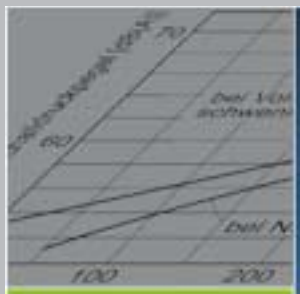
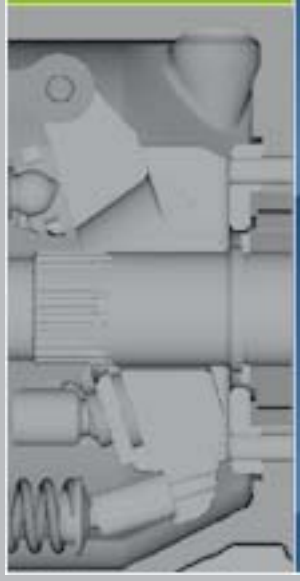
Axial Piston Pump
Series PV
Variable Displacement

Catalogue HY11-3243/UK
September 2004





Note

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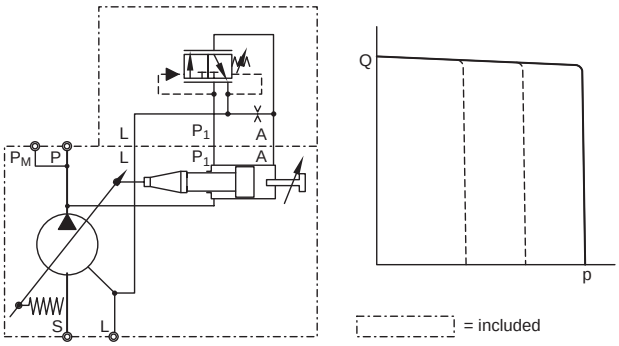
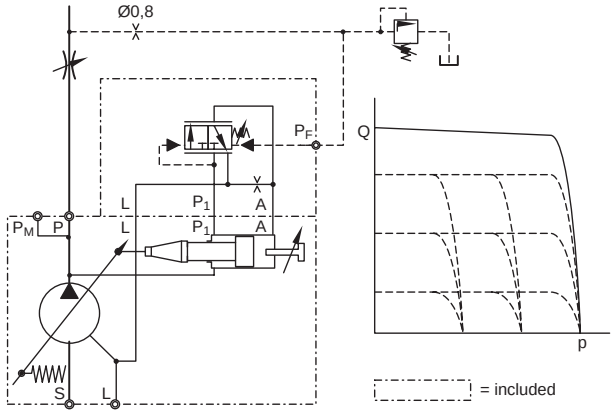
Pump with Standard Pressure Compensator, code F*S

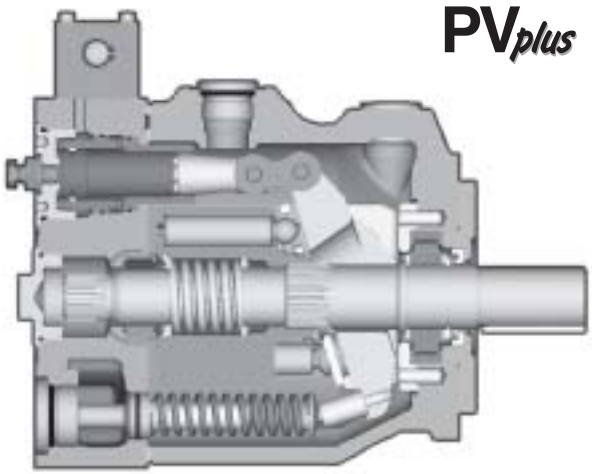


Pump with Load-Sensing Compensator, code FFC



With thru drive for single and multiple pumps

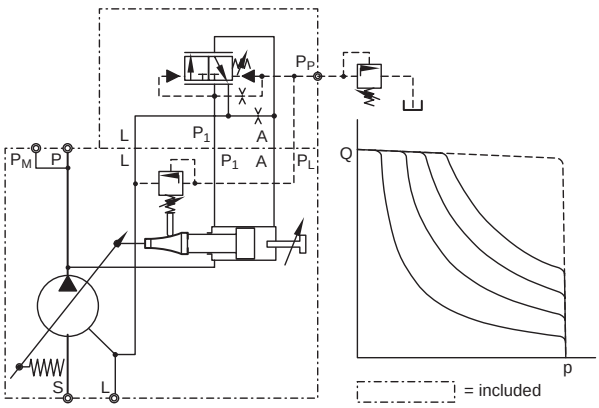
Swash plate type for open circuit



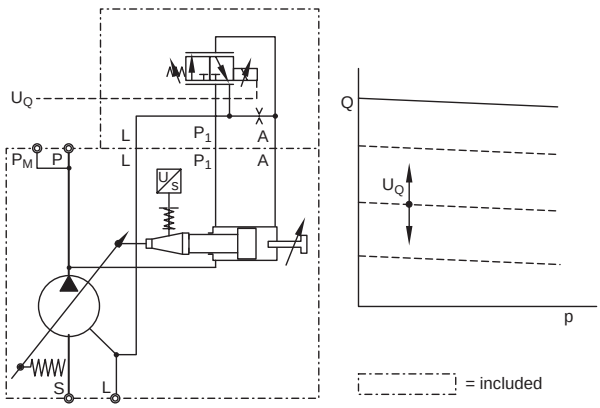
Technical Features

- Mounting interface according to VDMA-standards sheet 24560 part 1
- Standard: 4-hole flange ISO 3019/2 (metric)
  Optional: 4-hole flange ISO 3019/1 (SAE)
- Large servo piston with strong bias spring achieves fast response; e.g. for PV046
  upstroke < 70 ms
  downstroke < 40 ms
  Note: Follow installation instructions.
- Reduced pressure peaks due to active decompression of system at downstroke
- Also at low system pressure reliable compensator operation. Lowest compensating pressure 12-15 bar
- 9 piston and new precompression technology (precompression volume) result in unbeaten low outlet flow pulsation.
- Rigid and FEM-optimized body design for lowest noise level
- Complete compensator program
- Thru drive for 100% nominal torque
- Pump combinations (multiple pumps) of same size and model and mounting interface for basically all metric or SAE mounting interfaces

Pump with Horse Power Compensator, code *LB



Pump with Electrohydr. Displacement Control, code FPV



Technical data

Displacement	[cm^3/rev]	from 16 to 270
Operating pressures		
Outlet	[bar]	nominal pressure p_N 350
	[bar]	max. pressure $p_{max.}$ 420 [1]
	[bar]	drain port 2 [2]
Inlet min.	[bar]	0.8 (absolute)
max.	[bar]	16
Minimum speed	[min^{-1}]	300 min^{-1}
Mounting interface		4-hole flange ISO 3019/2
		optional ISO 3019/1, SAE
Installation		drain port as high as possible

[1] max. 20% of working cycle
[2] peak pressure only, special version up to 20 bar available (with X-Modification X5877)


Pump with Standard Pressure Comp.

Pump with Horse Power Comp.


Combination PV/PV


Combination PV/PGP

Pump combinations

See pages 26–27

Selection table

Model	Max. displacement [cm^3/rev]	Output flow at 1500 min^{-1} [l/min]	Input horse power at 1500 min^{-1} and 350 bar [kW]	Max speed * [min^{-1}]	Moment of inertia [kgm^2]	Weight [kg]
PV016	16	24	15.5			
PV020	20	30	19.5	3000	0.0017	19
PV023	23	34.5	22.5			
PV032	32	48	31			
PV040	40	60	39	2800	0.0043	30
PV046	46	69	45			
PV063	63	94.5	61.5	2800		
PV080	80	120	78	2500	0.018	60
PV092	92	138	89.5	2300		
PV140	140	210	136	2400	0.030	90
PV180	180	270	175	2200		
PV270	270	405	263	1800	0.098	172

* The maximum speed ratings are shown for an inlet pressure of 1 bar (absolute) and for a fluid viscosity of ν = 30 mm^2/s.

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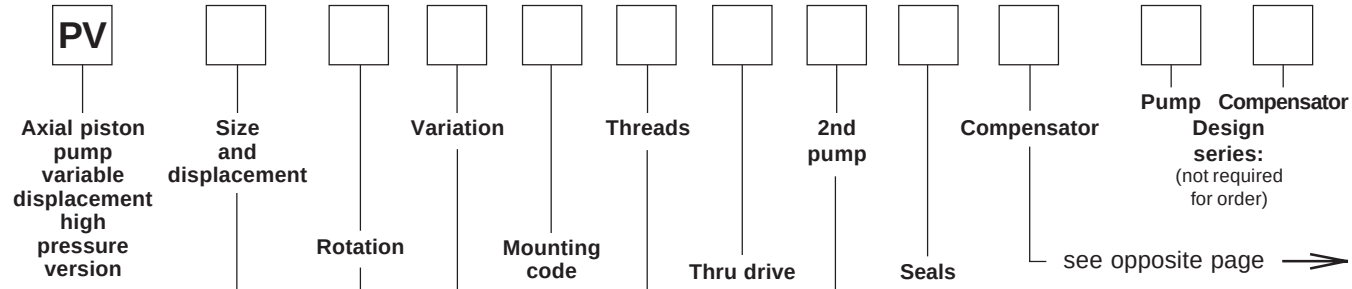

Code	Displacement
016	**16 cm³/rev**
020	**20 cm³/rev**
023	**23 cm³/rev**
032	**32 cm³/rev**
040	**40 cm³/rev**
046	**46 cm³/rev**
063	**63 cm³/rev**
080	**80 cm³/rev**
092	**92 cm³/rev**
140	**140 cm³/rev**
180	**180 cm³/rev**
270	**270 cm³/rev**

Code	Rotation [1]
R	**Clockwise**
L	Counter clockwise

[1] When looked on shaft

Code	Variation
1	**Standard**
9	Reduced displacement adjusted [2]

[2] For order specify displacement.

Code	Mounting interface		Shaft
D	SAE ISO 3019/1	4-hole flange	Cylindric, key
E		4-hole flange	Splined, SAE
F[3]		4-hole flange	Cylindric, key
G[3]		4-hole flange	Splined, SAE
K	**metr. ISO 3019/2**	**4-hole flange**	**Cylindric, key**
L		**4-hole flange**	**Splined, DIN 5480**

[3] Codes F and G only for PV140/180, see dimension sheet

Code	Port [4]	Threads[5]
1	**BSPP**	**Metric**
3	UNF	UNC
4[6]	BSPP	Metr. M14
7	ISO 6149	UNC
8	ISO 6149	Metric[1]

[4] Drain, gauge and flushing ports
[5] All mounting and connecting threads
[6] For PV063-PV180 only: pressure port 1 1/4" with 4 x M14 instead of 4 x M12

Code	Seals
N	**NBR**
V	FPM
E	EPDM
W	NBR with PTFE shaft seal
P	FPM with PTFE shaft seal
S	EPDM with PTFE shaft seal

Code	2nd pump option[7]
1	**Single pump, no 2nd pump and coupling**
2	PV140 or PV180 mounted
3	PV or PVM pump mounted
4	Gear pump series PGP mounted

[7] Specify 2nd pump with full model code

Code	Thru drive option no adaptor for 2nd pump
T	**Single pump prepared for thru drive**
	With adaptor for 2nd pump
Y[8]	SAE AA, Ø 50.8mm
A	SAE A, Ø 82.55mm
B	SAE B, Ø 101.6mm
C[9]	SAE C, Ø 127mm
D[10]	SAE D, Ø 152.4mm
E[11]	SAE E, Ø 165.1mm
G[12]	Metric, Ø 63mm
H	Metric, Ø 80mm
J	Metric, Ø 100mm
K[9]	Metric, Ø 125mm
L[10]	Metric, Ø 160mm
M[11]	Metric, Ø 200mm

[8] Only for PV016 - PV023
[9] Only for PV032 and larger
[10] Only for PV063 and larger
[11] Only for PV270
[12] Only for PV016 - PV092

Bold letters =
Short-term availability

PI PVplus UK.PMD RH

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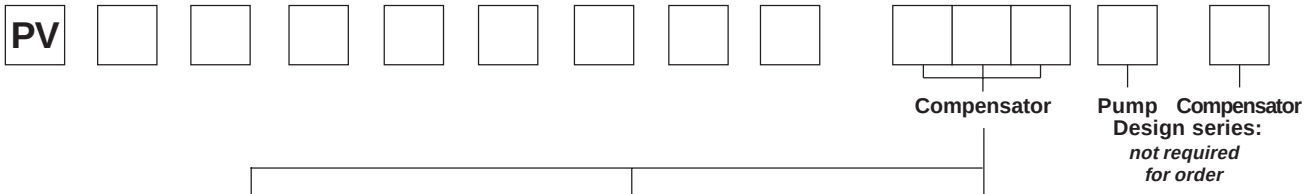

Standard Pressure Compensator			
Code			Compensator options
0	**0**	**1**	**No compensator**
1	**0**	**0**	**With coverplate, no control function**
F	**D**	**S**	**10 - 140 bar, spindle + lock nut**
F	**H**	**S**	**40 - 210 bar, spindle + lock nut**
F	**W**	**S**	**70 - 350 bar, spindle + lock nut**
			Remote Compensator options
F	**R**		**Remote pressure compensator**
F	S		Variation R, for quick unload valve
F	**F**		**Load-Sensing compensator**
F	T		Two valve load-sensing compensator
			Variations for Remote Compensator
		C	**External pressure pilot [13)]**
		1	**NG6/D03 interface top side**
		2	**Like 1 but with ext. pilot port [15)]**
		P	**Pilot valve PVAC1P* mounted**
		D	Proportional pilot valve type PVACPP* mounted
		L	Pilot valve with DIN lock mounted
		Z	Accessory mounted [14)]

Horse power compensator									
Code			Displacement						Compensator option
			016 023	032 046	063 092	140	180	270	Nom. HP [kW] at 1500 min^{-1} / Nom. torque [Nm]
B			x						3 / 19.5
C			x						4 / 26
D			x	x					5.5 / 36
E			x	x					7.5 / 49
G			x	x	x				11 / 71
H			x	x	x				15 / 97
K			x	x	x	x			18.5 / 120
M				x	x	x	x		22 / 142
S				x	x	x	x		30 / 195
T					x	x	x	x	37 / 240
U					x	x	x	x	45 / 290
W					x	x	x	x	55 / 355
Y						x	x	x	75 / 485
Z						x	x	x	90 / 585
2							x	x	110 / 715
3								x	132 / 850
Function									
	L		x	x	x	x	x	x	Horse power compensator
	C		x	x	x	x	x	x	Horse power compensator and load-sensing
Variation									
		A	x	x	x	x	x	x	NG6 interface top side
		B	x	x	x	x	x	x	No pressure compensation
		C	x	x	x	x	x	x	Adjustable pressure compensation
		D	x	x	x	x	x	x	Proportional pilot valve PVACPP* mounted
		Z	x	x	x	x	x	x	Accessories mounted [14)]

Electrohydraulic compensator			
Code			Compensator option
			Pilot pressure supply
F			Standard (internal), no shuttle valve
U			Elbow manifold, compensator horizontal [16)]
			Function
	P		Proportional displacement control
			Variation
		V	Standard, no pressure compensation
		R	Remote pressure comp. NG6 interface
		G	Variation R, Pressure sensor and proportional pilot valve mounted for pressure resp. horse power control
		D	Variation R, Proportional pilot valve PVACPP* mounted
		Z	Variation R, accessories mounted [14)]
		S	Remote pressure comp., NG6 interface top side, for quick unload valve
		T	Variation S, pressure sensor and proportional pilot valve mounted for pressure resp. horse power control
		P	Remote pressure comp., NG6 interface top side, for preload and quick unload manifold
		E	Variation P, pressure sensor and proportional pilot valve mounted for pressure resp. horse power control

[16)] not for *UPV

Note

Compensator differential Δp is to be adjusted:

Remote pressure comp., horse power comp. 15 ± 1 bar
(Codes FR*, FT*, *L*, *C*, FPR, FPD, FPZ, FPG)

With quick unload manifold 12 ± 1 bar
(Codes FS*, FPS, FPT, FPP, FPE)

Load-Sensing comp. (not horse power comp.) 10 ± 1 bar
(Codes FF*)

The ordering code PVACPP* correspond to the DSAE1007P07*

[13)] Not for two-valve-compensator

[14)] Accessories not included, please specify on order with full model code.

[15)] Only for Codes *FR* and *FT*

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Short-term availability

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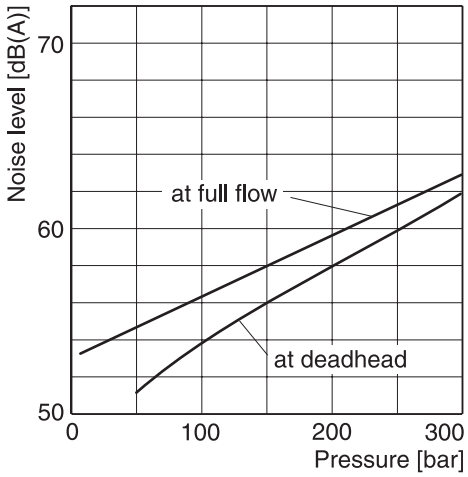
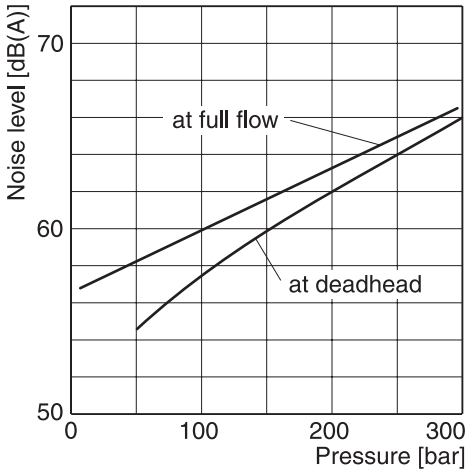
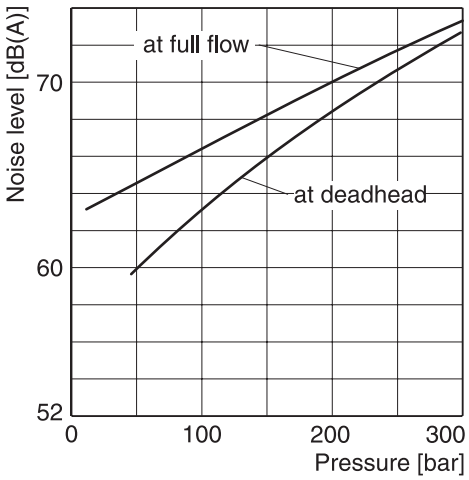
PV016 - PV023



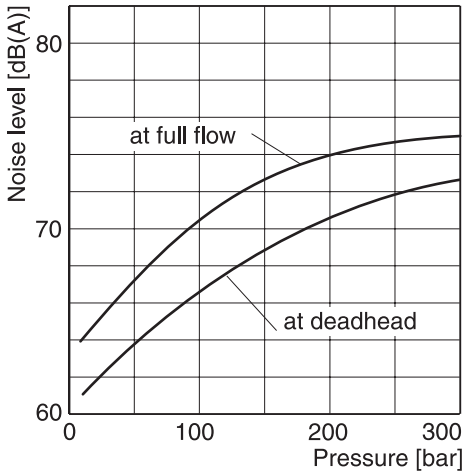
PV032 - PV046



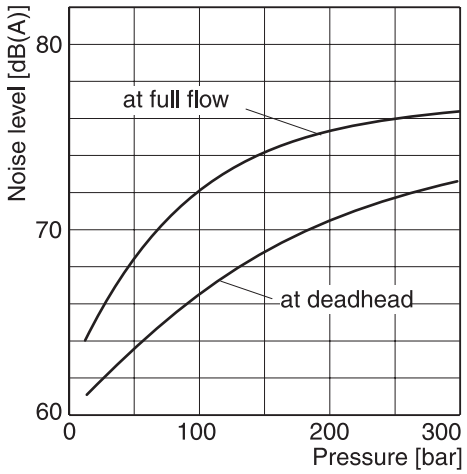
PV063 - PV092



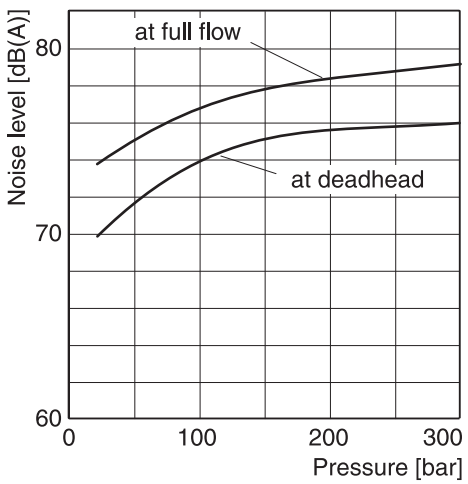
PV140



PV180



PV270



Typical sound level for single pumps, measured in unechoic chamber according to DIN 45 635, part 1 and 26. Microphone distance 1m; speed: n = 1500 min-1.

All data measured with mineral oil viscosity 30 mm²/s (cSt) at 50°C.

Operating noise of pumps

The normal operating noise of a pump and consequently the operating noise of the entire hydraulic system are largely determined by **where** and **how** the pump is mounted and how it is connected to the downstream 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

Talking about operating noise of a hydraulic pump, **primary** and **secondary** pump noise has to be taken into consideration.

Primary pump noise is caused by vibrations of the pump body due to internal alternating forces stressing the body structure.

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

Secondary pump noise is caused by vibration induced into all connected hydraulic components by the flow and pressure pulsation of the pump. This secondary noise adds typical 7 - 10 dB(A) to the noise of a pump measured in the sound chamber according to DIN 45 635 (see diagrams on opposite side). Therefore pipework, its mounting and the mounting of all hydraulic components like pressure filters and control elements have a major influence on the overall system noise level.

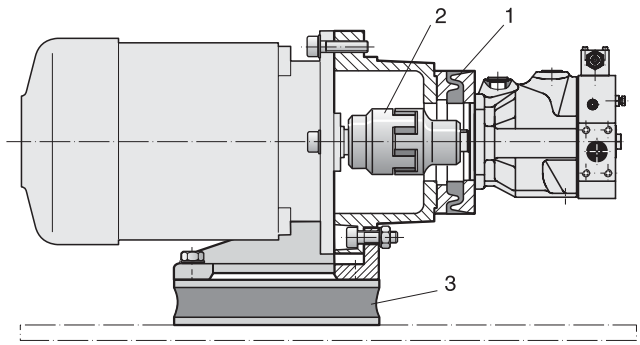
Pulsation reduction with precompression volume

The PV is equipped with a new technology for flow ripple reduction. This method reduces the pulsation at the pump outlet by **40 - 60 %**. That leads to a significant reduction of the overall system noise without additional cost and without additional components (silencers etc.). The typical reduction reaches **2 - 4 dB(A)**. That means: with a pump of the PV series the secondary noise adds only some 5 - 7 dB(A) to the pump noise instead of 7 - 10 dB(A) as usually found.

Figure 2 compares the measured pulsation of a system with 6 pumps of 180 cm³/rev each.

Last but not least the connection between pump and driving motor can be the cause of an unacceptably high noise emission. Even when the mounting space is limited there are suitable means and components to reduce the noise significantly.

The vibration of the pump body, created by high alternating forces in the rotating group and the pulsation of the output flow excite every part of the system connected to the pump mechanically or hydraulically.



1) Bell housing 2) Coupling 3) Damping rails

Figure 1: Components to avoid vibration transfer from the pump to the drive/installation and their position in the power unit (numbers refer to the text on the left)

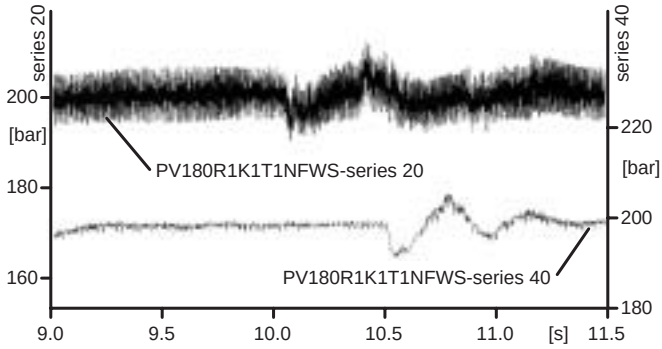


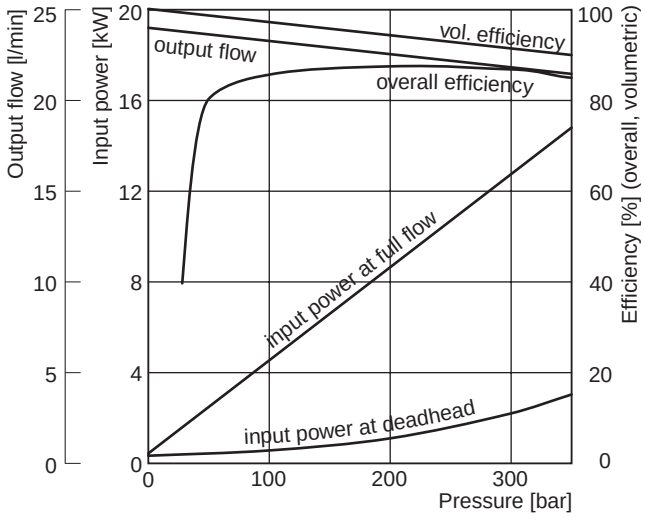
Figure 2: Comparison of the pressure pulsation in a system with 6 old PV pumps versus the same system with 6 PVplus pumps. The pulsation reduction effect of the precompression volume is evident.

Other measures

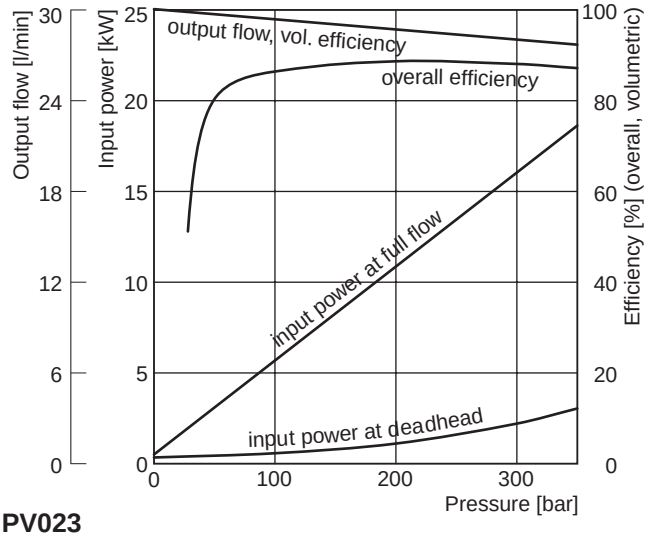
Small diameter tubes do not only cause high flow speeds, turbulences inside the tubes and cavitation in the pump, they also produce noise.

Only correctly sized connections of the largest possible diameter according to the port size of the pump should be used.

