

Variable Displacement Pump WA10VSO-31



Size 18~140
 Series 31
 Nominal pressure 280bar
 Peak pressure 350bar
 Swash plate design axial variable piston pump

Features

- Swash plate design axial variable piston pump used in open circuit.
- Continuous work pressure can reach 280bar,The highest instantaneous work pressure can reach 350bar.
- The flow is directly proportional to drive rotate speed and the displacement, and can make stepless variable come true by adjusting the obliquity of the swash plate.
- Wide range of controls such as DR,DFR,DFRL etc.Short response times.
- Low noises level,High efficiency,High reliability and long time service life.
- Small volume,High power density.
- Excellent oil absorbency.
- Axial and radial loading of drive shaft possible.
- SAE and ISO mounting flange.
- Thru drive option for multi-circuit system.

Ordering Code

WA10V(S) O 28 DR / 31 R - P S C 62 N00

Model:Variable pump,Swashplate design 280bar
 Rated pressure 280 bar
 350bar
 Peak pressure 350 bar

Mode of operation Pump,open circuit

Displacement 18.28.45.71.100.140(ml/r)

Controller

	18	28	45	71	100	140
DG--Two point,direct control						
DR--Pressure control	√	√	√	√	√	√
DRG--Remote pressure control	√	√	√	√	√	√
DFR--Pressure and flow control	√	√	√	√	√	√
DFR1--Pressure and flow control Orifice in X-channel closed	√	√	√	√	√	√
DFLR--Pressure,flow,torque control		√	√	√	√	√

Series: 31 Series

Direction of Rotation: R--clockwise
 L--anti-clockwise

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Port for service lines

18 28 45 71 100 140

11--SAE flange rear, fixing thread metric		√	√	√	√	
61--SAE flange rear, fixing thread UNC		√	√	√	√	
12--SAE flange on opposite side,fixing thread metric	√	√	√	√	√	√
62--SAE flange on opposite side, fixing thread metric(UNC)	√	√	√	√	√	√
41(91)--SAE flange rear, fixing thread metric(UNC)				√		
42(92)SAE,flange on opposite side, fixing threadmetric(UNC)				√		

Mounting flange:

18 28 45 71 100 140

A--ISO 2-hole	√	√	√	√	√	
C--SAE 2-hole	√	√	√	√	√	
B--ISO 4-hole						√
D--SAE 4-hole						√

Shaft end:

18 28 45 71 100 140

P--Metric parallel with key	√	√	√	√	√	√
S--SAE splined	√	√	√	√	√	√
R--SAE splined (higher through drive torque)	√	√	√	√	√	
K--SAE parallel with key	√	√	√	√	√	√
U--SAE splined,reduced dian, not for through drive		√		√		√
W--Similar to shaft "U",higher input torque not for through drive				√		√

Seals: P--Perbunan
 V--Viton

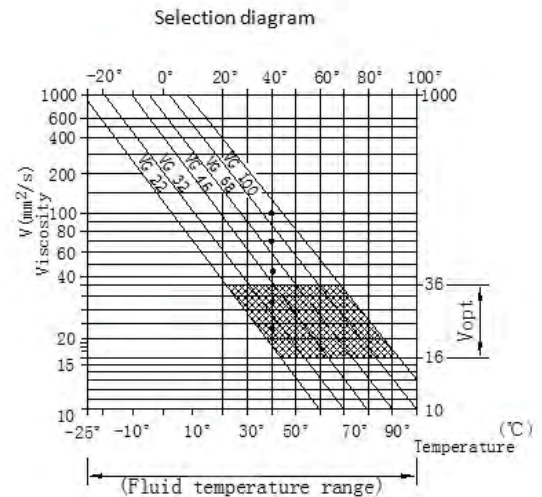
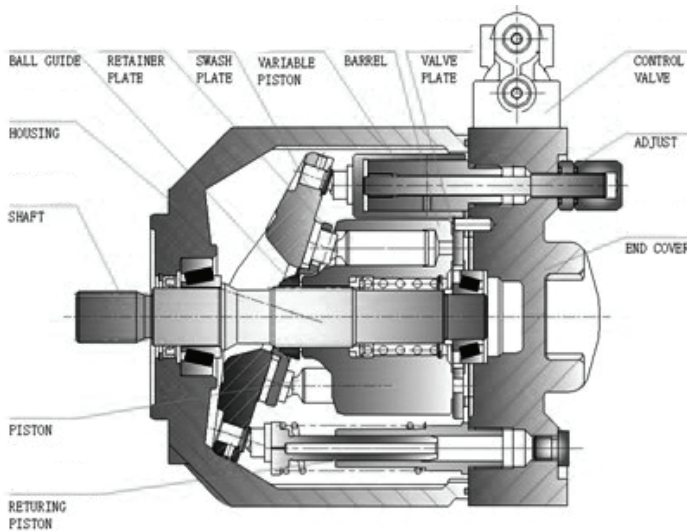
Variable Displacement Pump WA10VSO-31

With through drive to accept an axial piston pump or a gear pump

18 28 45 71 100 140

Without through drive				√	√	√	√	√	√	N00
Mounting flange	Shaft/coupling	For the mounting of								
ISO 80,2 hole	3/4"	19-4(SAE A-B)	WA10VSO10-18(shaft S or R)	√	√	√	√	√	√	KB2
ISO 100,2 hole	7/8"	22-4(SAE B)	WA10VSO28(shaft S or R)		√	√	√	√	√	KB3
ISO 100,2 hole	1"	25-4(SAE B-B)	WA10VSO45(shaft S or R)			√	√	√	√	KB4
ISO 125,2 hole	1 1/4"	32-4(SAE-C)	WA10VSO71(shaft S or R)				√	√	√	KB5
ISO 125,2 hole	1 1/2"	38-4(SAE C-C)	WA10VSO100(shaft S)					√	√	KB6
ISO 180,4 hole	1 3/4"	44-4(SAE D)	WA10VSO140(shaft S)						√	KB7
SAE 82-2,2 hole	5/8"	16-4(SAE A)	WA10VSO10-18(shaft U),1PFG2,PFG2	√	√	√	√	√	√	K01
SAE 82-2,2 sole	3/4"	19-4(SAE A-B)	WA10VSO10-18(shaft S or R)	√	√	√	√	√	√	K52
SAE 101-2,2 hole	7/8"	22-4(SAE B)	1PFG3		√	√	√	√	√	K02
SAE 101-2,2 hole	7/8"	22-4(SAE B)	WA10VSO28(shaft S or R),PGF3		√	√	√	√	√	K68
SAE 101-2,2 hole	1"	25-4(SAE B-B)	WA10VSO45(shaft S or R),PGH4			√	√	√	√	K04
SAE 127-2,2 hole	1 1/4"	32-4(SAE C)	WA10VSO71(shaft S or R)				√	√	√	K07
SAE 127-2,2 hole	1 1/2"	38-4(SAE C-C)	WA10VSO100(shaft S),PGH5					√	√	K24
SAE 152-4,4 hole	1 3/4"	44-4(SAE D)	WA10VSO140(shaft S)						√	K17
SAE 80-2	Key shaft Ø 18		WA10VSO18(shaft P)	√	√	√	√	√	√	K51
SAE A 82-2	Key shaft Ø19.05		WA10VSO18(shaft K)	√	√	√	√	√	√	K40
ISO 100-2	Key shaft Ø22		WA10VSO28(shaft P)		√	√	√	√	√	K25
SAE B 101-2	Key shaft Ø22.225		WA10VSO28(shaft K)		√	√	√	√	√	K03
ISO 100-2	Key shaft Ø25		WA10VSO45(shaft P)			√	√	√	√	K26
SAE B 101-2	Key shaft Ø25.4		WA10VSO45(shaft K)			√	√	√	√	K05
ISO 125-2	Key shaft Ø32		WA10VSO71(shaft P)				√	√	√	K27
SAE B 127-2	Key shaft Ø31.75		WA10VSO71(shaft K)				√	√	√	K08
ISO 125-2	Key shaft Ø40		WA10VSO100(shaft P)					√	√	K37
SAE C 127-2	Key shaft Ø38.1		WA10VSO100(shaft K)					√	√	K38
ISO 180-4	Key shaft Ø45		WA10VSO140(shaft P)						√	K59
SAE B 152-4	Key shaft Ø44.45		WA10VSO140(shaft K)						√	K21

