

Rexroth
Bosch Group

Variable pump A4VSH

Series 1, for use in semi-closed circuits
Axial piston swashplate design

RE
92110/01.89

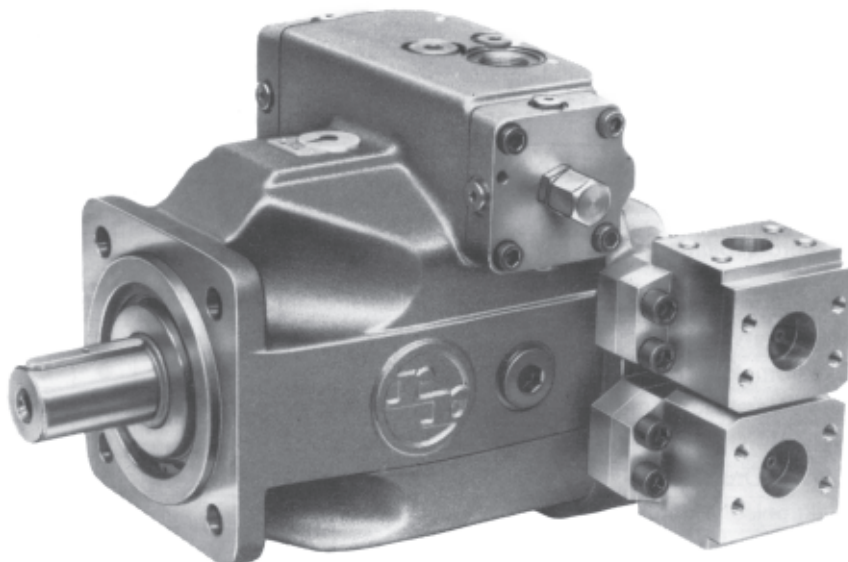
Sizes 40...250

Nominal pressure 350 bar Peak pressure 400 bar

Preliminary issue

High pressure range

For further information
see variable pump A4VSG
closed circuit, RE 92100

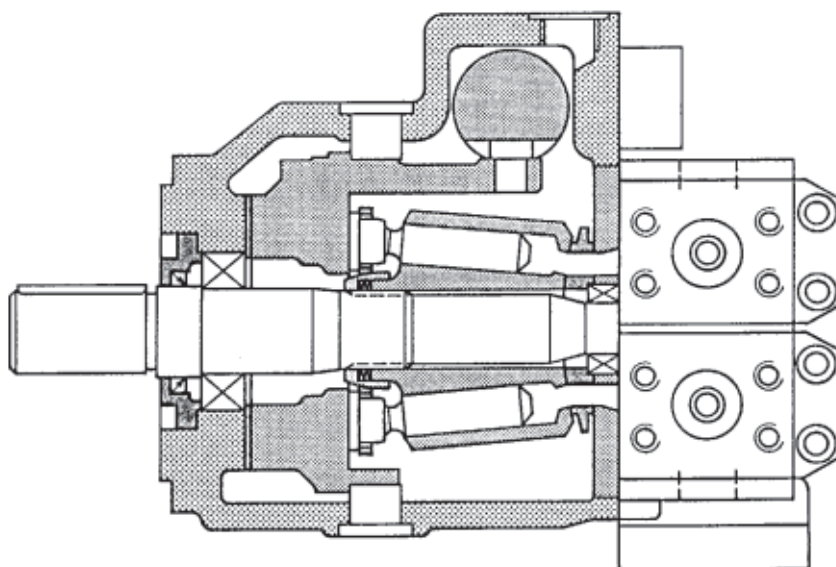


The A4VSH is a variable displacement axial piston pump of swashplate design for hydrostatic semi-closed circuit transmissions.

Flow is proportional to drive speed and the displacement is steplessly variable.

It increases with increasing swivel angle from zero to its maximum value. Swivelling the pump over centre smoothly changes the direction of flow.

- Reversible flow
- Permissible continuous pressure 350 bar
- Low noise level
- Long service life
- Combination pumps possible
- Through drive up to 100 % torque
- Operation on fire resistant fluids with reduced operating data



Variable pump A4VSH, series 1

Ordering Code

Fluid

Mineral oil or HFD fluid (no code)	<input type="checkbox"/>
HFA, HFB, HFC fluid ¹⁾	<input type="checkbox"/> E-

Axial piston unit

Swashplate design, variable	<input type="checkbox"/> A4VS
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Operation

Pump, half closed circuit	<input type="checkbox"/> H
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Size

△ Displacement $V_{g \max}$ (cm ³)	<input type="checkbox"/> 40	<input type="checkbox"/> 71	<input type="checkbox"/> 125	<input type="checkbox"/> 250
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Control device (for additional function and ordering details RE 92100)

Manual control	MA		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> MA
Electric motor control	EM		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> EM
Hydraulic control, flow dependent	HM		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> HM
Hydraulic control, with servo valve	HS		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> HS
for pressure and power control	HS	P	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> HSP
Electronic control	EO 1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> EO1
Hydraulic control, pressure dependent	HD		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> HD

Series

	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 10
only for HD control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> 11

Direction of rotation

Viewed on drive shaft	clockwise	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> R
	anti-clockwise	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> L ²⁾
	bi-directional	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> W ²⁾

Seals

Perbunan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> P
Viton	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> V
EPDM	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/> E

¹⁾ not permissible when building on gear or radial piston pumps G2, G3, G4, GU, GN, R4 (ordering code K01 – K57)

²⁾ not possible when building on internal gear pumps (K54, K55, K56)

³⁾ see RE 10030

⁴⁾ see RE 10039 and RE 10042

⁵⁾ see RE 10033, RE 11460 centre or rear pump. The connecting elements are not included in the supply of the A4VSH, if the gear pumps are not built on at the factory.

