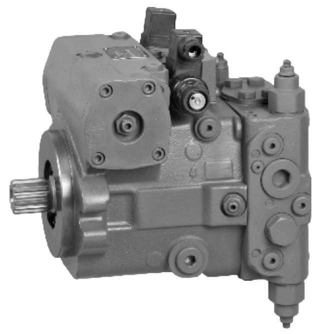
A4VG Series
Axial piston variable pump

Product show and brief introduction

Colsed circuits

Series 32
Sizes 56...71
Nominal pressure 40MPa
Maxmum pressure 45MPa



Features

— Integrated auxiliary pump of boost and pilot oil supply

— Flow direction changes when the swashplate is moved through the neutral position

— High-pressure relief valves with integrated boost function

— With adjustable pressure cut-off as standard

— Boost-pressure relief valve

— Through drive for mounting of further pumps up to same size

— Large variety of controls

— Swashplate design

Model Code

A4V	G	56	EP2	D	M	/32	R	-N	S	C	02	F	02	5	S	P
Axial piston unit	Operating mode	Size	Control unit	Pressure cut-off	Mechanical stroke limiter	series	Direction of rotation	Seals	Drive shaft	Mounting flange	Working port	Boost pump	Through drive	High-pressure relief valve	Filtration	Connector for solenoids
A4V: swashplate design, variable	G: pump; closed circuit	56 63 71	See below	No code: without pressure cut-off D: with pressure cut-off	No code: without mechanical troke limiter M: mechanical stroke limiter, externally adjustable	32	(Viewed on drive shaft) R: clockwise L: counter-clockwise	NBR (nitrile rubber), shaft seal made of FKM (fluorcaoutchouc rubber)	See below	C: SAE J744 2 -hole F: SAE J744 2+4-hole (only 71)	SAE working port A and B, top and bottom, suction port S bottom	See below	See below	See below	See below	DEUTSCH connector molded, 2-pin

Control Unit

Size			56	63	71	
Proportional control hydraulic	pilot-pressure relatied	without inlet filtration	√	√	√	HD1
		with inlet filtration	√	√	√	HD3
	mechanical servo		√	√	√	HW
Proportional control electric	with proportional solenoid without inlet filtration	U=12V	√	√	√	EP1
		U=24V	√	√	√	EP2
	with proportional solenoid with inlet filtration	U=12V	√	√	√	EP3
		U=24V	√	√	√	EP4
Two-point control, electric	with switching solenoid	U=24V	√	√	√	EZ1
		U=24V	√	√	√	EZ2

Drive Shafts

Size		56	63	71	
Splined shaft DIN5480	for single pump	√	√	√	Z
	for combination pump - 1st pump	√	√	√	A
Splined shaft ANSI B92.1a	for single pump	√	√	√	S
	for combination pump - 1st pump	√	√	√	T

Boost Pump

Size		56	63	71	
Without integrated boost pump	without through drive	√	√	√	N
	with through drive	√	√	√	K
Integrated boost pump	with and without through drive	√	√	√	F

Through Drive

Flange SAE J744	Hub for splined shaft	56	63	71	
Without through drive,only for version N and F		√	√	√	00
82-2(A)	5/8" 9T 16/32DP	√	√	√	01
101-2(B)	7/8" 13T 16/32DP	√	√	√	02
	1" 15T 16/32DP	√	√	√	04
127-2(C)	1 1/4" 14T 12/24DP	√	√	√	07

High-pressure relief valve

	Setting range		56	63	71	
High-pressure relief valve,pilot operated	10...42MPa	with bypass	√	√	√	1
High-pressure relief valve direct operated,fixed setting	25...42MPa	without bypass	√	√	√	3
		with bypass	√	√	√	5
	10...25MPa	without bypass	√	√	√	4
		with bypass	√	√	√	6

Filtration boost circuit/external boost pressure supply

		56	63	71	
Filtration in the boost pump suction line		√	√	√	S
Filtration in the boost pump pressusre line	Ports for external boost circuit filtration	√	√	√	D
	Attachment filter with cold start valve and visual contamination indicator	√	√	√	P
External boost pressure supply(version without integrated boost pump -N00,K...)		√	√	√	E

Technical Data

Hydraulic fluid

The A4VG variable displacement pump is suitable for use with mineral oil

Viscosity range

We recommend that a viscosity (at operating temperature)for optimum efficiendy and service life purposes of

V_{opt} = optimum viscosity16...36mm²/s

Be chosen,taken the tank temperature(closed circuit) into account.

Limits of viscosity range

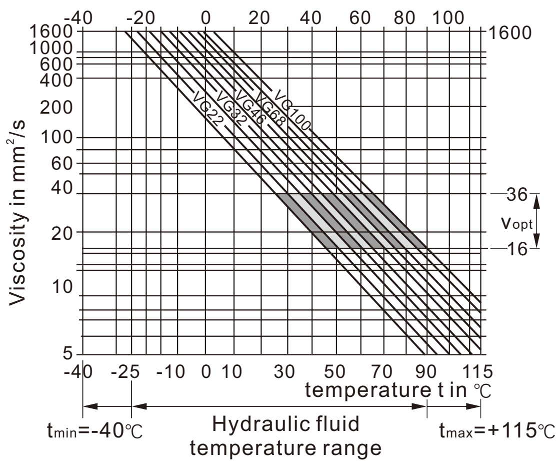
The following values apply in extreme cases:

Vmin = 5 mm²/s
short term(t < 3 min)at max.permitted temperature
tmax=115℃

Vmax = 1600 mm²/s
short term(t < 3 min) with cold start(P < 3MPa,
n≤1000rpm t_{min}=-40℃)

Note that the maximun hydraulic fluid temperature must not be exceeded locally either (e.g.bearing area).The temperature in the bearing area is-depending on pressure and speed-up to 12K higher than the average case drain temperature.

Setlection diagram



Details regarding the choice of hydraulic fluid

The correct selection of hydraulic fluid requires knowledge of the operating temperature in relation to the ambient temperature, in an open circuit the tank temperature.

The hydraulic fliuid should be selected so that within the operating temperature range, the operating viscosity lies within the optimun range (V_{opt})(see shaded section of the selection diagram).We recommend that the highest possible viscosity range should be chosen in each case.

Example:At an ambient temperature of X℃ an operating temperature of 60℃ is set in the circuit. In the optimun operating viscosity range(V_{opt}; shaded area) this corresponds to the viscosity classes VG 46 or VG68; to be selected: VG 68.

Please note: The leakage fluid temperature, which is affected by pressure and rotational spaad,is always higher than the tank temperature . At no point in the system may the temperature be higher than 115℃.

Filtartion

Finer filtration improves the cleanliness level of the hydraulic fluid ,witch increases the service life of the axial piston unit.

A cleanliness level of at least 20/18/15 is to be maintained according to ISO 4406.

At a hydraulic fluid visconsity of less than 10 mm2/s(e.g.due to high temperatures during short-term operation),a cleanlinesss level of at least 19/17/14 according to ISO 4406 is required.

Operational pressure range

Enter:

Variable pump(with external oil supply.E)

Charge pressure(at n=2000rpm)P_{sp} ———— =2MPa

Charge pump

Suction pressure $P_{s\ min}$ (V≤30mm2/s) ≥0.08MPa

Output:

Variable pump

Pressure at port A or B

Nominal pressure P_N ———— 40MPa

Peak pressure Pmax ———— 45MPa

Total pressure (pressure A+pressure B) P_{max} ———— 70MPa

Charge pump

Peak pressure $P_{sp\ max}$ ———— 4MPa

Shaft seal

Permissible pressure loading

The service life of the shaft seal is influenced by the rotational speed of the axial piston unit and the leakage pressure in the housing (case pressure).Momentary (t < 0.1s) pressure peaks of up to1MPa are allowed.Case pressure of a continuous 0.2MPa maximum are permitted to be able to utilize the entire speed range.Higher case pressure are permissible at lower rotational speeds.
The service life of the shaft seal decreases with increasing frequency of pressure peaks and increasing mean differential pressure.
The case pressure must be equal to or higher than the ambient pressure.

