Axial Piston Variable Pump
HP2VC Series 3*

Size:：56-180 mL/r
Rated pressure：40 MPa
Max. pressure：45 MPa

Features

- Axial variable pump in swashplate design for hydrostatic drives in closed circuits
- The flow is proportional to the drive speed and displacement and is infinitely varied
- The output flow increases from zero to the maximum value as the swashplate swivels
- The flow direction changes when the swashplate is moved through the neutral position
- Various mutually compatible control options to provide diverse control and regulation functions
- Two pressure relief valves on each high-pressure side to prevent overloading of hydrostatic drives (pump and motor)
- Pressure relief valve with boost function
- Integrated boost pump works as the boost and control pump
- Maximum boost pressure limited by integrated boost-pressure relief valve
- With integrated pressure cut-off valve as standard

Contents

Model Code

	c	A	B	C	D	E	F	G	H		I	K		M	N	P	R	S	T	U	X		Z
HP2V	C								1	/	3*		-									-	

Axial piston unit

–	Swashplate design, variable closed circuits	HP2V

Operation

		56	63	71	125	135	145	180	
c	Closed circuit	●	●	●	●	●	●	●	C

Displacement

A	Geometric displacement, in mL/r	56	63	71	125	135	145	180	

Variable control method

					56	63	71	125	135	145	180	
B	Hydraulic control	Pilot pressure control	Without inlet filtration		●	●	●	●	●	○	●	HD1
			With inlet filtration		●	●	●	●	●	○	●	HD3
		Mechanical servo			●	●	●	●	●	○	○	HW
	Electric control	With proportional solenoid	Without inlet filtration	U=12V DC	●	●	●	●	●	○	●	EP1
				U=24V DC	●	●	●	●	●	○	●	EP2
			With inlet filtration	U=12V DC	●	●	●	●	●	○	○	EP3
				U=24V DC	●	●	●	●	●	○	○	EP4
		With switching solenoid	Without inlet filtration	U=12V DC	●	●	●	○	○	○	○	EZ1
				U=24V DC	●	●	●	●	●	○	○	EZ2
			With inlet filtration	U=12V DC	○	○	○	○	○	○	○	EZ3
				U=24V DC	○	○	○	●	●	○	○	EZ4

Brake valve

				56	63	71	125	135	145	180	
C	Without brake valve (without code)			●	●	●	●	●	○	○	
	only for HW control valve on the HW valve body	NO	U=12V DC	○	○	○	○	○	○	○	O1
			U=24V DC	●	●	●	○	○	○	○	O2
		NC	U=12V DC	○	○	○	○	○	○	○	C1
			U=24V DC	●	●	●	○	○	○	○	C2
	all control valve on the back cover	NO	U=12V DC	—	—	—	—	—	—	—	O3
			U=24V DC	—	—	—	—	—	—	—	O4
		NC	U=12V DC	—	—	—	—	—	—	—	C3
			U=24V DC	—	—	—	—	—	—	—	C4

Model Code

	c	A	B	C	D	E	F	G	H		I	K		M	N	P	R	S	T	U	X		Z
HP2V	C								1	/	3*		-									-	

Neutral position switch(only for HW control)

		56	63	71	125	135	145	180	
D	Without neutral position switch (without code)	●	●	●	●	●	○	○	
	With neutral position switch (with DEUTSCH molded connector)	●	●	○	●	●	○	○	L

Pressure cut-off valve

		56	63	71	125	135	145	180	
E	Without pressure cut-off valve (without code)	●	●	●	●	●	○	●	
	With pressure cut-off valve	●	●	●	●	●	○	●	D

Stroke limiter

		56	63	71	125	135	145	180	
F	Without mechanical stroke limiter (without code)	●	●	●	●	●	○	●	
	With mechanical stroke limiter, externally adjustable	●	●	●	●	●	○	●	M

Stroking chamber pressure port(X_3/X_4)

		56	63	71	125	135	145	180	
G	Without port X_3/X_4 (without code)	●	●	●	●	●	○	●	
	With port X_3/X_4	●	●	●	●	●	○	●	T

DA control valve

		56	63	71	125	135	145	180	
H	Without DA control valve	●	●	●	●	●	○	●	1

Series

		56	63	71	125	135	145	180	
I	Series 3*	●	●	●	●	●	○	●	3*

Direction of rotation (viewed on drive shaft)

		56	63	71	125	135	145	180	
K	CW (right-hand)	●	●	●	●	●	○	●	R
	CCW (left-hand)	●	●	●	●	●	○	●	L

Sealing material

		56	63	71	125	135	145	180	
M	NBR seal + FKM Shaft seal	●	●	●	●	●	○	●	N
	NBR seal + NBR Shaft seal	●	●	●	●	●	○	●	P
	FKM seal + FKM Shaft seal	●	●	●	●	●	○	●	V

Model Code

	c	A	B	C	D	E	F	G	H		I	K		M	N	P	R	S	T	U	X		Z
HP2V	C								1	/	3*		-									-	

Drive shaft

			56	63	71	125	135	145	180	
N	Splined shaft DIN 5480	For single pump	●	●	●	●	●	○	●	Z
		For the 1st pump of a combination pump	●	●	●	●	●	○	○	A
	Splined shaft ANSI B92.1-1976	For single pump	●	●	●	●	●	○	●	S
		For single pump,With connecting flange	●	●	○	○	○	○	○	L
		For the 1st pump of a combination pump	●	●	●	●	●	○	●	T

Mounting flange

		56	63	71	125	135	145	180	
P	2-hole,SAE J744	●	●	—	—	—	—	—	C
	4-hole,SAE J744	—	—	—	—	—	—	●	D
	2+4-hole,SAE J744	—	—	●	●	●	○	—	F

Working ports (viewed on drive shaft)

			56	63	71	125	135	145	180	
R	Ports at opposite sides	Suction port downwards	●	●	●	●	●	○	●	02
		Suction port upwards	●	●	●	●	●	○	●	03
	Ports at same side	Suction port downwards, working port leftwards	○	○	○	○	○	○	○	10
		Suction port upwards, working port rightwards	○	○	○	○	○	○	○	13

Boost pump and through drive

			Splined shaft ANSI B92.1		56	63	71	125	135	145	180	
S	Integrated boost pump	Without through drive			●	●	●	●	●	○	○	F00
		Flange SAE J 744-82-2(A)	5/8″	9T 16/32DP	●	●	●	●	●	○	●	F01
		Flange SAE J 744-101-2(B)	7/8″	13T 16/32DP	●	●	●	●	●	○	●	F02
			1″	15T 16/32DP	●	●	●	●	●	○	●	F04
		Flange SAE J 744-127-2(C)	1 1/4″	14T 12/24DP	●	●	●	●	●	○	○	F07
		Flange SAE J 744-152-2(D)	1 3/4″	13T 8/16DP	○	○	○	●	●	○	●	F69
		Flange SAE J 744-165-2(E)	1 3/4″	13T 8/16DP	○	○	○	○	○	○	●	F72
	Without integrated boost pump	Without through drive			●	●	●	●	●	○	●	N00
		Flange SAE J 744-82-2(A)	5/8″	9T 16/32DP	●	●	●	●	●	○	●	K01
		Flange SAE J 744-101-2(B)	7/8″	13T 16/32DP	●	●	●	●	●	○	●	K02
			1″	15T 16/32DP	●	●	●	●	●	○	●	K04
		Flange SAE J 744-127-2(C)	1 1/4″	14T 12/24DP	●	●	●	●	●	○	●	K07
		Flange SAE J 744-152-2(D)	1 3/4″	13T 8/16DP	○	○	○	●	●	○	●	K69
		Flange SAE J 744-165-2(E)	1 3/4″	13T 8/16DP	○	○	○	○	○	○	●	K72

Model Code

	c	A	B	C	D	E	F	G	H		I	K		M	N	P	R	S	T	U	X		Z
HP2V	C								1	/	3*		-									-	

High-pressure relief valve

				56	63	71	125	135	145	180	
T	With high-pressure relief valve, pilot operated	10-42MPa	With bypass	—	—	●	●	●	○	●	1
	With high-pressure relief valve, direct operated, fixed setting	35-45MPa	Without bypass	●	●	—	—	—	—	—	2
			With bypass	●	●	—	—	—	—	—	6
		25-34MPa	Without bypass	●	●	—	—	—	—	—	3
		10-24MPa	Without bypass	●	●	—	—	—	—	—	4
		10-34MPa	With bypass	●	●	—	—	—	—	—	5

Filtration[1)]

		56	63	71	125	135	145	180	
U	Integrated filter, without cold start valve, without contamination indicator	●	●	●	○	○	○	○	A
	Integrated filter, with cold start valve, without contamination indicator	●	●	●	○	○	○	○	F*
	Integrated filter, without cold start valve, with window type contamination indicator	●	●	●	○	○	○	○	G
	Integrated filter, with cold start valve, with electrical signals contamination indicator	○	○	○	○	○	○	○	B*
	Integrated filter, with cold start valve, with window type contamination indicator	●	●	●	●	●	○	○	P*
	External suction filter (not included in delivery, to be selected by customer)	●	●	●	●	●	○	●	S
	External pressure filter (not included in delivery, to be selected by customer)	●	●	●	●	●	○	●	D
	External fluid supply (optional, only for N00, K**)	●	●	●	●	●	○	●	E

Solenoid connector

		56	63	71	125	135	145	180	
X	Without solenoid (without code)	●	●	●	●	●	○	●	
	DEUTSCH molded connector, 2-pin, without suppressor diode[2)]	●	●	●	●	●	○	●	P

Special configuration

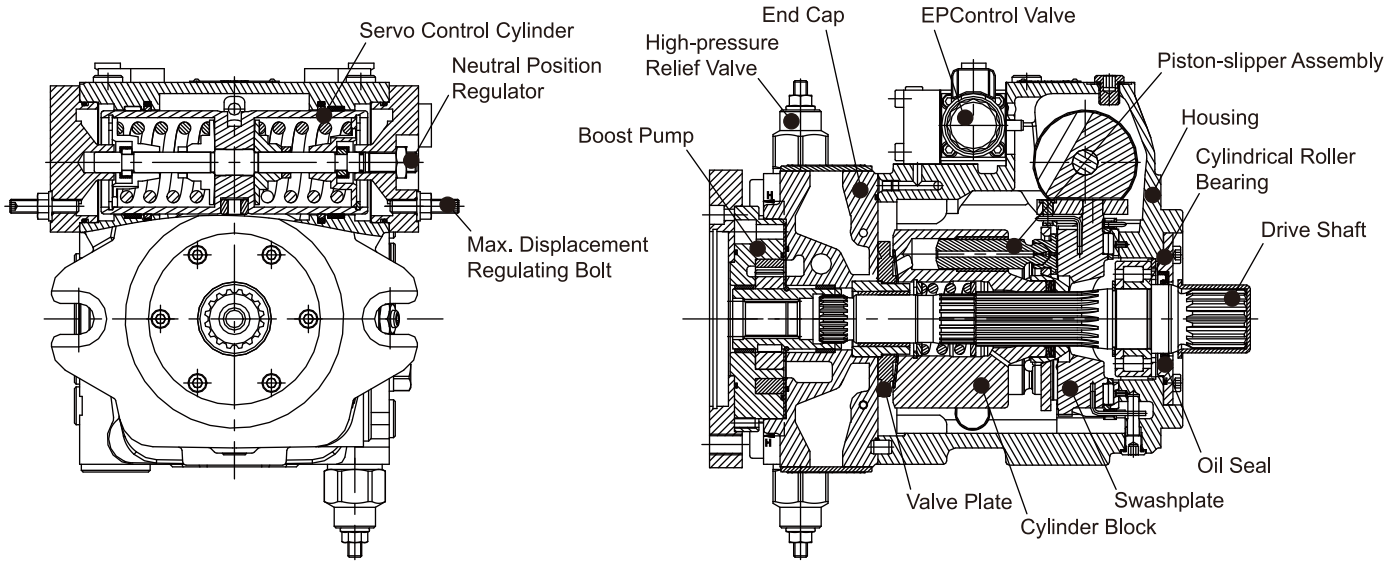
		56	63	71	125	135	145	180	
Z	Without special configuration(without code)	●	●	●	●	●	○	●	
	Special configuration	○	○	○	○	○	○	○	***

1) Filter: F/B/P opposite ports are available.

2) Connector model: Deutsch DT04-2p (for HWO/HWC/EP/EZ control).

● Available ○ On request — Not available ▭ Recommended model

Structure


Servo Control Cylinder
Neutral Position Regulator
Max. Displacement Regulating Bolt
End Cap
EPControl Valve
High-pressure Relief Valve
Piston-slipper Assembly
Housing
Boost Pump
Cylindrical Roller Bearing
Drive Shaft
Oil Seal
Valve Plate
Swashplate
Cylinder Block

Hydraulic Fluid

Mineral oil

Working Viscosity

In order for the optimum efficiency and service life, it is recommended to select the working viscosity at working temperature within the range below:

V_{opt}= optimal working viscosity 16...36 mm^2/s

It is subject to the temperature of a closed circuit.

Limit Viscosity

Limit viscosity：

V_{min}=5mm^2/s

Short-term operation(t＜3min)

Permissible maximum temperature t_{max}=+115℃

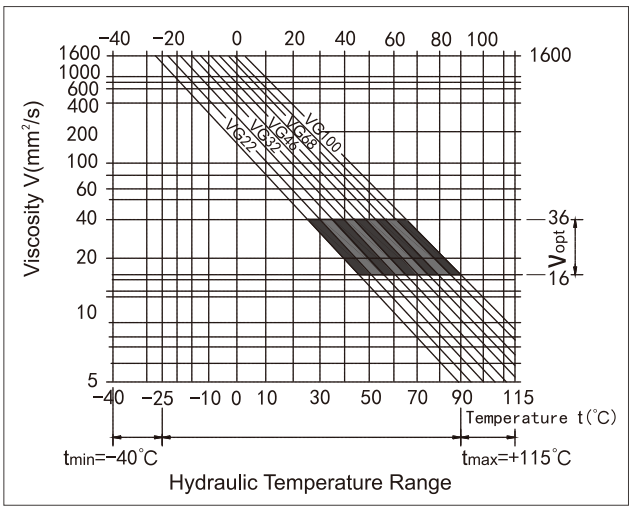
V_{max}=1600mm^2/s

Short-term operation(t＜3min)

Cold start(p≤3Mpa，n≤1000rpm，t_{min}=-40℃)

Only for no-load start, it must reach the optimum working temperature in 15 min.

Selection Diagram



Instructions on Selection of Hydraulic Fluid

The working temperature dependent on the ambient temperature is required for correct selection of hydraulic fluid. It refers to the circuit temperature of a closed circuit and the reservoir temperature of an open circuit.

The hydraulic fluid should be so selected that the working viscosity in the working range is within the optimum range (V_{opt} ,the shaded area on the selection diagram). The higher viscosity is recommended under the same conditions.

For example:

At an ambient temperature of X ℃, the working temperature of the circuit is 60 ℃. The viscosity within the optimum range (V_{opt} ,shaded area) is VG46 or VG68 and the latter should be selected.

Note:

The case drain temperature depends on the pressure and speed, and it is always higher than the circuit temperature. The temperature at any point within the system should not exceed +115 ℃. Please contact us if the above condition cannot be maintained due to extreme working conditions.

Filtration

Finer filtration improves the cleanliness level of the hydraulic fluid, thus increasing the service life of the axial piston unit. To ensure normal operation of the axial piston unit, a cleanliness level of at least 20/18/15 according to ISO 4406 is to be maintained.

Based on the system and application, we recommend for HP2VC:

filter element $\beta_{20} \geq 100$

β should not decrease as differential pressure of the filter element increases.

When the hydraulic fluid has a high temperature (+90 ℃ to +115 ℃), the cleanliness level should at least reach 19/17/14 according to ISO 4406.

Please contact us if the above cleanliness level cannot be maintained.

Working Pressure Range

Input

Variable pump (with external fluid supply,E）：

Boost pressure(n=2000rpm)P_{sp}_____2MPa

Boost pump：

Suction pressure $P_{s\,min}$($V \leq 30mm^2/s$)_____≥0.08MP absolute pressure

Oil Seal

Permissible pressure load

The service life of the shaft seal depends on the pump speed and case drain pressure. It is recommended that the average lasting case drain pressure at working temperature is no greater than 0.3MPa absolute pressure (as the speed falls, the maximum permissible case drain pressure is 0.6MPa) and the short-term (t < 0.1s) permissible absolute pressure peak may reach 1MPa.

The service life of the shaft seal decreases with increasing frequency of pressure peaks.