Construction



Variable Displacement Pump WA10VSO-31

Hydraulic fluid

- The WA10VSO variable displacement pump is suitable for use with mineral oil.

- Operating viscosity range: In order to obtain optimum efficiency and service life, we recommend that the operating viscosity (at operating temperature) be selected from within the range.

V_{opt} = opt. operating viscosity

16---36 mm²/s

Referred to the reservoir temperature (open circuit).

-Viscosity limits

V_{min} = 10 mm²/s short term at a max. permissible drain of 90 °C.

V_{max} = 1000 mm²/s short term on cold start

-Temperature range (see selection diagram): t = -25~90°C

-Notes on the selection of the hydraulic fluid. In order to select the correct fluid, it is necessary to know the operating temperature in the tank (open loop) in relation to the ambient temperature. The hydraulic fluid should be selected so that within the operating temperature range, the operating viscosity lies within the optimum range (V_{opt}) (see shaded section of the selection diagram). We recommend that the higher viscosity range should be chosen in each case.

-The finer the filtration the better the cleanliness of the pressure fluid and the longer the life of the axial piston unit, to ensure the functioning of the axial piston unit a minimum cleanliness level of: 9 to NAS 1638 18/15 to ISO/DIS 4406 is necessary.

Mechanical displacement limiter

Mechanical displacement limiter is possible on the nonthrough-drive model, N00 series but not for the model with through-drive.

V_g max: for size 18 to 140; Setting range V_g max to 50% V_g max stepless

V_g min 50% V_g max; Setting range V_g min to 50% V_g max stepless

Parameter

Operating pressure range - inlet

Absolute pressure at port S

$P_{abs\ min}$ ----- 0.8 bar

$P_{abs\ max}$ ----- 30 bar

Operating pressure range - outlet

Pressure at port B

Nominal pressure P_N ----- 280 bar

Peak pressure P_{max} ----- 350 bar

Applications with intermittent operating pressures up to 315 bar at 10% duty are permissible.

Case drain pressure

Max. permissible pressure of leakage fluid (at port L,L): Maximum 0,5 bar higher than inlet pressure at port S, but no higher than 2 bar absolute.

Sizes				18	28	45	71	100	140
Displacement	V_g max cm ³			18	28	45	71	100	140
Max speed	n_{max} rpm			3300	3000	2600	2200	2000	1800
Max. flow	in 1500 r/min	q_v	L/min	59.4	84	117	156	200	252
				27	42	68	107	150	210
△ p=280bar Max. power	in n_{max} in 1500 r/min	P_{max}	kW	27.7	39	55	73	93	118
				12.6	20	32	50	70	98
△ p=280bar Max. torque	in V_g max	T_{max}	Nm	80.1	125	200	316	445	623
△ Weight				12	15	21	33	45	60

Parameter relations

$$\text{Flow } q_v = \frac{V_g \cdot n \cdot \eta_v}{1000}$$

$$\text{Drive Torque } T = \frac{1.59 \cdot V_g \cdot \Delta p}{100 \cdot \eta_{mh}} = \frac{V_g \cdot \Delta p}{20 \cdot \eta_{mh}} \quad [\text{Nm}]$$

$$\text{Drive Power } P = \frac{T \cdot n}{9549} = \frac{2\pi \cdot T \cdot n}{60000} = \frac{q \cdot \Delta p}{600 \cdot \eta_t} \quad [\text{kW}]$$

V_g = [cm³] Geometry displacement each rotate

Δp = [bar] Pressure drop/differential

n = [rpm] Rotary speed

η_v = Cubage's efficiency

η_{mh} = Mechanical-Hydraulic efficiency

η_t = ($\eta_t = \eta_v \times \eta_{mh}$) Overall efficiency

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Installation Notes

Optional installation position. The pump housing must be filled with during commissioning and remain full when operating. In order to attain the lowest noise level, all connections (suction, pressure, case drain ports) must be linked by flexible couplings to tank. Avoid placing a check valve in the case drain line.

1. Vertical installation (shaft end upwards)

The following installation conditions must be taken into account:

1.1. Arrangement in the reservoir

Before installation fill pump housing, keeping it in a horizontal position.

- If the minimum fluid level is equal to or above the pump mounting face close port "L" plugged, leave ports "L₁" and "S" open; L piped and recommendation S piped (see Fig.1).
- If the minimum fluid level is below the pump mounting face pipe port "L₁" and "S" according to Fig.2. Close port "L" with respect taking into consideration

1.2. Arrangement outside the reservoir

Before installation fill the pump housing, keeping it in a horizontal position. For mounting above reservoir see Fig.2.

Limiting condition:

1.2.1. Minimum pump inlet pressure $p_{abs\ min} = 0.8\ bar$ under both static and dynamic conditions.

Note: Avoid mounting above reservoir wherever possible in order to achieve a low noise level.

The permissible suction height h comes from the overall pressure loss, but may not bigger than $h_{max} = 500\ mm$ (immersion depth $h_{t\ min} = 200\ mm$).

Overall pressure loss

$$\Delta p = \Delta p_1 + \Delta p_2 + \Delta p_3 \leq (1 - p_{abs\ min}) = 0.2\ bar$$

Δp_1 : Pressure loss in pipe due to accelerating column of fluid

$$\Delta p_1 = \rho \times l \times (dv/dt) \times 10^{-5} \text{ (bar)}$$

ρ = density (kg/m³)
 l = pipe length (m)

dv/dt = rate of change in fluid velocity (m/s²)

Δp_2 = Pressure loss due to static head

$$\Delta p_2 = h \times \rho \times g \times 10^{-5} \text{ (bar)}$$

h = height (m)

ρ = density (kg/m³)

g = gravity = 9.81 m/s²

Δp_3 : Line losses

2. Horizontal installation

The pump must be installed, so that "L" or "L₁" is at the top.

