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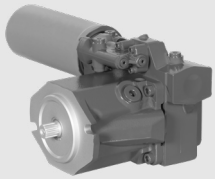
HP5VS SERIES
Axial Piston Variable Pumps

Mainly suitable for application in agricultural machinery, engineering machinery, etc

Apply to open circuits			
Size:	45	63	85
Nominal pressure(bar):	210	210	210
Peak pressure(bar):	250	250	250



Contents

Features

★ Variable pump in swash-plate design for open circuit.
★ Exceptional self-priming capability.
★ Excellent reliability and long life.
★ High power to weight ratio.
★ Variety of control options.
★ Optional through drive.
★ Quick control response.
★ Low pressure pulsation and low noise.

Technical Data

Size		45	63	85
Displacement(cc/rev)		45	63	85
Speed	Max(rpm)	2900	2700	2700
	Min(rpm)	600		
Pressure	Rated(bar)	210	210	210
	Peak(bar)	250	250	250
Case pressure (Relative)	Rated(bar)	1		
	Peak(bar)	4		
Suction pressure (Absolute)	Rated(bar) Oil viscosity ⩽ 30mm²/s	1		
	Peak(bar)	5		
Case oil filling volume （L）		0.3	0.6	0.8
Oil viscosity （mm²/s）		10~1000, optimal range 16~36		
Oil temperature （℃）		-20~100		
Oil cleanliness		20/18/15 (ISO 4406) and above		
Weight （kg） Without auxiliary flange		19	20	24

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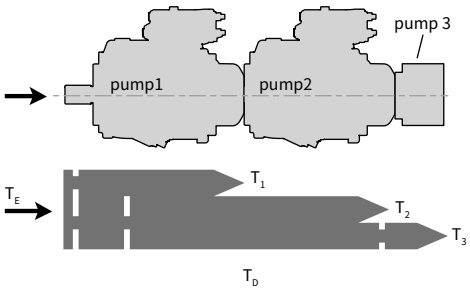
·Theoretical Calculation

Flow	$Q=\frac{V_g \cdot n \cdot \eta_v}{1000}$ （L/min）	V_g	= Displacement （cc/rev）
		Δp	= Pressure （bar）
Torque	$T=\frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}}$ （N·m）	n	= Speed （rpm）
		η_v	= Volume efficiency
Power	$P=\frac{2\pi \cdot T \cdot n}{60000}=\frac{Q \cdot \Delta p}{600 \cdot \eta_t}$ （kW）	η_{mh}	= Mechanical-hydraulic efficiency
		η_t	= Total efficiency （$\eta_t=\eta_v \cdot \eta_{mh}$）

Technical Data

Permissible input torque and through-drive torque					
Size			45	63	85
Torque (At $V_{g\,max}$ and P_{nom}) N·m		T	150	210	284
Max.input torque of the drive shaft (N·m)					
ANSI B92.1	7/8 in 13T 16/32DP	$T_{E\,max}$	250	250	
	1 in 15T 16/32DP	$T_{E\,max}$	272		400
	1 1/4 in 14T 12/24DP	$T_{E\,max}$			552
Max.through-drive torque (N·m)		$T_{D\,max}$	74	171	272

·Torque Distribution



Pump 1	T_1
Pump 2	T_2
Pump 3	T_3
Input torque	$T_E = T_1+T_2+T_3$
	$T_E < T_{E\,max}$
Through-drive torque	$T_D = T_2+T_3$
	$T_D < T_{D\,max}$

Type introduction

HP5VS	45	/	B	V	00	R	B2S1	MA	DR	S
①	②		③	④	⑤	⑥	⑦	⑧	⑨	⑩

Product series

①	Swash plate variable piston pumps, single pump, open circuit	HP5VS

Size

②	Size	18	28	35

Design series

		45	63	85	Code
③	High speed unboost（Without filter）	●	●	●	B
	High speed boost（With filter）	●	●		C

Note: "*" is only available for right rotation at present.

Seal

		45	63	85	Code
④	FKM （Fluoro rubber: DIN ISO 1629）	●	●	●	V
	NBR （Nitrile rubber: DIN ISO 1629）	●	●	●	N

Note：Temperature range 07/22.

Through drive

			45		63		85	
			Without boost pump	With boost pump	Without boost pump	With boost pump	Without boost pump	代号
⑤	Without through shaft drive, flange ports on both sides		●	●		●	●	00
	Without through shaft drive, rear flange ports		●		●		●	N1
	Without through shaft drive, rear thread ports				●			N2
	Mounting flanges	Through shaft splines						
	SAE A J744-82-2	ANSI B92.1 5/8 in 9T 16/32DP			●		●	A1
		ANSI B92.1 3/4 in 11T 16/32DP	●					A2

Clockwise

		18	28	35	Code
⑥	CW	●	●	●	R
	CCW	●	●	●	L

Note: view from shaft end.

