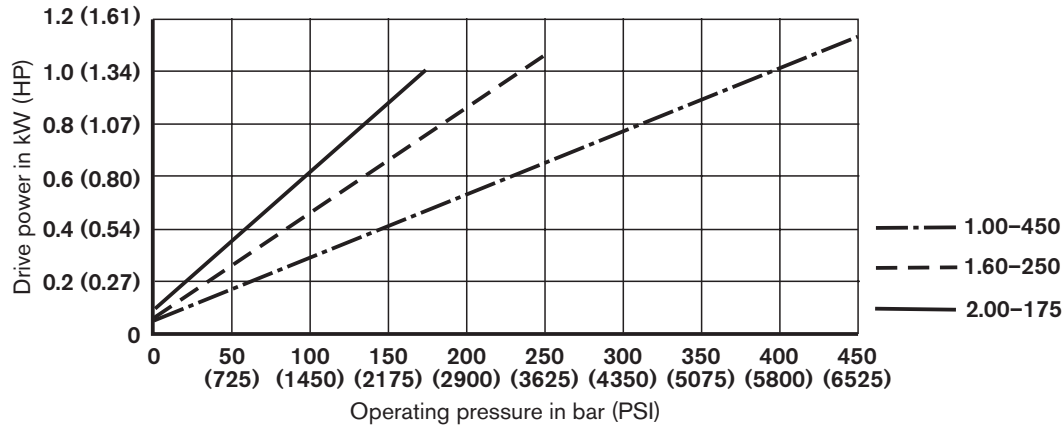
Flow



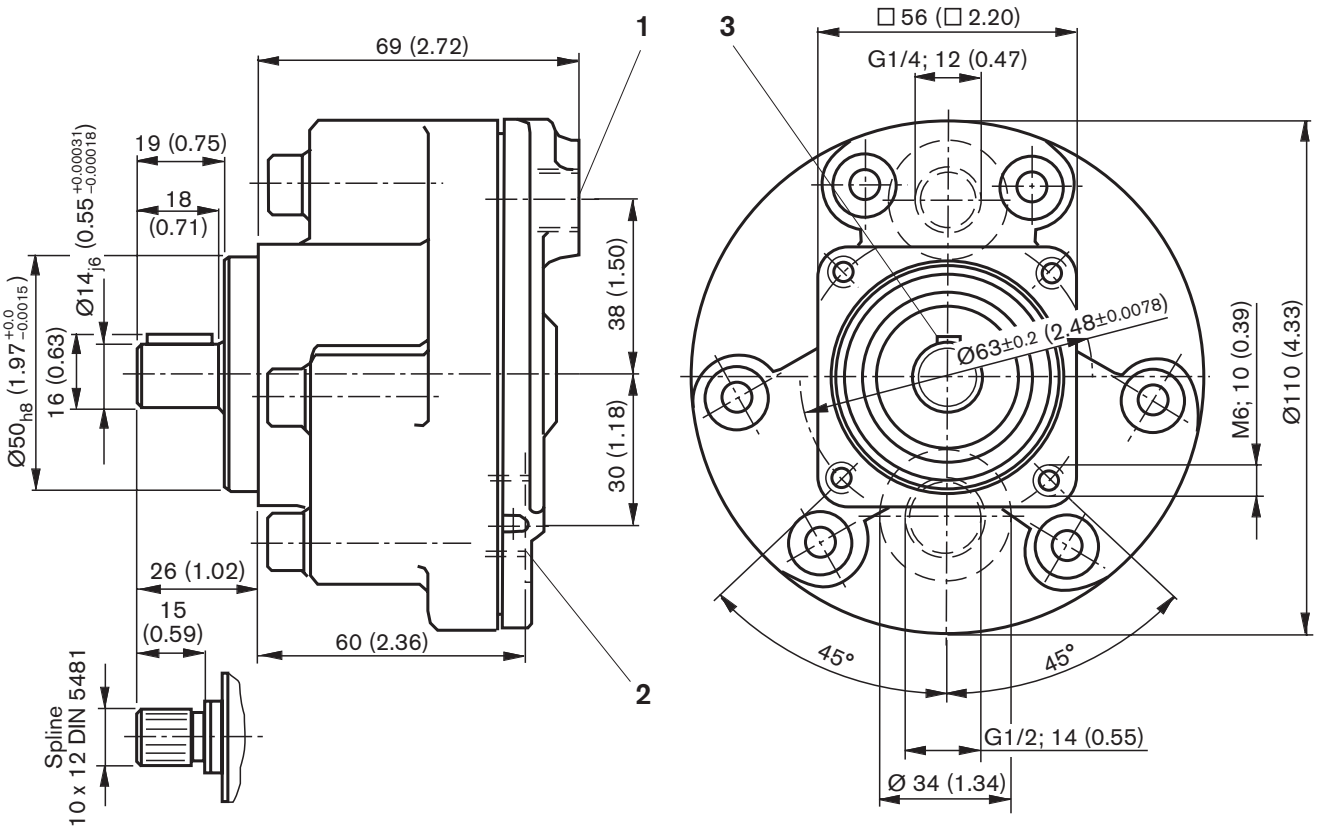


Drive power





Unit dimensions: nominal dimensions in mm (inches)



1 Pressure port P

2 Suction port S

3 Plate spring 5 x 6.5 DIN 6888

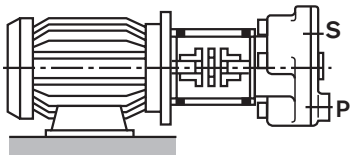
Seal kit (NBR):
Material no. **R900312138**
(valid for all sizes)

Seal kit (FKM)
Material no. **R900313049**
(valid for all sizes)

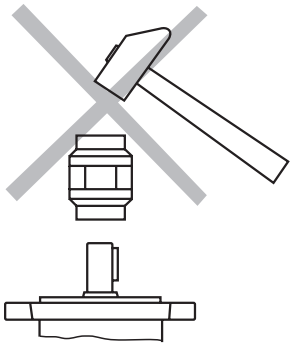
Installation notes

Drive

El. motor + pump mounting bracket + coupling + pump

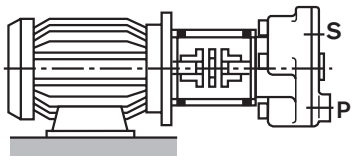


- No radial and axial forces permitted on the pump drive shaft!
- Motor and pump must be exactly aligned!
- Always use a coupling that is suitable for compensating for shaft offsets!
- When installing the coupling, avoid axial forces, that is, **do not hammer or press the coupling onto the shaft!** Use the female thread of the drive shaft!

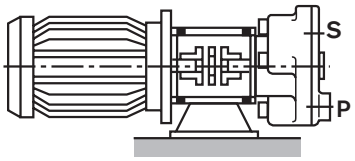


Installation positions

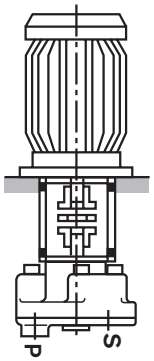
B3



B5



V1



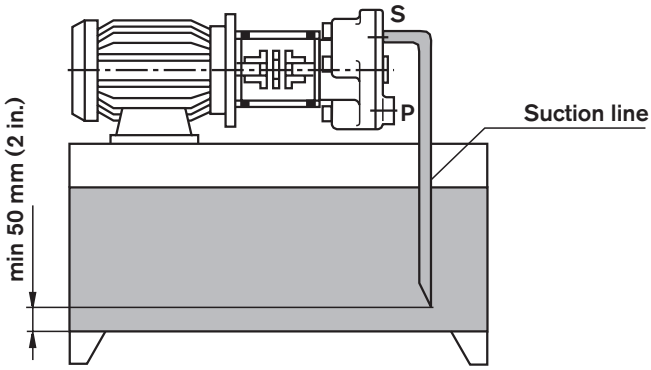
Fluid tank

- Adjust the useful capacity of the tank to the operating conditions
- The permissible fluid temperature must not be exceeded; if required, provide cooler

Lines and connections

- Remove protective plug from pump
- We recommend the use of seamless precision steel pipes according to DIN 2391 and pipe connections that can be loosened
- Select the clear width of pipes according to the connections (suction velocity 1 to 1.5 m/s [3.28 to 4.92 ft/s])
- For inlet pressure, see page 4
- Thoroughly clean pipes and fittings before their installation

Recommendation for piping



- The returning oil must **under no circumstances** be re-aspired directly, i.e. select the largest possible distance between suction and return line
- The return oil outlet must always be immersed in the oil
- Ensure suction-tight installation of the pipes

Filters

- If possible, use return line or pressure filters.
  (Use suction filters only in conjunction with an underpressure switch/clogging indicator)

Hydraulic fluid

- Please observe our regulations according to data sheet RE 07075
- We recommend the use of branded hydraulic oils
- Different oil grades must not be mixed, since this can result in decomposition and deterioration of the lubricating properties
- The fluid must be changed at certain intervals depending on the operating conditions. This involves cleaning of the fluid tank from residues.

Engineering notes

Comprehensive notes and suggestions can be found in The Hydraulic Trainer, Volume 3 RE 00281, “notes on the planning and design of hydraulic systems.”

When using radial piston pumps, the following notes should be observed in particular.

Technical data

All technical data given depend on manufacturing tolerances and are valid in conjunction with certain boundary conditions.

Please note that certain deviations are therefore possible, and that technical data may vary when boundary conditions (e.g. viscosity) change.

Characteristic curves

Characteristic curves for flow and required power.
When dimensioning the drive motor, observe the permissible maximum data.

Noise

The sound pressure level values given on page 4 were measured in line with DIN 45635 part 26. This means that only the noise emitted by the pump is shown. Influences by the surroundings (such as place of installation, piping, etc.) were eliminated. The values always refer to only one pump

Caution!

Due to the power unit design and influences at the final place of installation of the pump, the noise pressure level is usually 5 to 10 dB(A) higher than the value of the pump itself.

Commissioning notes

Bleeding

- All radial piston pumps of type PR4 are self-priming.
- Fill the housing with filtered oil via port S.
- For initial commissioning, set the pump to pressureless circulation. To this end, disconnect the pressure hose and route it to the tank.
- Before initial commissioning, the pump must be bled in order to protect it from damage.
- Switch over to pressureless circulation or route the pressure line or pressure hose back to the tank.
- Briefly switch the pump on (inching mode).
- Should the pump not displace bubble-free oil after approx. 20 seconds, re-check the system. After having reached operating values, check the pipe connections for leakage. Check the operating temperature.
- Take note of the generation of noise.

Commissioning

- Check that the system is properly and correctly installed.
- Start the pump under no-load conditions and let it displace fluid for some seconds at zero pressure to ensure sufficient lubrication.
- In no case may the pump be operated without fluid!

⚠ Important notes

- Adjustments, maintenance and repair of the pump may only be carried out by authorized, trained and instructed personnel!
- Use only genuine Rexroth spare parts!
- The pump may only be operated at the permissible data.
- The pump may only be operated when in perfect condition!
- When carrying out any work on the pump (e.g. installation or removal), the system must be switched off and depressurized!
- Unauthorized conversions or changes that affect safety and function are not permitted!
- Attach protective guards (e.g. coupling protection)!
- Any existing protective guards must not be removed!
- The generally valid safety regulations and regulations for the prevention of accidents must be strictly observed!

Bosch Rexroth Corp.
Industrial Hydraulics
2315 City Line Road
Bethlehem, PA 18017-2131
USA
Telephone (610) 684-8300
Facsimile (610) 694-8467
www.boschrexroth-us.com

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BOSCH

Engineering Data

RADIAL PISTON PUMP

FIXED DISPLACEMENT

MODEL 20L	3000 PSI 1.25 GPM
MODEL 20H	6000 PSI .79 GPM

1800 RPM





SYMBOL

SPECIFICATIONS

PRESSURE RATING — At 1800 RPM

Model 20L: 3000 psi (206.9 bar) maximum continuous pressure.
5000 psi (344.8 bar) maximum intermittent pressure.*
Model 20H: 6000 psi (413.8 bar) maximum continuous pressure.
10000 psi (689.7 bar) maximum intermittent pressure.*

*The pump should not be subjected to the maximum intermittent pressure more than 25% of the duty cycle and not more than 10 minutes per hour. If either the pressure or time exceed the recommended maximum, consult the factory.

FLOW RATE —

Model 20L: 1.25 gpm (4.7 l/min.) at 1800 rpm and 3000 psi (206.9 bar)
Model 20H: .79 gpm (3.0 l/min.) at 1800 rpm and 6000 psi (413.8 bar)

MAXIMUM DRIVE SPEED — 1800 rpm maximum drive speed.

MINIMUM DRIVE SPEED — 100 rpm minimum recommended speed.

OVERHUNG LOADS — Not recommended except under certain conditions. Consult the factory.

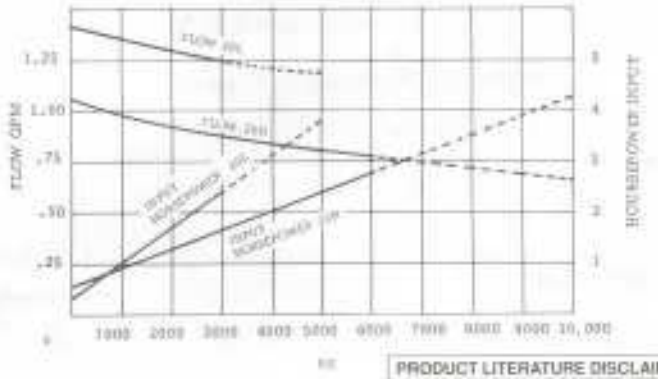
ROTATION — Standard piston pumps will operate in either direction of rotation with outlet flow remaining in the same direction.

PUMP SHAFT DESIGN — Use inline prime movers with flexible coupling alignment within 0.002" (0.05 mm) total indicator reading. The driving end of the pump shaft is splined to receive a special coupling which is furnished with each pump. It is necessary to ream a suitable hole in the drive accessory and press in the splined coupling.

PRIMING — Pump must have a positive head in the suction line and is accomplished by mounting it at least 3 feet (0.9 meters) below the oil level of the reservoir. Maximum inlet pressure for the standard pump is 10 psi (0.7 bar) which is equivalent to a head of 23 feet.

PERFORMANCE CHARACTERISTICS — 1800 RPM —

Dotted line indicates intermittent duty.



For repair parts see Bulletin 16.20.

PRODUCT LITERATURE DISCLAIMER

SPECIFICATIONS AND/OR DIMENSIONS ARE SUBJECT TO CHANGE WITHOUT PRIOR NOTICE. PLEASE CONSULT FACTORY.

SUPERCHARGING — If the pump is supercharged from an external source, a high pressure shaft seal is required and the drain port must be vented to tank. Maximum supercharge pressure is 250 psi (17.2 bar). The supercharge flow rate should be greater than the normal delivery of the pump to assure a positive head but not greater than 5 gpm (18.9 l/min) or the pistons will lift off the cam. To order the high pressure shaft seal, specify the letter "H" before the model number. Example: Model H20L.

FLUID RECOMMENDATIONS — Premium grade hydraulic fluid with 100 to 250 SUS (21 to 54 cSt) viscosity at operating temperature. Maximum allowable viscosity for cold start-up is 750 SUS (162 cSt). Minimum allowable viscosity is 60 SUS (10 cSt). For detailed fluid information refer to Racine publication S-106, "Petroleum Hydraulic Fluids".

SEALS — This pump may be used with phosphate ester fluids when equipped with proper seals. Water base fluids are not recommended. When ordering for use with phosphate ester fluids, specify "F2" after the model number. Example: Model 20L-F2. For additional information refer to Racine publication S-107, "Fire Resistant Fluids".

ISO-FLO — Available as standard:

Number of Outlets	Number of Pistons Per Outlet
2	1 Piston 6 Piston
7	1 Piston

Consult the factory for ISO-FLO combinations not shown.

TEMPERATURE — Under normal conditions of continuous operation, fluid temperature should not exceed 130°F (54°C). In no instance should the temperature exceed 160°F (71°C).

FILTRATION — 140 micrometre inlet filtration is recommended. Consult the factory for suggested types of both inlet and return the filtration for increased component life.

MOUNTING POSITION — Not restricted.

WEIGHT (Approx.) — Standard pump — 14.5 lbs. (6.6 kg)
Add for foot-mounting bracket — 4.7 lbs. (2.1 kg)

PERFORMANCE CHARACTERISTICS AT 1800 RPM

Delivery — GPM

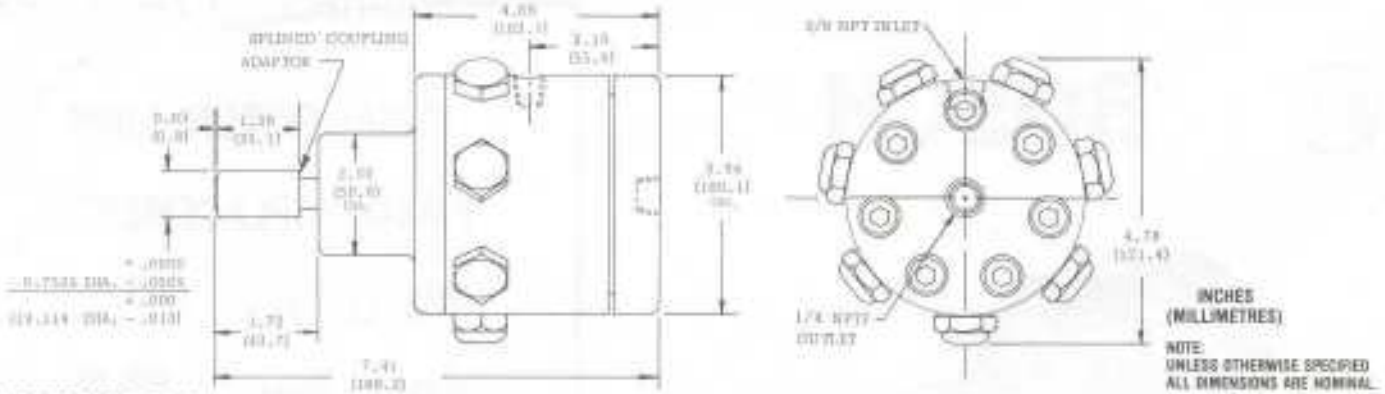
PUMP	0 PSI	1000 PSI	2000 PSI	3000 PSI	4000 PSI	5000 PSI	6000 PSI	7000 PSI	8000 PSI	9000 PSI	10,000 PSI
20L	1.4	1.35	1.3	1.25	1.22*	1.20*	—	—	—	—	—
20H	1.05	.98	.92	.89	.86	.83	.79	.75*	.73*	.70*	.67*

Horsepower Input

20L	.2	1.0	1.7	2.5	3.1*	3.8*	—	—	—	—	—
20H	.5	.9	1.2	1.7	2.0	2.4	2.8	3.1*	3.5*	3.9*	4.2*

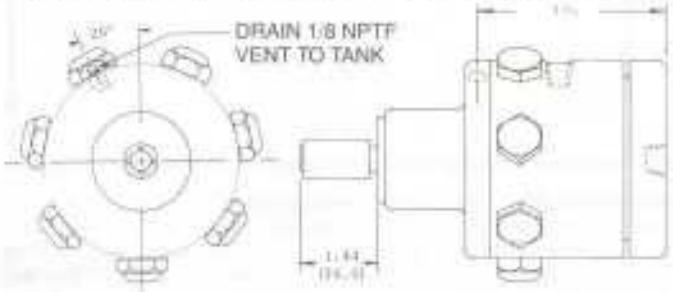
*Intermittent duty only.

DIMENSIONAL DATA



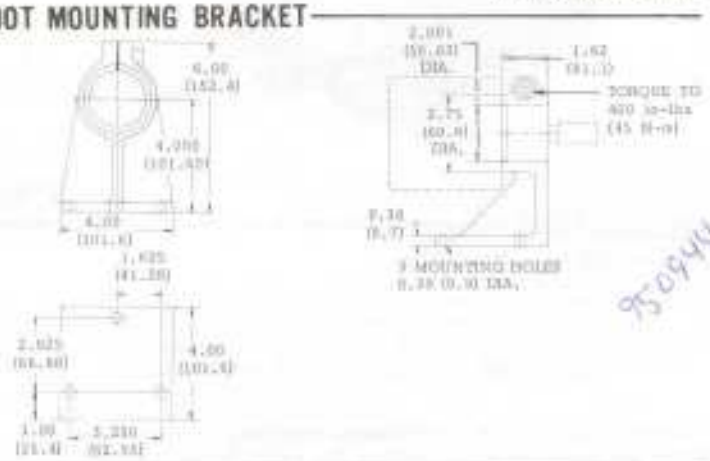
HIGH PRESSURE SEAL

DRAIN 1/8 NPTF MUST BE VENTED TO TANK BELOW FLUID LEVEL



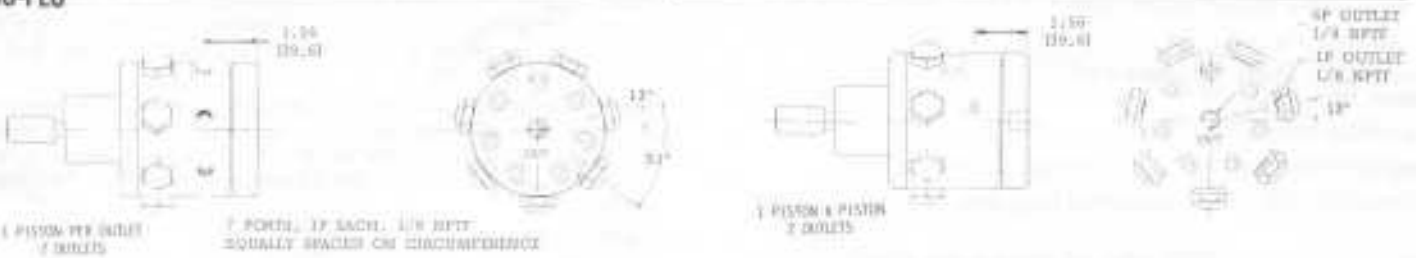
Model 20 pump with a high pressure shaft seal for pressure priming. Specify "H" before model number when ordering. See the "How to Order" section.

FOOT MOUNTING BRACKET



95 0944

ISO-FLO



To obtain ISO-FLO single piston delivery in a model 20 pump, divide the total delivery at desired pressure by the total number of pistons (seven).

Example: Single piston flow output in gpm at 4000 psi (275.9 bar; 27,590 kPa) delivered by a 20H pump.

$\frac{.86\ \text{GPM}}{7} = .123\ \text{GPM}$

$\frac{3.3\ \text{l/min.}}{7} = 0.47\ \text{l/min.}$

HOW TO ORDER

*ISO-FLO

H2OH-F2-2/0-1P-6P

*H — HIGH PRESSURE SHAFT SEAL FOR PRESSURE PRIMING

*F2 — SPECIFY FOR VITON SEALS

L — 1.25 GPM — 3000 PSI MAXIMUM
H — 0.79 GPM — 6000 PSI MAXIMUM

Foot mounting brackets are furnished by Racine but must be specified in addition to the model number of the unit selected.

Example: (1) H20L Pump
(2) PF2-10S Foot mounting bracket

When foot mounting bracket is not used, any other style of bracket that will clamp around the cylindrical projection of the shaft end cover plate may be substituted.

*These items are optional extras and should be specified by code only when desired. Consult factory for assistance when ordering ISO-FLO modifications.

~~9 535 235 085~~
HPUS AKY 002/10 US (4.94)

ROBERT BOSCH FLUID POWER CORPORATION
P.O. BOX 2025
RACINE, WISCONSIN 53401-2025 U.S.A.
Phone (414)554-7100, Fax (414)554-7117

9 535 233 081

BOSCH

Printed in USA

BOSCH

Engineering Data

RADIAL PISTON PUMP

FIXED DISPLACEMENT

MODEL E055

3000 PSI
.29 GPM

1800 RPM





SYMBOL

SPECIFICATIONS

PRESSURE RATING — At 1800 rpm
3000 psi (206.9 bar) maximum continuous pressure.
5000 psi (344.8 bar) maximum intermittent pressure.*

*The pump should not be subjected to the maximum intermittent pressure more than 25% of the duty cycle and not more than 10 minutes per hour. If either the pressure or time exceed the recommended maximum, consult the factory.

FLOW RATE — Model E055 pump at 1800 rpm and 3000 psi (206.9 bar) will deliver .29 gpm (1.1 l/min).

MAXIMUM DRIVE SPEED — 1800 rpm maximum drive speed.

MINIMUM DRIVE SPEED — 100 rpm minimum recommended speed.

OVERHUNG LOADS — Not recommended except under certain conditions. Consult the factory.

ROTATION — Standard piston pumps will operate in either direction of rotation with outlet flow remaining in the same direction.

PUMP SHAFT DESIGN — Use inline prime movers with flexible coupling alignment within 0.002" (0.5 mm) total indicator reading. The driving end of the pump shaft is flatted.

PRIMING — Pump must have a positive head in the suction line and is accomplished by mounting it at least 3 feet (0.9 meters) below the oil level of the reservoir. Maximum inlet pressure for the standard pump is 10 psi (0.7 bar) which is equivalent to a head of 23 feet.

PRODUCT LITERATURE DISCLAIMER

SPECIFICATIONS AND/OR DIMENSIONS ARE SUBJECT TO CHANGE WITHOUT PRIOR NOTICE. PLEASE CONSULT FACTORY.

SUPERCHARGING — If the pump is supercharged from an external source, a high pressure shaft seal is required and the drain port must be vented to tank. Maximum supercharge pressure is 250 psi (17.2 bar). The supercharge flow rate should be greater than the normal delivery of the pump to assure a positive head but not greater than 1.5 gpm (5.7 l/min) or the pistons will lift off the cam. To order the high pressure shaft seal, specify the letter "H" before the model number. Example: Model HE055.

FLUID RECOMMENDATIONS — Premium grade hydraulic fluid with 100 to 250 SUS (21 to 54 cSt) viscosity at operating temperature. Maximum allowable viscosity for cold start-up is 750 SUS (162 cSt). Minimum allowable viscosity is 60 SUS (10 cSt). For detailed fluid information refer to Racine publication S-106, "Petroleum Hydraulic Fluids."

SEALS — This pump may be used with phosphate ester fluids when equipped with proper seals. Water base fluids are not recommended. When ordering for use with phosphate ester fluids, specify "F2" after the model number. Example: Model E055-F2. For additional information refer to Racine publication S-107, "Fire Resistant Fluids."

ISO-FLO — Available with 2 outlets, 1 piston each outlet.

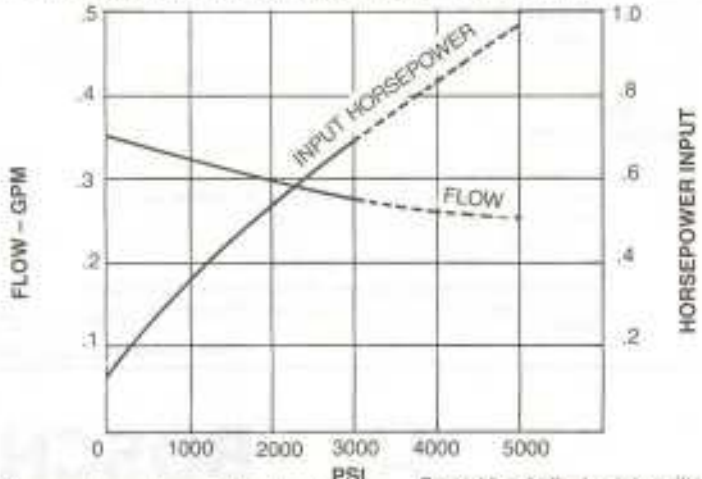
TEMPERATURE — Under normal conditions of continuous operation, fluid temperature should not exceed 130°F (54°C). In no instance should the temperature exceed 160°F (71°C).

FILTRATION — 149 micrometre inlet filtration is recommended. Consult the factory for suggested types of both inlet and return line filtration for increased component life.

MOUNTING POSITION — Not restricted.

WEIGHT (Approx.) — Standard pump — 9.5 lbs. (4.3 kg).
Add for foot-mounting bracket — 4.7 lbs. (2.1 kg).

PERFORMANCE CHARACTERISTICS — 1800 RPM



Dotted line indicates intermittent duty.

PERFORMANCE CHARACTERISTICS AT 1800 RPM

Delivery — GPM

0 PSI	1000 PSI	2000 PSI	3000 PSI	4000 PSI	5000 PSI
.35	.32	.30	.29	.28*	.27*

Horsepower Input

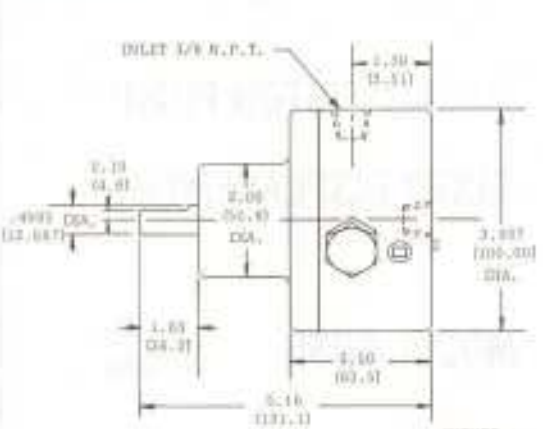
.15	.35	.55	.70	.85*	.98*

*Intermittent duty only.

DATA SHOWN IS CHARACTERISTIC WITH OIL VISCOSITY OF 130 SSU AT 120° F. AND 1750 RPM

For repair parts see Bulletin 16.10.

DIMENSIONAL DATA



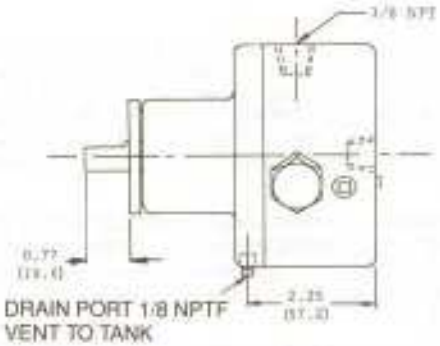
INCHES
(MILLIMETRES)

NOTE:
UNLESS OTHERWISE SPECIFIED
ALL DIMENSIONS ARE NOMINAL

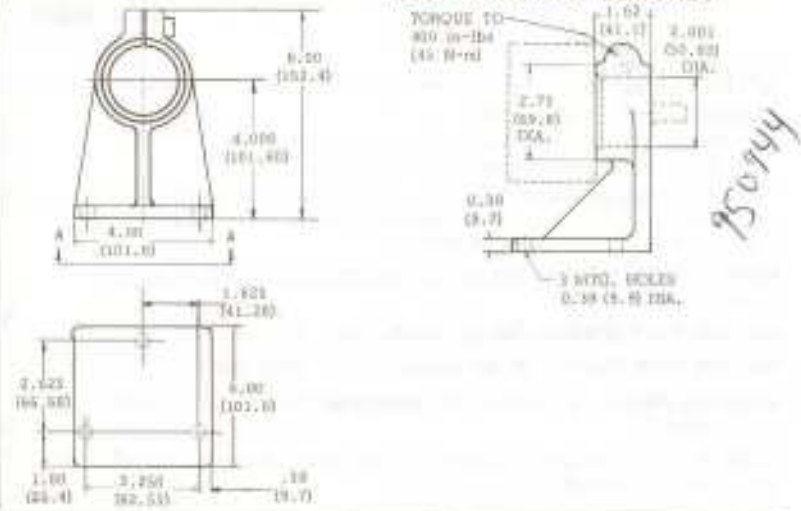
ISO-FLO

When ordering the ISO-FLO option, refer to the "How to Order" section for correct coding.

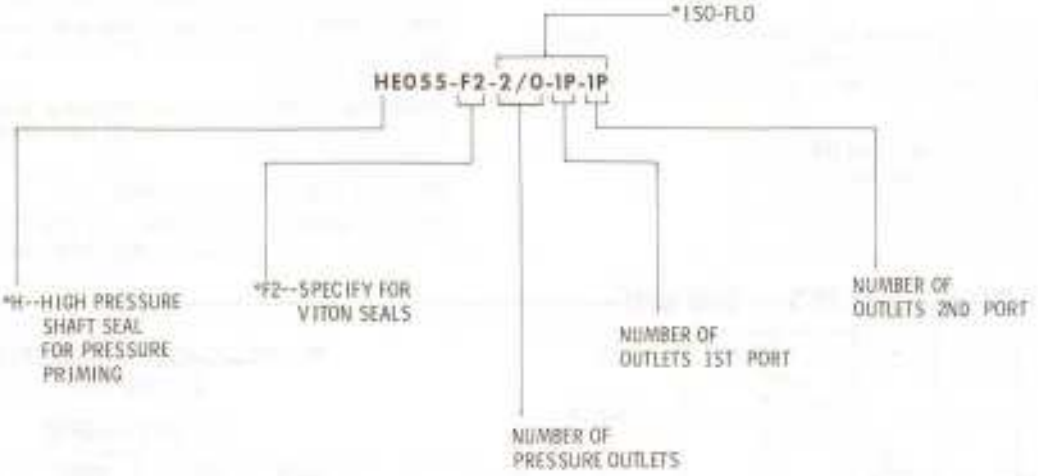
HIGH PRESSURE SEAL



FOOT MOUNTING BRACKET



HOW TO ORDER



*THESE ITEMS ARE OPTIONAL EXTRAS AND SHOULD BE SPECIFIED BY CODE ONLY WHEN DESIRED.

Foot mounting brackets are furnished by Racine but must be specified in addition to the model number of the unit selected.

Example: (1) E055 pump
(1) P52-005 foot mounting bracket

When foot mounting bracket is not used, any style of bracket that will clamp around the cylindrical projection of the shaft end cover plate may be substituted.

9 535 233 080
HPUS AKY 002/9 US (2.96)

ROBERT BOSCH FLUID POWER CORPORATION
P.O. BOX 2025
RACINE, WISCONSIN 53401-2025 U.S.A.
Phone (414)554-7100, Fax (414)554-7117

Printed in USA

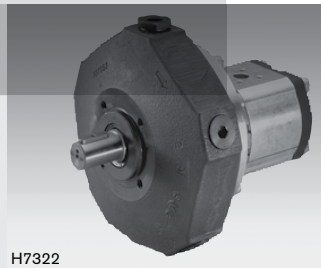
BOSCH

Rexroth
Bosch Group

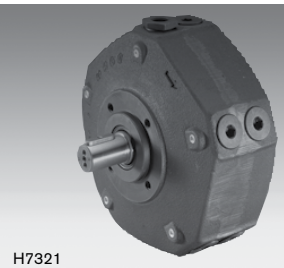
Fixed displacement radial piston pump

RA 11263/10.05
Replaces: 03.95

Model PR4


H7322

P2R4-3X/4.00-700RK01M01+AZPF8


H7321

PR4-3X/16.00-500RA01M01

Sizes 1.60 to 20.00 cm^3 (0.10 to 1.22 in^3)
Component series 3X
Maximum operating pressure 700 bar (1015 PSI)

Table of contents

Contents	Page
Ordering code for PR4	2
Function, section, symbol	3
Design variants for multi-circuit pumps	4
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Flow and drive power	6
Characteristic curves	7
Unit dimensions	8 and 9
Seal kits	10
Multiple pumps	11 to 14
Ordering code for P2R4 and P3R4	11
Notes on the engineering of multiple pumps	12
Unit dimensions	13 and 14
Installation notes	15
Engineering notes	16
Commissioning note	16

Features

- Self-priming, valve-controlled
- 11 sizes available for optimum pump selection
- Long service life due to hydrodynamically lubricated sliding bearings
- Several pressure ports with various cylinder combinations

Ordering code

PR	4	−3X/	R					*

Type of device = PR

Series = 4

Component series
Component series 30 to 39 = **3X**
(30 to 39: unchanged installation and connection dimensions)

Component size
Component size - pressure stage (maximum)

1.51 cm³ (0.09 in³)	(3)	**= 1.60-700**
2.14 cm³ (0.13 in³)	(3)	**= 2.00-700**
2.59 cm³ (0.16 in³)	(3)	**= 2.50-700**
3.57 cm³ (0.22 in³)	(5)	**= 3.15-700**
4.32 cm³ (0.26 in³)	(5)	**= 4.00-700**
7.14 cm³ (0.44 in³)	(10)	**= 6.30-700** [1]
8.63 cm³ (0.53 in³)	(10)	**= 8.00-700** [2]
3.39 cm³ (0.21 in³)	(3)	**= 3.15-500**
4.82 cm³ (0.29 in³)	(3)	**= 5.00-500**
5.83 cm³ (0.36 in³)	(3)	**= 6.30-500**
8.03 cm³ (0.49 in³)	(5)	**= 8.00-500**
9.71 cm³ (0.59 in³)	(5)	**= 10.00-500**
16.07 cm³ (0.98 in³)	(10)	**= 16.00-500** [1]
19.43 cm³ (1.19 in³)	(10)	**= 20.00-500** [2]

Direction of rotation
Clockwise rotation **= R**

Shaft version
A = Cylindrical shaft end
G = Serrated shaft 21x24 to DIN 5481
K = Cylindriical shaft with output for mounting an AZPF or AZPFF

Line connection
01 = BSP thread to ISO 228/1
12 = SAE thread to ANSI B1.1

Seal material
M = NBR seals
V = FKM seals

Number of pressure ports

Code	Number of pressure ports	Combination of cylinders		
		Radial piston pump with		
		3 pistons	5 pistons	10 pistons
01 =	1	3	5	10
02 =	2	1+2		5+5
03 =	3	1+1+1		
08 =	5		1+1+1+1+1	2+2+2+2+2
11 =	6			2+2+2+2+1+1
12 =	10			10x1

Further details in clear text

[1] not available with shaft end (versions “G“ and „K“)

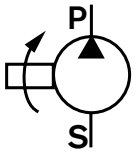
[2] not available with shaft end (version “K“)

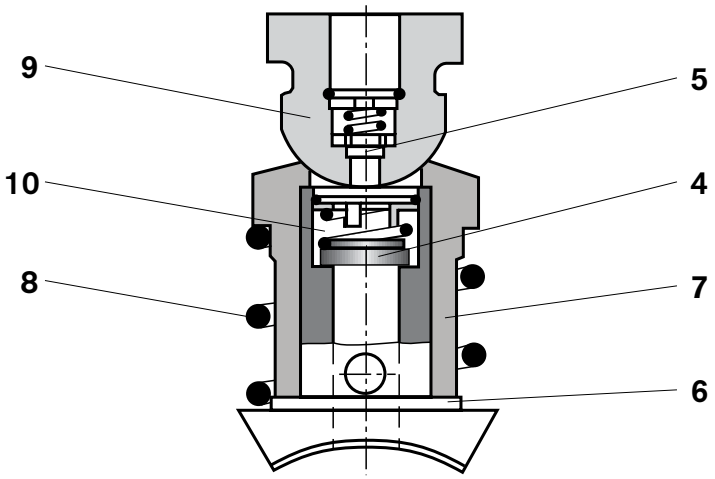
Function, section, symbol

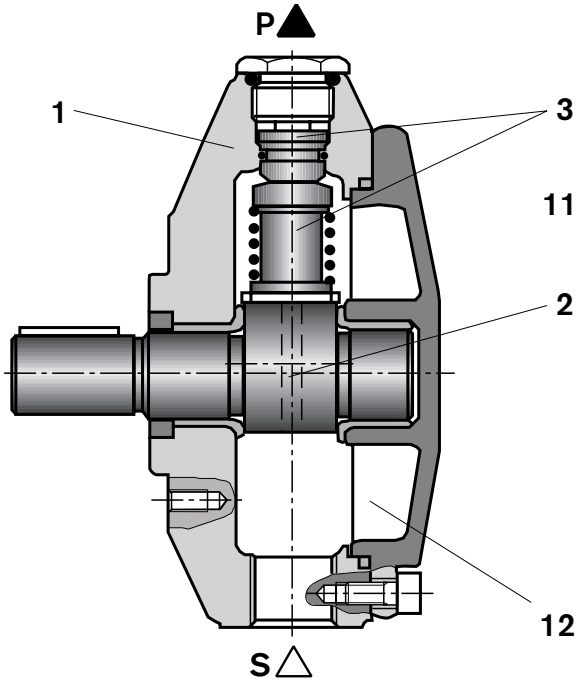
Hydraulic pumps of type PR4 are valve-controlled, self-priming radial piston pumps with fixed displacement.
Radial piston pump type PR4 mainly consists of the housing (1), eccentric shaft (2) and 3, 5 or 10 pumping elements (3) with suction valve (4), pressure valve (5) and piston (6).

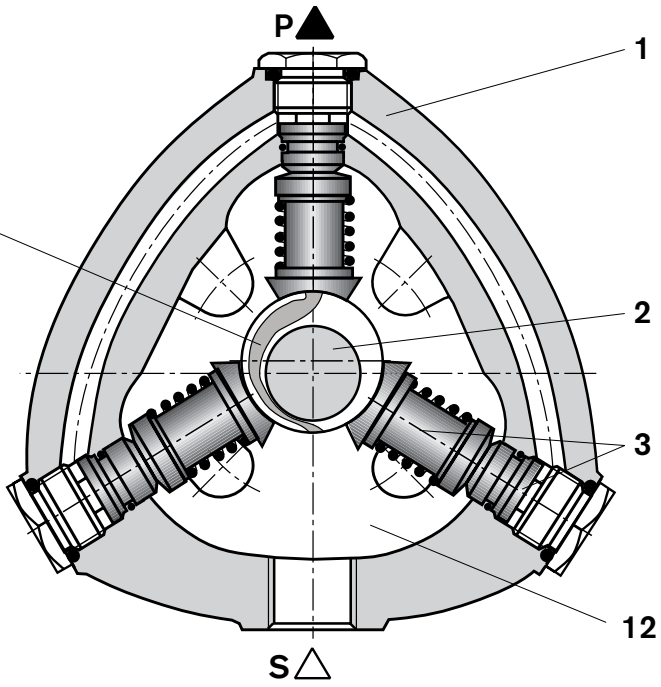
Suction and displacement process

The pistons (6) are arranged radially to the eccentric shaft (2). The hollow piston (6) with suction valve (4) is guided in a cylinder (7) and pressed by a spring (8) onto the eccentric shaft (2). The radius of the piston running face corresponds to the radius of the eccentric shaft. The cylinder (7) seals against a semi-spherical element (9).
As the piston (6) moves downwards, the working chamber (10) enlarges in cylinder (7). The ensuing negative pressure causes the suction valve plate to lift off the sealing edge. At the same time, the connection from suction chamber (12) to working chamber (10) is opened via a radial groove (11) in the eccentric shaft (2).
The working chamber fills with fluid. As the piston (6) moves upwards, suction valve (4) closes and pressure valve (5) opens. The fluid now flows via pressure port (P) into the system.



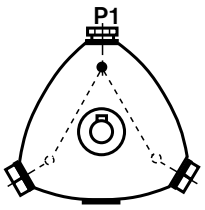
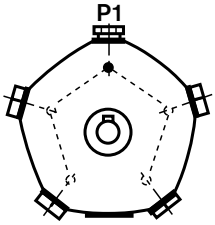
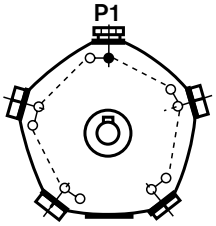
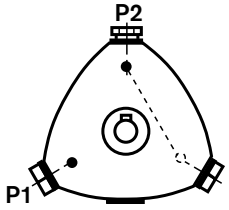
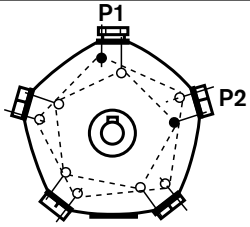
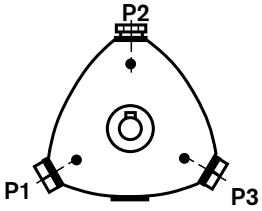
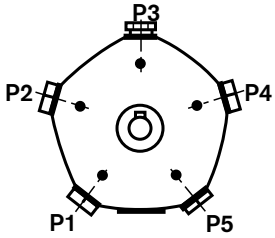
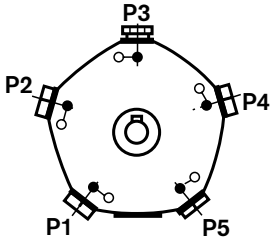
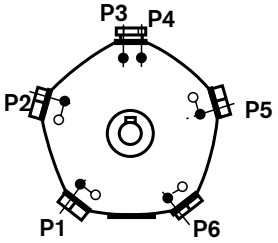
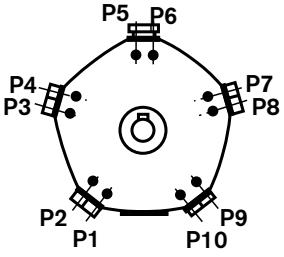






Design options for multi-circuit pumps

The following can be seen from the schematic diagrams below:
– The number and position of pressure ports,
– which cylinders are interconnected.
The dots indicate the cylinders that are connected directly to the pressurised pressure port.
The circles indicate the cylinders that are not connected directly to the pressurised pressure port.
The dotted and chain-dotted lines show, which cylinders are interconnected.
The pressurised pressure ports are numbered clockwise.
The pressure port, which - in the clockwise direction - is closest to the suction port, is identified with "P1".

Code	Number of pressure ports	Combination of cylinders		
		3 pistons	5 pistons	10 pistons
01	1			
02	2			
03	3			
08	5			
11	6			
12	10			

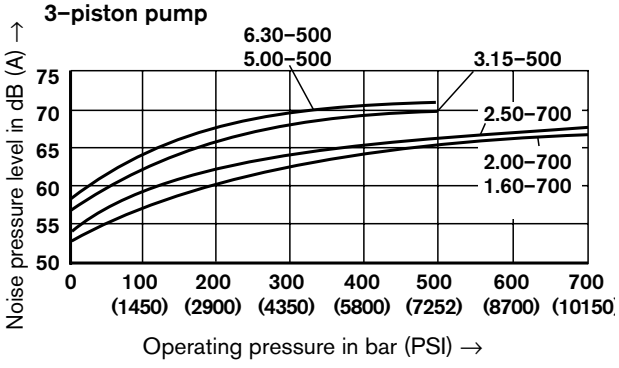
Technical data (for applications outside these parameters, please consult us!)

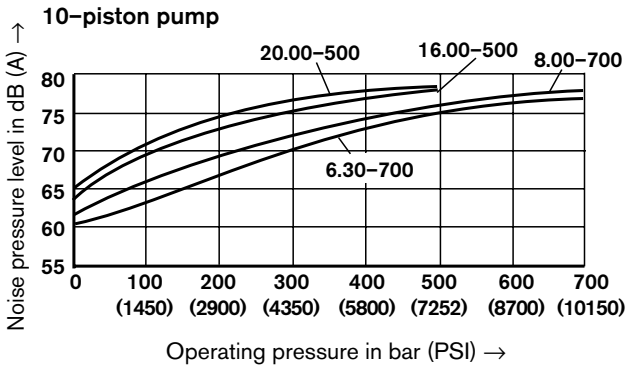
Speed range			RPM	1000 to 2000	
Operating pressure	Inlet		bar (PSIA)	0.8 to 2.5 (11.6 to 36.3) absolute	
		Cylinder ID	mm (inches)	Ø 10 (0.39)	Ø 15 (0.59)
	Outlet		bar (PSI)	700 (10,150)	500 (7252)
Max. permissible torque (drive shaft)			Nm (lb-ft)	160 (118)	
Installation position				Optional	
Shaft loading				Radial and axial forces **cannot** be absorbed	
Type of mounting				Face mounting	
Line connections				Screw-in fittings	
Direction of rotation (viewed to shaft end)				Clockwise	
Hydraulic fluid				HLP mineral oil to DIN 51524 part 2 **Please observe the regulations according to RE 07075!**	
Hydraulic fluid temperature range			°C (°F)	–10 to +70 (+14 to +158)	
Viscosity range			mm²/s (SUS)	10 to 200 (46 to 927)	
Max. permissible degree of contamination of the hydraulic fluid - cleanliness classes to ISO 4406 (c)				Class 20/18/15 [1]	
				3 pistons	5 pistons	10 pistons
Weight			kg (lb)	9.2 (20.3)	12.4 (27.3)	16.4 (36.1)

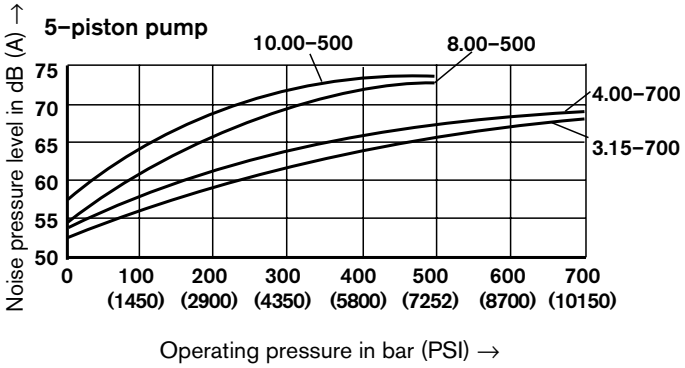
[1] The cleanliness classes specified for components must be adhered to in hydraulic systems. Effective filtration prevents malfunction and, at the same time, prolongs the service life of the components. For the selection of filters, see data sheet RE 51144.

Noise pressure level (average value) - measured at $n = 1450$ RPM, $\nu = 41$ mm²/s (190 SUS) and $\vartheta = 50$ °C (122 °F)

The characteristic curves are not valid for multi-circuit variants.







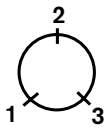
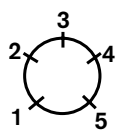
Measured in the anechoic chamber according to DIN 45635, part 26, distance from pump to microphone = 1 m (3 ft)

Flow and drive power (average value): referred to 1 cylinder ($n = 1450$ RPM)

Cylinder ID in mm	Stroke in mm	V_{geom} in cm³		Operating pressure p in bar													
				50	100	150	200	250	300	350	400	450	500	550	600	650	700
10	6.4	0.509	$q_{V.eff}$ L/min	0.71	0.7	0.69	0.69	0.69	0.685	0.68	0.68	0.675	0.67	0.67	0.665	0.66	0.66
			$q_{V.eff}$ (GPM)	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)
			P_a kW	0.093	0.164	0.231	0.29	0.358	0.42	0.481	0.54	0.605	0.67	0.739	0.81	0.888	0.97
			P_a (HP)	(0.12)	(0.22)	(0.31)	(0.39)	(0.48)	(0.56)	(0.65)	(0.72)	(0.81)	(0.90)	(0.99)	(1.09)	(1.19)	(1.30)
10	9.1	0.714	$q_{V.eff}$ L/min	1.02	1.01	1.0	0.995	0.99	0.985	0.98	0.975	0.97	0.965	0.96	0.955	0.95	0.94
			$q_{V.eff}$ (GPM)	(0.27)	(0.27)	(0.26)	(0.26)	(0.26)	(0.26)	(0.26)	(0.26)	(0.26)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)
			P_a kW	0.129	0.23	0.328	0.41	0.503	0.58	0.677	0.77	0.856	0.94	1.046	1.16	1.257	1.36
			P_a (HP)	(0.17)	(0.31)	(0.44)	(0.55)	(0.67)	(0.78)	(0.91)	(1.03)	(1.15)	(1.26)	(1.40)	(1.56)	(1.69)	(1.82)
10	11.0	0.864	$q_{V.eff}$ L/min	1.22	1.21	1.205	1.2	1.195	1.19	1.184	1.18	1.174	1.17	1.163	1.157	1.147	1.14
			$q_{V.eff}$ (GPM)	(0.32)	(0.32)	(0.32)	(0.32)	(0.32)	(0.31)	(0.31)	(0.31)	(0.31)	(0.31)	(0.31)	(0.31)	(0.30)	(0.30)
			P_a kW	0.15	0.275	0.392	0.49	0.594	0.7	0.804	0.91	1.018	1.13	1.244	1.37	1.486	1.61
			P_a (HP)	(0.20)	(0.37)	(0.53)	(0.66)	(0.80)	(0.94)	(1.08)	(1.22)	(1.37)	(1.51)	(1.67)	(1.84)	(1.99)	(2.16)
15	6.4	1.13	$q_{V.eff}$ L/min	1.6	1.59	1.58	1.567	1.56	1.556	1.546	1.54	1.53	1.523				
			$q_{V.eff}$ (GPM)	(0.42)	(0.42)	(0.42)	(0.41)	(0.41)	(0.41)	(0.41)	(0.41)	(0.40)	(0.40)				
			P_a kW	0.213	0.4	0.547	0.7	0.85	1.0	1.14	1.27	1.433	1.566				
			P_a (HP)	(0.29)	(0.54)	(0.73)	(0.94)	(1.14)	(1.34)	(1.53)	(1.70)	(1.92)	(2.10)				
15	9.1	1.61	$q_{V.eff}$ L/min	2.28	2.26	2.25	2.24	2.23	2.22	2.20	2.19	2.18	2.17				
			$q_{V.eff}$ (GPM)	(0.60)	(0.60)	(0.59)	(0.59)	(0.59)	(0.59)	(0.58)	(0.58)	(0.58)	(0.57)				
			P_a kW	0.27	0.49	0.71	0.91	1.11	1.31	1.51	1.7	1.91	2.12				
			P_a (HP)	(0.36)	(0.66)	(0.95)	(1.22)	(1.49)	(1.76)	(2.03)	(2.28)	(2.56)	(2.84)				
15	11.0	1.94	$q_{V.eff}$ L/min	2.74	2.73	2.71	2.7	2.68	2.67	2.65	2.64	2.62	2.6				
			$q_{V.eff}$ (GPM)	(0.72)	(0.72)	(0.72)	(0.71)	(0.71)	(0.71)	(0.70)	(0.69)	(0.69)	(0.69)				
			P_a kW	0.32	0.57	0.826	1.06	1.31	1.55	1.8	2.05	2.29	2.53				
			P_a (HP)	(0.43)	(0.76)	(1.11)	(1.42)	(1.76)	(2.08)	(2.41)	(2.75)	(3.07)	(3.39)				

Factor "*f*" for uneven running at $n = 1450$ min^{-1}

The values given in the table "flow and drive power" refer to only 1 cylinder. In order to determine the required drive power, the value must be multiplied by the number of cylinders.
At the same time, the uneven running factor "*f*" must be applied.

Radial piston pump			
3 cylinders		5 or 10 cylinders	
Cylinders under load	Factor *f*	Cylinders under load	Factor *f*
1	3.13	1	3.13
		1+2	1.89
1+2	1.57	1+3	1.57
		1+2+3	1.60
		1+3+4	1.35
		1+2+3+4	1.30
1+2+3	1.00	1+2+3+4+5	1.00
			

For pumps with 10 cylinders, 2 cylinders each are connected to a pressure port.

Example

Pump PR4–3X/1,60-700/RA01M02

Ports 1 and 2 are connected together and loaded to 450 bar, 3 is circulating at zero pressure.

$P_a = 2 \times 0.605$ kW $= 1.21$ kW

$f = 1.57$

$P_{erf} = 1.21$ kW x $1.57 = 1.90$ kW

Port 3 loaded to 300 bar,
1 and 2 circulating at zero pressure.

$P_a = 0.42$ kW

$f = 3.13$

$P_{erf} = 0.42$ kW x $3.13 = 1.31$ kW

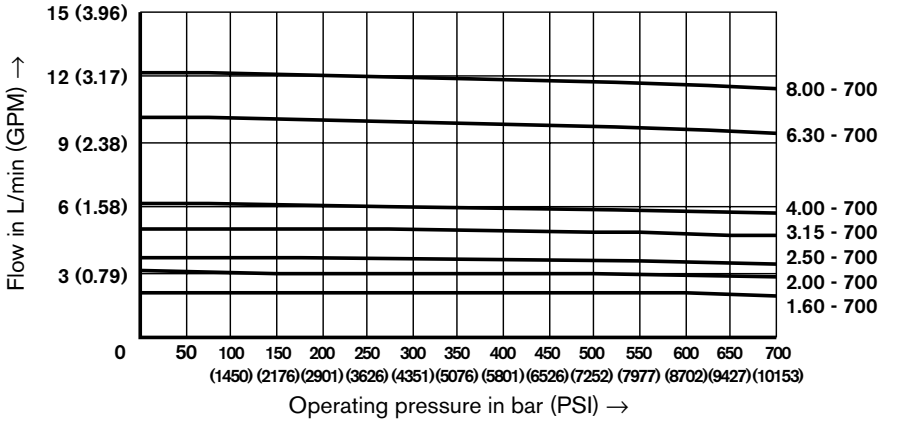
Ports 1, 2 and 3 loaded to 200 bar.

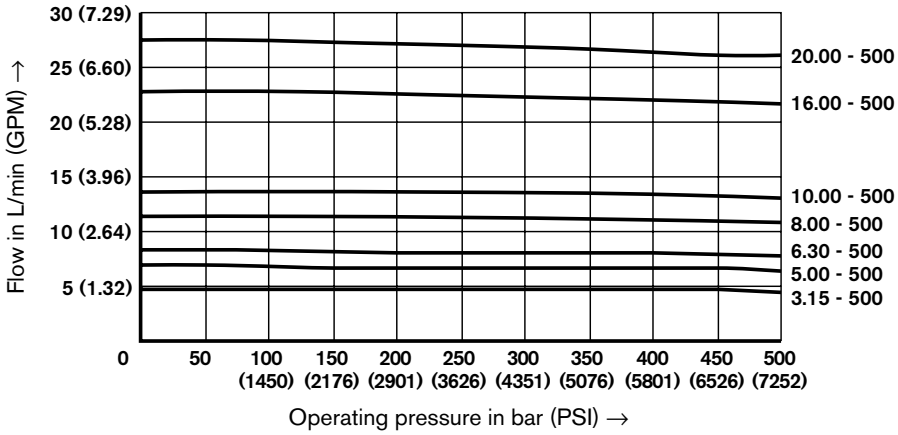
$P_a = 3 \times 0.29$ kW $= 0.87$ kW

$P_{erf} = 0.87$ kW x $1.0 = 0.87$ kW

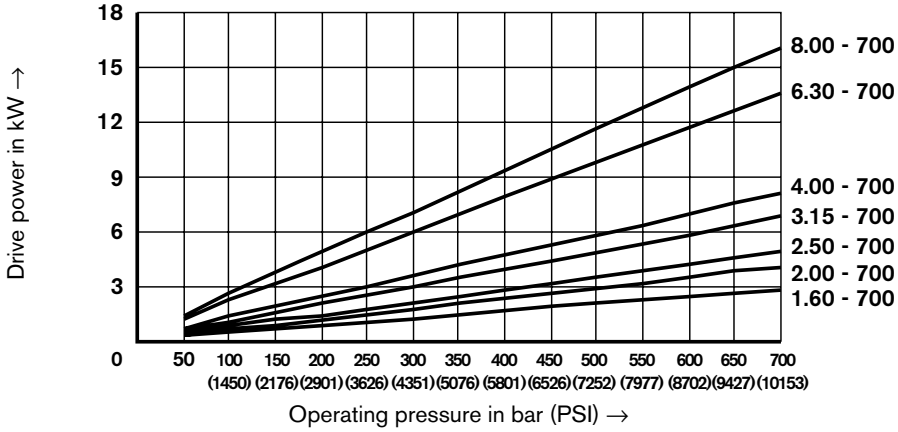
Characteristic curves - measured at $n = 1450$ RPM, $\nu = 41$ mm²/s (190 SUS) and $\vartheta = 50$ °C (122°F)

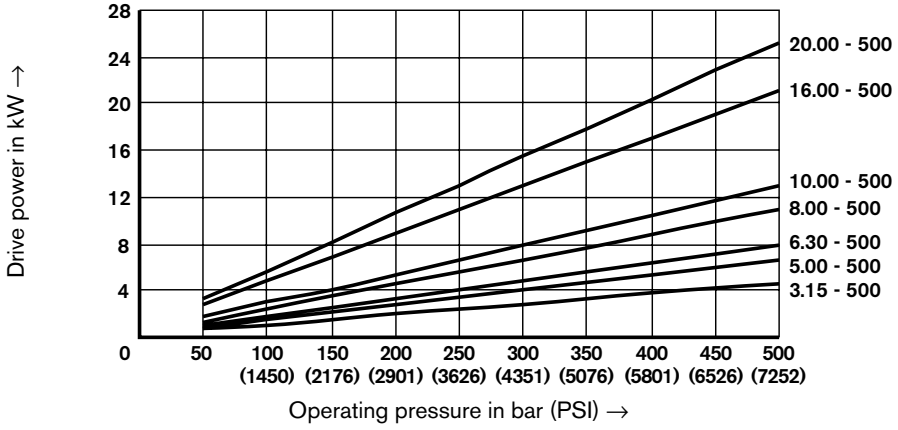
Flow



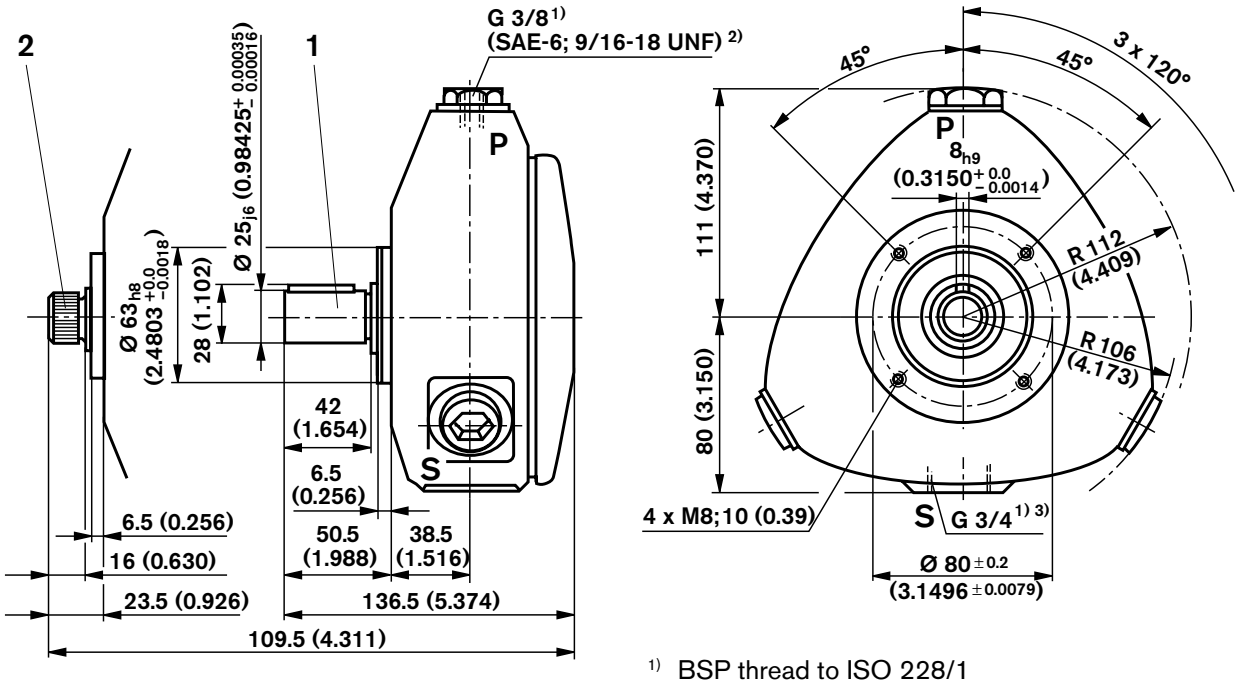


Drive power





Unit dimensions: Radial piston pump with 3 pistons, nominal dimensions in mm (inches)



1 Cylindrical shaft end

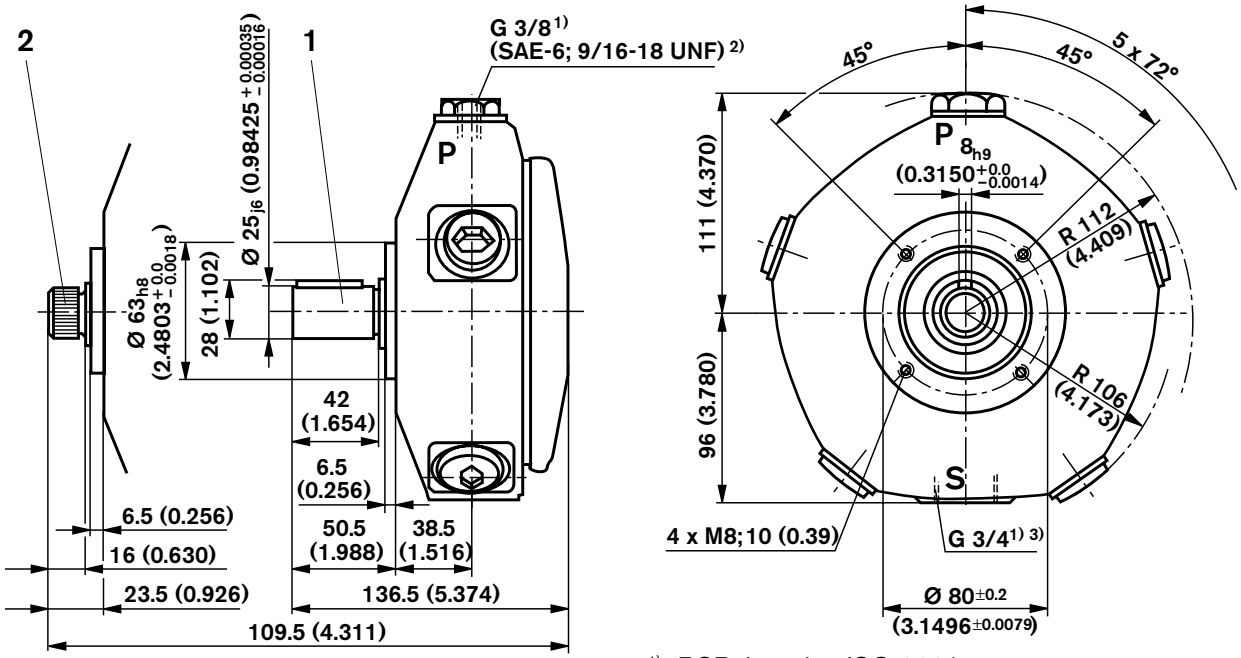
2 Splined shaft to DIN 5481

1) BSP thread to ISO 228/1

2) For line connection with code 12 to ANSI B 1.1

3) For line connection with code 12, connection adapter (SAE-12; 1 1/16-12 UN) to ANSI B 1.1 not included in the scope of supply

Unit dimensions: Radial piston pump with 5 pistons, nominal dimensions in mm (inches)



1 Cylindrical shaft end

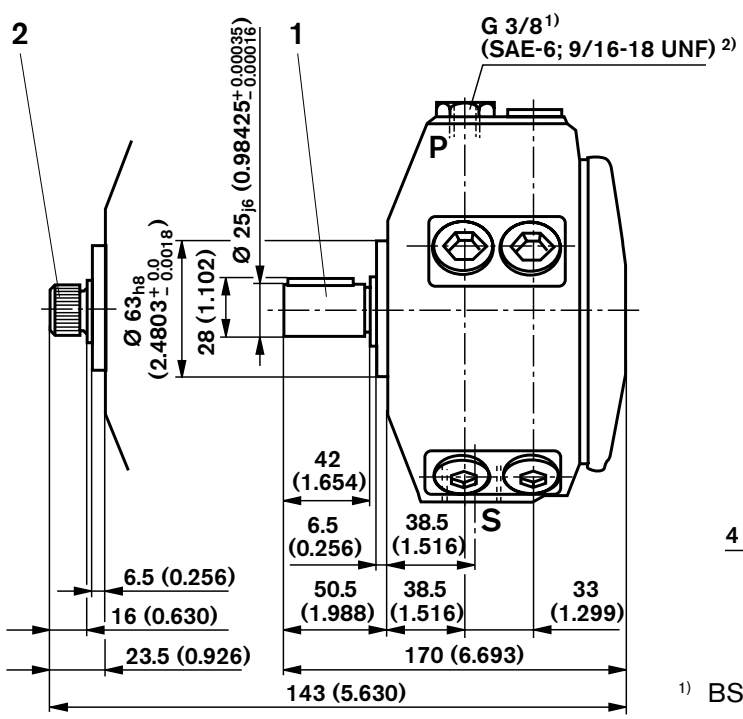
2 Splined shaft to DIN 5481

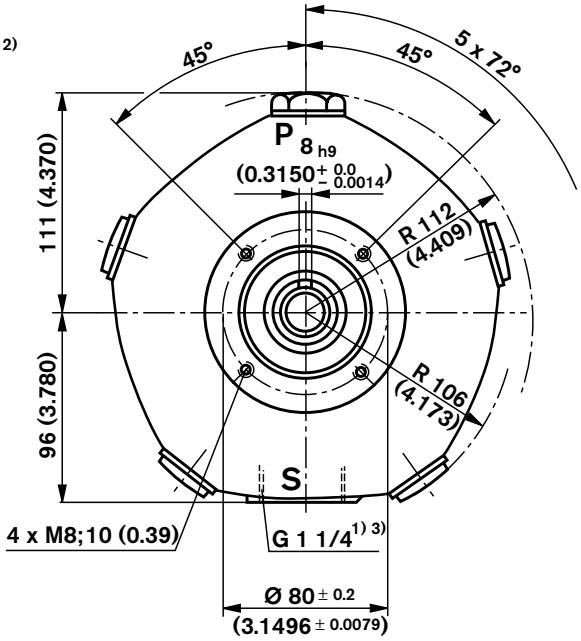
1) BSP thread to ISO 228/1

2) For line connection with code 12 to ANSI B 1.1

3) For line connection with code 12, connection adapter (SAE-12; 1 1/16-12 UN) to ANSI B 1.1 not included in the scope of supply

Unit dimensions: Radial piston pump with 10 pistons, code 08, nominal dimensions in mm (inches)





1 Cylindrical shaft end

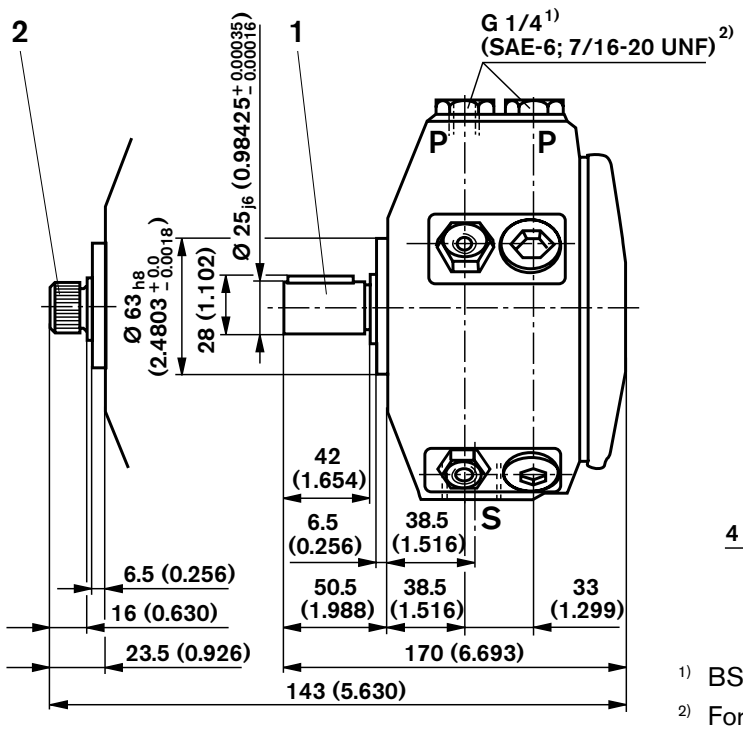
2 Splined shaft end to DIN 5481

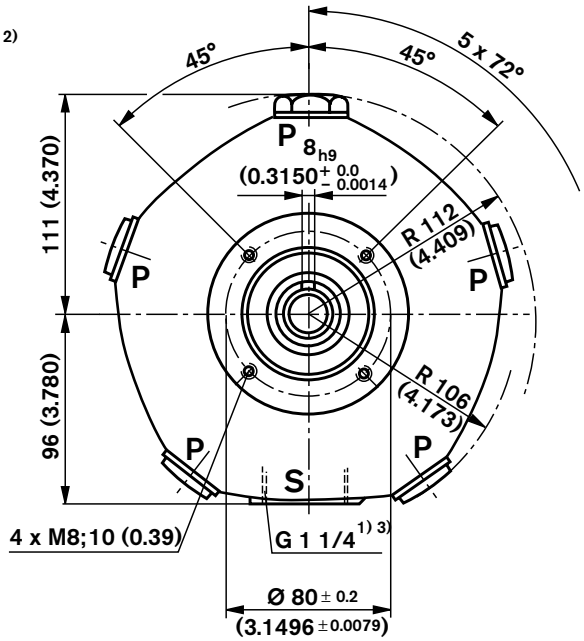
1) BSP thread to ISO 228/1

2) For line connection with code 12

3) For line connection with code 12, connection adapter (SAE-20; 1 5/8-20 UN) to ANSI B 1.1 not included in the scope of supply

Unit dimensions: Radial piston pump with 10 pistons, codes 11 and 12, nominal dimensions in mm (inches)





1 Cylindrical shaft end

2 Splined shaft end to DIN 5481

1) BSP thread to ISO 228/1

2) For line connection with code 12

3) For line connection with code 12, connection adapter (SAE-20; 1 5/8-20 UN) to ANSI B 1.1 not included in the scope of supply

Seal kits

Material number for NBR seals	Material number for FKM seals	Valid for
R900307726	R900307729	3-piston pumps
R900307727	R900307730	5-piston pumps
R900307728	R900307594	10-piston pumps

Ordering code for P2R4 and P3R4 pump combinations

	R4 – 3X /	R	K		M	+	*

Type of device
Double = **P2**
Triple = **P3**

Series = **4**

Component series
Component series 30 to 39 = **3X**
(30 to 39: unchanged installation and connection dimensions)

Component size
Component size - pressure stage (maximum)

1.51 cm³ (0.09 in³)	(3)	= **1.60-700**
2.14 cm³ (0.13 in³)	(3)	= **2.00-700**
2.59 cm³ (0.16 in³)	(3)	= **2.50-700**
3.57 cm³ (0.22 in³)	(5)	= **3.15-700**
4.32 cm³ (0.26 in³)	(5)	= **4.00-700**
3.39 cm³ (0.21 in³)	(3)	= **3.15-500**
4.82 cm³ (0.29 in³)	(3)	= **5.00-500**
5.83 cm³ (0.36 in³)	(3)	= **6.30-500**
8.03 cm³ (0.49 in³)	(5)	= **8.00-500**
9.71 cm³ (0.59 in³)	(5)	= **10.00-500**

Direction of rotation
Clockwise rotation = **R**

Shaft version
Cylindrical shaft end with output for mounting an AZPF or AZPFF = **K**

Line connection
BSP thread to ISO 228/1 = **01**
SAE thread to ANSI B1.1 = **12**

Seal material
NBR seals = **M**

Further details in clear text

Component sizes for double pump

AZPF4 =	4 cm³ (0.24 in³),	p_{max} = 280 bar (4061 PSI) [1]
AZPF5 =	5 cm³ (0.31 in³),	p_{max} = 280 bar (4061 PSI) [1]
AZPF8 =	8 cm³ (0.49 in³),	p_{max} = 280 bar (4061 PSI) [1]
AZPF11 =	11 cm³ (0.67 in³),	p_{max} = 230 bar (3336 PSI) [1]
AZPF14 =	14 cm³ (0.85 in³),	p_{max} = 180 bar (2611 PSI) [1]
AZPF16 =	16 cm³ (0.98 in³),	p_{max} = 160 bar (2321 PSI) [1]
AZPF19 =	19 cm³ (1.16 in³),	p_{max} = 135 bar (1958 PSI) [1]
AZPF22 =	22 cm³ (1.34 in³),	p_{max} = 110 bar (1595 PSI) [1]
AZPF25 =	25 cm³ (1.53 in³),	p_{max} = 100 bar (1450 PSI) [1]
AZPF28 =	28 cm³ (1.71 in³),	p_{max} = 90 bar (1305 PSI) [1]

Component sizes for triple pump

AZPFF5-4 =	5 cm³ - 4 cm³ (0.31 in³ - 0.24 in³)
AZPFF8-4 =	8 cm³ - 4 cm³ (0.49 in³ - 0.24 in³)
AZPFF8-8 =	8 cm³ - 8 cm³ (0.49 in³ - 0.49 in³)
AZPFF11-4 =	11 cm³ - 4 cm³ (0.67 in³ - 1.71 in³)
AZPFF11-5 =	11 cm³ - 5 cm³ (0.67 in³ - 0.31 in³)
AZPFF11-8 =	11 cm³ - 8 cm³ (0.67 in³ - 0.49 in³)
AZPFF16-8 =	16 cm³ - 8 cm³ (0.98 in³ - 0.49 in³)
AZPFF16-16 =	16 cm³ - 16 cm³ (0.98 in³ - 0.98 in³)

Number of pressure ports

Code	Number of pressure ports	Combination of cylinders	
		Radial piston pump with	
		3 pistons	5 pistons
01 =	1	3	5
02 =	2	1+2	
03 =	3	1+1+1	
08 =	5		1+1+1+1+1

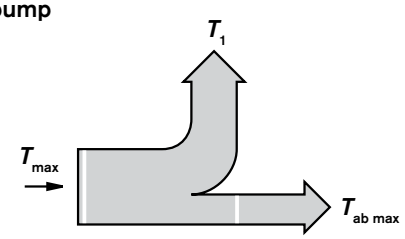
[1] Observe the note on the engineering of multiple pumps (page 12)

Notes on the engineering of multiple pumps

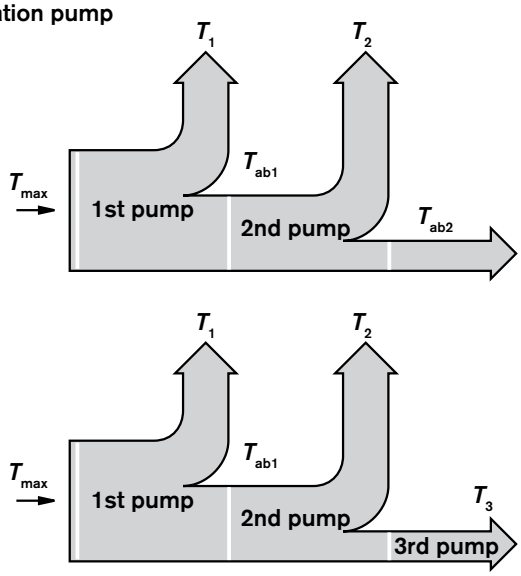
- The general technical data of the single pumps are also valid for multiple pumps (see below and page 5).
- The pump that is subjected to greater loads (pressure x flow) should be the first pump stage.
- When several pumps are combined, the occurring torque can reach impermissibly high values.
- The sum of torques must not exceed the permissible values (see table below)

Pump type	Max. permissible input torque T_{max}	Max. permissible output torque T_{max}
PR4…	160 Nm (118 lb-ft)	45 Nm (33 lb-ft)
AZPF…	45 Nm (33 lb-ft)	45 Nm (33 lb-ft)
AZPFF…	45 Nm (33 lb-ft)	45 Nm (33 lb-ft)

Single pump



Combination pump



$$T = \frac{\Delta p \bullet V \bullet 0.0159}{\eta_{hydr.\text{-}mech.}} \text{ (Nm)}$$

Example: Pump combination
P3R4-3X/3.15-700… + AZPFF8-4

$$T_1 = \frac{700 \text{ bar} \bullet 3.57 \text{ cm}^3 \bullet 0.0159}{0.9} = 44.2 \text{ Nm}$$

$$T_2 = \frac{100 \text{ bar} \bullet 8 \text{ cm}^3 \bullet 0.0159}{0.85} = 15.0 \text{ Nm}$$

$$T_3 = \frac{50 \text{ bar} \bullet 4 \text{ cm}^3 \bullet 0.0159}{0.85} = 3.8 \text{ Nm}$$

$T_{ab2} = 45$ Nm

$T_3 = 3.8 \text{ Nm} \leq T_{ab2\ max}$

$T_{ab1} = 45$ Nm

$T_{1,2} = T_2 + T_3$

$T_{1,2} = 18.8 \text{ Nm} \leq T_{ab1\ max}$

$T_{max} = 160$ Nm

$T = T_1 + T_2 + T_3$

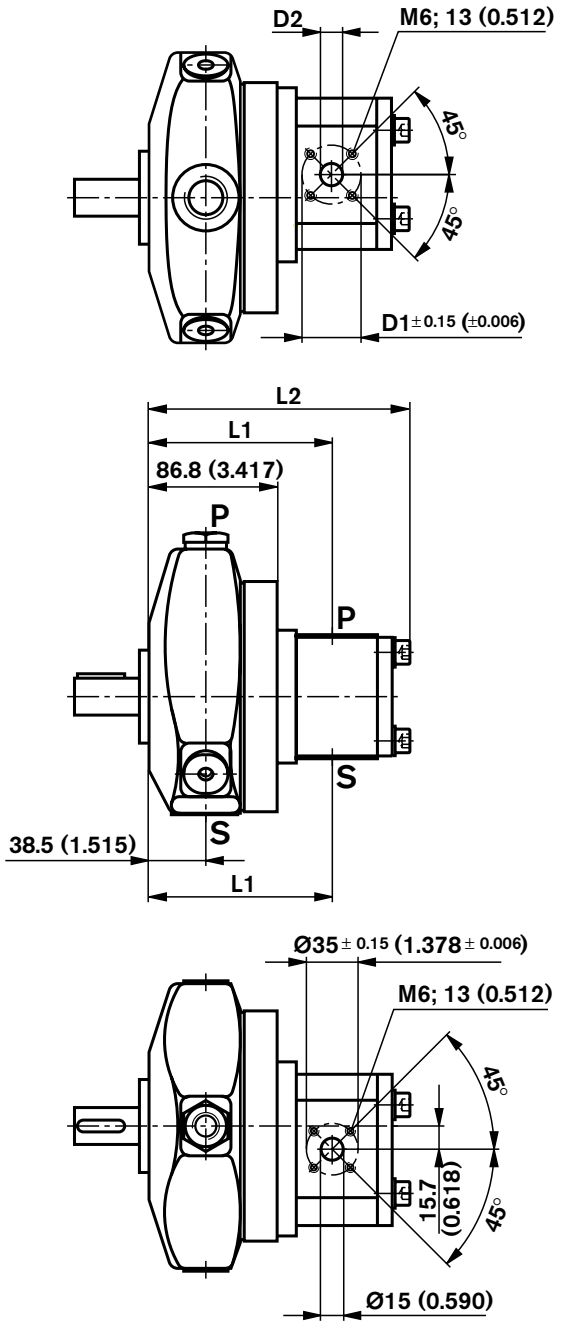
$T = 63 \text{ Nm} \leq T_{max}$

The pump combination can be operated at the calculated technical data.

Calculation example:

V	=	displacement in cm³
$\eta_{hydr.\text{-}mech.}$	=	hydraulic-mechanical efficiency
T	=	torque in Nm
Δp	=	pressue in bar

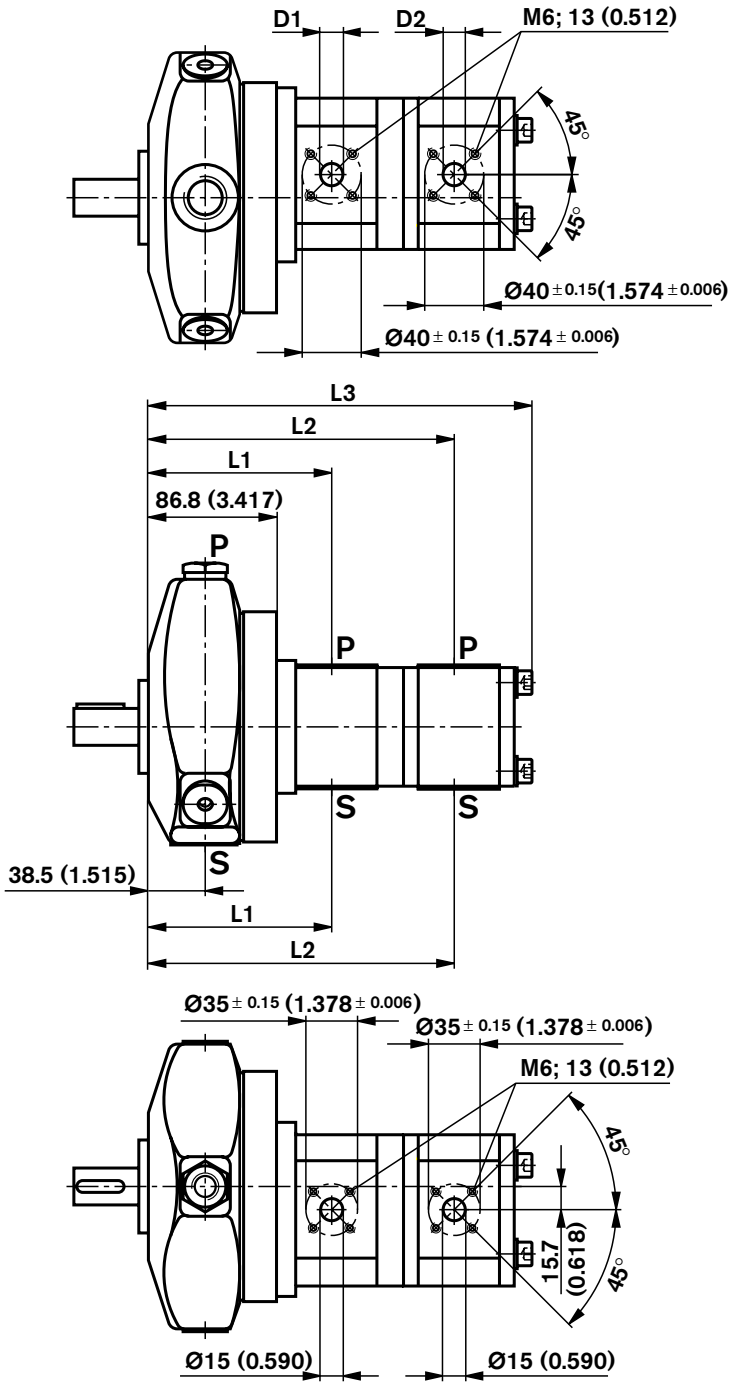
Unit dimensions: P2R4…, nominal dimensions in mm (inches)



Type P2R4- ...+	D1 ±0.15 (±0.006)		D2		L1		L2	
	mm	(inch)	mm	(inch)	mm	(inch)	mm	(inch)
AZPF4	40.00	(1.575)	15.00	(0.591)	124.2	(4.890)	170.5	(6.713)
AZPF5	40.00	(1.575)	15.00	(0.591)	125.4	(4.937)	173.0	(6.811)
AZPF8	40.00	(1.575)	20.00	(0.787)	127.5	(5.020)	177.1	(6.972)
AZPF11	40.00	(1.575)	20.00	(0.787)	131.3	(5.169)	182.1	(7.169)
AZPF14	40.00	(1.575)	20.00	(0.787)	131.8	(5.189)	187.1	(7.366)
AZPF16	40.00	(1.575)	20.00	(0.787)	131.8	(5.189)	190.5	(7.500)
AZPF19	40.00	(1.575)	20.00	(0.787)	131.8	(5.189)	195.5	(7.697)
AZPF22	40.00	(1.575)	20.00	(0.787)	139.4	(5.488)	200.9	(7.909)
AZPF25	55.00	(2.165)	26.00	(1.024)	147.5	(5.807)	217.3	(8.555)
AZPF28	55.00	(2.165)	26.00	(1.024)	148.1	(5.831)	222.1	(8.744)

For dimensions missing for R4, see pages 8 and 9.

Unit dimensions: P3R4…, nominal dimensions in mm (inches)



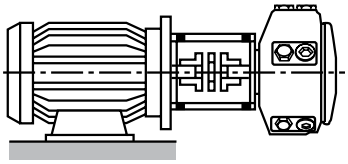
Type P3R4- ...+	D1		D2		L1		L2		L3	
	mm	(inch)	mm	(inch)	mm	(inch)	mm	(inch)	mm	(inch)
AZPFF5-4	15.00	(0.591)	15.00	(0.591)	125.4	(4.937)	208.4	(8.205)	254.7	(10.028)
AZPFF8-4	20.00	(0.787)	15.00	(0.591)	127.5	(5.02)	212.5	(8.366)	258.8	(10.189)
AZPFF8-8	20.00	(0.787)	20.00	(0.787)	127.5	(5.020)	215.8	(8.496)	265.4	(10.449)
AZPFF11-4	20.00	(0.787)	15.00	(0.591)	131.3	(5.169)	217.5	(8.563)	263.8	(10.386)
AZPFF11-5	20.00	(0.787)	15.00	(0.591)	131.3	(5.169)	218.7	(8.610)	266.3	(10.484)
AZPFF11-8	20.00	(0.787)	20.00	(0.787)	131.3	(5.169)	220.8	(8.693)	270.4	(10.646)
AZPFF16-16	20.00	(0.787)	20.00	(0.787)	131.8	(5.189)	233.5	(9.193)	292.2	(11.504)

For dimensions missing for R4, see pages 8 and 9.

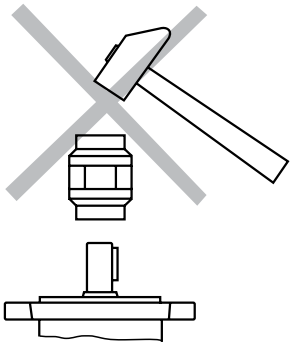
Installation notes

Drive

El. motor + pump mounting bracket + coupling + pump

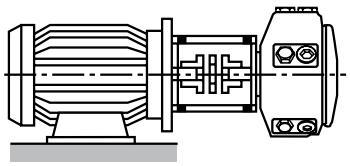


- No radial and axial forces permitted on the pump drive shaft!
- Motor and pump must be exactly aligned!
- Always use a coupling that is suitable for compensating for shaft offsets!
- When installing the coupling, avoid axial forces, that is, **do not hammer or press the coupling onto the shaft!** Use the female thread of the drive shaft!

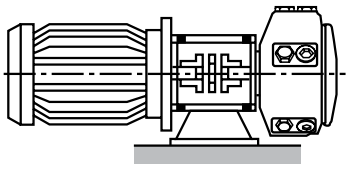


Installation positions

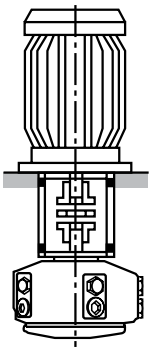
B3



B5



V1



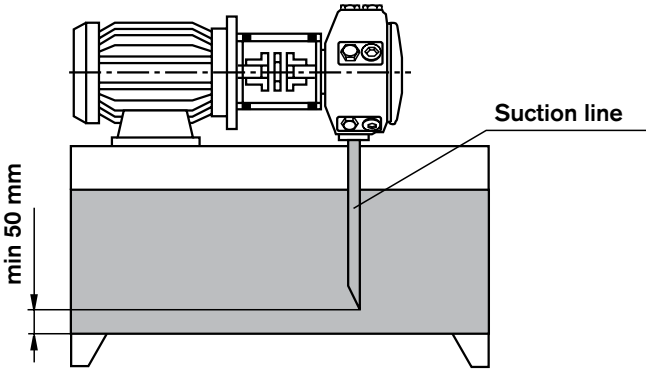
Fluid tank

- Adjust the useful capacity of the tank to the operating conditions
- The permissible fluid temperature must not be exceeded; if required, provide cooler

Lines and connections

- Remove protective plug from pump
- We recommend the use of seamless precision steel pipes according to DIN 2391 and pipe connections that can be loosened
- Select the clear width of pipes according to the connections (suction velocity 1 to 1.5 m/s)
- For inlet pressure, see page 5
- Thoroughly clean pipes and fittings before their installation

Recommendation for piping



- The returning oil must **under no circumstances** be re-aspired directly, i.e. select the largest possible distance between suction and return line
- The return oil outlet must always be immersed in the oil
- Ensure suction-tight installation of the pipes

Filters

- If possible, use return line or pressure filters. (Use suction filter only in conjunction with an underpressure switch/clogging indicator)

Hydraulic fluid

- Please observe our regulations according to data sheet RE 07075
- We recommend the use of branded hydraulic oils
- Different oil grades must not be mixed, since this can result in decomposition and deterioration of the lubricating properties
- The fluid must be changed at certain intervals depending on the operating conditions. This involves cleaning of the fluid tank from residues.

Engineering notes

Comprehensive notes and suggestions can be found in The Hydraulic Trainer, Volume 3 RE 00281, "notes on the planning and design of hydraulic systems".
For the use of radial piston pumps, we recommend that the notes given in the following be strictly observed.

Technical data
All technical data given depend on manufacturing tolerances and are valid in conjunction with certain boundary conditions.
Please note that certain tolerances are therefore possible, and that technical data may vary when boundary conditions (e.g. viscosity) are changed.

Characteristic curves
Characteristic curves for flow and required power.
When selecting the drive motor, take the max. possible operating data into account.

Noise

The noise pressure level values given on page 5 are measured in accordance with DIN 45635 part 26. This means that only the noise emitted by the pump is shown. Influences by the surroundings (such as place of installation, piping, etc.) were eliminated. The values always refer to only one pump.

Caution!

The power unit design and influences at the place of final installation of the pump result in the fact that the noise pressure level is usually 5 to 10 10 dB(A) higher than the value of the pump alone.

Commissioning notes

Bleeding

- All radial piston pumps of type PR4 are self-priming.
- Before initial commissioning, the pump must be bled in order to protect it from damage.
- **During initial commissioning, foaming oil must be drainedn by opening the pressure flange or the pressure line (if required, provide splash guard) while the pump is running in absolutely pressureless circulation. Only when bubble-free oil starts to flow out can the flange be re-tightened to the specified torque.**
- Should the pump not displace bubble-free oil after approx. 20 seconds, check the system again. When the operating values are reached, check the pipe connections for leakage. Check the operating temperature.

Commissioning

- Check that the system is thoroughly and properly installed.
- Observe the arrows for the direction of rotation of the motor and the pump.
- Start the pump up under no load and let it displace at zero pressure for some seconds in order to ensure sufficient lubrication.
- **The pump may in no case be operated without fluid!**

Important notes

- Adjustments, maintenance and repair of the pump may only be carried out by authorised, trained and instructed personnel!
- Use only genuine Rexroth spare parts!
- The pump may only be operated at the permissible data.
- The pump may only be operated when in perfect condition!
- When carrying out any work on the pump (e.g. installation or removal), the system must be switched off and depressurised!
- Unauthorised conversions or changes that affect safety and function are not permitted!
- Attach protective guards (e.g. coupling protection)!
- Any existing protective guards must not be removed!
- The generally valid safety regulations and regulations for the prevention of accidents must be strictly observed!

Bosch Rexroth Corp.
Industrial Hydraulics
2315 City Line Road
Bethlehem, PA 18017-2131
USA
Telephone (610) 694-8300
Facsimile (610) 694-8467
www.boschrexroth-us.com

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Subject to change.

BOSCH

Engineering Data

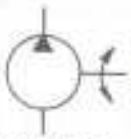
RADIAL PISTON PUMP

FIXED DISPLACEMENT

MODEL 80L	2000 PSI 5.6 GPM
MODEL 80M	3000 PSI 3.4 GPM
MODEL 80H	6000 PSI 1.8 GPM

1800 RPM





SYMBOL

SPECIFICATIONS

PRESSURE RATING — At 1800 rpm

Model 80L: 2000 psi (137.9 bar) maximum continuous pressure.
3000 psi (206.9 bar) maximum intermittent pressure.*
Model 80M: 3000 psi (206.9 bar) maximum continuous pressure.
5000 psi (344.8 bar) maximum intermittent pressure.*
Model 80H: 6000 psi (413.8 bar) maximum continuous pressure.
10,000 psi (689.7 bar) maximum intermittent pressure.*

*The pump should not be subjected to the maximum intermittent pressure more than 25% of the duty cycle and not more than 10 minutes per hour. If either the pressure or time exceed the recommended maximum, consult the factory.

FLOW RATE —

Model 80L: 5.6 gpm (21.2 l/min.) at 1800 rpm and 2000 psi (137.9 bar)
Model 80M: 3.4 gpm (12.9 l/min.) at 1800 rpm and 3000 psi (206.9 bar)
Model 80H: 1.85 gpm (7.0 l/min.) at 1800 rpm and 6000 psi (413.8 bar)

MAXIMUM DRIVE SPEED — 1800 rpm maximum drive speed.

MINIMUM DRIVE SPEED — 100 rpm minimum recommended speed.

OVERHUNG LOADS — Not recommended except under certain conditions. Consult the factory.

ROTATION — Standard piston pumps will operate in either direction of rotation with outlet flow remaining in the same direction.

PUMP SHAFT DESIGN — Use inline prime movers with flexible coupling alignment within 0.002" (0.05 mm) total indicator reading. The driving end of the pump shaft is splined to receive a special coupling which is furnished with each pump. It is necessary to ream a suitable hole in the drive accessory and press in the splined coupling.

PRIMING — Pump must have a positive head in the suction line and is accomplished by mounting it at least 3 feet (0.9 meters) below the oil level of the reservoir. Maximum inlet pressure for the standard pump is 10 psi (0.7 bar) which is equivalent to a head of 23 feet.

SUPERCHARGING — If the pump is supercharged from an external source, a high pressure shaft seal is required and the drain port must be vented to tank. Maximum supercharge pressure is 250 psi (17.2 bar). Supercharge flow rate should be at least .5 gpm (1.9 l/min.) greater than the normal delivery of the pump to assure a positive head but not greater than 10 gpm (37.9 l/min.) or the pistons will lift off the cam. To order this high pressure shaft seal, specify the letter "H" before the model number. Example: Model H80L.

FLUID RECOMMENDATIONS — Premium grade hydraulic fluid with 100 to 250 SUS (21 to 54 cSt) viscosity at operating temperature. Maximum allowable viscosity for cold start-up is 750 SUS (162 cSt). Minimum allowable viscosity is 60 SUS (10 cSt).

SEALS — This pump may be used with phosphate ester fluids when equipped with proper seals. Water base fluids are not recommended. When ordering for use with phosphate ester fluids, specify "F2" after the model number. Example: Model 80L-F2. For additional information refer to Racine publication S-107, "Fire Resistant Fluids."

ISO-FLO — Available as standard:

Number of Outlets	Number of Pistons Per Outlet
2	1 Piston 6 Piston
7	1 Piston

Consult the factory for ISO-FLO combinations not shown.

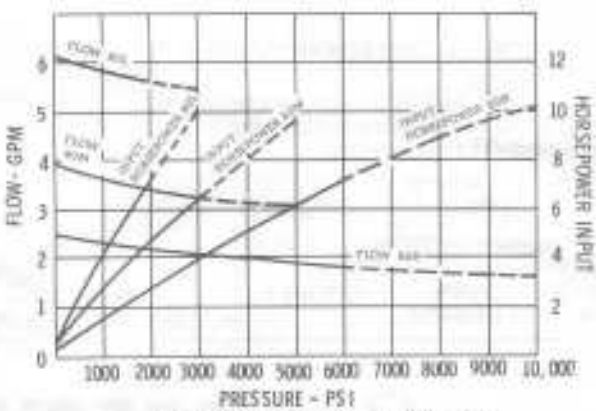
TEMPERATURE — Under normal conditions of continuous operation, fluid temperature should not exceed 130°F (54°C). In no instance, should temperature exceed 160°F (71°C).

FILTRATION — 149 micrometre inlet filtration is recommended. Consult the factory for suggested types of both inlet and return line filtration for increased component life.

MOUNTING POSITION — Not restricted.

WEIGHT (Approx.) — Standard pump ..... 36.5 lbs (16.6 kg)
Add for foot mounting bracket ..... 8.2 lbs (3.7 kg)

PERFORMANCE CHARACTERISTICS — 1800 RPM



Dotted line indicates intermittent duty.

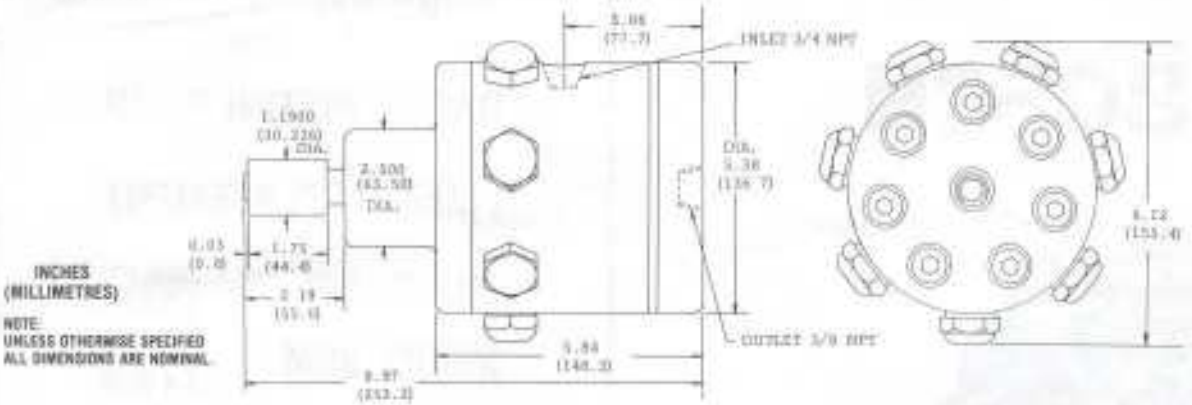
PERFORMANCE CHARACTERISTICS AT 1800 RPM

PUMP	DELIVERY — GPM										
	0 PSI	1000 PSI	2000 PSI	3000 PSI	4000 PSI	5000 PSI	6000 PSI	7000 PSI	8000 PSI	9000 PSI	10,000 PSI
80L	6.1	5.8	5.6	5.4*	—	—	—	—	—	—	—
80M	4.0	3.7	3.5	3.4	3.2*	3.1*	—	—	—	—	—
80H	2.5	2.3	2.2	2.1	2.0	1.9	1.85	1.8*	1.75*	1.7*	1.65*
	HORSEPOWER INPUT										
80L	.3	4.2	7.3	10*	—	—	—	—	—	—	—
80M	.3	2.8	4.8	6.5	8.0*	9.7*	—	—	—	—	—
80H	.3	1.6	2.9	4.0	5.1	6.1	7.0	8.0*	8.8*	9.7*	10.2*

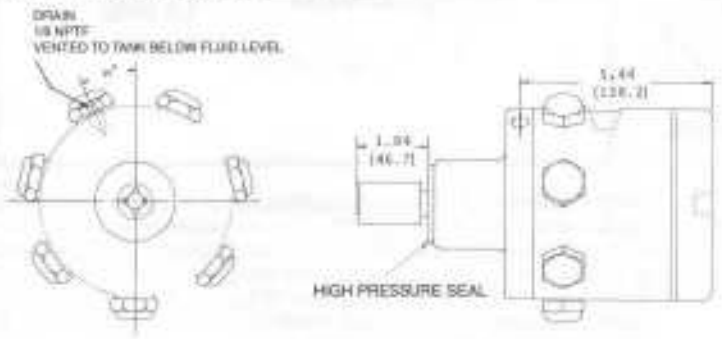
*Intermittent duty only.

DATA SHOWN IS CHARACTERISTIC WITH OIL VISCOSITY OF 130 SSU AT 120° F. AND 1160 RPM

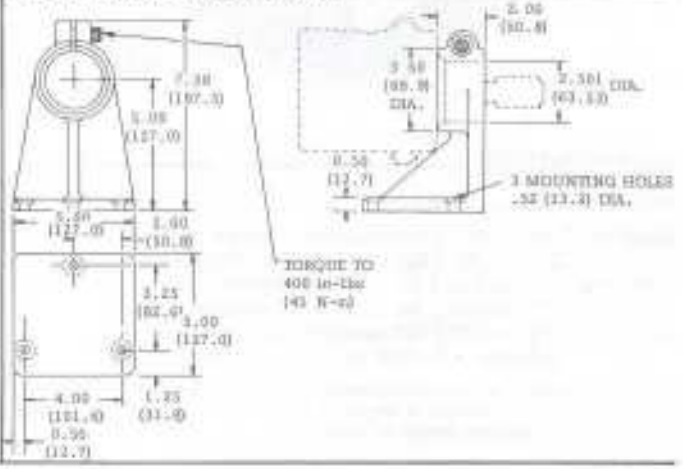
DIMENSIONAL DATA



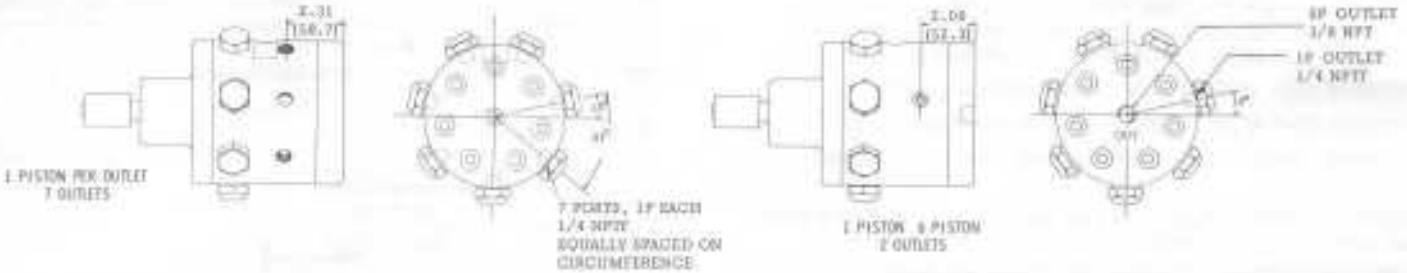
HIGH PRESSURE SEAL



FOOT MOUNTING BRACKET



ISO-FLO



To obtain ISO-FLO single piston delivery in a model 80 pump, divide the total delivery at desired pressure by the total number of pistons (seven).

Example: Single piston flow output in gpm at 3000 psi (206.8 bar) delivered by an 80H pump.

$\frac{2.1 \text{ GPM}}{7} = .3 \text{ GPM}$

$\frac{7.9 \text{ l/min.}}{7} = 1.1 \text{ l/min.}$

HOW TO ORDER

H80L-F2-2/O-1P-6P

*ISO-FLO

*H--HIGH PRESSURE SHAFT SEAL FOR PRESSURE PRIMING

L--5.4 GPM — 3000 PSI MAXIMUM
M--3.1 GPM — 5000 PSI MAXIMUM
H--1.65 GPM — 10000 PSI MAXIMUM

*F2--SPECIFY FOR VITON SEALS

*These items are optional extras and should be specified by code when desired. Consult factory for assistance when ordering ISO-FLO modifications.

Foot mounting brackets are furnished by Racine but must be specified in addition to the model number of the unit selected.

Example: (1) 80H Pump
(1) PF8-10S Foot mounting bracket

When foot mounting bracket is not used, any style of bracket that will clamp around the cylindrical projection of the motor end shaft plate may be substituted.

9 535 233 077
HPUS AKY 002/4 US (5.95)

ROBERT BOSCH FLUID POWER CORPORATION
P.O. BOX 2025
RACINE, WISCONSIN 53401-2025 U.S.A.
Phone (414)554-7100, Fax (414)554-7117

Printed in USA

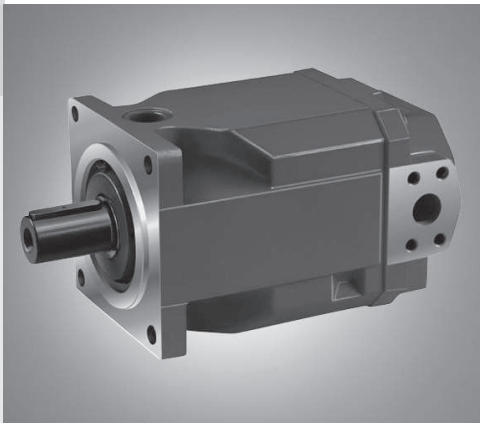
BOSCH

Rexroth
Bosch Group

Fixed Displacement Pump A4FO

RE 91 455/04.00
replaces: 01.94

for open circuits



Sizes 16...500
Series 1, Series 3
Nominal pressure up to 400 bar
Peak pressure up to 450 bar

Inhalt

Features	1
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Features

- A4FO axial piston fixed displacement pumps of swashplate design are used for hydraulic drives in open loop circuits.
- Flow is proportional to the drive speed and to the displacement.
- Good suction characteristic
- Low noise level
- Long service life
- Pump combinations possible
- Through drive for mounting other pumps

- Further Informations:
  Variable Pump A4VSO RE 92 050

Ordering Code

Fluid / Design	**16**	**22**	**28**	**40**	**71**	**125**	**250**	**500**	
Mineral oil, HFD-Fluid	●	●	●	●	●	●	●	●	
HFA-, HFB-, HFC-Fluid	–	–	–	–	●	●	●	●	**E-**
High-Speed Design	–	–	–	–	–	–	●	●	**H-**

Axial piston unit	
Fixed swashplate design	**A4F**

Operation	
Pump in open circuits	**O**

Size								
≙ Displacement V_g (cm^3)	**16**	**22**	**28**	**40**	**71**	**125**	**250**	**500**

Series	
sizes 16...40, 125...500	**3**
size 71	**1**

Index	
sizes 16...40	**2**
sizes 71...500	**0**

Direction of rotation		
viewed on shaft end	clockwise	**R**
	anti-clockwise	**L**

Seals		
NBR (nitril-caoutchouc), shaft seal in FKM (fluor-caoutchouc)	sizes 16...40	**N**
	sizes 71...500	**P**
FKM (fluor-caoutchouc)	sizes 71...500	**V**

Shaft end	**16**	**22**	**28**	**40**	**71**	**125**	**250**	**500**	
splined shaft SAE	●	●	●	–	–	–	–	–	**S**
splined shaft SAE	–	–	–	●	–	–	–	–	**T**
Splined shaft DIN 5480	–	–	–	–	●	●	●	●	**Z**
parallel shaft, with key DIN 6885	–	–	–	–	●	●	●	●	**P**

Mounting flange	**16**	**22**	**28**	**40**	**71**	**125**	**250**	**500**	
SAE 2-hole	●	●	●	●	–	–	–	–	**C**
ISO 4-hole	–	–	–	–	●	●	●	–	**B**
ISO 8-hole	–	–	–	–	–	–	–	●	**H**

Service line connections	**sizes 16...40**	**sizes 71...500**	
Pressure and suction port SAE at side (opposite side) (metric fixing screws)	●	–	**12**
Pressure and suction port SAE at side, rotated by 90° (metric fixing screws) 2nd pressure port B_1 opposite B - when delivered plugged with a flange	–	●	**25**

● = available
○ = in preparation
– = not available

Ordering Code



Through Drive			16	22	28	40	71	125	250	500	
flange	hub	for mounting									
–	–		●	●	●	–	●	●	●	●	**N00**
SAE A, 2-hole	SAE A	G2, A10VSO 10	●	●	●	●	–	–	–	–	**K01**
SAE B, 2-hole	SAE B	A4FO 16...28	–	●	●	–	–	–	–	–	**K02**
ISO 80, 2-hole	SAE A-B	A10VSO 18	–	–	–	–	○	●	●	○	**KB2**
ISO 100, 2-hole	SAE B	A10VSO 28	–	–	–	–	○	○	○	○	**KB3**
ISO 100, 2-hole	SAE B-B	A10VSO 45	–	–	–	–	○	○	○	○	**KB4**
ISO 125, 2-hole	SAE C	A10VSO 71	–	–	–	–	○	○	○	○	**KB5**
ISO 125, 2-hole	SAE C-C	A10VSO 100	–	–	–	–	–	○	○	○	**KB6**
ISO 180, 4-hole	SAE D	A10VSO 140	–	–	–	–	–	–	○	○	**KB7**
ISO 125, 4-hole	N32 (DIN 5480)	A4VS 40	–	–	–	–	○	○	●	○	**K31**
ISO 140, 4-hole	N40 (DIN 5480)	A4FO 71 / A4VS 71	–	–	–	–	●	●	●	○	**K33**
ISO 160, 4-hole	N50 (DIN 5480)	A4FO 125 / A4VS 125, 180	–	–	–	–	–	●	●	○	**K34**
ISO 224, 4-hole	N60 (DIN 5480)	A4FO 250 / A4VS 250	–	–	–	–	–	–	●	○	**K35**
ISO 315, 8-hole	N80 (DIN 5480)	A4FO 500 / A4VS 500	–	–	–	–	–	–	–	○	**K43**
with through drive shaft, without hub, without adapter flange, with cover plate			–	–	–	–	○	●	●	○	**K99**

Technical Data

Fluid

To review the application of A4FO pumps with the selected hydraulic fluid, detailed fluid compatibility and application data can be found in data sheets RE 90220 (mineral oil), RE 90221 (environmentally acceptable hydraulic fluids) and RE 90223 (fire resistant fluids, HF).

When using HF- or environmentally acceptable hydraulic fluids possible limitations for the technical data have to be taken into consideration. If necessary please consult our technical department (please indicate type of the hydraulic fluid used for your application on the order sheet).
Sizes 16...40 of fixed pump A4FO are not suitable for operation with HFA, HFB or HFC-fluids.

Operating viscosity range

In order to optain optimum efficiency and service life, we recommend that the operating viscosity (at operating temperature) be selected from within the range:

ν_{opt} = operating viscosity 16...36 mm²/s

referred to the tank temperature (open circuit).

Viscosity limits

The limiting values for viscosity are as follows:

Sizes 16...40

ν_{min} = 5 mm²/s,
short term at a max. permissible temperature of t_{max} = 115°C

ν_{max} = 1600, short term on cold start (t_{min} = -40°C)

Sizes 71...500

ν_{min} = 10 mm²/s,
short term at a max. permissible leakage oil temp. of t_{max} = 90°

ν_{max} = 1000 mm²/s, short term on cold start (t_{min} = -25°C)

Please note that the max. fluid temperature is also not exceeded in certain areas (for instance bearing area).

At temperatures of -25°C up to -40°C special measures may be required for certain installation positions. Please contact us.

Notes on the selection of the hydraulic fluid

In order to select the correct fluid, it is necessary to know the operating temperature in the tank (open circuit) in relation to the ambient temperature.

The hydraulic fluid should be selected so that within the operating temperature range, the operating viscosity lies within the optimum range (ν_{opt}) (see shaded section of the selection diagram). We recommend that the highest possible viscosity range should be chosen in each case.

Example: At an ambient temperature of X°C the operating temperature is 60°C. Within the operating viscosity range (ν_{opt}; shaded area), this corresponds to viscosity ranges VG 46 or VG 68. VG 68 should be selected.

Important: The leakage oil (case drain oil) temperature is influenced by pressure and pump speed and is always higher than the tank temperature. However, at no point in the circuit may the temperature exceed 115°C for sizes 16…40 or 90°C for sizes 71…500.

If it is not possible to comply with the above conditions because of extreme operating parameters or high ambient temperatures please consult us.

Filtration

The finer the filtration the better the achieved cleanliness level of the pressure fluid and the longer the life of the axial piston unit.

To ensure the functioning of the axial piston unit a minimum cleanliness level of

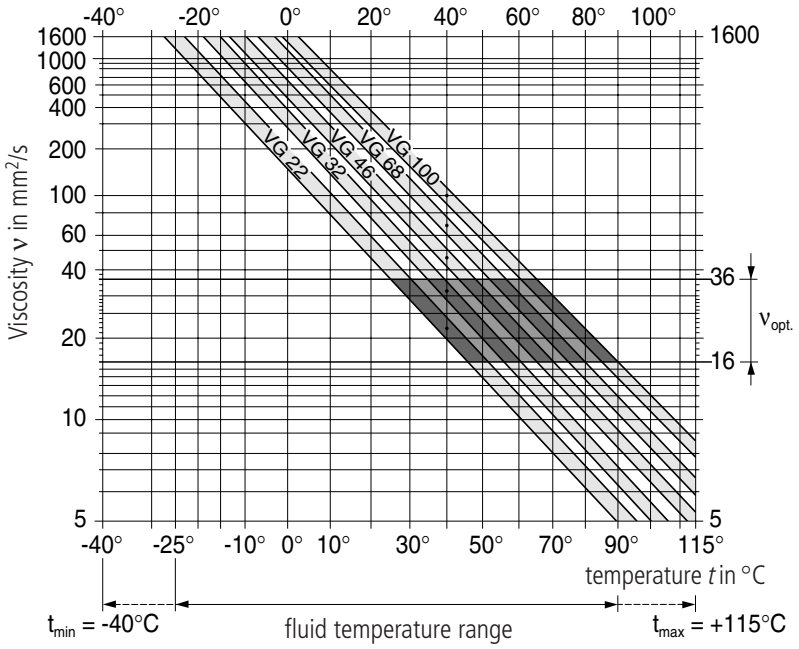
9 to NAS 1638
18/15 to ISO/DIS 4406 is necessary.

At very high temperatures of the hydraulic fluid (90°C to max. 115°C, not permissible for sizes 71…500) at least cleanliness level

8 to NAS 1638
17/14 to ISO/DIS 4406 is necessary.

If above mentioned grades cannot be maintained please consult us.

Selection diagram



valid for operation with mineral oils

Sizes 16...40

Working pressure range inlet

Absolut pressure at port S (suction port)

$p_{abs.\ min}$ 0,8 bar

$p_{abs.\ max}$ 2 bar

Working pressure range outlet

Maximum pressure at port A or B (pressure data to DIN 24312)

Nominal pressure p_N 400 bar

Peak pressure p_{max} 450 bar

Note:

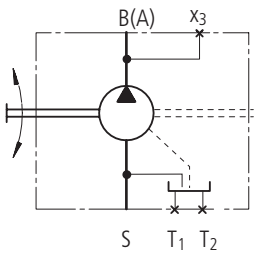
When mounting further pumps at the through drive of the A4FO the max. input torque of the drive shaft has not to be exceeded (as to page 15). This may necessitate a limitation of the max. admissible pressure values.

