



PSM HYDRAULICS

VARIABLE DISPLACEMENT PUMPS



SECTION 3

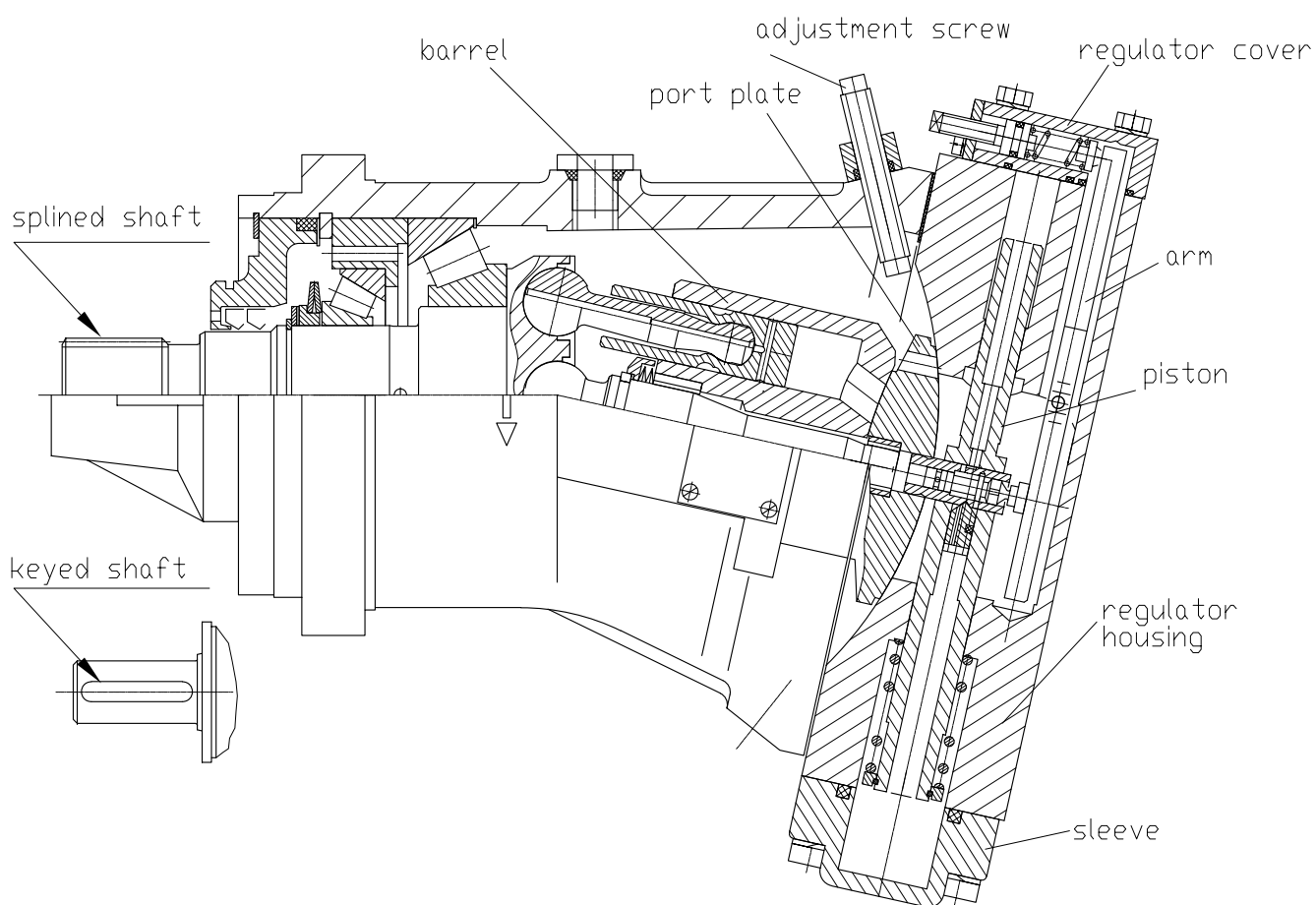


Variable displacement axial-piston pumps 313 series are characterized by a wide displacement changing range and different regulation/control modes. In the initial state the displacement can be both maximal and minimal. The control can be positive or negative. The positive control increases the displacement, the negative – decreases it.

Changing the displacement causes changes of delivery rate and consumed (driving) moment.

Limitation of the minimal and maximal displacements is effected by means of adjusting screws.

The design without displacement limitation (without the screws) is the basic one.





Structural designation diagram for variable displacement pumps

313															
Type: 313 –variable displacement pump												NBR		Climatic version	
Model 0, 1, 2, 3, 4...															
Working displacement, cm ³ /rev: 28, 45, 55, 56, 80, 107, 112, 160, 250															
Regulation mode															
proportional															
negative discrete electric control															
constant pressure differential «LS»															
constant pressure															
constant power															
positive discrete electric control															
without control group															
Mechanical limitation of working displacement*															
without limitation															
with limitation V min															
with limitation V max															
with limitation V min and V max															
Control mode:															
Absent															
hydraulic positive															
hydraulic negative*															
mechanical		shift by progressive motion													
		shift by rotary motion													
electric		discrete 12V, 24V, 127V, 220V													
		proportional 12V, 24V, 127V, 220V													
hydraulic positive with internal limiter															
hydraulic positive with power adder															
hydraulic negative with power adder															
direct control		two-chamber versatile piston													
		one-chamber versatile piston													
		two-chamber equilateral piston													
Shaft design		Shaft rotation sense													
splined		reversible													
		clockwise													
		anticlockwise													
keyed		reversible													
		clockwise													
		anticlockwise													

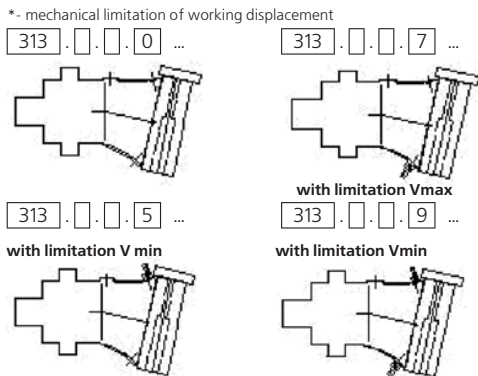
Pipelines connections and article mounting	
connection	flange
0	2 flanges
1	3 flanges
2	4 flanges
3	2 flanges at sides, 2 threaded on end
4	2 threaded on end
5	2 threaded at sides
6	1 threaded, 1 flange
7	2 threaded, 1 flange
8	
9	

4 holes ISO 3019/2

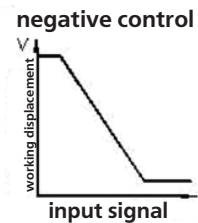
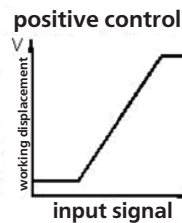
System conditions:	
0	for open loops
1	for close loops

Hydraulic equipment:	
0	absent
1	safety valve
2	safety valves
3	valve "or" of regulator connection to servofeed
4	valve "or" of regulator connection to servofeed, safety valve at output
5	valve "or" of regulator connection to servofeed, safety valves
6	reverse distributor with safety valve
7	maximum working displacement selection mechanism
8	control signal selection block
9	cut-off valve

Secondary control:	
0	absent
1	control signal selection block
2	pressure-triggered cut-off valve
3	power regulator in servoline
4	power regulator, cut-off valve in servoline
5	power regulator, power adder, cut-off valve in servoline
6	power regulator, power adder in servoline
7	corrective adjustment plunger
8	cut-off valve in control line
9	constant differential block «LS»
A	mechanical blocking of regulator for setting at zero working displacement



** - control mode





Operating principle of pumping unit

The pumping unit includes a shaft supported in the body in bearings and a cylinder block. The shaft flange is connected with pistons and a tongue through spherical connecting rod heads. The pistons move in the block's cylinders. The piston stroke is determined by the angle between the rotation axes of the cylinder block and the shaft.

The block contacts by a spherical surface with a directional control valve whose opposite side adjoins the supporting surface of the regulator body.

On the shaft endside the pump is closed with a cover sealed with a rubber ring and a sealing collar.

With the pump running, the shaft is set in rotation by the motor. Rotation from the shaft is transmitted to the connecting rods and from them through the pistons – to the cylinder block.

Each piston sucks working fluid in one half revolution of the shaft and then pumps it into hydraulic system in another half revolution.

The output pressure is determined by working member load, its valve is limited by the hydraulic system safety valve.

The delivery rate is determined by rotational speed of the pump shaft as well as by the pump displacement.

The displacement is determined by the cylinder block angle relative to the shaft axis.

Operating principle of regulator

The regulator consists of a stepped piston mounted in the body, a pin, a retention screw, a valve spool with two throttling orifices and a shoe and thrust bearing, a double-armed lever, and a cover contained components which have different functions. On its bottom side the regulator block is closed by a sleeve with a sealing ring.

The components included in the cover change the ratio of moments at the lever and valve spool position relative to the pin. In the neutral position, the valve spool ensures equilibrium of the forces acting on the regulator piston. Displacement of the valve spool to the right or to the left from the neutral position causes changing pressure in the piston chamber of greater diameter and displacement of the piston.

During movement of the piston, which is connected with the pumping unit through the spherical pin head, changing the cylinder block and pump displacement occurs.

The cylinder chamber of the piston with smaller diameter is constantly connected with the high pressure channel.

The chamber under the cylinder with greater diameter can be connected to the high pressure line or drainage line through the openings in the pin, valve spool land, and opening in the screw.

Variable displacement pumps 313.2.28, 313.3... series

313.4... series

Max operating pressure (bar):

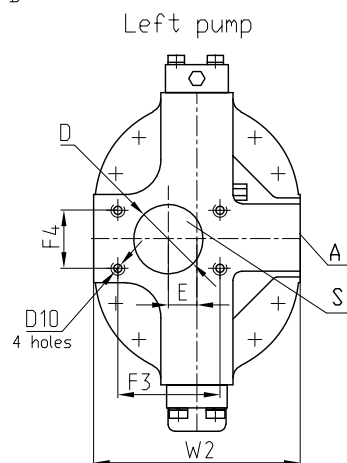
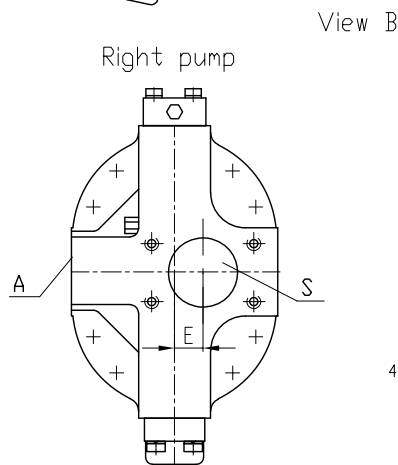
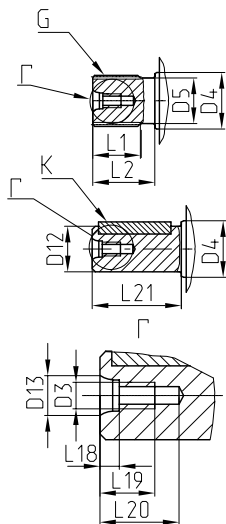
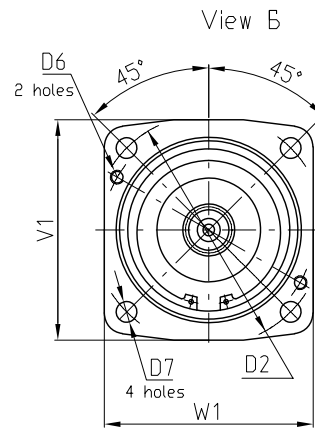
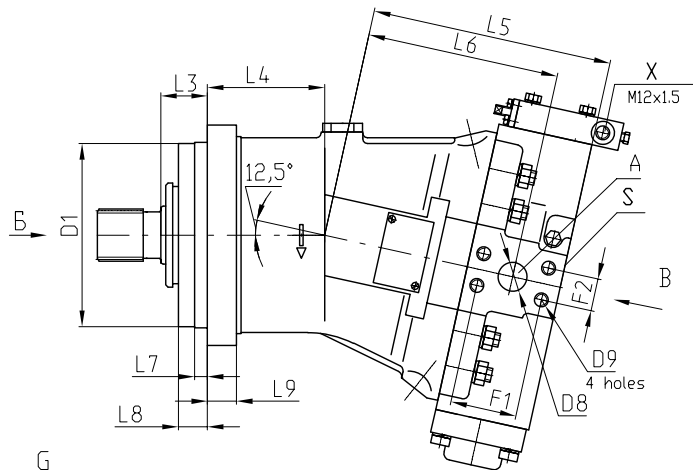
- | | | |
|--------------|-----|-----|
| • Continuous | 280 | 400 |
| • Peak | 350 | 450 |

Size			28	55	56	80	107	112	160	250
Displacement	$V_{g_{max}}$	cm ³	28	55	56	80	107	112	160	250
Rotational speed at p= 0,2MPa	n_{max}	min ⁻¹	4750	3750	3750	3350	3000	3000	2650	2100
Rated delivery rate at n_{max}	$Q_{V_{max}}$	l/min	133	206	210	268	321	336	424	525
Rated power (consumed) at $\Delta p=450$ bar* at $\Delta p=400$ bar at $\Delta p=350$ bar at $\Delta p=250$ bar	N_{max}	kW	93	144	147	187	224	235	296	367
			83	128	130	166	199	209	263	326
			72	112	114	146	174	183	230	285
			52	80	81	104	125	130	165	204
Torque at $\Delta p=450$ bar* at $\Delta p=400$ bar at $\Delta p=350$ bar at $\Delta p=250$ bar	M_{max}	Nm	187	367	373	534	714	747	1067	1667
			166	326	332	474	634	664	948	1482
			145	285	290	41	555	581	830	1297
			104	204	207	296	396	415	593	926
Pump weight	m_{max}	kg	15.5	24	22	38	40	37.5	55	85

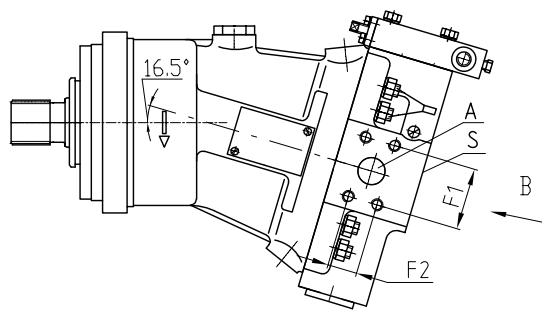
• - to be considered while calculating drive motor overload



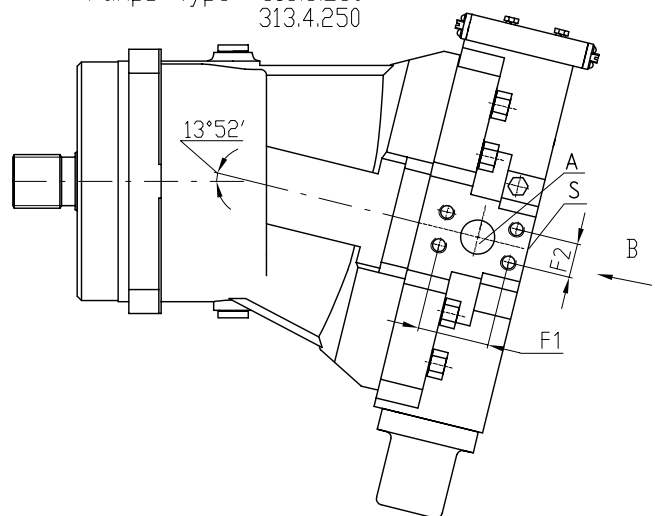
Pumps 313.2.28 series
 313.3.55, 313.4.55
 313.3.80, 313.4.80
 313.3.107, 313.4.107
 313.3.160, 313.4.160