The case pressure must be equal to or greater than the external pressure at the shaft seal.

Temperature range

The FKM shaft seal may be used for case temperatures from -25 ℃ to +115 ℃.

Technical Data

Size			Unit	56	63	71	125	135	145	180
Displacement	Variable pump	$V_{g\ max}$	mL/r	56	63	71	125	135	–	180
	Boost pump(△p=2MPa)	$V_{g\ SP}$	mL/r	15. 8	15. 8	19. 6	28. 3	28. 3	–	39. 8
Speed	Maximum speed at $V_{g\ max}$	$n_{max\ cont}$	rpm	3600	3600	3300	2850	2850	–	2500
	Limit maximum[1]	$n_{min\ limit}$	rpm	3900	3900	3600	3250	3250	–	2900
	Intermittent maximum[2]	$n_{max\ interm}$	rpm	4500	4500	4100	3450	3450	–	3000
	Minimum	n_{min}	rpm	500	500	500	500	500	–	500
Flow	At $n_{max\ cont}$ and Vg_{max}	$q_{v\ max}$	L/min	202	227	234	356	385	–	450
Power[3]	At $n_{max\ cont}$ and $V_{g\ max}$, △p=40MPa	P_{max}	KW	134	151	156	237	257	–	300
Torque[3]	At $V_{g\ max}$, △p=40MPa	T_{max}	Nm	356	401	451	795	860	–	1146
	At $V_{g\ max}$, △p=10MPa	T	Nm	89	100	112. 8	198. 8	215	–	286
Moment of inertia of drive shaft		J	Kgm^2	0. 0066	0. 0066	0. 0097	0. 0232	0. 0232	–	0. 0444
Max. angular acceleration[4]			rad/s^2	24000	24000	21000	14000	14000	–	11000
Max. speed change[4]			rpm	72	72	69	55	55	–	50
Case volume		V	L	1. 5	1. 5	1. 3	2. 1	2. 1	–	3. 1
Weight (without through drive)		m	KG	38	38	50	80	80	80	101

1) Power at half corner power (e.g. at $V_{g\ max}$ and $P_n/2$)
2) At high-speed no-load operation; at overspeed, Δp =7-15MPa and $V_{g\ max}$; at reverse peak load, Δp<30MPa, t<0.1s
3) Without boost pump
4) For a single pump only

Specification Calculation

Flow $q_v = \frac{V_g \cdot n \cdot \eta_v}{1000}$ [L/min]

Torque $T = \frac{V_g \cdot \Delta p}{2 \cdot \pi \cdot \eta_{mh}}$ [Nm]

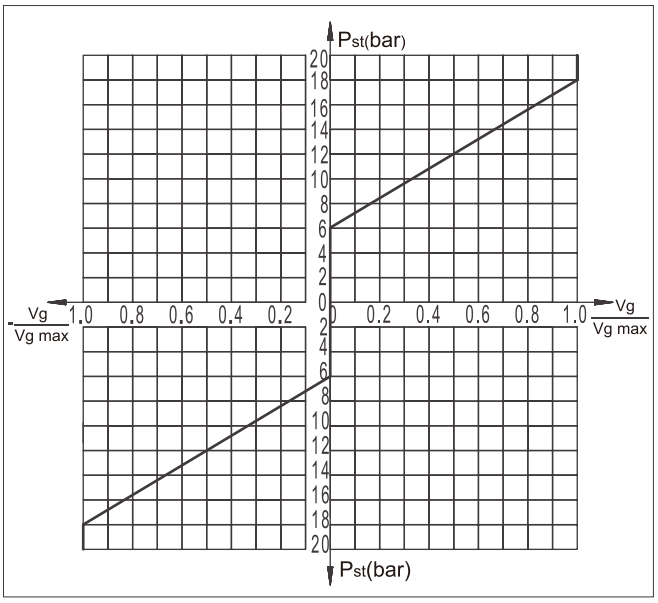
Power $P = \frac{2\pi \cdot T \cdot n}{60000} = \frac{q_v \cdot \Delta p}{60 \cdot \eta_t}$ [KW]

V_g = Displacement,mL/r
Δp = Differential pressure,MPa
n = Speed,rpm
η_v = Volumetric efficiency
η_{mh} = Mechanical-hydraulic efficiency
η_t = Total efficiency

HD - Pilot Pressure Control

Dependent on the difference between the pilot pressure P_{st} (at ports Y_1 and Y_2) of two control lines, the variable cylinder of the pump obtains control pressure via the HD controller so that the swashplate moves to infinitely adjust the displacement. Each control line corresponds to one flow direction.

HD3：with inlet filter (standard)
HD1：without inlet filter (Not for new projects!)

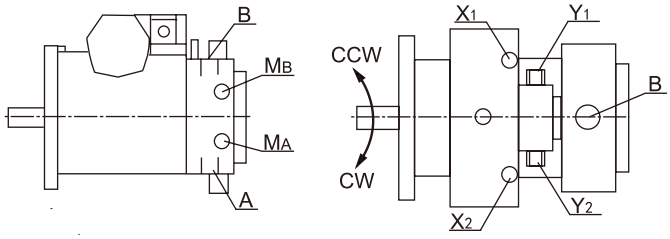


Vg	Displacement at P_{St}-
Vg max	Displacement at P_{St}=18bar
Pilot pressure at port Y_1 and Y_2	P_{St}-=6-18bar
Start of control 6bar	
End of control 18bar（maximum displacement $V_{g\,max}$）	

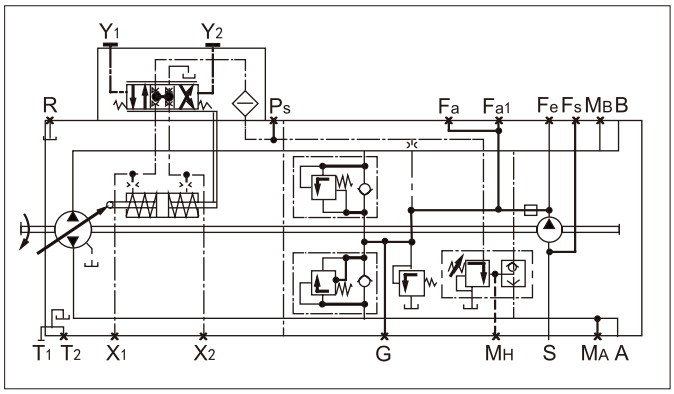
Note:
The HD controller must be unloaded to the neutral position with the external pilot control device on the reservoir.
The spring at the center of the pilot control device is not a safety device.
The spool may get stuck at any position due to contamination of the control device, such as hydraulic fluid pollutant, wear debris and foreign matters in the system, etc.
In this case, the pump flow no longer observes the operator's instructions.
- Make sure the driven device can promptly reach a safety state (e.g. stop) with the emergency stop module.
- Always observe the cleanliness level according to ISO 4406:
20/18/15 (< 90 ˚C) or 19/17/14 (> 90 ˚C)

Correlation of Direction of rotation, Control and Flow direction

Direction of rotation (viewed on drive shaft)					
	Size	Pilot Pressure	Control Pressure	Flow Direction	Working Pressure
CW	56/63	Y_1	X_1	A to B	M_B
		Y_2	X_2	B to A	M_A
	71/125/145/180	Y_1	X_1	B to A	M_A
		Y_2	X_2	A to B	M_B
CCW	56/63	Y_1	X_1	B to A	M_A
		Y_2	X_2	A to B	M_B
	71/125/145/180	Y_1	X_1	A to B	M_B
		Y_2	X_2	B to A	M_A

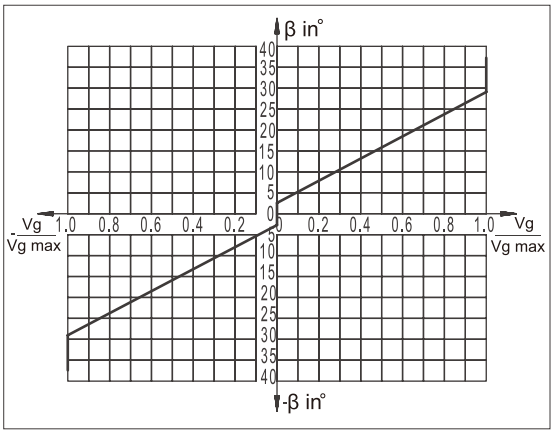


Circuit diagram,HD3



HW - Mechanical Servo Control

Dependent on the moving direction a or b of the control lever, the variable cylinder of the pump obtains control pressure via the HW controller so that the swashplate moves to infinitely adjust the displacement. Each moving direction of the control lever corresponds to one flow direction.



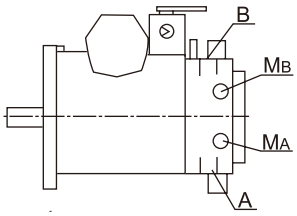
Swivel angle β of control lever:
Start of control β=3°
End of control β=29°(maximum displacement $V_{g\,max}$)
Mechanical limit: ±40°

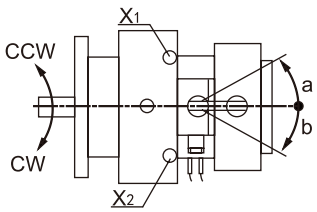
The maximum required torque at the control lever is 170 Ncm.
The rotation of HW control lever must be limited with an external position sensor (set point device).

Note:
When there is no torque on the HW control lever, spring centering enables the pump to move automatically to the neutral position (V_g = 0) (independent of swivel angle).

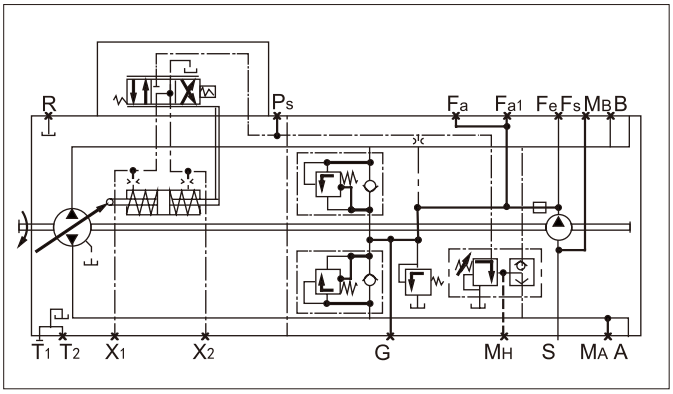
Correlation of Direction of rotation, Control and Flow direction

Direction of rotation (viewed on drive shaft)					
	Size	Pilot Pressure	Control Pressure	Flow Direction	Working Pressure
CW	56/63	a	X_2	B to A	M_A
		b	X_1	A to B	M_B
	71/125/145/180	a	X_2	A to B	M_B
		b	X_1	B to A	M_A
CCW	56/63	a	X_2	A to B	M_B
		b	X_1	B to A	M_A
	71/125/145/180	a	X_2	B to A	M_A
		b	X_1	A to B	M_B





Circuit diagram

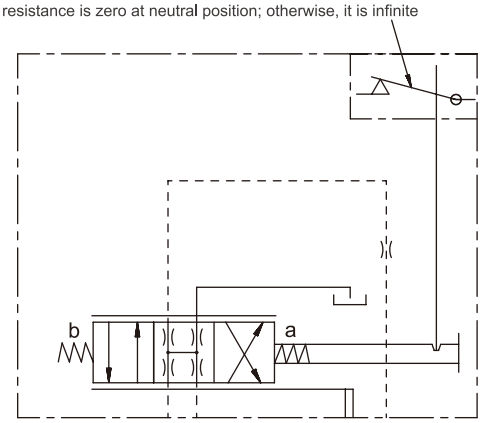


Variant I: with neutral position switch,HWL

With the control lever of the HW control valve in its neutral position, the neutral position switch is off; when the lever of the control valve turns to any side away from the neutral position, the switch is on. The neutral position switch is intended to protect the system that needs to keep zero flow in certain conditions, such as start of engine.

Neutral Position Switch Specification	
Switching capacity	5A/12V&3A/24V
Connector version	DJ7021-1.8-20

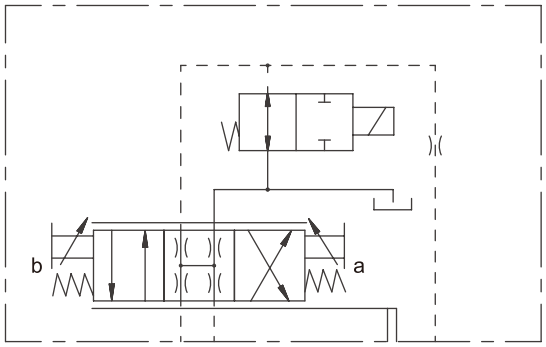
The resistance is zero at neutral position; otherwise, it is infinite



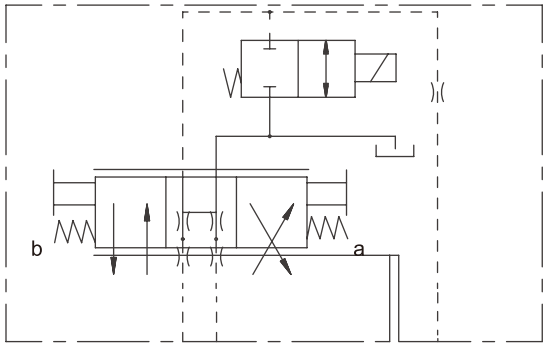
Variant II: with brake valve,HWO/HWC

Solenoid Specification	HWO(C)1	HWO(C)2
Voltage	12V DC(±1.8V)	24V DC(±3.6V)
Nominal resistance(20˚C)	9Ω	36Ω
Rated power	18W	18W
Required min. current	1.5A	0.75A
Connector version	DEUTSCH DT04-2P-EP04	
Working time	100%	
Protection rating	IP67	

With NO brake valve,HWO,power loss braking



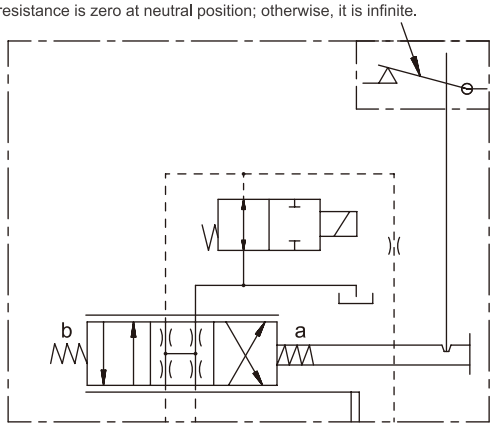
With NC brake valve,HWC,electric braking



Variant III: with brake valve and neutral position switch, HWOL/HWCL

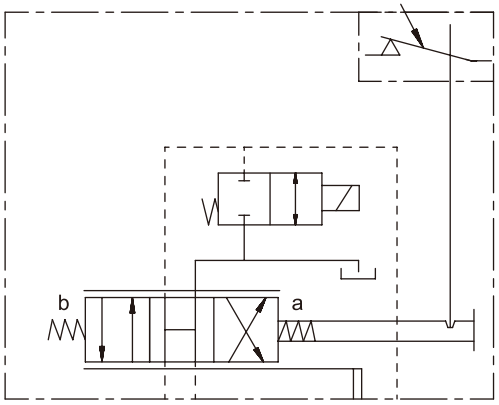
With NO brake valve and neutral position switch, HWOL

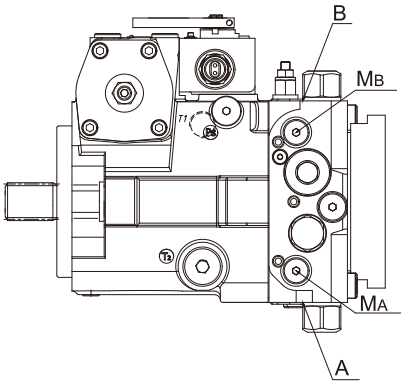
The resistance is zero at neutral position; otherwise, it is infinite.

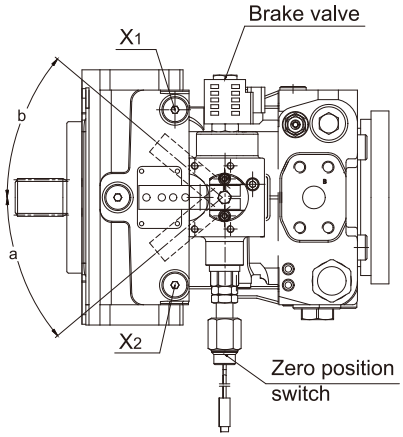


With NO brake valve and neutral position switch, HWCL

The resistance is zero at neutral position; otherwise, it is infinite.