Direction of flow

	clockwise operation	anti-clockwise operation
Sizes 16...40	**S** to **B**	**S** to **A**

Symbol

A, B	service line port
S	suction port
T_1, T_2	drain port (plugged)
x_3	gauge port



Case drain pressure

Perm. case drain pressure (housing pressure)

p_L 2 bar abs.

The leakage oil chamber is connected to the suction chamber. A case drain line is therefore not necessary.

Sizes 71...500

Working pressure range inlet

Absolut pressure at port S (suction port)

$p_{abs.\ min}$ 0,8 bar

$p_{abs.\ max}$ 30 bar

Working pressure range outlet

Maximum pressure at port A or B (pressure data to DIN 24312)

Nominal pressure p_N 350 bar

Peak pressure p_{max} 400 bar

Flushing of the bearings (Sizes 125...500)

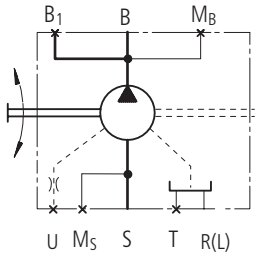
For informations about operating conditions, flushing quantities and notes on bearing flushing see data sheet RE 92 050 (A4VSO).

Direction of flow

	clockwise operation	anti-clockwise operation
Sizes 71...500	**S** to **B**	**S** to **B**

Symbol

B, B_1	service line port
S	suction port
T, R(L)	drain port (1 port plugged)
M_B	gauge port working pressure
M_S	gauge port suction pressure
U	flushing port (sizes 125...500)



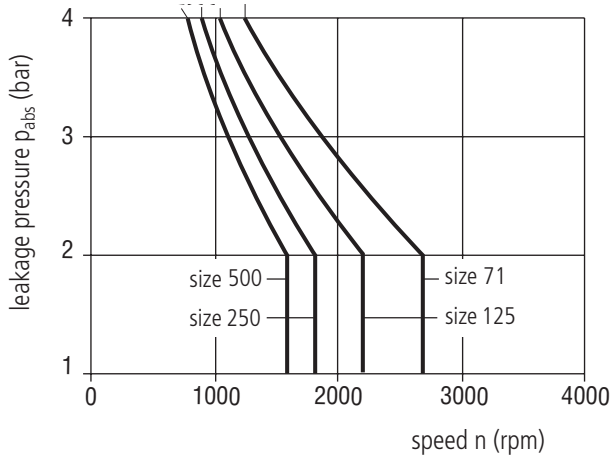
Leakage pressure

The max. permissible leakage pressure (housing pressure) is dependent on speed (see diagram). The pressure in the housing must be equal to or greater than the external pressure on the shaft sealing ring.

Max. leakage pressure (housing pressure)

p_L 4 bar abs.

A case drain line to the tank is necessary.



Technical Data

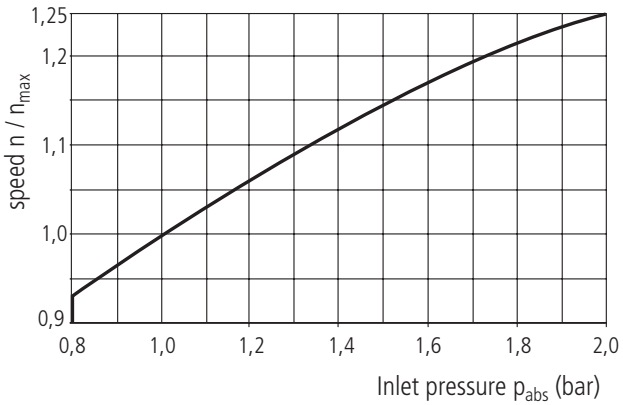
Table of values (theoretical values, without considering η_{mh} and η_v: values rounded)

Size			16	22	28	40	71	125	250/H*	500/H*
Displacement	V_g	cm^3	16	22	28	40	71	125	250	500
Max. speed [1])	n_{max}	rpm	4000	3600	3000	2750	2200	1800	1500 / 1900	1320 / 1500
Max. permissible speed (speed limit) with increased inlet pressure	$n_{max\ perm.}$	rpm	4800	4500	3750	3400	2700	2200	1800 / 2100	1600 / 1800
Output flow at n_{max} [2])	$q_{V\ max}$	L/min	62	77	81	107	152	218	364 / 461	640 / 728
Power at $q_{V\ max}$; Δp = 400 bar	P_{max}	kW	43	53	56	73	91 [3])	131 [3])	219 / 277 [3])	385 / 437 [3])
Max. torque at Δp = 400 bar	T_{max}	Nm	102	140	178	254	395 [3])	696 [3])	1391 [3])	2783 [3])
Case volume		L	0,3	0,3	0,3	0,4	2,0	3,0	7,0	11,0
Moment of inertia, about drive axis	J	kgm^2	0,0017	0,0017	0,0017	0,0030	0,0121	0,0300	0,0959	0,3325
Weight (approx.)	m	kg	13,5	13,5	13,5	16,5	34	61	120	220

[1]) The values shown are valid for an absolute pressure (p_{abs}) of 1 bar at the suction inlet S and when operated on mineral oil.
[2]) 3 % volumetric loss included [3]) Δp = 350 bar H*: High-speed-design

Maximum permissible speed (speed limit)

Maximum permissible speed with increased inlet pressure p_{abs} at suction port S (note: max. perm. speed $n_{max\ perm}$ (speed limit))



Calculation of size

Flow $q_v = \frac{V_g \bullet n \bullet \eta_v}{1000}$ in L/min

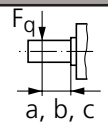
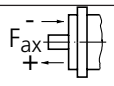
Torque $T = \frac{1{,}59 \bullet V_g \bullet \Delta p}{100 \bullet \eta_{mh}} = \frac{V_g \bullet \Delta p}{20 \bullet \pi \bullet \eta_{mh}}$ in Nm

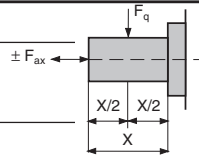
Power $P = \frac{T \bullet n}{9549} = \frac{2\pi \bullet T \bullet n}{60\,000} = \frac{q_v \bullet \Delta p}{600 \bullet \eta_t}$ in kW

V_g = displacement per revolution in cm^3
Δp = differential pressure in bar
n = speed in rpm
η_v = volumetric efficiency
η_{mh} = mechanical-hydraulic efficiency
η_t = overall efficiency

Input drive

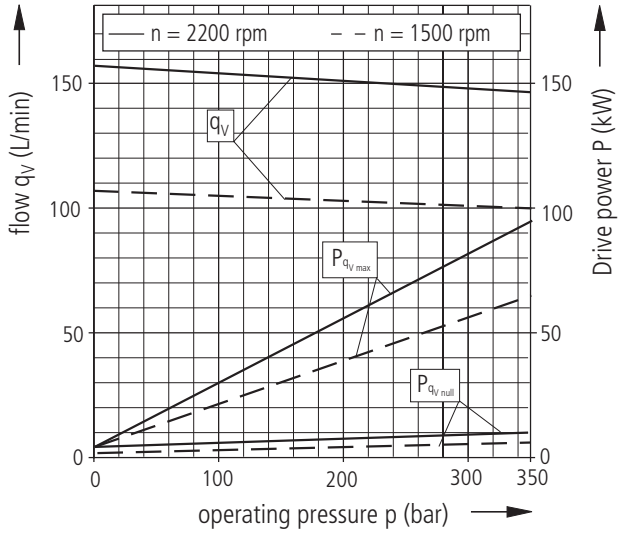
Permissible axial and radial force on drive shaft

Size				16	22	28	40
Distance of F_q (from shaft collar) 	a	mm		17,5	17,5	17,5	17,5
	b	mm		30	30	30	30
	c	mm		42,5	42,5	42,5	42,5
max. permissible radial force at distance	a	$F_{q\ max}$	N	2800	2500	2050	3600
	b	$F_{q\ max}$	N	1600	1400	1150	2891
	c	$F_{q\ max}$	N	1150	1000	830	2416
max. permissible axial force 		$-F_{ax\ max}$	N	1557	1557	1557	2120
		$+F_{ax\ max}$	N	417	417	417	880

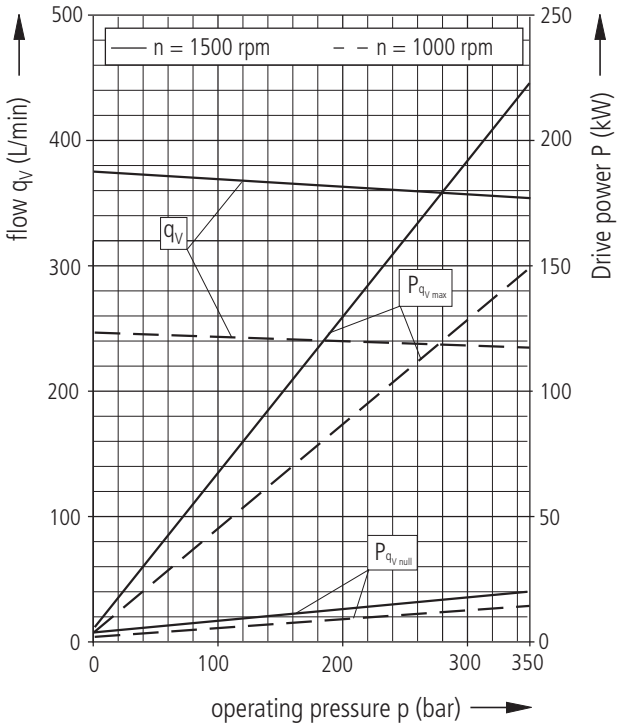
Size				71	125	250	500
Max. axial force at housing pressure p_{max} 1 bar abs. 		$\pm F_{ax\ max}$	N	1400	1900	3000	4000
Max. axial force at housing pressure p_{max} 4 bar abs.		$+F_{ax\ max}$	N	810	1050	1850	2500
		$-F_{ax\ max}$	N	1990	2750	4150	5500
Max. shearing force		$F_{q\ max}$	N	1700	2500	4000	5000

Input Power and Flow

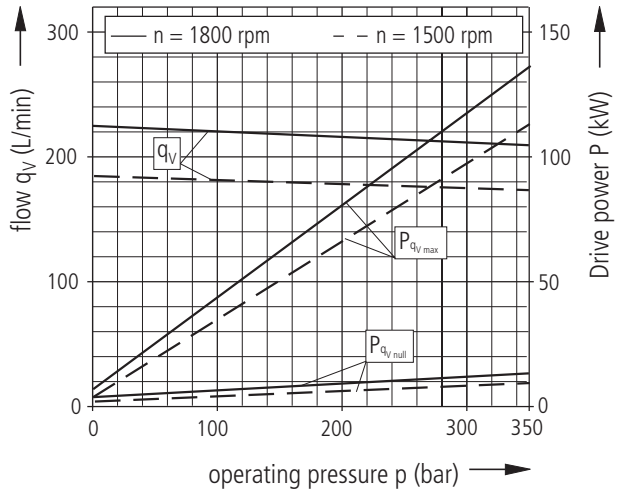
Size 71



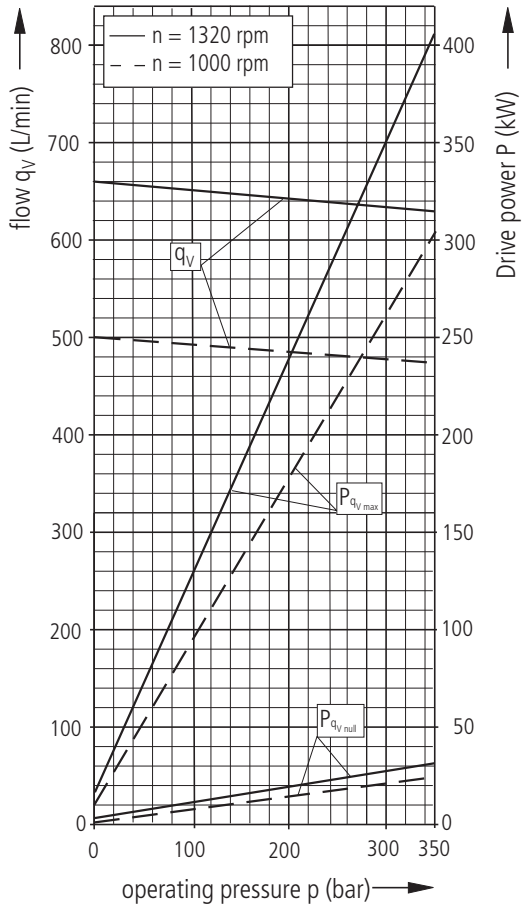
Size 250



Size 125



Size 500



Total efficiency: $$\eta_t = \frac{q_V \bullet p}{P_{q_{V\,max}} \bullet 600}$$

Volumetric efficiency: $$\eta_v = \frac{q_V}{q_{V,\,theor}}$$

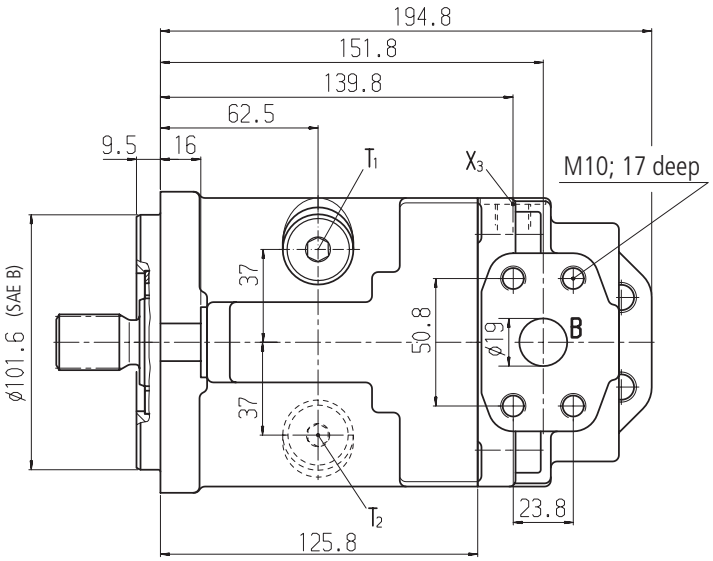
(Fluid: hydraulic oil ISO VG 46 DIN 51519, t = 50°C)

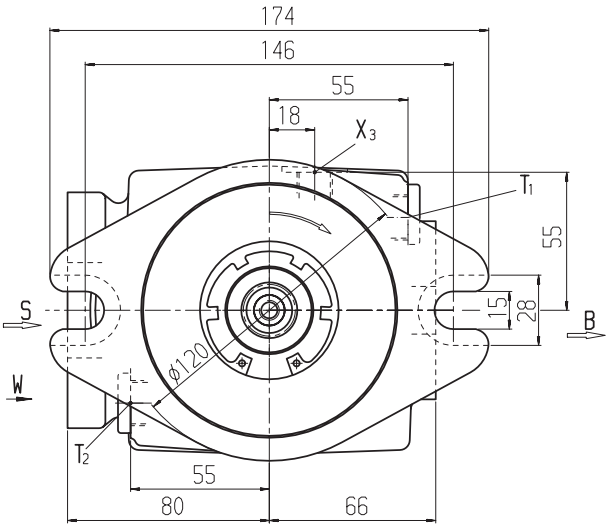
Unit Dimensions, Sizes 16, 22, 28

Prior to finalising your design, please obtain a certified drawing.

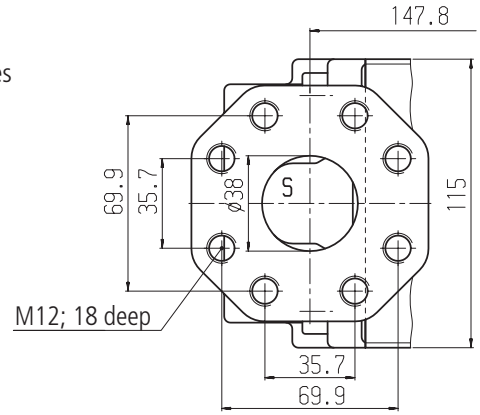
Clockwise operation

(port plate is rotated via 180° for anti-clockwise operation)





View W



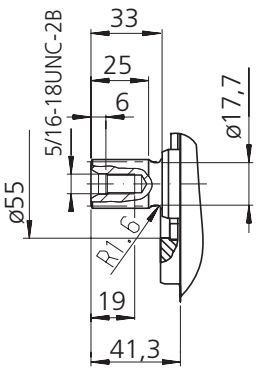
Connections

B (A)	Service line ports	SAE $^{3}/_{4}$" 420 bar (6000 psi) high pressure series
S	Suction port	SAE $1^{1}/_{2}$" 35 bar (500 psi) standard series
T_1, T_2	Case drain port, oil filling	M18x1,5; 12 deep
x_3	Gauge port	M14x1,5; 12 deep

Shaft ends

S

Splined shaft SAE $^{7}/_{8}$"(SAE B),
pressure angle 30°,
13 teeth, 16/32 Pitch,
flat root, side fit,
tolerance class 5
ANSI B92.1a-1976

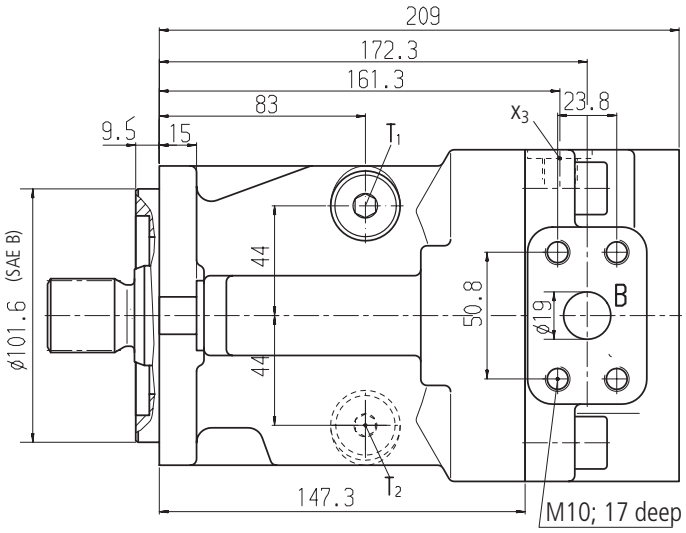


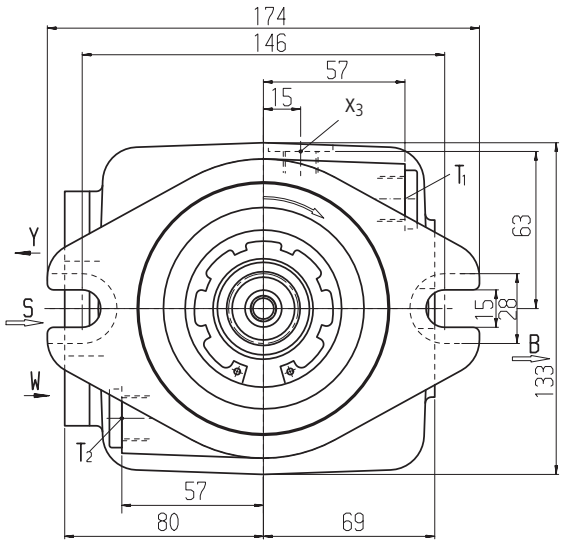
Unit Dimensions, Size 40

Prior to finalising your design, please obtain a certified drawing.

Clockwise operation

(port plate is rotated via 180° for anti-clockwise operation)

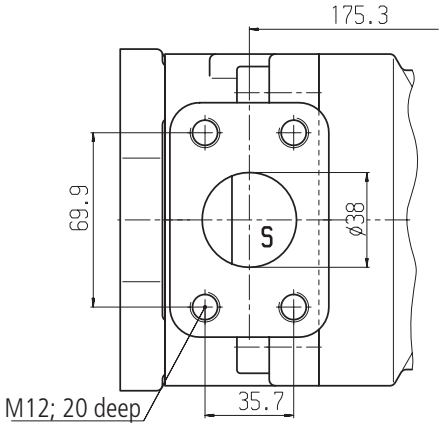




View W

Connections

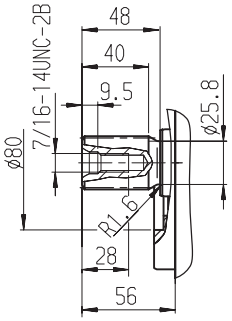
B (A)	Service line ports	SAE 3/4" 420 bar (6000 psi) high pressure series
S	Suction port	SAE 1 1/2" 35 bar (500 psi) standard series
T_1, T_2	Case drain port, oil filling	M18x1,5; 12 deep
x_3	Gauge port	M14x1,5; 12 deep



Shaft ends

T

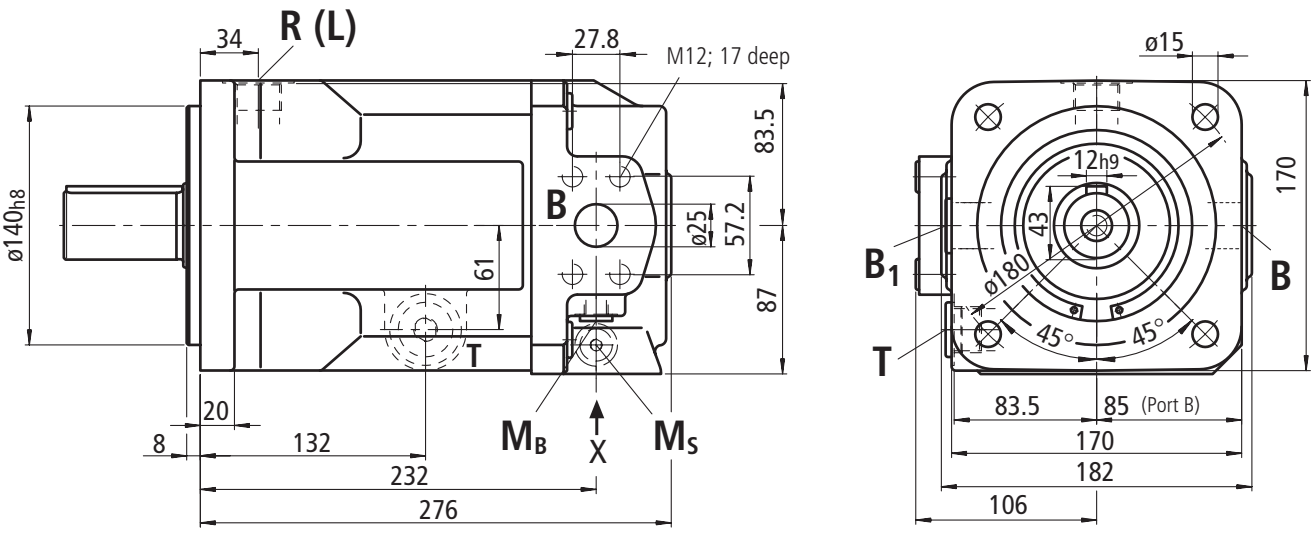
Splined shaft SAE 1 1/4"(SAE C)
pressure angle 30°,
14 teeth, 12/24 Pitch
flat root side fit,
tolerance class 5
ANSI B92.1a-1976



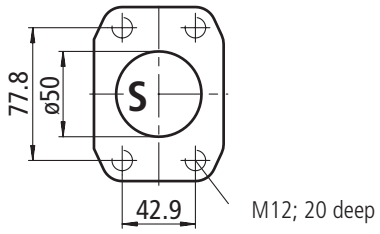
Unit Dimensions, Size 71

Prior to finalising your design, please obtain a certified drawing.

Clockwise and anti-clockwise operation



View X



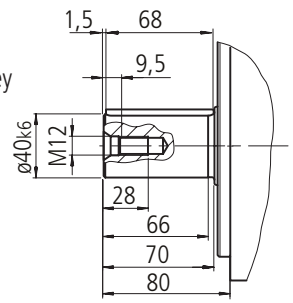
Connections

B	Service line port	SAE 1" (high pressure series)
B_1	2nd service line port (plugged with a flange)	SAE 1" (high pressure series)
S	Suction port	SAE 2" (standard series)
R (L)	Case drain port, oil filling	M27x2
T	Oil drain (plugged)	M27x2
M_B	Gauge port operating pressure (plugged)	M14x1,5
M_S	Gauge port suction pressure (plugged)	M14x1,5

Shaft ends

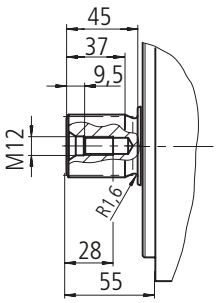
P

Parallel shaft with key
AS 12x8x68
DIN 6885



Z

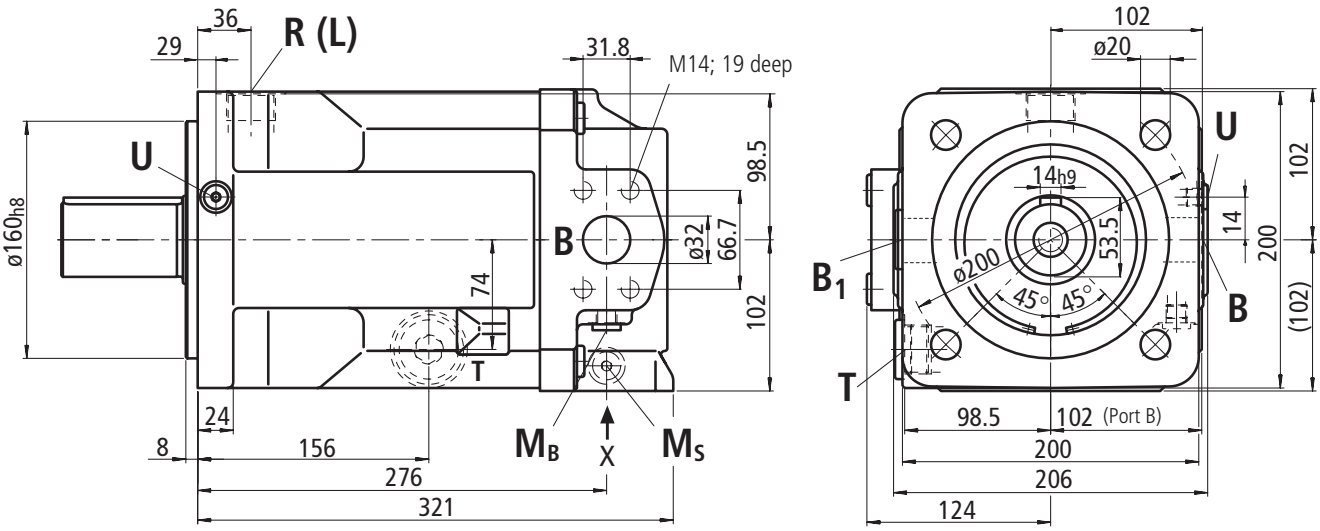
Splined shaft
W40x2x30x18x9g
DIN 5480



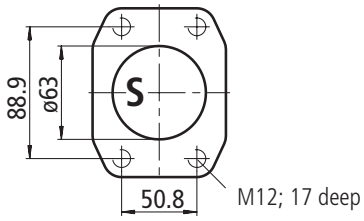
Unit Dimensions, Size 125

Prior to finalising your design, please obtain a certified drawing.

Clockwise and anti-clockwise operation



View X



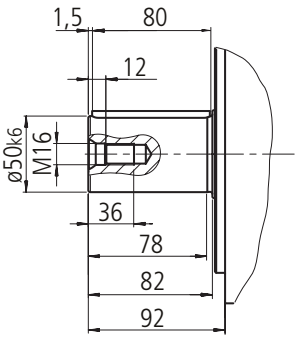
Connections

B	Service line port	SAE 1 1/4" (high pressure series)
B_1	2nd service line port (plugged with a flange)	SAE 1 1/4" (high pressure series)
S	Suction port	SAE 2 1/2" (standard series)
R (L)	Case drain port, oil filling	M33x2
T	Oil drain (plugged)	M33x2
M_B	Gauge port operating pressure (plugged)	M14x1,5
M_S	Gauge port suction pressure (plugged)	M14x1,5
U	Flushing port (bearing flushing) (plugged)	M14x1,5

Shaft ends

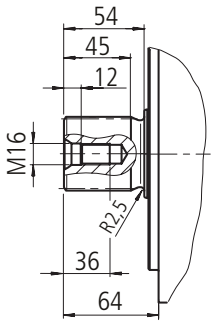
P

Parallel shaft with key
14x9x80
DIN 6885



Z

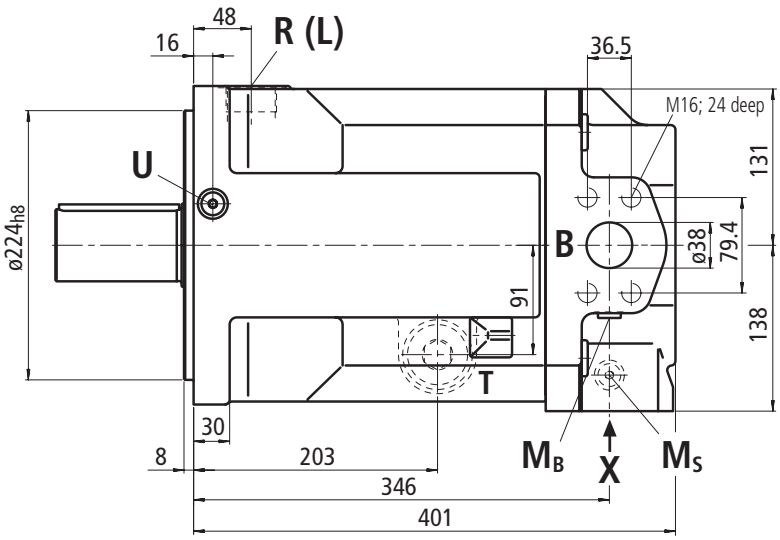
Splined shaft
W50x2x30x24x9g
DIN 5480

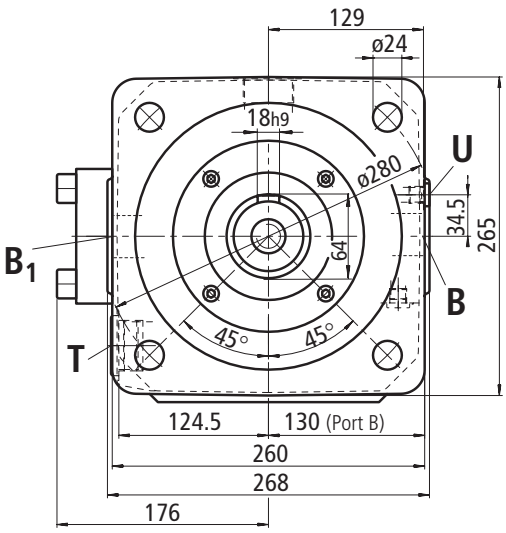


Unit Dimensions, Size 250

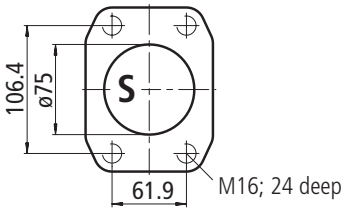
Prior to finalising your design, please obtain a certified drawing.

Clockwise and anti-clockwise operation





View X



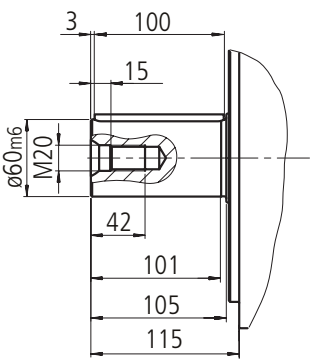
Connections

B	Service line port	SAE 1 $^1/_2$"	(high pressure series)
B_1	2nd service line port (plugged with a flange)	SAE 1 $^1/_2$"	(high pressure series)
S	Suction port	SAE 3"	(standard series)
R (L)	Case drain port, oil filling	M42x2	
T	Oil drain (plugged)	M42x2	
M_B	Gauge port operating pressure (plugged)	M14x1,5	
M_S	Gauge port suction pressure (plugged)	M14x1,5	
U	Flushing port (bearing flushing) (plugged)	M14x1,5	

Shaft ends

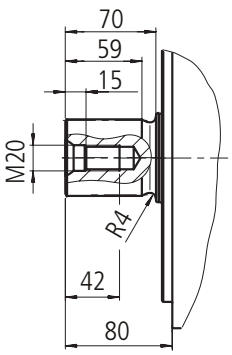
P

Parallel shaft with key
AS 18x11x100
DIN 6885



Z

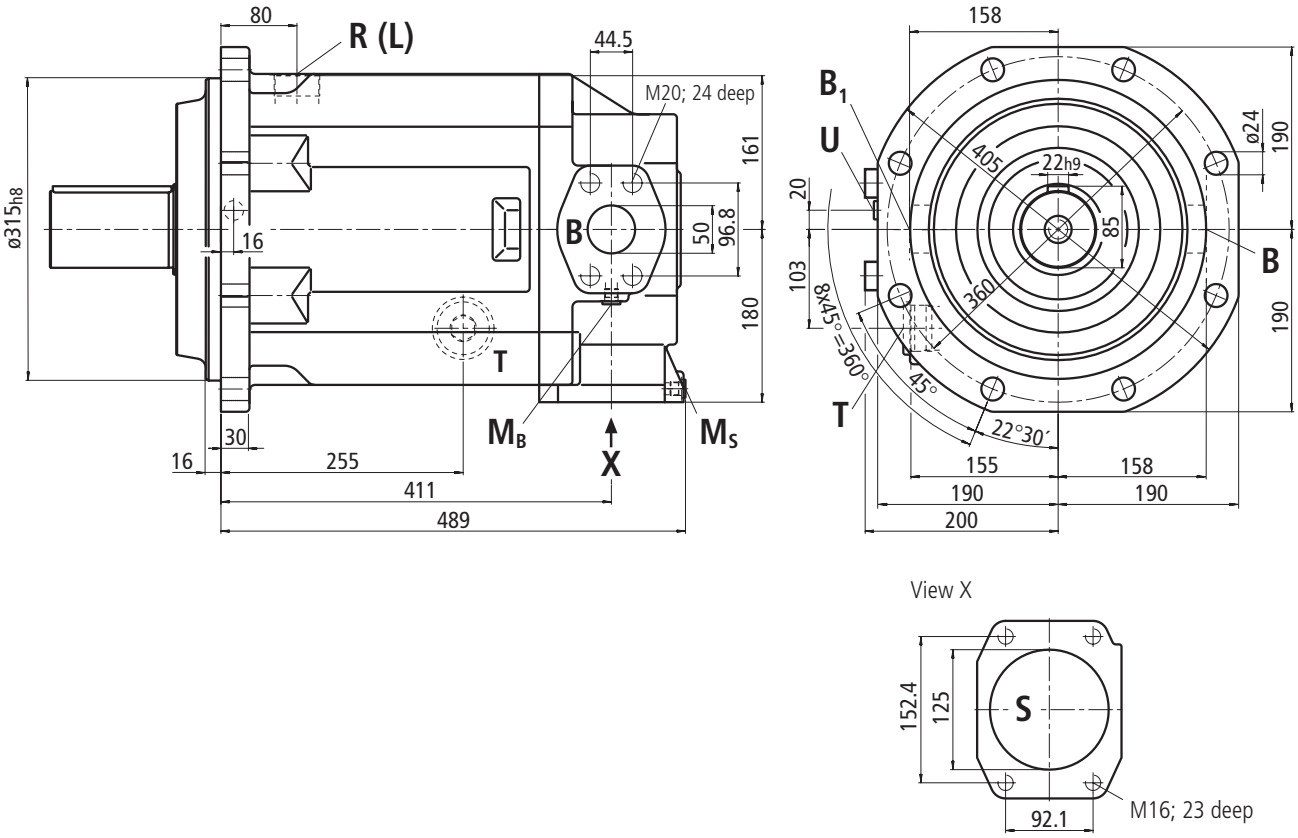
Splined shaft
W60x2x30x28x9g
DIN 5480



Unit Dimensions, Size 500

Prior to finalising your design, please obtain a certified drawing.

Clockwise and anti-clockwise operation



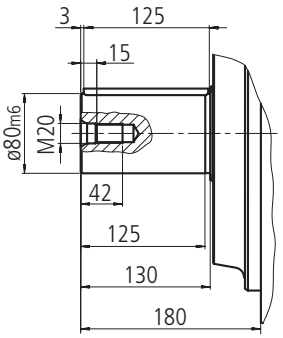
Connections

B	Service line port	SAE 2" (high pressure series)
B_1	2nd service line port (plugged with a flange)	SAE 2" (high pressure series)
S	Suction port	SAE 5" (standard series)
R (L)	Case drain port, oil filling	M48x2
T	Oil drain (plugged)	M48x2
M_B	Gauge port operating pressure (plugged)	M18x1,5
M_S	Gauge port suction pressure (plugged)	M18x1,5
U	Flushing port (bearing flushing) (plugged)	M18x1,5

Shaft ends

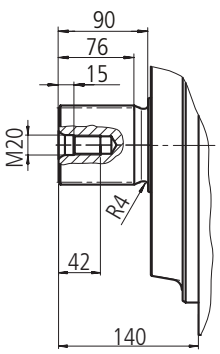
P

Parallel shaft with key
AS 22x14x125
DIN 6885



Z

Splined shaft
W80x3x30x25x9g
DIN 5480

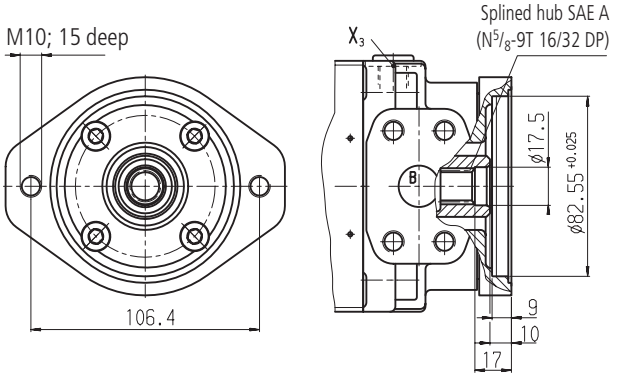


Unit Dimensions, Through Drives

Prior to finalising your design, please obtain a certified drawing.

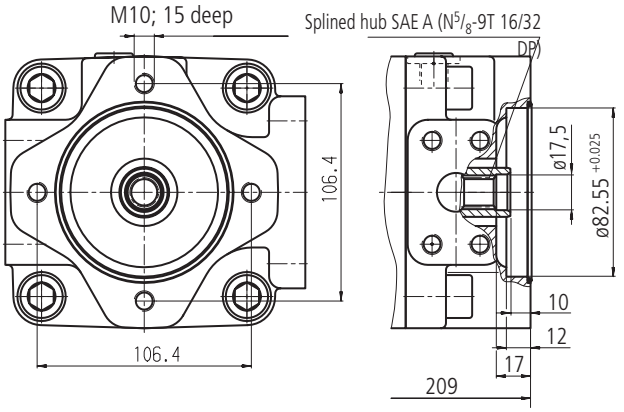
Through drive SAE A (K01)

Sizes 16, 22, 28



suitable for connection of:
– gear pump G2 (RE 10030)
– variable pump A10VSO10 (RE 92713)
– variable pump A10VSO18 (RE 92712)

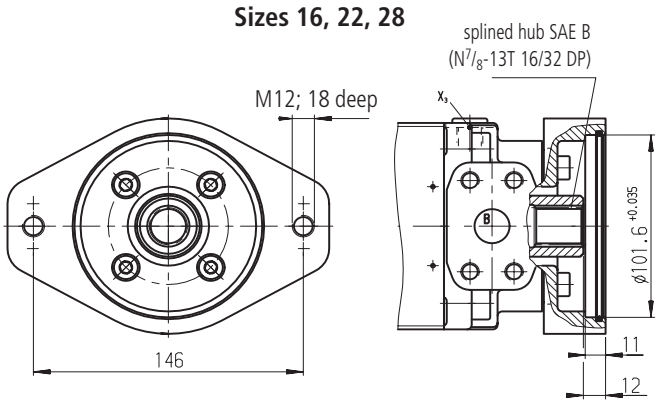
Size 40



suitable for connection of:
– gear pump G2 (RE 10030)
– variable pump A10VSO10 (RE 92713)
– variable pump A10VSO18 (RE 92712)

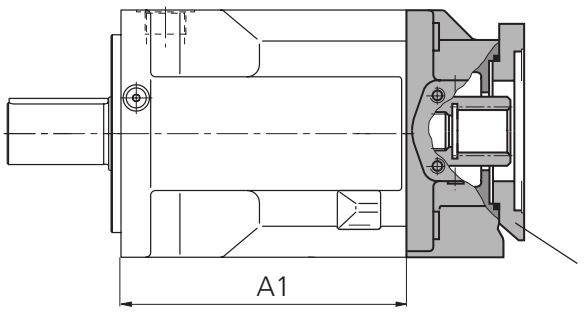
Through drive SAE B (K02)

Sizes 16, 22, 28



suitable for connection of:
– fixed pump A4FO 16, 22, 28
– gear pump G3 (RE 10039)
– gear pump G4 (RE 10042)
– variable pump A10VG18 (RE 92750)
– variable pump A10VO28 (RE 92701/ RE 92703)

Through drive sizes 71...500 (see RE 92050, A4VSO)



Through drive dimensions see RE 92050 (A4VSO)

Size	71	125	250	500
A1	194	231	293	335

Permissible Input and Through Drive Rotation Torques

Size				16	22	28	40
Corner torque (at Δp = 400 bar) [1]		T_{max}	Nm	102	140	178	254
Max. perm. through drive torque [2]		$T_{D\ perm.}$	Nm	192	192	192	314
Max. perm. input torque [3]	shaft end S (SAE J744)	$T_{E\ perm.}$	Nm	192 (SAE B, W7/8")	192 (SAE B, W7/8")	192 (SAE B, W7/8")	–
	shaft end T (SAE J744)	$T_{E\ perm.}$	Nm	–	–	–	602 (SAE C, W11/4")
Size				**71**	**125**	**250**	**500**
Corner torque (at Δp = 350 bar) [1]		T_{max}	Nm	395	696	1391	2783
Max. perm. through drive torque [2]		$T_{D\ perm.}$	Nm	395	696	1391	2783
Max. perm. input torque [3]	shaft end Z (DIN 5480)	$T_{E\ perm.}$	Nm	790 (W40)	1392 (W50)	2782 (W60)	5566 (W80)
	shaft end P (keyed shaft, DIN 6885)	$T_{E\ perm.}$	Nm	700 (AS12x8x68)	1392 (AS14x9x80)	2300 (AS18x11x100)	5200 (AS22x14x125)

[1]) efficiency not taken into consideration

[2]) note: max. perm. input torque $T_{E\ perm.}$ may not be exceeded

[3]) drive shaft without side load

Code explanations

$T_{D\ perm.}$ = max. permissible through drive torque — in Nm

$T_{E\ perm.}$ = max. permissible input torque at the drive shaft — in Nm

T_1 = take off torque at 1st pump $= \dfrac{1{,}59 \bullet V_{g1} \bullet \Delta p_1}{100 \bullet h_{mh}}$ in Nm

T_2 = take off torque at 2nd pump $= \dfrac{1{,}59 \bullet V_{g2} \bullet \Delta p_2}{100 \bullet h_{mh}}$ in Nm

V_{g1} = pump displacement per rev. 1st pump — in cm^3

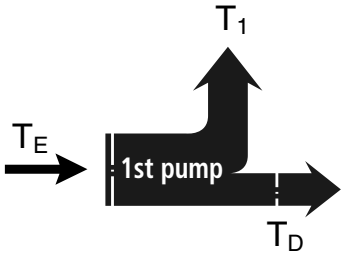
V_{g2} = pump displacement per rev. 2nd pump — in cm^3

Δp_1 = differential pressure 1st pump — in bar

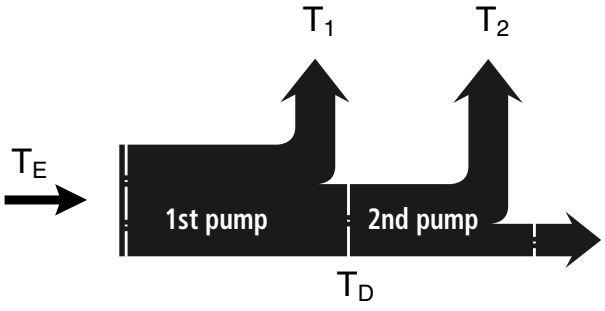
Δp_2 = differential pressure 2nd pump — in bar

η_{mh} = mechanical-hydraulic efficiency

Single pump



Combination pump



Installation and Commissioning Guidelines, Sizes 16...40

General

At start-up and during operation the pump housing has imperatively to be filled up with hydraulic fluid (filling of the case chamber). Start-up has to be carried out at low speed and without load till the system is completely bleeded.

At a longer standstill the case may discharge via operating line. At new start-up a sufficient filling of the housing has to be granted.

The min. suction pressure at port S should not fall below 0,8 bar absolute.

Installation position

Shaft horizontally resp. to the bottom. When mounting on top of the tank the installation position "shaft horizontally, suction port to the bottom" is not admssible!

Installation below tank level

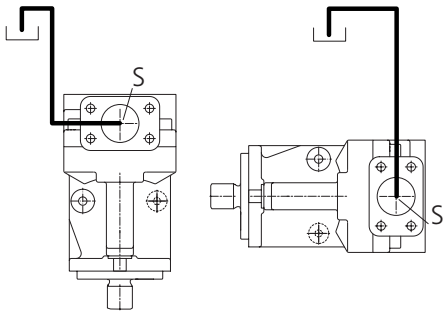
Pumps below min. oil level in the tank (standard)

➔ Fill up axial piston pump before start-up via highest positioned case drain port

➔ Recommendation: Fill up suction lines

➔ Operate pump at low speed (igniton speed) till pump system is completely filled up

➔ Minimum immersion depth of the suction line or drain line in the tank: 200 mm (relative to the min. oil level in the tank).



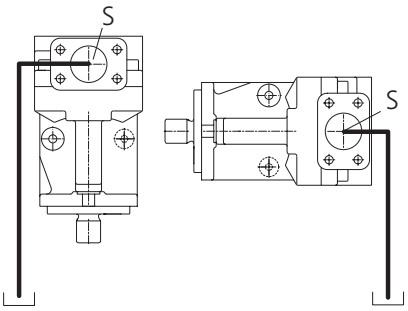
Installation on top of tank level

Pump on top of min. oil level in the tank

➔ Actions as installation below tank level

➔ Installation positions "shaft to the top" and "shaft horizontally, suction port at bottom" are not admissible (at standstill the pump case is bleeding via suction line).

➔ note: - max. perm. suction pipe lenght h_{max} = 800 mm
- min. admissible presssure at port S (min. suction pressure)



Installation and Commissioning Guidelines, Sizes 71...500

see RE 92050 (A4VSO)

Bosch Rexroth AG
Mobile Hydraulics
Product Segment Axial Piston Units
Elchingen Plant
Glockeraustrasse 2
89275 Elchingen, Germany
Telephone +49 (0) 73 08 82-0
Facsimile +49 (0) 73 08 72 74
info.brm-ak@boschrexroth.de
www.boschrexroth.com/brm

Horb Plant
An den Kelterwiesen 14
72160 Horb, Germany
Telephone +49 (0) 74 51 92-0
Facsimile +49 (0) 74 51 82 21

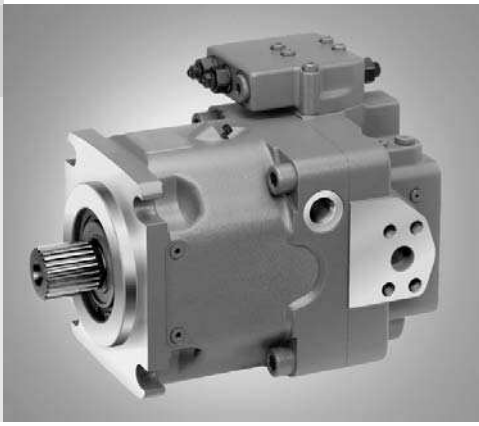
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Rexroth
Bosch Group

Axial Piston Variable Pump AA11VO

RA 92500-A/10.09 **1**/68
Replaces: 06.09

Data sheet



Series 1
Size NG40 to 260
Nominal pressure 5100 psi (350 bar)
Maximum pressure 5800 psi (400 bar)
Open circuit

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Features

- Variable axial piston pump of swashplate design for hydrostatic drives in open circuit hydraulic system.
- Designed primarily for use in mobile applications.
- The pump operates under self-priming conditions, with tank pressurization, or with an optional built-in charge pump (impeller).
- A comprehensive range of control options is available matching any application requirement.
- Power control option is externally adjustable, even when the pump is running.
- The through drive is suitable for adding gear pumps and axial piston pumps up to the same size, i.e. 100% through drive.
- The output flow is proportional to the drive speed and infinitely variable between $q_{V\,max}$ and $q_{V\,min} = 0$.

Ordering code for standard program

AA11V		O			/	1			–	N							
01	02	03	04	05		06	07	08		09	10	11	12	13	14	15	16

Axial piston unit

01	Swashplate design, variable, nominal pressure 5100 psi (350 bar), maximum pressure 5800 psi (400 bar)	**AA11V**

Charge pump (impeller)

		40	60	75	95	130	145	190	260	
02	without charge pump (no code)	●	●	●	●	●	●	●	●	
	with charge pump	–	–	–	–	●	●	●	●	**L**

Operation

03	Pump, open circuit	**O**

Size

			40	60	75	95	130	145	190	260
04	≈ Displacement $V_{g\,max}$	cm^3/rev.	42	58.5	74	93.5	130	145	193	260
		in^3/rev.	2.56	3.57	4.52	5.71	7.93	8.84	11.78	15.87

Control unit

										40	60	75	95	130	145	190	260	
05	Power control					LR					●	●	●	●	●	●	●	●	**LR**
	with override	cross sensing		negative		LR		C			●	●	●	●	●	●	●	●	**LR .C**
		high-pressure related		negative		LR3					●	●	●	●	●	●	●	●	**LR3**
		pilot-pressure related		negative		LG1					●	●	●	●	●	●	●	●	**LG1**
				positive		LG2					●	●	●	●	●	●	●	●	**LG2**
		electric	U = 12 V	negative		LE1					❍	❍	❍	●	●	●	●	●	**LE1**
			U = 24 V	negative		LE2					❍	●	●	●	●	●	●	●	**LE2**
	with pressure cut-off						D				●	●	●	●	●	●	●	●	**L . D. .**
		hydraulic, 2-stage					E				●	●	●	●	●	●	●	●	**L . E. .**
		hydraulic, remote controlled							G		●	●	●	●	●	●	●	●	**L . . G.**
	with load sensing									S	●	●	●	●	●	●	●	●	**L . . .S**
		electric, prop. override, 24 V								S2	❍	❍	❍	●	●	●	●	●	**L . . .S2**
		hydraulic, prop. override								S5	❍	❍	❍	●	●	●	●	●	**L . . .S5**
	with stroke limiter	negative characteristic	Δp=365 psi (25 bar)							H1	●	●	●	●	●	●	●	●	**L . . .H1**
			Δp=145 psi (10 bar)							H5	●	●	●	●	●	●	●	●	**L . . .H5**
		positive characteristic	Δp=365 psi (25 bar)							H2	●	●	●	●	●	●	●	●	**L . . .H2**
			Δp=145 psi (10 bar)							H6	●	●	●	●	●	●	●	●	**L . . .H6**
			U = 12 V							U1	●	●	●	●	●	●	●	●	**L . . .U1**
			U = 24 V							U2	●	●	●	●	●	●	●	●	**L . . .U2**
	Pressure control					DR					●	●	●	●	●	●	●	●	**DR**
		with load sensing				DRS					●	●	●	●	●	●	●	●	**DRS**
		remote controlled				DRG					●	●	●	●	●	●	●	●	**DRG**
		for parallel operation				DRL					●	●	●	●	●	●	●	●	**DRL**
	Hydraulic control pilot-pressure related		Δp = 145 psi (10 bar)			HD1					●	●	●	●	●	●	●	●	**HD1**
		(positive characteristic)	Δp = 365 psi (25 bar)			HD2					●	●	●	●	●	●	●	●	**HD2**
		with pressure cut-off					D				●	●	●	●	●	●	●	●	**HD.D**
		with pressure cut-off, remote controlled					G				❍	●	❍	❍	❍	❍	●	●	**HD. G**
	Electric control		U = 12 V			EP1					●	●	●	●	●	●	●	●	**EP1**
	with proportional solenoid	(positive characteristic)	U = 24 V			EP2					●	●	●	●	●	●	●	●	**EP2**
		with pressure cut-off					D				●	●	●	●	●	●	●	●	**EP. D**
		with pressure cut-off, remote control					G				●	●	●	●	●	●	●	●	**EP. G**

In case of controls with several additional functions, observe the order of the columns, only one option per column is possible (e.g. LRDCH2). The following combinations are not available for the power control: LRDS2, LRDS5, L...GS, L...GS2, L...GS5, L...EC and the combination L...DG in conjunction with the stroke limiters H1, H2, H5, H6, U1 and U2.

● = available ❍ = on request – = not available

Ordering code for standard program

AA11V		O			/	1			–	N							
01	02	03	04	05		06	07	08		09	10	11	12	13	14	15	16

Series

06		**1**

Index

07		Size 40 to 130	**0**
		Size 145 to 260	**1**

Direction of rotation

08	Viewed from drive shaft	clockwise	**R**
		counter-clockwise	**L**

Seals

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

	Drive shaft (see page 8 for permissible input and through drive torques)		**40**	**60**	**75**	**95**	**130**	**145**	**190**	**260**	
10	Parallel keyed shaft DIN 6885		●	●	●	●	●	●	●	●	**P**
	Splined shaft ANSI B92.1a–1976	for single pump	●	●	●	●	●	●	●	●	**S**
		for combination pump	●	●	●	–[1]	–[1]	–[1]	●	●	**T**

	Mounting flange	**40**	**60**	**75**	**95**	**130**	**145**	**190**	**260**	
11	SAE J744 – 2-hole	●	●	–	–	–	–	–	–	**C**
	SAE J744 – 4-hole	–	–	●	●	●	●	●	●	**D**
	SAE J617[2] (SAE 3)	–	–	–	●	●	●	●	–	**G**

	Service line ports	**40**	**60**	**75**	**95**	**130**	**145**	**190**	**260**	
12	Pressure and suction port SAE, at side, opposite side (with UNC fastening threads)	●	●	●	●	●	●	●	●	**62**

	Through drive (see page 58 for attachments)				**40**	**60**	**75**	**95**	**130**	**145**	**190**	**260**	
13	Flange SAE J744[3]	Coupler for splined shaft											
	–	–			●	●	●	●	●	●	●	●	**N00**
	82-2 (A)	5/8in	9T 16/32DP	(A)	●	●	●	●	●	●	●	●	**K01**
		3/4in	11T 16/32DP	(A-B)	❍	●	❍	●	●	●	❍	❍	**K52**
	101-2 (B)	7/8in	13T 16/32DP	(B)	●	●	●	●	●	●	●	●	**K02**
		1 in	15T 16/32DP	(B-B)	●	●	●	●	●	●	●	●	**K04**
	127-2 (C)[4]	1 1/4in	14T 12/24DP	(C)	–	●	●	●	●	●	●	●	**K07**
		1 1/2in	17T 12/24DP	(C-C)	–	–	–	●	●	●	●	●	**K24**
	152-4 (D)	1 1/4in	14T 12/24DP	(C)	–	–	●	●	●	●	●	●	**K86**
		1 3/4in	13T 8/16DP	(D)	–	–	–	–	●	●	●	●	**K17**
	165-4 (E)	1 3/4in	13T 8/16DP	(D)	–	–	–	–	–	–	●	●	**K72**

1) **S**-shaft suitable for combination pump!
2) To fit the flywheel case of the combustion engine
3) 2 ≙ 2-hole; 4 ≙ 4-hole
4) Size 190 and 260 with 2 + 4-hole flange

● = available ❍ = on request – = not available

Ordering code for standard program

AA11V		**O**			**/**	**1**			**–**	**N**							
01	02	03	04	05		06	07	08		09	10	11	12	13	14	15	16

	Swivel angle indicator (page 63)	**40**	**60**	**75**	**95**	**130**	**145**	**190**	**260**	
14	without swivel angle indicator (no symbol)	●	●	●	●	●	●	●	●	
	with optical swivel angle indicator	●	–	●	●	●	●	●	●	**V**
	with electric swivel angle sensor	●	–	●	●	●	●	●	●	**R**

	Connector for solenoids (page 64)	**40**	**60**	**75**	**95**	**130**	**145**	**190**	**260**	
15	DEUTSCH connector molded, 2-pin – without suppressor diode	●	●	●	●	●	●	●	●	**P**

Standard / special version

16	Standard version	without symbol	
		combined with attachment part or attachment pump	**-K**
	Special version		**-S**
		combined with attachment part or attachment pump	**-SK**

● = available ❍ = on request – = not available

Technical data

Hydraulic fluid

Before starting project planning, please refer to our data sheets RE 90220 (mineral oil), RE 90221 (environmentally acceptable hydraulic fluids) and RE 90223 (HF hydraulic fluids) for detailed information regarding the choice of hydraulic fluid and operating conditions.

The variable pump AA11VO is not suitable for operating with HFA, HFB and HFC. If HFD or environmentally acceptable hydraulic fluids are being used, the limitations regarding technical data and seals mentioned in RE 90221 and RE 90223 must be observed.

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

Operating viscosity range

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

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

depending on the tank temperature (open circuit).

Limits of viscosity range

The limiting values for viscosity are as follows:

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

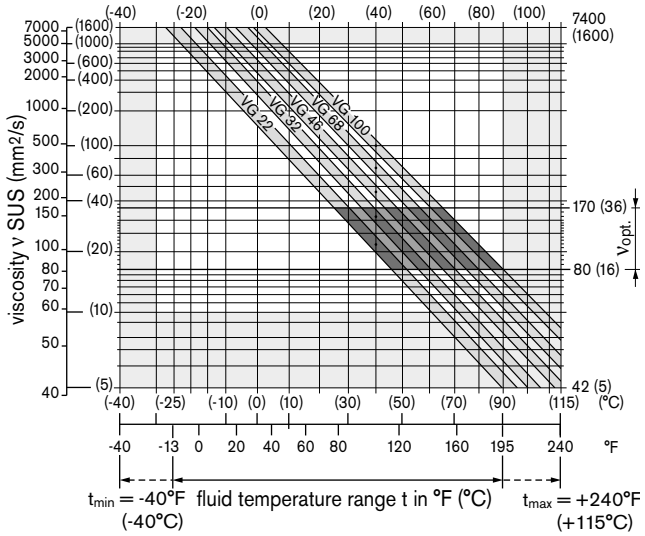
ν_{max} = 7400 SUS (1600 mm²/s)
Short-term (t < 3 min)
At cold start (p ≤ 435 psi (30 bar), n ≤ 1000 rpm, t_{min} = -40 °F (-40 °C)).
Only for starting up without load. Optimum operating viscosity must be reached within approx. 15 minutes.

Note that the maximum hydraulic fluid temperature of 240 °F (115 °C) must not be exceeded locally either (e.g. in the bearing area). The temperature in the bearing area is – depending on pressure and speed – up to 9°F (5 K) higher than the average case drain temperature.

Special measures are necessary in the temperature range from -40 °F (-40 °C) and -13 °F (-25 °C) (cold start phase), please contact us.

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

Selection diagram



Details regarding the choice of hydraulic fluid

The correct choice of hydraulic fluid requires knowledge of the operating temperature in relation to the ambient temperature: in an open circuit the tank temperature.

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

Example: At an ambient temperature of X °C an operating temperature of 140 °F (60 °C) is set. In the optimum operating viscosity range (ν_{opt}; shaded area) this corresponds to the viscosity classes VG 46 and VG 68; to be selected: VG 68.

Note
The case drain temperature, which is affected by pressure and speed, is always higher than the tank temperature. At no point in the system may the temperature be higher than 240 °F (115°C).

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

Filtration

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

To ensure functional reliability of the axial piston unit, the hydraulic fluid must have a claenliness level of at least 20/18/15 according to ISO 4406.

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

If the above classes cannot be observed, please contact us.

Technical data

Operating pressure range

Inlet

Absolute pressure at port S (suction port)
Version **without** charge pump

$p_{abs\ min}$ 12 psi (0.8 bar)
$p_{abs\ max}$ 435 psi (30 bar)

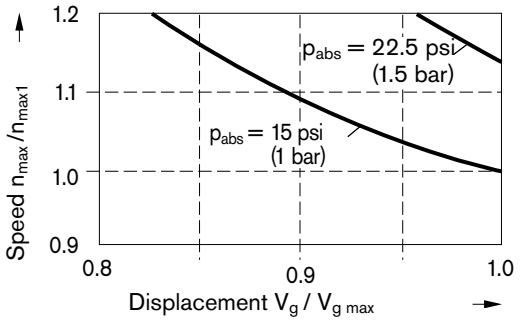
If the pressure is > 75 psi (5 bar), please ask.

Version **with** charge pump

$p_{abs\ min}$ 9 psi (0.6 bar)
$p_{abs\ max}$ 30 psi (2 bar)

Maximum permissible speed (speed limit)

Permissible speed by increasing the inlet pressure p_{abs} at the suction port S or at $V_g \leq V_{g\ max}$



Outlet

Pressure at port A or B

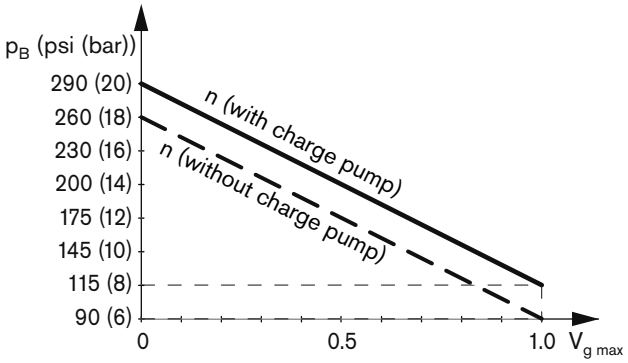
Nominal pressure p_N 5100 psi (350 bar)
Maximum pressure p_{max} 5800 psi (400 bar)

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

Maximum pressure: Maximum operating pressure which is permissible for short-term (t < 1s).

Minimum operating pressure

A minimum operating pressure $p_{B\ min}$ is required in the pump service line depending on the speed, the swivel angle and the displacement (see diagram).



Case drain pressure

The case drain pressure at the ports T_1 and T_2 may be a maximum of 17.5 psi (1.2 bar) higher than the inlet pressure at the port S but not higher than

$p_{L\ abs.\ max}$ 30 psi (2 bar).

An unrestricted, full size case drain line directly to tank is required.

Temperature range of the shaft seal ring

The FKM shaft seal ring is permissible for case drain temperatures of -13 °F to 240 °F (-25 °C to +115 °C).

Note
For applications below-13 °F (-25 °C), an NBR shaft seal ring is necessary (permissible temperature range: -40 °F to 194 °F (-40 °C to +90 °C).
State NBR shaft seal ring in clear text in the order.

Flushing the case

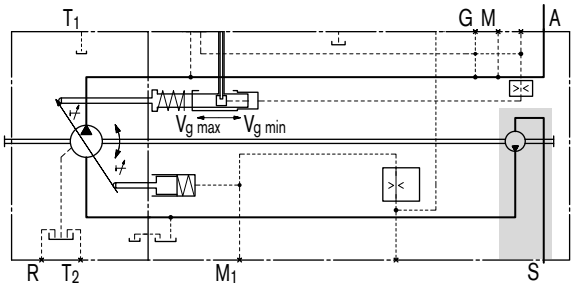
If a variable pump with control unit **EP, HD, DR** or stroke limiter (**H., U.,**) is operated over a long period (t > 10 min) with flow zero or operating pressure < 220 psi (15 bar), flushing of the case via ports "T_1", "T_2" or "R" is necessary.

Size		40	60	75	95	130	145	190	260
$q_{V\ flush}$	gpm	0.5	0.8	0.8	1.0	1.0	1.0	1.3	1.6
	(l/min)	2	3	3	4	4	4	5	6

Flushing the case is unnecessary in versions with charge pump (AA11VLO), since a part of the charge flow is directed to the case.

Charge pump (impeller)

The charge pump is a circulating pump with which the AA11VLO (size 130 to 260) is filled and therefore can be operated at higher speeds. This also simplifies cold starting at low temperatures and high viscosity of the hydraulic fluid. Tank charging is therefore unnecessary in most cases. A tank pressure of a maximum 30 psi (2 bar) is permissible with charge pump.



Technical data

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

Size	AA11VO		40	60	75	95	130	145	190	260
Displacement	$V_{g\,max}$	in^3/rev.	2.56	3.57	4.52	5.71	7.93	8.84	11.78	15.87
		cm^3	42	58.5	74	93.5	130	145	193	260
	$V_{g\,min}$	cm^3	0	0	0	0	0	0	0	0
Speed maximum at $V_{g\,max}$ [1]	n_{max}	rpm	3000	2700	2550	2350	2100	2200	2100	1800
maximum at $V_g \leq V_{g\,max}$ [2]	n_{max1}	rpm	3500	3250	3000	2780	2500	2500	2100	2300
Flow at n_{max} and $V_{g\,max}$	$q_{v\,max}$	gpm	33.3	41.7	49.9	58.1	72.1	84.3	107	123.6
		l/min	126	158	189	220	273	319	405	468
Power at $q_{v\,max}$ and $\Delta p = 350$ bar	P_{max}	hp	99.2	123.4	147.5	171.7	213.2	249.4	316.5	366.1
		kW	74	92	110	128	159	186	236	273
Torque at $V_{g\,max}$ and $\Delta p = 350$ bar	T_{max}	lb-ft	172.6	240.4	303.9	384.3	534	596	792.9	1068
		Nm	234	326	412	521	724	808	1075	1448
Rotary stiffness	P shaft	lb-ft/rad	64512	79574	105548	14883	230417	230417	282702	482244
		Nm/rad	87467	107888	143104	196435	312403	312403	383292	653835
	S shaft	lb-ft/rad	43035	63658	75173	128117	174700	174700	191599	259628
		Nm/rad	58347	86308	101921	173704	236861	236861	259773	352009
	T shaft	lb-ft/rad	54931	75556	92640	–	–	–	222691	418282
		Nm/rad	74476	102440	125603	–	–	–	301928	567115
Moment of inertia for rotary group	J_{TW}	$lbs\text{-}ft^2$	0.1139	0.1946	0.2729	0.4105	0.7546	0.8092	1.3052	2.0835
		kgm^2	0.0048	0.0082	0.0115	0.0173	0.0318	0.0341	0.055	0.0878
Angular acceleration, maximum [3]	α	rad/s^2	22000	17500	15000	13000	10500	9000	6800	4800
Filling capacity	V	gal	0.29	0.36	0.49	0.55	0.77	0.77	1.0	1.22
		L	1.1	1.35	1.85	2.1	2.9	2.9	3.8	4.6
Mass (approx.)	m	lbs	71	88	99	117	145	168	209	276
		kg	32	40	45	53	66	76	95	125

1) The values apply at absolute pressure (p_{abs}) 15 psi (1 bar) at the suction port S and mineral hydraulic fluid.
2) The values apply at $V_g \leq V_{g\,max}$ or in case of an increase in the inlet pressure p_{abs} at the suction port S (see diagram page 6)
3) The area of validity is situated between 0 and the 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 loading on the connection parts has to be considered.

Caution
Exceeding the permissible limit values could cause a loss of function, reduced service life or the destruction of the axial piston unit. The permissible values can be determined by calculation.

Technical data

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

Size	AA11VLO (with charge pump)		130	145	190	260
Displacement	$V_{g\,max}$	in^3/rev.	7.93	8.84	11.78	15.87
		cm^3	130	145	193	260
	$V_{g\,min}$	cm^3	0	0	0	0
Speed maximum at $V_{g\,max}$ [1]	n_{max}	rpm	2500	2500	2500	2300
maximum at $V_g \le V_{g\,max}$ [2]	n_{max1}	rpm	2500	2500	2500	2300
Flow at n_{max} and $V_{g\,max}$	$q_{v\,max}$	gpm	85.9	95.9	127.6	158
		l/min	325	363	483	598
Power at $q_{v\,max}$ and $\Delta p = 350$ bar	P_{max}	hp	254.8	283	376.8	468
		kW	190	211	281	349
Torque at $V_{g\,max}$ and $\Delta p = 350$ bar	T_{max}	lb-ft	534	596	792.9	1068
		Nm	724	808	1075	1448
Rotary stiffness	P shaft	lb-ft/rad	230417	230417	282702	482244
		Nm/rad	312403	312403	383292	653835
	S shaft	lb-ft/rad	174700	174700	191599	259628
		Nm/rad	236861	236861	259773	352009
	T shaft	lb-ft/rad	–	–	222691	418282
		Nm/rad	–	–	301928	567115
Moment of inertia for rotary group	J_{TR}	$lbs\text{-}ft^2$	0.7997	0.8543	1.3692	2.1238
		kgm^2	0.0337	0.036	0.0577	0.0895
Angular acceleration, maximum [3]	α	rad/s^2	10500	9000	6800	4800
Filling capacity	V	gal	0.77	0.77	1.0	1.22
		L	2.9	2.9	3.8	4.6
Mass (approx.)	m	lbs	159	161	229	304
		kg	72	73	104	138

1) The values apply at absolute pressure (p_{abs}) of at least 12 psi (0.8 bar) at the suction port S and mineral hydraulic fluid.
2) The values apply at $V_g \le V_{g\,max}$ or in case of an increase in the inlet pressure p_{abs} at the suction port S (see diagram page 6)
3) The area of validity is situated between 0 and the 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 loading on the connection parts has to be considered.

Caution
Exceeding the permissible limit values could cause a loss of function, reduced service life or the destruction of the axial piston unit. The permissible values can be determined by calculation.

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] $\left(\dfrac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}} \text{ [Nm]} \right)$

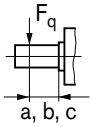
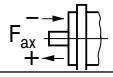
Power $P = \dfrac{2\pi \cdot T \cdot n}{33000} = \dfrac{q_v \cdot \Delta p}{1714 \cdot \eta_t}$ [hp] $\left(\dfrac{q_v \cdot \Delta p}{600 \cdot \eta_t} = \dfrac{2\pi \cdot T \cdot n}{60000} \text{ [kW]} \right)$

V_g = Displacement per revolution [cm^3]
Δ_p = Differential pressure [bar]
n = Speed [rpm]
η_v = Volumetric efficiency
η_{mh} = Mechanical-hydraulic efficiency
η_t = Total efficiency ($\eta_t = \eta_v \cdot \eta_{mh}$)

Technical data

Permissible radial and axial loading on drive shaft

The values stated are maximum data and not permissible for continuous operation

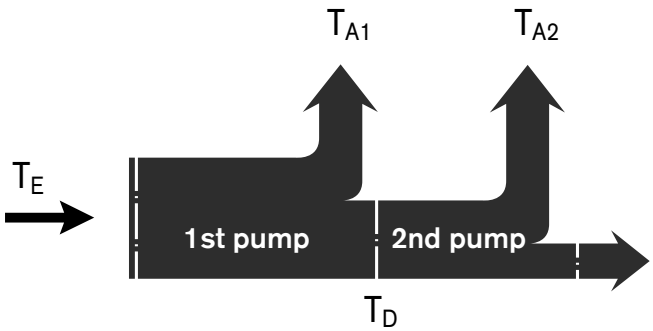
Size			Size	40	60	75	95	130	145	190	260
Radial force, maximum at distance a, b, c (from shaft collar)		$F_{q\,max}$	lbf	809	1124	1416	1798	2472	2472	3805	4946
			N	3600	5000	6300	8000	11000	11000	16925	22000
		a	in	0.69	0.69	0.79	0.79	0.89	0.89	1.02	1.14
			mm	17.5	17.5	20	20	22.5	22.5	26	29
		$F_{q\,max}$	lbf	650	910	1113	1424	1932	1932	2973	3779
			N	2891	4046	4950	6334	8594	8594	13225	16809
		b	in	1.18	1.18	1.38	1.38	1.57	1.57	1.81	1.97
			mm	30	30	35	35	40	40	46	50
		$F_{q\,max}$	lbf	543	764	917	1178	1585	1585	2439	3057
			N	2416	3398	4077	5242	7051	7051	10850	13600
		c	in	1.67	1.67	1.97	1.97	2.26	2.26	2.60	2.80
			mm	42.5	42.5	50	50	57.5	57.5	66	71
Axial force, maximum		± $F_{ax\,max}$	lbf	337	495	618	787	1079	1079	1349	933
			N	1500	2200	2750	3500	4800	4800	6000	4150

Permissible input and through drive torques

Size		Size	40	60	75	95	130	145	190	260
Torque (at $V_{g\,max}$ and $\Delta p = 5100$ psi (350 bar[1]))	T_{max}	lb-ft	173	240	304	384	534	596	793	1068
		Nm	234	326	412	521	724	808	1075	1448
Input torque, maximum[2]										
at shaft end P Shaft key DIN 6885	$T_{E\,perm.}$	lb-ft	345	478	608	770	1068	1068	1642	2056
		Nm	468	648	824	1044	1448	1448	2226	2787
		DIA in	1.26	1.38	1.57	1.77	1.97	1.97	2.17	2.36
		DIA mm	ø32	ø35	ø40	ø45	ø50	ø50	ø55	ø60
at S shaft end ANSI B92.1a-1976 (SAE J744)	$T_{E\,perm.}$	lb-ft	232	444	444	1210	1210	1210	1210	1210
		Nm	314	602	602	1640	1640	1640	1640	1640
		in	1 in	1 1/4 in	1 1/4 in	1 3/4 in	1 3/4 in	1 3/4 in	1 3/4 in	1 3/4 in
at T shaft end ANSI B92.1a-1976 (SAE J744)	$T_{E\,perm.}$	lb-ft	444	715	715	–	–	–	1969	3002
		Nm	602	970	970	–	–	–	2670	4070
		in	1 1/4 in	1 3/8 in	1 3/8 in	–	–	–	2 in	2 1/4 in
Through drive torque, maximum [3]	$T_{D\,perm.}$	lb-ft	232	384	487	606	819	819	1298	1523
		Nm	314	521	660	822	1110	1110	1760	2065

1) Efficiency not considered
2) For drive shafts with no radial force
3) Observe maximum input torque for shaft **S**!

Torque distribution



LR – Power control

The power control regulates the displacement of the pump depending on the operating pressure so that a given drive power is not exceeded at constant drive speed.

$p_B \cdot V_g = \text{constant}$

p_B = operating pressure
V_g = displacement

The precise control with a hyperbolic control characteristic, provides an optimum utilization of available power.

The operating pressure acts on a rocker via a measuring piston. An externally adjustable spring force counteracts this, it determines the power setting.

If the operating pressure exceeds the set spring force, the control valve is actuated by the rocker, the pump swivels back (direction $V_{g\,min}$). The lever length at the rocker is shortened and the operating pressure can increase at the same rate as the displacement decreases without the drive powers being exceeded ($p_B \cdot V_g$ = constant).

The hydraulic output power (characteristic LR) is influenced by the efficiency of the pump.

State in clear text in the order:

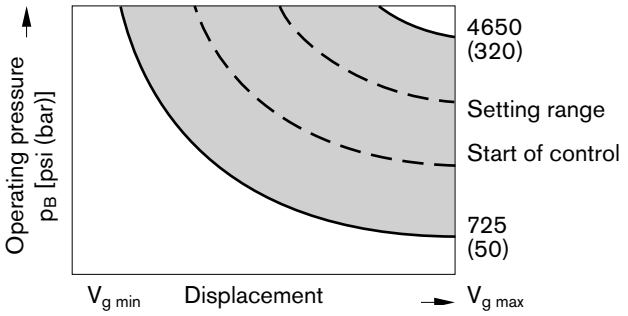
– drive power P in kW

– drive speed n in rpm

– maximum flow $q_{V\,max}$ in l/min

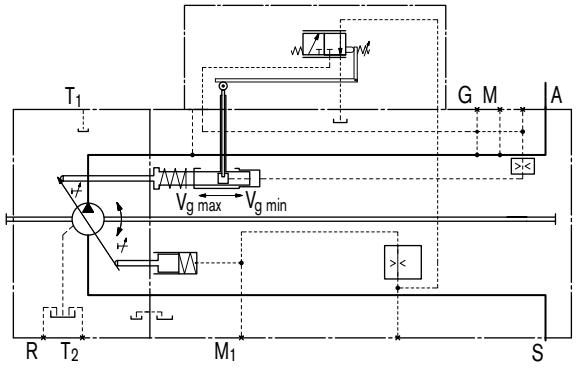
After clarifying the details a power diagram can be created by our computer.

Characteristic LR

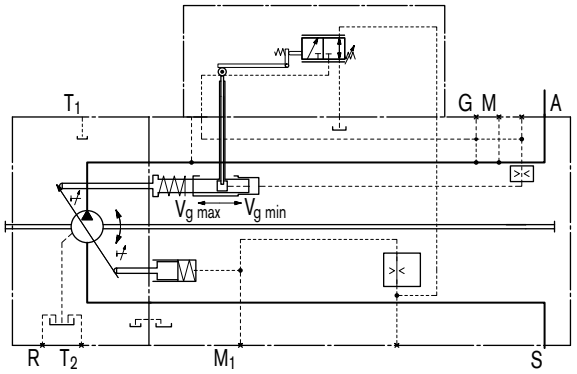


Circuit diagram LR

Size 40 to 145



Size 190 to 260



LR – Power control

LRC Override with cross sensing

Cross sensing control is a summation power control system, whereby the total power, of both the AA11VO and of a same size AA11VO power controlled pump mounted onto the through drive, are kept constant.

If a pump is operating at pressures below the start of the control curve setting, then the surplus power not required, in a critical case up to 100 %, becomes available to the other pump. Total power is thus divided between two systems as demand requires.

Any power being limited by means of pressure cut-off or other override functions is not taken into account.

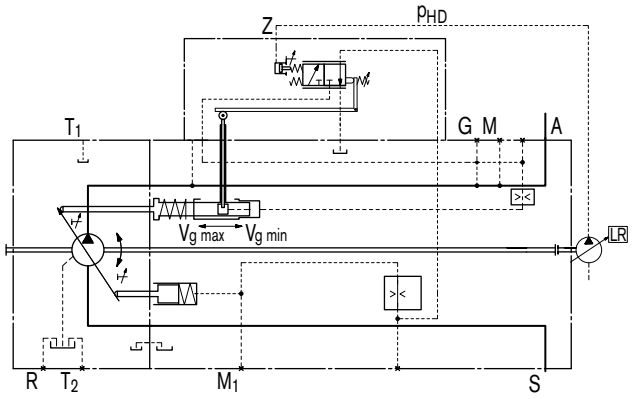
Half side cross sensing function

When using the LRC control on the 1st pump (AA11VO) and a power-controlled pump without cross sensing attached to the through drive, the power required for the 2nd pump is deducted from the setting of the 1st pump. The 2nd pump has priority in the total power setting.

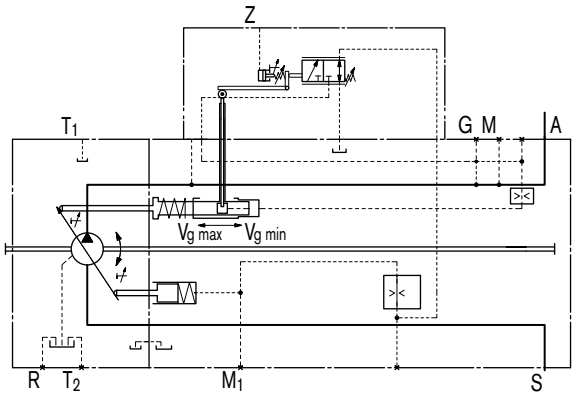
The size and start of control of the power control of the 2nd pump must be specified for rating the control of the 1st pump.

Circuit diagram LRC

Size 40 to 145



Size 190 to 260



LR3 High-pressure related override

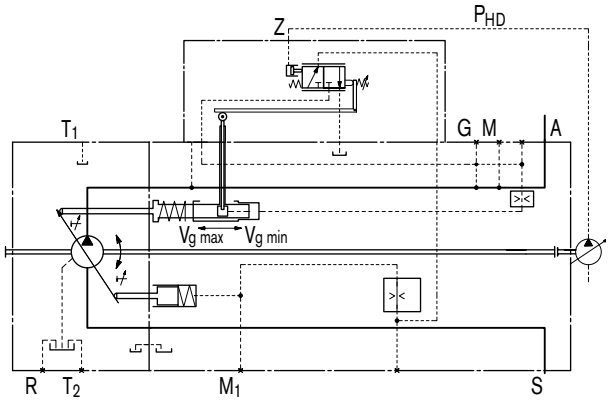
The high-pressure related power override is a total power control in which the power control setting is piloted by the load pressure of an attached fixed pump (port Z).

As a result the AA11VO can be set to 100 % of the total drive power. The power setting of the AA11VO is reduced proportional to the load-dependent rise in operating pressure of the fixed pump. The fixed pump has priority in the total power setting.

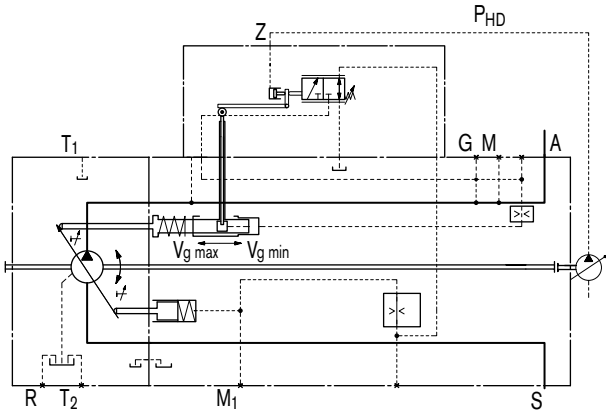
The measuring area of the power reduction pilot piston is designed as a function of the size of the fixed pump.

Circuit diagram LR3

Size 40 to 145



Size 190 to 260



LR – Power control

LG1/2 Pilot-pressure related override

This power control works by overriding the control setting with an external pilot pressure signal. This pilot pressure acts on the adjustment spring of the power regulator via port Z.

The mechanically adjusted basic setting can be hydraulically adjusted by means of different pilot pressure settings, enabling different power mode settings.

If the pilot pressure signal is then adjusted by means of an external power limiting control, the total hydraulic power consumption of all users can be adapted to the available drive power from the engine.

The pilot pressure used for power control is generated by an external control element that is not a component part of the AA11VO (e.g. see also data sheet RE 95310, Electronic Load Limiting Control, LLC).

LG1 Negative power override

Power control with negative override, LG1: the force resulting from the pilot pressure is acting against the mechanical adjustment spring of the power control.

Increasing the pilot pressure reduces the power setting.

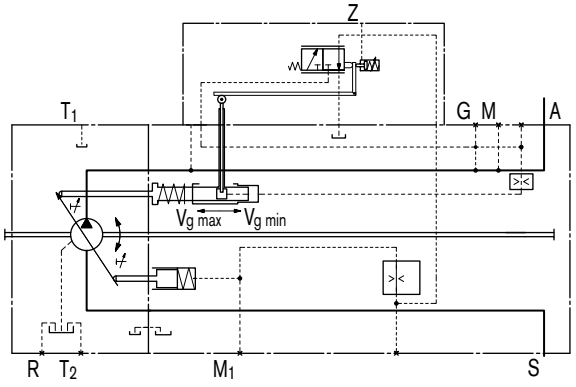
LG2 Positive power override

Power control with positive override, LG2: the force resulting from the pilot pressure is additive the mechanical adjustment spring of the power control.

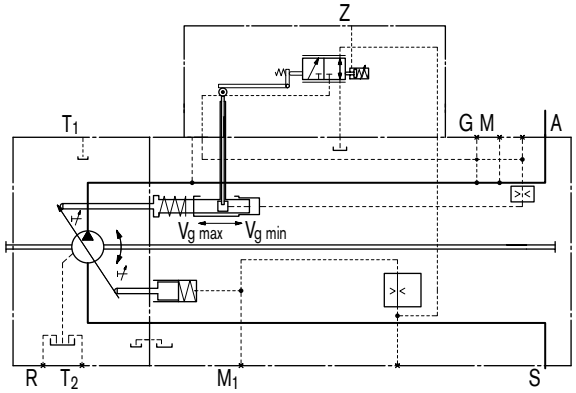
An increase in pilot pressure increases the power output.

Circuit diagram LG1

Size 40 to 145

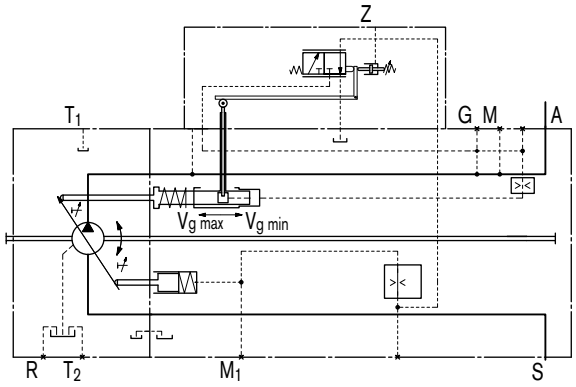


Size 190 to 260

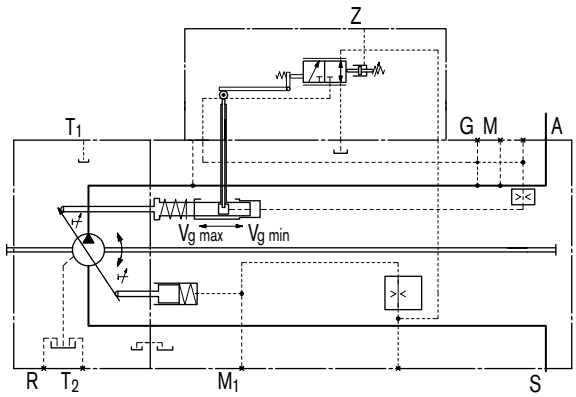


Circuit diagram LG2

Size 40 to 145



Size 190 to 260



LR – Power control

LE1/2 Electric override (negative)

Contrary to hydraulic power control override, the basic power setting is reduced by an electric pilot current applied to a proportional solenoid. The resulting force is acting against the mechanical power control adjustment spring.

The mechanically adjusted basic power setting can be varied by means of different control current settings.

Increase in current = decrease in power

If the pilot current signal is adjusted by a load limiting control the power consumption of all actuators will be reduced to match the available power from the diesel engine.

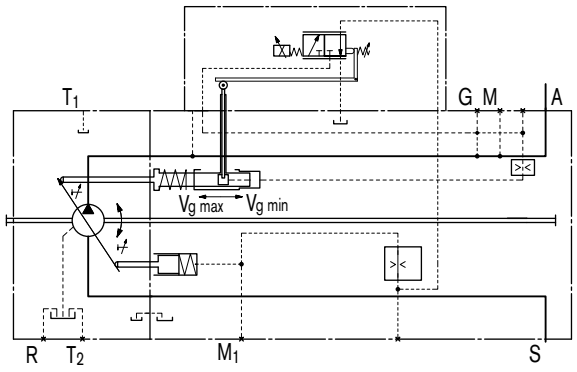
A 12V (LE1) or 24V (LE2) supply is required for the control of the proportion solenoid.

Technical data - Solenoids

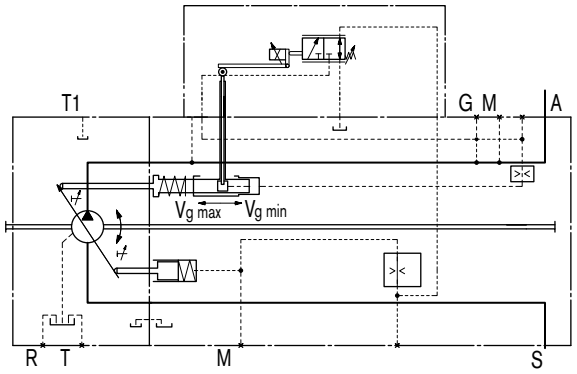
	LE1	LE2
Voltage	12 V (±20 %)	24 V (±20 %)
Control current		
Start of control	400 mA	200 mA
End of control	1200 mA	600 mA
Limiting current	1.54 A	0.77 A
Nominal resistance (at 68 °F (20 °C))	5.5 Ω	22.7 Ω
Dither frequency	100 Hz	100 Hz
Actuated time	100 %	100 %
Type of protection	see connector version, page 60	

Circuit diagram LE1/2

Size 40 to 145

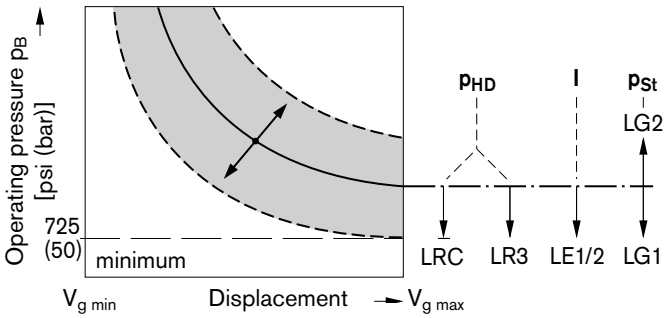


Size 190 to 260



Overview of power overrides

Effect of power overrides at rising pressure or current



LR – Power control

LRD Power control with pressure cut-off

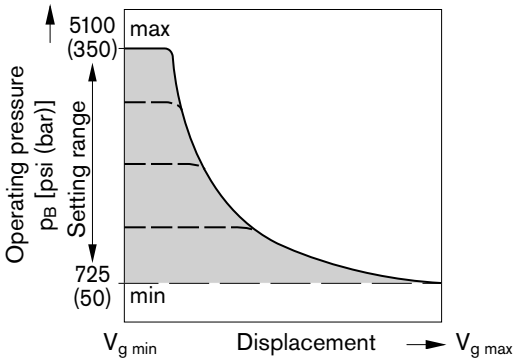
The pressure cut-off corresponds to a pressure control which adjusts the pump displacement back to $V_{g\,min}$, when the pressure setting is reached.

This function overrides the power control, i.e. below the preset pressure value, the power function is effective.

The pressure cut-off function is integrated into the pump control module and is preset to a specified value at the factory.

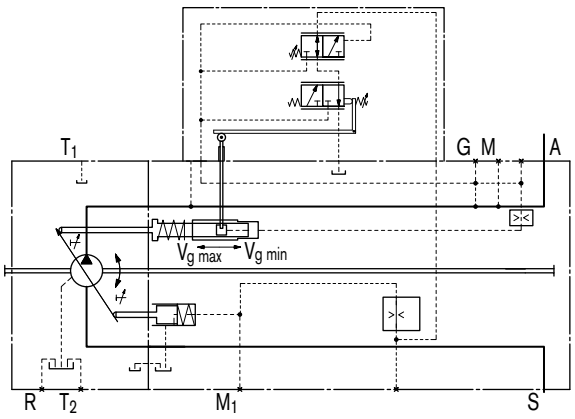
Setting range from 725 to 5100 psi (50 to 350 bar)

Characteristic LRD

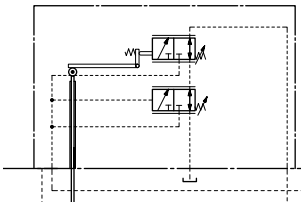


Circuit diagram LRD

Size 40 to 145



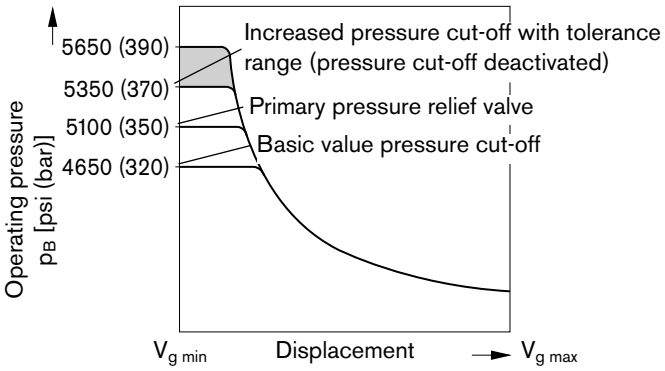
Size 190 to 260



LRE Power control with pressure cut-off, 2-stage

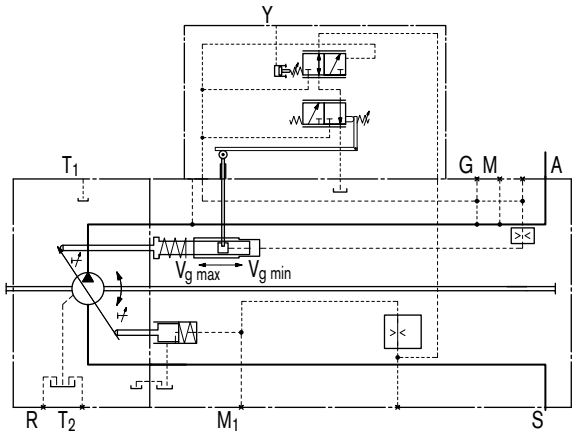
By connecting an external pilot pressure to port Y, the basic value of the pressure cut-off can be increased by 725^{+290} psi (50^{+20} bar) and a 2nd pressure setting implemented.
This value is usually above the primary pressure relief valve setting and therefore disables the pressure cut-off function.
The pressure signal at port Y must be between 290 and 725 psi (20 and 50 bar).

Characteristic LRE

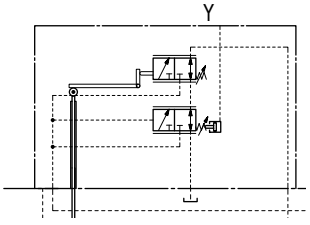


Circuit diagram LRE

Size 40 to 145



Size 190 to 260



LRG Power control with pressure cut-off, hydraulically remote controlled

See page 21 for description and characteristic (pressure control remote controlled, DRG)

LR – Power control

LRDS Power control with pressure cut-off and load sensing

The load sensing control is a flow control option that operates as a function of the load pressure to regulate the pump displacement to match the actuator flow requirement.

The flow depends here on the cross section of the external sensing orifice (1) fitted between the pump outlet and the actuator. The flow is independent of the load pressure below the power curve and the pressure cut-off setting and within the control range of the pump.

The sensing orifice is usually a separately arranged load sensing directional valve (control block). The position of the directional valve piston determines the opening cross section of the sensing orifice and thus the flow of the pump.

The load sensing control compares pressure before and after the sensing orifice and maintains the pressure drop across the orifice (differential pressure Δp) and with it the pump flow constant.

If the differential pressure Δp increases at the sensing orifice, the pump is swivelled back (towards $V_{g\,min}$), and, if the differential pressure Δp decreases, the pump is swivelled out (towards $V_{g\,max}$) until the pressure drop across the sensing orifice in the valve is restored.

$\Delta p_{orifice} = p_{pump} - p_{actuator}$

The setting range for Δp is between 200 psi and 365 psi (14 bar and 25 bar).

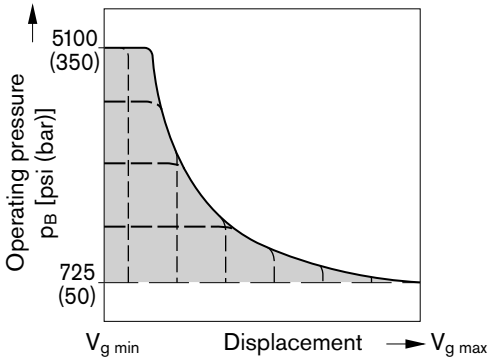
The standard differential pressure setting is 260 psi (18 bar). (Please state in clear text when ordering).

The stand-by pressure in zero stroke operation (sensing orifice plugged) is slightly above the Δp setting.

In a standard LS system the pressure cut-off is integrated in the pump control. In a LUDV (flow sharing) system the pressure cut-off is integrated in the LUDV control block.

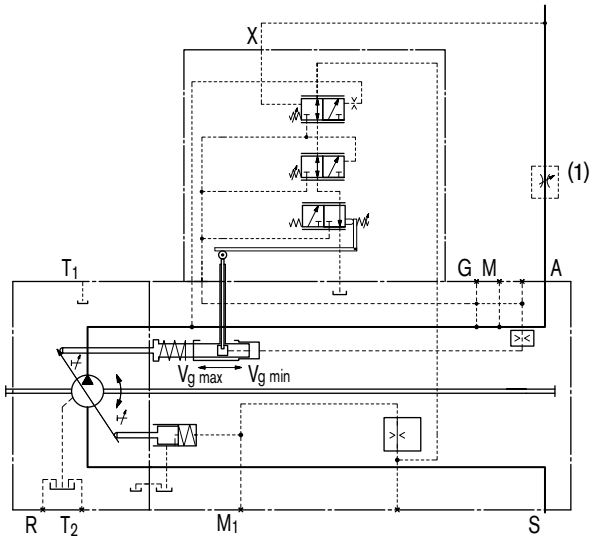
(1) The sensing orifice (control block) is not included in the pump supply.

Characteristic LRDS

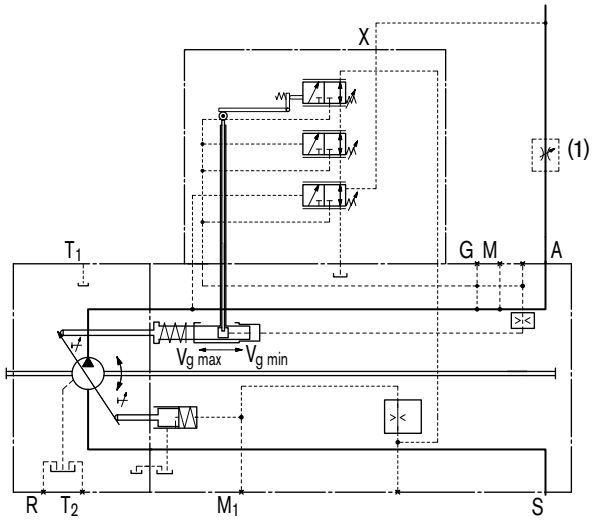


Circuit diagram LRDS

Size 40 to 145



Size 190 to 260



LR – Power control

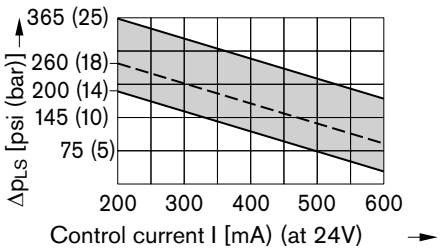
LRS2 Power control with load sensing, electric override

This control option adds a proportional solenoid to override to the mechanically set load sensing pressure. The pressure differential change is proportional to the solenoid current.

Increasing current = smaller Δp-setting

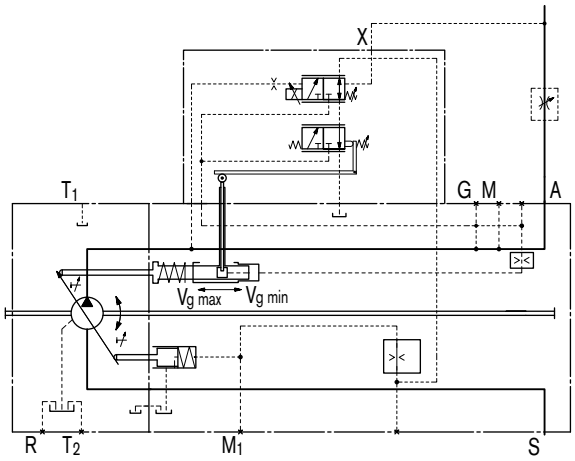
See following characteristic for details (example). Please consult us during the project planning phase.
For solenoid specification, see page 12 (LE2)

Characteristic LRS2

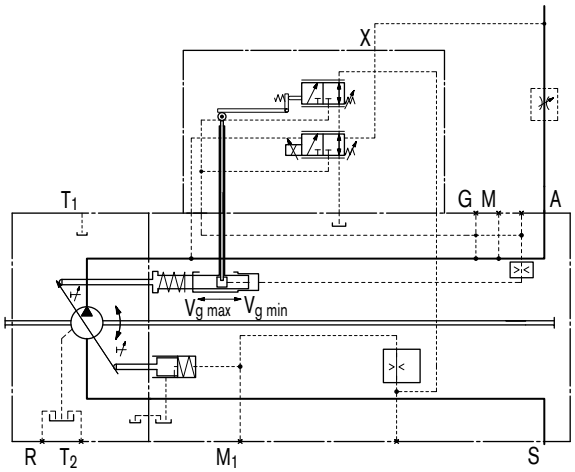


Circuit diagram LRS2

Size 40 to 145



Size 190 to 260



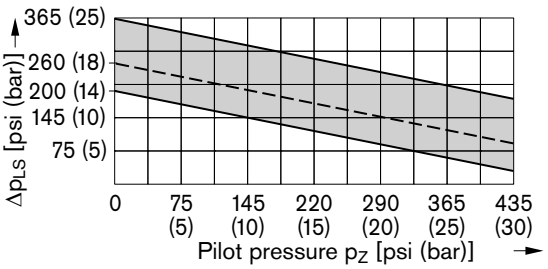
LRS5 Power control with load sensing, hydraulic override

This control option adds an external proportional pilot pressure signal (to port Z) to override the mechanically set load sensing pressure.

Increasing pilot pressure = smaller Δp-setting

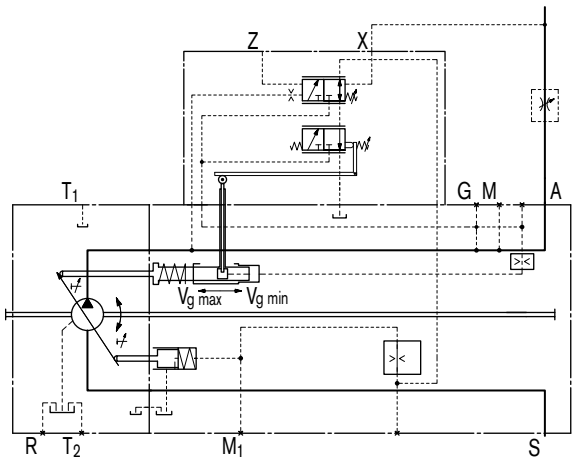
See following characteristic for details (example). Please consult us during the project planning phase.

Characteristic LRS5

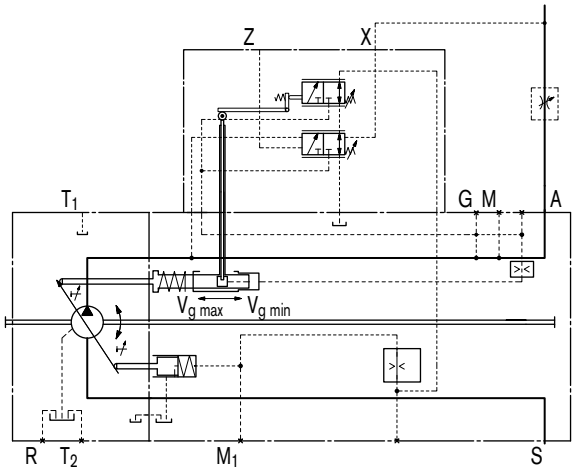


Circuit diagram LRS5

Size 40 to 145



Size 190 to 260



LR – Power control

LR... Power control with stroke limiter

The stroke limiter can be used to vary or limit the displacement of the pump continuously over the whole control range. The displacement is set in LRH with the pilot pressure p_{St} (maximum 580 psi (40 bar)) applied to port Y or in LRU by the control current applied to the proportional solenoid. A DC current of 12V (U1) or 24V (U2) is required to control the proportional solenoid.

The power control overrides the stoke limiter control, i.e. below the hyperbolic power characteristic, the displacement is controlled by the control current or pilot pressure. When exceeding the power characteristic with a set flow or load pressure, the power control overrides and reduces the displacement following the hyperbolic characteristic.

To permit operation of the pump displacement control from its starting position $V_{g\,max}$ to $V_{g\,min}$, a minimum control pressure of 435 psi (30 bar) is required for the electric stroke limiter LRU1/2 and the hydraulic stroke limiter LRH2/6.

The required control pressure is taken either from the load pressure, or from the externally applied control pressure at the G port.

To ensure functioning of the stroke limiter even at low operating pressure, port G must be supplied with external control pressure of approx. 435 psi (30 bar).

Note
If no external control pressure is connected at G, the shuttle valve must be removed.

Note

The spring return feature in the controller is not a safety device

The spool valve inside the controller 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 safe position (e.g. immediate stop).

LR – Power control

LRH1/5 Hydraulic stroke limiter (negative characteristic)

Control from $V_{g\,max}$ to $V_{g\,min}$

With increasing pilot pressure the pump swivels to a smaller displacement.

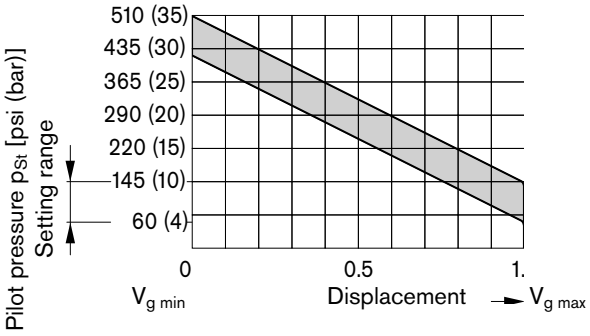
Start of control (at $V_{g\,max}$), can be set from _____ 60 to 145 psi (4 to 10 bar)

State start of control in clear text in the order.

Starting position without control signal (pilot pressure): $V_{g\,max}$

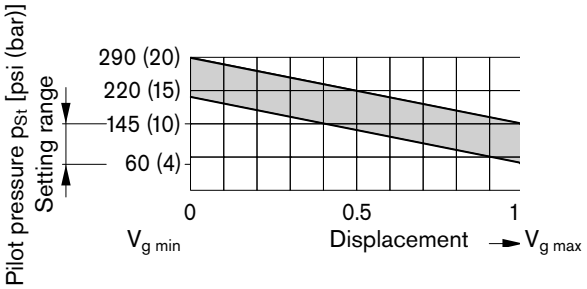
Characteristic H1

Increase in pilot pressure ($V_{g\,max} - V_{g\,min}$)
$\Delta p = 365$ psi (25 bar)



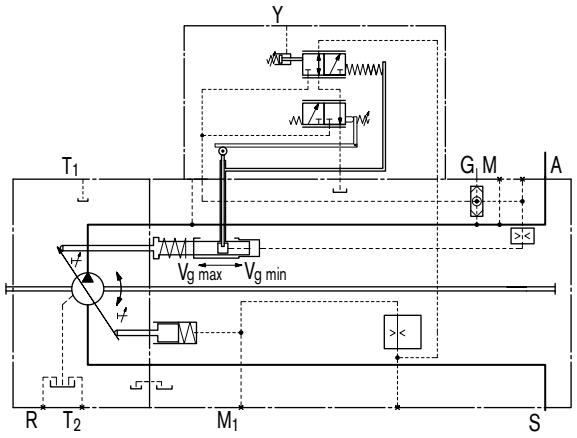
Characteristic H5

Increase in pilot pressure ($V_{g\,max} - V_{g\,min}$)
$\Delta p = 145$ psi (10 bar)

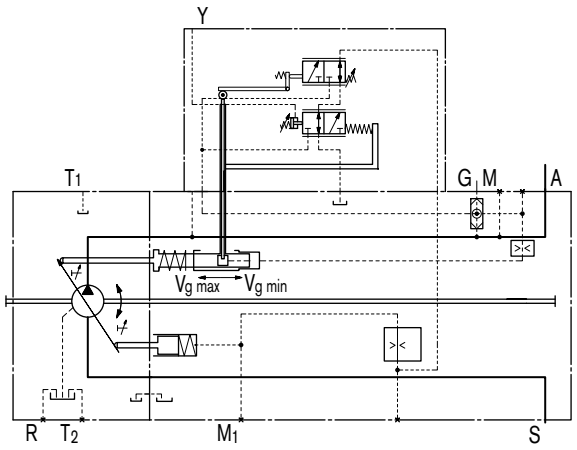


Circuit diagram LRH1/5

Size 40 to 145



Size 190 to 260



LR – Power control

LRH2/6 Hydraulic stroke limiter (positive characteristic)

Control from $V_{g\,min}$ to $V_{g\,max}$

With increasing pilot pressure the pump swivels to a higher displacement.

Start of control (at $V_{g\,min}$), can be set
_____ from 60 to 145 psi (4 to 10 bar)

State start of control in clear text in the order.

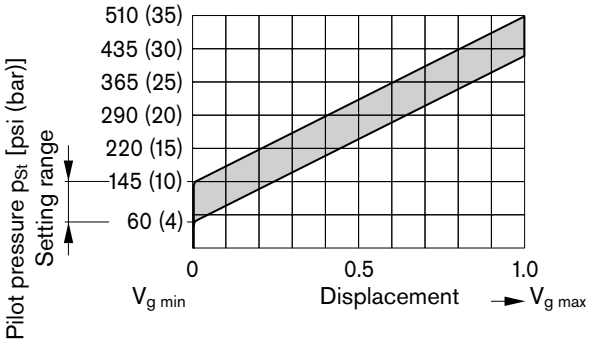
Starting position without control signal (pilot pressure):

– at operating pressure and external control pressure < 435 psi (30 bar): $V_{g\,max}$

– at operating pressure or external control pressure > 435 psi (30 bar): $V_{g\,min}$

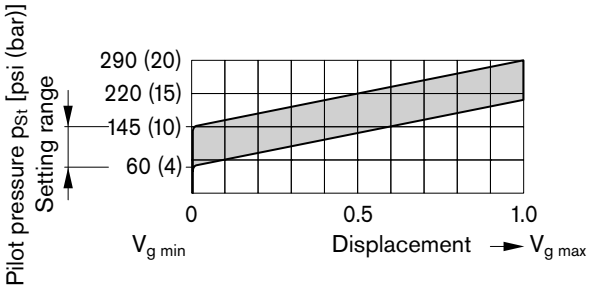
Characteristic H2

Increase in pilot pressure ($V_{g\,min}$ – $V_{g\,max}$)
Δp = 365 psi (25 bar)



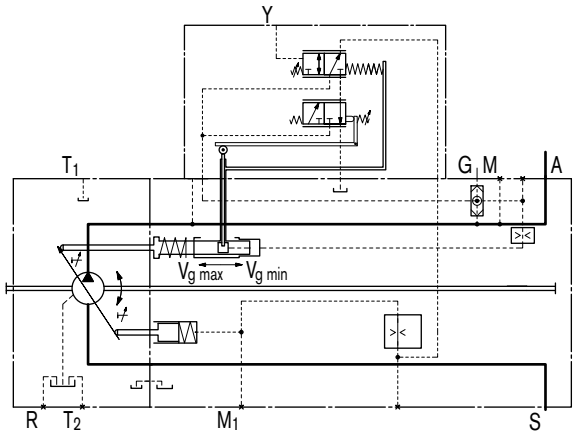
Characteristic H6

Increase in pilot pressure ($V_{g\,min}$ – $V_{g\,max}$)
Δp = 145 psi (10 bar)

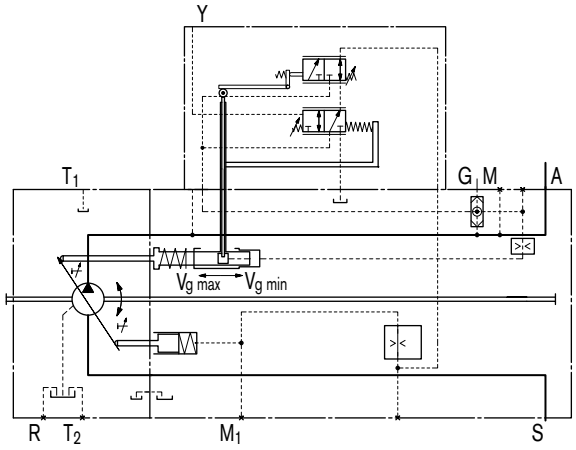


Circuit diagram LRH2/6

Size 40 to 145



Size 190 to 260



LR – Power control

LRU1/2 Electric stroke limiter (positive characteristic)

Control from $V_{g\,min}$ to $V_{g\,max}$

With increasing control current the pump swivels to a higher displacement.

Technical data - solenoids

	LRU1	LRU2
Voltage	12 V (±20 %)	24 V (±20 %)
Control current		
Start of control at $V_{g\,max}$	400 mA	200 mA
End of control at $V_{g\,min}$	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 version, page 60	

Starting position without control signal (control current):

– at operating pressure and external control pressure < 435 psi (30 bar): $V_{g\,max}$

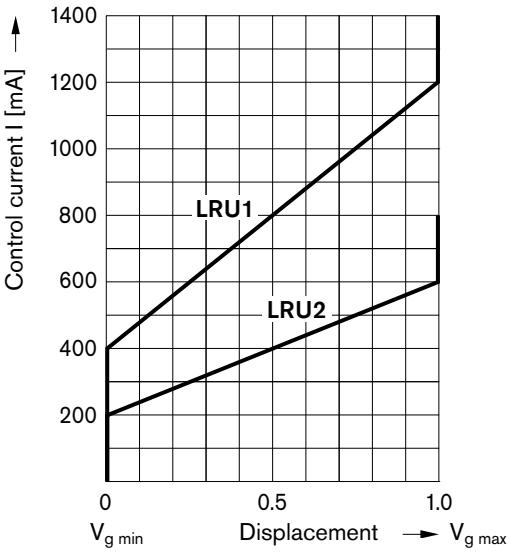
– at operating pressure or external control pressure > 435 psi (30 bar): $V_{g\,min}$

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

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

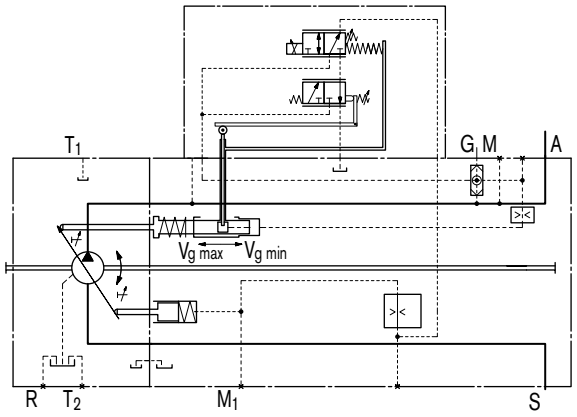
– Analog amplifier RA _____ RE 95230

Characteristic LRU1/2

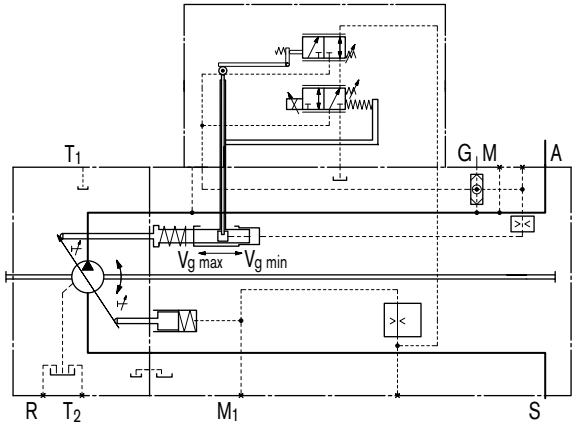


Circuit diagram LRU1/2

Size 40 to 145



Size 190 to 260



DR – Pressure control

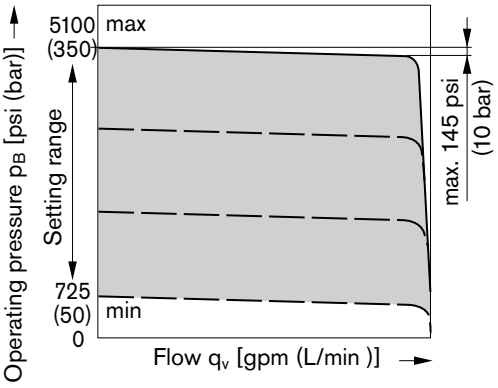
DR Pressure control

The pressure control keeps the pressure in a hydraulic system constant within its control range even under varying flow conditions. The variable pump only moves as much hydraulic fluid as is required by the actuators. If the operating pressure exceeds the setpoint set at the integral pressure control valve, the pump displacement is automatically swivelled back until the pressure deviation is corrected.

Starting position in depressurized state: $V_{g\,max}$

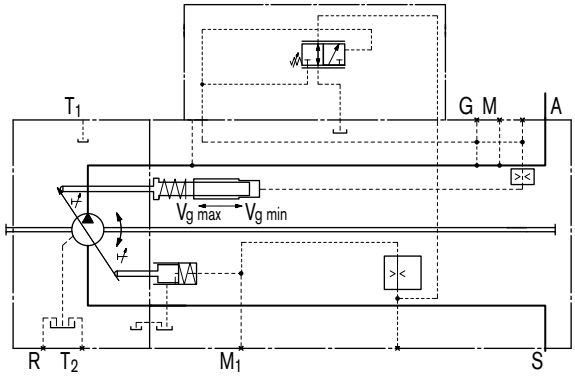
Setting range from 725 to 5100 psi (50 to 350 bar).