Humps type 313...56...
112



Pumps type 313.3.250
313.4.250





Mounting Dimensions Table

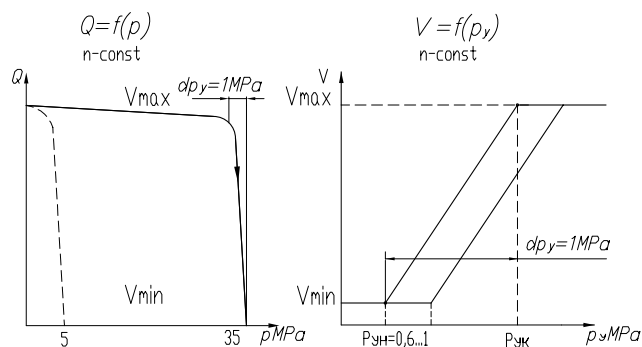
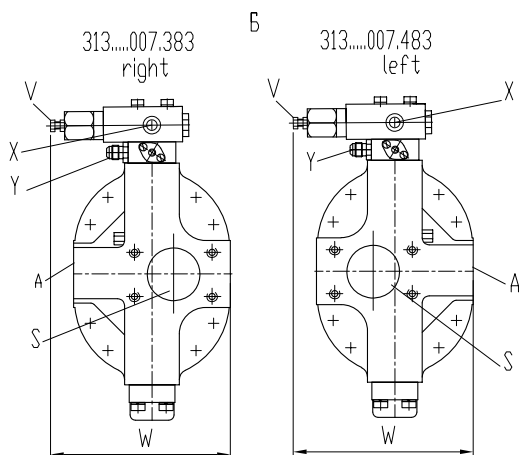
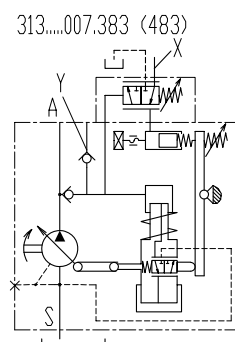
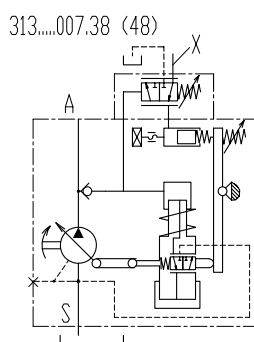
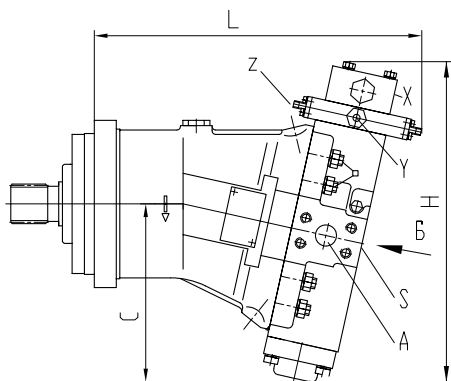
Size	313.2.28	313.3.55 313.4.55/ 313.3.56 313.4.56	313.3.80 313.4.80	313.3.107 313.4.107 313.3.112 31.4.112	313.3.160 313.4.160	313.3.250 313.4.250
G spline DIN 5480	WA25x1,5x30x15xf7x9g *W25-1,5x30x15x9g	WA35x2x30x16x f7x9g *W35-2x30x16x9g	WA40x2x30x18xf7x9g *W40-2x30x18x9g	WA45x2x30x21xh8x9g *W45-2x30x21x9g	WA45x2x30x21xh8x9g *W45-2x30x21x9g	WA50x2x30x24xh8x9g *W50-2x30x24x9g
K key DIN 6885	A 8x7x40	A 8x7x50	A 10x8x56	A 12x8x63	A 14x9x70	A 14x9x80
D	38H13	50H13	62H13	62H13	75H13	75H13
D1	100 h7	125 h7	140 h7	160 h7	180 h7	224 h7
D2	125	160	180	200	224	280
D3	M8-7H	M12-7H	M12-7H	M12-7H	M16-7H	M16-7H
D4	30h8	40 h8	45 h8	50 h8	50 h8	55 h8
D5	21,2	30 h11	35 h11	40 h11	40 h11	45 h11
D6	M8-7H	-	M10 -7H	M12-7H	M12-7H	M12-7H
D7	11	14	14	18	18	22
D8	14	22	25	25	25	32
D9	M8;14 deep	M10;18 deep	M12;18 deep	M12;18 deep	M12;18 deep	M14;20 deep
D10	M10;12 deep	M12;18 deep	M12;18 deep	M12;18 deep	M12;18 deep	M16;24 deep
D12	25k5	30k6	35k6	40k6	45k6	50k6
D13	12,5	17	17	17	21	21
E	12	19 / 16	24	25	20	32
F1	18,2	50,8	57,2	57,2	57,2	66,7
F2	40,5	23,8	27,8	27,8	27,8	31,8
F3	69,9	77,8	88,9	88,9	88,9	106,4
F4	35,7	42,9	50,8	50,8	50,9	61,9
L1	33	32,5	34,5	39,5	39,5	43,5
L2	50	50	50	55	55	58
L3	50	32,5	32	40	40	50
L4	62	85	99	101	108,5	162
L5	136	180 / 192	196	210	220	239
L6	110	141	150	169	178	193
L7	10	9	9	11	10	9
L8	48	18	12	25	34	48
L9	16	20	23	25	28	30
L18	7	8,5	8,5	8,5	8,5	9
L19	17	24	24	25	36	36
L20	23	35	35	35	46	46
L21	50	58	70	80	90	82
V1	118	140	160	180	200	246
W1	118	140	160	180	200	246
W2	130	154	168	178	182	206

* - to be negotiated at order



**Pumps with proportional positive hydraulic adjustment and cutoff valve in servo line
Delivery sets of pumps with above mentioned regulation type:**

	313 . 3 . 55 . 0 0 7 . 3 8 3
Pump	
with roller bearings	3
or with bimetallic cylinder block	4
or with roller bearings (only with 28 cm ³ displacement)	2
with working displacement: 55 or 28, 80, 107, 160 cm ³	
with proportional regulation	
without working displacement limitation screw	0
with V _{min} limitation screw	5
or with V _{max} limitation screw	7
or with V _{min} and V _{max} limitation screws	9
positive hydraulic control	
shaft design – splined, shaft rotation - clockwise	3
shaft design – splined, shaft rotation - counterclockwise	4
with cut-off valve at regulation line	
with "or" valve connecting regulator to the servo line	



Pumps displacement:	L	H	C	W
55	323	345	185	190
80	352	358	196	197
107	372	363	202	202
160	402	432	255	216

S – suction line
A- pressure line
X – control (hole M12x1,5-7H)
Y – outer feed of regulator, 3 MPa not less than (nipple.M16x1,5-7H)
313...007.38(48) no valve Y
Z – adjustment screw P_у н.
V – cutoff valve adjusting screw



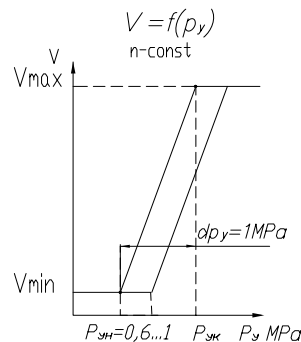
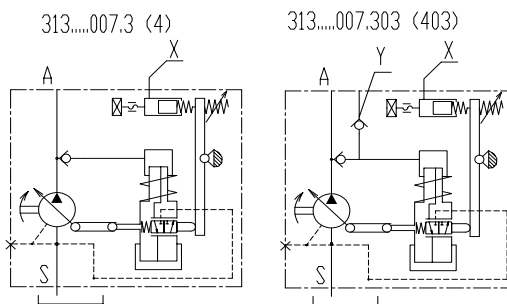
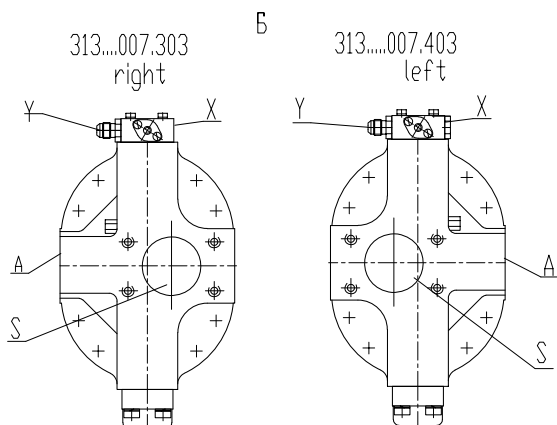
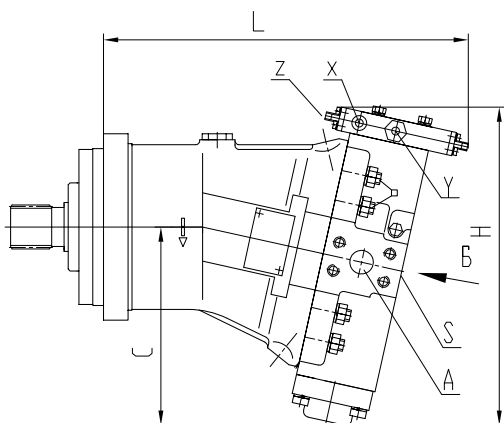
Pumps with proportional positive hydraulic adjustment 313... 55. 007. 3 Delivery sets of pumps with above mentioned regulation type:

313 . 3 . 55 . 0 0 7 . 3 0 3

Pump

with roller conical bearings	3
or with bimetallic cylinder block	4
with working displacement: 55 or 80, 107, 160 (cm ³)	
with proportional regulation	
without working displacement limitation screw	0
or with V _{min} limitation screw	5
or with V _{max} limitation screw	7
or with V _{min} and V _{max} limitation screws	9
positive hydraulic control	
shaft design – splined, shaft rotation - clockwise	3
shaft design – splined, shaft rotation - counterclockwise	4
with valve connecting regulator to the servo line	

Pump regulator changes the delivery rate Q depending on operator control signal



S – suction line
A – pressure line
X – control (hole M12x1,5-7H)
Y – outer feed of regulator, 3 MPa not less than (nipple.M16x1,5-7H)
313...007.3(4) no valve Y
Z – adjustment screw P_{yH}.

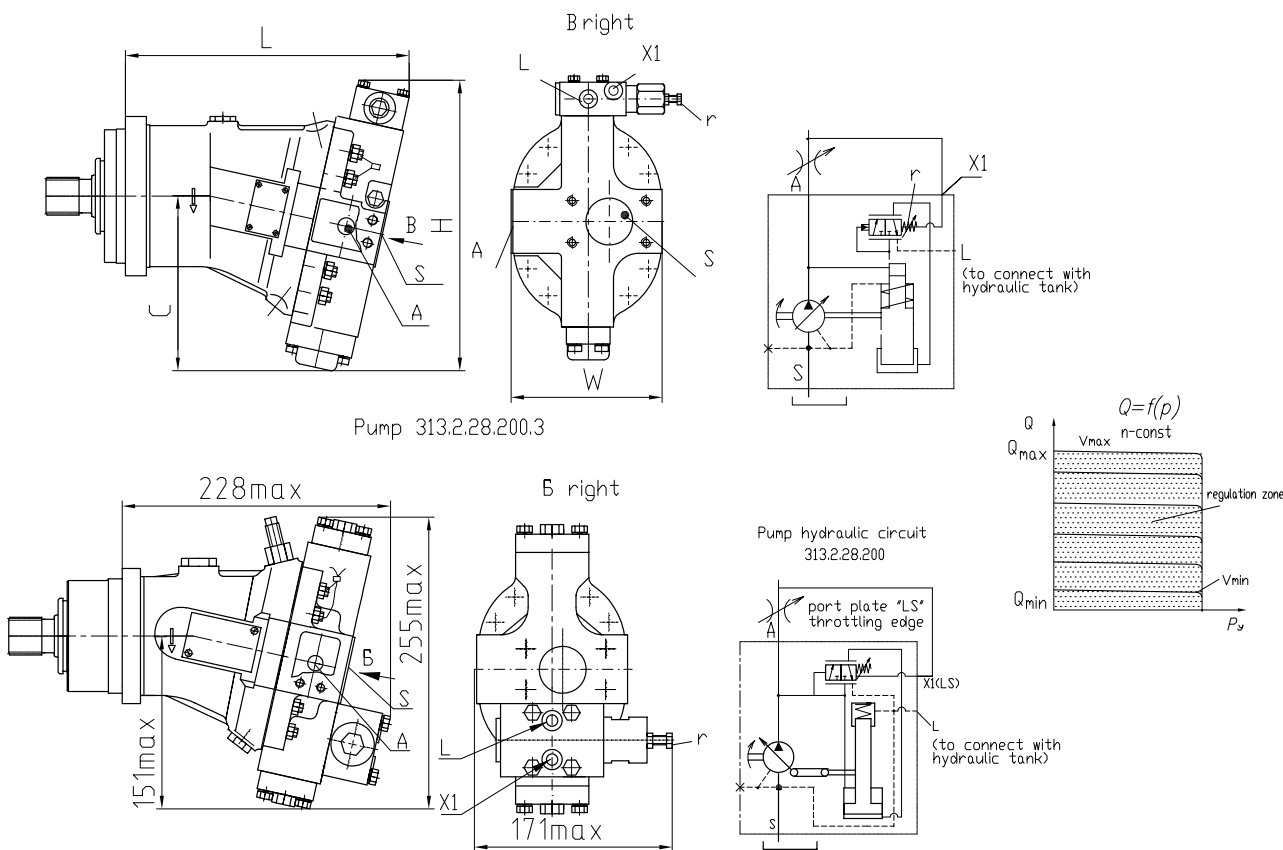
Pumps displacement:	L	H	C
55	323	315	185
80	352	328	196
107	372	333	202
160	402	402	255



Pumps with constant pressure differential regulator (LS) Delivery sets of pumps with above mentioned regulation type:

Pump	313	. 3	. 55	. 200	. 3
with roller conical bearings		3			
or with bimetallic cylinder block		4			
with working displacement: 55 or 80, 107, 160 cm ³					
constant pressure differential regulator (LS)					
without working displacement limitation screw					0
or with V _{min} limitation screw					5
or with V _{max} limitation screw					7
or with V _{min} and V _{max} limitation screws					9
no regulation					
shaft design – splined, shaft rotation - clockwise					3
shaft design – splined, shaft rotation - counterclockwise					4

The pump regulator ensures the constant pressure difference at the LS directional control valve orifice by delivery rate Q regulation (similarly to an automatic flow regulator).



Pumps displacement:	L	H	C	W
55	295	320	185	182
80	325	335	196	195
107	338	340	202	202
160	375	408	255	216

- S – suction line
- A – pressure line
- X1 – LS line (M12x1,5-7H)
(supply from LS –directional control valve)
- r – adjusting screw for maintaining pressure differential (1,5...2,5 MPa)
- L – drain/outlet line (M12x1,5-7H)
(to be connected with hydraulic tank)



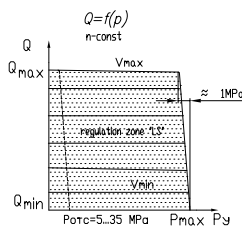
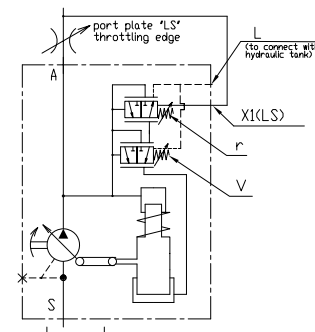
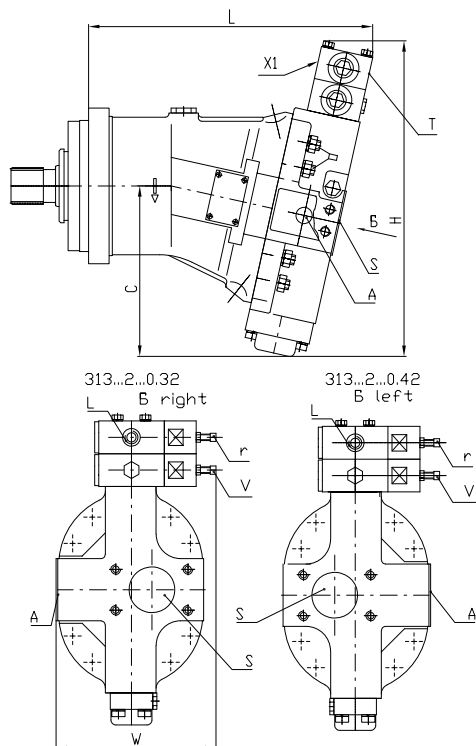
Pumps with constant pressure difference regulator (LS) and cutoff valve Delivery sets of pumps with above mentioned regulation type: --

313 . 3 . 55 . 2 0 0 . 3 2

Pump	
with roller conical bearings	3
or with bimetallic cylinder block	4
with working displacement: 55 or 80, 107, 160 cm ³	
constant pressure differential regulator (LS)	
without working displacement limitation screw	0
or with Vmin limitation screw	5
or with Vmax limitation screw	7
or with Vmin and Vmax limitation screws	9
no regulation	
shaft design – splined, shaft rotation - clockwise	3
shaft design – splined, shaft rotation - counterclockwise	4
with safety valves	

The pump regulator:

- ensures the constant pressure difference at the LS directional control valve orifice by delivery rate Q regulation (similarly to an automatic flow regulator);
- limits pressure P in hydraulic system by delivery rate Q regulation of the pump at duties with high pressure P and low delivery Q (for example, when a working member meets an obstacle).



- S – suction line
- A – pressure line
- X1 – LS line (M12x1,5-7H)
(supply LS-line from directional control valve)
- V – cut-off valve setting screw
- r – adjusting screw for maintaining differential (1,5...2,5MPa)
- L – regulator drain/outlet line (M12x1,5-7H)
(to be connected with hydraulic tank)

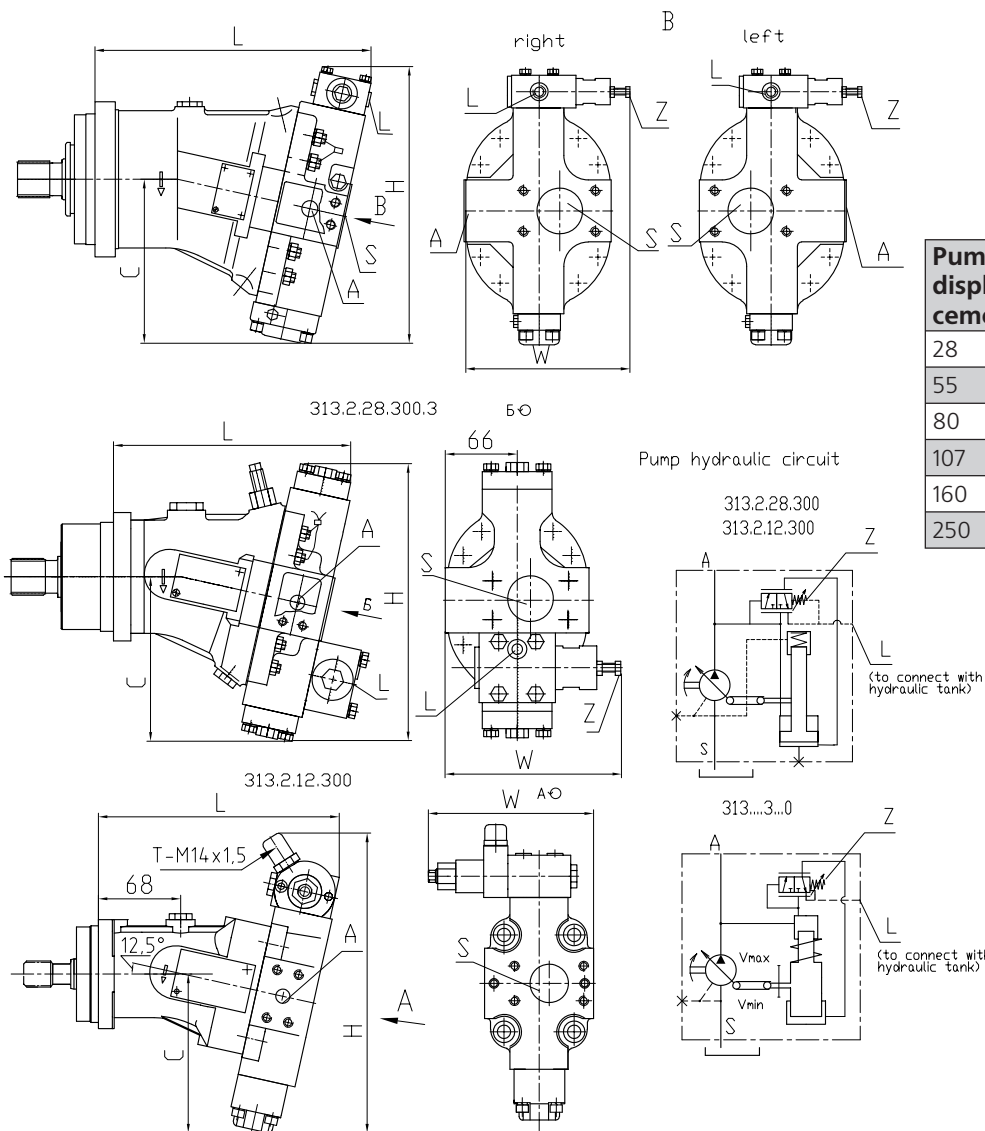
Pumps displacement:	L	H	C	W
55	302	356	185	195
80	333	375	196	195
107	348	378	202	202
160	383	448	255	219



Pumps with constant pressure regulator Delivery sets of pumps with above mentioned regulation type:

		313 . 3 . 55 . 3 0 0 . 3			
Pump					
with roller conical bearings		3			
or with bimetallic cylinder block		4			
or with roller bearings (only with 12, 28 cm ³ displacement)		2			
with working displacement: 55 or 12, 28, 80, 107, 160, 250 cm ³					
constant pressure regulator					
without working displacement limitation screw					0
or with V _{min} limitation screw					5
or with V _{max} limitation screw					7
or with V _{min} and V _{max} limitation screws					9
positive hydraulic control					
shaft design – splined, shaft rotation - clockwise					3
shaft design – splined, shaft rotation - counterclockwise					4

The pump regulator ensures constant pressure P_n in hydraulic system by delivery rate Q regulation.



