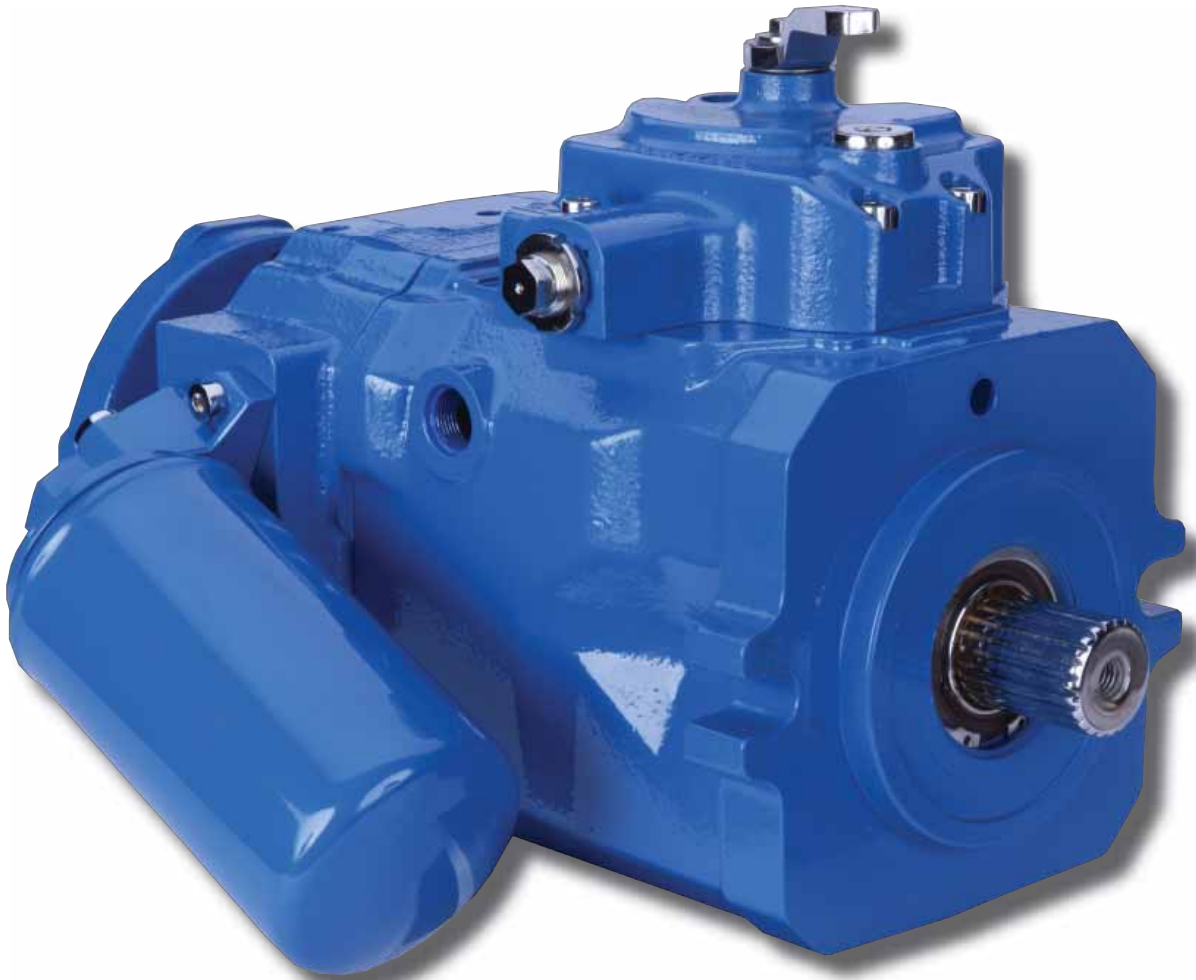


DuraForce™ HPV
Variable Pumps for Closed Loop Operation



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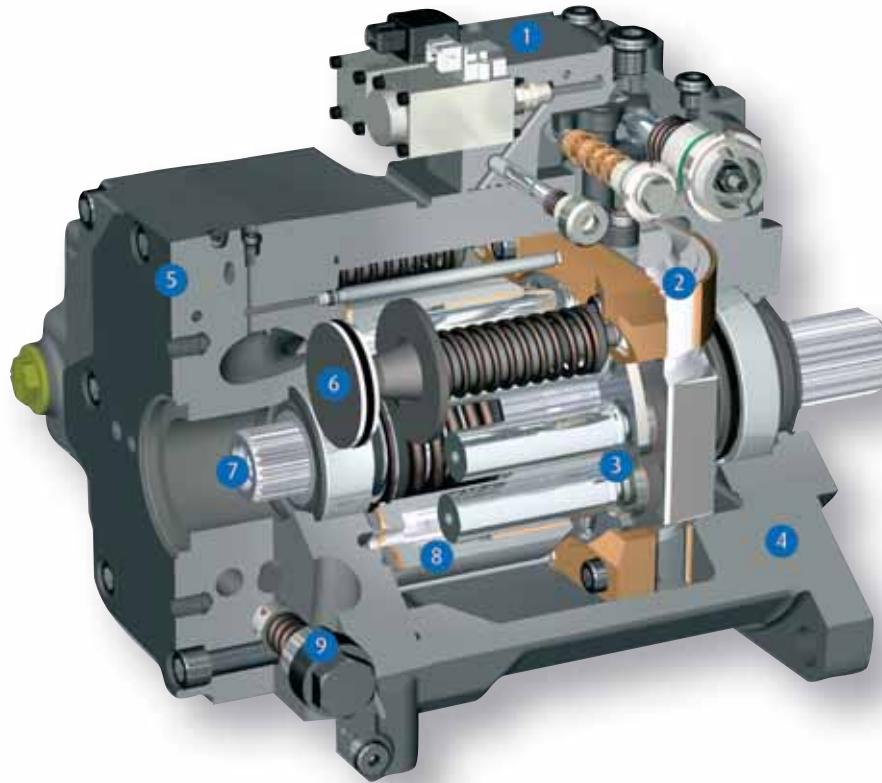
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- 1 **Control device**
Modular design, precise and load-independent
- 2 **Swash-plate**
Hydrostatic bearing
- 3 **Piston-slipper assembly**
21° swash angle
- 4 **Housing**
Monoshell for high rigidity
- 5 **Valve plate housing**
Highly integrated
- 6 **Control piston**
Integrated, hydraulically captured
- 7 **Through shaft**
For additional pumps
- 8 **Cylinder barrel**
Compact due to 21° technology
- 9 **Integrated pressure relief valves**
For system and boost pressure
- 10 **Optional PTO**
Pumps and motors are available with this torque transmission

Design characteristics

- Axial piston pump in swashplate design for high pressure closed loop systems
- Clockwise or counter clockwise rotation
- Exact and rugged servo control devices (mechanical, hydraulic, electro-hydraulic)
- Integrated high pressure relief valves with make-up function
- Integrated low pressure relief valves for boost, control and cooler circuits
- Replaceable cartridge filter
- SAE high pressure ports
- SAE mounting flange with ANSI or SAE spine shaft
- Through shaft SAE A, B, B-B, C, D and E
- Boost pressure pumps for internal and external suction, integrated cold start relief valve optional
- Hydrostatic bearings of the rotating group compensate for axial forces
- Optional tandem and multiple pumps

Product advantages

- Compact design
- High power density
- Dynamic response
- High reliability
- Long service life
- Noise-optimized
- Precise and load-independent servo control

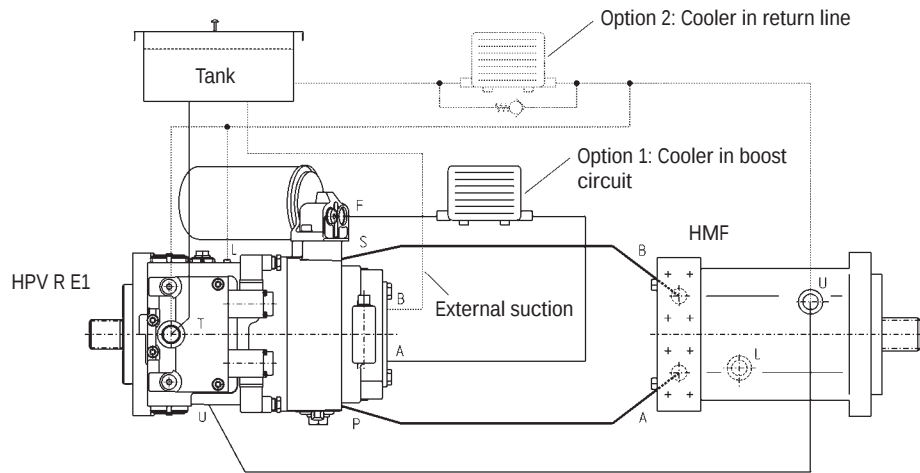
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The Closed Loop

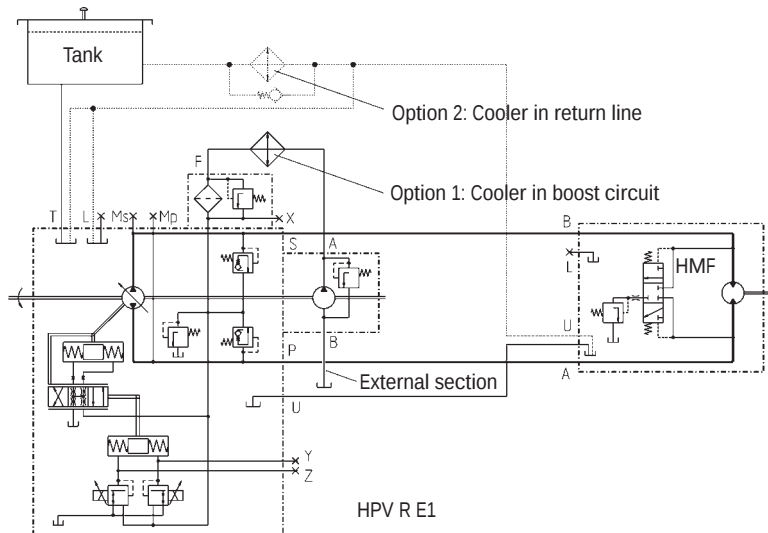
Representation of the hydraulic components of a closed loop hydrostatic drive: Variable electro-hydraulic controlled pump HPV R E1 and fixed displacement motor HMF plus filter, cooler and oil tank. The function diagram and the circuit diagram show two types of cooling.

Function diagram



Circuit diagram

The boost pump is shown with external suction.



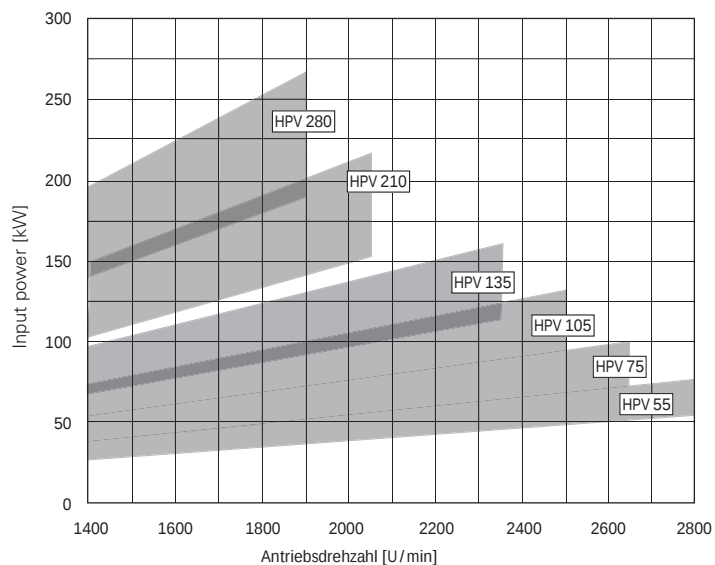
The table shows the complete capacity range of the pumps, while the diagram below shows the recommended practical range for the different nominal sizes of the HPV pump with control limit between 200 bar p_{min} and 280 bar p_{max}. It enables initial selection of the required nominal pump size.

Specifications and Performance

Specifications

			55	75	105	135	165	210	280
Rated size	Maximum displacement	cm ³ /rev	54.8	75.9	105	135.6	165	210	280
Speed	Maximum continuous speed (at 100 % duty cycle)	min ⁻¹	3300	3100	2900	2700	2500	2300	2000
	Maximum speed (intermittent) higher speed on request	min ⁻¹	3700	3500	3200	2900	2700	2500	2200
	Minimum continuous speed	min ⁻¹			500			500	500
Pressure	Maximum operating pressure	bar			420			420	420
	Maximum pressure (intermittent)	bar			500			500	500
	Continuous pressure (Δp)	bar			250			250	250
	Permissible housing pressure (absolute)	bar			2.5			2.5	2.5
Torque	Continuous input torque at continuous pressure	Nm	220	305	420	540	1100	840	1115
	Maximum input torque at max. operating pressure and 19 bar boost pressure	Nm	350	485	670	870	170	1340	1785
Power	Continuous power at max. continuous speed, continuous pressure	kW	75	98	127	153	275	201	234
	Maximum power at max. continuous speed, max. operating pressure and 19 bar boost pressure	kW	121	157	204	245	275	322	373
Permissible shaft loads	Axial	N			2000			2000	2000
	Radial	N			on request			on request	on request
Perm. housing temperature	Perm. housing temperature with minimum perm. viscosity > 10 cSt	°C			90			90	90
Weights inclusive IGP (Size 55-135) or EGP (Size 210-280)	HPV with H1-control without oil (approx.)	kg	46	49	66	72	95	132	164
	Filling volume HPV housing with filter	dm ³	2.1	2.8	3.4	3.8	4.2	4.8	5.5
	Maximum moment of inertia	kgm ² x 10 ⁻²	0.54	0.84	1.49	2.2	3.11	4.77	9.38

Recommended operating range of HPV



Model Code

HVP – Variable Pump for Closed Loop Operation

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1-800-895-4326

HPV 055 R 0 S1 M A 0 0 0 A 0 0 0 0G 00 0 0 000 000 0 0 A A

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36

	55	75	105	135	165	210	280
1 2 3 Product							
HPV – Closed Loop Variable Displacement Pump	●	●	●	●	●	●	●
4 5 6 Displacement							
055 – 055 cc (028 - 055 cc maximum displacement range)	●						
075 – 075 cc (055 - 075 cc maximum displacement range)		●					
105 – 105 cc (075 - 105 cc maximum displacement range)			●				
135 – 135 cc (105 - 135 cc maximum displacement range)				●			
165 – 165 cc (135 - 165 cc maximum displacement range)					●		
210 – 210 cc (165 - 210 cc maximum displacement range)						●	
280 – 280 cc (210 - 280 cc maximum displacement range)							●
7 Rotation							
R – CW	●	●	●	●	●	●	●
L – CCW	●	●	●	●	●	●	●
8 Mounting Flange							
0 – SAE J744 standard	●	●	●	●		●	●
1 – SAE J744 / additional threads (frame sizes 75; 105;135: (*u))		●	●	●			
2 – SAE J744 / additional holes (frame sizes 135; 165: (*u))				●	●		
9 10 Input Driveshaft							
S1 – splined ANSI B92.1 12/24 - 14 teeth (SAE J744 C)	●	●	●				
S2 – splined ANSI B92.1 12/24 - 17 teeth (SAE J744 C-C)			●	●			
S3 – splined ANSI B92.1 8/16 - 13 teeth (SAE J744 D&E)				●			
S4 – splined ANSI B92.1 8/16 - 15 teeth (SAE J744 F)						●	●
T1 – splined ANSI B92.1 16/32 - 21 teeth (*t)	●	●					
T2 – splined ANSI B92.1 16/32 - 23 teeth (*t)			●				
T3 – splined ANSI B92.1 16/32 - 27 teeth (*t)				●	●	●	
T4 – splined ANSI B92.1 16/32 - 33 teeth (*t)							●
11 Porting							
M – ISO 6149 metric	●	●	●	●	●	●	●
D – DIN 3852	●	●	●	●	●	●	●
12 Pump Control							
A – M1: mechanical hydraulic	●	●	●	●	●	●	●
B – H1: hydraulic proportional	●	●	●	●	●	●	●
C – H1P hydraulic proportional / pressure cut-off	●	●	●	●	●	●	●
D – E1: electro-proportional	●	●	●	●	●	●	●

