RE 92 012/04.00

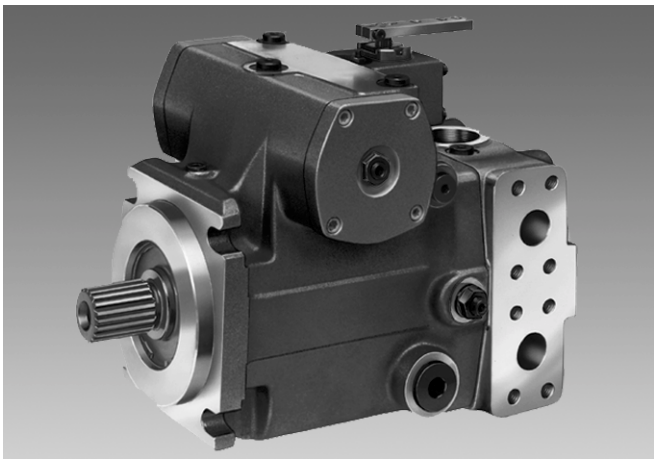
replaces: 11.94

engineering
mannesmann
Rexroth

Variable Displacement Pump A4VTG

for drum drives on mobile concrete mixers
for closed circuits

Sizes 56...90
Series 3
Nominal pressure 400 bar
Peak pressure 450 bar



A4VTG...HW

Index

Features

- variable displacement 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 swivel angle from 0 to its maximum value
- swivelling the pump over centre smoothly changes the direction of flow
- the pump is equipped with two pressure relief valves on the high pressure ports to protect the hydrostatic transmission (pump and motor) from overloads
- these valves also function as boost inlet valves
- an integral auxiliary pump serves as boost and pilot oil pump
- the maximum boost pressure is limited by a built-in boost pressure relief valve

Brueninghaus
Hydromatik

Ordering Code

Hydraulic fluid

Mineral oil (no code)	

Axial piston unit

Variable swashplate design, for drum drives on mobile concrete mixers	**A4VT**

Operation

Pump in closed circuits	**G**

Size

≙ Displacement $V_{g\,max}$ in cm³	**56**	**71**	**90**

Control device

		56	71	90	
Hydraulic control, mechanical servo		○	●	●	**HW**
Electrical control with proportional solenoid	12V	○	●	●	**EP1**
	24V	○	●	●	**EP2**

Mechanical stroke limiter

without mechanical stroke limiter (no code)	
with mechanical stroke limiter	**M**

Ports X_3, X_4 for positioning pressure

without ports X_3, X_4 (no code)	
with ports X_3, X_4	**T**

Series

	3

Index

	2

Direction of rotation

viewed on shaft end	clockwise	**R**
	anti-clockwise	**L**

Seals

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

Shaft end

Splined shaft SAE	without coupling flange	**S**
	with coupling flange	**L**

Mounting flange

	56	71	90	
SAE C, 2-hole	○	–	–	**C**
SAE C, 4-hole	–	●	●	**D**

Service line connections

Ports A/B SAE, (metric fixing screws) at side (same side)	**10**

● = available
○ = in preparation
– = not available

A4VT	G			/	3	2		–	N			10			S	

Axial piston unit
Operation
Size
Control device
Series
Index
Direction of rotation
Seals
Shaft end
Mounting flange
Service line connections

Auxiliary pump and through drive

auxiliary pump	through drive *flange*	*hub*		
●	–	–		**F00**
●	SAE A. 2-Loch	SAE A	(N $^{5}/_{8}$"-9T 16/32DP)	**F01**
●	SAE B, 2-Loch	SAE B	(N $^{7}/_{8}$"-13T 16/32DP)	**F02**

Valves	**56**	**71**	**90**	
with high pressure relief valve, pilot controlled; with bypass	–	●	●	**1**
with high pressure relief valve, direct controlled; with bypass	○	–	–	**5**

Filtration

Filtration in the suction line of the auxiliary (boost) pump	**S**

Speed sensor

without speed sensor (no code)	
with speed sensor	**G**

Technical Data

Fluid

To review the application of A4VTG 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).

The variable pump A4VTG is not suitable for operation with HFA, HFB and HFC. When using HFD or environmentally acceptable hydraulic fluids 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).

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:

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

referred to the circuit temperature (closed circuit).

Viscosity limits

The limiting values for viscosity are as follows:

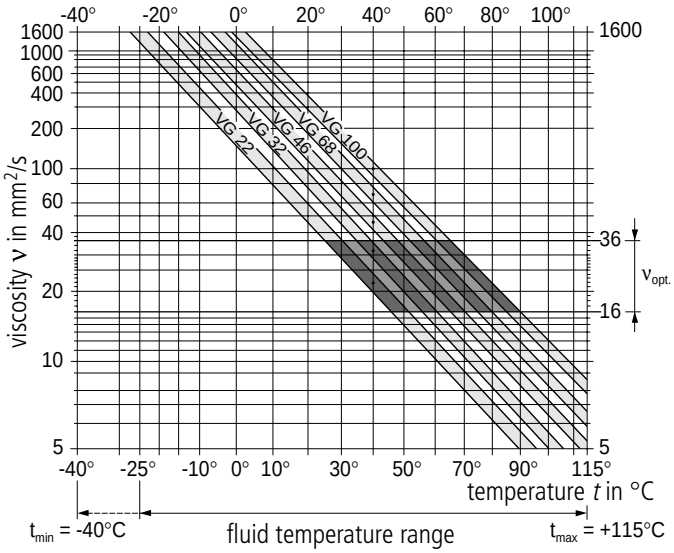
ν_{min} = 5 mm²/s
short term at a max. permissible temp. of t_{max} = 115°C.