Temperature range

The FKM shaft seal ring may be used for leakage temperature from -25℃ to +115℃.For application cases below -25℃,an NBR shaft seal is required(permissible temperature range:-40℃ to +90℃).

Technical Data

Size				56	63	71
Geometric displacement,per revolution						
variable pump		$V_{g\,max}$	mL/r	56	63	71
boost pump (at P=2MPa)		$V_{g\,sp}$	mL/r	15.8	15.8	19.6
Rotational speed						
maximum at $V_{g\,max}$		$n_{max\,continuous}$	rpm	3600	3600	3300
limited maximum 1)		$n_{max\,limited}$	rpm	3900	3900	3600
intermittent maxium 2)		$n_{max\,interm}$	rpm	4500	4500	4100
minimum		n_{min}	rpm	500	500	500
Flow						
at n_{nom} and $V_{g\,max}$		$q_{v\,max}$	L/min	202	227	234
Power 3)						
at n_{nom} and $V_{g\,max}$	△P=40MPa	P_{max}	kW	134	151	156
Torque 3)						
with at $V_{g\,max}$	△P=40MPa	T_{max}	Nm	356	401	451
	△P=10MPa	T	Nm	89	100	113
Moment of inertia of the rotary group		J	kgm	0.0066	0.0066	0.0097
Maximum angular acceleration 4)			rad/s^2	24000	24000	21000
Maximum speed change 4)			rpm	72	72	69
Case volume		V	L	1.5	1.5	1.3
Weight(without through drive) approx.		M	kg	38	38	50

1) Valid at half corner power(e.g.at $V_{g\,max}$ and $P_n/2$)
2) Valid at △P=7MPa to 15 MPa or △P＜30MPa and t＜0.1s
3) without boost pump
4) the limit value is only valid for a single pump.

Determining the nominal value

Flow $$q_v = \frac{V_g \times n \times \eta_v}{1000} \quad \text{(L/min)}$$

Torque $$T = \frac{V_g \times \triangle P}{20 \times \pi \times \eta_{mh}} \quad \text{(Nm)}$$

Power $$P = \frac{2\pi \times T \times n}{60000} = \frac{q_v \times \triangle P}{600 \times \eta_t} \quad \text{(kW)}$$

V_g = Displacement per revolution in mL/r
$\triangle P$ = Differential pressure in bar
n = Speed in rpm
η_v = Volumetric efficiency
η_{mh} = Mechanical-hydraulic efficiency
η_t = Overall efficiency($\eta_t = \eta_v . \eta_{mh}$)

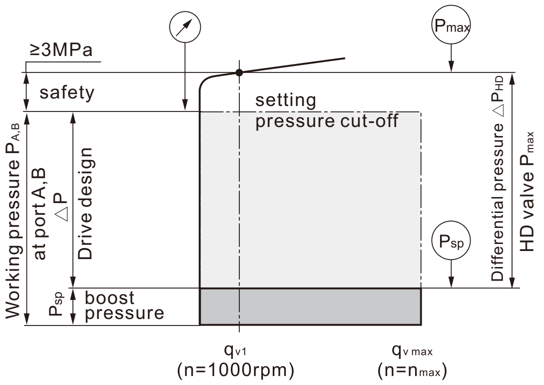
Hgih-pressure Relief Valves

Setting ranges

High-pressure relief valve, direct operated (size 56,63)	Differential pressure setting △P_{HD}
Setting range valve 3,5 △P_{HD} =27-42MPa	42 MPa
	40 MPa
	36 MPa
	34 MPa
	32 MPa
	30 MPa
	27 MPa
Setting range valve 4,6 △P_{HD} =10-25MPa	25 MPa
	23 MPa
	20 MPa
	15 MPa
	10 MPa

High-pressure relief valve, pilot operated (size 71)	Differential pressure setting △P_{HD}
Setting range valve 4,6 △P_{HD} =10-42MPa	42 MPa
	40 MPa
	36 MPa
	34 MPa
	32 MPa
	30 MPa
	27 MPa
	25 MPa
	23 MPa
	20 MPa
	15 MPa
	10 MPa

Setting diagram



Note:the valve settings are made at n=1000 rpm and at $V_{g\,max}(q_{v1})$,

Example:charge pressure 3 MPa,working pressure 40 Mpa
working pressure $P_{A,B}$ - Boost pressure P_{SP} + Safety = Differential pressure △P_{HD}
40 MPa - 3MPa +3MPa = 40 MPa

Bypass function

A connection between the two high-pressure passages A and B can be established using the bypass function(e.g.for machine towing).

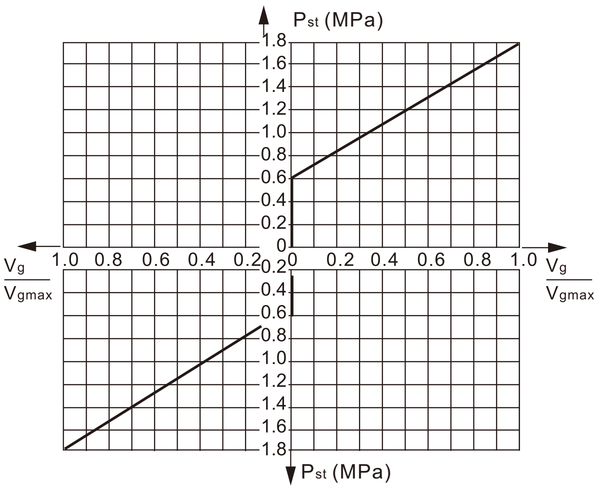
Pressure cut-off,D

The pressure cut-off is a pressure control which,after reaching the set pressure,adjusts the displacement of the pump back to V_{gmin}.
This valve prevents the operation of the high-pressure reliefvalves when accelerating or decelerating.
The high-pressure relief valves protect against the pressurepeaks which occur during fast swiveling of the swashplate and limit the maximum pressure in the system.
The setting range of the pressure cut-off may be anywhere withinthe entire working pressure range.However,it must at least be set 3 Mpa lower than the setting value of the high-pressure reliefvalves.

Please state the setting value of the pressure cut-off in plain textwhen ordering.

HD-Proportional control,hydraulic,pilot-pressure related

The output flow of the pump is infinitely variable between o and 100%,proportional to the difference in pilot pressure applied to the two pilot signal ports (Y_1 and Y_2).
The pilot signal,coming from an external source, is a pressure signal.Flow is negligible,as the pilot signal acts only on the control spool of the control valve.
This control spool then directs control oil into and out of the stroking cylinder to adjust pump displacement as required.
A feedback lever connected to the stroking piston maintains the pump flow for any given pilot signal within the control range.



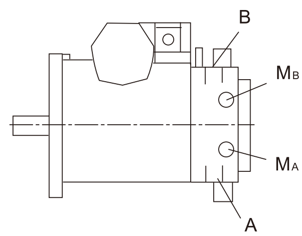
V_g Displacement
$V_{g\,max}$ Maximum displacement

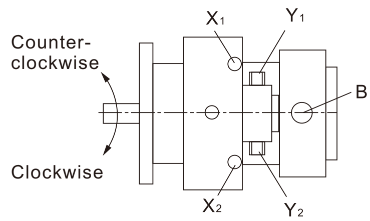
Pilot pressure Pst=0.6-1.8MPa for Ports Y1,Y2
Start of control 0.6MPa (at $V_{g\,0}$)
End of control 1.8MPa (at $V_{g\,max}$)

Notice:
In the neutral position,the HD control module must be unloaded to reservoir via the external pilot control device.

