



HI HYDROME

**BOMBAS
AXIALES DE
PISTON**



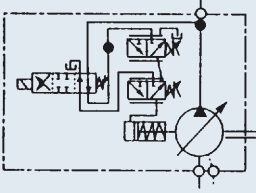
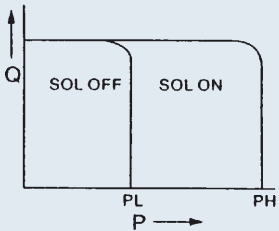
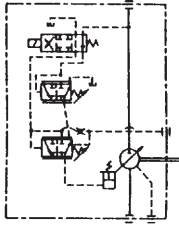
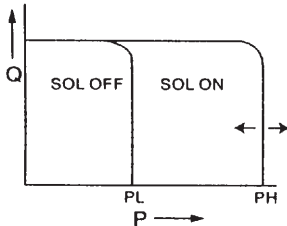
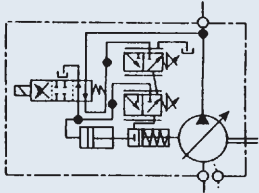
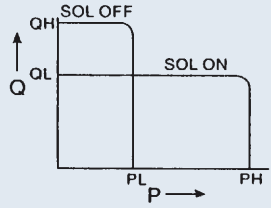
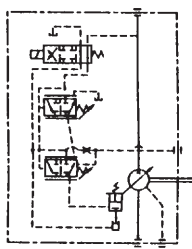
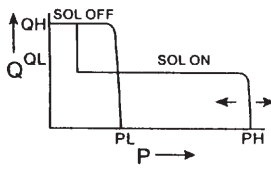
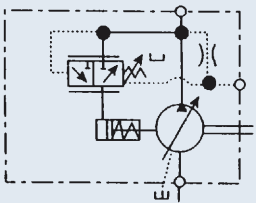
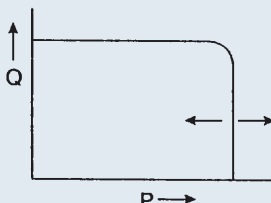
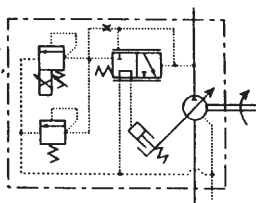
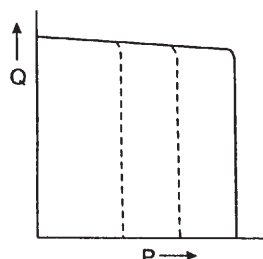
V SERIES AXIAL PISTON PUMP

Control Types

Control Types	JIS Symbols	Characteristics	Feature
A: Pressure Compensator Control			1. When system pressure increase and reach preset pressure the flow decrease automatically and pressure maintain without changing. 2. Power and pressure can be adjusted manually.
B: Multi-stage Flow & Single stage Pressure Control Type (With Cylinder)			1. Flow can be adjusted from 0 to maximum and pressure can be maintaining at preset pressure. 2. Absorbing impact and vibration which are produced by up and down motions of actuators. It is suitable for lifting equipment etc.
C: 2 stage Pressure & Flow Control Type			1. Low consumption electric motor can be selected to save energy because of the functions of high flow at low pressure and low flow at high pressure. 2. When pressure increase and reach preset pressure "PH", flow is reduced to "QL". 3. Pressure "PH""PL", and Flow "QH""QL" can be adjusted optionally. 4. It is applied to actuators requiring long unloaded or short loaded strokes. Speedy and horsepower efficient.
CG: 2 stage remote Pressure & Flow Control Type			1. The same function of "C" control type. 2. The pressure and the range can be adjusted remotely by the integrated remote pressure control valve. 3. Proportional Electro-hydraulic pressure control can be applied with HYDROME proportional valve.
D: Solenoid Controlled Pressure Compensating Type with Unloading Device			1. Same as type A and unloading function added. 2. It is applied to systems requiring long term unloading operation. 3. When solenoid is turned off, pump operation under unloading condition maintains low noise level and oil heat generation.
DG: Solenoid Controlled Pressure Compensating Type with Unloading & Remote Device			1. The same function of "C" control type. 2. The pressure and the range can be adjusted remotely by the integrated remote pressure control valve. 3. Proportional Electro-hydraulic pressure control can be applied with HYDROME proportional valve.

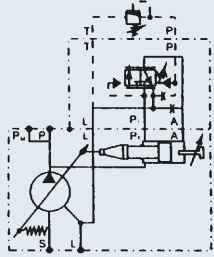
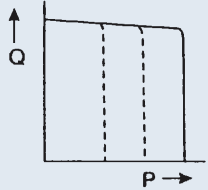
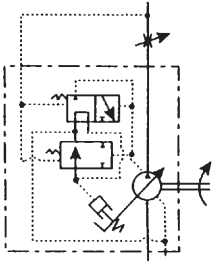
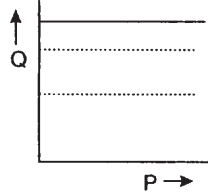
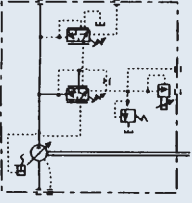
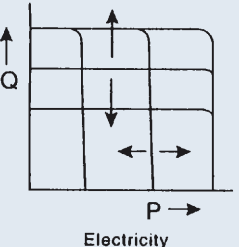
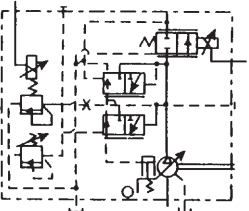
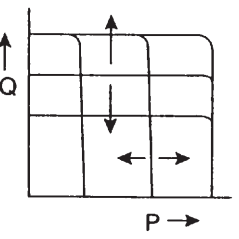
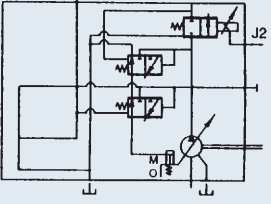
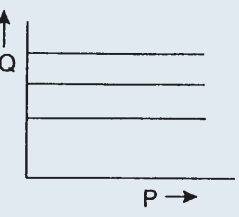
V SERIES AXIAL PISTON PUMP

Control Types

Control Types	JIS Symbols	Characteristics	Feature
E: Dual Pressure Control			1. Preset high and low pressure can be controlled by switching directions of solenoid control valves. 2. This type is applied to actuators requiring 2 stage pressures with single speed. 3. One of "PL" and "PH" can be optionally be high pressure.
EG: Dual & Remote Pressure Control			1. The same function of "E" control type. 2. The pressure and the range can be adjusted remotely by the integrated remote pressure control valve. 3. Proportional Electro-hydraulic pressure control can be applied with HYDROME proportional valve.
F: 2 flow-2 pressure p.c.by solenoid operated valve			1. Actuators can be shifted slowly (high pressure low flow) and quickly (low pressure high flow) by switching directions of solenoid control valve. When solenoid valve turns on, pressure increase to "PH", and flow decrease to "QL". 2. Pressure "PL", "PH" and flow "QL", "QH" can be adjusted optionally. 3. This type is applied to actuator requiring operations of shift speed from high to low or low to high.
FG: 2 flow-2 pressure p.c. by solenoid operated & remote valve			1. The same function of "F" control type. 2. The pressure and the range can be adjusted remotely by the integrated remote pressure control valve. 3. Proportional Electro-hydraulic pressure control can be applied with HYDROME proportional valve.
G: Remote pressure compensator control			1. The same function of "A" control type. 2. Pressure can be adjusted remotely by the integrated remote pressure control valve.
GJ: Proportional Pressure with interface			1. Same as Type "GM" and proportional valve added. 2. The proportional valve is installed on the NG 6 interface to reach Proportional Electro-hydraulic control to save energy.

V SERIES AXIAL PISTON PUMP

Control Types

Control Types	JIS Symbols	Characteristics	Feature
GM: Remote Interface (Not include pilot valve)			1. GM control with a NG6 interface, supply an installation for pilot valve to prove the operating pressure. The pressure setting can be set directly from the control panel of the machine. 2. The remote pressure compensator responds faster and offers more stable pressure. 3. The adjustment can also be manual or proportional pressure control.
HL: Load Sensing Compensator			1. The pump outlet can be controlled by the setting pressure value of flow control valve. An ideal energy conservation system can be configured by combining the proportional directional control. 2. When setting pressure value, flow is changed depending on throttle valve. The sensing flow feedback function can reach to low oil heat generation and saving energy.
HJ: Load Sensing & Proportional Electro-hydraulic Pilot Relief Valve			1. Same as Type "HL" and proportional pressure function added. 2. Supplied with proportional Electro-hydraulic pilot relief valve can reach to horse-saving and energy-saving.
HK: Proportional Electro-hydraulic Load Sensing Type			1. HK type supplies the system pressure and flow depending on the proportional pressure and flow, voltage, and load value to save the energy. When in waiting circle, the outlet displacement and horse power loss are close to zero. When pressure reaches to preset value, the flow decrease to the min., and the pressure is constant to reach low oil heat generation and energy loss. 2. HK type can save 30%~50% energy compare to vane pump and gear pump+PQ valve. It is an energy-saving and environmental design.
HQ: Load-sensing Proportional Flow control			1. Same as Type "HL" and proportional flow function added. 2. The proportional flow control allows the adjustment of the pumps output flow with an electrical input signal. Supplied and adjusted the displacement by the electronic control module.

V SERIES AXIAL PISTON PUMP

Performance curves

MEASURING CONDITIONS

ROOM TEMPERATURE: $20 \pm 2^\circ\text{C}$

SPEED OF ROTATION: 1800 rpm

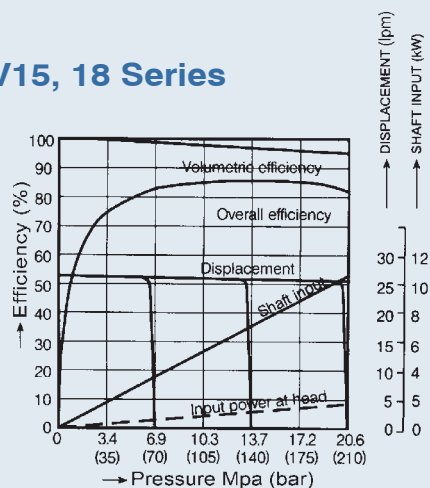
OIL: ISO VG 32-68

OIL CAPACITY: 40 lpm

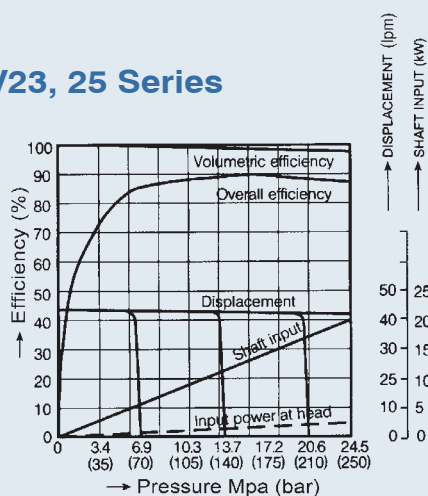
ADOPTS SEALED CIRCUIT: 70 bar

ADJUST PRESSURE: 35 bar

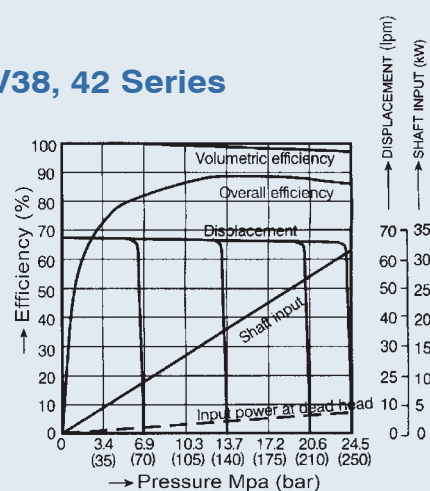
V15, 18 Series



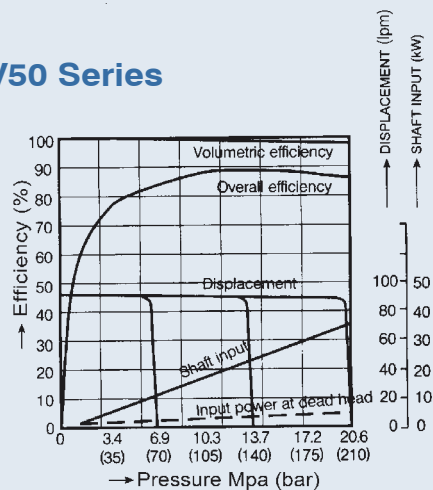
V23, 25 Series



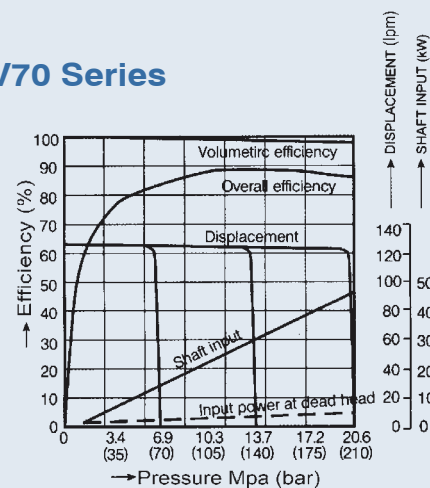
V38, 42 Series



V50 Series



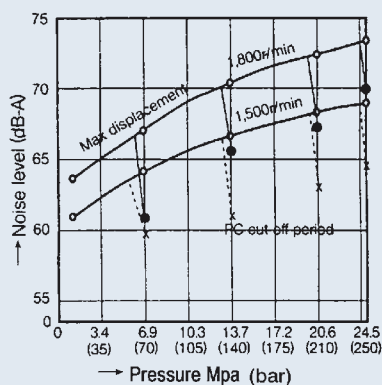
V70 Series



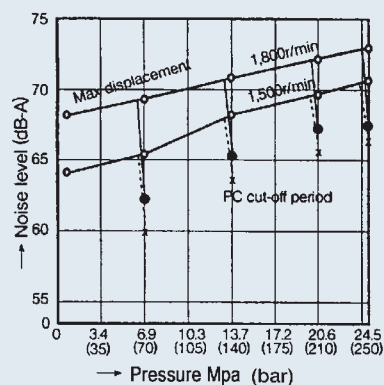
V SERIES AXIAL PISTON PUMP

Performance curves

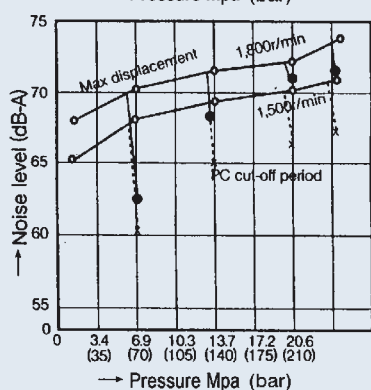
V15, 18



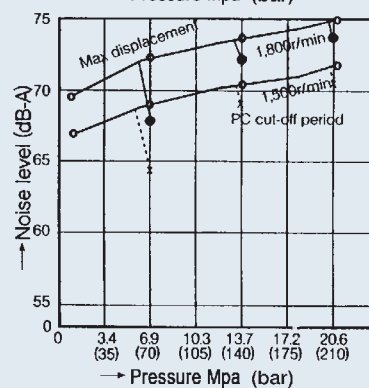
V23, 25



V38, 42

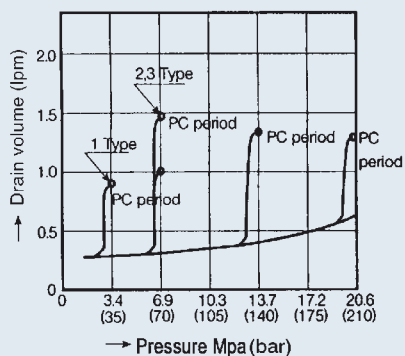


V50, 70



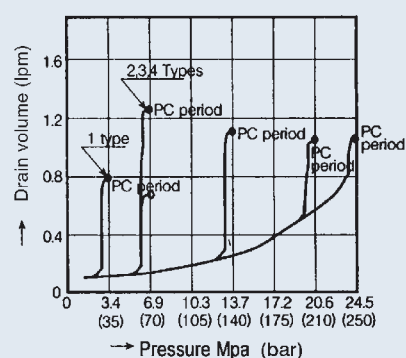
V15, 18

Drain volume characteristic



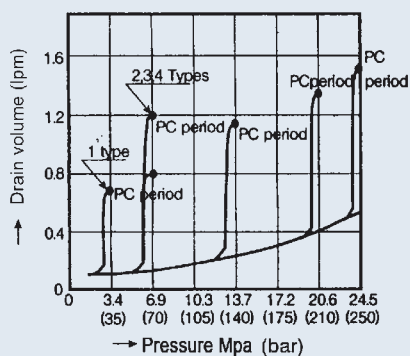
V23, 25

Drain volume characteristic



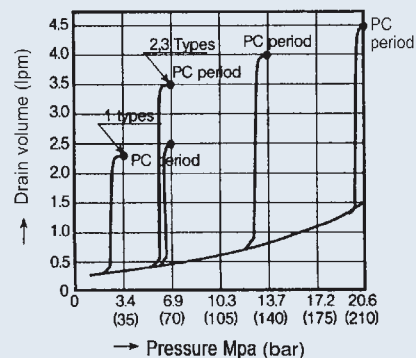
V38, 42

Drain volume characteristic



V50, 70

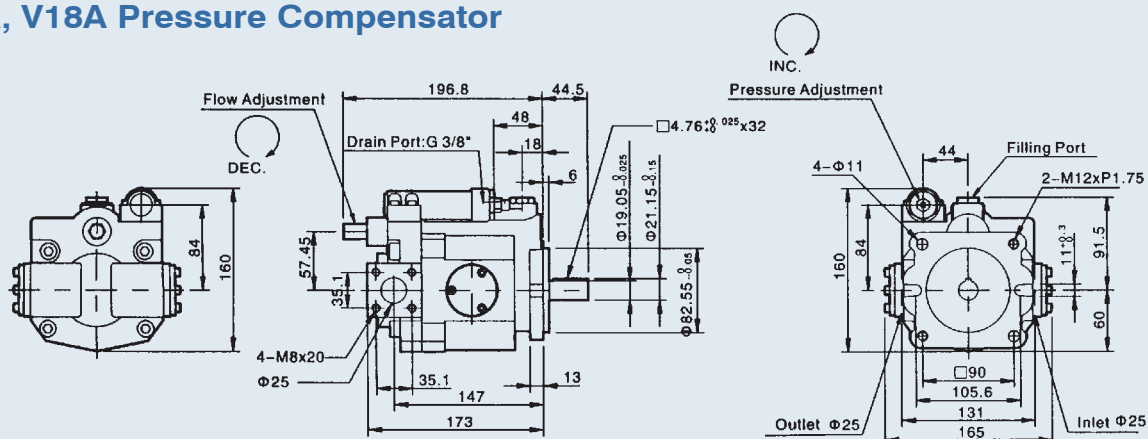
Drain volume characteristic



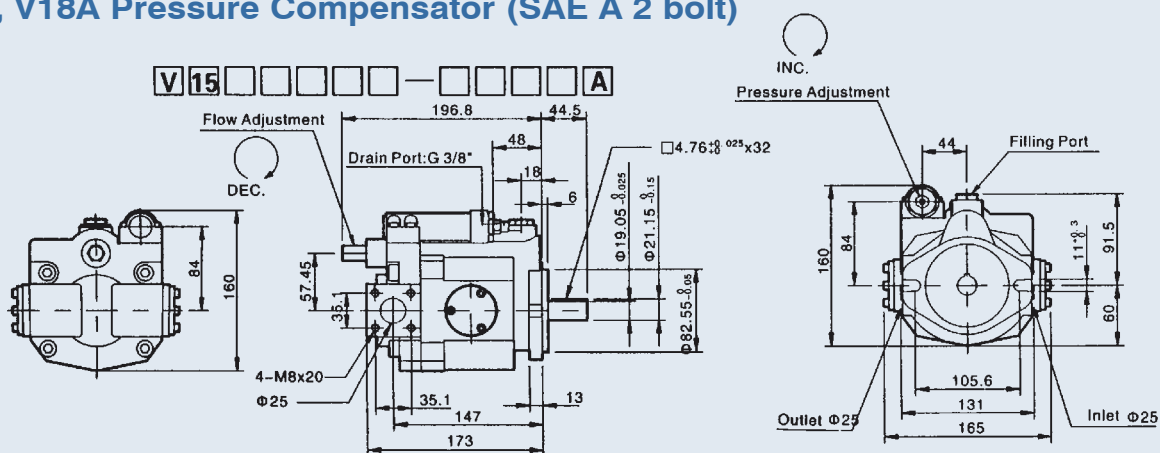
V SERIES AXIAL PISTON PUMP

Dimensions

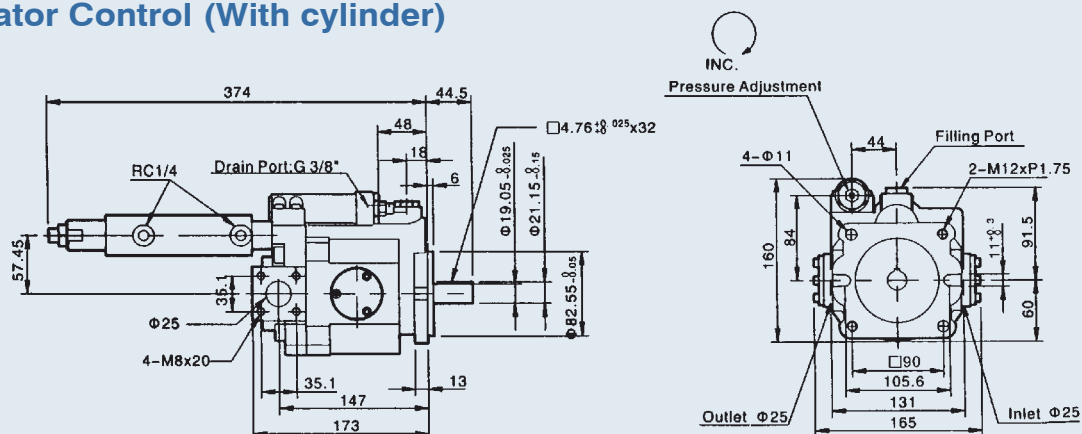
V15A, V18A Pressure Compensator



V15A, V18A Pressure Compensator (SAE A 2 bolt)



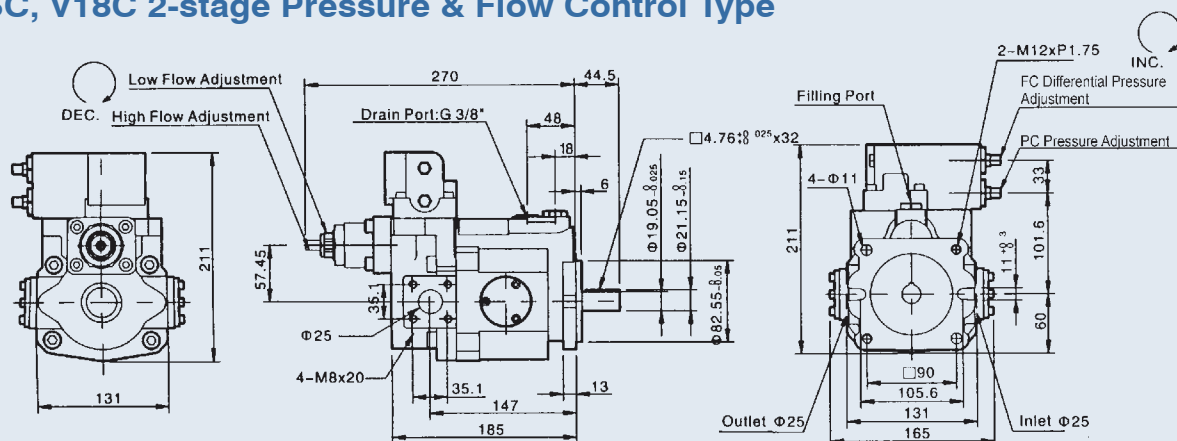
V15B, V18B Multi-stage Flow & Single-stage Pressure Compensator Control (With cylinder)



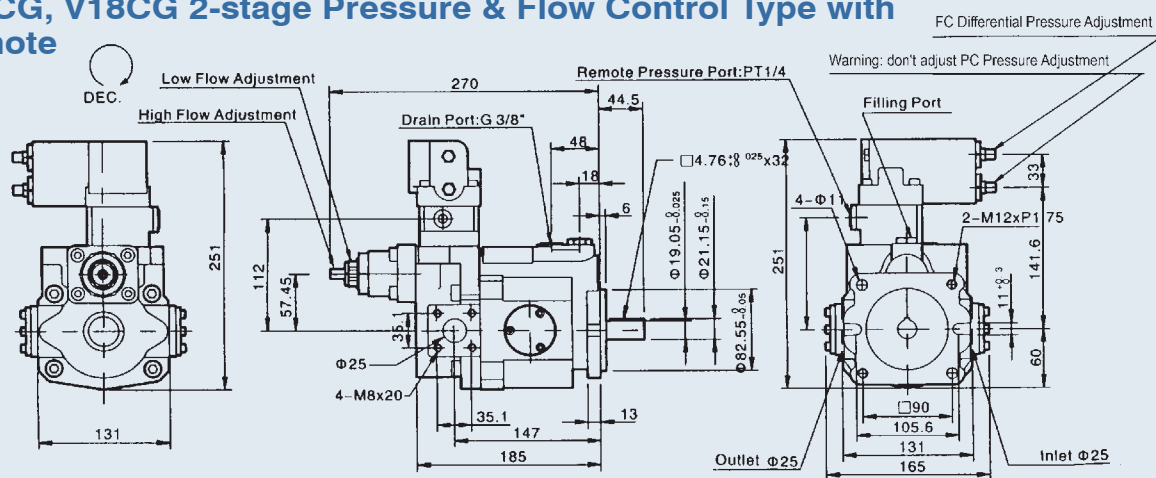
V SERIES AXIAL PISTON PUMP

Dimensions

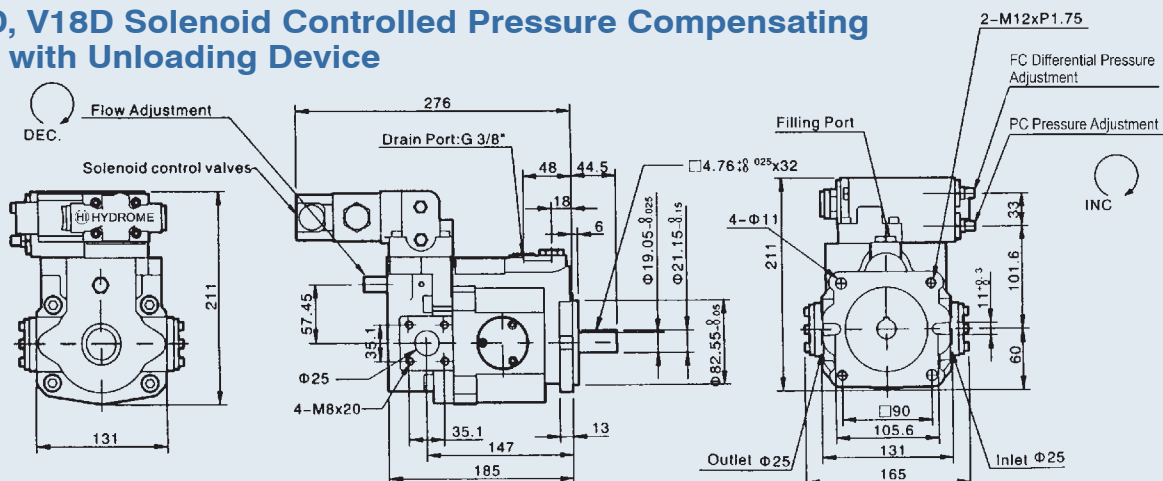
V15C, V18C 2-stage Pressure & Flow Control Type



V15CG, V18CG 2-stage Pressure & Flow Control Type with Remote



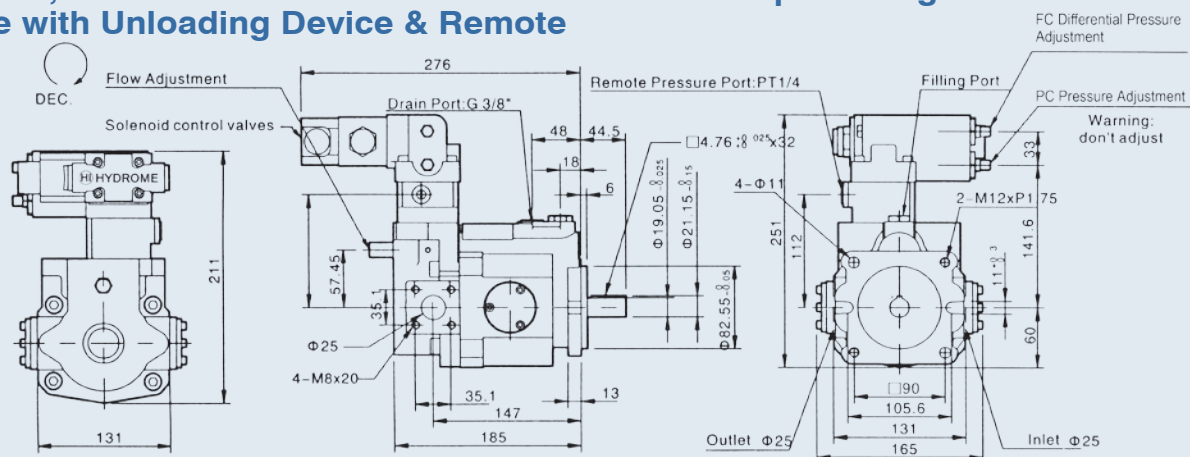
V15D, V18D Solenoid Controlled Pressure Compensating Type with Unloading Device



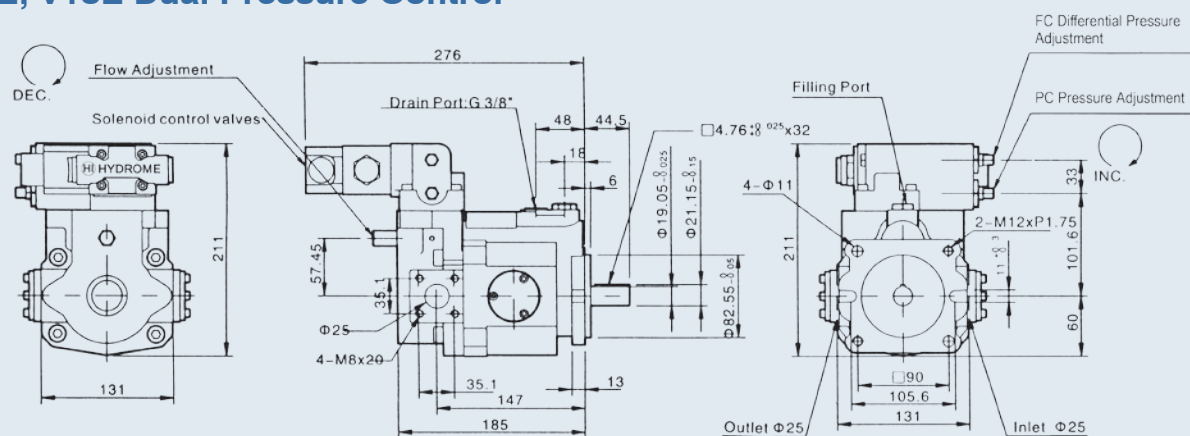
V SERIES AXIAL PISTON PUMP

Dimensions

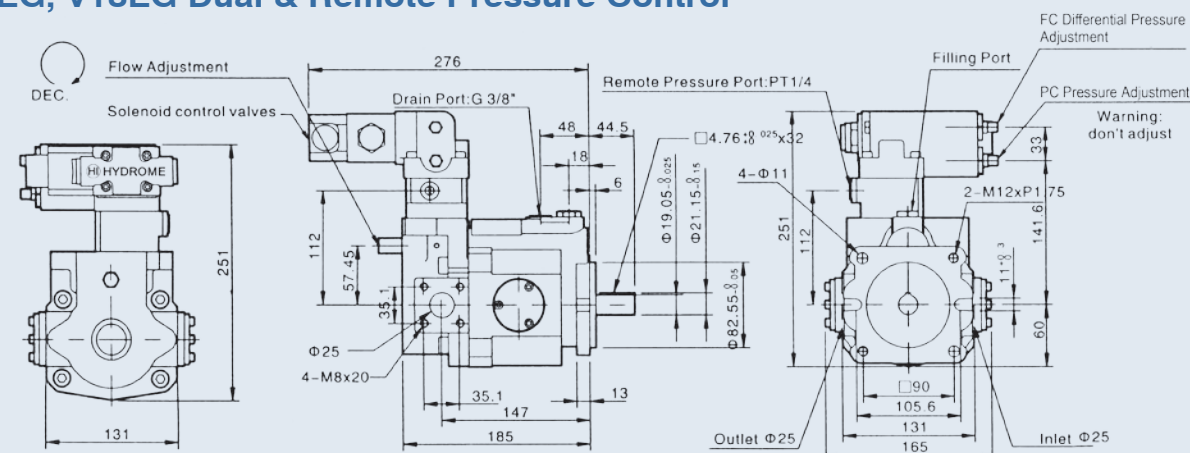
V15DG, V18DG Solenoid Controlled Pressure Compensating Type with Unloading Device & Remote



V15E, V18E Dual Pressure Control



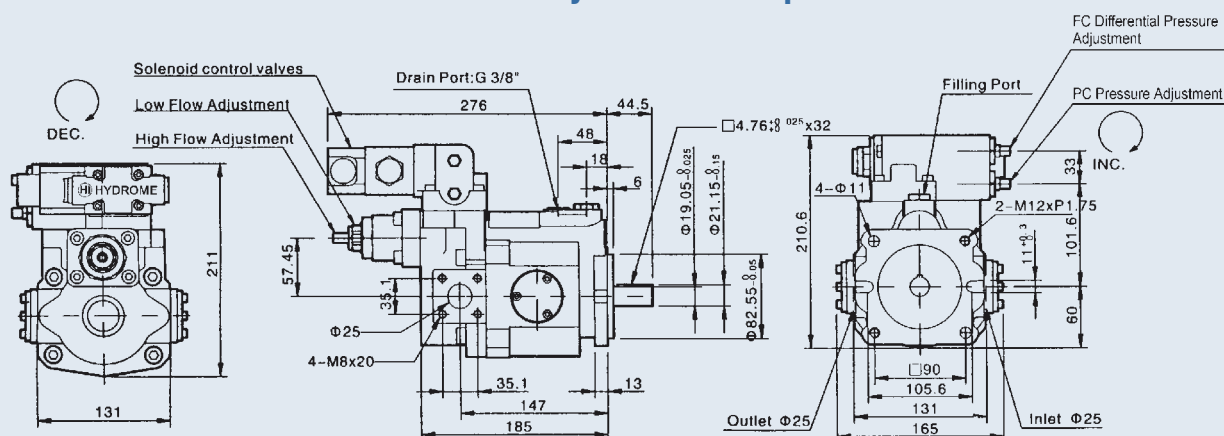
V15EG, V18EG Dual & Remote Pressure Control



