replaces: 02.98



Variable Displacement Pump A4VG

for closed circuits

Sizes 28...250 Series 3 Nominal pressure 400 bar Peak pressure 450 bar



A4VG...EP

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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
- a highly adaptable range of control and regulating devices is available
- 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
- the integral pressure cut-off is standard
- Further Informations:

Variable Displacement Pump A4VTG RE 92 012 for drum drives on mobile concrete Mixers





A4VG **1**/44

Ordering Code / Standard Program

Hydraulic fluid												
Mineral oil (no code)												
Axial piston unit										ļ I ,		
Variable swashplate design, nominal pressure 400 bar,	, peak	pressi	ire 45	0 bar					A4V	J		
Operation									_	_		
Pump in closed circuits									(j		
Size												
			28	40	56	71	90	125	180	250		
Control device			28	40	56	71	90	125	180	250		
without control module		NV	•	•	•	•	•	•	•	•	NV	
Hydraulic control, pilot pressure related		HD	•	•	•	•	•	•	•	•	HD	
Hydraulic control, mechanical servo		HW	•	•	•	•	•	•	•	•	HW	
Hydraulic control, speed related		DA	•	•	•	•	•	•	•	•	DA	
Hydraulic control, direct operated Electrical two-position control with switching solenoid		DG EZ	•	•	•	•	•	•	•	•	DG EZ	
Electrical two-position control with switching solenoid		EP	•	•	•	•	•	•	•	•	EP	
		LI									LI	
Solenoid voltage (only for EP, EZ or DA)											4	
U = 12 V U = 24 V			•				•				2	
Pressure cut-off												_
with pressure cut-off (standard)			•	•	•	•	•	•	•	•	D	
Zero position switch (only for HW)												
without zero position switch (no code)			•	•	•	•	•	•	•	•		
with zero position switch			•	•	•	•	•	•	•	•	L	
Mechanical stroke limiter												
without mechanical stroke limiter (no code)			•	•	•	•	•	•	•	•		
with mechanical stroke limiter, external adjustable			•	•	•	•	•	•	•	•	M	
Ports X ₃ , X ₄ for positioning pressure												
without ports X ₃ , X ₄ (no code)			•	•	•	•	•	•	•	•		
with ports X ₃ , X ₄			•	•	•	•	•	•	•	•	T	
DA control valve		NV	EZ	DG	EP	HW	HD	DA	_28. .	250		
without DA control valve		•	•	•	•	•	•	_	-	•	1	
with DA control valve, fixed setting		_	_	•	•	•	•	•	<u> </u>	•	2	
with DA control valve, mech. adjust. with control lever	L R	_	_	•	•	•	•	•	<u>'</u>	•	3L 3R	
with DA control valve, fixed setting and hydraulic inch	N.	-	_	•	_			_			οn	
valve built-on, control with breaking fluid		_	_	_	_	_	_	•		•	4	
with DA control valve, mech. adjust. with control lever and	L	_	_	_	_	_	_	•			5L	
hydraulic inch valve built-on, control with breaking fluid	R	_	_	_	_	_	_	•		•	5R	
with DA control valve, fixed setting										_	7	
and connections for master controller		_	_	_	•	•	•	_	'	•	7	
with DA control valve, fixed setting and hydraulic inch		_	_						Ι.		8	
valve built-on, control with mineral oil										_		
with DA control valve, mech. adjust. with control lever and		_	_	-	_	-	_	•	<u> </u>	•	9L	
hydraulic inch valve built-on, control with mineral oil	R					-	_	•	I '	•	9R	
DA control valve with control lever		7										
without control lever (no code)		4										
with control lever - anti-clockwise operation direction with control lever - clockwise operation direction	L R	-										
•	ΓŃ											
Series												
											3	
Index												
											2	
Direction of rotation									28.	250		
viewed on shaft end							<wise td="" <=""><td></td><td></td><td>•</td><td>R</td><td></td></wise>			•	R	
						anti-	<u>·clockv</u>	vise		•	L	

Axial piston unit											
Operation Size											
Control device											
Series											
Index											
Direction of rotation							_				
Seals											
NBR, shaft seal in FPM								N			
'	20	40	Г.	71	00	125	100				
Shaft end (permissible input torque see page 38)	28	40	56	71	90	125	180		7	-	
Splined shaft DIN 5480 (standard for single pump) Splined shaft DIN 5480 (standard for combi. pump, 1st pu	$ \bullet $ mp) $ -1 \rangle$			•	•	•	●	●	Z	+	
Splined shaft SAE (standard for single pump)	- ·)				•	•	_ ')	- ')	S	+	
Splined shaft SAE (standard for single pump) Splined shaft SAE (standard for combi. pump, 1st pump)		<u> </u>			- ²)	•	•		T	1	
Splined shaft SAE (only for combination pump, 2nd pump		•	 	_		_	_	_	U	1	
Mounting flange	Ρ/	28	40	56	71	90 '	125 °	180 2	250	_	
SAE 2-hc	ole	•	•	•		_	_	_	<u> </u>	С	
4-hc		_	_	_	_	_	_	•	•	D	
	4-hole	_	_	_	•	•	•	-	- [F	
Service line connections			•		•	•	28	401	80 25	0	
Ports A and B SAE, (metric fixing screws), at side (on c	pposite s	ides)					_	•			2
Ports A and B SAE, (metric fixing screws), at side (sam							•	_	•) 1	0
Auxiliary pump			28	40	56	71	90	125	180	250	
with integral auxiliary pump, without through drive			•	•	•	•	•	•	•	•	F0
without integral auxiliary pump, without through drive)		•	•	•	•	•	•	•	•	N0
with integral auxiliary pump, with through drive			•	•	•	•	•	•	•	•	F.
without integral auxiliary pump, with through drive			•	•	•	•	•	•	•	•	K.
Through drive flange hub			28	40	56	71	90	125	180	250	
SAE A, 2-hole SAE A (N ⁵ / ₈ "	'-9T 16/3	2DP)	•	•	•	•	•	•	•	•	0
SAE B, 2-hole SAE B (N ⁷ / ₈ "	'-13T 16/	32DP)	•	•	•	•	•	•	•	•	0
	·15T 16/3 ·15T 16/3		-	•	•	• -	_	• -	•	•	0
	-131 10/3 ₄ "-14T 12			<u>-</u>	-	•	-	-	•	-	0
SAE D, 2+4-hole DIN 5480 (N35)			-	1 –	<u> </u>	_	•	† <u>-</u>	_	_	7
SAE D, 2+4-hole SAE D (N1 ³ / ₂	₄ "-13T 8/	16DP)	_	_	_	_	_	•	•	•	6
SAE E, 4-hole SAE E (N1 ³ / ₂	₄ "-13T 8/	16DP)	_	-	_	_	_	_	•	•	7
Valves setting range	ē		28	40	56	71	90	125	180	250	
with high press. relief valve, pilot controlled 100420 ba				_	_	•	•	•	•	•	1
with high pressure relief valve, 250420 ba			s •	•	•	_	_	-	_	_	3
direct controlled, (fixed setting)	with b		•	•	•	<u> </u>	_	-	-	-	5
100250 ba				•	•	-	_	_	_	-	4
	with b	ypass	•	•	•	<u> </u>	_				6
Filtration			28	40	56	71	90	125	180	250	_
Filtration in the suction line of the auxiliary (boost) pur			•	•	•	•	•	•	•	•	S
Filtration in the pressure line of the auxiliary (boost) puports for external boost circuit filter, (F _e and F _a)	ımp:		•	•	•	•	•	•	•	•	D
cold start valve and ports for external boost circuit fil	lter. (F. ai	nd F _a)	<u> </u>	•	•	•	•	•	•	_	К
filter built-on (supplied complete) ³)	iter, (re ar	id i a/	 	•	•	•	•	•	•	_	F
filter built-on with visual contamination indicator ³)	-	•	•	•	•	•	•	_	P		
filter built-on with electrical contamination indicator	,		_	•	•	•	•	•	•	_	L
filter built-on with visual and electrical contamination			_	•	•	•	•	•	•	_	M
		١.						•			ΙE
External supply (model without integral auxiliary pump	- N00, K)									

Technical Data

Fluid

We request that before starting a poject detailed information about the choice of pressure fluids and application conditions are taken from our catalogue sheets RE 90220 (mineral oil), RE 90221 (environmentally acceptable hydraulic fluids) and RE 90223 (fire resistant hydraulic 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). The operation with HFA-, HFB and HFC- hydraulic fluids requires additional special measures.

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} = operating viscosity 16...36 mm²/s

referred to the circuit temperature (closed circuit).

Viscosity limits

The limiting values for viscosity are as follows:

 $v_{min} = 5 \text{ mm}^2/\text{s}$

short term at a max. permissible temp. of $t_{max} = 115$ °C.

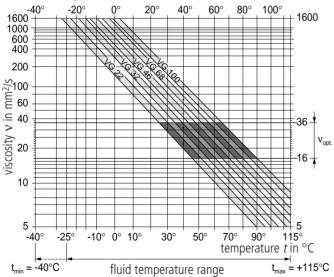
Please note that the max. fluid temperature is also not exceeded in certain areas (for instance bearing area).

 $v_{max} = 1600 \text{ mm}^2/\text{s}$

short term on cold start ((n \leq 1000 min⁻¹, 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 FPM 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

Operating pressure range - inlet

Variable pump (with external supply, E):	
for control devices EP, EZ, HW and HD boost pressure (when $n = 2000 \text{ rpm}$) p_{Sp}	20 bar
for control devices DA, DG boost pressure (when $n = 2000 \text{ rpm}$) p_{Sp}	25 bar
Auxiliary pump: suction pressure $p_{s min}$ ($\nu \leq 30 mm^2/s$) for cold start	$_$ ≥ 0,8 bar absolute ≥ 0,5 bar absolute

Operating 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 I_1 and I_2	
p _L	_4 bar abs.
short term (at start)	_6 bar abs.

Installation position

Optional. The housing must be filled with fluid prior the commissioning, and must remain full whenever it is operating.

For extensive information on installation position, please consult our data sheet RE 90 270 before completing your design work.

Note for installation position "drive shaft up" (only sizes 71-250): When ordering please state in clear text "installation position: drive shaft up". The pump will be delivered with an additional air bleed port R1 located at the flange area.

Technical Data

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

Size					28	40	56	71	90	125	180	250
Displacement	variable pun	ıp	$V_{g max}$	cm ³	28	40	56	71	90	125	180	250
	auxiliary pur	np (at p = 20 bar)	V_{gH}	cm ³	6,1	8,6	11,6	19,6	19,6	28,3	39,8	52,5
Speed	max. speed	with V _{g max}	n _{max contin.}	rpm	4250	4000	3600	3300	3050	2850	2500	2400
	limited max.	speed ¹)	n _{max limited}	rpm	4500	4200	3900	3600	3300	3250	2900	2600
	intermittent	max. speed ²)	n _{max interm.}	rpm	5000	5000	4500	4100	3800	3450	3000	2700
	minimum sp	eed	n _{min}	rpm	500	500	500	500	500	500	500	500
Flow	at n _{max contin.}	and $V_{g max}$	q _{v max}	L/min	119	160	202	234	275	356	450	600
Power	at n _{max contin.}	$\Delta p = 400 \text{ bar}$	P _{max}	kW	79	107	134	156	183	237	300	400
Torque	at $V_{g max}$	$\Delta p = 400 \text{ bar}$	T_{max}	Nm	178	255	356	451	572	795	1144	1590
(variable pump without	aux. pump)	$\Delta p = 100 \text{ bar}$	Τ	Nm	44,5	63,5	89	112,8	143	198,8	286	398
Moment of inertia (about drive axis)			J	kgm ²	0,0017	0,003	0,0051	0,0072	0,0106	0,0164	0,0323	0,0879
Weight (standard model	without throug	h drive) approx.	т	kg	29	31	38	50	60	80	101	156

1) Limited maximum speed:

- at half corner power (e.g. at $V_{q\;max}$ and p_N /2)

2) Intermittent maximum speed:

– at high idling speed

– at engine overspeed: $\Delta p = 70...150$ bar and $V_{g max}$ – with reversing heads: $\Delta p < 300$ bar and t < 5 sec.

Calculation of size

Output flow	$q_v = \frac{V_g \bullet n \bullet \eta_v}{1000}$	in I /min	V_g = displacement per revolution in cm ³
Output now	$q_v \equiv {1000}$	in L/min	$\Delta p = differential pressure in bar$
T	$1,59 \bullet V_g \bullet \Delta p \qquad V_g \bullet \Delta p$	in Nm	n = speed in rpm
Torque	$1 = \frac{1}{100 \bullet \eta_{mh}} = \frac{1}{20 \bullet \pi \bullet \eta_{mh}}$	in Nm	$\eta_v = \text{volumetric efficiency}$
	$P = \frac{T \cdot P}{r} = \frac{2 \pi \cdot T \cdot P}{r} = q_v \cdot \Delta P$		$\eta_{\text{mh}} \; = \; \text{mechanical-hydraulic efficiency}$
Power	$P = \frac{1}{9549} = \frac{1}{60000} = \frac{1}{600} \cdot \eta_t$	in kW	η_t = overall efficiency

Input drive

Permissible axial and radial loading on drive shaft

Size				28	40	56	71	90	125	180	250
Distance of F _q (from shaft collar)	Fqt	а	mm	17,5	17,5	17,5	20	20	22,5	25	29
		b	mm	30	30	30	35	35	40	45	50
	a, b, c	С	mm	42,5	42,5	42,5	50	50	57,5	60	71
max. permissible radial load at dista	ance a	$F_{q max}$	Ν	2500	3600	5000	6300	8000	11000	16000	22000
	b	$F_{q max}$	Ν	2000	2891	4046	4950	6334	8594	12375	16809
	C	F _{q max}	N	1700	2416	3398	4077	5242	7051	10150	13600
max. permissible axial load	<u>- →ſſ</u>	- F _{ax max}	N	1557	2120	2910	4242	4330	5743	7053	4150
'	Fax =	+ F _{ax ma}		417	880	1490	2758	2670	3857	4947	4150

Filtration

The finer the filtration the better the achieved purity grade of the pressure fluid and the longer the life of the axial piston unit.

