2.3

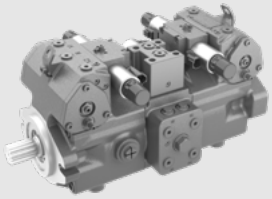
V90C SERIES

Swash-plate Type Axial Piston
Variable Displacement Double Pump

V90C series axial piston pump is a high pressure closed circuit double pump, which can meet the application requirements of customers for harsh working conditions such as high pressure, high rotational speed and frequent impact.

Suitable for a high-pressure closed circuit

Displacement (cc/rev):	23×2	47×2
Rated pressure (bar):	250	420
Max. pressure (bar):	300	450



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Features

- ◁ Swashplate design axial piston pump for traveling machinery applications such as skid steer loader.
- ◁ Compact size, small installation space
- ◁ Various control modes such as hydraulic control, electronic control and manual control.
- ◁ Combination of DA control valve and emergency shut-off valve, etc.
- ◁ Only one drain port shared for two circuits
- ◁ With pressure gauge oil port MA and MB.

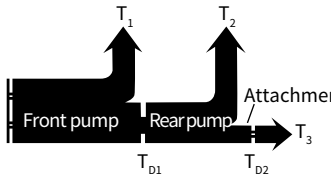
Technical data

Size			23	47
Displacement (cc/rev)			23×2	47×2
Speed	Rated (rpm)		3300	3300
	Max. (rpm)		3600	3550
	Min. (rpm)		500	500
Pressure	Rated (bar)		250	420
	Max. (bar)		300	450
	Min. (bar)	High-pressure side	20	25
		Low-pressure side	10	10
Charge pump displacement (cc/rev)			9.4	-
Casting pressure	Rated (bar)		1.5	3
	Max. (bar)(Short-time peak pressure)		2.5	5
Oil viscosity (mm^2/s)			10~1000, Best range: 16~36	
Oil temperature (°C)			-20~80	-20~95
Oil cleanliness			ISO 4406 Class 20/18/15 or higher	
Weight (Kg)			28	56

Technical data

Permissible input and through-drive torques				
Size		NG	23	47
Torque at $V_{g\,max}$ and Δp = 420 bar Nm		T	183	602
Maximum input torque at drive shaft (Nm)				
ANSI B92.1b	7/8 in 13T-16/32 DP	$T_{E\,max}$	300	
	1 in 15T 16/32 DP	$T_{E\,max}$		342
	1 1/4 in 14T 12/24 DP	$T_{E\,max}$		602
Maximum through-drive torque (Nm)		$T_{D1\,max}$	100	318
		$T_{D2\,max}$	$T_{D2\,perm} = 100 - T_2$	$T_{D2\,perm} = 318 - T_2$

·Torque distribution



V90C	Front pump	T_1
	Rear pump	T_2
Attachment pump		T_3
Input torque		$T_E=T_1+T_2+T_3$
		$T_E < T_{E\,max}$
Through-drive torque		T_{D1}
		T_{D2}

Type introduction

V90	C	47	H3	A	0	/	R	N	B4	3	K	B1	-	E
①	②	③	④	⑤	⑥		⑦	⑧	⑨	⑩	⑪	⑫		⑬

Axial piston unit

①	Swashplate design, variable	V90

Operating mode

②	Pump, closed circuit	C

Displacement

③	Displacement cc/rev	23	47

Control mode

		23	47	Code
④	Proportional control, electric U = 12 V DC	●	●	E1
	Proportional control, electric U = 24 V DC	●	●	E2
	Mechanical servo control		●	H1
	Hydraulic control direct operated – optimized for hydraulic control	●	●	H3
	Direct mechanical control	●		H4

DA control valve

		23	47	Code
⑤	Without swivel DA control valve	●	●	Blank
	Swivel DA control valve		●	A

Connection type

		23	47	Code
⑥	ANSI, port threads with O-ring seal according to ISO 11926		●	0
	Inch thread, port threads with ED flat washer seal according to ISO 1179	●		E

Rotation

⑦	Right hand (clockwise)	R
	Left hand (counter-clockwise)	L

Sealing material

⑧	NBR (nitrile rubber) Shaft seal in FKM (fluoroelastomer)	N

Type introduction

Mounting flangew and drive shaft

	Mounting flange	Drive shaft	23	47	Code
⑨	SAE J744 101-2	ANSI B92.1b 7/8 in 13T 16/32DP	●		B1
		ANSI B92.1b 1 in 15T 16/32 DP		○	B3
		ANSI B92.1b 1/4 in 14T 12/24 DP		●	B4

