RE 92 750/03.98

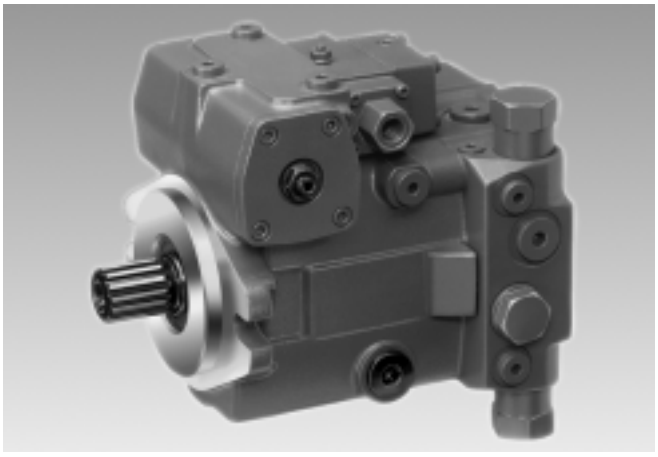
replaces: 12.95

engineering mannesmann Rexroth

Variable Displacement Pump A10VG

for closed circuits

Sizes 18...63
Series 1
Nominal pressure 300 bar
Peak pressure 350 bar



A10VG...HD

Index

Features

- variable displacement axial piston pump of swashplate design for hydrostatic closed circuit transmissions
- flow is proportional to drive speed and displacement and is infinitely variable
- output flow increases with swivel angle from 0 to its maximum value
- swivelling the pump over centre smoothly changes the direction of flow
- 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

Brueninghaus Hydromatik

Ordering Code / Standard Program

Hydraulic fluid

Mineral oil (no code)	

Axial piston unit

Variable swashplate design, nominal pressure 300 bar, peak pressure 350 bar	A10V

Operation

Pump in closed circuits	G

Size

≙ Displacement $V_{g\,max}$ in cm³	18	28	45	63

Control device

		18	28	45	63	
Mechanical pivot control	MD	●	–	–	–	MD
Hydraulic control, direct operated	DG	●	●	●	●	DG
Electrical control with proportional solenoid	EP	●	●	●	●	EP
Electrical two-position control with switching solenoid	EZ	●	●	●	●	EZ
Hydraulic control, mechanical servo	HW	●	●	●	●	HW
Hydraulic control, pilot pressure related	HD	●	●	●	●	HD
Hydraulic control, speed related	DA	–	●	●	●	DA

Solenoid voltage (only for EP, EZ or DA)

U = 12 V	●	●	●	●	1
U = 24 V	●	●	●	●	2

Pressure cut-off

without pressure cut-off (no code)	●	●	●	●	
with pressure cut-off (standard for version with DA-control valve)	–	●	●	●	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

Spring centering to neutral (only MD)

without spring centering to neutral (no code)	●	–	–	–	
with spring centering to neutral	●	–	–	–	N

DA control valve

		EZ	DG	EP	HW	HD	DA	28	45	63	
without DA control valve		●	●	●	●	●	–	●	●	●	1
with DA control valve, fixed setting		–	●	●	●	●	●	●	●	●	2
with DA control valve, mech. adjustable with control lever	L	–	●	●	●	●	●	●	●	●	3L
	R	–	●	●	●	●	●	●	●	●	3R
with DA control valve, fixed setting and hydraulic inch valve built-on, control with breaking fluid		–	–	–	–	–	●	●	●	●	4
with DA control valve, mech. adjustable with control lever and hydraulic inch valve built-on, control with breaking fluid	L	–	–	–	–	–	●	●	●	●	5L
	R	–	–	–	–	–	●	●	●	●	5R
with DA control valve, fixed setting and connections for master controller		–	●	●	●	●	●	●	●	●	7
with DA control valve, fixed setting and hydraulic inch valve built-on, control with mineral oil		–	–	–	–	–	–	●	●	●	8
with DA control valve, mech. adjustable with control lever and hydraulic inch valve built-on, control with mineral oil	L	–	–	–	–	–	–	●	●	●	9L
	R	–	–	–	–	–	–	●	●	●	9R

DA control valve with control lever

without control lever (no code)	
with control lever - anti-clockwise operation direction	L
with control lever - clockwise operation direction	R

Series

	1

Index

	0

A10V	G			/	1	0		–	N		C						

Axial piston unit

Operation

Size

Control device

Series

Index

Direction of rotation

		18	28	45	63	
viewed on shaft end	clockwise	●	●	●	●	R
	anti-clockwise	●	●	●	●	L

Seals

	18	28	45	63	
NBR, shaft seal in FPM (fluor-caoutchouc)	●	●	●	●	N

Shaft end (permissible input torque see page 23)

		18	28	45	63	
Splined shaft SAE	standard for single pump	●	●	●	●	S
	standard for combination pump	–	–	●	●	T

Mounting flange

SAE 2-hole	C

Service line connections

	18	28	45	63	
Ports A/B SAE (metric fixing screws), at side (same side)	–	●	●	●	10
Ports A/B threads metric, at side (same side)	●	–	–	–	16

Auxiliary pump and through drive

auxiliary pump	through drive *flange*	*hub*	18	28	45	63	
–	–	–	●	●	●	●	N00
●	–	–	●	●	●	●	F00
●	SAE A, 2-hole	SAE A ($^5/_8$" - 9T 16/32 DP)	●	●	●	●	F01
●	SAE B, 2-hole	SAE B ($^7/_8$" - 13T 16/32 DP)	●	●	●	●	F02
●	SAE B, 2-hole	SAE B-B (1" - 15T 16/32 DP)	–	●	●	●	F04
●	SAE C, 2-hole	SAE C ($1^1/_4$" - 14T 12/24 DP)	–	–	–	●	F07
–	SAE A, 2-hole	SAE A ($^5/_8$" - 9T 16/32 DP)	●	●	●	●	K01
–	SAE B, 2-hole	SAE B ($^7/_8$" - 13T 16/32 DP)	●	●	●	●	K02
–	SAE B, 2-hole	SAE B-B (1" - 15T 16/32 DP)	–	●	●	●	K04
–	SAE C, 2-hole	SAE C ($1^1/_4$" - 14T 12/24 DP)	–	–	–	●	K07

Valves (see page 7)

			18	28	45	63	
with high pressure relief valve, direct controlled, (fixed setting)	setting range 250 ... 340 bar,	without bypass	●	●	●	●	3
		with bypass	●[1]	●	●	●	5
	setting range 100 ... 250 bar,	without bypass	●	●	●	●	4
		with bypass	●	●	●	●	6

Filtration (see page 6)

	18	28	45	63	
Filtration in the suction line of the auxiliary (boost) pump	●	●	●	●	S
Filtration in the pressure line of the auxiliary (boost) pump ports for external boost circuit filter, (F_e and G (F_a)) [2]	–	●	●	●	D
External supply (model without integral auxiliary pump - N00, K..)	●	●	●	●	E

[1]) no preferred program at design with MD control (preferred: **3**, without bypass)

[2]) at size 28 and 45 not possible at design with DA control valve

● = available

– = not available

= preferred program (preferred types see page 24)

Technical Data

Fluid

We request that before starting a project 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 resistance 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 tem-perature) be selected from within the range:

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

referred to the circuit temperature (closed circuit).

Viscosity limits

The limiting values for viscosity are as follows:

ν_{min} = 5 mm²/s,

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

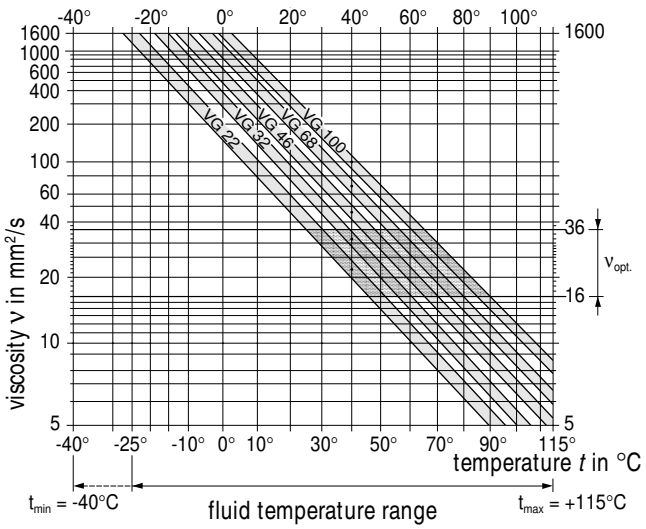
Please note that the max. fluid temperature is also not exceeded in certain areas (for instance bearing area).

ν_{max} = 1600 mm²/s,

short term on cold start (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 loop) in relation to the ambient temperature.

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

Example: At an ambient temperature of X°C the operating temperature is 60°C. Within the operating viscosity range (ν_{opt}; shaded area), this corresponds to viscosity ranges VG 46 or VG 68. VG 68 should be selected.

Important: The leakage oil (case drain oil) temperature is influenced by pressure and pump speed and is always higher than the 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

Installation position

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

For extensive information on the installation position, please read our data sheet RE 90270.

Operating pressure range - inlet

Variable pump (with external supply, E)

boost pressure p_{sp}: control device DA, DG _____ 25 bar
control device HD, HW, EP, EZ (n = 2000 rpm) ___ 18 bar

Auxiliary pump

suction pressure $p_{s\,min}$: $\nu \leq 30$ mm²/s _____ ≥ 0,8 bar abs.
for cold start _____ ≥ 0,5 bar abs.

Operating pressure range - outlet

Variable pump (pressure at ports A or B)

nominal pressure p_N _____ 300 bar
peak pressure p_{max} _____ 350 bar

Auxiliary pump

peak pressure $p_{H\,max}$ size 18 _____ 25 bar
peak pressure $p_{H\,max}$ sizes 28, 45, 63 _____ 40 bar
(pressure data to DIN 24312)

Case drain pressure

Permissible case drain pressure at ports T_1 or T_2

p_L _____ 4 bar abs.
short term (at start) _____ 6 bar abs.

Technical Data

Table of values (theoretical values, not considering η_{mh} and η_v; values rounded)

Size						18	28	45	63
Displacement		variable pump		$V_{g\,max}$	cm^3	18	28	46	63
		auxiliary pump		V_{gH}	cm^3	5,5	6,1	8,4	14,9
Speed		maximum		n_{max}	rpm	5000	4250	3800	3500
		minimum		n_{min}	rpm	500	500	500	500
Flow	at n_{max}	variable pump		$q_{V\,max}$	L/min	90	119	175	221
Power	at n_{max}	variable pump	Δp = 300 bar	P_{max}	kW	45	59	87	110
Torque	at $V_{g\,max}$	variable pump (without aux. pump)	Δp = 300 bar	T_{max}	Nm	86	134	219	301
			Δp = 100 bar	T	Nm	28,6	44,5	73	100
Moment of inertia (about drive axis)				J	kgm^2	0,00093	0,0017	0,0033	
Weight (standard model, without through drive)				m	kg (approx.)	14 (18) [1]	25	27	39

[1]) 14 kg: MD control, 18 kg: HD control

Calculation of size

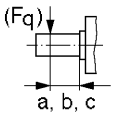
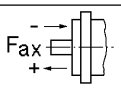
Flow $$q_V = \frac{V_g \bullet n \bullet \eta_v}{1000} \text{ in L/min}$$

Torque $$T = \frac{V_g \bullet \Delta p}{20 \bullet \pi \bullet \eta_{mh}} = \frac{1{,}59 \bullet V_g \bullet \Delta p}{100 \bullet \eta_{mh}} \text{ in Nm}$$

Power $$P = \frac{2\pi \bullet T \bullet n}{60\,000} = \frac{T \bullet n}{9549} = \frac{q_V \bullet \Delta p}{600 \bullet \eta_t} \text{ in kW}$$

V_g = displacement per revolution in cm^3
T = torque in Nm
Δp = pressure differential in bar
n = speed in rpm
η_v = volumetric efficiency
η_{mh} = mechanical-hydraulic efficiency
η_t = overall efficiency ($\eta_t = \eta_v \bullet \eta_{mh}$)

Input drive (permissible axial and radial loading on drive shaft)

Size					18	28	45	63
Distance of F_q (from shaft collar)		a	mm		16,5	17,5	17,5	17,5
		b	mm		29	30	30	30
		c	mm		41,5	42,5	42,5	42,5
max. permissible radial load at distance	a	$F_{q\,max}$	N		1300	2500	3600	5000
	b	$F_{q\,max}$	N		1000	2000	2891	4046
	c	$F_{q\,max}$	N		880	1700	2416	3398
max. permissible axial load		$\pm F_{ax\,max}$	N		973	987	1500	2200

Filtration

Before finalising your design, please request a certified drawing.