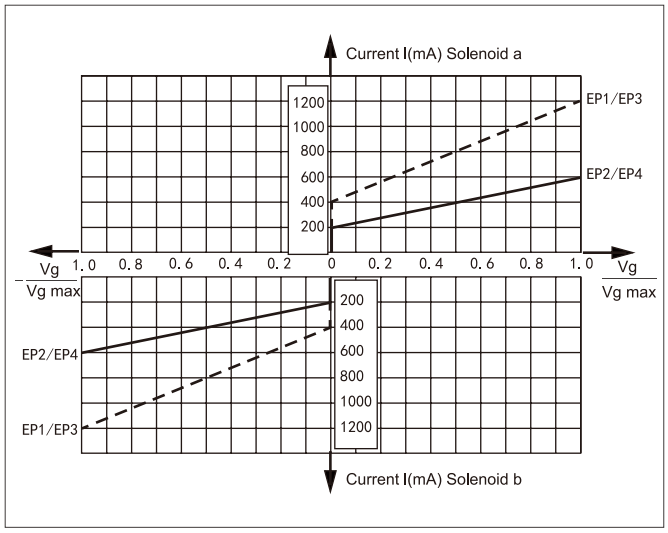


EP - Electric Control with Proportional Solenoid

Dependent on the preset current I of the two proportional solenoids (a and b), the variable cylinder of the pump obtains control pressure via the EP controller so that the swashplate moves to infinitely adjust the displacement. Each proportional solenoid corresponds to one flow direction.

Technical data, solenoid	EP1/3	EP2/4
Voltage	12V DC(±20%)	24V DC(±20%)
Control current		
Start of control V_g=0	400mA	200mA
End of control $V_{g\ max}$	1200mA	600mA
Current limit	1.54A	0.77A
Nominal resistance(20℃)	5.5Ω	22.7Ω
Dither frequency	100Hz	
Duty cycle	100%	
Type of protection	IP65	

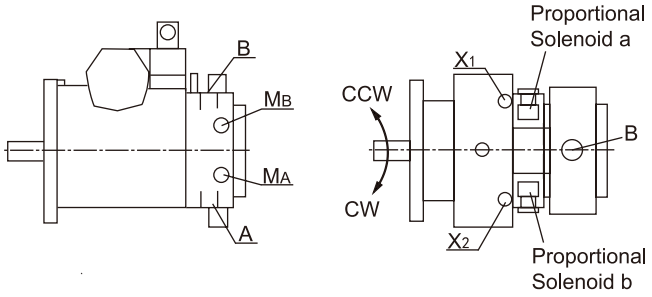
EP3/4：with inlet filter (standard)
EP1/2：without inlet filter (Not for new projects!)



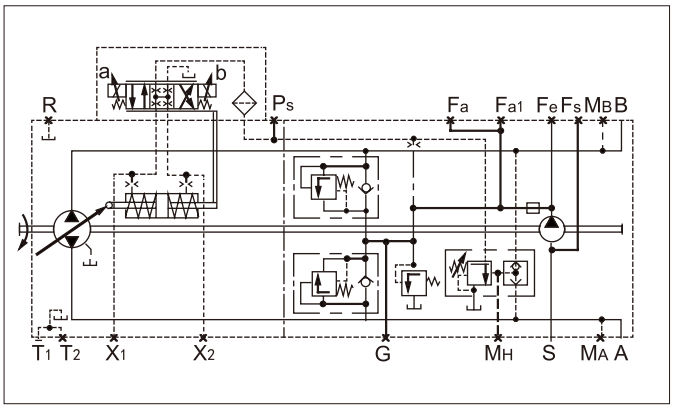
Note:
The spring at the center of the pilot control device is not a safety device. The spool may get stuck at any position due to contamination of the control device, such as hydraulic fluid pollutant, wear debris and foreign matters in the system, etc.
In this case, the pump flow no longer observes the operator's instructions.
- Make sure the driven device can promptly reach a safety state (e.g. stop) with the emergency stop module.
- Always observe the cleanliness level according to ISO 4406: 20/18/15 (< 90 ℃) or 19/17/14 (> 90 ℃)

Correlation of Direction of rotation, Control and Flow direction

Direction of rotation (viewed on drive shaft)					
	Size	Pilot Pressure	Control Pressure	Flow Direction	Working Pressure
CW	56/63	a	X_1	A to B	M_B
		b	X_2	B to A	M_A
	71/125/145/180	a	X_1	B to A	M_A
		b	X_2	A to B	M_B
CCW	56/63	a	X_1	B to A	M_A
		b	X_2	A to B	M_B
	71/125/145/180	a	X_1	A to B	M_B
		b	X_2	B to A	M_A



Circuit diagram



EZ - Electric Control with Switching Solenoid

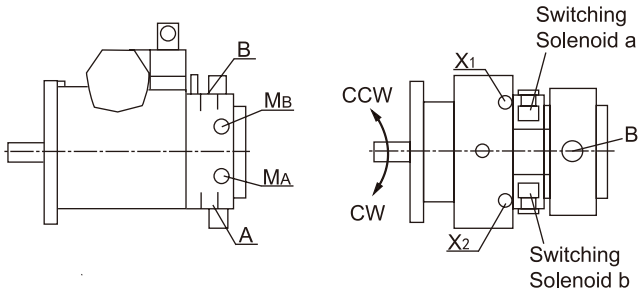
By switching on or off the switching solenoid a or b, the control cylinder of the pump obtains control pressure via the EZ controller so that the swashplate realizes adjustment between V_g=0 and $V_{g\ max}$.
Each solenoid corresponds to one flow direction.

Technical data, solenoid	EZ1	EZ2
Voltage	12V DC(±20%)	24V DC(±20%)
Neutral position V_g=0	De-energized	De-energized
Position $V_{g\ max}$	Energized	Energized
Nominal resistance(20℃)	5.5Ω	21.7Ω
Rated power	26.2W	26.5W
Minimum required current	1.32A	0.67A
Duty cycle	100%	
Type of protection	IP65	

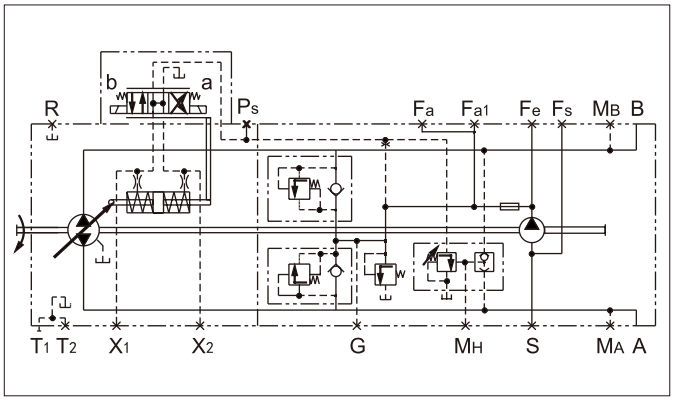
Standard: switching solenoid without manual emergency control.
The manual emergency control realized by returning spring may be provided as required.

Correlation of Direction of rotation, Control and Flow direction

Direction of rotation (viewed on drive shaft)					
	Size	Pilot Pressure	Control Pressure	Flow Direction	Working Pressure
CW	56/63	a	X_2	B to A	M_A
		b	X_1	A to B	M_B
	71/125/145/180	a	X_2	A to B	M_B
		b	X_1	B to A	M_A
CCW	56/63	a	X_2	A to B	M_B
		b	X_1	B to A	M_A
	71/125/145/180	a	X_2	B to A	M_A
		b	X_1	A to B	M_B



Circuit diagram



High-pressure Relief Valve

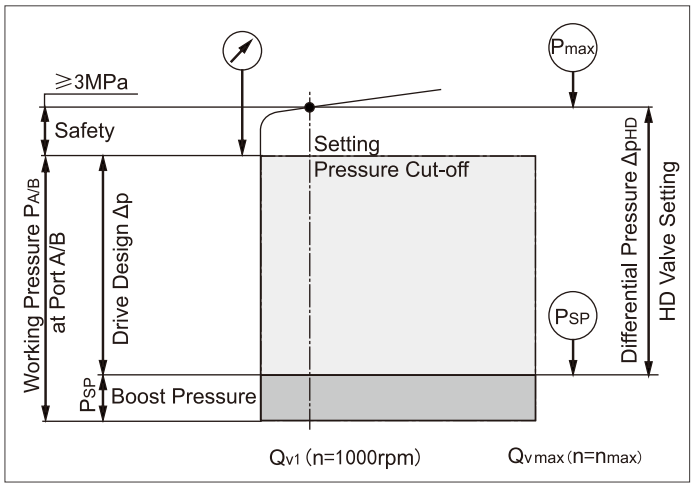
Setting range

High-pressure relief valve, direct operated (size 56/63)	Differential pressure setting Δp_{HP}
Setting range valve 3，5 Δp=27-42MPa	42MPa
	39MPa[1)]
	37MPa
	35MPa
	33MPa
	31MPa
	27MPa
Setting range valve 4，6 Δp=10-25MPa	25MPa
	23MPa[1)]
	20MPa
	16MPa
	12MPa

High-pressure relief valve, pilot operated (size71/125/135/145/180)	Differential pressure setting Δp_{HP}
Setting range valve 1 Δp=10−42MPa	42MPa
	39MPa[1)]
	37MPa
	35MPa
	33MPa
	31MPa
	27MPa
	25MPa
	23MPa
	20MPa
	16MPa
	12MPa

1) Standard differential pressure setting.
Values when no special remarks are made when ordering.

Pressure setting diagram



Note: The high-pressure relief valve is set at n =1000rpm and $V_{g\,max}$ (q_{v1}).
Hint: boost pressure 3MPa, working pressure 40MPa
Working pressure $P_{A/B}$-pressure P_{SD}+safety
=differential pressure $\triangle p_{HP}$ (40-3+3=40MPa)

Bypass function

The bypass function is only intended for short-term operation at reduced displacement, for example to tow a vehicle out of a danger zone.
Do not exceed the corresponding flow Q =30L/min

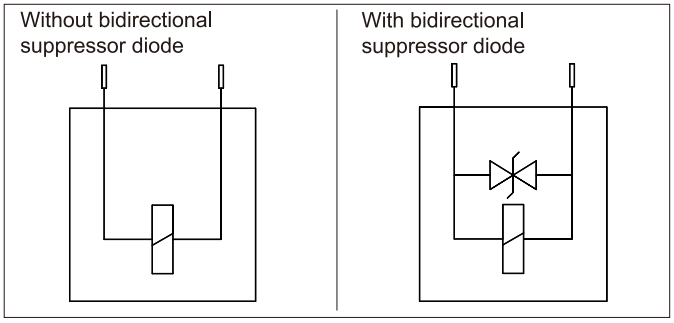
Pressure Cut-off Valve，D

The pressure cut-off is a pressure control which adjusts the displacement of the pump to $V_{g\,min}$ after the set pressure is reached.
The pressure cut-off valve prevents the operation of the high-pressure relief valve during acceleration or deceleration.
The high-pressure relief valve protects against pressures occurring during fast swiveling of the swashplate and maximum pressure in the system.
The setting range of the pressure cut-off valve may be anywhere within the entire working pressure range.
However, the range must be set 3 MPa lower than the setting of the high-pressure relief valve.
Please specify in plain text the setting of the pressure cut-off valve when ordering.

Connectors for Solenoids

DEUTSCH DT04-2P-EP04
Molded, 2-pin, without bidirectional suppressor diode (standard)_____P
Molded, 2-pin, with bidirectional suppressor diode (only for control modules EZ1/2 and switching solenoids on DA)_____Q
The installed connector is provided to ensure the following type of protection：
IP67 DIN/EN 60529 and IP69K DIN 40050-9
The protection circuit with bidirectional suppressor diode is needed to control over-voltage. Over-voltage is caused by switching off the current with switches, relay contacts or by disconnecting the connector while voltage is applied.

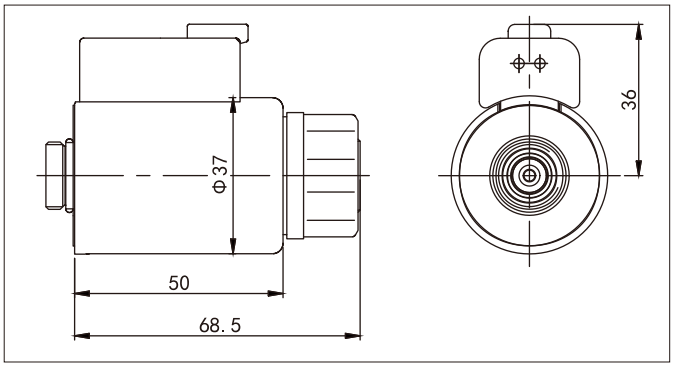
Fluid line symbol



Connector

DEUTSCH DTO6-2S-EP04
1 housing_____DT06-2S-EP04
1 wedge_____W2S
2 sockets_____0462-201-16141

The connector is not included in the scope of delivery. This may be supplied on request.

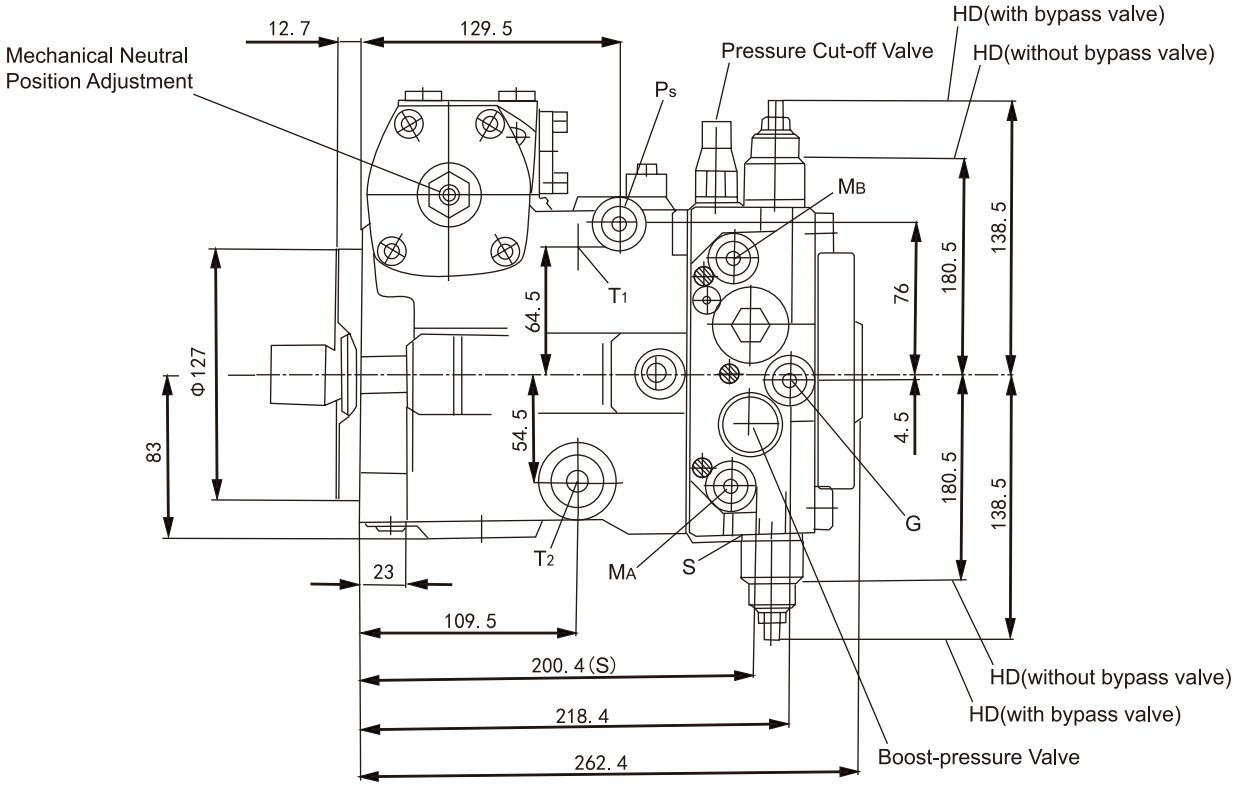


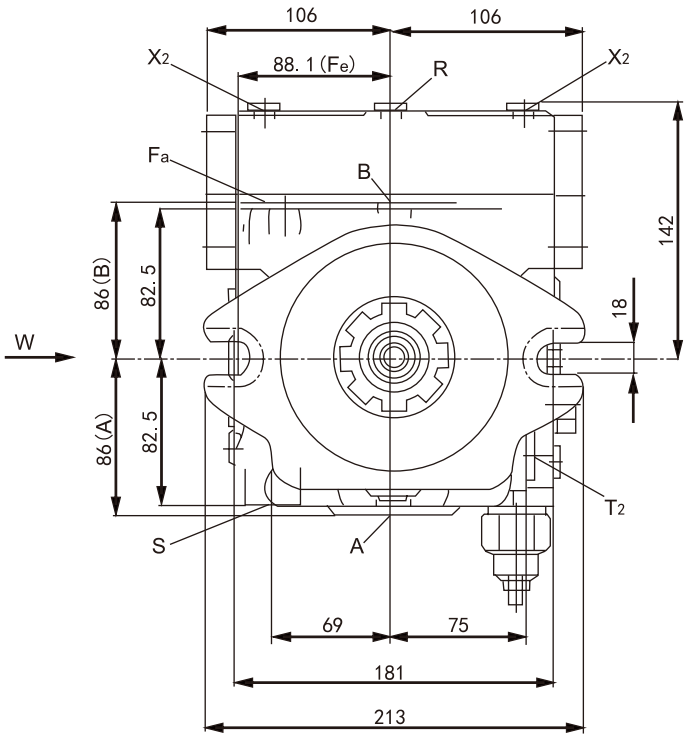
Change connector orientation
If necessary, you may change the connector orientation by turning the solenoid.