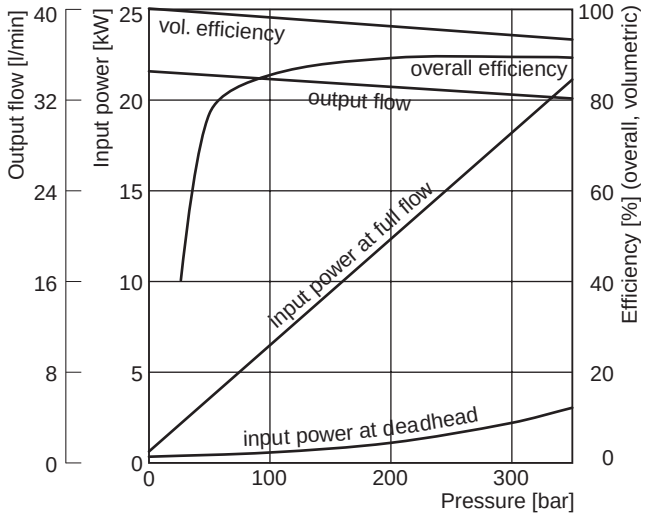
Efficiency, power consumption
PV016



PV020



PV023



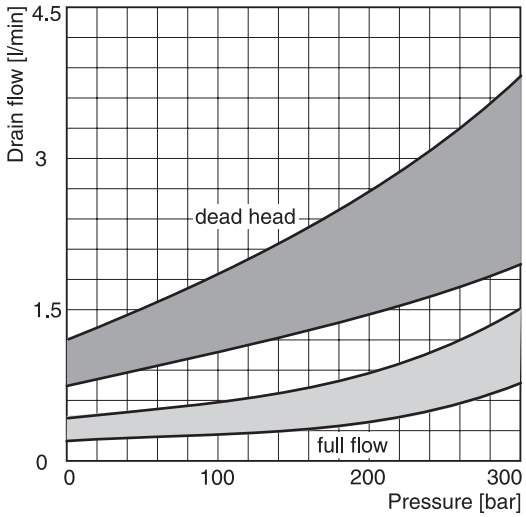
Efficiency and case drain flows PV016, PV020, PV023

The efficiency and power graphs are measured at an input speed of n = 1500 min^{-1}, a temperature of 50°C and a fluid viscosity of 30 mm^2/s.

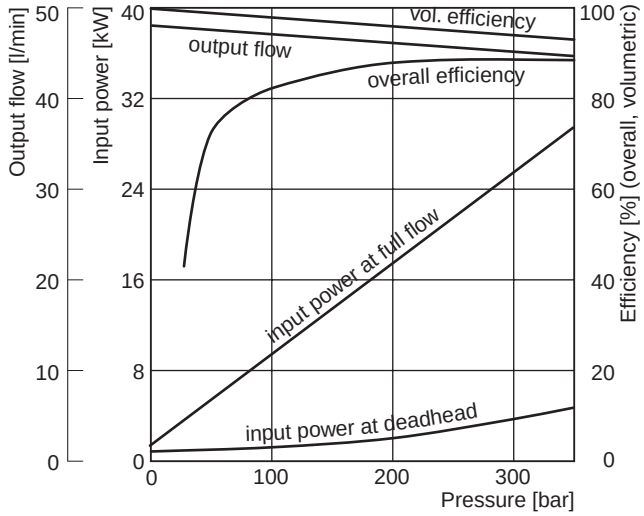
Case drain flow and compensator control flow leave via the drain port of the pump. To the values shown are to be added 1 to 1.2 l/min , if at pilot operated compensators (codes FR*, FF*, FT*, horse power compensator and p/Q-control) the control flow of the pressure pilot valve also goes through the pump.

Please note: The values shown below are only valid for static operation. Under dynamic conditions and at rapid compensation 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 l/min! Therefore the case drain line is to lead to the reservoir at full size and without restrictions as short and direct as possible.

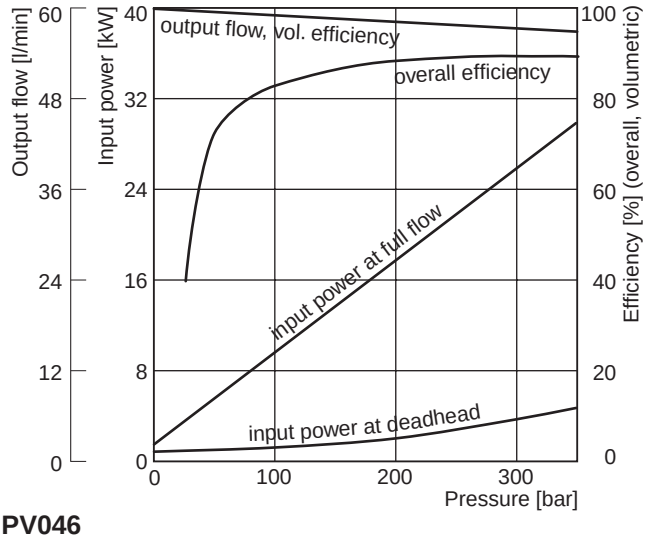
Case drain flows PV016-023



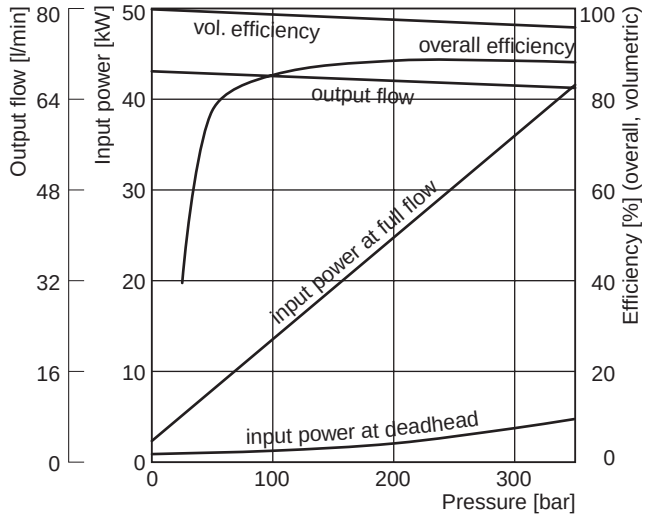
Efficiency, power consumption
PV032



PV040



PV046



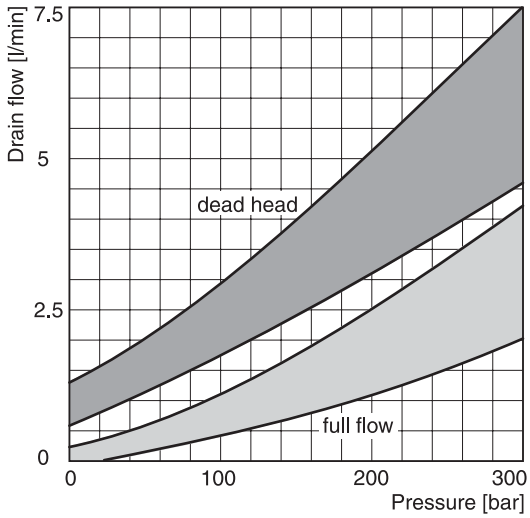
Efficiency and case drain flows PV032, PV040, PV046

The efficiency and power graphs are measured at an input speed of n = 1500 min^{-1}, a temperature of 50°C and a fluid viscosity of 30 mm^2/s.

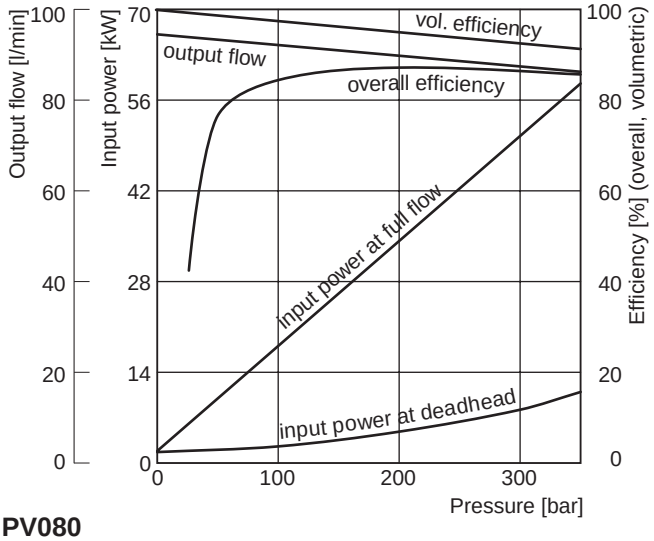
Case drain flow and compensator control flow leave via the drain port of the pump. To the values shown are to be added 1 to 1.2 l/min , if at pilot operated compensators (codes FR*, FF*, FT*, horse power compensator and p-Q-control) the control flow of the pressure pilot valve also goes through the pump.

Please note: The values shown below are only valid for static operation. Under dynamic conditions and at rapid compensation 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 l/min! Therefore the case drain line is to lead to the reservoir at full size and without restrictions as short and direct as possible.

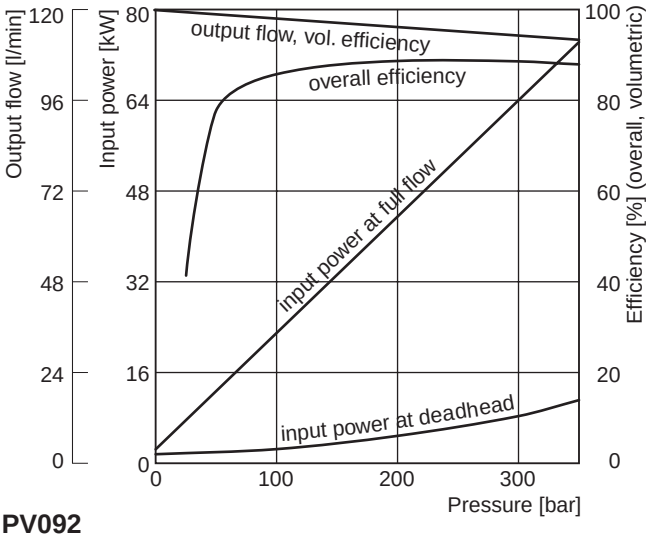
Case drain flows PV032-046



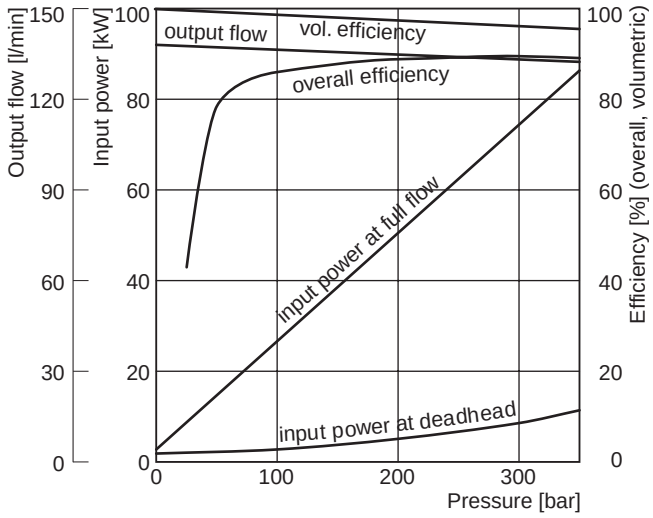
Efficiency, power consumption
PV063



PV080



PV092



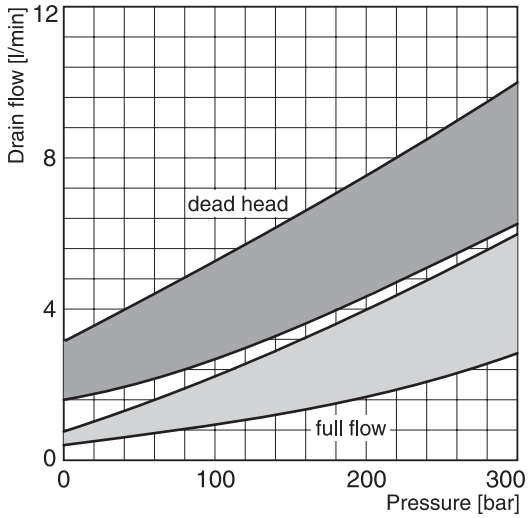
Efficiency and case drain flows PV063, PV080, PV092

The efficiency and power graphs are measured at an input speed of n = 1500 min^{-1}, a temperature of 50°C and a fluid viscosity of 30 mm^2/s.

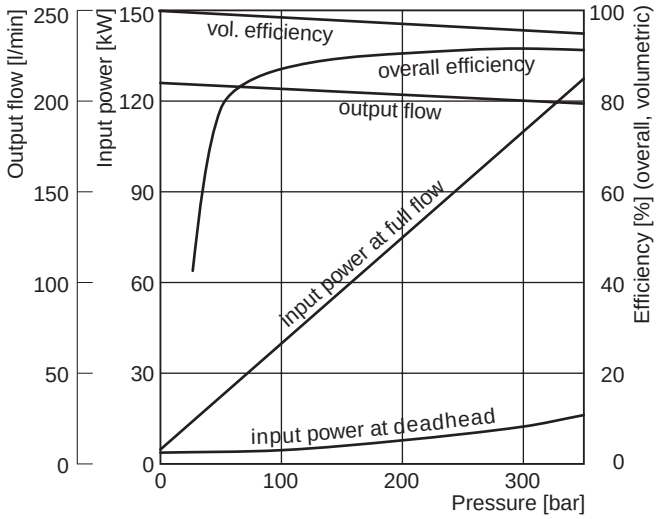
Case drain flow and compensator control flow leave via the drain port of the pump. To the values shown are to be added 1 to 1.2 l/min , if at pilot operated compensators (codes FR*, FF*, FT*, horse power compensator and p-Q-control) the control flow of the pressure pilot valve also goes through the pump.

Please note: The values shown below are only valid for static operation. Under dynamic conditions and at rapid compensation 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 l/min! Therefore the case drain line is to lead to the reservoir at full size and without restrictions as short and direct as possible.

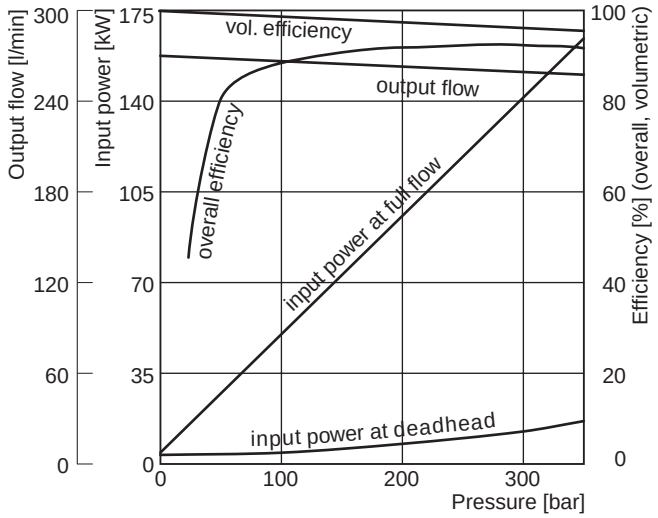
Case drain flows PV063-092



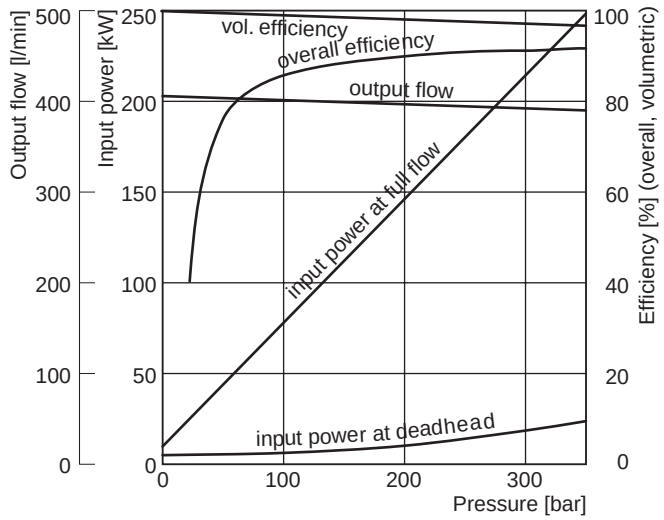
Efficiency, power consumption
PV140



PV180



PV270



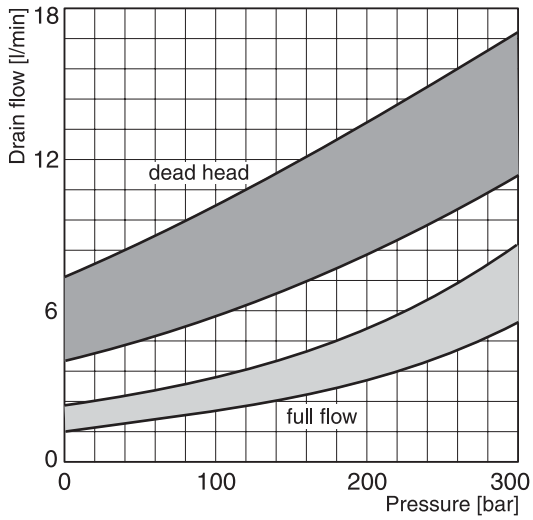
Efficiency and case drain flows PV140, PV180, PV270

The efficiency and power graphs are measured at an input speed of n = 1500 min^{-1}, a temperature of 50°C and a fluid viscosity of 30 mm^2/s.

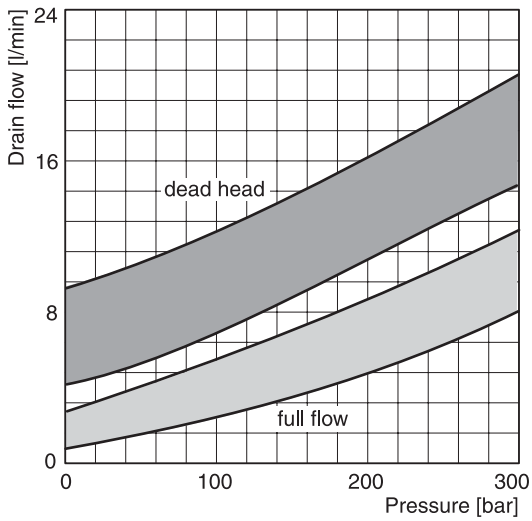
Case drain flow and compensator control flow leave via the drain port of the pump. To the values shown are to be added 1 to 1.2 l/min , if at pilot operated compensators (codes FR*, FF*, FT*, horse power compensator and p-Q-control) the control flow of the pressure pilot valve also goes through the pump.

Please note: The values shown below are only valid for static operation. Under dynamic conditions and at rapid compensation 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 l/min! Therefore the case drain line is to lead to the reservoir at full size and without restrictions as short and direct as possible.

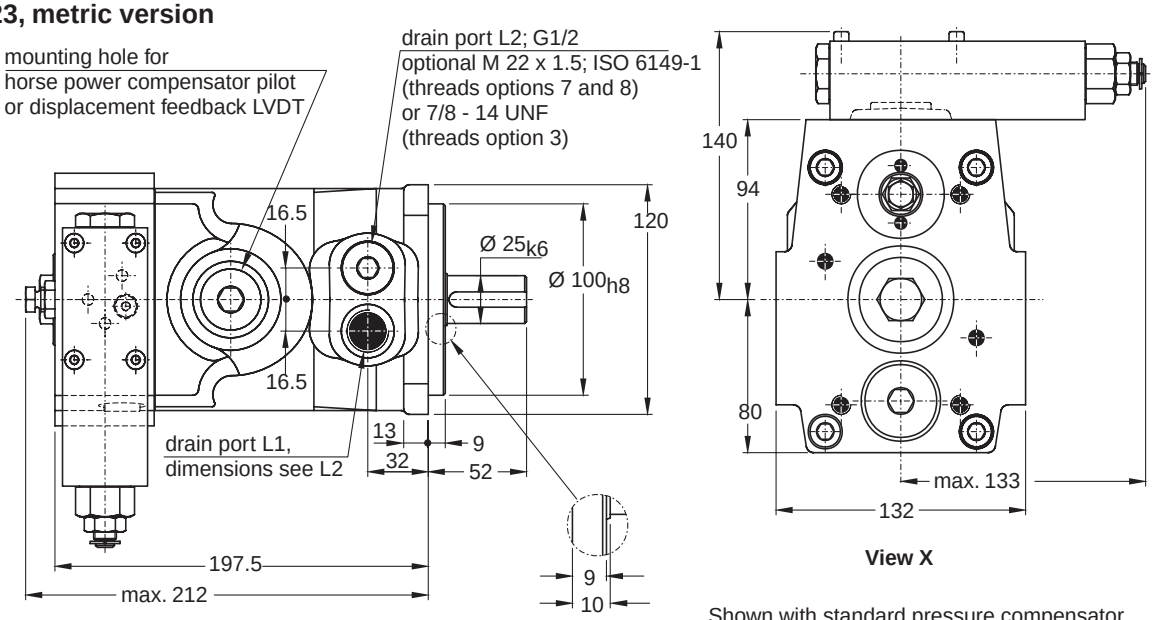
Case drain flows PV140-180



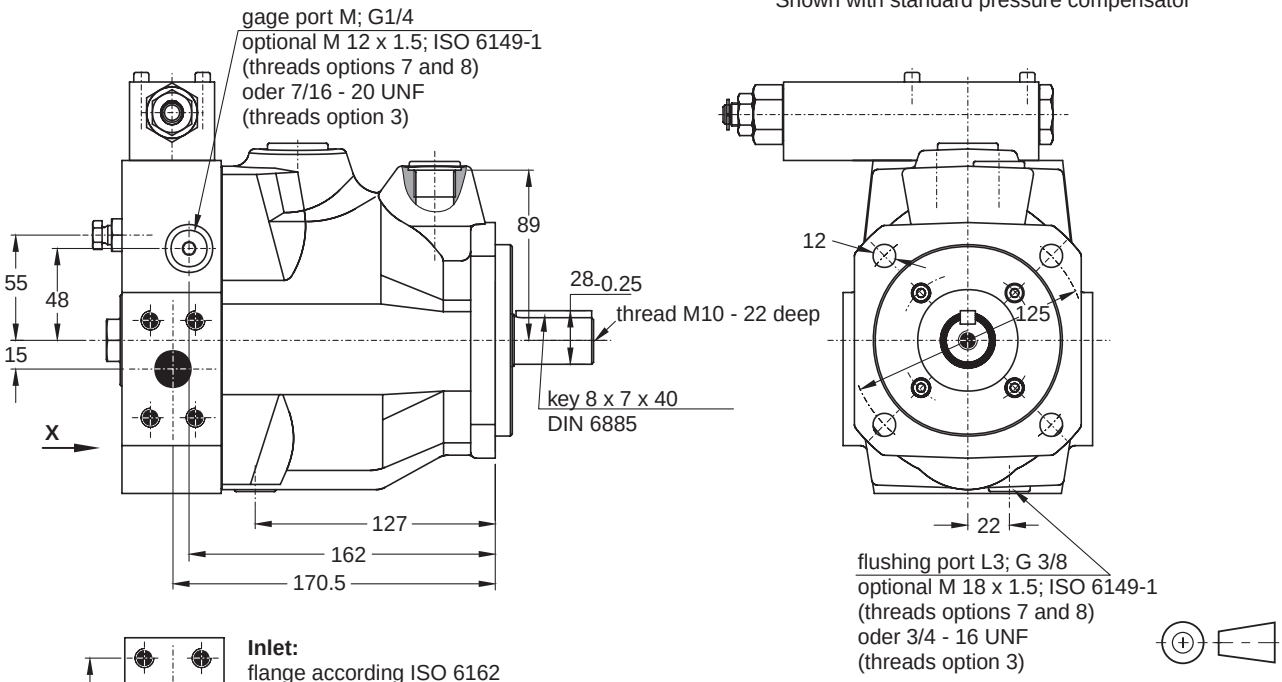
Case drain flows PV270

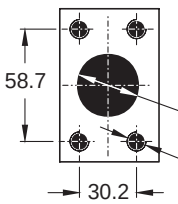


PV016 - 023, metric version



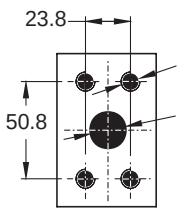
Shown with standard pressure compensator





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

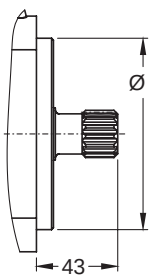
4 x M10, 18 deep
optional 7/16 - 14 UNC - 2B
(threads options 3 and 7)



4 x M10, 18 deep
optional 3/8 - 16 UNC - 2B
(threads options 3 and 7)

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

The pump shown above has **mounting option K** and **thru drive option T** (prepared for thru drive).



mounting option L
splined shaft W 25 x 1.5 x 15 x 8f DIN 5480

For further information about flanges see catalogue No. 4039/UK „Pressure Hydraulic Flanges“ (on request).
Shown is a clockwise rotating pump. Counter clockwise rotating pumps have inlet, outlet and gauge ports reversed.