Type introduction

Input mounting flange

⑦	Mounting flange	Input shaft	45	63	85	Code
	SAE B J744-101-2	ANSI B92.1 7/8 in 13T 16/32DP	●	●		B2S1
		ANSI B92.1 1 in 15T 16/32DP	●		●	B2S2
		ANSI B92.1 1 1/4 in 14T 12/24DP			●	B2S3

Working port

⑧	Inlet and outlet flange connection thread	Port type	45	63	85	Code
	Metric Thread	UNF Thread	●	●	●	MA
		Metric Thread			●	MM

Control type

⑨		45	63	85	Code
	Pressure cut-off	●	●	●	DR
	Pressure cut-off + Load sensitive	●	●	●	L1
	Pressure cut-off + Load sensitive + Throttling unloading	●	●	●	L0

Standard / special version

⑩		45	63	85	Code
	Standard version	●	●	●	None
	Special version	○	○	○	S

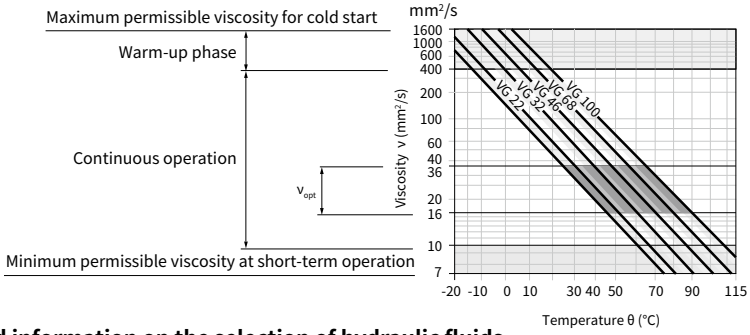
Remark: ● = available; ○ = On request;

Hydraulic fluid

Viscosity and temperature of the hydraulic fluid

	Viscosity(mm^2/s)	Oil seal	Temperature	Note
Cold start	$v_{max} \leqslant 1600$	NBR	$\theta_{St} \geqslant -40°C$	t ⩽ 3 minutes, no load(p ⩽ 50bar), n ⩽ 1000rpm, Maximum permissible temperature difference between the rotating parts of the system and the hydraulic fluid 25° C.
		FKM	$\theta_{St} \geqslant -25$ °C	
Warm-up phase	v = 1600 ⋯ 400			t ⩽ 15 minutes, $p \leqslant 0.7 \times p_{nom}$, $n \leqslant 0.5 \times n_{nom}$
Continuous operation	v = 400 ⋯ 10	NBR	θ ⩽ +85 °C	Measured at oil port T
		FKM	θ ⩽ +110°C	
	v_{opt} = 36 ⋯ 16			Optimum operating viscosity and efficiency range
Short-term operation	v_{min} = 10 ⋯ 7	NBR	θ ⩽ +85°C	t ⩽ 3 minutes, $p \leqslant 0.3 \times p_{nom}$, Measured at oil port T
		FKM	θ ⩽ +110°C	

Selection chart



Detailed information on the selection of hydraulic fluids

To select the hydraulic fluid correctly, it is necessary to know the operating temperature in relation to the ambient temperature: in open circuits the tank temperature.
When selecting a hydraulic fluid, the operating viscosity should be in the optimum range for the operating temperature range (v_{opt} see shaded area of the selection chart). We recommend selecting a higher viscosity grade in all cases.
Example: When the operating temperature in the circuit is 60° C, in the optimum operating viscosity range (shaded area of the v_{opt}), corresponding to viscosity grades VG46 or VG68; VG68 should be selected.

Caution

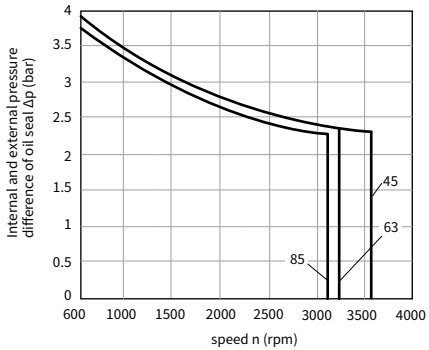
The case drain temperature (influenced by pressure and speed) may be higher than the oil line temperature or tank temperature.
However, the temperature of any part of the component must not exceed 100° C.

Hydraulic fluid

Filtration of hydraulic fluid

Finer filtration improves the cleanliness of the hydraulic fluid, thereby extending the life of rotating parts. A cleanliness of at least 20/18/15 (ISO 4406) should be maintained. When the viscosity of the hydraulic fluid is less than 10mm²/s (e.g. due to high temperatures during short-term operation, a cleanliness level of at least 19/17/14 (ISO 4406) is required.

Oil seals



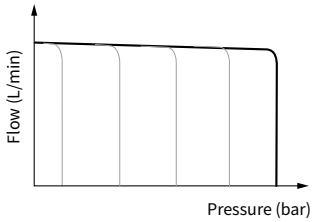
▲ Note

When using mineral oil based hydraulic fluid, refer to the left diagram for the range of pressures used for oil seals, please contact us if other hydraulic fluids are used.

The service life of the oil seal is affected by the rotational speed and the pressure difference between the inside and outside of the seal, in addition to the hydraulic oil and temperature.

The pressure difference between the inside and outside of the seal must be greater than or equal to zero.