Installation Dimensions

Size 56/63

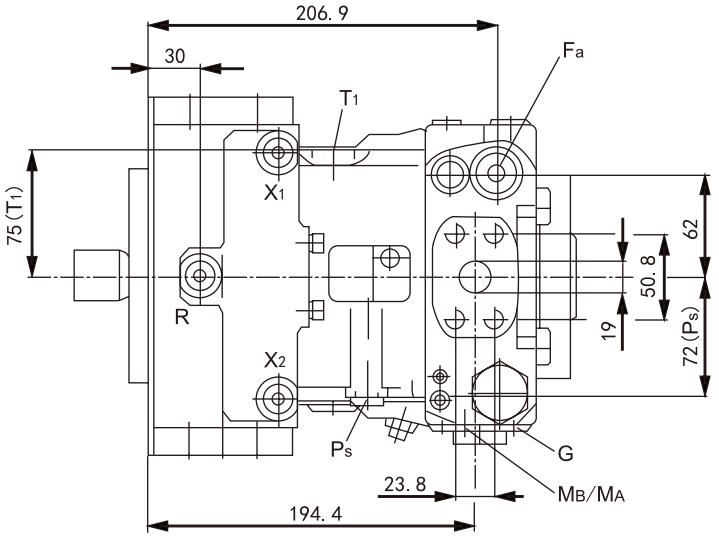
Without control valve



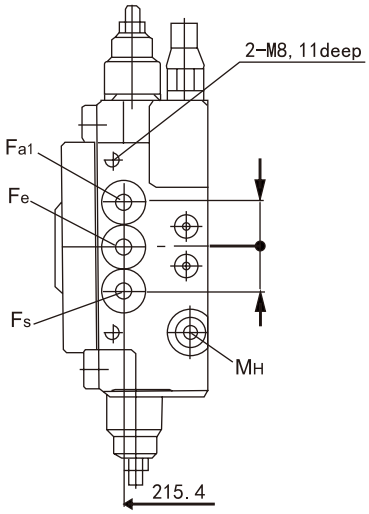


Installation Dimensions

Size 56/63



Detail W



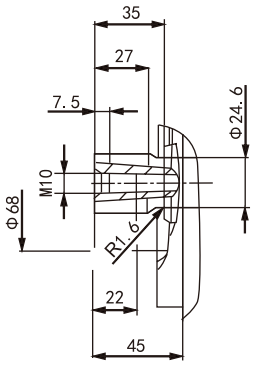
Ports DIN3852

A/B	Working port (high pressure series)	3/4″
	Fastening thread A/B	M10，17deep
T_1	Case drain port or filling port	M22x1.5,14deep
T_2	Case drain port	M22x1.5,14deep
M_A/M_B	Measuring port pressure A/B	M12x1.5,12deep
R	Air bleed port	M12x1.5,12deep
S	Boost suction port	M33x2,18deep
X_1/X_2	Control pressure port (upstream of orifice)	M12x1.5,12deep

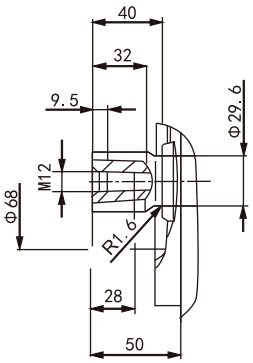
G	Pressure port, auxiliary circuit	M14x1.5,12deep
P_S	Control pressure inlet port	M14x1.5,12deep
F_a	Filter outlet	M18x1.5,12deep
F_{a1}	Filter outlet (a filter may be installed)	M18x1.5,12deep
F_e	Filter inlet	M18x1.5,12deep
F_S	Port from filter to suction line (cold start)	M18x1.5,12deep
M_H	Balancing high-pressure port	M12x1.5,12deep

Drive shaft

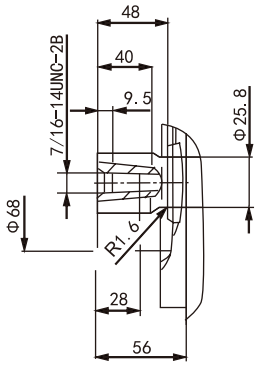
Splined shaft Z DIN 5480
W30x2x30x14x9g



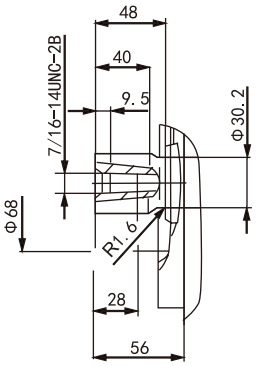
Splined shaft A DIN 5480
W35x2x30x16x9g



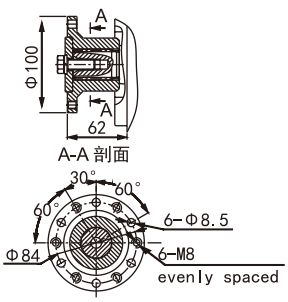
Splined shaft S 1 1/4″
14T 12/24DP[1] (SAE J744-32-4(C))



Splined shaft T 1 3/8″
21T 16/32DP[1]



Splined shaft L 1 1/4″
With connecting flange

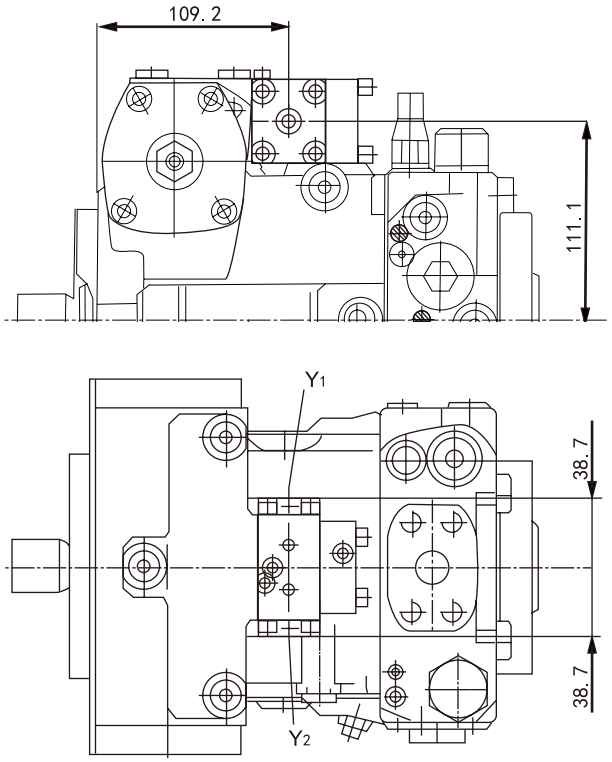


1) ANSI B92.1a-1976，30°pressure angle, flat root, side fit, tolerance class 5

Installation Dimensions

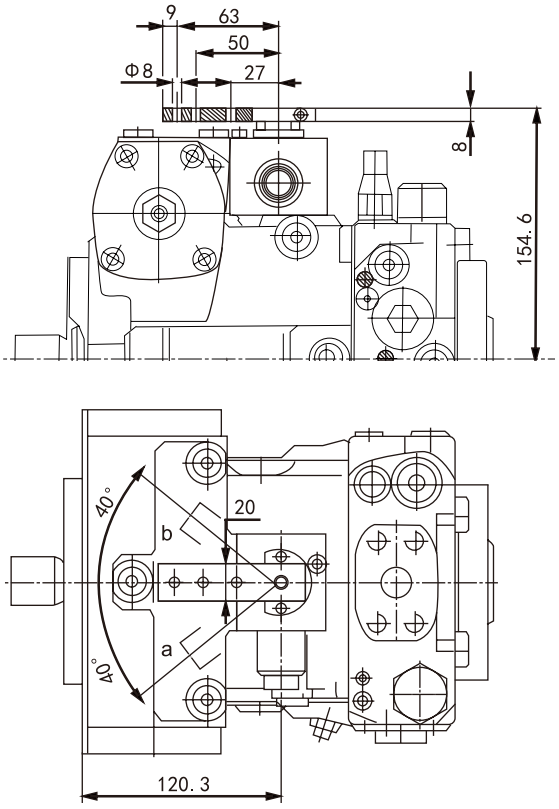
Size 56/63

HD hydraulic control, pilot pressure related

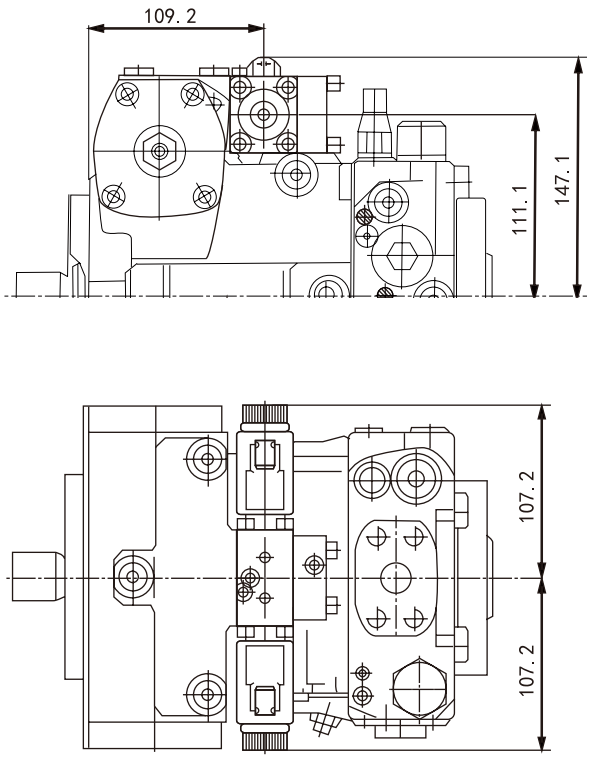


Y_1/Y_2 Remote control port M14x1.5, 12deep

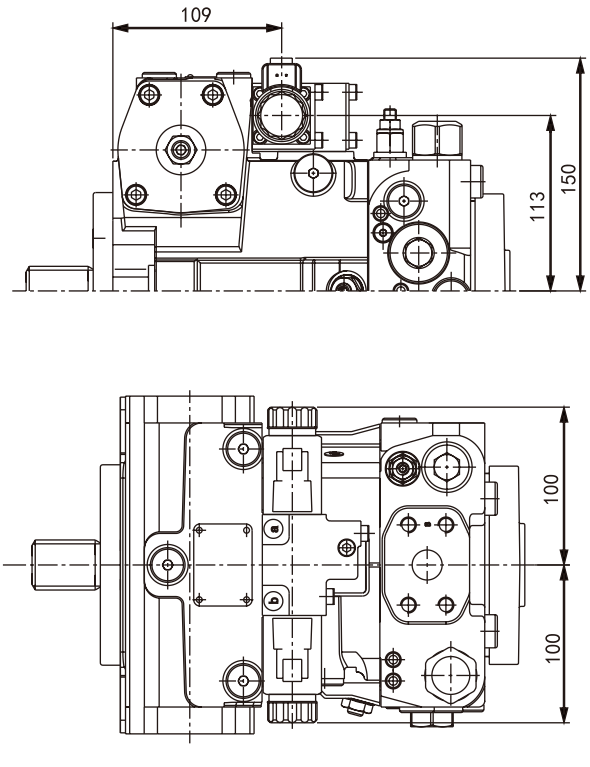
HW hydraulic control, mechanical servo



EP electric control, with proportional solenoid



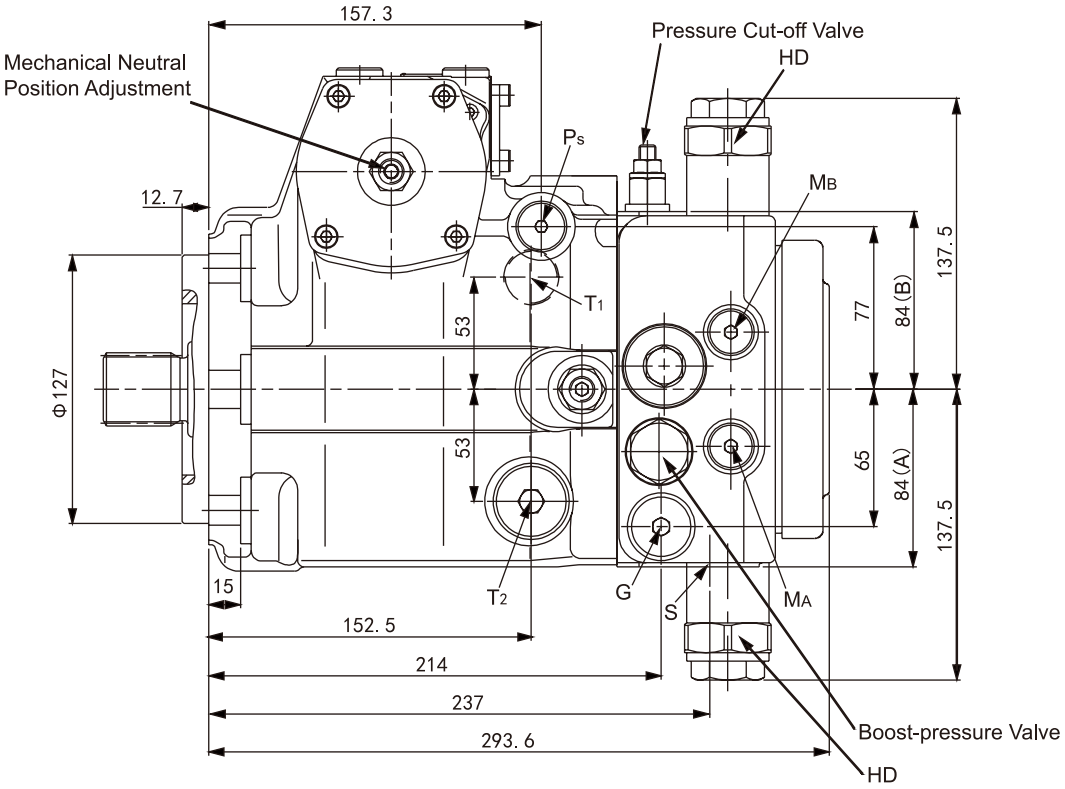
EZ electric control, with switching solenoid

