

# ZP6V

## Axial piston variable motor

- Sizes (ml/r): 28...160
- Nominal pressure (bar): 350bar
- Maximum pressure (bar): 400bar



- Effective range of adjustment for hydrostatic transmission
- 2nd controls and adjustments with various controls
- Increasing the maximum output speed at a smaller Angle saves money by using a smaller pump Without multi-ratio gear drive
- High power density
- High external axial load is allowed
- Installation position is not fixed
- High efficiency
- Excellent starting characteristics
- Small moment of inertia

### Ordering Code / Standard Program

ZP6V	80	HA2	2	F	Z	2	-	039
01	02	03	04	05	06	07	08	09

#### Motor

01	Variable motor	ZP6V
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#### Size

02	< Displacement $V_{gmax}$ cm <sup>3</sup>	28	55	80	107	160
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#### Structure

			28	55	80	107	160	
Hydraulic variable	Control pressure difference	$\Delta p=1\text{MPa}$	●	●	●	●	●	HD1
	With constant pressure control	$\Delta p=1\text{MPa}$	●	●	●	●	●	HD1D
Hydraulically controlled two-speed variable	Control pressure difference	$\Delta p=2.5\text{MPa}$	●	●	●	●	●	HD2
	With constant pressure control	$\Delta p=1\text{MPa}$	●	●	●	●	●	HD2D
	Control start	0.2-2MPa	●	●	●	●	●	HS1
	Control start	0.5-5MPa	●	●	●	●	●	HS2
03 Automatic control high pressure related	constant pressure	0.2-2MPa	●	●	●	●	●	HA1
	Without overtravel control	0.5-5MPa	●	●	●	●	●	HA1H
	With overtravel control		●	●	●	●	●	HA2
	Pressure increase	$\Delta p=10\text{MPa}$	●	●	●	●	●	HA2
Hydraulic control speed related	Without override		●	●	●	●	●	HA2H
	With override		●	●	●	●	●	DA
Electrical 2-speed control		●	●	●	●	●	ES1,ES2	
Electrical control with proportional solenoid		●	●	●	●	●	EP1,EP2	
Mooring control		●	●	●	●	●	MO	
Manual control with handwheel	Without pressure increase		●	●	●	●	●	MA

#### Sizes

04	Size 28-255	2
	Size 500	1

#### Shaft end

06	Keyed parallel shaft: GB 1096-79	P
	Splined shaft DIN 5480	Z
	Splined shaft GB 3487.1-83	S

#### For crane products (one-way throttle valve)

08	-
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#### Min. displacement

09	$V_{gmin}=39\text{ml/r}$	039
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Order example: **ZP6V80HD12FZ2-39**

Axial piston variable motor ZP6V, size 80, with hydraulic control,  $\Delta p=1\text{MPa}$ , series 2, SAE flange connections on side, splined shaft, assembly type 2, min. displacement  $V_{gmin}=39\text{ml/r}$ .

#### Pipe Connections

05	SAE flange, on side	F
	Metrics threads, on side	G

#### Assembly type

07	For explanation see description of control	1
	Device and unit dimensions	2

## Technical data

Working pressure range

Pressure at port A or B :

Normal pressure  $P_n=31.5\text{MPa}$

Max. pressure  $P^{***}=35\text{MPa}$

The sum of the pressures at ports A and B should not exceed

63MPa, Individual pressure at either Port max. 35MPa.

Leakage oil pressure

Maximum permissible leakage oil pressure  $P^{***}0.2\text{MPa}$

Fluid Temperature Range

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

$t_{\max}$   $+80^\circ\text{C}$

Viscosity Range

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

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

Optimum operating viscosity

$V^{***}$   $16-36\text{mm}^2/\text{s}$

Filtration of Hydraulic Fluid

Recommended filtration  $10\ \mu\text{m}$  or  $25-40\ \mu\text{m}$ , however longer service life is achieved with filtration of  $10\ \mu\text{m}$  (reduced wear)

Speed range

No limitation on minimum speed  $n_{\min}$ . Where very even speeds are required,  $n_{\min}$  should not be less than  $50\text{r/min}$ . The maximum flow from the pump and the minimum swept volume of the variable motor together determine the maximum output speed. The min swept volume is limited mechanically by means of an adjustment screw so that the max. permissible speeds (of the variable motor and the driven unit) cannot be exceeded. See data table for max. permissible speeds.

Fluid Recommendation

Viscosity grade temperature to DIN51519

30-40°C	VG22=22mm <sup>2</sup> /s	at40°C
40-50°C	VG32=32mm <sup>2</sup> /s	at40°C
50-60°C	VG46=46mm <sup>2</sup> /s	at40°C
60-70°C	VG68=68mm <sup>2</sup> /s	at40°C
70-80°C	VG100=100mm <sup>2</sup> /s	at40°C

## Technical Data

Size				28	55	80	107	160
Control Device				●	●	●	●	●
Hydraulic control pilot pressure related					●		●	
HD1D Hydraulic control pilot pressure related				●	●	●	●	●
HS Hydraulic control (two speed), pilot pressure related				●	●	●	●	●
HA Hydraulic control, speed related				●	●	●	●	●
DA Hydraulic control, speed related				●	●	●	●	●
ES Electric control (two speed)				●	●	●	●	●
EP Electric control (proportional)				●	●	●	●	●
MO Mooring control								
MA Manual control								
Displacement	$V_{g\max}$	ml/r		28.1	54.8	80	107	160
	$V_{g\min}$	ml/r		8.1	15.8	23	30.8	46
Max. Permissible Swept volume		L/min		133	206	268	321	424
Max. speed	below $Q_{\max}$	$n_{\max}$ at $V_{g\max}$	r/min	4750	3750	3350	3000	2650
		$n_{\max}$ at $V_g < V_{g\max}$	r/min	6250	5000	4500	4000	3500
Torque constants		$M_x$ at $V_{g\max}$	Nm/MPa	4.463	8.701	12.75	16.97	25.41
		$M_x$ at $V_{g\min}$	Nm/MPa	1.285	2.511	3.73	4.9	7.35
Max. torque	at $\Delta p=35\text{MPa}$	$M_{\max}$ at $V_{g\max}$	Nm	156	304	446	594	889
		$M_{\max}$ at $V_{g\min}$	Nm	45	88	130	171	257
Max. output power (at 35MPa and $Q_{\max}$ )		kW		78	120	156	187	247
Moment		kgm <sup>2</sup>		0.0017	0.0052	0.0109	0.0167	0.0322
Weight		kg		18	27	39	52	74

## HD Hydraulic Control, Pilot Pressure Related

Stepless control of the motor capacity dependent of a pilot pressure signal

Standard model: assembly type 2

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

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

For assembly type 1, the control function is reversed: start of control at  $V_{g\min}$

end of control at  $V_{g\max}$

Setting of Regulator. Two options are available:

1. HD1- Pilot pressure increase adjustable (from  $V_{g\max} \rightarrow V_{g\min}$ ) -

$\Delta P_s=1\text{MPa}$  Start of control adjustable from 0.2-2MPa

Standard setting: start of control at 0.3MPa, end of control at 1.3MPa

2. HD2- Pilot pressure increase (from  $V_{g\max} \rightarrow V_{g\min}$ ) 5MD.2n -

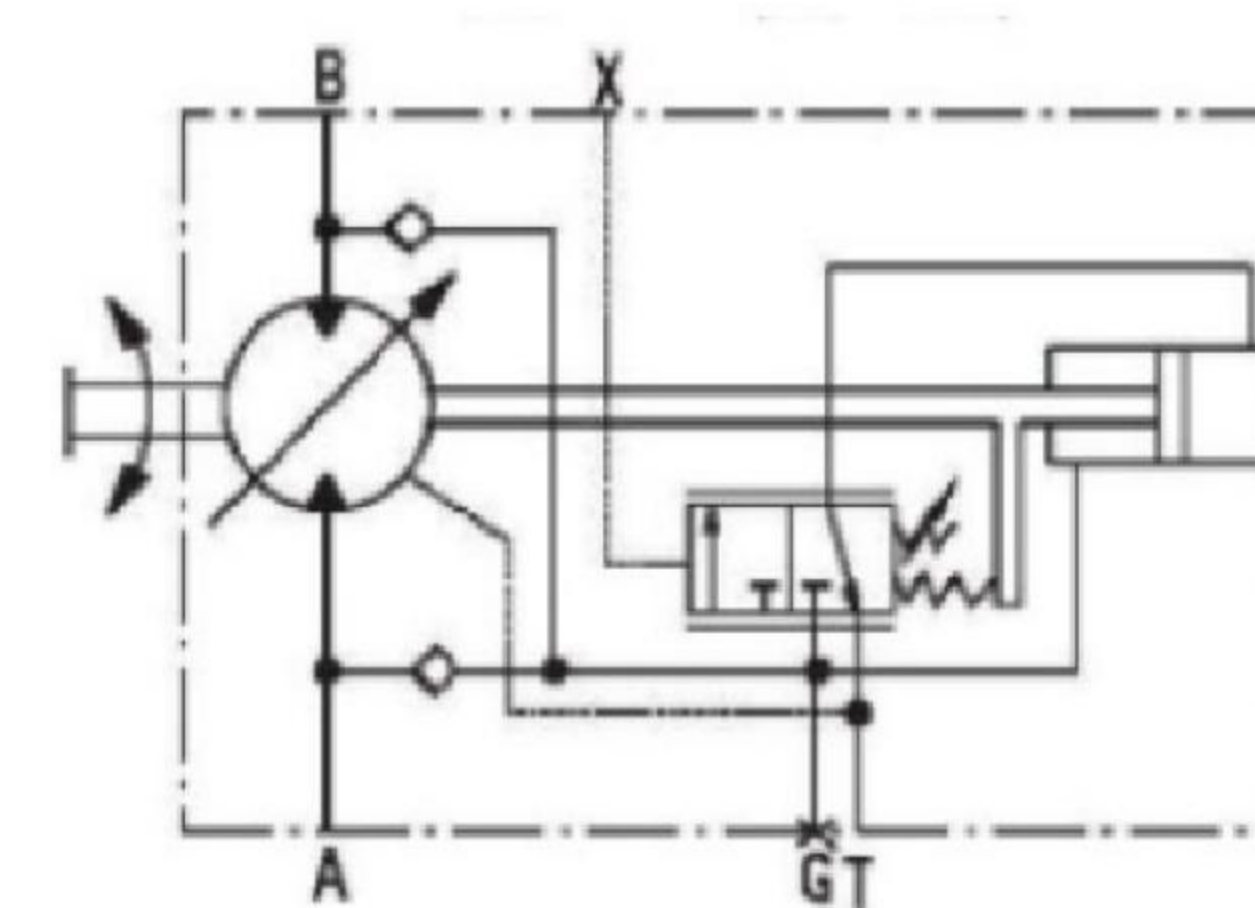
$\Delta P_s=2.5\text{MPa}$  Start of control adjustable from 0.5-5MPa

