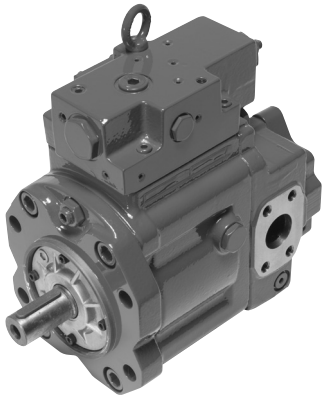


2.4 HEAVY DUTY SERIES

CONTENTS PPV102

ORDERING CODE

2.4.1 Heavy Duty Series

PPV102 – 112 – 1 0 N R S – 4000 – __ – __ – XXXX

Axial piston pump
Heavy Duty Series

Size

63	63 cm³/rev
112	112 cm³/rev
180	180 cm³/rev
280	280 cm³/rev
360	2 x 180 cm³/rev
560	2 x 280 cm³/rev

Fluid type

–	Mineral oil
W	Water glycol
P	Polyolester

Open circuit: 1

Gear pumps, through drive and pilot port options

0	No gear pump, no pilot port
1	10 cm³/rev with built-in safety valve, set to 40 bar (50 bar max), not for sizes 360 and 560
2	15 cm³/rev with built-in safety valve, set to 40 bar (50 bar max), not for sizes 360 and 560
3	No gear pump, with pilot ports
6	With pilot ports, SAE A through drive, 13 T splined shaft
H	With pilot ports, SAE A through drive, 9 T splined shaft
7	No pilot port, SAE A through drive, 13 T splined shaft
G	No pilot port, SAE A through drive, 9 T splined shaft
A	SAE B through drive for sizes 280, 360 and 560 only

Installation type

N	Flange mounting

Shaft rotation (viewed from shaft end)

R	Clockwise
L	Anti-clockwise, sizes 360 and 560 only

Series

S	Low pressure pulsation (standard)

Installation position

–	Horizontal (standard)
V	Horizontal / vertical

Compensator ordering code (see next page)

Confluent block (sizes 360 and 560 only)

–	Single pump
0	Without confluent block
R	Rear outlet
S	Side outlet

Auxiliary gear pump (sizes 360 and 560 only)

–	No gear pump
1	With gear pump, see Standard Gear Pump Arrangements

Modification number

XXXX	Determined by manufacturer

2.4.2 Heavy Duty Series compensator

4 0 0 0

Power control / pressure compensation
0 No power control and no pressure compensation
1 Power control
4 Pressure compensation
7 Power control and pressure compensation

Displacement control
0 No displacement control
P Positive displacement control
N Negative displacement control
E Electrical positive displacement control
L Load sensing control

Power control mode
0 No power control
L Low setting range
M Medium setting range
H High setting range
] see table: Power Setting Code

Power setting code
0 No power control
1 - 4 Power setting code – see table: Power Setting Code

Power setting code

Standard compensator code at 1500 rpm drive speed, pumps without auxiliary gear pump

Motor power [kW]	Nominal size [cm³] 63	112	180	280	360	560
11	**L4**					
15	**L1**					
18.5	**M2**					
22	**M1**	**L3**				
30	**H2**	**M3**	**L3**			
37		**M1**	**L1**			
45		**H5**	**M4**			
55		**H3**	**M2**	**L2**		
75			**H4**	**M4**	**L2**	
90			**H2**	**M2**	**M4**	
110				**H4**	**M2**	**L3**
132				**H2**	**H4**	**L1**
160					**H2**	**M3**
200						**M1**
250						**H4**
280						**H2**

For other drive speeds or different power settings, please contact HYDAC.

Power control adjustment range at 1500 rpm drive speed

Power control mode	Nominal size [cm³] 63	112	180	280	360	560
L Low setting range	10.6 - 18.9	19.1 - 30.7	29.9 - 45.6	46.8 - 75.0	59.9 - 91.1	93.5 - 160.0
M Medium setting range	15.6 - 22.4	27.1 - 45.6	43.-9 - 75.0	67.3 - 113.5	87.9 - 134.5	137.2 - 239.2
H High setting range	22.0 - 33.8	37.0 - 62.1	55.0 - 96.5	90.0 - 150.1	109.4 - 192.9	197.3 - 300.3

2.4.3 Standard gear pump models

Pump size and ordering code													Gear pump displacement
PPV102-63	–	1	1	#	#	S	–	####	–	#			10 cm³/rev
PPV102-112	–	1	1	#	#	S	–	####	–	#			10 cm³/rev
PPV102-180	–	1	1	#	#	S	–	####	–	#			10 cm³/rev
PPV102-280	–	1	2	#	#	S	–	####	–	#			15 cm²/rev
PPV102-360	–	1	A	#	#	S	–	####	–	#	–	1	25.3 cm³/rev
PPV102-560	–	1	A	#	#	S	–	####	–	#	–	1	32.5 cm³/rev

Note: The "#" denotes all available models for the pump. See point **2.4.1 Ordering code for the pump.**

TECHNICAL INFORMATION

2.4.4 Specifications

Pump size			**63**	**112**	**180**	**280**	**360**	**560**
Geometric displacement		[cm³/rev]	63	112	180	280	360	560
Pressure	Rated	[bar]	350					
	Peak	[bar]	400					
Drive speed	Min.	[rpm]	600					
	Max.self-priming	[rpm]	1800	1800	1800	1500	1800	1500
	Max. *	[rpm]	3250	2700	2300	2000	2300	2000
Power (1500 rpm, 350 bar)		[kW]	61	108	173	270	347	539
Drive torque (350 bar)		[Nm]	388	688	1101	1720	2210	3430
Pre-fill oil volume		[cm³]	1000	1200	2900	3200	6000	6500
Approx. weight		[kg]	48	68	86	160	160	300

* required supply pressure p = 1 bar (2 bar abs.)

2.4.5 Hydraulic fluids

H, HL	Mineral Oil
HEES	Fatty acid esters (Polyolester), biodegradable
HFC	Water glycol
HLP, HLPD, HV, HVLP	High quality hydraulic fluids based on mineral oil and with additional anti-wear properties (at pressures above 200 bar)
HFD-U	Polyolester

For use with other fluids, please contact HYDAC.

2.4.6 Viscosity range

Minimum viscosity: 10 cSt (mm²/s)
Normal operating viscosity: 10 - 200 cSt (mm²/s)
Maximum viscosity (during cold start): 1000 cSt (mm²/s)

2.4.7 Temperature range

-20 to +80 °C

Note:
The highest fluid temperature will be at the drain port of the pump, up to 20 °C higher than in the reservoir.

2.4.8 Fire-resistant fluids

	Fluid type		
	Mineral oil	Polyolester	Water glycol*
Maximum continuous pressure (bar)	350		207
Temperature range (°C)	-20 ~ +80	0 ~ +60	10 ~ 50
Cavitation resistance	◯	△	△
Pump service life compared to mineral oil	100 %	50 % ~ 100 %	20 % ~80 %

◯ = Recommended

△ = Acceptable but with reduced pump life

* = Do not exceed the rated speed. *
Maximum speed for size 280 pumps when operated with water glycol: 1500 rpm

2.4.9 Seals

Fluid type code (see Ordering code)	Generic fluid type	Shaft seal ring material	General seal material (O-Rings)
–	Mineral oil	FPM	NBR
W	Water glycol	NBR	NBR
P	Polyolester	FPM	FPM

2.4.10 Filtration

For maximum service life of the pump and system components, the system should be protected from contamination by effective filtration.

Cleanliness class to NAS 1638 Class 9 (20/18/15 ISO 4406:1999) or cleaner.