Pumps displacement:	L	H	C	W
28	225	255	151	161
55	253	320	185	179
80	325	335	196	179
107	340	346	209	184
160	375	408	255	198
250	414	470	315	320

S – suction line
 A – pressure line
 Z – adjusting screw
 L – outlet line
 (M12x1,5-7H)
 (to be connected with hydraulic tank)



Pumps with constant pressure regulator, discrete electrical control and safety valve
Delivery sets of pumps with above mentioned regulation type:

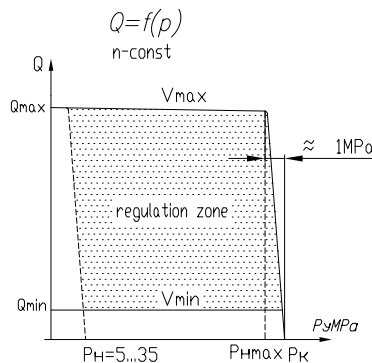
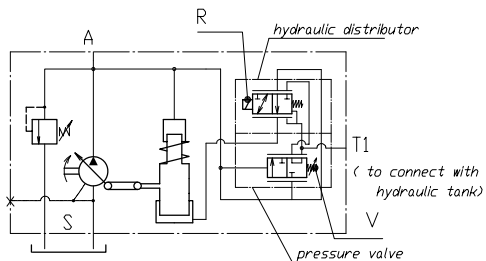
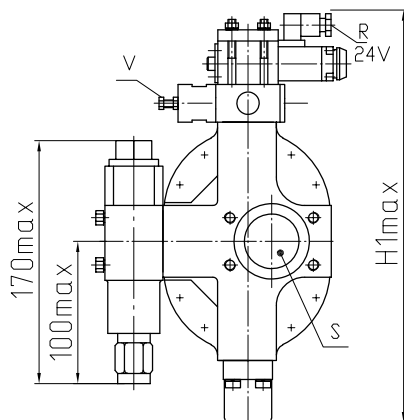
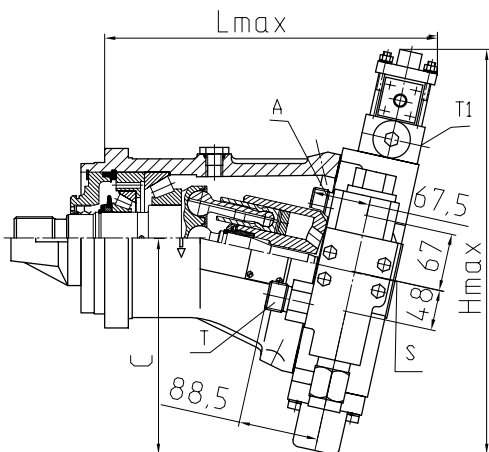
313 . 3 . 55 . 3 0 5 . 3 0 1

Pump

with roller conical bearings	3
or with bimetallic cylinder block	4
with working displacement: 55 or 160 cm ³	
constant pressure regulator	
without working displacement limitation screw	0
or with V _{min} limitation screw	5
or with V _{max} limitation screw	7
or with V _{min} and V _{max} limitation screws	9
discrete electrical control	
shaft design – splined, shaft rotation - clockwise	3
shaft design – splined, shaft rotation - counterclockwise	4
with safety valve	

The pump regulator:

- ensures constant pressure in hydraulic system by means of feed rate (Q) regulation;
 - insures the emergency limitation of pressure P in hydraulic system.
- On applying (removing) power to (from) the electromagnet, the pressure regulator switching on (off) functions are activated.



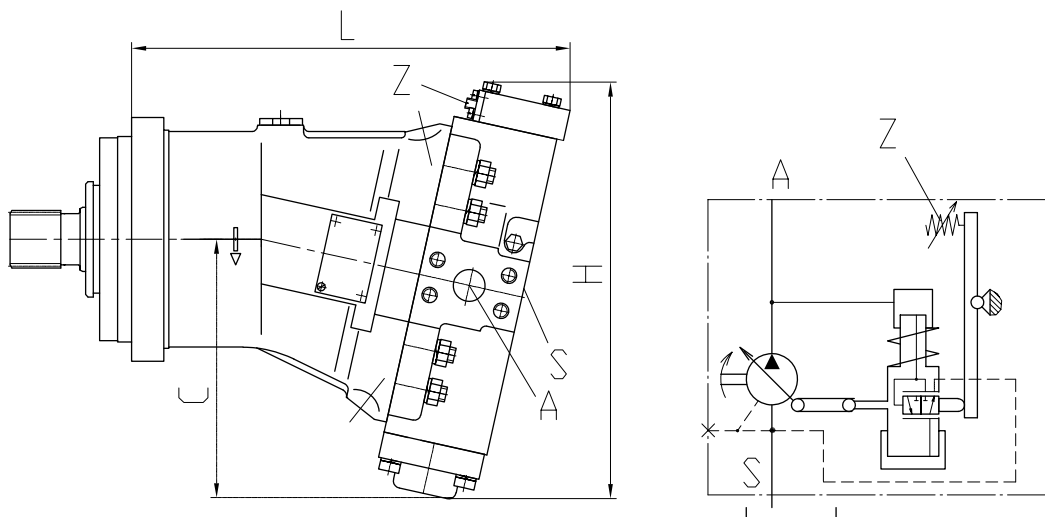
Pumps displacement:	L	H	C	H1
55	300	390	200	400
160	420	480	260	490



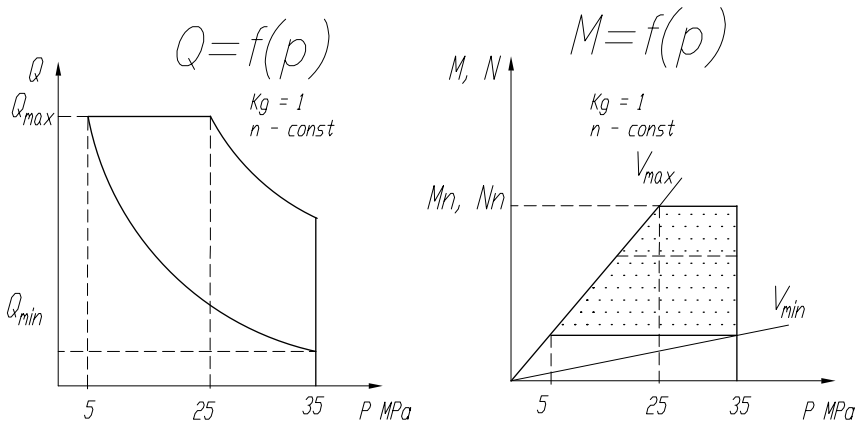
Pumps with power regulator Delivery sets of pumps with above mentioned regulation type:

Pump	313 . 3 . 55 . 5 0 0 . 3
with roller conical bearings	3
or with bimetallic cylinder block	4
with working displacement: 55 or 56, 80, 107, 112, 160, 250 cm ³	
power regulator	
without working displacement limitation screw	0
or with V _{min} limitation screw	5
or with V _{max} limitation screw	7
or with V _{min} and V _{max} limitation screws	9
positive hydraulic control	
shaft design – splined, shaft rotation - clockwise	3
shaft design – splined, shaft rotation - counterclockwise	4

The pump regulator ensures the constant consumed (driving) moment M_{pa} by adjustment of the pumping unit slope.



S – suction line
A – pressure line
Z – consumed torque adjusting screw



$P_H = 5 \dots 25 \text{ MPa}$ - regulation starting pressure

Pumps displacement:	L	H	C
55	293	305	185
56	291	240	150
80	325	315	197
107	338	325	195
112	336	270	175
160	374	395	255
250	414	470	315

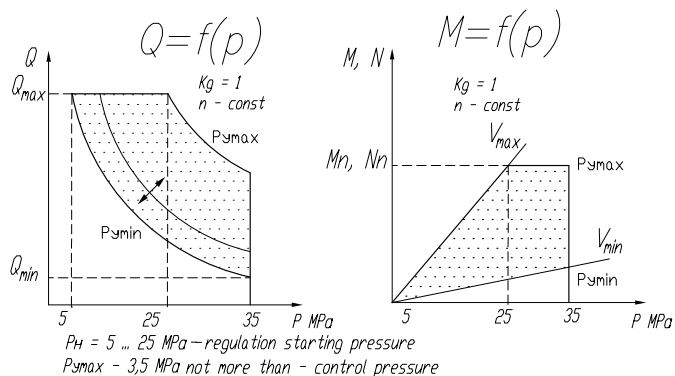
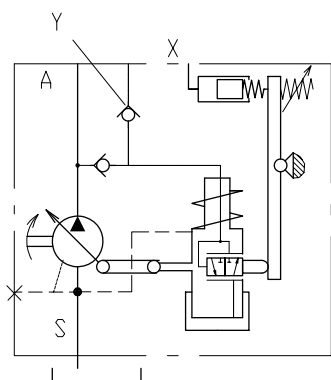
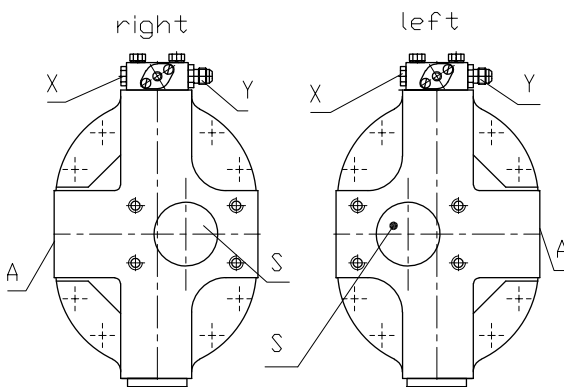
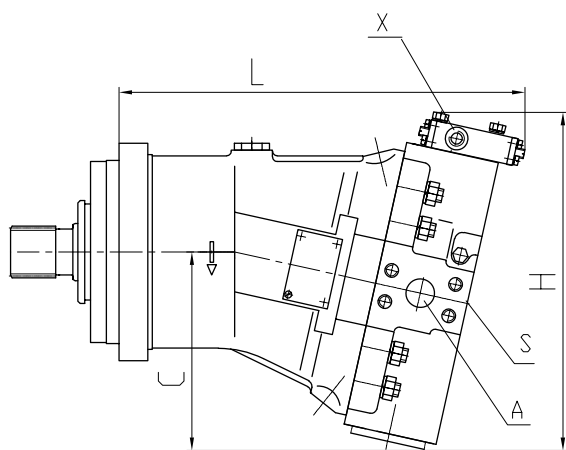


Pumps with power regulator and hydraulic positive control Delivery sets of pumps with above mentioned regulation type:

313 . 3 . 56 . 5 0 1 . 3 0 3

Pump	
with roller conical bearings	3
or with bimetal cylinder block	4
with working displacement: 56 or 112 cm ³	
power regulator	
without working displacement limitation screw	0
or with V _{min} limitation screw	5
or with V _{max} limitation screw	7
or with V _{min} and V _{max} limitation screws	9
hydraulic positive control	
shaft design – splined, shaft rotation - clockwise	3
shaft design – splined, shaft rotation - counterclockwise	4
with valve connecting regulator to servo line	

The pump regulator adjusts the power N_n consumed by the pump depending on the control pressure P_y



- S – suction line
- A – pressure line
- X – control pressure line (M12x1,5-7H)
- Y – regulator input line of external feed,
3 MPa, not less than (nipple M16x1,5-7H)
313.3...501.3(4) do not have valve Y

Pumps displacement:	L	H	C
56	314	242	150
112	360	270	175

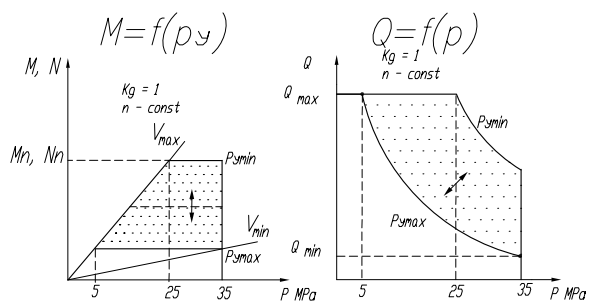
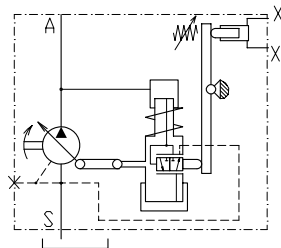
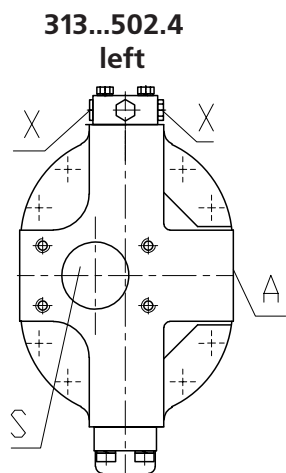
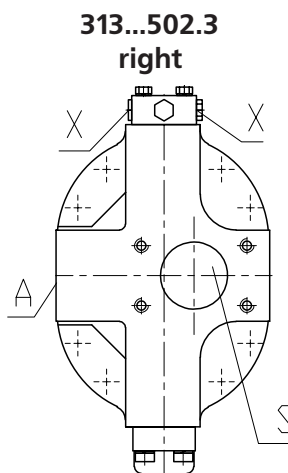
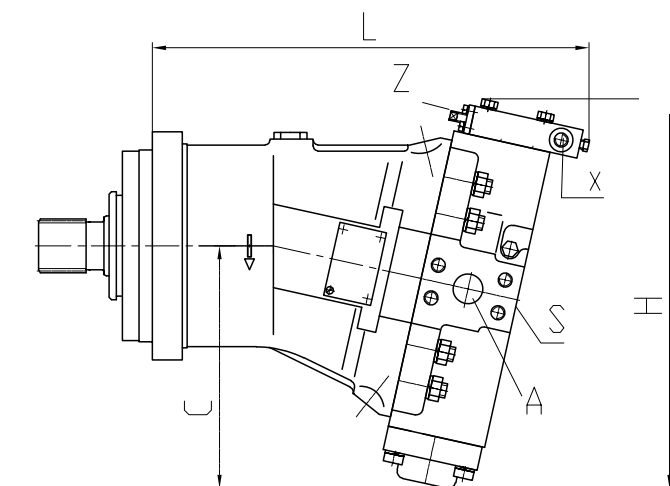


Pumps with power regulator and hydraulic negative control Delivery sets of pumps with above mentioned regulation type:

Pump	313 . 3 . . 55 . 5 0 2 . 3
with roller conical bearings	3
or with bimetal cylinder block	4
with working displacement: 55 or 56, 80, 107, 112, 160, 250 cm ³	
power regulator	
without working displacement limitation screw	0
or with V _{min} limitation screw	5
or with V _{max} limitation screw	7
or with V _{min} and V _{max} limitation screws	9
hydraulic negative control	
shaft design – splined, shaft rotation - clockwise	3
shaft design – splined, shaft rotation - counterclockwise	4

The pump regulator:

- automatically maintains the consumed power N_n (torque M_{kr}) under changes of pressure P in hydraulic system;
changes over the pump to a lower consumed power $N_{n_{min}}$ (delivery rate Q) by control signal



Pumps displacement:	L	H	C
55	320	300	185
56	316	240	150
80	350	320	196
107	365	324	202
112	363	270	175
160	401	394	255
250	440	467	313

- S – suction line
- A – pressure line
- Z – consumed power limiting screw
- X – control pressure line (M12x1,5-7H)