Working port

		23	47	Code
⑩	Threaded ports A1, B1, A2,and B2,left and right sides (viewed on drive shaft)	●		2
	Threaded ports A and B, left (viewed on drive shaft)		●	3
	Threaded ports A and B, right (viewed on drive shaft) – consult factory		○	4

Boost pump and rotary group configuration

		23	47	Code
⑪	Standard rotary group, without boost pump		●	K
	Standard rotary group, built-in boost pump	●	●	F

Through drive

	Through drive		23	47	Code
	Without through drive		●	○	None
⑫	Flange	Splined shaft			
	SAE A J744-82-2	ANSI B92.1b 5/8 in 9T 16/32 DP	●	○	A1
		ANSI B92.1b 3/4 in 11T 16/32 DP		○	A2
		ANSI B92.1b 7/8 in 13T 16/32 DP		○	A3
	SAE B J744-101-2	ANSI B92.1b 7/8 in 13T 16/32DP		●	B1
		ANSI B92.1b 1 in 15T 12/24 DP		○	B2
		ANSI B92.1b 1 1/4 in 19T 16/32 DP		●	B5

Standard / special version

			23	47	Code
⑬	Standard version		●	●	Blank
	Special version	Pilot shut-off valve, 12 V DC		●	E
		Pilot shut-off valve, 24 V DC		○	F

Remark: ● = Available; ○ = On request

Hydraulic fluid

The axial piston unit is designed for operation with HLP mineral oil according to DIN 51524. Application instructions and requirements for hydraulic fluid selection, behavior during operation as well as disposal and environmental protection should be taken from the following data sheets before the start of project planning:

· 90220: Hydraulic fluids based on mineral oils and related hydrocarbons
· 90221: Environmentally acceptable hydraulic fluids
· 90222: Fire-resistant, water-free hydraulic fluids (HFDR/HFDU)
· 90225: Limited technical data for operation with water free and water-containing fire-resistant hydraulic fluids(HFDR, HFDU, HFAE, HFAS, HFB, HFC)

Notes on selection of hydraulic fluid

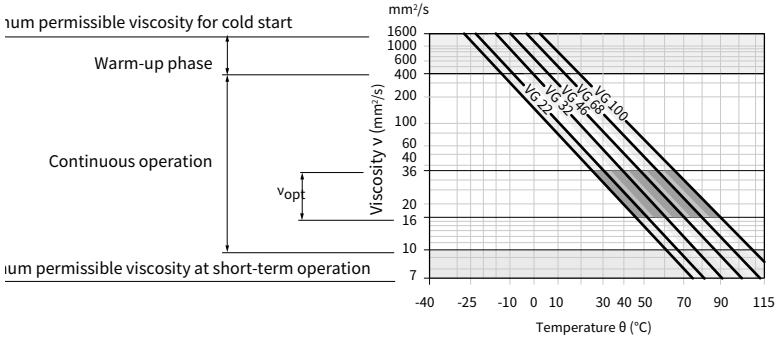
The hydraulic fluid should be selected so that the operating viscosity in the operating temperature range is within the optimum range (v_{opt} see selection diagram).

Viscosity and temperature of hydraulic fluids

	Viscosity (mm^2/s)	Shaft seal	Temperature	Comment
Cold start	$v_{max} \leqslant 7400$ (1600)	NBR	$\vartheta St \geqslant$ -40°C	t ⩽ 3min, without load (p ⩽ 725psi(50bar), n ⩽ 1000rpm, Permissible temperature difference between axial piston unit and hydraulic fluid in the system maximum 45 °F (25 K).
		FKM	$\vartheta St \geqslant$ -25 °C	
Warm-up phase	v = 7400 ··· 1850 (1600 ··· 400)			t ⩽ 15min, p ⩽ 0.7×p_{nom}, n ⩽ 0.5×n_{nom}
Continuous operation	v = 1850 ··· 60 (400 ··· 10)	NBR	θ ⩽ +85 °C	Measured at port T
		FKM	θ ⩽ +110°C	
	v_{opt} = 170 ··· 82 (36 ··· 16)			Range of optimum operating viscosity and efficiency
Short-term operation	v_{min} = 60 ··· 49 (10 ··· 7)	NBR	θ ⩽ +85°C	t ⩽ 3min, p ⩽ 0.3×p_{nom}, measured at port T
		FKM	θ ⩽ +110°C	

Hydraulic fluid

·Selection diagram



·Filtration of the hydraulic fluid

Finer filtration improves the cleanliness level of the hydraulicfluid, which 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.

We recommend, depending on the system and application, for the V90C : filter cartridges β20 ⩾ 100.

At very high hydraulic fluid temperatures (90°C , to maximum 110 °C , measured at port T), a cleanliness level of at least 19/17/14 according to ISO 4406 is necessary.