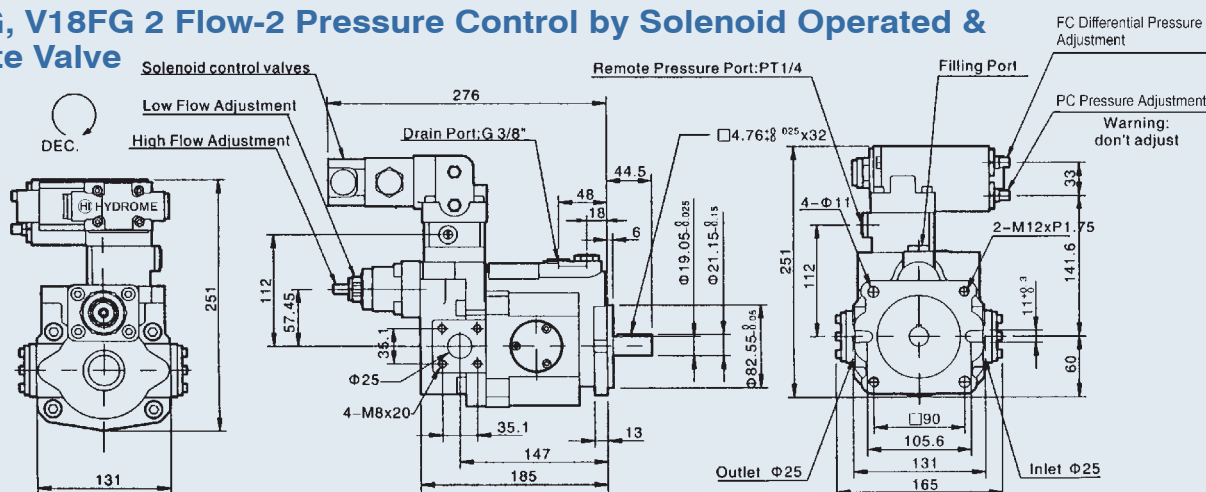
V SERIES AXIAL PISTON PUMP

Dimensions

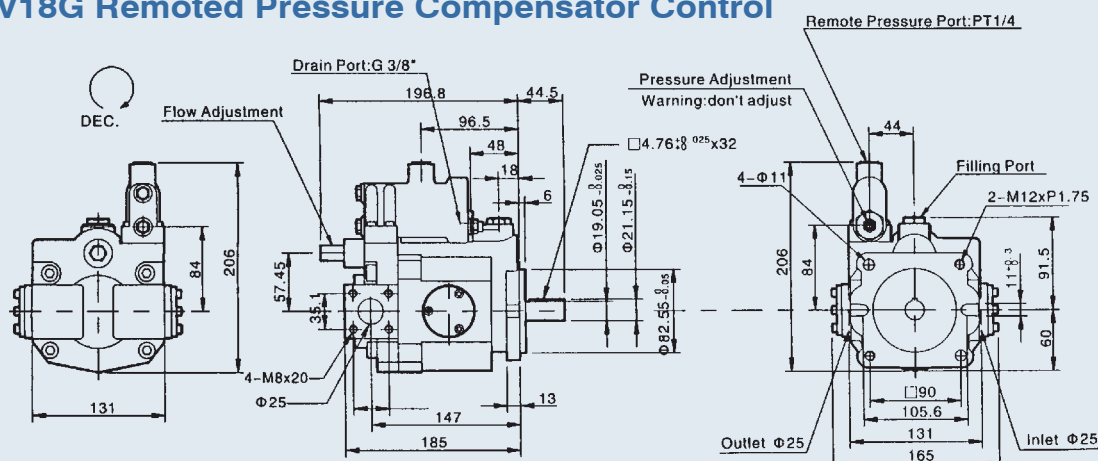
V15F, V18F 2 Flow-2 Pressure Control by Solenoid Operated Valve



V15FG, V18FG 2 Flow-2 Pressure Control by Solenoid Operated & Remote Valve



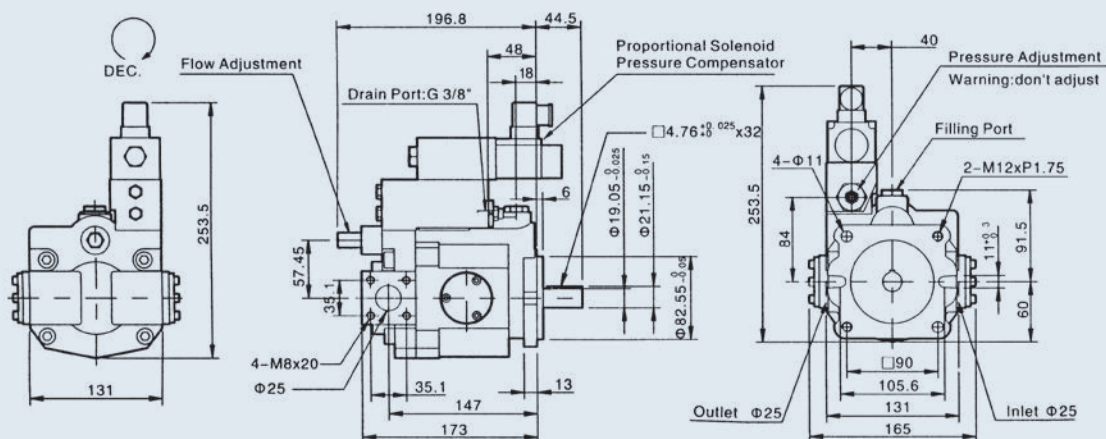
V15G, V18G Remoted Pressure Compensator Control



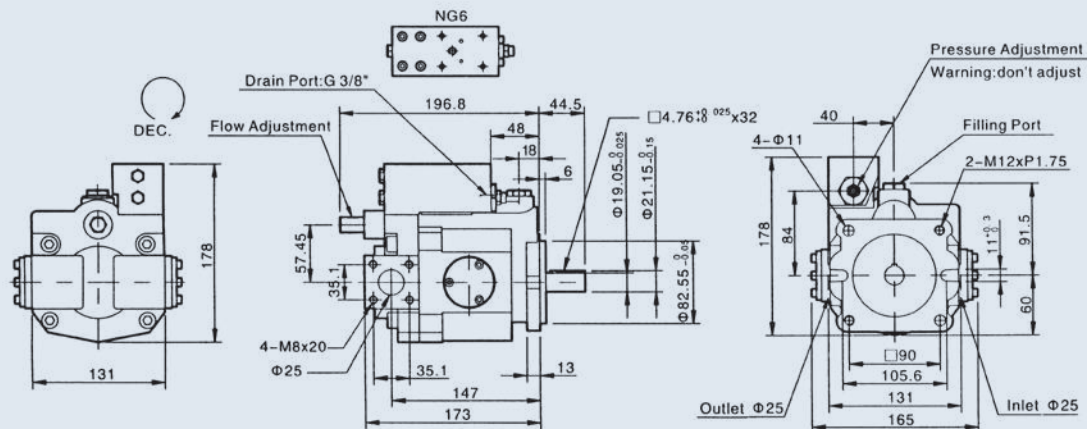
V SERIES AXIAL PISTON PUMP

Dimensions

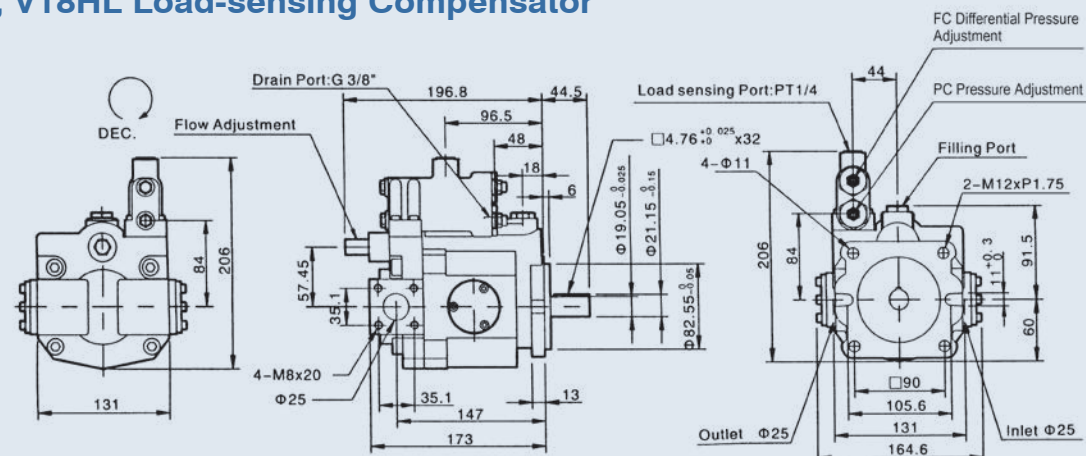
V15GJ, V18GJ Proportional Pressure with Interface



V15GM, V18GM Remote Interface (Not include valve)



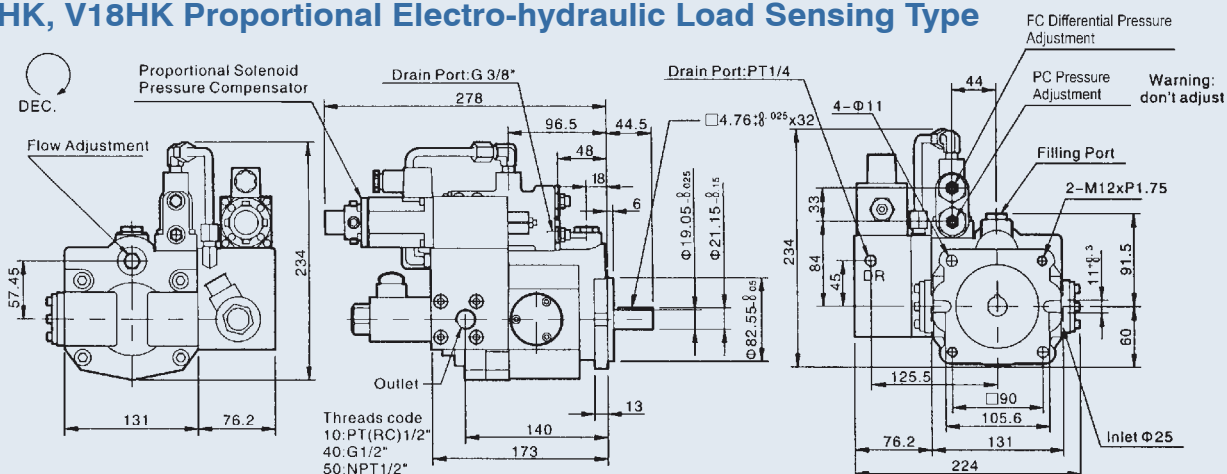
V15HL, V18HL Load-sensing Compensator



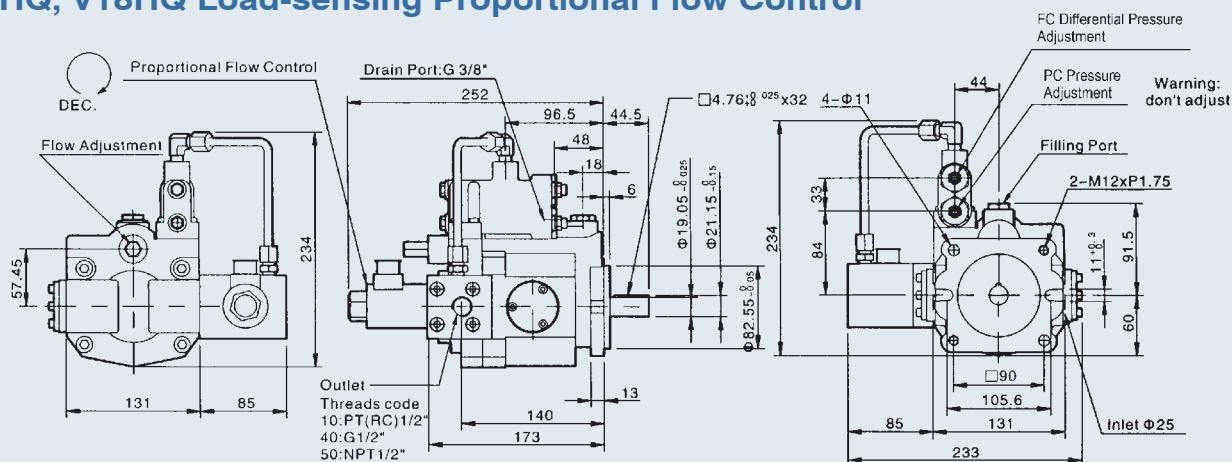
V SERIES AXIAL PISTON PUMP

Dimensions

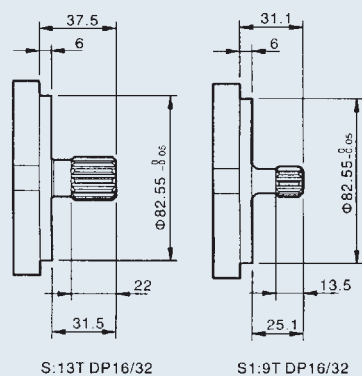
V15HK, V18HK Proportional Electro-hydraulic Load Sensing Type



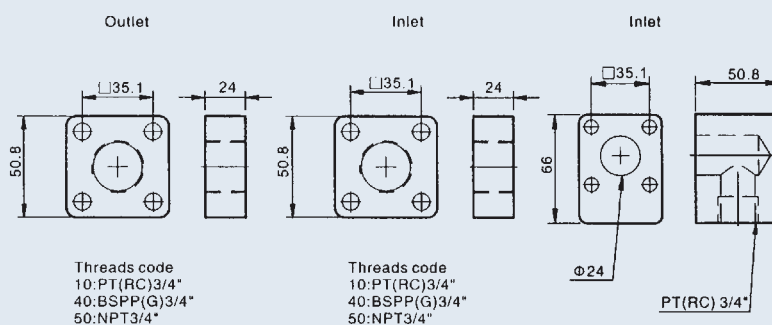
V15HQ, V18HQ Load-sensing Proportional Flow Control



V15, V18 Splined Shaft Type



V15, V18 Hydraulic Flange



Dimensions

Type	A	B	C	CG	D	DG	E	EG	F	FG	G	GJ	GM	HL	HK	HQ
	O				O	O	O	O			O	O	O	O	O	O

Thru Drive Option

DEC.
Flow Adjustment
9T DP 16/32

Drain Port: G 3/8"

Pressure Adjustment
INC.

4.76 $\pm$ 0.025x32

Φ19.05 $\pm$ 0.025
Φ21.15 $\pm$ 0.15
Φ82.55 $\pm$ 0.05

4-M8x20
Φ25

2-M10xP1.5

185
44.5
48
18
6
35.1
35.1
13
146
185

178
Φ82.55 $\pm$ 0.05
106.3

2-M10xP1.5

Pressure Adjustment
INC.

Filling Port
2-M12xP1.75

4-Φ11
44
160
84
11 $\pm$ 0.3
91.5
60
105.6
131
165
Outlet Φ25
Inlet Φ25

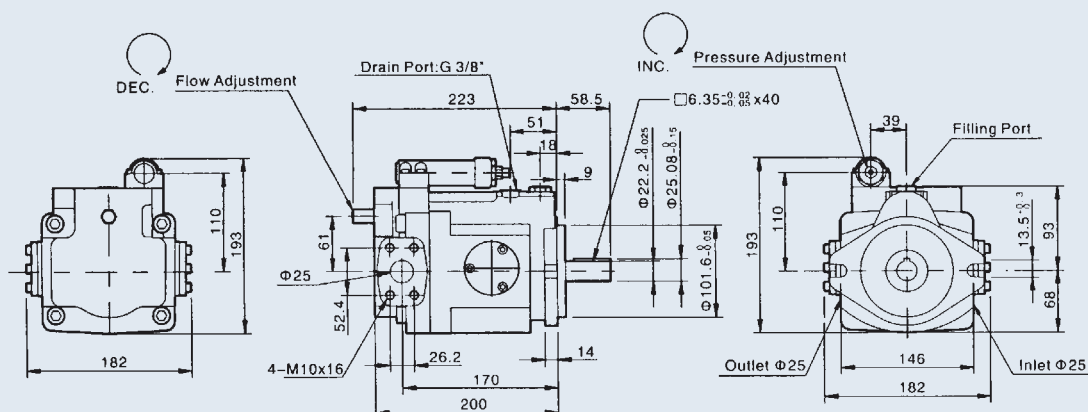
LINKS: D:SAE A Φ82.55

Thru Drive Option

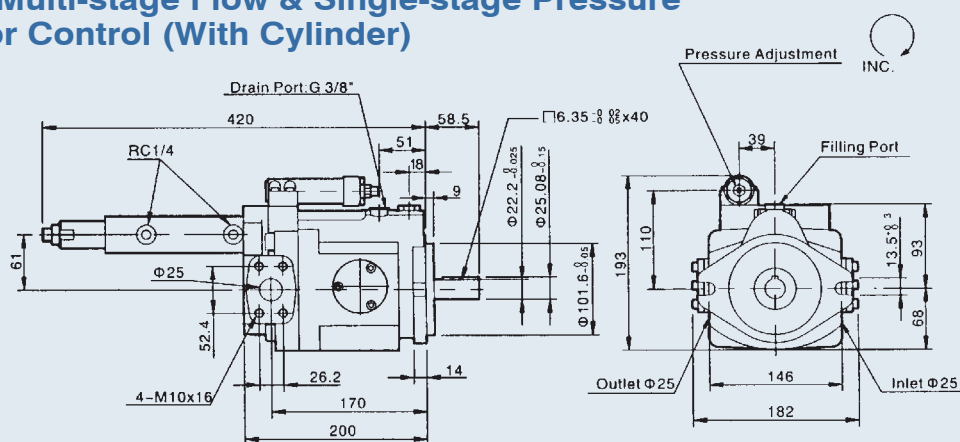
V SERIES AXIAL PISTON PUMP

Dimensions

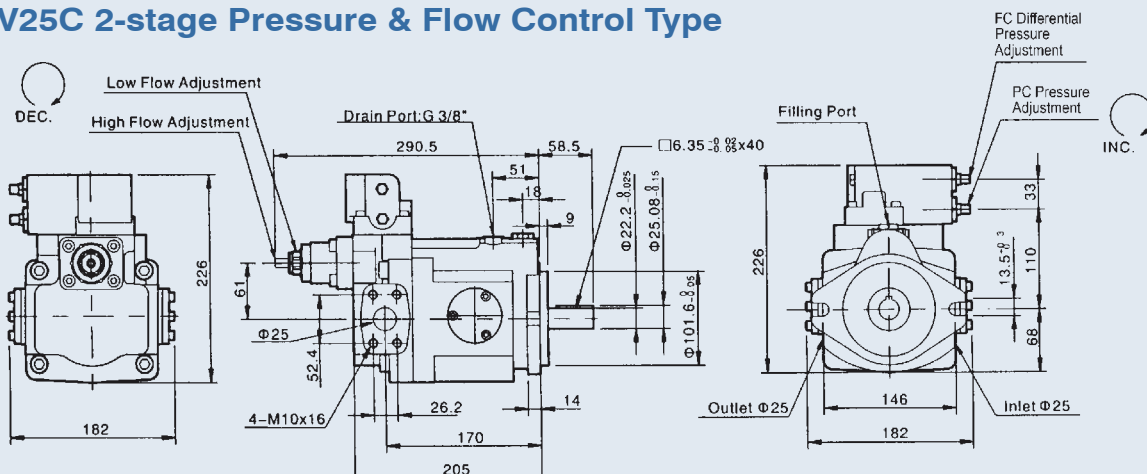
V23A, V25A Pressure Compensator



V23B, V25B Multi-stage Flow & Single-stage Pressure Compensator Control (With Cylinder)



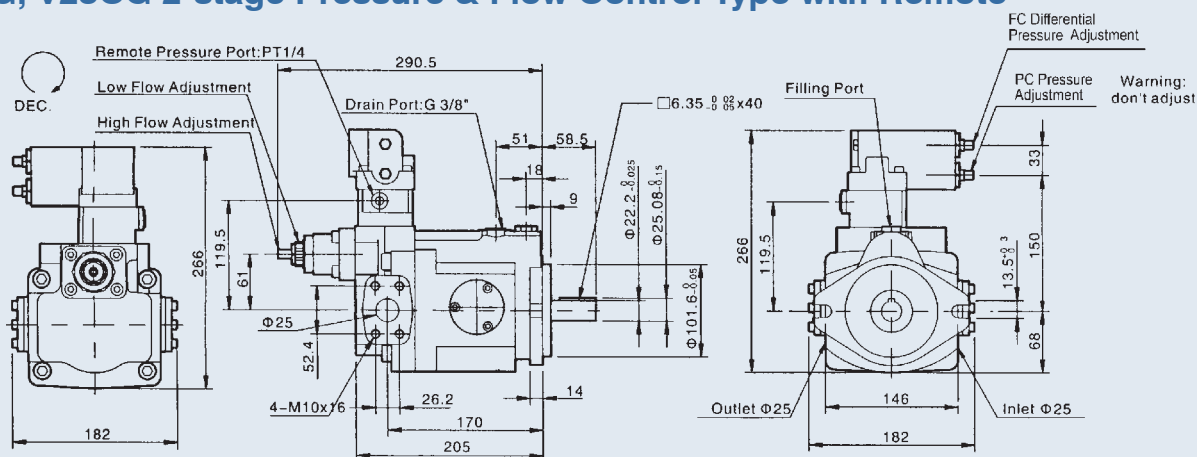
V23C, V25C 2-stage Pressure & Flow Control Type



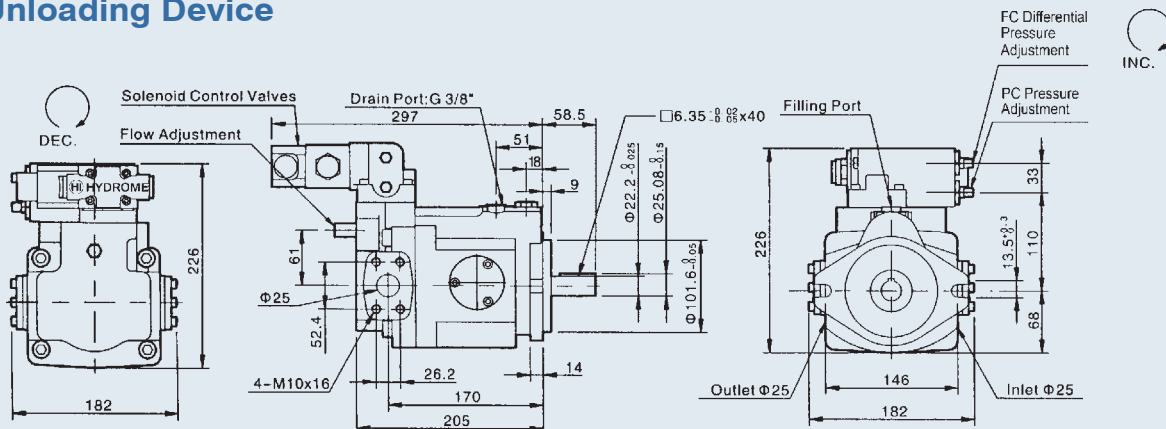
V SERIES AXIAL PISTON PUMP

Dimensions

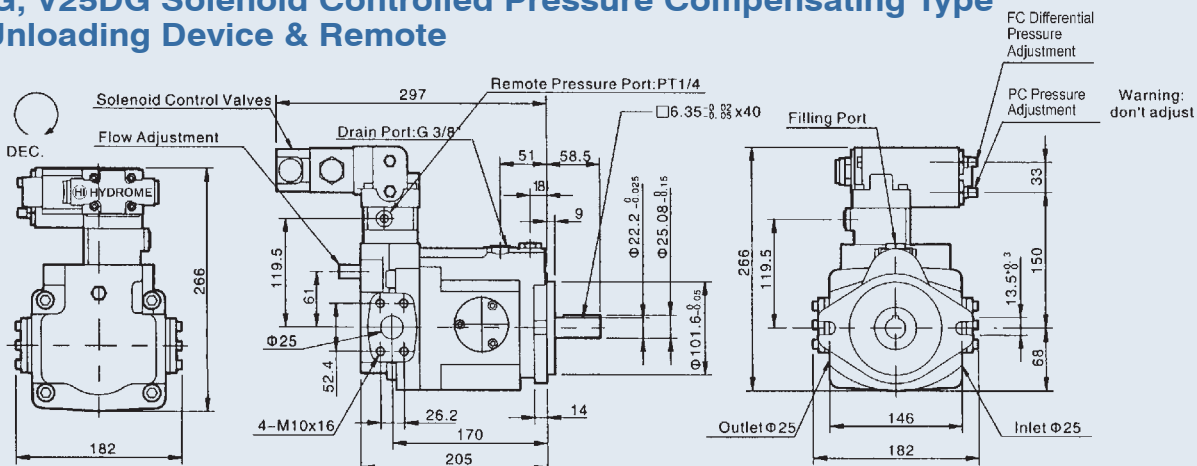
V23CG, V25CG 2-stage Pressure & Flow Control Type with Remote



V23D, V25D Solenoid Controlled Pressure Compensating Type with Unloading Device



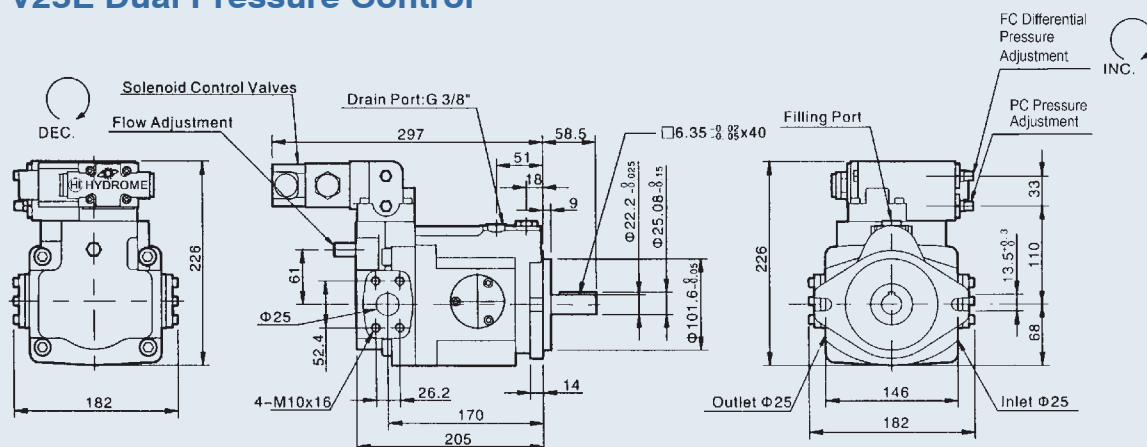
V23DG, V25DG Solenoid Controlled Pressure Compensating Type with Unloading Device & Remote



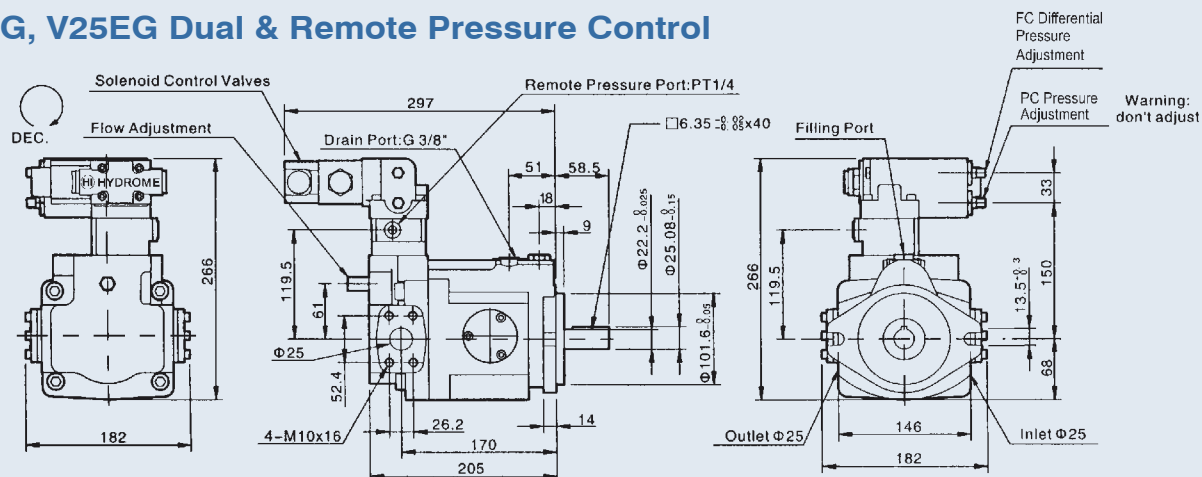
V SERIES AXIAL PISTON PUMP

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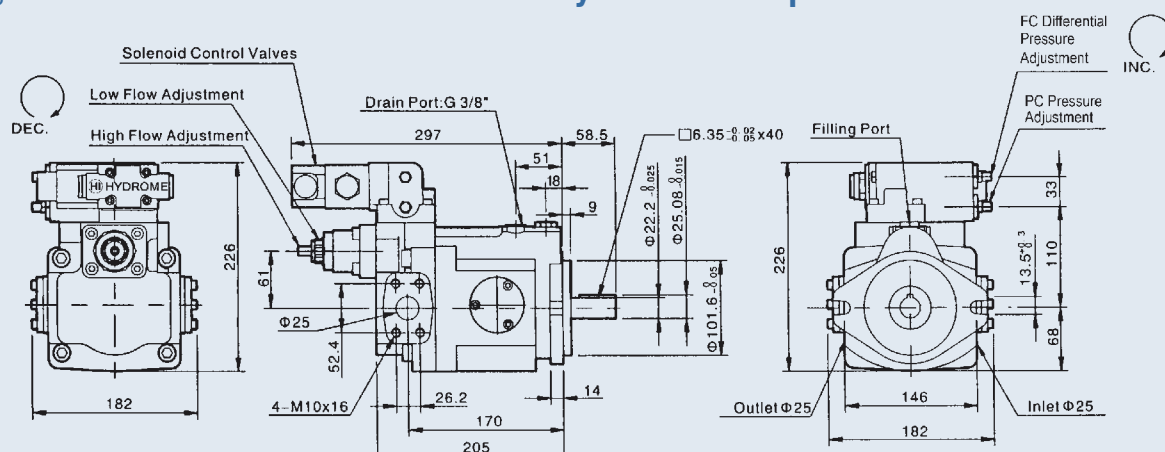
V23E, V25E Dual Pressure Control



V23EG, V25EG Dual & Remote Pressure Control



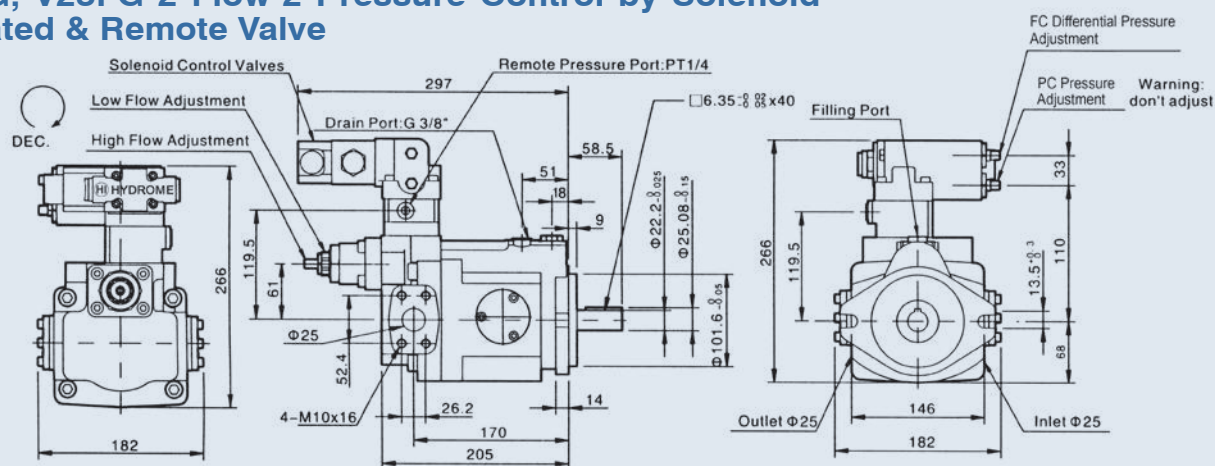
V23F, V25F 2 Flow-2 Pressure Control by Solenoid Operated Valve



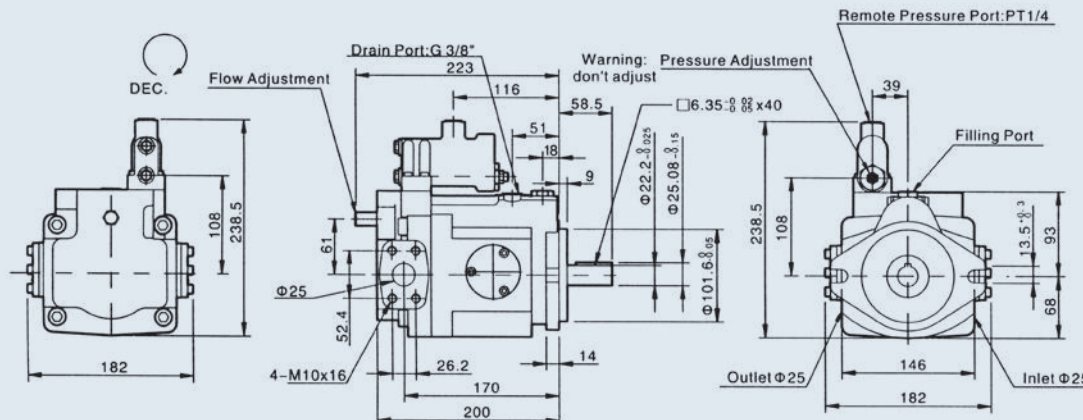
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Dimensions

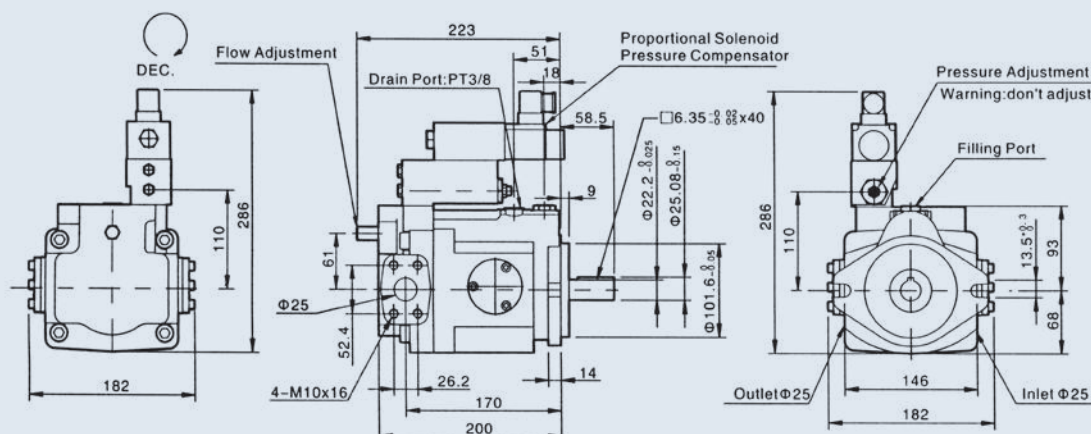
V23FG, V25FG 2 Flow-2 Pressure Control by Solenoid Operated & Remote Valve



V23G, V25G Remoted Pressure Compensator Control



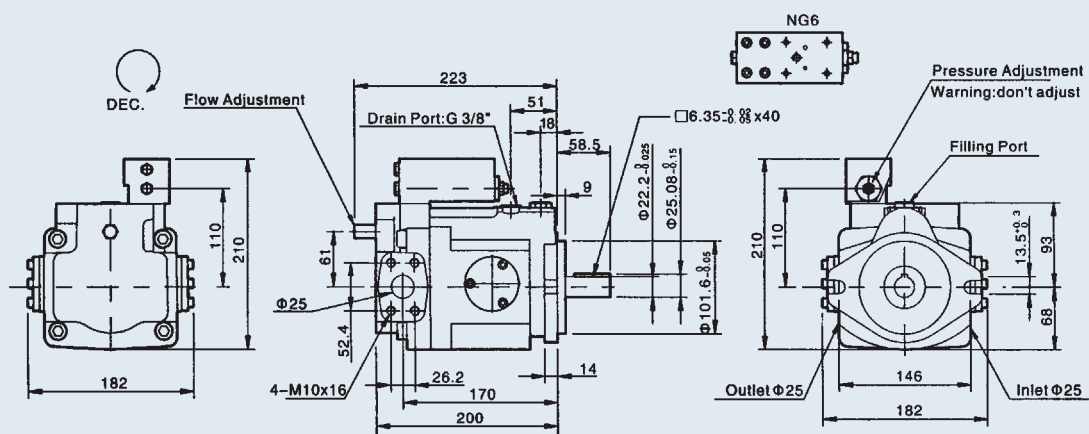
V23GJ, V25GJ Proportional Pressure with interface