To ensure the functioning of the axial piston unit a minumum purity grade 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 cleanless class

8 to NAS 1638

17/14 to ISO/DIS 4406 necessary.

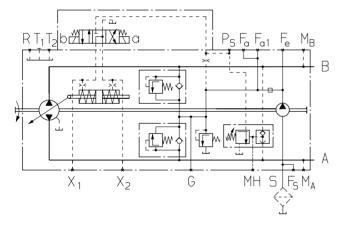
If above mentioned grades cannot be maintained please consult supplier.

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

Standard model (preferred)

Filter type:	filter without bypass
Recommendation:	_ with contamination indicator
Through flow resistance at the filter	r element:
at $\nu=$ 30 mm ² /s, $n=n_{max}$	$\Delta p \leq 0,1$ bar
at $\nu=$ 1000 mm ² /s, $n=$ n_{max}	$\Delta p \le 0.3$ bar
Pressure at port S of the auxiliary p	ump:
at $v = 30 \text{ mm}^2/\text{s}$	p ≥ 0,8 bar
at cold start ($v = 1600 \text{ mm}^2/\text{s. n} \le$	1000 min ⁻¹) $p \ge 0.5$ bar

Circuit diagram standard S



Variation: external supply, E

This variation is to be applied with models **without** integral auxiliary pump (N00 or K..).

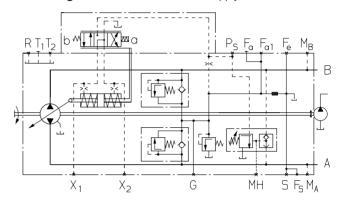
Connection S is closed.

Supply comes from connection F_a.

Filter arrangement: _____ separately

To ensure functioning the above mentioned purity grade for the boost pressure fluids at connection F_a has to be ensured.

Circuit diagram variation E (external supply)



Variation: Filtration in the pressure line of the auxiliary pump, ports for external boost circuit filter, D

Port F_e: Filter inlet
Port F_a: Filter outlet

Filter type: Filter with bypass are **not** recommended, when

applying with bypass please consult supplier.

Recommendation: with contamination indicator

Please note:

for type with **DG**-displacement (with control pressure not from the supply circuit) the following filter type has to be used:

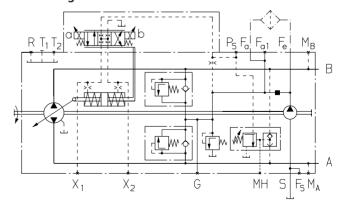
filter with bypass and with contamination indicator

Filter arrangement: ___ separately in the pressure line (hose filter)
Through flow resistance at filter element:

at $\nu = 30 \text{ mm}^2\text{/s}$ ______ $\Delta p \leq 1 \text{ bar}$ at cold start ______ $\Delta p_{\text{max}} = 3 \text{ bar}$

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

Circuit diagram variation D



Filtration

Variation: Filtration in the pressure line of the auxiliary pump, with cold start valve and ports for external boost circuit filter, K

Design as variation D, however additionally with cold start valve:

 Filter is equipped with **cold start valve** and therefore protects the pump from damage. The valve opens at

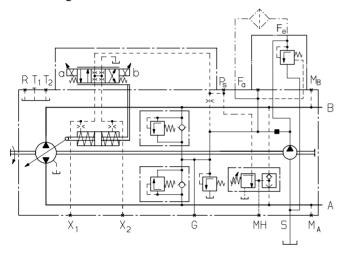
through flov	v resistance	$\Delta p \ge 6$ bar.
--------------	--------------	-----------------------

Port F_e: Filter inlet (at th cold start valve)

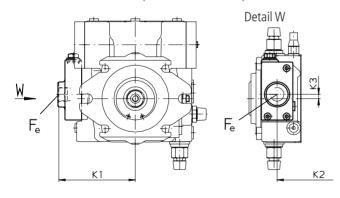
Port F_a: Filter outlet

Filter arrangement separately in the pressure line (hose filter)

Circuit diagram variation K (with cold start valve)



Dimensions variation K (with cold start valve)



Size	K1	K2	К3	F_e
40	122,5	198,7	0	M18x1,5; 15 deep
56	125,5	215,4	0	M18x1,5; 15 deep
71	145,5	239,0	8	M26x1,5; 16 deep
90	139,5	248,5	24	M26x1,5; 16 deep
125	172,0	267,9	20	M33x2; 18 deep
180	173,0	311,9	3	M33x2; 18 deep

Variation: Filtration in pressure line of the auxiliary pump, filter built-on, supplied complete, F

Filter type: ______ Filter **without** bypass

Please note:

 Filter is equipped with cold start valve and therefore protects the pump from damage.

The valve opens at

through flow resistance $\Delta p \ge 6$ bar.

Recommendation: **with** contamination indicator

(differential pressure $\Delta p = 5$ bar)

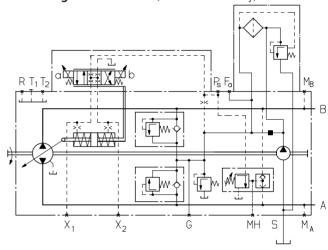
Filter arrangement connected to pump through flow resistance at filter element:

at $v = 30 \text{ mm}^2\text{/s}$ _____ $\Delta p \le 1 \text{ bar}$ at cold start _____ $\Delta p_{\text{max}} = 3 \text{ bar}$

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

To be considered for sizes 40, 56: max perm. boost pressure $p_{SD\ max} = 35\ bar$

Circuit diagram variation F (with filter assembly)

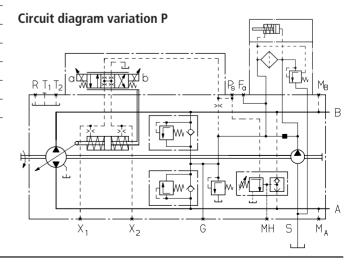


Variation: Filtration in pressure line ot the auxiliary pump, filter built-on, supplied complete, with visual contamination indicator. P

Design as variation F, however additionally with visual contamination indicator.

Indication: green/red window

differential pressure (switching pressure) $\Delta p = 5$ bar



Filtration

Variation: Filtration in pressure line ot the auxiliary pump, filter built-on, supplied complete, with electrical contamination indicator, L

Design as variation F, however additionally with electrical contamination indicator.

Indication: electrical

differential pressure (switching pressure) $\Delta p = 5$ bar

Max. switching power at 24 V DC 60 W

Circuit diagram variation L

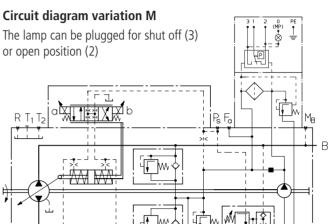
Variation: Filtration in pressure line ot the auxiliary pump, filter built-on, supplied complete, with visual and electr. contamination indicator, M

Design as variation F, however additionally with visual and electrical contamination indicator.

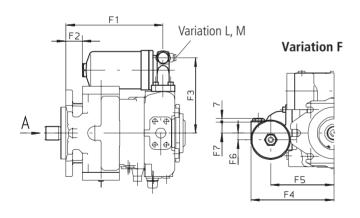
Indication: electrical and visual by lamp

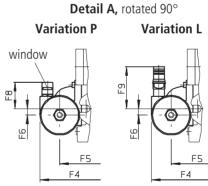
differential pressure (switching pressure) $\Delta p = 5$ bar 60 W

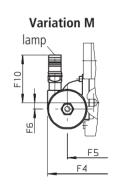
Max. switching power at 24 V DC



Dimensions variation F, P, L, M (with filter assembly)

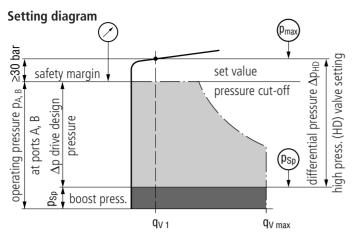






Size	F1	F2	F3	F4	F5	F6	F7	F8	F9	F10
40	201,7	47,7	160	175	135	0	42	78,5	122	125
56	218,4	64,4	163	178	138	0	42	78,5	122	125
71	239	46,5	185	203,5	155	16	29	65,5	109	112
90	248,5	56	179	197,5	149	0	45	81,5	125	128
125	235,9	59,4	201	219,5	171	0	53	89,5	133	136
180	279,9	40,3	202	220,4	171,9	17	36	72,5	116	119

High Pressure Relief Valve



Note: valve setting is done at $n = 1000 \text{ min}^{-1} \text{ and } V_{g \text{ max}} (q_{V 1})$

Example: boost pressure 20 bar; operating pressure 410 bar operating pres. $p_{A,B}$ - boost pres. p_{Sp} + safety margin = differential pres. Δp_{HD} 410 bar - 20 bar + 30 bar = **420 bar**

Setting range

Setting range	
High pressure relief valve, pilot controlled (sizes 71250)	Differential pressure setting Δp_{HD}
Setting range valve 1 Δp 100 - 420 bar (see ordering code)	420 bar 400 bar 1) 360 bar 340 bar 320 bar 300 bar 270 bar 250 bar 230 bar 200 bar 150 bar 100 bar

High pressure relief valve, direct controlled (sizes 2856)	Differential pressure setting Δp _{HD}
Setting range valve 3, 5 Δ p 250 - 420 bar (see ordering code)	420 bar 400 bar ¹) 360 bar 340 bar 320 bar 300 bar 270 bar
Setting range valve 4, 6 Δp 100 - 250 bar (see ordering code)	250 bar 230 bar ¹) 200 bar 150 bar 100 bar

¹⁾ Standard setting of differential pressure, valves set to this value if no details given on order.

Bypass function

Sizes 28...56: HD valves direct controlled (3), (4): without bypass

Sizes 28...56: HD valves direct controlled (**5**), (**6**): with bypass Sizes 71...250: HD valves pilot controlled (**1**): with bypass

Simplification: The bypass function is not shown in the circuit

diagrams

The pilot controlled HD-valves (sizes 71..250) are

not shown in the circuit diagrams.

Please state in clear text when ordering:

(possible are only the values Δp_{HD} shown in the table)

High pressure relief valve A

Differential pressure setting: $\Delta p_{HD} = ...$ bar

Opening pressure of the HD-valve (at q_{V1}): $p_{max} = ...$ bar

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

High pressure relief valve B

Differential pressure setting: $\Delta p_{HD} = ...$ bar

Opening pressure of the HD-valve (at q_{V 1}): $p_{max} = ...$ bar

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

Pressure Cut-Off, D

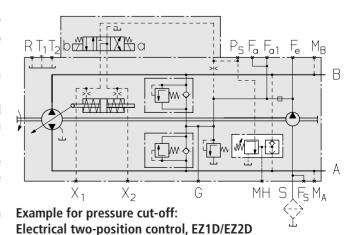
The pressure cut-off corresponds to a pressure regulation which, after reaching the set pressure, adjusts the pump volume of the pump to $V_{q\,0}=0.$

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

The pressure peaks occurring when the swashplate is swivelled rapidly and also the maximum pressure in the system are safeguarded by the high pressure limit valves.

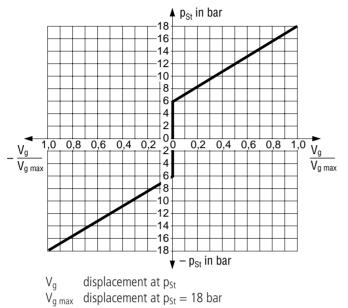
The setting range of the pressure cut-off may be anywhere within the entire working pressure range. However, it must be set 30 bar lower than the setting of the high pressure safety relief valves (see setting diagram).

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



HD Hydraulic Control, Pilot Pressure Related

The positioning cylinder of the pump and therefore the swivel angle is varied in proportion to the difference in pilot pressure applied to the two control ports (Y_1 and Y_2). The pump displacement is therefore steplessly variable. One pilot line is assigned to each direction of flow.



Pilot pressure $p_{St}=6$ - 18 bar (at ports Y_1, Y_2) Start of control 6 bar End of control 18 bar (max. displacement $V_{q max}$)

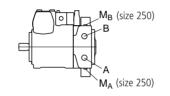
If the pump is also fitted with a DA control valve, e.g. for automotive control of the vehicle transmission is also possible. DA control valve see page 13.

For pressure cut-off, see page 9.