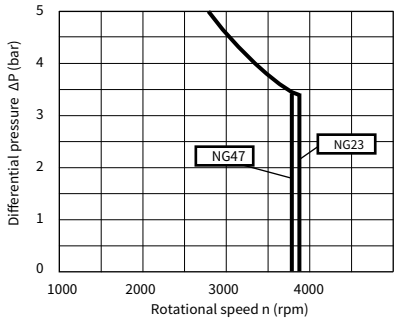
02

Shaft seal

The service life of the shaft seal is influenced by the speed of the axial piston unit and the leakage pressure in

the housing (case pressure). Momentary pressure spikes (t < 0.1 s) of up to 10 bar are permitted. The service life of the shaft seal decreases with increasing frequency of pressure spikes and increasing mean differential pressure. The case pressure must be equal to or higher than the ambient pressure.

Permissible pressure loading

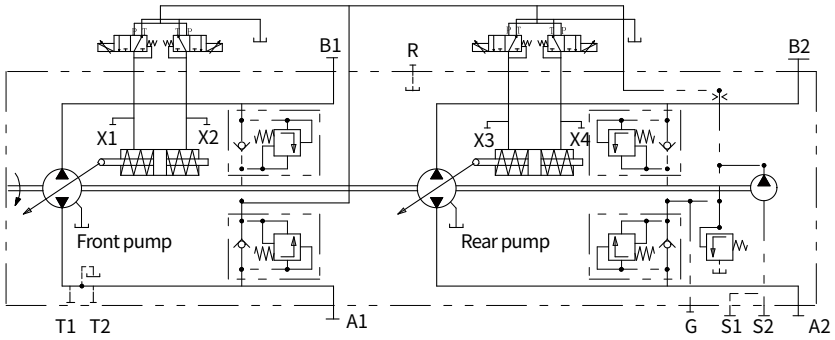


The FKM shaft seal may be used for leakage temperatures from -25°C to +115°C .

For application cases below -25°C , an NBR shaft seal is required (permissible temperature range: -40°C to +90°C).

V90C23 Control principle

· Proportional control



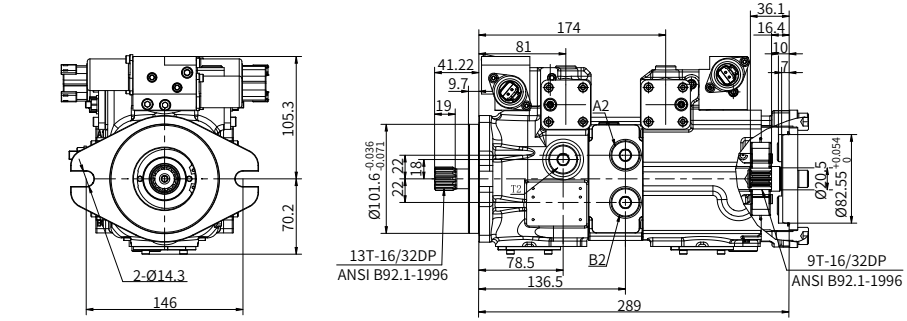
Control and Flow		Front pump			
		Start the electromagnet	Control pressure	High pressure	Low voltage
Rotation direction	Dextrorotation	D1	X2	A1	B1
		D2	X1	B1	A1
	Levorotation	D1	X2	B1	A1
		D2	X1	A1	B1

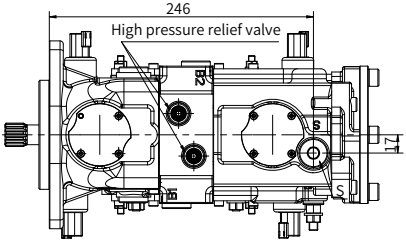
Control and Flow		Rear pump			
		Start the electromagnet	Control pressure	High pressure	Low voltage
Rotation direction	Dextrorotation	D3	X4	A2	B2
		D4	X3	B2	A2
	Levorotation	D3	X4	B2	A2
		D4	X3	A2	B2