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 minimum purity grade of:

9 to NAS 1638
6 to SAE
18/15 to ISO/DIS 4406 is necessary.

In this case we recommend, depending on system and application

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

for the A10VG. With the rising differential pressure at the filter element the β-value must **not** decrease.

At very high temperatures of the hydraulic fluid (90°C to max. 115°C) at least cleanless class

8 to NAS 1638
5 to SAE
17/14 to ISO/DIS 4406 is necessary.

If above mentioned grades cannot be maintained please consult supplier.

Standard: Filtration in the suction line of the auxil. pump, S

Filter type: _____ Filter **without** bypass

Recommendation: _____ **with** contamination indicator

Through flow resistance at the filter element:
at ν = 30 mm²/s, n = n_{max} _____ $\Delta p \leq 0{,}1$ bar
at ν = 1000 mm²/s, n = 1000 rpm _____ $\Delta p \leq 0{,}3$ bar

Pressure at port S of the auxiliary pump:
at ν = 30 mm²/s _____ $p \geq 0{,}8$ bar
at cold start _____ $p \geq 0{,}5$ bar

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

Filter inlet _____ port F_e

Filter outlet (size 63) _____ port F_a
(size 28, 45) _____ port $G(F_a)$

Filter type: Filter with bypass are **not** recommended, when applying with bypass please consult supplier.

Recommendation: **with** contamination indicator

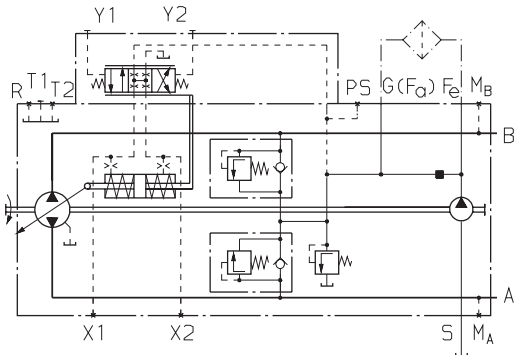
Resistance to flow at the filter element:
at ν = 30 mm²/s _____ $\Delta p \leq 1$ bar
at cold start _____ $\Delta p_{max} = 3$ bar

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

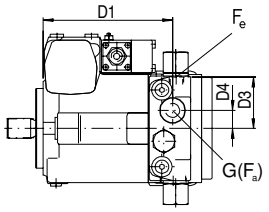
Please note:
- at size 28, 45 variation is not possible with DA control valve
- for type with DG control (with control pressure not from the supply circuit) the following filter type has to be used:

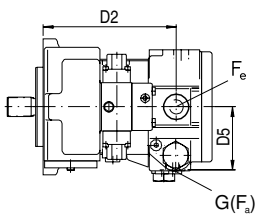
filter with bypass and with contamination indicator

Circuit diagram (pressure filtration)

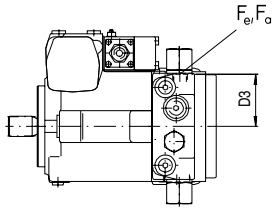


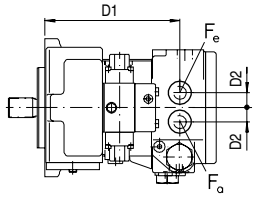
Size 28, 45





Size 63





Size	D1	D2	D3	D4	D5	F_e, F_a, G[1])
28	164,9	169,9	65,5	23	80,5	M18x1,5
45	178,6	180,6	71,5	23	83,5	M18x1,5
63	189,8	19,5	82,5	–	–	M18x1,5

[1]) For sizes 28 and 45 port G is used as the " Filter outlet F_a " . Pressure filtration is for sizes 28 and 45 not possible in conjunction with a DA control valve (see ordering code on page 3).

Variation: external supply, E

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

Boost pressure is via:

size 18 _____ port S
size 28, 45 (*without* DA control valve) _____ port G
size 28, 45 (*with* DA control valve) _____ port F_e
size 63 _____ port F_a

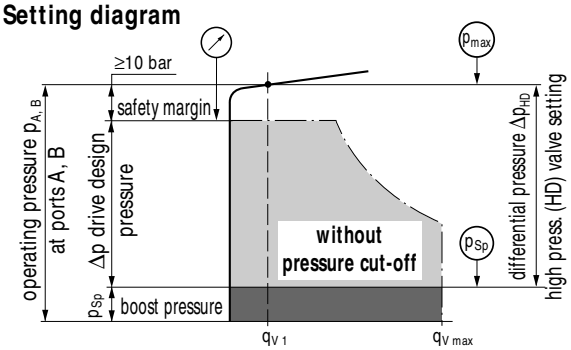
Port S is plugged on sizes 28, 45 and 63.

Filter arrangement: separately

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

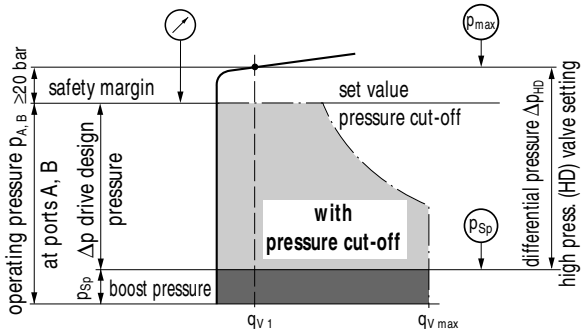
High Pressure Relief Valves

Setting diagram



Example (design *without* pressure cut-off):

operating pressure $p_{A,B}$ – boost pressure p_{sp} = differential pressure Δp_{HD}
300 bar – 20 bar = 280 bar



Example (design *with* pressure cut-off):

operating pressure $p_{A,B}$ – boost pressure p_{sp} + safety margin = differential pressure Δp_{HD}
300 bar – 20 bar + 20 bar = 300 bar

High pressure relief valve, direct controlled	Differential pressure setting Δp_{HD}	
Setting range Δp = 250... 340 bar (valve 3 and 5, see ordering code)	340 bar 320 bar 300 bar [1]	270 bar
Setting range Δp = 100... 250 bar (valve 4 and 6, see ordering code)	250 bar 230 bar 200 bar [1]	150 bar 100 bar

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

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: Δp_{HD} = ... bar
Opening pressure of the HD-valve (at $q_{V\,max}$): p_{max} = ... bar
($p_{max} = \Delta p_{HD} + p_{Sp}$)

High pressure relief valve B
Differential pressure setting: Δp_{HD} = ... bar
Opening pressure of the HD-valve (at $q_{V\,max}$): p_{max} = ... bar
($p_{max} = \Delta p_{HD} + p_{Sp}$)

Please note:
- valve setting is done at through flow quantity $q_{V\,1}$ = 6 - 10 L/min
- simplification: the bypass function is not shown in the hydraulic schemes

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 $V_g = 0$.

This valve prevents the operation of the high pressure relief valves when accelerating or decelerating quickly (quick pressure rise).

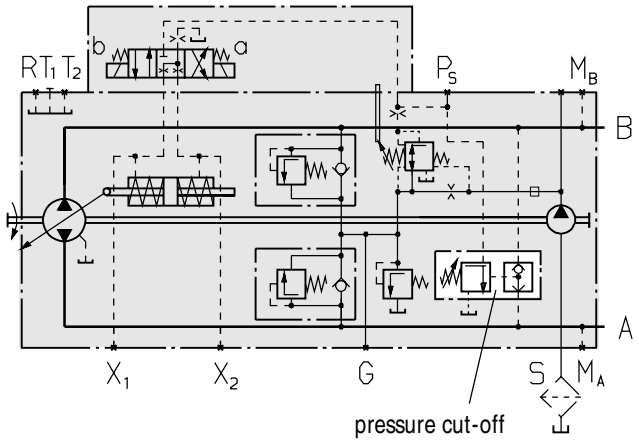
The pressure peaks occurring when the swashplate is swivelled rapidly and also the maximum pressure in the system are safeguarded by the high pressure limit valves.

The setting range of the pressure cut-off may be anywhere within the entire working pressure range. However, it must be set 20-30 bar lower than the setting of the high pressure safety relief valves (see diagram).

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

Circuit diagram

Hydraulic control, speed related, with pressure cut-off DA.D3



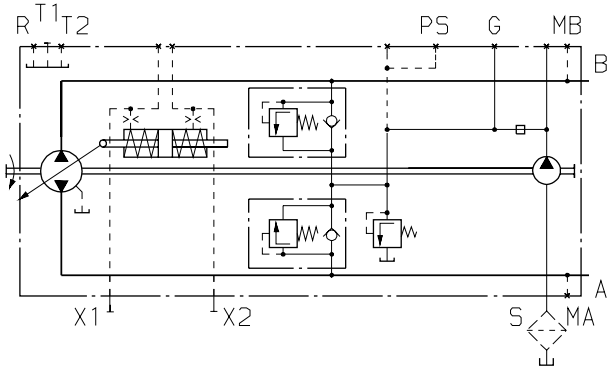
DG Hydraulic Control, Direct Operated

The pump swivels out to an oil flow between 0 and $V_{g\,max}$ by means of pressure load at the positioning chamber through control pressure at the ports X_1 or X_2. Each port determinate one direction of flow (see table below).

The oil flow value which results from a defined control pressure is under these conditions dependent from the speed and the operating pressure.

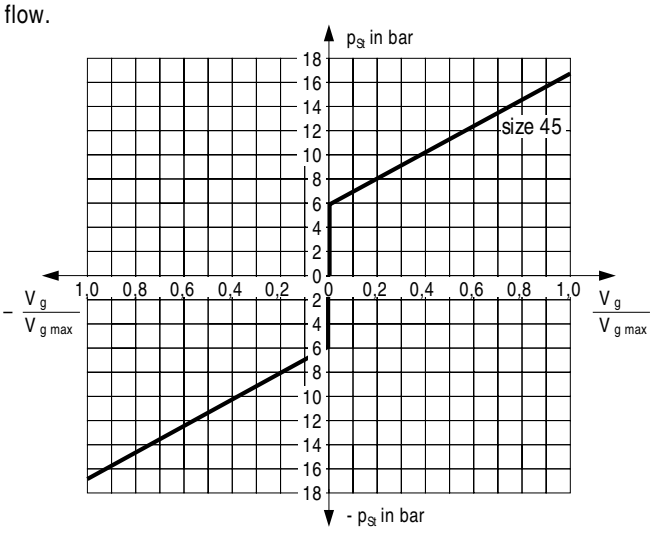
pilot pressure 0 bar ⟶ displacement $V_g = 0$

max. perm. control pressure: 40 bar



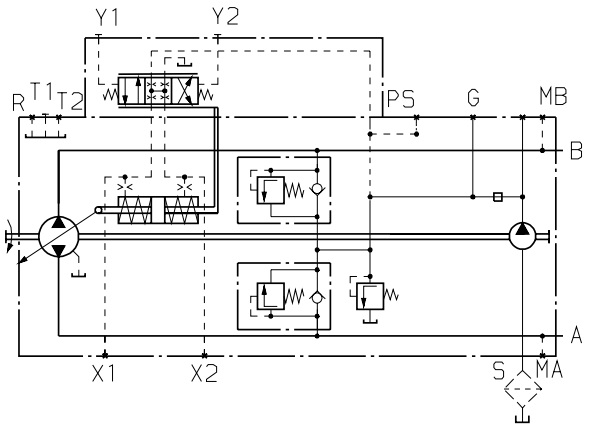
HD Hydraulic Control, Pilot Pressure Related

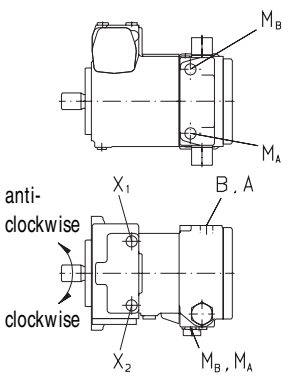
The positioning cylinder of the pump and therefore the swivel angle is varied in proportion to the difference in pilot pressure applied to the two control ports (Y_1 and Y_2). The pump displacement is therefore steplessly variable. One pilot line is assigned to each direction of flow.