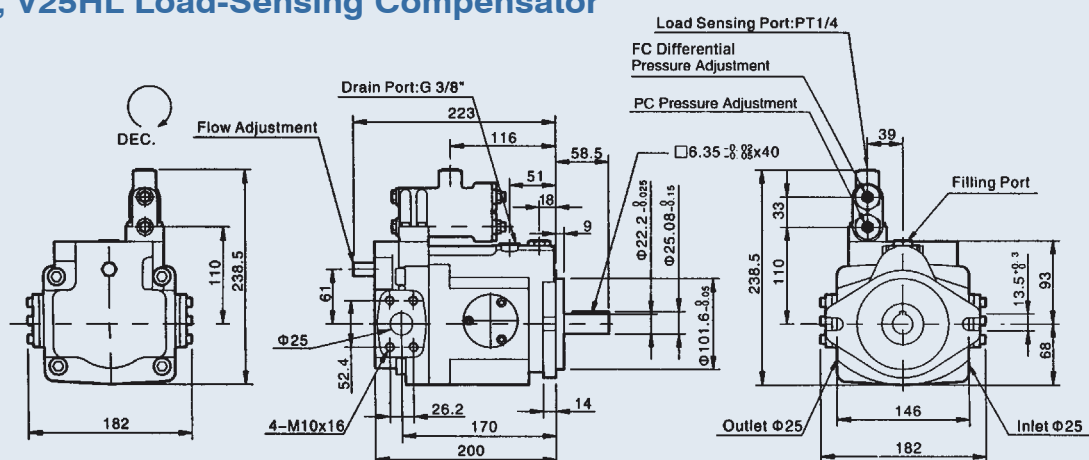
V SERIES AXIAL PISTON PUMP

Dimensions

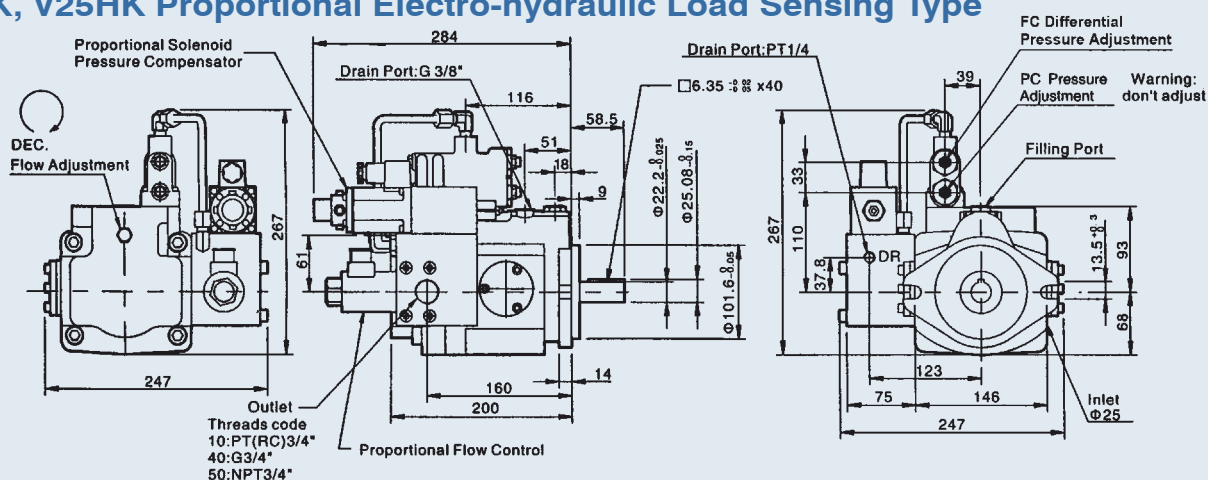
V23GM, V25GM Remoted Interface (Not include valve)



V23HL, V25HL Load-Sensing Compensator



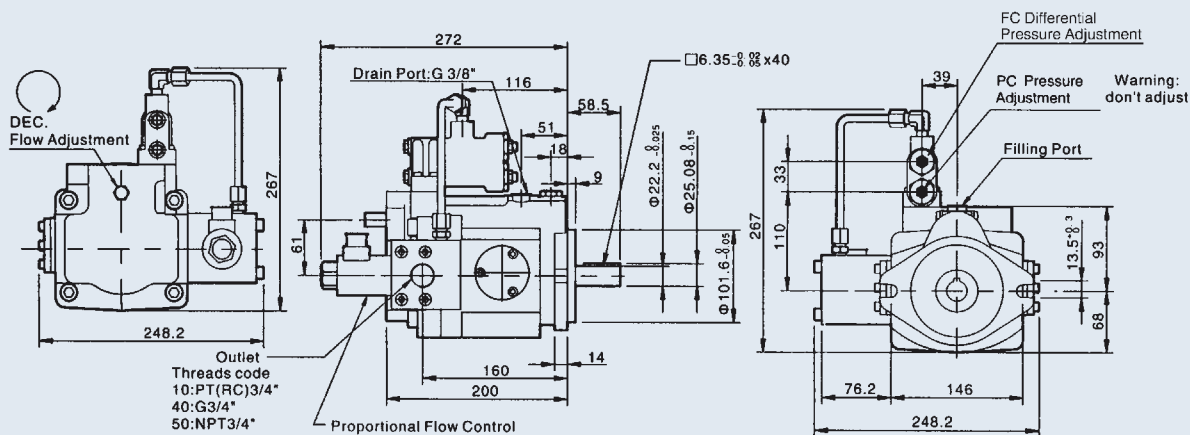
V23HK, V25HK Proportional Electro-hydraulic Load Sensing Type



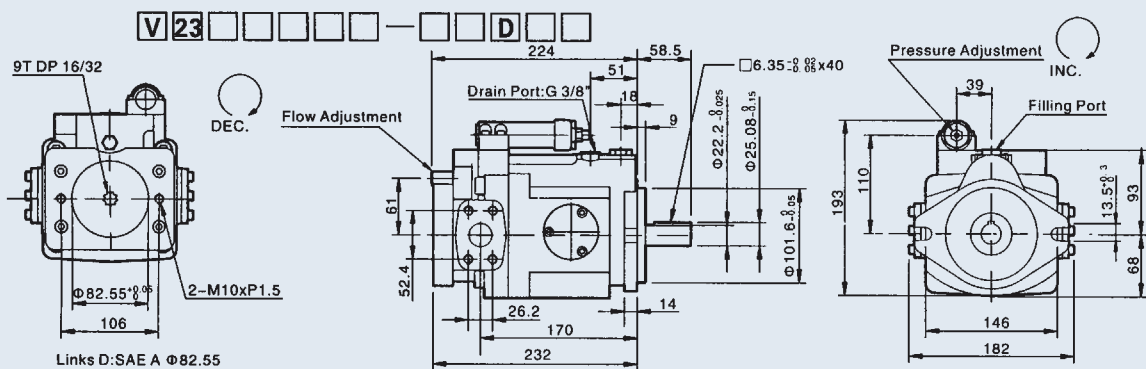
V SERIES AXIAL PISTON PUMP

Dimensions

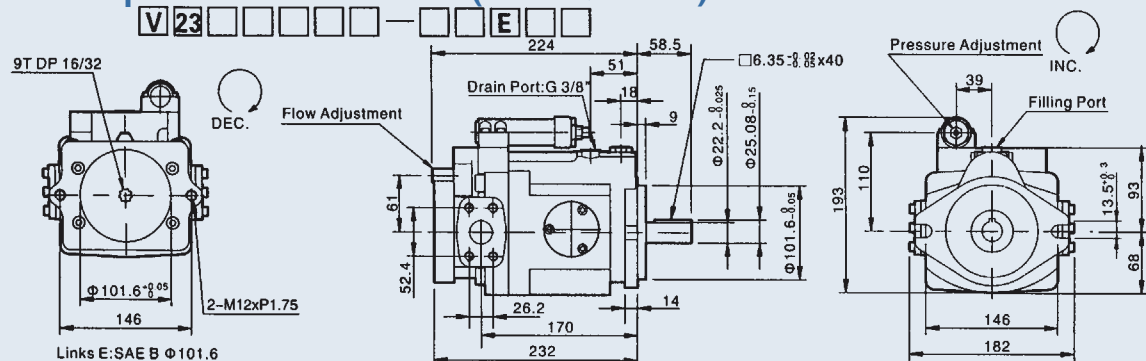
V23HQ, V25HQ Load-Sensing Proportional Flow Control



V23, V25 Prepared for Thru Drive (SAE A $\phi 82.55$)



V23, V25 Prepared for Thru Drive (SAE B $\phi 101.6$)



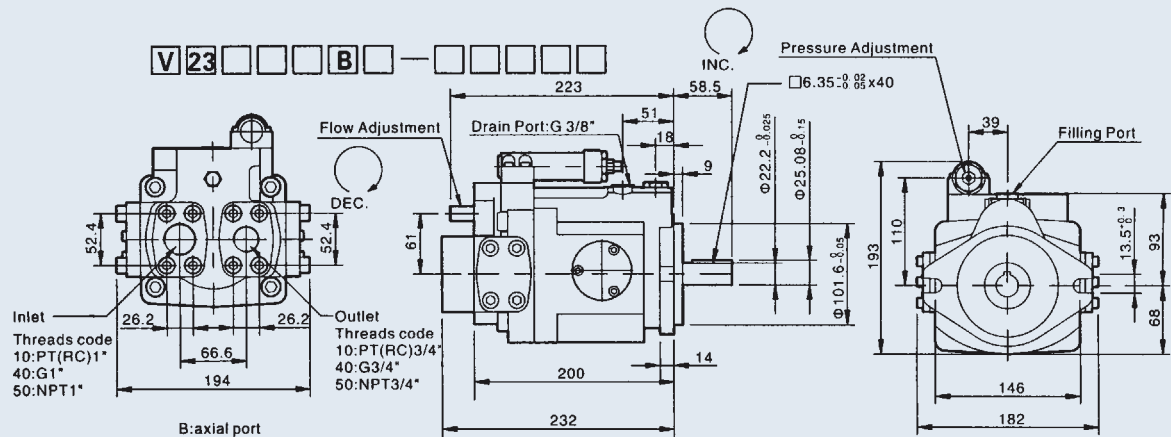
Type	A	B	C	CG	D	DG	E	EG	F	FG	G	GJ	GM	HL	HK	HQ
	O				O	O	O	O			O	O	O	O	O	O

Thru Drive Option

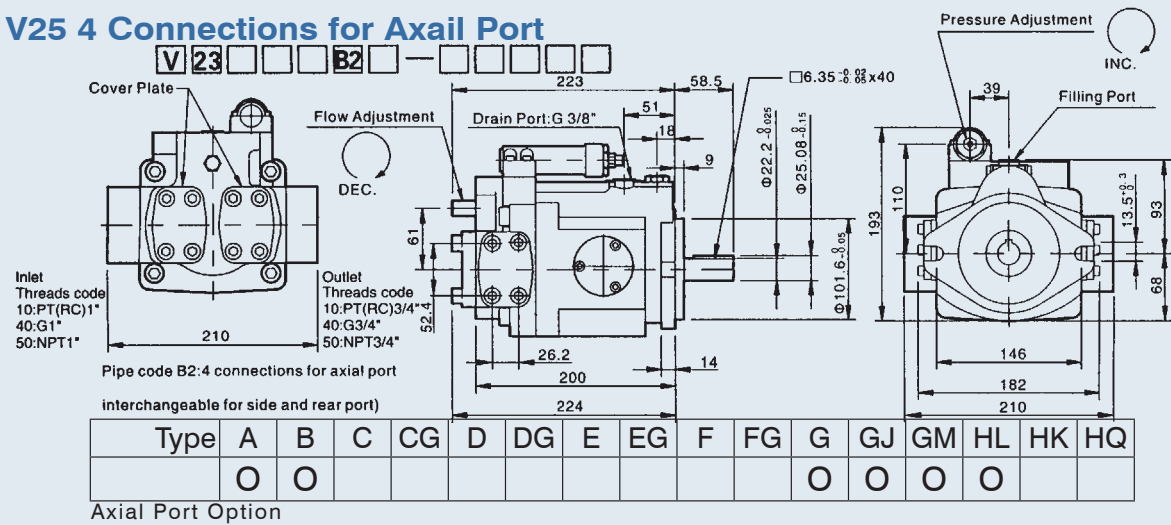
V SERIES AXIAL PISTON PUMP

Dimensions

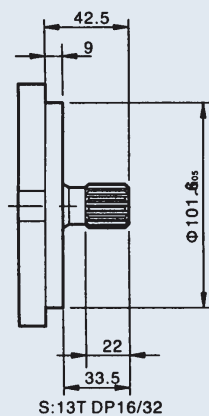
V23, V25 Axial Port



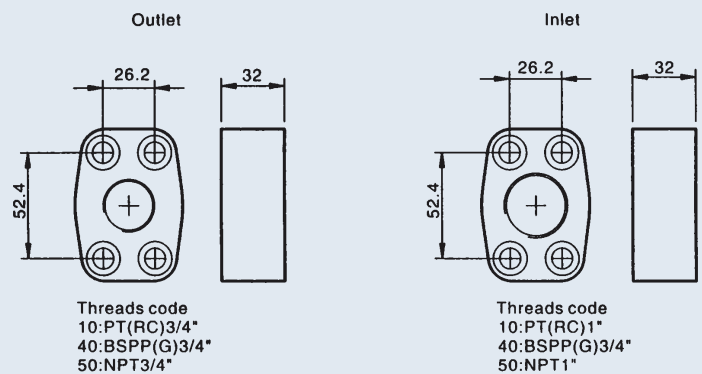
V23, V25 4 Connections for Axial Port



V23, V25 Splined Shaft Type



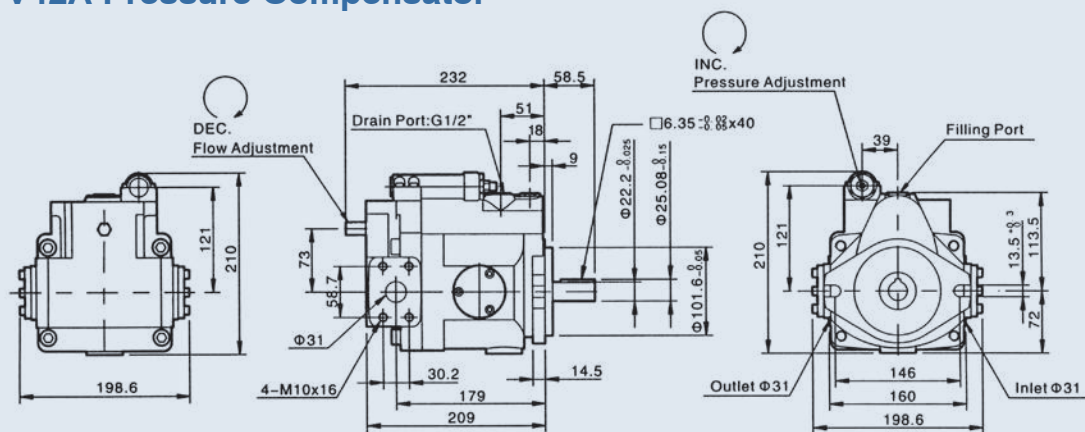
V23, V25 Hydraulic Flange



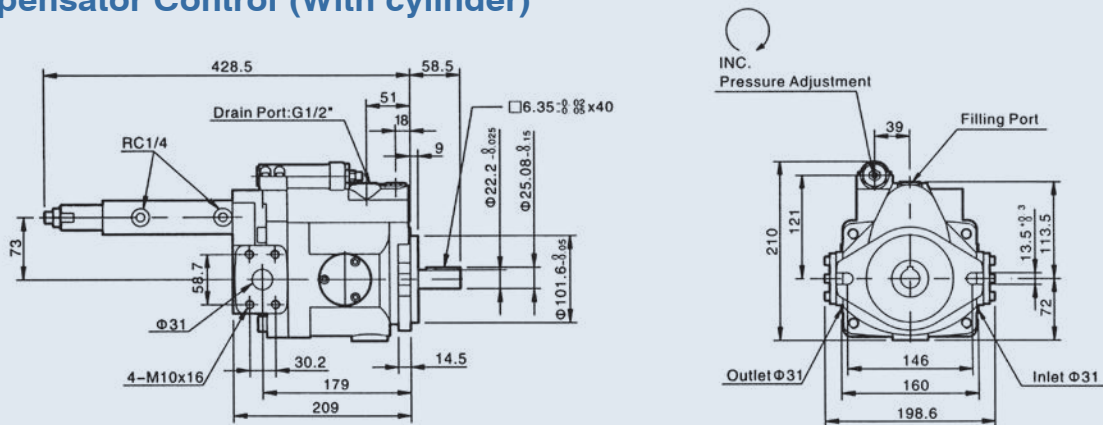
V SERIES AXIAL PISTON PUMP

Dimensions

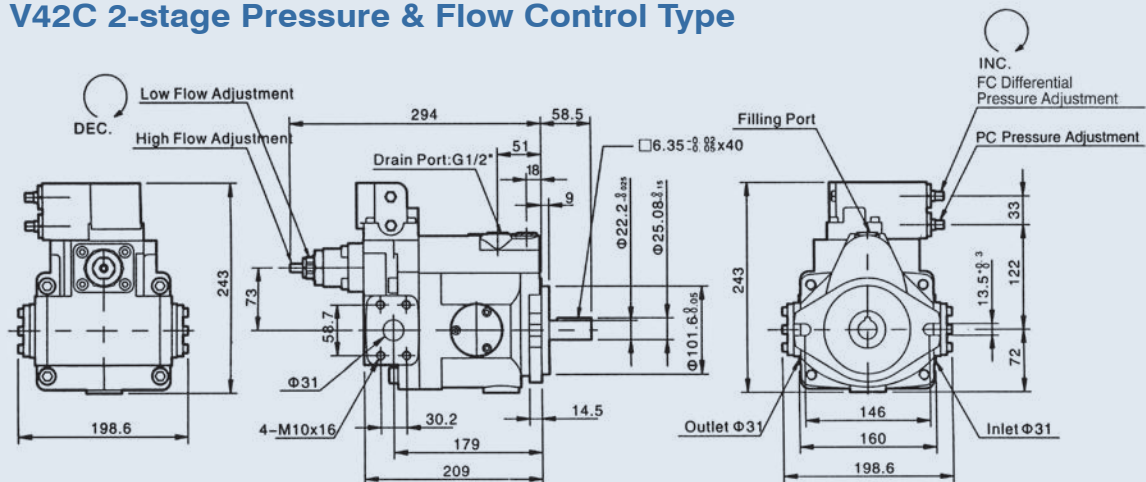
V38A, V42A Pressure Compensator



V38B, V42B Multi-stage Flow & Single-stage Pressure Compensator Control (With cylinder)



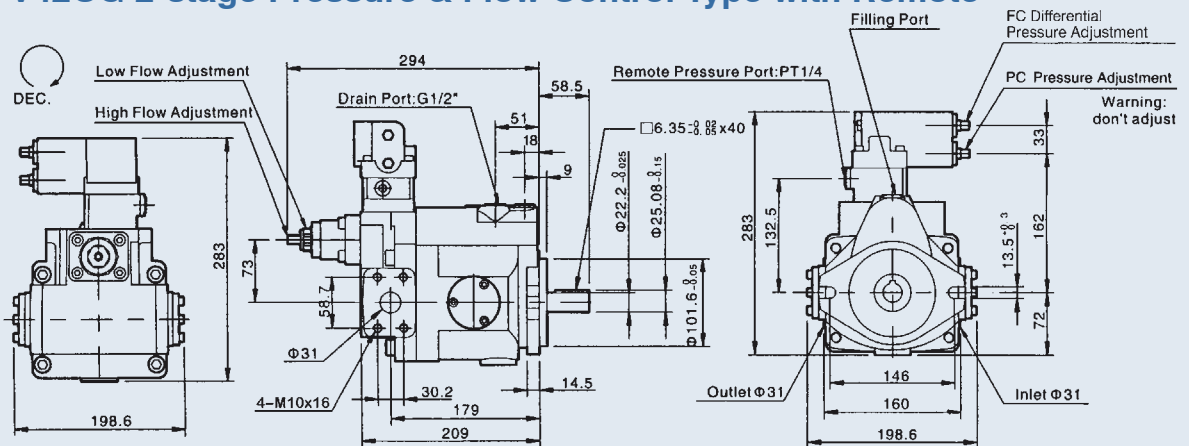
V38C, V42C 2-stage Pressure & Flow Control Type



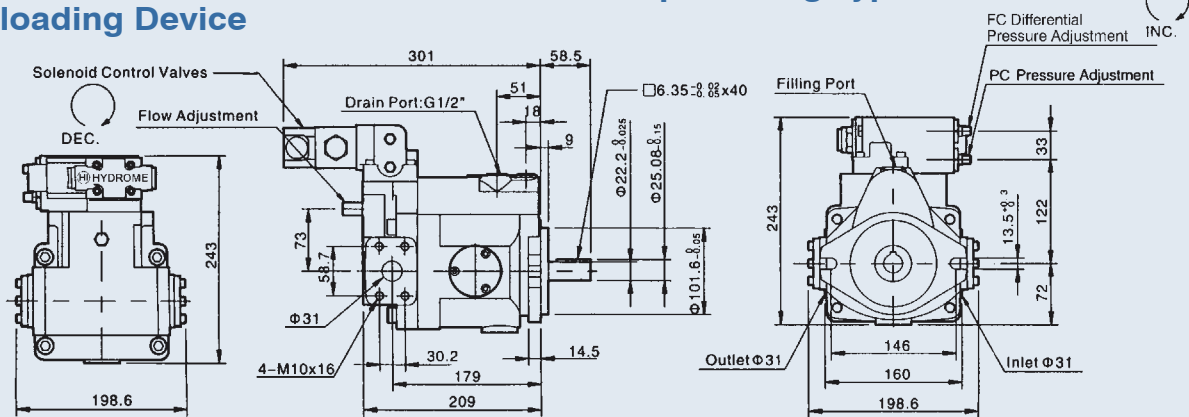
V SERIES AXIAL PISTON PUMP

Dimensions

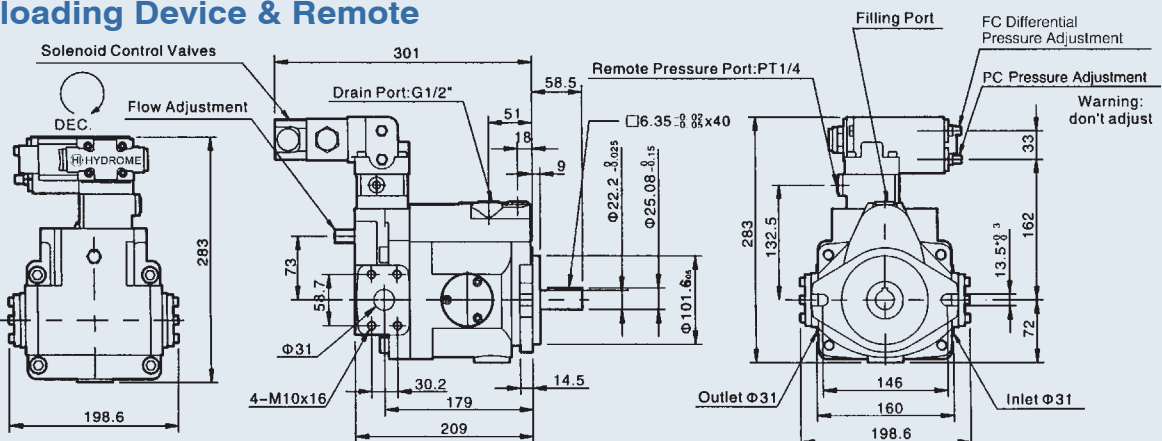
V38CG, V42CG 2-stage Pressure & Flow Control Type with Remote



V38D, V42D Solenoid Controlled Pressure Compensating Type with Unloading Device



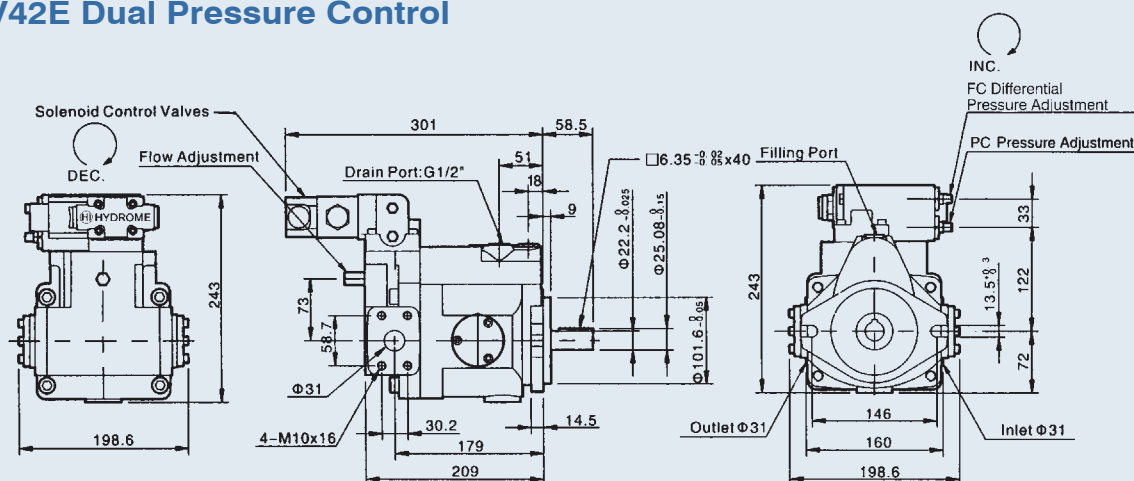
V38DG, V42DG Solenoid Controlled Pressure Compensating Type with Unloading Device & Remote



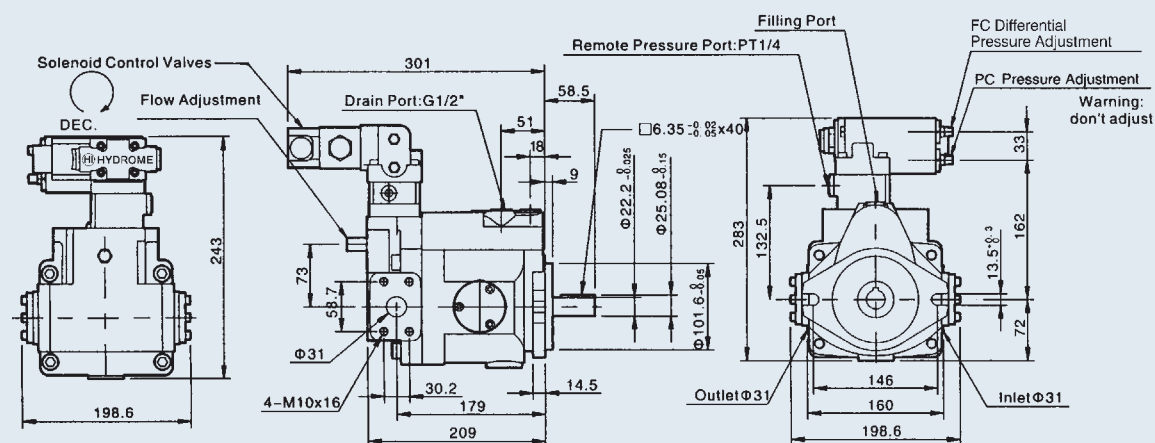
V SERIES AXIAL PISTON PUMP

Dimensions

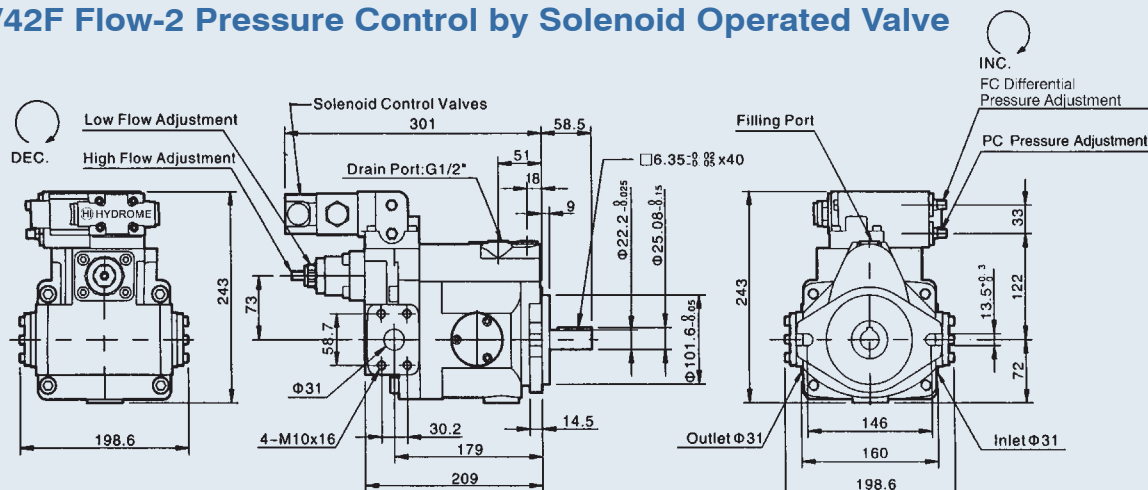
V38E, V42E Dual Pressure Control



V38EG, V42EG Dual & Remote Pressure Control



V38F, V42F Flow-2 Pressure Control by Solenoid Operated Valve



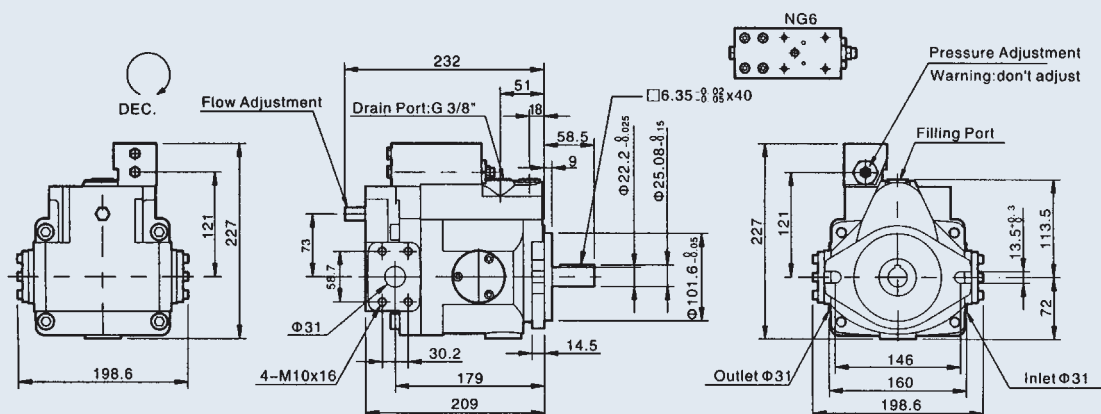
V38FG, V42FG 2 Flow-2 Pressure Control by Solenoid Operated & Remote Valve



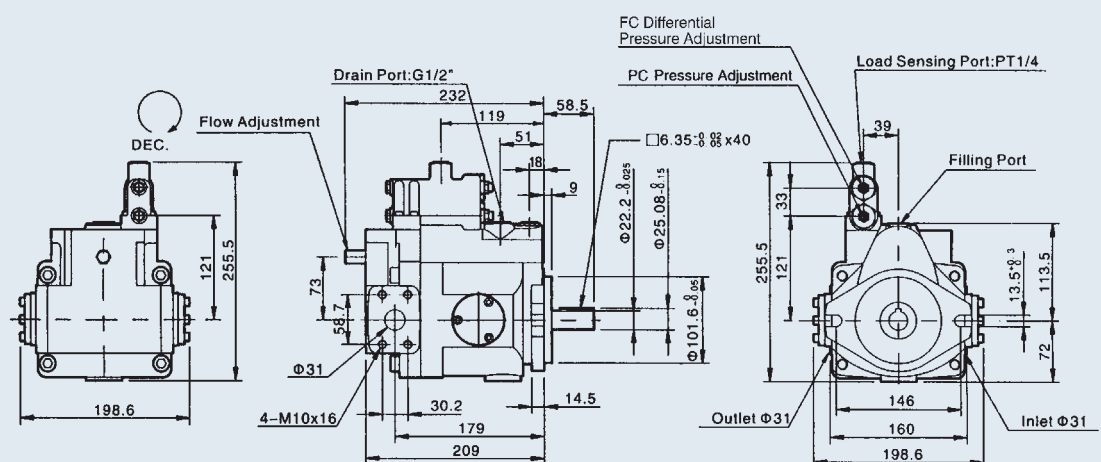
V SERIES AXIAL PISTON PUMP

Dimensions

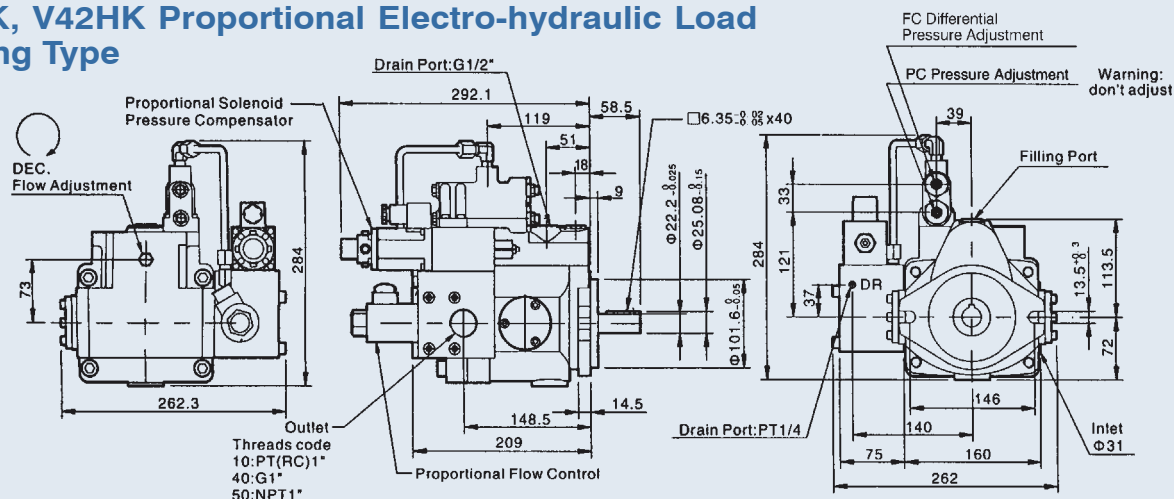
V38GM, V42GM Remote Interface (Not include valve)



V38HL, V42HL Load-sensing Compensator



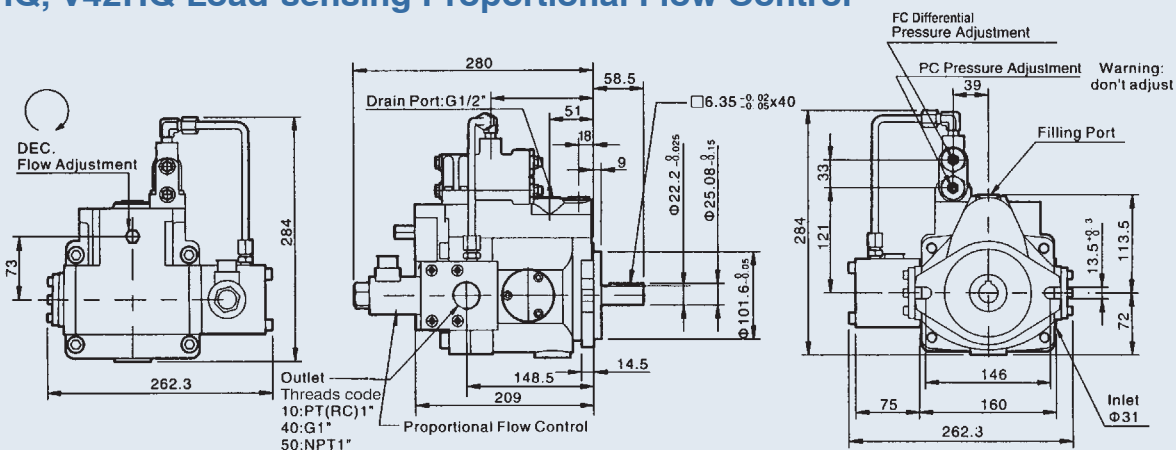
V38HK, V42HK Proportional Electro-hydraulic Load Sensing Type