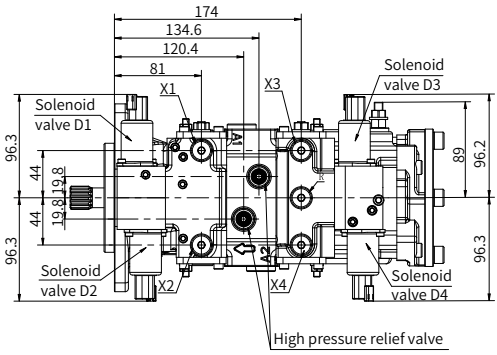
Installation size

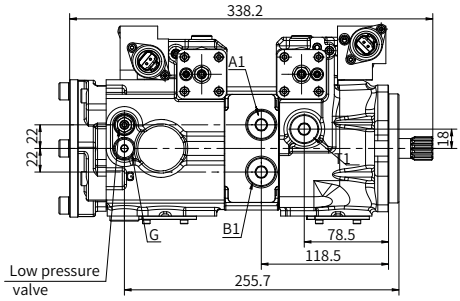
V90C23 Installation size

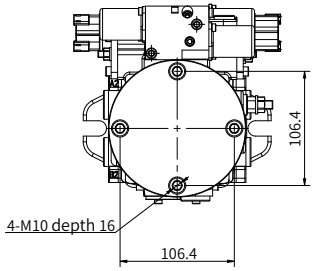
·Proportional control











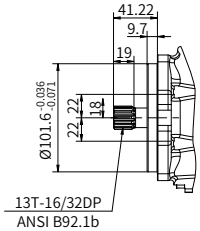
Installation size

·V90C23 Port details

Port	Port use	Standard	Oil Port Specification (thread depth)	Maximum pressure
A1, B1	Work lines	ISO 1179-1	G 1/2（depth 15）	250
A2, B2	Work lines	ISO 1179-1	G 1/2（depth 15）	250
S1, S2	Oil suction line	ISO 1179-1	G 1/2（depth 15）	5
T1	Oil drain line	ISO 1179-1	G 1/2（depth 15）	3
T2	Oil drain line	ISO 1179-1	G 1/2（depth 15）	3
R	Exhaust port	ISO 1179-1	G 1/4（depth 12.5）	3
X1, X2, X3, X4	Control cavity pressure	ISO 1179-1	G 1/4（depth 12.5）	40
G	Top-up pressure	ISO 1179-1	G 1/4（depth 12.5）	40