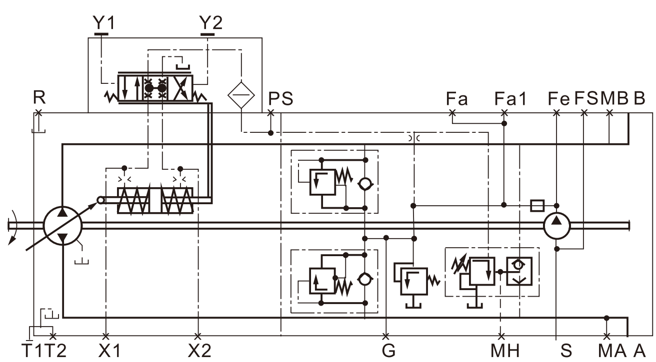
Correlation of direction of rotation, control and flow direction

		Size	Pilot signal	Control pressure	Flow direction	Working pressure
Direction of rotation	Clockwise	56,63	Y_1	X_1	A to B	M_B
			Y_2	X_2	B to A	M_A
		71	Y_1	X_1	B to A	M_A
			Y_2	X_2	A to B	M_B
	Counter-clockwise	56,63	Y_1	X_1	B to A	M_A
			Y_2	X_2	A to B	M_B
		71	Y_1	X_1	A to B	M_B
			Y_2	X_2	B to A	M_A



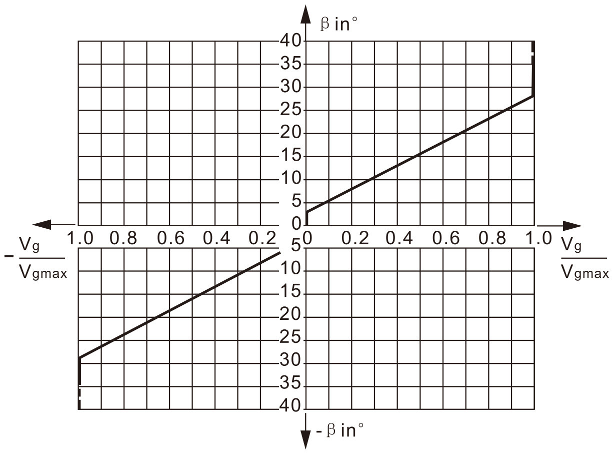


Circuit diagram HD3



HW-Proportional control,hydraulic,mechanical servo

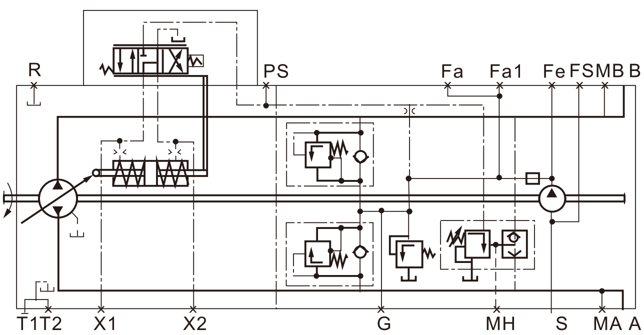
The output flow of the pump is infinitely variable between o and 100%,proportional to the swivel angle of the control lever.
A feedback lever connected to the stroking piston maintains the pump flow for any given position of the control lever.



The swing angle of the lever when swinging β :
Start of control β =±3° (at V_{g0})
End of control β =±29° (at $V_{g\,max}$)
Rotational limiter control β =±40°

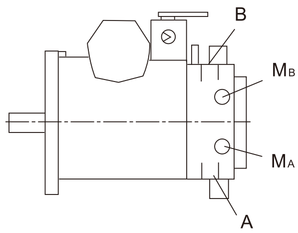
The maximum required torque at control lever is 170 Ncm.To prevent damage to the HW control module,a positive mechanical stop of 38° ±1 must be provided for the HW control lever on the customer side.

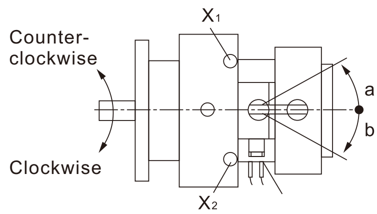
Circuit diagram HW



Correlation of direction of rotation, control and flow direction

		Size	Lever direction	Control pressure	Flow direction	Working pressure
Direction of rotation	Clockwise	56,63	a	X_2	B to A	M_A
			b	X_1	A to B	M_B
		71	a	X_2	A to B	M_B
			b	X_1	B to A	M_A
	Counter-clockwise	56,63	a	X_2	A to B	M_B
			b	X_1	B to A	M_A
		71	a	X_2	B to A	M_A
			b	X_1	A to B	M_B





Notice:
Spring-centering enables the pump,depending on pressure and rotational speed,to move automatically to the neutral position(Vg =0) as soon as there is no longer any torque no the control lever of the HW control module.

As standard delivery,the control lever can be changed toward the through drive(see dimensions).

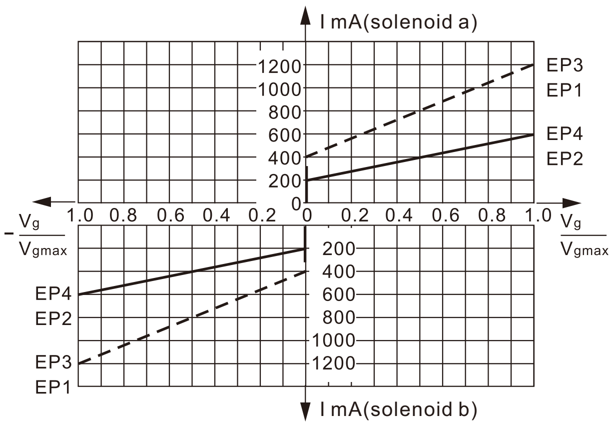
If necessary,the position of the lever can be changed.The procedure is defined in the instruction manual.

The position of the control lever can deviate from the installation drawing.

EP-Proportional control,electric

The output flow of the pump is infinitely variable between o and 100%,proportional to the electric current supplied to solenoid a or b.

The electrical energy is converted into a force acting on the control spool.This control spool then directs control oil into and out of the stroking cylinder to adjust pump displacement as required. A feedback lever connected to the stroking piston maintains the pump flow for any given current within the control range.

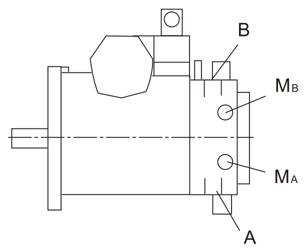


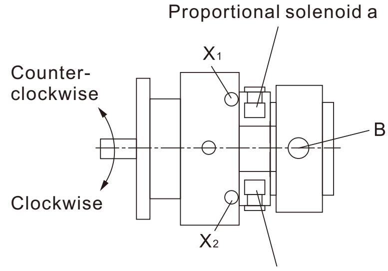
Notice:
The proportional solenoid do not have manual override.
Proportional solenoid with manual override and spring return are available on request.