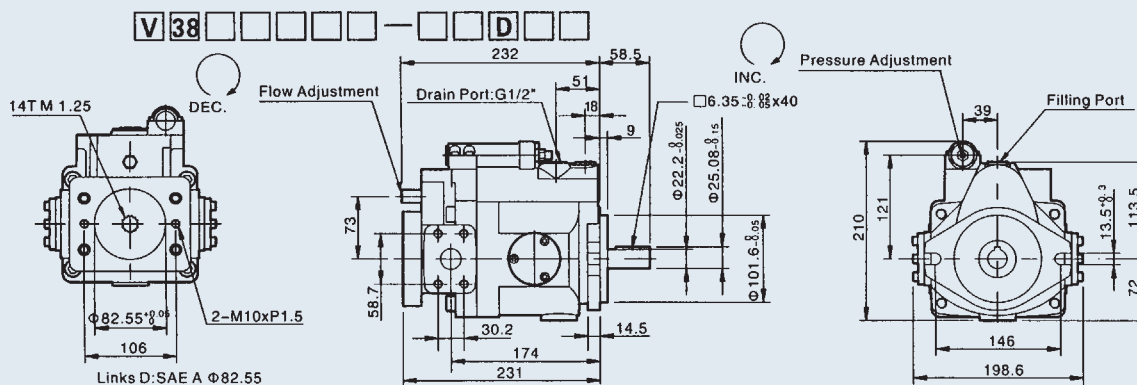
V SERIES AXIAL PISTON PUMP

Dimensions

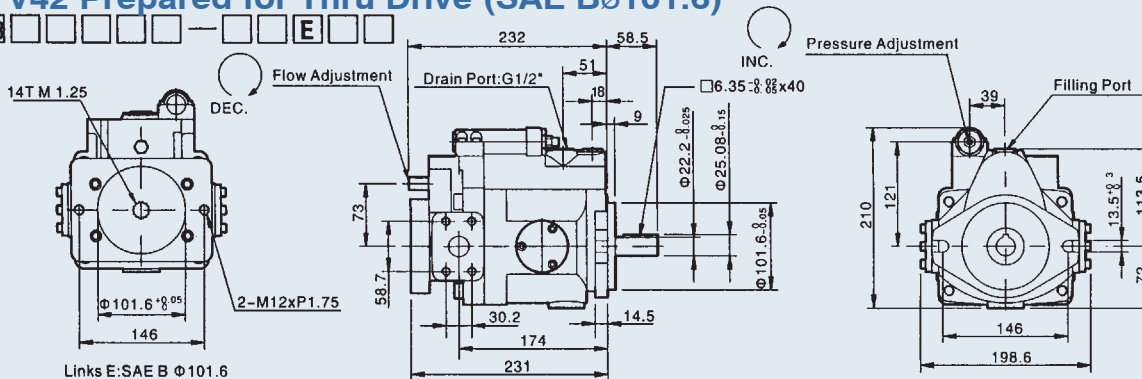
V38HQ, V42HQ Load-sensing Proportional Flow Control



V38, V42 Prepared for Thru Drive (SAE A $\Phi 82.55$)



V38, V42 Prepared for Thru Drive (SAE B $\Phi 101.6$)



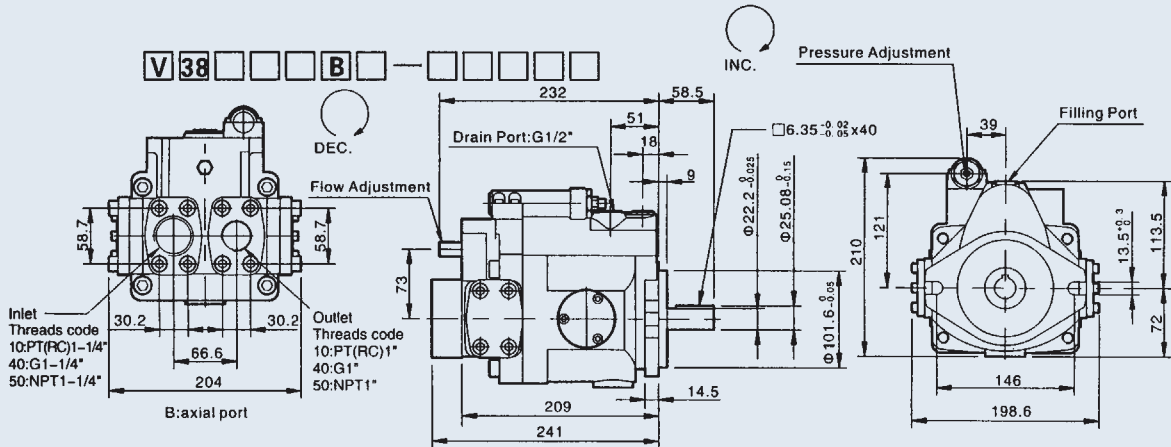
Type	A	B	C	CG	D	DG	E	EG	F	FG	G	GJ	GM	HL	HK	HQ
	O				O	O	O	O			O	O	O	O	O	O

Thru Drive Option

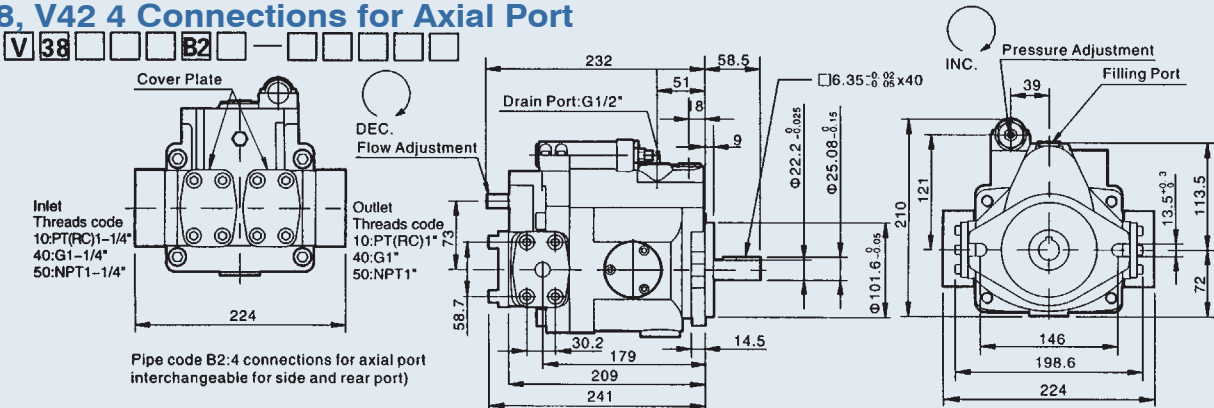
V SERIES AXIAL PISTON PUMP

Dimensions

V38, V42 Axial Port



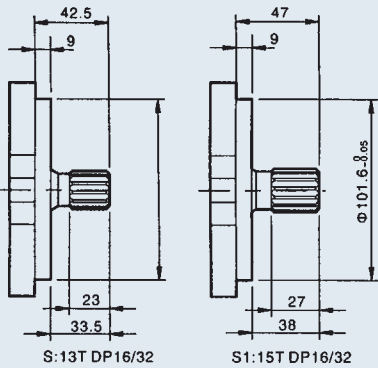
V38, V42 4 Connections for Axial Port



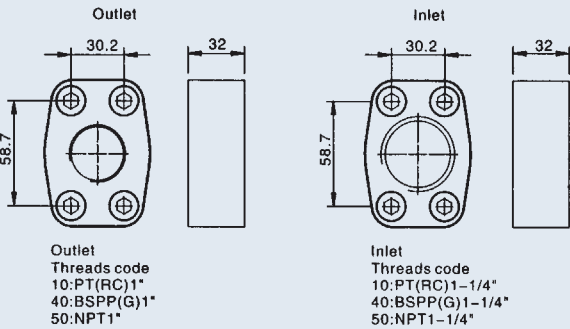
Type	A	B	C	CG	D	DG	E	EG	F	FG	G	GJ	GM	HL	HK	HQ
	O	O	O	O					O	O	O	O	O	O		

Axial Port Option

V38, V42 Splined Shaft Type



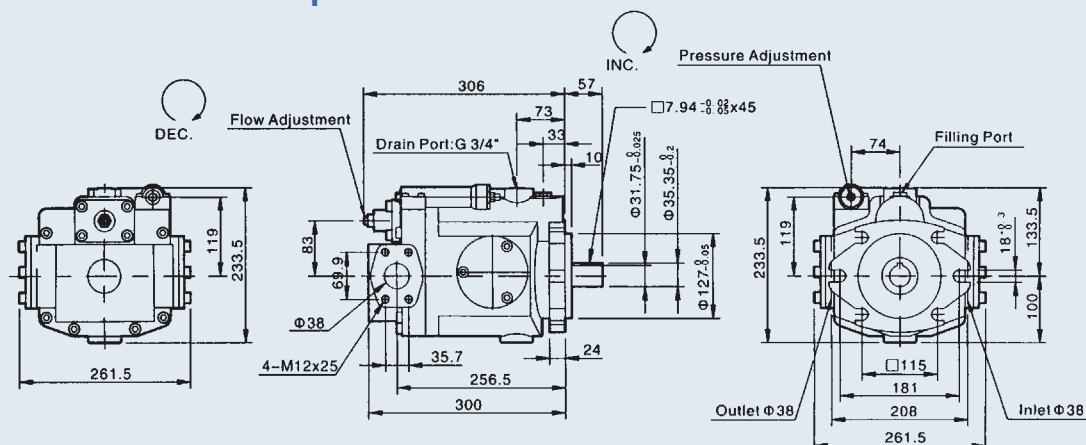
V38, V42 Hydraulic Flange



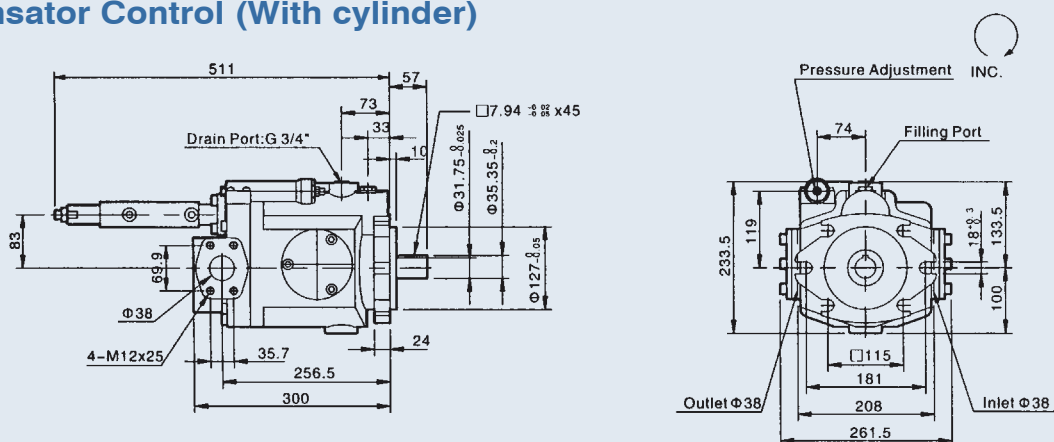
V SERIES AXIAL PISTON PUMP

Dimensions

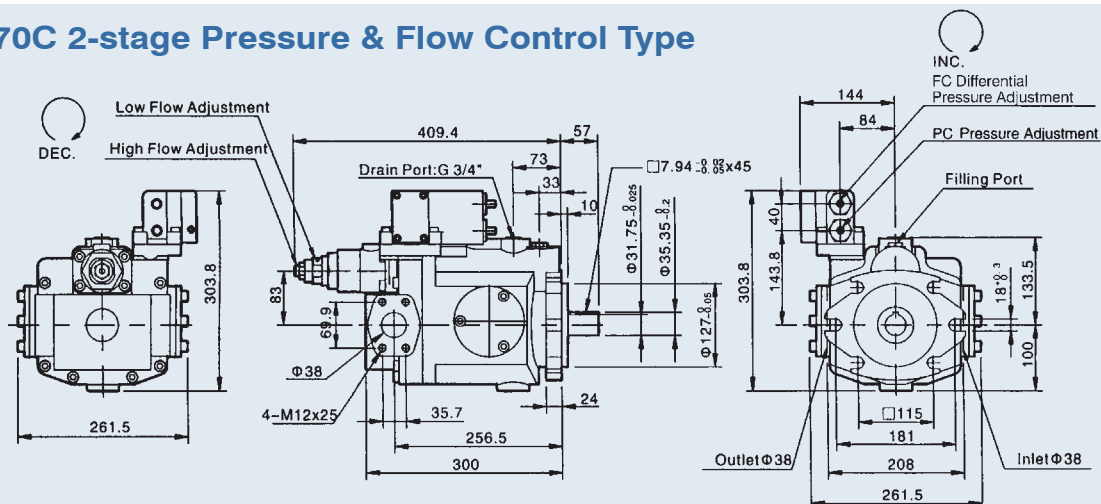
V50A, V70A Pressure Compensator



V50B, V70B Multi-stage Flow & Single-stage Pressure Compensator Control (With cylinder)



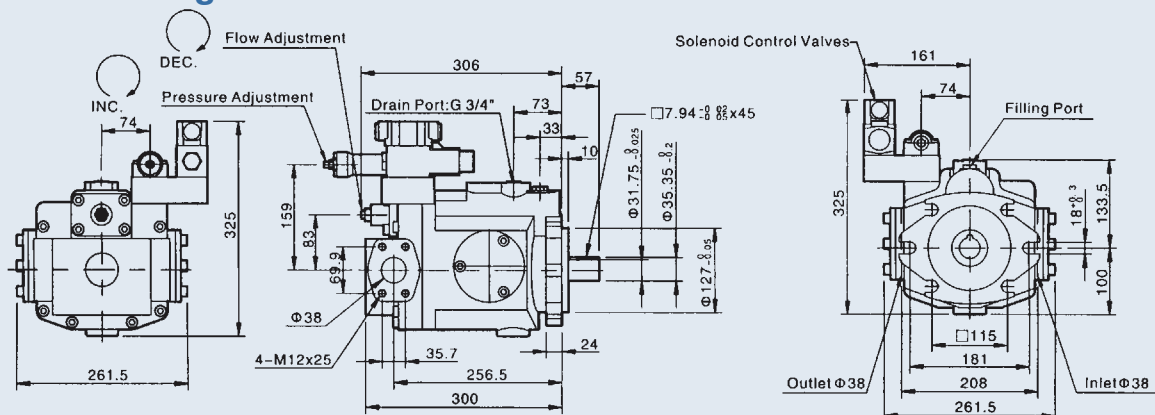
V50C, V70C 2-stage Pressure & Flow Control Type



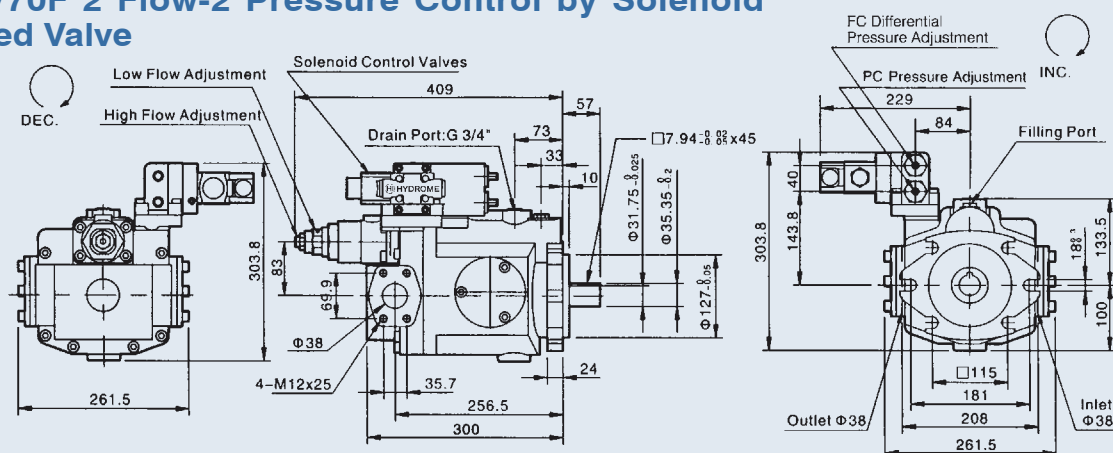
V SERIES AXIAL PISTON PUMP

Dimensions

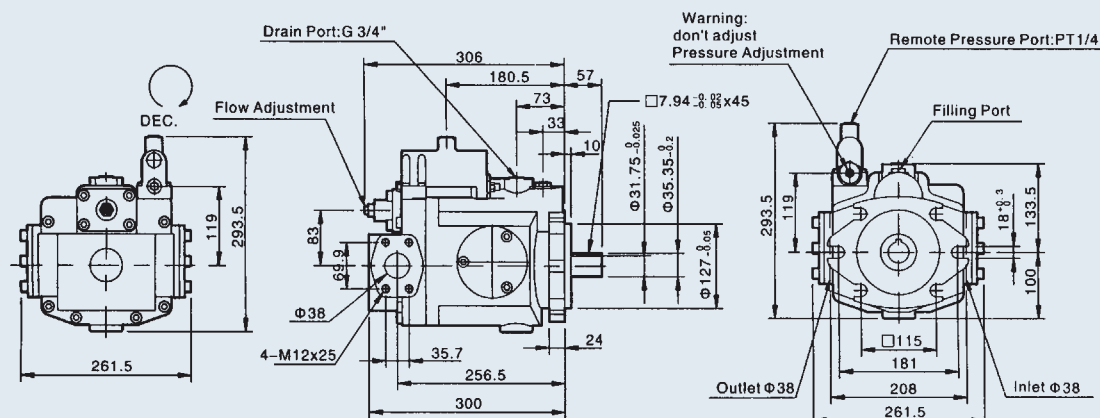
V50D, V70D Solenoid Controlled Pressure Compensating Type with Unloading Device



V50F, V70F 2 Flow-2 Pressure Control by Solenoid Operated Valve



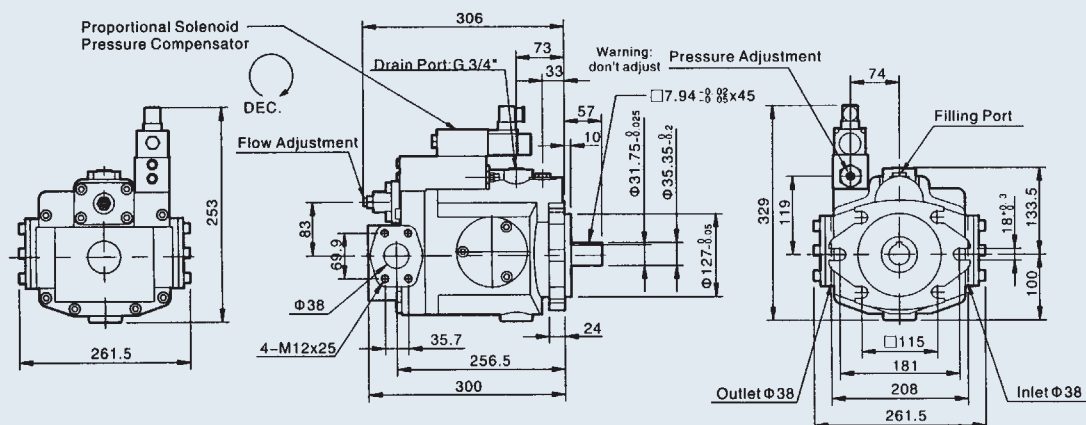
V50G, V70G Remoted Pressure Compensator Control



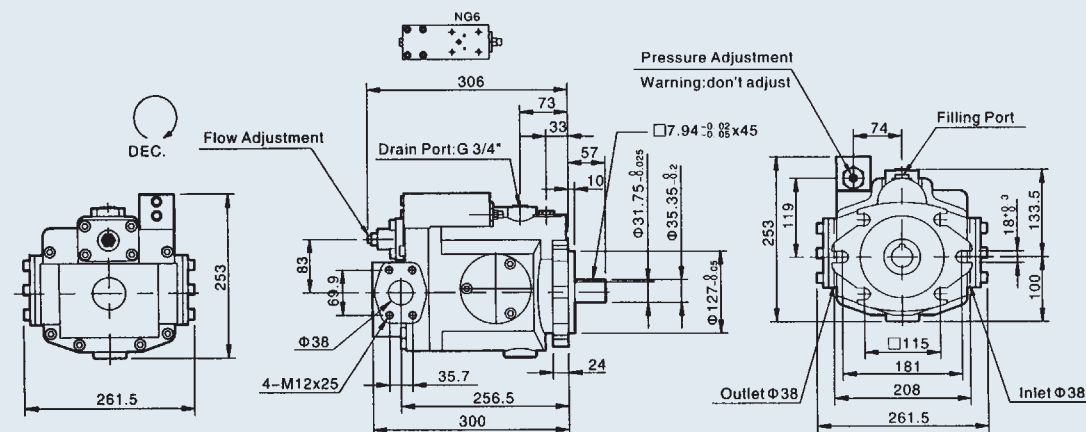
V SERIES AXIAL PISTON PUMP

Dimensions

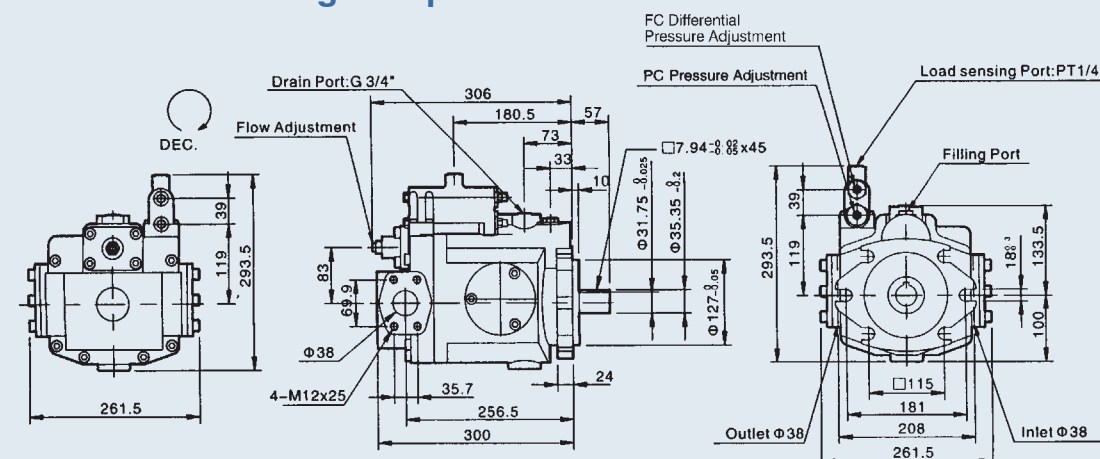
V50GJ, V70GJ Proportional Pressure with interface



V50GM, V70GM Remote Interface (Not include valve)



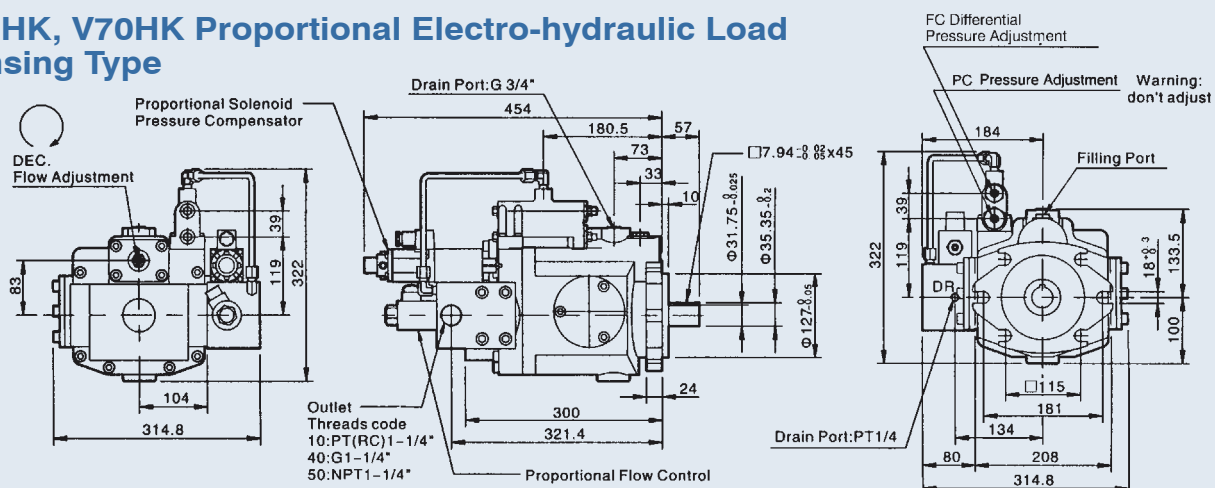
V50HL, V70HL Load-sensing Compensator



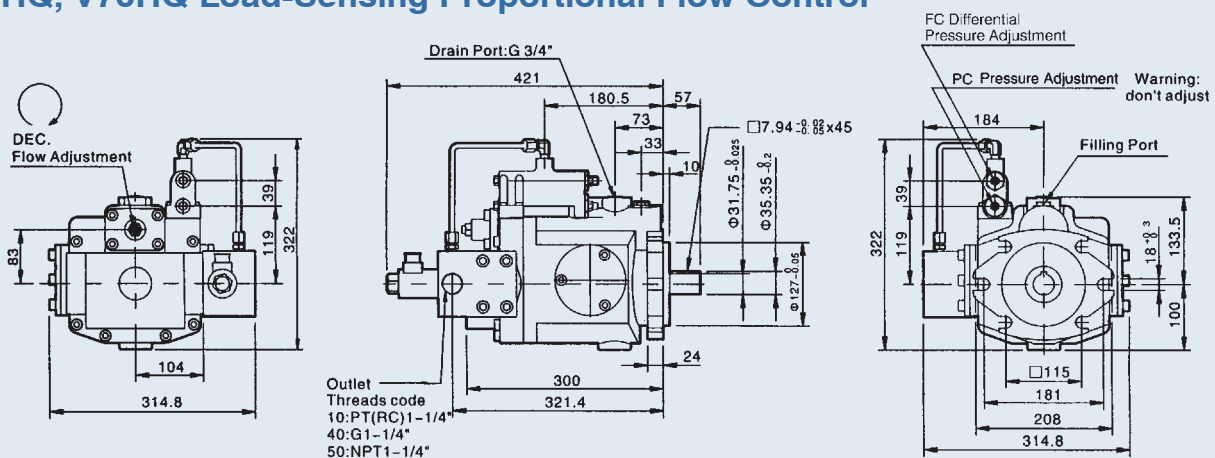
V SERIES AXIAL PISTON PUMP

Dimensions

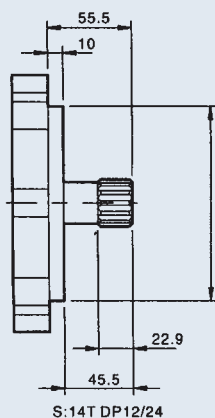
V50HK, V70HK Proportional Electro-hydraulic Load Sensing Type



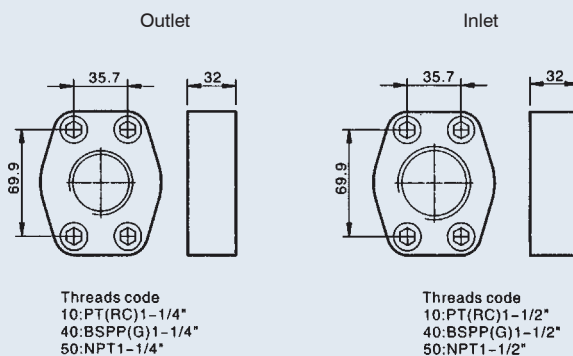
V50HQ, V70HQ Load-Sensing Proportional Flow Control



V50, V70 Splined Shaft Type



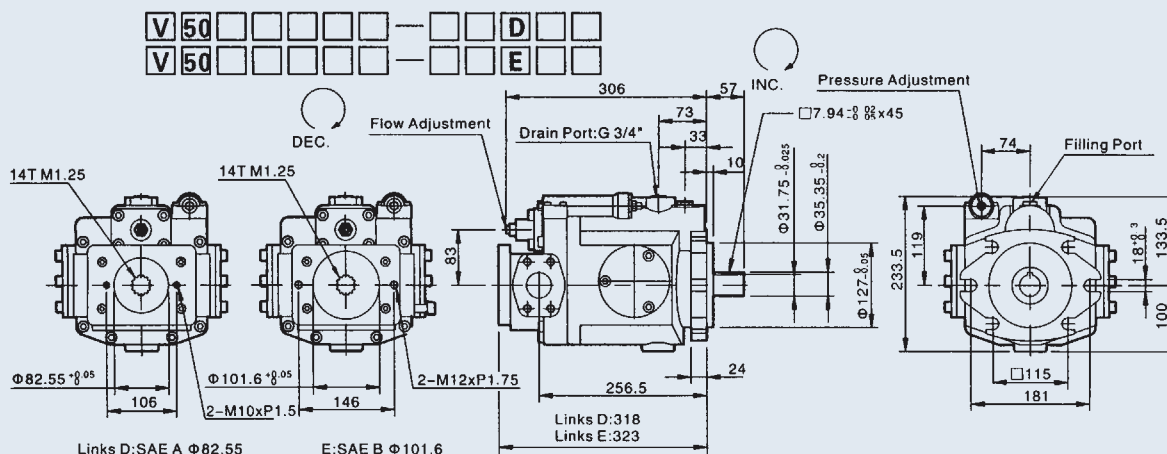
V50, V70 Hydraulic Flange



V SERIES AXIAL PISTON PUMP

Dimensions

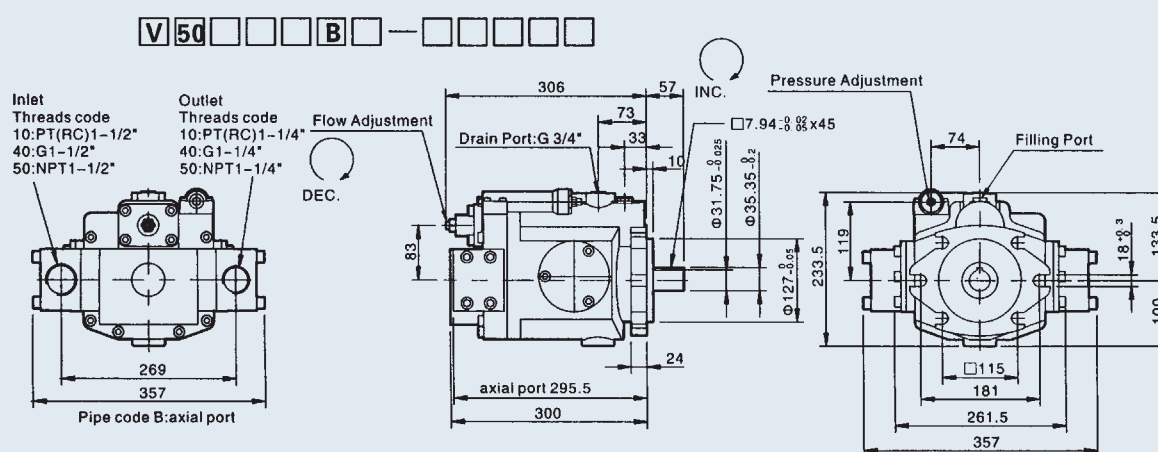
V50, V70 Prepared for Thru Drive (SAE Aø82.55, SAE Bø101.6)



Type	A	B	C	CG	D	DG	E	EG	F	FG	G	GJ	GM	HL	HK	HQ
	O				O	O	O	O			O	O	O	O	O	O

Thru Drive Option

V50, V70 Axial Port



Type	A	B	C	D	F	G	GJ	GM	HL	HK	HQ
	O	O	O	O	O	O	O	O	O		

Axial Port Option

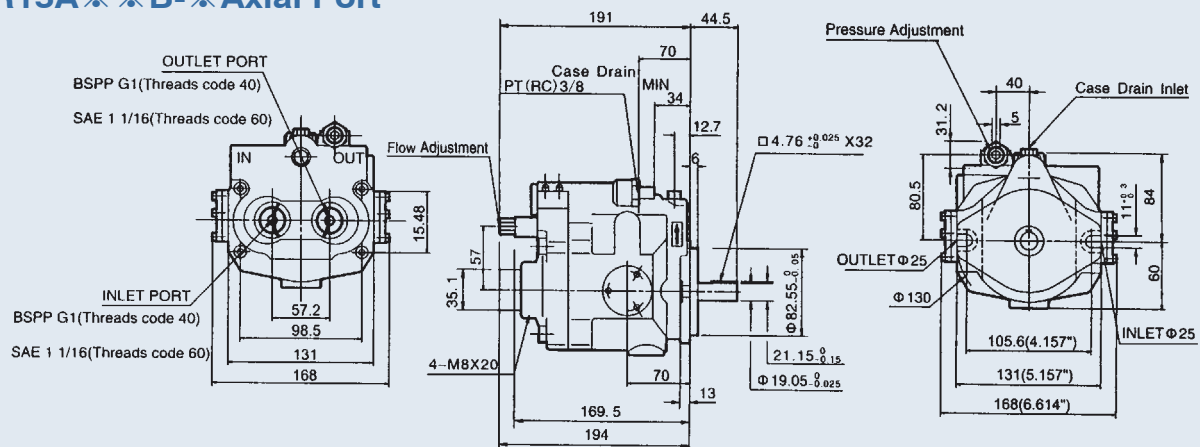
This exploded view diagram illustrates the assembly of a mechanical component, likely a pump or valve. The parts are numbered 1 through 66. The assembly is shown in a disassembled state, with components arranged to show their relative positions and how they fit together. Key sub-assemblies include a central body with a rotating element, a side housing, and a bottom cover. The diagram uses perspective to show the three-dimensional arrangement of the parts.