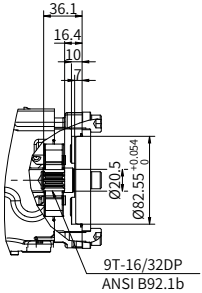
Installation size

·V90C23 shaft extension type



"B1" type spline shaft
ANSI B92.1b 1 1/4 14T
12/24DP

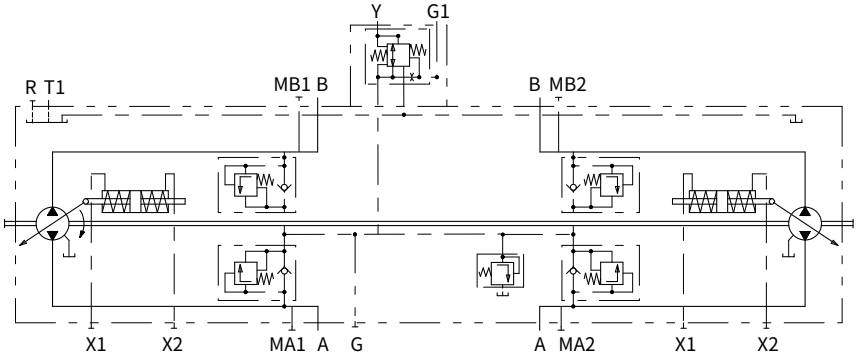
·V90C23 through shaft drive



"B1" type through drive

V90C47 Control principle

· Hydraulic control direct operated（With DA control）

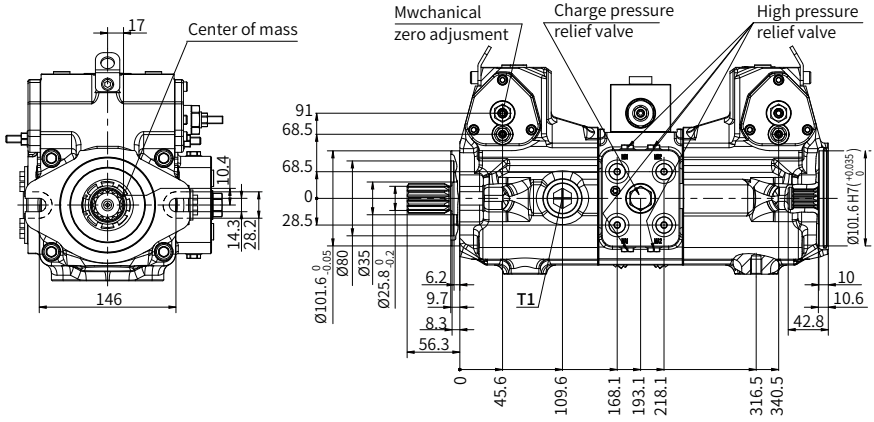


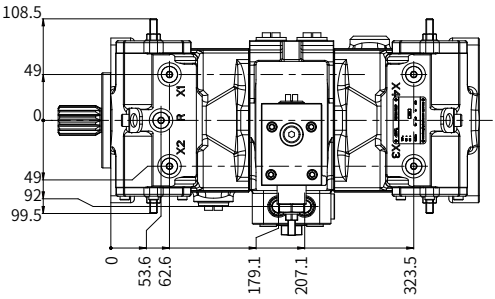
Direction of rotation	Clockwise				Counter-clockwise			
	1st pump		2nd pump		1st pump		2nd pump	
Control pressure	X1	X2	X3	X4	X1	X2	X3	X4
Flow direction	A to B	B to A	B to A	A to B	B to A	A to B	A to B	B to A
Working pressure	MB1	MA1	MA2	MB2	MA1	MB1	MB2	MA2

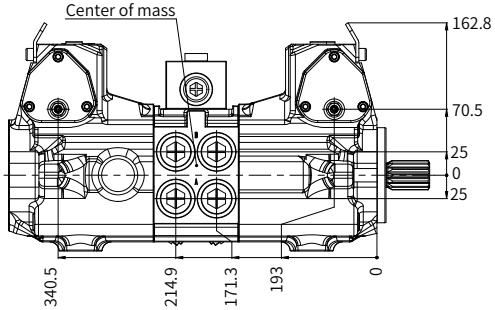
Installation size

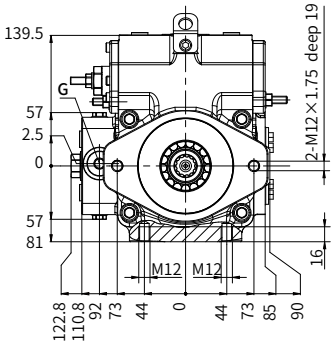
V90C47 Installation size

·Hydraulic control direct operated（With DA control）









Installation size

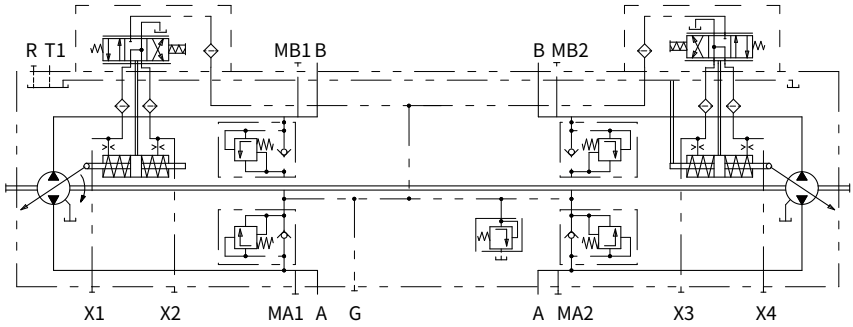
V90C47 Port details

·Hydraulic control direct operated（With DA control）

Port	**Port Name**	**Standard**	Oil Port Specification (thread depth)
A, B	Working port	ISO 11926	1 1/16-12UN-2B（depth 20）
T1	Drain port	ISO 11926	1 1/16-12UN-2B（depth 20）
R	Air bleed port	ISO 11926	9/16-18UNF-2B（depth 13）
X1，X2 X3，X4	Control pressure port	ISO 11926	9/16-18UNF-2B（depth 13）
Y	Pilot pressure port inlet	ISO 11926	9/16-18UNF-2B（depth 13）
G1	Boost pressure port inlet	ISO 11926	3/4-16UNF-2B（depth 15）
G	Boost pressure port inlet	ISO 11926	3/4-16UNF-2B（depth 15）