When placing an additional order, please state size of pump.

The choice is: G2: 4; 11; 16

G3: 20; 26; 38

⁶⁾ see RE 10211, for internal gear pump model: only clockwise rotation is possible

1 PF 2 G U 1-1 X
N 2-2 X / ... RG 07 M KO
3-1 X V

with combination parts for building A4VS + GU/GN
(when ordering separately, please write order in this form)

⁷⁾ see RE 11263

● = available

- = not available

Variable pump A4VSH, series 1

	A4VS	H		/	10	-		B	02				
Fluid													
Axial piston unit													
Operation													
Size													
Control device													
Series													
Direction of rotation													
Seals													
Shaft end (Input shaft)													
Parallel with key DIN 6885													P
Splined to DIN 5480													Z
Mounting flange			40	71	125	250							
ISO 4 hole			●	●	●	●							B
Service ports													
Ports A, B	SAE at the sides (opposite sides) (metric fixing screws)												
Anti-cavitation valve- : ports S _A , S _B	SAE at the sides (same side) offset 90° with regard to A and B											02	
Auxiliary pump and through drive			40	71	125	250							
Without aux. pump, without through drive			●	●	●	●							N00
With through drive for axial piston pump, gearpump or radial piston pump													
Flange	Spigot/shaft	for building on											
ISO 125, 4 hole	Splined shaft 32x2x14x9g	A4VSO/H/G 40	●	●	●	●							K31
ISO 140, 4 hole	Splined shaft 40x2x18x9g	A4VSO/H/G 71	-	●	●	●							K33
ISO 160, 4 hole	Splined shaft 50x2x24x9g	A4VSO/H/G 125	-	-	●	●							K34
ISO 224, 4 hole	Splined shaft 60x2x28x9g	A4VSO/H/G 250	-	-	-	●							K35
ISO 100, 2 hole	Keyed shaft Ø 22	A10VSO28	●	●	●	●							K25
ISO 100, 2 hole	Keyed shaft Ø 25	A10VSO45	●	●	●	●							K26
ISO 125, 2 hole	Keyed shaft Ø 32	A10VSO71	-	●	●	●							K27
ISO 125, 2 hole	Keyed shaft Ø 40	A10VSO100	-	-	●	●							K37
ISO 180, 4 hole	Keyed shaft Ø 45	A10VSO140	-	-	-	●							K59
SAE A, 2 hole	Splined shaft 5/8"	G2 ³⁾	●	●	●	●							K01
SAE B, 2 hole	Splined shaft 7/8"	G3/G4 ⁴⁾	●	●	●	●							K02
	Tongued shaft	G2/G3 ⁵⁾	●	●	●	●							K49
ISO 100, 4 hole	Splined shaft 21x24	GU/GN (1) ⁶⁾	●	●	●	●							K54
ISO 125, 4 hole	Splined shaft 21x24	GU/GN (2) ⁶⁾	●	●	●	●							K55
ISO 160, 4 hole	Splined shaft 30x34	GU/GN (3) ⁶⁾	-	●	●	●							K56
ISO 125, 4 hole	Keyed shaft Ø 25	R4 ⁷⁾	●	●	●	●							K57
Valves													
Without valve block													0
SDVB valve block built-on													9
Filtration													
Without filter													N
Sandwich plate filter for HS control													Z

Variable pump A4VSH, series 1

Fluid

Mineral oil or Fire Resistant Fluids

For extensive information on the selection of fluids and for application conditions, please consult our data sheet RE 90220 (mineral oils) or RE 90223 (fire resistant fluids). When operating on HF fluids, reduced operating conditions apply. Please follow RE 90220, or refer to our technical department.

Operating viscosity range

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

$$v_{opt.} = \text{Operating Viscosity } 16...36 \text{ mm}^2/\text{s}$$

referred to the loop and tank temperature (semi-closed circuit).

Viscosity limits

The limiting values for viscosity are as follows:

$$v_{min} = 10 \text{ mm}^2/\text{s}$$

short term at a maximum permissible drain temperature of 90° C.

$$v_{max} = 1000 \text{ mm}^2/\text{s}$$

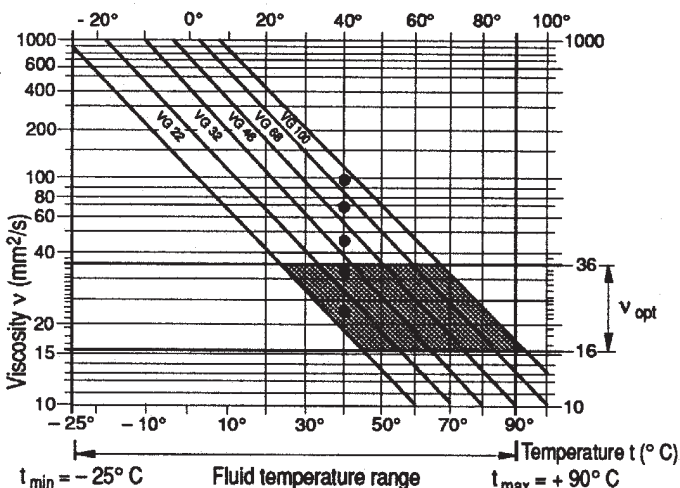
short term on cold start

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 circuit and in the tank (semi-closed loop) 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 the selection diagram). We recommend that the highest possible viscosity range should be chosen in each case.