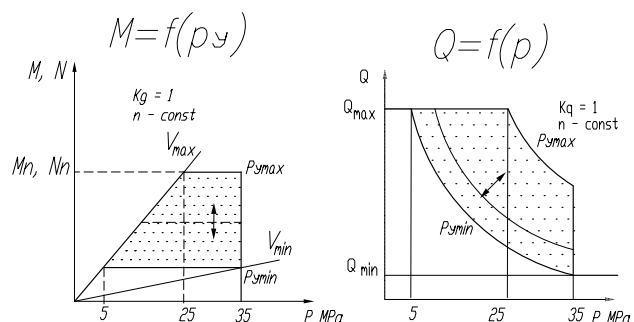
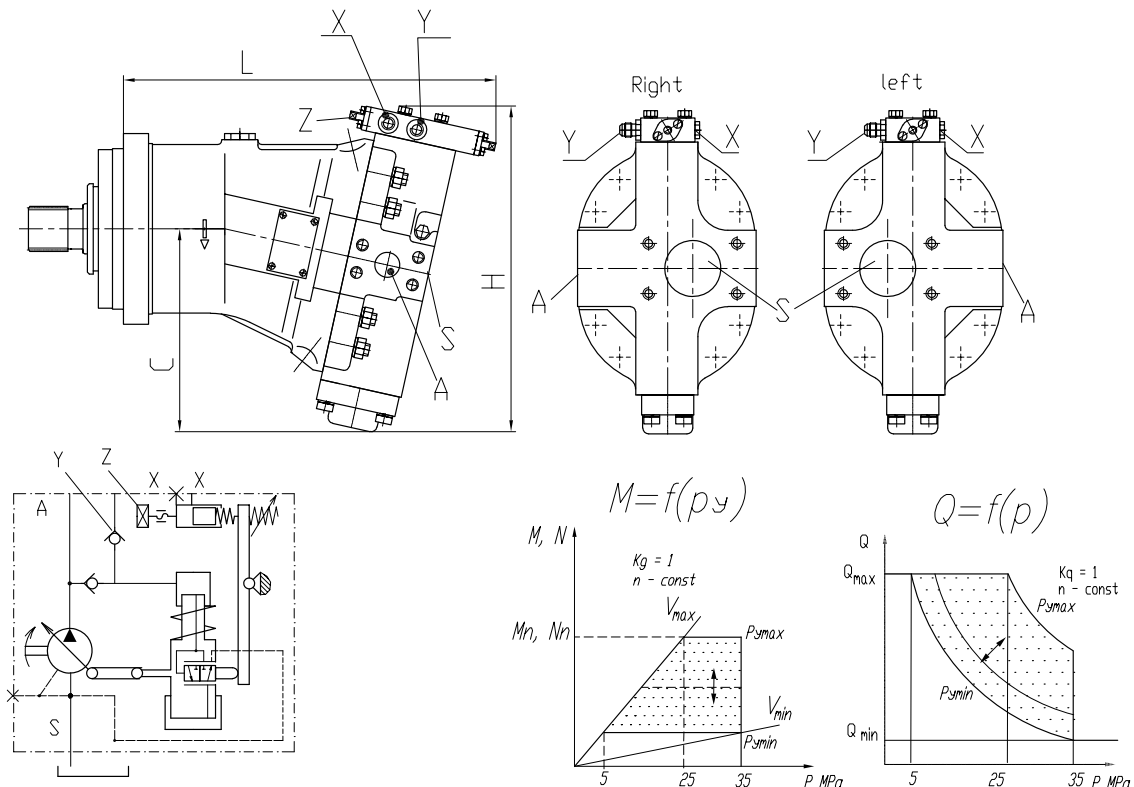


**Pumps with power regulator, positive control and restriction of upper response limit
Delivery sets of pumps with above mentioned regulation type:**

	313 . 3 . 55 . 5 0 7 . 3
Pump	
with roller conical bearings	3
or with bimetal cylinder block	4
with working displacement: 55 or 56, 80, 107, 112, 160, 250 cm ³	
power regulator	
without working displacement limitation screw	0
or with Vmin limitation screw	5
or with Vmax limitation screw	7
or with Vmin and Vmax limitation screws	9
positive control and restriction of upper response limit	
shaft design – splined, shaft rotation - clockwise	3
shaft design – splined, shaft rotation - counterclockwise	4

The pump regulator:

- adjusts the pump consumed power N_n depending on the control pressure P_y ;
- restricts the maximum consumed power N_n of the pump by an internal mechanical limiter Z.



P_H - 5...25 MPa - regulation starting pressure
 P_{ymax} - 3,5 MPa not more than - control pressure

Pumps displacement:	L	H	C
55	320	302	185
56	316	243	150
80	352	320	196
107	422	360	180
112	363	273	175
160	402	395	255
250	438	470	315

- S – suction line
- A – pressure line
- Z – power regulator adjusting screw
- X – control pressure line (M12x1,5-7H)
- Y – outer feed regulator supply line, 3MPa not less than (nipple M16x1,5-7H) 313.3...507.3(4) no valve Y

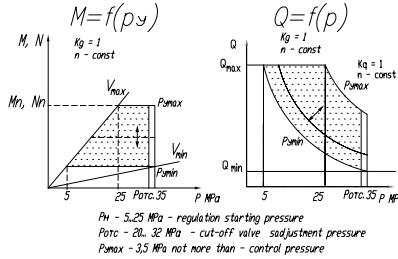
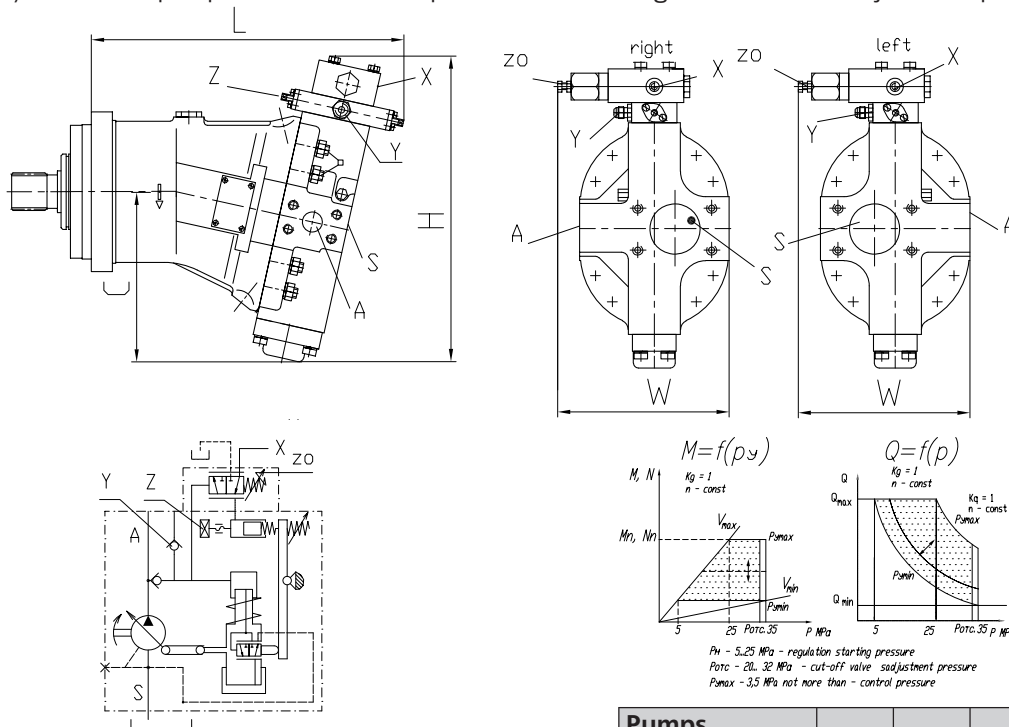


Pumps with power regulator, positive control, restriction of upper response limit and cutoff valve in servo line
Delivery sets of pumps with above mentioned regulation type:

	313 . 3 . 55 . 5 0 7 . 3 8 3			
Pump				
with roller conical bearings	3			
or with bimetal cylinder block	4			
with working displacement: 55 or 56, 80, 107, 160, 250 cm ³				
power regulator				
without working displacement limitation screw			0	
or with V _{min} limitation screw			5	
or with V _{max} limitation screw			7	
or with V _{min} and V _{max} limitation screws			9	
positive hydraulic control				
shaft design – splined, shaft rotation - clockwise				3
shaft design – splined, shaft rotation - counterclockwise				4
with cut-off valve at control line				
with valve connecting regulator to servo line				

The pump regulator:

- adjusts the pump consumed power N_n depending on the control pressure P_y ;
- restricts the maximum consumed power N_n of the pump by an internal mechanical limiter Z ;
- decreases/cuts off the pump feed rate at outlet pressure P exceeding the cutoff valve adjustment pressure P_{otc}



- S – suction line
- A- pressure line
- Z power regulator adjusting screw
- X – control pressure line (M12x1,5-7H)
- Y – outer feed source supply line
not less than 3 MPa (nipple M16x1,5-7H)
- 313.3...507.38(48) no valve Y
- ZO – cutoff valve setting screw

Pumps displacement:	L	H	C	W
55	320	315	185	190
56	316	278	150	190
80	352	258	196	196
107	365	363	202	202
112	363	308	175	202
160	402	421	255	216
250	438	506	315	220



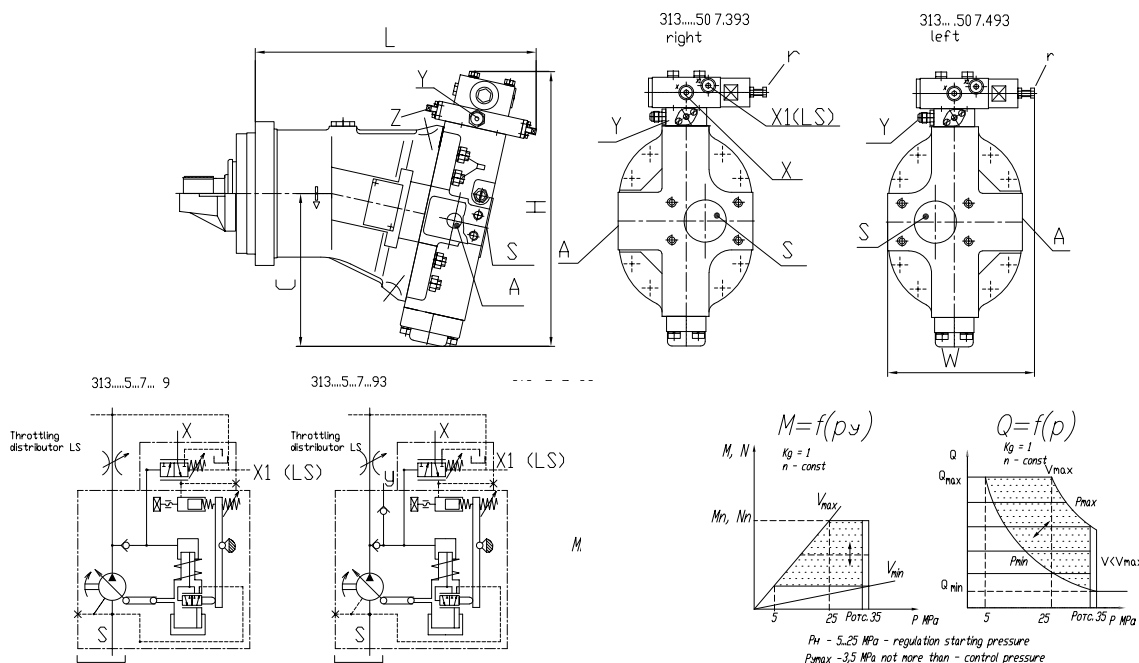
Pumps with power regulator, hydraulic positive control and constant pressure difference block (LS) in servo line Delivery sets of pumps with above mentioned regulation type:

313 . 3 . 55 . 5 0 7 . 3 9 3

Pump	
with roller conical bearings	3
or with bimetal cylinder block	4
with working displacement: 55 or 56, 80, 107, 160, 250 cm ³	
power regulator	
without working displacement limitation screw	0
or with Vmin limitation screw	5
or with Vmax limitation screw	7
or with Vmin and Vmax limitation screws	9
hydraulic positive control	
shaft design – splined, shaft rotation - clockwise	3
shaft design – splined, shaft rotation - counterclockwise	4
constant pressure difference block (LS)	
with valve connecting regulator to servo line	

The pump regulator:

- automatically maintains the consumed power N_{Π} (torque M_{kr}) under changes of pressure P in hydraulic system by adjusting the pumping unit slope;
- ensures the constant pressure difference at the LS directional control valve orifice by delivery rate (Q) regulation at power values not exceeding the power regulator setting.



Pumps displacement:	L	H	C	W
55	300	315	185	190
80	352	258	196	197
107	365	363	202	202
160	402	431	255	216
250	438	506	315	320

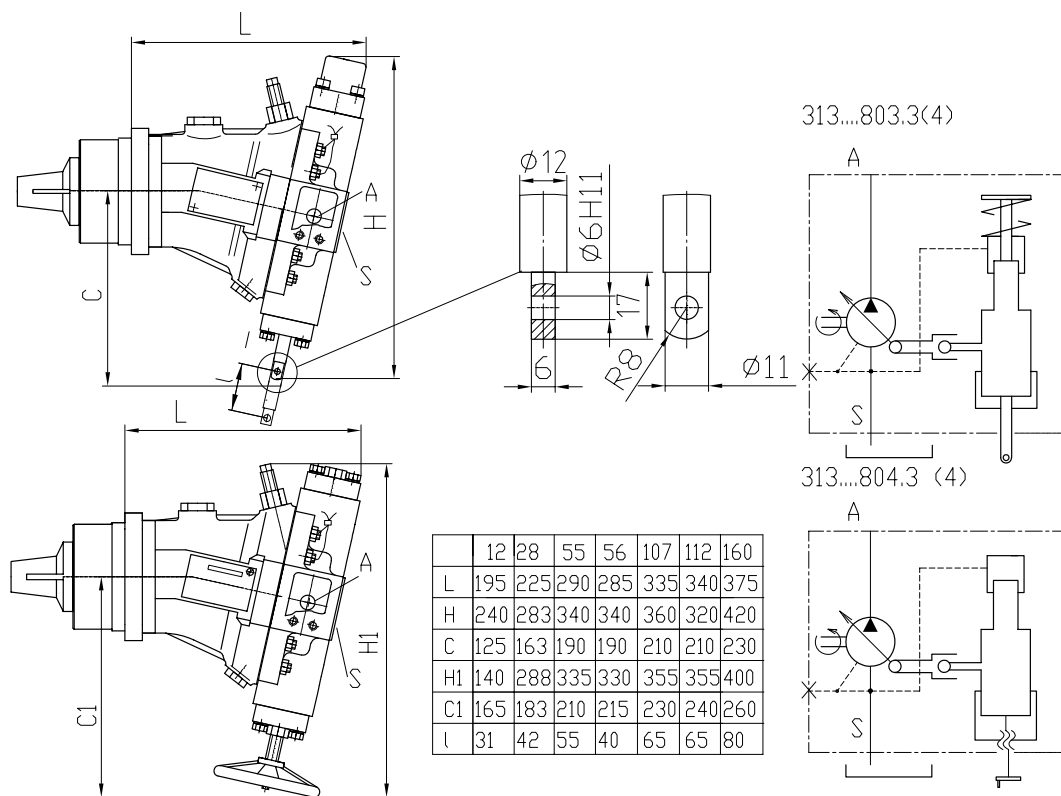
- S – suction line
- A – pressure line
- Z – consumed power adjusting screw
- R – maintained differential adjusting screw (1,5...2 MPa)
- X – control pressure line $P_y = 3 \text{ MPa}$ M12x1,5-7H
- X1 – LS line (supply from LS directional control valve)
- Y – regulator outer feed supply, 3 MPa not less than 313.3...507.39(49) no valve Y



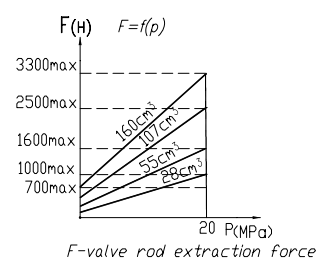
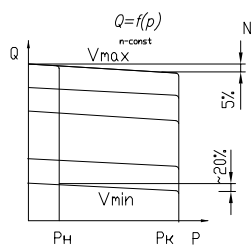
Pumps with direct rearrangement (manual regulation) of displacement Delivery sets of pumps with above mentioned regulation type:

Pump	313 . 3 . 55 . 8 0 3 . 3
with roller conical bearings	3
or with bimetal cylinder block	4
or with roller bearings (only with 12, 28 cm ³ displacement)	2
with working displacement: 55 or 12, 28, 56, 107, 112, 160 cm ³	
direct rearrangement (manual regulation)	
without working displacement limitation screw	0
or with V _{min} limitation screw	5
or with V _{max} limitation screw	7
or with V _{min} and V _{max} limitation screws	9
mechanical - shift by progressive movement	3
- shift by rotary movement	4
shaft design – splined, shaft rotation - clockwise	3
shaft design – splined, shaft rotation - counterclockwise	4

The regulator of the pump with direct displacement rearrangement adjusts the feed rate Q by an external (mechanical) action.