2.1. Arrangement in the reservoir

- If the minimum fluid level is above the top the pump, port "L₁" closed, "L" and "S" should remain open, L piped and recommendation S piped (see Fig.3).
- If the minimum fluid level is equal to or below the top the pump, pipe ports "L" and possibly "S" as Fig.4.; close port "L₁".
The conditions according to item 1.2.1

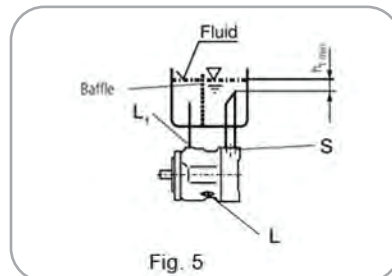
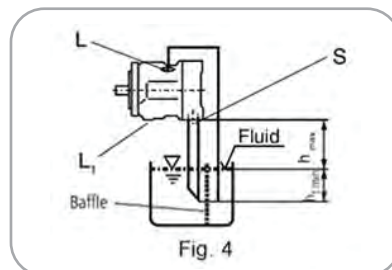
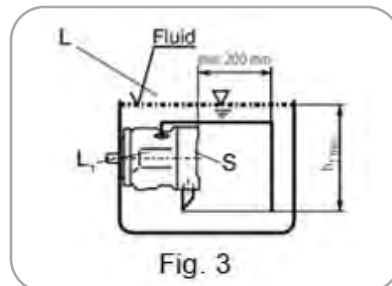
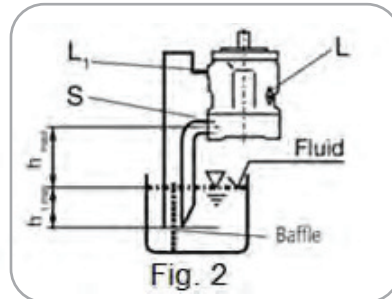
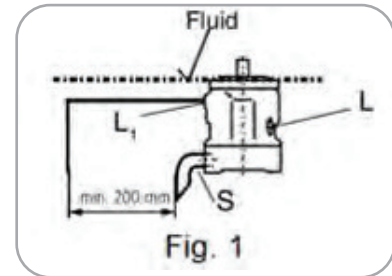
2.2. Installation outside the reservoir

Fill the pump housing before commissioning. Pipe port "S" and the higher port "L" or "L₁".

- When mounting above the reservoir, see Fig.4.
Conditions according to 1.2.1.

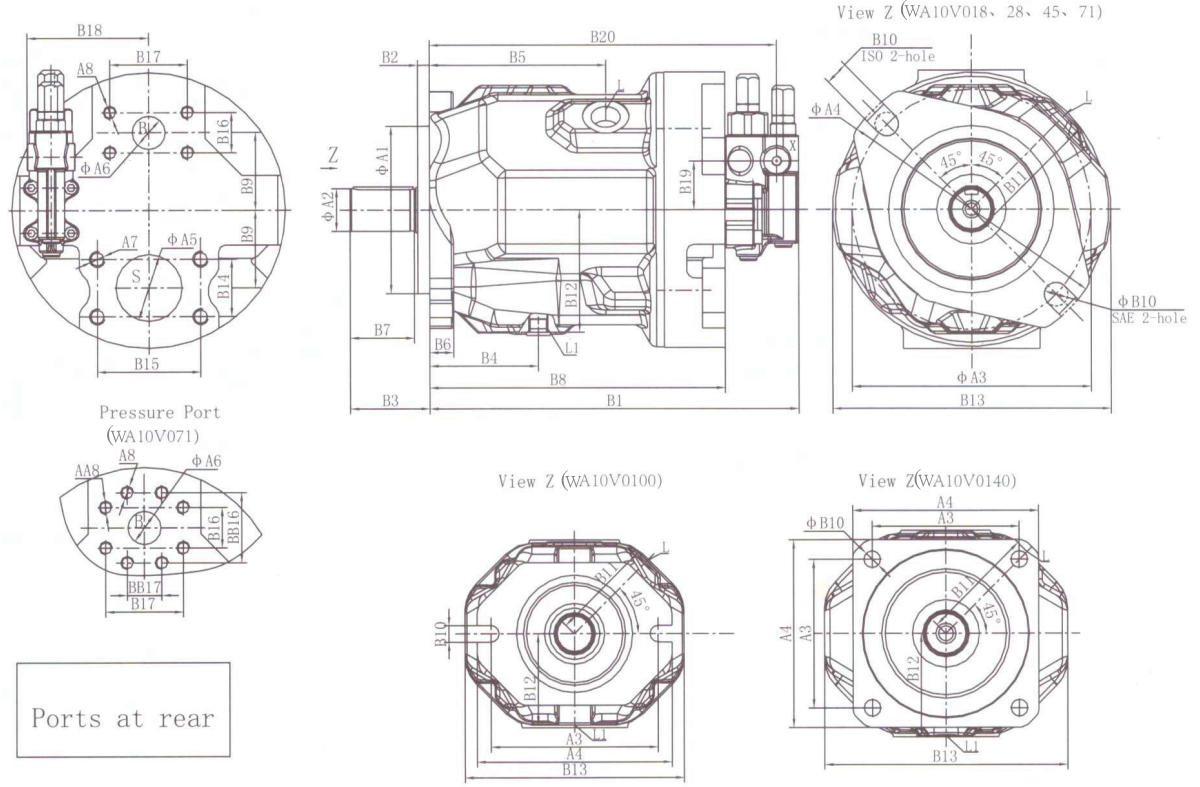
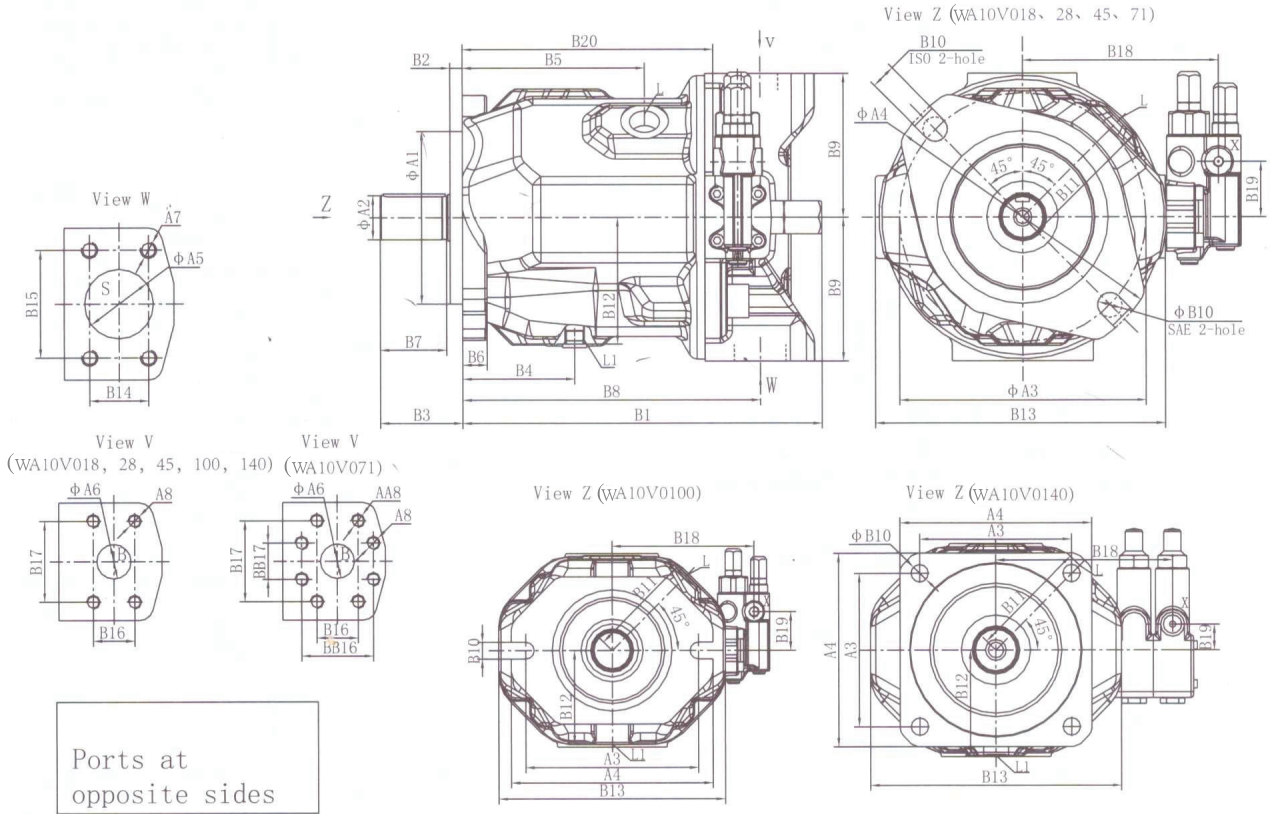
b) Mounting below the reservoir

