

**MANNESMANN  
REXROTH**

**Variable Displacement Pump A10VSO**

Series 52, open circuits,  
Axial piston, swashplate design

**RA  
92 713/01.98**

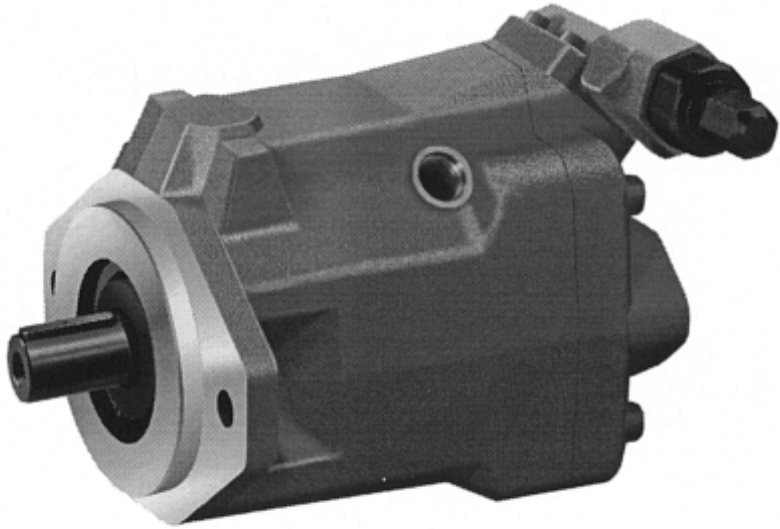
Size 10

Nominal pressure 3600 psi  
(250 bar)

Peak pressure 4600 psi  
(315 bar)

A10VSO Nominal size 18 see RA 92712

AA10VSO Nominal size 28....140 see RA 92711

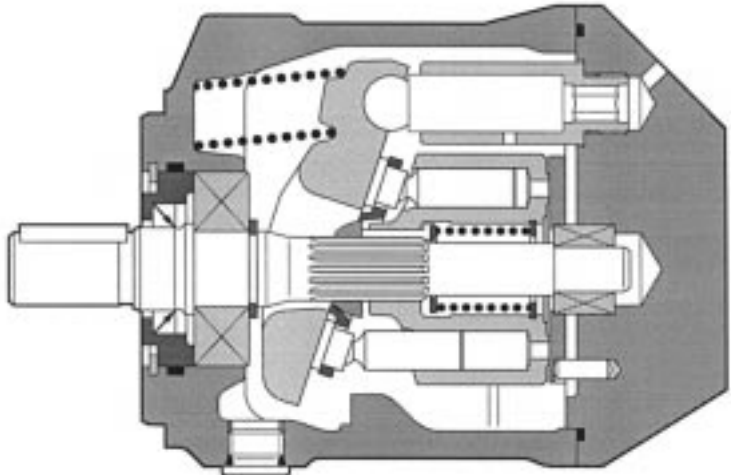


The variable displacement axial piston pump A10VSO in swashplate design was designed for hydrostatic drives in open circuits.

The pump is suitable for use in both stationary and mobile applications.

Volumetric flow is proportional to the drive speed and the displacement. By adjusting the position of the swashplate it is possible to vary the flow.

- Mounting flange and shaft per SAE-J74 and ISO
- Compact design
- High power-weight ratio
- Low noise level
- High efficiency
- Short control times
- Pressure and flow control
- High permissible speeds
- SAE-O-ring or metric threaded ports



Variable displacement pump A10VSO, Series 52

**Ordering Code**

<b>A10VS</b>	<b>O</b>	<b>10</b>		<b>/</b>	<b>52</b>		<b>-</b>	<b>P</b>				<b>N00</b>
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**Fluid**

Mineral oil (no desig.)

**Axial piston unit**

Variable, swashplate design SAE nominal pressure 250 bar, peak pressure 315 bar **A10VS**

**Mode of operation**

Pump, open circuit **O**

**Size**

△ Displacement  $V_{g,max}$  0.64 in<sup>3</sup>/rev (10.5 cm<sup>3</sup>/rev) **10**

**Control devices**

Pressure control	<b>DR</b>
Remote pressure control	<b>DRG</b>
Pressure- and flow control	<b>DFR1</b>
Pressure- and flow control with LS bleed-off orifice	<b>DFR</b>

**Series**

**52**

**Direction of rotation**

Looking at driveshaft	clockwise	<b>R</b>
	counter-clockwise	<b>L</b>

**Seals**

NBR (Nitrile rubber to DIN ISO 1629) **P**

**Shaft end**

Cylindrical with shaft key 19-1 (SAE A-B)	●	-	<b>K</b>
Cylindrical with shaft key DIN 6885		●	<b>P</b>
Splined shaft 9-4 (SAE A-B, 3/4" – 11 teeth)	●	-	<b>S</b>
Splined shaft 16-4 (SAE A, 5/8" – 9 teeth)	●	-	<b>U</b>

**Mounting flange**

SAE 2-bolt	●	-	<b>C</b>
ISO 2-bolt	●	-	<b>A</b>

**Service ports**

Pressure port B Inlet port S	} UNF-straight thread O-ring ports rear	●	-	<b>64</b>
Pressure port B Inlet port S				

**Through drive**

without through drive **N00**

**Special options**

No special options	-
Stroke limiter for 0.49 in <sup>3</sup> /rev (8 cm <sup>3</sup> /rev)	<b>SO 858</b>
Stroke limiter for 0.37 in <sup>3</sup> /rev (6 cm <sup>3</sup> /rev)	<b>SO 857</b>

= preferred program (with short delivery times)

● = available

○ = not available

Variable displacement pump A10VSO, Series 52

## Hydraulic fluid

Prior to project design, please see our catalog sheets RA 90 220 (mineral oils) and REA 90 221 (environmentally compatible fluids) for detailed information on the selection of hydraulic fluids and application conditions.

