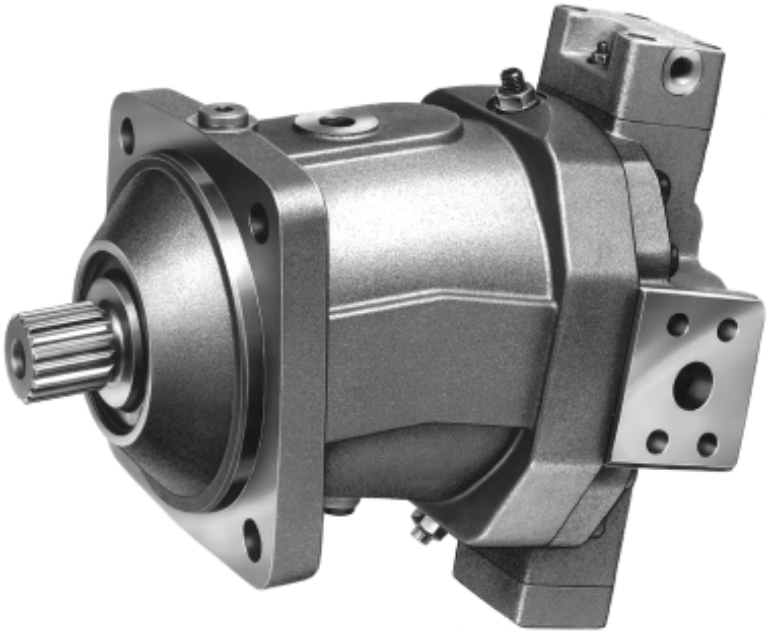
Variable Displacement Motor AA6VM (A6VM)

Series 6, for open and closed circuits
Axial tapered piston - bent axis design

Sizes 28…1000 | Nominal Pressure up to 5800 psi (400 bar) | Peak Pressure up to 6500 psi (450 bar)

RA 91 604/08.97

Replaces: RA 91604/07.95
RA 91603/05.95



Variable displacement motor with axial piston rotary group of bent axis design, for hydrostatic drives in open and closed circuits.
The motor is suitable for both mobile and industrial applications.
The wide control range of the variable displacement motor allows it to meet the requirements of high speed and high torque.
The displacement is infinitely variable in the range $V_{g\,max}$ to $V_{g\,min} = 0$.
Output speed is proportional to flow and inversely proportional to displacement. The output torque increases with the pressure drop between the high and low pressure sides and with increasing displacement.

- Wide control range for hydrostatic drives
- Various control and regulating devices
- Cost saving through elimination of gearbox and possibility of using smaller pumps
- Compact, robust bearing system with long service life
- Low unit power
- Good starting characteristics
- Low inertia
- Wide swivel range

Variable Displacement Motor AA6VM (A6VM)

Ordering Code / Standard Program

															M			/	6	3	W		-						

Hydraulic fluid

Petroleum oil (no code)		
HF-fluids	sizes 28...200 (no code)	
	sizes 250...1000 (only in connection with drive shaft bearings "**L**")	**E**

Axial piston unit

		28	55	80	107	140	160	200	250	355	500	1000	
Bent axis design, variable displacement	Version SAE		●	●	●		●	●	●				**AA6V**
	Version ISO	●				●				●	●	●	**A6V**

Drive shaft bearings

	28...200	250...500	1000	
Mechanical bearings (no code)	●	●	–	
Long-Life bearings	–	●	●	**L**

Mode of operation

Motor (Plug-in motor A6VE see RE 91606)	**M**

Size

size ≙ Displacement $V_{g\,max}$												
	cm³/rev	**28**	**55**	**80**	**107**	**140**	**160**	**200**	**250**	**355**	**500**	**1000**
	in³/rev	**1.71**	**3.34**	**4.88**	**6.53**	**8.54**	**9.76**	**12.20**	**15.25**	**21.66**	**30.51**	**61.02**

Control device

						28	55	80	107	140	160	200	250	355	500	1000	
Hydraulic control, pilot presure related	HD	1				●	●	●	●	●	●	●	●	●	●	●	**HD1**
	HD		2			●	●	●	●	●	●	●	●	●	●	●	**HD2**
	HD	1		D		●	●	●	●	●	●	●	●	●	●	○	**HD1D**
	HD		2	D		●	●	●	●	●	●	●	●	●	●	○	**HD2D**
	HD	1			G	–	–	–	–	–	–	–	●	●	●	○	**HD1G**
	HD		2		G	–	–	–	–	–	–	–	●	●	●	○	**HD2G**
pilot pressure increase Δp = 145 psi (10 bar)																	
pilot pressure increase Δp = 365 psi (25 bar)																	
with remote constant pressure control																	
with direct constant pressure control																	
Hydraulic two-position control	HZ					–	–	–	–	–	–	–	●	●	●	●	**HZ**
	HZ1					●	–	–	–	●	●	●	–	–	–	–	**HZ1**
	HZ3					–	●	●	●	–	–	–	–	–	–	–	**HZ3**
Electrical control, with proportional solenoid	EP	1				●	●	●	●	●	●	●	●	●	●	○	**EP1**
	EP		2			●	●	●	●	●	●	●	●	●	●	○	**EP2**
	EP	1		D		●	●	●	●	●	●	●	●	●	●	○	**EP1D**
	EP		2	D		●	●	●	●	●	●	●	●	●	●	○	**EP2D**
	EP	1			G	–	–	–	–	–	–	–	●	●	●	○	**EP1G**
	EP		2		G	–	–	–	–	–	–	–	●	●	●	○	**EP2G**
control voltage 12 V																	
control voltage 24 V																	
with remote constant pressure control																	
with direct constant pressure control																	
Electrical two-position control, with switching solenoid	EZ	1				●	–	–	–	●	●	●	●	●	●	●	**EZ1**
	EZ		2			●	–	–	–	●	●	●	●	●	●	●	**EZ2**
	EZ	3				–	●	●	●	–	–	–	–	–	–	–	**EZ3**
	EZ		4			–	●	●	●	–	–	–	–	–	–	–	**EZ4**
control voltage 12 V																	
control voltage 24 V																	
Automatic control, high pressure related	HA	1				●	●	●	●	●	●	●	●	●	●	●	**HA1.**
	HA		2			●	●	●	●	●	●	●	●	●	●	●	**HA2.**
Model without pressure increase																	
Model with pressure increase Δp = 1450 psi (100 bar)																	
Hydraulic control, speed related						–	–	–	–	–	–	–	●	●	●	●	**DA**
p_{St}/p_{HD} = 5/100, hydraulic valve for travel direction						●	●	●	●	●	●	●	–	–	–	–	**DA1**
el. valve for travel direction (12V) + el. $V_{g\,max}$-switch (12V)						●	●	●	●	●	●	●	–	–	–	–	**DA2**
el. valve for travel direction (24V) + el. $V_{g\,max}$-switch (24V)						●	●	●	●	●	●	●	–	–	–	–	**DA3**
p_{St}/p_{HD} = 8/100, hydraulic valve for travel direction						●	●	●	●	●	●	●	–	–	–	–	**DA4**
el. valve for travel direction (12V) + el. $V_{g\,max}$-switch (12V)						●	●	●	●	●	●	●	–	–	–	–	**DA5**
el. valve for travel direction (24V) + el. $V_{g\,max}$-switch (24V)						●	●	●	●	●	●	●	–	–	–	–	**DA6**

Override

	28...200	250...1000	
without override (no code)	●	●	
with hydraulic override	●	●	**T**
with electrical override, 12V	●	–	**U1**
with electrical override, 24V	●	–	**U2**
with el. override + el. valve for travel direction, 12V	●	–	**R1**
with el. override + el. valve for travel direction, 24V	●	–	**R2**

Hydraulic fluid

Axial piston unit

Drive shaft bearings

Mode of operation

Size

Control device

Series/Index

	6 3

Direction of rotation

viewed on shaft end	bi-directional	**W**

Setting range for displacement [1)]

	28	55	80	107	140	160	200	250	355	500	1000	
$V_{g\,min}$ = 0 to 0,8 $V_{g\,max}$ (no code)	●	●	●	●	●	●	●	–	–	–	–	
$V_{g\,min}$ = 0 to 0,4 $V_{g\,max}$/$V_{g\,max}$ = $V_{g\,max}$ to 0,8 $V_{g\,max}$	–	–	–	–	–	–	–	●	●	●	●	**1**
$V_{g\,min}$ = 0,4 $V_{g\,max}$ to 0,8 $V_{g\,max}$/$V_{g\,max}$ = $V_{g\,max}$ to 0,8 $V_{g\,max}$	–	–	–	–	–	–	–	●	●	●	●	**2**

Seals

NBR (nitril-caoutchouc), shaft seal in FPM	–	–	–	–	–	–	–	●	●	●	●	**P**
FPM (fluor-caoutchouc)	●	●	●	●	●	●	●	●	●	●	●	**V**

Shaft end

SAE-Version (AA6VM) SAE-splined shaft	–	●	●	●	–	●	●	●	–	–	–	**S**
ISO-Version (A6VM) Splined shaft DIN 5480	●	–	–	–	–	–	–	–	–	–	–	**A**
	●	–	–	–	●	–	–	–	●	●	●	**Z**
Parallel shaft with key DIN 6885	–	–	–	–	–	–	–	–	●	●	●	**P**

Mounting flange

SAE-Version (AA6VM) SAE 2-bolt	–	–	●	–	–	–	–	–	–	–	–	**C**
SAE 4-bolt	–	●	–	●	–	●	●	●	–	–	–	**D**
ISO-Version (A6VM) ISO 4-bolt	●	–	–	–	●	–	–	–	–	–	–	**B**
ISO 8-bolt	–	–	–	–	–	–	–	–	●	●	●	**H**

Service ports

				28	55	80	107	140	160	200	250	355	500	1000	
SAE-Version (AA6VM)	Ports A, B: SAE rear end (UN threads)	**51**	0	–	●	●	●	–	●	●	●	–	–	–	**510**
			7	–	●	●	●	–	●	●	●	–	–	–	**517**
	Ports A, B: SAE on (opposite) sides (UN threads)	**52**	0	–	●	●	●	–	●	●	●	–	–	–	**520**
			7	–	●	●	●	–	●	●	●	–	–	–	**527**
	Port plate for mounting a motion control valve	**58**	0	–	–	–	–	–	–	–	●	–	–	–	**580**
			8	–	–	–	–	–	–	–	●	–	–	–	**588**
	Port plate with pressure relief valve, for mounting a motion control valve [2)]	**37**	0	–	–	–	●	–	–	–	–	–	–	–	**370**
		38	0	–	●	●	●	–	●	–	–	–	–	–	**380**
ISO-Version (A6VM)	Ports A, B: SAE rear end (metric threads)	**01**	0	●	–	–	–	●	–	–	–	●	●	○	**010**
			7	●	–	–	–	●	–	–	–	●	●	○	**017**
	Ports A, B: SAE on (opposite) sides (metric threads)	**02**	0	●	–	–	–	●	–	–	–	●	●	●	**020**
			7	●	–	–	–	●	–	–	–	●	●	●	**027**

Valves

without valve	**0**
with flushing and boost pressure valve	**7**
with built-on motion control valve	**8**

Speed sensor

without speed sensor (no code)	●	●	●	●	●	●	●	●	●	●	●	
prepared for speed sensor	●	●	●	●	●	●	●	○	○	○	○	**D**

Swivel angle indicato

without swivel angle indicator (no code)	●	●	●	●	●	●	●	●	●	●	●	
with optical swivel angle indicator	–	–	–	–	–	–	–	●	●	●	●	**V**
with electronical swivel angel indicator	–	–	–	–	–	–	–	●	●	●	●	**E**

Start of control

at $V_{g\,min}$ (standard for HA)	●	●	●	●	●	●	●	●	●	●	●	**A**
at $V_{g\,max}$ (standard for HD, HZ, EP, EZ, DA)	●	●	●	●	●	●	●	●	●	●	●	**B**

[1)] indicate in the order in clear text:
sizes 28...200 _____ $V_{g\,min}$ = ... in³ (cm³)
sizes 250...1000 ___ $V_{g\,min}$ = ... in³ (cm³), $V_{g\,max}$ = ... in³ (cm³)

[2)] only possible in connection with controls HD, HA1, HA2; metric threads!

● = available ○ = in preparation – = not available

Technical Data

Hydraulic 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 RA 90220 (petroleum oil), RA 90221 (environmentally acceptable hydraulic fluids) and RA 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 us or your fluid supplier (please indicate type of the hydraulic fluid used for your application on the order sheet).

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

Optimum operating viscosity (v_{opt})...80-170 SUS (16...36 mm²/s)

referred to the loop temperature (closed circuit) or reservoir temperature (open circuit).

Viscosity limits
The limiting values for viscosity are as follows:

Sizes 28...200

v_{min} = 42 SUS (5 mm²/s)
short term at a max. permissible temp. of t_{max} = 240°F (115°C)

v_{max} = 7400 SUS (1600 mm²/s)
short term on cold start (t_{min} = -40°F/-40°C)

Sizes 250...1000

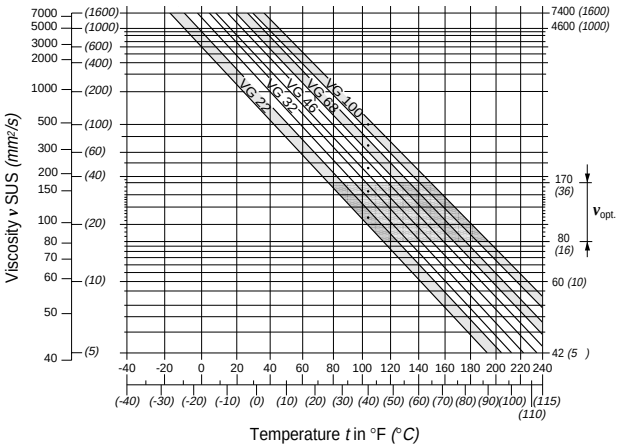
v_{min} = 60 SUS (10 mm²/s)
short term at a max. permissible leakage oil temperature of t_{max} = 195°F (90°C)

v_{max} = 4600 SUS (1000 mm²/s)
short term on cold start (t_{min} = -13°F/-25°C)

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

At temperatures of -13°F up to -40°F (-25°C up to -40°C) special measures may be required for certain installation positions. 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 loop (closed circuit) or the reservoir temperature (open 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 (v_{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° the operating temperature (closed circuit: loop temperature; open circuit: reservoir temperature) is 140°F (60°C). Within the optimum operating viscosity range (v_{opt}; shaded area), this corresponds to viscosity grades VG 46 or VG 68. VG 68 should be selected.
Important: The leakage oil (case drain oil) temperature is influenced by pressure and motor speed and is always higher than the circuit temperature or the reservoir temperature. However, at no point in the system may the temperature exceed 240°F (115°C) for sizes 28...200 or 195°F (90°C) for sizes 250...1000.
If it is not possible to comply with the above condition because of extreme operating parameters or high ambient temperatures we recommend housing flushing via port U or use of a flushing valve (see page 5). Please consult us.

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 minimum purity grade of:

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

At very high temperatures of the hydraulic fluid
(195°F to max. 240°F / 90°C to max. 115°C, not perm. for sizes 250...1000) 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 us.

Direction of flow

clockwise rotation	counter-clockwise rotation
A to **B**	**B** to **A**

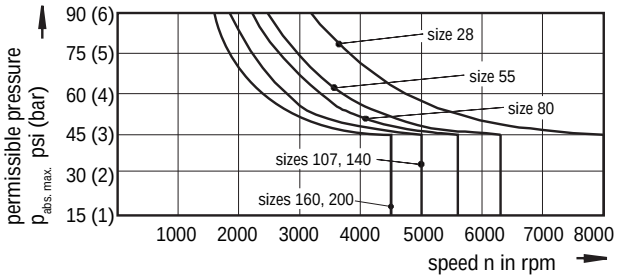
Speed range
There is no limitation on minimum speed n_{min}. If uniformity of rotation is required, however, speed n_{min} should not be allowed to fall below 50 rpm. See table on page 6 for max. permissible speeds.

Installation position
Optional. The motor 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 RA 90 270 before completing your design work.

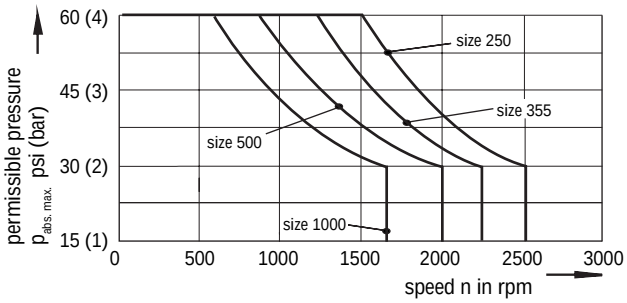
Technical Data

Case drain pressure
Shaft seal ring **FPM** (fluor-caoutchouc)
The lower the speed and the case drain pressure the higher the life expectation of the shaft seal ring.
The values shown in the diagram are permissible loads of the seal ring and shall not be exceeded.
At stationary pressure loads in the range of the max. admissible leakage pressure a reduction of the life experience of the seal ring will result.
For a short period (t < 5 min.) pressure loads up to 75 psi (5 bar) independent from rotational speeds are permissible respectively for sizes 28...200.

Sizes 28...200



Sizes 250...1000



Special operation conditions may require limitations of these values.

Note:
- max. permissible motor speeds are given in the table on page 6.

- max.permissible housing pressure
  sizes 28...200: $p_{abs.\ max}$ = 90 psi (6 bar)
  sizes 250...1000: $p_{abs.\ max}$ = 60 psi (4 bar)

The pressure in the housing must be the same as or greater than the external pressure on the shaft seal.

Long-life bearings *(sizes 250...1000)*
For long service life and HF fluids.
Special features:
The external dimensions of the axial piston pump do not vary from the standard.
The long-life bearing set may be subsequently built into available axial piston pumps.
The drain case port must always be open.
It is recommended that the bearings are flushed via port U.

Flushing and boost pressure valve
The flushing and boost pressure valve (closed circuits) is set at a fixed pressure of 230 psi (16 bar) and serves to maintain the minimum boost pressure (set primary valve accordingly). Dependend on the control device and motor size, the valve is mounted onto the variable motor or integrated in the control device (see page 35).
A quantity of hydraulic fluid, determined by the orifice fitted, is drawn off from the low pressure side and passed into the motor housing, from where it is led off to reservoir together with the leakage fluid. The fluid thus taken from the circuit must be replaced with cooled oil by means of the boost pump.

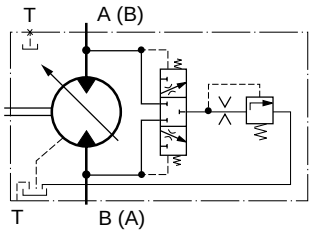
Different flushing volumes can be selected by means of orifices.

Flow * (for low pressure Δp= 365 psi/25 bar)

Size	Volume	Orifice-No.
28, 55	0.9 gpm (3,5 L/min)	09651766/503.12.01.01
80	1.3 gpm (5 L/min)	09419695/503.12.01.01
107	2.1 gpm (8 L/min)	09419696/503.12.01.01
160, 200	2.6 gpm (10 L/min)	09419697/503.12.01.01
250	2.6 gpm (10 L/min)	
355	4.2 gpm (16 L/min)	
500	5.3 gpm (20 L/min)	
1000	6.6 gpm (25 L/min)	

* Standard flushing volumes

(for sizes 28…200 flushing volumes of 0.9 - 2.6 gpm (3,5 - 10 L/min) can be supplied. If a flushing volume different from the standard flushing volume is required, please indicate the requested orifice in clear text when ordering.)



Operating pressure range
Maximum pressure at port A or B
(Pressure data to DIN 24312)

Sizes 28...200

Nominal pressure p_N	5800 psi (400 bar)*
Peak pressure p_{max}	6525 psi (450 bar)*

*) size 80: p_N = 5100 psi (350 bar), p_{max} = 5800 psi (400 bar)
Attention: shaft end **Z** and **S** with drives of radial force loads at the drive shaft (pinion V-belt drives) necessitate reduction of the nominal pressure to p_N = 4570 psi (315 bar),
size 80: p_N = 2900 psi (200 bar). Please contact us.