Pipe ports "L" and "S" according to Fig.5, close port "L₁".



Variable Displacement Pump WA10VSO-31

Mounting Dimension (Size 18 to 140)



Variable Displacement Pump WA10VSO-31

Dimensions-Mounting flange

Size	A(B) ISO 2 (4)-hole					C(D) SAE 2 (4)-hole					A4	A5	A6
	A1	A3	B2	B10	L(L1)	A1	A3	B2	B10	L(L1)			
18	80h8	109	7	11	M16x1.5	82.55h8	106.4	6.3	11	9/16-18UNF	134	25	20
28	100h8	140	9	14	M18x1.5	101.6h8	146	9.5	Φ14	3/4-16UNF	174	32	20
45	100h8	140	9	14	M22x1.5	101.6h8	146	9.5	Φ14	7/8-14UNF	174	40	25
71	125h8	180	9	18	M22x1.5	127h8	181	12.7	Φ18	7/8-14UNF	210	50	25
100	125h8	180	9	17.5	M27x2	127h8	181	12.7	17.5	1 1/16-12UNF	210	60	32
140	180h8	158.4x158.4	9	Φ18	M27x2	152.4h8	161.6x161.6	12.7	Φ20	1 1/16-12UNF	200x200	63	32

Dimensions-Ports for service lines

Size	(Ports at opposite sides)						(Ports at rear)						Metric (UNC)threads		
	B1	B8	B9	B18	B19	B20	B1	B8	B9	B18	B19	B20	A7	A8	AA8
18	195	145	63	109	40	130							M10(3/8-16UNC)	M10(3/8-16UNC)	
28	206	164	80	119	40	140	225	170	45	73	43	209	M10(7/16-14UNC)	M10(3/8-16UNC)	
45	224	184	90	129	40	155	244	189	50	81.5	40	228	M12(1/2-13UNC)	M10(3/8-16UNC)	
71	259	217	104	143	40	183	278	223	58	91.5	40	262	M12(1/2-13UNC)	M10(3/8-16UNC)	M10(7/16-14UNC)
100	329	275	100	148	40	250	344	288	55	99	40	327	M12(1/2-13UNC)	M14(1/2-13UNC)	
140	337.5	275	110	183	27	222	379	293	60	140	27	353	M12(1/2-13UNC)	M14(1/2-13UNC)	

Dimensions-shaft end

Size		A2			B3	B7		A2			B3	B7		A2			B3	B7		
		A2	B3	B7				A2	B3	B7				A2	B3	B7				
18		Φ15.875(16/32DP;9t)	31.8	23.8			Φ18(Key6x25)	36	28				Φ19.05(16/32DP;11T)	38	30			Φ19.05(key4.76X28.6)	41	33
28	S					S	Φ22(Key6x32)	46	36	S	Φ22.225(16/32DP;13T)	41	33.1	S	Φ22.225(key6.35X28.6)	41.3	33.3			
45	H	Φ22.225(16/32DP;13T)	41	33.1	H	Φ25(Key8x36)	52	42	H	Φ25.4(16/32DP;15T)	45.9	38	H	Φ25.4(key6.35X34.9)	45.9	38.1				
71	A				A	Φ32(Key10x45)	60	50	A	Φ31.75(12/24DP;17T)	55.4	47.5	A	Φ31.75(key7.94X41.3)	55.4	47.5				
100	F	Φ31.75(12/24DP;14t)	55.4	47.5	F	Φ40(Key12x68)	80	70	F	Φ38.1(12/24DP;17T)	61.9	54	F	Φ38.1(9.52X52.1)	61.9	54				
140	T				T	Φ45(Key14X80)	92	82	T	Φ44.45(8/16DP;13T)	75	67	T	Φ44.45(key11.11X65)	75	67				

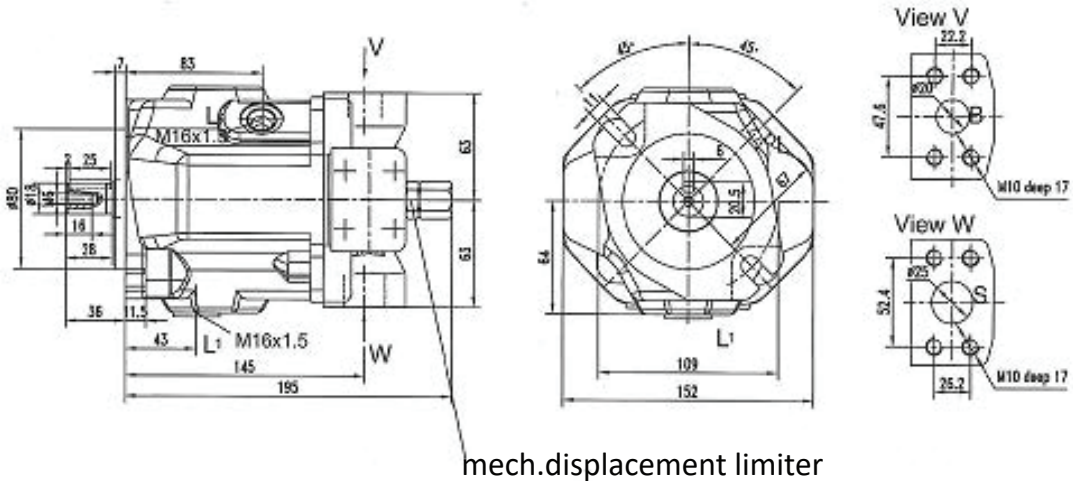
Dimensions

Size	B4	B5	B6	B11	B12	B13	B14	B15	B17	BB16	BB17	X	B	S
18	43	83	11.5	67	64	152	26.2	52.4	47.6			7/16-20UNF	3/4"	1"
28	40	90	13	74	75	164	30.2	58.7	47.6			7/16-20UNF	3/4"	1 1/4"
45	45	96	13	83	80.5	184	35.7	69.9	52.4			7/16-20UNF	1"	1 1/2"
71	53	115	17	98	92	210	42.9	30.2	58.7	52.4	26.2	7/16-20UNF	1"	2"
100	95	175	20	106	95	236	50.8	31.8	66.7			7/16-20UNF	1 1/4"	2 1/2"
140	78	173	21	118.5	108	262	50.8	31.8	66.7			M14x1.5	1 1/4"	2 1/2"