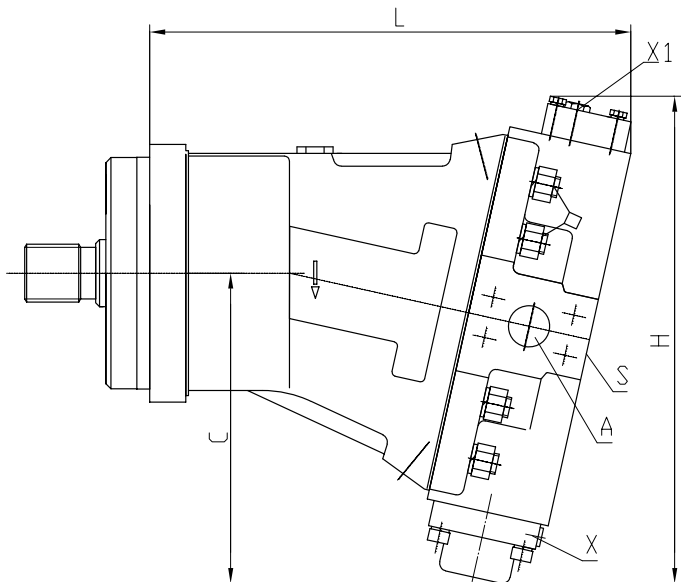
	12	28	55	56	107	112	160
L	195	225	290	285	335	340	375
H	240	283	340	340	360	320	420
C	125	163	190	190	210	210	230
H1	140	288	335	330	355	355	400
C1	165	183	210	215	230	240	260
l	31	42	55	40	65	65	80





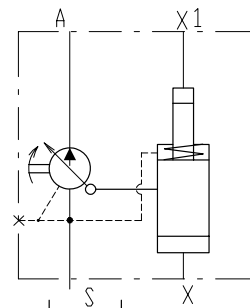
Pumps with equilateral two-chambered piston for control

313...55.8...A.3(4) 313...107.8...A.3(4)
313...80.8...A.3(4) 313...160.8...A.3(4)

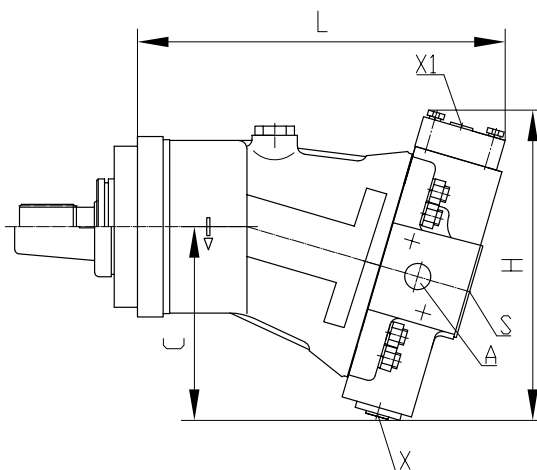


Pump hydraulic circuit

313...160.8..A3 313...80.8..A3
313...160.8..A4 313...80.8..A4
313...107.8..A3 313...55.8..A3
313...107.8..A4 313...55.8..A4

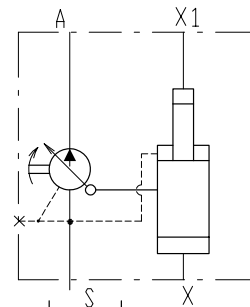


313... 56.8...A.3(4)
313...112.8...A.3(4)

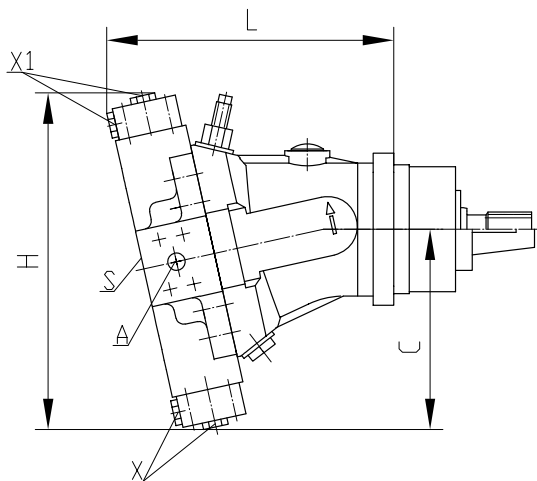


Pump hydraulic circuit

313...56.8..A3 313...112.8..A3
313...56.8..A4 313...112.8..A4

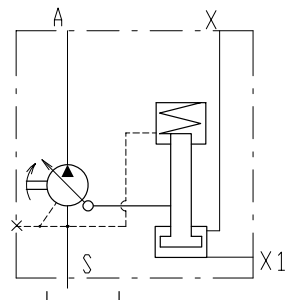


313.2. 28.8...A.3(4)



Pump hydraulic circuit

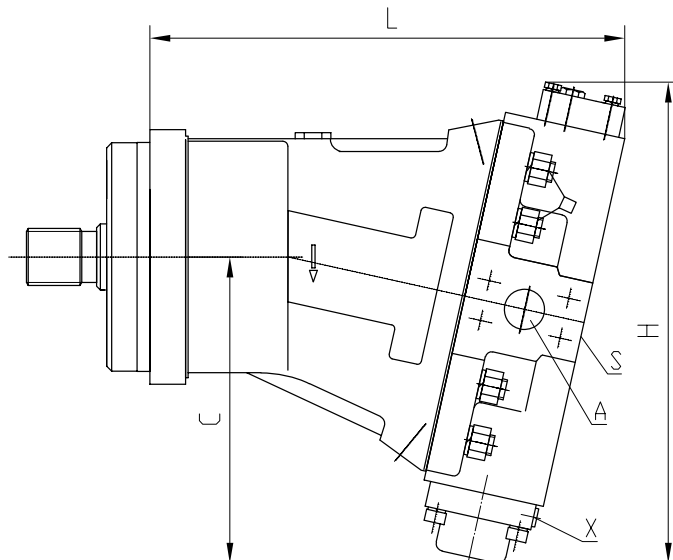
313.2.28.8..A3
313.2.28.8..A4





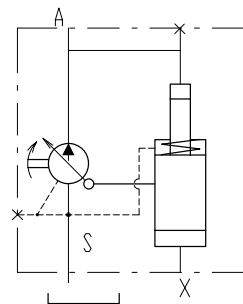
Pumps with equilateral one-chambered piston for control

313...55.8...B.3(4) 313...107.8...B.3(4)
313...80.8...B.3(4) 313...160.8...B.3(4)

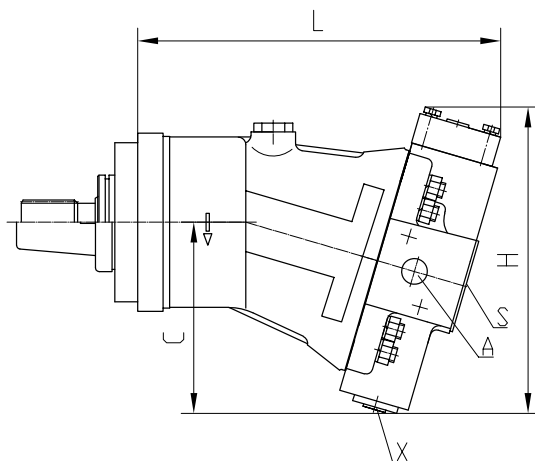


Pump hydraulic circuit

313...160.8...B.3 313...80.8...B.3
313...160.8...B.4 313...80.8...B.4
313...107.8...B.3 313...55.8...B.3
313...107.8...B.4 313...55.8...B.4

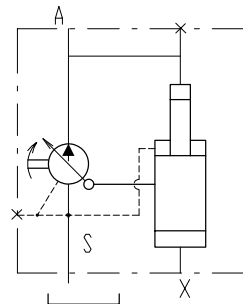


313... 56.8...B.3(4)
313...112.8...B.3(4)

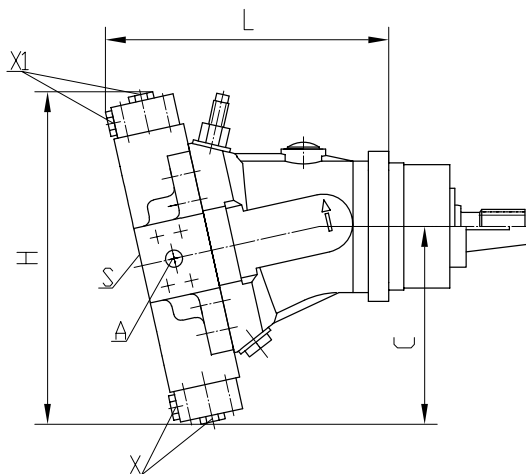


Pump hydraulic circuit

313...56.8...B.3 313...112.8...B.3
313...56.8...B.4 313...112.8...B.4

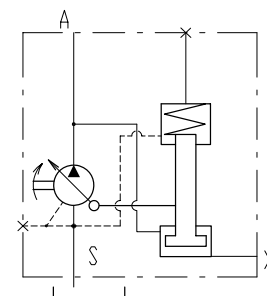


313.2. 28.8...B.3(4)



Pump hydraulic circuit

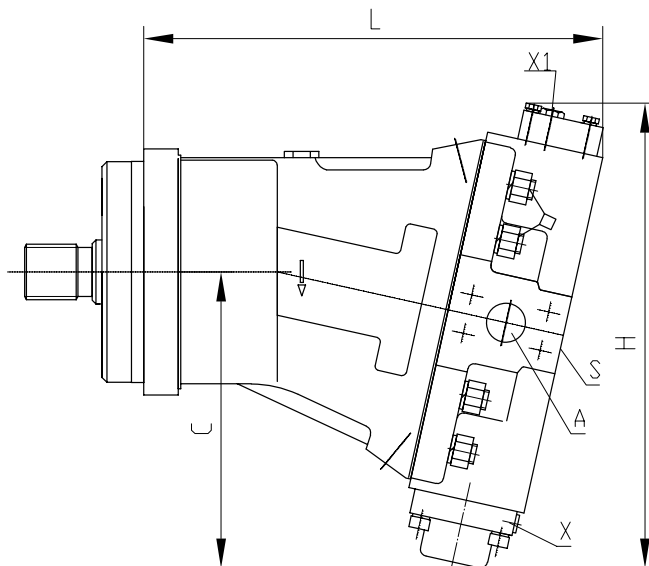
313.2.28.8...B.3
313.2.28.8...B.4





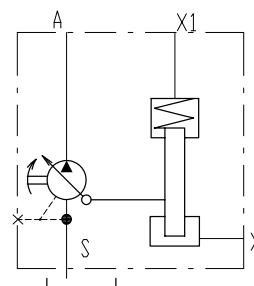
Pumps with equilateral two-chamber piston for control

313...55.8...C.3(4) 313...107.8...C.3(4)
313...80.8...C.3(4) 313...160.8...C.3(4)

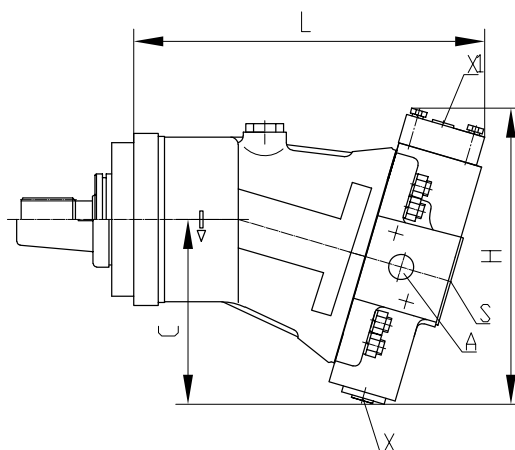


Pump hydraulic circuit

313...160.8...C.3 313...80.8...C.3
313...160.8...C.4 313...80.8...C.4
313...107.8...C.3 313...55.8...C.3
313...107.8...C.4 313...55.8...C.4

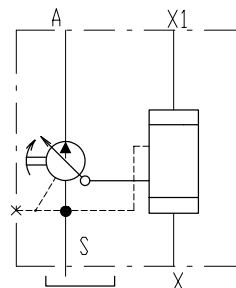


313... 56.8...C.3(4)
313...112.8...C.3(4)

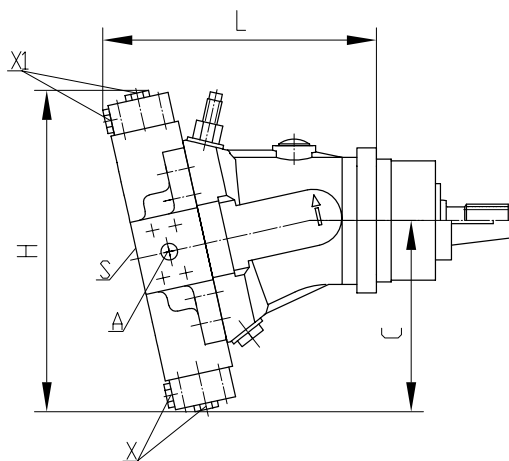


Pump hydraulic circuit

313...56.8...C.3 313...112.8...C.3
313...56.8...C.4 313...112.8...C.4

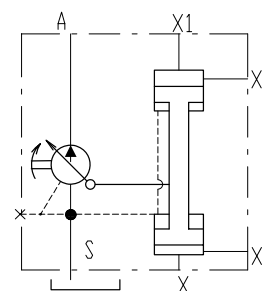


313.2.28.8...C.3(4)



Pump hydraulic circuit

313.2.28.8...C.3
313.2.28.8...C.4





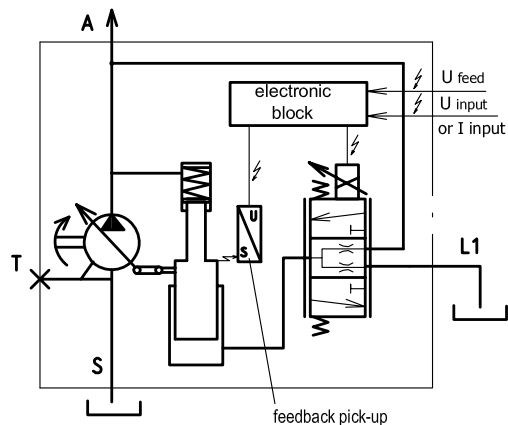
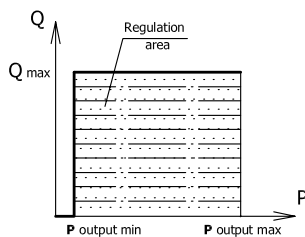
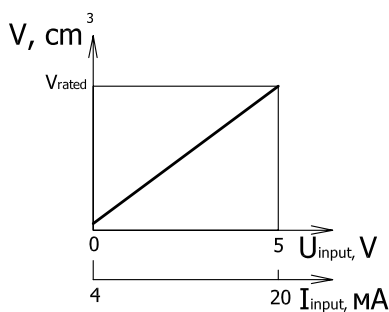
Pumps with regulator and electric hydraulic control 313.3.0.056 (0 – 55, 107, 160)

The regulator consists of a stage piston, piston position feedback pickup, hydraulic distributor with proportional electric magnets, electronic block and other parts having various functions. When applying feed voltage and input electric control signal to the pump electronic block at rotation speed of not less than the minimum one, the working displacement corresponds to the input electric control signal.

Electronic block forms and passes to the proportional magnet a signal corresponding to the difference of signal values from the feedback pickup and the input electric control signal. Proportional electric magnet moves the hydraulic distributor control valve. Hydraulic distributor connects the space of the big diameter regulator cylinder either with the high pressure channel or with drain.

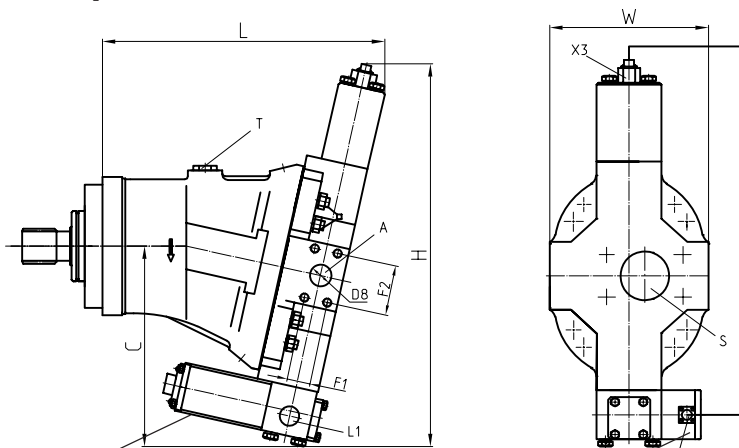
Parameter	Value		
	313.3.55 313.4.55	313.3.107 313.4.107	313.3.160 313.4.160
Output pressure, MPa (kg/cm ²)	20 (200)		
- rated Poutput rate	35 (350)		
- max Poutput max	[for 313.4... - 40 (400)]		
Regulator stable operation pressure - min Poutput min, MPa (kg/cm)	3 (30)		
Pump reaction time to input electric control signal not more than, s	0,1		
Pump working displacement minimum variation time, s:			
- from position Vmin to position Vrated	0,6		
- from position Vrated to position Vmin	0,3		
Input electric control signal:			
version 1: U input, V (R input=130 kW)	0..5;		
version 2: I input, mA (R input=100 W)	4..20		
Rated voltage U feed, V	24		
Voltage allowed values range, V	12..30		
Current, A, not more than			
- at absence of working displacement change объема	0,2		
- during working displacement change	0,8		
Weight (working fluid excluded), kg		38	

$V = f(U \text{ input})$ $Q = f(P)$
 $V = f(I \text{ input})$





Pumps 313.□.55.0□6.□ series



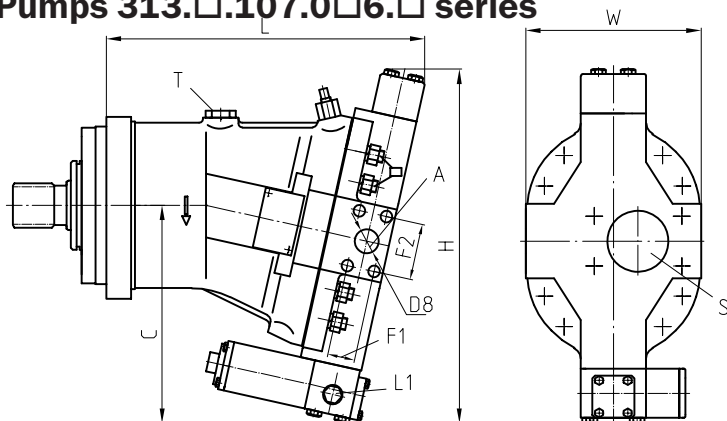
Hydraulic distributor with proportional electric magnet

Electronic block

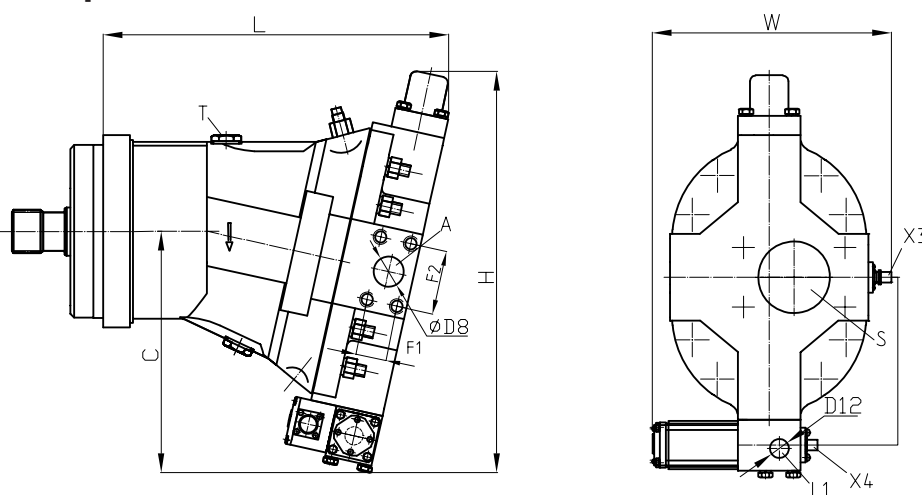
	(mm)		
	313.3.55	313.3.107	313.3.160
L	285	324	360
H	392	364	419
C	203	223	248
W	155	178	269
F1	23,8	27,8	31,8
F2	50,8	57,2	66,7
D8	22	25	32

- A – pressure line
- L1 – outlet line (to be connected to tank)
- S – suction line
- T – drain (plugged) used for air emission
- X3 – plug PCF4TB
- X4 – plug PCF4TB