Characteristic: DR

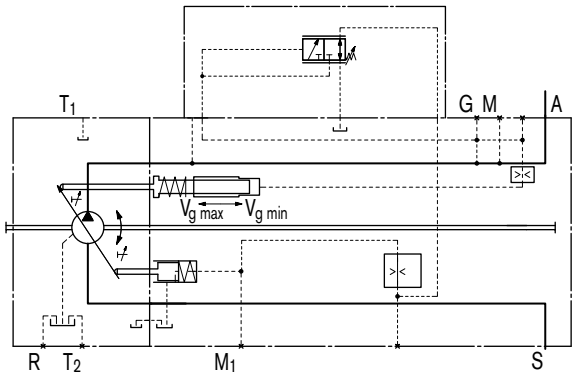


Circuit diagram DR

Size 40 to 145



Size 190 to 260



DR – Pressure control

DRS Pressure control with load sensing

The load sensing control is a flow control option that operates as a function of the load pressure to regulate the pump displacement to match the actuator flow requirement.

The flow depends here on the cross section of the external sensing orifice (1) fitted between the pump outlet and the actuator. The flow is independent of the load pressure below the pressure cut-off setting and within the control range of the pump.

The sensing orifice is usually a separately arranged load sensing directional valve (control block). The position of the directional valve piston determines the opening cross section of the sensing orifice and thus the flow of the pump.

The load sensing control compares pressure before and after the sensing orifice and maintains the pressure drop across the orifice (differential pressure Δp) and with it the pump flow constant.

If the differential pressure Δp increases, the pump is swivelled back (towards $V_{g\,min}$) and, if the differential pressure Δp decreases the pump is swivelled out (towards $V_{g\,max}$) until the pressure drop across the sensing orifice in the valve is restored.

$\Delta p_{orifice} = p_{pump} - p_{actuator}$

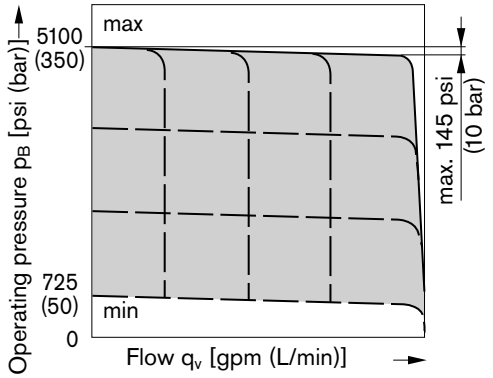
The setting range for Δp is between 200 psi and 360 psi (14 bar and 25 bar).

The standard differential pressure setting is 260 psi (18 bar). (Please state in clear text when ordering).

The stand-by pressure in zero stroke operation (sensing orifice plugged) is slightly above the Δp setting.

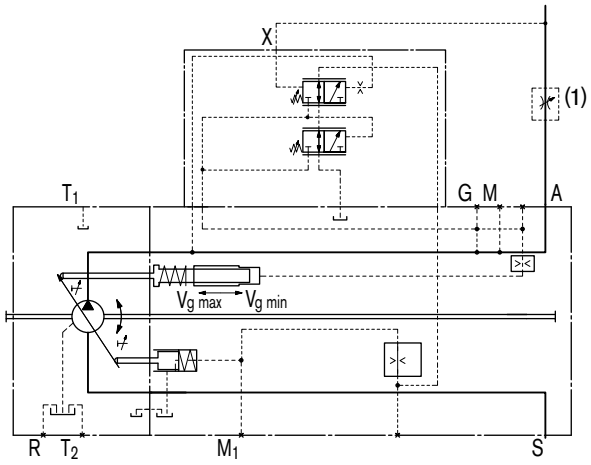
(1) The sensing orifice (control block) is not included in the pump supply.

Characteristic: DRS

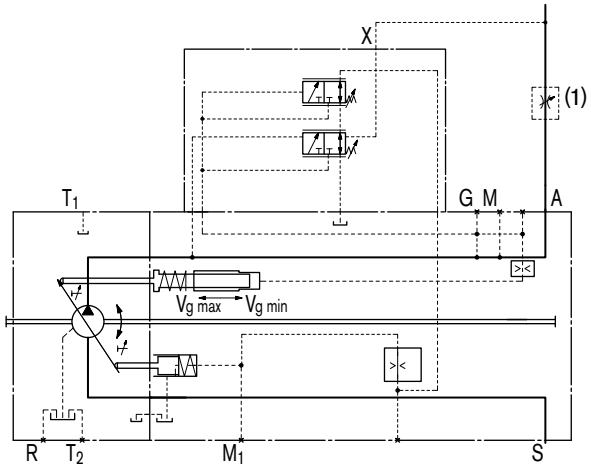


Circuit diagram DRS

Size 40 to 145



Size 190 to 260



DR – Pressure control

DRG Pressure control, remote controlled

The remote control pressure cut-off regulator permits the adjustment of the pressure setting by a remotely installed pressure relief valve (1). Pilot flow for this valve is provide by a fixed orifice in the control module.

Setting range from 725 to 5100 psi (50 to 350 bar).

In addition the pump can be unloaded into a standby pressure condition by an externally installed 2/2-way directional valve (2).

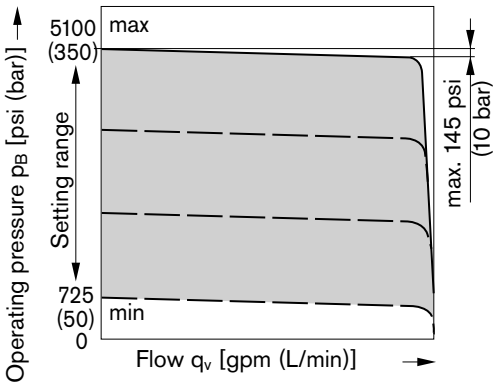
Both functions can be used individually or in combination (see circuit diagram).

The external valves are not included in the pump supply.

As a separate pressure relief valve (1) we recommend:

DBDH 6 (manual control), see RE 25402

Characteristic: DRG

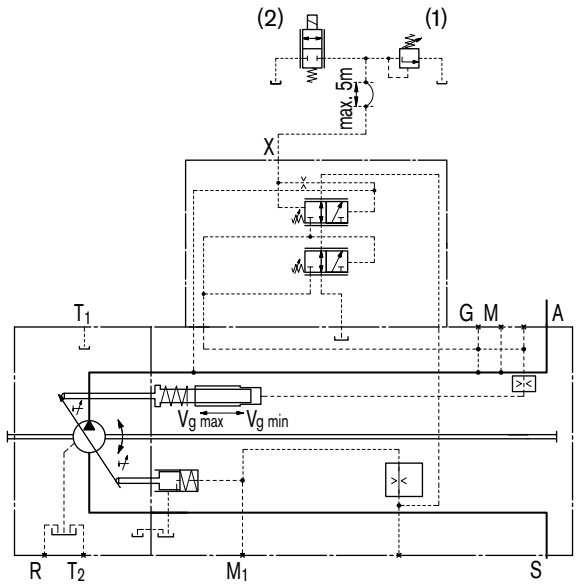


Note

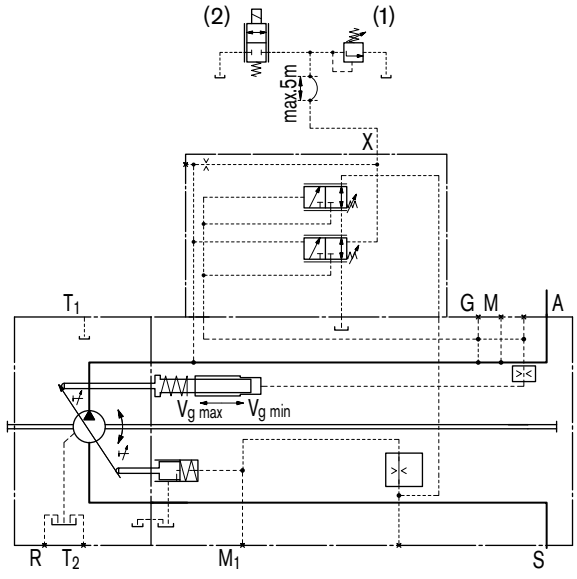
The remote controlled pressure cut-off is also possible in combination with LR, HD and EP.

Circuit diagram DRG

Size 40 to 145



Size 190 to 260



DR – Pressure control

DRL Pressure control for parallel operation

The pressure control DRL is suitable for pressure control of several axial piston pumps AA11VO in parallel operation pumping into a common pressure header.

The parallel pressure control has a pressure rise characteristic of approx. 220 psi (15 bar) from $q_{v\,max}$ to $q_{v\,min}$. The pump regulates therefore to a pressure dependent swive angle. This results in stable control behavior, without the need of "staging" the individual pump compensators.

With the externally installed pressure relief valve (1) the nominal pressure setting of all pumps connected to the system is adjusted to the same value.

Setting range from 725 to 5100 psi (50 to 350 bar).

Each pump can be individually unloaded from the system by a separately installed 3/2-way directional valve (2).

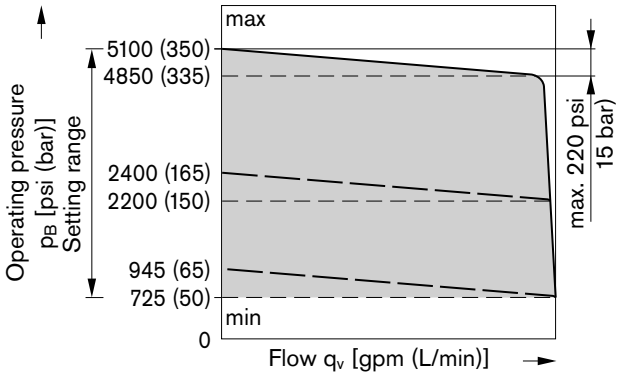
The check valves (3) in the service line (port A) or control line (port X) must be provided generally.

The external valves are not included in the pump supply.

As a separate pressure relief valve (1) we recommend:

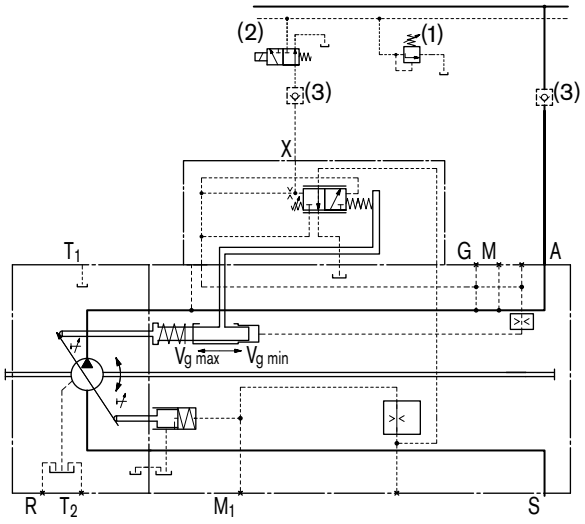
DBDH 6 (manual control), see RE 25402

Characteristic DRL

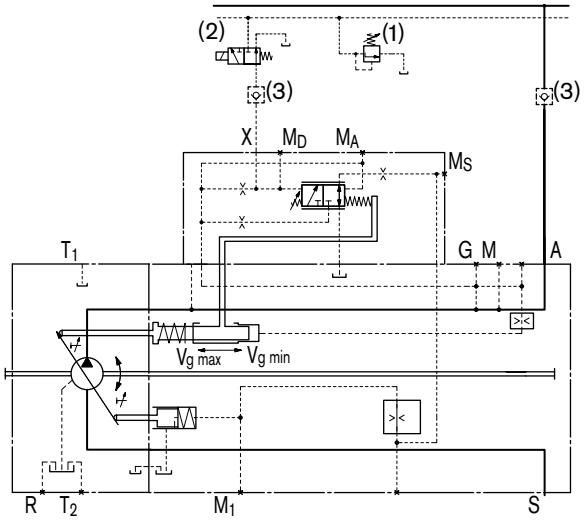


Circuit diagram DRL

Size 40 to 145



Size 190 to 260



HD – Hydraulic control, pilot-pressure related

With the pilot-pressure related control the pump displacement is adjusted in proportion to the pilot pressure applied to port Y. Maximum permissible pilot pressure $p_{St\ max}$ = 580 psi (40 bar)

Control from $V_{g\ min}$ to $V_{g\ max}$.

With increasing pilot pressure the pump swivels to a higher displacement.

Start of control (at $V_{g\ min}$), can be set from 60 to 145 psi (4 to 10 bar)

State start of control in clear text in the order.

Starting position without control signal (pilot pressure):

– at operating pressure and external control pressure < 435 psi (30 bar): $V_{g\ max}$

– at operating pressure or external control pressure > 435 psi (30 bar): $V_{g\ min}$

A control pressure of 435 psi (30 bar) is required to swivel the pump from its starting position $V_{g\ max}$ to $V_{g\ min}$.

The required control pressure is taken either from the load pressure, or from the externally applied control pressure at the G port.

To ensure the control even at low operating pressure < 435 psi (30 bar) the port G must be supplied with an external control pressure of approx. 435 psi (30 bar).

Note
If no external control pressure is connected at G, the shuttle valve must be removed.

Note

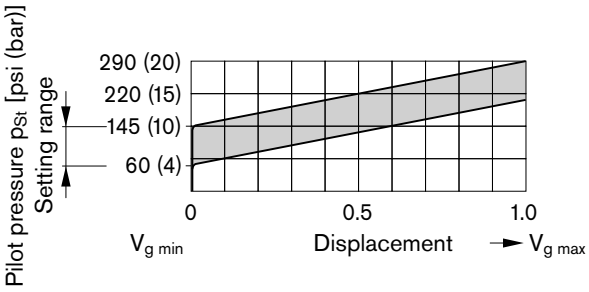
The spring return feature in the controller is not a safety device

The spool valve inside the controller 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 safe position (e.g. immediate stop).

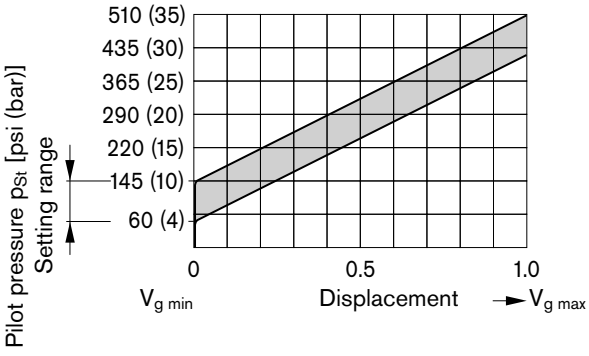
Characteristic HD1

Increase in pilot pressure $V_{g\ min}$ to $V_{g\ max}$
Δp = 145 psi (10 bar)



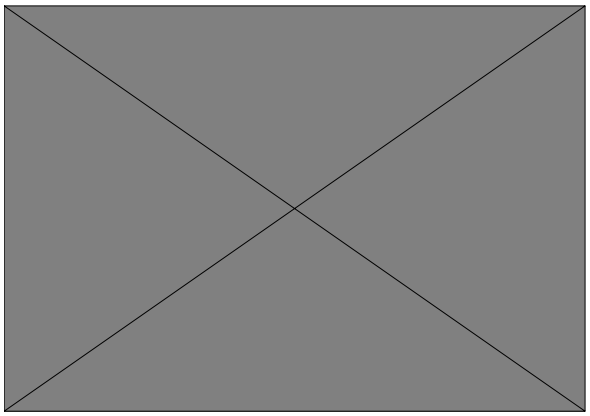
Characteristic HD2

Increase in pilot pressure $V_{g\ min}$ to $V_{g\ max}$
Δp = 365 psi (25 bar)



Circuit diagram HD

Size 40 to 260



HD – Hydraulic control, pilot-pressure related

HD.D Hydraulic control with pressure cut-off

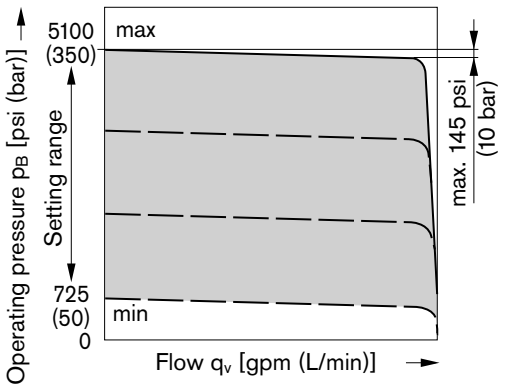
The pressure cut-off corresponds to a pressure control which adjusts the pump displacement back to $V_{g\,min}$ when the pressure setting is reached.

This function overrides the HD control, i.e. the pilot-pressure related displacement control is functional below the pressure setting.

The pressure cut-off function is integrated into the pump control module and is preset to a specified value at the factory.

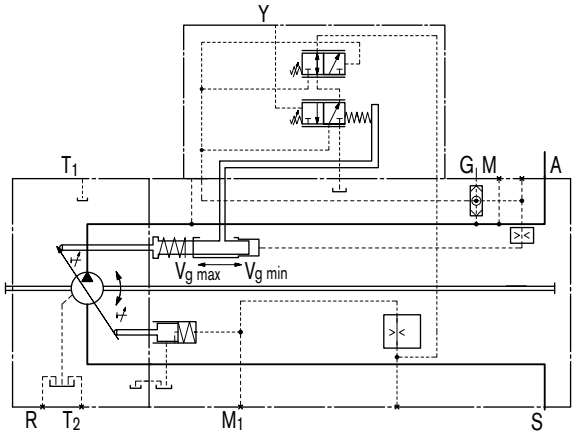
Setting range from 725 to 5100 psi (50 to 350 bar).

Pressure cut-off characteristic D

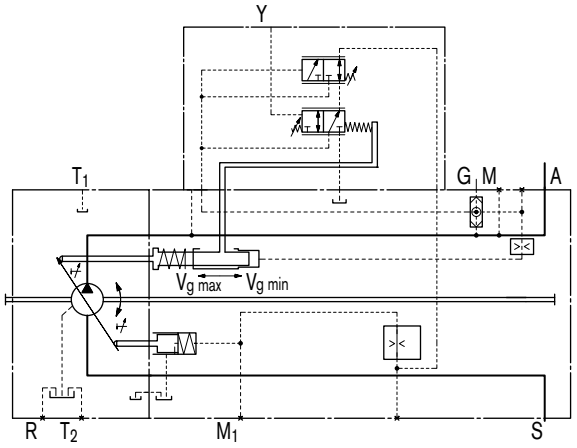


Circuit diagram HD.D

Size 40 to 145



Size 190 to 260



EP – Electric control with proportional solenoid

With the electric control with proportional solenoid, the pump displacement is adjusted proportionally to the solenoid current, resulting in a magnetic control force, acting directly onto the control spool that pilots the pump control piston.

Control from $V_{g\,min}$ to $V_{g\,max}$

With increasing control current the pump swivels to a higher displacement.

Starting position wthout control signal (control current):

– at operating pressure and external control pressure < 435 psi (30 bar): $V_{g\,max}$

– at operating pressure or external control pressure > 435 psi (30 bar): $V_{g\,min}$

A control pressure of 435 psi (30 bar) is required to swivel the pump from its starting position $V_{g\,max}$ to $V_{g\,min}$.

The required control pressure is taken either from the load pressure, or from the externally applied control pressure at port G.
To ensure the control even at low operating pressure < 435 psi (30 bar) the port G must be supplied with an external control pressure of approx. 435 psi (30 bar).

Note
If no external control pressure is connected at G, the shuttle valve must be removed.

Note
Install pump with EP control in the oil tank only when using mineral hydraulic oils and an oil temperature in the tank of maximum 180 °F (80 °C).

The following electronic control units and amplifiers are available for actuating the proportional solenoids (see also www.boschrexroth.com/mobilelektronik):

– 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

Note

The spring return feature in the controller is not a safety device

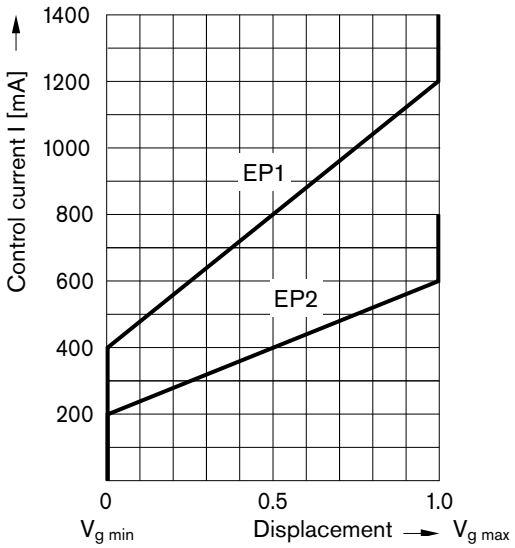
The spool valve inside the controller can get stuck in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the axial piston unit can no longer supply the flow specified by the operator.

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

Technical data, solenoid at EP1, EP2

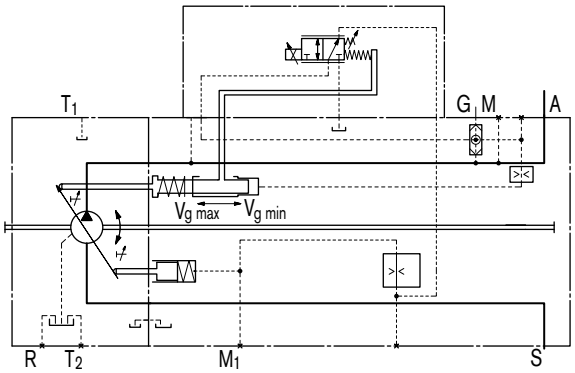
	EP1	EP2
Voltage	12 V (±20 %)	24 V (±20 %)
Control current		
Start of control at $V_{g\,min}$	400 mA	200 mA
End of control at $V_{g\,max}$	1200 mA	600 mA
Limiting current	1.54 A	0.77 A
Nominal resistance (at 68 °F (20 °C))	5.5 Ω	22.7 Ω
Dither frequency	100 Hz	100 Hz
Actuated time	100 %	100 %
Type of protection	see connector version, page 60	

Characteristic EP1/2



Circuit diagram EP1/2

Size 40 to 260



EP – Electric control with proportional solenoid

EP.D Electric control with pressure cut-off

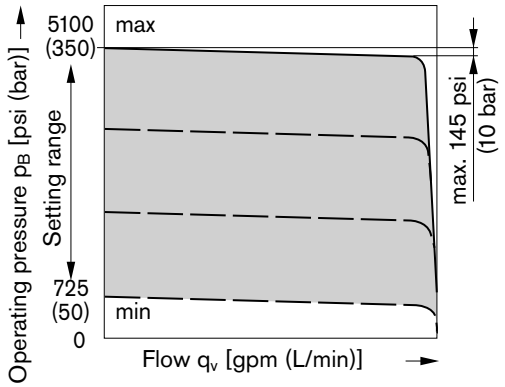
The pressure cut-off corresponds to a pressure control which adjusts the pump displacement back to $V_{g\,min}$ when the pressure setting is reached.

This function overrides the EP control, i.e. the control current related displacement control is functional below the pressure setting.

The valve for the pressure cut-off is integrated in the control case and is set to a fixed specified pressure value at the factory.

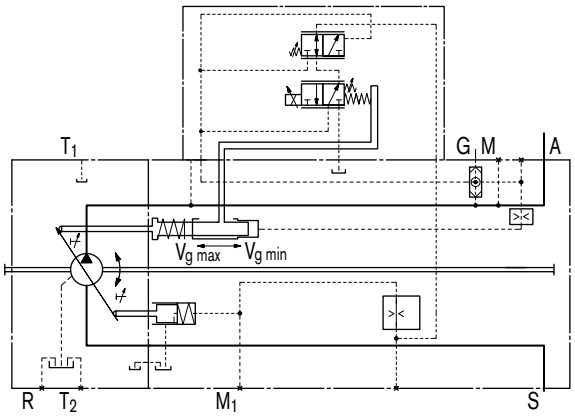
Setting range from 725 to 5100 psi (50 to 350 bar)

Pressure cut-off characteristic D

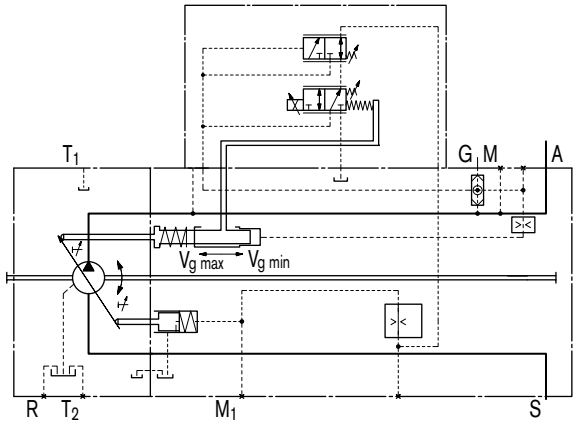


Circuit diagram EP.D

Size 40 to 145



Size 190 to 260

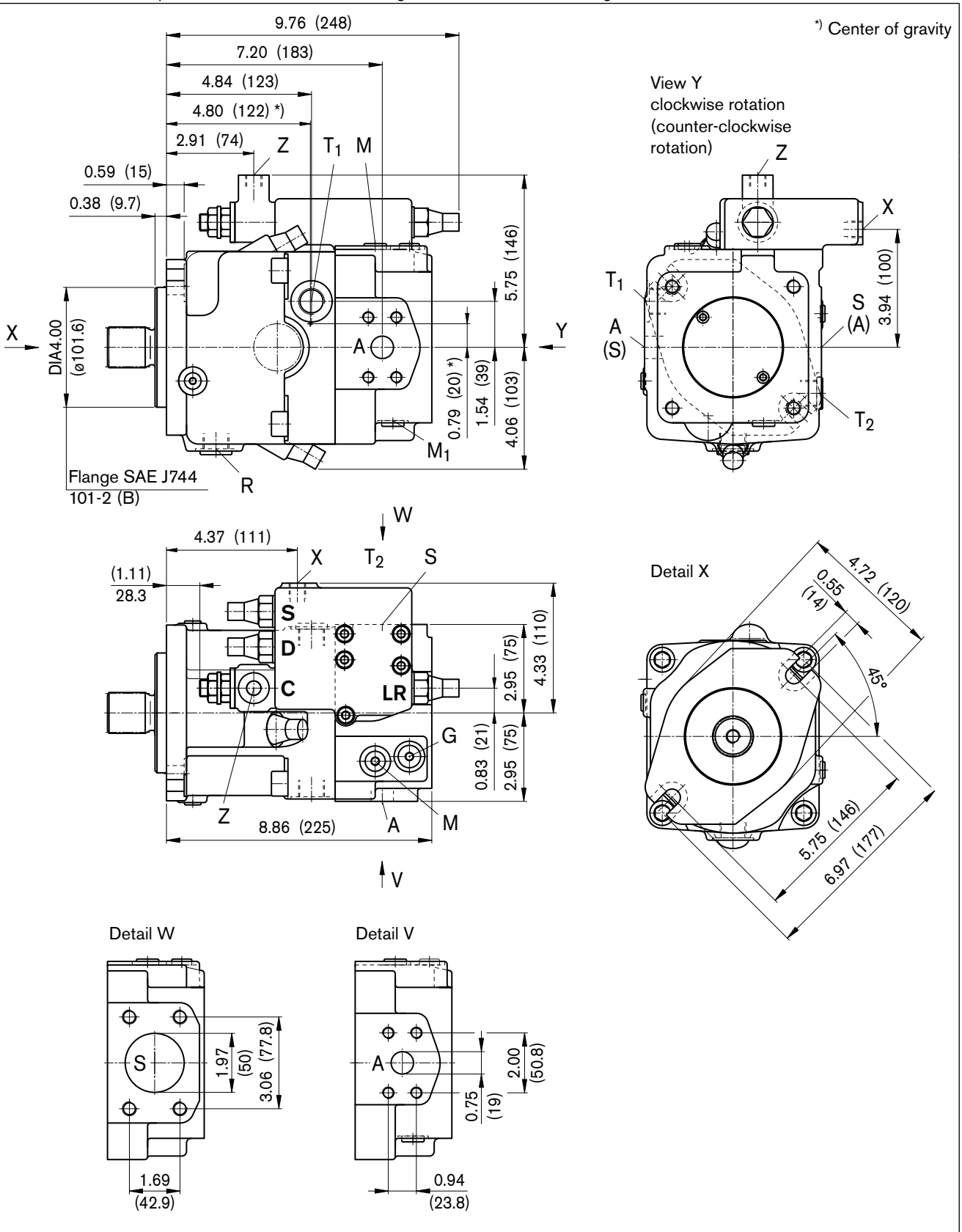


Dimensions size 40

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

LRDCS

Power control LR with pressure cut-off D, cross sensing control C and load sensing control S

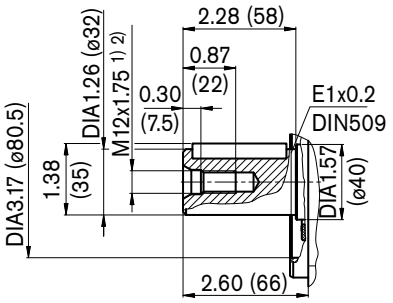


Dimensions size 40

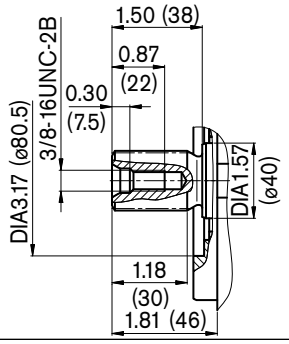
Before finalizing your design,
please request a certified drawing.
Dimensions in inches and (millimeters).

Drive shaft

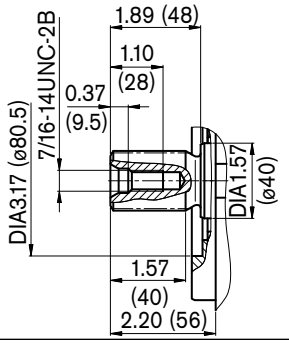
P Parallel keyed shaft DIN 6885, AS10x8x56



S Splined shaft SAE J744 1 in 15T 16/32[3)]



T Splined shaft SAE J744 1 1/4 in 14T 12/24DP[3)]



Ports

Designation	Function	Standard	Size[2)]	Max. pressure [psi (bar)][4)]	State
A	Service line port	SAE J518	3/4 in	5800 (400)	O
	Fixing thread	ISO 68	3/8in-16UNC-2B; 0.63 (16) deep		
S	Suction port	SAE J518	2 in	435 (30)	O
	Fixing thread	ISO 68	1/2in-13UNC-2B; 0.67 (17) deep		
T_1, T_2	Tank port	ISO 11926	7/8in-14UNF-2B; 0.55 (14) deep	145 (10)	5)
R	Air bleed	ISO 11926	7/8in-14UNF-2B; 0.55 (14) deep	145 (10)	X
M_1	Measurement point, positioning chamber	ISO 11926	9/16in-18UNF-2B; 0.47 (12) deep	5800 (400)	X
M	Measurement point, service line port	ISO 11926	9/16in-18UNF-2B; 0.47 (12) deep	5800 (400)	X
X	Pilot pressure port in version with load sensing (S) and remote controlled pressure cut-off (G)	ISO 11926	9/16in-18UNF-2B; 0.47 (12) deep	5800 (400)	O
Y	Pilot pressure port in version with stroke limiter (H...), 2-stage pressure cut-off (E) and HD	ISO 11926	9/16in-18UNF-2B; 0.47 (12) deep	580 (40)	O
Z	Pilot pressure port in version with cross sensing (C) and power override (LR3) power overrice (LG1)	ISO 11926	9/16in-18UNF-2B; 0.47 (12) deep	5800 (400) 580 (40)	O
G	Port for control pressure (controller) in version with stroke limiter (H.., U2), HD and EP with screw union GE10 - PLM (otherwise closed)	ISO 11926	9/16in-18UNF-2B; 0.47 (12) deep	580 (40)	O

1) Center bore according to DIN 332 (thread acc. to DIN 13)
2) For maximum tightening torque, please refer to general notes on page 64
3) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
4) Depending on adjustment data and operating pressure
5) Depending on installation position, T_1 or T_2 must be connected (see also page 61)

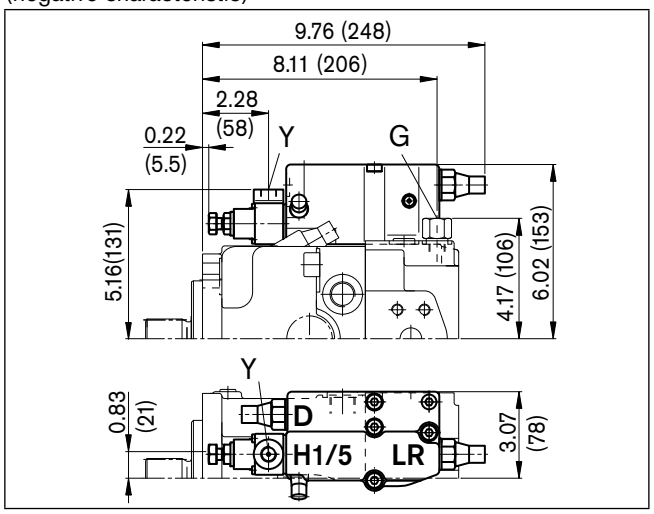
O= Open, must be connected (closed on delivery)
X= Closed (in normal operation)

Dimensions size 40

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

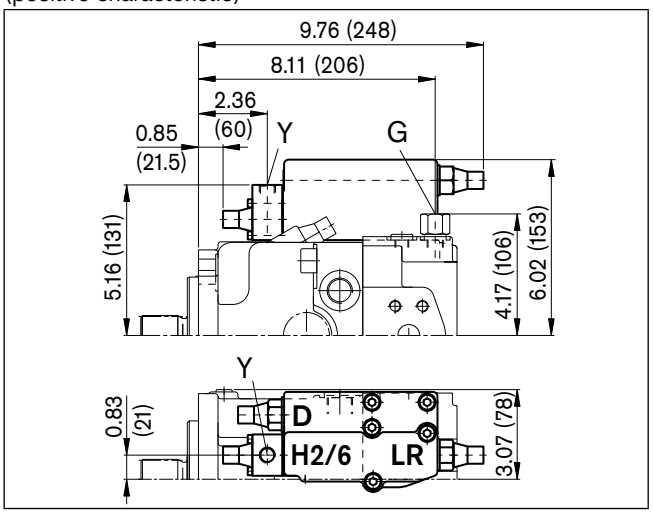
LRDH1/LRDH5

Power control with pressure cut-off and hydraulic stroke limiter (negative characteristic)



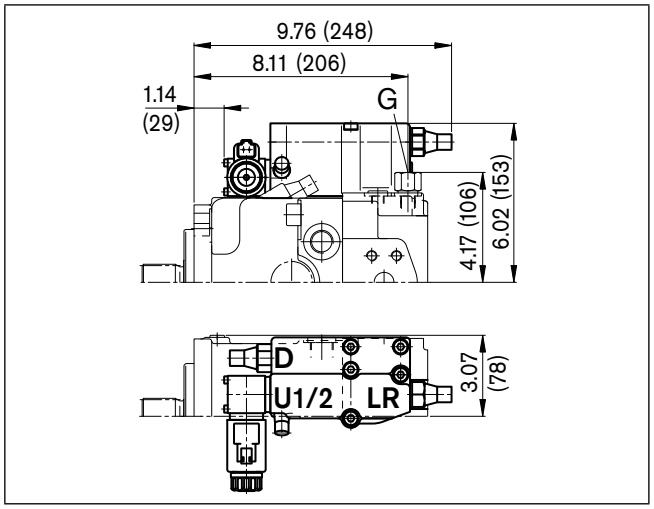
LRDH2/LRDH6

Power control with pressure cut-off and hydraulic stroke limiter (positive characteristic)



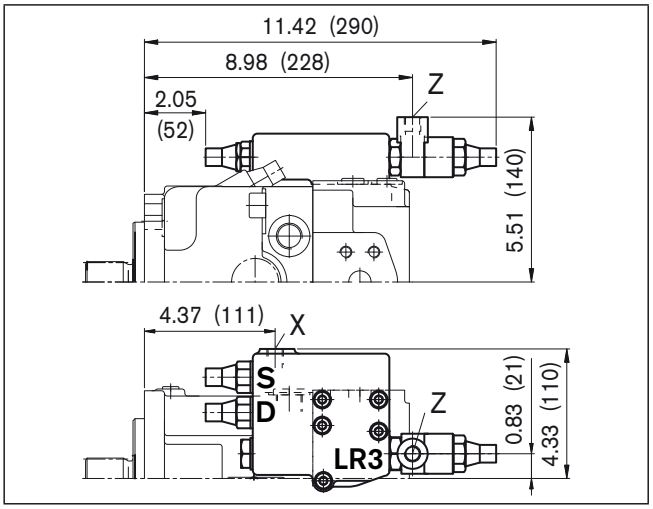
LRDU1/LRDU2

Power control with pressure cut-off and electric stroke limiter (positive characteristic)



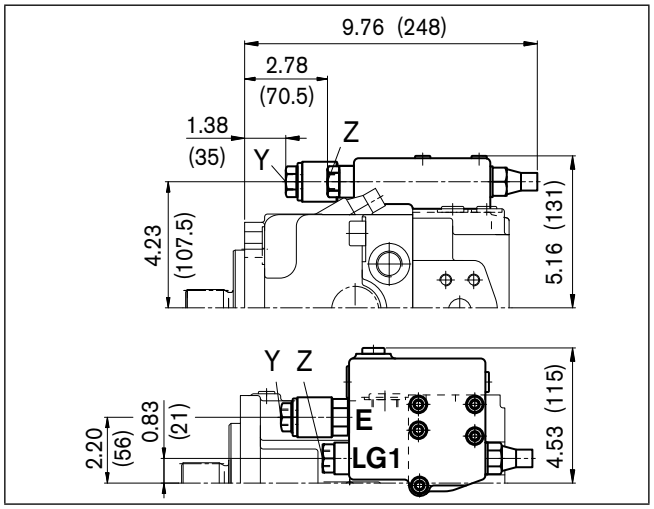
LR3DS

Power control with high-pressure related override, pressure cut-off and load sensing control



LG1E

Power control with pilot-pressure related override (negative) and 2-stage pressure cut-off



LG2E

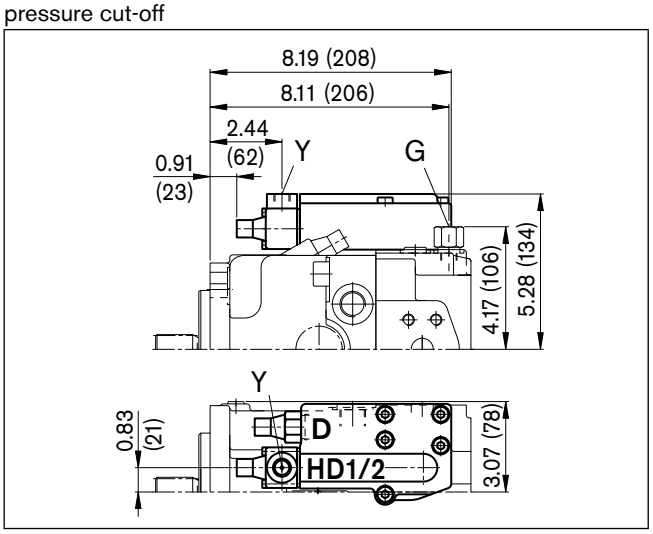
Power control with pilot-pressure related override (positive) and 2-stage pressure cut-off

Dimensions size 40

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

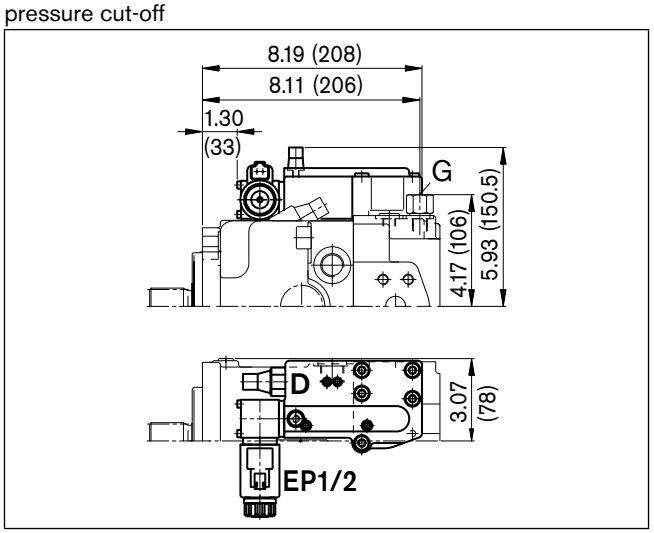
HD1D/HD2D

Hydraulic control, pilot-pressure related with pressure cut-off



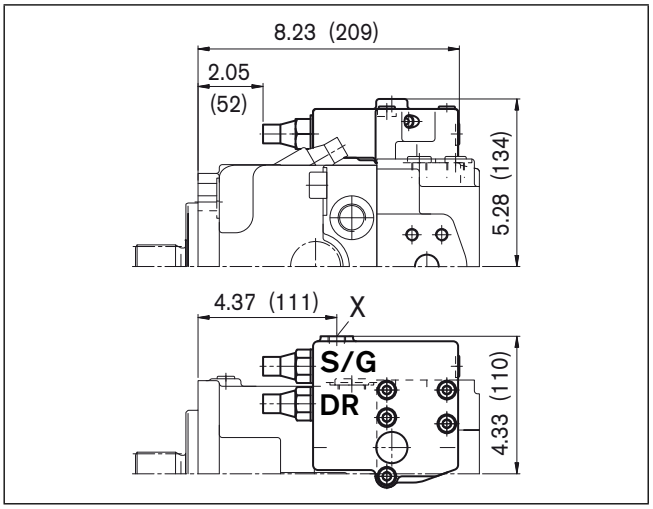
EP1D/EP2D

Electric control with proportional solenoid and pressure cut-off



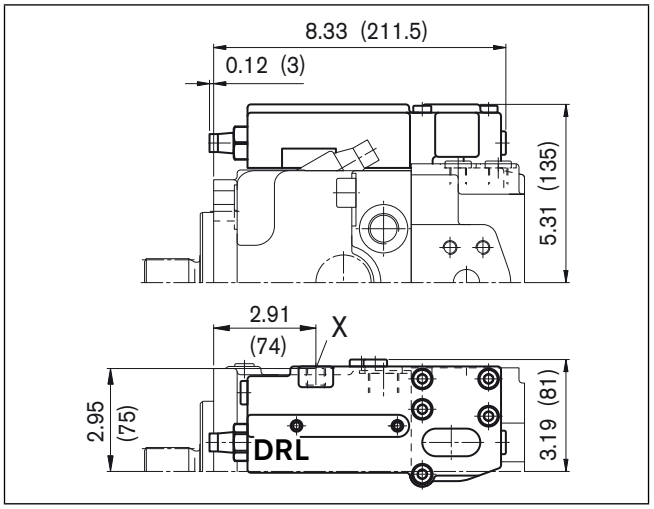
DRS/DRG

Pressure control with load sensing control
Pressure control remote controlled



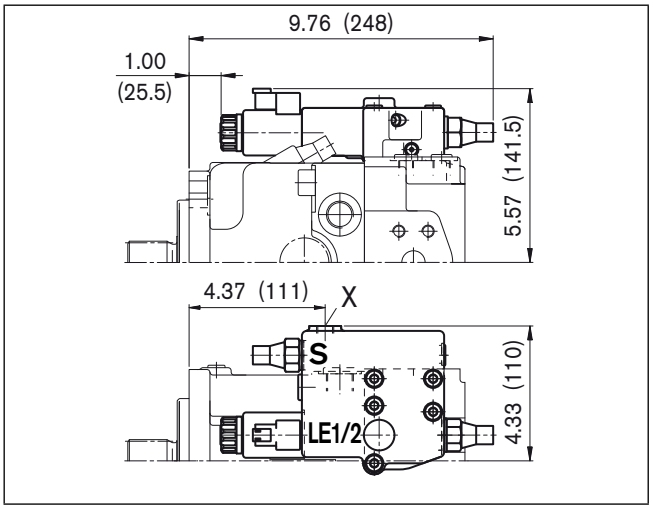
DRL

Pressure control for parallel operation



LE1S/LE2S

Power control with electric override (negative) and load sensing control



LE2S2/LE1S5/LE2S5

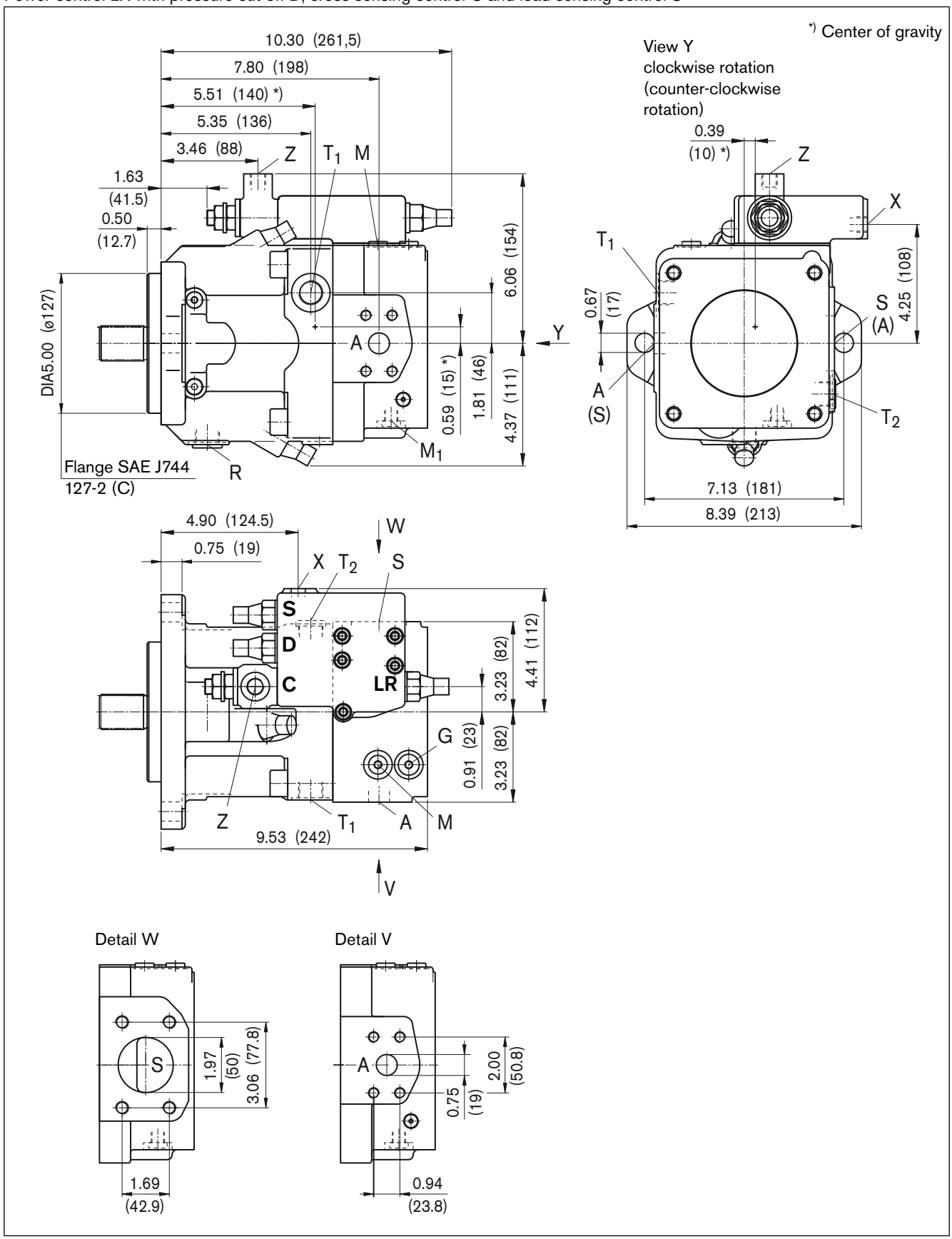
Power control with electric override (negative) and load sensing control, override

Dimensions size 60

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

LRDCS

Power control LR with pressure cut-off D, cross sensing control C and load sensing control S

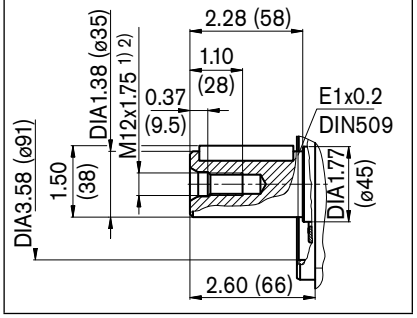


Dimensions size 60

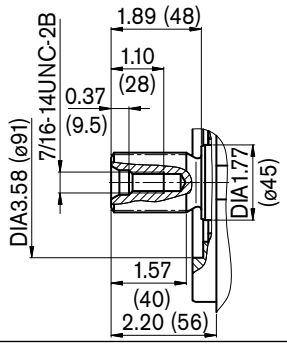
Before finalizing your design,
please request a certified drawing.
Dimensions in inches and (millimeters).

Drive shaft

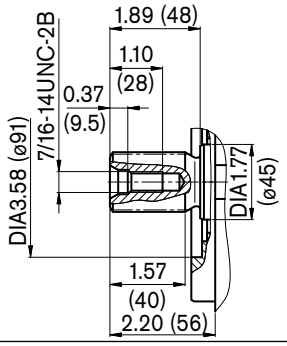
P Parallel keyed shaft DIN 6885, AS10x8x56



S Splined shaft SAE J744 1 1/4 in 14T 12/24DP 3)



T Splined shaft SAE J744 1 3/8 in 21T 16/32DP 3)



Ports

Designation	Function	Standard	Size[2)]		Max. pressure [psi (bar)][4)]	State
A	Service line port	SAE J518	3/4 in		5800 (400)	O
	Fixing thread	ISO 68	3/8in-16UNC-2B;	0.67 (17) deep		
S	Suction port	SAE J518	2 in		435 (30)	O
	Fixing thread	ISO 68	1/2in-13UNC-2B;	0.79 (20) deep		
T_1, T_2	Tank port	ISO 11926	7/8in-14UNF-2B;	0.55 (14) deep	145 (10)	5)
R	Air bleed	ISO 11926	7/8in-14UNF-2B;	0.55 (14) deep	145 (10)	X
M_1	Measurement point, positioning chamber	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	5800 (400)	X
M	Measurement point, service line port	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	5800 (400)	X
X	Pilot pressure port in version with load sensing (S) and remote controlled pressure cut-off (G)	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	5800 (400)	O
Y	Pilot pressure port in version with stroke limiter (H...), 2-stage pressure cut-off (E) and HD	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	580 (40)	O
Z	Pilot pressure port in version with cross sensing (C) and power override (LR3) power overrice (LG1)	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	5800 (400) 580 (40)	O
G	Port for control pressure (controller) in version with stroke limiter (H.., U2), HD and EP with screw union GE10 - PLM (otherwise closed)	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	580 (40)	O

1) Center bore according to DIN 332 (thread acc. to DIN 13)
2) For maximum tightening torque, please refer to general notes on page 64
3) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
4) Depending on adjustment data and operating pressure
5) Depending on installation position, T_1 or T_2 must be connected (see also page 61)

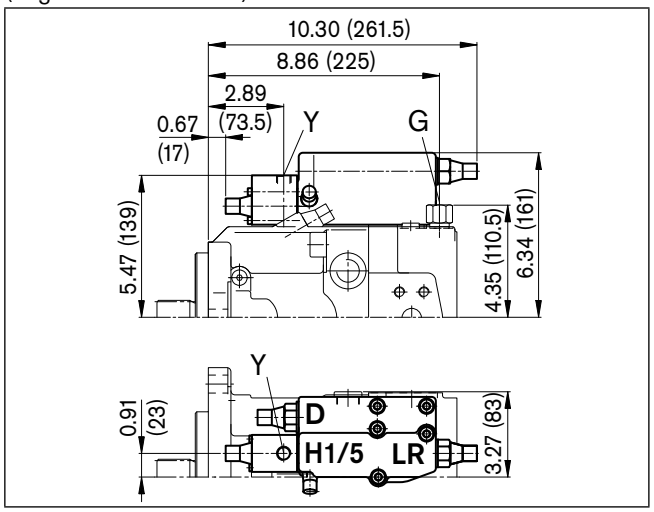
O= Open, must be connected (closed on delivery)
X= Closed (in normal operation)

Dimensions size 60

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

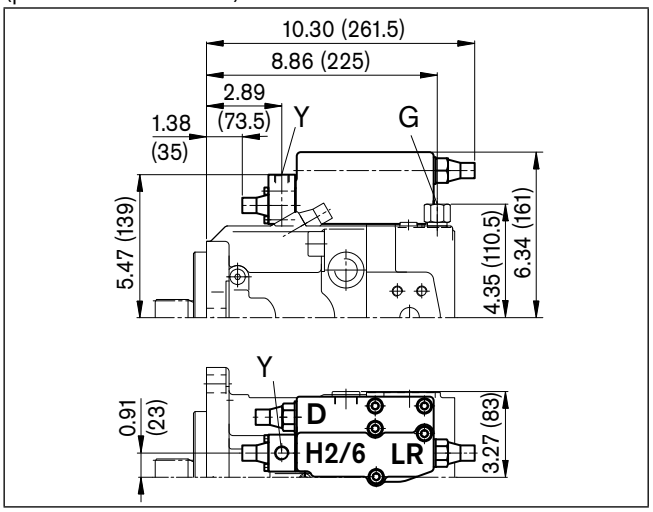
LRDH1/LRDH5

Power control with pressure cut-off and hydraulic stroke limiter (negative characteristic)



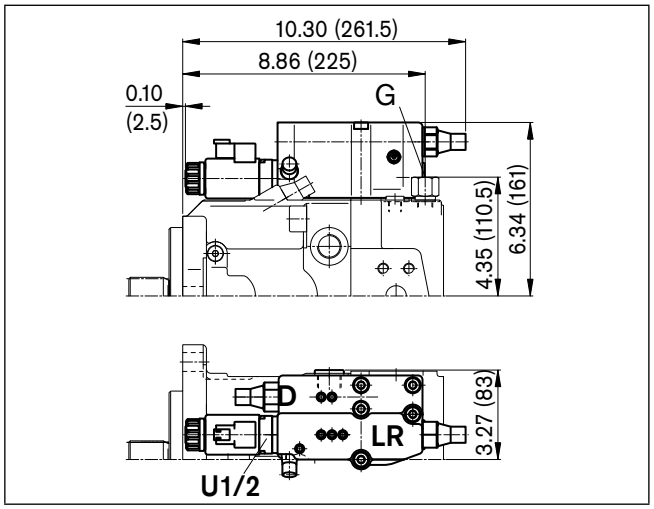
LRDH2/LRDH6

Power control with pressure cut-off and hydraulic stroke limiter (positive characteristic)



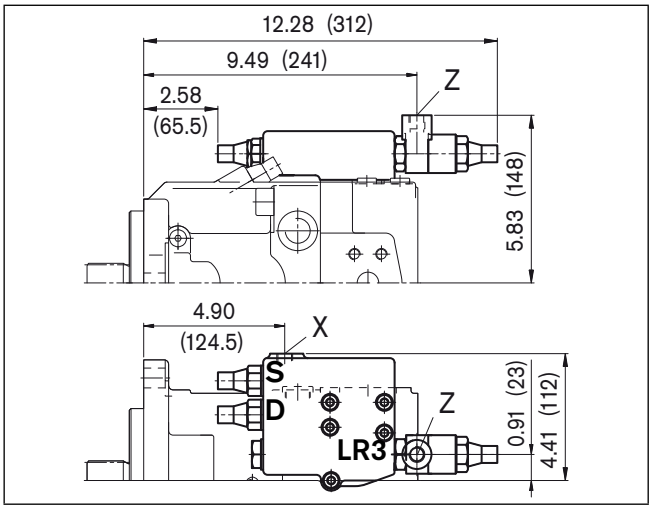
LRDU1/LRDU2

Power control with pressure cut-off and electric stroke limiter (positive characteristic)



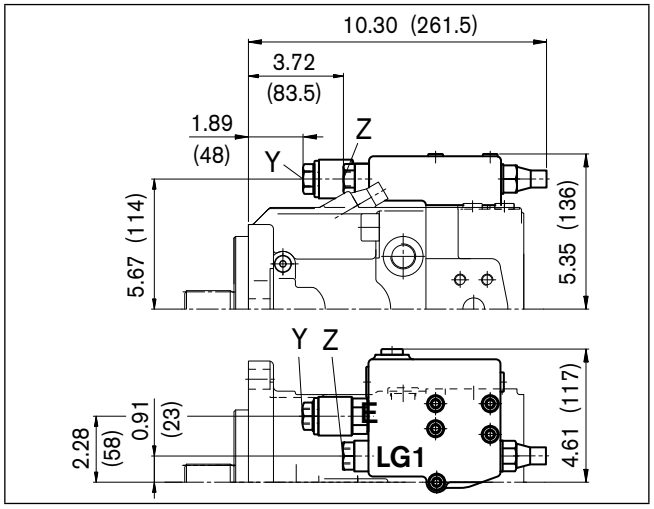
LR3DS

Power control with high-pressure related override, pressure cut-off and load sensing control



LG1E

Power control with pilot-pressure related override (negative) and 2-stage pressure cut-off



LG2E

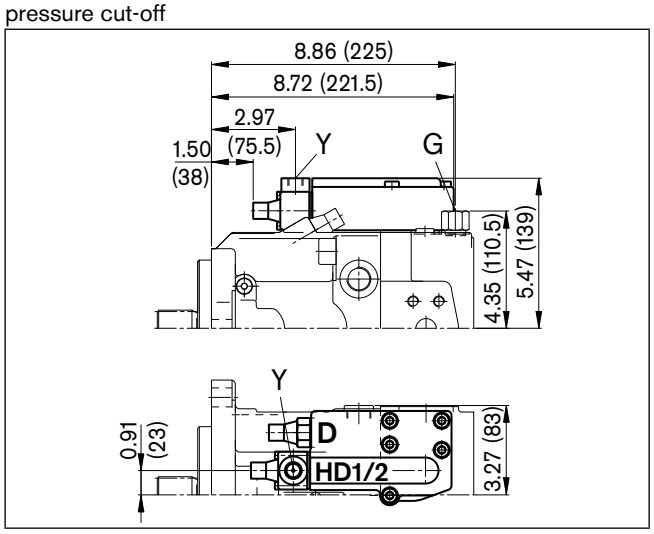
Power control with pilot-pressure related override (positive) and 2-stage pressure cut-off

Dimensions size 60

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

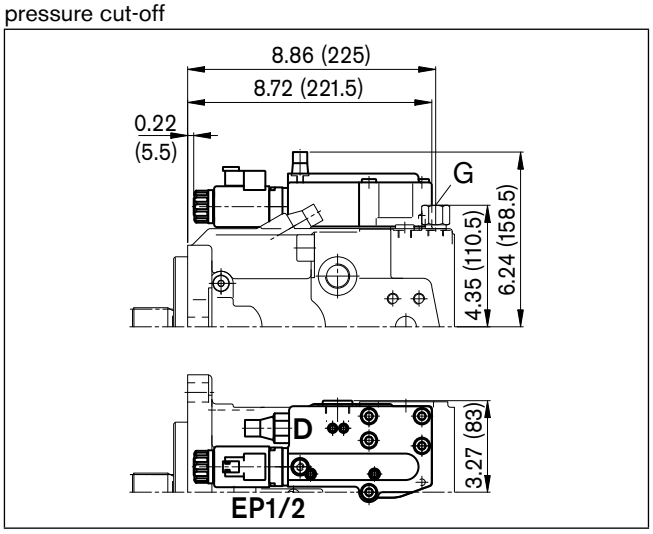
HD1D/HD2D

Hydraulic control, pilot-pressure related with pressure cut-off



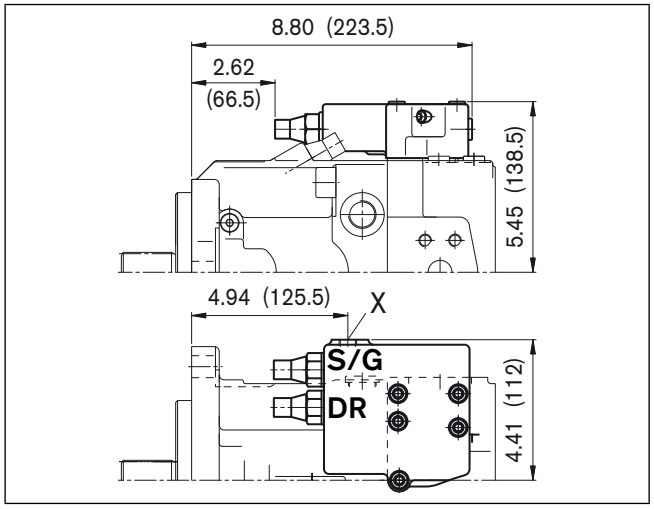
EP1D/EP2D

Electric control with proportional solenoid and pressure cut-off



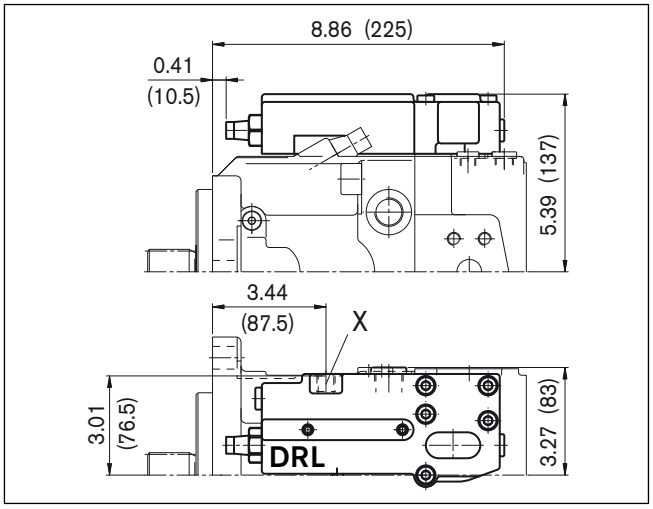
DRS/DRG

Pressure control with load sensing control
Pressure control remote controlled



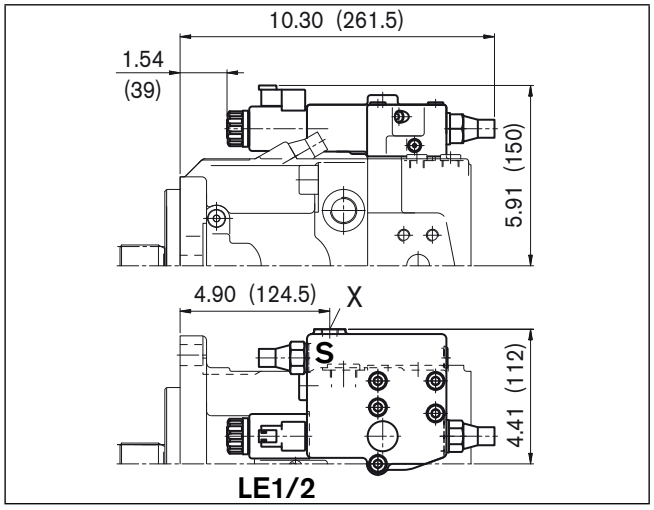
DRL

Pressure control for parallel operation



LE1S/LE2S

Power control with electric override (negative) and load sensing control



LE2S2/LE1S5/LE2S5

Power control with electric override (negative) and load sensing control, override

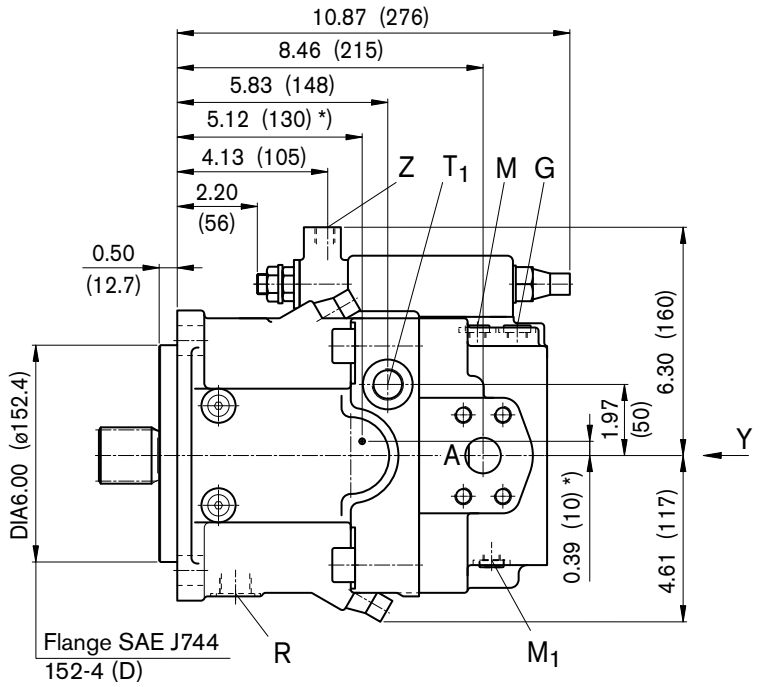
Dimensions size 75

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

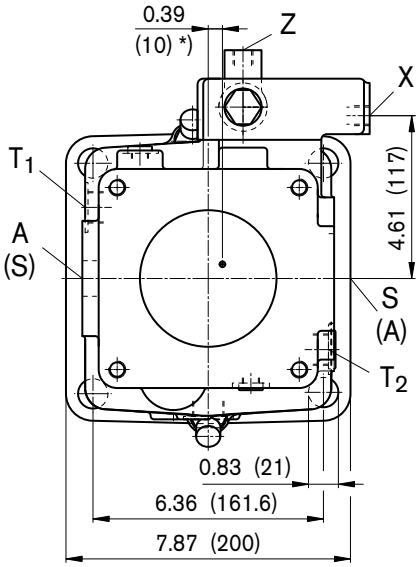
LRDCS

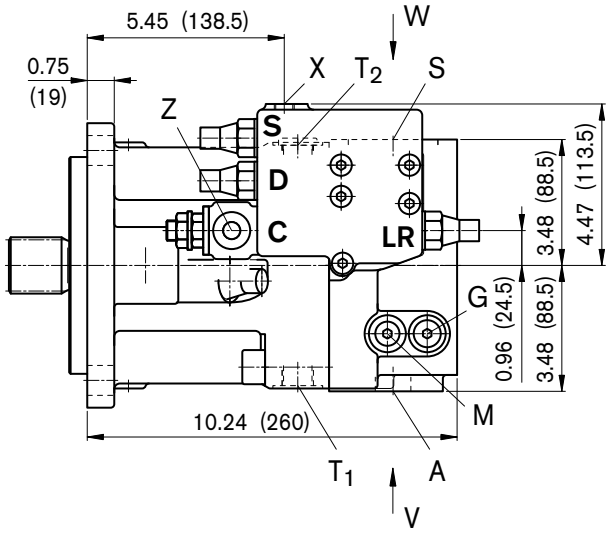
Power control LR with pressure cut-off D, cross sensing control C and load sensing control S

*) Center of gravity

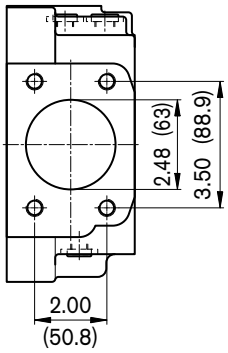


View Y
clockwise rotation
(counter-clockwise
rotation)

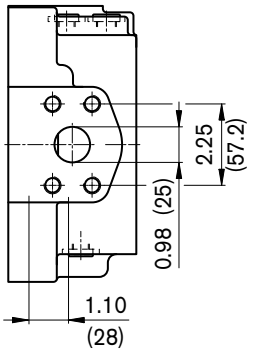




Detail W



Detail V

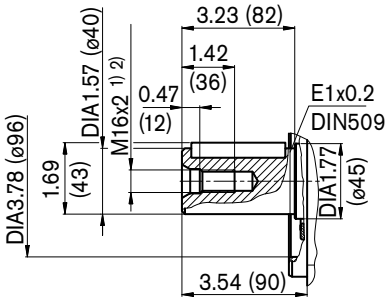


Dimensions size 75

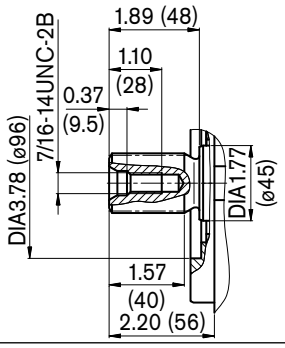
Before finalizing your design,
please request a certified drawing.
Dimensions in inches and (millimeters).

Drive shaft

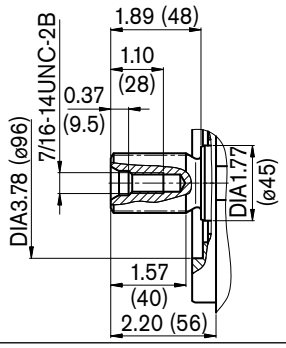
P Parallel keyed shaft DIN 6885
AS12x8x80



S Splined shaft SAE J744
1 1/4 in 14T 12/24DP 3)



T Splined shaft SAE J744
1 3/8 in 21T 16/32DP 3)



Ports

Designation	Function	Standard	Size[2)]		Max. pressure [psi (bar)][4)]	State
A	Service line port	SAE J518	1 in		5800 (400)	O
	Fixing thread	ISO 68	7/16in-14UNC-2B;	0.67 (17) deep		
S	Suction port	SAE J518	2 1/2in		435 (30)	O
	Fixing thread	ISO 68	1/2in-13UNC-2B;	0.67 (17) deep		
T_1, T_2	Tank port	ISO 11926	7/8in-14UNF-2B;	0.55 (14) deep	145 (10)	5)
R	Air bleed	ISO 11926	7/8in-14UNF-2B;	0.55 (14) deep	145 (10)	X
M_1	Measurement point, positioning chamber	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	5800 (400)	X
M	Measurement point, service line port	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	5800 (400)	X
X	Pilot pressure port in version with load sensing (S) and remote controlled pressure cut-off (G)	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	5800 (400)	O
Y	Pilot pressure port in version with stroke limiter (H...), 2-stage pressure cut-off (E) and HD	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	580 (40)	O
Z	Pilot pressure port in version with cross sensing (C) and power override (LR3) power overrice (LG1)	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	5800 (400) 580 (40)	O
G	Port for control pressure (controller) in version with stroke limiter (H.., U2), HD and EP with screw union GE10 - PLM (otherwise closed)	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	580 (40)	O

1) Center bore according to DIN 332 (thread acc. to DIN 13)
2) For maximum tightening torque, please refer to general notes on page 64
3) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
4) Depending on adjustment data and operating pressure
5) Depending on installation position, T_1 or T_2 must be connected (see also page 61)

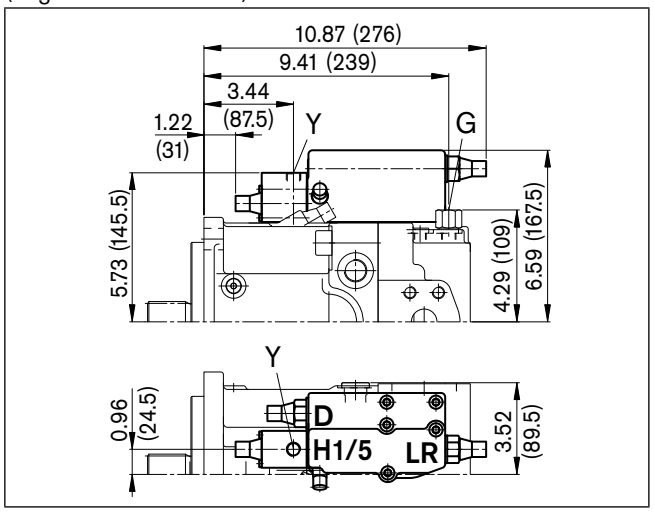
O = Open, must be connected (closed on delivery)
X = Closed (in normal operation)

Dimensions size 75

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

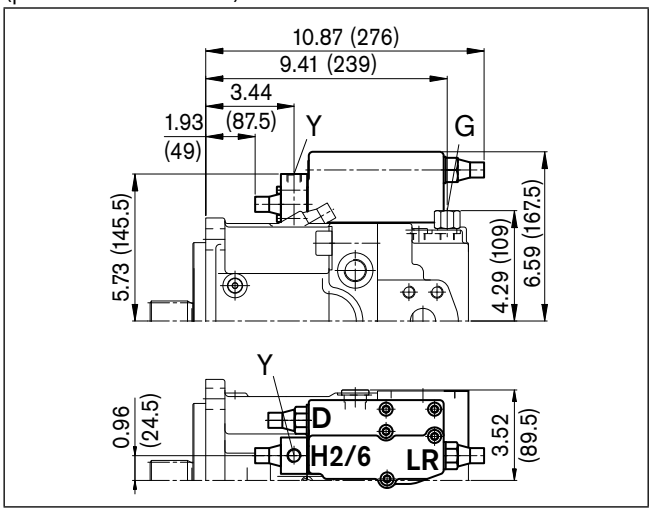
LRDH1/LRDH5

Power control with pressure cut-off and hydraulic stroke limiter (negative characteristic)



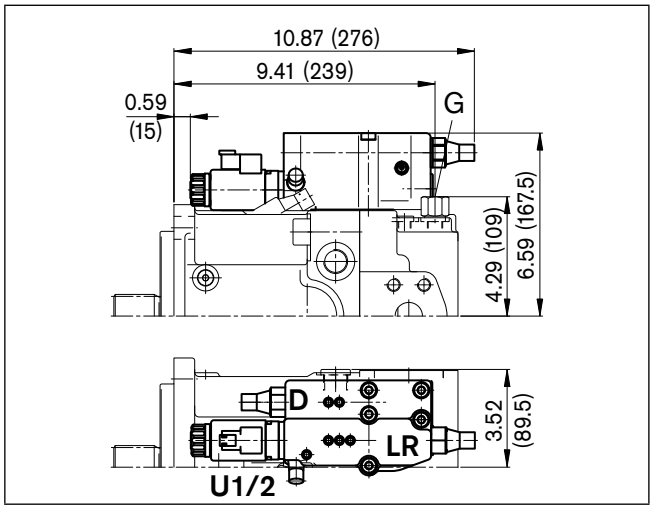
LRDH2/LRDH6

Power control with pressure cut-off and hydraulic stroke limiter (positive characteristic)



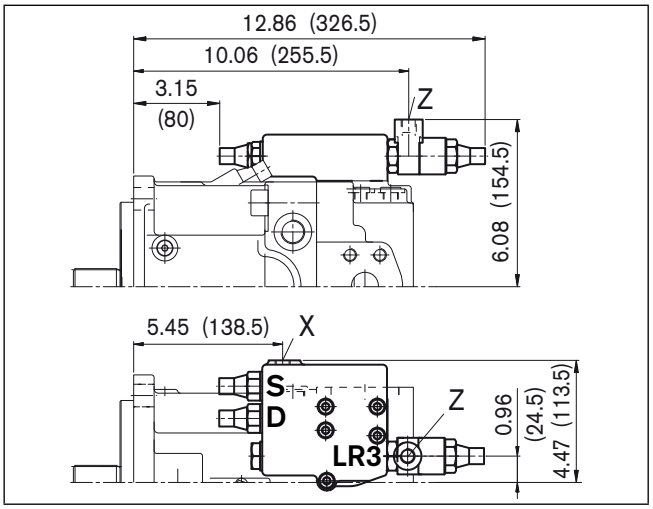
LRDU1/LRDU2

Power control with pressure cut-off and electric stroke limiter (positive characteristic)



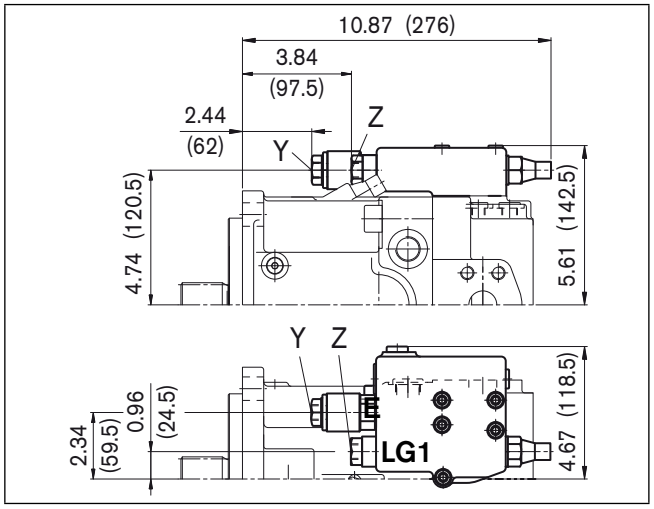
LR3DS

Power control with high-pressure related override, pressure cut-off and load sensing control



LG1E

Power control with pilot-pressure related override (negative) and 2-stage pressure cut-off



LG2E

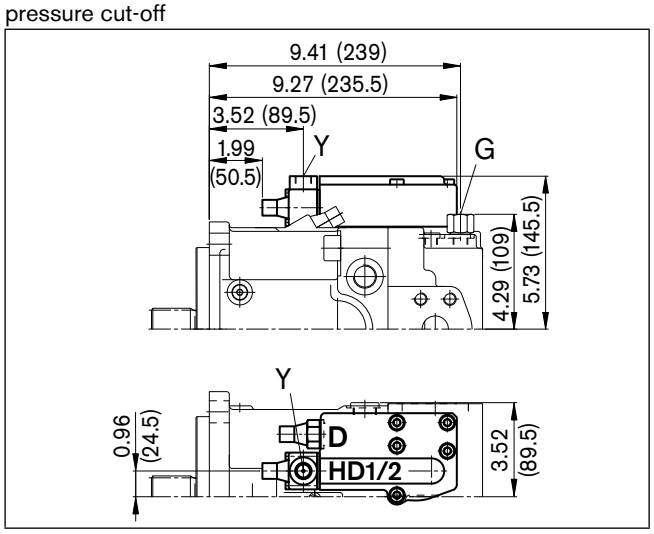
Power control with pilot-pressure related override (positive) and 2-stage pressure cut-off

Dimensions size 75

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

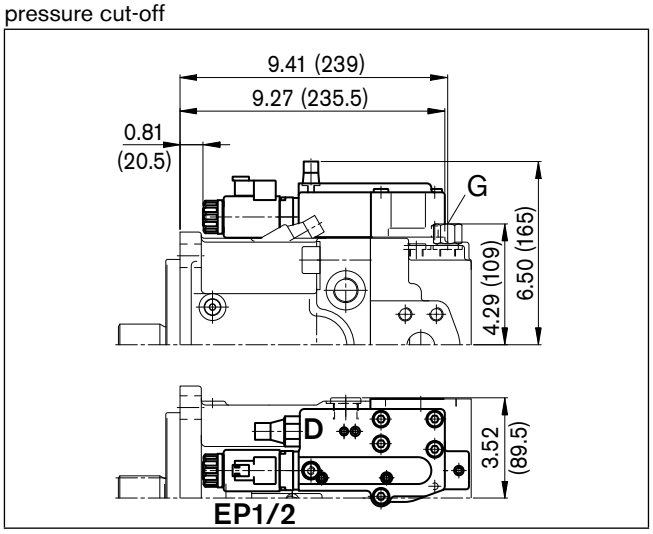
HD1D/HD2D

Hydraulic control, pilot-pressure related with pressure cut-off



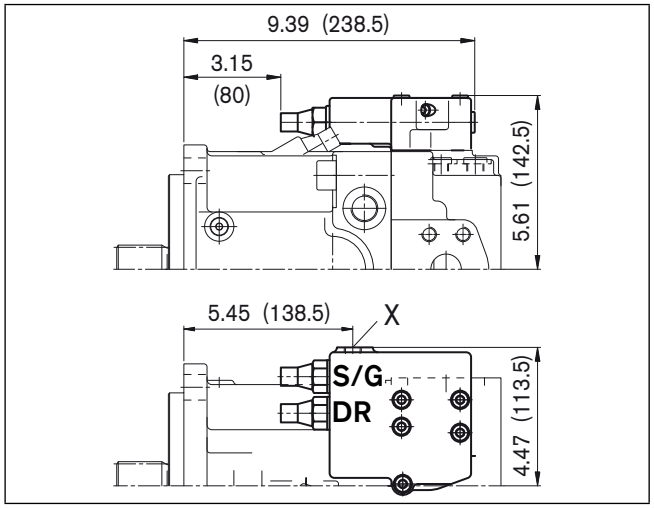
EP1D/EP2D

Electric control with proportional solenoid and pressure cut-off



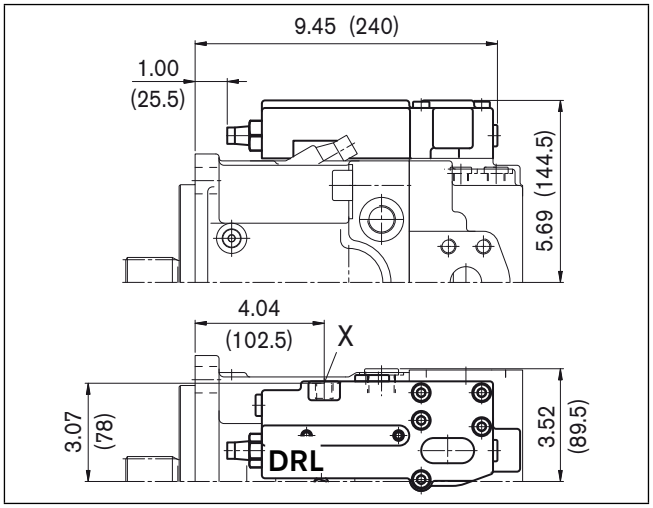
DRS/DRG

Pressure control with load sensing control
Pressure control remote controlled



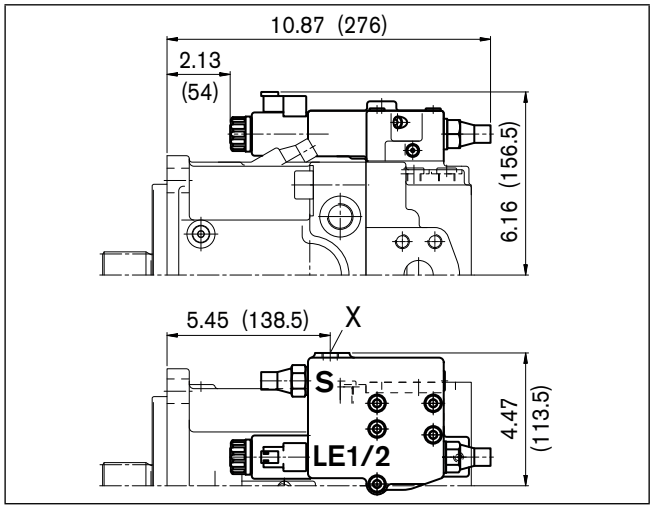
DRL

Pressure control for parallel operation



LE1S/LE2S

Power control with electric override (negative) and load sensing control



LE2S2/LE1S5/LE2S5

Power control with electric override (negative) and load sensing control, override

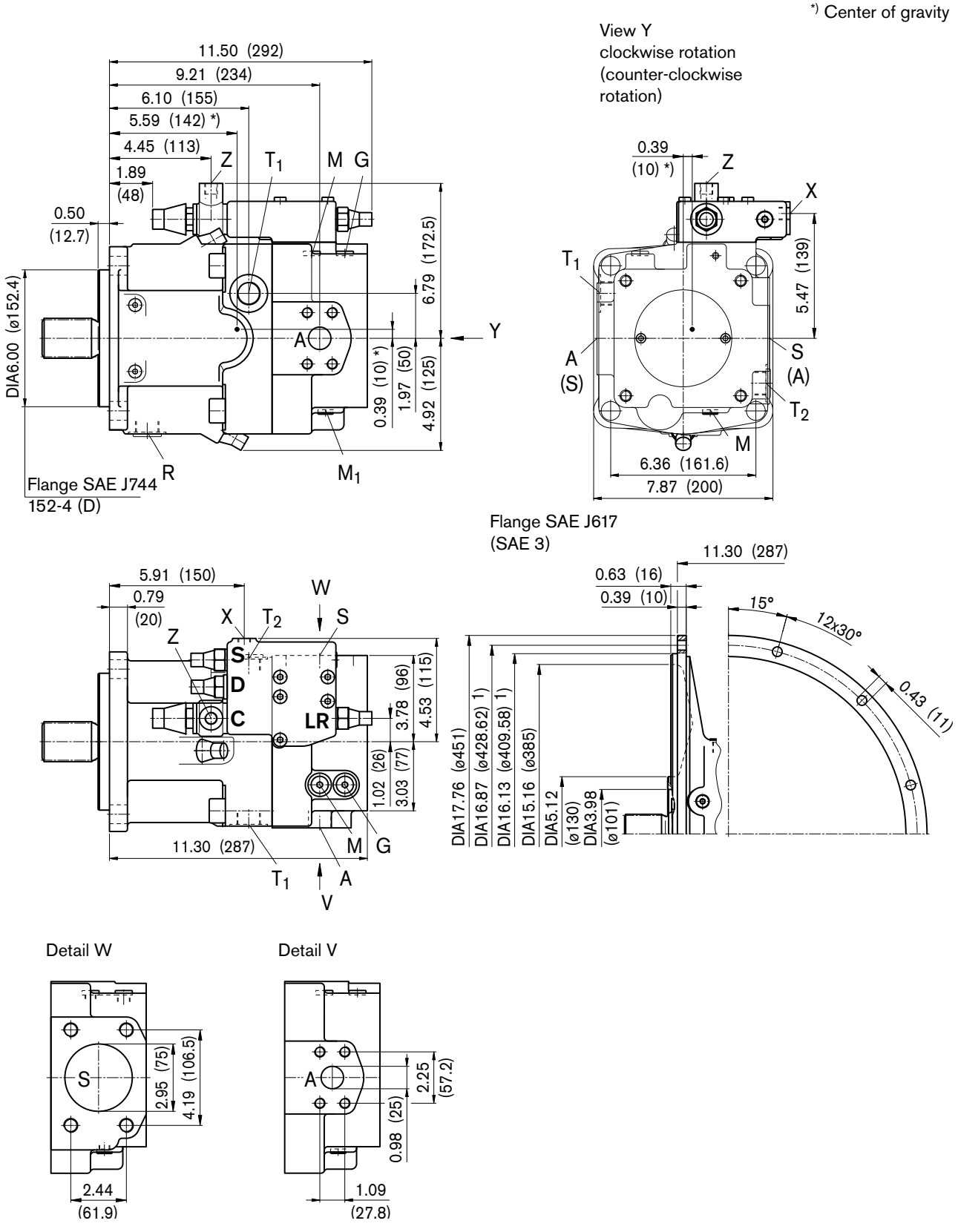
Dimensions size 95

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

LRDCS

Power control LR with pressure cut-off D, cross sensing control C and load sensing control S

*) Center of gravity



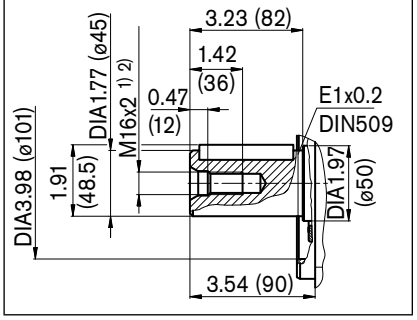
1) Dimensions according to SAE J617-No. 3, for connection to the flywheel case of the combustion engine

Dimensions size 95

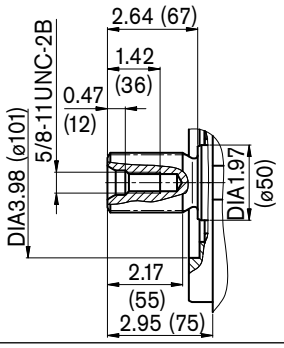
Before finalizing your design,
please request a certified drawing.
Dimensions in inches and (millimeters).

Drive shaft

P Parallel keyed shaft DIN 6885 – AS14x9x80



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



Ports

Designation	Function	Standard	Size[2)]		Max. pressure [psi (bar)][4)]	State
A	Service line port	SAE J518	1 in		5800 (400)	O
	Fixing thread	ISO 68	7/16in-14UNC-2B;	0.67 (17) deep		
S	Suction port	SAE J518	3 in		435 (30)	O
	Fixing thread	ISO 68	5/8in-11UNC-2B;	0.94 (24) deep		
T_1, T_2	Tank port	ISO 11926	1 1/16in-12UNF-2B;	0.63 (16) deep	145 (10)	[5)]
R	Air bleed	ISO 11926	1 1/16in-12UNF-2B;	0.63 (16) deep	145 (10)	X
M_1	Measurement point, positioning chamber	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	580 (400)	X
M	Measurement point, service line port	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	5800 (400)	X
X	Pilot pressure port in version with load sensing (S) and remote controlled pressure cut-off (G)	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	5800 (400)	O
Y	Pilot pressure port in version with stroke limiter (H...), 2-stage pressure cut-off (E) and HD	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	580 (40)	O
Z	Pilot pressure port in version with cross sensing (C) and power override (LR3) power overrice (LG1)	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	5800 (400) 580 (40)	O
G	Port for control pressure (controller) in version with stroke limiter (H.., U2), HD and EP with screw union GE10 - PLM (otherwise closed)	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	580 (40)	O

1) Center bore according to DIN 332 (thread acc. to DIN 13)
2) For maximum tightening torque, please refer to general notes on page 64
3) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
4) Depending on adjustment data and operating pressure
5) Depending on installation position, T_1 or T_2 must be connected (see also page 61)

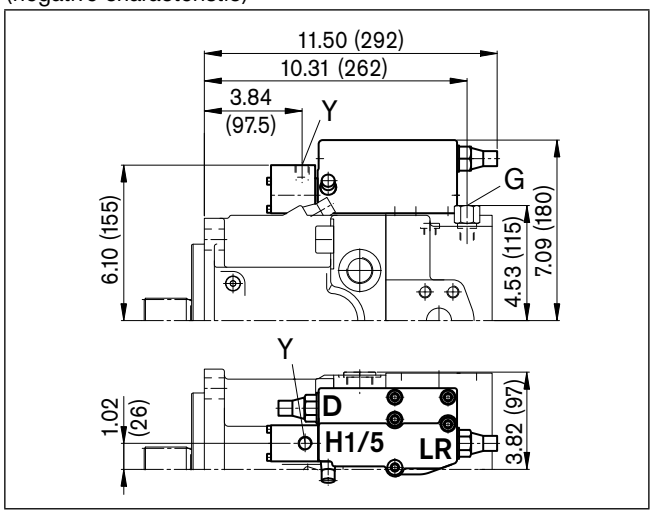
O = Open, must be connected (closed on delivery)
X = Closed (in normal operation)

Dimensions size 95

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

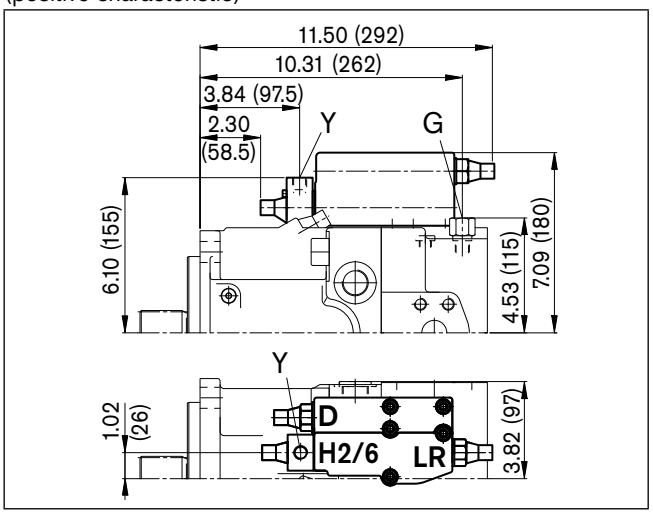
LRDH1/LRDH5

Power control with pressure cut-off and hydraulic stroke limiter (negative characteristic)



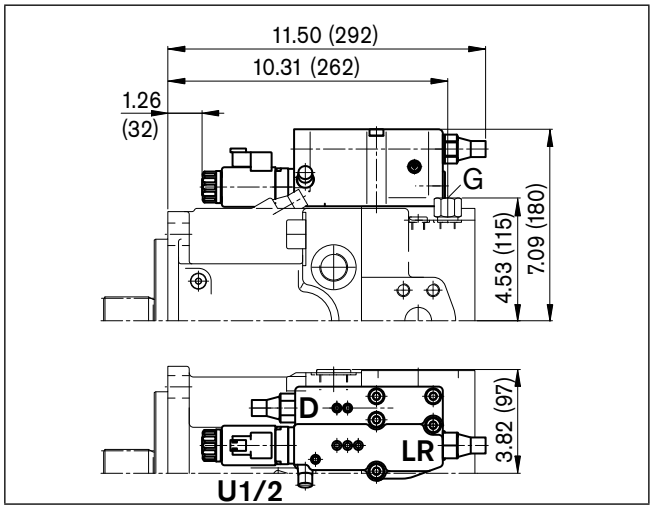
LRDH2/LRDH6

Power control with pressure cut-off and hydraulic stroke limiter (positive characteristic)



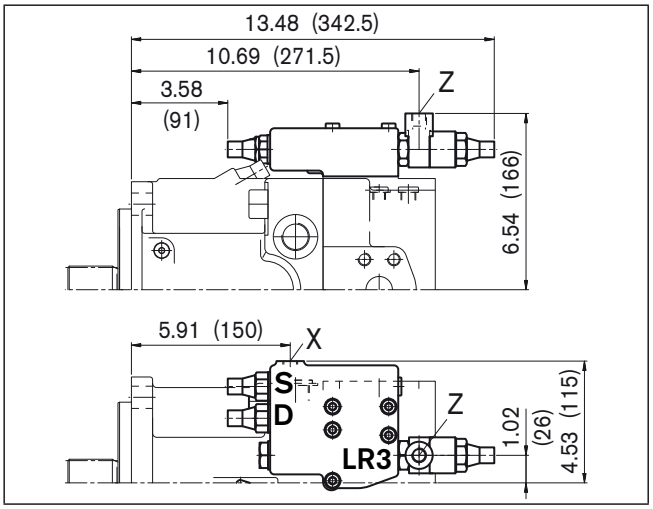
LRDU1/LRDU2

Power control with pressure cut-off and electric stroke limiter (positive characteristic)



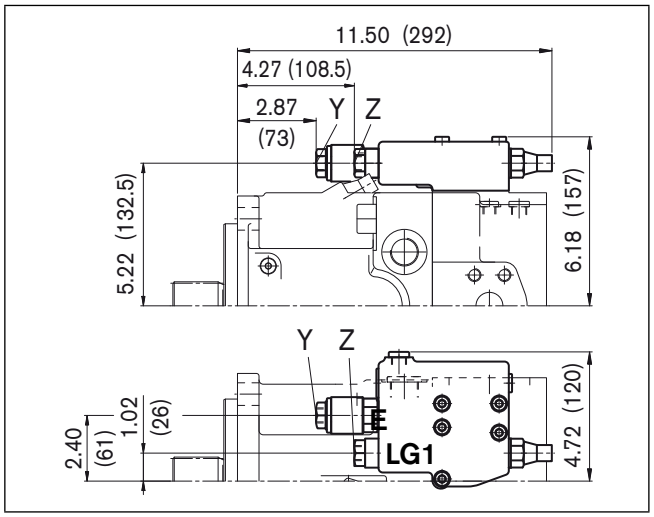
LR3DS

Power control with high-pressure related override, pressure cut-off and load sensing control



LG1E

Power control with pilot-pressure related override (negative) and 2-stage pressure cut-off



LG2E

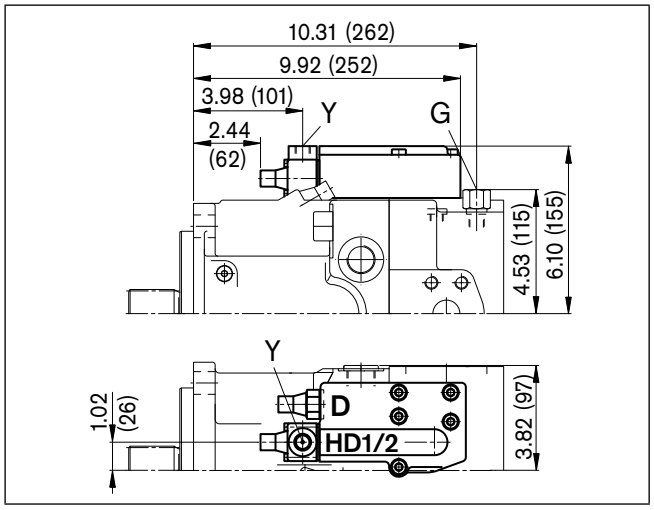
Power control with pilot-pressure related override (positive) and 2-stage pressure cut-off

Dimensions size 95

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

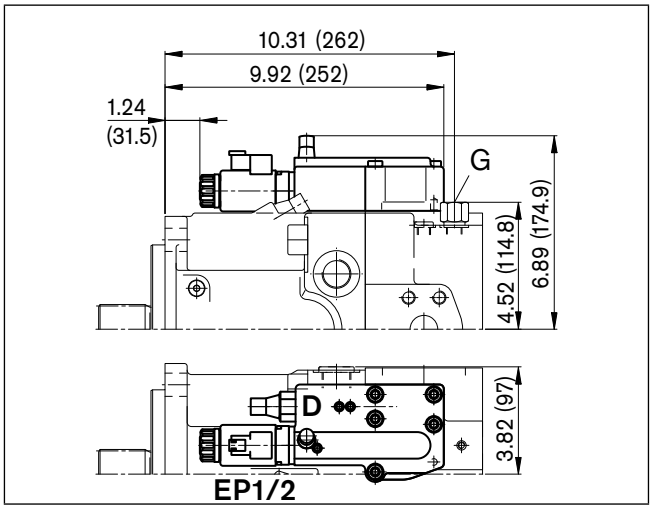
HD1D/HD2D

Hydraulic control, pilot-pressure related with pressure cut-off



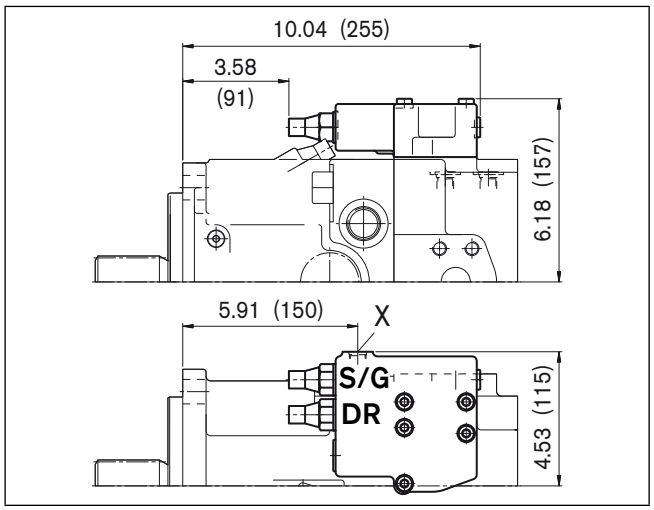
EP1D/EP2D

Electric control with proportional solenoid and pressure cut-off



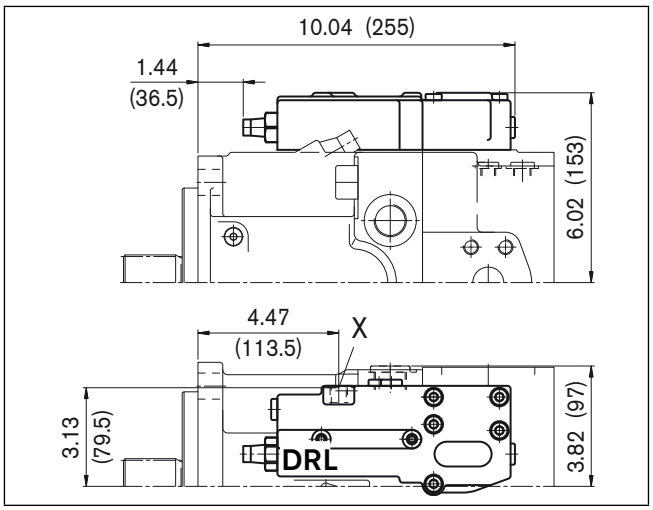
DRS/DRG

Pressure control with load sensing control
Pressure control remote controlled



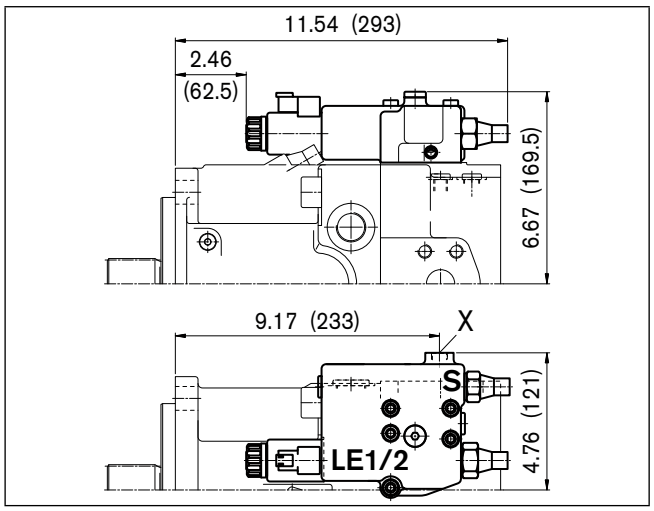
DRL

Pressure control for parallel operation



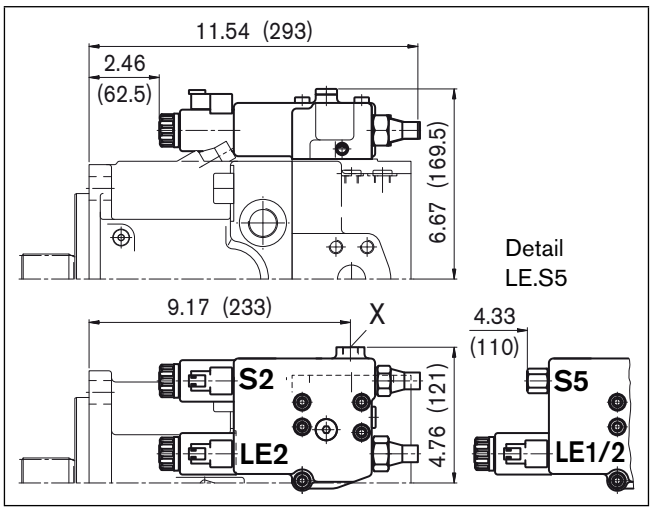
LE1S/LE2S

Power control with electric override (negative) and load sensing control



LE2S2/LE1S5/LE2S5

Power control with electric override (negative) and load sensing control, override



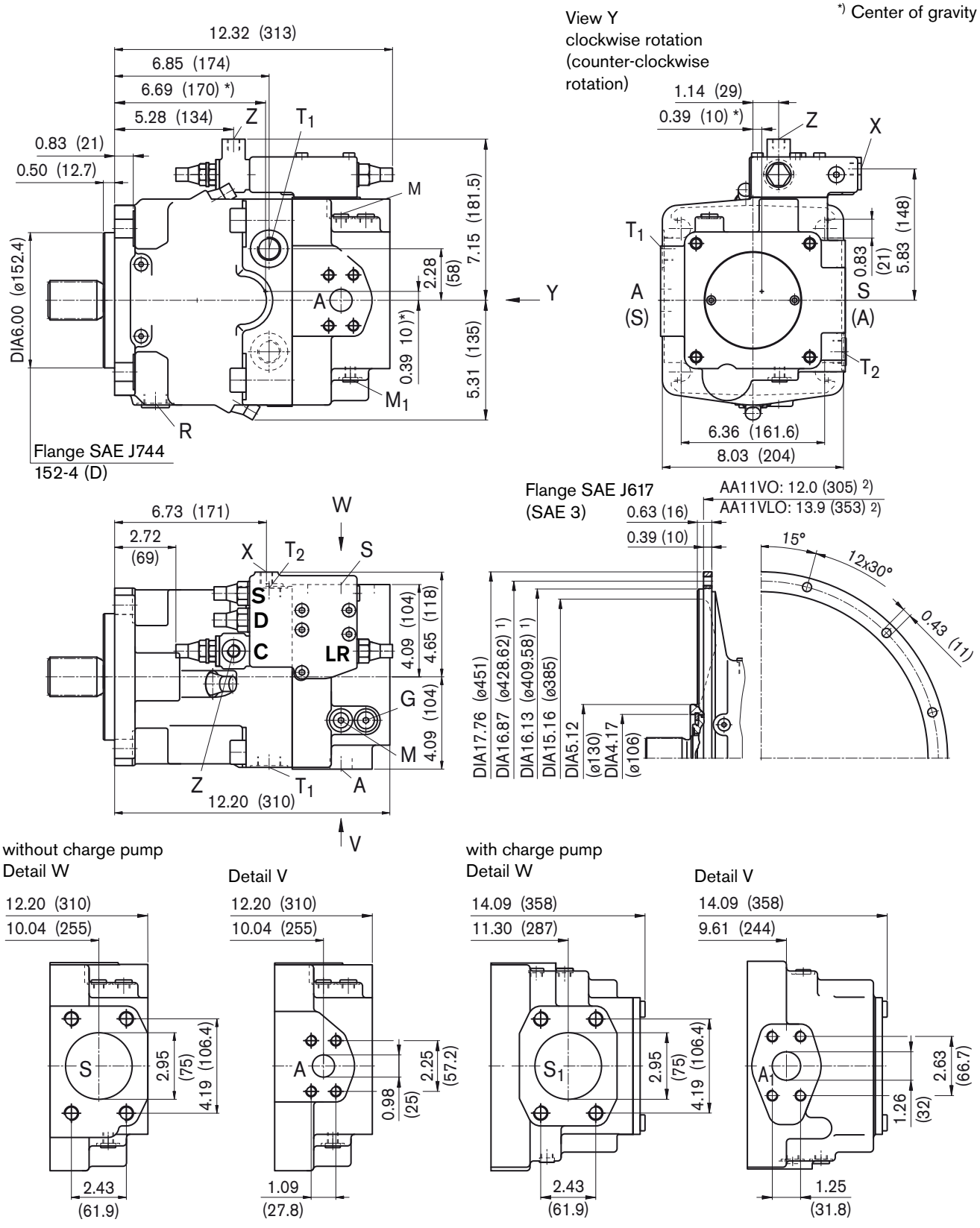
Dimensions size 130/145

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

LRDCS

Power control LR with pressure cut-off D, cross sensing control C and load sensing control S

*) Center of gravity



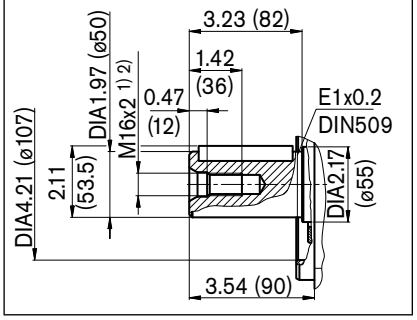
1) Dimensions according to SAE J617-No. 3, for connection to the flywheel case of the combustion engine
2) The case or length dimension with flange SAE 3 is 5 mm shorter than the standard case.

Dimensions size 130/145

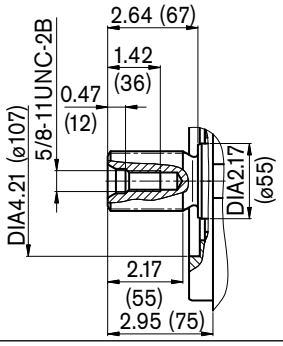
Before finalizing your design,
please request a certified drawing.
Dimensions in inches and (millimeters).

Drive shaft

P Parallel keyed shaft DIN 6885,
AS14x9x80



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



Ports

Designation	Function	Standard	Size[2)]		Max. pressure [psi (bar)][4)]	State
A	Service line port	SAE J518	1 in		5800 (400)	O
	Fixing thread	ISO 68	7/16in-14UNC-2B;	0.67 (17) deep		
A_1	Service line port	SAE J518	1 1/4 in		5800 (400)	O
	Fixing thread	ISO 68	1/2in-13UNC-2B;	0.75 (19) deep		
S,	Suction port	SAE J518	3 in		435 (30)	O
S_1	Fixing thread	ISO 68	5/8in-11UNC-2B;	0.94 (24) deep	30 (2)[6)]	
T_1, T_2	Tank port	ISO 11926	1 1/16in-12UNF-2B;	0.63 (16) deep	145 (10)	5)
R	Air bleed	ISO 11926	1 1/16in-12UNF-2B;	0.63 (16) deep	145 (10)	X
M_1	Measurement point, positioning chamber	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	5800 (400)	X
M	Measurement point, service line port	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	5800 (400)	X
X	Pilot pressure port in version with load sensing (S) and remote controlled pressure cut-off (G)	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	5800 (400)	O
Y	Pilot pressure port in version with stroke limiter (H...), 2-stage pressure cut-off (E) and HD	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	580 (40)	O
Z	Pilot pressure port in version with cross sensing (C) and power override (LR3) power overrice (LG1)	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	5800 (400) 580 (40)	O
G	Port for control pressure (controller) in version with stroke limiter (H.., U2), HD and EP with screw union GE10 - PLM (otherwise closed)	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	580 (40)	O

1) Center bore according to DIN 332 (thread acc. to DIN 13)
2) For maximum tightening torque, please refer to general notes on page 64
3) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
4) Depending on adjustment data and operating pressure
5) Depending on installation position, T_1 or T_2 must be connected (see also page 61)
6) with charge pump

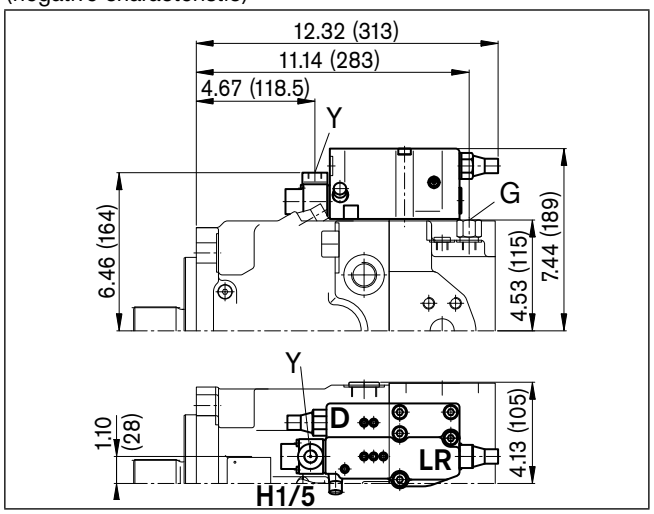
O = Open, must be connected (closed on delivery)
X = Closed (in normal operation)

Dimensions size 130/145

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

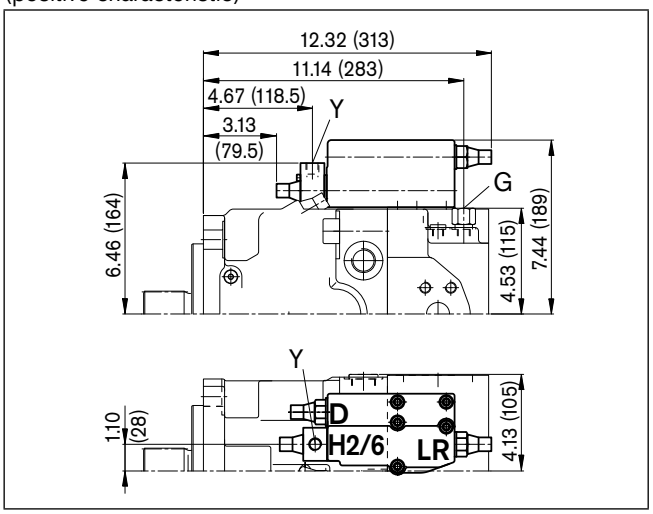
LRDH1/LRDH5

Power control with pressure cut-off and hydraulic stroke limiter (negative characteristic)



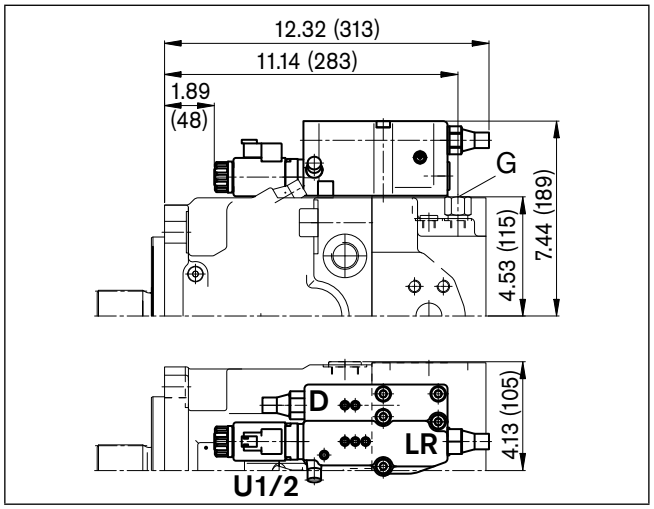
LRDH2/LRDH6

Power control with pressure cut-off and hydraulic stroke limiter (positive characteristic)



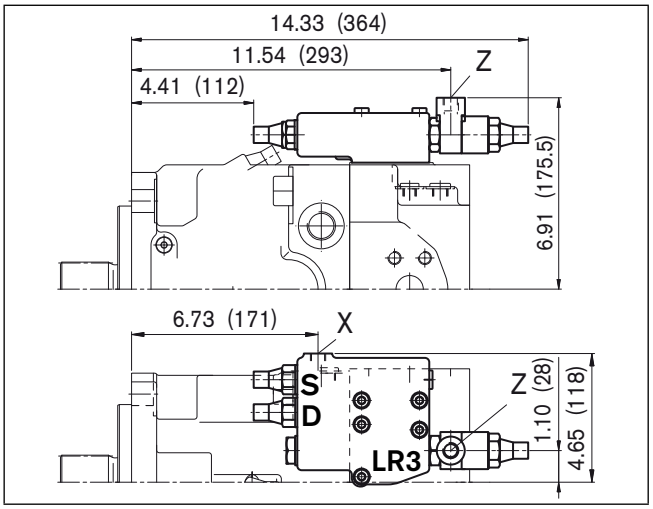
LRDU1/LRDU2

Power control with pressure cut-off and electric stroke limiter (positive characteristic)



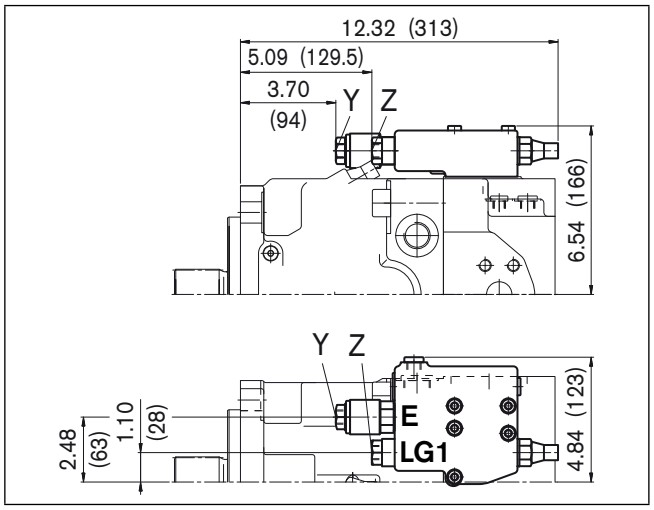
LR3DS

Power control with high-pressure related override, pressure cut-off and load sensing control



LG1E

Power control with pilot-pressure related override (negative) and 2-stage pressure cut-off



LG2E

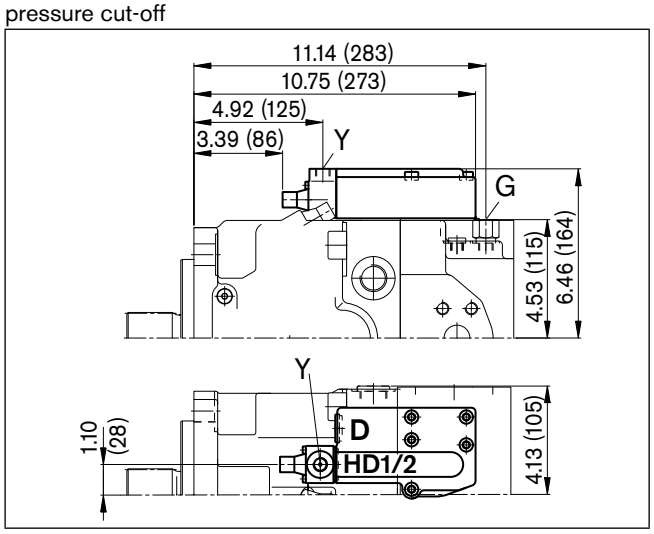
Power control with pilot-pressure related override (positive) and 2-stage pressure cut-off

Dimensions size 130/145

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

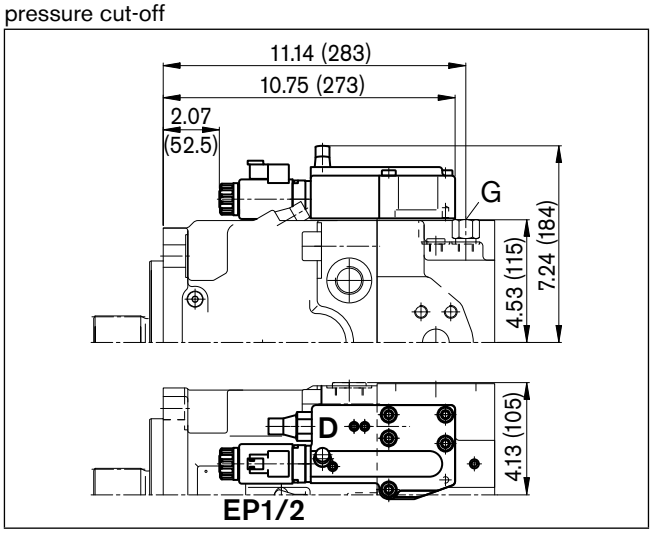
HD1D/HD2D

Hydraulic control, pilot-pressure related with pressure cut-off



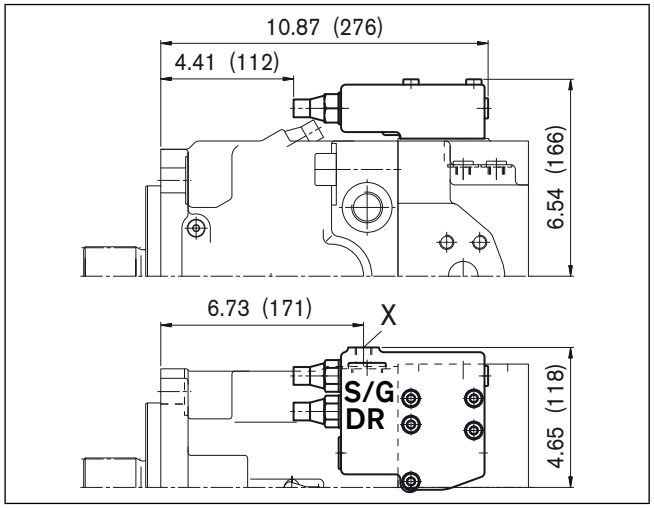
EP1D/EP2D

Electric control with proportional solenoid and pressure cut-off



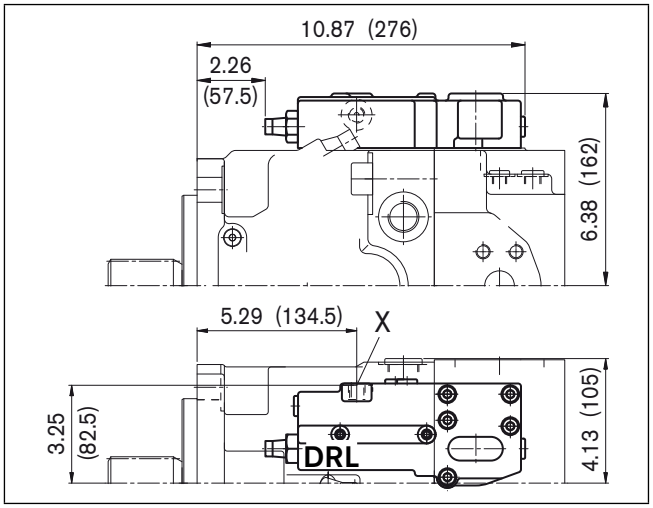
DRS/DRG

Pressure control with load sensing control
Pressure control remote controlled



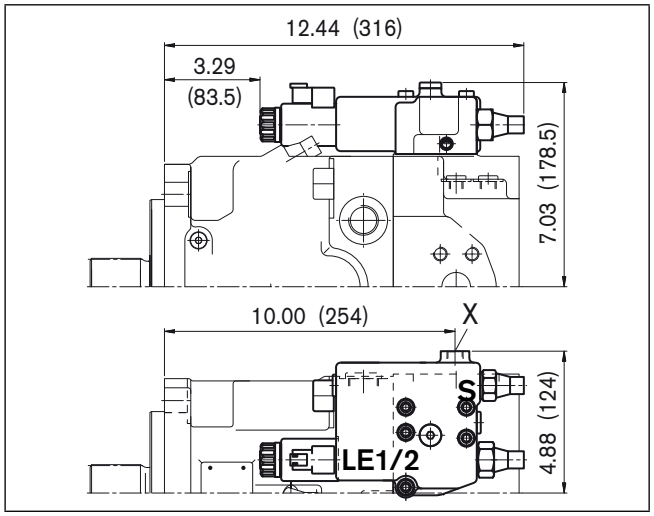
DRL

Pressure control for parallel operation



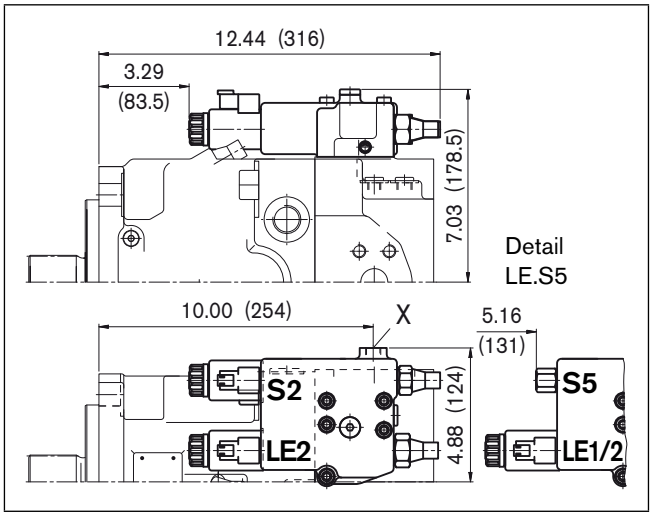
LE1S/LE2S

Power control with electric override (negative) and load sensing control



LE2S2/LE1S5/LE2S5

Power control with electric override (negative) and load sensing control, override

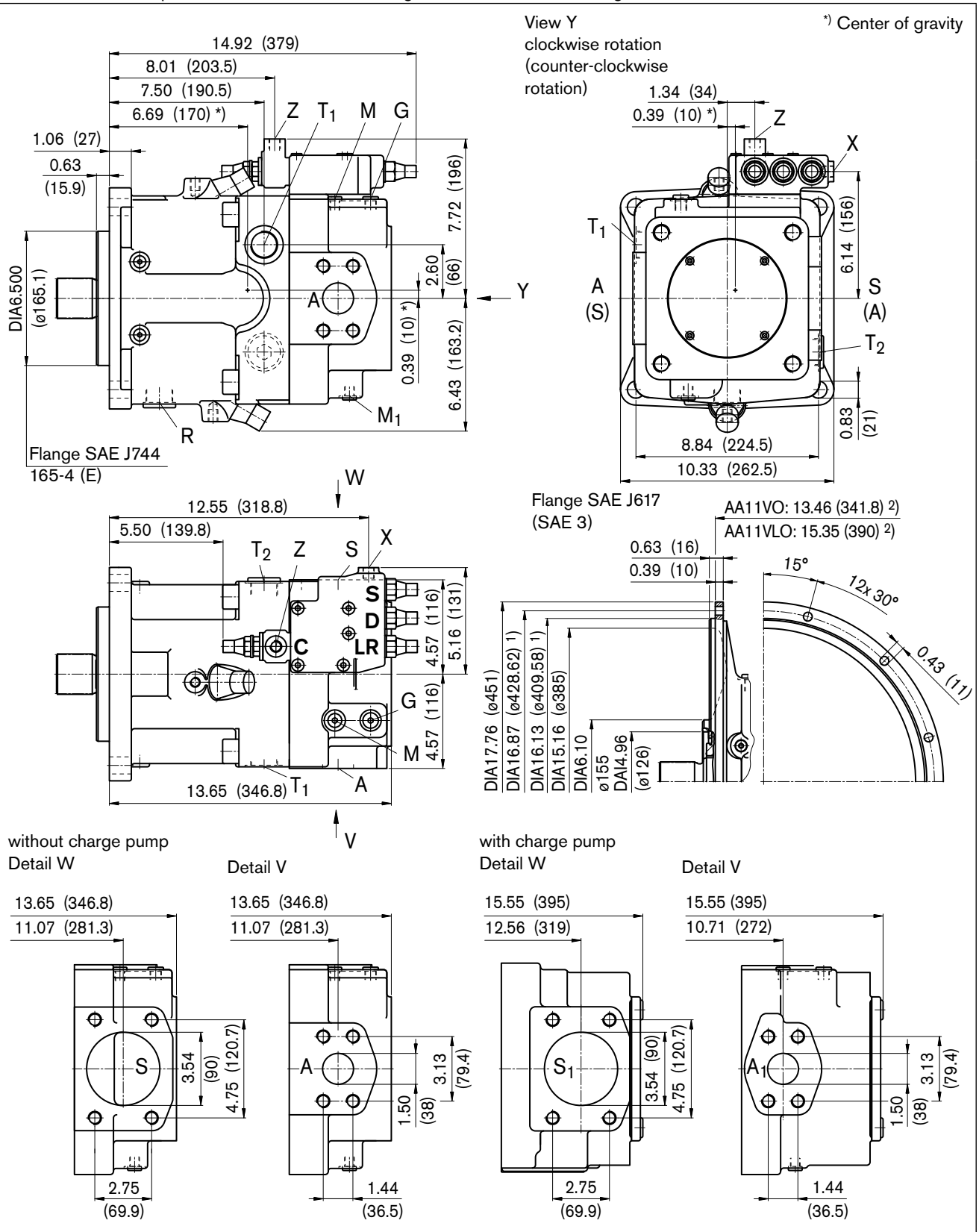


Dimensions size 190

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

LRDCS

Power control LR with pressure cut-off D, cross sensing control C and load sensing control S



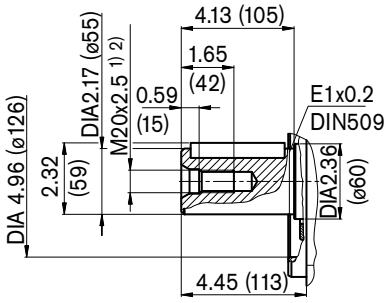
1) Dimensions according to SAE J617-No. 3, for connection to the flywheel case of the combustion engine
2) The case or length dimension with flange SAE 3 is 5 mm shorter than the standard case.