Technical data, proportional solenoid	EP3/1	EP4/2
Voltage	12V DC(±20%)	24V DC(±20%)
Control current		
Start of control at $V_{g\,0}$	400mA	200mA
End of control at $V_{g\,max}$	1200mA	600mA
Current limit	1.54A	0.77A
Nominal resistance(at 20°C)	5.5Ω	22.7Ω
Frequency	100Hz	100Hz
Duty cycle	100%	100%
Type of protection	Ip65	

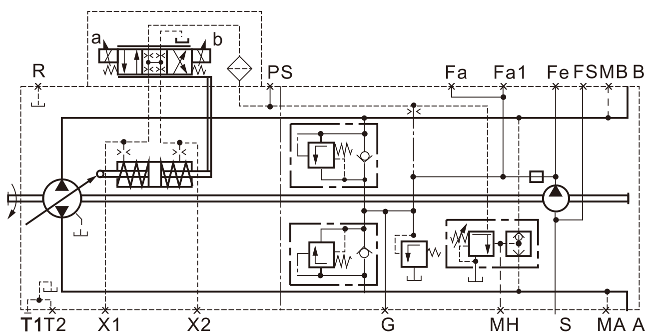
Correlation of direction of rotation, control and flow direction

		Size	Actuation of proportional solenoid	Control pressure	Flow direction	Working pressure
Direction of rotation	Clockwise	56,63	a	X_1	A to B	M_B
			b	X_2	B to A	M_A
		71	a	X_1	B to A	M_A
			b	X_2	A to B	M_B
	Counter-clockwise	56,63	a	X_1	B to A	M_A
			b	X_2	A to B	M_B
		71	a	X_1	A to B	M_B
			b	X_2	B to A	M_A





Circuit diagram EP



EZ-Two-point control,electric

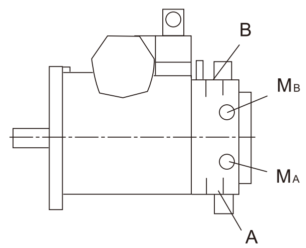
By actuating either switching solenoid a or b,internal control pressure is applied directly to the stroking piston and the pump swivels to maximum displacement.
The EZ control enables pump flow to be switched between V_g= 0 and $V_{g\,max}$.
Flow direction is determined by which solenoid is energized.

Technical data, switching solenoid	EZ3/1	EZ4/2
Voltage	12V DC(±20%)	24V DC(±20%)
Neutral position V_g=0	de-energized	de-energized
Position $V_{g\,max}$	current switched on	current switched on
Nominal resistance(at 20°C)	5.5Ω	22.7Ω
Nominal power	26.2W	26.5W
Minimum required active current	1.32A	0.67A
Duty cycle	100%	100%
Type of protection	Ip65	

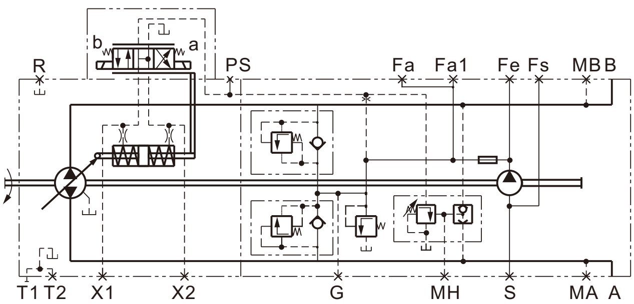
Standard : switch electromagnet without manual emergency operation function.Manual emergency operation via spring return is available on request.

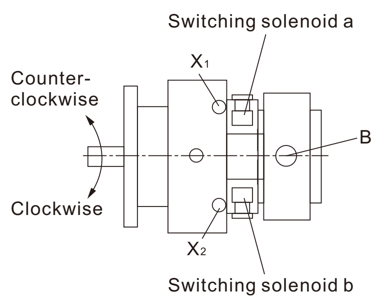
Correlation of direction of rotation, control and flow direction

		Size	Actuation of proportional solenoid	Control pressure	Flow direction	Working pressure
Direction of rotation	Clockwise	56,63	a	X_2	B to A	M_A
			b	X_1	A to B	M_B
		71	a	X_2	A to B	M_B
			b	X_1	B to A	M_A
	Counter-clockwise	56,63	a	X_2	A to B	M_B
			b	X_1	B to A	M_A
		71	a	X_2	B to A	M_A
			b	X_1	A to B	M_B



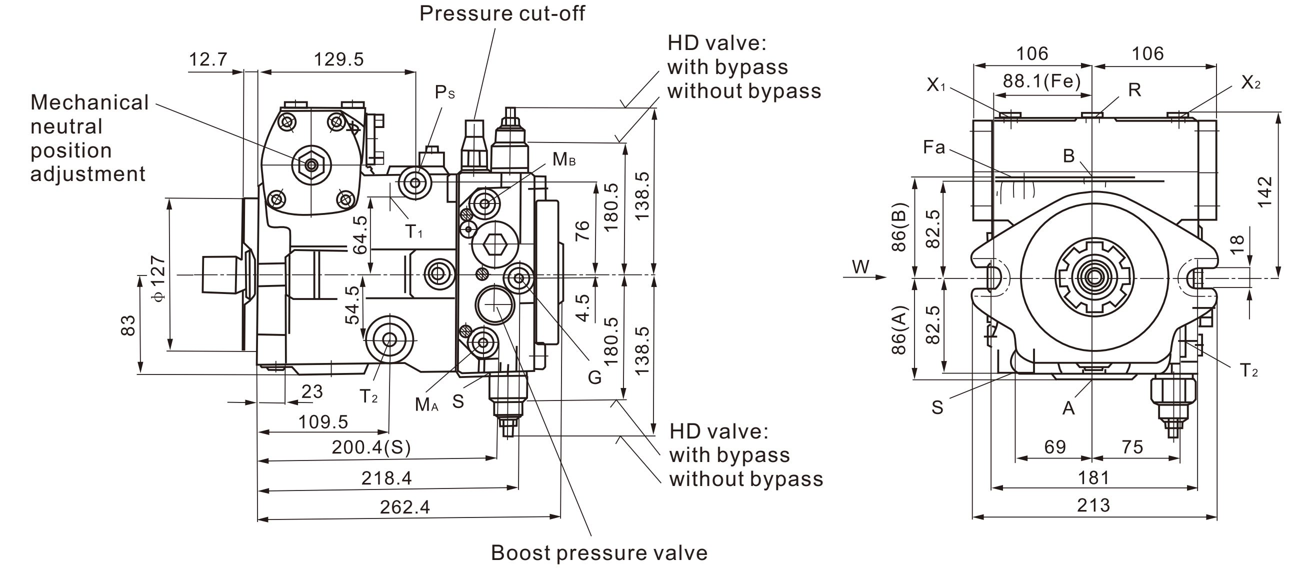
Circuit diagram EZ

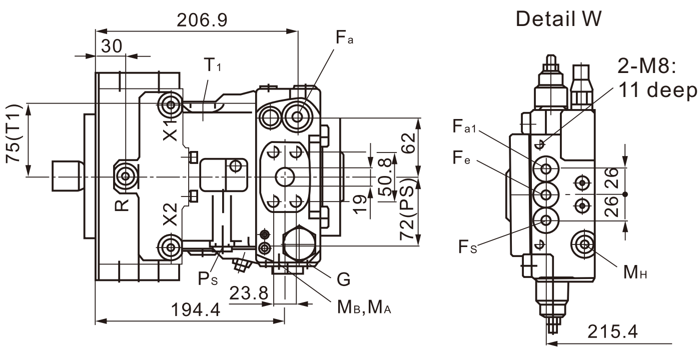




Installation dimensions Size 56,63

Without control valve





Ports

A,B	Working port	3/4 in
	Fastening thread	M10;17 deep
S	Suction port	M33×2;18 deep
T_1	Drain port	M22×1.5;15 deep
T_2	Drain port	M22×1.5;15 deep
M_A,M_B	Measuring port presssure A,B	M12×1.5;12 deep
R	Air bleed port	M12×1.5;15 deep
X_1,X_2	Control pressure port (upstream of orifice)	M12×1.5;12 deep
G	Boost pressure port inlet	M14×1.5;12 deep
P_s	Pilot pressure port	M14×1.5;12 deep
F_a	Boost pressure port inlet	M18×1.5;12 deep
F_{a1}	Boost pressure port inlet (attachment filter)	M18×1.5;12 deep
F_e	Boost pressure port outlet	M18×1.5;12 deep
F_s	Line from filler to suction port (cold start)	M18×1.5;12 deep
M_H	Measuring port, high pressure	M12×1.5;12 deep