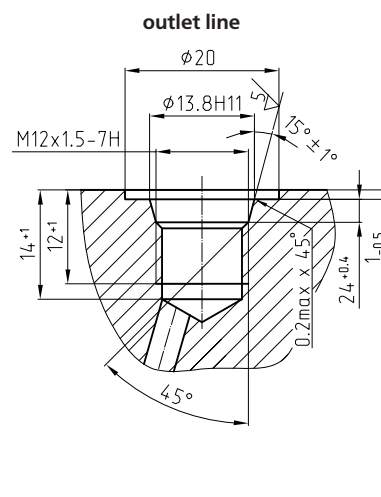
Pumps 313.□.107.0□6.□ series



Pumps 313. □.160.0□6.□ series



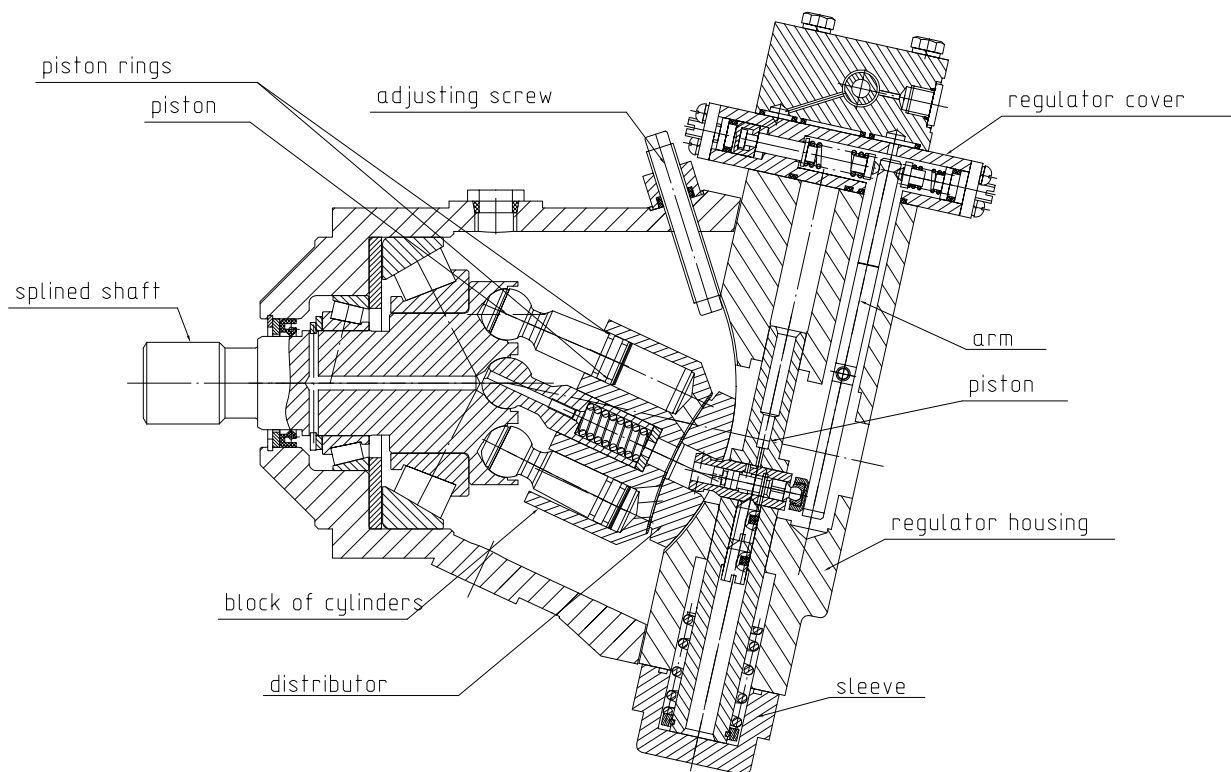
Mounting dimensions





Design and operation principle of variable displacement axial-piston pump 413 series is similar to pump 313 series, except the design of rod-piston unit of the pump rotary group. The piston is conical with two spherical heads. With one spherical head rod rests on shaft, the second spherical head of the shaft is in the block of cylinders mov-

ing progressively. Sealing is ensured by two piston rings of compression type. The present design of piston unit allows to decrease weight and pump dimensions, to increase max working pressure and rotation speed of drive shaft.



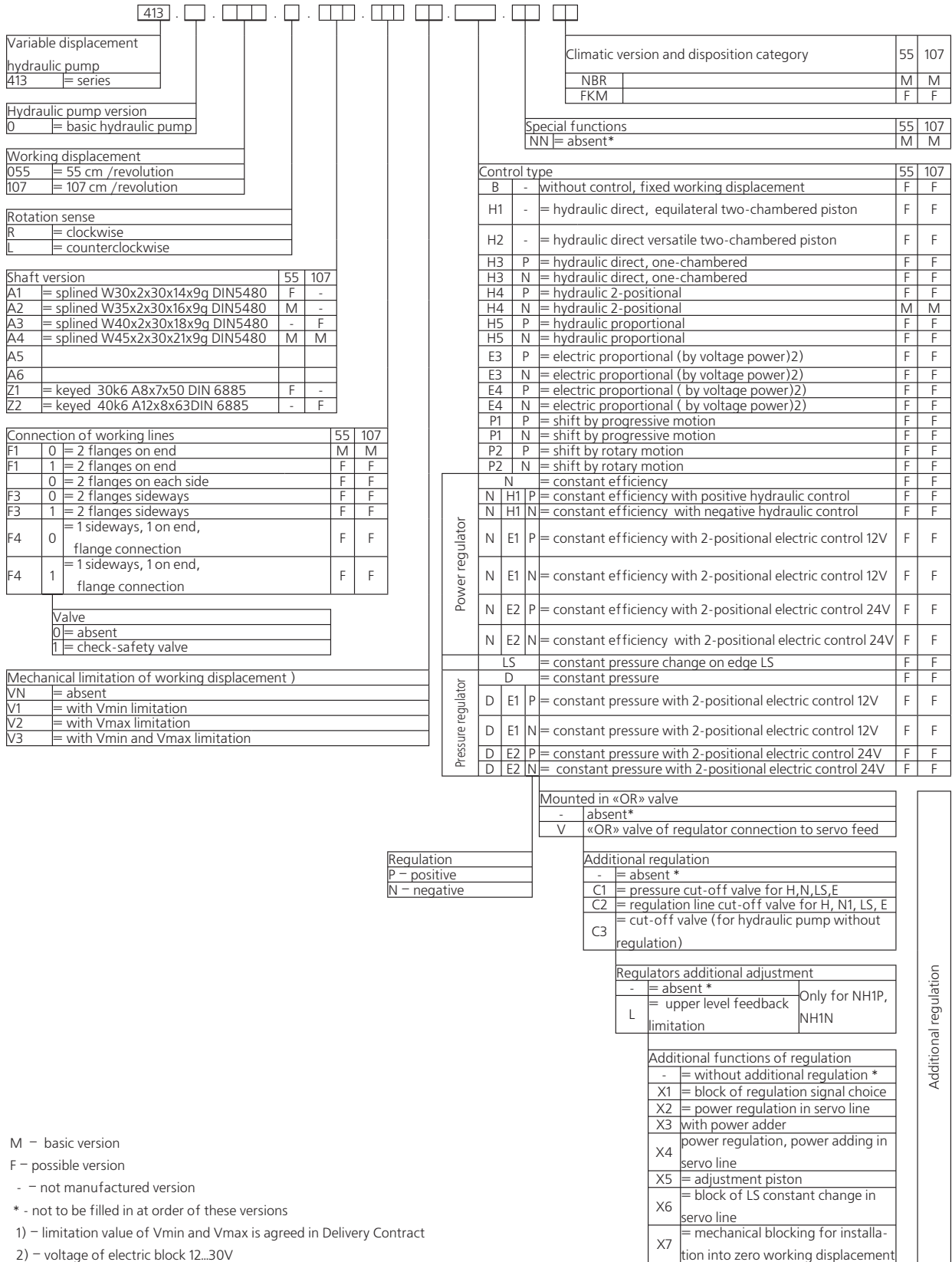
Technical characteristics

Max working pressure:
-continuous 400 bar
-peak 450 bar

Parameter	413.0.55		
Working displacement	$V_{g_{max}}$ $V_{g_{min}}$	cm ³	54,8 0
Max rotation speed at $V_{g_{max}}$ and input pressure (p_{in})	n_{min} n_{max}	min ⁻¹	2500 3750
- min (absolute) $p_{in_{min}} = 0,08\text{MPa}$			
- max (absolute) $p_{in_{max}} = 0,2\text{MPa}$			
Output pressure	Δp_{max}	bar	450
Regulation start pressure	p_{st}	bar	2-10
Feed at n_{max}	$Q_{V_{max}}$	l/min	195
Consumed power at $\Delta p=450$ bar and $Q_{V_{max}}$	N_{max}	kW	160
Volumetric efficiency	v		0,95
Full efficiency	t		0,9
Weight (without working fluid)	m_{max}	kg	25



Designation structure diagram of variable displacement hydraulic pump 413 series



M – basic version

F – possible version

- - not manufactured version

* - not to be filled in at order of these versions

1) – limitation value of Vmin and Vmax is agreed in Delivery Contract

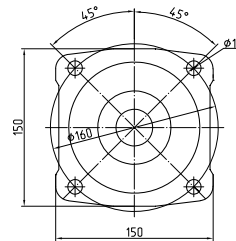
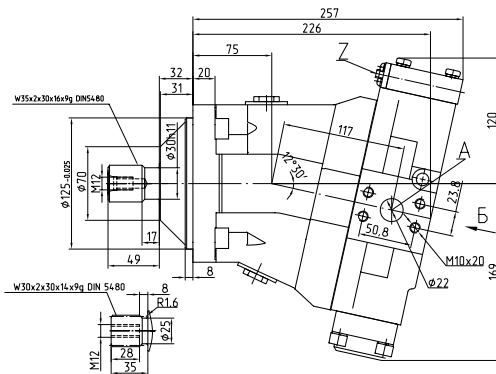
2) – voltage of electric block 12...30V



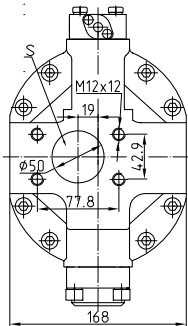
Pump with constant power regulation

413 . 0 . 055 . R . A1 . F1 0 . VN . N

Pump – series	413	0	055	R	A1	F1	0	VN	N
hydraulic pump version									
working displacement: 55 cm ³									
rotation sense:	clockwise								
	counterclockwise								
shaft version –	splined 30x2x30x14x9g DIN5480				A1				
	splined W35x2x30x16x9g DIN5480				A2				
connection of working lines:	= 2 flanges on end					F1			
	= 1 flange sideways, 1 – on end					F4			
valve - absent									
mechanical limitation of working displacement: absent								VN	
								V1	
								V2	
								V3	
regulation type – power regulation									

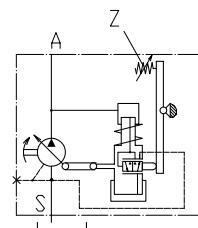
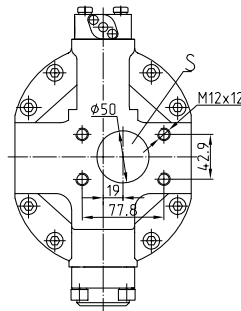


413.0.055.L.A1.F40.VN.N

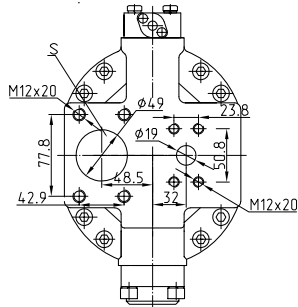


B

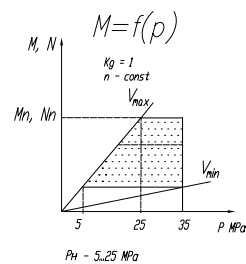
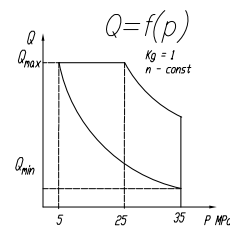
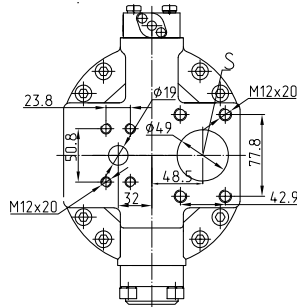
413.0.055.R.A1.F40.VN.N



413.0.055.L.A1.F10.VN.N

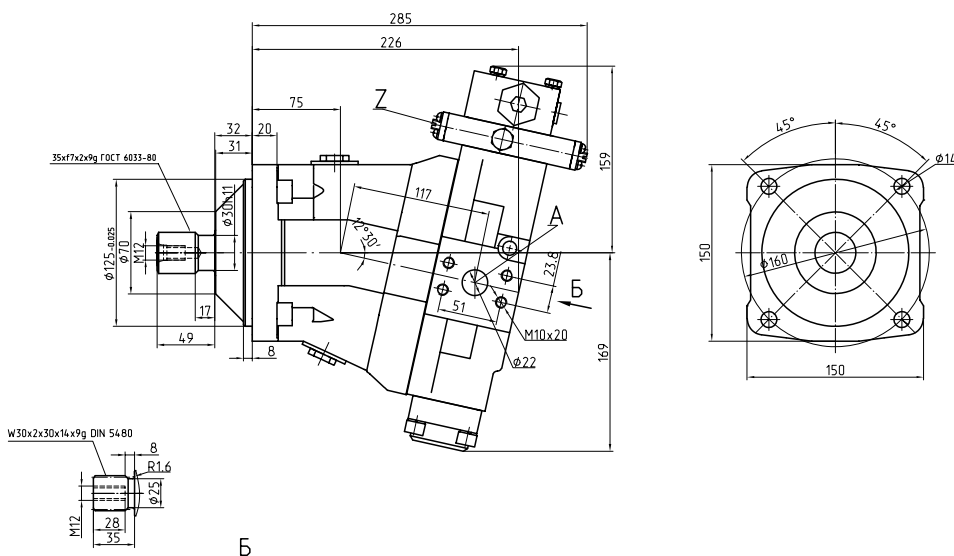


413.0.055.R.A1.F10.VN.N





Pump with constant power regulator, positive regulation, limitation of upper reaction level and cut-off valve in servo line

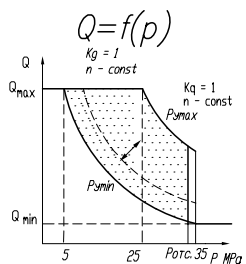
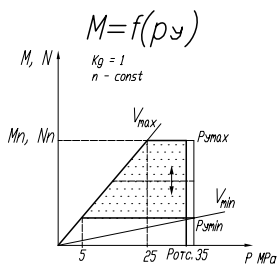
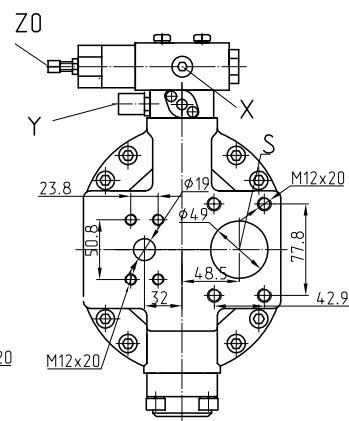
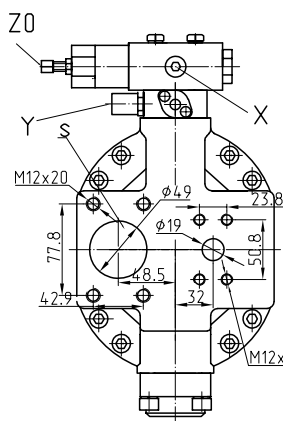
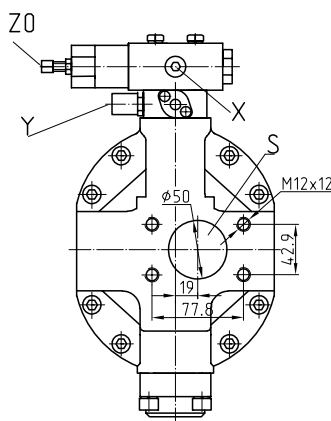
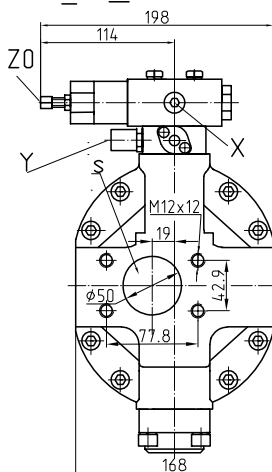


413.0.055.L.A1.F40.VN.NH1P.VC2L

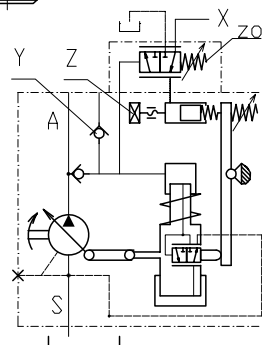
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413.0.055.L.A1.F10.VN.NH1P.VC2L

413.0.055.R.A1.F10.VN.NH1P.VC2L



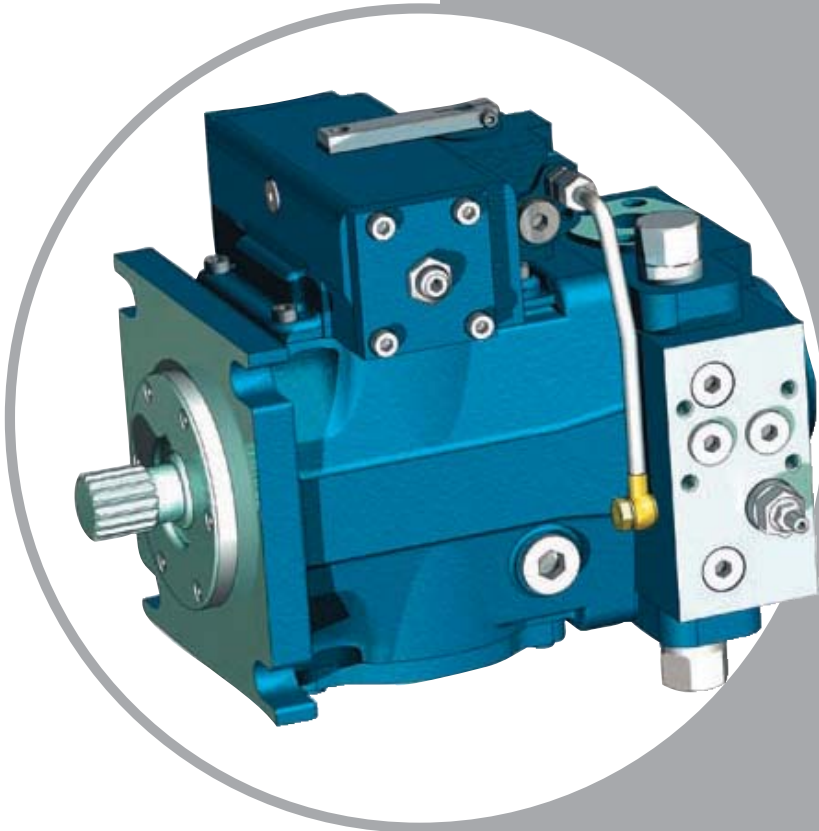
$P_H - 5...25 \text{ MPa}$
 $P_{potc} - 20...32 \text{ MPa}$
 $P_{max} - 3.5 \text{ MPa}$






PSM HYDRAULICS

SWASH-PLATE VARIABLE DISPLACEMENT HYDRAULIC PUMPS



SECTION 4

Section 4		300 КД/2007	
Swash-plate variable displacement hydraulic pumps 416 series		Sheet 1	Sheets 9

Swash-plate variable displacement axial-piston pumps 416 series are intended for operation in close loops in mobile, industrial and stationary equipment.