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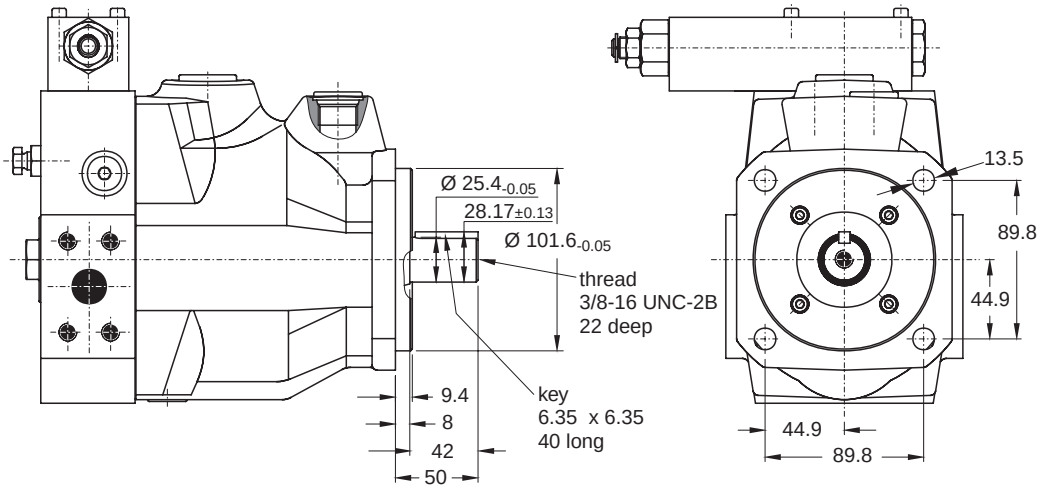
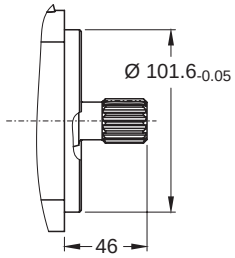
PV016 - 023, SAE version and thru drive

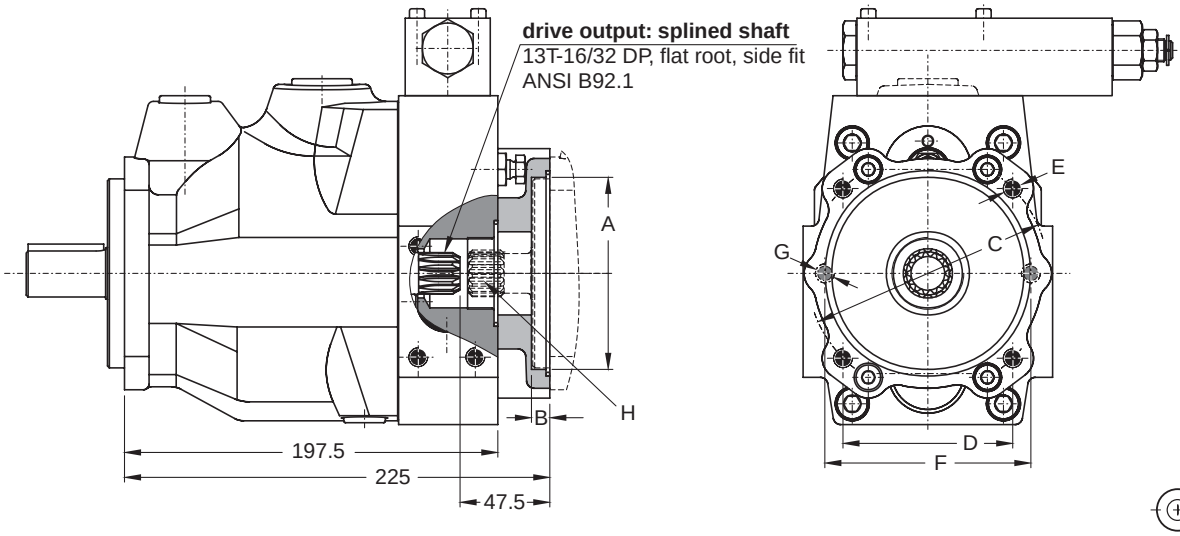


Shown above is **mounting option D**



mounting option E
splined shaft 15T 16/32 DP, flat root, side fit
ANSI B92.1

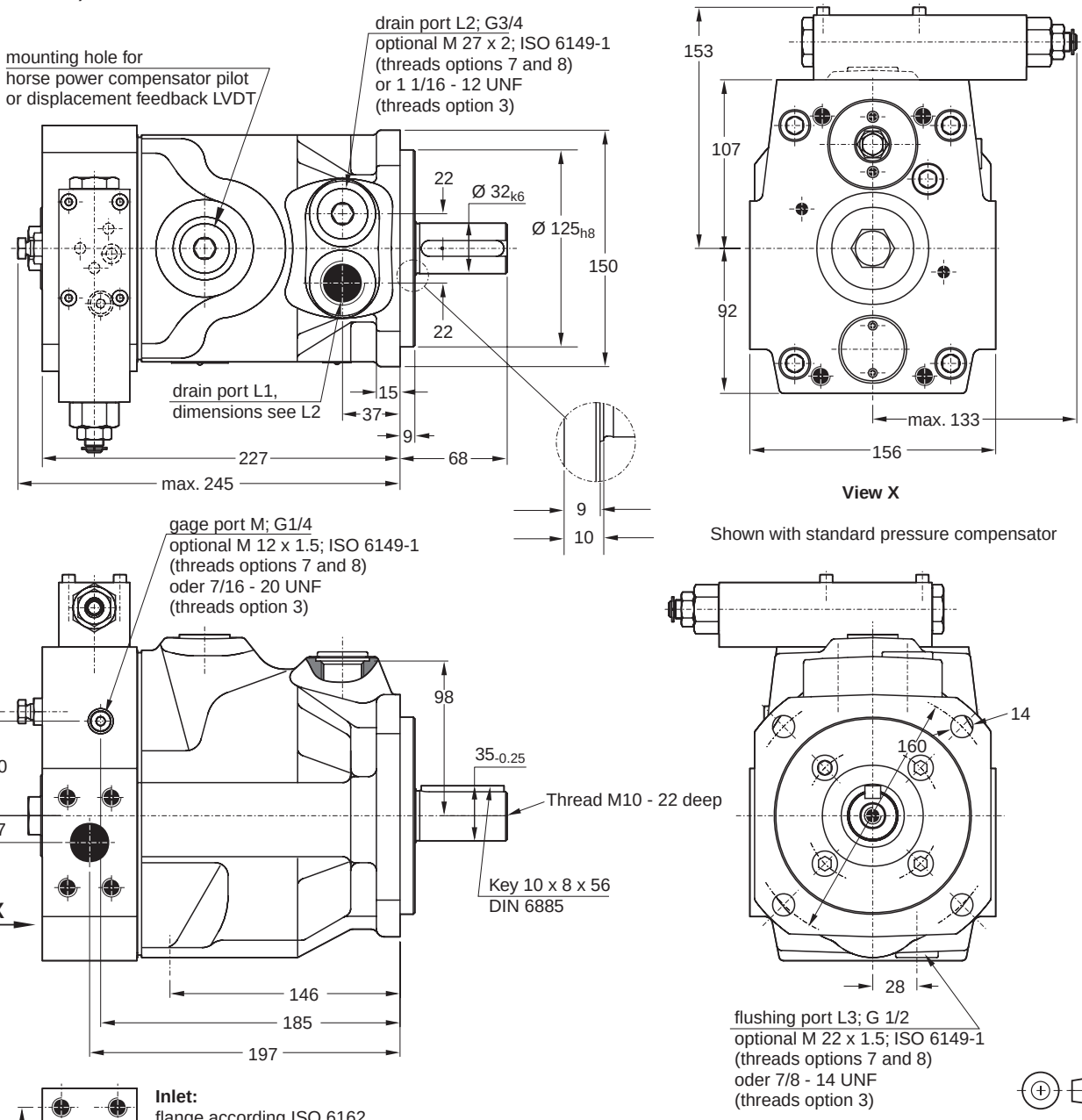
Variation with thru drive

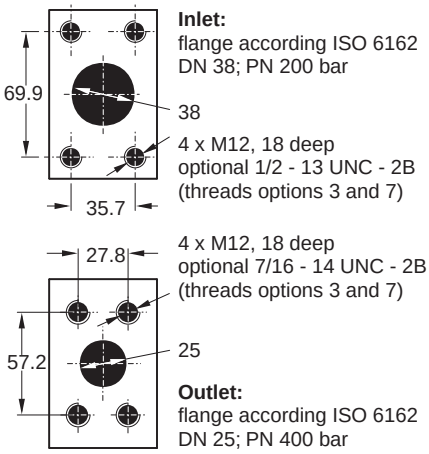


Thru shaft adaptors are available with the following dimensions:						
A	**B**	**C**	**D**	**E**	**F**	**G**
63	10	85	-	M8	100	M8
80	10	103	-	M8	109	M10
100	10.5	125	-	M10	-	-
50.8	10	-	-	-	82	M8
82.55	10	-	-	-	106	M10
101.6	10.5	-	89.8	M12	-	-

Dimension H and available couplings see page 24.
At threads options 3 and 7 the dimensions E and G are UNC - 2B threads.

PV032 - 046, metric version

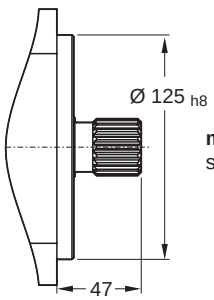




Inlet:
flange according ISO 6162
DN 38; PN 200 bar

Outlet:
flange according ISO 6162
DN 25; PN 400 bar

The pump shown above has **mounting option K**
and **thru drive option T** (prepared for thru drive)



mounting option L
splined shaft W 32 x 1.5 x 20 x 8f DIN 5480

For further information about flanges see catalogue No. 4039/UK „Pressure Hydraulic Flanges“ (on request).
Shown is a clockwise rotating pump. Counter clockwise rotating pumps have inlet, outlet and gauge ports reversed.

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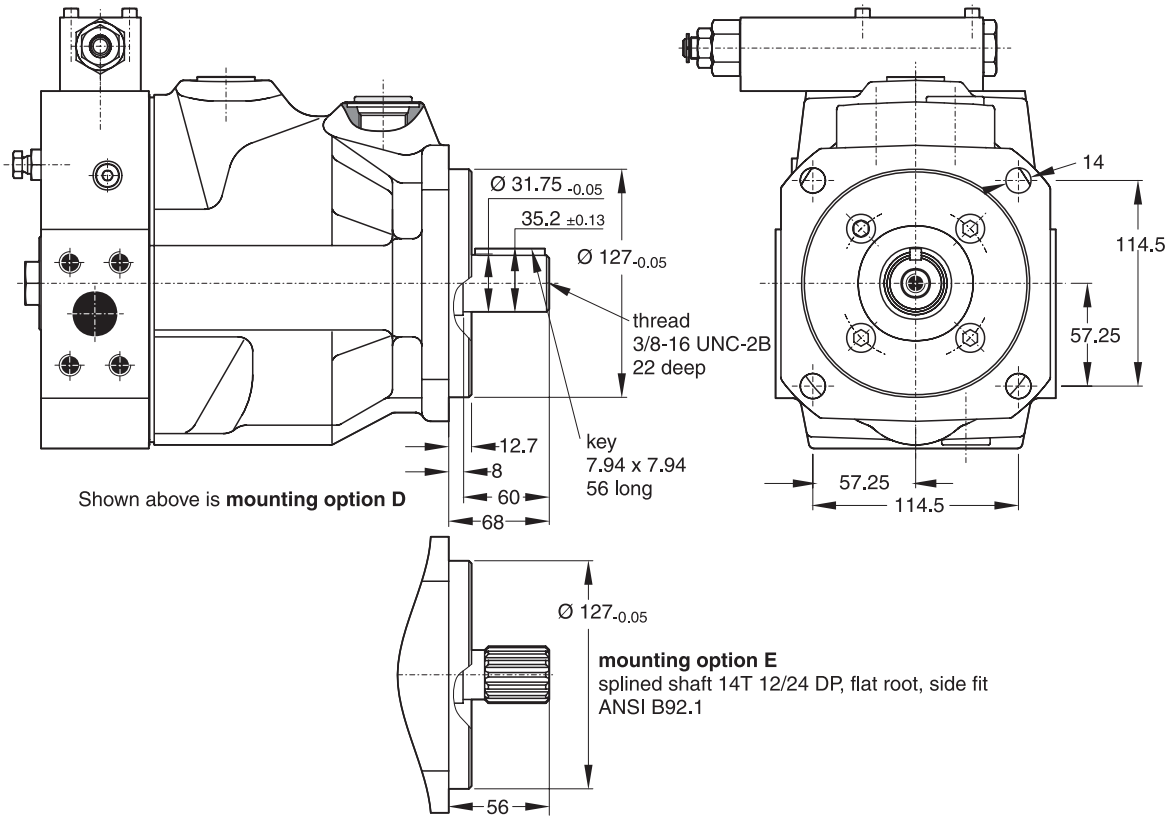
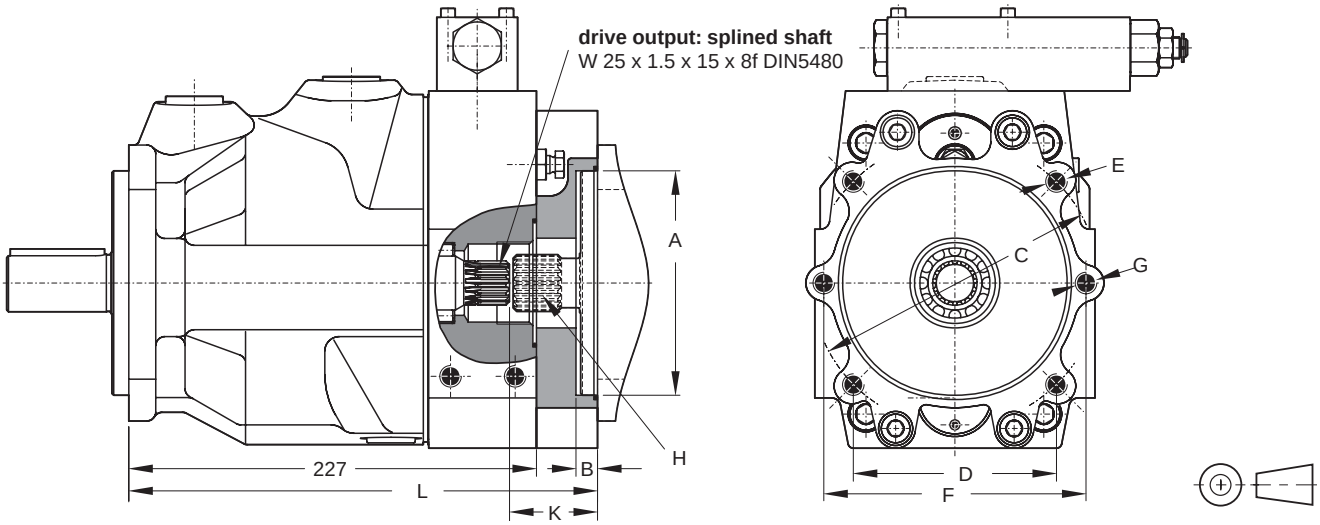
PV032 - 046, SAE version and thru drive version



Variation with thru drive



Thru shaft adaptors are available with the following dimensions:								
A	**B**	**C**	**D**	**E**	**F**	**G**	**K**	**L**
63	8.5	85	-	M8	100	M8	49	261
80	8.5	103	-	M8	109	M10	49	261
100	10.5	125	-	M10	140	M12	49	261
125	12	160	-	M12	-	-	49	261
82.55	8	-	-	-	106	M10	49	261
101.6	11	-	89.8	M12	146	M12	49	261
127	13.5	-	114.5	M12	-	-	64	276

Dimension H and available couplings see page 24.
At threads options 3 and 7 the dimensions E and G are UNC - 2B threads.

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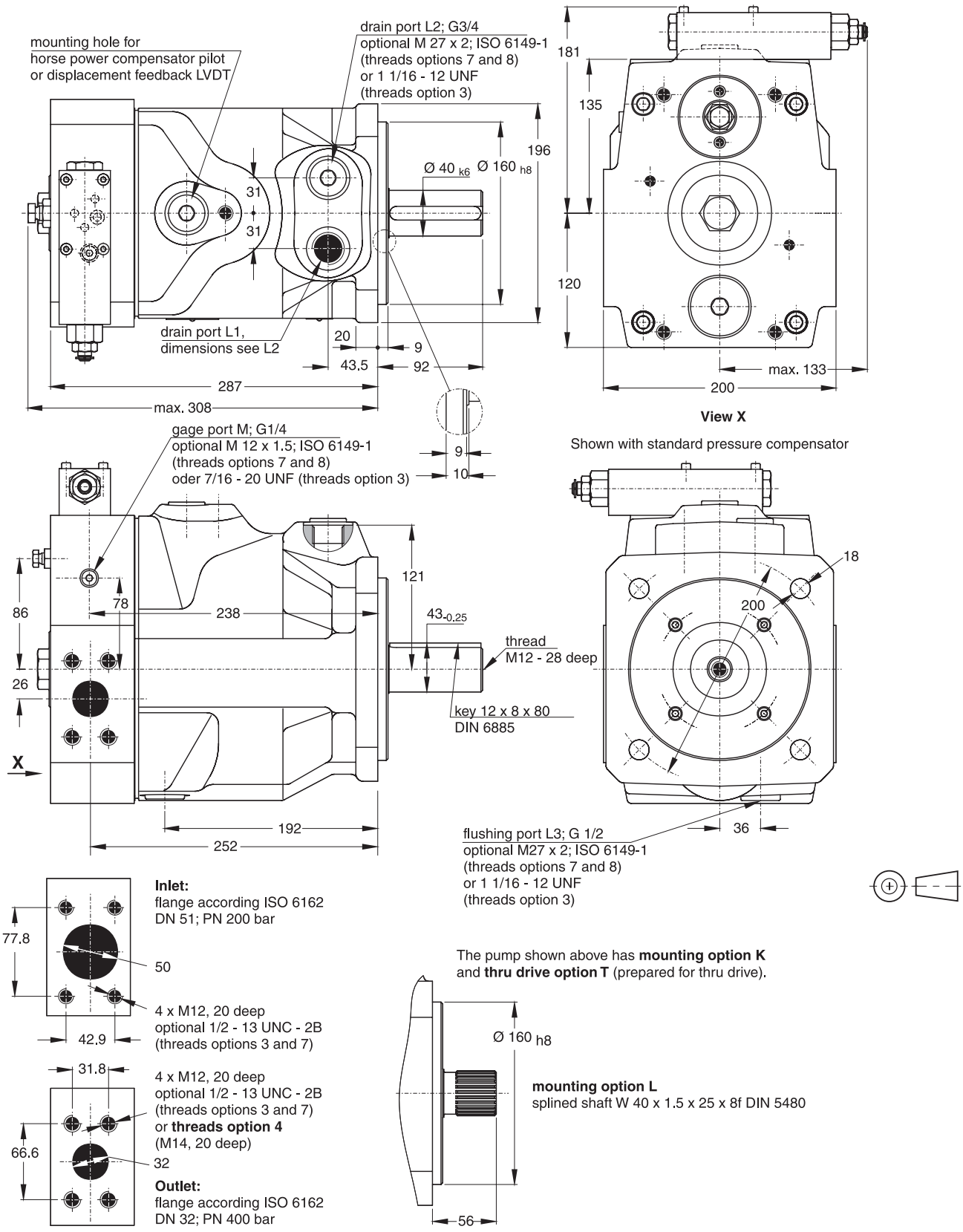
Kaarst, Germany

PV063 - 092, metric version



For further information about flanges see catalogue No. 4039/UK „Pressure Hydraulic Flanges“ (on request).
Shown is a clockwise rotating pump. Counter clockwise rotating pumps have inlet, outlet and gauge ports reversed.

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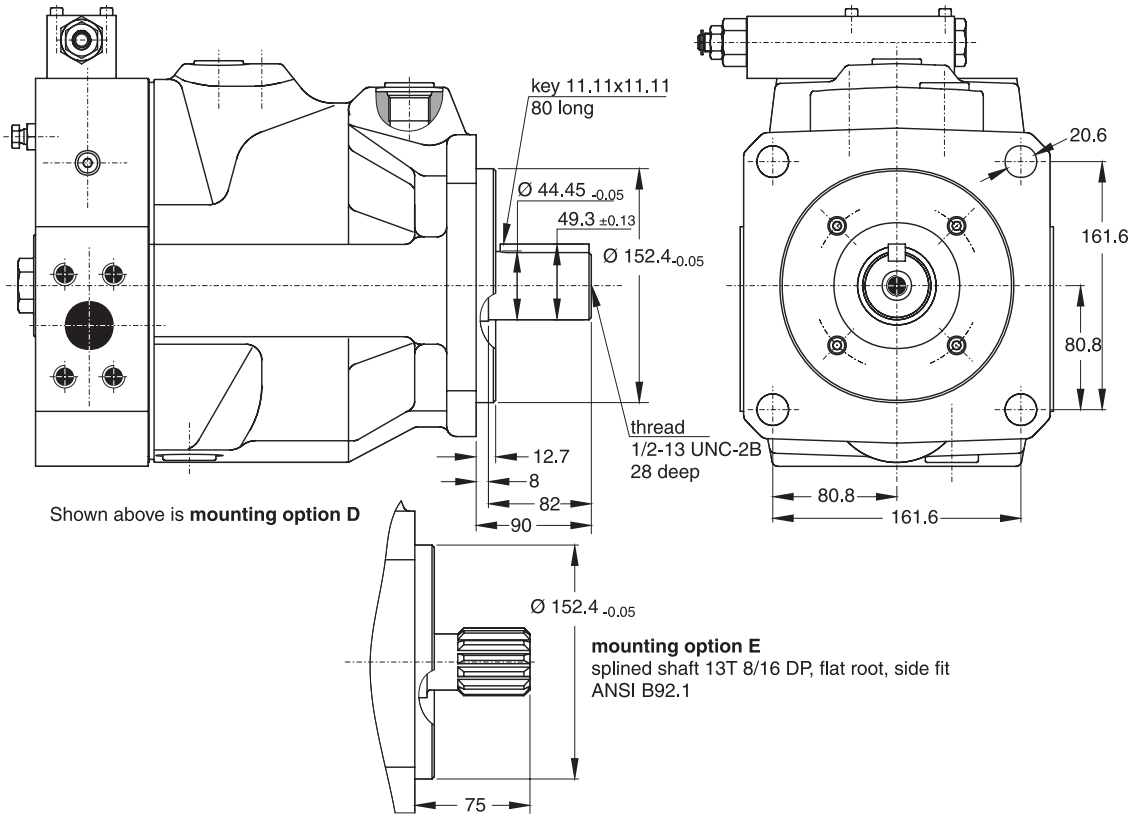
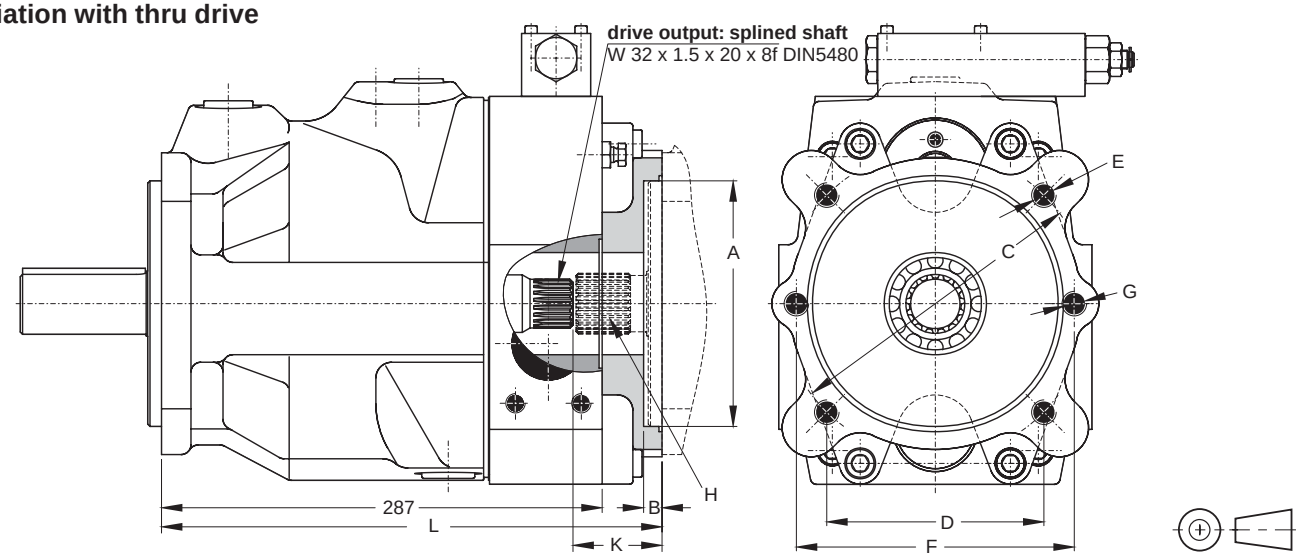
PV063 - 092, SAE version and thru drive version



Variation with thru drive



Thru shaft adaptors are available with the following dimensions:								
A	**B**	**C**	**D**	**E**	**F**	**G**	**K**	**L**
63	10	85	-	M8	100	M8	58	326
80	10	103	-	M8	109	M10	58	326
100	12	125	-	M10	140	M12	58	326
125	12	160	-	M12	180	M16	58	326
160	12	200	-	M16	-	-	58	326
82.55	10	-	-	-	106	M10	58	326
101.6	12	-	89.8	M12	146	M12	58	326
127	14	-	114.5	M12	181	M16	58	326
152.4	14	-	161.6	M16	-	-	78	346

Dimension H and available couplings see page 24.
At threads options 3 and 7 the dimensions E and G are UNC - 2B threads.

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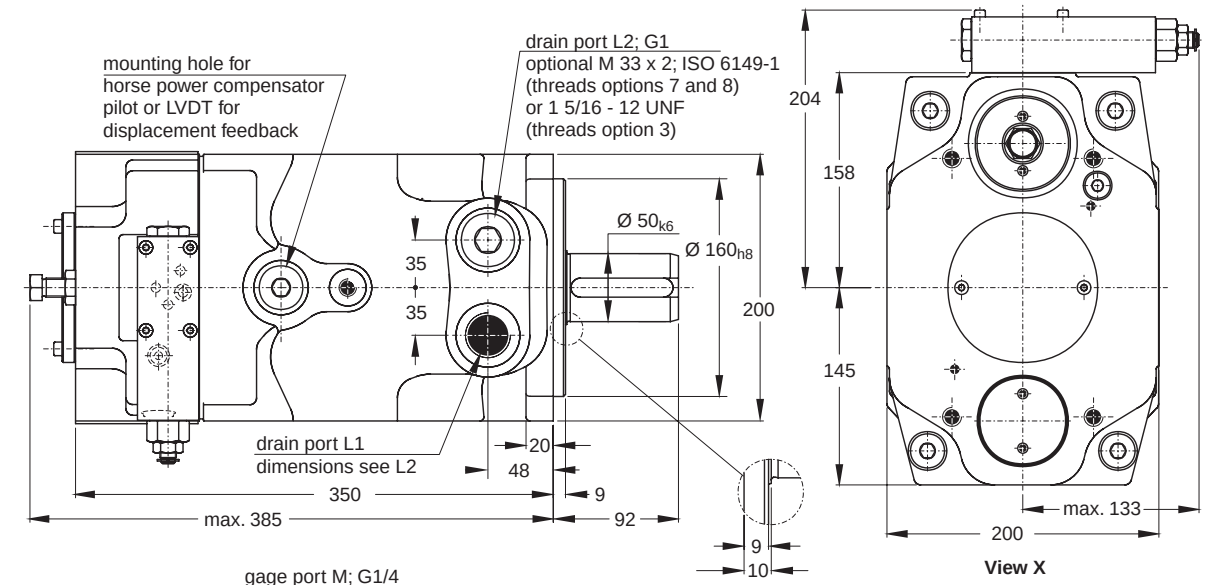
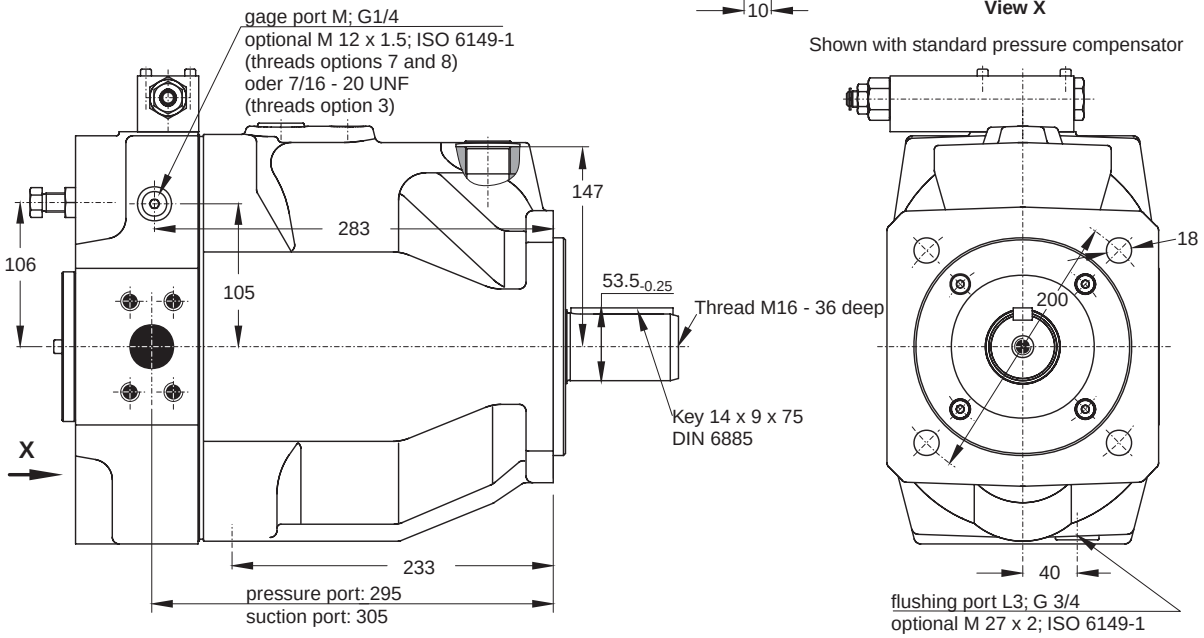
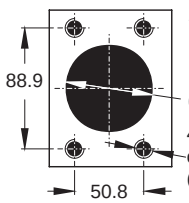
PV140 - 180, metric version



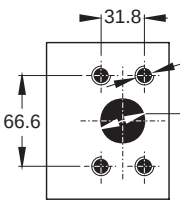
Shown with standard pressure compensator





Inlet:
flange according ISO 6162
DN 64; PN 160 bar

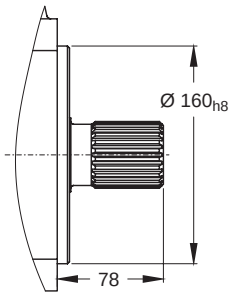
4 x M12, 20 deep
optional 1/2 - 13 UNC - 2B
(threads options 3 and 7)



4 x M12, 20 deep
optional 1/2 - 13 UNC - 2B
(threads options 3 and 7)
or **threads option 4**
(M14, 22 deep)

Outlet:
flange according ISO 6162
DN 32; PN 400 bar

The pump shown above has **mounting option K**
and **thru drive option T (prepared for thru drive).**

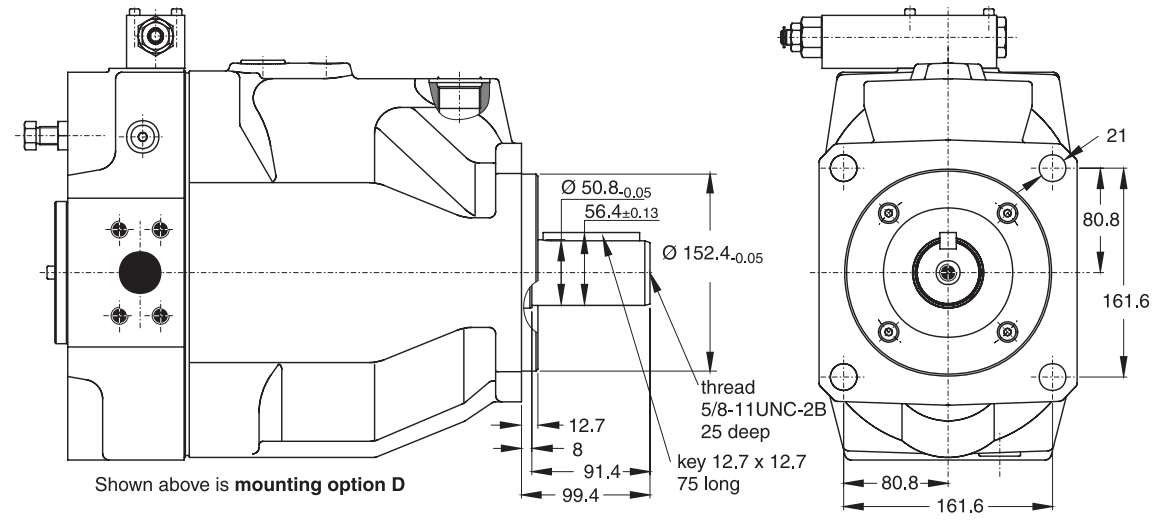


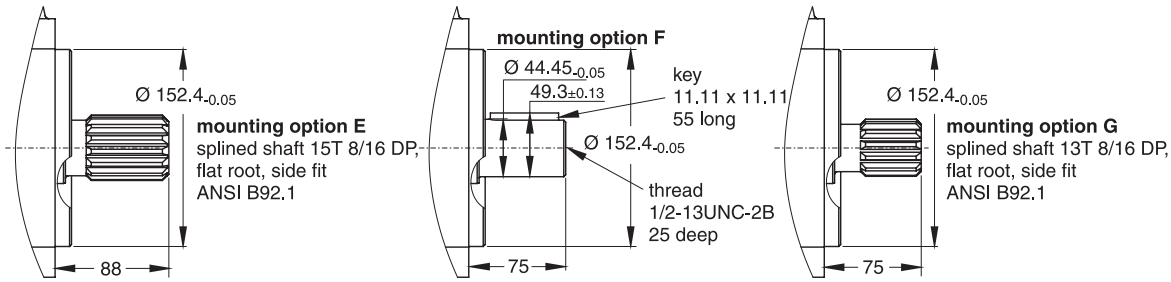
mounting option L
splined shaft W 50 x 2 x 24 x 9g DIN 5480

For further information about flanges see catalogue No. 4039/UK „Pressure Hydraulic Flanges“ (on request).
Shown is a clockwise rotating pump. Counter clockwise rotating pumps have inlet, outlet and gauge ports reversed.

