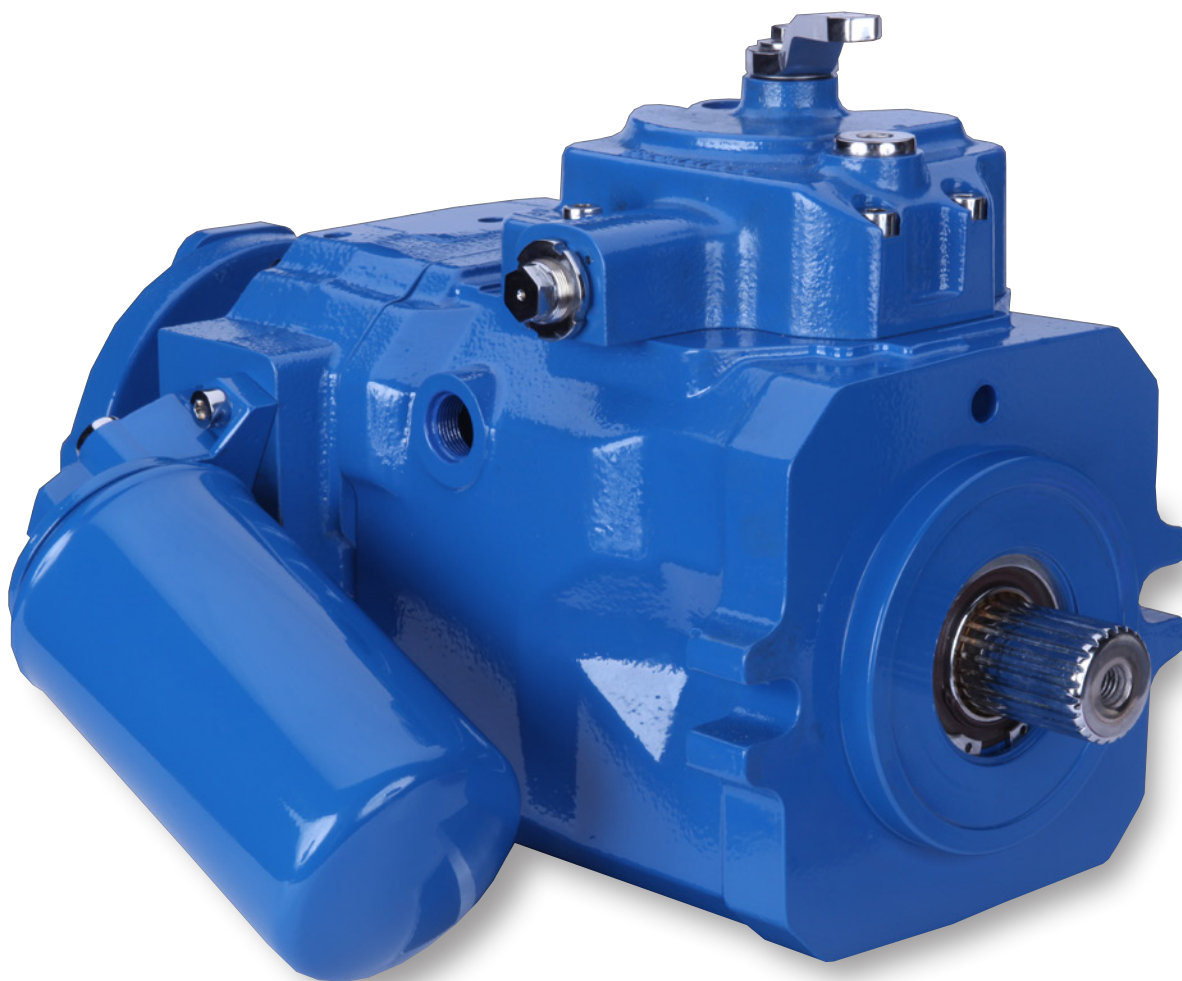


DuraForce™ HPV
Variable Pumps for Closed Loop Operation



EATON

Powering Business Worldwide

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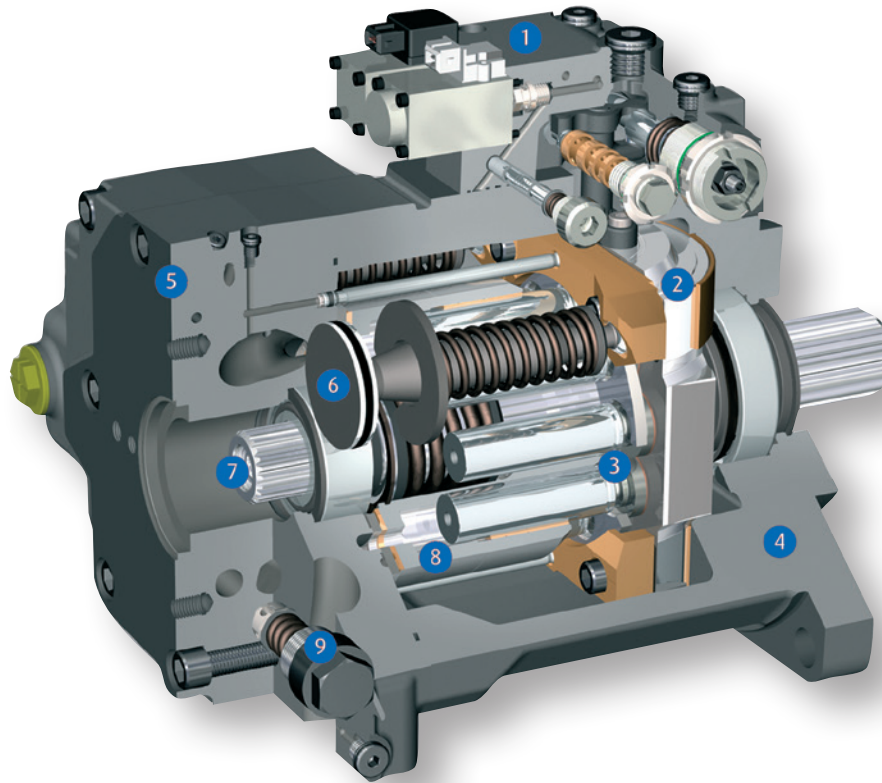
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The data on which this brochure is based correspond to the current state of development. We reserve the right to make changes in case of technical progress. The dimensions and technical data of the individual installation drawings are prevailing. The features listed in this data sheet are not available in all combinations and nominal sizes. Our sales engineers will be happy to provide advice regarding the configuration of your hydraulic system and on product selection.

Data Sheets

Find the right products for your application.

Product	Application	Product name	
Pump	Self-regulating pump	open loop operation	HPR
	Variable pump	closed loop operation	HPV
Motor	Variable motor	closed and open loop operation	HMV
	Regulating motor	closed and open loop operation	HMR
	Fixed motor	closed and open loop operation	HMF
		open loop operation	HMF-P
		closed and open loop operation	HMA
Valve Technology	LSC manifold plate	open loop operation	VT modular
	Pilot valve block	open loop operation	
Electronics	Electronic Control	closed and open loop operation	
	Peripheral Equipment	closed and open loop operation	
	Software	diagnosis and configuration	



- 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 charge pressure

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
- Charge 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

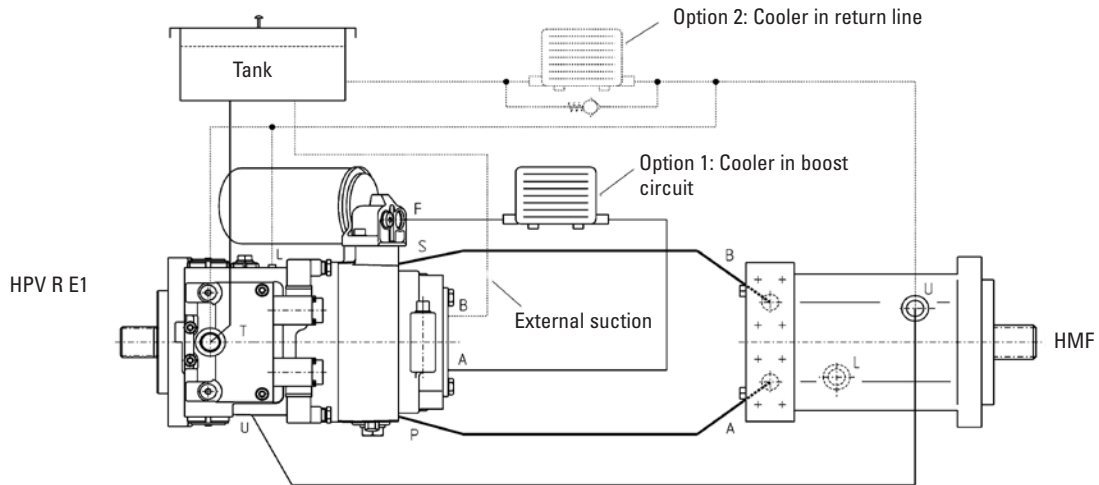
Product advantages

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

The Closed Loop

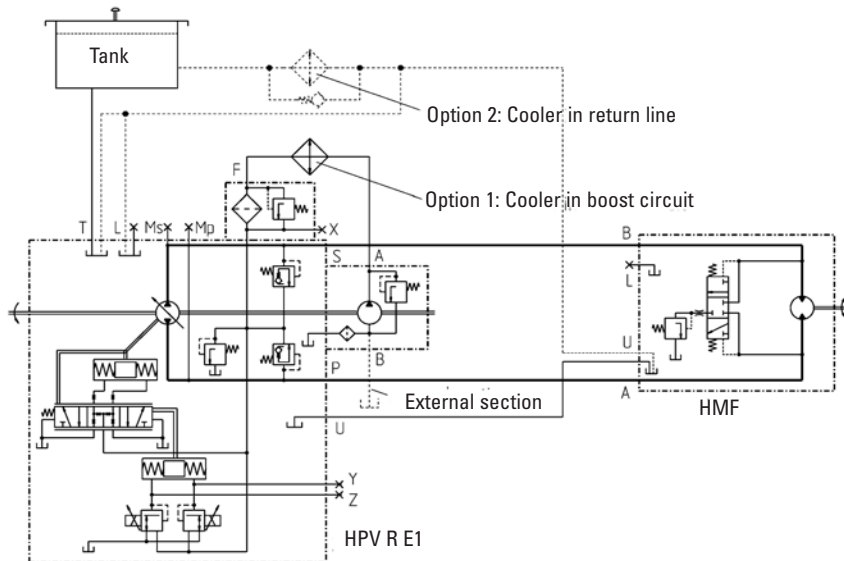
Representation of the hydraulic components of a closed loop hydrostatic drive: Variable electro-hydraulic controlled pump HPV E1 and fixed displacement motor HMF plus filter, cooler and oil tank. The function diagram and the circuit diagram show two types of cooling.

Function diagram



Circuit diagram

The boost pump is shown with external suction.



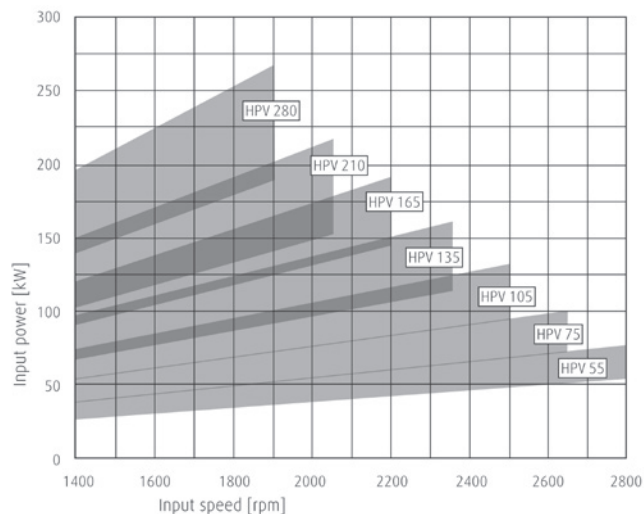
General Technical Data

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 Δp_{min} and 280 bar Δp_{max} . It enables initial selection of the required nominal pump size.