When operating with environmentally evaluated (EE) fluids certain limitations may apply. Please consult us.

### Operating viscosity range

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

$v_{opt} = \text{optimum operating viscosity } 16 \dots 36 \text{ mm}^2/\text{s}$
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referred to tank temperature (open circuit).

### Limits of viscosity range

The following values are valid for extreme operating conditions:

- $v_{min} = 60 \text{ sus (10 mm}^2/\text{s)}$   
for short periods at max. leakage oil temperature of 195°F (90 °C).
- $v_{max} = 4600 \text{ sus (1000 mm}^2/\text{s)}$   
for short periods during cold start.

### Temperature range (see selection diagram)

$$t_{min} = -13^\circ\text{F } (-25^\circ\text{C})$$

$$t_{max} = +195^\circ\text{F } (+90^\circ\text{C})$$

### Notes on the selection of the hydraulic fluid

For correct selection of the fluid it is assumed that the operating temperature in the tank is known (open circuits), in relation to the ambient temperature.

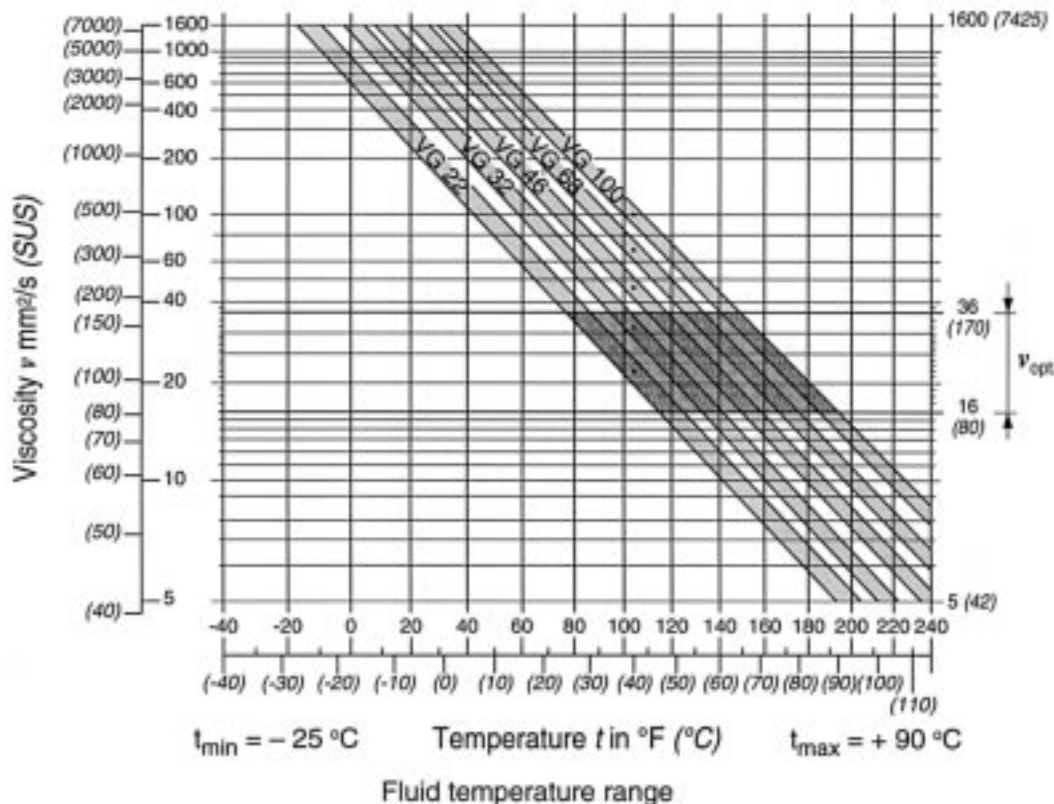
The hydraulic fluid should be selected so that, within the operating temperature range, the operating viscosity lies within the optimum range  $v_{opt}$ , (see shaded section of selection diagram). We recommend that the higher viscosity grade is selected in each case.

Example: At an ambient temperature of X °F (°C) the operating temperature in the tank will be 140 °F (60° C). In the optimum operating viscosity range ( $v_{opt}$ ; shaded section) this corresponds to viscosity grade VG 46 or VG 68; VG 68 should be selected.

Important: The case drain oil temperature is influenced by pressure and speed and is always higher than the tank temperature. At no point in the system, however, may the temperature be higher than 195°F (90 °C).

If it is not possible to comply with the above conditions because of extreme operating parameters or a high ambient temperature, please consult us.

### Selection diagram



### Filtration

In order to ensure reliable operation, the hydraulic fluid must be maintained to a minimum cleanliness level of:

- class 9 to NAS 1638 or
- class 18/15 to ISO/DIS 4406
- class 6 per SAE, ASTM, AIA

This may be achieved, for example with filterelement type...D010...(see RA 31278) with a minimum retention rate:

$\beta_{10} \geq 100$
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### Technical Data

#### Operating pressure range - Inlet side

Absolute pressure at port S (inlet port)

$P_{abs \text{ min}}$  \_\_\_\_\_ 12 psi (0.8 bar)  
 $P_{abs \text{ max}}$  \_\_\_\_\_ 435 psi (30 bar)

#### Operating pressure range - Outlet side

pressure at port B

Nominal pressure  $p_N$  \_\_\_\_\_ 3600 psi (250 bar)  
 Peak pressure  $p_{max}$  \_\_\_\_\_ 4600 psi (315 bar)  
 (Pressure data to DIN 24312)

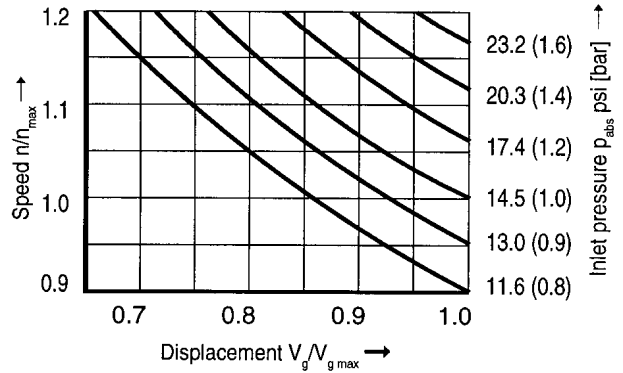
#### Direction of flow

S to B.