- Available Option ● Preferred Option
- ◆ Separate Specification Required

	55	75	105	135	165	210	280
E – E1P: electro-proportional / pressure cut-off	●	●	●	●	●	●	●
F – E2: electro-proportional / shutt-off	●	●	●	●	●	●	●
H – CA: speed related hydraulic mechanical (*d)/(*r)	◆	◆	◆	◆			
13 Control Pressure Range Hydraulic and Electric Controls							
0 – not applicable (M1)	●	●	●	●	●	●	●
1 – 4-10 bar	●	●	●	●	●	●	●
2 – 4-16 bar	●	●	●	●	●	●	●
14 Control Solenoids							
0 – not applicable (M1; H1; H1P)	●	●	●	●	●	●	●
A – AMP / 12V	●	●	●	●	●	●	●
B – AMP / 24 V	●	●	●	●	●	●	●
C – DIN / 12 V	●	●	●	●	●	●	●
D – DIN / 24 V	●	●	●	●	●	●	●
E – Deutsch / 12V	●	●	●	●	●	●	●
F – Deutsch / 24V	●	●	●	●	●	●	●
15 Response Orifices							
0 – without response orifices	●	●	●	●	●	●	●
C – 0,8 mm	●	●	●	●	●	●	●
E – 1,0 mm	●	●	●	●	●	●	●
G – 1,2 mm	●	●	●	●	●	●	●
J – 1,5 mm	●	●	●	●	●	●	●
16 System Relief Valves							
A – 150 bar	●	●	●	●	●	●	●
B – 200 bar	●	●	●	●	●	●	●
C – 250 bar	●	●	●	●	●	●	●
D – 285 bar	●	●	●	●	●	●	●
E – 300 bar	●	●	●	●	●	●	●
F – 305 bar	●	●	●	●	●	●	●
G – 350 bar	●	●	●	●	●	●	●
H – 360 bar	●	●	●	●	●	●	●
J – 380 bar	●	●	●	●	●	●	●
K – 400 bar	●	●	●	●	●	●	●
L – 420 bar	●	●	●	●	●	●	●
17 Charge Relief Valves							
0 – purge orifice	●	●	●	●	●	●	●
1 – 19 bar	●	●	●	●	●	●	●
2 – 20 bar	●	●	●	●	●	●	●
3 – 22,5 bar	●	●	●	●	●	●	●
4 – 23 bar	●	●	●	●	●	●	●
5 – 24 bar	●	●	●	●	●	●	●
6 – 29 bar	●	●	●	●	●	●	●
18 Filter Configuration							
0 – No Filter - Straight Flange Port	●	●	●	●	●	●	●
1 – Filter flange with filter cartridge	●	●	●	●	●	●	●
2 – 90° charge port flange	●	●	●	●	●	●	●

(*r) cw rotation only (see pos. 7)

(*d) DIN porting only (see pos. 11)

(*m) ISO metric porting only (see pos. 11)

(*t) recommended if second unit is attached to PTO (see pos. 22,23)

(*u) required if second unit is attached to PTO (see pos. 22,23)

(*s) second HPV/R unit has be specified / separately

Model Code

HVP – Variable Pump for Closed Loop Operation

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1-800-895-4326

HPV 055 R 0 S1 M A 0 0 0 A 0 0 0 0G 00 0 0 000 000 0 0 A A

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36

	55	75	105	135	165	210	280
19 Swash Angle Sensor							
0 – Without swash angle sensor	●	●	●	●	●	●	●
S – With swash angle sensor		●	●	●	●	●	●
20 21 Auxiliary Pad and Shaft Definition							
0G – to add Gear Pump (see pos. 22,23)	●	●	●	●	●	●	●
AA – SAE J744 A Pad without shaft coupling (default)	●	●	●	●	●	●	●
AB – SAE J744 A / ANSI B92.1 16/32 - 9 teeth (A)	●	●	●	●	●	●	●
AC – SAE J744 A / ANSI B92.1 16/32 - 11 teeth	●	●	●	●	●	●	●
AD – SAE J744 A / ANSI B92.1 16/32 - 13 teeth	●	●	●	●	●	●	●
AE – SAE J744 B without shaft coupling	●	●	●	●	●	●	●
AF – SAE J744 B / ANSI B92.1 16/32 - 13 teeth (B)	●	●	●	●	●	●	●
AG – SAE J744 B / ANSI B92.1 16/32 - 15 teeth (B-B)	●	●	●	●	●	●	●
AH – SAE J744 C without shaft coupling	●	●	●	●	●	●	●
AJ – SAE J744 C / ANSI B92.1 12/24 - 14 teeth (C)	●	●	●	●	●	●	●
AK – SAE J744 C / ANSI B92.1 16/32 - 21 teeth	●	●	●	●	●	●	●
AL – SAE J744 C / ANSI B92.1 16/32 - 23 teeth	●	●	●	●	●	●	●
AM – SAE J744 D without shaft coupling	●	●	●	●	●	●	●
AN – SAE J744 D / ANSI B92.1 8/16 - 13 teeth (D)	●	●	●	●	●	●	●
AP – SAE J744 D / ANSI B92.1 12/24 - 17 teeth	●	●	●	●	●	●	●
AQ – SAE J744 D / ANSI B92.1 16/32 - 27 teeth	●	●	●	●	●	●	●
AR – SAE J744 E without shaft coupling	●	●	●	●	●	●	●
AS – SAE J744 E / ANSI B92.1 16/32 - 27 teeth	●	●	●	●	●	●	●
AT – SAE J744 E / ANSI B92.1 16/32 - 33 teeth	●	●	●	●	●	●	●
22 23 Charge Pump (internal Gear) or Tandem Adapter							
00 – without	●	●	●	●	●	●	●
BA – Internal gear pump 16 cc	●	●	●	●	●	●	●
BB – Internal gear pump 22,5 cc	●	●	●	●	●	●	●
BC – Internal gear pump tandem 16+16 cc	●	●	●	●	●	●	●
BD – Internal gear pump tandem 16+22,5 cc	●	●	●	●	●	●	●
BE – Internal gear pump tandem 22,5+16 cc	●	●	●	●	●	●	●

- Available Option ● Preferred Option
- ◆ Separate Specification Required

	55	75	105	135	165	210	280
BF – Internal gear pump tandem 22,5+22,5 cc	●	●	●	●	●	●	●
BK – HPV/R 55-02 mounting preparation (*s)	●	●	●	●	●	●	●
BL – HPV/R 75-02 mounting preparation (*s)	●	●	●	●	●	●	●
BM – HPV/R 105-02 mounting preparation (*s)	●	●	●	●	●	●	●
BN – HPV/R 135-02 mounting preparation (*s)	●	●	●	●	●	●	●
BP – HPV/R 165-02 mounting preparation (*s)	●	●	●	●	●	●	●
BQ – HPV/R 210-02 mounting preparation (*s)	●	●	●	●	●	●	●
BR – HPV/R 280-02 mounting preparation (*s)	●	●	●	●	●	●	●
24 Auxiliary Drive on Internal Gear Pump							
0 – Without internal gear pump	●	●	●	●	●	●	●
A – SAE J744 A / ANSI B92.1 16/32 - 9 teeth (A) (default)	●	●	●	●	●	●	●
B – SAE J744 B without shaft coupling	●	●	●	●	●	●	●
C – SAE J744 B / ANSI B92.1 16/32 - 13 teeth (B)	●	●	●	●	●	●	●
D – SAE J744 B / ANSI B92.1 16/32 - 15 teeth (B-B)	●	●	●	●	●	●	●
E – SAE J744 C without shaft coupling	●	●	●	●	●	●	●
F – SAE J744 C / ANSI B92.1 12/24 - 14 teeth (C)	●	●	●	●	●	●	●
25 Internal Gear Pump Supply							
0 – Without internal gear pump	●	●	●	●	●	●	●
E – External supply port	●	●	●	●	●	●	●
26 27 28 Displacement Setting – P Port							
000 – Catalog Pump Rating	●	●	●	●	●	●	●
29 30 31 Displacement Setting – S Port							
000 – Catalog Pump Rating	●	●	●	●	●	●	●
32 33 Special Requirements							
0 – Without special requirements (default)	●	●	●	●	●	●	●
34 Surface Coating							
0 – Anti rust conservation oil (default)	●	●	●	●	●	●	●
A – Primer blue	●	●	●	●	●	●	●
35 Unit Identification							
A – Eaton	●	●	●	●	●	●	●
36 Type Code Release							
A – Revision Level A	●	●	●	●	●	●	●

(*r) cw rotation only (see pos. 7)

(*d) DIN porting only (see pos. 11)

(*m) ISO metric porting only (see pos. 11)

(*t) recommended if second unit is attached to PTO (see pos. 22,23)

(*u) required if second unit is attached to PTO (see pos. 22,23)

(*s) second HPV/R unit has be specified / separately

Operational Parameters

Life Time Recommendations

Beneficial Conditions For Long Service Life

Speed	Lower continuous maximum speed
Operating Pressure	Less than 300 bar on average
Max. Pressure	Only at reduced displacement
Viscosity	15 ... 30 cSt
Power	Continuous power or lower
Purity of Fluid	18/16/13 in acc. with ISO 4406 or better

Eaton high pressure units are designed for excellent reliability and long service life. The actual service life of a hydraulic unit is determined by numerous factors. It can be extended significantly through proper maintenance of the hydraulic system and by using high-quality hydraulic fluid.

Speed	Between continuous maximum speed and intermittent maximum speed
Adverse Factors Affecting	
Operating Pressure	More than 300 bar on average
Viscosity	Less than 10 cSt
Power	Continuous operation close to max. power
Purity of Fluid	Lower than 18/16/13 in acc. with ISO 4406

Operational parameters. Filtration

In order to guarantee long-term proper function and high efficiency of the hydraulic pumps the cleanliness level of the lubricant must comply with the following criteria according to

Hydraulic Fluid Recommendation 03-401-2010. Maintaining the recommended cleanliness level can extend the service life of the hydraulic system significantly.

For reliable proper function and long service life

18/16/13 in accordance with ISO 4406 or better

Commissioning

The minimum cleanliness level requirement for the hydraulic oil is based on the most sensitive component. For commissioning we recommend a filtration in order to achieve the required cleanliness level.

Filling and operation of hydraulic systems

The required cleanliness level of the hydraulic oil must be ensured during filling or topping up. When drums, canisters, or large-capacity tanks are used the oil generally has to be filtered. We recommend the implementation of suitable filters to ensure that the required cleanliness level of the oil is achieved and maintained during operation.

International standard

Code number according to ISO 4406

18/16/13

Available filter sizes

Filter size	55	75	105	135	165	210	280
No. 2	x						
No. 3	x	x	x	x	x	x	x

In order to ensure the functional performance and high efficiency of the hydraulic pumps the viscosity and purity of the operating fluid should meet the different operational requirements. Eaton recommends using only hydraulic fluids which are confirmed by the manufacturer as suitable for use in high pressure hydraulic installations or approved by the original equipment manufacturer.

Operational Parameters

Pressure Fluids

Permitted pressure fluids

- Mineral oil HLP to DIN 524-2
- Biodegradable fluids in accordance with ISO 15 380 on request
- Other pressure fluids on request

Recommend viscosity ranges

Pressure fluid temperature range	[°C]	-20 to +90
Working viscosity range	[mm ² /s] = [cSt]	10 to 80
Optimum working viscosity	[mm ² /s] = [cSt]	15 to 30
Max. viscosity (short time start up)	[mm ² /s] = [cSt]	1000

In order to be able to select the right hydraulic fluid it is necessary to know the working temperature in the hydraulic circuit. The hydraulic fluid should be selected such that is

optimum viscosity is within the working temperature range (see tables).

The temperature should not exceed 90 °C in any part of the system. Due to pressure and speed influences the leakage

fluid temperature is always higher than the circuit temperature. Please contact Eaton if the stated conditions cannot be met in special circumstances.

Viscosity recommendations

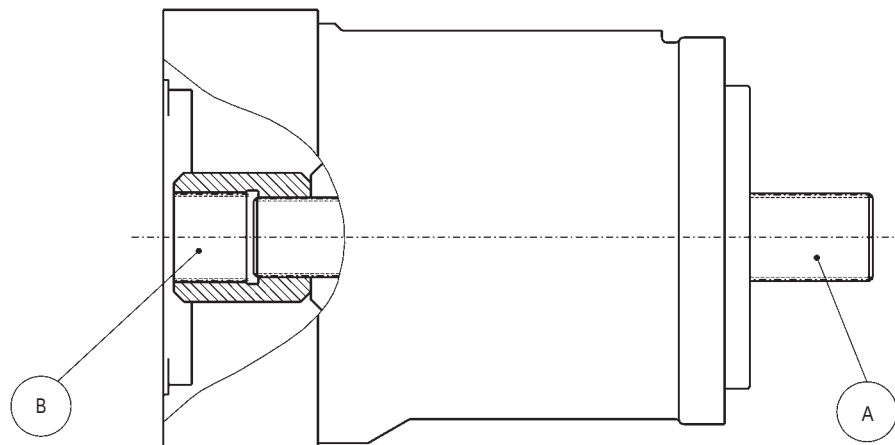
Working temperature [°C]	Viscosity class [mm ² /s] = [cSt] at 40 °C
Approx. 30 to 40	22
Approx. 40 to 60	32
Approx. 60 to 80	46 or 68

Further information regarding installation can be found in the operating instructions.

Depending on the selected components, different torques may be transferred. Please ensure that the load transfer components such as mounting flange, PTO-through shaft and additional pumps are designed adequately. Our sales engineers will be pleased to provide design advice.

Torque Transmission

Torque transmission of HPV



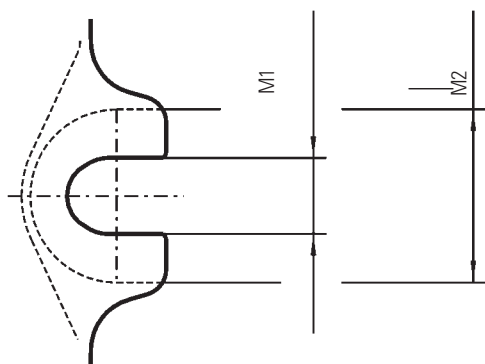
This shows the input side (A) and PTO/output side (B) of a HPV pump. The information on the following pages refers to

- Mounting flange and drive shaft (A)
- PTO flange and through shaft (B).