Specifications

			55	75	105	135	165	210	280
Rated size	Maximum displacement	cm ³ /rev	54.7	75.9	105	135.7	165.6	210.1	281.9
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
	Maximum speed (intermittent)	rpm	3700	3500	3200	2900	2700	2500	2200
	Minimum continuous speed	min ⁻¹				500			
Pressure	Maximum operating pressure	bar			420				
	Maximum pressure (intermittent)	bar			500				
	Permissible housing pressure (absolute)	bar			2.5				
Torque	Continuous input torque at continuous pressure	Nm	218	302	418	540	659	836	1122
	Maximum input torque at max. operating pressure and 19 bar boost pressure	Nm	353	489	677	875	1067	1354	1817
Power	Continuous power at max. continuous speed, continuous pressure	kW	75	98	127	153	173	201	235
	Maximum power at max. continuous speed, max. operating pressure and 19 bar boost pressure	kW	122	159	206	247	279	326	381
Permissible shaft loads	Axial	N			2000				
Perm. housing temperature	Perm. housing temperature with minimum perm. viscosity > 10 cSt	°C	90	90	90	90	90	90	90
Weights	HPV with H1-control inclusive IGP (Size 55-135) or EGP (Size 210-280)	kg	46	49	66	72	113	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

HPV – Variable Pump for Closed Loop Operation

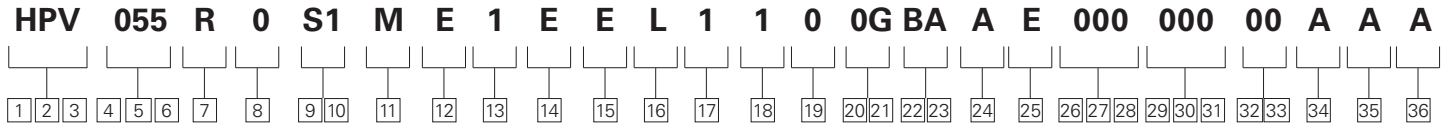
HPV 055 R 0 S1 M E 1 E E L 1 1 0 0G BA A E 000 000 00 A A A

	55	75	105	135	165	210	280		55	75	105	135	165	210	280
1 2 3 Product HPV – Closed Loop Variable Displacement Pump	●	●	●	●	●	●	●	G	E5: Electric three position / Square solenoids	●	●	●	●	●	●
4 5 6 Displacement 055 – 055 cc/r 075 – 075 cc/r 105 – 105 cc/r 135 – 135 cc/r 165 – 165 cc/r 210 – 210 cc/r 280 – 280 cc/r	●	●	●	●	●	●	●	M	E1: Electro-proportional / Round solenoids	●	●	●	●	●	●
7 Rotation R – CW L – CCW	●	●	●	●	●	●	●	N	E1P: Electro-proportional / Pressure cut-off / Round solenoids	●	●	●	●	●	●
8 Mounting Flange 0 – SAE J744 standard (size 135: (*d)) 1 – SAE J744 standard / additional threads (sizes 105; 135: (*u)) 2 – SAE J744 standard / additional holes (sizes 135; 165: (*u) / size 135: (*d))	●	●	●	●	●	●	●	P	E5: Electric three position / Round solenoids	●	●	●	●	●	●
9 10 Input Driveshaft S1 – splined ANSI B92.1 12/24- 14 teeth (SAE J744 C) (size 105: (*w)) 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) (sizes 210, 280: (*t)) 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)	●	●	●	●	●	●	●	R	CAF:Speed Related Hydraulic Mechanical (for 165;210;280)	◆	◆	◆	◆		
11 Porting M – ISO 6149 metric D – DIN 3852	●	●	●	●	●	●	●	H	CA: speed related hydraulic mechanical (*c)(*d)(*r)(*z)	◆	◆	◆	◆		
12 Pump Control A – M1: mechanical hydraulic B – H1: hydraulic proportional C – H1P: hydraulic proportional / pressure cut-off D – E1: Electro-proportional / Square solenoids E – E1P: Electro-proportional / Pressure cut-off / Square solenoids F – E2: electro-proportional / shutt-off (*z)	●	●	●	●	●	●	●	K	E1T: electro-proportional / torque cut-off (*c)(*y)	◆					
								13 Control Pressure Range Hydraulic and Electric Controls 0 – not applicable (M1;CA) 1 – 4-10 bar 2 – 4-16 bar (not for E5)		●	●	●	●	●	●
								14 Control Solenoids 0 – not applicable (M1; H1; H1P) A – AMP / 12V B – AMP / 24V C – DIN / 12V D – DIN / 24V E – Deutsch / 12V (E1; E1P; E2; CA)(*z) F – Deutsch / 24V (E1; E1P; E2; CA)(*z)		●	●	●	●	●	●
								15 Response Orifices 0 – without response orifices C – 0,8 mm (standard for M1, H1, H1P controls) E – 1,0 mm (standard for E1, E1P, E2 controls) 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		●	●	●	●	●	●

● Available Option ● Preferred Option ◆ Separate Specification Required

Model Code

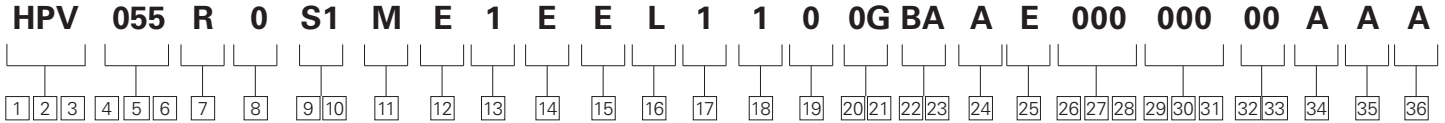
HPV – Variable Pump for Closed Loop Operation



	55	75	105	135	165	210	280
2 – 20 bar				●	●	●	●
3 – 22,5 bar	●	●	●				
4 – 23 bar				●	●	●	●
5 – 24 bar	●	●	●				
6 – 29 bar				●	●	●	●
7 – 17.5 bar (CA control only, CA default)	◆	◆	◆	◆			
18 Filter Configuration							
0 – No Filter–straight flange port (*d)	●	●	●				
1 – Filter flange with filter cartridge	●	●	●	●	●	●	●
2 – 90° charge port flange without filter	●	●	●	●	●	●	●

Model Code

HPV – Variable Pump for Closed Loop Operation



	55	75	105	135	165	210	280
19 Swash Angle Sensor							
0 – Without swash angle sensor	●	●	●	●	●	●	●
S – With swash angle sensor (*m)		●	●	●		●	●
20 21 Auxiliary Pad and Shaft Definition							
0G – to add gear pump see positions 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	●	●	●	●			
BF – Internal gear pump tandem 22,5+22,5 cc	●	●	●	●		●	●

	55	75	105	135	165	210	280
BG – external gear pump 31 cc (*r)	●		●			●	
BH – external gear pump 38 cc		●	●			●	●
BJ – external gear pump 44 cc (*r)					●		●
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 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 Gear Pump Supply							
0 – without 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							
00 – 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	●	●	●	●	●	●	●

(*c) Always set option C in position 24

(*d) DIN porting only (see position 11)

(*e) Availability depends on controller type (see position 12)

(*m) ISO metric porting only (see position 11)

(*r) CW rotation only (see position 7)

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

(*t) Recommended if HPV/R unit is attached to PTO (see position 22,23)

(*u) Required for PTO flange size C (see position 22,23)

(*w) Not for tandem units (see position 22,23)

(*y) Solenoids with square cross section

(*z) Solenoids with circular cross section - only offered with M, N & P control options.

Operational Parameters

Life Time Recommendations, Filtration and Filters

Life Time Recommendations

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.

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

Adverse Factors Affecting Service Life

Speed	Between continuous maximum speed and intermittent maximum speed
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

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 Eaton 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

Minimum requirements

20/18/15 in accordance with ISO 4406

Commissioning

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

Filling and operation of hydraulic systems

The required purity 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 measures (e.g. filters) to ensure that the required minimum purity of the oil is also achieved during operation.

International standard

Code Number according to ISO 4406		Purity Class according to SAE AS 4059
118/16/13	corresponds to	8A/7B/7C
20/18/15		9A/8B/8C

Filters

Units of the HPV series can be equipped with a pure charge pressure manifold or with a combined charge pressure and filter flange manifold. The following filter sizes are available, depending on the rated size of the unit. Further details about the mounting of the charge pressure manifold see section "Dimensions. Modular System".

Available filter sizes

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

Operational Parameters

Pressure Fluids, Mounting Orientation

Permitted pressure fluids

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

- Mineral oil HLP to DIN 51 524-2
- Biodegradable fluids in accordance with ISO 15 380 on request
- Other pressure fluids on request

Eaton offers an oil testing service in accordance with VDMA 24 570 and the test apparatus required for in-house testing. Prices available on request.

fluids which are confirmed by the manufacturer as suitable for use in high pressure hydraulic installations or approved by the original equipment manufacturer.

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 its 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 [mm²/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.

Mounting orientation

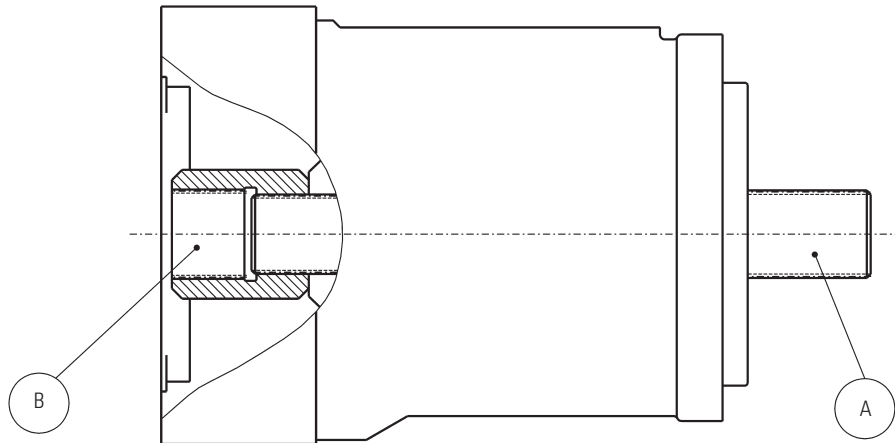
The preferred mounting orientation is generally horizontal. Special pump configurations for vertical mounting with the drive shaft pointing either upward or downward are available for selected rated sizes and have to be requested separately.

For further information concerning the installation of the unit please refer to the operating instructions manual.

Torque Transmission

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 of HPV



This shows the input side (A) and PTO-/output side (B) of a HPV pump.

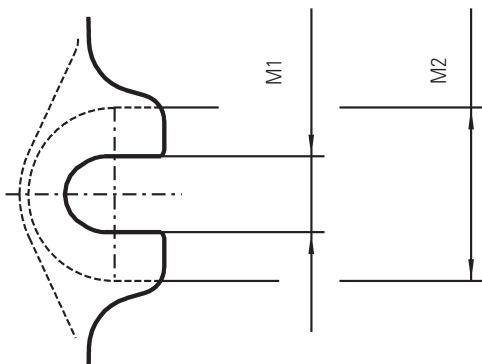
The information on the following pages refers to

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

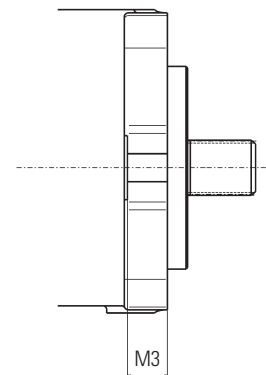
A) Flange profile

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

Both hole diameter



Bolt hole length



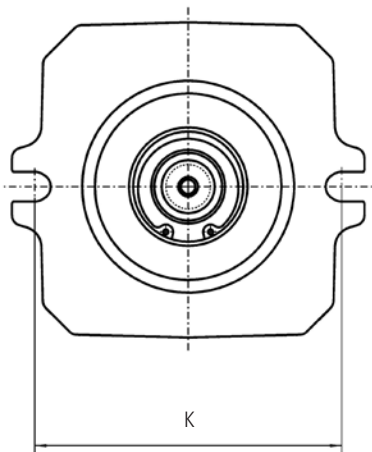
Torque Transmission

Mounting Flange

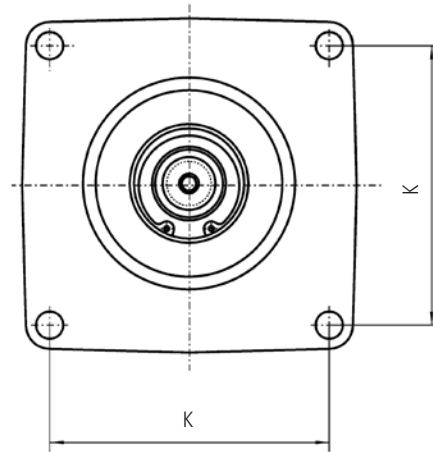
A) Mounting flange dimensions

Mounting flange in accordance with SAE J744	For Rated Size	Shim	Screw	Torque 8.8	Torque 10.9	K	H	V	G
				Nm	Nm	mm	mm	mm	mm
SAE C, 2 hole	55, 75, 105	17x33x10	M16	195	275	181.0	—	—	—
SAE C, 2 hole with 4 additional threads M12	75 & 105	17x33x10	M16	195	275	181.0	—	—	114
SAE D, 2 hole	135	21x37x8	M20	385	540	228.6	—	—	—
SAE D, 2 hole with 4 additional threads M16	135	21x37x8	M20	385	540	228.6	—	—	138
SAE D 2 hole with additional bolt holes (d=17.5mm)	135 & 165	21x37x8	M20	385	540	228.6	230	190	—
SAE E, 4 hole	210 & 280	—	M20	385	540	224.5	—	—	—