#### Case drain pressure

Maximum permissible pressure of leakage fluid (at port L,  $L_1$ ):  
 maximum 7 psi (0.5 bar) higher than the inlet pressure at port S,  
 but not higher than 30 psi (2 bar) absolute.

#### Determination of inlet pressure $p_{abs}$ at the inlet port, resp. the reduction in displacement for increasing speed.



**Table of values** (theoretical values, without considering  $\eta_{mh}$  and  $\eta_v$ ; values rounded)

Displacement		$V_{g \text{ max}}$	0.64 in <sup>3</sup>	10.5 cm <sup>3</sup>
Optional maximum stroke-limiter	at $V_{red}$		0.49 in <sup>3</sup>	8 cm <sup>3</sup>
	at $V_{red}$		0.37 in <sup>3</sup>	6 cm <sup>3</sup>
Max. speed <sup>1)</sup>	at $V_{g \text{ max}}$	$n_{o \text{ max}}$	3600 min <sup>-1</sup>	3600 min <sup>-1</sup>
Max. perm. speed (speed limit)	at increase in input pressure $p_{abs}$ or $V_g < V_{g \text{ max}}$	$n_{o \text{ max perm}}$	4300 min <sup>-1</sup>	4300 min <sup>-1</sup>
Max. volumetric flow	at $n_{o \text{ max}}$	$q_{v \text{ max}}$	9.77 GPM	37 L/min
	at $n_E = 1750 \text{ min}^{-1}$		4.78 GPM	18 L/min
Max. power ( $\Delta p = 3626 \text{ psi (250 bar)}$ )	at $n_{o \text{ max}}$	$P_{o \text{ max}}$	21 HP	16 kW
	at $n_E = 1750 \text{ min}^{-1}$		10 HP	7.8 kW
Max. torque ( $\Delta p = 3626 \text{ psi (250 bar)}$ )	at $V_{g \text{ max}}$	$T_{max}$	31 lb-ft	42 Nm
Moment of inertia about drive axis		J	0.014 lb-ft <sup>2</sup>	0.0006 kgm <sup>2</sup>
Fill capacity			0.05 gal.	0.2 L
Approx. weight (without oil fill)		m	17.6 lbs	8 kg
Permissible loading on drive shaft:				
max. perm. axial force		$F_{ax \text{ max}}$	90 lbf	400 N
max. perm. radial force		$F_{q \text{ max}}$	56 lbf	250 N

<sup>1)</sup> The values shown are valid provided there is an absolute pressure of 14.5 (1 bar) at suction inlet S.

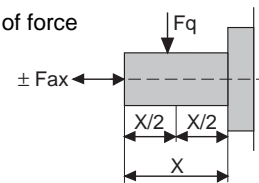
#### Calculation of size

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

$$\text{Drive torque } T = \frac{V_g \cdot \Delta p}{24 \cdot \pi \cdot \eta_{mh}} \quad \text{lb-ft} \left( \frac{1.59 \cdot V_g \cdot \Delta p}{100 \cdot \eta_{mh}} \right) \quad \text{Nm}$$

$$\text{Drive power } P = \frac{T \cdot n}{5252} = \frac{Q \cdot \Delta p}{1714 \cdot \eta_t} \quad \text{HP} \left( \frac{2\pi \cdot T \cdot n}{60000} = \frac{T \cdot n}{9549} = \frac{Q \cdot \Delta p}{600 \cdot \eta_t} \right) \quad \text{kW}$$

#### Direction of force



$V_g$  = geometric displacement [in<sup>3</sup> (cm<sup>3</sup>)] per revolution  
 $\Delta p$  = pressure differential [psi (bar)]  
 $n$  = speed [rpm]  
 $\eta$  = volumetric efficiency  
 $\eta_{mh}$  = mech.-hydr. efficiency  
 $\eta$  = overall efficiency ( $\eta_t = \eta_v \cdot \eta_{mh}$ )

## Installation Notes

Installation position is optional. Prior to start-up, pump housing must be completely filled with system fluid during commissioning, prior to start-up, and remain full when operating. In order to achieve the lowest noise value, all connections (suction, pressure, case drain ports) must be linked by flexible connections to tank.

Avoid placing a check valve in the case drain line.

This may, however, be permissible in individual cases, after consultation with us.

### 1. Vertical installation (shaft end upwards)

The following installation conditions must be taken into account:

#### 1.1. Installation inside a tank

Before installation fill pump housing, keeping it in a horizontal position.

a) If the minimum fluid level is maintained equal to or above the pump mounting surface leave ports "L", "L<sub>1</sub>" and "S" open (see Fig.1).

b) If the minimum fluid level is below the pump mounting surface pipe port "L<sub>1</sub>", and possibly "S" according to Fig. 2.

Close port "L" with respect to conditions in 1.2.1.

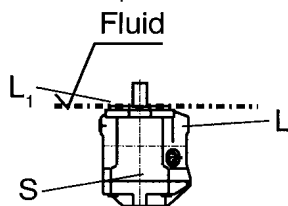


Fig. 1

#### 1.2. Installation outside a tank

Before installing the pump, fill the pump with housing in the horizontal position.

For mounting above a tank see fig. 2.

Limiting conditions:

1.2.1. Minimum pump inlet pressure  $p_{in\ min} = 12\ \text{psi}$  (0.8 bar) both static and dynamic conditions.

Note: Avoid mounting above a tank wherever possible in order to achieve a low noise level.