Standard setting: start of control at 1MPa, end of control at 3.5MPa,

When using the HD control as a two-point control a max. pilot pressure of 7.5MPa is permissible.

The max oil flow at pilot X is approx 0.5L/min

Should the available operating pressure be  $< 1.5\text{MPa}$ , then an auxiliary pressure of 1.5MPa must be applied at port G.



HD Hydraulic Control (HD1, HD2)

## HD1D Constant pressure control

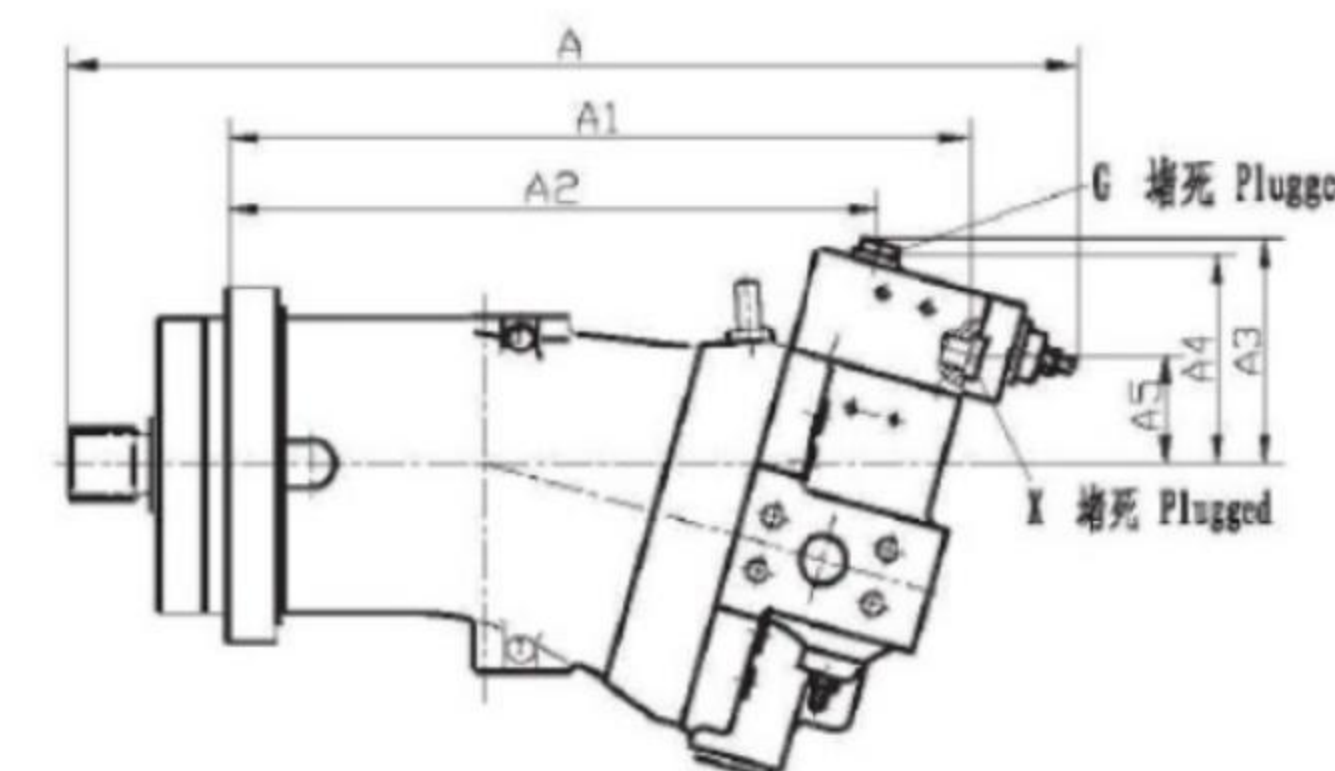
The constant pressure control is superimposed on the HD function.

Should system pressure rise as a result of the load torque or reduction of the motor swivel angle, when the setting swiveled out to a higher angle. When the setting swiveled 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. Throw a pressure signal at port G2 will receive the second constant setting pressure.

(for example rise and drop), the signal between 2 and 5MPa

Setting range of constant pressure control valve: 8-40MPa

Start of control at  $V_{g\max}$  (Max. torque, Min. rotation speed) End of control at  $V_{g\min}$  (Min. torque, Max. rotation speed)



HD1, HD2

## HS Hydraulic Control, 2-Speed Pilot Pressure Related

Two point Control of the motor capacity dependent on a pilot pressure signal Standard model: assembly type 2

Start of control at  $V_{g\max}$  (Max. torque, Min. rotation speed)

End of control at  $V_{g\min}$  (Min. torque, Max. rotation speed) For assembly type 1, the control function is reversed:

Start of control at  $V_{g\min}$  End of control at  $V_{g\max}$

Setting of Regulator

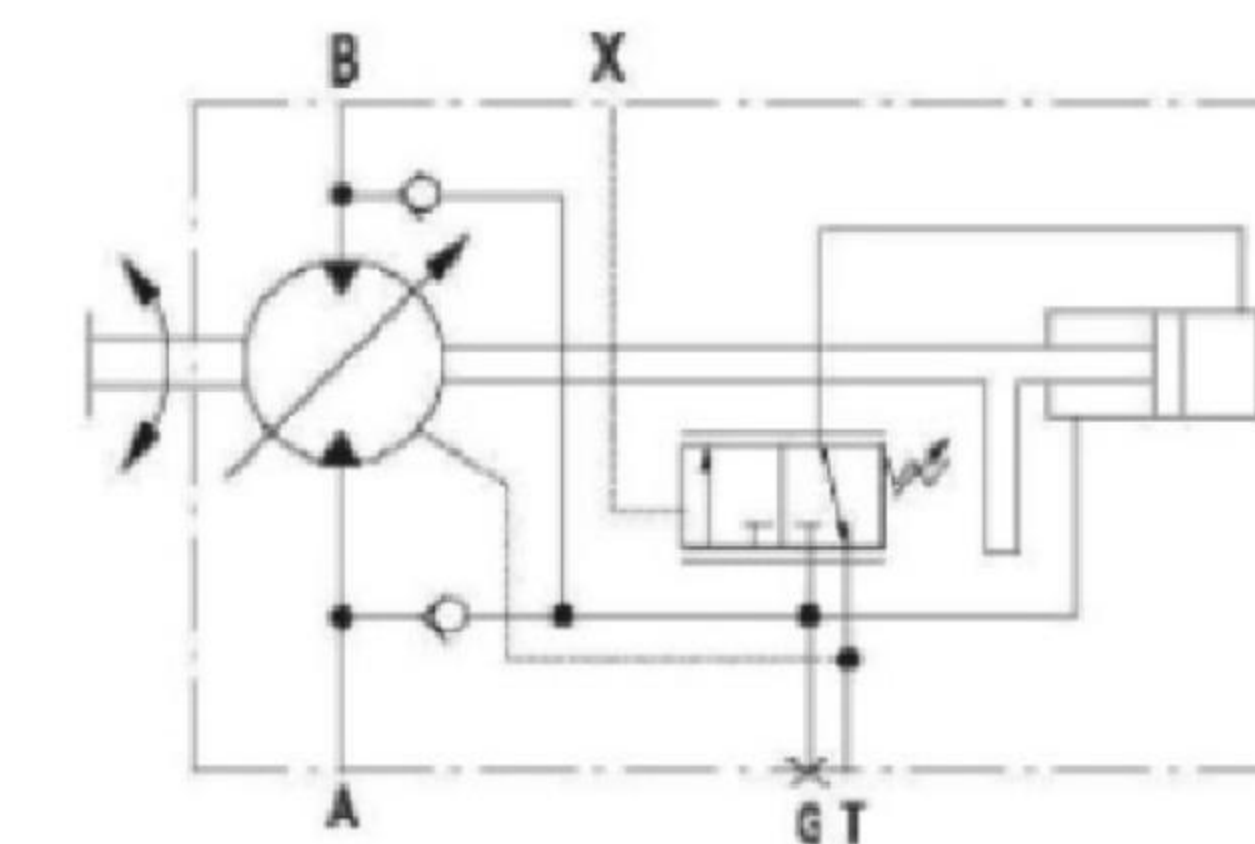
Two options are available

1. HS1- Start of control adjustable (from 0.2-2MPa)

2. HS2- Start of control adjustable (from 0.5-5MPa (from  $V_{g\min} \rightarrow V_{g\max}$ )) -

$\Delta p \leq 0.2\text{MPa}$  The max oil flow at pilot X: approx 0.5L/min

Should the available operating pressure be  $< 1.5\text{MPa}$  then an auxiliary pressure of must be applied at port G