No.	Description	No.	Description	No.	Description	No.	Description
1	Bolt	18	Shaft Key	35	M snap ring	52	Valve plate
2	Port plug	19	Bearing of shaft	36	Plug	53	Snap ring
3	Pressure compensator	20	Bearing of shaft	37	Bolt	54	Washer cylinder block
4	O-ring	21	Servo spring washer	38	Flange	55	Retainer spring
5	Gasket	22	Servo spring	39	O-ring	56	Washer cylinder block
6	Lock nut	23	End cover seal	40	Bolt	57	Cylinder block
7	O-ring	24	Pump body	41	Roller	58	Roller
8	Control compensator shaft	25	Drain plug	42	Roller	59	Cylinder block holder
9	Spring washer	26	Filling screw	43	End cover	60	Slipper retainer
10	Control spring	27	O-ring	44	Roller	61	Pistons
11	O-ring washer	28	O-ring	45	O-ring	62	Piston head
12	O-ring	29	Swash shaft	46	Flange	63	Flow screw
13	Lock nut	30	Bolt	47	Bolt	64	O-ring
14	Screw	31	Bolt	48	Plug	65	Sleeve piston
15	Slipper plate	32	Swash shaft	49	Washer cylinder block	66	Servo piston sleeve
16	Swash	33	O-ring	50	Bearing of pump cover		
17	Shaft	34	Shaft seal	51	Bearing of pump cover		

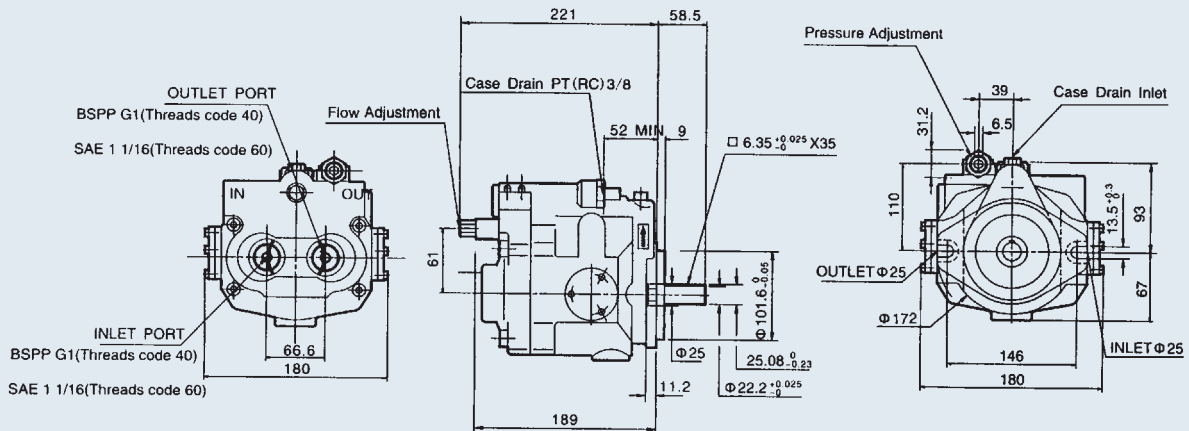
VR SERIES AXIAL PISTON PUMP

Dimensions

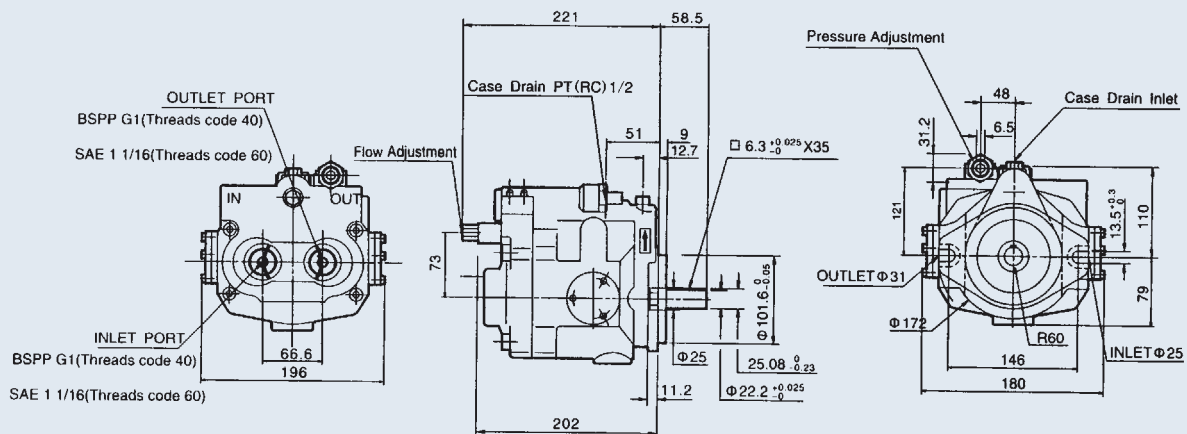
VR15A***B-Axial Port



VR23A***B-Axial Port (Pipe type)



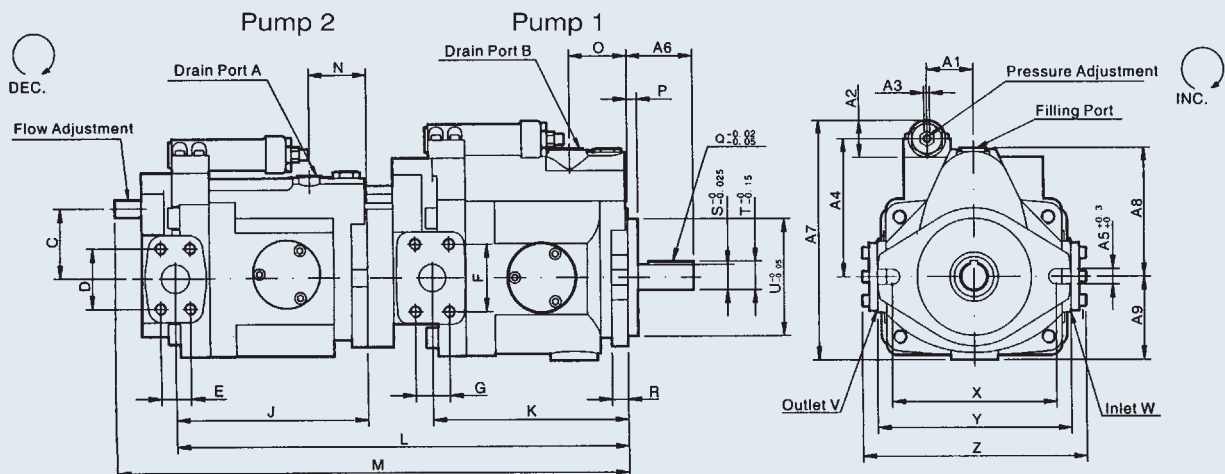
VR38A***B-Axial Port (Pipe type)



V SERIES TANDEM AXIAL PISTON PUMP

Tandem pump (Multi-option for tandem pump)

Pump 1	V15(V18)	V23(V25)	V23(V25)	V38(V42)	V38(V42)	V38(V42)	V50(V70)	V50(V70)	V50(V70)
Pump 2	V15(V18)	V15(V18)	V23(V25)	V15(V18)	V23(V25)	V38(V42)	V15(V18)	V23(V25)	V38(V42)
A	G 3/8"	G 3/8"	G 3/8"	G 3/8"	G 3/8"	G 1/2"	G 3/8"	G 3/8"	G 1/2"
B	G 3/8"	G 3/8"	G 3/8"	G 1/2"	G 1/2"	G 1/2"	G 3/4"	G 3/4"	G 3/4"
C	57.45	57.45	61	57.45	61	73	57.45	61	73
D	35.1	35.1	52.4	35.1	52.4	58.7	35.1	52.4	58.7
E	35.1	35.1	26.2	35.1	26.2	30.2	35.1	26.2	30.2
F	35.1	52.4	52.4	58.7	58.7	58.7	69.9	69.9	69.9
G	35.1	26.2	26.2	30.2	30.2	30.2	35.7	35.7	35.7
H	M8×20	M8×20	M10×16	M8×20	M10×16	M10×16	M8×20	M10×16	M10×16
I	M8×20	M10×16	M10×16	M10×16	M10×16	M10×16	M12×25	M12×25	M12×25
J	147	147	170	147	170	179	147	170	179
K	147	170	170	179	179	179	256.5	256.5	256.5
L	332	369	402	378	401	410	464	493	502
M	382	419	455	428	454	465	515	546	555
N	48	48	51	48	51	51	48	51	51
O	48	51	51	51	51	51	73	73	73
P	6	9	9	9	9	9	10	10	10
Q	4.76×32	6.35×40	6.35×40	6.35×40	6.35×40	6.35×40	7.94×45	7.94×45	7.94×45
R	13	14	14	14.5	14.5	14.5	24	24	24
S	ø19.05	ø22.22	ø22.22	ø22.22	ø22.22	ø22.22	ø31.75	ø31.75	ø31.75
T	21.15	25.08	25.08	25.08	25.08	25.08	35.35	35.35	35.35
U	ø82.55	ø101.6	ø101.6	ø101.6	ø101.6	ø101.6	ø127	ø127	ø127
V	ø25	ø25	ø25	ø31	ø31	ø31	ø38	ø38	ø38
W	ø25	ø25	ø25	ø31	ø31	ø31	ø38	ø38	ø38
X	106	146	146	146	146	146	181	181	181
Y	131	146	146	160	160	160	208	208	208
Z	165	182	182	198.6	198.6	198.6	261.5	261.5	261.5
A1	44	39	39	39	39	39	74	74	74
A2	31.2	31.2	31.2	31.2	31.2	31.2	40	40	40
A3	5	5	5	5	5	5	8	8	8
A4	84	110	110	121	121	121	119	119	119
A5	11	13.5	13.5	13.5	13.5	13.5	18	18	18
A6	44.5	58.5	58.5	58.5	58.5	58.5	57	57	57
A7	160	193	193	210	210	210	233.5	233.5	233.5
A8	91.5	93	93	113.5	113.5	113.5	133.5	133.5	133.5
A9	60	68	68	72	72	72	100	100	100

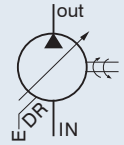


AR SERIES AXIAL PISTON PUMP

AR Control Type (see page. 15,16,17)



- 01: Pressure Compensator
- G: Remote Pressure Compensator
- GJ: Layer Porportional Pressure Compensator
- GR: Electrical Unloading
- GB: Dual Pressure Control
- GC: Dual Pressure+Electrical Unloading
- GM: Remote Pressure Compensator allows a pilot valve
- HL: Load-sensing Compensator

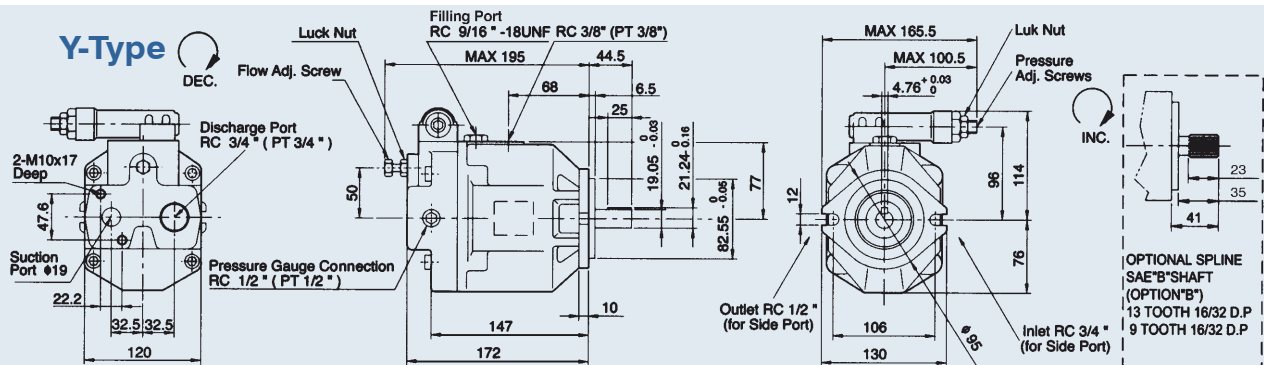


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Ordering Codes

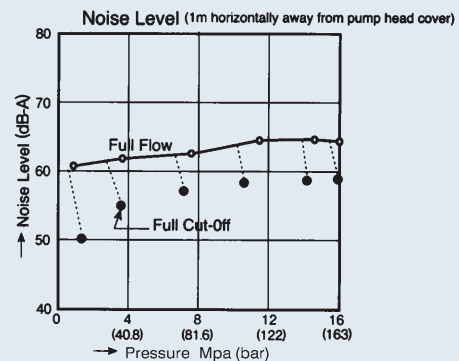
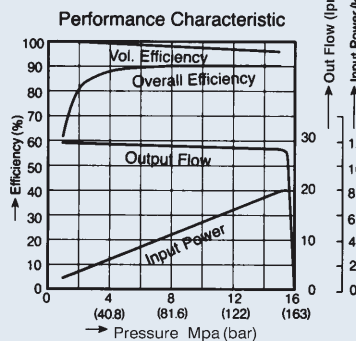
※Standard

Model	F	R	01	C	S	K	10	Y
	Mounting	Direction of Rotation	Control Type	Pres. Adj. Range bar (MPa)	Port Position	Shaft Extension	Threads Code	Design
AR16 (15.8cc/rev)	F: Flange Mtg.	Viewed from Shaft End * R: Clockwise (Standard) L: Counter Clockwise	01: Pressure Compensator Type HL: Load Sensing Compensator G: Remote Pressure Compensator	B:12~70 (1.2~7) C:12~210 (1.2~21)	None: Axial Port S: Side Port	*K: Keyed G: 16/32 DP-13T T: 16/32 DP-9T	*10: PT(RC) theard 40: BSPP(G) theard 50: NPT theard	X *Y
AR22 (22.2cc/rev)								



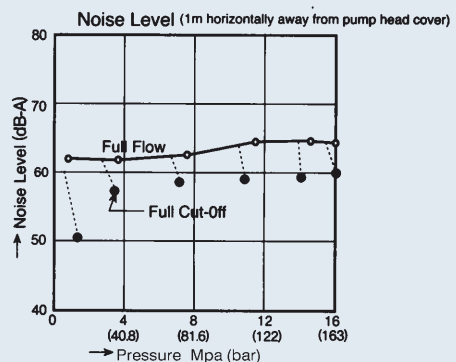
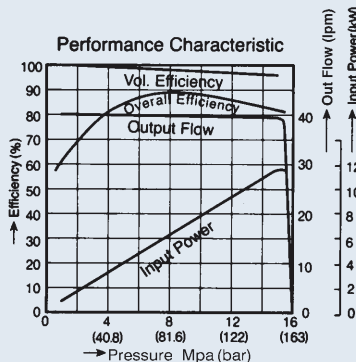
AR-16 Input Speed:1800 rpm/min

Fluid:Standard Hydraulic Oil ISO VG32 @50°C



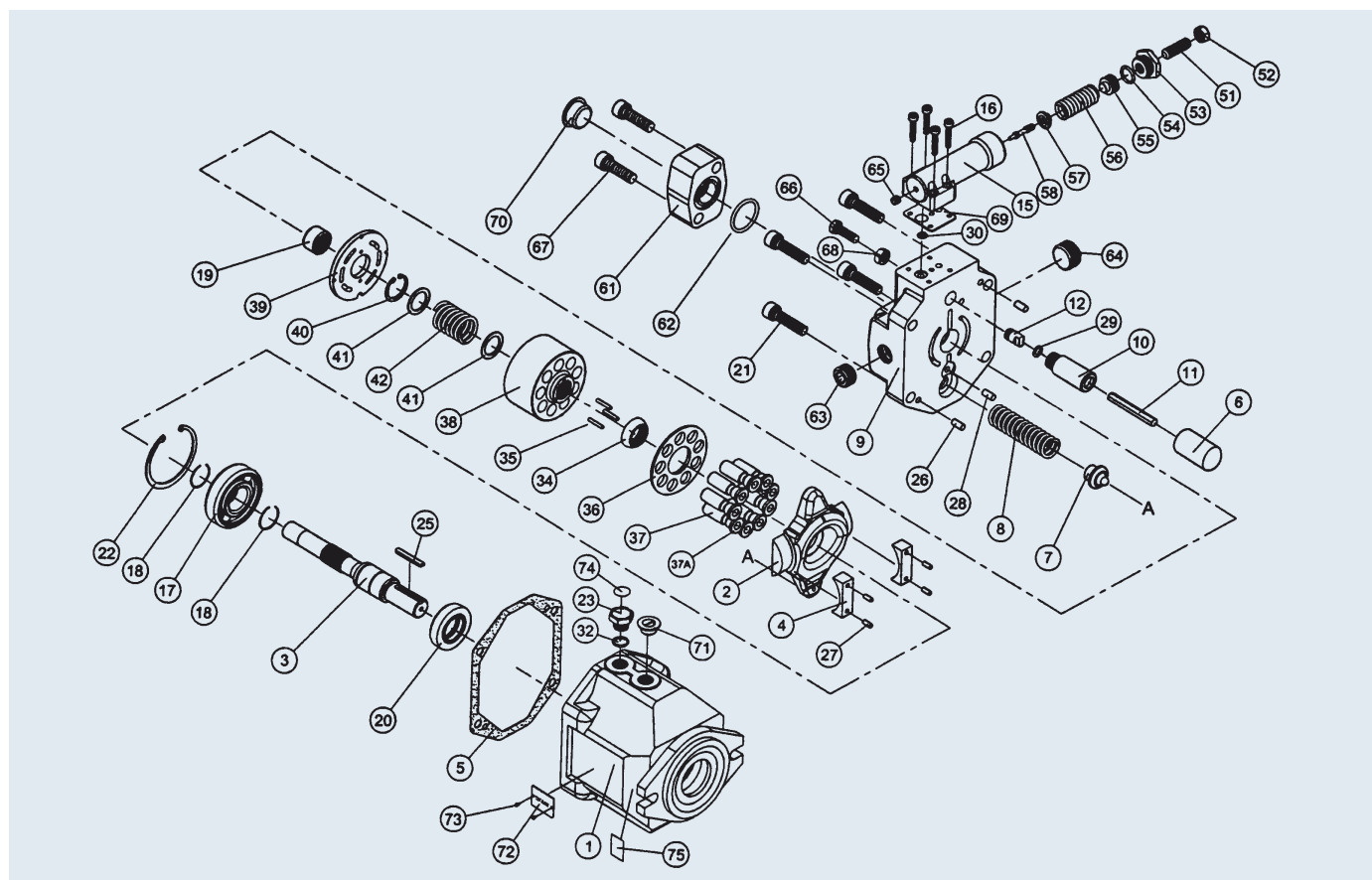
AR-22 Input Speed:1800 rpm/min

Fluid:Standard Hydraulic Oil ISO VG32 @50°C



AR SERIES AXIAL PISTON PUMP

Decomposition Chart

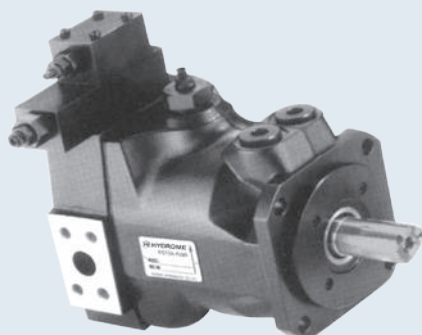


List of parts

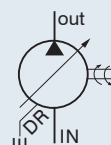
No.	Description	No.	Description	No.	Description	No.	Description
1	Pump body	18	C snap ring 1-1/2	36	Slipper retainer	58	Control compensator shaft
2	Swash	19	1715 bearing rear	37	Piston	61	Flange 506A (6")
3	Swash shaft	20	Shaft seal	37A	Head of piston	62	O-ring G30
4	Swash plate	21	Screw M10x40L	38	Cylinder block	63	Pipe plug 1/2
5	Body seal	22	R62 snap ring	39	Valve plate	64	Pipe plug 3/4
6	Servo piston sleeve	23	Plug, feeder	40	Snap ring for bore R28	65	NPT 1/16
7	Servo spring washer	25	Key	41	Washer cylinder block	66	Screw M8x35
8	Swash spring	26	Locator pin, body	42	Retainer spring	67	Screw M10x35
9	Pump body / end cover	27	Locator pin, cradle	51	Screw M10x30	68	Lock nut M8
10	Sleeve piston	28	Locator pin, ø6x12.8	52	Lock nut M10	69	Body seal
11	Flow bar	29	O-ring P8 70°	53	Control lock nut	70	Plastic plug 3/4
12	Seal	30	O-ring P7	54	O-ring P14 70°	71	Plastic plug 3/8
15	Valve	32	O-ring S11	55	Control washer	72-73	Name Plate
16	Screw M5x25L	34	Cylinder block holder	56	Control spring	74-75	Description label
17	6305 bearing front	35	Roller	57	Spring washer		

PV SERIES AXIAL PISTON PUMP

FEATURES



1. New type of swash plate and large servo pistons with strong bias spring achieve fast response, reduce the noise due to active decompression of system at down stroke.
2. Nine piston and new precompression technology (precompression filter volume) result in unbeaten low outlet flow pulsation.
3. Rigid and FEM-optimized body design for lowest noise level.
4. Thru drive for 100% nominal torque.
5. Pump combinations (tandem pumps) of same size and model and mounting interface for basically all metric or SAE mounting interfaces.



Continuous: 350bar
Intermittent: 420bar

B

Quick Reference Data Chart

Model	Displacement		Pump Delivery (7 bar) 100 PSI					
			1200 RPM		1500 RPM		1800 RPM	
	cc/rev	in³/rev	LPM	U.S. GPM	LPM	U.S. GPM	LPM	U.S. GPM
PV016	16	0.98	19.2	5.1	24	6.3	28.8	7.6
PV020	20	1.2	24	6.3	30	7.9	36	9.5
PV023	23	1.4	27.6	7.3	34.5	9.1	41.4	10.9
PV032	32	19	38.4	10.1	48	12.7	57.6	15.2
PV040	40	2.4	48	12.7	60	15.9	72	19
PV046	46	2.8	55.2	14.6	69	18.2	82.8	21.9
PV063	63	3.8	75.6	20	94.5	25	113.4	30
PV071	71	4.3	85.8	22.7	107	28.3	128.7	34
PV080	80	4.8	96	25.4	120	31.7	144	38
PV092	92	5.6	110.4	29.2	138	36.5	165.6	43.8
PV140	140	8.5	168	44.4	210	55.5	252.1	66.6
PV180	180	11	216	57.1	270	71.3	324	85.6
PV270	270	16.5	324	85.6	405	107	486	128.4

Model	APPROX. Noise Levels Db(A) Full Flow and 1500 RPM			Input Horse Power, Max. Displacement & 345 bar (5000PSI)		Operating Speed		Weight (kg)	
	70 bar (1 KPSI)	207 bar (3 KPSI)	343 bar (5 KPSI)	1500 rpm	1800 rpm	Max.	Min.		
				KW(hp)	KW(hp)	RPM	RPM	kg	lb
PV016	56	60	68	15.5 (20.8)	18.5 (24.8)	2750	300	19	41.8
PV020				19.5 (26.1)	23.4 (31.4)				
PV023				22.5 (30.2)	25.1 (33.6)				
PV032	59	62	69	31 (41.6)	35.1 (47.1)	2400		30	66
PV040				39 (52.3)	46.5 (62.3)				
PV046				45 (60.3)	50.2 (67.3)				
PV063	66	70	74	61.5 (82.4)	70.1 (94)	2100		60	132
PV071				70 (93.8)	80 (107.2)	2100			
PV080				78 (104.6)	89.2 (119.6)	2000			
PV092				89.5 (120)	136.8 (183.4)	1900			
PV140	70	74	76	136 (182.3)	149.4 (200.3)	2200		90	198
PV180	71	75	77	175 (235)	210 (282)	2200		90	198
PV270	77	79	81	263 (353)	298 (400)	1800		172	378.4

1. Installation outlet port top, the pipe have to less than 2 bar.
2. The use of max. pressure override 6 min, hydraulic oil clean that see General Installation Information.
3. Hydrome offer tandem pumps, and other pumps connection, the connection type use metric version and SAE version dimensions.

PV SERIES AXIAL PISTON PUMP

How to order

PV - 063 - GT - R - M - 1 - A - ✱ - ✱ - ✱

1 2 3 4 5 6 7 8 9 10

1	Series	Axial piston pump variable displacement high pressure version
---	--------	---

2	Size and Displacement	
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Code	Displacement cc/rev (In ³ /rev)	Code	Displacement cc/rev (In ³ /rev)	Code	Displacement cc/rev (In ³ /rev)
016	16 (0.98)	046	46 (2.8)	140	140 (8.5)
020	20 (1.2)	063	63 (3.8)	180	180 (10.9)
023	23 (1.4)	071	71 (4.3)	270	270 (16.5)
032	32 (1.9)	080	80 (4.8)		
040	40 (2.4)	092	92 (5.6)		

3	Control Types	
---	---------------	--

	Code	Compensator	Code	Horse power	PV016~ PV023	PV032~ PV046	PV063~ PV092	PV140	PV180	PV270
✱	Standard Type Pressure Compensator		A	3 KW	●					
	A2	10~140 bar	B	4 KW	●					
	A3	40~210 bar	C	5.5 KW	●	●				
	A4	70~350 bar	D	7.5 KW	●	●				
	Remote Type		E	11 KW	●	●	●			
✱	GT	Remote pressure compensator	F	15 KW		●	●			
✱	GM	Remote pressure compensator allows a pilot valve	G	18.5 KW		●	●	●		
	GA	Remote pressure compensator allows a pilot valve (valve included)	H	22 KW		●	●	●	●	
	GJ	Layer proportional pressure compensator (valve included)	I	30 KW			●	●	●	
	Electrical Unloading Type		J	37 KW			●	●	●	●
	GR	Electrical unloading	K	45 KW			●	●	●	●
	GB	Dual pressure control	L	55 KW				●	●	●
	GC	Dual pressure+electrical unloading	M	75 KW					●	●
	Load-sensing Type		N	90 KW					●	●
✱	HL	Load-sensing type	O	110 KW						●
	HM	Load-sensing type	P	132 KW						●
	HJ	2-valve load-sensing type (valve included)								
	HA	2-valve load-sensing type								
	HK	Proportional electro-hydraulic load sensing type								
	HQ	Load-sensing & Proportional flow control								
	Proportionable displacement Type									
	FV	Proportionable displacement control								
	FR	Proportionable displacement control with pressure								
	FG	Proportionable displacement control with pressure control								
	Horse Power Type									
	PA□	Horse power compensator								
✱	PM□	Horse power compensator, pilot flow internal pressure pilot valve (valve included)								
	PG□	Horse power compensator, pilot flow internal								
	PL□	Horse power compensator, load-sensing compensator								
	PH□	Horse power compensator, pilot flow external for load-sensing								

4	Rotation (Viewed from shaft end)	
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	Code	Rotation
✱	R	clockwise ↻
	L	counterclockwise ↺

PV SERIES AXIAL PISTON PUMP

How to order

PV - 063 - GT - R - M - 1 - A - * - * - *

1 2 3 4 5 6 7 8 9 10

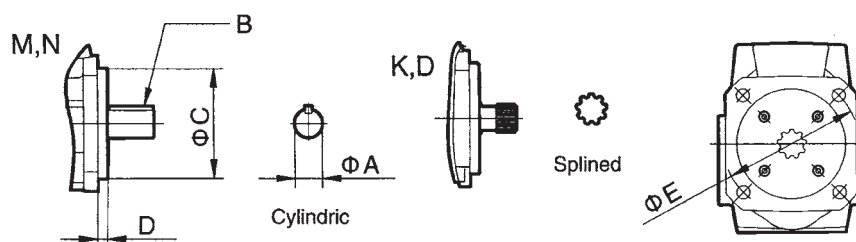
5 Mounting

※

Code		Mounting		Code		Mounting		
M (standard)		Metric	ISO 3019/2 Cylindric, key		N	Inch	ISO 3019/1 Cylindric, key	
K			ISO 3019/2 Splined, DIN5480		D		ISO 3019/1 Splined, SAE	

※

Code		Model	Shaft		Flange		Mounting
			A	B	C	D	E
M	Metric	PV016~PV023	ø25	8×7×40	ø100	9	ø125
		PV032~PV046	ø32	10×8×56	ø125	9	ø160
		PV063~PV092	ø40	12×8×80	ø160	9	ø200
		PV140~PV180	ø50	12×8×80	ø160	9	ø200
		PV270	ø65	12×8×80	ø200	9	ø250
K	Metric	PV016~PV023	W25×1.5×15×8f DIN5480		ø100	9	ø125
		PV032~PV046	W32×1.5×20×8f DIN5480		ø125	9	ø160
		PV063~PV092	W40×1.5×25×8f DIN5480		ø160	9	ø200
		PV140~PV180	W50×2×24×9g DIN5480		ø160	9	ø200
		PV270	W60×2×28×9g DIN5480		ø200	9	ø250
N	Inch	PV016~PV023	ø1"	0.25"×0.25"×1.6"	ø4"	3/8"	ø5"
		PV032~PV046	ø1-1/4"	5/16"×5/16"×2.2"	ø5"	1/2"	ø6.37"
		PV063~PV092	ø1-3/4"	7/16"×7/16"×3.15"	ø6"	1/2"	ø9"
		PV140~PV180	ø2"	1/2"×1/2"×2.95"	ø6"	1/2"	ø9"
		PV270	ø2"	1/2"×1/2"×2.95"	ø6.5"	5/8"	ø12.5"
D	Inch	PV016~PV023	Splined 15T 16/32DP ANSI B92.1		ø4"	3/8"	ø5"
		PV032~PV046	Splined 14T 12/24DP ANSI B92.1		ø5"	1/2"	ø6.37"
		PV063~PV092	Splined 13T 8/16DP ANSI B92.1		ø6"	1/2"	ø9"
		PV140~PV180	Splined 15T 8/16DP ANSI B92.1		ø6"	1/2"	ø9"
		PV270	Splined 15T 8/16DP ANSI B92.1		ø6.5"	5/8"	ø12.5"



6 Threads

Code	Threads
1 (standard)	BSPP (G)
2	PT (RC)
3	UNF
4	NPT
7	ISO 6149

PV SERIES AXIAL PISTON PUMP

How to order

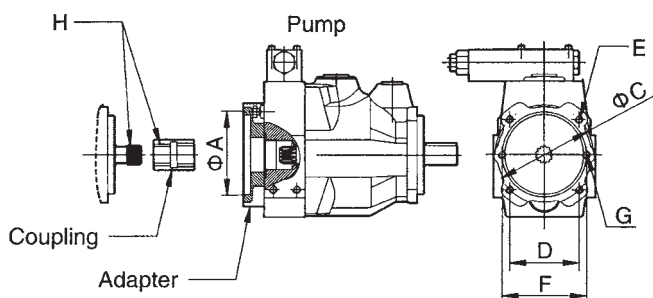
PV - 063 - GT - R - M - 1 - A - *-*-*

1 2 3 4 5 6 7 8 9 10

7 Thru drive & 2nd pump

Code	Thru drive & 2nd pump
* A (standard)	Single pump
* B	Prepared for thru drive
With adaptor for 2nd pump	
C	SAE AA, $\phi 2"$ ($\phi 50.8$ mm)
D	SAE A, $\phi 3-1/4"$ ($\phi 82.55$ mm)
E	SAE B, $\phi 4"$ ($\phi 101.6$ mm)
F	SAE C, $\phi 5"$ ($\phi 127$ mm)
G	SAE D, $\phi 6"$ ($\phi 152.4$ mm)
H	SAE E, $\phi 6.5"$ ($\phi 165.1$ mm)
I	Metric, $\phi 63$
J	Metric, $\phi 80$
K	Metric, $\phi 100$
L	Metric, $\phi 125$
M	Metric, $\phi 160$
N	Metric, $\phi 200$

Other pump are acceptable order



Code	Model	ϕA	ϕC	D	E	F	G	H
C	SAE AA, $\phi 2"$ ($\phi 50.8$ mm)	$\phi 2"$ ($\phi 50.8$)				3.25" (82.55mm)	5/16"-18	9T 20/40 DP
D	SAE A, $\phi 3-1/4"$ ($\phi 82.55$ mm)	$\phi 3-1/4"$ ($\phi 82.55$)				4.188" (106.3mm)	3/8"-16	9T 16/32 DP
E	SAE B, $\phi 4"$ ($\phi 101.6$ mm)	$\phi 4"$ ($\phi 101.6$)		3.536" (89.8mm)	1/2"-13	5.75" (146.05mm)	1/2"-13	13T 16/32 DP, 15T 16/32 DP
F	SAE C, $\phi 5"$ ($\phi 127$ mm)	$\phi 5"$ ($\phi 127$)		4.508" (114.5mm)	1/2"-13	7.125" (180.98mm)	5/8"-11	14T 12/24 DP, 15T 16/32 DP
G	SAE D, $\phi 6"$ ($\phi 152.4$ mm)	$\phi 6"$ ($\phi 152.4$)		6.364" (161.6mm)	5/8"-11	9" (228.6mm)	5/8"-11	13T 8/16 DP, 15T 8/16 DP
H	SAE E, $\phi 6.5"$ ($\phi 165.1$ mm)	$\phi 6.5"$ ($\phi 165.1$)		8.839" (224.5mm)	3/4"-10			15T 8/16 DP
I	Metric, $\phi 63$	$\phi 63$	$\phi 85$		M8	100	M8	
J	Metric, $\phi 80$	$\phi 80$	$\phi 103$		M8	109	M10	
K	Metric, $\phi 100$	$\phi 100$	$\phi 125$		M10	150	M12	W25×1.5×15×8f
L	Metric, $\phi 125$	$\phi 125$	$\phi 160$		M12	180	M16	W32×1.5×20×8f
M	Metric, $\phi 160$	$\phi 160$	$\phi 200$		M16	224	M20	W40×1.5×25×8f, W50×2×24×9g
N	Metric, $\phi 200$	$\phi 200$	$\phi 250$		M20			W50×2×24×9g

Coupling	pump	H
A-D1	PV016~PV023	D1 9T 20/40 DP
A-D2		D2 9T 16/32 DP
A-D3		D3 13T 16/32 DP
A-D4		D4 15T 16/32 DP
A-W1		W1 W25×1.5×15×8f
B-D2	PV032~PV046	D2 9T 16/32 DP
B-D3		D3 13T 16/32 DP
B-D4		D4 15T 16/32 DP
B-D5		D5 14T 12/24 DP
B-W1		W1 W25×1.5×15×8f
B-W2		W2 W32×1.5×20×8f
C-D2	PV063~PV092	D2 9T 16/32 DP
C-D3		D3 13T 16/32 DP
C-D4		D4 15T 16/32 DP

Coupling	pump	H
C-D5	PV063~PV092	D5 14T 12/24 DP
C-D6		D6 13T 8/16 DP
C-D7		D7 15T 8/16 DP
C-W1		W1 W25×1.5×15×8f
C-W2		W2 W32×1.5×20×8f
C-W3		W3 W40×1.5×25×8f
C-W4		W4 W50×2×24×9g
D-D2	PV140~PV180	D2 9T 16/32 DP
D-D3		D3 13T 16/32 DP
D-D4		D4 15T 16/32 DP
D-D5		D5 14T 12/24 DP
D-D6		D6 13T 8/16 DP
D-D7		D7 15T 8/16 DP
D-W1		W1 W25×1.5×15×8f

Coupling	pump	H
D-W2	PV140~PV180	W2 W32×1.5×20×8f
D-W3		W3 W40×1.5×25×8f
D-W4		W4 W50×2×24×9g
E-D2	PV270	D2 9T 16/32 DP
E-D3		D3 13T 16/32 DP
E-D4		D4 15T 16/32 DP
E-D5		D5 14T 12/24 DP
E-D6		D6 13T 8/16 DP
E-D7		D7 15T 8/16 DP
E-W1		W1 W25×1.5×15×8f
E-W2		W2 W32×1.5×20×8f
E-W3		W3 W40×1.5×25×8f
E-W4		W4 W50×2×24×9g
E-W5		W5 W60×2×28×9g

8 Voltage

Code	Voltage
0	None
A	AC100V (50-60Hz)
B	AC110V (60Hz)

Code	Voltage
C	AC200V (50-60Hz)
D	AC220V (60Hz)
E	DC12V

Code	Voltage
F	DC24V

9 Seals

Code	Seals
* N	NBR
V	FPM

Code	Seals
E	Ethylene-propylene

10 Design No. Not require for order

PV SERIES AXIAL PISTON PUMP

Compensator

Standard Type

- A:** Standard pressure compensator remote type
- GT:** Remote pressure compensator
- GM:** Remote pressure compensator allows a pilot valve
- GA:** Remote pressure compensator allows a pilot valve (valve included)
- GJ:** Layer proportional pressure compensator (valve included)

Electrical Unloading Type

- GR:** Electrical unloading
- GB:** 2 pressure electrical selection
- GC:** 2 pressure + electrical unloading

Load-sensing Type

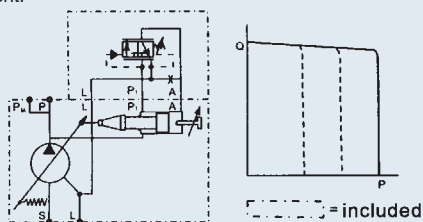
- HL:** Load-sensing compensator
- HM:** Load-sensing compensator
- HJ:** 2-valve load-sensing compensator
- HA:** 2-valve load-sensing compensator (valve included)
- HK:** Proportional electro-hydraulic load sensing type
- HQ:** Load-sensing & Proportional flow control

Horse Power Type

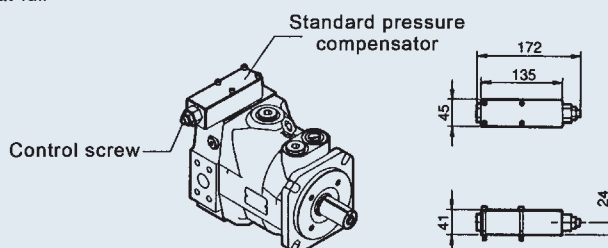
- PA:** Horse power compensator
- PM:** Horse power compensator, pilot flow internal pressure pilot valve included
- PG:** Horse power compensator, pilot flow internal
- PL:** Horse power compensator, Load-sensing compensator
- PH:** Horse power compensator, pilot flow external for load-sensing

A: Standard Pressure compensator

The standard pressure compensator adjusts the pump displacement according to the actual need of the system in order to keep the pressure constant. As long as the system pressure at outlet port P is lower than the set pressure (set as spring preload of the compensator spring) the working port A of the compensator valve is connected to the case drain and the piston area is unloaded. Bias spring and system pressure on the annulus area keep the pump at full displacement.