The permissible suction height  $h$  is based on the overall pressure loss, but may **not** be greater than  $h_{max} = 31.5\ \text{in}$  (800 mm) (immersion depth  $h_{d\ min} = 7.9\ \text{in}$  (200 mm)).

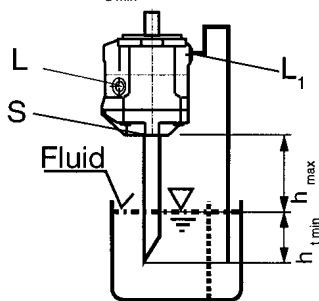


Fig. 2

Overall pressure loss  $\Delta p_{total} = \Delta p_1 + \Delta p_2 + \Delta p_3 \leq (1 - p_{in\ min}) = 3\ \text{psi}$  (0.2 bar)

$\Delta p_1$ : Pressure loss in pipe due to accelerating column of fluid

$$\Delta p_1 = \frac{\rho \cdot l \cdot dv}{dt} \cdot 10^{-5} \text{ (bar)}$$

$\rho$  = density (kg/m<sup>3</sup>)

$l$  = pipe length (m)

$dv/dt$  = change in rate of fluid velocity (m/s<sup>2</sup>)

$\Delta p_2$ : Pressure loss due to static head

$$\Delta p_2 = h \cdot \rho \cdot g \cdot 10^{-5} \text{ (bar)}$$

$h$  = head (m)

$\rho$  = density (kg/m<sup>3</sup>)

$g$  = gravity. = 9.81 m/s<sup>2</sup>

$\Delta p_3$ : Line losses (elbows etc.)

### 2. Horizontal installation

The pump must be installed, so that "L" or "L<sub>1</sub>" is at the top.

#### 2.1. Installation inside a tank

a) If the minimum fluid level is equal to or above the top of the pump, ports "L", "L<sub>1</sub>" and "S" should remain open (see fig. 3).

b) If the minimum fluid level is below the top of the pump, pipe ports "L", "L<sub>1</sub>" and possibly "S" as fig. 4. The conditions correspond to item 1.2.1.

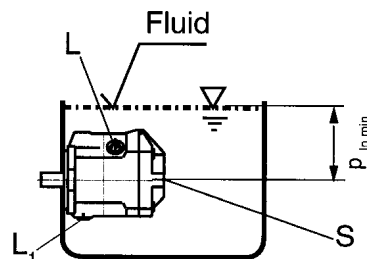


Fig. 3

#### 2.2. Installation outside a tank

Fill the pump housing before commissioning.

Pipe ports "S" and the higher port "L" or "L<sub>1</sub>".

a) When mounting above the tank, see fig. 4. Conditions correspond to 1.2.1.

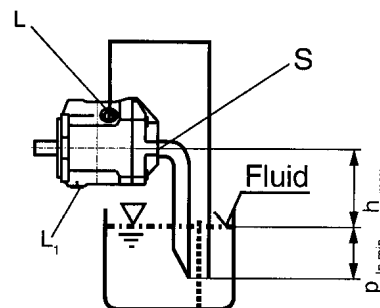


Fig. 4

b) Mounting below the tank

Pipe ports "L" and "S" according to fig.5.

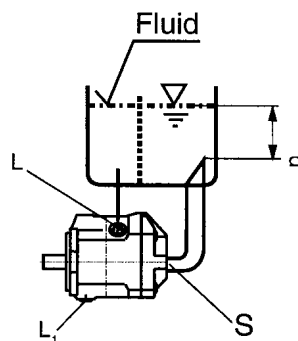


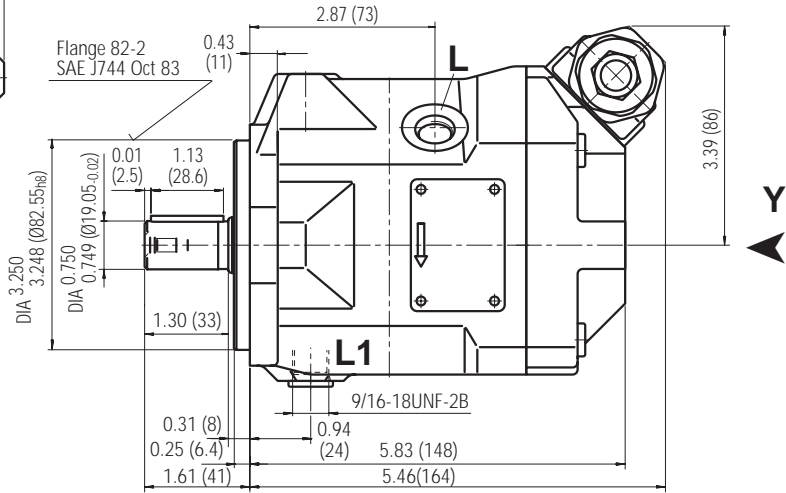
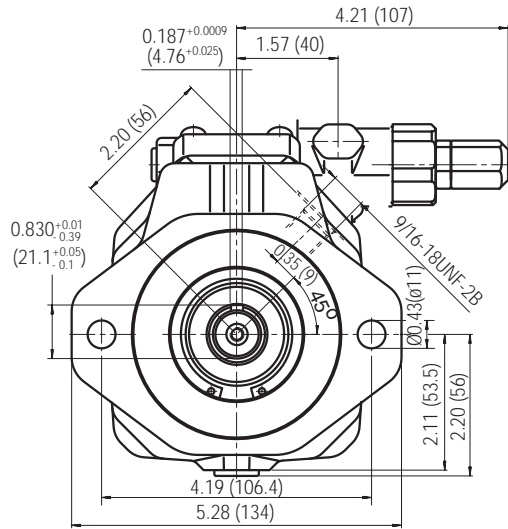
Fig. 5