2.4.11 Adjustments

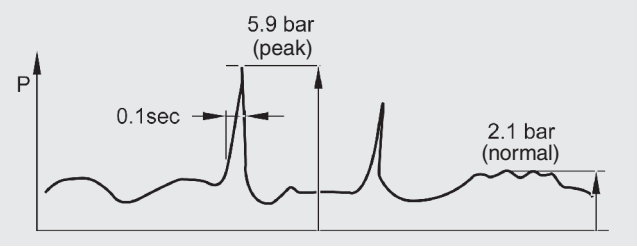
	Volume	
	Volume adjustment screw rate per ¼ turn	Min. adjustable displacement
Pump size	[cm³]	[cm³/rev]
PPV102-63	1.54	22.5
PPV102-112	2.86	56
PPV102-180	3.81	87
PPV102-280	5.10	140
PPV102-360	3.81	2x 87
PPV102-560	5.10	2x 140

2.4.12 Installation notes

Recommended pump installation

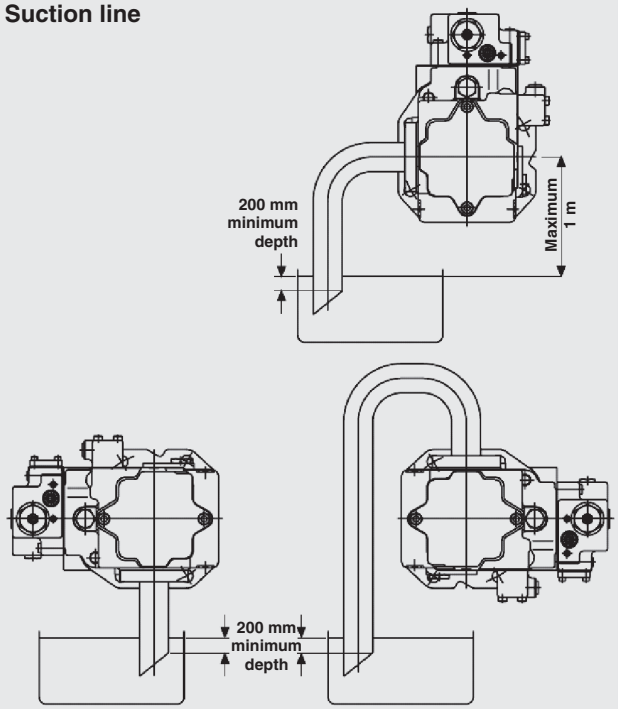
The pump should be installed horizontally with the case drain line initially rising above the level of the pump before continuing to the tank as shown in the diagram below. Do not connect the drain line to the suction line.

The top drain port should always be used and the internal diameter of the drain line should be equal to or larger than the drain port to minimise pressure in the pump case. The pressure in the pump case should not exceed 2.1 bar as shown in the diagram below. Peak pressure should never exceed 5.9 bar.



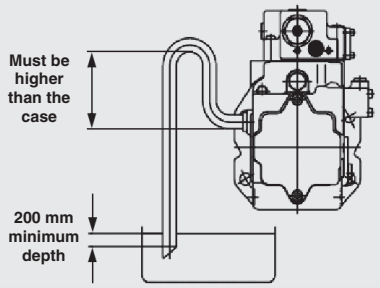
Installing the pump above the tank

Suction line



Drain line

"Goose neck" configuration ensures oil remains in the pump case.



Precautions:

- The suction and drain lines must be immersed at least 200 mm below the lowest oil level under operating conditions.
- The distance between the oil surface and the centre of the shaft must not exceed 1 m.
- The oil in the pump case must be refilled if the pump has not been operated for one month or longer.
- When installing a HYDAC pump always ensure that the fluid in the pump is prevented from draining away during stoppages.

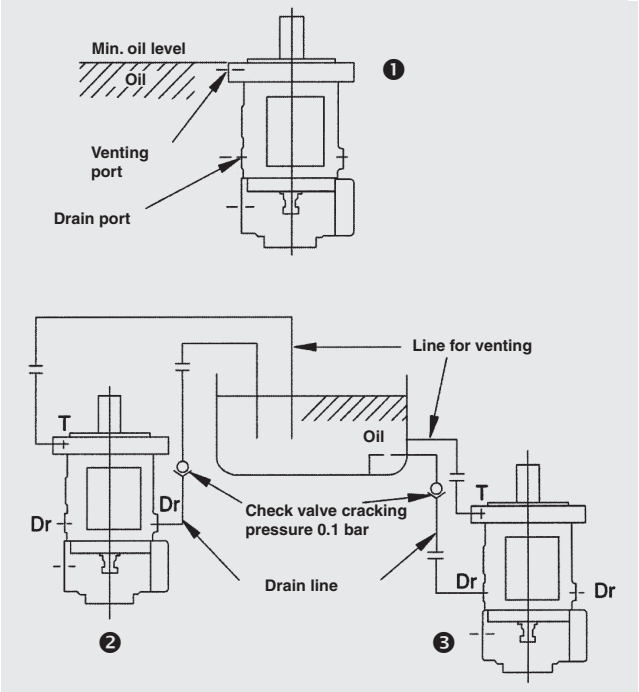
Vertical installation of the pump (shaft at the top)

For applications requiring vertical installation (shaft at the top) the pump must be provided with additional means to lubricate the front bearing. Do not use a standard pump for this type of application (a "V - vertical installation" version should be used instead).

The oil level in the tank should be higher than the pump mounting flange (see diagram ❶ below).
If the oil level in the tank is lower than the mounting flange, forced lubrication is required through the venting port (1-2 l/min.)

When installing the pump in the tank and submerged in the oil, open the drain and venting ports to provide adequate lubrication to the internal components.

If the pump is installed outside the tank, the drain and venting lines must be run to the tank (see diagram ❸).
If these lines are higher than the level of the oil (see diagram ❷), they must be filled with oil before commissioning.



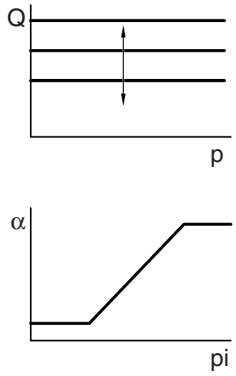
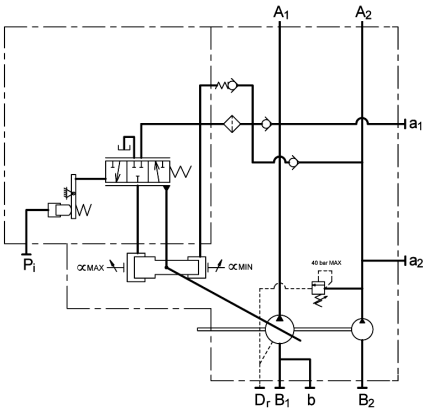
A check valve with cracking pressure of 0.1 bar should be fitted to the case drain port as shown.

Recommended check valves

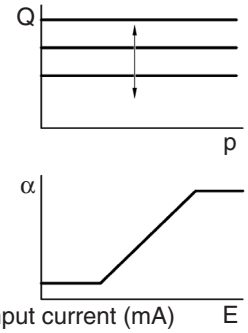
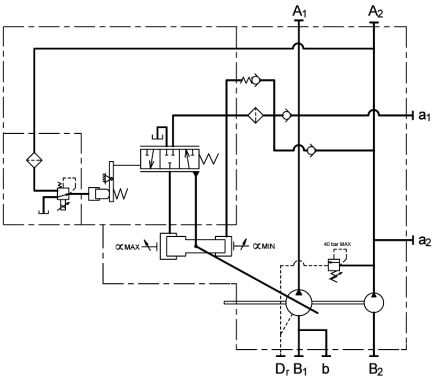
Pump	Check valve	Part no.
PPV102-63	RV-12-0.1X/0 - 0.1 bar	3474099
PPV102-112 to PPV102-280	RV-16-0.1X/0 - 0.1 bar	858636
PPV102-360 to PPV102-560	RV-20-0.1X/0 - 0.1 bar	706734

CONTROL OPTIONS

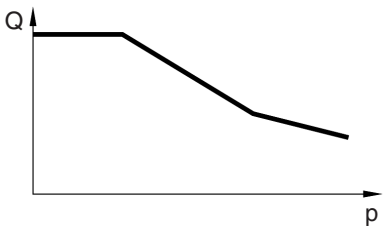
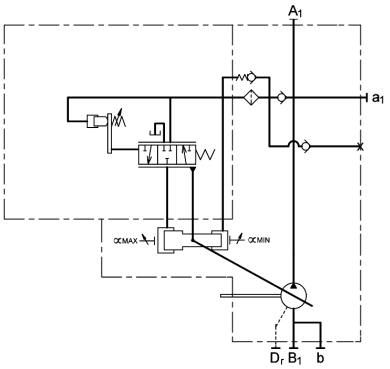
2.4.13 Variable delivery positive displacement control – 0P

Description	Performance characteristics	Hydraulic circuit
The pilot pressure enables the flow rate of the pump to be steplessly adjusted. An increase in pilot pressure will result in an increase in flow, hence the positive control. Also available as negative control - 0N	 Range of displacement control 2.5 – 100 %	