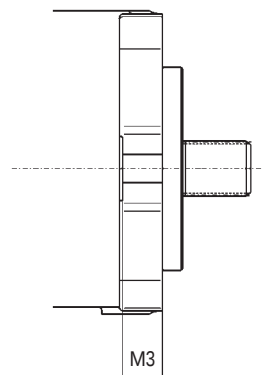
A) Flange profile

Bolt hole dimensions		Rated size HPV						
		55	75	105	135	165	210	280
M1 inside diameter	mm	17.5	17.5	17.5	21.5	21.5	22	22
M2 outside diameter	mm	34	40	34	40	40	38	39
M3 length	mm	20	20	25	20	28	30	30
Min. plate thickness	mm	6	6	6	6	(8)	(8)	(8)

Bolth hole diameter



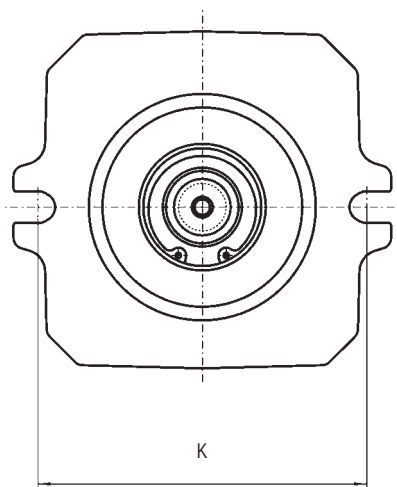
Bolt hole length



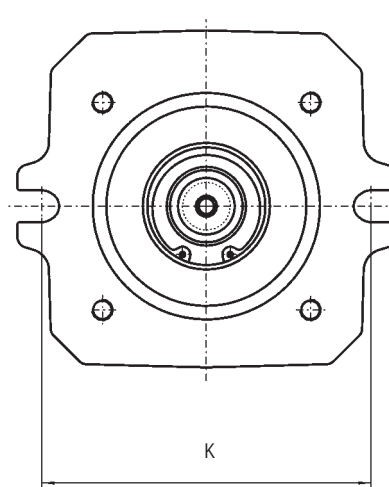
A) Mounting flange dimensions

Mounting flange dimensions in accordance with SAE J744	Dimension K [mm]	Rated size HPV						
		55	75	105	135	165	210	280
SAE C, C-C 2-hole	181.0	x	x	x				
SAE C, C-C 2-hole with 4 additional threaded holes	181.0		x	x				
SAE D 2-hole	228.6				x			
SAE C, C-C 2-hole with 4 additional bolt holes	228.6				x	x		
SAE E 4-hole	224.5						x	x

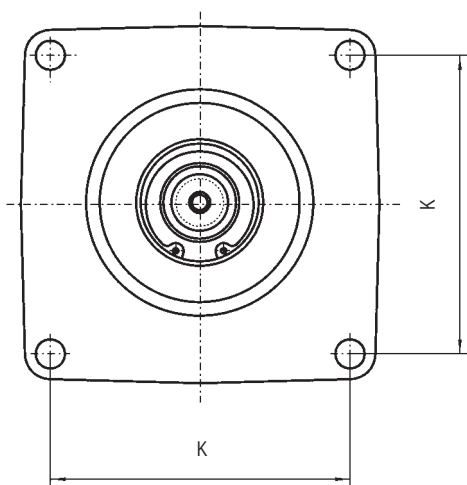
A) Fixing hole distance K 2-hole flange



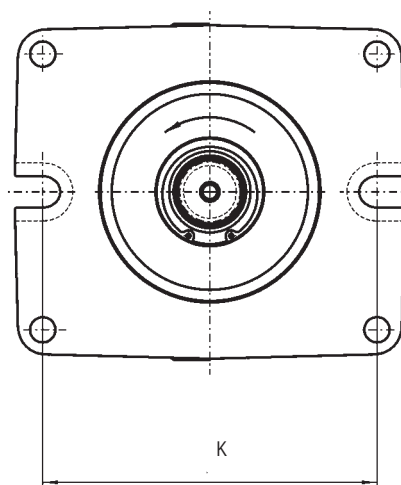
2-hole flange with 4 additional threaded holes



4-hole flange



2-hole flange with 4 additional bolt holes



Torque Transmission

Drive Shaft

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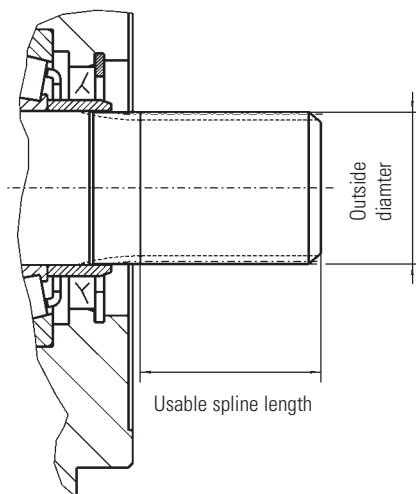
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A) Dimensions ANSI and SAE drive shafts

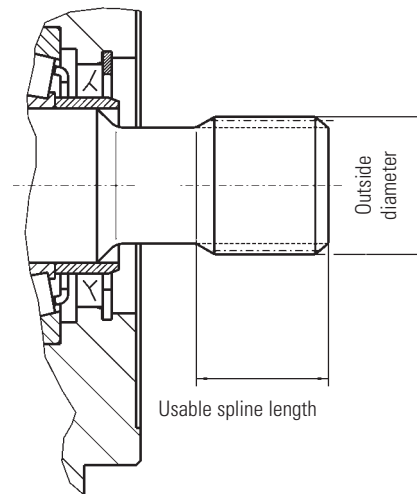
Shaft Spline in accordance with ANSI B92.1	SAE J744 code for centering and shaft	Outside diameter (mm)	Usable spline length (mm)	Shaft type	Available for rated size						
					55	75	105	135	165	210	280
16/32, 21 t		34.51	39.5	1	x	x					
16/32, 23 t		37.68	38.5	1			x				
16/32, 27 t		44.05	62	1				x	x	x	
16/32, 33 t		53.57	58	1							x
12/24, 14 t	C	31.22	30	2	x	x	x				
12/24, 17 t	C-C	37.68	30	2			x	x			
8/16, 13 t	D	43.71	50	2				x			
8/16, 15 t	F	50.06	58	1						x	

A) Hydraulics shaft types

Type 1. Without undercut



Type 2. With undercut



Torque Transmission

PTO Flange

LIFCO
HYDRAULICS INC

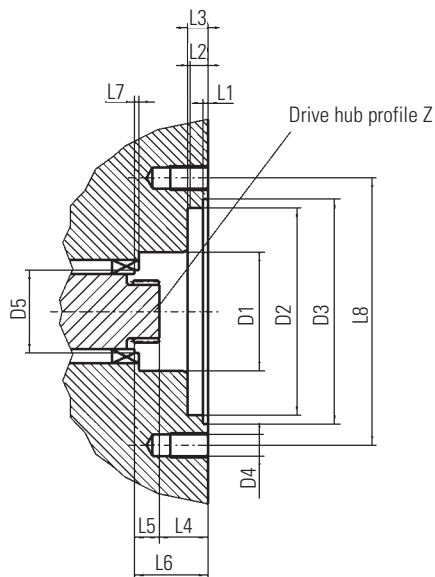
lifcohydraulics.com
1-800-895-4326

Eaton pumps can be combined into tandem and multiple pumps. The combination options are determined by the permitted transfer torque. The following data refers to the PTO (pump output side, without further attachments).

B) PTO dimensions

Rated size		55	75	105	135	165	210	280
Z Drive hub profile in accordance with ANSI B92.1		16/32, 15 t	16/32, 18 t	16/32, 19 t	16/32, 21 t	16/32, 21 t	16/32, 24 t	16/32, 27 t
D1	mm	40	42	48	52	52	63	72
D2 spigot pilot diameter	mm		82.55			82.55	82.55	
D3	mm		88			88	89.5	
D4	mm		M 10			M10	M10	M12
D5 max. bearing clearance	mm	30	35	38	43	43	47	49
L1	mm		1.5			1.5	1.9	
L2 adapter length	mm		7			7	8	
L3	mm		9			9	9	
L4 minimum distance	mm	35	39	33	35	-	38.5	50.5
L5 usable spline length	mm	14	18	19	20	-	29	30.6
L6 distance to bearing	mm	51	57.5	53	55.9	-	68.3	83
L7 min. bearing clearance	mm	3	3	3	4	-	3	-
L8 hole distance 2-hole	mm		106.4			-	106.4	146

B) PTO dimensions



Torque transmission. Output shaft

B) Output shaft transfer torque

Rated size		55	75	105	135	165	210	280
Continuous transfer torque	Nm	220	305	420	540	660	840	1120
Max. transfer torque	Nm	350	485	670	870	1100	1340	1800

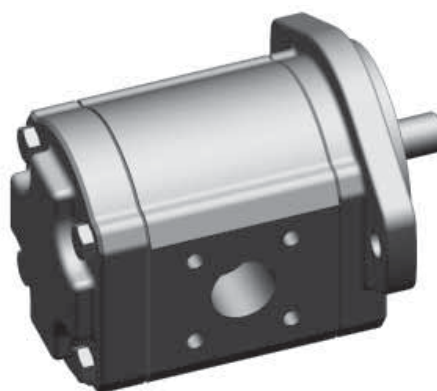
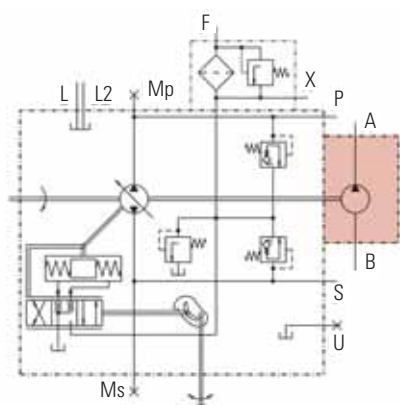
Two types of gear pumps are available: internal gear pump IGP and external gear pump EGP. The possible combinations of and with IGP and EGP are determined by the PTO option and the permitted shaft torque. Both types can be used as boost pump for the main circuit or the control and cooling circuit. The suction limit of 0.8 bar min. (absolute) must be adhered to. The boost pressure relief valves for the rated sizes 55-135 are integrated in the port plate housing, and for the rated sizes 210 and 280 in the charge pressure manifold of the HPV.

Gear Pumps

Technical data

Max. displacement volume	cm ³ /rev	16	19	22,5	31	38	44
Standard boost pump for HPV	Rated size	55		75-135		210	280
Type of gear pump		IGP	EGP	IGP	EGP	EGP	EGP
Mounting flange and drive shaft profile		SAE A 16/32, 18 t	SAE A 16/32, 9 t	SAE A 16/32, 18 t	SAE A 16/32, 9 t	SAE A 16/32, 13 t	SAE A 16/32, 13 t
Type of suction		internal, external	external	internal, external	external	external	external
Max. perm. operating pressure observe max. permissible rated pressures for filter and cooler	bar	40	250	40	165	275	220
Standard PTO flange and shaft spline		SAE A 16/32, 9 t	-	SAE A 16/32, 9 t	-	-	-
Continuous output torque	Nm	175			175		
		75 Nm with SAE A		-	75 Nm with SAE A		-
Max. output torque	Nm	250			250		
		107 Nm with SAE A		-	107 Nm with SAE A		-
Cold start relief valve		integrated	-	integrated	-	-	-

External gear pump EGP

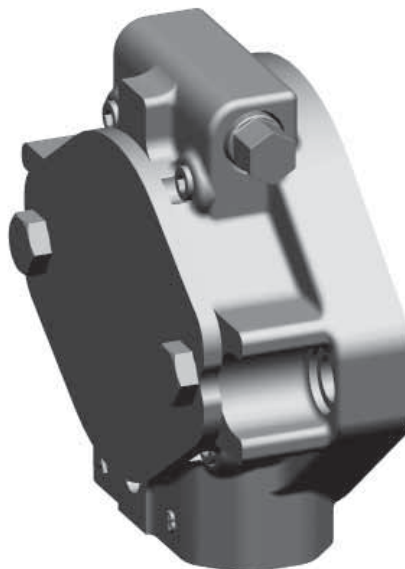
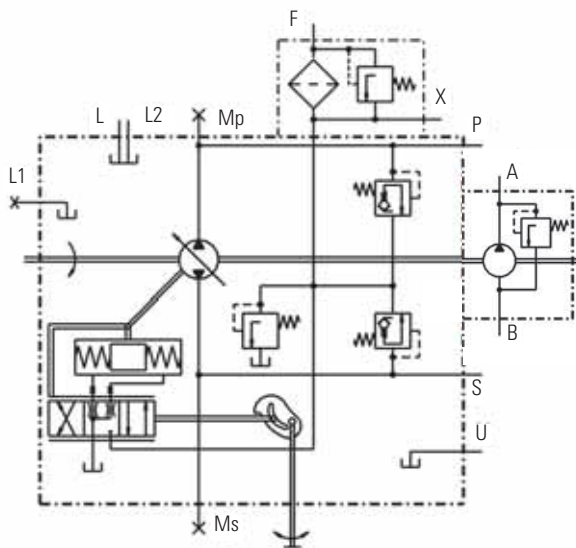


The EGP type features external suction.

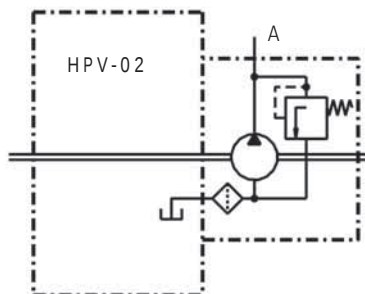
The IGP boost pumps include a cold start relief valve and a through drive for attaching additional pumps. The suction can be internal, external or combined. IGP types are available in rated sizes of 16 cm³/rev and 22.5 cm³/rev.

Gear Pumps

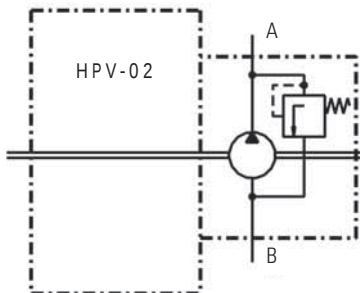
Internal gear pump IGP with external suction



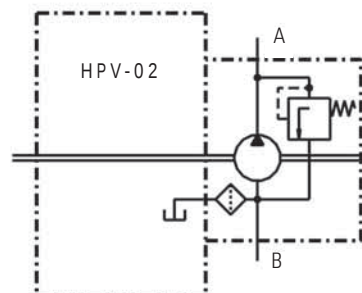
Internal suction



External suction



Combined suction



Internal suction

- The boost pump supplies the main circuit with oil from the pump housing.
- External connection B is closed.

External suction

- The boost pump supplies the main circuit with oil from the oil tank.
- Ther internal connection is closed.