Variable displacement pump A10VSO, Series 52

**Dimensions size 10**

**Shaft end "K"**

Version A10VSO 10 DR /52 R- XKC64N00

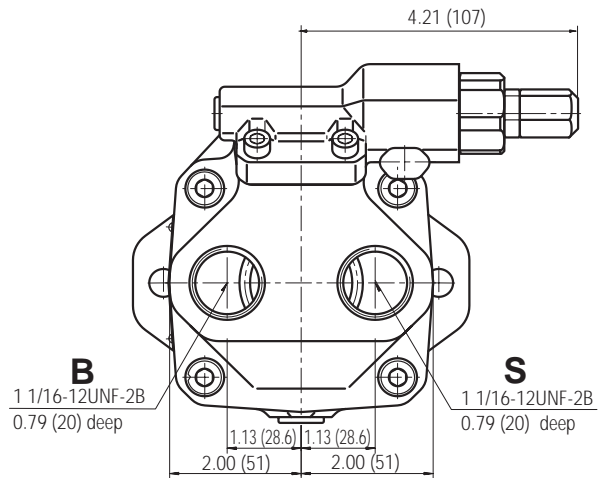
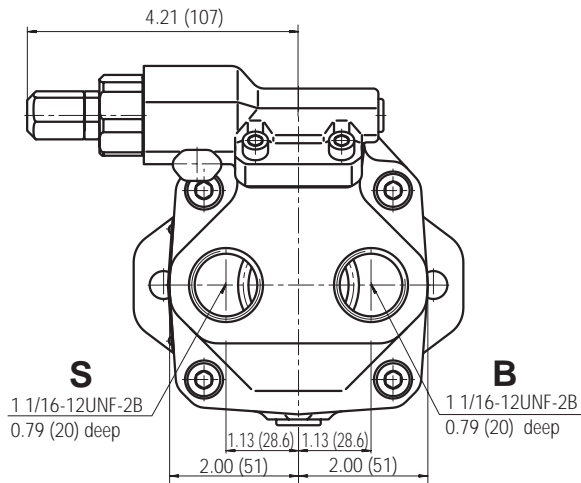


**View Y**

shown is clockwise rotation (R)

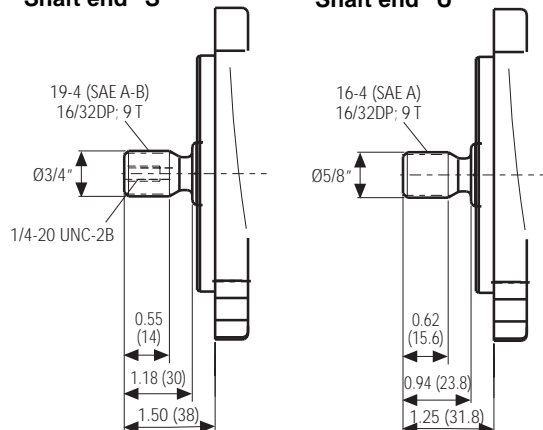
**View Y**

shown is counter-clockwise rotation (L)



**Shaft end "S"**

**Shaft end "U"**



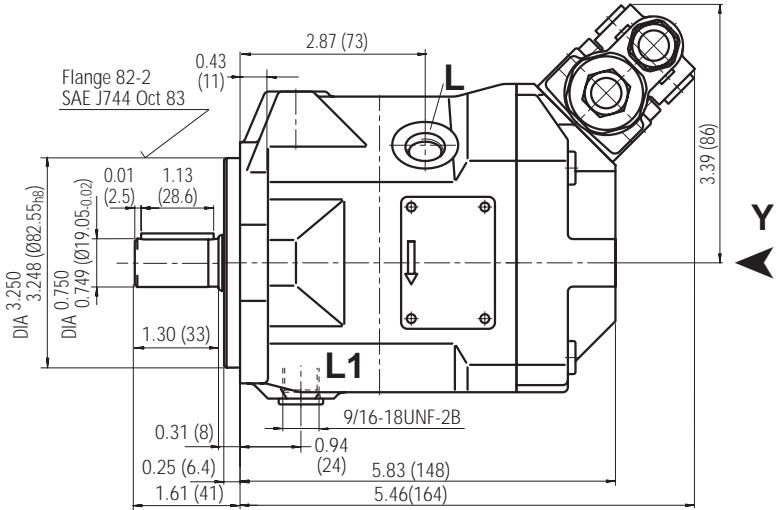
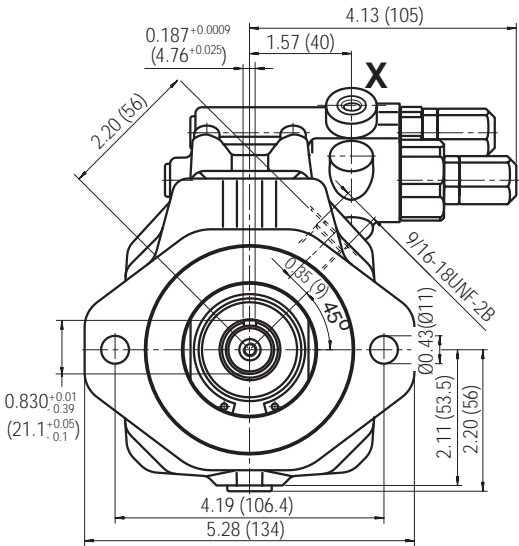
**Ports**

- B Pressure port 1 1/16-12UNF-2B
- S Inlet port 1 1/16-12UNF-2B
- L/L<sub>1</sub> Case drain 9/16-18UNF-2B