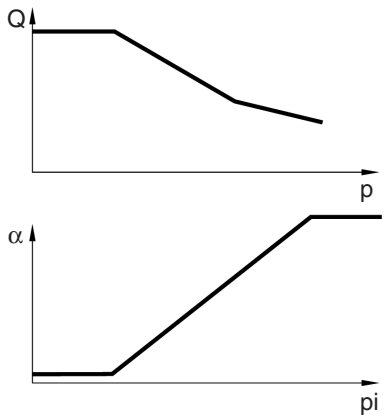
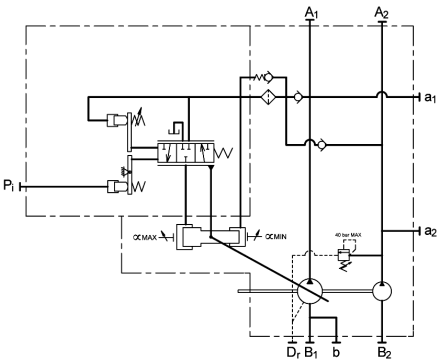
2.4.14 Variable delivery electrical displacement control – 0E

Description	Performance characteristics	Hydraulic circuit
The proportional valve enables the flow rate of the pump to be steplessly adjusted. If the gear pump is also ordered, there is no need for additional external piping for the proportional valve. An electrical amplifier card is also required.	 Range of displacement control 2.5 – 100 %	

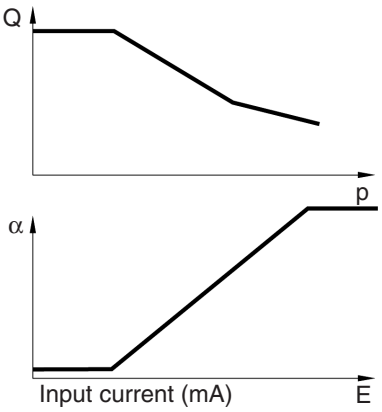
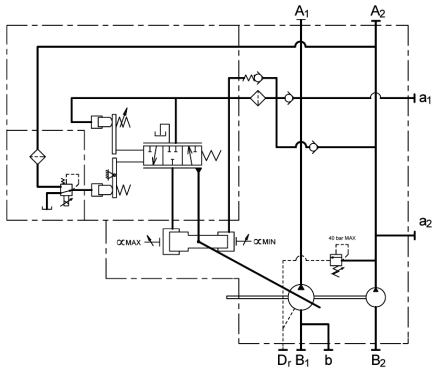
2.4.15 Power control – 10

Description	Performance characteristics	Hydraulic circuit
In response to a rise in operating pressure, the swash plate adjustment angle is reduced, limiting the input power. This control prevents an overload of the drive motor.		

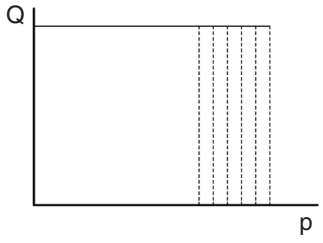
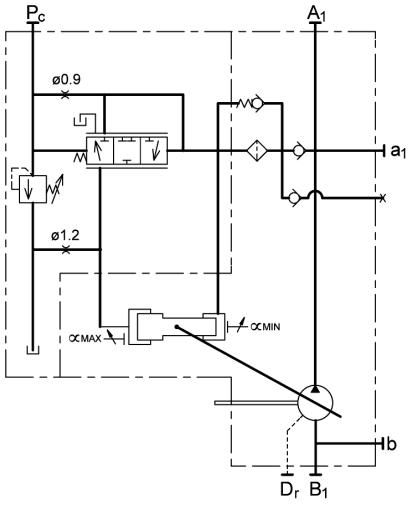
2.4.16 Power and positive displacement control – 1P

Description	Performance characteristics	Hydraulic circuit
This is a combination of power control and positive displacement control. The pilot pressure enables the flow rate of the pump to be steplessly adjusted. An increase in pilot pressure will result in an increase in flow, hence the positive control. Also available as negative control - 1N	 Range of displacement control 15 – 100 %	

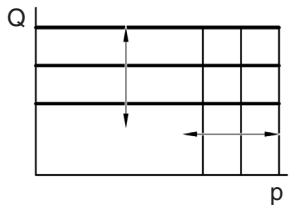
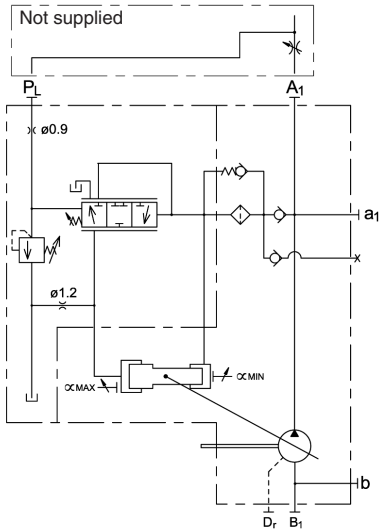
2.3.17 Power and electrical displacement control - 1E

Description	Performance characteristics	Hydraulic circuit
This is a combination of power control and electrical displacement control. The proportional valve enables the flow rate of the pump to be steplessly adjusted. An increase in the input signal will result in an increase in flow. An electrical amplifier card is also required.	 Range of displacement control 2.5 – 100 %	

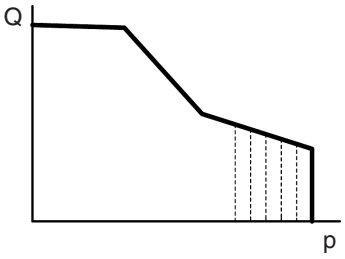
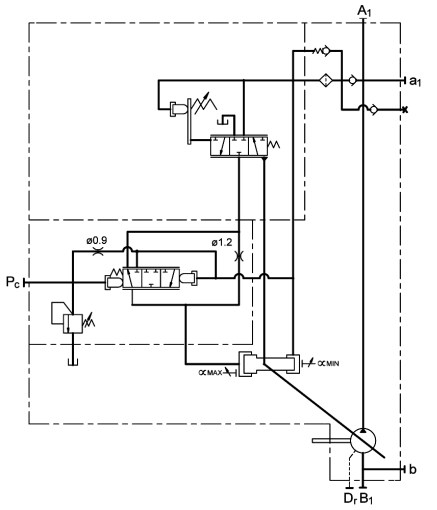
2.4.18 Pressure compensation control – 4000

Description	Performance characteristics	Hydraulic circuit
As the system pressure rises to the pre-set value, the swash plate pivots back to prevent the system pressure from exceeding the compensator setting. A pressure relief valve must be built into the system. **Note:** The factory pressure setting is 200 bar with an adjustable range of 80 bar to 315 bar. Pressures above 315 bar must be stated clearly on the order.	 Range of displacement control 0 – 100 %	

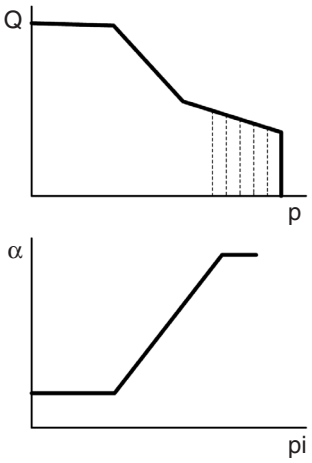
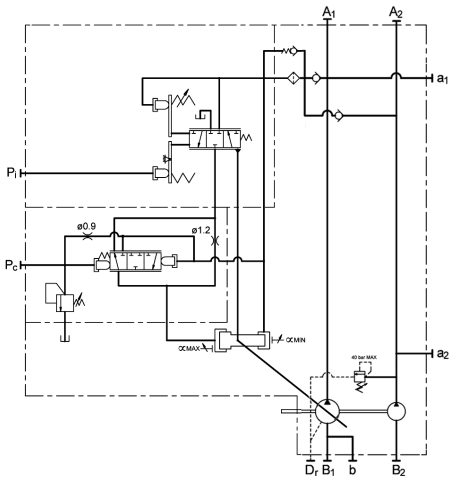
2.4.19 Pressure compensation and load sensing control - 4L00