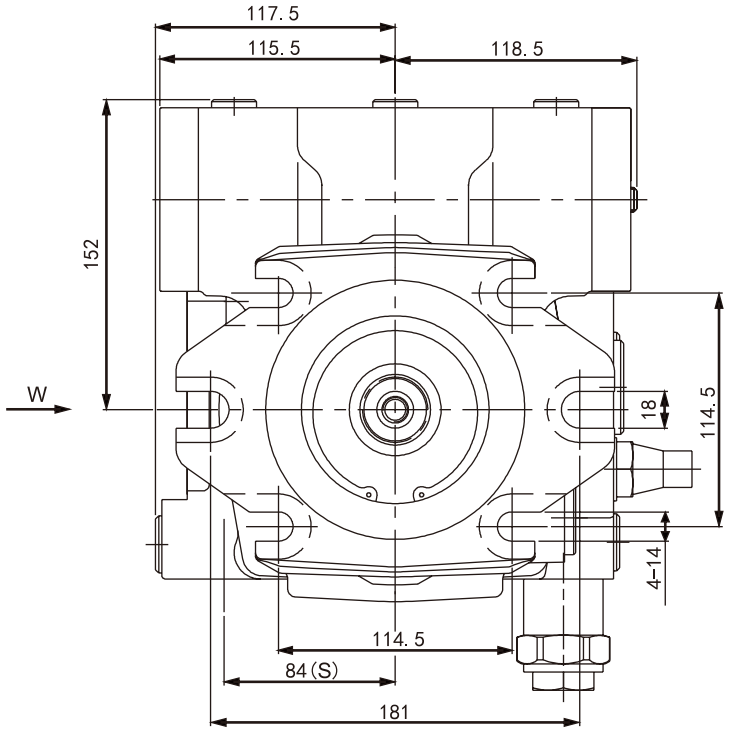


Installation Dimensions

Size 71

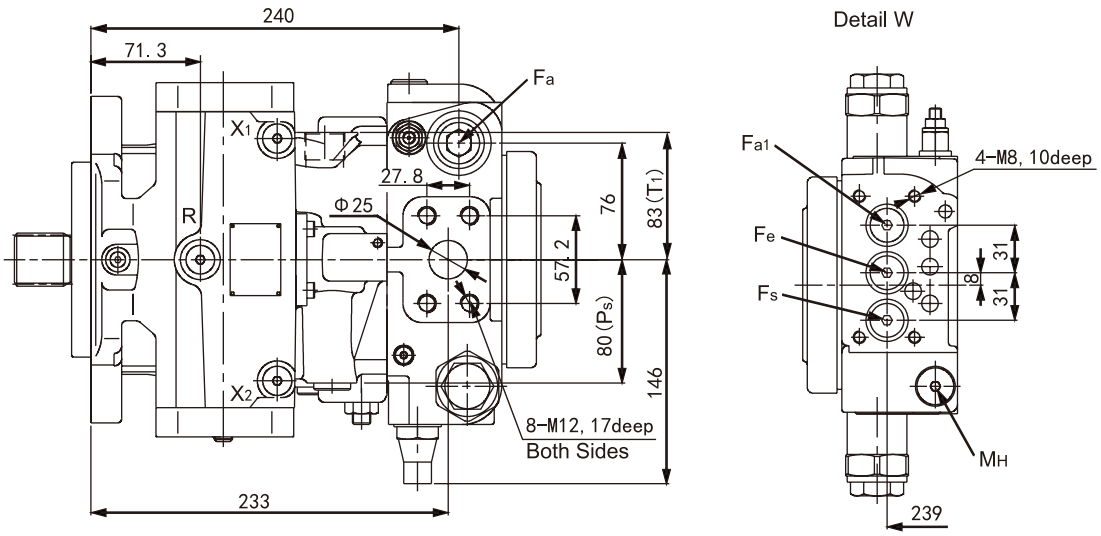
Without control valve





Installation Dimensions

Size 71



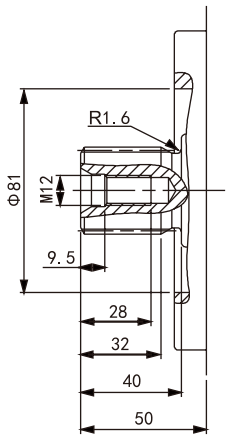
Ports DIN3852

A/B	Working port (high pressure series)	1″
T_1	Case drain port or filling port	M26x1.5,16deep
T_2	Case drain port	M26x1.5,16deep
M_A/M_B	Measuring port pressure A/B	M12x1.5,12deep
R	Air bleed port	M12x1.5,12deep
S	Boost suction port	M42x2,20deep
X_1/X_2	Control pressure port (orifice)	M12x1.5,12deep

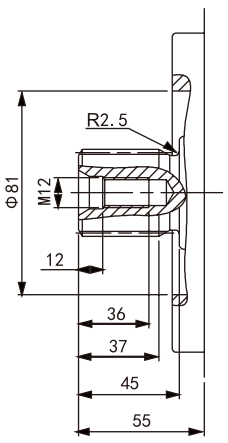
G	Pressure port, auxiliary circuit	M18x1. 5, 14deep
P_S	Control pressure inlet port	M14x1. 5, 12deep
F_a	Filter outlet	M26x1. 5, 16deep
F_{a1}	Filter outlet	M22x1. 5, 14deep
F_e	Filter inlet	M22x1. 5, 14deep
F_S	Port from filter to suction line	M22x1. 5, 14deep
M_H	Balancing high-pressure port	M12x1. 5, 12deep

Drive shaft

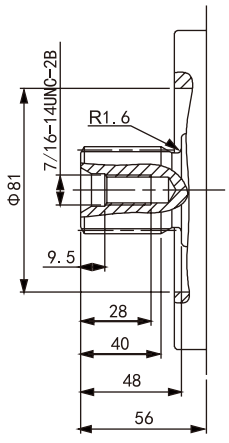
Splined shaft Z DIN 5480
W35x2x30x16x9g



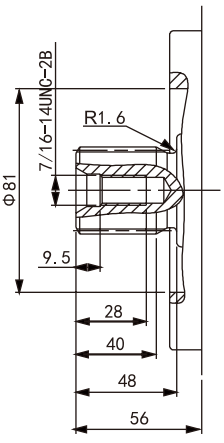
Splined shaft A DIN 5480
W40x2x30x18x9g



Splined shaft S 1 1/4″
14T 12/24DP



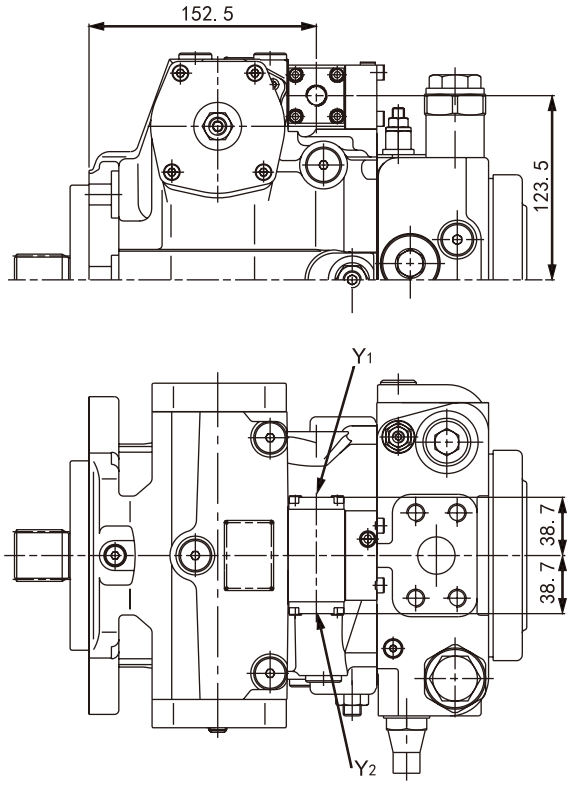
Splined shaft T 1 3/8″
21T 16/32DP



Installation Dimensions

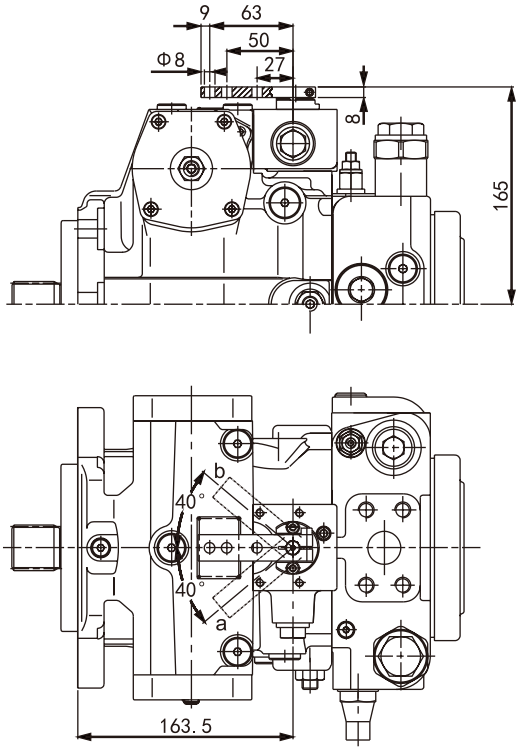
Size 71

HD hydraulic control, pilot pressure related

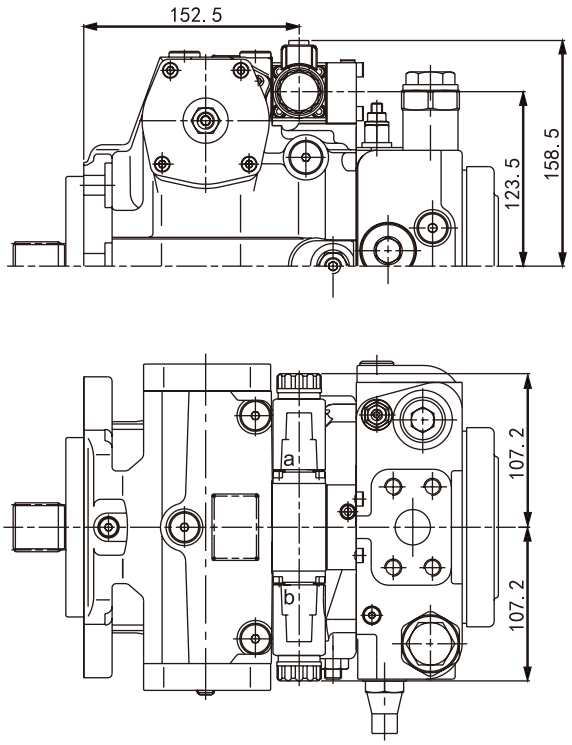


Y1/Y2 Remote control port M14x1.5,12deep

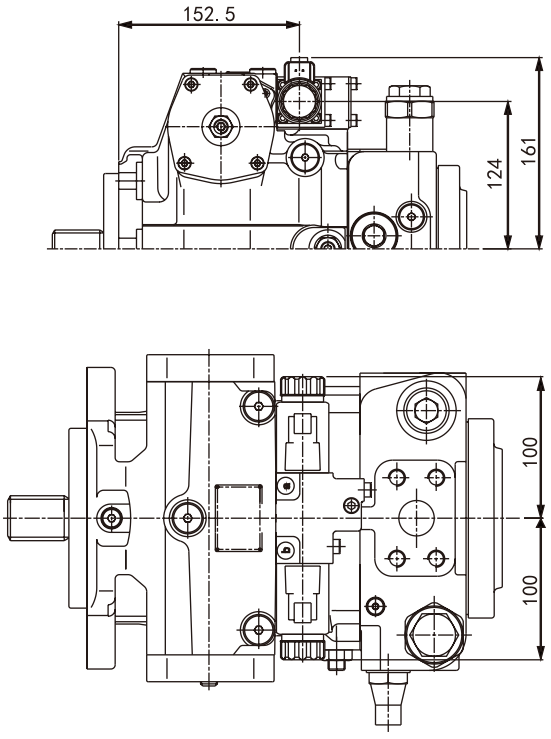
HW hydraulic control, mechanical servo



EP electric control, with proportional solenoid



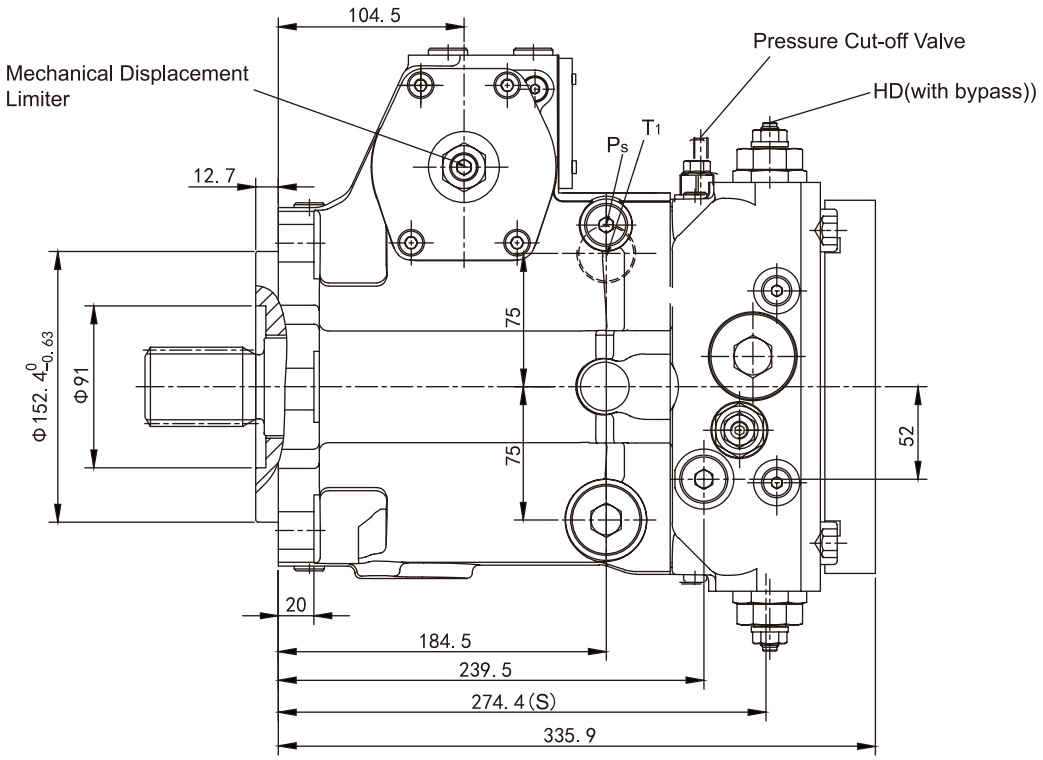
EZ electric control, with switching solenoid

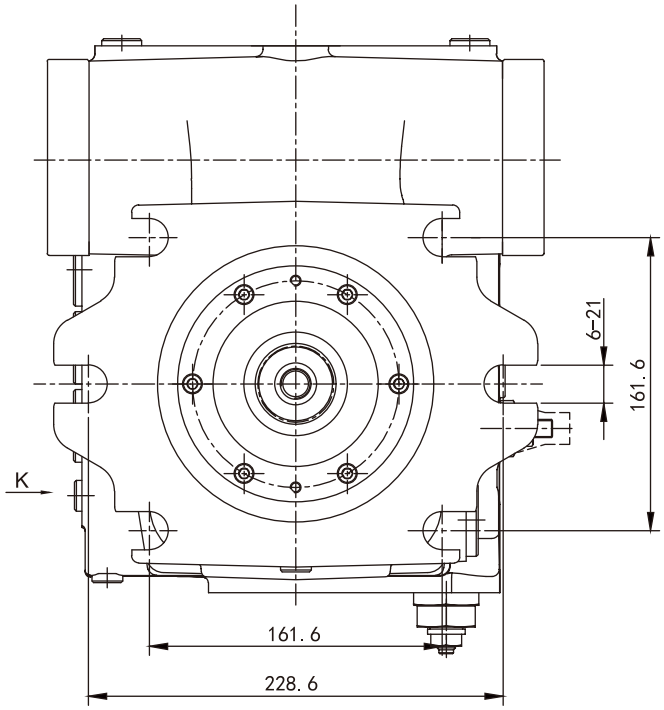


Installation Dimensions

Size 125/135/145

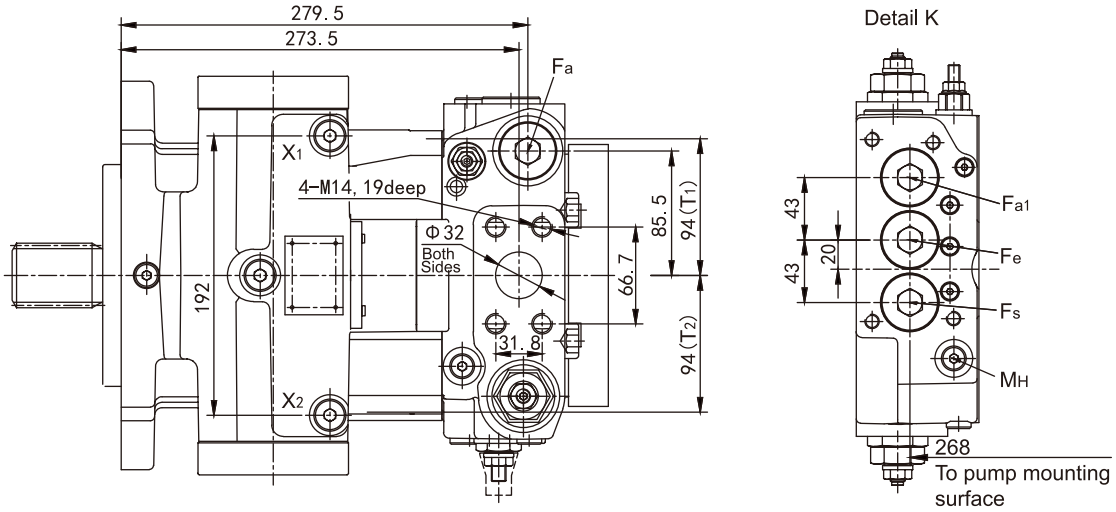
Without control valve





Installation Dimensions

Size 125/135/145



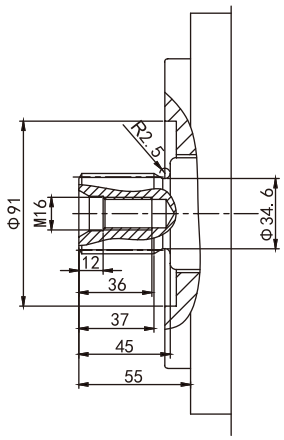
Ports DIN3852

A/B	Working port (high pressure series)	1 1/4″
T_1	Case drain port or filling port	M33x2,18deep
T_2	Case drain port	M33x2,18deep
M_A/M_B	Measuring port pressure A/B	M12x1.5,12deep
R	Air bleed port	M16x1.5,12deep
S	Boost suction port	M48x2,22deep
X_1/X_2	Control pressure port (orifice)	M16x1.5,12deep