Output fluid feed is directly proportional to pump shaft rotation frequency and working displacement.

The working displacement at that can be steplessly regulated from zero to maximum value.

The fluid feed direction can be reversed by changing the swash plate tilt to the opposite from the neutral position side (zero delivery mode).

The hydraulic pumps are equipped by various control units:

- non-proportional hydraulic;
- proportional servocontrol;
- proportional hydraulic;
- proportional electric control

Hydraulic pumps series 416 have integrated booster pump.

Robust auxiliary flange for tandem mounting of pumps allows installation of a second hydraulic pump 416.0.90, or any other of the same or lesser power. It is possible to mount several hydraulic pumps the total power of which should not exceed the power of the main hydraulic pump. It is possible to connect PTO for various purposes.

Additionally the hydraulic pumps can be equipped with a pressure shut-off valve.

The working fluid filtration is achieved by using external filter in the suction line of a booster pump or by using pressure filter mounted on the rear cover of hydraulic pump in a pressure line of the booster pump.

Technical characteristics

Max working pressure:

Continuous 400 bar

Peak 450 bar

Parameter			Hydraulic pump	
			416.0.28	416.0.90
Working displacement	$V_{g_{max}}$	cm ³	28	90
Shaft rotation speed	n_{max}	min ⁻¹	4250	3200
Feed at n_{max}	$Q_{v_{max}}$	l/min	119	288
Feed at $\Delta p=400$ bar	N_{max}	kW	84	203
Torque at $\Delta p=400$ bar	M_{max}	Nm	190	611
Weight	m_{max}	kg	29	67



Designation structure diagram

416

Variable displacement hydraulic pump
416 = series

Hydraulic pump version
0 = basic

Working displacement
028 = 28 cm³/rotation
090 = 90 cm³/rotation

Sense of shaft rotation
R = right (clockwise)
L = left (counterclockwise)

Mounting flange	28	90
Y1 = SAE J744 - 2 holes	M	-
Y2 = SAE J744 - 4 holes	-	F
Y3 = SAE J744 - 2+4 holes	-	M

Shaft version	28	90
A2 = splined W35x2x30x16x9g DIN5480	-	F
A4 = splined W45x2x30x21x9g DIN5480	-	M
S1 = splined 1 1/4» 14T 12/24DP ANSI B92.1a	-	F
S2 = splined 1 3/8 « 21T16/32DP ANSI B92.1a	-	F
S3 = splined 1 1/2» 23T 16/32DP ANSI B92.1a	-	F
S4 = splined 1 3/4» 13T 8/16DP ANSI B92.1a	-	F
A7 = splined W25x1,25x30x18x9g DIN5480	M	-

- basic version
- possible version
- not manufactured version
- 1) - electronic control block voltage 12...30 V

Climatic version and category of disposition		28	90
NBR		M	M
FKM		F	F

Special functions
NN = absent

Filtration in pressure line		28	90
F1 = absent		M	M
F2 = filter without indication		-	M
F3 = filter with contamination sensor		-	F

Mechanical limitation of working displacement		28	90
N = absent		M	M
V = installed		F	-

Control type		28	90
B = absent		F	F
HD = non-proportional hydraulic (direct)		F	F
HP = proportional hydraulic		F	F
P = proportional servo control		M	M
E1 = electronic proportional (by current strength)1)		F	F
E2 = electronic proportional (by voltage)		F	F

Connection of working lines			28	90
F1	1	= 23,8x50,8 mm M10-6H	M	-
F2	2	= 26,2x52,4 mm M10-7H	-	M
F2	3	= 26,2x52,4 mm M10-7H	-	F
F3	2	= 27,8x57,2 mm M12-6H	-	F
F3	3	= 27,8x57,2 mm M12-6H	-	F

Connection of suction line	
1	= M33x2; 18 mm
2	= M36x2; 26 mm
3	= M42x2; 24 mm

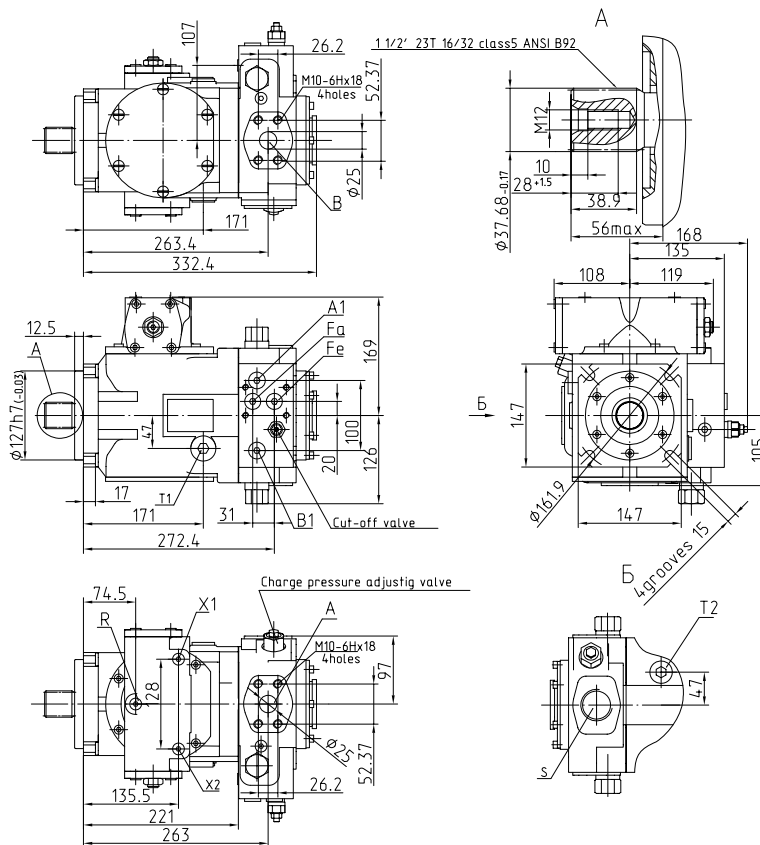


Hydraulic pumps with non-proportional hydraulic control

416. 0. 090. R Y2. S3. F22 HD. N. F1. NBR

Hydraulic pump - series	
Hydraulic pump version - basic	
Working displacement = 90 cm ³ /rotation	
Sense of shaft rotation – right (clockwise)	R
	L
Mounting flange = SAE J744 - 4 holes	
Shaft version = splined 1 1/2" 23T 16/32DP ANSI B92.1a	
Connection of working lines	F2
Connection of suction line = M36x2; 26 mm	2
Control type = non-proportional hydraulic (direct)	
Mechanical limitation of working displacement = absent	
Filtration in pressure line = absent	
Climatic version	

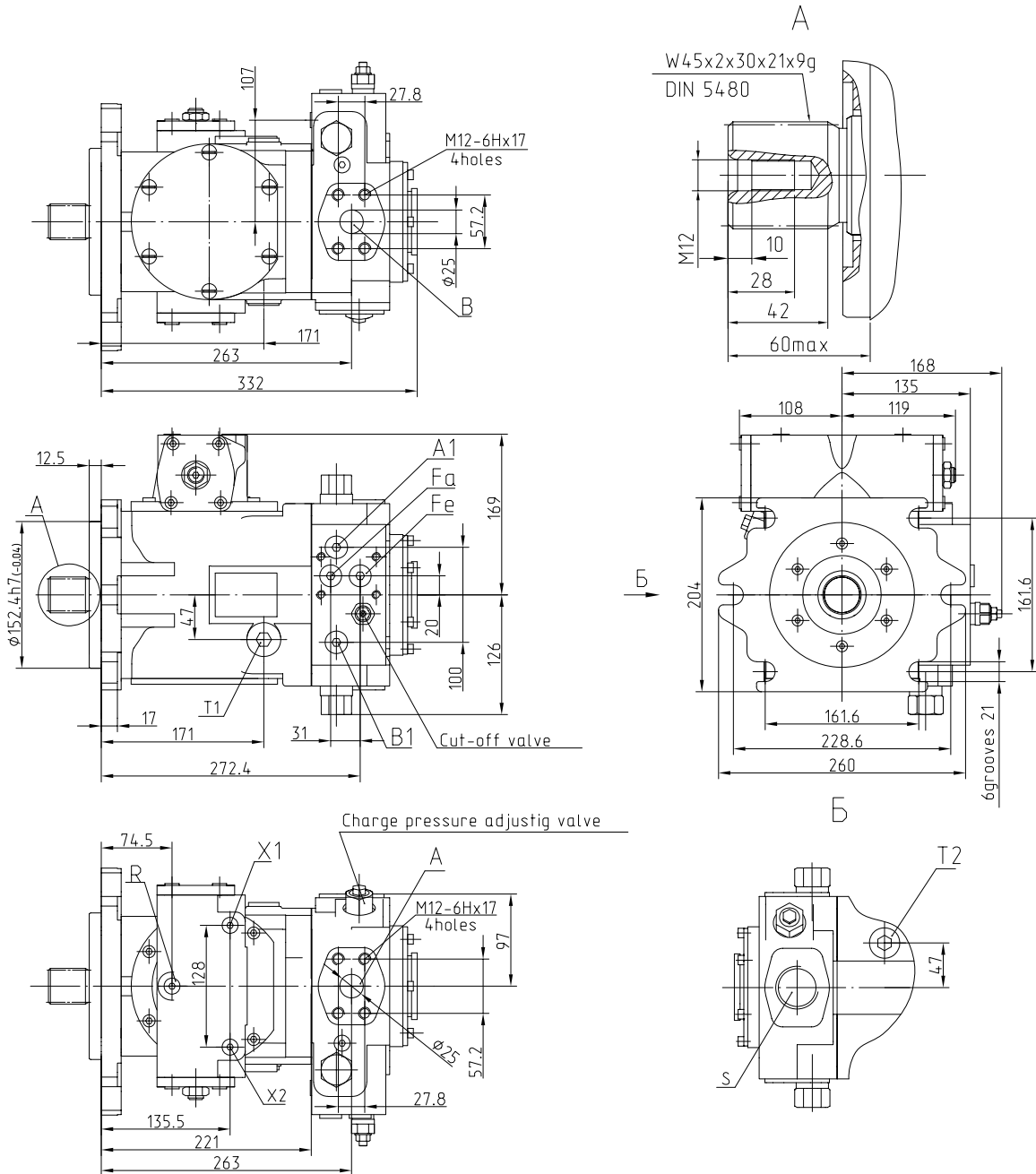
Overall and mounting dimensions



A, B	Suction line/pressure line	SAE 1"3000 psi
A1, B1	Suction line/pressure line	M18x1,5 - 12
Ps	Control voltage feed line	M10x1 - 12
S	Charge pump suction line	M36x2 - 26
Fa, Fe	Charge line	M18x1.5 - 12
T1, T2	Drain line	M22x1.5 - 15
R	Deaeration	M12x1.5 - 12
X1, X2	Control line	M12x1,5 - 12



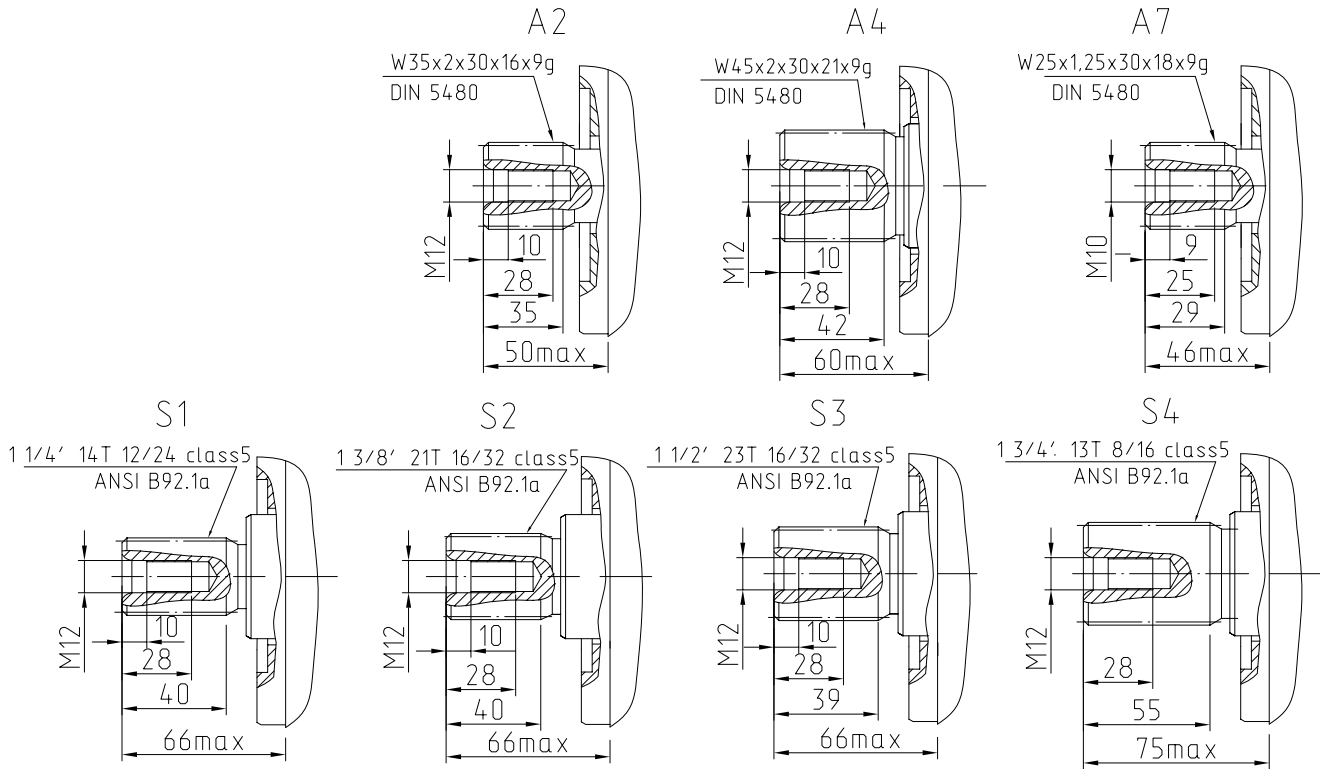
Hydraulic pumps with non-proportional hydraulic control
416.0.90.Y3.A4.F33.HD.N.F1.NBR
Overall and mounting dimensions



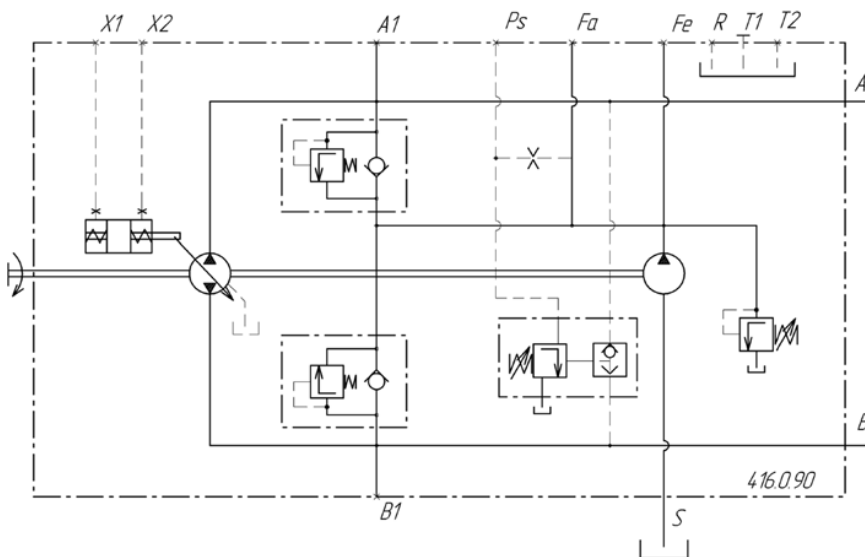
A, B	Suction line/pressure line	SAE 1"6000 psi
A1, B1	Suction line/pressure line	M18x1,5 - 12
Ps	Control voltage feed line	M10x1 - 12
S	Charge pump suction line	M42x2 - 24
Fa, Fe	Pressure line	M18x1.5 - 12
T1, T2	Drain line	M22x1.5 - 15
R	Deaeration	M12x1.5 - 12
X1, X2	Control line	M12x1,5 - 12