HS Hydraulic Control, 2-Speed (HS1, HS2)

## ► HA Automatic Control, High Pressure Related

Automatic control displacement of motor according to working pressure Standard model; assembly type 1  
Start of control at  $V_{gmax}$  (Min. torque- Max. rotation speed)

End of control at  $V_{gmin}$  (Max. torque- Min. rotation speed)

This control device measures the internal operating pressure at port A or B. (no pilot line required), and when the set operating pressure is reached swivels the motor from min. capacity  $V_{gmin}$  to max. capacity  $V_{gmax}$ .

Start of control is adjustable between 8 to 35MPa.

Two options are available:

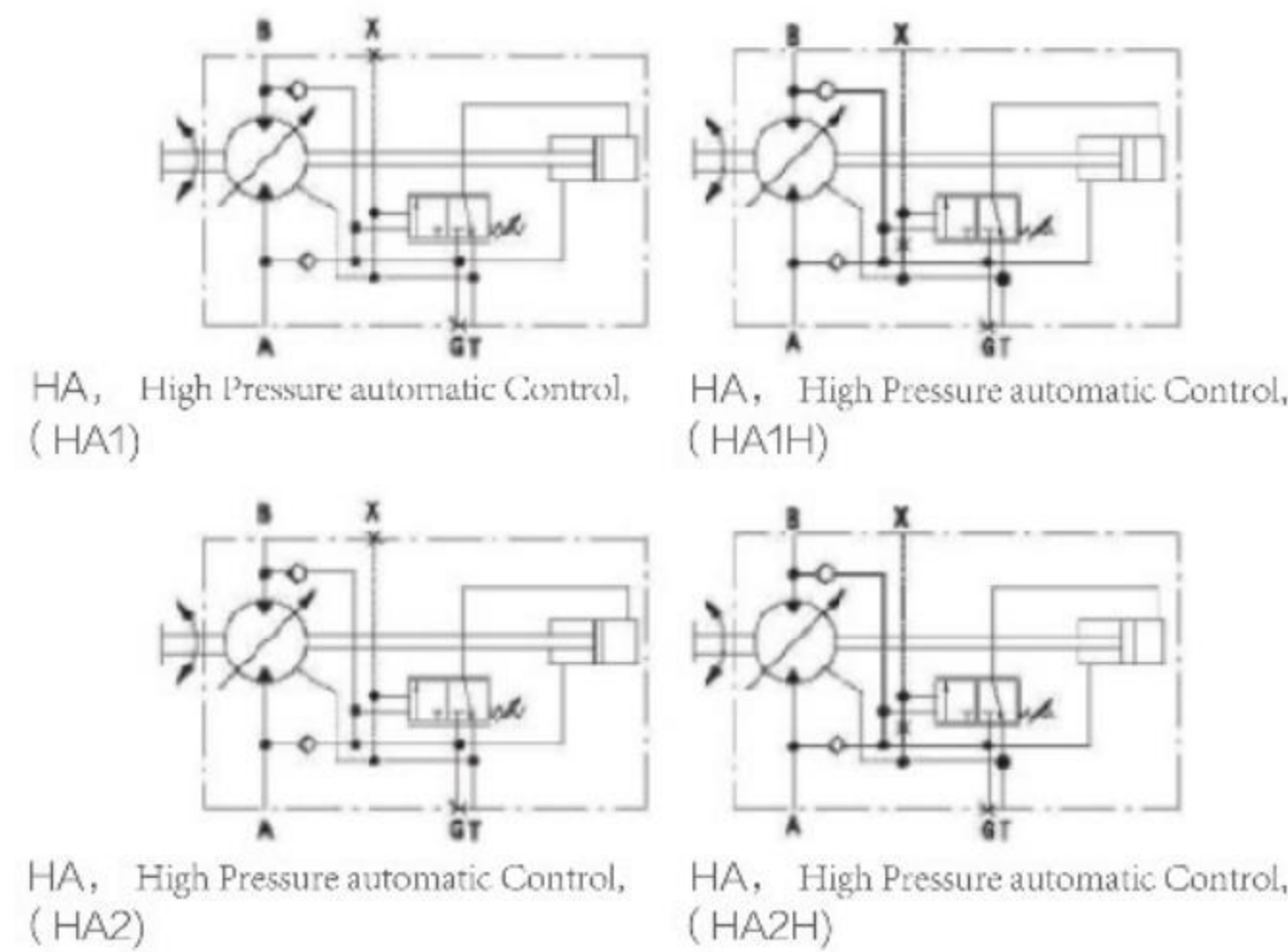
- 1.HA1- Within the control range, the operating pressure is held practically constant,  $\Delta P=1\text{MPa}$  Pressure increase between  $V_{gmin}$  and  $V_{gmax}$  is approx 1MPa.
- 2.HA2- Within the control range, with pressure increase,  $\Delta P=10\text{MPa}$
3.  $\Delta P=10\text{MPa}$  from  $V_{gmin} = (7^\circ)$  to  $V_{gmax} = (25^\circ)$ .

### ► Two options are available for HA control with override

1.HA1H- With in the control range, the operating pressure is held practically constant  $\Delta P=1\text{MPa}$ .

2.HA2H- With in the control range, the operating pressure increase,  $\Delta P=10\text{MPa}$ .

If override is only required to set max. capacity (swiveling the motor to  $V_{gmax}$ ) a pilot pressure of up to 5MPa max is permissible. The max oil flow at X is approx. 0.5L/min.



## ► ES, Electrical 2-Speed Control

The motor capacity is set to  $V_{gmin}$  or  $V_{gmax}$  by switching on or off an electrical current at the switching solenoid. Standard model: assembly type 2

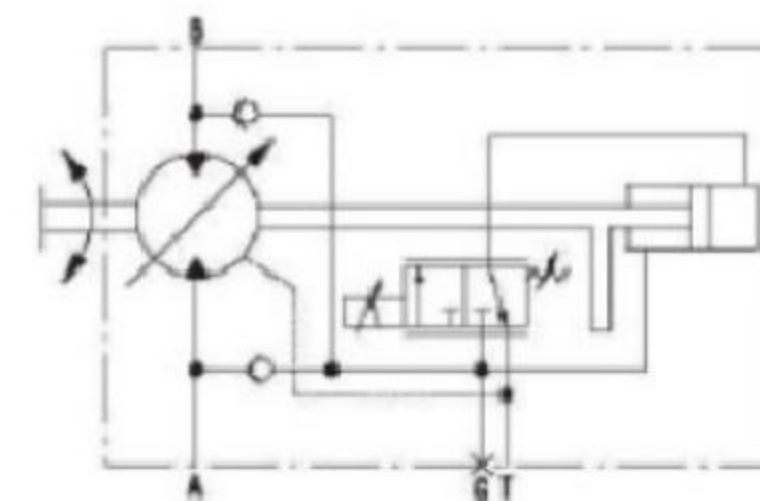
Start of control at  $V_{gmax}$  (Max. torque- Min. rotation speed)

End of control at  $V_{gmin}$  (Min. torque- Max. rotation)

For assembly type 1 the control function is reversed

Two options are available:

- 1.ES1- control voltage 12VDC
- 2.BS2- control voltage 24VDC



ES, Electrical 2-Speed Control

## ► EP, Electrical Proportional Control

For two- speed control of the motor capacity, or for two point control dependent on an electrical signal

Standard model; assembly type 2

Start of control at  $V_{gmax}$  (Max. torque- Min. rotation speed)

End of control at  $V_{gmin}$  (Min. torque- Max. rotation)

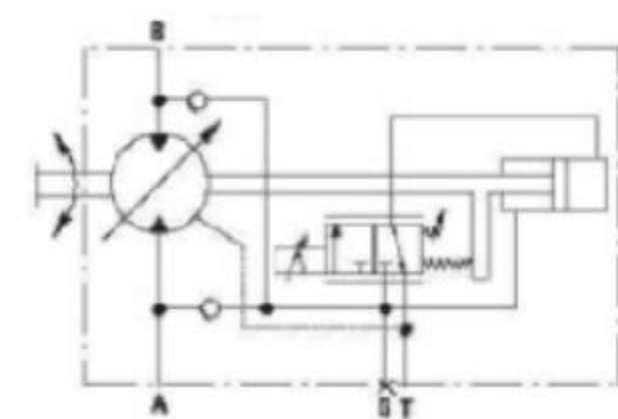
For assembly type 1, the control function is reversed:

The hydraulic control is operated by a proportional solenoid

Two options are available:

- 1.ES1- control voltage: 12VDC 400mA-900mA
- 2.ES2- control voltage 24VDC 200mA-450mA

Should the variable motor only be required for two point control, simply switching the current on and off is sufficient to attain these two positions (for assembly type 2: deenergise at  $V_{gmin}$  for assembly type 1; deenergise at  $V_{gmin}$ ) if the operating pressure is less than 1.5MPa, then an auxiliary pressure of 1.5MPa is required at port G



EP, Electrical Proportional Control

## ► DA Hydraulic Control, Speed Related.

Speed related hydraulic control is used exclusively for transmission drives in conjunction with variable pump ZP4V.DA.