Selection diagram



Example: At an ambient temperature of X° C, the operating temperature is 60° C. Within the operating viscosity range ($v_{opt.}$ 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 circuit temperature. However, at no point in the circuit may the temperature exceed 90° C.

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

Filtration of fluid

In order to ensure correct functioning of the unit, a minimum level of cleanliness to NAS 1638, class 9 or class 6 to SAE, ASTM or AIA is required.

This is achievable (for example) with a filter element ...D020... (see RE 31278).

This gives a filter quotient of:

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

Temperature range (see selection diagram)

$$t_{min} = -25^\circ \text{ C}$$

$$t_{max} = +90^\circ \text{ C}$$

Determination of displacement

Output flow $Q = \frac{V_g \cdot n \cdot \eta_v}{1000}$ (L/min)

Torque $M = \frac{1,59 \cdot V_g \cdot \Delta p}{100 \cdot \eta_{mh}}$ (Nm)

Power $P = \frac{2\pi \cdot M \cdot n}{60000} = \frac{M \cdot n}{9549} = \frac{Q \cdot \Delta p}{600 \cdot \eta_t}$ (kW)

- V_g = Displacement (cm³) per revolution
- Δp = Differential pressure (bar)
- n = Speed (rpm)
- η_v = Volumetric efficiency
- η_{mh} = Mechanical-hydraulic efficiency
- η_t = Overall efficiency ($\eta_t = \eta_v \cdot \eta_{mh}$)

Variable pump A4VSH, series 1

Technical Data

(Valid for operation of mineral oil, for water based fluids, see RE 90223)

Operating pressure at outlet

Pressure at ports A or B

Nominal pressure p_N _____ 350 bar

Peak pressure p_{max} _____ 400 bar

(Pressure data to DIN 24312)

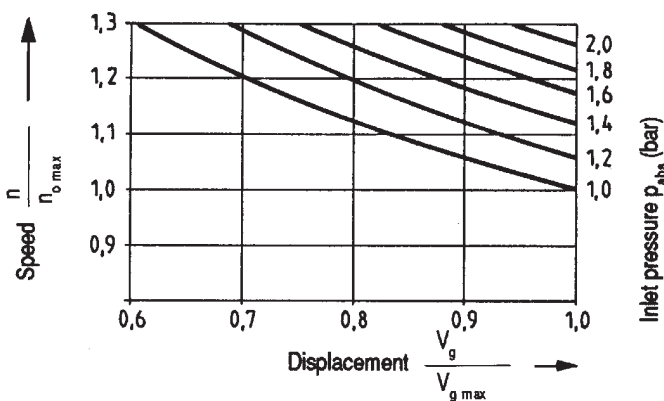
Operating pressure at inlet

Pressure at the anti-cavitation ports S_A and S_B

$p_{abs\ min}$ _____ 1 bar abs.

$p_{abs\ max}$ _____ 16 bar abs.

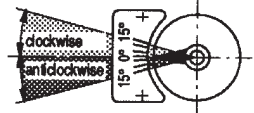
Permissible speed increase with a reduction in displacement / the determination of the inlet pressure p_{abs} at the suction ports S_A and S_B .



Direction of flow

Swivel angle range 1) or Pilot pressure /or sol. op.	Direction of rotation clockwise	a/clockwise
clockwise/in X_1/b	B (S_B) to A	A (S_A) to B
a/clockwise/in X_2/a	A (S_A) to B	B (S_B) to A

1) as shown on swivel angle indicator



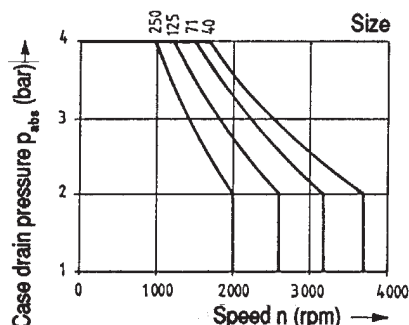
Case drain pressure

Maximum pressure of the leakage fluid

p_{max} _____ 6 bar abs.

This maximum pressure is also dependent upon speed and the seal material.

With "Perbunan" shaft seal



Viton and EPDM shaft seals

Compared with motors equipped with Perbunan seals, in motors equipped with Viton or EPDM seals the case drain pressure can be raised by 50 % at the same drive speed.

These values are guide values.

Under certain operating conditions, it may be necessary to reduce these values.

Note:

Max. permissible speed n_{max} . (Absolute speed limit).