Please note that the max. fluid temperature is also not exceeded in certain areas (for instance bearing area).

ν_{max} = 1600 mm²/s
short term on cold start (($n \leq 1000$ rpm, t_{min} = -40°C).

At temperatures of -25°C up to -40°C special measures are required. Please contact us for further information.

Selection diagram



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 (closed 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 circuit 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 circuit temperature. However, at no point in the circuit may the temperature exceed 115°C.

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

Temperature range of the radial shaft seal

The FKM shaft seal is admissible for a housing temperature range from -25°C to +115°C.

Note:
For applications below -25°C a NBR shaft seal is necessary (admissible temperature range -40°C to +90°C).
When ordering, please state in clear text: with NBR shaft seal

Working pressure range - inlet

Auxiliary pump:
suction pressure $p_{s\,min}$ ($\nu \leq 30$ mm²/s) _____ ≥ 0,8 bar absolute
for cold start _____ ≥ 0,5 bar absolute

Working pressure range - outlet

Variable pump:
Pressure at port A or B
nominal pressure p_N _____ 400 bar
peak pressure p_{max} _____ 450 bar
Auxiliary pump:
peak pressure $p_{H\,max}$ _____ 40 bar
(pressure data to DIN 24312)

Case drain pressure

Permissible case drain pressure at ports T_1 and T_2
p_L _____ 4 bar abs.
short term (at start) _____ 6 bar abs.

Technical Data

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

Size					71	90
Displacement	variable pump		$V_{g\,max}$	cm^3	71	90
	auxiliary pump (at p = 20 bar)		$V_{g\,H}$	cm^3	19,6	28,3
Speed	max. speed with $V_{g\,max}$		$n_{max\ contin.}$	rpm	3300	3050
	minimum speed		n_{min}	rpm	500	500
Flow	at $n_{max\ contin.}$ and $V_{g\,max}$		$q_{v\,max}$	L/min	234	275
Power	at $n_{max\ contin.}$	Δp = 400 bar	P_{max}	kW	156	183
Torque	at $V_{g\,max}$	Δp = 400 bar	T_{max}	Nm	451	572
(variable pump without aux. pump)		Δp = 100 bar	T	Nm	112,8	143
Moment of inertia (about drive axis)			J	kgm^2	0,0072	0,0106
Weight (standard model without through drive) approx.			m	kg	46	48

Pressure Relief Valve

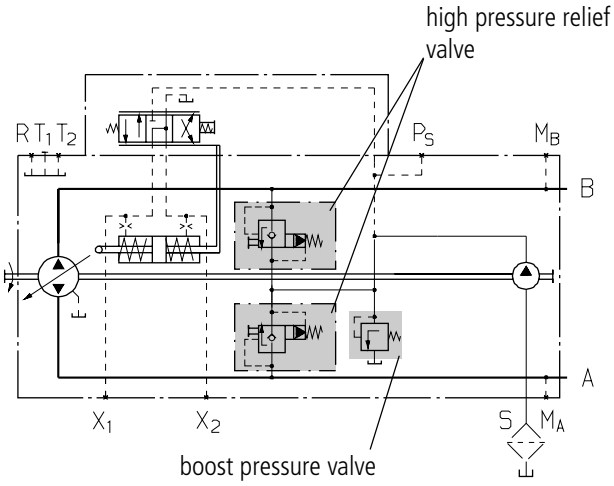
The two high pressure relief valves are protecting the hydrostatic transmission (pump and motor) against overcharge. They are limiting the max. pressure of the respective high pressure line and are serving at the same time for boost valves.

The boost pressure is set via boost pressure valve.

Standard setups:

- boost pressure valve: p_{SP} _____ 22 bar
- high pressure valve: p_{max} _____ 420 bar

Note: The valve setups are carried out at n = 1000 rpm and $V_{g\,max}$. At other operating parameters differences in the opening pressures may occur.



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) at least cleanliness level

8 to NAS 1638

17/14 to ISO/DIS 4406 necessary.

If above mentioned grades cannot be maintained please consult supplier.

Standard: Filtration in the suction line of the auxiliary pump, S

Filter type: _____ filter **without** bypass

Recommendation: _____ **with** contamination indicator

Through flow resistance at filter element:

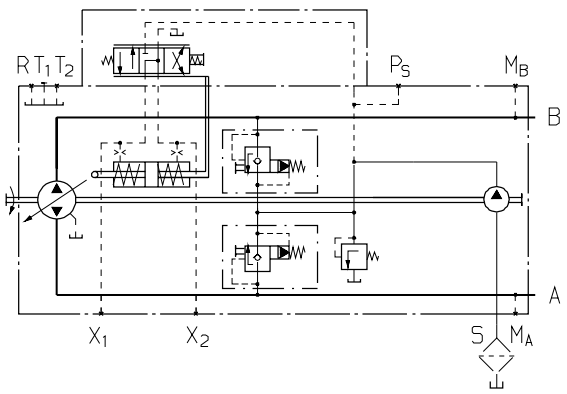
at ν = 30 mm^2/s, n = n_{max} _____ $\Delta p \leq 0{,}1$ bar

at ν = 1000 mm^2/s, n = n_{max} _____ $\Delta p \leq 0{,}3$ bar

Pressure at port S of the auxiliary pump:

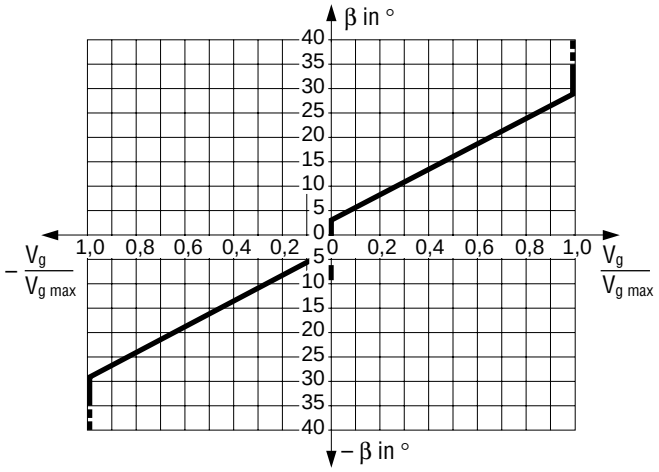
at ν = 30 mm^2/s _____ $p \geq 0{,}8$ bar

at cold start (ν = 1600 mm^2/s, n ≤ 1000 rpm) _____ $p \geq 0{,}5$ bar



HW Hydraulic Control, Mechanical Servo

The positioning cylinder of the pump and therefore the swivel angle is varied in proportion to the movement of the control lever. The pump control is steplessly variable. Each direction of flow is assigned to one direction of lever movement.



Swivel angle of control lever:

- from 0 to ± $V_{g\,max}$ ____ β = 0° to ± 29°
- mech. stop: ____ ± 40°

Torque at control lever

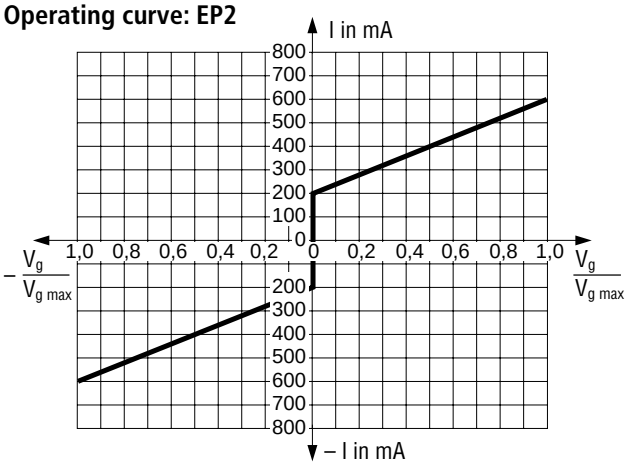
- necessary torque for displacement ____ approx. 85 to 210 Ncm
- max. torque ____ 700 Ncm (7 Nm)

Dependant from the operation conditions of the pump (operation pressure, oil temperature) changes of the curve can occur.

EP Electrical Control, with Proportional Solenoid

In relation to the preselected current, control pressure is applied to the positioning cylinder of the pump via two proportional solenoids on control device EP. The displacement of the pump is thus steplessly variable. One solenoid is assigned to each direction of flow.

Operating curve: EP2

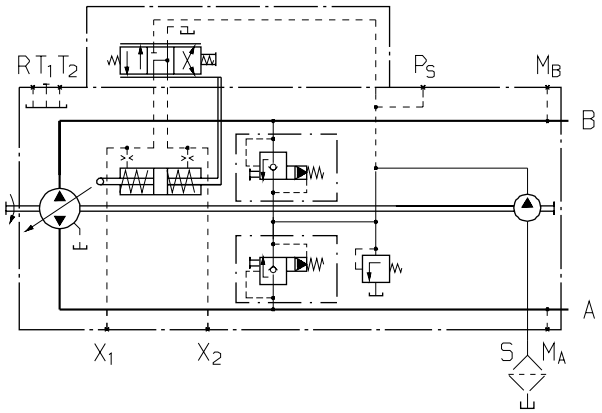


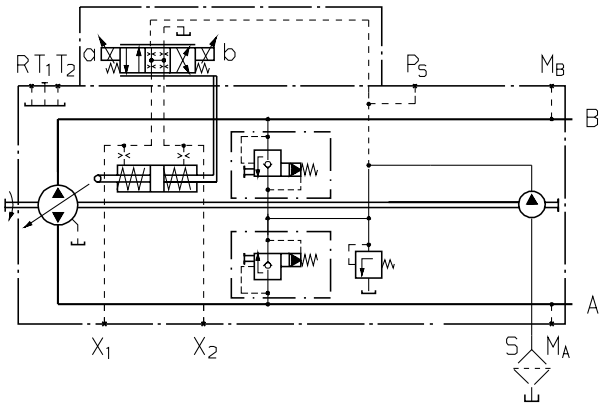
model	control voltage (DC)	control current *I* start of control – end of control at $V_{g\,0}$		at $V_{g\,max}$
EP1	12 V	400 mA	–	1200 mA
EP2	24 V	200 mA	–	600 mA

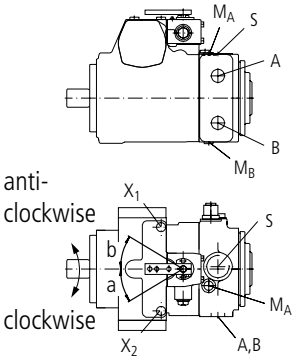
To control the proportional solenoids the following electronic amplifiers and microcontroller are available:

proportional amplifier PVR (RE 95022), chopper amplifier CV (RE 95029) and microcontroller MC with software solutions related to the field of application (RE 95050) (e.g. CSD).