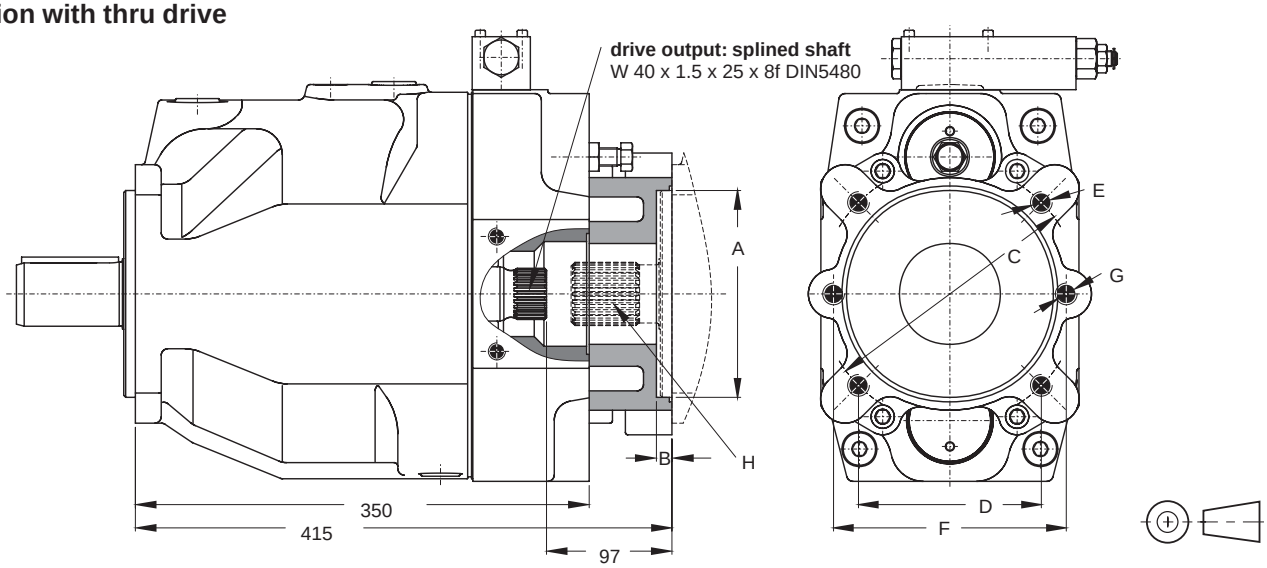
PI PVplus UK.PMD RH

PV140 - 180, SAE version and thru drive version





Variation with thru drive



Thru shaft adaptors are available with the following dimensions:						
A	**B**	**C**	**D**	**E**	**F**	**G**
80	10	103	-	M8	109	M10
100	12	125	-	M10	140	M12
125	12	160	-	M12	180	M16
160	12	200	-	M16	-	-
82.55	10	-	-	-	106	M10
101.6	12	-	89.8	M12	146	M12
127	14	-	114.5	M12	181	M16
152.4	14	-	161.6	M16	-	-

Dimension H and available couplings see page 24.
At threads options 3 and 7 the dimensions E and G are UNC - 2B threads.

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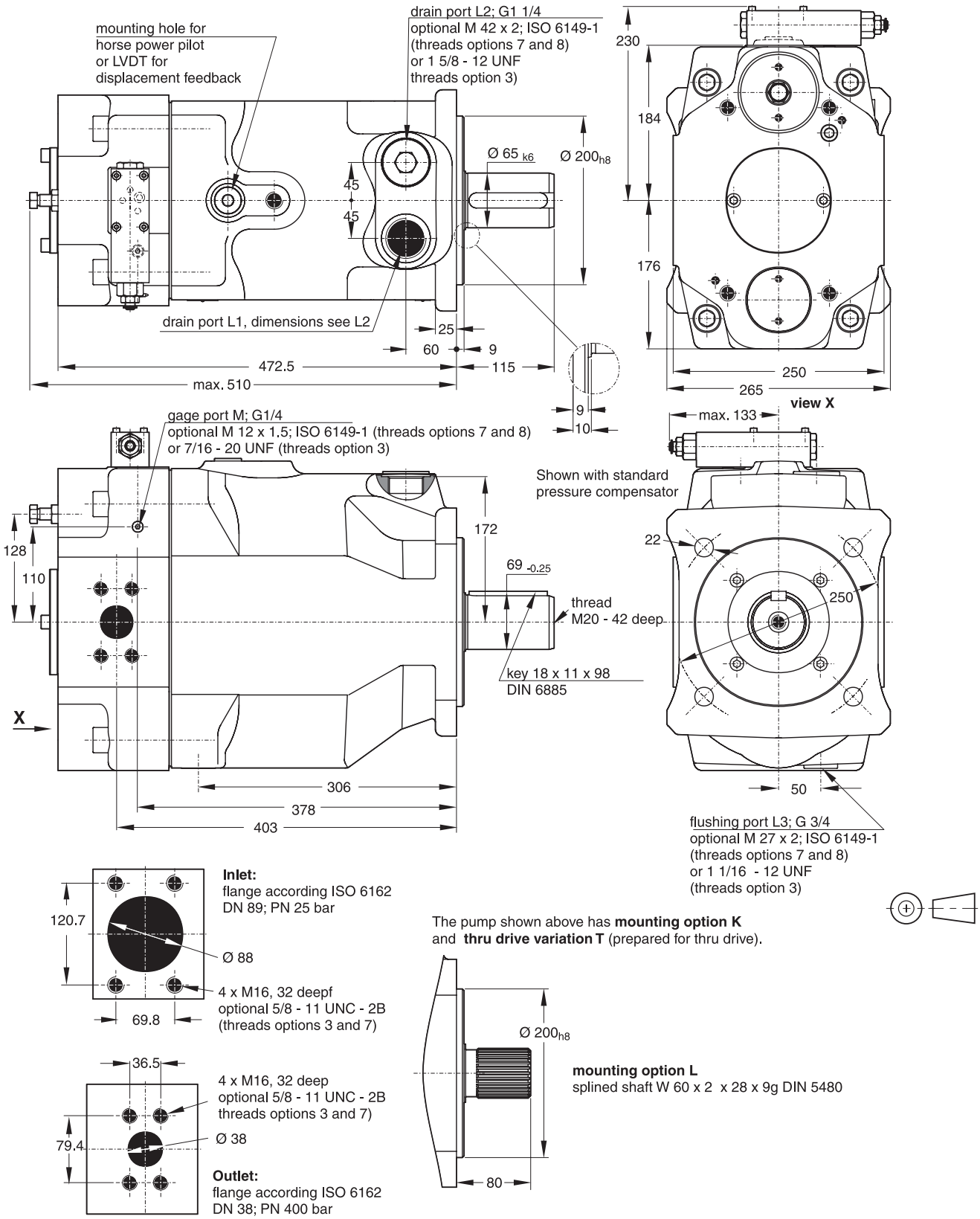
Kaarst, Germany

PV 270, metric version



For further information about flanges see catalogue No. 4039/UK „Pressure Hydraulic Flanges“ (on request).
Shown is a clockwise rotating pump. Counter clockwise rotating pumps have inlet, outlet and gauge ports reversed.

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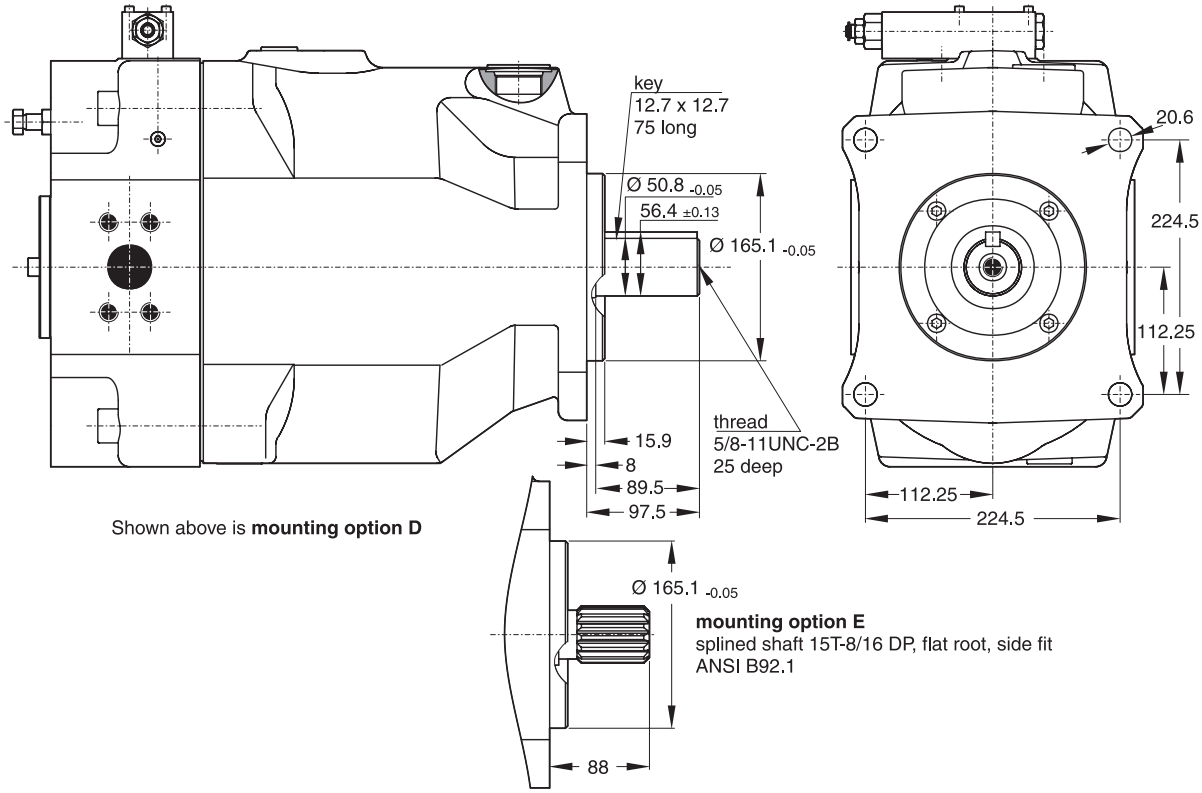
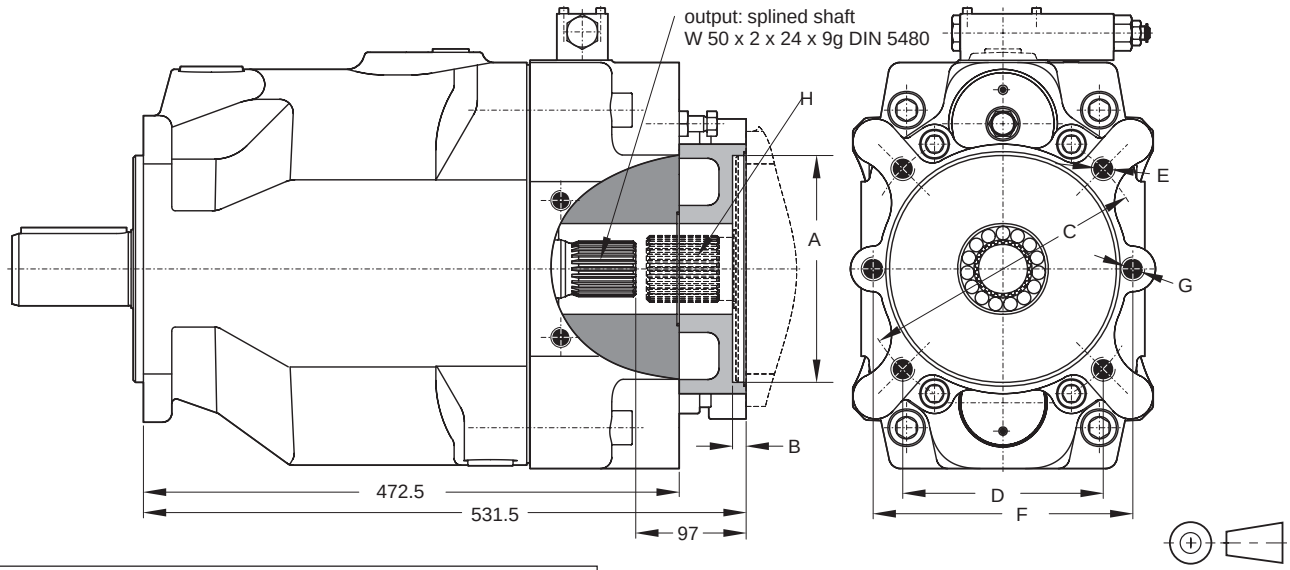
PV 270, SAE version and thru drive version



Variation with thru drive



Thru shaft adaptors are available with the following dimensions:						
A	**B**	**C**	**D**	**E**	**F**	**G**
80	8.5	103	-	M8	109	M10
100	10.5	125	-	M10	140	M12
125	10.5	160	-	M12	180	M16
160	13.5	200	-	M16	224	M20
200	13.5	250	-	M20	-	-
82.55	8	-	-	-	106	M10
101.6	11	-	89.8	M12	146	M12
127	13.5	-	114.5	M12	181	M16
152.4	13.5	-	161.6	M16	229	M20
165.1	17	-	224.5	M20	-	-

Dimension H and available couplings see page 24.
At threads options 3 and 7 the dimensions E and G are UNC - 2B threads.

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Kaarst, Germany

Mounting kits for multiple pumps, for second pump option

MK	–	PV	BG	☐	☐	☐	☐	☐
Mounting kit		Axial piston pump series PV		Size	Second pump	Thread	Seals	Design series (see name plate)

Code	Pump size
1	Pump size 1: PV016 - PV023
2	Pump size 2: PV032 - PV046
3	Pump size 3: PV063 - PV092
4	Pump size 4: PV140 - PV180
5	Pump size 5: PV270

Code	Second pump, SAE
T	Prepared for thru drive option (plugged)
Y	SAE AA, diameter 50.8 mm
A	SAE A, diameter 82.55 mm
B	SAE B, diameter 101.6 mm
C	SAE C, diameter 127 mm
D	SAE D, diameter 152.4 mm
E	SAE E, diameter 165.1 mm
	Second pump, metric
G	Diameter 63 mm
H	Diameter 80 mm
J	Diameter 100 mm
K	Diameter 125 mm
L	Diameter 160 mm
M	Diameter 200 mm

Code	Seals
N	NBR
V	FPM
E	EPR

Code	Thread
M	Metric
S	SAE

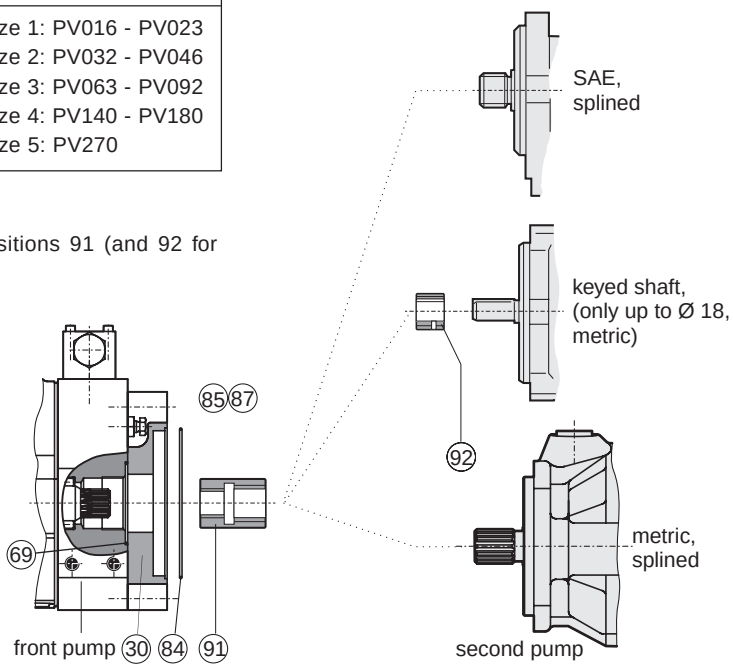
Kit contains positions 30, 69, 84, 85 and 87, see drawing below.

Mounting kits for multiple pumps, couplings

MK	–	PV	BG	☐	K	☐	☐
Mounting kit		Axial piston pump series PV		Size		Coupling	Design series (see name plate)

Code	Pump size
1	Pump size 1: PV016 - PV023
2	Pump size 2: PV032 - PV046
3	Pump size 3: PV063 - PV092
4	Pump size 4: PV140 - PV180
5	Pump size 5: PV270

Kit contains positions 91 (and 92 for keyed shaft).



Code	Coupling for metric, splined shaft DIN 5480
01	N25 x 1.5 x 15
02	N32 x 1.5 x 20
03	N40 x 1.5 x 25
04	N50 x 2 x 24
05	N60 x 2 x 28
	Coupling for SAE splined shaft flat root, side fit
11	9T 16/32
12	11T 16/32
13	13T 16/32
14	15T 16/32
15	14T 12/24
16	17T 12/24
17	13T 8/16
18	15T 8/16
	Coupling + adaptor for keyed shaft
20	Diameter 12 mm
21	Diameter 16 mm
22	Diameter 18 mm

PI PVplus UK.PMD RH

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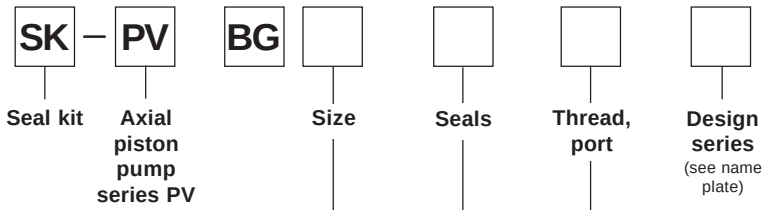
Hydraulic Controls Division
Kaarst, Germany

Seal kits

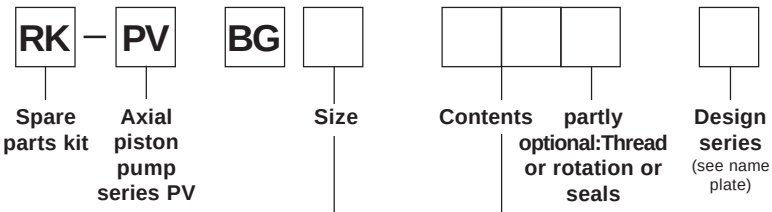


Code	Pump size
1	Pump size 1: PV016 - PV023
2	Pump size 2: PV032 - PV046
3	Pump size 3: PV063 - PV092
4	Pump size 4: PV140 - PV180
5	Pump size 5: PV270

Code	Seals
N	NBR
V	FPM
E	EPR
W	NBR with PTFE shaft seal
P	FPM with PTFE shaft seal
S	EPDM with PTFE shaft seal

Code	Thread	Port
1	Metric	BSPP
3	UNC	UNF
7	UNC	ISO 6149
8	Metric	ISO 6149

Repair and spare parts kits

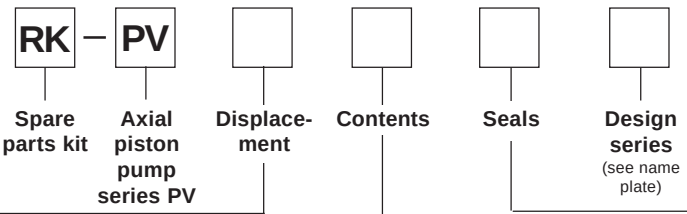


Code	Pump Size
1	Pump size 1: PV016 - PV023
2	Pump size 2: PV032 - PV046
3	Pump size 3: PV063 - PV092
4	Pump size 4: PV140 - PV180
5	Pump size 5: PV270

Code	Contents	Optional
VT	Connecting parts, kit	Thread
WP	Shaft with key	Thread
WZ	Splined shaft	Thread
SS	Valve plate	Rotation
SB	Bushing for servo piston	Seals
	Contents - fixed	
GLE	Trunnion bearing kit	
ROG	Rotating unit incl. piston set	
KOS	Piston set	
SRS	Swash plate	
WQS	Shaft with key, reinforced, only for size 4, only with SAE	
WFS	Splined shaft, reinforced, only for size 4, only with SAE	
RFE	Bias spring kit	
SKS	Servo piston kit	

Code	Thread
M	Metric
S	SAE / UNC
	Rotation
R	Clockwise
L	Counter-clockw.
	Seals
N	NBR
V	FPM
E	EPR

Repair and spare parts kits for adjustable displacement limiter



Code	Displacement		
016	PV016	063	PV063
020	PV020	080	PV080
023	PV023	092	PV092
032	PV032	140	PV140
040	PV040	180	PV180
046	PV046	270	PV270

Code	Contents
HE	Displacement limiter adjustable

Code	Seals
N	NBR
V	FPM
E	EPR

For parts included, see spare parts list PVI-BG**x**-GB-**yy**; available upon request.
x stands for frame size 1 - 5
yy stands for design series

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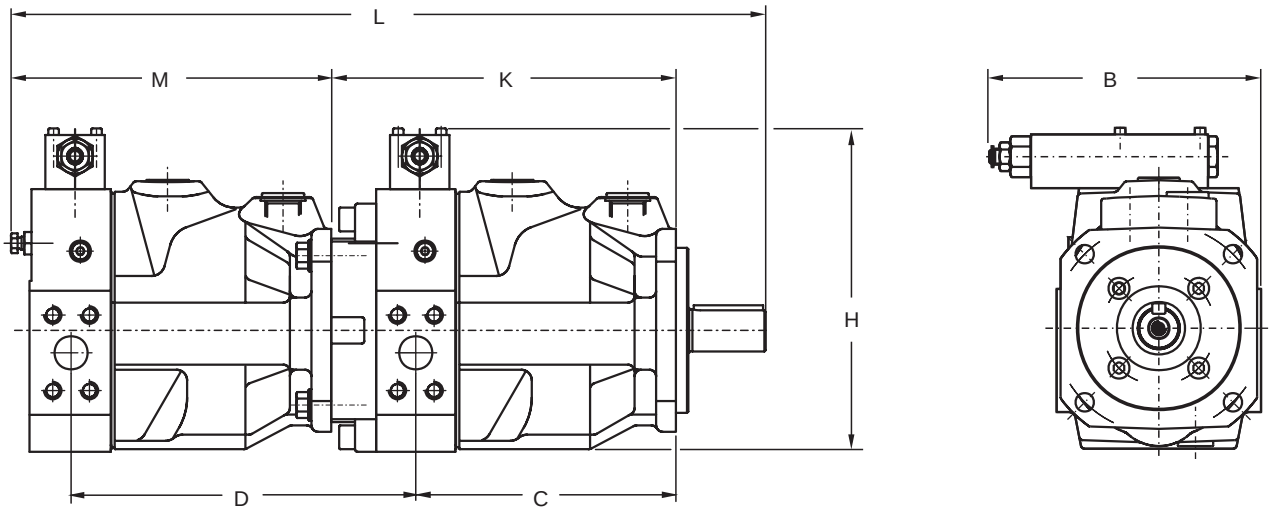
Kaarst, Germany

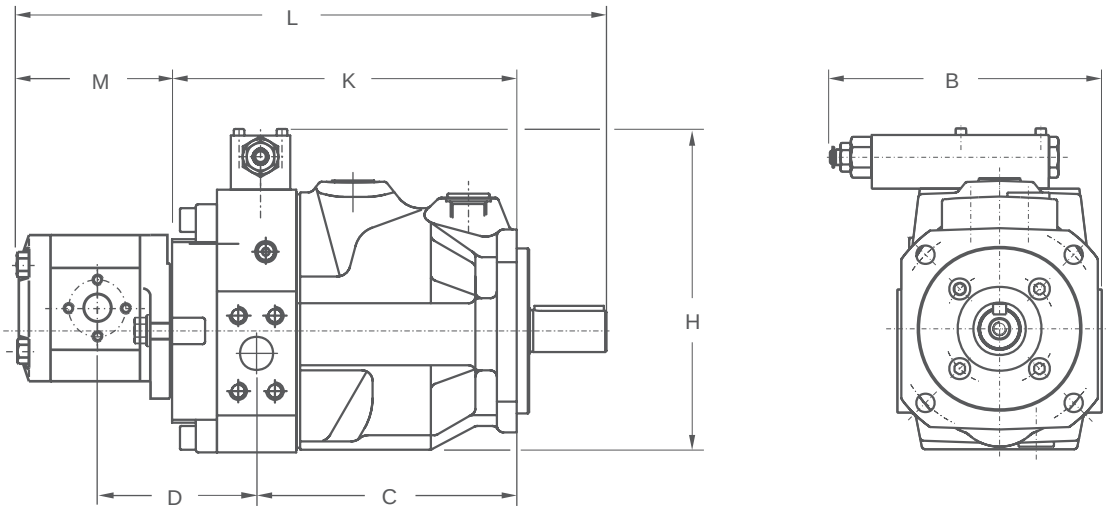
Combinations PV / PV or PV / PVM (metric version)



Main pump	Second pump	Interface main pump	L	B	C	D	H	K	M
PV016, 020 or 023	PV016, 020 or 023	100 B4 HW	489	196	170.5	225	220	225	212
PV032, 040 or 046	PV016, 020 or 023 PV032, 040 or 046	125 B4 HW	541 574	208 208	197 197	235.5 261	245 245	261 261	212 245
PV063, 080 or 092	PV016, 020 or 023 PV032, 040 or 046 PV063, 080 or 092	160 B4 HW	630 663 724	232 232 232	252 252 252	244.5 271 326	299 299 299	326 326 326	212 245 306
PV140 or 180	PV016, 020 or 023 PV032, 040 or 046 PV063, 080 or 092 PV140 or 180 *	160 B4 HW	719 752 813 878	230 230 230 230	305 305 305 305	280.5 307 362 415	349 349 349 349	415 415 415 415	212 245 306 385
PV270	PV016, 020 or 023 PV032, 040 or 046 PV063, 080 or 092 PV140 or 180 PV270 *	200 B4 HW	860 893 954 1033 1134	255 255 255 255 255	403 403 403 403 403	299 325.5 380.5 433.5 531.5	406 406 406 406 406	531.5 531.5 531.5 531.5 531.5	212 245 306 385 510

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

Combinations PV / PGP511 or PGP517



Main pump	2nd pump	Interface main pump	L*	B	C	D*	H	K	M
PV016, 020 or 023	PGP511	100 B4 HW	363.7-409.3	199	170,5	97.1-119.9	220	225	86.7-132.3
PV032, 040 or 046	PGP511	125 B4 HW	415.7-461.3	211	197	106.6-129.4	245	261	86.7-132.3
	PGP517		451.8-490.2	211	197	122.8-161.2	245	261	122.8-161.2
PV063, 080 or 092	PGP511	160 B4 HW	504.7-550.3	233	252	86.7-132.3	301	326	86.7-132.3
	PGP517		540.8-579.2	233	252	122.8-161.2	301	326	122.8-161.2
PV140 or 180	PGP511	160 B4 HW	593.7-639.3	233	305	86.7-132.3	349	415	86.7-132.3
	PGP517		629.8-668.2	233	305	122.8-161.2	349	415	122.8-161.2
PV270	PGP511	200 B4 HW	733.2-778.8	258	403	86.7-132.3	406	531.5	86.7-132.3
	PGP517		769.3-807.7	258	403	122.8-161.2	406	531.5	122.8-161.2

Dimensions PGP511* code H2 and PGP517* code H3

* For other dimensions of series PGP/PGM, see catalogue HY11-2500/UK, chapter 1, ‘Pumps & Motors’.