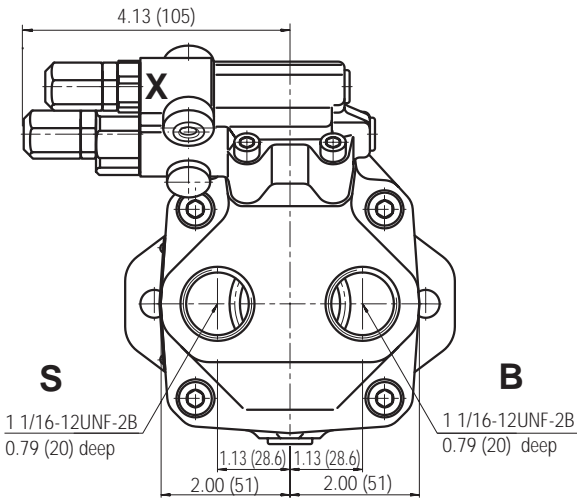
**Dimensions size 10**

**Shaft end "K"**

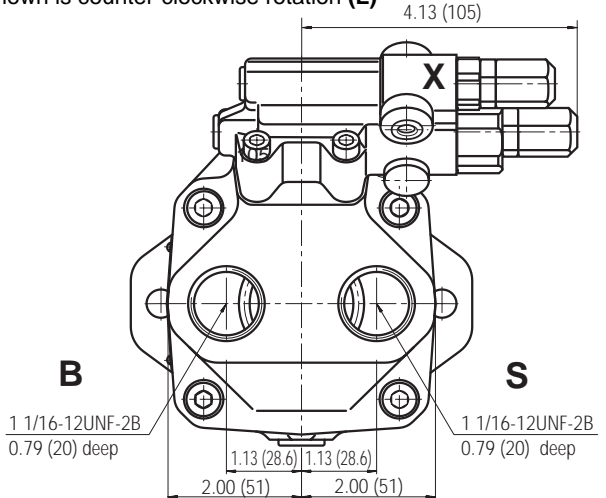
DR  
Version A10VSO 10 DRG /52 R- PKC64N00  
DFR1



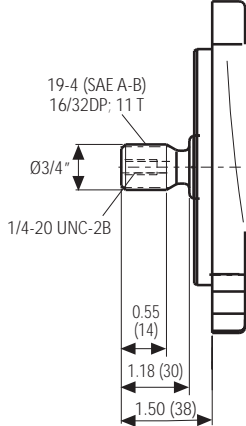
**View Y**  
shown is clockwise rotation (R)



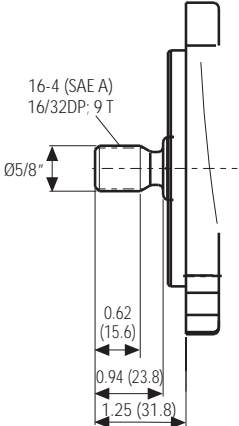
**View Y**  
shown is counter-clockwise rotation (L)



**Shaft end "S"**



**Shaft end "U"**



**Note:** Alternate X-port may be used. (One side plugged)

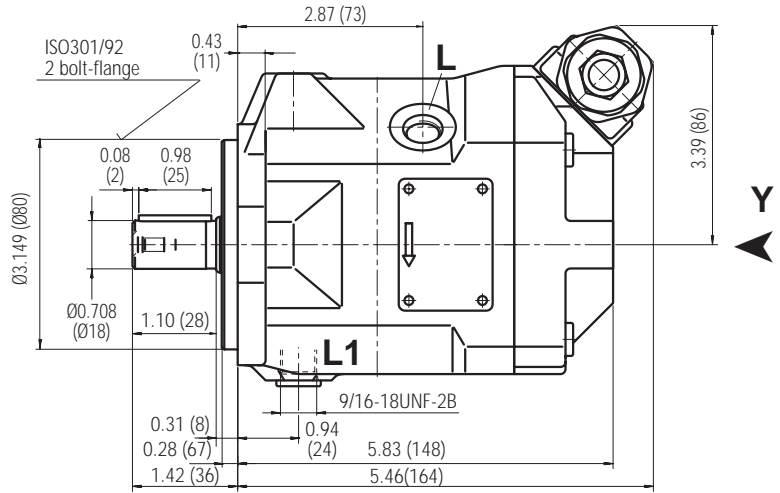
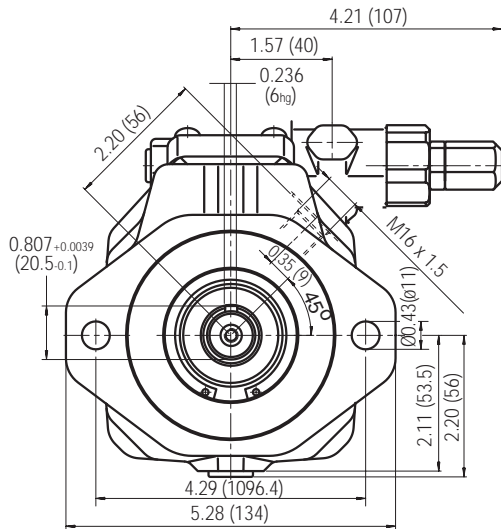
**Ports**

B	Pressure port	1 1/16-12UNF-2B
S	Inlet port	1 1/16-12UNF-2B
L/L <sub>1</sub>	Case drain	9/16-18UNF-2B
X	Pilot port	7/16-20UNF-2B

**Dimensions size 10**

**Shaft end "P"**

Version A10VSO 10 DR /52 R- PKA14N00  
DFR1

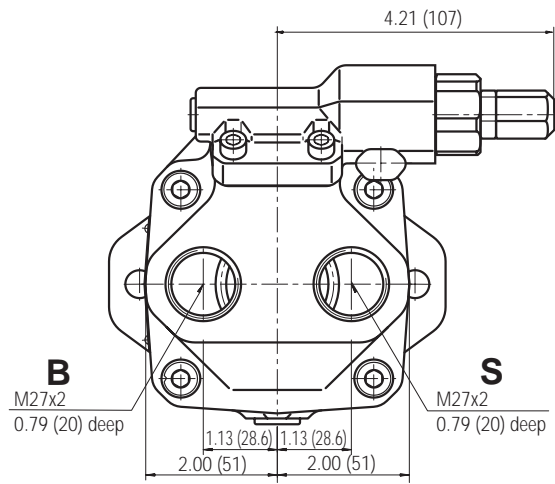
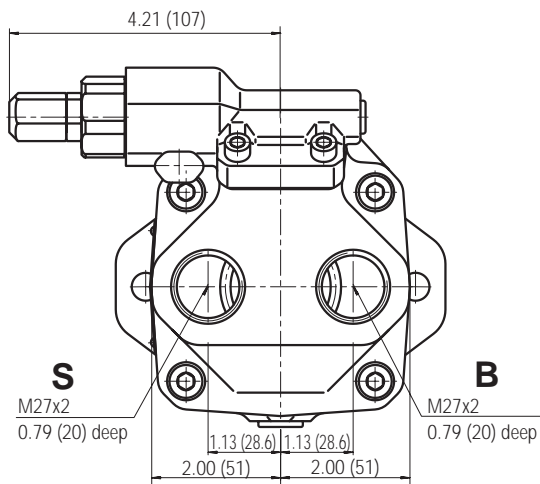