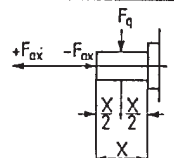
Theoretical values, not considering η_{mh} and η_v ; values rounded

Size				40	71	125	250
Displacement	$V_{g\ max}$	cm ³		40	71	125	250
Max. speed ¹⁾	n_{max}	rpm		2000	1650	1500	1200
Max. permissible speed (absolute speed limit ²⁾ by increasing the inlet pressure p_{abs} or $V_g < V_{g\ max}$	$n_{max\ adm.}$	rpm		2400	2000	1800	1500
Max. flow	at n_{max}	Q_{max}	L/min	80	117	188	300
	at $n_E = 1450$ rpm		L/min	58	103	181	254
Max. power ($\Delta p = 350$ bar)	at n_{max}	P_{max}	kW	47	68	109	175
	at $n_E = 1450$ rpm		kW	34	60	106	148
Max. torque ($\Delta p = 350$ bar)	at $V_{g\ max}$	M_{max}	Nm	223	395	696	1391
Specific torque ($\Delta p = 100$ bar)	at $V_{g\ max}$	M	Nm	64	113	199	398
moment of inertia about drive axis		J	kgm ²	0,0049	0,0121	0,03	0,0959
Volume to fill case		l		2	2,5	5	10
Approx. weight (pump with pressure control)		m	kg	45	59	100	202
Permissible axial force at a housing pressure of p_{max} 1 bar abs.		$\pm F_{ax\ max}$	N	1000	1400	1900	3000
Permissible axial force at a housing pressure of p_{max} 4 bar abs.		$+ F_{ax\ max}$	N	620	810	1050	1850
		$- F_{ax\ max}$	N	1300	1900	2750	4150
Permissible radial force		$F_{rad\ max}$	N	1200	1700	2500	4000

1) These values apply for an absolute pressure of 1 bar at suction ports S_A/S_B .

2) By increasing the inlet pressure ($p_{abs} > 1$ bar) or reducing the displacement, the speed can be increased to the "max. permissible speed (absolute speed limit)" (see diagram).

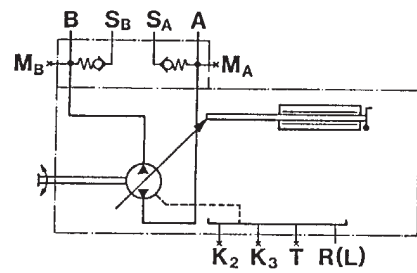
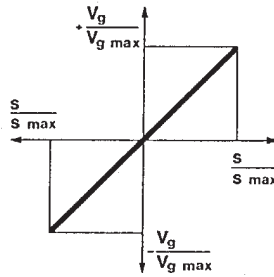
Application of forces



Overview of Control Devices (for extensive information see RE 92100)

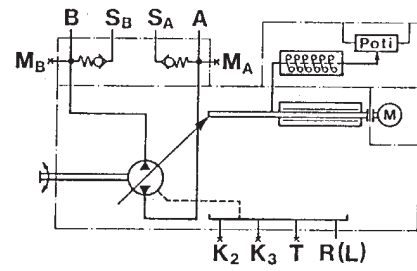
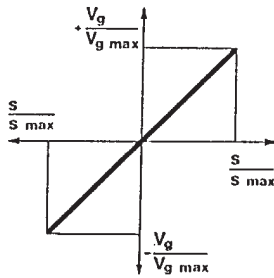
Manual control MA

Stepless adjustment of the output flow by means of a hand wheel.



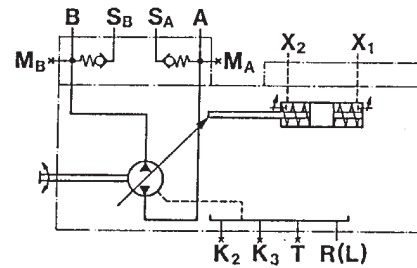
Electric motor control EM

Stepless adjustment of the output flow by means of an electric motor. Any intermediate position on the control may be selected by means of a programmed control in conjunction with built-on limit switches or a potentiometer.



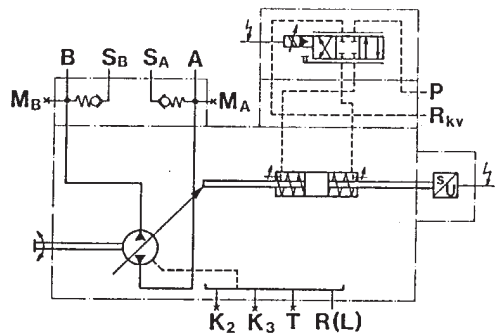
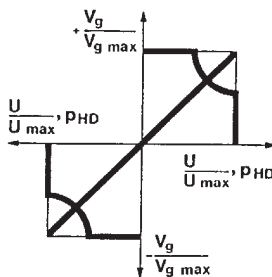
Hydraulic control, flow dependent, HM1/2

(max. positioning pressure 100 or 350 bar)
The displacement of the pump is steplessly adjustable dependent upon the flow of fluid to ports X₁ and X₂.
Applications: - Stepped two position control
- As the basis of a servo or proportional control