Standard: proportional solenoid with manual emergency (without spring return)

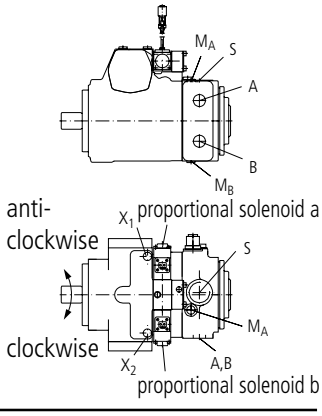






Graph Direction of rotation - Control - Direction of through flow

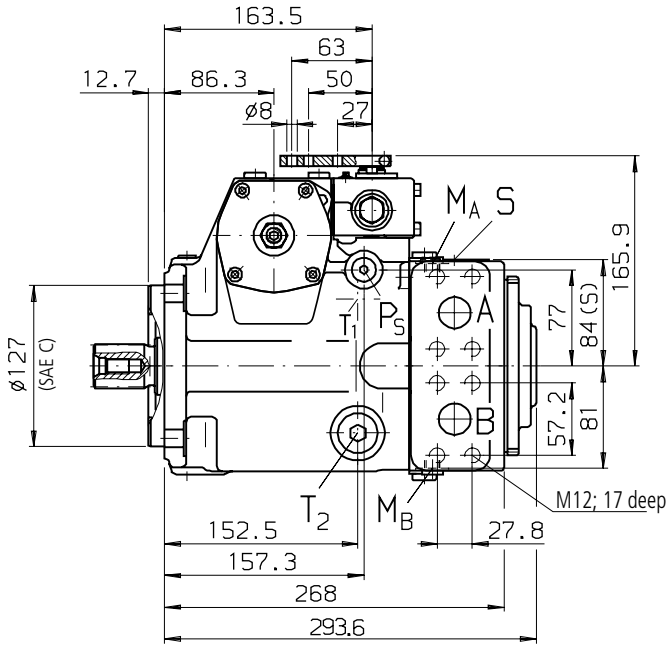
Direction of rotation	clockwise		anti-clockwise	
Lever direction (HW)	a	b	a	b
Operated solenoid (EP)	b	a	b	a
Control pressure	X_2	X_1	X_2	X_1
Direction flow	B to A	A to B	A to B	B to A
Working pressure	M_A	M_B	M_B	M_A

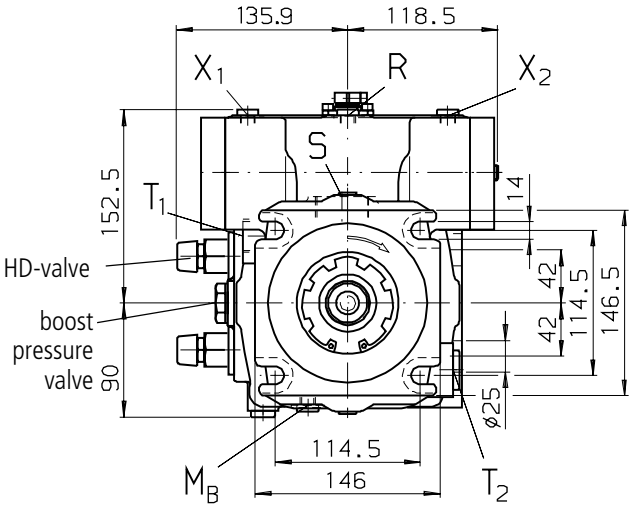


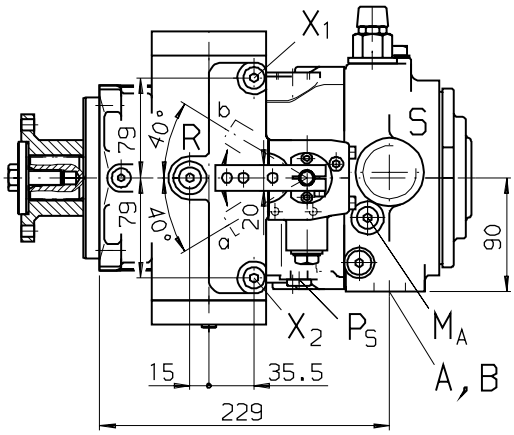
Unit Dimensions, Size 71

Prior to finalising your design, please obtain a certified drawing.

Hydraulic control, mechanical servo HW



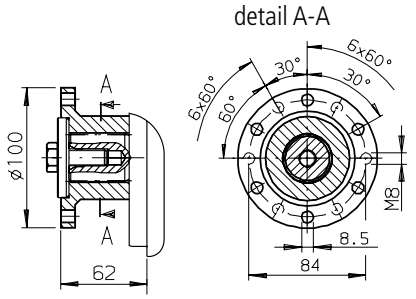




Connections

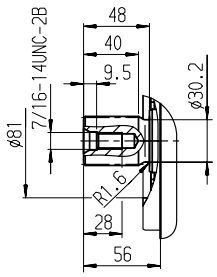
A,B	Service line ports SAE 1" 420 bar (6000 psi) (high pressure series)	
T_1	Case drain or filling port	M 26x1,5; 16 deep
T_2	Case drain	M 26x1,5; 16 deep
M_A	Pressure gauge - working pressure A	M 12x1,5; 12 deep
M_B	Pressure gauge - working pressure B	M 12x1,5; 12 deep
R	Air bleed	M 16x1,5; 12 deep
S	Boost suction port	M 42x2; 18 deep
X_1, X_2	Control pressure ports (before the orifice)	M 12x1,5; 12 deep
p_S	Control pressure supply	M 14x1,5; 12 deep