Description	Performance characteristics	Hydraulic circuit
The pump displacement is controlled to match the flow requirements as a function of the system differential pressure (load pressure vs. pump pressure). The factory setting of the differential pressure is 25 bar. In addition, there is a pressure cut-off function incorporated into the control. **Note:** The factory pressure setting is 200 bar with an adjustable range of 80 bar to 315 bar. Pressures above 315 bar must be stated clearly on the order.	 Range of displacement control 0 – 100 %	

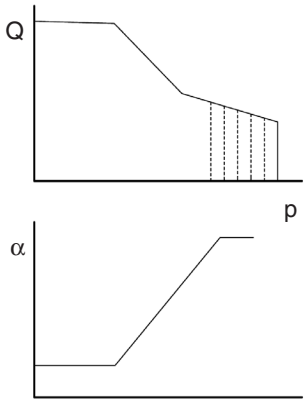
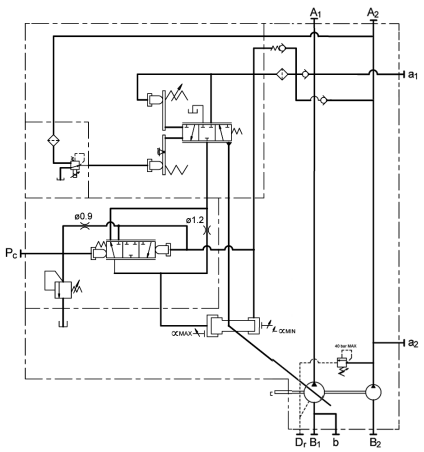
2.4.20 Power and pressure compensation - 70

Description	Performance characteristics	Hydraulic circuit
This is a combination of power control and pressure compensation. **Note:** The factory pressure setting is 320 bar with an adjustable range of 80 bar to 350 bar.		

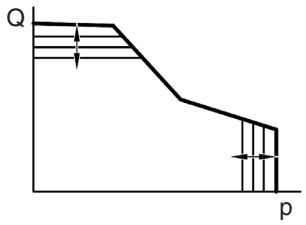
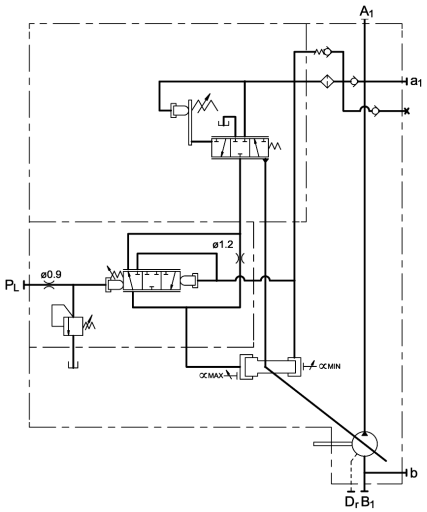
2.4.21 Power, pressure compensation and positive displacement control - 7P

Description	Performance characteristics	Hydraulic circuit
This is a combination of power control and pressure compensation. The pilot pressure enables the flow rate of the pump to be steplessly adjusted. An increase in pilot pressure will result in an increase in flow, hence the positive control. **Note:** The factory pressure setting is 315 bar with an adjustable range of 80 bar to 350 bar. Also available as negative control - 7N	 Range of displacement control 2.5 – 100 %	

2.4.22 Power, pressure compensation and electrical displacement control - 7E

Description	Performance characteristics	Hydraulic circuit
This is a combination of power control, pressure compensation and electrical displacement control. The proportional valve enables the flow rate of the pump to be steplessly adjusted. An increase in the input signal will result in an increase in flow. An electrical amplifier card is also required. **Note:** The factory pressure setting is 200 bar with an adjustable range of 80 bar to 315 bar. Pressures above 315 bar must be stated clearly on the order.	 Range of displacement control 2.5 – 100 %	

2.4.23 Power, pressure compensation and load sensing control - 7L

Description	Performance characteristics	Hydraulic circuit
This is a combination of power control, pressure compensation and load sensing control. The factory setting of the differential pressure is 25 bar with a setting range of 10 bar to 30 bar. **Note:** The factory pressure setting is 200 bar with an adjustable range of 80 bar to 315 bar. Pressures above 315 bar must be stated clearly on the order.	 Range of displacement control 0 – 100 %	

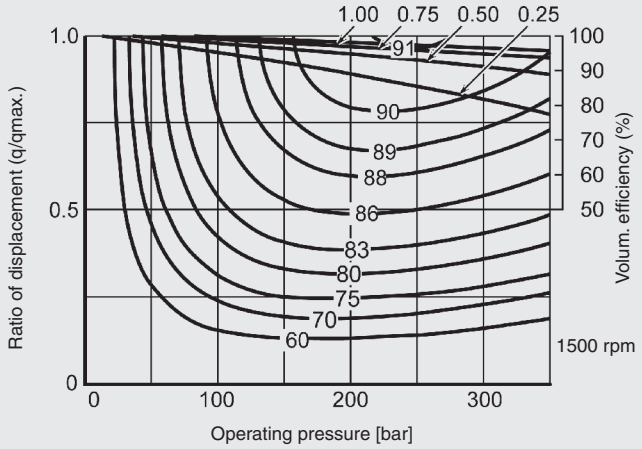
Recommended valve for use with remote pressure compensation

Type:	Part no.:
DB4E-01X-630V	716004

PERFORMANCE DATA

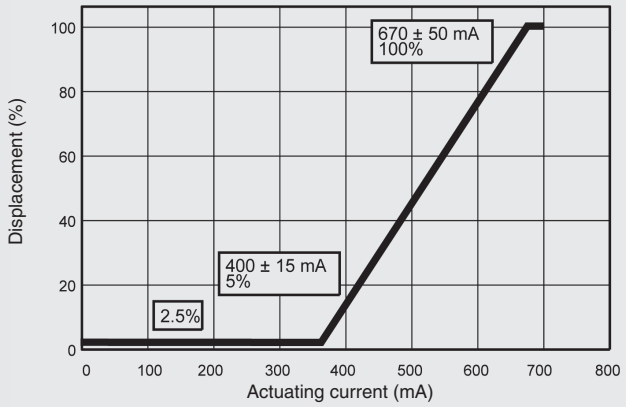
2.4.24 PPV102-63

● Efficiency

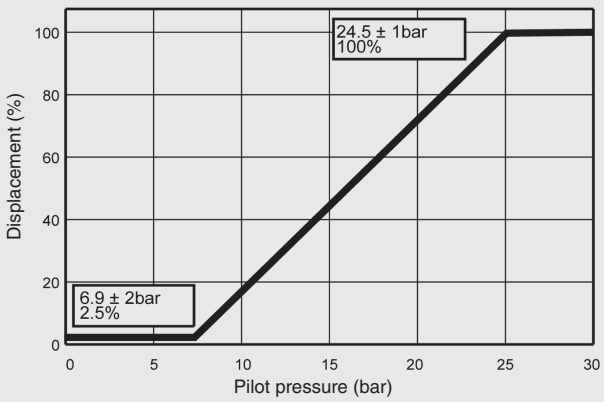


● Displacement control curves

Electrical displacement (type E)

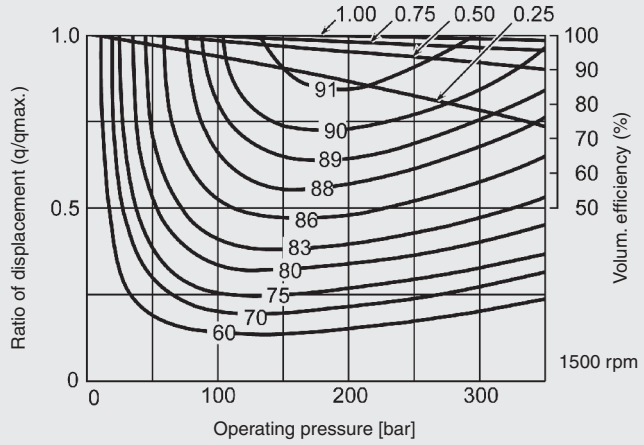


Positive displacement (type P)