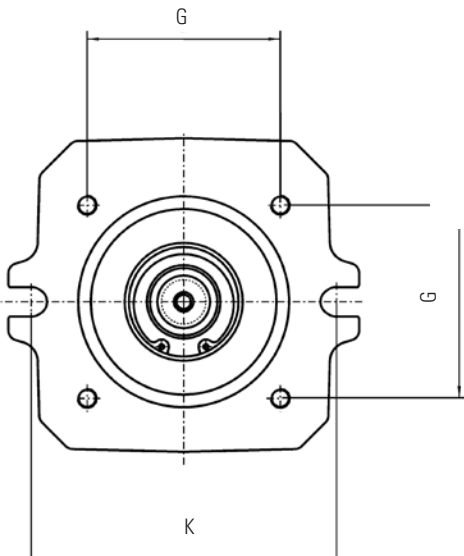
2-hole flange



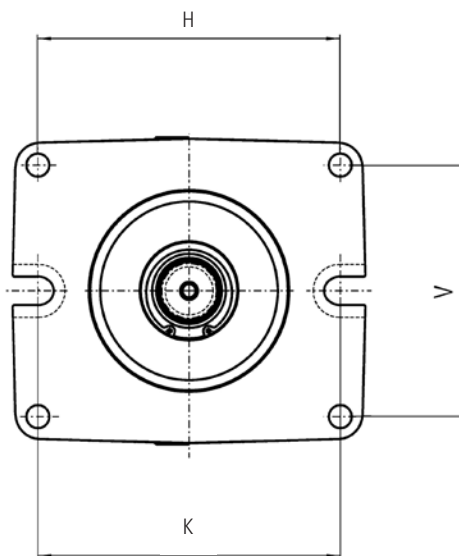
4-hole flange



2-hole flange with 4 additional threaded holes



2-hole flange with 4 additional bolt holes



Torque Transmission

Drive Shaft

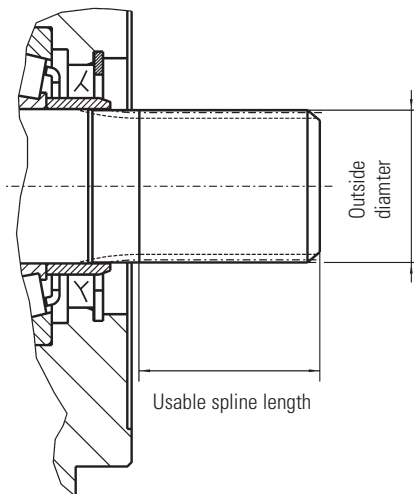
A) Dimensions ANSI and SAE drive shafts

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

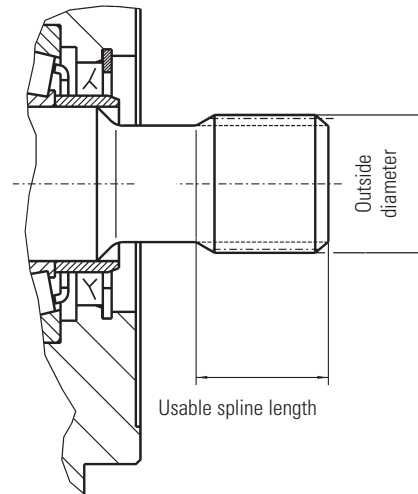
* Recommended for Tandem Configurations

A) Eaton Hydraulics shaft types

Type 1. Without undercut



Type 2. With undercut



Maximum Input Torque

Rated Size		55	75	105	135	165	210	280
Shaft		16/32 21 t	16/32 21 t	16/32 23 t	16/32 27 t	16/32 27 t	8/16 15 t	16/32 33 t
Continuous Torque	Nm	435	604	836	1080	1318	1672	2243
Maximum Torque	Nm	649	900	1245	1609	1964	2491	3343
Excess Length	mm	54	55	55	75	75	75	75

Torque Transmission

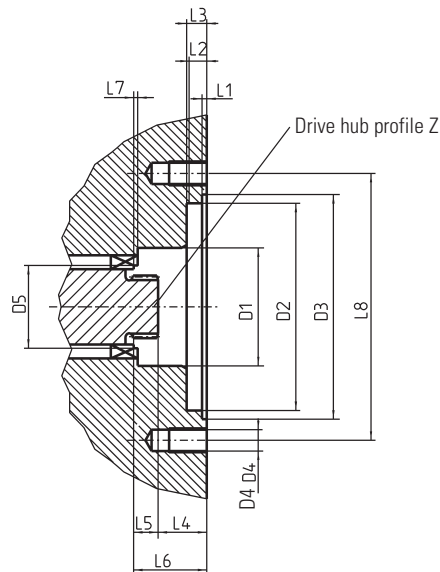
PTO Flange

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	82.55	82.55	82.55	82.55
D3	mm	88	88	88	88	89.5	89.5	89.5
D4	mm	M10	M10	M10	M10	M10	M10	M12
D5 max. bearing clearance	mm	30	35	38	43	44.5	47	49
L1	mm	1.5	1.5	1.5	1.5	1.9	1.9	1.9
L2 adapter length	mm	7	7	7	7	8	8	8
L3	mm	9	9	9	9	9	9	9
L4 minimum distance	mm	35	39	33	35	37	38.5	50.5
L5 usable spline length	mm	14	18	19	20	25	29.0	30.6
L6 distance to bearing	mm	51	57.5	53	55.9	63.1	68.3	83.0
L7 min. bearing clearance	mm	3	3	3	4	3	3	-
L8 hole distance 2-hole	mm	106.4	106.4	106.4	106.4	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	218	302	418	540	659	836	1122
Max. transfer torque	Nm	431	598	763	1069	1305	1655	2221

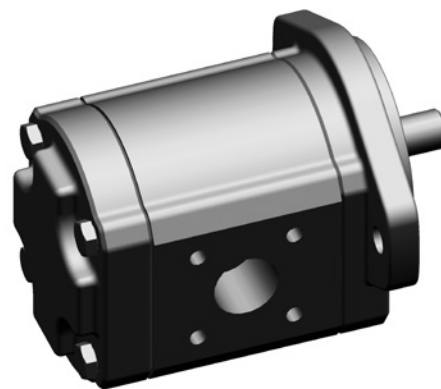
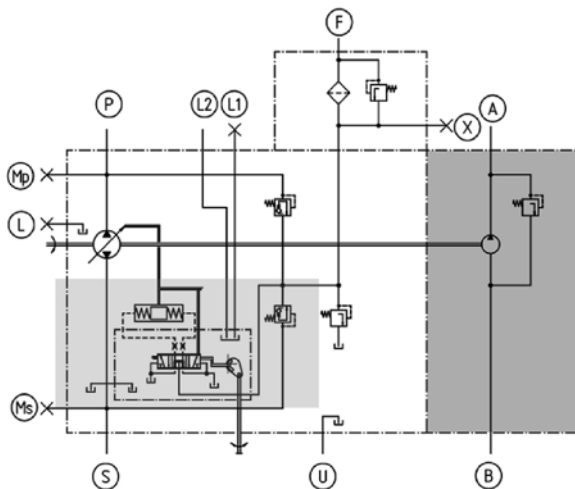
Gear Pumps

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.

Technical data

Max. displacement volume	cm ³ /rev	16	19	22,5	31	38	44
Standard boost pump for HPV	Rated size	55-105		75-135	165	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	210	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 75 Nm with SAE A		-	175 75 Nm with SAE A		-
Max. output torque	Nm	250 107 Nm with SAE A		-	250 107 Nm with SAE A		-
Cold start relief valve		integrated	-	integrated	-	-	-

External gear pump EGP

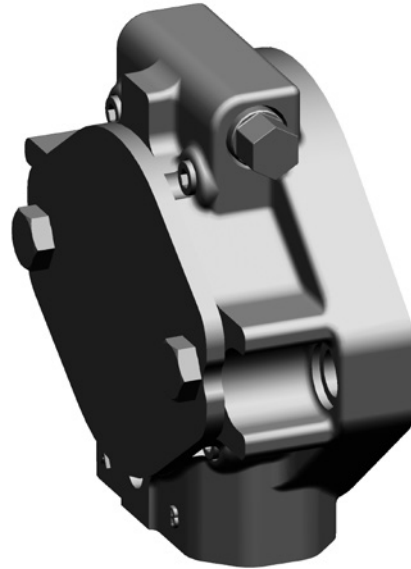
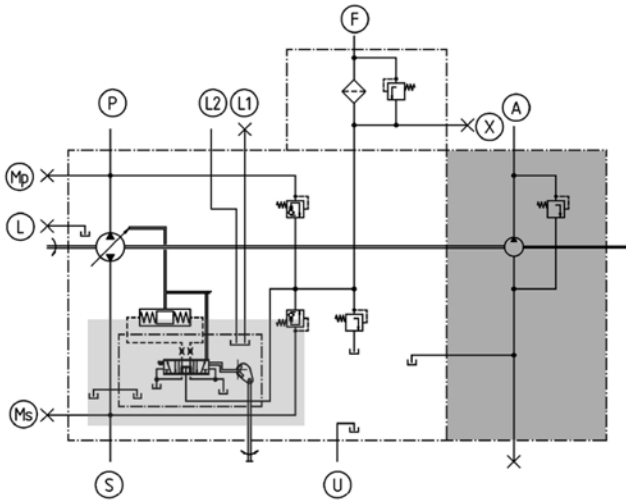


The EGP type features external suction.

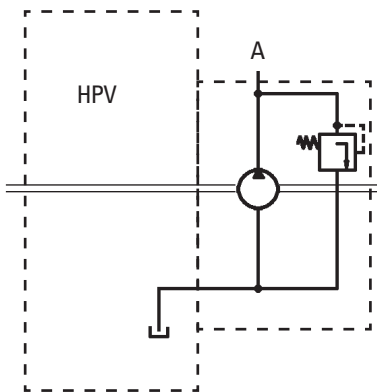
Gear Pumps

The IGP charge 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.

Internal gear pump IGP with external suction



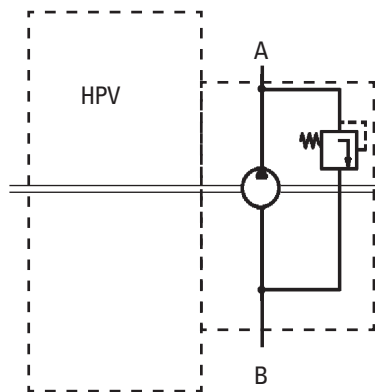
Internal suction



Internal suction

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

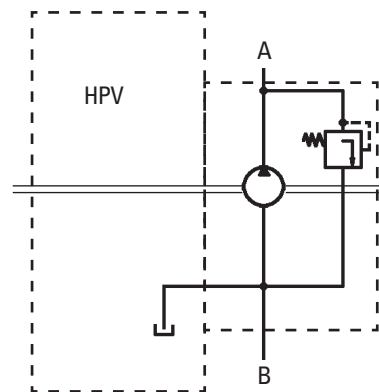
External suction



External suction

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

Combined suction



Combined suction

- The charge 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.

Gear Pumps

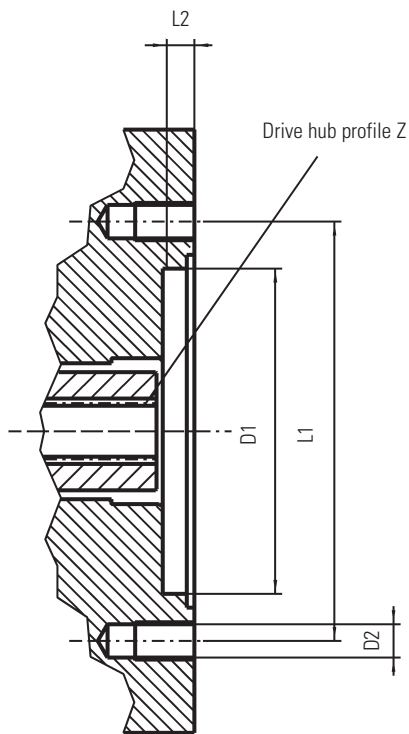
PTO flange with IGP

Flange profile 2-hole

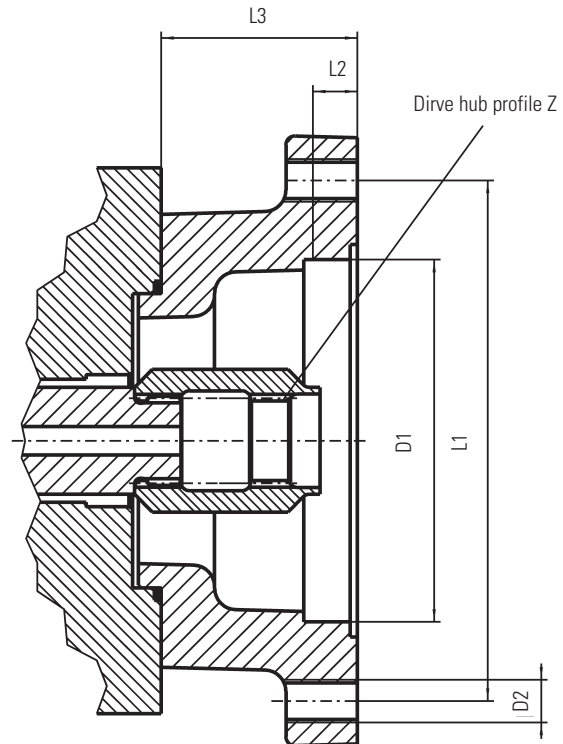
Z Internal drive hub profile in accordance w/ ANSI B92.1

		SAE A	SAE B	SAE B-B	SAE C
D1 Spigot pilot diameter	mm	82.55	101.6	101.6	127
D2 Thread size	mm	M 10 -1.5	M 12 -1.75	M 12 -1.75	M 16 -2
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



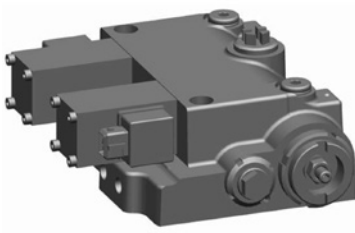
Controls

The modular control concept with standardized 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 standardized and load-independent machine or vehicle control.