Shaft ends



L

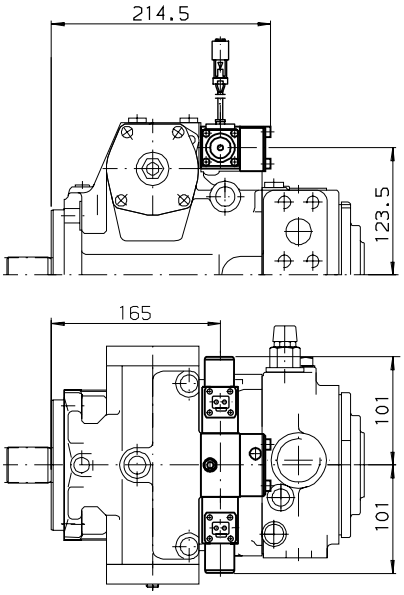
Splined shaft
SAE $1^3/_8$"
with coupling
flange



S

Splined shaft SAE $1^3/_8$"
pressure angle 30°,
21 teeth, 16/32 pitch,
flat root side fit,
tolerance class 5
ANSI B92.1a-1976

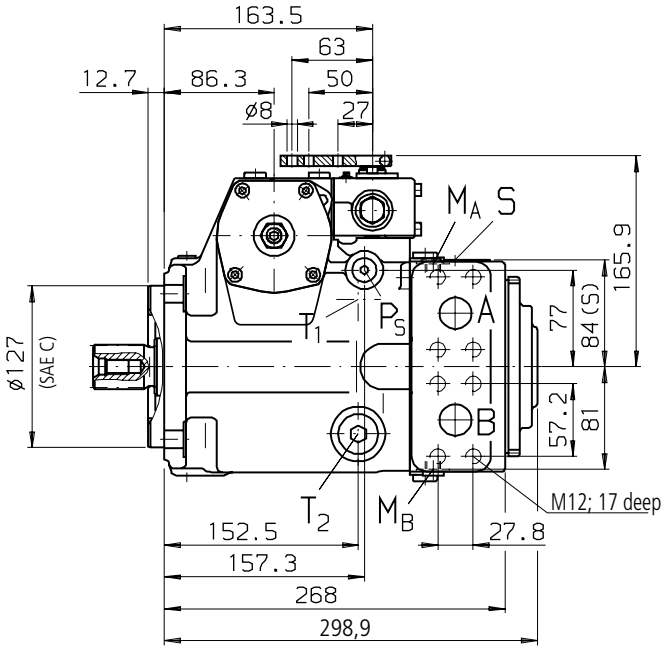
Electrical control, with proportional solenoid, EP

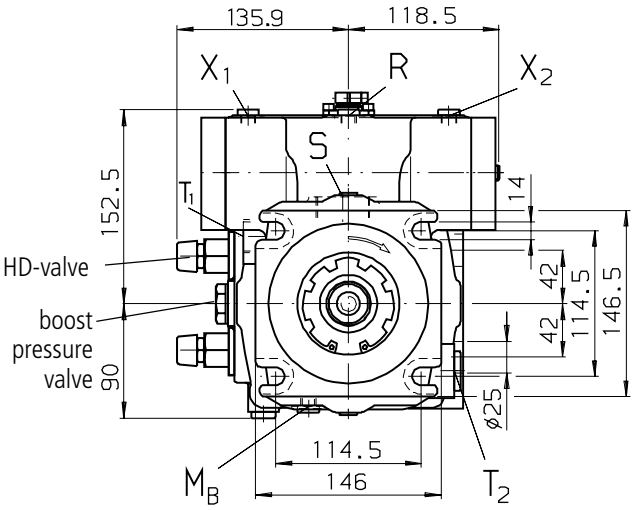


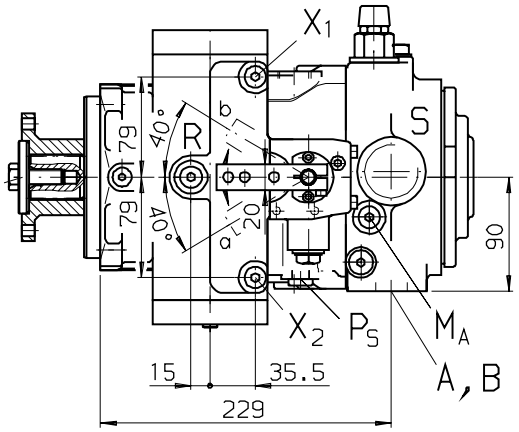
Unit Dimensions, Size 90

Prior to finalising your design, please obtain a certified drawing.