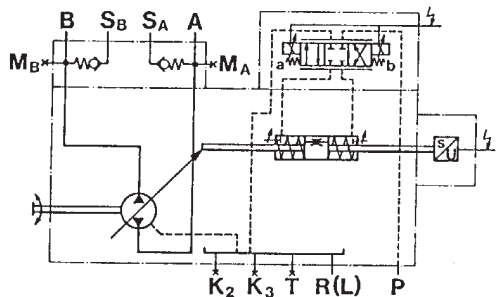
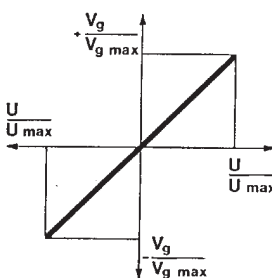
Hydraulic control with servo valve HS, HSP

The displacement of the pump is steplessly adjustable via a servo valve with feedback of the swivel angle under electronic control. Model HSP also offers electronic feedback of pressure and power.



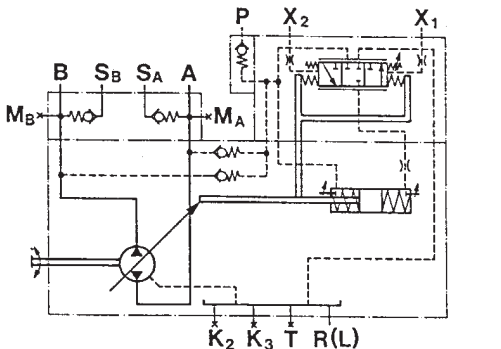
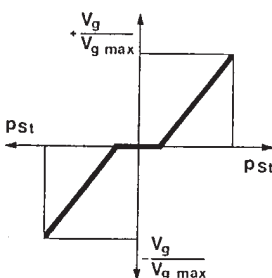
Hydraulic control with proportional valve EO1

The displacement of the pump is steplessly adjustable via a proportional valve with feedback of the swivel angle under electronic control.



Hydraulic control, pressure dependent HD

The displacement of the pump is steplessly adjustable dependent upon the pilot pressure. The swivel angle is proportional to the pilot pressure applied.



Installation position

Optional. The motor housing must be filled with fluid prior to commissioning, and must remain full whenever it is operating. In order to reduce noise levels, all connecting lines (suction pressure and drain lines) must be de-coupled by means of flexible elements.

A non return valve in the drain line should be avoided.

Warning:

A minimum pressure of 1 bar absolute must be maintained in the suction port or the pump (S_A and S_B).

1. Vertical installation

(shaft end uppermost)

1.1 Installation in the tank

The minimum fluid level must be level with or above the pump mounting flange. Ports "R/L", "T", "S_A" and "S_B" must remain open (see fig.1).

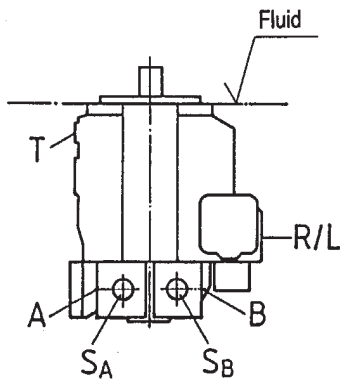


Fig. 1

2. Horizontal installation

The highest of ports "T", "K₂", "K₃" or "R/L" is to be used as to fill the pump and also as the case drain port.

2.1 Installation in the tank

The minimum fluid level must be level with or above the top of the pump. Ports "S_A" and "S_B" must remain open (see fig.2).

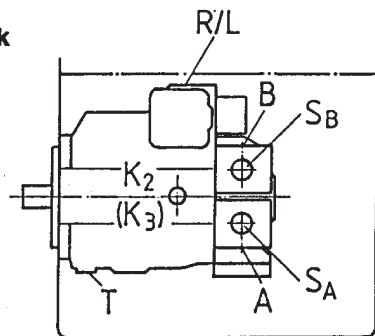


Fig. 2

2.2 Installation under the tank

Pipe the case drain and ports "S_A" and "S_B" as shown in figure 3.