HD control		size	18	28	45	63
Start of control ($V_{g\,0}$)	p_{St}	bar	6	6	6	6
End of control ($V_{g\,max}$)	p_{St}	bar	15,7	16	16,7	16,7

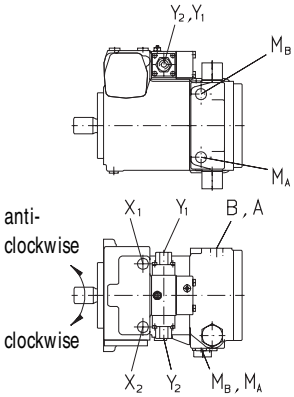
p_{St}: pilot pressure at ports Y_1, Y_2





Graph direction of rotation - Control - Direction of through flow

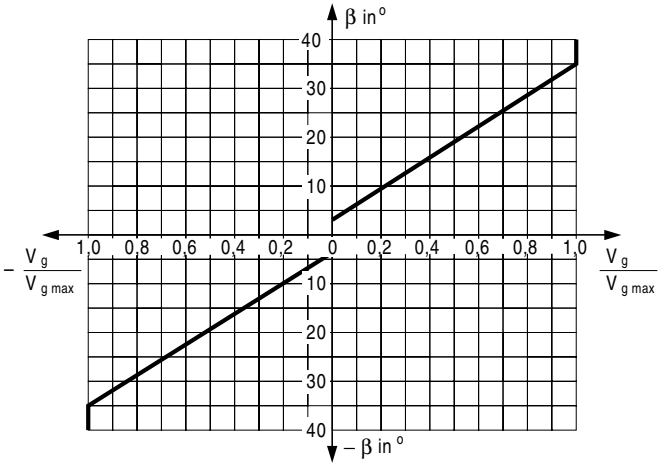
Direction of rotation		clockwise		anti-clockwise	
DG control	Control pressure	X_1	X_2	X_1	X_2
	Direction of flow	A to B	B to A	B to A	A to B
	Operating pressure	M_B	M_A	M_A	M_B
HD control	Pilot pressure	Y_1	Y_2	Y_1	Y_2
	Control pressure	X_1	X_2	X_1	X_2
	Direction of flow	A to B	B to A	B to A	A to B
	Operating pressure	M_B	M_A	M_A	M_B



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 for swivel from

0 to $\pm V_{g\,max}$: _____ $\pm \beta = 0$ to 35°

mechanical stop _____ at $\pm 40^\circ$

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).

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

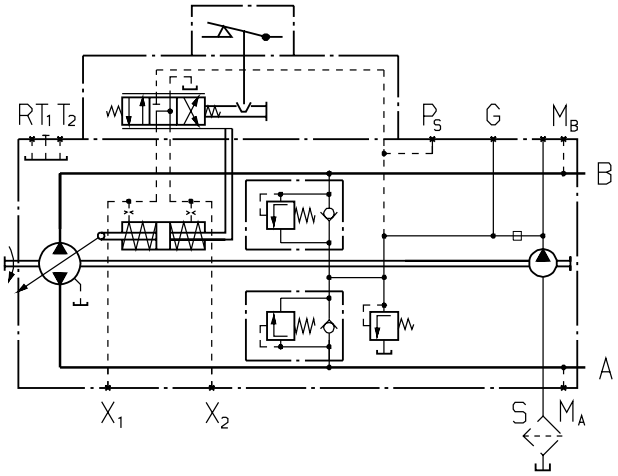
Variation: zero position switch, L

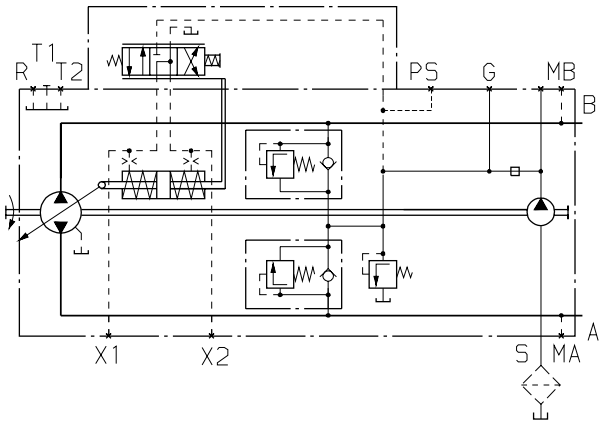
At zero position of the control lever the switch contact is closed. In case of start-on of the control lever from the center position the contact is interrupted.

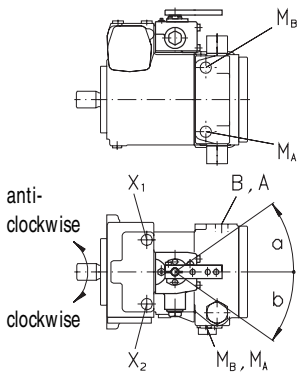
The zero position switch assures a safety function for drives which necessiate the zero position under certain conditions (for example start of the diesel engine).

Technical data (switch):

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

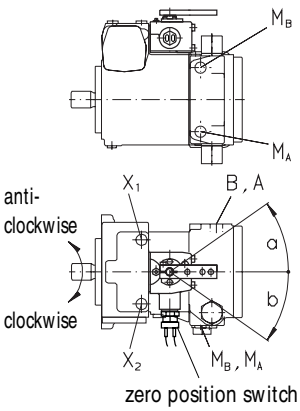






Graph direction of rotation - Control - Direction of through flow

Direction of rotation		clockwise		anti-clockwise	
HW control	Lever direction	b	a	b	a
	Control pressure	X_1	X_2	X_1	X_2
	Direction of flow	A to B	B to A	B to A	A to B
	Operating pressure	M_B	M_A	M_A	M_B



zero position switch

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.

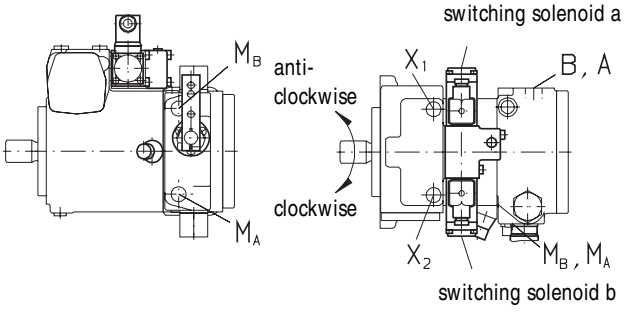
In an automative transmission, the DA control valve is used in conjunction with the directly controlled hydraulic "DA control".

However, pumps with HD, HW, EP or DG controls 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

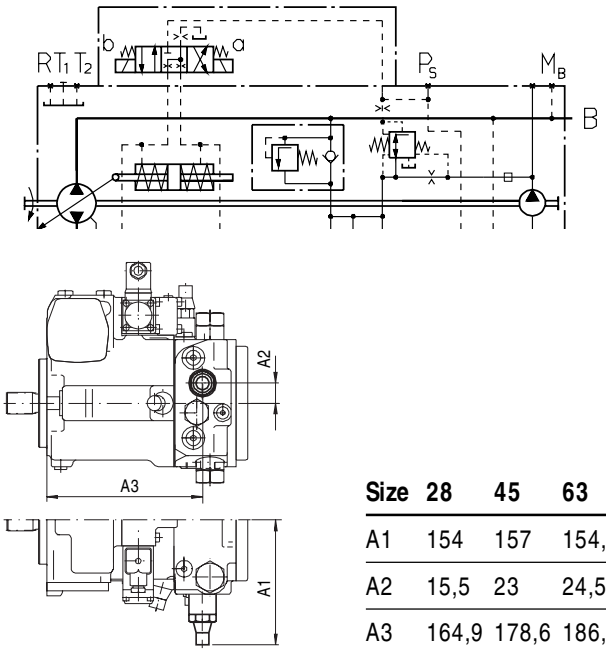
Direction of rotation	clockwise		anti-clockwise	
Solenoid	b	a	b	a
Control pressure	X_1	X_2	X_1	X_2
Direction of flow	A to B	B to A	B to A	A to B
Operating pressure	M_B	M_A	M_A	M_B



Function and Control of DA Valves

DA control valve, fixed setting, (DA..2)

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



Size	28	45	63
A1	154	157	154,5
A2	15,5	23	24,5
A3	164,9	178,6	186,3

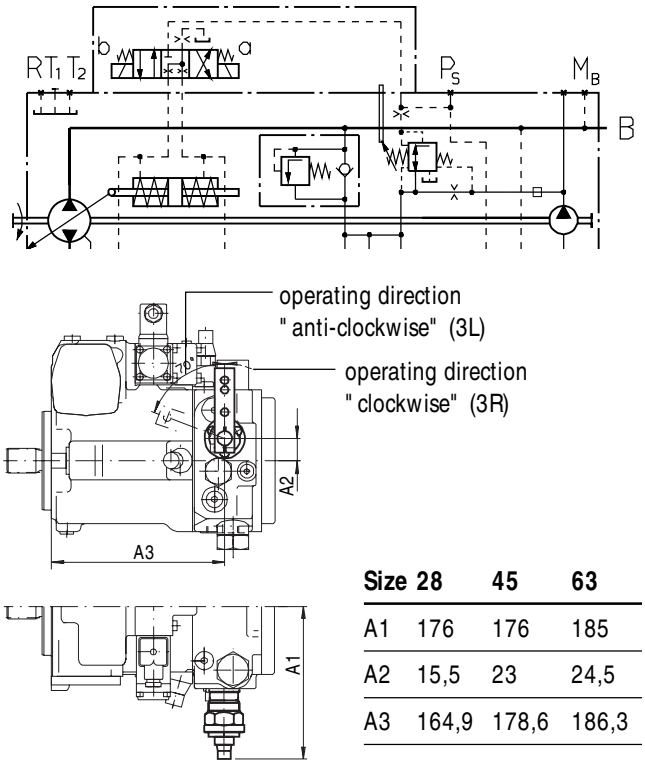
DA control valve, mechanically adjustable with control lever (DA..3)

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 Nm

Max. angle of lever operation 70°. The position of the lever is optional.



Size	28	45	63
A1	176	176	185
A2	15,5	23	24,5
A3	164,9	178,6	186,3

Function and control of DA valves

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

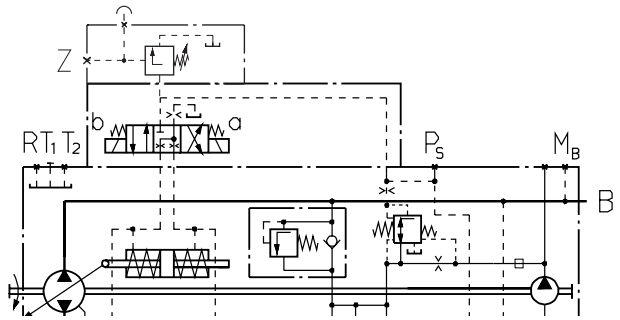
(only for pumps with DA control device)

- for inch function; for use in conjunction with DA control valve, fixed setting (4, 8) or mechanically adjustable (5, 9)

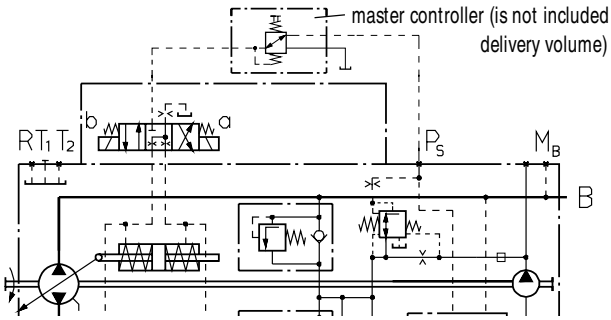
Permits the control pressure to be reduced independently of the drive speed via hydraulic control (port Z).

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.



DA control valve, fixed setting, Inching is via a separately allocated master controller (DA..7)



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).

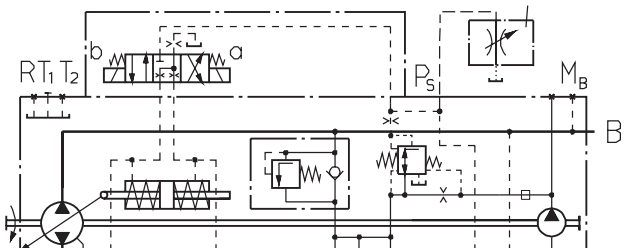
The rotary inch valve is to be ordered separately.

Ordering code: 438 553 / 470.05.31.01

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)

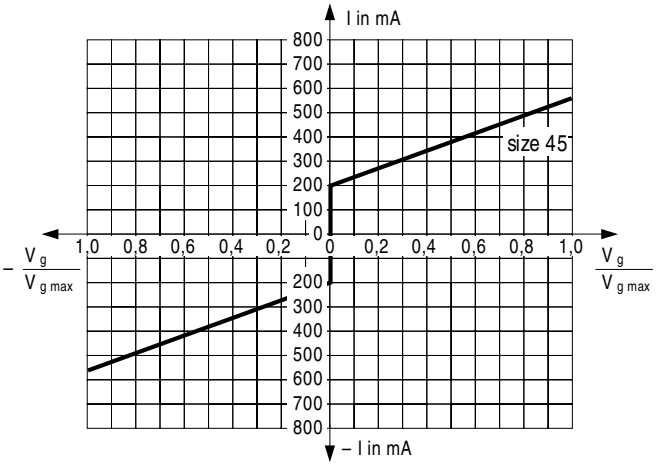


Extensive information is available from our mobile sales department. Please make use of an opportunity to confirm your transmission design through our computer program in BRUENINGHAUS HYDROMATIK. A DA-control can only be approved by BRUENINGHAUS HYDROMATIK.