Sizes 250...1000

Nominal pressure p_N	5100 psi (350 bar)
Peak pressure p_{max}	5800 psi (400 bar)

With pulsating loads above 4570 psi (315 bar) we recommend using the model with splined shaft (sizes 250...1000).

The summ of the pressures at ports A and B may not exceed 10000 psi (700 bar).

Variable Displacement Motor AA6VM (A6VM)

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

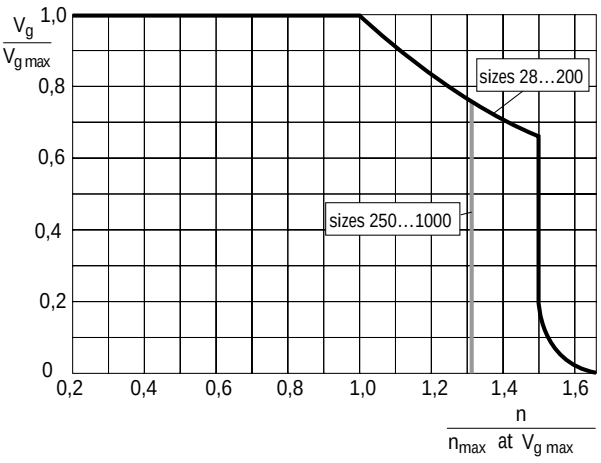
Size			28	55	80	107	140	160	200	250	355	500	1000
Displacement	$V_{g\,max}$	in³/rev	1.71	3.34	4.88	6.53	8.54	9.76	12.20	15.25	21.66	30.51	61.02
		cm³/rev	28,1	54,8	80	107	140	160	200	250	355	500	1000
	$V_{g\,0}$ [1])	in³(cm³)/rev	0	0	0	0	0	0	0	0	0	0	0
Max. speed	n_{max} at $V_{g\,max}$	rpm	5300	4200	3750	3300	3150	3000	2750	2500	2240	2000	1600
	$n_{max,\,intermittent}$ at $V_{g\,max}$ [2])	rpm	5850	4600	4100	3650	3450	3300	3000	2500	2240	2000	1600
	n_{max} at $V_g < V_{g,1}$	rpm	8000	6300	5600	5000	4700	4500	4100	3300	2950	2650	2100
	$V_{g,1}$	in³/rev	1.16	2.26	3.30	4.33	5.68	6.53	8.18	11.59	16.48	23.49	46.50
		cm³/rev	19	37	54	71	93	107	134	190	270	385	762
	n_{max} at $V_{g\,0}$	rpm	8800	7100	6300	5600	5200	5000	4500	3300	2950	2650	2100
Max. perm. flow	$q_{V\,max}$	gpm	39.4	60.8	79.3	93.3	116.5	126.8	145.3	165.1	210.0	264.2	422.7
		L/min	149	230	300	353	441	480	550	625	795	1000	1600
Torque constants	T_k at $V_{g\,max}$	lb-ft/psi	0.023	0.044	0.065	0.086	0.113	0.129	0.162	0.202	0.287	0.405	0.810
		Nm/bar	0,446	0,87	1,27	1,70	2,23	2,54	3,18	3,98	5,65	7,96	15,92
Max. torque	T_{max} at $V_{g\,max}$ [3])	lb-ft	131.3	256.7	376.1	500.8	657.1	749.3	938.9	1025.9	1458.8	2054	4109
		Nm	178	348	510	679	891	1016	1273	1391	1978	2785	5571
Case volume		gal	0.13	0.20	0.32	0.40	0.48	0.63	0.71	0.79		1.85	
		L	0,5	0,75	1,2	1,5	1,8	2,4	2,7	3,0		7,0	
Moment of inertia about drive axis	J	lbs-ft²	0.033	0.100	0.190	0.301	0.491	0.600	0.838	1.448	2.420	4.224	13.05
		kgm²	0,0014	0,0042	0,0080	0,0127	0,0207	0,0253	0,0353	0,061	0,102	0,178	0,550
Weight (approx.)	m	lbs	35.3	57.3	75.0	103	132	141	176	198	375	463	952
		kg	16	26	34	47	60	64	80	90	170	210	432

[1]) The minimum displacement $V_{g\,min}$ is infinitely adjustable between $V_{g\,0}$ and $0{,}8 \cdot V_{g\,max}$.
Indicate in the order: $V_{g\,min}$ = ... cm³ (note for sizes 250...1000: $V_{g\,min}$ is set to $0{,}2 \cdot V_{g\,max}$ when there is no indication in the order!)

[2]) Intermittent max. speed: overspeed at discharge and overtaking travel operation, t < 5 sec. and Δp < 2175 psi (150 bar)

[3]) Sizes 28...200: Δp = 5800 psi (400 bar); sizes 250...1000: Δp = 5100 psi (350 bar)

Permissible displacement, speed related



Calculation of size

Flow $q_V = \dfrac{V_g \cdot n}{231 \cdot \eta_v}$ gpm $\left(q_V = \dfrac{V_g \cdot n}{1000 \cdot \eta_v} \text{ L/min}\right)$

Output Speed $n = \dfrac{q_V \cdot 231 \cdot \eta_v}{V_g}$ rpm $\left(n = \dfrac{q_V \cdot 1000 \cdot \eta_v}{V_g} \text{ rpm}\right)$

Output Torque $T = \dfrac{V_g \cdot \Delta p \cdot \eta_{mh}}{24 \cdot \pi}$ lb-ft $\left(T = \dfrac{V_g \cdot \Delta p \cdot \eta_{mh}}{20 \cdot \pi} \text{ Nm}\right)$

Output Power $P = \dfrac{T \cdot n}{5252} = \dfrac{q_V \cdot \Delta p \cdot \eta_t}{1714}$ HP

$\left(P = \dfrac{T \cdot n}{9549} = \dfrac{q_V \cdot \Delta p \cdot \eta_t}{600} \text{ kW}\right)$

V_g = geometric displacement per rev. - in³ (cm³)
Δp = pressure differential - psi (bar)
η_v = volumetric efficiency
η_{mh} = mech.-hyd. efficiency
η_t = total efficiency ($\eta_v \cdot \eta_{mh} = \eta_t$)

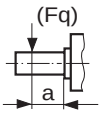
Output drive

Permissible axial and radial loading on drive shaft. The values given are maximum values and not permissible for continuous operation.

Size			28	55	80	107	140	160	200	250	355	500	1000
a	in		0.49	0.59	0.69	0.79	0.89	0.89	0.98	1.61	2.07	2.07	2.66
	mm		12.5	15	17.5	20	22.5	22.5	25	41	52.5	52.5	67.5
$F_{q\,max}$	lbf		1280	2347	1911	3434	4003	4568	5147	270[1])	337[1])	427[1])	
	N		5696	10440	8500	15278	17808	20320	22896	1200[1])	1500[1])	1900[1])	
$\pm F_{ax\,max}$	lbf	$+F_{ax\,max}$	71	112	160	202	231	252	281	899	1124	1405	2248
		$-F_{ax\,max}$	71	112	160	202	231	252	281	270	337	427	584
	N	$+F_{ax\,max}$	315	500	710	900	1030	1120	1250	4000	5000	6250	10000
		$-F_{ax\,max}$	315	500	710	900	1030	1120	1250	1200	1500	1900	2600
$\pm F_{ax\,perm.}$/psi	lbf/psi		0.07	0.12	0.15	0.18	0.21	0.23	0.26	[2])	[2])	[2])	[2])
$\pm F_{ax\,perm.}$/bar	N/bar		4.6	7.5	9.6	11.3	13.3	15.1	17.0	[2])	[2])	[2])	[2])

[1]) Axial piston unit in stationary or in bypass operation, please contact us when appearing higher forces!
[2]) Please contact us!

Code explanation



a = distance of F_q from shaft shoulder

$F_{q\,max}$ = max. perm. radial force at distance a (at intermittent operation)

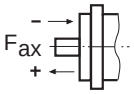
$\pm F_{ax\,max}$ = max. perm. axial force when stationary or when axial piston unit is running at zero pressure

$\pm F_{ax\,perm.}$/psi = perm. axial force/psi operating pressure
$\pm F_{ax\,perm.}$/bar = perm. axial force/bar operating pressure

The direction of the max. axial force must be noted by sizes 28...200

$-F_{ax\,max}$ = increased bearing life

$+F_{ax\,max}$ = reduced bearing life (avoid if possible)



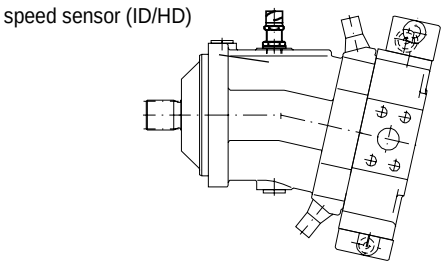
Speed sensor (D)

Version AA6VM (A6VM). . . D ("with provisions for speed sensor") includes toothed collar on the rotary group.
A speed-proportional signal is produced by means of the rotating, toothed rotary group which can be picked up by a suitable sensor and fed back for evaluation.
The speed sensor can be screwed into the upper drain port. An additional adapter piece (included in supply) is necessary for the drain ports sizes 55-200 in order to install the speed sensors (thread metric M18x1,5).

Size	28	55	80	107	140	160	200
no. of teath	42	54	58	67	72	75	80

The speed sensor is not included in standard supply;

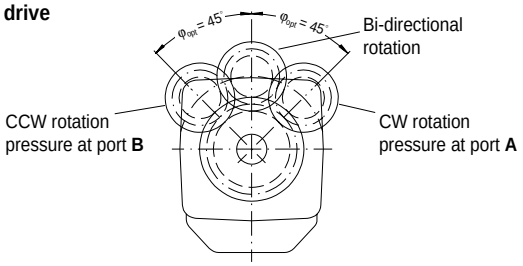
Suitable sensors:
- Induktive impulse detector ID (see RA 95038)
- Hall effect speed sensor HD (see RA 95042); order seperately!



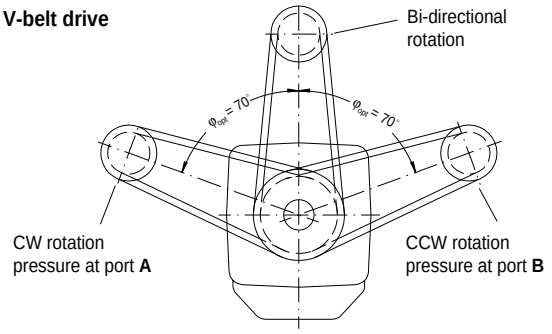
Optimal force direction of F_q (valid for sizes 28...200)

By means of appropriate force directions of F_q the bearing load caused by inside rotary group forces can be reduced.
An optimal life expectation of the bearing can be reached.

Gear drive



V-belt drive



HD Hydraulic Control, Pilot Pressure Related

The pilot pressure related hydraulic control allows infinite variation of the motor displacement in relation to a pilot pressure signal. The control function is proportional to the pilot pressure applied at port X.

HD1 Pilot pressure increase 145 psi (10 bar)

- sizes 28...200 ($V_{g\,min}$ = 0 to $V_{g\,max}$) _____ Δp_S = 145 psi (10 bar)
- sizes 250...1000 ($V_{g\,min}$ = 0,2 $V_{g\,max}$ to $V_{g\,max}$) __ Δp_S = 145 psi (10 bar)

Start of control, setting range:
- sizes 28...1000 _____ 30 - 290 psi (2 - 20 bar)

Standard setting: start of control at 45 psi (3 bar)
end of control at 190 psi (13 bar)

HD2 Pilot pressure increase 365 psi (25 bar)

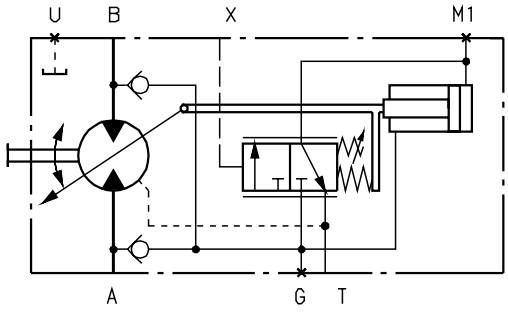
- sizes 28...200 ($V_{g\,min}$ = 0 to $V_{g\,max}$) _____ Δp_S = 365 psi (25 bar)
- sizes 250...1000 ($V_{g\,min}$ = 0,2 $V_{g\,max}$ to $V_{g\,max}$) __ Δp_S = 365 psi (25 bar)

Start of control, setting range:
- sizes 28...1000 _____ 75 - 725 psi (5 - 50 bar)

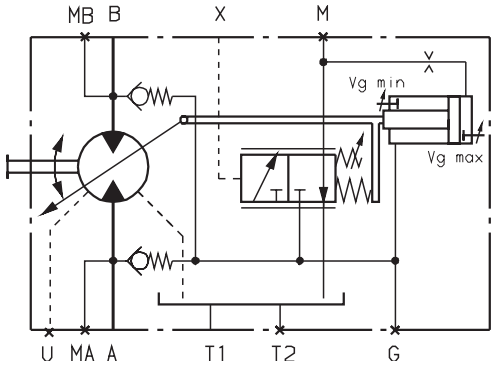
Standard setting: start of control at 145 psi (10 bar)
end of control at 510 psi (35 bar)

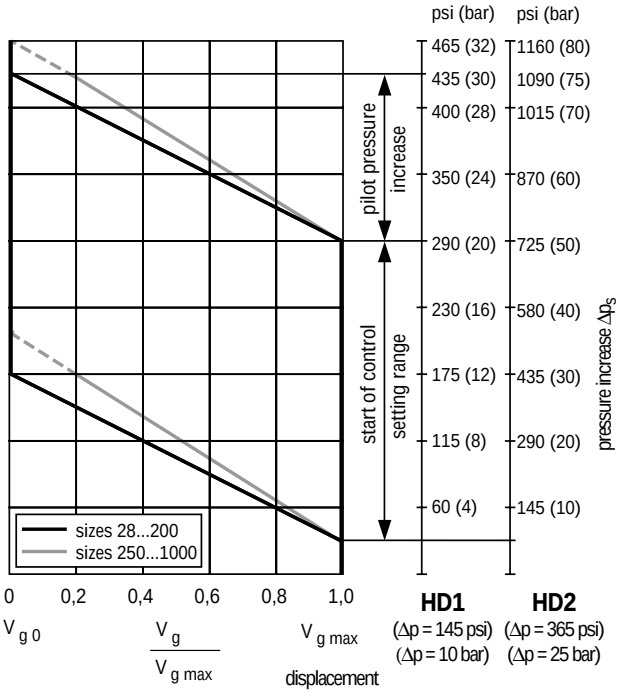
When ordering please state required start of control in clear text, e.g. start of control at 45 psi (3 bar).

Circuit diagram:
Hydraulic control, pilot pressure related HD1, HD2
Sizes 28...200



Sizes 250...1000





Standard version:
- start of control at $V_{g\,max}$ (max. torque, min. speed)
- end of control at $V_{g\,min}$ (min. torque, max. perm. speed)

Max. perm. pilot pressure _____ 1450 psi (100 bar)

Because of internal leakage, there is a leakage flow of approx. 0.08 gpm (0,3 L/min.) at port X.
To prevent an influence on the characteristic, leakage flow has to be led into the tank through the control device.

Unit dimensions control HD, see page 22...32

Variation: Constant pressure control (HD.**D)**

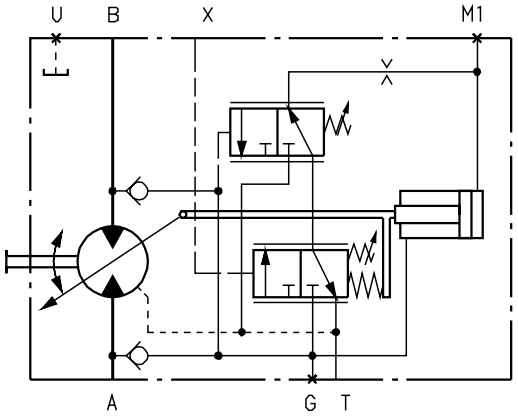
The constant pressure control is superimposed on the HD function. Should system pressure rise as a result of the load torque or reduction of the motor swivel angle, when the setting of the constant pressure control is reached the motor is swivelled out to a higher angle.

As a result of the increased displacement and consequent pressure reduction, the control deviation is eliminated. By increasing the displacement the motor produces a higher torque at a constant pressure.

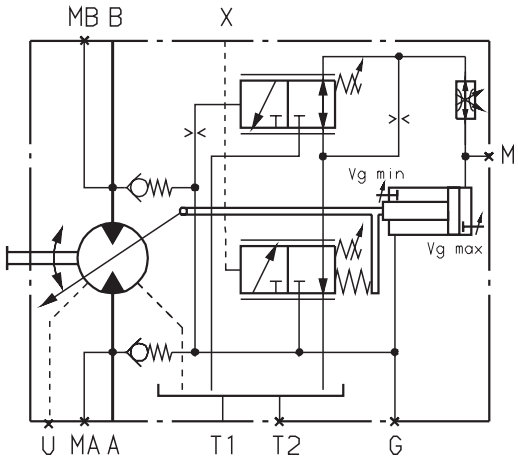
Setting range of constant pressure control valve:

sizes 28...200 _____ 1160 - 5800 psi (80 - 400 bar)
sizes 250...1000_____ 1160 - 5100 psi (80 - 350 bar)

Circuit diagram:
Hydraulic control, pilot pressure related,
with constant pressure control HD1D, HD2D
Sizes 28...200



Sizes 250...1000



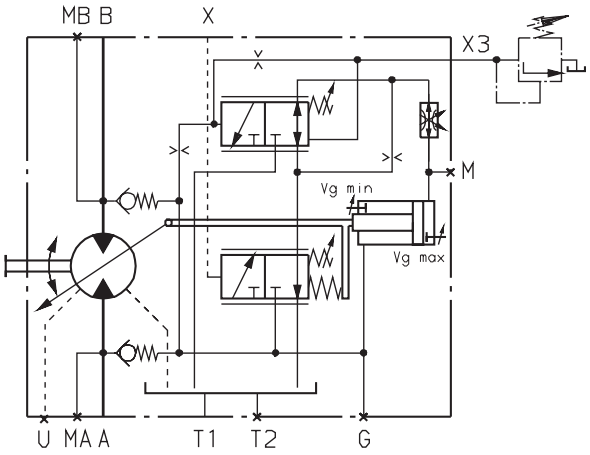
Variation: Remote constant pressure control (HD.**G)**

The remote pressure control controls the motor when reaching the set pressure command signal continuously until it reaches the max. displacement $V_{g\,max}$. A pressure relief valve (not supplied), which is separate to the motor, is responsible for the control of the internal pressure cut-off valve. As long as the pressure command signal has not been obtained, the valve is, in addition to the spring force, pressurised from both sides, and is held closed. The pressure command signal is between 1160 and 5100 psi (80 bar and 350 bar). On reaching the pressure command signal at the separate pressure relief valve, this opens, whereby the pressure on the spring side is allowed to flow to tank. The internal pilot valve operates and the motor swivels to maximum displacement $V_{g\,max}$. The pressure difference at the pilot valve is set as standard to 365 psi (25 bar). We recommend the following as a separate pressure relief valve:

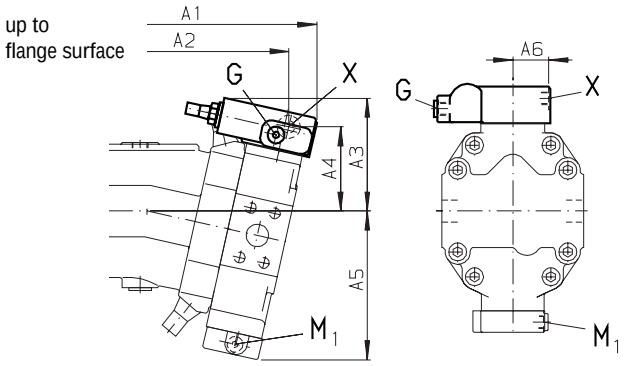
DBD 6 (hydraulic) to RA 25402

The max. line length should not exceed 6 ft (2 m).