Control module function introduction



Pressure cut-off control

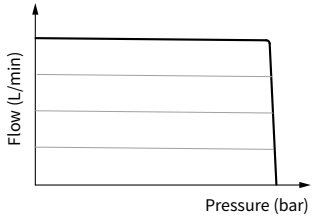
Function introduction

The pressure cut-off control is used to limit the maximum pressure of the main pump, which provides the flow required by the load at the set pressure. When the outlet pressure reaches the set value, the main pump displacement starts to decrease, keeping the pump outlet pressure constant.

Adjustment range

Standard setting: 250bar

Adjustable range: 50~250bar(Maximum not exceeding rated pump pressure)



Load-sensitive control

Function introduction

Load-sensitive control senses the differential pressure between the main pump outlet and the load side. When the differential pressure reaches the set value, the main pump displacement starts to decrease, keeping the pump differential pressure constant.

Adjustment range

Standard setting: 15bar

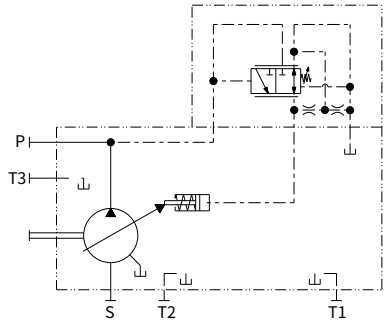
Adjustable range: 10bar~25bar(Please contact Hengli if you exceed this range)

Hydraulic connection

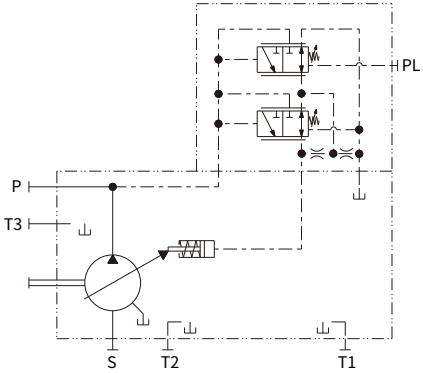
If the piping from the control port to the main valve does not have sufficient unloading capacity, an unloading function can be added to the pump control valve, please specify when ordering.

Control module function symbols*

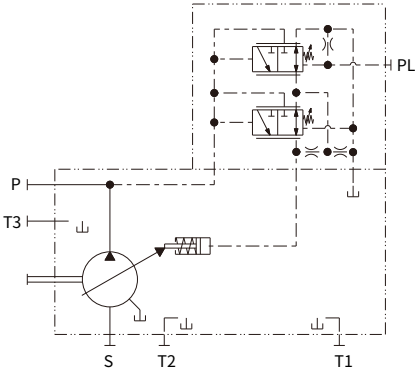
DR
Pressure cut-off



L1
Pressure cut-off + Load sensitive



L0
Pressure cut-off + Load sensitive +
Throttling unloading



Note: "*" is used as an example for non turbocharged models.

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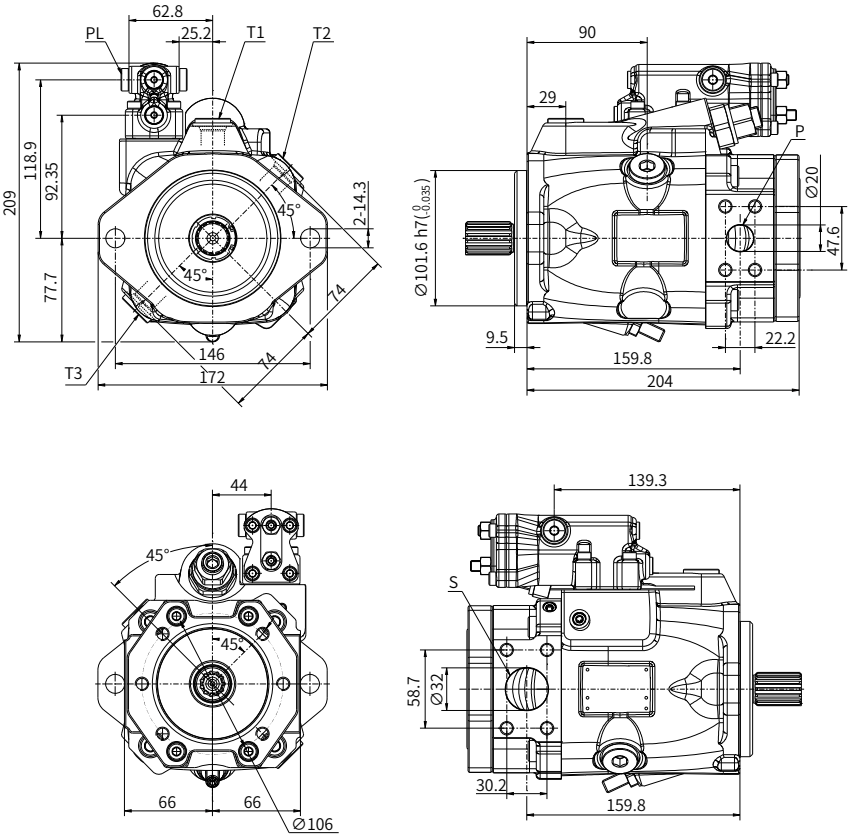
Installation size