Shafts

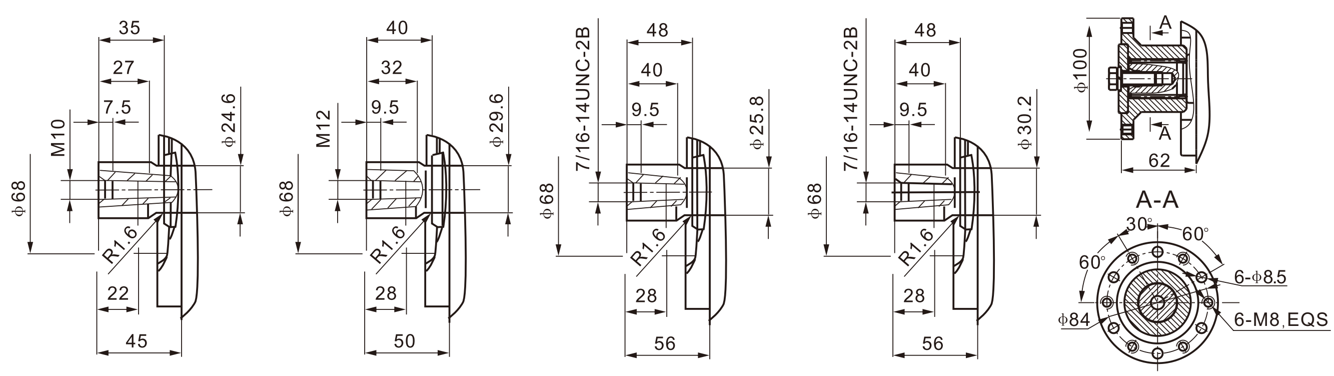
Z spline shaft DIN5480 W30×2×30×14×9g

A spline shaft DIN5480 W35×2×30×16×9g

S spline shaft SAE J744 1 1/4in 14T 12/24DP1)

T spline shaft SAE J744 1 3/8in 21T 16/32DP1)

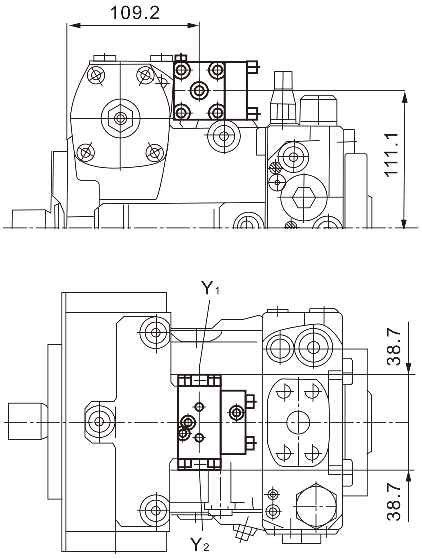
L spline shaft SAE J744 with connecting flange



1) Involute spline according to ANSI B92.1a,30 pressure angle,flat root,side fit,tolerancd class 5

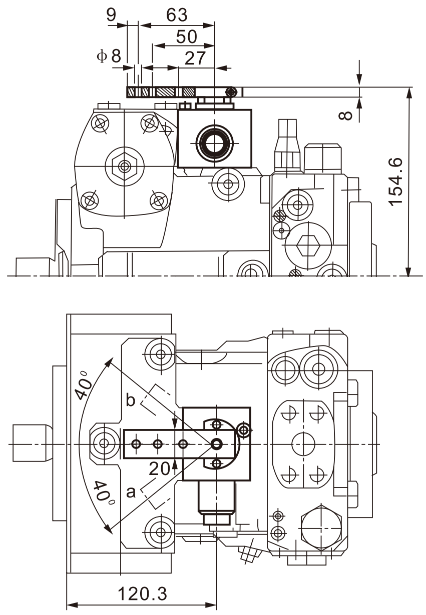
Installation dimensions Size 56,63

HD-Proportional control,hydraulic, pilot-pressure related

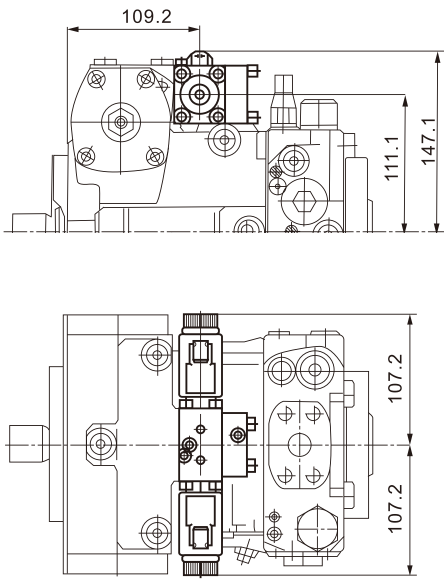


Y1,Y2 Pilot pressure port outlet M14×1.5;12 deep

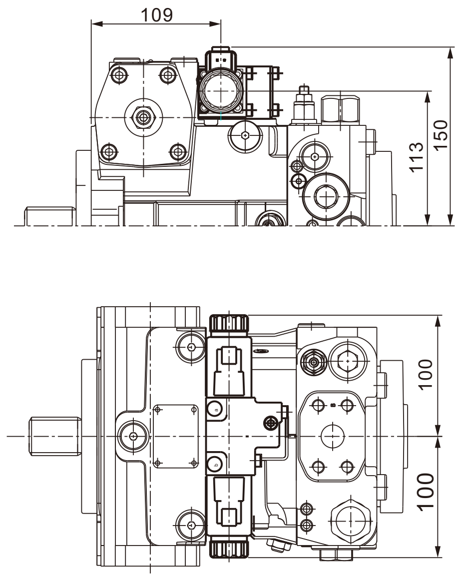
HW-Proportional control,hydraulic, mechanical servo