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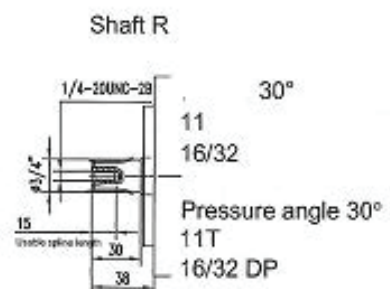
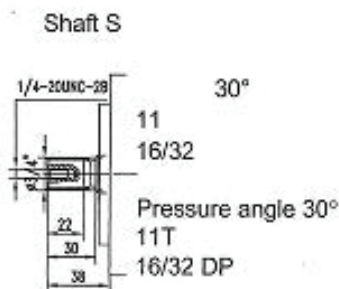
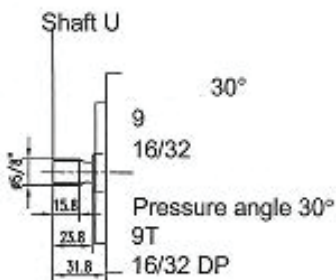
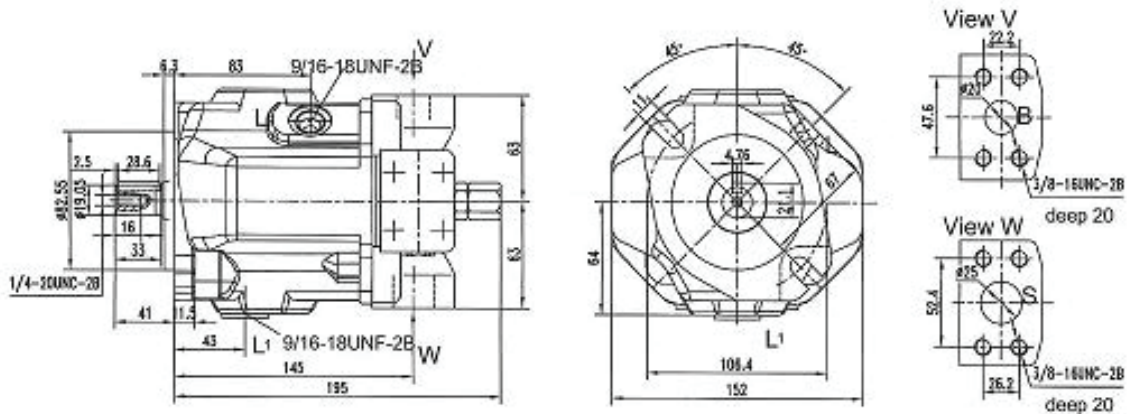
(Unit dimensions, size 18)

ISO Shaft P (WA10VSO 18 XXX/31X-PPA12N00)



Flange SAE

Shaft K (WA10VSO 18 XXX/31X-PKC62N00)

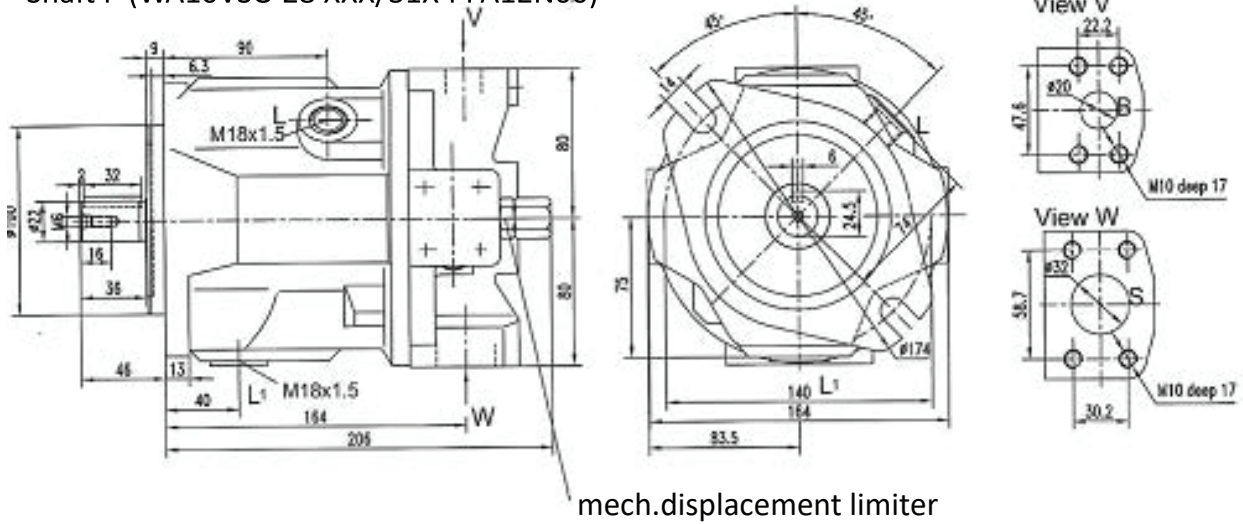


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(Unit dimensions, size 28)

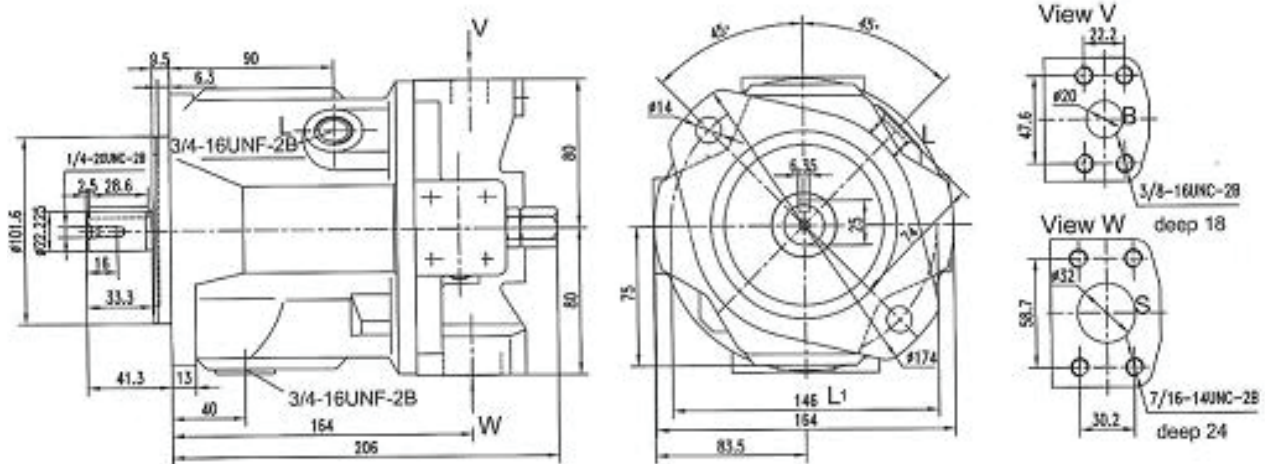
Flange ISO

Shaft P (WA10VSO 28 XXX/31X-PPA12N00)