HP5VS45 (Without boost pump) installation dimension

· HP5VS45/BVA2LB2S2MAL1 as an example



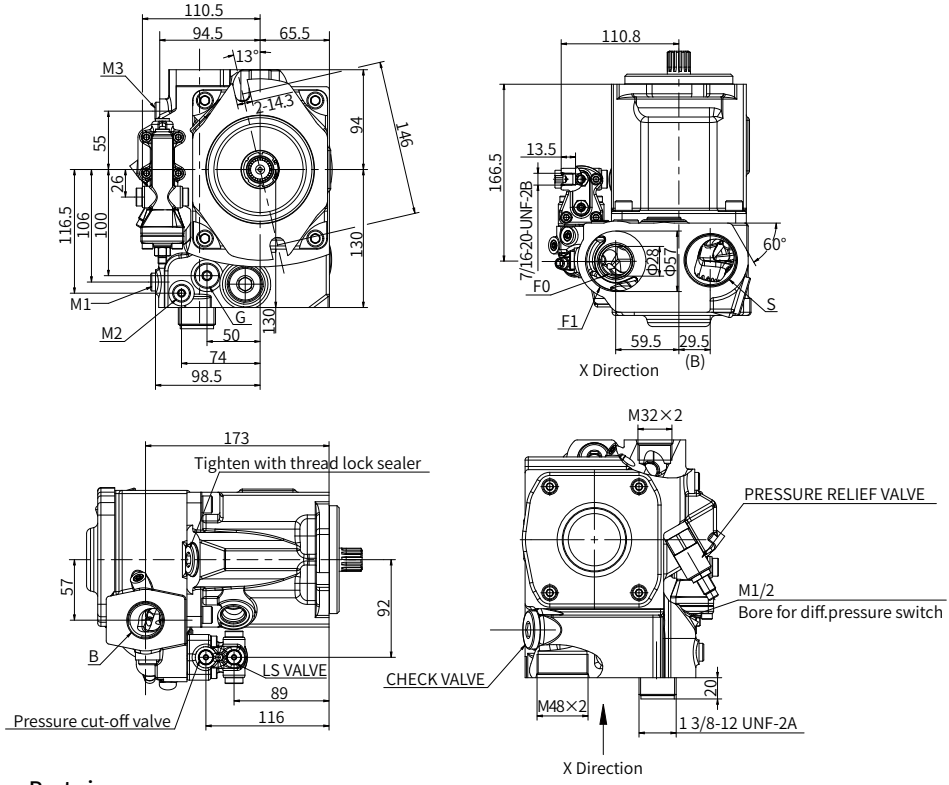
Port size

Port	Port name	Standard	Port size(Thread depth)	Max.pressure(bar)
P	Working port	SAE J518C	1 in M10×1.5(Thread depth 17mm)	250
S	Suction port	SAE J518C	1-1/4 in M10×1.5(Thread depth 17mm)	5
T1/T2/T3	Drain port	ISO 11926-1	3/4-16UNF(Thread depth 13mm)	4
PL	LS Control port	ISO 11926-1	7/16-20UNF(Thread depth 11.5mm)	250

Installation size

HP5VS45 (With boost pump) installation dimension

·HP5VS45/CV00RB2S1MAL1 as an example



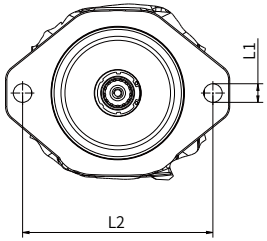
Port size

Port	Port name	Standard	Port size(Thread depth)	Max. pressure(bar)
P	Working port	ISO 6149	M33×2(Thread depth 19mm)	250
S	Suction port	ISO 6149	M48×2(Thread depth 22mm)	5
L	Drain port	ISO 6149	M22×1.5(Thread depth 13mm)	4
X	LS Control port	ISO 11926-1	7/16-20UNF(Thread depth 11.5mm)	250
G	External interface	ISO 6149	M18×1.5(Thread depth 15mm)	6
M1/M2/M3	Pressure measuring port	ISO 6149	M12×1.5(Thread depth 11.5mm)	250
M1/2	Differential pressure switch	ISO 11926-1	9/16-18UNF(Thread depth 9.5mm)	250