Circuit diagram:
Hydraulic control, pilot pressure related,
with remote constant pressure control HD1G, HD2G
Sizes 250...1000

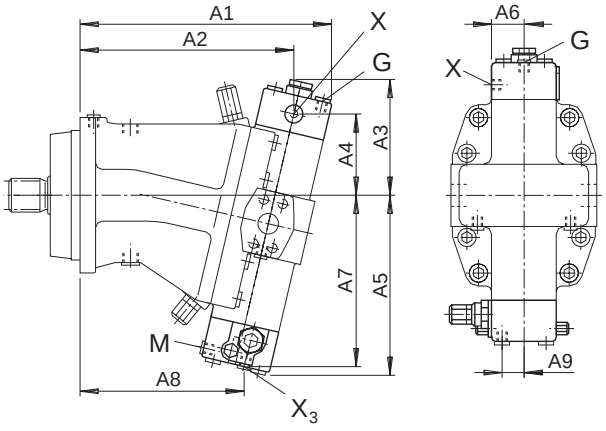


Unit dimensions HD1**D,** HD2**D**
Sizes 28...200



Size		A1	A2	A3	A4	A5	A6	port X
A6VM	**28**	8.43	7.44	4.69	3.43	5.35	1.40	M14x1,5
		(214)	(189)	(119)	(87)	(136)	(35,5)	
	140	12.72	11.42	5.55	4.25	7.68	1.59	M14x1,5
		(323)	(290)	(141)	(108)	(195)	(40,5)	
AA6VM	**55**	10.43	9.45	4.72	3.50	5.94	1.40	9/16-18 UNF-2B
		(265)	(240)	(120)	(89)	(151)	(35,5)	
	80	11.54	10.55	4.96	3.74	6.57	1.40	9/16-18 UNF-2B
		(293)	(268)	(126)	(95)	(167)	(35,5)	
	107	12.72	11.42	5.24	3.98	6.89	1.59	9/16-18 UNF-2B
		(323)	(290)	(133)	(101)	(175)	(40,5)	
	160	14.21	12.95	5.55	4.25	7.76	1.59	9/16-18 UNF-2B
		(361)	(329)	(141)	(108)	(197)	(40,5)	
	200	14.88	13.58	5.71	4.41	8.23	1.59	9/16-18 UNF-2B
		(378)	(345)	(145)	(112)	(209)	(40,5)	

Unit dimensions HD1**D,** HD2**D,** HD1**G,** HD2**G**
Sizes 250...1000



Size		A1	A2	A3	A4	A5	A6	A7	A8	A9	ports X, X_3
AA6VM	**250**	16.81	14.53	7.40	4.84	10.71	1.91	10.08	12.52	1.38	9/16-18 UNF-2B
		(427)	(369)	(188)	(123)	(272)	(48,5)	(256)	(318)	(35)	
A6VM	**355**	17.01	14.41	7.99	5.39	11.34	2.13	10.67	11.30	1.30	M14x1,5
		(432)	(366)	(203)	(137)	(288)	(54)	(271)	(287)	(33)	
	500	19.29	16.42	8.46	5.83	12.05	2.42	11.30	12.36	0.91	M14x1,5
		(490)	(417)	(215)	(148)	(306)	(61,5)	(287)	(314)	(23)	
	1000										

Pilot pressure port X_3: open at HD.G, plugged at HD.D

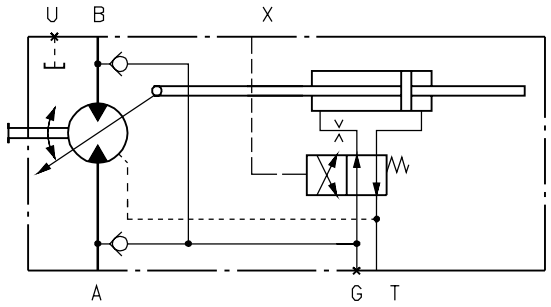
HZ Hydraulic Two-Position Control

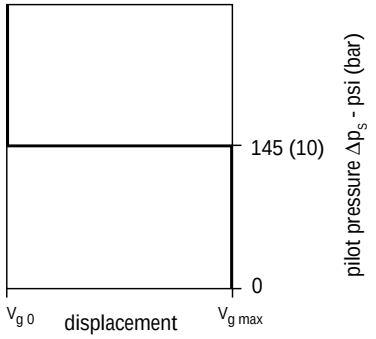
The hydraulic two-position control allows the displacement to be set to $V_{g\,min}$ or $V_{g\,max}$ by applying or venting pilot pressure at port X.

Standard version:

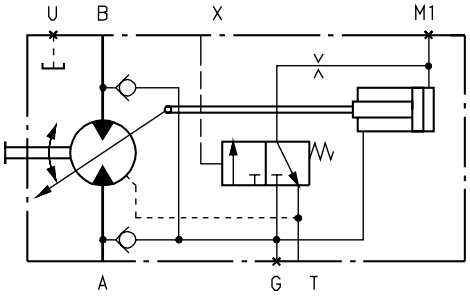
- start of control at $V_{g\,max}$ (max. torque, min. speed)
- end of control at $V_{g\,min}$ (min. torque, max. perm. speed)

Circuit diagram: ***Hydraulic two-position control HZ3***
Sizes 55, 80, 107

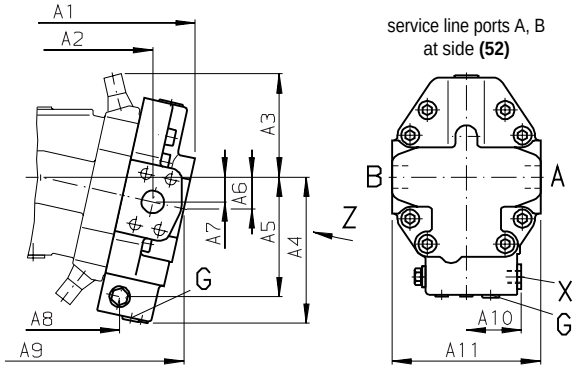




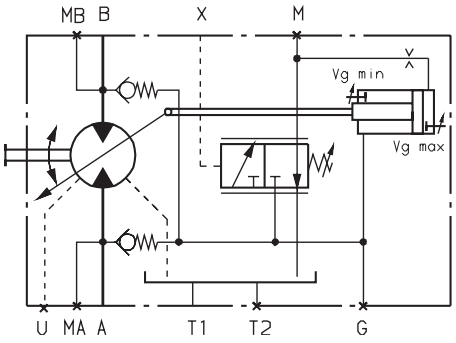
Circuit diagram: ***Hydraulic two-position control HZ1***
Sizes 28, 140, 160, 200



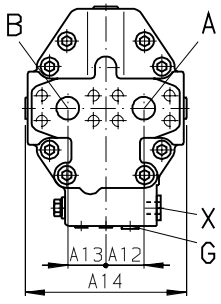
Unit dimensions HZ3
Sizes 55, 80, 107
Unit dimensions of control HZ (sizes 250...1000) and HZ1 (sizes 28, 140, 160, 200) see pages 22-32



Circuit diagram: ***Hydraulic two-position control HZ***
Sizes 250...1000



View Z service line ports A, B at rear end **(51)**



Size		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14
AA6VM	**55**	9.88	8.15	3.94	5.75	4.61	1.22	0.94	6.89	9.41	2.40	5.98	1.48	1.48	6.30
		(251)	(207)	(100)	(146)	(117)	(31)	(24)	(175)	(239)	(61)	(152)	(37,5)	(37,5)	(160)
	80	10.98	9.13	4.49	6.34	5.20	1.38	1.06	7.72	10.47	2.40	6.46	1.65	1.65	6.77
		(279)	(232)	(114)	(161)	(132)	(35)	(27)	(196)	(266)	(61)	(164)	(42)	(42)	(172)
	107	11.89	9.92	4.80	6.81	5.63	1.50	1.18	8.43	11.34	2.40	7.09	1.65	1.65	7.40
		(302)	(252)	(122)	(173)	(143)	(38)	(30)	(214)	(288)	(61)	(180)	(42)	(42)	(188)

Size		Service line ports A, B[1)]	Pilot pressure port X
AA6VM	**55**	SAE 3/4"; threads 2/8-16 UNC-2B	9/16-18 UNF-2B
	80	SAE 1"; threads 7/16-14 UNC-2B	9/16-18 UNF-2B
	107	SAE 1"; threads 7/16-14 UNC-2B	9/16-18 UNF-2B

1) 6000 psi (420 bar) high pressure series

EP Electrical Control with Proportional Solenoid

The electrical control with proportional solenoid or proportional valve (sizes 250...1000) allows infinite variation of the motor displacement in relation to an electrical signal.
The control function is proportional to the electrical control current applied.

Sizes 28...200

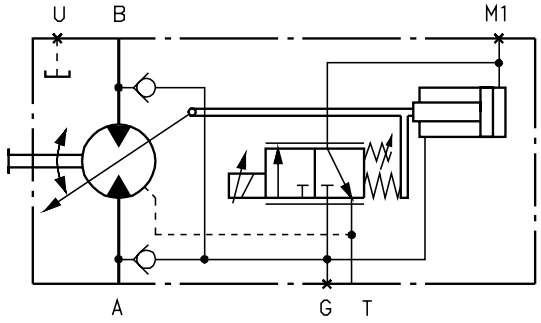
	control voltage (DC)	control current start of control ($V_{g\,max}$)	control current end of control ($V_{g\,min}$ = 0)
EP1	12 V	400 mA	1200 mA
EP2	24 V	200 mA	600 mA

Sizes 250...1000

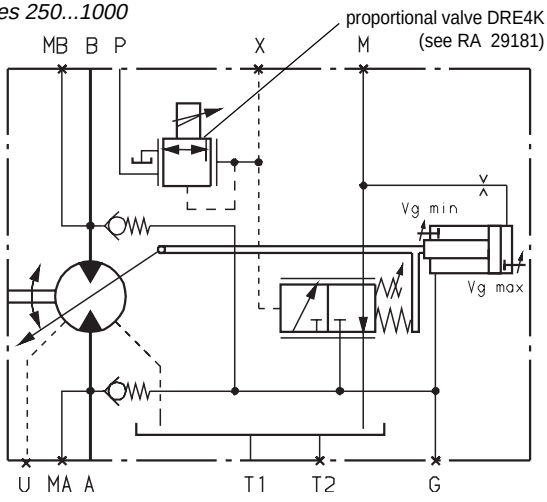
	control voltage (DC)	control current start of control ($V_{g\,max}$)	control current end of control ($V_{g\,min}$ = 0,2 $V_{g\,max}$)
EP1	12 V	900 mA	1400 mA
EP2	24 V	450 mA	700 mA

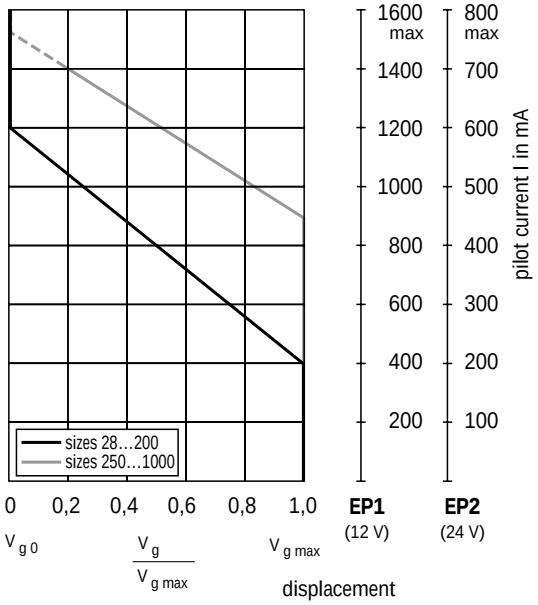
Pilot pressure p...435 psi, max. 1450 psi (30 bar, max. 100 bar)

Circuit diagram:
Electrical control with proportional solenoid EP1, EP2
Sizes 28...200



Circuit diagram:
Electrical control with proportional solenoid EP1, EP2
Sizes 250...1000





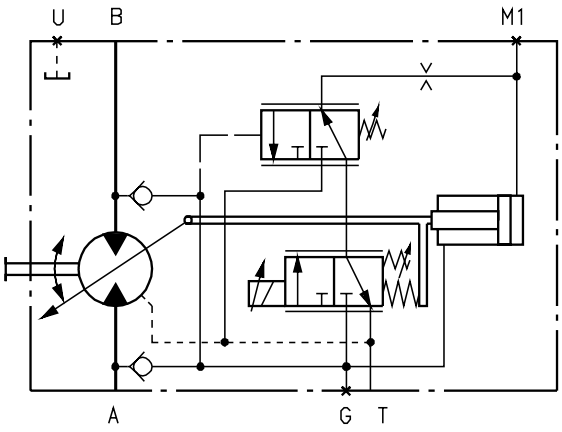
Standard version:
- start of control at $V_{g\,max}$ (max. torque, min. speed)
- end of control at $V_{g\,min}$ (min. torque, max. perm. speed)

Adjustment of the control speed or limiting of the displacement (limiting of swivel) range by electrical means is possible using the following control devices:

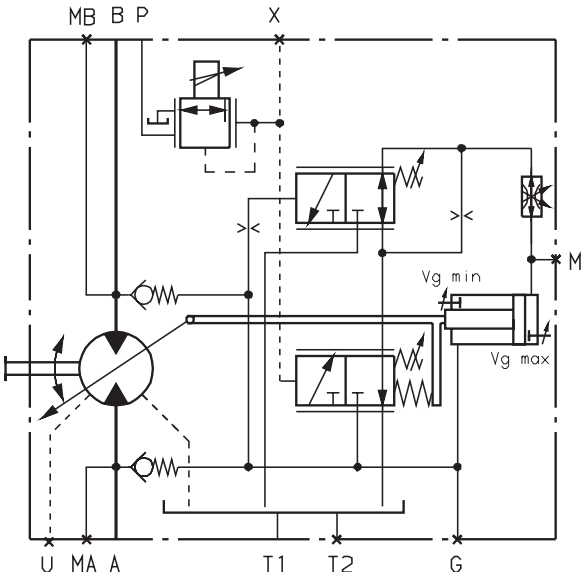
Proportional amplifier PV _____ see RA 95023
Chopper amplifier CV _____ see RA 95029
Electrical amplifier 2014/15 _____ see RA 95027
Electrical amplifier VT 2000, series 5 _____ see RA 29904

Variation: Direct constant pressure control (EP.**D)**
The constant pressure control is superimposed on the EP function. Should system pressure rise as a result of the load torque or reduction of the motor swivel angle, when the setting of the constant pressure control is reached the motor is swivelled out to a higher angle.
As a result of the increased displacement and consequent pressure reduction, the control deviation is eliminated. By increasing the displacement the motor produces a higher torque at a constant pressure.
Setting range of constant pressure control valve:
Sizes 28...200 _____ 1160 - 5800 psi (80 - 400 bar)
Sizes 250...1000 _____ 1160 - 5100 psi (80 - 350 bar)

Circuit diagram:
Electrical control with proportional solenoid,
with direct constant pressure control EP1D, EP2D
Sizes 28...200

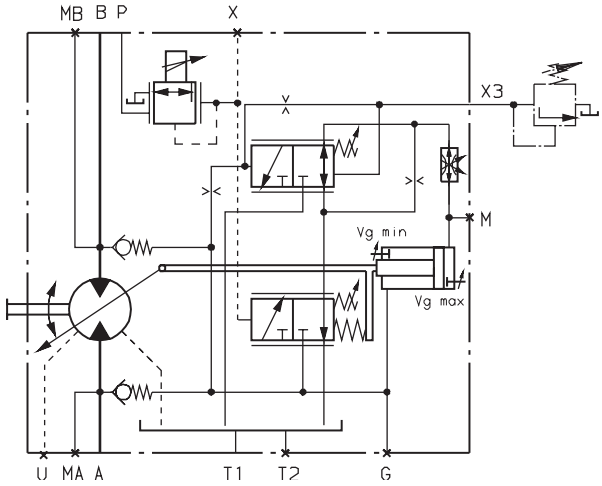


Sizes 250...1000

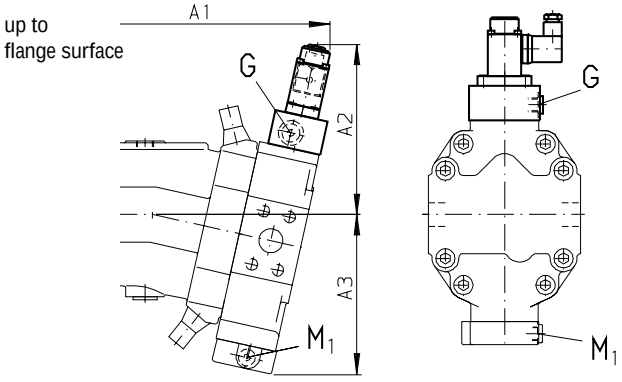


Variation: Remote constant pressure control (EP.**G)**
The remote pressure control controls the motor when reaching the set pressure command signal continuously until it reaches the max. displacement $V_{g\,max}$. A pressure relief valve (not supplied), which is separate to the motor, is responsible for the control of the internal pressure cut-off valve. As long as the pressure command signal has not been obtained, the valve is, in addition to the spring force, pressurised from both sides, and is held closed. The pressure command signal is between 1160 psi and 5100 psi (80 bar and 350 bar). On reaching the pressure command signal at the separate pressure relief valve, this opens, whereby the pressure on the spring side is allowed to flow to tank. The internal pilot valve operates and the motor swivels to maximum displacement $V_{g\,max}$. The pressure difference at the pilot valve is set as standard to 365 psi (25 bar). We recommend the following as a separate pressure relief valve:
DBD 6 (hydraulic) to RA 25402
The max. line length should not exceed 6 ft (2 m).