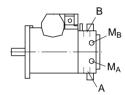
Graph
Direction of rotation - Control - Direction of through flow

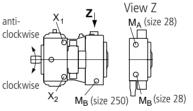
		Size	Pilot pressure	Control pressure	Direction flow	Operating pressure
		2856	Y ₁	X ₁	A to B	M _B
'n	wise	2830	Υ ₂	X ₂	B to A	M _A
tatic	lock	71250	Y ₁	X ₁	B to A	M _A
of rc	anti-clockwise clockwise	/1250	Y ₂	X ₂	A to B	M _B
ction	ise	2856	Y ₁	X ₁	B to A	M _A
Dire	ckw	2050	Y ₂	X ₂	A to B	M _B
	ıti-ck	71250	Y ₁	X ₁	A to B	M _B
	an	/1230	Y ₂	X ₂	B to A	M _A

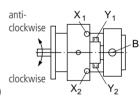
Sizes 28, 250



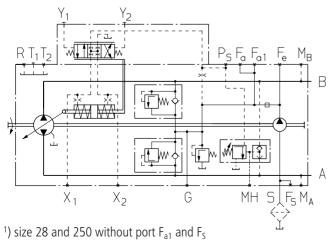
Sizes 40...180



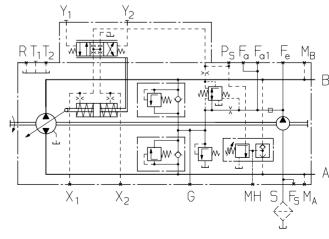




Standard model 1)

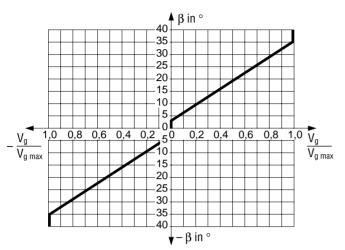


Model with DA control valve 1)



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 bis
$$\pm$$
 V_{g max} \triangleq β = 0° to \pm 35° mech, stop: sizes 28...71

mech. stop: sizes 28...71 ____ ± 40° sizes 90...250 ___ ± 35°

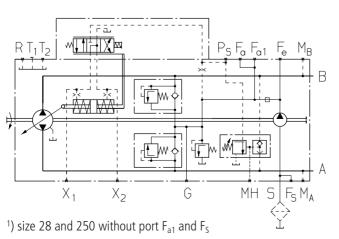
Torque necessary at control lever is between 85 and 210 Ncm. The limitation of the operating range of the HW control lever must be fixed in the external control mechanism (required value setting). If the pump is also fitted with a DA control valve, automotive control of the vehicle transmission is also possible. DA control valve see page 13. For pressure cut-off, see page 9.

Variation: zero position switch, L

At zero position of the control lever of the HW control device the switch contact of the zero position switch is closed. In case of starton of the control lever from the center position the contact is interrupted.

The zero position switch assures a safety function for drives which necessitate the zero position under certain operation conditions (for example start of the diesel engine).

Standard model 1)



Graph Direction of rotation - Control - Direction of through flow

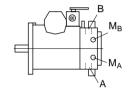
		Size	Lever direction	Control pressure	Direction flow	Operating pressure
		20 F.C	а	X ₂	B to A	M _A
Ë	wise	2856	b	X ₁	A to B	M _B
Direction of rotation anti-clockwise	lock	74 250	а	X ₂	A to B	M _B
	•	71250	b	X ₁	B to A	M _A
	ise	2856	а	X ₂	A to B	M _B
	ckw	2030	b	X ₁	B to A	M _A
	ti-ck	71250	а	X ₂	B to A	M _A
	an	71230	b	X ₁	A to B	M _B

Sizes 28, 250

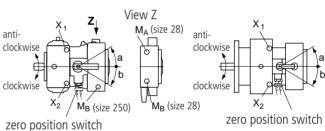
M_B (size 250)

A

M_A (size 250)



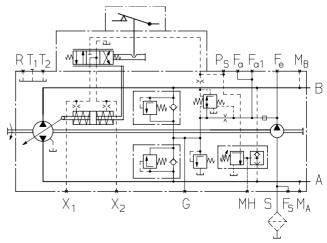
Sizes 40...180



Technical data for zero position switch

load performance	20 A (continuous)
switch performance	15A / 32V (DC)
	4A / 32V (AC - inductive)

Model with DA control valve and zero position switch 1)



DA Hydraulic Control, Speed Related

In relation to the drive speed, control pressure is applied to the positioning cylinder of the pump by means of the DA control valve via a 4/3 way directional valve. Pump displacement is steplessly variable in each direction of flow. Each direction of flow is assigned to one of the two solenoids on the directional valve.

Increasing drive speed generates a higher control pressure through the DA valve.

Increasing control pressure increases the pump displacement.

Dependent upon the pump operating curve, pressure in the high pressure lines causes the pump to swivel back towards a smaller displacement.

Increasing operating pressure gives reduced displacement.

A constant torque input to the pump is achieved by this combination of de-stroking of the pump as the operating pressure increases and in response to the "pull-down" of the prime mover (leading to a reduced control pressure).

The least possible pull down leads to optimum usage of the drive power. This is achieved by "partial inching". In this form of the control, the DA valve is mechanically coupled to the accelerator pedal. This means that on reaching a certain speed (movement of the accelerator pedal), the control curve is offset parallel to the engine speed curve.

Any additional power requirements, e.g. the service hydraulics, may lead to engine pull down occuring. This leads to a reduction in control pressure and therefore pump displacement. The power thus released is then available to supply that demanded. Automatic power division and full utilisation of power available is thus achieved for both the vehicle transmission and the service hydraulics.

In an automative transmission, the DA control valve is used in conjunction with the directly controlled hydraulic "DA control".

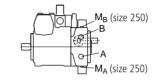
However, pumps with EP, HW or HD control devices can also be equipped with a DA control valve. In this way, the automatic transmission function (speed related high pressure/flow increase with load limiting control) may be overridden.

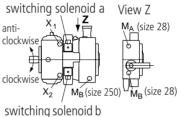
The maximum flow will then be determined by the setting of the relevant control module fitted.

Graph
Direction of rotation - Control - Direction of through flow

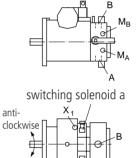
		Size	Solenoid	Control pressure	Direction flow	Operating pressure
		2856	a	X ₂	B to A	M _A
u	wise	2030	b	X ₁	A to B	M _B
otatic	lock	71250	а	X ₂	A to B	M _B
of ro	anti-clockwise clockwise	71250	b	X ₁	B to A	M _A
ction	ise	2856	a	X ₂	A to B	M _B
Dire	ckw	2030	b	X ₁	B to A	M _A
	ti-ck	71250	a	X ₂	B to A	M _A
	an	71230	b	X ₁	A to B	M _B

Sizes 28, 250



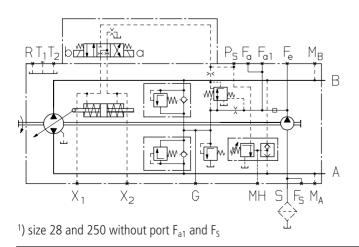


Sizes 40...180



switching solenoid b

Hydraulic control, speed related, DA-control valve, fixed setting, DA1D2/DA2D2 1)



Function and Control of DA Valves

(Unit dimensions see page 32...34)

DA control valve, fixed setting, (2)

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

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

Control pressure is generated in relation to drive speed. When ordering, please state in clear text: Start of control (set at factory). Control pressure may be reduced (independently of drive speed) as required by operation of the control lever (inch function).

Max. adm. operating torque at the control lever $____T_{max} = 4 \text{ Nm}$ Max. angle of lever operation 70°. The position of the lever is optional. **Variation 3L** $_$ operation direction of the control lever anti-clockwise **Variation 3R** $___$ operation direction of the control lever clockwise

Hydraulic inch valve, (4, 5, 8, 9)

(only for pumps with DA control device)

 for inch function; for use in conjunction with DA control valve, fixed setting (4, 8) or mechanically adjustable (5, 9) Model with throttle valve sizes 28, 40, 56, 71 Model with pressure reducing valve sizes 90, 125, 180, 250

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

Variation 4, 5:

The control at port Z by means of braking fluid from the vehicle braking system (hydraulically linked with the operation brake).

Variation 8, 9:

The control at port Z by means of mineral oil.

Master controller as inch valve, (7)

for inch function; for use in conjuction with DA control valve, fixed setting

Any reduction of control pressure, independent from the input speed through the mechanical operation of the master controller.

The master controller is installed separately from the pump (for instance in the driver's cabin) connected with the pump by 2 hydraulic control lines at ports P_S and Y.

A suitable master controller is to be ordered separately and is not included in delivery volume.

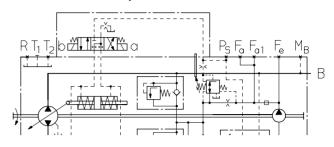
Extensive information is available from our mobile sales department. Please make use of an opportunity to confirm your transmission design through our computer programme in BRUENINGHAUS HYDROMATIK. A DA control can only be approved by BRUENINGHAUS HYDROMATIK.

Note: rotary inch valve see page 41.

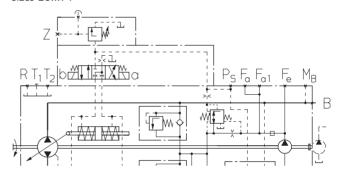
 1) size 28 and 250 without port F_{a1} and F_{S}

Circuit diagrams 1):

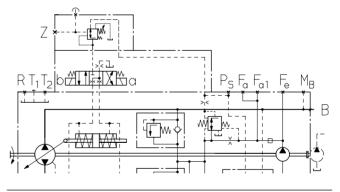
Hydraulic control, speed related, DA control valve, mech. adjustable with control lever DA1D**3**/DA2D**3**



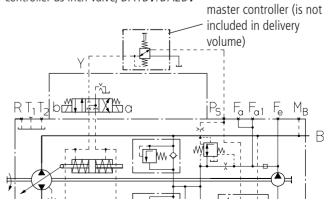
Hydraulic control, speed related, DA control valve, fixed setting, with hydraulic inch valve, DA1D**4**/DA2D**4** with throttle valve, sizes 28...71



with pressure reducing valve, sizes 90...250



Hydraulic control, speed related, DA DA control valve, fixed setting, with separately installed master controller as inch valve, DA1D**7**/DA2D**7**



DG Hydraulic Control, Direct Operated

By switching the pilot pressure at the connections X_1 or X_2 the positioning cylinder of the pump is directly supplied with internal control pressure. Thus the swashplate and so the displacement is adjustable between $V_{g\ 0}=0$ and $V_{g\ max}$. Each direction of flow is assigned to a connection.

pilot pressure 0 bar $\stackrel{\triangle}{=}$ setting $V_{g\;0}=0$

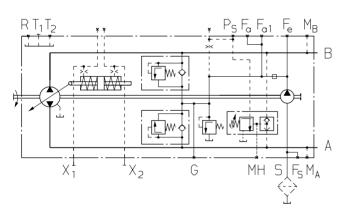
The necessary pilot pressure for the setting $V_{g\,max}$ depends upon the operation pressure and rotational speed.

Please contact us for further information.

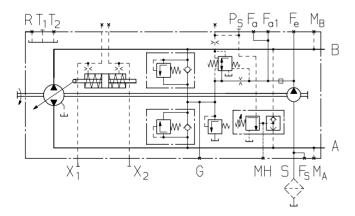
For pressure cut-off, see page 9.

Assignment direction of rotation – control – direction of flow HD control see page 10 (control pressure X_1 ; X_2).

Standard model 1)



Model with DA control valve 1)



EZ Electrical Two-Position Control with Switching Solenoid

By energizing either solenoid a or b, the positioning cylinder of the pump is directly supplied with internal control pressure, and the pump swivels to maximum displacement. In this way, the swashplate and thus the displacement is switchable from Vg $_0=0$ to Vg $_{\text{max}}.$ Each direction of flow is assigned to a solenoid.

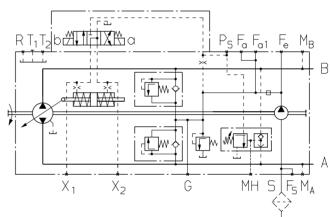
solenoid de-energized $\, \, \cong \, \,$ setting $V_{g \ 0} = 0$ solenoid energized $\, \, \cong \, \,$ setting $V_{g \ max}$

EZ1______solenoid 12 V
EZ2_____solenoid 24 V

For pressure cut-off, see page 9.

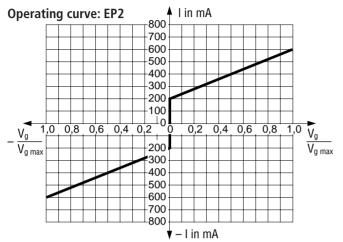
Assignment direction of rotation – control – direction of flow DA control see page 12.

Standard model 1)



EP Electrical Control, with Proportional Solenoids

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.



model	control voltage (DC)	control current / start of control		
		at V_{g0}	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 amplifiers PVR and PVRS (see RE 95022), chopper amplifier CV (see RE 95029), open loop control electronics RVR (see RE 95031), open loop control electronics CSD (see RE 95075), closed loop control electronics RVE (see RE 95033), universal closed loop control electronics RVU (see RE 95048) and microcontroller MC with software solutions related to the field of application (see RE 95050).

If the pump is also fitted with a DA control valve, automotive control of the vehicle transmission is also possible.

DA control valve, see page 13.

For pressure cut-off, see page 9.