Shaft versions

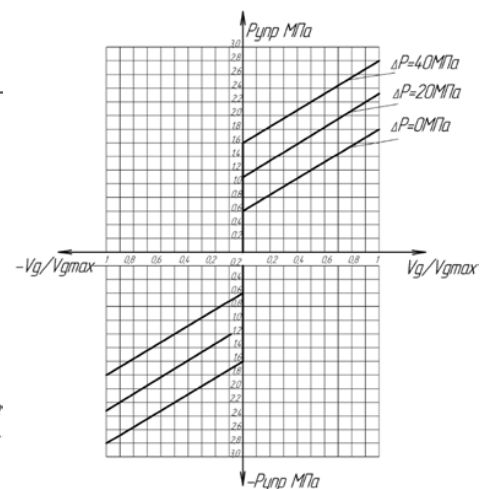


Hydraulic diagram



Characteristics of control

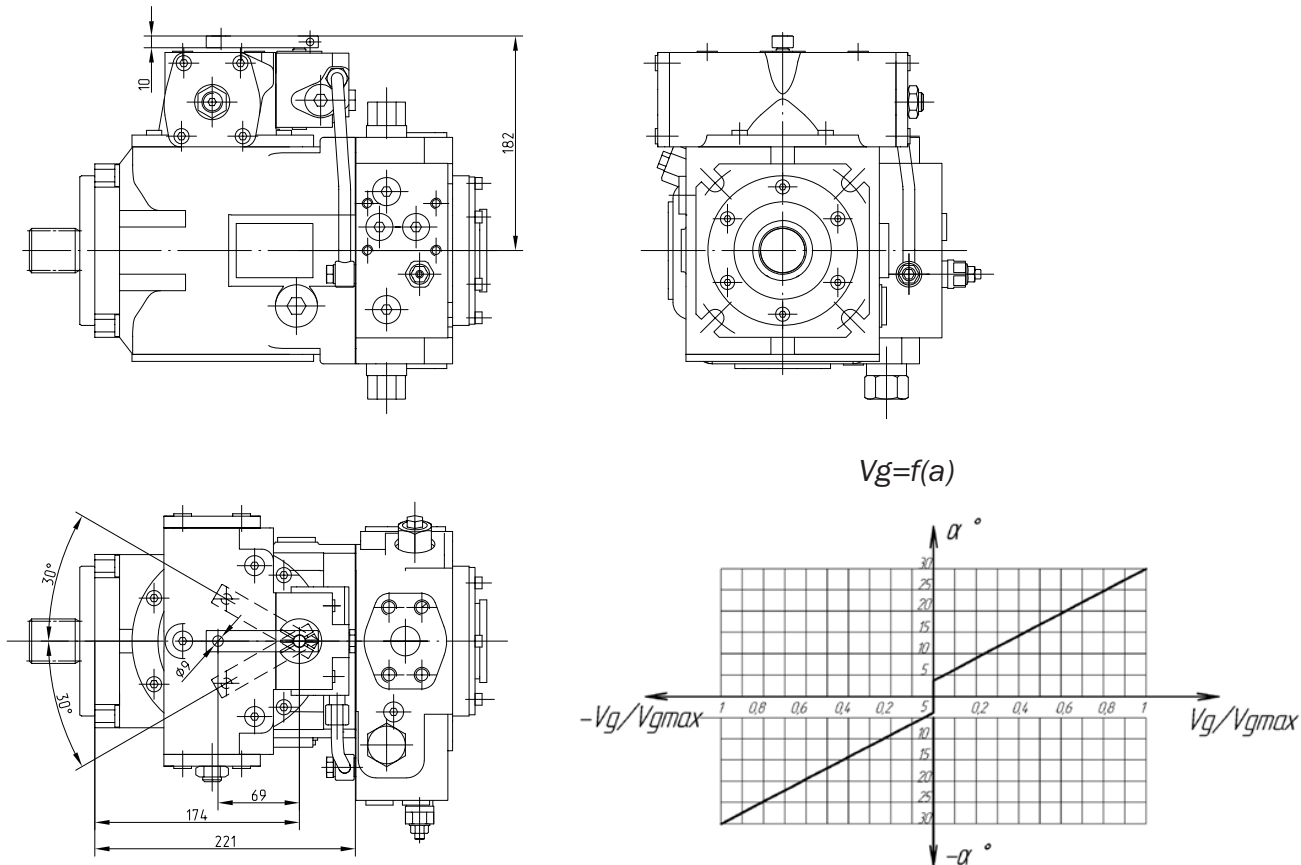
$$V_g = f(P_y)$$



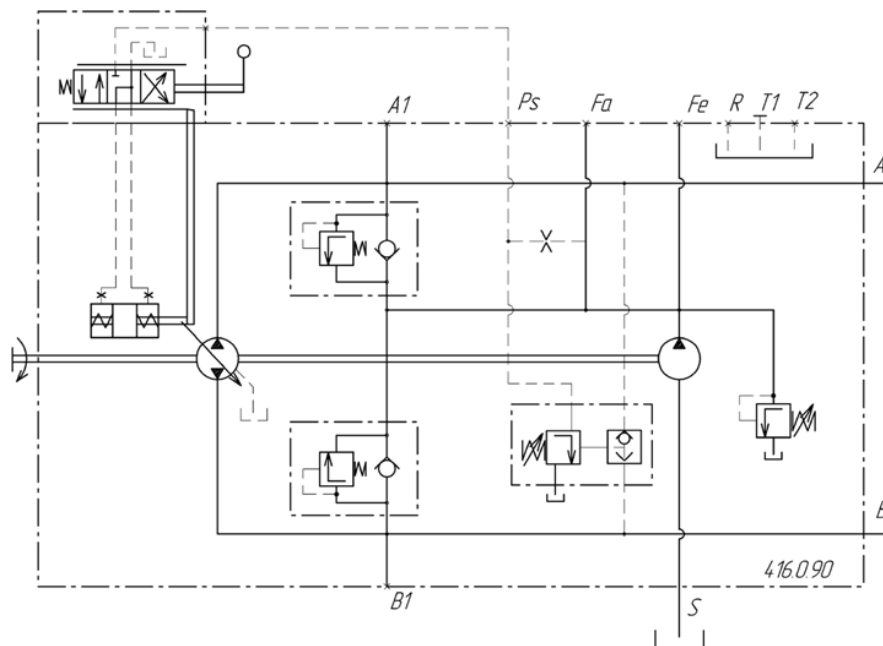


Hydraulic pumps with proportional servo-control 416.0.90...P...

Overall and mounting dimensions

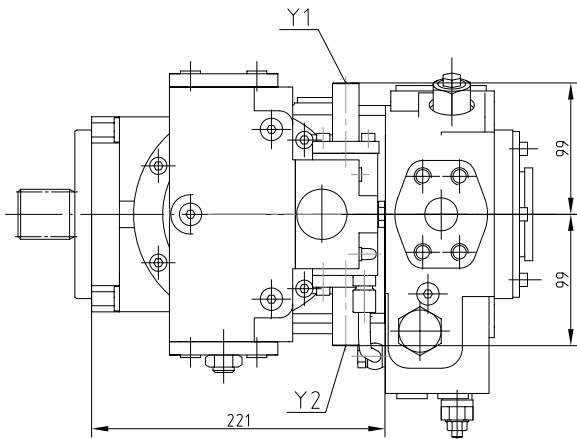
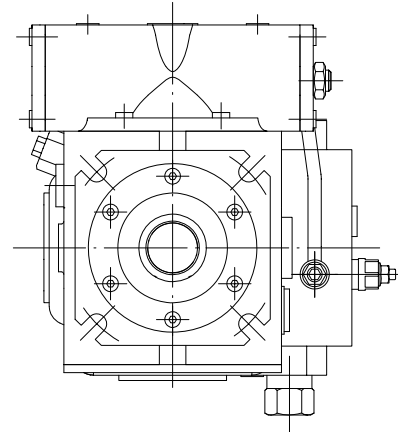
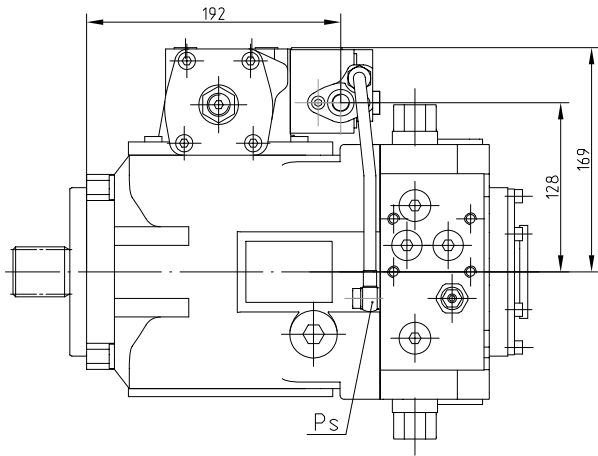


Hydraulic diagram

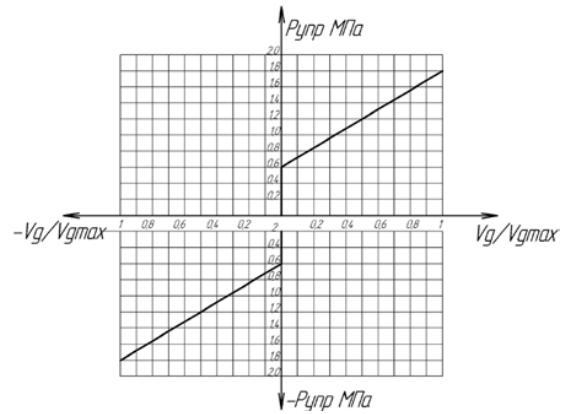




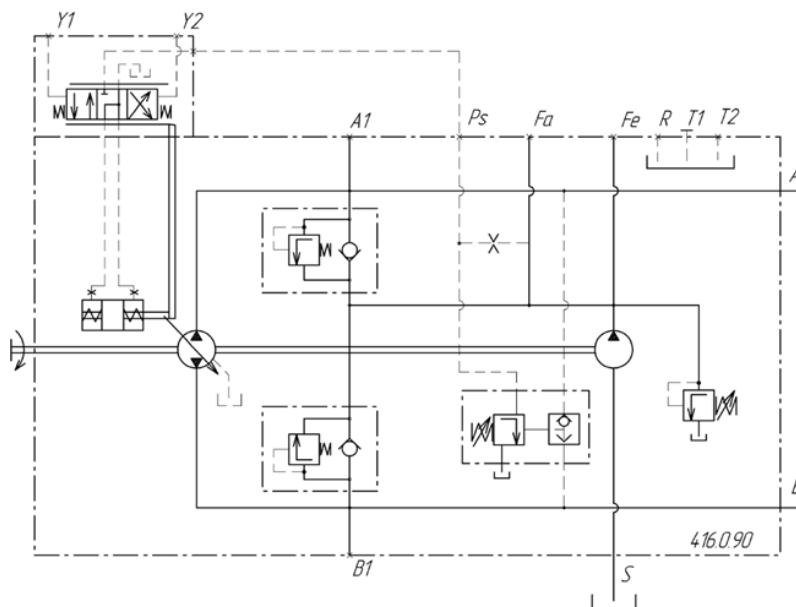
Hydraulic pumps with proportional hydraulic control 416.0.90...HP
Overall and mounting dimensions



$V_g = f(P_y)$

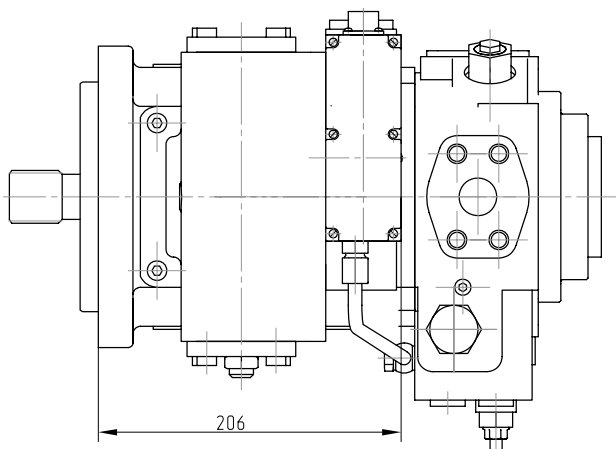
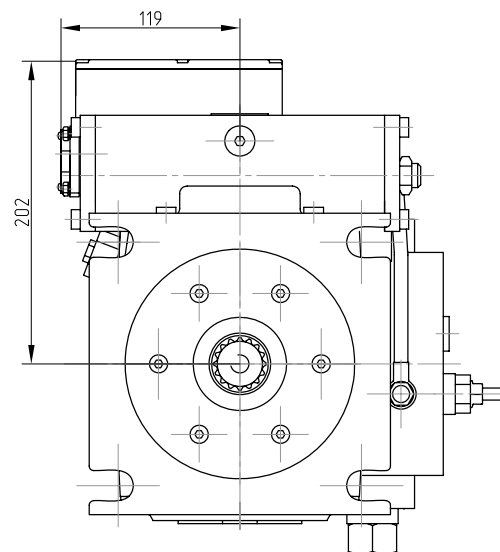
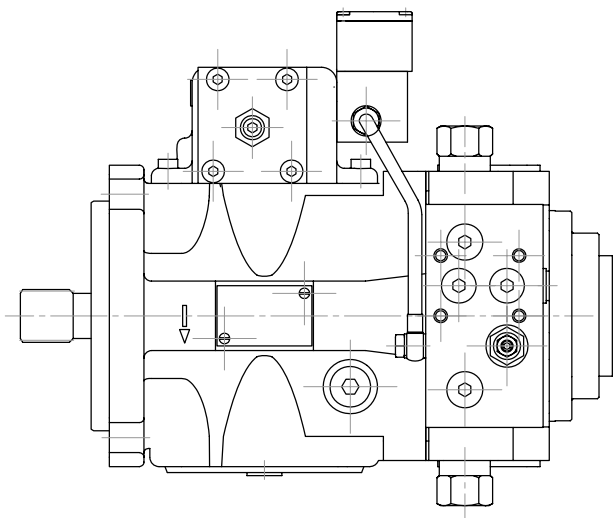


Hydraulic diagram

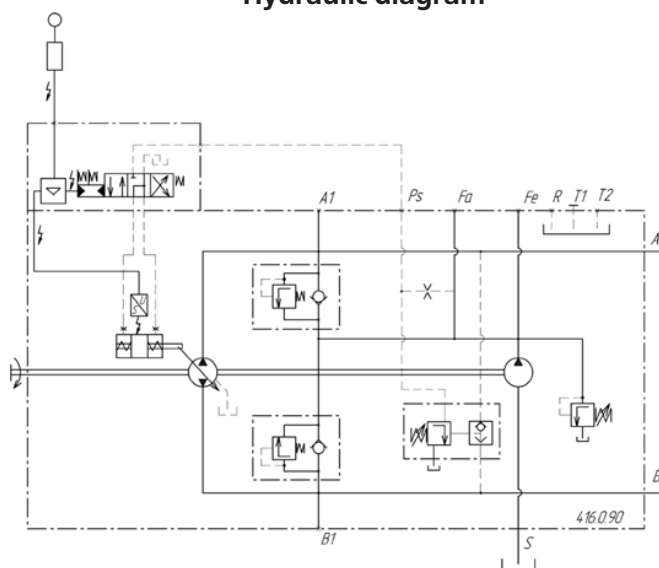




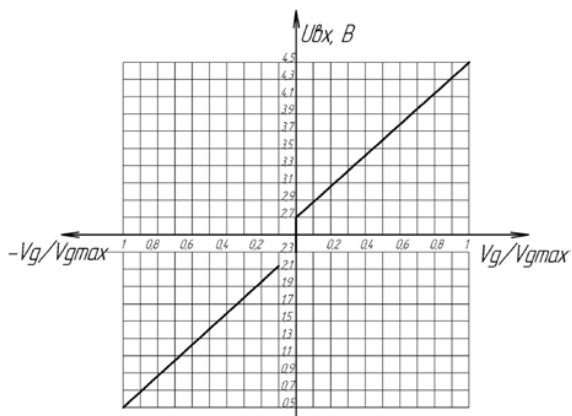
Hydraulic pumps with proportional electric hydraulic control 416.0.90...E1... Overall and mounting dimensions



Hydraulic diagram



$V_g = f(U_y)$



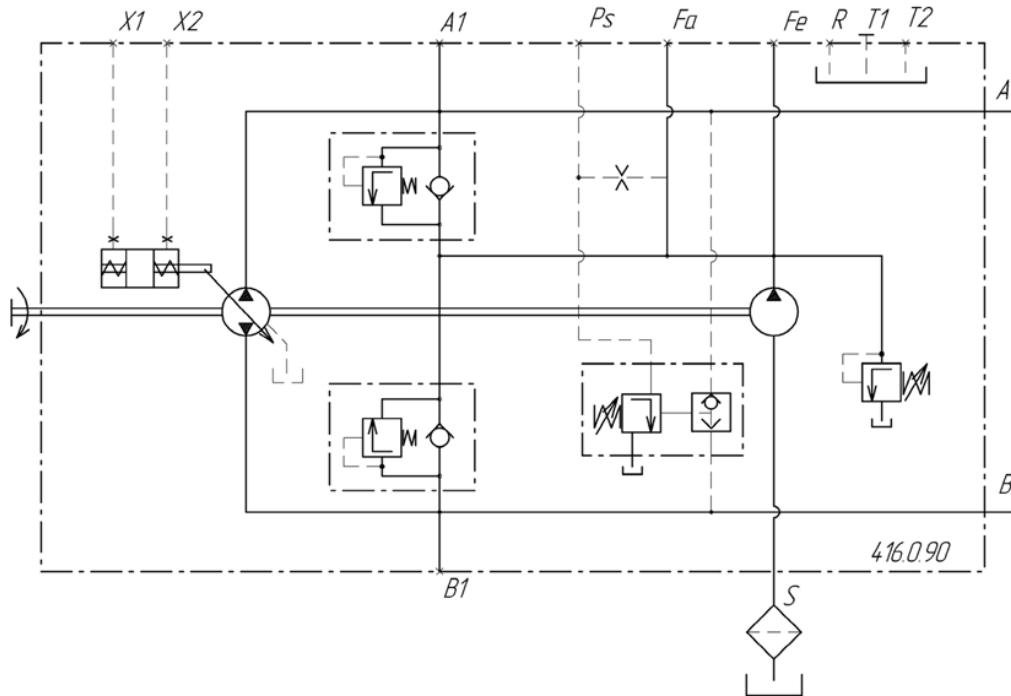
Parameter	Value
Input control electric signal	
- U_{yx} , B	0,5...4,5
- I_{yx} , mA ($R_{yx}=100$ Ом)	4...20
Rated feed voltage, Упит, В	24
Feed voltage range, В	12...30
Consumed current, not more than, А	
- at absence of working displacement variation	0,2
- during working displacement variation	0,8



Filtration

The hydraulic pumps type 416 design allows the use of two kinds of working fluid filtration.

Filtration in the charge pump suction line



Filtration in the charge pump pressure line