Dimensions size 190

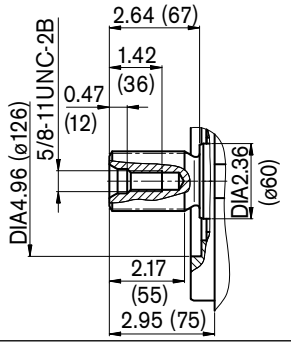
Before finalizing your design, please request a certified drawing. Dimensions in inches and (millimeters).

Drive shaft

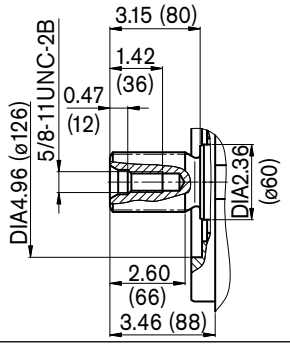
P Parallel keyed shaft DIN 6885, AS16x10x100



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



T Splined shaft SAE J744 2 in 15T 8/16DP[3)]



Ports

Designation	Function	Standard	Size[2)]		Max. pressure [psi (bar)] [4)]	State
A, A_1	Service line port	SAE J518	1 1/2 in		5800 (400)	O
	Fixing thread	ISO 68	5/8in-11UNC-2B;	0.83 (21) deep		
S,	Suction port	SAE J518	3 1/2 in		435 (30)	O
S_1	Fixing thread	ISO 68	5/8in-11UNC-2B;	0.94 (24) deep	30 (2)[6)]	
T_1, T_2	Tank port	ISO 11926	1 5/16in-12UNF-2B;	0.71 (18) deep	145 (10)	5)
R	Air bleed	ISO 11926	1 5/16in-12UNF-2B;	0.71 (18) deep	145 (10)	X
M_1	Measurement point, positioning chamber	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	5800 (400)	X
M	Measurement point, service line port	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	5800 (400)	X
X	Pilot pressure port in version with load sensing (S) and remote controlled pressure cut-off (G)	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	5800 (400)	O
Y	Pilot pressure port in version with stroke limiter (H...), 2-stage pressure cut-off (E) and HD	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	580 (40)	O
Z	Pilot pressure port in version with cross sensing (C) and power override (LR3) power overrice (LG1)	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	5800 (400) 580 (40)	O
G	Port for control pressure (controller) in version with stroke limiter (H.., U2), HD and EP with screw union GE10 - PLM (otherwise closed)	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	580 (40)	O

1) Center bore according to DIN 332 (thread acc. to DIN 13)
2) For maximum tightening torque, please refer to general notes on page 64
3) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
4) Depending on adjustment data and operating pressure
5) Depending on installation position, T_1 or T_2 must be connected (see also page 61)
6) with charge pump

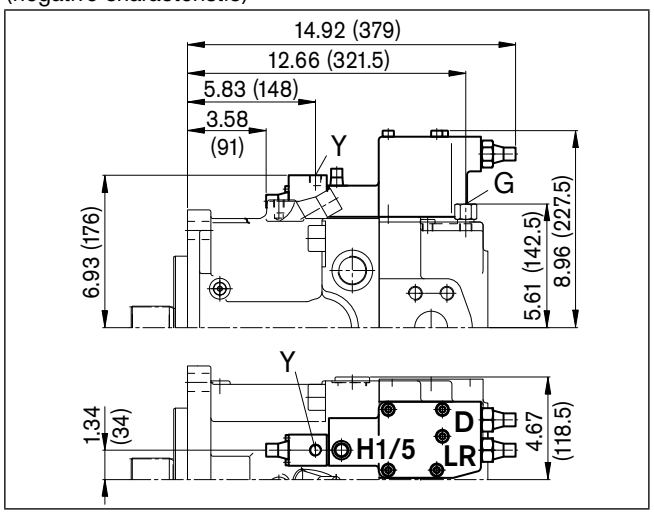
O = Open, must be connected (closed on delivery)
X = Closed (in normal operation)

Dimensions size 190

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

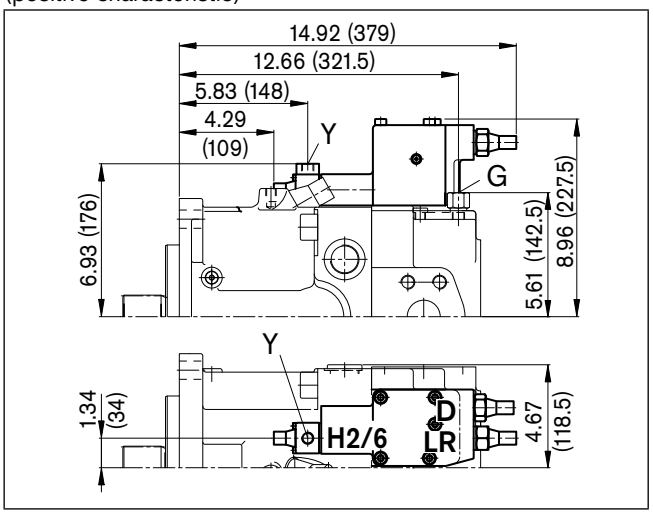
LRDH1/LRDH5

Power control with pressure cut-off and hydraulic stroke limiter (negative characteristic)



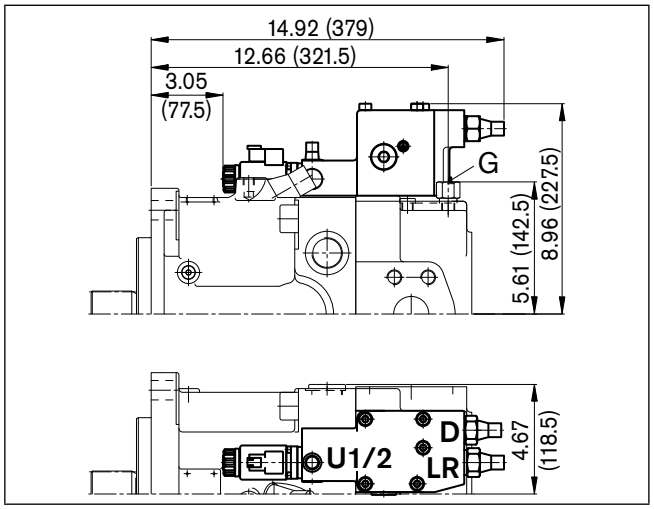
LRDH2/LRDH6

Power control with pressure cut-off and hydraulic stroke limiter (positive characteristic)



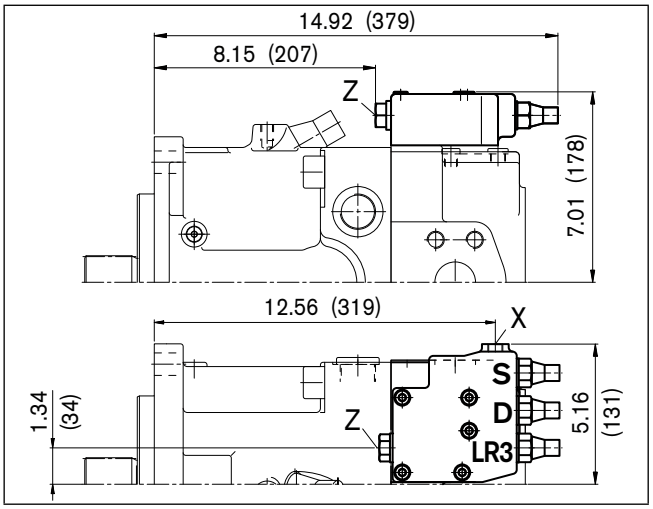
LRDU1/LRDU2

Power control with pressure cut-off and electric stroke limiter (positive characteristic)



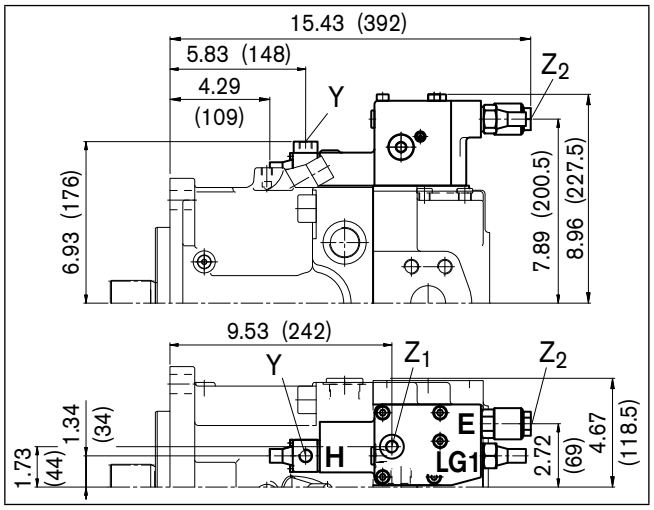
LR3DS

Power control with high-pressure related override, pressure cut-off and load sensing control



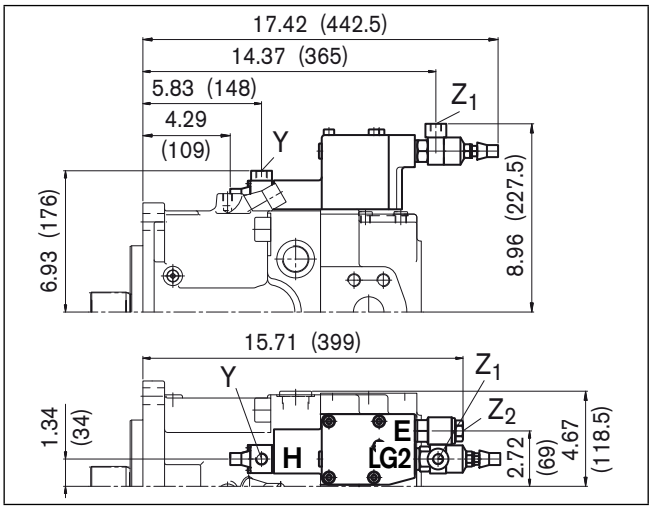
LG1EH

Power control with pilot-pressure related override (neg.), 2-stage pressure cut-off and hydr. stroke limiter



LG2EH

Power control with pilot-pressure related override (pos.), 2-stage pressure cut-off and hydr. stroke limiter

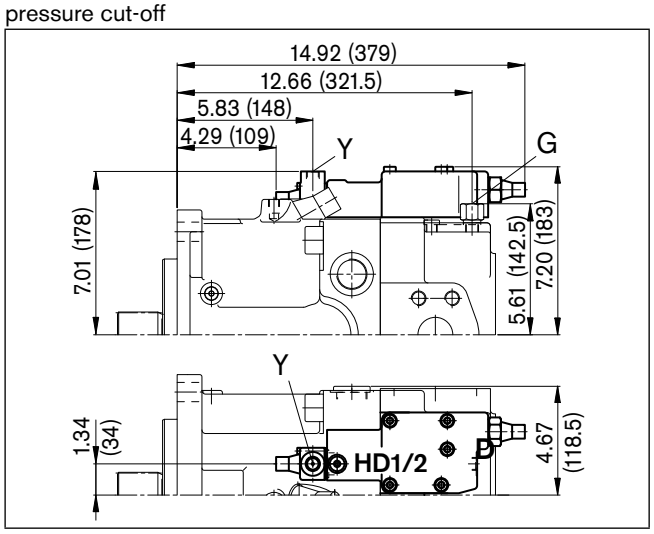


Dimensions size 190

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

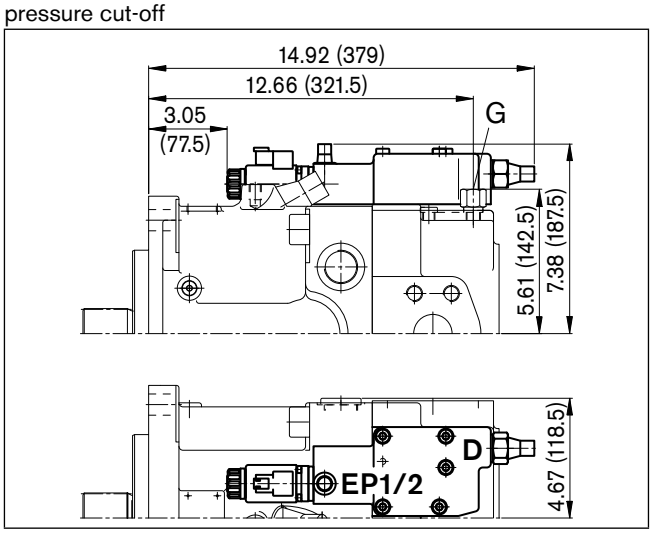
HD1D/HD2D

Hydraulic control, pilot-pressure related with pressure cut-off



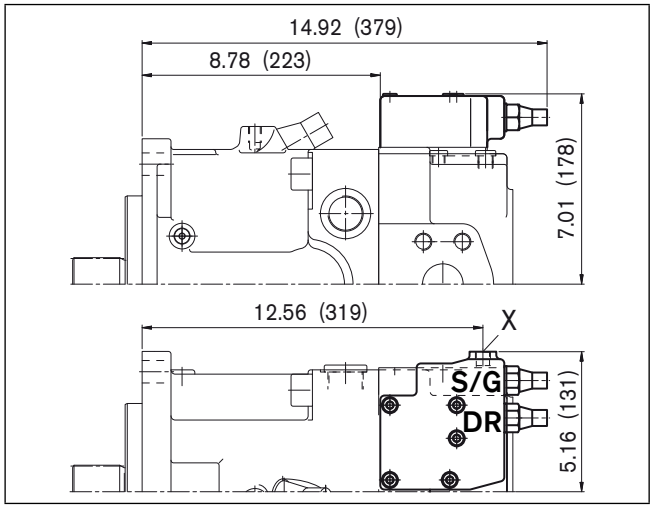
EP1D/EP2D

Electric control with proportional solenoid and pressure cut-off



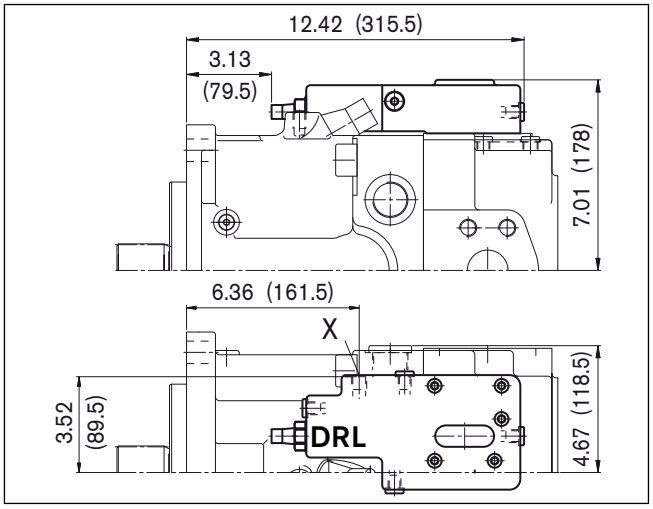
DRS/DRG

Pressure control with load sensing control
Pressure control remote controlled



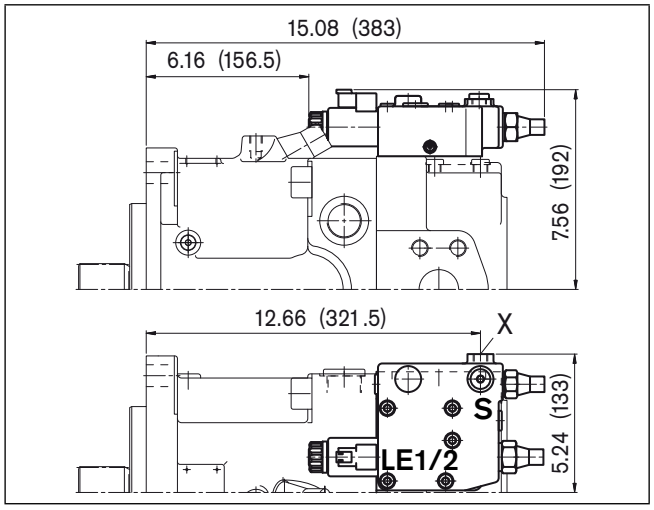
DRL

Pressure control for parallel operation



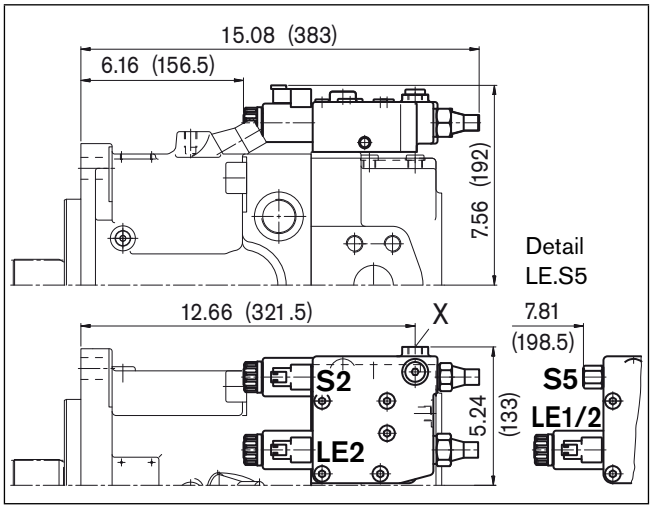
LE1S/LE2S

Power control with electric override (negative) and load sensing control



LE2S2/LE1S5/LE2S5

Power control with electric override (negative) and load sensing control, override

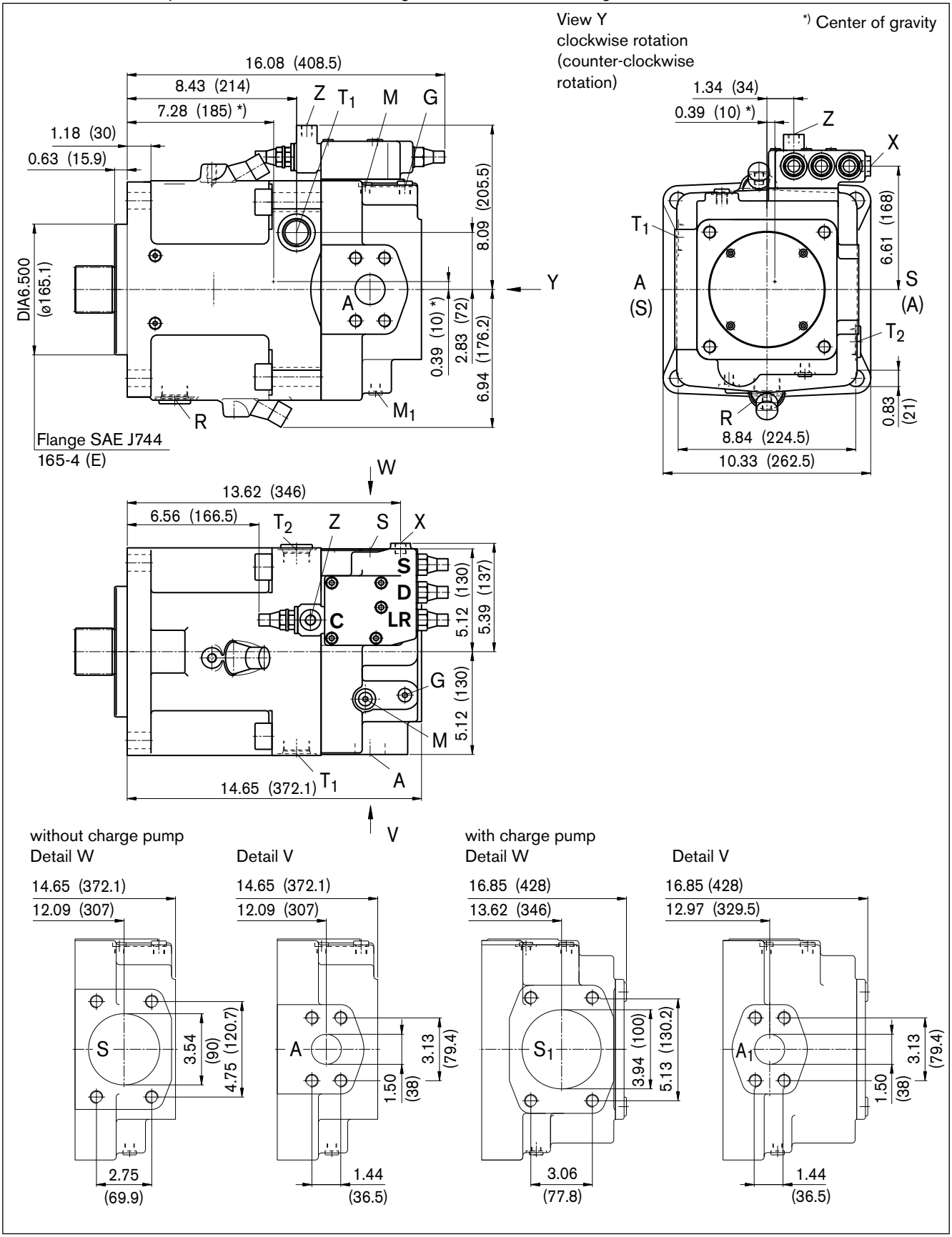


Dimensions size 260

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

LRDCS

Power control LR with pressure cut-off D, cross sensing control C and load sensing control S

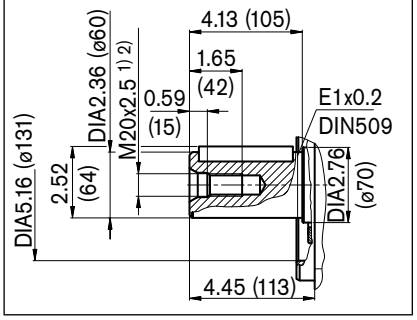


Dimensions size 260

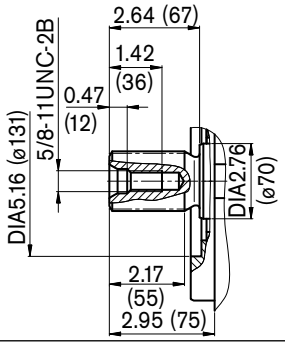
Before finalizing your design,
please request a certified drawing.
Dimensions in inches and (millimeters).

Drive shaft

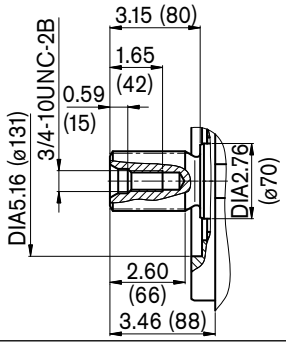
P Parallel keyed shaft DIN 6885,
AS18x11x100



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



T Splined shaft SAE J744
2 1/4 in 17T 8/16DP[3)]



Ports

Designation	Function	Standard	Size[2)]		Max. pressure [psi (bar)][4)]	State
A, A_1	Service line port	SAE J518	1 1/2 in		5800 (400)	O
	Fixing thread	ISO 68	5/8in-11UNC-2B;	0.83 (21) deep		
S	Suction port	SAE J518	3 1/2 in		435 (30)	O
	Fixing thread	ISO 68	5/8in-11UNC-2B;	0.94 (24) deep		
S_1	Suction port	SAE J518	4 in		30 (2)[6)]	O
	Fixing thread	ISO 68	5/8in-11UNC-2B;	0.83 (21) deep		
T_1, T_2	Tank port	ISO 11926	1 5/16in-12UNF-2B;	0.63 (16) deep	145 (10)	[5)]
R	Air bleed	ISO 11926	1 5/16in-12UNF-2B;	0.63 (16) deep	145 (10)	X
M_1	Measurement point, positioning chamber	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	5800 (400)	X
M	Measurement point, service line port	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	5800 (400)	X
X	Pilot pressure port in version with load sensing (S) and remote controlled pressure cut-off (G)	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	5800 (400)	O
Y	Pilot pressure port in version with stroke limiter (H...), 2-stage pressure cut-off (E) and HD	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	580 (40)	O
Z	Pilot pressure port in version with cross sensing (C) and power override (LR3) power overrice (LG1)	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	5800 (400) 580 (40)	O
G	Port for control pressure (controller) in version with stroke limiter (H.., U2), HD and EP with screw union GE10 - PLM (otherwise closed)	ISO 11926	9/16in-18UNF-2B;	0.47 (12) deep	580 (40)	O

1) Center bore according to DIN 332 (thread acc. to DIN 13)
2) For maximum tightening torque, please refer to general notes on page 64
3) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
4) Depending on adjustment data and operating pressure
5) Depending on installation position, T1 or T2 must be connected (see also page 61)
6) with charge pump

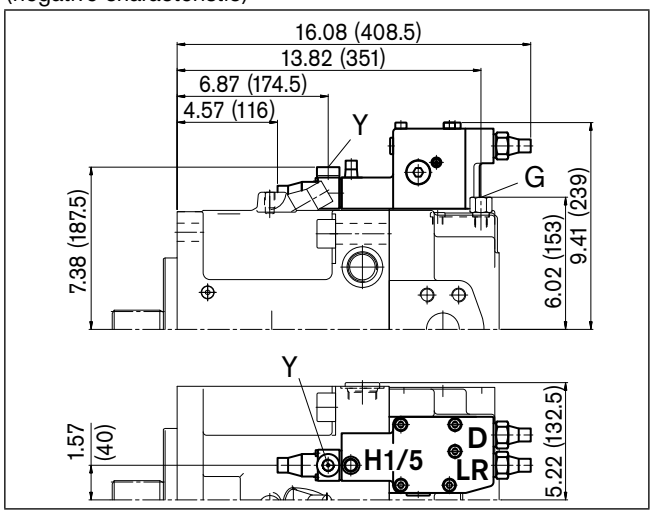
O = Open, must be connected (closed on delivery)
X = Closed (in normal operation)

Dimensions size 260

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

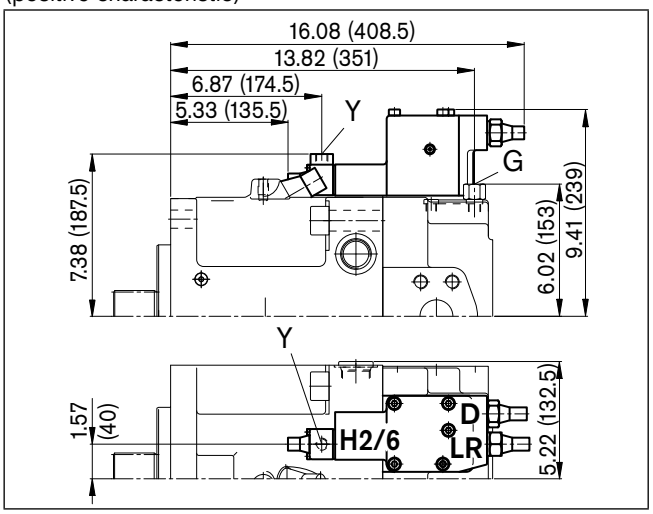
LRDH1/LRDH5

Power control with pressure cut-off and hydraulic stroke limiter (negative characteristic)



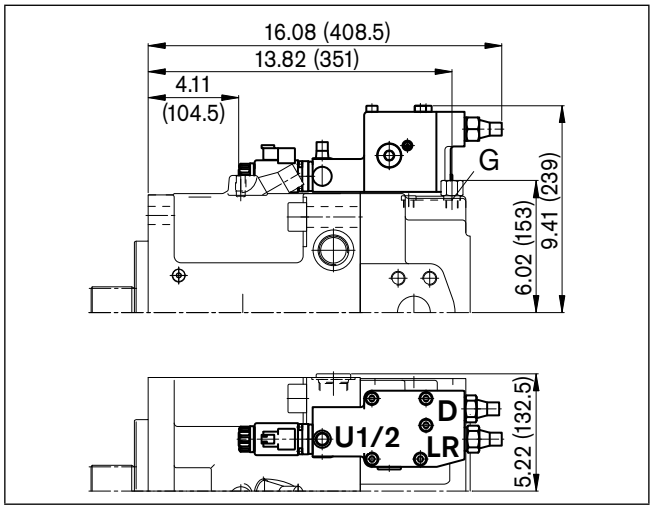
LRDH2/LRDH6

Power control with pressure cut-off and hydraulic stroke limiter (positive characteristic)



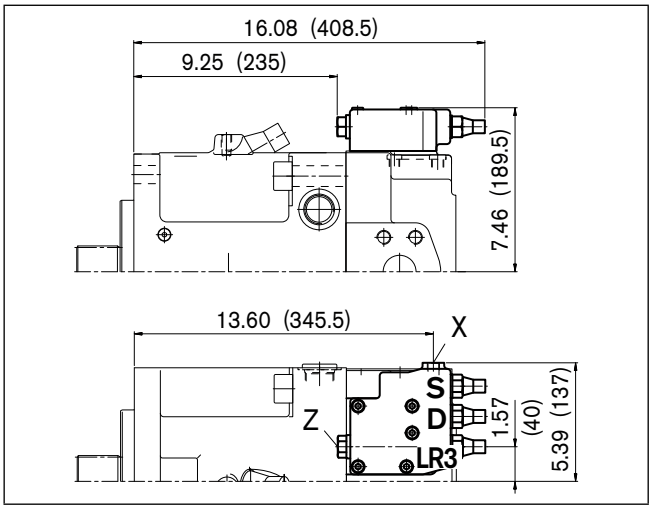
LRDU1/LRDU2

Power control with pressure cut-off and electric stroke limiter (positive characteristic)



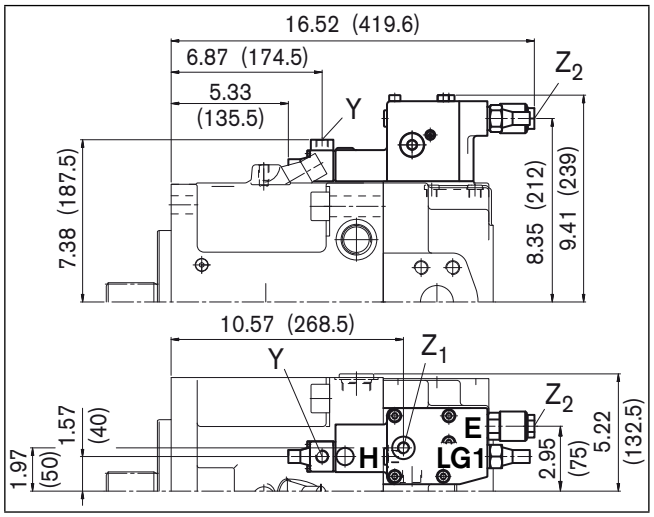
LR3DS

Power control with high-pressure related override, pressure cut-off and load sensing control



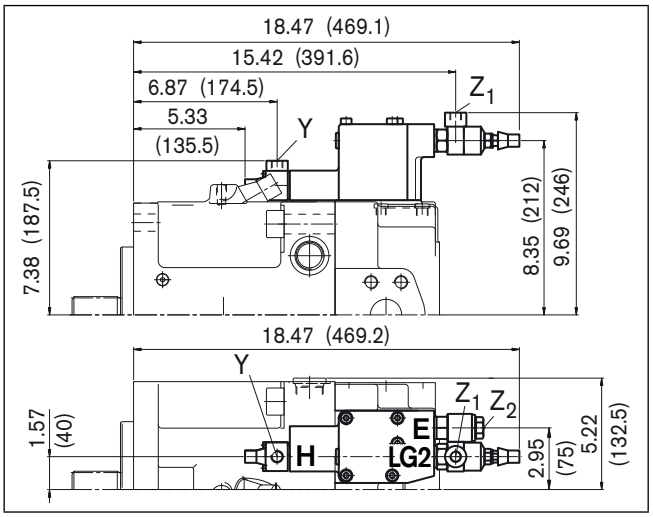
LG1EH

Power control with pilot-pressure related override (neg.), 2-stage pressure cut-off and hydr. stroke limiter



LG2EH

Power control with pilot-pressure related override (pos.), 2-stage pressure cut-off and hydr. stroke limiter

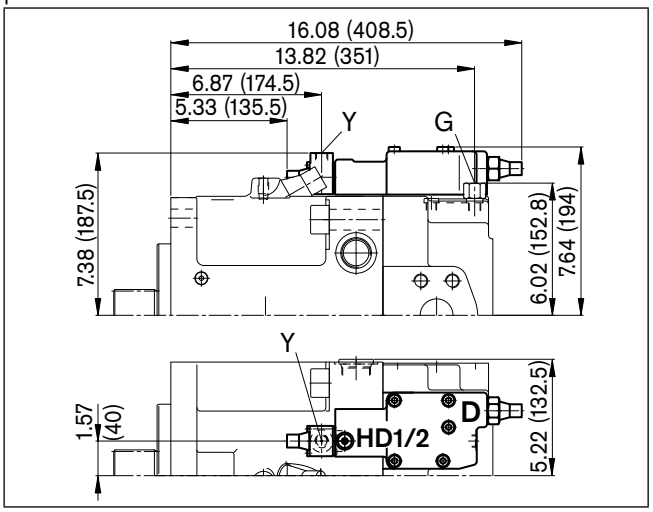


Dimensions size 260

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

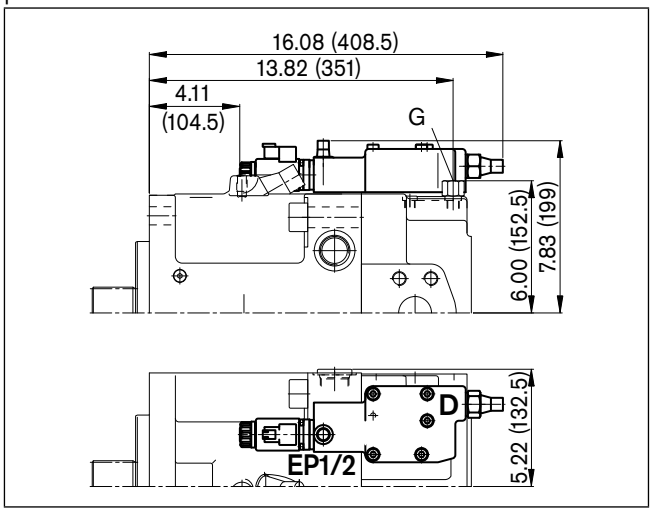
HD1D/HD2D

Hydraulic control, pilot-pressure related with pressure cut-off



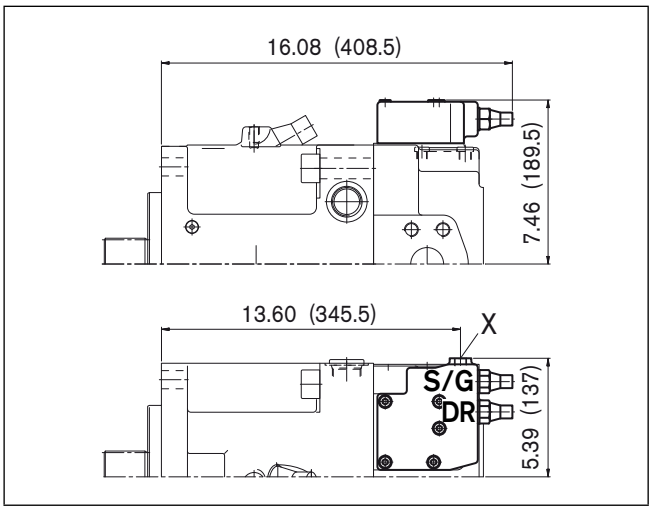
EP1D/EP2D

Electric control with proportional solenoid and pressure cut-off



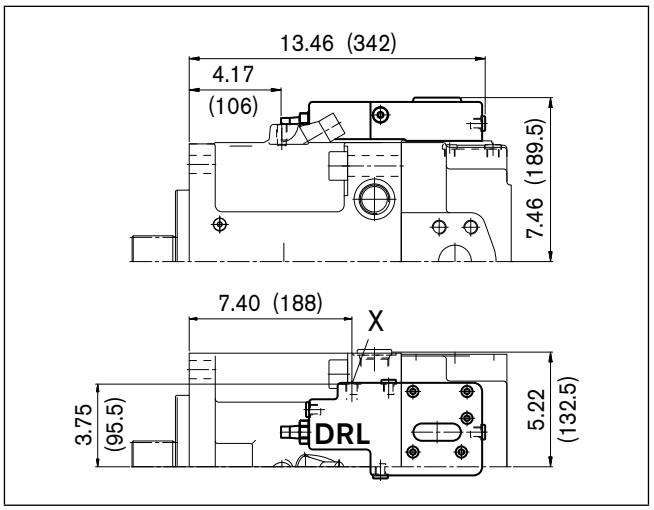
DRS/DRG

Pressure control with load sensing control
Pressure control remote controlled



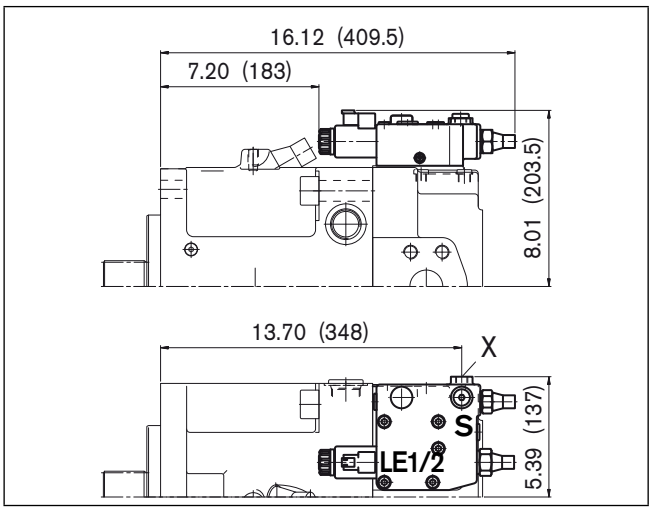
DRL

Pressure control for parallel operation



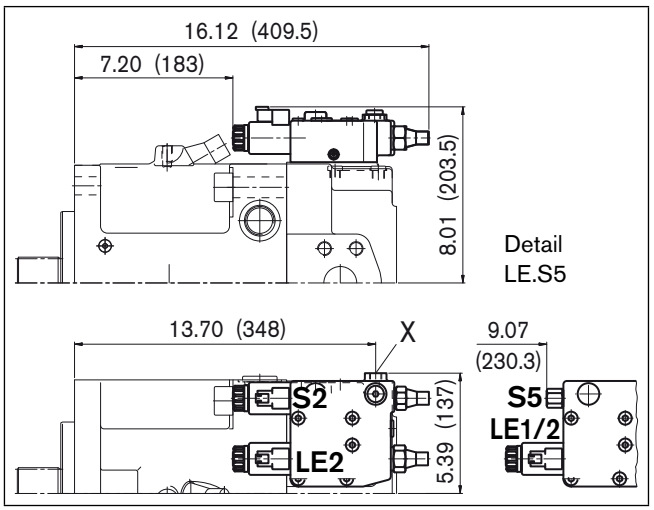
LE1S/LE2S

Power control with electric override (negative) and load sensing control



LE2S2/LE1S5/LE2S5

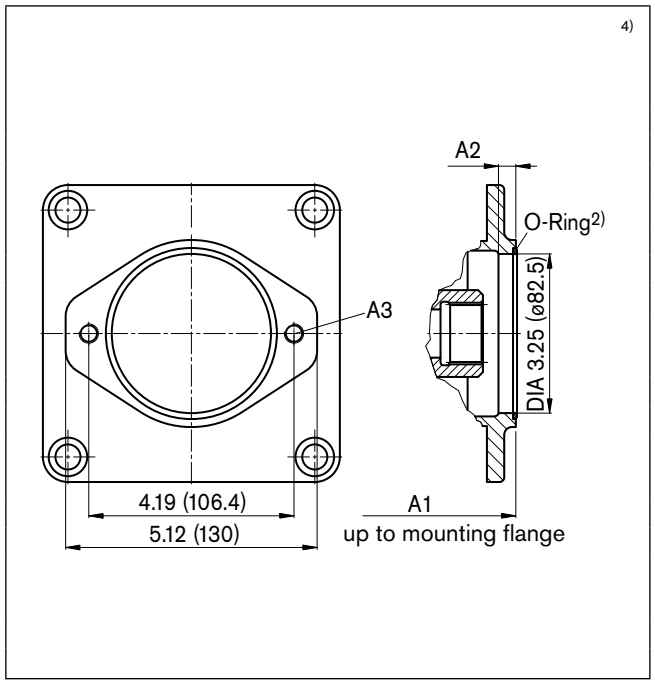
Power control with electric override (negative) and load sensing control, override



Through drive dimensions

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

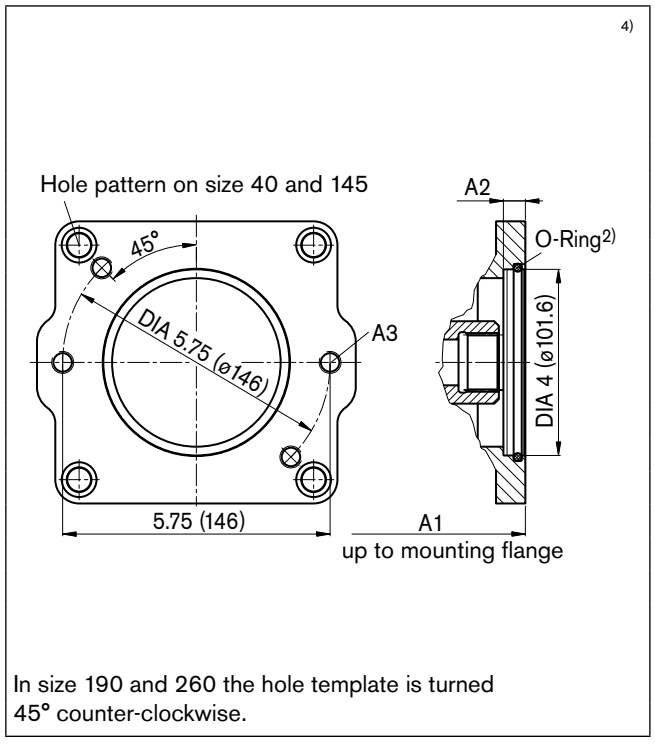
Flange SAE J744 – 82-2 (A) **Coupler** for splined shaft acc. to ANSI B92.1a-1976 5/8 in 9T 16/32 DP[1] (SAE J744 – 16-4 (A) **K01**
3/4 in 11T 16/32 DP[1] (SAE J744 – 19-4 (A-B)) **K52**



Size	A1 K01	A1 K52	A2	A3[3]	deep
40	9.45	9.45	0.32	3/8in-16UNC	0.59
	(240)	(240)	(8)		(15)
60	10.12	10.12			0.59
	(257)	(257)	–		(15)
75	10.83	10.83			0.59
	(275)	(275)	–		(15)
95	12.05	12.05			0.49
	(306)	(306)	–		(12.5)
130/145	12.95	12.95			0.49
	(329)	(329)	–		(12.5)
130/145*	14.29	14.29			0.49
	(363)	(363)	–		(12.5)
190	14.17	14.17			0.51
	(359.8)	(359.8)	–		(13)
190*	15.51	15.51			0.51
	(394)	(394)	–		(13)
260	15.16	15.16			0.51
	(385)	(385)	–		(13)
260*	16.82	16.82			0.51
	(427.3)	(427.3)	–		(13)

*) Version with charge pump

Flange SAE J744 – 101-2 (B) **Coupler** for splined shaft acc. to ANSI B92.1a-1976 7/8 in 13T 16/32 DP[1] (SAE J744 – 22-4 (B)) **K02**
1 in 15T 16/32 DP[1] (SAE J744 – 25-4 (B-B)) **K04**



Size	A1 K02	A1 K04	A2	A3[3]	deep
40	9.61	9.61	0.39	1/2in-10UNC	0.75
	(244)	(244)	(10)		(19)
60	10.28	10.28	0.39		0.75
	(261)	(261)	(10)		(19)
75	10.98	10.98	0.39		0.75
	(279)	(279)	(10)		(19)
95	11.93	11.93	0.39		0.63
	(303)	(303)	(10)		(16)
130/145	12.83	12.83	0.39		0.63
	(326)	(326)	(10)		(16)
130/145*	14.17	14.17	0.39		0.63
	(360)	(360)	(10)		(16)
190	14.64	14.56	–		0.59
	371.8	369.8	–		(15)
190*	15.91	15.91	–		0.59
	(404)	(404)	–		(15)
260	15.55	15.55	–		0.59
	(395)	(395)	–		(15)
260*	17.22	17.22	–		0.59
	(437.5)	(437.5)	–		(15)

*) Version with charge pump

Note

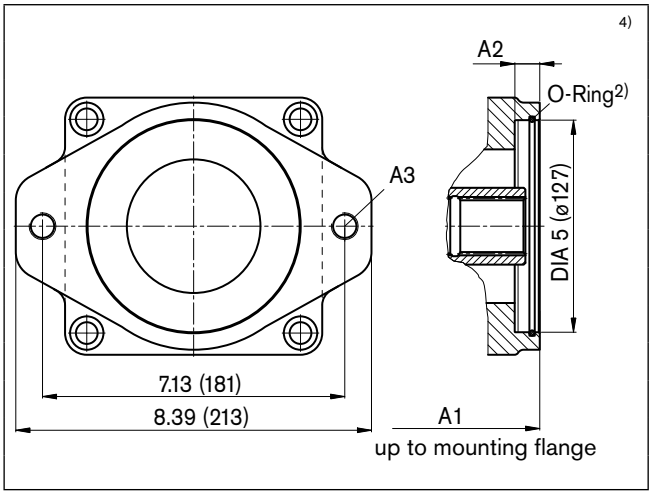
The mounting flange may be turned through 90°. Standard position as illustrated. Please state in clear text if required.

1) 30° pressure angle, flat root, side fit, tolerance class 5
2) O-ring included in the delivery contents
3) ISO 68, for maximum tightening torque, please refer to general notes on page 64
4) See page 59

Through drive dimensions

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

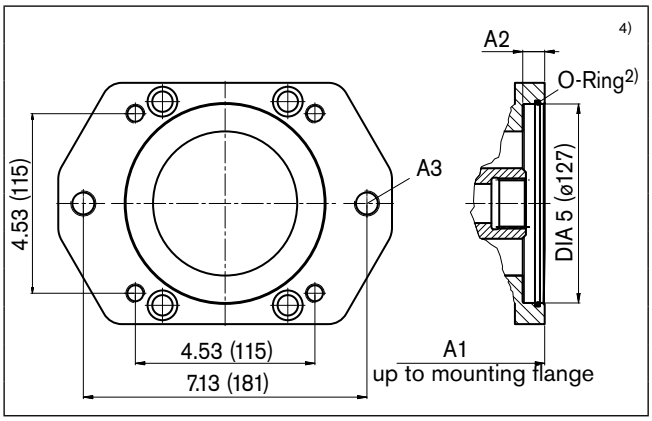
Flange SAE J744 – 127-2 (C) **Coupler** for splined shaft acc. to ANSI B92.1a-1976 1 1/4 in 14T 12/24 DP[1] (SAE J744 – 32-4 (C)) **K07**
1 1/2 in 17T 12/24 DP[1] (SAE J744 – 38-4 (C-C)) **K24**



Size	A1 K07	A1 K24	A2	A3[3]	
					deep
60	10.71	–	0.51	5/8in-11UNC	0.79
	(272)	–	(13)		(20)
75	11.42	–	0.51		0.79
	(290)	–	(13)		(20)
95	12.52	12.52	0.51		0.79
	(318)	(318)	(13)		(20)
130/145	12.99	12.99	0.51		0.79
	(330)	(330)	(13)		(20)
130/145*	14.33	14.33	0.51		0.79
	(364)	(364)	(13)		(20)

*) Version with charge pump

Flange SAE J744–127-2+4 (A) **Coupler** for splined shaft acc. to ANSI B92.1a-19761 1/4 in 14T 12/24 DP[1] (SAE J744 – 32-4 (C) **K07**
1 1/2 in 17T 12/24 DP[1] (SAE J744 – 38-4 (C-C)) **K24**



Size	A1 K07	A1 K24	A2	A3[3]	
190	14.48	14.48	0.51	5/8in-11UNC	0.75
	(367.8)	(367.8)	(13)		(19)
190*	15.75	15.75	0.51		0.75
	(400)	(400)	(13)		(19)
260	15.41	15.41	0.51		0.75
	(391.5)	(391.5)	(13)		(19)
260*	17.07	17.07	0.51		0.75
	(433.5)	(433.5)	(13)		(19)

*) Version with charge pump

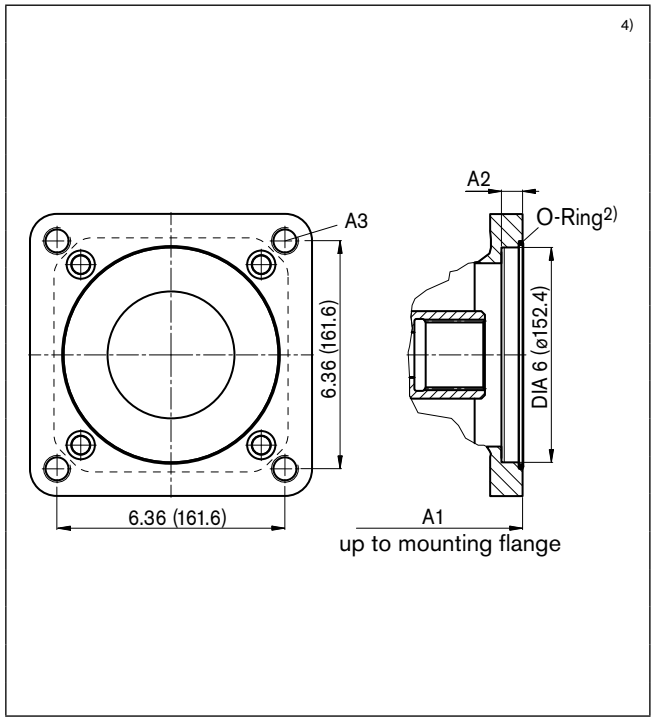
Note
The mounting flange may be turned through 90°. Standard position as illustrated. Please state in clear text if required.

1) 30° pressure angle, flat root, side fit, tolerance class 5
2) O-ring included in the delivery contents
3) ISO 68, for maximum tightening torque, please refer to general notes on page 64
4) See page 59

Through drive dimensions

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

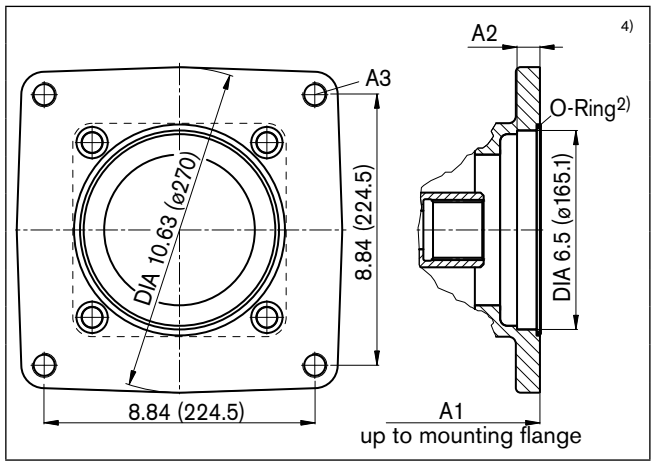
Flange SAE J744 – 152-4 (D) **Coupler** for splined shaft acc. to ANSI B92.1a-1976 1 1/4 in 14T 12/24 DP[1] (SAE J744 – 32-4 (C)) **K86**
1 3/4 in 13T 8/16 DP[1] (SAE J744 – 44-4 (D)) **K17**



Size	A1 K86	A1 K17	A2	A3[3]	deep
75	11.42	–	0.51	3/4in-10UNC	1.10
	(290)	–	(13)		(28)
95	12.48	12.87	1.18		0.98
	(317)	(327)	(30)		(25)
130/145	13.39	13.78	1.18		0.98
	(340)	(350)	(30)		(25)
130/145*	14.72	15.12	1.18		0.98
	(374)	(384)	(30)		(25)
190	15.43	15.43	0.51		0.87
	(392)	(392)	(13)		(22)
190*	16.69	16.69	0.51		0.87
	(424)	(424)	(13)		(22)
260	16.42	16.42	0.51		0.87
	(417)	(417)	(13)		(22)
260*	18.07	18.07	0.51		0.87
	(459)	(459)	(13)		(22)

*) Version with charge pump

Flange SAE J744 – 101-2 (E) **Coupler** for splined shaft acc. to ANSI B92.1a-1976 1 3/4 in 13T 16/32 DP[1] (SAE J744 – 32-4 (C)) **K72**



Size	A1 K72	A2	A3[3]	deep
190	14.83	0.75	3/4in-10UNC	0.79
	(376.8)	(19)		(20)
190*	16.10	0.75		0.79
	(409)	(19)		(20)
260	16.42	0.75		0.79
	(417)	(19)		(20)
260*	18.07	0.75		0.79
	(459)	(19)		(20)

*) Version with charge pump

Note
The mounting flange may be turned through 90°. Standard position as illustrated. Please state in clear text if required.

1) 30° pressure angle, flat root, side fit, tolerance class 5
2) O-ring included in the delivery contents
3) ISO 68, for maximum tightening torque, please refer to general notes on page 64
4) See page 59

Overview of attachments for AA11V(L)O

Through drive Flange	AA11VO Coupler for splined shaft	Code	Attachment – 2nd pump AA11VO Size (shaft)	AA10V(S)O/31 Size (shaft)	A10V(S)O/53 Size (shaft)	A4FO Size (shaft)	AA4VG Size (shaft)	AA10VG Size (shaft)	External gear pump	Through drive available for size
82-2 (A)	5/8 in	K01	–	18 (U)	10 (U)	–	–	–	Frame size F Size 4-22 [1]	40...260
	3/4 in	K52	–	18 (S)	10 (S)	–	–	–	–	40...260
101-2 (B)	7/8 in	K02	–	28 (S, R) 45 (U)	28 (S, R) 45 (U, W)	16, 22, 28 (S)	–	18 (S)	Frame size N Size 20-32 [1] Frame size G Size 38-45 [1]	40...260
	1 in	K04	40 (S)	45 (S, R)	45 (S, R) 60 (U, W)	–	28 (S)	28, 45 (S)	–	40...260
127-2 (C)	1 1/4 in	K07	60 (S)	71 (S, R) 100 (U)	60 (S) [2] 85 (U)	–	40, 56, 71 (S)	63 (S)	–	60...260
	1 1/2 in	K24	–	100 (S)	85 (S)	–	–	–	–	95...260
152-4 (D)	1 1/4 in	K86	75 (S)	–	–	–	–	–	–	75...260
	1 3/4 in	K17	95, 130, 145 (S)	140 (S)	–	–	90, 125 (S)	–	–	130...260
165-4 (E)	1 3/4 in	K72	190, 260 (S)	–	–	–	180, 250 (S)	–	–	190...260

1) Rexroth recommends special versions of the gear pumps. Please ask.

2) Only A10VO with 4-hole mounting flange can be mounted to AA11V(L)O 190 and 260.

Combination pumps AA11VO + AA11VO

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

Total length A[1)]

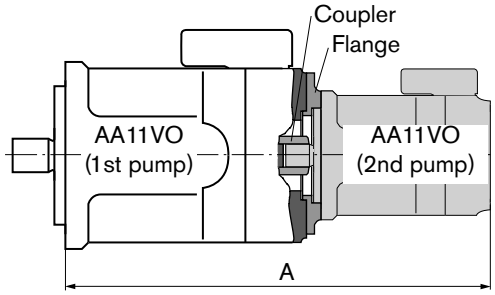
AA11VO	2nd pump									
1st pump	Size 40	Size 60	Size 75	Size 95	Size 130/145	Size 130/145[2)]	Size 190	Size 190[2)]	Size 260	Size 260[2)]
Size 40	–	–	–	–	–	–	–	–	–	–
Size 60	19.29 (490)	19.96 (507)	–	–	–	–	–	–	–	–
Size 75	–	20.67 (525)	21.65 (550)	–	–	–	–	–	–	–
Size 95	20.79 (528)	22.05 (560)	22.72 (577)	23.78 (604)	–	–	–	–	–	–
Size 130/145	21.96 (551)	22.52 (572)	23.62 (600)	24.69 (627)	25.59 (650)	27.48 (698)	–	–	–	–
Size 130/145[2)]	23.03 (585)	23.86 (606)	24.96 (634)	26.02 (661)	26.93 (684)	28.82 (732)	–	–	–	–
Size 190	23.10 (586.8)	24.01 (609.8)	25.67 (652)	26.73 (679)	27.64 (702)	29.53 (750)	28.49 (723.6)	30.41 (772.3)	–	–
Size 190[2)]	24.37 (619)	25.28 (642)	26.93 (684)	27.99 (711)	28.90 (734)	30.79 (782)	29.76 (755.8)	31.67 (804.5)	–	–
Size 260	24.41 (620)	24.94 (633.5)	26.65 (677)	27.72 (704)	28.62 (727)	30.51 (775)	29.40 (746.8)	31.32 (795.5)	30.39 (772)	32.60 (828)
Size 260[2)]	26.08 (662.5)	26.59 (675.5)	28.31 (719)	29.37 (746)	30.28 (769)	32.17 (817)	31.07 (789.3)	32.99 (838)	32.07 (814.5)	34.27 (870.5)

1) When using the S shaft (splined shaft ANSI B92.1a - 1976) for the attached pump (2nd pump)

2) Version with charge pump

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

Ordering example:
AA11VO130LRDS/10R-NSD62K17 + AA11VO60LRDS/10R-NSC62N00

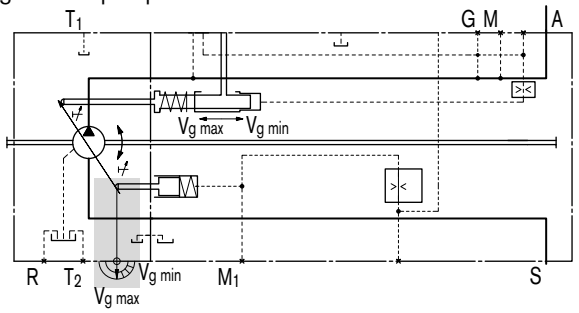


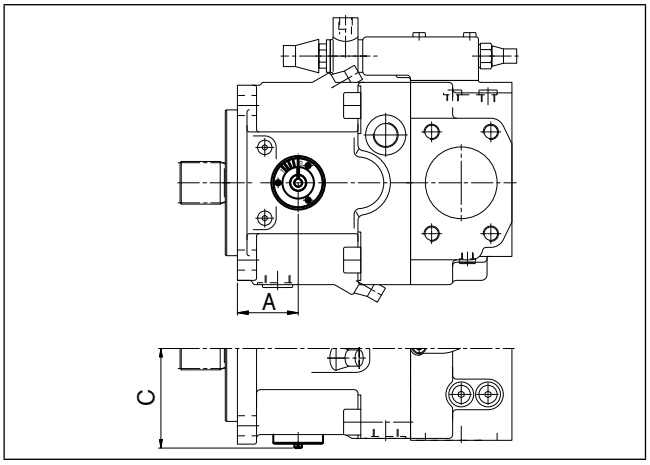
Swivel angle indicator

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

Optical swivel angle indicator, V

With the optical swivel angle indicator, a mechanical pointer on the side of the pump case displays the position of the swivel angle of the pump.



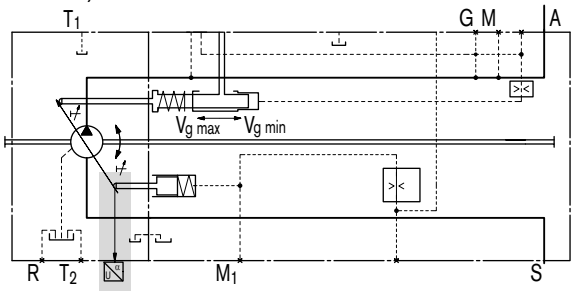


Size	A	C
40	1.99 (50.5)	3.31 (84.0)
60	not available	
75	2.39 (60.7)	3.82 (97.0)
95	2.50 (63.5)	4.09 (104.0)
130	2.79 (70.9)	4.41 (112.0)
190	3.45 (87.6)	4.86 (123.5)
260	3.45 (87.6)	5.39 (137.0)

Electric swivel angle sensor, R

With the electric swivel angle indicator the swivel position of the pump is measured by an electric swivel angle sensor. It has a robust, sealed case and integrated electronics designed for automotive applications.

As an output the Hall effect swivel angle sensor supplies a voltage signal proportional to the swivel angle (see technical parameters).



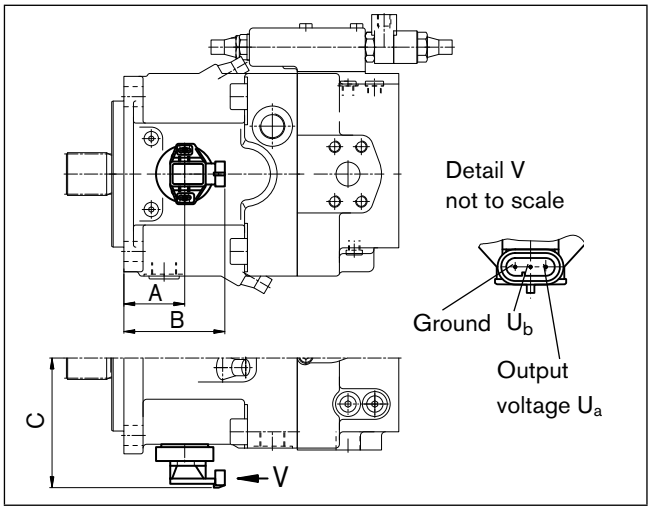
Parameters		
Supply voltage U_b	10...30 V DC	
Output voltage U_a	2.5 V ($V_{g\,min}$)	4.5 V ($V_{g\,max}$)
Reverse-connect protection	Short-circuit-proof	
EMC stability	Details on request	
Operating temperature range	-40 °F to +257 °F (-40 °C to +125 °C)	
Vibration resistance Sinusoidal vibration EN 60068-2-6	10 *g* / 5...2000 Hz	
Shock resistance: Continuous shock IEC 68-2-29	*25 g*	
Resistance to salt spray DIN 50021-SS	96 h	
Type of protection DIN/EN 60529	IP67 and IP69K	
Case material	synthetic material	

Mating connector

AMP Superseal 1.5; 3-pin,
Rexroth mat. no. R902602132

Consisting of:	AMP no.
– 1 female connector case, 3-pin	282087-1
– 3 single wire seals, yellow	281934-2
– 3 female connector contacts 0.07 to 0.13 in (1.8 to 3.3 mm)	283025-1

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



Size	A	B	C
40	1.99 (50.5)	3.48 (88.5)	4.66 (118.3)
60		not available	
75	2.39 (60.7)	3.89 (98.7)	5.17 (131.3)
95	2.50 (63.5)	4.00 (101.5)	5.44 (138.3)
130	2.79 (70.9)	4.29 (108.9)	5.76 (146.3)
190	3.45 (87.6)	4.94 (125.6)	6.21 (157.8)
260	3.45 (87.6)	4.94 (125.6)	6.74 (171.3)

Connector for solenoids

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

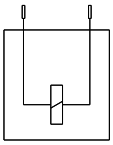
DEUTSCH DT04-2P-EP04, 2-pin

molded, without bidirectional suppressor diode
(standard) _____ **P**

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

Circuit diagram symbol

without bidirectional
suppressor diode

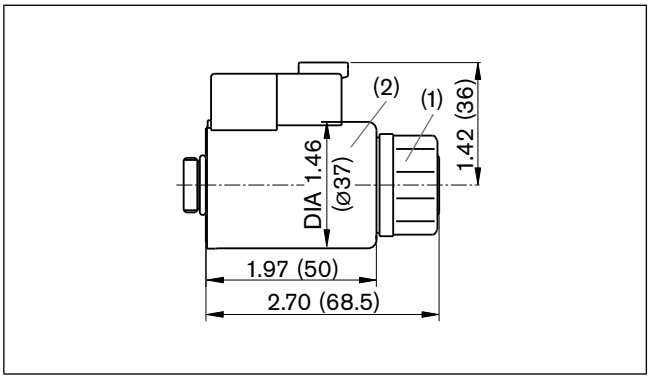


Mating connector

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 delivered by Rexroth on request.



Note for round solenoids:

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

Proceed as follows:

– 1. Loosen fixing nut (1)

– 2. Turn the solenoid body (2) to the desired position.

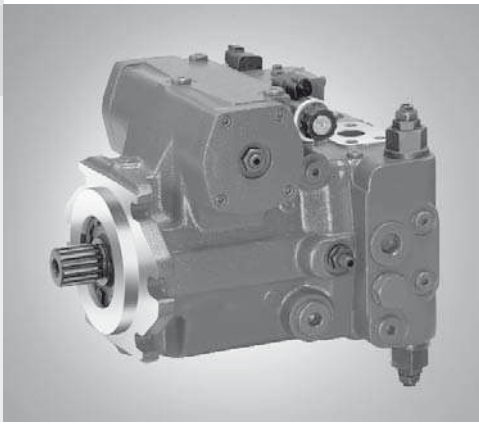
– 3. Tighten the fixing nut
Tightening torque of fixing nut: $3.69^{+0.74}$ lb-ft (5^{+1} Nm)
(width across the flats WAF 26, 12kt DIN 3124)

Rexroth
Bosch Group

Axial Piston Variable Pump AA4VG

RA 92003-A/06.09 1/64
Replaces: 03.09

Data sheet



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

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Features

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

Ordering Code / Standard Program

AA4V	G			D					/	32		–	N										
01	02	03	04	05	06	07	08	09		10	11		12	13	14	15	16	17	18	19	20	21	22

Axial piston unit

01	Variable swashplate design, nominal pressure 5800 psi (400 bar), peak pressure 6500 psi (450 bar)	**AA4V**

Operation mode

02	Pump in closed circuit	**G**

Size

03	≈ Displacement $V_{g\,max}$	in³/rev.	**1.71**	**2.44**	**3.42**	**4.33**	**5.49**	**7.63**	**10.98**	**15.25**
		cm³/rev.	**28**	**40**	**56**	**71**	**90**	**125**	**180**	**250**

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

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

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

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

	Ports X_3, X_4 for positioning pressure	**28**	**40**	**56**	**71**	**90**	**125**	**180**	**250**	
08	Without ports X_3, X_4 (without code)	●	●	●	●	●	●	●	●	
	With ports X_3, X_4	●	●	●	●	●	●	●	●	**T**

	DA control valve		**NV**	**HD1**	**HW**	**DG**	**DA**	**EP**	**EZ**	
09	Without DA control valve		●	●	●	●	–	●	●	**1**
	With DA control valve, fixed setting		–	●	●	●	●	●	–	**2**
	With DA control valve, mech. adjustable with position lever	clockwise	–	●	●	●	●	●	–	**3R**
		counter-clockwise	–	●	●	●	●	●	–	**3L**
	With DA control valve, fixed setting and hydraulic inch valve mounted, control with brake fluid according to ISO 4925, **no** mineral oil		–	–	–	–	●	–	–	**4**
	With DA control valve, fixed setting and ports for pilot control device		–	●	●	●	●	●	–	**7**
	With DA control valve, fixed setting and hydraulic inch valve mounted, control with brake fluid based on mineral oil		–	–	–	–	●	–	–	**8**

Ordering Code / Standard Program

AA4V	G			D					/	32		–	N										
01	02	03	04	05	06	07	08	09		10	11		12	13	14	15	16	17	18	19	20	21	22

Series

10	Series 3, Index 2	**32**

Direction of rotation

11	Viewed from shaft end	clockwise	**R**
		counter-clockwise	**L**

Seals

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

Shaft end (permissible input torque see page 8)

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

Mounting flange

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

Service line ports (UN fixing thread)

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

Boost pump

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

Through drive (mounting options, see page 53)

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

Ordering Code / Standard Program

AA4V	G			D					/	32		–	N										
01	02	03	04	05	06	07	08	09		10	11		12	13	14	15	16	17	18	19	20	21	22

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

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

	Swivel angle indicator	**28**	**40**	**56**	**71**	**90**	**125**	**180**	**250**	
20	Without swivel angle indicator (without code)	●	●	●	●	●	●	●	●	
20	Electrical swivel angle sensor	●	●	●	●	●	●	●	●	**R**

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

Standard / special version[5])

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

[1]) Standard for combination pump – 1st pump: shaft **S**
[2]) 2 = 2-bolt; 4 = 4-bolt
[3]) Hub for splined shaft acc. to ANSI B92.1a-1976 (splined shaft assigned acc. to SAE J744, see page 50-52)
[4]) (100...420 bar)
[5]) Adjustment data are included in the material number

● = available ❍ = on request – = not available

Technical Data

Hydraulic fluid

Before starting project planning, please refer to our data sheets RE 90220 (mineral oil), RE 90221 (environmentally acceptable hydraulic fluids) and RE 90223 (HF hydraulic fluids) for detailed information regarding the choice of hydraulic fluid and application conditions.

The variable pump AA4VG is unsuitable for operation with HFA, HFB and HFC. If HFD or environmentally acceptable hydraulic fluids are being used, the limitations regarding technical data and seals mentioned in RE 90221 and RE 90223 must be observed.

When ordering, please indicate the used hydraulic fluid.

Operating viscosity range

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

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

depending on the circuit temperature (closed circuit).

Limits of viscosity range

The limiting values for viscosity are as follows:

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

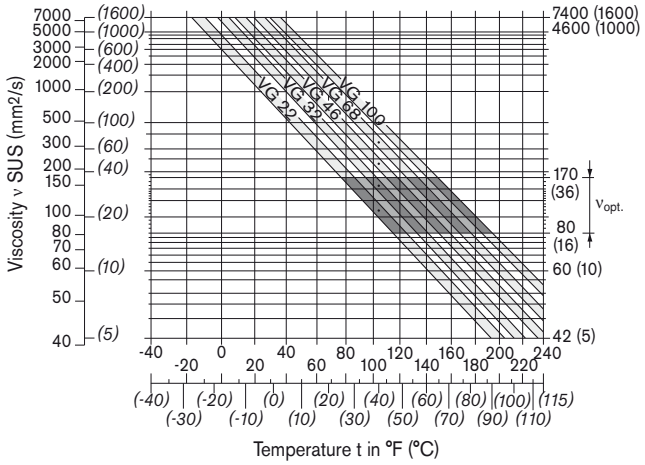
ν_{max} = 7400 SUS (1600 mm²/s)
short term (t < 3 min)
at cold start (p ≤ 435 psi / 30 bar, n ≤ 1000 rpm, t_{min} = -40 °F / -40 °C).
Only for starting up without load. Optimum operating viscosity must be reached within approx. 15 minutes.

Note that the maximum hydraulic fluid temperature of 240 °F (115 °C) must not be exceeded locally either (e.g. in the bearing area). The temperature in the bearing area is - depending on pressure and speed - up to 9 °F (5 K) higher than the average case drain temperature.

Special measures are necessary in the temperature range from -40 °F to -13 °F (-40 °C to -25 °C) (cold start phase), please contact us.

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

Selection diagram



Details regarding the choice of hydraulic fluid

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

The hydraulic fluid should be chosen so that the operating viscosity in the operating temperature range is within the optimum range (ν_{opt}) - the shaded area of the selection diagram. We recommended that the higher viscosity class be selected in each case.
Example: At an ambient temperature of X °F (X °C) an operating temperature of 140 °F (60 °C) is set in the circuit. In the optimum operating viscosity range (ν_{opt}; shaded area) this corresponds to the viscosity classes VG 46 or VG 68; to be selected: VG 68.

Please note: The case drain temperature, which is affected by pressure and speed, is always higher than the circuit temperature. At no point in the system may the temperature be higher than 240 °F (115 °C).

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

Technical Data

Filtration

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

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

20/18/15 according to ISO 4406.

Depending on the system and the application, for the AA4VG, we recommend

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

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

At very high hydraulic fluid temperatures (195 °F to max. 240 °F / 90 °C to max. 115 °C) at least cleanliness level

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

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

Operating pressure range

Input

Variable pump (with external supply, E):

For control EP, EZ, HW and HD
boost pressure (at n = 2000 rpm) p_{Sp} _____ 290 psi (20 bar)

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

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

Output

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

Nominal pressure p_N _____ 5800 psi (400 bar)
Peak pressure p_{max} _____ 6500 psi (450 bar)

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

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

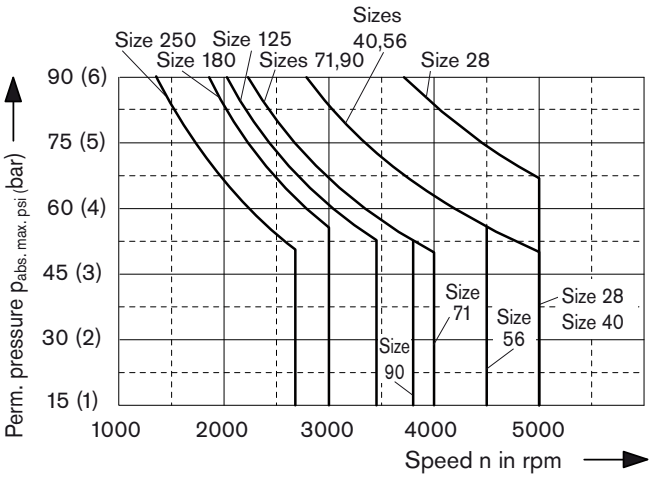
Peak pressure: Max. operating pressure which is permissible for short term (t<1s).

Shaft seal ring

Permissible pressure loading

The service life of the shaft seal ring is affected by the speed of the pump and the case drain pressure. It is recommended that the average, continuous case drain pressure at operating temperature 45 psi (3 bar) absolute not be exceeded (max. permissible case drain pressure 90 psi (6 bar) absolute at reduced speed, see diagram). Short term (t < 0.1 s) pressure spikes of up to 145 psi (10 bar) absolute are permitted. The service life of the shaft seal ring decreases with an increase in the frequency of pressure spikes.

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



Temperature range

The FKM shaft seal ring is permissible for case temperatures of -13 °F to +240 °F (-25 °C to +115 °C).

Note:
For application cases below -13 °F (-25 °C), an NBR shaft seal ring is necessary (permissible temperature range: -40 °F to +195 °F / -40 °C to +90 °C). Please state NBR shaft seal ring in plain text when ordering. Please contact us.

Technical Data

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

Size				28	40	56	71	90	125	180	250
Displacement		$V_{g\,max}$	in³	1.71	2.44	3.42	4.33	5.49	7.63	10.98	15.25
variable pump			cm³	28	40	56	71	90	125	180	250
boost pump (at p = 290 psi / 20 bar)		$V_{g\,Sp}$	in³	0.37	0.52	0.71	1.20	1.20	1.73	2.43	3.20
			cm³	6.1	8.6	11.6	19.6	19.6	28.3	39.8	52.5
Speed											
maximum at $V_{g\,max}$		$n_{max\,continuous}$	rpm	4250	4000	3600	3300	3050	2850	2500	2400
limited maximum [1]		$n_{max\,limited}$	rpm	4500	4200	3900	3600	3300	3250	2900	2600
intermittent maximum [2]		$n_{max\,interm.}$	rpm	5000	5000	4500	4100	3800	3450	3000	2700
minimum		n_{min}	rpm	500	500	500	500	500	500	500	500
Flow		$q_{v\,max}$	gpm	31.5	42.3	53.4	61.8	72.5	94.1	118.8	158.4
at $n_{max\,continuous}$ and $V_{g\,max}$			l/min	119	160	202	234	275	356	450	600
Power [3]	Δp = 5800 psi	P_{max}	hp	106	144	180	209	245	318	402	536
at $n_{max\,continuous}$ and $V_{g\,max}$	Δp = 400 bar		kW	79	107	134	156	183	237	300	400
Torque [3]	Δp = 5800 psi	T_{max}	lb-ft	131	187	263	333	422	587	844	1173
at $V_{g\,max}$	Δp = 400 bar		Nm	178	255	356	451	572	795	1144	1590
	Δp = 1450 psi	T	lb-ft	22.7	32.4	45.4	57.4	72.8	101.2	145.6	202.2
	Δp = 100 bar		Nm	44.5	63.5	89	112.8	143	198.8	286	398
Rotary stiffness	shaft end S	c	lb-ft/rad	23159	50892	59595	72871	116609	161010	180334	261466
			Nm/rad	31400	69000	80800	98800	158100	218300	244500	354500
	shaft end T	c	lb-ft/rad	–	–	70068	89171	–	185939	234840	394079
			Nm/rad	–	–	95000	120900	–	252100	318400	534300
	shaft end U	c	lb-ft/rad	–	37468	–	–	79362	–	–	–
			Nm/rad	–	50800	–	–	107600	–	–	–
Moment of inertia for rotary group		J_{GR}	lbs-ft²	0.0522	0.0902	0.1566	0.2302	0.3536	0.5505	1.0536	2.3327
			kgm²	0.0022	0.0038	0.0066	0.0097	0.0149	0.0232	0.0444	0.0983
Angular acceleration max. [4]		α	rad/s²	38000	30000	24000	21000	18000	14000	11000	6700
Filling capacity		V	gal	0.24	0.29	0.40	0.34	0.40	0.55	0.82	1.66
			L	0.9	1.1	1.5	1.3	1.5	2.1	3.1	6.3
Weight approx. (without through drive)		m	lbs	64	68	84	110	145	176	223	344
			kg	29	31	38	50	60	80	101	156

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

[2]) Intermittent maximum speed:
- at high idle speed
- at overspeed: Δp = 70...150 bar and $V_{g\,max}$
- at reversing peaks: Δp < 300 bar and t < 0.1 s.

[3]) Without boost pump

[4]) – The area of validity is situated between the minimum required and maximum permissible speed. It applies for external stimuli (e.g. engine 2-8 times rotary frequency, cardan shaft twice the rotary frequency).

– The limit value applies for a single pump only.

– The load capacity of the connection parts has to be considered.

Caution: Exceeding the permissible limit values may result in a loss of function, a reduction in service life or in the destruction of the axial piston unit.
A calculation can be performed to determine the permissible values.

Determining the size

Flow $q_v = \dfrac{V_g \cdot n \cdot \eta_v}{231}$ 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 $\left(\dfrac{q_v \cdot \Delta p}{600 \cdot \eta_t} = \dfrac{2 \pi \cdot T \cdot n}{60000} \text{ kW} \right)$

V_g = displacement volume per revolution in in³ (cm³)

Δp = differential pressure in psi (bar)

n = speed in rpm

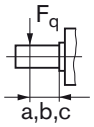
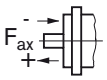
η_v = volumetric efficiency

η_{mh} = mechanical-hydraulic efficiency

η_t = total efficiency

Technical Data

Permissible axial and radial loading on drive shaft

Size			28	40	56	71	90	125	180	250
Radial force, max. at distance (from shaft collar)	$F_{q\,max}$	lbf	562	809	1124	1416	1798	2473	3597	4946
		N	2500	3600	5000	6300	8000	11000	16000	22000
	a	in	0.69	0.69	0.69	0.79	0.79	0.89	0.98	1.14
		mm	17.5	17.5	17.5	20	20	22.5	25	29
	$F_{q\,max}$	lbf	450	650	910	1113	1424	1932	2782	3779
		N	2000	2891	4046	4950	6334	8594	12375	16809
	b	in	1.18	1.18	1.18	1.38	1.38	1.57	1.77	1.97
		mm	30	30	30	35	35	40	45	50
	$F_{q\,max}$	lbf	382	543	764	917	1178	1585	2282	3057
		N	1700	2416	3398	4077	5242	7051	10150	13600
	c	in	1.67	1.67	1.67	1.97	1.97	2.26	2.36	2.80
		mm	42.5	42.5	42.5	50	50	57.5	60	71
Axial force, max.	$-F_{ax\,max}$	lbf	350	476	654	953	973	1291	1585	933
		N	1557	2120	2910	4242	4330	5743	7053	4150
	$+F_{ax\,max}$	lbf	94	198	335	620	600	867	1112	933
		N	417	880	1490	2758	2670	3857	4947	4150

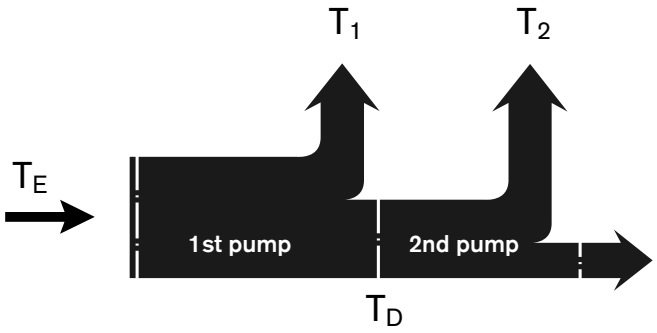
Note: special requirements apply in the case of belt drives. Please contact us.

Permissible input and through-drive torques

Size			28	40	56	71	90	125	180	250
Torque (at $V_{g\,max}$ and $\Delta p = 5800$ psi) [1]	T_{max}	lb-ft	131	187	263	333	422	587	844	1173
(at $V_{g\,max}$ and $\Delta p = 400$ bar) [1]		Nm	178	254	356	451	572	795	1144	1590
Input torque, max. [2]										
at shaft end S	$T_{E\,perm.}$	lb-ft	232	444	444	444	1210	1210	1210	1210
		Nm	314	602	602	602	1640	1640	1640	1640
ANSI B92.1a-1976 (SAE J744)			1 in	1 1/4 in	1 1/4 in	1 1/4 in	1 3/4 in	1 3/4 in	1 3/4 in	1 3/4 in
at shaft end T	$T_{E\,perm.}$	lb-ft	–	–	715	715	–	1969	3002	3002
		Nm	–	–	970	970	–	2670	4070	4070
ANSI B92.1a-1976 (SAE J744)					1 3/8 in	1 3/8 in		2 in	2 1/4 in	2 1/4 in
at shaft end U [3]	$T_{E\,perm.}$	lb-ft	–	232	–	–	444	–	–	–
		Nm	–	314	–	–	602	–	–	–
ANSI B92.1a-1976 (SAE J744)				1 in			1 1/4 in			
Through-drive torque, max. [4]	$T_{D\,perm.}$	lb-ft	170	232	384	487	606	819	1298	1645
		Nm	231	314	521	660	822	1110	1760	2230

[1]) Efficiency not considered
[2]) For drive shafts with no radial force
[3]) Shaft "U" is only permitted as a shaft end on the **2nd pump** in a combination pump of the same size.
[4]) Note max. input torque for **shaft S**!

Torque distribution



High-Pressure Relief Valves

Setting ranges

High-pressure relief valve, direct operated (size 28...56)	Differential pressure setting Δp_{HD}
Setting range for valve **3, 5** Δp 3900 - 6100 psi (Δp 270 - 420 bar) (refer to ordering code)	6100 psi (420 bar)
	5800 psi (400 bar) [1]
	5200 psi (360 bar)
	4950 psi (340 bar)
	4650 psi (320 bar)
	4350 psi (300 bar)
	3900 psi (270 bar)
Setting range for valve **4, 6** Δp 1450 - 3600 psi (Δp 100 - 250 bar) (refer to ordering code)	3600 psi (250 bar)
	3350 psi (230 bar) [1]
	2900 psi (200 bar)
	2200 psi (150 bar)
	1450 psi (100 bar)

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

[1] Standard differential pressure setting. The valves will be set to this value if the differential pressure is not specified on ordering.

Please state in plain text when ordering:
(only the Δp_{HD} values shown in the table are possible)

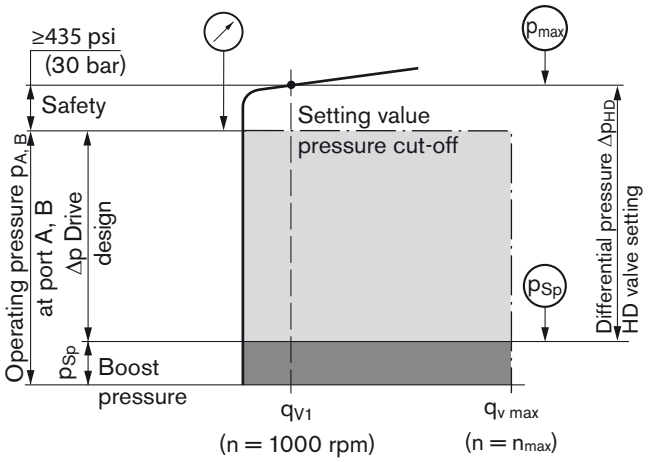
High-pressure relief valve A

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

High-pressure relief valve B

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

Setting diagram



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

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

Operating pres. $p_{A,B}$	-	boost pres. p_{Sp}	+ safety	=	differential pres. Δp_{HD}
5800 psi	-	435 psi	+ 435 psi	=	**5800 psi**
(400 bar	-	30 bar	+ 30 bar	=	**400 bar**)

Bypass function

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

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

Pressure Cut-Off, D

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

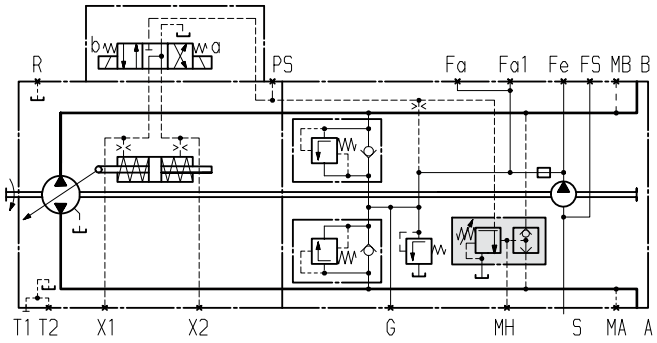
This valve prevents the operation of the high-pressure relief valves when accelerating or decelerating.

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

The setting range of the pressure cut-off may be anywhere within the entire operating pressure range. However, it must be set 435 psi (30 bar) lower than the setting of the high-pressure relief valves (see setting diagram, page 9).

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

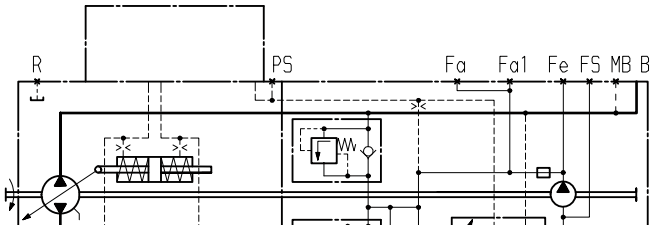
Circuit diagram with pressure cut-off.
Example: Electric two-point control, EZ1D/EZ2D



NV - Version Without Control Unit

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

Standard version [1)]



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

DG - Hydraulic Control, Direct Operated

With the direct operated hydraulic control (DG), pump displacement is controlled by a hydraulic pilot pressure applied directly to the stroking piston through either the X_1 or X_2 port.

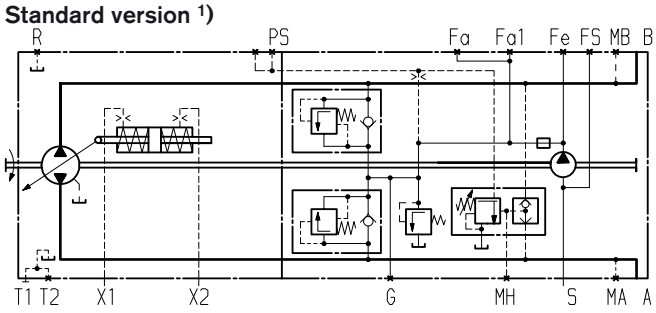
Flow direction is determined by which pilot port is pressurized (please refer to the data table at the top of page 12; control pressure column- X_1; X_2).

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

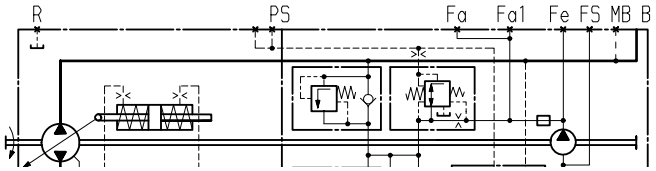
The P_s port must be used as the pilot pressure source for the selected control device, to enable the function of the built-in pressure cut-off valve. Please refer to page 10 for a description of the pressure cut-off function.

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

Standard version [1)]



Version with DA control valve [1)]



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

EZ - Electric Two-Point Control, With Switching Solenoid

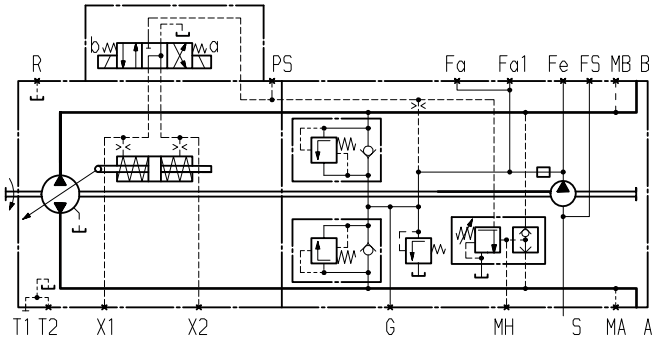
By energizing or de-energizing a control current to either switching solenoid a or b, the stroke cylinders of the pump are supplied with control pressure by the EZ control unit. In this way, the swashplate and thus the displacement is switchable without intermediate settings from $V_g = 0$ to $V_{g\,max}$.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

Solenoid technical data	EZ1	EZ2
Voltage	12 V DC (±20 %)	24 V DC (±20 %)
Neutral position $V_g = 0$	de-energized	de-energized
Position $V_{g\,max}$	current energized	current energized
Nominal resistance (at 68°F /20°C)	5.5 Ω	21.7 Ω
Nominal power	26.2 W	26.5 W
Current required, minimum effective	1.32 A	0.67 A
Actuated time	100 %	100 %
Type of protection	see range of connectors on page 60	

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

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

Standard version [1)]



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

HD - Hydraulic Control, Pilot-Pressure Related

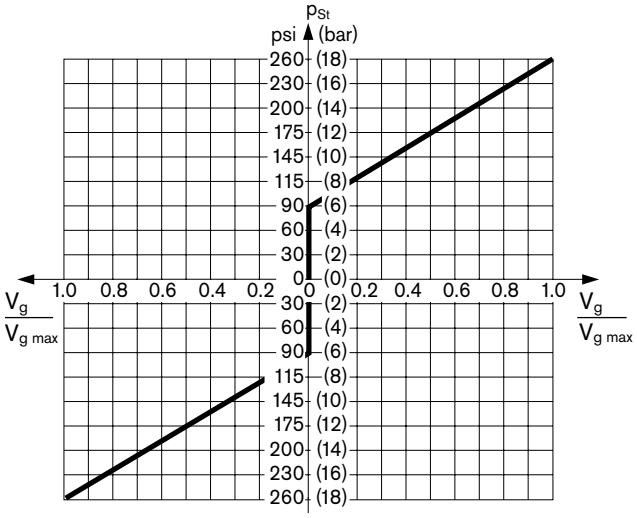
The flow output of the pump is infinitely varied between 0 and 100%, proportional to the difference in pilot pressure applied to the two control ports (Y_1 and Y_2).

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

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

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

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



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

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

Start of control 90 psi (6 bar)

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

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

Note

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

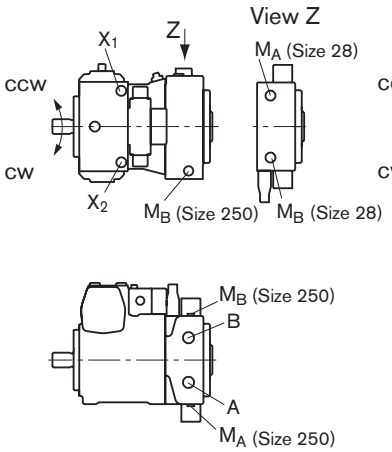
The spool valve inside the control unit can get stuck in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the axial piston unit can no longer supply the flow specified by the operator.

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

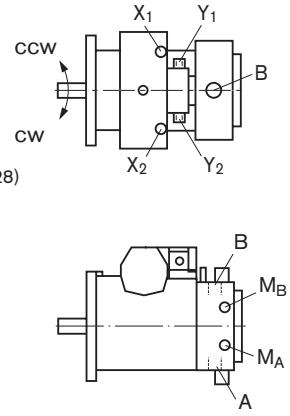
Assignment
Direction of rotation - Control - Direction of through put flow

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

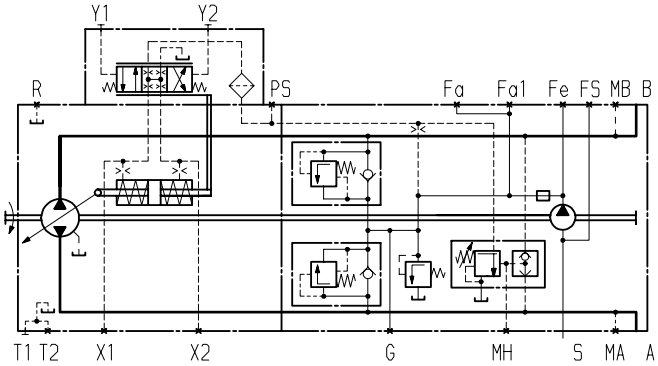
Sizes 28, 250



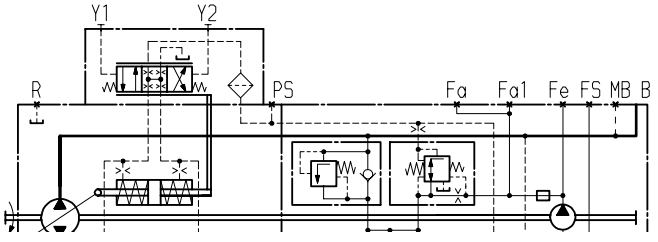
Sizes 40...180



Standard version[1])



Version with DA control valve[1])



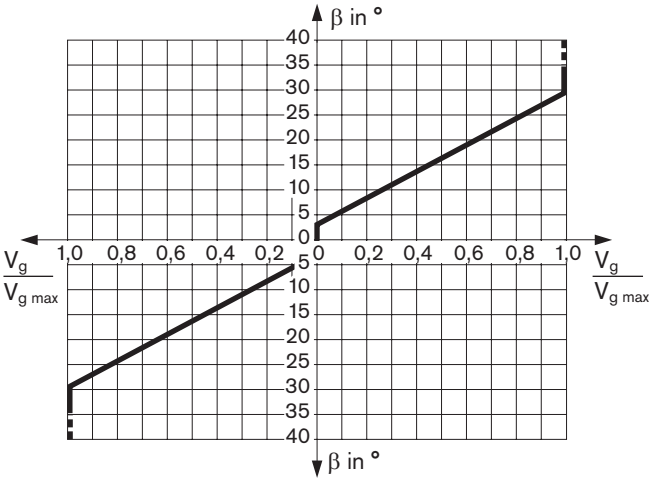
[1]) Size 28 and 250 without port F_{a1} and F_S

HW - Hydraulic Control, Mechanical Servo

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

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

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



Swivel angle β at the control lever for deflection:

Start of control at β = 3°

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

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

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

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

Variation: Neutral position switch, L

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

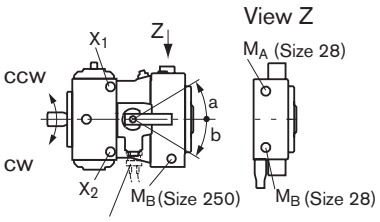
The neutral position switch provides a safety function for drive units that require zero flow under certain operating conditions (e.g. starting diesel engines).

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

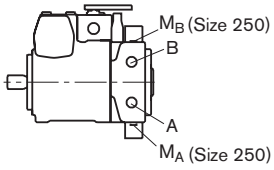
Assignment
Direction of rotation - Control - Direction of through put flow

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

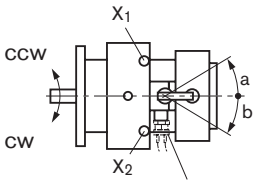
Sizes 28, 250



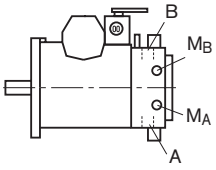
Neutral position switch



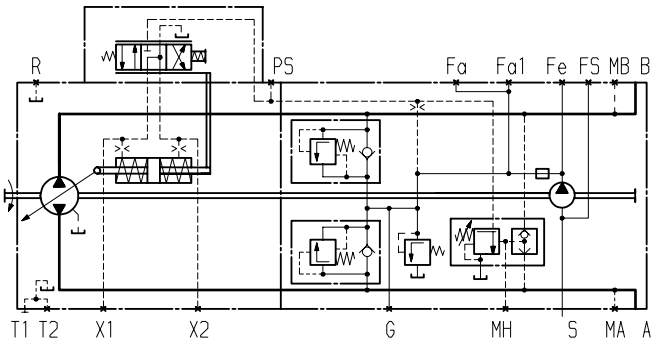
Sizes 40...180



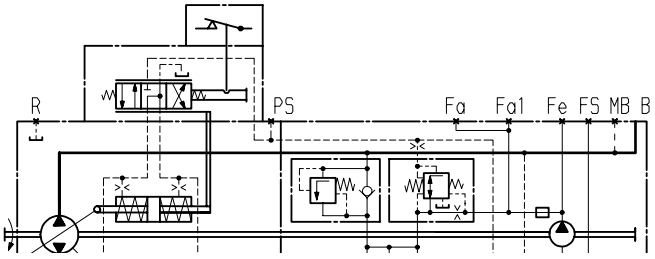
Neutral position switch



Standard version [1]



Version with DA control valve and neutral position switch [1]



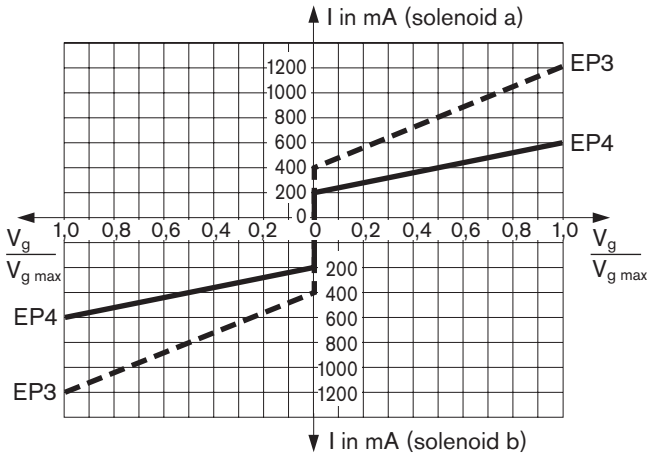
[1] Size 28 and 250 without port F_{a1} and F_S

EP - Electric Control, With Proportional Solenoid

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

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

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



Solenoid technical data	EP3	EP4
Voltage	12 V DC (±20 %)	24 V DC (±20 %)
Control current		
Start of control at $V_{g\,0}$	400 mA	200 mA
End of control at $V_{g\,max}$	1200 mA	600 mA
Limiting current	1.54 A	0.77 A
Nominal resistance (at 68 °F / 20 °C)	5.5 Ω	22.7 Ω
Dither frequency	100 Hz	100 Hz
Actuated time	100 %	100 %
Type of protection	see range of connectors on page 60	

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

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

– Analog amplifier RA ____ RE 95230

Note

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

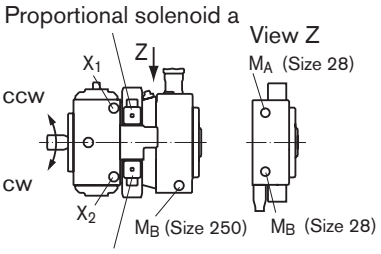
The spool valve inside the control unit can get stuck in an undefined position by internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the axial piston unit can no longer supply the flow specified by the operator.

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

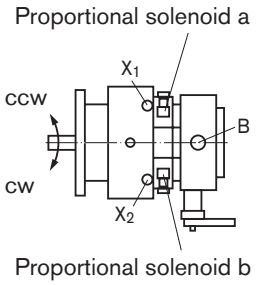
Assignment
Direction of rotation - Control - Direction of through put flow

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

Sizes 28, 250



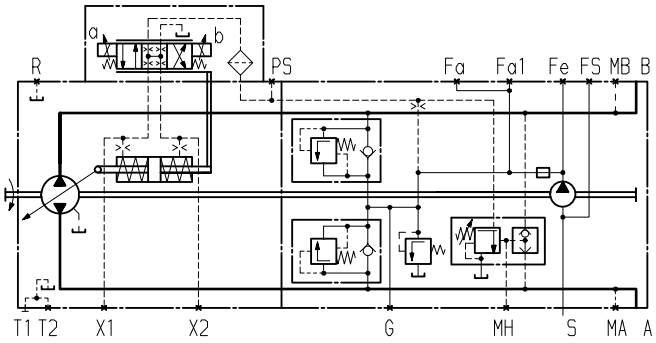
Sizes 40...180



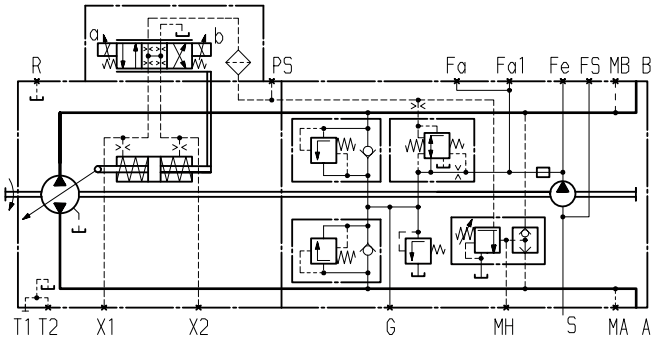
Standard: proportional solenoid without manual emergency operation.
On request: manual emergency operation with spring reset available.

EP - Electric Control, With Proportional Solenoid

Standard version[1])



Version with DA control valve[1])



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

DA - Hydraulic Control, Speed Related

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

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

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

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

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

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

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

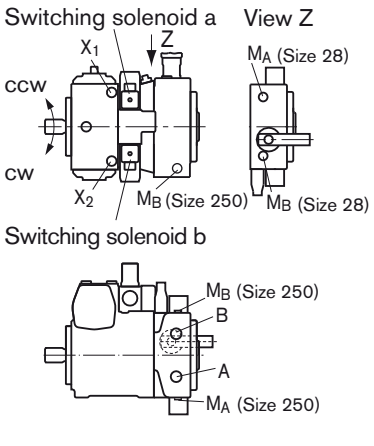
Solenoid technical data	DA1	DA2
Voltage	12 V DC (±20 %)	24 V DC (±20 %)
Neutral position $V_{g\,0}$	de-energized	de-energized
Position $V_{g\,max}$	current energized	current energized
Nominal resistance (at 68 °F / 20 °C)	5.5 Ω	21.7 Ω
Nominal power	26.2 W	26.5 W
Current required, minimum effective	1.32 A	0.67 A
Actuated time	100 %	100 %
Type of protection	see range of connectors on page 60	

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

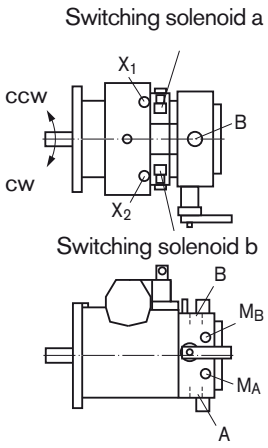
Assignment
Direction of rotation - Control - Direction of through put flow

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

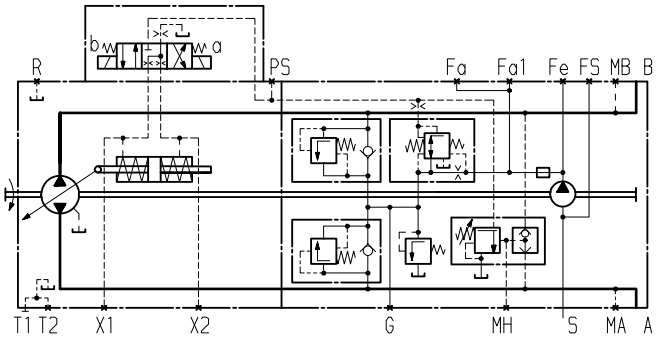
Sizes 28, 250



Sizes 40...180



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



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

DA - Hydraulic Control, Speed Related

Function and control of DA control calves

DA control valve, fixed setting (2)

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

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

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

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

Max. perm. operating torque at the position lever $T_{max} = 3$ lb-ft (4 Nm)

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

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

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

DA control valve, fixed setting and hydraulic inch valve mounted, (4, 8)
(only for pumps with DA control unit)

– Version with throttle valve sizes 28, 40, 56, 71

– Version with pressure-reducing valve sizes 90, 125, 180, 250

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

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

Variation 8:
Control at port Z by means of brake fluid based on mineral oil.

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

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

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

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

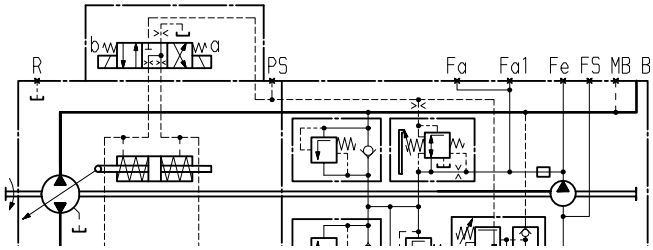
Detailed information is available from our sales department and on our website www.boschrexroth.com/da-control. Use our computer program to work out the input design that meets your needs. A DA control must be approved by Rexroth.

Note: see page 61 for rotary inch valves.