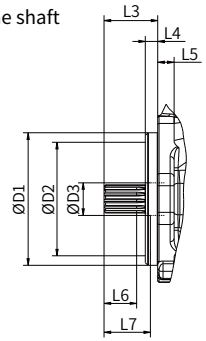
Installation size

HP5VS45 mounting flange and input shaft dimensions

·B2 Flange



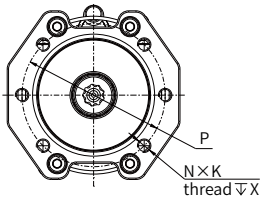
·Spline shaft

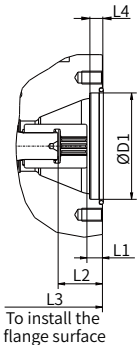


Code	L1	L2	L3	L4	L5	L6	L7	D1	D2	D3
B2S1	14.3	146	28.5	9.5	12.5	25	35.5	101.6	87	25
B2S2			46			33	38			

HP5VS45 through drive dimensions

·A2



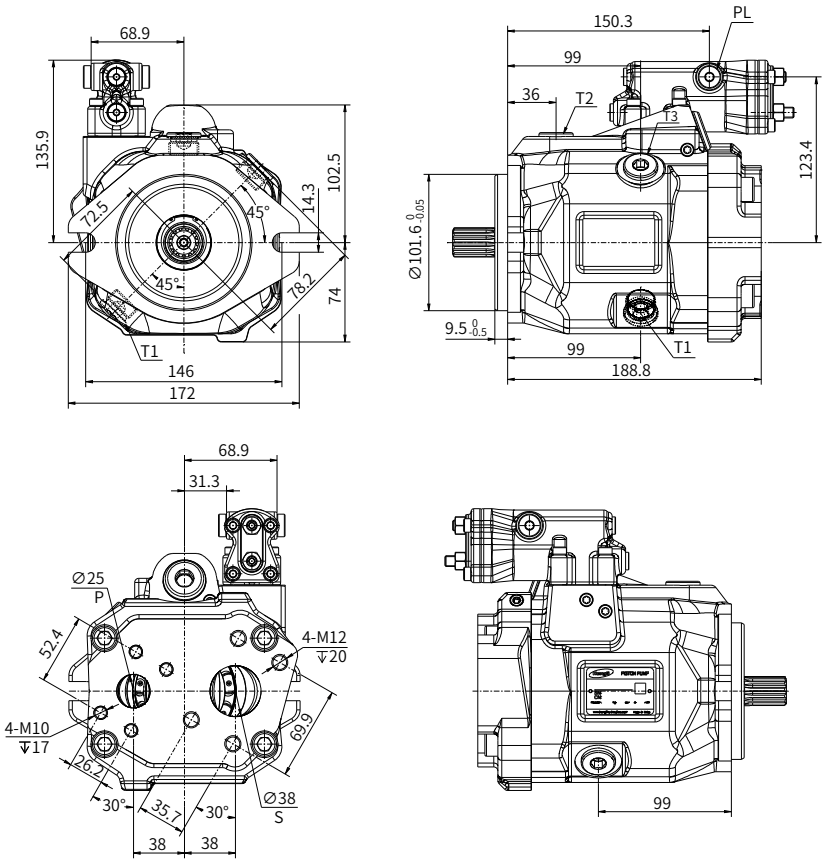


Code	N	K	X	P	D1	L1	L2	L3	L4
A2	**6**	**M10**	**18**	**106**	**82.55**	**15.5**	**43.3**	**204**	**10**

Installation size

HP5VS63 (Without boost pump) installation dimension

· HP5VS63/AVN1LB2S1MAL1 as an example



Port size

Port	Port name	Standard	Port size(Thread depth)	Max.pressure(bar)
P	Working port	SAE J518C	1 in M10×1.5(Thread depth 17mm)	250
S	Suction port	SAE J518C	1 1/2 in M12×1.75(Thread depth 20mm)	5
T1/T2/T3	Drain port	ISO 11926-1	7/8-14UNF(Thread depth 18mm)	4
PL	LS Control port	ISO 11926-1	7/16-20UNF(Thread depth 11.5mm)	250

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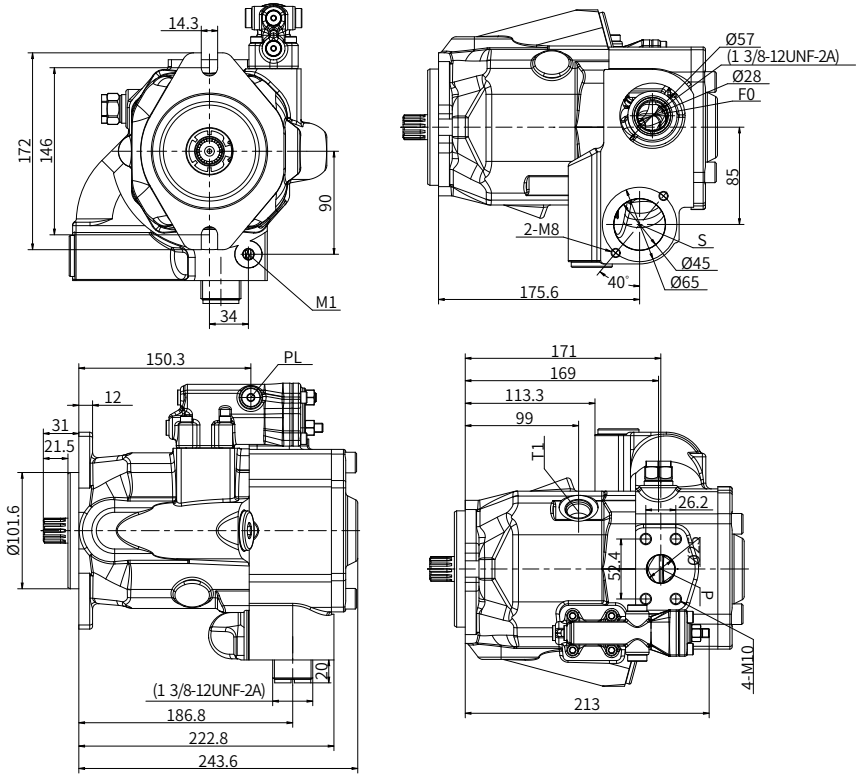
Installation size