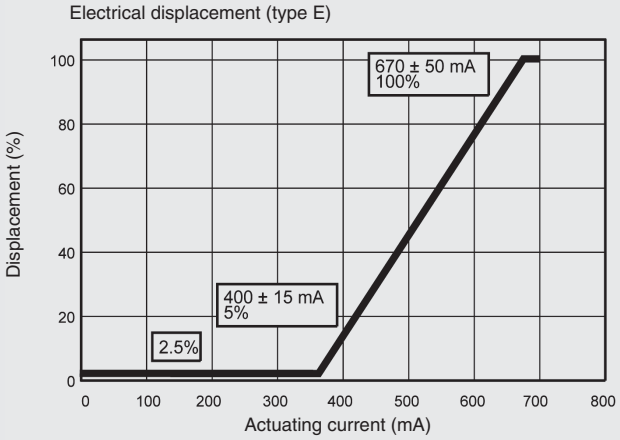


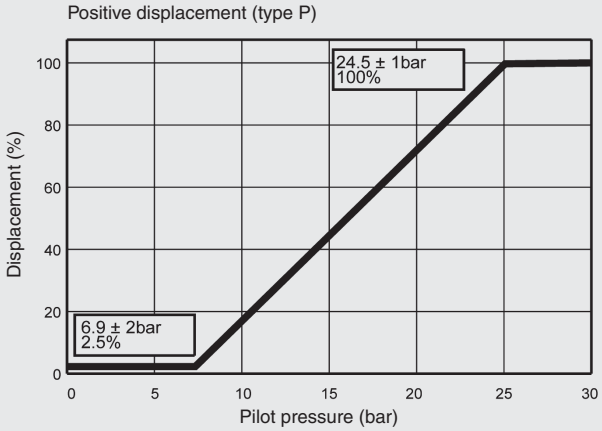
2.4.25 PPV102-112

● Efficiency

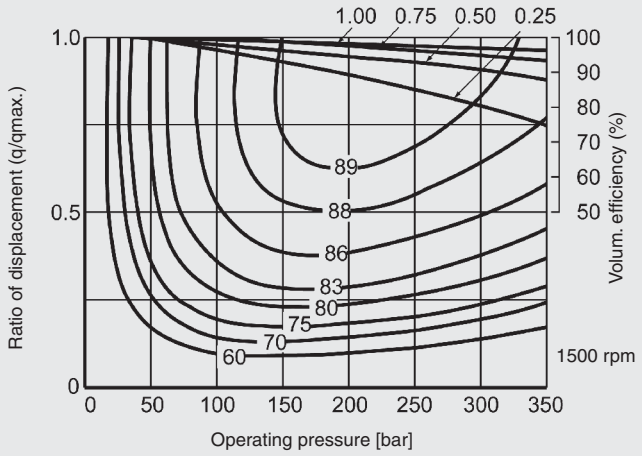


● Displacement control curves

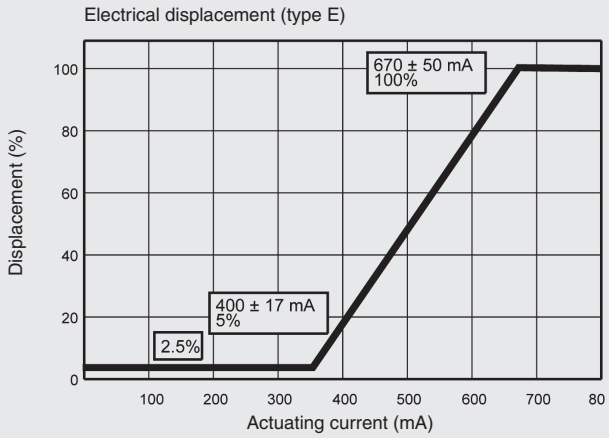


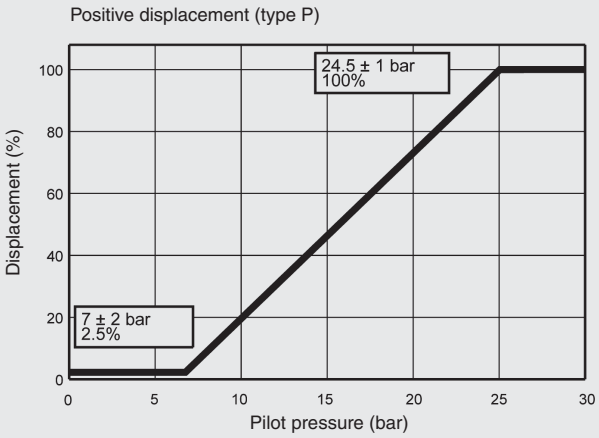


● Efficiency

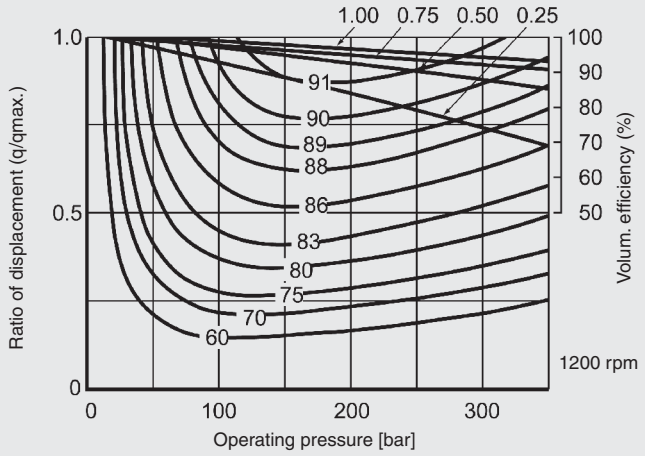


● Displacement control curves

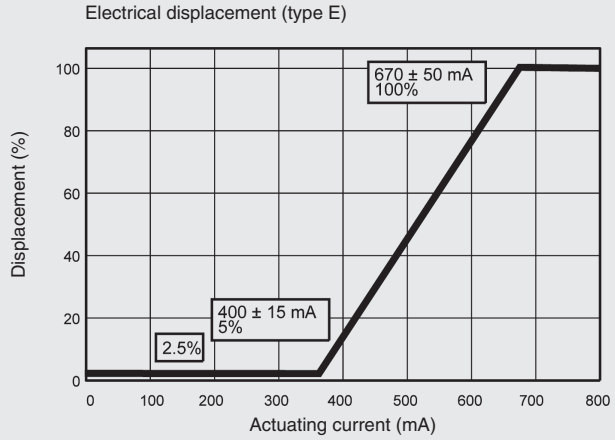


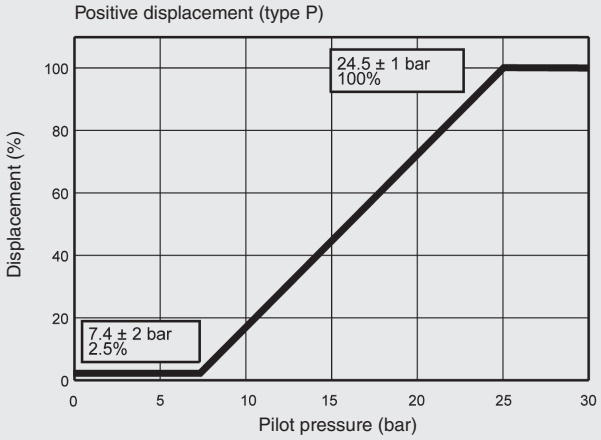


● Efficiency



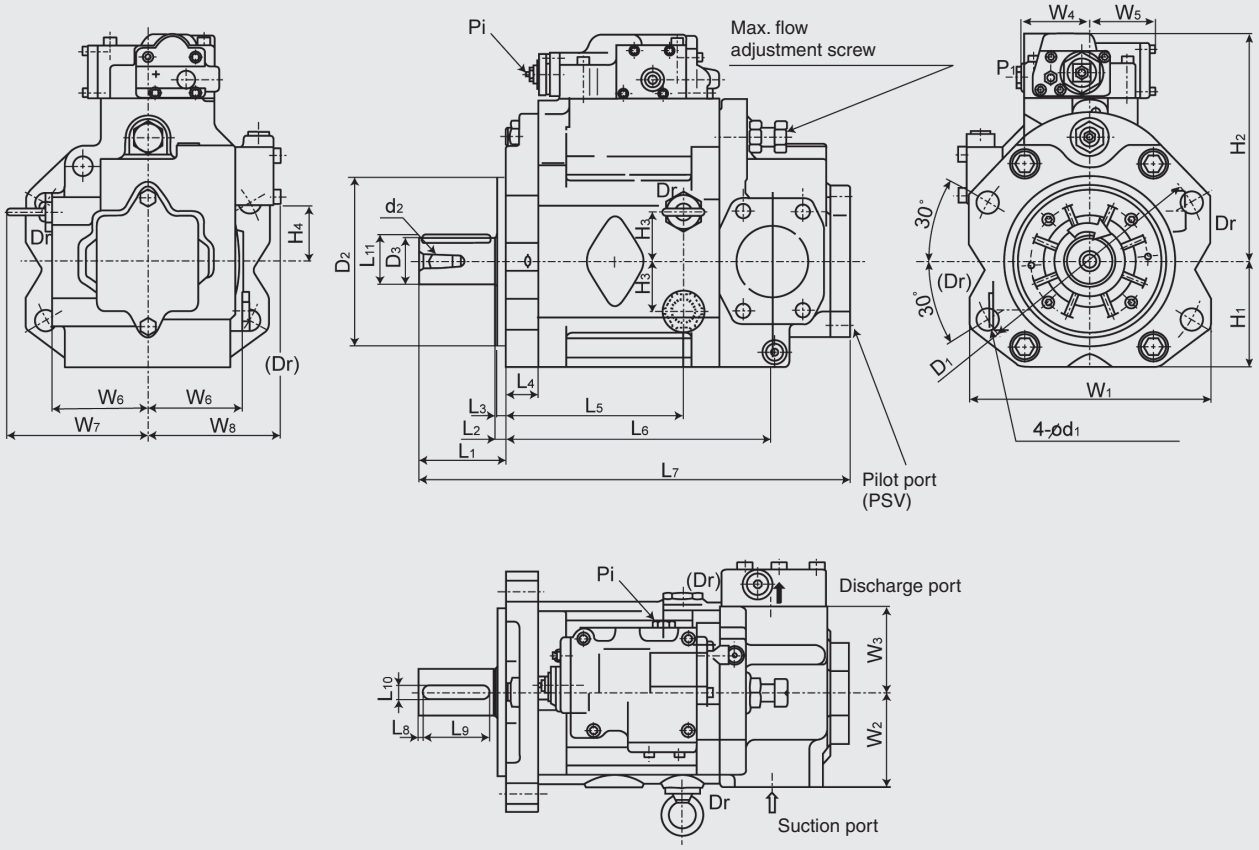
● Displacement control curves





DIMENSIONS

2.4.28 PPV102-63 / -112 / -180 / -280



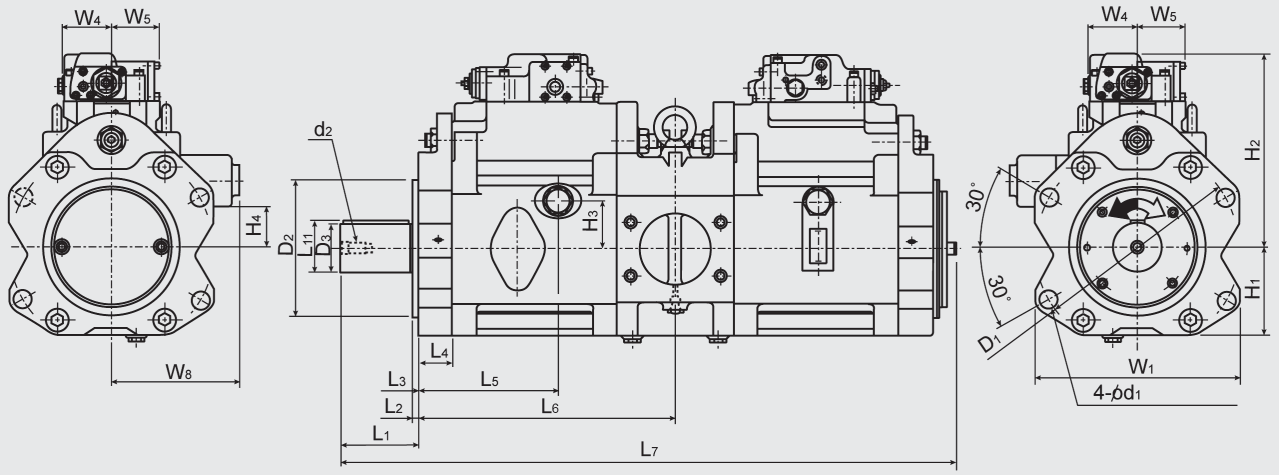
Dimensions (in mm) of single pumps without gear pump

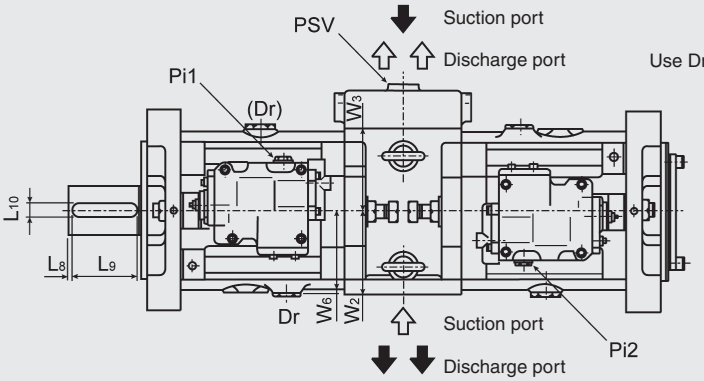
Pump size	D_1	D_2	D_3	L_1	L_2	L_3	L_4	L_5	L_6