Assembly design: 2

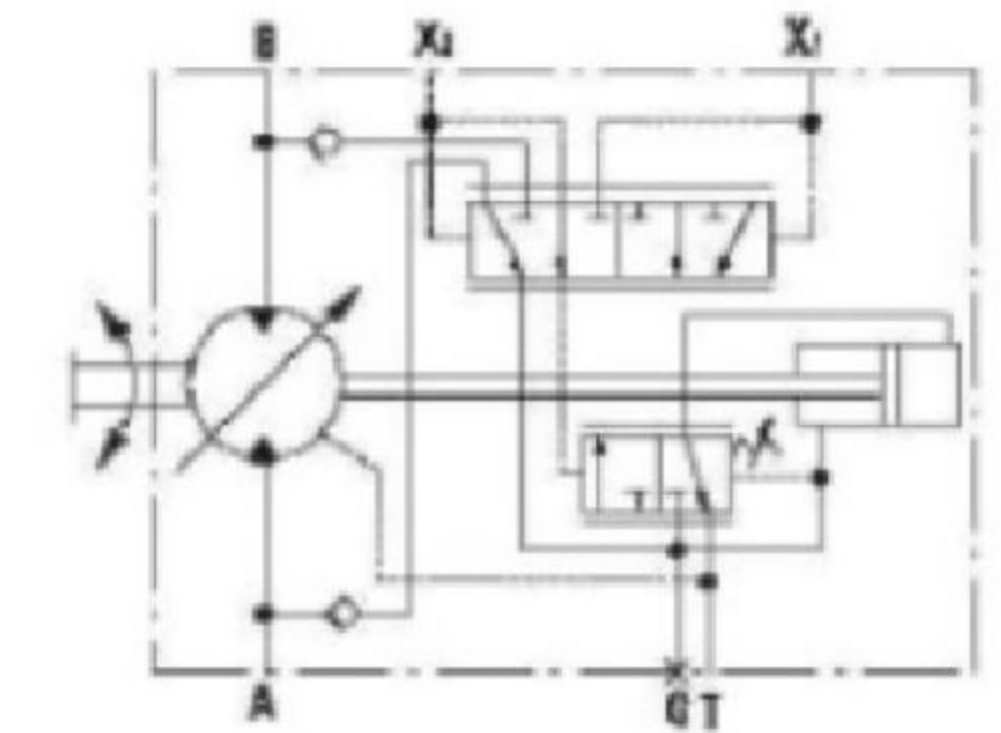
Start of control, pilot pressure dependent. at  $V_{max}$  to  $V_{min}$  high pressure dependent at  $V_{gmin}$  to  $V_{gmax}$

Start point at  $V_{gmax}$  (max. torque)

The pilot pressure, which is determined by the variable pump A4V (increasing speed of prime mover = increasing speed of variable pump - increasing pilot pressure is directed to ports X1 or X2 dependent on the direction of travel, and causes a swiveling towards smaller motor capacity (lower torque, higher speed).

Pilot pressure and high pressure remain in a fixed relationship:  $P_{st}/P_H = 3/100$ .

0.3MPa variation pilot pressure (rise or fall) gives a pressure rise or fall 10MPa in operating pressure. When designing a drive with a DA control the technical data of the variable pump type A4V.DA must be considered.



DA, Hydraulic Control, Speed Related.

## ► MO Mooring control

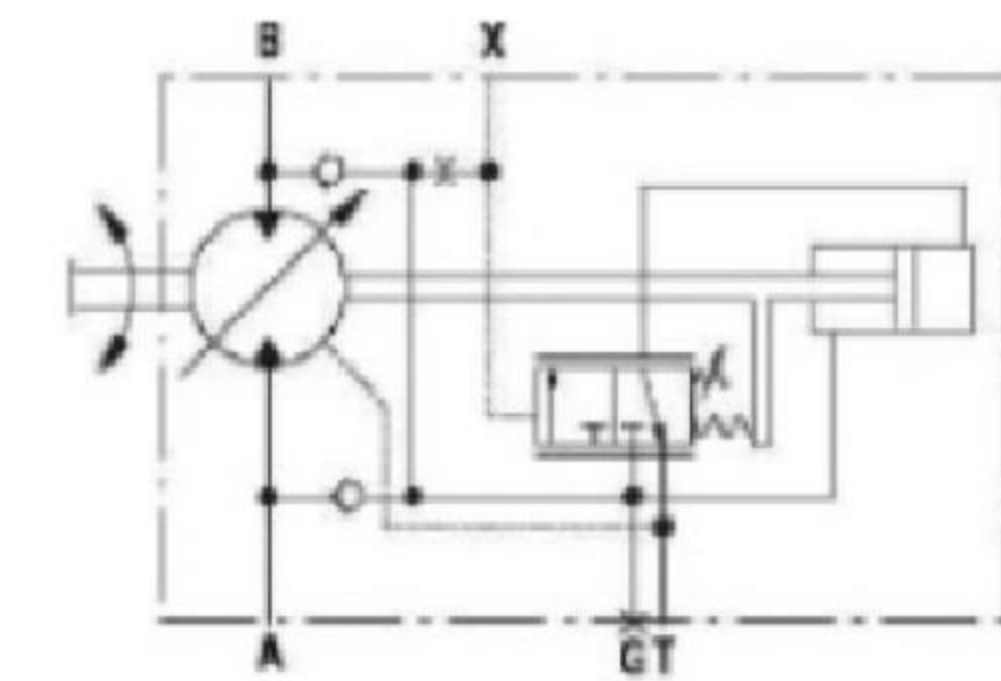
The mooring control is used mainly for the drive of winches, to generate a constant line pull.

Assembly design: 1

Start of control at  $V_{gmin}$  (Min. torque- Max. rotation speed)

Setting regulator:

Pilot pressure increase ( $V_{gmin}-V_{gmax}$ )  $\Delta p=5\text{MPa}$ , start of control at 8-35MPa. A constant torque, which may be altered according to requirements in order to generate a constant line pull at the winch is achieved by varying the capacity of the variable motor. If there is no pull at the drum, the variable motor requires a lower operating pressure and therefore generates a smaller pilot pressure. The variable motor moves to a min. capacity  $V_{gmin}$ . The higher motor speed thus resulting (warping speed) causes rapid operation of the winch until the mooring pull required of the winch is reached and set. In order to limit the maximum speed of the variable motor, a flow limiting valve, or other such suitable, must be placed in the circuit before the motor. As a pilot control for the mooring control itself, a variable pressure relief valve may be used. The max. oil flow at port X is approx. 5L/min. The pilot oil flow reduces with lower differential pressure between pilot pressure and operating pressure.

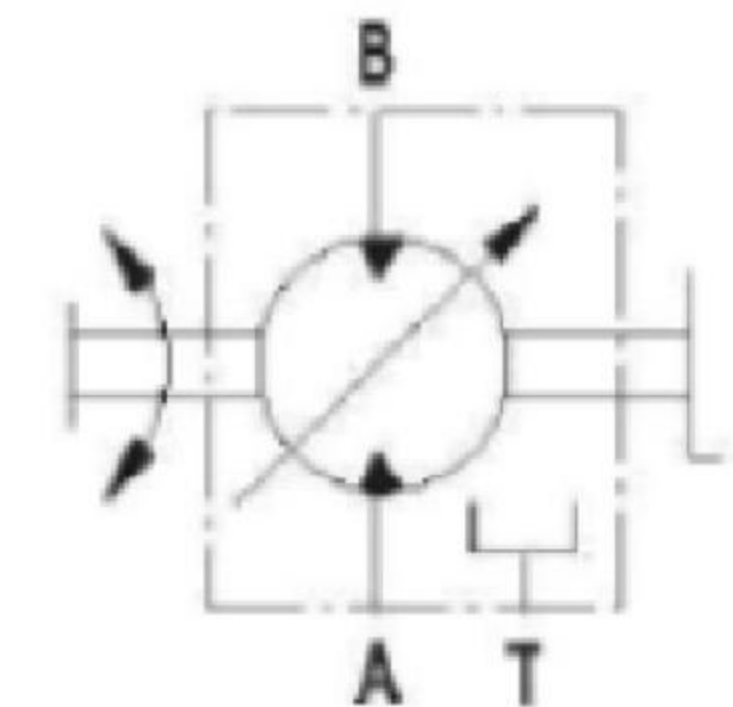


MO Mooring control

## ► MA Manual control

Adjustment of motor capacity dependent on the position of a threaded spindle-hand operation.