V90C47 Control principle

· Mechanical servo control

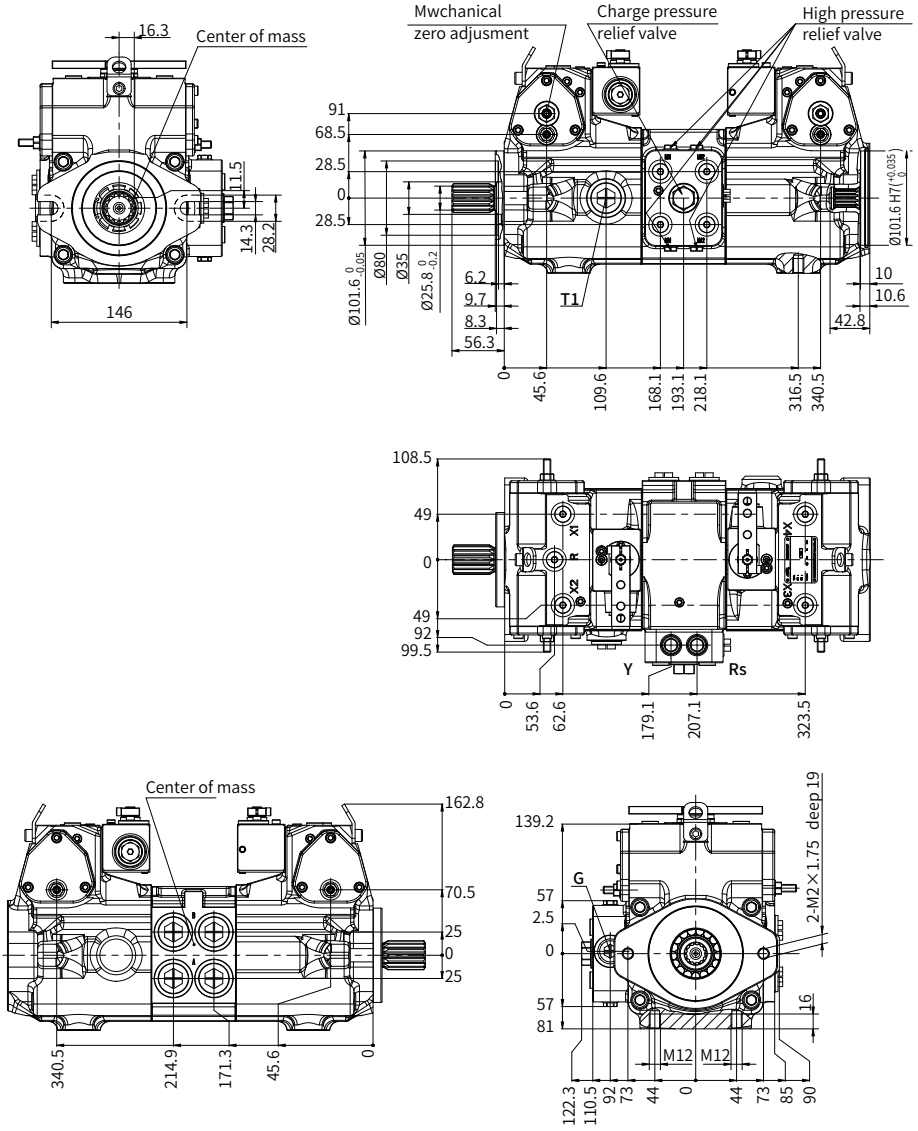


Direction of rotation	Clockwise				Counter-clockwise			
	1st pump		2nd pump		1st pump		2nd pump	
Control pressure	X1	X2	X3	X4	X1	X2	X3	X4
Flow direction	A to B	B to A	B to A	A to B	B to A	A to B	A to B	B to A
Working pressure	MB1	MA1	MA2	MB2	MA1	MB1	MB2	MA2

Installation size

V90C47 Installation size

· Mechanical servo control



Installation size

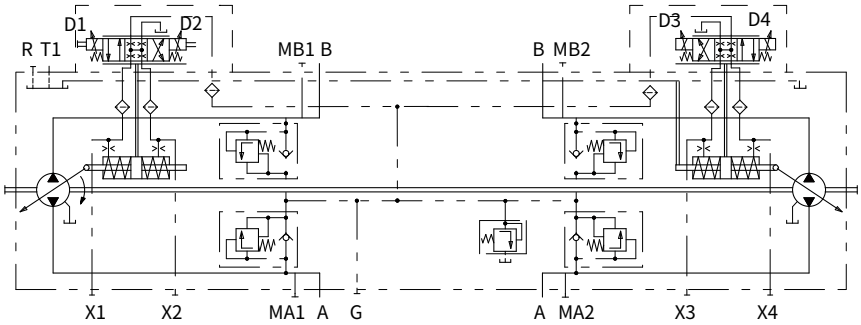
V90C47 Port details

·Mechanical servo control

Port	**Port Name**	**Standard**	Oil Port Specification (thread depth)
A, B	Working port	ISO 11926	1 1/16-12UN-2B（depth 20）
T1	Drain port	ISO 11926	1 1/16-12UN-2B（depth 20）
R	Air bleed port	ISO 11926	9/16-18UNF-2B（depth 13）
X1，X2 X3，X4	Control pressure port	ISO 11926	9/16-18UNF-2B（depth 13）
G	Boost pressure port inlet	ISO 11926	3/4-16UNF-2B（depth 15）
MA1，MB1 MA2，MB2	Pressure port	ISO 11926	9/16-18UNF-2B（depth 13）