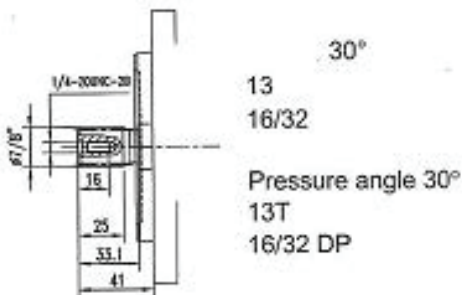


Flange SAE

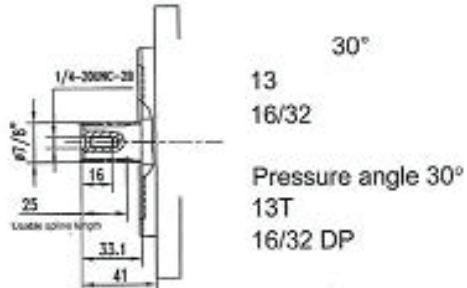
Shaft K (WA10VSO 28 XXX/31X-PKC62N00)



Shaft S



Shaft R

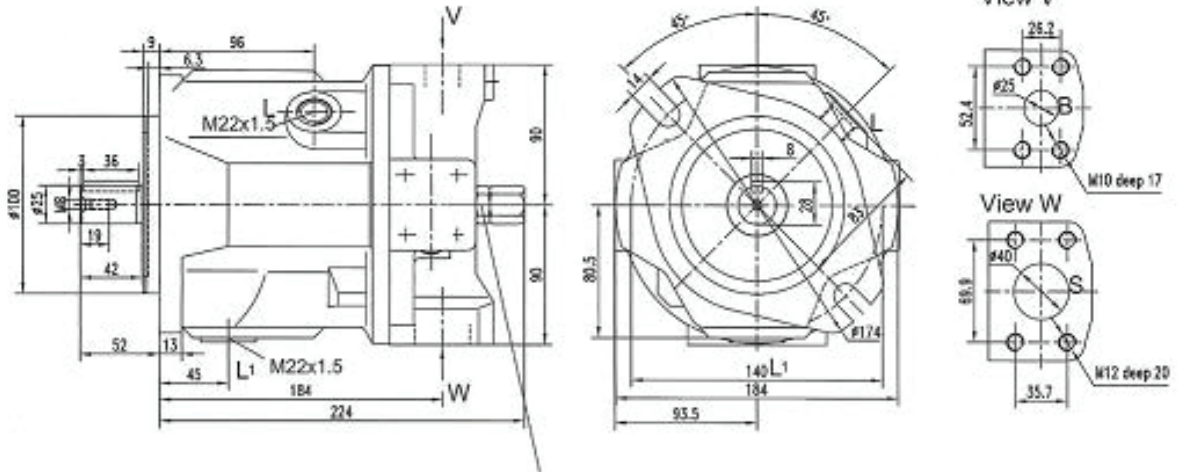


Variable Displacement Pump WA10VSO-31

(Unit dimensions, size 45)

Flange ISO

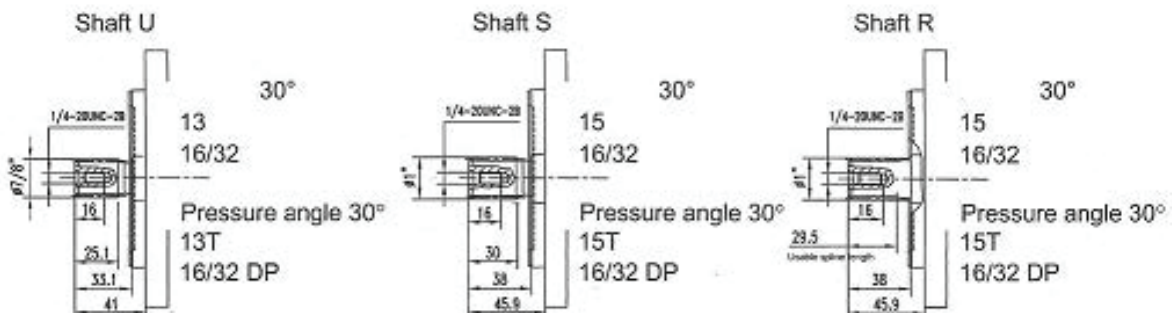
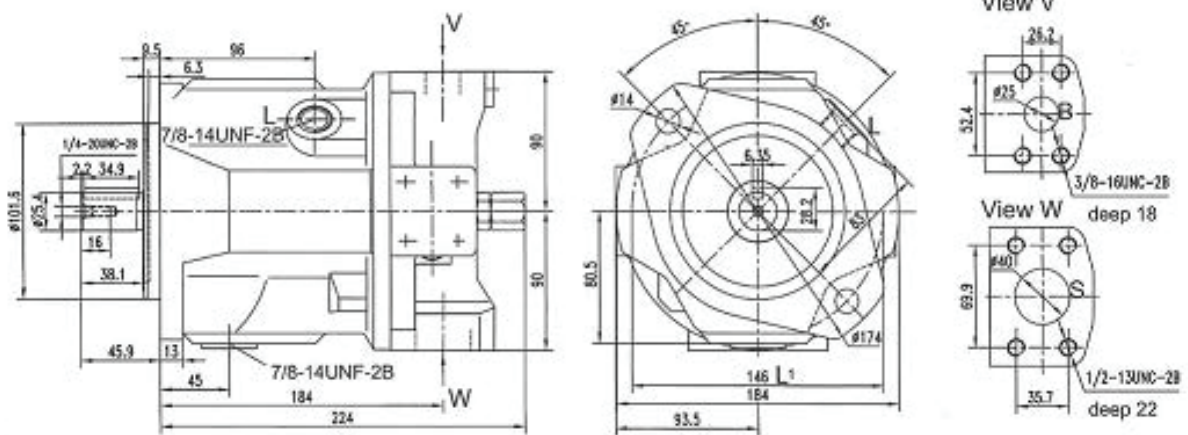
Shaft P (WA10VSO 45 XXX/31X-PPA12N00)



mech. displacement limiter

Flange SAE

Shaft K (WA10VSO 45 XXX/31X-PKC62N00)