HP5VS63 (With boost pump) installation dimension

· HP5VS63/CV00RB2S1MAL1 as an example



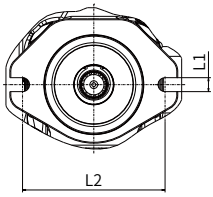
Port size

Port	Port name	Standard	Port size(Thread depth)	Max. pressure(bar)
P	Working port	SAE J518C	1 in M10×1.5(Thread depth 17mm)	250
S	Suction port	-	Ø45mm M8×1.25(Thread depth 13mm)	5
T1/T2/T3	Drain port	ISO 11926-1	7/8-14UNF(Thread depth 18mm)	4
PL	LS Control port	ISO 11926-1	7/16-20UNF(Thread depth 11.5mm)	250
G1	Lubricating port	-	Ø24mm M8×1.25(Thread depth 13mm)	5
M1	Pressure measuring port	ISO 9974-1	M10×1(Thread depth 9mm)	6
F0	Filter outlet	ISO 11926-1	1 3/8-12UNF(Thread depth 11.5mm)	6

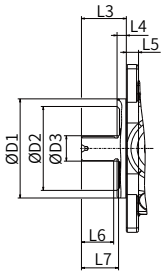
Installation size

HP5VS63 mounting flange and input shaft dimensions

·B2 Flange



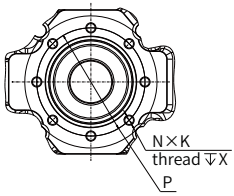
·Spline shaft

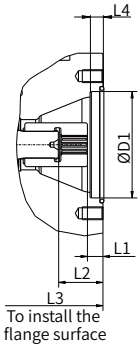


Code	L1	L2	L3	L4	L5	L6	L7	D1	D2	D3
B2S1	14.3	146	31	9.5	12	15	21.5	101.6	87	21.8

HP5VS63 through drive dimensions

·A1





Code	N	K	X	P	D1	L1	L2	L3	L4
A1	**8**	**M10**	**16**	**106.4**	**82.55**	**9.2**	**39**	**229**	**11**

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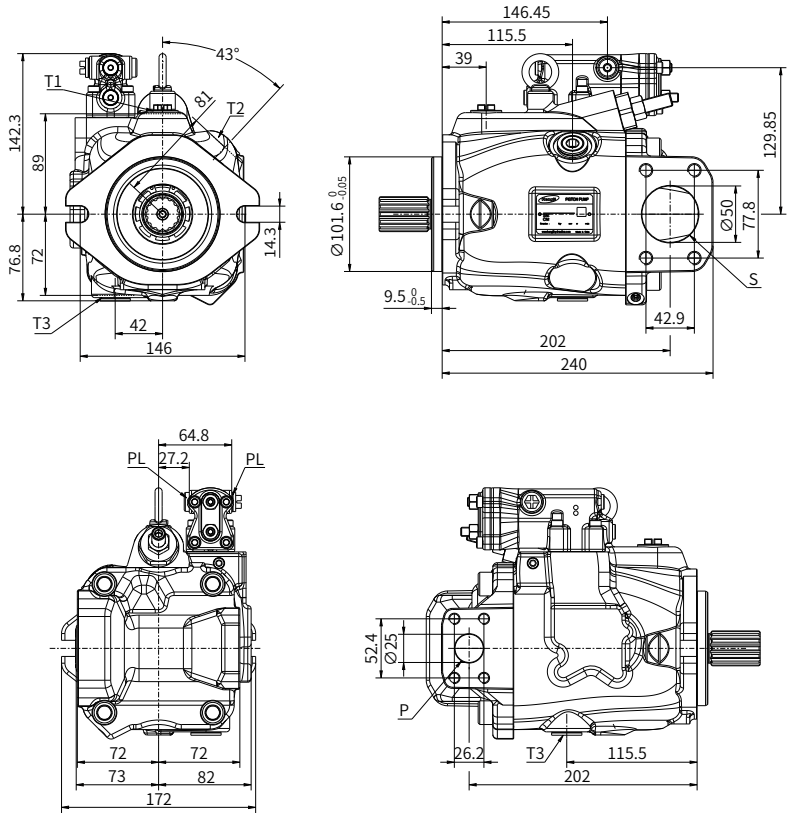
Installation size

HP5VS85 (Without boost pump) installation dimension

· HP5VS85/BV00RB2S3MML1 as an example



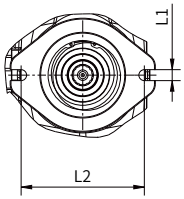
Port size

Port	Port name	Standard	Port size(Thread depth)	Max.pressure(bar)
P	Working port	SAE J518C	1 in M10×1.5(Thread depth 17mm)	250
S	Suction port	SAE J518C	2 in M12×1.75(Thread depth 20mm)	5
T1/T2/T3	Drain port	ISO 11926-1	M22×1.5(Thread depth 15.5mm)	4
PL	LS Control port	ISO 11926-1	M22×1.5(Thread depth 11.5mm)	250