V90C47 Control principle

· Proportional control

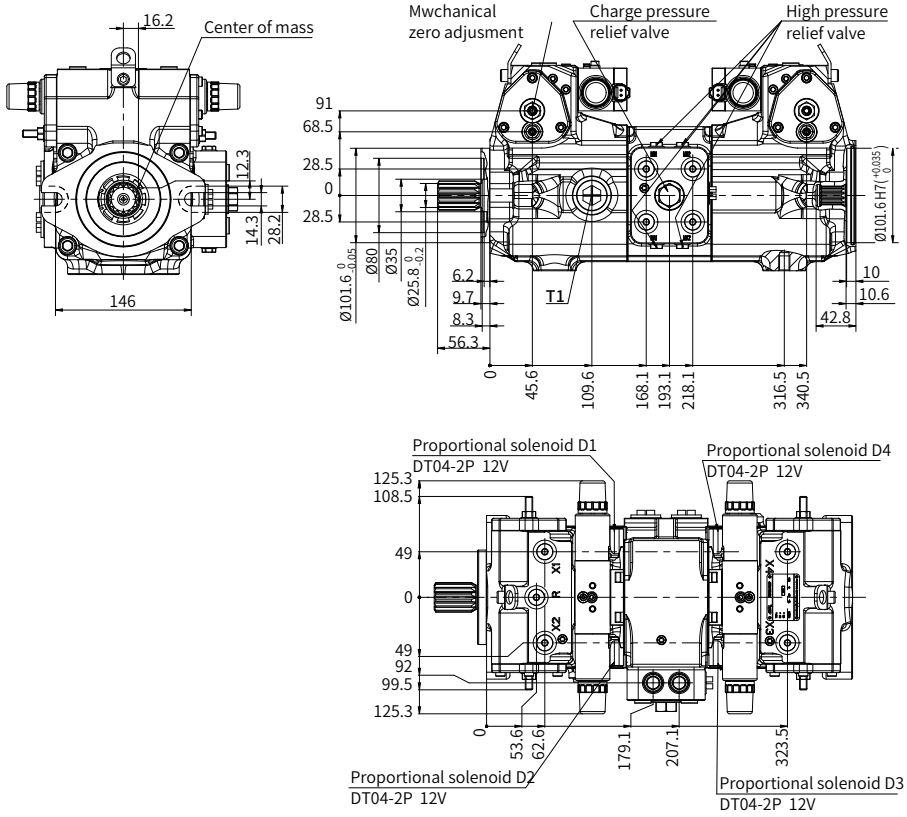


Direction of rotation	Clockwise				Counter-clockwise			
	1st pump		2nd pump		1st pump		2nd pump	
Start the electromagnet	D1	D2	D3	D4	D1	D2	D3	D4
Control pressure	X1	X2	X3	X4	X1	X2	X3	X4
Flow direction	A to B	B to A	B to A	A to B	B to A	A to B	A to B	B to A
Working pressure	MB1	MA1	MA2	MB2	MA1	MB1	MB2	MA2

Installation size

V90C47 Installation size

· Proportional control



Installation size

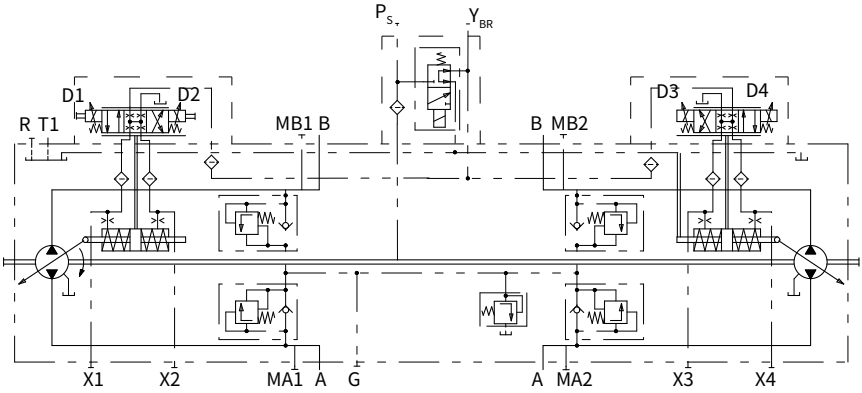
V90C47 Port details

·Proportional control

Port	**Port Name**	**Standard**	Oil Port Specification (thread depth)
A, B	Working port	ISO 11926	1 1/16-12UN-2B（depth 20）
T1	Drain port	ISO 11926	1 1/16-12UN-2B（depth 20）
R	Air bleed port	ISO 11926	9/16-18UNF-2B（depth 13）
X1，X2 X3，X4	Control pressure port	ISO 11926	9/16-18UNF-2B（depth 13）
G	Boost pressure port inlet	ISO 11926	3/4-16UNF-2B（depth 15）
MA1，MB1 MA2，MB2	Pressure port	ISO 11926	9/16-18UNF-2B（depth 13）