**View Y**

shown is clockwise rotation (R)

**View Y**

shown is counter-clockwise rotation (L)



**Ports**

- B Pressure port M27x2
- S Inlet port M27x2
- L/L<sub>1</sub> Case drain M16x1.5



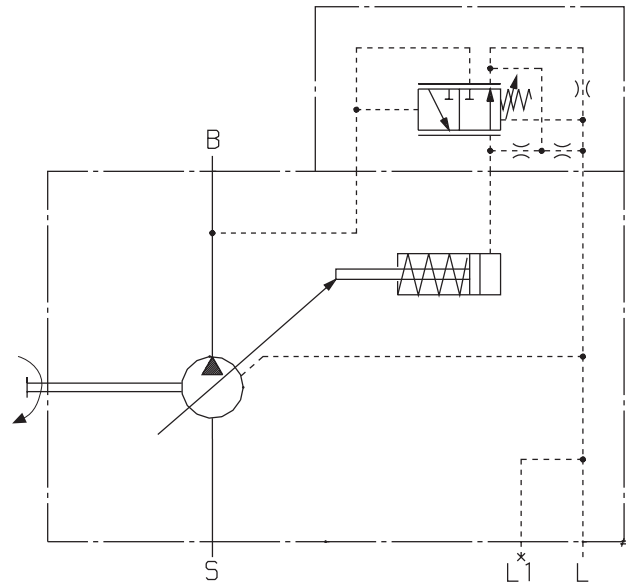
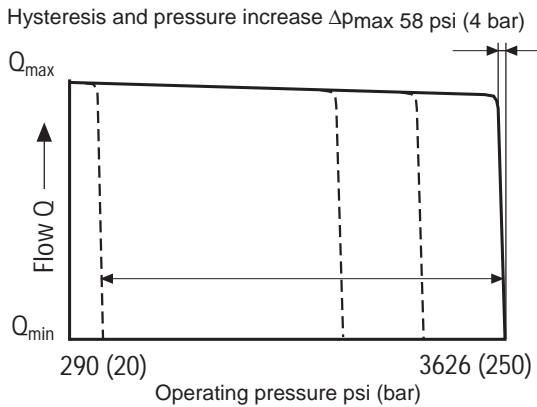
## DR Pressure control

The pressure control serves to maintain a constant pressure in the hydraulic system, within the control range of the pump. The pump therefore supplies only the amount of hydraulic fluid required by the actuators. Pressure may be steplessly set at the pilot valve.

Dimensions see page 6.

### Static characteristic

(at  $n_1 = 1500 \text{ rpm}$ ;  $t_{oil} = 122 \text{ °F}$  (50 °C))



## DRG Remote pressure control

Function and design as for DR.

The remote pressure control can be adjusted up to the pre set pressure level of the DR control.

A pressure relief valve may be externally piped to port X for remote control purposes. It is not, however, included with the DRG control.

The differential pressure at the pilot valve is set as standard to 290 psi (20 bar) and this results in a pilot flow of 0.5 GPM (1.5 L/min). If another setting is required (in the range 145–320 (10\_20 bar), please state this in clear text.

We recommend that one of the following is used as the separate pressure relief valve:

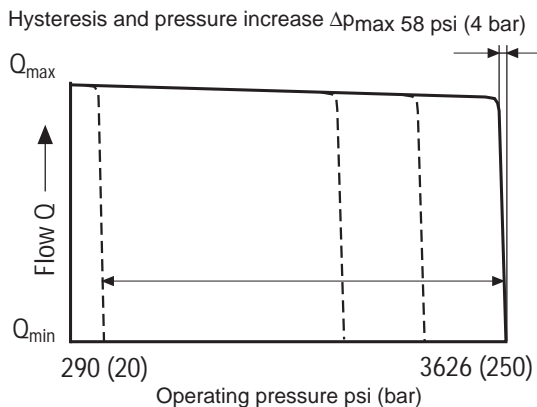
DBDH 6 (hydraulic) to RA 25402

DBETR-SO 437 with 0.03 (0.8 mm) dia. nozzle in P (electrical) to RA 29166.

The length of piping must notDimensions see page 6.

### Static characteristic

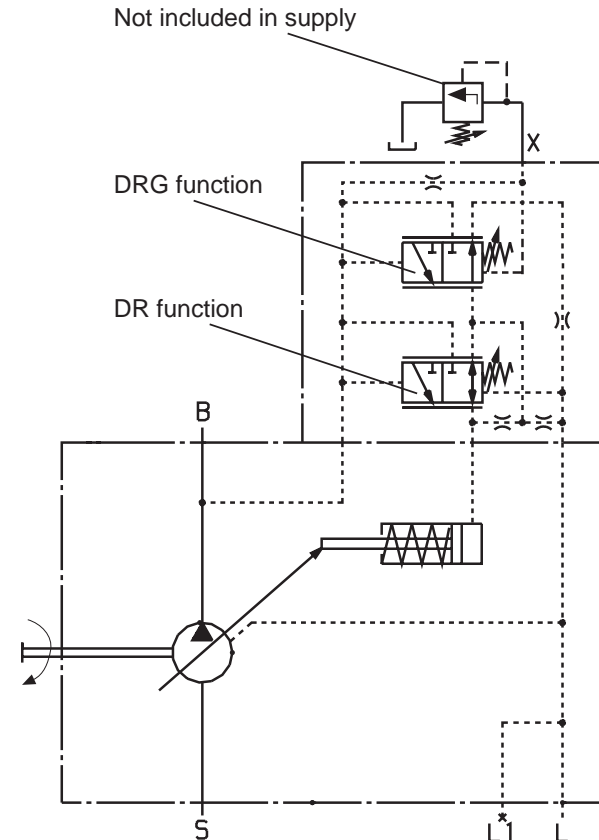
(at  $n_1 = 1500 \text{ rpm}$ ;  $t_{oil} = 122 \text{ °F}$  (50 °C))