Assembly design: 1

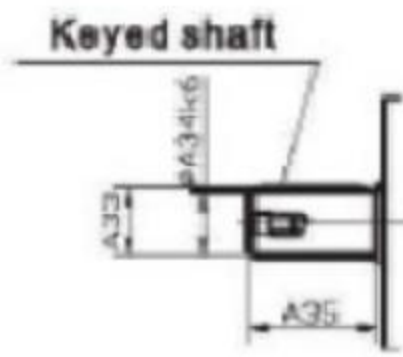
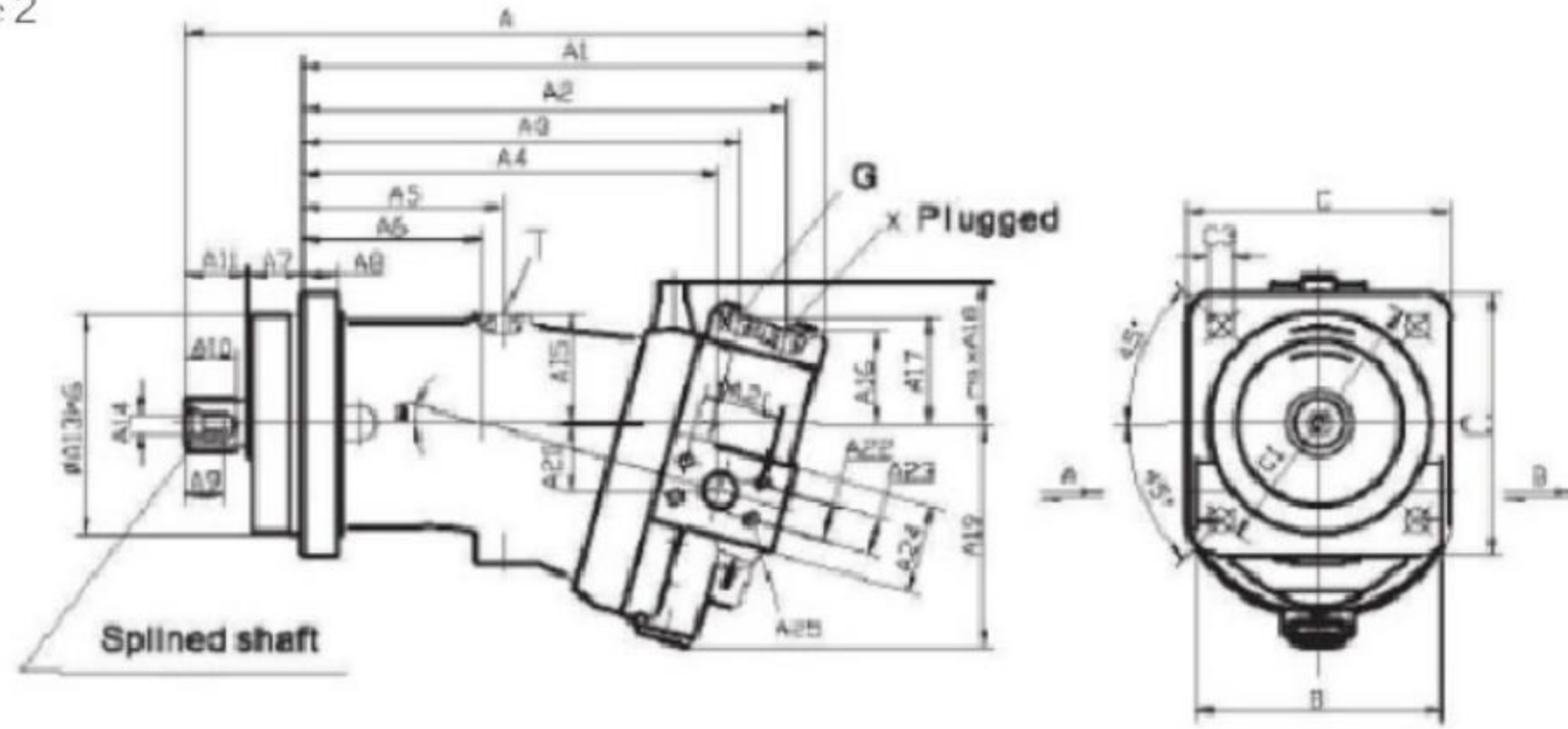


MA Manual control

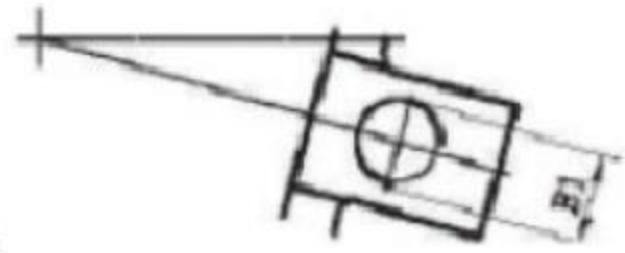
## HD、HS Control

Sizes 28-225

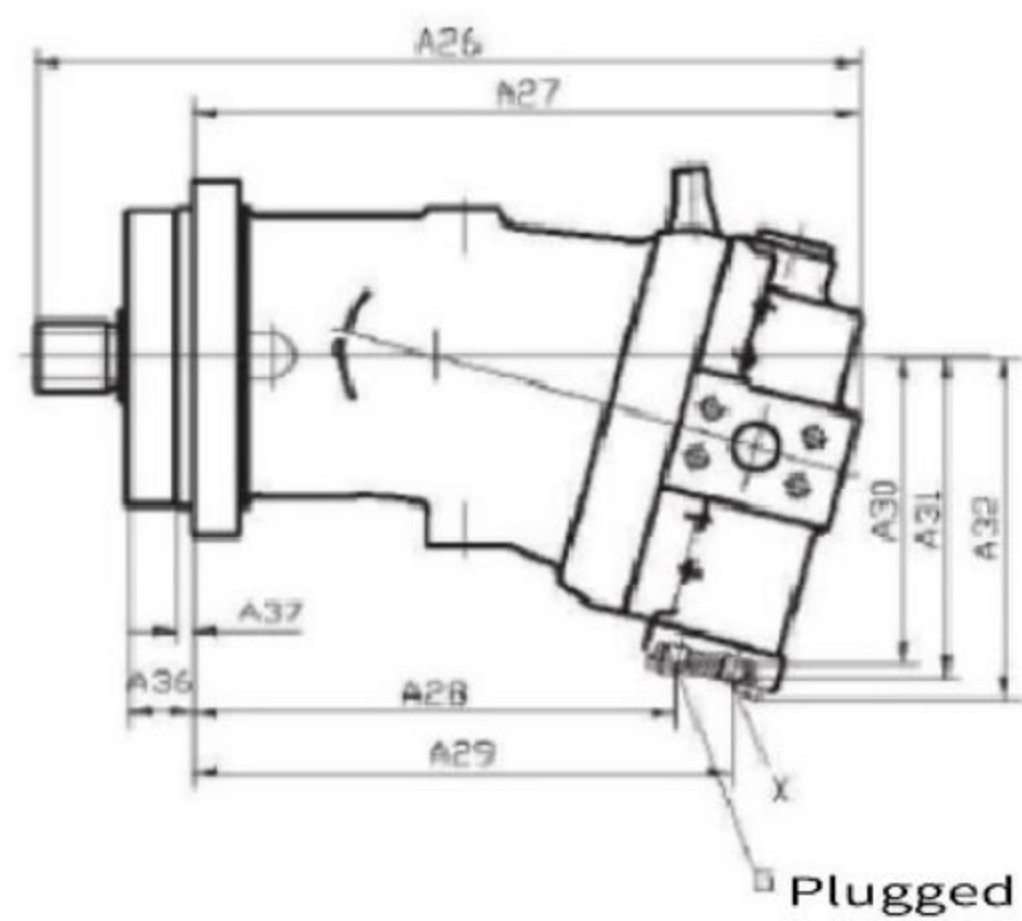
Assembly type 2



SAE pressure port: 1/1 threaded pressure port



A,B: Working port  
G: port for synchronous control of multiple units and for remote control pressure  
X: Pilot pressure T: case drain