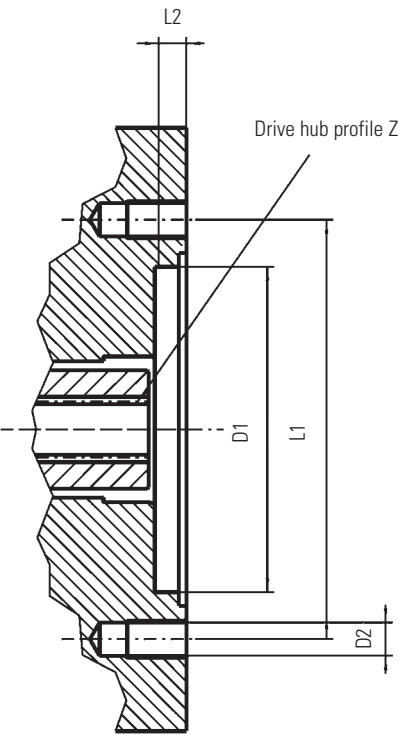
Combined suction

- The boost pump supplies the main circuit with oil from the pump housing and oil tank.
- This type of suction is a combination of internal and external suction.

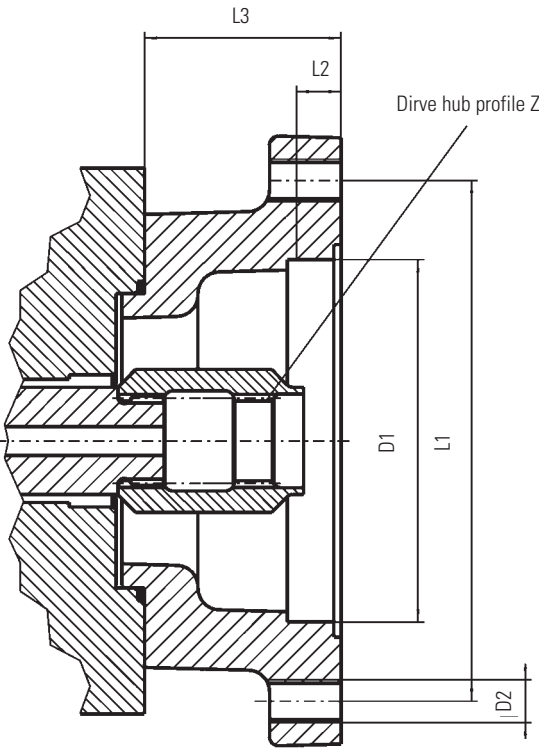
PTO flange with IGP

Flange profile 2-hole		SAE A	SAE B	SAE B-B	SAE C
Z Internal drive hub profile in accordance w/ ANSI B92.1		16/32, 9 t	16/32, 13 t	16/32, 15 t	12/24, 14 t
D1 Spigot pilot diameter	mm	82.55	101.6	101.6	127
D2 Thread size	mm	M 10	M 12	M 12	M 16
L1 Hole distance	mm	106.4	146	146	181
L2 Adapter length	mm	7	11	11	13
L3 Flange length	mm	-	55	55	72
Continuous transfer torque	Nm	75	175	175	175
Maximum transfer torque	Nm	107	250	250	250

PTO SAE A with IGP



PTO SAE B, B-B and C with IGP



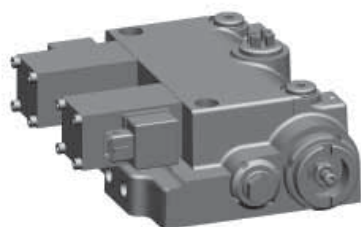
The modular control concept with standardised interface enables quick selection and adaptation for different customer and system requirements with mechanical, hydraulic or electronic control. All HPV controls feature an upstream signal circuit that is adapted to the respective control, and a standardised and load-independent servo control for simple and constantly available machine or vehicle control.

Controls

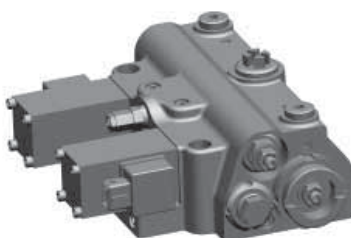
Technical data

Type of control	Additional option	Name of control
Mechanical		M1
Hydraulic		H1
	with pressure cut-off regulation	H1P
	speed dependent	CA
	torque-/power controlled	CA
	with additional safety function	CA
Electrical		E1
	with pressure cut-off regulation	E1P
	with additional safety function	E2

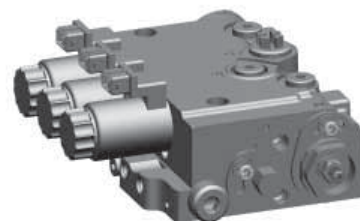
E1-control



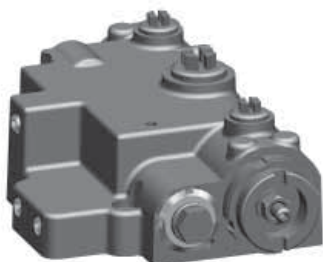
E1P-control



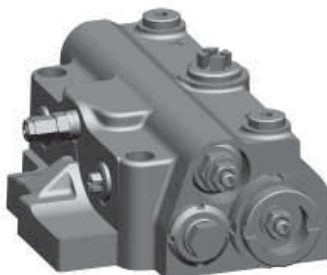
E2-control



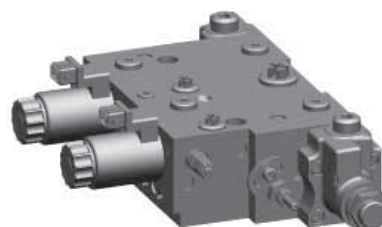
h1-control



H1P-control



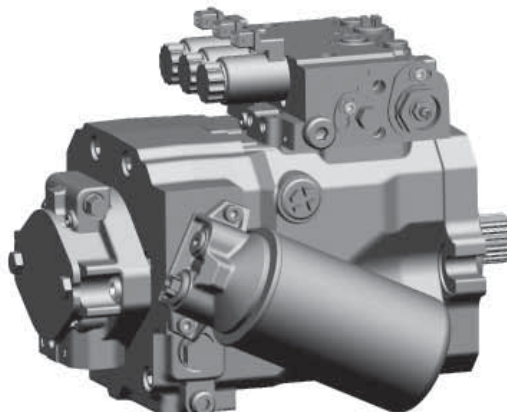
CA-control



M1-control



HPV E2

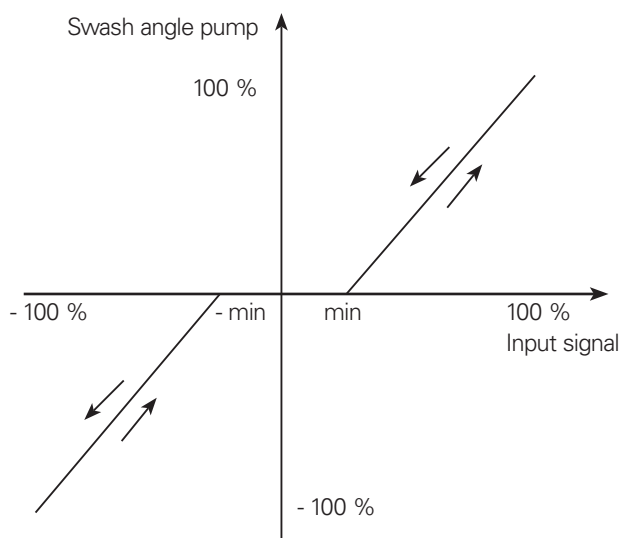


All HPV controls result in the same machine response for identical motion commands, irrespective of the control type. Corrective action by the operator is no longer required. The reliable control of the pump can easily be integrated into any kind of vehicle management control system.

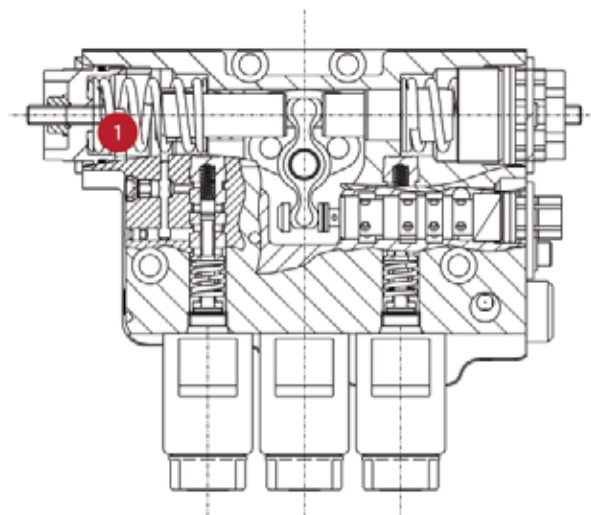
Controls

Control Accuracy

Control accuracy of a HPV pump



E2-control



1. Setting the maximum displacement

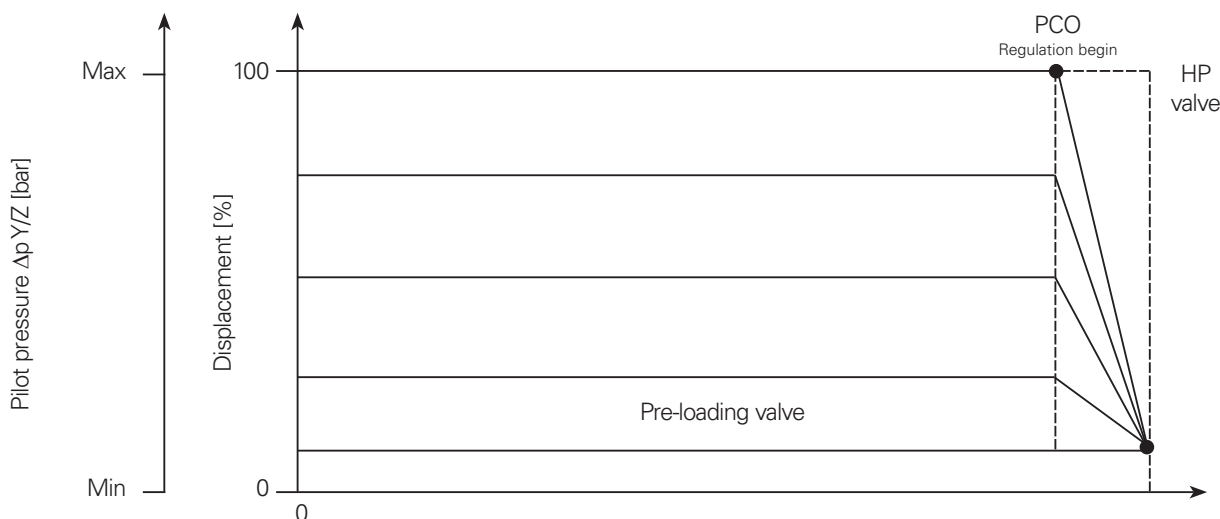
Pressure cut-off regulation PCO

Special control elements deal with functions such as torque control or pressure cut-off regulation. Controls with pressure cut-off

regulation (PCO) reduce pump flow when the cut-off pressure is reached. Because system pressure is maintained at low flow,

the power consumption and thermal balance of the system are optimised.

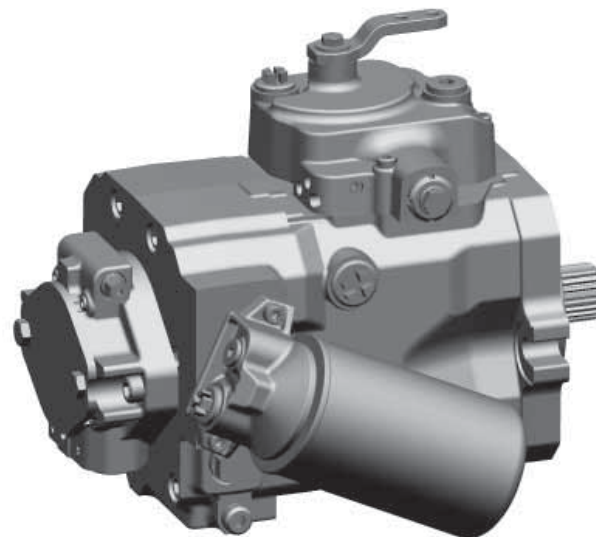
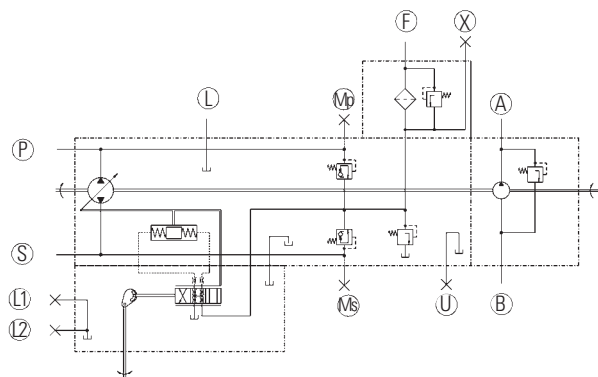
Displacement relative to pilot pressure and pressure cut-off regulation for M-, H- and E-controls



Controls

Mechanical-hydraulic M

M1. Mechanical control



Flow direction

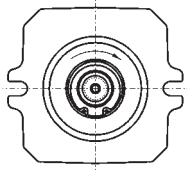
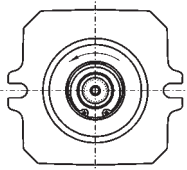
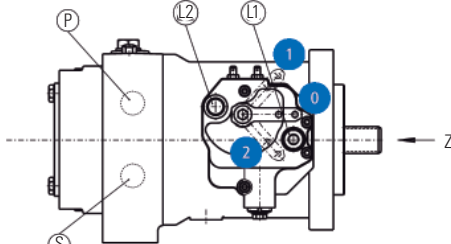
By turning the control lever the pump flow rate and direction of flow are controlled via a cam plate. The

flow direction of the fluid depends on

- the pump direction of rotation

- the over centre direction of the swash plate.

High pressure outlet port

Cam lever direction		Shaft rotation (view on Z)	
			
		Right hand	Left hand
	0 → 1	P	S
	0 → 2	S	P

P, S High pressure ports
A Pressure port, boost pump
B Suction port, boost pump
F Feed port, boost and control
X Test port, control pressure
Ms, Mp Test ports, high pressure

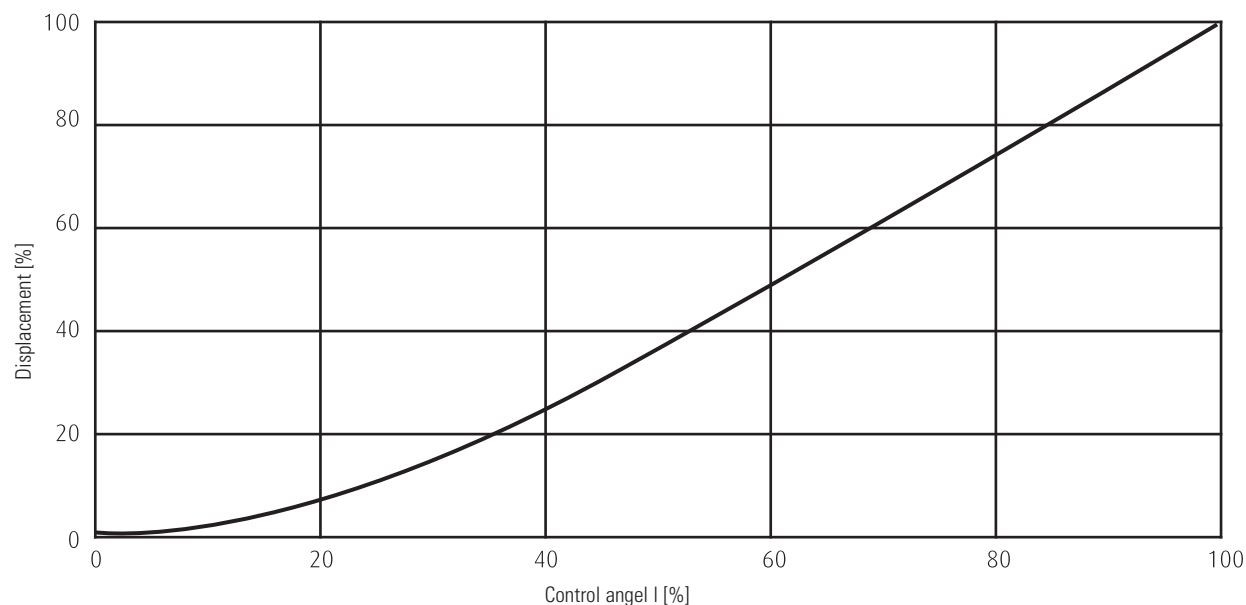
L, U Drain ports
L1, L2 Vent ports
 Note for left hand rotation
A Suction port, boost pump
B Pressure port, boost pump

Controls

Mechanical-hydraulic M

Displacement relative to control angle

The cam plate offers a large control angle with progressive control characteristic and a wide neutral range. The resulting high resolution for movements from the neutral range (and vice versa) enables precise manoeuvring. Reliable and robust control of the displacement volume is achieved through position feedback.