EP Electrical Control with Proportional Solenoid

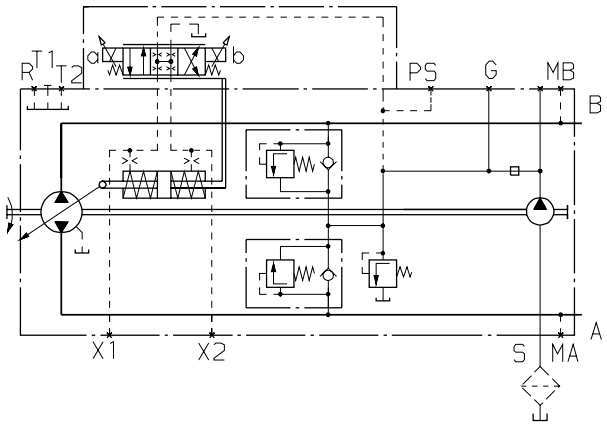
In relation to the preselected current, control pressure is applied to the positioning cylinder of the pump via two proportional solenoids on control device EP. The displacement of the pump is thus steplessly variable. One solenoid is assigned to each direction of flow.

Operating curve EP2



EP2 (24V DC)	**Size**	**18**	**28**	**45**	**63**
Start of control	mA	200	200	200	200
End of control	mA	525	530	560	560

EP1 (12V DC)	**Size**	**18**	**28**	**45**	**63**
Start of control	mA	400	400	400	400
End of control	mA	1050	1060	1115	1115



EZ Electrical Two-Position Control with Switching Solenoid

By energizing either solenoid a or b the swashplate and thus the displacement is switchable from $V_g = 0$ to $V_{g\,max}$.

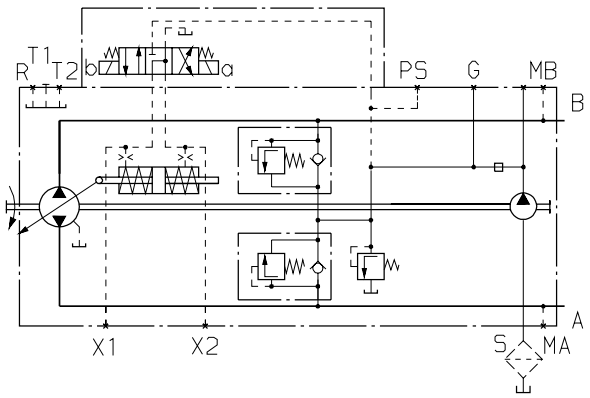
Each direction of flow is assigned to a solenoid.

solenoid de-energized — pump set to $V_g = 0$

solenoid energized — pump set to $V_{g\,max}$

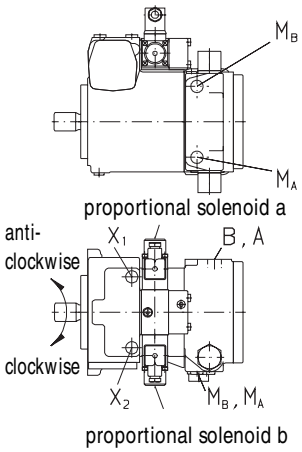
EZ1 switching solenoid 12 V, 26 W

EZ2 switching solenoid 24 V, 26W



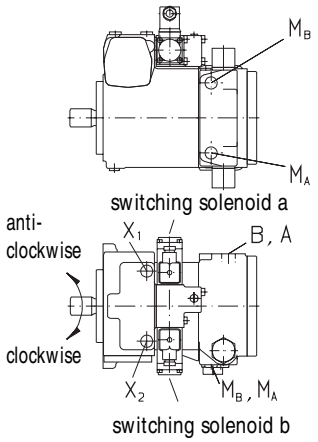
For control of the proportional solenoids (EP-control) are available:

proportional amplifier **PVR** or **PVRS** _____ (see RE 95022)
chopper amplifier **CV** _____ (see RE 95029)
electronic control for reversing drives **RVR** _____ (see RE 95031)
electronic control for reversing drives **CSD** _____ (see RE 95075)
closed loop control electronics **RVE** _____ (see RE 95033)
universal closed loop control electronics **RVU** ____ (see RE 95048)
microcontroller **MC** _____ (see RE 95050)



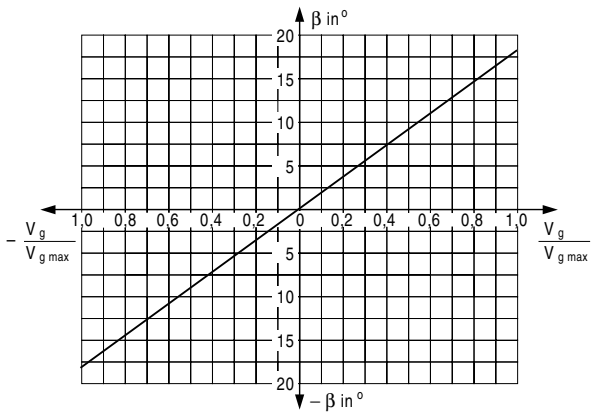
Graph direction of rotation - Control - Direction of through flow

Direction of rotation		clockwise		anti-clockwise	
EP control	Solenoid	a	b	a	b
	Control pressure	X_1	X_2	X_1	X_2
	Direction of flow	A to B	B to A	B to A	A to B
	Operating pressure	M_B	M_A	M_A	M_B
EZ control	Solenoid	b	a	b	a
	Control pressure	X_1	X_2	X_1	X_2
	Direction of flow	A to B	B to A	B to A	A to B
	Operating pressure	M_B	M_A	M_A	M_B



MD Mechanical Pivot Control

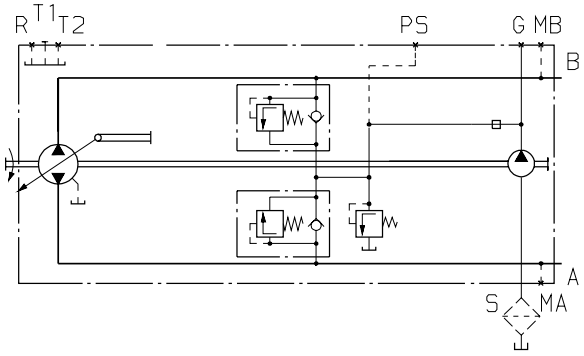
The swashplate angle is varied directly by the rotary movement of the pivot. The pump displacement is steplessly variable. Each direction of flow is assigned to one direction of rotation of the pivot.



Swivel angle at the pivot for swivel from

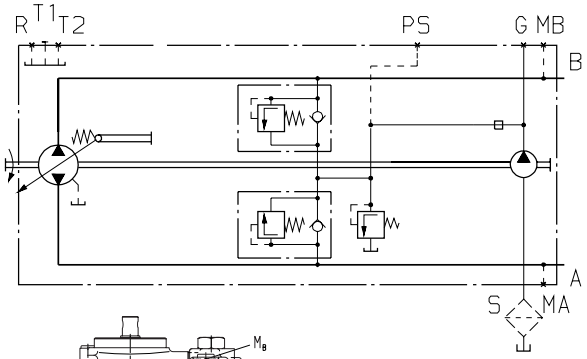
0 to $\pm V_{g\,max}$: _____ $\pm \beta$ = 0 to 18°12´

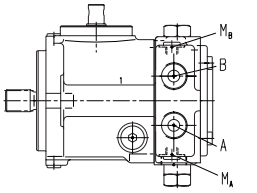
Max. adm. operating torque at the control lever: __ T_{max}= 30 Nm

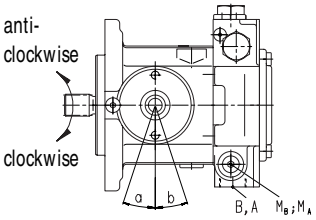


Spring centering to neutral (MDN)

The spring centering device automatically returns the unit to zero swivel angle position as soon as there is no adjustment torque present on the swivel pin.







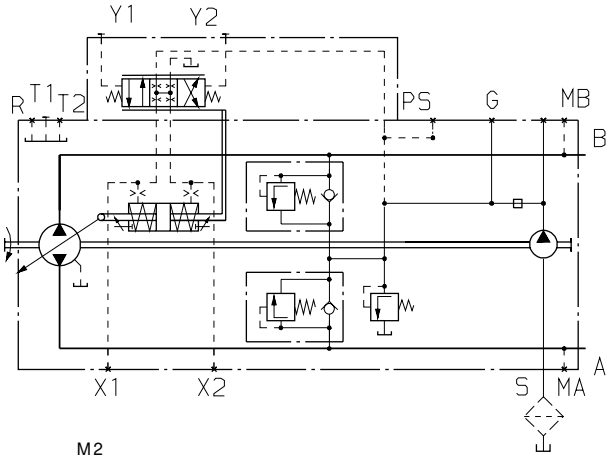
Graph direction of rotation - Control - Direction of through flow

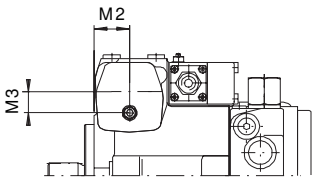
Direction of rotation		clockwise		anti-clockwise	
MD control	Lever direction	a	b	a	b
	Control pressure	X_2	X_1	X_2	X_1
	Direction of flow	B to A	A to B	A to B	B to A
	Operating pressure	M_A	M_B	M_B	M_A

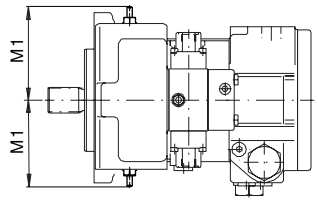
Mechanical Stroke Limiter, M

The mechanical stroke limiter is an additional function that independently from the relevant control unit makes it possible to infinitely reduce the maximum displacement of the pump.

The stroke of the adjustment cylinder is limited by two adjustment screws which, thereby also limit the pump swivel angle.





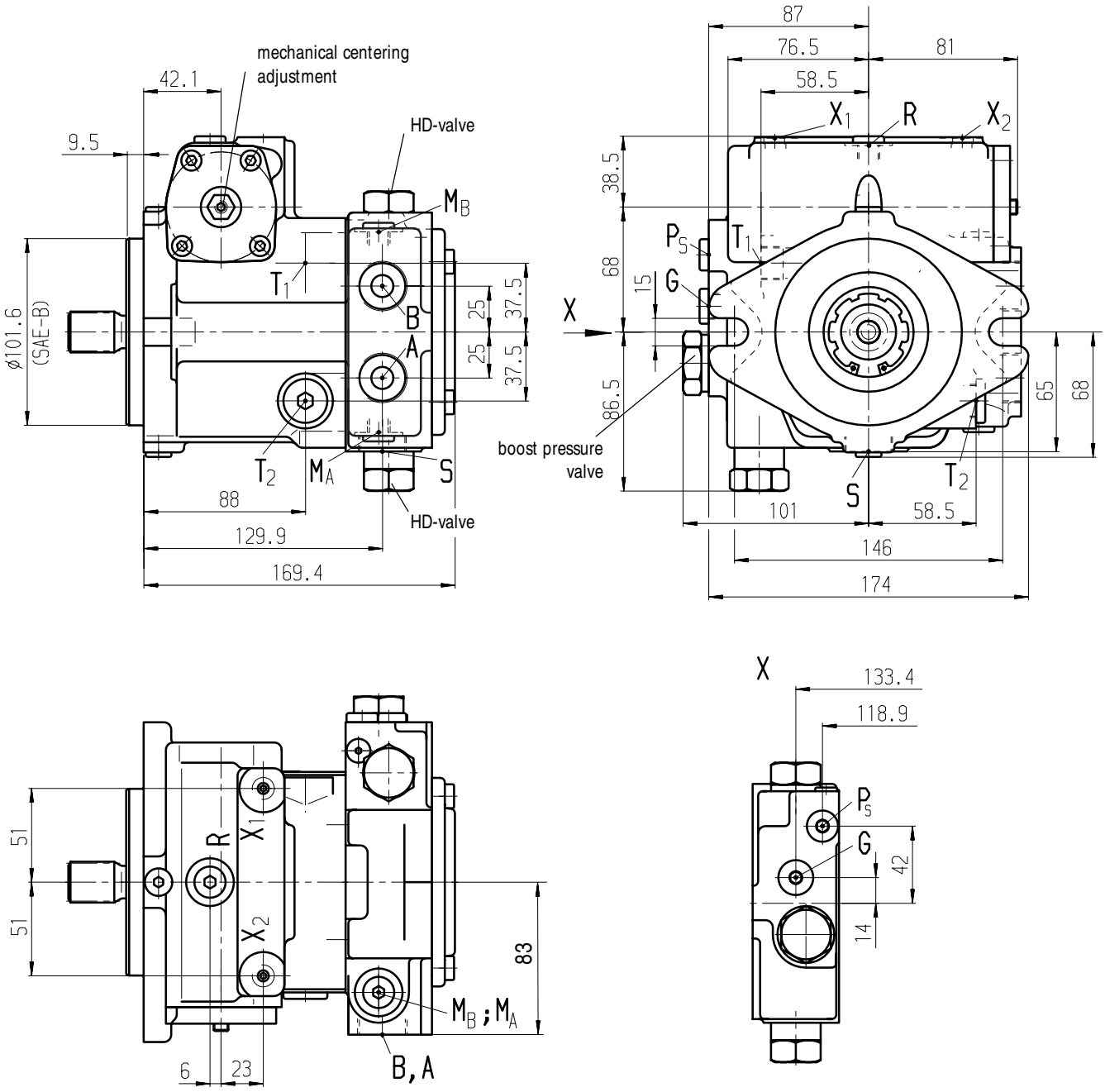


Size	18	28	45	63
M1		99	101,6	124
M2	42,1	35	35,5	43
M3	18	21,5	22,5	26,5

Unit Dimensions, Size 18

Before finalising your design, please request a certified drawing.