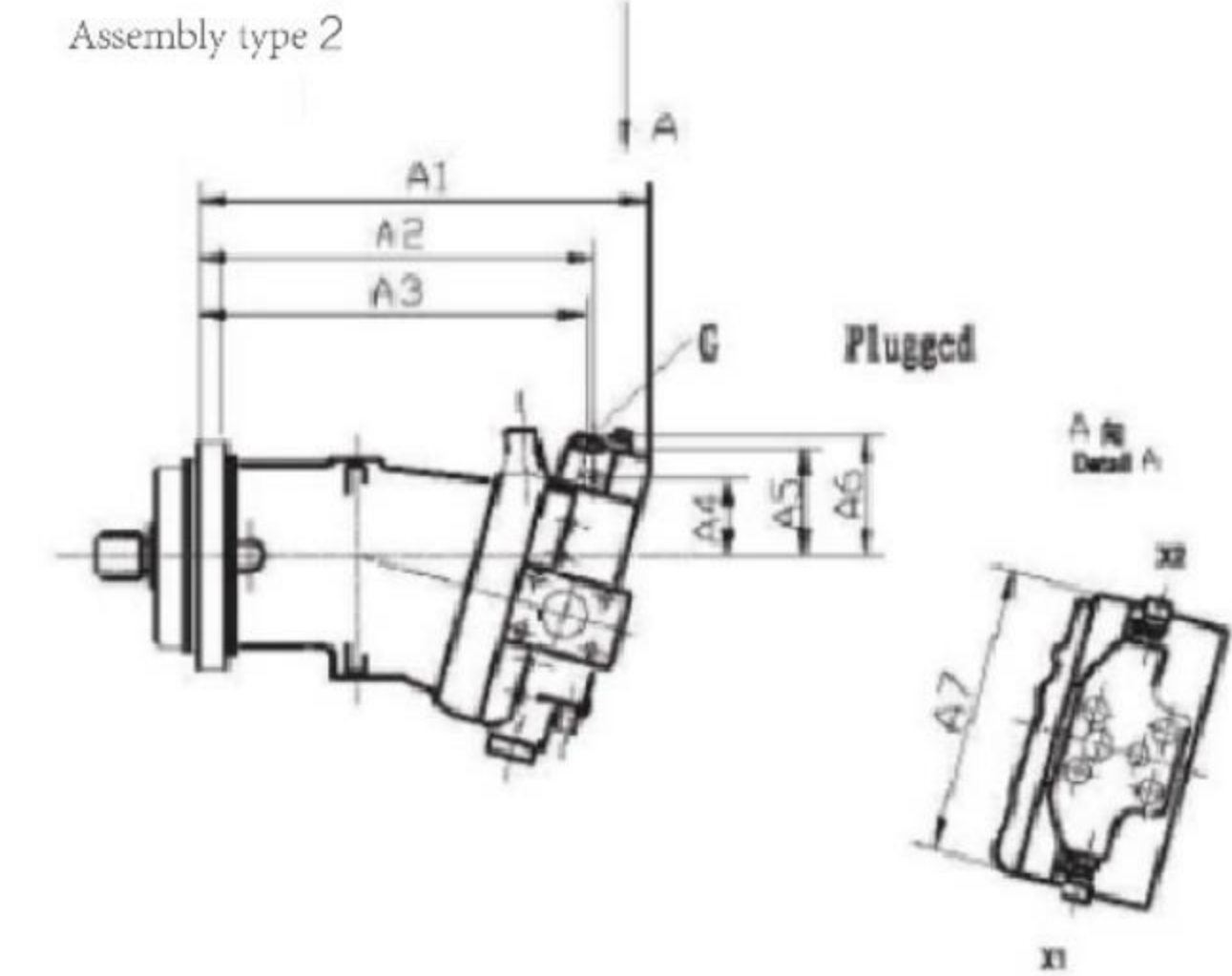
Sizes	A	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	A <sub>4</sub>	A <sub>5</sub>	A <sub>6</sub>	A <sub>7</sub>	A <sub>8</sub>	A <sub>9</sub>	A <sub>10</sub>	A <sub>11</sub>	A <sub>12</sub>	A <sub>13</sub>	A <sub>14</sub>	A <sub>15</sub>	A <sub>16</sub>	A <sub>17</sub>	A <sub>18</sub>	A <sub>19</sub>	A <sub>20</sub>	A <sub>21</sub>	A <sub>22</sub>	A <sub>23</sub>	A <sub>24</sub>	A <sub>25</sub>	Deep	A <sub>26</sub>	A <sub>27</sub>	A <sub>28</sub>
28	317	249	230	208	189	107	75	25	16	19	28	43M16×1.5	100	M8	50	57	64	81	110	33	50.8	20	23.8	45	M10	17	298	230	152	
55	379	312	291	264	249	123	108	32	20	28	28	35M18×1.5	125	M12	63	52	60	84	132	40	50.8	20	23.8	53	M10	17	368	301	208	
80	440	368	345	316	297	152	137	32	23	28	33	40M18×1.5	140	M12	71	59	68	99	150	46	57.2	25	27.8	64	M12	18	425	353	252	
107	483	378	356	328	301	145	130	40	25	28	37.5	45M18×1.5	160	M12	80	63	71	104	162	49	57.2	25	27.8	64	M12	18	442	357	259	
160	530	440	412	377	354	213	155	40	28	36	42.5	50V22×1.5	180	M16	88	66	77	108	182	57	66.7	32	31.8	70	M14	19	513	423	302.5	
225	373	468	441	405	375	222	162	50	32	36	43.5	55V22×1.5	200	M16	96	74	85	121	199	61	66.7	32	31.8	70	M14	21	545	441	324	

Sizes	A <sub>30</sub>	A <sub>31</sub>	A <sub>32</sub>	A <sub>33</sub>	A <sub>34</sub>	A <sub>35</sub>	A <sub>36</sub>	A <sub>37</sub>	B	B <sub>1</sub>	C	C <sub>1</sub>	C <sub>2</sub>	C <sub>3</sub>	Keyed	Splined shaft	Splined shaft	G	X
28176	124	131	139	27.9	25	50	23	8	116	M27×2	118	125	12	11	key 8×50	W25×1.25×18×9g	EXT18Z×1.25M×30R×5f	M12×1.5	M14×1.5
55236	133	141	153	32.9	30	60	29	10	142	M33×2	150	160	16	13.5	key 8×50	W30×2×14×9g	EXT14Z×2M×30R×5f	M14×1.5	M14×1.5
80282	152	161	177	38	35	70	29.5	10	172	M42×2	165	180	16	13.5	key 10×56	W35×2×18×9g	EXT16Z×2M×30R×5f	M14×1.5	M14×1.5
107298	164	173	188	43.1	40	80	35	10	178	M42×2	190	200	20	17.5	key 12×63	W40×2×18×9g	EXT18Z×2M×30R×5f	M14×1.5	M14×1.5
160338	182.5	193	201	48.5	45	90	36.5	11.5	208	M48×2	210	224	20	17.5	key 14×70	W45×2×21×9g	EXT21Z×2M×30R×5f	M14×1.5	M14×1.5
225369	201	211	219	53.5	50	100	50	12	226	M48×2	236	250	25	22	key 14×70	W50×2×24×9g	EXT24Z×2M×30R×5f	M14×1.5	M14×1.5

## DA Control

Sizes	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	A <sub>4</sub>	A <sub>5</sub>	A <sub>6</sub>	A <sub>7</sub>	X <sub>1</sub> , X <sub>2</sub>
28	253	212	209	53	73	81	144	M14×1.5
55	317	272	268	49	70	77	146	M14×1.5
80	371	326	322	56	77	83	152	M14×1.5
107	380	336	332	59	81	88	152	M14×1.5
160	442	387	383	65	86	94	158	M14×1.5
225	471	416	411	73	95	103	158	M14×1.5

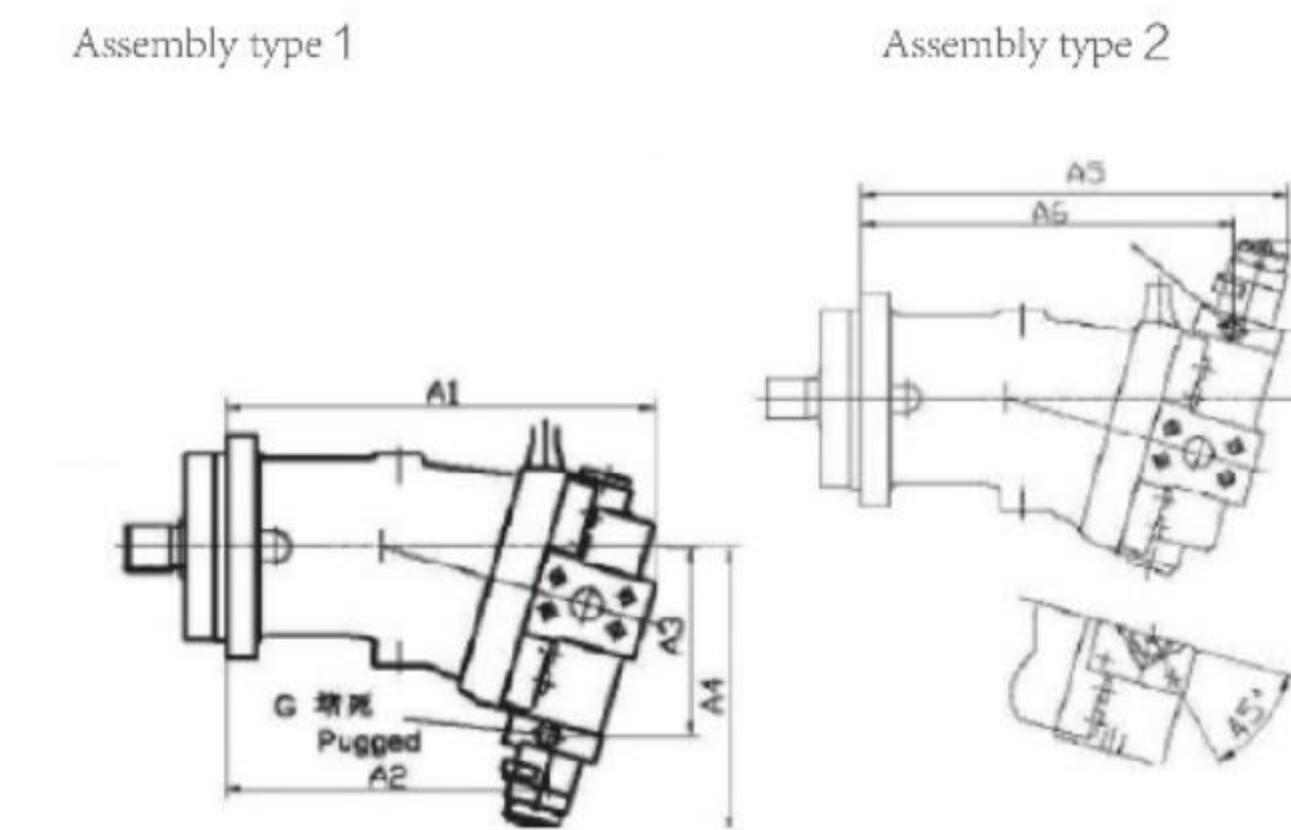
Other dimension see HD/HA.