Control force with max. long lever radius $r = 70$ mm

17 N

Max. permissible control force (intermittent)

500 N

Control torque

1.2 Nm

Centred reset by external force

1.2 Nm

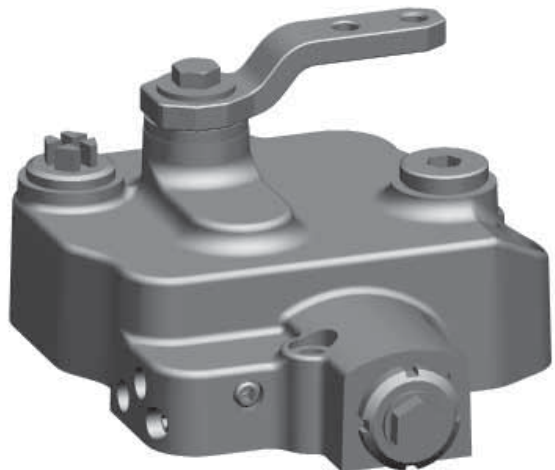
Control angle neutral range ... to end position

$\pm 4^\circ \dots \pm 48^\circ$

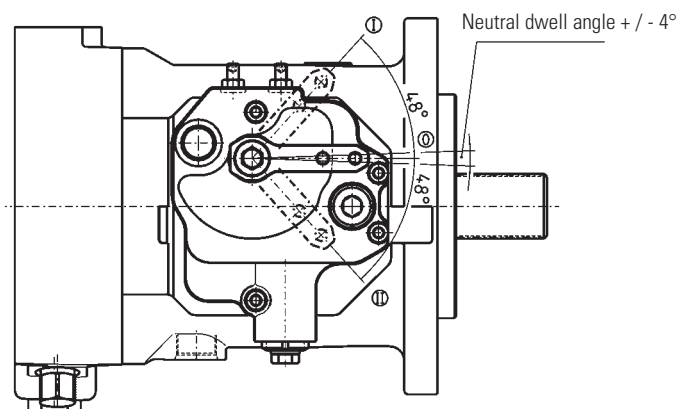
Minimum response time with standard restrictors

0.5 sec

M1-cam plate



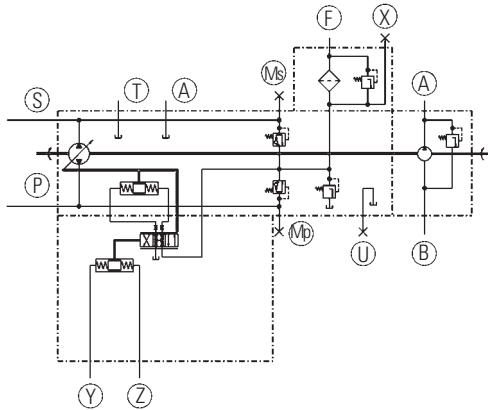
Control range



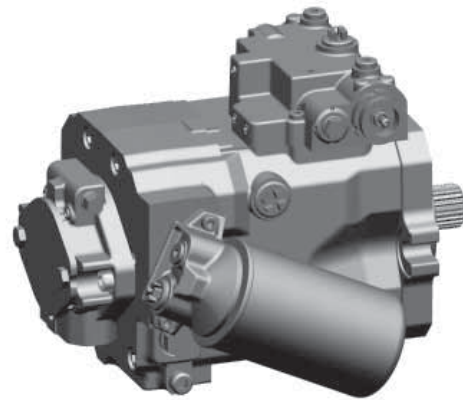
Controls

Hydraulic H

H1. Hydraulic control



The HPV H1 features hydraulic control with a wide pilot pressure range for improved machine control. It can be combined with a fixed, variable or regulating hydraulic motor. The data is specific for hydraulic controls, and independent of the nominal pump size and pressure cut-off regulation PCO, unless specified otherwise otherwise (see section Controls. Control accuracy).



Flow direction

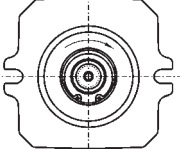
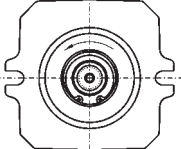
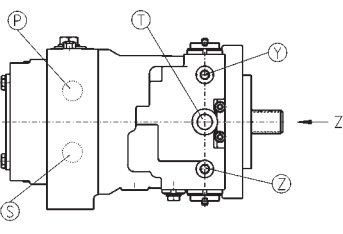
By an external hydraulic signal input at the pilot pressure ports (Y, Z) the pump flow rate and direction of flow are controlled.

The flow direction of the fluid depends on

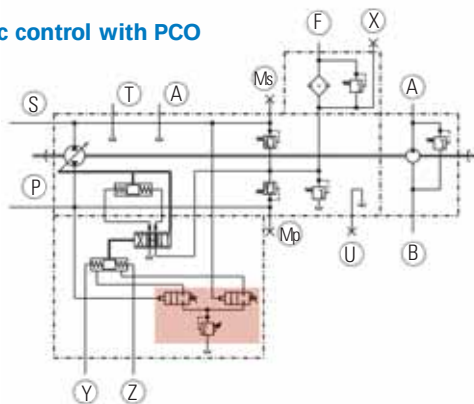
- the pump direction of rotation

- the over centre direction of the swash plate.

High pressure outlet port

Shaft rotation (view on Z)			
Pilot pressure port		Right hand	Left hand
	Y	P	S
	Z	S	P

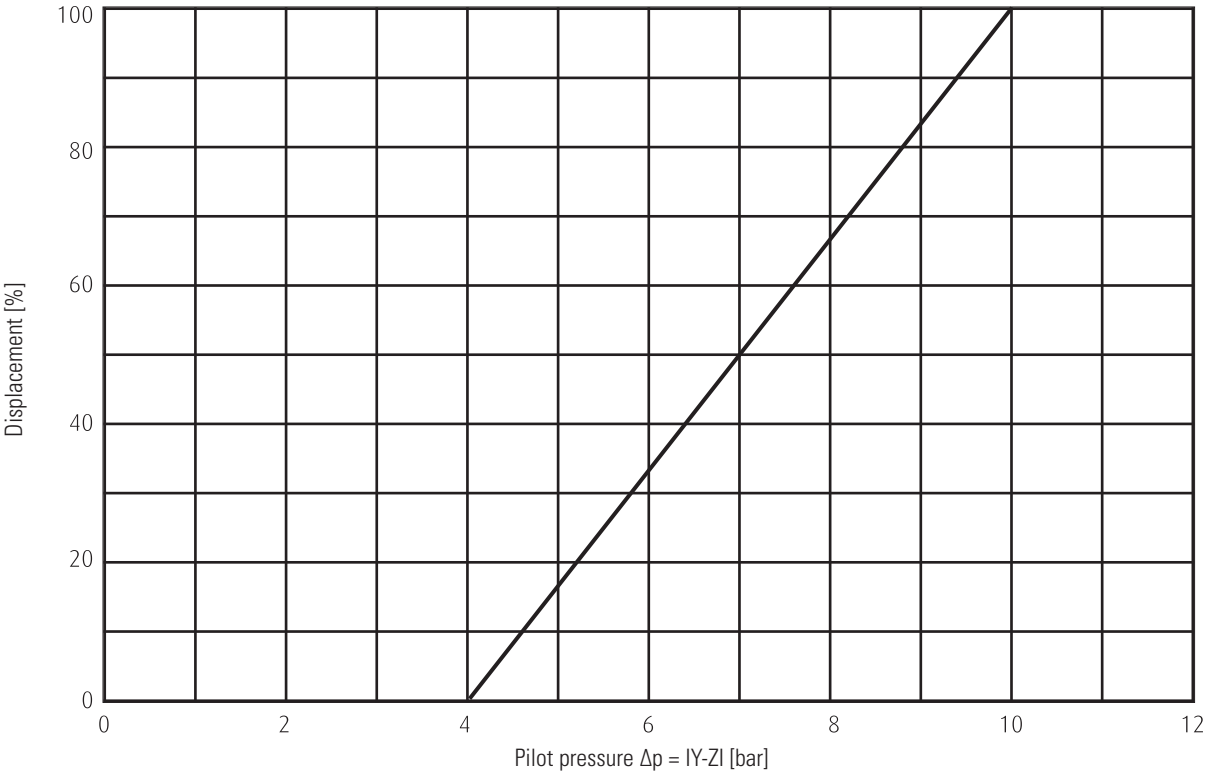
H1P. Hydraulic control with PCO



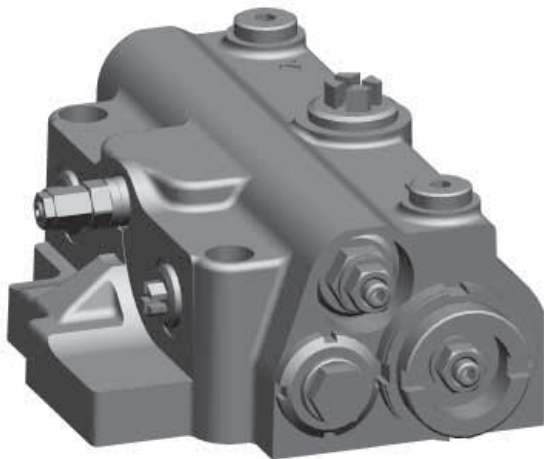
- | | | | |
|---------------|------------------------------|-----------------------------|---------------------------|
| P, S | High pressure ports | L, U | Drain ports |
| A | Pressure port, boost pump | T | Vent port |
| B | Suction port, boost pump | Y, Z | Pilot pressure ports |
| F | Feed port, boost and control | Note for left hand rotation | |
| X | Test port, pilot pressure | A | Suction port, boost pump |
| Ms, Mp | Test ports, high pressure | B | Pressure port, boost pump |

Pilot pressure range standard	4-10 bar differential pressure Y-Z
Maximum permissible pressure at Y or Z	30 bar
Minimum response time with standard orifices for one-way swashing between 0 and max	0.5 sec

Displacement relative to pilot pressure



H1P-control with PCO

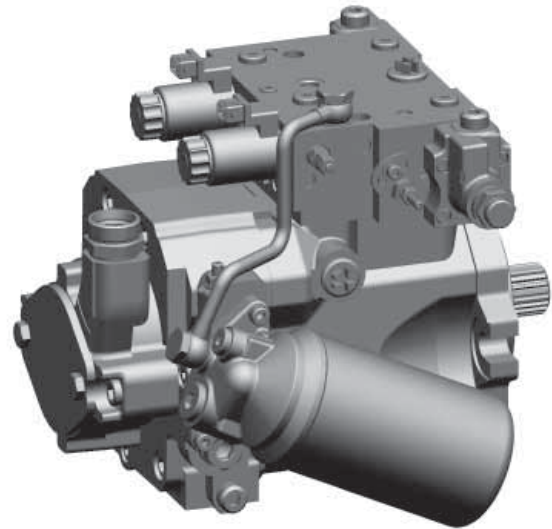
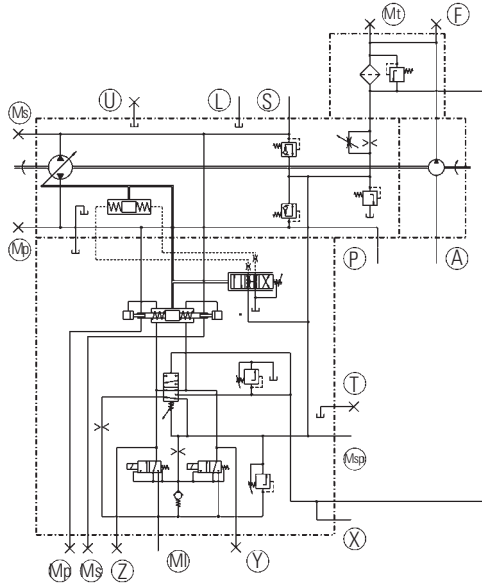


The HPV CA is a speed-dependent pump control with torque/power regulation. It can be combined with a hydraulic motor as fixed, variable or regulating motor or a variable motor with pressure regulator. The modular design offers a high degree of versatility in terms of function and control.

Controls

Hydraulic-mechanical CA

CA. Hydraulic-mechanical control



CA-control. Advantages

- pilot operated system
 - controlled load response
 - temperature independent
 - dynamics
 - precision
 - low hysteresis
 - high versatility (modular design)
 - various motor control possible
- simple adjusting
- direct control of torque and tractive force
- speed optimized inching function
- high safety standard
- hydrostatic deceleration

P, S

High pressure ports

A

Suction port, boost pump

F

Feed port, boost and control

Test ports

Mt

Temperature

Ms, Mp

High pressure

Y, Z

Pilot pressure

Ml

For power settings and inch pressure port

Msp

Boost pressure

X

Pilot pressure port HMV

L, U

Drain ports

L1, L2

Vent ports

T

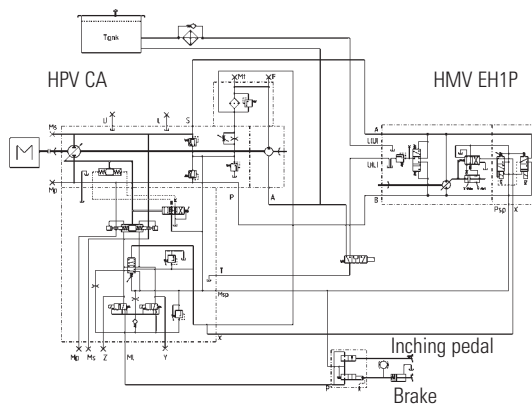
Drain and vent port

Note for left hand rotation

A

Suction port, boost pump

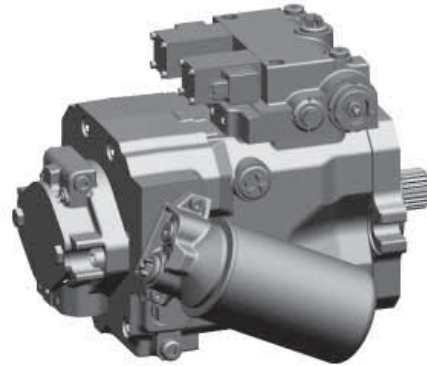
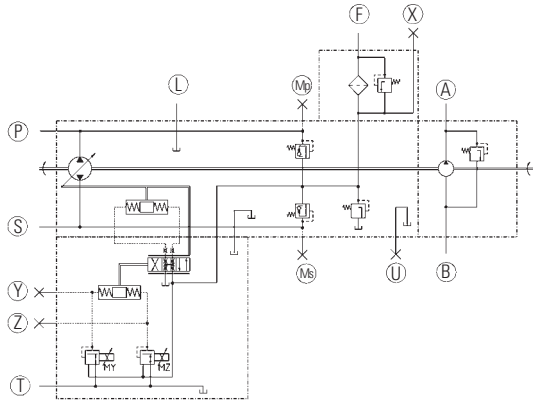
Drive with speed-dependent variable pump and variable motor with pressure override



Controls

Electro-hydraulic E1

E1. Electro-hydraulic control



Flow direction

By an external electrical signal input at the solenoids (MY and MZ) the pump flow rate and direc-

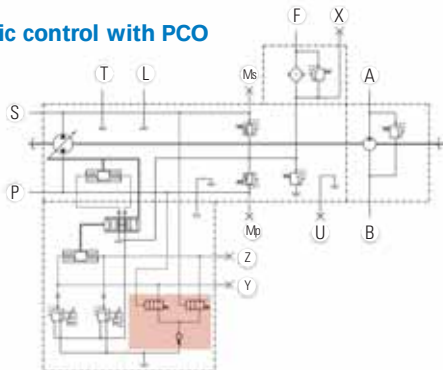
tion of flow are controlled. The flow direction of the fluid depends on

- the pump direction of rotation
- the over centre direction of the swash plate.