Technical data

Type of control	Additional option	Name of control
Mechanical	proportional	M1R
Hydraulic	proportional	H1
	with pressure cut-off regulation	H1P
	speed dependent	CA
	torque-/power controlled	CA
	with additional safety function	CA
Electrical	proportional	E1
	with pressure cut-off regulation	E1P
	with additional safety function	E2
	3 position	E5

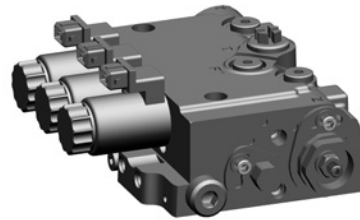
E1/E5 control



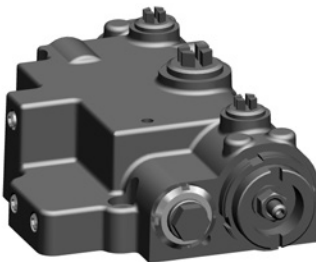
E1P-control



E2-control



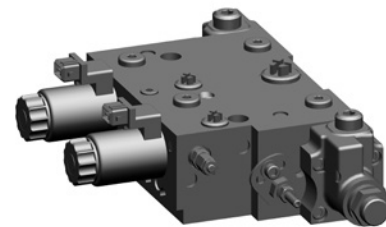
H1-control



H1P-control



CA-control



M1-control

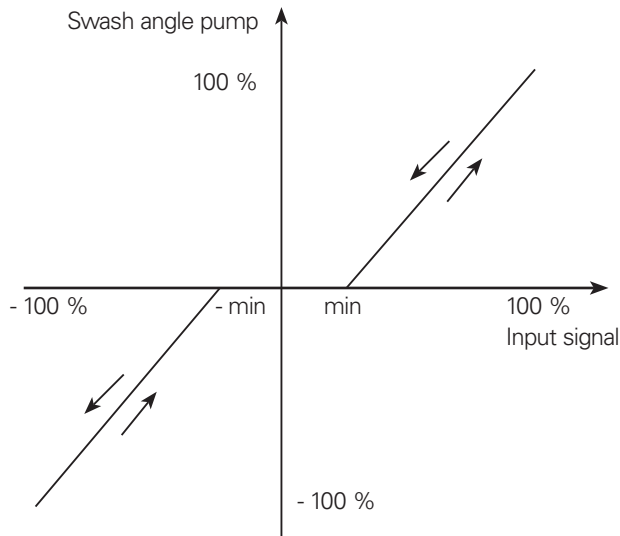


Controls

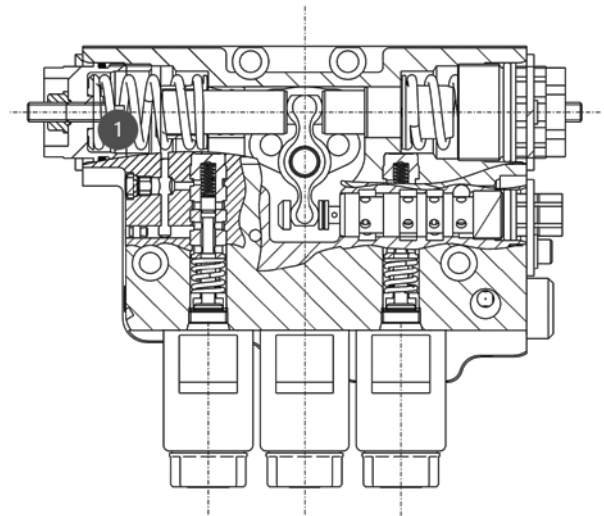
Control Accuracy

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.

Control accuracy of a HPV pump



E2-control



1. Setting the maximum displacement

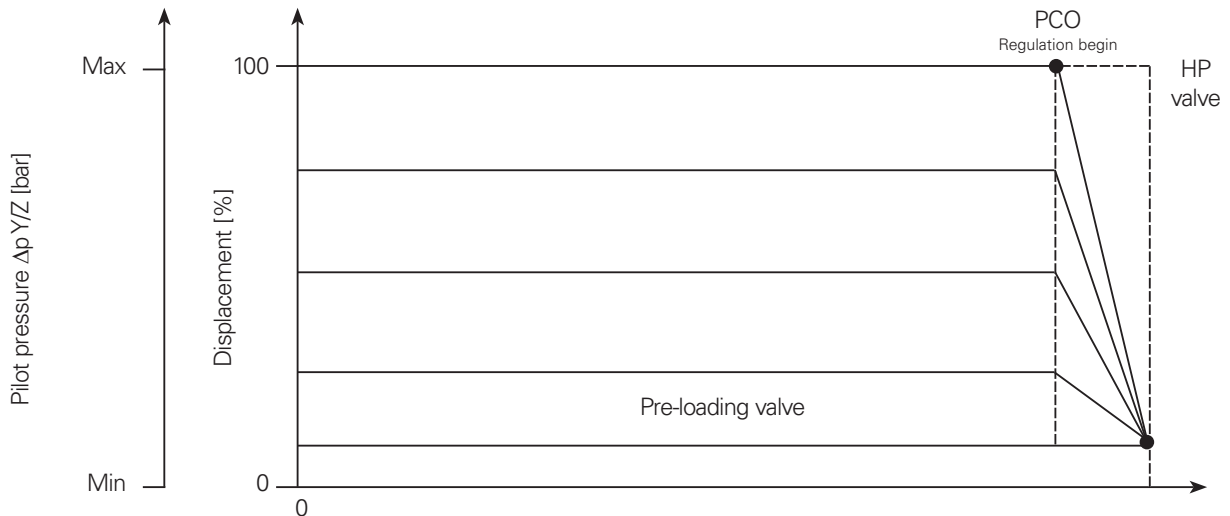
Pressure cut-off regulation PCO

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

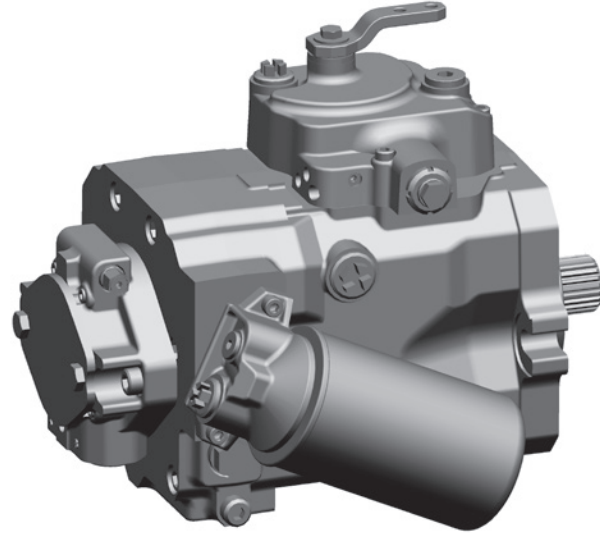
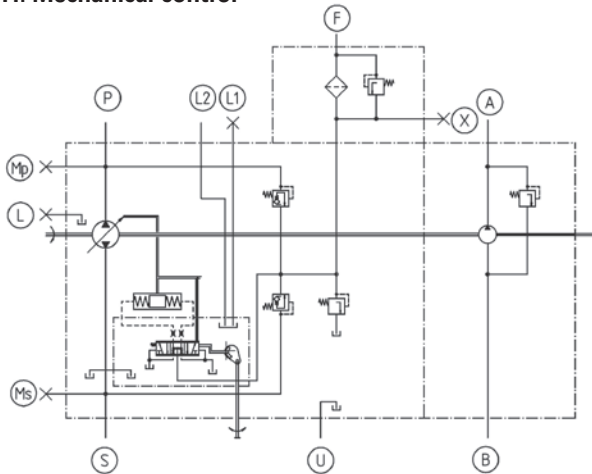


Controls

Mechanical-hydraulic M

The M1-pump control combines robustness with high precision for direct and reliable machine control. It is mechanically controlled and can be combined with a fixed, variable or regulating hydraulic motor. The control-specific data is independent of the nominal pump size.

M1. Mechanical control



Flow direction

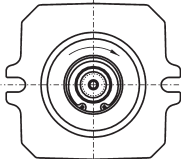
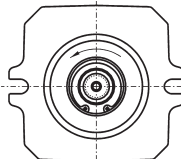
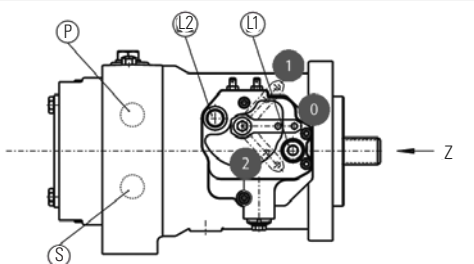
By turning the control lever the pump flow rate and direction of flow are controlled via a cam plate. The

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
		 Right hand	 Left hand
	0 → 1	P	S
	0 → 2	S	P

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

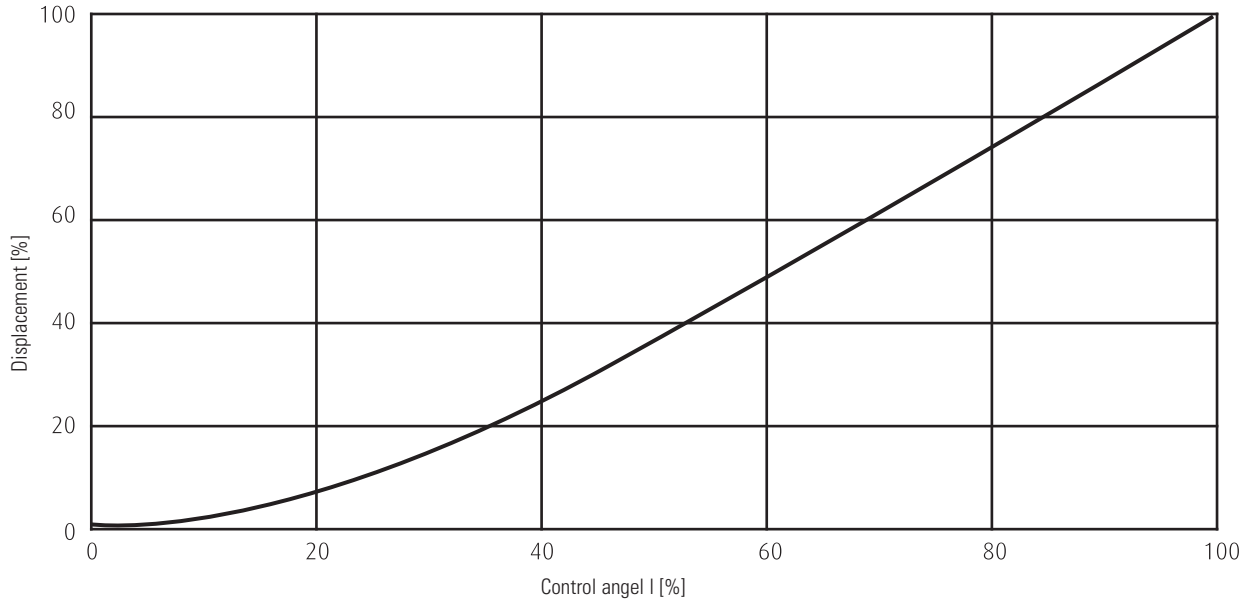
- L, U** Drain ports
- L1, L2** Vent ports
- Note for left hand rotation
- A** Suction port, charge pump
- B** Pressure port, charge pump

Controls

Mechanical-hydraulic M

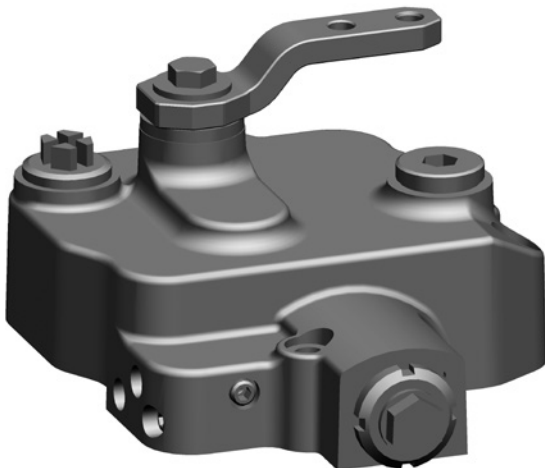
The cam plate offers a large control angle with progressive control characteristic and a wide neutral range. The resulting high resolution for movements from the neutral range (and vice versa) enables precise manoeuvring. Reliable and robust control of the displacement volume is achieved through position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