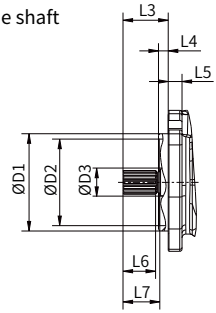
Installation size

HP5VS85 mounting flange and input shaft dimensions

·B2 Flange



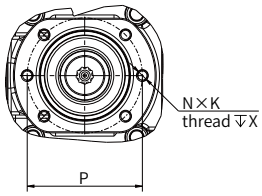
·Spline shaft

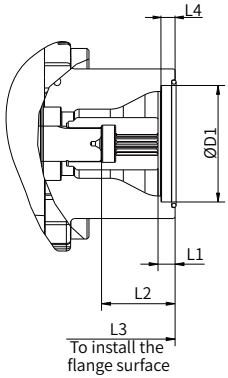


Code	L1	L2	L3	L4	L5	L6	L7	D1	D2	D3
B2S2	14.3	146	45.9	9.5	15	29	42.5	101.6	87	34.91
B2S3			56			43	48			

HP5VS85 through drive dimensions

·A1





Code	N	K	X	P	D1	L1	L2	L3	L4
A1	6	M10	16	106.4	82.55	12.1	52.4	255	10

Installation type

Installation instructions

During commissioning and operation, the plunger pump must always be filled with hydraulic oil and purged of air. After prolonged periods of inactivity, the above precautions must also be observed, as the plunger pump may drain hydraulic oil back to the tank through the hydraulic lines. Particularly when the drive shaft is in a vertical orientation (facing upward or downward), complete filling and thorough venting are essential; otherwise, risks such as dry running may occur.

The plunger pump must be drained through the highest installed port among the three available drain ports: T1, T2, and T3.

When multiple plunger pumps operate together, each pump must be connected to a drain line. If a common drain line is used, ensure that the line pressure does not exceed the case pressure of any pump. If pressure differences exist between the drain ports of individual pumps, the drain line must be adjusted to ensure that under no circumstances does the drain pressure exceed the permissible case pressure of all pumps. If this cannot be achieved, separate drain lines should be installed.

To suppress noise generation, different lines should be isolated using elastic elements, and mounting the plunger pump directly on the oil tank should be avoided. Under all operating conditions, the suction and drain lines must extend below the minimum submerged depth in the oil tank. When the plunger pump is mounted above the oil tank, the height (hs) from the pump’s suction port to the highest oil level in the tank must not exceed 800 mm. During operation, including cold starts, the minimum suction pressure at the suction port must not fall below 0.8 bar (absolute pressure).

When designing the oil tank, ensure sufficient distance between the suction line and the case drain line. Prevent heated return flow from being directly drawn back into the suction line.

Under certain installation conditions, gravity, hydraulic oil, and case pressure may cause slight variations in control characteristics and alter response times.

Symbol definitions and notes

Symbol	
R	Filling / Air bleeding
S	Suction port
T1/T2/T3	Drain port
DB	Baffle plate
$h_{t\ min}$	Minimum required depth of immersion depth (200mm)
h_{min}	Minimum distance required to the bottom (100mm)
$h_{ES\ min}$	Minimum height required to prevent piston unit from draining (25mm)
$h_{s\ max}$	Maximum permissible suction height (800mm)

Note： The oil port R is part of the external pipework and must be supplied by the customer to make filling and venting easier.

Please refer to the following examples: Figure 1 to Figure 15.

Other installation positions are available upon request.

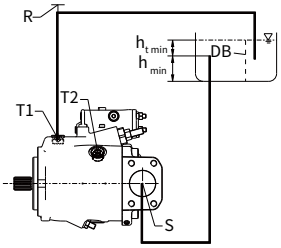
Recommended installation positions: 1 and 3.

Installation type

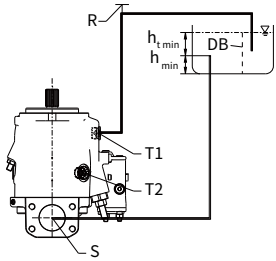
Mounting under tank (Standard)

Under tank mounting means that the piston pump is mounted outside the tank, below the lowest oil level.

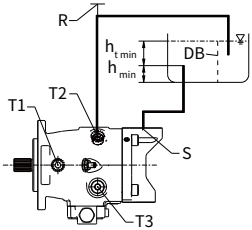
· **Figure 1**
Air bleed：R
Filling：T1 or T2



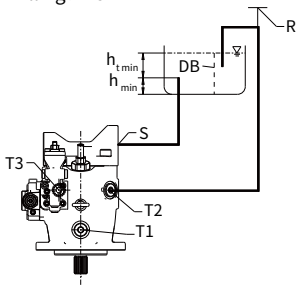
· **Figure 2***
Air bleed：R
Filling：T1



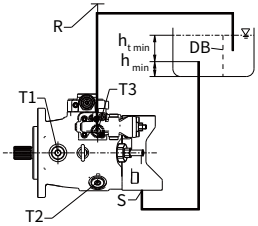
· **Figure 3**
Air bleed：R
Filling：T2



· **Figure 4**
Air bleed：R
Filling：T3



· **Figure 5**
Air bleed：R
Filling：T3



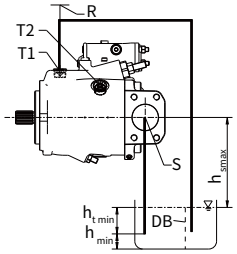
Note："*""As the pump cannot be fully vented and oiled in this position, it should be vented and oiled in a horizontal position before installation.