Standard Gear Pumps for combination with PV

Model	Ordering code	Part number	Displacement [cm³/U]	Flow [l/min at 1500min⁻¹]	Weight [kg]
PGP505	PGP505A0040CA1H2NJ4J4B1B1	3319111251	4	6	2.3
	PGP505A0080CA1H2NJ4J4B1B1	3319111258	8	12	3.6
PGP511	PGP511A0110CA1H2NL2L1B1B1	3349111186	11	16.5	3.6
	PGP511A0140CA1H2NL2L1B1B1	3349111187	14	21	3.8
	PGP511A0160CA1H2NL2L1B1B1	3349111737	16	24	3.9
	PGP511A0190CA1H2NL2L1B1B1	3349111575	19	28.5	4.0
	PGP511A0220CA1H2NL2L2B1B1	3349111797	22	33	4.1
	PGP511A0270CA1H2NL2L2B1B1	3349111576	27	40.5	4.3
	PGP511A0330CA1H2NL2L2B1B1	3349111191	33	49.5	4.6
PGP517	PGP517A0230CD1H3NL3L2B1B1	3339111151	23	34.5	8.3
	PGP517A0280CD1H3NL3L2B1B1	3339111484	28	42	8.5
	PGP517A0330CD1H3NL3L2B1B1	3339111048	33	49.5	8.7
	PGP517A0380CD1H3NL3L2B1B1	3339111004	38	57	9.1
	PGP517A0520CD1H3NL3L3B1B1	3339111152	52	78	9.5
	PGP517A0700CD1H3NL3L3B1B1	3339111154	70	105	10.5
PGP350	PGP350A197EVAB2025	3239111027	83.6	125.4	25

Max. transferable torque in [Nm] for different shafts options

Shaft code	PV016-023	PV032-046	PV063-092	PV140-180	PV270
D	300	550	1320	2000	2000
E	300	610	1218	2680	2680
F	--	--	--	1320	--
G	--	--	--	1640	--
K	300	570	1150	1900	2850
L	405	675	1400	2650	3980
Max. torque transmission cap. for rear mounted pump	140	275	560	1100	1650

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.

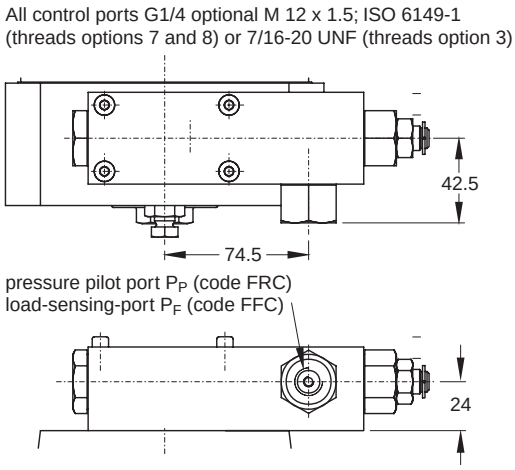
Total torque factor of the combination
= sum of individual torque factors of all pumps

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 cm^3/rev).

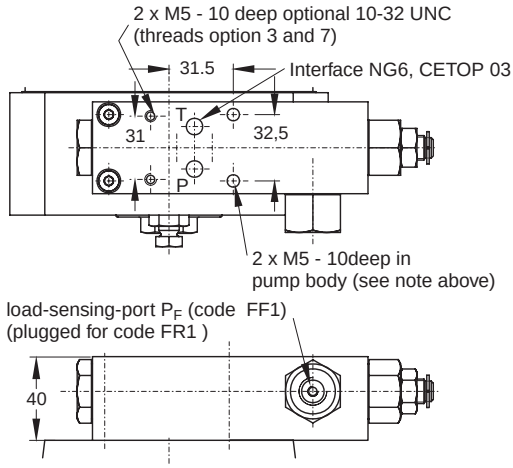
Torque factor of any pump
= p x Vg

Pump	Shaft	Torque limit factor
PV016-023	D	17700
	E	17700
	K	17700
	L	20130
PV032-046	D	32680
	E	36380
	K	33810
	L	40250
PV063-092	D	77280
	E	72450
	K	67620
	L	83720
PV140-180	D	118400
	E	158760
	F	78750
	G	97650
	K	113400
	L	157500
PV270	D	119000
	E	159700
	K	170100
	L	236250

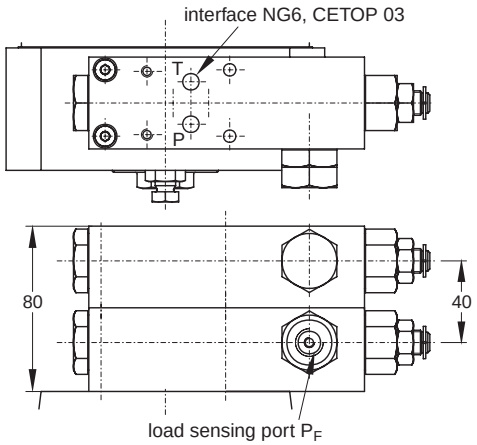
Remote pressure compensator, code FRC
Load-Sensing compensator, code FFC



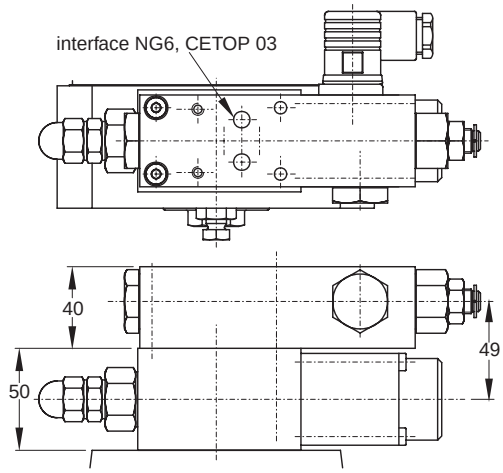
Remote pressure comp. with interface NG6, code FR1
Load-Sensing comp. with interface NG6, code FF1



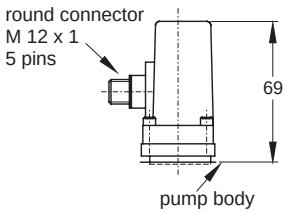
2-valve compensator, code FT1



Proportional p-Q-compensator, code FPR
(for code FPV lower valve only without interface)



LVDT for proportional compensator



Pilot valve for horse power compensator

Ordering code seal kit, compensator

SK – **PVC** ☐

Seal kit — **Compensator for axial piston pump series PV** — **Seal**

Code	Seal
N	NBR
V	FPM
E	EPR

The seal kit includes all seals for all single compensator options as well as seals for LVDT and horse power pilot valve. For 2-valve compensators two seal kits have to be ordered.
Spare parts lists and ordering codes for replacement compensator valves see manual upon request.

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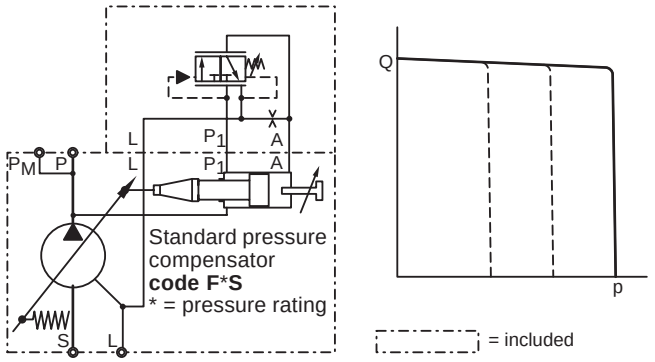
Standard pressure compensator, code F*S

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 P_1 to A and builds up a pressure at the servo piston resulting in a downstroking of the pump. The displacement of the pump is controlled in order to match the flow requirement of the system.

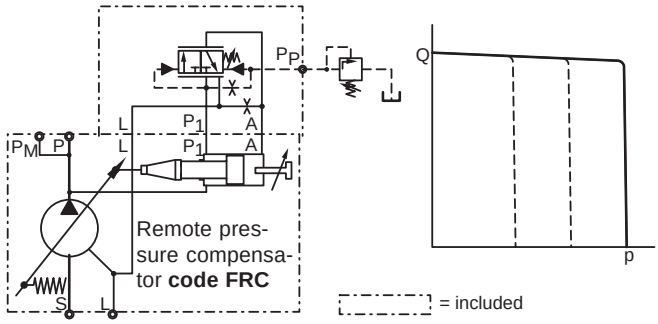


Remote pressure compensator, code FRC

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 P_P. The pilot flow supply is internal through the valve spool.

The pilot flow is 1 - 1.5 l/min. 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 typically responds faster and more precisely than the standard 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.

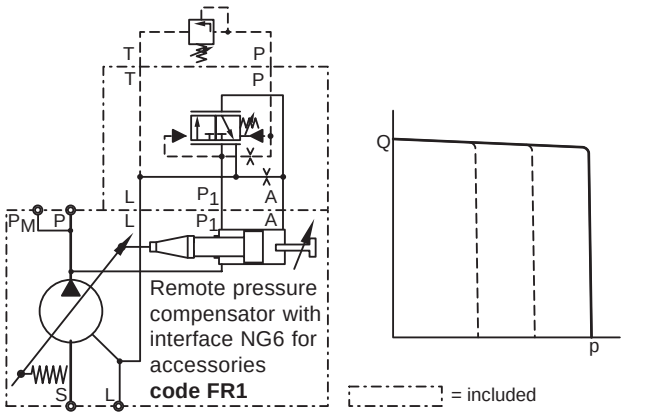


Remote pressure compensator, code FR1

Version FR1 of the remote pressure compensator provides on its top side an interface NG6, DIN 24340 (CETOP 03 at RP35H, NFPA D03).

This interface allows a direct mounting of a pilot valve. Beside manual or electrohydraulic operated valves it is also possible to mount complete multiple pressure circuits directly on the compensator body. Parker offers a variety of these compensator accessories ready to install. See pages 44-46.

All remote pressure compensators 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.

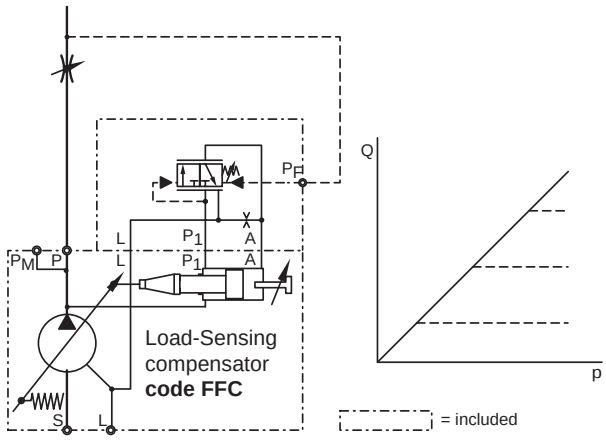


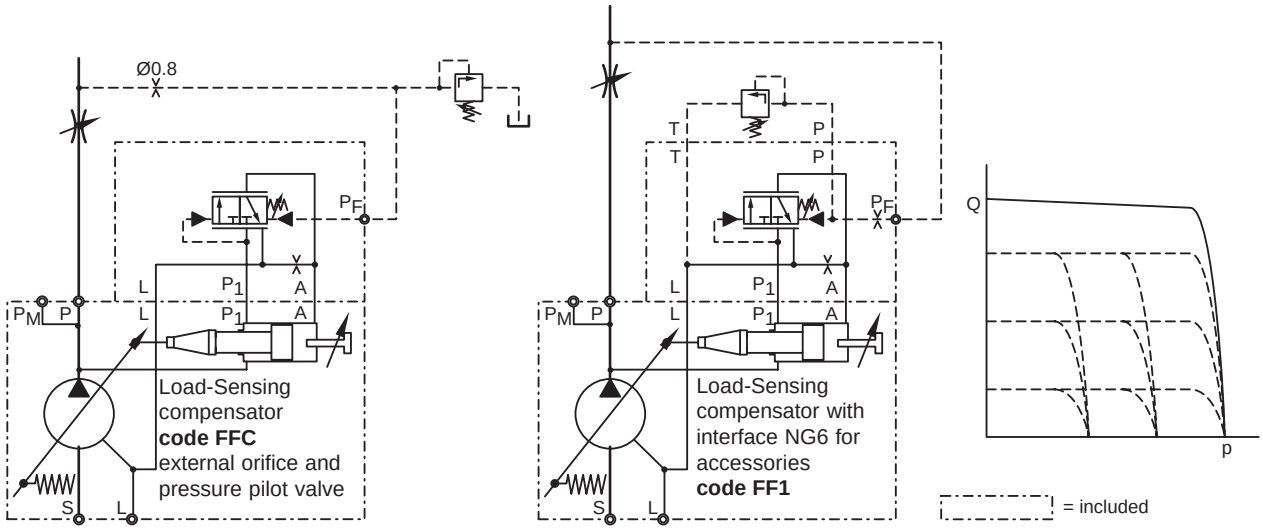
Load-Sensing compensator, code FFC

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 the speed of the actuator.

By adding a pilot orifice (Ø 0.8 mm) and a pressure pilot valve pressure compensation can be added to the flow control function. See the circuit diagram below, left.





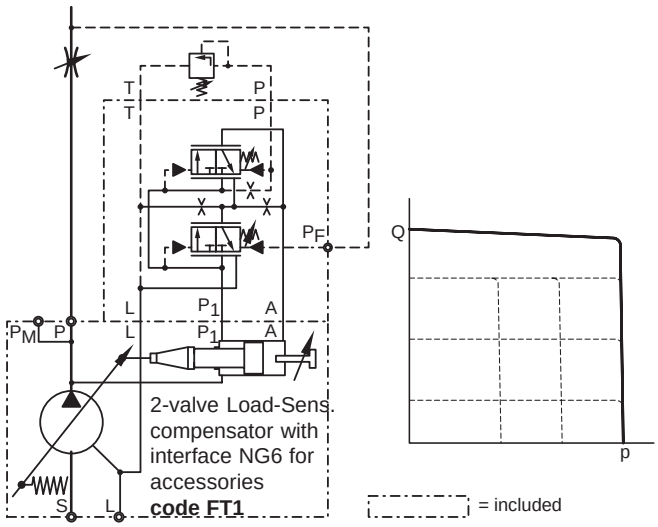
Shown above is **load-sensing compensator, code FF1** with an NG6 interface on top of the control valve. That allows direct mounting of a pilot valve for pressure compensation. This version includes the pilot orifice.

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.

If a more accurate pressure compensation is required, the **2-valve load-sensing compensator code FT1** 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.



Hydraulic-mechanical horse power compensator

The hydraulic-mechanical horse power compensator consists of a modified remote pressure compensator (Code *L*) or of a modified load-sensing compensator (Code *C*) 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 (see diagrams on opposite page).

For all nominal powers of standard electrical motors Parker 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 adjusting the preload of the pilot control cartridge spring . That allows an adjustment of a constant horse power setting for other than the nominal speeds (1500 min^{-1}) or for other horse powers.

Ordering code for the horse power option

The first digit designates the horse power setting:

Code B = 3.0 kW etc. up to
Code 3 = 132.0 kW

The second digit designates the pilot flow source:

Code L internal pilot pressure, remote pressure function.

Code C external pilot pressure, combines horse power compensation with load-sensing compensation.

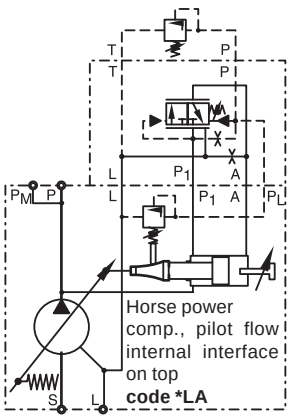
The third digit designates the possibility to adjust the overriding pressure compensation:

Code A comes with a top side NG6/D03 interface on the control valve to mount any suitable pilot valve or Parker pump accessories.

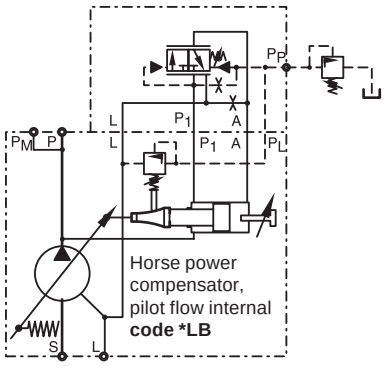
Code B has a threaded pilot port P_p (G1/4) to connect a remote pilot valve with piping.

Code C includes a pilot valve for manual pressure adjustment. Max. setting: 350 bar.

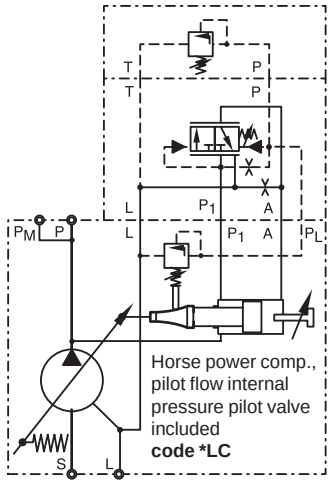
Page 33 shows typical control characteristics and the available horse power settings for the different pump sizes and displacements.



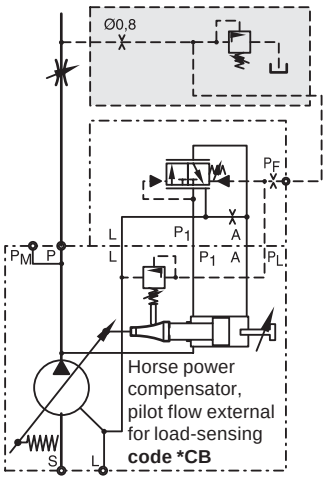
Horse power comp., pilot flow internal interface on top
code *LA



Horse power compensator, pilot flow internal
code *LB



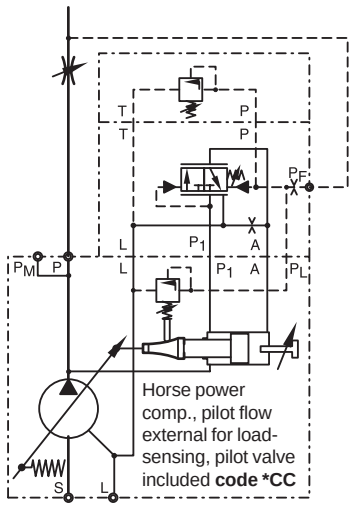
Horse power comp., pilot flow internal pressure pilot valve included
code *LC



Horse power compensator, pilot flow external for load-sensing
code *CB

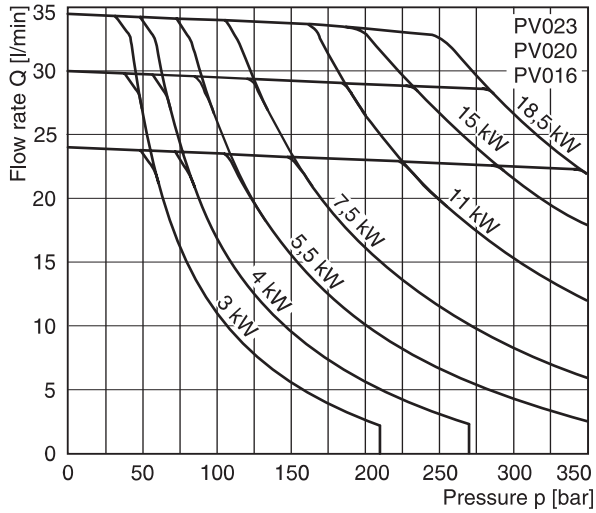
Note:
If version *CB
is equiped with an external pilot valve and an Ø0.8 mm orifice, the orifice in port P_F has to be removed.

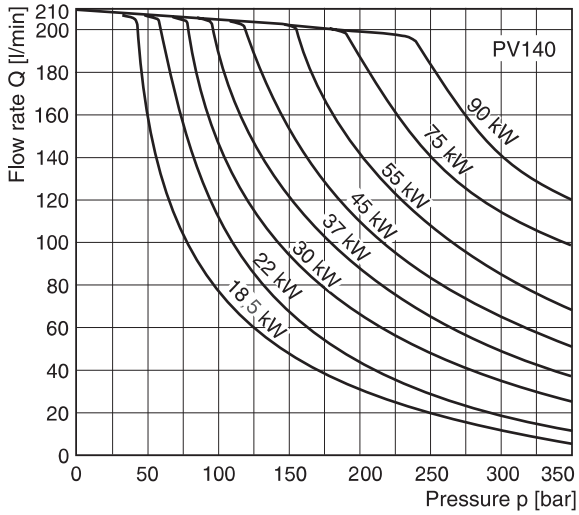
= included

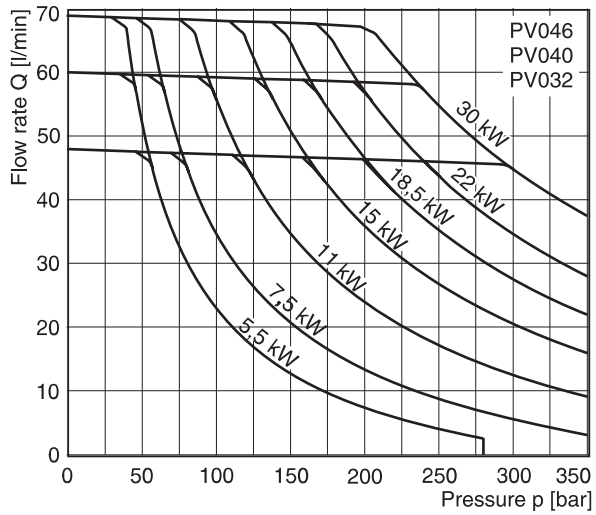


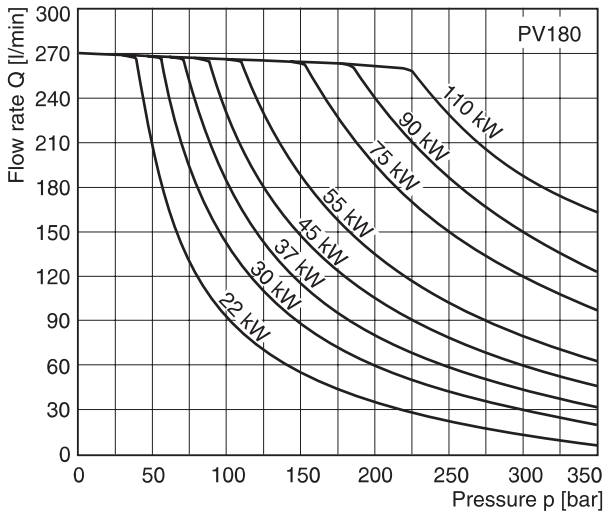
Horse power comp., pilot flow external for load-sensing, pilot valve included **code *CC**

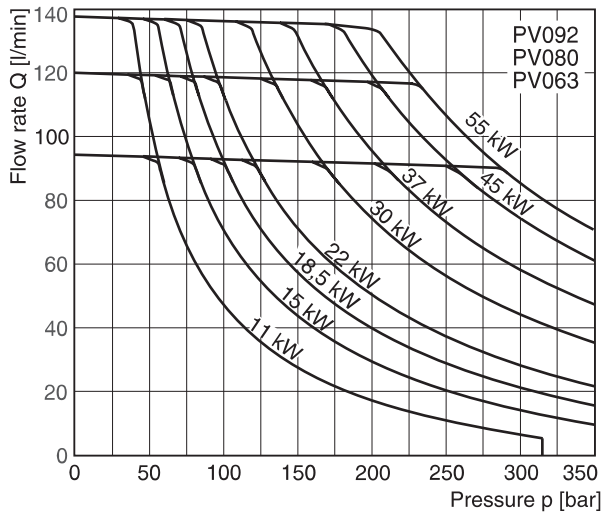
Characteristic curves, horse power compensators

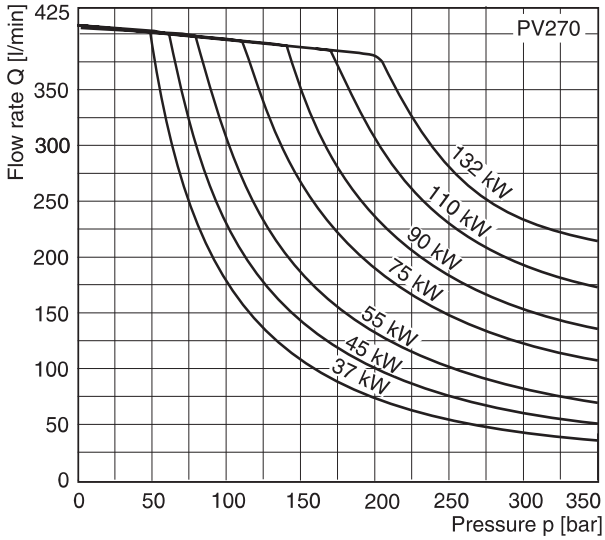












The diagrams shown are only valid for the following working conditions:

Speed : n = 1500 rev/min
Temperature : t = 50°C

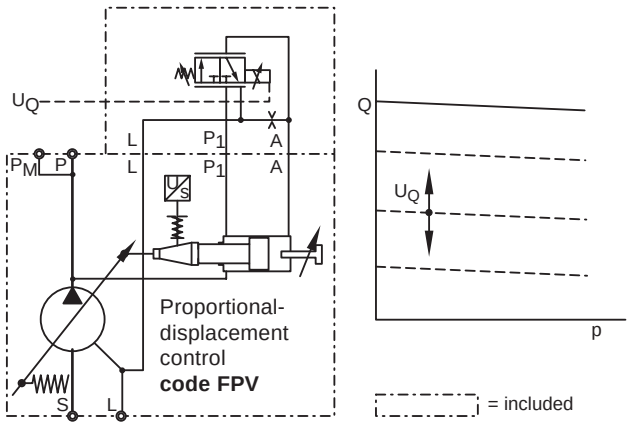
Fluid : HLP, ISO VG46
Viscosity : ν = 46 mm²/s at 40°C

PI PVplus UK.PMD RH

Parker Hannifin GmbH
Hydraulic Controls Division
Kaarst, Germany

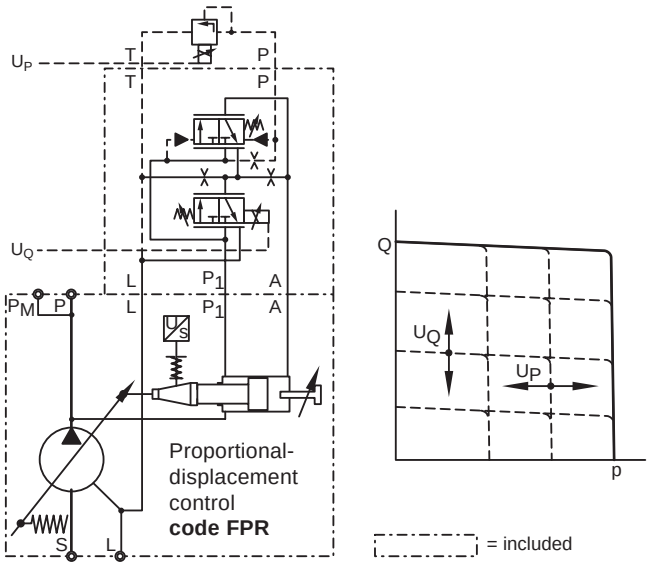
Proportional displacement control, code FPV

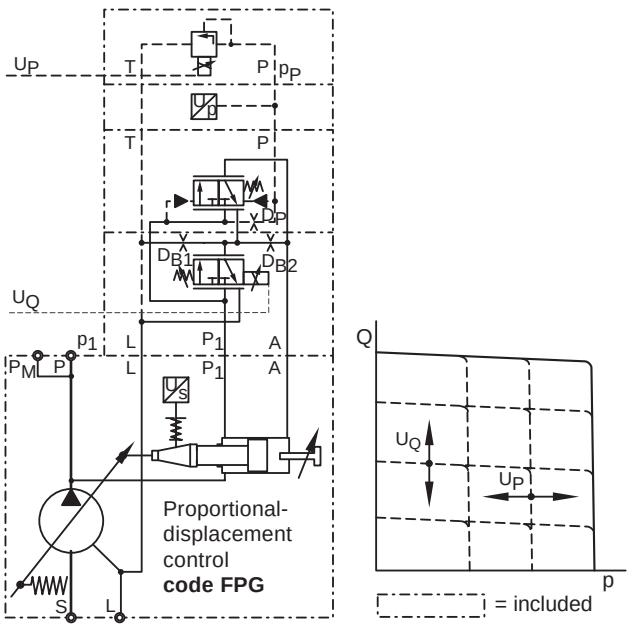
The proportional displacement control allows the adjustment of the pumps output flow with an electrical input signal.
The actual displacement of the pump is monitored by an LVDT and compared with the commanded displacement in an electronic control module PQ0*-F00 (see opposite side). The command is given as an electrical input signal (0 - 10 V or 0 resp. 4 - 20 mA) from the supervising machine control. The command can also be provided by a potentiometer. The electronic control module offers a stabilized 10 V source to supply the potentiometer.
The electronic module compares permanently the input command and the actual displacement by powering the proportional solenoid of the control valve. A deviation from the commanded displacement leads to a modulation of the input current to the solenoid. The control valve then changes the control pressure (port A) until the correct displacement is adjusted.
Version FPV of the proportional control does not provide a pressure compensation. The hydraulic circuit must be protected by a pressure relief valve.