Hydraulic control, mechanical servo HW







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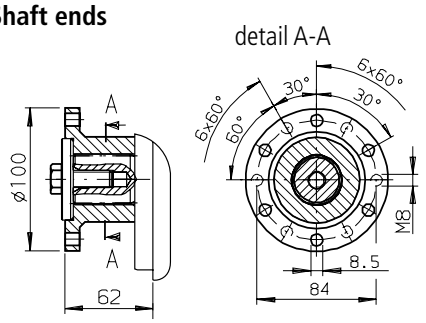
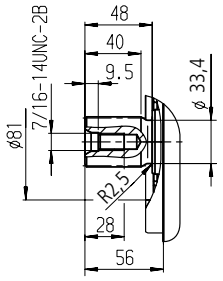
p_S	Control pressure supply	M 14x1,5; 12 deep

Shaft ends

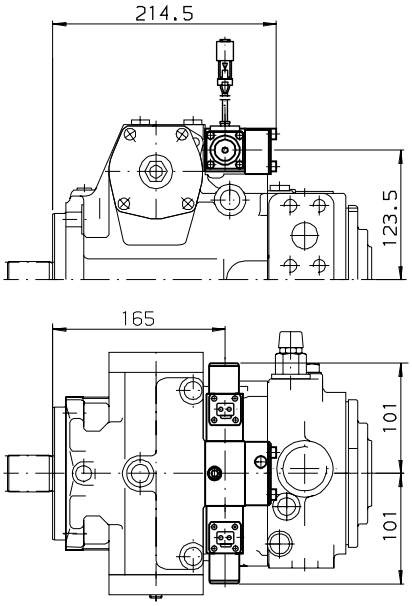


L
Splined shaft
SAE $1^1/_2$"
with coupling
flange



S
Splined shaft SAE $1^1/_2$"
pressure angle 30°,
23 teeth, 16/32 pitch,
flat root side fit,
tolerance class 5
ANSI B92.1a-1976

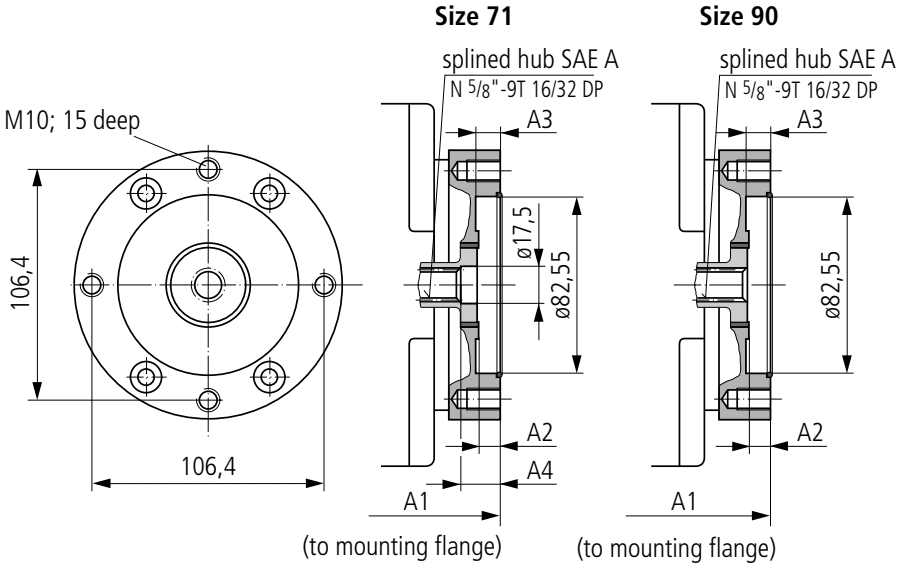
Electrical control, with proportional solenoid, EP



Dimensions for Through Drives

Prior to finalising your design, please obtain a certified drawing.

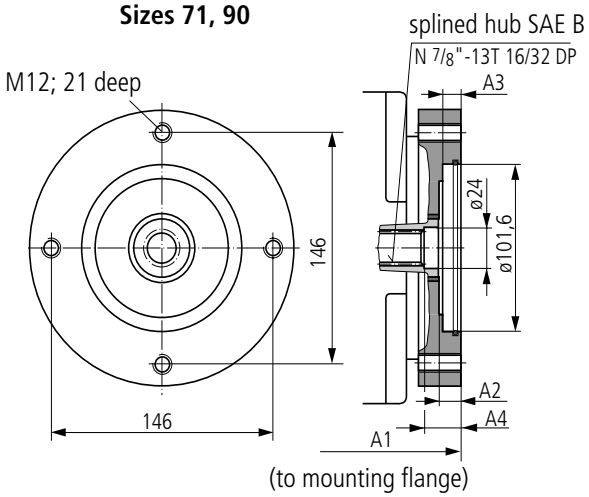
Through drive SAE A (F01)



Size	A1	A2	A3	A4
71	297,6	9	10	17
90	297,6	9	8	–

suitable for connection of:
– gear pump G2 (RE 10030)
– variable pump A10VSO10 (RE 92713)
– variable pump A10VSO18 (RE 92712)

Through drive SAE B (F02)



Size	A1	A2	A3	A4
71	300,6	12,5	9,8	15,5
90	313,6	13	9,8	19

suitable for connection of:
– gear pump G3 (RE 10039)
– gear pump G4 (RE 10042)
– variable pump A10VG18 (RE 92750)
– variable pump A10VO28 (RE 92701/ RE 92703)

Permissible Input and Through Drive Rotation Torques

Size			71	90
Corner torque (when V_{gmax} and Δp = 400 bar) [1]	T_{max}	Nm	451	572
Max. perm. through drive rotation torque	$T_{D\ perm.}$	Nm	660	822
Max. permissible input torque [2]	$T_{E\ perm.}$	Nm	970 (W 1 3/8")	1305 (W 1 1/2")