Hydraulic control, direct operated, DG



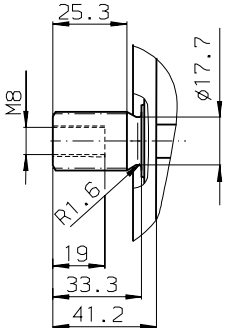
Connections

A, B	Service line ports	M27x2;16 deep
T_1	Case drain or filling port	M18x1,5; 12 deep
T_2	Case drain	M18x1,5; 12 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	M26x1,5; 16 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	M12x1,5; 12 deep
Y_1, Y_2	Remote control ports (only for HD control)	M14x1,5; 12 deep

Shaft end

S

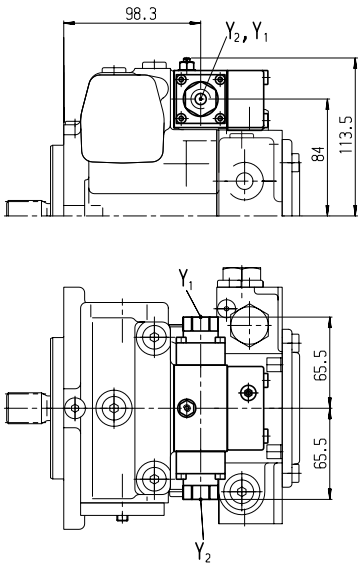
Splined shaft SAE 7/8" (SAE B)
pressure angle 30°,
13 tooth, 16/32 pitch,
flat root side fit,
tolerance class 5,
ANSI B92.1a-1976



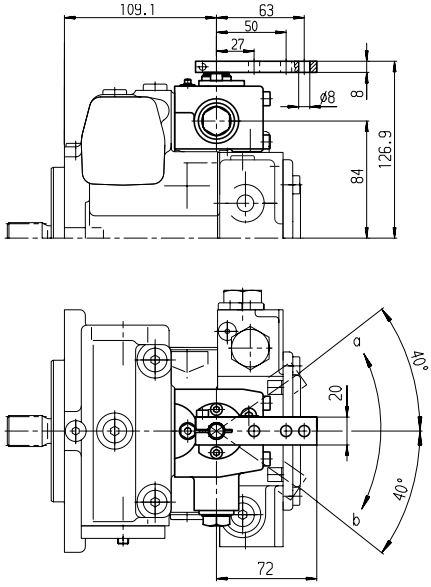
Unit Dimensions, Size 18

Before finalising your design, please request a certified drawing.

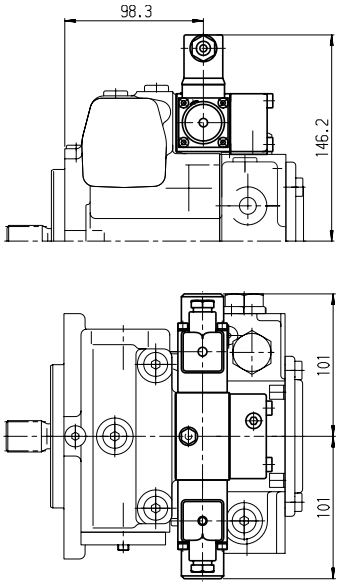
Hydraulic control, pilot pressure related, HD



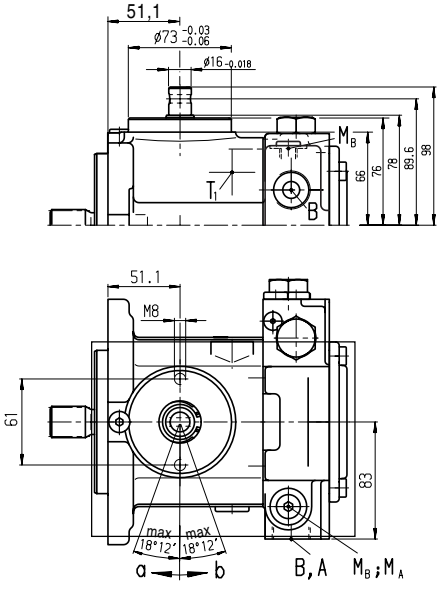
Hydraulic control, mechanical servo, HW



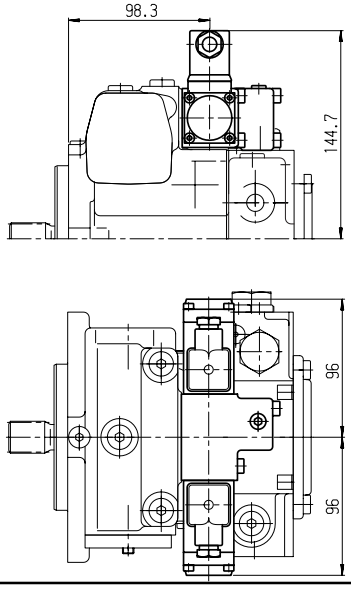
Electrical control, with proportional solenoid, EP



Mechanical pivot control MD



Electrical two-position control with switching solenoid, EZ

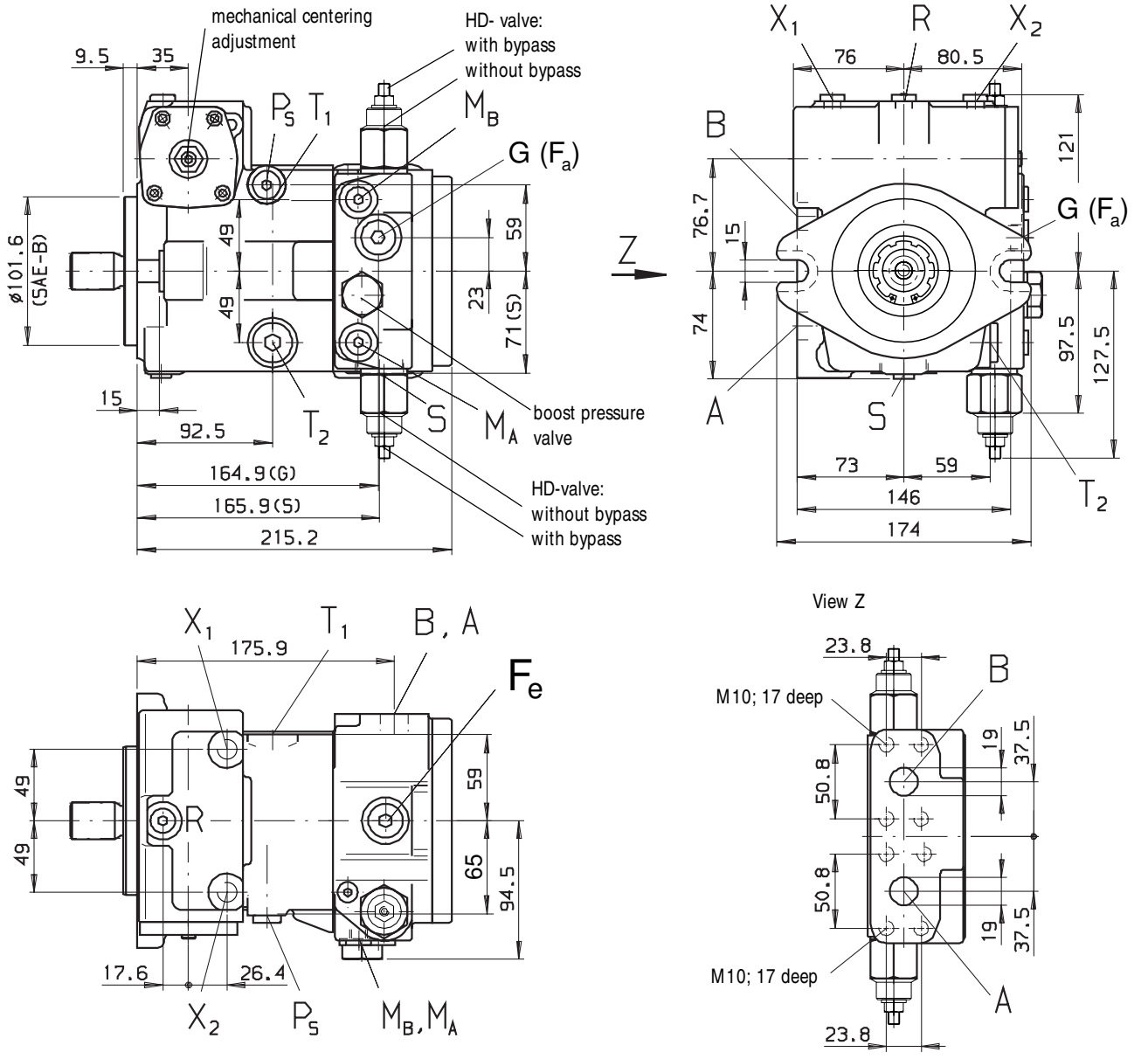


Mechanical pivot control, spring centering to neutral, MDN

Unit Dimensions, Size 28

Before finalising your design, please request a certified drawing.

Hydraulic control, direct operated, DG



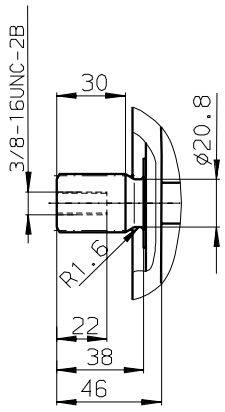
Connections

A,B	Service line ports SAE 3/4" 420 bar (6000 psi) (high pressure series)	
T_1	Case drain or filling port	M 22x1,5; 14 deep
T_2	Case drain	M 22x1,5; 14 deep
M_A	Pressure gauge - operating pressure A	M 12x1,5; 12 deep
M_B	Pressure gauge - operating pressure B	M 12x1,5; 12 deep
R	Air bleed	M 12x1,5; 12 deep
S	Boost suction port	M 33x2; 18 deep
X_1, X_2	Control pressure ports (before the orifice)	M 12x1,5; 12 deep
Y_1,Y_2	Remote control ports (only for HD control)	M 14x1,5; 12 deep
P_S	Control pressure supply, boost pressure	M 14x1,5; 12 deep
G (F_a)	Pressure port for auxiliary circuit	M 18x1,5; 12 deep
F_e	Filter inlet	M 18x1,5; 12 deep

Shaft ends

S

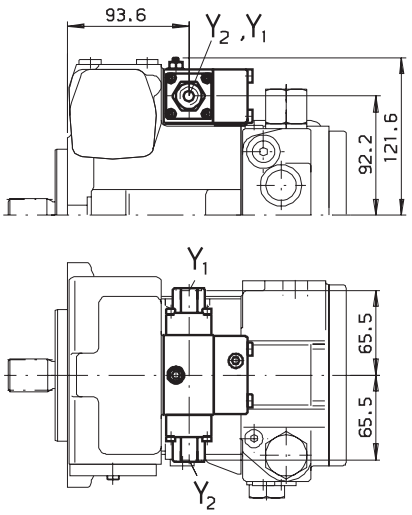
Splined shaft SAE 1" (SAE B-B)
pressure angle 30°,
15 tooth, 16/32 pitch,
flat root side fit,
tolerance class 5
ANSI B92.1a-1976



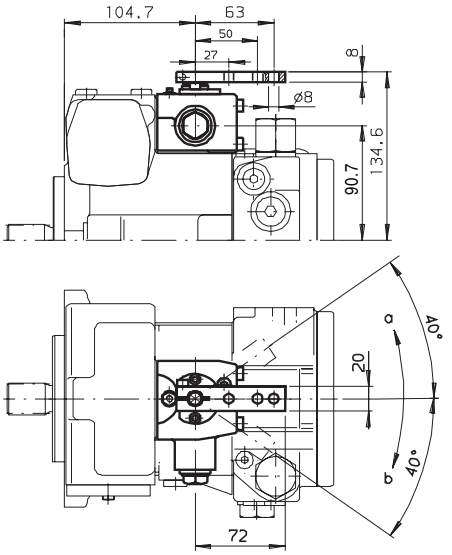
Unit Dimensions, Size 28

Before finalising your design, please request a certified drawing.