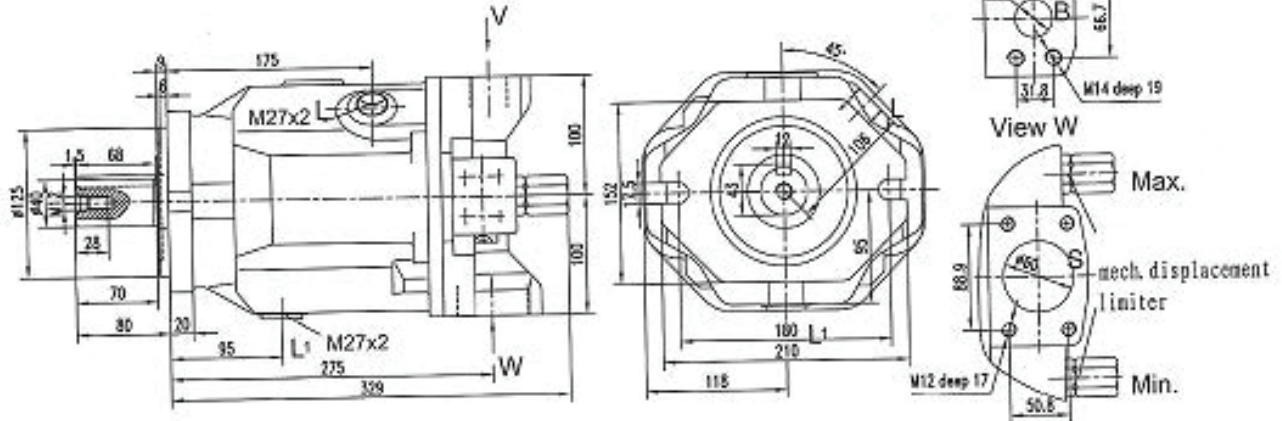


Variable Displacement Pump WJA10VSO-31

(Unit dimensions, size 100)

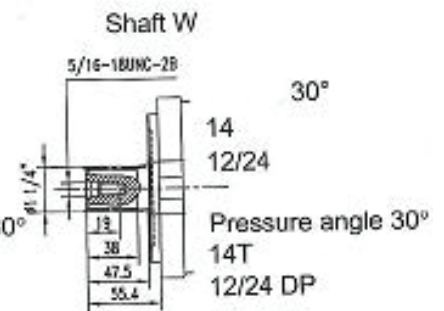
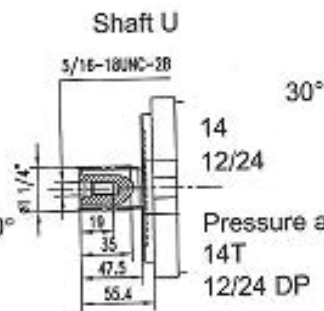
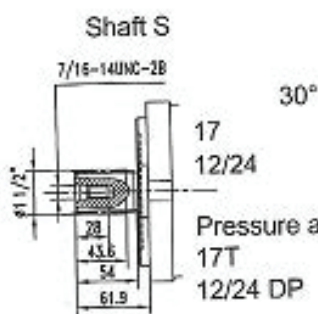
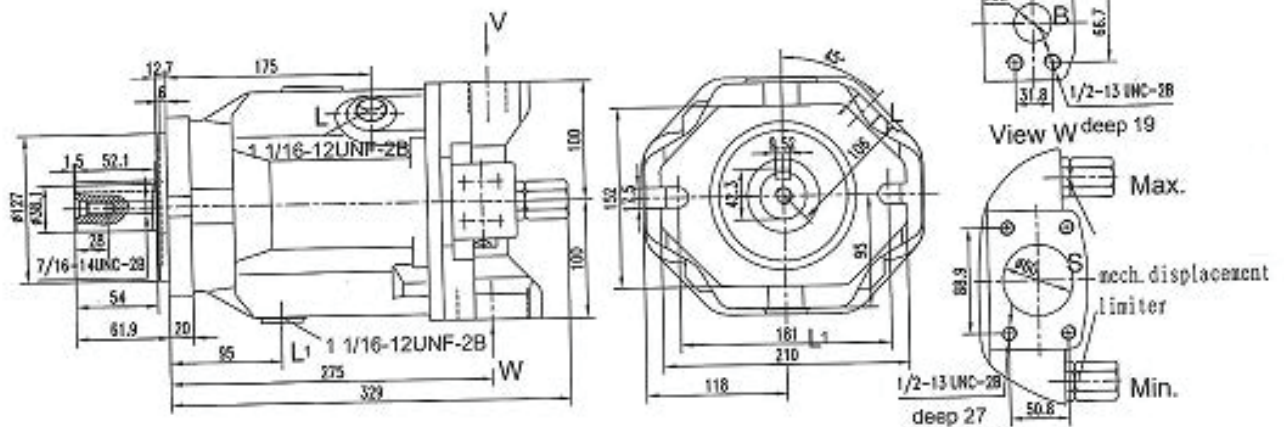
Flange ISO

Shaft P (WA10VSO 100 XXX/31X-PPA12N00)



Flange SAE

Shaft K (WA10VSO 100 XXX/31X-PKC62N00)

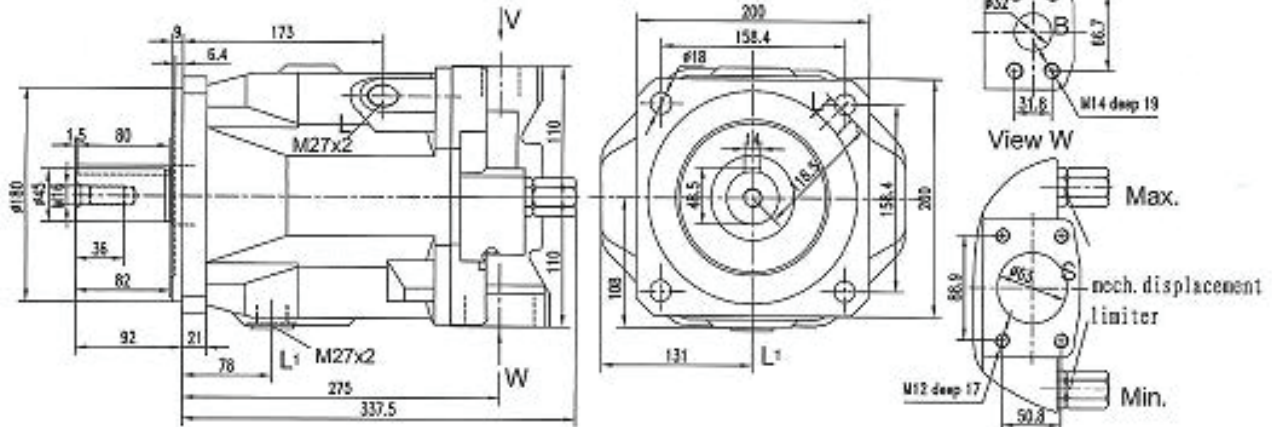


Variable Displacement Pump WA10VSO-31

(Unit dimensions, size 140)