High pressure outlet port

Shaft rotation (view on Z)			
Active solenoid		Right hand	Left hand
	MY		S
	MZ	S	

E1P. Electro-hydraulic control with PCO



- P, S** High pressure ports
- A** Pressure port, boost pump
- B** Suction port, boost pump
- F** Feed port, boost and control
- X** Test port, pilot pressure

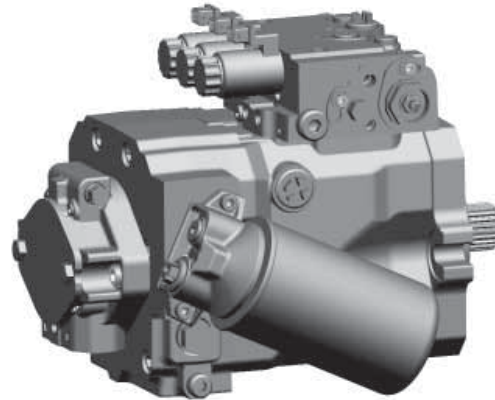
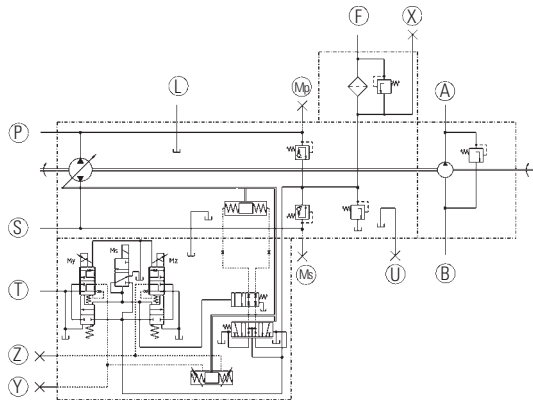
- Ms, Mp** Test ports, high pressure
- L, U** Drain ports
- T** Vent ports
- Note for left hand rotation
- A** Suction port, boost pump
- B** Pressure port, boost pump

The HPV E2, with its additional release function, can easily be integrated in an electronic vehicle management control system like an E1-control. In addition it offers a safety standard that meets the stringent requirements for road traffic use. The E2-control features two proportional solenoids and a switching solenoid.

Controls

Electro-hydraulic E2

E2. Electro-hydraulic control



Flow direction

By an external electrical signal input at the solenoids (MY and MZ) the pump flow rate and direc-

tion of flow are controlled. The flow direction of the fluid depends on

- the pump direction of rotation
- the over centre direction of the swash plate.

High pressure outlet port (see section Control. Electro-hydraulic E1)

E2 with safety function

The electronic control unit compares the travel command to other machine signals. In case of a system fault (e.g. by cable break or short-circuit) the electronic control unit will deactivate the release solenoid of the E2-control and the pump is brought actively to neutral under full control. Upon this the vehicle is brought to rest in a smooth jerk-free manner - without endangering the driver.

Its use is recommended for mobile applications where specific criteria have to be met in terms of travel and coasting behaviour, e.g. road traffic use.

Product advantages of E2

- fulfils the rigorous demands for road traffic use
- active drive enable
- minimized susceptibility to interference
- with HMF: defined swashing back of pump for controlled deceleration and stop in case of system fault
- with HMV: diesel over-speed protection by fast swashing back of pump

P, S	High pressure ports
A	Pressure port, boost pump
B	Suction port, boost pump
F	Feed port, boost and control
X	Test port, control pressure
Ms, Mp	Test ports, high pressure
Y, Z	Test ports, control pressure
L, U	Drain ports
T	Vent port

Note for left hand rotation

A	Suction port, boost pump
B	Pressure port, boost pump

The data is specific for electrical controls, and independent of the nominal pump size and PCO pressure cut-off regulation, unless specified otherwise (see section Controls. Control accuracy). Figures HPV E1 and HPV E2 (page 24, 25) show the standard mounting position for the respective E-control.

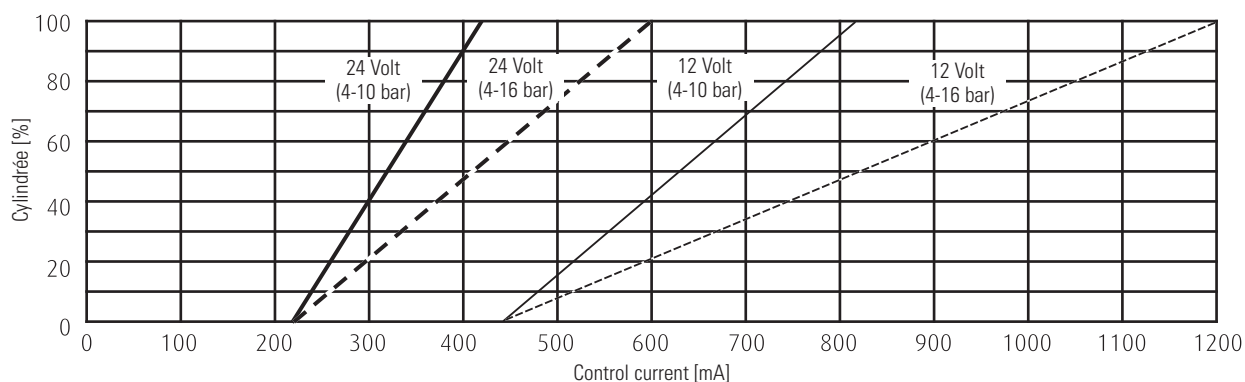
Controls

Electro-hydraulic E

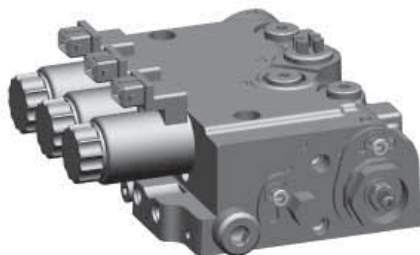
Control signal characteristics

Supply voltage = limiting voltage		V	12	24
Connector type			Hirschmann (not for round solenoids) AMP-Junior-Timer, 2-pin	
Voltage type			Direct Current (D.C.)	
Power consumption		W	15.6	15.6
Rated current = limiting current			mA	1300 650
Control current	Swash begin	mA	450±10	225 ±10
	Swash end on request	pilot pressure range 4-10 bar	810	410
		pilot pressure range 4-16 bar	1200	600
Relative duty cycle		%	100	100
Protection class			IP 6K6K, Teil 9	IP 6K6K, Teil 9
Control types			digital control via Pulse Width Modulation PWM with transducers 100 Hz Rectangle, Pulse duty ratio variable over control range analogue control with alternative transducers Direct Current (with or without superimposed dither signal for stability and reducing hysteresis, dither: 125 mA, 32-40 Hz, pulse duty ratio 1:1)	
Minimum response time with standard orifices		s	0.5	0.5

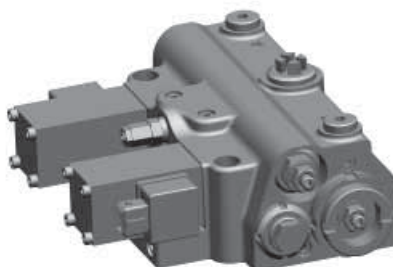
Displacement relative to control current



E2-electro-hydraulic control



E1P-electro-hydraulic control with PCO

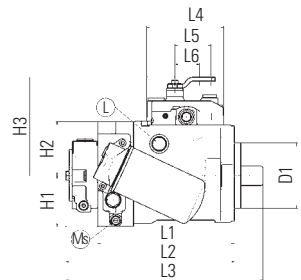
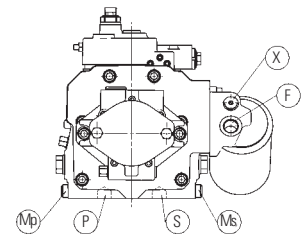
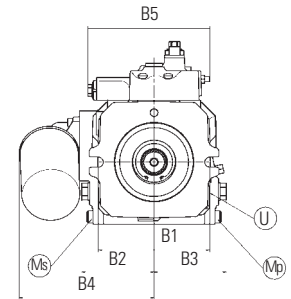


Dimensions

M-controls

Port sizes and dimensions for M-controls

Rated size	55	75	105	135	165	210	280
Gear pump rated size [cm ³]	16	22.5	22.5	22.5	38	38	44
F flange profile	2-hole mounting flange		2-hole mounting flange		4-hole mounting flange		
	SAE C	SAE C	SAE C	SAE D	SAE D	SAE E	SAE E
W shaft profile in accordance with ANSI B92.1	16 / 32 spline pitch				16 / 32	16 / 32	16 / 32
	21 teeth	21 teeth	23 teeth	27 teeth	27 teeth	27 teeth	33 teeth
D1 (mm)	127	127	127	152.4	152.4	165.1	165.1
B1 (mm)	181	181	181	228.6	228.6	224	225
B2 (mm)	101	116	116	141	138.5	142	155
B3 (mm)	101	116	116	141	127.5	135	-
B4 (mm)	192	216	216	219	223	240	246
B5 (mm)	194	194	194	194	194	194	194
L1 (mm)	225	242	267	288	327	346	392
L2 (mm)	282	304	329	350	490	516	571
L3 (mm)	335	359	385	425	564	591	646
L4 (mm)	151	151	151	151	151	151	151
L5 (mm)	70	70	70	70	70	70	70
L6 (mm)	48	48	48	48	48	48	48
H1 (mm)	88	93	99	106	120	134	152
H2 (mm)	95	103	105	112	-	133	150
H3 (mm)	184	188	193	198	-	226	238
P	SAE 3/4"	SAE 1"	SAE 1"	SAE 1 1/4"	SAE 1 1/4"	SAE 1 1/2"	SAE 1 1/2"
S	SAE 3/4"	SAE 1"	SAE 1"	SAE 1 1/4"	SAE 1 1/4"	SAE 1 1/2"	SAE 1 1/2"
A gear pump	M27x2	M27x2	M27x2	M27x2	-	SAE 3/4"	SAE 3/4"
B gear pump	M27x2	M27x2	M27x2	M27x2	-	SAE 1 1/4"	SAE 1 1/4"
L	M22x1.5	M22x1.5	M22x1.5	M27x2	M27x2	M27x2	M33x2
U	M22x1.5	M22x1.5	M22x1.5	M27x2	M27x2	M27x2	M33x2
F	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M27x2	M27x2
X	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M14x1.5	M14x1.5	M14x1.5
Mp	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5
Ms	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5
L1	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M22x1.5
L2	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M22x1.5

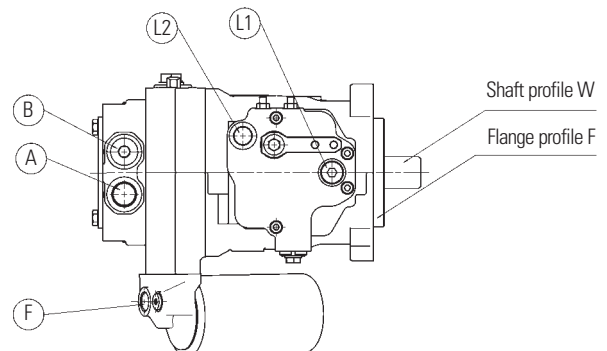


Threads metric in accordance with ISO 6149

Threads for SAE high pressure port metric in accordance
with ISO 261

Socket cap screw in accordance with ISO 4762

Further threads on request

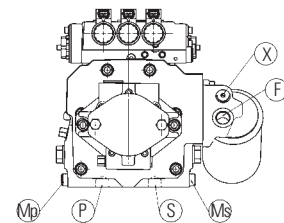
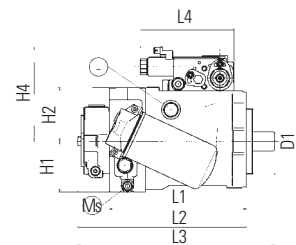
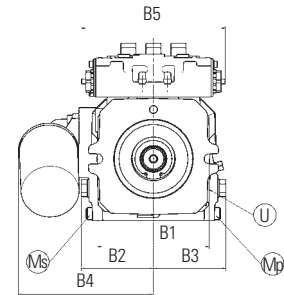


Dimensions

H-controls

Port sizes and dimensions for H-controls

Rated size	55	75	105	135	165	210	280
Gear pumps rated size (cm ³)	16	22.5	22.5	22.5	38	38	44
F flange profile	2-hole mounting flange		2-hole mounting flange		4-hole mounting flange		
	SAE C	SAE C	SAE C	SAE D	SAE D	SAE E	SAE E
W shaft profile in accordance with ANSI B92.1	16 / 32 spline pitch		16 / 32 spline pitch		16 / 32	16 / 32	16 / 32
	21 teeth	21 teeth	23 teeth	23 teeth	27 teeth	27 teeth	27 teeth
D1 (mm)	127	127	127	152.4	152.4	165.1	165.1
B1 (mm)	181	181	181	228.6	228.6	224	225
B2 (mm)	101	116	116	141	138.5	143	155
B3 (mm)	101	116	116	141	127.5	135	139
B4 (mm)	192	216	216	219	223	240	246
B5 (mm)	231	231	231	231	231	231	231
L1 (mm)	225	242	267	288	327	346	392
L2 (mm)	282	304	329	350	489.3	516	571
L3 (mm)	335	359	385	425	564	591	646
L4 (mm)	133	133	133	133	133	133	133
H1 (mm)	88	93	99	106	119	134	152
H2 (mm)	95	103	105	112	-	133	150
H3 (mm)							
w/o PCO	194	154	158	163	190	191	204
with PCO	185	190	194	199	200	201	214
P	SAE ¾"	SAE 1"	SAE 1"	SAE 1 ¼"	SAE 1 ¼"	SAE 1 ½"	SAE 1 ½"
S	SAE ¾"	SAE 1"	SAE 1"	SAE 1 ¼"	SAE 1 ¼"	SAE 1 ½"	SAE 1 ½"
A gear pump	M27x2	M27x2	M27x2	M27x2	-	SAE ¾"	SAE ¾"
B gear pump	M27x2	M27x2	M27x2	M27x2	-	SAE 1 ¼"	SAE 1 ¼"
L	M22x1.5	M22x1.5	M22x1.5	M27x2	M27x2	M27x2	M33x2
U	M22x1.5	M22x1.5	M22x1.5	M27x2	M27x2	M27x2	M33x2
F	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M27x2	M27x2	M27x2
T	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M22x1.5
X	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5
Mp	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5
Ms	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5
Y	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5
Z	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5