Not included in supply

DRG function

DR function



Dimensions see page 7.

### DFR1/DFR Pressure/flow control

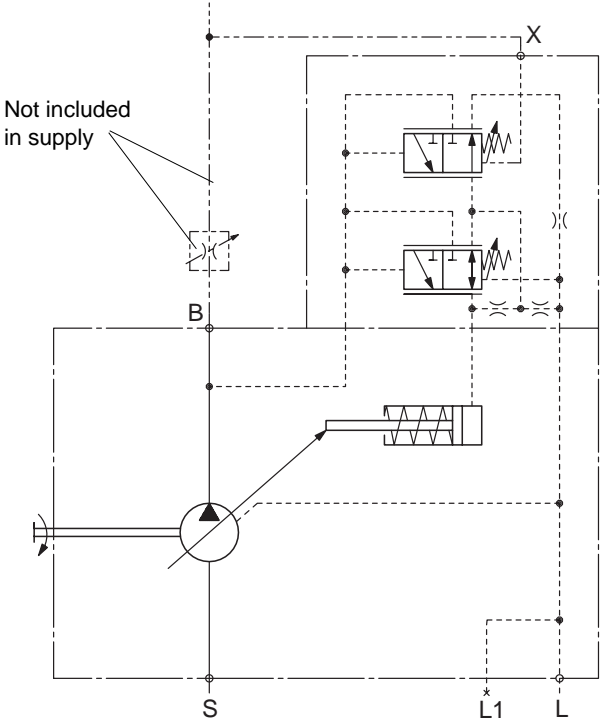
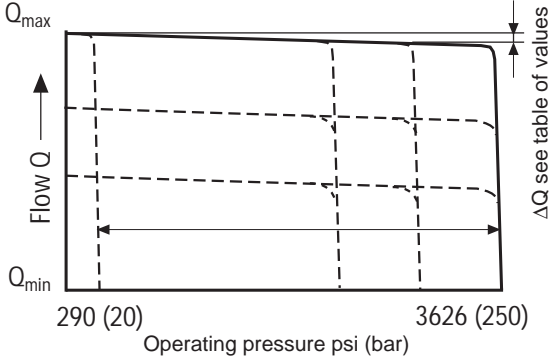
In addition to the pressure control function, the pump flow may be varied by means of a differential pressure at the actuator (e.g. an orifice, not included in supply). The pump flow is equal to the actual required flow by the actuator.

The DFR1-valve has no connection between X and tank.

Dimensions see page 7 and 9.

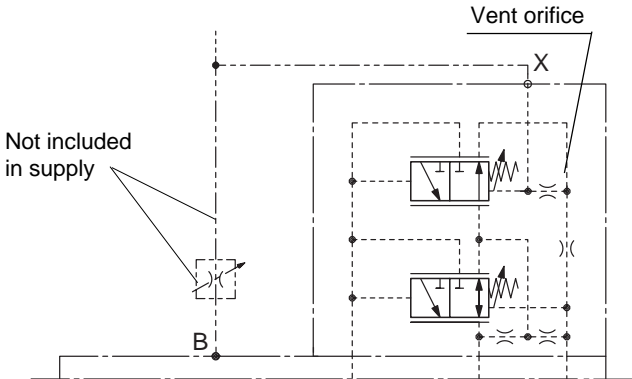
#### Static characteristic

(at  $n_1 = 1500 \text{ rpm}$ ;  $t_{oil} = 50 \text{ }^\circ\text{C}$ )



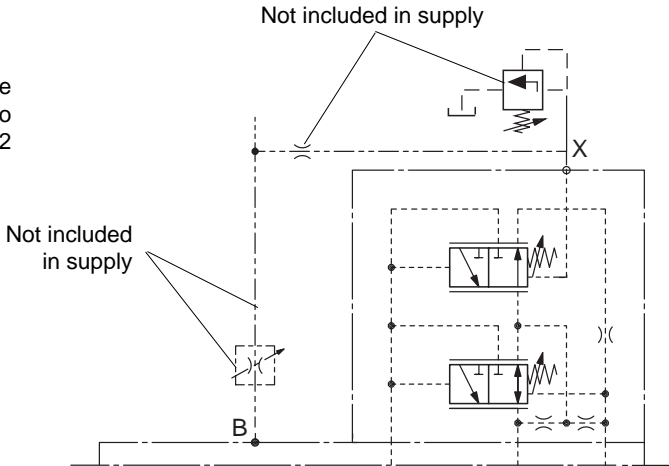
### DFR

The function is the same as the DFR1 control, however, in addition a bleed down orifice is provided to vent trapped pressure in the loadsense line.



### DFR1 Remote pressure/flow control

The DFR control can be used for combination of remote pressure and flow control. A pressure relief valve may be externally piped to the X-point, together with the load sense line. An orifice (0.8-1.2 mm) need to be installed in the loadsense line.



## Notes



**Mannesmann Rexroth Corporation**  
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*Rexroth Hydraulics Div., Mobile, 1700 Old Mansfield Road, Wooster, OH 44691-0394 Tel. (330) 263-3400 Fax: (330) 263-3333*