Circuit diagrams [1]:

DA1D3/DA2D3

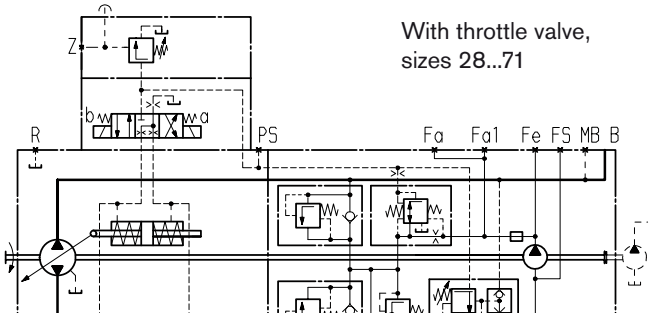
Hydraulic control, speed related, DA control valve, mech. adjustable with position lever



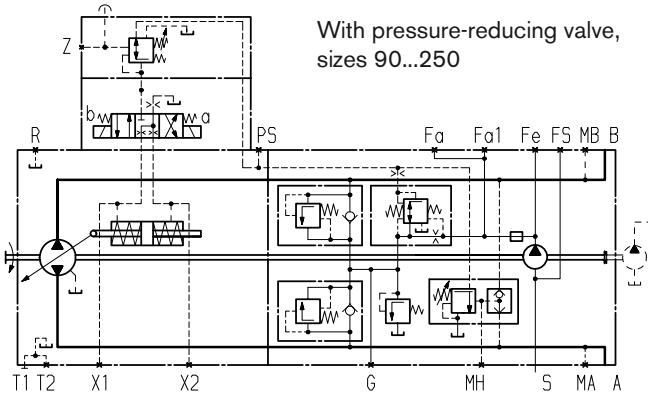
DA1D4/DA2D4

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

With throttle valve, sizes 28...71

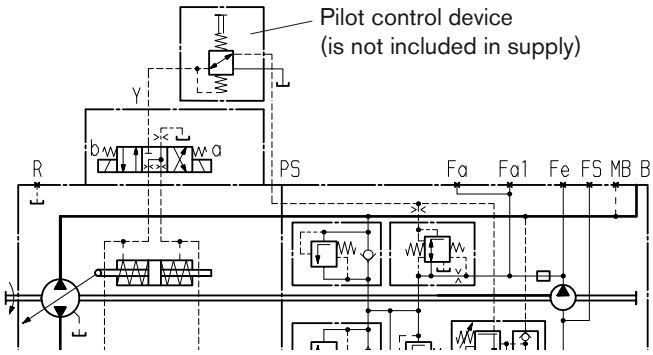


With pressure-reducing valve, sizes 90...250



DA1D7/DA2D7

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



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

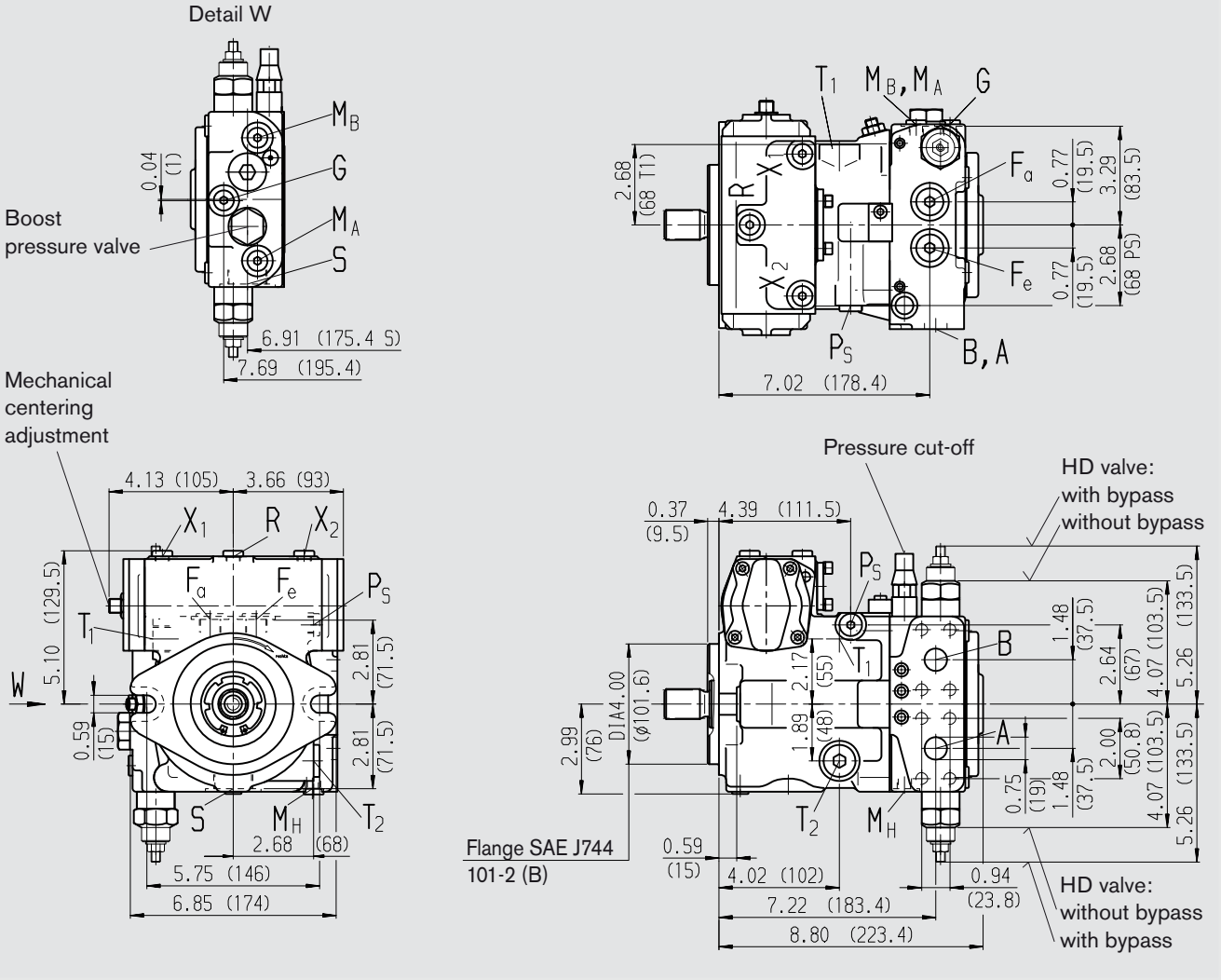
Unit Dimensions, Size 28

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

Version without control unit NV

Standard: suction port S at bottom (60)

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

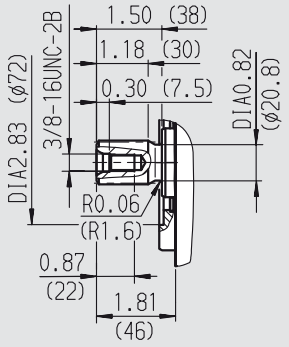


Unit Dimensions, Size 28

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

Shaft ends

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



Ports

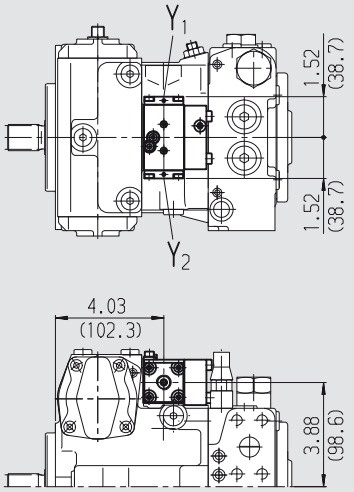
A, B	service line ports (high-pressure series)	SAE J518	3/4 in		
	fixing thread A/B	ISO 68	3/8 in -16 UNC-2B;	0.67 (17) deep [2])	
T_1	case drain or fill	ISO 11926	7/8 in -14 UNF-2B;	0.67 (17) deep	180 lb-ft (240 Nm) [2])
T_2	case drain [3])	ISO 11926	7/8 in -14 UNF-2B;	0.67 (17) deep	180 lb-ft (240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

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

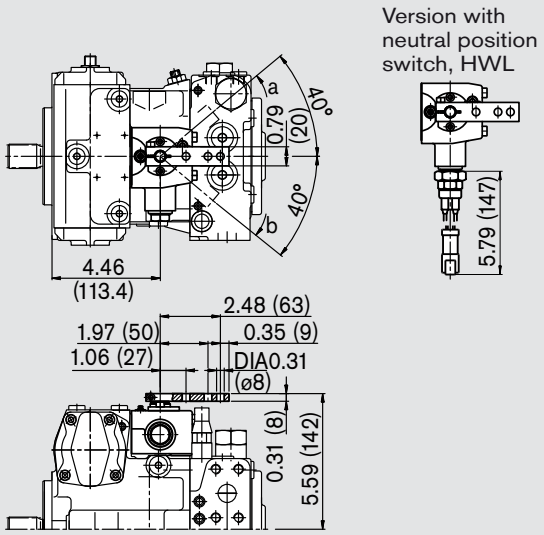
Unit Dimensions, Size 28

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

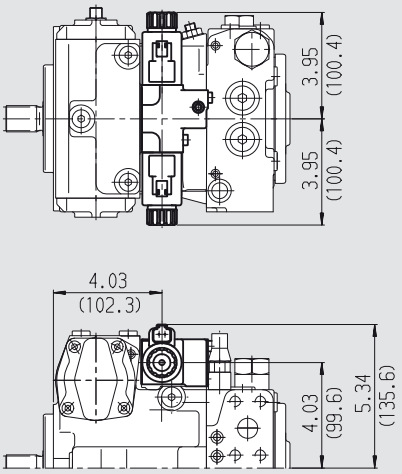
Hydraulic control, pilot-pressure related, HD



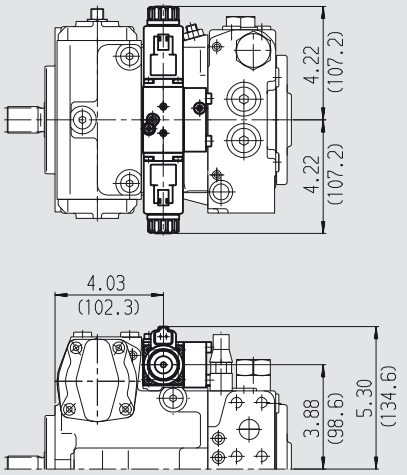
Hydraulic control, mechanical servo, HW



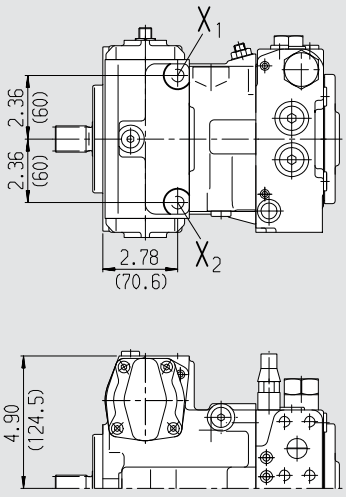
Electric two-point control with switching solenoid, EZ



Electric control with proportional solenoid, EP



Hydraulic control, direct operated, DG

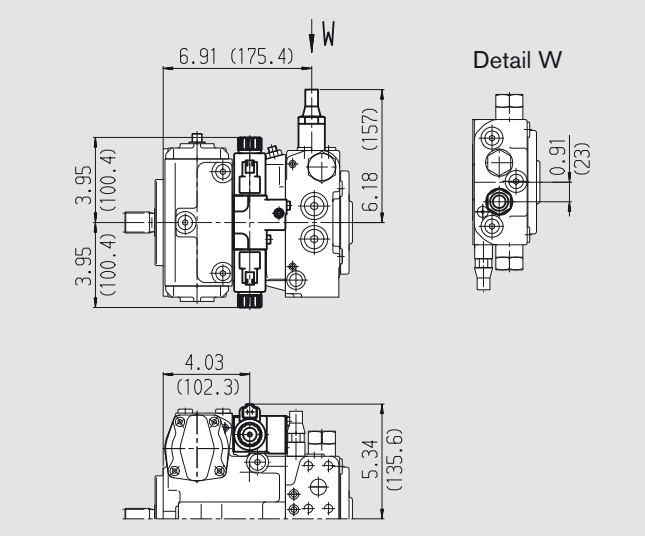


Unit Dimensions, Size 28

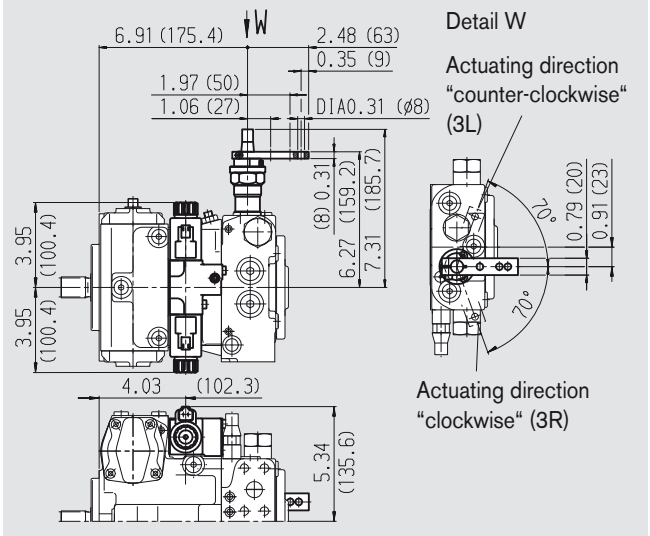
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Hydraulic control, speed related, DA

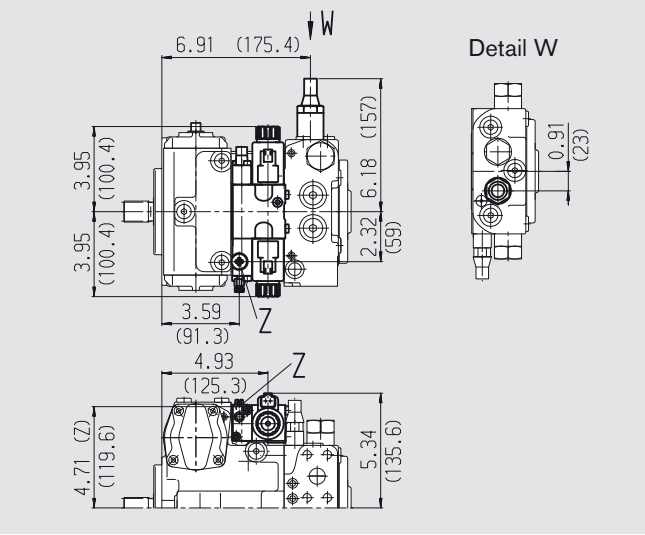
Control valve, fixed setting, DA2



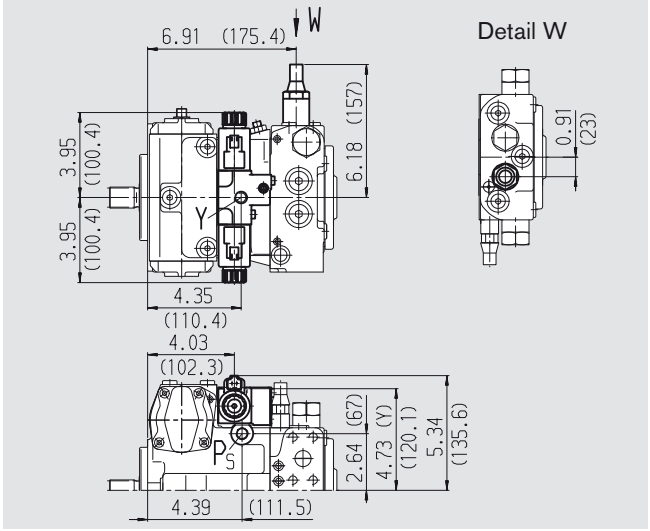
Control valve, mech. adjustable with position lever, DA3



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



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



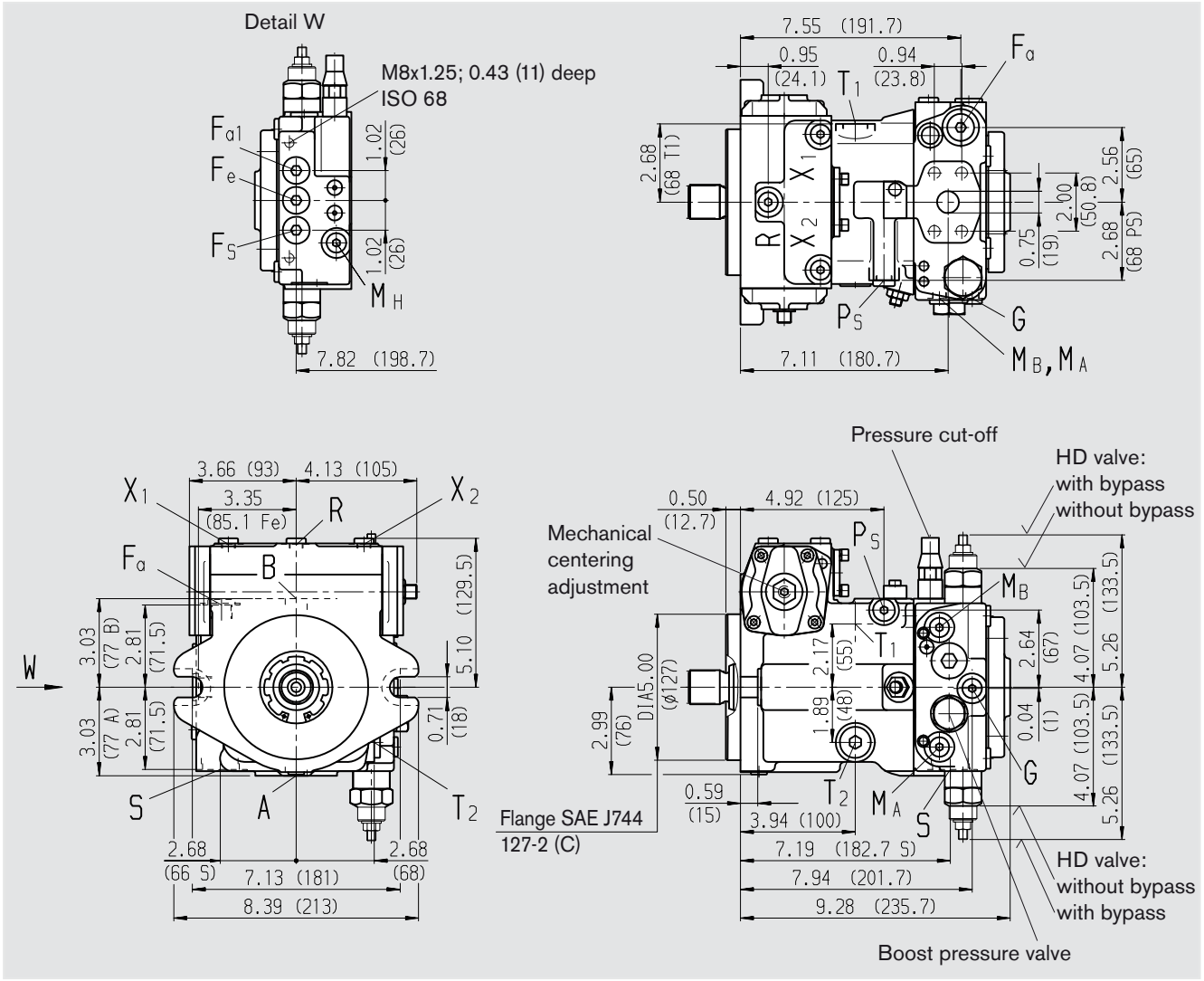
Unit Dimensions, Size 40

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

Version without control unit NV

Standard: suction port S at bottom (52)

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

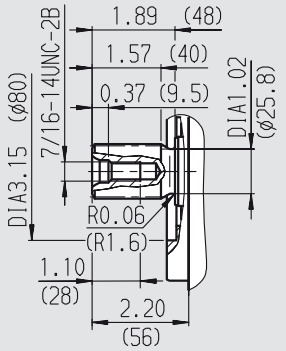


Unit Dimensions, Size 40

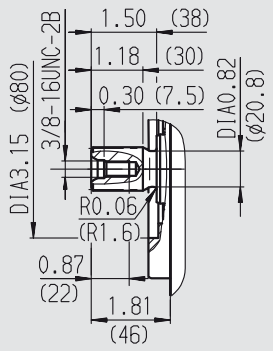
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Shaft ends

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



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



Ports

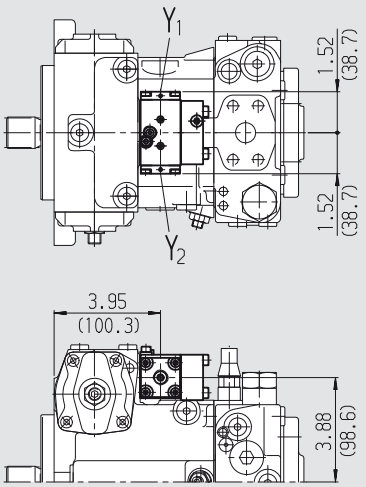
A, B	service line ports (high-pressure series)	SAE J518	3/4 in		
	fixing thread A/B	ISO 68	3/8 in -16 UNC-2B;	0.67 (17) deep [2])	
T_1	case drain or fill	ISO 11926	7/8 in -14 UNF-2B;	0.67 (17) deep	180 lb-ft (240 Nm) [2])
T_2	case drain [3])	ISO 11926	7/8 in -14 UNF-2B;	0.67 (17) deep	180 lb-ft (240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

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

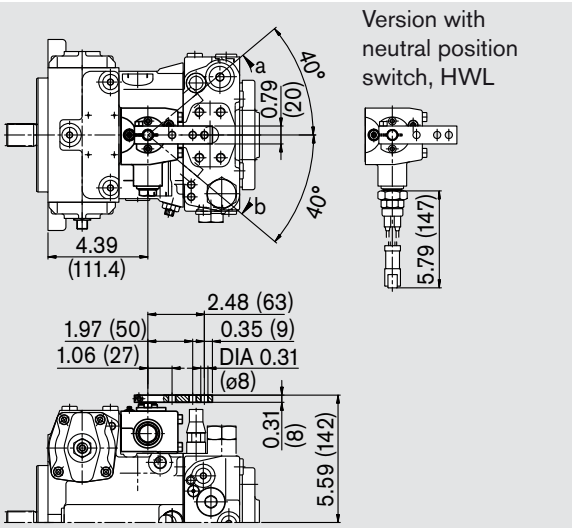
Unit Dimensions, Size 40

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

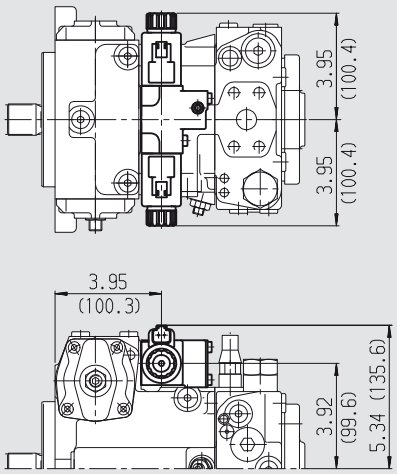
Hydraulic control, pilot-pressure related, HD



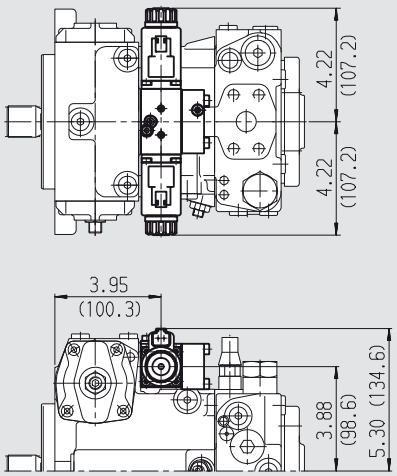
Hydraulic control, mechanical servo, HW



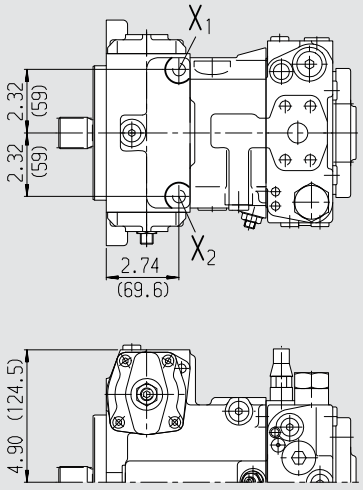
Electric two-point control with switching solenoid, EZ



Electric control with proportional solenoid, EP



Hydraulic control, direct operated, DG

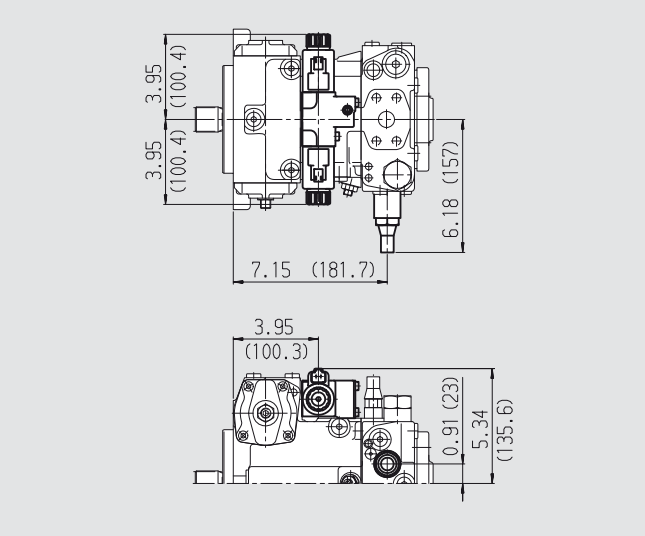


Unit Dimensions, Size 40

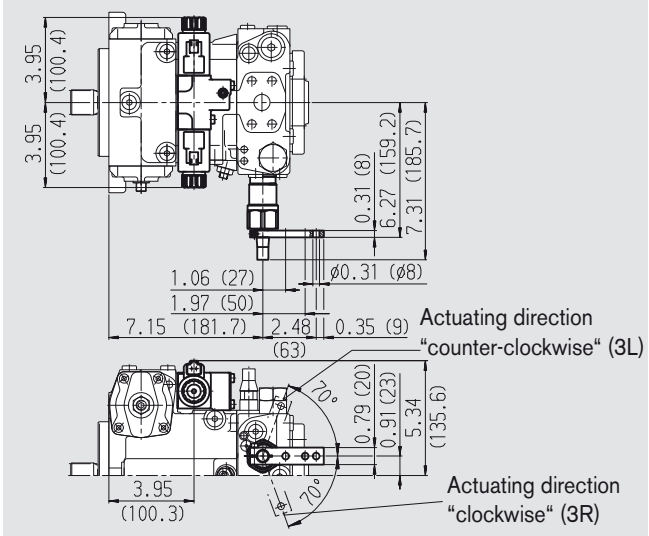
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Hydraulic control, speed related, DA

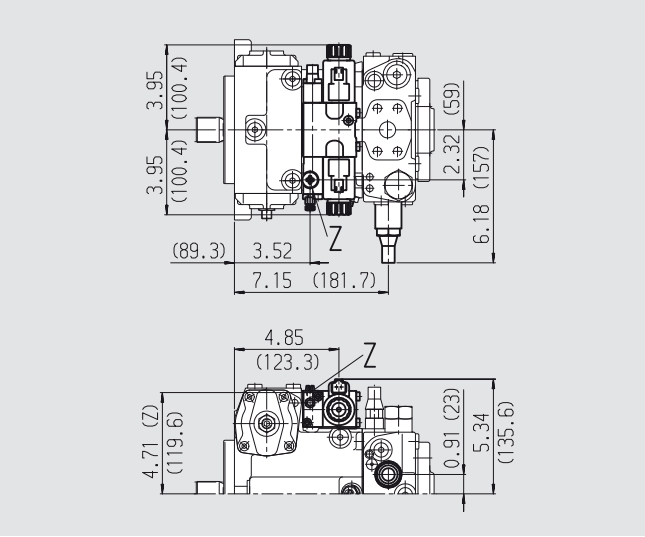
Control valve, fixed setting, DA2



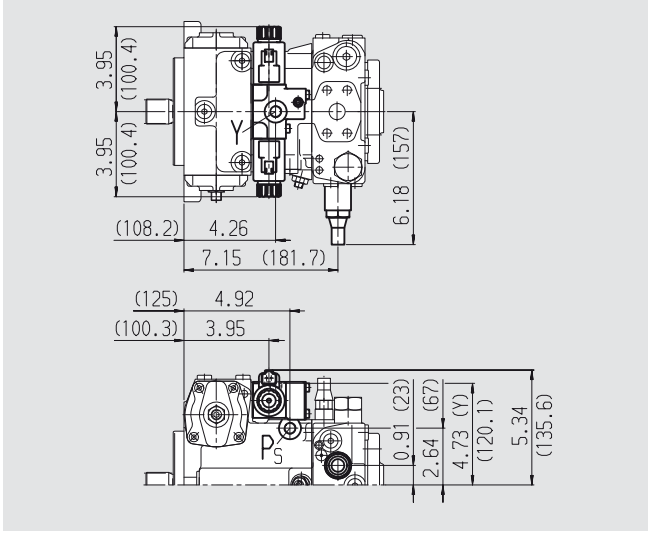
Control valve, mech. adjustable with position lever, DA3



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



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



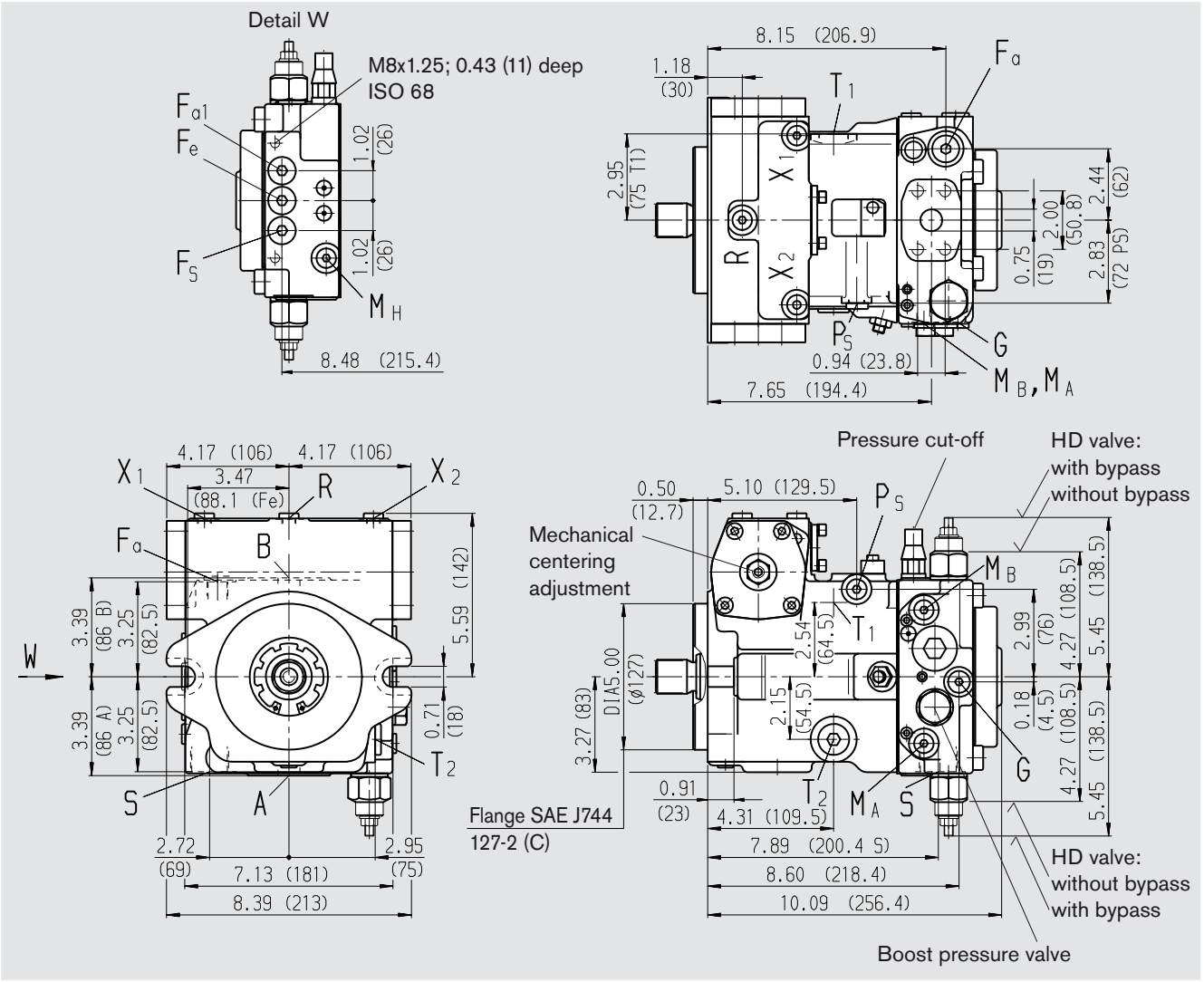
Unit Dimensions, Size 56

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

Version without control unit NV

Standard: suction port S at bottom (52)

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

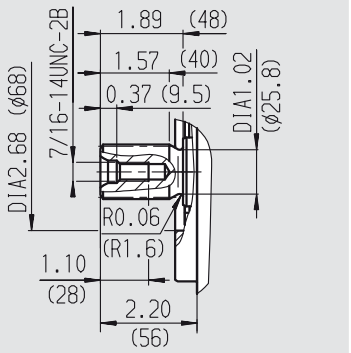


Unit Dimensions, Size 56

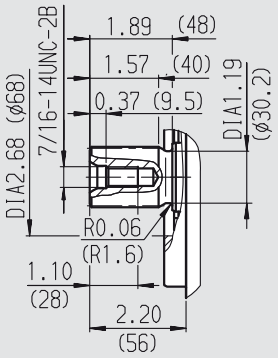
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Shaft ends

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



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



Ports

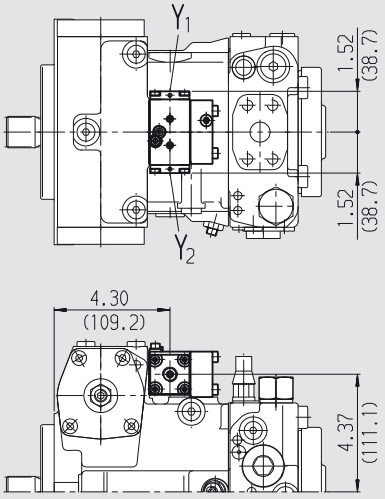
A, B	service line ports (high-pressure series)	SAE J518	3/4 in		
	fixing thread A/B	ISO 68	3/8 in -16 UNC-2B;	0.67 (17) deep [2])	
T_1	case drain or fill	ISO 11926	1 1/16 in -12 UN-2B;	0.79 (20) deep	265 lb-ft (360 Nm) [2])
T_2	case drain [3])	ISO 11926	1 1/16 in -12 UN-2B;	0.79 (20) deep	265 lb-ft (360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

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

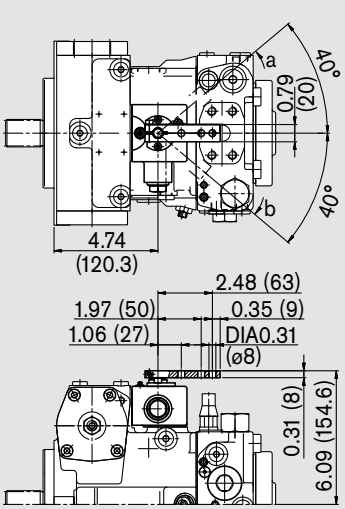
Unit Dimensions, Size 56

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

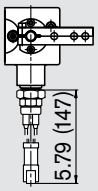
Hydraulic control, pilot-pressure related, HD



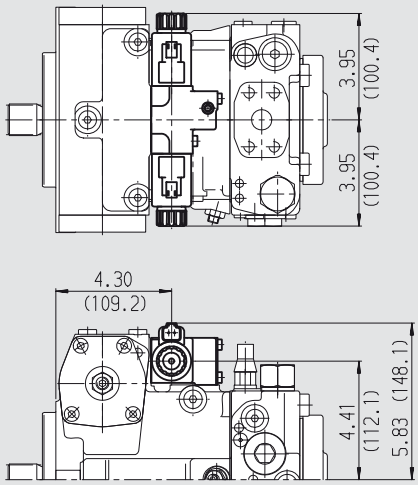
Hydraulic control, mechanical servo, HW



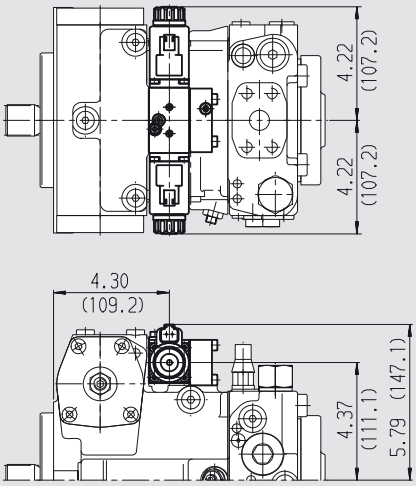
Version with neutral position switch, HWL



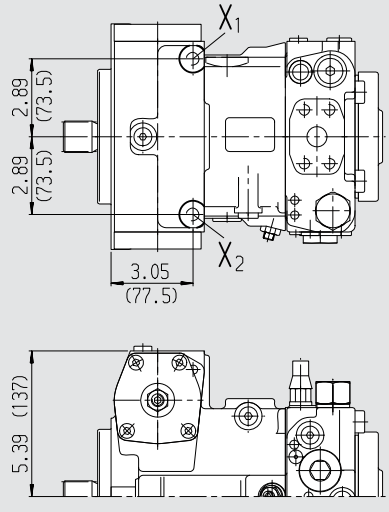
Electric two-point control with switching solenoid, EZ



Electric control with proportional solenoid, EP



Hydraulic control, direct operated, DG

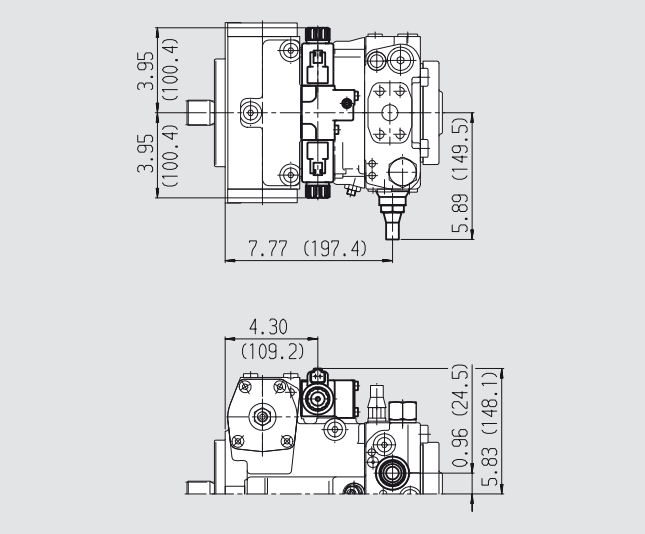


Unit Dimensions, Size 56

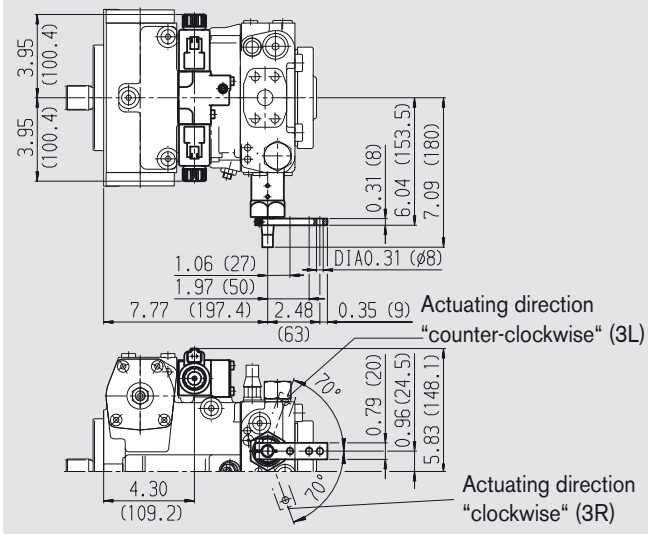
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Hydraulic control, speed related, DA

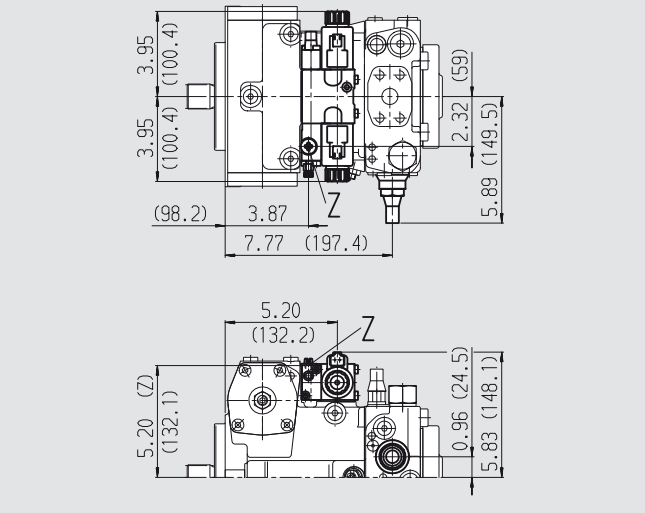
Control valve, fixed setting, DA2



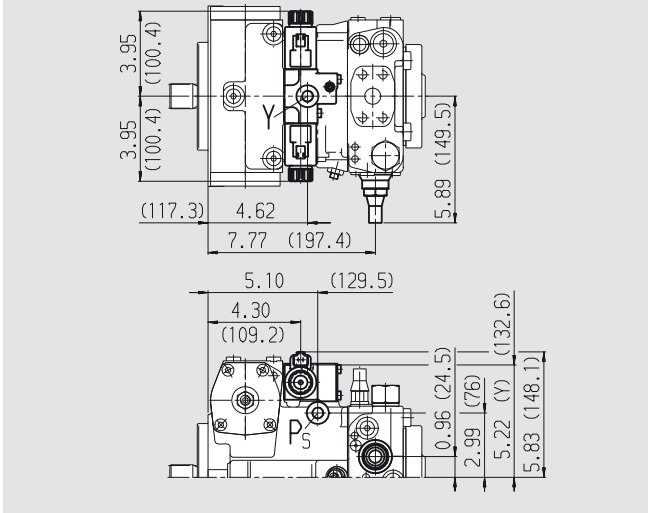
Control valve, mech. adjustable with position lever, DA3



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



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



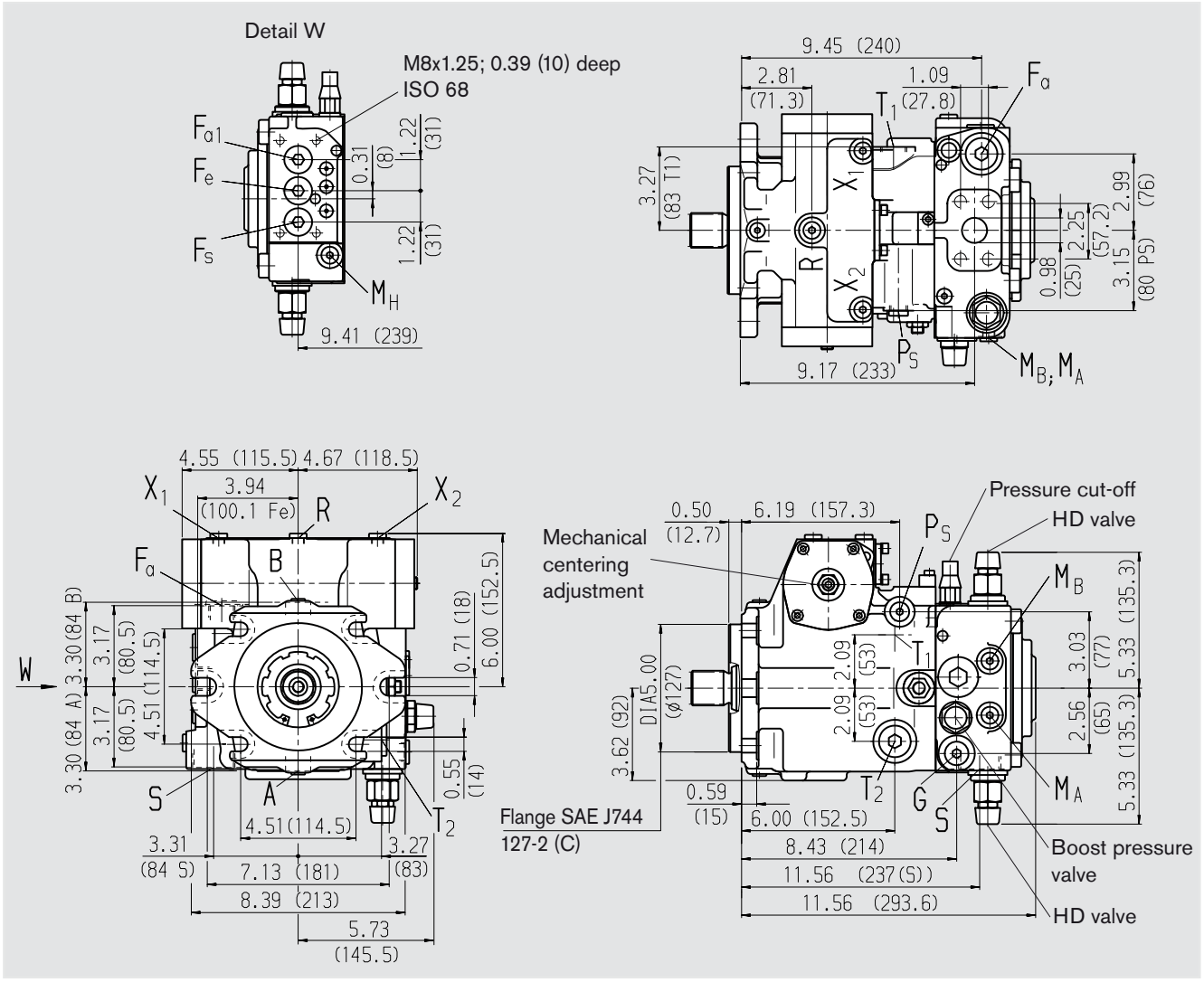
Unit Dimensions, Size 71

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

Version without control unit NV

Standard: suction port S at bottom (52)

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

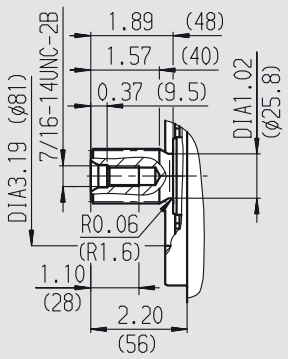


Unit Dimensions, Size 71

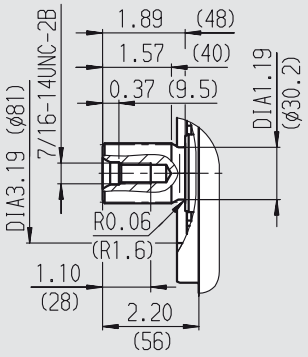
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Shaft ends

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



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



Ports

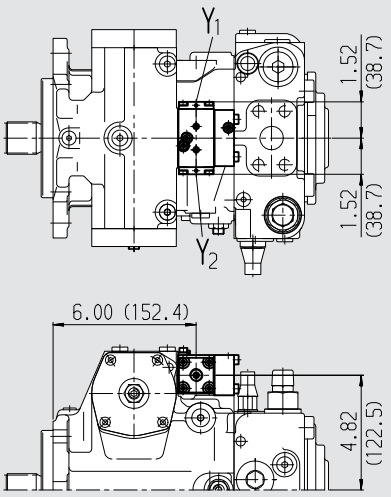
A, B	service line ports (high-pressure series)	SAE J518	1 in		
	fixing thread A/B	ISO 68	7/16 in -14 UNC-2B;	0.67 (17) deep [2])	
T_1	case drain or fill	ISO 11926	1 1/16 in -12 UN-2B;	0.79 (20) deep	265 lb-ft (360 Nm) [2])
T_2	case drain [3])	ISO 11926	1 1/16 in -12 UN-2B;	0.79 (20) deep	265 lb-ft (360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

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

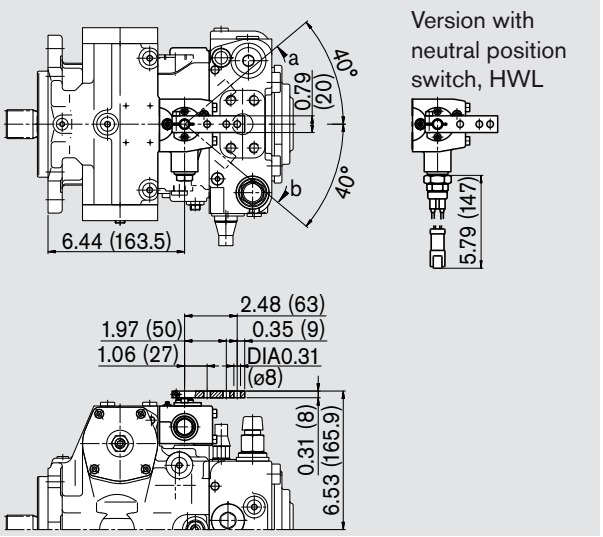
Unit Dimensions, Size 71

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

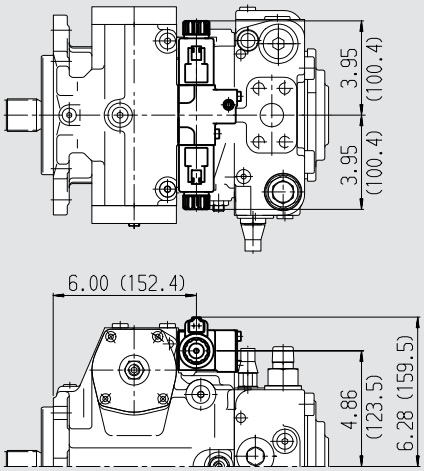
Hydraulic control, pilot-pressure related, HD



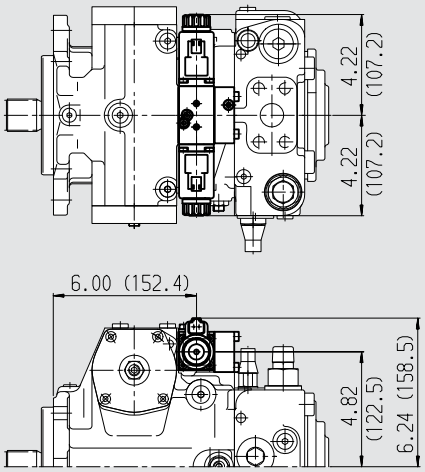
Hydraulic control, mechanical servo, HW



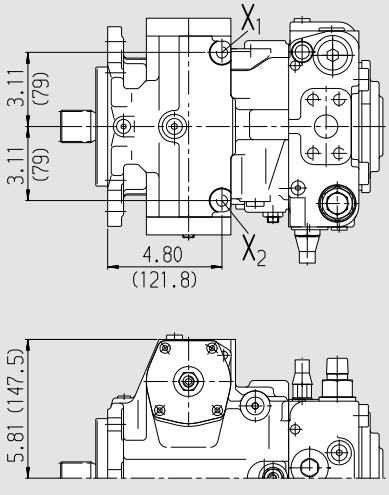
Electric two-point control with switching solenoid, EZ



Electric control with proportional solenoid, EP



Hydraulic control, direct operated, DG

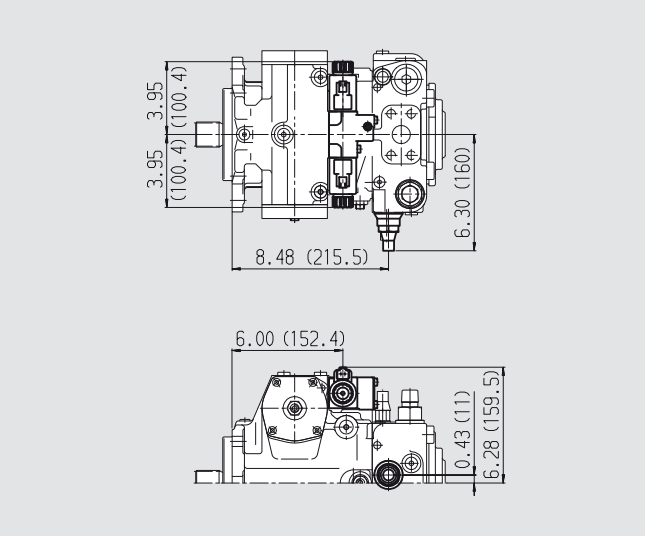


Unit Dimensions, Size 71

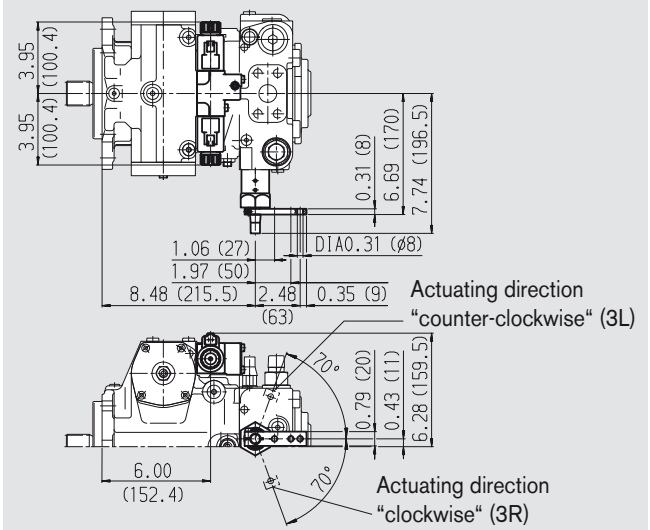
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Hydraulic control, speed related, DA

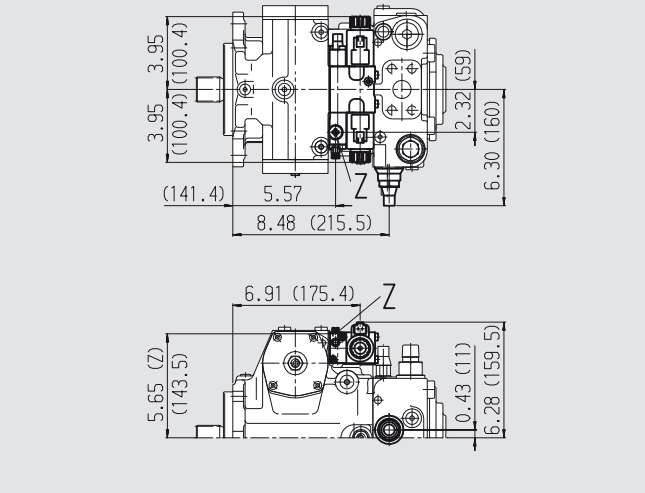
Control valve, fixed setting, DA2



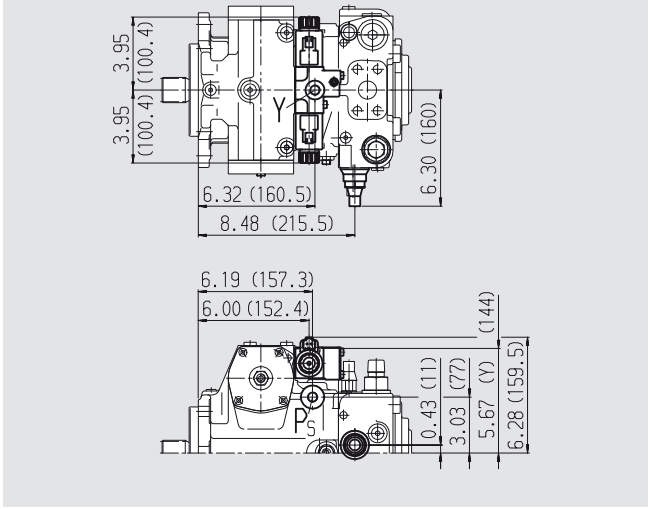
Control valve, mech. adjustable with position lever, DA3



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



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



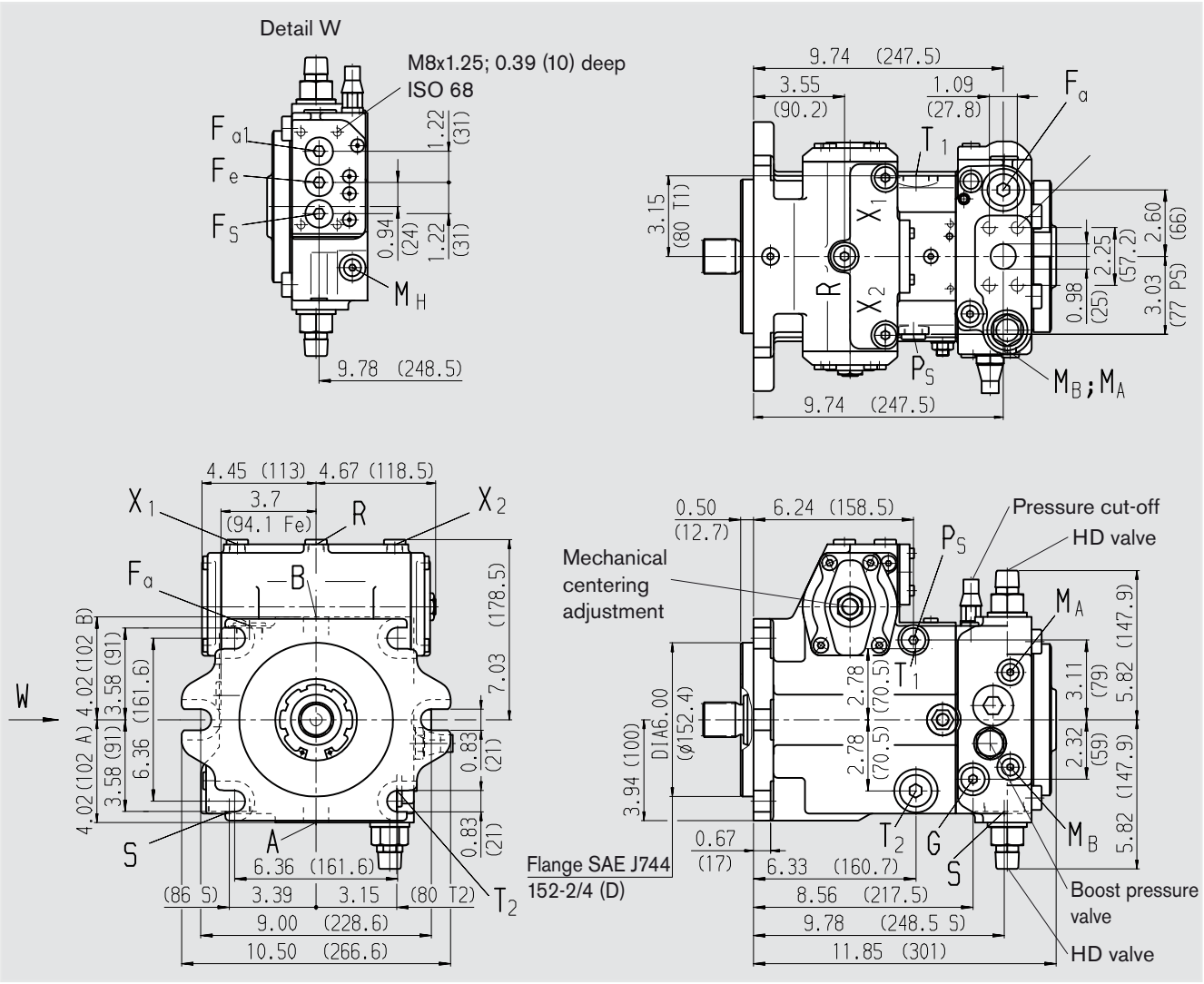
Unit Dimensions, Size 90

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

Version without control unit NV

Standard: suction port S at bottom (52)

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

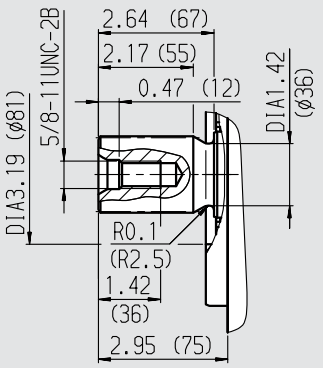


Unit Dimensions, Size 90

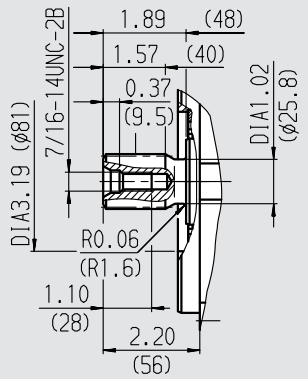
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Shaft ends

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



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



Ports

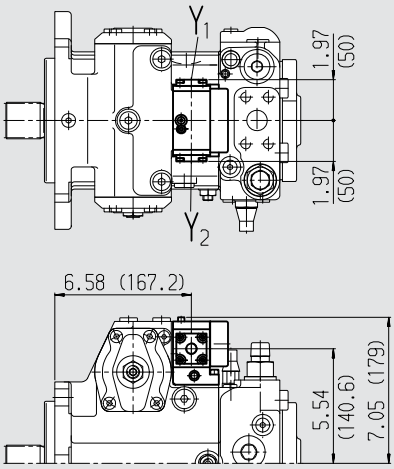
A, B	service line ports (high-pressure series)	SAE J518	1 in		
	fixing thread A/B	ISO 68	7/16 in -14 UNC-2B;	0.67 (17) deep [2])	
T_1	case drain or fill	ISO 11926	1 1/16 in -12 UN-2B;	0.79 (20) deep	265 lb-ft (360 Nm) [2])
T_2	case drain [3])	ISO 11926	1 1/16 in -12 UN-2B;	0.79 (20) deep	265 lb-ft (360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

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

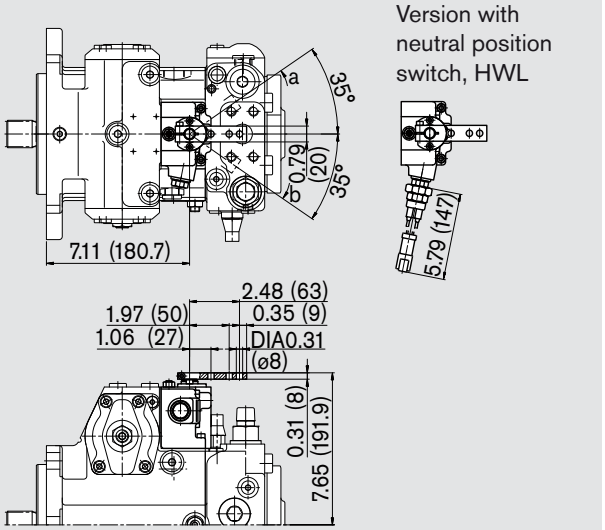
Unit Dimensions, Size 90

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

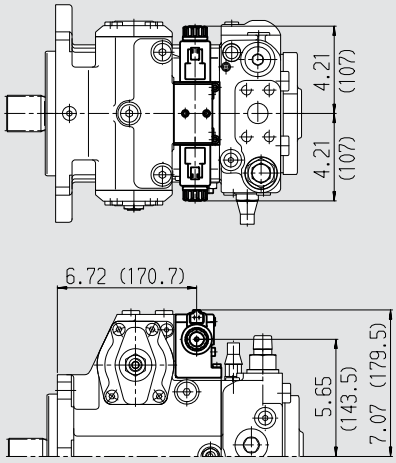
Hydraulic control, pilot-pressure related, HD



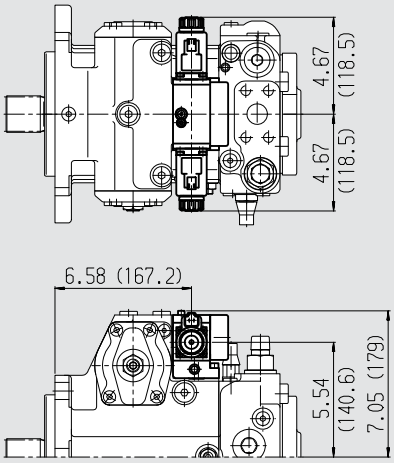
Hydraulic control, mechanical servo, HW



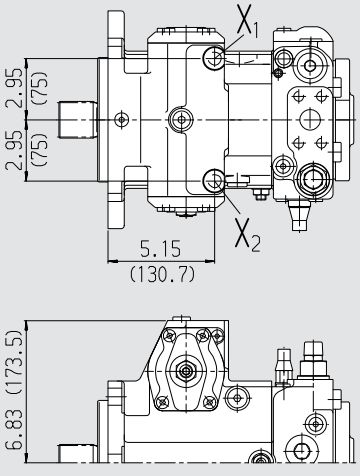
Electric two-point control with switching solenoid, EZ



Electric control with proportional solenoid, EP



Hydraulic control, direct operated, DG

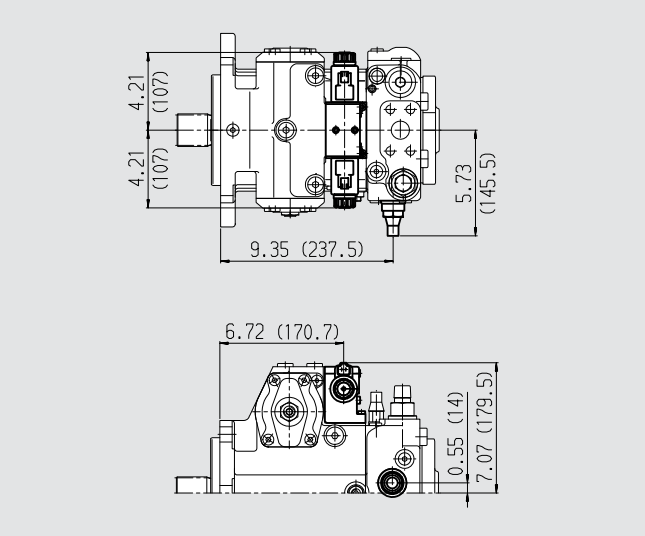


Unit Dimensions, Size 90

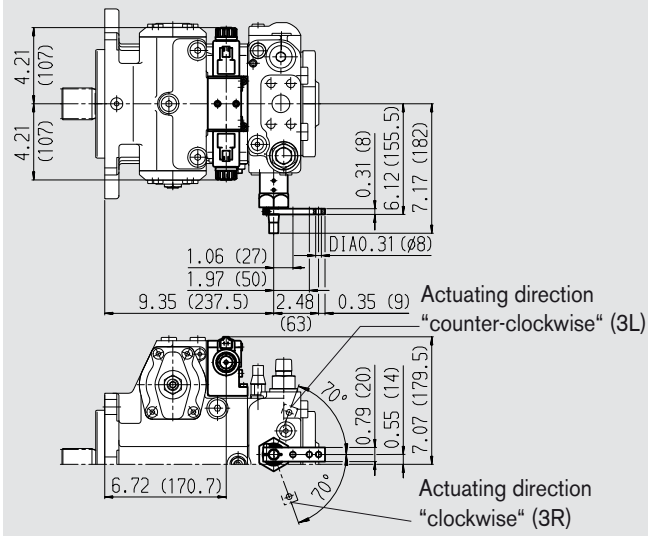
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Hydraulic control, speed related, DA

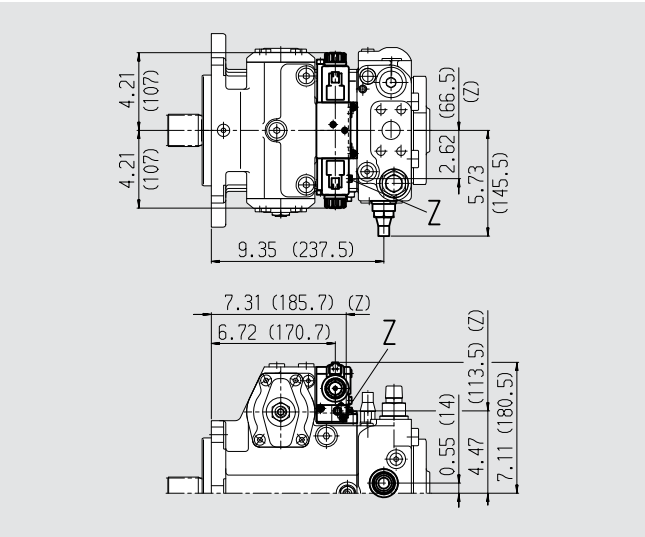
Control valve, fixed setting, DA2



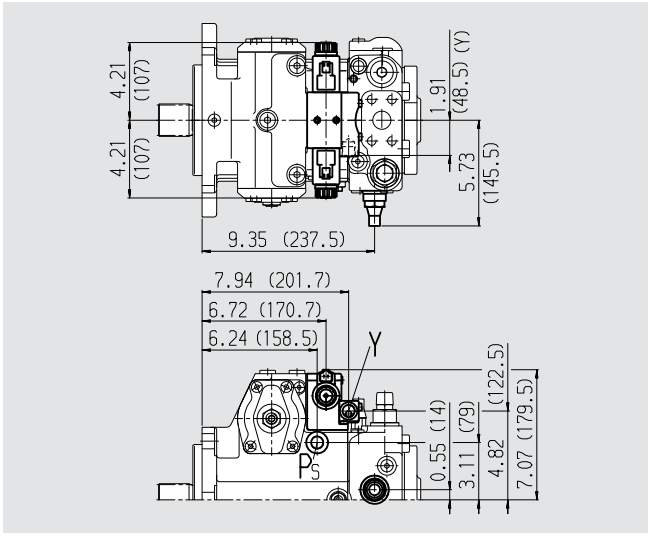
Control valve, mech. adjustable with position lever, DA3



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



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



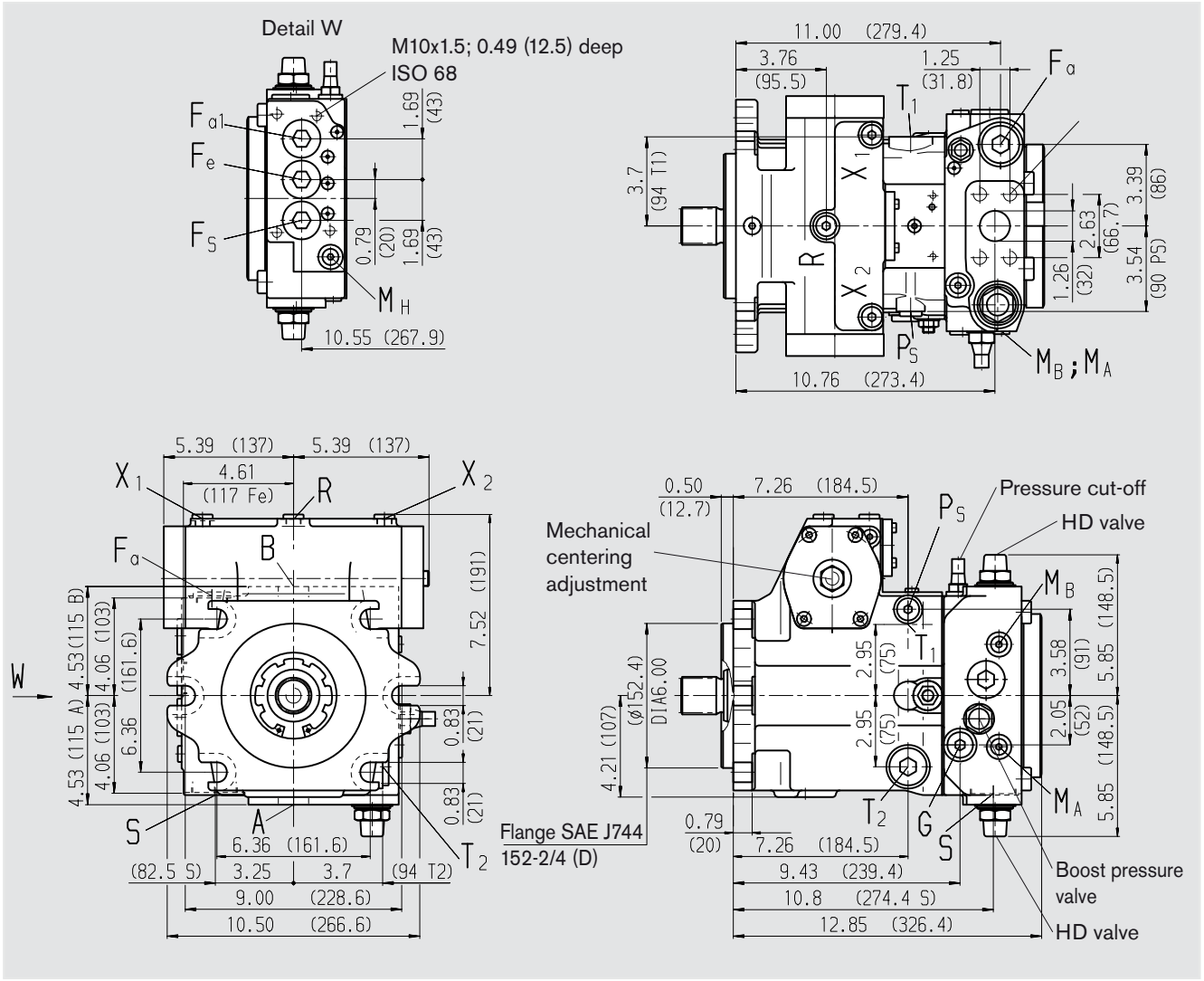
Unit Dimensions, Size 125

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

Version without control unit NV

Standard: suction port S at bottom (52)

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

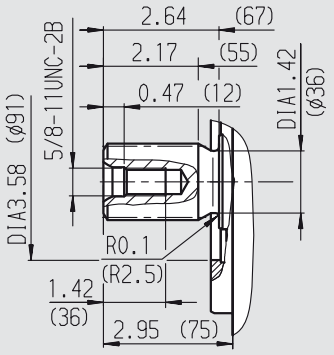


Unit Dimensions, Size 125

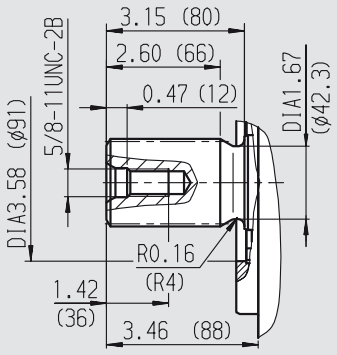
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Shaft ends

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



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



Ports

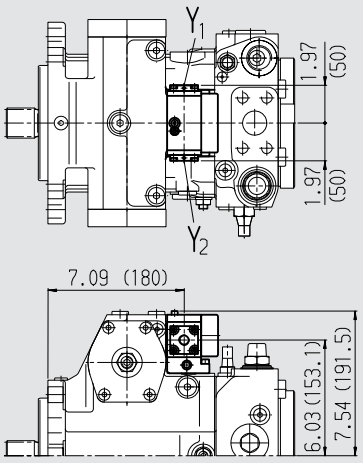
A, B	service line ports (high-pressure series)	SAE J518	1 1/4 in		
	fixing thread A/B	ISO 68	1/2 in -13 UNC-2B;	0.75 (19) deep [2])	
T_1	case drain or fill	ISO 11926	1 5/16 in -12 UN-2B;	0.79 (20) deep	400 lb-ft (540 Nm) [2])
T_2	case drain [3])	ISO 11926	1 5/16 in -12 UN-2B;	0.79 (20) deep	400 lb-ft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

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

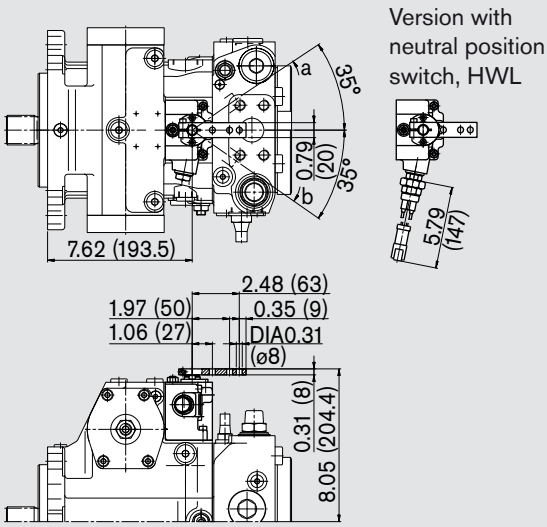
Unit Dimensions, Size 125

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

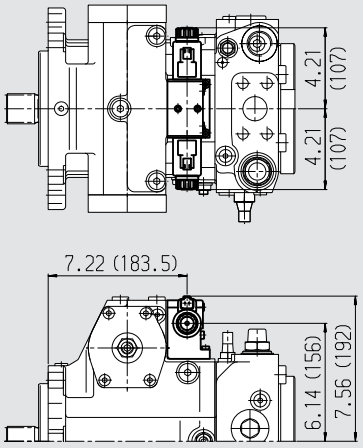
Hydraulic control, pilot-pressure related, HD



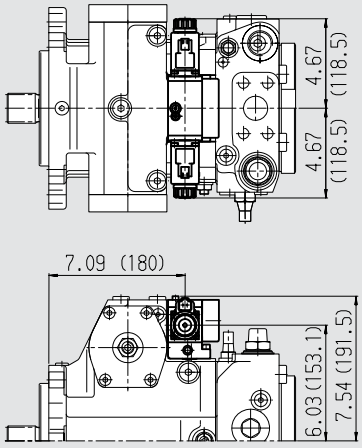
Hydraulic control, mechanical servo, HW



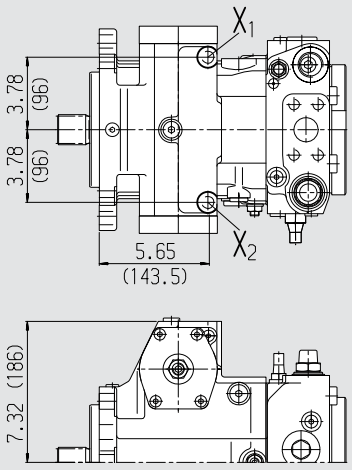
Electric two-point control with switching solenoid, EZ



Electric control with proportional solenoid, EP



Hydraulic control, direct operated, DG

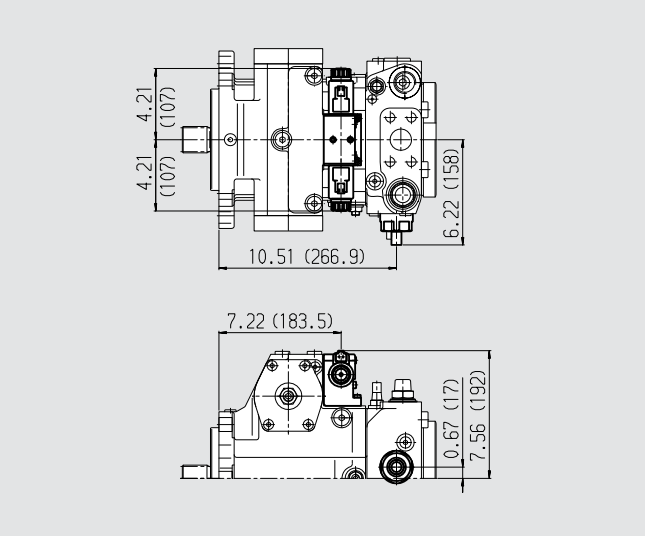


Unit Dimensions, Size 125

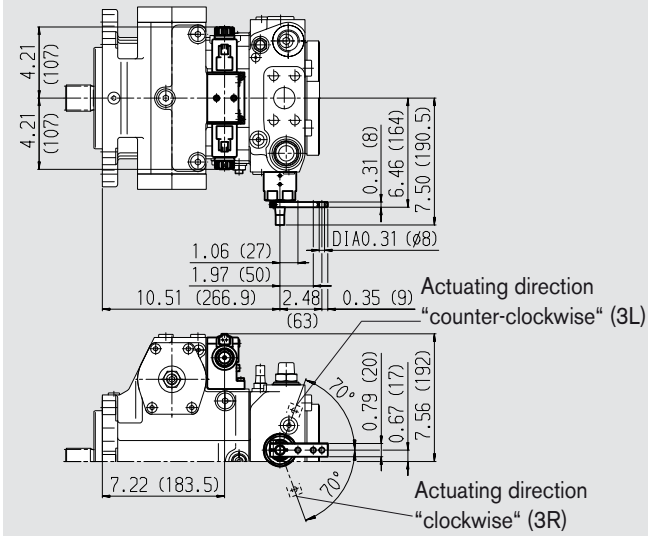
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Hydraulic control, speed related, DA

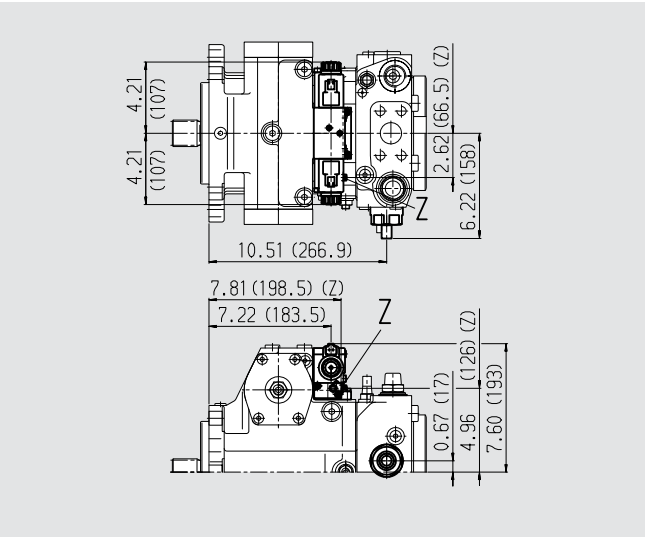
Control valve, fixed setting, DA2



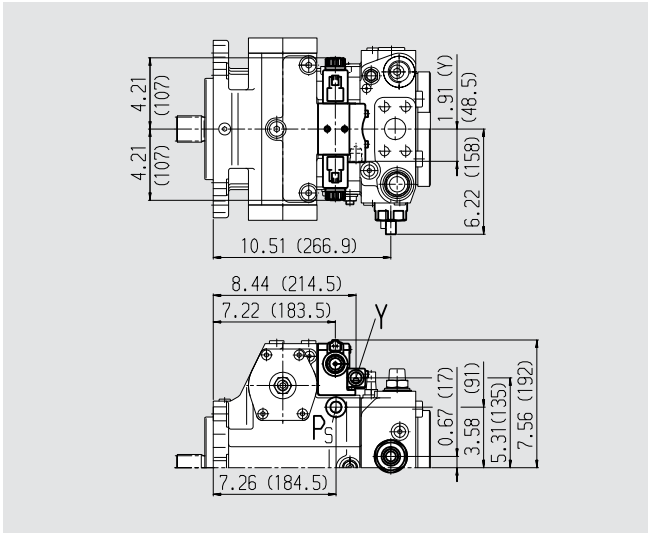
Control valve, mech. adjustable with position lever, DA3



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



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



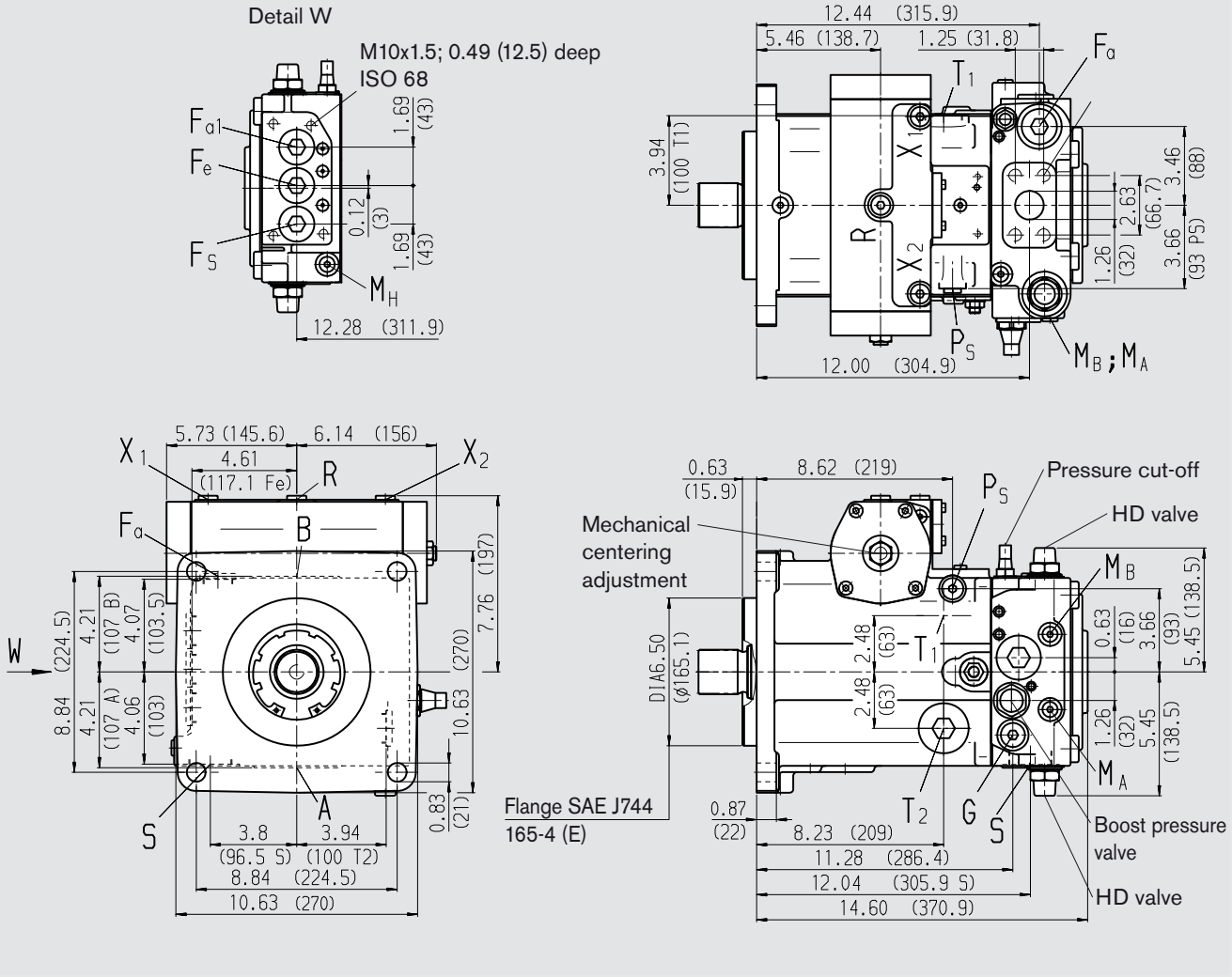
Unit Dimensions, Size 180

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

Version without control unit NV

Standard: suction port S at bottom (52)

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

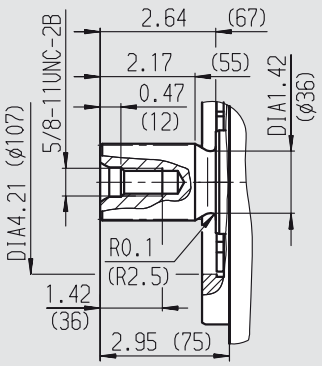


Unit Dimensions, Size 180

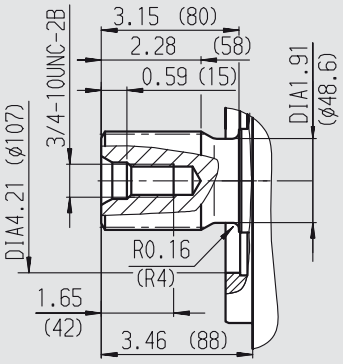
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Shaft ends

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



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



Ports

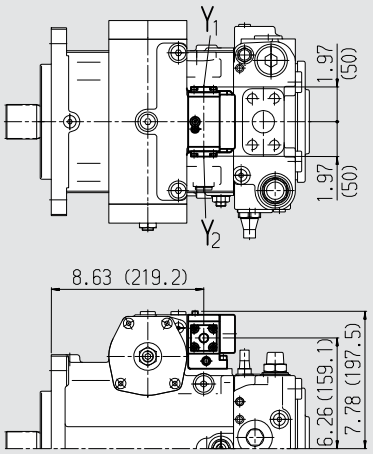
A, B	service line ports (high-pressure series)	SAE J518	1 1/4 in		
	fixing thread A/B	ISO 68	1/2 in -13 UNC-2B;	0.75 (19) deep [2])	
T_1	case drain or fill	ISO 11926	1 5/8 in -12 UN-2B;	0.79 (20) deep	710 lb-ft (960 Nm) [2])
T_2	case drain [3])	ISO 11926	1 5/8 in -12 UN-2B;	0.79 (20) deep	710 lb-ft (960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

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

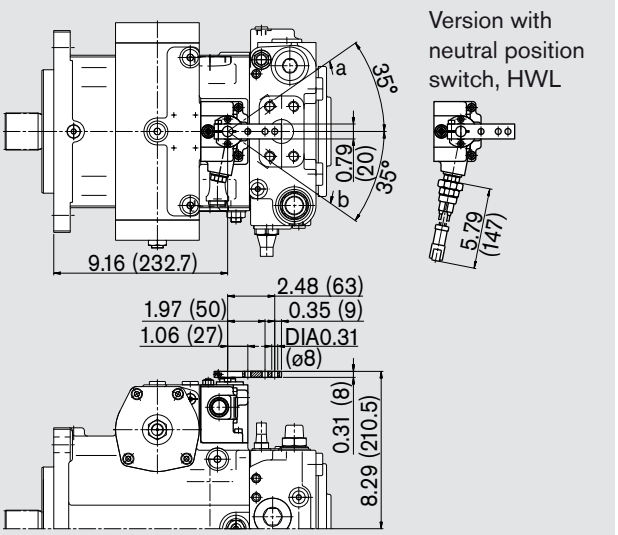
Unit Dimensions, Size 180

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

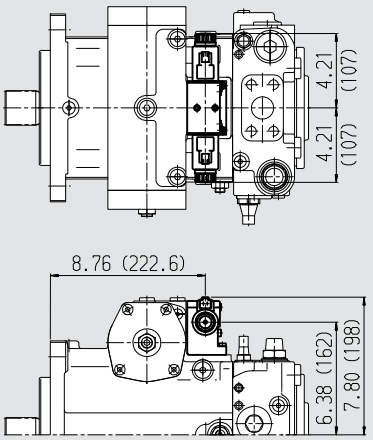
Hydraulic control, pilot-pressure related, HD



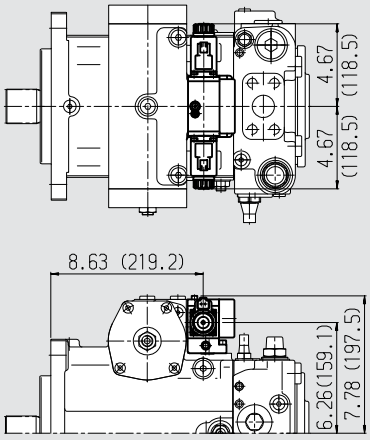
Hydraulic control, mechanical servo, HW



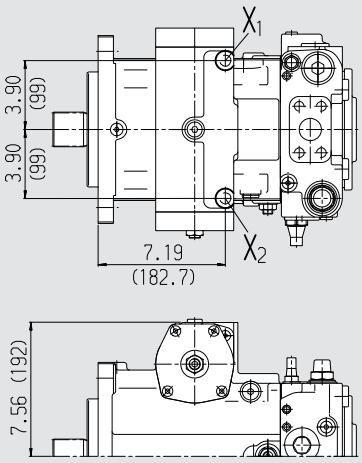
Electric two-point control with switching solenoid, EZ



Electric control with proportional solenoid, EP



Hydraulic control, direct operated, DG

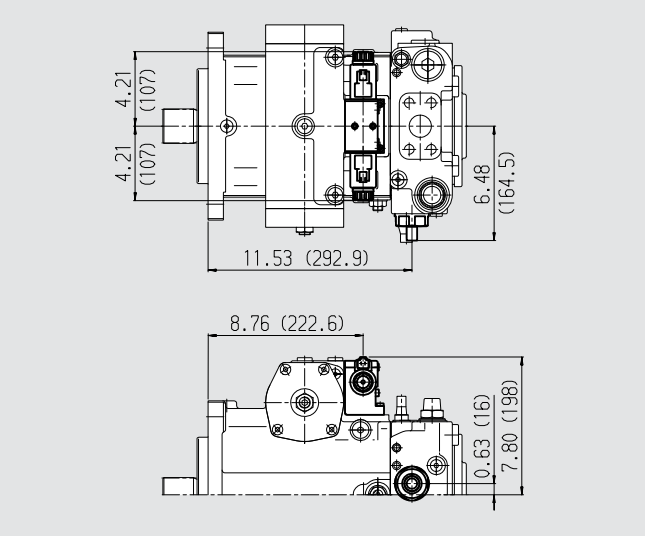


Unit Dimensions, Size 180

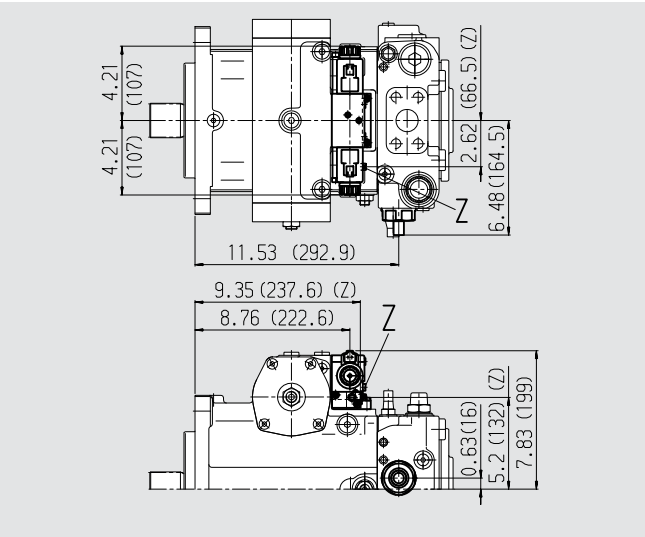
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Hydraulic control, speed related, DA

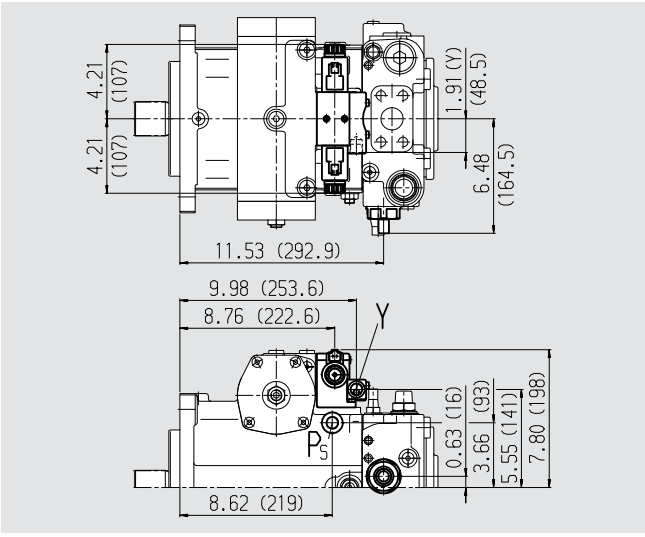
Control valve, fixed setting, DA2



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



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



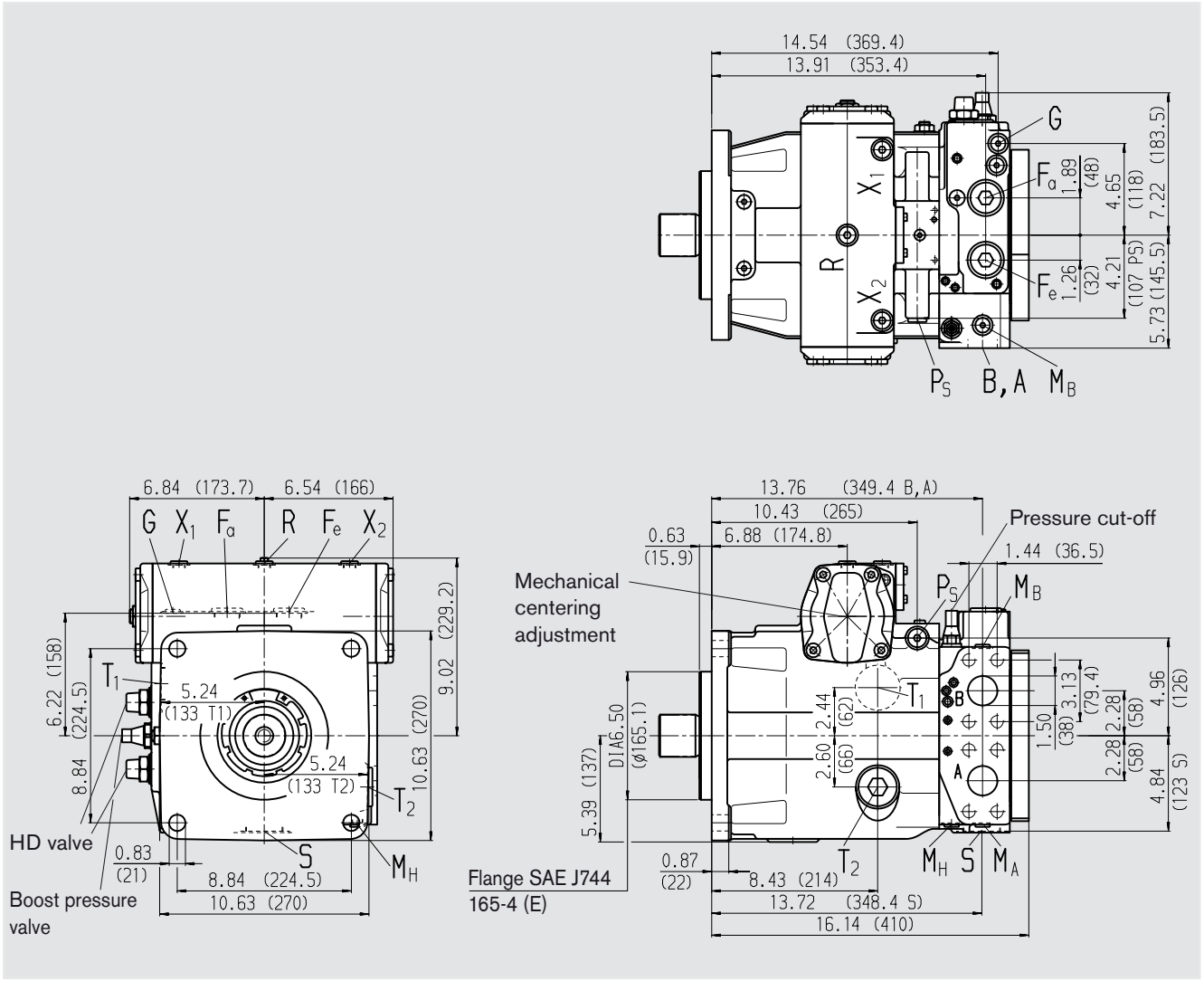
Unit Dimensions, Size 250

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

Version without control unit NV

Standard: suction port S at bottom (60)

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

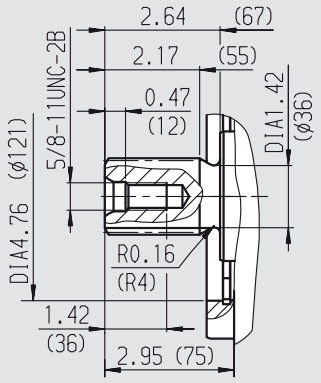


Unit Dimensions, Size 250

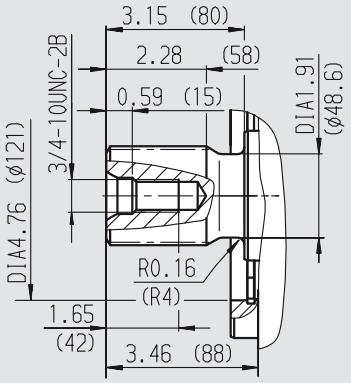
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Shaft ends

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



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



Ports

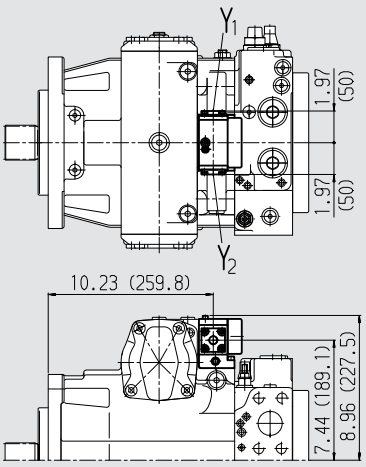
A, B	service line ports (high-pressure series)	SAE J518	1 1/2 in	
	fixing thread A/B	ISO 68	5/8 in -11 UNC-2B; 0.83 (21) deep [2])	
T_1	case drain or fill	ISO 11926	1 5/8 in -12 UN-2B; 0.79 (20) deep	710 lb-ft (960 Nm) [2])
T_2	case drain [3])	ISO 11926	1 5/8 in -12 UN-2B; 0.79 (20) deep	710 lb-ft (960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

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

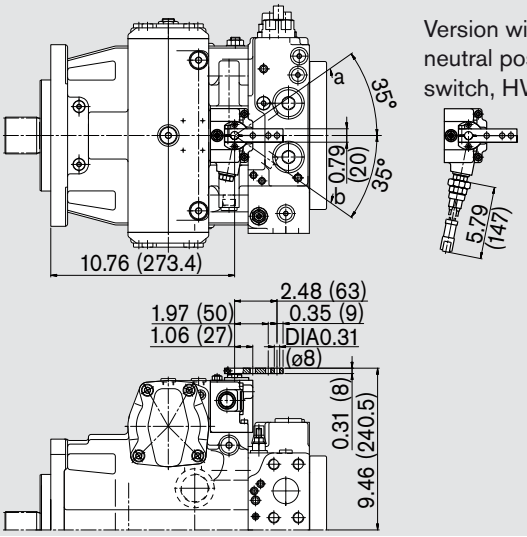
Unit Dimensions, Size 250

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

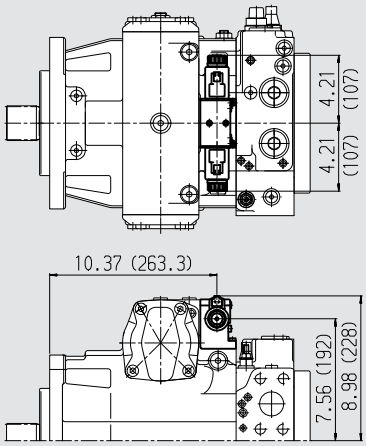
Hydraulic control, pilot-pressure related, HD



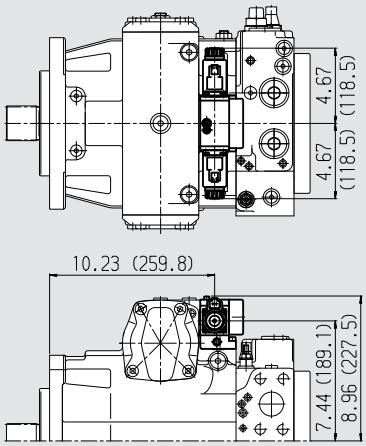
Hydraulic control, mechanical servo, HW



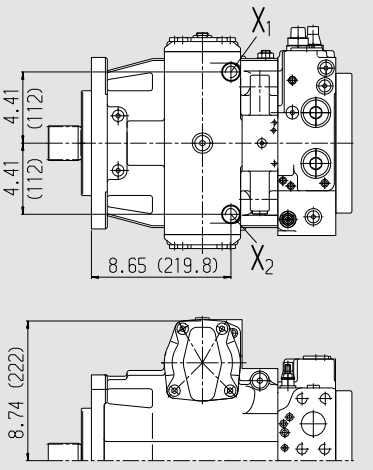
Electric two-point control with switching solenoid, EZ



Electric control with proportional solenoid, EP



Hydraulic control, direct operated, DG

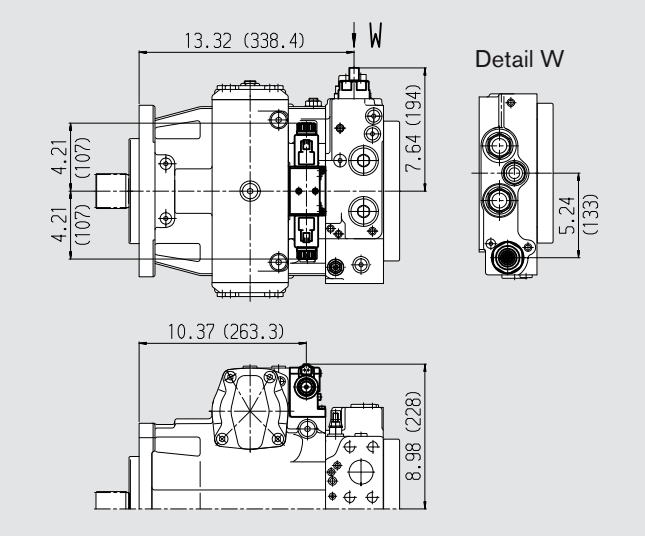


Unit Dimensions, Size 250

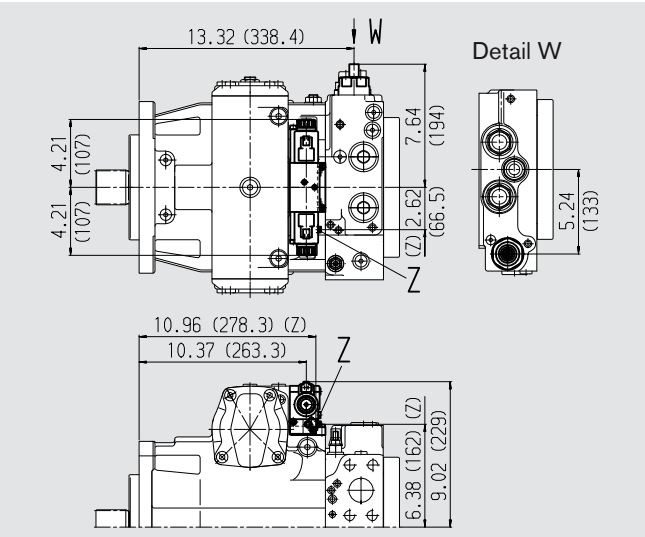
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters).

Hydraulic control, speed related, DA

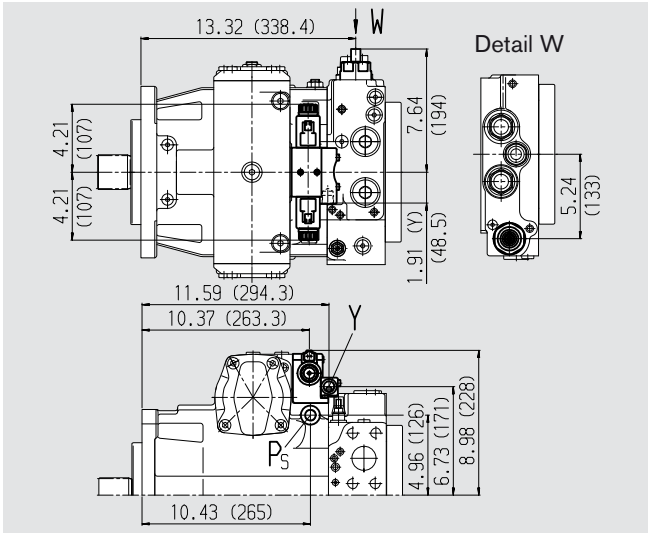
Control valve, fixed setting, DA2



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



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

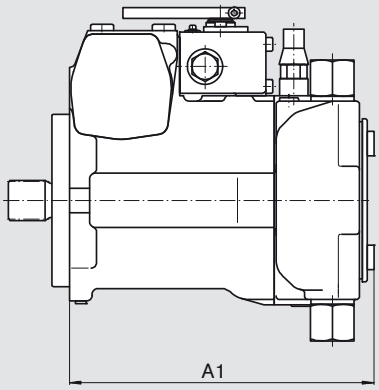


Through Drive Dimensions

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

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

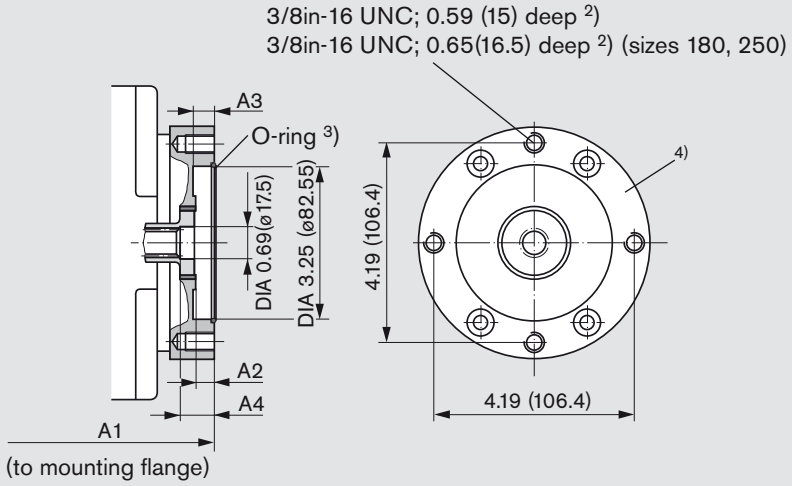
F00 **With boost pump, without through drive**



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

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

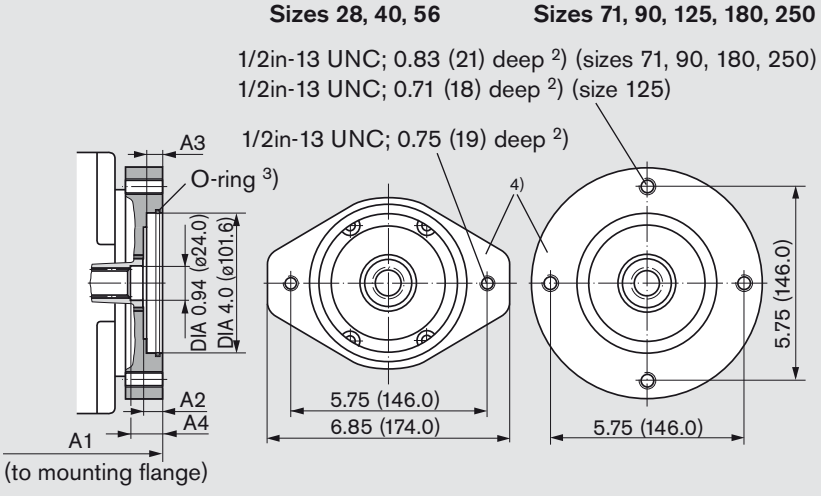
Hub for splined shaft according to ANSI B92.1a-1976 5/8 in 9T 16/32DP [1] (SAE J744 – 16-4 (A))



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

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

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



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

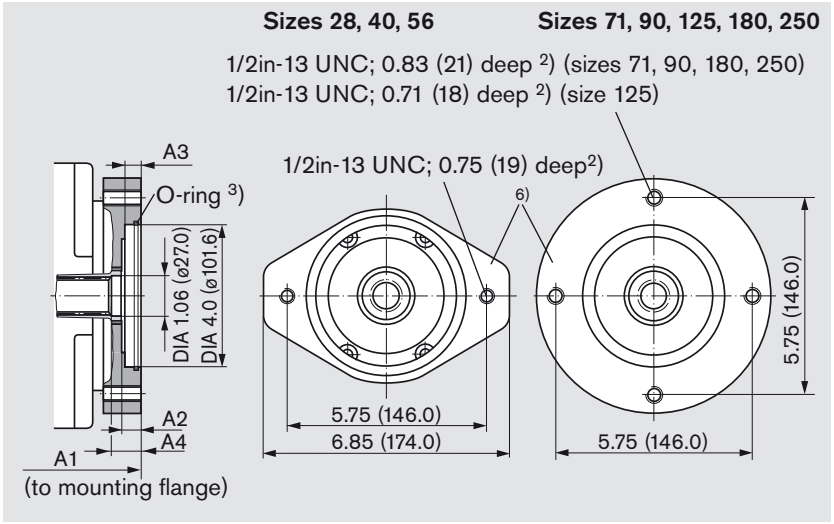
[1] 30° pressure angle, flat root; side fit, tolerance class 5
[2] Thread acc. to ISO 68, please observe the general notes for the max. tightening torques on page 64
[3] O-ring included in supply
[4] Shown is the 2-bolt version. Please specify in plain text whether the 2-bolt horizontal or 2-bolt vertical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

Through Drive Dimensions

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

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

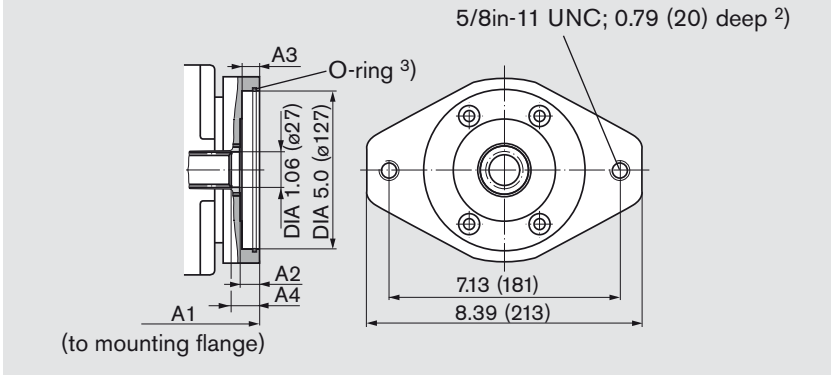
Hub for splined shaft according to ANSI B92.1a-1976 1 in 15T 16/32DP [1] (SAE J744 – 25-4 (B-B))



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

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

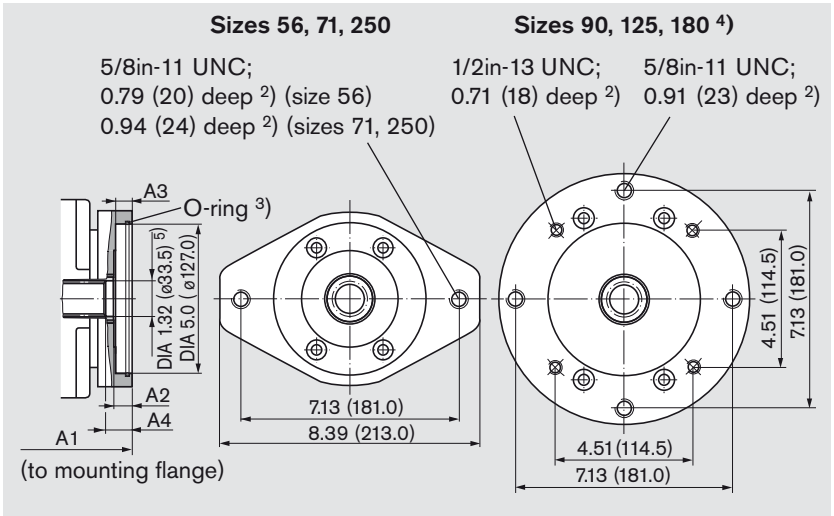
Hub for splined shaft according to ANSI B92.1a-1976 1 in 15T 16/32DP [1] (SAE J744 – 25-4 (B-B))



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

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

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



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

Shown is the 4-bolt and 2-bolt version. Please specify in plain text whether the 4-bolt, 2-bolt horizontal or 2-bolt vertical version is used.

[1] 30° pressure angle, flat root, side fit, tolerance class 5
[2] Thread acc. to ISO 68, Please observe the general notes for the max. tightening torques on page 64
[3] O-ring included in supply
[4] Size 180 only with SAE 2-bolt flange
[5] Size 56: DIA 1.29 (ø32.7)
[6] Shown is the 2-bolt version. Please specify in plain text whether the 2-bolt horizontal or 2-bolt vertical version is used.