Installation type

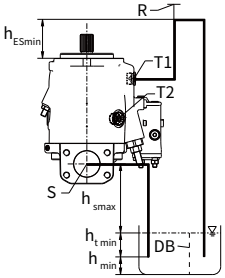
Mounting above tank

Mounting above the tank means that the piston pump is mounted above the lowest level of the tank and that the difference in height, $h_{ES\,min}$, must be at least 25 mm in order to prevent the piston pump from emptying out in Fig. 7. Observe the maximum permissible suction height, $h_{s\,max}$ = 800 mm. The use of check valves in the drain line is only permitted in individual cases. Information can be obtained by contacting Hengli.

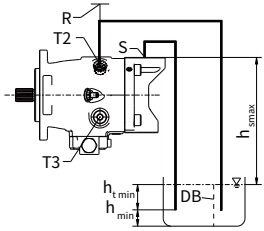
· **Figure 6**
Air bleed：R
Filling：T1 or T2



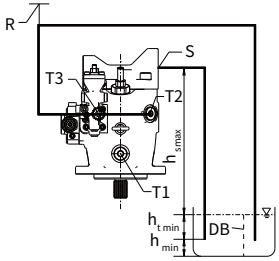
· **Figure 7***
Air bleed：R
Filling：T1



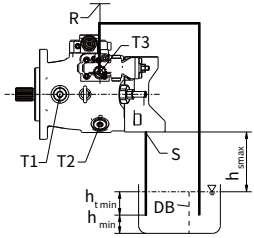
· **Figure 8**
Air bleed：R
Filling：T2



· **Figure 9***
Air bleed：R
Filling：T2



· **Figure 10**
Air bleed：R
Filling：T3



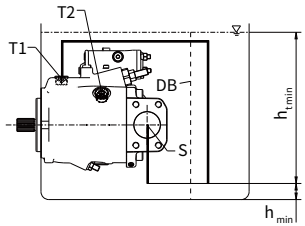
Note："*""As the pump cannot be fully vented and oiled in this position, it should be vented and oiled in a horizontal position before installation.

Installation type

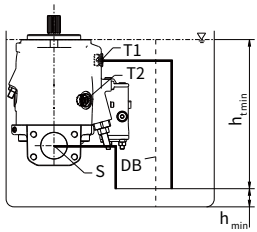
In-tank mounting

In-tank mounting means that the axial piston pump is mounted in the tank, below the lowest oil level. The axial piston pump is completely below the hydraulic oil. If the minimum oil level is equal to or lower than the upper edge of the pump, see section "Mounting above the tank". Piston pumps with electrical components (e.g. electronic controllers, sensors) cannot be mounted below the oil level in the tank.

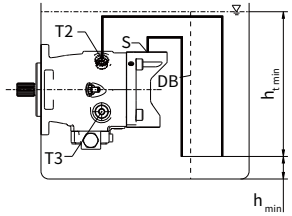
· **Figure 11**[*]
Air bleed: Through the highest available port T1



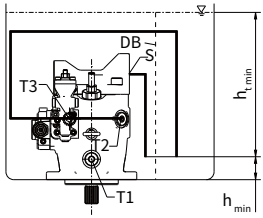
· **Figure 12**[*]
Air bleed: Through the highest available port T1



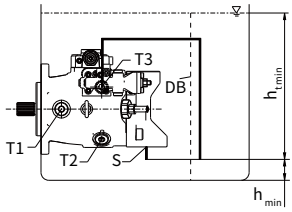
· **Figure 13**[*]
Air bleed: Through the highest available port T2



· **Figure 14**[*]
Air bleed: Through the highest available port T3



· **Figure 15**[*]
Air bleed: Through the highest available port T3



Note: "*"As the position is below the hydraulic oil level, oil filling is carried out automatically via the open ports T1,T2 or T3.

Instructions

Rules of use

△ This fluid technology product leaves the factory in a technically safe and perfect condition. In order to maintain this condition and ensure safe operation, the user must observe the instructions and warnings contained in this document.

△ The fluid technology products may only be installed and integrated into hydraulic systems by qualified specialists who have knowledge of and observe the general standards for this technology. In addition, it must be ensured, if necessary, that the selected product is suitable for its specific application and meets environmental and legal requirements.

△ The products may only be used as pumps in hydraulic systems.

△ The products must operate within the specified technical parameters.

Tips for use

The hydraulic components are to be integrated into the unit with the aid of commercially available, compliant connecting elements (bolted connections, hoses, pipes...). Before dismantling, stop the hydraulic system as specified (especially in the case of equipment with hydraulic accumulators).