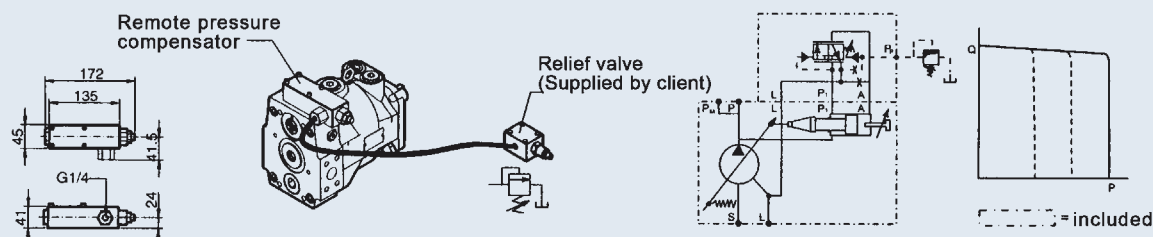
When the system pressure reaches the set pressure the compensator valve spool connects port P1 to A and builds up a pressure at the servo piston resulting in a down stroking of the pump. The displacement of the pump is controlled in order to match the flow requirement of the system.



GT: Remote Pressure compensator

While at the standard pressure compensator the pressure is set directly at the compensator spring, the setting of the remote pressure compensator can be achieved by any suitable pilot pressure valve connected to pilot port PP. The pilot flow supply is internal through the valve spool.

The pilot flow is 1-1.5 lpm. The pilot valve can be installed remote from the pump in some distance. That allows pressure setting e.g. from the control panel of the machine. The remote pressure compensator and is able to solve instability problems that may occur with a standard pressure compensator in critical applications. The pressure pilot valve can also be electronically controlled (proportional pressure valve) or combined with a directional control valve for low pressure standby operation.



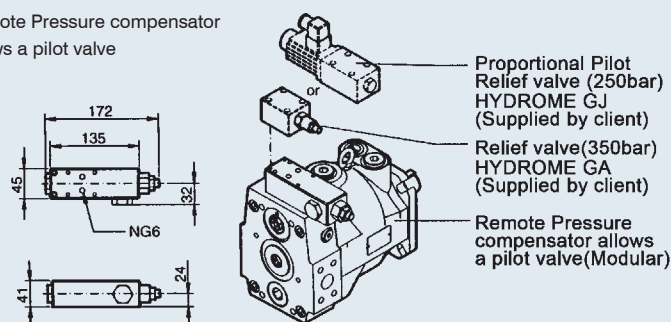
PV SERIES AXIAL PISTON PUMP

Compensator

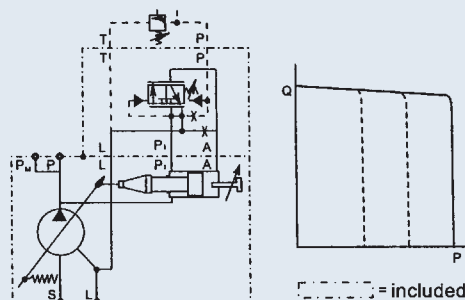
Remote Pressure compensator allows pilot valve

Version GM of remote pressure compensator provides on its top side an interface NG6, DIN24340 (CETOP 03 at RP35H, NFPA D03). This interface allows a direct mounting of a pilot valve. Beside manual or electro hydraulic operated valves it is also possible to mount complete multiple pressure circuits directly on the compensator body. HYDROME

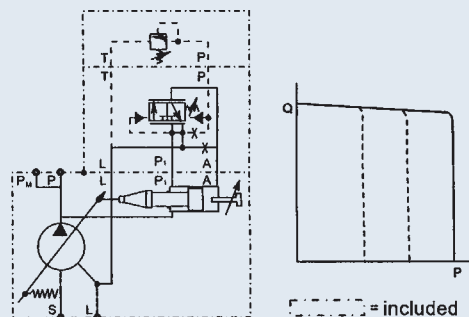
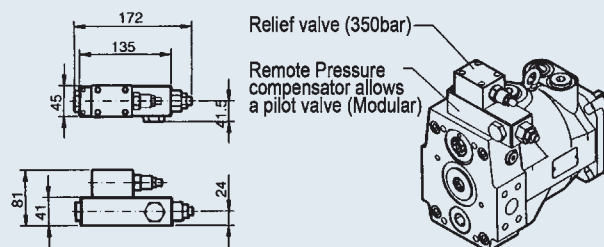
GM: Remote Pressure compensator allows a pilot valve



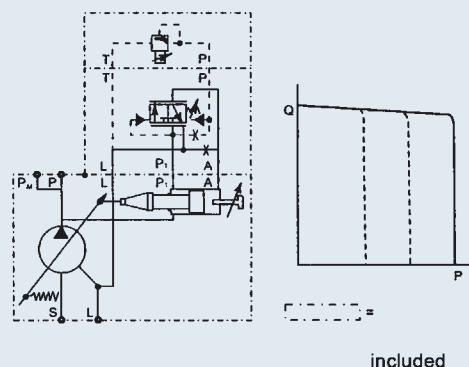
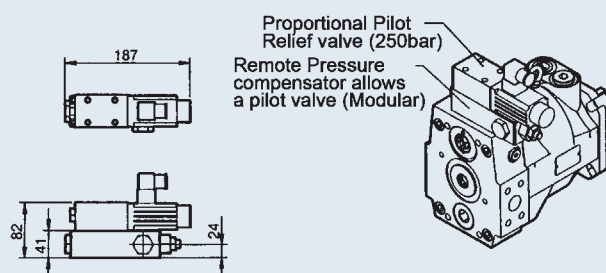
offers a variety of these compensator accessories ready to install. All remote pressure compensator have a factory setting of 15 bar differential pressure. With this setting, the controlled pressure at the pump outlet is higher than the pressure controlled by the pilot valve.



GA: Remote Pressure compensator allows a pilot valve (valve included)



GJ: Layer Proportional pressure compensator (valve included)



PV SERIES AXIAL PISTON PUMP

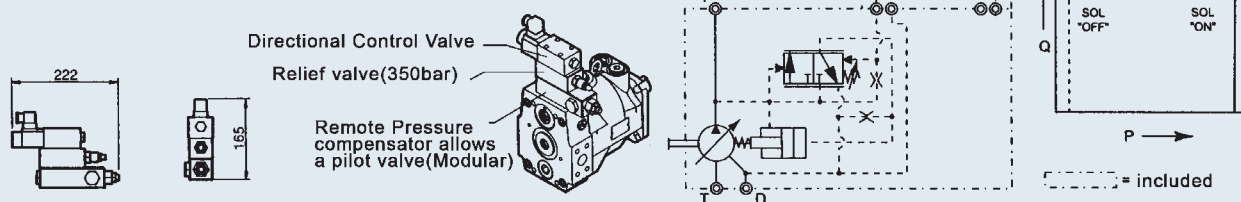
Compensator

Electrical Unloading Type

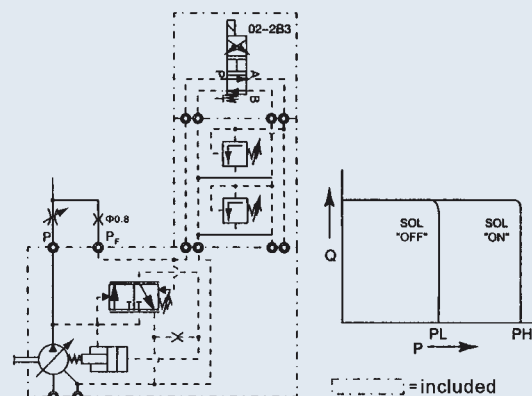
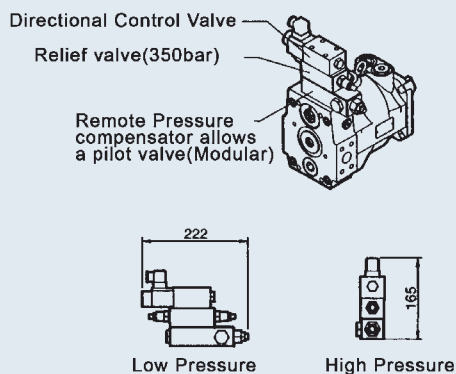
PV pump with fast response remote pressure control, relief valve with 2 pressure stages, electrical pressure selection, nitrile seals, spindle adjustment, 24 VDC solenoid, plug to DIN46350 accessories fitted.

Usable for horsepower control and proportional volume control, too.

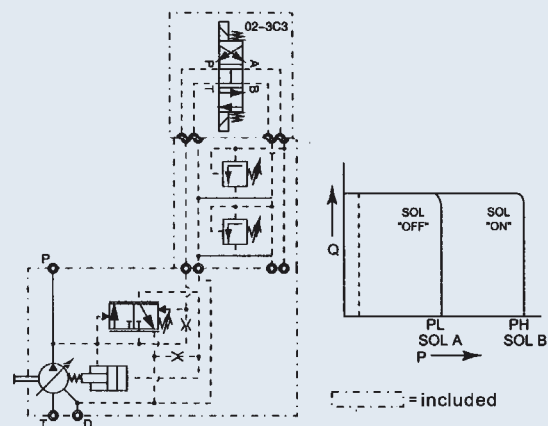
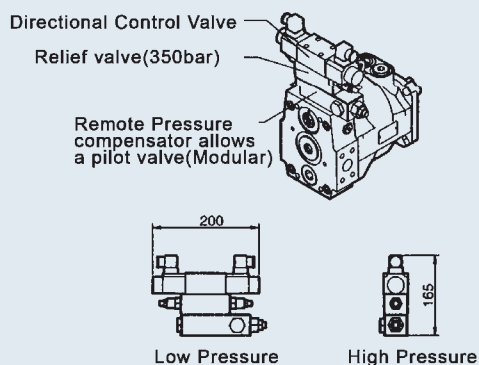
GR: Electrical unloading type



GB: Dual pressure control



GC: Dual pressure + electrical unloading



PV SERIES AXIAL PISTON PUMP

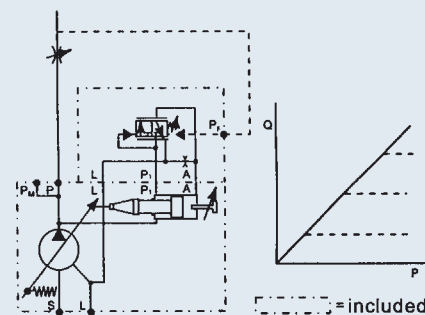
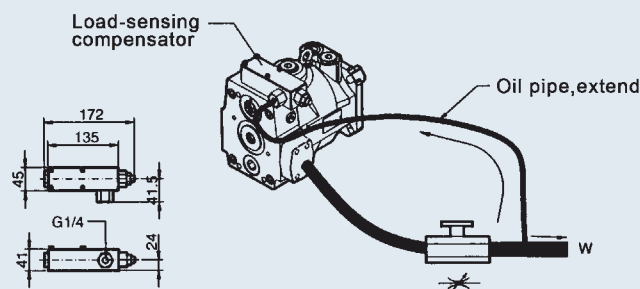
Compensator

Load-sensing Type

HL: Load-sensing compensator

The load-sensing compensator has an external pilot pressure supply. Factory setting for the differential pressure is 10 bar. The input signal to the compensator is the differential pressure at a main stream resistor. A load-sensing compensator represents mainly a flow control for the pump output flow, because the compensator keeps

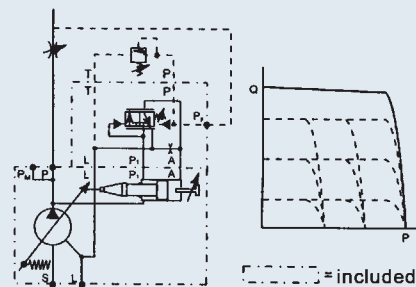
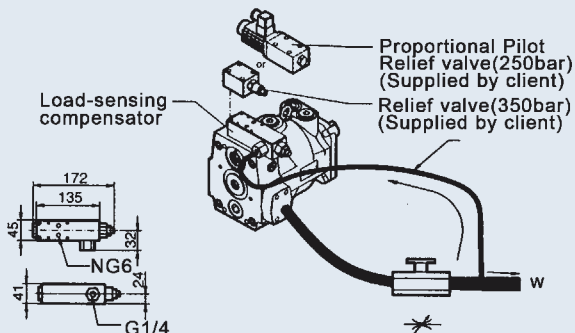
the pressure drop at the main stream resistor constant. A variable input speed or a varying load (pressure) has consequently no influence on the output flow of the pump and speed of the actuator. By adding a pilot orifice ($\phi 0.8\text{mm}$) and compensation can be added to the flow control function. See the circuit diagram below, left.



HM: Load-sensing compensator

Shown above is load sensing compensator code HM with an NG6 interface on top of the control valve. That allows direct mounting of a pilot valve for pressure compensation. This version includes the pilot orifice. Due to the interaction of flow and pressure compensation

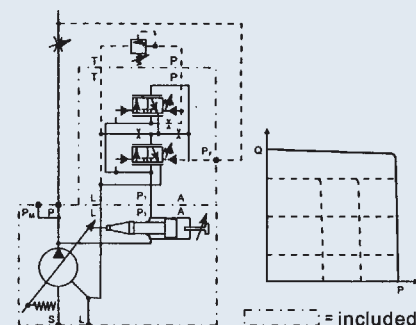
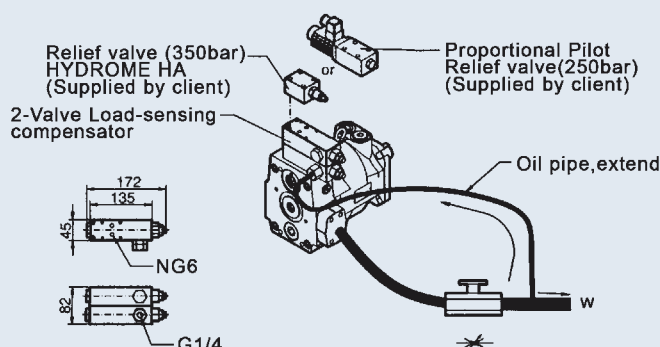
this package has not the "ideal" control characteristic. The deviation is caused by the pilot valves characteristic.



HJ: 2-valve load-sensing compensator

If a more accurate pressure compensation is required, the 2-valve load-sensing compensator code HJ can be used. The circuit diagram of this version is shown left. Here the interaction of the two control

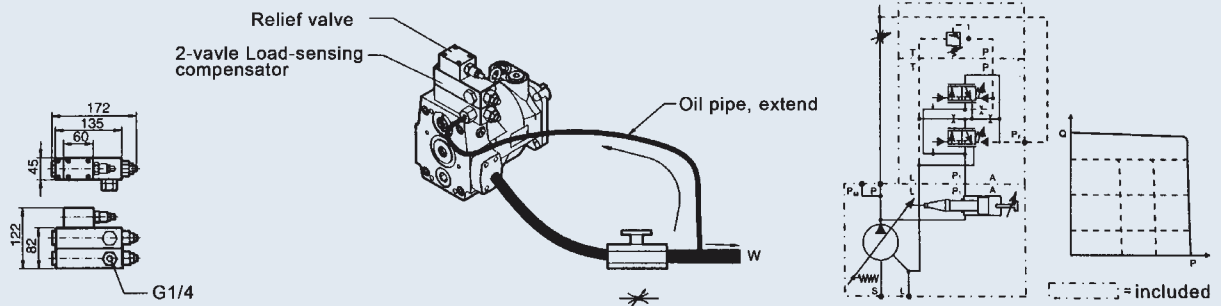
functions is avoided by using two separate control valves for flow and pressure compensation. The 2-valve compensator is equipped with an interface NG6 on the compensators top side.



PV SERIES AXIAL PISTON PUMP

Compensator

HA: 2-valve load-sensing compensator (valve included)



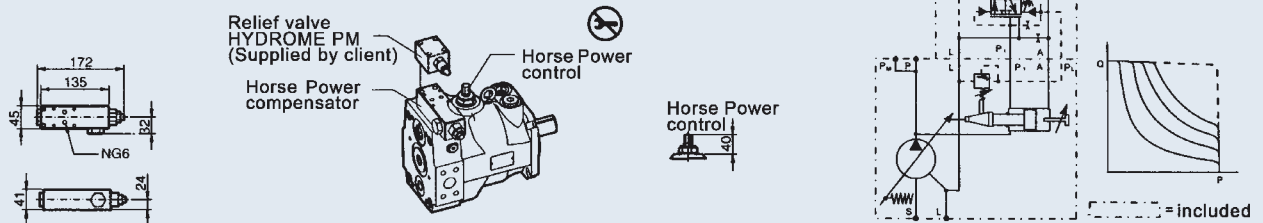
The hydraulic-mechanical horse power compensator consists of a modified remote pressure compensator (Code PG* \ PM*) or of a modified load-sensing compensator (Code PH*) and a pilot valve. This pilot valve is integrated into the pump and is adjusted by a cam sleeve. The cam sleeve has a contour that is designed and machined for the individual displacement and the nominal horse power setting. At a large displacement the opening pressure (given by the cam sleeve diameter) is lower than at small displacements. This makes the pump compensate along a constant horse power (torque) curve.

For all nominal powers of standard electrical motors HYDROME offers a dedicated cam sleeve. The exchange of this cam sleeve (e. g. : to change horse power setting) can easily be done without disassembly of the pump.

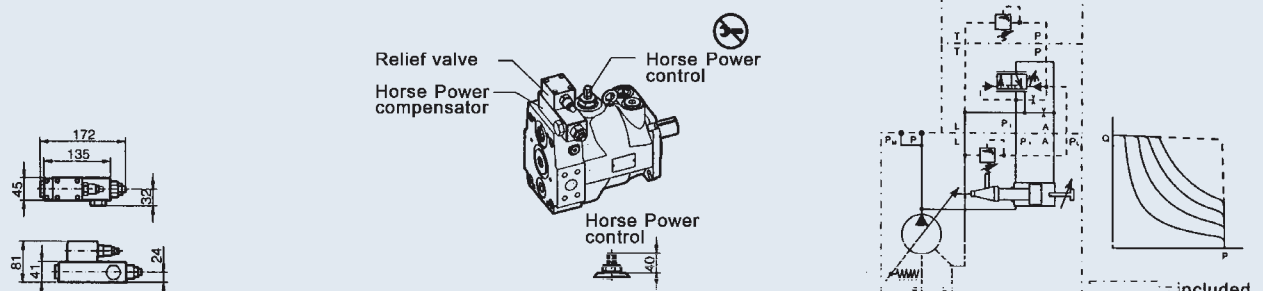
On top of that an adjustment of the horse power setting can be done within certain limits by adjustment the preload of the pilot control cartridge spring.

That allows an adjustment of a constant horse power setting for other than the nominal speeds (1500min-1) or for other horse power.

PA: Horse power compensator



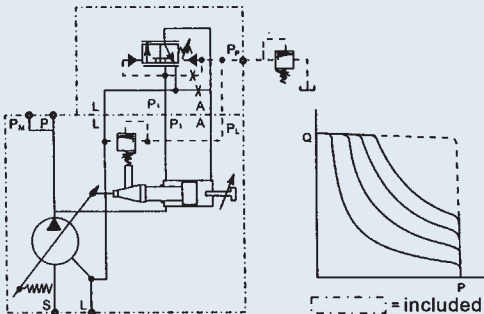
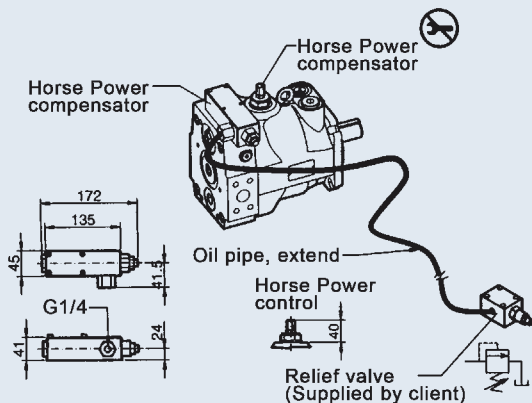
PM: Horse power compensator, pilot flow internal pressure pilot valve included



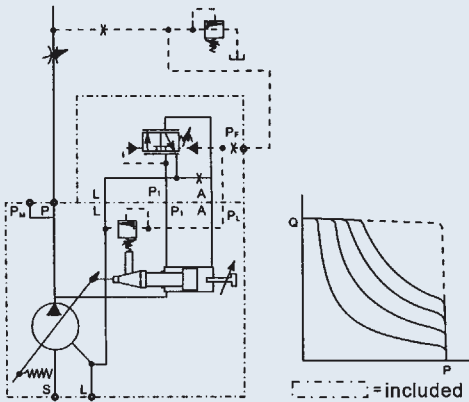
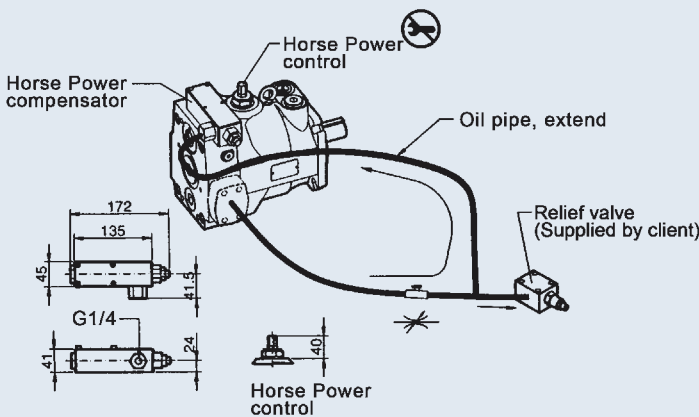
PV SERIES AXIAL PISTON PUMP

Compensator

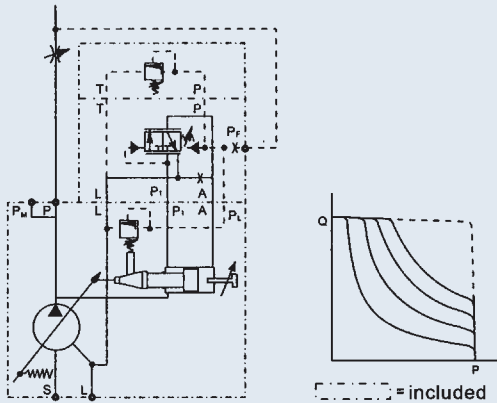
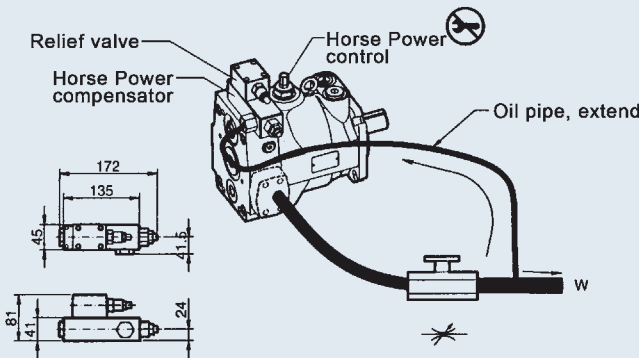
PG: Horse power compensator, pilot flow internal



PL: Horse power compensator, Load-sensing compensator



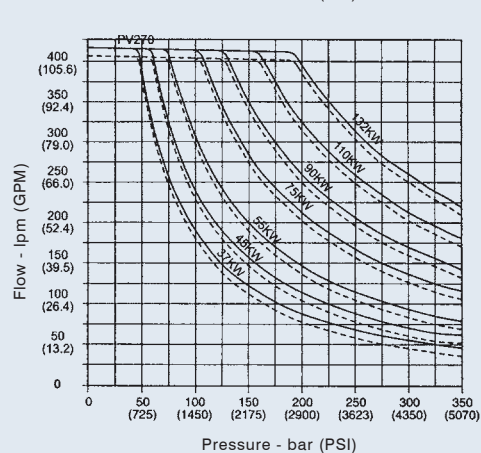
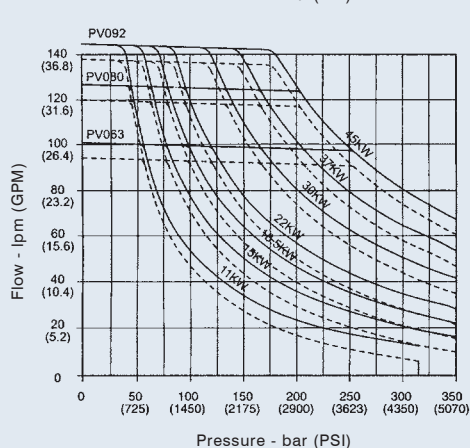
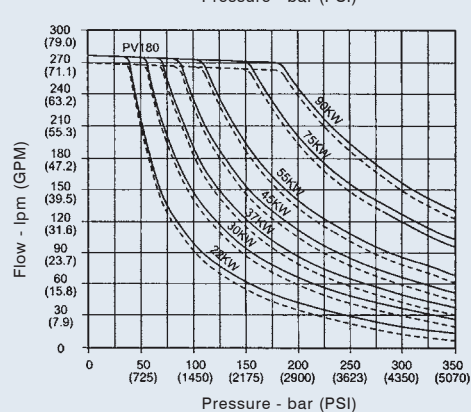
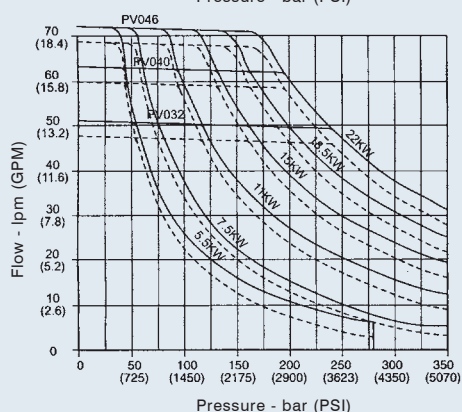
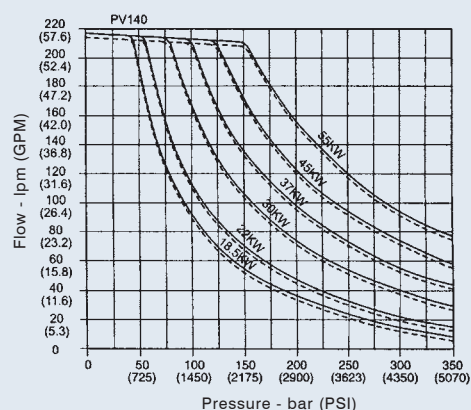
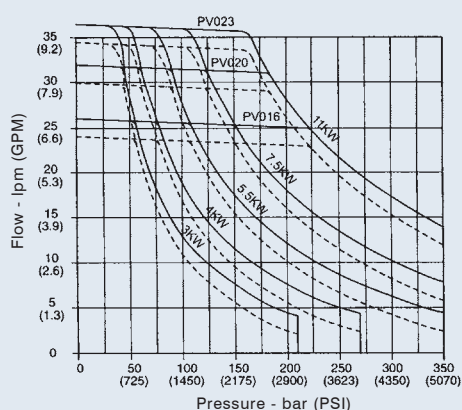
PH: Horse power compensator, pilot flow external for load-sensing



PV SERIES AXIAL PISTON PUMP

Performance curves

Horse Power Compensator, diagrams



The diagrams shown are only valid for the following working conditions:
 speed: $n=1500$ (—) and 1800 (---) rev/min
 temperature: $t=50^{\circ}\text{C}$
 fluid: mineral oil HLP, ISO VG46
 viscosity: $v=46\text{mm}^2/\text{s}$ at 40°C

PV SERIES AXIAL PISTON PUMP

Efficiency And Case Drain Flows

PV016-PV023

The efficiency and power graphs are measured at an input speed of $n = 1500 \text{ min}^{-1}$, a temperature of 40°C and a fluid viscosity of $46 \text{ mm}^2/\text{s}$. Case drain flow and compensator control flow leave via the drain port of the pump. To the valves shown are to be added 1 to 1.2 lpm, if at pilot operated compensator (code G*, H* horse power compensator and P/Q-control) the control flow of the pressure pilot valve also goes

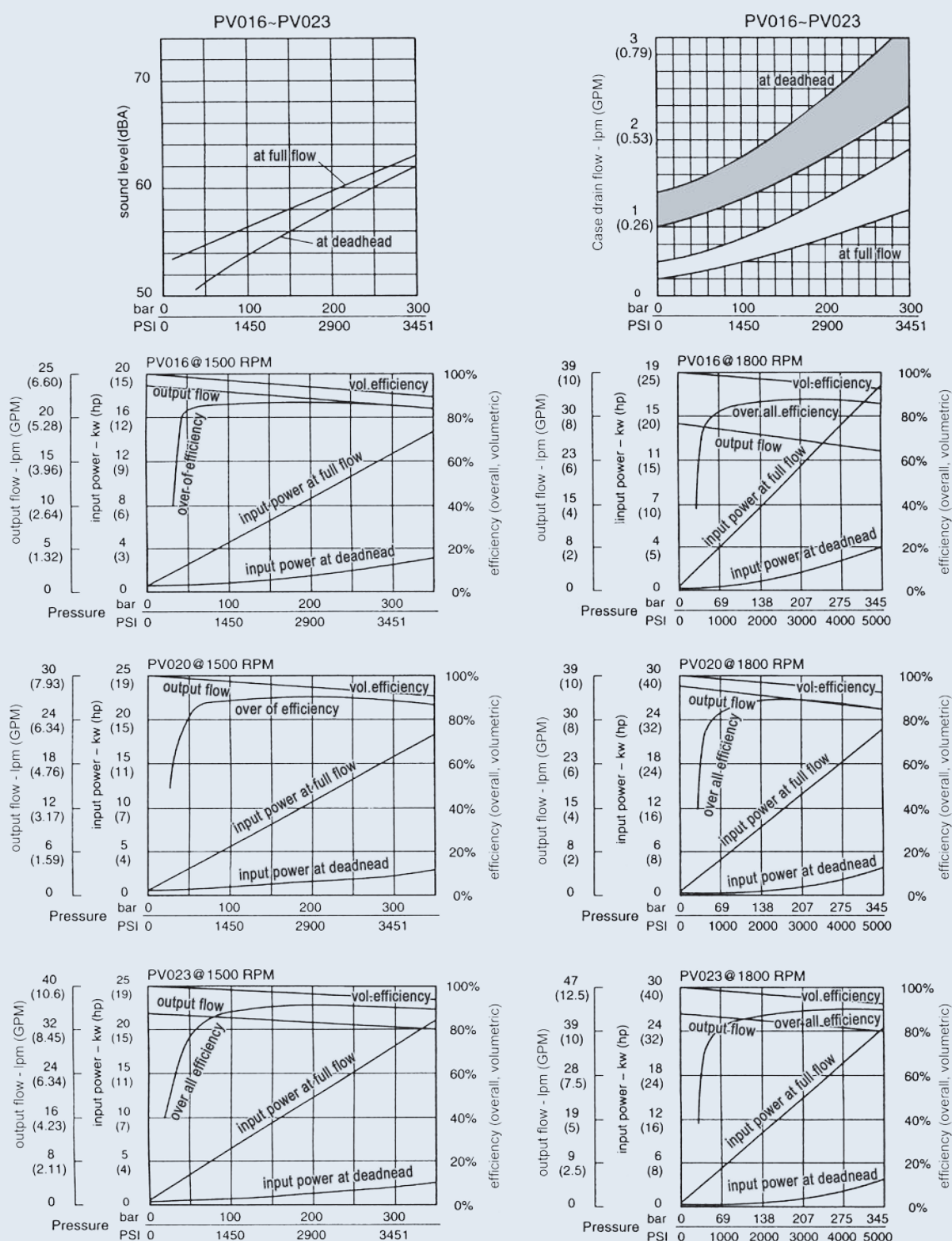
through the pump.

Please note: The valves shown below are only valid for static operation. Under dynamic conditions and at rapid compensator of the pump the volume displaced by the servo piston also leaves the case drain port.

This dynamic control flow can reach up to 40 lpm.

Therefore the case drain line is to lead to the reservoir at full size and without restrictions at short and direct as possible.

Performance curves



PV SERIES AXIAL PISTON PUMP

Efficiency And Case Drain Flows

PV032-PV046

The efficiency and power graphs are measured at an input speed of $n = 1500 \text{ min}^{-1}$, a temperature of 40°C and a fluid viscosity of $46 \text{ mm}^2/\text{s}$. Case drain flow and compensator control flow leave via the drain port of the pump. To the valves shown are to be added 1 to 1.2 lpm, if at pilot operated compensator (code G*, H* horse power compensator and P/Q-control) the control flow of the pressure pilot valve also goes

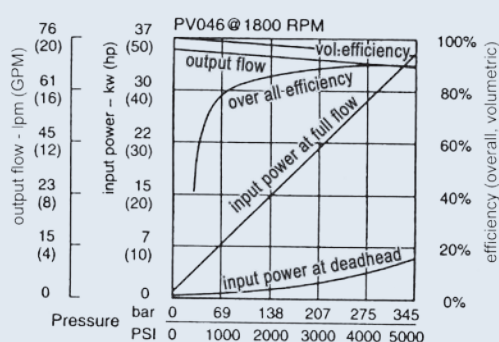
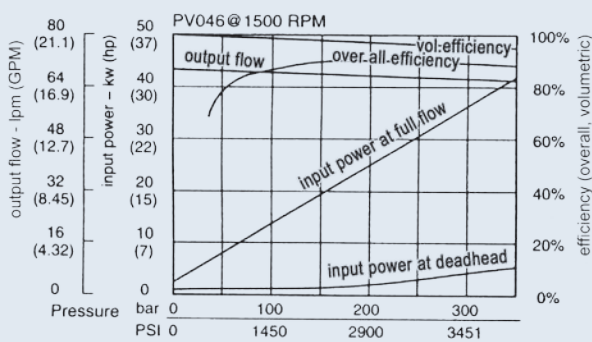
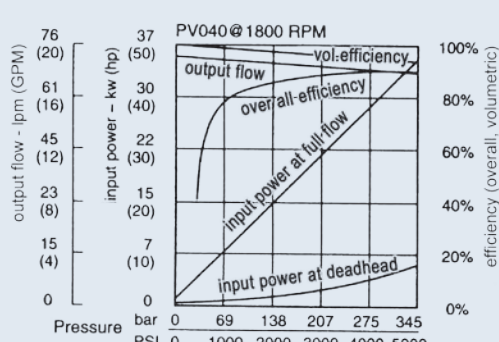
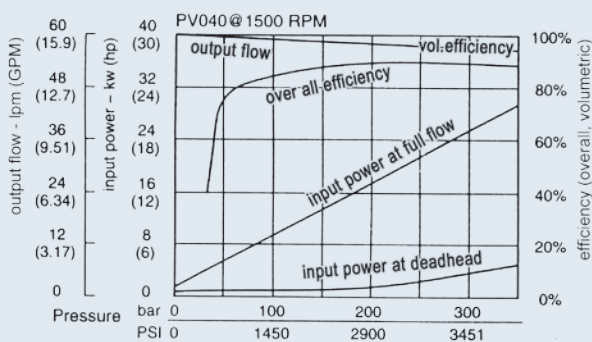
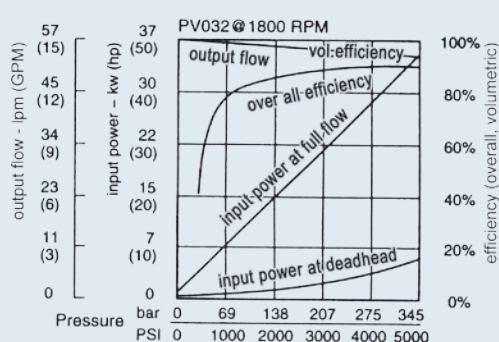
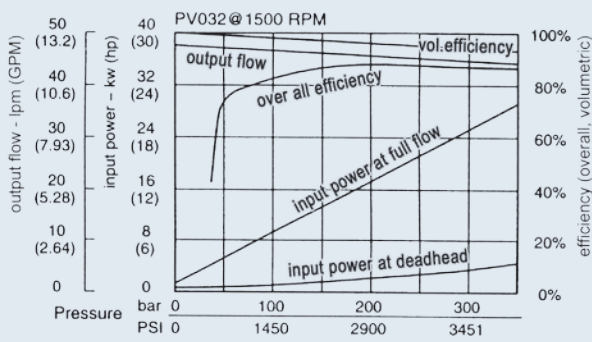
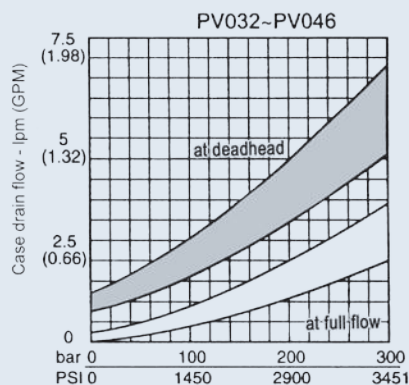
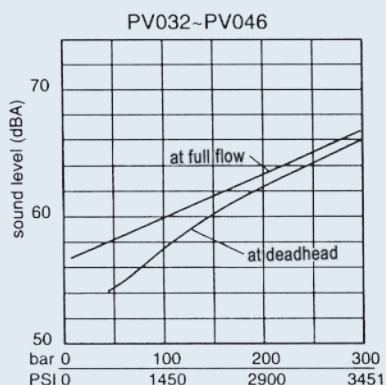
through the pump.