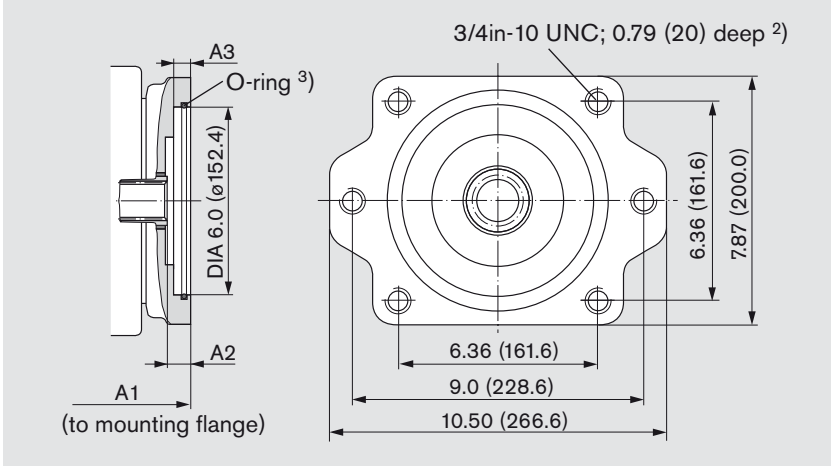
Through Drive Dimensions

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

F90/K90

Flange SAE J744 – 152-2/4 (D)

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



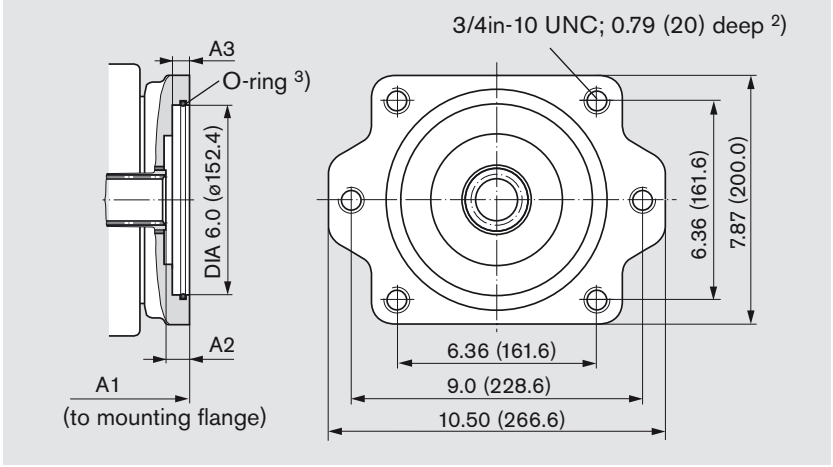
Size	A1	A2	A3
90	12.17	0.47	0.55
	(309.0)	(12.0)	(14.0)

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

F69/K69

Flange SAE J744 – 152-2/4 (D)

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



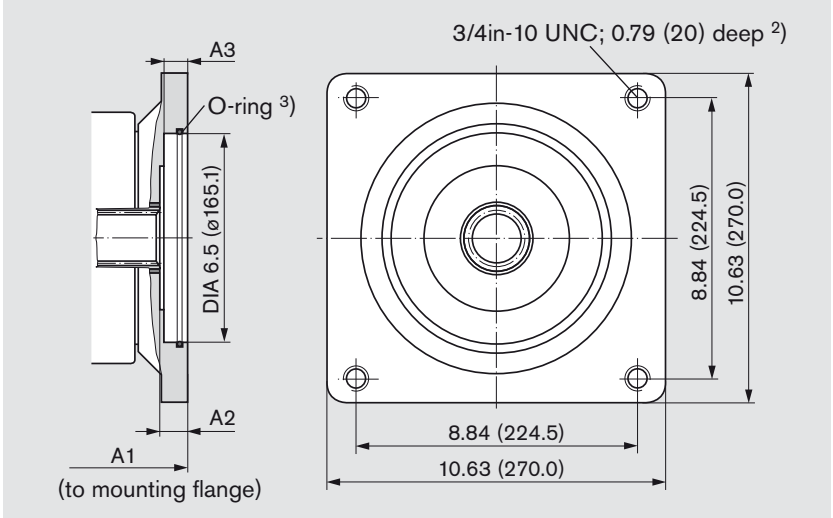
Size	A1	A2	A3
125	13.54	0.71	0.55
	(343.9)	(18.0)	(14.0)
180	15.43	0.82	0.71
	(391.9)	(20.9)	(18.0)
250	17.52	0.35	0.67
	(444.9)	(9.0)	(17.0)

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

F72/K72

Flange SAE J744 – 165-4 (E)

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



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

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

Overview of Attachments on AA4VG

Through drive – AA4VG										Through drive
Flange	Hub for splined shaft	Code	AA4VG Size (shaft)	AA10V(S)O/31 Size (shaft)	A10V(S)O/53 Size (shaft)	A4FO Size (shaft)	AA11VO Size (shaft)	AA10VG Size (shaft)	External gear pump	Available for size
82-2 (A)	5/8 in	**F/K01**	–	18 (U)	10 (U)	–	–	–	Size F Size 4-22 [1]	28...250
101-2 (B)	7/8 in	**F/K02**	–	28 (S,R) 45 (U)	28 (S,R) 45 (U,W)	16 (S) 22 (S) 28 (S)	–	18 (S)	Size N Size 20-32 [1] Size G Size 38-45 [1]	28...250
	1 in	**F/K04**	28 (S)	45 (S,R)	45 (S,R) 60 (U,W)	–	40 (S)	28 (S) 45 (S)	–	28...250
127-2 (C)	1 in	**F/K09**	40 (U)	–	–	–	–	–	–	40
	1 1/4 in	**F/K07**	40 (S), 56 (S) 71 (S)	71 (S,R) 100 (U)	85 (U)	–	60 (S)	63 (S)	–	56...250
152-2/4 (D)	1 1/4 in	**F/K90**	90 (U)	–	–	–	–	–	–	90
	1 3/4 in	**F/K69**	90 (S) 125 (S)	140 (S)	–	–	95 (S) 130 (S)	–	–	125...250
165-4 (E)	1 3/4 in	**F/K72**	180 (S) 250 (S)	–	–	–	190 (S) 260 (S)	–	–	180...250

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

Combination Pumps AA4VG + AA4VG

Overall length A

AA4VG (1st pump)		AA4VG (2nd pump) [1]							
		Size 28	**Size 40**	**Size 56**	**Size 71**	**Size 90**	**Size 125**	**Size 180**	**Size 250**
Size 28	in	17.87							
	mm	(453.8)	–	–	–	–	–	–	–
Size 40	in	18.27	18.91						
	mm	(464.1)	(480.4)	–	–	–	–	–	–
Size 56	in	19.13	19.77	20.58					
	mm	(485.8)	(502.1)	(522.8)	–	–	–	–	–
Size 71	in	20.63	21.23	22.05	23.51				
	mm	(524.0)	(539.3)	(560.0)	(597.2)	–	–	–	–
Size 90	in	20.80	21.44	22.26	23.72	24.02			
	mm	(528.4)	(544.7)	(565.4)	(602.6)	(610.0)	–	–	–
Size 125	in	21.82	22.50	23.32	24.78	25.39	26.39		
	mm	(554.3)	(571.6)	(592.3)	(629.5)	(644.9)	(670.3)	–	–
Size 180	in	23.81	24.41	25.23	26.69	27.28	28.28	30.03	
	mm	(604.8)	(620.1)	(640.8)	(678.0)	(692.9)	(718.3)	(762.8)	–
Size 250	in	25.68	26.05	26.86	28.33	29.37	30.37	32.19	33.65
	mm	(652.3)	(661.6)	(682.3)	(719.5)	(745.9)	(771.3)	(815.8)	(854.8)

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

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

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

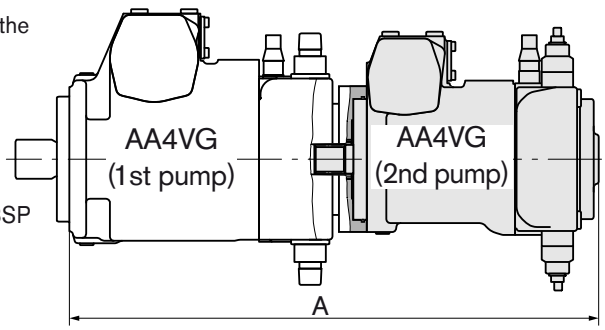
Example of order:

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

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

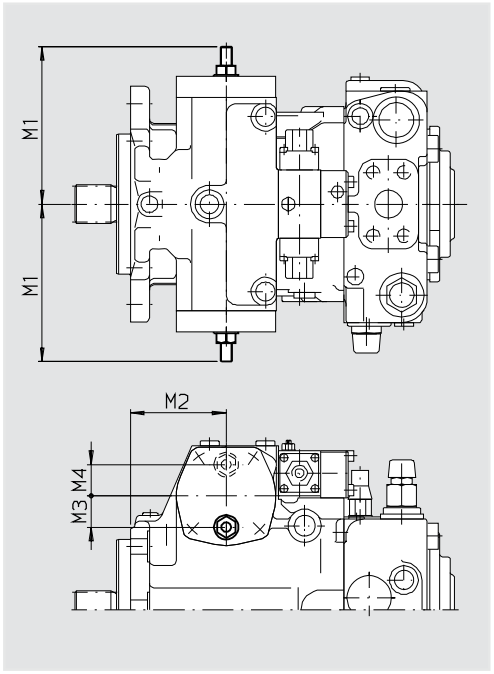
We recommend the use of 4-bolt mounting flanges from size 71 and larger.

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



Mechanical Stroke Limiter, M

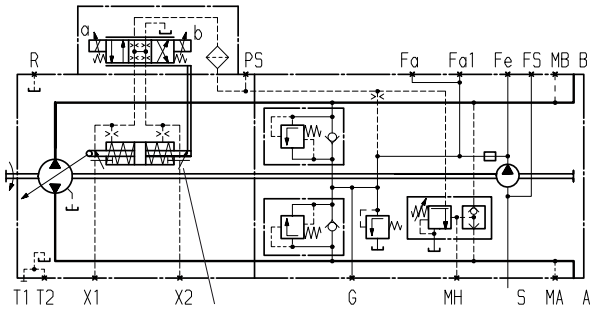
The mechanical stroke limiter is an additional function allowing continuous reduction of the maximum displacement of the pump, regardless of the control unit used. The stroke of the stroke cylinder and hence the maximum swivel angle of the pump are limited by means of two adjusting screws.



Dimensions

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

Circuit diagram [1])

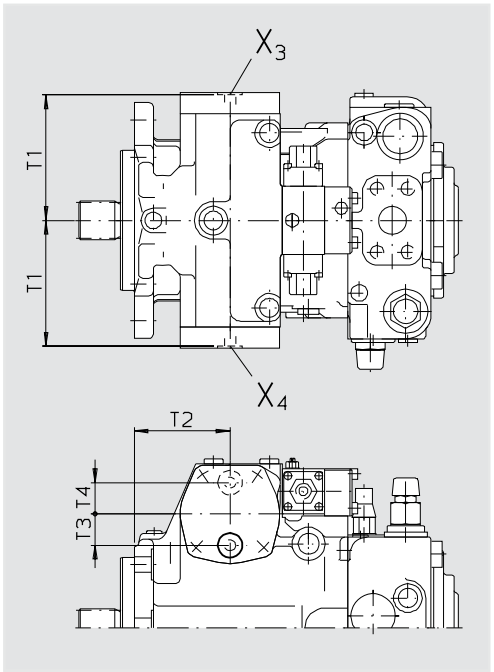


Mechanical stroke limiter, M

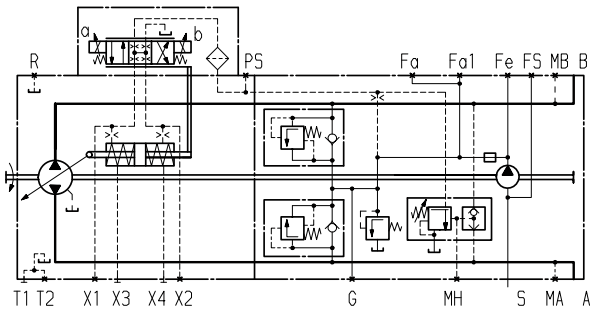
Ports X_3 and X_4 for Positioning Pressure, T

Dimensions

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



Circuit diagram [1])



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

Filtration Types

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

Standard version (preferred)

Filter type: _____ filter **without** bypass

Recommendation: _____ **with** contamination indicator

Flow resistance at the filter element:

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

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

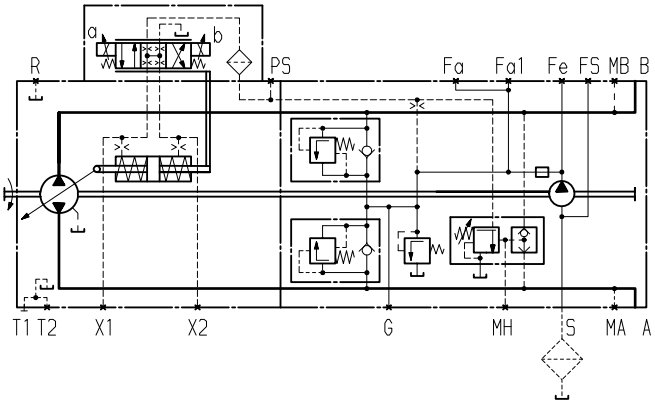
Pressure at port S of the boost pump:

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

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

Filter is not included in supply.

Circuit diagram - standard version S



Variation: External supply, E

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

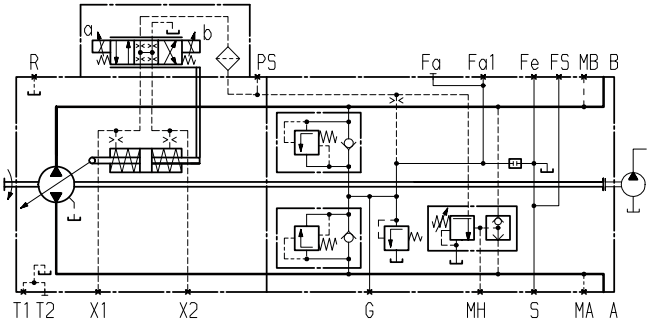
Port S is plugged.

Supply comes from port F_a.

Filter arrangement: _____ separate

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

Circuit diagram variation E (external supply)



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

Filter input: Port F_e
Filter output: Port F_a
Filter type: Filter with bypass are **not recommended**. When applying with bypass please consult us.
Recommendation: **with** contamination indicator

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

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

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

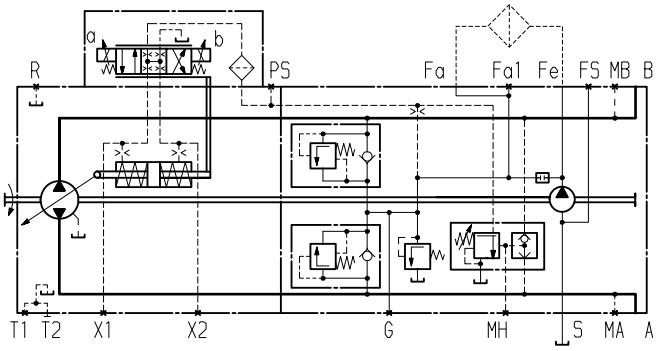
Flow resistance at the filter element:

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

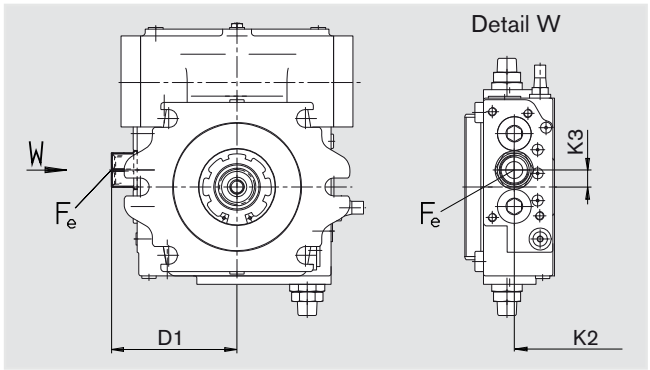
for cold start _____ $\Delta p \leq 45$ psi (3 bar)
(valid for entire speed range $n_{min} - n_{max}$)

Filter is not included in supply.

Circuit diagram variation D



Dimensions variation D



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

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

Filtration Types

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

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

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

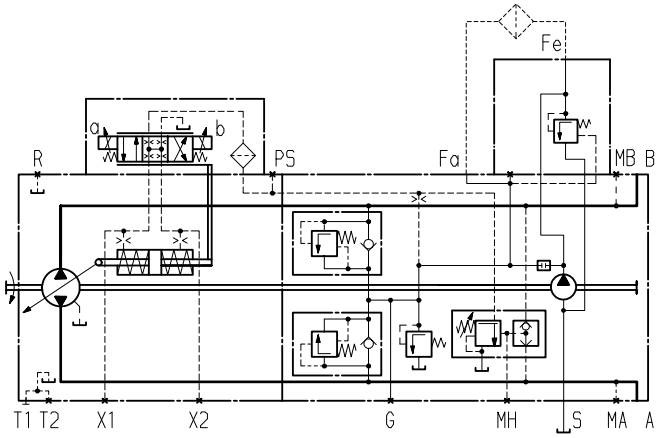
Port F_e : Filter input (at the cold start valve)

Port F_a : Filter output

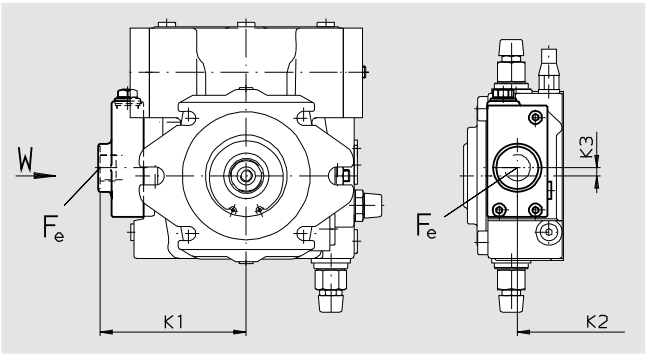
Filter arrangement _____ separately in the pressure line (line filter)

Filter is not included in supply.

Circuit diagram variation K (with cold start valve)



Dimensions variation K (with cold start valve)



Size	K1	K2	K3	F_e [1]	$T_{max.}$ [2]
40	4.82	7.82	0	3/4in-16 UNF-2B	120 lb-ft
	(122.5)	(198.7)	(0)	0.59 (15) deep	(160 Nm)
56	4.94	8.48	0	3/4in-16 UNF-2B	120 lb-ft
	(125.5)	(215.4)	(0)	0.59 (15) deep	(160 Nm)
71	5.73	9.41	0.31	1 1/16in-12 UN	265 lb-ft
	(145.5)	(239.0)	(8)	0.63 (16) deep	(360 Nm)
90	5.49	9.78	0.94	1 1/16in-12 UN	265 lb-ft
	(139.5)	(248.5)	(24)	0.63 (16) deep	(360 Nm)
125	6.77	10.55	0.79	1 5/16in-12 UN-2B	400 lb-ft
	(172.0)	(267.9)	(20)	0.71 (18) deep	(540 Nm)
180	6.81	12.28	0.12	1 5/16in-12 UN-2B	400 lb-ft
	(173.0)	(311.9)	(3)	0.71 (18) deep	(540 Nm)

[1]) ISO 11926

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

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

Filter type _____ filter **without** bypass

Filter grade (absolute) _____ 20 microns

Filter material _____ glass fiber

Pressure capacity _____ 1450 psi (100 bar)

Filter arrangement _____ connected to pump

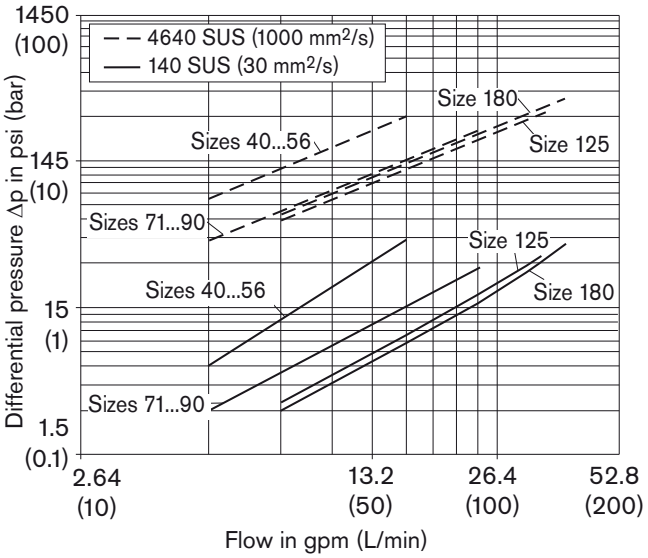
Note:

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

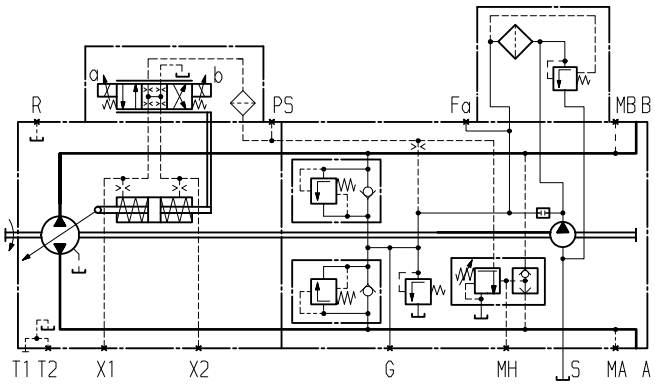
Recommendation: **with** contamination indicator (variation P, L, M, B)
(differential pressure $\Delta p = 75$ psi / 5 bar)

Filter characteristic

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



Circuit diagram variation F (with mountable filter)



Filtration Types

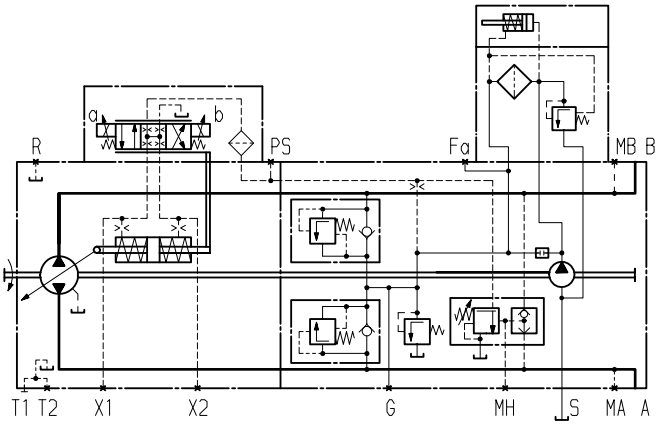
Variation:
Filtration in pressure line of the boost pump, filter mounted, supplied, with visual contamination indicator, P

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

Indication: green/red window

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

Circuit diagram variation P



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

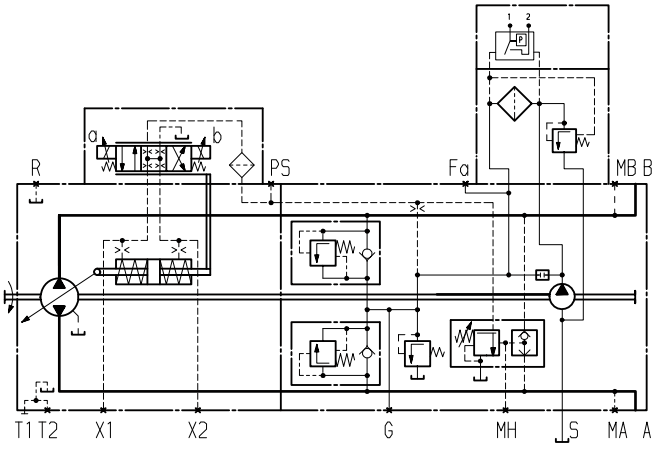
Version similar to variation F, however additionally with electrical contamination indicator.

Indication: electrical

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

Max. switching power at 24 V DC _____ 60 W

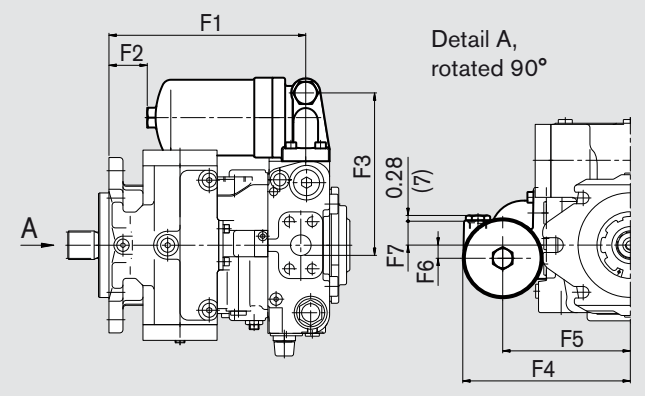
Circuit diagram variation B



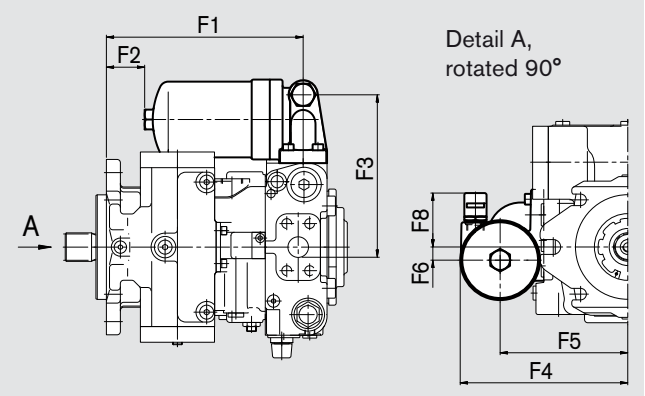
Filtration Types

Dimensions with mountable filter

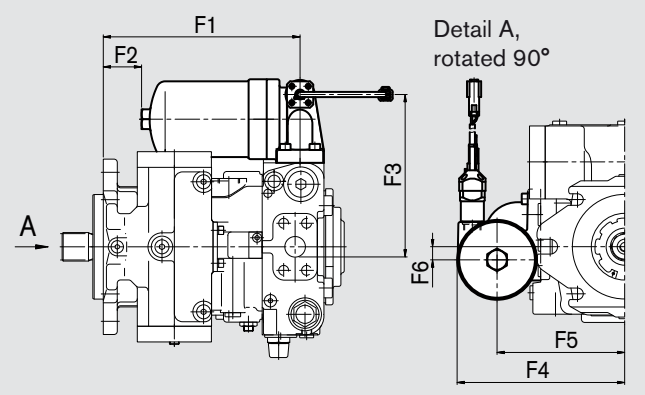
Variation F



Variation P: viewing window



Variation B: electr. signal with DEUTSCH connector



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

Swivel Angle Indicator

Electrical swivel angle sensor, R

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

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

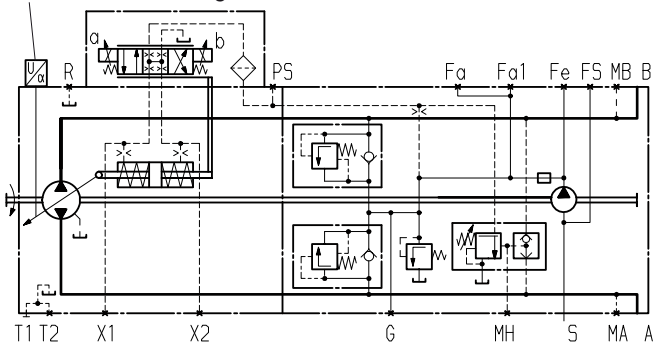
Technical Data			
Supply voltage U_b	10...30 V DC		
Output voltage U_a	0,5 V ($V_{g\ max\ a}$)	2,5 V ($V_{g\ 0}$)	4,5 V ($V_{g\ max\ b}$)
Reserve-connect protection	Short circuit-resistant		
EMC resistance	Details on request		
Operating temperature range	-40 °F...+257 °F (-40 °C...+125 °C)		
Vibration resistance sinusoidal vibration EN 60068-2-6	10*g* / 5...2000 Hz		
Shock resistance: continuous shock IEC 68-2-29	25*g*		
Salt spray resistance (DIN 50 021-SS)	96h		
Type of protection DIN/EN 60529	IP67 and IP69K		
Case material	Plastic		

Output voltage

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

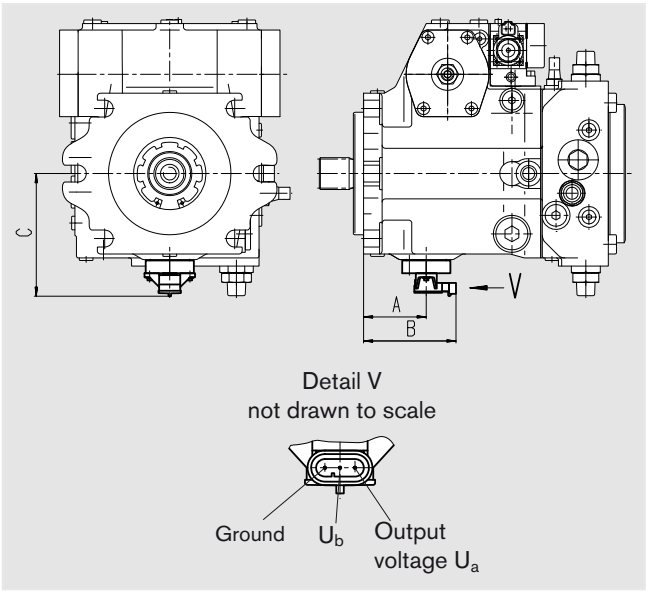
Circuit diagram

Electrical swivel angle sensor



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

Dimensions



Size	A	B	C
28	2.23 (56.6)	3.70 (94.0)	4.69 (119.0)
40	2.31 (58.6)	3.78 (96.0)	4.69 (119.0)
56	2.39 (60.5)	3.84 (97.5)	5.06 (128.5)
71	2.82 (71.6)	4.28 (108.6)	5.41 (137.5)
90	2.78 (70.7)	4.24 (107.7)	5.73 (145.5)
125	3.07 (78.0)	4.53 (115.0)	6.00 (152.5)
180	3.96 (100.7)	5.42 (137.7)	6.04 (153.5)
250	4.14 (105.1)	5.59 (142.1)	7.11 (180.5)

Mating connector

AMP Superseal 1.5; 3-pin,
Rexroth mat. no. R902602132

comprising:	AMP no.
– 1 socket case, 3-pins	282087-1
– 3 single wire seal, yellow	281934-2
– 3 socket contact 0.07 - 0.13 in (1.8 - 3.3 mm)	183025-1

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

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

DEUTSCH DT04-2P-EP04, 2-pin

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

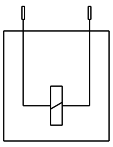
Molded, with bi-directional suppressor diode
(only for switching solenoids on control unit EZ1/2, DA) **____Q**

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

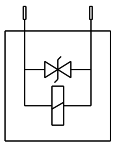
The protection circuit with a bi-directional suppressor diode is necessary for limiting overvoltages. Overvoltages are generated by disconnecting the current using switches, relay contacts or by unplugging an energized mating connector.

Circuit symbol

without bi-directional suppressor diode



with bi-directional suppressor diode

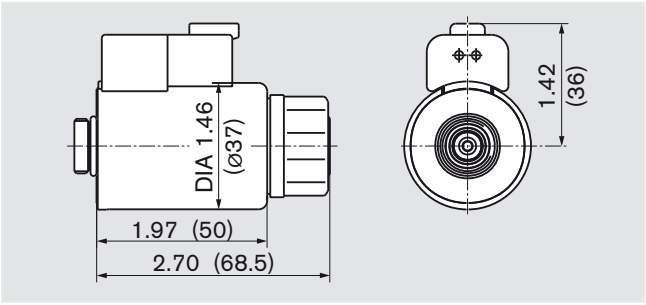


Mating connector

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

consisting of:	DT designation
– 1 case	DT06-2S-EP04
– 1 wedge	W2S
– 2 sockets	0462-201-16141

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



Note for round solenoids:

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

Proceed as follows:

1. Loosen the fixing nut (1)
2. Turn the solenoid body (2) to the desired position
3. Tighten the fixing nut
   Tightening torque of the fixing nut: $3.69^{+0.74}$ lb-ft (5+1 Nm)
   (width across flats WAF26, 12-sided DIN 3124)

Rotary Inch Valve

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

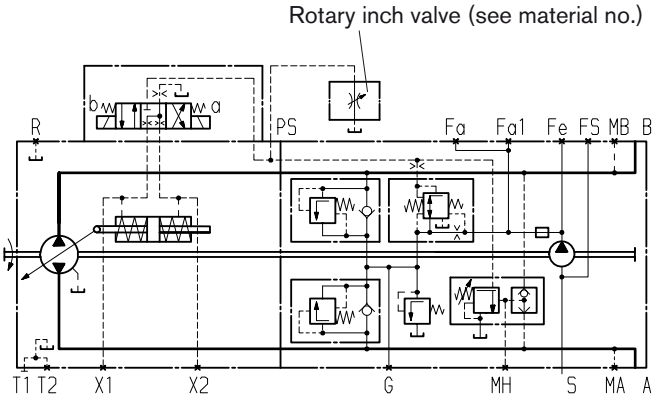
The valve is mounted separately from the pump and connected with a pump by the hydraulic control line at port P_S (max. line length approximately 6.5 ft / 2 meters).

The rotary inch valve must be ordered separately.

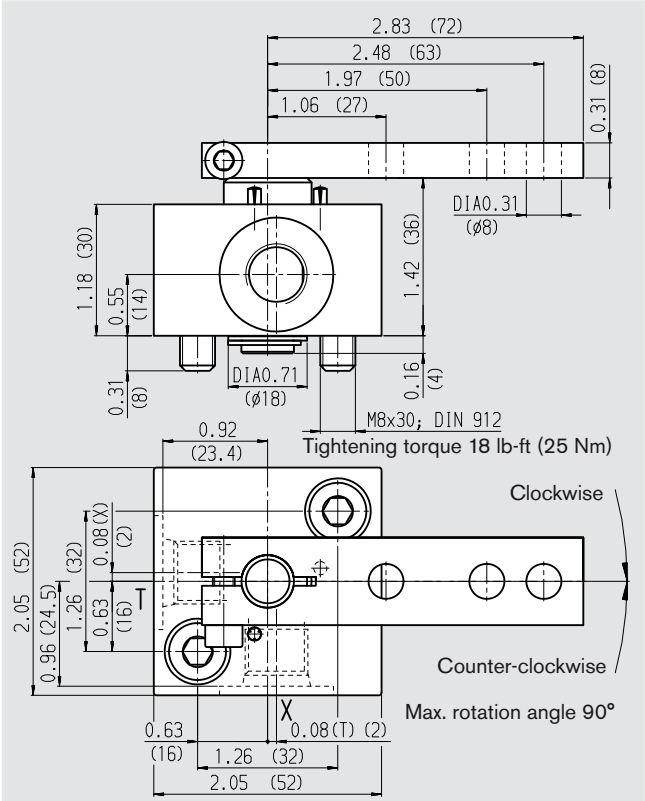
Size	Material no.	Direction of actuation of position lever
28, 40, 56, 71, 90	R902048738 R902048739	clockwise counter-clockwise
125	R902048742 R902048743	clockwise counter-clockwise
180, 250	R902048746 R902048747	clockwise counter-clockwise

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

Circuit diagram:
hydraulic control, speed related, DA
with separate rotary inching valve



Unit dimensions



Ports

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

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

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

Installation Situation for Coupling Assembly

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

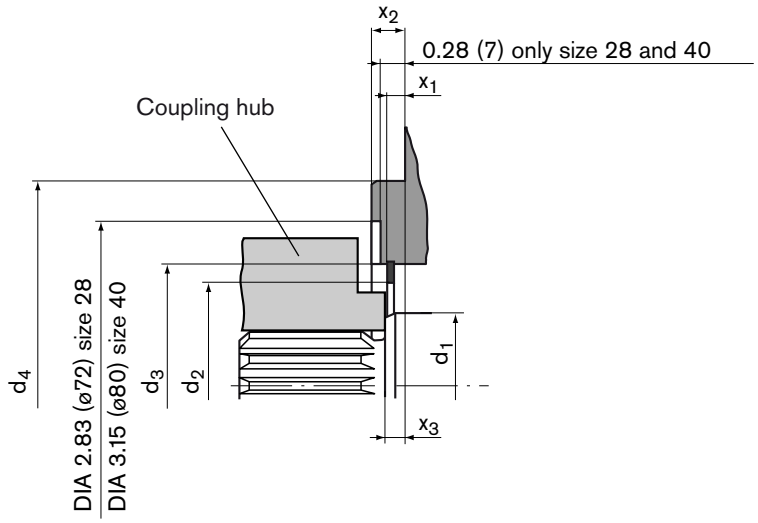
Size 28 and 40 (with free turning):

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

Size 56 to 250 (without free turning):

– SAE splined shaft (shaft S or T)
The outer diameter of the coupling hub must be smaller than the inner diameter of the retaining ring $\mathbf{d_2}$ at the zone of the drive shaft collar (measure $x_2 - x_3$).

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



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

Installation Notes

General

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

The pump case drain connection (i.e.-T_1/T_2) must be directed to the tank via the highest case drain port. The minimum suction pressure at port S must not fall below 12 psi (0.8 bar) abs. (cold start 7.5 psi / 0.5 bar absolute).

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

Installation position

See examples below. Additional installation positions are available upon request.
Note:
With size 71...250, installation position “shaft at top” must be specified at time of order (pump is supplied with additional vent port R_1 in flange area).

Below-tank installation (standard)

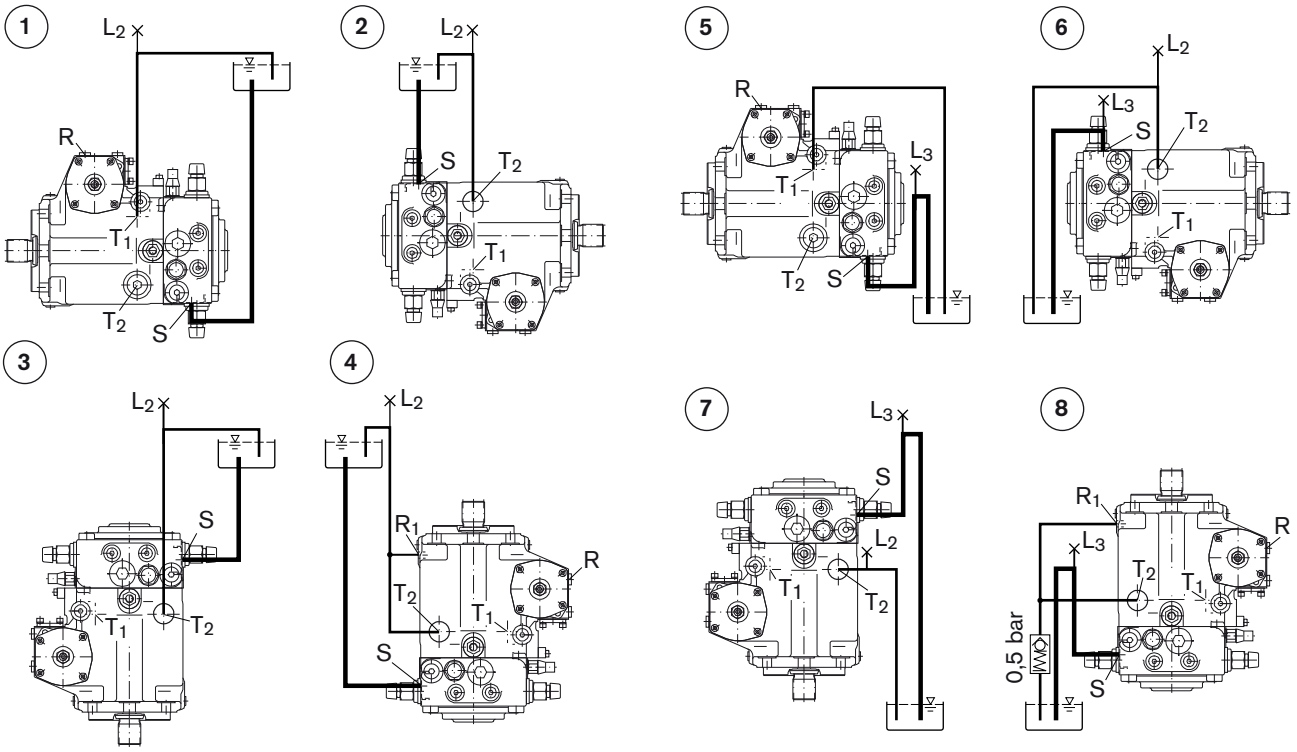
Pump below the minimum fluid level of the tank.

Recommended installation positions: 1 and 2.

Above-tank installation

Pump above the min. fluid level of the tank

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



Installation position	Air bleeding	Filling
1	R	S + T_1 (L_2)
2	L_2	S + T_2 (L_2)
3	L_2	S + T_2 (L_2)
4	R + L_2 (size 28 - 56) R_1+L_2 (size 71-250)	S + T_2 (L_2)

Installation position	Air bleeding	Filling
5	R	T_1 + (L_3)
6	L_2	S (L_3) + T_2 (L_2)
7	L_2 + L_3	S (L_3) + T_2 (L_2)
8	R + L_3 (size 28 - 56) R_1+L_3 (size 71-250)	S (L_3) + T_2

General Notes

– The AA4VG pump is designed to be used in closed circuits.

– Project planning, assembly and commissioning of the pump require the involvement of qualified personnel.

– The service line ports and function ports are only designed to accommodate hydraulic lines.

– During and shortly after operation, there is a risk of burns on the pump and especially on the solenoids. Take suitable safety precautions, e.g. wear protective clothing

– There may be shifts in the characteristic depending on the operating state of the pump (operating pressure, fluid temperature).

– Tightening torques:
  - The tightening torques specified in this data sheet are maximum values and must not be exceeded (maximum values for screw thread).
    Manufacturer´s instruction for the max. permissible tightening torques of the used fittings must be observed!
  - For ISO 68 / DIN 13 fixing screws, we recommend checking the tightening torque individually according to VDI 2230 Edition 2003.

– The data and information contained herein must be adhered to.

Bosch Rexroth Corporation
Mobile 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

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Subject to change.

Axial Piston Variable Pump AA4VSO for HFC Fluids

RA 92053-A/06.09 1/8
Supplementary to RA 92050
Replaces: 02.05

Data sheet



Series 10, 11 and 30
Size NG71 to 355
Nominal pressure 5100 psi (350 bar)
Peak pressure 5800 psi (400 bar)
Open circuit

Contents

Ordering code for standard program	2
Technical data	3
Installation notes	7
Safety information	8

Note

This data sheet shows only the particular information which is valid for operation of the axial piston pump with HFC-fluids.
All fundamental details on the AA4VSO must be taken from the main data sheet RA 92050.

Features

- Axial piston pump in swash plate design for hydrostatic drives in open circuit operation
- Especially suitable for operation with HFC fluids
- With the approved HFC fluids the units can be operated with the same speeds and pressures as on mineral oil
- The flow is proportional to the input drive speed and displacement. By adjusting the swash plate angle it is possible to infinitely vary the output flow.
- Good suction characteristics
- Low noise level
- Long service life
- High power/weight ratio
- Drive shaft capable of absorbing axial and radial loads
- Modular design
- Short control times
- Through drive and pump combinations possible
- Swivel angle indicator
- Optional mounting position

Ordering code for standard program

AA4VS	O			/			–	F					
01	02	03	04		05	06		07	08	09	10	11	12

Axial piston unit

01	Swashplate design, variable	**AA4VS**

Type of operation

02	Pump, open circuit	**O**

	Size			**71**	**125**	**180**	**250**	**355**
03	Displacement $V_{g\ max}$		in³/rev.	4.33	7.63	10.98	15.26	21.66
			(cm³/rev.)	(71)	(125)	(180)	(250)	(355)

Control device

04	Pressure control	(RA 92060)	DR	❍	●	●	●	●	**DR..**
	Pressure control for parallel operation		DP	❍	●	●	●	●	**DP..**
	Flow control		FR	❍	●	●	●	●	**FR..**
	Pressure and flow control		DFR	❍	●	●	●	●	**DFR..**
	Power control with hyperbolic curve	(RA 92064)	LR	❍	●	●	●	●	**LR..[1)]**
	Manual control	(RA 92072)	MA	❍	●	●	●	●	**MA..**
	Electric motor control		EM	❍	●	●	●	●	**EM..**
	Hydraulic control, control volume dependent	(RA 92076)	HM	❍	●	●	●	●	**HM..**
	Hydr. control, with servo/proportional valve		HS	❍	●	●	●	●	**HS..[1)]**
	Electronic control		EO	❍	●	●	●	●	**EO..[1)]**
	Hydraulic control, pilot pressure dependent	(RA 92080)	HD	❍	●	●	●	●	**HD..[1)]**
	Electro-hydraulic control system DFE1 System solution SYHDFEE	(RE 92088) (RE 30035)		❍	●	●	●	●	**DFE1..[1)]**

Series

05		❍	–	–	–	–	**10(11)[2)]**
		–	●	●	●	●	**30**

Direction of rotation

06	With view on drive shaft	clockwise	**R**
		counter clockwise	**L**

Seals and fluid

07	NBR Nitrile-rubber, shaft seal PTFE Teflon, special version for HFC-fluids	**F**

08	**Shaft end**	For further details see: RA 92050 – AA4VSO index number 10 to 14
09	**Mounting flange**	
10	**Ports for service connections**	
11	**Through drive**	
12	**Filtration**	

1) On operation with HFC-fluids make sure to observe the limitations in the individual data sheets of the control devices or the mounted control valves

2) Versions with HD-controls only in series 11

● = available ❍ = in preparation – = not available

Technical data

Hydraulic fluid

For extensive information on the selection of hydraulic fluids and for application conditions, please consult our data sheet RE 90223 (fire retardant HF fluids).

In comparison with mineral oil based fluids, HFC fluids demonstrate other, at times unfavourable properties. The following guidelines will show how these special properties may be taken into account in the project design, operation and servicing of hydraulic systems.

The following fluids, with a water content of approx. 35 to 55% in weight, are approved without any restrictions for speed and pressure in comparison with operation on mineral oil based fluids.

– Fuchs Hydrotherm 46M

– Petrofer Ultrasafe 620

– Fuchs Renosafe 500

– Houghton Houghto Safe 620

– Union Carbide HP 5046

Operation on HFC-fluids is only possible when their properties and values correspond to ISO 12922.

For HFC-fluids, other than the above mentioned ones, limitations of the technical data according to RE 90223 must be observed.

For operation on rolling oils and HFA-fluids, please consult us.

The notes on filtration, limit of viscosity and temperature range must also be observed.

Operating viscosity range

see RA 92050

Limit of viscosity range

For critical operating conditions the following values apply:

ν_{min} = 60 SSU (10 mm²/s)
for short periods (t < 1min),
t_{max} < 122 °F (+50 °C)

ν_{max} = 4600 SSU (1000 mm²/s)
only during start (cold start, within 15 min an operating viscosity below 460 SSU (100 mm²/s) should be reached) t_{min} > +14 °F (–10 °C)

Selection diagram and notes on the selection of hydraulic fluid

see RA 92050

Temperature range

$t_{min} \geq$ +14 °F (–10 °C)

$t_{max} \leq$ 122 °F (+50 °C)

t_{opt} = 104 °F (+40 °C)

Higher temperatures are not permissible since this will result in a substantial loss of water content.

When meeting the limits of viscosity and temperature, operation on HFC-fluids is also allowed at low temperatures.

Important: The case drain fluid temperature is influenced by speed and pressure, and is always higher than the tank temperature. However the max. temperature at any point in the system may not exceed 122 °F (50 °C).

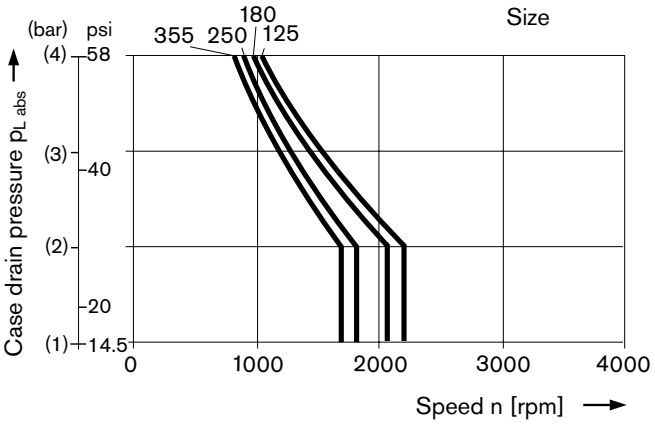
Filtration of the hydraulic fluid

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 (weight of filtrations membranes) is necessary for the hydraulic fluid to determine the amount of contamination by solid matter and to determine the cleanliness level similar to ISO 4406. A cleanliness level of at least –/18/15 is to be maintained.

Case drain pressure

The permissible case drain pressure (housing pressure) depends on drive speed (see diagram).



Maximum case drain pressure (housing pressure)

$p_{L\ abs\ max}$ _____ 58 psi (4 bar) absolute

These are approximate values; under certain operating conditions a reduction in these values may be necessary

Direction of flow

S to B (like in RA 92050)

Technical data

Bearing flushing

Operating with HFC-fluids **requires external bearing flushing**.

The flushing flow is carried out via port „U“, located in the front flange of the axial piston pump. The flushing fluid flows through the front bearing and leaves the housing together with the case drain flow.

Important

1. Minimum required flushing flow $q_{fl\ min}$ in port U see table
2. Maximum permissible pressure p_{max} in port U see table
3. Reference flushing flow $q_{fl\ ref}$ to check the minimum required flushig flow (see example)

Size		125	180	250	355
$q_{fl\ min}$	gpm (L/min)	0.26 (1.0)	0.40 (1.5)	0.53 (2.0)	0.80 (3.0)
p_{max}	psi (bar)	72 (5.0)	72 (5.0)	72 (5.0)	72 (5.0)
$q_{fl\ ref}$	gpm (L/min)	0.92 (3.5)	1.32 (5.0)	1.72 (6.5)	2.64 (10.0)

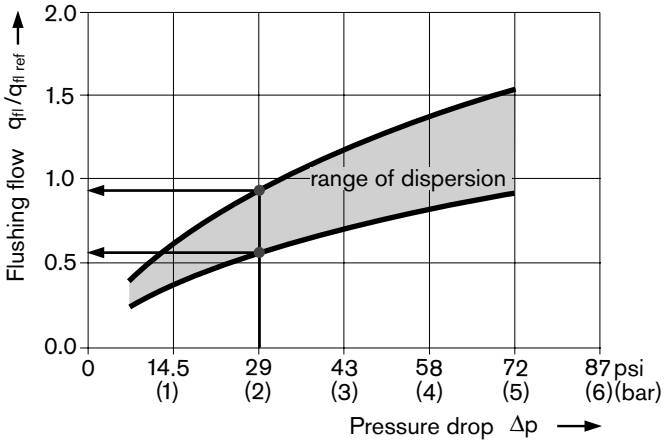
Note

Make sure that the throttle screw in port U is turned in all the way.

Notes for setting and checking the flushing flow:

The flushing flow is dependent on the pressure difference Δp between U-port inlet and housing ($\Delta p = p_U - p_{hous}$).
This correlation is depicted, independently of the pump size, in the following diagram.

Flushing flow through the U-port



Example:

Type: AA4VSO 250...F
Housing pressure: p_{hous} = 14.5 psi (1 bar)
Pressure in port U: p_U = 43 psi (3 bar)
Δp = 29 psi (2 bar)

– The table on the left side of this page shows a reference flushing flow $q_{fl\ ref}$ = 1.72 gpm (6.5 L/min)

– The above diagram shows the limits of the flushing flow range
$q_{fl\ 1} = 0.56 \bullet q_{fl\ ref}$ = 0.95 gpm (3.6 L/min)
$q_{fl\ 2} = 0.94 \bullet q_{fl\ ref}$ = 1.61 gpm (6.1 L/min)

– with this pressure drop of 29 psi (2 bar) the minimum required flushing flow of $q_{fl\ min}$ = 0.53 gpm (2 L/min) is reached. A flow check should confirm a flushing flow within this range

Technical data

Operating pressure at pump inlet

Absolute pressure at port S (inlet port)

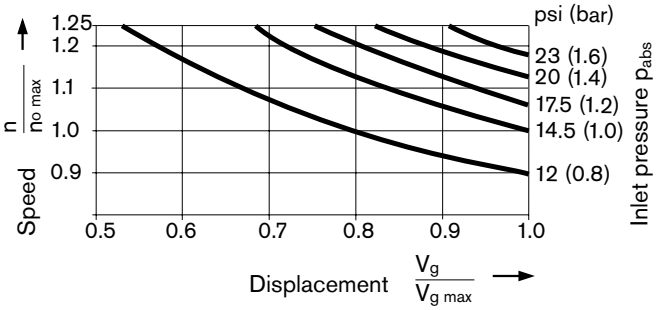
$p_{abs\ min}$ _____ 12 psi (0.8 bar) absolute

$p_{abs\ max}$ _____ 435 psi (30 bar) absolute

The density of almost all HF-fluids is higher than the density of mineral oil. It is therefore absolutely necessary to ensure, that the inlet pressure $p_{abs\ min}$ does not fall below the min. permissible 12 psi (0.8 bar) value.

All measures, which could obstruct the suction performance must be avoided (eg. suction filter).

Determination of inlet pressure p_{abs} at the inlet port S or reduction of displacement with increase of drive speed



The inlet pressure is the static feed pressure or the minimum dynamic value of the boost pressure.

Important:
Observe the maximum permissible drive speed $n_{o\ max.\ zul.}$ (speed limit) see page 6

Operating pressure range outlet

see RA 92050

Technical data

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

Size	NG		125	180	250	355
Displacement	$V_{g\ max}$	in³ (cm³)	7.63 (125)	10.98 (180)	15.26 (250)	21.65 (355)
Speed [1]						
maximum at $V_{g\ max}$	$n_{o\ max}$	rpm	1800	1800	1800	1500
maximum at $V_g \leq V_{g\ max}$ (speed limit)	$n_{o\ max\ zul.}$	rpm	2200	2100	1800	1700
minimum	$n_{o\ min}$	rpm	800	800	800	800
Flow						
at $n_{o\ max}$	$q_{vo\ max}$	gpm (L/min)	59.4 (225)	85.6 (324)	99 (375)	141 (533)
at n_E = 1500 rpm	$q_{VE\ max}$	gpm (L/min)	49.1 (186)	71.3 (270)	99 (375)	141 (533)
Power Δp = 5100 psi (350 bar)						
at $n_{o\ max}$	$P_{o\ max}$	HP (kW)	176 (131)	254 (189)	294 (219)	417 (311)
at n_E = 1500 rpm	$P_{E\ max}$	HP (kW)	146 (109)	212 (158)	294 (219)	417 (311)
Torque						
at $V_{g\ max}$ Δp = 5100 psi (350 bar)	T_{max}	lb-ft (Nm)	513 (696)	739 (1002)	1026 (1391)	1457 (1976)
Δp = 1450 psi (100 bar)	T	lb-ft (Nm)	147 (199)	211 (286)	294 (398)	416 (564)
Torsional stiffness						
Shaft end K	c	lb-ft/rad (kNm/rad)	191765 (260)	241920 (328)	388695 (527)	590050 (800)
Shaft end S	c	lb-ft/rad (kNm/rad)	193980 (263)	244870 (332)	400495 (543)	567920 (770)
Moment of inertia Rotary unit	J_{TW}	lb-ft² (kgm²)	0.712 (0.03)	1.305 (0.055)	2.276 (0.0959)	4.503 (0.19)
Angular acceleration maximum [2]	α	rad/s²	8000	6800	4800	3600
Case volume	V	gal (L)	1 (4)	1.3 (5)	2.6 (10)	2.1 (8)
Weight (with pressure control) approx.	m	lbs (kg)	194 (88)	224 (102)	409 (184)	455 (207)

1) Values are valid with inlet pressure p_{abs} 14.5 psi (1 bar) at inlet port S, with increased speed up to speed limit please observe diagram, page 5

2) – The range of validity lies between the minimum required and the maximum permissible drive speeds. Valid for external excitation (eg. diesel engine 2- to 8-fold rotary frequency, cardan shaft 2 fold rotary frequency).
– The limiting value is only valid for a single pump.
– The loading capacity of the connecting parts must be considered..

Caution: Exceeding the maximum or minimum permissible values can lead to a loss of function, a reduction in operational service life or total destruction of the axial piston unit.
The permissible values can be determined through calculation.

Determination of pump size

Flow $q_V = \frac{V_g \cdot n \cdot \eta_V}{231}$ [gpm] $\left(\frac{V_g \cdot n \cdot \eta_V}{1000} \text{ [L/min]} \right)$

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

Power $P = \frac{q_V \cdot \Delta p}{1714 \cdot \eta_t}$ [HP] $\left(\frac{q_V \cdot \Delta p}{600 \cdot \eta_t} \text{ [kW]} \right)$

V_g = geometr. displacement per rev. in in³ (cm³)
Δp = pressure difference in psi (bar)
n = speed in rpm
η_V = volumetric efficiency
η_{mh} = mechanical-hydraulic efficiency
η_t = overall efficiency ($\eta_t = \eta_V \cdot \eta_{mh}$)

Permissible radial and axial forces on the drive shaft

see RA 92050

Installation notes

General check on components

It must be checked, that every component in the system is suitable for the chosen hydraulic fluid. At the same time it must be ascertained, that seal and hose materials and casings, as well as paint finishes are compatible with the hydraulic fluid.

Reservoir

HF fluids feature poor air and contamination seperating properties.

The seperating capacity can be improved by a longer dwell time in the tank, thus by using a larger reservoir. In addition, baffles may be installed, either with openings or as weirs, with meshes fitted in the openings (settling of the fluid).

The lower temperature limits require a controlled cooling of the fluid. A large reservoir surface improves the natural cooling capacity of the system.

Evaporation losses may be considerably reduced by using a tank breather.

Installation position

No restrictions in comparison with the AA4VSO (RA 92050).

Commissioning

Following correct filling with the operating fluid, start the system under partial load and gradually increase to full load. After operation of all components, the system must carefully bled.

Filters and fluid must be carefully monitored, especially during the first few days of operation. Paint deposits and any remaining old fluid must be removed.

Literature references

ISO 12922 similar to the 7. Luxembourg report

VDMA standard 24314 (Conversion guidelines)

General information

– The pump AA4VSO was designed for operation in open loop circuits.

– Systems design, installation and commissioning requires trained technicians or tradesmen.

– All hydraulic ports can only be used for the fastening of hydraulic service lines.

– Tightening torques:
  - All tightening torques mentioned in this data sheet are maximum values and may not be exceeded. (Maximum values for the female threads in the castings). Please comply with the manufacturer‘s information regarding the max. permissible tightening torques for the used fittings.
  - For fastening screws to ISO 68 / DIN 13 we recommend to check the permissible tightening torque in each individual case acc. to VDI 2230 issue 2003.

– During and shortly after operation of a pump the housing and especially a solenoid can be extremely hot. Take suitable safety measures (e.g. wear protective clothing).

– All given data and information has to be adhered to.

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

Bosch Rexroth Corporation
2315 City Line Road
Bethlehem, PA 18017-2131, USA
Telephone (610) 694-8300
Facsimile (610) 694-8467
www.boschrexroth-us.com

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Subject to change.

Rexroth
Bosch Group

Universal Through Drive
A10VSO; A4VSO; A15VSO

RE 95581/01.12 **1**/12
Replaces: 12.05

Data sheet



A10VSO series 32; sizes 45 to 180
A4VSO series 30; sizes 125 to 355
A15VSO series 10; sizes 175 to 280

Contents

Universal trough drive – adapter kits 2
Overview of material numbers 3
General instructions 12

Features

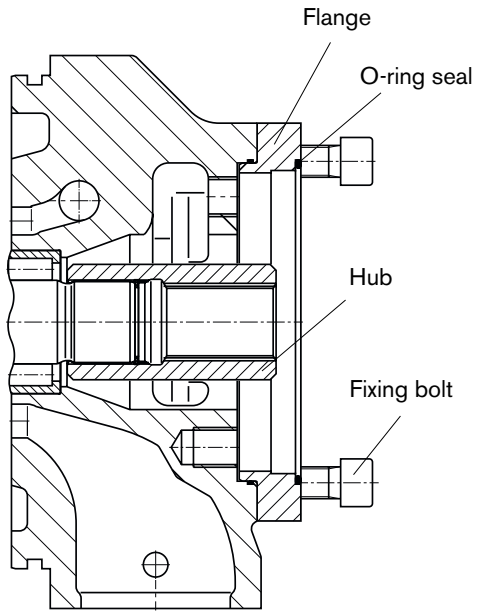
- Flexibler universal through drive
- The through drives are exchangeable without machining the port plate

For more information see data sheet:

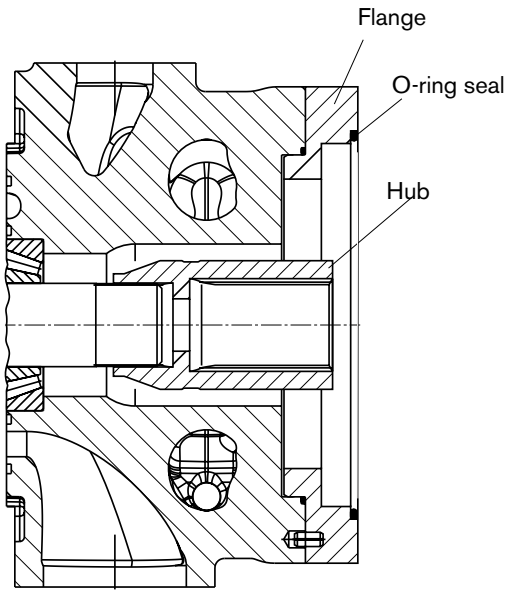
RE 92050 A4VSO
RE 92800 A15VSO
RE 92714 A10VSO
RE 92705 A10VO
RE 91485 A10VZO

Universal trough drive – adapter kits

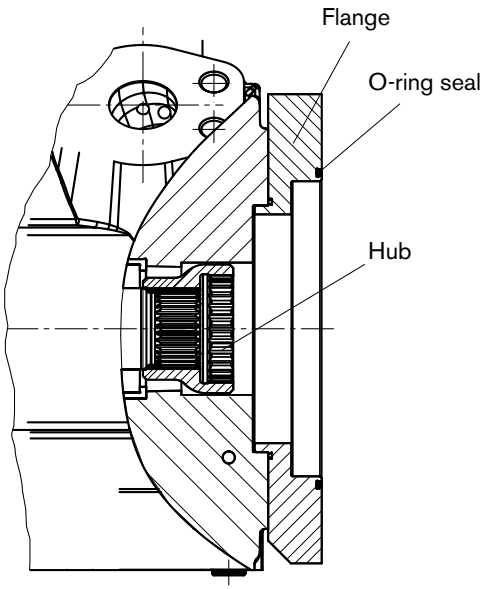
A4VSO…/30



A10VSO…/32



A15VSO…/10



Assembly group

The through drives come as assembly group. The assembly group „flange and hub“ includes flange, hub, cylinder head screws and O-ring seal.
Fixing screws for the 2. Pump will be delivered only for universal through drives of the A4VSO.

Overview of material numbers

Material Number

In the column „Code“ you will find the name of the through drive. This corresponds to the ordering code in the technical data sheet (see first page). The column „Available for Pump“ specifies for which pump, respectively for which size the through drive is available. The column „Length to Pump Mounting Face“ shows the maximum length to the pump´s flange. The column assembly group „Cover“ and assembly group „Flange and Hub“ shows the until now and paticulate new part numbers of the universal through drive kits.

Code	Available for pump	Length to pump mounting face in mm	Assembly group „Cover“ cover, cylinder screws	
			Until now material number	New material number
U000	A15VSO 175	327	R902473330 (Cover, O-Ring, Cylinder Screw)	–
	A15VSO 210	345		
	A15VSO 280	387		
U99	A4VSO125	359	R902438778	–
	A4VSO180	383		
until now **U99** **New U00**	A10VSO45/32	254	–	R902496168
	A10VSO71/32	289	R902438778[1)]	R902496186
U99	A4VSO250	443	R902444736	–
	A4VSO355	472		
until now **U99** **New U00“**	A10VSO100/32	350		R902496173
	A10VSO140/32	367		
	A10VSO180/32	377		
ISO 3019-2			**Assembly group „Flange and Hub“ flange, hub, cylinder screw**	
UB2	A4VSO125	369	R902446991	–
	A4VSO180	393		
	A10VSO45/32	264	–	R902496439
	A10VSO71/32	299	R902446992[1)]	R902496440
	A4VSO250	453	R902446993	–
	A4VSO355	482		
	A10VSO100/32	360	R902446994[1)]	R902496441
	A10VSO140/32	377	R902446995[1)]	R902496442
	A10VSO180/32	387	–	R902496443
UB3	A4VSO125	369	R902446996	–
	A4VSO180	393		
	A10VSO45/32	264	–	R902492531
	A10VSO71/32	299	R902446997	R902496444
	A4VSO250	453	R902446998	–
	A4VSO355	482		
	A10VSO100/32	360	R902446999[1)]	R902496445
	A10VSO140/32	377	R902447000[1)]	R902496446
	A10VSO180/32	387	–	R902496447

1) Equates to U99, not for new projects

Overview of material numbers

Code	Available for pump	Length to pump mounting face in mm	Assembly group „Flange and Hub“ flange, hub, cylinder screw	
			Until now material number	New material number
UB4	A4VSO125	369	R902447001	–
	A4VSO180	393		
	A10VSO45/32	264	–	R902496448
	A10VSO71/32	299	R902447002[1)]	R902496449
	A4VSO250	453	R902447003	–
	A4VSO355	482		
	A10VSO100/32	360	R902447004[1)]	R902496450
	A10VSO140/32	377	R902447005[1)]	R902496451
	A10VSO180/32	387	–	R902496452
UB5	A4VSO125	369	R902447006	–
	A4VSO180	393		
	A10VSO45/32	264	–	R902496453
	A10VSO71/32	299	R902451441[1)]	R902496454
	A4VSO250	453	R902447007	–
	A4VSO355	482		
	A10VSO100/32	360	R902451442[1)]	R902496455
	A10VSO140/32	377	R902451443[1)]	R902496456
	A10VSO180/32	387	–	R902496457
UE1	A10VSO 45/32	264	R902497739[1)]	R902510125
	A10VSO 71/32	299	R902492823[1)]	R902510126
	A10VSO 100/32	360	R902488254[1)]	R902510127
	A10VSO 140/32	377	R902491915[1)]	R902510128
	A10VSO 180/32	387	–	R902510129
UB6	A4VSO125	369	R902447008	–
	A4VSO180	393		
	A4VSO250	453	R902447009	–
	A4VSO355	482		
U31	A4VSO125	369	R902447010	–
	A4VSO180	393		
	A4VSO250	453	R902447011	–
	A4VSO355	482		
U33	A4VSO125	369	R902447012	–
	A4VSO180	393		
	A4VSO250	453	R902447013	–
	A4VSO355	482		

1) Equates to U99, not for new projects

Overview of material numbers

Code	Available for pump	Length to pump mounting face in mm	Assembly group „Flange and Hub“ flange, hub, cylinder screw	
			Until now material number	New material number
UB8	A4VSO125	369	R902447014	–
	A4VSO180	393		
	A10VSO71/32	299	R902447015	R902496458
	A4VSO250	453	R902447016	–
	A4VSO355	482		
	A10VSO100/32	360	R902447017[1)]	R902496459
	A10VSO140/32	377	R902447018[1)]	R902496460
	A10VSO180/32	387	–	R902496461
U34	A4VSO125	369	R902447019	–
	A4VSO180	393		
	A4VSO250	453	R902447020	–
	A4VSO355	482		
UB9	A4VSO125	382	R902447021	–
	A4VSO180	406		
	A4VSO250	453	R902447022	–
	A4VSO355	482		
	A10VSO100/32	360	R902447023[1)]	R902496462
	A10VSO140/32	377	R902447024[1)]	R902496463
	A10VSO180/32	387	–	R902496464
UB7	A4VSO180	406	R902447025	–
	A4VSO250	453	R902447026	–
	A4VSO355	482		
	A10VSO140/32	377	R902447027[1)]	R902496465
	A10VSO180/32	387	–	R902496466
U35	A4VSO250	469	R902447028	–
	A4VSO355	498		
U77	A4VSO355	498	R902447029	–

1) Equates to U99, not for new projects

Overview of material numbers

ISO 3019-1 (SAE J744)

(The lengths to the pump mounting face are valid for the SAE version. The metric pumps are 2mm shorter.)

Code	Available for pump	Length to pump mounting face in mm	Assembly group „Flange and Hub“ flange, hub, cylinder screw	
			Until now material number	New material number
A1S2	A15VSO 175	327	in preparation	–
	A15VSO 210	372	in preparation	–
	A15VSO 280	387	in preparation	–
A2S2	A15VSO 175	327	in preparation	–
	A15VSO 210	372	in preparation	–
	A15VSO 280	387	in preparation	–
U01	A4VSO125	369	R902447030	–
	AA4VSO125	371		
	A4VSO180	393		
	AA4VSO180	395		
	A10VSO45/32	264	–	R902496467
	A10VSO71/32	299	R902447031[1)]	R902496468
	A4VSO250	453	R902447032	–
	AA4VSO250	455		
	A4VSO355	482		
	AA4VSO355	484		
	A10VSO100/32	360	R902447033[1)]	R902496469
	A10VSO140/32	377	R902447034[1)]	R902496470
	A10VSO180/32	387	–	R902496471
U52	A4VSO125	369	R902447035	–
	AA4VSO125	371		
	A4VSO180	393		
	AA4VSO180	395		
	A10VSO45/32	264	–	R902496472
	A10VSO71/32	299	R902447036[1)]	R902496473
	A4VSO250	453	R902447037	–
	AA4VSO250	455		
	A4VSO355	482		
	AA4VSO355	484		
	A10VSO100/32	360	R902447038[1)]	R902496474
	A10VSO140/32	377	R902447039[1)]	R902496475
	A10VSO180/32	387	–	R902496476
B1S4	A15VSO 175	327	in preparation	–
	A15VSO 210	372	in preparation	–
	A15VSO 280	414	R902481625	R902497163
B2S4	A15VSO 175	354	R902485107	R902496014
	A15VSO 210	372	R902485107	R902496014
	A15VSO 280	414	R902484088	R902497165
B5S4	A15VSO 175	327	in preparation	–
	A15VSO 210	372	in preparation	–
	A15VSO 280	387	in preparation	–

1) Equates to U99, not for new projects

Overview of material numbers

Code	Available for pump	Length to pump mounting face in mm	Assembly group „Flange and Hub“ flange, hub, cylinder screw	
			Until now material number	New material number
U68	A4VSO125	369	R902447040	–
	AA4VSO125	371		
	A4VSO180	393		
	AA4VSO180	395		
	A10VSO45/32	264	–	R902496477
	A10VSO71/32	299	R902447041[1)]	R902496478
	A4VSO250	453	R902447042	–
	AA4VSO250	455		
	A4VSO355	482		
	AA4VSO355	484		
	A10VSO100/32	360	R902447043[1)]	R902496479
	A10VSO140/32	377	R902447044[1)]	R902496480
	A10VSO180/32	387	–	R902496481
B5S5	A15VSO 175	327	in preparation	–
	A15VSO 210	372	in preparation	–
	A15VSO 280	387	in preparation	–
U04	A4VSO125	369	R902447045	–
	AA4VSO125	371		
	A4VSO180	393		
	AA4VSO180	395		
	A10VSO45/32	264	–	R902496482
	A10VSO71/32	299	R902447046[1)]	R902496663
	A4VSO250	453	R902447047	–
	AA4VSO250	455		
	A4VSO355	482		
	AA4VSO355	484		
	A10VSO100/32	360	R902447048[1)]	R902496664
	A10VSO140/32	377	R902447049[1)]	R902496665
	A10VSO180/32	387	–	R902496666
UE2	A10VSO 45/32	264	–	R902510131
	A10VSO 71/32	299	R902489415[1)]	R902510132
	A10VSO 100/32	360	R902510130[1)]	R902510133
	A10VSO 140/32	377	R902489414[1)]	R902510134
	A10VSO 180/32	387	–	R902510135
C1S7	A15VSO 175	327	in preparationg	–
	A15VSO 210	372	in preparation	–
	A15VSO 280	387	in preparation	–
U07	A4VSO125	369	R902447050	–
	AA4VSO125	371		
	A4VSO180	393		
	AA4VSO180	395		
	A4VSO250	453	R902447051	–
	AA4VSO250	455		
	A4VSO355	482		
	AA4VSO355	484		

1) Equates to U99, not for new projects

Overview of material numbers

Code	Available for pump	Length to pump mounting face in mm	Assembly group „Flange and Hub“ flange, hub, cylinder screw	
			Until now mateial number	New Material number
C1S9	A15VSO 175	327	in preparation	–
	A15VSO 210	372	in preparation	–
	A15VSO 280	387	in preparation	–
C2S9	A15VSO 175	354	R902487896	–
	A15VSO 210	372	R902487896	–
	A15VSO 280	414	R902485145	–
U24	A4VSO125	369	R902447052	–
	AA4VSO125	371		
	A4VSO180	393		
	AA4VSO180	395		
	A4VSO250	453	R902447053	–
	AA4VSO250	455		
	A4VSO355	482		
	AA4VSO355	484		
	A10VSO 100/32	360	R902479709[1)]	R902510136
	A10VSO 140/32	377	R902463283[1)]	R902510137
	A10VSO 180/32	387	–	R902510138
U15	A4VSO125	369	R902447054	–
	AA4VSO125	371		
	A4VSO180	393		
	AA4VSO180	395		
	A4VSO250	453	R902447055	–
	AA4VSO250	455		
	A4VSO355	482		
	AA4VSO355	484		
	A10VSO 71/32	299	R902482578[1)]	R902510139
	A10VSO 100/32	360	R902461290[1)]	R902510140
	A10VSO 140/32	377	R902479710[1)]	R902510141
	A10VSO 180/32	387	–	R902510142
U16	A4VSO125	369	R902447056	–
	AA4VSO125	371		
	A4VSO180	393		
	AA4VSO180	395		
	A4VSO250	453	R902447057	–
	AA4VSO250	455		
	A4VSO355	482		
	AA4VSO355	484		

1) Equates to U99, not for new projects

Overview of material numbers

Code	Available for pump	Length to pump mounting face in mm	Assembly group „Flange and Hub“ flange, hub, cylinder screw	
			Until now material number	New material number
U96	A4VSO125	369	R902447058	–
	AA4VSO125	371		
	A4VSO180	393		
	AA4VSO180	395		
	A4VSO250	453	R902447059	–
	AA4VSO250	455		
	A4VSO355	482		
	AA4VSO355	484		
	A10VSO100/32	360	R902447060[1)]	R902496667
	A10VSO140/32	377	R902447061[1)]	R902496668
	A10VSO180/32	387	–	R902496669
D4T1	A15VSO 175	372	R902495015	–
	A15VSO 210	390	R902495015	–
	A15VSO 280	387	in preparation	–
U17	A4VSO125	382	R902447062	–
	AA4VSO125	384		
	A4VSO180	406		
	AA4VSO180	408		
	A4VSO250	453	R902447063	–
	AA4VSO250	455		
	A4VSO355	482		
	AA4VSO355	484		
	A10VSO140/32	377	R902447064[1)]	R902496670
	A10VSO180/32	387	–	R902496671
U78	A4VSO180	431	R902447065	–
	AA4VSO180	433		
	A4VSO250	479	R902447066	–
	AA4VSO250	481		
	A4VSO355	508		
	AA4VSO355	510		
E4A2	A15VSO 175	363	R902495006	–
	A15VSO 210	381	R902495006	–
	A15VSO 280	423	R902485669	R902495955
E4A4	A15VSO 280	423	R902474356	R902495953
U18	A4VSO250	479	R902447067	–
	AA4VSO250	481		
	A4VSO355	508		
	AA4VSO355	510		
U72	A4VSO250	479	R902453019	–
	AA4VSO250	481		
	A4VSO355	508		
	AA4VSO355	510		

1) Equates to U99, not for new projects

Axial piston variable pump (A)A4VSO

RA 92050-A/06.09 1/64
Replaces: 09.97

Data sheet



Series 10, 11 and 30
Size 40...1000
Nominal pressure 5100 psi (350 bar)
Peak pressure 5800 psi (400 bar)
Open circuit

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Features

- Axial piston pump in swash plate design for hydrostatic drives in open circuit operation
- The flow is proportional to the input drive speed and displacement. By adjusting the swash plate angle it is possible to infinitely vary the output flow.
- Excellent suction characteristics
- Low noise level
- Long service life
- Modular design
- Short response times
- Wide range of through drive options
- Visual swivel angle indicator
- Optional mounting position
- Operation on HF-fluids under reduced operational data possible
  A special version is available for operation with HFC-fluid see data sheet RA 92053

For the descriptions of the control devices see the separate RA (RE) data sheets
RE 92056, RA 92060, RA 92064,
RE 92072, RA 92076, RA 92080, RE 92088

Type code for standard program[1)]

	(A)A4VS		O			/			–						
01	02	03	04	05	06		07	08		09	10	11	12	13	14

Hydraulic fluid / Version

		40	71	125	180	250	355	500	750	1000	
01	Mineral oil and HFD-fluids (no code)	●	●	●	●	●	●	●	●	●	
	HFA-, HFB- and HFC-Fluids	●	●	–	–	–	–	●	–	–	**E**
	For operation on HFC-special performance version see RA 92053 (HFA and HFB see RE 90223)			●	●	●	●				
	High-Speed-Version	–	–	–	–	●	●	●	–	–	**H**

Axial piston unit

02	Swash plate design, variable	SAE-version	●	●	●	●	●	●	–	–	–	**AA4VS**
		Metric-version	–	–	–	–	–	–	●	●	●	**A4VS**[2)]

Boost pump (Impeller)

03	without boost pump (no code)	●	●	●	●	●	●	●	●	●	
	with boost pump (Impeller) only with port plate 25 (service port connections)	–	–	–	–	–	–	–	●	–	**L**

Type of operation

04	Pump, open circuit	**O**

Size

			40	71	125	180	250	355	500	750	1000
05	Displacement $V_{g\ max}$	in^3/rev.	2.44	4.33	7.63	10.98	15.26	21.66	30.51	45.76	61.02
		(cm^3/rev.)	(40)	(71)	(125)	(180)	(250)	(355)	(500)	(750)	(1000)

Control devices

06	Pressure control	(RA 92060)	DR	●	●	●	●	●	●	●	●	●	**DR..**
	Pressure control for parallel operation		DP	●	●	●	●	●	●	●	●	●	**DP..**
	Flow control		FR	●	●	●	●	●	●	–	–	–	**FR..**
	Pressure and flow control		DFR	●	●	●	●	●	●	–	–	–	**DFR..**
	Power control with hyperbolic curve	(RA 92064)	LR	●	●	●	●	●	●	●	●	●	**LR..**[3)]
	Manual control	(RE 92072)	MA	●	●	●	●	●	●	●	–	–	**MA..**
	Electric motor control		EM	●	●	●	●	●	●	●	–	–	**EM..**
	Hydraulic control, control volume dependent	(RA 92076)	HM	●	●	●	●	●	●	●	●	●	**HM..**
	Hydr. control, with servo/proportional valve		HS	●	●	●	●	●	●	●	●	●	**HS..**[3)]
	Electronic control		EO	●	●	●	●	●	●	●	●	●	**EO..**[3)]
	Hydraulic control, pilot pressure dependent	(RA 92080)	HD	●[4)]	●[4)]	●	●	●	●	●	●	●	**HD..**[3)]
	Secondary speed control	(RE 92056)	DS1	●	●	●	●	●	●	●	●	❍	**DS1..**[3)]
	Electro-hydraulic control system DFE1 System solution SYHDFEE	(RE 92088) (RE 30035)		●	●	●	●	●	●	–	–	–	**DFE1..**[3)]

Series

07		●	●	–	–	–	–	–	–	–	**10(11)**[4)]
		–	–	●	●	●	●	●	●	●	**30**

[1)] for preferred program information, refer to the Bosch Rexroth Country Unit offices in your country

[2)] for metric version all sizes, see RE 92050

[3)] when operating on HF-fire resistant fluids, observe the limitations as shown in the relevant data sheets of the control devices and the mounted valves

[4)] Versions with HD-controls only in series 11

● = available ❍ = in preparation – = not available

Type code for standard program[1)]

	(A)A4VS		O			/			–						
01	02	03	04	05	06		07	08		09	10	11	12	13	14

Direction of rotation

08	with view on shaft end	clockwise	R
		counter-clockwise	L

	Seals	**40**	**71**	**125**	**180**	**250**	**355**	**500**	**750**	**1000**	
09	NBR (Nitrile-rubber), Shaft seal FKM (Fluoro-rubber)	●	●	●	●	●	●	●	●	●	**P**
	FKM (Fluoro-rubber) / for operation on HFD	●	●	●	●	●	●	●	●	●	**V**
	HFC-special performance version see RA 92053	–	–	●	●	●	●	–	–	–	**F**

Shaft end

10	SAE parallel keyed shaft to ISO 3019-1	●	●	●	●	●	●	–	–	–	**K**
	SAE splined shaft to ISO 3019-1	●	●	●	●	●	–	–	–	–	**S**
	SAE splined shaft similar to ISO 3019-1	–	–	–	–	–	●	–	–	–	**R**
	Metric keyed parallel shaft to DIN 6885	–	–	–	–	–	–	●	●	●	**P**
	Metric splined shaft to DIN 5480	–	–	–	–	–	–	●	●	●	**Z**

	Mounting flange		**40**	**71**	**125**	**180**	**250**	**355**	**500**	**750**	**1000**	
11	to ISO 3019-1 (SAE J 744)	4-bolt	●	●	●	●	●	●	–	–	–	**D**
	similar to ISO 3019-2 metric	8-bolt	–	–	–	–	–	–	●	●	●	**H**

Service line connections

12	Port B and S: SAE flange on side, 90° offset, UNC mounting bolts		●	●	●	●	●	●	–	–	–	**63** [2)]
	Port B and S: SAE flange on side, 90° offset, 2nd pressure port B_1, opposite to B – closed with blanking plate on delivery	UNC mounting bolts	●	●	●	●	●	●	–	–	–	**75**
		metric mounting bolts	–	–	–	–	–	–	●	●	●	**25**

[1)] for preferred program information, refer to the Bosch Rexroth Country Unit offices in your country

[2)] only with through drive code N00 and K..

● = available – = not available

continuation of type code see page 4

Type code for Standard program[1)]

	(A)A4VS		O			/			–						
01	02	03	04	05	06		07	08		09	10	11	12	13	14

	Through drive			40	71	125	180	250	355	500	750	1000	
	without auxiliary pump, without through drive			●	●	●	●	●	●	●	●	●	N00
	with through drive for mounting an axial piston unit, gear or radial piston pump			●	●	–	–	–	–	●	●	●	K...
	Universal through drive, can be adapted			–	–	●	●	●	●	–	–	–	U...
	Flange	splined shaft coupler [2)]	to mount										
	127-4 (SAE C, 4-bolt)	32-4 (SAE C)	AA4VSO/G 40	●	●	●	●	●	●	–	–	–	15
	127-4 (SAE C, 4-bolt)	38-4 (SAE C-C)	AA4VSO/G 71	–	●	●	●	●	●	–	–	–	16
	152-4 (SAE D, 4-bolt)	44-4 (SAE D)	AA4VSO/G 125	–	–	●	●	●	●	–	–	–	17
	152-4 (SAE D, 4-bolt)	50-4 (SAE F)	AA4VSO/G 180	–	–	–	●	●	●	–	–	–	78
	165-4 (SAE E, 4-bolt)	50-4 (SAE F)	AA4VSO/G 250	–	–	–	–	●	●	–	–	–	18
	165-4 (SAE E, 4-bolt)	50-4 (similar to SAE F)	AA4VSO/G 355	–	–	–	–	–	●	–	–	–	18
	125, 4-bolt (ISO[3)])	32x2x14x9g	A4VSO/G 40	–	–	–	–	–	–	●	❍	❍	31
	140, 4-bolt (ISO[3)])	40x2x18x9g	A4VSO/G 71	–	–	–	–	–	–	●	●	❍	33
	160, 4-bolt (ISO[3)])	50x2x24x9g	A4VSO/G 125 u. 180	–	–	–	–	–	–	●	●	❍	34
	224, 4-bolt (ISO[3)])	60x2x28x9g	A4VSO/G, A4CSG 250	–	–	–	–	–	–	●	●	❍	35
	224, 4-bolt (ISO[3)])	70x3x22x9g	A4VSO/G, A4CSG 355	–	–	–	–	–	–	●		❍	77
	315, 8-bolt (ISO[3)])	80x3x25x9g	A4VSO/G, A4CSG 500	–	–	–	–	–	–	●	●	❍	43
	400, 8-bolt (ISO[3)])	90x3x28x9g	A4VSO/G, A4CSG 750	–	–	–	–	–	–	–	●	❍	76
13	400, 8-bolt (ISO[3)])	100x3x32x9g	A4VSO/G 1000	–	–	–	–	–	–	–	–	●	88
	82-2(SAE A)	5/8in 16-4 (SAE A)	AZ-PF-1X-004...022	●	●	●	●	●	●	●	●	❍	01
	82-2(SAE A)	3/4in 19-4 (SAE A-B)	A10VSO 10, 18/31/52(3)	●	●	●	●	●	●	❍	❍	❍	52
	101-2 (SAE B)	7/8in 22-4 (SAE B)	AZ-PN-1X-020...032, (A)A10V(S)O 28/31/52(3)	●	●	●	●	●	●	●	❍	❍	68
	101-2 (SAE B)	1in 25-4 (SAE B-B)	PGH4, (A)A10V(S)O45/31	●	●	●	●	●	●	●	❍	❍	04
	127-2 (SAE C)	1 1/4in 32-4 (SAE C)	(A)A10V(S)O 71/31	–	●	●	●	●	●	●	❍	❍	07
	127-2 (SAE C)	1 1/2in 38-4 (SAE C-C)	PGH5, (A)A10V(S)O100/31	–	–	●	●	●	●	●	❍	❍	24
	152-4 (SAE D)	1 3/4in 44-4 (SAE D)	(A)A10V(S)O 140/31(2)	–	–	–	●	●	●	●	❍	❍	17
	80, 2-bolt (ISO[3)])	3/4in 19-4 (SAE A-B)	A10VSO 10/52, 18/31	–	–	–	–	–	–	❍	❍	❍	B2
	100, 2-bolt (ISO[3)])	7/8in 22-4 (SAE B)	A10VSO 28/31	–	–	–	–	–	–	❍	❍	❍	B3
	100, 2-bolt (ISO[3)])	1in 25-4 (SAE B-B)	A10VSO 45/31	–	–	–	–	–	–	●	❍	❍	B4
	125, 2-bolt (ISO[3)])	1 1/4in 32-4 (SAE C)	A10VSO 71/31	–	–	–	–	–	–	❍	❍	❍	B5
	160, 4-bolt (ISO[3)])	1 1/4in 32-4 (SAE C)	A10VSO 71/32	–	–	–	–	–	–	❍	❍	❍	B8
	125, 2-bolt (ISO[3)])	1 1/2in 38-4(SAE C-C)	A10VSO 100/31	–	–	–	–	–	–	❍	❍	❍	B6
	180, 4-bolt (ISO[3)])	1 1/2in 38-4 (SAE C-C)	A10VSO 100/32	–	–	–	–	–	–	❍	❍	❍	B9
	180, 4-bolt (ISO[3)])	1 3/4in 44-4 (SAE D)	A10VSO 140/31/32	–	–	–	–	–	–	●	❍	❍	B7
	Ø 63, metr.4-bolt	for keyed shaft Ø 25	R4	●	●	❍	❍	❍	❍	❍	❍	❍	57
	with through drive shaft, without coupler, without adapter flange, closed with cover plate			●	●	●	●	●	●	●	●	●	99

Filtration (only with HS- and DS-control)

14	without filter	N
	Sandwich plate filter (with HS- and DS-control see RA 92076 and RE 92056)	Z

[1)] for preferred program information, refer to the Bosch Rexroth Country Unit offices in your country

[2)] Keyed shaft coupler on K/U 57 through drive [3)] to ISO 3019-2 metric

Combination pumps

1. Combination pumps consisting of axial piston units – ordering example see page 38; overview mounting options see page 39
2. if delivery with mounted gear or radial piston pump is desired, please consult us.

● = available ❍ = in preparation – = not available

Technical data

Hydraulic fluid

For extensive information on the selection of hydraulic fluids and application conditions please consult our data sheets RA 90220 (mineral oils), RA 90221 (ecologically acceptable fluids) and RA 90223 (HF-fire resistant fluids).

The variable pump (A)A4VSO is suitable for operation on HF-fluids. (HFA, HFB, and HFC: ***E***A4VSO or A4VSO....***F*** HFD: standard version A4VSO with FKM seals)
However, limitations to the technical data, according to RA 90223 must be observed.

On certain selected HFC-fluids, pump sizes **125...355**, executed in accordance to RA 92053 can be operated with the **same pressures and speeds** as on mineral oil.

On operation with HFA and HFB-fluids, limitations of the technical data must be observed according to RA 90223.
On operation with rolling oil (e.g. kerosene + additives) please consult us.

When ordering, please state the fluid to be used.

Operating viscosity range

Within the operating viscosity range between 80...450 SUS (16...100 mm²/s) the units can be operated without limitations of the technical data.
In order to obtain optimum efficiency and service life, we recommend that the operating viscosity (at operating temperature) be selected in the range

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

referred to tank temperature (open circuit).

Limit of viscosity range

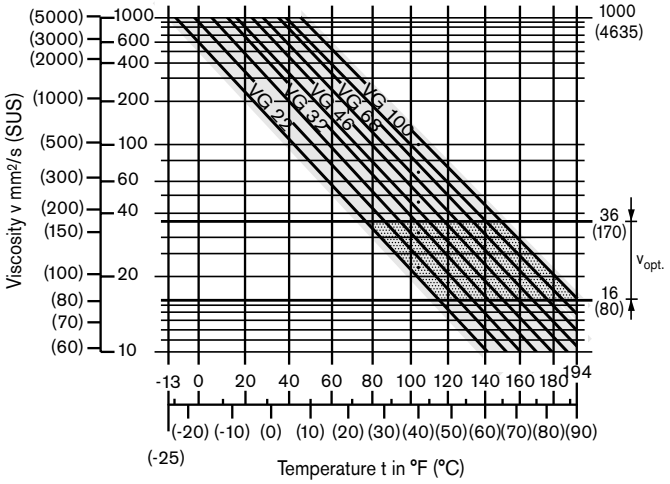
For critical operating conditions the following values apply:

ν_{min} = 60 SUS (10 mm²/s)
for short periods (t < 3 min)
at max. permissible case drain temperature
t_{max} = 194°F (+90°C).

ν_{max} = 4550 SUS (1000 mm²/s)
for short periods (on cold start, operating viscosity should be below 450 SUS (100 mm²/sec) within 15 minutes)
t_{min} = −13°F (−25°C)

For detailed information on operation with low temperatures see RA 90300-03-B.

Selection diagram



Notes on the selection of hydraulic fluid

In order to select the correct fluid, it is necessary to know the operating temperature in the tank (open circuit) in relation to the ambient temperature.

The hydraulic fluid should be selected so that within the operating temperature range, the viscosity lies within the optimum range (ν_{opt}); see shaded section in the selection diagram. We recommend, that the higher viscosity grade is selected in each case.

Temperature range (see selection diagram)

t_{min} = −13°F (−25° C)
t_{max} = 194°F (+90° C)

Example: at an ambient temperature of X° C the operating temperature in the tank is 140°F (60° C). In the optimum viscosity range (ν_{opt} ; shaded area), this corresponds to grades VG 46 or VG 68; select: VG 68.
Important: The case drain temperature is influenced by pressure and speed and is always higher than the tank temperature. However the max. temperature at any point in the system may not exceed 194°F (90° C).

Technical data

Bearing flushing

For the following operating conditions bearing flushing is required for a safe, continuous operation:

- Applications with special fluids (non mineral oils) due to limited lubricity and narrow operating temperature range
- Operation at critical conditions of temperature and viscosity with mineral oil

Flushing is recommended with vertical mounting (drive shaft facing upwards) in order to ensure lubrication of the front bearing and shaft seal.

Flushing is carried out via port „U“, located in the front flange area of the pump. The flushing fluid flows through the front bearing and leaves the pump together with the case drain flow.

Depending on pump size, the following flushing flows are recommended:

Size			40	71	125	180	250
recommended flushing flow	q_{Sp}	gpm	0.8	1.0	1.3	1.8	2.6
		(L/min)	(3)	(4)	(5)	(7)	(10)

Size			355	500	750	1000
recommended flushing flow	q_{Sp}	gpm	4.0	5.3	7.9	10.6
		(L/min)	(15)	(20)	(30)	(40)

These recommended flushing flows will cause a pressure drop of approx. 30 psi (2 bar) (series 1) and 45 psi (3 bar) (series 3) between the entrance to port„U“ and the pump case (including the pipe fittings).

Notes regarding series 30

When using external bearing flushing the throttle screw at port U must be turned in to the end stop.

Filtration of the fluid (Axial piston unit)

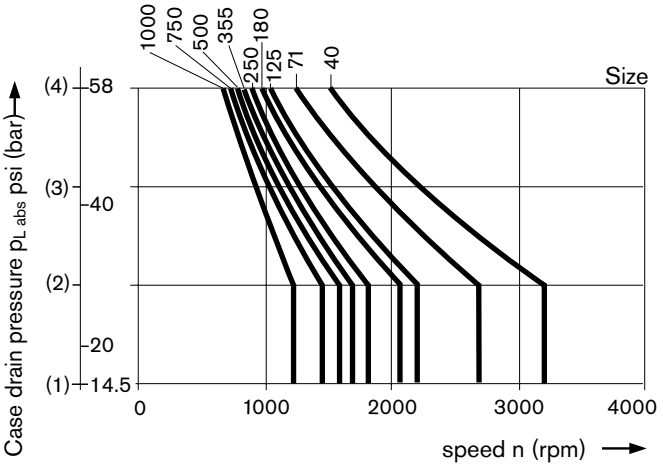
The finer the filtration, the better the achieved cleanliness of the fluid and the longer the life of the axial piston pump.

To ensure a reliable functioning of the axial piston unit, a minimum cleanliness class of

20/18/15 acc. to ISO 4406 is necessary.

Case drain pressure

The permissible case drain pressure (housing pressure) is dependent on the drive speed (see diagram).



Max. case drain pressure (housing pressure)

$p_{L\,abs\,max}$ _____ 60 psi (4 bar) absolute

These are approximate values; under certain operating conditions a reduction in these values may be necessary.

Technical data

Operating pressure range

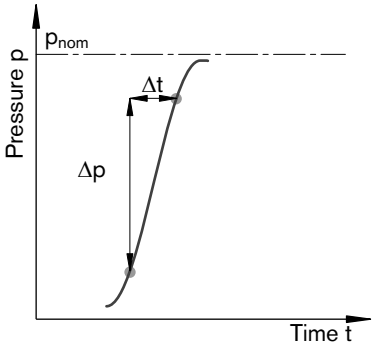
Pressure at service line port (pressure port) B

Nominal pressure p_{nom} _____ 5100 psi (350 bar) absolute

Peak pressure p_{max} _____ 5800 psi (400 bar) absolute
Total operating period _____ 300 h
Single operating period _____ 1 s

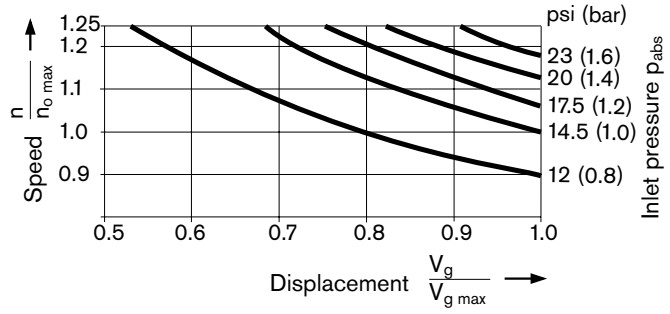
Minimum pressure (high-pressure side) ___ 215 psi (15 bar)
For lower pressures please consult us.

Rate of pressure change R_A ___ 232000 psi/s (16000 bar/s)



Pressure at suction port S (inlet)
Minimum suction pressure $p_{S\ min}$ ____ 12 psi (0,8 bar) absolute
Maximum suction pressure $p_{S\ max}$ ___ 435 psi (30 bar) absolute

Minimum pressure (inlet)
In order to avoid damage to the axial piston unit, a minimum pressure must be ensured at the suction port S (inlet). The minimum pressure is dependent on the speed and displacement of the axial piston unit.



The inlet pressure is the static feed pressure or the minimum dynamic value of the boost pressure.

Please note:
Max. permissible drive speed $n_{o\ max.\ perm.}$ (speed limit) see page 8

Please contact us if these conditions cannot be satisfied.

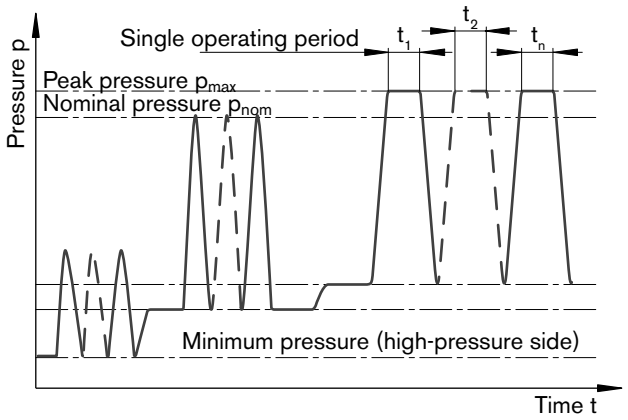
Definition

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

Peak pressure p_{max}
The peak pressure corresponds 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 (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 considering efficiencies and tolerances; values rounded off)

Size			40	71	125	180	250/ H [1]	355/ H [1]	500/ H [1]	750	750 with boost pump	1000
Displacement	$V_{g\ max}$	in³ (cm³)	2.44 (40)	4.33 (71)	7.63 (125)	11.0 (180)	15.26 (250)	21.7 (355)	30.51 (500)	45.8 (750)	45.8 (750)	61.02 (1000)
Speed [2]												
max. at $V_{g\ max}$	$n_{o\ max}$	rpm	2600	2200	1800	1800	1500/ 1900	1500/ 1700	1320/ 1500	1200	1500	1000
max. at $V_g \leq V_{g\ max}$ (speed limit)	$n_{o\ max\ perm.}$	rpm	3200	2700	2200	2100	1800/ 2100	1700/ 1900	1600/ 1800	1500	1500	1200
Flow												
at $n_{o\ max}$	$q_{vo\ max}$	gpm	27.5	41.2	59.4	85.6	99/ 125	140/ 159	174/ 198	237.9	297.2	264.1
		(L/min)	(104)	(156)	(225)	(324)	(375/ 475)	(533/ 604)	(660/ 750)	(900)	(1125)	(1000)
Power $\Delta p = 5100$ psi (350 bar)												
at $n_{o\ max}$	$P_{o\ max}$	HP	81	122	176	254	294/ 372	417/ 473	518/ 587	708	885	781
		(kW)	(61)	(91)	(131)	(189)	(219/ 277)	(311/ 352)	(385/ 437)	(525)	(656)	(583)
Torque												
at $V_{g\ max}$ $\Delta p = 5100$ psi (350 bar)	T_{max}	lb-ft (Nm)	165 (223)	292 (395)	516 (696)	744 (1002)	1032 (1391)	1467 (1976)	2063 (2783)	3097 (4174)	3097 (4174)	4104 (5565)
$\Delta p = 1450$ psi (100 bar)	T	lb-ft (Nm)	47 (64)	83 (113)	147 (199)	211 (286)	294 (398)	417 (564)	586 (795)	880 (1193)	880 (1193)	1172 (1590)
Rotary stiffness												
Shaft end K	c	klb-ft/rad (kNm/rad)	57 (79)	106 (146)	175 (241)	235 (323)	322 (443)	592 (814)	–	–	–	–
Shaft end S	c	klb-ft/rad (kNm/rad)	49 (67)	92 (126)	141 (194)	202 (278)	267 (368)	–	–	–	–	–
Shaft end R	c	klb-ft/rad (kNm/rad)	–	–	–	–	–	345 (475)	–	–	–	–
Shaft end P	c	klb-ft/rad (kNm/rad)	–	–	–	–	–	–	832 (1145)	1352 (1860)	1352 (1860)	1985 (2730)
Shaft end Z	c	klb-ft/rad (kNm/rad)	–	–	–	–	–	–	826 (1136)	1317 (1812)	1317 (1812)	2068 (2845)
Moment of inertia rotary group	J_{TW}	lb-ft² (kgm²)	0.116 (0.0049)	0.287 (0.0121)	0.712 (0.03)	1.305 (0.055)	2.276 (0.0959)	4.509 (0.19)	7.809 (0.3325)	15.66 (0.66)	15.66 (0.66)	28.47 (1.20)
Angular acceleration max.[4]	α	rad/s²	17000	11000	8000	6800	4800	3600	2800	2000	2000	1450
Case volume	V	gal (L)	0.5(2)	0.6(2.5)	1.3(5)	1.0(4)	2.6(10)	2.1(8)	3.7(14)	5.0(19)	5.8(22)	7.13(27)
Weight (with pressure control) approx.	m	lbs (kg)	86 (39)	117 (53)	194 (88)	225 (102)	406 (184)	456 (207)	705 (320)	1014 (460)	1080 (490)	1333 (605)

[1] High-Speed-Version

[2] Values are valid with inlet pressure p_{abs} 14.5 psi (1 bar) at inlet port S, with increased speed up to speed limit please observe diagram, page 7

[3] $V_g < V_{g\ max}$

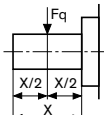
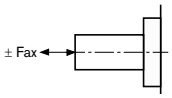
[4] – The range of validity lies between zero and the maximum permissible drive speeds.
Valid for external excitation (eg. diesel engine 2- to 8-fold rotary frequency, cardan shaft 2-fold rotary frequency).
– The limiting value is only valid for a single pump.
– The loading capacity of the connecting parts must be considered.

Notes

Exceeding the maximum or falling below the minimum permissible values can lead to a loss of function, a reduction in operational service life or total destruction of the axial piston unit.
The permissible values can be determined through calculation.

Technical data

Permissible radial and axial forces on the drive shaft

Size			40	71	125	180	250	355	500	750*	1000
Radial force, max. 	at X/2 $F_{q\ max}$	lb	225	270	360	450	450	495	560	675	786
		(N)	(1000)	(1200)	(1600)	(2000)	(2000)	(2200)	(2500)	(3000)	(3500)
Axial force, max. 	$\pm F_{ax\ max}$	lb	135	180	225	315	405	450	450	495	495
		(N)	(600)	(800)	(1000)	(1400)	(1800)	(2000)	(2000)	(2200)	(2200)

* also valid for versions with boost pump

Determination of pump size

Flow $q_V = \frac{V_g \cdot n \cdot \eta_V}{231}$ [gpm] $\left(\frac{V_g \cdot n \cdot \eta_V}{1000} \text{ [L/min]} \right)$

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

Power $P = \frac{q_V \cdot \Delta p}{1714 \cdot \eta_t}$ [HP] $\left(\frac{q_V \cdot \Delta p}{600 \cdot \eta_t} \text{ [kW]} \right)$

V_g = geometr. displacement per rev. in in³ (cm³)
Δp = pressure difference in psi (bar)
n = speed in rpm
η_V = volumetric efficiency
η_{mh} = mechanical-hydraulic efficiency
η_t = overall efficiency ($\eta_t = \eta_V \cdot \eta_{mh}$)

Characteristics

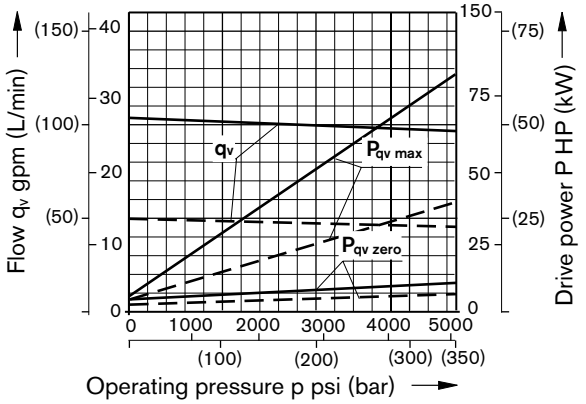
Drive power and flow

(Fluid: Hydraulic oil ISO VG 46 DIN 51519, t = 122°F (50°C))

Overall efficiency: $\eta_t = \frac{q_v \cdot p}{P_{q_v\,max} \cdot 1714}$ q_v = gpm, p = psi, P = HP ($\eta_t = \frac{q_v \cdot p}{P_{q_v\,max} \cdot 600}$ q_v = L/min, p = bar, P = kW)

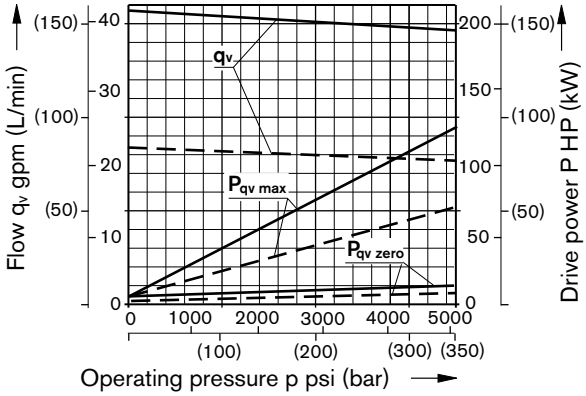
Volumetric efficiency: $\eta_v = \frac{q_v}{q_{v\,theor}}$

Size 40



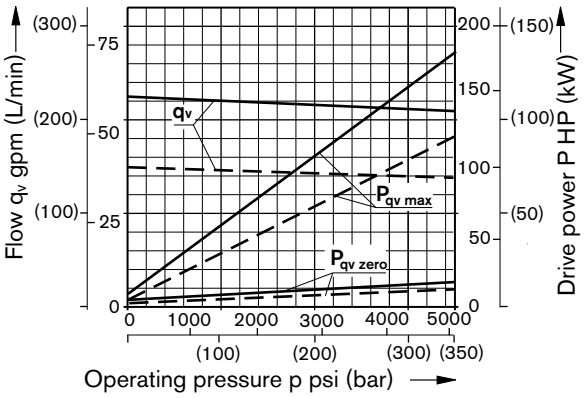
n = 2600 rpm
n = 1200 rpm

Size 71



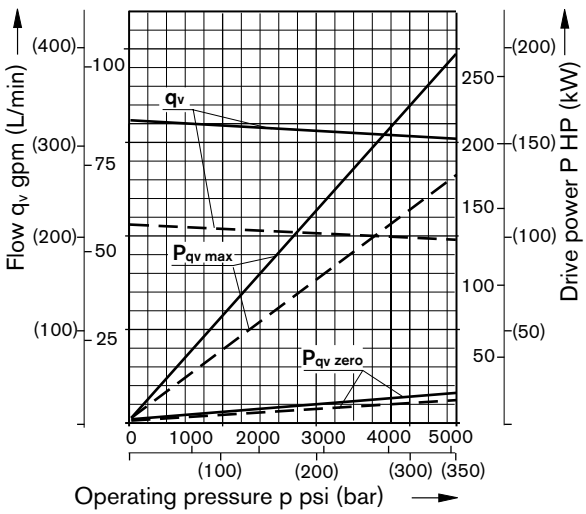
n = 2200 rpm
n = 1200 rpm

Size 125



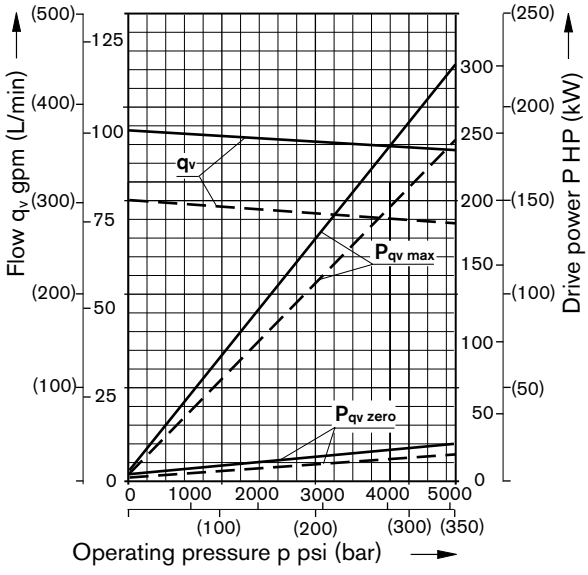
n = 1800 rpm
n = 1200 rpm

Size 180



n = 1800 rpm
n = 1200 rpm

Size250



n = 1500 rpm
n = 1200 rpm

Characteristics

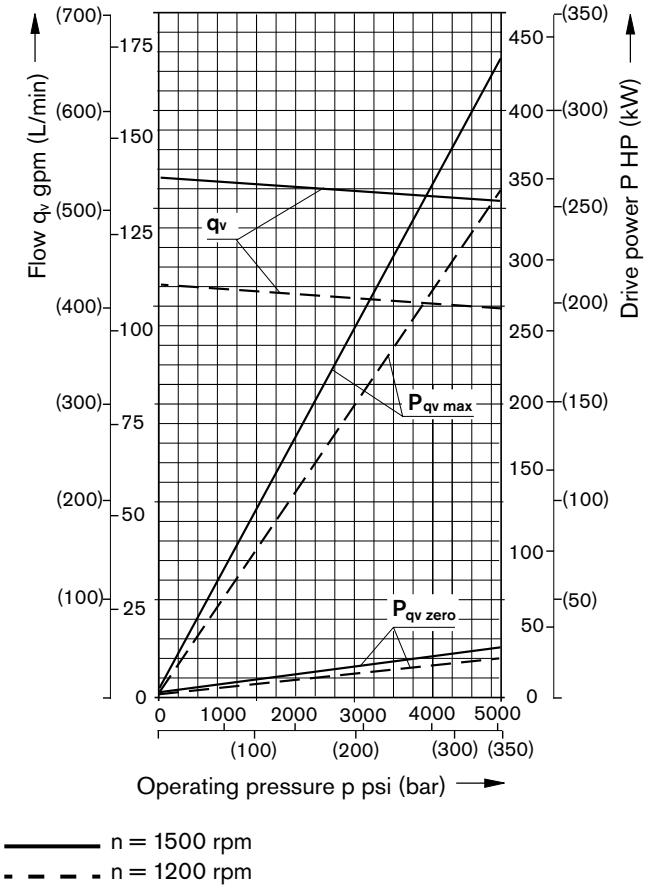
Drive power and flow

(Fluid: Hydraulic oil ISO VG 46 DIN 51519, t = 122°F (50°C))

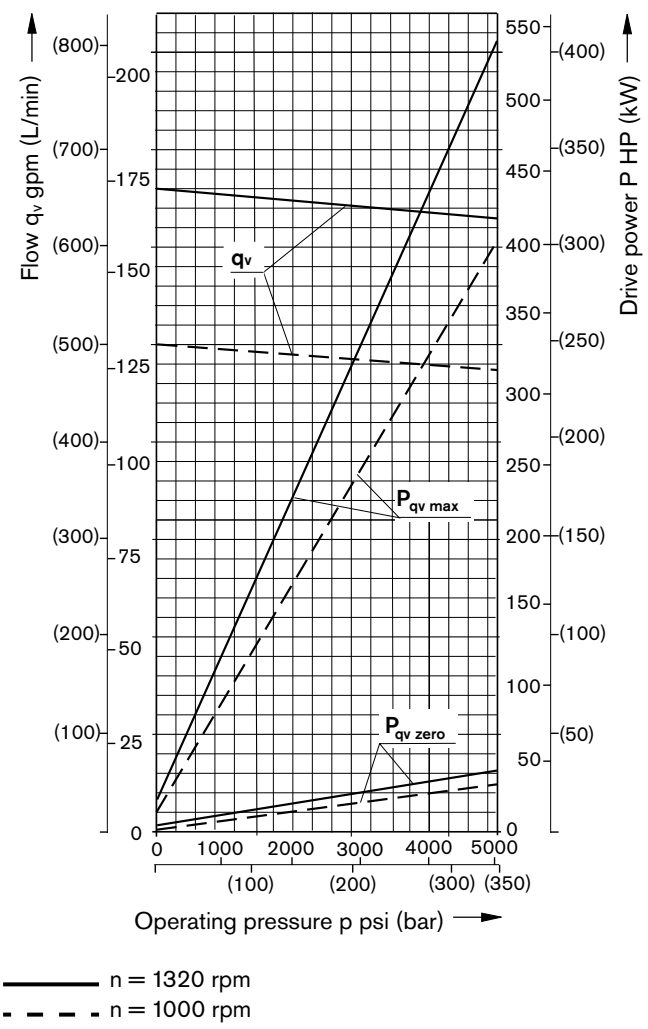
Overall efficiency: $\eta_t = \frac{q_v \cdot p}{P_{q_v\,max} \cdot 1714}$ q_v = gpm, p = psi, P = HP ($\eta_t = \frac{q_v \cdot p}{P_{q_v\,max} \cdot 600}$ q_v = L/min, p = bar, P = kW)

Volumetric efficiency: $\eta_v = \frac{q_v}{q_{v\,theor}}$

Size 355



Size 500



Characteristics

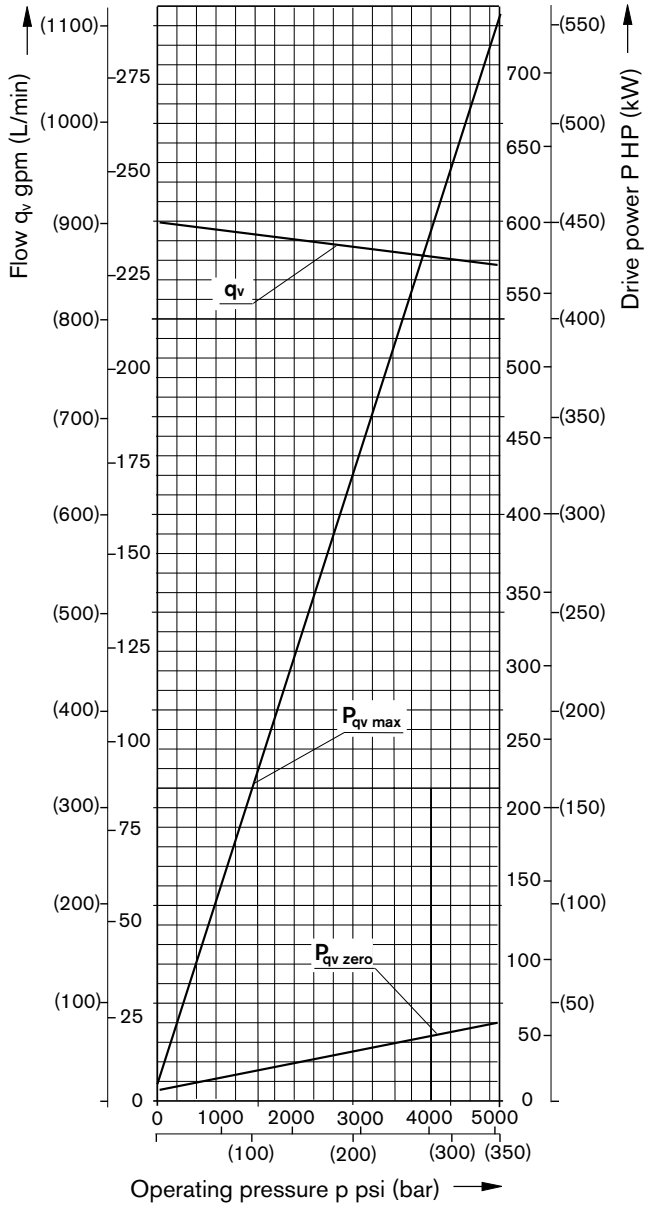
Drive power and flow

(Fluid: Hydraulic oil ISO VG 46 DIN 51519, t = 122°F (50°C))

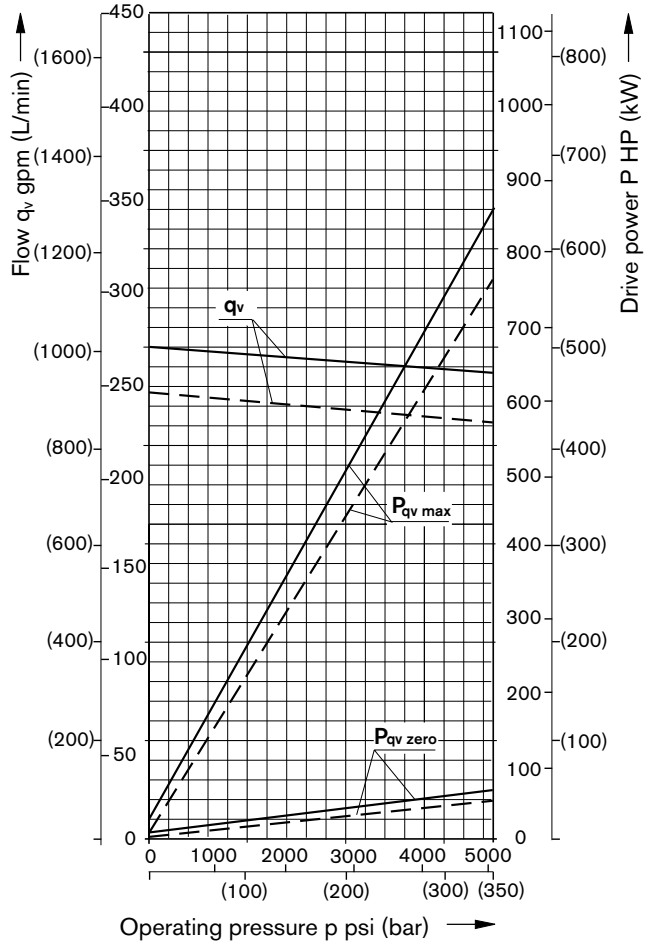
Overall efficiency: $\eta_t = \frac{q_v \cdot p}{P_{q_v\,max} \cdot 1714}$ q_v = gpm, p = psi, P = HP ($\eta_t = \frac{q_v \cdot p}{P_{q_v\,max} \cdot 600}$ q_v = L/min, p = bar, P = kW)

Volumetric efficiency: $\eta_v = \frac{q_v}{q_{v\,theor}}$

Size 750



Size 1000

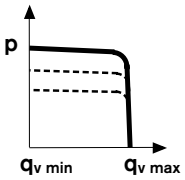


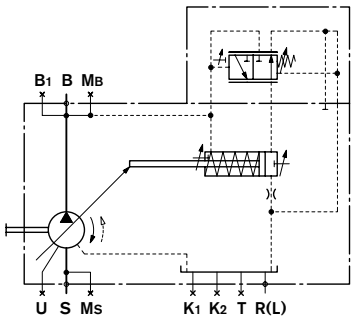
Summary of controls

Pressure control DR (see RA 92060)

The DR- pressure control limits the maximum pressure at the pump outlet within the pump's control range. This max. pressure level can be steplessly set at the control valve.
Setting range 725...5100 psi (50...350 bar)

Optional:
Remote control (DRG)

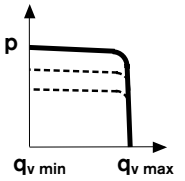


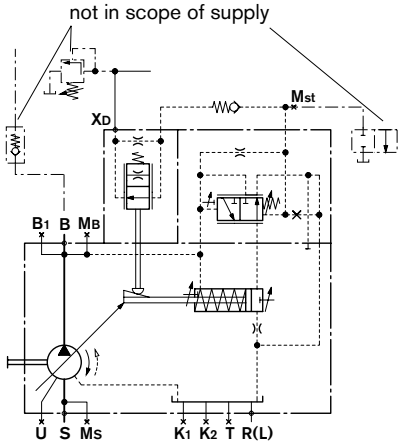


Pressure control for parallel operation DP (see RA 92060)

Suitable for pressure control with multiple A4VSO axial piston pumps in parallel operation.

Optional:
Flow control (DPF)

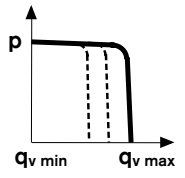


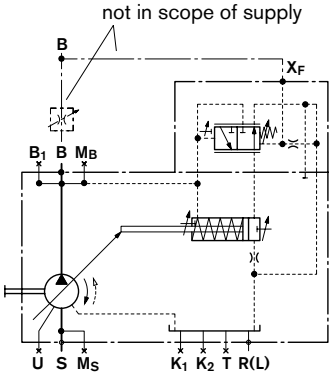


Flow control FR (see RA 92060)

Maintains a constant flow in a hydraulic system.

Optional:
Remote pressure control (FRG)
connection between X_F and tank closed (FR1, FRG1)

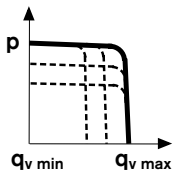


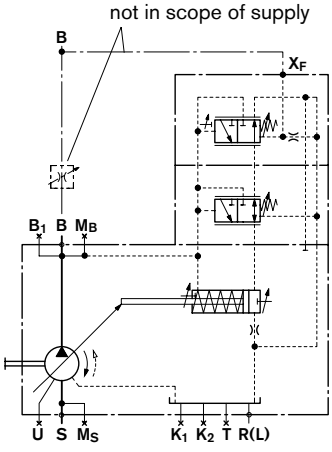


Pressure and flow control DFR (see RA 92060)

This control maintains a constant flow from the pump even under varying operating conditions. Overriding this control is a mechanically adjustable pressure control.