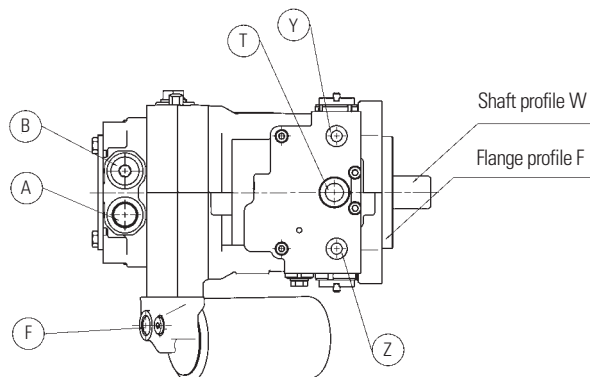


Threads metric in accordance with ISO 6149

Threads for SAE high pressure port metric in accordance
with ISO 261

Socket cap screw in accordance with ISO 4762

Further threads on request



Dimensions

CA-controls

Port sizes and dimensions for CA-controls

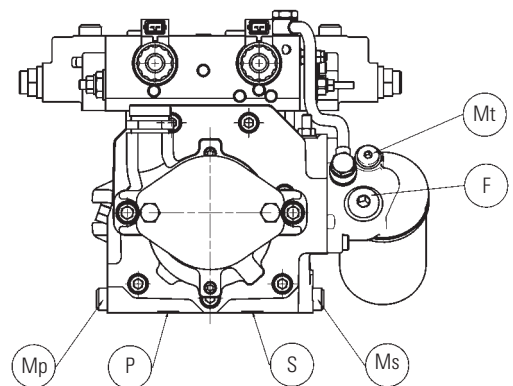
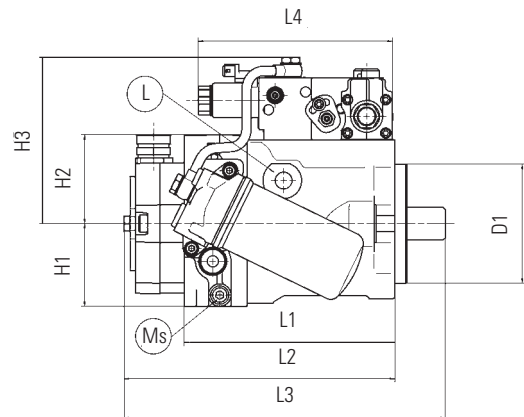
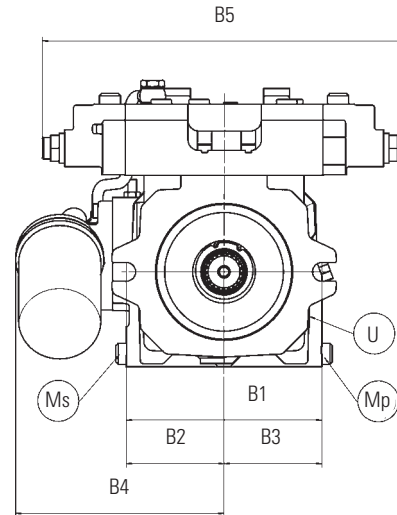
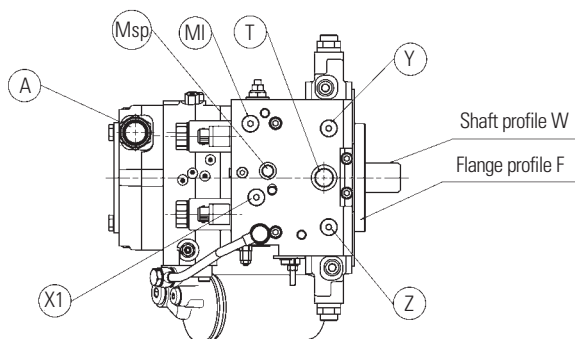
Rated size	55	75	105
Gear pumps rated size [ccm]	16	16	16
F flange profile	2-hole mounting flange		
	SAE C	SAE C	SAE C
	16 / 32 spline pitch		
	21 teeth	21 teeth	23 teeth
D1 [mm]	127	127	127
B1 [mm]	181	181	181
B2 [mm]	101	116	116
B3 [mm]	101	116	116
B4 [mm]	193	212	214
B5 [mm]	336	336	336
L1 [mm]	225	242	267
L2 [mm]	282	306	331
L3 [mm]	343	361	386
L4 [mm]	207	207	207
H1 [mm]	88	93	99
H2 [mm]	95	103	105
H3 [mm]	178	184	188
A gear pump	M36x2	M36x2	M36x2
P	SAE 1"	SAE 1"	SAE 1"
S	SAE 1"	SAE 1"	SAE 1"
L	M22x1.5	M22x1.5	M22x1.5
U	M22x1.5	M22x1.5	M22x1.5
F	M22x1.5	M22x1.5	M22x1.5
T	M22x1.5	M22x1.5	M22x1.5
X1	M14x1.5	M14x1.5	M14x1.5
Mp	M14x1.5	M14x1.5	M14x1.5
MI	M14x1.5	M14x1.5	M14x1.5
Ms	M14x1.5	M14x1.5	M14x1.5
Msp	M14x1.5	M14x1.5	M14x1.5
Mt	M14x1.5	M14x1.5	M14x1.5
Y, Z	M14x1.5	M14x1.5	M14x1.5
Z	M14x1.5	M14x1.5	M14x1.5

Threads metric in accordance with ISO 6149

Threads for SAE HP port metric in accordance with ISO 261

Socket cap screw in accordance with ISO 4762

Furhter threads on request



Dimensions

E-controls

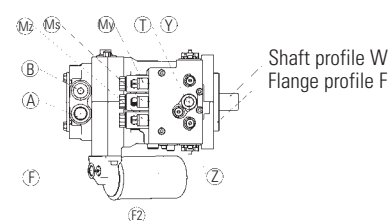
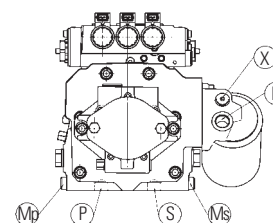
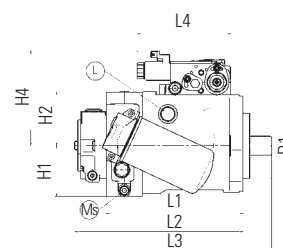
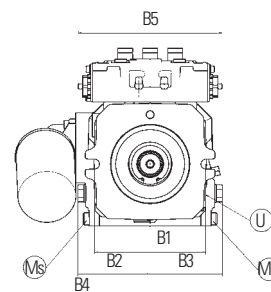
Control-specific dimensions for HPV with electro-hydraulic controls.

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Port sizes and dimensions for E-controls

Rated size	55	75	105	135	165	210	280
Gear pumps rated size [cm³]	16	22.5	22.5	22.5	38	38	44
F flange profile	2-hole mounting flange		2-hole mounting flange		4-hole mounting flange		
	SAE C	SAE C	SAE C	SAE D	SAE D	SAE E	SAE E
W shaft profile in accordance with ANSI B92.1	16 / 32 spline pitch		16 / 32 spline pitch		16 / 32	16 / 32	16 / 32
	21 teeth	21 teeth	23 teeth	23 teeth	27 teeth	27 teeth	27 teeth
D1 (mm)	127	127	127	152.4	152.4	165.1	
B1 (mm)	181	181	181	228.6	228.6	224	225
B2 (mm)	101	116	116	141	138.5	143	155
B3 (mm)	101	116	116	141	127.5	135	139
B4 (mm)	192	216	216	219	223	240	246
B5 (mm) E1	226	226	226	226	226	226	226
B5 (mm) E2	230	230	230	230	230	230	230
L1 (mm)	225	242	267	288	327	346	392
L2 (mm)	282	304	329	350	-	516	571
L3 (mm)	335	359	385	425	-	591	646
L4 (mm)	183	183	183	183	-	183	183
H1 (mm)	88	93	99	106	119.5	134	152
H2 (mm)	95	103	105	112	-	133	150
H4 (mm) E1 / E2							
with AMP-JT-connector	159	164	168	173	195	218	231
H4 [mm] E1 with Hirschmann-connector	195	200	204	209	(231)	254	(267)
P	SAE ¾"	SAE 1"	SAE 1"	SAE 1 ¼"	SAE 1 ¼"	SAE 1 ½"	SAE 1 ½"
S	SAE ¾"	SAE 1"	SAE 1"	SAE 1 ¼"	SAE 1 ¼"	SAE 1 ½"	SAE 1 ½"
Mp	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M 14x1.5	M 14x1.5
Ms	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M 14x1.5	M 14x1.5
A gear pump	M27x2	M27x2	M27x2	M27x2	-	SAE ¾"	SAE ¾"
B gear pump	M27x2	M27x2	M27x2	M27x2	-	SAE 1 ¼"	SAE 1 ¼"
L	M22x1.5	M22x1.5	M22x1.5	M27x2	M27x2	M27x2	M33x2
U	M22x1.5	M22x1.5	M22x1.5	M27x2	M27x2	M27x2	M33x2
F	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M27x2	M27x2
T	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M22x1.5	M22x1.5
X	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5
Y	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5
Z	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5
F2	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5	M14x1.5
Ms	E2-control round solenoids		AMP-JT, Deutsch				
My	E1-control		Hirschmann, AMP-JT, Deutsch				
	E2-control round solenoids		AMP-JT, Deutsch				
Mz	E1-control		Hirschmann, AMP-JT, Deutsch				
	E2-control round solenoids		AMP-JT, Deutsch				



Threads metric in accordance with ISO 6149

Threads for SAE high pressure port metric in accordance with ISO 261

Socket cap screw in accordance with ISO 4762

Further threads on request

The following data enable quick calculation of the overall maximum external dimensions. In each case only the relevant dimensions are shown so that length, width and height can simply be determined through addition. The actual fitting dimensions of the respective units are shown on the installation drawing.

Dimensions

Modular System



External dimensions for addition

Component	Type	Length	Width	Height
1	Basic unit	55	230	185
	75	245	235	190
	105	270	235	210
	135	290	280	220
	165	327	285	245
	210	350	290	275
	280	395	315	305
2	Control	M1	-	95
	H1	-	5	55
	H1P	-	10	75
	CA	-	135	95
	E1	-	5	110
	E1P	-	10	110
	E2	-	15	110
3	Gear pump	16 cm ³	60	-
		22,5 cm ³	65	-
		31 cm ³	135	-
		38 cm ³	175	-
		44 cm ³	180	-
4	Filter	No. 2	10 without gear pump	95
		No. 3	10 without gear pump	105
		F-port 90°	15	50
5	Coupling flange not shown	75	-	-
6	Intermediate flange Shown under Dimensions. Tandem pumps	SAE B, B-B	20	-
		SAE C size 55/75	50	-
		SAE C size 105	40	-
		SAE C, C-C, D	65	-

Dimensions

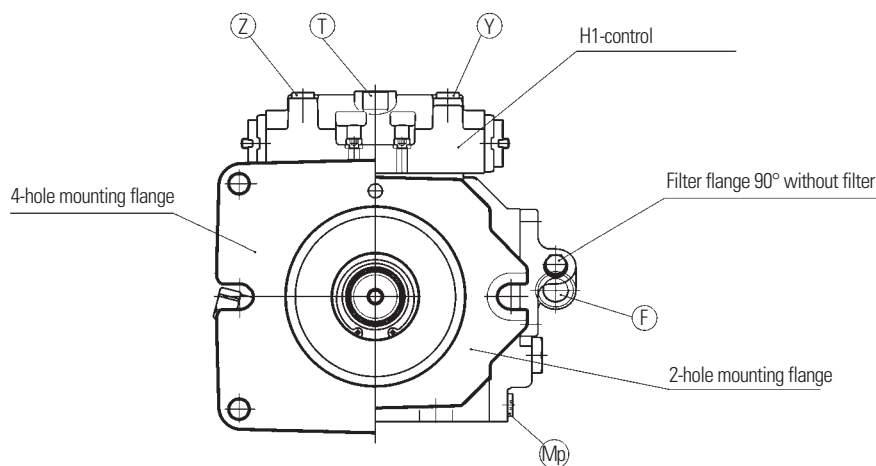
Modular System

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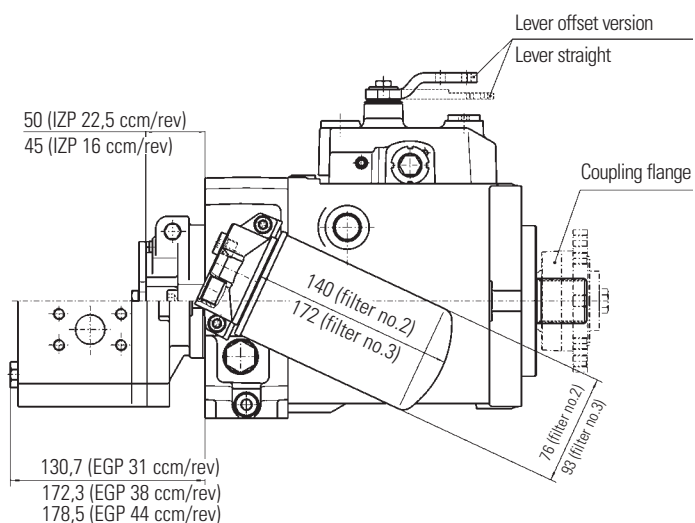
The following diagrams show the proportions of similar components.