## EP Control

Sizes	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	A <sub>4</sub>	A <sub>5</sub>	A <sub>6</sub>	A <sub>7</sub>	A <sub>8</sub>
28	230	164	119	204	266	212	53	131
55	301	223	129	213	334	274	48	124
80	353	267	148	240	392	326	56	137
107	357	269.5	160	254	393	333	61.5	144
160	423	313	177	265	452	386	70	139
225	441	334	196	284	481	414	74.5	147

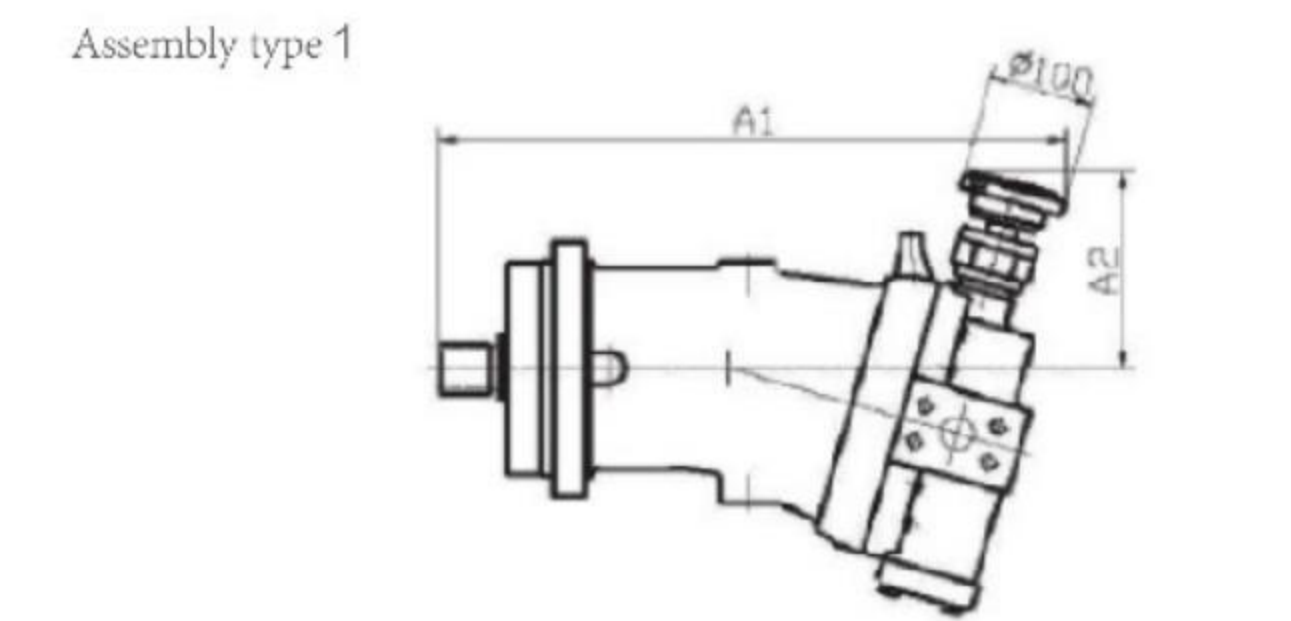
Other dimension see HD/HA.



## MA Control

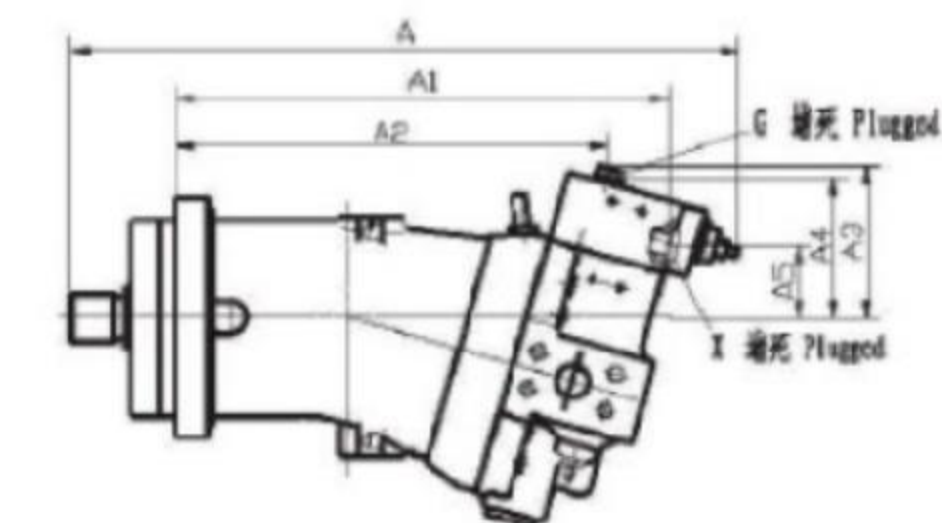
Sizes	A <sub>1</sub>	A <sub>2</sub>
28	269	128
55	329	134
80	381	138
107	390	137
160	441	149
225	470	155

Other dimension see HD/HA.



## HD1D

Sizes	A	A <sub>1</sub>	A <sub>2</sub>	A <sub>3</sub>	A <sub>4</sub>	A <sub>5</sub>
55	422	311	273	96	89	46
107	496	376.5	335.5	108	100	56



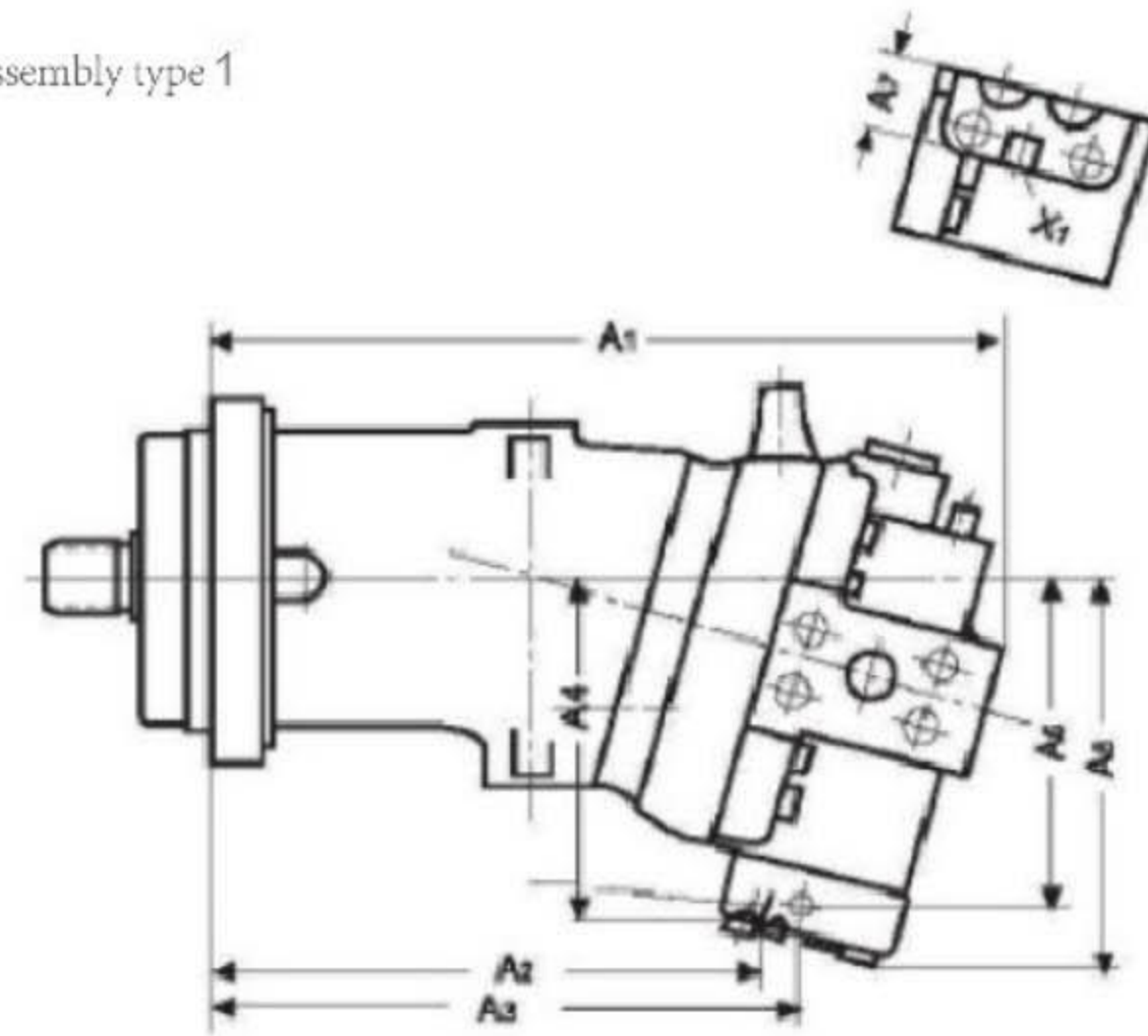
MO Control

Sizes	A1	A2	A3	A4	A5	A6	A7	X1
55	301	208	224	138	130	155	30	M14 × 1.5
80	353	252	268	157	149	177	33	M14 × 1.5
107	357	257	273	169	161	188	33	M14 × 1.5
160	423	300	312	187	178	206	34	M14 × 1.5
225	441	322	334	206	197	225	34	M14 × 1.5