Optional:
connection between X_F and tank closed (DFR1)



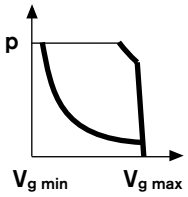


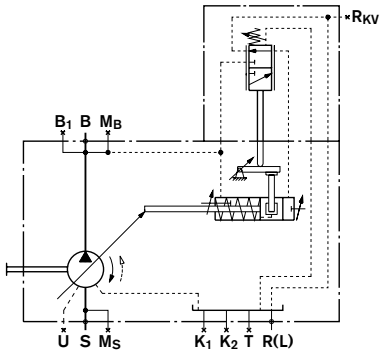
Summary of controls

Power control LR2 with hyperbolic characteristic (see RA 92064)

The hyperbolic power control maintains a constant preset drive power at the same input speed.

Optional:
Pressure control (LR2D), remotely controlled (LR2G);
Flow control (LR2F, LR2S);
Hydraulic stroke limiter (LR2H);
Mechanical stroke limiter (LR2M);
Hydraulic two-point control (LR2Z);
with electric unloading valve for easy start (LR2Y).

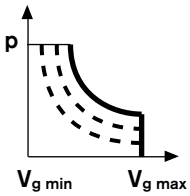


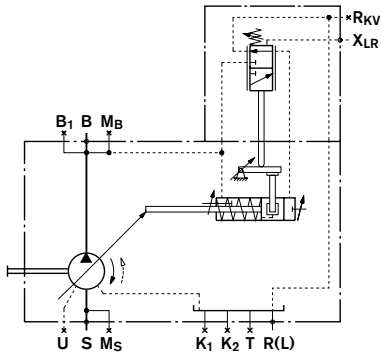


Power control LR3 with remote control of power characteristics (see RA 92064)

This power control maintains a constant preset drive power, with remote control of the power characteristics.

Optional:
Pressure control (LR3D), remotely controlled (LR3G);
Flow control (LR3F, LR3S);
Hydraulic stroke control (LR3H);
Mechanical stroke control (LR3M);
Hydraulic two-point control (LR3Z).
with electric unloading valve for easy start (LR3Y)



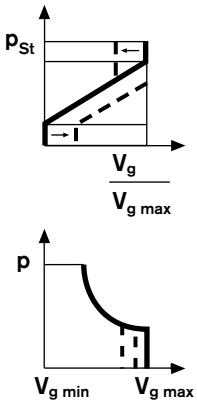


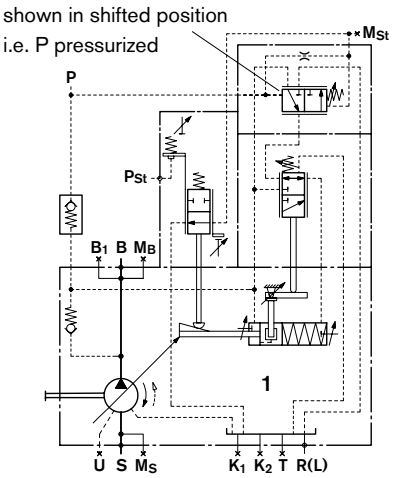
Hydraulic control LR2N and LR3N pilot pressure dependent, initial position $V_{g\,min}$ (see RA 92064)

With overriding power control.

The pump displacement is proportional to a pilot pressure signal in P_{St}.
The additional hyperbolic power control overrides the pilot pressure signal and holds the preset drive power constant.

Optional:
Remote control of power characteristics (LR3N)
Pressure control (LR.DN),
Remote pressure control (LR.GN)
Electric control of pilot pressure signal (LR.NT)

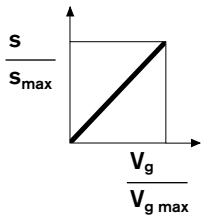


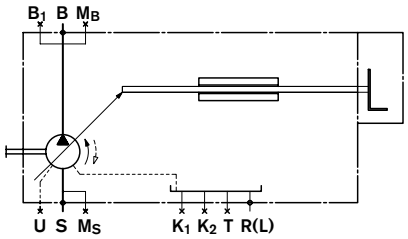


Summary of controls

Manual control MA (see RE 92072)

Stepless adjustment of displacement by means of a handwheel.

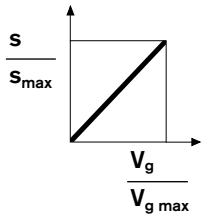


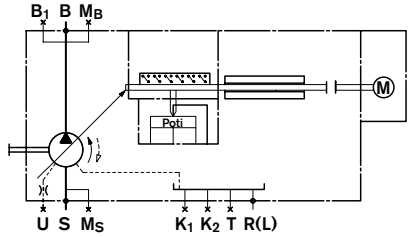


Electric motor control EM (see RE 92072)

Stepless adjustment of displacement via an electric motor.

Various intermediate displacement values can be selected with a programmed sequence control, by means of built on limit switches and an optional potentiometer for feedback signal.

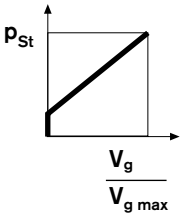


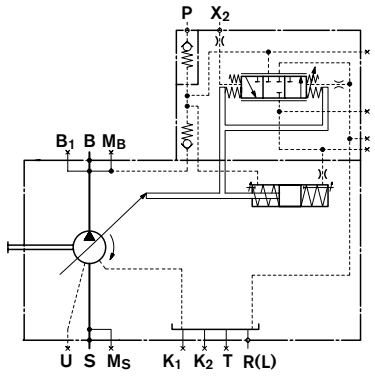


Hydraulic control HD pilot pressure dependent (see RA 92080)

Stepless adjustment of displacement proportional to a pilot pressure signal. The displacement is proportional to the applied pilot pressure (Difference between pilot pressure level and pump case pressure).

Optional:
Pilot pressure curves (HD1, HD2, HD3)
Pressure control (HD.B),
Remote pressure control (HD.GB)
Power control (HD1P)
with electric control of pilot pressure (HD1T)



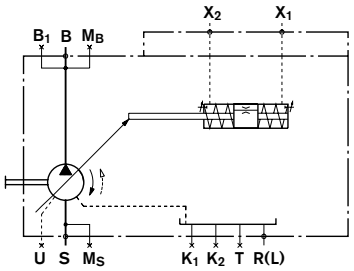


Summary of controls

Hydraulic control HM 1/2, control volume dependent (see RA 92076)

The pump displacement is infinitely variable in relation to the control oil volume in ports X_1 and X_2.

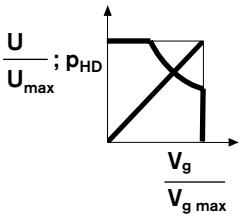
Application:
– 2-point control
– basic control device for servo or proportional valve control

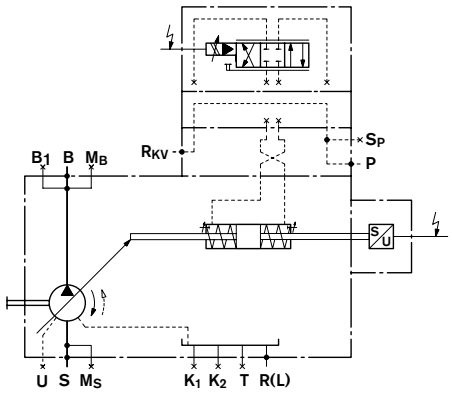


Control system HS, HS4, with servo or proportional valve (see RA 92076)

The stepless displacement control is accomplished by by means of servo or proportional valve with electrical feedback of the swivel angle.
The HS4P-control system is fitted with a built on pressure transducer so that it can be utilized for electrical pressure and power control.

Optional:
Servo valve (HS);
Proportional valve (HS4);
Short circuit valve (HSK, HS4K, HS4KP);
Without valves (HSE, HS4E).
For oil-immersed use (HS4M)

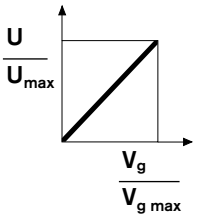


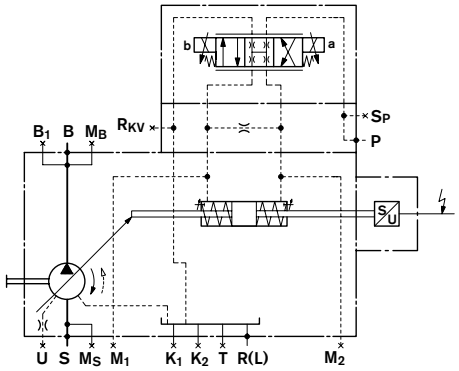


Control system EO1/2 (see RA 92076)

The stepless adjustment of the displacement is accomplished by means of a proportional valve with electrical feedback of the swivel angle.
This control can be utilized as an electric control of displacement.

Optional:
Control pressure range (EO1, EO2)
Short circuit valve (EO1K, EO2K)
Without valves (EO1E, EO2E)

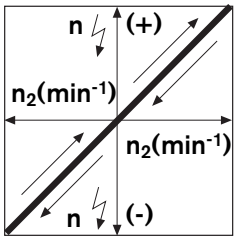


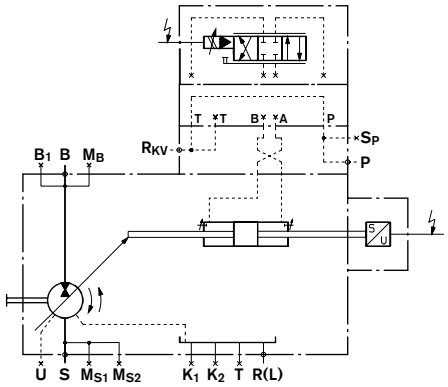


Summary of controls

Speed control DS1, secundary controlled (see RE 92056)

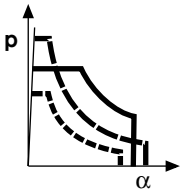
The speed control DS1 controls the secundary unit (motor) in such a manner, that this motor delivers sufficient torque to maintain the required output speed. When connected to a constant pressure system, this torque is proportional to motor displacement and thus also proportional to the swivel angle.

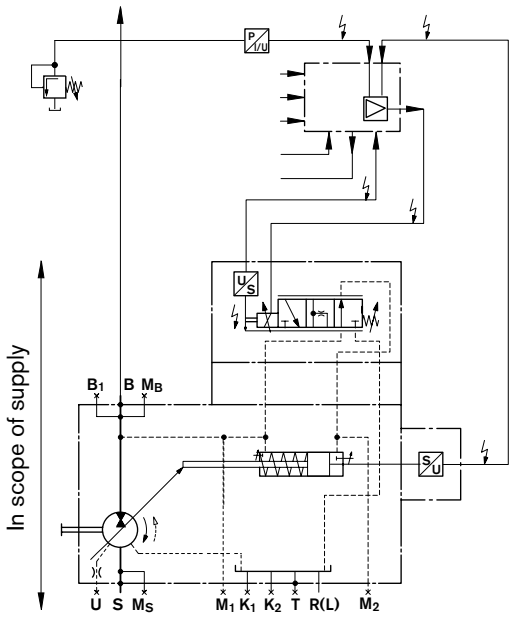




Electro hydraulic control system DFE1 (see RE 92088)

The power, pressure and swivel angle control of the variable pump A4VSO...DFE1 is accomplished by means of an electrically controlled proportional valve. A current signal to the proportional valve moves the control piston and determines via an integrated positional transducer the cradle's swivel angle and thus the pump flow. When the electric drive motor is switched off and the system is pressureless, the bias spring in the control chamber will swivel the pump to max. displacement ($V_{g\,max}$).



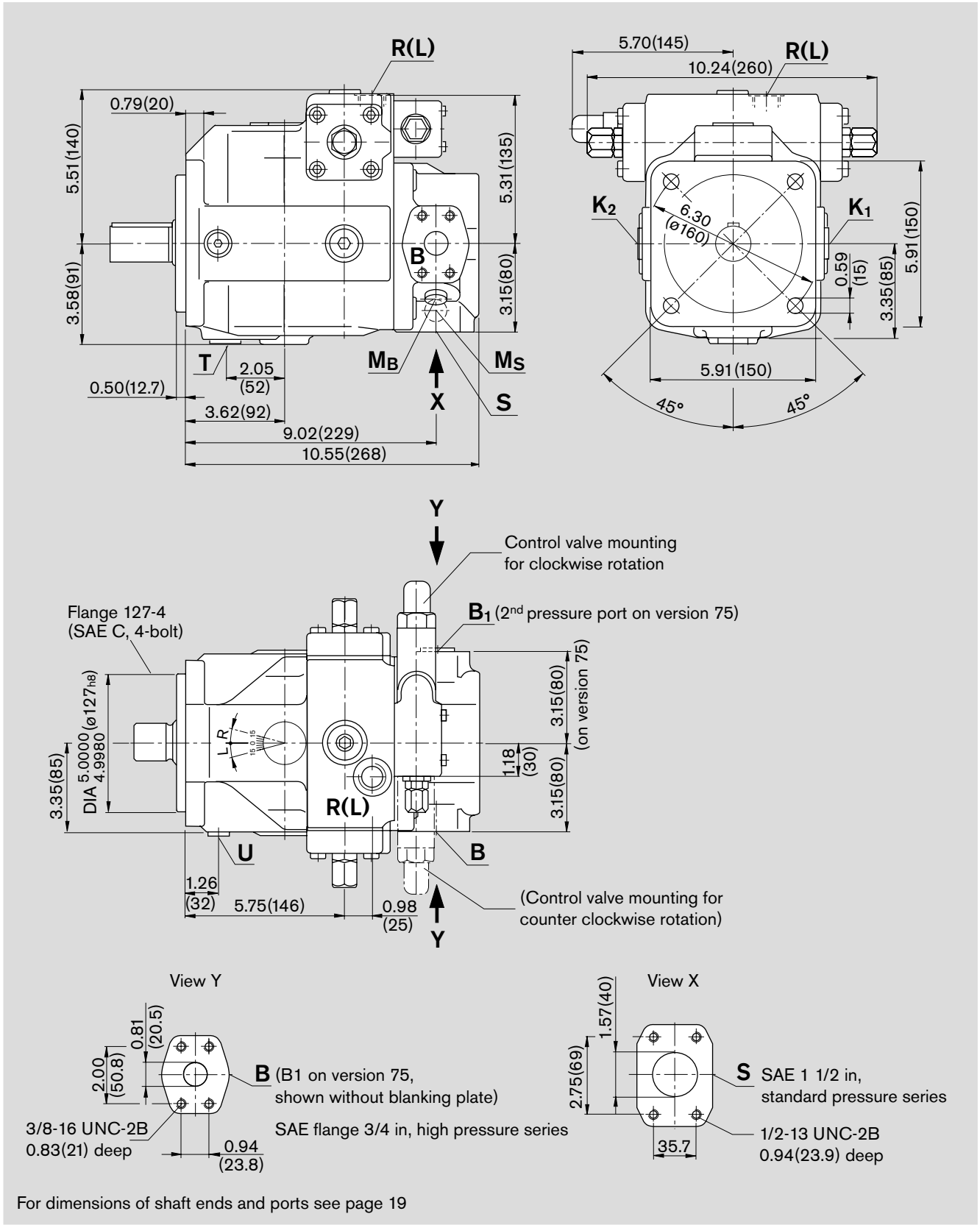


Dimensions, size 40

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

Series 1

Example: SAE with N00
pressure control; for exact dimensions of the control devices see separate data sheets



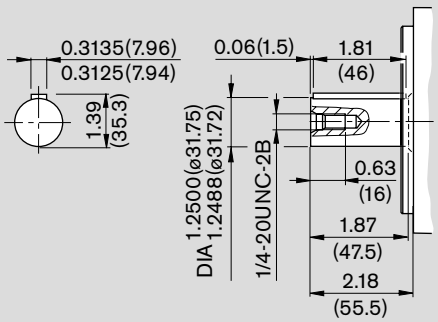
For dimensions of shaft ends and ports see page 19

Dimensions, size 40

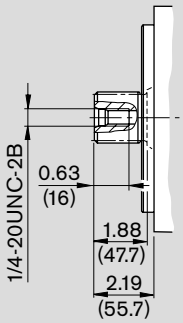
Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

Shaft ends

K Parallel keyed shaft to ISO 3019-1, SAE C



S Splined shaft to ISO 3019-1, SAE C
32-4, 1 1/4 in, 12/24 DP; 14T [1]



Ports

				max. tightening torque [2]
S	Suction port (standard pressure series) Mounting bolts	SAE J518 ISO 68	1 1/2 in 1/2-13UNC-2B; 0.94(24) deep [2]	
K_1, K_2	Flushing port	ISO 11926	7/8-14UNF-2B; 0.67(17) deep (plugged)	175 lb-ft (240 Nm)
T	Drain	ISO 11926	7/8-14UNF-2B; 0.67(17) deep (plugged)	175 lb-ft (240 Nm)
M_B	Gauge port outlet pressure	ISO 11926	7/16-20UNF-2B; 0.39(10) deep (plugged)	29 lb-ft (40 Nm)
M_S	Gauge port suction pressure	ISO 11926	7/16-20UNF-2B; 0.39(10) deep (plugged)	29 lb-ft (40 Nm)
R(L)	Fill and bleed (case drain port)	ISO 11926	7/8-14UNF-2B; 0.67(17) deep	175 lb-ft (240 Nm)
U	Flushing port	ISO 11926	7/16-20UNF-2B; 0.39(10) deep (plugged)	29 lb-ft (40 Nm)
on version 63				
B	Pressure port (high pressure series) Mounting bolts	SAE J518 ISO 68	3/4 in 3/8-16UNC-2B; 0.83(21) deep [2]	
B_1	Additional port	ISO 11926	7/8-14UNF-2B; 0.67(17) deep (plugged)	175 lb-ft (240 Nm)
on version 75				
B	Pressure port (high pressure series) Mounting bolts	SAE J518 ISO 68	3/4 in 3/8-16UNC-2B; 0.83(21) deep [2]	
B_1	2nd press. port (high pressre series) Mounting bolts	SAE J518 ISO 68	3/4 in (closed with blanking plate) 3/8-16UNC-2B; 0.83(21) deep [2]	

[1] ANSI B92.1a–1976, 30° pressure angle, flat base, flank centering, fit class 5

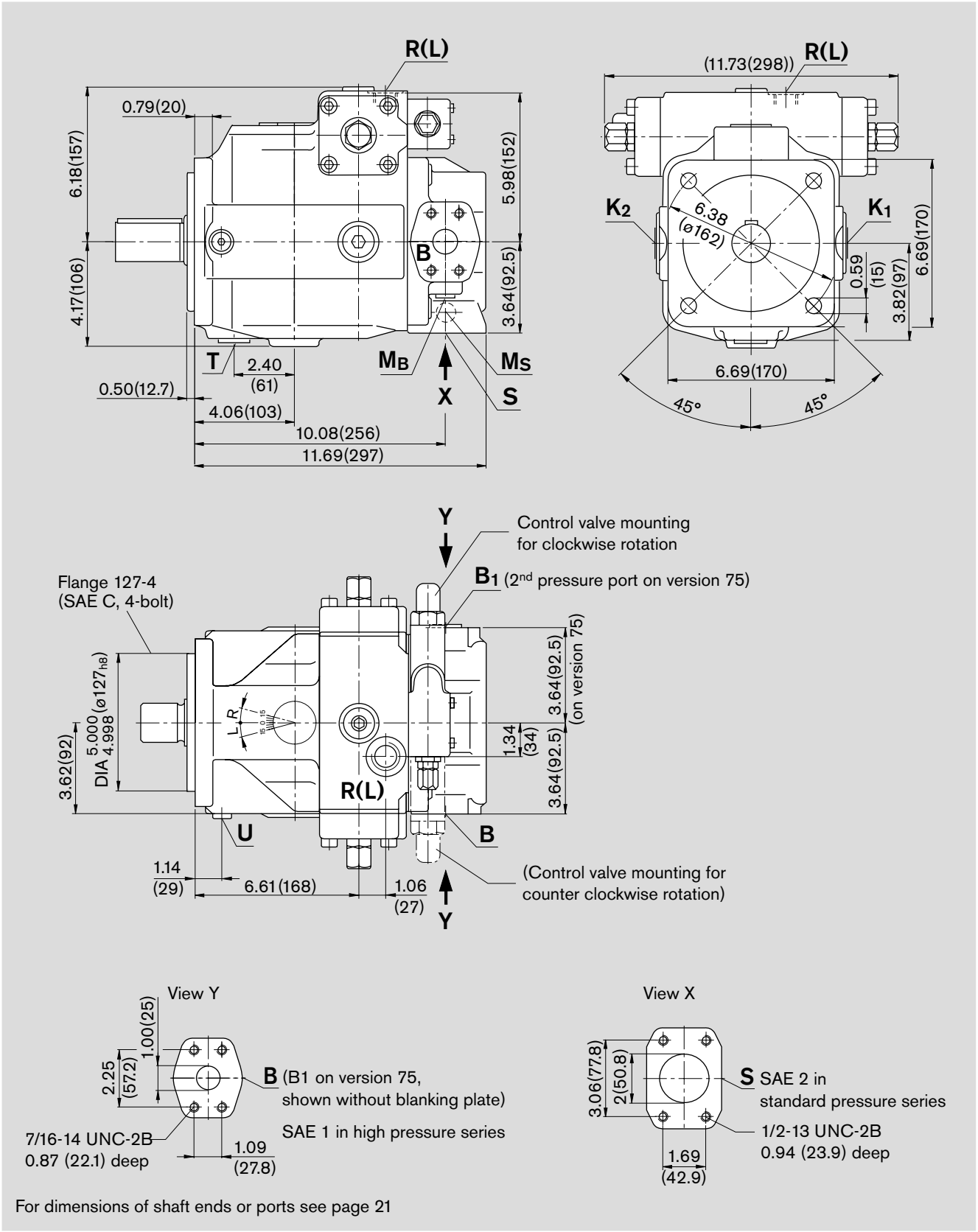
[2] for the max. tightening torques please observe the manufacturer's information on the used fittings and the general information on page 64

Dimensions, size 71

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

Series 1

Example: SAE with N00
pressure control; for exact dimensions of control devices see separate data sheets



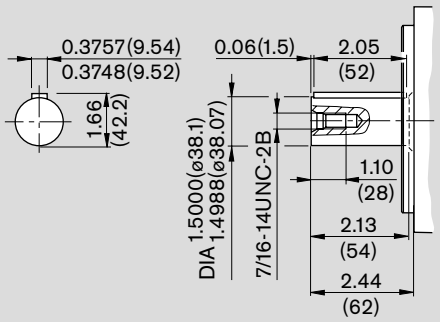
For dimensions of shaft ends or ports see page 21

Dimensions, size 71

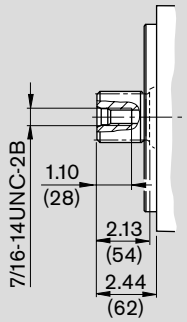
Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

Shaft ends

K Parallel keyed shaft to ISO 3019-1, SAE C-C



S Splined shaft to ISO 3019-1, SAE C-C
38-4, 1 1/2 in, 12/24 DP; 17T [1]



Ports

				max. tightening torque [2]
S	Suction port (standard pressure series) Mounting bolts	SAE J518 ISO 68	1 1/2 in 1/2-13UNC-2B; 0.87(22) deep [2]	
K_1, K_2	Flushing port	ISO 11926	1 1/16-12UN-2B; 0.79(20) deep (plugged)	265 lb-ft (360 Nm)
T	Drain	ISO 11926	1 1/16-12UN-2B; 0.79(20) deep (plugged)	265 lb-ft (360 Nm)
M_B	Gauge port outlet pressure	ISO 11926	7/16-20UNF-2B; 0.39(10) deep (plugged)	29 lb-ft (40 Nm)
M_S	Gauge port suction pressure	ISO 11926	7/16-20UNF-2B; 0.39(10) deep (plugged)	29 lb-ft (40 Nm)
R(L)	Fill + air bleed (case drain port)	ISO 11926	1 1/16-12UN-2B; 0.79(20) deep	265 lb-ft (360 Nm)
U	Flushing port	ISO 11926	7/16-20UNF-2B; 0.39(10) deep (plugged)	29 lb-ft (40 Nm)
on version 63				
B	Pressure port (high pressure series) Mounting bolts	SAE J518 ISO 68	1 in 7/16-14UNC-2B; 0.87(22) deep [2]	
B_1	Additional port	ISO 11926	1 1/16-12UN-2B; 0.79(20) deep (plugged)	265 lb-ft (360 Nm)
on version 75				
B	Pressure port (high pressure series) Mounting bolts	SAE J518 ISO 68	1 in 7/16-14UNC-2B; 0.87(22) deep [2]	
B_1	2nd pressure port (high pressure series) Mounting bolts	SAE J518 ISO 68	1 in (closed with blanking plate) 7/16-14UNC-2B; 0.87(22) deep [2]	

[1] ANSI B92.1a–1976, 30° pressure angle, flat base, flank centering, fit class 5

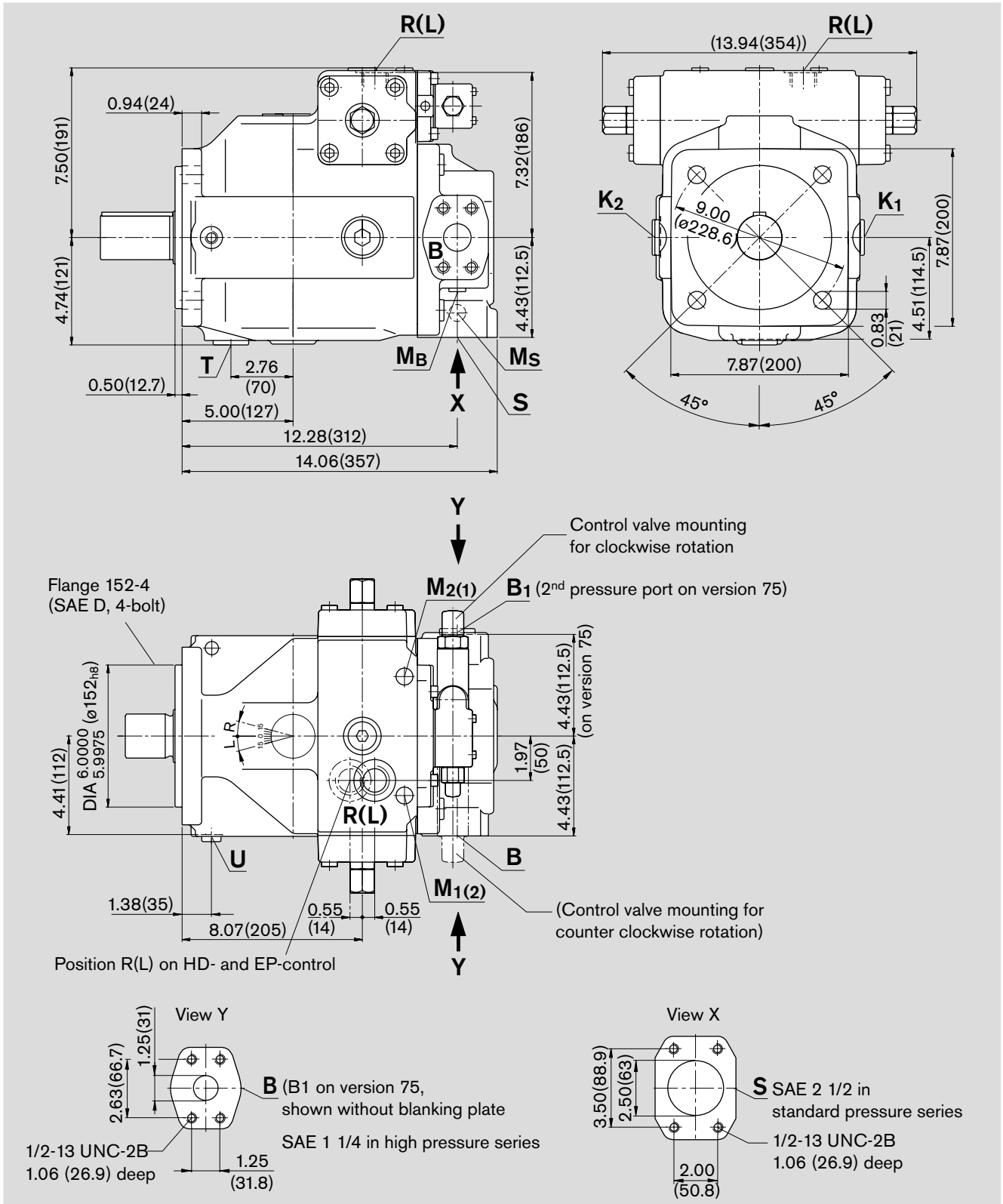
[2] for the max. tightening torques please observe the manufacturer's information on the used fittings and the general information on page 64

Dimensions, size 125

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

Series 3

Example: SAE with N00 (for U99 dimensions, see page 61)
pressure control; for exact dimensions of control devices see separate data sheets



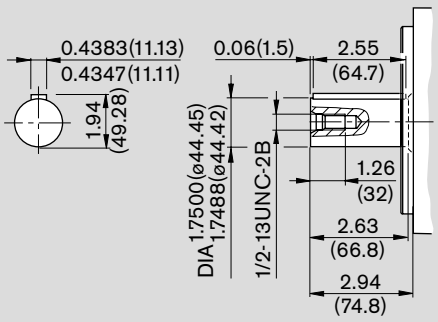
For dimensions of shaft ends and ports see page 23

Dimensions, size 125

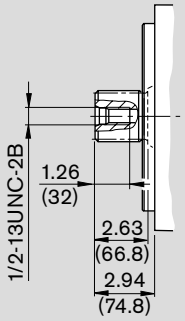
Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

Shaft ends

K Parallel keyed shaft to ISO 3019-1, SAE D



S Splined shaft to ISO 3019-1, SAE D
44-4, 1 3/4 in, 8/16 DP; 13T [1]



Ports

				max. tightening torque [2]
S	Suction port (standard pressure series)	SAE J518	2 1/2 in	
	Mounting bolts	ISO 68	1/2-13UNC-2B; 1.06(27) deep [2]	
K_1, K_2	Flushing port	ISO 11926	1 5/16-12UN-2B; 0.79(20) deep (plugged)	394 lb-ft (540 Nm)
T	Drain	ISO 11926	1 5/16-12UN-2B; 0.79(20) deep (plugged)	394 lb-ft (540 Nm)
M_B	Gauge port outlet pressure	ISO 11926	7/16-20UNF-2B; 0.39(10) deep (plugged)	29 lb-ft (40 Nm)
M_S	Gauge port suction pressure	ISO 11926	7/16-20UNF-2B; 0.39(10) deep (plugged)	29 lb-ft (40 Nm)
R(L)	Fill + air bleed (case drain port)	ISO 11926	1 5/16-12UN-2B; 0.79(20) deep	394 lb-ft (540 Nm)
U	Flushing port	ISO 11926	7/16-20UNF-2B; 0.39(10) deep (plugged)	29 lb-ft (40 Nm)
M_1, M_2	Gauge port control chamber press.	DIN 3852	M14x1.5; 0.47(12) deep (plugged)	29 lb-ft (40 Nm)

on version 63

B	Pressure port (high pressure series)	SAE J518	1 1/4 in	
	Mounting bolts	ISO 68	1/2-13UNC-2B; 1.06(27) deep [2]	
B_1	Additional port	ISO 11926	1 5/16-12UN-2B; 0.79(20) deep (plugged)	394 lb-ft (540 Nm)

on version 75

B	Pressure port (high pressure series)	SAE J518	1 1/4 in	
	Mounting bolts	ISO 68	1/2-13UNC-2B; 1.06(29) deep [2]	
B_1	2nd pressure port (high pressure series)	SAE J518	1 1/4 in (closed with blanking plate)	
	Mounting bolts	ISO 68	1/2-13UNC-2B; 1.06(29) deep [2]	

[1] ANSI B92.1a–1976, 30° pressure angle, flat base, flank centering, fit class 5

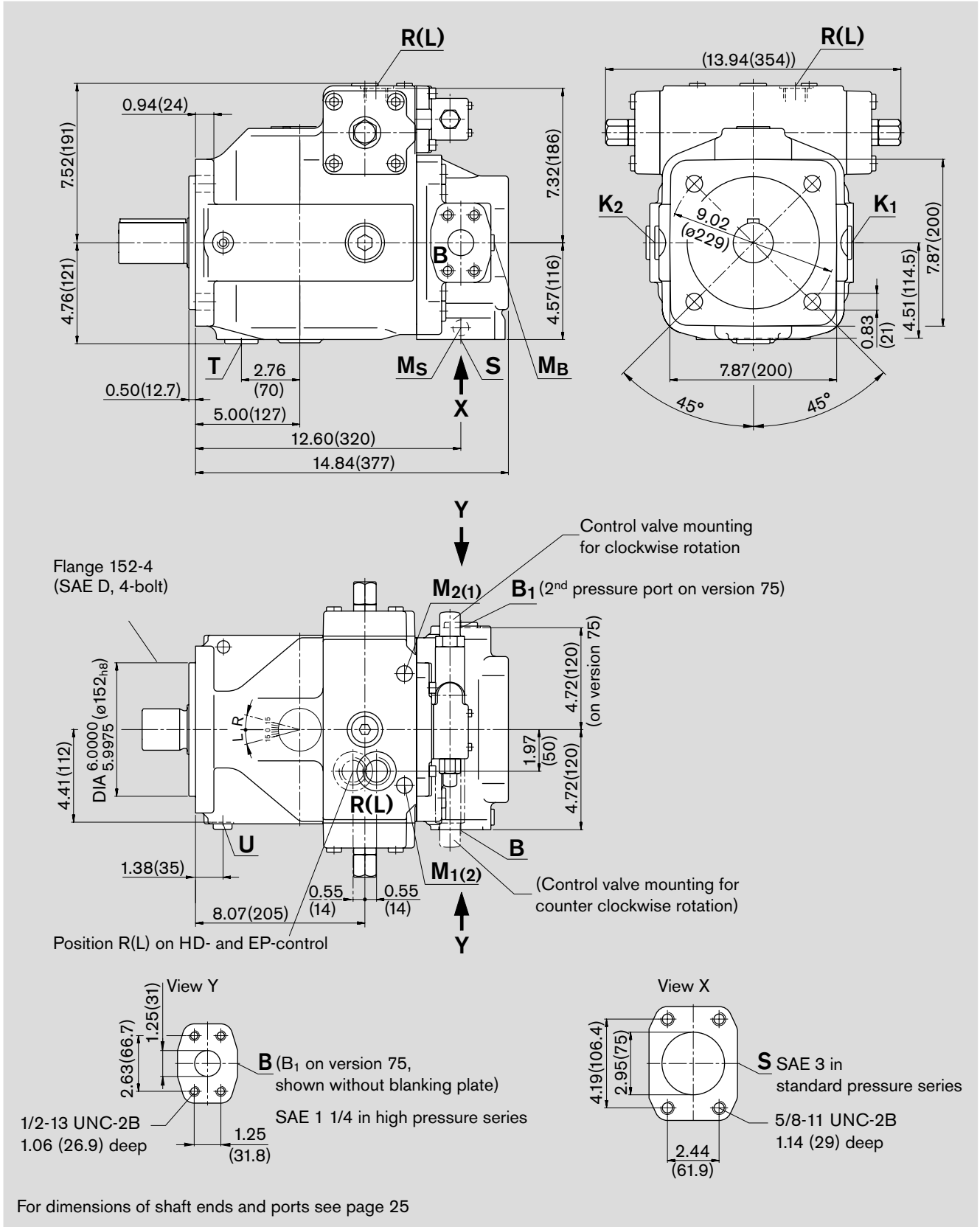
[2] for the max. tightening torques please observe the manufacturer's information on the used fittings and the general information on page 64

Dimensions, size 180

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

Series 3

Example: SAE with N00 (for U99 dimensions see page 61)
pressure control; for exact dimensions of control devices see separate data sheets



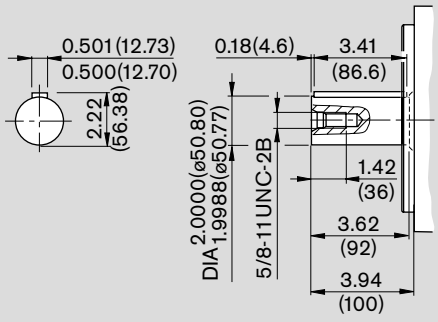
For dimensions of shaft ends and ports see page 25

Dimensions, size 180, SAE with N00[3)]

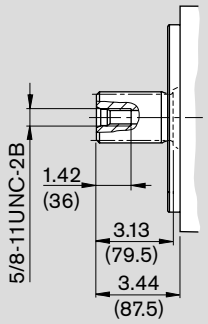
Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

Shaft ends

K Parallel keyed shaft to ISO 3019-1, SAE F



S Splined shaft to ISO 3019-1, SAE F
50-4, 2 in, 8/16 DP; 15T [1)]



Ports

				max. tightening torque [2)]
S	Suction port (standard pressure series) Mounting bolts	SAE J518 ISO 68	3 in 5/8-11UNC-2B; 1.14(29) deep [2)]	
K_1, K_2	Flushing port	ISO 11926	1 5/16-12UN-2B; 0.79(20) deep (plugged)	394 lb-ft (540 Nm)
T	Drain	ISO 11926	1 5/16-12UN-2B; 0.79(20) deep (plugged)	394 lb-ft (540 Nm)
M_B	Gauge port outlet pressure	ISO 11926	7/16-20UNF-2B; 0.39(10) deep (plugged)	29 lb-ft (40 Nm)
M_S	Gauge port suction pressure	ISO 11926	7/16-20UNF-2B; 0.39(10) deep (plugged)	29 lb-ft (40 Nm)
R(L)	Fill + air bleed (case drain port)	ISO 11926	1 5/16-12UN-2B; 0.79(20) deep	394 lb-ft (540 Nm)
U	Flushing port	ISO 11926	7/16-20UNF-2B; 0.39(10) deep (plugged)	29 lb-ft (40 Nm)
M_1, M_2	Gauge port control chamber pressure	DIN 3852	M14x1,5; 0.47(12) deep (plugged)	58 lb-ft (80 Nm)
on version 63				
B	Pressure port (high pressure series) Mounting bolts	SAE J518 ISO 68	1 1/4 in 1/2-13UNC-2B; 1.06(27) deep [2)]	
B_1	Additional port	ISO 11926	1 5/16-12UN-2B; 0.79(20) deep (plugged)	394 lb-ft (540 Nm)
on version 75				
B	Pressure port (high pressure series) Mounting bolts	SAE J518 ISO 68	1 1/4 in 1/2-13UNC-2B; 1.06(27) deep [2)]	
B_1	2nd pressure port (high pressure series) Mounting bolts	SAE J518 ISO 68	1 1/4 in (closed with blanking plate) 1/2-13UNC-2B; 1.06(27) deep [2)]	

[1)] ANSI B92.1a–1976, 30° pressure angle, flat base, flank centering, fit class 5

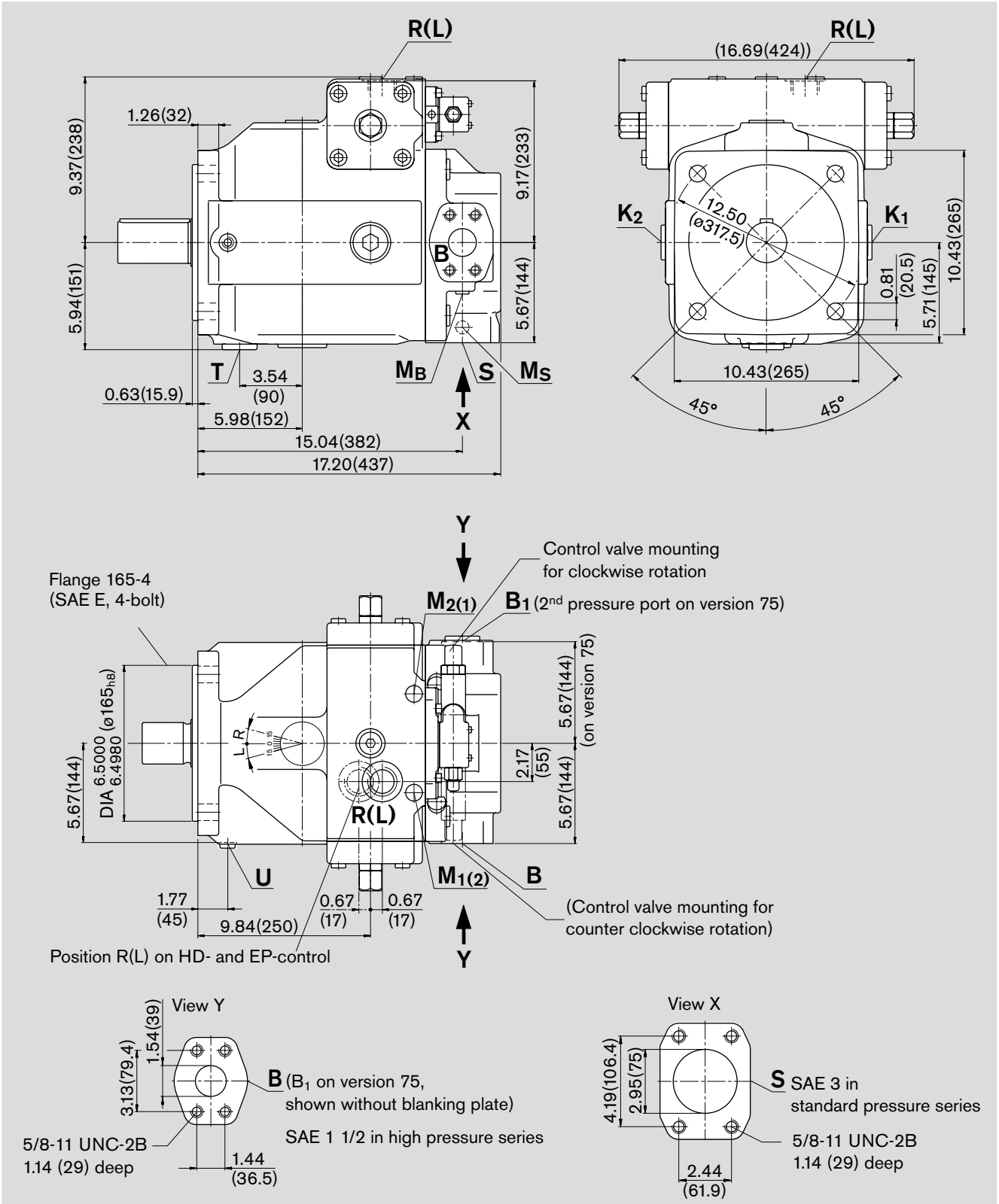
[2)] for the max. tightening torques please observe the manufacturer's information on the used fittings and the general information on page 64

Dimensions, size 250

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

Series 3

Example: SAE with N00 (for U99 dimensions, see page 61)
pressure control; for exact dimensions of control devices see separate data sheets



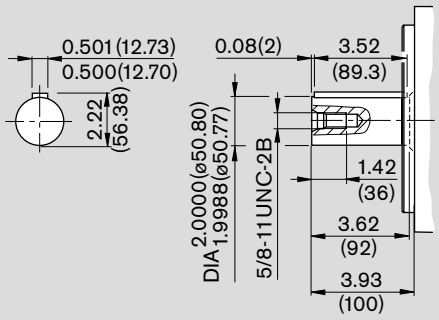
For dimensions on shaft ends and ports see page 27

Dimensions, size 250

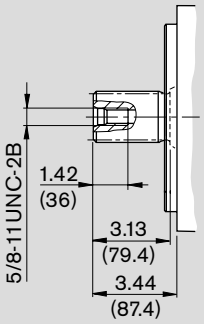
Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

Shaft ends

K Parallel keyed shaft to ISO 3019-1, SAE F



S Splined shaft to ISO 3019-1, SAE F
50-4 (2 in, 8/16 DP; 15T [1])



Ports

				max. tightening torque [2]
S	Suction port (standard pressure series) Mounting bolts	SAE J518 ISO 68	3 in 5/8-11UNC-2B; 1.14(29) deep [2]	
K_1, K_2	Flushing port	ISO 11926	1 5/8-12UN-2B; 0.79(20) deep (plugged)	700 lb-ft (960 Nm)
T	Drain	ISO 11926	1 5/8-12UN-2B; 0.79(20) deep (plugged)	700 lb-ft (960 Nm)
M_B	Gauge port outlet pressure	ISO 11926	7/16-20UNF-2B; 0.39(10) deep (plugged)	29 lb-ft (40 Nm)
M_S	Gauge port suction pressure	ISO 11926	7/16-20UNF-2B; 0.39(10) deep (plugged)	29 lb-ft (40 Nm)
R(L)	Fill + air bleed (case drain port)	ISO 11926	1 5/8-12UN-2B; 0.79(20) deep	700 lb-ft (960 Nm)
U	Flushing port	ISO 11926	7/16-20UNF-2B; 0.39(10) deep (plugged)	29 lb-ft (40 Nm)
M_1, M_2	Gauge port control chamber pressure	DIN 3852	M18x1,5; 0.47(12) deep (plugged)	102 lb-ft (140 Nm)

on version 63

B	Pressure port (high pressure series) Mounting bolts	SAE J518 ISO 68	1 1/2 in 5/8-11UNC-2B; 1.14(29) deep [2]	
B_1	Additional port	ISO 11926	1 5/8-12UN-2B; 0.79(20) deep (plugged)	700 lb-ft (960 Nm)

on version 75

B	Pressure port (high pressure series) Mounting bolts	SAE J518 ISO 68	1 1/2 in 5/8-11UNC-2B; 1.14(29) deep [2]	
B_1	2nd pressure port (high pressure series) Mounting bolts	SAE J518 ISO 68	1 1/2 in (closed with blanking plate) 5/8-11UNC-2B; 1.14(29) deep [2]	

[1] ANSI B92.1a–1976, 30° pressure angle, flat base, flank centering, fit class 5

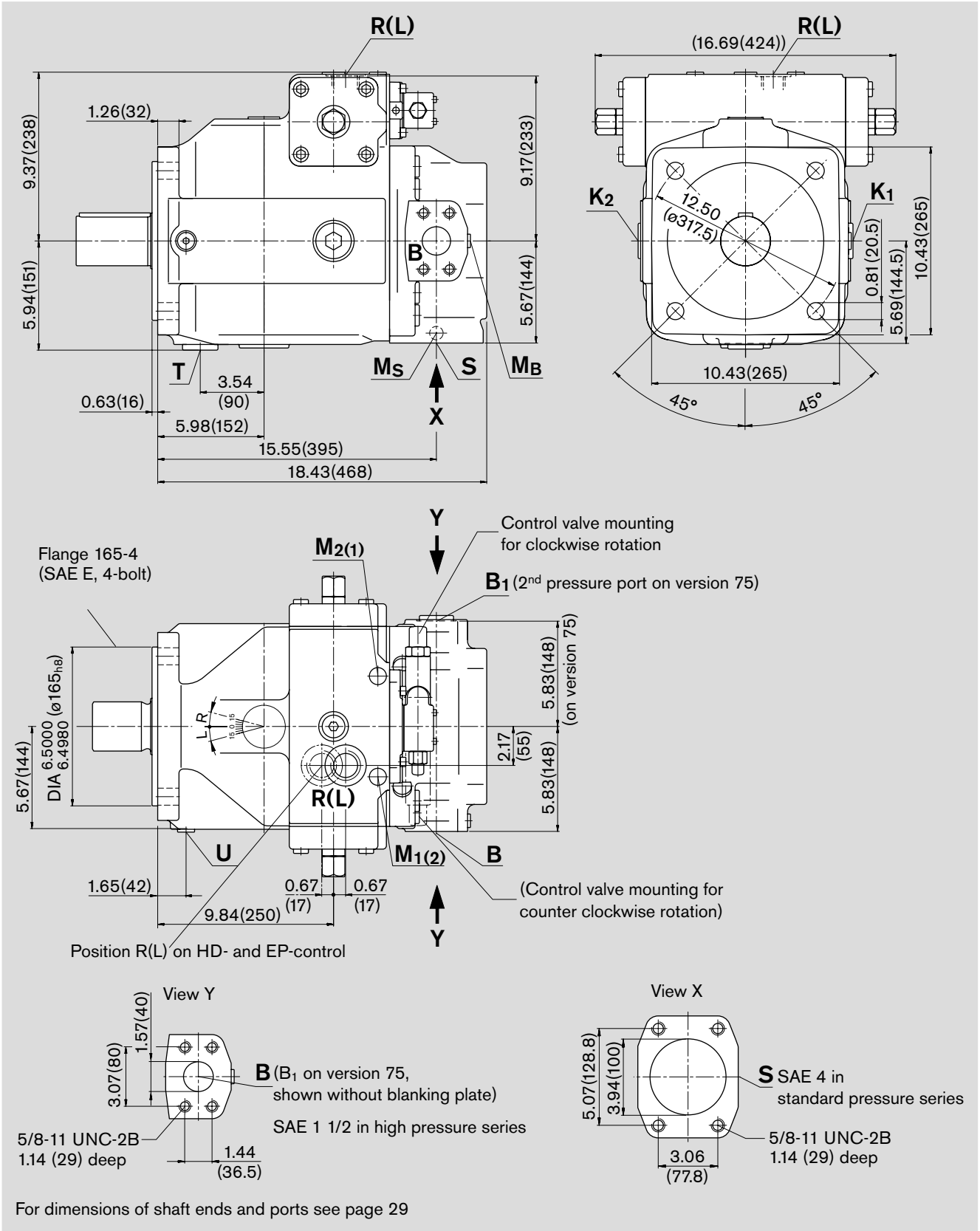
[2] for the max. tightening torques please observe the manufacturer's information on the used fittings and the general information on page 64

Dimensions, size 355

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

Series 3

Example: SAE with N00 (for U99 dimensions, see page 61)
pressure control; for exact dimensions of control devices see separate data sheets)



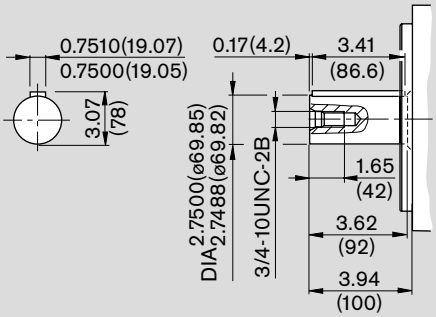
For dimensions of shaft ends and ports see page 29

Dimensions, size 355

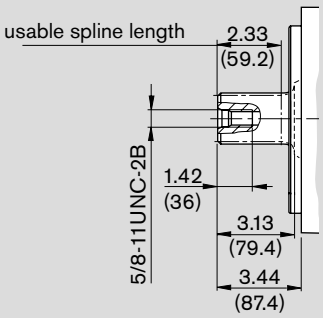
Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

Shaft ends

K Parallel keyed shaft to ISO 3019-1



R Splined shaft similar to ISO 3019-1, similar to SAE F 50-4, 2 in, 8/16 DP; 15T [1]



Ports

				max. tightening torque [2]
S	Suction port (standard pressure series) Mounting bolts	SAE J518 ISO 68	3 in 5/8-11UNC-2B; 1.14(29) deep [2]	
K_1, K_2	Flushing port	ISO 11926	1 5/8-12UN-2B; 0.79(20) deep (plugged)	700 lb-ft (960 Nm)
T	Drain	ISO 11926	1 5/8-12UN-2B; 0.79(20) deep (plugged)	700 lb-ft (960 Nm)
M_B	Gauge port outlet pressure	ISO 11926	7/16-20UNF-2B; 0.39(10) deep (plugged)	29 lb-ft (40 Nm)
M_S	Gauge port suction pressure	ISO 11926	7/16-20UNF-2B; 0.39(10) deep (plugged)	29 lb-ft (40 Nm)
R(L)	Fill + air bleed (case drain port)	ISO 11926	1 5/8-12UN-2B; 0.79(20) deep	700 lb-ft (960 Nm)
U	Flushing port	ISO 11926	3/4-16UNF-2B; 0.59(15) deep (plugged)	117 lb-ft (160 Nm)
M_1, M_2	Gauge port control chamber pressure	DIN 3852	M18x1,5; 0.47(12) deep (plugged)	102 lb-ft (140 Nm)

on version 63

B	Pressure port (high pressure series) Mounting bolts	SAE J518 ISO 68	1 1/2 in 5/8-11UNC-2B; 1.14(29) deep [2]	
B_1	Additional port	ISO 11926	1 5/8-12UN-2B; 0.79(20) deep (plugged)	700 lb-ft (960 Nm)

on version 75

B	Pressure port (high pressure series) Mounting bolts	SAE J518 ISO 68	1 1/2 in 5/8-11UNC-2B; 1.14(29) deep [2]	
B_1	2nd pressure port (high pressure series) Mounting bolts	SAE J518 ISO 68	1 1/2 in (closed with blanking plate) 5/8-11UNC-2B; 1.14(29) deep [2]	

[1] ANSI B92.1a–1976, 30° pressure angle, flat base, flank centering, fit class 5

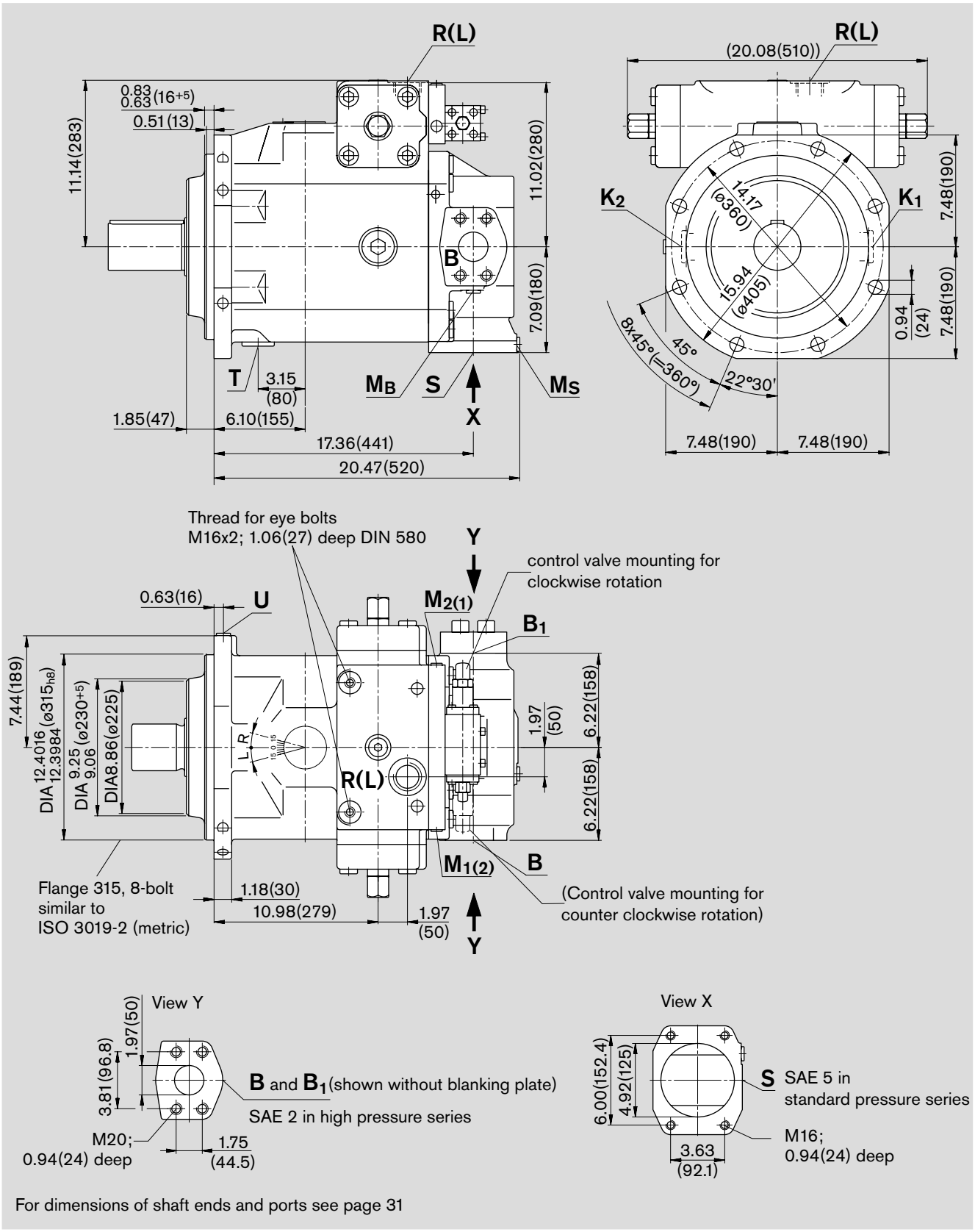
[2] for the max. tightening torques please observe the manufacturer's information on the used fittings and the general information on page 64

Dimensions, size 500

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

Series 3

Example: metric with N00
pressure control; for exact dimensions of control devices see separate data sheets



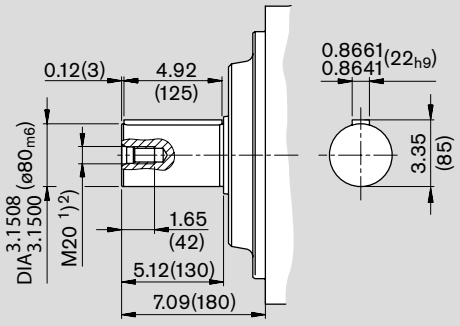
For dimensions of shaft ends and ports see page 31

Dimensions, size 500

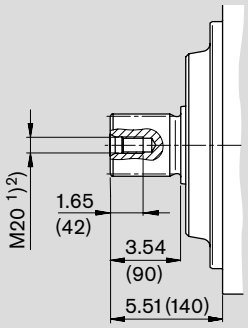
Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

Shaft ends

P Keyed to DIN 6885
AS22x14x125



Z Splined to DIN 5480
W80x3x25x9g



Ports

				max. tightening torque 2)
S	Suction port (standard pressure series) Mounting bolts	SAE J518 3) DIN 13	5 in M16x2; 0.94(24) deep 2)	
K_1, K_2	Flushing port	DIN 3852	M48x2; 0.87(22) deep (plugged)	700 lb-ft (960 Nm)
T	Drain	DIN 3852	M48x2; 0.87(22) deep (plugged)	700 lb-ft (960 Nm)
M_B	Gauge port outlet pressure	DIN 3852	M18x1,5; 0.47(12) deep (plugged)	102 lb-ft (140 Nm)
M_S	Gauge port suction pressure	DIN 3852	M18x1,5; 0.47(12) deep (plugged)	102 lb-ft (140 Nm)
R(L)	Fill + air bleed (case drain port)	DIN 3852	M48x2; 0.87(22) deep	700 lb-ft (960 Nm)
U	Flushing port	DIN 3852	M18x1,5; 0.47(12) deep (plugged)	102 lb-ft (140 Nm)
M_1, M_2	Gauge port control chamber pressure or dependent on control device	DIN 3852 DIN 3852	M18x1,5; 0.47(12) deep (plugged) M14x1,5; 0.47(12) deep (plugged)	102 lb-ft (140 Nm) 58 lb-ft (80 Nm)
B	Pressure port (high pressure series) Mounting bolts	SAE J518 3) DIN 13	2 in M20x2,5; 0.94(24) deep 2)	
B_1	2nd pressure port (high pressure series) Mounting bolts	SAE J518 3) DIN 13	2 in (closed with blanking plate) M20x2,5; 0.94(24) deep 2)	

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

2) for the max. tightening torques please observe the manufacturer's information on the used fittings and the general information on page 64

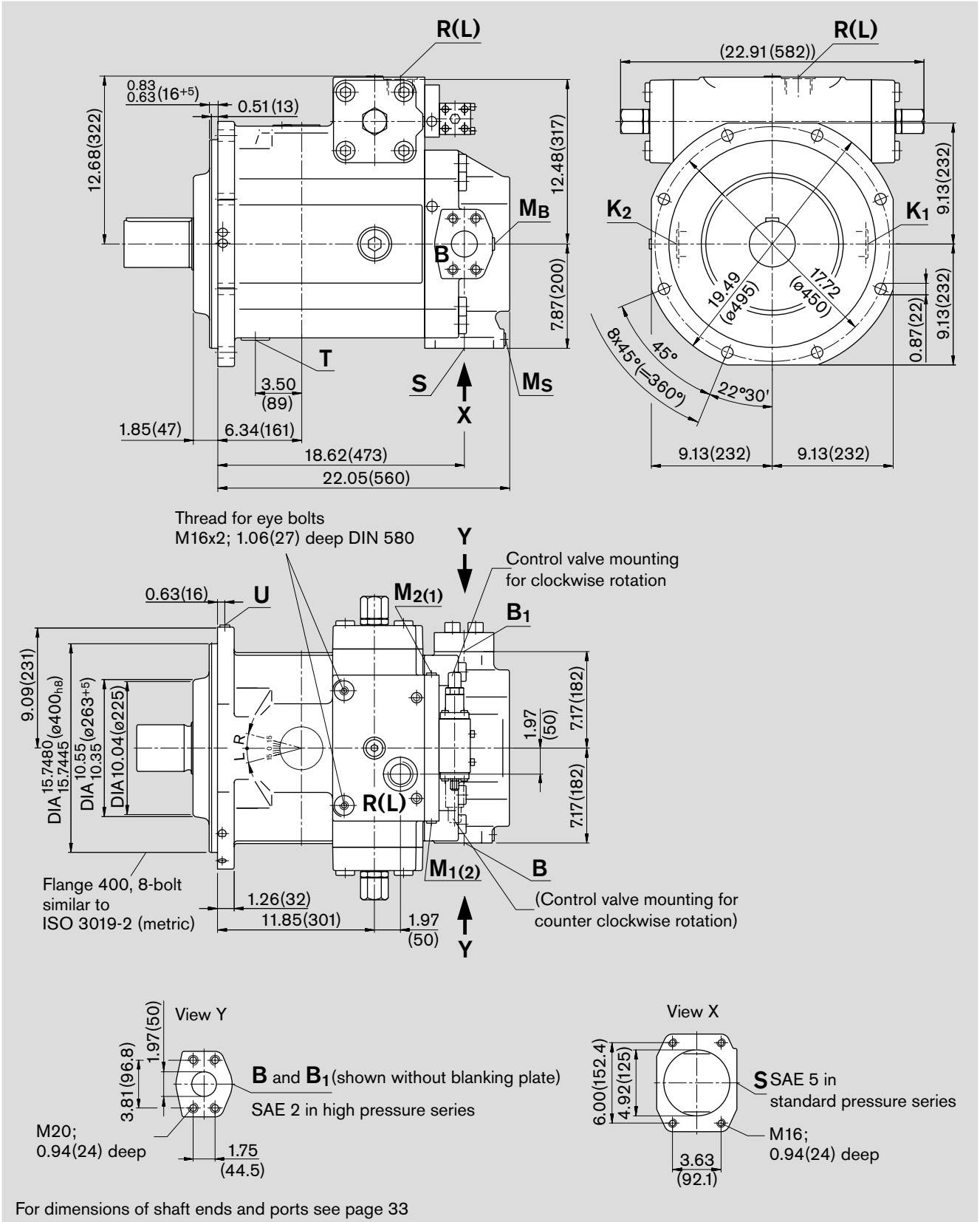
3) Caution: metric thread deviates from standard

Dimensions, size 750

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

Series 3

Example: metric with N00
pressure control; for exact dimensions of control devices see separate data sheets



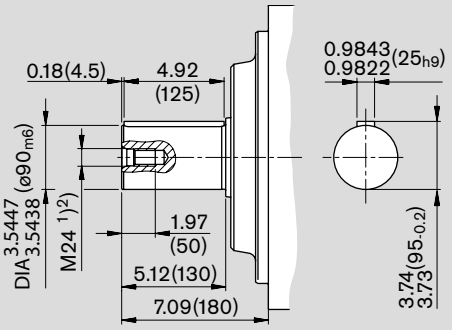
For dimensions of shaft ends and ports see page 33

Dimensions, size 750

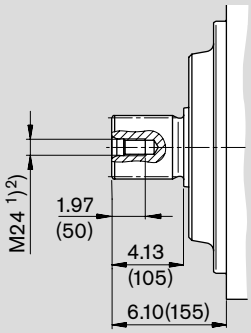
Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

Shaft ends

P Keyed to DIN 6885
AS25x14x125



Z Splined to DIN 5480
W90x3x28x9g



Ports

				max. tightening torques 2)
S	Suction port (standard pressure series) Mounting bolts	SAE J518 3) DIN 13	5 in M16x2; 0.94(24) deep 2)	
K_1, K_2	Flushing port	DIN 3852	M48x2; 0.79(20) deep (plugged)	700 lb-ft (960 Nm)
T	Drain	DIN 3852	M48x2; 0.79(20) deep (plugged)	700 lb-ft (960 Nm)
M_B	Gauge port outlet pressure	DIN 3852	M18x1,5; 0.47(12) deep (plugged)	102 lb-ft (140 Nm)
M_S	Gauge port suction pressure	DIN 3852	M18x1,5; 0.47(12) deep (plugged)	102 lb-ft (140 Nm)
R(L)	Fill + air bleed (case drain port)	DIN 3852	M48x2; 0.79(20) deep	700 lb-ft (960 Nm)
U	Flushing port	DIN 3852	M18x1,5; 0.47(12) deep (plugged)	102 lb-ft (140 Nm)
M_1, M_2	Gauge port control chamber press. or dependent on control device	DIN 3852 DIN 3852	M18x1,5; 0.47(12) deep (plugged) M14x1,5; 0.47(12) deep (plugged)	102 lb-ft (140 Nm) 58 lb-ft (80 Nm)
B	Pressure port (high pressure series) Mounting bolts	SAE J518 3) DIN 13	2 in M20x2,5; 0.94(24) deep 2)	
B_1	2nd pressure port (high pressure series) Mounting bolts	SAE J518 3) DIN 13	2 in (closed with blanking plate) M20x2,5; 0.94(24) deep 2)	

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

2) for the max. tightening torques please observe the manufacturer's information on the used fittings and the general information on page 64

3) Caution: metric thread deviates from standard

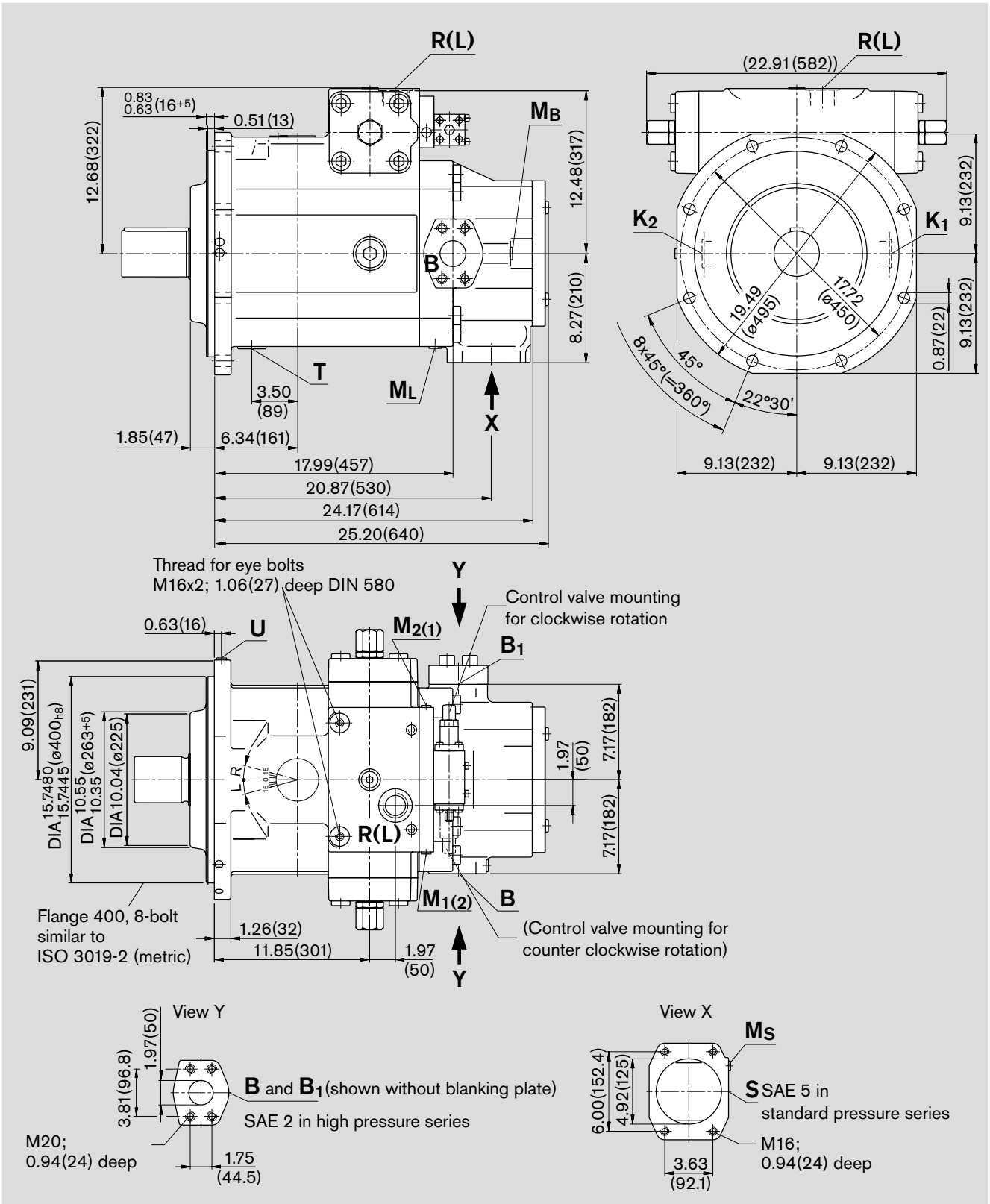
Dimensions, size 750

with boost pump (Impeller)

Series 3

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

Example: metric with N00
pressure control; for exact dimensions of control devices see separate data sheets



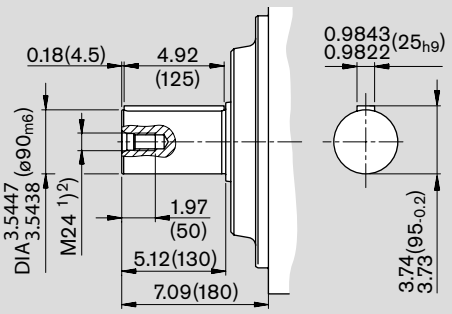
For dimensions of shaft ends and ports see page 35

Dimensions, size 750
with boost pump (Impeller)

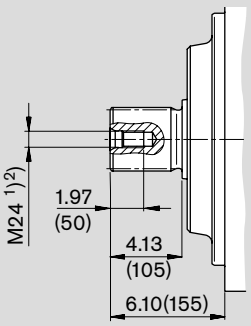
Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

Shaft ends

P Keyed to DIN 6885
AS25x14x125



Z Splined to DIN 5480
W90x3x28x9g



Ports

				max. tightening torque 2)
S	Suction port (standard pressure series) Mounting bolts	SAE J518 3) DIN 13	5 in M16x2; 0.94(24) deep 2)	
K_1, K_2	Flushing port	DIN 3852	M48x2; 0.79(20) deep (plugged)	700 lb-ft (960 Nm)
T	Drain	DIN 3852	M48x2; 0.79(20) deep (plugged)	700 lb-ft (960 Nm)
M_B	Gauge port outlet pressure	DIN 3852	M18x1,5; 0.47(12) deep (plugged)	102 lb-ft (140 Nm)
M_S	Gauge port suction pressure	DIN 3852	M18x1,5; 0.47(12) deep (plugged)	102 lb-ft (140 Nm)
M_L	Gauge port boost pressure	DIN 3852	M18x1,5; 0.47(12) deep (plugged)	102 lb-ft (140 Nm)
R(L)	Fill + air bleed (case drain port)	DIN 3852	M48x2; 0.79(20) deep	700 lb-ft (960 Nm)
U	Flushing port	DIN 3852	M18x1,5; 0.47(12) deep (plugged)	102 lb-ft (140 Nm)
M_1, M_2	Gauge port control chamber press. or dependent on control device	DIN 3852 DIN 3852	M18x1,5; 0.47(12) deep (plugged) M14x1,5; 0.47(12) deep (plugged)	102 lb-ft (140 Nm) 58 lb-ft (80 Nm)
B	Pressure port (high pressure series) Mounting bolts	SAE J518 3) DIN 13	2 in M20x2,5; 0.94(24) deep 2)	
B_1	2nd pressure port (high pressure series) Mounting bolts	SAE J518 3) DIN 13	2 in (closed with blanking plate) M20x2,5; 0.94(24) deep 2)	

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

2) for the max. tightening torques please observe the manufacturer's information on the used fittings and the general information on page 64

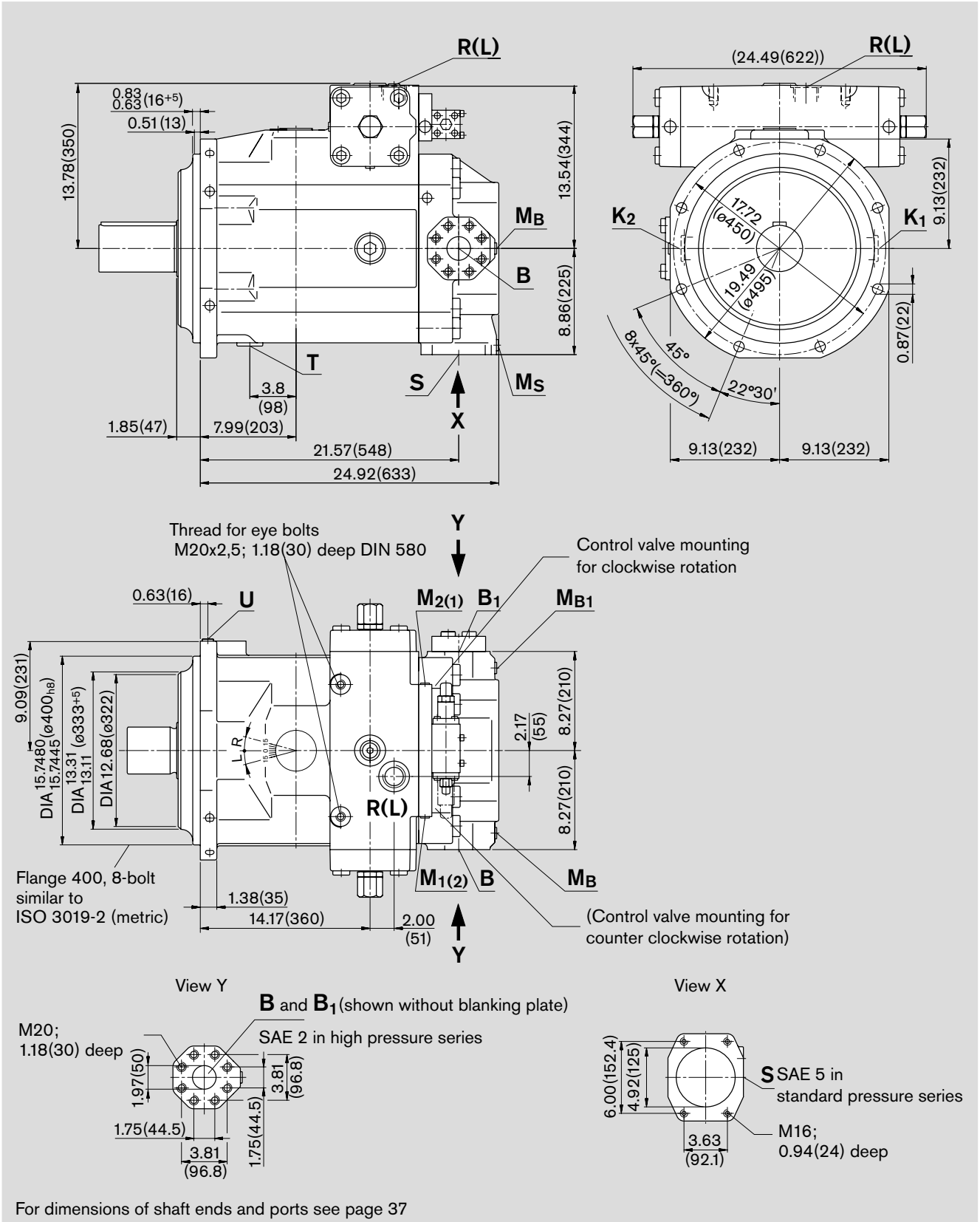
3) Caution: metric thread deviates from standard

Dimensions, size 1000

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

Series 3

Example: metric with N00
pressure control; for exact dimensions of control devices see separate data sheets



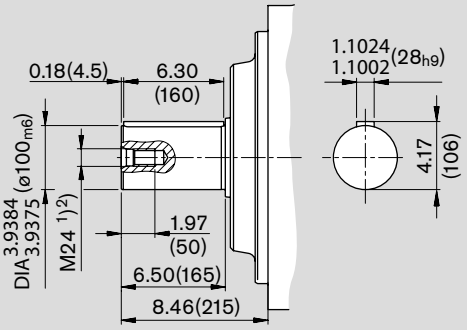
For dimensions of shaft ends and ports see page 37

Dimensions, size 1000

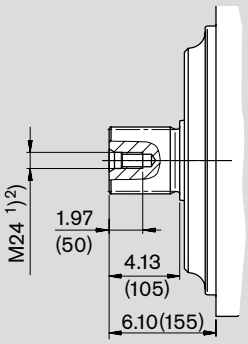
Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

Shaft ends

P Keyed to DIN 6885
AS28x16x160



Z Splined to DIN 5480
W100x3x32x9g



Ports

				max. tightening torque 2)
S	Suction port (standard pressure series) Mounting bolts	SAE J518 3) DIN 13	5 in M16x2; 0.94(24) deep 2)	
K_1, K_2	Flushing port	DIN 3852	M48x2; 0.79(20) deep (plugged)	700 lb-ft (960 Nm)
T	Drain	DIN 3852	M48x2; 0.79(20) deep (plugged)	700 lb-ft (960 Nm)
M_B, M_{B1}	Gauge port outlet pressure	DIN 3852	M18x1,5; 0.47(12) deep (plugged)	102 lb-ft (140 Nm)
M_S	Gauge port suction pressure	DIN 3852	M18x1,5; 0.47(12) deep (plugged)	102 lb-ft (140 Nm)
R(L)	Fill + air bleed (case drain port)	DIN 3852	M48x2; 0.79(20) deep	700 lb-ft (960 Nm)
U	Flushing port	DIN 3852	M18x1,5; 0.47(12) deep (plugged)	102 lb-ft (140 Nm)
M_1, M_2	Gauge port control chamber press.or dependent on control device	DIN 3852 DIN 3852	M18x1,5; 0.47(12) deep (plugged) M14x1,5; 0.47(12) deep (plugged)	102 lb-ft (140 Nm) 58 lb-ft (80 Nm)
B	Pressure port (high pressure series) Mounting bolts	SAE J518 3) DIN 13	2 in M20x2,5; 1.18(30) deep 2)	
B_1	2nd pressure port (high pressure series) Mounting bolts	SAE J518 3) DIN 13	2 in (closed with blanking plate) M20x2,5; 1.18(30) deep 2)	

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

2) for the max. tightening torques please observe the manufacturer's information on the used fittings and the general information on page 64

3) Caution: metric thread deviates from standard

Through drive

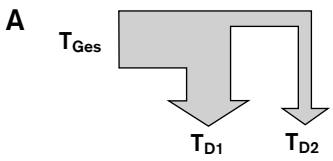
The axial piston unit (A)A4VSO can be equipped with a through drive, as shown in the type code on page 4.
The through drive execution is designated by the code K/U 15...99.

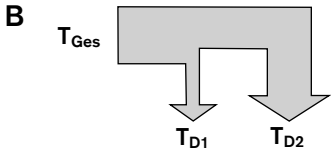
We recommend, that no more than three pumps be coupled together.

Permissible input and through drive torques

Size			40	71	125	180	250	355	500	750	1000
Splined shaft											
Max. perm. total input torque at shaft of pump 1											
(Pump 1 + pump 2)	$T_{tot\ max}$	lb-ft	329	583	1027	1478	2052	2133	4105	6157	8209
		Nm	(446)	(790)	(1392)	(2004)	(2782)	(2890)	(5566)	(8348)	(11130)
A Perm.through drive torque	$T_{D1\ max}$	lb-ft	164	291	513	739	1026	1457	2052	3078	4104
		Nm	(223)	(395)	(696)	(1002)	(1391)	(1976)	(2783)	(4174)	(5565)
	$T_{D2\ max}$	lb-ft	164	291	513	739	1026	675	2052	3078	4104
		Nm	(223)	(395)	(696)	(1002)	(1391)	(914)	(2783)	(4174)	(5565)
B Perm. through drive torque	$T_{D1\ max}$	lb-ft	164	291	513	739	1026	675	2052	3078	4104
		Nm	(223)	(395)	(696)	(1002)	(1391)	(914)	(2783)	(4174)	(5565)
	$T_{D2\ max}$	lb-ft	164	291	513	739	1026	1457	2052	3078	4104
		Nm	(223)	(395)	(696)	(1002)	(1391)	(1976)	(2783)	(4174)	(5565)
Keyed shaft											
Max. perm. total input torque at shaft of pump 1											
(Pump 1 + pump 2)	$T_{tot\ max}$	lb-ft	329	583	1027	1479	1889	2917	3835	5541	6965
		Nm	(446)	(790)	(1392)	(2004)	(2560)	(3952)	(5200)	(7513)	(9444)
A Perm. through drive torque	$T_{D1\ max}$	lb-ft	164	291	513	739	1026	1457	2052	3078	4104
		Nm	(223)	(395)	(696)	(1002)	(1391)	(1976)	(2783)	(4174)	(5565)
	$T_{D2\ max}$	lb-ft	164	291	513	739	863	1457	1783	2463	2860
		Nm	(223)	(395)	(696)	(1002)	(1169)	(1976)	(2417)	(3339)	(3879)
B Perm. through drive torque	$T_{D1\ max}$	lb-ft	164	291	513	739	863	1457	1783	2463	2860
		Nm	(223)	(395)	(696)	(1002)	(1169)	(1976)	(2417)	(3339)	(3879)
	$T_{D2\ max}$	lb-ft	164	291	513	739	1026	1457	2052	3078	4104
		Nm	(223)	(395)	(696)	(1002)	(1391)	(1976)	(2783)	(4174)	(5565)

Distribution of torques





Single pump with through drive

If no further pumps are factory-mounted the simple type code is sufficient.

included in this case are:

on all through drives except K/U 99
shaft coupler, mounting screws, seal and if required an adapter flange

on K/U 99
with through drive shaft, without shaft coupler, without adapter flange; unit is closed with pressure tight cover.

Universal through drive

On pump sizes 125...355 all through drives are supplied as universal through drives „U“ .

These have the advantage, that they can be adapted later on.

Simply by exchanging the adapter flange and the shaft coupler it is possible to convert the through drive option.
The conversion sets must be ordered separately, see RE 95581.

Combination pumps

Independent circuits are available for the user when further pumps are built on.

1. If the combination consists of **2 Rexroth axial piston pumps**, and if this must be **factory mounted**, the two individual type codes must be joined by a „+“ .

   Ordering example:
   AA4VSO 125 DR / 30 R – PSD75U16 **+** AA4VSO 71 DR / 10 R – PSD63N00

2 If a **gear** or a radial piston pump must be **factory mounted** as the second pump please consult us.

Overview of (A)A4VSO through drive options

Through drive - (A)A4VSO			Mounting option 2. pump					Through drive
Flange	Coupler for splined shaft [6]	Code	(A)A4VSO/G size (shaft)	(A)A4CSG size (shaft)	(A)A10V(S)O/31(2) [5] size (shaft)	A10V(S)O/52(3) size (shaft)	Gear and vane pump (shaft) cm^3/rev	available on size
Flange SAE J 744 (ISO 3019-1)								
82-2 (A) [1]	16-4 (5/8in, 9T) [3]	**K/U01**	–	–	–	–	AZ-PF-1X-(R) 004...028 [4] PGH2/3(R) 5...16	40...750
	19-4 (3/4in, 11T) [3]	**K/U52**	–	–	18 (S)/31	10, 18 (S)	–	40...355
101-2 (B) [1]	22-4 (7/8in, 13T) [3]	**K/U68**	–	–	28 (S)/31	28 (S)	AZ-PN-1X-(D) 020...036 [4]	40...500
	25-4 (1in, 15T) [3]	**K/U04**	–	–	45 (S)/31	45 (S)	PGH4-3X(R) 20...50	40...500
127-2 (C) [1]	32-4 (1 1/4in, 14T) [3]	**K/U07**	–	–	71 (S)/31	–	PVV/Q4/5(J) 69...193	71...500
	38-4 (1 1/2in, 17T) [3]	**K/U24**	–	–	100 (S)/31	85 (S)	PGH5-3X(R) 63...250	125...500
127-4(C) [1]	32-4 (1 1/4in, 14T) [3]	**K/U15**	40 (S)	–	71(S)32	–	–	40...355
	38-4 (1 1/2in, 17T) [3]	**K/U16**	71 (S)	–	–	–	–	71...355
152-4(D) [1]	44-4 (1 3/4in, 13T) [3]	**K/U17**	125 (S)	–	140 (S)/31/32	–	–	125...500
	50-4 (2in, 15T) [3]	**U78**	180 (S)	–	–	–	–	180...355
165-4(E) [1]	50-4 (2in, 15T) [3]	**U18**	250 (S)	250 (S)	–	–	–	250, 355
			355 (R)	355 (R)	–	–	–	355
Flange ISO 3019-2 (metric)								
80, 2-bolt	19-4 (3/4in, 11T) [3]	**KB2**	–	–	18 (S)/31	10 (S)	–	in preparation
100, 2-bolt	22-4 (7/8in, 13T) [3]	**KB3**	–	–	28 (S)/31	–	–	in preparation
	25-4 (1in, 15T) [3]	**KB4**	–	–	45 (S)/31	–	–	500
125, 2-bolt	32-4 (1 1/4in, 14T) [3]	**KB5**	–	–	71 (S)/31	–	–	in preparation
	38-4(1 1/2in, 17T) [3]	**KB6**	–	–	100 (S)/31	–	–	in preparation
125, 4-bolt	W 32x2x14x9g [2]	**K31**	40 (Z)	–	–	–	–	500
140, 4-bolt	W 40x2x18x9g [2]	**K33**	71 (Z)	–	–	–	–	500, 750
160, 4-bolt	W 50x2x24x9g [2]	**K34**	125 (Z)	–	–	–	–	500, 750
			180 (Z)	–	–	–	–	500, 750
	32-4 (1 1/4in, 14T) [3]	**KB8**	–	–	71 (S)/32	–	–	in preparation
180, 4-bolt	44-4 (1 3/4in, 13T) [3]	**KB7**	–	–	140 (S)/31/32	–	–	500
	38-4 (1 1/2in, 17T) [3]	**KB9**	–	–	100 (S)/32	–	–	in preparation
224, 4-bolt	W 60x2x28x9g [2]	**K35**	250 (Z)	250 (Z)	–	–	–	500, 750
	W 70x3x22x9g [2]	**K77**	355 (Z)	355 (Z)	–	–	–	500
315, 8-bolt	W 80x3x25x9g [2]	**K43**	500 (Z)	500 (Z)	–	–	–	500, 750
400, 8-bolt	W 90x3x28x9g [2]	**K76**	750 (Z)	750 (Z)	–	–	–	750
	W 100x3x32x9g [2]	**K88**	1000 (Z)	–	–	–	–	1000
Dia 63-4, metr.	Keyed dia 25	**K/U57**	–	–	–	–	R4	40 a. 71

[1] 2 = 2-bolt, 4 = 4-bolt

[2] to DIN 5480

[3] Splined shafts acc. to ISO 3019-1 (SAEJ744)

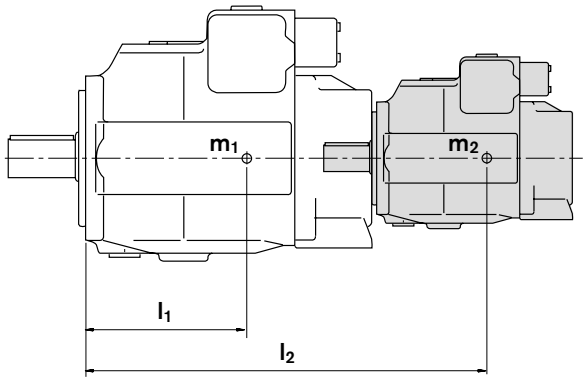
[4] Rexroth recommends special versions of the gear pumps. Please consult us.

[5] If a through drive for an A10V(S)O with R-shaft is desired, please consult us.

[6] Keyed shaft on through drive code K/U57

Permissible mass moment of inertia

referred to the mounting flange of the main pump



m_1, m_2 lbs (kg) Weight of pump

l_1, l_2 in (mm) Distance center of gravity

$$T_m = m_1 \bullet l_1 \bullet \frac{1}{12} + m_2 \bullet l_2 \bullet \frac{1}{12} \text{ [lb-ft]}$$

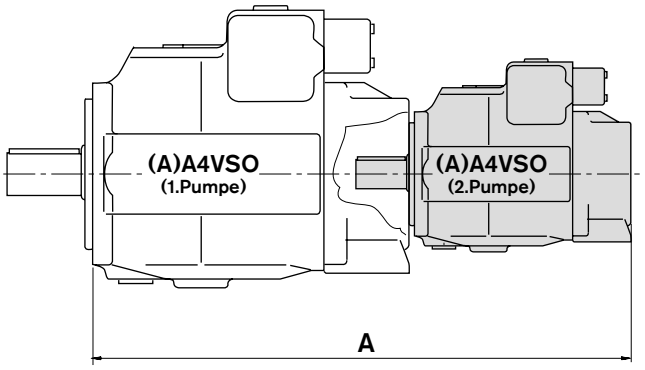
$$(T_m = m_1 \bullet l_1 \bullet \frac{1}{102} + m_2 \bullet l_2 \bullet \frac{1}{102} \text{ [Nm]})$$

Size			40	71	125	180	250	355	500	750	1000
Perm. mass moment of inertia	$T_{m\ perm.}$	lb-ft (Nm)	1327 (1800)	1475 (2000)	3098 (4200)	3098 (4200)	6859 (9300)	6859 (9300)	11506 (15600)	14382 (19500)	14382 (19500)
Perm. mass moment at dynam. acceleration of 10 g ≙ 98,1 m/sec²	$T_{m\ perm.}$	lb-ft (Nm)	132 (180)	148 (200)	310 (420)	310 (420)	686 (930)	686 (930)	1151 (1560)	1438 (1950)	1438 (1950)
Weight (A4VSO...DR)	m	lbs (kg)	86 (39)	117 (53)	194 (88)	225 (102)	406 (184)	456 (207)	705 (320)	1041 (460)	1333 (605)
Distance center of gravity	l_1	in (mm)	4.72 (120)	5.51 (140)	6.69 (170)	7.08 (180)	8.26 (210)	8.66 (220)	9.05 (230)	10.23 (260)	11.41 (290)

Dimensions combination pumps

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

(A)A4VSO + (A)A4VSO



Overall lenght A

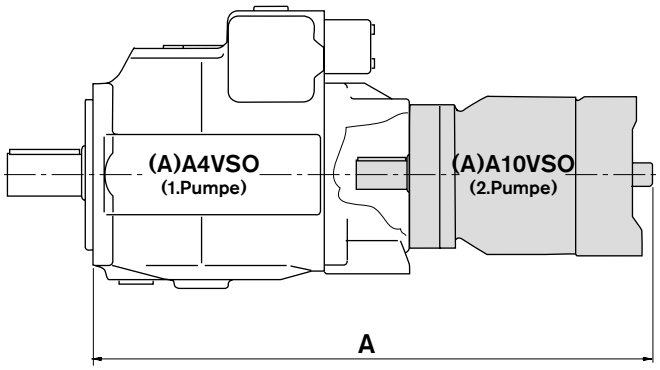
(A)A4VSO	(A)A4VSO..DR..N00 (2. pump)								
(1. pump)	Size 40	Size 71	Size 125	Size 180	Size 250	Size 355	Size 500	size 750	Size 1000
Size 40	22.17(563)	–	–	–	–	–	–	–	–
Size 71	23.27(591)	24.41(620)	–	–	–	–	–	–	–
Size 125	25.16(639)	26.30(668)	29.17(741)	–	–	–	–	–	–
Size 180	26.10(663)	27.24(692)	30.12(765)	31.89(810)	–	–	–	–	–
Size 250	28.46(723)	29.61(752)	31.97(812)	33.78(858)	36.14(918)	–	–	–	–
Size 355	29.61(752)	30.75(781)	33.11(841)	34.92(887)	37.28(947)	38.44(976)	–	–	–
Size 500	30.35(771)	31.50(800)	33.86(860)	34.65(880)	38.43(976)	39.57(1005)	43.70(1110)	–	–
Size 750	32.32(821)	33.46(850)	35.83(910)	36.61(930)	40.39(1026)	41.54(1055)	45.67(1160)	47.80(1214)	–
Size 1000	*	*	*	*	*	*	*	*	53.86(1368)

* on request

Dimensions combination pumps

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

(A)A4VSO + (A)A10VSO



Overall lenght A

(A)A4VSO	(A)A10VSO.../31 (2. pump)					
(1. pump)	Size 18	Size 28	Size 45	Size 71	Size 100	Size 140
Size 40	18.11(460)	19.61(498)	20.31(516)	–	–	–
Size 71	20.16(512)	20.87(530)	21.57(548)	22.83(580)	–	–
Size 125	22.28(566)	22.72(577)	23.43(595)	24.72(628)	27.56(700)	–
Size 180	23.23(590)	23.66(601)	24.37(619)	25.67(652)	28.50(724)	29.33(745)
Size 250	25.59(650)	26.02(661)	26.73(679)	28.03(712)	30.87(784)	31.18(792)
Size 355	*	*	27.87(708)	29.17(741)	*	32.32(821)
Size 500	27.56(700)	27.99(711)	28.70(729)	30.08(764)	33.74(857)	34.17(868)
Size 750	29.53(750)	29.96(761)	30.67(779)	31.97(812)	35.71(907)	36.10(917)
Size 1000	*	*	*	*	*	*

* on request

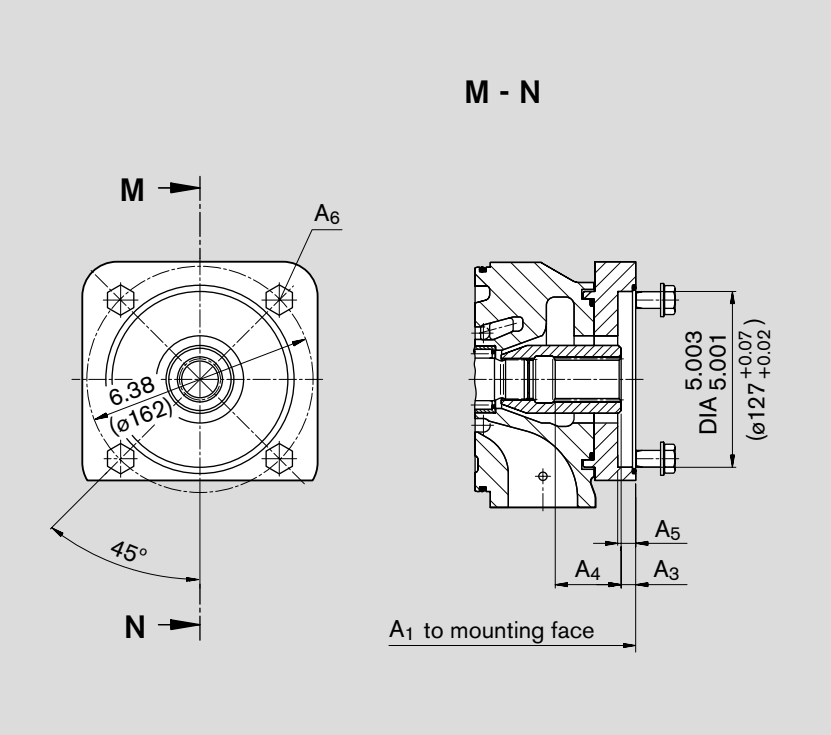
Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

K15

Flange 127-4 to ISO 3019-1 (SAE C, 4-bolt)
Shaft coupler 32-4 to ISO 3019-1 (SAE C, 1 1/4 in, 12/24 DP; 14 T) [3]

for mounting an AA4VSO/G 40 splined shaft



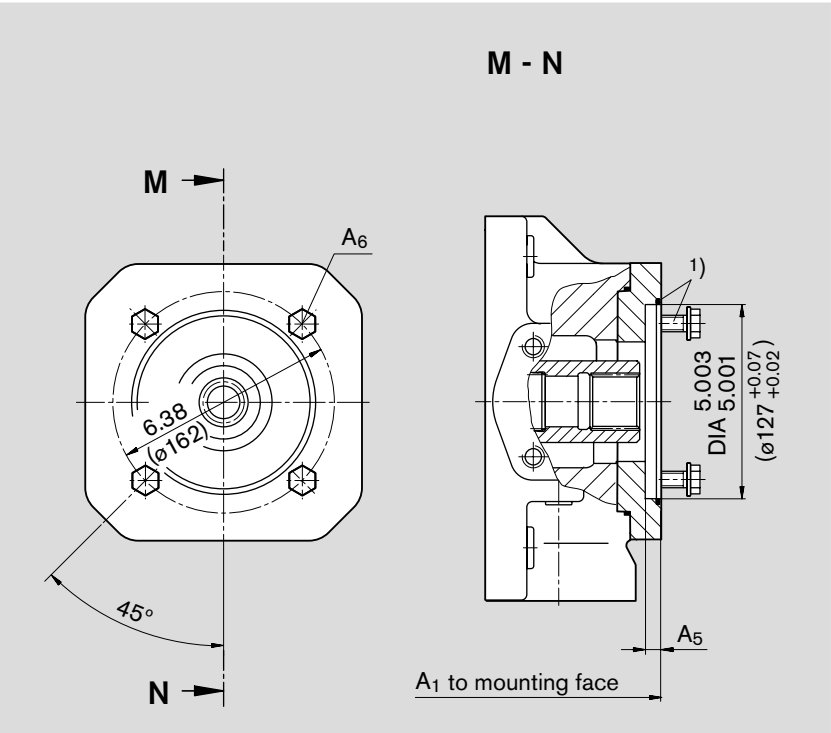
Size	A_1	A_3	A_4
40	11.61(295)	0.51(13)	1.73(44)
71	12.72(323)	0.41(10.4)	1.87(47.5)

Size	A_5	A_6 [2]
40	0.51(13)	M12
71	0.51(13)	M12

U15

Flange 127-4 to ISO 3019-1 (SAE C, 4-bolt)
Shaft coupler 32-4 to ISO 3019-1 (SAE C, 1 1/4 in, 12/24 DP; 14 T) [3]

for mounting an AA4VSO/G 40 splined shaft



Size	A_1	A_5	A_6 [2]
125	14.61(371)	0.51(13)	M12
180	15.55(395)	0.51(13)	M12
250	17.91(455)	0.51(13)	M12
355	19.06(484)	0.51(13)	M12

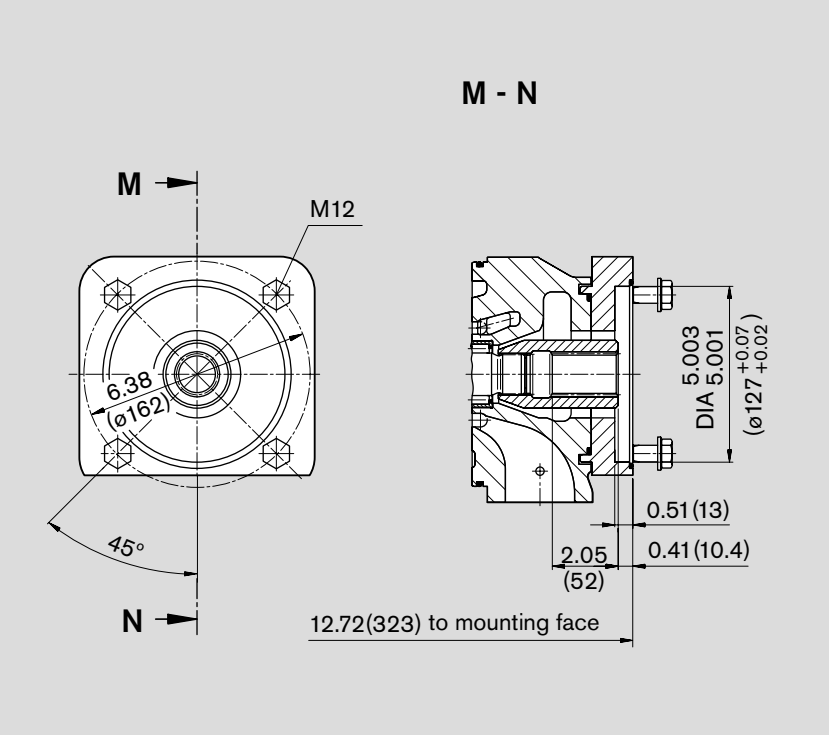
Further dimensions on request

[1] Mounting screws and O-ring seal are included with supply
[2] Thread to DIN 13, for the max. tightening torques observe the general information on page 64
[3] To ANSI B92.1a-1976, 30° pressure angle, flat base, flank centering, fit class 5

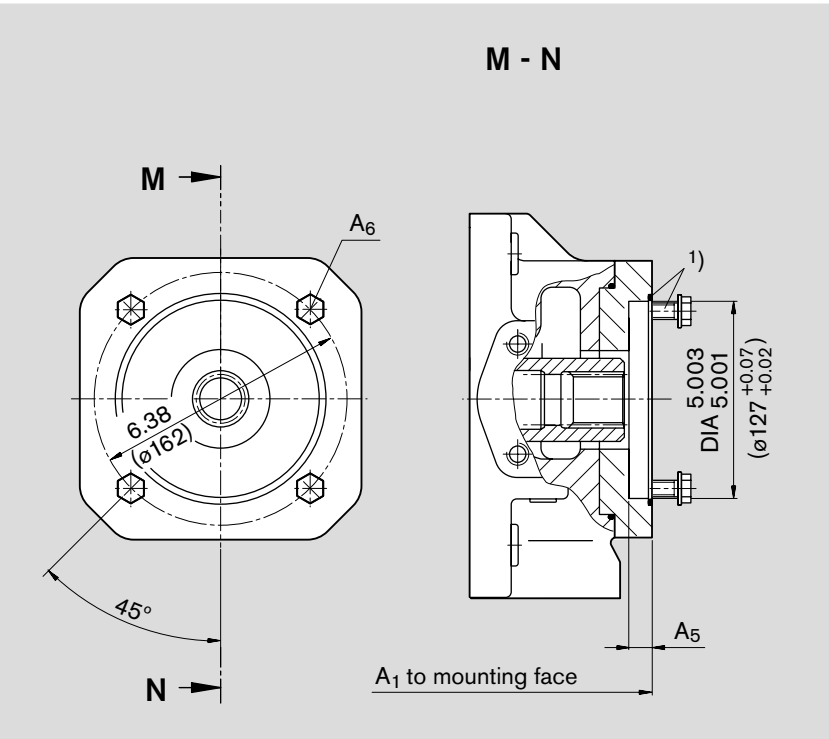
Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

K16 **Flange 127-4 to** ISO 3019-1 (SAE C, 4-bolt)
Shaft coupler 38-4 to ISO 3019-1 (SAE C-C, 1 1/2 in, 12/24 DP; 17T) [3]
for mounting an AA4VSO/G 71 splined shaft
only on mainpump AA4VSO/G 71



U16 **Flange 127-4 to** ISO 3019-1 (SAE C, 4-bolt)
Shaft coupler 38-4 to ISO 3019-1 (SAE C-C, 1 1/2 in, 12/24 DP; 17T) [3]
for mounting an AA4VSO/G 71 splined shaft



Size	A_1	A_5	A_6 [2]
125	14.61(371)	0.51(13)	M12
180	15.55(395)	0.51(13)	M12
250	17.91(455)	0.51(13)	M12
355	19.06(484)	0.51(13)	M12

Further dimensions on request

[1]) Mounting screws and O-ring seal are included with supply
[2]) Thread to DIN 13, for the max. tightening torques observe the general information on page 64
[3]) To ANSI B92.1a-1976, 30° pressure angle, flat base, flank centering, fit class 5

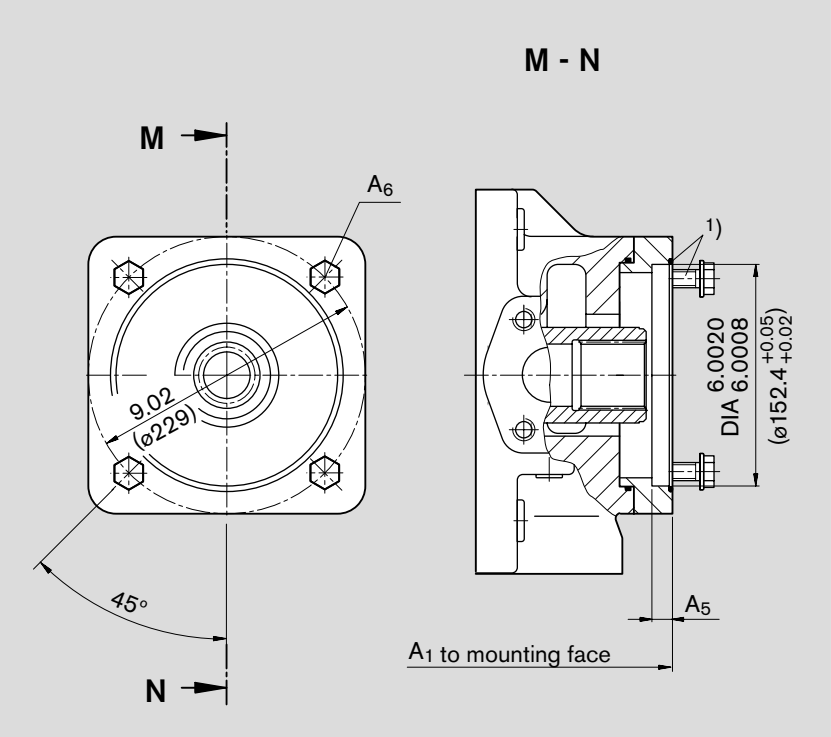
Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

U17

Flange 152-4 to ISO 3019-1 (SAE D, 4-bolt)
Shaft coupler 44-4 to ISO 3019-1 (SAE D, 1 3/4 in, 8/16 DP; 13 T) [3]

for mounting an AA4VSO/G 125 splined shaft, A10VO140/31(2) or AA10VSO 140/31(2) splined shaft S (see RA 92701, RA 92711 or RA 92714)



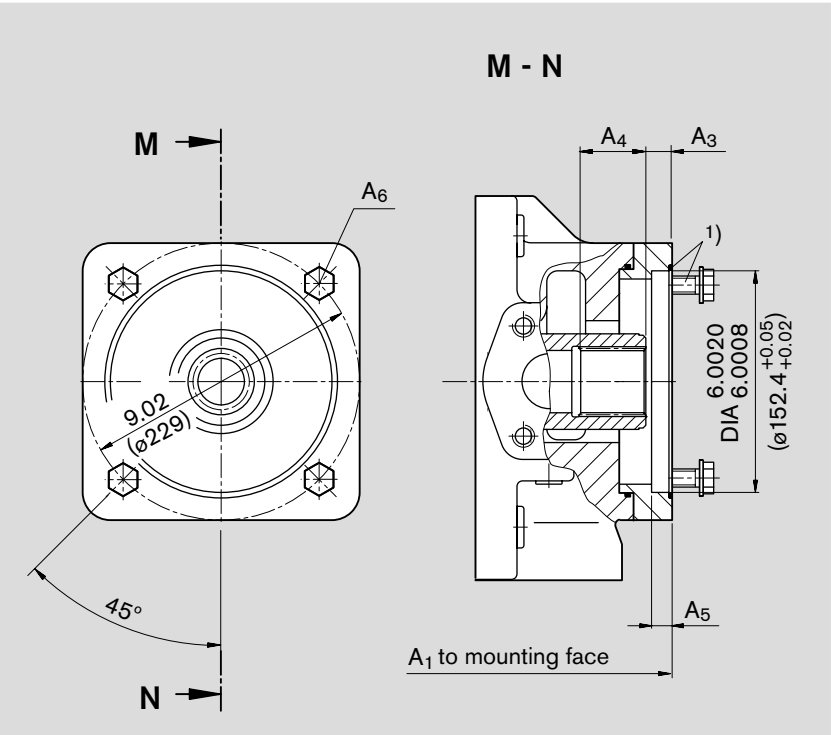
Size	A_1	A_5	A_6 [2]
125	15.12(384)	0.51(13)	M16
180	16.06(408)	0.51(13)	M16
250	17.91(455)	0.51(13)	M16
355	19.06(484)	0.51(13)	M16

Further dimensions on request

U78

Flange 152-4 to ISO 3019-1 (SAE D, 4-bolt)
Shaft coupler 50-4 to ISO 3019-1 (SAE F, 2 in, 8/16 DP; 15 T) [3]

for mounting an AA4VSO/G 180 splined shaft



Size	A_1	A_3	A_4
180	17.05(433)	0.41(10.4)	3.39(86.1)
250	18.94(481)	1.20(30.4)	2.33(59.1)
355	20.08(510)	1.20(30.4)	2.33(59.1)

Size	A_5	A_6 [2]
180	0.51(13)	M16
250	0.51(13)	M16
355	0.51(13)	M16

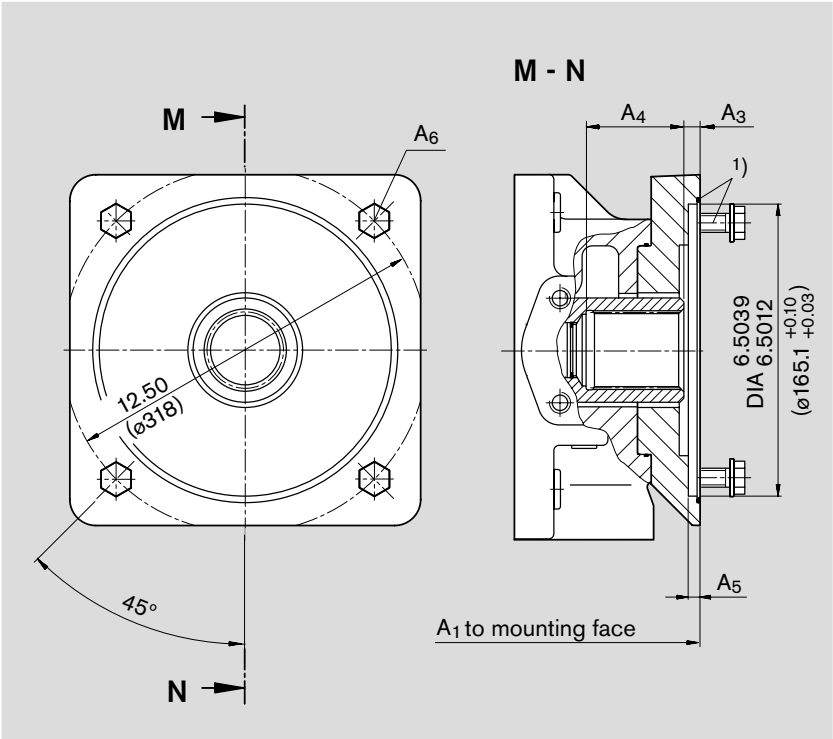
[1] Mounting screws and O-ring seal are included with supply
[2] Thread to DIN 13, for the max. tightening torques observe the general information on page 64
[3] To ANSI B92.1a-1976, 30° pressure angle, flat base, flank centering, fit class 5

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

U18 **Flange 165-4 to** ISO 3019-1 (SAE E, 4-bolt)
Shaft coupler 50-4 to ISO 3019-1 (SAE F, 2 in 8/16 DP; 15 T) [3]

for mounting an AA4VSO/G or AA4CSG 250 or 355 splined shaft



Size	A_1	A_3	A_4
250	18.94(481)	1.20(30.4)	2.33(59.3)
355	20.09(510)	1.20(30.4)	2.34(59.4)

Size	A_5	A_6 [2]
250	0.67(17)	M20
355	0.67(17)	M20

[1] Mounting screws and O-ring seal are included with supply
[2] Thread to DIN 13, for the max. tightening torques observe the general information on page 64
[3] To ANSI B92.1a-1976, 30° pressure angle, flat base, flank centering, fit class 5

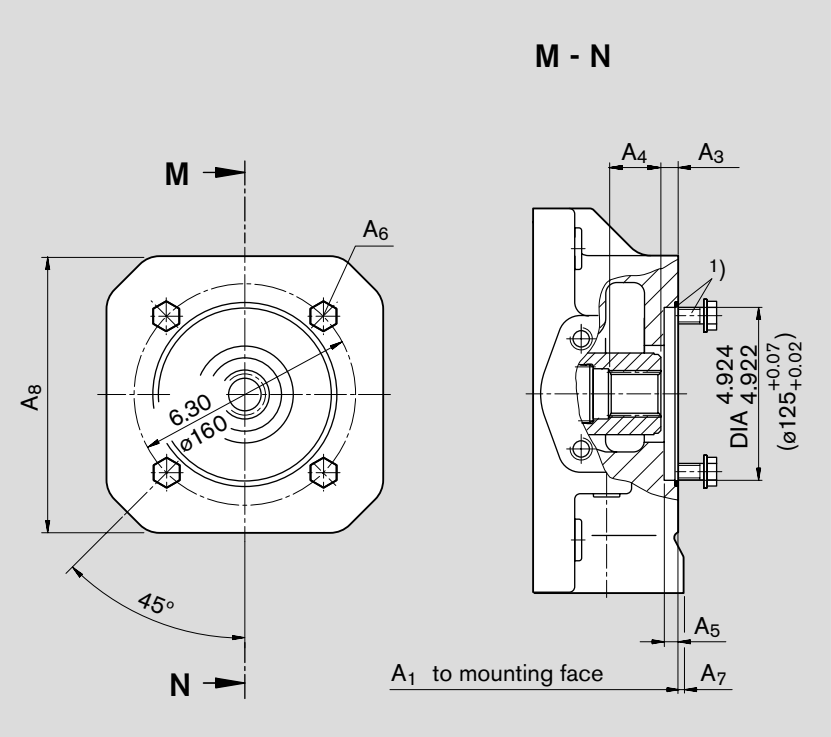
Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

K31

Flange 125, 4-bolt – 125B4HW **to** ISO 3019-2
Shaft coupler N32x2x14x8H **to** DIN 5480

for mounting an A4VSO/G 40 splined shaft



Size	A_1	A_3	A_4
500	19.88(505)	0.49(12.5)	1.52(38.5)
750	in preparation		
1000	in preparation		

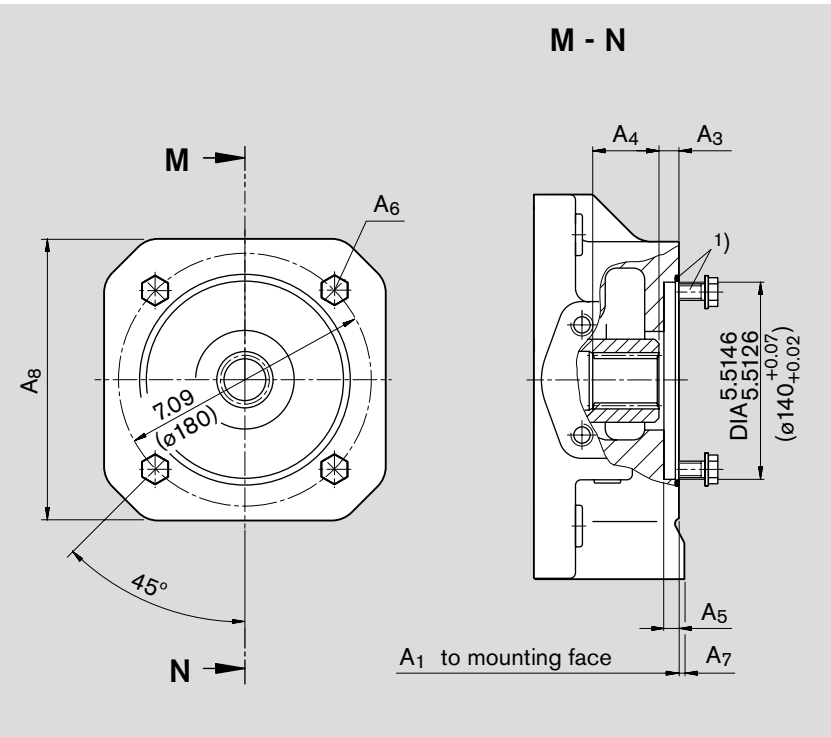
Size	A_5	A_6 2)	A_7
500	0.35(9)	M12	0.59(15)
750	in preparation		
1000	in preparation		

Size	A_8
500	9.45(240)
750	in preparation
1000	in preparation

K33

Flange 140, 4-bolt B4HW to ISO 3019-2
Shaft coupler N40x2x18x8H **to** DIN 5480

for mounting an A4VSO/G 71 splined shaft



Size	A_1	A_3	A_4
500	19.88(505)	0.49(12.5)	2.24(57)
750	21.85(555)	0.49(12.5)	1.75(44.5)
1000	in preparation		

Size	A_5	A_6 2)	A_7
500	0.35(9)	M12	0.59(15)
750	0.35(9)	M12	–
1000	in preparation		