Circuit diagram:
Electrical control with proportional solenoid,
with remote constant pressure control EP1G, EP2G
Sizes 250...1000

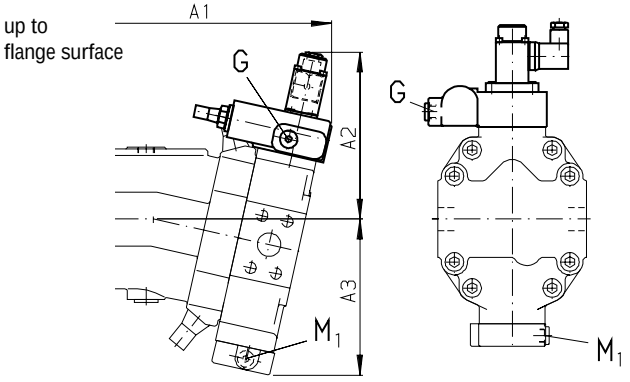


Unit dimensions EP1, EP2
Sizes 28...200



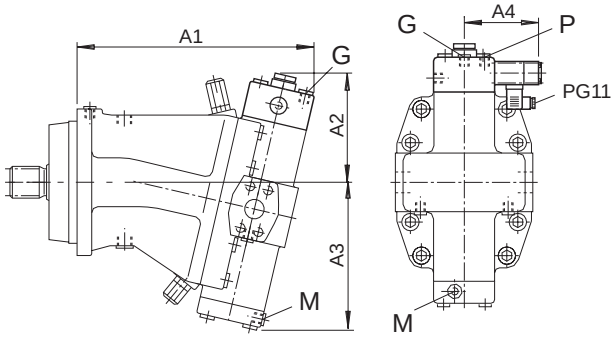
Size		A1	A2	A3
A6VM	**28**	8.43 (214)	6.54 (166)	5.35 (136)
	140	12.68 (322)	7.36 (187)	7.68 (195)
AA6VM	**55**	10.43 (265)	6.57 (167)	5.94 (151)
	80	11.54 (293)	6.81 (173)	6.57 (167)
	107	12.72 (323)	7.05 (179)	6.89 (175)
	160	14.21 (361)	7.36 (187)	7.76 (197)
	200	14.84 (377)	7.52 (191)	8.23 (209)

Unit dimensions EP1**D,** EP2**D**
Sizes 28...200



Size		A1	A2	A3
A6VM	**28**	8.43 (214)	6.54 (166)	5.35 (136)
	140	12.68 (322)	7.36 (187)	7.68 (195)
AA6VM	**55**	10.43 (265)	6.57 (167)	5.94 (151)
	80	11.54 (293)	6.81 (173)	6.57 (167)
	107	12.72 (323)	7.05 (179)	6.89 (175)
	160	14.21 (361)	7.36 (187)	7.76 (197)
	200	14.84 (377)	7.52 (191)	8.23 (209)

Unit dimensions EP1, EP2
Sizes 250...1000

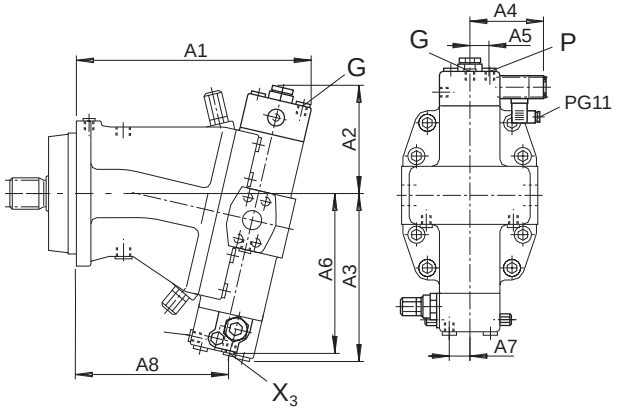


Size		A1	A2	A3	A4
AA6VM	**250**	16.81 (427)	7.40 (188)	10.71 (272)	4.88 (124)
A6VM	**355**	17.01 (432)	7.99 (203)	11.34 (288)	4.92 (125)
	500	19.29 (490)	8.46 (215)	12.05 (306)	5.20 (132)
	1000				

Pilot pressure port P: AA6VM 250 9/16-18 UNF-2B
A6VM 250...1000 M 14x1,5

Pilot pressure port X_3: AA6VM 250 9/16-18 UNF-2B
A6VM 250...1000 M 14x1,5
(open at EP.**G**, plugged at EP.**D**)

Unit dimensions EP1**D,** EP2**D,** EP1**G,** EP2**G**
Sizes 250...1000



Size		A1	A2	A3	A4
AA6VM	**250**	16.81 (427)	7.40 (188)	10.71 (272)	4.88 (124)
A6VM	**355**	17.01 (432)	7.99 (203)	11.34 (288)	4.92 (125)
	500	19.29 (490)	8.46 (215)	12.05 (306)	5.20 (132)
	1000				

Size		A5	A6	A7	A8
AA6VM	**250**	1.42 (36)	10.08 (256)	1.38 (35)	12.17 (309)
A6VM	**355**	1.42 (36)	10.67 (271)	1.30 (33)	11.30 (287)
	500	1.69 (43)	11.30 (287)	1.26 (32)	12.36 (314)
	1000				

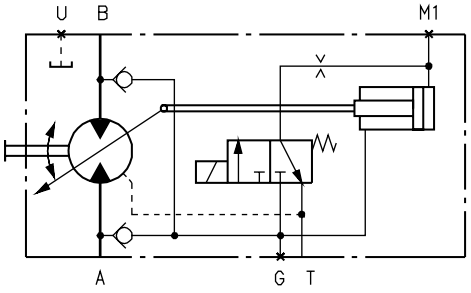
EZ Electrical Two-Position Control with Switching Solenoid

The electrical two-position control with switching solenoid allows the displacement to be set to $V_{g\,max}$ or $V_{g\,min}$ by energizing or de-energizing the solenoid.

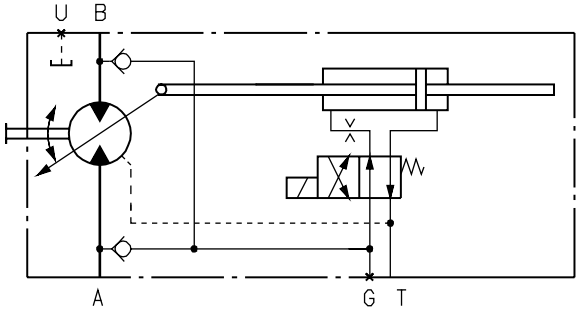
Solenoid de-energized ≙ motor set to $V_{g\,max}$
Solenoid energized ≙ motor set to $V_{g\,min}$

EZ1, EZ3	switching solenoid 12 V DC, 26W (EZ1) 30W (EZ3)
EZ2, EZ4	switching solenoid 24 V DC, 26W (EZ2) 30W (EZ4)

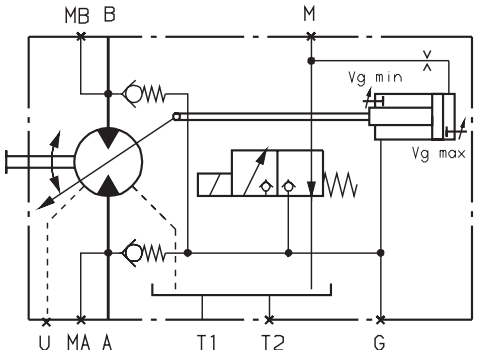
Electrical two-position control EZ1, EZ2
Sizes 28, 140, 160, 200



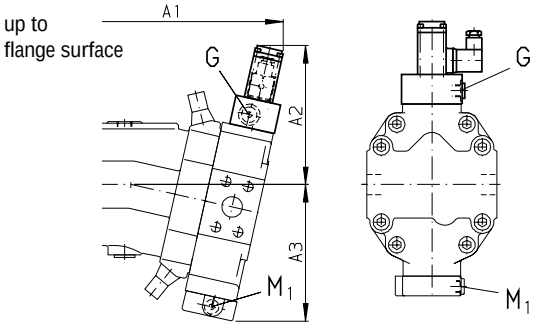
Electrical two-position control EZ3, EZ4
Sizes 55, 80, 107



Electrical two-position control EZ1, EZ2
Sizes 250...1000

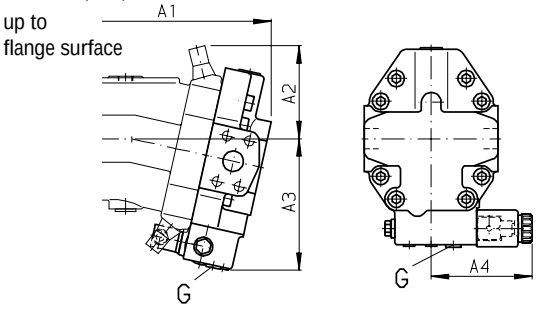


Unit dimensions EZ1, EZ2
Sizes 28, 140, 160, 200



Size		A1	A2	A3
A6VM	28	8.50 (216)	6.42 (163)	5.35 (136)
	140	12.64 (321)	7.24 (184)	7.68 (195)
AA6VM	160	14.17 (360)	7.24 (184)	7.76 (197)
	200	14.80 (376)	7.40 (188)	8.23 (209)

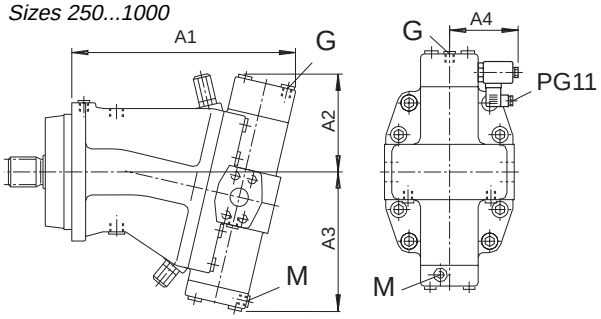
Unit dimensions EZ1, EZ2
Sizes 55, 80, 107



Size		A1	A2	A3	A4
AA6VM	55	9.88 (251)	3.94 (100)	5.75 (146)	4.88 (124)
	80	10.98 (279)	4.49 (114)	6.34 (161)	4.88 (124)
	107	11.89 (302)	4.80 (122)	6.81 (173)	4.88 (124)

(Additional dimensions of the port plate see page 11, HZ3-control)

Unit dimensions EZ1, EZ2
Sizes 250...1000



Size		A1	A2	A3	A4
AA6VM	250	16.81 (427)	6.73 (171)	9.76 (248)	4.92 (125)
A6VM	355	17.01 (432)	7.17 (182)	10.98 (279)	5.06 (128,5)
	500	19.29 (490)	7.76 (197)	12.05 (306)	5.33 (135,5)
	1000				

DA Hydraulic Control, Speed Related

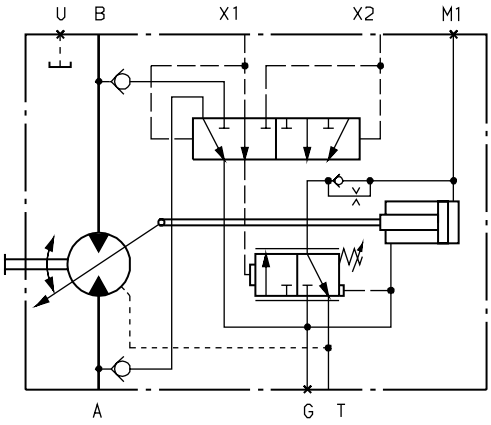
The AA6VM (A6VM) variable motor with speed related hydraulic control is particularly suitable for use in hydrostatic transmissions in conjunction with variable pump AA4VG with DA control.
The swivel angle of the hydraulic motor is controlled by means of the pilot pressure determined by the input speed of the AA4VG variable pump and by the operating pressure.
An increase in the pump input speed and thus in the pilot pressure causes the motor, in relation to the existing operating pressure, to swivel towards a lower displacement volume (lower torque, higher speed).
If operating pressure should rise above the value set with the pressure control, the motor is then swivelled towards a higher displacement volume (higher torque, lower speed).

DA (sizes 250...1000) DA1, DA4 (sizes 28...200)

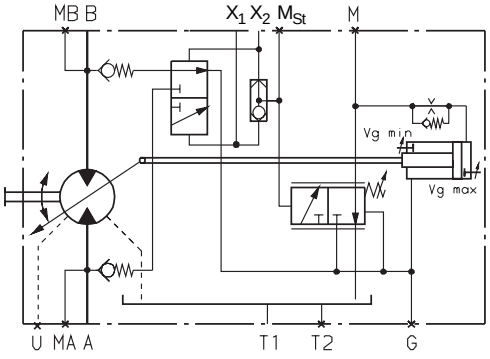
Hydraulic valve for travel direction
Through the control pressure X_1 or X_2 this valve is switched on/off dependend on the direction of rotation (travel direction)

direction of rotation	operating pressure in	switching solenoid a
clockwise	**A**	**X_1**
anti-clockwise	**B**	**X_2**

Circuit diagram:
Hydraulic control, speed related DA1, DA4
Sizes 28...200



Circuit diagram:
Hydraulic control, speed related DA
Sizes 250...1000



When designing a drive using DA control, note also the technical data of variable pump A4VG with DA control.
A computer program is available at Rexroth to help you with the design of your drive. Full details on request.

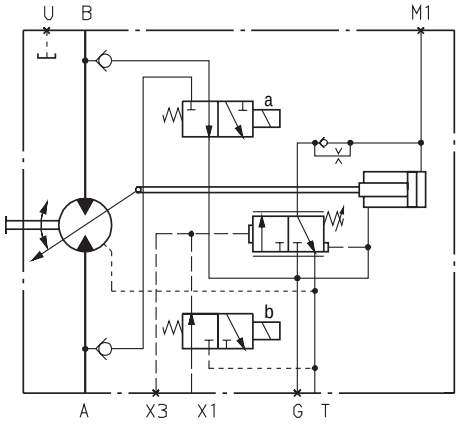
DA2, DA3, DA5, DA6 (sizes 28...200)

El. valve for travel direction + el. $V_{g\,max}$-switching process
The electrical valve is operated by the pressure spring or switch solenoid (a) dependent on the rotational direction (travel direction).
Through connection of the electric current at the switch solenoid (b) override of the control is possible and the motor is switched to max. swivel angle (high torque, low speed) (el. $V_{g\,max}$-switching process).

DA2, DA5	switching solenoid a, b 12 V DC; 1,6 A (min.)
DA3, DA6	switching solenoid a, b 24 V DC; 0,8 A (min.)

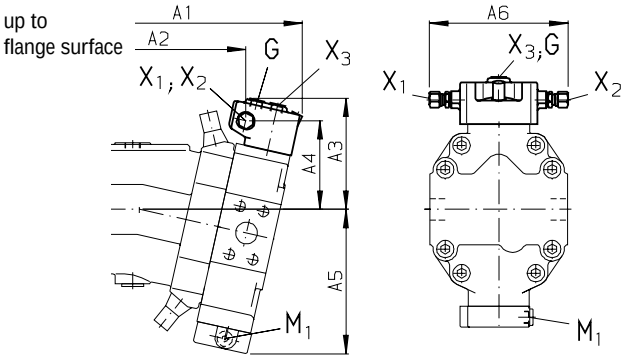
direction of rotation	operating pressure in	switching solenoid a
clockwise	**A**	**energized**
anti-clockwise	**B**	**de-energized**

Circuit diagram:
Hydraulic control, speed related DA2, DA3, DA5, DA6
Sizes 28...200



Unit dimensions DA1, DA4

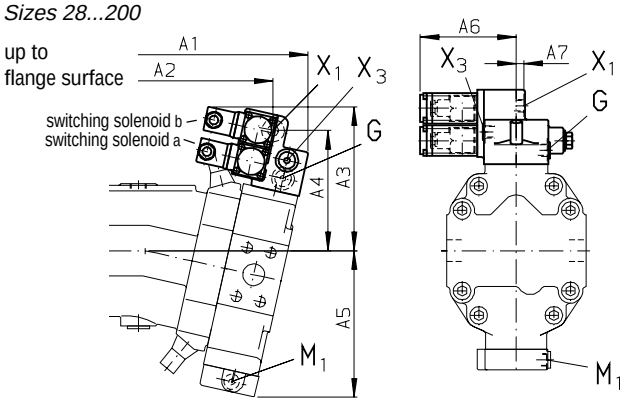
Sizes 28...200



Size		A1	A2	A3	A4	A5	A6	ports X_1, X_2
A6VM	**28**	8.50	5.98	4.72	3.66	5.35	6.30	locking GE-8LM
		(216)	(152)	(120)	(93)	(136)	(160)	
	140	12.68	9.72	5.55	4.53	7.68	6.85	locking GE-8LM
		(322)	(247)	(141)	(115)	(195)	(174)	
AA6VM	**55**	10.47	7.99	4.80	3.70	5.94	6.30	7/16-20 UNF-2B
		(266)	(203)	(122)	(94)	(151)	(160)	
	80	11.61	9.09	5.00	3.94	6.57	6.30	7/16-20 UNF-2B
		(295)	(231)	(127)	(100)	(167)	(160)	
	107	12.72	9.76	5.28	4.21	6.89	6.85	7/16-20 UNF-2B
		(323)	(248)	(134)	(107)	(175)	(174)	
	160	14.21	11.26	5.55	4.53	7.76	6.85	7/16-20 UNF-2B
		(361)	(286)	(141)	(115)	(197)	(174)	
	200	14.88	11.93	5.75	4.69	8.23	6.85	7/16-20 UNF-2B
		(378)	(303)	(146)	(119)	(209)	(174)	

Unit dimensions DA2, DA3, DA5, DA6

Sizes 28...200



Size		A1	A2	A3	A4	A5	A6	A7	port X_1
A6VM	**28**	8.58	6.89	6.22	5.12	5.35	4.33	0.33	M14x1,5
		(218)	(175)	(158)	(130)	(136)	(110)	(8,5)	
	140	12.72	10.63	7.13	6.06	7.68	4.41	0.33	M14x1,5
		(323)	(270)	(181)	(154)	(195)	(112)	(8,5)	
AA6VM	**55**	10.59	8.90	6.26	5.20	5.94	4.33	0.33	9/16-18 UNF-2B
		(269)	(226)	(159)	(132)	(151)	(110)	(8,5)	
	80	11.61	10.00	6.38	5.43	6.57	4.33	0.33	9/16-18 UNF-2B
		(295)	(254)	(162)	(138)	(167)	(110)	(8,5)	
	107	12.76	10.67	6.81	5.75	6.89	4.41	0.33	9/16-18 UNF-2B
		(324)	(271)	(173)	(146)	(175)	(112)	(8,5)	
	160	14.25	12.17	7.13	6.02	7.76	4.41	0.33	9/16-18 UNF-2B
		(362)	(309)	(181)	(153)	(197)	(112)	(8,5)	
	200	14.92	12.83	7.28	6.22	8.23	4.41	0.33	9/16-18 UNF-2B
		(379)	(326)	(185)	(158)	(209)	(112)	(8,5)	

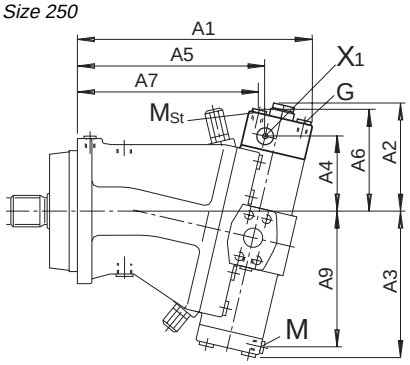
X_1: pilot pressure port

Unit dimensions DA

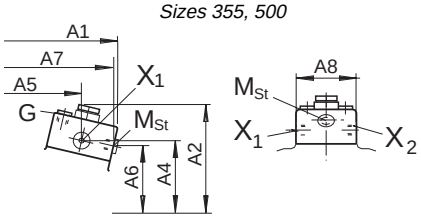
Sizes 250...1000

Note: different position of the ports G and M_{St} for size 250 and sizes 355, 500

Size 250



Sizes 355, 500



Size		A1	A2	A3	A4	A5	A6	A7	A8	A9	ports X, X_3
AA6VM	**250**	16.81	7.40	9.76	4.96	13.74	6.34	13.31		8.94	9/16-18 UNF-2B
		(427)	(188)[1])	(248)	(126)	(349)	(161)	(338)		(227)	
A6VM	**355**	17.01	7.99	10.98	5.51	12.87	4.84	16.61	4.25	10.12	M14x1,5
		(432)	(203)[1])	(279)	(140)	(327)	(123)	(422)	(108)	(257)	
	500	19.29	8.46	12.05	5.94	16.65	5.39	18.94	4.84	11.18	M14x1,5
		(490)	(215)[1])	(306)	(151)	(423)	(137)	(481)	(123)	(284)	
	1000										

[1]) max.

HA Automatic Control, High Pressure Related

With the automatic, high pressure related control, setting of the displacement is effected automatically as a function of the operating pressure.
This control device measures the operating pressure at A or B internally (no pilot line required) and swivels from $V_{g\ min}$ to $V_{g\ max}$ once the pressure setting of the control is reached.

Standard version:

start of control at $V_{g\ min}$ (no torque, max. perm. speed)

end of control at $V_{g\ max}$ (max. torque, min. speed)

HA1

Version with virtually no pressure increase from start of control to end of control.