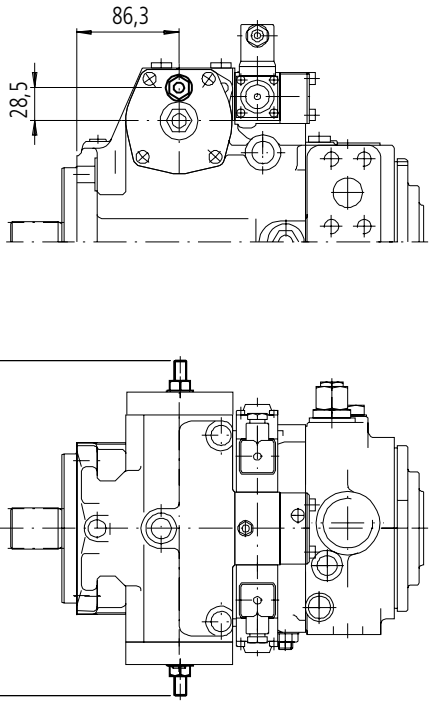
[1]) efficiency not taken into consideration
[2]) drive shaft without side load

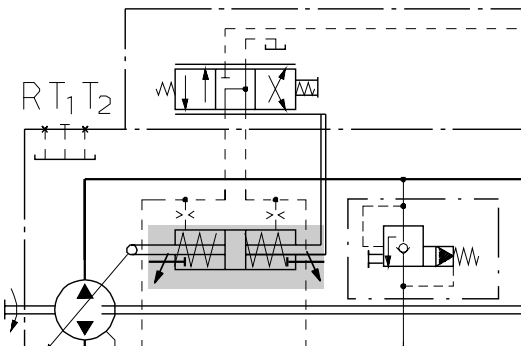
Code explanations

$T_{D\ perm.}$ = max. permissible through drive torque in Nm
$T_{E\ perm.}$ = max. permissible input torque at the drive shaft in Nm

Mechanical Stroke Limiter, M

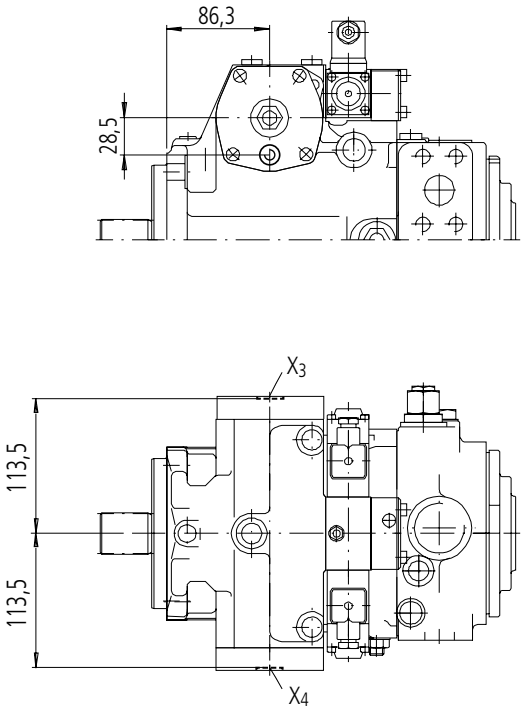
Adjustment screws to both $V_{g\,max}$ – values

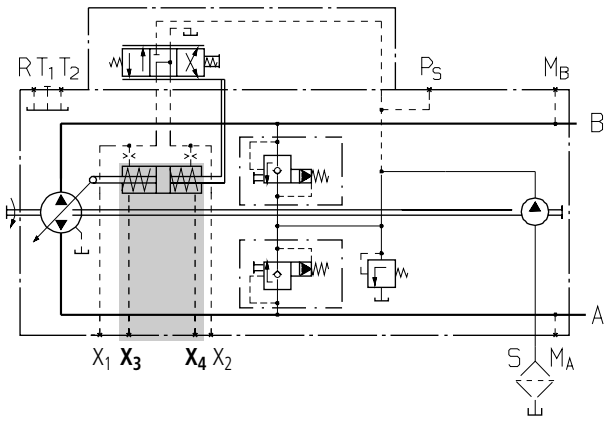




Circuit diagram A4VTG 71HWM

Ports X_3 and X_4 for Positioning Pressure, T





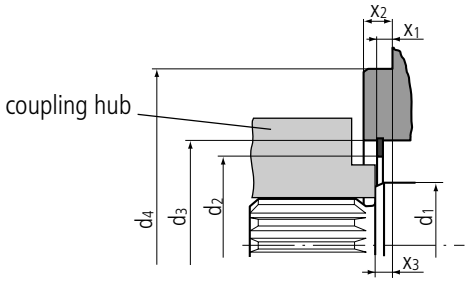
Circuit diagram A4VTG 71HWT

Installation Situation for Coupling Assembly

In order to assure that rotating parts (coupling hub) and fixed parts (housing, circlip) do not contact each other the installation situations are described in this leaflet have to be observed.

At design "shaft end L" (SAE splined shaft with mounted coupling flange) Brueninghaus Hydromatik already considered this fact.