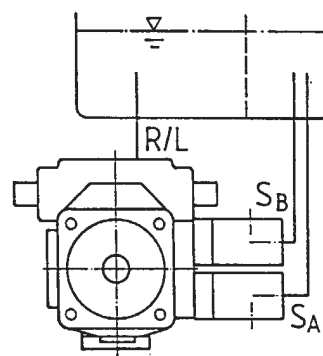
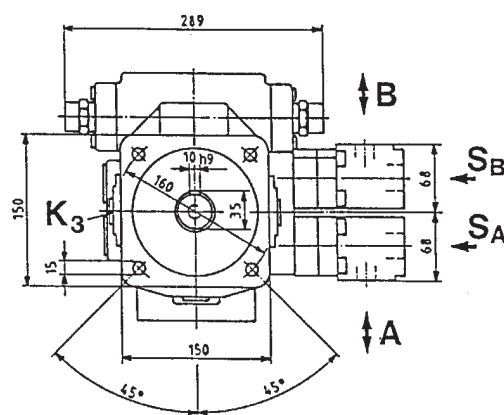
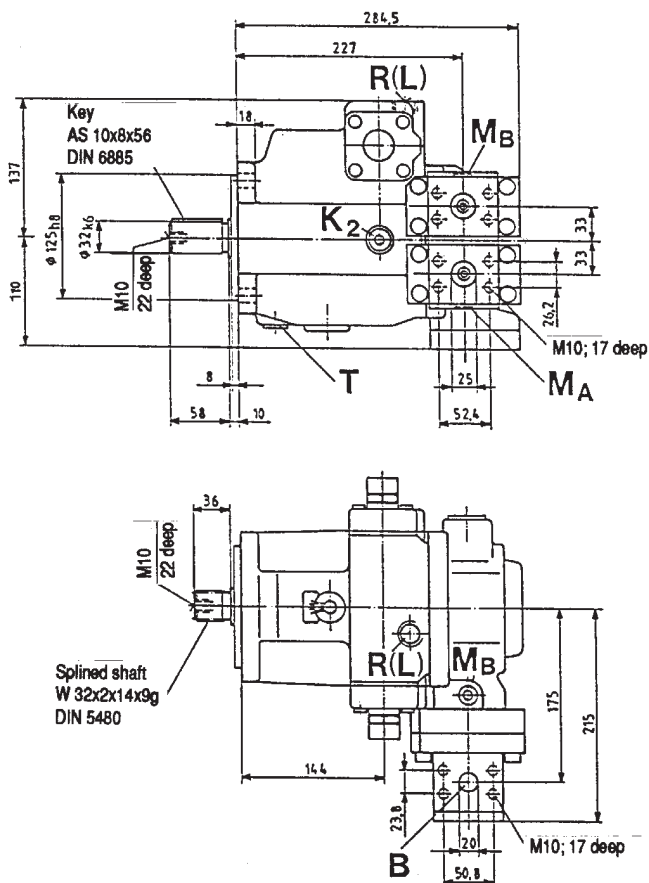


Fig. 3

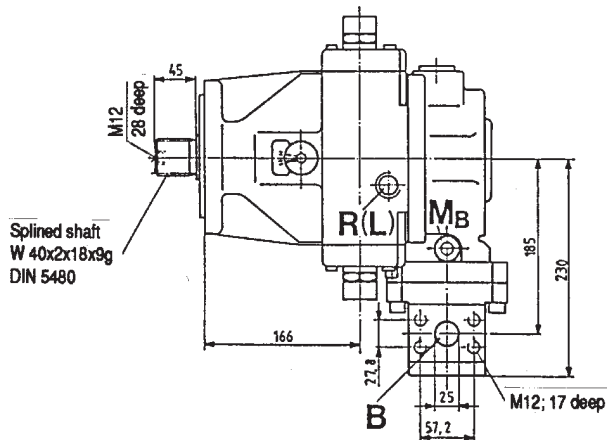
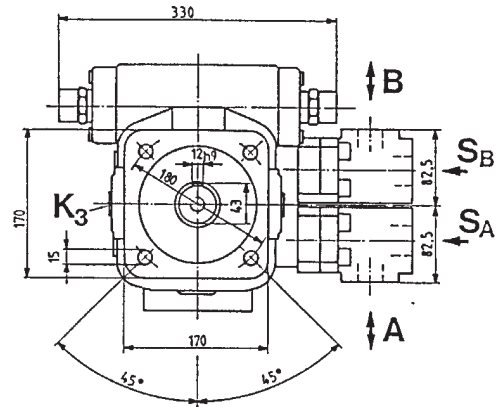
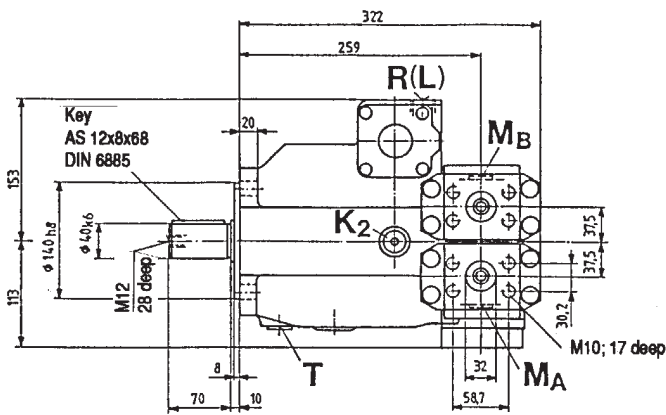
Unit dimensions, size 40 (not including the control)



Connections

- A, B High pressure ports 3/4" SAE (H.P. series)
- S_A, S_B Anti-cavitation port 1" SAE (Standard pressure series)
- M_A, M_B Pressure gauge ports M14x1,5 (plugged)
- T Case drain M22x1,5 (plugged)
- R(L) Case bleed or filling point (case drain) M22x1,5
- K₂, K₃ Case flushing port (plugged) M22x1,5