Pressure increase:

sizes 28...200 ($V_{g\ min}$ = 0 to $V_{g\ max}$) _____ ≤ Δp 145 psi (10 bar)

sizes 250...1000 ($V_{g\ min}$ = 0,2 $V_{g\ max}$ to $V_{g\ max}$) ___ ≤ Δp 145 psi (10 bar)

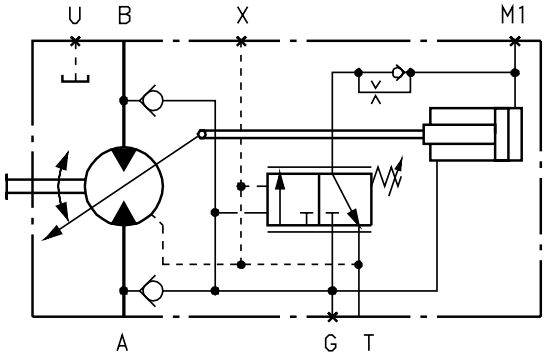
Start of control, setting range :

sizes 28...200 _____ 1160 - 5100 psi (80 - 350 bar)

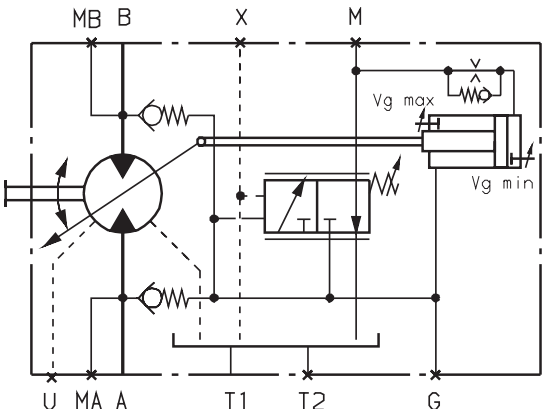
sizes 250...1000 _____ 1160 - 4900 psi (80 - 340 bar)

(state required setting in clear text when ordering)

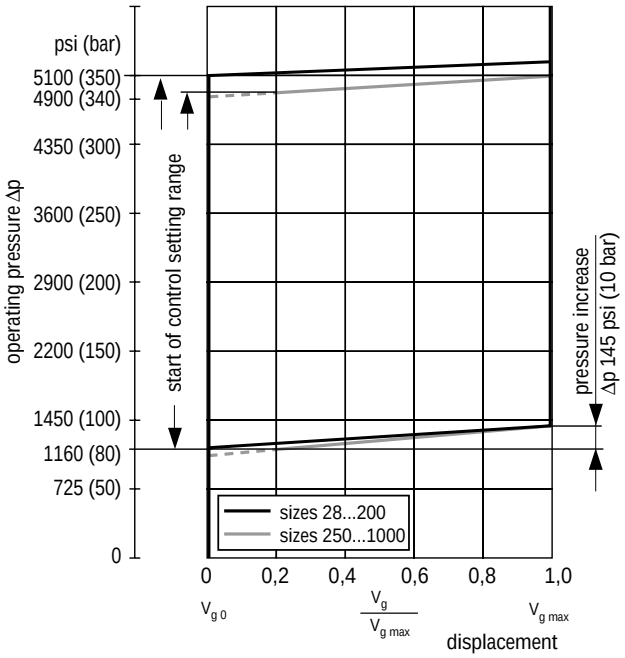
Circuit diagram:
Automatic control, high pressure related HA1
Sizes 28...200



Sizes 250...1000



HA1



HA2

Version with pressure increase from start of control to end of control.

Pressure increase:

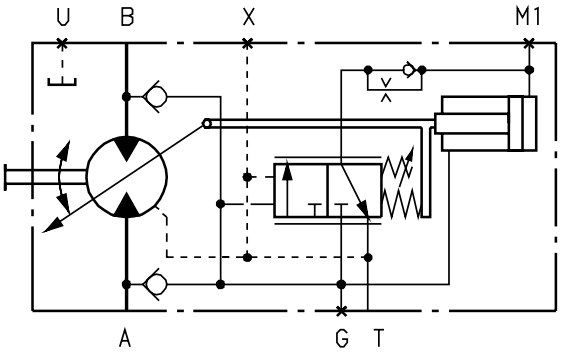
sizes 28...200 ($V_{g\,min}$ = 0 to $V_{g\,max}$) _____ ≤ Δp 1450 psi (100 bar)
sizes 250...1000 ($V_{g\,min}$ = 0,2 $V_{g\,max}$ to $V_{g\,max}$) _ ≤ Δp 1450 psi (100 bar)

Start of control, setting range:

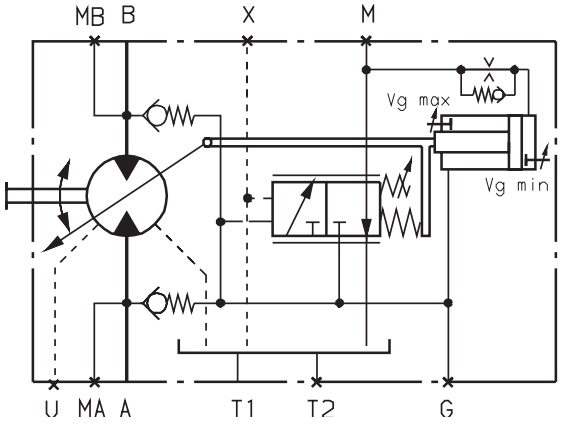
sizes 28...200 _____ 1160 - 5100 psi (80 - 350 bar)
sizes 250...1000 _____ 1160 - 3600 psi (80 - 250 bar)

(state required setting in clear text when ordering)

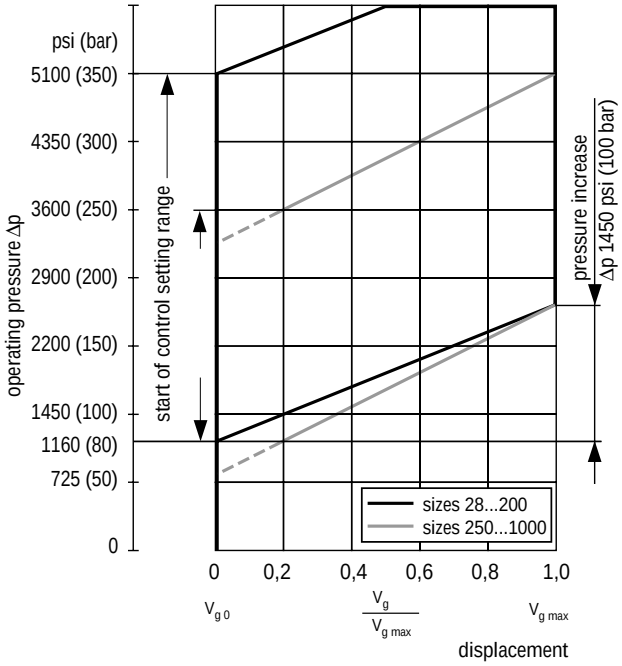
Circuit diagram:
Automatic control, high pressure related HA2
Sizes 28...200



Sizes 250...1000



HA2



Variation: **Hydraulic override of pressure setting (**HA**.T)**

On versions HA1and HA2 the pressure setting (start of control) can be influenced by applying a pilot pressure at port X.

The pressure setting is reduced by:
sizes 28...200 _____ 17 psi (17 bar)
sizes 250...1000 _____ 8 psi (8 bar)
per 1 psi (1 bar) pilot pressure.

(i.e. - Pilot pressure to high pressure ratio: 1:17)

Example (sizes 28...200):

pressure setting	4350 psi (300 bar)	4350 psi (300 bar)
pilot pressure at port X	0 psi (0 bar)	145 psi (10 bar)
start of control	4350 psi (300 bar)	1885 psi (130 bar)

If the override is only required to set the max displacement (motor swivel to $V_{g\,max}$), a pilot pressure of up to 1450 psi (100 bar) max. is permissible.

(Circuit diagram and unit dimensions see control HA1, HA2, port X open, no connection from X to T)

Variation: Electrical override of pressure setting (HA.**U1,** HA.**U2)**

On versions HA1and HA2 the high pressure related control can be overridden by means of an electrical signal to a switching solenoid. The override causes the motor to swivel to its maximum angle.

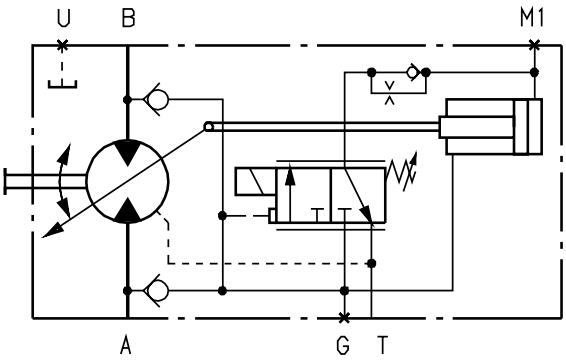
Switching solenoid de-energised ≙ no override

Switching solenoid energised ≙ motor set to $V_{g\,max}$

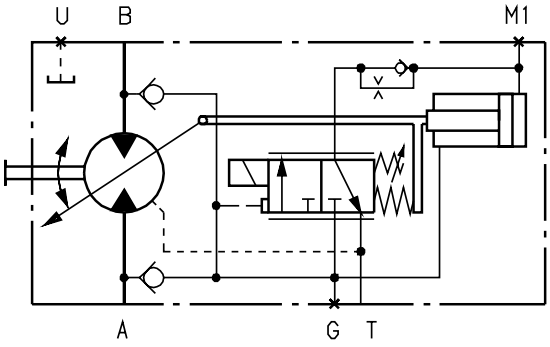
HA.**U1**	switching solenoid 12 V DC, 1,6 A (min.)
HA.**U2**	switching solenoid 24 V DC, 0,8 A (min.)

Start of control adjustable between 1160 psi and 4350 psi (80 and 300 bar)
(state required setting in clear text when ordering)

Circuit diagram:
Automatic control, with electrical override HA1U1, HA1U2 *Sizes 28...200*



HA2U1, HA2U2 *Sizes 28...200*



Variation: Electrical override of pressure setting, with electrical valve for travel direction (HA.**R1,** HA.**R2)**

On version HA1 and HA2 the high pressure related control can be overridden by means of an electrical signal to the switching solenoid b. The overrie causes the variable motor to swivel to its maximum angle.

Switching solenoid b de-energized ≙ no override

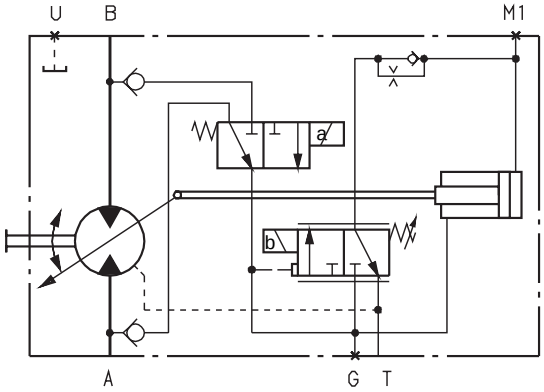
Switching solenoid b energized ≙ motor set to $V_{g\,max}$

The travel directional valve ensures that also at a change of the high pressure side (for instance travel drive at down hill operation) always the preselected pressure side of the hydraulic motor regulates the swivel angle.
An undesired swivel of the variable motor to bigger stroke volume can be avoided.
In depending of the direction (travel direction) the travel directional valve is actuated by the pressure spring or the switching solenoid a.

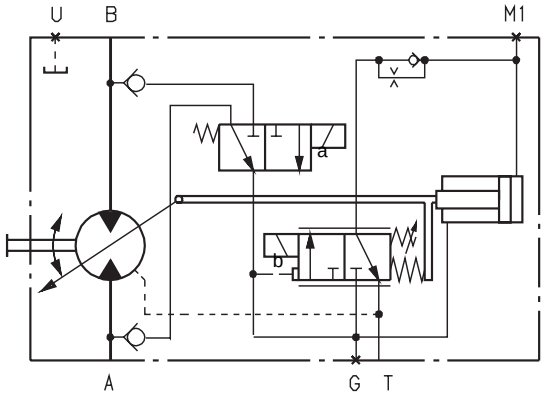
direction of rotation	operating pressure in	switching solenoid a
clockwise	**A**	**energized**
counter-clockwise	**B**	**de-energized**

HA.**R1**	switching solenoid a, b 12 V DC; 1,6 A (min.)
HA.**R2**	switching solenoid a, b 24 V DC; 0,8 A (min.)

Circuit diagram:
Automatic control, with electrical override and electrical valve for travel direction HA1R1, HA1R2 *Sizes 28...200*

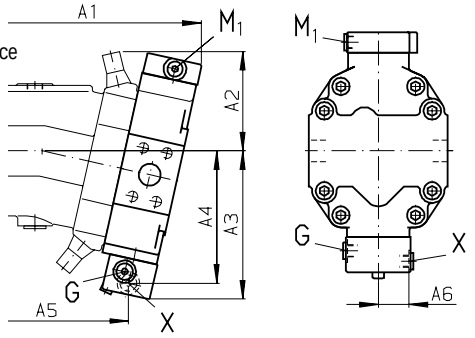


HA2R1, HA2R2 *Sizes 28...200*



Unit dimensions HA1, HA2, HA1**T,** HA2**T**
Sizes 28...200

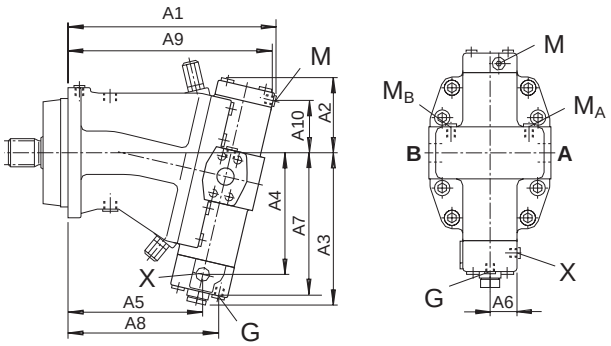
up to flange surface



Size		A1	A2	A3	A4	A5	A6
A6VM	**28**	8.23	3.82	5.94	5.24	5.28	1.36
		(209)	(97)	(151)	(133)	(134)	(34,5)
	140	12.44	5.20	7.80	7.01	8.86	1.59
		(316)	(132)	(198)	(178)	(225)	(40,5)
AA6VM	**55**	10.28	4.09	6.26	5.59	7.20	1.31
		(261)	(104)	(159)	(142)	(183)	(33,4)
	80	11.50	4.49	6.73	5.98	8.15	1.36
		(292)	(114)	(171)	(152)	(207)	(34,5)
	107	12.68	4.80	7.20	6.46	9.09	1.59
		(322)	(122)	(183)	(164)	(231)	(40,5)
	160	13.98	5.39	7.87	7.13	10.39	1.59
		(355)	(137)	(200)	(181)	(264)	(40,5)
	200	14.61	5.63	8.23	7.48	10.91	1.59
		(371)	(143)	(209)	(190)	(277)	(40,5)

port X: A6VM 28/140 _____ M14x1,5
AA6VM 55...200 _____ 9/16-18 UNF-2B
(plugged, open for design HA.**T)**

Unit dimensions HA1, HA2, HA1**T,** HA2**T**
Sizes 250...1000

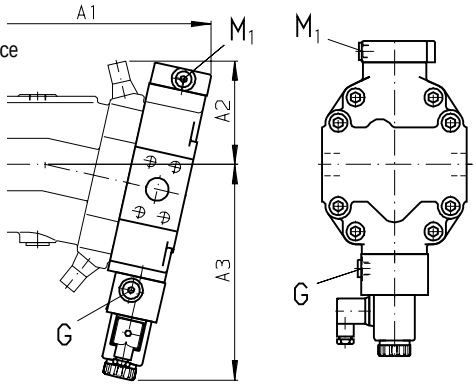


Size		A1	A2	A3	A4	A5	A6	A7	A8	A9	A10
AA6VM	**250**	16.77	6.34	10.83	8.27	11.42	1.91	9.76	12.60	16.50	4.57
		(426)	(161)	(275)	(210)	(290)	(48,5)	(248)	(320)	(419)	(116)
A6VM	**355**	17.01	7.13	11.81	9.21	10.98	2.13	10.83	12.40	16.73	5.20
		(432)	(181)	(300)	(234)	(279)	(54)	(275)	(315)	(425)	(132)
	500	19.25	7.72	12.80	10.16	12.68	2.42	11.81	14.13	19.02	5.67
		(489)	(196)	(325)	(258)	(322)	(61,5)	(300)	(359)	(483)	(144)
	1000										

port X: AA6VM 250 _____ 9/16-18 UNF-2B
A6VM 355...1000 ____ M14x1,5
(plugged, open for design HA.**T)**

Unit dimensions HA1**U1,** HA1**U2,** HA2**U1,** HA2**U2**
Sizes 28...200

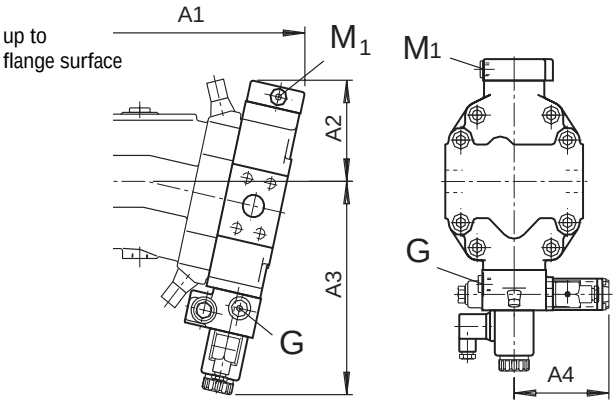
up to flange surface



Size		A1	A2	A3
A6VM	**28**	8.23 (209)	3.82 (97)	8.50 (216)
	140	12.44 (316)	5.20 (132)	10.35 (263)
AA6VM	**55**	10.28 (261)	4.09 (104)	8.82 (224)
	80	11.50 (292)	4.49 (114)	9.37 (238)
	107	12.36 (314)	4.80 (122)	9.80 (249)
	160	13.98 (355)	5.39 (137)	10.47 (266)
	200	14.61 (371)	5.63 (143)	10.83 (275)

Unit dimensions HA1**R1,** HA1**R2,** HA2**R1,** HA2**R2**
Sizes 28...200

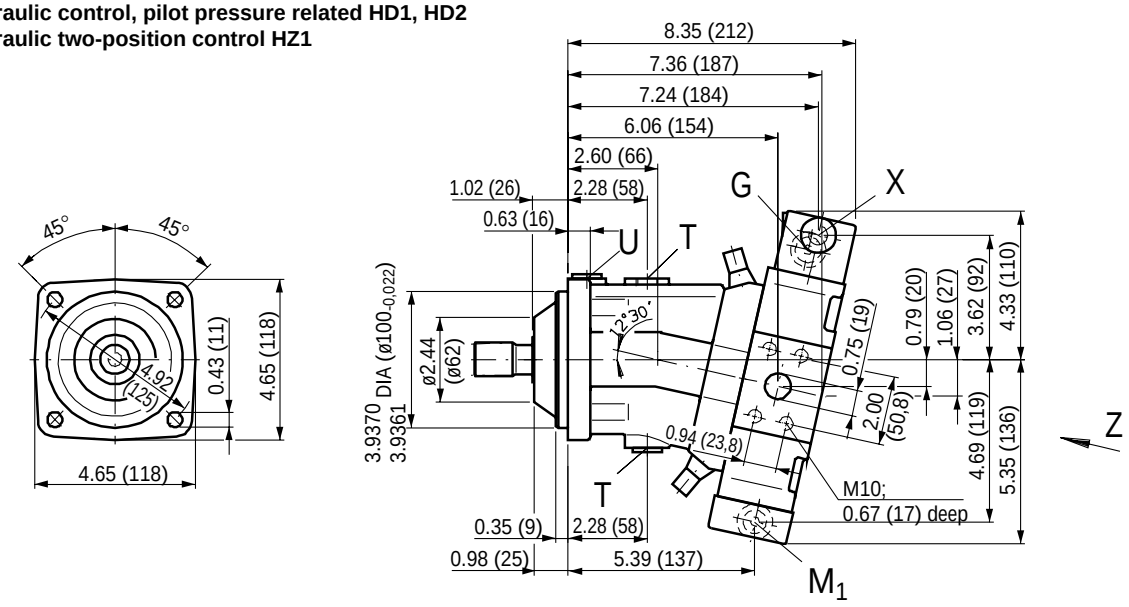
up to flange surface



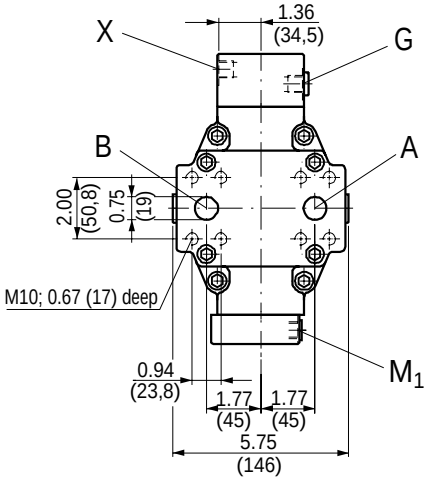
Size		A1	A2	A3	A4
A6VM	**28**	8.23 (209)	3.82 (97)	8.50 (216)	4.33 (110)
	140	12.44 (316)	5.20 (132)	10.35 (263)	4.41 (112)
AA6VM	**55**	10.28 (261)	4.09 (104)	8.82 (224)	4.33 (110)
	80	11.50 (292)	4.49 (114)	9.37 (238)	4.33 (110)
	107	12.36 (314)	4.80 (122)	9.80 (249)	4.41 (112)
	160	13.98 (355)	5.39 (137)	10.47 (266)	4.41 (112)
	200	14.61 (371)	5.63 (143)	10.83 (275)	4.41 (112)