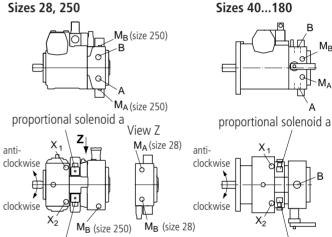
Standard: proportional solenoid with manual emergency

(without spring return)

Direction of rotation - Control - Direction of through flow

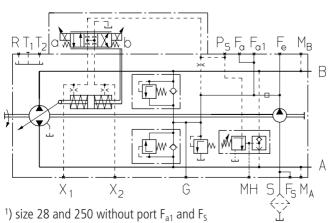
Graph

		Size	Solenoid	Control pressure	Direction flow	Operating pressure
		2856	а	X ₁	A to B	M _B
u	wise	2030	b	X ₂	B to A	M _A
tatic	clock	71250	a	X ₁	B to A	M _A
of ro	•	71230	b	X ₂	A to B	M _B
ction	ise	2856	а	X ₁	B to A	M _A
Direction of rotation anti-clockwise	ckw	2030	b	X ₂	A to B	M _B
	ti-ck	71250	а	X ₁	A to B	M _B
	an	71230	b	X ₂	B to A	M _A



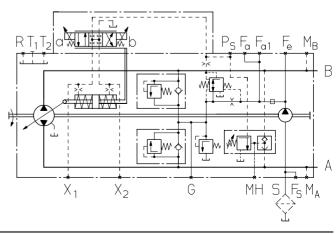
proportional solenoid b

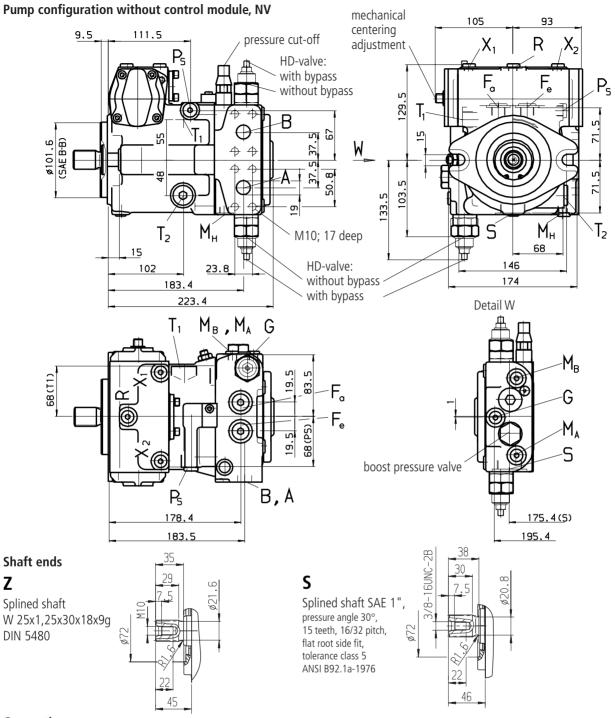
Standard model 1)



Model with DA control valve 1)

proportional solenoid b

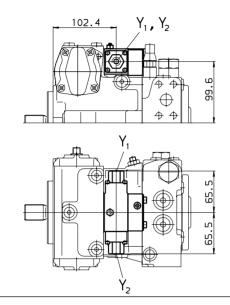




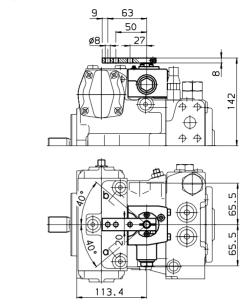
Connections

Service line ports SAE 3/4", high pressure series	420 bar (6000 psi)
Case drain or filling port	M22x1,5; 14 deep
Case drain	M22x1,5; 14 deep
Pressure gauge - operating pressure A, B	M12x1,5; 12 deep
Air bleed	M12x1,5; 12 deep
Boost suction port	M33x2; 18 deep
Control pressure ports (before the orifice)	M12x1,5; 12 deep
Pressure port for auxiliary circuit	M12x1,5; 12 deep
Control pressure supply	M14x1,5; 12 deep
Filter outlet	M18x1,5; 12 deep
Filter inlet	M18x1,5; 12 deep
Port for balanced high pressure	M12x1,5; 12 deep
Remote control ports (only for HD control)	M14x1,5; 12 deep
	Case drain Pressure gauge - operating pressure A, B Air bleed Boost suction port Control pressure ports (before the orifice) Pressure port for auxiliary circuit Control pressure supply Filter outlet Filter inlet Port for balanced high pressure

Hydraulic control, pilot pressure related, HD

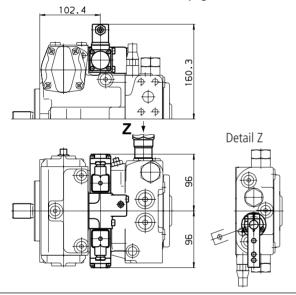


Hydraulic control, mechanical servo, HW

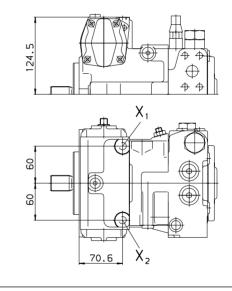


Hydraulic control, speed related, DA

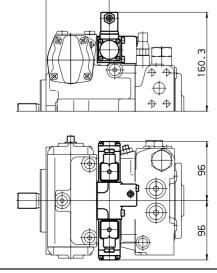
(dimensions of the DA control valve see pages 32, 33)



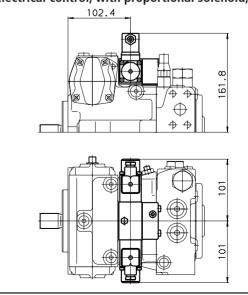
Hydraulic control, direct operated, DG



Electrical two-position control, with switching solenoid, EZ



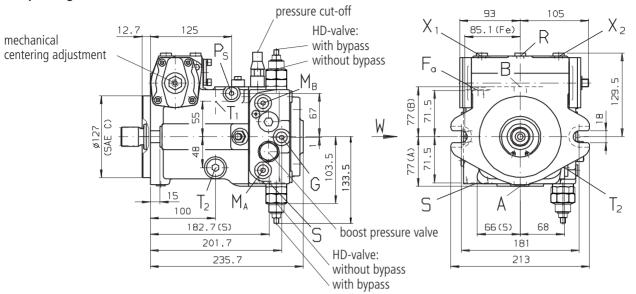
Electrical control, with proportional solenoid, EP

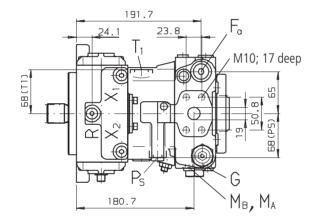


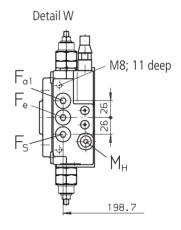
Unit Dimensions, Size 40

Before finalising your design, please request a certified drawing.

Pump configuration without control module, NV



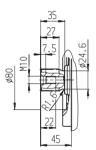




Shaft ends

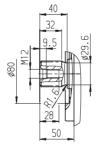
Z

Splined shaft W 30x2x30x14x9g DIN 5480



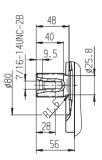
Α

Splined shaft W 35x2x30x16x9g DIN 5480



S

Splined shaft SAE 11/4" pressure angle 30°, 14 teeth, 12/24 pitch, flat root side fit, tolerance class 5 ANSI B92.1a-1976

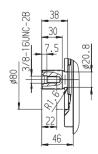


Connections

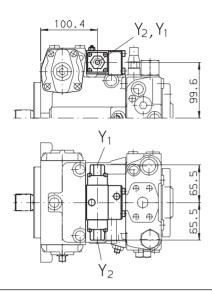
A, B	Service line ports SAE 3/4", high pressure series	420 bar (6000 psi)
T_1	Case drain or filling port	M22x1,5; 14 deep
T_2	Case drain	M22x1,5; 14 deep
M_A , M_B	Pressure gauge - operating pressure A, B	M12x1,5; 12 deep
R	Air bleed	M12x1,5; 12 deep
S	Boost suction port	M33x2; 18 deep
X_1, X_2	Control pressure ports (before the orifice)	M12x1,5; 12 deep
G	Pressure port for auxiliary circuit	M12x1,5; 12 deep
P_{S}	Control pressure supply	M14x1,5; 12 deep
F_a	Filter outlet	M18x1,5; 12 deep
F_{a1}	Filter outlet (filter assembly)	M18x1,5; 12 deep
Fe	Filter inlet	M18x1,5; 12 deep
F_{S}	Port from filter to suction line (cold start)	M18x1,5; 12 deep
M_{H}	Port for balanced high pressure	M12x1,5; 12 deep
Y_1, Y_2	Remote control ports (only for HD control)	M14x1,5; 12 deep

U

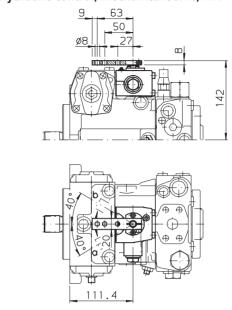
Splined shaft SAE 1" pressure angle 30°, 15 teeth, 16/32 pitch, flat root side fit, tolerance class 5 ANSI B92.1a-1976



Hydraulic control, pilot pressure related, HD

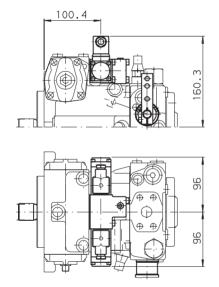


Hydraulic control, mechanical servo, HW

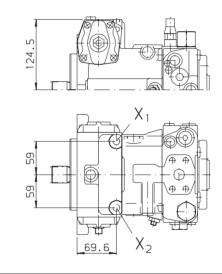


Hydraulic control, speed related, DA

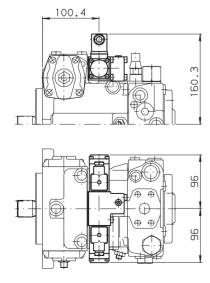
(dimensions of the DA control valve see pages 32, 33)



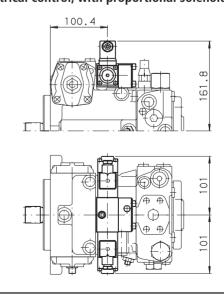
Hydraulic control, direct operated, DG



Electrical two-position control, with switching solenoid, EZ



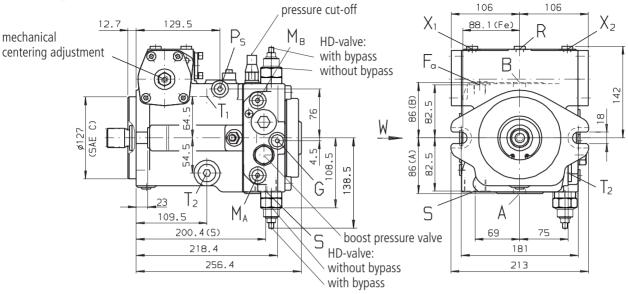
Electrical control, with proportional solenoid, EP

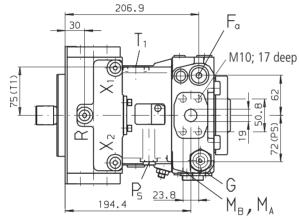


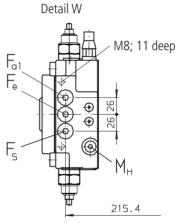
Unit Dimensions, Size 56

Before finalising your design, please request a certified drawing.

Pump configuration without control module, NV



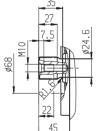




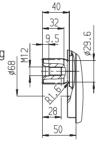
Shaft ends

Z

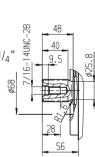
Splined shaft
W 30x2x30x14x9g
DIN 5480



A Splined shaft W 35x2x30x16x9g DIN 5480



Splined shaft SAE 11/4" pressure angle 30°, 14 teeth, 12/24 pitch, flat root side fit, tolerance class 5 ANSI B92.1a-1976

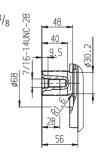


Connections

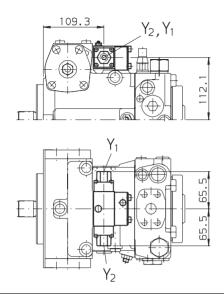
A, B	Service line ports SAE 3/4", high pressure series	420 bar (6000 psi)
T_1	Case drain or filling port	M22x1,5; 14 deep
T_2	Case drain	M22x1,5; 14 deep
M_A , M_B	Pressure gauge - operating pressure A, B	M12x1,5; 12 deep
R	Air bleed	M12x1,5; 12 deep
S	Boost suction port	M33x2; 18 deep
X_1, X_2	Control pressure ports (before the orifice)	M12x1,5; 12 deep
G	Pressure port for auxiliary circuit	M14x1,5; 12 deep
P_S	Control pressure supply	M14x1,5; 12 deep
F_a	Filter outlet	M18x1,5; 12 deep
F_{a1}	Filter outlet (filter assembly)	M18x1,5; 12 deep
F_{e}	Filter inlet	M18x1,5; 12 deep
F_{S}	Port from filter to suction line (cold start)	M18x1,5; 12 deep
M_H	Port for balanced high pressure	M12x1,5; 12 deep
Y_1, Y_2	Remote control ports (only for HD control)	M14x1,5; 12 deep

Τ

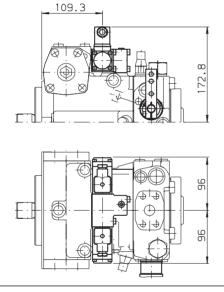
Splined shaft SAE 13/8 pressure angle 30°, 21 teeth, 16/32 pitch, flat root side fit, tolerance class 5 ANSI B92.1a-1976



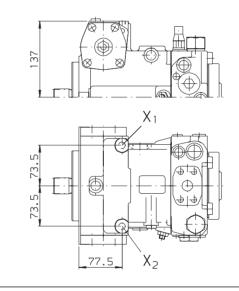
Hydraulic control, pilot pressure related, HD



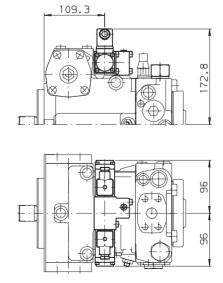
Hydraulic control, speed related, DA (dimensions of the DA control valve see pages 32, 33)



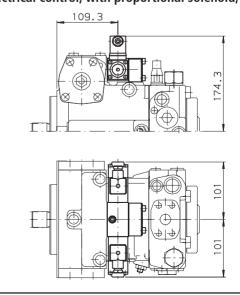
L 120.3 L Hydraulic control, direct operated, DG



Electrical two-position control, with switching solenoid, EZ



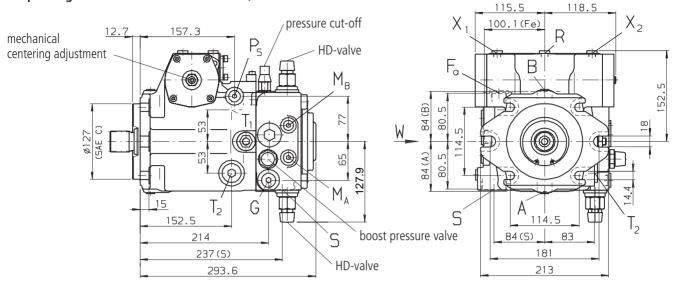
Electrical control, with proportional solenoid, EP

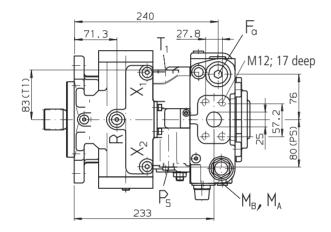


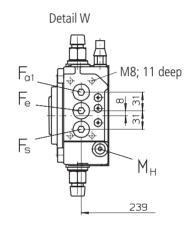
Unit Dimensions, Size 71

Before finalising your design, please request a certified drawing.