Displacement relative to control angle

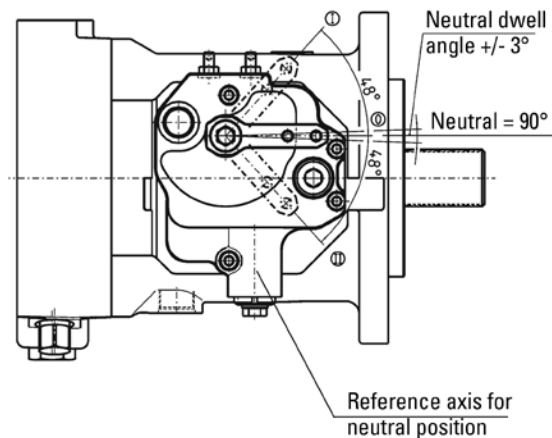


Control force with max. long lever radius $r = 70 \text{ mm}$	17 N
Max. permissible control force (intermittent)	500 N
Control torque	<1.0 Nm
Centred reset by external force	<1.5 Nm
Control angle neutral range ... to end position	$\pm 3^\circ \dots \pm 48^\circ$
Minimum response time with standard restrictors	0.5 sec

M1-cam plate



Control range

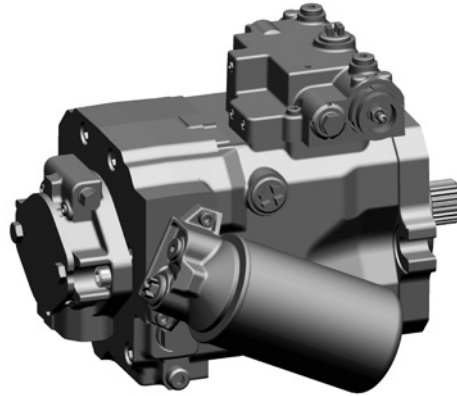
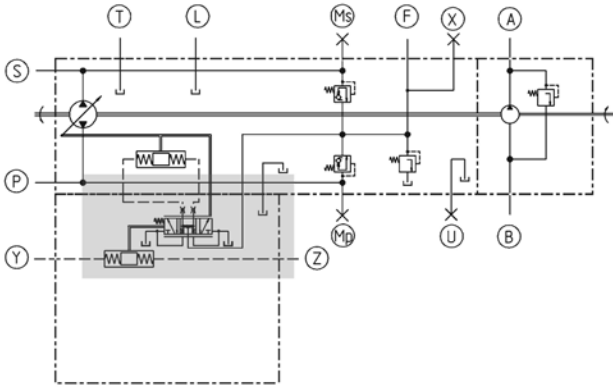


Controls

Hydraulic H

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. (see section Controls, Control Accuracy).

H1. Hydraulic control



Flow direction

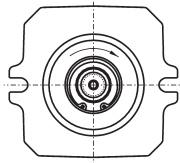
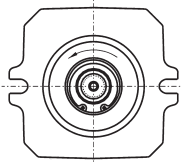
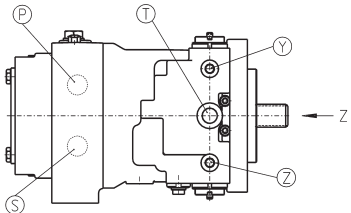
By an external hydraulic signal input at the pilot pressure ports (Y, Z) the pump flow rate and direction of flow are controlled.

The flow direction of the fluid depends on

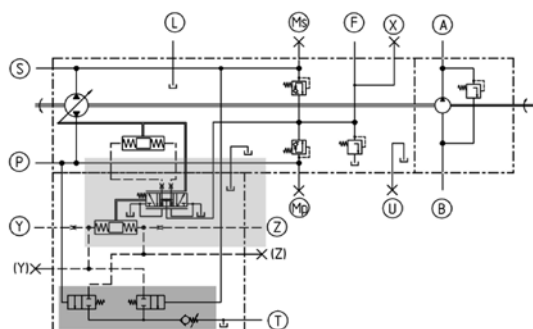
- the pump direction of rotation

- 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

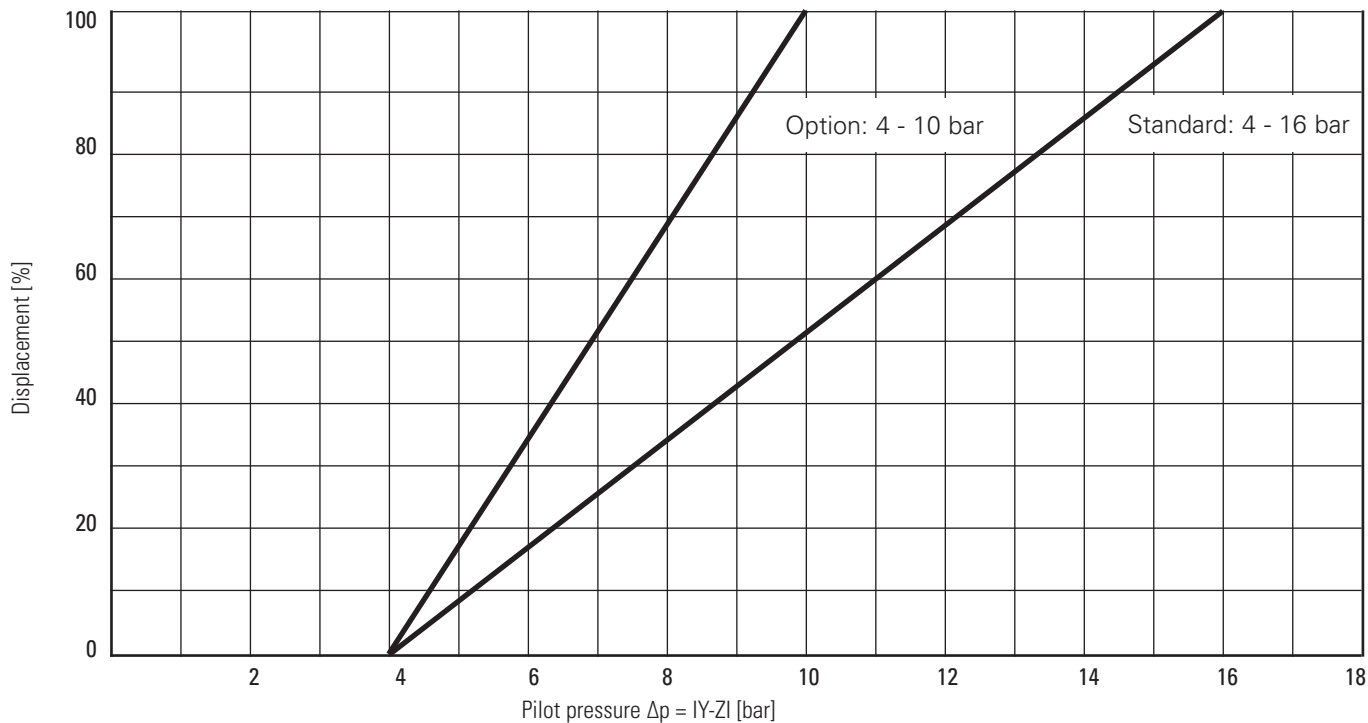


- | | | | |
|---------------|------------------------------|-----------------------------|----------------------------|
| P, S | High pressure ports | L, U | Drain ports |
| A | Pressure port, charge pump | T | Vent port |
| B | Suction port, charge pump | Y, Z | Pilot pressure ports |
| F | Feed port,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

Controls

Hydraulic H

Displacement relative to pilot pressure



Pilot pressure range

standard 4-16 bar differential pressure |Y-Z|

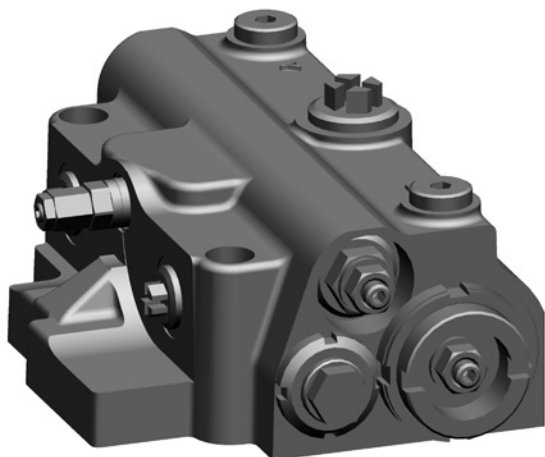
Maximum permissible pressure at Y or Z

30 bar

Minimum response time with standard orifices
for one-way swashing between 0 and max

0.5 sec

H1P-control with PCO

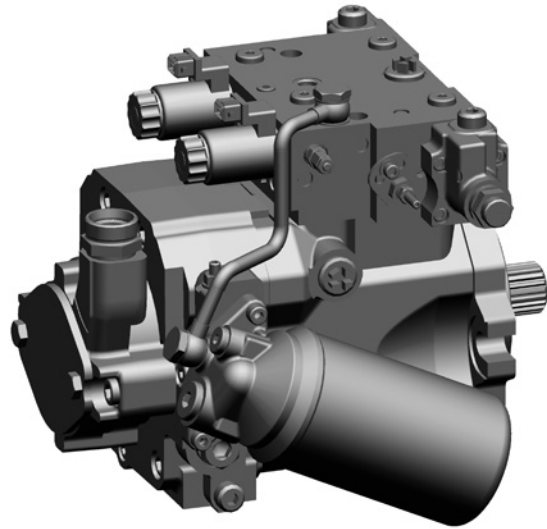
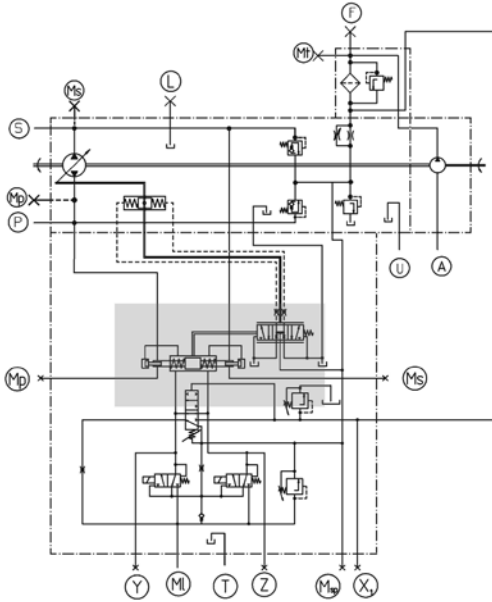


Controls

Hydraulic-mechanical CA

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.

CA. Hydraulic-mechanical control



CA-control. Advantages

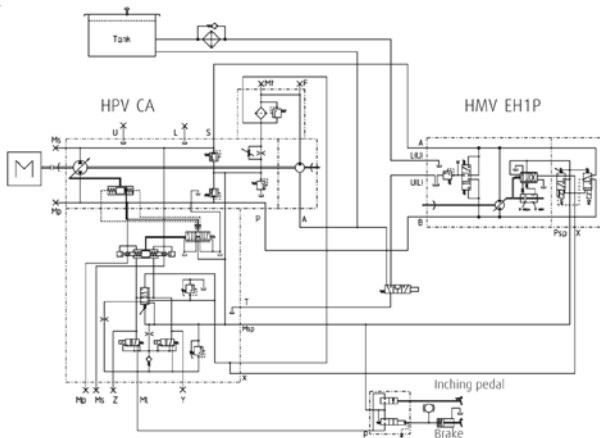
- pilot operated system
 - controlled load response
 - temperature independent
 - dynamics
 - precision
 - low hysteresis
 - high versatility (modular design)
 - various motor control possible
- simple adjusting
- direct control of torque and tractive force
- speed optimized inching function
- high safety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

- P,S** High pressure ports
- A** Suction port, charge pump
- F** Feed port, charge and control

Test ports

- Mt** Temperature
- Ms, Mp** High pressure
- Y, Z** Pilot pressure
- MI** 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, charge pump

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



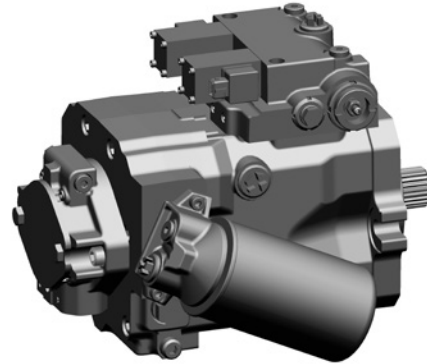
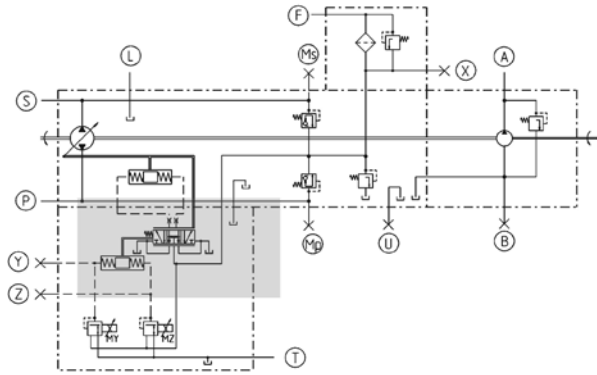
Controls

Electro-hydraulic E1 an E5

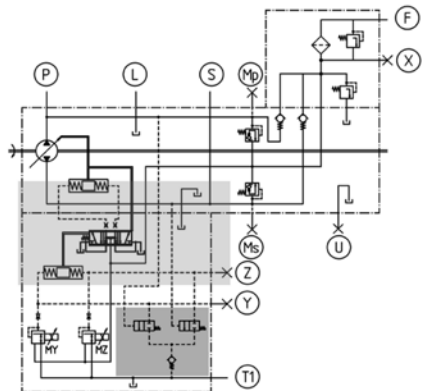
The HPV E1 has two proportional solenoids and through the upstream signal circuit it combines the flexibility of electronic vehicle management with the reliability of a pump control marked by its high operational availability. Precise and simple. Identical commands always call for the same response in the machine, so no corrective action is required by the operator or the electronic system.