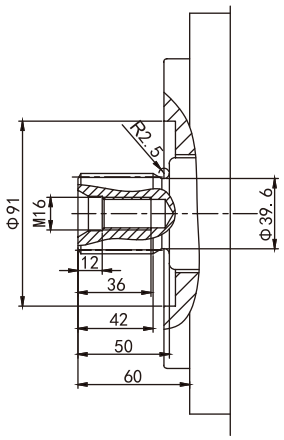
G	Pressure port, auxiliary circuit	M22x1.5,14deep
P_S	Control pressure inlet port	M18x1.5,12deep
F_a	Filter outlet	M33x2,18deep
F_{a1}	Filter outlet	M33x2,18deep
F_e	Filter inlet	M33x2,18deep
F_s	Port from filter to suction line	M33x2,18deep
M_H	Balancing high-pressure port	M12x1.5,12deep

Drive shaft

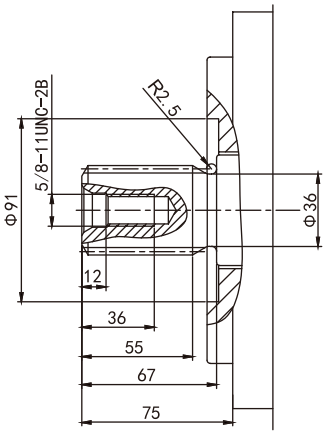
Splined shaft Z DIN 5480
W40x2x30x18x9g



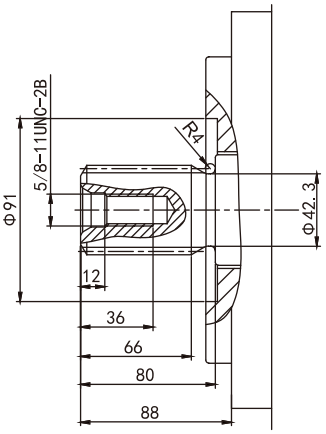
Splined shaft A DIN 5480
W45x2x30x21x9g



Splined shaft S 1 3/4″
13T 8/16DP



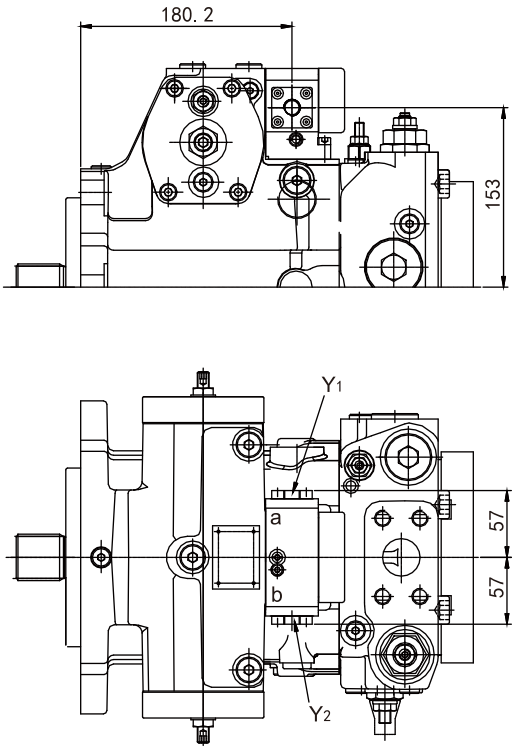
Splined shaft T 2″
15T 8/16DP



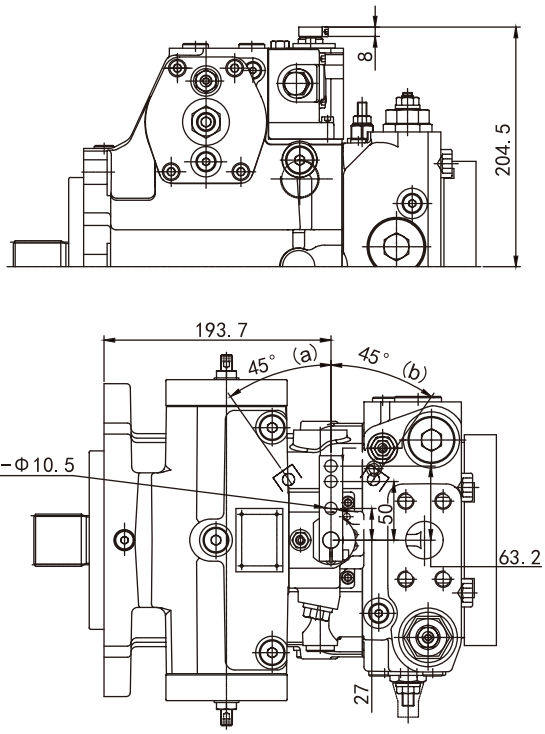
Installation Dimensions

Size 125/135/145

HD hydraulic control, pilot pressure related

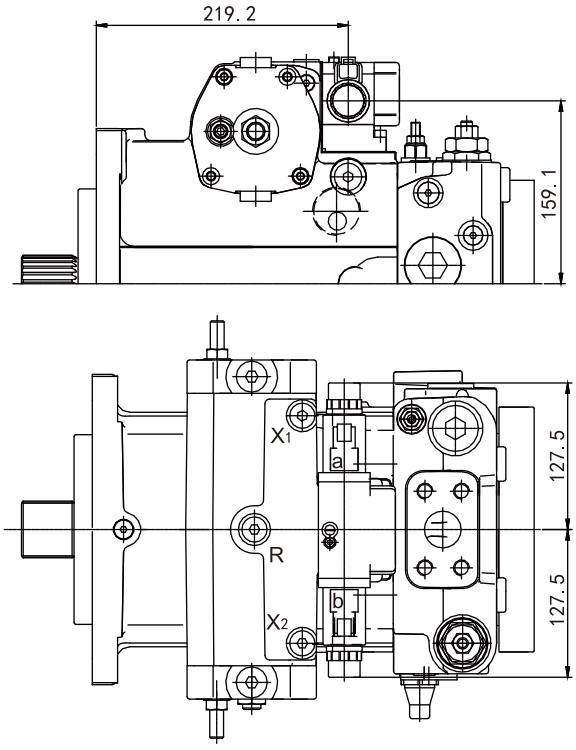


HW hydraulic control, mechanical servo

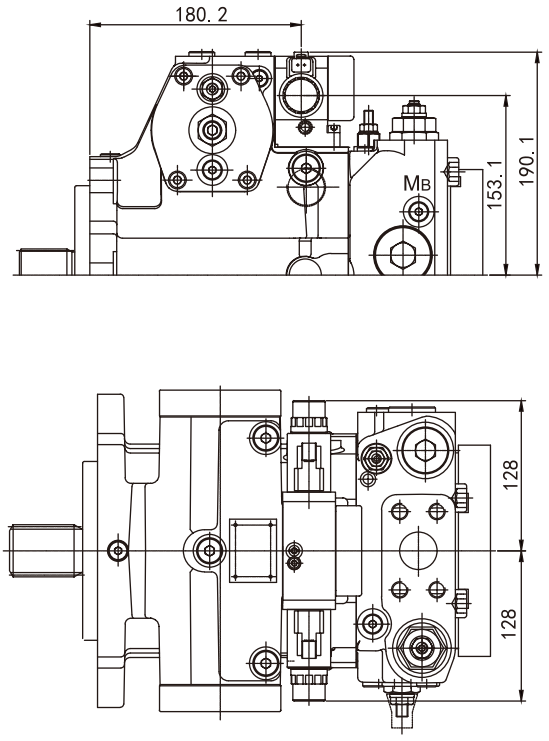


Y_1/Y_2 Remote control port M14x1.5,12deep

EP electric control, with proportional solenoid



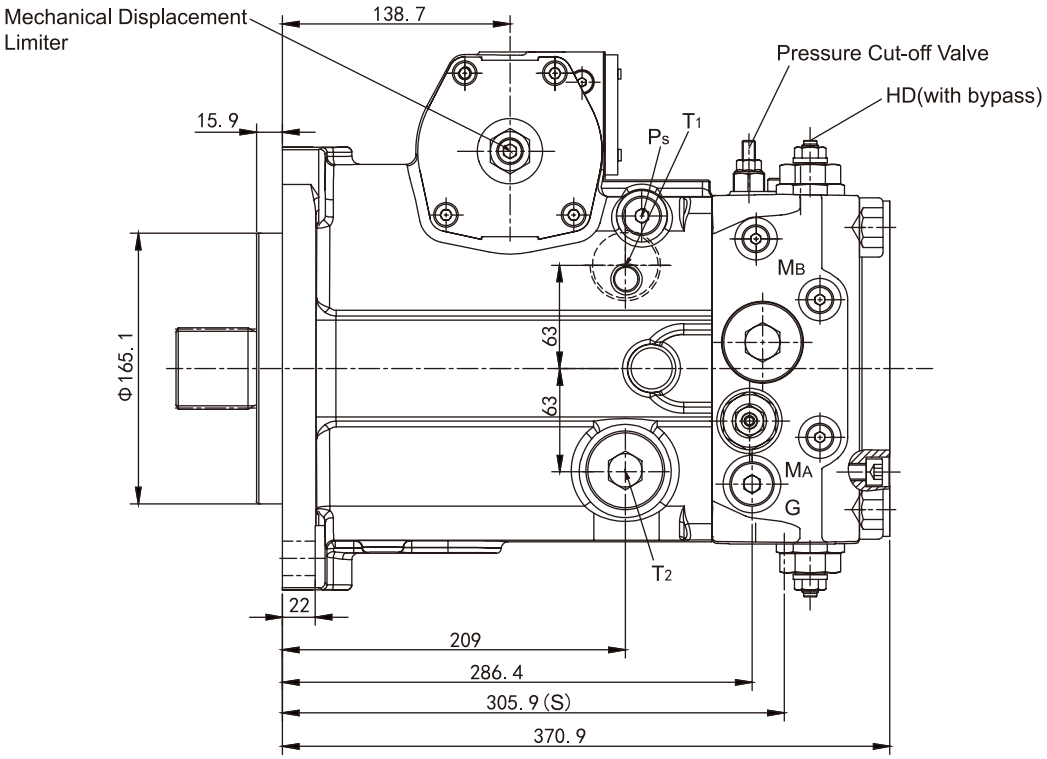
EZ electric control, with switching solenoid

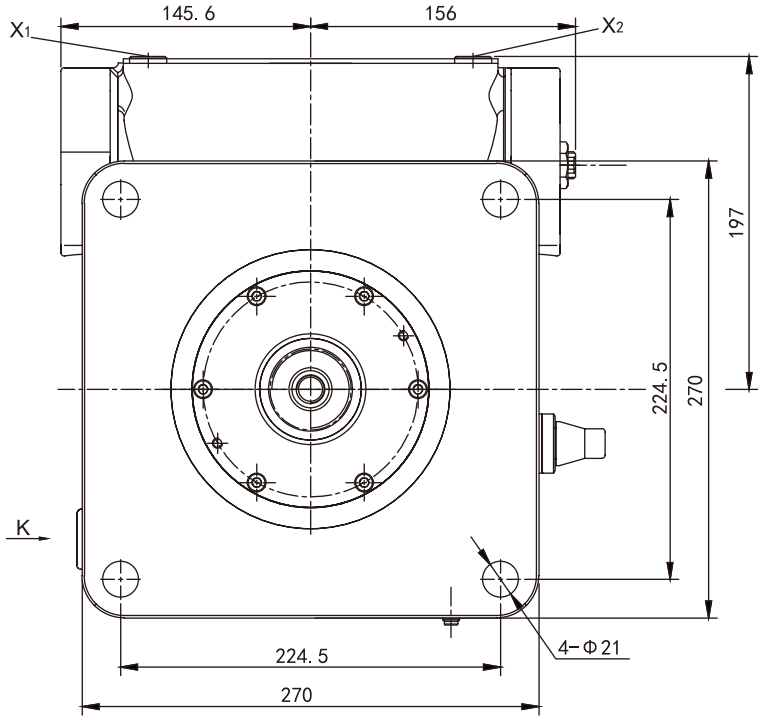


Installation Dimensions

Size 180

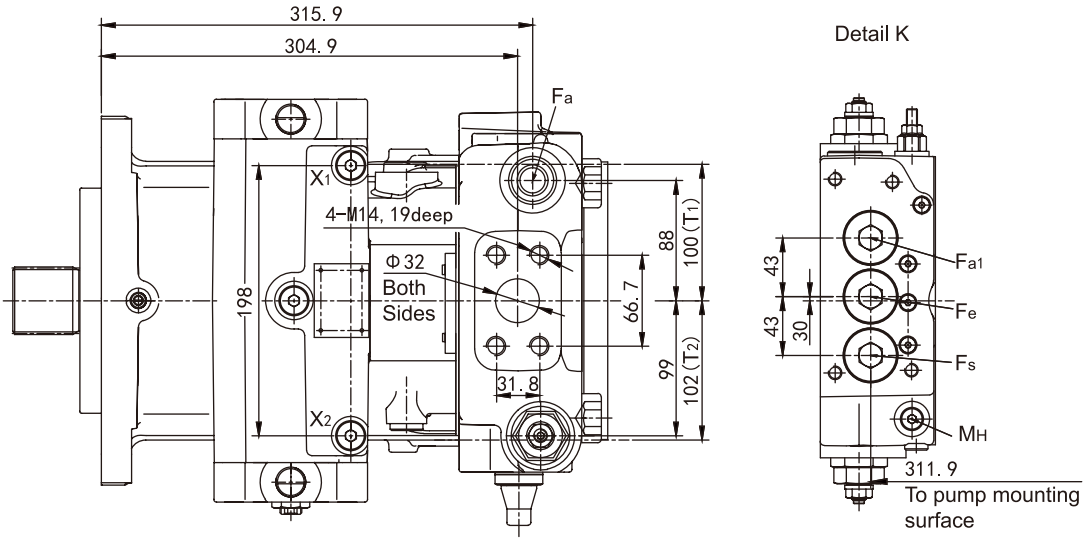
Without control valve





Installation Dimensions

Size 180

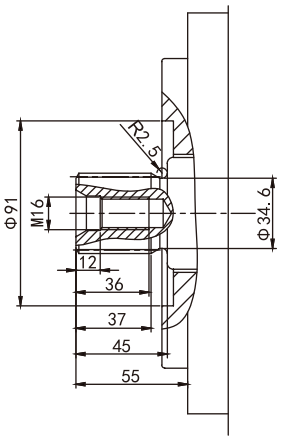


Ports DIN3852

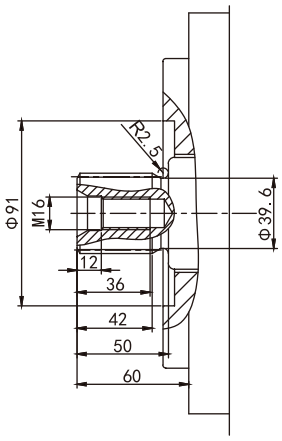
A/B	Working port	1 1/4″	G	Pressure port, auxiliary circuit	M22x1. 5, 14deep
T_1	Case drain port or filling port	M42x2,20deep	P_S	Control pressure inlet port	M18x1. 5, 12deep
T_2	Case drain port	M42x2,20deep	F_a	Filter outlet	M33x2, 18deep
M_A/M_B	Measuring port pressure A/B	M12x1.5,12deep	F_{a1}	Filter outlet	M33x2, 18deep
R	Air bleed port	M16x1.5,12deep	F_e	Filter inlet	M33x2, 18deep
S	Boost suction port	M48x2,22deep	F_S	Port from filter to suction line	M33x2, 18deep
X_1/X_2	Control pressure port	M16x1.5,12deep	M_H	Balancing high-pressure port	M12x1. 5, 12deep