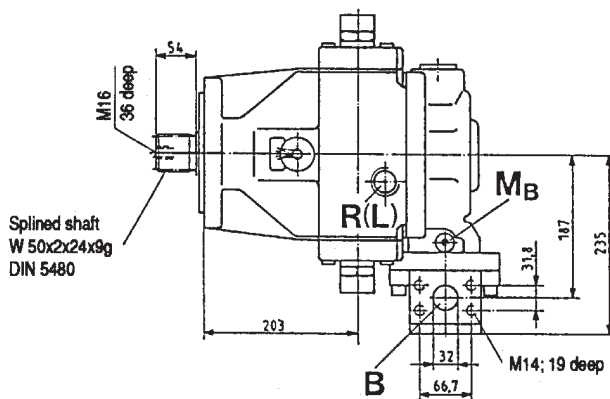
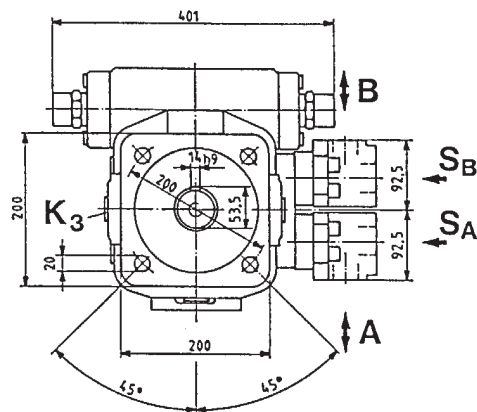
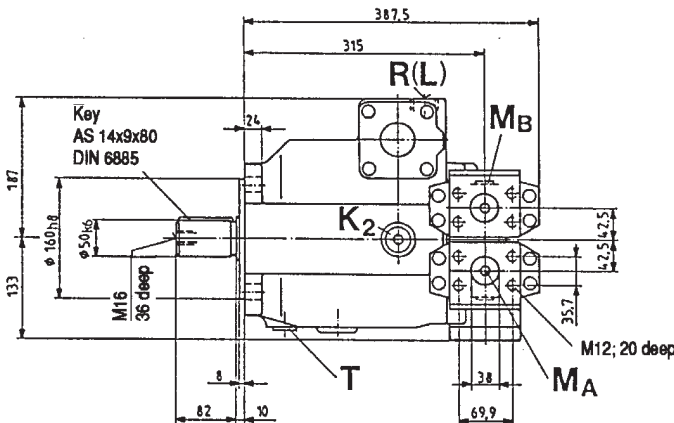
Unit dimensions, size 71 (not including the control)



Connections

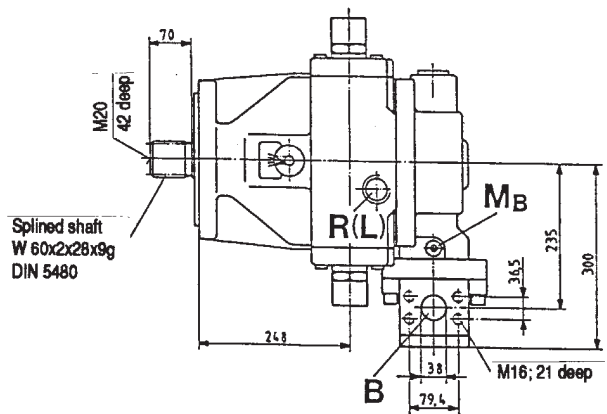
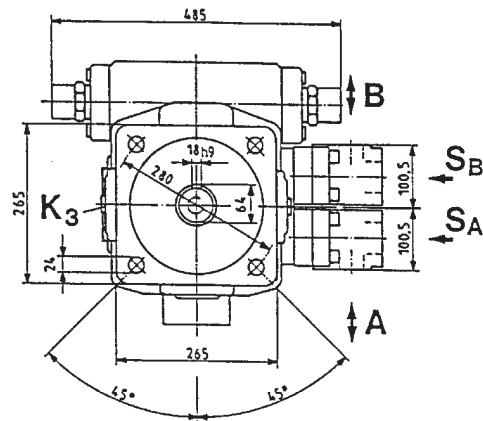
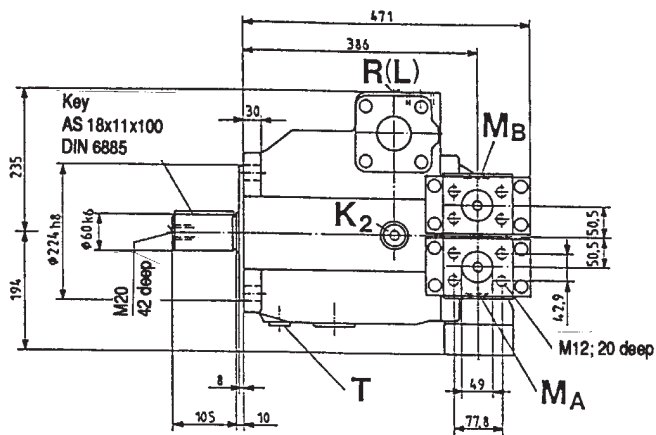
- A, B High pressure ports 1" SAE (H.P. series)
- S_A, S_B Anti-cavitation port 1 1/4" SAE (Standard pressure series)
- M_A, M_B Pressure gauge ports M14x1,5 (plugged)
- T Case drain M27x2 (plugged)
- R(L) Case bleed or filling point (case drain) M27x2
- K₂, K₃ Case flushing port (plugged) M27x2

Unit dimensions, size 125 (not including the control)