Unit Dimensions, Size 28 (ISO-Version)

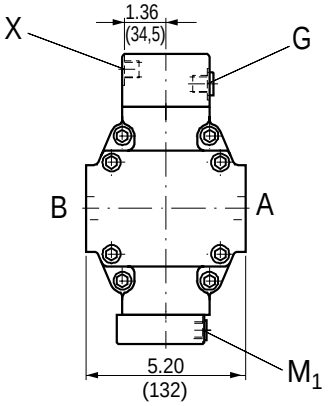
Hydraulic control, pilot pressure related HD1, HD2
Hydraulic two-position control HZ1



Service line ports A/B at rear end **(01)**
View Z

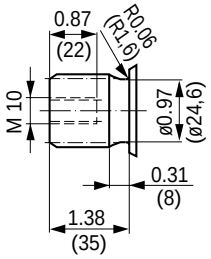


Service line ports A/B on (opposite) sides **(02)**
View Z

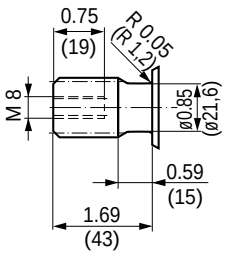


Shaft ends

A
Splined shaft,DIN 5480
W 30x2x30x14x9g



Z
Splined shaft, DIN 5480
W 25x1,25x30x18x9g

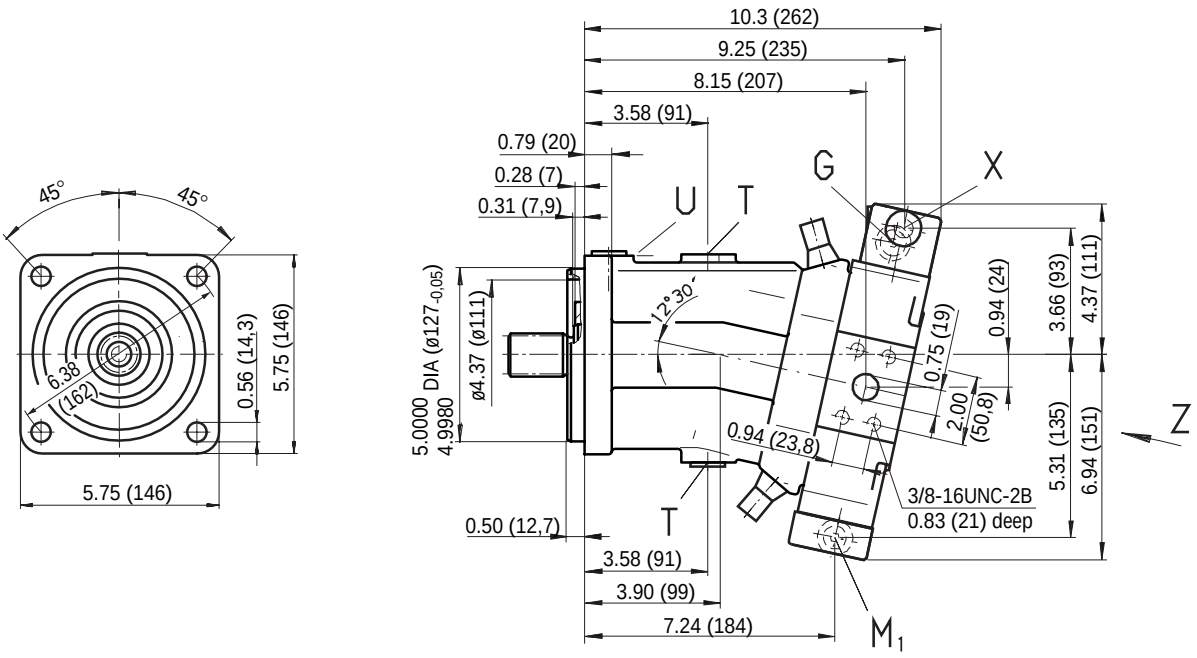


Connections

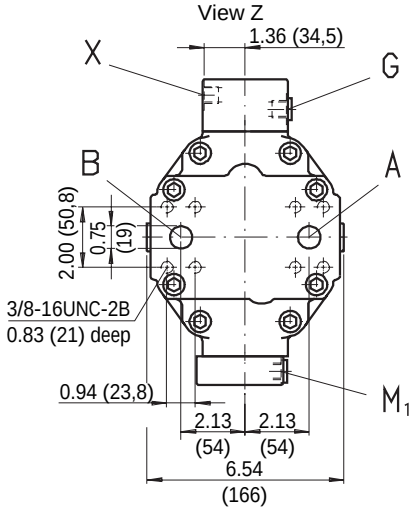
A,B	Service line ports 6000 psi (420 bar) high pressure series	SAE 3/4"
G	Port for synchronous control of a number of units and for remote control pressure (plugged)	M14x1,5
X	Pilot pressure port	M14x1,5
T	Case drain ports	M18x1,5
U	Flushing port (plugged)	M16x1,5
M_1	Test port for control pressure (plugged)	M14x1,5

Unit Dimensions, Size 55 (SAE Version)

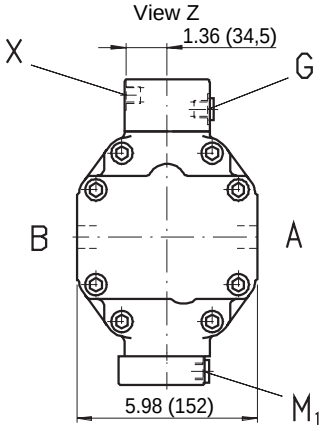
Hydraulic control, pilot pressure related HD1, HD2



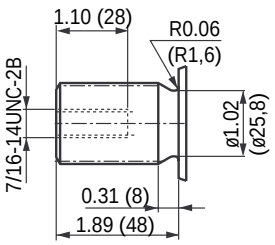
Service line ports A/B at rear end **(51)**



Service line ports A/B on (opposite) sides **(52)**



Shaft end
S
Splined shaft, SAE 1 1/4"
14 T, 12/24 DP, Tolerance class 5
ANSI B92.1a-1976

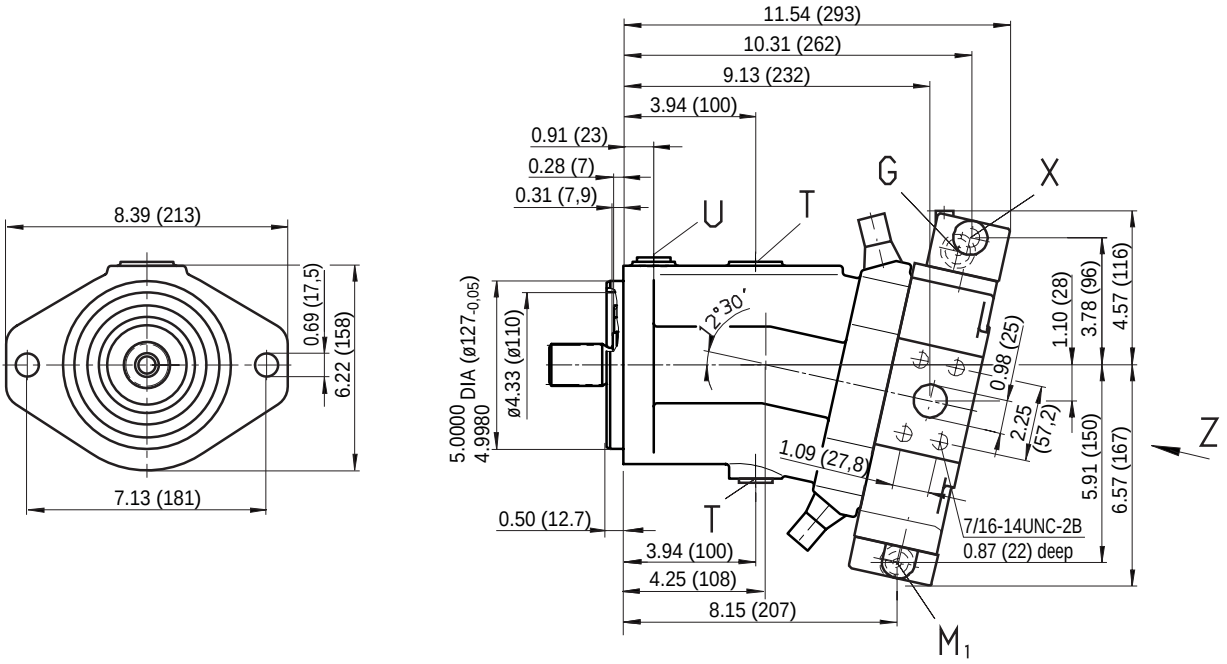


Connections

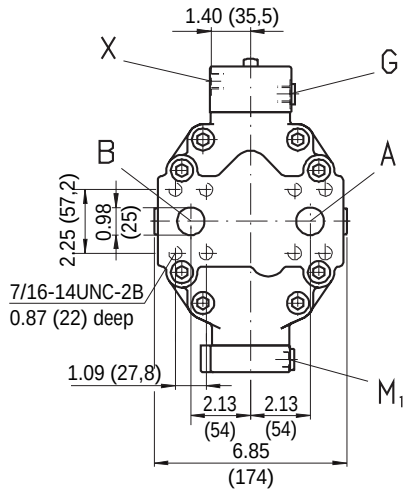
A,B	Service line ports 6000 psi (420 bar) high pressure series	SAE 3/4"
G	Port for synchronous control of a number of units and for remote control pressure (plugged)	SAE 6, 9/16-18UNF-2B
X	Pilot pressure port	SAE 6, 9/16-18UNF-2B
T	Case drain ports	SAE 12, 1 1/16-12UN-2B
U	Flushing port (plugged)	SAE 10, 7/8-14UNF-2B
M_1	Test port for control pressure (plugged)	SAE 6, 9/16-18UNF-2B

Unit Dimensions, Size 80 (SAE Version)

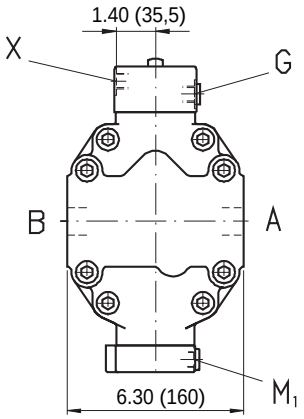
Hydraulic control, pilot pressure related HD1, HD2



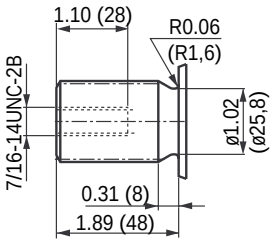
Service line ports A/B at rear end **(51)**
View Z



Service line ports A/B on (opposite) sides **(52)**
View Z



Shaft end
S
Splined Shaft, SAE 1 1/4"
14 T, 12/24 DP, Tolerance class 5
ANSI B92.1a-1976

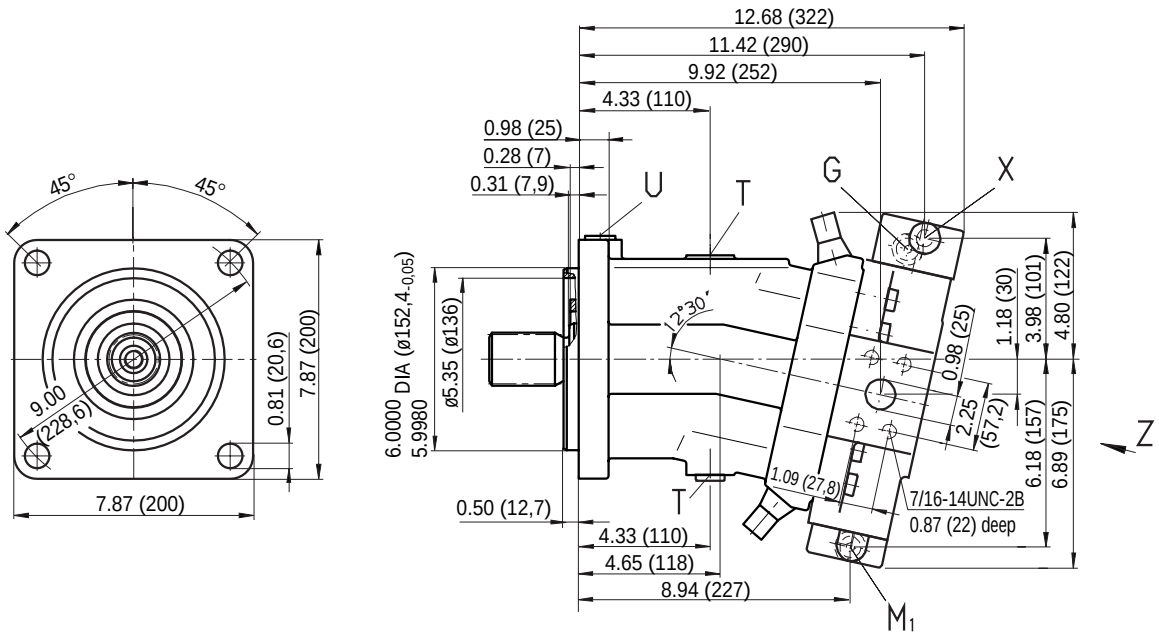


Connections

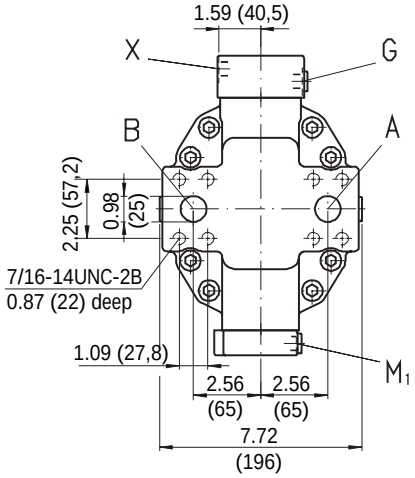
A,B	Service line ports 6000 psi (420 bar) high pressure series	SAE 1"
G	Port for synchronous control of a number of units and for remote control pressure (plugged)	SAE 6, 9/16-18UNF-2B
X	Pilot pressure port	SAE 6, 9/16-18UNF-2B
T	Case drain ports	SAE 12, 1 1/16-12UN-2B
U	Flushing port (plugged)	SAE 10, 7/8-14UNF-2B
M_1	Test port for control pressure (plugged)	SAE 6, 9/16-18UNF-2B

Unit Dimensions, Size 107 (SAE Version)

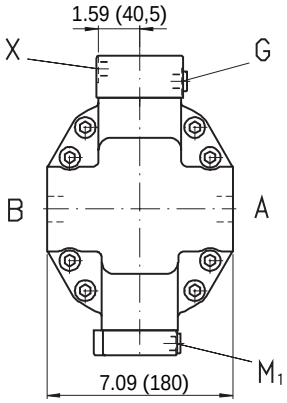
Hydraulic control, pilot pressure related HD1, HD2



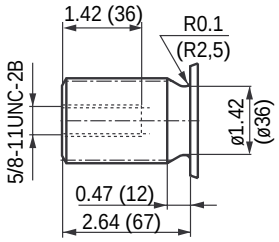
Service line ports A/B at rear end **(51)**
View Z



Service line ports A/B on (opposite) sides **(52)**
View Z



Shaft end
S
Splined shaft, SAE 1 3/4"
13 T, 8/16 DP, Tolerance class 5
ANSI B92.1a-1976

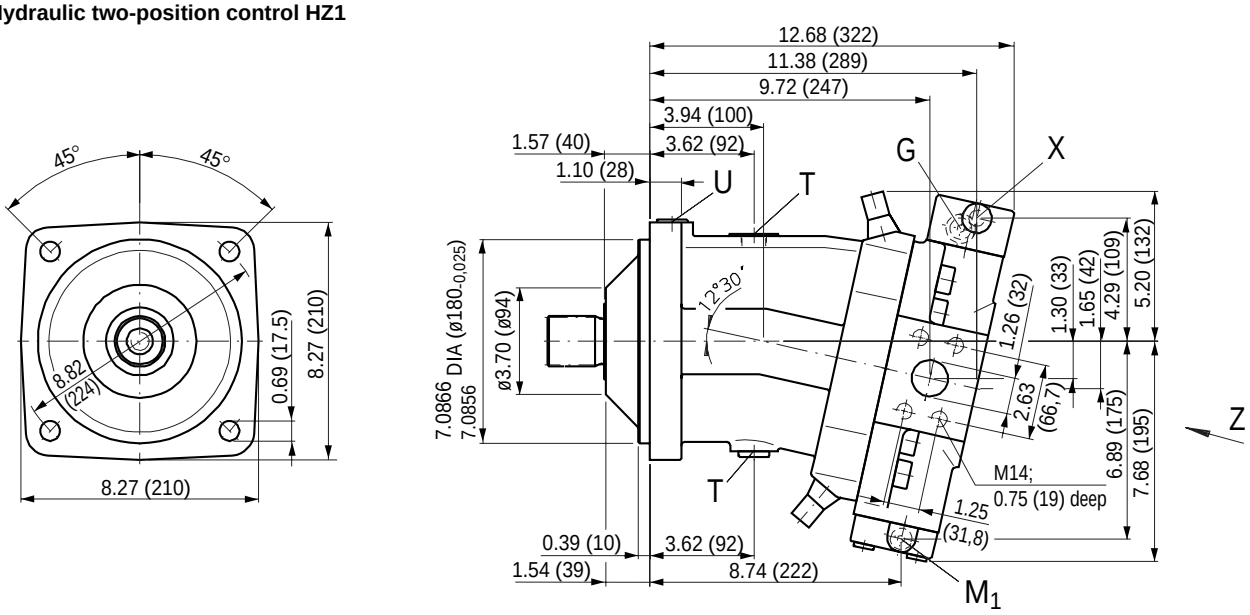


Connections

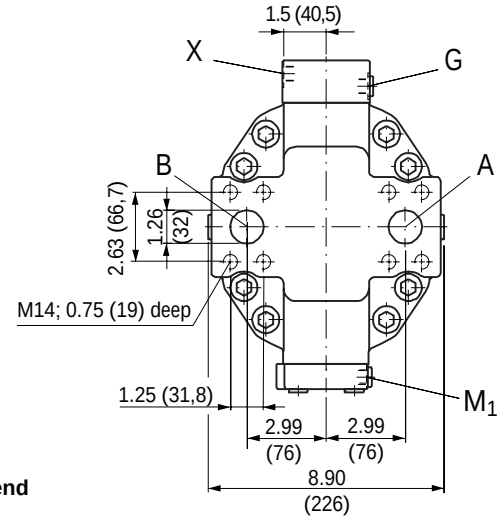
A,B	Service line ports 6000 psi (420 bar) high pressure series	SAE 1"
G	Port for synchronous control of a number of units and for remote control pressure (plugged)	SAE 6, 9/16-18UNF-2B
X	Pilot pressure port	SAE 6, 9/16-18UNF-2B
T	Case drain ports	SAE 12, 1 1/16-12UN-2B
U	Flushing port (plugged)	SAE 10, 7/8-14UNF-2B
M_1	Test port for control pressure (plugged)	SAE 6, 9/16-18UNF-2B