EP-Proportional control,electric

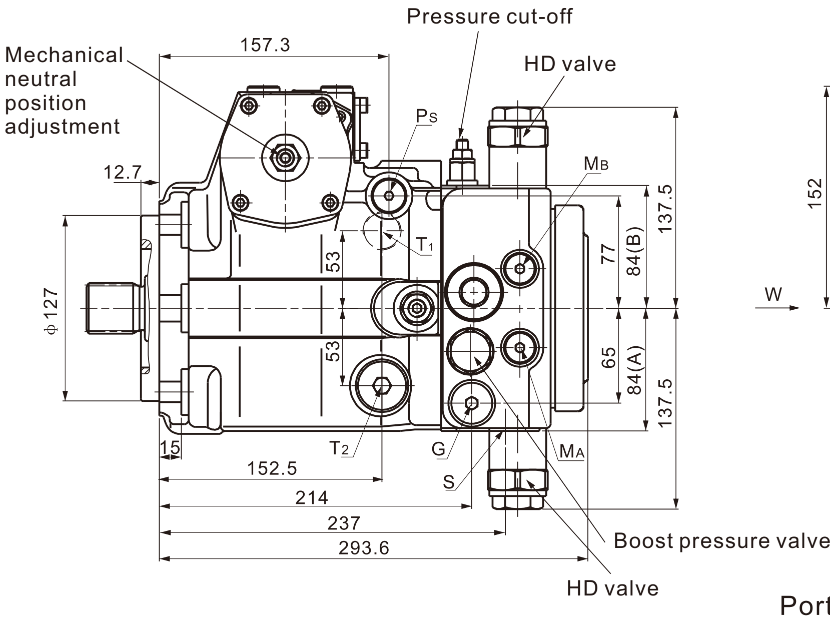


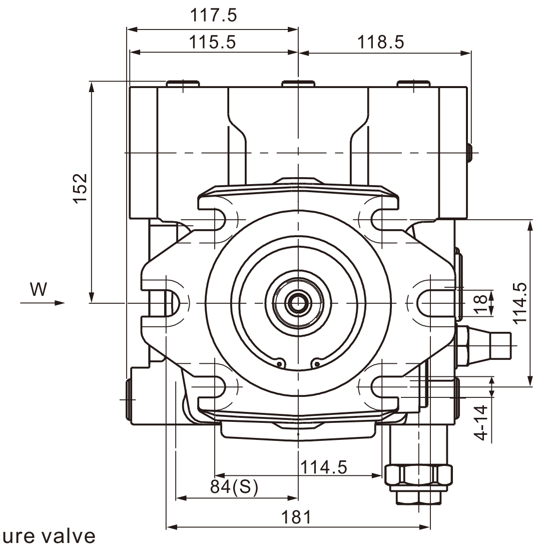
EZ-Two-point control,electric

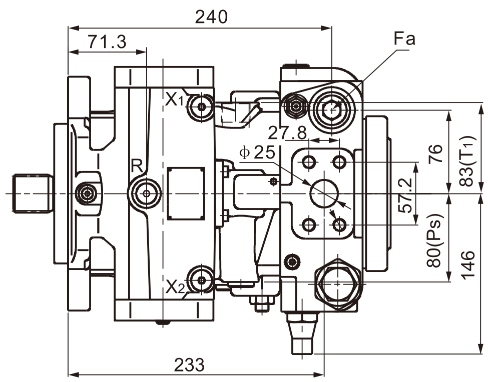


Installation dimensions Size 71

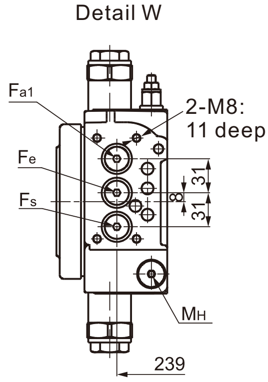
Without control valve







Detail W

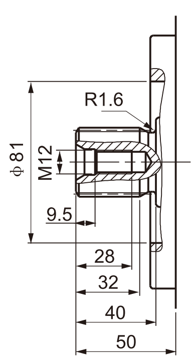


Ports

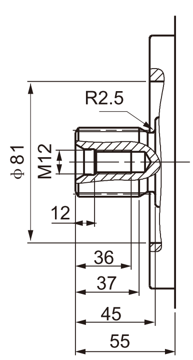
A,B	Working port	1 in
	Fastening thread	M12;17 deep
S	Suction port	M42×2;20 deep
T_1	Drain port	M26×1.5;16 deep
T_2	Drain port	M26×1.5;16 deep
M_A,M_B	Measuring port presssure A,B	M12×1.5;12 deep
R	Air bleed port	M12×1.5;12 deep
X_1,X_2	Control pressure port (upstream of orifice)	M12×1.5;12 deep
G	Boost pressure port inlet	M12×1.5;12 deep
P_s	Pilot pressure port	M14×1.5;12 deep
F_a	Boost pressure port inlet	M26×1.5;16 deep
F_{a1}	Boost pressure port inlet (attachment filter)	M22×1.5;14 deep
F_e	Boost pressure port outlet	M22×1.5;14 deep
F_s	Line from filler to suction port (cold start)	M22×1.5;14 deep
M_H	Measuring port, high pressure	M12×1.5;12 deep

Shafts

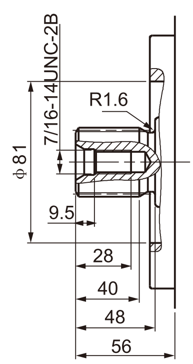
Z spline shaft DIN5480
W35×2×30×16×9g



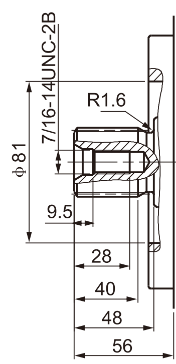
A spline shaft DIN5480
W40×2×30×18×9g



S spline shaft SAE J744
1 1/4in 14T 12/24DP1)



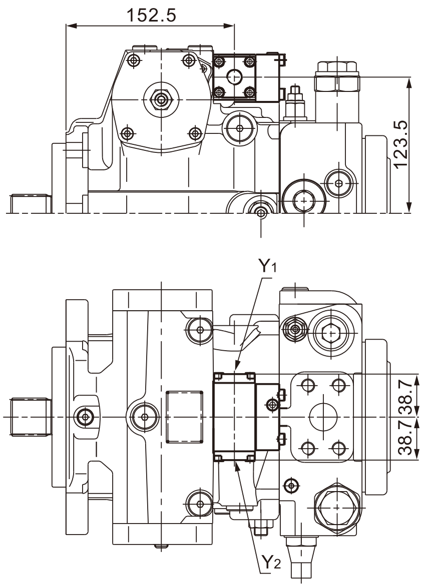
T spline shaft SAE J744
1 3/8in 21T 16/32DP1)



1) Involute spline according to ANSI B92.1a,30 pressure angle,flat root,side fit,tolerancd class 5

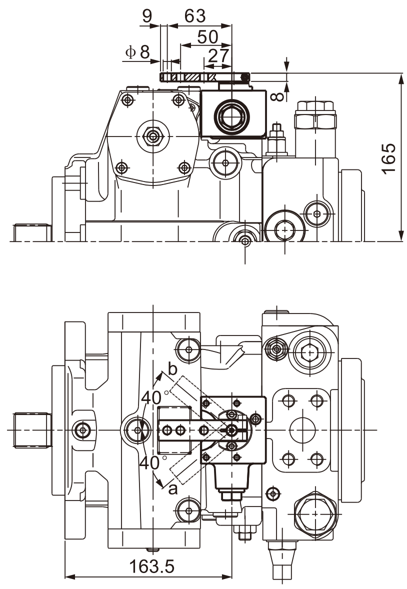
Installation dimensions Size 71

HD-Proportional control,hydraulic, pilot-pressure related

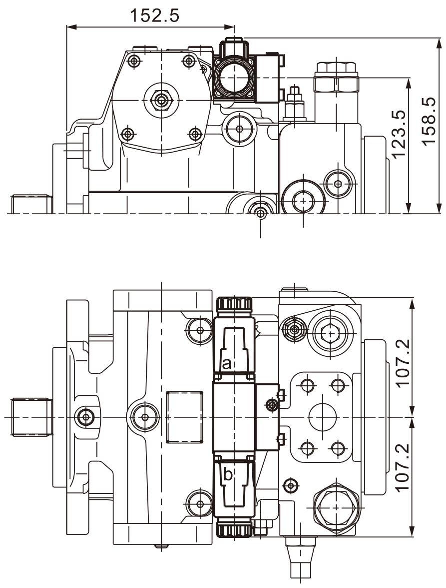


Y_1,Y_2 Pilot pressure port outlet M14×1.5;12 deep

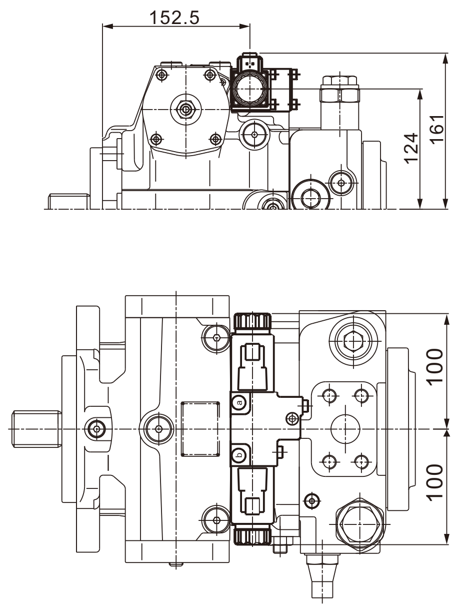
HW-Proportional control,hydraulic, mechanical servo