Drive shaft

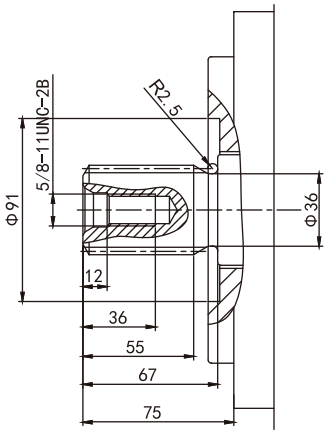
Splined shaft Z DIN 5480
W50x2x30x24x9g



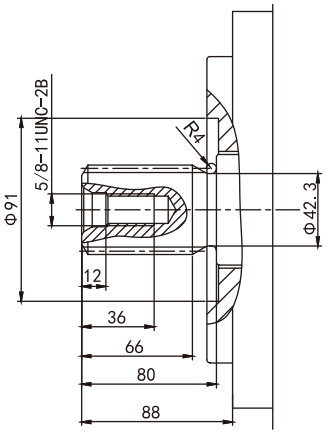
Splined shaft A DIN 5480
W70x2x30x22x9g



Splined shaft S 1 3/4″
13T 8/16DP



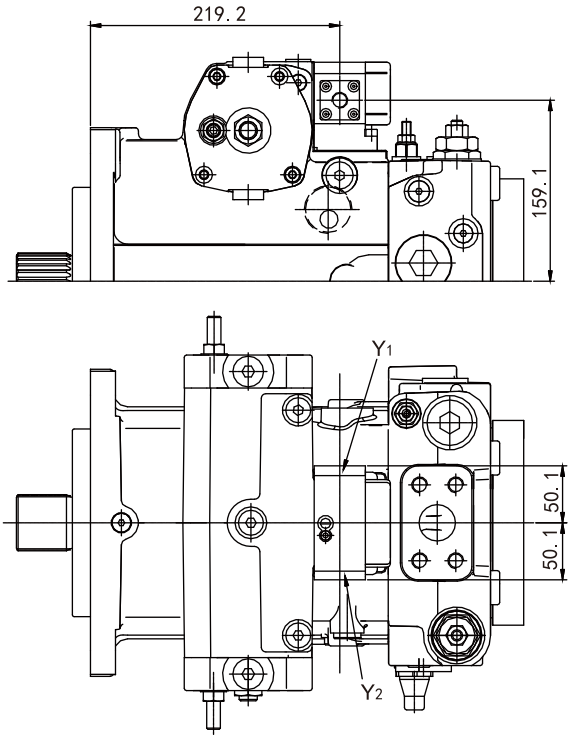
Splined shaft T 2″
15T 8/16DP



Installation Dimensions

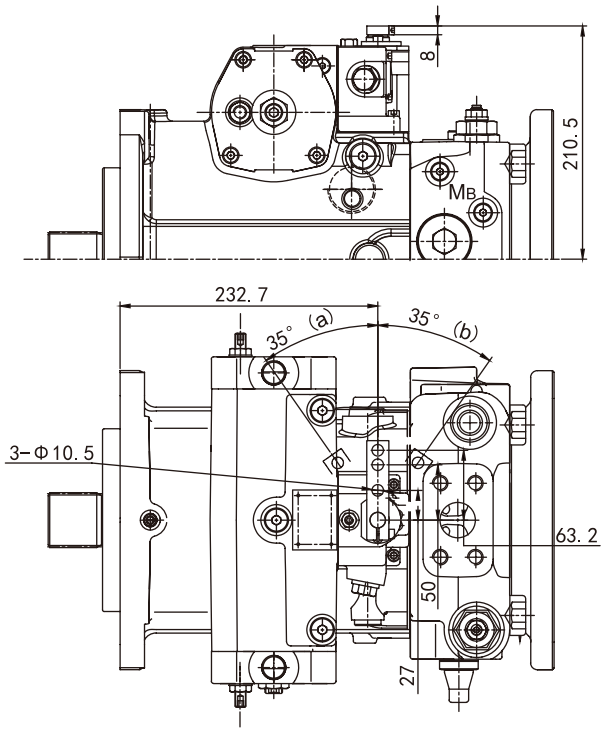
Size 180

HD hydraulic control, pilot pressure related

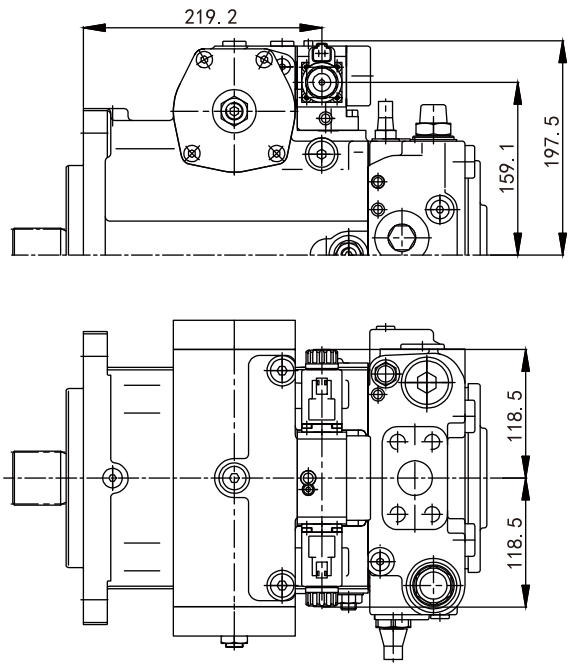


Y_1/Y_2 Remote control port M14x1.5,12deep

HW hydraulic control, mechanical servo



EP electric control, with proportional solenoid

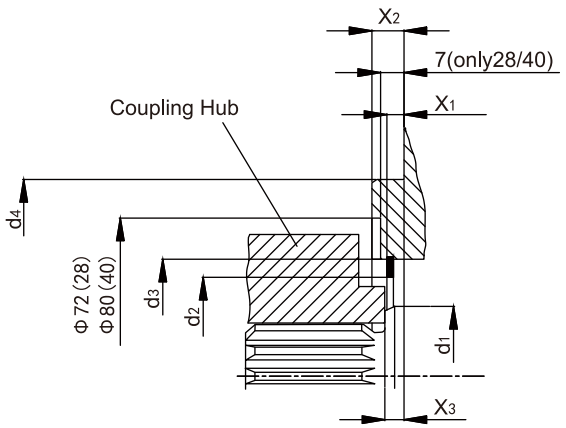


Installation dimensions for coupling assembly

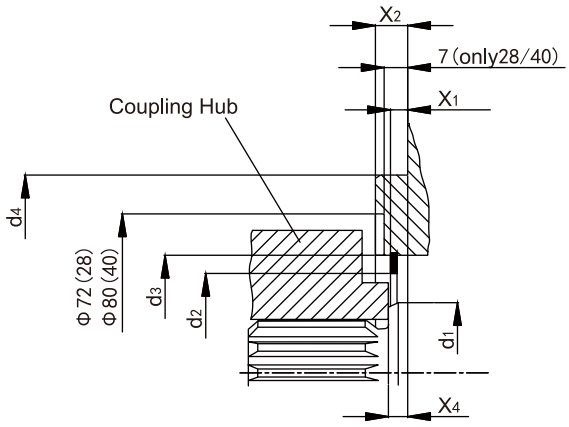
To ensure the rotary components (coupling hub) and fixed components (valve body, retaining ring) will not come into contact with each other, the installation conditions below must be observed.
This depends on the pump size and the splined shaft.

Sizes 56 to 180 (not freely rotary):
- Spline SAE(shaft S or T)
The outer diameter of the coupling hub must be smaller than the inner diameter d_2 of the retaining ring in the area near the drive shaft collar (dimension X_2 - X_3).
- Splined shaft DIN（shaft Z or A）
The outer diameter of the coupling hub must be smaller than the case diameter d_3 in the area near the drive shaft collar (dimension X_2 - X_4).

Splined shaft SAE(spline according to ANSI B92.1a)



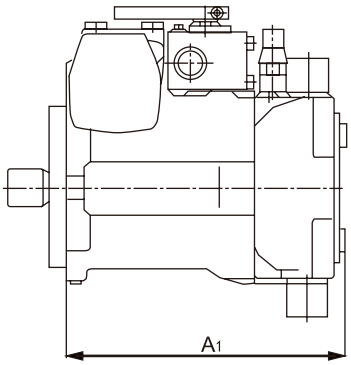
Splined shaft DIN(spline according to DIN 5480)



Size	Φd1	Φd1min	Φd3	Φd4	X1	X2	X3	X4
56	40	54.4	68±0.1	127	$7.0^{+0.2}$	$12.7_{-0.5}$	$8^{+0.9}_{-0.6}$	$10^{+0.9}_{-0.6}$
63	40	54.4	68±0.1	127	$7.0^{+0.2}$	$12.7_{-0.5}$	$8^{+0.9}_{-0.6}$	$10^{+0.9}_{-0.6}$
71	45	66.5	81±0.1	127	$7.0^{+0.2}$	$12.7_{-0.5}$	$8^{+0.9}_{-0.6}$	$10^{+0.9}_{-0.6}$
125	55	76.3	91±0.1	152.4	$7.0^{+0.2}$	$12.7_{-0.5}$	$8^{+0.9}_{-0.6}$	$10^{+0.9}_{-0.6}$
135	55	76.3	91±0.1	152.4	$7.0^{+0.2}$	$12.7_{-0.5}$	$8^{+0.9}_{-0.6}$	$10^{+0.9}_{-0.6}$
145	–							
180	60	88	107±0.1	152.4	$7.4^{+0.2}$	$15.9_{-0.5}$	$8^{+0.9}_{-0.6}$	$10^{+0.9}_{-0.6}$

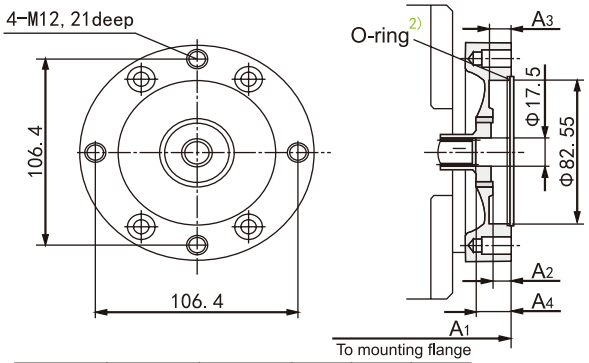
Dimensions of Through Drive

N00 without boost pump, without through drive
F00 with boost pump, without through drive



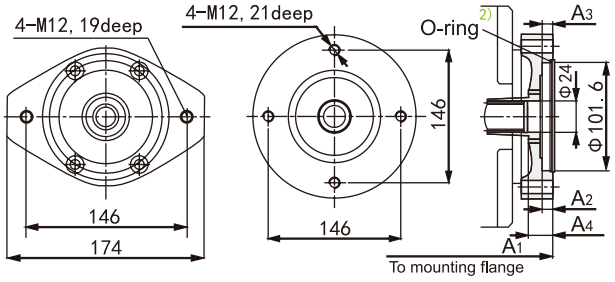
Size	A1	
	N00	F00
56/63	239. 4	262. 4
71	279. 1	293. 6
125	320. 9	326. 4
145	320. 9	326. 4
180	370. 9	370. 9

F01/K01
Flange SAE J 744-82-2(A)
Hub for splined shaft ANSI B92.1a-1976 5/8″ 9T 16/32DP[1)]
(SAE J744-16-4(A))(O-ring,82.27×1.78)



Size	A1 (F01)	A1 (K01)	A2	A3	A4
56/63	267. 4	254. 9	10	10	18
71	297. 6	297. 6	9	10	17
125	330. 9	330. 9	10. 5	9	–
135	330. 9	330. 9	10. 5	9	–
145	330. 9	330. 9	10. 5	9	–
180	378. 4	378. 4	7. 5	7. 5	15. 5

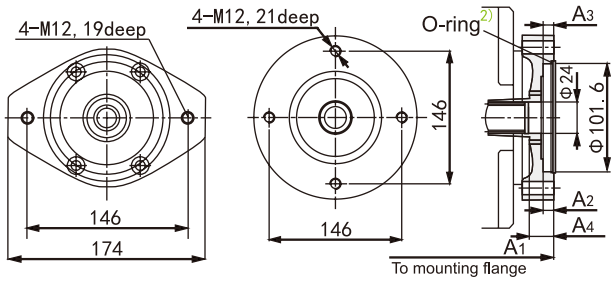
F02/K02
Flange SAE J 744-101-2(B)
Hub for splined shaft ANSI B92.1a-1976 7/8″ 13T 16/32DP[1)]
(SAE J744-22-4(B))(O-ring,101.32×1.78)



Size 56/63 Size 71/125/135/145/180

Size	A1	A2	A3	A4
56/63	268. 4	12	11	19. 5
71	300. 6	13	9. 8	17
125	330. 9	10	11	17
135	330. 9	10	11	17
145	330. 9	10	11	17
180	381. 4	11	11	18

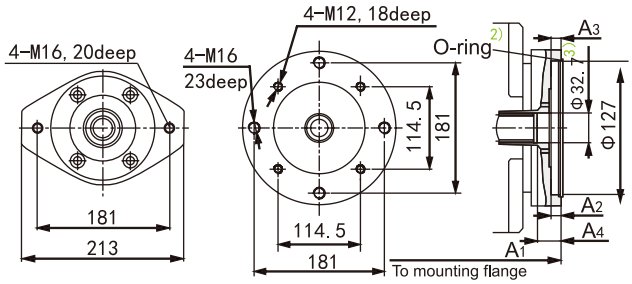
F04/K04
Flange SAE J 744-101-2(B)
Hub for splined shaft ANSI B92.1a-1976 1″ 15T 16/32DP[1)]
(SAE J744-25-4(B-B))(O-ring,101.32×1.78)



Size 56/63 Size 71/125/135/145/180

Size	A1	A2	A3	A4
56/63	268. 4	13	11	18. 5
71	300. 6	13	9. 8	15. 5
125	330. 9	10	11	16. 5
125	330. 9	10	11	16. 5
145	330. 9	10	11	16. 5
180	381. 4	11	11	18

F07/K07
Flange SAE J 744-127-2(C)
Hub for splined shaft ANSI B92.1a-1976 1 1/4″ 14T 12/24DP[1)]
(SAE J744-32-4(C))(O-ring,128×2.65)



Size 56/63 Size 71/125/135/145/180

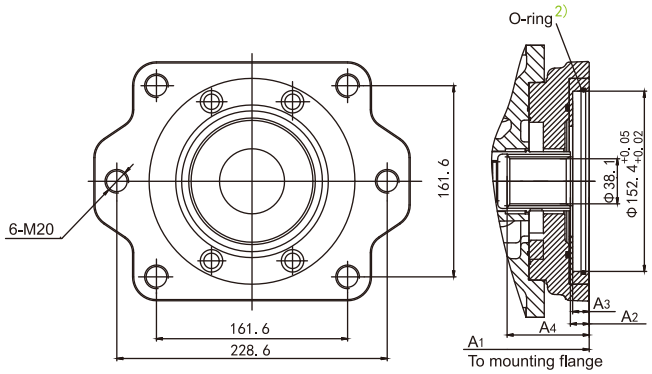
Size	A1	A2	A3	A4
56/63	272. 4	15	14	17. 5
71	303. 6	15	13. 5	20
125	335. 9	15	15. 5	22. 5
135	335. 9	15	15. 5	22. 5
145	335. 9	15	15. 5	22. 5
180	384. 8	14	19	17

Note: Size 125/135/145 without F07/K07

1) 30° pressure angle, flat root, side fit, tolerance class 5
2) O-ring included in the scope of delivery
3) Size 71(Φ33)

Dimensions of Through Drive

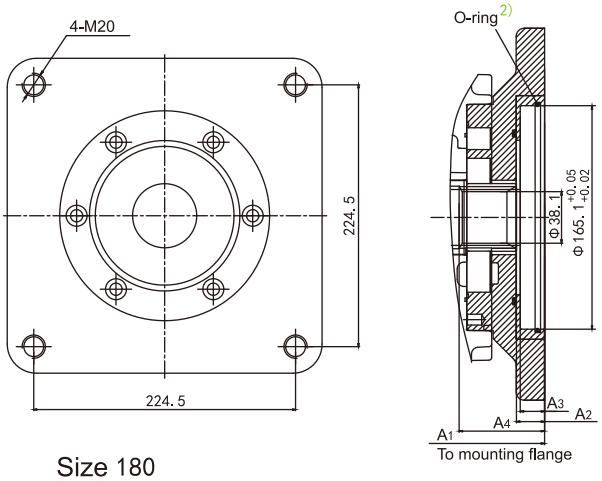
F69/K69
Flange SAE J 744-152-2/4(D)
Hub for splined shaft ANSI B92.1a-1976 1 3/4″ 13T 8/16DP[1)]
(SAE J744-44-4(D&E))(O-ring,155×3.0)