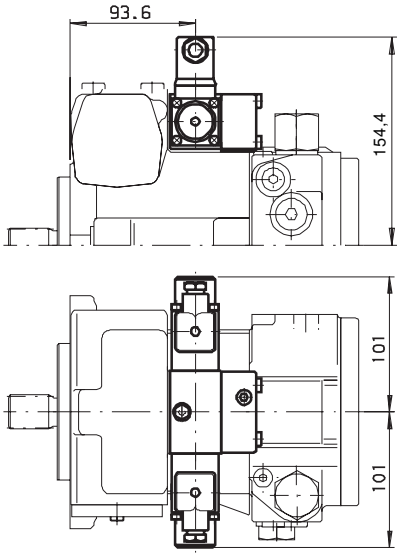
Hydraulic control, pilot pressure related, HD



Hydraulic control, mechanical servo, HW

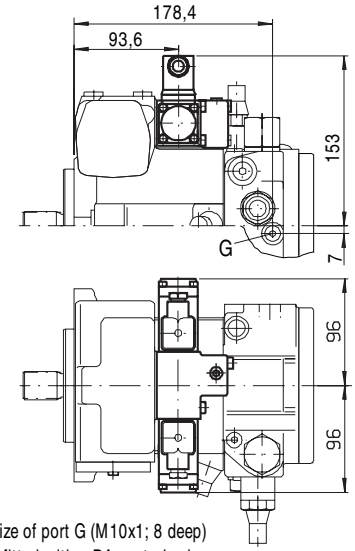


Electrical control with proportional solenoid, EP



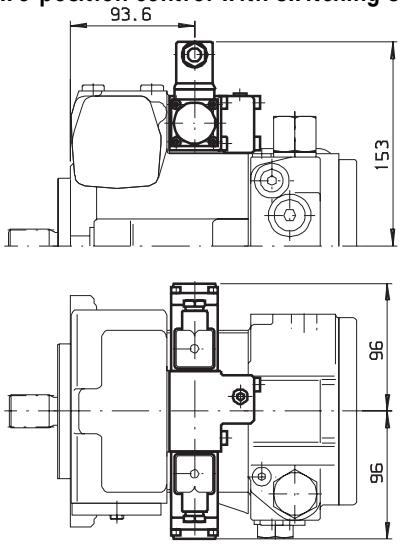
Hydraulic control, speed related, DA

(dimensions of the DA control valve see page 10)

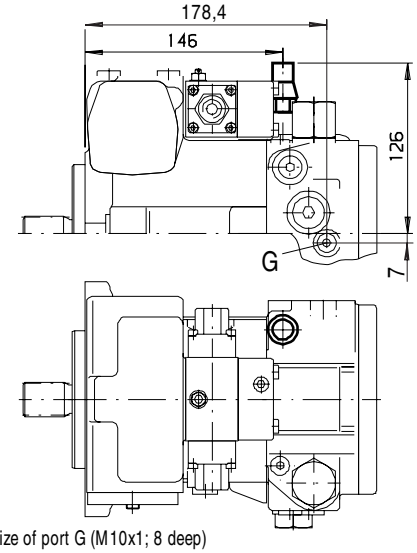


Note:
Location and size of port G (M10x1; 8 deep)
for the version fitted with a DA control valve.

Electrical two-position control with switching solenoid, EZ



..... pressure cut-off, D

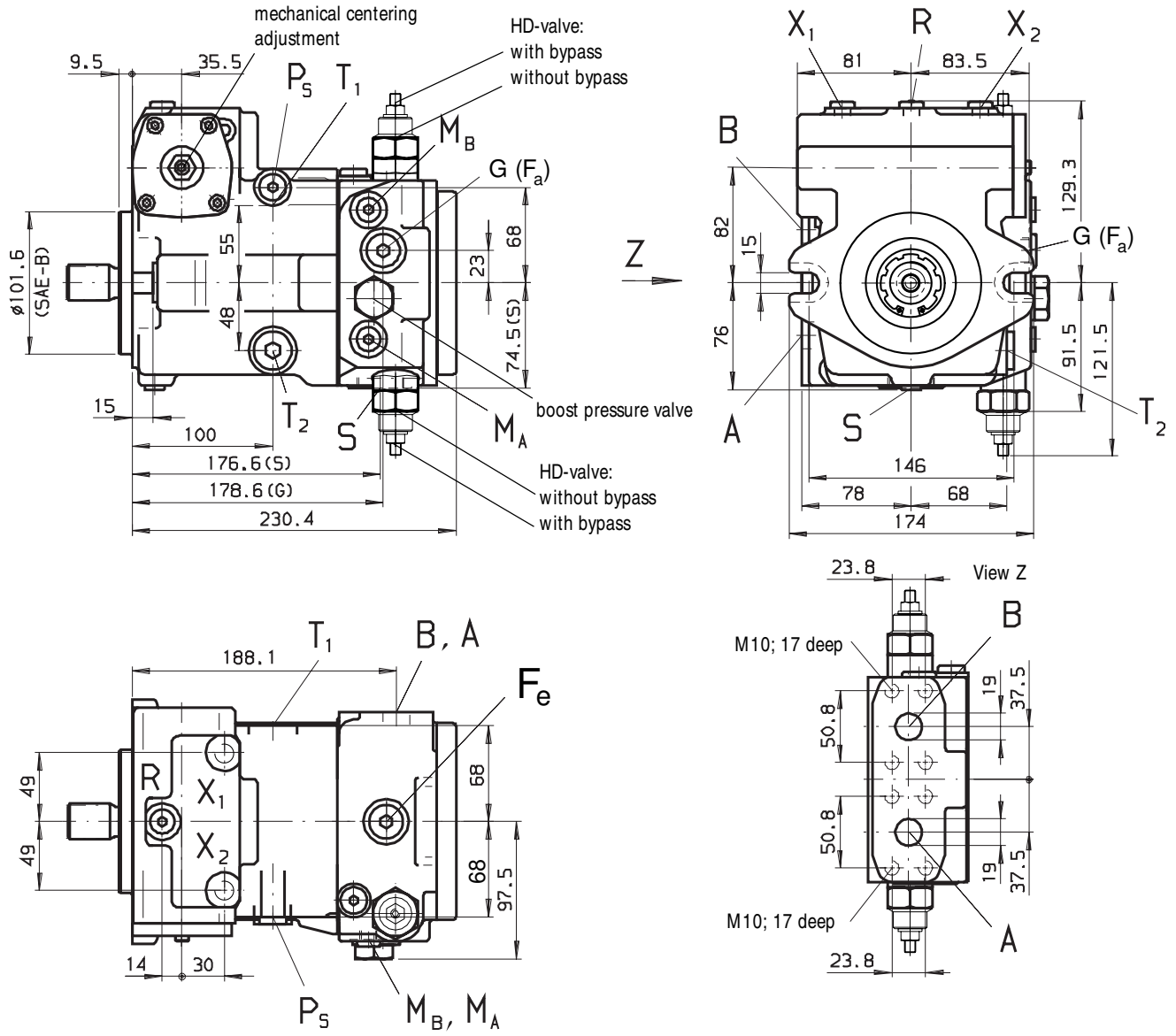


Note:
Location and size of port G (M10x1; 8 deep)
for the version fitted with a pressure cut-off.

Unit Dimensions, Size 45

Before finalising your design, please request a certified drawing.

Hydraulic control, direct operated, DG



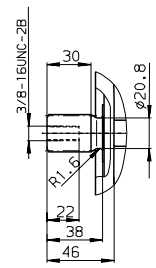
Connections

A,B	Service line ports SAE 3/4" 420 bar (6000 psi) (high pressure series)	
T_1	Case drain or filling port	M 22x1,5; 14 deep
T_2	Case drain	M 22x1,5; 14 deep
M_A	Pressure gauge - operating pressure A	M 12x1,5; 12 deep
M_B	Pressure gauge - operating pressure B	M 12x1,5; 12 deep
R	Air bleed	M 12x1,5; 12 deep
S	Boost suction port	M 33x2; 18 deep
X_1, X_2	Control pressure ports (before the orifice)	M 12x1,5; 12 deep
Y_1,Y_2	Remote control ports (only for HD control)	M 14x1,5; 12 deep
P_S	Control pressure supply, boost pressure	M 14x1,5; 12 deep
G (F_a)	Pressure port for auxiliary circuit	M 18x1,5; 12 deep
F_e	Filter inlet	M 18x1,5; 12 deep

Shaft ends

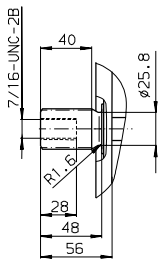
S

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



T

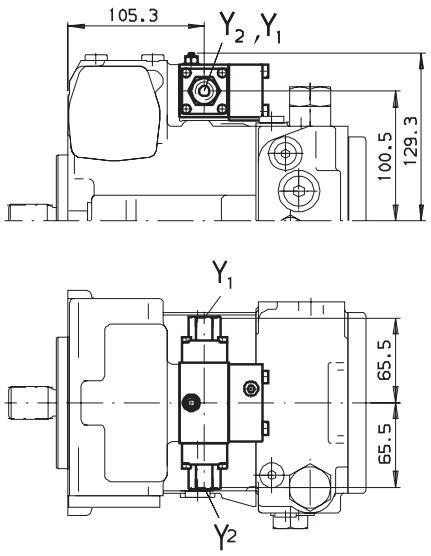
Splined shaft SAE 1¼" (SAE C),
pressure angle 30°,
14 tooth, 12/24 pitch,
flat root side fit,
tolerance class 5
ANSI B92.1a-1976



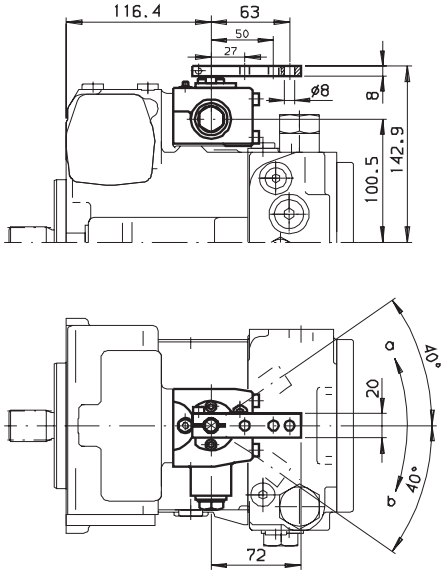
Unit Dimensions, Size 45

Before finalising your design, please request a certified drawing.