Other dimension see HD/HA.

size  
HA control  
splined shaft  
W70 × 3 × 22 × 9g  
(1)IN 5480)  
Assembly type 1

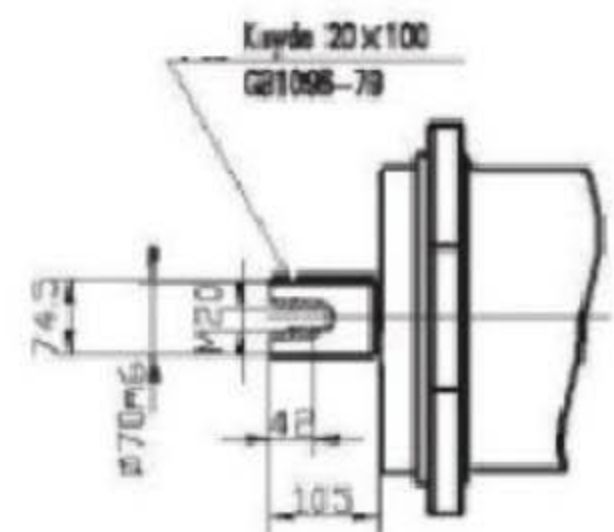
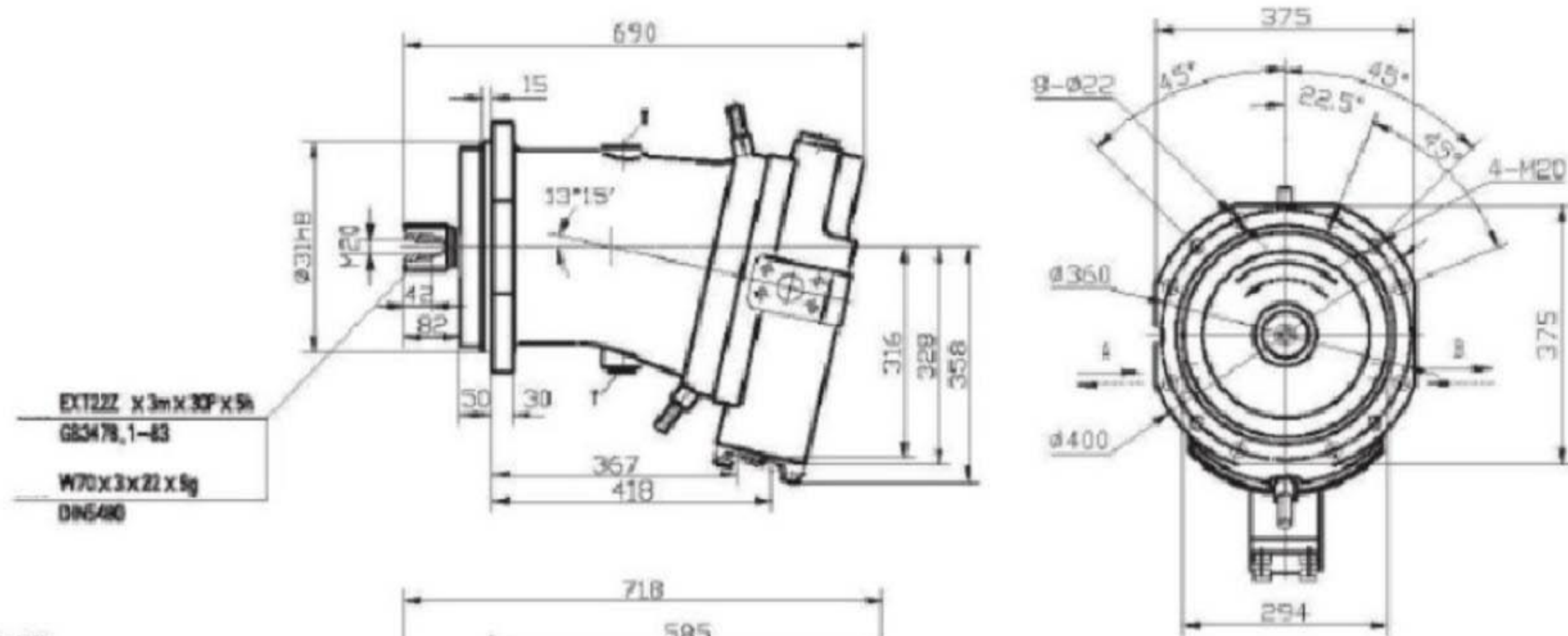
Assembly type 1



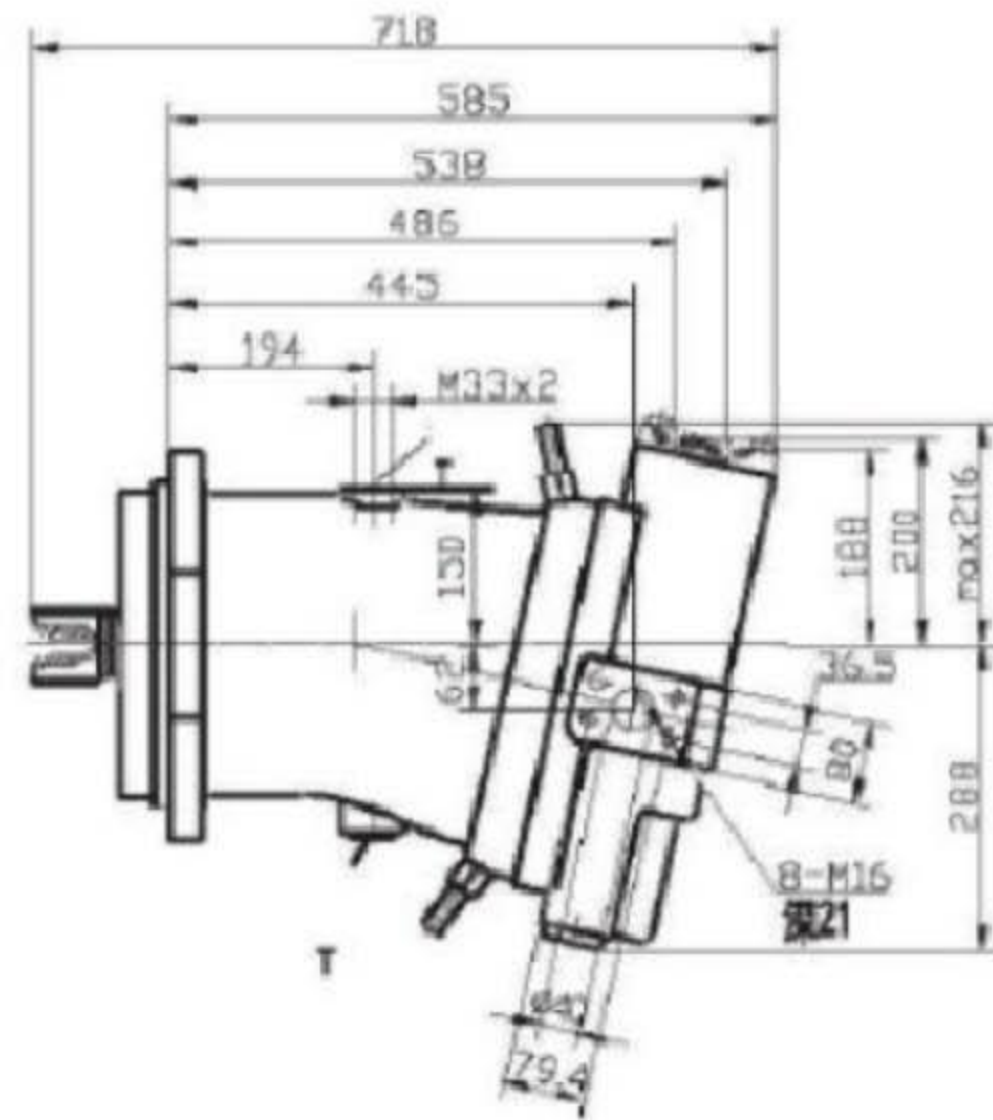
HA Control

Size 500  
Splined shaft 70 × 3 × 22 × 9g

Assembly type 1



Assembly type 2



Plant overview