View on mounting flange



- 4-hole mounting flange
- 2-hole mounting flange
- H1-control
- Filter flange 90° without filter

Side view



- M1-control lever geometry
- IGP
- EGP
- Filter
- Coupling flange

Dimensions

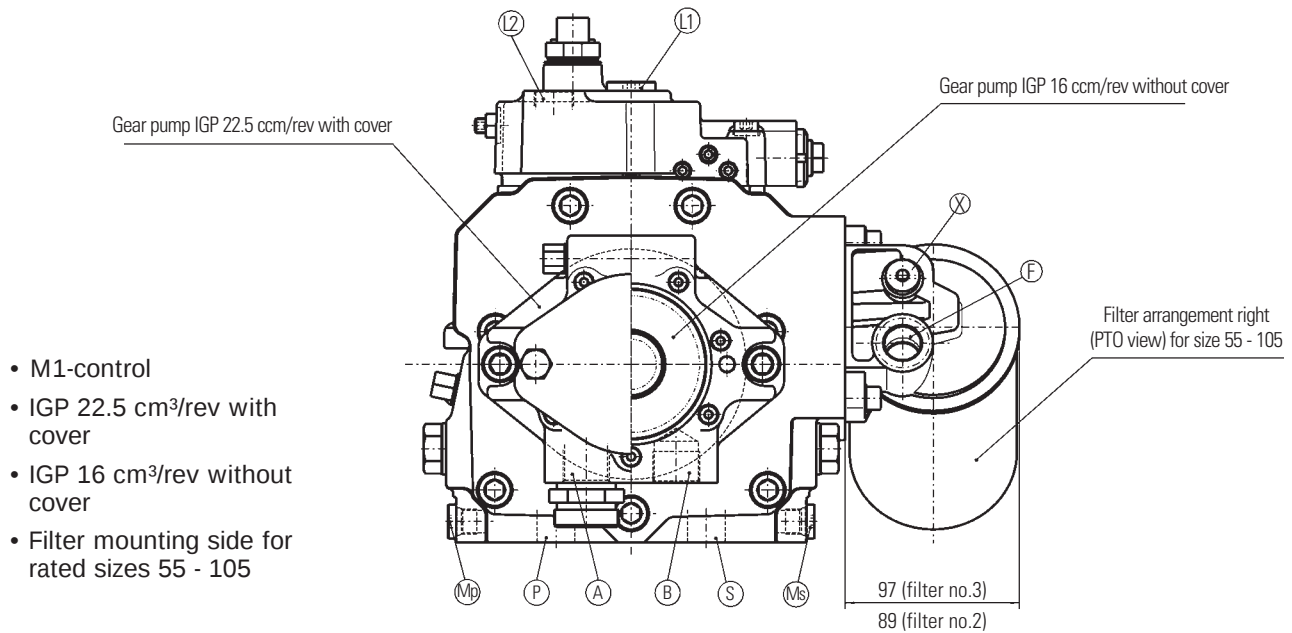
Modular System

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PTO view

The following diagrams show the proportions of similar components.



Dimensions

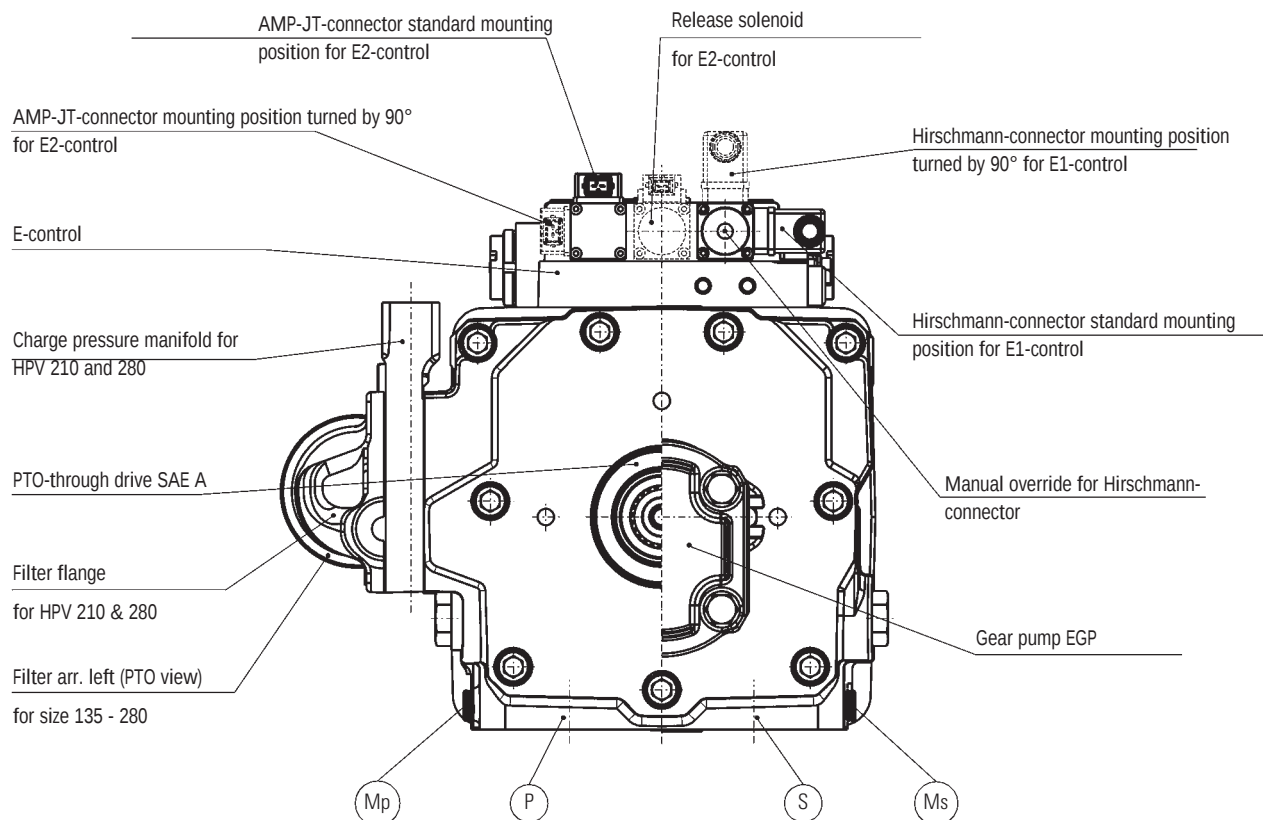
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The following diagrams show the proportions of similar components.

PTO view



- E1-control with mounting position of solenoid connectors
- E2-control with mounting position of solenoid connectors
- Manual override
- Hirschmann-connector
- AMP-JT-connector
- Filter mounting side for rated size 135 - 280
- Charge pressure manifold for rated size 210 and 280 without filter
- SAE A PTO-mounting flange
- EGP

Dimensions

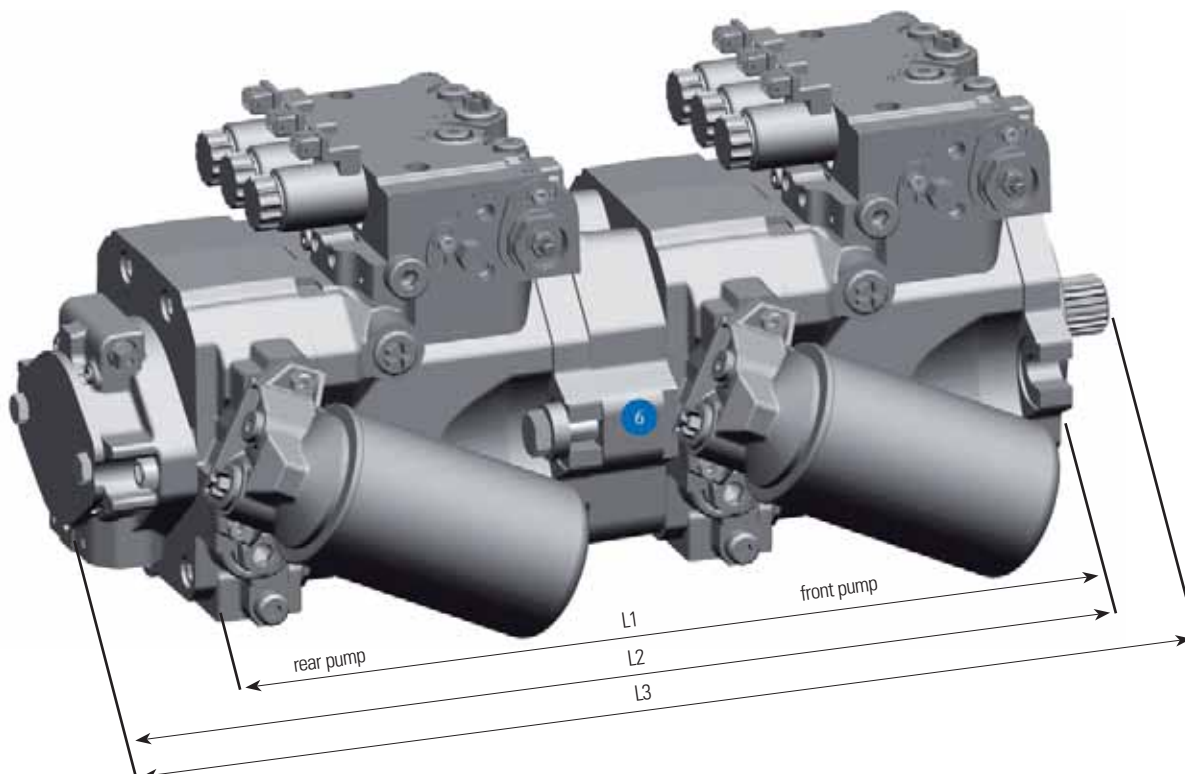
Tandem Pumps

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HPV tandem pump

Tandem pumps are created by connecting individual HPV units in series, with the pumps arranged by capacity. Positioning the boost pump(s) at the end of the tandem ensures optimum space utilisation, output allocation and load distribution.



Overall length of tandem pump

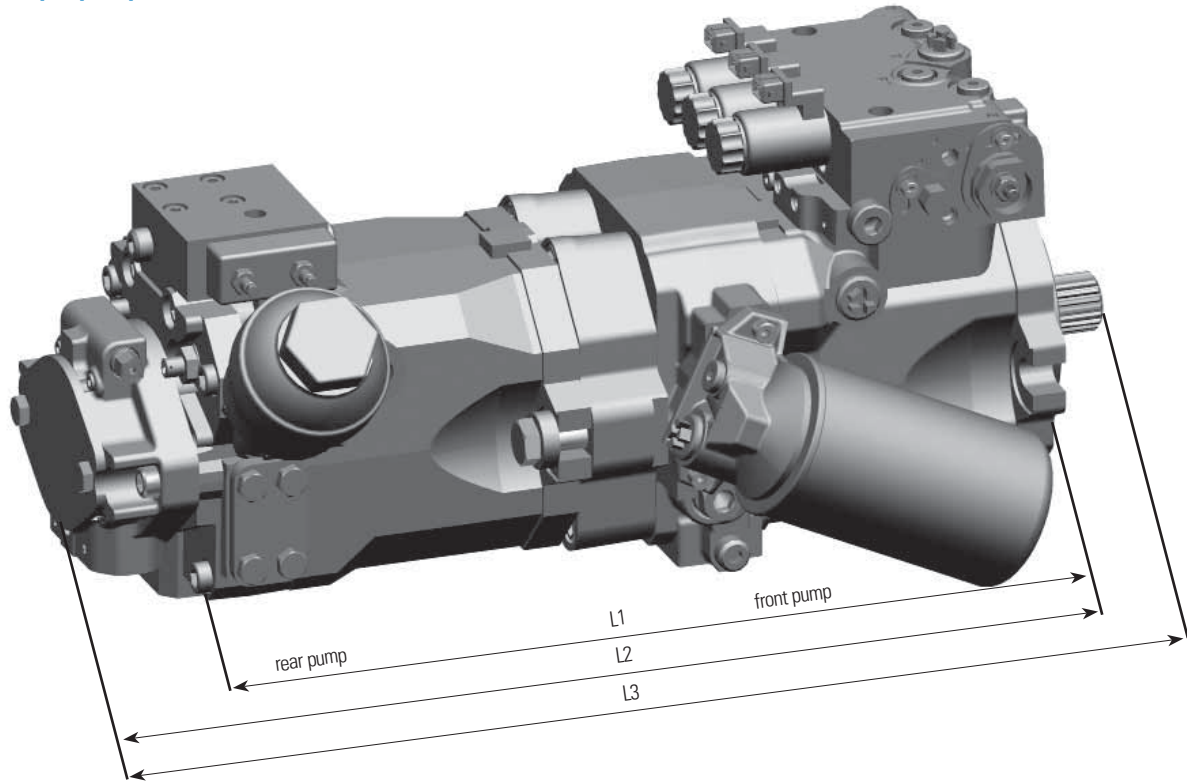
Rated size	Rear pump	HPV 55	HPV 75	HPV 105	HPV 135	HPV 210	HPV 280
Front pump	Lengths (mm)						
HPV 55	L1	496	-	-	-	-	-
with IGP 16 cm ³	L2	553	-	-	-	-	-
at rear pump	L3	607	-	-	-	-	-
HPV 75	L1	513	530	-	-	-	-
with IGP 22.5 cm ³	L2	575	592	-	-	-	-
at rear pump	L3	631	648	-	-	-	-
HPV 105	L1	529	546	572	-	-	-
with IGP 22.5 cm ³	L2	591	608	634	-	-	-
at rear pump	L3	647	663	586	-	-	-
HPV 135	L1	543	560	586	640	-	-
with IGP 22.5 cm ³	L2	605	622	648	702	-	-
at rear pump	L3	680	696	722	777	-	-
HPV 210	L1	610	627	653	689	731	-
with EGP 38 cm ³	L2	782	799	825	861	903	-
at rear pump	L3	857	874	900	935	978	-
HPV 280	L1	655	672	698	in development	777	823
with EGP 44 cm ³	L2	834	851	877		956	1002
at rear pump	L3	909	925	951		1030	1076

Multiple pumps are created by combining individual pump units in series, with the pumps arranged by capacity. Positioning the gear pump(s) at the end of the unit ensures optimum space utilization, output allocation and load distribution. The following table is based on the gear pump acting as boost pump for the HPV variable pump.

Dimensions

Multiple Pumps

HPV-HPR multiple pump



Overall length of multiple pump

Rated size	Rear pump	HPV 55	HPV 75	HPV 105	HPV 135	HPV 210
Front pump	Lengths (mm)					
HPV 55	L1	492	-	-	-	-
with IGP 16 cm ³	L2	549	-	-	-	-
at HPR	L3	603	-	-	-	-
HPV 75	L1	509	521	-	-	-
with IGP 22.5 cm ³	L2	586	598	-	-	-
at HPR	L3	642	653	-	-	-
HPV 105	L1	525	536	567	-	-
with IGP 22.5 cm ³	L2	602	613	629	-	-
at HPR	L3	657	669	684	-	-
HPV 135	L1	539	550	581	637	-
with IGP 22.5 cm ³	L2	616	627	643	699	-
at HPR	L3	690	702	717	774	-
HPV 210	L1	606	618	648	686	733
with EGP 38 cm ³	L2	793	805	820	858	905
at HPR	L3	868	879	895	932	980
HPV 280	L1	651	663	693		779
with EGP 44 cm ³	L2	845	856	872		958
at HPR	L3	919	931	946		1033

The HPV is based on a modular system and offers the features listed below. This enables the product to be configured to your requirements. With the modular system being constantly extended, we ask you to contact our sales engineers for the latest system features.

Modular System Features

- Size
- Vmax
- Mounting flange
- Coupling flange
- Drive Shaft
- Direction of Rotation
- PTO direct mounting
- Tandem pump
- Internal gear pump
- External gear pump
- Suction internal gear pump
- Direction of GP suction
- PTO mounting on IGP
- Port threads
- Control
- Pilot pressure range for H-/E-control
- Control lever geometry
- Position of control lever
- Voltage for E-controls
- Cut-off for E-controls
- Connectors for E-controls
- Arrangement of solenoids
- High pressure relief valve
- Boost pressure relief valve
- Cold start relief valve
- Drain port U + L
- Filter/charge pressure manifold
- Filter flange mounting
- Surface treatment
- Name plate