The HPV E5 has two switching solenoids and thus sets the pump to either neutral or maximum swash angle of any direction.

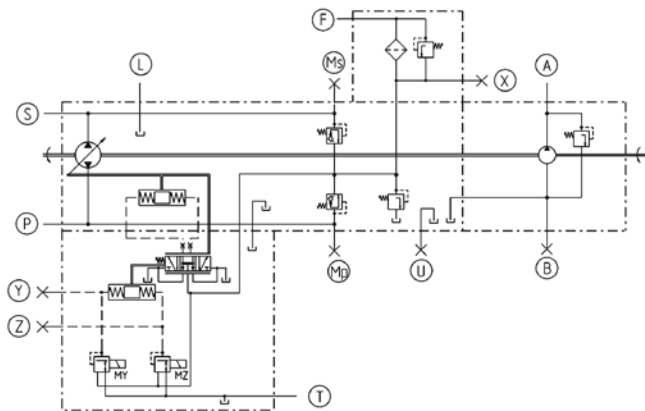
E1. Electro-hydraulic control



E1P. Electro-hydraulic control with PCO



E5. Electro-hydraulic 3 position control



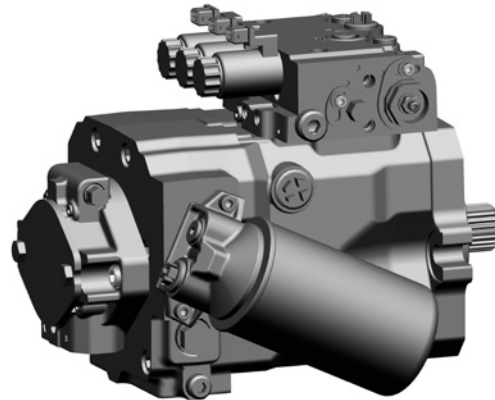
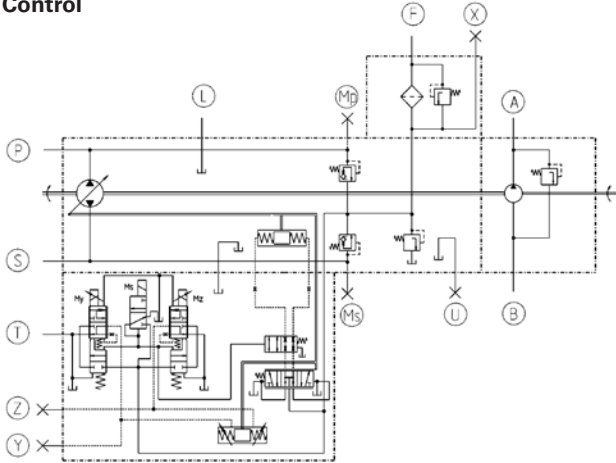
- | | | | |
|-------------|------------------------------|-----------------------------|----------------------------|
| P, S | High pressure ports | Ms, Mp | Test ports, high pressure |
| A | Pressure port, charge pump | L, U | Drain ports |
| B | Suction port, charge pump | T | Vent ports |
| F | Feed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

Controls

E2

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.

E2. 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.

E2 with switch-off function

The E2 control offers an interface for switching off the whole system. In case of signal irregularity or perturbation like cable break or short-circuit in the switching solenoid circuit (co called 'watchdog'), the pump swashes back to neutral position in a defined manner.

The vehicle is decelerated until standstill and thus provides a safe condition of the machine as per EN ISO 13849.

In case of dysfunction in the proportional magnets' circuits, a similar reaction can be induced by the intervention of the electronic control units.

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

Product advantages of E2

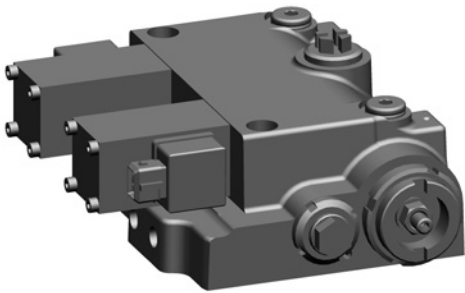
- fulfils the rigorous demands for road traffic use
- active drive enable
- minimized susceptibility to interference
- with HMF: defined swashing back of pump for controlled deceleration and stop in case of system fault
- with HMF: diesel overspeed protection by fast swashing back of pump

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

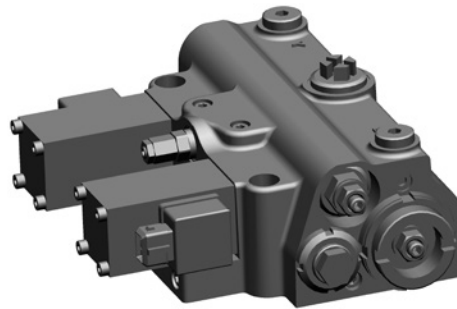
Controls

Electro-hydraulic E

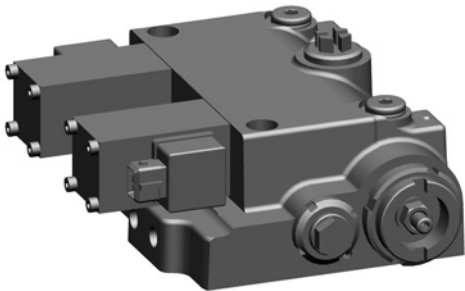
E1 control



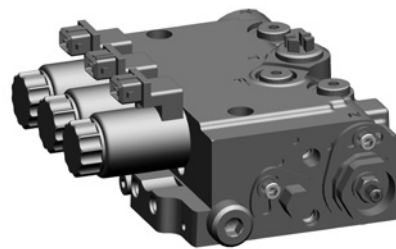
E1P control



E5 control



E2 control



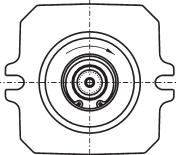
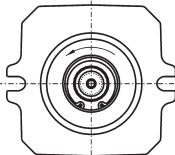
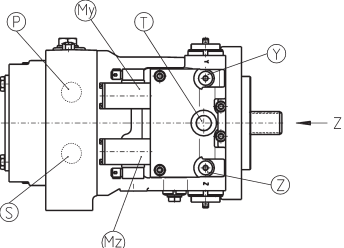
Flow direction

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 center direction of the swash plate.

High pressure outlet port

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

Controls

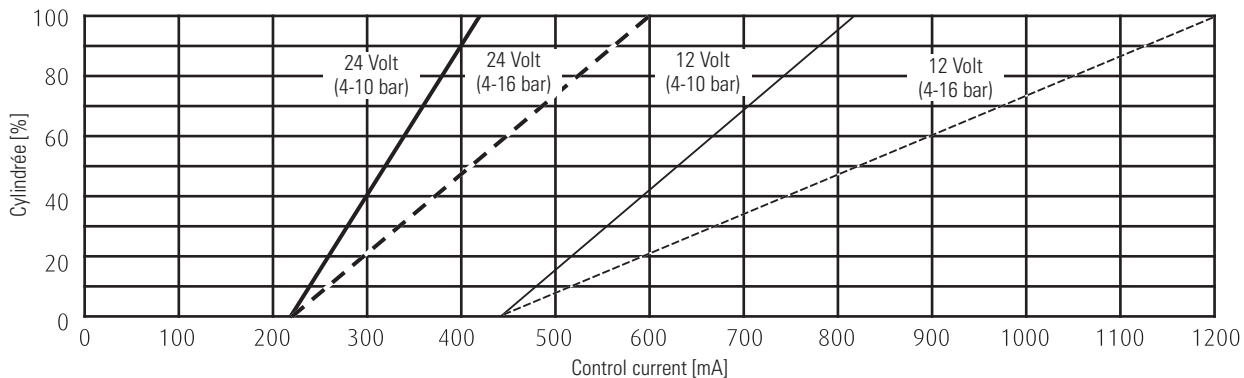
E

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 show the standard mounting position for the respective E-control.

Control signal characteristics

Supply voltage = limiting voltage		V	12	24	
Connector type			DIN EN 175301-803, Deutsch, 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	mA	810	410
		pilot pressure range 4-16 bar	mA	1200	600
Relative duty cycle		%	100	100	
Protection class			IP54 (DIN), IP67 (Deutsch), IP 6K6K (AMP)	IP54 (DIN), IP67 (Deutsch), IP 6K6K (AMP)	
Control types	digital control via Pulse Width Modulation PWM		100 Hz Rectangle, Pulse duty ratio variable over control range		
	analogue control		Direct current with dither overlay (dither frequency nom. 35 Hz, duty cycle 1:1). Further details on request		
Minimum response time with standard orifices		s	0.5	0.5	

Displacement relative to control current



Dimensions

M-controls

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

Port sizes and dimensions for M-controls

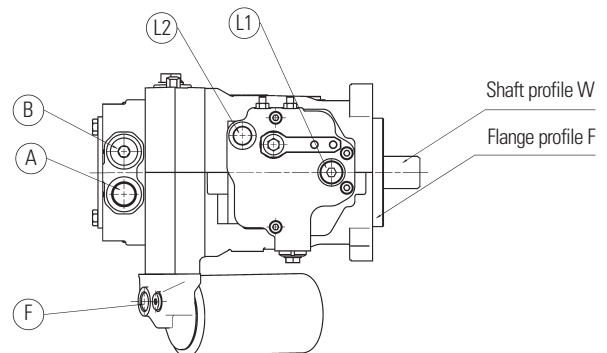
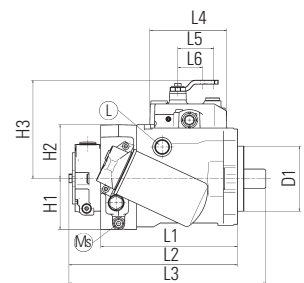
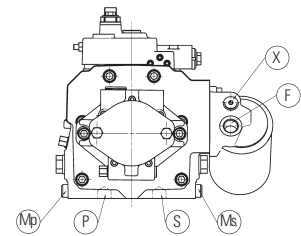
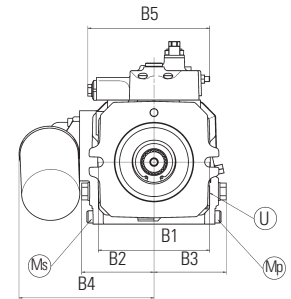
Rated size	55	75	105	135	165	210	280
Gear pump rated size [cm ³]	16	22.5	22.5	22.5	38	38	44
F flange profile	2-hole mounting flange		2-hole mounting flange		4-hole mounting flange		
	SAE C	SAE C	SAE C	SAE D	SAE D	SAE E	SAE E
W shaft profile in accordance with ANSI B92.1	16 / 32 spline pitch				16 / 32	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	141	142	155
B3 (mm)	101	116	116	141	138.5	135	-
B4 (mm)	192	216	216	219	233	240	246
B5 (mm)	194	194	194	194	194	194	194
L1 (mm)	225	242	267	288	319.5	346	392
L2 (mm)	282	304	329	350	485.5	516	571
L3 (mm)	335	359	385	425	560.4	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	119.5	134	152
H2 (mm)	95	103	105	112	122.5	133	150
H3 (mm)	184	188	193	198	214.5	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 1"	SAE 1"	SAE 1"
B gear pump*	M27x2	M27x2	M27x2	M27x2	SAE 1 1/4"	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

*Units ship with M36x2 stud in suction port.

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



Dimensions

H-controls

Control-specific dimensions for HPV with hydraulic controls.