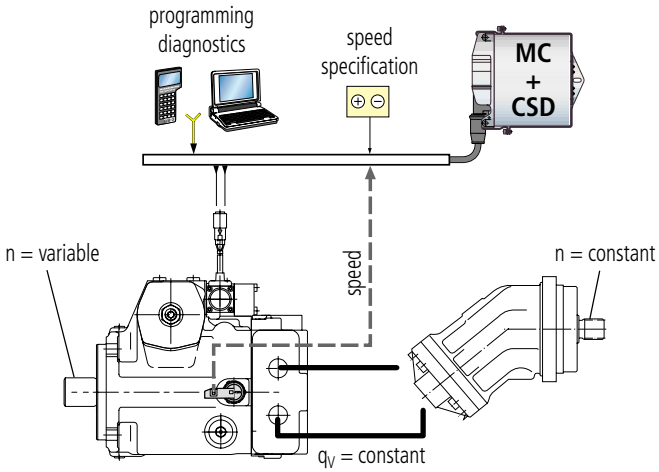
At design "shaft end S" (SAE splined shaft) it has to be considered when selecting the coupling, that the external diameter of the coupling hub in the area of the shaft collar (size $x_2 - x_3$) has to be smaller than the internal diameter of the circlip d_2.



Size	ød$_1$	ød$_{2\,min}$	ød$_3$	ød$_4$	x$_1$	x$_2$	x$_3$
71	45	66,5	$81_{\pm 0,1}$	127	$7,0^{+0,2}$	$12,7_{-0,5}$	$8\,^{+0,9}_{-0,6}$
90	45	66,5	$81_{\pm 0,1}$	127	$7,0^{+0,2}$	$12,7_{-0,5}$	

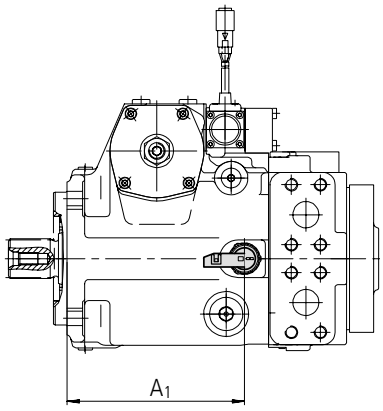
Speed Sensor, G

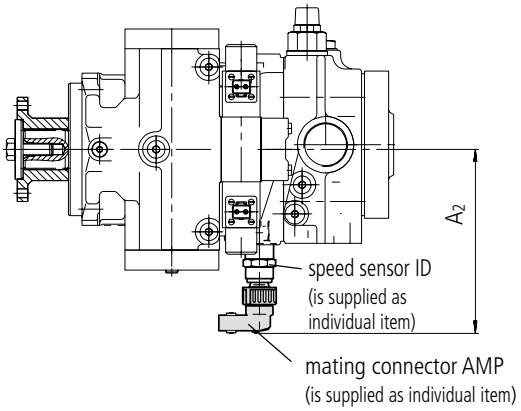
The design "with speed sensor G" is facilitating at electronically piloted drives a speed record of the variable pump A4VTG. In connection with a microcontroller MC (RE 95050) and software CSD an alternating input speed of the pump can thus be picked up and the constant flow q_V is resulting. Consequently a constant output speed (mixer drum speed) is generated at the output shaft of the so driven hydromotor.



The design "with speed sensor G" is including a gears spline at the rotary group of the variable pump and an additional port for the speed record, in which an inductive speed sensor type IDR 18/20-L250 (as to RE 95130) is screwed in.

Note: The sensor inclusively necessary mating connector (mating connector for IDR elbow) is supplied as individual item and has to be screwed into the provided port before start-up. To avoid measurment errors, the max. tightening torque of 50 Nm should not be exceeded.





Size	71	90
No. of teath	46	50
A_1	176	176
A_2	170	170

Installation and Commissioning Guidelines

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 leakage oil in the housing has to be discharged to the tank via highest positioned case drain port. The min. suction pressure at port S should not fall below 0,8 bar absolute (cold start 0,5 bar absolute).

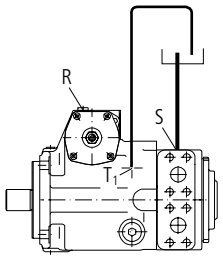
Installation position

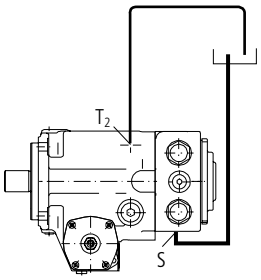
Shaft horizontal, further installation positions as to agreement.

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 (Verification: oil is leaking out without bubbles at port p_S, discharge oil via gauge pipe into reservoir).
- ➔ Bleed pump at installation position "control device on top" via port R.
- ➔ Bleed closed loop:
  - variable motor A6VM: via port G
  - fixed motor A2FM: via operating port A, B
  - motor with flushing valve: bleeding not necessary
- ➔ Minimal depth of immersion of the suction resp. case drain line in the tank: 200 mm (corresponding to the min. oil level in the tank)

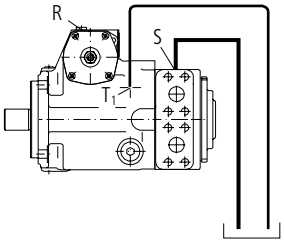


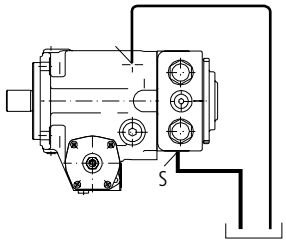


Installation on top of tank level

Pump on top of min. oil level in the tank

- ➔ Actions as installation below tank level
- ➔ Note:
  - max. admissible suction height h_{max} = 800 mm
  - min. admissible presssure at port S (min. suction pressure)





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