V90C47 Control principle

· Proportional control (with emergency brake valve)

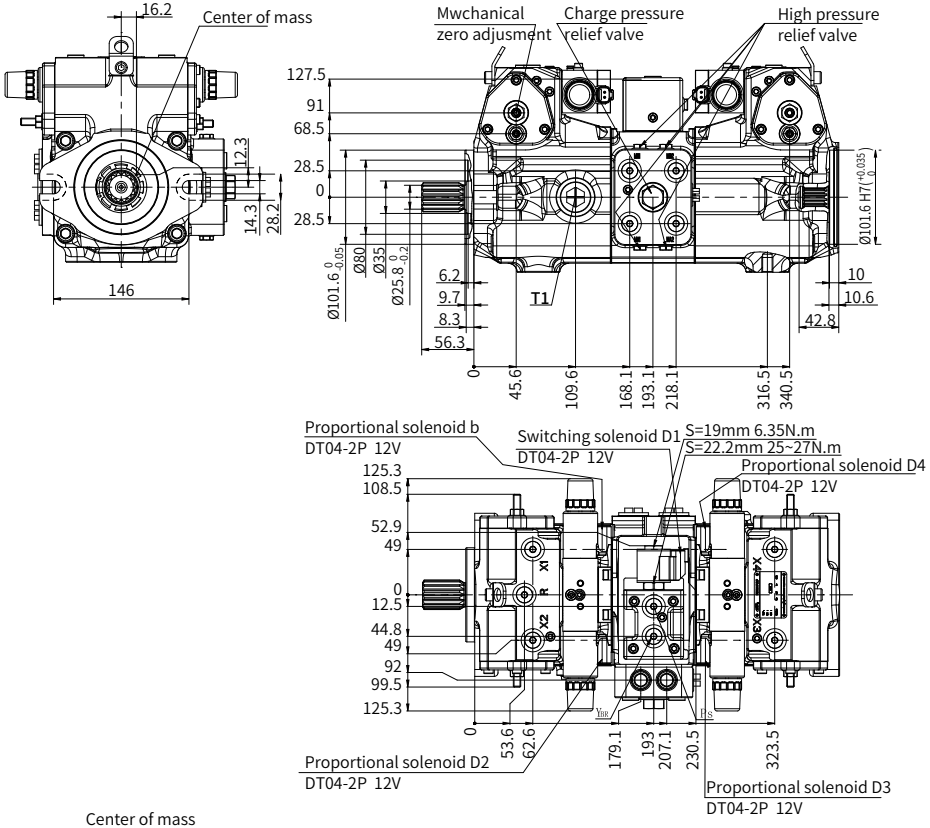


Direction of rotation	Clockwise				Counter-clockwise			
	1st pump		2nd pump		1st pump		2nd pump	
Start the electromagnet	D1	D2	D3	D4	D1	D2	D3	D4
Control pressure	X1	X2	X3	X4	X1	X2	X3	X4
Flow direction	A to B	B to A	B to A	A to B	B to A	A to B	A to B	B to A
Working pressure	MB1	MA1	MA2	MB2	MA1	MB1	MB2	MA2

Installation size

V90C47 Installation size

· Proportional control (with emergency brake valve)



Installation size

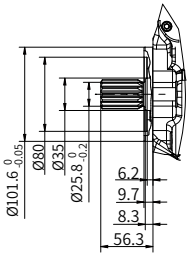
V90C47 Port details

·Proportional control (with emergency brake valve)

Port	**Port Name**	**Standard**	Oil Port Specification (thread depth)
A, B	Working port	ISO 11926	1 1/16-12UN-2B（depth 20）
T1	Drain port	ISO 11926	1 1/16-12UN-2B（depth 20）
R	Air bleed port	ISO 11926	9/16-18UNF-2B（depth 13）
X1，X2 X3，X4	Control pressure port	ISO 11926	9/16-18UNF-2B（depth 13）
G	Boost pressure port inlet	ISO 11926	3/4-16UNF-2B（depth 15）
Y_{BR}	Pressure port	ISO 11926	9/16-18UNF-2B（depth 13）
P_S	Pressure port	ISO 11926	9/16-18UNF-2B（depth 13）
MA1，MB1 MA2，MB2	Pressure port	ISO 11926	9/16-18UNF-2B（depth 13）

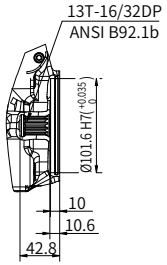
Installation size

·V90C47 shaft extension type



"B4" type spline shaft
ANSI B92.1b
1 1/4 14T 12/24DP

·V90C47 through shaft drive



"B1" type through drive

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