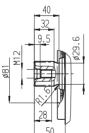
Pump configuration without control module, NV



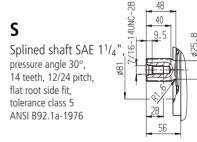






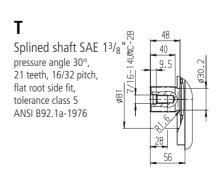


A Splined shaft W 40x2x30x18x9g & DIN 5480

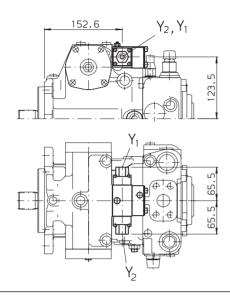


Connections

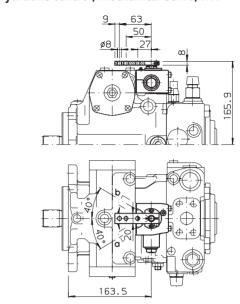
A, B	Service line ports SAE 1", high pressure series	420 bar (6000 psi)
T ₁	Case drain or filling port	M26x1,5; 16 deep
T_2	Case drain	M26x1,5; 16 deep
M_A , M_B	Pressure gauge - operating pressure A, B	M12x1,5; 12 deep
R	Air bleed	M12x1,5; 12 deep
S	Boost suction port	M42x2; 20 deep
X_1, X_2	Control pressure ports (before the orifice)	M12x1,5; 12 deep
G	Pressure port for auxiliary circuit	M18x1,5; 12 deep
P_{S}	Control pressure supply	M14x1,5; 12 deep
F_a	Filter outlet	M26x1,5; 16 deep
F_{a1}	Filter outlet (filter assembly)	M22x1,5; 14 deep
F_{e}	Filter inlet	M22x1,5; 14 deep
F_{S}	Port from filter to suction line (cold start)	M22x1,5; 14 deep
M_{H}	Port for balanced high pressure	M12x1,5; 12 deep
Y ₁ , Y ₂	Remote control ports (only for HD control)	M14x1,5; 12 deep



Hydraulic control, pilot pressure related, HD

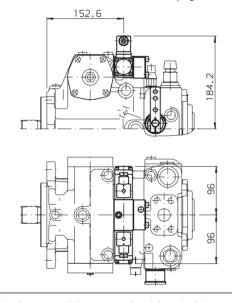


Hydraulic control, mechanical servo, HW

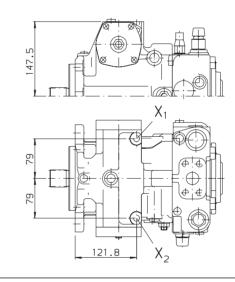


Hydraulic control, speed related, DA

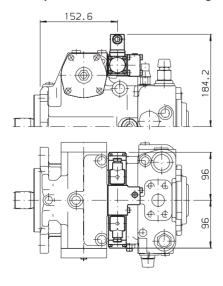
(dimensions of the DA control valve see pages 32, 33)



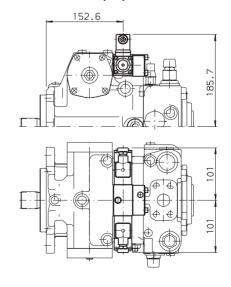
Hydraulic control, direct operated, DG



Electrical two-position control, with switching solenoid, EZ



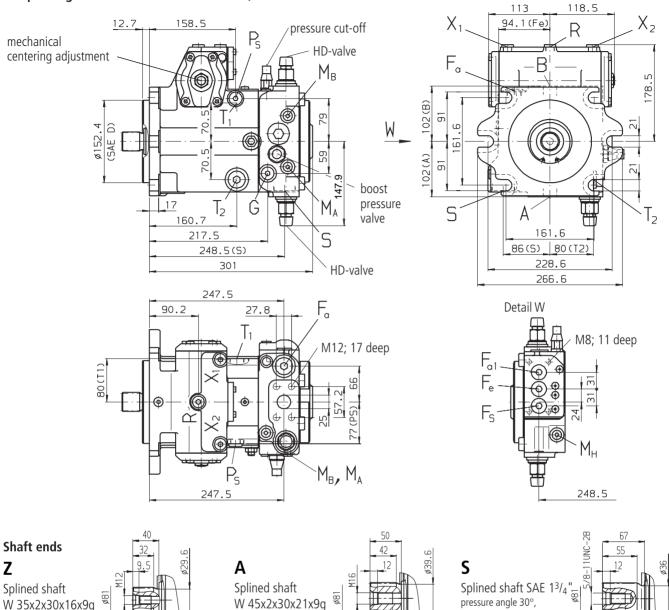
Electrical control, with proportional solenoid, EP



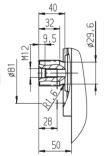
Unit Dimensions, Size 90

Before finalising your design, please request a certified drawing.

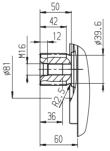
Pump configuration without control module, NV



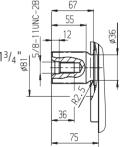
Splined shaft W 35x2x30x16x9q DIN 5480



DIN 5480



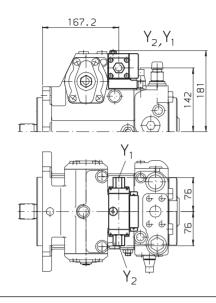
pressure angle 30°, 13 teeth, 8/16 pitch, flat root side fit, tolerance class 5 ANSI B92.1a-1976



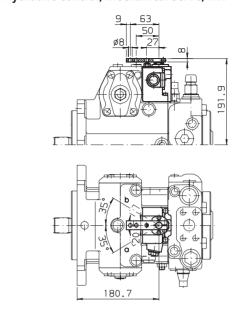
Connections

A, B	Service line ports SAE 1", high pressure series	420 bar (6000 psi)
T_1	Case drain or filling port	M26x1,5; 16 deep
T_2	Case drain	M26x1,5; 16 deep
M_A , M_B	Pressure gauge - operating pressure A, B	M12x1,5; 12 deep
R	Air bleed	M16x1,5; 12 deep
S	Boost suction port	M42x2; 20 deep
X_1, X_2	Control pressure ports (before the orifice)	M16x1,5; 12 deep
G	Pressure port for auxiliary circuit	M18x1,5; 12 deep
P_{S}	Control pressure supply	M18x1,5; 12 deep
F_a	Filter outlet	M26x1,5; 16 deep
F_{a1}	Filter outlet (filter assembly)	M22x1,5; 14 deep
F_{e}	Filter inlet	M22x1,5; 14 deep
F_{S}	Port from filter to suction line (cold start)	M22x1,5; 14 deep
M_{H}	Port for balanced high pressure	M12x1,5; 12 deep
Y ₁ , Y ₂	Remote control ports (only for HD control)	M14x1,5; 12 deep

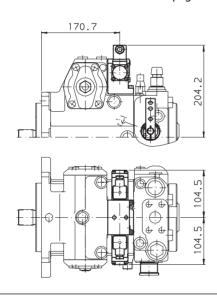
Hydraulic control, pilot pressure related, HD



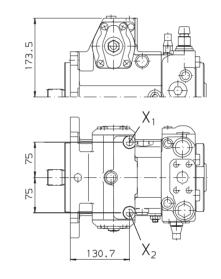
Hydraulic control, mechanical servo, HW



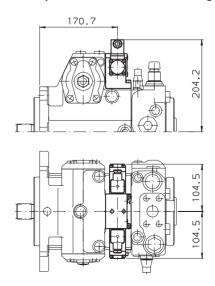
Hydraulic control, speed related, DA (dimensions of the DA control valve see pages 32, 33)



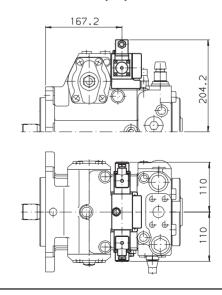
Hydraulic control, direct operated, DG



Electrical two-position control, with switching solenoid, EZ



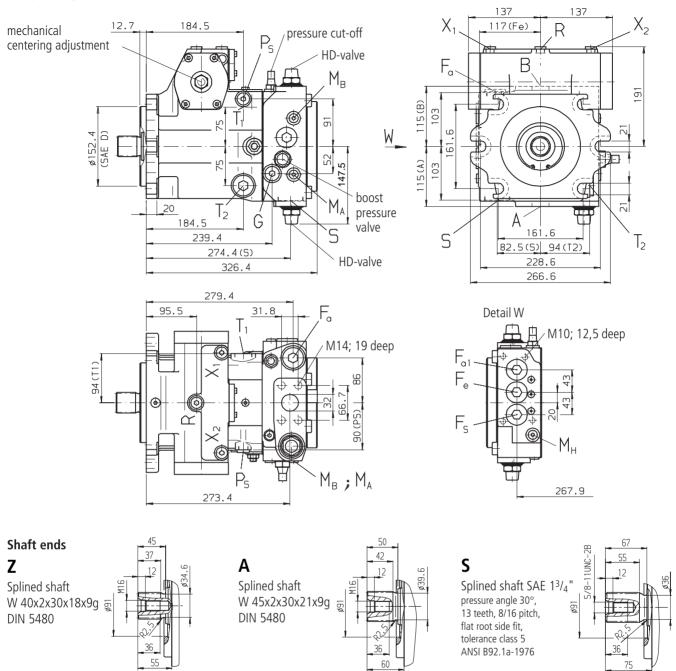
Electrical control, with proportional solenoid, EP



Unit Dimensions, Size 125

Before finalising your design, please request a certified drawing.

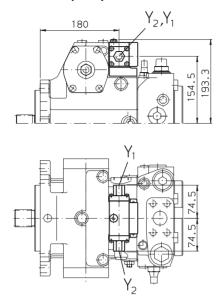
Pump configuration without control module, NV



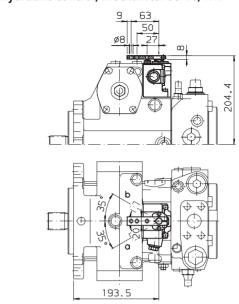
Connections

A, B	Service line ports SAE 11/4", high pressure ser	ies 420 bar (6000 psi)		
T_1	Case drain or filling port	M33x2; 18 deep	-	m . 80 .
T_2	Case drain	M33x2; 18 deep	ı	66 12
M_A , M_B	Pressure gauge - operating pressure A, B	M12x1,5; 12 deep	Splined shaft SAE 2"	
R	Air bleed	M16x1,5; 12 deep	pressure angle 30°,	842
S	Boost suction port	M48x2; 22 deep	15 teeth, 8/16 pitch, flat root side fit,	
X_1, X_2	Control pressure ports (before the orifice)	M16x1,5; 12 deep	tolerance class 5	
G	Pressure port for auxiliary circuit	M22x1,5; 14 deep	ANSI B92.1a-1976	
P_S	Control pressure supply	M18x1,5; 12 deep		36
F_a	Filter outlet	M33x2; 18 deep		88
F_{a1}	Filter outlet (filter assembly)	M33x2; 18 deep		
F_{e}	Filter inlet	M33x2; 18 deep		
F_S	Port from filter to suction line (cold start)	M33x2; 18 deep		
M_H	Port for balanced high pressure	M12x1,5; 12 deep		
Y_1, Y_2	Remote control ports (only for HD control)	M14x1,5; 12 deep		

Hydraulic control, pilot pressure related, HD

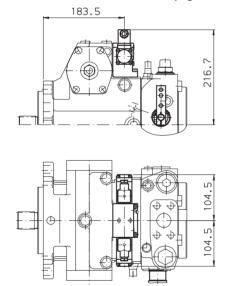


Hydraulic control, mechanical servo, HW

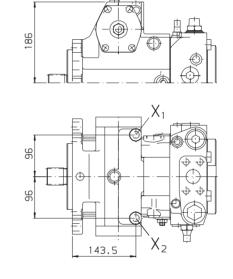


Hydraulic control, speed related, DA

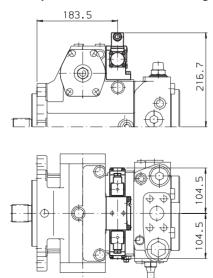
(dimensions of the DA control valve see pages 32, 33)



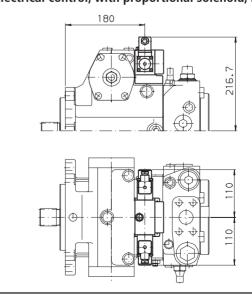
Hydraulic control, direct operated, DG



Electrical two-position control, with switching solenoid, EZ



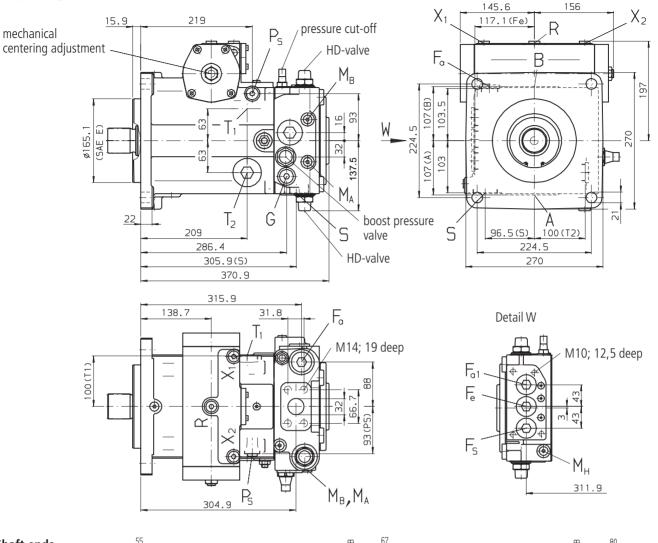
Electrical control, with proportional solenoid, EP



Unit Dimensions, Size 180

Before finalising your design, please request a certified drawing.