Port sizes and dimensions for H-controls

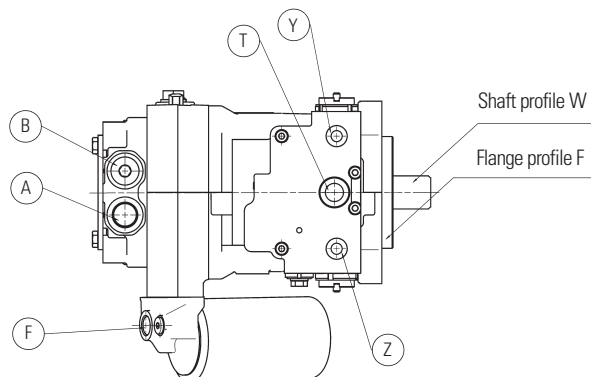
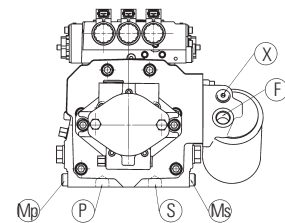
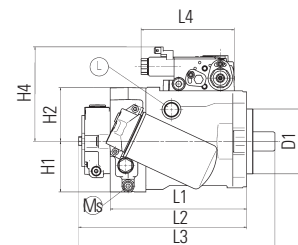
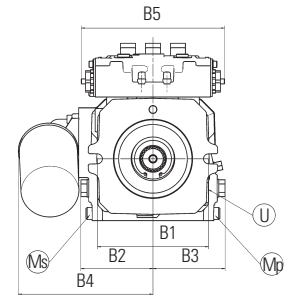
Rated size	55	75	105	135	165	210	280
Gear pumps rated size (cm ³)	16	22.5	22.5	22.5	38	38	44
F flange profile	2-hole mounting flange		2-hole mounting flange		4-hole mounting flange		
	SAE C	SAE C	SAE C	SAE D	SAE D	SAE E	SAE E
W shaft profile in accordance with ANSI B92.1	16 / 32 spline pitch		16 / 32 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	134.5	143	155
B3 (mm)	101	116	116	141	134.5	135	139
B4 (mm)	192	216	216	219	233	240	246
B5 (mm)	231	231	231	231	231	231	231
L1 (mm)	225	242	267	288	319.5	346	392
L2 (mm)	282	304	329	350	485.5	516	571
L3 (mm)	335	359	385	425	560.4	591	646
L4 (mm)	133	133	133	133	133	133	133
H1 (mm)	88	93	99	106	119.5	134	152
H2 (mm)	95	103	105	112	-	133	150
H3 (mm)							
w/o PCO	194	154	158	163	187	191	204
with PCO	185	190	194	199	223	201	214
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 1"	SAE 1"	SAE 1"
B gear pump*	M27x2	M27x2	M27x2	M27x2	SAE 1 1/4"	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	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

*Units ship with M36x2 stud in suction port.

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



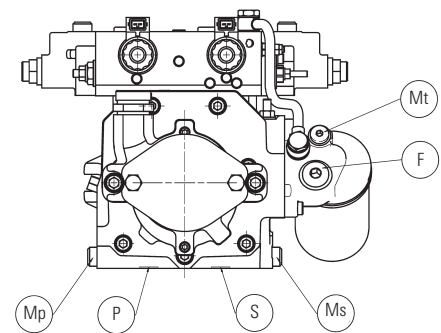
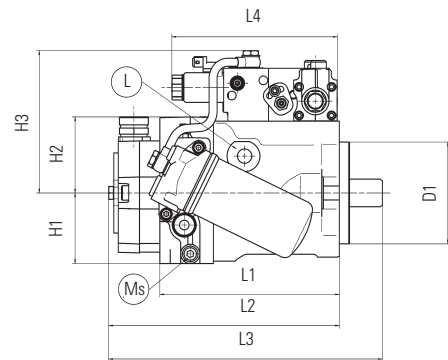
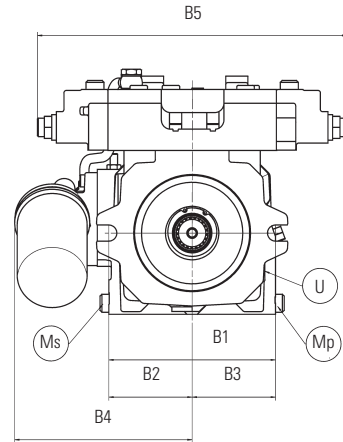
Dimensions

CA-controls

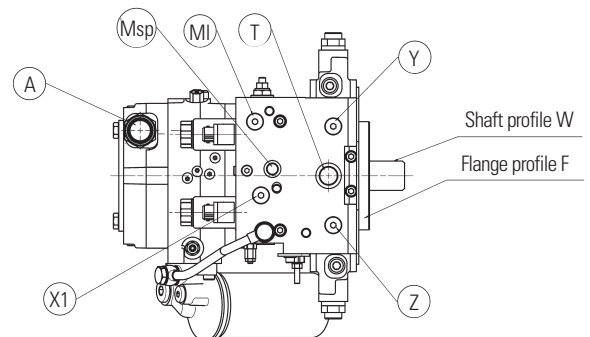
Control-specific dimensions for HPV with hydraulic-mechanical controls.

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	152.4
B1 [mm]	181	181	228.6
B2 [mm]	101	116	141
B3 [mm]	101	116	141
B4 [mm]	193	212	217
B5 [mm]	336	336	336
L1 [mm]	225	242	288
L2 [mm]	282	306	351.5
L3 [mm]	343	361	426.1
L4 [mm]	207	207	207
H1 [mm]	88	93	105.5
H2 [mm]	95	103	104
H3 [mm]	178	184	191.1
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



Dimensions

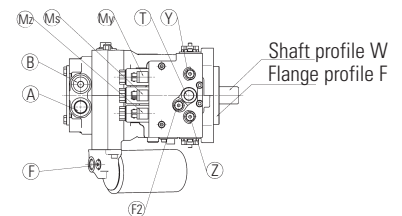
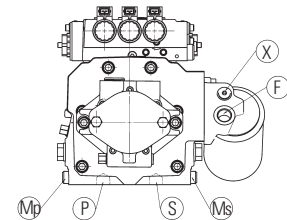
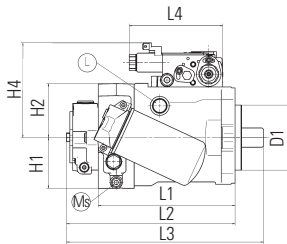
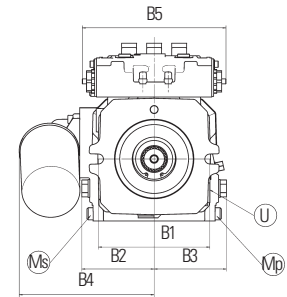
E-controls

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

Port sizes and dimensions for E-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	
B1 (mm)	181	181	181	228.6	228.6	224	225
B2 (mm)	101	116	116	141	134.5	143	155
B3 (mm)	101	116	116	141	134.5	135	139
B4 (mm)	192	216	216	219	233	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	319.5	346	392
L2 (mm)	282	304	329	350	485.5	516	571
L3 (mm)	335	359	385	425	560.4	591	646
L4 (mm)	183	183	183	183	183	183	183
H1 (mm)	88	93	99	106	119.5	134	152
H2 (mm)	95	103	105	112	122.5	133	150
H4 (mm) E1 / E2 with AMP-JT-connector	159	164	168	173	189.5	218	231
H4 [mm] E1 with Hirschmann-connector	195	200	204	209	225.5	254	(267)
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"
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	M27x2	SAE 1"	SAE 1"
B gear pump*	M27x2	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
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		Hirschmann, AMP-JT, Deutsch				
My	E1-control		Hirschmann, AMP-JT,				
	E2-control round solenoids		Hirschmann, AMP-JT, Deutsch				
Mz	E1-control		Hirschmann, AMP-JT				
	E2-control round solenoids		Hirschmann, AMP-JT, Deutsch				

*Units ship with M36x2 stud in suction port.



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

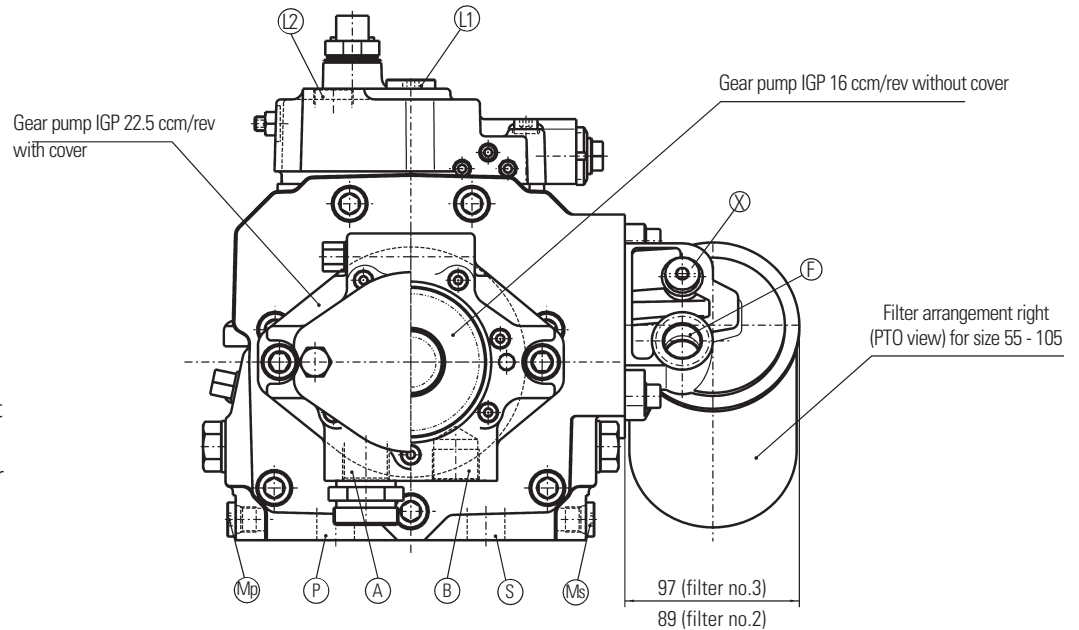
Dimensions

Modular System

The following diagrams show the proportions of similar components.

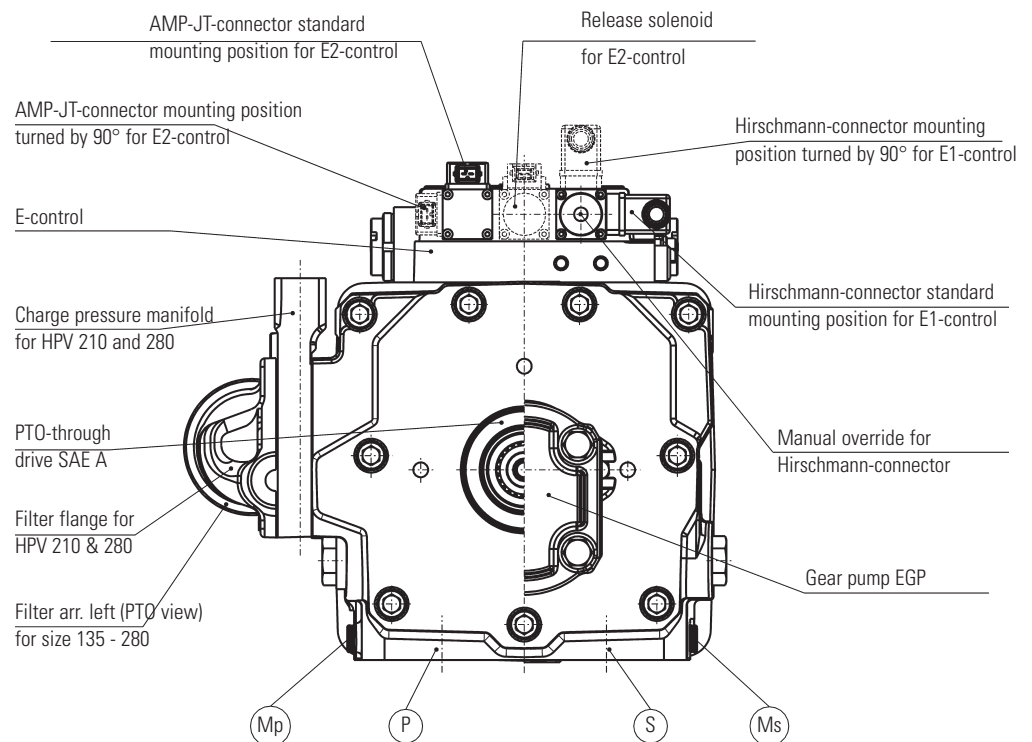
PTO view M1 control

- M1-control
- IGP 22.5 cm³/rev with cover
- IGP 16 cm³/rev without cover
- Filter mounting side for rated sizes 55 - 105



PTO view E1 control

- 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

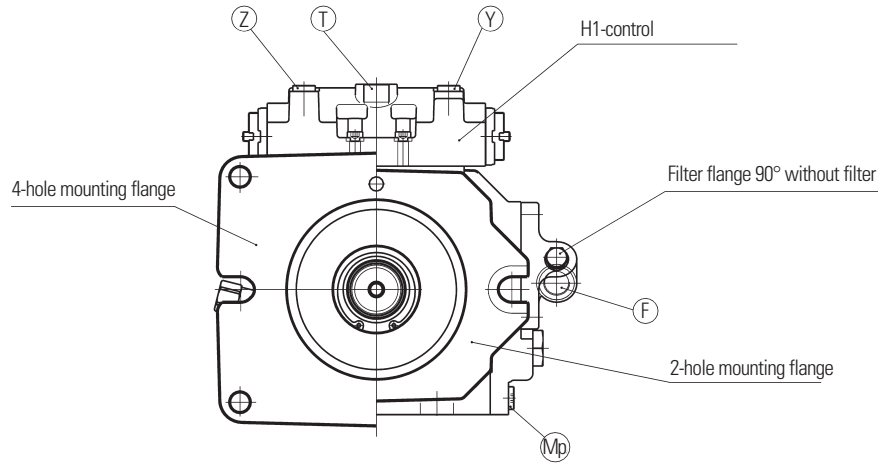


Dimensions

Modular System

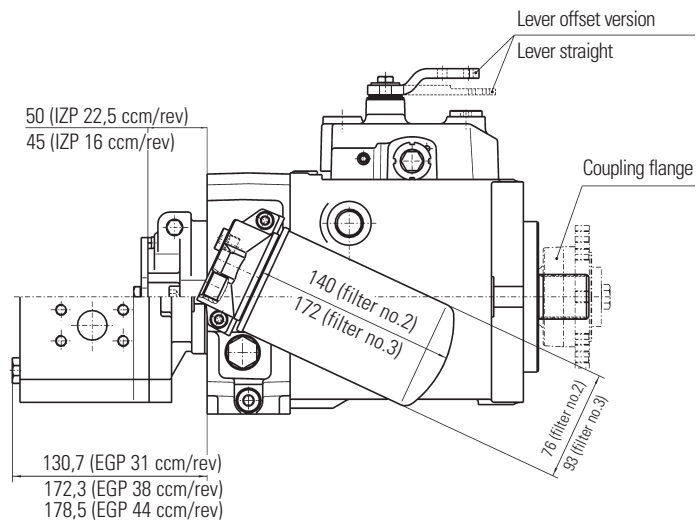
The following diagrams show the proportions of similar components.