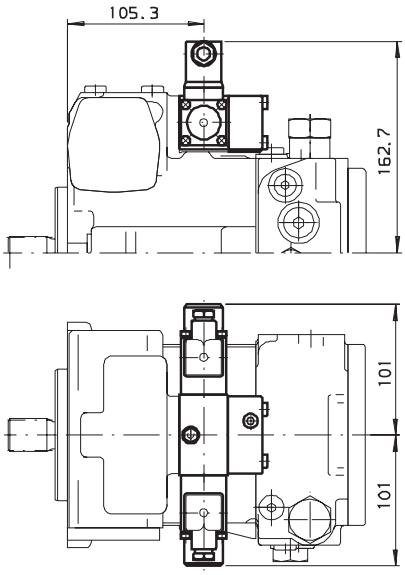
Hydraulic control, pilot pressure related, HD



Hydraulic control, mechanical servo, HW

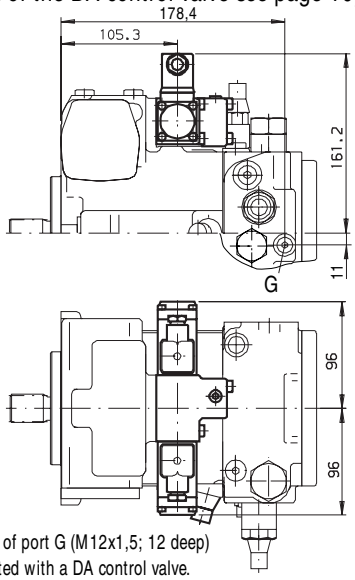


Electrical control with proportional solenoid, EP



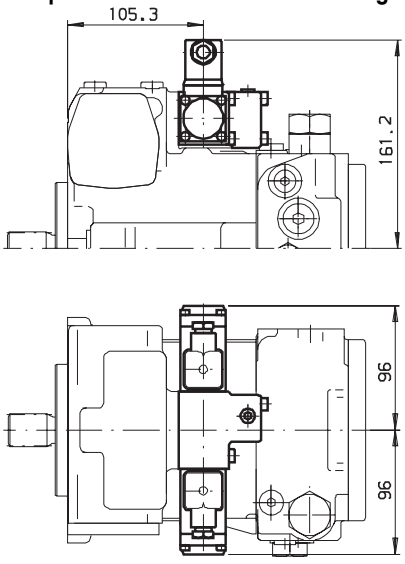
Hydraulic control, speed related, DA

(dimensions of the DA control valve see page 10)

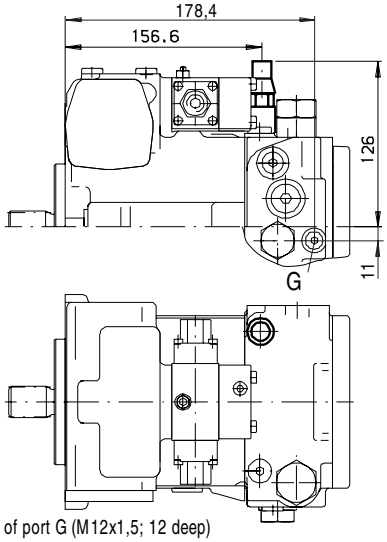


Note:
Location and size of port G (M12x1,5; 12 deep)
for the version fitted with a DA control valve.

Electrical two-position control with switching solenoid, EZ



..... pressure cut-off, D

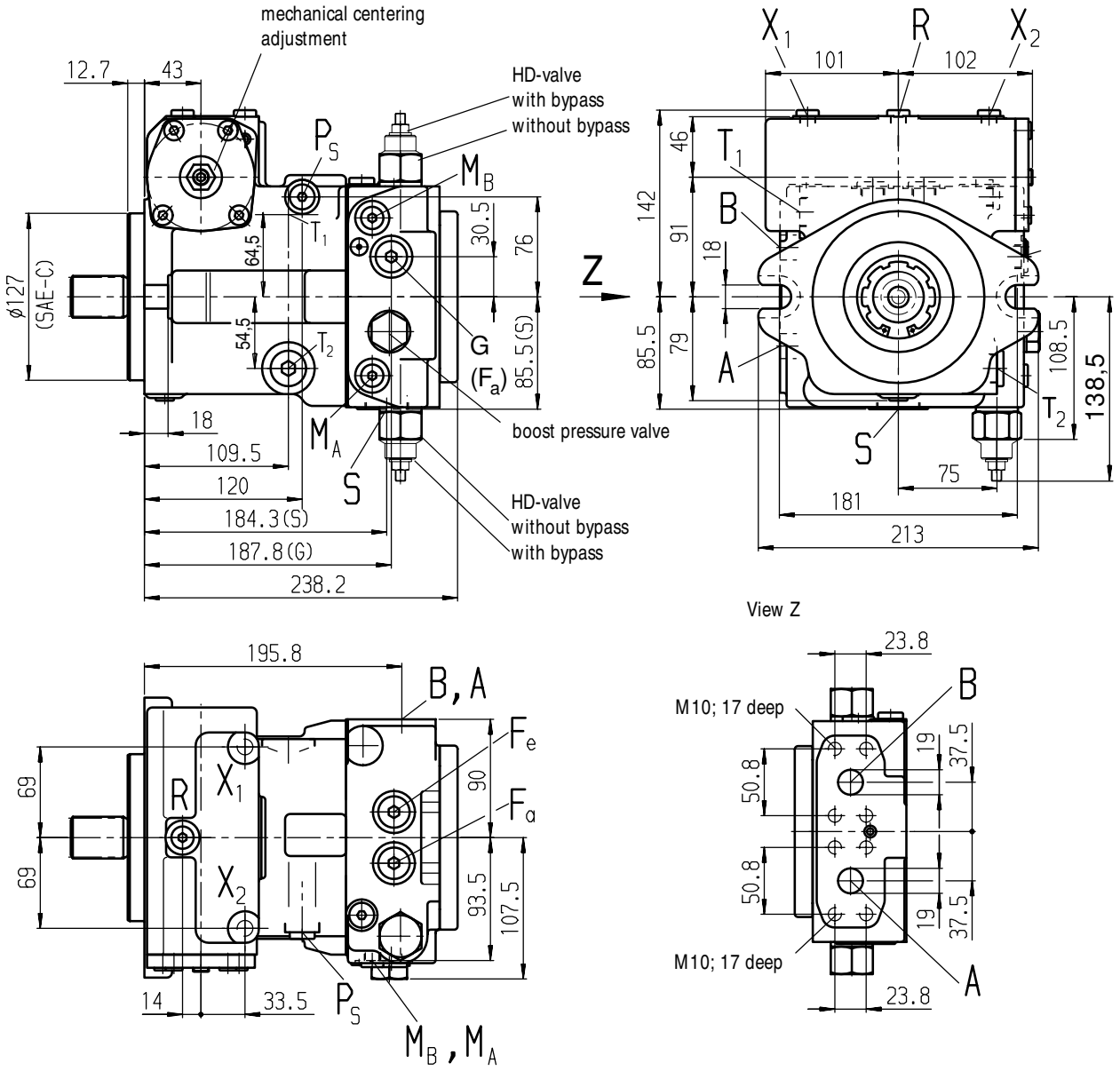


Note:
Location and size of port G (M12x1,5; 12 deep)
for the version fitted with a pressure cut-off.

Unit Dimensions, Size 63

Before finalising your design, please request a certified drawing.

Hydraulic control, direct operated, DG



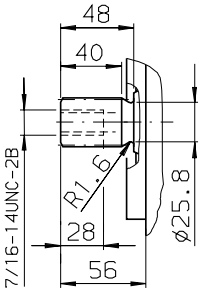
Connections

A,B	Service line ports SAE 3/4" 420 bar (6000 psi) (high pressure series)	
T_1	Case drain or filling port	M 22x1,5; 15 deep
T_2	Case drain	M 22x1,5; 15 deep
M_A	Pressure gauge - operating pressure A	M 12x1,5; 12 deep
M_B	Pressure gauge - operating pressure B	M 12x1,5; 12 deep
R	Air bleed	M 12x1,5; 12 deep
S	Boost suction port	M 33x2; 18 deep
X_1, X_2	Control pressure ports (before the orifice)	M 12x1,5; 12 deep
Y_1,Y_2	Remote control ports (only for HD control)	M 14x1,5; 12 deep
P_S	Control pressure supply, boost pressure	M 14x1,5; 12 deep
G	Pressure port for auxiliary circuit	M 18x1,5; 12 deep
F_a	Filter outlet	M 18x1,5; 12 deep
F_e	Filter inlet	M 18x1,5; 12 deep

Shaft ends

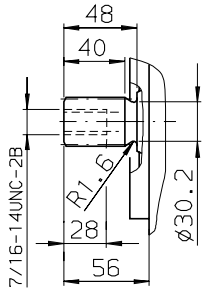
S

Splined shaft SAE $1^1/_4$" (SAEC),
pressure angle 30°,
14 tooth, 12/24 pitch,
flat root side fit,
tolerance class 5
ANSI B92.1a-1976



T

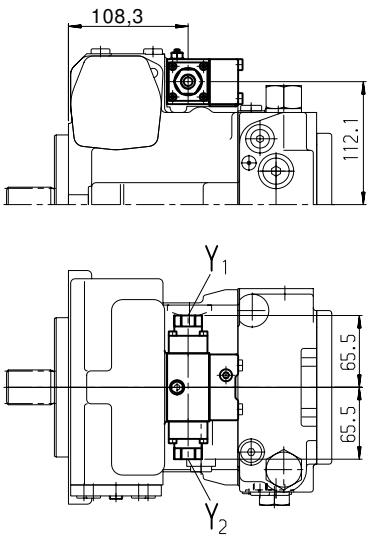
Splined shaft SAE $1^3/_8$",
pressure angle 30°,
21 tooth, 16/32 pitch,
flat root side fit,
tolerance class 5
ANSI B92.1a-1976



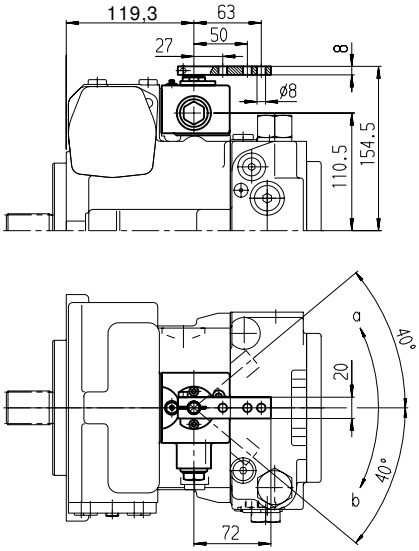
Unit Dimensions, Size 63

Before finalising your design, please request a certified drawing.

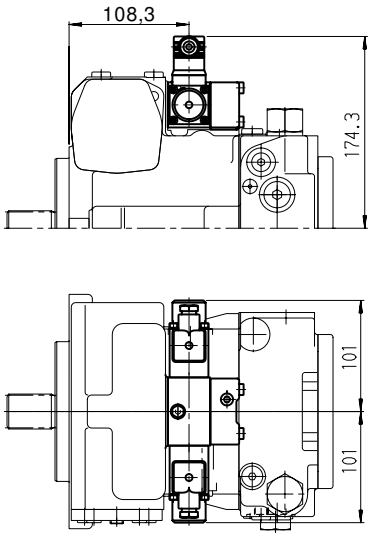
Hydraulic control, pilot pressure related, HD



Hydraulic control, mechanical servo, HW

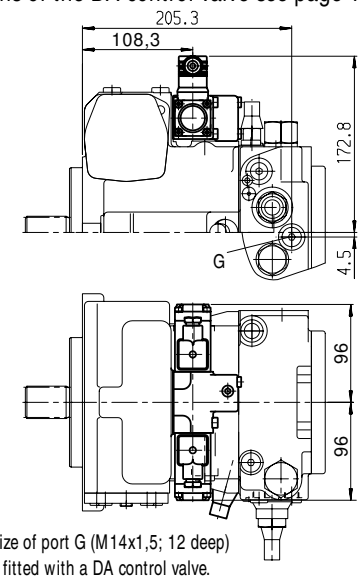


Electrical control with proportional solenoid, EP



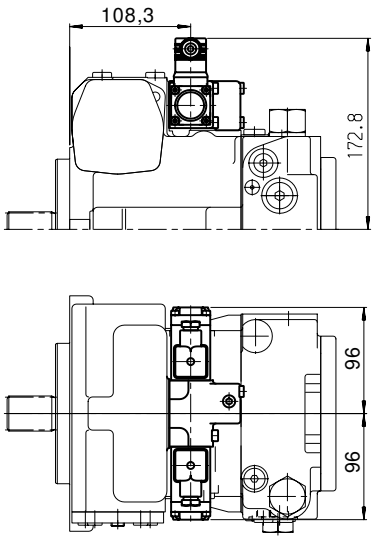
Hydraulic control, speed related, DA

(dimensions of the DA control valve see page 10)

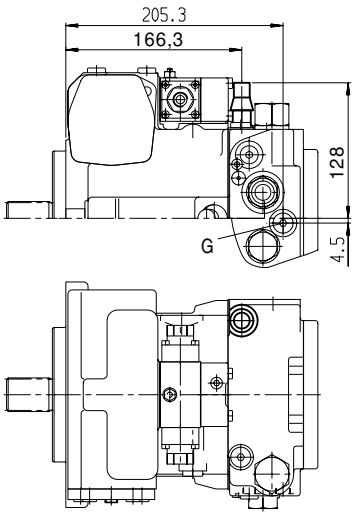


Note:
Location and size of port G (M14x1,5; 12 deep)
for the version fitted with a DA control valve.