EP-Proportional control,electric

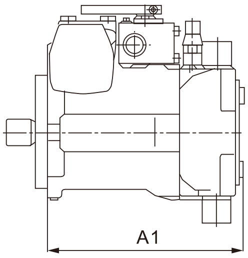


EZ-Two-point control,electric



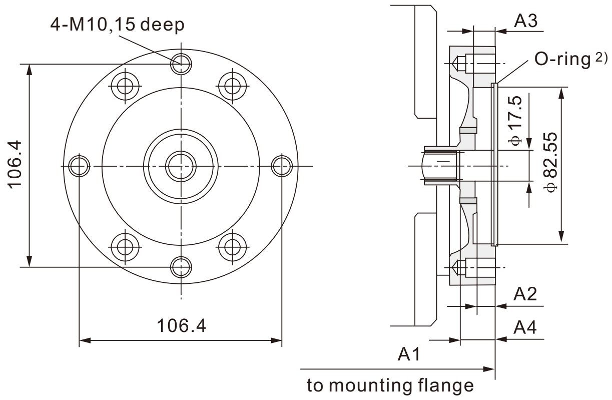
Installation dimensions,through drive

N00-without boost pump
F00-with boost pump



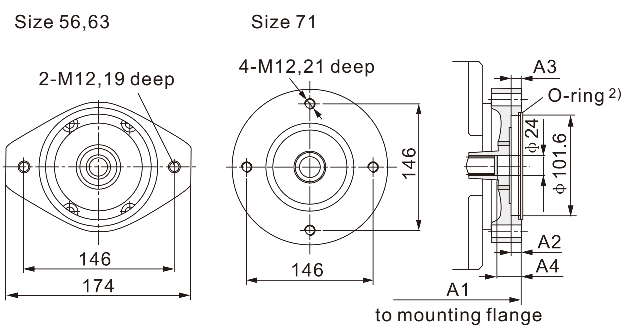
Size	A1	
	N00	F00
56,63	239.4	262.4
71	279.1	293.6

F01/K01
Flange SAE J744
Spline shaft sleeve to ANSI B92.1
5/8in 9T 16/32DP[1]



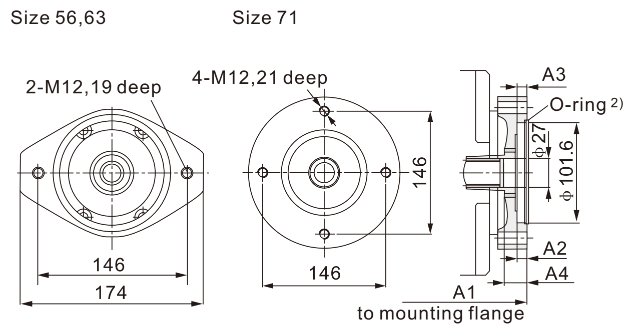
Size	A1(F01)	A1(K01)	A2	A3	A4
56,63	267.4	259.4	10	10	18
71	297.6	297.6	9	10	17

F02/K02
Flange SAE J744
Spline shaft sleeve to ANSI B92.1
7/8in 13T 16/32DP[1]



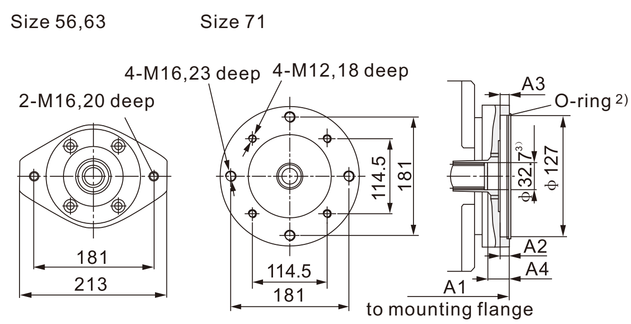
Size	A1	A2	A3	A4
56,63	268.4	12	11	19.5
71	300.6	13	9.8	17

F04/K04
Flange SAE J744
Spline shaft sleeve to ANSI B92.1
1in 15T 16/32DP[1]



Size	A1	A2	A3	A4
56,63	268.4	13	11	18.5
71	300.6	13	9.8	15.5

F07/K07
Flange SAE J744
Spline shaft sleeve to ANSI B92.1
1 1/4in 14T 12/24DP[1]



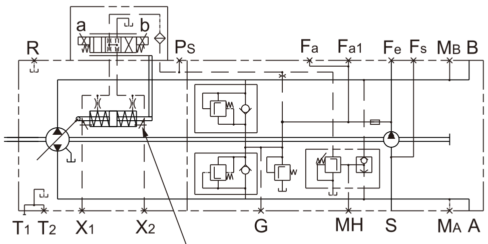
Size	A1	A2	A3	A4
56,63	272.4	15	14	17. 5
71	303.6	15	13.5	20

1) Involute spline according to ANSI b92,1a,30°pressure angle, flat root,side fit,tolerance class 5
2) O-ring included in the scope of delivery
3) Size 71 ϕ33.5

Mechanical stroke limiter

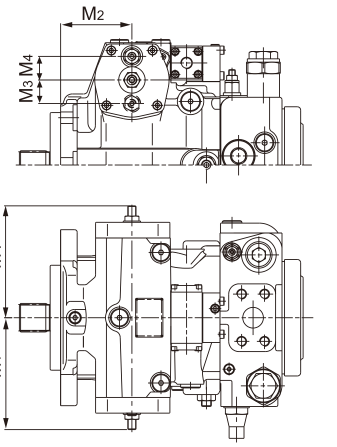
The mechanical stroke limiter is an auxiliary function allowing the maximum displacement of the pump to be steplessly reduced, regardless of the control module used.
By means of two threaded pins, the stroke of the stroking piston and thus the maximum swivel angle of the pump can be limited.