View on mounting flange



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

Side view



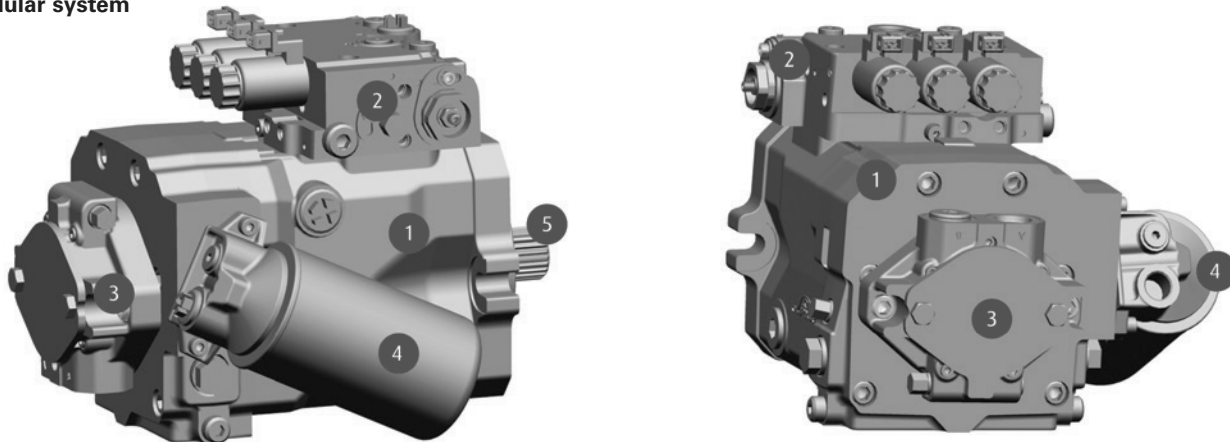
- M1-control lever geometry
- IGP
- EGP
- Filter
- Coupling flange

Dimensions

Modular System

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.

Modular system



External dimensions for addition

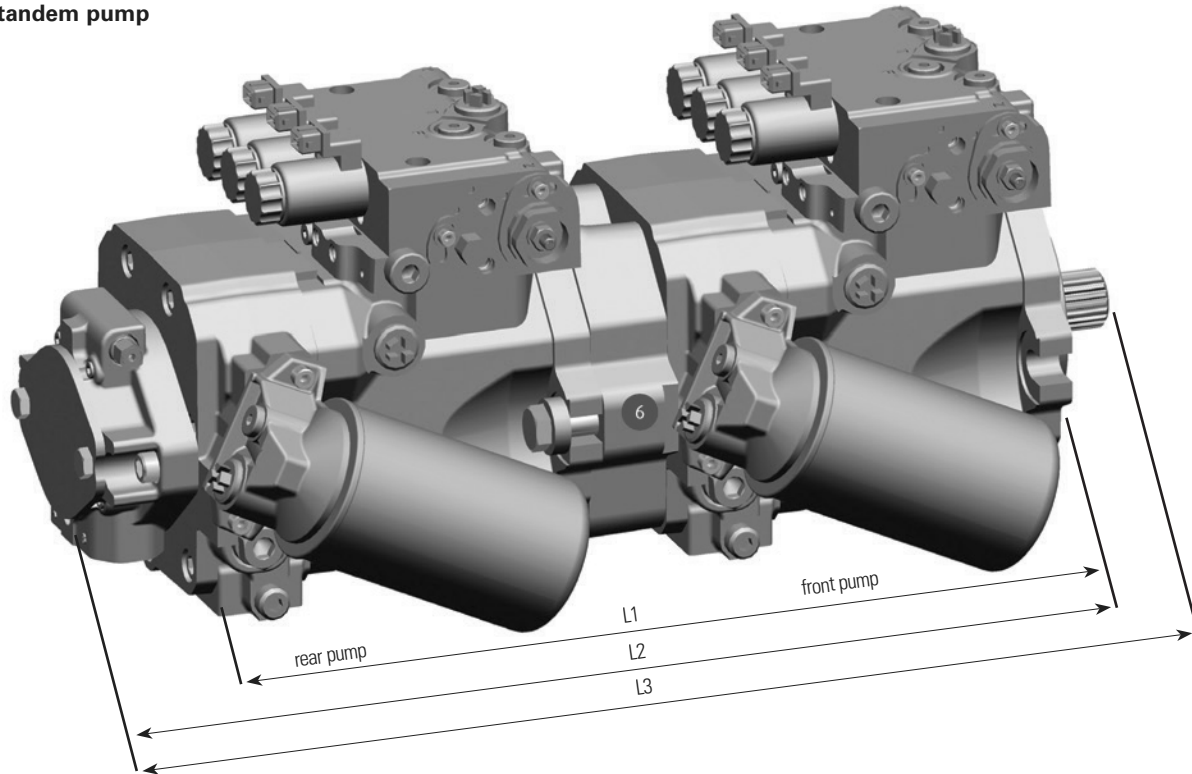
Component	Type	Length	Width	Height
1	Basic unit	55	230	185
		75	245	190
		105	270	210
		135	290	220
		165	320	245
		210	350	275
2	Control			
	M1	-	10	95
	H1	-	5	55
	H1P	-	10	75
	CA	-	135	95
	E1	-	5	110
3	Gear pump			
	22.5cc	60	-	-
	22.5cc	65	-	-
	31 cc	135	-	-
	38 cc	175	-	-
4	Filter			
	No. 2	10 without 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

Tandem Pumps

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 utilization, output allocation and load distribution.

HPV tandem pump



Overall length of tandem pump

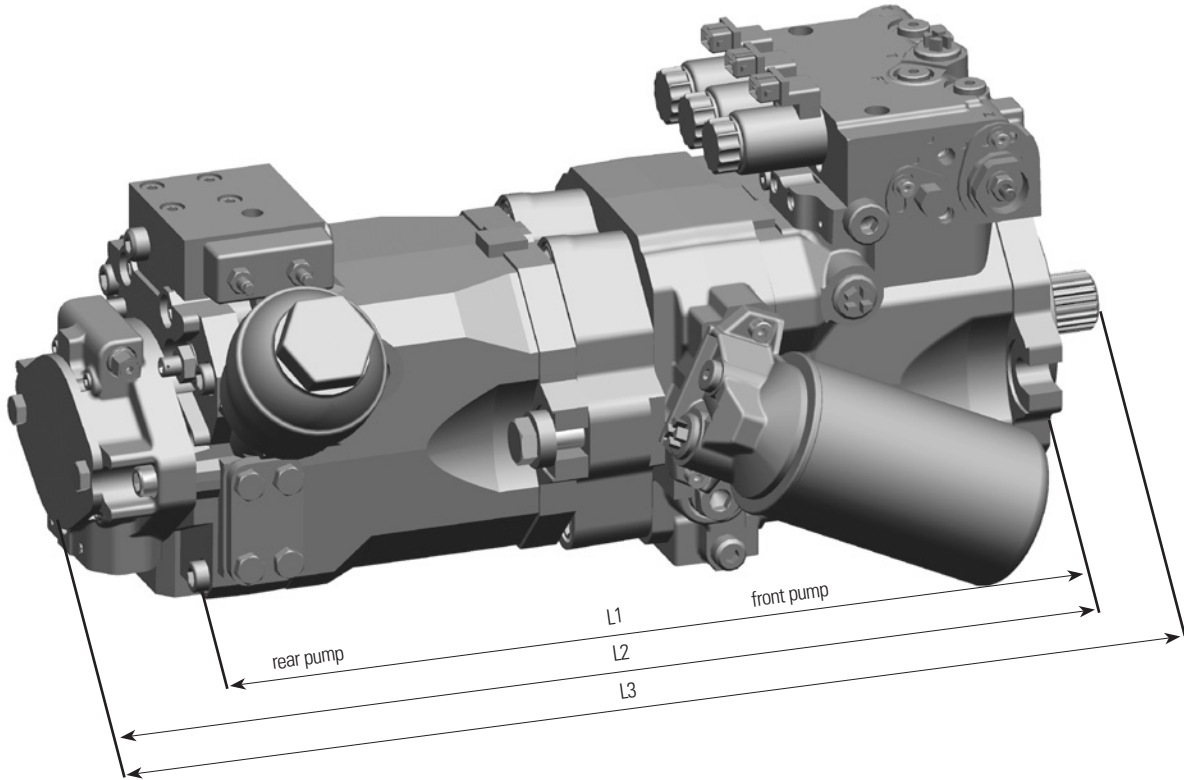
Rated size	Rear pump	HPV 55	HPV 75	HPV 105	HPV 135	HPV165	HPV 210	HPV 280
Front pump	Lengths (mm)							
HPV 55 with IGP 16 cc at rear pump	L1	496	-	-	-	-	-	-
	L2	553	-	-	-	-	-	-
	L3	607	-	-	-	-	-	-
HPV 75 with IGP 22,5 cc at rear pump	L1	513	530	-	-	-	-	-
	L2	575	592	-	-	-	-	-
	L3	631	648	-	-	-	-	-
HPV 105 with IGP 22.5 cc at rear pump	L1	529	546	572	-	-	-	-
	L2	591	608	634	-	-	-	-
	L3	647	663	586	-	-	-	-
HPV 135 with IGP 22.5 cc at rear pump	L1	543	560	586	640	-	-	-
	L2	605	622	648	702	-	-	-
	L3	680	696	722	777	-	-	-
HPV 165 with IGP 38 cc at rear pump	L1	571	588	613	670	684	-	-
	L2	746	763	788	844	859	-	-
	L3	820	837	865	919	934	-	-
HPV 210 with IGP 38 cc at rear pump	L1	610	627	653	702	722	731	-
	L2	782	799	825	874	897	903	-
	L3	857	874	900	947	971	978	-
HPV 280 with IGP 44 cc at rear pump	L1	655	672	698	723	755	777	823
	L2	834	851	877	903	935	956	1002
	L3	909	925	951	978	1009	1030	1076

Dimensions

Multiple Pumps

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.

HPV-HPR multiple pump



Overall length of multiple pump

Rated size	Rear pump	HPR 55	HPR 75	HPR 105	HPR 135	HPR 165	HPR 210	HPR 280
Front pump	Lengths (mm)							
HPV 55 with IGP 16 cc at HPR L3	L1	492	-	-	-	-	-	-
	L2	549	-	-	-	-	-	-
	L3	603	-	-	-	-	-	-
HPV 75 with IGP 22.5 cc at HPR	L1	509	521	-	-	-	-	-
	L2	586	598	-	-	-	-	-
	L3	642	653	-	-	-	-	-
HPV 105 with IGP 22.5 cc at HPR	L1	525	536	567	-	-	-	-
	L2	602	613	629	-	-	-	-
	L3	657	669	684	-	-	-	-
HPV 135 with IGP 22.5 cc at HPR	L1	539	550	581	637	-	-	-
	L2	616	627	643	699	-	-	-
	L3	690	702	717	774	-	-	-
HPV 165 with IGP 38 cc at HPR	L1	565	578	608	667	715	733	-
	L2	741	753	783	842	882	905	-
	L3	815	827	857	916	956	980	-
HPV 210 with IGP 38 cc at HPR	L1	606	618	648	699	722	733	-
	L2	793	805	820	871	897	905	-
	L3	868	879	895	945	972	980	-
HPV 280 with IGP 44 cc at HPR	L1	651	663	693	720	768	779	834
	L2	845	856	872	900	948	958	1014
	L3	919	931	946	975	1023	1033	1089

Modular System Features

The HPV is based on a modular system with the following characteristics. This enables our distribution partners to configure the product according to your requirements. The latest characteristics and available options can be taken from the model code.

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 and charge pressure relief valve
- Cold start relief valve
- Drain port U + L
- Filter/charge pressure manifold
- Filter flange mounting
- Surface treatment
- Name plate
- Swash angle sensor

Notes

Notes

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