Electrical two-position control with switching solenoid, EZ



..... pressure cut-off, D

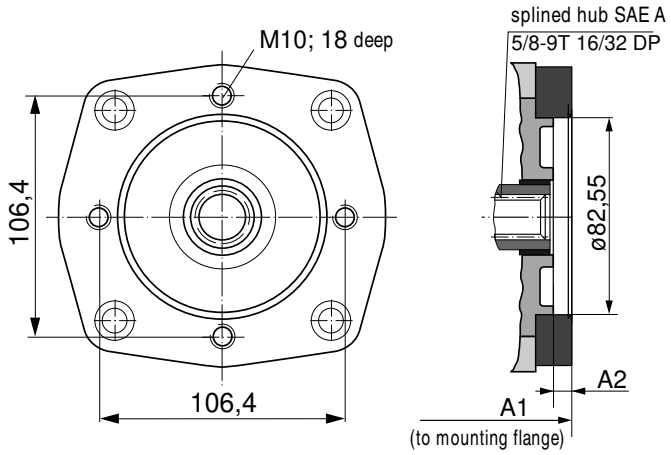


Note:
Location and size of port G (M14x1,5; 12 deep)
for the version fitted with a pressure cut-off.

Dimensions for Through Drives

Before finalising your design, please request a certified drawing.

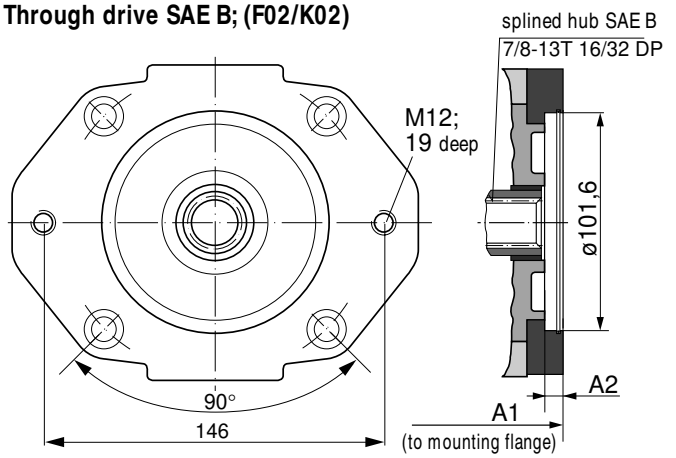
Through drive SAE A; (F01/K01)



Size	A1	A2
18	178,4	9
28	219,2	9
45	234,4	9
63	242,2	9

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

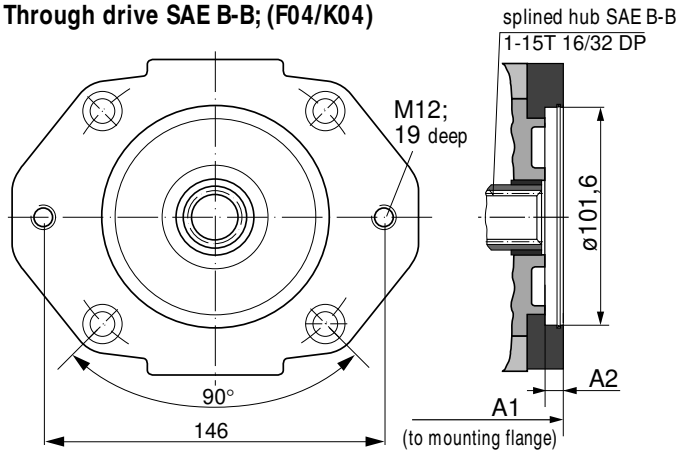
Through drive SAE B; (F02/K02)



Size	A1	A2
18	187,4	10
28	220,2	10
45	235,4	10
63	243,2	10

suitable for connection of:
gear pump G3 (RE 10039)
gear pump G4 (RE 10042)
variable pump A10VO 28 (RE 92701)
variable pump A10VG 18

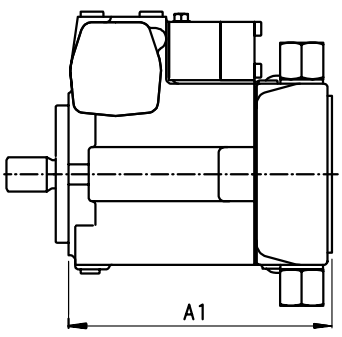
Through drive SAE B-B; (F04/K04)



Size	A1	A2
28	220,2	10
45	235,4	10
63	243,2	10

suitable for connection of:
variable pump A4VG28 (RE 92003)
variable pump A10VO45 (RE 92701)
variable pump A11VO40 (RE 92500)
variable pump A10VG28, 45

Without auxiliary pump, without through drive, (N00)



Size	A1
18	169,4
28	201,7
45	216,8
63	224,5

With auxiliary pump, without through drive, (F00)

(see unit dimensions pages 14 - 21)

Permissible Input and Through Drive Rotation Torques

Size			18	28	45	63
Corner torque (when $V_{g\,max}$, Δp = 300 bar) [1]	T_{max}	Nm	86	134	219	301
Max. perm. through drive rotation torque	$T_{D\,perm.}$	Nm	112	220	314	439
Max. permissible input torque [2]						
at shaft end S	$T_{E\,perm.}$	Nm	192	314	314	602
SAE (ANSI B92.1a-1976)			($^7/_8$" -13T 16/32DP)	(1" -15T 16/32DP)	(1" -15T 16/32DP)	($1^1/_4$" -14T 12/24DP)
at shaft end T	$T_{E\,perm.}$	Nm	–	–	602	970
SAE (ANSI B92.1a-1976)					($1^1/_4$" -14T 12/24DP)	($1^3/_8$" -21T 16/32DP)

[1]) efficiency not taken into consideration [2]) drive shafts without radial load

Code explanations

$T_{D\,perm.}$ = max. permissible through drive torque in Nm

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

T_1 = take off torque at the 1st pump $= \dfrac{1{,}59 \cdot V_{g1} \cdot \Delta p_1}{100 \cdot \eta_{mh}}$ in Nm

T_2 = take off torque at the 2nd pump $= \dfrac{1{,}59 \cdot V_{g2} \cdot \Delta p_2}{100 \cdot \eta_{mh}}$ in Nm

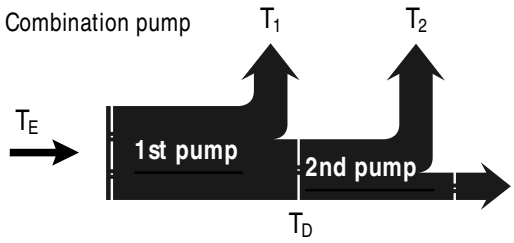
V_{g1} = pump displacement per rev. 1st pump in cm^3

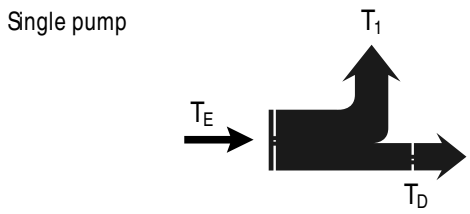
V_{g2} = pump displacement per rev. 2nd pump in cm^3

Δp_1 = differential pressure 1st pump in bar

Δp_2 = differential pressure 2nd pump in bar

η_{mh} = mechanical-hydraulic efficiency





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:

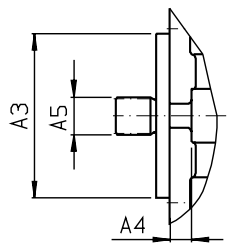
order example: Code 1st pump (front pump) + Code 2nd pump (rear pump)

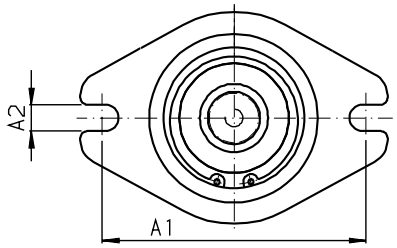
A10VG 45HW1/10R–P**TC**10**F04**2S + A10VG 45HW1/10R–P**SC**10F002S

The series connection of two single pumps of the same size is permissible without additional supports where the dynamic acceleration does not exceed 10 g (= 98,1m/s²).

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

						Single pump	Combination pump of the same size 1st pump		2nd pump
Size	**mount. flange**	**A1**	**A2**	**A3**	**A4**	**A5**	**A5**	**through drive**	**A5**
18	SAE B, 2-hole	146	15	101,6	15	S (SAE $^7/_8$")	S (SAE $^7/_8$")	F02/K02	S (SAE $^7/_8$")
28	SAE B, 2-hole	146	15	101,6	15	S (SAE 1")	S (SAE 1")	F04/K04	S (SAE 1")
45	SAE B, 2-hole	146	15	101,6	15	S (SAE 1")	T (SAE 1 $^1/_4$")	F04/K04	S (SAE 1")
63	SAE C, 2-hole	181	18	127	18	S (SAE 1 $^1/_4$")	T (SAE 1 $^3/_8$")	F07/K07	S (SAE 1 $^1/_4$")





Preferred Types

Type	Ident-No.
A10VG18MD/10R-NSC16F003S	2005230
A10VG18MD/10R-NSC16F013S	2010550
A10VG18EP11/10R-NSC16F005S	2025955
A10VG18EP11/10R-NSC16F015S	2025956
A10VG18HW1/10R-NSC16F005S	2025957
A10VG18HW1/10R-NSC16F015S	2025958
A10VG28EP11/10R-NSC10F005S	2020156
A10VG28EP11/10R-NSC10F015S	2020155
A10VG28EP11/10R-NSC10F045S	2020157
A10VG28HW1/10R-NSC10F005S	2020195
A10VG28HW1/10R-NSC10F015S	2020194
A10VG28HW1/10R-NSC10F045S	2020196
A10VG28DA1D2/10R-NSC10F005S	2020248
A10VG28DA1D2/10R-NSC10F015S	2020254
A10VG28DA1D2/10R-NSC10F045S	2020249
A10VG45EP1M1/10R-NSC10F005S	2017642
A10VG45EP1M1/10R-NSC10F015S	2017641
A10VG45EP1M1/10R-NSC10F045S	2017643
A10VG45HWM1/10R-NSC10F005S	2017720
A10VG45HWM1/10R-NSC10F015S	2017718
A10VG45HWM1/10R-NSC10F045S	2017721
A10VG45DA1DM2/10R-NSC10F005S	2017813
A10VG45DA1DM2/10R-NSC10F015S	2017812
A10VG45DA1DM2/10R-NSC10F045S	2017814

Please state type and ident-no. when ordering.

Installation Situation for Coupling Assembly

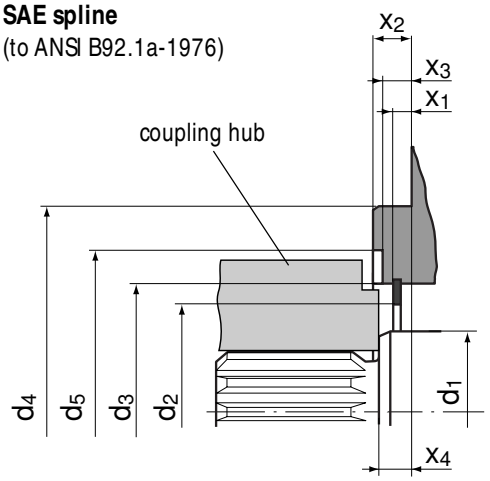
In order to assure that rotating parts (coupling hub) and fixed parts (housing, safety rings) do not contact each other the installation situations are described in this leaflet have to be observed. The installation situation depend upon the sizes and the spline.

Sizes 18...45 (with free turning):
Please observe diameter of the free turning.

Size 63 (without free turning):
The outer diameter of the coupling hub must be smaller than the inner diameter of the circlip at the zone of the drive shaft collar (measure x_2 - x_4).

Size	$ød_1$	$ød_{2\,min}$	$ød_3$	$ød_4$	$ød_5$	x_1	x_2	x_3	x_4
18	30	36,1	$49_{\pm}$	101,6	65	$5{,}9^{+0{,}2}$	$9{,}5_{-0{,}5}$	7	$8^{+0{,}9}_{-0{,}6}$
28	35	43,4	$55_{\pm 0{,}1}$	101,6	72	$3{,}9^{+0{,}2}$	$9{,}5_{-0{,}5}$	7	$8^{+0{,}9}_{-0{,}6}$
45	40	51,4	$63_{\pm 0{,}1}$	101,6	80	$4{,}3^{+0{,}2}$	$9{,}5_{-0{,}5}$	7	$8^{+0{,}9}_{-0{,}6}$
63	40	54,4	$68_{\pm 0{,}1}$	127	-	$7{,}0^{+0{,}2}$	$12{,}7_{-0{,}5}$	-	$8^{+0{,}9}_{-0{,}6}$

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



Brueninghaus Hydromatik GmbH
Plant Elchingen
Glockeraustraße 2 • D–89275 Elchingen
Phone +49 (0) 73 08 / 82-0
Telefax +49 (0) 73 08 / 72 74