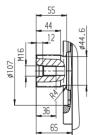
Pump configuration without control module, NV



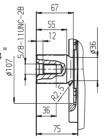
Shaft ends

Z

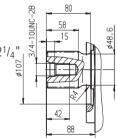
Splined shaft W 50x2x30x24x9g DIN 5480



Splined shaft SAE 1³/₄ pressure angle 30°, 13 teeth, 8/16 pitch, flat root side fit, tolerance class 5 ANSI B92.1a-1976



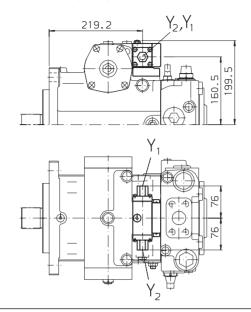
Splined shaft SAE 2¹/₄" pressure angle 30°, 17 teeth, 8/16 pitch, flat root side fit, tolerance class 5
ANSI B92.1a-1976



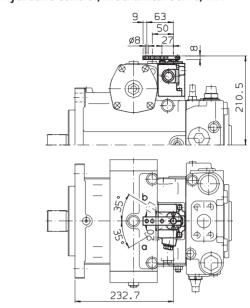
Connections

A, B	Service line ports SAE $1^{1}/_{4}^{-}$, high pressure seri	es 420 bar (6000 psi)
T_1	Case drain or filling port	M42x2; 20 deep
T_2	Case drain	M42x2; 20 deep
M_A , M_B	Pressure gauge - operating pressure A, B	M12x1,5; 12 deep
R	Air bleed	M16x1,5; 12 deep
S	Boost suction port	M48x2; 22 deep
X_1, X_2	Control pressure ports (before the orifice)	M16x1,5; 12 deep
G	Pressure port for auxiliary circuit	M22x1,5; 14 deep
P_{S}	Control pressure supply	M18x1,5; 12 deep
F_a	Filter outlet	M33x2; 18 deep
F_{a1}	Filter outlet (filter assembly)	M33x2; 18 deep
F_{e}	Filter inlet	M33x2; 18 deep
F_S	Port from filter to suction line (cold start)	M33x2; 18 deep
M_{H}	Port for balanced high pressure	M12x1,5; 12 deep
Y ₁ , Y ₂	Remote control ports (only for HD control)	M14x1,5; 12 deep

Hydraulic control, pilot pressure related, HD

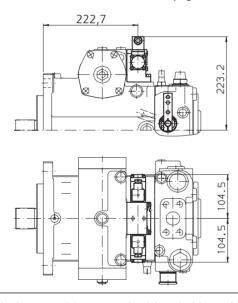


Hydraulic control, mechanical servo, HW

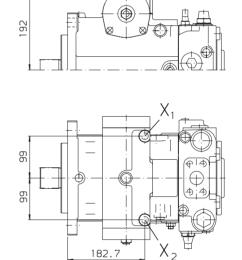


Hydraulic control, speed related, DA

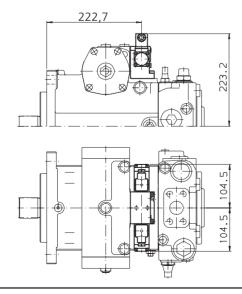
(dimensions of the DA control valve see pages 32, 33)



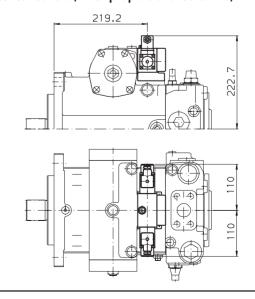
Hydraulic control, direct operated, DG



Electrical two-position control, with switching solenoid, EZ



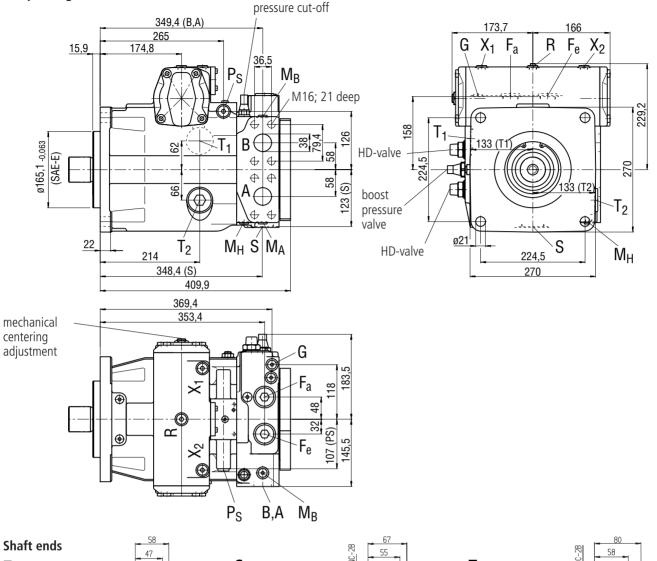
Electrical control, with proportional solenoid, EP

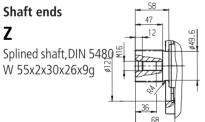


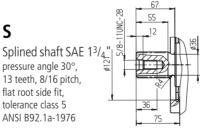
Unit Dimensions, Size 250

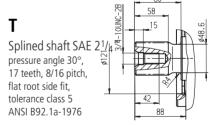
Before finalising your design, please request a certified drawing.

Pump configuration without control module, NV





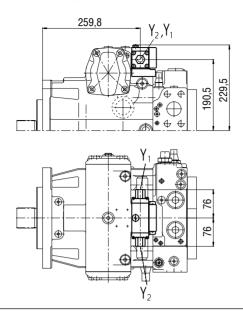




Connections

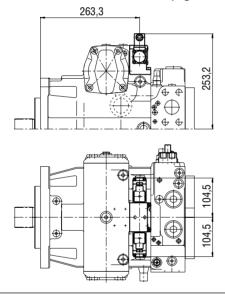
A, B	Service line ports SAE $1^{1}/_{2}$ ", high pressure s	series 420 bar (6000 psi)
T_1	Case drain or filling port	M42x2; 20 deep
T_2	Case drain	M42x2; 20 deep
M_A , M_B	Pressure gauge - operating pressure A/B	M14x1,5; 12 deep
R	Air bleed	M16x1,5; 12 deep
S	Boost suction port	M48x2; 22 deep
X_1, X_2	Control pressure ports (before the orifice)	M16x1,5; 12 deep
G	Pressure port for auxiliary circuit	M14x1,5; 12 deep
P_S	Control pressure supply	M18x1,5; 12 deep
F_a	Filter outlet	M33x2; 18 deep
F _e	Filter inlet	M33x2; 18 deep
M_{H}	Port for balanced high pressure	M14x1,5; 12 deep
Y_1, Y_2	Remote control ports (only for HD control)	M14x1,5; 12 deep

Hydraulic control, pilot pressure related, HD



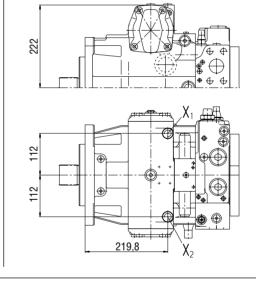
Hydraulic control, speed related, DA

(dimensions of the DA control valve see pages 33, 34)

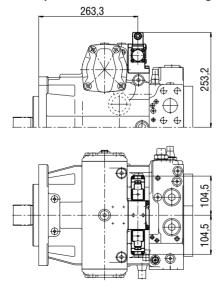


Hydraulic control, direct operated, DG

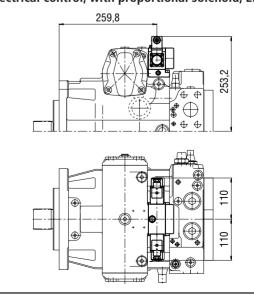
273,4



Electrical two-position control, with switching solenoid, EZ

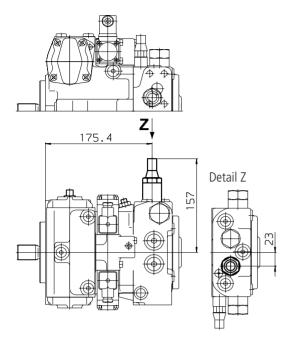


Electrical control, with proportional solenoid, EP

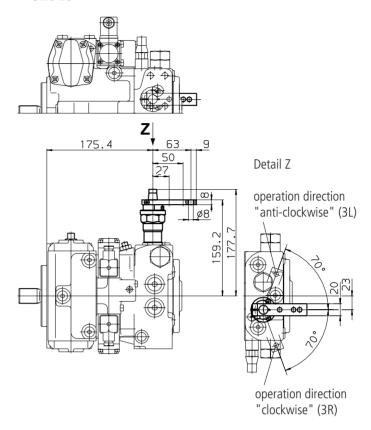


Unit Dimensions DA Control Valves

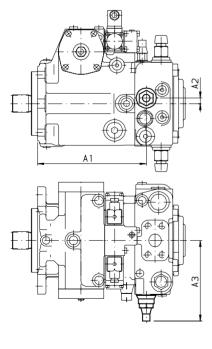
DA control valves, fixed setting, (2) Size 28



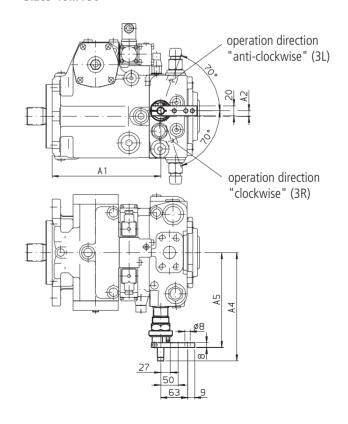
DA control valves, mech. adjustable with lever, (3) Size 28



DA control valves, fixed setting, (2) Sizes 40...180



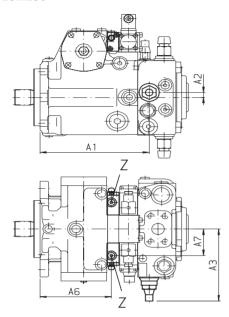
DA control valves, mech. adjustable with lever, (3) Sizes 40...180



DA control valve, fixed setting and hydraulic inch valve built-on (only for pumps with DA control device), (4/8)

Z pilot pressure port M10x1; 8 deep (plugged by supplier on delivery)

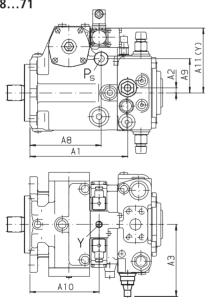
Sizes 28...250



DA control valve, fixed setting and connections for master controller, (7)

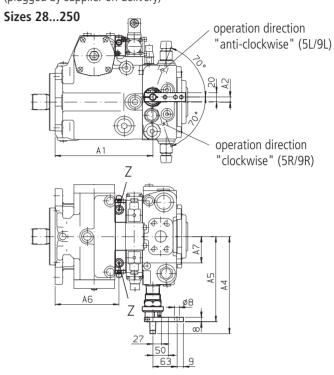
(order master controller separately)
P_S and Y pilot pressure ports for master controller

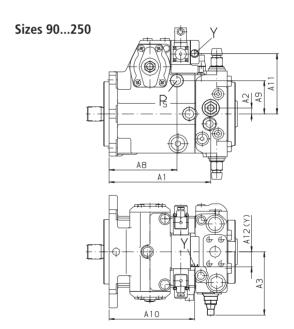
Sizes 28...71



DA control valve, mechanically adjustable with lever and built-on hydraulic inch valve, (only for pumps with DA control device), (5/9)

Z pilot pressure port M10x1; 8 deep (plugged by supplier on delivery)