Size 125/135/145/180

Size	A1	A2	A3	A4
125	343.9	15.9	14	69.4
135	343.9	15.9	14	69.4
145	343.9	15.9	14	69.4
180	391.8	20.8	14	63.3

F72/K72
Flange SAE J 744-164-4(E)
Hub for splined shaft ANSI B92.1a-1976 1 3/4″ 13T 8/16DP[1)]
(SAE J744-44-4(D&E))(O-ring,164×3.0)



Size 180

Size	A1	A2	A3	A4
180	391.8	20.8	18	63.3

Note: Size 125/135/145 without F07/K07

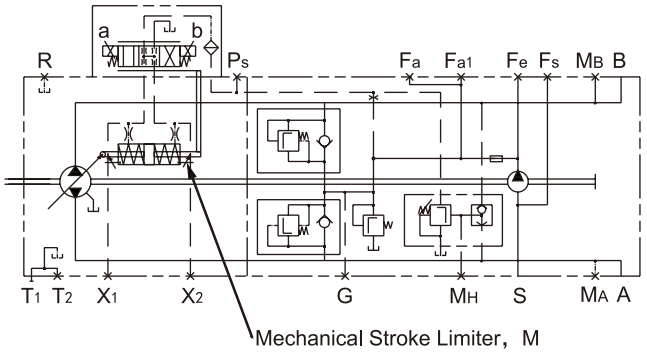
1) 30° pressure angle, flat root, side fit, tolerance class 5

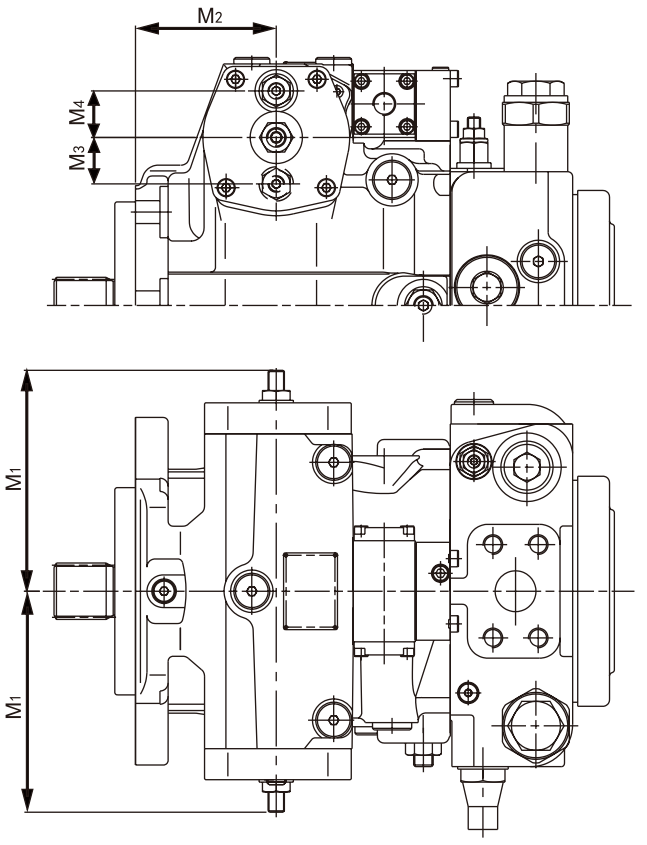
2) O-ring included in the scope of delivery

3) Size 71(Φ33)

Mechanical Stroke Limite，M

The mechanical stroke limiter is an auxiliary function for continual reduction of the maximum displacement of the pump, regardless of the control device used.
Two adjusting screws are used to limit the stroke of the stroking cylinder and thus the maximum swivel angle of the pump.

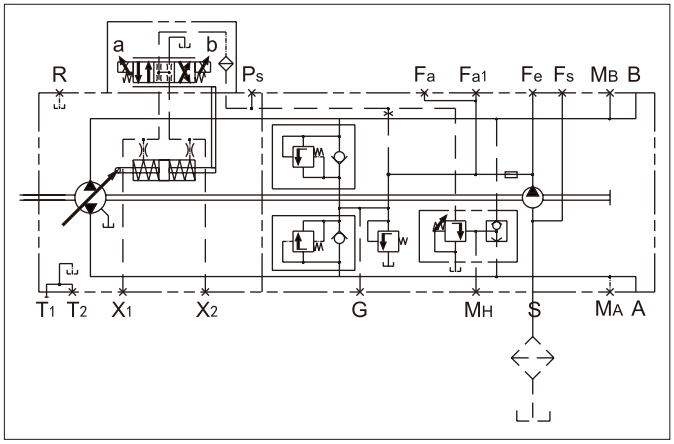




Size	M1	M2	M3	M4
56/63	130. 5max	44	25. 5	–
71	135. 4max	86. 3	–	28. 5
125	162max	104. 5	–	35. 5
135	162max	104. 5	–	35. 5
145	162max	104. 5	–	35. 5
180	181. 6max	138. 7	38	–

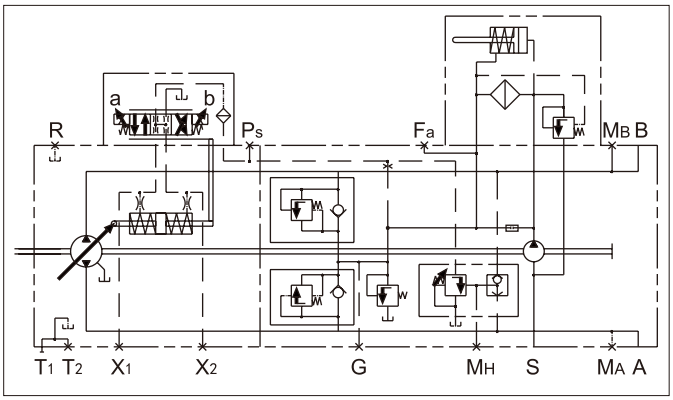
Filter

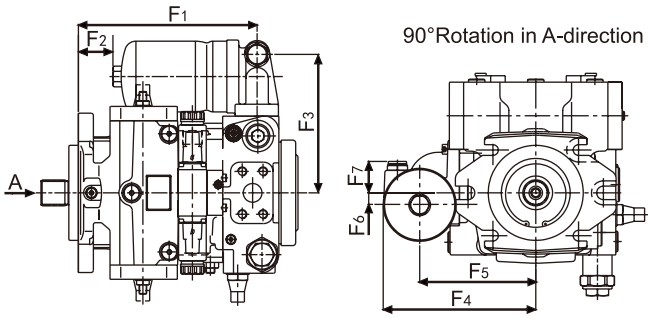
Standard: external suction filter
Standard type S (preferred)
Type of filter_____filter without bypass
Recommendation_____with contamination indicator
Flow resistance at filter element
V=30mm²/s n=nmax_____Δp≤0.01MPa
V=100mm²/s n=nmax_____Δp≤0.03MPa
Pressure at suction port S
V=30mm²/s_____Δp≥0.08MPa
Cold start(V=1600mm²/s, n≤1000rpm)_____Δp≥0.05MPa
The filter is not included in the scope of delivery.



Version: integrated filter with cold start valve and visual contamination indicator, P

Type of filter_____filter without bypass
Filter size (absolute value)_____20μm
Filter material_____glass fiber
Pressure capacity_____10MPa
Filter arrangement_____connected to pump
Note:
- The port plate has a cold start valve to prevent pump damages.
  The valve is open at flow resistance ≥0.6MPa
- With visual contamination indicator
  Differential pressure (cracking pressure) Δp=0.5MPa

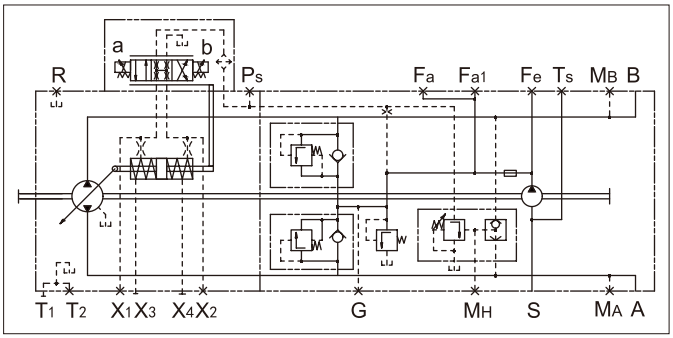


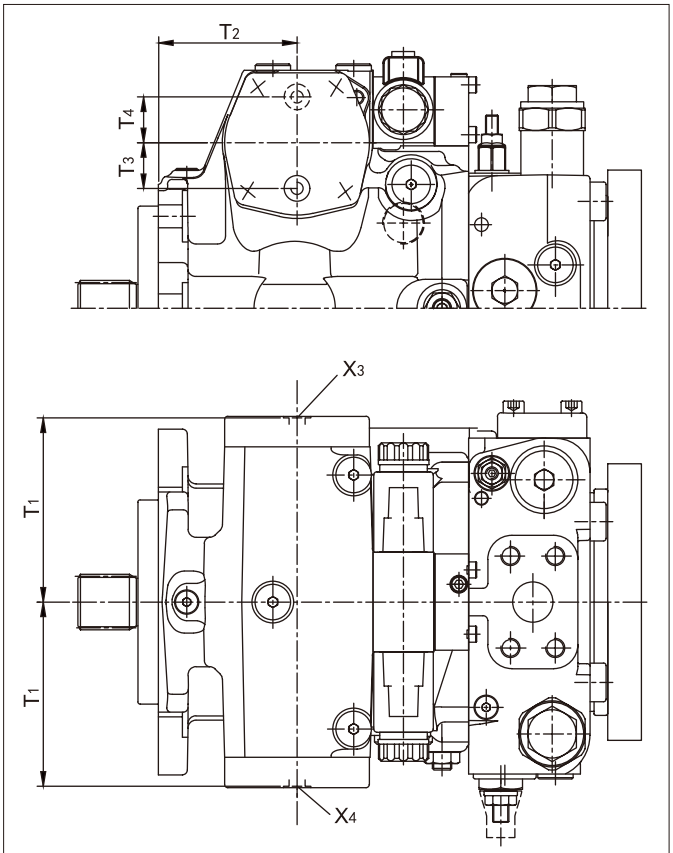


Size	F1	F2	F3	F4	F5	F6	F7
56/63	218.4	64.4	163	178	138	0	78.5
71	239	46.5	185	203.5	155	16	65.5
125	235.9	59.4	201	219.5	171	0	89.5
135	235.9	59.4	201	219.5	171	0	89.5
145	235.9	59.4	201	219.5	171	0	89.5

Variable Pressure Ports X_3/X_4, T

Stroking chamber pressure ports X_3 and X_4





Size	T_1	T_2	T_3	T_4	X_3/X_4
56	104.5	44	–	25	M12x1.5
63	104.5	44	–	26	M12x1.5
71	113.5	86.3	28	–	M12x1.5
125	136	104.5	34	–	M12x1.5
135	136	104.5	34	–	M12x1.5
145	136	104.5	34	–	M12x1.5
180	146.5	138.7	–	35	M12x1.5

Installation Instructions

General

The axial piston unit must be always be filled with hydraulic fluid and air bled during commissioning and operation.
This must also be observed following a longer standstill as the system may empty via the hydraulic lines.
The leakage in the housing must be directed to the reservoir via the highest drain port.
The minimum suction pressure at port S must not fall below 0.08 MPa absolute pressure (or 0.05 MPa absolute pressure at cold start).
Under all operating conditions, the suction line and case drain line must flow into the reservoir below the minimum fluid level.

Installation positions

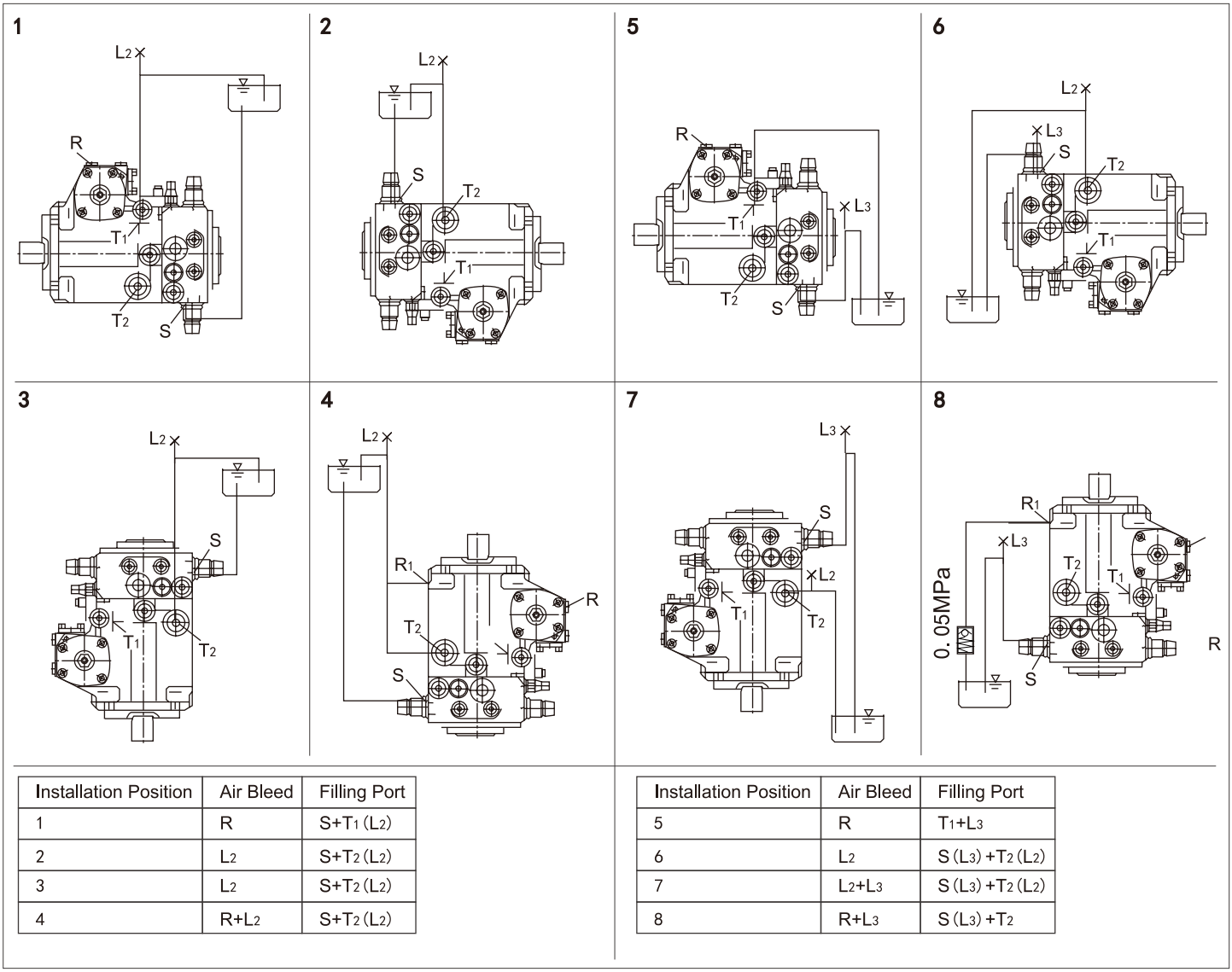
See the examples below. Other installation positions may be provided as required.

Below-reservoir installation (standard)

Pump below the minimum fluid level of the reservoir. Recommended installation positions: 1 and 2.

Above-reservoir installation

Pump above the minimum fluid level of the reservoir. Do not exceed the maximum permissible suction height h_{max}=800mm。
Recommendation for installation position 8 (shaft upwards):
Draining inside the housing may be prevented by installing a check valve (cracking pressure 0.05 MPa) in the drain line.



Installation Position	Air Bleed	Filling Port
1	R	S+T_1 (L_2)
2	L_2	S+T_2 (L_2)
3	L_2	S+T_2 (L_2)
4	R+L_2	S+T_2 (L_2)

Installation Position	Air Bleed	Filling Port
5	R	T_1+L_3
6	L_2	S (L_3) +T_2 (L_2)
7	L_2+L_3	S (L_3) +T_2 (L_2)
8	R+L_3	S (L_3) +T_2

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