63	180	$125^{-0.050}_{-0.090}$	32^{k6}	68	10	8	27	138	210
112	224	$160^{-0.050}_{-0.090}$	40^{k6}	92	10	8	33	167	249
180	250	$180^{-0.050}_{-0.090}$	50^{k6}	92	10	8	36	190	285
280	300	$200^{-0.050}_{-0.090}$	55^{k6}	92	10	8	50	203	351

Pump size	L_7	L_8	L_9	L_{10}	L_{11}	H_1	H_2	H_3	H_4
63	349	4	5	10	35	89	195	37	41
112	419	5	70	12	43	100	220	41	49
180	466	5	70	14	53.5	112	245	53	58
280	539	5	70	16	59	127	286	70	68

Pump size	W_1	W_2	W_3	W_4	W_5	W_6	W_7	W_8	d_1	d_2
63	190	70	70	72	69	76	115	113	18	M12
112	234	90	80	72	69	90	138	125	22	M12
180	256	100	92	72	69	101	149	139	22	M16
280	300	120	120	72	69	118	–	167	26	M16

2.4.29 PPV102-360 / -560





Use Dr or (Dr) for drain port

Direction of rotation

Clockwise

Anti-clockwise

(viewed from shaft end)

Note: pump shown is designed for clockwise rotation.