Please note: The valves shown below are only valid for static operation. Under dynamic conditions and at rapid compensator of the pump the volume displaced by the servo piston also leaves the case drain port.

This dynamic control flow can reach up to 60 lpm.

Therefore the case drain line is to lead to the reservoir at full size and without restrictions at short and direct as possible.

Performance curves



PV SERIES AXIAL PISTON PUMP

Efficiency And Case Drain Flows

PV063, PV080, PV092

The efficiency and power graphs are measured at an input speed of $n = 1500 \text{ min}^{-1}$, a temperature of 40°C and a fluid viscosity of $46 \text{ mm}^2/\text{s}$. Case drain flow and compensator control flow leave via the drain port of the pump. To the valves shown are to be added 1 to 1.2 lpm, if at pilot operated compensator (code G*, H* horse power compensator and P/Q-control) the control flow of the pressure pilot valve also goes

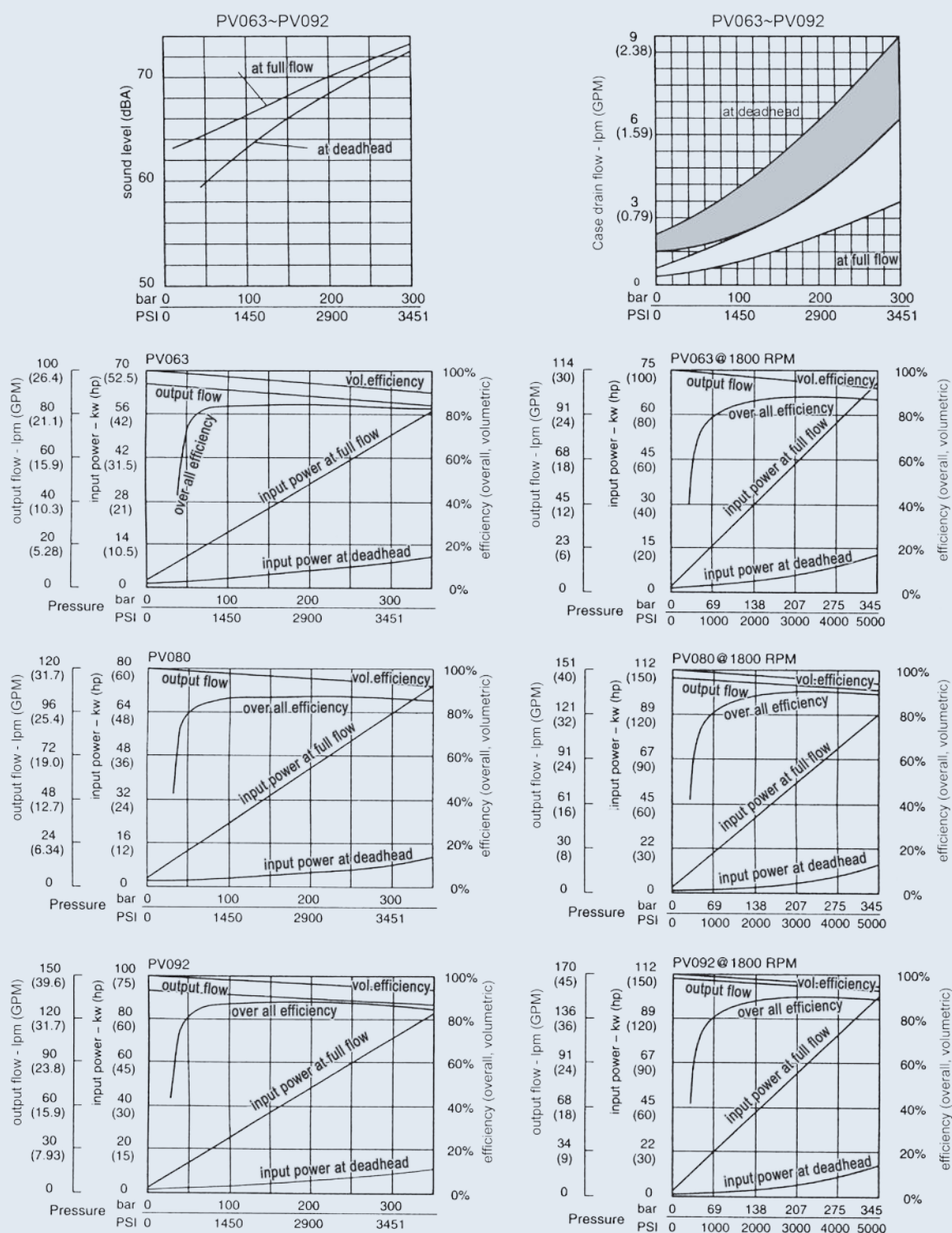
through the pump.

Please note: The valves shown below are only valid for static operation. Under dynamic conditions and at rapid compensator of the pump the volume displaced by the servo piston also leaves the case drain port.

This dynamic control flow can reach up to 80 lpm.

Therefore the case drain line is to lead to the reservoir at full size and without restrictions at short and direct as possible.

Performance curves



PV SERIES AXIAL PISTON PUMP

Efficiency And Case Drain Flows

PV140, PV180

The efficiency and power graphs are measured at an input speed of $n = 1500 \text{ min}^{-1}$, a temperature of 40°C and a fluid viscosity of $46 \text{ mm}^2/\text{s}$. Case drain flow and compensator control flow leave via the drain port of the pump. To the valves shown are to be added 1 to 1.2 lpm, if at pilot operated compensator (code G*, H* horse power compensator and P/Q-control) the control flow of the pressure pilot valve also goes

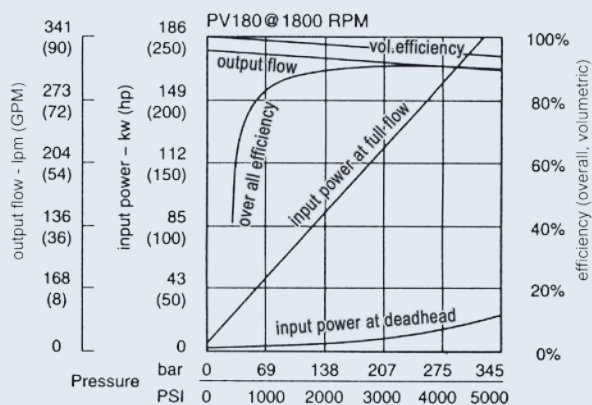
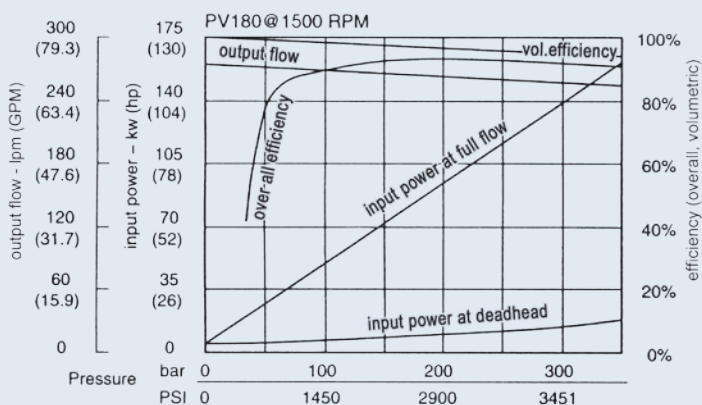
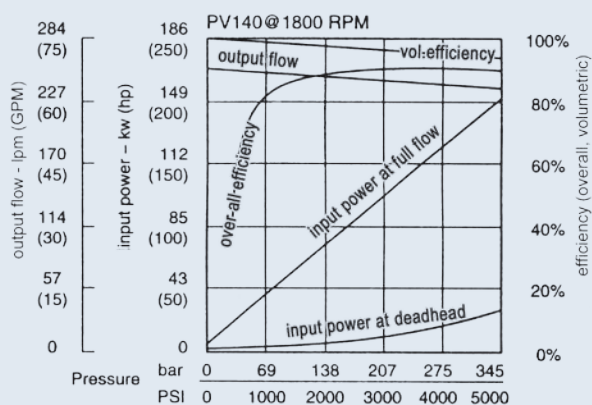
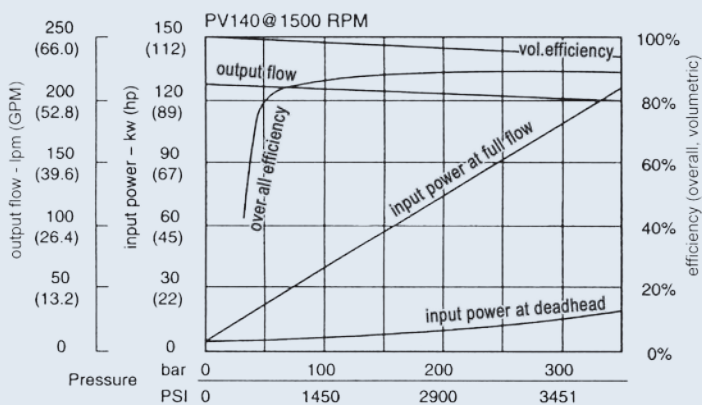
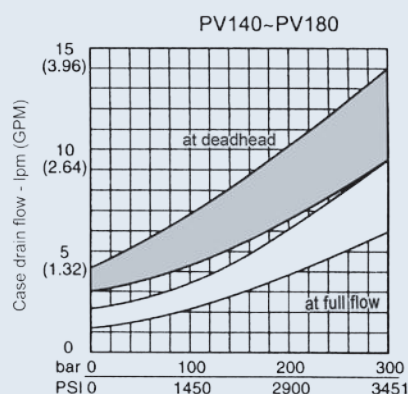
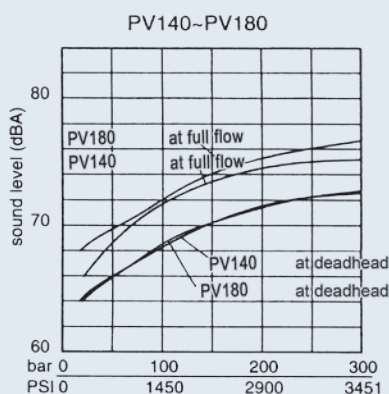
through the pump.

Please note: The valves shown below are only valid for static operation. Under dynamic conditions and at rapid compensator of the pump the volume displaced by the servo piston also leaves the case drain port.

This dynamic control flow can reach up to 120 lpm.

Therefore the case drain line is to lead to the reservoir at full size and without restrictions at short and direct as possible.

Performance curves



PV SERIES AXIAL PISTON PUMP

Efficiency And Case Drain Flows

PV270

The efficiency and power graphs are measured at an input speed of $n = 1500 \text{ min}^{-1}$, a temperature of 40°C and a fluid viscosity of $46 \text{ mm}^2/\text{s}$. Case drain flow and compensator control flow leave via the drain port of the pump. To the valves shown are to be added 1 to 1.2 lpm, if at pilot operated compensator (code G*, H* horse power compensator and P/Q-control) the control flow of the pressure pilot valve also goes

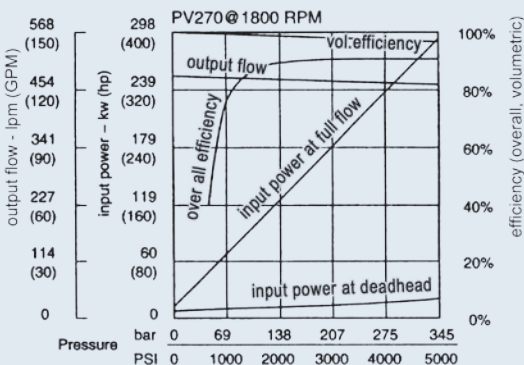
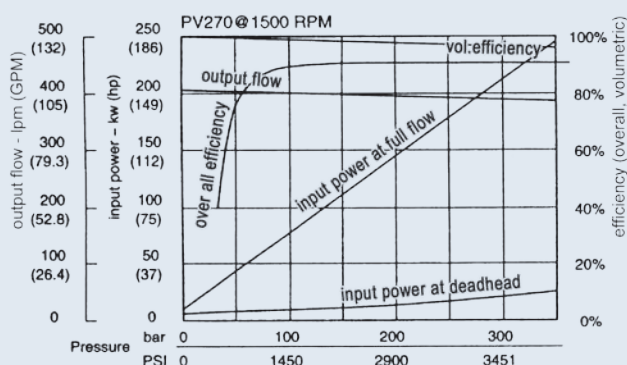
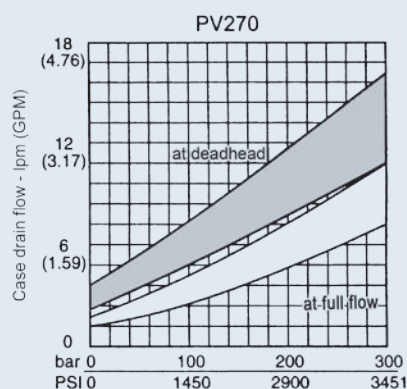
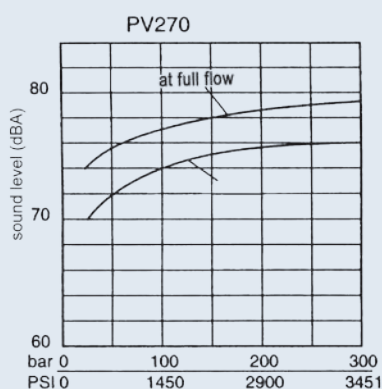
through the pump.

Please note: The valves shown below are only valid for static operation. Under dynamic conditions and at rapid compensator of the pump the volume displaced by the servo piston also leaves the case drain port.

This dynamic control flow can reach up to 120 lpm.

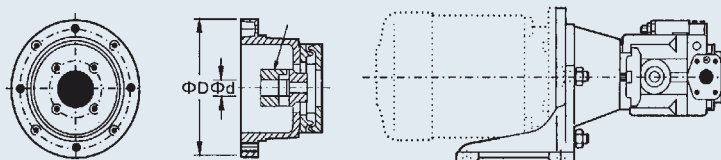
Therefore the case drain line is to lead to the reservoir at full size and without restrictions at short and direct as possible.

Performance curves

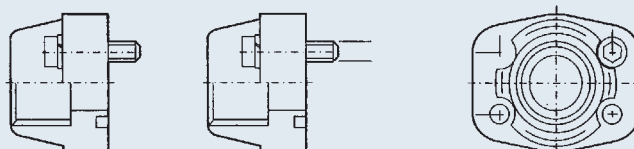


Pump Accessories

Bell housing, coupling and foot flange

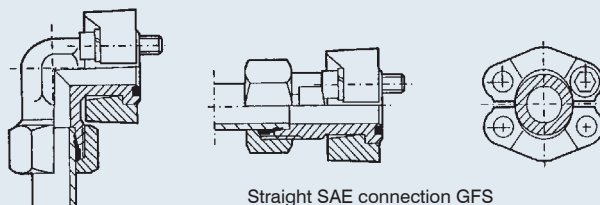


Welding flange, Threaded flange



SAE-flange connections, pipe connection in accordance to DIN-2353

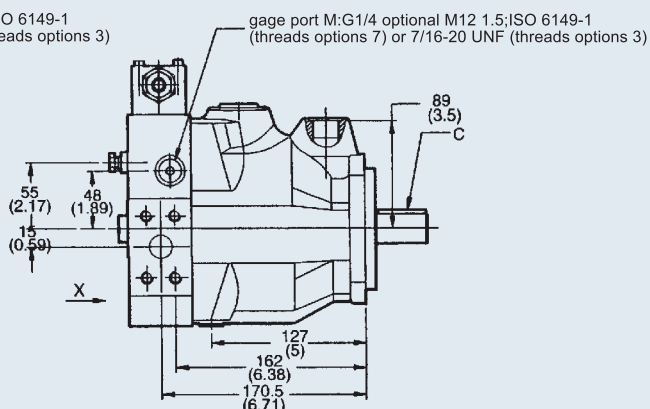
Elbow SAE-flange connection WFS



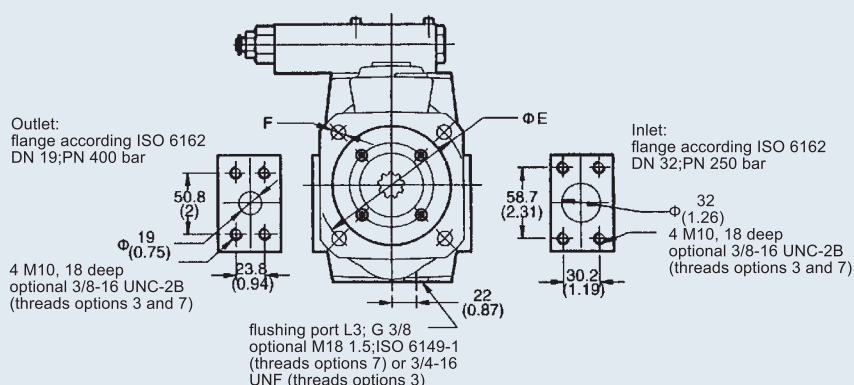
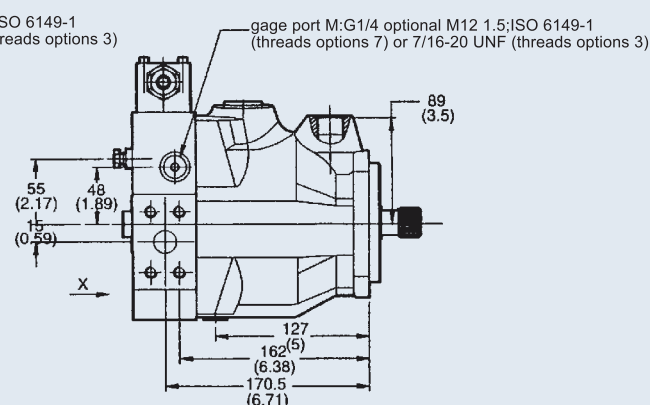
Straight SAE connection GFS

PV016~PV023

mounting hole for horse power
compensator pilot or displacement
feedback LVDT



mounting hole for horse power
compensator pilot or displacement
feedback LVDT



Shown with standard pressure compensator

P67

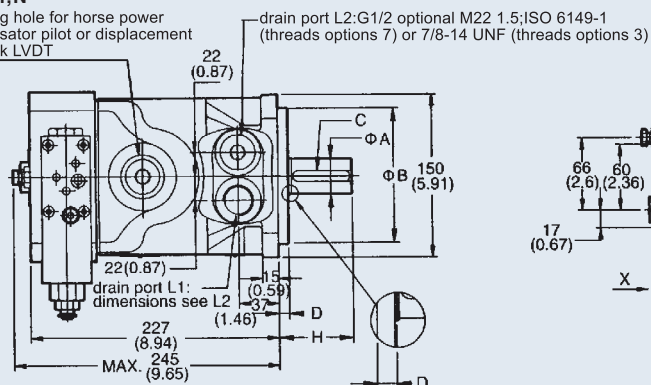
PV SERIES AXIAL PISTON PUMP

Dimensions

PV032~PV046

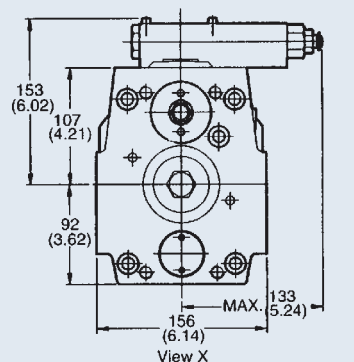
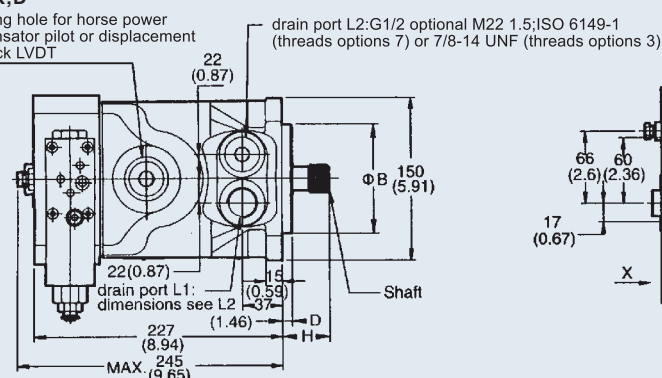
Mounting: M,N

mounting hole for horse power compensator pilot or displacement feedback LVDT

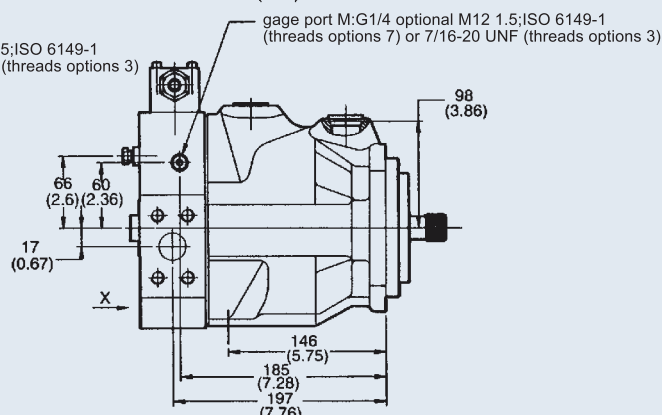
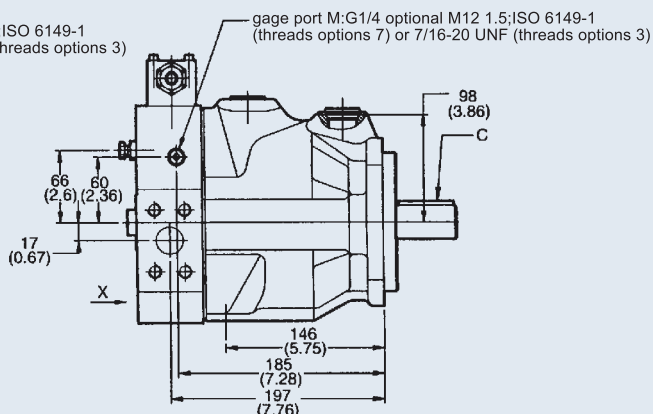


Mounting: K,D

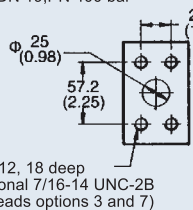
mounting hole for horse power compensator pilot or displacement feedback LVDT



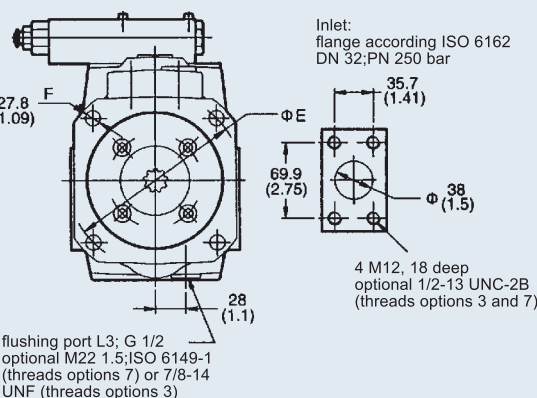
Shown with standard pressure compensator



Outlet:
flange according ISO 6162
DN 19;PN 400 bar



4 M12, 18 deep
optional 7/16-14 UNC-2B
(threads options 3 and 7)



Inlet:
flange according ISO 6162
DN 32;PN 250 bar

4 M12, 18 deep
optional 1/2-13 UNC-2B
(threads options 3 and 7)

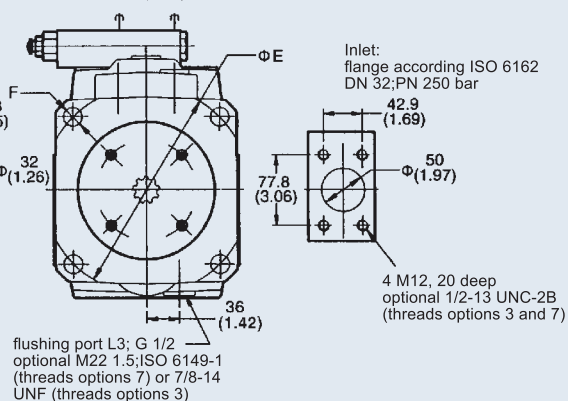
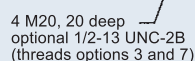
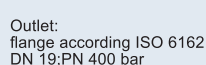
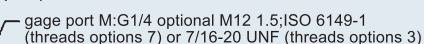
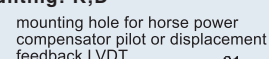
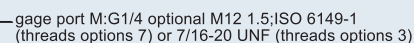
flushing port L3; G 1/2
optional M22 1.5;ISO 6149-1
(threads options 7) or 7/8-14
UNF (threads options 3)

PV032~PV046 Dimensions

Mounting			øA	øB	C	D	øE	F	H
M (standard)	Metric	ISO 3019/2	ø32	ø125 h8	10x8x56	9	160	14	68
	Splined, DIN 5480								
N	Inch	ISO 3019/2	ø31.75 (1.25")	ø127 (5")	7.94x7.94x56 (5/16")	12.7 (0.5")	161.93 (6.38")	14 (0.55")	68 (2.68")
	Cylindric, key								
Mounting			Shaft		øB	D	øE	F	H
K (standard)	Metric	ISO 3019/2	Splined W32x1.5x20x8f DIN 5480		ø125 h8	9	160	14	47
	Cylindric, key								
D	Inch	ISO 3019/1	Splined 14T 12/24 DP, flat root, side fit ANSI B92.1		ø127 (5")	12.7 (0.5")	161.93 (6.38")	14 (0.55")	56 (2.31")
	Splined, SAE								
D1	Inch	ISO 3019/1	Splined 15T 16/32 DP, flat root, side fit ANSI B92.1		ø127 (5")	12.7 (0.5")	161.93 (6.38")	14 (0.55")	56 (2.31")
	Splined, SAE								

PV063~PV092

mounting hole for horse power
compensator pilot or displacement
feedback LVDT 31



PV063~PV092 Dimensions

P69

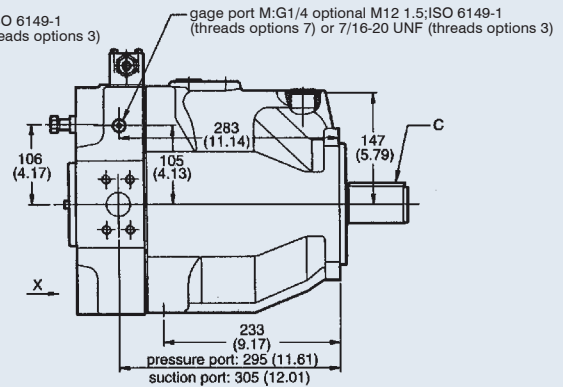
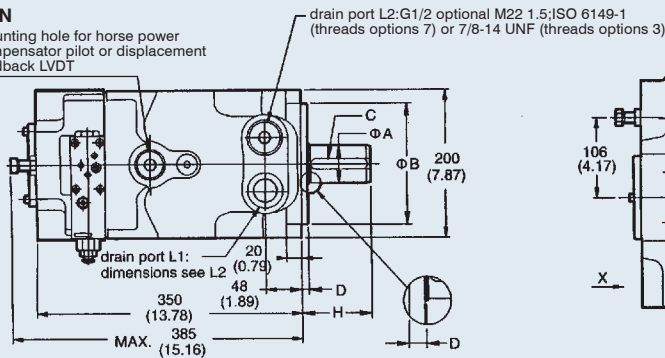
PV SERIES AXIAL PISTON PUMP

Dimensions

PV140~PV180

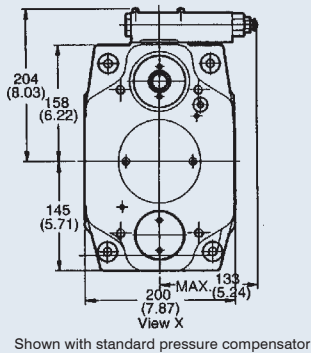
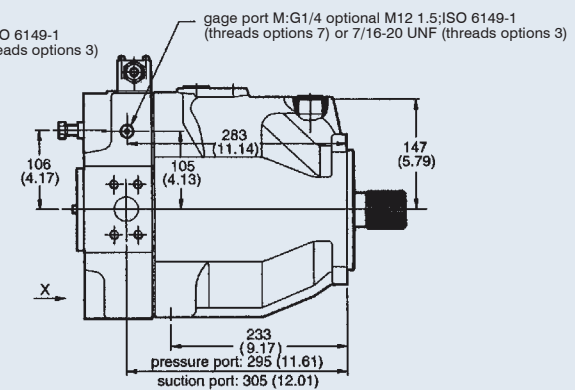
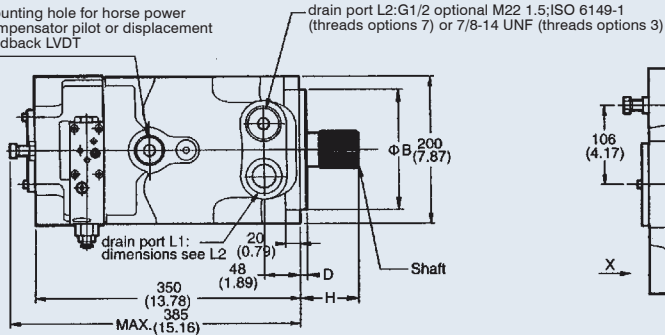
Mounting: M,N

mounting hole for horse power compensator pilot or displacement feedback LVDT



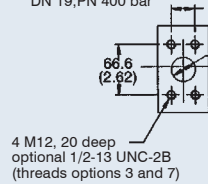
Mounting: K,D

mounting hole for horse power compensator pilot or displacement feedback LVDT

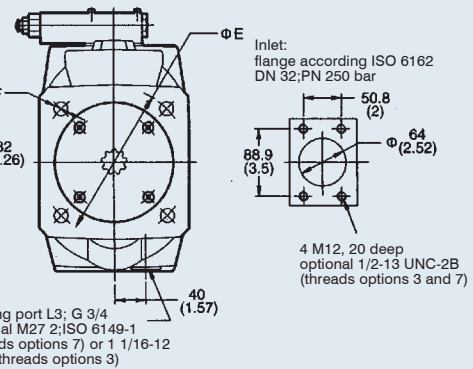


Shown with standard pressure compensator

Outlet: flange according ISO 6162 DN 19;PN 400 bar



4 M12, 20 deep optional 1/2-13 UNC-2B (threads options 3 and 7)



Inlet: flange according ISO 6162 DN 32;PN 250 bar

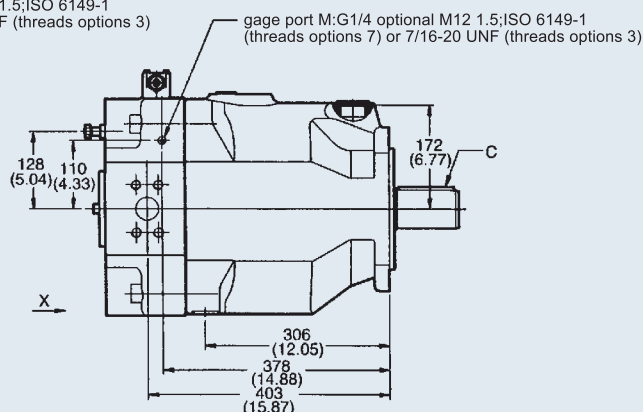
4 M12, 20 deep optional 1/2-13 UNC-2B (threads options 3 and 7)

PV140~PV180 Dimensions

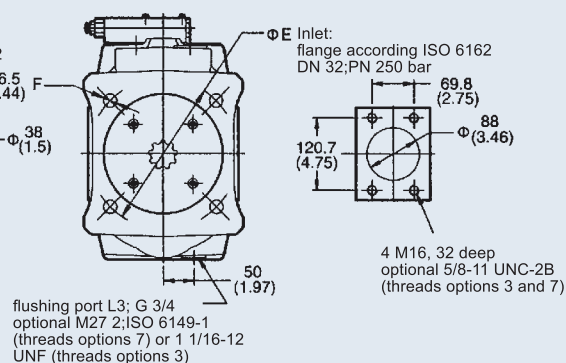
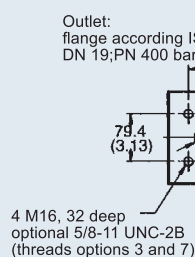
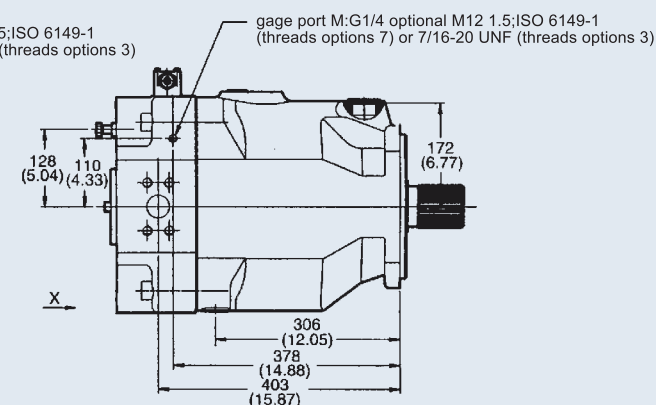
Mounting			øA	øB	C	D	øE	F	H
M (standard)	Metric	ISO 3019/2 Splined, DIN 5480	ø50	ø160 h8	14x9x75	9	200	18	92
N	Inch	ISO 3019/2 Cylindric, key	ø50.8 (2")	ø152.4 (6")	12.7x12.7x75 (1/2")	12.7 (0.5")	228.6 (9")	20.6 (0.81")	99.4 (3.91")
F	Inch	ISO 3019/2 Splined, DIN 5480	ø44.45	ø152.4 (6")	11.11x11.11	12.7 (0.5")	228.6 (9")	20.6 (0.81")	75 (2.95")
Mounting			Shaft		øB	D	øE	F	H
H (standard)	Metric	ISO 3019/2 Cylindric, key	Splined W50x2x24x8f DIN 5480		ø160 h8	9	200	18	78
D	Inch	ISO 3019/1 Splined, SAE	Splined 15T 8/16 DP, flat root, side fit ANSI B92.1		ø152.4 (6")	12.7 (0.5")	228.6 (9")	20.6 (0.81")	88 (3.46")
G	Inch	ISO 3019/1 Splined, SAE	Splined 13T 8/16 DP, flat root, side fit ANSI B92.1		ø152.4 (6")	12.7 (0.5")	228.6 (9")	20.6 (0.81")	75 (2.95")

PV270

mounting hole for horse power
compensator pilot or displacement
feedback I VDT 45



mounting hole for horse power
compensator pilot or displacement
feedback | VDT



flushing port L3; G 3/4
optional M27 2;ISO 6149-1
(threads options 7) or 1 1/16-12
UNF (threads options 3)

P71

PV SERIES AXIAL PISTON PUMP

Thru drive, shaft load limitations

The max. transferable torque in Nm for the different shafts options are:

Shaft code	PV16~23	PV32~46	PV63~92	PV140~180	PV270
N	300	550	1320	2000	2000
D	300	610	1218	2680	2680
F	-	-	-	1320	-
G	-	-	-	1640	-
M	300	570	1150	1900	2850
K	405	675	1400	2650	3980

Important notice

The max. allowable torque of the individual shaft must not be exceeded. For 2-pump combinations there is no problem because PV series offers 100% thru torque. For 3-pump combinations (and more) the limit torque could be reached or exceeded.

Therefore it is necessary to calculate the torque factor and compare it with the allowed torque limit factor in the table.

**Required: calculated torque factor
<torque limit factor**

To make the necessary calculations easier and more user friendly it is not required to calculate actual torque requirements in Nm and compare them with the shaft limitations. The table on the right shows limit factors that include material specification, safety factors and conversion factors.

The total torque factor is represented by the sum of the individual torque factors of all pumps in the complete pump combination.