Unit Dimensions, Size 140 (ISO Version)

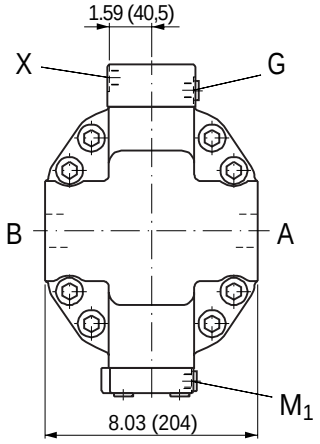
Hydraulic control, pilot pressure related HD1, HD2
Hydraulic two-position control HZ1



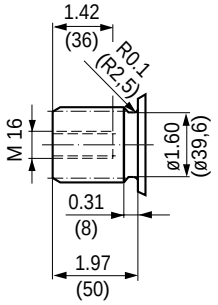
Service line ports A/B at rear end **(01)**
View Z



Service line ports A/B on (opposite) sides **(02)**
View Z



Shaft end
Z
Splined shaft, DIN 5480
W 45x2x30x21x9g

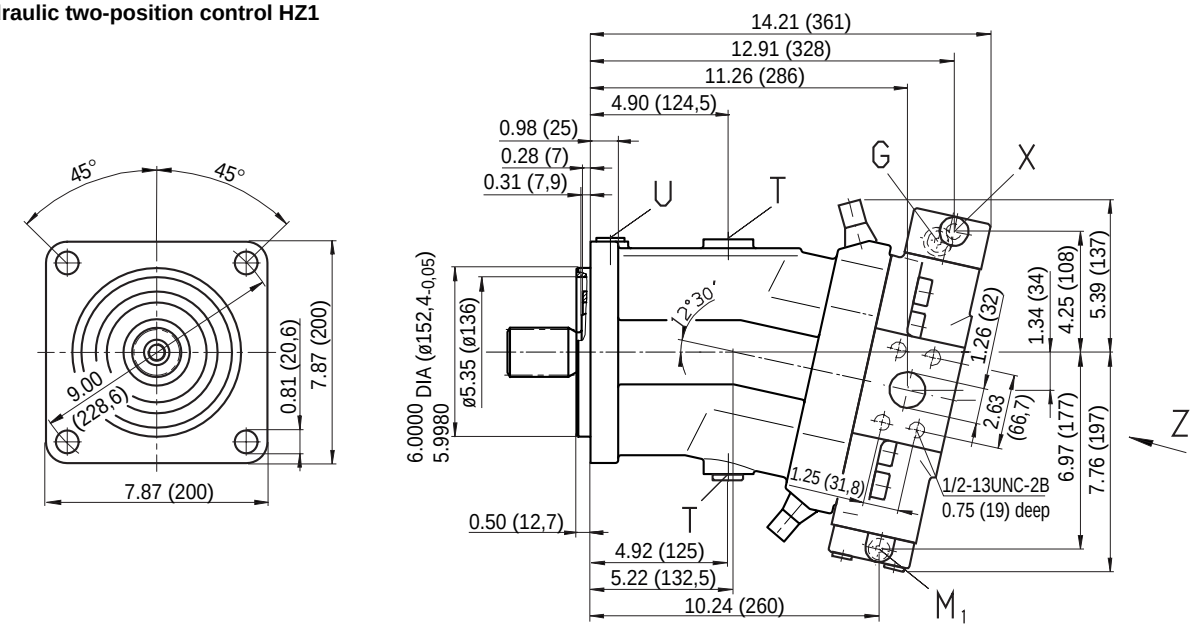


Connections

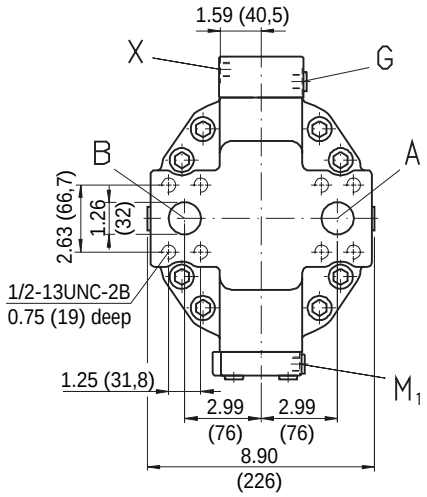
A,B	Service line ports 6000 psi (420 bar) high pressure series	SAE 1 1/4"
G	Port for synchronous control of a number of units and for remote control pressure (plugged)	M14x1,5
X	Pilot pressure port	M14x1,5
T	Case drain ports	M26x1,5
U	Flushing port (plugged)	M22x1,5
M_1	Test port for control pressure (plugged)	M14x1,5

Unit Dimensions, Size 160 (SAE Version)

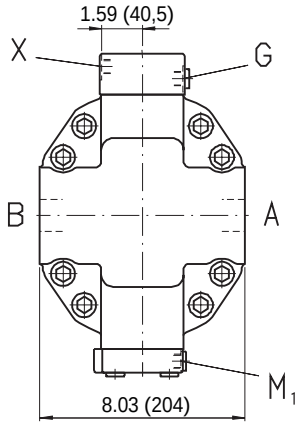
Hydraulic control, pilot pressure related HD1, HD2
Hydraulic two-position control HZ1



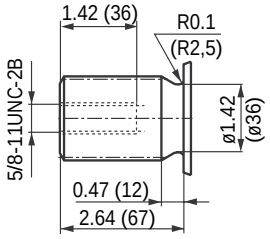
Service line ports A/B at rear end **(51)**
View Z



Service line ports A/B on (opposite) sides **(52)**
View Z



Shaft end
S
Splined shaft, SAE 1 3/4"
13 T, 8/16 DP, Tolerance class 5
ANSI B92.1a-1976

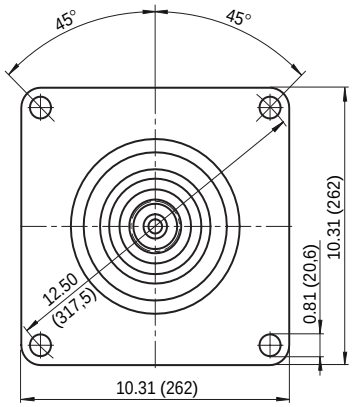


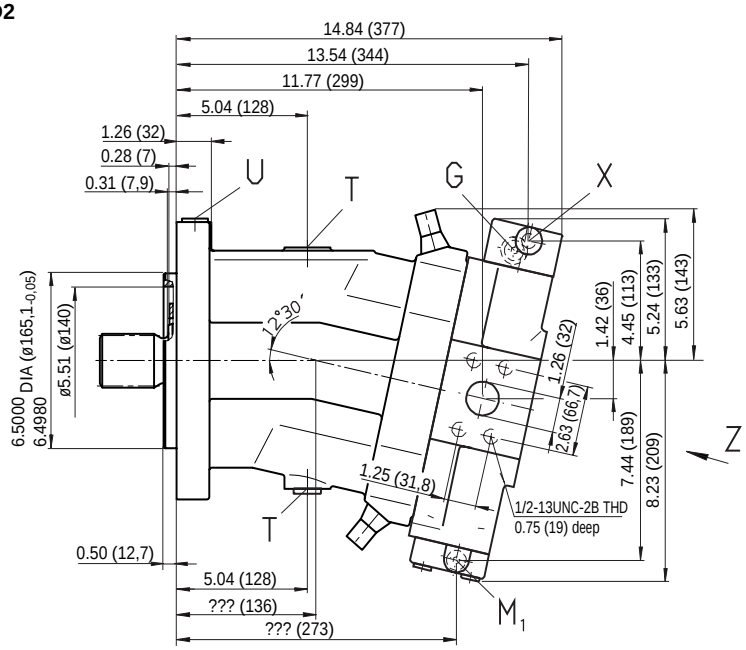
Connections

A,B	Service line ports 6000 psi (420 bar) high pressure series	SAE 1 1/4"
G	Port for synchronous control of a number of units and for remote control pressure (plugged)	SAE 6, 9/16-18UNF-2B
X	Pilot pressure port	SAE 6, 9/16-18UNF-2B
T	Case drain ports	SAE 12, 1 1/16-12UN-2B
U	Flushing port (plugged)	SAE 10, 7/8-14UNF-2B
M_1	Test port for control pressure (plugged)	SAE 6, 9/16-18UNF-2B

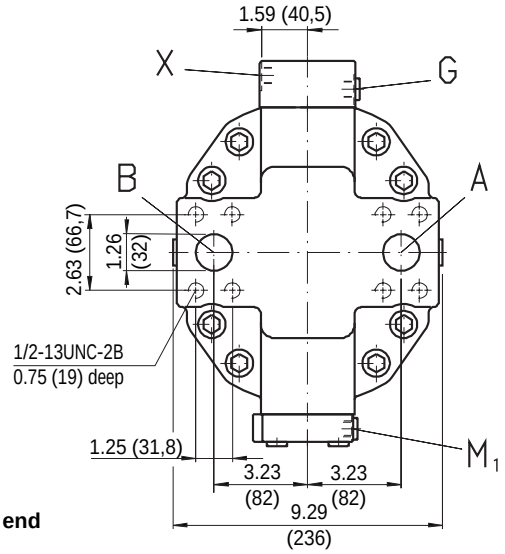
Unit Dimensions, Size 200 (SAE Version)

Hydraulic control, pilot pressure related HD1, HD2
Hydraulic two-position control HZ1

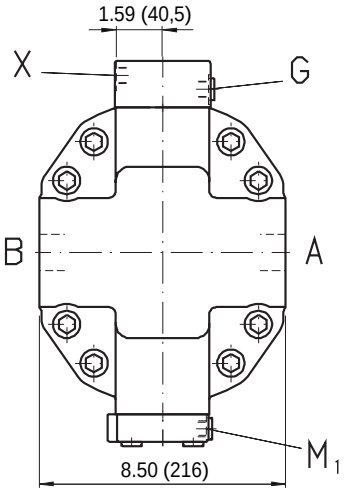




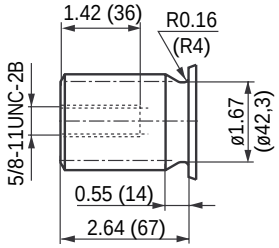
Service line ports A/B at rear end **(51)**
View Z



Service line ports A/B on (opposite) sides **(52)**
View Z



Shaft end
S
Splined shaft, SAE 2"
15 T, 8/16 DP, Tolerance class 5
ANSI B92.1a-1976

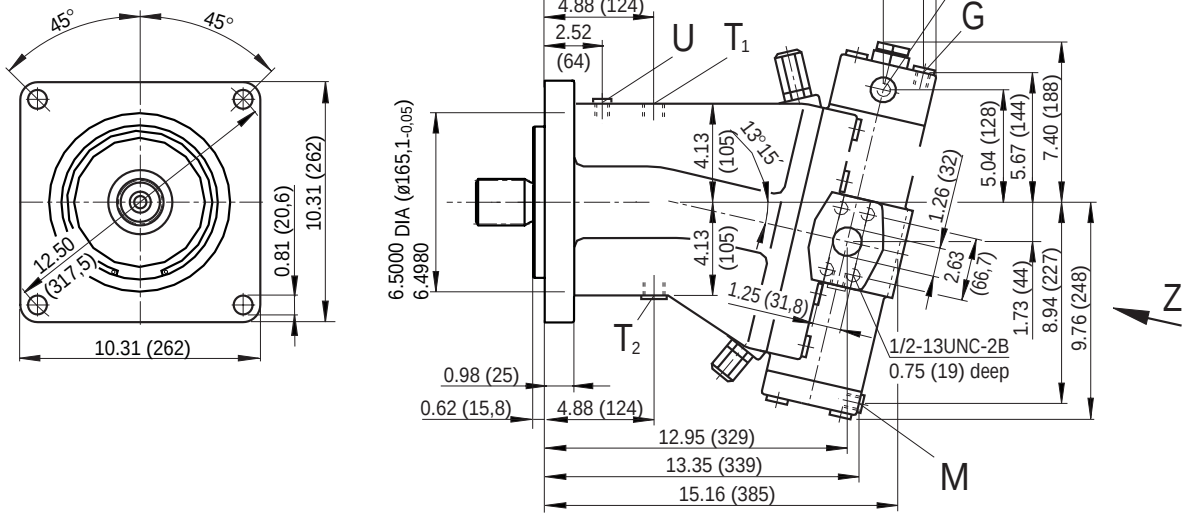


Connections

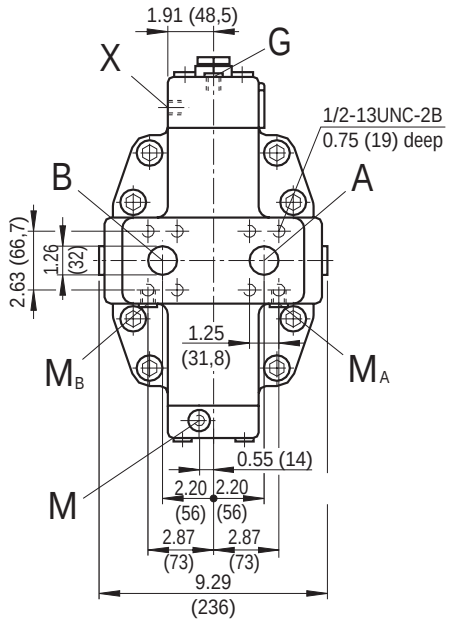
A,B	Service line ports 6000 psi (420 bar) high pressure series	SAE 1 1/4"
G	Port for synchronous control of a number of units and for remote control pressure (plugged)	SAE 6, 9/16-18UNF-2B
X	Pilot pressure port	SAE 6, 9/16-18UNF-2B
T	Case drain ports	SAE 12, 1 1/16-12UN-2B
U	Flushing port (plugged)	SAE 10, 7/8-14UNF-2B
M_1	Test port for control pressure (plugged)	SAE 6, 9/16-18UNF-2B

Unit Dimensions, Size 250 (SAE Version)

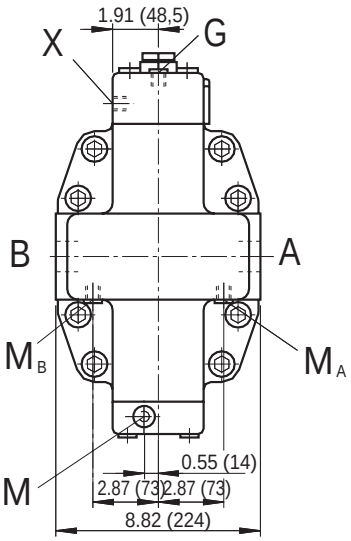
Hydraulic control, pilot pressure related HD1, HD2
Hydraulic two-position control HZ



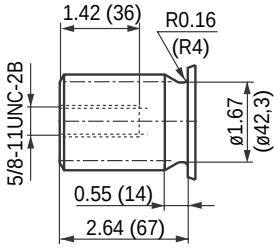
Service line ports A/B at rear end **(51)**
View Z



Service line ports A/B on (opposite) sides **(52)**
View Z



Shaft end
S
Splined shaft, SAE 2"
15 T, 8/16 DP, Tolerance class 5
ANSI B92.1a-1976

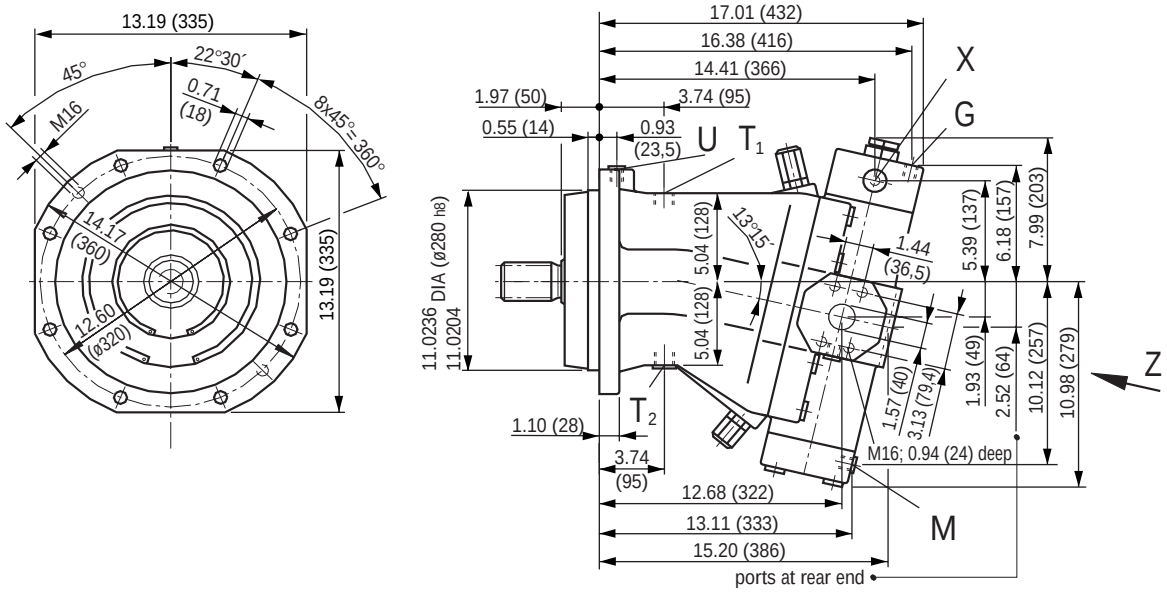


Connections

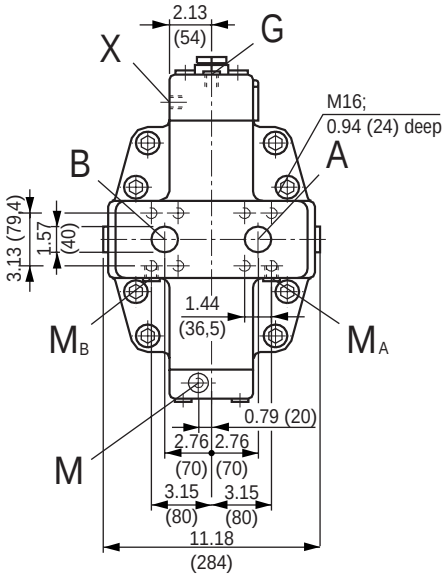
A,B	Service line ports 6000 psi (420 bar) high pressure series	SAE 1 1/4"
G	Port for synchronous control of a number of units and for remote control pressure (plugged)	SAE 6, 9/16-18UNF-2B
X	Pilot pressure port	SAE 6, 9/16-18UNF-2B
T_1,T_2	Case drain ports	SAE 10, 7/8-14UNF-2B
U	Flushing port (plugged)	SAE 6, 9/16-18UNF-2B
M_A,M_B	Test ports	SAE 6, 9/16-18UNF-2B
M	Test port for control pressure (plugged)	SAE 6, 9/16-18UNF-2B

Unit Dimensions, Size 355 (ISO Version)

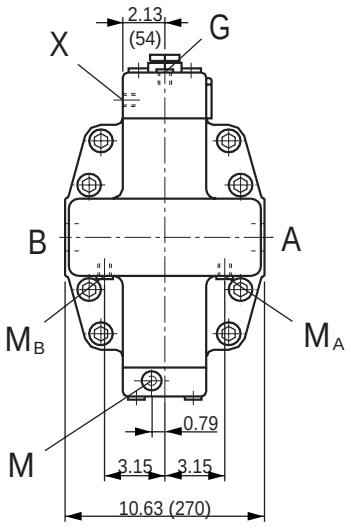
Hydraulic control, pilot pressure related HD1, HD2
Hydraulic two-position control HZ



Service line ports A/B at rear end **(01)**
View Z

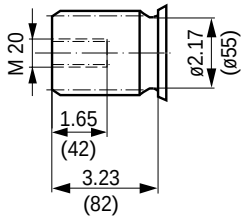


Service line ports A/B on (opposite) sides **(02)**
View Z

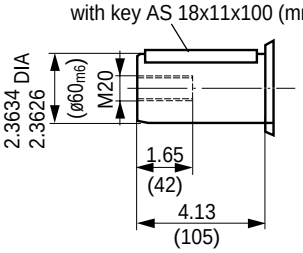


Shaft ends

Z
Splined shaft, DIN 5480
W 60x2x30x28x9g



P
Parallel shaft, DIN 6885
with key AS 18x11x100 (mm)