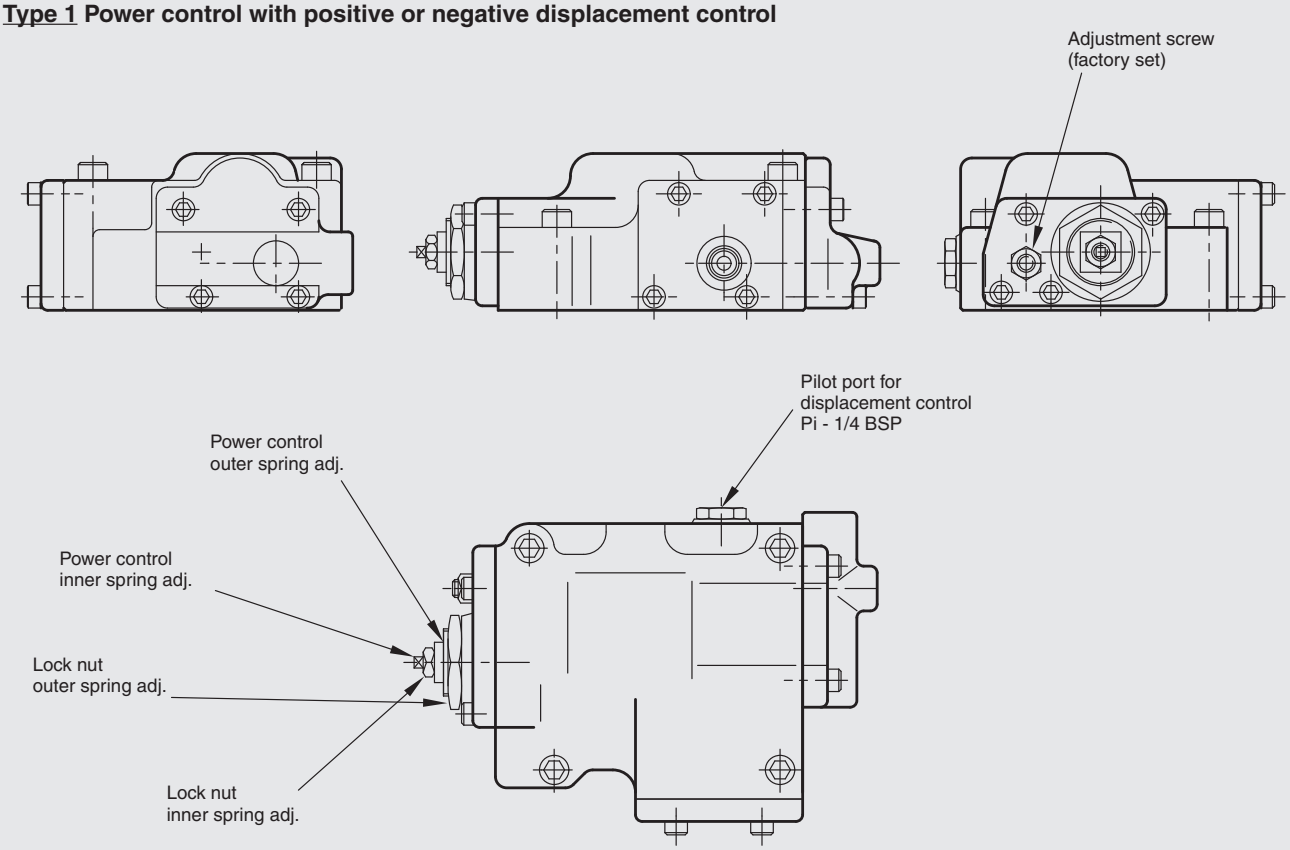
Dimensions (in mm) of tandem pumps without gear pump

Pump size	D_1	D_2	D_3	L_1	L_2	L_3	L_4	L_5	L_6
360	250	$180^{-0.050}_{-0.090}$	60^{k6}	115	10	8	36	190	311
560	300	$200^{-0.050}_{-0.090}$	70^{k6}	115	10	9	50	203	374

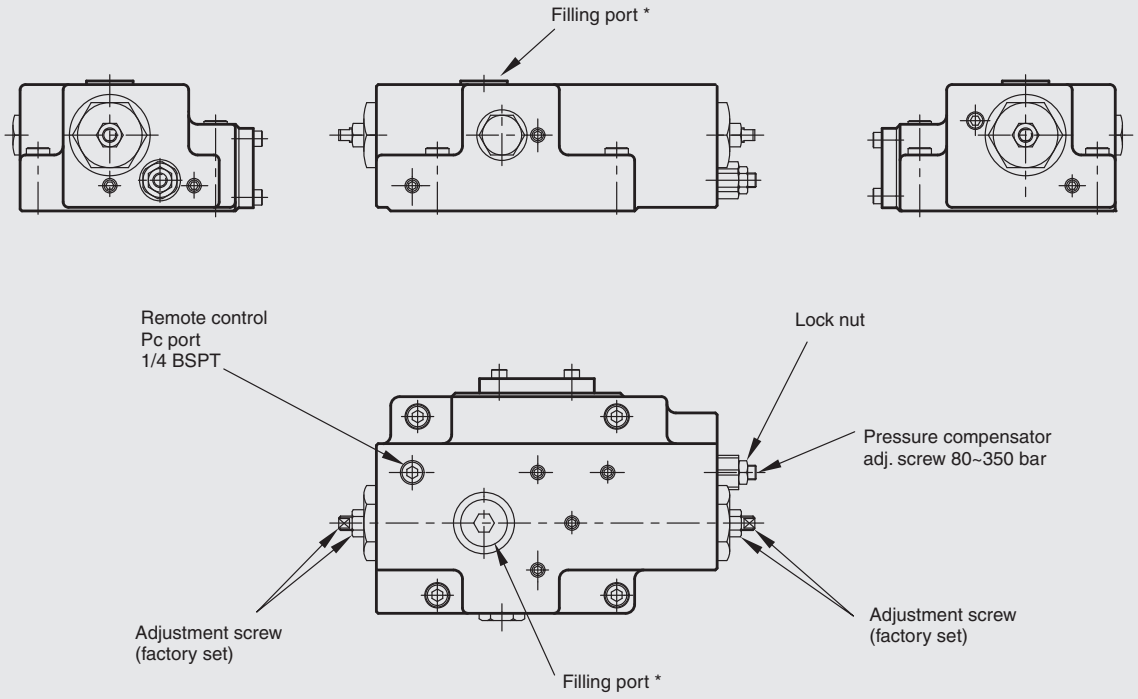
Pump size	L_7	L_8	L_9	L_{10}	L_{11}	H_1	H_2	H_3	H_4
360	786	5	95	18	64	112	245	53	51
560	896	5	95	20	74.5	127	286	70	59

Pump size	W_1	W_2	W_3	W_4	W_5	W_6	W_8	d_1	d_2
360	256	100	100	72	69	101	165	22	M16
560	300	120	120	72	69	118	185	26	M16

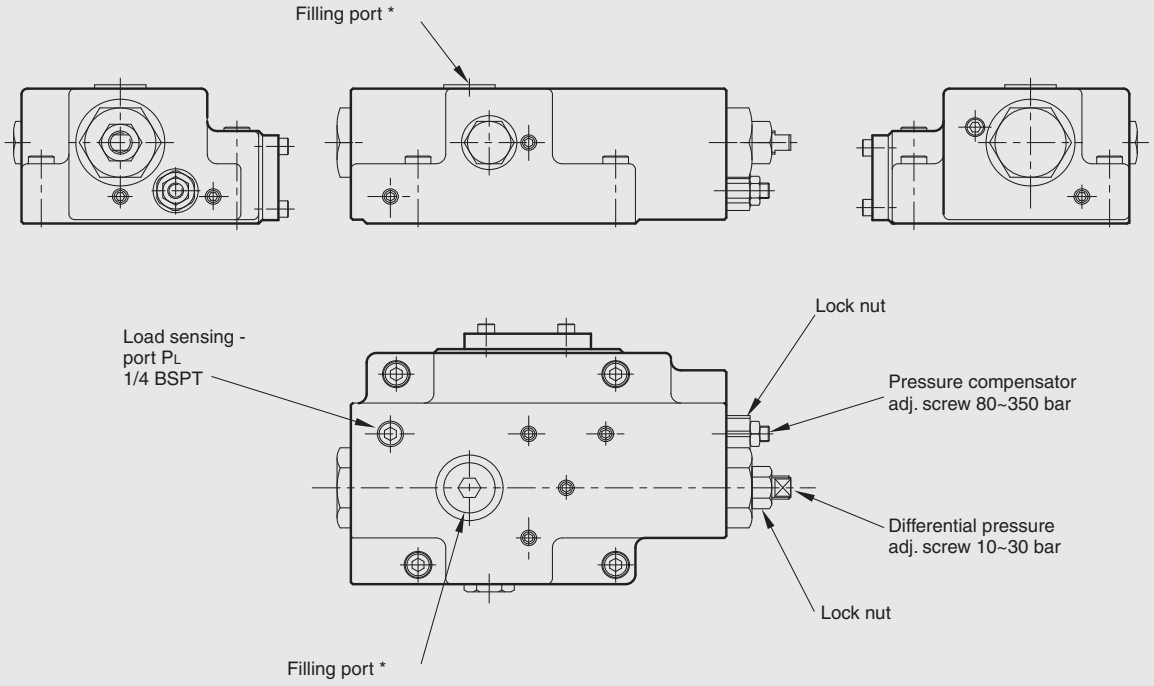
Type 1 Power control with positive or negative displacement control