The torque factor of each individual pump is calculated by multiplying the max. operating pressure p of the pump (in bar) with the max. displacement Vg of the pump (in cc/rev)

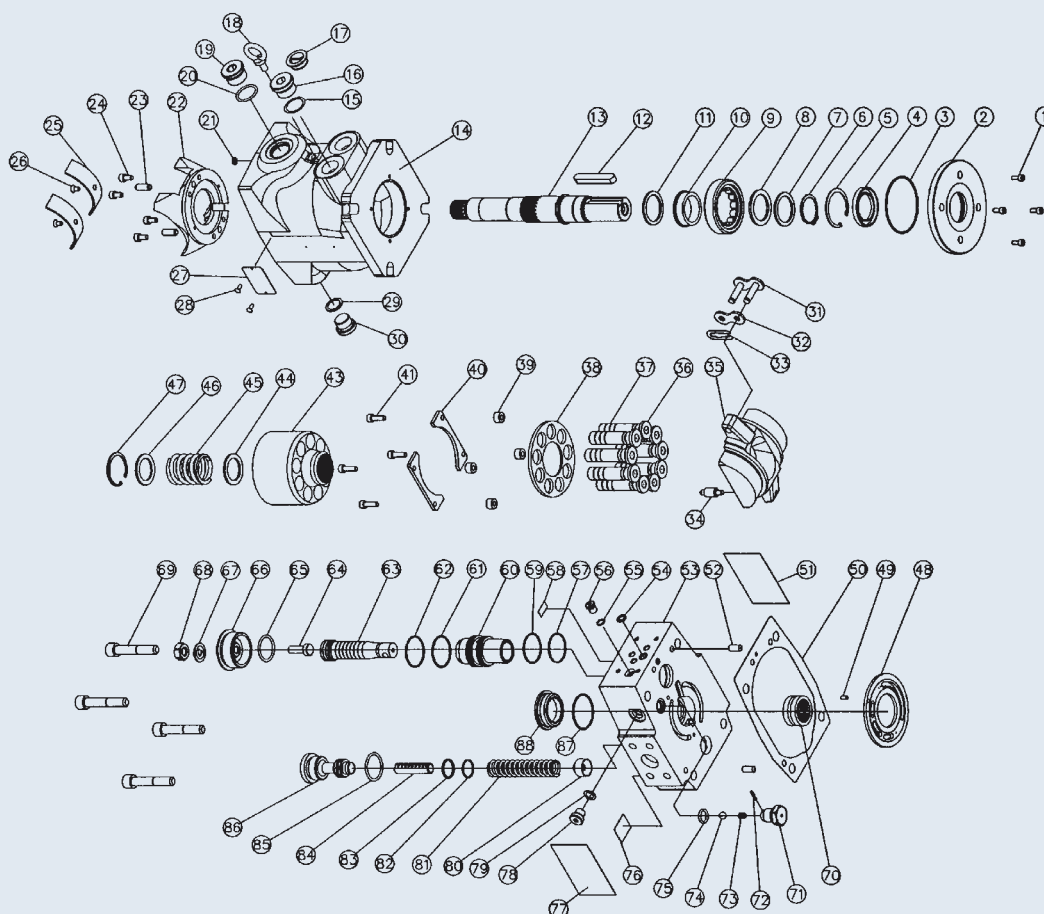
Pump	Shaft	Torque limit factor
PV016 ~ PV023	N	17700
	D	17700
	M	17700
	K	20130
PV032 ~ PV046	N	32680
	D	36380
	M	33810
	K	40250
PV063 ~ PV092	N	77280
	D	72450
	M	67620
PV140 ~ PV180	K	83720
	N	118400
	D	158760
	F	78750
	G	97650
PV270	M	113400
	K	157500
	N	119000
	D	159700
	M	170100
	K	236250

**Total torque factor of the combination =
sum of individual torque factors of all pumps**

**Torque factor of any pump = P x Vg
(Pressure in bar x displacement in cc/rev)**

PV SERIES AXIAL PISTON PUMP

Decomposition Chart



List of parts

No.	Description	Quantity	No.	Description	Quantity	No.	Description	Quantity	No.	Description	Quantity
1	Head cap screw	4	23	Pin	2	46	Washer	1	68	Piston nut	1
2	Pilot cover	1	24	Screw	4	47	Snap ring	1	69	Screw	1
3	O-ring	1	25	Trunnion bearing	2	48	Valve plate	1	70	Trunnion bearing	1
4	Shaft seal	1	26	Screw	2	49	Pin	1	71	Plug	1
5	Snap ring	1	27	Name plate	1	50	Seal	1	72	Pin	1
6	Snap ring	1	28	Rivet	2	51	Seal	1	73	Spring	1
7	Washer	1	29	O-ring	1	52	Pin	1	74	Ball	1
8	Washer	1	30	Plug	1	53	Pump body	2	75	O-ring	2
9	Roller bearing	1	31	Chain link	1	54	O-ring	1	76	Label	1
10	Roller bearing	1	32	Chain link	1	55	O-ring	1	77	Seal	1
11	Roller bearing	1	33	Chain link	1	56	Plug	1	78	Plug	1
12	Key	1	34	Connector servo spring	1	57	O-ring	1	79	O-ring	1
13	Shaft	1	35	Swash plate	1	58	Label	1	80	Washer	1
14	Pump body	1	36	Piston	9	59	O-ring	1	81	Spring	1
15	O-ring	1	37	Piston	9	60	Servo piston sleeve	1	82	O-ring	1
16	Plug	1	38	Slipper segment	1	61	O-ring	1	83	O-ring	1
17	Plug	1	39	Washer	4	62	O-ring	1	84	Pin	1
18	Ring	1	40	Retainer segment	2	63	Servo piston	1	85	O-ring	1
19	Plug	1	41	Screw	4	64	Set screw	1	86	Screw	1
20	O-ring	1	43	Cylinder block	1	65	O-ring	1	87	O-ring	1
21	O-ring	1	44	Washer	1	66	Servo spring cover	1	88	Spring cover	1
22	Cradle	1	45	Spring	1	67	Washer	1			

PV SERIES AXIAL PISTON PUMP

General installation information

1. Fluid recommendations

Premium quality hydraulic mineral oil fluids are recommended, like H-LP oils to DIN 51524, part 2. The viscosity range should be 25 to 50 s mm²/(cst) at 50°C. Operating temperatures -10 to +70°C. For other fluids such as phosphoric acid esters or for, other operating conditions consult HYDROME for assistance.

2. Seals

NBR (Nitrile) seals are used for operation with hydraulic fluids based on mineral oil. For synthetic, as perhaps phosphoric acid esters, Fluorocarbon seals are required. Consult HYDROME for assistance.

3. Filtration

For maximum pump and system component functionality and life, the system should be protected from contamination by effective filtration. Fluid cleanliness should be in accordance with ISO classification ISO 4406. The quality of filter elements should be in accordance with ISO standards.

- (1) Minimum requirement for filtration rate x (um):
General hydraulic systems for satisfactory operation:
Class 19/15, to ISO 4406. X=25 µm (β10≥75) to ISO 4572
- (2) Hydraulic systems with maximized component life and functionality:
Class 16/13, to ISO 4406. X=10 µm (β10≥75) to ISO 4572
It is recommended to use return line or pressure filters. HYDROME Filter Division offers a wide range of these filters for all common applications and mounting styles. The use of suction filters should be avoided, especially with fast response pumps. Bypass filtration is a good choice for best filter efficiency.

4. Installation and mounting

Horizontal mounting: Outlet port side or top. Inlet port side or bottom, drain port always uppermost.
Vertical mounting: Shaft pointing upwards.
Install pump and suction line in such a way that the maximum inlet vacuum never exceeds 0.8 bar absolute.
The inlet line should be as short and as straight as possible. A short suction line cut to 45° is recommended when the pump is mounted inside the reservoir, to improve the inlet conditions. All connections to be leadfree, as air in the suction line will cause cavitations, noise, and damage to the pump.

5. Shaft rotation and alignment

Pump and motor shafts must be aligned within 0.25mm T.I.R. maximum. A floating coupling must be used.
Bell housings and couplings can be ordered at manufacturers listed in this catalogue. Please follow the coupling manufacturer's installation instructions.
Consult HYDROME for assistance on radial load type drives.

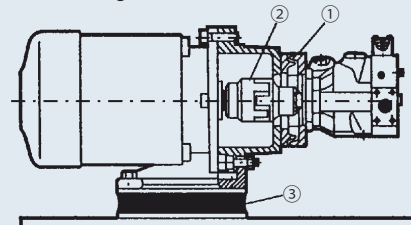
6. Start up

Prior to start up, the pump case must be filled with hydraulic fluid (use case drain port). Initial start up should be at zero pressure with an open circuit to enable the pump to prime. Pressure should only be increased once the pump has been fully primed.
Attention: Check motor rotation direction.
Operating noise of pumps
The normal operating noise of a pump and consequently the operating noise of the entire hydraulic system is largely determined by where and how the pump is mounted and how it is connected to the down stream hydraulic system. Also size, style and installation of the hydraulic tubing have a major influence on the overall noise emitted by a hydraulic system.

Noise reduction measures

Flexible elements help to prevent pump body vibration being transmitted to other construction elements, where possible amplification may occur, Such elements can be:
Bell housing with elastic dampening flange with vulcanized labyrinth ①

- (1) Floating and flexible coupling ②
- (2) Damping rails ③
- (3) Or silent blocks for mounting the electric motor or the foot mounting flange
- (4) Flexible tube connections (compensators) or hoses on inlet, outlet and drain port of the pump.
- (5) Exclusive use of gas tight tube fittings for inlet connections to avoid ingress of air causing cavitations and excessive noise.



7. Drain line

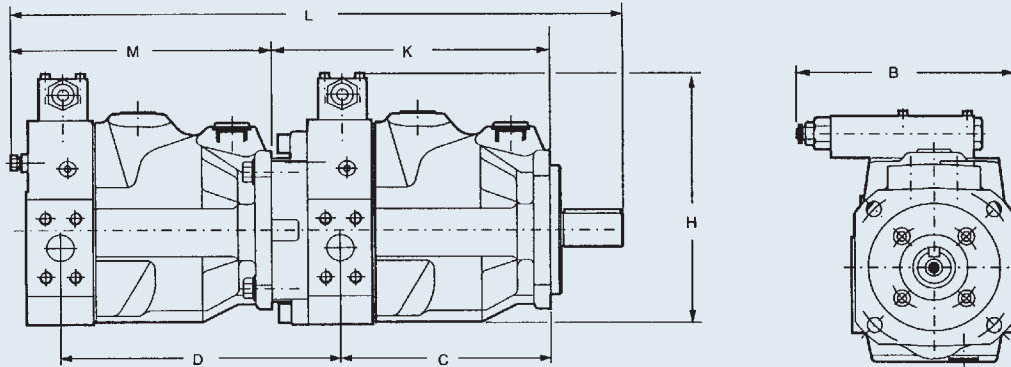
The drain line must lead directly to the reservoir without restriction. The drain line must not be connected to any other return line. The end of the drain line must be below the lowest fluid level in the reservoir and as far away as possible from the pump inlet line. This ensures that the pump does not empty itself when not in operation and that hot airtreated oil will not be recirculated. For the same reason, when the pump is mounted inside the reservoir, the drain line should be arranged in such a way that a siphon is created. This ensures that the according to the port size and a straight low pressure fitting with maximized bore should be used.

	PV016~PV023	PV032~PV046	PV063~PV092	PV140~PV180	PV270
Size of pipe joints	3/8 (ø8.5 or more)	1/2 (ø12 or more)	3/4 (ø16 or more)	1 (ø19 or more)	1-1/4 (ø22 or more)
I.D. of pipes	ø12 or more	ø15 or more	ø19 or more	ø25 or more	ø32 or more
Length of drain	Under 1m	Under 1m	Under 1m	Under 1m	Under 1m

PV SERIES TANDEM AXIAL PISTON PUMP

Dimensions

Pump Combination PV



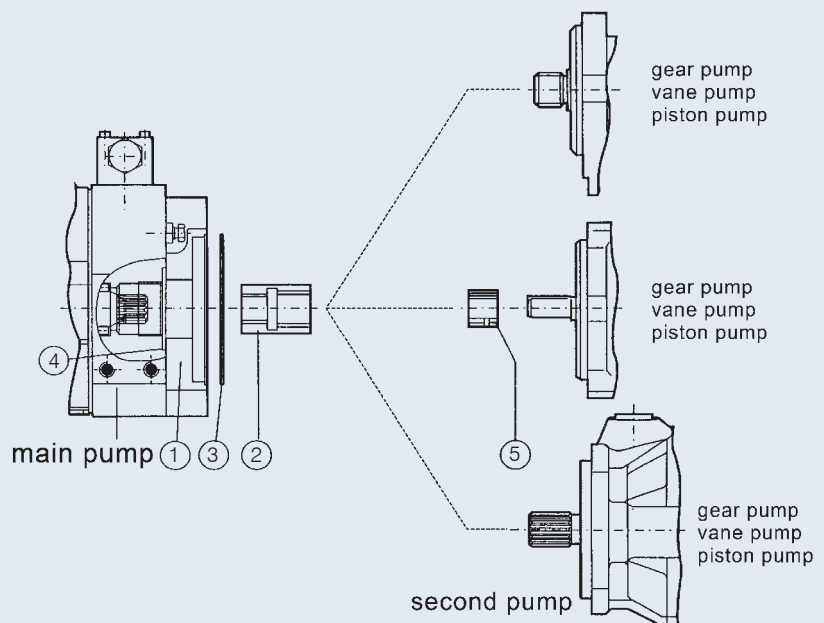
Main pump	Second pump	Interface main pump	L	B	C	D	H	K	M
PV16, 20, 23	PV16, 20, 23	100 B4 HW	489	196	170.5	225	220	225	212
PV32, 40, 46	PV16, 20, 23	125 B4 HW	541	208	197	235.5	245	261	212
	PV32, 40, 46		574	208	197	261	245	261	245
PV63, 80, 92	PV16, 20, 23	160 B4 HW	630	232	252	244.5	299	326	212
	PV32, 40, 46		663	232	252	271	299	326	245
	PV63, 80, 92		724	232	252	326	299	326	306
PV140, 180	PV16, 20, 23	160 B4 HW	719	230	305	280.5	349	415	212
	PV32, 40, 46		752	230	305	307	349	415	245
	PV63, 80, 92		813	230	305	362	349	415	306
	PV140, 180		878	230	305	415	349	415	385
PV270	PV16, 20, 23	200 B4 HW	860	255	403	299	406	531.5	212
	PV32, 40, 46		893	255	403	325.5	406	531.5	245
	PV63, 80, 92		954	255	403	380.5	406	531.5	306
	PV140, 180		1033	255	403	433.5	406	531.5	385
	PV270		1134	255	403	531.5	406	531.5	510

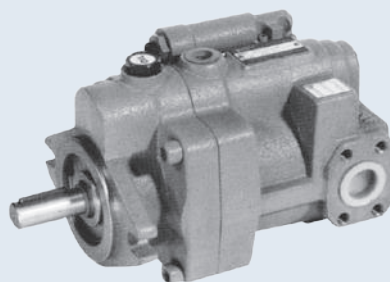
Combination PV140/180+PV140/180 and PV270+PV270 only with splined shaft on main pump due to high torque

PV pump with thru drive

List of parts

No.	Description
1	Connector
2	Coupling
3	Seal
4	Seal
5	Coupling



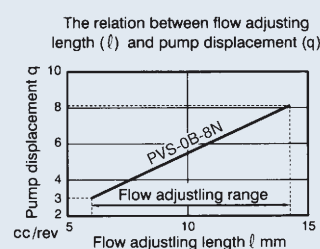
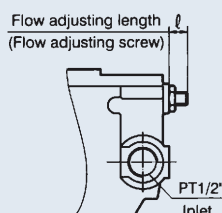
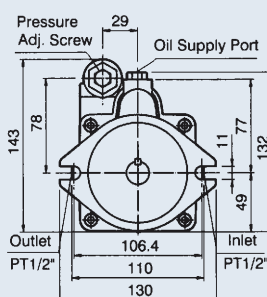
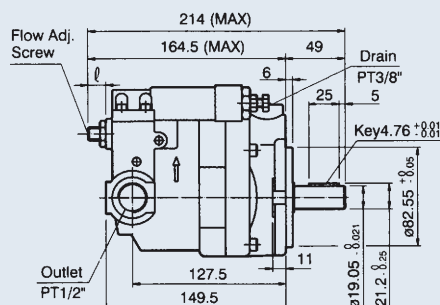
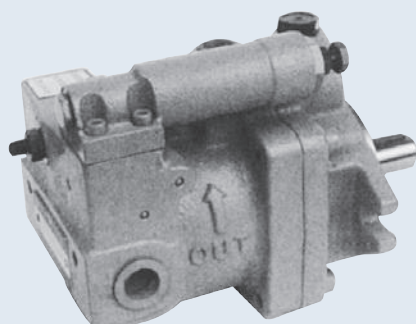


PVS - 1 B - 16 N 2 - R - ✖

1	2	3	4	5	6	7	8
1	PVS: Pump size 0, 1, 2 PZS: Pump size 3, 4						
2	Pump sizes: 0: 8 cc/rev 1: 16, 22 cc/rev 2: 36, 46 cc/rev 3: 70 cc/rev 4: 100 cc/rev						
3	Mounting Type: B: Flange type (normal) A: Foot type						
4	Displacement: 8, 16.5, 22, 36, 46, 70, 100 cc/rev						
5	Control types standard type: N Option type: P, NQ, RS (RA), WS (WA), HL						
6	Pressure adjusting PVS 0: 20-40 bar 1: 20-73 bar 2: 30-145 bar 3: 30-215 bar PZS 1: 20-73 bar 3: 30-215 bar 4: 30-286 bar						
7	Shaft rotation (viewed from shaft end) R: Clockwise L: Counter clockwise						
8	Shaft type none: Cylindric, key S: Splined, SAE						

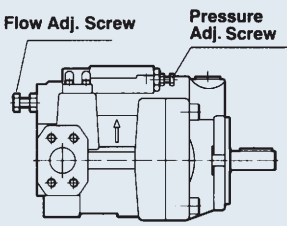
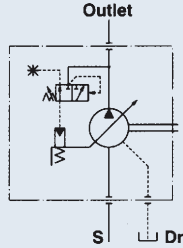
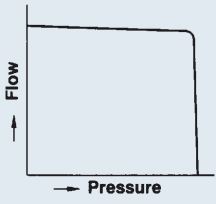
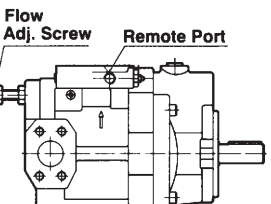
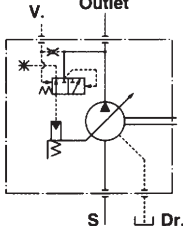
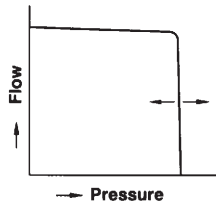
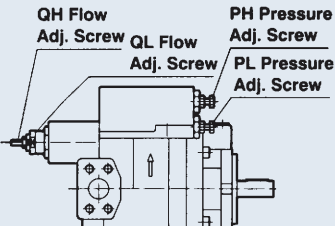
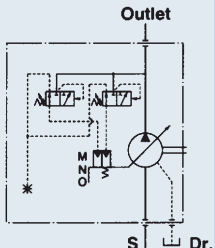
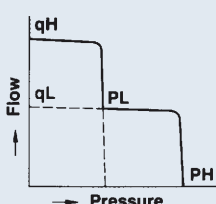
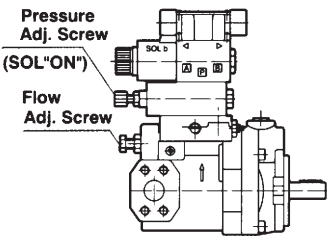
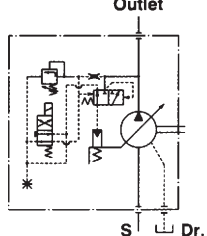
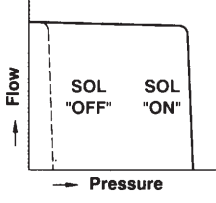
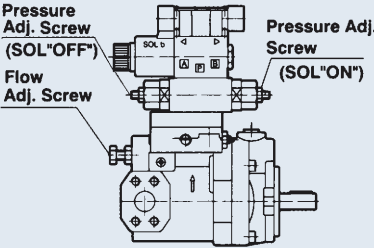
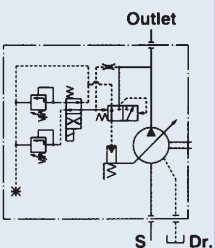
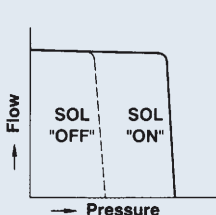
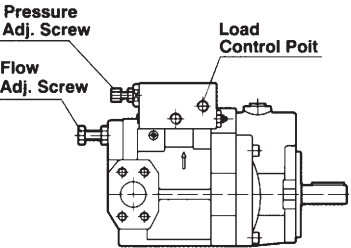
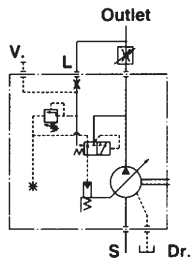
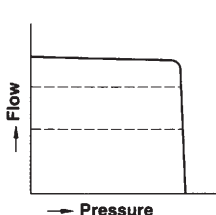
Model	Displacement cc/rev	Unloading Conditions (lpm)			Pressure Adj. Range bar	Max . Pressure bar	Input Speed Range (rpm)		Weight (kg)
		1200 rpm	1500 rpm	1800 rpm			Min.	Max.	
PVS-0B-8	8	9.6	12	14.4	0: 20-40 1: 20-73	255	500	2000	9
PVS-1B-16	16.5	19.8	24.7	29.7					12
PVS-1B-22	22	26.4	33	39.6	2: 30-145				12
PVS-2B-35	36	43.2	54	64.8	3: 30-215				23
PVS-2B-45	46	55.2	69	82.8	1: 20-73 3: 30-215 4: 30-286	286	1800	23	
PZS-3B-70	70	84	105	126				41	
PZS-4B-100	100	120	150	180				60	

PVS-0B-8N



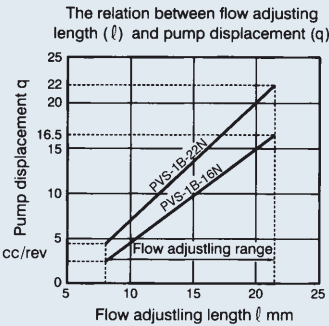
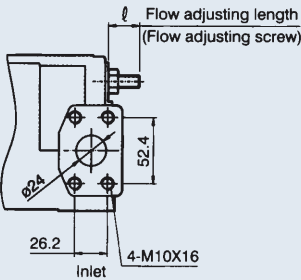
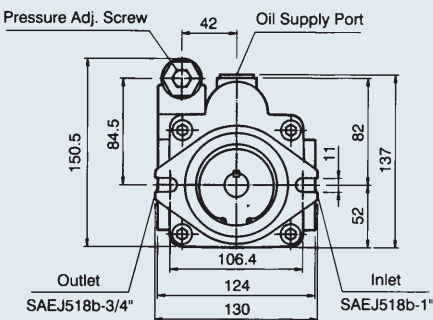
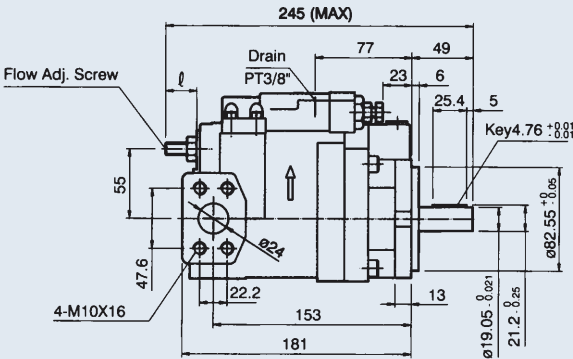
PVS, PZS SERIES VARIABLE VOLUME PISTON PUMP

Control Types

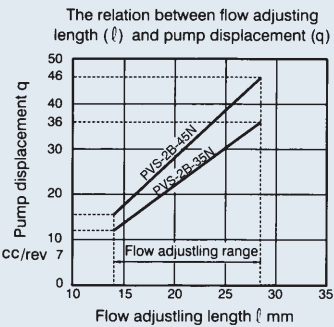
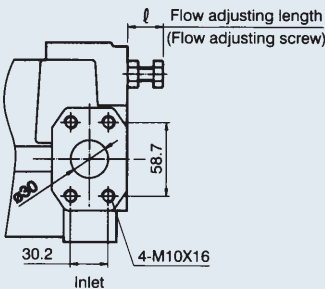
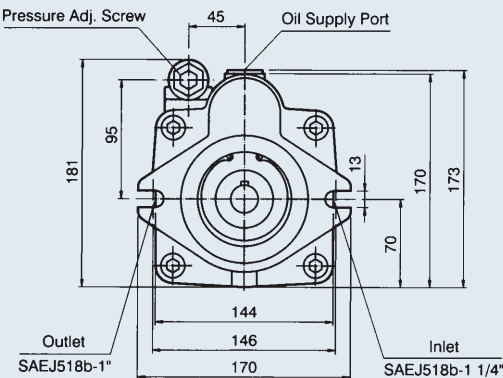
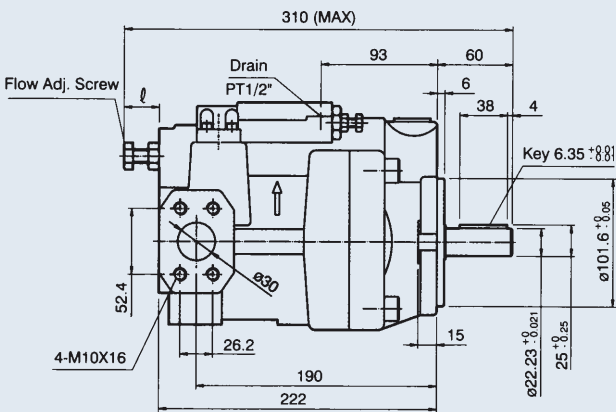
Type	External View	JIS Symbols	Characteristics	Description
N				Pressure Compensating Type (Manual) - When the pressure reaches the value set with the compensator, the flow is reduced automatically and the set pressure is maintained. - The pressure and flow are controlled manually.
P				Remote Pressure Control Type - The pressure can be controlled according to the pilot pressure. - The flow can be controlled manually.
NQ				Two Pressure-Two Flow Control Type By means of the sequence valve, two stage flow rate can be obtained and each flow rate has the different pressure eventually enabling energy savings.
RS (RA)				Solenoid Cut-Off Control Type - An unloading solenoid valve is used to minimize the lost energy when the pump output is not required. - Heat generated is very small.
WS (WA)				Two Pressure Cut-Off Control Type By means of "ON" "OFF" control of solenoid valves, two different pressure compensating types can be obtained.
HL				Load Sensing Control - The "HL" compensator is used for load sensing circuits and is a true load sensor. This is the "P" compensator with a pin in the compensator spool. The pin prevents pilot flow from entering the circuit which will eliminate creeping of the load. - The "HL" compensator will let the pump deliver a constant flow rate to the circuit by providing an adjustable ΔP across the customers orifice or valve. The pump will operate at 17.2~27.5 bar (250-400 psi) above "Load pressure".

Dimensions

PVS-1B-16N, PVS-1B-22N



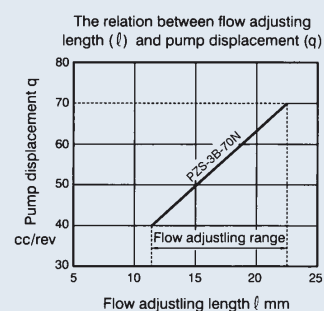
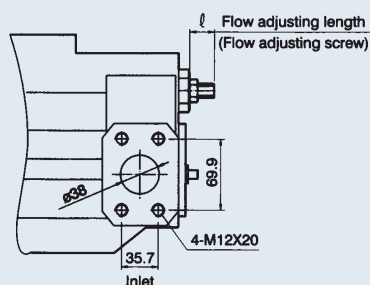
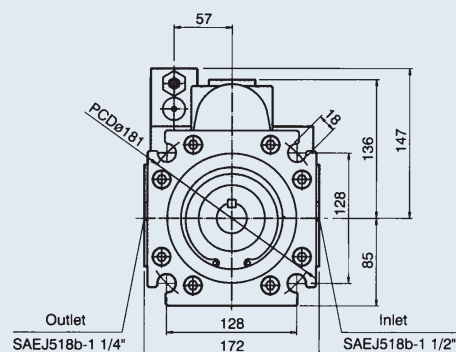
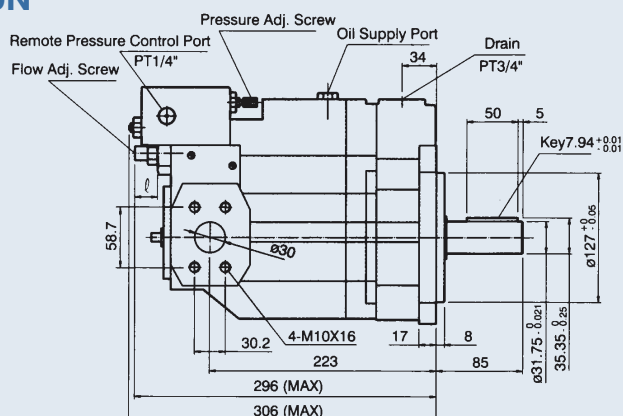
PVS-2B-35N, PVS-2B-45N



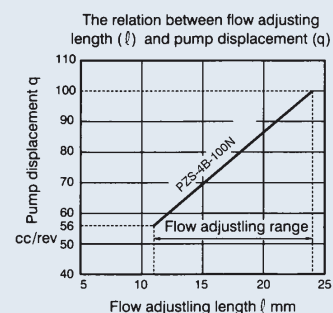
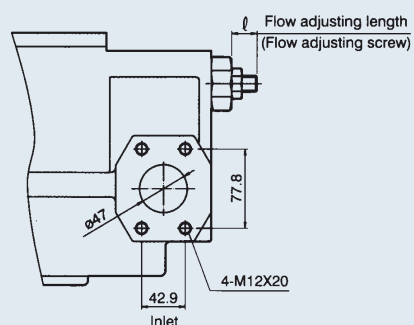
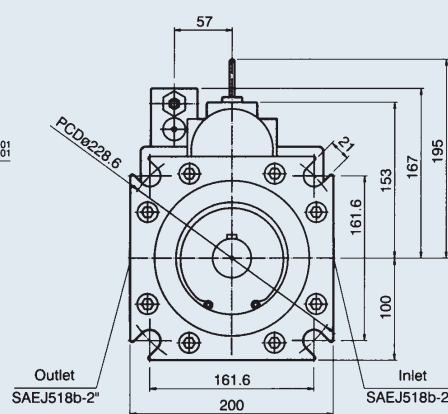
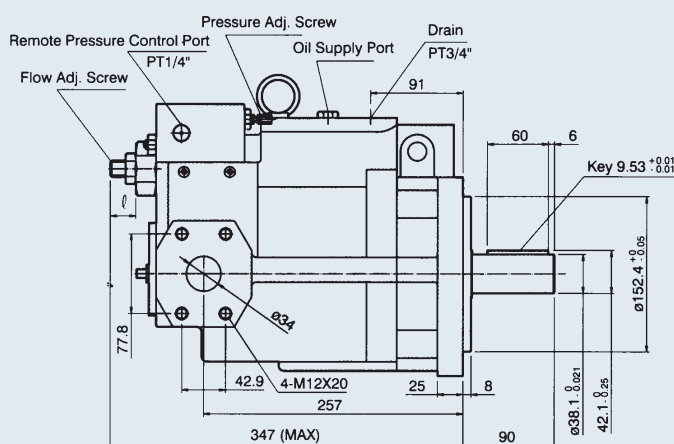
PVS, PZS SERIES VARIABLE VOLUME PISTON PUMP

Dimensions

PZS-3B-70N

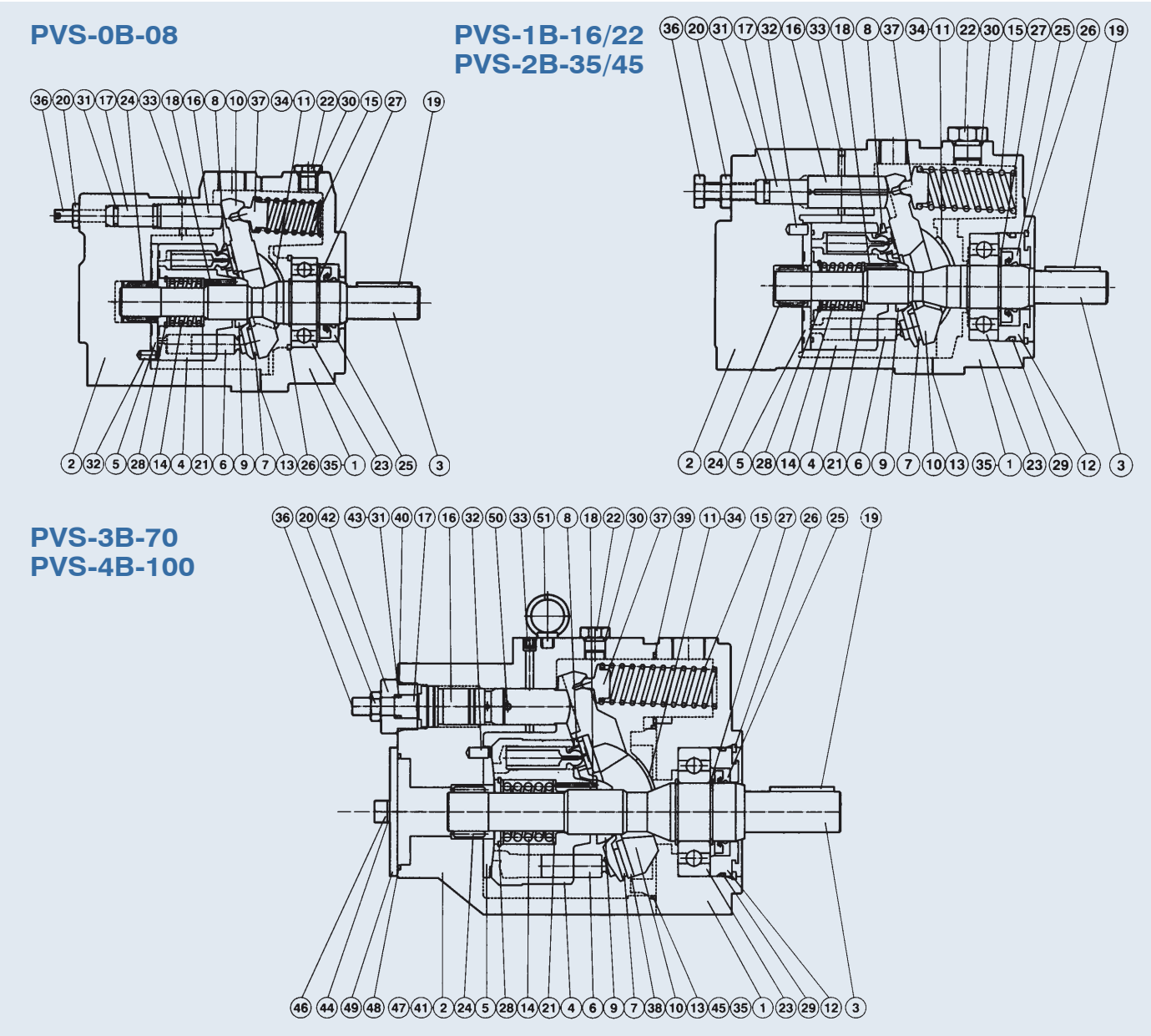


PZS-4B-100N



PVS, PZS SERIES VARIABLE VOLUME PISTON PUMP

Cross section drawing



Parts list

N0.	Part Name	N0.	Part Name	N0.	Part Name	N0.	Part Name	N0.	Part Name
1	Bady	9	Barrel holder	17	Guide	25	Oil seal	33	Expander plug
2	Case	10	Swash plate	18	Needle	26	Snap ring	34	Machine screw
3	Shaft	11	Thrust bush	19	Key	27	Snap ring	35	Machine screw
4	Cylinder barrel	12	Seal holder	20	Nut	28	Snap ring	36	Flow adj. screw
5	Valve plate	13	Gasket	21	Retainer	29	O-ring	37	Spring Holder
6	Piston	14	Spring	22	Plug	30	O-ring		
7	Shoe	15	Spring	23	Ball bearing	31	O-ring		
8	Shoe holder	16	Control Piston	24	Needle bearing	32	Pin		



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