Size	A_8
500	9.45(240)
750	–
1000	in preparation

1) Mounting screws and O-ring seal are included with supply
2) Thread to DIN 13, for the max. tightening torques observe the general information on page 64

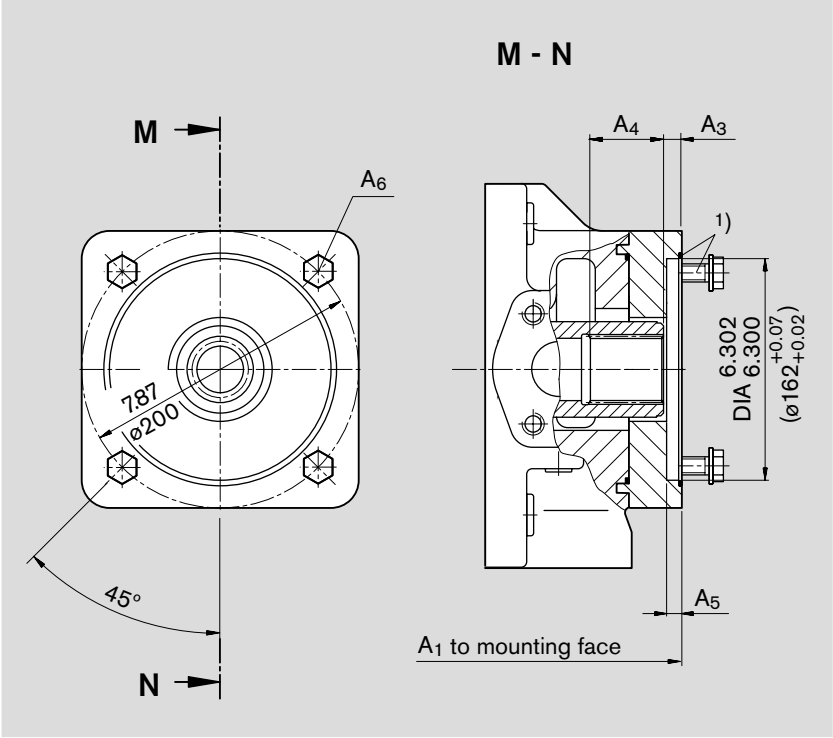
Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

K34

Flange 160, 4-bolt – 160B4HW to ISO 3019-2
Shaft coupler N50x2x24x8H to DIN 5480

for mounting an A4VSO/G 125 or 180 splined shaft



Size	A_1	A_3	A_4
500	19.69(505)	0.53(13.5)	2.15(54.5)
750	21.85(555)	0.49(12.5)	2.19(55.5)
750 *	in preparation		
1000	in preparation		

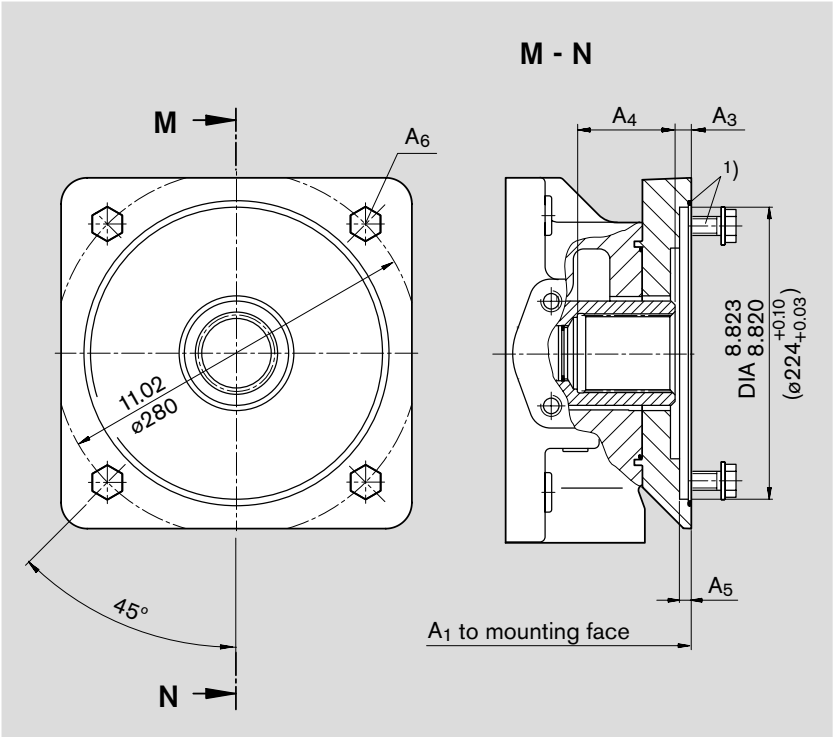
Size	A_5	A_6 2)
500	0.35(9)	M16
750	0.35(9)	M16
750 *	in preparation	
1000	in preparation	

* with boost pump

K35

Flange 224, 4-bolt – 224B4HW to ISO 3019-2
Shaft coupler N60x2x28x8H to DIN 5480

for mounting an A4VSO/G or A4CSG 250 splined shaft



Size	A_1	A_3	A_4
500	21.30(541)	0.49(12.5)	2.91(74)
750	23.27(591)	0.49(12.5)	2.91(74)
750*	in preparation		
1000	in preparation		

Size	A_5	A_6 2)
500	0.35(9)	M20
750	0.35(9)	M20
750*	in preparation	
1000	in preparation	

* with boost pump

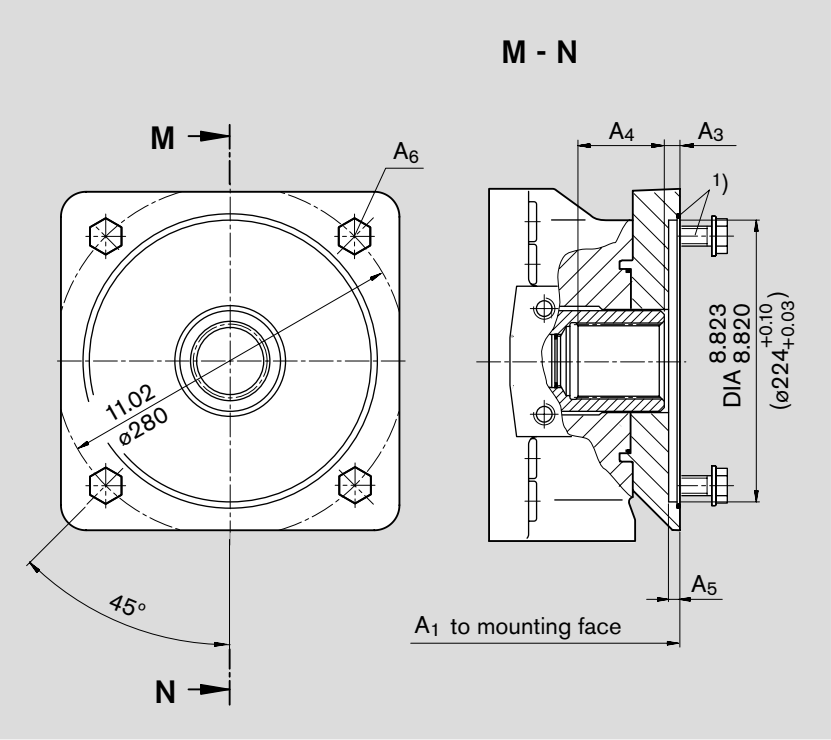
1) Mounting screws and O-ring seal are included with supply
2) Thread to DIN 13, for the max. tightening torques observe the general information on page 64

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

K77 **Flange** 224, 4-bolt – 224B4HW to ISO 3019-2
Shaft coupler N70x3x22x8H to DIN 5480

for mounting an A4VSO/G or A4CSG 355 splined shaft

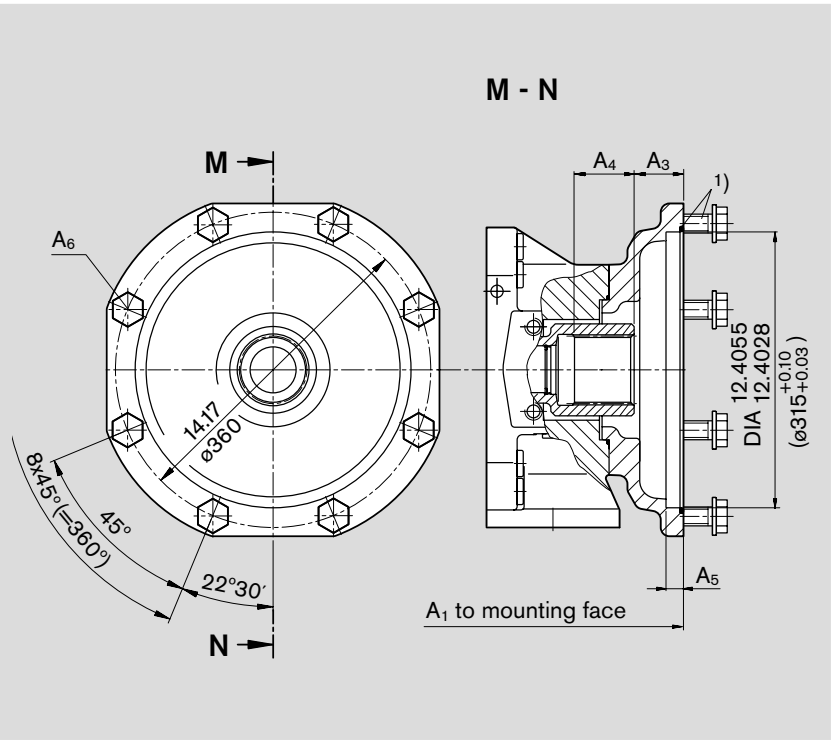


Size	A_1	A_3	A_4
500	21.30(541)	0.49(12.5)	2.99(76)
750	in preparation		
1000	in preparation		

Size	A_5	A_6 2)
500	0.35(9)	M20
750	in preparation	
1000	in preparation	

K43 **Flange** 315, 8-bolt – 315D8HW to ISO 3019-2
Shaft coupler N80x3x25x8H to DIN 5480

for mounting an A4VSO/G or A4CSG 500 splined shaft



Size	A_1	A_3	A_4
500	23.23(590)	2.11(53.5)	2.83(71.9)
750	25.20(640)	2.11(53.5)	2.83(71.9)
750*	in preparation		
1000	in preparation		

Size	A_5	A_6 2)
500	0.75(19)	M20
750	0.75(19)	M20
750*	in preparation	
1000	in preparation	

* with boost pump

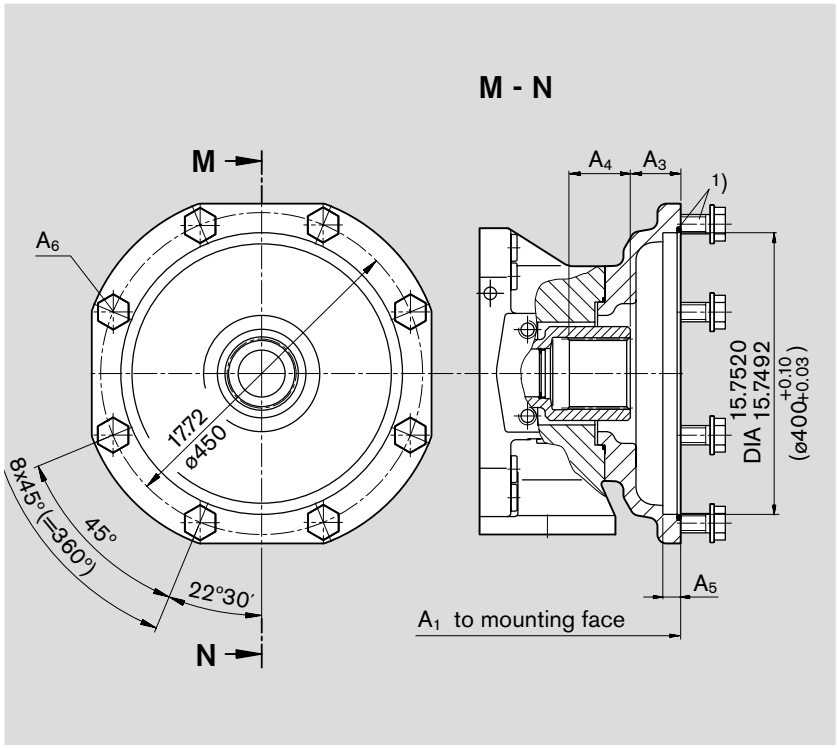
1) Mounting screws and O-ring seal are included with supply
2) Thread to DIN 13, for the max. tightening torques observe the general information on page 64

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

K76 **Flange** 400, 8-bolt – 400D8HW to ISO 3019-2
Shaft coupler N90x3x28x8H to DIN 5480

for mounting an A4VSO/G or A4CSG 750 splined shaft



Size	A_1	A_3	A_4
750	25.79(655)	2.09(53)	4.09(104)
750*	in preparation		
1000	in preparation		

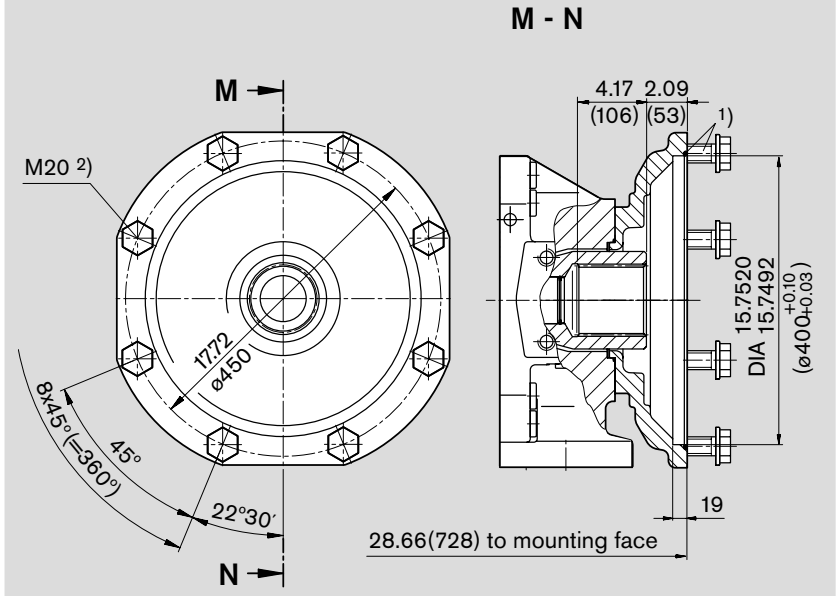
Size	A_5	A_6 2)
750	0.75(19)	M20
750*	in preparation	
1000	in preparation	

* with boost pump

K88 **Flange** 400, 8-bolt – 400D8HW to ISO 3019-2
Shaft coupler N100x3x32x8H to DIN 5480

for mounting an A4VSO/G 1000 splined shaft

Size 1000



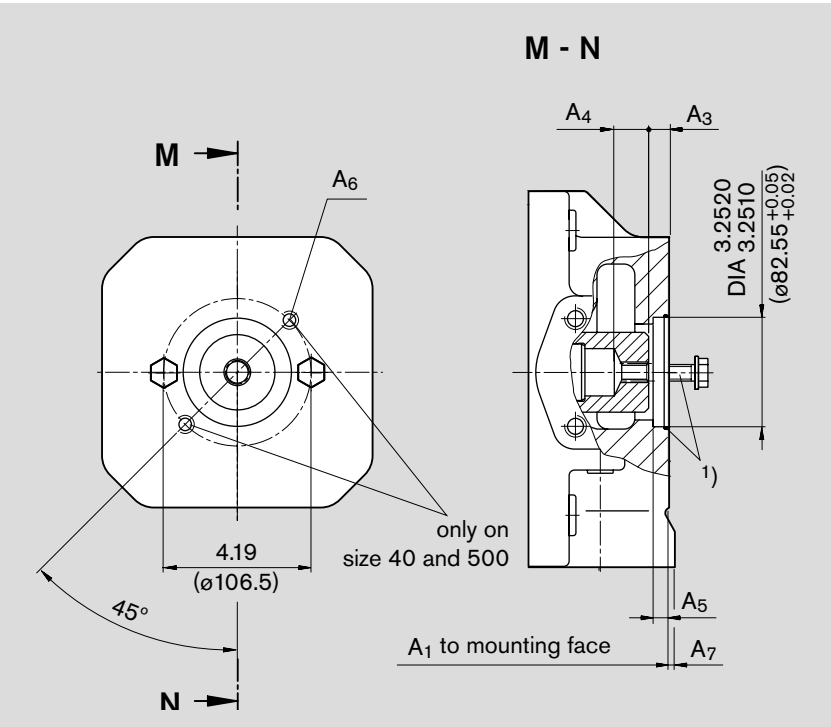
1) Mounting screws and O-ring seal are included with supply
2) Thread to DIN 13, for the max. tightening torques observe the general information on page 64

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

K01 **Flange** 82-2 (SAE A) to ISO 3019-1
Shaft coupler for splined shaft, 16-4 SAE A, 5/8 in, 16/32 DP; 9T [3])

for mounting an external gear pump AZ-PF-1X-004 ... 022 (see RE 10089)
Rexroth recommends a special execution of the gear pump, please consult us



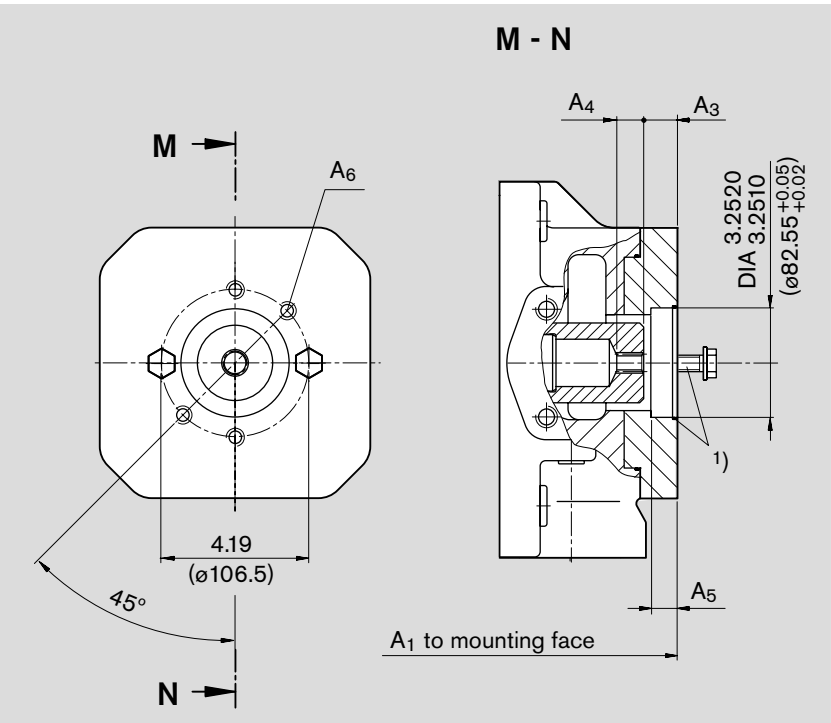
Size	A_1	A_3	A_4
40	10.43(265)	0.41(10.3)	1.02(25.9)
71	11.54(293)	0.41(10.3)	0.97(24.6)
500	19.88(505)	0.41(10.3)	1.29(32.7)
750	21.85(555)	0.41(10.3)	1.29(32.7)
750*	in preparation		
1000	in preparation		

NG	A_5	A_6 [2])	A_7
40	0.39(10)	M10	–
71	0.39(10)	M10	0.08(2)
500	0.39(10)	M10	0.59(15)
750	0.39(10)	M10	–
750*	in preparation		
1000	in preparation		

* with boost pump

U01 **Flange** 82-2 (SAE A) to ISO 3019-1
Shaft coupler for splined shaft, 16-4 SAE A, 5/8 in, 16/32 DP; 9T [3])

for mounting an external gear pump AZ-PF-1X-004 ... 022 (see RE 10089)
Rexroth recommends a special execution of the gear pump, please consult us



Size	A_1	A_3	A_4
125	14.61(371)	0.63(16)	0.76(19.4)
180	15.55(395)	0.63(16)	0.76(19.4)
250	17.91(455)	0.63(16)	0.76(19.4)
355	19.06(484)	0.63(16)	0.76(19.4)

Size	A_5	A_6 [2])
125	0.51(13)	M10
180	0.51(13)	M10
250	0.51(13)	M10
355	0.51(13)	M10

[1]) 2 mounting screws and O-ring seal are included with supply
[2]) Thread to DIN 13, for the max. tightening torques observe the general information on page 64
[3]) To ANSI B92.1a-1976, 30° pressure angle, flat base, flank centering, fit class 5

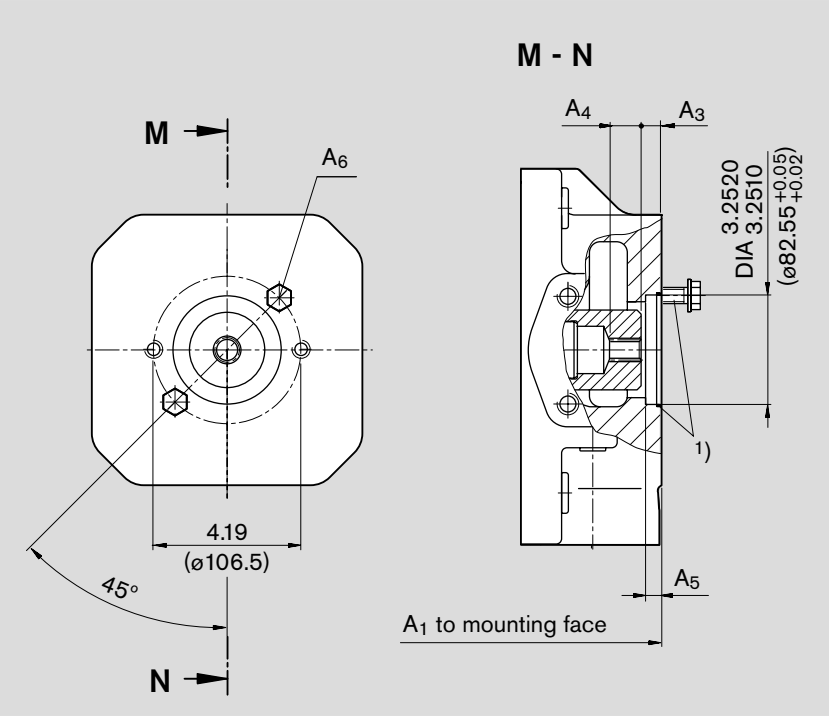
Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

K52

Flange 82-2 (SAE A) to ISO 3019-1
Shaft coupler for splined shaft, 19-4 SAE A-B, 3/4 in, 16/32 DP; 11T [3])

for mounting an A10VSO 18/31 splined shaft S (see RA 92711) or A10VSO10 or 18/52 splined shaft S (see RA 92703)



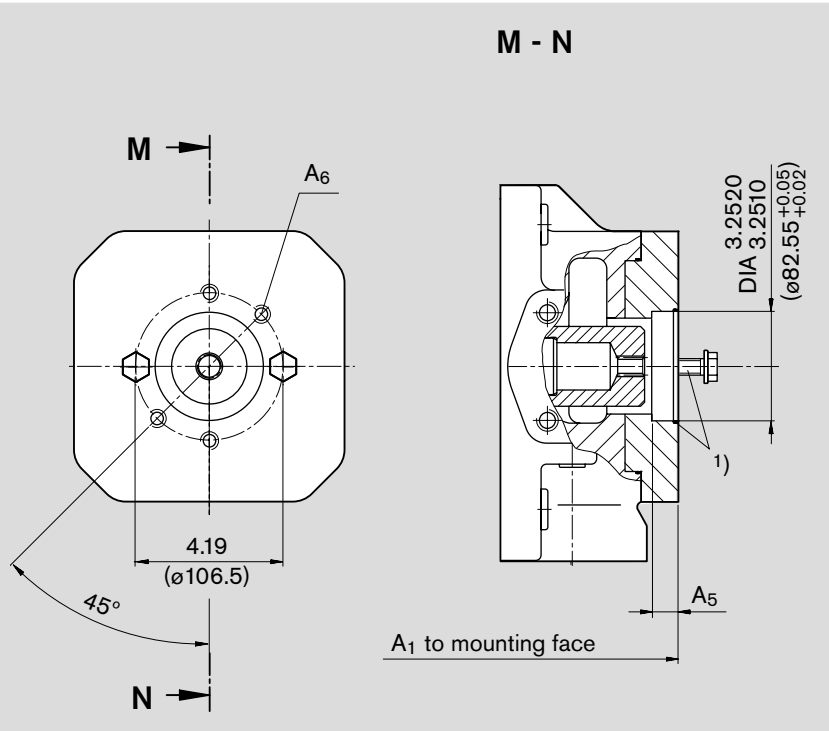
Size	A_1	A_3	A_4
40	10.43(265)	0.41(10.5)	1.33(33.8)
71	12.48(317)	0.41(10.5)	1.18(30)
500	in preparation		
750	in preparation		
1000	in preparation		

NG	A_5	A_6 [2])
40	0.39(10)	M10
71	0.39(10)	M10
500	in preparation	
750	in preparation	
1000	in preparation	

U52

Flange 82-2 (SAE A) to ISO 3019-1
Shaft coupler for splined shaft, 19-4 SAE A-B, 3/4 in, 16/32 DP; 11T [3])

for mounting an A10VSO 18/31 splined shaft S (see RA 92711) or A10VSO10 or 18/52 splined shaft S (see RA 92703)



Size	A_1	A_5	A_6 [2])
125	14.61(371)	0.51(13)	M10
180	15.55(395)	0.51(13)	M10
250	17.91(455)	0.51(13)	M10
355	19.06(484)	0.51(13)	M10

Further dimensions on request

[1]) 2 mounting screws and O-ring seal are included with supply
[2]) Thread to DIN 13, for the max. tightening torques observe the general information on page 64
[3]) To ANSI B92.1a-1976, 30° pressure angle, flat base, flank centering, fit class 5

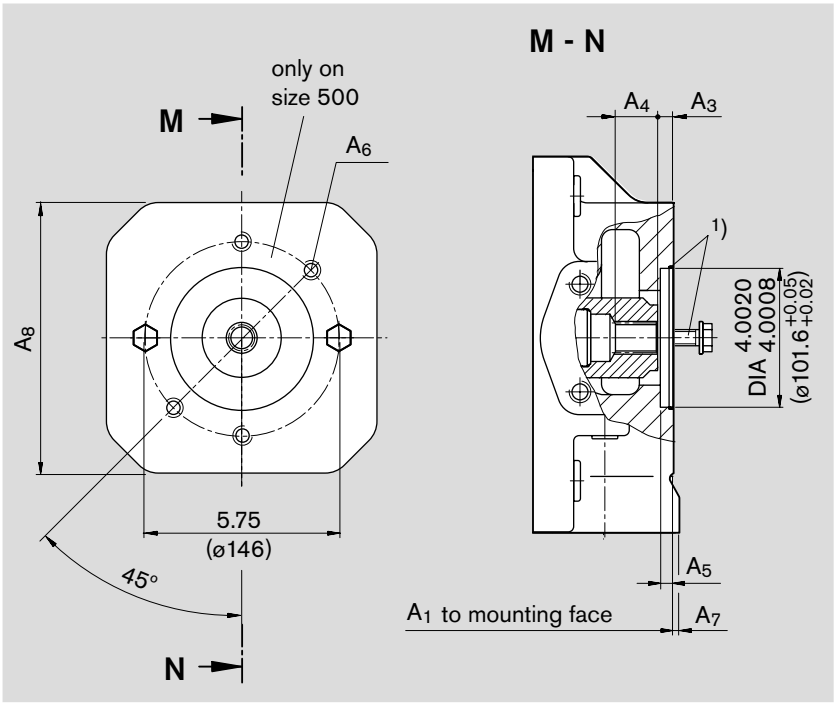
Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

K68

Flange 101-2 (SAE B) to ISO 3019-1
Shaft coupler for splined shaft 22-4 SAE B, 7/8 in, 16/32 DP; 13T [3])

for mounting an external gear pump AZ-PN-1X020...032 (see RE 10091 or an A10VO 28/31 and 52(53) or AA10VSO 28/31 splined shaft S (see RA 92701, RA 92703 or RA 92711)
Rexroth recommends a special excution of the gear pump, please consult us



Size	A_1	A_3	A_4
40	11.50(292)	0.80(20.4)	0.91(23.1)
71	12.76(324)	0.41(10.4)	1.38(35.1)
500	19.88(505)	0.77(19.5)	0.98(25)
750	in preparation		
1000	in preparation		

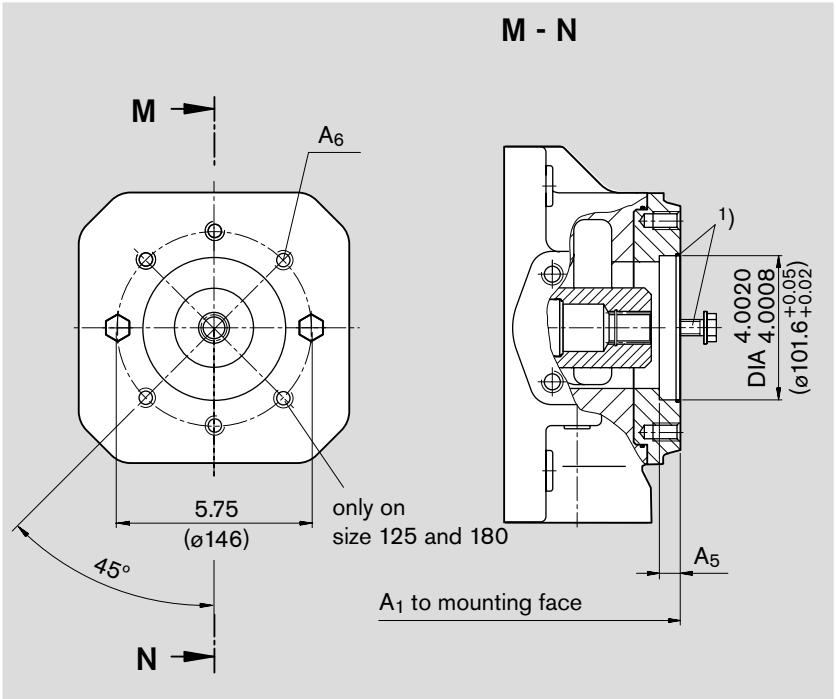
Size	A_5	A_6 [2])	A_7
40	0.39(10)	M12	–
71	0.39(10)	M12	–
500	0.39(10)	M12	0.59(15)
750	in preparation		
1000	in preparation		

Size	A_8
40	–
71	–
500	9.45(240)
750	in preparation
1000	in preparation

U68

Flange 101-2 (SAE B) to ISO 3019-1
Shaft coupler for splined shaft 22-4 SAE B, 7/8 in, 16/32 DP; 13T [3])

for mounting an external gear pump AZ-PN-1X020...032 (see RE 10091 or an A10VO 28/31 and 52(53) or AA10VSO 28/31 splined shaft S (see RA 92701, RA 92703 or RA 92711)
Rexroth recommends a special execution of the gear pump, please consult us



Size	A_1	A_5	A_6 [2])
125	14.61(371)	0.51(13)	M12
180	15.55(395)	0.51(13)	M12
250	17.91(455)	0.51(13)	M12
355	19.06(484)	0.51(13)	M12

Further dimensions on request

[1]) 2 mounting screws and O-ring seal are included with supply
[2]) Thread to DIN 13, for the max. tightening torques observe the general information on page 64
[3]) To ANSI B92.1a-1976, 30° pressure angle, flat base, flank centering, fit class 5

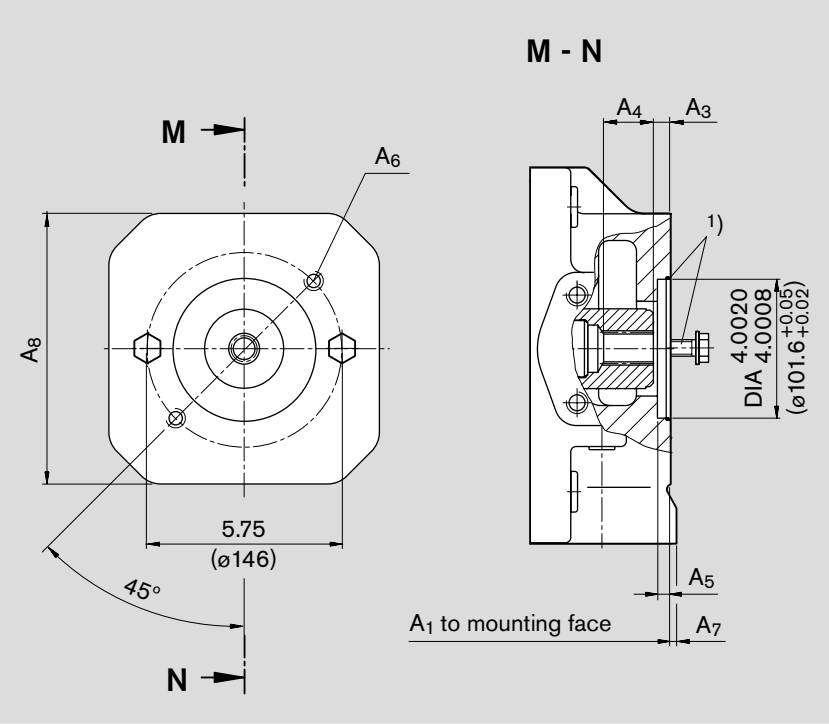
Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

K04

Flange 101-2 (SAE B) to ISO 3019-1
Shaft coupler for splined shaft 25-4 SAE B-B, 1 in, 16/32 DP; 15T [3])

for mounting an A10VO 45/31 and 52 (53) or AA10VSO 45/31 splined shaft S (see RA 92701, RA 92703 or RA 92711) or an internal gear pump PGH4 (see RE 10223)



Size	A_1	A_3	A_4
40	11.50(292)	0.41(10.4)	1.49(37.9)
71	12.76(324)	0.41(10.3)	1.41(35.7)
500	19.88(505)	0.41(10.3)	1.14(28.9)
750	in preparation		
1000	in preparation		

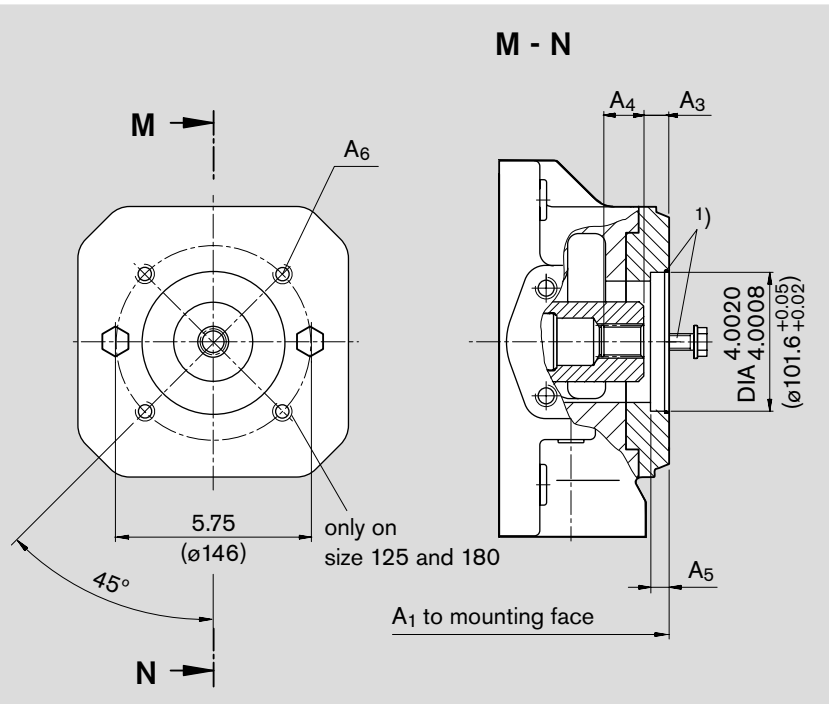
Size	A_5	A_6 [2])	A_7
40	0.39(10)	M12	–
71	0.39(10)	M12	–
500	0.39(10)	M12	0.59(15)
750	in preparation		
1000	in preparation		

Size	A_8
40	–
71	–
500	9.45(240)
750	in preparation
1000	in preparation

U04

Flange 101-2 (SAE B) to ISO 3019-1
Shaft coupler for splined shaft 25-4 SAE B-B, 1 in, 16/32 DP; 15T [3])

for mounting an A10VO 45/31 and 52 (53) or AA10VSO 45/31 splined shaft S (see RA 92701, RA 92703 or RA 92711) or an internal gear pump PGH4 (see RE 10223)



Size	A_1	A_3	A_4
125	14.53(371)	0.74(18.9)	1.16(29.4)
180	15.55(395)	0.74(18.9)	1.16(29.4)
250	17.91(455)	0.74(18.9)	1.16(29.4)
355	19.06(484)	0.74(18.9)	1.16(29.4)

Size	A_5	A_6 [2])
125	0.51(13)	M12
180	0.51(13)	M12
250	0.51(13)	M12
355	0.51(13)	M12

[1]) 2 mounting screws and O-ring seal are included with supply
[2]) Thread to DIN 13, for the max. tightening torques observe the general information on page 64
[3]) To ANSI B92.1a-1976, 30° pressure angle, flat base, flank centering, fit class 5

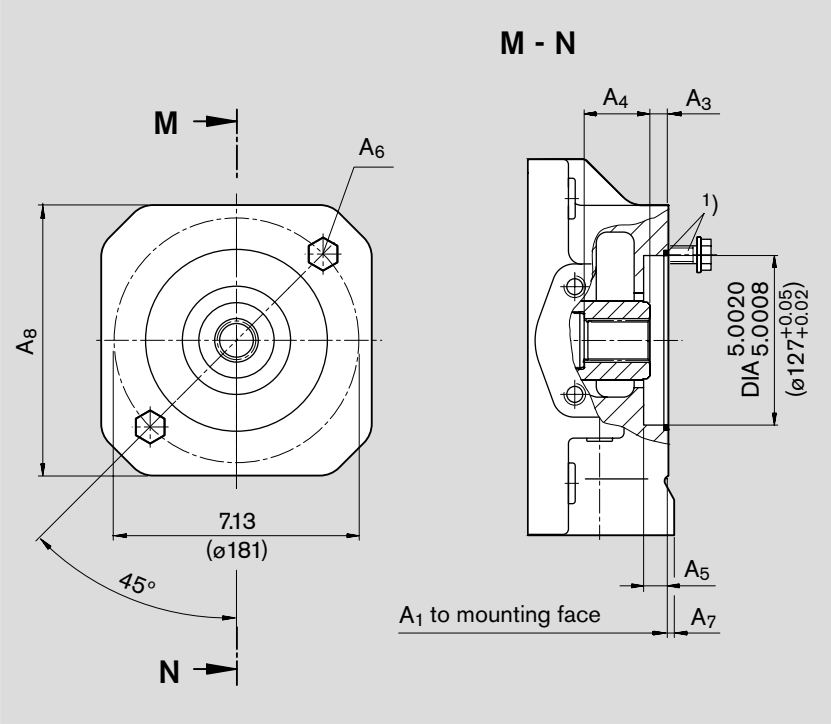
Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

K07

Flange 127-2 (SAE C) to ISO 3019-1
Shaft coupler for splined shaft 32-4 SAE C, 1 1/4 in, 12/24 DP; 14T [3])

for mounting an A10VO 71/31 or AA10VSO 71/31 splined shaft S (see RA 92701 or RA 92711)



Size	A_1	A_3	A_4
71	12.72(323)	0.41(10.4)	1.87(47.6)
500	19.88(505)	0.44(11.3)	1.58(40.2)
750	in preparation		
1000	in preparation		

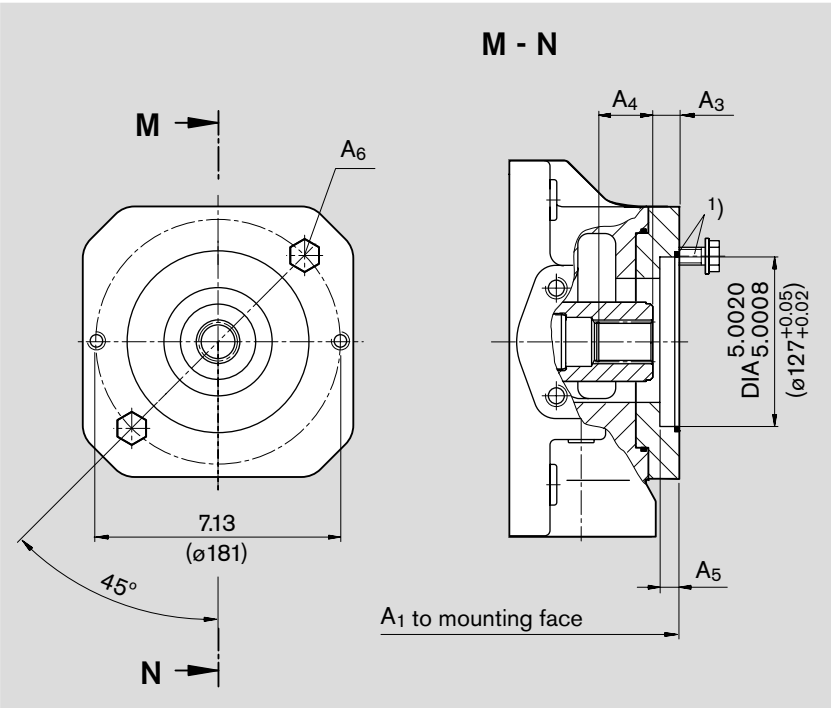
Size	A_5	A_6 [2])	A_7
71	0.51(13)	M16	–
500	0.51(13)	M16	0.59(15)
750	in preparation		
1000	in preparation		

Size	A_8
71	–
500	9.45(240)
750	in preparation
1000	in preparation

U07

Flange 127-2 (SAE C) to ISO 3019-1
Shaft coupler for splined shaft 32-4 SAE C, 1 1/4 in, 12/24 DP; 14T [3])

for mounting an A10VO 71/31 or AA10VSO 71/31 splined shaft S (see RA 92701 or RA 92711)



Size	A_1	A_3	A_4
125	14.53(371)	0.82(20.9)	1.49(37.9)
180	15.55(395)	0.82(20.9)	1.49(37.9)
250	17.91(455)	0.82(20.9)	1.49(37.9)
355	19.06(484)	0.82(20.9)	1.49(37.9)

Size	A_5	A_6 [2])
125	0.51(13)	M16
180	0.51(13)	M16
250	0.51(13)	M16
355	0.51(13)	M16

[1]) 2 mounting screws and O-ring seal are included with supply
[2]) Thread to DIN 13, for the max. tightening torques observe the general information on page 64
[3]) To ANSI B92.1a-1976, 30° pressure angle, flat base, flank centering, fit class 5

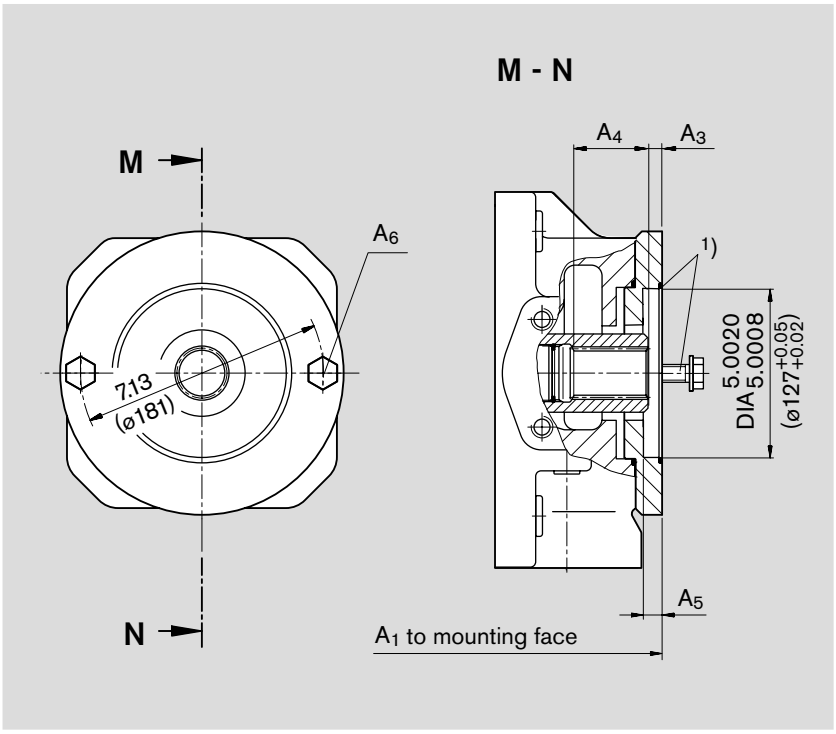
Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

K24

Flange 127-2 (SAE C) to ISO 3019-1
Shaft coupler for splined shaft 38-4 SAE C-C, 1 1/2 in, 12/24 DP; 17T [3])

for mounting an A10VO 100/31 or AA10VSO 100/31 splined shaft S (see RA 92701 or RA 92711)
or an A10VO 85/52(53) splined shaft S (see RA 92703) or an internal gear pump PGH5 (see RE 10223)



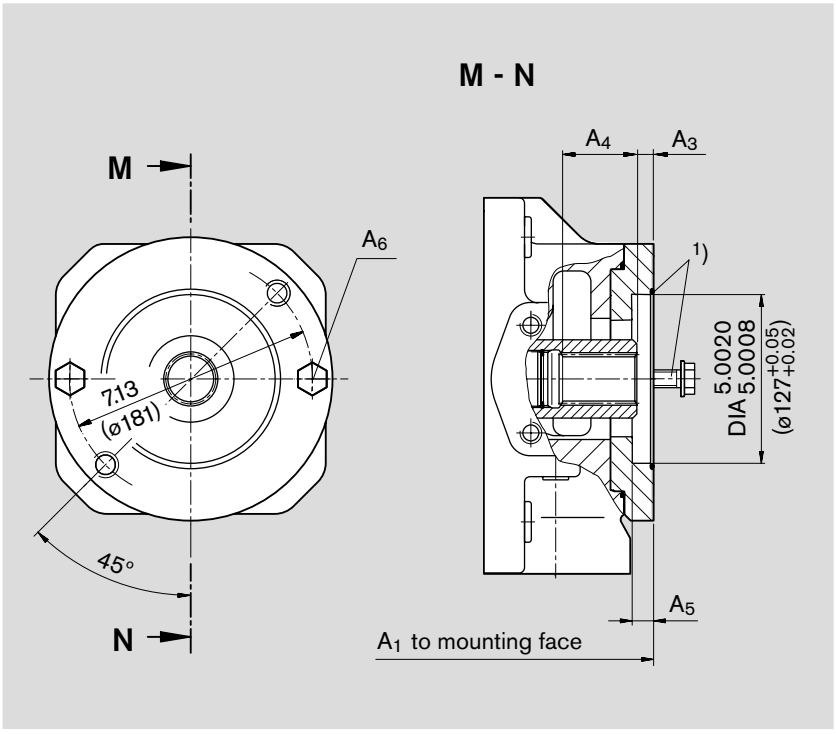
Size	A_1	A_3	A_4
500	19.88(505)	0.41(10.3)	2.23(56.7)
750	in preparation		
1000	in preparation		

Size	A_5	A_6 [2])
500	0.51(13)	M16
750	in preparation	
1000	in preparation	

U24

Flange 127-2 (SAE C) to ISO 3019-1
Shaft coupler for splined shaft 38-4 SAE C-C, 1 1/2 in, 12/24 DP; 17T [3])

for mounting an A10VO 100/31 or AA10VSO 100/31 splined shaft S (see RA 92701 or RA 92711)
or an A10VO 85/52(53) splined shaft S (see RA 92703) or an internal gear pump PGH5 (see RE 10223)



Size	A_1	A_3	A_4
125	14.53(371)	0.41(10.4)	1.97(50)
180	15.55(395)	0.41(10.4)	1.97(50)
250	17.91(455)	0.49(12.4)	2.17(55)
355	19.06(484)	0.49(12.4)	2.17(55)

Size	A_5	A_6 [2])
125	0.51(13)	M16
180	0.51(13)	M16
250	0.51(13)	M16
355	0.51(13)	M16

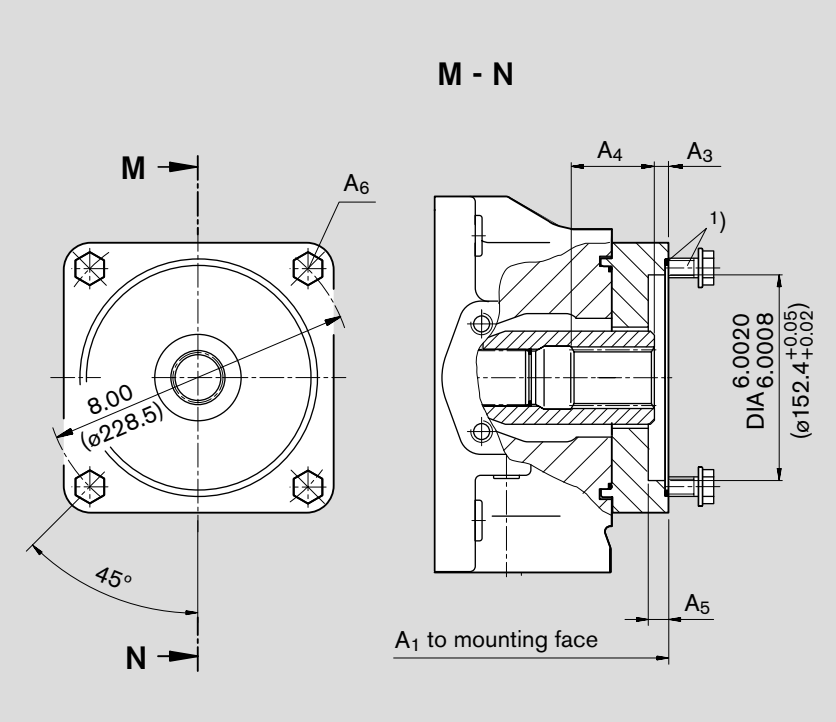
[1]) 2 mounting screws and O-ring seal are included with supply
[2]) Thread to DIN 13, for the max. tightening torques observe the general information on page 64
[3]) To ANSI B92.1a-1976, 30° pressure angle, flat base, flank centering, fit class 5

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

K17 **Flange** 152-4 (SAE D) to ISO 3019-1
Shaft coupler for splined shaft 44-4 SAE D, 1 3/4 in, 8/16 DP; 13T [3])

for mounting an A10VO 140/31 or AA10VSO 140/31 splined shaft S (see RA 92701 or RA 92711)

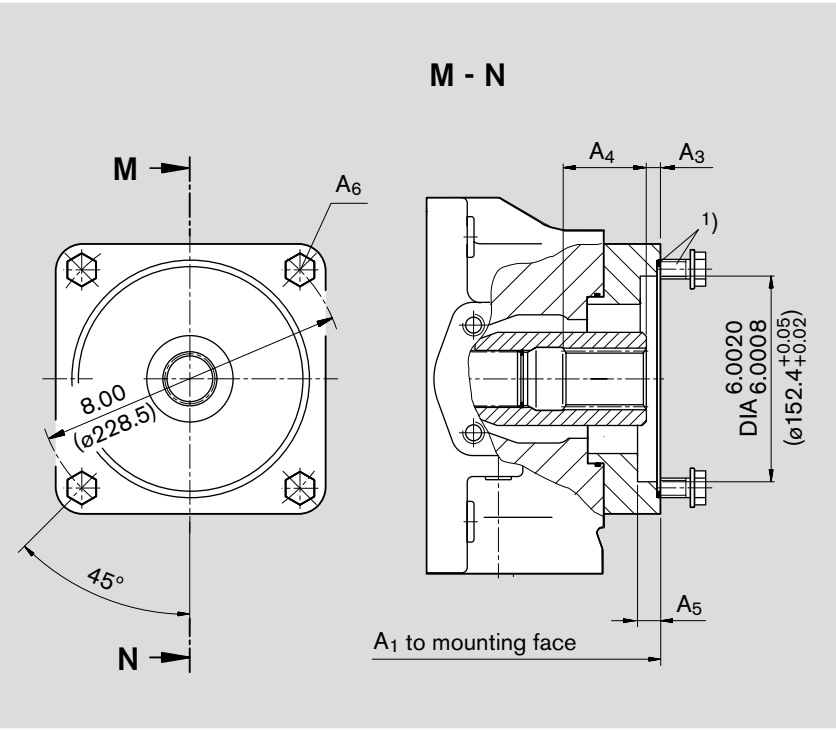


Size	A_1	A_3	A_4
500	19.88(505)	0.41(10.4)	2.35(59.6)
750	in preparation		
1000	in preparation		

Size	A_5	A_6 [2])
500	0.51(13)	M16
750	in preparation	
1000	in preparation	

U17 **Flange** 152-4 (SAE D) to ISO 3019-1
Shaft coupler for splined shaft 44-4 SAE D, 1 3/4 in, 8/16 DP; 13T [3])

for mounting an A10VO 140/31 or AA10VSO 140/31 splined shaft S (see RA 92701 or RA 92711)



Size	A_1	A_3	A_4
180	16.06(408)	0.41(10.4)	2.44(62)
250	17.91(455)	0.42(10.6)	2.44(62)
355	19.06(484)	0.42(10.6)	2.44(62)

Size	A_5	A_6 [2])
180	0.51(13)	M16
250	0.51(13)	M16
355	0.51(13)	M16

[1]) 2 mounting screws and O-ring seal are included with supply
[2]) Thread to DIN 13, for the max. tightening torques observe the general information on page 64
[3]) To ANSI B92.1a-1976, 30° pressure angle, flat base, flank centering, fit class 5

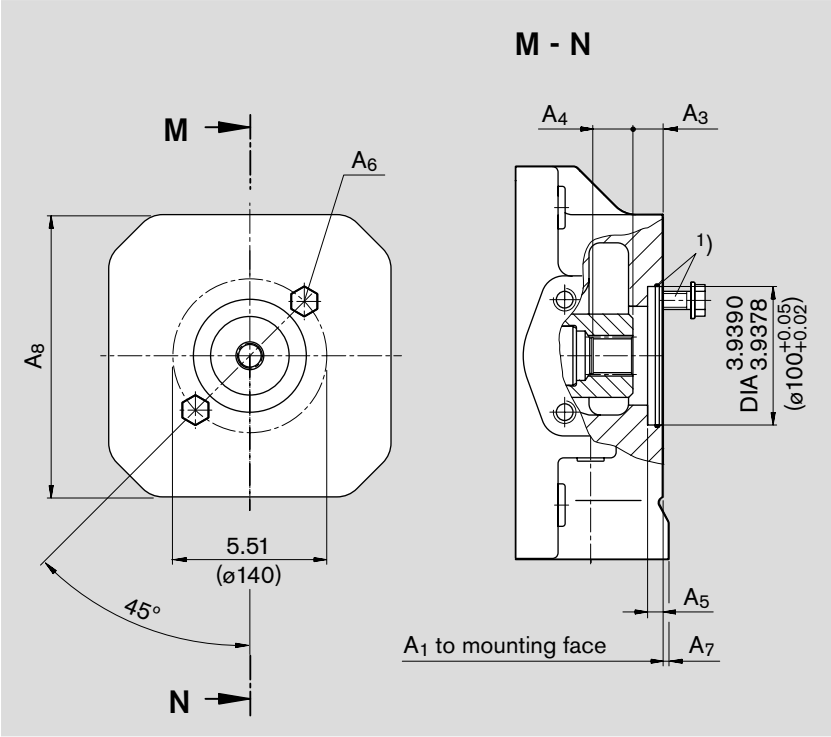
Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

KB4

Flange 100, 2-bolt – 100A2HW to ISO 3019-2
Shaft coupler for splined shaft, 25-4 SAE B-B, 1 in, 16/32 DP; 15T [3])

for mounting an A10VSO 45/31 splined shaft S – see RE 92711



Size	A_1	A_3	A_4
500	19.88(505)	0.80(20.4)	1.14(28.9)
750	in preparation		
1000	in preparation		

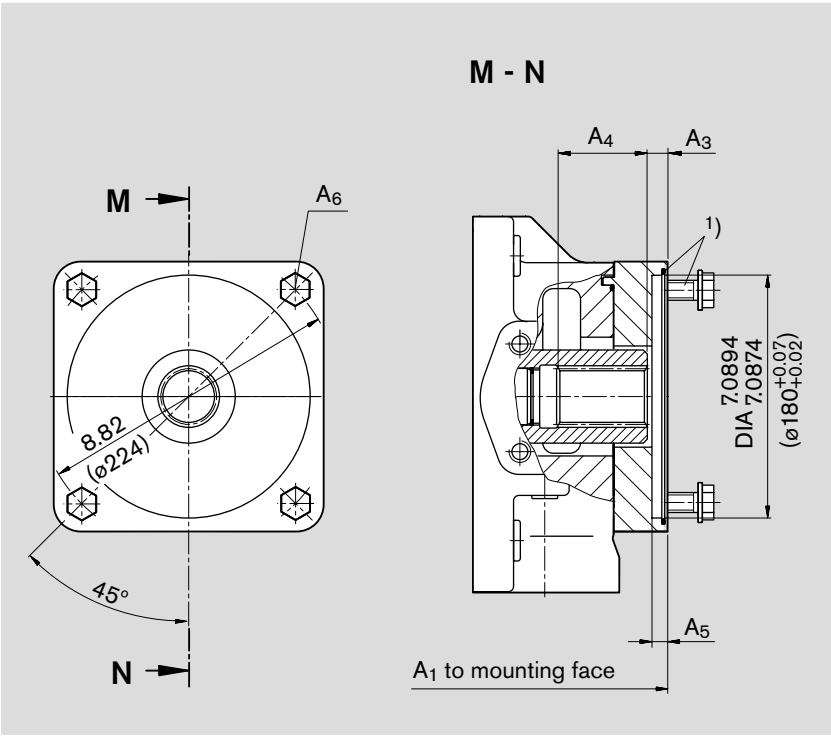
Size	A_5	A_6 [2])	A_7
500	0.39(10)	M12	0.59(15)
750	in preparation		
1000	in preparation		

Size	A_8
500	9.45(240)
750	in preparation
1000	in preparation

KB7

Flange 180, 4-bolt – 180B4HW to ISO 3019-2
Shaft coupler for splined shaft, 44-4 SAE D, 1 3/4 in, 8/16 DP; 13T [3])

for mounting an A10VSO 140/31(32) splined shaft S – see RE 92711 (RE 92714)



Size	A_1	A_3	A_4
500	20.87(530)	0.41(10.4)	2.50(63.6)
750	in preparation		
1000	in preparation		

Size	A_5	A_6 [2])
500	0.39(10)	M16
750	in preparation	
1000	in preparation	

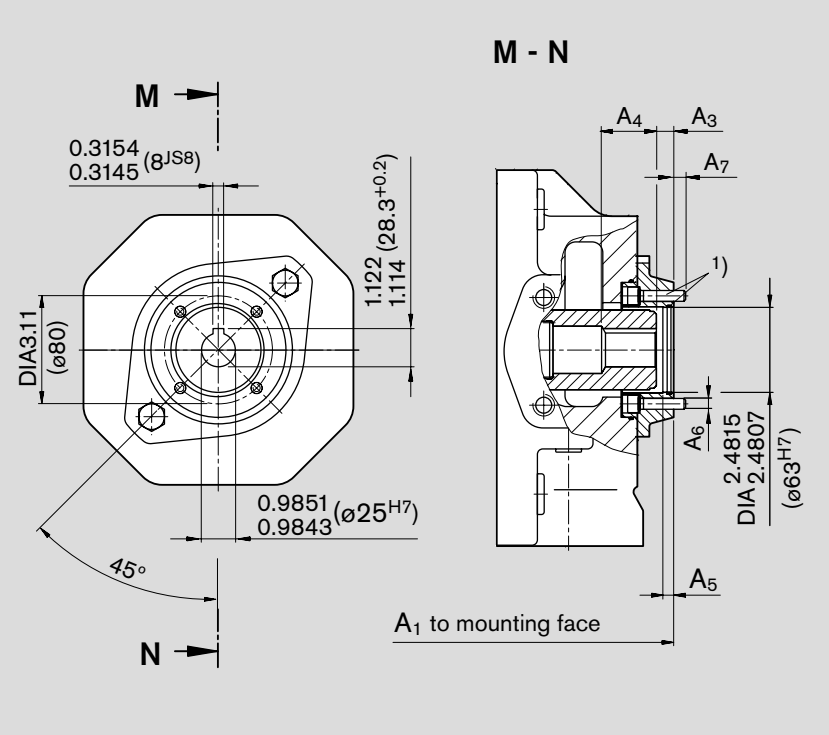
[1]) 2 mounting screws and O-ring seal are included with supply
[2]) Thread to DIN 13, for the max. tightening torques observe the general information on page 64
[3]) To ANSI B92.1a-1976, 30° pressure angle, flat base, flank centering, fit class 5

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

K57 **dia. 63 metric**, 4-bolt
Shaft coupler for keyed shaft dia. 25

for mounting a radial piston pump R4 (see RE 11263)



Size	A_1	A_3	A_4
40	11.42(290)	0.43(11)	2.20(56)
71	12.64(321)	0.43(10.9)	1.65(42)
500	in preparation		
750	in preparation		

Size	A_5	A_6 2)	A_7
40	0.31(8)	M8	0.35(9)
71	0.31(8)	M8	0.35(9)
500	in preparation		
750	in preparation		

Sizes 125...355 with U-through drive in preparation

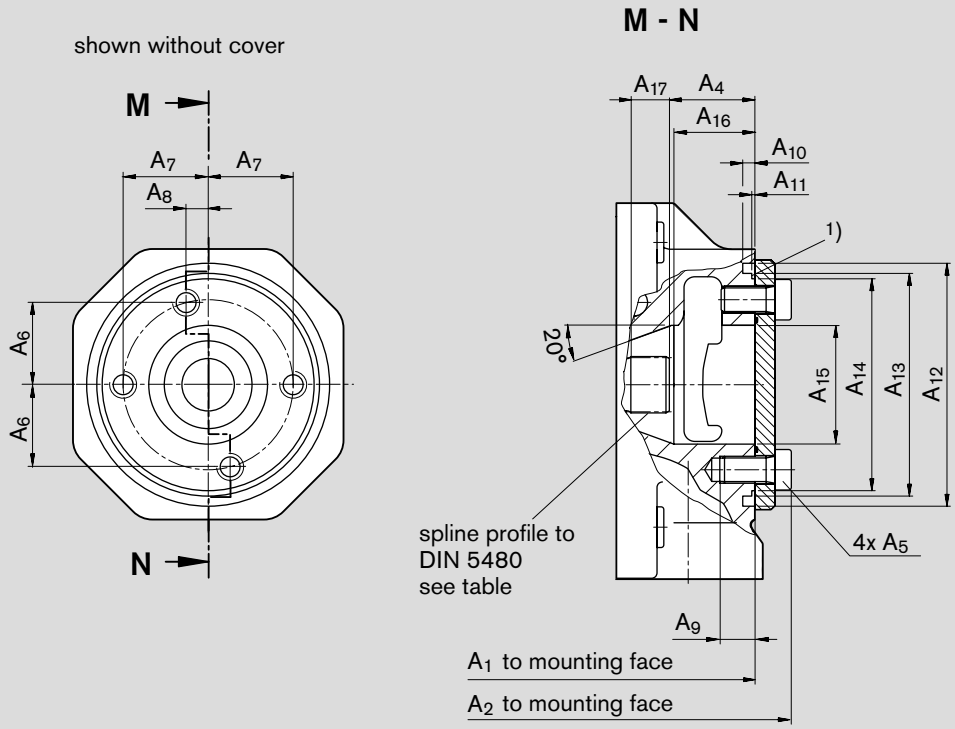
1) Mounting screws and O-ring seal are included with supply
2) Thread to DIN 13, for the max. tightening torques observe the general information on page 64

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

K99 Sizes 40 and 71

with through drive shaft, without shaft coupler, without adapter flange, **closed with pressure tight cover**



depiction shows
size 71

Size Main pump	A_1	A_2	A_4	A_5 [1]	A_6	A_7	A_8
40	10.43(265)	11.10(282)	2.02(51.3±1)	M12x25	1.46(37±0.2)	1.46(37±0.2)	0
71	11.54(293)	12.28(312)	1.89(48±1)	M12x25	1.67(42.3 ±0,15)	1.77(45 ±0.5)	0.61(15.4±0.15)

Size Main pump	A_9	A_{10}	A_{11}	A_{12}	A_{13}	A_{14}
40	0.71(18)	0.35(9)	0.09($2.3^{+0.1}$)	Dia4.65(ø118)	Dia $^{4.1334}_{4.1325}$ ($ø105_{g6}$)	Dia$3.843_{-0.016}$($ø97.6_{-0.4}$)
71	0.71(18)	0.35(9)	0.11($2.7^{+0.1}$)	Dia5.12(ø130)	Dia $^{4.5665}_{4.5656}$ ($ø116_{g6}$)	Dia$4.189_{-0.016}$($ø106.4_{-0.4}$)

Sizes 125...1000 see pages 65 and 66

Size Main pump	A_{15}	A_{16}	A_{17}	**Spline profile to DIN 5480**	[1] **O-Ring** for retrofitting (not in supply)
40	Dia2.05(ø52)	1.73(44)	0.55(14)	W25x1,25x18x9g	99 x 3
71	Dia2.48(ø63)	1.50(38)	0.63(16)	W30x1,25x22x9g	110,72 x 3,53

[1]) Thread to DIN 13, for the max. tightening torques observe the general information on page 64

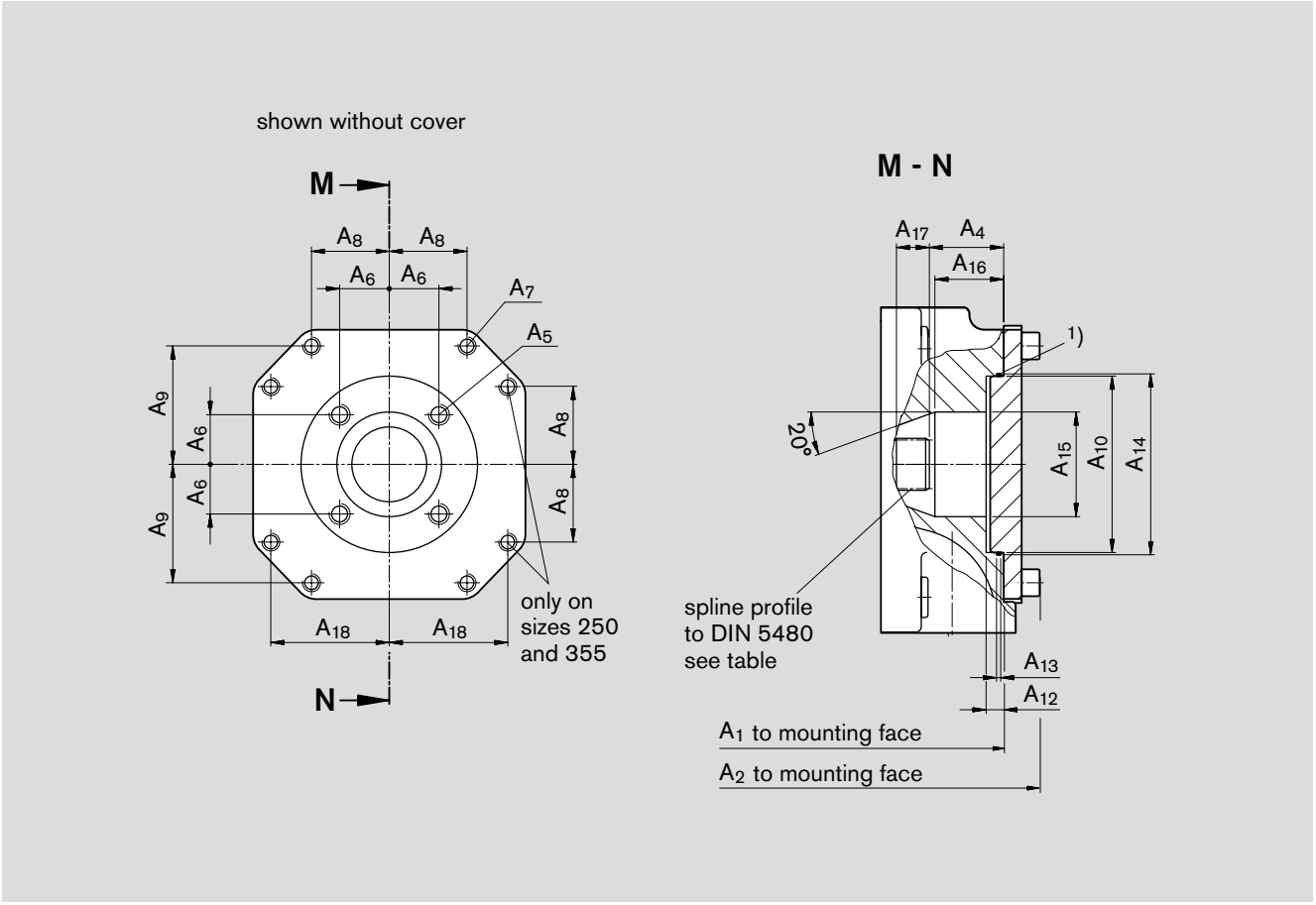
Sizes 125...1000 see pages 61 and 62

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

U99 Sizes 125...355

with through drive shaft, without shaft coupler, without adapter flange, **closed with pressure tight cover**



Size Main pump	A_1	A_2	A_4	A_5 [1]	A_6	A_7 [1]	A_8
125	13.74(349)	14.57(370)	$1.957^{\pm 0.04}$(49.7±1)	M14; 15 deep	$1.31(33.2^{+0.15})$	M12; 18 deep	–
180	14.69(373)	15.51(394)	$1.957^{\pm 0.04}$(49.7±1)	M14; 15 deep	$1.31(33.2^{+0.15})$	M12; 18 deep	–
250	17.05(433)	17.99(457)	$2.417^{\pm 0.04}$(61.4±1)	M20; 22 deep	$1.75(44,5^{+0.15})$	M10; 15 deep	$2.29(58.15^{+0.15})$
355	18.19(462)	19.25(489)	$2.417^{\pm 0.04}$(61.4±1)	M20; 22 deep	$1.75(44,5^{+0.15})$	M10; 15 deep	$2.29(58.15^{+0.15})$

Size Main pump	A_9	A_{10}	A_{12}	A_{13}	A_{14}	A_{15}
125	$3.12(79.2^{+0.15})$	Dia $\frac{4.6470}{4.6457}$ ($ø118^{H7}$)	0.35(9)	$0.110^{+0.008}$($2.8^{+0.2}$)	Dia4.76($ø121^{+0.1}$)	Dia2.76(ø70)
180	$3.12(79.2^{+0.15})$	Dia $\frac{4.6470}{4.6457}$ ($ø118^{H7}$)	0.35(9)	$0.110^{+0.008}$($2.8^{+0.2}$)	Dia4.76($ø121^{+0.1}$)	Dia2.76(ø70)
250	$3.39(86.2^{+0.15})$	Dia $\frac{6.3008}{6.2992}$ ($ø160^{H7}$)	0.35(9)	$0.110^{+0.008}$($2.8^{+0.2}$)	Dia6.42($ø163^{+0.1}$)	Dia3.43(ø87)
355	$3.39(86.2^{+0.15})$	Dia $\frac{6.3008}{6.2992}$ $ø160^{H7}$)	0.35(9)	$0.110^{+0.008}$($2.8^{+0.2}$)	Dia6.42($ø163^{+0.1}$)	Dia3.43(ø87)

Size Main pump	A_{16}	A_{17}	A_{18}	Spline profile to DIN 5480	[1] **O-Ring** for retrofitting (included in supply)
125	1.81(46)	0.87(22)	–	W35x1.25x26x9g	118 x 2
180	1.81(46)	0.98(25)	–	W35x1.25x26x9g	118 x 2
250	2.53(64)	1.20(30.5)	$3.394^{+0.006}(86.2^{+0.15})$	W42x1.25x32x9g	160 x 2
355	2.53(64)	1.34(34)	$3.394^{+0.006}(86.2^{+0.15})$	W42x1.25x32x9g	160 x 2

[1]) Thread to DIN 13, for the max. tightening torques observe the general information on page 64

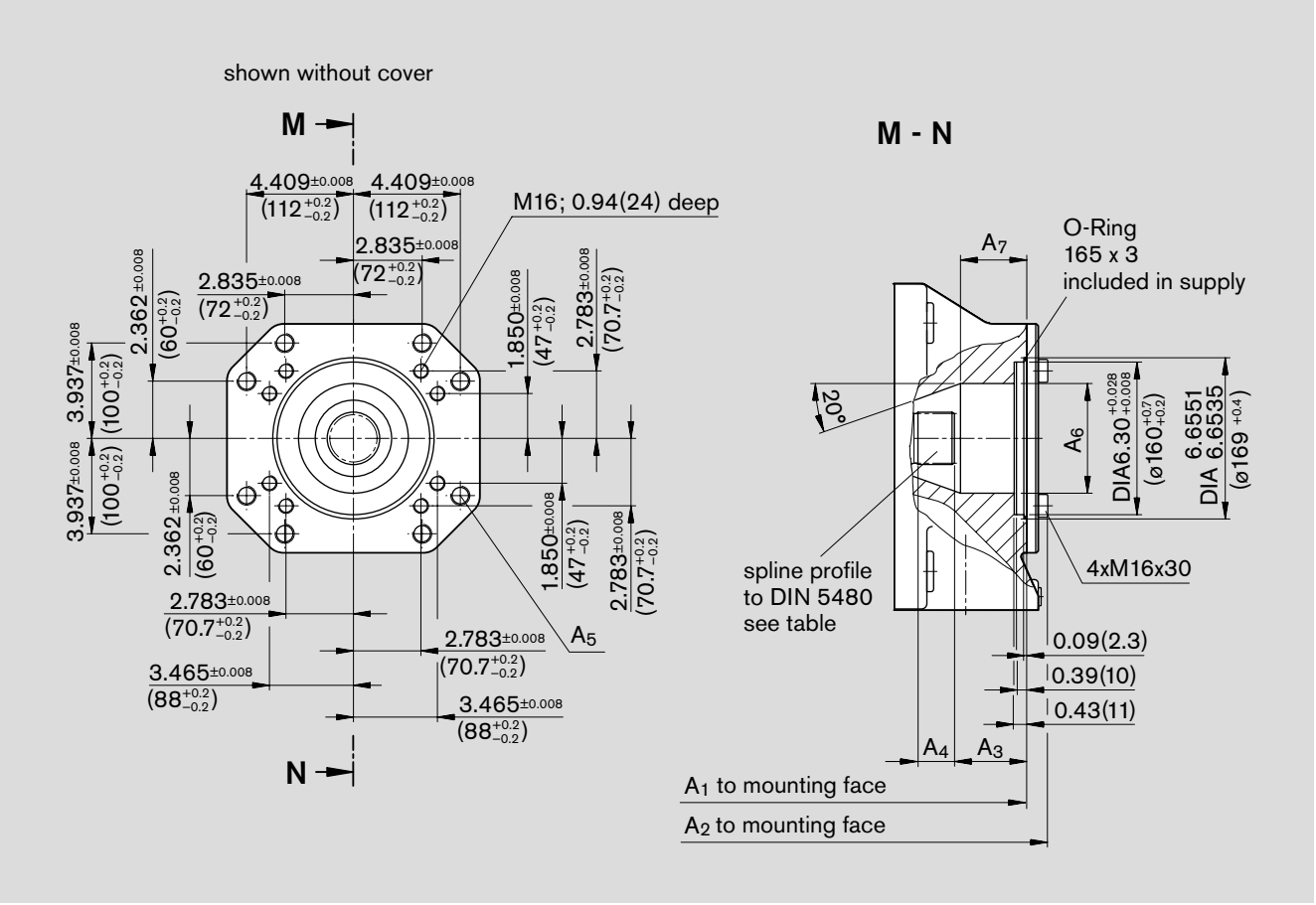
Sizes 500...1000 see page 62

Dimensions through drives

Before finalising your design please request a certified installation drawing. Dimensions in inches (mm).

K99 Sizes 500...1000

with through drive shaft, without shaft coupler, without adapter flange, **closed with pressure tight cover**



Size Main pump	A_1	A_2	A_3	A_4	A_5 [1]	A_6	A_7
500	19.88(505)	20.75(527)	2.87(73)	1.61(41)	M20; 0.94(24) deep	Dia4.53(ø115)	2.95(75)
750	21.85(555)	22.72(577)	2.87(73)	1.61(41)	M20; 0.94(24) deep	Dia4.53(ø115)	2.95(75)
750*	in preparation						
1000	24.72(628)	25.59(650)	3.03(77)	2.62(66.5)	M20; 1.18(30) deep	Dia5.43(ø138)	2.56(65)

Size Main pump	Spline profile to DIN 5480
500	W55x1,25x42x9g
750	W55x1,25x42x9g
750*	in preparation
1000	W65x1,25x50x9g

* with boost pump

[1]) Thread to DIN 13, for the max. tightening torques observe the general information on page 64

Sizes 40 and 71 see page 60 and sizes 125...355 see page 61

Installation notes

Mounting position:

Optional. The pump case must be filled with fluid during commissioning and remain full when operating.
In order to reduce the operating noise level, all connecting lines (suction, pressure and case drain lines) must be de-coupled from the tank, using flexible elements.
The use of check valves in the case drain line must be avoided.
The case drain line must be returned directly to tank without a reduction in cross section.
Exceptions maybe possible, please consult us first.

1. **Vertical installation** (shaft end pointing upwards)
With a vertical installation, bearing flushing is recommended to provide lubrication for the front bearing, see page 6.

The following installation conditions must be taken into account:

1.1 Installation into the reservoir

a) When the minimum fluid level is equal to or above the pump mounting flange area: ports »R/L«, »T« and »S« open (see fig. 1).

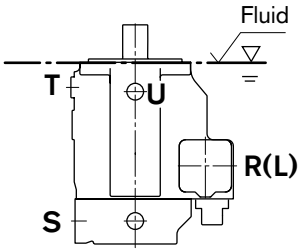


Fig. 1

b) When the minimum fluid level is below the mounting flange area: ports»R/L«,»T« und possibly »S« must be piped as shown in fig. 2. Also observe the conditions as shown in point 1.2.

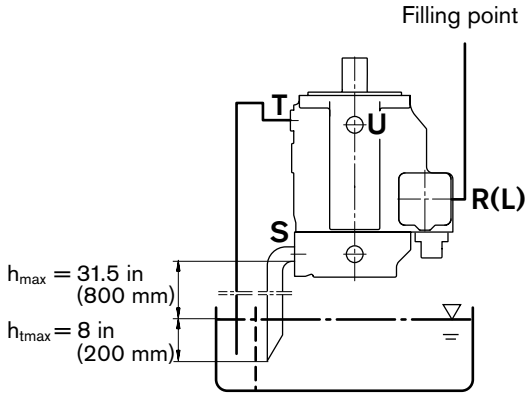


Fig. 2

1.2 Installation outside the reservoir

Before installation, fill the pump housing with the pump in a horizontal position.
Pipe port »T« to tank, »R/L« plugged.
Filling in mounted condition: fill via »R« and bleed via»T«, afterwards plug port»R«.
Conditions: A minimum pump inlet pressure (suction pressure) of 12 psi (0,8 bar) abs. is necessary. Avoid mounting above the reservoir in order to reduce the noise level.

2. **Horizontal installation**

The highest situated of the ports»T«,»K_1«, »K_2« or »R/L« must be used for filling/bleeding and subsequently to connect the case drain line.

2.1 Installation inside the reservoir

a) When the minimum fluid level is equal to or lies above the upper edge of the pump: case drain port and suction port »S« open (see fig. 3).

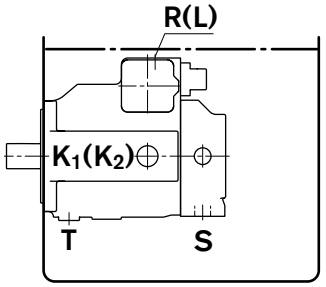


Fig. 3

b) When the minimum fluid level lies below the upper edge of the pump: case drain port and possibly port »S« must be piped, see fig. 4. Observe conditions as shown in point 1.2.

Fill pump housing prior to commissioning.

2.2 Installation outside the reservoir

Fill the pump housing before commissioning.
a) Mounting above the reservoir see fig. 4.
Observe conditions as shown in point 1.2.
b) Mounting below the reservoir
Case drain port and port »S« must be piped (see fig. 5).

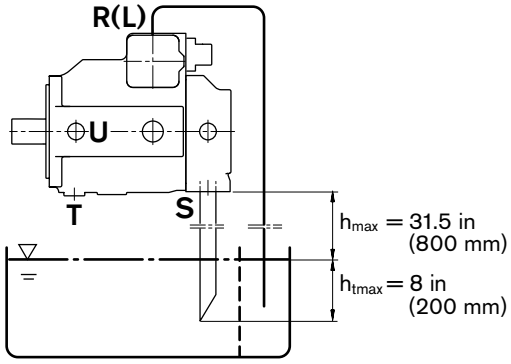


Fig. 4

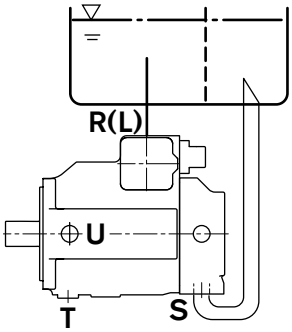


Fig. 5

General information

– The pump(A)A4VSO was designed for operation in open loop circuits.

– Systems design, installation and commissioning requires trained technicians or tradesmen.

– All hydraulic ports can only be used for the fastening of hydraulic service lines.

– Tightening torques:
  - All tightening torques mentioned in this data sheet are maximum values and may not be exceeded (Maximum values for the female threads in the castings).
    Please comply with the manufacturer's information regarding the max. permissible tightening torques for the used fittings.
  - For fastening screws to ISO 68 / DIN 13 we recommend to check the permissible tightening torque in each individual case acc. to VDI 2230 issue 2003.

– During and shortly after operation of a pump the housing and especially a solenoid can be extremely hot. Take suitable safety measures (e.g. wear protective clothing).

– All given data and information has to be adhered to.

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

Bosch Rexroth Corporation
2315 City Line Road
Bethlehem, PA 18017-2131, USA
Telephone (610) 694-8300
Facsimile (610) 694-8467
www.boschrexroth-us.com

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Subject to change.

Rexroth
Bosch Group

Axial piston variable pump A10VSNO

RE 92740/07.10 1/16

Data sheet



Series 32
Size 63
Nominal pressure 210 bar
Peak pressure 250 bar
Open circuit

Contents

Type code for standard program	2
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DR – Pressure control	8
DRG – Pressure control remotely operated	9
DRS – Pressure and flow control	10
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Features

- Variable pump in axial piston swashplate design
- The flow is proportional to the drive speed and the displacement
- Hydrostatic unloading of the cradle bearings
- Low noise level
- Low pressure pulsations
- High efficiency
- Compact design
- Excellent power to weight ratio
- Proven A10 rotary group technology

Type code for standard program

A10VSN	O	63		/	32		–	V		B	12	N00
01	02	03	04		05	06		07	08	09	10	11

Axial piston unit

01	Swashplate design, variable, nominal pressure 210 bar, peak pressure 250 bar	**A10VSN**

Type of operation

02	Pump, open circuit	**O**

Size (NG)

03	Theoretical displacement $V_{g\,max}$ in cm^3 see table of values page 5	**063**

	Control devices		**063**	
04	Two point control	directly operated	●	**DG**
	Pressure control		●	**DR**
		hydraulic remotely operated	●	**DRG**
		with flow control hydraulic, X-T closed with flushing function	●	**DRS**

	Series	**063**	
05	Series 3, Index 2	●	**32**

	Direction of rotation		**063**	
06	With view on drive shaft	clockwise	●	**R**
		counter clockwise	●	**L**

	Seals	**063**	
07	FKM (Fluoro rubber)	●	**V**

	Drive shaft	**063**	
08	Splined shaft for higher torques to SAE J744	●	**R**
	Parallel keyed shaft to DIN 6885	●	**P**

Mounting flange

09	ISO 3019-2 – 4-bolt	**B**

	Ports for service lines	**063**	
	SAE flange on top and at the bottom, opposite, Metric fixing threads	●	**12**
10	SAE flange on top and at the bottom, opposite, Metric fixing thread, with universal through drive	❍	**22U**

	Through drive[1]	**063**	
11	Without through drive	●	**N00**
	With through drive shaft, without shaft coupler, without adapter flange, closed with proper cover	❍	**00**

● = available ❍ = on request – = not available

1) For through drives and mounting options see RE 92714

Technical data

Fluid

Prior to project design please observe the extensive information on the selection of hydraulic fluids in our data sheets RE 90220 (mineral oil), RE 90221 (ecologically acceptable fluids) and RE 90223 (HF-fluids) .

When using HF- or ecologically acceptable fluids possible limitations on the technical data may be applicable, if necessary please consult us (when ordering please state the type of fluid to be used in clear text).

Operating viscosity range

In order to obtain optimum efficiency and service life, we recommend that the operating viscosity (at operating temperature) be selected within the range

ν_{opt} = opt. operating viscosity 16 ... 36 mm²/s

referred to the reservoir temperature (open circuit).

Limits of viscosity range

For extreme operating conditions the following limits apply:

ν_{min} = 10 mm²/s
short term (t ≤ 1 min)
at max.permissible case drain temperature of 90 °C.

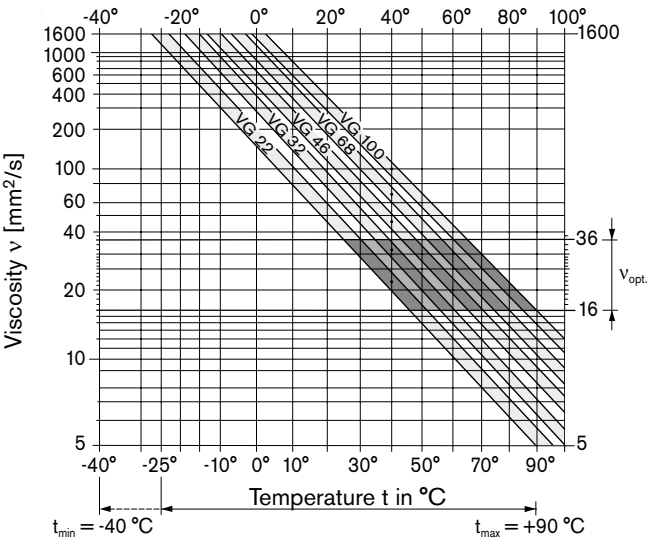
Please note, that the max. case drain temperature of 90 °C is also not exceeded in certain areas (eg. bearing area). The temperature in the bearing area is approx. 5 K higher than the average case drain temperature.

ν_{max} = 1000 mm²/s
short term (t ≤ 1 min)
on cold start
(t_{min} = p ≤ 30 bar, n ≤ 1000 rpm, -25 °C)

At temperatures between -25 °C and -40 °C special measures may be required for certain installation positions, please contact us for further information.

For detailed information on operation at very low temperatures see RE 90300-03-B.

Selection diagram



Fluid temperature range

Notes on the selction of hydraulic fluid

In order to select the correct fluid, it is necessary to know the operating temperature in the tank (open circuit) in relation to the ambiet temperature.

The hydraulic fluid should be selected so that within the operating temperature range, the operating viscosity lies within the optimum range (ν_{opt}) (see shaded section of the selction diagram). We recommend that the higher viscosity grade should be selected in each case.

Example: At an ambient temperature of X °C the fluid temperature in the tank is 60 °C. In the optimum viscosity range (ν_{opt}; shaded area) this corresponds to viscosity grades VG 46 or VG 68; VG 68 should be selected.

Important
The case drain temperature is influenced by pressure and speed and is typically higher than the tank temperature. However max. temperature at any point of the component may not exceed 90 °C.

If the above mentioned conditions cannot be kept due to extreme operating parameters or high ambient temperatures please consult us.

Filtration of fluid

The finer the filtration, the better the achieved cleanliness of the fluid and the longer the life of the axial piston unit.

In order to guarantee a reliable function of the axial piston unit a gravimetric evaluation of the fluid to determine the particle contamination and the cleanliness class to ISO 4406 is necessary. A cleanliness class of at least 20/18/15 is necessary.
At very high fluid temperatures (90°C to maximum 115 °C) a cleanliness class of at least 19/17/14 to ISO 4406 is necessary.

If above mentioned cleanliness classes cannot be met please consult us.

Technical data

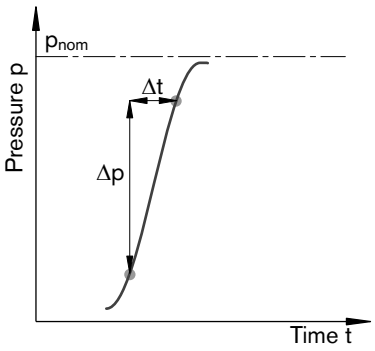
Operating pressure range

Pressure at outlet port (pressure port) B

Nominal pressure p_{nom} _____ 210 bar absolute

Peak pressure p_{max} _____ 250 bar absolute
Individual operating period _____ 2.0 ms
Total operating period _____ 300 h
Minimum pressure**(high pressure side)** _____ 10 bar[2)]

Rate of pressure change $R_{A\ max}$ _____ 16000 bar/s



To safeguard against over pressure pump safety blocks to RE 25880 and RE 25890 for direct mounting onto the SAE flange ports can be ordered separately.

Pressure at suction port S (inlet)

Inlet pressure

At 1800 rpm
Minimum suction pressure $p_{abs\ min}$ _____ 0.8 bar absolute

Maximum suction pressure $p_{abs\ max}$ _____ 5 bar[1)] absolute

Case drain pressure

Maximum permissible case drain pressure
(at port L, L_1):
Maximum 0.5 bar higher than the inlet pressure at port S, however not higher than 2 bar absolute.

$p_{L\ max\ abs}$ _____ 2 bar[1]

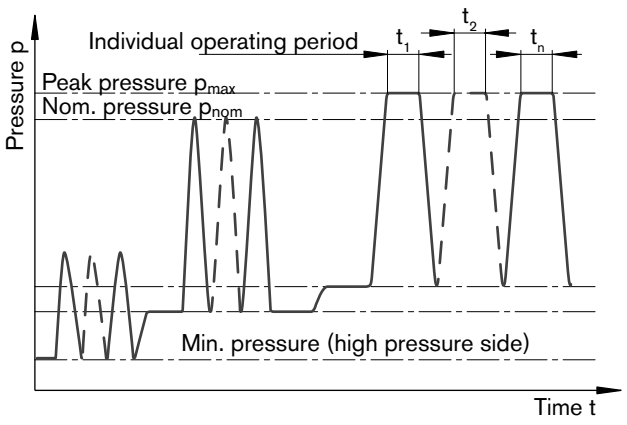
Definition

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

Peak pressure p_{max}
The peak pressure corresponds to the maximum pressure within the individual operating period. The total of the individual operating periods must not exceed the total operating period.

Minimum pressure (in pump outlet)
Minimum pressure in the pump outlet side (port B) that is required in order to prevent damage to the axial piston unit.

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



Total operating period = $t_1 + t_2 + ... + t_n$

[1)] Other values on request

[2)] Lower pressure, depends on timeframe, please consult us.

Technical data

Tables of value (theoretical values, without efficiencies and tolerances: values rounded)

Size			NG	63
Displacement		$V_{g\,max}$	cm^3	63
Speed[1]				
maximum at $V_{g\,max}$		$n_{o\,max}$	rpm	1800
Flow				
at $n_{o\,max}$ and $V_{g\,max}$		$q_{vo\,max}$	L/min	113
at n_E = 1500 rpm		$q_{vE\,max}$	L/min	94
Power				
at $n_{o\,max}$, Δp = 210 bar		P_{max}	kW	39
at n_E = 1500 rpm		P_{max}	kW	33
Torque				
at $V_{g\,max}$ and	Δp = 210 bar	T_{max}	Nm	210
	Δp = 100 bar	T	Nm	100
Torsionsl stiffness	Drive shaft P	c	Nm/rad	41232
	Drive shaft R	c	Nm/rad	41025
Moment of inertia rotary group		J_{TW}	kgm^2	0.004
Case volume		V	L	1.0
Weight (without fluid fill) approx.		m	kg	30

1) The values are applicable for a pressure of 0,8 bar at suction port S and mineral hydraulic fluid.

Important

Exceeding the maximum or falling below the minimum permissible values can lead to a loss of function, a reduction in operational service life or total destruction of the axial piston unit. We recommend to check the loading through tests or calculation / simulation and comparison with the permissible data.

Determination of size

Flow $q_V = \frac{V_g \cdot n \cdot \eta_V}{1000}$ [L/min]

Torque $T = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}}$ [Nm]

Power $P = \frac{2\pi \cdot T \cdot n}{60000} = \frac{q_V \cdot \Delta p}{600 \cdot \eta_t}$ [kW]

V_g = Geometr. displacement per revolution in cm^3
Δp = Pressure differential in bar
n = Speed in rpm
η_V = Volumetric efficiency
η_{mh} = Mechanical-hydraulic efficiency
η_t = Overall efficiency ($\eta_t = \eta_V \cdot \eta_{mh}$)

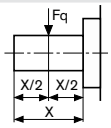
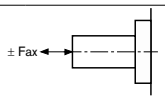
Mechanical flow limitation

Versions with port plate 22 (optional through drive plate) are not available with mechanical flow limitation. The max. displacement as stated in the order will be set to a fixed value .

Please state the desired $V_{g\,min}$ or $V_{g\,max}$ values in clear text.

Technical data

Permissible radial and axial forces on the drive shaft

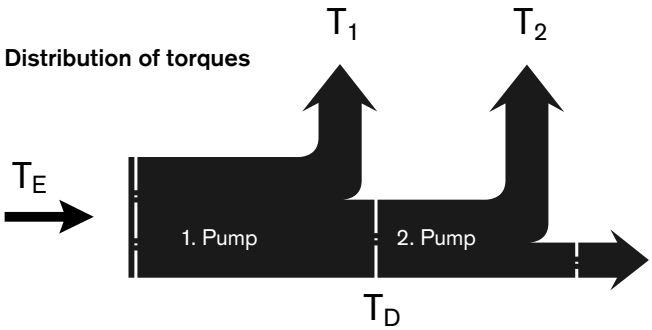
Size			NG		63
Radial force, maximum		at X/2	$F_{q\,max}$	N	1000
Axial force, maximum			$F_{ax\,max}$	N	1000

Permissible input and through drive torques

Size		NG	63
Torque, max. (at $V_{g\,max}$ and $\Delta p = 210$ bar[1)])	T_{max}	Nm	210
Input torque with drive shaft maximum[2)]			
P	$T_{E\,perm}$	Nm	210
DIN 6885		mm	25
R	$T_{E\,perm}$	Nm	400
SAE J744 (ANSI B92.1a-1996)		in	1
Through drive torque, maximum			
with drive shaft R	$T_{D\,perm}$	Nm	365

1) Without considering efficiency
2) For drive shafts without radial load

Distribution of torques



DG – Zweipunktverstellung direktgesteuert

The pump can be set to a minimum swivel angle by connecting an external control pressure to port X.

This will supply control fluid directly to the stroking piston; a minimum pressure of $p_{st} \geq 50$ bar is required.

The pump can only be switched between $V_{g\,max}$ or $V_{g\,min.}$

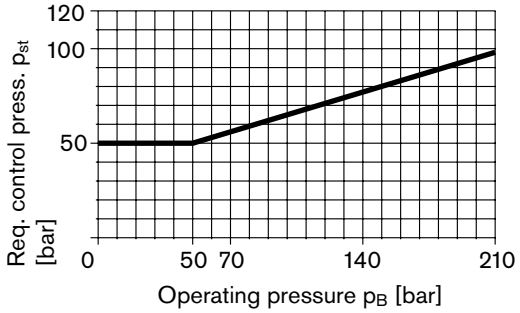
Please note, that the required control pressure at port X is directly dependent on the actual operating pressure p_B in port B. (see control pressure diagram).

Control pressure p_{st} in X = 0 bar $\triangleq V_{g\,max}$

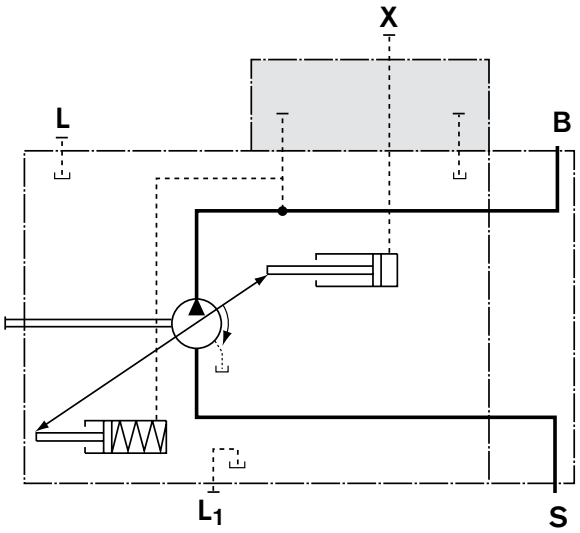
Control pressure p_{st} in X ≥ 50 bar $\triangleq V_{g\,min}$

The max. permissible control pressure amounts to p_{st} = 120 bar.

Control pressure diagram



Schematic



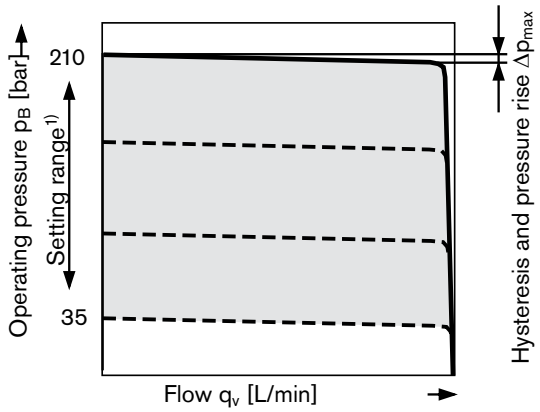
	Port for
B	Service line
S	Suction
L, L_1	Case drain fluid (L_1 plugged)
X	Control pressure (plugged)

DR – Pressure control

The DR-pressure control limits the maximum pressure at the pump outlet within the pump's control range. The pump therefore supplies only the amount of fluid as required by the actuators. This maximum pressure level can be set steplessly at the control valve.

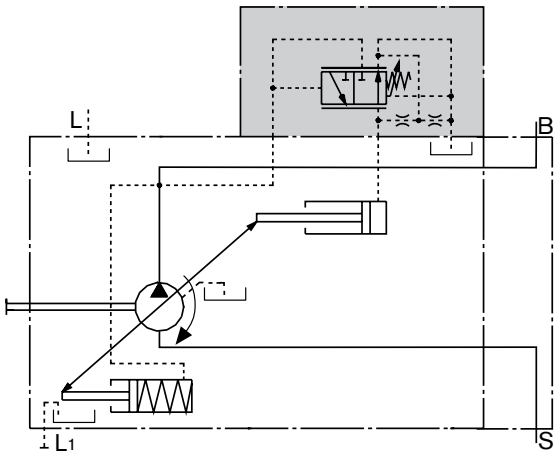
Static characteristic

(at $n_1 = 1500$ rpm; $t_{fluid} = 50°C$)



1) In order to prevent damage to the pump and the system the shown values in the pressure setting range are the maximum permissible and may not be exceede.
The valve is capable of higher settings.

Schematic



	Port for
B	Service line
S	Suction
L, L_1	Case drain fluid (L_1 plugged)

Control data

Hysteresis and repeatability Δp _____ max. 3 bar

Pressure rise, max

Size		63
Δp	bar	6

Control fluid consumption_____ max. approx. 3 L/min

DRG – Pressure control remotely operated

The DR-pressure control (see page 8) is overriding this DRG-remote setting of max. outlet pressure.

A pressure relief valve can be externally piped to port X for remote setting of pressure below the setting of the DR control valve spool. This relief valve is not included in the pump supply.

The differential pressure at the DRG-control spool is set as standard to20 bar. This results in a pilot oil flow to the relief valve of approx. 1,5 L/min. If another setting is required (range from 10-22 bar) please state in clear text.

As a separate relief valve we can recommend:

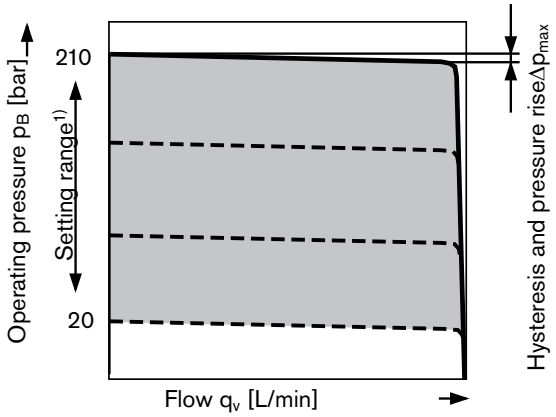
DBDH 6 (hydraulic) to RE 25402 or

DBETR-SO 381 with orifice dia. 0,8 mm in P (electric)to RE 29166.

The max. lenght of piping should not exceed 2 m.

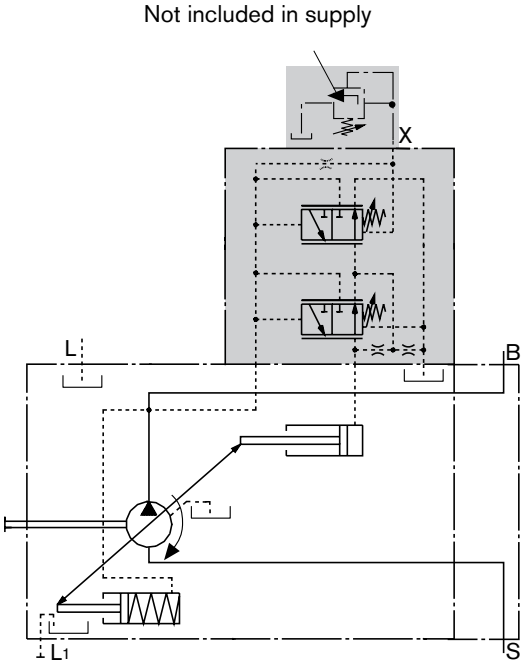
Static characteristic

(at n_1 = 1500 rpm; t_{fluid} = 50°C)



1) In order to prevent damage to the pump and the system the shown values in the pressure setting range are the maximum permissible and may not be exceede.
The valve is capable of higher settings.

Schematic DRG



	Port for
B	Service line
S	Suction
L, L_1	Case drain fluid (L_1 plugged)
X	Control pressure (plugged)
M_B	Measuring operating pressure (plugged)

Control data

Hysteresis and repeatability Δp _____ max. 3 bar

Pressure rise, max

Size		63
Δp	bar	6

Control fluid consumption_____max. approx. 4.5 L/min

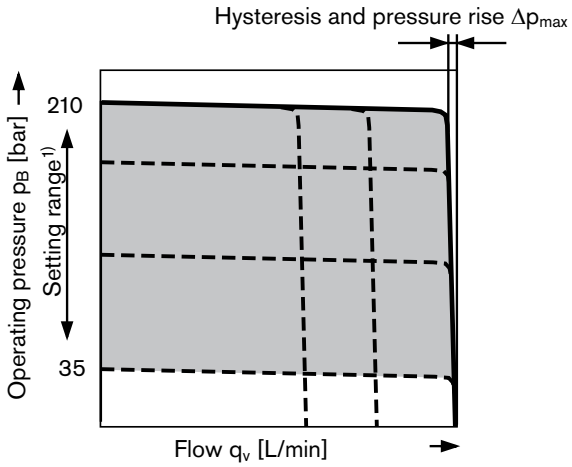
DRS – Pressure and flow control

In additon to the pressure control function (see page 8), the pump flow may be varied by means of a differential pressure over an orifice or valve spool installed in the service line to the actuator. The pump flow is equal to the actual required flow by the actuator, regardless of changing pressure levels.

The pressure control overrides the flow control function.

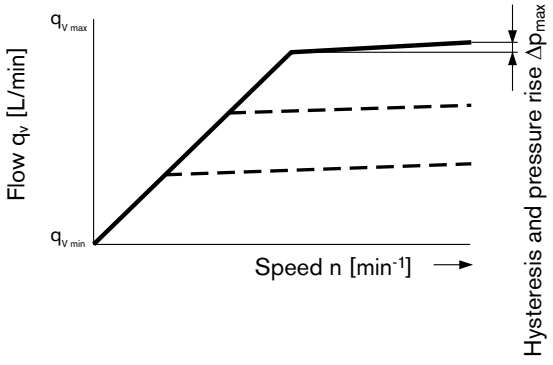
Note
The DRS-valve version has no connection between X and the tank (pump housing).
Unloading the LS-pilot line must be possible in the valve system.
Because of the flushing function sufficient unloading of the X-line must also be provided.

Static characteristic
Flow control at $n_1 = 1500$ rpm; $t_{fluid} = 50°C$)

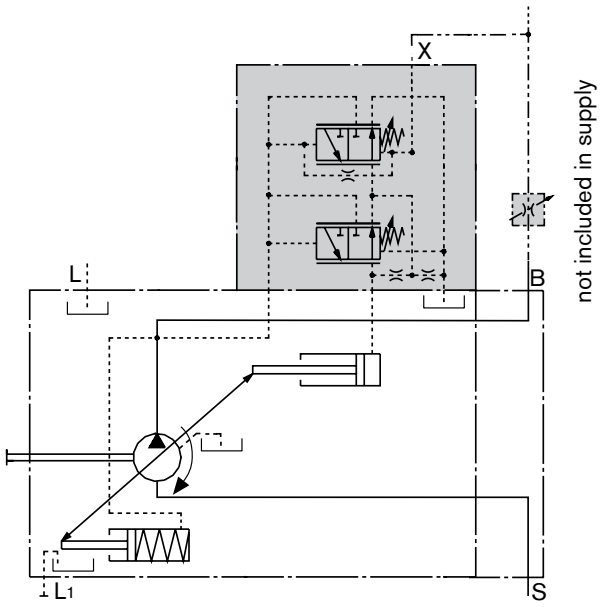


1) In order to prevent damage to the pump and the system the shown values in the pressure setting range are the maximum permissible and may not be exceede.
The valve is capable of higher settings.

Static characteristic at variable speeds



Schematic



	Port for
B	Service line
S	Suction
L, L_1	Case drain fluid (L_1 plugged)
X	Control pressure (plugged)

Differential pressure Δp:

Standard setting: 14 to 22 bar.

If another setting is required, please state in clear text.
Unloading port X to tank (with outlet port B closed) results in a zero stroke (standby) pressure which lies about 1 to 2 bar higher than the Δp setting).

Controller data

Data pressure control DR see page 8
Maximum flow deviation measured with drive speed n = 1500 rpm.

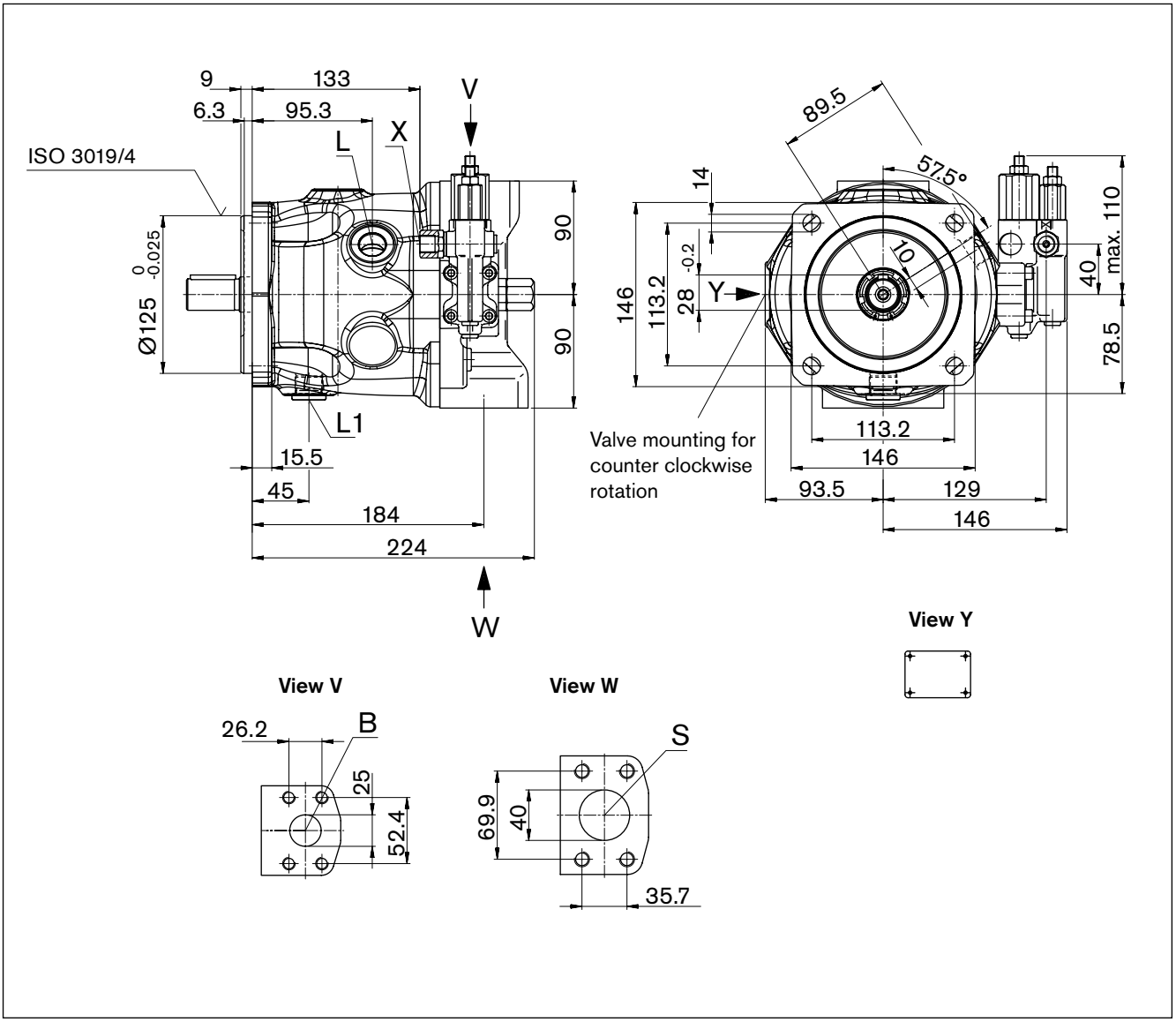
Size		**63**
$\Delta q_{v\,max}$	L/min	1.8

Control fluid consumption DRF __ max. approx. 3 bis 4.5 L/min
Control fluid consumption DRS_____ max. approx. 3 L/min

Dimensions size 63

Before finalising your design request a certified installation drawing. Dimensions in mm

DRS Pressure and flow control



Ports

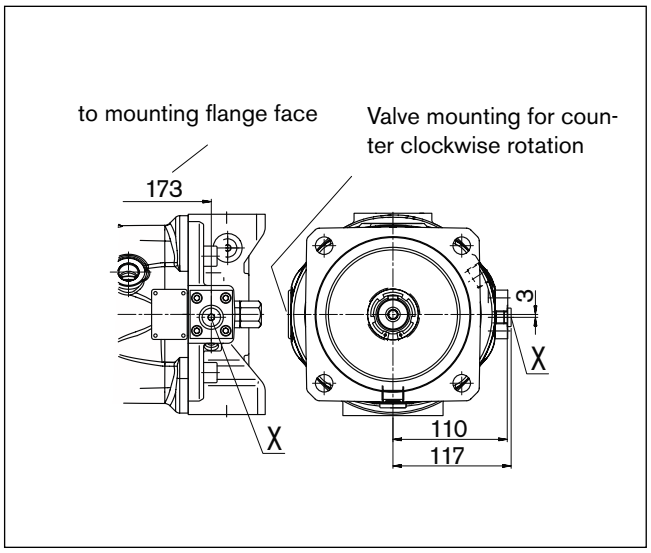
Designation	Port for	Standard	Size [1]	Peak pressure [bar] [2]	State
B	Service line (standard pressure range) Fixing thread	SAE J518 DIN 13	1 in M10 x 1.5; 17 deep	250	O
S	Suction (standard pressure range) Fixing thread	SAE J518 DIN 13	1 1/2 in M12 x 1.75; 20 deepf	5	O
L	Case drain fluid	DIN 3852[4]	M 22 x 1.5; 14 deep	2	O [3]
L_1	Case drain fluid	DIN 3852[4]	M 22 x 1.5; 14 deep	2	plugged [3]
X	Load sensing pressure	DIN 3852	M14x1.5; 12 deep	250	O
X	Control pressure for DG control	DIN 3852	G 1/4 in	250	O

1) For the maximum tightening torques the general information on page 14 must be observed.
2) Depending on the application, momentary pressure spikes can occur. Consider this when selecting measuring devices and fittings.
3) Depending on the installation postion, L or L_1 must be connected
4) The spot face can be deeper than as specified in the standard.
O = Must be connected (plugged on delivery)

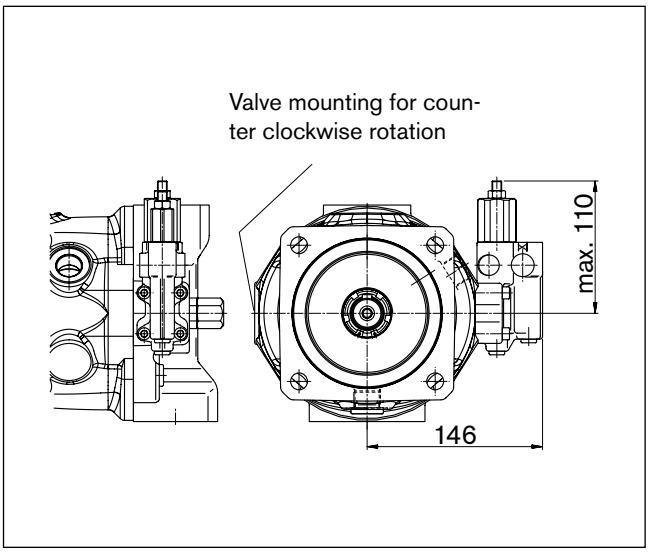
Dimensions size 63

Before finalising your design request a certified installation drawing. Dimensions in mm

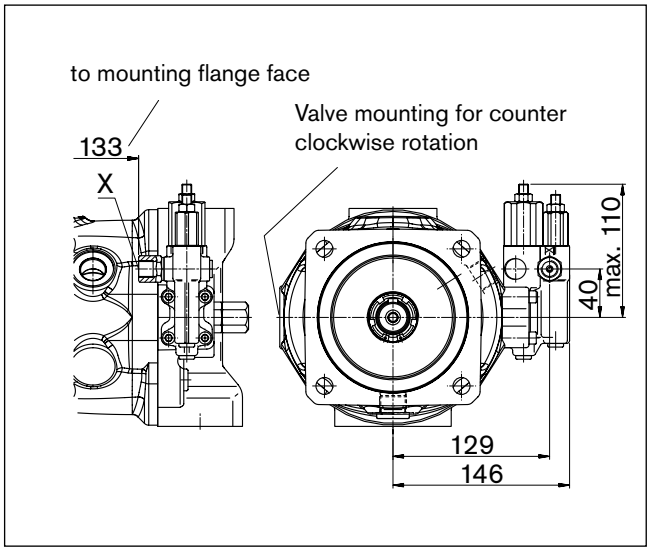
DG - Two point control, directly operated



DR - Pressure control

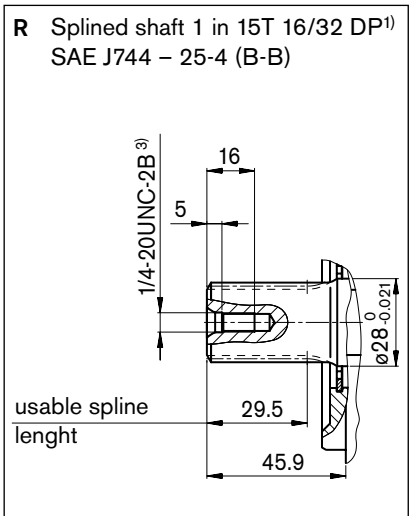


DRG - Pressure control, remotely operated

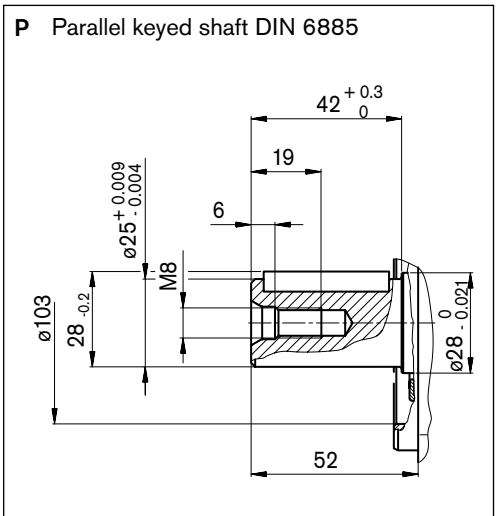


Drive shaft

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



P Parallel keyed shaft DIN 6885



1) ANSI B92.1a-1976, 30° pressure angle, flat base, flank centering, tolerance class 5
2) Thread in drive shaft „P“ to DIN 332.
3) For the maximum tightening torques the general information on page 14 must be observed.