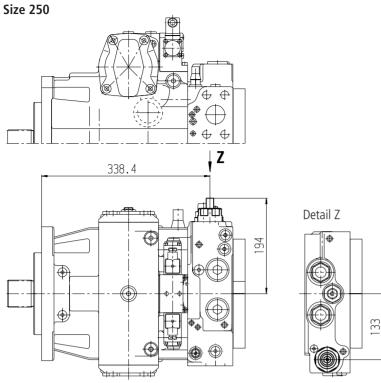




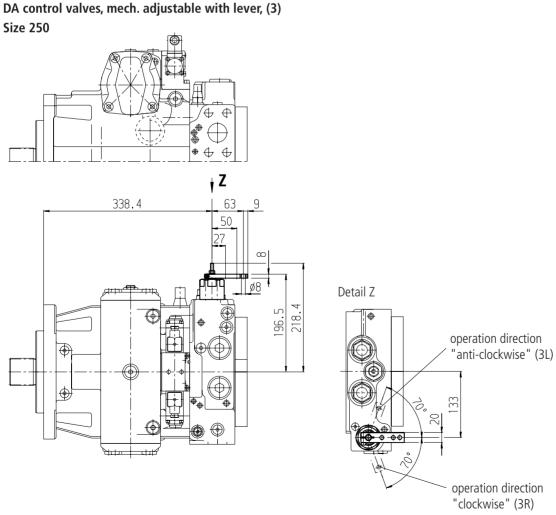
Size	A1	A2	А3	A4	A5	A6	Α7	A8	Α9	A10	A11	A12	Υ
28	Variatio	n 2 and 1	3, dimensi	ions see p	age 32	90,9	59	111,5	67	93,9	119,6	_	M14x1,5; 12 deep
40	181,7	23	157	177,7	159,2	88,9	59	125	67	91,9	119,6	_	M14x1,5; 12 deep
56	197,4	24,5	149,5	172	153,5	97,8	59	129,5	76	100,8	132,1	_	M14x1,5; 12 deep
71	215,5	11	160	197	170	141	59	157,3	76	144,8	143,5	_	M14x1,5; 12 deep
90	237,5	14	145,5	182,5	154,5	185,6	66,5	159	79	201,6	122,5	48,5	M14x1,5; 12 deep
125	266,9	17	163,5	181	162,5	198,5	66,5	184,5	91	214,5	135	48,5	M14x1,5; 12 deep
180	292,9	16	164,5	187,5	169	237,7	66,5	219	93	253,7	141	48,5	M14x1,5; 12 deep
250	Variatio	Variation 2 and 3, dimensions see page 34											

Unit Dimensions DA Control Valves

DA control valves, fixed setting, (2)

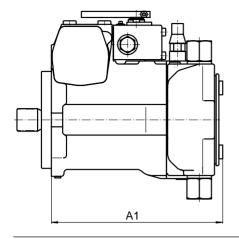


DA control valves, mech. adjustable with lever, (3)



Dimensions for Through Drives

Without auxiliary pump, without through drive, (N00)

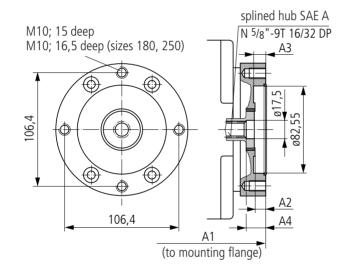


Size	A1
28	213,9
40	220,2
56	239,4
71	279,1
90	287
125	320,9
180	370,9
250	398,2

With auxiliary pump, without through drive, (F00)

standard model, see unit dimensions pages 16...31

Through drive SAE A (F01/K01)

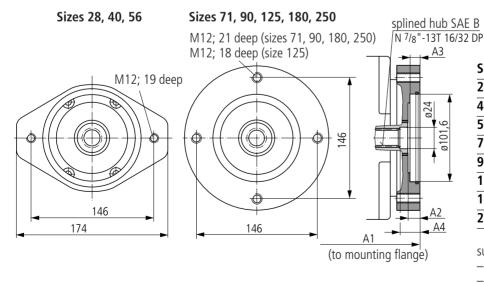


Size	A1 (F01)	A1 (K01)	A2	А3	Α4
28	227,9	227,9	7,5	7,5	
40	239,7	234,2	9	10	18
56	261,4	254,9	10	11	19
71	297,6	297,6	9	10	17
90	304	304	9	8	
125	330,9	330,9	10,5	9	
180	378,4	378,4	7,5	7,5	15,5
250	426,9		11	11	18

suitable for connection of:

- gear pump G2 (RE 10030)
- variable pump A10VSO10 (RE 92713)
- variable pump A10VSO18 (RE 92712)

Through drive SAE B (F02/K02)

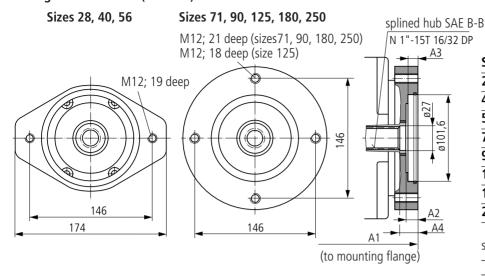


Size	A1	A2	А3	A4
28	230,4	9,7	9,7	
40	240,7	11	11	17
56	262,4	12	11	19,5
71	300,6	13	9,8	17
90	305	9	11	17
125	330,9	10	11	17
180	381,4	11	11	19
250	428,9	11	11	16

suitable for connection of:

- gear pump G3 (RE 10038)– gear pump G4 (RE 10042)
- variable pump A10VG18 (RE 92750)
- variable pump A10VO28 (RE 92701/ RE 92703)

Through drive SAE B-B (F04/K04)

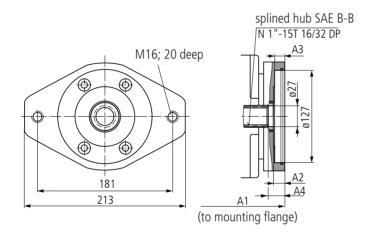


Size	A1	A2	A3	A4
28	230,4	9,7	9,7	
40	240,7	11	9,7	16
56	262,4	13	11	18,5
71	300,6	13	9,8	15,5
90	305	9	11	15
125	330,9	10	11	16,5
180	381,4	11	11	18
250	428,9	11	11	15,5

suitable for connection of:

- variable pump A4VG28
- variable pump A10VG28 (RE 92750)
- variable pump A10VG45 (RE 92750)
- variable pump A10VO45 (RE 92701/ RE 92703)
- variable pump A11VO40 (RE 92500)

Through drive: flange SAE C, 2-hole; hub SAE B-B (F09/K09)

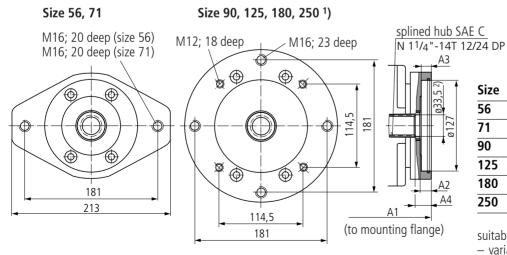


Size	A1	A2	A3	A4	
40	244,7	11	11		

suitable for connection of:

- variable pump A4VG40

Through drive SAE C (F07/K07)



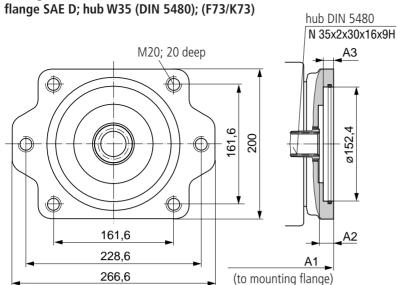
Size	A1	A2	A3	A4
56	266,4	15	14	
71	303,6	16	13,5	20
90	309	13	14	20,5
125	335,9	15	15,5	22,5
180	384,4	14	14	19
250	425,9	11	11	16

suitable for connection of:

- variable pump A4VG40
- variable pump A4VG56
- variable pump A4VG71
- variable pump A10VO71 (RE 92701)
- variable pump A11VO60 (RE 92500)

- 1) size 180 only with SAE 2-hole flange
- 2) size 56: ø32,7

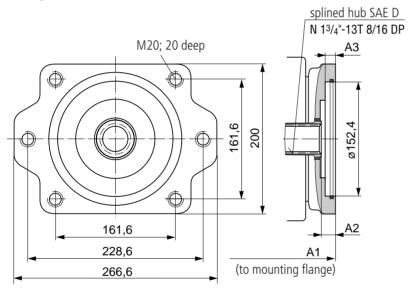
Through drive:



Size	A1	A2	A3	
90	309	12	14	

suitable for connection of: - variable pump A4VG90

Through drive SAE D (F69/K69)

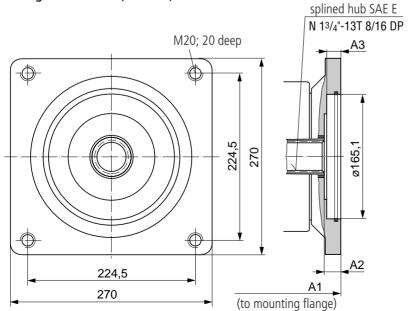


Size	A1	A2	А3	
125	343,9	18	14	
180	391,9	20,9	18	
250	444,9		17	

suitable for connection of:

- variable pump A4VG90
- variable pump A4VG125
- variable pump A10VO140 (RE 92701)
- variable pump A11VO95 (RE 92500) variable pump A11VO130 (RE 92500)

Through drive SAE E (F72/K72)



Size	A1	A2	А3	
180	391,9	20,9	18	
250	444,9		17	

suitable for connection of:

- variable pump A4VG180
- variable pump A4VG250
- variable pump A11VO190 (RE 92500)
- variable pump A11VO260 (RE 92500)

Permissible Input and Through Drive Rotation Torques

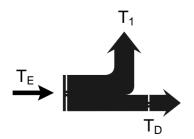
Size				28	40	56	71
Corner torque	e (when V_{gmax} a. $\Delta p = 400$ b	ar) ¹)	T _{max}	Nm	178	254	356 451
Max. perm. t	hrough drive rotation torque	T _{D perm.}	Nm	231	314	521	660
Max. permiss	sible input torque ²)						
	at shaft end Z (DIN 5480)	$T_{E \text{ perm.}}$	Nm	352 (W25x1,25x30x18x9g)	522 (W30x2x30x14x9g)	522 (W30x2x30x14x9g)	912 (W35x2x30x16x9g)
	at shaft end A (DIN 5480)	T _{E perm.}	Nm	-	912 (W35x2x30x16x9g)	912 (W35x2x30x16x9g)	1460 (W40x2x30x18x9g)
	at shaft end S SAE (ANSI B92.1a-1976)	T _{E perm.}	Nm	314 (SAE B-B) (W1"-15T 16/32DP)	602 (SAE C) (W1 ¹ / ₄ "-14T 12/24DP)	602 (SAE C) (W1 ¹ / ₄ "-14T 12/24DP)	602 (SAE C) (W1 ¹ / ₄ "-14T 12/24DP)
	at shaft end T SAE (ANSI B92.1a-1976)	T _{E perm.}	Nm	-	_	970 (W1 ³ / ₈ "-21T 16/32DP)	970 (W1 ³ / ₈ "-21T 16/32DP)
	at shaft end U ³) SAE (ANSI B92.1a-1976)	T _{E perm.}	Nm	-	314 (SAE B-B) (W1"-15T 16/32DP)	-	-
	,				,		
Size	,			90	125	180	250
	e (when V_{gmax} a. $\Delta p = 400 \text{ b}$	ar) ¹)	T _{max}	90 Nm	•	180 795	250 1144 1590
Corner torque	· · ·				125		
Corner torque Max. perm. t	e (when V_{gmax} a. $\Delta p = 400$ b			Nm	125 572	795	1144 1590
Corner torque Max. perm. t	e (when V_{gmax} a. $\Delta p = 400$ b hrough drive rotation torque		Nm	Nm	125 572	795	1144 1590
Corner torque Max. perm. t	e (when V_{gmax} a. $\Delta p = 400$ b hrough drive rotation torque sible input torque ²)	T _{D perm.}	Nm	Nm 822	125 572 1110	795 1760	1144 1590 2230
Corner torque Max. perm. t	e (when V_{gmax} a. $\Delta p = 400$ b hrough drive rotation torque sible input torque ²) at shaft end Z	T _{D perm.}	Nm Nm	Nm 822 912	125 572 1110 1460	795 1760 3140 (W50x2x30x24x9g)	1144 1590 2230 4350
Corner torque Max. perm. t	e (when V_{gmax} a. $\Delta p = 400$ b hrough drive rotation torque sible input torque ²) at shaft end Z (DIN 5480) at shaft end A	$T_{D perm.}$ $T_{E perm.}$	Nm Nm	Nm 822 912 (W35x2x30x16x9g) 2190	125 572 1110 1460 (W40x2x30x18x9g) 2190	795 1760 3140 (W50x2x30x24x9g)	1144 1590 2230 4350 (W55x2x30x26x9g) — 1640 (SAE D)
Corner torque	e (when V_{gmax} a. $\Delta p = 400$ b hrough drive rotation torque sible input torque ²) at shaft end Z (DIN 5480) at shaft end A (DIN 5480) at shaft end S	$T_{D \text{ perm.}}$ $T_{E \text{ perm.}}$	Nm Nm Nm	Nm 822 912 (W35x2x30x16x9g) 2190 (W45x2x30x21x9g) 1640 (SAE D)	125 572 1110 1460 (W40x2x30x18x9g) 2190 (W45x2x30x21x9g) 1640 (SAE D)	795 1760 3140 (W50x2x30x24x9g) - 1640 (SAE D)	1144 1590 2230 4350 (W55x2x30x26x9g)

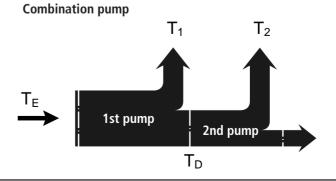
¹⁾ efficiency not taken into consideration

Code explanations

		max. permissible through drive torque max. permissible input torque at the drive shaft			in Nm in Nm
T ₁		take off torque at 1st pump	=	$\frac{1,59 \bullet V_{g1} \bullet \Delta p_1}{100 \bullet h_{mh}}$	in Nm
T ₂	=	take off torque at 2nd pump	=	$\frac{1,59 \bullet V_{g2} \bullet \Delta p_2}{100 \bullet h_{mh}}$	in Nm
V_{a1}	=	pump displacement per rev. 1st pump		in cm ³	
V_{g1} 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





²) drive shaft without side load

³⁾ shaft "U" is only permissible as the shaft end in the **2nd pump** of a combination pump of the same size

Combination Pumps

Combination pumps offer the facility of independent circuits without the need to fit splitter boxes.