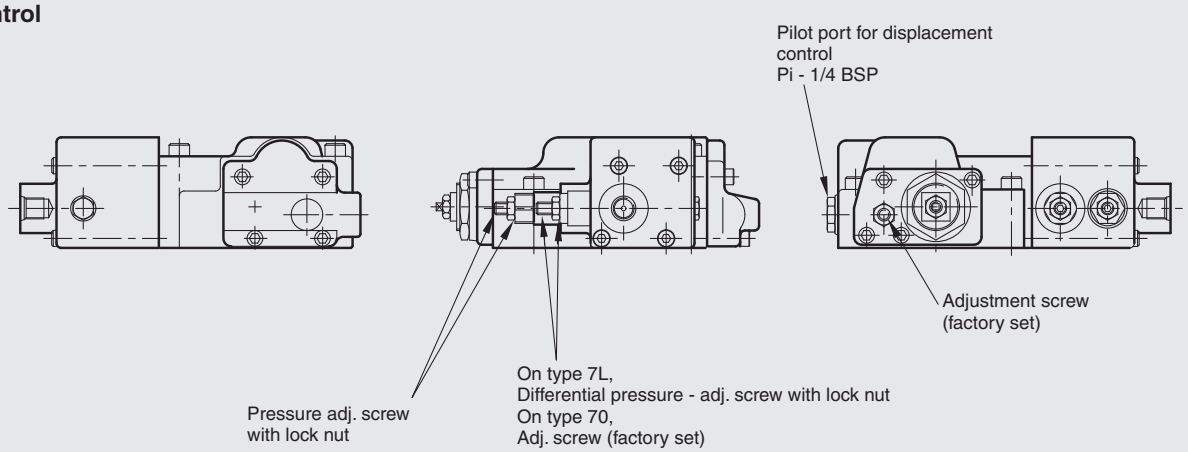
Type 4 Pressure compensation control

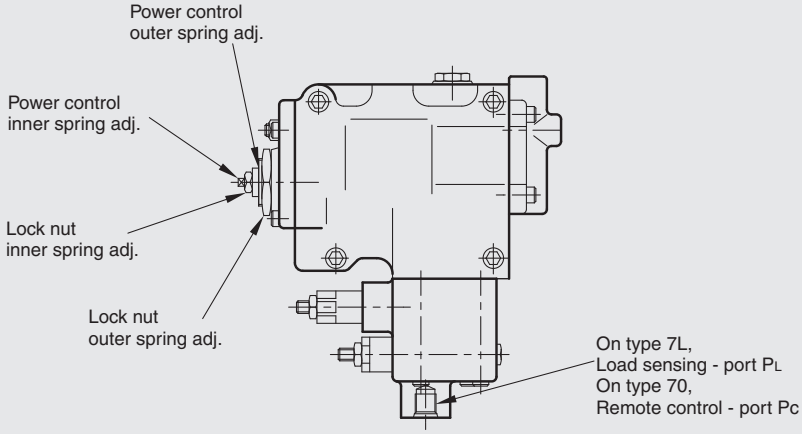


<u>Type 4L</u> Pressure compensation and load sensing control



<u>Type 7</u> Power control with positive or negative displacement control, pressure compensation or load sensing control





2.4.31 Auxiliary ports

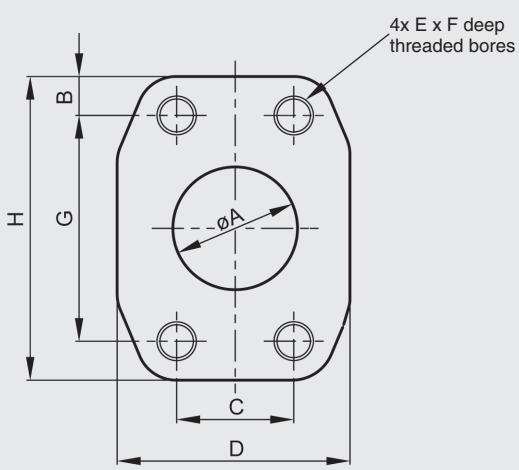
Dimensions of drain ports (in mm)

Pump size	a	b	c	d
63	½ BSP	22.6	2.5	19
112	¾ BSP	30.8	3.5	20
180 / 360	¾ BSP	30.8	3.5	20
280 / 560	¾ BSP	30.8	3.5	20

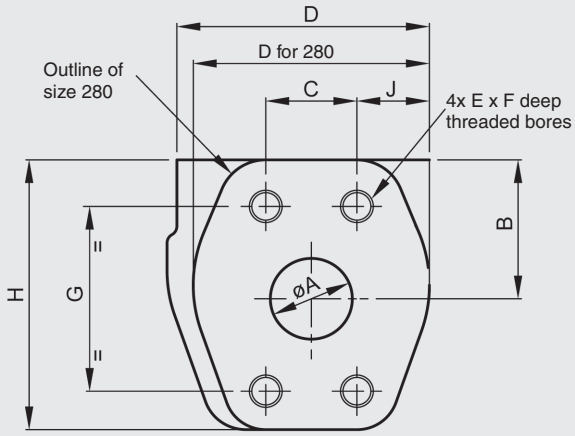
Other ports

Port	Size
P_C and P_L for 4000 control	¼ BSPT
P_C and P_L for type 7 control	¼ BSP
P_i and PSI pilot port for displacement control	¼ BSP
Measurement ports	¼ BSP
Venting port, V-type Sizes 63, 112, 180, 360	⅛ BSP
Venting port, V-type Sizes 280, 560	¼ BSP

2.4.32 Suction and discharge ports



Suction port



Discharge port

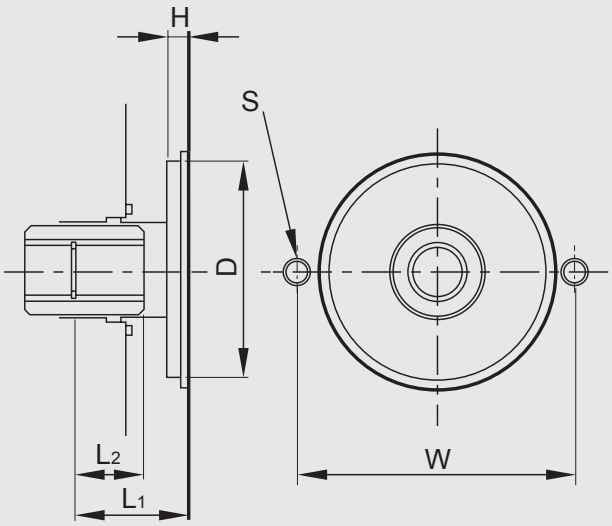
Suction port

Size	A	B	C	D	E	F	G	H
63	38	12	35.7	71	M12 x 1.75	18	69.9	94
112	64	12	50.8	91	M12 x 1.75	18	88.9	113
180	76	15	61.9	108	M16 x 2.0	24	106.4	136
280	89	15.5	69.9	123	M16 x 2.0	24	120.7	152
360	102	15	77.8	152	M16 x 2.0	24	130.2	162
560	102	18	77.8	152	M16 x 2.0	24	130.2	170

Discharge port

Size	A	B	C	D	E	F	G	H	J
63	25	41	27.8	77	M10 x 1.5	18	57.2	83.5	22
112	32	49	31.8	91	M12 x 1.75	18	66.7	98	30
180	38	58	36.5	111.5	M16 x 2.0	24	79.4	112	36
280	38	70	36.5	96	M16 x 2.0	24	79.4	112	30
360	32	51	31.8	80	M12 x 1.75	22	66.7	102	23
560	38	59	36.5	83	M16 x 2.0	24	79.4	117	16
When using confluent block:									
360	51	62	44.5	148	M20 x 2.5	30	96.8	124	26
560	51	72	44.5	180	M20 x 2.5	30	96.8	140	23

2.4.33 Through drive for optional gear pump



Pump size		63, 112, 180, 280		280, 360, 560
Ordering code	Without pilot port	7	G	A
	With pilot port	6	H	
Dimensions (SAE type "A" for 63, 112, 180 and 280) (SAE type "B" for 280, 360 and 560)	D	82.5		101.6
	H	8		11
	W	106		146
	S	2x M10 – 16 deep		2x M12 – 20 deep
	L_1	43	34	43
	L_2	26	18	26
Dimensions of splined shaft	Standard	SAE flat root, side fit		
	Number of teeth	13	9	13
	Diametral pitch	16/32		
	Pressure angle	30^0		
	Root diameter	$22.225^{+0.279}_{-0}$	$16.535^{+0.279}_{-0}$	$22.225^{+0.279}_{-0}$
	Measurement between pins	$16.589^{+0}_{-0.067}$	$10.089^{+0}_{-0.095}$	$16.589^{+0}_{-0.067}$
	Pin diameter	2.743		
Max. torque (Nm)		214	60	214