Proportional displacement control with overriding pressure control, codes FPR, FPZ and FPG

In **version FPR** an additional pressure compensator valve can override the electrohydraulic displacement control. That adds pressure compensation to this control.
The compensator valve has an NG6/D03 interface on top to mount a pressure pilot valve. When using a proportional pressure pilot valve an electro-hydraulic p/Q control can be realized. The electronic driver modules are tuned for the valve type PVACPP* to get the best performance.
The electronic control module PQ*-P00 (see page p-Q control analogue) contains, beside the displacement control unit, also the driver electronics for the a. m. proportional pressure valves.
Using **ordering code FPZ** and specifying the desired pilot valve/compensator accessory, a complete multiple pressure adjustment can be mounted in our factory (see compensator accessories, pages 44-46) and the complete unit will be tested and shipped together with the pump.
With **ordering code FPG** the proportional pressure pilot valve and a pressure transducer (Parker SCP 8181 CE) are included with the pump control. In combination with control module PQ0*-Q00 a closed loop pressure control of the pump outlet pressure is available. Module PQ*-L00 offers an electronic horse power limiter in addition to the closed loop pressure control.
Parker variable displacement pumps have a large servo piston. That leads to a extremely robust and stable pump control. On the other hand that requires high control flows (up to > 100 l/min). Parker has therefore chosen the 2-valve p-Q control concept, because in this case a hydraulic-mechanical compensator valve takes care of the pressure compensation of the pump. That allows a very fast pressure compensation and makes this the control unsensitive to fluid contamination. We see the 2-valve concept as a contribution to system and pressure control safety.





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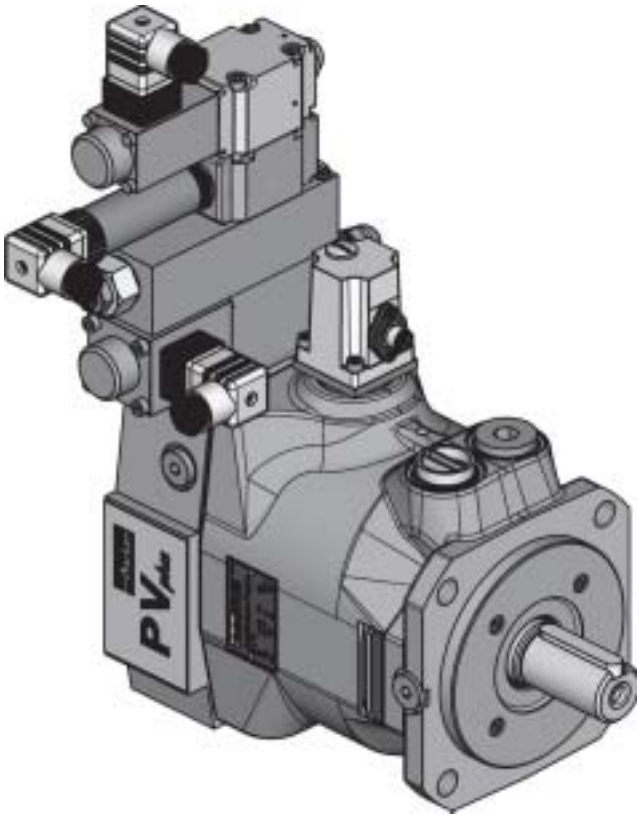
Hydraulic Controls Division
Kaarst, Germany

New version of electrohydraulic displacement and pressure control

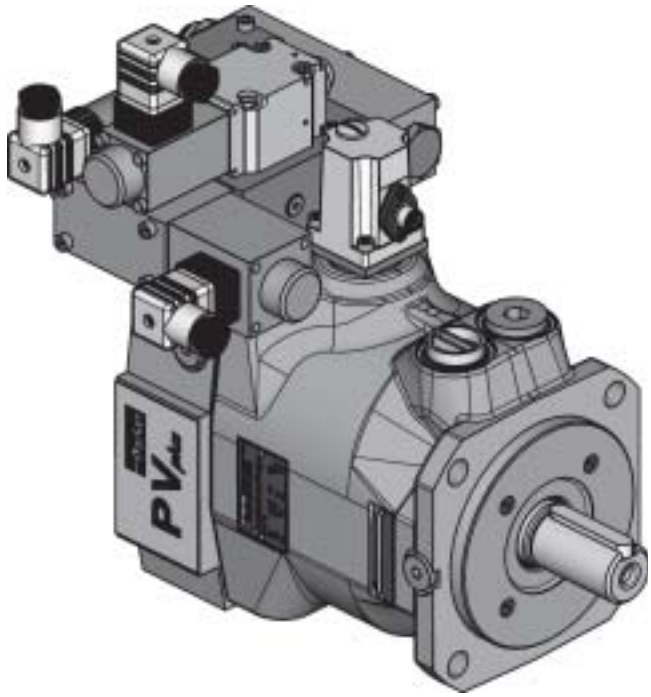
Since shortly a new and more compact version of the p-Q-control for the PVplus is available. The two figures below compare the current and the new version. The left hand side image shows a PV046 with compensator code ...FPG. With this ordering code the pump is equipped with an electro hydraulic displacement control and an overriding closed loop pressure control.

In version ...FPG the sandwich style mounting of the compensator valves, pilot valve and transducer leads to a high „tower“ of control elements. This has caused in some cases a space problem.

Therefore the version with an „elbow“ manifold - shown in the right figure - has been developed. A manifold on the compensator interface of the pump allows horizontal mounting of all control and pilot elements without stacking. The compensator ordering code changes from ...FPG to ...UPG for this new version (see ordering code “electrohydraulic compensators“ on page 6).



PV046R1K1T1NFPG
Pump with electrohydraulic displacement and closed loop pressure control



PV046R1K1T1NUPG
Pump with electrohydraulic displacement and closed loop pressure control with elbow manifold

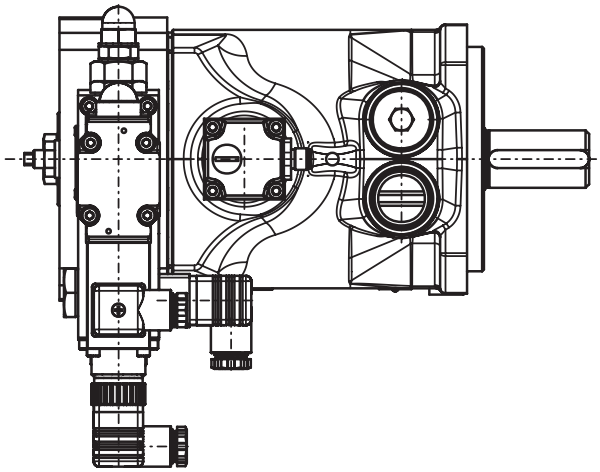
Beside the more compact and less vibration sensitive arrangement the elbow manifold version has more advantages:

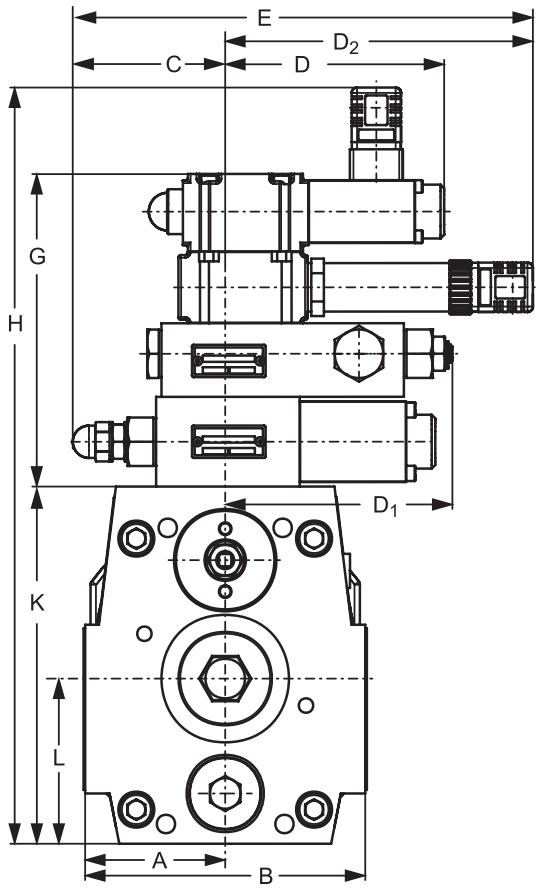
All elements (compensator valves, pilot valve, pressure sensor) can be removed and serviced separately.

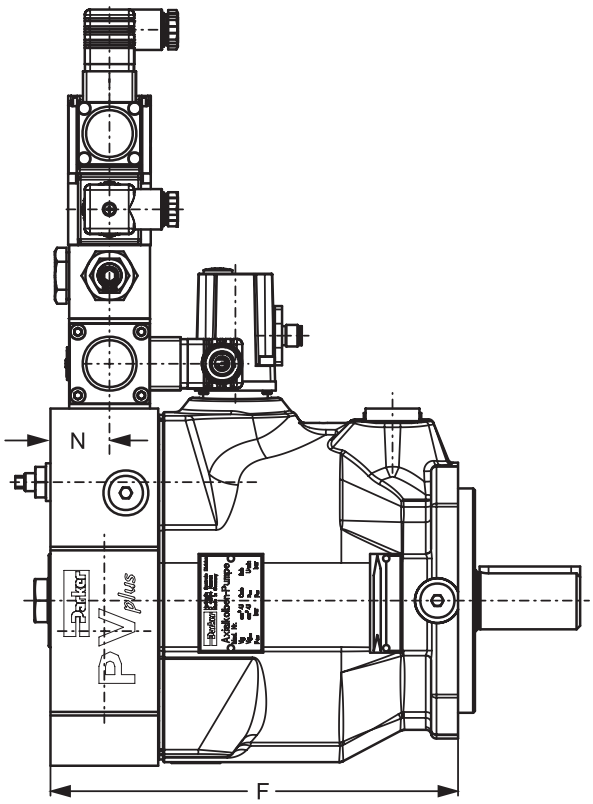
The valve bodies of the compensator valves are standard versions and no longer the special sandwich style versions (simplified logistics).

Dimensions
Axial piston pump series PV with p-Q-control, compensator ordering code ...FPG (closed loop pressure control)

Note
For version without pressure sensor (open loop pressure control) dimensions G and H are shorter by 40 mm and dimension D_2 is not applicable.







Size	Dimension [mm]	A	B	C	D	D_1	D_2	E	F	G	H	K	L	N
BG1	PV016-PV023	66	132	85	122	126.5	171.5	256.5	197.5	174.1	396.5	174	80	26.5
BG2	PV032-PV046	78	156	85	122	126.5	171.5	256.5	227.0	174.1	421.5	199	92	33.0
BG3	PV063-PV092	102	204	85	122	126.5	171.5	256.5	287.0	174.1	475.5	253	118	40.0
BG4	PV140-PV180	100	200	85	122	126.5	171.5	256.5	350.0	174.1	525.5	303	145	58.0
BG5	PV270	125	250	85	122	126.5	171.5	256.5	472.5	174.1	582.5	360	176	85.5

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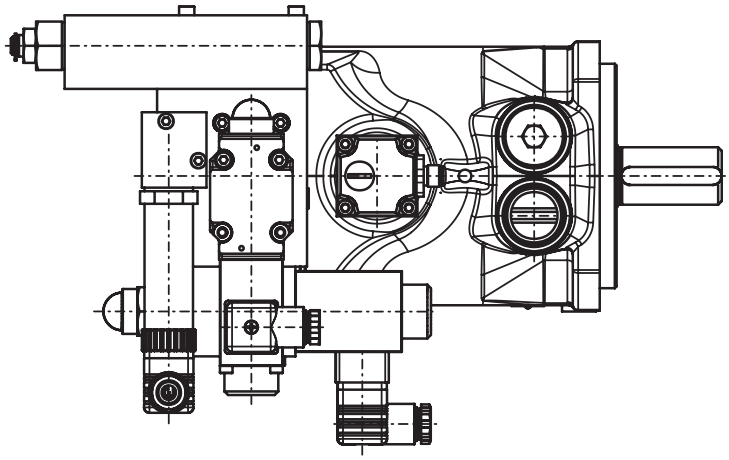
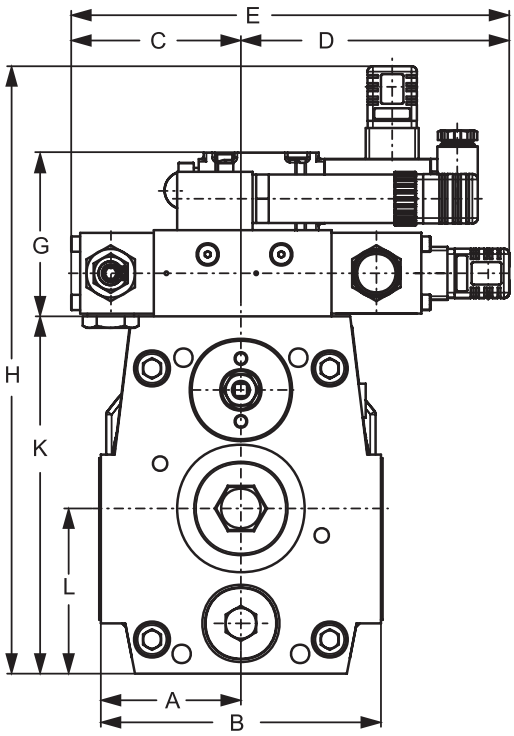
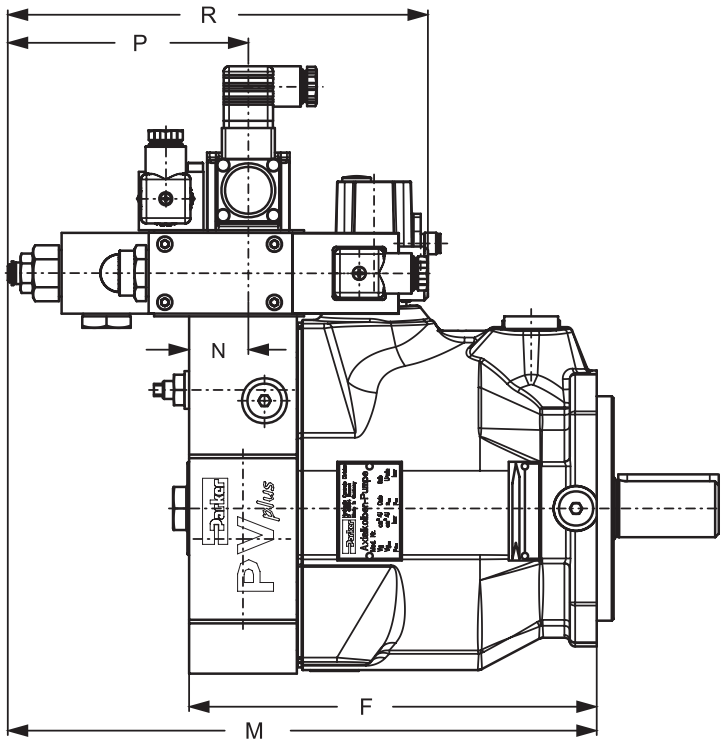
Dimensions

Axial piston pump series PV with p-Q-control, compensator ordering code ...UPG (closed loop pressure control).







Size	Dimension [mm]	A	B	C	D	E	F	G	H	K	L	M	N	P	R
BG1	PV016-PV023	66	132	94.5	149.5	243.9	197.5	91.1	313.3	174	80	305	26.5	134	234
BG2	PV032-PV046	78	156	94.5	149.5	243.9	227.0	91.1	438.3	199	92	328	33.0	134	234
BG3	PV063-PV092	102	204	94.5	149.5	243.9	287.0	91.1	392.3	253	118	381	40.0	134	234
BG4	PV140-PV180	100	200	94.5	149.5	243.9	350.0	91.1	442.3	303	145	426	58.0	134	234
BG5	PV270	125	250	94.5	149.5	243.9	472.5	91.1	499.3	360	176	521	85.5	134	234

The electronic modules to power the displacement control and the pressure control are snap-on type modules. They can be mounted on installation rails according to EN 50022. A card holder is not required.
The modules have potentiometers to adjust up and down ramps (ramp time up to 5s) and a min. and max. adjustment for optimum resolution and sensitivity as required by the application.
They comply with the latest legal requirements and confirm to European law. They are EMC approved and correspond to the CE guidelines.

Electronic modul PQ0*-P00 to operate the p-Q control for PV pumps

Ordering code analogue electronic module

PQ	□	–	□	00	–	□
Pump amplifier	Pump variation		Module variation			Design series

Code	Pump variation
01	PV 016/020/023
02	PV 032/040/046
03	PV 063/080/092
04	PV 140/180
05	PV 270

Code	Variation
F	flow control only
P	flow control and pressure adjustment
Q	flow and pressure control
L	flow and pressure control with horse power limitation

NOTE!
The electronic modules are not included in the pump compensator. Please order separately.

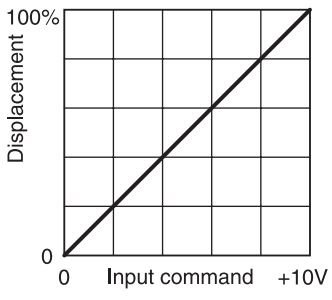
More technical information on these modules can be found in catalogue HY11-2500/UK, chapter 10, ‘Electronics’.

Technical data

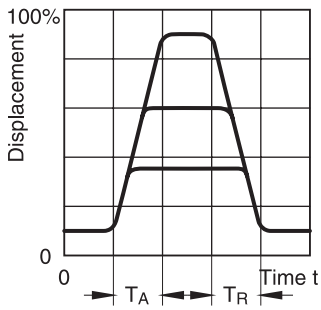
Minimum control pressure required (at internal pressure supply = minimum system pressure)	15 bar
Repeatability	± 0.75 %
Proportional flow compensator (solenoid):	
- nominal voltage	16 V
- environmental temperature	50 °C
- duty cycle	100 %
- protection class	IP54
- connector	ISO 4400
Inductive position feedback (LVDT):	
- supply voltage	18 to 36 VDC
- current requirement	<50 mA
- output voltage	3.5 to 11.5 VDC
- environmental temperature	0 to 50 °C
- load to output signal	> 5 kOhm (short circuit protected)
- connector	round connector M12x1.5 pin

Diagrams

Typical static characteristic



Typical dynamic characteristic



Response times

Size	TA [ms]	TR [ms]
PV023	50	50
PV046	70	70
PV092	90	90
PV180	150	150
PV270	200	200

The digital control module code PDDXXA-Z00 is also designed for rail mounting like the analog modules.

Features

- Digital control circuit
- Parameter setting via RS-232 interface
- All settings (ramps, MIN/MAX, control parameters) can be stored digitally and recalled from a PC to duplicate settings to other modules
- Ramp time up to 60 seconds
- Compatible to the relevant european EMC specifications
- Easy to use PC based setup software
- Covers all displacements from 16 to 270 cm³/rev
- Covers all functions: displacement control, displacement control with open loop pressure control, displacement control with closed loop pressure control and displacement control with closed loop pressure control and electronic horse power limitation.

Ordering code

PQD	XX	A	–	Z00
Digital control module for p-Q control	For all frame sizes series PV	Version A		Option

Please order the "interface cable to PC" separately.
Ordering code: PQDXXA-KABEL

Note

More technical information on these modules can be found in catalogue HY11-2500/UK, chapter 10, 'Electronics'.

Technical data

Mounting style		Snap-on mounting for EN50022 rail
Body material		Polycarbonate
Inflammation class		V2...V0 acc. UL 94
Mounting position		any
Env. temperature range	[°C]	-20...+55
Protection class		IP 20 acc. DIN 40 050
Weight	[g]	160
Duty ratio	[%]	100
Supply voltage	[V]	18...30VDC, ripple <5% eff.
Rush in current	[A]	22 for 0.2 ms
Current consumption	[A]	< 4 for p/Q-control < 2 for Q-control
Resolution	[%]	0.025 (horse power 0.1)
Interface		RS232C, 9600 baud, 3.5 mm cinch
EMC		EN 50 081-2, EN 50 082-2
Connctors		Screw terminals 0.2...2.5 mm² plug in style
Cables	[mm²]	1.5 (AWG 16) overall braid shield, for supply and solenoid connection 0.5 mm² (AWG 20) overall braid shield, for sensor and command signal connections
Max. cable length	[m]	50

For programming the module via PC, an interface cable is needed, to order seperately.

Programming software

The programming of the p-Q-control module is done in an easy to learn mode. To select the pump model and size and to set the control paramters the program **ProPVplus** must be started. This program runs under WINDOWS® 95 and higher.
The latest version of this software can be downloaded at the following internet address:

http://www.parker.com/euro_hcd

The software offers the following features:
A **TERMINAL** window to set or read out the control parameters of the module. Settings as well as comments entered in the terminal window can be stored also in RTF-format (opens e. g. under WORD or other text editors)
A **MONITOR** window allows to display process variables in numerical format.
An **OSZILLOSKOP** window displays process variables as curves. The oscilloscope offers a start - stop function. The images can be saved and stored e. g. for import into other programs.

Features

- Display and documentation of parameter sets
- Save ond reload of optimized parameter sets
- Offers oscilloscope function for easy performance evaluation and optimization
- Pre-optimized parameter sets for all PVplus piston pump
- Sizes already in E²PROM memory

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Hydraulic Controls Division
Kaarst, Germany

Preload valve for proportional displacement control, code PVAPVV*

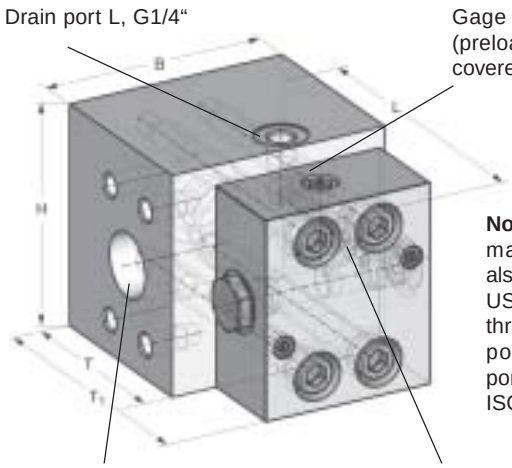
An alternative solution is the use of a direct operated preload valve. The preload valve is offered in a manifold for direct mounting to the pressure port of the pump.

The opening pressure of the valve is set to approx. 20 bar. At 30 bar load pressure the valve is fully open (pressure drop <1 bar).

The ordering code for the preload valve is **PVAPVV***.

Therefore * stands for the frame size of the pump (thread, port and seal material option).

Preload valve PVAPVV*



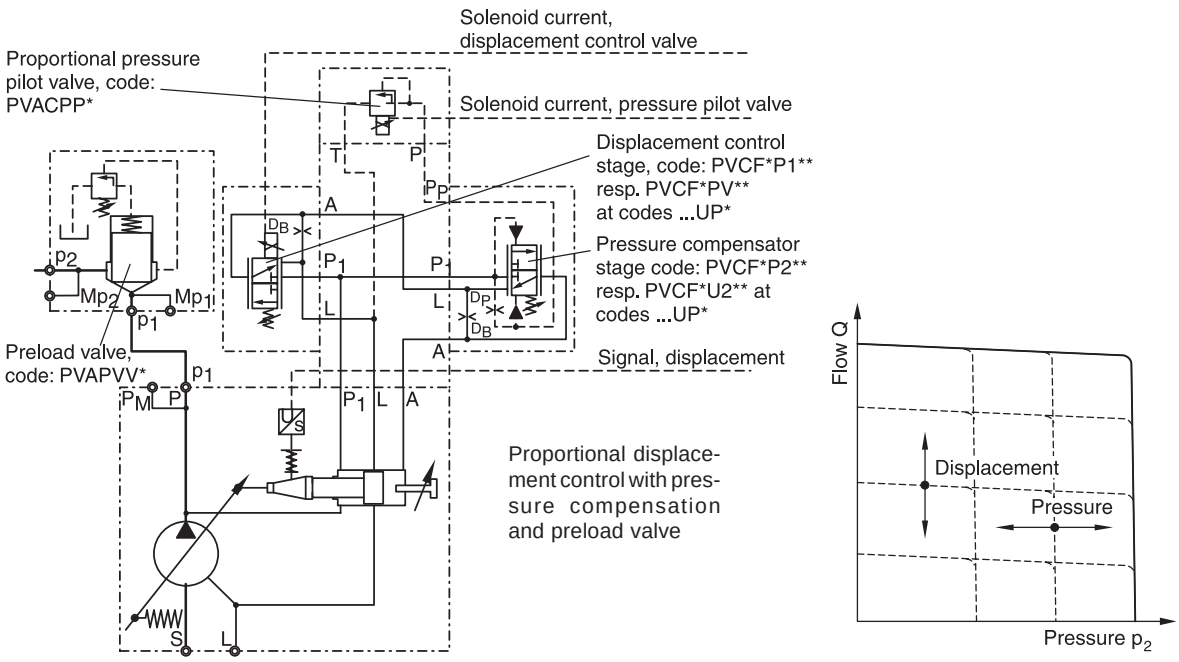
Note: All auxiliary manifolds can also be supplied in US-version (UNC threads and UNF ports) and with ports according to ISO 6149.