When ordering combination pumps the model descriptions have to be connected by a "+" sign:

Code 1st pump (front pump)

+ Code 2nd pump (rear pump)

order example: A4VG56EP1D1/32R-PAC02F073S

+ A4VG56EP1D1/32R-P**S**C02F003S

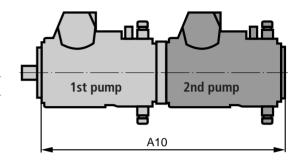
The series connection of two single pumps of the same size is permisssible without additional supports where the dynamic acceleration does not exceed 10 g (= $98,1 \text{ m/s}^2$).

We recommend the use of 4-hole connection flanges from size 71 onwards.

Combination pump of the same size

(2nd pump without through drive and with auxiliary pump, F00)

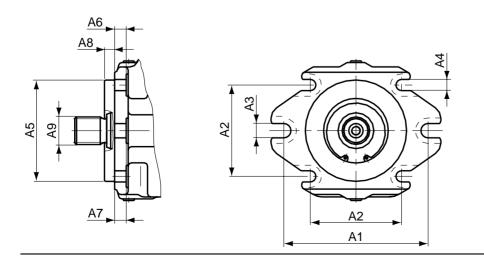
Size	28	40	56	71	90	125	180	250
A10	453,8	476,4	522,8	597,2	610,0	670,3	762,8	854,8



Mounting flange - shaft ends (of single and combination pumps)

											Combination pump of the same size		
										Single pump	1st pump		2nd pump
Size	Mount. flange	A1	A2	А3	A4	A5	A6	A7	A8	A9	A9	Through drive	A9
28	SAE B-B, 2-hole	146	_	15	-	ø101,6	-	15	9,5	Z (W25) S (SAE 1")	Z (W25) S (SAE 1")	F04/K04 F04/K04	S (SAE 1") S (SAE 1")
40	SAE C, 2-hole	181	-	18	_	ø127	_	15	12,7	Z (W30) S (SAE 1 ¹ / ₄ ")	A (W35) S (SAE 1 ¹ / ₄ ")	F09/K09 F09/K09	U (SAE 1") U (SAE 1")
56	SAE C, 2-hole	181	-	18	_	ø127	_	18	12,7	Z (W30) S (SAE 1 ¹ / ₄ ")	A (W35) T (SAE 1 ³ / ₈ ")	F07/K07 F07/K07	S (SAE 1 ¹ / ₄ ") S (SAE 1 ¹ / ₄ ")
71	SAE C, 2+4-hole	181	114,5	18	14,4	ø127	15	15	12,7	Z (W35) S (SAE 1 ¹ / ₄ ")	A (W40) T (SAE 1 ³ / ₈ ")	F07/K07 F07/K07	S (SAE 11/4") S (SAE 11/4")
90	SAE D, 2+4-hole	228,6	161,5	21	21	ø152,4	17	20	12,7	Z (W35) S (SAE 1 ³ / ₄ ")	A (W45) S (SAE 1 ³ / ₄ ")	F73/K73) F73/K73	Z (W35) Z (W35)
125	SAE D, 2+4-hole	228,6	161,6	21	21	ø152,4	20	20	12,7	Z (W40) S (SAE 1 ³ / ₄ ")	A (W45) T (SAE 2")	F69/K69 F69/K69	S (SAE 1 ³ / ₄ ") S (SAE 1 ³ / ₄ ")
180	SAE E, 4-hole	-	224,5	_	21	ø165,1	22	-	15,9	Z (W50) S (SAE 1 ³ / ₄ ")	Z (W50) T (SAE 2 ¹ / ₄ "	F72/K72) F72/K72	S (SAE 1 ³ / ₄ ") S (SAE 1 ³ / ₄ ")
250	SAE E, 4-hole	-	224,5	_	21	ø165,1	22	-	15,9	Z (W55) S (SAE 1 ³ / ₄ ")	Z (W55) T (SAE 2 1/4"	F72/K72) F72/K72	S (SAE 1 ³ / ₄ ") S (SAE 1 ³ / ₄ ")

Mounting flange

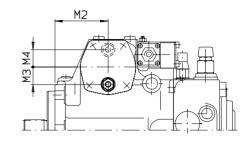


Mechanical Stroke Limiter, M

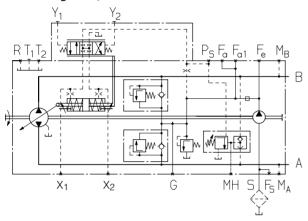
Adjustment screws to both $V_{g\ max}$ – values

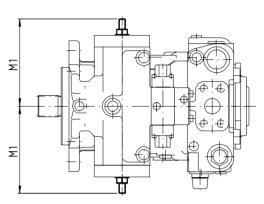
Dimensions

Size	M1		M2	M3	M4
28	110,6	max.	40,1	24	_
40	110,6	max.	38,1	24	_
56	130,5	max.	44	25,5	_
71	135,4	max.	86,3	_	28,5
90	147	max.	95,7	31,5	_
125	162	max.	104,5	_	35,5
180	181,6	max.	138,7	38	_
250	198,9	max.	174,8	39,5	_



Circuit diagram 1)

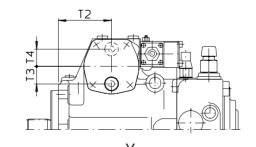




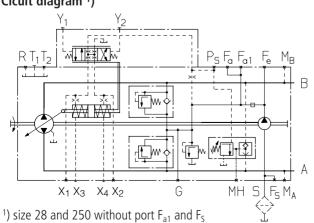
Ports X₃ and X₄ for Positioning Pressure, T

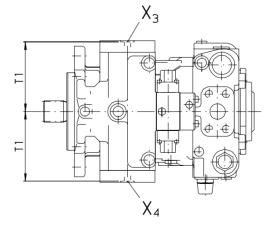
Dimensions

Size	T1	T2	T3	T4	X ₃ , X ₄	
28	92	40,1	_	24	M12x1,5	
40	92	38,1	_	24	M12x1,5	
56	104,5	44	_	25	M12x1,5	
71	113,5	86,3	28	_	M12x1,5	
90	111,5	95,7	_	30	M12x1,5	
125	136	104,5	34	_	M12x1,5	
180	146,5	138,7	_	35	M12x1,5	
250	164,5	174,8	_	38	M16x1,5	



Cicuit diagram 1)





Rotary Inch Valve

Permits the control pressure to be reduced independently of the drive speed controlled by the position of the inch lever. Maximum movement 90°. The lever my be fixed in any position.

The valve is mounted separately from the pump and connected with the pump by the hydraulic control line at port P_S ; (max. line length approximately 2 metres).

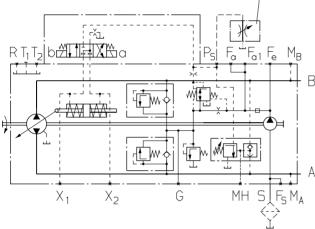
The rotary inch valve is to be ordered separately.

Size	Ordering code
28, 40, 56, 71, 90	438 553/470.05.31.01
125	438 554/470.05.31.02
180, 250	438 555/470.05.31.03

Please state your requirements in clear text: Inching, clockwise or anti-clockwise operation of the lever (This is determined on assembly).

Attention: The rotary inch valve can be use independently from the control device.

rotary inch valve (see ordering code)



Hydraulic control, speed related, DA with separately installed hydraulic inch valve

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. The installation situation depend upon the sizes and the spline.

Size 28 and 40 (with free turning):

Please observe diameter of the free turning.

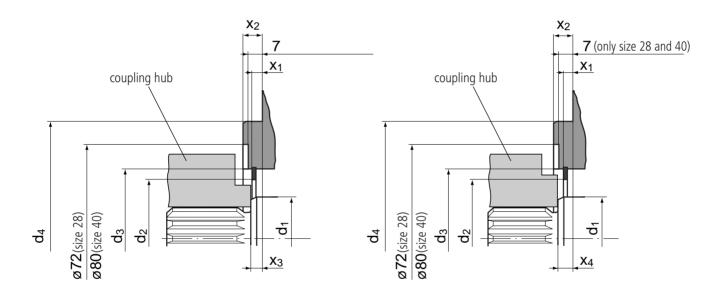
Size 56 to 250 (without free turning):

For *SAE spline* (shaft S or T) the outer diameter of the coupling hub must be smaller than the inner diameter of the circlip d_2 at the zone of the drive shaft collar (measure $x_2 - x_3$).

For *DIN spline* (shaft Z or A) the outer diameter of the coupling hub must be smaller than the housing diameter d_3 at the zone of the drive shaft collar (measure $x_2 - x_4$).

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

DIN spline (to DIN 5480)



Size	$\emptyset d_1$		ϕd_3		\mathbf{X}_{1}	X_2	X ₃	x_4
28	35	43,4	55 _{±0,1}	101,6	3,3+0,2	9,5 _{-0,5}		
40	40	51,4	63 _{±0,1}	127	4,3+0,2	12,7 _{-0,5}		
56	40	54,4	68 _{±0,1}	127	7,0+0,2	12,7 _{-0,5}		
71	45	66,5	81 _{±0,1}	127	7,0+0,2	12,7 _{-0,5}	8 +0,9	$10^{+0,9}_{-0,6}$
90	50	66,5	81 _{±0,1}	152,4	6,8+0,2	12,7 _{-0,5}		
125	55	76,3	91 _{±0,1}	152,4	7,0+0,2	12,7 _{-0,5}		
180	60	88	107 _{±0,1}	165,1	7,4+0,2	15,9-0,5		
250	75	104,6	121	165,1	6,3+0,2	15,9 _{-0,5}		

Preferred Types

AMVG28DA1D2/32R-NZC10F005S 2036417 AAVG71DA2D2/32R-NZF02F001S 2022720 AAVG28DA1D2/32R-NZC10F015S 2015607 AAVG71DA2D2/32R-NZF02F011S 2022722 AAVG28DA1D2/32R-NZC10F015S 2036419 AAVG71DA2D2/32R-NZF02F011S 2022529 AAVG28DA2D2/32R-NZC10F015S 2036419 AAVG71DA2D2/32R-NZF02F011S 2036478 AAVG28DA2D2/32R-NZC10F015S 2036421 AAVG71DG173ZR-NZF02F011S 2036478 AAVG28DG01/32R-NZF010F015S 2036423 AAVG71DG0173ZR-NZF02F011S 2036478 AAVG28DG01/32R-NZF010F015S 2036423 AAVG71DG0173ZR-NZF02F011S 2036480 AAVG28DG01/32R-NZF010F015S 2036425 AAVG71DG0173ZR-NZF02F011S 2022684 AAVG28DG02/32R-NZF010F015S 2036425 AAVG71DG0173ZR-NZF02F011S 2022084 AAVG28EP0173ZR-NZF010F005S 2036482 AAVG71DG0173ZR-NZF02F011S 2022085 AAVG28EP10173ZR-NZF010F015S 2036482 AAVG71DG0173ZR-NZF02F011S 2022085 AAVG28EP10173ZR-NZF010F015S 2036482 AAVG71DG0173ZR-NZF02F011S 2022085 AAVG28EP10173ZR-NZF010F015S 2036482 AAVG71EP20173ZR-NZF02F011S 2022625 AAVG28EP10173ZR-NZF010F015S 2036429 AAVG71EP20173ZR-NZF02F011S 2022625 AAVG28EP10173ZR-NZF010F015S 2036429 AAVG71EP20173ZR-NZF02F011S 2022625 AAVG28EP10173ZR-NZF010F015S 2036431 AAVG71EP20173ZR-NZF02F011S 2022664 AAVG28EP20173ZR-NZF010F015S 2036431 AAVG71EP20173ZR-NZF02F011S 2036488 AAVG28EP20173ZR-NZF010F015S 2036431 AAVG71EP20173ZR-NZF02F011S 2036688 AAVG28EP20173ZR-NZF010F015S 2036434 AAVG71EP20173ZR-NZF02F011S 2036688 AAVG28EP20173ZR-NZF010F015S 2036434 AAVG71EP20173ZR-NZF02F011S 2036688 AAVG28EP20173ZR-NZF010F015S 2036434 AAVG71EP20173ZR-NZF02F011S 2022661 AAVG28EP20173ZR-NZF010F015S 2036434 AAVG71EP20173ZR-NZF02F011S 2036688 AAVGGADA1D2/3ZR-NZF010F015S 2036434 AAVG71EP20173ZR-NZF02F011S 2036688 AAVGGADA1D2/3ZR-NZF02F015S 2036434 AAVG71EP20173ZR-NZF02F011S 2036688 AAVGGADA1D2/3ZR-NZF02F015S 2036434 AAVG71EP00173ZR-NZF02F011S 2036689 AAVGGADA1D2/3ZR-NZF02F0015S 2036434 AAVG71EP00173ZR-NZF02F011S 2036694 AAVGGADA2D2/3ZR-NZF02F0015S 2036440 AAVGGADA2D2/3ZR-NZF02F0015S 2036440 AAVGGADA2D2/3ZR-NZF02F0015S 2036440 AAVGGADA2D2/3ZR-NZF02F0015S 2036440 AAVGGADA2D2/3ZR-NZF02F0015S 2036440 AAVGGADA2D2/3ZR-NZF02F0015S 2036440 AAVGG	Туре	Ident-No.	Туре	Ident-No.
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Bei Bestellung bitte Typ und Ident-Nr. angeben.

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