Circuit diagram



Mechanical stroke limiter

Dimensions



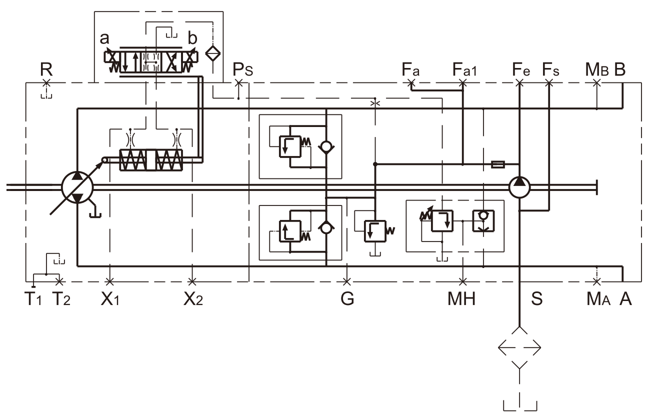
Size	M1	M2	M3	M4
56,63	130.5max	44	25.5	-
71	135.4max	86.3	-	28.5

Filter type

Filtration in the boost pump suction line, S

Filter version	Suction filter
Recommendation	With contamination indicator, with cold start valve
Recommended flow resistance at filter element	
At v=30 mm^2/s,n=n_{max}	△P=0.1bar
At v=1000 mm^2/s,n=n_{max}	△P=0.3bar
Pressure at suction port S	
Continuous $P_{s\,min}$(v≤30mm^2/s)	≥0.8bar absolute
Short-term, at a cold start(t < 3 min)	≥0.5bar absolute
Maximum pressure Ps max	⩽5bar absolute

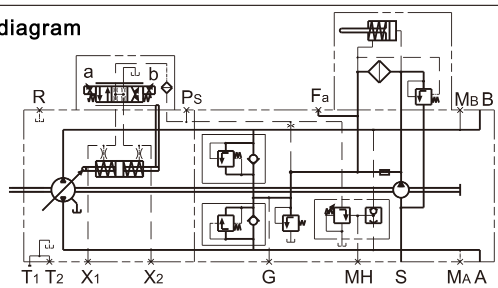
Circuit diagram



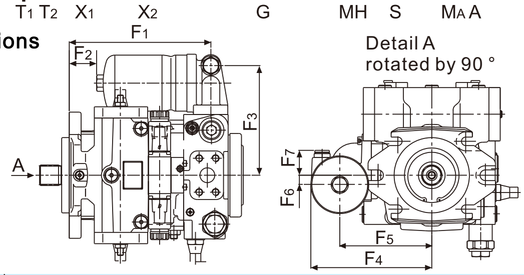
Attachment filter with cold start valve and visual contamination indicator, P

Filter version	Attachment filter
Recommendation	Version with contamination indicator,(differential pressure)
Filter grade(absolutd)	20μm
Filter material	Glass fiber
Pressure rating	100 bar
Filter arrangement	Mounted on pump
Display type	Green/red window
Differential pressure (switching pressure)	△P=5 bar

Circuit diagram



Dimensions



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

Installation instructions

General

The axial piston unit must be filled with hydraulic fluid and air bled during commissioning and operation.This must also be observed following a longer standstill as the axial piston unit may empty via the hydraulic lines.
Particularly in the installation position ”drive shaft upwards”,filling and air bleeding must carried out completely as there is,for example,a danger of dry running.
The leakage in the housing area must be directed to the reservoir via the highest drain port(T1,T2).
For combination pumps,the leakage must be drained off at each single pump.
If a shared drain line is used for several units,make sure that the respective case pressure in each unit is not exceeded.The shared drain line must be dimensioned to ensure that the maximum permissible case pressure of all connected units is not exceeded in any operating condition, particularly at cold start,If this is not possible,separate drain lines must be laid,if necessary.
To achieve favorable nosie values,decouple all connecting lines using elastic elements and avoid above-reservoir installation.
Under all operating conditions,the suction line and drain line must flow into the reservoir below the minimum fluid level.The permissible suction height h_s results from the total pressure loss;it must not however,be higher than $h_{s\,max}$=800 mm.
The suction pressure at port S must also not fall below the minimum value of 0.8 bar absolut during operation(cold start 0.5 bar absolute).

Installation position

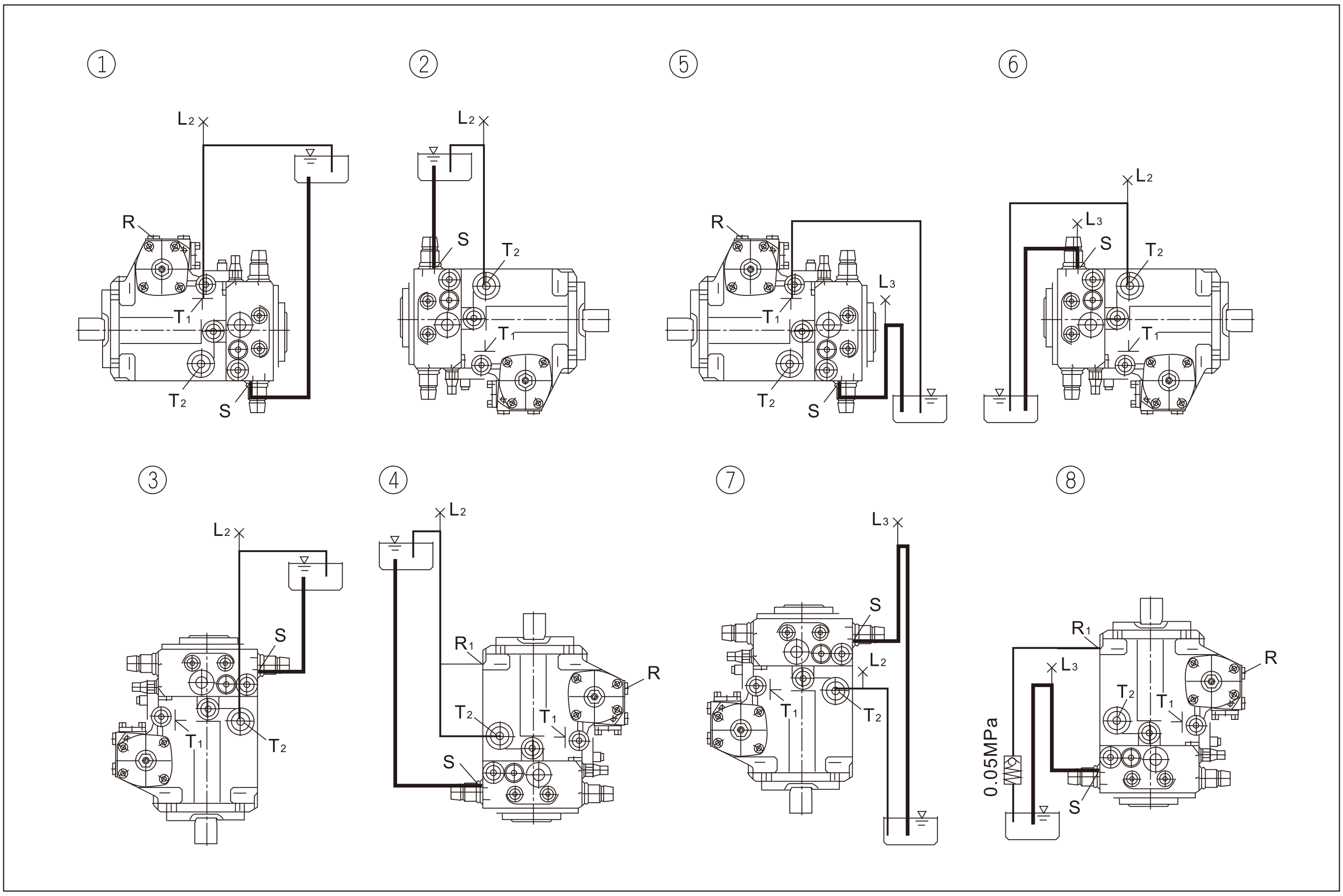
See the following example. Other installation positions available upon request.

Below-reservoir installation (standard)

Below-reservoir installation means that the axial piston unit is installed outside of the reservoir below the minimum fluid level.

Above-reservoir installation

Aboove-reservoir installation means that the axial piston unit is installed above the minimum fluid level of the reservoir,Observe the maximum permissible suction height $h_{s\,max}$=800 mm.
Recommendation for installation position 8 (drive shaft upward):A check valve in the drain line (cracking pressure 0.5bar) can prevent the housing area from draining.



Installation position	Air bleed the housing	Filling
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 the housing	Filling
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	$R+L_3$	$S(L_3)+T_2$