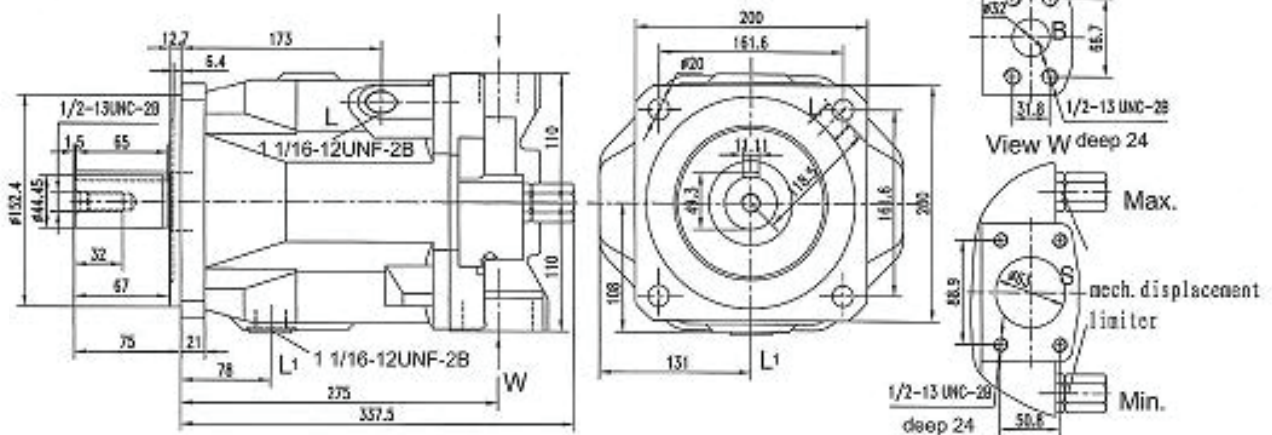
Flange ISO

Shaft P (WA10VSO 140 XXX/31X-PPB12N00)

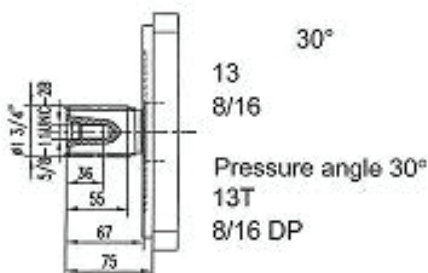


Flange SAE

Shaft K (WA10VSO 140 XXX/31X-PKD62N00)



Shaft S

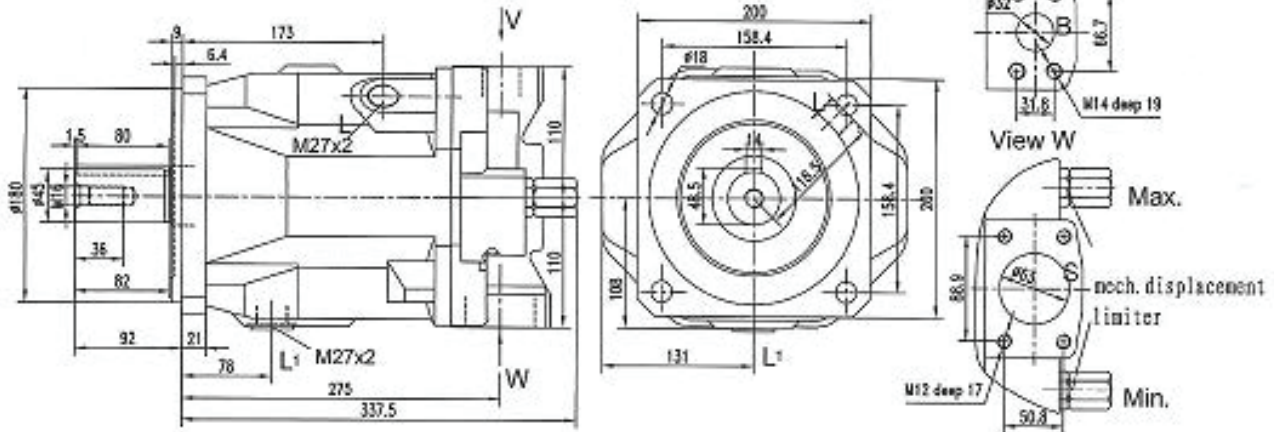


Variable Displacement Pump WA10VSO-31

(Unit dimensions, size 140)

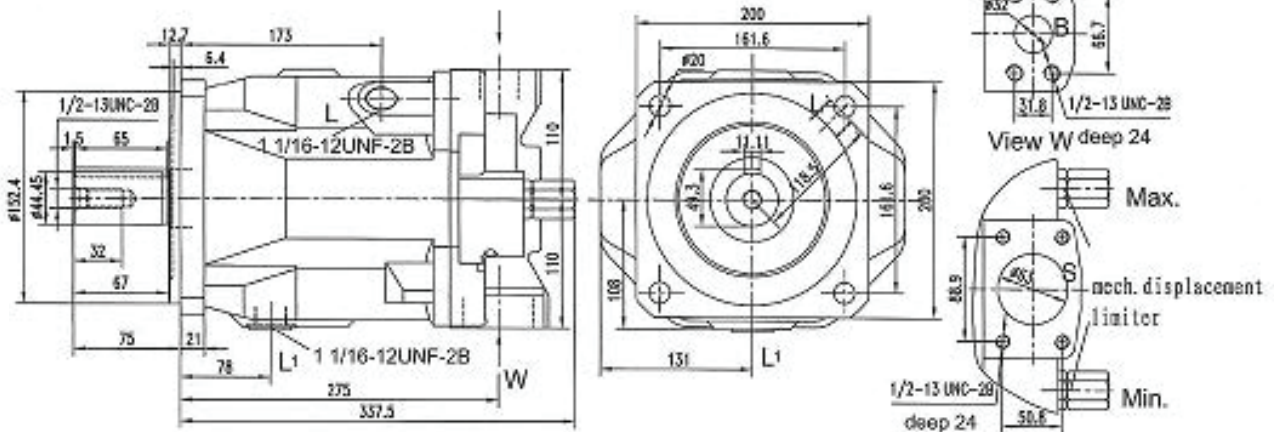
Flange ISO

Shaft P (WA10VSO 140 XXX/31X-PPB12N00)

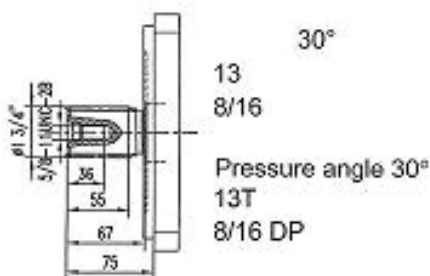


Flange SAE

Shaft K (WA10VSO 140 XXX/31X-PKD62N00)



Shaft S



Variable Displacement Pump WA10VSO-31

Controller

(Static characteristic)	(Circuit drawing)		
<p>DR</p>	<p>Size 18...100</p>	<p>Size 140</p>	<p>The pressure controller serves to maintain a constant pressure in a hydraulic system within the control range of the pump. The pump therefore supplies only the amount of hydraulic fluid required by the system. Pressure may be steplessly set at the control valve.</p>
<p>DRG</p>	<p>Size 18...100</p>	<p>Size 140</p>	<p>Function and equipment as for DR. A pressure relief valve can be connected to part X for remote control applications; this is not included in the items supplied with the DRG control.</p>
<p>DFR/DFR1</p>	<p>Size 18...100</p>	<p>Size 140</p>	<p>Function and equipment as for DR. In addition to the pressure control function, the pump flow may be varied by means of a differential pressure over an orifice or volvespool, installed in the service line. The pump flow is equal to the actual required flow by the actuator. The DFR1-valve has no connection between X and the tank.</p>
<p>DFLR</p>	<p>Size 28...100</p>	<p>Size 140</p>	<p>In order to achieve a constant drive torque with a varying operating pressure, the swivel angle and with it the output flow of the axial piston pump is varied so that the product of flow and pressure remains constant. Constant flow control is possible below the power curve.</p>