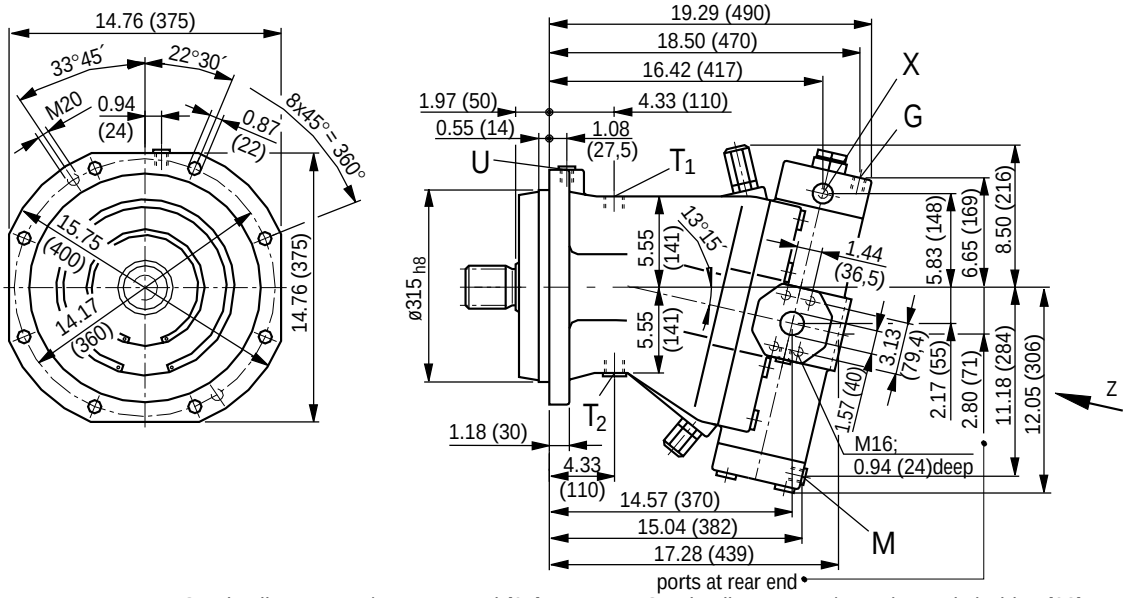


Connections

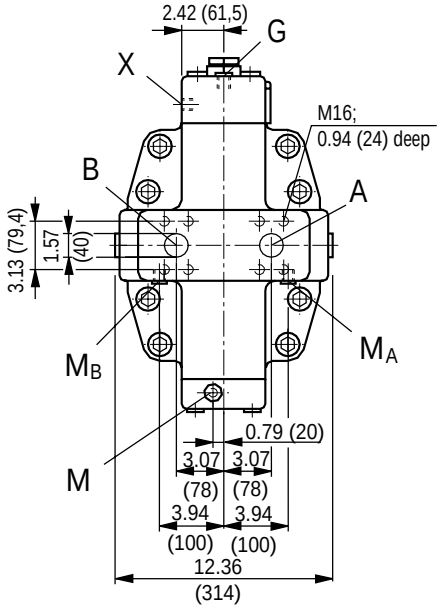
A,B	Service line ports 6000 psi (420 bar) high pressure series	SAE 1 1/2"
G	Port for synchronous control of a number of units and for remote control pressure (plugged)	M14x1,5
X	Pilot pressure port	M14x1,5
T_1,T_2	Case drain ports	M33x2
U	Flushing port (plugged)	M14x1,5
M_A,M_B	Test ports	M14x1,5
M	Test port for control pressure (plugged)	M14x1,5

Unit Dimensions, Size 500 (ISO Version)

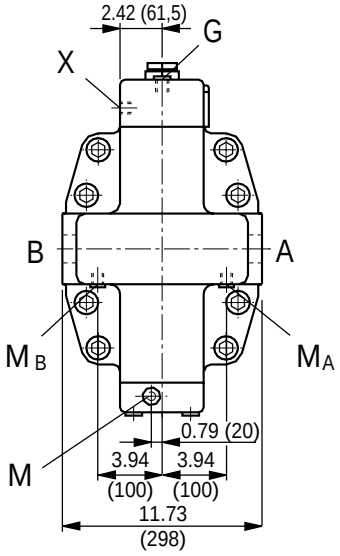
Hydraulic control, pilot pressure related HD1, HD2
Hydraulic two-position control HZ



Service line ports A/B at rear end **(01)**
View Z

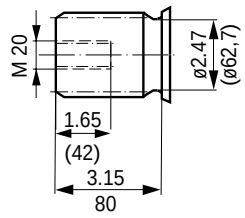


Service line ports A/B on (opposite) sides **(02)**
View Z

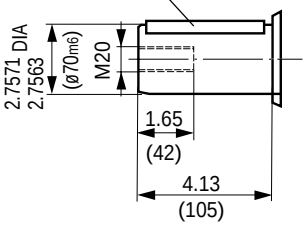


Shaft ends

Z
Splined shaft, DIN 5480
W 70x3x30x22x9g



P
Parallel shaft, DIN 6885
with key AS 20x12x100 (mm)

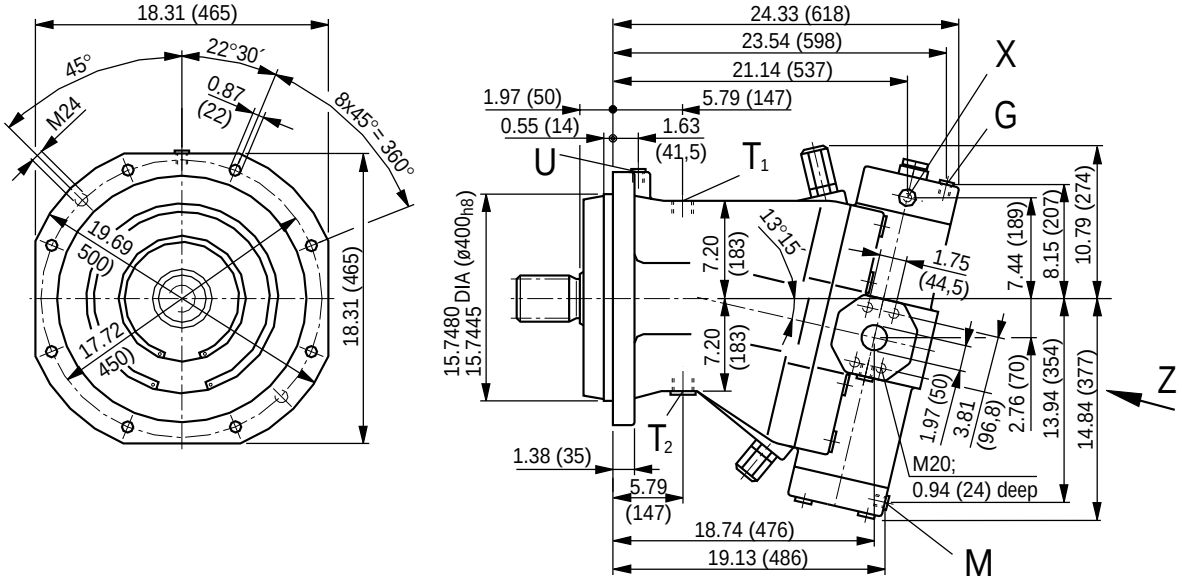


Connections

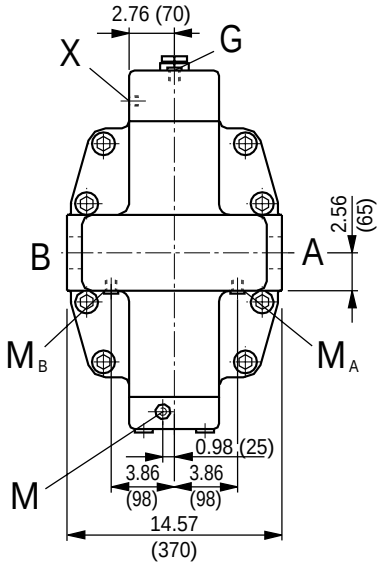
A,B	Service line ports 6000 psi (420 bar) high pressure series	SAE 1 1/2"
G	Port for synchronous control of a number of units and for remote control pressure (plugged)	M18x1,5
X	Pilot pressure port	M14x1,5
T_1,T_2	Case drain ports	M33x2
U	Flushing port (plugged)	M18x1,5
M_A,M_B	Test ports	M14x1,5
M	Test port for control pressure (plugged)	M14x1,5

Unit Dimensions, Size 1000 (ISO Version)

Hydraulic control, pilot pressure related HD1, HD2
Hydraulic two-position control HZ

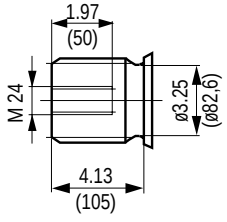


Sorts A/B on (opposite) sides **(02)**
View Z

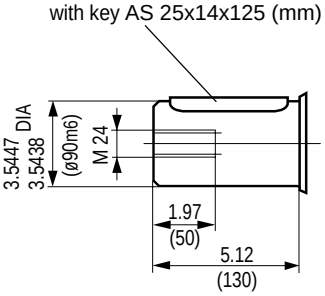


Shaft ends

Z
Splined shaft, DIN 5480
W 90x3x30x28x9g



P
Parallel shaft, DIN 6885
with key AS 25x14x125 (mm)



Connections

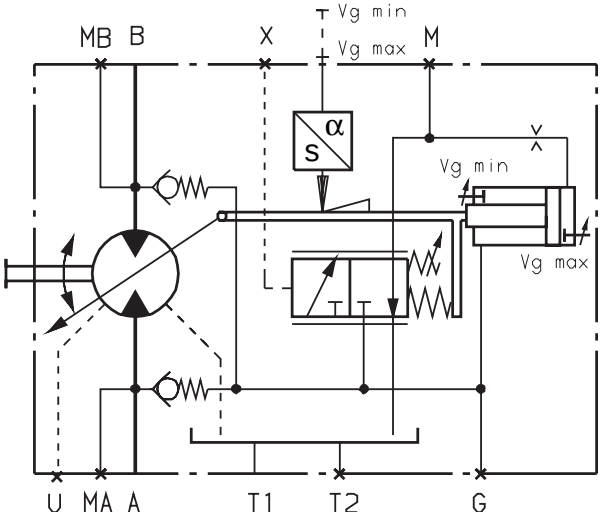
A,B	Service line ports 6000 psi (420 bar) high pressure series	SAE 2"
G	Port for synchronous control of a number of units and for remote control pressure (plugged)	M18x1,5
X	Pilot pressure port	M14x1,5
T_1,T_2	Case drain ports	M33x2
U	Flushing port (plugged)	M18x1,5
M_A,M_B	Test ports	M14x1,5
M	Test port for control pressure (plugged)	M14x1,5

Swivel Angle Indicator

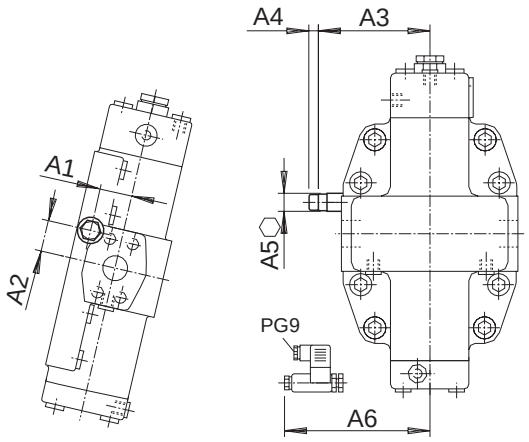
Optical swivel angle indicator (V)
The swivel position is indicated by a pin on the side of the housing. Depending on the position of the control lens the pin is pushed out. If it is **flush with the housing** the motor is at **zero**.
At max. swivel $V_{g\,max}$ the length of the pin is 0.31 inches (8 mm). (Display is still possible if the protective cap is removed)

Electronical swivel angle indicator (E)
The motor position is fed back here by means of an inductive positional transducer. It converts the displacement of the variable unit into an electrical signal. The swivel position may be further processed by means of this signal, eg. it may be fed to an amplifier card.
Inductive positional transducer type IW9–03–01

Circuit diagram:
Hydraulic control, pilot pressure related HD, with optical swivel angle indicator V



Unit dimensions

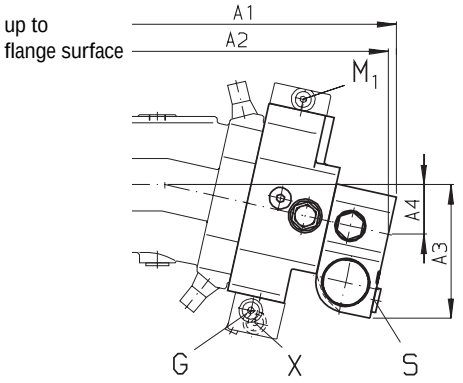


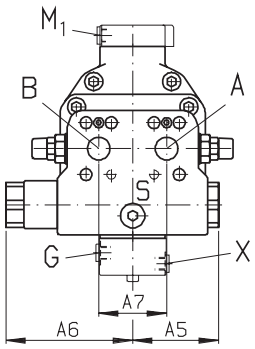
Size	A1	A2	A3	A4*)	A5⬡	A6
250	1.63	1.57	5.37	0.43	0.75	7.17
	(41.3)	(40)	(136.5)	(11)	(19)	(182)
355	1.83	1.85	6.28	0.43	0.75	8.07
	(46.5)	(47)	(159.5)	(11)	(19)	(205)
500	2.00	1.85	6.79	0.43	0.75	8.58
	(50.8)	(47)	(172.5)	(11)	(19)	(218)
1000	2.05	2.05	8.21	0.43	0.75	
	(52)	(52)	(208.5)	(11)	(19)	

*) Space required to remove protective cap

Unit Dimensions - motion control valve

Port plate with pressure relief valves, for mounting a motion control valve (37, 38), sizes 55...160





Connections

A, B Service line ports
6000 psi (420 bar) high pressure series
S Boosting (plugged)

suitable for mounting:

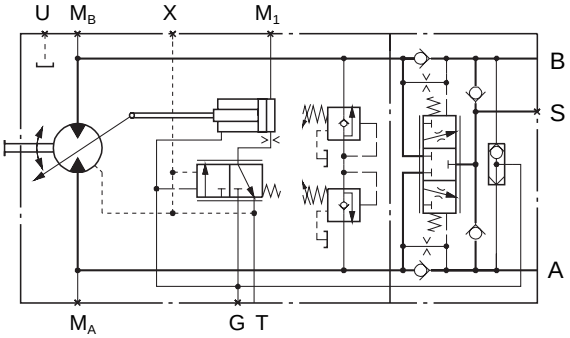
– 1 Rexroth motion control valve (see RE 64317)
MHB**16**RNP...18E (size 55, port plate 38)
MHB**20**RNP...11 (size 55, port plate 38)
MHB**20**RNP...18 (size 80, port plate 38)
MHB**20**RNP...18E (size 107, port plate 37)
MHB**25**RNP...18 (size 107, size 160, port plate 38)

– 1 Rexroth motion control valve (see RE 64316)
MHB**30** (size 250, port plate 08)

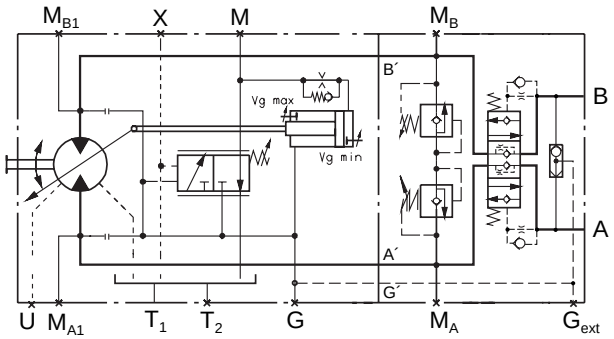
The motion control valve is not included in the type references, please order separately!
(Exception: size 250, port plate 08**8**, with mounted motion control valve)**!**

We recommend total supply through Rexroth!

Sizes 55...160



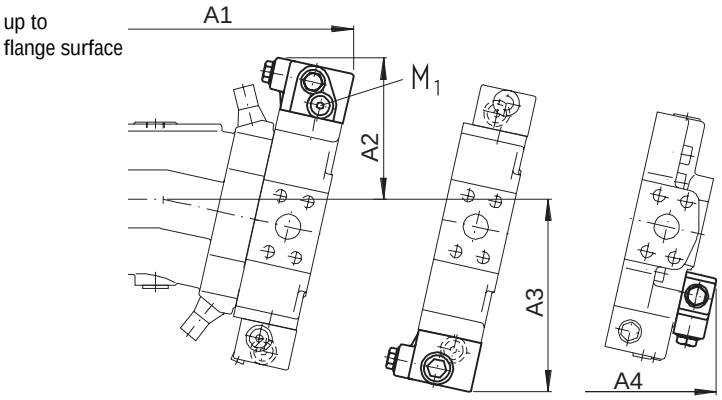
Size 250



Size	*port plate*	A1	A2	A3	A4	A5	A6	A7	ports A, B	boosting S
55	*38*	12.24	11.89	5.63	1.97	3.78	5.47	2.95	SAE 3/4"	M22x1,5
		(311)	(302)	(143)	(50)	(96)	(139)	(75)	SAE 3/4"	M22x1,5
80	*38*	13.39	13.03	5.83	2.16	3.78	5.47	2.95	SAE 1"	M22x1,5
		(340)	(331)	(148)	(55)	(96)	(139)	(75)	SAE 1"	M22x1,5
107	*37*	14.25	13.90	5.98	2.32	3.78	5.47	3.31	SAE 1"	M22x1,5
		(362)	(353)	(152)	(59)	(96)	(139)	(84)	SAE 1"	M22x1,5
107	*38*	14.96	14.57	6.50	2.48	4.74	6.52	3.31	SAE 1 1/4"	M27x2
		(380)	(370)	(165)	(63)	(120.5)	(165.5)	(84)	SAE 1 1/4"	M27x2
160	*38*	16.42	16.02	6.65	2.68	4.74	6.52	3.31	SAE 1 1/4"	M27x2
		(417)	(407)	(169)	(68)	(120.5)	(165.5)	(84)	SAE 1 1/4"	M27x2
250	*08*	17.80	14.17	8.93	–	9.49	9.49	3.82	SAE 1 1/4"	–
		(452)	(360)	(227)	–	(241)	(241)	(97)	SAE 1 1/4"	–

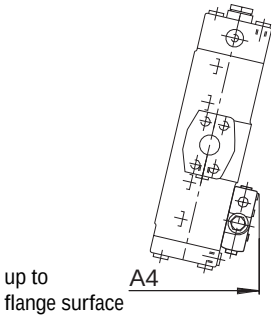
Unit Dimensions - flushing and boost pressure valve (7)

Sizes 28...200



HA1, HA2 | HD, EP, DA, HZ1, EZ1, EZ2, | HZ3, EZ3, EZ4

Sizes 250...1000



HD, EP, DA, HZ, EZ

Size		A1	A2	A3	A4
A6VM	**28**	8.43	4.92	6.34	–
		(214)	(125)	(161)	–
	140	12.64	6.06	8.58	–
		(231)	(154)	(218)	–
AA6VM	**55**	10.51	5.24	6.93	10.24
		(267)	(133)	(176)	(260)
	80	11.69	5.59	7.60	10.94
		(297)	(142)	(193)	(278)
	107	12.60	5.67	7.87	11.85
		(320)	(144)	(200)	(301)
	160	14.17	6.06	8.66	–
		(360)	(154)	(220)	–
	200	14.84	6.30	9.09	–
		(377)	(160)	(231)	–

Size		A4
AA6VM	**250**	15.63
		(397)
A6VM	**355**	17.56
		(446)
	500	
	1000	