Dimensions preload valve PVAPVV*

Dimension		BG1	BG2	BG3	BG4	BG5
H	[mm]	110	110	110	110	130
B	[mm]	92	92	100	100	154
T	[mm]	80	80	92	92	105
L [2)]	[mm]	120	120	140	140	160
T_1	[mm]	116	116	137	137	150
for size		PV016 - 023	PV032 - 046	PV063 - 092	PV140 - 180	PV270
DN	[mm]	19 (3/4“)	25 (1“)	32 (1 1/4“)	32 (1 1/4“)	38 (1 1/2“)
PN	[bar]	400	400	400	400	400
M		M10	M12	M12 (M14*)	M12 (M14*)	M16
valve insert		DIN E16	DIN E16	DIN E25	DIN E25	DIN E32
$Q_{nominal}$	[l/min]	160	160	300	300	550

* optional for PV063 - PV180, thread option 4; [2)] L = clamping length for bolts M

Hydraulic circuit FPR/UPR control and preload manifold



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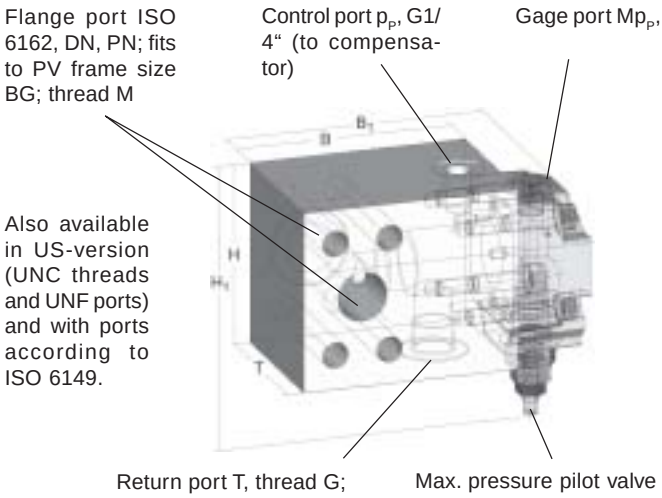
Quick unload manifold for proportional pump control, code PVAPSE*

When working with a proportional pressure control on variable displacement pumps, pressure decrease can be slow. When the pump strokes to deadhead, there is no active pressure relief. To achieve a response similar to a valve controlled system, the quick unload manifold can be mounted to the pump outlet.

This manifold includes a cartridge valve with a 4 bar spring preload. The pilot pressure supply for the compensator valve is passing this cartridge valve and creates a pressure drop across the poppet. At normal working conditions this pressure drop does not exceed 3 bar and the poppet stays closed. In a dynamic response situation the pressure drop can exceed 4 bar and the cartridge actively reduces the system pressure acoording to the setting of the proportional pilot valve.

As the pilot pressure is fed through the quick unload manifold, the compensator needs no orifice in the spool. Ordering code for the proportional displacement and pressure control for combination with the quick unload manifold is **FPS for pressure compensation** and **FPT for closed loop pressure control** (pressure transducer and proportional pressure pilot valve included).

Quick unload manifold

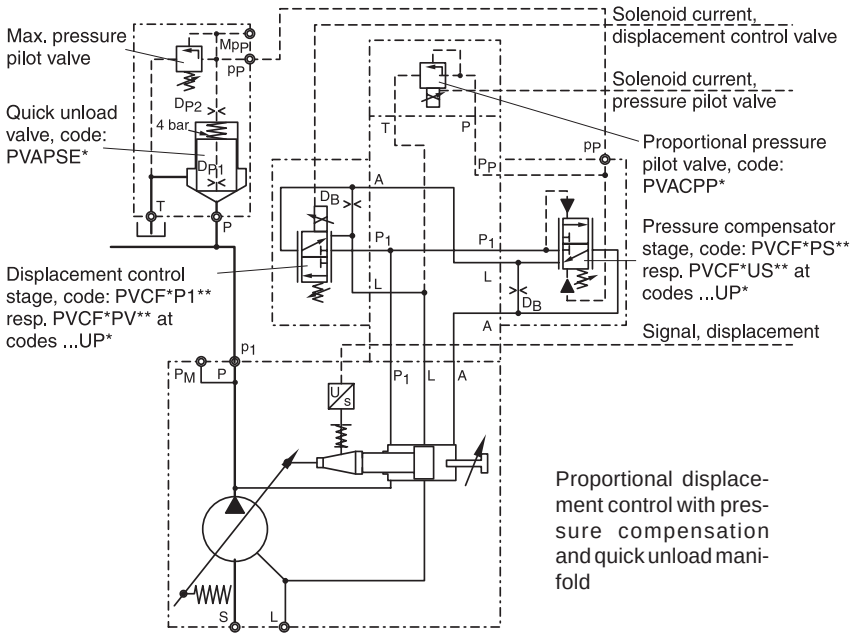


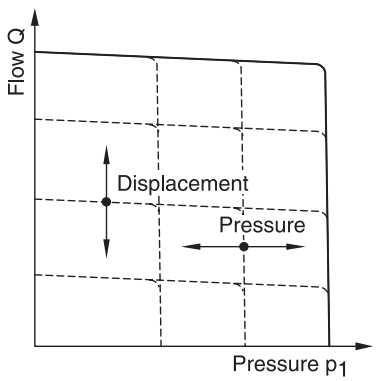
Dimensions quick unload manifold PVAPSE*

Dimension	BG1	BG2	BG3	BG4	BG5
B [mm]	110	110	110	110	154
H [mm]	92	92	100	100	120
T [mm]	80	80	92	92	105
B_1 [mm]	150	150	150	150	199
H_1 [mm]	133	133	141	141	143
for size	PV016 - 023	PV032 - 046	PV063 - 092	PV140 - 180	PV270
DN [mm]	19 (3/4“)	25 (1“)	32 (1 1/4“)	32 (1 1/4“)	38 (1 1/2“)
PN [bar]	400	400	400	400	400
M	M10	M12	M12 (M14*)	M12 (M14*)	M16
valve insert	DIN E16	DIN E16	DIN E16	DIN E16	DIN E25
$Q_{nominal}$ [l/min]	160	160	160	160	300
G (port T)	1/2“	1/2“	1/2“	1/2“	3/4“

* optional for PV063 - PV180, thread option 4

Hydraulic circuit FPS/UPS control with quick unload manifold





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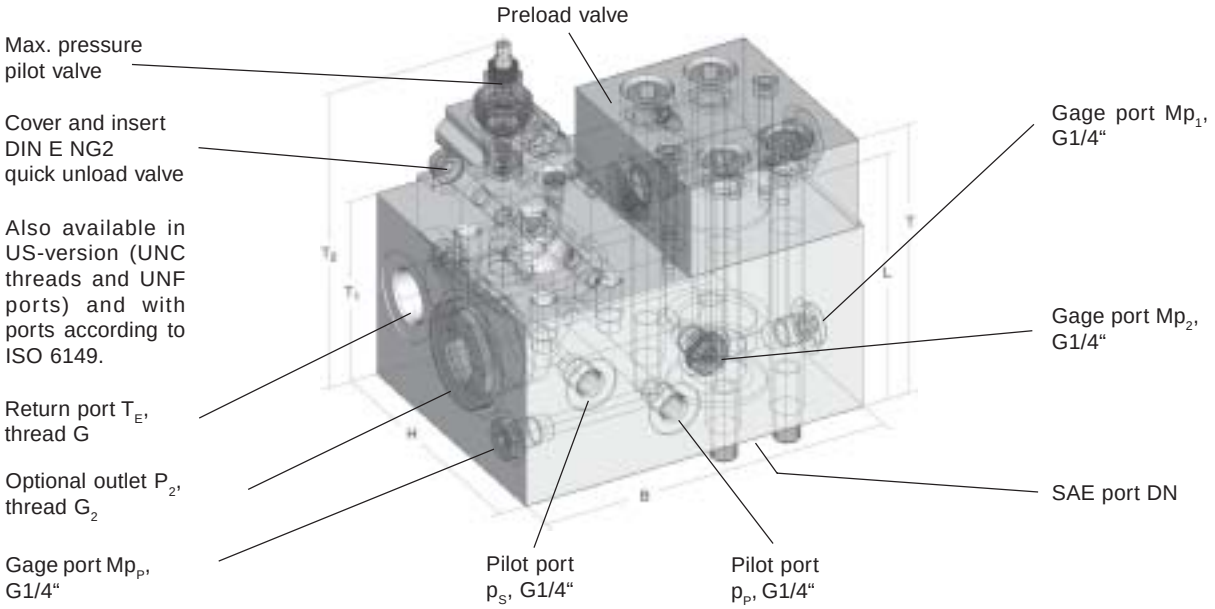
Preload and quick unload manifold, code PVAPVE*

The combination of the preload and the quick unload function into one manifold can be ordered under the code PVAPVE*. This manifold is also designed for direct pump outlet mounting.
To maintain a secure function under all conditions the pressure compensator requires an external sensing line (P_S) which is connected to the system side of the preload valve.
The ordering code for this proportional displacement control option is **FPP for pressure compensation** and **FPE for closed loop pressure control**.



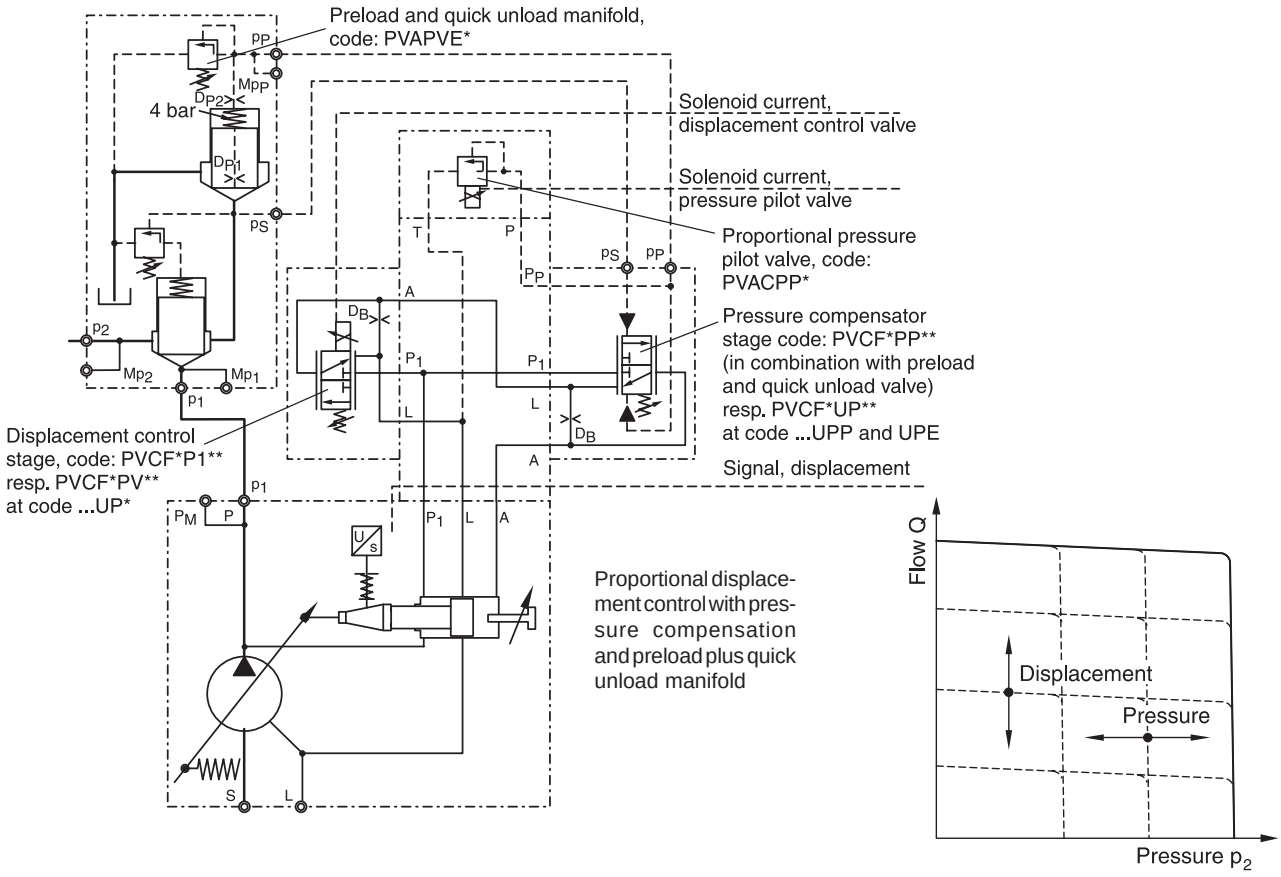
Flange ports ISO 6162; DN, PN; fit to PV, frame size BG; thread M

Dimensions preload and quick unload manifold PVAPVE*

Dimension	BG1	BG2	BG3	BG4	BG5
B [mm]	145	145	175	175	210
H [mm]	113	113	135	135	160
T [mm]	80	80	92	92	105
L [mm]	120	120	140	140	160
H_1 [mm]	153	153	175	175	205
T_1 [mm]	116	116	137	137	150
for size	PV016 - 023	PV032 - 046	PV063 - 092	PV140 - 180	PV270
DN [mm]	19 (3/4“)	25 (1“)	32 (1 1/4“)	32 (1 1/4“)	38 (1 1/2“)
PN [bar]	400	400	400	400	400
M	M10	M12	M12 (M14*)	M12 (M14*)	M16
valve insert NG1	DIN E16	DIN E16	DIN E25	DIN E25	DIN E32
$Q_{nominal}$ [l/min]	160	160	300	300	550
valve insert NG2	DIN E16	DIN E16	DIN E16	DIN E16	DIN E25
$Q_{nominal}$ [l/min]	160	160	160	160	300
G (port T_E)	1/2“	1/2“	3/4“	3/4“	3/4“
G_2 (opt. outlet)	3/4“	1“	1 1/4“	1 1/4“	1 1/2“

* optional for PV063 - PV180, thread option 4

Hydraulic circuit FPS/UPS control with preload and quick unload manifold



Ordering code pump accessories

PVAP				
Accessories for axial piston pump, PV series, pressure port mounting	Function	Frame size	Thread option	Seal

Code	Function
VV	Preload manifold
SE	Quick unload manifold
VE	Preload and quick unload manifold

Code	Size
1	PV016-023
2	PV032-046
3	PV063-092
4	PV140-180
5	PV270

Code	Seal
N	NBR
V	FPM
E	EPDM

Code	Ports[1]	Threads[2]
1	BSPP	Metric
3	UNF	UNC
4[3]	BSPP	Metr. M14
7	ISO 6149	UNC
8	ISO 6149	Metric

[1] Drain, gage and control ports
[2] Mounting threads
[3] For PV063-PV180 only: pressure port 1 1/4" with M14 instead of M12

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Ordering Examples

Example 1

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

PV * * * * * * * * FR**Z;** **Z** = PVAC2PCMNSJW35

Example 2

Same pump, accessories **not fitted:**

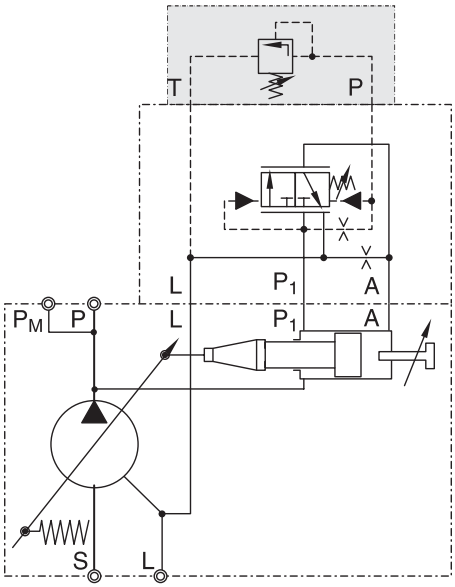
PV * * * * * * * * FR**1;** **1** = PVAC2PCMNSJW35

Example 3

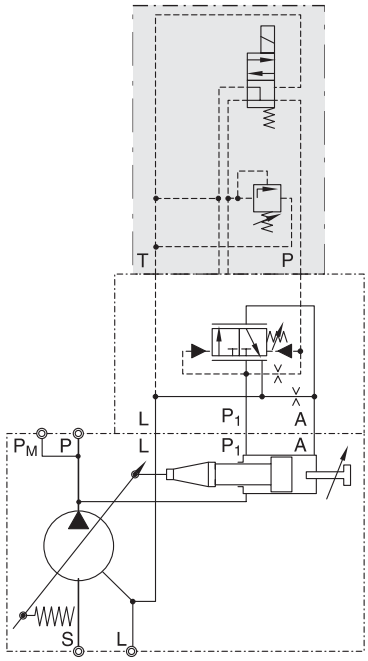
Usable for horsepower control and proportional volume control, too.

PV * * * * * * * * FR**Z;** **Z** = PVAC2PCMNSJW35

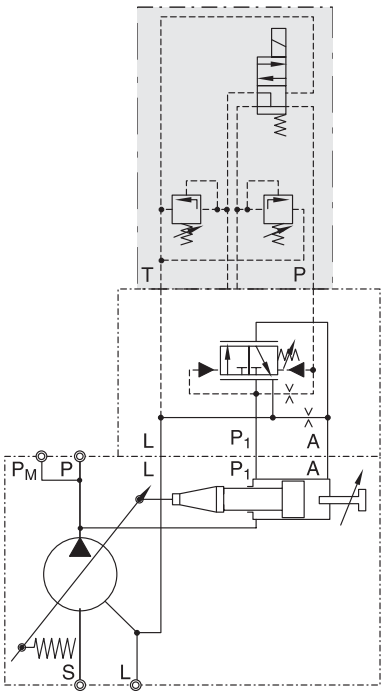
Schematics PVAC1P*



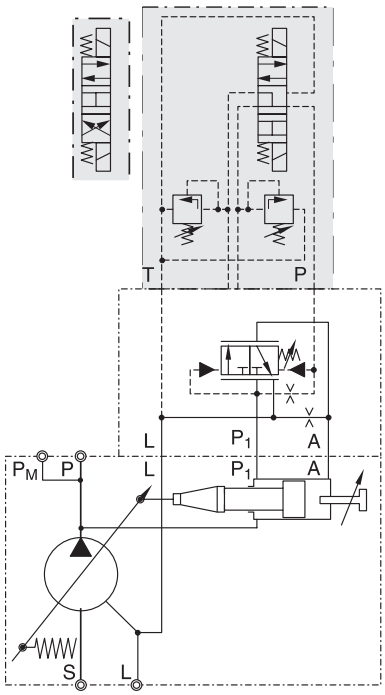
Schematics PVAC1E*



Schematics PVAC2P*



Schematics PVAC2E



PI PVplus UK.PMD RH

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Hydraulic Controls Division
Kaarst, Germany

PV	AC								35	
For PV pump series	Accessories for compensa-tors	Function	Mounting bolts	Threads	Seals	Adjustment	Solenoid	Solenoid acces-sories	Nominal pressure 350 bar [1]	Design series (not required for order)

Code	Function
1P	Max. pressure relief
1E	1 pressure, electrical unloading
2P	2 pressures, electrical selection
2E	2 pressures + stands electrical selection low pressure default
2M	2 pressures + stands electrical selection stand by default

Code	Threads
M	metric
S	SAE / UNC

Code	Seals
N	NBR
V	FPM
E	EPR

Code	Mounting bolts
C	For single compensators type R or F
T	For 2-valve-compensator type T
S	Without bolts [2]
P	For code FP*
U	For code UP*

Code	Adjustment
S	Spindle with lock nut
L	DIN lock

Code	Solenoid accessories
omit	For function 1P
C	Conduit box with free wires
W	DIN plug socket without plug

Code	Solenoid voltage
omit	For function 1P
Y	110V/50Hz - 120V/60Hz
T	220V/50Hz - 240V/60Hz
J	24V DC

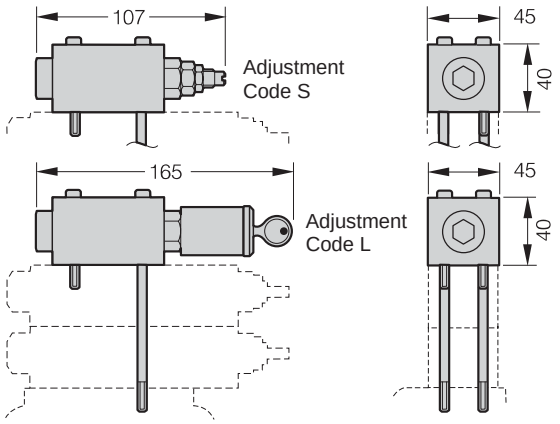
[1] Other pressures on request.

[2] Mounting bolts code "S" only in combination with thread option "M".

For spare parts and replacement kits see manual upon request.
Please order plugs separately. See accessories in catalogue HY11-2500/UK, chapter 2, 'DC Valves'.

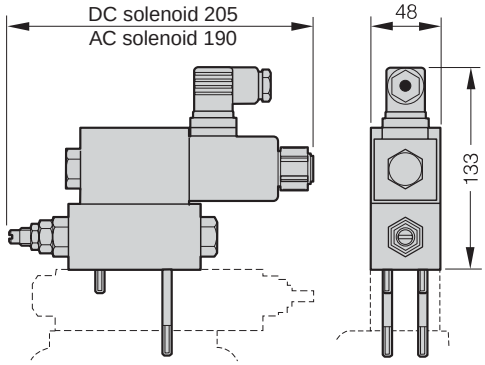
Dimensions

PVAC1P*



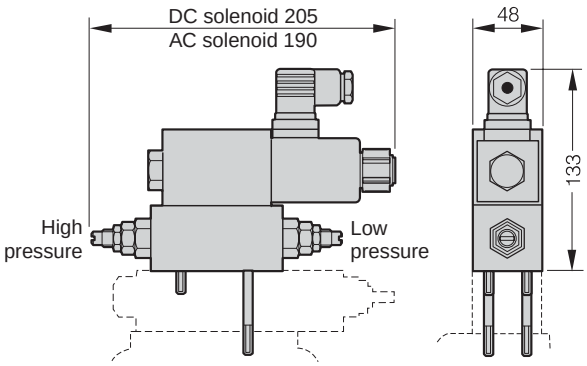
Pressure relief valve mounted on 2-valve pressure-flow compensator type T

PVAC1E*



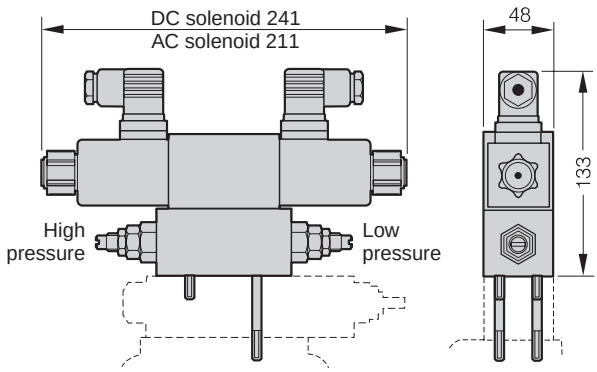
Pressure relief valve, electrical unloading, mounted on compensator type R or F

PVAC2P*



2-pressure relief valve, electrical selection, mounted on compensator type R or F

PVAC2E*/2M*



2-pressure relief valve, electrical selection and unloading, mounted on compensator type R or F

PI PVplus UK.PMD RH

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Ordering code proportional pressure control valve

PV	AC	PP						
Pump series PV	Accessories for controller	Prop. pressure valve	Mounting bolts	Thread option	Seal	Nominal pressure	Design series (not required for order)	

Code	Mounting bolts/ ports
C	For single controller type R or F
T	For double valve contr. type T
S	Without bolts*
D	For code FPD, FPS, FPP
P	For code FPG, FPE, FPT
U	For code UP*

* Mounting bolts code “S“ only in combination with thread option “M“

Code	Thread option
M	Metric
S	SAE / UNC

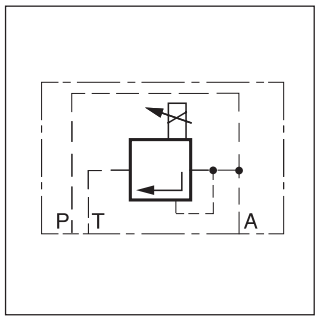
Code	Nominal pressure
35	350 bar
42	420 bar

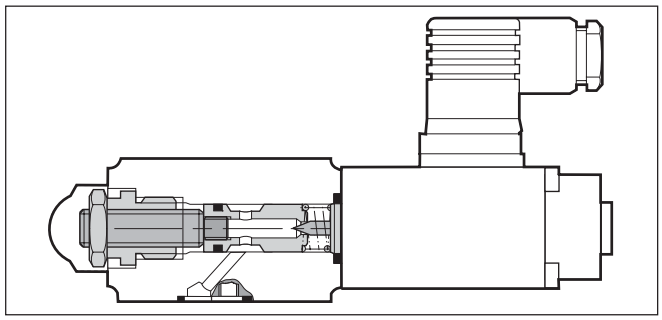
Code	Seal
N	NBR
V	FPM
E	EPDM

Proportional pressure control valve

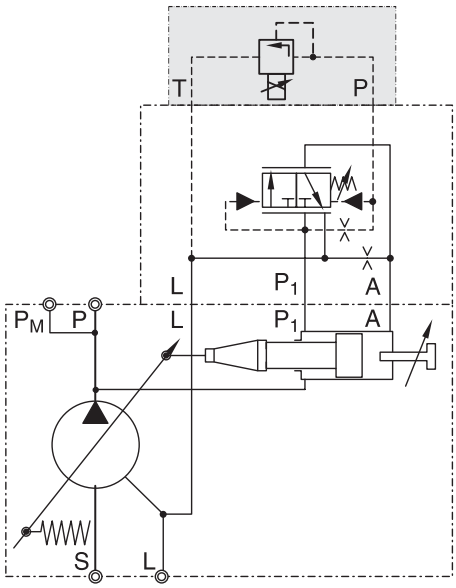
Proportional pressure pilot valves of series PVACPP* are powered by external electronic modules (e. g. PCD00*, see catalogue HY11-2500/UK, chapter10, ‘Electronics’).

They allow an infinite electronic adjustment of the pumps compensating pressure. The different pressure ratings come with different control orifices in the pilot valve.

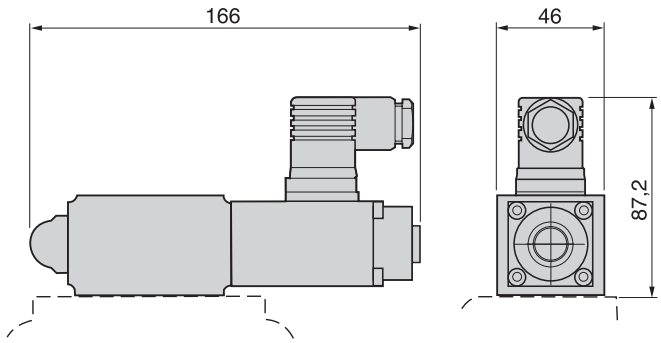




Schematic PVACPP*



Dimensions PVACPP*



PI PVplus UK.PMD RH

Parker Hannifin GmbH
Hydraulic Controls Division
Kaarst, Germany

System protection through new manifolds for pump safety

These manifolds for pumps prevent hydraulic systems from inadmissible pressure rises. In addition to pressure limiting types, modules with integrated check valves which allow several pumps to co-operate in a hydraulic circuit are available.