Connections

- A, B High pressure ports 1 1/4" SAE (H.P. series)
- S_A, S_B Anti-cavitation port 1 1/2" SAE (Standard pressure series)
- M_A, M_B Pressure gauge ports M14x1,5 (plugged)
- T Case drain M33x2 (plugged)
- R(L) Case bleed or filling point (case drain) M33x2
- K₂, K₃ Case flushing port (plugged) M33x2

Unit dimensions, size 250 (not including the control)**Connections**

- A, B High pressure ports 1 1/2" SAE (H.P. series)
- S_A, S_B Anti-cavitation port 2" SAE
(Standard pressure series)
- M_A, M_B Pressure gauge ports M14x1,5 (plugged)
- T Case drain M42x2 (plugged)
- R(L) Case bleed or filling point (case drain) M42x2
- K₂, K₃ Case flushing port (plugged) M42x2

Unit dimensions and other details of the controls, the inductive positional transducer, through drives and accessories appear in RE 92100.

Variable pump A4VSH, series 1

Valve Block SDVB 16 (for sizes 40...125)

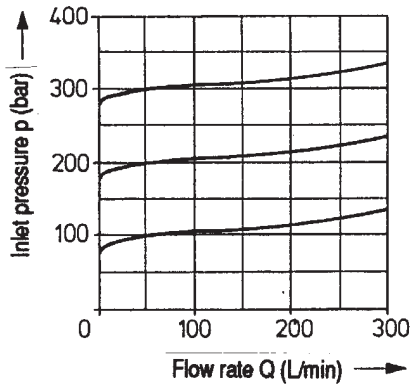
This is a high pressure cross line relief unit. It contains two pilot operated high pressure relief valves, size 16.

Setting range is 25 – 350 bar.

Operating curves

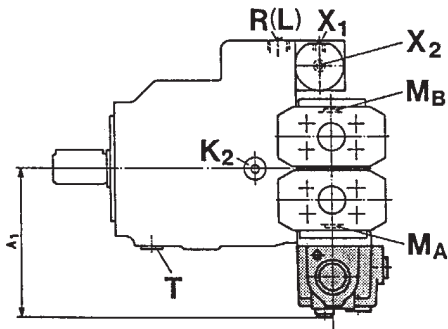
The operating curves were measured at $v = 36 \text{ mm}^2/\text{s}$, $t = 50^\circ \text{C}$ and with an external return line pipe at zero pressure back to tank. With an internal tank return, any back pressure adds to the inlet pressure.

Operating pressure $p = f(Q)$

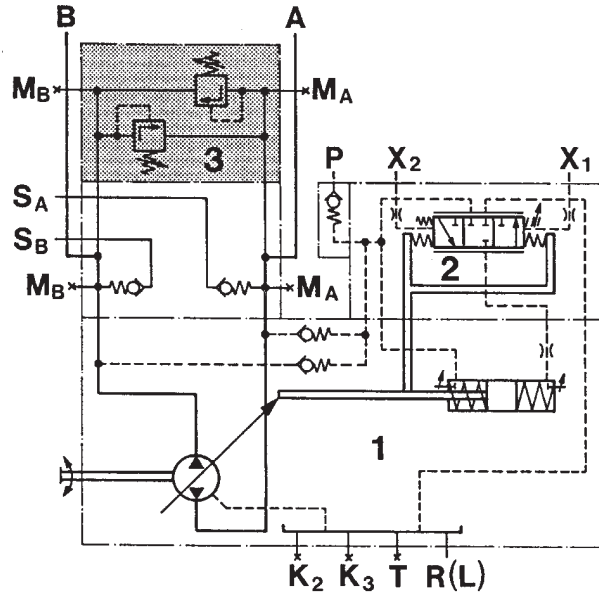


Weight: 5,5 kg

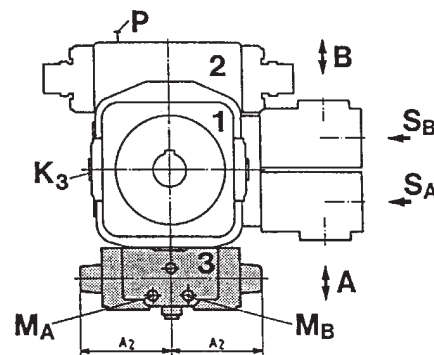
Unit dimensions



Circuit diagram (sample with HD control)



- 1 A4VSH with anti-cavitation valves
- 2 HD control
- 3 Valve block SDVB 16



Connections

- A, B High pressure ports
- SA, SB Anti-cavitation ports (Standard pressure series)
- MA, MB Pressure gauge ports M14x1,5 (plugged)
- T Case drain (plugged)
- R(L) Case bleed or filling point (case drain)
- K2, K3 Case flushing port (plugged)
- X1, X2 Pilot pressure port (HD control) M14x1,5

Size	Ports				
	A ₁	A ₂	A, B	SA, SB	T, R(L), K ₂ , K ₃
40	182	107	3/4"	1"	M22x1,5
71	176	107	1"	1 1/4"	M27x2
125	196	107	1 1/4"	1 1/2"	M33x2
250	320	107	1 1/2"	2"	M42x2

Valve block SDVB 30 (for size 250)

see RE 95533 – Control type 1, without flushing valve (model 2.1)