The product range also includes electrically unloadable manifolds with or without check valves.

The Parker manifolds for pump safety match all pumps with SAE flange bearings from SAE 3/4 to 1 1/2 -6000 PSI. The modules can be mounted directly onto the pump flange, rendering expensive piping and assembly superfluous.

- Protection against inadmissible increase in hydraulic systems
- Variety of functions - pressure relief with check valve for pump combinations, electrical unloading with/without check valve
- Direct mounting on pump pressure port - extra piping and assembly unnecessary
- Pressure-free pump start and bypass function
- Suitable for pump ports SAE 3/4 to SAE 1 1/2 6000 PSI

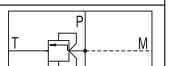
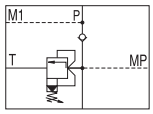
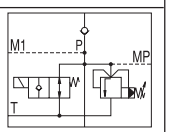
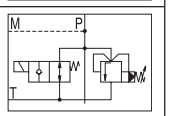
Pump size	Max. flow [l/min]	Min/Max pressure DB [bar]	Min. circulation pressure DCV [bar]
PV016 / PV023	24 / 34,5	7 / 350	5
PV032 / PV046	48 / 69	5 / 350	5
PV063 / PV092	94.5 / 138	6 / 350	5
PV140 / PV180	210 / 270	6 / 350	5
PV270	405	6 / 350	5

Please note that a pressure increase by more than approx. 20% of the adjusted pressure is possible by increasing volume flow.

Ordering code

PVAP □ □ □ □

Accessories for axial piston pump, PV series, pressure port mounting | **Function** | **Size** | **Thread option** | **Seal**

Code	Function	
SV	Pressure relief valve	
SR	Pressure relief valve with check valve	
ST	Pressure relief valve with check valve, electr. unloading	
SS	Pressure relief valve with electr. unloading	

Code	Size
1	PV016 – PV023 (SAE3/4–6000PSI)
2	PV032 – PV046 (SAE1–6000PSI)
3	PV063 – PV092 (SAE11/4–6000PSI)
4	PV140 – PV180 (SAE11/4–6000PSI)
5	PV270 (SAE11/2–6000PSI)

Code	Seal
N	NBR
V	FPM
E	EPDM

Code	Ports[1)]	Threads[2)]
1	BSPP	Metric
3	UNF	UNC
4[3)]	BSPP	Metr. M14
7	ISO 6149	UNC
8	ISO 6149	Metric

[1)] Drain, gage and control ports
[2)] Mounting threads
[3)] For PV063-PV180 only: pressure port 1 1/4" with M14 instead of M12

PI PVplus UK.PMD RH

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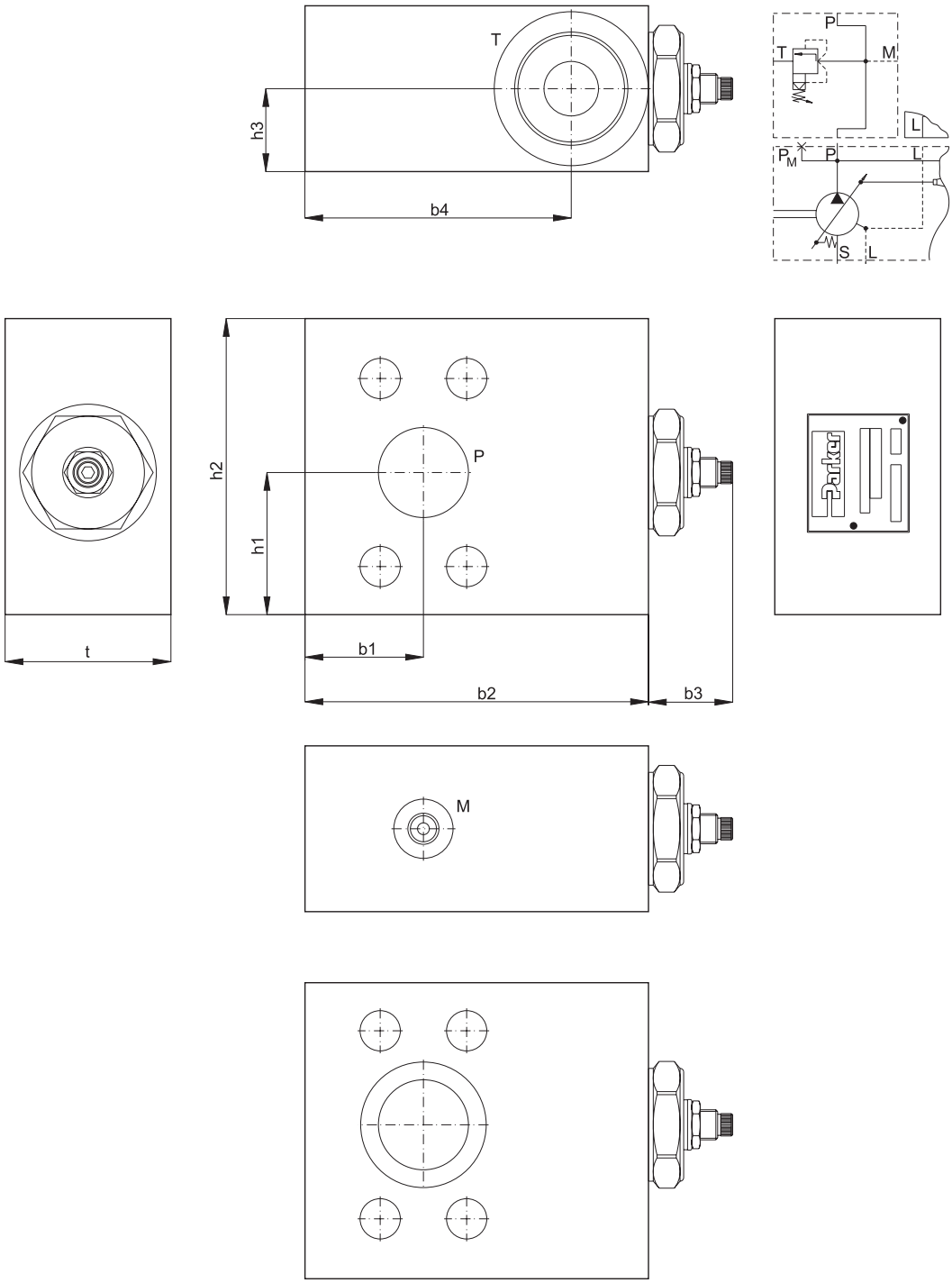
Kaarst, Germany

Option SV, pump safety manifold with pressure relief valve



Size	b1	b2	b3	b4	h1	h2	h3	t	M	P 6000 PSI	T	O-ring
PVAPSV11	27	85	27.4	67	40	90	22.5	45	G 1/4	G/SAE 3/4	G 1/2	2-214
PVAPSV21	32	95	30	73.2	45	100	22.5	45	G 1/4	SAE 1	G 3/4	2-219
PVAPSV31	37	125	27	94.3	60	120	30	60	G 1/4	SAE 1 1/4	G 1 1/4	2-222
PVAPSV41	37	125	31	94.3	60	120	30	60	G 1/4	SAE 1 1/4	G 1 1/4	2-222
PVAPSV51	50	145	36	112.4	60	125	35	70	G 1/4	SAE 1 1/2	G 1 1/2	2-225

Mounting bolts not included in delivery.

PI PVplus UK.PMD RH

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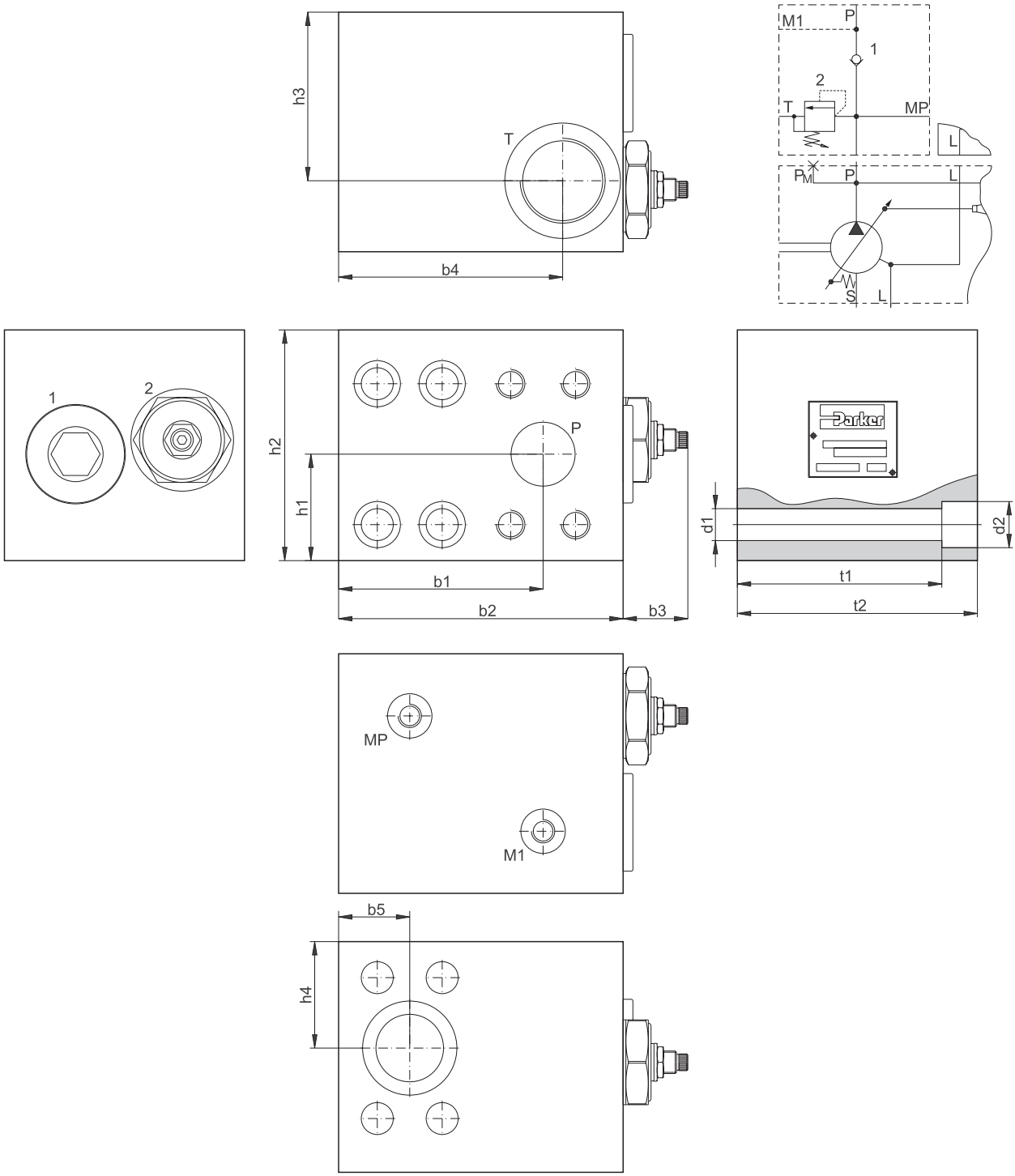
Kaarst, Germany

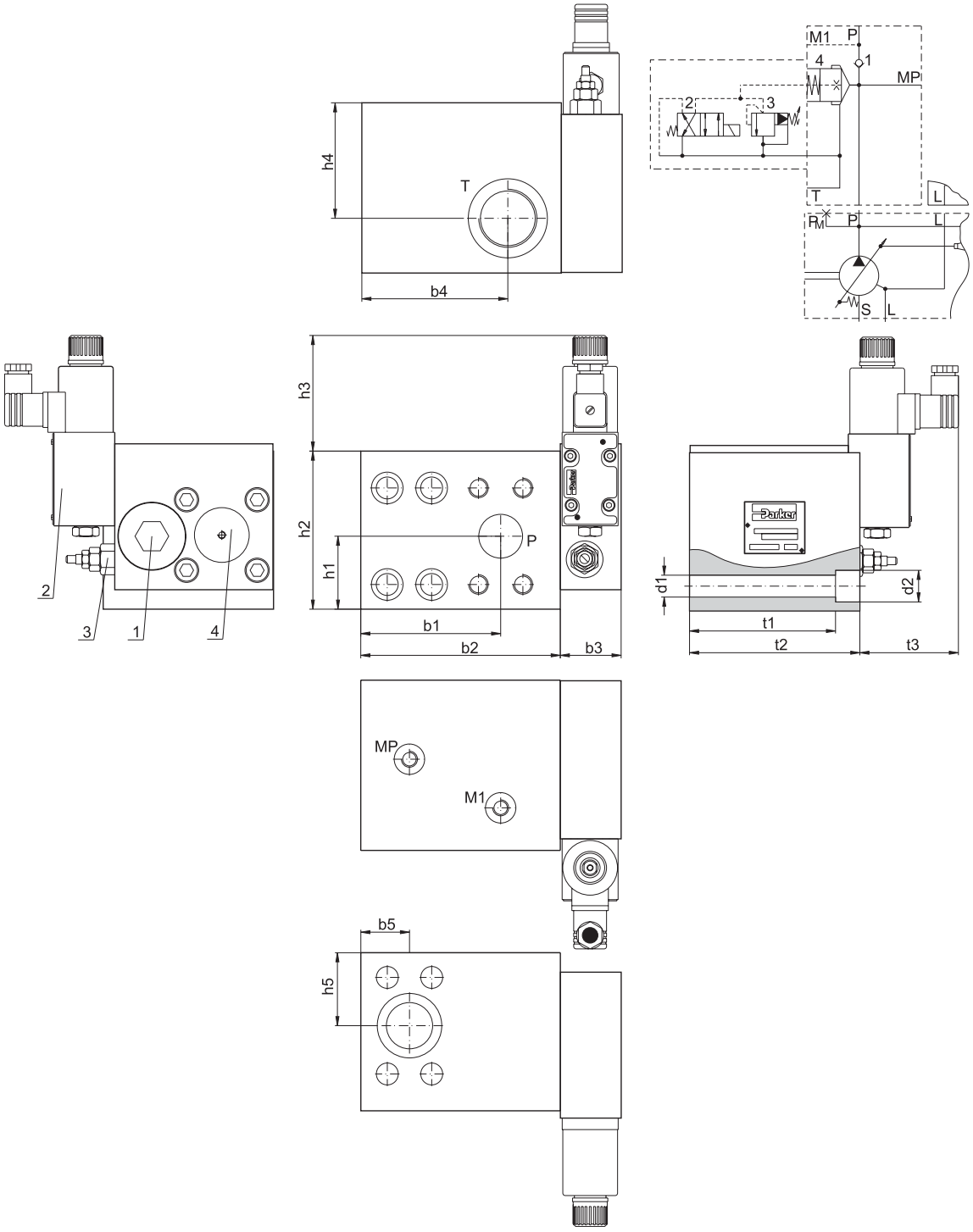
Option SR, pressure relief with check valve



Size	b1	b2	b3	b4	b5	h1	h2	h3	h4	t1	t2	d1	d2	M	P 6000 PSI	T	O-ring
PVAPSR11	63,5	85	29	67,5	22,5	42	93	70	41	89	90	11	17	G 1/4	G/SAE 3/4	G 1/2	2-214
PVAPSR21	75	110	30,5	88,5	26	50	104	68	50	75	90	13	20	G 1/4	SAE 1	G 3/4	2-219
PVAPSR31	95,5	140	31	110,4	37	60	120	90	60	105	120	13	20	G 1/4	SAE 1 1/4	G 1 1/4	2-222
PVAPSR41	95,5	140	31	110,4	37	60	120	90	60	105	120	13	20	G 1/4	SAE 1 1/4	G 1 1/4	2-222
PVAPSR51	115	160	36,4	126	40	60	130	95	60	115	135	18	26	G 1/4	SAE 1 1/2	G 1 1/2	2-225

Mounting bolts included in delivery.

Option ST, pressure relief with check valve, electr. unloading with/without check valve



Size	b1	b2	b3	b4	b5	h1	h2	h3	h4	h5	t1	t2	t3	d1	d2	M	P 6000 PSI	T	O-ring
PVAPST11	63.5	90	29	72.5	22.5	41	90	72	70	41	89	90	8	11	17	G 1/4	G/SAE 3/4	G 1/2	2-214
PVAPST21	74.5	110	50	80	26	50	100	124	70	50	90	105	96.5	13	20	G 1/4	SAE 1	G 3/4	2-219
PVAPST31	95.5	140	50	99	37	60	120	99.1	96	60	125	140	82.5	13	20	G 1/4	SAE 1 1/4	G 1 1/4	2-222
PVAPST41	95.5	140	50	99	37	60	120	99.1	96	60	125	140	82.5	13	20	G 1/4	SAE 1 1/4	G 1 1/4	2-222
PVAPST51	115	164	50	123	40	60	130	95.1	96	60	120	140	81	18	26	G 1/4	SAE 1 1/2	G 1 1/2	2-225

Mounting bolts included in delivery.

PI PVplus UK.PMD RH

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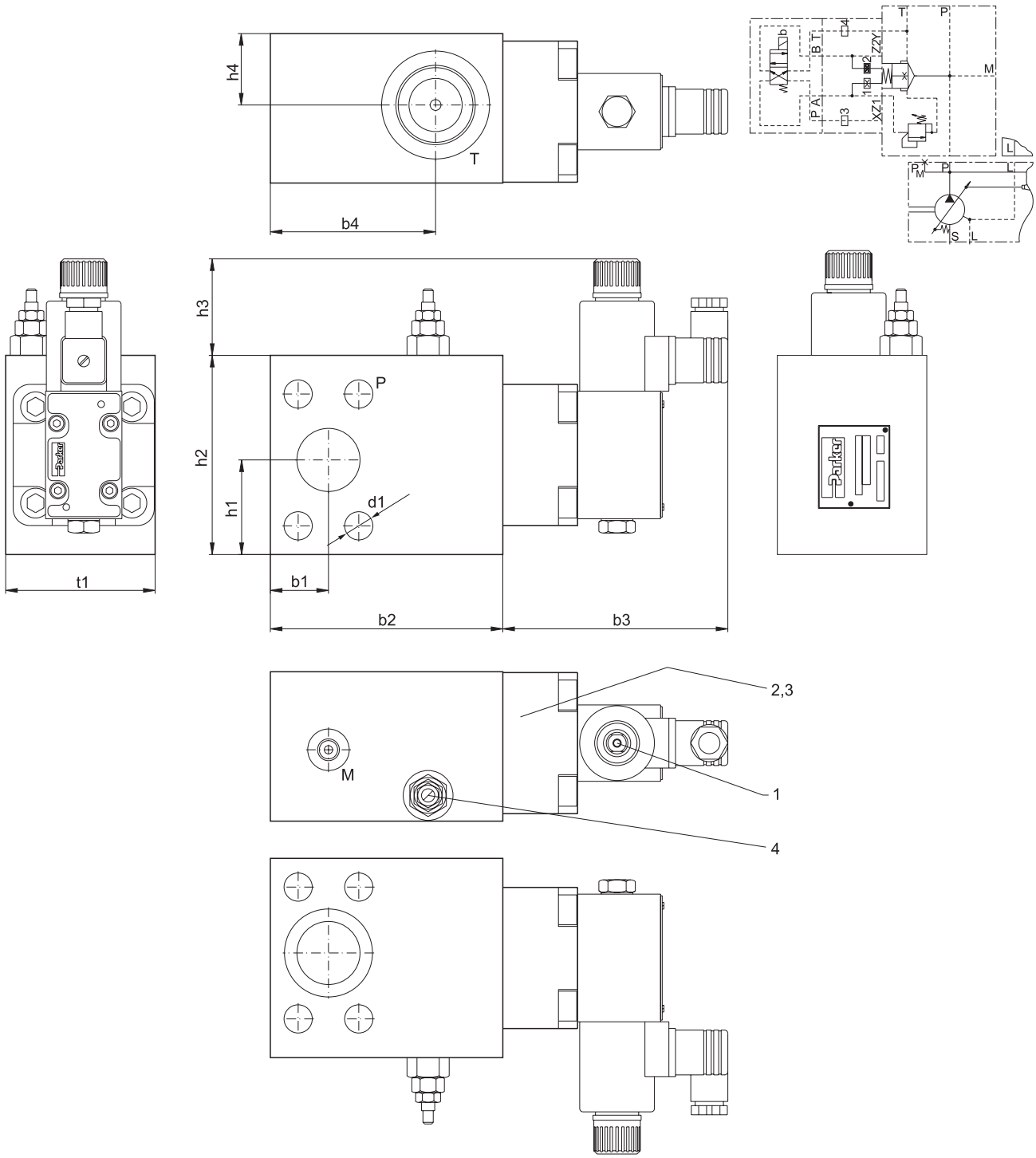
Hydraulic Controls Division
Kaarst, Germany

Option SS, pressure relief valve with electr. unloading



Size	b1	b2	b3	b4	h1	h2	h3	h4	t1	d1	M	P 6000 PSI	T	O-ring
PVAPSS11	27	100	33	82	40	100	79	23	46	11	G 1/4	G/SAE 3/4	G 1/2	2-214
PVAPSS21	29	110	88	80.5	45	100	72	34	75	13	G 1/4	SAE 1	G 3/4	2-219
PVAPSS31	34	130	138	89.5	55	110	64	43	90	13	G 1/4	SAE 1 1/4	G 1 1/4	2-222
PVAPSS41	34	130	138	89.5	55	110	64	43	90	13	G 1/4	SAE 1 1/4	G 1 1/4	2-222
PVAPSS51	35	140	138	99.5	57	120	59	43	90	17	G 1/4	SAE 1 1/2	G 1 1/2	2-225

Mounting bolts not included in delivery.

PI PVplus UK.PMD RH

Parker Hannifin GmbH
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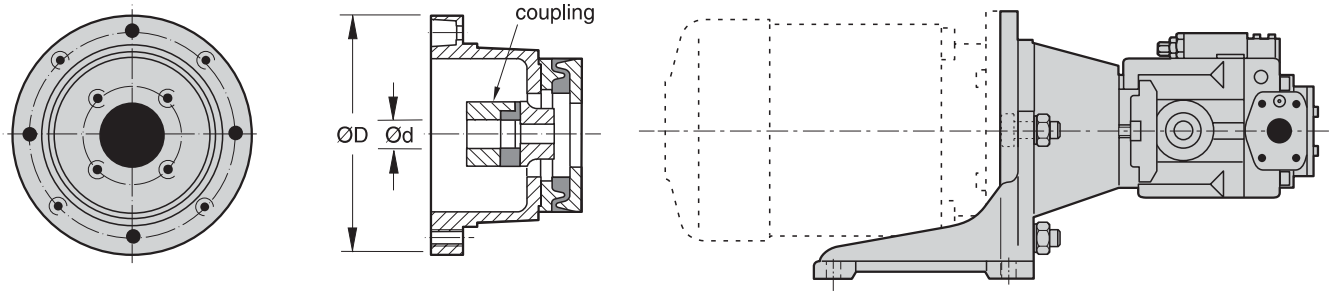
Kaarst, Germany

Bell housing, coupling and foot flange



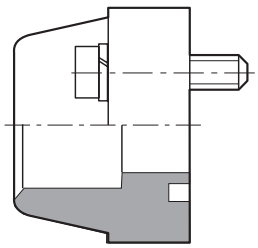
Can be purchased at:

Raja
Rahmer + Jansen GmbH
Vorthstr. 1
58775 Werdohl, Germany
Tel.: (+2392) 5090, fax: (+2392) 4966

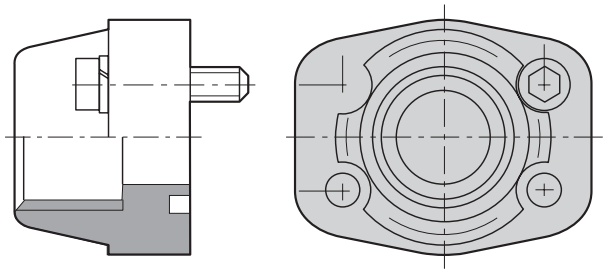
or

KTR
Kupplungstechnik GmbH
Rodder Damm
48432 Rheine, Germany
Tel.: (+5971) 798-0, fax: (+5971) 798443

Welding flange *



Threaded flange *

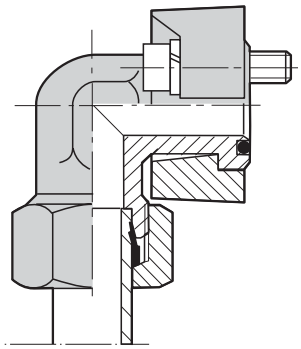


Can be purchased at:

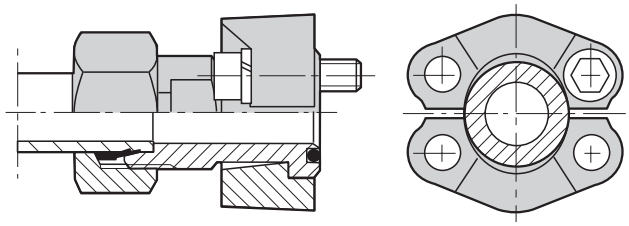
Parker Hannifin GmbH
Tube Fittings Division
Am Metallwerk 9
33659 Bielefeld, Germany
Tel.: (+521) 4048-0, fax: (+521) 4048280

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

Elbow SAE-flange connection WFS *



Straight SAE-flange connection GFS *



Can be purchased at:

Parker Hannifin GmbH
Tube Fittings Division
Am Metallwerk 9
33659 Bielefeld, Germany
Tel.: (+521) 4048-0, fax: (+521) 4048280

* For further information about flanges see catalogue No. 4039/UK „Pressure Hydraulic Flanges“ (on request)

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 mm^2/s (cSt) at 50 ^0C.

Normal operating viscosity range between 12 and 100 mm^2/s (cSt). Maximum start-up viscositiy is 320 mm^2/s (cSt). Operating temperature -10 to + 70 ^0C.

For other fluids such as phosphoric acid esters or for other operating conditions consult your Parker representative for assistance.

Seals

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

Filtration

For maximum pump and system component functionability and life, the system should be protected from contamination by effective filtration.

Fluid cleanliness should be in accordance with ISO classification ISO 4406:1999. The quality of filter elements should be in accordance with ISO standards.

Minimum requirement for filtration rate x (mm):

General hydraulic systems for satisfactory operation:

Class 20/18/15, to ISO 4406:1999

x = 25 µm ($ß_{25} \geq 75$) to ISO 4572

Hydraulic systems with maximised component life and functionability:

Class 18/16/13, to ISO 4406:1999

x = 10 µm ($ß_{10} \geq 75$) to ISO 4572

It is recommended to use return line or pressure filters. Parker 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.

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 pressure never exceeds 0.8 bar absolute. The inlet line should be as short and as straight as possible. A short suction line cut to 45^0 is recommended when the pump is mounted inside the reservoir, to improve the inlet conditions. All connections to be leak-free, as air in the suction line will cause cavitation, noise, and damage to the pump.

Drain port

Compensation may cause short-term (20 to 30 ms) flow increase, e.g. 30 l/min (PV 016 to 023), 40 l/min (PV 032 to 046), 60 l/min (PV 063 to 092),80 l/min (PV 140 to 180) and/or 120 l/min (PV270). Please consider for dimensioning.

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 aireated 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 pump is always filled with fluid. The drain pressure must not exceed 2 bar. Drain line length should not exceed 2 metres. Minimum diameter should be selected according to the port size and a straight low pressure fitting with maximised bore should be used.

Shaft rotation and alignment

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

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.

For more details see installation manual HY11-PVI016.

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